भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

दिनांक: 17.08.2024

सेवा में : संरक्षण उप-समिति के सदस्य (सूची के अनुसार) ।
To: Members of Protection Sub-Committee (As per mail list)

विषय: संरक्षण उप-समिति की 51 वीं बैठक की कार्यवृत्त |
Subject: Minutes for 51st Protection Sub-Committee Meeting.

संरक्षण उप-समिति की **51 वीं बैठक, दिनांक 23.07.2024 को 10:30 बजे** से **गंगा कॉन्फ्रेंस हॉल, एनआरएलडीसी, कटवारिया सराय, नई दिल्ली-110016 में** आयोजित की गयी थी | उक्त बैठक की कार्यवृत्त संलग्न है । यह उत्तर क्षेत्रीय विद्युत् समिति की वेबसाइट (http://164.100.60.165/) पर भी उपलब्ध है |

The **51st meeting** of Protection Sub-Committee was held on **23.07.2024** at **10:30 Hrs** at **Ganga Conference Hall, NRLDC, Katwaria Sarai, New Delhi-110016**. The minutes of the meeting is attached herewith. The same is also available on NRPC website (http://164.100.60.165/).

Signed by Dharmendra Kumar Meena
Date: 17-08-2024 18:35:57

(डी के मीना)
अधीक्षण अभियंता (संरक्षण)

51st Protection Sub-Committee Meeting (23rd July, 2024)-MoM

Contents

Minutes of
51st Meeting of Protection Sub-Committee (PSC) of
Northern Regional Power Committee

Date and time of meeting : ***23.07.2024 10.30 Hrs.***

Venue : ***Ganga Conference Hall, NRLDC, Katwaria Sarai, New Delhi-110016***

MS, NRPC welcomed all the participants. List of participants is attached as **Annexure-P**. Agenda-wise deliberations held and decision taken is given as below;

A.1. Confirmation of minutes of 50th meeting of Protection Sub-Committee

A.1.1 AEE (P), NRPC apprised that the 50th PSC meeting was held on 29.04.2024. Minutes of the meeting were issued vide letter dtd. 06.06.2024. No comment has been received till the date.

Decision taken by Forum:

Forum approved the minutes of 50th PSC meeting as issued.

A.2. Submission of protection performance indices to NRPC Secretariat on monthly basis (agenda by NRPC Secretariat)

A.2.1 AEE (P), NRPC apprised that as per clause 15 (6) of IEGC 2023;

- *Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 kV and above (132 kV and above in NER) system, which shall be reviewed by the RPC:*

  *a) The **Dependability Index** defined as* $D = Nc/Nc+Nf$

  *b) The **Security Index** defined as* $S = Nc/Nc+Nu$

  *c) The **Reliability Index** defined as* $R = Nc/Nc+Ni$

  where,

  Nc is the number of correct operations at internal power system faults,

  Nf is the number of failures to operate at internal power system faults,

Nu is the number of unwanted operations,

Ni is the number of incorrect operations and is the sum of Nf and Nu

- *Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.*

A.2.2 In earlier PSC meeting, it was decided that each utility shall submit the Performance indices of previous month by 7th day of next month.

A.2.3 Accordingly, the status of the indices reported for the months from April-2024 to May-2024 were presented and concerned were asked to submit the same at the earliest.

A.2.4 RVPNL representative informed that the data of May month has been sent to Grid-India email. NTPC representative conveyed to submit the indices data timely in future. ATIL representative were requested to send the indices for their TBCB projects. UPSLDC representative mentioned that they have been coordinating with UPRVUNL for protection related data. As of now data is being reported from DTPS Anpara only. UPSLDC has been taking up the matter with IPPs of its control area also.

A.2.5 The current status of the indices reported for the months of April & May 2024 is attached as **Annexure-I**.

A.2.6 Further, it was gathered that an exhaustive addressee list may be prepared including all utilities which are not NRPC members.

A.2.7 MS, NRPC was of the same view and asked to extend the addressee list for PSC meeting. He emphasized that protection is utmost requirement for our system to operate smoothly and uninterruptedly. All utilities should participate in the PSC meeting.

A.2.8 Further, the summary of events, reported prior to this meeting which caused indices less than unity was discussed. The concerned utilities were supposed to submit the reason for the same and corrective action taken to resolve the related issue. Accordingly, concerned utilities were asked about the reason and remedial action taken for unwanted, incorrect operation and failure of operation.

A.2.9 PSTCL representative informed that at 220kV Sarna S/s of PSTCL, the bus bar is not operational as of now which is leading any bus fault to be cleared in zone-4 (time setting-160msec) at Sarna. The other feeders are of POWERGRID at Sarna have zone -4 settings as 500msec. He advised POWERGRID to keep zone -4 time setting of its feeders emanating from Sarna as 160msec till bus bar gets operationalized at 220kV

Sarna substation of PSTCL. **Forum recommended the same to POWERGRID to implement the settings and intimate.**

A.2.10 Forum recommended PSTCL to issue letters to its substations for taking control measures to avoid water/moisture ingression so that unwanted tripping of ICTs may be prevented.

A.2.11 Regarding unhealthiness of carrier on most of the lines, PSTCL representative informed that matter is being taken up to resolve. It involves a huge procurement. Forum advised PSTCL to expedite the process.

A.2.12 POWERGRID NR-3 representative mentioned that relay settings were corrected to resolve the issue relate to tripping of 220 KV Fatehpur (PG)-Naubasta Kanpur (UP) (PG) Ckt-1 in May, 2024. Forum directed POWERGRID to confirm whether any changes in settings were done or deviation with respect to finalized Protection philosophy of Northern Region.

A.2.13 Based on detailed discussion and submission of information, the reason and corrective action taken for Performance Indices less than Unity are attached as **Annexure- II.**

A.2.14 MS, NRPC emphasized that repetitive tripping due to same causes may be avoided and relay settings coordination may be implemented properly. He stressed that Bus Bar relay should be operational as per applicability, numerical relay should be available.

A.2.15 Subsequently, MS, NRPC highlighted that utilities may submit the performance indices of previous month by 7th day of next month element wise along with the reason for indices less than unity and corrective action taken. He directed all concerned utilities to send their reasons within a week via email along with corrective action taken for indices less than unity.

Decision taken by Forum:

Concerned utilities were requested to submit the Protection performance indices of previous month by 7th day of next month element wise along with corrective action taken for indices less than unity.

A.3. Annual protection audit plan for FY 2024-25 and third-party protection audit plan (agenda by NRPC Secretariat)

Annual Internal Audit Plan:

A.3.1 AEE (P), NRPC apprised that under as per clause 15 of IEGC 2023;

- *Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.*

A.3.2 In the 48th, 49th & 50th PSC meetings, all utilities were requested to submit the annual protection audit plan.

A.3.3 In view of above, some utilities have submitted their annual audit plans and others were requested to submit annual audit plan for FY 2024-25.

Third party protection audit:

A.3.4 As per clause 15 of IEGC 2023:

All users shall also conduct third party protection audit of each sub-station at 220 kV and above (132 kV and above in NER) once in five years or earlier as advised by the respective RPC.

A.3.5 In view of above, some utilities have submitted their third-party protection audit plans and other remaining were requested submit the same.

A.3.6 HPPTCL representative mentioned that they will convey HPPCL and HPSEBL to update the Protection Audit Plan.

A.3.7 UPSLDC representative informed that tender was floated for DTPS Anpara third party protection audit. However, higher authorities decided to float tender for all UPRVUNL plants. He confirmed to send the revised third-party protection audit plan for DTPS Anpara and other UPRVUNL plants.

A.3.8 MS, NRPC directed that concerned SLDCs shall send the internal annual audit plan for FY 2024-25 and third party protection audit plan of all utilities in its control area. The status of audit as per submitted schedule, audit report and compliance of observations shall also to be updated by SLDCs of all utilities (GENCOs, TRANSCOs) in its control area.

A.3.9 Subsequently, it was decided that utilities may send the 3rd party protection audit

plan/schedule, the audit reports along with compliance status may be submitted to NRPC Secretariat regularly.

A.3.10 As on date the status of Internal Protection Audit plan for FY 2024-25 and third-party protection audit plan is attached as **Annexure-III** & **Annexure-IV**.

Decision taken by Forum:

Utilities were requested to submit the Annual Internal Protection Audit plan for FY 2024-25 and third-party protection audit plan in next one month and comply the same timely. Audit report along with action plan for deficiency detected, if any may be submitted.

A.4. Compliance of recommendations of protection audit (agenda by NRPC Secretariat)

A.4.1 AEE (P), NRPC apprised that as per clause 15 of IEGC 2023*;*

- *All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 kV and above (132 kV and above in NER).*

A.4.2 Utilities have submitted the internal audit report based on the audit done at their substations. The submitted reports are attached as **Annexure-V**. However, compliance of audit recommendations has not been reported to NRPC Secretariat except POWERGRID NR-2.

A.4.3 The reports were presented and discussed, thereafter concerned utilities were asked to look into observations as per audit report. Based on observations, compliance status was requested.

A.4.4 POWERGRID NR-2 representative submitted the compliance report. The same is attached as **Annexure-V.I.**

A.4.5 APRAAVA representative apprised that there was no observation in the audit report.

A.4.6 HPPTCL representative informed that during audit, bus bar relay was found faulty, that

has been removed and sent to vendor for repair. Now, one bus bar relay is operational.

A.4.7 NPCIL was requested to furnish the compliance of observations of audit reports along with status of Auto-recloser at the RAP units.

A.4.8 RVPN representative suggested to have a uniform audit report format. EE (P), NRPC conveyed that the format available in the IEGC, 2023 will be made available at NRPC website. POWERGRID, NR-2 representative informed that they have been using the same for its third party protection audit plan.

A.4.9 The submitted reports of 3rd Party audit attached as **Annexure-VI** was presented and RVUNL was requested to submit the compliance.

A.4.10 RVUNL representative highlighted that audit observations will be complied after the availability of shutdown. He added that resistive reach is higher at Chhabra due to terrain of area.

Decision taken by Forum:

Utilities were requested to submit action taken/ compliance of observations/recommendations of audit.

A.5. Proposal for implementation of SPS at 400/200kV ICTs at 400kV S/S Muktsar (agenda by Punjab SLDC)

A.5.1 AEE (P), NRPC apprised that NRLDC issued detailed report in respect of Punjab's ATC/TTC limits for Summer/2024 on dated 24-05-2024. Vide the said report, NRLDC requested PSTCL to implement the SPS at 400/200kV ICTs at 400kV Substation Muktsar (PSTCL), considering the N-1 contingency at Muktsar substation.

A.5.2 Punjab SLDC has mentioned that there are 3 no. 400/220Kv ICTs (2 x 315MVA + 1 x 500MVA) at 400kV Muktsar substation. Further, there are 6 no. 220kV downstream circuits at Muktsar***.***

A.5.3 AEE (P), NRPC added that Punjab SLDC has submitted a proposal regarding implementation of SPS at 400/200kV ICTs at 400kV S/S Muktsar (PSTCL) in view of the N-1 contingency attached as **Annexure-VII**.

A.5.4 NRLDC representative stated that study/review has been done and SPS logic is found in order. PSTCL was requested to share the relay operating time of overcurrent relay

on different ICT loading (125%, 130%, 140%, 150% etc.) to check that SPS operating time is in coordination with ICT overcurrent logic.

A.5.5 PSTCL representative assured to send the settings as desired.

A.5.6 Meanwhile, RVPN representative raised its concern for one phase overcurrent issue observed during SPS operation at Suratgarh. RVUNL has also its observations over the same. Forum advised RVPN to submit the agenda with detailed analysis and proposal for the same in next meeting or special meeting may be held as per urgency.

Decision taken by Forum:

Forum approved the proposal of PSTCL regarding implementation of SPS at 400/200kV ICTs at 400kV S/S Muktsar. PSTCL shall submit the overcurrent protection time settings for various ICT loading up to 160%.

A.6. Frequent outage of 800kV HVDC Champa-Kurukshetra inter-regional link (agenda by NLDC & NRLDC)

A.6.1 NLDC representative mentioned that during January, 24 to May, 24 Multiple pole tripping (28 no of times) of HVDC Champa-Kurukhetra has been observed. At 13:53hrs on 17.06.24 all poles of HVDC Champa-Kurukhetra tripped which followed by 16.5GW load loss in NR region and multiple 765kV Lines tripped on over voltage during Peak NR demand period. Reliability of HVDC Champa-Kurukhetra poles need to be ensured by POWERGRID for safe and secure grid operation.

A.6.2 Further, NRLDC representative apprised that frequency of tripping of HVDC Champa-Kurukshetra has increased. 11 nos. of events of multiple pole trippings have been observed in this link since January 2024. List of all the tripping of HVDC Champa-Kurukshetra is enclosed as **Annexure-VIII**. The tripping of this high-capacity link may cause overloading of other parallel transmission lines and further tripping may cause cascade tripping.

A.6.3 It is also well known that, on account of summer, the Northern Region load would remain high till September and therefore, high import requirement exists. Thus, the HVDC Champa-Kurukshetra inter-regional link is a very important link for fulfilling the Northern Region demand requirement.

A.6.4 In 17th June, 2024 load loss event also, triggering event was tripping of all poles of 800kV HVDC Champa-Kurukshetra.

A.6.5 It has been observed that in majority of the events, tripping cause was mainly due to DC line fault, filter protection, software issues, protection mal-operation etc. The reason of most of the tripping seems similar indicating the repetitive nature of fault/tripping.

A.6.6 POWERGRID(NR-1) was requested to share the Protection and control philosophy, power compensation philosophy of 800kV HVDC Champa-Kurukshetra inter regional link along with analysis of protection and control system operation during the grid event.

A.6.7 NRLDC representative requested POWERGRID to apprise the status of remedial measures taken/to be taken to avoid frequent tripping of this inter-regional link.

A.6.8 POWERGRID representative stated that continuous follow-up is being done with the GE to rectify the issues. During May-2023, software was upgraded to version 06. However, frequent cases of maloperation have been observed. Two major issues identified are maloperation of software of control system and failure of analog cards & communication system.

A.6.9 It was further informed that most of the tripping during recent past was due to maloperation of T-zone protection and maloperation during lane changeover. As per current logic, tripping of parallel pole would occur on T-zone protection operation. Cases of maloperation of T-zone protection was due to card failure and communication failure.

Following points have been incorporated in new version (version 7) of the software:

i. Logic for individual pole tripping on T-zone protection operation and use of under voltage logic in T-zone protection.
ii. Necessary modifications have been done to address the maloperation during lane changeover.

Testing of version 7 of the software would be done during 1st week of September 2024 and implementation would be done during 2nd week of September 2024.

A.6.10 NRLDC representative highlighted the importance of HVDC Champa-Kurukshetra Inter regional link for secure and reliable grid operation especially during high

demand scenario. Incidents of outage of all four pole simultaneously have been observed in recent past and which affects the security and reliability of the grid. On 17th June 2024 at 13:53hrs, Northern Region demand experienced a reduction in load of the order of 16.5 GW. The incident occurred immediately after tripping of both bipoles of +/-800 kV HVDC Champa (WR) – Kurukshetra (NR) which was carrying 4,500 MW from the Western Region to Northern Region. After tripping of the HVDC link, low voltages were observed across the Northern region and the above load reduction occurred. Partial outage of the 765/400kV Aligarh (PGCIL) station occurred due to reported tripping of all five (5) nos 765 kV lines. In the incident, grid frequency increased from 50.03 Hz to 50.68 Hz and recovered back to ~50.0 Hz within 6 minutes.

A.6.11 In view of above, POWERGRID was requested to expedite the necessary remedial actions to ensure the reliability of HVDC Champa-Kurukshetra Inter regional link.

Decision taken by Forum:

Forum requested POWERGRID to take effective remedial actions as per the mentioned timelines to avoid the frequent outage of 800kV HVDC Champa-Kurukshetra inter-regional and share the Protection and control philosophy & power compensation philosophy.

A.7. Revision of System Protection Scheme for Anpara Complex (agenda by UPSLDC)

A.7.1 AEE (P), NRPC apprised that UPSLDC vide letter (**Annexure-IX)** dated 01.7.2024 submitted the revised System Protection Scheme for Anpara Complex.

A.7.2 The revised proposal of System Protection Scheme for safe evacuation of power from Anpara Complex after commissioning of 2X1000 MVA ICTs at Obra C TPS was discussed and approved as attached at **Annexure- X**.

Decision taken by Forum:

Forum approved the proposal of revised SPS for Anpara complex.

A.8. Review of SPS scheme no. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Swara Kuddu, Baspa Sorang and Karcham Wangtoo HEP (agenda by HPPTCL)

A.8.1 HPPTCL representative apprised that HPPTCL vide letter dated 27.03.2024 has submitted proposal for review of SPS for evacuation of power from NJPS, Rampur, Swara Kuddu, Baspa Sorang and Karcham Wangtoo HEP (attached as **Annexure-XI**).

A.8.2 HPPTCL representative mentioned that some portion of evacuating lines (which have been separated now) do not have ambient temperature more than 40 degree. Further, there are two D/C 400kV triple snowbird corridors to Nalagarh and Panchkula respectively and one 400kV quad moose corridor to Abdullapur/Kala amb from Karcham wangtoo interconnected with Jhakri through 400kV D/C triple snowbird line. The triple snowbird lines under N-1 contingency shall be sufficient to carry around 1500 to 1600MVA power at 45degree ambient temperature and 85degree conductor temperature. The 400kV quad moose has capacity to transfer from 2100 to 2200MVA at 45degree ambient temperature and 85degree conductor temperature.

A.8.3 In view of above, HPPTCL representative submitted that the 850MW load on any of the 400kV triple snowbird line from Jhakri, Gumma and Rampur towards Nalagarh and Panchkula seems to be very highly conservative. By removal/revision of SPS, it will enhance the overall capacity to the grid and backing down of the hydro generators may be avoided.

A.8.4 NRLDC representative conveyed that study on the same has been carried out attached as **Annexure-XII.** The confirmation has been sought from POWERGRID side regarding conductor capacity with respect to temperature**.** POWERGRID has also highlighted that the CT, CB rating are of 2kA at Nalagarh, Panchkula and Abdullapur which limits the line loading to 1385MVA. Therefore, lines can't be loaded more than ~1385 MVA due to limitation of switchgear equipment's (CT, CB & isolators) rating. Hence, SPS is required. Therefore, NRLDC did not give consent to remove backing down of generation.

A.8.5 HPPTCL representative was of view that switchgear uprating will help not only in this scenario but also in future also. Therefore, the same may be explored.

A.8.6 Further, NRLDC representative mentioned that POWERGRID has denied to have flow of 2200MVA on 400kV quad moose. Due to operational constraints, the loading may go up to 1704MVA.

A.8.7 POWERGRID representative conveyed that these lines are of PHTL and these are trespassing through tough hilly terrain. However, loading of the line may gradually be increase as per their observation.

A.8.8 POWERGRID was directed to submit the reason for not allowing the 2200MVA on 400kV quad moose and restricting to 1704MVA only.

A.8.9 It was recommended that detailed discussion needs to be done with CEA (PSPA-I), NRPC Secretariat, CTU, PGCIL, NRLDC, HPPTCL, HPSLDC, HPPCL, HPSEBL and other private generators, other upcoming generators via separate meeting.

Decision taken by Forum:

Forum decided to discuss the issue in separate meeting among CEA (PSPA-I), NRPC Secretariat, CTU, PGCIL, NRLDC, HPPTCL, HPSLDC, HPPCL, HPSEBL and other private generators, other upcoming generators.

A.9. Proposal of System Protection Scheme (SPS) at 400kV Substation Jaunpur (agenda by UPSLDC)

A.9.1 AEE (P), NRPC apprised that UPSLDC vide letter dated 15.6.2024 submitted the System Protection Scheme for 400kV Substation Jaunpur as additional agenda in the 220th OCC meeting (held on 19.6.2024).

A.9.2 UPSLDC informed that 2x315 MVA ICT at 400kV Substation Jaunpur is not N-1 compliant. In order to ensure the reliability of Jaunpur Substation during peak demand, SPS is required. Accordingly, the logic **(Annexure-XIII)** was put up.

A.9.3 However, NRLDC vide mail dated 2.7.2024 commented that SPS action would only provide relief in case 220kV Jaunpur-Phulpur and 220kV Jaunpur-Jhusi are kept open. Incase these lines are kept closed, SPS relief may not be sufficient.

A.9.4 Incase 220kV Jaunpur-Phulpur and 220kV Jaunpur-Jhusi are kept open, loading of 400/220kV Alllahabad (PG) ICTs would increase. Further, reliability of supply for

these substations would also be poor.

A.9.5 Further, UPSLDC vide mail dated 22.07.2024 submitted that 220 kV Jaunpur-Jhunsi and 220 kV Jaunpur -Phoolpur lines have been included in the SPS logic to ensure adequate load relief (**Annexure-XIV).**

A.9.6 Vide the same mail, UPSLDC also added that by including 220 kV Jaunpur-Jhunsi and 220 kV Jaunpur -Phoolpur in SPS logic, loading on ICTs at Allahabad PG may be higher than the loading before operation of SPS, However, it is worth noting that presently 220 kV Jaunpur-Jhunsi and 220 kV Jaunpur -Phoolpur remains in open condition and entire load of Junsi and Phulpur is fed from Allahabad PG. Therefore, maximum loading on these ICTs shall not breach existing maximum loading (observed in June 2024). Also, to take care of N-1 non-compliance, SPS planned for ICTs at Allahabad PG is in process of implementation.

A.9.7 As far as reliability is concerned, all the 220 kV substations viz 220 kV Jhunsi, Phulpur, Bhadohi and Azamgarh New are fed by two sources. In the event of operation of SPS supply shall be available through a second source.

A.9.8 The above mentioned was also confirmed by the UPSLDC representative in the PSC meeting.

A.9.9 NRLDC representative stated that SPS logic have been reviewed and found in order.

Decision taken by Forum

*Forum approved the proposal (**Annexure-XIV**) of SPS at at 400kV Substation Jaunpur taking 220 kV Jaunpur-Jhunsi and 220 kV Jaunpur –Phoolpur in the logic.*

A.10. Intimation of performance of SPS (agenda by NRPC Secretariat)

A.10.1 AEE (P), NRPC apprised that as per clause 16 of IEGC 2023;

- *The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.*
- *The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on*

the corrective actions taken to the concerned RPC within a fortnight.

A.10.2 However, it has been observed that reporting of operation/failure of operation of SPS is not being done by the utilities.

A.10.3 Meanwhile, the matter of non-operation of Agra- Gwalior SPS on 17.06.2024 was discussed. POWERGRID representative mentioned that during mock testing, tripping of the designated feeder due to triggering of formulated condition was checked. However, the operation of SPS was not covered during that mock testing.

A.10.4 Therefore, POWERGRID representative desired to do the real time testing of SPS during opportune shutdown to make it more effective by feeding voltage and current.

A.10.5 CGM, NRLDC asked POWERGRID to submit the reason for the non-operation of Agra Gwalior SPS within 15 days.

A.10.6 MS, NRPC emphasized that utilities may intimate the same to the NRPC and NRLDC timely. Further, utilities may submit the protection performance indices for the SPS also.

Decision taken by Forum

All utilities were requested to intimate the performance of SPS to the NRPC and NRLDC timely and submit the protection performance indices for the SPS also.

A.11. Non-availability of Bus Bar protection scheme at 220 KV GSS Sakatpura, RVPN, Kota (agenda by RVUNL)

A.11.1 RVUNL apprised that Bus Bar protection scheme is not in operation at 220kV GSS sakatpura since long. Due to this reason, 220 kV Bus faults at GSS sakatpura are not cleared in time at GSS Sakatpura end.

A.11.2 These faults are fed through 04 Nos. KTPS- sakatpura feeders and are cleared later during delayed tripping (in Zone 2 time or back up protection) creating system instability at KSTPS, which many times results in tripping of running KSTPS generating units and feeders etc. causing huge revenue loss to RVUNL.

A.11.3 RVPN representative informed that Bus Bar protection scheme has been operational at 220kV GSS sakatpura since 9 July, 2024.

Decision taken by Forum

Forum directed RVPN and RVUNL to resolve the matters first bilaterally with coordination, later the agenda may be brought to the Forum, if required.

A.12. Instantaneous Setting in 132 kV Chandak-Pithoragarh & 132 kV Chandak-Almora Line (agenda by PTCUL)

A.12.1 AEE (P), NRPC apprised that PTCUL has submitted that the matter of instantaneous setting in the Chandak-Pithoragarh and Chandak-Almora power transmission lines has also been raised in the 47th PSC meeting. Currently, the instantaneous setting of the Chandak-Almora Line is set at 1200 Amperes, which is deemed inadequate considering the fault level of the 132 kV Bus at 3938 Amperes and Chandak-Pithoragarh Line is set at 900 Amperes.

A.12.2 Consequently, occasional tripping of the Chandak-Pithoragarh Line has been observed when faults occur in the 33 kV line nearer to the substation.

A.12.3 PTCUL representative added that a recent tripping incident has taken place on 25/06/2024. During this event, the fault current in the y-Phase reached 1621 Amperes, surpassing the instantaneous setting of the line. It is crucial to address this issue promptly in order to ensure reliable and uninterrupted power transmission.

A.12.4 Tripping details of 132 kV Chandak (PGCIL)-Almora Line & 132KV Chandak (PGCIL)-Pithoragarh line submitted by PTCUL are attached as **Annexure- XV**.

A.12.5 Based on the aforementioned circumstances, the following potential solution was proposed by PTCUL to mitigate the problem:

Disabling the instantaneous trip function: The viable solution is to disable the instantaneous trip function entirely. Instead, reliance would be placed on other protective measures, such as backup overcurrent settings, to offer adequate fault protection. It is worth noting that instantaneous setting in backup overcurrent is not recommended for 132 kV lines. Nevertheless, under the given circumstances, it could prove to be more reliable than the current configuration.

A.12.6 Forum was also of view that there should not be any instantaneous overcurrent setting for line.

A.12.7 POWERGRID representative informed that they are in the process of reviewing this matter.

Decision taken by Forum

Forum directed POWERGRID to look into the matter and resolve it considering the concern of PTCUL. Instantaneous overcurrent settings on the line may be replaced with IDMT overcurrent protection. POWERGRID shall intimate NRPC Secretariat after resolution of issue.

A.13. Implementation of 3-phase Auto-Reclosure for the Phase-to-Phase Tripping of Transmission Lines due to Kite threads. (Agenda by POWERGRID, NR3)

A.13.1 POWERGRID representative apprised that as per the analysis of the Tripping Incidents of the Phase-to-Phase Tripping of the transmission lines at NR-III Region of POWERGRID, it has been observed that the majority of the Phase-to phase Tripping of the Transmission Lines have occurred due to the presence of foreign material (such as Kite Threads).

A.13.2 In last three years (from May'21 to April'24), a total of 76 phase-to-phase tripping instances have occurred at transmission lines of NR-III Region due to the presence of kite thread and the Line got charged during charging attempt (within 01-02 hrs. of tripping).

A.13.3 List of Transmission Lines in which more than 02 instances/Line of such phase-to-phase tripping have occurred are presented below: -

Sl. No.	Description of the Transmission Line	No. of Phase-to-Phase fault Instances due to Kite thread in which Line held during charging attempt.
1.	400kV Bareilly Moradabad-1 Line	16
2.	400kV Jehta(UP)- Unnao(UP)-1 Line	6
3.	220kV Bareilly(UP)- Sitarganj Line	5
4.	400kV Jehta(UP)- Unnao(UP)-2 Line	3

A.13.4 He added that as per the protection scheme implemented at POWERGRID for Transmission Line Distance Protection, Auto Reclosure is only attempted in case of

1-phase to earth Faults. And if the fault is phase-to-phase/3-phase in nature, 3-phase tripping of the transmission line is issued and Auto-Reclosure is blocked.

A.13.5 However, in the above-mentioned phase-to-phase tripping instances, Transmission Lines got three-phase tripped (as per the implemented protection scheme) but got charged/held during the charging attempt. During the tripping of the line due to Kite thread, in most of the cases the thread causing the tripping gets burnt during the first tripping instance and subsequently the transmission line holds during the charging attempt.

A.13.6 Further, it could be observed that maximum number of Kite thread caused tripping pertain to a particular geographical section between Bareilly and Moradabad near Moradabad end where Kite Flying is prominent and even after multiple awareness drive and taking up the matter with local administration, the instances of Kite related tripping has not reduced. A total of 16 Nos. of instances are observed in 400kV Bareilly Moradabad-1 Line, whereas 400kV Bareilly Moradabad2 Line which has been done LILO at 765/400kV PRSTL Rampur Substation runs through different route near Moradabad section, therefore such trippings are not observed in 400kV Rampur Moradabad Line (Line formed after LILO of Bareilly Moradabad-2 Ckt).

A.13.7 Due to multiple tripping of the same transmission element on such transient nature fault caused by Kite Thread, reliability and availability of the transmission system is heavily affected. Therefore, to enhance the same, it is proposed that 3-phase Auto Reclosure for phase-to-phase faults may be implemented in such lines having tripping on account of kite thread so that the number of trippings and outage duration of the transmission line during phase-to-phase fault may be reduced.

A.13.8 Since, Majority of such instances have been occurred in 400kV Bareilly Moradabad-1 Line, therefore the scheme for 3-phase Auto-reclosure on phase-to-phase faults may be implemented in the above line on pilot basis.

A.13.9 Scheme proposed by POWERGRID, NR-3 for 3-phase auto-reclosure: -

- In the proposed scheme for 3-phase Auto-reclosure of Line on Phase-to-phase faults, Line shall auto-reclose on Single-phase to earth faults & Phase to Phase Faults. However, Auto-reclosure should get blocked in case of Three-phase faults and three phase to earth faults.
- To achieve the above through scheme, auto reclosure initiation is to be taken

from the pickup signals of Single-phase to earth fault loop and Phase to phase Selection (in case of Rph-Yph fault, Yph-Bph fault and Bph-Rph Fault).

- Further in case actuation of all three phase to earth fault selection loops together or actuation of all phase-to-phase fault loops together, blocking of Auto-reclosure is to be configured.

A.13.10 Further, he conveyed that with the implementation of the above proposed scheme, 3-phase Auto-reclosure shall be only permitted for phase to earth and phase to phase faults and Auto-reclosure shall remain blocked for more severe faults such as 3-phase faults and 3-phase to earth faults to ensure grid stability.

A.13.11 POWERGRID submitted the logic for this proposed scheme (attached as **Annexure-XVI**)**.**

A.13.12 NRLDC representative asked POWERGRID whether it can be ascertained that fault occurred due to kite thread or not. Because, in case fault is of permanent nature with high fault current then three phase auto-reclosing may have impact on healthiness of equipment at substation. POWERGRID representative replied that based on history of fault observed at this line, scheme has been proposed on pilot basis.

A.13.13 DTL representative recommended that one parallel circuit should be there and dead time may be enhanced in the auto reclosure for phase-to-phase faults.

A.13.14 NTPC representative mentioned that auto reclosure for phase-to-phase fault may not be recommended to any generating end. Because any delayed fault leads to vibration in the machine of plant. DRs of past event need to be studied. BBMB representative highlighted the same point.

A.13.15 BBMB representative mentioned that in case if fault is of permanent nature, then it may be highly dangerous for parallel lines.

A.13.16 UPPTCL representative conveyed that compatibility of relay may be checked. He advised to keep different dead time at both ends to get the sync check for 3 phase auto reclosure. Further, DT may be sent from less Dead time breaker to the more breaker in case of identification of unsuccessful A/R at one end.

A.13.17 AESL/Adani representative mentioned that dead time discrepancy may be taken at both end to avoid undesired multiple breaker operation. Further, after tripping of one

circuit, loading pattern on other circuit may be studied. Resistive reach and load encroachment criteria may be reviewed for parallel circuit. Main and tie breaker priority pass may be reviewed.

A.13.18 EE (P), NRPC asked the protection simulation studies for this scenario. POWERGRID replied that analysis will be done by its study team for various fault scenarios.

A.13.19 It was gathered that this is going to be unique case for auto reclosure on phase-to-phase fault. Deliberation in detail is required. POWERGRID may perform simulation study or may approach/engage any expert/consultant for same.

Decision taken by Forum:

A.13.20 *Forum requested POWERGRID to perform protection simulation studies and then put up the matter again in upcoming meetings. POWERGRID may perform simulation study itself or may approach/engage any expert/consultant for same.*

A.14. Sudden failure of 400/220/33KV, 315 MVA ICT-1 at Kaithal during external faults in 220KV Lines (Agenda by POWERGRID, NR-2)

A.14.1 POWERGRID, NR-2 representative apprised that on 11.05.2024, there was fault in downstream network at Kaithal (PG). The sequence of events is as under:

1. 00:51:06.816 220kV Kaithal (PG)-HVPNL Neemwala-2 tripped on B_N Line fault, with fault current 23.6KA. Due to successful A/R at Kaithal (PG) end at 00:51:08.258 Hrs, above fault was repeated and again fed by ICT with fault current 23.5kA.
2. 00:51:10.808 220kV Kaithal (PG)-HVPNL Kaithal-1 tripped on B-N Line fault, with fault current 20kA. Due to successful A/R at Kaithal (PG) end at 00:51:11.858 Hrs, above fault was repeated and again fed by ICT with fault current 23.5kA.
3. 00:51:11.878 Hrs: ICT-1 had failed on failure of HV B-Phase winding while feeding above fault.

A.14.2 Further, he briefed the event through presentation attached as **Annexure- XVII.**

A.14.3 He mentioned that summary of faults fed by ICT in last 02 Years as below-

Total faults fed in last 24 months	23Nos	
Line faults with fault distance less than 2KM	10 Nos	Fault current in 20-24KA
Line faults with fault distance between 2-6kM	07 Nos	
Line faults with fault distance 7—20km	06 Nos	Fault current in 4-8KA

Note: Out of 23 No Line faults in 220KV Lines, 19 No Line faults were in B Phase and ICT also failed due to failure of B Phase winding.

A.14.4 Most of time fault is in the B phase of lines restricted to limited locations (in 6kM) and B winding of the transformer was also failed.

A.14.5 POWERGRID representative informed that again there was fault in 220KV Kaithal Neemawali 1&2 Lines on 01.06.2024, with fault current 25KA. As fault was very near to Substation, patrolling of the HVPNL line was carried out and following were the findings:

- Insufficient Jumper clearance was noticed in B-Phase in angle tower at LOC NO 4 of Kaithal (PG)-Neemwala-1&2 Lines. Similar clearance issues were found in other angle towers of the Line and suggested for Installation of additional horizontal polymer insulator to maintain sufficient clearance.

- Punctured porcelain insulators were found at No of locations in 220KV Kaithal Kaithal 1 &2 and 220KV Kaithal Cheekha 1 &2 Lines. HVPNL was suggested to replace all porcelain insulators with polymer insulators.

A.14.6 POWERGRID representative also added that many lines of HVPNL have the cracked and punctured porcelain insulator which again points out the problems associated with its transmission systems.

A.14.7 HVPNL representative conveyed that due to storm, there was earth wire found broken that led to tripping of line. He conveyed that fault is found generally in B phase due to being bottom most conductor. He mentioned that pilot string issues have already been resolved, however, if any other issue comes, same shall be resolved. He ensured that there will be no fault in future due to above defects. He

also submitted that a number of Transformer had also failed in their distribution network, but failure is considered due to problem in transformer and not due to line faults.

A.14.8 POWERGRID representative submitted that distribution transformers cannot be compared with large ICTs. Further, POWERGRID representative informed that AMP & DGA of failed transformer was carried out as per schedule and all test results were normal.

A.14.9 Regarding the concern of failure of only this particular ICT, RVUNL representative opined that due to different percentage impedance of ICTs, the low impedance has most chances to feed the fault.

A.14.10 HVPNL representative highlighted that most of the faults are of zone -1 that got cleared within 50 to 100msec. However, Power transformers are designed to feed short circuit current for 1 sec.

A.14.11 POWERGRID representative mentioned that in this case fault have been fed by ICT many times rather than one or two times. POWERGRID representative further intimated that ICT has been replaced at its own cost.

A.14.12 POWERGRID representative submitted that in view of above facts, it may be concluded that ICT had failed due to frequent B-N line faults as mentioned above. As such, POWERGRID requested to condone above outage and may be attributed to others/HVPNL.

A.14.13 MS, NRPC directed HVPNL to increase the patrolling frequency of lines and may replace the insulators as per requirement. He conveyed that the availability for the above outage of ICT would be examined by NRPC Secretariat as per CERC Tariff Regulation, 2024 considering above discussion.

A.14.14 Subsequently, POWERGRID representative sought direction of Forum to implement adaptive auto reclosure scheme to avoid multiple faults feeding operations that causes undesirable stress on their assets. Forum addressed POWERGRID to bring the agenda for the same with supporting historical data.

Decision taken by Forum:

Forum guided HVPNL to increase patrolling frequency of its lines and insulators may be replaced as per requirement to avoid multiple trippings.

A.15. Status of remedial actions recommended during 50th PSC meeting (agenda by NRLDC)

A.15.1 NRLDC representative apprised that as per discussion in 50th PSC meeting, necessary remedial actions were recommended based on the analysis and discussion of the grid events. Constituents were requested to share the details of actions taken and present status via mail to NRLDC and NRPC. However, details not received on mail. During the meeting constituents were requested to apprise the status of the same. Constituents informed following during the meeting:

a) **Grid disturbance in 220kV Kunihar, Baddi complex during Feb'24**

50th PSC recommendations: PSC forum deliberated that in view of multiple incidents of grid events in this complex, a committee may be constituted for third party protection audit of Kunihar, Baddi complex. HP may also proceed with the process of third-party protection audit and shall share the report of the audit. HP was also requested to plan for suitable SPS scheme in this complex to avoid complete outage of the complex during contingency.

HPSEBL representative informed that protection audit of 220kV Kunihar has been awarded and it would be completed within next 15-20 days. In next phase, by 15th September, protection audit of substations in downstream and upstream of 220kV Kunihar S/s would be completed.

HPPTCL representative informed that, downstream network of 220kV Kala Amb(HP) is almost ready and within next 25 days it would be connected to the grid. It would provide 80-90 MVA loading relief to the 220kV Kunihar S/s.

NRLDC representative requested HPSEBL to coordinate with STU and try to resolve the already identified issues at the earliest so that undesired multiple elements tripping may be avoided.

PSC Forum requested HP to complete the protection audit as per mentioned timelines and resolve the protection related issues. HP was also requested to

share the reports of protection audit to NRPC & NRLDC after completion of audits.

b) **Multiple elements tripping at 400kV Anpara_D TPS (UP) & Anpara TPS (UP) on 27th February 2024, 13:57 hrs:**

50th PSC recommendations: the followings were recommended-

i. Anpara_D TPS and UPPTCL shall review the carrier communication issue at Anpara_D end and ensure the healthiness of the same.
ii. Protection settings need to be kept in line with the protection philosophy. Overcurrent protection need to be kept disabled in the lines and protection setting of back up E/F protection need to be kept in coordination with Z-3 distance protection setting.
iii. Time synchronization of recording instruments (DR/EL) need to be ensured.

UP representative informed following during the meeting:

i. As per internal review, carrier communication system was found healthy at Anpara_D. Further review would be done during 3rd party protection audit.
ii. Over current protection in line at Anpara_C end has been disabled and protection setting of DEF protection has been corrected at Anpara_B end.
iii. Update of status of time synchronisation of recording instruments yet to be received.

UP representative stated that necessary follow ups are being done and pending issues would be addressed at the earliest.

c) Multiple elements tripping at 400/220kV Akal (RS) on 02nd Jan 2024, 07:28 hrs:

50th PSC recommendations: the followings were recommended-

i. Bus bar protection at 220kV bus at 400/220kV Akal shall be made operational by June 2024.
ii. Time synchronization of recording instruments (DR/EL) need to be ensured.

Rajasthan representative stated that work of rectification of issues in bus bar protection at 400/220kV Akal S/s has not been completed yet.

NRLDC representative requested Rajasthan to expedite the process as Akal S/s is in RE complex and important S/s for evacuation of RE generation. Rajasthan agreed to resolve the issues on priority.

d) Multiple elements tripping at 765/400kV Unnao (UP) on 20th February 2024 at 21:47hrs and 11th March 2024 at 01:56hrs:

50 PSC recommendations: Static bus bar relay at Unnao end need to be replaced with the numerical relay.

UP representative informed that requirement has been sent to design team. Further process yet to be started.

NRLDC representative requested UP to expedite the process. UP agreed for the same.

e) Multiple elements Multiple elements tripping at 220kV Badarpur (DTL) on 31st January 2024, 21:22 hrs

50 PSC recommendations: Issues related to bus bar protection need to be rectified. Healthiness and proper operation of protection system need to be ensured.

DTL representative informed that necessary modification has been done in bus bar scheme at 220kV Badarpur (DTL) and it has been kept under observation. Z-4-time delay setting is also kept as 160msec. It would be revised to standard time delay setting after confirmation of proper operation of bus bar protection.

f) Multiple elements tripping at 220kV Upperla Nangal (HP) on 19th March 2024, 19:18 hrs

50 PSC recommendations: the followings were recommended

i. Healthiness and proper operation of protection system need to be ensured.

ii. HPSEBL shall submit the detailed analysis of the event and take remedial action to avoid such event in future.

HP representative informed that audit of 220kV Upperla Nangal would also be completed by 15th September.

NRLDC representative requested HPSEBL to coordinate with STU and try to resolve the already identified issues at the earliest so that undesired multiple elements tripping may be avoided. HPSEBL agreed for the same.

A.16. Status of Bus bar protection (agenda by NRLDC)

A.16.1 NRLDC representative apprised that Clause - 4 in schedule - V of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022 reads as

"Bus bar protection and local breaker backup protection shall be provided in 220kV and higher voltage interconnecting sub- stations as well as in all generating station switchyards".

A.16.2 During analysis of many grid incidents/disturbances, it has been found that the Busbar protection at the affected substation was **not present or non-operational** which resulted in considerably increasing both the number of affected elements and fault clearance time. Accordingly, it becomes critical to monitor and keep Busbar protection at all the 220 kV and above voltage level substations healthy and operational.

A.16.3 Continuous follow-ups have been done at OCC & PSC forum to expedite the commissioning of bus bar protection at 220kV & above stations and to ensure their healthiness. On the basis of details received till date, it is observed that the status of bus bar protection has been improved however, further improvement is desired.

A.16.4 Constituent wise status of bus bar protection where bus bar protection is either not installed or installed but not operational along with present status as per detail received from constituents is attached as **Annexure-XVIII.**

A.16.5 Constituents were requested to share the present status of remedial action taken/to be taken regarding commissioning and healthiness of bus bar protection at 220kV & above substations and also expedite the implementation of bus bar protection.

A.16.6 Members were requested to appraise the status of bus bar protection in their respective control areas.

A.16.7 Haryana representative informed that bus bar commissioning is being done in two phases. Material pertaining to 1st phase has already arrived, commissioning has been done at few of the stations and would be done at remining stations by August 2024. Material for stations selected in 2nd phase yet to be arrived. Commissioning of bus bar protection at these stations would be completed by March 2025 tentatively.

A.16.8 UP representative informed that updated status didn't receive from most of the zones. Regular follow ups are being done to expedite the commissioning process of bus bar protection. Updated status would be shared. It was also informed that bus bar protection at 220kV Dadri (UP) was made operational on 23rd April 2024.

A.16.9 HP representative informed that management has called a meeting with ABB to resolve the issues on priority. Regular follow ups are being done.

A.16.10 Punjab representative informed that bus bar protection has been commissioned at 220kV Badhni kalan and 220kV Bhari S/s. All required material has arrived, commissioning shall be done as per shutdown availability.

A.16.11 Rajasthan representative informed that bus bar protection has been commissioned at total 20 number of stations out of 42 (Nos.). Bus bar protection at 220kV Kota Sakatpura S/s has been commissioned on 09th July 2024. Commissioning process at 12 number of stations is being done. Necessary actions are being taken to make bus bar protection operational at all the stations.

A.16.12 NRLDC representative stated that details have been received from Rajasthan, HP & Punjab. Partial detail received from UP & Haryana. Members were requested to share the updated status details by mail. An updated sheet based on detail received is attached as **Annexure-XIX.**

Decision taken by Forum:

Forum requested all the constituents to update the status of bus bar protection at S/s of their control area and expedite the commissioning and implementation work of bus bar protection system. Members agreed for the same.

A.17. Replacement of electromechanical relays with numerical relays (agenda by NRLDC)

A.17.1 NRLDC representative apprised that Clause-37.2(c) of IEGC, clause-15(4) of CEA Grid standards and clause-48(4) of CEA Construction Standards 2022 mandates that

''each line or transformer or reactor or any other bay shall be provided with facility for disturbance recording, event logging and time synchronizing equipment''.

A.17.2 During analysis of grid incidents/disturbances, it has been found that there are few stations where electromechanical relays are still in use and thus disturbance recorders are not available there which accounts for violation of Clause-37.2(c) of IEGC, clause-15(4) of CEA Grid Standards and clause 48(4) CEA Construction Standards 2022.

A.17.3 In addition, clause-3 in part III (Grid Connectivity Standards applicable to Transmission Line and Sub-Station) of Standards for Connectivity to the Grid, 2007 reads as

''*Two main numerical Distance Protection Schemes shall be provided on all the transmission lines of 220 kV and above for all new sub-stations. For existing sub-stations, this shall be implemented in a reasonable time frame''*

A.17.4 It is known that Disturbance recorder (DR) is essential for analysis of grid incidents/disturbances. Its non-availability eventually affects the proper analysis of grid incidents/disturbances and monitoring of protection system.

A.17.5 Continuous follow-ups have been done at OCC & PSC forum. During the meeting, all the constituents/SLDC/STU were requested to review the same in their control area and take expedite actions to replace electromechanical relays with numerical relays.

A.17.6 Constituent wise details of static/electromechanical type protection relays at their respective substations along with its present status per detail received from constituents is attached as **Annexure-XX**.

A.17.7 Constituents were requested to share the status of remedial action taken/to be taken regarding replacement of static/electromechanical relay with numerical relays at 220kV & above substations and also expedite the process of replacement of static/electromechanical relay with numerical relays.

A.17.8 Rajasthan representative informed that six number of relays have been replaced with numerical relay. Order has been placed for procurement of 350 number of numerical relays. Elements up to 132kV level are being covered in this process.

A.17.9 Haryana representative informed that except few lines, all the line protection relays have been retrofit with numerical relays. Except few of the transformers, differential protection relay in all the transformers have been replaced with numerical relay. Mainly back up protection relays are of electromechanical type. Necessary actions and follow ups are being done to replace them also with the numerical relays.

A.17.10 UP representative informed that updated status didn't receive from most of the zones. Regular follow ups are being done to replace the static and electromechanical relays with the numerical relays. Updated status would be shared.

A.17.11 NPCIL representative informed that all the relays have been replaced with numerical relays.

A.17.12 NRLDC representative stated that details have been received from Rajasthan & NPCIL only. Partial detail received from UP & Haryana. Members were requested to share the updated status details by mail. An updated sheet based on detail received is attached as **Annexure-XXI.**

Decision taken by Forum:

Forum requested all the constituents to update the status of type of protection relays at S/s of their control area and expedite the replacement work of static/electromechanical type protection relays with numerical relays. Members agreed for the same.

A.18. Frequent multiple elements tripping at 220kV Kunihar, Baddi, Upperla Nangal complex and load loss event in HP control area (agenda by NRLDC)

A.18.1 NRLDC representative shared following details related to grid events in Kunihar, Baddi, Upperla Nangal complex:

Frequent event of multiple elements tripping has been reported at 220kV Kunihar, Baddi, Upperla Nangal complex of HP control area. Total six (06) number of grid events have been reported in this complex in 2024. Major affected substations were

220kV Kunihar, Baddi & Upperla Nangal. Significant quantum of load (400-700MW) affected during these grid events. Protection coordination and load management related issues were observed during these events however, tripping details and details of remedial action taken not received yet from HP. List of events is attached as **Annexure-XXII**.

A.18.2 During Aug-Sept 2023 also, Grid events were reported in this complex. Those events were discussed in 48th PSC meeting and PSC forum had recommended third party protection audit of Kunihar S/s. Thereafter, in view of further grid events in 2024, deliberation on above subject had been done at various forums. PSC forum (49th & 50th PSC) recommended expeditious 3rd Party protection audit of this complex and to submit the report. However, no update on the details of remedial action taken same have received and multiple events in recent past indicates that issues related to protection system and their coordination at these affected stations are still existing.

A.18.3 DR/EL and detail analysis of any of these events have not received from HP. Therefore, HP was requested to analyse the tripping events in detail and share the report along with remedial action taken to avoid such events in future.

A.18.4 As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event and as per IEGC clause 37.2 (e), the user shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC.

A.18.5 During 48th, 49th & 50th PSC meeting, third party protection audit of this complex i.e., 220kV Kunihar, Baddi & Upperla Nangal was recommended. However, no details in this regard received from HP. HP was requested to take necessary remedial actions on priority.

A.18.6 HP representative informed that during most of the events, fault occurred due to damage of CTs. It was further informed that CTs are very old and scheme for replacement of old CTs has already been raised. In addition, audit plan of substation in this complex has already been shared in agenda point 15 (a).

Decision taken by Forum:

Forum requested HP to complete the protection audit as per mentioned timelines and resolve the protection related issues. HP was also requested to take necessary remedial actions on priority.

A.19. Availability and Standardization of recording instrument (Disturbance recorder and Station Event Logger) (agenda by NRLDC)

A.19.1 NRLDC representative apprised that as per IEGC clause 17

1) *All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.*
2) *The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals.*

A.19.2 *IEGC clause 37.2 (c) also mandates the submission of Disturbance Recorder* (DR), station Event Logger (EL), Data Acquisition System (DAS) within 24 hrs of the event.

A.19.3 During FTC process, cases of non-availability of station event logger and non-standardisation of recording instruments have been observed. Undertaking received in this regard from UP & Punjab is attached with **Annexure-XXIII**.

A.19.4 Data of recording instruments (DR/EL) are very helpful in grid event analysis and is being used in availability verification of transmission lines. Complete and conclusive analysis of any grid event is not possible without these recording instruments and thus their standardisation is very important.

A.19.5 Therefore, availability of disturbance recorder with standardisation, time sync and correct nomenclature and station event logger need to be ensured by users at the station of their respective control area.

A.19.6 Deliberation on this subject was done during 50th PSC meeting. Details were received from UP (Lucknow & Gorakhpur zone) & Haryana only.

A.19.7 In view of above, all the constituents were requested share the updated details w.r.t. availability and standardisation of disturbance recorder and event logger at the station of their respective control area in format attached as **Annexure-XXIII**.

Decision taken by Forum:

Forum requested all the members to share the status of their control area and ensure the standardisation of recording instruments at all the stations of their control area.

A.20. Analysis of load loss event occurred at 13:53 hrs on 17th June 2024 (agenda by NRLDC)

A.20.1 NRLDC representative highlighted the 17th June grid event in brief:

A.20.2 At 13:53 Hrs of 17th June 2024, Northern Region demand experienced a reduction in load of the order of 16.5 GW. The incident occurred immediately after tripping of both bipoles of +/-800 kV HVDC Champa (WR) – Kurukshetra (NR) which was carrying 4,500 MW from the Western Region to Northern Region. After tripping of the HVDC link, low voltages were observed across the Northern region and the above load reduction occurred. Partial outage of the 765/400kV Aligarh (PGCIL) station occurred due to reported tripping of all five (5) nos 765 kV lines. In the incident, grid frequency increased from 50.03 Hz to 50.68 Hz and recovered back to ~50.0 Hz within 6 minutes.

A.20.3 Constituents were requested to share their inputs/observations on following points:

a) SLDCs may share the analysis of load reduction in their respective control area during the event. Kindly share details w.r.t. following points:
   - Supporting DR/EL if triggered during low and high voltage scenario at any substation may be shared.
   - Any analysis and feedback pertaining to distribution side may also be shared.
   - Categorisation of load affected (agricultural/industrial/domestic) during the event.
   - Any load relief occurred through under voltage load shedding (UVLS).
   - Whether load restored automatically or through manual intervention during the grid event.

b) ISGS and state control generating stations may share the analysis of generator response during the event. Kindly share details w.r.t. following points:
   - Primary response as per grid requirement during the event
   - PSS/AVR response and MVAr support as per grid requirement during the event

c) Some of the generating units also tripped during the event. List of the generating units tripped is attached as **Annexure XXIV**. Concerned constituents are requested to share the Disturbance recorder file (DR:.dat/.cfg), Station Event log-

ger file (EL), Reason of tripping (Relay flags, control panel annunciation etc.) and protection setting of protection operated.

A.20.4 Punjab representative informed that load of agriculture, domestic and industrial dropped in same proportions (20-30%).

A.20.5 UP representative informed that there was no feeder tripping occurred during the event and load recovered automatically.

A.20.6 NRLDC representative requested SLDCs to categorise the load based on consumer type i.e., agricultural, domestic, industry etc. and whether load is of motor or non-motor load (AC, DC) by taking feedback from the DISCOMs in your respective control area. This detail would be helpful in such type of event analysis in future.

A.20.7 NRLDC representative also requested members to share the DR/EL of the generating unit tripped during the event in their respective control area.

Decision taken by Forum:

Forum requested members to share the desired details and discuss with DISCOM regarding categorisation of load in your respective control area.

A.21. Analysis of the tripping events occurred during April-2024 to June-2024 and status of remedial action taken (agenda by NRLDC)

A.21.1 NRLDC representative apprised that list of major tripping events occurred during April-2024 to June-2024 is attached as **Annexure-XXV**. Concerned constituents/utilities were requested to share the detailed analysis of the tripping elements along with status of remedial action taken/to be taken.

A.21.2 As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event and as per IEGC clause 37.2 (e), the user shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC

Tripping Events

A. Multiple elements tripping at 220kV Hissar(BBMB) 07th May 2024, 11:16 hrs

1. **Discussion during the meeting:**

a. Brief of the event shared by NRLDC representative based on detail available is as follows:

- 220/132/33kV Hissar(BB) S/s has double main bus scheme at 220kV level.
- During antecedent Condition, all the 220kV feeders (Chirawa ckt, Jin-dal Steel ckt, Sangrur ckt-1 & 2, Bhiwani ckt-1 & 2, Hissar I/A ckt-1 & 2) and 220/132kV 100MVA ICT-1, 2 & 3 were connected to 220kV Bus-1. 220kV Bus-2 was not in service.
- As reported, at 11:16 hrs R-ph jumper of 220 KV Hissar-Sangrur (BB) Ckt-1 snapped from common point of 220kV Bus isolator no. 223 & 224 at Hissar(BBMB) S/s which caused R-N phase to earth fault.
- As reported, on this fault, Bus bar relay at 220kV Hissar(BBMB) didn't operate. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 & 2 tripped in Zone-4 from Hissar(BB) end and other all 220kV feeders (Chirawa ckt, Jindal Steel ckt, Sangrur ckt-1 & ckt-2, Bhiwani ckt-1 & ckt-2) tripped from the remote ends in Zone-2 protection operation.
- During the same time 220 KV Barnala-Sangrur (BB) Ckt also tripped (exact reason of tripping need to be shared).
- As per DR of 220 KV Hissar(BB)-Hissar IA(HV)(end) (BBMB) Ckt-2, R-N phase to earth fault (fault current Ir=~7.4kA) is observed in zone-4 with fault clearing time of 360ms.
- As per DR of 220 KV Hissar-Sangrur(end) (BB) Ckt-1, R-N phase to earth fault converted into R-Y phase to phase fault (fault current Ir=~1.3kA, Iy=~1.3kA) is observed in zone-2 with fault clearing time of 560ms.
- As reported, Isolator status of 220 KV Hissar-Sangrur (BB) Ckt-2 provided in the Bus bar relay settings were incorrect (status of isolator no. 227 & 228 were incorrect). Due to this, false differential current generated in Bus Bar Z-2 and differential current supervision feature of relay picked up which led to blocking of Bus bar relay.
- Due to tripping of all the elements connected to 220kV Bus-1 (220kV Bus-2 was not in service) at Hissar(BB), the complete 220/132/33kV Hissar(BB) S/s became dead.
- As per PMU at Hissar (PG), R-N phase to earth fault with fault clearing time of 360ms (delayed) is observed.

- As per SCADA, change in demand of approx. 150MW is observed in Haryana control area. But as reported by BBMB, load loss of 207MW occurred in Haryana control area.
- Major observations:
  - Bus bar differential relay settings need to be reviewed and correct operation of the same need to be ensured.
  - Reason of delayed clearance of fault need to be analysed and shared.
  - Exact reason of tripping of 220 KV Barnala-Sangrur (BB) Ckt need to be shared.
  - DR/EL (.dat/.cfg file) of all the tripped elements along with tripping report of the event need to be shared (from Haryana end).
  - Remedial action taken report to be shared.

b. BBMB representative and others informed the following:

- 220kv Bus-II was taken under shutdown and all the elements were connected to 220kV Bus-I.

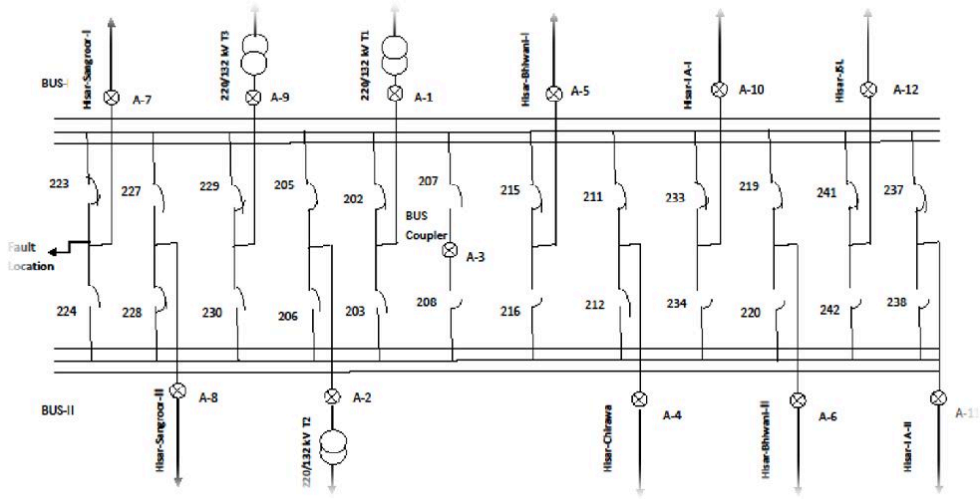


Figure: SLD diagram of 220kV Hissar(BBMB)

- At 11:16 hrs, R-N phase to earth bus fault occurred on 220kV Bus-1 due to snapping of bus post jumper of 220kV Hissar-Sangrur ckt-1.
- On this fault, 220kV bus bar protection didn't operate, and fault cleared with the tripping of all the 220kV lines from remote end in Z-2.
- During investigation, alarm of CT supervision was found. The alarm was there due to incorrect status of bus-II isolator of 220kV Hissar-Sangrur ckt-2 which was coming as close instead of open.

- As per protection logic implemented, there was logic of bus bar protection blocking on CT supervision alarm. Therefore, during the event, bus bar protection was in blocked condition, and it didn't operate on actual bus fault.
- As a remedial action, logic of bus bar protection blocking on CT supervision alarm has been removed and correct status of all the isolators has been ensured.
- POWERGRID representative stated that they keep bus bar protection blocking on CT supervision alarm to avoid maloperation. And healthiness of isolator status is very important. It should be ensured for proper operation of bus bar protection.

NRLDC representative requested BBMB to ensure the healthiness of isolator status at all their stations and timely attend of any such important alarm need to be ensured. It was also highlighted that status of DR/El submission is not satisfactory of BBMB. Unavailability if DR/EL affected the proper analysis of the grid event on time. BBMB was reseeded to ensure timely submission of DR/EL.

BBMB agreed for the same.

NRLDC representative asked about the status of implementation of differential protection on short lines between Hissar(BB), Hissar_IA)(HR) & Hissar(PG). This issue has been discussed in previous PSC meeting also.

Haryana and BBMB representatives informed that consent has been accorded. Implementation and design part would get start soon.

2. ***Forum Recommendations:***

- *Ensure the healthiness of isolator status at all their stations.*
- *Timely attend of important alarms at stations needs to be ensured.*
- *Expedite the implementation of differential protection in short lines to avoid undesired operation of distance protection.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance*

Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.

B. Multiple elements tripping at 400/220kV Akal (RS) on 08th Jun 2024, 19:53 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - As reported, at 19:53hrs, due to heavy thunderstorm weather condition, B-ph jumper of dead-end tower of 220 kV Akal-Lala (RS) line got earthed at distance of 46.77 meter from Akal (RS) S/s which caused B-N phase to earth fault on 220 kV Akal-Lala (RS) ckt with fault current of Ib=~25kA from Akal (RS) end. As per DR at Akal (RS) end of 220 kV Akal-Lala (RS) ckt, R-N phase to earth fault in zone-1 with fault current of Ir=~25.4kA is observed (phase sequence issue).
      - As reported, during the same time, due to very high fault current, 400/220 kV 315 MVA ICT-3 and 400/220 kV 500 MVA ICT-4 tripped instantaneously on High Set overcurrent protection operation at Akal (RS) S/s. 400 KV Akal-Jodhpur (RS) Ckt also tripped from Akal (RS) end on zone-5 (reverse) distance protection operation (not tripped from the remote end). Tie CB of 400/220kV 315MVA ICT-3 also opened along with tripping of 400/220kV 315MVA ICT-3 which separated 400kV Bus-1 & Bus-2.
      - As reported, at the same time, Bus coupler of 220kV Bus-1 & Bus-2 and all 220kV lines (Mulana, Rajgarh, Amarsagar, Giral, Bhensara(RS) ckt-1, Dangri ckt-1 & ckt-2) connected to 220kV Bus-2 at Akal(RS) S/s also tripped (exact reason of tripping yet to be shared). Due to tripping of Bus coupler, 220kV Bus-1 and Bus-2 separated at Akal (RS).
      - As reported, further at 19:55 hrs, due to bad weather conditions, Y-N phase to earth fault occurred on 400 KV Akal-Kankani (RS) ckt & 400 KV Akal- Jaisalmer2(Bhainsra) (RS) ckt (D/C lines on same tower) at a distance of approx. 3km from Akal (RS) S/s which led to tripping of both the mentioned lines (exact operation of protection yet to be shared).

- As reported, due to tripping of 400 KV Akal-Kankani (RS) ckt & 400 KV Akal- Jaisalmer2(Bhainsra) (RS) ckt, high voltage was observed on the 400 KV Akal-Barmer (RS) Ckt and line voltage reached up to 436kV on the same line and 400 KV Akal-Barmer (RS) Ckt tripped from Barmer(RS) end on over-voltage protection operation and also from Akal(RS) end on receiving DT from Barmer(RS) end.
- Due to tripping of 400 KV Akal-Barmer (RS) Ckt, 400kV Bus-1 lost its connectivity from grid and 400kV Bus-1 and elements connected to 400kV Bus-1 (400/220 kV 500 MVA ICT-1 & 2, 220kV Bus-1 and 220kV lines connected to 220kV Bus-1) became dead at Akal (RS) S/s.
- After all the above-mentioned tripping events, only 400kV Bus-2 remain charged through 400kV Akal-Ramgarh (RS) D/C.
- As per PMU at Jodhpur (RS), B-N phase to earth fault with delayed fault clearance time of 1080ms @19:53hrs and Y-B phase to phase fault followed by Y-N phase to earth fault with fault clearance time of 80msec and 240msec (delayed) respectively are observed.
- As per SCADA, change in Rajasthan wind generation of approx. 168MW is observed. As per SCADA, change in Rajasthan wind generation of approx. 690MW is observed.
- Major observations:
  - O/C protection settings of ICTs need to be shared.
  - Reason of delayed clearance of fault need to be shared.
  - Exact reason of tripping of all 220kV lines connected to 220kV Bus-2 (Mulana, Rajgarh, Amarsagar, Giral, Bhensara(RS) ckt-1, Dangri ckt-1 & ckt-2) at Akal(RS) S/s need to be shared.
  - SCADA data was not healthy during the event. Availability and healthiness of SCADA data need to be ensured.
  - Date and time sync issue is observed in the given DRs of the tripped elements. Issue needs to be resolved.
  - Remedial action taken report to be shared.

b. Rajasthan representative and others informed the following:

- 400/220kV GSS Akal has one & half breaker scheme at 400kV level and double main transfer bus scheme at 220kV level.

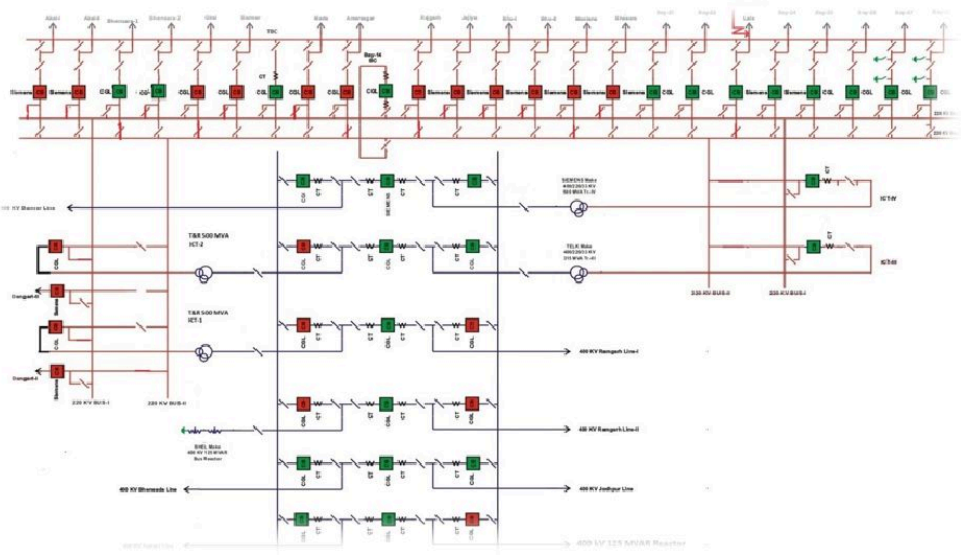


Figure: SLD diagram of 400/220kV Akal(RS)

- There was inclement weather condition prior to the event and all the elements didn't trip on single fault. There was multiple faults occurred at different location leading to tripping of multiple elements.
- At first instance, R-N fault occurred on 220kV Akal-Lala ckt, fault current was ~25kA. Line tripped instantaneously on operation of distance protection and fault got cleared.
- Further at 19:53:07:400hrs, B-N fault occurred on 220kV Akal-Bhainsra ckt-2, fault current was ~21kA and fault location was ~1.1km from Akal end. Line tripped instantaneously on operation of distance protection and fault got cleared.
- Further at 19:53:07:620hrs, B-N fault occurred on 220kV Akal-Bhainsra ckt-1, fault current was ~14kA and fault location was ~1km from Akal end. Distance protection initiated the tripping however, CB at Akal end failed to open.
- Bus bar protection is not healthy at 400/220kV Akal S/s therefore, there was no LBB operation. Bus bar protection is not healthy at 220kV Akal due to defect in 04 number of PUs.
- Fault cleared with the tripping of 400/220kV 315MVA ICT-3 & 500MVA ICT-4 at Akal (RS) and opening of 220kV bus coupler on O/C E/F protection operation. Fault got cleared and fault bus also got isolated with the system.
- Further at 19:55:51 hrs, 400kV Akal-Bhainsra line tripped on Y-B ph-ph fault. At 19:55:52hrs, 400kV Akal-Kankani ckt tripped on Y-N phase to earth fault.

- 400kV Akal-Barmer ckt tripped on overvoltage protection operation at Barmer end, DT received from at Akal end. 400kV Akal-Jodhpur ckt tripped on Z-4 distance protection operation at Akal end. There was no fault near to the 400kV bus. Tripping of 400kV Akal-Jodhpur ckt is suspected due to misbehaviour of CVT. Further review of Z-4 distance protection setting would be done.

NRLDC representative raised concern over non-operational of bus bar protection at many of the 220kV stations. Rajasthan was requested to expedite the commissioning of bus bar protection and priority may be given to frequently affected substations. Significant quantum of RE generation is connected at 400/220kV Akal (RS) therefore, healthiness of protection system is very important at this station. It was also highlighted that recording instruments (DR & EL) are not time synchronised at 400/220kV Akal S/s. Proper analysis of grid events can't be done without proper time stamping. Hence, time synchronisation also ned to be ensured on priority.

2. ***Forum Recommendations:***

- *Bus bar protection at 220kV bus at 400/220kV Akal shall be made operational at the earliest.*
- *Time synchronization of recording instruments (DR/EL) need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

C. Multiple elements tripping at 400kV Sainj (HP), 400kV Parbati2 & Parbti3 (NHPC) Stations on 07th May 2024, 16:17 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**

- Total generated power of Sainj HEP(HP), Parbati_2(NH) and parbati_3(NH) evacuates through 400 kV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt and 400 kV Parbati_3(NH)- Banala(PG) (PKTCL) Ckt via 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt and 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt.
- During antecedent condition, only 50MW Unit-1 at Sainj HEP(HP) was running (generating approx. ~30MW) and 50MW Unit-2 at Sainj HEP(HP), all four units (4*250MW) at Parbati_2(NH) and all four units (4*130MW) at Parbati_3(NH) were not in service.
- As reported, at 16:17hrs, 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt tripped on B-N phase to earth fault with fault distance of 1.808km from Sainj end. From initial patrolling it was observed that a Pine Tree admeasuring approx. 50m fell from an uphill position outside the transmission line corridor. The tree weight resulted in simultaneous failing of cross arm of Tower Location No. 7 of 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt as well as snapping of conductor leading to tripping of line.
- As per DR of 400 KV Parbati_3(NH) (end)-Sainj(HP) (PKTCL) Ckt, B-N phase to earth fault is observed with delayed fault clearance time of 400ms and fault current of 7.105kA from Parbati_3(NH) end. Fault was sensed in zone-2 from Parbati_3(NH). Due to non-receipt of carrier signal from remote end, three phase trip command issued after Z2 time delay.
- As further reported, 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt also tripped at the same time (exact reason of the same yet to be shared). As per DR (time sync issue observed), B-N phase to earth fault with fault current of 1.212kA from Parbati_2(NH) end is observed.
- During the same time, 400 KV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt also tripped from Parbati_2(NH) end only on B-N phase to earth fault with fault distance of 22.5km and fault current of 1.304kA from Banala(PG) end. As per DR, fault was sensed in zone-1 at Banala(PG) end and carrier sent to Parbati_2(NH) end and line successfully auto-reclosed from Banala(PG). But as reported by NHPC, fault was sensed in zone-2 at Parbati_2(NH) end and upon receipt of carrier signal from Banala(PG) B-phase CB opened. But reclosing command

was not extended to B-phase CB after dead time, hence, line tripped from Parbati_2(NH) on operation of Pole discrepancy relay.

- As per PMU at Banala(PG), B-N phase to earth fault is observed with delayed fault clearing time of 400ms.
- As per SCADA, generation loss of approx. 30 MW at Sainj HEP (HP) is observed.
- As per SCADA, change in demand of approx. 170MW is observed in Haryana control area.
- Major observations:
  - Reason of delayed clearance of fault need to be shared.
  - DR time sync issue at Parbati_2(NH) needs to be resolved.
  - A/R issue at Parbati_2(NH) needs to be resolved at the earliest.
  - DR/EL (.dat/.cfg file) along with tripping report need to be shared from HP end. Main-2 DR of lines from NHPC end need to be shared.
  - Remedial action taken report to be shared.

b. NHPC representative and others informed the following:

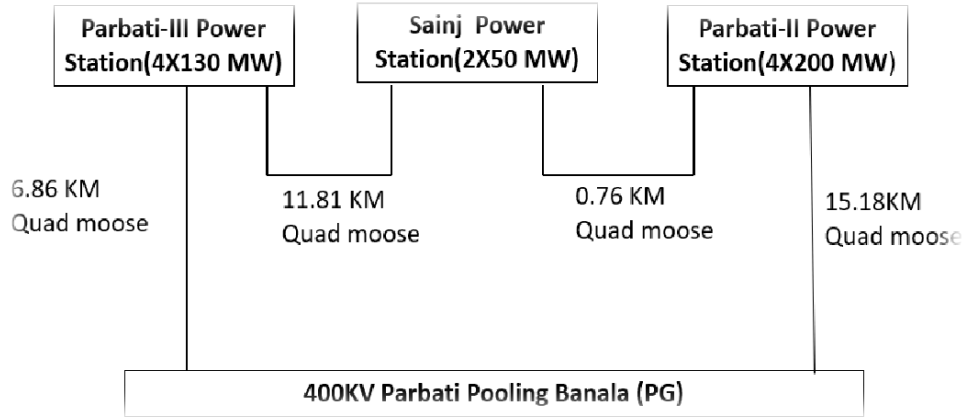


Figure: Connectivity diagram of Parbati generation complex

- At 16:17:44hrs, B-N fault occurred on 400kV Parbati2-Banala line and 400kV Parbati3-Sainj line.
- Parbati2 end sensed the fault in Z-2, carrier also received from Banala end. Line successfully auto reclosed from Banala end however, A/R closing attempt was not initiated at Parbati2 end. Line later tripped on pole discrepancy from Parbati2 end.
- Parbati3 end also sensed the fault in Z-2 however carrier didn't receive at Parbati3 end and line tripped with Z-2 time delay of ~350msec.

- Order has been placed to GE for reviewing of A/R operation during carrier aided tripping at Parbati2 end.
- PLCC has been checked and found healthy at Parbati3 end. It is suspected that PLCC is not healthy at Sainj end.
- 400kV Parbati2-Sainj line length is 0.7km and therefore implementation of differential protection has been planned on this line. Necessary materials have been arrived and implementation work would start soon.

NRLDC representative asked to share the fault locator details and highlighted the time sync issue in DR at Parbati2 end.

2. ***Forum Recommendations:***

- *Proper operation of protection system needs to be ensured. NHPC shall follow up with the relay engineer and taken necessary remedial actions to ensure proper operation of A/R scheme at Parbati2 end.*
- *NHPC and HPPTCL shall review the healthiness of PLCC at Parbati3 and Sainj end and take necessary actions to ensure their proper operation.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*
- *Standardisation of recording instruments (DR/EL) need to be ensured.*
- *Expedite the implementation of differential protection in* 400kV Parbati2-Sainj line.

D. Multiple elements tripping at 400kV Khedar(RGTPS) Station at 10th May 2024, 19:35 hrs

1. **Discussion during the meeting:**
   a. Brief of the event shared by NRLDC representative based on detail available is as follows:

- Generation of 600MW Unit-1 & 2 at Khedar TPS (total ~1072MW) was evacuating through 400kV Khedar(HR)-Fatehabad(PG) ckt (carrying ~858MW), 400kV Khedar-Nuhiyawali (HR) ckt (carrying ~174MW) only.
- At 19:35:24:255 hrs, R-N phase to earth fault occurred on 400kV Khedar-Nuhiyawali (HR) ckt. As per DR of 400kV Khedar-Nuhiyawali (HR) ckt, distance protection relay at both ends sensed R-N fault in Z-1 (Khedar end: Ir=12kA, 75km). R-ph A/R started from both ends.
- At 19:35:24:291 hrs, as per DR of 400kV Khedar(HR)-Fatehabad(PG) ckt, distance protection relay at Khedar end sensed B-N fault in Z-1(Khedar end: Ib=1.1kA, 8.5km) and initiated A/R in B-ph at Khedar end. Fatehabad(PG) end distance protection relay didn't sense this B-N fault and no operation occurred at Fatehabad end.
- At 19:35:24:758 hrs, as per DR of 400kV Khedar(HR)-Fatehabad(PG) ckt, distance protection relay at Khedar end initiated 3-ph tripping command and R & Y ph pole also opened.
- As R-ph autoreclosing was also going on in 400kV Khedar-Nuhiyawali (HR) ckt at this time and all 3-ph pole of 400kV Khedar(HR)-Fatehabad(PG) ckt opened, all the power now started evacuating through Y & B phase of 400kV Khedar-Nuhiyawali (HR) ckt. Current in Y & B phase started increasing, it increased to ~1850A by 19:35:25:153 hrs.
- At 19:35:25:376 hrs, R-ph pole of 400kV Khedar-Nuhiyawali (HR) ckt closed from both ends and line successfully autoreclosed.
- At 19:35:25:421 hrs, all 3-ph pole at Khedar end of 400kV Khedar(HR)-Fatehabad(PG) ckt closed and line successfully autoreclosed.
- At the same time, power swing also observed in DR of Unit-1&2 and evacuating lines.
- At 19:35:25:944hrs, 600MW Unit-1 tripped on pole slip protection operation.
- At 19:35:25:974hrs, 600MW Unit-2 tripped on pole slip protection operation.
- At 19:35:30:309 hrs and 19:35:30:350 hrs, over frequency protection also operated of Unit-1 & 2 respectively.

- 600MW Unit-1 at Khedar TPS revived at 04:26hrs on 11th May 2024 and Unit-2 have been kept out for inspection purpose.
- Further as reported, broken 220kV Isolator (489B) B-phase jumper of 220kV Bus Coupler-1 was already replaced.
- Major observations:
  - Reason of tripping of 400kV Khedar-Kirori (HR) D/C from Khedar end only need to be investigated further. Operation of distance protection relay doesn't seem correct. Proper A/R operation did also not occur. Distance protection relay at Khedar end of both circuits needs to be reviewed.
  - 400kV Khedar(HR)-Fatehabad(PG) ckt:
    - ✓ Only Khedar(HR) end distance protection relay of 400kV Khedar(HR)-Fatehabad(PG) ckt sensed B-N fault. During initiation of Z-1 in B-Ph, current in B-ph was ~600A and voltage was ~175kv (0.75pu). Whether distance protection relay have operated correctly?
    - ✓ During B-ph A/R operation at Khedar end, distance protection relay initiated tripping command for R & Y phase. As there was no fault in system during that time instant, reason of 3-ph tripping initiation need to be identified.
    - ✓ Further, after 1sec (dead time) of B-ph A/R start, all three phase autoreclosed. After 3-ph tripping, A/R lockout should have operated.

    In view of aforementioned points, operation of distance protection relay at Khedar end in 400kV Khedar(HR)-Fatehabad(PG) ckt need to be reviewed. Autoreclosed scheme also needs to be shared.
  - Details of remedial action taken also need to be shared.

b. Haryana representative and others informed the following:

- At 19:08 hrs, R-N fault occurred on 400kV Fatehabad-Nuhiyawali line. Line tripped after unsuccessful A/R operation on permanent nature of fault.

- Kirori end Main-2 Micom P442 relay of 400kV Khedar-Kirori D/C sensed the fault 400kV Fatehabad-Nuhiyawali line in Z-1 and initiated tripping.
- Further at 19:35hrs, R-N fault occurred on 400kv Khedar-Nuhiyawali line, A/R was unsuccessful on this line. During this same fault, Khedar end Main-2 Micom P442 relay of 400kV Khedar-Fatehabad line sensed fault in Z-1 and initiated A/R.
- During dead time of A/R operation of 400kV Khedar-Fatehabad line at ~500msec of dead time, all three poles of CB opened at Kedar end.
- In all the lines with no fault (400kV Khedar-Kirori D/C and 400kV Khedar-Fatehabad line), tripping was initiated by Main-2 Micom P442 relay. Main-1 relay Khedar end and relays at remote station didn't sense the fault.
- During investigation, it was found that resistive reach setting in Main-2 Micom P442 relay at Khedar end was very high (approximately 8-10 times as compared to remote end setting). Simulation testing was also conducted for same fault scenario at POWERGID lab, tripping initiation was found with this setting in Micom relay. It confirmed that higher resistive reach setting was leading to desired operation of distance protection relays at Khedar end.
- Revised settings has already been recommended to Khedar(RGTPS). Third party protection is also planned at Khedar(RGTPS).
- On 3-ph auto reclosing during dead time, it was informed that 1p/2p/3p A/R is enabled at Khedar end. However, 3-ph A/R during 1p A/R dead time is due to maloperation.
- Khedar(RGTPS) has been recommended to keep only 1 pole auto reclosing scheme.

2. ***Forum Recommendations:***
   - *Revised corrected protection settings of Main-2 Micome P4442 distance protection relay and A/R scheme at Khedar(RGTPS) end need to implemented at the earliest.*
   - *Healthiness and proper operation of protection system need to be ensured.*

E. Multiple elements tripping at 400kV Koteshwar(PG) on 17th May 2024, 17:21 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - 400kV Tehri (THDC) has double main bus scheme.
      - During antecedent condition, 250 MW TEHRI HPS – UNIT- 1, 2, 3 & 4 were not in service.
      - As reported, at 17:21 hrs, 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1 tripped on Y-B phase to phase fault. Fault distance was ~2.8km from Tehri(THDC) end. At the same time, 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2 tripped from Koteshwar(PG) end only.
      - As per DR of Tehri end of 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1, directional earth fault started followed by sensing Y-B-N fault in Z-1. Fault current was Iy=~4.9kA, Ib=~4.2kA. Total fault clearance time was ~760ms..
      - As per DR of Tehri end of 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2, distance protection sensed Y-B-N fault in Z-4, no tripping was initiated. Fault current was Iy=~4.8kA, Ib=~4.0kA.
      - As per PMU at Koteshwar(PG), Y-N phase to earth fault converted into Y-B phase to phase fault is observed with delayed fault clearance time of 760ms is observed.
      - As per SCADA no load loss/generation loss is observed during the tripping event (there was no generation at Tehri HEP during the event).
      - Major observations:
        - Exact location and nature of fault need to be shared.
        - Detail of protection operation in 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2 at Koteshwar(PG) end along with DR/ EL (.dat/.cfg file) of Koteshwar(PG) end need to be shared.
        - Reason for delayed clearance of fault needs to be shared.
        - Tripping report of the event need to be shared.
        - Remedial action taken report to be shared.

b. POWERGRID representative and others informed the following:

- 400KV Koteshwar(PG)-Tehri D/C line length is short, ckt-1 is of 14km and ckt-2 of 16km.

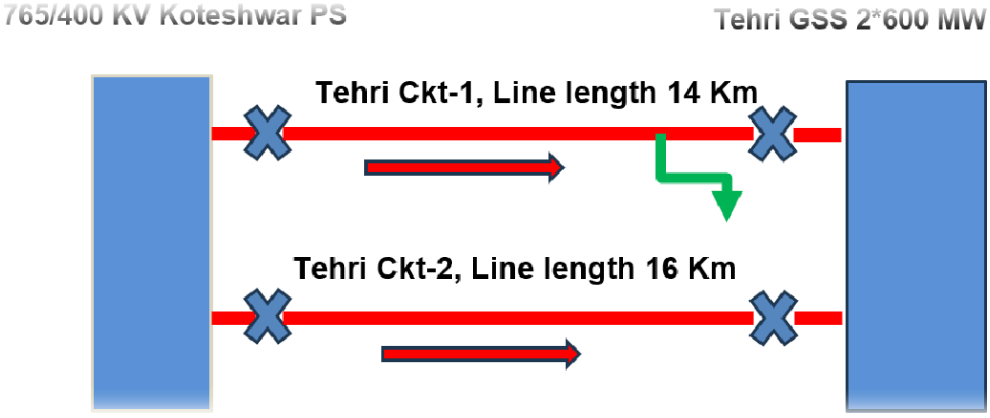


Figure: Connectivity diagram of Koteshwar(PG) & Tehri HEP

- There were two events of tripping of 400KV Koteshwar(PG)-Tehri D/C. One on 06th May 2024 and second on 17th May 204. Fault occurred due to vegetation fire at bottom of the line and fault was of high resistive nature.
- In both the events, fault was on line-1 at location ~2km from Koteshwar end. Line-1 tripped correctly in both the events.
- During 1st event, line-2 tripped due to overreach of distance protection at Koteshwar end. Koteshwar end sensed the fault in Z-1 and initiated tripping. During 2nd event, line-2 sensed fault in Z-2 however initiated tripping on receipt of carrier.
- During investigation it was found that PLCC at Koteshwar end received carrier by itself due to bandwidth issue in PLCC.
- As a remedial action, PLCC frequency at Koteshwar(PG) end has been modified and verified through simulation testing.
- No maloperation of PLCC was observed after modification and system is working properly.
- In long term, differential protection would also be implemented in line to avoid any cases of overreach of distance protection.

NRLDC representative stated that Tehri HEP is 1000MW generating station and PSP would also come in near future. Total capacity would be 2000MW after commissioning of PSP. In view of this, POWERGRID may plan for the differential protection in the lines on priority in near future.

POWERGRID agreed for the same.

2. ***Forum Recommendations:***
   - *Healthiness of protection system need to be ensured.*
   - *In view of short line length of* 400KV Koteshwar(PG)-Tehri D/C, *POWERGRID shall plan for the differential protection in the line on priority in near future to avoid overreach of distance protection.*

F. Multiple elements tripping at 400/220kV Bhiwadi(PG) on 13th May 2024, 17:11 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - 400/220kV Bhiwadi(PG) has one and half breaker bus arrangement at 400kV side and double main and transfer bus scheme at 220kV side.
      - During antecedent condition, 500 KV HVDC Balia-Bhiwadi (PG) ckt-1 & ckt-2 were carrying approx. 200 MW each.
      - As reported, at 07:11hrs, B-N phase to earth fault occurred (exact location of fault yet to be received).
      - As per DR of Bhiwadi(RS) end, 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 and 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt tripped from Bhiwadi(RS) end only on back up E/F protection operation. Line didn't trip from Bhiwadi(PG) end.
      - At the same time, 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) D/C, 400KV Bhiwadi-Neemrana (PG) Ckt-1, 400 KV Bassi-Bhiwadi (PG) Ckt, 500 KV HVDC Balia-Bhiwadi (PG) D/C, 220 KV Neemrana(PG)-Neemrana(RS) (RS) Ckt-1 and 220kV lines from Bhiwadi(PG) to Rewari(HV) (HV) D/C, HSIIDC Bawal(HV), Mau(HV) also tripped (exact reason for multiple elements tripping yet to be received).
      - As per PMU at Bhiwadi(PG), at 07:11 hrs, B-N phase to earth fault with no A/R operation is observed with delayed fault clearing time of 1480ms.
      - As per SCADA, change in demand of approx. 136MW in Rajasthan control area is observed.

- Major observations:
  - Exact reason, nature and location of fault need to be shared.
  - Reason for multiple elements tripping need to be shared.
  - Reason for delayed clearance of fault need to be shared.
  - DR/EL (.dat/.cfg file) along with tripping report for each element need to be shared from both the ends.
  - Remedial action taken report to be shared.

b. POWERGRID representative and others informed the following:

- 400/220kV Bhiwadi(PG) has one and half bus scheme at 400kV level.

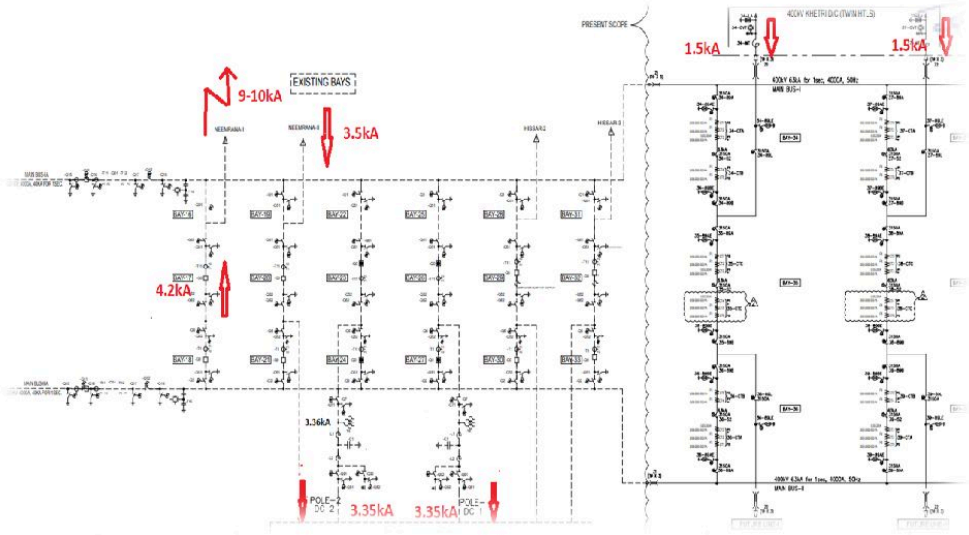


Figure: SLD of 400kV Bhiwadi(PG)

- Fault occurred on 400kV Bhiwadi-Neemrana ckt-1. Fault occurred due to tree touching with the line during tree shifting by villagers.
- Main-2 relay (REL 670, ABB make) at Bhiwadi(PG) end didn't sense the fault and Main-1 relay (Siemens make) read very low fault current ~1.2kA and didn't sense in Z-1/Z-2. Physically fault was in Z-1 from Bhiwadi(PG) end.
- As fault didn't clear on time, adjacent lines tripped on back up protection (Z-2 distance protection, DEF) and at last 400kV Bhiwadi-Neemrana ckt-1 tripped on DT received from Neemrana end.
- During investigation, Main-2 relay was found in hanged condition and Ir value of S1 CT core was found earthed due to which fault current was bypassing through it and Main-1 relay sensed very low fault current.

- Main-2 relay was replaced with the new healthy relay on the same day and issue was flagged to the OEM to find out the root cause to avoid such incident in future. Issue related to CT earthing was resolved and Main-1 relay is also working properly.

NRLDC representative asked whether any alarm system is in placed in such cases of relay hanging. So that it can be attended on priority.

POWERGRID representative informed that there is a logic of forming watchdog contact during issue in any relay which raise the alarm through other relays or in event logger. However, ABB relay as it was not OFF or not showing any error was in hanged condition (data was not updating), watchdog contact was not formed. Other members also flagged such issues faced in the ABB relays.

NRLDC representative requested POWERGRID and other members to flag the issues with the relay OEM so that such issues can be considered during relay designing process.

2. ***Forum Recommendations:***
   - *Healthiness and proper operation of protection system need to be ensured.*
   - *POWERGRID shall flag the issues faced with the relay-to-relay OEM and asked them to address these issues to avoid mis operations.*

G. Multiple elements tripping at 400/220kV Mandaula(PG) on 11th June 2024, 14:10 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - During antecedent condition, 400/220kV 500MVA ICT-1, 2, 3 and 4 at Mandaula(PG) were carrying approx. 337MW, 337MW, 336MW and 337MW respectively with total loading of 1347MW (as reported by CPCC1, Power Grid). 104 MW GTG-1 & 2 and 122 MW STG at Pragati were generating approx. 85MW, 85MW and 109MW respectively with total generation of 279MW (as reported by SLDC Delhi). 212

MAIN BAY - 400/220 kV 500 MVA ICT-3 at Mandaula(PG) was under planned shutdown and ICT-3 was charged from transfer bus through isolator.

- As reported, at 14:10 hrs, fire was observed in isolator (transfer bus side) of 400/220 kV 500 MVA ICT-3 at Mandaula(PG). As per DR, Ir is reduced upto ~97.2A while Iy and Ib increased upto ~1.092kA and 1.107kA respectively and imbalance occurred in the system.
- As reported by CPCC1, Power Grid, the sequence of the event is as follows:
  a) At 14:10:24hrs: 400/220 kV 500 MVA ICT 2 at Mandaula(PG) tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=~615.8A, Iy=~488.8A and Ib=~498.3A before tripping of ICT-2.
  b) Due to tripping of ICT-2, loading of 400/220kV 500MVA ICT-1, 3 and 4 at Mandaula(PG) were increased to 457MW each.
  c) At 14:10:27hrs: 400/220 kV 500 MVA ICT 1 at Mandaula(PG) also tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=~1.668kA, Iy=~1.214kA and Ib=~1.237kA before tripping of ICT-1.
  d) Due to tripping of both ICT-1 & 2, loading of 400/220kV 500MVA ICT-3 and 4 at Mandaula(PG) were increased to 696MW each.
  e) At 14:10:29hrs: 400/220 kV 500 MVA ICT 3 at Mandaula(PG) hand-tripped due to melting of isolator which led to heavy spark-ing.
  f) Due to unavailability of ICT-1, 2 & 3, loading of 400/220kV 500MVA ICT-4 at Mandaula(PG) was increased to 1454MW.
  g) At 14:10:30hrs: 400/220 kV 500 MVA ICT 4 at Mandaula(PG) tripped on back-up over-current protection operation due to excess over-loading. As per DR, maximum current recorded was: Ir=~2.09kA, Iy=~2.136kA and Ib=~2.124kA (max MW loading of approx. 1480MW as per DR).
- As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed.

- As per SCADA, change in demand of approx. 1572 MW in Delhi Control area and change in generation of approx. 284 MW at Pragati are observed.
- As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed. Again, at 17:26 hrs, 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt tripped on R-N phase to earth fault with fault distance of 0.865km from Bhiwadi(PG) end.
- Major observations:
  - Reason of delayed clearance of fault need to be shared.
  - Healthiness of protection system and equipment's need to be ensured at Mandaula(PG).
  - The scheme for protection switch-over in case of switching any element to transfer bus needs to be shared.
  - Back-up E/F and back-up O/C settings of each ICT need to be shared.
  - Remedial action taken report need to be shared.

b. POWERGRID representatives and others informed the following:

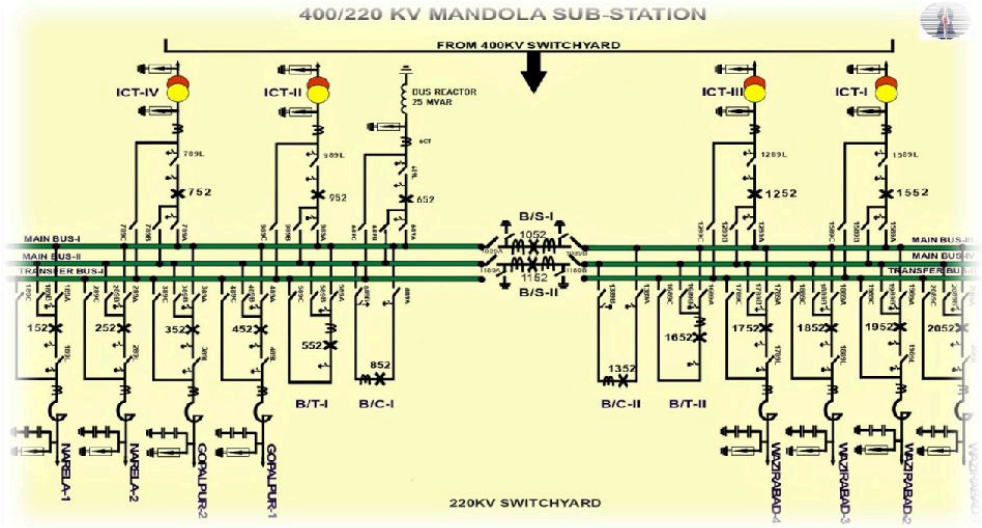


Figure: SLD of 400kV Mandaula(PG)

- 400/220kV ICT-3 was shifted to transfer bus for AMP work of 212 main bay of ICT-3.
- At 14:10 hrs, R-ph isolator of transfer bus got burnt and R-ph current stopped. This created unbalance in the system.

- ICT-2 & ICT-1 tripped on operation of back up E/F protection at 14:10:24 hrs and 14:10:27 hrs respectively.
- ICT-3 was hand tripped at 14:10:27 hrs and ICT-4 tripped on phase overcurrent protection operation as its loading got increased to ~1454MW after tripping of other ICTs.

NRLDC representative asked the reason of non-operation of DEF protection of ICT-3 as it was carrying more unbalance current. And whether protection shifting to transfer bay was ensured during shifting of ICT-3 on transfer bus. It was further asked about the status of healthiness of isolators.

POWERGRID representative informed that protection shifting was done as per standard operating procedure and DEF protection also started but it got reset. On isolator status, it was informed that isolators are old, and their replacement work would start from 1st week of August 2024. Compete overhauling of 400/220kv Mandula(PG) would also be planned in coordination with DTL.

2. ***Forum Recommendations:***

- *Healthiness and proper operation of protection system need to be ensured.*
- *Healthiness of equipment's and their proper maintenance need to be ensured. POWERGRID shall replace old isolators at their substations on priority.*

H. Multiple elements tripping at 500kV Mahindergarh(APL) on 17th May 2024 at 16:21hrs:

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - During antecedent condition, 500 KV HVDC Mundra-Mahindergarh(APL) bipole was carrying total ~1500MW.
      - As reported, at 16:21 hrs, 500 KV HVDC Mundra-Mahindergarh(APL) bipole blocked due to RPC No AC Filter alarm raised at Mohindergarh end. After thorough investigation, it was observed that RCI changeover

has been initiated from RCI B to RCI A ACTIVE and after that "RPC SET RANGE EXCEED" event triggered followed by RPC NO AC FILTER, which caused blocking of both the Poles.

- As per PMU at Mahinedergarh(PG), no fault in system is observed, fluctuation voltage is observed.
- Due to blocking of both the poles of 500 KV HVDC Mundra-Mahindergarh(APL), there was power order reduction of ~1500MW. As per HVDC Mundra-Mahendergarh SPS, SPS case-3 would have operated and as per action in this case, load relief in UP, Haryana, Punjab, Rajasthan & Delhi and generation relief at Mundra Stage-III is desired.
- Details of load relief not received from SLDCs. Communication has been sent to all the SLDCs to share the quantum of load relief occurred in their respective control area due to SPS operation. SCADA data at NRLDC was not healthy during the event time.
- As per detail BCU log of Mahindergarh end, DTPC fail alarm is recorded except Dhanonda. Any communication related issue needs to be rectified at the earliest to ensure proper SPS operation.
- Both RCI System was restarted, and the system was normalized.
- Major observations:
  - Why did SPS not operate?
  - Remedial action taken report to be shared.

NRLDC representative raised concern over non-operation of SPS. Being an important inter regional link, healthiness of protection system and correct operation is important to ensure security and reliability of the grid. It was also requested to plan mock testing of SPS at the earliest and resolve the issues.

ADANI representative agreed to review the healthiness of SPS system at their end and resolve the issues on priority.

2. ***Forum Recommendations:***

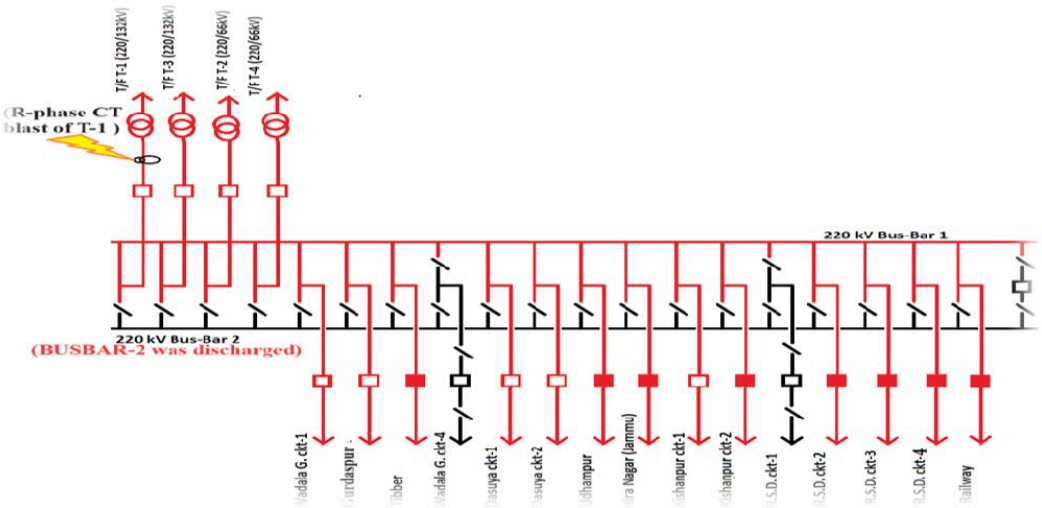
- *Healthiness and proper operation of protection system need to be ensured.*
- *Mock testing of HVDC Mundra-mahindergarh need to be conducted at the earliest.*

I. Multiple elements tripping at 220kV Sarna (PS) on 04th May 2024, 07:10 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - As reported, at 07:10 hrs, 220kV side R-Ph CT of 220/132kV Auto T/F-1 at Sarna (PS) blasted which created bus fault at both the 220kV buses at Sarna (PS).
      - Bus-bar protection is not available at Sarna (PS). Hence, all the 220kV lines connected to Sarna (PS) tripped on zone-4 protection operation at Sarna (PS) end and lines tripped from remote ends on zone-2 protection operation. From DR at Sarna (PS), it was observed that zone-4 operated after a delay of ~500ms.
      - Due to tripping of all the 220kV lines connected to Sarna (PS), complete blackout occurred at
      - As per PMU at Kishenpur(PG), R-N phase to earth fault with fault clearing time of 120ms followed by R-B phase to phase fault converted to R-Y phase to phase fault with delayed fault clearing time of 560ms is observed.
      - As per SCADA, no change in demand is observed in Punjab control area. But as reported by SLDC-Punjab, load loss of approx. 90MW occurred in Punjab Control area.
      - As per SCADA, change in demand of approx. 40MW is observed in J&K control area. But as reported by SLDC-J&K, no load loss occurred in J&K Control area.
      - Major observations:
        - As per Protection Philosophy of Northern Region, Zone-4 time delay setting should be 160ms where busbar protection is not available. Zone-4 time delay settings of lines at Sarna (PS) need to be reviewed.
        - Exact reason, location and nature of fault need to be shared.
        - DR time sync issue at Sarna (PS) needs to be resolved at the earliest.

- Reason of delayed clearance of fault need to be shared.
- DR/EL along with tripping report need to be shared from both the ends.
- Remedial action taken report need to be shared.

b. Punjab representative and others informed the following:



- Fault occurred due to damage of R phase CT of ICT-1. ICT-1 tripped on differential protection operation. ICT-2 also tripped on differential protection operation on fault due to fire flame.
- Fault was of bus fault nature. Bus bar differential protection at 220kV Sarna is also not in service.
- As bus bar protection was not there, all the PSTCL lines tripped in Z-4 with time delay of 160msec. Lines from RSD HEP tripped in Z-1 due to overreach of distance protection operation.
- Line from Kishenpur(PG) tripped from Kishenpur end in Z-2 as there Z-4 distance protection scheme at Sarna end has not revised to 160msec.

NRLDC representative asked the status of implementation of bus bar protection at 220kV Sarna (PS). POWERGRID was also requested to revise the Z-4 time delay setting of Kishenpur lines at Sarna end as 160msec till bus bar get operational.

Punjab representative informed that earlier bus bar scheme was centralised type. Now with the addition of new transformer bays total bays have become more than 18. OEM is not able to incorporate all the bays in centralised

scheme due to limitation of total number of bays. Therefore, procurement process for decentralised bus bar scheme has been started.

2. ***Forum Recommendations:***
   - *Punjab shall expedite the commissioning of new bus scheme.*
   - *POWERGRID shall revise the Z-4 time delay setting of Kishenpur lines at Sarna (PS) end as 160msec till bus bar get operational.*
   - *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

J. Multiple elements tripping at 220kV Goindwal(GVK) on 07th May 2024, 14:30 hrs

1. **Discussion during the meeting:**
   a. Brief of the event shared by NRLDC representative based on detail available is as follows:
   - During antecedent condition, 220 kV Sultanpur (PS)-Chohla Sahib (PS) Ckt, 220 kV Sultanpur (PS)-Patti (PS) Ckt and 220 kV Chohla Sahib (PS)- Patti (PS) Ckt were not in service.
   - As reported, at 14:30 hrs, a piece of stray flexible conductor came within induction zone of 220 KV Sultanpur (PS)- Goindwal TPS(PS) Ckt-2 as it fell on tower location no. 16 which led to tripping of this circuit with fault distance of 5km from Goindwal TPS end.
   - Distance Protection Relay (DPR) at Goindwal TPS end sensed the fault in zone-1 and line tripped immediately from Goindwal TPS end. But Distance Protection Relay at Sultanpur end detected power swing scenario and due to PSD block of DPR for 2 seconds (de-blocking time) at Sultanpur end, fault continued to feed through 220 KV Sultanpur (PS)- Badshahpur(PS) Ckt, 220 KV Sultanpur(PS)- Jamsher(PS) Ckt and 220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-1.
   - Badshahpur and Jamsher end DPRs issued trip command in zone-3 after 800ms and fault feeding stopped from these ends. But fault feed-

ing continued through 220 KV Sultanpur (PS)- Goindwal TPS(PS) Ckt-1 as Goindwal TPS end DPR did not pick up the fault in zone-3.

- This led to tripping of 270 MW Goindwal(GVK) - UNIT 1 & 2 on earth-fault protection operation (51 NGT) after 1 sec.
- As per PMU at Amritsar (PG), R-N phase to earth fault converted to 3-phase fault with delayed fault clearing time of 2120ms is observed.
- As per SCADA, change in demand of approx. 100MW is observed in Punjab control area.
- As reported by SLDC-Punjab, generation loss of approx. 500MW occurred at Goindwal TPS(PS).
- Major observations:
  - Exact nature of fault needs to be shared.
  - Reason of delayed clearance of fault need to be shared.
  - Protection co-ordination need to be ensured at Sultanpur (PS) and Goindwal TPS(PS).
  - Zone-3 settings at Goindwal TPS(PS) need to be shared and reviewed.
  - Earth-fault protection settings (51 NGT) of units at Goindwal TPS(PS) need to be shared and reviewed.
  - DR/EL along with tripping report need to be shared from both the ends.
  - Remedial action taken report need to be shared.

b. Punjab representative and others informed the following:

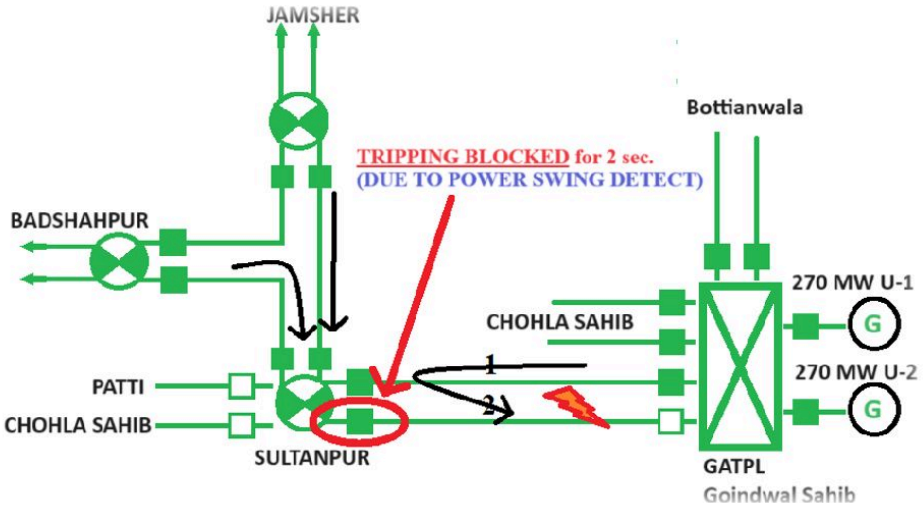


Figure: Network diagram during fault

- 220kV feeders to Patti and Chohla Sahib connected at Sultanpur were under shutdown. 220kV Goindwal-Chohla Sahib D/C were in operating in radial condition.
- Fault occurred on 220kv Goindwal-Sultanpur ckt-2 at location near to Goindwal(GVK). Line tripped from Goindwal end within the time however didn't trip from Sultanpur end.
- One of the relay was found hanged and another relay detected power swing and distance protection got blocked.
- 220kV Sultanpur-Badshahpur line and 220kv Sultanpur-Jamsher line tripped from remote end in Z-3. 220kV Goindwal(GVK) didn't sense the fault in Z-3.
- Later fault cleared after tripping of 220kV Goindwal-Sultanpur ckt-2 from Sultanpur end after deblocking of power swing.
- Units of Goindwal(GVK) tripped on back up O/C E/F protection operation. Ony definite time setting was implemented with 1sec time delay.
- Revised Z-3 distance protection setting and O/C E/F protection setting with IDMT characteristics were recommended to Goindwal(GVK). Confirmation *of implementation of the same yet to be received.*

NRLDC representative asked whether PSB should initiated in this network scenario with sufficient connectivity and optimal loading. Alarm system also should be there in case of relay hanging so that same can be attended.

Punjab representative informed that they have tested the settings through simulations, and it was detecting as PSB.

2. ***Forum Recommendations:***
   - *Healthiness and proper operation of protection system need to be ensured.*
   - *Revision of protection settings at Goindwal(GVK) end need to be confirmed.*
   - *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

K. Multiple elements tripping at 400/220kV Gr. Noida (UP) on 18th May 2024, 17:25 hrs

1. **Discussion during the meeting:**

   a. Brief of the event shared by NRLDC representative based on detail available is as follows:

   - 400/220kV Gr. Noida S/s has double main transfer bus scheme and feeds 220/132kV Noida Sec20, Noida RC Green, Noida Sec 129 sub-stations through 220kV feeders.
   - As reported, at 17:25hrs, B-ph CT at Gr. Noida end of 220kV Gr. Noida – Noida sec 20 ckt-1 damaged and R-ph isolator arm of 220kV Gr. Noida – Noida sec 20 ckt-1 also broked.
   - As per PMU at Dadri Thermal (NTPC), B-N and R-N fault with delayed clearance in ~600msec is observed.
   - On this fault, 220kV Gr. Noida – Noida sec 20 D/C tripped and supply to Noida Sec 20 S/s lost.
   - At the same time, 400/220 kV 315 MVA ICT 6 at Gr.Noida(UP) tripped on of PRD (Pressure Relief Device) and OSR (Oil Surge Relay) pro-tection operation.
   - As per SCADA SOE at NRLDC, 220kV Gr. Noida – Noida Sec 129 ckt and 220kV Greater Noida - Jalpura ckt also tripped at the same time.
   - As per SCADA, total change in demand of approx. 860MW occurred in UP control, area.
   - Partial supply of Noida Sec 20 restored at 18:00 hrs from 132KV Noida Sec 45 and at 18:06 hrs from Noida Sec 66.
   - Major observations:
     - Exact location and nature of fault need to be shared.
     - Reason of delayed clearance of fault need to be shared.
     - As per SCADA SOE, 220kV Gr. Noida – Noida Sec 129 ckt and 220kV Greater Noida - Jalpura ckt also tripped. Exact details of all the tripped elements during the incident along with their relay flags need to be shared.
     - Details of station wise quantum of load affected also need ot be shared.

- DR/EL of all the tripped elements during the incident need to be shared.
- Remedial action taken report need to be shared.

b. UP representative and others informed the following:

- Multiple faults occurred during the event due to damage of multiple CTs.
- 1st fault occurred due to damage of R-ph CT of 220kV Gr Noida-Noida Sec 20 ckt-2. Tripping initiated on operation of distance protection. However, shattered pieces of damaged CT led to the damage of Y-ph CT of same line during dead time and B-ph CT of 220kV Gr. Noida-Noida Sec 20 ckt-1.
- Noida Sec 20 ckt-1 tripped on distance protection operation and Noida Sec 20 ckt-2 tripped on back up overcurrent E/F protection operation.
- On this fault 220kV circuit to RC Green-I & II and Jalpura also tripped from their end in Z-2 distance protection operation and overreach of Z-1 distance protection. 400/220kv ICT-4 tripped on Bucholz protection operation due to oil surge during fault. Other ICTs had remained charged.
- Damaged CTs were replaced with the new healthy CTs.
- Partial discharge test of CTs more than 10 year old is planned in first phase. Later, based on PD results, Tan Delta testing of selected CTs would be done and if required, old CTs will be replaced.
- Instructions have been issued to maintenance teams regarding regular checking of CT oil levels, thermography of CT primary terminals and better maintenance of CT junction boxes and associated cables.
- Proposal have been given to implement differential protection in short lines to avoid undesired tripping due to overreach of Z-1 distance protection

2. ***Forum Recommendations:***

- *Healthiness and proper operation of protection system need to be ensured.*
- *Healthiness of equipment's and their proper maintenance need to be ensured.*

- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

L. Multiple elements tripping at 400/132kV Masoli(UP) on 29th May 2024, 15:57 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - 400/132kV Masoli(UP) S/s has one and half breaker bus scheme at 400kV voltage level side.
      - During antecedent condition, loading of 400/132 kV 200 MVA ICT 1,2&3 at 400/132kV Masoli(UP) was approx. 162MW (approx. 54MW for each ICT) (As per SCADA).
      - As reported, at 15:57 hrs, during inclement weather condition, towers of 132kV feeders to Naini and Karchhana from Masoli(UP) damaged which created B-N phase to earth fault on 132kV Masoli-Naini (UP) ckt followed by Y-N phase to earth fault on 132kV Masoli-Karchhana (UP) ckt.
      - B-N phase to earth fault on 132kV Masoli-Naini (UP) ckt cleared instantaneously (within 120msec as per PMU). CB of 132kV Masoli-Karchhana (UP) ckt could not open from Masoli(UP) end on Y-N phase to earth fault.
      - As CB of 132kV Masoli-Karchhana (UP) ckt failed to open, fault cleared with the tripping of 400/132 kV 200 MVA ICT 1,2&3 and 125 MVAR Bus Reactor at Masoli(UP) tripped on O/C E/F protection operation.
      - As per PMU at Allahabad(PG), B-N followed by Y-N phase to earth fault is observed with fault clearing time of 120msec and 840msec respectively.

- As per SCADA, change in demand of approx. 94MW is observed in UP control area. However, 100MW load loss is reported by SLDC-UP in UP control area.
- Major observations:
  - DR/EL (.dat/.cfg) for all the tripped elements need to be shared.
  - Reason for delayed clearance of Y-N phase to earth fault need to be shared.
  - Detailed report along with remedial action taken details need to be shared.

b. UP representative and others informed the following:

- 132kV Masoli-Naini ckt and 132kV Masoli-Karchhana ckt are on same tower (D/C tower) for major of the line length. Fault occurred on D/C tower portion due to which fault occurred on both the lines.
- Naini lien tripped from Masoli end within time but CB of Karchhana line got stuck end line didn't open.
- Fault cleared with the tripping of 400/132kv ICTs on overcurrent protection operation. 125MVAr bus reactor at 400kV Masoli also got tripped on operation of O/C E/F.
- Directional feature has been incorporated in O/C E/F protection of bus reactor.

NRLDC representative suggested to commission bus bar protection at 132kV level stations also where 132kV level is directly connected to 400kV network to ensure timely clearance of fault.

UP agreed for the same.

2. ***Forum Recommendations:***
   - *Healthiness and proper operation of protection system need to be ensured.*
   - *Healthiness of equipment's and their proper maintenance need to be ensured.*
   - *Up shall implement the bus bar protection at 132kv level at 400/132kV Masoli S/s.*

- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

M. Multiple elements tripping at 220kV Panipat(BBMB) on 03rd June 2024, 00:38 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - As reported, at 00:38 hrs, bursting of B-ph CT of 220kV bus coupler-2 at Panipat(BB) end occurred which created B-N phase to earth fault in busbar differential zone. The reason of bursting of the B-ph CT was observed to be some internal fault in Heptacare make CT installed on the bay on 29th November 2018.
      - The Numerical low Impedance type MiCom P741 Bus-Bar Differential Protection Scheme (ALSTOM make) sensed the fault and operated tripping all the elements on either side of bus coupler i.e. 220kV Bus-1 & Bus-2 at Panipat(BB).
      - As per PMU at Panipat(BBMB), Y-N phase to earth fault is observed with fault clearing time of 120ms. (phase sequence issue observed)
      - As per SCADA, load loss of approx. 565 MW (~445 MW in Haryana and ~120 MW in Delhi control area) is observed.
      - As reported by BBMB, 220kV Bus-1 at Panipat(BB) was charged by closing A-17 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-1 at 01:26 hrs and 220kV Bus-2 at Panipat(BB) was charged by closing A-18 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-2 at 01:36 hrs.
      - As remedial action taken, on 03rd June 2024 an old and used Rade Koncar make CT of same ratio i.e. 1200/1-1-1-1-1A was tested thoroughly and installed in place of bursted CT and bus coupler-2 was charged at 17:38 hrs on 03rd June 2024.
      - Major observations:
        - Exact location and nature of fault need to be shared.

- Reason of delayed clearance of fault need to be shared.
- DR/EL of all the tripped elements during the incident need to be shared.
- Remedial action taken report need to be shared.

b. BBMB representative and others informed the following:

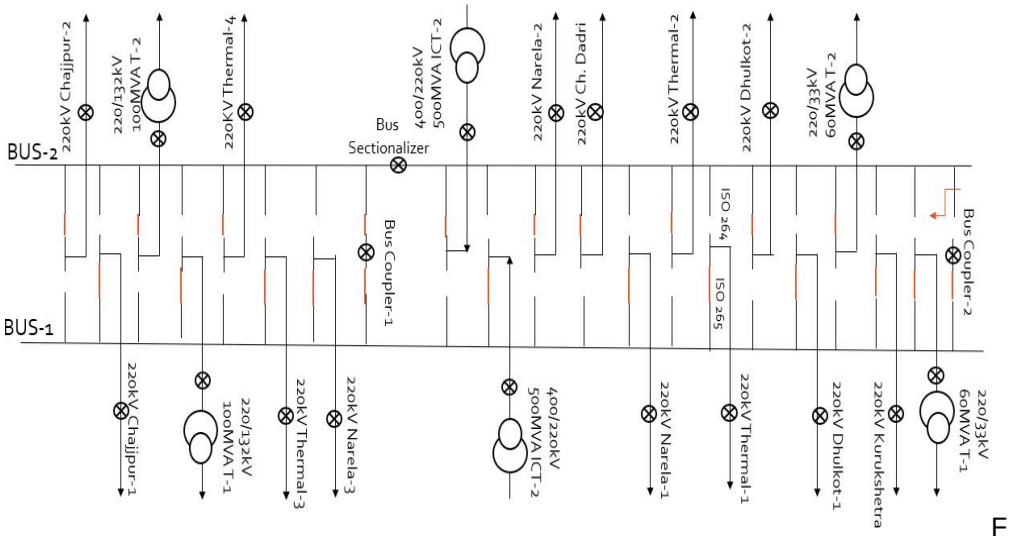


Figure: SLD of 220kV Panipat(BBMB)

- Both the 220kV bus were in service and bus bar protection was also in healthy condition.
- Fault occurred due to damage of B-ph CT of bus coupler connected to Bus-2. This led to bus fault on 220kv Bus-2.
- Bus bar protection operated however, elements connected to both the bus tripped.
- During investigation it was found that isolator status of 220kV Panipath TPS ckt-2 was incorrect. Status of Isolator to both the bus were coming as CLOSE.
- Isolator status was corrected, and operators were sensitised to inform the alarm coming on bus bar control panel to concern protection engineer so that alarms can be attended on time.
- Damaged CT was of Hepta make and same has been replaced with the spare healthy CT.
- feature has been incorporated in O/C E/F protection of bus reactor.

2. ***Forum Recommendations:***

- *Healthiness and proper operation of protection system need to be ensured.*
- *Healthiness of equipment's and their proper maintenance need to be ensured.*
- *Timely attend of important alarms at stations needs to be ensured*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

N. Multiple elements tripping at 220kV KTPS (RVUN) on 21st June 2024, 11:37 hrs

1. **Discussion during the meeting:**
   a. **Brief of the event shared by NRLDC representative based on detail available is as follows:**
      - 220kV KTPS(RS) has double main Bus arrangement at 220kV side.
      - During antecedent condition, power generation of 110 MW Unit-1 & 2, 210 MW Unit-3, 4 & 5 and 195 MW Unit-6 & 7 were 81MW, 95MW, 174MW, 150MW, 167MW, 171MW & 172MW respectively. 210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3 & station transformer (ST)-3 were connected to 220kV Bus-3 and 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 were connected to 220kV Bus-5 at KTPS(RS). 220kV Bus-3 and Bus-5 were coupled through isolator only.
      - As reported, at 11:37hrs, due to inclement weather conditions, 220 KV KSTPS-Ranpur (RS) ckt tripped on R-Y phase to phase fault at a distance of 12.49km from KTPS(RS) end. Zone-1 distance protection operated from both ends. As per PMU, R-N followed by Y-N phase to earth fault is observed with fault clearing time of 120ms and 120ms.
      - As reported, at 11:39hrs, due to inclement weather conditions, 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 tripped on B-N phase to earth fault (Ib=~ 14.1kA & Ib=~11.7kA from Kota(PG) and KTPS(RS) ends respectively) at a distance of 2.96km from Kota(PG) end. Zone-1 dis-

tance protection operated from Kota(PG) end. However, B-phase CB pole lagged in opening while clearing the fault from KTPS(RS) end which led to LBB protection operation at KTPS(RS). As per PMU, B-N phase to earth fault with delayed fault clearing time of 320msec is observed.

- Since 220kV bus-3 & bus-5 were coupled through isolator only, due to LBB operation all elements connected to 220kV bus-3 & bus-5 tripped (210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3, ST-3, 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1).
- Due to tripping of ST-3, auxiliary supply of 110 MW Unit-1 and 210 MW Unit-3 & 4 disrupted which led to tripping of Unit-1, 3 & 4 at KTPS(RS)
- At the same time, 220 KV Duni(RS)-Kota(PG) (RS) Ckt also tripped on R-N phase to earth fault (Ir=~21kA & Ir=~1.3kA from Kota(PG) and Duni(RS) end respectively) with fault distance of 75.2km from Kota(PG) end. Fault sensed in zone-1 from both ends. As per PMU, multiple R-N phase to earth fault with fault clearing time of 120ms, 120ms and 80ms.
- As per SCADA, no change in demand in Rajasthan control area is observed.
- As per SCADA, approx. 714 MW generation loss at KTPS(RS). However, 744 MW generation loss at KTPS(RS) is reported by SLDC-Rajasthan.
- As reported, the case for installation of bus coupler CB between 220kV Bus-3 and Bus-5 at KTPS(RS) is under process.
- Major observations:
  - 220kV Bus-3 and Bus-5 should be coupled using bus coupler CB instead of isolator.
  - Tripping report along with remedial action taken report need to be shared.
  - Time sync issue in DR of 220 KV Duni(RS)-Kota(PG) (RS) Ckt from Duni(RS) end.

b. RVUN representative and others informed the following:

- Fault occurred on 220kV Kota(PG)-KTPS ckt-1. Distance protection operation however, breaker got stuck and didn't open.
- Due to this, LBB operated and multiple elements tripped.
- Follow ups are being done to implement the bus coupler between 220kV Bus-3 & 5. There is delay in tendering process due to finalisation of specification.
- Existing bus bar to be extended for incorporation of future bus coupler in bus bar protection.

2. ***Forum Recommendations:***
   - *Commissioning of* bus coupler between 220kV Bus-3 & 5 need to be expedited.
   - *Healthiness and proper operation of protection system need to be ensured.*
   - *Healthiness of equipment's and their proper maintenance need to be ensured.*

A.21.3 Tripping analysis details of all the tripping discussed during 51st PSC meeting is attached as **Annexure-XXVI.**

A.22. Review and uniformity of df/dt (ROCOF) protection philosophy in Northern Region (agenda by NRLDC & NLDC)

A.22.1 NRLDC representative apprised that Multiple incidents of load shedding on df/dt (ROCOF) protection operation have been reported during recent past. Major operations were reported from Punjab control area. Delhi, Rajasthan & UP have also reported load shedding on df/dt operation during some of the incidents. Incidents during which df/dt operation have reported is attached as **Annexure XXVII**.

A.22.2 In view of frequent incidents of tripping of distribution feeders on df/dt operation, analysis and review of df/dt operation is necessary. Communication was sent to SLDCs via mail to provide details of stage wise quantum of load relief on df/dt operation and protection setting adopted (average cycle, time delay etc.)

Name of State	df/dt settings (average cycles considered, time delay etc)	Maximum quantum of relief (MW)

		Stage-1	Stage-2	Stage-3

A.22.3 SLDCs were requested to share the adopted philosophy of df/dt protection and confirm whether uniform philosophy has been adopted throughout the state or not. Kindly share the details at the earliest so that analysis and review of df/dt operation and its philosophy may be done.

A.22.4 Details have been received from Haryana & Rajasthan and partial detail received from UP.

A.22.5 Punjab representative informed that during 23rd June event, only feeders mapped in stage-1 (df/dt) tripped except two stations. Relays at those stations would be reviewed.

A.22.6 It was further informed that average cycle considered for df/dt measurement have been revised from 8 cycles to 12 cycles and validation is being done for 05 cycles.

A.22.7 Delhi representative informed that average cycle considered for df/dt measurement is 10 in their control area.

A.22.8 Haryana & BBMB representative informed that there is slight difference in df/dt setting in different zones.

A.22.9 NRLDC representative stated that further review of df/dt protection setting also need to be done to ensure its uniformity and to avoid undesired operation and load loss.

A.22.10 NLDC representative asked whether disturbance recorder files were generated during all these events.

A.22.11 Punjab representative informed that during review it was observed that at some of the station's relays are of old version and files are not supporting in new software. And at some of the locations, tripping has not been mapped with DR triggering. Corrective actions are being taken to resolve these issues.

A.22.12 NRLDC requested all the members to ensure the DR triggering in case of tripping of feeders on df/dt. It would be helpful in analysis of the event.

A.22.13 NRLDC representative also highlighted that df/dt protection is not uniformly implemented at all India level. As intimated df/dt protection is not implemented in Eastern region and setting is different in Southern Region. Therefore, review of ROCOF protection need to be done to ensure its uniformity and its proper operation.

Decision taken by Forum:

Forum requested all the states to share the details related to df/dt protection in their control area. Based on those details, further discussion would be done in next PSC meeting to review the ROCOF (df/dt) protection and ensure its uniformity.

A.23. Review of procedure of approval of Protection Settings in Northern Region (agenda by NRPC Secretariat)

A.23.1 AEE (P), NRPC apprised that as per clause 14 (2) of IEGC 2023:

All users connected to the grid shall:

- *obtain approval of the concerned RPC for (i) any revision in settings, and (ii) implementation of new protection system;*
- *intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;*

A.23.2 In view of above, the procedure for approval of settings was finalized in the 49th PSC meeting wherein it was decided that NRPC Secretariat will provide the approval of protection settings.

A.23.3 Further, the agenda was again discussed in 50th PSC meeting (held on 29.05.2024), wherein the procedure was revised (attached as **Annexure-XXVIII**). The same was also taken in the 50th TCC and 74th NRPC meetings (held on 28-29 June, 2024) for final approval of forum. However, NRLDC requested to deliberate the revised procedure again in the upcoming PSC meeting.

A.23.4 NRLDC has submitted request for revision of procedure as attached as **Annexure-XXIX.** The same was presented for discussion.

A.23.5 EE (P) asked about procedures followed by states for approval of protection settings.

A.23.6 UPSLDC representative informed that protection settings are accepted by SLDC. TRANSCO has delegated authority at competent level and accordingly TRANSCO

submit protection settings to SLDC during FTC.

A.23.7 UPPTCL highlighted that protection settings are done as per protection philosophy of NRPC, and hence taking approval of forum may not be required in each case. However, approval of forum may be taken when protection settings require deviation from NRPC philosophy.

A.23.8 Other representative also supported the view of UP.

A.23.9 After discussion, it was gathered that protection settings are reviewed by STUs and then these finalized settings are forwarded to SLDCs to allow the FTC.

A.23.10 AESL representative raised concern that some time in case of RE integration, it is not possible to send the settings before one month. NRLDC representative replied that before one month, only intimation of setting template may be sent. Extracted settings (actual settings) may be sent at the time of FTC procedure on portal.

A.23.11 After detailed deliberation, the finalized procedure of approval of Protection Settings in Northern Region is attached as **Annexure-XXX.**

Decision taken by Forum:

1. *NRLDC/SLDCs may accept protection settings and allow charging, if settings are as per protection philosophy of NRPC. However, approval of forum shall be taken when protection settings require deviation from NRPC philosophy.*
2. *Forum finalized the procedure of approval of Protection Settings in Northern Region as* ***Annexure-XXX.***

A.24. Discussion on Grid Sync Philosophy and Protection Scheme installed at IOCL (agenda by HVPNL)

A.24.1 220kV Substation Indian Oil Corporation Limited (IOCL) owned by IOCL is being fed from 220kV Substation Mundh. On the request of IOCL, extension of Load of M/s Indian Oil Corporation Limited (IOCL) from 78 MVA to 320 MVA at 220kV level from 220kV Substation Mundh was approved by office of Chief Engineer/ Planning vide R. No. 1988 /Ch-81/ HAP-184/ Vol-I dated 02.04.2024 **(Annexure-XXXI).**

A.24.2 In addition, another separate connectivity at 220kV level for additional load of 320 MVA from 220kV Substation Nain has been approved by office of Chief Engineer/Planning vide R. No. 1988/Ch-81/ HAP-184/ Vol-I dated 02.04.2024 (**Annexure-XXXII**).

A.24.3 IOCL vide reference no. IOCL/ HVPNLAF/ 64 dated 22.03.2024 requested for approval for operating the grid with their captive generation in parallel **(Annexure-**

XXXIII).

A.24.4 Technical details of their system are reproduced as under:

S.No.	Technical Attributes	Remarks
1.	Sanctioned Maximum demand capacity	70 MW 78 MVA)
2.	Load Extension Proposal	288 MW 320 MVA) (under WTD approval)
3.	Captive generation level.	33kV level.
4.	In house Generation capacity	462.5 MW
5.	Total Operating Load of System.	310 MW
6.	Base operating condition of Generating Machines	5GTs (30 MW) + 5 GTs (25 MW)
7.	Connectivity of 220kV with 33 kV generation level.	4 Nos of 220/ 33 kV 50/65 MVA Transformers.
8.	Continuous operating load.	50 MW-70 MW
9.	Ultimate load in case of multiple machine contingencies of IOCL end.	260 MVA (restricted by transformer capacities)
10.	Load shedding.	Available
11.	Momentary load during contingencies before actuation of load shedding.	310 MW
12.	Load post actuation of load shedding.	Limited by transformer capacities
13.	Power export Conditions (if any)	No

A.24.5 HVPNL conveyed that the proposal of IOCL containing the request for parallel operation with the grid was taken up by Central Electricity Authority (CEA) for further deliberation and examining the stability study for captive generation being owned by IOCL.

A.24.6 The meeting was held between members from CEA, CTUIL, Grid India, NRPC, HVPNL and IOCL on 03.06.2024 related to synchronization of grid with IOCL PRPC. As desired by CEA, the issue is required to be deliberated by the Protection

committee of NRPC (**Annexure-XXXIV**). The proposal containing the details of existing protection at HVPNL end and IOCL end along with other technical parameters is annexed as **Annexure-XXXV**.

A.24.7 IOCL representative briefed about the Panipat refinery and petrochemical complex expansion requiring additional power. This additional power is to be met from Grid.

A.24.8 As of now, the refinery loads are met by captive generation in islanded mode. In order to meet load demand, the synchronization of the captive generation with grid will make IOCL system more reliable.

A.24.9 NRLDC representative highlighted that IOCL has been drawing 78MVA load from Mundh S/s. However, for 310MVA, HVPNL needs to look in to connectivity issues.

A.24.10 RVUNL representative highlighted that in case of captive generation machine contingency or backing down of generation at IOCL, all power would be drawn from Mundh to IOCL.

A.24.11 In view of above, NRLDC representative mentioned that upstream ICTs (Jind) should not get overloaded.

A.24.12 IOCL representative replied that in case of backing down of generation, load shedding scheme is available. Further, he reiterated that extension of Load of M/s Indian Oil Corporation Limited (IOCL) from 78 MVA to 320 MVA at 220kV level from 220kV Substation Mundh was approved by office of Chief Engineer/ Planning vide R. No. 1988 /Ch-81/ HAP-184/ Vol-I dated 02.04.2024 **(Annexure-XXXI).**

A.24.13 IOCL representative informed that reconductoring has already been done from Jind to Mundh lines with HTLS conductor. Therefore, load extension has been granted from 78MVA to 320MVA.

A.24.14 HVPNL confirmed the same and informed that Jind substation will not get overloaded as reconductoring has been done. They concurred that IOCL may draw 78MVA from Mundh in normal condition and up to 320MVA in case of contingency of machine at IOCL Captive plant.

A.24.15 IOCL representative confirmed that there 33Kv system, through which they are going to synchronize the system, is able to cater the 320MVA load.

A.24.16 In view of above, Forum consented the synchronization for IOCL captive plant with grid.

Decision taken by Forum:

Forum accorded approval for proposal of IOCL regarding synchronization of its captive plant at Panipat refinery and petrochemical complex with the Grid for drawl of

78MVA load from Mundh and up to 320MVA in case of machine contingency at IOCL Captive plant.

A.25. Approval of protection settings in compliance of IEGC 2023 (agenda by POWERGRID)

A.25.1 POWERGRID representative apprised that vide mail dtd. 10.07.2024 it was intimated that 765kV Fatehgarh-II-Bhadla-II D/C line (Ckt-3 & 4) has been charged after FTC clearance by NRLDC (FTC case ID 1119119 &1119120). Protection settings have been accepted by NRLDC during FTC.

A.25.2 As per protection setting procedure approved in 50th PSC meeting, utility has to get final approval of settings in PSC meeting, therefore, implemented settings were presented (**Annexure-XXXVI**) for approval of forum.

A.25.3 Further, overvoltage stage-I settings of below lines have also been changes as per instruction of NRLDC. Same was also put up for approval of Forum.

Line name	Existing setting		Proposed modified setting		Switchable Line Reactor		Sequence
	Voltage setting stage I (%)	Time delay (sec)	Voltage setting stage I (%)	Time delay (sec)	At Fatehgarh-II	At Bhadla-II Or Bhadla	
765kV Fatehgarh-II-Bhadla-II Ckt-1	109	9	106	5	240	0	1
765kV Fatehgarh-II-Bhadla-II Ckt-2	110	15	107	6	240	0	2
765kV Fatehgarh-II-Bhadla-II Ckt-3	NA	NA	109	9	240	240	4
765kV Fatehgarh-II-Bhadla-II Ckt-4	NA	NA	110	15	240	240	6
765kV Fatehgarh-II-Bhadla Ckt-1	108	6	108	8	240	0	3
765kV Fatehgarh-II-Bhadla Ckt-2	110	12	110	12	240	0	5

A.25.4 NRLDC representative agreed with the proposal of POWERGRID regarding settings and had already approved the all settings.

Decision taken by Forum:

*Forum approved the protection settings enclosed as **Annexure-XXXVI** along with above-mentioned changes in overvoltage stage-I settings.*

A.26. Revised SPS for 2X315 MVA, 400/220kV ILTs at 400kV GSS Jodhpur (Agenda by RVPN)

A.26.1 AEE (P), NRPC apprised that SPS for 2X315 MVA, 400/220 kV ILTs at 400kV GSS Jodhpur (Surpura) was approved in 197th OCC meeting.

A.26.2 RVPN vide letter dated 28.06.2024 has submitted that due to increased loading in the Bilara, Jodhpur and Bhawad region, operational arrangement of lines and transformers has been changed at 400kV GSS Jodhpur. This has necessitated the revision of the approved and implemented SPS.

A.26.3 In this regard, RVPN has submitted the revised SPS for for 2X315 MVA, 400/220kV ILTs at 400kV GSS Jodhpur (Surpura). (**Annexure-XXXVII**).

A.26.4 NRLDC vide email dated 18.7.2024 commented on the proposal of RVPN. The same is attached as **Annexure-XXXVIII.**

A.26.5 Subsequently matter was discussed in the 221st OCC and RVPN requested to review the NRLDC comment.

A.26.6 In the PSC meeting, RVPN representative mentioned that they will submit the reply shortly.

Decision taken by Forum:

Forum requested RVPN to submit the reply on NRLDC comment and deferred the agenda.

Meeting ended with vote of thanks to the chair.

*****

Members of Protection Sub-Committee (FY 24-25)

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55	Fatehgarh Bhadla Transmission Limited	AGM- Protection and Metering	ashish.baviskar@adani.com
56	NTPC Vidyut Vyapar Nigam Ltd.	CEO	ceonvvn@ntpc.co.in
*	*Organizations from where nominations are not received for PSC, memebers of NRPC have been mentioned. Nomination for PSC forum may be sent at the earliest.*		

Annexure-P

51th Protection Sub-Committee Meeting on 23.07.2024 (10:30 AM)				
S. No	**Name**	**Designation**	**Organization**	**E-mail**
1	Sh. V.K. Singh	Member Secretary	NRPC	ms-nrpc@nic.in
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13	Er. Ranbir Singh Sharma	Assistant Director	BBMB	ranbir.bbmb@gmail.com
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19	Vijay Pal	Executive Engineer	RRVPNL	xenkmpt&s@rvpn.co.in
20	Rohit Kumar Jain	Assistan Engineer	RVPNL	ce.ld@rvpn.co.in
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22	Anu Gautam	General Manager	HPPTCL	gmcd.tcl@hpmail.in
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44	Amandeep Singh	Assistan Engineer/ SLDC (OP)	PUNJAB SLDC	ase-sldc@pstcl.org
45	Maaz	Assistant Engineer (T&C)	UPPTCL	setncmrt@upptcl.org
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47	Sachin Kumar	Sr. Manager (E)	NJHPS-Jhakri SJVN Ltd.	sachin_kr@sjvn.co.in
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Annexure-I

Status of perfomance indices report of April 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received (NR-1,2,3)
2	NTPC	Received (Dadri)
3	BBMB	Received (Transmission)
4	THDC	Received
5	SJVN	Received
6	NHPC	Received
7	NPCIL	Received from RAP (1-8) , NAP (1-2)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Received
11	UPPTCL	Received combinedly
12	PTCUL	Received
13	PSTCL	Received
14	HPPTCL	Received
15	IPGCL	Received (PPCL)
16	HPGCL	Not Recevied
17	RRVUNL	Received
18	UPRVUNL	Received from DTPS Anpara
19	UJVNL	Received (Khodri, chibro, vyasi, Dharasu)
20	HPPCL	Not Recevied
21	PSPCL	Not Recevied
22	HPSEBL	Not Recevied
23	Prayagraj Power Generation Co. Ltd.	Received
24	Aravali Power Company Pvt. Ltd	Received
25	Apraava Energy Private Limited	Received
26	Talwandi Sabo Power Ltd.	Not Recevied
27	Nabha Power Limited	Received
28	Lanco Anpara Power Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Not Recevied
32	Adani Power Rajasthan Limited	Received (Kawai)
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	AESL	Received
35	Tata Power Renewable Energy Ltd.	Received
36	UT of J&K	Recevied (Udhampur, Ramban, Bishnah, Budgam, Alusteng, Harwan, Glandi, Chowdi)
37	UT of Ladakh	Not Recevied
38	UT of Chandigarh	Not Recevied
39	ATIL, BKTL, FBTL	Not Recevied
40	INDIGRID	Received
41	POWERLINK	Not Recevied
42	ADHPL	Received
43	Sekura Energy Limited	Not Recevied
44	WUPPTCL	Received
45	SEUPPTCL	Received
46	Vishnuprayag Hydro Electric Plant (J.P.)	Received
47	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Status of perfomance indices report of May 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received (NR-1,2,3)
2	NTPC	Recevied (Unchahar, Tanda, Rihand)
3	BBMB	Received (Transmission)
4	THDC	Recevied (Tehri, Koteshwar HEP)
5	SJVN	Recevied
6	NHPC	Recevied
7	NPCIL	Recevied (RAP- 1-6), NAP (1-2)
8	DTL	Recevied
9	HVPNL	Recevied
10	RRVPNL	Not Recevied
11	UPPTCL	Recevied
12	PTCUL	Recevied
13	PSTCL	Recevied
14	HPPTCL	Recevied
15	IPGCL	Recevied (PPCL)
16	HPGCL	Not Recevied
17	RRVUNL	Recevied
18	UPRVUNL	Recevied (DTPS-Anpara)
19	UJVNL	Received (Dharshu, Uttrakashi. Khodri, chibro, vyasi)
20	HPPCL	Not Recevied
21	PSPCL	Not Recevied
22	HPSEBL	Not Recevied
23	Prayagraj Power Generation Co. Ltd.	Recevied
24	Aravali Power Company Pvt. Ltd	Recevied
25	Apraava Energy Private Limited	Recevied
26	Talwandi Sabo Power Ltd.	Not Recevied
27	Nabha Power Limited	Recevied
28	Lanco Anpara Power Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Recevied
30	Lalitpur Power Generation Company Ltd	Recevied
31	MEJA Urja Nigam Ltd.	Not Recevied
32	Adani Power Rajasthan Limited	Received (Kawai)
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	AESL	Not Recevied
35	Tata Power Renewable Energy Ltd.	Recevied
36	UT of J&K	Not Recevied
37	UT of Ladakh	Not Recevied
38	UT of Chandigarh	Not Recevied
39	ATIL, BKTL, FBTL	Recevied (ATIL)
40	INDIGRID	Recevied
41	POWERLINK	Not Recevied
42	ADHPL	Recevied
43	Sekura Energy Limited	Not Recevied
44	WUPPTCL	Recevied
45	SEUPPTCL	Not Recevied
46	Vishnuprayag Hydro Electric Plant (J.P.)	Not Recevied
47	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Reason and corrective action taken for Performance Indices less than Unity- April 2024 (based on submission by utilities)

RVPN

Case-1 220/132KV 160MVA BHEL Transformer at 220KV GSS HINDAUN on 10.04.2024

No. of Unwanted operation – 1

Reason of unwanted operation – REF protection operated. After testing it is found that Easun Reyrolle make MIT161 REF relay(static) is defective and mal operating.

Corrective Action taken – The relay has been replaced with numerical relay.

Case-2 220KV Bhilwara - HAMIRGARH Line at 220KV BHILWARA on 18.04.2024

No. of Unwanted operation – 1

Reason of unwanted operation – Tripping relay 86 operated due to contact shorting done by reptile.

Corrective Action taken – The dead reptile has been removed from the 86 relay and entry point has been sealed toprevent reptile entry in the relay.

Case-3 220KV Dausa- PGCIL Bassi line-II at 220KV GSS DAUSA on 25.04.2024

No. of Unwanted operation – 1

Reason of unwanted operation – QMho Distance Protection Relay operated on Power Swing indication. QMho being staticrelay, no DR is available. After testing NO result found abnormal.

Corrective Action taken – The relay is under observation, if such incident is repeated, the DPS relay shall be replaced.

UPPTCL

Case-1 160MVA ICT-1 at 220kV Bagpat Substation

No. of unwanted operation- 1

Reason of unwanted operation- OSR cable found damaged.

Corrective Action taken- faulty cable replaced.

Case-2 400kV Substation Sarnath, SPS issued command to gajokhar -1 & 2 on 26.04.2024

No. of unwanted operation- one on each line

Reason of unwanted operation- Defective Three phase transducer of 315MVA ICT-1 caused wrong operation of SPS

Corrective Action taken- Defective transducer has been replaced and mock testing done. The SPS is operating properly.

Case-3 DT received at Sarnath end on 400kV Anpara-3 to Sarnath line on 27.04.2024

No. of unwanted operation- 1

Reason of unwanted operation- No cause found.

Corrective Action taken – During shutdown, DT testing has been done, nothing spurious was found. No further wrong operation happened.

INDIGRID

Case-1 Tripping of 400kV Kadarpur(GPTL) - Sohna Road(GPTL) Ckt-2

No. of unwanted operation- 2

Reason of unwanted operation- Overvoltage protection operated due to maloperation of L90 Relay

Corrective Action taken- Matter is taken up with OEM for the early resolution.

NHPC

Case-1 Tripping of 132kV Sewa-2 to Kathua ckt-2

No. of unwanted opeartion-1

Reason of unwanted operation- due to improper PSL, line tripped on LBB operation on bus-II

Corrective Action taken- Revised PSL has been implemented.

JKPTCL

Case-1 at 220/132/33 kV substation udhampur

No. of unwanted operation -1

Reason of unwanted operation- not received from utility.

Corrective Action taken – Not received from the utility

PSTCL

Case-1 tripping of 220 kV Wdala Granthia-Sarna ckt.I on 9.4.2024

No of failure operation -1

Reason of failure operation- due to Y phase CVT damaged at Wdala Granthia line did not trip and tripped on zone -2 from Sarna end.

Corrective action taken- Before the CVT actually bursted/got damaged, both distance protection relays got blocked due to VT fail.

Case-2 tripping of 220 kV G-2-Bhari ckt & 220 kV 220 kV G-2-Ganguwal ckt on 11.4.2024

No of failure operation -1 on each circuit

Reason of failure operation- B-ph CT Damaged at 220 kV S/S G-2 both lines did not trip at G-2 end and tripped in zone -1 at other ends for both the lines. (bus bar protection did not operate at G-2).

Corrective action taken- Reason for non-operation of BBPS is being investigated. Matter has been taken with M/S Hitachi

Case-3 tripping of 220kV Bottianwala-GVK ckt.II on 11.4.2024 & 12.4.2024

No of unwanted operation-2

Reason of unwanted operation- Main II (D60) Mal-operated at Bottianwala end (Relay found to be defective as VT module is faulty)

Corrective action taken- Relay has been taken out of circuit & sent for repairs.

Case -4 tripping of 220 kV Mohali-Banur ckt on 24.4.2024 at Mohali end only.

No of unwanted operation-1

Reason of unwanted operation- Unwanted & incorrect E/F operation with Damaging of LA of transformer

Corrective action taken- Protection coordination issue of E/F relay. Matter has been resolved.

Case-5 tripping of 220 KV Sandhwan-Muktsar Line on 19.4.2024

No of unwanted operation-1

Reason of unwanted operation- Configuration issue regarding Z4 timer, line tripped on zone-4 at Sandhwan end, did not trip at Muktsar end.

Corrective action taken- In PSL Z4 logic was without timer. Corrective action has been taken.

Case-6 tripping of NABHA-220/66 kV, 160 MVA Power T/F T-4 on 23.4.2024

No of unwanted operation-1

Reason of unwanted operation- Buchholz Relay (Stage-I) operated due to Due to ingress of Rain Water in M.B of T/F Marshalling box

Corrective action taken- Rubber seal of marshalling box has been replaced.

Case-7 tripping of 220/66 kV, 100 MVA P.T/F T-6 at 220 kV S/S G-1 on 26.4.2024

No of unwanted operation-1

Reason of unwanted operation- REF tripping as R-ph CT & CB damaged of 66 kV Focal Point ckt.II

Corrective action taken- Transformer tripped on REF relay due to damaging of CT of 66 KV O/G line (through fault). Resistance in series of REF relay has been increased.

Case-8 tripping of 220/66 KV T/F T-2 100 MVA at 220kV s/S Majra on 26.4.2024

No of unwanted operation-1

Reason of unwanted operation- differential operation due to harmonic block setting issue

Corrective action taken Harmonics Block settings revised & issue resolved.

Case-9 tripping of 220 kV Sarna-Wadala Granthia ckt.IV on 9.4.2024

No of unwanted operation-1

Reason of unwanted operation- line tripped on zone-2 at Sarna end and zone-4 at other end.

Corrective action taken- Distance protection relay at Wadala Granthian was tested and relay was found to be operating correctly.

Case-10 tripping of 400 kV Muktsar-Makhu ckt.I on 19.4.2024

No of unwanted operation-1

Reason of unwanted operation- line tripped on DT received due to PLCC Cabinet (ABB mal functioning)

Corrective action taken- Main CB at Makhu tripped but line remained charged through Tie CB. No reason found in relays why DT signal was sent to remote end i.e Muktsar. Weather was rainy and stormy.

Case- 11 tripping of 220 kV Verpal-Udhoke ckt on 9.4.2024

No of unwanted operation-1

Reason of unwanted operation- tripping due to instantaneous over current setting.

Corrective action taken- On analyzing the data of relay it was found that instantaneous over current element was enabled. It has been disabled now.

Case-12 tripping of 220 kV Chogawan-Cvil Lines ckt.

No of unwanted operation-1

Reason of unwanted operation-Tripping on earth fault relay operation.

Corrective action taken- E/F relay operated at Chogawan end in stormy weather conditions. Relay has been tested & found ok.

Case -13 Incorrect operations due to unhealthiness of carrier.

Lines subjected- 220 kV Sunam-Bangan ckt., 220 kV Kotla Janga-Kartarpur ckt.I, 220 KV Kotlajanga- Kartarpur Ckt.II, 220KV Katorewala-Mukatsar (220) Line, 220KV Botianwala-Ferozepur Line., 220 kV Jamsher-Rehana Jattan ckt., 220 kV Sultanpur-Patti ckt., 220 kV Patti-Cholla Sahib ckt.

Due to unhealthiness of carrier, the concerned end getting tripped in zone-2 leading to delayed clearance.

Corrective action taken- Matter referred to communication wing. Timeline will be intimated as per their procurement plan.

Reason and corrective action taken for Performance Indices less than Unity- May, 2024 (based on submission by utilities)

ATIL

Case-1 500kV Mundra - Mohindergarh HVDC Pole-1,2 tripped due to No RPC Filter alarm at Mahendragarh end on 17.5.2024

No. of unwanted operation -1

No. of correct operation -1

Reason for indices less than unity - Alarm seems to be false as there is no such failure of reactive power compensation.

Corrective action taken- Detailed RCA under progress with OEM.

HVPNL

Case-1 220kV Panchkula (PG)-Pinjore ckt. -II

No of failures to operate-1

No. of correct operation-1

Reason for indices less than unity- Not received from utility

Corrective action taken- Not received from utility

PTCUL

Case-1 Tripping of 220kv Jafarpur-TSS

No. of unwanted operation -1

No. of correct operation -0

Reason for indices less than unity - Due to Malfunctioning of distance protection Main 1 relay

Corrective action taken- Main 1 relay taken out of service and line is being protected by main -2 relay.

INDIGRID

Case-1 Tripping of PARBATI2-BANALA (POOLING POINT)-I line

No. of unwanted operation -1

No. of correct operation -0

Reason for indices less than unity- Tripped at Parbati_2 end Due to B-Phase to Earth Fault and idle charged from Parbati Pooling Banala end.

Corrective action taken- Tripping happened due to relay maloperation. Only line portion under the ownership of PrKTCL. Further, Parbati end belong to NHPC. NHPC needs do relay testing to avoid such maloperation in future.

Case-2 Tripping of 400kV Parbati-II HEP Sainj HEP

No. of unwanted operation -1

No. of correct operation -0

Reason for indices less than unity- Tripped at Sainj end Due to B-Phase to Earth Fault and idle charged from Parbati-2.

Corrective action taken- Tripping happened due to relay maloperation. Only line portion under the ownership of PrKTCL. Further, Sainj end belong to HPPCL. HPPCL needs to do relay testing to avoid such maloperation in future.

UPPTCL

Case-1 Tripping of 160MVA T/F-3 at 220kV S/s Baraut

No. of unwanted operation -1

No. of correct operation -0

Reason for indices less than unity- erratic tripping due to REF relay was wrongly programmed as two winding transformer instead of auto transformer.

Corrective action taken- Relay has been correctly programmed as auto transformer

Case-2 tripping of 400kV Aligarh-Muradnagar line

No. of unwanted operation -1

No. of correct operation -4

Reason for indices less than unity- Auxiliary relay maloperated (85L/O)

Corrective action taken- attended and rectified

Case-3 tripping of 220kV shamli to GIS shamli line

No. of unwanted operation -1

No. of correct operation -0

Reason for indices less than unity- resistive reach setting issue.

Corrective action Taken- issue of reverse resistive reach setting has been resolved.

Case-4 tripping of 500MVA ICT-4 at 400kV Greater Noida

No. of unwanted operation -1

No. of correct operation -0

Reason for indices less than unity- Tripping due to PRD and OSR due to heavy jerk near ICT

Corrective action Taken- ICT was tested and taken into service.

Case-5 tripping of 220kV Khurja – Dadri line

No. of unwanted operation -1

No. of correct operation -0

Reason for indices less than unity- Maloperation of Main-2 relay

Corrective action taken- O&M wing is under process of replacement of relay.

Case-6 Tripping of 220kV parichha Mahoba line (Jhansi zone)

No. of unwanted operation -1

Reason for indices less than unity- tripping of 220kV parichha Mahoba line in zone-3 due to fault in 132kV Mahoba TSS line

Corrective action Taken- Primarily, nothing wrong found in settings at Parichha end during review. However, third party protection audit tender is about to be completed. This issue will be reviewed during the third-party protection audit.

Case-7 Tripping of Jhusi Sarangapur line (Prayagraj zone)

No. of unwanted operation -0

Reason for indices less than unity - Tripped from POWERGRID end only.

Corrective action Taken- Mistakenly, taken in unwanted operation of UPPTCL.

POWERGRID (NR-2)

Case-1 Tripping of 400kV KAITHAL-MALERKOTLA

NO of failure operation-1

Reason for indices less than unity- Line Auto-reclose on B-N fault from Malerkotla (PG) but tripped from Kaithal (PG) due to Continuous Trip initiated by LBB

Corrective action Taken- Proper greasing/cleaning of Contact Multiplier Relay done for Main and tie CB LBB and contact latch issue rectified.

Case-2 tripping of JALANDHAR 25 MVAR BUS REACTOR-1

No. of unwanted operation- 1

Reason for indices less than unity- Bus Reactor tripped due to REF relay maloperation caused by loose CT link. On inspection, R-ph HV TB-1-1 D-Link found loose in reactor MB caused by Reactor vibrations.

Corrective action Taken- All CT wiring in Reactor MB tightened after IR measurement. Other wiring also tightened in Reactor MB.

PSTCL

Case-1 Tripping of 500 MVA ICT-3 at 400 kV S/S Rajpura on 13.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- Mal-operation due to filter change of dry out system

Corrective action Taken- While changing the filter some oil got drained out thus resulting in operation of Buchholz. Concerned officials have been advised to do such activity after availing shut down

Case-2 Tripping of 220/66 kV, 100 MVA P.T/F T-1 at 220 kV S/S Mansa on 10.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- Moisture ingress due to rain led to tripping of ICT on Buchholz Relay

Corrective action taken – Now Buchholz relay has been covered properly.

Case-3 Tripping of 220 kV Bagha Purana-Moga ckt.I & II on 21.5.2024

No. of failure to operate -1 on each line

Reason for failure to operate- tripping from one end while no tripping at other end on phase to earth fault

Corrective action taken- Bus Bar Protection relay tripping was out of service due to isolator status issues. Issue will be attended after 15-09-24 after availing shut down. Till then time settings of Z4 made 160msec.

Case-4 tripping pf 220/66 kV, 100 MVA P.T/F T-2 at 220kV S/S Mohali on 5.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- Damage of control cable (Shorted) by squirrel in terminal box NCT

Corrective action Taken - Control cable replaced.

Case-5 tripping of 220 KV Sultanpur- Jamsher ckt on 8.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- CB Low gas pressure trip due to control cable damage

Corrective action Taken- Spare strands of control cable used to attend the problem.

Case-6 tripping of 220/132 kV, 100 MVA P.T/F T-1 at 220 KV S/S Sultanpur on 11.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- B phase Over current operation

Corrective action Taken - As per field report nothing abnormal found on testing of relay.

Case- 7 tripping of 220kV Badshahpur-Sultanpur ckt on 7.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- tripped at Badshahpur end in zone-3 and did not trip at other end

Corrective action Taken - Due to PSB Sultanpur –GATP Goindwal Sahib Circuit-2

Case- 8 tripping of 220KV Botianwala-Mastewala ckt-1 on 10.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- tripped at Botianwala end with O/C E/F and did not trip at other end

Corrective action Taken - *As per field report nothing abnormal found on testing of standalone E/F relay at Botianwala end.*

Case -9 tripping of 220 kV Bangan Chajali Ckt 1& II on 11.5.2024

No. of unwanted operation- 1 on each line

Reason for unwanted operation- Bus Bar mal operation

Corrective action Taken - It was reported wrongly as mal-operation because 220 KV CT of Banga-Chajjli ckt-2 got damaged at Banga end. Simultaneously both busses along with bus coupler tripped. Bus coupler settings are being reviewed.

Case-10 tripping of 220/66KV 100MVA T/F T-3 at 220KV Ikolaha on 18.5.2024 & 19.5.2024

No. of unwanted operation- 2

Reason for unwanted operation- Faulty Buchholz relay operated

Corrective action Taken - Bucholz relay was replaced.

Case- 11 tripping of 220 kV Fatehgarh Churian - Kotli Surat Malhi Circuit on 15.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- O/C Master operated at Fatehgarh Churian and did not trip at other end.

Corrective action Taken - As per field report nothing abnormal found on testing of standalone E/F relay at Fathegarh Churian end.

Case – 12 tripping of 220 kV Gurdaspur - Sarna Circuit on 4.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- tripped in zone -2 at Gurdaspur end & zone -4 at Sarna end.

Corrective action Taken - Distance protection relay at Gurdaspur was tested and relay was found to be operating correctly.

Case -13 Tripping of 220 kV Sarna-Wadala Granthian ckt.I on 4.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- tripped in zone -2 at Wadala Granthian end & zone -4 at Sarna end.

Corrective action Taken – Distance protection relay at Wadala Granthian was tested and relay was found to be operating correctly.

Case- 14 tripping of 220 kV Dasuya-Sarna ckt.I & II on 4.5.2024

No. of unwanted operation- 1 on each line

Reason for unwanted operation- tripped in zone -2 at Dasuya end & zone -4 at Sarna end.

Corrective action Taken - Time settings is 500msec at both ends for Z2 & Z4. Requires revision to 160msec at Sarna end as BBPS is not operational.

Case – 15 tripping of 160MVA P/T/F T- 2 at 220 kV S/S Malerkotla on 21.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- tripped due to defective OTI Gauge

Corrective action Taken - OTI gauge has been replaced

Case- 16 tripping of 220 kV BaghaPurana-Bajhakhana ckt.II

No. of unwanted operation- 1

Reason for unwanted operation- tripped as CT Polarity of Bajakhana ckt-2 at Baghapurana was wrong

Corrective action Taken - CT Polarity has been corrected.

Case- 17 220 kV Rashiana-Makhu ckt.I on 29.5.2024

No. of unwanted operation- 1

Reason for unwanted operation- tripped on zone-1 at Makhu and tripped on earth fault at other end.

Corrective action Taken - Back up E/F relay tripped before Distance Protection relay-Relay coordination issue has been resolved**.**

Case- 18 Incorrect operations due to unhealthiness of carrier.

Lines subjected- 220KV RehanaJattan-Hoshiarpur ckt., 220 kV Gaunsgarh-Dhanansu ckt.I, 220KV Patti-Algon Kothi ckt.I , 220KV Patti-Algon Kothi ckt.II, 220KV Patti-Rashiana ckt., 220 kV Dharamkot-KotKaror ckt.II, 220 KV Rajpura-Banur ckt , 220 kV Bajhakhana-Baghapuran ckt.I, 220 kV Bajhakhana-Baghapuran ckt.I, 220 kV Bajhakhana-Lehra ckt.I, 220 kV Khassa-Civil Lines ckt., 220 kV Khassa-Chogawan ckt.

Due to unhealthiness of carrier, the concerned end getting tripped in zone-2 leading to delayed clearance.

Corrective action taken- Matter referred to communication wing. Timeline will be intimated as per their procurement plan.

UJVNL

Case-1 tripping of 220kV Khodri- Majri circuit-1

No. of unwanted operation-1

Reason for unwanted operation- Terminal Box of relay protection panel was found damaged.

Corrective Action taken- wire was replaced.

Case-2 220kV chibro to Khdodri ckt-1 & II

No. of unwanted operation-1 on each line

Reason for unwanted operation- fault in 220V DC distribution board caused to tripping due to DC failure as there is only one DC source at chibro end.

Corrective Action taken- tender approval for installation of 220V double dc source been received**.**

POWERGRID-NR-3

Case-1 tripping of 220 KV Fatehpur (PG)-Naubasta Kanpur (UP) (PG) Ckt-1

No. of unwanted operation-1

Reason for unwanted operation- issue of relay setting.

Corrective Action taken-relay setting corrected.

Status of Protection Audit Plan for FY 2024 -25

S. No.	NRPC Member	Category	Status
1	PGCIL	Central Government owned Transmission Company	Received (NR-1,3)
2	NTPC	Central Generating Company	Received
3	BBMB		Received
4	THDC		Received
5	SJVN		Received
6	NHPC		Received
7	NPCIL		
8	DTL	State Transmission Utility	Received
9	HVPNL		Received
10	RRVPNL		
11	UPPTCL		Received for Jhansi, Lucknow, Meerut zone
12	PTCUL		Received
13	PSTCL		Received
14	HPPTCL		Received
15	IPGCL	State Generating Company	Received (PPCL)
16	HPGCL		
17	RRVUNL		Received
18	UPRVUNL		Received (obra -B)
19	UJVNL		Received (Dharasu, Tiloth)
20	HPPCL		
21	PSPCL	State Generating Company & State owned Distribution Company	
22	HPSEBL	Distribution company having Transmission connectivity ownership	
23	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Received
24	Aravali Power Company Pvt. Ltd		Received
25	Apraava Energy Private Limited		Received
26	Talwandi Sabo Power Ltd.		
27	Nabha Power Limited		
28	Lanco Anpara Power Ltd		
29	Rosa Power Supply Company Ltd		
30	Lalitpur Power Generation Company Ltd		Received
31	MEJA Urja Nigam Ltd.		
32	Adani Power Rajasthan Limited		Received (Kawai)
33	JSW Energy Ltd. (KWHEP)		Received
34	AESL	Other transmission licensee	
35	Tata Power Renewable Energy Ltd.		Recevied (TPGEL, BTPSL)
36	UT of J&K	UT of Northern Region	
37	UT of Ladakh		
38	UT of Chandigarh		
39	ATIL	Other transmission licensee in NR	
40	INDIGRID		Received
41	POWERLINK		
42	ADHPL		Received
43	Sekura Energy Limited		
44	WUPPTCl	Other transmission licensee in UP	
45	SEUPPTCL	Other transmission licensee in UP	
46	Vishnuprayag Hydro Electric Plant (J.P.)	Other Generating Units in UP	Received
47	Alaknanda Hydro Electric Plant (GVK)	Other Generating Units in UP	

Status of 3rd Party Protection Audit Plan

S. No.	NRPC Member	Category	Status	Schedule submitted as per utililty	Present Status Comlpleted (yes/no)
1	PGCIL	Central Government owned Transmission Company			
2	NTPC	Central Generating Company	Received (Tanda)	By 17.07.2025	
3	BBMB				
4	THDC				
5	SJVN		Received	FY-2025-26 for RHPS, Nov 24- March 25 for NJHPS	
6	NHPC		Received	FY-2025-26	
7	NPCIL				
8	DTL	State Transmission Utility			
9	HVPNL				
10	RRVPNL				
11	UPPTCL				
12	PTCUL				
13	PSTCL				
14	HPPTCL				
15	IPGCL	State Generating Company			
16	HPGCL				
17	RRVUNL				
18	UPRVUNL		Received (DTPS-Anpara)	01.05.2024	Revised schedule will be submitted
19	UJVNL				
20	HPPCL				
21	PSPCL	State Generating Company & State owned Distribution Company			
22	HPSEBL	Distribution company having Transmission connectivity ownership			
23	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity			
24	Aravali Power Company Pvt. Ltd				
25	Apraava Energy Private Limited		Received	By May, 2025	
26	Talwandi Sabo Power Ltd.				
27	Nabha Power Limited				
28	Lanco Anpara Power Ltd				
29	Rosa Power Supply Company Ltd		Received	By 30.09.2024	
30	Lalitpur Power Generation Company Ltd				
31	MEJA Urja Nigam Ltd.				
32	Adani Power Rajasthan Limited		Received (Kawai)	September, 2024	
33	JSW Energy Ltd. (KWHEP)		Received	December 2024 to March 2025	
34	AESL	Other Transmission Licensee			
35	Tata Power Renewable Energy Ltd.	IPP having less than 1000 MW installed capacity (alphabetical rotaional basis)			
36	UT of J&K	UT of Northern Region			
37	UT of Ladakh				
38	UT of Chandigarh				
39	ATIL	Other transmission licensee in NR			
40	INDIGRID				
41	POWERLINK				
42	ADHPL		Received	30.09.2024	
43	Sekura Energy Limited				
44	WUPPTCl	Other transmission licensee in UP	Received	*2024-25	
45	SEUPPTCL	Other transmission licensee in UP			
46	Vishnuprayag Hydro Electric Plant (J.P.)	Other Generating Units in UP			
47	Alaknanda Hydro Electric Plant (GVK)	Other Generating Units in UP			

* Revised Schedule

Protection Check-List Rev-NR2- Dated 07 June'18

	Name: 220kV/66KV Substation Khalsti Month and Year of Commissioning: Substation: JANUARY 2019 Date of Audit : 01.05.2024-02.05.2024		Status (OK/ Not Ok)	Remarks
Element		Description		
Main-I/Main-II		Check the settings Parameters with respect to the template updated with latest in-feed values	OK	
		Check the Signal Matrix/PSL/Application Configuration/Masking with respect to the Input and Output assignment as per scheme	OK	
		Check the Logic for DT send	OK	
		Check the Logic for 86A and 86B trip	OK	
		Check the Logic for single phase tripping	OK	
		Check the Logic for LBB Initiations	OK	
		Check the Logic for A/R starts	OK	
		Check the Logic of STUB protection & Line Isolator open status (to be enable for one & Half CB scheme having no Line side CT and to be disable for DMT scheme & having Line side CT)	NA	
		Check that the wiring of Line Isolator open is connected at correct input for Stub Protection	NA	
		Check the Logic for SOTF protection	OK	
		Check that OV protection is analog (Voltage) as well as time graded for Double Ckt/Parallel lines	NA	
		Check that the VT fail shall block the tripping	OK	
		Check the current, and voltage and angle in the relay	OK	
		Check for mutual compensation wiring (if applicable) and Check setting and configuration according to wiring.	NA	
		Whether all relays are accessible from remote dedicated PC for setting & DR extraction in control room	OK	
		Whether Main-I & Main-II protections of all line are time synchronised with GPS based time synchronised equipment.	OK	
PLCC		Check the healthiness of PLCC protection panels	OK	
		Check alarm during OUT position of Carrier IN/OUT Switch in Control room as well as in RTAMC/NTAMC	OK	
Auto Reclosure		Check the logic and configuration of the AR Start and Block	OK	
		Check the dead time and reclaim time settings	OK	
		Check the Logic and Configuration of the AR Lockout	OK	

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		Check the logic & wiring for Priority Ckt in one & Half CB scheme.		NA	
		Whether priority scheme is working properly. (check previous A/R DR)		NA	
LBB relay/PU relay	Check the relay settings (particularly, pick-up, retrip time and back-trip time)			OK	
	Check that single phase initiation is wired and configured correctly for lines			OK	
	Check the logic that retrip trips the same breaker			OK	
	Check the Signal Matrix/PSL/Application Configuration with respect to the Input and Output assignment as per scheme			OK	
	Check the logic that back-trip trips the associated bus-bar(for Main-CB LBB) OR both the Main-CB (for Tie CB LBB)			NA	
	In case of half dia, check that the Tie Bay LBB instantaneously trips the Bus connected to future bay(also check the wiring)			NA	
	For bays commissioned in the extension projects have Tie-LBB wiring changed from "Tripping the bus" to "Tripping the Main CB"			NA	
	Dead Zone/ End zone Protection is disabled; Topology is independent of switch status in One and Half CB scheme			OK	
	Check/measure phase wise current in LBB/PU relay			OK	
Reactor/Transformer Differential	Check the differential current and bias current in the relay			OK	
	Check the relay settings as per the template			OK	
	Check the relay configuration for proper input and output contact assignment.			OK	
	Check the tripping logic wrt the scheme.			OK	
	In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic			NA	
REF protection	Check the current in the relay			OK	
	Check the relay settings as per the template			OK	
	Check the relay configuration for proper input and output contact assignment.			OK	
	Check the tripping logic wrt the scheme.			OK	
	In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic			NA	
	Check for the CT selection scheme and logic			NA	

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Back-up Impedance	Check the current and voltage in the relay		OK	
	Check the VT selection logic in BCU/relay panel		OK	
	Check that at a time only one bus VT is selected		OK	
	Check the relay settings as per the template		OK	
	Check the relay configuration for proper input and output contact assignment.		OK	
	Check the tripping logic wrt the scheme.		OK	
	Check that VT fail blocks the tripping		OK	
	Check for implementation of NGR protection scheme		NA	
CSD	Check whether CSD installed with ICT/Reactor is working properly as per its requirement. (Check recent graph/DR)		NA	
	Check provision of bypassing of CSD is provided		NA	
	Check DR trigging of other relay on Manual operation of CB in case CSD is not having the provision of extraction of DR/graph.		NA	
General	Check that the two tripping of PRD, Bucholz etc are wired to two separate relays		NOT OK	
	Check that the relays powered by DC-1 are supervised by relays powered by DC-2 and Vice-versa		OK	
	Check the Opto Input pickup voltage for all the binary inputs		OK	
	Check Relay Failure and Relay disconnected alarms for all the relays.		OK	
	Check for time-sync status of the relay		OK	
	Check the DR channel standardisation		OK	
	Check pre-commissioning test reports (whether print-outs of DR and EL enclosed)		OK	
	Check the logic of Bus earth switch interlock		OK	
	Check the auto download of DR		OK	
	Check for implementation of relevant CC-AM circulars Check the single point earthing of CT secondary core on sample basis.		OK	
	Check the earthing interconnecting link/strip connected in inter panel/adjacent panel		OK	
	Check WTI & OTI trip modification as per latest circular. (20ms time delay)		OK	
	Check implementation of Bucholz Alarm/ Trip with 200ms time delay as per latest circular.		NOT OK	

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	Check PRV NO NC contact combination used for tripping (And 20ms time delay)		NOT OK	
	Check modification of tripping on OLTC OSR as per latest circular (Applicable for ICTs)		OK	
	Check NGR-Bypass CB/ isolator closing on broken conductor trip or earth fault in case of single phasing		NA	
	Check no element tripping on NGR Body Protection operation (Not applicable for 765Kv)		NA	
Bus Bar Protection	Whether duplicate bus bar protection provided in 400 & 765 kV Bus bar		NA	
	Check the topology of both the CUs		NA	
	Check the Diff current and restrain current		OK	
	Check /Measure the Spill current in bus-bar relay		OK	
	Check that CB status is permanently shorted in one and half CB scheme		NA	
	Check the operation of the selector switch and correct alarms in SCADA		OK	
	Check the settings and Configuration of the CU		OK	
	Simulate PU disconnected and check for Bus Bar Block		NA	
	Check the setting of CT supervision/CT fail/CT circuitry fault alarm		OK	
	Check logic for LBB initiation on bus bar trip		OK	
	Check the logic for BUS Bar Tripping on SF6 Gas compartment zone trip in case of GIS Station.		NA	
	Check that the Bus-Bar bay selection is independent of the topology status in One and Half CB schemes		NA	
SAS	As per Annexure-I (SAS Checklist)			
	Image CD of SAS PC should be available		OK	
	Back-up of all the ICD and SCD files available in hard disk/CD		OK	
Alarms	Simulate the alarms as per Annex-II for at least 20% bays, Minimum 6 bays.		OK	
DC System	Check DC voltage at the farthest point in the switchyard (+ to Earth, - to earth)		OK	S1: +123.44V & -120.1 V S2: +123.42 V & -122.22 V
AC system	Check auto operation of DG set		OK	
FFPH	Check auto operation of HVW and Diesel driven pump		NA	

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Smoke detection system	Simulate smoke detection in any kiosk and check for alarm		OK	

OBSERVATIONS:

220KV Kargil Line:(21M1 P444):

1. Setting Parameter to be implemented as per latest Template.
2. Vmem Validity to be kept 900ms in place of 3 Sec.
3. Aided Distance Delay to be 0 Sec in place of 20 ms.
4. In Earth Fault setting Block Pole Dead to be kept disabled as per template.
5. O/V Setting to be Kept Phase to Neutral in place of Phase to Phase as per Setting Template.
6. O/V stage-2 V>2 to be kept 150% in place of 140%
7. In Configuration system checks to be disabled as per template.
8. SF6 gas trip to be removed from 86A & 86B in PSL as the wiring is already removed from TB.

220KV Kargil Line:(21M2 REL670):

1. Setting Parameter to be implemented as per latest Template.
2. SFG gas trip to be removed from 86A,86B & DT Send in PSL as the wiring is already removed from TB.

220KV Leh Line:(21M1 P444):

1. Setting Parameter to be implemented as per latest Template.
2. In Earth Fault setting Block Pole Dead to be kept disabled as per template.
3. In Configuration system checks to be disabled as per template.
4. SF6 gas trip to be removed from 86A & 86B in PSL as the wiring is already removed from TB.

220KV Leh Line:(21M2 REL670):

1. Setting Parameter to be implemented as per latest Template.
2. SF6 gas trip to be removed from 86A,86B & DT Send in PSL as the wiring is already removed from TB.

ICT-1 Differential Relay & HV O/C E/F:

1. Bucholz -1 & 2 Trip & Alarm are to be wired in two different Relays.
2. Overcurrent Setting I>1 & Earth Fault Setting IN>1 :
   a. VTS Block I>1 & 2H I>3 to be set 1 as per template

ICT-1 REF Relay & LV O/C E/F:

1. Overcurrent Setting I>1 & Earth Fault Setting IN>1 VTS Block I>1 & 2H I>3 to be set 1 as per template.
2. PRV-1&2 NO NC combination to be implemented in ICT-1.

66KV INTERCONNECTION LINE:

1. Overcurrent setting Characteristics angle to be 60 degree in place of 45 degree.

02/05/24

विवेक राज / VIVEK RAJ
अभियंता / ENGINEER
पावरग्रिड किशनपुर : POWER GRID KISHENPUR

02/05/24

कर्मवीर/Karamveer
अभियंता/Engineer
पावरग्रिड फ्यांग एव खलत्सी (लेह)
POWERGRID Phyang & Khaltsi (Leh)

02/05/24

जाविद अली/ JAVID ALI
अभियंता /ENGINEER
पॉवरग्रिड /POWERGRID
फ्यांग (लेह) /PHYANG(LEH)

Protection Check-List Rev-NR2- Dated 07 June'18

	Name: 220kV/66KV Substation Phyang Month and Year of Commissioning: Substation: JANUARY 2019 Date of Audit : 30.04.2024		Status (OK/ Not Ok)	Remarks
Element		Description		
Main-I/Main-II		Check the settings Parameters with respect to the template updated with latest in-feed values	OK	
		Check the Signal Matrix/PSL/Application Configuration/Masking with respect to the Input and Output assignment as per scheme	OK	
		Check the Logic for DT send	OK	
		Check the Logic for 86A and 86B trip	OK	
		Check the Logic for single phase tripping	OK	
		Check the Logic for LBB Initiations	OK	
		Check the Logic for A/R starts	OK	
		Check the Logic of STUB protection & Line Isolator open status (to be enable for one & Half CB scheme having no Line side CT and to be disable for DMT scheme & having Line side CT)	NA	
		Check that the wiring of Line Isolator open is connected at correct input for Stub Protection	NA	
		Check the Logic for SOTF protection	OK	
		Check that OV protection is analog (Voltage) as well as time graded for Double Ckt/Parallel lines	NA	
		Check that the VT fail shall block the tripping	OK	
		Check the current, and voltage and angle in the relay	OK	
		Check for mutual compensation wiring (if applicable) and Check setting and configuration according to wiring.	NA	
		Whether all relays are accessible from remote dedicated PC for setting & DR extraction in control room	OK	
		Whether Main-I & Main-II protections of all line are time synchronised with GPS based time synchronised equipment.	OK	
PLCC		Check the healthiness of PLCC protection panels	OK	
		Check alarm during OUT position of Carrier IN/OUT Switch in Control room as well as in RTAMC/NTAMC	OK	
Auto Reclosure		Check the logic and configuration of the AR Start and Block	OK	
		Check the dead time and reclaim time settings	OK	
		Check the Logic and Configuration of the AR Lockout	OK	

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		Check the logic & wiring for Priority Ckt in one & Half CB scheme.	NA	
		Whether priority scheme is working properly. (check previous A/R DR)	NA	
LBB relay/PU relay	Check the relay settings (particularly, pick-up, retrip time and back-trip time)		OK	
	Check that single phase initiation is wired and configured correctly for lines		OK	
	Check the logic that retrip trips the same breaker		OK	
	Check the Signal Matrix/PSL/Application Configuration with respect to the Input and Output assignment as per scheme		OK	
	Check the logic that back-trip trips the associated bus-bar(for Main-CB LBB) OR both the Main-CB (for Tie CB LBB)		NA	
	In case of half dia, check that the Tie Bay LBB instantaneously trips the Bus connected to future bay(also check the wiring)		NA	
	For bays commissioned in the extension projects have Tie-LBB wiring changed from "Tripping the bus" to "Tripping the Main CB"		NA	
	Dead Zone/ End zone Protection is disabled; Topology is independent of switch status in One and Half CB scheme		OK	
	Check/measure phase wise current in LBB/PU relay		OK	
Reactor/Trans former Differential	Check the differential current and bias current in the relay		OK	
	Check the relay settings as per the template		OK	
	Check the relay configuration for proper input and output contact assignment.		OK	
	Check the tripping logic wrt the scheme.		OK	
	In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic		NA	
REF protection	Check the current in the relay		OK	
	Check the relay settings as per the template		OK	REF Setting to be reviewed of ICT-1 & ICT-2
	Check the relay configuration for proper input and output contact assignment.		OK	
	Check the tripping logic wrt the scheme.		OK	

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	In case of single phase transformer with spare, check the correct implementation of spare selection in trip logic		NA	
	Check for the CT selection scheme and logic		NA	
Back-up impedance	Check the current and voltage in the relay		OK	
	Check the VT selection logic in BCU/relay panel		OK	
	Check that at a time only one bus VT is selected		OK	
	Check the relay settings as per the template		OK	
	Check the relay configuration for proper input and output contact assignment.		OK	
	Check the tripping logic wrt the scheme.		OK	
	Check that VT fail blocks the tripping		OK	
	Check for implementation of NGR protection scheme		NA	
CSD	Check whether CSD installed with ICT/Reactor is working properly as per its requirement. [Check recent graph/DR)		NA	
	Check provision of bypassing of CSD is provided		NA	
	Check DR trigging of other relay on Manual operation of CB in case CSD is not having the provision of extraction of DR/graph.		NA	
General	Check that the two tripping of PRD, Bucholz etc are wired to two separate relays		NOT OK	
	Check that the relays powered by DC-1 are supervised by relays powered by DC-2 and Vice-versa		OK	
	Check the Opto Input pickup voltage for all the binary inputs		OK	
	Check Relay Failure and Relay disconnected alarms for all the relays.		OK	
	Check for time-sync status of the relay		OK	
	Check the DR channel standardisation		OK	
	Check pre-commissioning test reports (whether print-outs of DR and EL enclosed)		OK	
	Check the logic of Bus earth switch interlock		OK	
	Check the auto download of DR		OK	
	Check for implementation of relevant CC-AM circulars Check the single point earthing of CT secondary core on sample basis.		OK	
	Check the earthing interconnecting link/strip connected in inter panel/adjacent panel			

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	Check WTI & OTI trip modification as per latest circular. (20ms time delay)			
	Check implementation of Bucholz Alarm/ Trip with 200ms time delay as per latest circular.		NOT OK	Bucholz -1 & 2 Trip & Alarm are to be wired in two different Relays.
	Check PRV NO NC contact combination used for tripping (And 20ms time delay)		NOT OK	PRV-1&2 NO NC to be implemented in ICT-1,ICT-2 & Reactor
	Check modification of tripping on OLTC OSR as per latest circular (Applicable for ICTs)		OK	
	Check NGR-Bypass CB/ isolator closing on broken conductor trip or earth fault in case of single phasing		NA	
	Check no element tripping on NGR Body Protection operation (Not applicable for 765Kv)		NA	
Bus Bar Protection	Whether duplicate bus bar protection provided in 400 & 765 kV Bus bar		NA	
	Check the topology of both the CUs		NA	
	Check the Diff current and restrain current		OK	
	Check /Measure the Spill current in bus-bar relay		OK	
	Check that CB status is permanently shorted in one and half CB scheme		NA	
	Check the operation of the selector switch and correct alarms in SCADA		OK	
	Check the settings and Configuration of the CU		OK	
	Simulate PU disconnected and check for Bus Bar Block		NA	
	Check the setting of CT supervision/CT fail/CT circuitry fault alarm		OK	
	Check logic for LBB initiation on bus bar trip		OK	
	Check the logic for BUS Bar Tripping on SF6 Gas compartment zone trip in case of GIS Station.		NA	
	Check that the Bus-Bar bay selection is independent of the topology status in One and Half CB schemes		NA	
SAS	As per Annexure-I (SAS Checklist)			
	Image CD of SAS PC should be available		OK	

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	Back-up of all the ICD and SCD files available in hard disk/CD		OK	
Alarms	Simulate the alarms as per Annex-II for at least 20% bays, Minimum 6 bays.		OK	
DC System	Check DC voltage at the farthest point in the switchyard (+ to Earth, - to earth)		OK	S1: +122.15V & -119.61 V S2: +122.40 V & -119.3 V
AC system	Check auto operation of DG set		OK	
FFPH	Check auto operation of HVW and Diesel driven pump		NA	
Smoke detection system	Simulate smoke detection in any kiosk and check for alarm		OK	

OBSERVATIONS:

220KV Khalsti Line:(21M1 P444):

1. SOTF/TOR Mode : SOTF I>3 (Bit-14) to be enabled.
2. O/V Setting to be Kept Phase to Neutral in place of Phase to Phase as per Setting Template.

ICT-1 & ICT-2 Differential Relay & HV O/C E/F:

1. Configuration of Record control, Control Inputs, Control Input Config, control Input labels to be kept Visible in place of Invisible as per template.
2. Overcurrent Setting I>1 & Earth Fault Setting IN>1 :
   a. tReset to be kept 0 Sec as per template
   b. VTS Block I>1 & 2H I>3 to be set 1 as per template
3. IN>3 current setting to be kept 1.66A in place of 1.5 A as per template.
4. Supervision setting to be reviewed as per template.

ICT-1 & ICT-2 REF Relay & LV O/C E/F:

1. Overcurrent Setting I>1 & Earth Fault Setting IN>1 VTS Block I>1 & 2H I>3 to be set 1 as per template.

REACTOR Differential Relay:

1. PRD NO NC Logic to be implemented.

66KV Nimmu Line P442:

1. Vmem Validity to be kept 900ms in place of 300ms.
2. In Earth Fault setting Block Pole Dead to be kept disabled as per template.

66KV Leh Line P442:

1. E/F O/C Setting IN>1 setting to be kept IEC S Inverse in place of DT as per template.
2. Power Swing I2(% Imax) to be kept 40% in place of 30%
3. Imax Line> to be kept 5A in place of 3A.

66KV Kharu & Chuchot Line P442.

1. IN>1 Current set to be Kept as 500 mA in place of 250mA as per template.

30/04/2024
कर्मवीर/Karamveer
अभियंता/Engineer
पावरग्रिड फ्यांग एव खलसी (लेह)
POWERGRID Phyang & Khaltsi (Leh)

30.04.2024
Vivek Roy
Asst. Manager

30/4/24
जाविद अली/JAVID ALI
अभियंता /ENGINEER
पॉवरग्रिड /POWERGRID
फयांग (लेह) /PHYANG(LEH)

3.624

Format		
Internal Protection Audit		
As per annexure 1		
Part A	General Information	Remarks
(i)	Substation name	M/s Raj pur Power Limited, Vill Khanpur, Pargal, Haryana
(ii)	Name of Owner Utility	M/s Apraava Energy Pvt. Ltd., Pargal, Haryana
(iii)	Voltage Level (s) or highest voltage level?	400kV
(iv)	Short circuit current rating of all equipment (for all voltage level)	50KA
(v)	Date of commissioning of the substation	Unit-1 March 2013, Unit-2 July 2013
(vi)	Checking and validation date	
(vii)	Record of previous tripping's (in last one year) and details of protection operation	400KV PK Kishanpur Ckt-I tripped on Zone-1 Distance protection on 7.3.2024
(viii)	Previous Relay Test Reports	Available
(ix)	Overall single line diagram (SLD)	Available
(x)	AC aux SLD	Available
(xi)	DC aux SLD	Available
(xii)	SAS Architecture diagram	Available
(xiii)	SPS scheme implemented (if any)	Not Installed
Part B	History and current status	
(i)	Recommendation of last protection checking and validation	No observations
(ii)	Review of existing settings at substation	No observations
(iii)	Disturbance recorder not available for last 6 trippings (Y/N)	Y
(iv)	Chronic reason of tripping, if any	None
(v)	Major non-conformity/deficiency observed	None
Part C	The relay configuration checklist for available power system elements at station	
(i)	Transmission Line	Available
(ii)	Bus Reactor/Line Reactor	Not applicable
(iii)	Inter-connecting Transformer	Not applicable
(iv)	Busbar Protection Relay	Available
(v)	AC auxiliary system	230VAC
(vi)	DC auxiliary system	220VDC
(vii)	Communication system	Available
(viii)	Circuit Breaker Details	LW28-420/I 420kV
(ix)	Current Transformer Details	LVQBT-500W 2X1250/1A
(x)	Capacitive Voltage Transformers Details	TYD-400/√3-0.005H
(xi)	Any other equipment/system relevant for protection system operation	None
Part D	The minimum set of points on which checking and validation carried out	
(i)	Transmission Line Distance Protection/Differential Protection	
a	Name and Length of line	400kV D/C Kishanpur (PK)-132/34.5kM; 400KV Channahi Line 1&2(21.01KM
b	Whether series compensated or not	
c	Mode of communication used (PLCC/OPGW)	Kabalcon-OPGW ABB RCXpanel PLCC; Channahi-Conventional ABB PLCC
d	Relay Make and Model for Main-I and Main-II	Make Siemens, Model no- Main I 7SA6113, Main II 7SA522I
e	List of all active protections & settings	Available
f	Carrier aided scheme if any	
g	Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto(1)reclose/Load encroachment etc	Power Swing: Active Out of Step SOTF: Active Breaker Failure: Active STUB: Active Fault Locator: Active DR: Active VT Fuse fail: Active Overvoltage Protection: Active Trip Circuit supervision: Active Auto reclose: Not applicable Load encroachment: Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
	CT ratio and PT ratio	CT Ratio: 2500/1A, PT Ratio: 400/0.1/0.1/0.1/33kV
	Feed from DC supply 1 or 2	Both
	Connected to dedicated CT core (mention name)	Yes, Core-1 & Core-2
	Other requirements for protection checking and validation	
(ii)	Busbar Protection Relay	
a	Busbar and redundant relay make and model	REC 615AB-4134/B, Make-N/L Electric China
	Type of busbar arrangement	Double bus with bus coupler
	Zones	Check zone and Main zone
	Dedicated CT core for each busbar protection (Yes/No)	Yes

o	Breaker Failure relay included (Yes/No), if additional then furnish make and model	Yes, Model RCS923, Make Alstom Electric, China
p	Trip issued to both Busbar protection in case of anything	Yes
q	Isolator indications and check relays	Yes
r	Other requirements for protection checking and validation	
(v)	AC auxiliary system	
a	Source of AC auxiliary system	415V UPS
b	Supply changeover between sources (Auto/Manual)	Auto
c	Diesel generator (DG) details	Available
d	Maintenance plan and supply changeover periodicity in DG	Yearly once
e	Single Line Diagram	Available
f	Other requirements for protection checking and validation	
(vi)	DC auxiliary system	
a	Type of Batteries (Make, voltage, model)	VRLA, 220V/DC, 982Ah, Make Amara Raja
b	Status of battery Charger	Functional
c	Measured voltage (positive to earth and negative to earth)	P-E 234VDC, P-E 117VDC, N-E 117VDC
d	Availability of ground fault detectors	Available
e	Protection relays and trip circuits with independent DC sources	Yes
f	Other requirements for protection checking and validation	
g	Communication system	
a	Mode of communication for Main-1 and Main-2 protection	RS232
b	Mode of communication for data and speech communication	PLCC
c	Status of PLCC channels	Healthy
d	Time synchronization equipment details	NR and Meinberg Make GPS installed
e	POPGW on geographically diversified paths for Main-1 and main-2 relay	
vii	Other requirements for protection checking and validation	
(vii)	Circuit Breaker Details	
a	Details and status	Type LW10-420Tx4 220V 4000 50KA, Healthy
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/Multi pole operation	Multipole operation
d	Pole Discrepancy Relay available(Y/N)	Yes
e	Monitoring Devices for checking the dielectric medium	Available
f	Other requirements for protection checking and validation	
(viii)	Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details	
a	CT/CVT ID name and voltage level	CT:LVQBT-500W-2X1250/1A 420KV CVT:TYD-420√3-1732-0.01H, 420/0.11KV, 400Hz
b	CT/CVT core connection details	2X1250/1A, 5 CORE 420/√3/0.1/0.1/0.1732/√3, 3 CORE
c	Accuracy Class	CT:5 CORE, TPY/TPY/TPY/TPY/5P30/0.2/0.2/5P20 CVT: 3 CORE, 0.2/0.2/3P
d	Whether Protection/Metering	Protection and metering
e	CT/CVT ratio available and ratio adopted	Yes
f	Details of last checking and validation of CT/CVT healthiness	Checked as per schedule
g	Other requirements for protection checking and validation	
h	Other protections: Directional earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.	Directional earth fault: Back up EF, Active in Distance protection relay Negative sequence: Active in GRP Over current: Disable in Distance protection relay Overvoltage: Active in Distance protection relay Over frequency: Active in GRP Under voltage: Active in GRP Under frequency: Active in GRP Forward power: NA Reverse power: Active in GRP Out of step power swing: Active in GRP HVDC protection: Not applicable
Part-I	Summary & Remarks	
(i)	The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines	Yes
(ii)	Any deviations from the RPC protection philosophy	None
(iii)	Any major general deficiency	None
(iv)	Simulation or EMTP studies report	

Sr. Mgr. EMD

H P POWER TRANSMISSION CORPORATION LIMITED.
(A State Government Undertaking)
DGM (Protection & Communication), Chowki-Jamwalan, Hamirpur (HP).
Email. dgmprot.tcl@hpmail.in

No: HPPTCL/DGM (P&C)/NRPC/2024-25- 88-89 **Dated:-** 27/04/2024

To

The Superintending Engineer (Operation),
Northern Regional Power Committee,
18-A, Shaheed Jeet Singh Marg,
Katwaria Sarai, New Delhi-110016.
Email: seo-nrpc@nic.in

Subject: **Protection audit report in r/o 400/220/66 kV GIS S/stn. Gumma.**

Sir,

With reference to the subject cited above, as per the agenda item no. A.8.1(d) of minutes of 49th protection sub-committee meeting, protection audit report of 400/220/66 kV GIS /Stn. Gumma is enclosed herewith for your reference please.

Yours faithfully,

DA: As above

DGM (Prot. & Comm.)
HPPTCL, Chowki Jamwalan,
Hamirpur (HP).

Copy to:

1. The General Manager (Projects), HPPTCL, Himfed Bhawan, Shimla-05.

DGM (Prot. & Comm.)
HPPTCL, **Chowki Jamwalan,**
Hamirpur (HP).

Protection System Checklist Report

1) General information

i) **Substation Name:** 400/220/66 kV GIS S/stn Gumma.
ii) **Name of Owner Utility:** Himachal Pradesh Power Transmission Corporation Ltd.
iii) **Voltage Level(s) or highest voltage level:** 400 kV & 220 kV
iv) **Short circuit current rating of all equipments:** 63kA for 3 sec
v) **Date of commissioning of the substation:** 30-10-2020
vi) **Checking and validation date:**
vii) **Record of previous tripping's (in last one year) and details of protection operation:** Annexure-A
viii) **Previous Relay Test Reports:** Annexure-B
ix) **Overall Single Line Diagram (SLD):** Annexure-C
x) **AC aux SLD:** Annexure-D
xi) **DC aux SLD:** Annexure-D
xii) **SAS architecture diagram:** Annexure-E
xiii) **SPS scheme implemented (if any):** Yes

*** TABLE: FORMAT OF PRELIMINARY REPORT**

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	
2	Review of existing settings at substation	
3	Disturbance Recorder out available for last 6 tripping's (Y/N)	
4	Chronic reason of tripping, if any	
5	Major non-conformity/deficiency observed	**In 400 kV, Y-Phase relay of Bus Bar main-I is malfunctioning.**

2) The relay configuration checklist for available power system elements at station

i) Transmission Line
400 kV & 200 kV Lines:

1.	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	YES
2.	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	YES
3.	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	YES
4.	Is both main-I & Main-II distance relay are numerical design having Quadrilateral operating charectenstic.	YES
5.	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	YES
6.	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	YES

7.	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	YES
8.	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistence & tower footing resistance. (In case, it is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	YES
9.	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	YES
10.	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	NA
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	NO (500msec)
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	YES, (Zone 3 - 1.5 Sec)
13.	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	YES
14.	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	YES (500 msec)
15.	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault? Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	YES YES YES
16.	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	YES
17.	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	YES (Separate)
18.	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	
19.	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	NO
20.	Are the line parameters used for setting the relay verified by field testing	NO
21.	Is Two stages Over-Voltage protection provided for 765 & 400kV Lines? Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I . (typical value - 106 to 112 %, delay : 4-7 Sec) Stage-II: (typical value - 140 %, delay: 0 to 100msec.)	YES YES 110%, 5 sec 140%, 100 msec
22.	Is 1-ph Auto-reclosing provided on 765, 400 & 220kV lines? Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)	YES
23.	Is the Distance communication, Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	YES No

24.	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	NO
25.	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	NO
26.	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	NO
27.	What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)	I= V= Angle= S=
28.	a) What are the Zones blocked on Power swing block function: b) Setting for Unblock timer. (typical 02 second) c) Out of Step trip enabled	Z1 / Z2 / Z3 / Z4 Time: 2sec NO
29.	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	NO
30.	a) Is Disturbance recorder and Fault locator provided on all line feeder ? b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC d) Whether DR is time synchronised with the GPS based time synchronising equipment e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage. f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	YES Built-in YES YES YES YES
31.	Does the Setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be Blocked / Disabled). Are all default settings validated or revised settings given in the setting document?	

ii) Inter-connecting Transformer

1.	Do you use Group A and Group B protections connected to separate DC sources for power transformers	YES
2.	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	YES
3.	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 765kV and 400kV levels	YES
4.	Do you classify transformer protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up Protection(HV) Back up Protection(MV) • Over fluxing protection(HV) Over fluxing protection(MV)	YES Group A or B
5.	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	NO

6.	Is Restricted earth fault (REF) protection used a high impedance type	YES
7.	Are Main protection relays provided for transformers are of numerical design.	YES
8.	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design. b) Do the back-up earth fault relays have harmonic restrain feature	YES .....
9.	Is Fire protection system (HVW type) provided for power transformer and functioning	YES
10.	a) Is the Disturbance recorder provided for Transformer feeder b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC d) Whether DR is time synchronised with the GPS time synchronising equipment	YES Built-in YES YES
11.	Does the Setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be Blocked / Disabled). Are all default settings validated or revised settings given in the setting document?	.....

iii) Busbar Protection Relay

1.	Bus Bar protection for 400 & 220kV buses is provided	YES
2.	Duplicated Bus bar protection is provided for 400kV buses	YES
3.	CBIP guideline for Protection (274 and 296) settings is followed	YES
4	In an existing substation if CTs are of different ratios, is biased type bus protection provided.	NO
5	In stations where single bus bar protection is provided, is backup provided by reverse locking elements of distance relays or by second zone elements of remote end distance relays?	NO
6	In case of GIS where burn through time of SF6 is shorter than remote back up protection is the bus bar protection duplicated irrespective of voltage level?	.....
7	Since it is difficult to get shutdowns to allow periodic testing of bus protection, numerical bus protections with self-supervision feature is an answer. Is this followed?	.....
8	Does the Setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be Blocked / Disabled). Are all default settings validated or revised settings given in the setting document?	.....

iv) AC auxiliary system

v) DC auxiliary system

vi) Communication system

1.	a) Do you use PLCC for tele-protection of distance relays at 765, 400 & 220kV feeders b) Specify type of coupling c) Whether redundant PLCC channels provided for 400 & 765kV lines d) Specify number of PLCC channels per circuit : e) Whether dependability & security of each tele-protection channel measured & record kept ?	YES (Ph-Ph / Ph-G/ Inter-ckt) YES (two) YES
2.	a) In case you use OPGW for tele-protection, are they on geographically diversified route for Main-I and Main-II relay? b) Whether dedicated fibre is being used for Main-I / Main-II relay or multiplexed channel are being used.	

vii) Circuit Breaker Details

1.	Is breaker fail protection (LBB / BFR) provided for all the Circuit Breakers at 220kV , 400kV & 765kV rating	YES
2.	For Circuit Breaker connected to line feeder / transformer feeder, whether operation of LBB / BFR sends direct trip signal to trip remote end breaker ?	YES
3.	For lines employing single phase auto reclosing, is start signal from protection trip to LBB / BFR relay is given on single phase basis?	YES
4.	Is separate relay provided for each breaker and the relay has to be connected from the secondary circuit of the CTs associated with that particular breaker?	YES
5.	Is LBB relay provided with separate DC circuit independent from Group-A and Group-B Protections?	YES
6.	Is the LBB initiation provided with initiating contact independent of CB trip relay contact?	.....
7.	Is Separation maintained between protective relay and CB trip coil DC circuit so that short circuit or blown fuse in the CB circuit will not prevent the protective relay from energizing the LBB scheme?	YES
8.	Is LBB relay initiated by Bus bar protection in addition to other fault sensing relays, since failure of CB to clear a bus fault would result in the loss of entire station if BFP relay is not initiated?	.....
9.	Is tripping logic of the bus bar protection scheme used for LBB protection also?	NO
10.	Are the special considerations provided to ensure proper scheme operation by using Circuit Breaker contact logic in addition to current detectors in cases breaker-fail relaying for low energy faults like buckholz operation?	.....
11.	Are the Current level detectors set as sensitive as the main protection? (Generally setting of 0.2 A is commonly practiced for lines and transformers)	YES
12.	Is timer set considering breaker interrupting time, current detector reset time and a margin? (Generally a timer setting of 200ms has been found to be adequate)	YES
13.	Is the back-up fault clearance time is shorter than the operating time of the remote protections (distance relay Zone-2) ?	NO

14.	Is the breaker failure protection provided with two steps (First stage – retrip own CB, Second stage- Trip all associated CBs) . This mitigates unwanted operation of breaker failure protection during maintenance and fault tracing.	.....
15.	Is the breaker failure protection hardware provided is separate from line /transformer feeder protection?	YES

viii) **Current Transformer Details**

ix) **Capacitive Voltage Transformers Details**

x) **Station DC Supply System:**

1.	Do you have two separate independent DC system (220V or 110V) (Source-A and Source-B)	YES
2.	Do you have two independent DC system (48V) for PLCC (source-A and source-B)	YES
3.	There is no mixing of supplies from DC source-A and DC source-B	YES
4.	Whether the protection relays and trip circuits are segregated into two independent system fed through fuses from two different DC source	YES
5.	Whether Bay wise distribution of DC supply done in the following way: a) Protection b) CB functions c) Isolator / earth switch functions d) Annunciation / Indications e) Monitoring functions	YES
6	Whether following has been ensured in the cabling: a) Separate cables are used for AC & DC circuits b) Separate cables are used for DC-I & DC-II circuits c) Separate cables are used for different cores of CT and CVT outputs to enhance reliability & security	YES
7	Is guidelines prescribed in CBIP manual 274 & 296 followed in general	YES

xi) **Performance Indices:**

1.	Is there a system of periodically measuring Dependability & Security of Protection system (as given in CBIP manual 296) and recorded	YES
2.	Is there a system of periodically measuring Dependability of switchgear associated with Protection system and recorded	YES
3.	Is there a process of Root cause analysis of unwanted tripping events	YES
4.	Are improvement action like revision of relay setting, better maintenance practices, modernising & retrofitting of switching & protection system taken based on above data.	YES
5.	Is attention also given to DC supply system, tele-protection signalling, healthiness of tripping cables, terminations etc. in order to improve the performance of fault clearance system	YES

xii) **Disturbance recorder (DR) and event logger (EL):**

1.	a) Is the Disturbance recorder and Fault locator provided on all line feeders of 765, 400 & 220kV substations? b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC d) Whether Central PC for DR , EL are powered by inverter (fed from station DC)	YES Built-in YES YES
2.	Whether DR is having the following main signals for lines: Analogue signals: • From CT: IA, IB, IC, IN • From VT: VAN, VBN, VCN • From Aux. VT: V0 Digital Signals • Main 1 Carrier receive • Main 1 Trip • Line O/V Stage I / Stage II • Reactor Fault Trip • Stub Protection Operated. • Main II Trip • Main II Carrier Receive • Direct Trip CH I / II • CB I Status (PH-R, Y & B) • CB II Status (PH R, Y & B) • Bus bar trip • Main / Tie CB LBB Operated • Main / Tie Auto-reclose operated. DR for Transformer / Reactor feeder should contain analog channel like input currents & voltage. Binary signal include all protection trip input, Main & Tie CB status, LBB trip	YES
3.	Whether substation (765, 400 , 220kV) is having Event logger facility (standalone or built-in-SAS)	YES
4.	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	YES

xiii) **Additional checks for series compensated lines:**

1.	What is the operating principle of Main protection employed	NA
2.	Are both main-I & Main-II distance relay are numerical design	NA
3.	Are both main-I & Main-II distance relay suitable for Series compensated lines	NA
4.	Are POR tele-protection scheme employed for distance relays	NA
5.	Position of Line VT provided on series compensated line	NA
6.	What is the under reaching (Zone 1) setting used in teleprotection schemes (Local & Remote end)	NA
7.	What is the overreaching (Zone 2) setting in used teleprotection schemes	NA

8.	What kinds of measurement techniques are used to cope with voltage inversion?	NA
9.	Whether system studies carried out to check the possibility of current inversion due to series compensation	NA
10.	Whether any system studies conducted to find the impact of series compensation on the performance of protections installed on adjacent lines? If yes, how many lines were found to be affected. Pl. specify _____	NA
11	If YES, are the affected protections on adjacent lines changed / setting revised after the introduction of series compensation?	NA
12.	Is dynamic simulation done to fine tune settings of distance relay installed on series compensated double circuit lines?	NA
13.	Whether performance of directional earth fault relay verified by simulation studies	NA
14.	When is flashover of spark gaps expected?	NA
15.	Whether measures taken for under/overreach problems at sub-harmonic oscillations?	NA
16.	Whether MOV influence considered while setting the distance relay reach	NA
17.	Have you experienced any security problems (Relay mal-operation) with high frequency transients caused by Flashover of spark gaps Line energisation Other, specify:	NA
18.	If YES, how the above problem has been addressed?	

3) The detailed list shall be prepared by checking and validationteam in consultation with concerned entity, RLDC and RPC

i) Transmission Line Distance Protection/Differential Protection

a. **Name and Length of Line**
400 kV

		Line-1	Line-2	Line-3	Line-4	Line-5	Line-6
Name of Line		400 kV Panchkula ckt. 2	400 kV Jhakri ckt. 2	400 kV Jhakri ckt. 1	400 kV Panchkula ckt. 1	220 kV (Hatkoti ckt.-1)	220 kV (Hatkoti ckt.-2)
Line length (km)		111.5	54.5	54.5	111.5	26	26
Line Parameters (In Ohms/Per KM/Per Phase Primary value)	R1	0.019387	0.019387	0.019387	0.019387	0.0208313	0.0208313
	X1	0.275728	0.275728	0.275728	0.275728	0.28146	0.28146
	R0	0.2858	0.2858	0.2858	0.2858	0.20328	0.20328
	X0	1.0869	1.0869	1.0869	1.0869	1.1684	1.1684
	R0M	0.266	0.266	0.266	0.266		
	X0M	0.7625	0.7625	0.7625	0.7625		
Relay setting	Adopted	Please enclose the settings for all lines, transformers, Reactors and Bus Bars as Annexure-I					
	Recommended	Please enclose the settings for all lines, transformers, Reactors and Bus Bars as Annexure-II					

b. Whether series compensated or not :- No

c. Mode of communication used (PLCC/OPGW) – PLCC/OPGW

d. Relay Make and Model for Main-I and Main-II

400 kV:

1	Line-1 404 Panchkula - Ckt. 2	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	15.12.2021	REL 670 ABB	Yes	15.12.2021	P442 MICOM	Yes	30.10.2020
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
		ALSTOM e-terragridcom	Yes	Inbuilt	Yes	Masibus	Ok			
2	Line-2 406 Jhakri Ckt. 2	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	14.12.2021	REL 670 ABB	Yes	14.12.2021	P442 MICOM	Yes	30.10.2020
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch Unit (Make & Model)	OK / Not OK			
		ALSTOM e-terragridcom	Yes	Inbuilt	Yes	Masibus	OK			
3	Line-3 407 Jhakri Ckt. 1	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	21.10.2021	REL 670 ABB	Yes		P442 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch Unit (Make & Model)	OK / Not OK			
		ALSTOM e-terragridcom	Yes	Inbuilt	Yes	Masibus	Ok			
4	Line-4 409 Panchkula Ckt. 1	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	21.10.2021	REL 670 ABB	Yes		P442 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch Unit (Make & Model)	OK / Not OK			
		ALSTOM e-terragridcom	Yes	Inbuilt	Yes	Masibus	OK			

220 kV

1	Line-1 203 Halkoti Ckt. 1	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	19.10.2023	REL 670 ABB	Yes		P746 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
				Inbuilt	Yes	Meinberg	OK			
2	Line-2 204 Halkoti Ckt. 2	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing
		P443 MICOM	Yes	19.10.2023	REL 670 ABB	Yes		P746 MICOM	Yes	
		PLCC/ Protection coupler (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)	Time Synch. Unit (Make & Model)	OK / Not OK			
				Inbuilt	Yes	Meinberg	OK			

e. List of all active protections & settings

f. Carrier aided scheme if any: **PUR**

g. Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.

h. Relay connected to Trip Coil-1 or 2 or both: **Both**

i. **CT ratio and PT ratio**

   i. **Location of CT : Bay 401 ICT-1**
   ii. Date of CT ratio Test Testing
   iii. **Test Results**

		Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000	2000	2000	2000	2000	2000
ii	Ratio measured						
iii	error calculated						
	Knee point voltage						

j. Feed from DC supply-1 or 2

k. Connected to dedicated CT core (mention name)

Sr. No.	CT Core used	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Line	Bus Bar-I	Bus Bar-II	BCU/Metering	Spare	Main-2 Distance/Backup	Main-I Distance
ii	Transformer	Bus Bar-I	Bus Bar-II	BCU/Metering	Spare	Backup	Differential

l. Other requirements for protection checking and validation

ii) Inter-connecting Transformer Protection

a. Whether two groups of protections used (Group A and Group B): Yes

b. Do the groups have separate DC sources: Yes

c. Relay Make and Mode

d. 400 kV ICTs:

1	ICT-1 (400/220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flu x Protection (Make & Model)	Other protection
		P643 MICOM	P643 MICOM	P643/P141 MICOM	P643 (REF) MICOM	
		Bucholtz / PRD	LA Rating HV Side	LA Rating LV Side	OTI/WTI Indication working or not	Date of last testing
		P643 (REF)	390 kV	198 kV	Yes	19/10/2023
2	ICT-2 (400/220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flu x Protection (Make & Model)	Other protection
		P643 MICOM	P643 MICOM	P643/P141 MICOM	P643 (REF) MICOM	
		Bucholtz / PRD	LA Rating HV Side	LA Rating LV Side	OTI/WTI Indication working not	Date of last testing
		P643 (REF)	390 kV	198 kV	Yes	18/10/2023
3	ICT-3 (400/220/66 kV Spare)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flu x Protection (Make & Model)	Other protection
			642 64R MICOM	P141 MICOM		
		Bucholtz / PRD	LA Rating HV Side	LA Side Rating LV	OTI/WTI Indicatio n or workin g not	Date of last testing
			390 kV	198 kV	Yes	20/10/2023

220/66 kV Power Transformer

1	Power Transformer # 1 (220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flux Protection (Make & Model)	Other protection
		87T-P643(HV) MICOM	64LV-P643(LV) MICOM	67/67N-P141 MICOM		
		Bucholtz / PRD	LA Rating HV Side	LA Side Rating LV	OTI/WTI Indication working or not	Date of last testing
2	Power Transformer # 2 (220/66 kV)	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flux Protection (Make & Model)	Other protection
		87T-P643(HV) MICOM	64LV-P643(LV) MICOM	67/67N-P141 MICOM		
		Bucholtz / PRD	LA Rating HV Side	LA Side Rating LV	OTI/WTI Indication working or not	Date of last testing

e. List of all active protections along with settings

f. Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure: **OK**

g. Status of Oil Temperature Indicator/Winding Temperature Indicator/Bucholz/Pressure Release Device etc.: **Ok**

h. Relay connected to Trip Coil-1 or 2 or both: **Both**

i. CT ratio and PT ratio

j. Feed from DC supply-1 or 2: **Both**

k. Connected to dedicated CT core (mention name)

l. Other requirements for protection checking and validation

iii) Busbar Protection Relay

a. Busbar and redundant relay make and model

		400kV	220kV
i)	Make and Model of Bus Bar relay	P746 MICOM	P746 MICOM
ii)	Whether stability checks done or not	Yes	Yes

iii)	Date of testing	Oct, 2020	Oct, 2020
iv)	Remarks (if any)		

b. Type of Busbar arrangement

400 kV: One and Half Breaker Scheme

220 kV: Double Bus Bar Scheme

c. Zones: Z_1/Z_2/Check zone.

d. Dedicated CT core for each busbar protection: Yes

e. Breaker Failure relay included (Yes in 220 kV), if additional then furnishmake and model :

In 400 kV P442

f. Trip issued to both Busbar protection in case of enabling: **No as per Isolator status.**

g. Isolator indication and check relays **Yes(Built in)**

h. Other requirements for protection checking and validation

iv) AC auxiliary system

a. Source of AC auxiliary system

Auxiliary Supply-1: Source of supply: ICT-1 Tertiary

Reliability of Supply:100%

Average trippings per month: 0

Auxiliary Supply-2: Source of supply: ICT-2 Tertiary

Reliability of Supply:100%

Average trippings per month: 0

b. Supply changeover between sources (Auto)

c. Diesel generator (DG) details

DG Set-1:

Make Jackson/Cummins

Rating 250 kVA

Weather on Auto or Manual: Auto

Fuel Level 802 Litre (as on dated 23.04.2024)

d. Maintenance plan and supply changeover periodicity in DG

e. Single Line Diagram

f. Other requirements for protection checking and validation

(v) DC auxiliary system

a. Type of Batteries (Make, vintage, model)

Make: HBL Type: **Tubular LMLA Battery** **Model: T400PNDP, 2V-400AH**

b. Status of battery Charger: **OK**

c. Measured voltage (positive to earth and negative to earth)

		220 /110 V DC-I	220 /110 V DC-II	48 V DC-I	48 V DC-II
a)	Measured voltage (to be measured at farthest Panel	243.1 V	241 V	52.4 V	53 V
i.	Positive to Earth	121 V	120 V	NA	NA
ii.	Negative to Earth	- 120 V	- 120 V	- 52.4 v	- 52.9 V
b)	No. of Cells Per Bank	110	110	24	24
c)	Availability of Battery Charger	Yes	Yes	Yes	Yes

d. Availability of ground fault detectors: Yes/No

e. Protection relays and trip circuits with independent DC sources: **Yes**

f. Other requirements for protection checking and validation

g. Communication system

i. Mode of communication for Main-1 and Main-2 protection

ii. Mode of communication for data and speech communication

iii. Status of PLCC channels

iv. Time synchronization equipment details

v. 7OPGW on geographically diversified paths for Main-1 and main-2relay.

vi. Other requirements for protection checking and validation

(vi) Circuit Breaker Details

a. Details and Status

		Make and Model	Status of Breaker Available or Not	No.of trip/close coil & healthiness	PIR (Available or Not)	Date of Last Timing taken	Remarks (If any)
A	400kV System						
i	Bay-401 (ICT-1)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	19.10.2023	
ii	Bay-401S (Spare ICT)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	20.10.2023	
iii	Bay-402 (TIE)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	18.10.2023	
iv	Bay-403 (ICT-2)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	18.10.2023	
v	Bay-404 (Panchkula ckt-2)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	17.10.2023	
vi	Bay-405 (TIE)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	17.10.2023	
vii	Bay-406 (Jakhri ckt-2)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	17.10.2023	
viii	Bay-407 (Jakhri ckt-1)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	21.10.2023	
ix	Bay-408 (TIE)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	21.10.2023	
x	Bay-409 (Panchkula ckt-1)	ALSTOM T155-3	Avilable	02 Trip coil/01 Close	Not	21.10.2023	
B	220kV System						
i	Bay-201 (ICT-1)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	19.10.2023	
ii	Bay-203 (Hatkoti ckt-1)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	19.10.2023	
iii	Bay-204 (Hatkoti ckt-2)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	18.10.2023	
iv	Bay-205 (Bus-Coupler)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	18.10.2023	

v	Bay-207 (ICT-2)	ALSTOM	Avilable	02 Trip coil/01 Close	Not	18.10.2023	

b. Healthiness of Tripping Coil and Trip circuit supervision relay: **Healthy**

c. Single Pole/Multi pole operation: **Multi Pole**

d. Pole Discrepancy Relay available(Y/N): **Yes**

e. Monitoring Devices for checking the dielectric medium: **SF6 Gas Density Monitor**

f. Other requirements for protection checking and validation

(vii) Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details: (Attached as Annexure-F)

a. CT/CVT ID name and voltage level

b. CT/CVT core connection details

c. Accuracy Class

d. Whether Protection/Metering

e. CT/CVT ratio available and ratio adopted

f. Details of last checking and validation of CT/CVT healthiness

g. Other requirements for protection checking and validation

h. Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

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Er. Rajat Sharma
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Annexure – A

Tripping Detail w.e.f 01/04/2023 to 31/03/2024 in r/o 400/220/66 kv GIS s/stn. Gumma.

Sr. No	Name of Element	Voltage Level	Date & Time of tripping	Date & Time of Restoration	Detailed reason of tripping	Remarks
1	Bay 406 Gumma Jhakri -2 Y- phase	400kv	18/04/2023 20:16hrs.	18/04/2023 21:28hrs.	Tranrient fault relay operated according by Z-1 trip on y phase. Auto recloser did not work	
2	DT received from jhakri end	400kv	26/04/2023 06:32p.m	26/04/2023 11:05 p.m	DT received from Jhakri end on with circuit (Relay operated)	
3	ICT-2	220KV	15/08/2023 14:37hrs.	T/f under shut down	PRV operated ICT-2 in LV side due to moisture ingression (relay operated)	
4	Bus 1 and Bus 2	400kv	16/11/23 02:01 hrs.	16/11/23 Bus-2 Time-08:19 AM Bus-1 Time-08:53 PM	Bus 1 and Bus 2 were tripped due to malfunction of Y Phase main-1 Bus Bar Differential Relay i.e. P746	
5	DT received Hatkoti end	220kv	19/01/2024		DT received from Hatkoti end and tripping due over voltage .	

Annexure-B

2021

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Bay-406 (Guma - Jhakri ckt-2) Date 15/12/2021

D. Detailed of Equipment to be tested: Distance Protection Relay (Main -1 & Main - 2)& Back up Relay(Over current & Earth fault) –Details below:

Description of Test: Zone Reach Testing.

S. No.	Relay	Relay make & Model	Remarks
1	Distance relay (Main-I)	Alstom&P443	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
2	Distance relay (Main-II)	ABB&REL670	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Øfault by selecting different values of fault impedance (z) points for respective zones
3	Backup Relay (O/C & E/F)	Alstom&P141	Pick up test of relay conducted by injecting current more than the current setting value for overcurrent in one Phase .

D.1 Main-I Relay

Fault type: Line to Earth fault (L1-E)

	Values selected for test				
Sr. No.	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	17.89	50	30.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	44.72	63.43	530.0	Relay tripped in zone-2	
3	72.80	74.05	1.030	Relay tripped in zone-3	
4	6.622	170.0	530.0	Relay tripped in zone-4	

Fault type: Line to Line fault(L1-L2)

	Values selected for test				
Sr. No.	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(s)	Result	Remarks
1	4.806	40.0	30.0	Relay tripped in zone-1	Operation of the relay

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O/o DGM (Prot & Comm.)
HPPTCL, Hamirpur (H.P.)

2	20.00	60.0	530.0	Relay tripped in zone-2	found satisfactory
3	40.00	80.0	1.030	Relay tripped in zone-3	
4	8.084	180	530.0	Relay tripped in zone-4	

Fault type: 3 Phase fault(L1-L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(s)**	**Result**	**Remarks**
1	4.806	40.0	30.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	60.0	530.0	Relay tripped in zone-2	
3	40.00	80.0	1.030	Relay tripped in zone-3	
4	8.084	180	530.0	Relay tripped in zone-4	

D.2 Main-II

Fault type: Line to Earth fault(L2-E)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(s)**	**Result**	**Remarks**
1	8.962	30.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	29.48	41.73	524.00	Relay tripped in zone-2	
3	38.50	48.76	1.024	Relay tripped in zone-3	
4	12.08	176.66	524.0	Relay tripped in zone-4	

Fault type: Line to Line fault(L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time (s)**	**Result**	**Remarks**
1	5.5	40.0	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.64	34.39	524.00	Relay tripped in zone-2	
3	22.00	43.34	1.024	Relay tripped in zone-3	
4	5.5	180.0	524.0	Relay tripped in zone-4	

Assistant Engineer (P&C)
O/o DGM (Prot. & Comm.)
HPPTCL, Hamirpur (H.P.)

Fault type: 3 Phase fault(L1-L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(s)**	**Result**	**Remarks**
1	5.5	40.0	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.64	34.39	524.00	Relay tripped in zone-2	
3	22.00	43.34	1.024	Relay tripped in zone-3	
4	5.5	180.0	524.0	Relay tripped in zone-4	

D.3 Over Current & Earth fault Relay

Sr. No.	**Phase**	**Applied Voltage**	**Applied Current**	**Result**	**Remarks**
1	R Ø	63.5 V	1.00 A	Relay Tripped for Y Phase over Current	Operation of the relay found satisfactory
2	Y Ø	63.5 V	1.50 A		
3	B Ø	63.5 V	1.00 A		

2. Location: Bay no.405 (Tie Breaker)

A. Detailed of Equipment to be tested: Circuit Breaker

Make	Alstom

A.1 Description of the test :Circuit Breaker Time Interval test

Results:

Sr. No.	**Operation Mode**	**R-Phase Time (mSec)**	**Y-Phase Time (mSec)**	**B-Phase Time (mSec)**	**Remarks**
1.	Closing	19	19	20	Values are within permissible limits
2.	Opening	98	97	98	

Assistant Engineer (P3C)
O/o DGM (Prot. & Comm.)
HPPTCL, Hamirpur (H.P.)

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Bay-404 Gumma-Hamirpur CKT-2

D. Detailed of Equipment to be tested: Distance Protection Relay (Main -1 & Main - 2)& Back up Relay(Over current & Earth fault) –Details below:

Description of Test: Zone Reach Testing.

S. No.	Relay	Relay make & Model	Remarks
1	Distance relay (Main-I)	Alstom&P443	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
2	Distance relay (Main-II)	ABB&REL670	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Øfault by selecting different values of fault impedance (z) points for respective zones
3	Backup Relay (O/C & E/F)	Alstom&P141	Pick up test of relay conducted by injecting current more than the current setting value for overcurrent in one Phase .

D.1 Main-I Relay

Fault type: Line to Earth fault (L1-E)

	Values selected for test				
Sr. No.	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(s)	Result	Remarks
1	10.89	40.0	30.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	45.95	64.20	530.0	Relay tripped in zone-2	
3	75.35	74.61	1.530	Relay tripped in zone-3	
4	3.226	-150.00	530.0	Relay tripped in zone-4	

Fault type: Line to Line fault(L1-L2)

	Values selected for test				
Sr. No.	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(s)	Result	Remarks
1	6.843	30.00	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	70.00	530.0	Relay tripped in zone-2	

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HPPTCL, Hamirpur (H.P.)

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3	37.45	70.00	1.530	Relay tripped in zone-3	
4	6.573	-180.0	530.0	Relay tripped in zone-4	

Fault type: 3 Phase fault(L1-L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(s)**	**Result**	**Remarks**
1	6.843	30.00	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	70.00	530.0	Relay tripped in zone-2	
3	37.45	70.00	1.530	Relay tripped in zone-3	
4	6.573	-180.0	530.0	Relay tripped in zone-4	

D.2 Main-II

Fault type: Line to Earth fault(L2-E)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(ms)**	**Result**	**Remarks**
1	22.94	53.17	24.0	Relay tripped in zone-1	Operation of the relay found satisfactory
2	49.49	50.00	524.0	Relay tripped in zone-2	
3	76.89	60.00	1.524	Relay tripped in zone-3	
4	13.75	180.00	524.0	Relay tripped in zone-4	

Fault type: Line to Line fault(L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time (ms)**	**Result**	**Remarks**
1	8.348	50.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	22.87	60.0	524.00	Relay tripped in zone-2	
3	35.289	70.00	1.524	Relay tripped in zone-3	
4	9.524	-170.00	524.00	Relay tripped in zone-4	

Assistant Engineer (P&C)
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HPPTCL, Hamirpur (H.P.)

Fault type: 3 Phase fault(L1-L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(s)**	**Result**	**Remarks**
1	8.348	50.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	22.87	60.0	524.00	Relay tripped in zone-2	
3	35.289	70.00	1.524	Relay tripped in zone-3	
4	9.524	-170.00	524.00	Relay tripped in zone-4	

D.3 Over Current & Earth fault Relay

Sr. No.	**Phase**	**Applied Voltage**	**Applied Current**	**Result**	**Remarks**
1	R Ø	63.5 V	1.00 A	Relay Tripped for Y Phase over Current	Operation of the relay found satisfactory
2	Y Ø	63.5 V	1.50 A		
3	B Ø	63.5 V	1.00 A		

4. Location: Bay no.403 (400 kV bay ICT#1 400/220/33 kV)

Equipment to be tested: 3 x 1Ø Power Transformer

Make	GE T&D India Ltd		
Sr. No.	B-31182 T-7015E-3	B-31182 T-7015E-2	B-31182 T-7015E-1
Vector Group	YNa0d11		
Rating	105 MVA	105 MVA	105 MVA
Type of Cooling	OFAF	OFAF	OFAF
Voltage Ratio	400/√3/220/√3/33	400/√3/220/√3/33	400/√3/220/√3/33

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Sr. Manager (P&C)
O/o DGM (Prot.&Comm.)
HPPTCL, Hamirpur (H.P.)

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F. Detailed of Equipment to be tested : Differential Relay & Restricted Earth fault Relay

Sr. No.	Relay Name	Relay make & Model	Remarks
1	Transformer Differential relay	Alstom & P 643	Slope test, 2nd Harmonics test & 5th Harmonics test of relay conducted successfully with the help of test universe software by selecting different values of Differential & Biased Currents in the operating region.
2	Restricted Earth Fault relay	Alstom & P 643	(i) Pick up test of relay conducted by injecting current in neutral CT circuit of ICT with the help of quick CMC Test software. (ii) Over flux test of relay conducted by injecting 1.5 times the rated voltage in two Phases with the help of quick CMC Test software.

F.1 Description of the test:

F.1.1. Differential Slope Test

Fault type: Line to Earth fault

	Values selected for test			
Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	4.00In	6.30In	No Trip received	Operation of the relay found satisfactory
2	6.30In	8.50In	0.5822	
3	8.40In	12.10In	No Trip received	
4	9.90In	12.90In	0.5069	

Fault type: Line to Line fault

	Values selected for test			
Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	4.00In	6.30In	No Trip received	Operation of the relay found satisfactory
2	6.30In	8.50In	0.6860	
3	8.40In	12.10In	No Trip received	
4	9.90In	12.90In	0.5840	

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Fault type: L-L-L fault

	Values selected for test			
Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	4.00In	6.30In	No Trip received	Operation of the relay found satisfactory
2	6.30In	8.50In	0.6860	
3	8.40In	12.10In	No Trip received	
4	9.90In	12.90In	0.5840	

F.1.2. 2nd Harmonic Test

Fault type: Line to Earth fault

	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Result	Remarks
1	1.10I/In	20.30 %	No Trip received	Operation of the relay found satisfactory
2	3.70I/In	19.20 %	Trip received	
3	6.20 I/In	20.60 %	No Trip received	
4	7.50 I/In	19.80 %	Trip received	

Fault type: L-L-L (3 Ø)fault

	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Result	Remarks
1	1.10I/In	20.30 %	No Trip received	Operation of the relay found satisfactory
2	3.70I/In	19.20 %	Trip received	
3	6.20 I/In	20.60 %	No Trip received	
4	7.50 I/In	19.80 %	Trip received	

F.1.3. 5th Harmonic Test

Fault type: Line to Earth fault

	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Results	Remarks
1	1.00I/In	39.10 %	No Trip received	Operation of the relay found satisfactory
2	3.60I/In	35.40 %	Trip received	
3	7.20 I/In	33.50 %	Trip received	
4	7.80 I/In	30.80 %	Trip received	

Fault type: L-L-L (3 Ø) fault

	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Results	Remarks
1	1.00I/In	39.10 %	No Trip received	Operation of the relay found satisfactory
2	3.60I/In	35.40 %	Trip received	
3	7.20 I/In	33.50 %	Trip received	
4	7.80 I/In	30.80 %	Trip received	

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F.2. Restricted earth fault Relay

F.2.1Ref fault test

Sr. No.	Phase	Applied Current (A)	Results	Remarks
1	R Ø	0.200	Trip Received	Operation of the relay found satisfactory
2	Y Ø	0.100	Trip received	
3	B Ø	0.100	Trip received	

F.2.2 Over flux test

Sr. No.	Phase	Applied Voltage	Results	Remarks
1	R Ø	0	Trip Received	Operation of the relay found satisfactory
2	Y Ø	96.00		
3	B Ø	96.00		

5. Bay no. B 207 (220 kV bay of ICT#2 400/220/33 kV)

A. Detailed of Equipment to be tested: Circuit Breaker

Make	ALSTOM

A.1 Description of the test :Circuit Breaker Time Interval test

Results:

Sr. No.	Operation Mode	R-Phase Time (mSec)	Y-Phase Time (mSec)	B-Phase Time (mSec)	Remarks
1.	Closing	21	21	21	Values are within permissible limits
2.	Opening	70	70	69	

B. Detailed of Equipment to be tested: Relay test

B.1 Description of the test :Over Current & Earth fault Relay

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O/o DGM (Prot. & Comm.)
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Sr. No.	Phase	Applied Voltage	Applied Current	Remarks
1	R Ø	63.50 V	1.00 A	operation of the relay found satisfactory
2	Y Ø	63.50 V	1.50 A	
3	B Ø	63.50 V	1.00 A	

C. Detailed of Equipment to be tested : Lightening Arrester

Make	OBLUM ELECTRICAL INDUSTRIES PVT. LTD.

C.1 Description of the test: Third harmonic Resistive Current Measurement

Ambient Temperature- 14deg.C System Voltage – 220 kV

Phase	3rd Harmonic Resistive Current (μA)	3rd Harmonic Resistive Current (Corrected) (μA)	Remarks
R	12	21	Values are within permissible limits
Y	13	24	
B	9	17	

Surge Counter Reading

Sr. No.	Description	R Phase	Y Phase	B Phase
1	Counter Sr. No.		1487	1498
2	Counter Make & Model	Crompton Greaves Ltd. & SC07-1		
3	Counter Reading	9	9	7

6. Location: Bay no. 302 (Transformer 630 KVA, 33/.415 kV)

A. Description of Test: INSULATION RESITANCE TEST

Main Winding	IR VALUE (GΩ)			Dielectric Absorption Index (60s/15s)	Polarization Index (600s/60s)	Remarks
	Time15 Sec.	Time60 Sec.	Time 600 Sec.			
HV to LV	23.5	30.40	45.50	1.30	1.50	Values are within permissible limits
HV to E	15.6	20.3	34.0	1.30	1.67	

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R	9	18	Values are within permissible limits
Y	43	82	
B	14	27	

F. Detailed of Equipment to be tested : Differential Relay & Restricted Earth fault Relay

Sr. No.	Relay Name	Relay make & Model	Remarks
1	Transformer Differential relay	Alstom &P 643	Slope test, 2nd Harmonics & 5th Harmonics of relay conducted successfully with the help of test universe software by selecting different values of Differential & Biased Currents in the operating region.
2	Ref relay	Alstom &P 643	(i) Pick up test of relay conducted by simulating current in neutral CT circuit of ICT. (ii) Over flux test of relay conducted by injecting 1.5 times voltage of one Phase.

F.1 Description of the test:

F.1.1 Differential Slope Test

Fault type: Line to Earth fault

	Values selected for test			
Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	1.2In	2.60In	No Trip received	Operation of the relay found satisfactory
2	3.6In	5.10In	0.7535	
3	7.60In	9.10In	0.5679	
4	10.10In	14.00In	No Trip received	

Fault type: Line to Line fault

Values selected for test			

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Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	1.2In	2.60In	No Trip received	Operation of the relay found satisfactory
2	3.6In	5.10In	0.8866	
3	7.00In	9.10In	0.6687	
4	10.10In	14.00In	No Trip received	

Fault type: 3 Ø fault

	Values selected for test			
Sr. No.	I-Diff	I-Bias	Trip Time(s)	Remarks
1	1.2In	2.60In	No Trip received	Operation of the relay found satisfactory
2	3.6In	5.10In	0.8866	
3	7.00In	9.10In	0.6687	
4	10.10In	14.00In	No Trip received	

F.1.2. 2nd Harmonic Test

Fault type: Line to Earth fault

	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Results	Remarks
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

Fault type: 3 Ø fault

	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Results	Remarks
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

F.1.3. 5th Harmonic Test

Fault type: Line to Earth fault

	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Result	Remarks
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

Fault type: 3 Ø fault

Superintending Engineer (P&C)
O/o SE(Prot. & Comm.)

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	Values selected for test			
Sr. No.	I-Diff	I2f/Idiff	Result	Remarks
1	0.80I/In	19.20 %	Trip received	Operation of the relay found satisfactory
2	2.50I/In	22.70 %	No Trip received	
3	4.40 I/In	19.50 %	Trip received	
4	6.00 I/In	23.50 %	No Trip received	

F.2. Restricted earth fault Relay

F.2.1Ref fault test

Sr. No.	Phase	Applied Current (A)	Result	Remarks
1	R Ø	0.100	Trip Received	Operation of the relay found satisfactory
2	Y Ø	0.100		
3	B Ø	0.100		

F.2.2. Over flux test

Sr. No.	Phase	Applied Voltage	Result	Remarks
1	R Ø	0	Trip received	Operation of the relay found satisfactory
2	Y Ø	96.00		
3	B Ø	63.50		

8. Bay no. B 207 (220 kV bay of ICT#1 400/220/33 kV)

A. Detailed of Equipment to be tested: Circuit Breaker

Make	ALSTOM

A.1 Description of the test :Circuit Breaker Time Interval test

Results:

Sr. No.	Operation Mode	R-Phase Time (mSec)	Y-Phase Time (mSec)	B-Phase Time (mSec)	Remarks
1.	Closing	20	21	20	Values are within permissible limits
2.	Opening	70	70	69	

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O/o DGM (Prot. & Comm.)
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B. Detailed of Equipment to be tested: Relay test

B.1 Description of the test :Over Current & Earth fault Relay

Sr. No.	Phase	Applied Voltage	Applied Current	Results	Remarks
1	R Ø	63.50 V	1.00 A	No trip received	Operation of the relay found satisfactory
2	Y Ø	63.50 V	2.00 A	Trip received	
3	B Ø	63.50 V	1.00 A	No trip received	

C. Detailed of Equipment to be tested : Lightening Arrester

Make	OBLUM ELECTRICAL INDUSTRIES PVT. LTD.

C.1 Description of the test: Third harmonic Resistive Current Measurement

Ambient Temperature- 22 deg.C System Voltage – 220 kV

Phase	3rd Harmonic Resistive Current (μA)	3rd Harmonic Resistive Current (Corrected) (μA)	Remarks
R	61	24	Values are within permissible limits
Y	14	5	
B	13	5	

9. Location: Bay no. 301 (Transformer 630 KVA, 33/.415 kV)

A. Description of Test: INSULATION RESITANCE TEST

Main Winding	IR VALUE (GΩ)			Dielectric Absorption Index (60s/15s)	Polarization Index (600s/60s)	Remarks
	Time15 Sec.	Time60 Sec.	Time 600 Sec.			
HV to LV	15.5	22.8	53.50	1.47	2.34	Values are within permissible limits
HV to E	25.5	35.04	56.30	1.38	1.61	

10. Location: Bay no.402 (Tie Breaker b/w bay no.401 & 403)

A. Detailed of Equipment to be tested: Circuit Breaker

Make	Alstom

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O/o DGM (Prot. & Comm.)
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D. Detailed of Equipment to be tested: Distance Protection Relay (Main -1 & Main -2) & Back up Relay(Over current & Earth fault) –Details below:

Description of Test: Zone Reach Testing.

S.. No.	Relay	Relay make & Model	Remarks
1	Distance relay (Main-I)	Alstom&P443	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
2	Distance relay (Main-II)	ABB&REL670	Zone reach Accuracy test conducted for Line to Earth, Line to Line & 3Ø fault by selecting different values of fault impedance (z) points for respective zones
3	Backup Relay (O/C & E/F)	Alstom&P141	Pick up test of relay conducted by injecting current more than the current setting value for overcurrent in one Phase .

D.1 Main-I Relay

Fault type: Line to Earth fault(L1-E)

	Values selected for test				
Sr. No.	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	17.65	34.51	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	33.12	64.92	380.00	Relay tripped in zone-2	
3	50.00	72.90	830.00	Relay tripped in zone-3	
4	15.91	-170.00	530.00	Relay tripped in zone-4	

Fault type: Line to Line fault(L1-L2)

	Values selected for test				
Sr. No.	(Z)Fault Impedance (Ω)	Phi (Angle)	Nominal Trip time(ms)	Result	Remarks
1	5.951	30.0	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.85	74.88	380.00	Relay tripped in zone-2	

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3	25.97	77.31	830.00	Relay tripped in zone-3	
4	7.639	-180.0	530.00	Relay tripped in zone-4	

Fault type: 3 Phase fault(L1-L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(ms)**	**Result**	**Remarks**
1	5.951	30.0	30.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	14.85	74.88	380.00	Relay tripped in zone-2	
3	25.97	77.31	830.00	Relay tripped in zone-3	
4	7.639	-180.0	530.00	Relay tripped in zone-4	

D.2 Main-II

Fault type: Line to Earth fault(L2-E)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(ms)**	**Result**	**Remarks**
1	11.10	30.0	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	20.00	60.0	374.0	Relay tripped in zone-2	
3	27.10	74.79	824.0	Relay tripped in zone-3	
4	12.60	-180.0	524.0	Relay tripped in zone-4	

Fault type: Line to Line fault(L1-L2)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(ms)**	**Result**	**Remarks**
1	6.271	40.00	24.00	Relay tripped in zone-1	Operation of the relay found satisfactory
2	10.00	50.00	374.0	Relay tripped in zone-2	
3	14.68	60.00	824.0	Relay tripped in zone-3	
4	7.565	180.00	524.0	Relay tripped in zone-4	

Fault type: 3 Phase fault(L1-L2-L3)

	Values selected for test				
Sr. No.	**(Z)Fault Impedance (Ω)**	**Phi (Angle)**	**Nominal Trip time(ms)**	**Result**	**Remarks**
1	6.271	40.00	24.00	Relay tripped	Operation of

Assistant Engineer (P&C)
DGM (Prot. & Comm.)
HPPTCL, Hamirpur (H.P.)

				in zone-1	the relay found satisfactory
2	10.00	50.00	374.0	Relay tripped in zone-2	
3	14.68	60.00	824.0	Relay tripped In zone-3	
4	7.565	180.00	524.0	Relay tripped in zone-4	

D.3 Over Current & Earth fault Relay

Sr. No.	Phase	Applied Current	Result	Remarks
1	R Ø	1.00 A	No trip received	operation of the relay found satisfactory
2	Y Ø	1.00 A	No trip received	
3	B Ø	2.00 A	Trip received	

14. Location: Bay no.204 (220 kV Line Gumma - Hatkoti) Spare bay

A. Detailed of Equipment to be tested: Circuit Breaker

Make	Alstom

A.1 Description of the test :Circuit Breaker Time Interval test

Results:

Sr. No.	Operation Mode	R-Phase Time (mSec)	Y-Phase Time (mSec)	B-Phase Time (mSec)	Remarks
1.	Closing	69	69	70	
2.	Opening	19	19	19	

15. Location: Bay no.206 (220 kV Bus Coupler)

A. Detailed of Equipment to be tested: Circuit Breaker

Make	Alstom

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Bay 407 Z1, 407 Z2, 407 Z3

Gumma – Thakri CKT – 1

Annexure-B

407 Z1

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 15:11:43	Test End:	21-Oct-2023 15:11:46
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type L1-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
14.61 Ω	40.00 °	30.00 ms	24.20 ms	-19.33 %	2.000 A	Passed

Test State:

Test passed

Overload occurred during testing!

(J.E)

Bay 407 Z1, 407 Z2, 407 Z3

407 Z2

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 16:13:02	Test End:	21-Oct-2023 16:13:06
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type L1-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
24.15 Ω	44.76 °	530.0 ms	522.3 ms	-1.453 %	2.000 A	Passed

Test State:
Test passed

(J-E)

407 23

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 18:14:19	Test End:	21-Oct-2023 18:14:24
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type 1,1-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
36.31 Ω	55.50 °	1.030 s	1.016 s	-1.32 %	2.000 A	Passed

Test State:
Test passed

(JE)

Panchkula CKT - 1

409 Z1

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 15:24:32	Test End:	21-Oct-2023 15:24:36
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type **L1-E**

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
17.97 Ω	40.00 °	30.00 ms	19.60 ms	-34.67 %	2.000 A	Passed

Test State:

Test passed

(J.E)

409 Z2

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 15:25:50	Test End:	21-Oct-2023 15:25:58
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type **L1-E**

|Z|	PH	t nom	t act.	Dev.	ITest	Result
44.72 Ω	63.43 °	690.0 ms	516.1 ms	-2.823 %	1.704 A	Passed

Test State:
Test passed

(J.B)

4 of 23

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	21-Oct-2023 15:27:06	Test End:	21-Oct-2023 15:27:10
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type L1-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
71.06 Ω	66.00 °	1.530 s	1.550 s	1.281 %	1.073 A	Passed

Test State:
Test passed

(Se)

Bay 203 Zone - I Gang Matkati CKT-1

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	19-Oct-2023 17:21:34	Test End:	19-Oct-2023 17:21:37
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type L1-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
8.999 Ω	40.00 °	30.00 ms	21.30 ms	-29 %	2.000 A	Passed

Test State:

Test passed

(JE)

Ø3 line-2 Zone-3

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	19-Oct-2023 17:29:14	Test End:	19-Oct-2023 17:29:21
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type L1-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
25.25 Ω	73.81 °	830.0 ms	818.5 ms	-1.385 %	2.000 A	Passed

Shot Test: Fault Type L2-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
26.37 Ω	87.71 °	830.0 ms	817.8 ms	-1.47 %	2.000 A	Passed

Test State:
Test passed

(J.E)

Bay 204, Gwma – Makoti CKT-2
2000 - 1

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	19-Oct-2023 17:22:51	Test End:	19-Oct-2023 17:22:55
User Name:		Manager:	
Company			

Test Results

Shot Test: Fault Type **L1-E**

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
5.697 Ω	40.00 °	30.00 ms	20.20 ms	-32.67 %	2.000 A	Passed

Test State:
Test passed

(J.E)

Bay 204, 2010-3

Distance:

Test Module

Name:	OMICRON Distance	Version:	4.30
Test Start:	19-Oct-2023 17:32:11	Test End:	19-Oct-2023 17:32:18
User Name:		Manager:	
Company:			

Test Results

Shot Test: Fault Type L1-E

|Z|	Phi	t nom	t act.	Dev.	ITest	Result
30.00 Ω	82.7°	830.0 ms	818.5 ms	-1.385 %	2.000 A	Passed

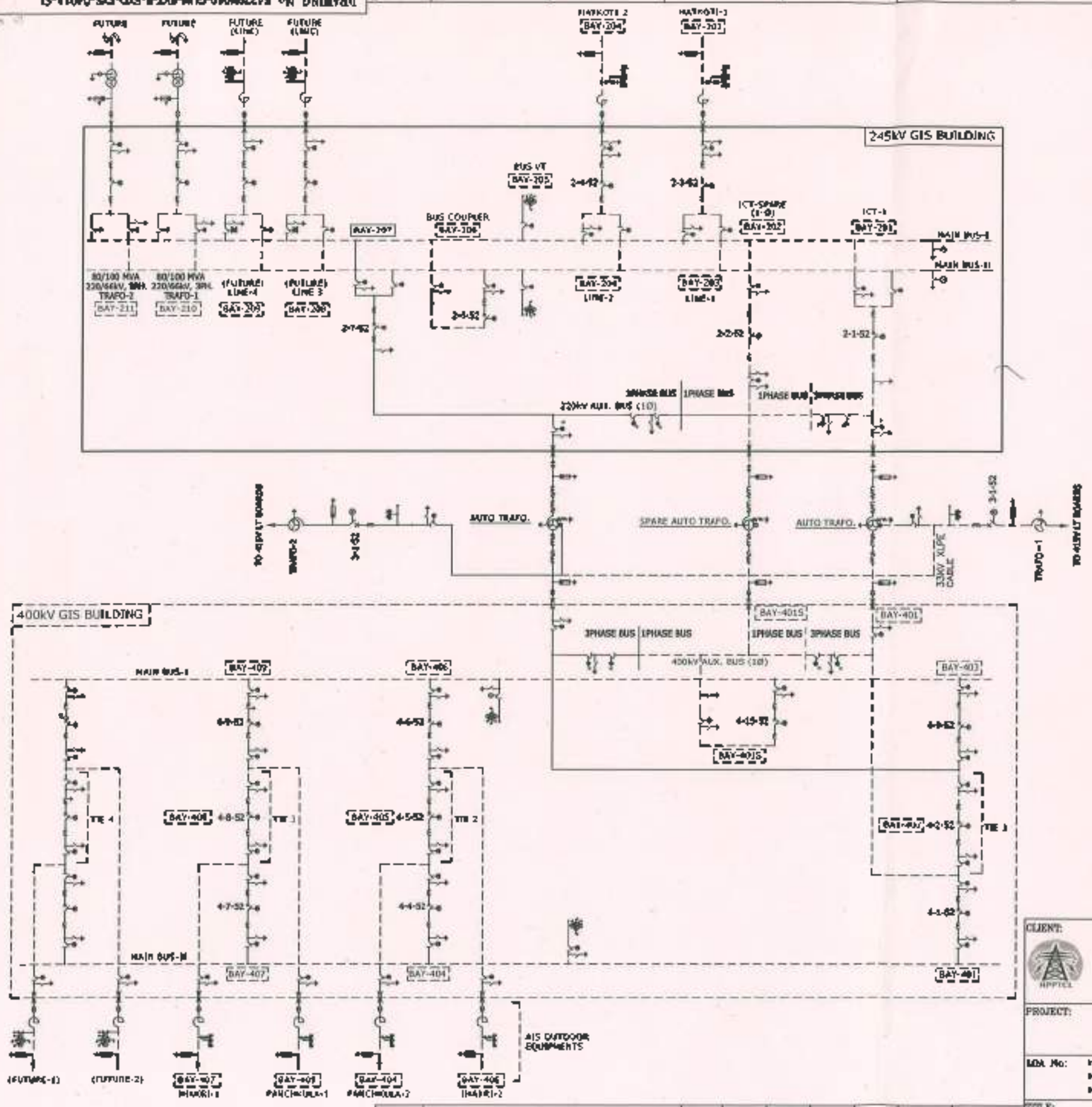
Test State:

Test passed

JE

Annexure-C

DRAWING No. 5427PM060-GUM-EXT-E-SYD-SYS-0401A-SL



SYSTEM PARAMETERS

SLNo.	DESCRIPTION OF PARAMETER	400kV SYSTEM	220kV SYSTEM	33kV SYSTEM
1	SYSTEM OPERATING VOLTAGE	400kV	220kV	33kV
2	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	420kV	245kV	36kV
3	RATED FREQUENCY	50Hz	50Hz	50Hz
4	NO. OF PHASES	3	3	3
5	ALTITUDE	1485mtr.		
6	ALTITUDE CORRECTION FACTOR AT 1500mtr	NIL @ POWER FREQ. WET		SIL + 0%
7	RATED INSULATION LEVEL AT 1500mtr			
	a) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.)	1550kVp	1175kVp	340kVp
	b) SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.) (LINE TERMINAL TO EARTH)	1110kVp	--	--
	c) ONE MINUTE POWER FREQUENCY DRY AND WET WITHSTAND VOLTAGE (kVrms)	630kVrms	460kVrms	80kVrms
8	RATED SHORT CIRCUIT CURRENT/TIME	63kA/3sec.	50kA/3sec.	40kA/3sec.
9	SYSTEM NEUTRAL EARTHING	SOLIDLY EARTHED	SOLIDLY EARTHED	UNEARTHED
10	MINIMUM CREEPAGE DISTANCE	31mm/kV	31mm/kV	31mm/kV

400KV AIS OUTDOOR EQUIPMENT's:-

1.	LIGHTNING ARRESTER 396kV, 10KA, Class-IV, 4kJ/kV, LIGHTNING ARRESTER (1Ø)	03	
2.	400/220/33kV, 105MVA, YNyOd11, ONAN/ONAF/OFAF, 1Ø TRAFO 50Hz., OLTC +10% TO -10% IN STEPS OF 1.25%	03	

220KV AIS OUTDOOR EQUIPMENT's:-

1.	LIGHTNING ARRESTER 198 / 216 kV, LIGHTNING ARRESTER, CLASS IV	03	

LEGEND:-

LIGHTNING ARRESTER	
CAPACITIVE VOLTAGE TRANSFORMER	
WAVE TRAP	
GIB	
GIS BUSDUCT	
ISOLATOR WITH ONE EARTH SWITCH	
CURRENT TRANSFORMER (CT)	
CIRCUIT BREAKER	
ISOLATOR WITHOUT EARTH SWITCH	
EARTH SWITCH	
AUTO TRAFO.	
POWER TRAFO.	
RCT	

REV. No.	DESCRIPTION	DATE	DRAWN	CHECKED: ELE	CIVIL	MECH.	APPROVED	STATUS
1	SECOND ISSUE	Name: SNT; Date: 08.11.19; Sign.		KS; 08.11.19			MGL; 08.11.19	APPROVAL
0	FIRST ISSUE	Name: SNT; Date: 22.03.17; Sign.		SGJ; 22.03.17			RMH; 22.03.17	APPROVAL

CLIENT: HIMACHAL PRADESH POWER TRANSMISSION CORPORATION LTD. (HPPTCL)

PROJECT: CONSTRUCTION OF ADDITIONAL 3X105 MVA 1- PHASE 220/400KV TRANSFORMER AT EXISTING 220/400KV GIS SUBSTATION AT GUMMA

LOA No: HPPTCL/Contracts/ADB/Gumma/Alstom/2013-4316-18 (First Contract), Dated 25.10.2013; HPPTCL/Contracts/ADB/Gumma/Alstom/2013-1319-26 (Second Contract) Dated 25.10.2013; HPPTCL/Contracts/KfW/Add Gumma-Vol-II/2016-7170-76 DATED 30.12.16

TITLE: KEY SLD FOR 400/220 KV SUBSTATION

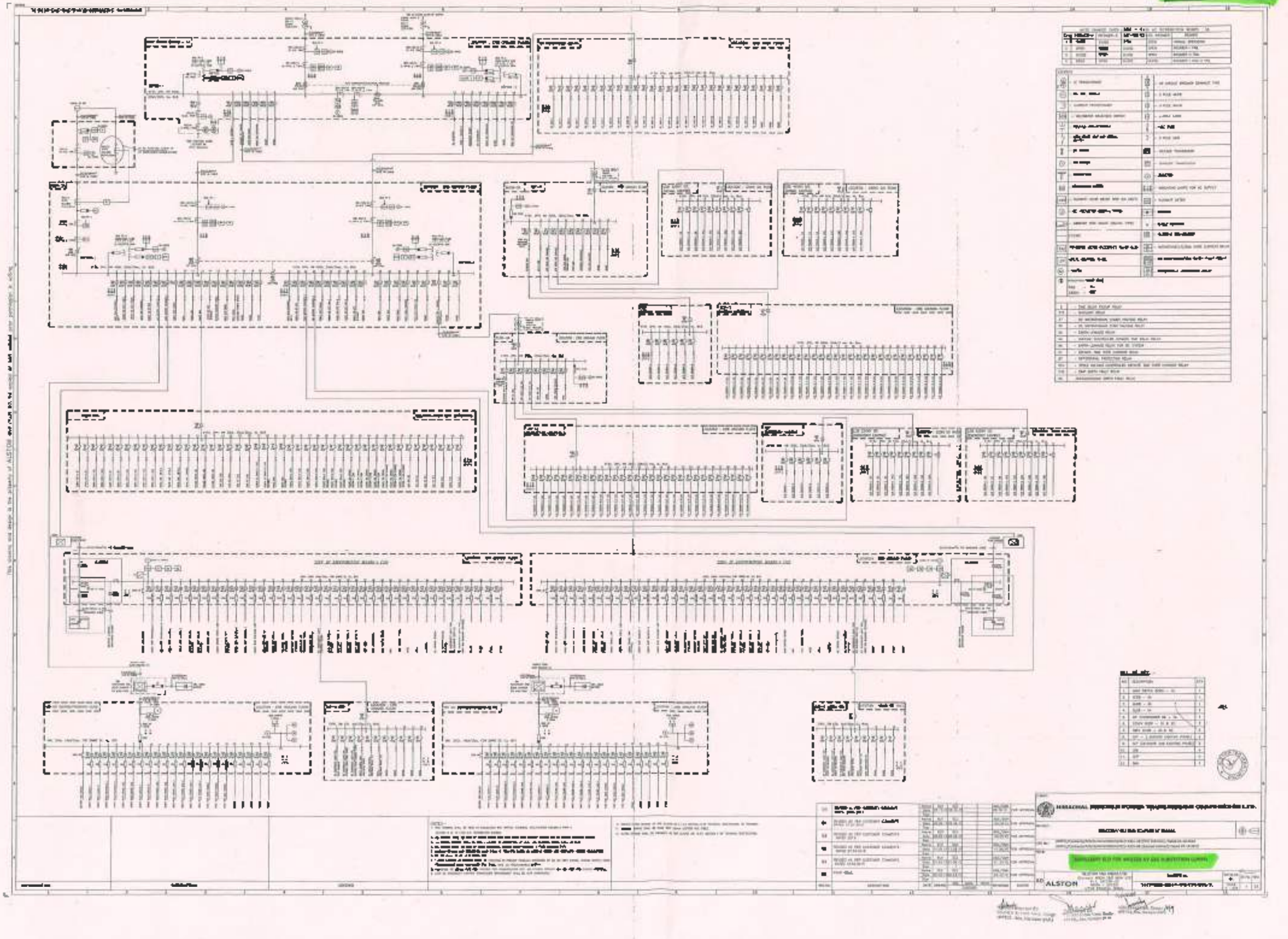
A3

GE T&D INDIA LTD (Formerly ALSTOM T&D INDIA LTD) A-7, SECTOR-65 NOIDA - 201301 UTTAR PRADESH (INDIA)

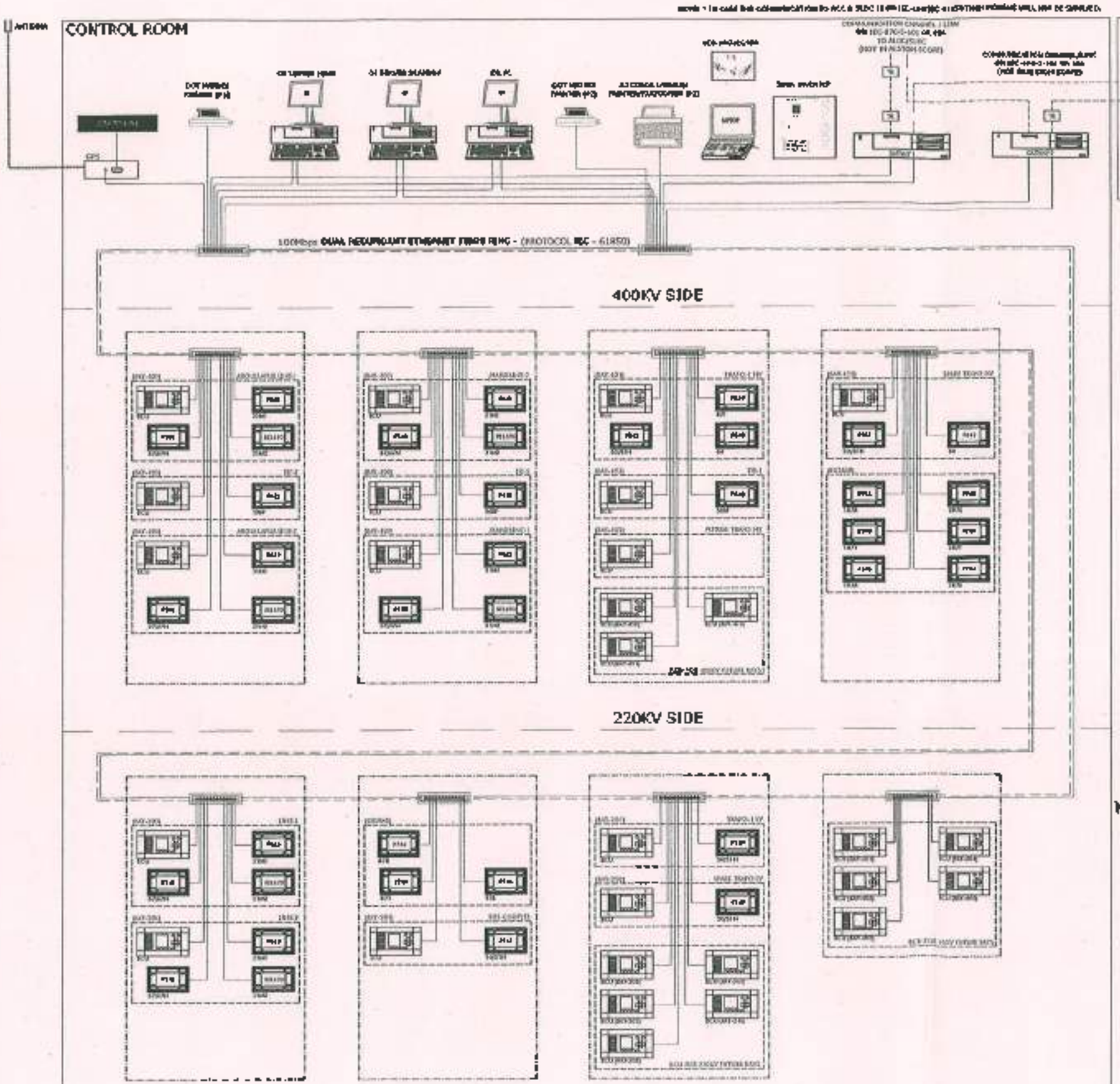
DRAWING No. 5427PM060-GUM-EXT-E-SYD-SYS-0401A-SL

TOTAL SH: 1 | SH. No.: 1 | REV.: 1 | SCALE: NTS | 1 OF 1

Annexure = D



Annexure - G



S.NO.	RELAY	DESCRIPTION
1	87T	MULTI-DIFFERENTIAL PROTECTION
2	50	REF PROTECTION
3	50/51 NH	BACKUP O/C & E/F PROTECTION
4	50BF	TIE BREAKER FAILURE PROTECTION
5	21MH	DISTANCE PROTECTION MAIN-1
6	21MH	DISTANCE PROTECTION MAIN-2
7	67/67N	BACKUP DIR. O/C & E/F PROTECTION
8	REF 670 / 287 RIB	INTEGRATED BUSBAR PROTECTION RELAY

S.NO.	DESCRIPTION	QTY.	HARDWARE/SOFTWARE SPECIFICATION
1	OI SERVER/WORKSTATION (MAIN & STANDBY)	2	MAKE: ADVANTECH ; AS PER APPROVED GTP
2	ENGINEERING WORKSTATION	1	MAKE: ADVANTECH ; AS PER APPROVED GTP
3	LAPTOP (PORTABLE ENGINEERING/WORKSTATION)	1	MAKE: HP/DELL ; AS PER APPROVED GTP
4	REMOTE HMI WORKSTATION	1	MAKE: ADVANTECH ; AS PER APPROVED GTP
5	GATEWAY WORKSTATION	2	MAKE: ADVANTECH ; AS PER APPROVED GTP
6	MONITOR 27"	4	MAKE: [illegible] ; AS PER APPROVED GTP
7	DOT MATRIX PRINTER	3	MAKE: EPSON ; AS PER APPROVED GTP
8	COLOUR LASER JET PRINTER - A3	1	MAKE: HP/CANON/EPSON ; AS PER APPROVED GTP
9	MODEM (HP)	4	MAKE: DECODE ; AS PER APPROVED GTP
10	LCD PROJECTOR	1	MAKE: PANASONIC/SANYO/HITACHI/EPSON ; AS PER APPROVED GTP
11	MIMIC TILE - SIEVA	1	MAKE: MURPHY/ENGINEERS/ANANDPC , AS PER APPROVED GTP
12	GPS RECEIVER (WITH ANTENNA & TIME DISPLAY UNIT)	1	MAKE: MASIBUS ; AS PER APPROVED GTP
13	BAY CONTROL UNIT (BCU)	28	MAKE: ALSTOM , CONFIGURED AS PER ASCHEMATIC ; REFER BOQ FOR DETAILS
14	BPS (ITEM #19)	80	MAKE: [illegible] ; AS PER APPROVED GTP ; REFER BOQ FOR DETAILS

NOTE:- i) PLCC / OPGW media selection facility should be available at remote end.
ii) DC battery charging +/- indication facility at remote end should be available.
iii) TVM metering data should be available at SCADA/Remote end.
iv) Online DGA data, hydrant status etc. should be available at remote/SCADA.
v) All required facilities as per Annexure-I, Section VIII (SAS), should be available.

Assistant Engineer (E)
O/o DGM & Head Trans Design
HPPTCL Anu, Hamirpur (HP)

Sr. Manager
O/o DGM & Head Trans Designs,
HPPTCL Hamirpur (H.P.)

Approved subject to incorporation of notes
DGM & Head Trans Design,
HPPTCL Anu, Hamirpur (H.P.)

CUSTOMER : HPPTCL
SYSTEM SPEC NO : 6420/HPPTCL/GUR-I/SVD-SAS-7000-07
SCADA MAKE : ALSTOM T&D INDIA LTD.
PROJECT : [illegible]
DRAWN : [illegible]
DATE : 26.10.2010
SYSTEM ARCHITECTURE
ALSTOM

Annexure-F

CURRENT TRANSFORMER
According to IEC 60044-1

Ith =63kA,3s Idyn =157.5kA : Ith =120% Iext=Ith

CT No	Bay Name	Customer Ref	Quantity (1 phase)	Alstom Ref	Application	Client Ref	Ratio (A)	Accuracy class	Burden (VA)	Max. KPV (Vk)	RCT (Ω) at 75deg C	Max. Exciting Current (mA) at Vk/2	ISF
LINE BAY CT													
CT-1	BAY 06 - BAY 04 BAY 09 - BAY 07	4-4-CT1, 4-6-CT2 4-7-CT1, 4-9-CT2	P1 12 Nos P2	F1	Busbar Differential Protection-2	CORE 1	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
				F1	Busbar Differential Protection-1	CORE 2	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
				M2	Metering+BCU	CORE 3	4000 / 1 2000 / 1 1000 / 1	0.2S 0.2S 0.2S	20 20 20	-	-	-	ISF < 5 ISF < 5 ISF < 5
				F1	Spare	CORE 4	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
CT-2	BAY 05 - BAY 04 BAY 09 - BAY 07	4-4-CT2, 4-6-CT1 4-7-CT2, 4-9-CT1	P1 12 Nos P2	F1	Distance Protection Main - II	CORE 5	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
				I2	Distance Protection Main - I	[illegible]	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
TRANSFORMER BAY CT													
CT-3	BAY 3 - BAY 1 BAY 1S	4-1-CT1, 4-3-CT2 4-1S-CT2	P1 07 Nos P2	F3	Busbar Differential Protection-2	CORE 1	2000 / 1 1000 / 1 500 / 1	PS PS PS	-	2000 1000 500	20 5 2.5	20 30 60	
				F3	Busbar Differential Protection-1	CORE 2	2000 / 1 1000 / 1 500 / 1	PS PS PS	-	2000 1000 500	10 5 2.5	20 30 60	
				M4	Metering+BCU	CORE 3	2000 / 1 1000 / 1 500 / 1	0.2S 0.2S 0.2S	20 20 20	-	-	-	ISF < 5 ISF < 5 ISF < 5
				F3	Spare	CORE 4	2000 / 1 1000 / 1 500 / 1	PS PS PS		2000 1000 500	10 5 2.5	20 30 60	
CT-4	BAY 3 - BAY 1 BAY 1S	4-1-CT2, 4-3-CT1 4-1S-CT1	P1 07 Nos P2	F3	Transformer Backup Protection	CORE 5	2000 / 1 1000 / 1 500 / 1	PS PS PS	-	2000 1000 500	10 5 2.5	20 30 60	
				F3	Trafo. Differential Protection	CORE 6	2000 / 1 1000 / 1 500 / 1	PS PS PS	-	2000 1000 500	10 5 2.5	20 30 60	
TIE BREAKER CT													
CT-5	BAY 05 - BAY 06 BAY 02	4-5-CT2, 4-8-CT2 4-2-CT2	P1 09 Nos P2	F5	Trafo Diff. Prot./ Line Distance Main I	CORE 1	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
				F5	Trafo Backup Prot./ Line Distance Main II	CORE 2	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
				M2	Metering+BCU	CORE 3	4000 / 1 2000 / 1 1000 / 1	0.2S 0.2S 0.2S	20 20 20	-			ISF < 5 ISF < 5 ISF < 5
CT-6	BAY 05 - BAY 06 BAY 02	4-5-CT1, 4-8-CT1 4-2-CT1	P1 09 Nos P2	F5	Trafo Diff. Prot./ Line Distance Main I	CORE 4	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
				F5	Trafo Backup Prot./ Line Distance Main II	CORE 5	4000 / 1 2000 / 1 1000 / 1	PS PS PS	-	4000 2000 1000	20 10 5	20 30 60	
				M2	Metering+BCU	CORE 6	4000 / 1 2000 / 1 1000 / 1	0.2S 0.2S 0.2S	20 20 20	-			ISF < 5 ISF < 5 ISF < 5

CVT DESIGNATION	BURDEN	CLASS	CORE NO.	RATIO
LINE CVTs (12 Nos.) 4-6-CVT, 4-4-CVT, 4-9-CVT, 4-7-CVT	50 VA	0.2	1	400kV/√3 / 110V/√3
	50 VA	3P	2	400kV/√3 / 110V/√3
	50 VA	[illegible]	[illegible]	400kV/√3 / 110V/√3

VOLTAGE TRANSFORMER DATA (EHVT)

VT NO	BAY NAME	Quantity (1 phase)	Core	Ratio (kV)	Class	Output (VA)	Thermal Burden
T1S T2S	METERING	6 Nos	VT-1	400kV/0.11kV	3P	50	1000
			VT-2	400kV/0.11kV	3P	50	1000
			VT-3	400kV/0.11kV	0.2	50	1000

33kV CT

CT No	Application	Core	Ratio	Accuracy class	Burden (VA)	ISF
3-1-CT	PROTECTION	CORE 1	5A / 1	5P10	10	-
	METERING	CORE 2	5A / 1	0.5	10	5

Insulation level and short ckt. current (SCC) to be intensified in separate dwg.

33kV VT #

VT NO	Application	Ratio (kV)	Class	Output (VA)
3-1-VT	PROTECTION	33kV/0.11kV	3P	10
	METERING		0.5	10

One minute power frequency withstand voltage dry/wet to be indudified in separate dwg.

NOTE: DIFFERENTIAL PROTECTION ALGORITHM REVIEWED DURING CVT SCHEME FINALISATION. SHALL BE

REPORT OF INTERNAL PROTECTION AUDIT

As per IEGC-2023 & HQ, Internal Protection audit of NAPS is to be carried out Annually. Committee has been constituted against letter no. NAPS/CS/2.26/2023/S-142 Dt. 27.10.2023.

Annual Internal Protection audit of NAPS was done on **28.03.2024** and details of audit are tabulated below:-

A.	**General Information:**	
1.	Name of Generating station:	Narora Atomic Power station, Narora, Bulandshahr (UP)
2.	Type of Bus Switching Scheme:	Double Main & Transfer scheme
3.	**Names of Audit Team:**	
	Sh. S.K. Goyal, SE(E&I), Team Leader	
	Sh. Harish Sharma, EMU, Member	
	Sh. Satish Kumar, Operation, Member	
	Smt. Arpita Chakravorty, TSU(E&I), Member Secretary	
B.	**Instrument Transformer**	

B1	Name of 220KV transmission bay	Current Transformer (CT)		Capacitive Voltage Transformer (CVT)		Voltage Transformer (VT)		Lightning Arrester (LA)
		Date of Ratio Testing	Date of Capacitance & tan delta Testing	Date of Ratio Testing	Date of Capacitance & tan delta Testing	Date of Ratio Testing	Date of Capacitance & tan delta Testing	Date of Replacement
1	220KV Line-1 (Sambhal)	25.11.23	25.11.23	25.11.23	25.11.23	-	-	06.09.23
2	220KV Line-2 (Simbholi)	30.11.23	30.11.23	30.11.23	30.11.23	-	-	03.12.23
3	220KV-LINE-3 (Dibai)	25.05.22	25.05.22	27.01.22	27.01.22	-	-	20.09.23
4	220KV-LINE-4 (Khurja)	29.05.22	29.05.22	27.01.22	27.01.22	-	-	17.12.23
5	220KV-LINE-5(Atrauli)	29.05.22	29.05.22	07.02.22	07.02.22	-	-	24.12.23
6	220KV Bus Coupler Bay	28.05.22	28.05.22	-	-	-	-	-
7	220KV Transfer Bay	26.05.22	26.05.22	-	-	-	-	-
8	220KV GT-1 Bay	09.12.23	10.12.23	-	-	-	-	21.11.23
9	220KV SUT-1 Bay	25.05.22	25.05.22	-	-	-	-	16.02.24
10	220KV GT-2 Bay	09.12.23	10.12.23	-	-	-	-	09.11.23
11	220KV SUT-2 Bay	26.12.23	26.12.23	-	-	-	-	21.12.23
12	220KV Bus-B	-	-	-	-	20.12.23	20.12.23	-
13	220KV Bus-C	-	-	-	-	03.01.24	03.01.24	-

28/3/24 28.3.24 28.3.24 28/03/24

C.	Availability of Protection System		
C1)	Bus Bar relay (220 KV)	Make and Model of Bus Bar relay	Date of testing
1	Bus-B Bus Bar differential protection	ABB Make, Model-RADSS	20.12.2023
2	Bus-C Bus Bar differential protection	ABB Make, Model-RADSS	03.01.2024

D.	Transmission Line Protection-										
D1	Name of Line	Main-I Protection	Availability (Yes or No)	Date of testing	Main-II Protection	Back up Protection	Availability (Yes or No)	Date of testing	LBB Protection	Availability (Yes or No)	Date of testing
1	NAPS-SAMBHAL	Make AREVA, Model-P442	Yes	02.08.2023	Not Provided	Make English Electric, Model CDD-26	Yes	02.08.2023	Make ABB, Model RAICA	Yes	02.08.2023
2	NAPS-SIMBHOLI		Yes	01.08.2023			Yes	01.08.2023		Yes	01.08.2023
3	NAPS-DIBAI		Yes	28.08.2023			Yes	28.08.2023		Yes	28.08.2023
4	NAPS-KHURJA		Yes	15.12.2023			Yes	15.12.2023		Yes	15.12.2023
5	NAPS-ATRAULI		Yes	04.08.2023			Yes	04.08.2023		Yes	04.08.2023
D2	Whether all numerical relays are time synchronized					Yes					
D3	Whether all numerical relays are configured for Disturbance recording					Yes					
D4	Whether all numerical relays are provided with PLCC					Yes					

E.	Transmission line parameters					
E1	Name of the line	NAPS-Sambhal	NAPS-Simboli	NAPS-Dibai	NAPS-Khurja	NAPS-Atrauli
1	Line length	64.01 Km	83.675 Km	21.0618 Km	60.05 Km	38.577 Km
2	Line parameters (in ohms/ per KM/ per phase primary value)					
	R1	0.075	0.075	0.075	0.075	0.075
	X1	0.399	0.399	0.399	0.399	0.399
	R0	0.22	0.22	0.22	0.22	0.22
	X0	1.339	1.339	1.339	1.339	1.339
	ZOM	-	-	0.4524	0.4524	-
	Note- NAPS-Dibai (line-3) and NAPS-Khurja (line-4) were originally double Ckt lines from NAPS to Khurja. After LILO formation at Dibai in year-2015, Line-3 length got reduced to 21.06 Km and both lines still run on same tower i.e. NAPS to Dibai and further Dibai to Khurja in parallel with NAPS-Khurja line.					

28.3.24 28/3/24 20.3.24 28/3/24

F.	Transmission line setting												
F1	Name of line	Zone-1		Zone-2			Zone-3			Zone-4			Remarks
		Reach (%)	Reach (Ohm)	Reach (%)	Reach (Ohm)	TD (ms)	Reach (%)	Reach (Ohm)	TD (ms)	Reach (%)	Reach (Ohm)	TD (ms)	
1	Narora-Sambhal	80% of line imp.	8.316	120% of line imp.	12.474	350	120% of (100% Protected Line + 100% adjacent Line)	17.155	1000	25% of Z-1 reach setting	2.079	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% (100% Protected Line + 100% adjacent Line+100% next to adjacent Line) with TD of 2.5 sec.
2	Narora-Simbholi	80% of line imp.	10.871	120% of line imp.	16.307	350	120% of (100% PL + 100% AL)	26.329	1000	25% of Z-1 reach setting	2.7178	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 2.0 sec.
3	Narora-Dibai	80% of line imp.	2.696	120% of line imp.	6.572	350	120% of (100% PL + 100% AL)	10.449	1000	25% of Z-1 reach setting	0.674	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 2.5 sec.
4	Narora-Khurja	80% of line imp.	7.802	120% of line imp.	11.702	350	120% of (100% PL + 100% AL)	21.739	1000	25% of Z-1 reach setting	1.9505	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 3.0 sec.
5	Narora-Atrauli	80% of line imp.	5.012	120% of line imp.	7.518	350	120% of (100% PL + 100% AL)	10.960	1000	25% of Z-1 reach setting	1.253	350	Z-5 is enabled in forward direction (next to Z-3) with reach setting of 300% with TD of 2.0 sec
6	Power Swing Block (PSB)	All zones are block except zone -1, Unblocking TD 2.0 sec											
7	Broken conductor	Enabled, TD 5.0 sec											
8	Auto Reclose	Single phase Auto Reclose scheme in all five lines is functional through a separate auto reclose EE make relay type VARM-11. Reclosing time (dead time)-0.6 sec, Reclaim time- 25 sec											
9	Over Voltage Prot.	Enabled in Main-I protection; Stage 1: Pickup>1.25 times rated with TD 5sec Stage 2: Pickup>1.45 times rated with TD 150msec											

28/3/24 Arpela 28.3.24 28.3.24

G.	Transformer Protection									
G1	Name of T/F	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protect. (Make & Model)	Over Flux Protection (Make & Model)	OTI/WTI	Buchholz & PRD	Date of testing	LA Rating HV Side	LA Rating LV Side
1	GT-1	Make ABB, Model RADSB	Make: ABB, Model: RADHD	Make-EE , Model CDG-31	Make: ABB, Model: RATUA	Working	Yes	09.06.2022	216 KV	NA
2	GT-2					Working	Yes	21.01.2024	216 KV	NA
3	SUT-1	Make ABB, Model RADSE	Make ABB, Model RADHD	Make: EE, Model: CDD-23 & CDD-21	-	Working	Yes	24.05.2022	216 KV	NA
4	SUT-2				-	Working	Yes	25.12.2023	216 KV	NA

H.	DC supply										
		NAPS-1		NAPS-2		NAPS-1	NAPS-2	NAPS-1	NAPS-2	NAPS-1	NAPS-2
		250V DC Bus-W	250V DC Bus-X	250V DC Bus-W	250V DC Bus-X	48 V DC BUS-J		48 V DC BUS-K		48 V DC BUS-L	
a	Measured voltage (to be measured at furtherest Panel	261.0	261.3	261.2	261.3	49.1	49.1	48.2	49.7	49.7	49.9
b	No. of Cells Per Bank	120		120		22	22	22	22	22	22
c	Availability of Battery Charger	Yes		Yes		Yes		Yes		Yes	

I.	Circuit Breaker				
I1	Name of 220 KV Bay	Make and Model	Status of Breaker Available or Not	No. of trip/close coil & healthiness	Date of Last Over hauling
1	220kV Bus Coupler Bay	MAKE: ABB, MODEL: DLF-245-NC-2 AIR BLAST CIRCUIT BREAKERS	Available	TRIP COIL-02 nos. CLOSE COIL-01 no. all coils are healthy	21.12.2023
2	220kV GT-1 Bay		Available		20.05.2023
3	220kV SUT-1 Bay		Available		12.05.2022
4	220kV Sambhal Bay		Available		20.12.2023
5	220kV SUT-2 Bay		Available		16.12.2023
6	220kV Simbholi Bay		Available		25.03.2023
7	220kV Dibai Bay		Available		10.12.2023
8	220kV Khurja Bay		Available		17.12.2023
9	220kV GT-2 Bay		Available		22.12.2023
10	220kV Transfer Bus Bay		Available		07.03.2023
11	220kV Atrauli Bay		Available		27.12.2023

28.3.24 28/3/24 28.3.24

J.	**Availability of UFR relay**	
J1	Make	ALSTOM
J2	Setting	i) 48.0 Hz Alarm ii) 47.9 Hz Tripping of transmission lines (NAPP-SAMBHAL, NAPS-ATRAULI) when both units under operation. iii) 47.9 Hz Tripping of transmission lines (NAPP-SAMBHAL, NAPS-ATRAULI & NAPS-KHURJA 1 & 2) when only one unit under operation iv) 47.5 Hz with 0.5 sec time delay- Tripping of SUT & initiation of ATS. v) 47.5 Hz with 1 sec time delay- Tripping of GT CB (Unit on house load operation) and all transmission lines.
K.	**Status of Corrective action based on Tripping analysis**	i) On Aug-2021, NAPS both units tripped and NAPS switchyard got isolated from grid due to fault caused by bursting of R-phase CVT of Narora-Sambhal line. Subsequently NPCIL designer, HQ suggested to implement two additional protections (Non-directional phase over current and Over voltage stage-1 & 2) in 220KV transmission line distance protection relay. Both the protections have been enabled in all lines after taking NRPC approval in PSC. ii) Zone-4 time setting of all five 220KV transmission lines has been changed to 350 msec from 800 msec as per NPCIL HQ designer's recommendation after CVT failure event.
L.	**Recommendation/ Suggestion**	Main-II protection is to be provided for all five 220KV transmission lines. **(Agency-EMU)**

To,
SE (O), NRPC (seo-nrpc@nic.in)
Sh. Ruchir V Oza, ACE, HQ (rvoza@npcil.co.in)

CC,
SD/ CS for kind info.
TSS/ MS/ OS
SME/ STE (E&I)

Arpita 28.3.24
Arpita Chakravorty
TSU (E&I), Member Secretary

28/3/24
Harish Sharma,
EMU, Member

28.3.24
Satish Kumar,
Operation, Member

S. K. Goyal 28/3/24
SE (E&I), Team Leader

न्यूक्लियर पॉवर कार्पोरेशन ऑफ इंडिया लिमिटेड
NUCLEAR POWER CORPORATION OF INDIA LIMITED
भारत सरकार का उद्यम (A Government of India Enterprise)
रावतभाटा राजस्थान साइट 1एवं 2 Rawatbhata Rajasthan Site-1&2
डाक:अणुशक्ति 323303-वाया:कोटा (राज.) PO:Anushakti–323303 Via:Kota(Raj.)

Report of the Internal protection Audit

A. General information

B. Check list for protection Audit

i. Name of Uti1ity: RAPS-UNIT-1&2), NPCIL

ii Name of Voltage level of Sub-Station :220KV

iii Date of commissioning: 1980

iv Type of bus-switching scheme: Sectionalized Main Bus and Transfer Bus

v Name and Audit Team:

1.0 Mr. Arvind Goyal, TE(E&I), TSU

vi Name of representative from utility whose audit is being carried out:

1.0 Mrs. Supriya Bhanja SME(Electrical).

2.0 Mr.VirendraYadav, SO/E

S. No	Check		Functional/ non-functional/Enabled/ Disabled	Type of relay (Numerical/Static/Electro mechanical)	Setting as found in field	Remark
1	**DC system**					
1.1	No. of independent DC sources	3				
1.2	Potential between +ve & earth (250V Source- l)	+120.5	Functional	Static, Model: S2 IL, E/F relay make: SIGMA	E/F Current setting: 3mA in 250V DC system and 0.03 mA in 48 V DC systems.	
1.3	Potential between –ve & earth (250V Source-I)	-138.2	Functional			
1.4	Potential between +ve & earth (250 V Source-2)	+123.0	Functional			
1.5	Potential between –ve & earth (250V Source-2)	-135.4	Functional			
1.6	Potential between +ve & earth (48 V Source-I)	+21.3	Functional			
1.7	Potential between –ve & earth (48 V Source-I)	-27.6	Functional			
2	Event logger panel	YES	Functional			
3	Event Logger Time Synchronised	Yes				
3.1	Disturbance recorder	Yes				
3.2	DR time Synchronised	Yes				

4	**Generator-Transformer Protection Panel:**					
4.1	**Tripping by Buchholz relay**	Yes	Functional	Electromechanical	200 CC alarm 400 CC Tripping	
4.2	**Differential Protection**	Yes	Functional	Electromechanical type, Model: BDD15B, Make. CGE Transformer Differential relay with percentage and harmonic restraint.	Slope: 25%, 2nd Harmonic restraining=20%, Id=1.23 to 1.28 A, CTR=8000/5A, for generator side, 1265/5A for 230 KV Bus side and 2000/5 UT Side	
4.2.1	2n Harmonic Block (setting)	Yes	Functional			
4.2.2	Event logger operation	Yes	Functional			
4.3.	**Restricted Earth Fault Protection (HV side)**	NO				
4.3.1	**REF protection (LV side)**	NO				
4.3.2	Event logger operation	Yes	Functional			
4.4	**Backup over current**	Yes	Functional	Electromechanical type, Model: IJCV51A, Make: CGE Inverse Time over current relay with voltage restrain	CTR=800/5A PSM=8 TMS=6	
4.4.1	Event logger operation	Yes	Functional			
4.5	Earth Fault protection	Yes	Functional	**HV Side-** Electromechanical type, Model- IAC53B Make-CGE Very Inverse Time 0.5-2A And 1-4A Instantaneous Over Current Relay **LV Side-** Protected by stator E/F protection of generator.	**HV Side-** Very Inverse type, CTR=800/5A, PSM=2, TMS=6 **LV Side-** NGT-21000/230 V Setting-10 V	

				Electromechanical type, Model- IAV51D Make-CGE Inverse Time 115 V Voltage Relay		
4.5.1	Event logger operation	Yes	Functional			
4.6	**Over flux Protection**	Yes	Functional	Electromechanical Type Model-GTT21 MAKE-EE	**Stage-I** 107.5% +5Sec alarm and AVR run back 107.5% +5 Min.-Trip **Stage-II** 112.5%+15Sec-Trip	
4.6.1	Event logger operation	Yes	Functional			
4.7	**Local Breaker Back up**	Yes	Functional	Electromechanical Type Model-CTIG 39 MAKE-EE	R, B Phase=4A Neutral Phase-1A CTR=800/5 A	
4.7.1	Re trip	Yes	Functional			
4.7.2	Current and time setting	Yes	Functional			
4.7.3	Separate single and three phase initiation	Yes	Functional			
4.7.4	Earth fault	Yes	Functional			
4.7.5	Event logger	Yes	Functional			
5	**220KV transmission lines** **(Distance protection panel: M-I/II)**					
5.1	Pole discrepancy relay	Yes	Functional		PDR TIME (a) 100ms in 220kV Transmission Lines	
5.2	PLCC panel	Yes	Functional			
5.3	Zone-1/2/3/4/5 (Setting)	Yes	Functional	For-Kota & Debari Line Main-I-Micom-P-442 relay Main-II-Micom P-443 relay For-RAPP-A&B Tie Line Main-I-Micom-P-545 relay Main-II-Micom P-545 relay	As recommended by HQ /NRPC guideline.	
5.4	Time chek-Z-1/2/3/4/5 (settings)	Yes	Functional			
5.5	SOTF	No				
5.6	Aided scheme	Yes	Functional			

5.7	Fault locator	Yes	Functional			
5.8	power swing (setting R and X)	Yes	Only Alarm configured			
5.9	All zone block	No				
5.10	DR	Yes				
5.11	Binary inputs	Yes				
5.12	Breaker contacts	NO				
5.13	Carrier receive	Yes	Functional			
5.14	Time synchronization	Yes	Relay manually scheduled time adjusted & match with GPS timing			
6	Bus Bar Protection	Yes	Functional	Electromechanical Relay Differential relay Model-IFD52BMake-CGE Differential Relay with 2-8 A Instantaneous unit Impedance check Relay Model-CFZ17B Make-CGE	CTR=1200/5A PTR-230000/115 V Differential relay-Trip-6 A Impedance Relay-Trip-6A at 100V	
6.1	Stability Check	Yes				
6.2	EL output for this event	Yes				
6.3	DR if available	No				
7	Single Phase Auto Reclose Scheme	No				
8	CT					
9	Suitable as per fault level	Yes				
10	DG Set	Yes	2 No. 1500KVA, 3Ph. 415 V			
11	Mock testing of a sample protection associated with transmission line***	Yes	Functional test of protection scheme is carried out once in every two year.			

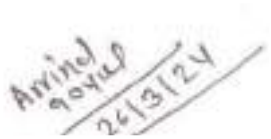
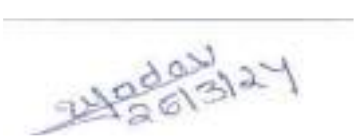
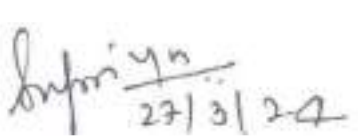
*** Purpose is to check whether the operation of that protection relay energizes the breaker trip coil.

C. Observation w.r.t compliance to NRPC protection philosophy. AS MENTIONED ABOVE.

D. Any other Observation/ Suggestion by the team of protection expert: NIL

Copy to:

i. SE (O), NRPC
ii. SD/CS/TSS/MS/SME(E), RAPP-A
iii. Shri Ruchir OZA, ACE (Operations), HQ, Mumbai

		
Arvind Goyal TE (E&I)	Virendra Yadav SO/E, EMU	Supriya Bhanja SME(E)

NUCLEAR POWER CORPORATION OF INDIA LTD.

Report of the Internal Protection Audit (19.02.24 to 23.02.24)

A. **General Information**

i) **Name of Utility**: RAPP-C (RAPS-Unit-5&6), NPCIL

ii) **Date of commissioning**: 2006 (For 220KV), 2008 for 400KV

iii) **Voltage level** : 220KV & 400 KV

iv) **Type of bus-switching scheme**: DOUBLE MAIN BUS((I&II) for 220KV and 1/2 Breaker scheme in 400 KV Switchyard.

v) **Name of Audit team**: Ranjeet Kumar, Jemini Vyas, G.S. Naruka, D.K. Shringi

vi) **Name of Section Head and Section, whose audit is being carried out:** Sh. Ajay Arora, SME (Electrical)

B. **Check list for protection Audit**

S. No	Check	Yes/No/ Value	Functional/ non-functional/Enabled/ Disabled	Type of relay (Numerical/Static/ Electro mechanical	Setting as found in field	Remark
1.	**DC system**					
	No. of independent DC sources	4				
	Potential between +ive & earth (220V Source-1)	+116.0 V	Functional	Static, Model: ALSTOM Make CAEM 21 E/F relay.	E/F Current setting: 07 mA	
	Potential between -ive & earth (220V Source-1)	-115.9 V	Functional			
	Potential between +ive & earth (220V Source-2)	+115.3 V	Functional			
	Potential between -ive & earth (220V Source-2)	-117 V	Functional			
	Potential between +ive & earth (48 V Source-1)	+25.6 V	Functional			
	Potential between -ive & earth (48V Source-1)	-24.9 V	Functional			

	Potential between -ive & earth (48 V Source-2)	+25 V	Functional			
	Potential between -ive & earth (48V Source-2)	-25 V	Functional			
2.	**Disturbance recorder**	**Yes**	Centralized type, make: Hathaway. Functional. DR is also inbuilt in all line numeric protection relays.	Hathaway		
	DR time Synchronised	**No**				
3.	**Generator-Transformer Protection Panel :**					
	Tripping by Buchholz relay (Alarm)	**Yes**	Functional	Electromechanical	Inbuilt	
	Differential Protection	**Yes**	Functional	RADSB	Id=25% of In, Iunrestrained =20 times of In, 2nd harmonic blocking enabled	
	2nd Harmonic Block (setting)		Functional			
	Event logger operation	**Yes**	Functional			
	Restricted Earth Fault Protection (HV side)	**Yes**	Functional	RADHD, ABB	Trip current=5% In	
	Event logger operation	**Yes**	Functional			
	REF protection (LV side)	**Yes**	Covered/protected by 100% stator E/F protection of generator. Static Relay Type: REG 316 (ABB)			
	Event logger operation	**Yes**	Functional			
	Backup over current	**Yes**	Functional	ICM 2IP, MAKE-ABB	PSM-50%, TMS-0.15, High set N/A	
	Event logger operation	**Yes**	Functional			
	Earth Fault protection	**Yes**	Functional	ICM 2IP, MAKE- ABB	PSM=40% TMS-0.39	
	Event logger operation	**Yes**	Functional			
	Over flux Protection	**Yes**	Functional	ABB RALK	Pick up 110%	
	Event logger operation	**Yes**	Functional			

	Local Breaker Back up	**Yes**	Functional	ABB RAICA	I=0.2A, T=0.25Sec	
	Retrip	**Yes**	Functional			
	Current and time setting					
	Separate single and three phase initiation (Auto Reclose)	**Yes**	Functional, R-PH, Y-PH, B-Phase.		Single phase Auto Reclose	
	Earth fault	**Yes**				
	Event logger	**Yes**	Functional			
5.	**Distance protection panel: M-I/II**					
	Pole discrepancy relay	**Yes**	Functional in all lines	Areva	PDR TIME (a) 1.2 Sec in 220kV Anta Line & 300 mSec RAPS-B To RAPS-C Tie lines. (b) 400 m sec in 400kV Lines	
	PLCC panel	**Yes**	Functional in all lines except Tie Lines			
	Zone-1/2/3/4/5 (Setting)	**Yes**	**Functional** in all lines	1 M-I relay: Micom P 442 & Back up protection relay: RAPDK3 in 220 KV Anta line. 2 M-I relay: Pilot wire diff protn (Micom P545) and M-II protection relay: Micom P543) in 220kV TIE line-I & II to RAPS-5&6. 3 M-I relay: Micom P 442 & M-II protection relay:	1. **220 KV Anta Line for main relay**: Z1=80%, Z2=100%of protected line+50% of next shortest line. Z3=(100% of protected line+100% of longest line at remote end) X 1.2. Z4= 25%of Z1. **220 KV Anta Line B/U O/C protection relays:** CTR=800/1 A, IDMT characteristic, PSM=100% TMS=0.20•, High set current=20A.	

				Micom P 437 in 400 KV lines.	2. **Tie line protection settings:** For 220 KV RAPS-C to RAPS-B Tie Lines Main I & II protection Micom P545 current differential relay, dual slope characteristic Is1- 0.2In, Is2- 2In, K1- 30% & K2- 150%. Zone-1 Setting-5.4 ohms, 0.35 Sec, Zone-2 Setting-20.04 ohms, 0.85 Sec. 3. **400 KV line Main:** Main-1 & Main-2 relay settings: Z1=80%, Z2=100%of protected line+50% of next shortest line. Z3=(100% of protected line+100% of longest line at remote end)x1.2. Z4=25% of Z1. CTR=2000/1 A,	
	Time check-Z-1/2/3/4/5 (settings)	**Yes**	Functional in all lines		tZ1= 0.0 ms tZ2=0.350 sec tZ3= 1 sec tZ4= 0.450 sec for 220 KV Anta line tZ1= 0.0 ms tZ2=0.350 sec	

					tZ3=1 sec tZ4= 0.35 sec for 400 KV Chittor line tZ3= 0.0 ms tZ2=0.300 sec tZ3=0.800 sec tZ4= 1 sec for 400 KV Kankroli & Kota line	
	SOTF	**Yes**	Functional in all lines having Main relay as Micom P 442 in 220 KV Anta Line. Main relay as Micom P 442 & P 437 in 400 KV Lines.		For all zones Tp=110 mSec Td=3 sec	
	Aided scheme	**Yes**	Functional in all lines			
	Fault locator	**Yes**	Available in all line protection relays.			
	Power swing (setting R and X)		Functional in all lines	Inbuilt with main relays.	ΔR & X=30% of Z3 R3 Unblocking time 0.5 sec	
	All zone block	**NO**			Z2,Z3,Z4 Block	
	DR	**Yes**	1) Inbuilt in all line protection relays. 2) Centralized type, make: Hathaway. Functional			
	Binary inputs					
	Breaker contacts	**Yes**				
	Carrier receive	**Yes**	Functional			

	Time synchronization	**Yes**	220KV: Tie Line-1, Tie Line-2, Anta line and 400KV: Kota Line-1 protection relays are time synchronized.	Micom P545, Micom P442		
6.	**Bus Bar Protection**	**Yes**	functional	Numeric P741 & P743 relay (Alstom) in 220 KV systems. High impedance	Id = 1.2 In with dual slope characteristic. Slope 1 & slope 2 are 30 & 60 %.	
				PBDCB in 400 KV Main Bus 1 & Main bus 2.	310.88 Volt in 400 KV bus bar protection.	
	Stability Check		Checked at the time of new bay integration in Yr-2018 for 220 KV system & in Yr-2016 for 400 KV system.			
	EL output for this event	**Yes**				
	DR if available	**Yes**				
7.	**Single Phase Auto Recloser Scheme**	**Yes**	Functional in all lines except Tie Lines	Main-I protection relay Micom P442 Main-II protection relay Micom P437	1 pole auto-reclose in zone-1 Dead Time-1 sec (400kV) - 600 ms (220kV)	
8.	**CT**					
	Suitable as per fault level	**Yes**	CT rating 40KA, 03sec for 220KV & 1Sec for 400KV. Station fault feeding capacity=39.36 KA			
9.	**DG Set**	**NO**				

10.	**Mock testing of a sample protection associated with transmission line**	No	It's a nuclear generating station. S/D could not be arranged and even minor disturbance due to malfunctioning or human error in the system is not tolerable.			

C. Recommendations/Suggestions by the Protection Audit Team:

1. Back up protection relay of 220kV Anta Line is to be changed as Main-II and to be replaced by Numerical Relay.
2. Time Synchronization of distance protection relays (400kV lines Kankroli line and Chitorgarh Line) & disturbance recorder / event logger has to be done.

(Name, Signature and Designation of team comprising of carrying out protection audit, as per letter no. RR Site/Unit-5&6/SD/2024/S/39 dt. 16.02.2024).

To,
SE (O), NRPC

Copy to: (i) Station Director
(ii) Chief Superintendent
(iii) MS/ OS/ TSS
(iv) **SME (E)**
(v) STE(E&I)

Ranjeet Kumar
SA/E, TU (E&I)

B.P. Bhatt, SA/F

(G.S. Narula)
TO/E, EMU-526

(D.K. Sharma)
SO/F, TSU

Compliance of protection audit for Khaltsi Substation		
1	Over current was wrongly enabled in 220kV Leh and Kargil lines, the same was disabled during audit.	Complied during audit
2	Buchholz alarm to be configured to trip as per CC guidelines for ICT-1.	Complied
3	20ms delay timer was not used for transformer and reactor body protections, the same was implemented during audit.	Complied during audit
4	Over flux and over current earth fault setting of transformer was not as per template, the same was corrected during audit.	Complied during audit
5	For backup earth fault IN>3 stage was enabled in setting, however in PSL the same was not in use. Same was corrected during audit.	Complied during audit
6	Relay test results are not available at site as well as in SAP.	Complied
7	Multiple extracted relay settings, PSL, PSL files are available in engineering PC. For avoiding confusion, only latest versions should be available.	Complied
8	Backup of all softwares and configuration files to be kept in CDs.	Complied
9	Battery bank discharge test is pending for all banks.	New 220V bank commissioned, spares available. Second 220V bank to be rejuvnated in August 2023, LOA already placed.
10	Dressing of Fiber cables to be done in C&R panels.	Complied
11	At NTAMC end, 34Nos. alarms persisting in abnormal summery, the same to be rectified in co-ordination with RTAMC	Complied

Compliance of protection audit for Phyang Substation		
1	Over current was wrongly enabled in 220kV Khalste line, the same was disabled during audit.	Complied during audit
2	Buchholz alarm to be configured to trip as per CC guidelines for ICT-1, ICT-2 and Bus reactor.	Complied
3	20ms delay timer was not used for transformer and reactor body protections, the same was implemented during audit.	Complied during audit
4	Over flux and over current earth fault setting of transformer was not as per template, the same was corrected during audit.	Complied during audit
5	For backup earth fault IN>3 stage was enabled in setting, however in PSL the same was not in use. Same was corrected during audit.	Complied during audit
6	NIFPS DC fail alarm persisting in Bus reactor R, Y and B units. Nitrogen gas pressure is low in Bus reactor - 3 nos. units and ICT – Spare unit.	Complied
7	Relay test results are not available at site as well as in SAP.	Being complied.
8	Multiple extracted relay settings, PSL, MCL files are available in engineering PC. For avoiding confusion, only latest versions should be available.	Complied
9	Backup of all softwares and configuration files to be kept in CDs.	Complied
10	Battery bank discharge test is pending for all banks. Further, no spare battery cell available at site.	New 220V bank commissioned, spares available. Second 220V bank to be rejuvnated in Aug 2023, LOA already placed.
11	Dressing of Fiber cables to be done in C&R panels.	Complied
12	At NTAMC end, 51Nos. alarms persisting in abnormal summery, the same to be rectified in coordination with RTAMC.	Complied

CONSULTANCY REPORT

Protection audit of 400/220 kV Substation at RVUNL-CTPP (250X4 MW) Chhabra

VOLUME-I

Clients Reference: PO NO: RVUNL/CTPP/SE(Elect)/F/D/1069
CPRI Reference: No. 2/9/PSD/CTPP/2023-24
CPRI Report: No. 2/9/PSD/RT100/2023

CUSTOMER

M/s RVUNL-CTPP, Chhabra

CONSULTANT

POWER SYSTEMS DIVISION
CENTRAL POWER RESEARCH INSTITUTE
Sir. C.V.RAMAN ROAD, P.B. NO. 8066
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BANGALORE – 560 080.
Website : http://www.cpri.res.in

November 2023

POWER SYSTEMS DIVISION
CENTRAL POWER RESEARCH INSTITUTE
Sir. C.V. RAMAN ROAD P.B.No.8066, BANGALORE 560080
Website: https://cpri.res.in

Ref. File No.: 2/9/PSD/CTPP/2023-24 Dated.21-02-2024

Title	**Third Party Protection audit at for 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW)**
Project Objectives	Review Of Protection Scheme, Relay Settings Of Various Element & Associated System Of for 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW)
Name and Address of the Customer	M/S CTPP, Chhabra
Client's Reference and Date	RVUNL/CTPP/SE(Elect)/F/D/1069 Date :08.09.2023
CPRI report No:	2/9/PSD/RT100/2023
Name(s) of investigator(s) from CPRI	1. Mr. Ved Prakash Yadav, Engineering Officer 2. Mr. Pola Soma Sekhar Reddy, Engineering officer
Name of RRVUNL, Chhabra officers, associated in providing support to CPRI	1. Shri Pawan Kumar, XEN 2. Shri Jitender Gupta, AEN 3. Shri Peeyush Tripathi, JEN
Report contains	Number of pages : 51
Report Reviewed by: Mr.Ved Prakash Yadav Engineering Officer Power Systems Division, CPRI Signature:	Report Approved by: Dr. J. Sreedevi Joint Director & HoD Power Systems Division, CPRI Signature:

ACKNOWLEDGEMENT

CPRI wishes to thank CTPP,Chhabra for awarding the contract of Third Party Protection audit of ***Third Party Protection audit at for 400kV Substation at CTPP, Chhabra-RRVUNL (250X4 MW)*** PO No. RRVUNL/CTPP/SE(Elect)/F/D/1069 to CPRI. CPRI wishes to thank all the Officers/Engineers of CTPP,Chhabra, who were associated in this work for their co-operation in providing the required data and for their interaction during the visit to the substation. CPRI Team specially thank the following personnel for their excellent co-operation without which this work would not have been possible.

1 Shri Pawan Kumar XEN

2 Shri Jitender Gupta AEN

3 Shri Peeyush Tripathi JEN

1. Executive Summary

Power Systems Division of Central Power Research Institute conducted the third Party protection audit at for 400kV Substation at CTPP, Chabbra-RRVUNL (250X4 MW**)** as per the PO No. RrVUNL/CTPP/SE(Elect)/F/D/1069 Dated 08/09/2023. The different protection that were covered under the audit are (i) Line Protection (ii) ICT&ST Protection (iii) Reactor protection and (iv) Bus bar Protection. It also included the checking of (i) DC Supply (ii) AC Supply with DG (iii) Communication system with DR (iv) Circuit Breaker (v) CT and (vi) CVT (vii) Synchro-Check. The audit format was provided by CPRI and the respective data was filled by the substation officers.

This report pertains to the audit carried out for 400kV Substation at CTPP, Chabbra-RRVUNL (250X4 MW). The protection audit of the substation was carried out from 02/01/2024 to 05/01/2024. CTPP, Chabbra-RRVUNL (250X4 MW) have (a) Four 400 kV transmission lines (b) Two 220kV transmission lines (c) One ICT and Four ST's.

For Continuous & uninterrupted generation and transmission, CTPP Chhabra is connected to RRVPNL 400 kV GSS and 220 kV GSS. After viewing the downloaded settings at substation for lines, transformer and bus-bar most of the settings are found to be in line with the recommended settings as per guidelines. However, some of the deviations found are given below. Chabbra Thermal Power Plant may review the suggested settings and adopt the settings as per local site condition requirements and remote end coordination.

1. The distance protection i.e. Main-I & II Zone 1, Zone 1B and Zone 3 impedance reach setting for 400KV BHILWARA line are properly set and some revisions are required in Zone-2 impedance reach settings.
2. Resistive reach setting of all the Zone may be reviewed for Main-I & II of 400KV 400kV BHILWARA line.
3. Quadrilateral reach settings of BHILWARA line may be reviewed.
4. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV ANTA line are properly set and some revisions are required in Zone-4, Main-I & II impedance reach settings.
5. Resistive reach setting of all the Zone may be reviewed for Main-I & II of for 400KV ANTA line.

6. The distance protection Main-I & II impedance reach setting for 400kV ADANI line are properly set and some revisions are required in Zone 1B and Zone 4.
7. Resistive reach setting of the all the Zone may be reviewed for Main-I & II of 400kV ADANI line.
8. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV HINDHAUN line are properly set and some revisions are required in Zone-3,4, Main-I & II impedance reach settings.
9. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 220kV AKLERA line are not properly set and revisions are required in all the zones of Main-I & II impedance reach settings.
10. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV AKLERA line.
11. The distance protection Main-I & II impedance reach setting for 220kV KAWAI line are properly set and some revisions are required in Zone 2, Zone 4.
12. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV KAWAI line.
13. The zone 4 settings of all distance protections scheme are calculated according to NRPC guide lines but as the all lines are originating from generating station the settings may be reviewed according to the plant conditions.
14. The load blinder settings were recommended considering the capacity of transmission line. The load blinder settings may be reviewed.
15. The earth fault protection is also protected to all line protection. Power swing, is also provided on all lines. Minor changes in Power swing.
16. The Auto reclose function shall be enabled with the Dead time of 1 sec and Reclaim time of 25 Sec.
17. The Pole discrepancy time setting may be coordinate with the auto reclose function and shall be set as PD time setting = (Auto reclose dead time + time delay of 200-500ms)
18. Resistive reach for Ph-Ph & Ph-Gnd may be reviewed for all the Lines. Since, For the calculation of resistive reach (Ph-Ph & Ph-Gnd), CPRI considered the Arc Resistance and Tower footing resistance as 15 Ω & 5 Ω respectively. If the Arc Resistance and Tower

footing resistance values are different at the substation based on local substation condition, then all resistive reach (Ph-Ph & Ph-Gnd) same setting may be retained.

19. Other Protection functionality for lines like SOTF, Voltage supervision and Carrier communication are working satisfactory.
20. It is observed that DC source for switchyard 3 & 4 is having earth fault. This has to be attended and rectify.
21. There is some oil seepage observed in switchyard from the ICT and it has to be attended whenever time permits as per scheduled shutdown.
22. The differential protection setting for transformers are properly set and stable.
23. The impedance protection setting for reactor are properly set and stable.
24. The differential protection setting for bus-bar are properly set and stable.
25. It is suggested to perform the third-party protection audit of substation/generating station periodically.

Minutes of Meeting

MOM Between	Date
CPRI, Bangalore & M/s RRVUNL, CTPP	04/01/2024

1. **Participants**:

Organization	Name
CPRI, Bangalore	Shri Ved Prakash Yadav, Engineering Officer Shri Pola Soma Shekhar Reddy, Engineering Officer
RRVUNL, CTPP	Shri Pawan Kumar, XEN Shri Jitender Gupta, AEN Shri Peeyush Tripathi, JEN

2. **Meeting Details**:

Subject:	Visit for Protection Audit of M/s RRVUNL, CTPP Switchyard
Reference:	PO. No. RVUNL/CTPP/SE (Elct.)/F/D/1069 dated: 08/09/2023

3. **Notes of Meeting**:

- CPRI officials visited CTPP Switchyard on 03/01/24 and 04/01/24 and briefed about the protection audit of the M/s RRVUNL, CTPP Switchyard to the personnel.
- During the protection audit work, the existing setting of Numerical protection IEDs of all lines, power transformer, line & bur reactor, Busbar were downloaded and taken for setting calculations.
- There is some oil seepage observed in switchyard from the ICT and it has to be attended whenever time permits as per scheduled shutdown.
- It is observed that ARBITOR make time synchronization unit is available for switchyard 1 & 2 and SANDS make time synchronization unit is available for switchyard 3 & 4. The available IEDs are time synchronized. However, few ABB make IEDs having time sync fail intermittently which needs to be attended at earliest.
- CPRI Officers went around 400 kV and 220 kV Switchyard to check the maintenance of the substation and measured the DC voltage (lead acid) in CB panel as below. It is observed that DC source for switchyard 3 & 4 is having earth fault. This has to be attended and rectify.

	Positive to Negative	Positive to Earth	Negative to Earth
DC Bank 1	240	129	-113
DC Bank 2	240	113	-129
DC Bank 3	240	4	-236
DC Bank 4	240	4	-235

P.S.S. Reddy

XEN(Elect-2)

- There is no centralized DR, Event logger available on site. However, all the numerical IEDs are facilitated with the inbuilt DR & event logger and the healthiness of the same were reviewed and found satisfactory.
- The availability & healthiness of PLCC is reviewed and found satisfactory.
- It is observed that the routine testing of CT, CVT, Numerical Protection IEDs and CBs have been done periodically. The test report of CTs, CVTs, Numerical protection IEDs and CBs are available for 400 & 220 kV system and reviewed.
- It is suggested to conduct the breaker overhauling as per the best practice adopted by power utilities or OEM.
- It is recommended that the all the Numerical Protection IEDs shall be tested once in 3/4 years as per the best practices adopted by the other organization such as PGCIL etc.
- Switchyard of 400 & 220 kV CTPP switchyard is being maintained properly and it is neat and clean.
- It is recommended that Relay Test System and other testing equipment must be calibrated from NABL Accreditated Laboratory & the calibration must include voltage, current, frequency, phase angle, power and time. The calibration point shall be decided as per the setting of Numerical Protection IEDs.
- It is suggested to have testing equipment on site such as leakage current tester and power analyzer is required at site for periodic testing and fault analysis.
- The report shall be submitted within 3 month of the site visit of protection audit subsequently followed by the training on findings of the protection audit.

The CPRI audit team thanked to the personnel of arranging the protection audit.

For CPRI

(Ved prakash yadav)

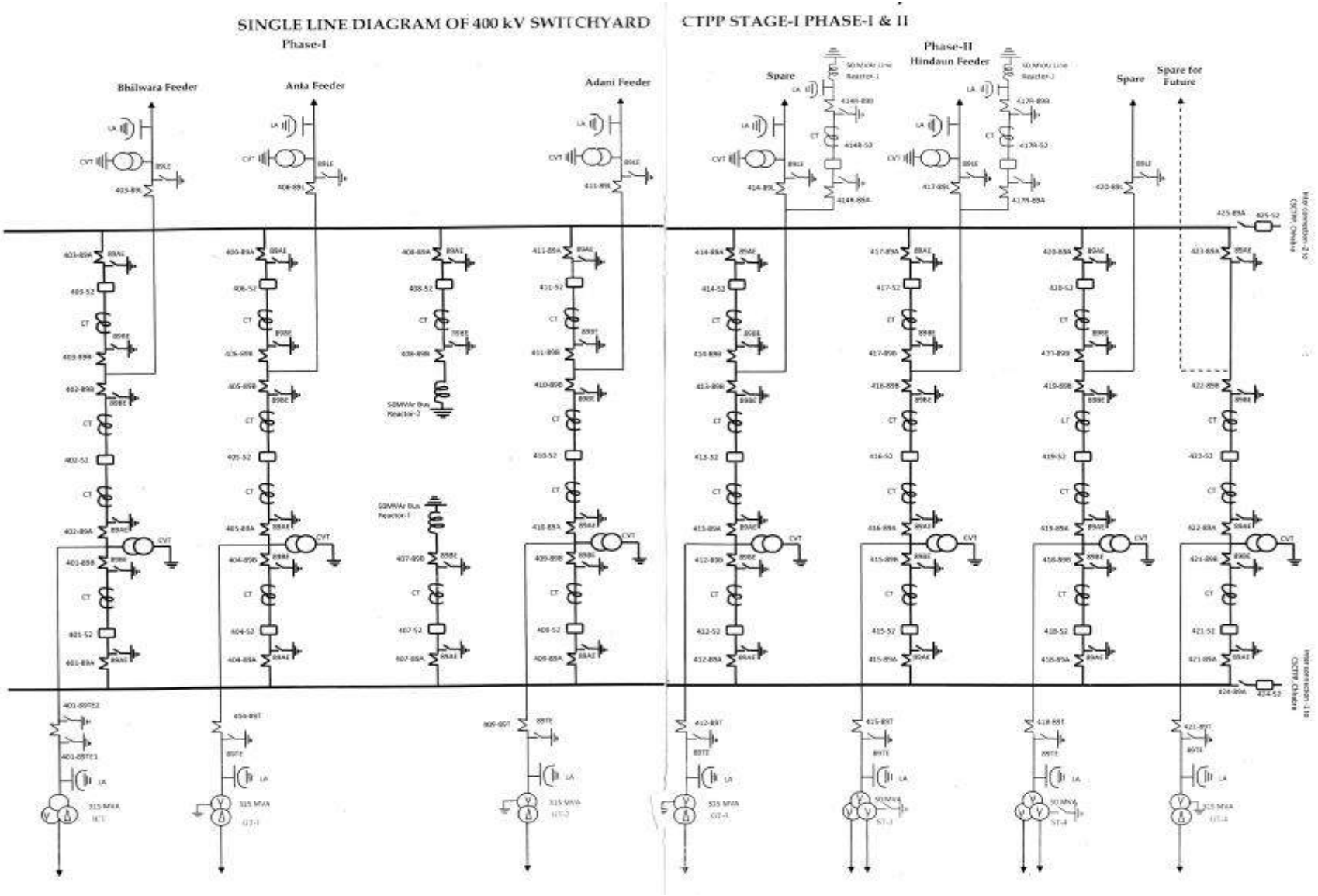
P.S.S. Reddy
(Pola Soma Sekhar Reddy)

For RRVUNL, CTPP

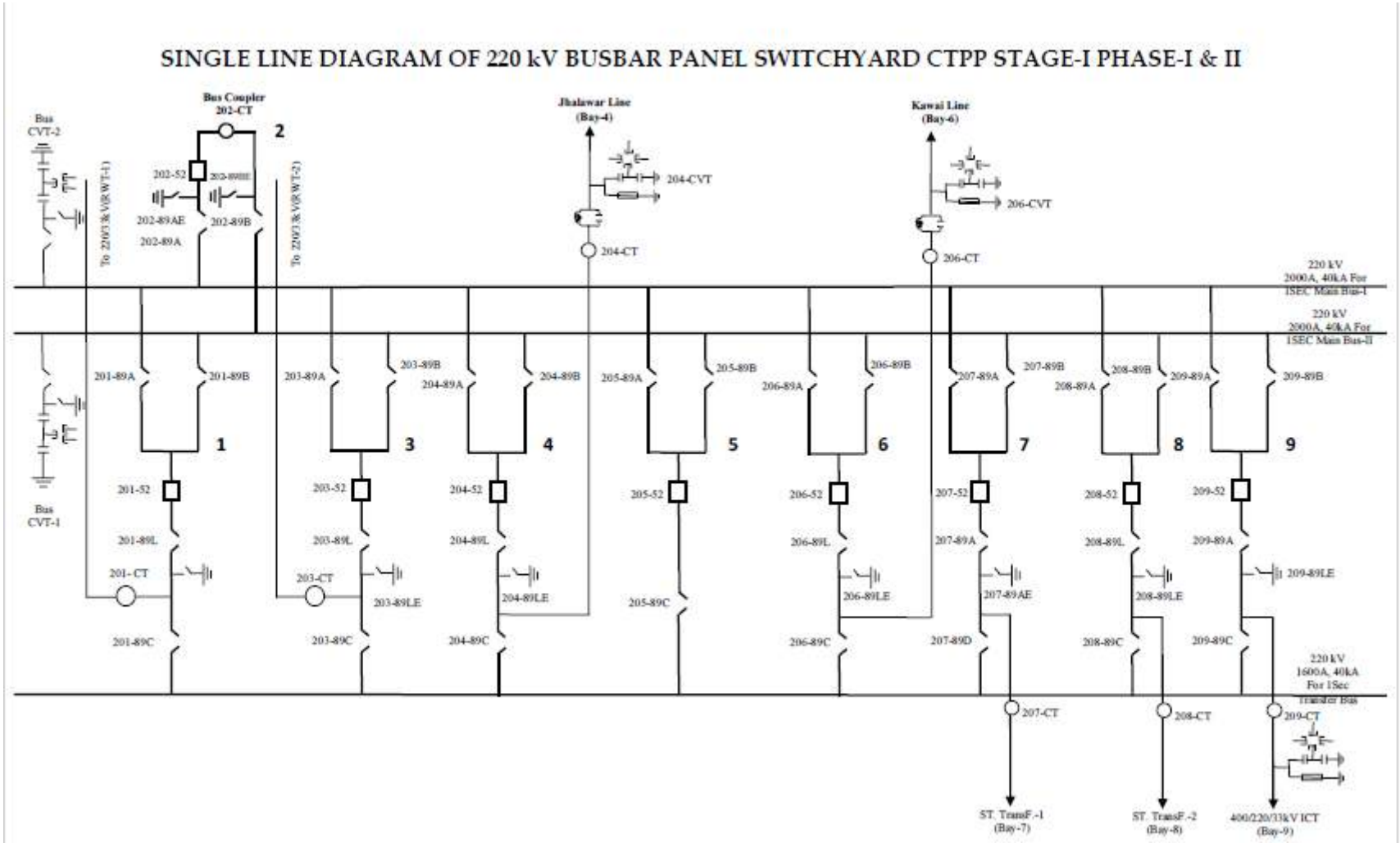
SEN(Com-IT)

CONTENTS

1.1: LINE DIAGRAM OF RVUNL-CTPP (Chhabra)



SINGLE LINE DIAGRAM OF 220 kV BUSBAR PANEL SWITCHYARD CTPP STAGE-I PHASE-I & II



1.2: Protection system overall review

RVUNL-CTPP, Chhabra		
DATE OF AUDIT BY CPRI TEAM : 02/01/2024 to 05/01/2024		
Sl. No	**Title**	**Details**
1	**Name Of Grid Substation**	RVUNL-CTPP, Chhabra
2	**Highest Voltage Level**	400 kV
3	**Year Of Installation**	2010
4	**No Of Feeders**	Four 400 kV, Two 220 kV Feeder
5	**No of Transformers, Make and Capacity**	315 MVA ICT 4*50 MVA Station transformers
6	**Busbar Arrangement**	Double main transfer bus for 220kV One and half breaker for 400kV
7	**Present Busbar Switching Status**	Commissioned
8	**Busbar Protection**	Commissioned
9	**Relay System Status**	In Service
10	**DC Supply System**	[1] 220/110 V DC-I System (1&2) [2] 220/110 V DC-II System (1&2) [3] 220/110 V DC-I System (3&4) [4] 220/110 V DC-II System (3&4) [5] 48 V DC-I System [6] 48 V DC-II System
11	**DC Supply Capacity And Adequacy**	Battery is adequate for the station load.
12	**DC System Earth Fault Status**	DC System in switch yard 1&2 is healthy. DC Earth fault is present in switch yard 3&4.
13	**GPS Receiver Make & Model**	SANDS
14	**GPS Clock Receiver & Synchronization Of Relay Status**	Relays are synchronised
15	**Common Event Logger Status**	In-built feature in numerical relay is used
16	**Line Disturbance Recorder**	In-built feature in numerical relay is used
17	**Fault Locator in Line**	Provided
18	**Breaker Failure Relay Status**	Provided
19	**Circuit Breaker test reports**	Available
20	**Relay test reports**	Available
21	**General Observation of Relay And Protection System**	It is recommended that the all the Numerical Protection IEDs shall be tested once in 3 or 4 years as per the best practices.

Protection audit teams at site:

Organization	Name
CPRI, Bangalore	Shri Ved Prakash Yadav, Engineering Officer Shri Pola Soma Sekhar Reddy, Engineering Officer
RVUNL, CTPP	Shri Pawan Kumar, XEN Shri Jitender Gupta, AEN Shri Peeyush Tripathi, JEN

1.3: relays used for transmission line, transformer, reactor and bus-bar protection substation

1.3.1: Relays used for Transmission Line Protection

Sl. No.	Name of the Feeder	Main-I	Main-II
1	CTPP-BHILWARA	SEIMENS&7SA522	SEIMENS&7SA612
2	CTPP-ANTA	SEIMENS&7SA522	SEIMENS&7SA612
3	CTPP-ADANI	SEIMENS&7SA522	SEIMENS&7SA612
4	CTPP-HINDHAUN	ABB&REL670	ABB&REL670
5	CTPP-KAWAI	SEIMENS&7SA522	SEIMENS&7SA612
6	CTPP-AKLERA	SEIMENS&7SA522	SEIMENS&7SA612

1.3.2: Relays used for Transformer Protection:

Sl. No.	Transformer	Primary Protection		Back Up protection		
		Differential Protection	Restricted Earth Fault	Over fluxing protection	HV back up over current and Earth	LV back up Over Current and Earth
1	ICT	SEIMENS&7UT613	SEIMENS&7SJ611	SEIMENS&7SJ613	SEIMENS&7SJ621	SEIMENS&7SJ621
2	ST-1	SEIMENS&7UT613	SEIMENS&7SJ611	SEIMENS&7SJ613	SEIMENS&7SJ621	SEIMENS&7SJ621
3	ST-2	SEIMENS&7UT613	SEIMENS&7SJ611	SEIMENS&7SJ613	SEIMENS&7SJ621	SEIMENS&7SJ621
4	ST-3	ABB&RET670	ABB&RET670	ABB&RET670	ABB&RET670	ABB&REF615
5	ST-4	ABB&RET670	ABB&RET670	ABB&RET670	ABB&RET670	ABB&REF615

1.3.3: Relays used for Reactor Protection:

Sl. No.	Reactor	Primary Protection	Backup protection
		Differential Protection	Over Current
1	BAY – 407 Bus reactor	SEIMENS&7SJ611	SEIMENS&7SA522
2	BAY – 408 Bus reactor	SEIMENS&7SJ611	SEIMENS&7SA522
3	BAY – 414R Line reactor	ABB&RET670	ABB&REL670
4	BAY – 417R Line reactor	ABB&RET670	ABB&REL670

1.3.4: Relays used for bus bar Protection:

Sl. No.	Voltage level	Make	Model
1	220kV	SIEMENS	7SS5220
2	400kV	SIEMENS	7SS5220
		SIEMENS	7SS5220

2.1. Input Data for Transmission Lines Substation

2.1.1.Input Data for Transmission Lines Substation – Bhilwara 400kv line

Sl. No.	Description	Units	Value
	Station Name	**RVUNL-CTPP, Chhabra**	
1	**Line Reference**	CTPP-BHILWARA	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Bhilwara
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
4	**Back-up Protection**		
4.1	Protection Type		-
4.2	Model & Make		-
5	**CT data for Main 1**		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
6	**CT data for Main 2**		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
7	**PT Ratio**	kV/V	400kV/110V
8	**PROTECTED LINE DATA**		
8.1	Line Length	Km	303
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0297
8.3	Positive seq. REACTANCE	Ohms/Km	0.332
8.4	Zero seq. RESISTANCE	Ohms/Km	0.162
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
9	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the shortest adjacent line is connected		**CHITTOR**
9.2	Line Length of shortest adjacent line	Km	49.5
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0297
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.332
9.5	Zero seq. RESISTANCE of	Ohms/Km	0.162

	shortest adjacent line		
9.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.24
10	**ADJACENT LONGEST LINE DATA (from remote bus)**		
10.1	Name of the substation to which the longest adjacent line is connected		**AJMER**
10.2	Line Length of longest adjacent line	Km	160
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0297
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.332
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.162
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.24
11	**Is there a transformer connected to the remote bus**	Yes/No	YES
11.1	Number of Transformers		2
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers 1	MVA	1*315,1*500 MVA
11.4	% Impedance of the transformers1	%	13.04,11.95

2.1.2 Input Data for Transmission Lines Substation – Anta 400kV line

Sl. No.	Description	Units	Value
	Station Name	**RVUNL-CTPP, Chhabra**	
1	**Line Reference**	CTPP-ANTA	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Anta
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
4	**Back-up Protection**		
4.1	Protection Type		-
4.2	Model & Make		-
5	**CT data for Main 1**		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
6	**CT data for Main 2**		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
7	**PT Ratio**	kV/V	400kV/110V
8	**PROTECTED LINE DATA**		
8.1	Line Length	Km	91.1
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0297
8.3	Positive seq. REACTANCE	Ohms/Km	0.332
8.4	Zero seq. RESISTANCE	Ohms/Km	0.162
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
9	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the shortest adjacent line is connected		**Adani 400kV**
9.2	Line Length of shortest adjacent line	Km	50.29
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0297
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.332
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.162
9.6	Zero seq. REACTANCE of	Ohms/Km	1.24

	shortest adjacent line		
10	**ADJACENT LONGEST LINE DATA (from remote bus)**		
10.1	Name of the substation to which the longest adjacent line is connected		**Nanta 400kV**
10.2	Line Length of longest adjacent line	Km	91
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0297
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.332
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.162
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.24
11	**Is there a transformer connected to the remote bus**	Yes/No	YES
11.1	Number of Transformers		3
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers 1	MVA	3*1500 MVA
11.4	% Impedance of the transformers1	%	14

2.1.3.Input Data for Transmission Lines Substation – Adani 400kV line

Sl. No.	Description	Units	Value
	Station Name	**RVUNL-CTPP, Chhabra**	
1	**Line Reference**	CTPP-Adani	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Adani
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
4	**Back-up Protection**		
4.1	Protection Type		-
4.2	Model & Make		-
5	**CT data for Main 1**		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
6	**CT data for Main 2**		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
7	**PT Ratio**	kV/V	400kV/110V
8	**PROTECTED LINE DATA**		
8.1	Line Length	Km	42
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0297
8.3	Positive seq. REACTANCE	Ohms/Km	0.332
8.4	Zero seq. RESISTANCE	Ohms/Km	0.162
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
9	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the shortest adjacent line is connected		**Anta 400kV**
9.2	Line Length of shortest adjacent line	Km	50
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0147
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.2528
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.248
9.6	Zero seq. REACTANCE of	Ohms/Km	1

	shortest adjacent line		
10	**ADJACENT LONGEST LINE DATA (from remote bus)**		
10.1	Name of the substation to which the longest adjacent line is connected		**Anta 400kV**
10.2	Line Length of longest adjacent line	Km	50
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0147
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.2528
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.248
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1
11	**Is there a transformer connected to the remote bus**	Yes/No	-
11.1	Number of Transformers		-
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers 1	MVA	-
11.4	% Impedance of the transformers1	%	-

2.1.4.Input Data for Transmission Lines Substation – Hindhaun 400KV line

Sl. No.	Description	Units	Value
	Station Name	**RVUNL-CTPP, Chhabra**	
1	**Line Reference**	CTPP- Hindhaun	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Hindhaun
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		ABB&REL670
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		ABB& REL670
4	**Back-up Protection**		
4.1	Protection Type		-
4.2	Model & Make		-
5	**CT data for Main 1**		
5.1	Ratio	A/A	2000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
6	**CT data for Main 2**		
6.1	Ratio		2000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
7	**PT Ratio**	kV/V	400kV/110V
8	**PROTECTED LINE DATA**		
8.1	Line Length	Km	305
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0266
8.3	Positive seq. REACTANCE	Ohms/Km	0.33
8.4	Zero seq. RESISTANCE	Ohms/Km	0.261
8.5	Zero seq. REACTANCE	Ohms/Km	1.031
9	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the shortest adjacent line is connected		**Alwar 400kV**
9.2	Line Length of shortest adjacent line	Km	96
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0266
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.33
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.261
9.6	Zero seq. REACTANCE of	Ohms/Km	1.031

	shortest adjacent line		
10	**ADJACENT LONGEST LINE DATA (from remote bus)**		
10.1	Name of the substation to which the longest adjacent line is connected		**Heerapura 400kV**
10.2	Line Length of longest adjacent line	Km	192.6
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0266
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.33
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.261
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.031
11	**Is there a transformer connected to the remote bus**	Yes/No	YES
11.1	Number of Transformers		2
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers	MVA	2*315 MVA
11.4	% Impedance of the transformers1	%	18.86,13.4

2.1.5.Input Data for Transmission Lines Substation – Aklera 220KV LINE

Sl. No.	Description	Units	Value
	Station Name	**RVUNL-CTPP, Chhabra**	
1	**Line Reference**	CTPP- Aklera	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Aklera
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
4	**Back-up Protection**		
4.1	Protection Type		
4.2	Model & Make		
5	**CT data for Main 1**		
5.1	Ratio	A/A	1000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
6	**CT data for Main 2**		
6.1	Ratio		1000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
7	**PT Ratio**	kV/V	220kV/110V
8	**PROTECTED LINE DATA**		
8.1	Line Length	Km	116.7
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0749
8.3	Positive seq. REACTANCE	Ohms/Km	0.3993
8.4	Zero seq. RESISTANCE	Ohms/Km	0.27
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
9	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the shortest adjacent line is connected		**Jhalawar 220kV**
9.2	Line Length of shortest adjacent line	Km	82.7
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.1363

9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.4048
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0341
9.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.3253
10	**ADJACENT LONGEST LINE DATA (from remote bus)**		
10.1	Name of the substation to which the longest adjacent line is connected		**Jhalawar 220kV**
10.2	Line Length of longest adjacent line	Km	82.7
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.1363
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.4048
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0341
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.3253
11	**Is there a transformer connected to the remote bus**	Yes/No	YES
11.1	Number of Transformers		1
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers	MVA	160 MVA
11.4	% Impedance of the transformers1	%	9.13

2.1.6.Input Data for Transmission Lines Substation – Kawai 220KV LINE

Sl. No.	Description	Units	Value
	Station Name	**RVUNL-CTPP, Chhabra**	
1	**Line Reference**	CTPP- Kawai	
1.1	Line voltage level	kV	400
1.2	Name of remote substation		Aklera
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		SIEMENS&7SA522
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		SIEMENS&7SA612
4	**Back-up Protection**		
4.1	Protection Type		
4.2	Model & Make		
5	**CT data for Main 1**		
5.1	Ratio	A/A	1000/1
5.2	Class		PS
5.3	Vk / VA burden	Vk/VA	1000/5
5.4	Rct	Ohms	5
5.5	Imag @ Vk/2	mA	30
6	**CT data for Main 2**		
6.1	Ratio		1000/1
6.2	Class		PS
6.3	Vk / VA burden		1000/5
6.4	Rct		5
6.5	Imag @ Vk/2		30
7	**PT Ratio**	kV/V	220kV/110V
8	**PROTECTED LINE DATA**		
8.1	Line Length	Km	42
8.2	Positive seq. RESISTANCE	Ohms/Km	0.0794
8.3	Positive seq. REACTANCE	Ohms/Km	0.3993
8.4	Zero seq. RESISTANCE	Ohms/Km	0.27
8.5	Zero seq. REACTANCE	Ohms/Km	1.24
9	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the shortest adjacent line is connected		**Atru 220kV**
9.2	Line Length of shortest adjacent line	Km	11.53
9.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.1363
9.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.4048
9.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0341
9.6	Zero seq. REACTANCE of	Ohms/Km	1.3253

	shortest adjacent line		
10	**ADJACENT LONGEST LINE DATA (from remote bus)**		
10.1	Name of the substation to which the longest adjacent line is connected		**Baran 220kV**
10.2	Line Length of longest adjacent line	Km	50.75
10.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.1363
10.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.4048
10.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0341
10.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.3253
11	**Is there a transformer connected to the remote bus**	Yes/No	YES
11.1	Number of Transformers		2
11.2	Voltage ratio of the Transformer	kV	-
11.3	MVA of the transformers	MVA	100 MVA
11.4	% Impedance of the transformers1	%	12.48,12.68

3.1. Transmission line protective relay settings review

Line Name	BHILWARA 400KV LINE			
Main I/II	**Main-I**		**Main-II**	
Relay	**SEIMENS&7SA522**		**SEIMENS&7SA612**	
Description/Parameter	**Existing setting**	**Reviewed setting**	**Existing setting**	**Reviewed setting**
Line angle	85	84.93	85	84.93
Zero seq. compensation factor (**Rg/Rl**) for Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (**Xg/Xl**) for Z1	0.91	0.91	0.91	0.91
Zero seq. compensation factor (**Rg/Rl**) for >Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (**Xg/Xl**) for >Z1	0.91	0.91	0.91	0.91
ZONE 1				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	8.620	8.91	8.620	8.91
X(Z1), Reactance	44.262	44.26	44.262	44.26
RG(Z1),Resistance for ph-gnd faults	**22.402**	**25.21**	**22.402**	**25.21**
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
ZONE 1B				
Operating mode Z1B	Forward	Forward	Forward	Forward
zone 1B	**12.52**	**10.89**	**12.52**	**10.89**
X(Z1B), Reactance	66.39	66.39	66.39	66.39
RG(Z1B),Resistance for ph-gnd faults	**23.00**	**26.20**	**23.00**	**26.20**
T1B-1Phase,delay for single phase faults	0	0	0	0
T1B multi-ph, delay for multi phase faults	0	0	0	0
ZONE 2				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	11.430	10.89	11.430	10.89
X(Z2), Reactance	**59.841**	**66.39**	**59.841**	**66.39**
RG(Z2),Resistance for ph-gnd faults	**24.452**	**27.19**	**24.452**	**27.19**
T2-1Phase,delay for single phase faults	**0.3**	**0.5**	**0.3**	**0.5**
T2 multi-ph, delay for multi phase faults	**0.3**	**0.5**	**0.3**	**0.5**
ZONE 3				

Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	**16.86**	**12.96**	**16.86**	**12.96**
X(Z3), Reactance	90.08	89.57	90.08	89.57
RG(Z3),Resistance for ph-gnd faults	**32.80**	**29.26**	**32.80**	**29.26**
T3-1PHASE,delay for single phase faults	1	1	1	1
T3 multi-ph, delay for multi phase faults	1	1	1	1
ZONE 4				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse
R(Z4) resistance for ph-ph faults	**1.71**	**5.94**	**1.71**	**5.94**
X(Z4), Reactance	**8.85**	**11.07**	**8.85**	**11.07**
RG(Z4),Resistance for ph-gnd faults	**4.02**	**22.24**	**4.02**	**22.24**
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
Power Swing Settings				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.10	0.10	0.08	0.10
SOTF				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	2.5	2.5	2.5	2.5
Ground Over Current				
Pickup	0.2	0.2	0.2	0.2
Time delay	1.25	1.25	1.25	1.25
Over Voltage Protection				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	70	70	70	70
Time delay	5	5	5	5
Pickup Overvoltage	95.3	95.3	95.3	95.3
Time delay	0.1	0.1	0.1	0.1

Line Name	ANTA 400KV LINE			
Main I/II	**Main-I**		**Main-II**	
Relay	**SEIMENS&7SA522**		**SEIMENS&7SA612**	
Description/Parameter	**Existing setting**	**Reviewed setting**	**Existing setting**	**Reviewed setting**
Line angle	85	84.93	85	84.93
Zero seq. compensation factor (Rg/Rl) for Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (Xg/Xl) for Z1	0.91	0.91	0.91	0.91
Zero seq. compensation factor (Rg/Rl) for >Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (Xg/Xl) for >Z1	0.91	0.91	0.91	0.91
ZONE 1				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	**3.012**	**6.14**	**3.012**	**6.14**
X(Z1), Reactance	13.301	13.31	13.301	13.31
RG(Z1),Resistance for ph-gnd faults	**17.468**	**22.44**	**17.468**	**22.44**
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
ZONE 1B				
Operating mode Z1B	Forward	Forward	Forward	Forward
zone 1B	**4.204**	**6.74**	**4.204**	**6.74**
X(Z1B), Reactance	19.951	19.96	19.951	19.96
RG(Z1B),Resistance for ph-gnd faults	**18.340**	**22.74**	**18.340**	**22.74**
T1B-1Phase,delay for single phase faults	0	0	0	0
T1B multi-ph, delay for multi phase faults	0	0	0	0
ZONE 2				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	**4.204**	**6.74**	**4.204**	**6.74**
X(Z2), Reactance	19.951	19.96	19.951	19.96
RG(Z2),Resistance for ph-gnd faults	**18.340**	**22.74**	**18.340**	**22.74**
T2-1Phase,delay for single phase faults	0.4	0.35	0.4	0.35
T2 multi-ph, delay for multi phase faults	0.4	0.35	0.4	0.35
ZONE 3				
Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	**6.904**	**7.92**	**6.904**	**7.92**

X(Z3), Reactance	34.990	33.25	34.990	33.25
RG(Z3),Resistance for ph-gnd faults	**22.006**	**24.22**	**22.006**	**24.22**
T3-1PHASE,delay for single phase faults	1	1	1	1
T3 multi-ph, delay for multi phase faults	1	1	1	1
ZONE 4				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse
R(Z4) resistance for ph-ph faults	**0.602**	**5.25**	**0.602**	**5.25**
X(Z4), Reactance	**2.660**	**3.33**	**2.660**	**3.33**
RG(Z4),Resistance for ph-gnd faults	**3.494**	**21.55**	**3.494**	**21.55**
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
Power Swing Settings				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.10	0.10	0.10	0.10
SOTF				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	2.5	2.5	2.5	2.5
Ground Over Current				
Pickup	0.2	0.2	0.2	0.2
Time delay	1.25	1.25	1.25	1.25
Over Voltage Protection				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	70	70	70	70
Time delay	5	5	5	5
Pickup Overvoltage	95.3	95.3	95.3	95.3
Time delay	0.1	0.1	0.1	0.1

Line Name	ADANI 400KV LINE			
Main I/II	**Main-I**		**Main-II**	
Relay	**SEIMENS&7SA522**		**SEIMENS&7SA612**	
Description/Parameter	**Existing setting**	**Reviewed setting**	**Existing setting**	**Reviewed setting**
Line angle	85	84.93	85	84.93
Zero seq. compensation factor (**Rg/Rl**) for Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (**Xg/Xl**) for Z1	0.91	0.91	0.91	0.91
Zero seq. compensation factor (**Rg/Rl**) for >Z1	1.48	1.48	1.48	1.48
Zero seq. compensation factor (**Xg/Xl**) for >Z1	0.91	0.91	0.91	0.91
ZONE 1				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	**3.850**	**5.50**	**3.850**	**5.50**
X(Z1), Reactance	6.135	6.14	6.135	6.14
RG(Z1),Resistance for ph-gnd faults	21.967	21.80	21.967	21.80
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
ZONE 1B				
Operating mode Z1B	Forward	Forward	Forward	Forward
zone 1B	3.988	5.77	3.988	5.77
X(Z1B), Reactance	**7.669**	**9.20**	**7.669**	**9.20**
RG(Z1B),Resistance for ph-gnd faults	22.133	21.93	22.133	21.93
T1B-1Phase,delay for single phase faults	0	0	0	0
T1B multi-ph, delay for multi phase faults	0	0	0	0
ZONE 2				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	**4.219**	**5.77**	**4.219**	**5.77**
X(Z2), Reactance	**11.327**	**9.20**	**11.327**	**9.20**
RG(Z2),Resistance for ph-gnd faults	22.410	22.60	22.410	22.60
T2-1Phase,delay for single phase faults	0.35	0.35	0.35	0.35
T2 multi-ph, delay for multi phase faults	0.35	0.35	0.35	0.35
ZONE 3				
Operating mode Z3	Forward	Forward	Forward	Forward

R(Z3) resistance for ph-ph faults	**4.587**	6.18	**4.587**	6.18
X(Z3), Reactance	16.517	16.16	16.517	16.16
RG(Z3),Resistance for ph-gnd faults	**22.852**	22.48	**22.852**	22.48
T3-1PHASE,delay for single phase faults	1	1	1	1
T3 multi-ph, delay for multi phase faults	1	1	1	1
ZONE 4				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse
R(Z4) resistance for ph-ph faults	**8.69**	**5.09**	**8.69**	**5.09**
X(Z4), Reactance	**0.766**	**1.53**	**0.766**	**1.53**
RG(Z4),Resistance for ph-gnd faults	**38.890**	**21.39**	**38.890**	**21.39**
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
Power Swing Settings				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.10	0.10	0.10	0.10
SOTF				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	2.5	2.5	2.5	2.5
Ground Over Current				
Pickup	0.2	0.2	0.2	0.2
Time delay	1.25	1.25	1.25	1.25
Over Voltage Protection				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	70	70	70	70
Time delay	5	5	5	5
Pickup Overvoltage	95.3	95.3	95.3	95.3
Time delay	0.1	0.1	0.1	0.1

Line Name	Hindhaun 400KV LINE	
Main I/II	**Main-I**	
Relay	**ABB&REL670 QUADRILATERAL**	
Description/Parameter	**Existing setting**	**Reviewed setting**
ZONE 1		
Operation	On	On
IBase	2000.00	2000.00
UBase	400.00	400.00
OperationDir	Forward	Forward
X1	81.01	80.52
R1	6.49	6.49
X0	251.56	251.56
R0	63.73	63.68
RFPP	30	30.00
RFPE	50	50.00
TPP	0	0.00
TPE	0	0.00
ZONE 2		
X1	121.51	120.78
R1	9.73	9.74
X0	377.34	377.35
R0	95.52	95.53
RFPP	60	60.00
RFPE	75	75.00
TPP	0.3	0.50
TPE	0.3	0.50
ZONE 3		
X1	**185.26**	**197.05**
R1	14.84	15.88
X0	**575.29**	**615.63**
R0	**145.63**	**155.85**
RFPP	75	75.00
RFPE	125	125.00
TPP	0.8	0.80

TPE	0.8	0.80
ZONE 4		
X1	20.25	20.13
R1	1.81	1.62
X0	62.89	62.89
R0	15.92	15.92
RFPP	**75**	**60.00**
RFPE	**125**	**75.00**
TPP	1	0.50
TPE	1	0.50
Residual over current		
IN1>	20	20
T1Min	1.1	1.1
K1	0.48	0.48
Automatic Switch Onto Fault Logic		
Ib	2000	2000
UB	400	400
IPh<	20	20
UPh<	70	70
tDuration	0.02	0.02
tSOTF	0.2	0.2
tDLD	0.2	0.2
AutoInit	OFF	ON
Over Voltage protection		
Operation Step 1	ON	ON
U1>	110	110
T1	5	5
U2>	150	150
T2	0.1	0.1

Line Name	Hindhaun 400KV LINE	
Main I/II	**Main-II**	
Relay	**ABB&REL670 MHO**	
Description/Parameter	**Existing setting**	**Reviewed setting**
ZONE 1		
Operation	On	On
IBase	2000.00	2000.00
UBase	400.00	400.00
OperationDir	Forward	Forward
Load ench mode	ON	ON
OpModePE	ON	ON
ZPE	81.325	80.78
ZAngPE	85	85
KN	**0.92**	**0.74**
KNAng	**-3**	**-13.89**
ZRevPE	81.325	80.78
Tpe	0.00	0.00
OpModePP	ON	ON
ZPP	81.325	80.78
ZAngPP	85	85
ZRevPP	81.325	80.78
Tpp	0.00	0.00
ZONE 2		
ZPE	121.988	121.17
ZAngPE	85	85
KN	**0.92**	**0.74**
KNAng	**-3**	**-13.89**
ZRevPE	121.98	121.17
Tpe	0.50	0.50
OpModePP	ON	ON
ZPP	121.98	121.17
ZAngPP	85	85
ZRevPP	121.98	121.17
Tpp	0.50	0.50

ZONE 3		
ZPE	**185.981**	**197.69**
ZAngPE	85	85
KN	**0.92**	**0.74**
KNAng	**-3**	**-13.89**
ZRevPE	**185.981**	**197.69**
Tpe	1.00	1.00
OpModePP	ON	ON
ZPP	**185.981**	**197.69**
ZAngPP	85	85
ZRevPP	**185.981**	**197.69**
Tpp	1	1.00
ZONE 4		
ZPE	**7**	**20.20**
ZAngPE	85	85
KN	**0.92**	**0.74**
KNAng	**-3**	**-13.89**
ZRevPE	**7**	**20.20**
Tpe	1	1.00
OpModePP	ON	ON
ZPP	**7**	**20.20**
ZAngPP	85	85
ZRevPP	**7**	**20.20**
Tpp	1	1.00
Residual over current		
IN1>	20	20
T1Min	1.1	1.1
K1	0.48	0.48
Automatic Switch Onto Fault Logic (OFF)		
Ib	-	2000
UB	-	400
IPh<	-	20
UPh<	-	70
tDuration	-	0.02
tSOTF	-	0.2

tDLD	-	0.2
AutoInit		ON
Over Voltage protection		
Operation Step 1	ON	ON
U1>	110	110
T1	5	5
U2>	150	150
T2	0.1	0.1

Line Name	AKLERA 220KV LINE			
Main I/II	**Main-I**		**Main-II**	
Relay	**SEIMENS&7SA522**		**SEIMENS&7SA612**	
Description/Parameter	**Existing setting**	**Reviewed setting**	**Existing setting**	**Reviewed setting**
Line angle	80	79.42	80	79.42
Zero seq. compensation factor (**Rg/Rl**) for Z1	0.64	0.65	0.64	0.65
Zero seq. compensation factor (**Xg/Xl**) for Z1	0.78	0.78	0.78	0.78
Zero seq. compensation factor (**Rg/Rl**) for >Z1	0.64	0.65	0.64	0.65
Zero seq. compensation factor (**Xg/Xl**) for >Z1	0.78	0.78	0.78	0.78
ZONE 1				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	**3.708**	**7.10**	**3.708**	**7.10**
X(Z1), Reactance	18.682	18.64	18.682	18.64
RG(Z1),Resistance for ph-gnd faults	**12.610**	**28.29**	**12.610**	**28.29**
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
ZONE 2				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	**5.562**	**9.16**	**5.562**	**9.16**
X(Z2), Reactance	28.022	27.98	28.022	27.98
RG(Z2),Resistance for ph-gnd faults	**18.915**	**27.30**	**18.915**	**27.30**
T2-1Phase,delay for single phase faults	0.3	0.35	0.3	0.35
T2 multi-ph, delay for multi phase faults	0.3	0.35	0.3	0.35
ZONE 3				
Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	**8.829**	**13.78**	**8.829**	**13.78**
X(Z3), Reactance	**44.480**	**40.54**	**44.480**	**40.54**
RG(Z3),Resistance for ph-gnd faults	**30.024**	**34.97**	**30.024**	**34.97**
T3-1PHASE,delay for single phase faults	0.8	0.8	0.8	0.8
T3 multi-ph, delay for multi phase faults	0.8	0.8	0.8	0.8
ZONE 4				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse

R(Z4) resistance for ph-ph faults	**0.74**	**4.53**	**0.74**	**4.53**
X(Z4), Reactance	**3.736**	**4.66**	**3.736**	**4.66**
RG(Z4),Resistance for ph-gnd faults	**2.522**	**23.59**	**2.522**	**23.59**
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
Power Swing Settings				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.1	0.1	0.1	0.1
SOTF				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	4	4	4	4
Ground Over Current				
Pickup	0.2	0.2	0.2	0.2
Time delay	0.75	0.75	0.75	0.75
Over Voltage Protection				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	73.5	73.5	73.5	73.5
Time delay	2	2	2	2
Pickup Overvoltage	76	76	76	76
Time delay	1	1	1	1

Line Name	KAWAI 220KV LINE			
Main I/II	**Main-I**		**Main-II**	
Relay	**SEIMENS&7SA522**		**SEIMENS&7SA612**	
Description/Parameter	**Existing setting**	**Reviewed setting**	**Existing setting**	**Reviewed setting**
Line angle	80	78.79	80	78.79
Zero seq. compensation factor (**Rg/Rl**) for Z1	0.65	0.80	0.65	0.80
Zero seq. compensation factor (**Xg/Xl**) for Z1	0.78	0.70	0.78	0.70
Zero seq. compensation factor (**Rg/Rl**) for >Z1	0.65	0.80	0.65	0.80
Zero seq. compensation factor (**Xg/Xl**) for >Z1	0.78	0.70	0.78	0.70
ZONE 1				
Operating mode Z1	Forward	Forward	Forward	Forward
R(Z1) resistance for ph-ph faults	**7.55**	**4.93**	**7.55**	**4.93**
X(Z1), Reactance	6.66	6.71	6.66	6.71
RG(Z1),Resistance for ph-gnd faults	**16.25**	**24.00**	**16.25**	**24.00**
T1-1Phase,delay for single phase faults	0	0	0	0
T1 multi-ph, delay for multi phase faults	0	0	0	0
ZONE 2				
Operating mode Z2	Forward	Forward	Forward	Forward
R(Z2) resistance for ph-ph faults	**8.749**	**5.60**	**8.749**	**5.60**
X(Z2), Reactance	**13.317**	**10.06**	**13.317**	**10.06**
RG(Z2),Resistance for ph-gnd faults	**17.5**	**24.33**	**17.5**	**24.33**
T2-1Phase,delay for single phase faults	0.3	0.5	0.3	0.5
T2 multi-ph, delay for multi phase faults	0.3	0.5	0.3	0.5
ZONE 3				
Operating mode Z3	Forward	Forward	Forward	Forward
R(Z3) resistance for ph-ph faults	**9.68**	**7.04**	**9.68**	**7.04**
X(Z3), Reactance	**18.30**	**18.48**	**18.30**	**18.48**
RG(Z3),Resistance for ph-gnd faults	**18.43**	**26.10**	**18.43**	**26.10**
T3-1PHASE,delay for single phase faults	0.8	1	0.8	1
T3 multi-ph, delay for multi phase faults	0.8	1	0.8	1
ZONE 4				
Operating mode Z4	Reverse	Reverse	Reverse	Reverse

R(Z4) resistance for ph-ph faults	**6.641**	**3.93**	**6.641**	**3.93**
X(Z4), Reactance	**2.08**	**1.68**	**2.08**	**1.68**
RG(Z4),Resistance for ph-gnd faults	**15.391**	**23.00**	**15.391**	**23.00**
T4-1Phase,delay for single phase faults	1	1	1	1
T4 multi-ph, delay for multi phase faults	1	1	1	1
Power Swing Settings				
Power swing operating mode	All zones blocked	All zones blocked	All zones blocked	All zones blocked
Power swing trip	NO	NO	NO	NO
Trip delay after power swing blocking	0.08	0.1	0.08	0.1
SOTF				
Instantaneous SOTF O/C	On	On	On	On
SOTF O/C pickup	4	4	4	4
Ground Over Current				
Pickup	0.2	0.2	0.2	0.2
Time delay	0.5	0.5	0.5	0.5
Over Voltage Protection				
Ph-g over voltage protection	On	On	On	On
Pickup Overvoltage	73.5	73.5	73.5	73.5
Time delay	2	2	2	2
Pickup Overvoltage	76	76	76	76
Time delay	1	1	1	1

4.1.Transformer Protection Data

4.1.1. Input Data for Transformer Protection

Sl. No.	Description	Units	Value	Value	Value
Substation Name					
	Transformer Name		ICT	ST 1&2	ST 3&4
1	Ratings				
1.1	MVA	MVA	315	50	50
1.2	Voltage Ratio	kV/kV	400/220/33	220/(6.9-6.9)	400/(6.9-6.9)
2	Impedance	%	12.50	17	17
3	Vector Group		YNa0d11	YNyn0yn0	YNyn0yn0
4	NGR Data (if Present)	Ohms	-	-	-
`5	OLTC Present	Yes/No	Yes	Yes	Yes
5.1	OLTC Data				
5.2	Min Tap voltage	kV	350	192.5	350
5.3	Max Tap voltage	kV	434	236.5	430
5.4	No. of Steps		17	17	17
6	Differential Protection provided	Yes/No	Yes	Yes	Yes
6.1	Differential CT Ratio				

6.2	HV CT Ratio (Main & ICT)	A/A	1000/1	300/1	1000/1
6.3	LV CT Ratio (Main & ICT)	A/A	1000/1	2500/1	2500/1
7	Differential Relay				
7.1	Make		SIEMENS	SIEMENS	ABB
7.2	Model		SIEMENS 7UT613	SIEMENS 7UT613	ABB RET670
8	REF provided	Yes/No	Yes	Yes	Yes
8.1	REF Protection CTs Ratio (Main & ICT)	A/A	HV: 400 LV: 220	-	-
8.2	Acc Class		PS	PS	PS
8.3	RCT (Ω)	Ohms	-	-	-
8.4	Vk(V)	V	-	-	-
8.5	Im@Vk/2	mA	-	-	-
8.6	Longest sec. one way lead R Ω	Ohms	-	-	-
8.7	REF Relay				
8.8	Make		SIEMENS	SIEMENS	ABB
8.9	Model		SIEMENS 7UT613	SIEMENS 7UT613	ABB RET670
8.10	Rstab Range (Ω)	Ohms	-	-	370
9	Over fluxing Protection provided	Yes/No	Yes	Yes	Yes
9.1	Over fluxing Protection Relay				

9.2	Make		SIEMENS	SIEMENS	ABB
9.3	Model		SIEMENS 7UT613	SIEMENS 7UT613	ABB RET670
10	HV Back-up Protection provided	Yes/No	Yes	Yes	Yes
10.1	HV Back-up Protection Relay				
10.2	Make		SIEMENS	SIEMENS	ABB
10.3	Model		SIEMENS 7SJ621	SIEMENS 7SJ621	ABB RET670
10.4	HV Back-up Protection CTs Ratio	A/A	1000/1	300/1	1000/1
10.5	Acc Class		PS	PS	PS
11	LV Back-up Protection provided	Yes/No	Yes	Yes	Yes
11.1	LV Back-up Protection Relay				
11.2	Make		SIEMENS	SIEMENS	ABB
11.3	Model		SIEMENS 7SJ621	SIEMENS 7SJ621	ABB RET670
11.4	LV Back-up Protection CTs Ratio	A/A	1000/1	2500/1	2500/1
11.5	Acc Class		PS	PS	PS

4.2. Transformers Protection Relay Setting Review

Sl. No.	PROTECTION			ICT	
				Existing	Reviewed
1	Differential	Relay Make & Model		SIEMENS 7UT613	
		Biased	Pickup value of diff.current	0.20	0.20
			T I-DIFF> Time delay	0.00	0.00
			Pickup value of High set trip	12.00	12.00
			T I-DIFF>>Time delay	0.00	0.00
			Slope 1	0.25	0.25
			Base point of slope 1	0.00	0.00
			Slope 2	0.5	0.5
			Base point of slope 2	2.50	2.50
2	Over Fluxing	Relay Make & Model		SIEMENS 7UT613	
		U/f > Pickup		1.15	1.15
		T U/f >> Time delay		Infinity	Infinity
		U/f > Pickup		1.40	1.40
		T U/f > >Time delay		5 sec	5 sec
3	HV Overcurrent	Relay Make & Model		SIEMENS 7SJ621	
		Pickup Current		0.6	0.6

		TSM(s)	0.3	0.3
4	LV Overcurrent	Relay Make & Model	SIEMENS 7SJ621	
		Pickup Current	1.10	1.10
		TSM(s)	0.3	0.3
5	HV Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.1	0.1
		TSM(s)	0.35	0.35
6	LV Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.18	0.18
		TSM(s)	0.35	0.35

Sl. No.	PROTECTION			ST 1&2	
				Existing	Reviewed
1	Differential	Relay Make & Model		SIEMENS 7UT613	
		Biased	Pickup value of diff.current	0.20	0.20
			T I-DIFF> Time delay	0.00	0.00
			Pickup value of High set trip	8.00	8.00
			T I-DIFF>>Time delay	0.00	0.00
			Slope 1	0.25	0.25
			Base point of slope 1	0.00	0.00
			Slope 2	0.5	0.5
			Base point of slope 2	2.50	2.50
2	Over Fluxing	Relay Make & Model		SIEMENS 7UT613	
		U/f > Pickup		1.10	1.10
		T U/f >> Time delay		5 sec	5 sec
		U/f > Pickup		1.40	1.40
		T U/f > >Time delay		1 sec	1 sec
3	SEF Protection	Relay Make & Model		SIEMENS 7SJ611	
		I>>> Pickup		35	35
		T I>>> Time delay		0	0

		I>> Pickup	3.72	3.72
		T I>> Time delay	0	0
4	HV Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.25	0.25
		TSM(s)	0.45	0.45
5	LV1 Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.2	0.2
		TSM(s)	0.55	0.55
6	LV2 Earth fault	Relay Make & Model	SIEMENS 7SJ621	
		PSM(A)	0.2	0.2
		TSM(s)	0.55	0.55

Sl. No.	PROTECTION			ST 3&4			
				Existing		Reviewed	
1	Differential	Relay Make & Model		ABB&RET670			
				main1	main2	main1	main2
		Biased	IDiffAlarm	0.2	0.2	0.2	0.2
			tAlarmDelay	10	10	10	10
			IdMin	0.3	0.5	0.3	0.5
			IdUnre	8	12	8	12
2	Over Fluxing	Relay Make & Model		ABB&RET670 main1/2			
		V/Hz>>		170		170	
		V/Hz>		110		110	
		AlaramLevel		100		100	
		tAlarm		5		5	
3	Residual over current	Relay Make & Model		ABB&RET670 main1/2			
		IN1>		10		10	
		T1		1.5		1.5	
		IN1 Mult		1.0		1.0	
		K1 (TSM)		0.3		0.3	
		T1 min		0		0	

4	HV Overcurrent	Relay Make & Model	ABB&RET670 main1/2	
		I1>	1.2	1.2
		T1	0	0
5	LV Overcurrent	Relay Make & Model	ABB&RET670 main1/2	
		I1>	1.2	1.2
		T1	0	0
7	LV Earth fault	Relay Make & Model	ABB REF615	
		Start value	0.15	0.15
		Time multiplier	0.55	0.55

5.1. Reactor protection Data

5.1.1. Reactor Protection Relay Setting Review

Sl. No.	PROTECTION		BAY – 407 Bus reactor & BAY – 408Bus reactor	
			Existing	**Reviewed**
1	**Earth fault Overcurrent**	**Relay Make & Model**	SIEMENS&7SJ611	
		I > Pickup	0.46	0.46
		T I > Time delay	0.50	0.50
		IE > Pickup	0.11	0.11
		T IE > Time delay	0.50	0.50
2	**High impedance diff protection R phase**	**Relay Make & Model**	SIEMENS&7SJ611	
		1Phase o/c I >Pickup Current	0.03	0.03
		T 1Phase o/c I >Pickup time delay	0.1	0.1
3	**High impedance diff protection Y phase**	**Relay Make & Model**	SIEMENS&7SJ611	
		1Phase o/c I >Pickup Current	0.03	0.03
		T 1Phase o/c I >Pickup time delay	0.1	0.1
4	**High impedance diff protection B phase**	**Relay Make & Model**	SIEMENS&7SJ611	
		1Phase o/c I >Pickup Current	0.03	0.03
		T 1Phase o/c I >Pickup time delay	0.1	0.1

5	**Impedance protection**	**Relay Make & Model**	SIEMENS&7SA522	
		R(Z1) resistance for ph-ph faults	33.80	33.80
		X(Z1), Reactance	386.6	386.6
		RG(Z1),Resistance for ph-gnd faults	50.73	50.73
		T1-1Phase,delay for single phase faults	0.15	0.15
		T1 multi-ph, delay for multi phase faults	0.15	0.15

Sl. No.	PROTECTION			BAY – 414R Line reactor & BAY – 417R Line reactor	
				Existing	**Reviewed**
1	High impedance Differential	Relay Make & Model		ABB&RET670 MAIN 1	
		High impedance Differential	U>Alarm	2	Stable
			tAlarm	5	
			U>Trip	5	
			Series resistor	250	
2	Phase Overcurrent	Relay Make & Model		ABB&RET670 MAIN 1	
		Pickup Current		1.3	33.80
		TSM(s)		1	386.6
3	Impedance protection	Relay Make & Model		ABB&RET670 MAIN 2	
		X1		2115	2115
		R1		0.6	0.6
		X0		1904	1904
		R0		0.54	0.54
		RFPP		75	75
		RFPE		125	125
		TPP		1	1
		TPE		1	1

6.1.Bus-bar protection data

6.1.1. Bus bar Protection (400kV) Relay Setting Review

Sl. No.			400kV		220kV	
	PROTECTION		Existing	Reviewed	Existing	Reviewed
1	Bus bar protection	Relay Make & Model	SIEMENS 7SS522		SIEMENS 7SS522	
		Stabilising factor-BZ	0.6	0.6	0.6	0.6
		Diff current threshold-BZ	0.8	0.8	1.10	1.10
		Stabilising factor-CZ	0.5	0.5	0.6	0.6
		Diff current threshold-CZ	0.8	0.8	1.10	1.10
2	Breaker failure protection	Relay Make & Model	SIEMENS 7SS522		SIEMENS 7SS522	
		Stabilising factor-BF protection	0.5	0.5	0.5	0.5

7.1 DC Measurements

DC battery and chargers are very important units as they are required to operate the protection relays. In this section, the details of the batteries and chargers are provided.

Following is the measurement of DC source which was taken during the site visit:

A. 220 V DC Source:

Sl. No.	Description	Switch yard 1&2		Switch yard 3&4	
		DC1	**DC2**	**DC1**	**DC2**
1	Voltage	220V	220V	220V	220V
	1) Positive to earth	+129	+113	+5	+4
	2)Negative to earth	-113	-129	-237	-236
2	Number of cells per Bank	110	110	108	108
3	Availability of Battery charge	YES	YES	YES	YES

B. 48V DC Source:

Sl. No.	Description	**Switch yard 1&2**	**Switch yard 3&4**
1	Voltage	48V	48V
	1) Positive to earth	0	0
	2)Negative to earth	-50.2	-47
2	Number of cells per Bank	38	36
3	Availability of Battery charge	YES	YES

8.1 Protection Review and Recommendations:

In general, protection schemes and setting are in order. All the 400 kV lines, Transformers are protected through numerical based protection schemes.

1. The distance protection i.e. Main-I & II Zone 1, Zone 1B and Zone 3 impedance reach setting for 400KV BHILWARA line are properly set and some revisions are required in Zone-2 impedance reach settings.
2. Resistive reach setting of all the Zone may be reviewed for Main-I & II of 400KV 400kV BHILWARA line.
3. Quadrilateral reach settings of BHILWARA line may be reviewed.
4. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV ANTA line are properly set and some revisions are required in Zone-4, Main-I & II impedance reach settings.
5. Resistive reach setting of all the Zone may be reviewed for Main-I & II of for 400KV ANTA line.
6. The distance protection Main-I & II impedance reach setting for 400kV ADANI line are properly set and some revisions are required in Zone 1B and Zone 4.
7. Resistive reach setting of the all the Zone may be reviewed for Main-I & II of 400kV ADANI line.
8. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 400KV HINDHAUN line are properly set and some revisions are required in Zone-3,4, Main-I & II impedance reach settings.
9. The distance protection i.e. Main-I & II of all zones, impedance reach setting for 220kV AKLERA line are not properly set and revisions are required in all the zones of Main-I & II impedance reach settings.
10. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV AKLERA line.
11. The distance protection Main-I & II impedance reach setting for 220kV KAWAI line are properly set and some revisions are required in Zone 2, Zone 4.
12. The resistance reach settings of, all the zones of both Main-I & II need to be reviewed for 220kV KAWAI line.
13. The zone 4 settings of all distance protections scheme are calculated according to NRPC guide lines but as the all lines are originating from generating station the settings may be reviewed according to the plant conditions.
14. The load blinder settings were recommended considering the ampacity of transmission line. The load blinder settings may be reviewed.
15. The earth fault protection is also protected to all line protection. Power swing, is also provided on all lines. Minor changes in Power swing.
16. The Auto reclose function shall be enabled with the Dead time of 1 sec and Reclaim time of 25 Sec.
17. The Pole discrepancy time setting may be coordinate with the auto reclose function and shall be set as PD time setting = (Auto reclose dead time + time delay of 200-500ms)

18. Resistive reach for Ph-Ph & Ph-Gnd may be reviewed for all the Lines. Since, For the calculation of resistive reach (Ph-Ph & Ph-Gnd), CPRI considered the Arc Resistance and Tower footing resistance as 15 Ω & 5 Ω respectively. If the Arc Resistance and Tower footing resistance values are different at the substation based on local substation condition, then all resistive reach (Ph-Ph & Ph-Gnd) same setting may be retained.
19. Other Protection functionality for lines like SOTF, Voltage supervision and Carrier communication are working satisfactory.
20. It is observed that DC source for switchyard 3 & 4 is having earth fault. This has to be attended and rectify.
21. There is some oil seepage observed in switchyard from the ICT and it has to be attended whenever time permits as per scheduled shutdown.
22. The differential protection setting for transformers are properly set and stable.
23. The impedance protection setting for reactor are properly set and stable.
24. The differential protection setting for bus-bar are properly set and stable.
25. It is suggested to perform the third-party protection audit of substation/generating station periodically.

9.1 Review of reports

Review of test reports of CTs & CVTs:

Pre-commissioning test reports were provided for all relays and CTs & CVT and these were reviewed. It is recommended that pre-commissioning reports of all relays, CTs and CVTs should be kept properly and they should be mandatorily provided whenever they are required to be reviewed. It is also recommended that routine testing of all relays should be carried out regularly in future.

Review of test reports of Circuit Breaker:

Test reports of all Circuit Breakers were provided and reviewed. It is recommended that pre-commissioning reports of all circuit breakers should be kept properly and they should be mandatorily being provided whenever they are required to be reviewed. It is also recommended that routine testing of all circuit breakers should be carried out regularly in future.

SPS for 400/220KV ICTs at 400KV Muktsar Substation, PSTCL	
Reporting Party	PSTCL/Punjab
Scheme's Name	SPS for 400/220 KV ICTs at 400KV Muktsar Substation, PSTCL
Classification	SPS related to overloading of remaining ICTs after tripping of 500MVA ICT at 400KV Muktsar Substation, PSTCL
Reference No.	NRLDC report dated 24-05-2024 regarding Punjab's ATC/TTC limits
Design Objective	To avoid overloading of remaining 2 no. 315MVA ICTs due to tripping of 500MVA ICT
Operation	During tripping of 400/220kV 500MVA ICT
Modelling	**400/220kV ICT Details at 400kV Muktsar:** 2 x 315MVA + 1 x 500MVA = 1130 MVA **220kV Transmission Lines at 400kV Muktsar:** 1. 220kV Muktsar-Abohar Ckt-1 2. 220kV Muktsar-Abohar Ckt-2 3. 220kV Muktsar-Ghubaya Ckt-1 4. 220kV Muktsar-Ghubaya Ckt-2 5. 220kV Muktsar-Katorewala Ckt 6. 220 Muktsar-Sandhwan Ckt **N-1 Contigency:** During tripping of 400/220KV 500MVA ICT at 400KV PSTCL Muktsar, the following feeders shall also be tripped automatically, to provide relief to the remaining 2 no. 400/220KV 315MVA ICTs at 400KV Substation Muktsar (PSTCL): **Feeder details for tripping during SPS operation** **Case 1.** After tripping of 400/220KV 500MVA ICT, if loading at remaining ICTs is more than **95% for 5 sec,** 220kV Muktsar-Sandhwan circuit will be disconnected/tripped. **Case 2.** After tripping of 400/220KV 500MVA ICT, if loading at remaining ICTs is more than **100% for 8 sec,** 220kV Muktsar-Sandhwan & 220kV Muktsar-Katorewala circuits will be disconnected/tripped. **NOTE: No load shedding shall be done during implementation of this SPS**
In-Service Period	Will be implemented at site after approval of the NRPC

Tentative Loading Scenario of 400/220 KV ICTs at 400KV Muktsar Substation, PSTCL				
Sr. No.	**Normal Loading on 3 no. ICTs**	**Loading on 2 no. 315MVA ICTs during N-1 Contingency**	**Loading after tripping of 220kV Muktsar-Sandhwan Ckt**	**Loading after tripping of 220kV Muktsar-Katorewala Ckt**
1	**~ 70%**	**~ 100-107%**	**~ 95-100%**	**~ 85-90%**

HVDC Champa-Kurukshetra Outages during 2024			
S.No.	**Outage**		**Name of Elements**
	Date	**Time**	
1	9-Jan-24	14:01	1) 800 KV HVDC Kurukshetra(PG) Pole-01 2) 800 KV HVDC Kurukshetra(PG) Pole-02 3) 800 KV HVDC Kurukshetra(PG) Pole-03 4) 800 KV HVDC Kurukshetra(PG) Pole-04
2	2-Mar-24	19:24	1) 800 KV HVDC Kurukshetra(PG) Pole-2 2) 800 KV HVDC Kurukshetra(PG) Pole-4
3	21-Mar-24	18:19	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
4	27-Mar-24	15:04	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
5	29-Mar-24	20:26	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
6	7-Apr-24	18:07	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-03
7	10-May-24	19:41	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04
8	30-May-24	09:07	1) 800 kV HVDC Kurukshetra(PG) Pole-03 2) 800 kV HVDC Kurukshetra(PG) Pole-04
9	17-Jun-24	13:53	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-02 3) 800 kV HVDC Kurukshetra(PG) Pole-03 4) 800 kV HVDC Kurukshetra(PG) Pole-04
10	23-Jun-24	09:11	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-03
11	27-Jun-24	21:17	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-02 3) 800 kV HVDC Kurukshetra(PG) Pole-03 4) 800 kV HVDC Kurukshetra(PG) Pole-04

Annexure-IX

उत्तरप्रदेशराज्य भारप्रेषणकेन्द्रलि०
यू०पी०एस०एल०डी०सी०परिसर, विभूति
खण्ड–II,गोमतीनगर, लखनऊ–226010
ई–मेल : sera@upsldc.org

U.P. State Load Despatch Centre Ltd
UPSLDC Complex, Vibhuti Khand – II
Gomti Nagar, Lucknow- 226010
E-mail:sera@upsldc.org

No: 2184 /SE(R&A)/EE-II/ Anpara SPS Dated: -01/07/2024

SE (Operations), 18 – A SJSS Marg,
Katwaria Sarai, New Delhi,
110016. (seo-nrpc@nic.in)

Subject: -Agenda item in 51th Protection Sub-Committee meeting regarding revision of System Protection Scheme (SPS) for Anpara Complex.

It is to inform that revised System Protection Scheme (SPS) for Anpara Complex was discussed in 74th NRPC meeting held on 28&29 June, 2024. In the meeting said SPS scheme was deemed approved and it was instructed that the scheme be put up in 51th Protection Sub-Committee (PSC) for the discussion.

It is therefore, requested to include revised SPS scheme for Anpara Complex (Copy enclosed) in the agenda of 51th PSC meeting to be held on 12.07.2024.

Encl: - As above

(Amit Narain)
Superintending Engineer (R&A)

No: /SE(R&A)/EE-II/ Anpara SPS Dated: - 2024

Copy forwarded to following via e-mail for information and necessary action:-

1. Chief Engineer (PSO), UPSLDC Vibhuti Khand – II, Gomti Nagar, Lucknow.
2. Chief Engineer (Trans. South - East), U.P. Power Transmission Corporation Ltd., 57, George Town, Prayagraj- 211003.
3. Chief General Manager, Anpara, Thermal Power Station, Anpara.
4. Chief General Manager, (Obra) Thermal Power Station, Obra, Sonbhadra Pin code-231219.
5. Superintending Engineer (System Control), UPSLDC Vibhuti Khand – II, Gomti Nagar, Lucknow.
6. M/s LANCO – Anpara Power Ltd, 411/09 River Side Apartment, New Hyderabad Lucknow-226007(arun.tholia@meilanparapower.com)

(Amit Narain)
Superintending Engineer (R&A)

Annexure-X

07.06.2024

Study for Revision of SPS for Anpara Complex

Objective: To Review the System Protection Scheme for safe evacuation of power from Anpara Complex after commissioning of 2X1000 MVA ICTs at Obra C TPS

Base case:

Generator	MW
Anpara A&B	1475
Anpara C	1110
Anpara D	900
Obra Thermal	510
Rihand Hydro Complex	0
Obra C	1250
All India Demand	208186
All India Generation	215000
UP Demand	27800
UP Generation	15200

400 kV Obra C-Jaunpur and 400 kV Obra B-Jaunpur are in service.

2X1000 MVA ICTs at Obra C is in of service.

400 kV Anpara Singrauli line is out service.

Here studies have been carried out for following scenarios;

Case-1: Tripping of 765 kV Anpara C-Unnao

Case-2: Tripping of 765 kV Anpara D-Obra C

Case-3: Tripping of 765 kV Obra C-Unnao

Case-4: Tripping of **Both 765kV Anpara C-Unnao AND Anpara D-Obra C**

Case-5: Tripping of **Both 765kV Anpara C-Unnao AND Obra C –Unnao**

Case-6: Tripping of **Both 765kV Anpara D-Obra C AND Obra C–Unnao**

Case-7: Tripping of Two ICTs (2X1000 MVA) at 765 kV substation Obra C

Case-8: Tripping of One ICT (1X1000 MVA) at 765 kV substation Unnao

Case-9: Tripping of Two ICT (2X1000 MVA) at 765 kV substation Unnao

Case-10: Tripping of Three ICTs (1X1000 MVA) at 765 kV substation Unnao

Inferences from studies:

1. **In case of single contingencies (Case No 1, 2, 3 and 8), there is no constraint observed.**

2. **Overloading of 400kV Anpara-Obra B line**

1. Overloading of 400kV Anpara –Obra line is observed in Case No.-4 and Case No.-7.
2. As per study if loading of 400kV Anpara-Obra line is more than 1100MW, generation reduction of 1400MW is required.
3. In case loading lies between 900MW and 1100MW, generation reduction of 900 MW is sufficient to keep the loading of the line below 800MW.

3. **Overloading of 400kV Obra C-Obra B line**

1. Overloading of 400kV Obra C- Obra B is observed in Case No.-5, 6 & 10.
2. As per study, in case loading of 400kV Obra C- Obra B is more than 1100MW, tripping of one unit at Obra C is required.
3. However if loading of the same line, lies between 900-1100MW, Automatic Run Back shall be done at Obra C to keep the loading below 900MW.

Loading Scenario for various contingencies in Anpara Complex

S.No.	Cases	400kV Anpara-Obra B (MW)	765 Anpara_C-Unnao(MW)	400kV Obra C-Obra B(MW)	**765kV AnparaD-ObraC-Unnao**(MW)	**765kV ObraC-Unnao**(MW)	**ICTs at 765 kV Unnao (MW)**
1	**Basecase flow (MW)**	490	1011	523	503	998	664 each
2	**765kV AnparaC-Unnao out**	628	0	639	1126	1450	478 each
3	**765kV Anpara D-Obra C out**	757	1157	192	0	144	662 each
4	**765kV Obra C-Unnao out**	483	1426	834	-116	0	470 each
5	**Both 765kV Anpara C-Unnao AND Anpara D-Obra C out**	1406	0	-225	0	1221	403 each
6	**Both 765kV AnparaC-Unnao AND ObraC –Unnao out**	712	0	1273	471	0	0
7	**Both 765kV Anpara D-ObraC AND Obra C–Unnao out**	406	1405	942	0	0	463 each
8	**Both ICT at Obra C Trip**	954	1075	-173	-101	1148	735 each
9	**One ICT at Unnao Trip**	507	946	577	499	925	927 each
10	**Three ICT at Unnao Trip***	709	0	1277	444	0	0

*** Tripping of 2 ICTs at 765 kV Unnao leads to tripping of all the three ICTs**

% Sensitivity of Transmission elements with respect to change in Generation

S.No.	Transmission elements	Anpara A&B TPS	Anpara_C TPS	Anpara DTPS	Obra CTPS	Obra BTPS
1	**400 kV Obra C-Obra B**	0 %	17.64%	18.00%	29.76%	-32.35%
2	**400 kV Anpara-Obra B**	28.70%	11.64%	11.33%	1.92%	-21.76%
3	**400 kV Anpara –Mau**	10.43%	8.36%	8.22%	7.52%	6.47%
4	**400 kV Anpara Sarnath ckt 1**	12.39%	9.64%	9.56%	8.48%	7.06%
5	**400 kV Anpara Sarnath ckt 2**	12.39%	9.64%	9.56%	8.48%	7.06%

% Sensitivity = Change in Line Loading*100/Change in Generation

Logic for SPS

Contingency related to overloading of 400 kV Obra C-Obra B line

i. **If 900<P1<1100- Automatic backdown at Obra C till P 1, becomes less than 900.**

ii. **If P_1>1100- Tripping of one Unit at Obra C.**

Contingency related to overloading of 400 kV Anpara-Obra B line

iii. **If 900<P2<1000- Automatic backdown at Anpara C AND Anpara D till P2 , becomes less than 900**

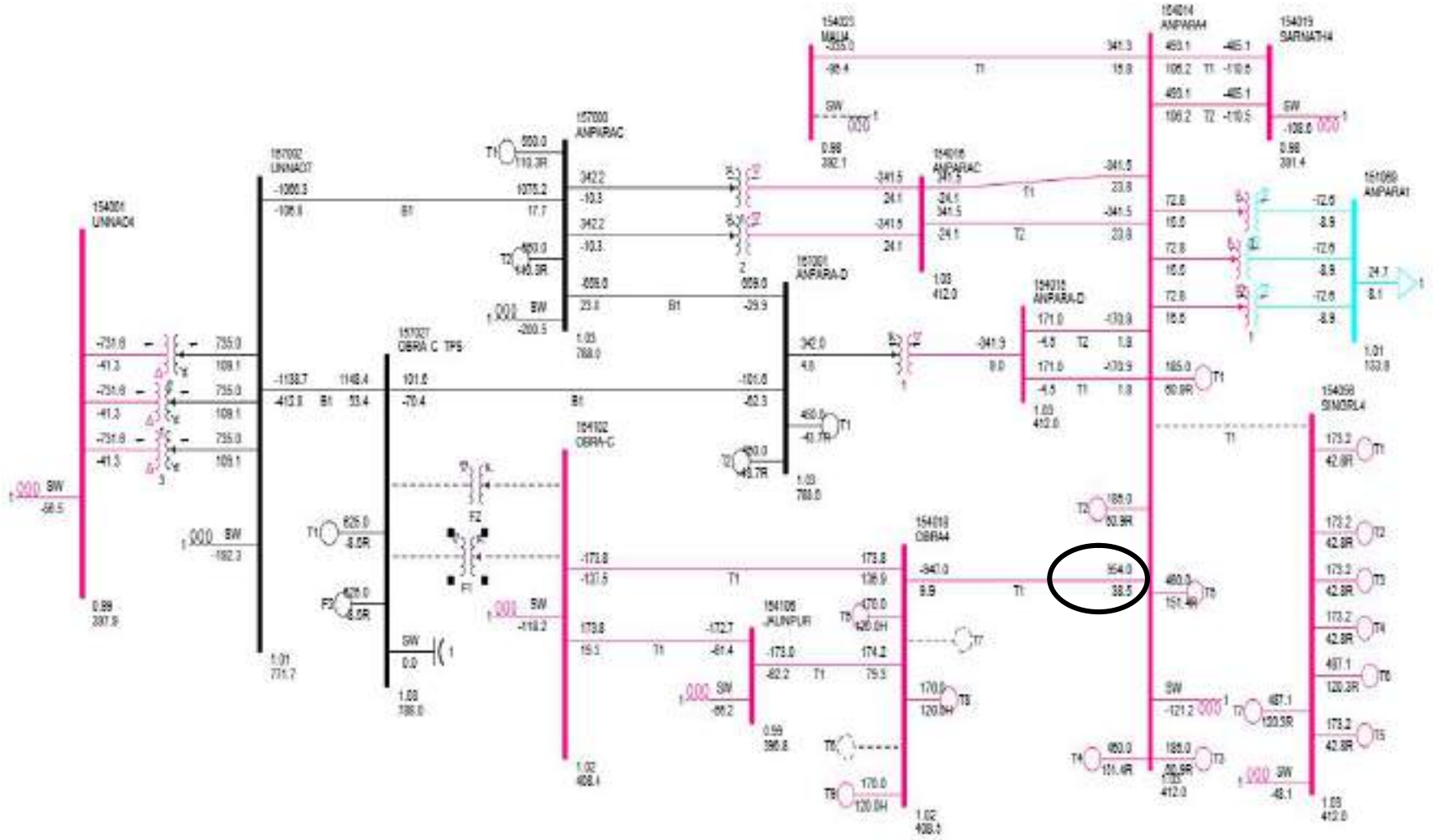
iv. **If 1000<P2<1100- Tripping of one unit at Anpara C or D and automatic backdown of Generation of remaining Unit of Anpara C AND Anpara D till P2 , becomes less than 900**

v. **If P2>1100- Tripping of two units at Anpara C TPS AND Anpara DTPS and automatic backdown of Generation of remaining Unit of Anpara C AND Anpara D till P2 , becomes less than 900**

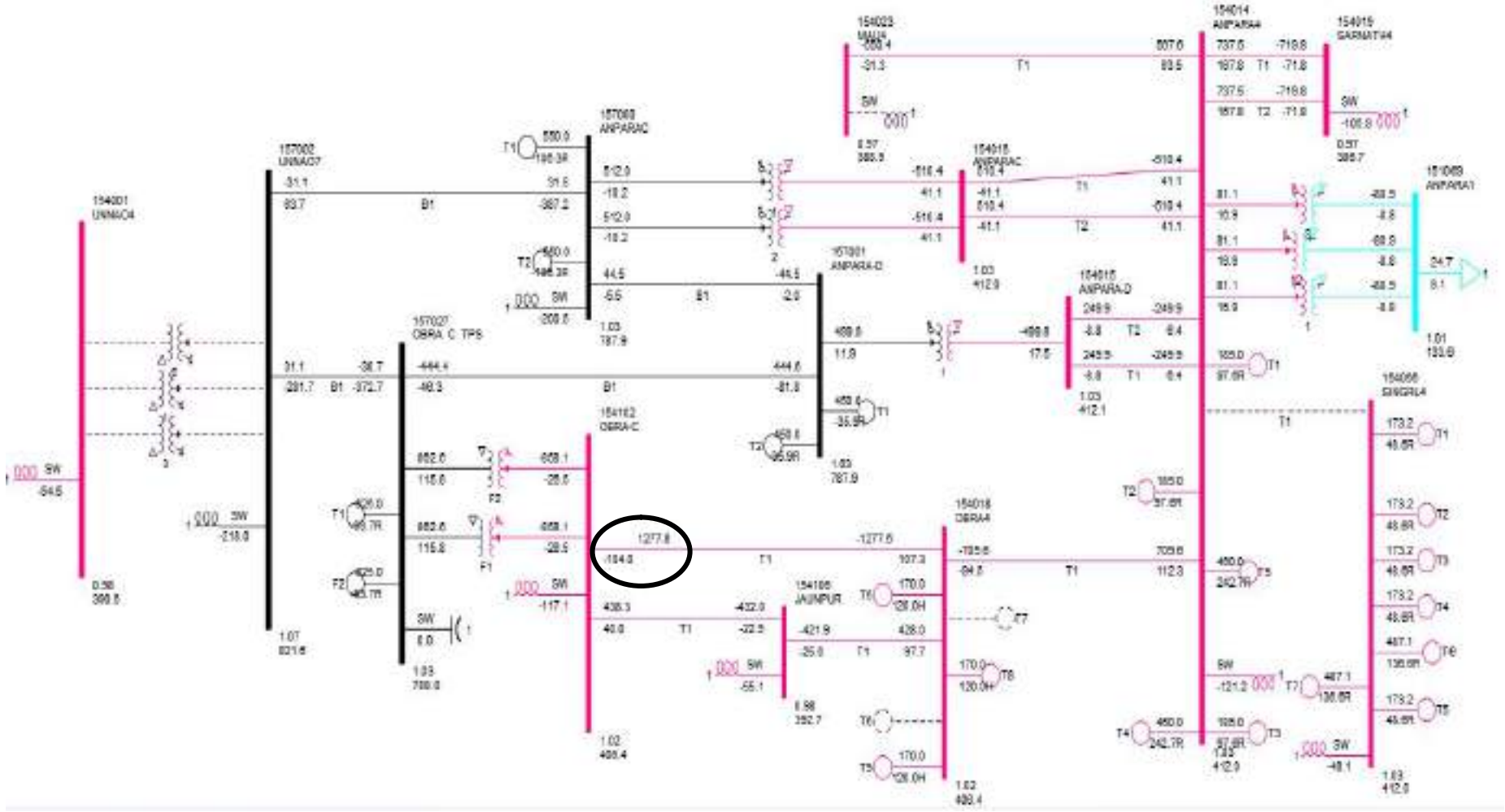
Where P1= Loading of 400 kV Obra C-Obra B line

P2 = Loading of 400 kV Anpara-Obra B line

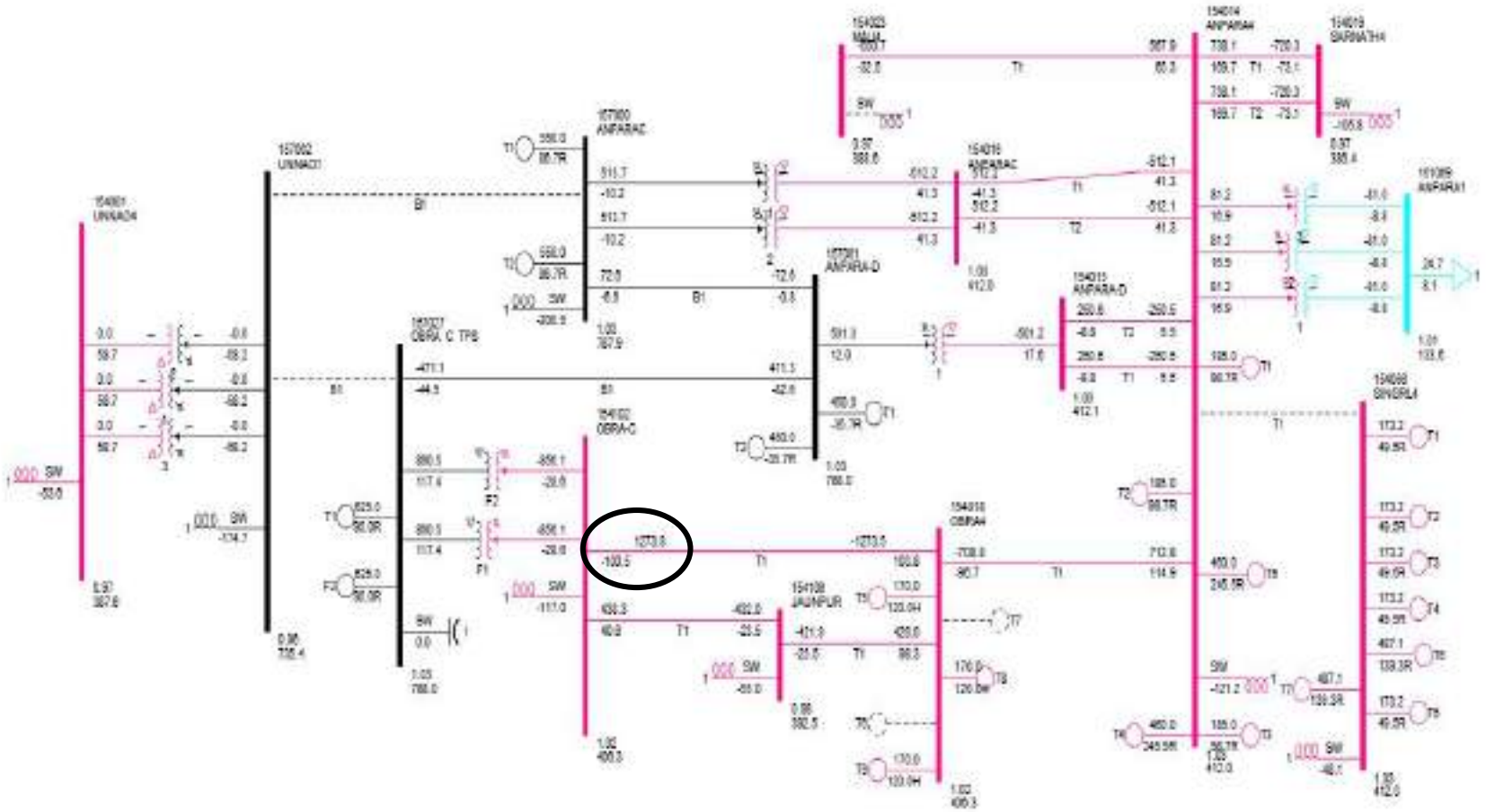
Both ICT Trip at Obra C



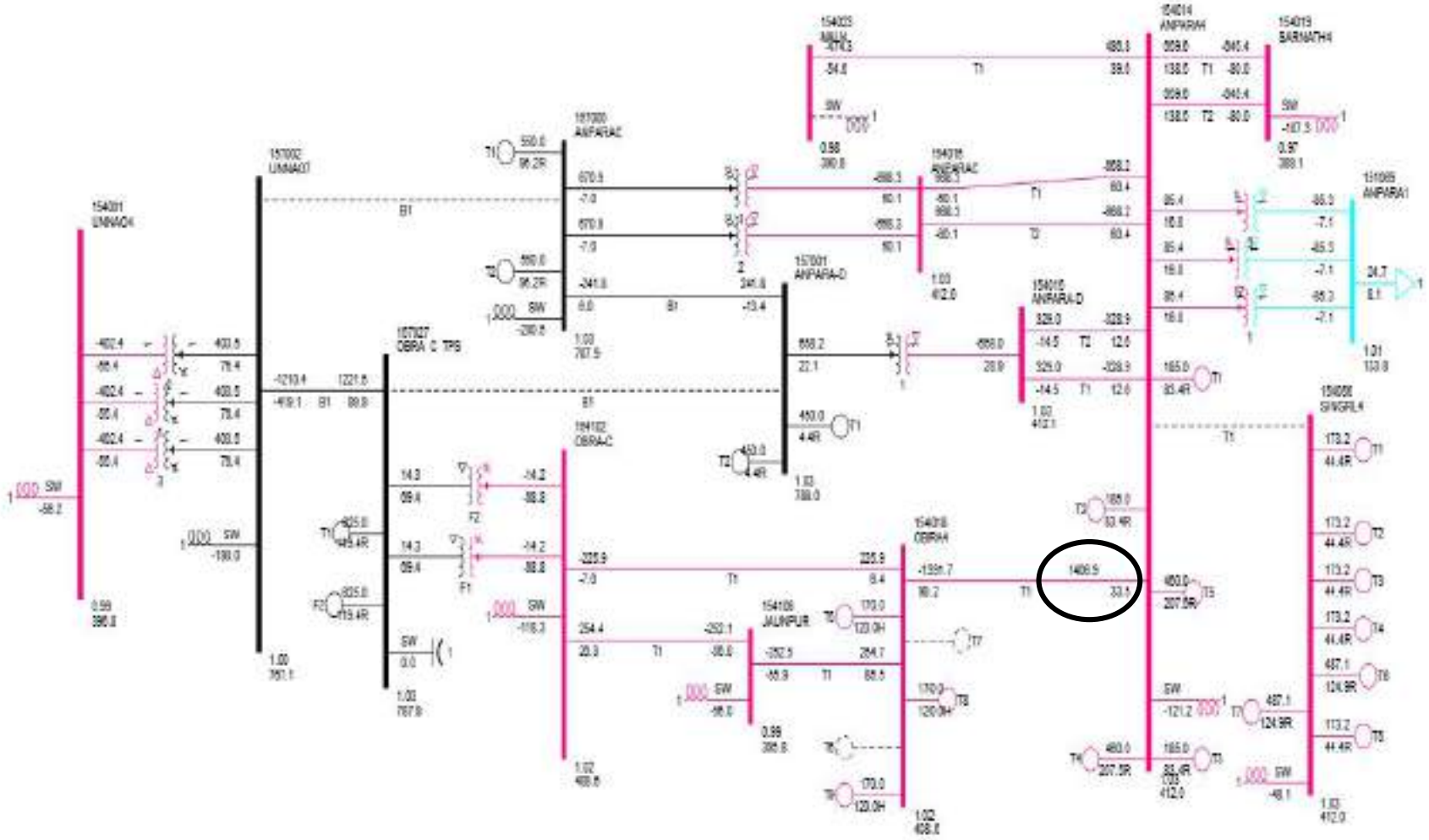
All ICT trip at Unnao



Both 765kV AnparaC-Unnao AND ObraC –Unnao out



Both 765kV Anpara C-Unnao AND Anpara D-Obra C out



Annexure-XI

HPPTCL-PLG-/9/2023-Planning Cell-HPPTCL HQ/374853/2024

HIMACHAL PRADESH POWER TRANSMISSION CORPORATION LTD.

(A State Govt. Undertaking)

Regd. Office: HimfedBhawan, New ISBT Road, Panjari Shimla-171005

Ph.:- 0177-2831283, 2831284 FAX:-0177-2831284

Web - www.hpptcl.com

(CIN):U40101HP2008SGC030950

(GSTIN) 02AACCH1543M1ZP

Date 27/03/2024

The

Member Secretary,
NRPC.
18-A, Shaheed Jeet Singh Marg, Katwaria Sarai,
New Delhi-110016

Sub: Review of SPS scheme No. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP- Regarding agenda for 49TCC & 72nd NRPC.

Sir,

HPPTCL had submitted the subject cited agenda for inclusion in 216th OCC committee vide email dated- 06.02.2024. The agenda item was not included in 216th OCC meeting. It is requested that matter may please be placed in upcoming **49TCC & 72nd NRPC for deliberations and discussions. The agenda item is attached along with for necessary action at your end please.**

Yours Faithfully

DGM (Plg & IT)
HPPTCL, Himfed Bhawan
Panjari, Shimla -05
dgmplgit.tcl@hpmail.in

Agenda: Review of SPS scheme No. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP.

BACKGROUND:

The System Protection Scheme is currently in operation i.r.o. reliable evacuation of the generation of Sawra Kuddu, Rampur, Karcham, Baspa, Sorang & Jhakri HEP, six outgoing circuits two from Jhakri/ Gumma, two from Rampur and two from Karcham Wangtoo are being used to evacuate power of these projects , which is adequate to take care of 'N-1' contingency of outgoing lines from Karcham/Jhakri/ Gumma & Rampur. The total injection of complex is as follows-

Sr. No.	Name of Project	Capacity including 10% O/L
1.	Baspa	330
2.	Karcham Wangtoo	1200
3.	Sorang	110
4.	Nathpa Jhakri	1650
5.	Rampur	453
6.	Sawra Kuddu	122
7.	Natwar Mori	66
8.	Small IPPs replecting at Gumma	55
9.	Max injection Wangtoo	150
10.	Total	4136

The modelling of SPS under operation is as follows-

1. **Case-1:** Load on any of the lines at Jhakri, Rampur or Gumma towards Nalagarh or Panchkula exceeds 850 MW.

   Action: Trip 1 unit of Karcham Wangtoo HPS, 1 unit of Jhakri HEP, 1 unit of Rampur HEP and 1 unit of Sawra Kuddu (Gumma) HEP.

2. **Case-2**: 400 kV bus voltage at Karcham Wangtoo drops below 395 kV.

Action : Trip 2 units of Karcham Wangtoo HPS.

3. **Case-3:** Any two outgoing lines of Jhakri (Jhakri-Rampur or Jhakri Gumma) or Rampur HPS (Rampur-Nalagarh D/C) or Gumma (Gumma-Panchkula) trip except in case of tripping of one ckt of 400 kV Jhakri-Gumma and one ckt of Gumma-Panchkula ckt or one ckt of Jhakri-Rampur and one ckt of RampurNalagarh ckt.

Action-1: Trip 2 units of Jhakri

Action-2: 2 units of Rampur HPS and

Action-3: 2 units of Karcham Wangtoo HPS

Action-4: 2 units of Sawra Kuddu (Gumma) HPS

No need to trip 2 units of Sawra-Kuddu HEP in case of tripping of 400kV JhakriGumma D/C as Sawra Kuddu generation will evacuate easily through 400 kV Gumma-Panchkula D/C.

4. **Case-4:** Both Karcham Wangtoo-Wangtoo(HP) lines trip or 400 kV Wangtoo(HP)-Kala Amb and 400kV Wangtoo(HP)-Sorang trip.

Action: Trip 2 units of Karcham Wangtoo HPS.

5. **Case-5:** Power Flow of any outgoing line of Rampur or Jhakri or Gumma Substation exceed by 800MW.

Action: Initiate the Alarm to the operators at Jhakri, Rampur, Karcham Wangtoo, Sorang HEP & Sawra Kuddu HEP.

6. **Case-6:** Both 400kV Kala Amb-Abdullapur lines trip or 400 kV Wangtoo(HP)- Kala Amb and 400kV Sorang HEP- Kala Amb trip.

Action: Trip 2 units of Karcham Wangtoo HPS & 1 unit of Sorang HEP.

The three corridors are as follows-

1. 400 kV D/C Jhakhri-Gumma-Panchkula- Abdullapur (Triple Snowbird)
2. 400 kV D/C Jhakri- Rampur Nalagarh (Triple Snowbird)

3. 400 kV Karcham Wangtoo- Wangtoo-Kala Amb- Abdullapur (Quad Moose)
4. 400 kV interconnecting line between Nathpa Jhakhri and Karcham Wangtoo (Triple Snowbird).

As such there are two 400 kV D/C triple snowbird corridors to Nalagarh and Panchkula respectively and One 400 kV Quad Moose Corridor to Abdullapur/Kala Amb from Karcham Wangtoo interconnected with Jhakhri through 400 kV D/C triple snowbird line. The triple snowbird lines under N-1 contigency shall be sufficient to carry around **1500 to 1600 MVA power at 45 Degree Ambient Temperature and 85 Degree conductor temperature**. The 400 kV Quad Moose has capacity to transfer 2100 MVA to 2200 MVA at **45 Degree Ambient Temperature and 85 Degree conductor temperature** power under N-1 contigency. The limit of 850 MW load on any of the 400 kV triple Snowbird line from Jhakri, Rampur or Gumma towards Nalagarh or Panchkula seems to be on highly conservative side. It is therefore proposed that these limits may be got reviewed keeping in view the overall transmission system. Review of these limits can result in-

1. Removal/Revison of SPS from the generation complex of various HEPs in the region thereby ensuring no loss of generation.
2. Avoiding construction of 400 kV Trasnmission line from 400/220 kV Wangtoo Substation to Panchkula. (Planned for evacuation of Hydro projects in upper Satluj Basin). This apart from savings on account of Capital investement shall also save valuable R.O.W.

Proposal- Considering above it is proposed that SPS scheme No. SPS/NR/GEN/01 for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP in state of Himachal Pradesh may be got reviewed keeping in view present system conditions.

Line	Sensitivity on parallel ckt	n-1 loading limit for 1270 MVA line rating	n-1 loading limit of 1600 MVA line rating	~ Max Loading of line recorded during 2023 -24
400kV Rampur - Nallagarh D/C	41%	850 MW	1078 MW	786 per ckt
400kV NJPC - Rampur D/C	87%	645 MW	812 MW	560 per ckt
400kV NJPC - Gumma D/C	68%	718 MW	904 MW	606 per ckt
400kV Gumma - Panchkula D/C	44%	837 MW	1055 MW	675 per ckt
400kV KWHEP - NJPC D/C	79%	674 MW	850 MW	

Line	Sensitivity on parallel ckt	n-1 loading limit for 1704 MVA line rating	n-1 loading limit of 2200 MVA line rating	~ Max Loading of line recorded during 2023 -24
400kV KWHEP-Wangtoo D/C	99%	813 MW	1050 MW	660 per ckt
400kV KalaAmb-Abdullapur D/C	79%	904MW	1168MW	700 per ckt

Two Line Trip	Generation backing required with 1270 MVA and 1704 MVA limits (existing)	Generation backing required with 1600 MVA and 2200 MVA limits
400kV Rampur - Nallagarh D/C	2 units each of Jhakri, Rampur, KWHEP and Swara Kuddu	No backing required
400kV NJPC - Rampur-1 and NJPC - Gumma -1	2 units each of Jhakri, Rampur, KWHEP and Swara Kuddu	No backing required
400kV Gumma- Panchkula D/C	2 units each of Jhakri, Rampur, KWHEP and Swara Kuddu	1 unit each of Jhakri, Rampur, KWHEP and Swara Kuddu
400kV NJPC - Gumma D/C	2 units each of Jhakri, Rampur, KWHEP and Swara Kuddu	1 unit each of Jhakri, Rampur, KWHEP and Swara Kuddu

उत्तरप्रदेशराज्य भारप्रेषणकेन्द्रलि०
यू0पी0एस0एल0डी0सी0परिसर, विभूति
खण्ड–।।,गोमतीनगर, लखनऊ–226010
ई–मेल : sera@upsldc.org

U.P. State Load Despatch Centre Ltd.
UPSLDC Complex, Vibhuti Khand – II
Gomti Nagar, Lucknow- 226010
E-mail:sera@upsldc.org

Annexure-XIII

No: **2034** /SE(R&A)/EE-II/ SPS Dated: - **15.06.** 2024

SE (Operations), NRPC
18 – A SJSS Marg,
Katwaria Sarai, New Delhi,
110016. (seo-nrpc@nic.in)

Subject: - Additional Agenda for approval of Proposed System Protection Scheme (SPS) at 400kV substation Jaunpur.

It is to inform that 2X315 MVA ICT at 400 kV substation Jaunpur is not N-1 compliant. In order to ensure the reliability of said substation during peak demand, System Protection Scheme is required. Proposed Logic for SPS of 2X315 MVA ICT at 400 kV substation Jaunpur is enclosed.

It is requested to kindly include Proposed SPS logic as an agenda of 220th OCC meeting of NRPC, so that the same may be discussed and approved.

Enclosure: As above

(Amit Narain)
Superintending Engineer (R&A)

No: /SE(R&A)/EE-II/ SPS Dated: - 2024

Copy forwarded to via e-mail following for information and necessary action:-

1. Director (Operation), UPPTCL, 11th Floor, Shakti BhawanExtn.,Lucknow.
2. Chief Engineer (PSO), UPSLDC Vibhuti Khand – II, Gomti Nagar, Lucknow.
3. Chief Engineer (Trans. South - East), U.P. Power Transmission Corporation Ltd., 57, George Town, Prayagraj - 211003.
4. General Manager, NRLDC 18-A, SJSS Marg, Katwaria Sarai, New Delhi–110016.
5. Superintending Engineer (System Control), UPSLDC, Vibhuti Khand – II, Gomti Nagar, Lucknow.

(Amit Narain)
Superintending Engineer (R&A)

Logic for proposed SPS (System Protection Scheme) for ICTs at 400kV Substation Jaunpur

Name of Substation	ICT Rating	Tripping Logic-I			Tripping Logic-II		
		% Setting	Time Delay	Priority of feeder for load cut off	% Setting	Time Delay	Priority of feeder for load cut off
400kV Substation Jaunpur	315MVA ICT- I	100-110% of rated current	5 sec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)	Above 110% of rated current	1500 msec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)
	315MVA ICT- II	100-110% of rated current	5 sec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)	Above 110% of rated current	1500 msec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II)

Note-132kV Machhalishahar and 132kV Mungrabadshahpur is likely to be charged in 15 days

Overcurrent setting of ICTs at Jaunpur

Fault current with respect to full load (FL) current	OC trip time (in Sec)
100% of FL	Pickup
105% of FL	43.02346548
110% of FL	22.01532991
120% of FL	11.50012415
130% of FL	7.986157208
150% of FL	5.161265654

Logic for proposed SPS (System Protection Scheme) for ICTs at 400kV Substation Jaunpur

Name of Substation	ICT Rating	Tripping Logic-I			Tripping Logic-II		
		% Setting	Time Delay	Priority of feeder for load cut off	% Setting	Time Delay	Priority of feeder for load cut off
400kV Substation Jaunpur	315MVA ICT- I	100-110% of rated current	5 sec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II) 5. 220kV Jhoosi 6. 220kV Phoolpur	Above 110% of rated current	1500 msec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II) 5. 220kV Jhoosi 6. 220kV Phoolpur
	315MVA ICT- II	100-110% of rated current	5 sec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II) 5. 220kV Jhoosi 6. 220kV Phoolpur	Above 110% of rated current	1500 msec	1. 132kV Machhalishahar 2. 132kV Mungrabadshahpur 3. 220kV Bhadohi 4. 220kV Azamgarh(II) 5. 220kV Jhoosi 6. 220kV Phoolpur

Overcurrent setting of ICTs at Jaunpur

Fault current with respect to full load (FL) current	OC trip time (in Sec)
100% of FL	Pickup
105% of FL	43.02346548
110% of FL	22.01532991
120% of FL	11.50012415
130% of FL	7.986157208
150% of FL	5.161265654

Annexure-V

Tripping Details of 132 kV Chandak (PGCIL)-Almora Line

s.no	Name of line and CB No.	Date/Time of Tripping & Closing	Almora End Flag	Almora End Fault Current	Chandak End Flag	Chandak End Fault Current
1	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 14/09/2023 16.29 HRS Close - 14/09/2023 17.53 HRS Duration - 01.24 HRS	Distance protection operated, Zone 1 Fault loop Phase C-N , Distance=24.28 KM.	I1 = 187.6 A I2 = 446.2 A I3 = 555.9 A IN = 1.079 KA	Backup O/C protection operated, Distance= 66.79 KM	I1 = 33 KA I2 = 1.44 KA I3 = 0.34 KA
2	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 09/04/2024 17.08 HRS Close - 09/04/2024 19.03 HRS Duration - 01.55 HRS	Distance protection operated, Fault loop A-C-N Distance - 21.05 KM	I1 = 1.653 KA I2 = 228.7 A I3 = 1.737 KA IN = 1.305 KA	Backup O/C protection operated, Fault loop R-B Distance - 85.27 KM	IL1 =1357.0 A IL2 = 233 .0A IL3 = 1583.0 A
3	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 09/06/2024 16.07 HRS Close - 09/06/2024 16.57 HRS Duration - 00.50 HRS	Distance protection operated, Zone 1 Distance= 6.314 KM	IL1 = 242.5 A IL2 = 193.8 A IL3 = 429.1 A IN = 9.374 A	Backup O/C protection operated, Distance= 95.15 KM	IL1 = 266 A IL2 = 1450 A IL3 = 1230.0 A IN = 7.0 A
4	132KV Chandak - Almora Line CB NO.- 72 CB NO. - 652	Trip - 25/06/2024 16.43 HRS Close - 25/06/2024 17.26 HRS Duration - 00.50 HRS	Distance protection operated, Zone 1 Distance= 10.39 KM	IL1 = 251.6 A IL2 = 149.6 A IL3 = 394.1 A IN = 9.679 A	Backup O/C protection operated, Distance= 78.98 KM	IL1 = 270 A IL2 = 1621 A IL3 = 1373.0 A IN = 7.0 A

132KV CHANDAK (PGCIL)-PITHORAGARH LINE TRIPPING DETAILS

S.no	Name of line and CB No.	Date/Time of Tripping & Closing	Pithoragarh End Flag	Pithoragarh End Fault Current	Chandak End Flag	Chandak End Fault Current
1	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 04/05/2023 16.41 HRS Close - 04/05/2023 17.53 HRS Duration - 1.12 HRS	Not Trip	Nil	Distance & Backup O/C & E/F protecton operated, B phase E/F	I1 = 345 A I2 = 463 A I3 = 2497 A IN = 1701 A
2	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 14/06/2023 19.09 HRS Close - 14/06/2023 20.16 HRS Duration - 1.07 HRS	Not Trip	Nil	Backup O/C protecton operated , R phase Distance - 173.73 KM	I1 = 1019 A I2 = 865 A I3 = 268 A
3	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 08/05/2024 19.15 HRS Close - 08/05/2024 20.09 HRS by C.B 72	Not Trip	Nil	Backup O/C protecton operated , Zone 1 Distance - 202.64 KM	I1 = 710 A I2 = 228 A I3 = 910 A IN = 289 A
		Trip - 08/05/2024 20.27 HRS Close - 08/05/2024 20.44 HRS by C.B 74 and 22.48 by C.B 72	Not Trip	Nil	Backup O/C protecton operated , Zone 1 Distance - 204.89 KM	I1 = 713 A I2 = 206 A I3 = 899 A IN = 273 A
4	132KV Chandak - Pithoragarh Line CB NO.- 72 CB NO. - 752	Trip - 3/06/2024 18.11 HRS Close - 03/06/2024 18.16 HRS Duration - 0.05 HRS	Not Trip	Nil	Dir O/C B phase protecton operated Distance - 186.54 KM	I1 = 864 A I2 = 835 A I3 = 1.08 KA IN = 92 A

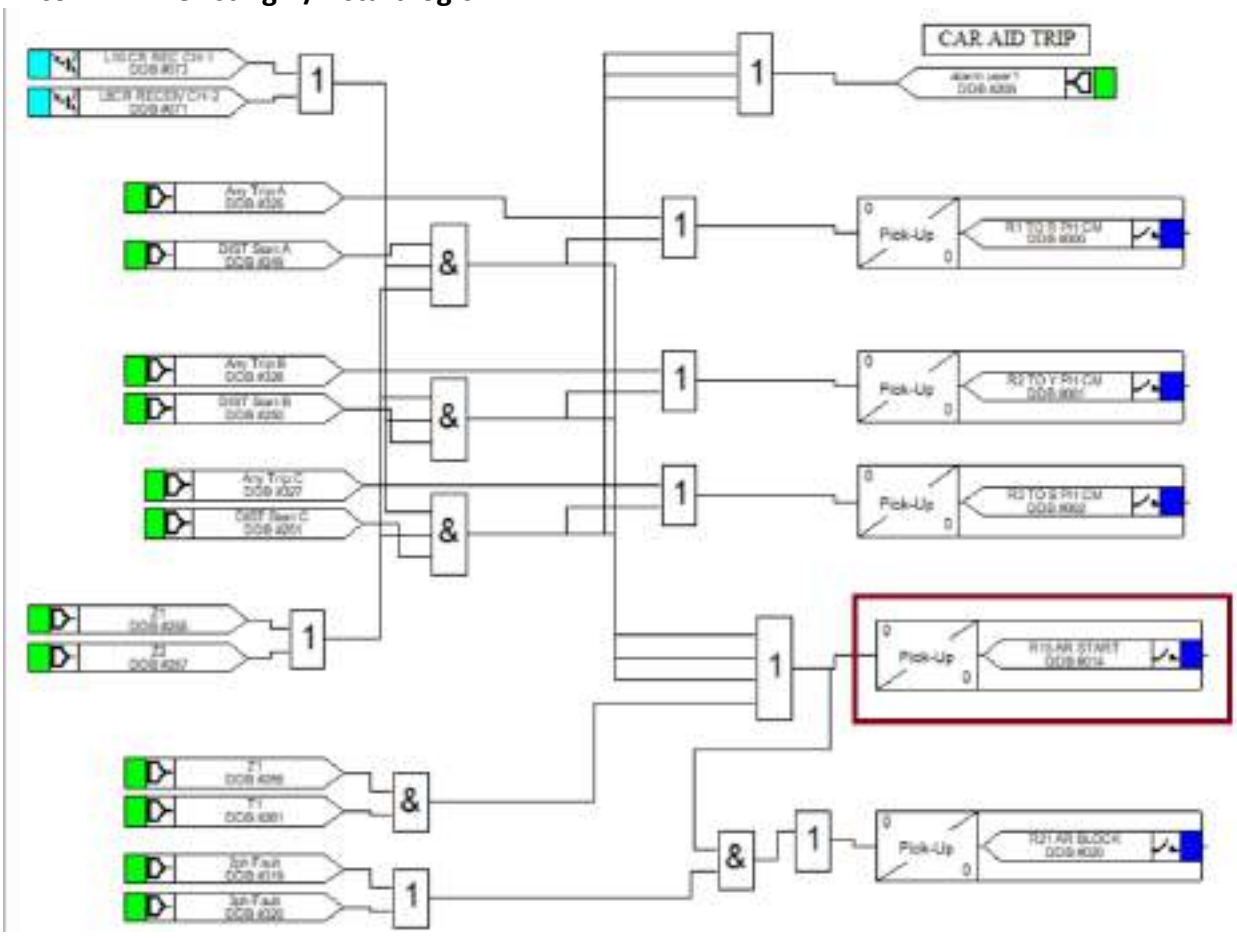
Generally, POWERGRID implemented Auto Reclosure Scheme for Single-phase fault and autoreclose block for phase-to-phase/3-phase fault.

It has been observed that in some specific lines, most of the Phase-to-phase Tripping of the Transmission Lines have occurred due to the presence of foreign material (such as Kite Threads) and the Line got charged during charging attempt. Due to majority of such type of Phase-Phase fault, 3-phase Auto-reclosure scheme is proposed for 400kV Bareilly-Moradabad Line on pilot basis.

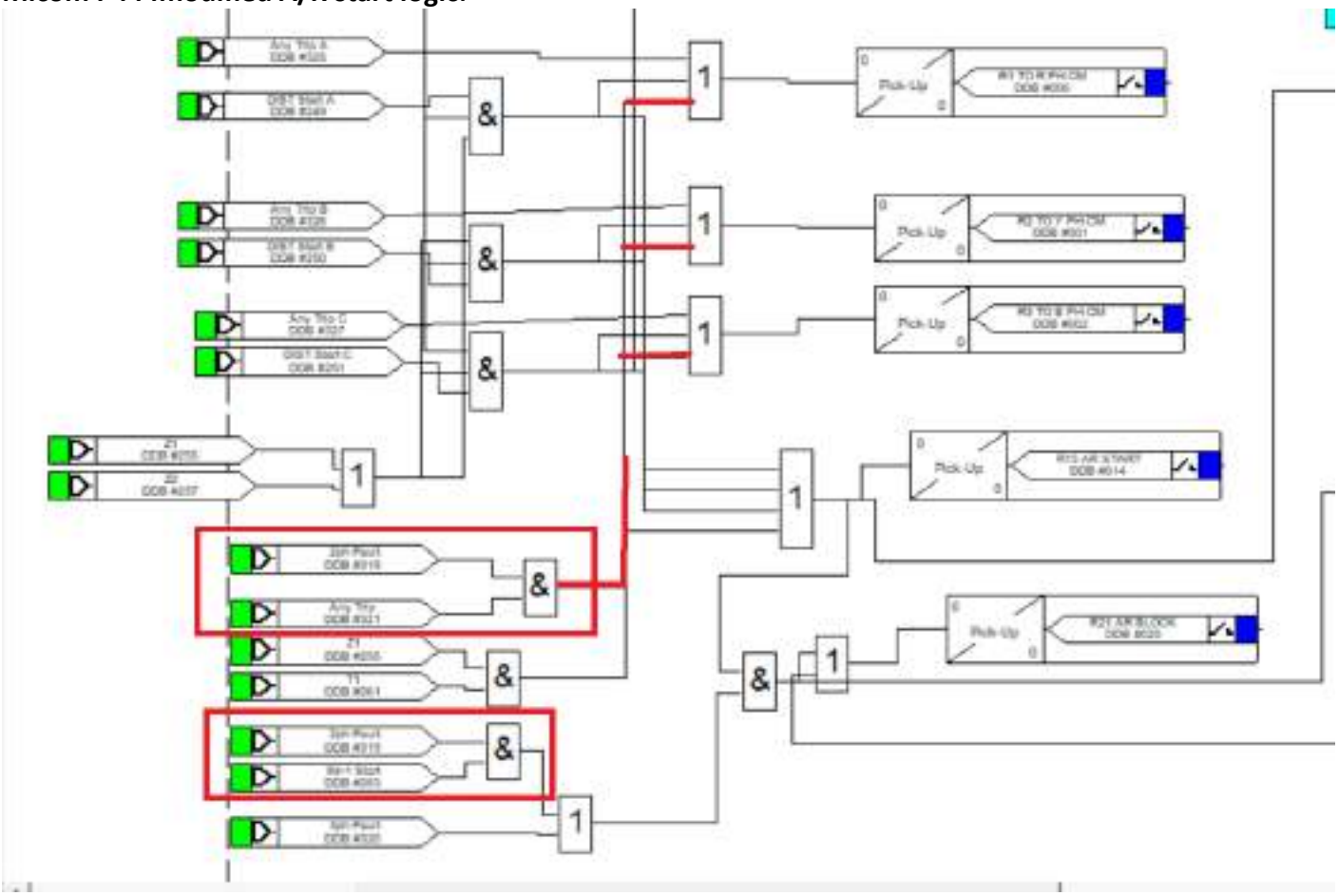
The implemented Autoreclosure scheme of phase to earth fault is modified for Phase-to-phase faults also However, Auto-reclosure should get blocked in case of Phase-Phase-earth fault and all Three-phase faults.

It is informed that in 400kV Bareilly-Moradabad line, A/R initiation generated from Distance protection relays (Main-I and main-II) and goes to ABB make (RAAM) relay and further RAAM relay processed the autoreclose operation. In the modified scheme, A/R initiation logic modified in Distance protection relays for A/R initiation for Single Ph-E fault and Ph-Ph fault both and further RAAM relay process the A/R operation in same way as earlier. The A/R initiation and A/R block logic modified for MiCOM P444 is as under

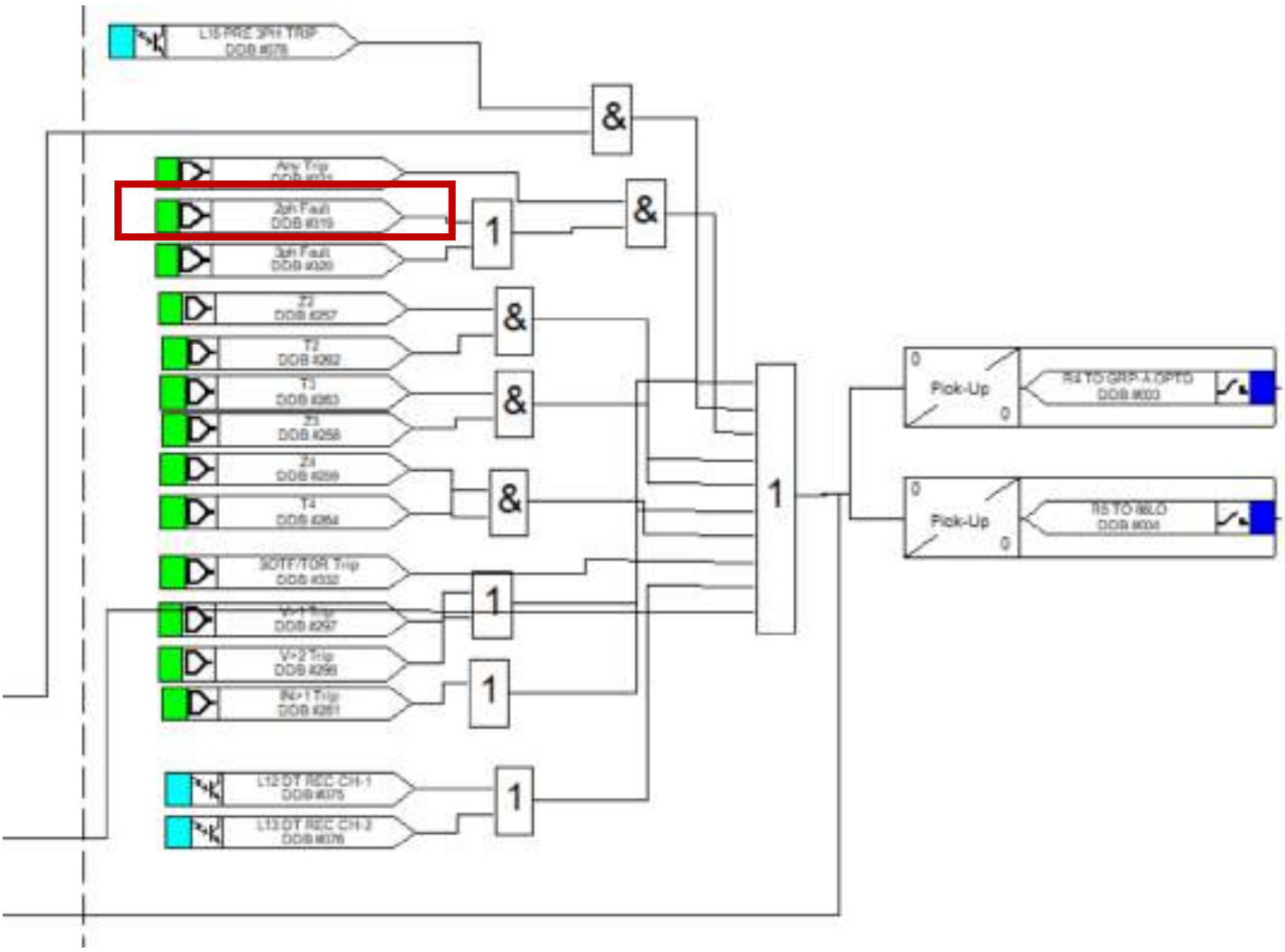
Micom P444 existing A/R start logic:



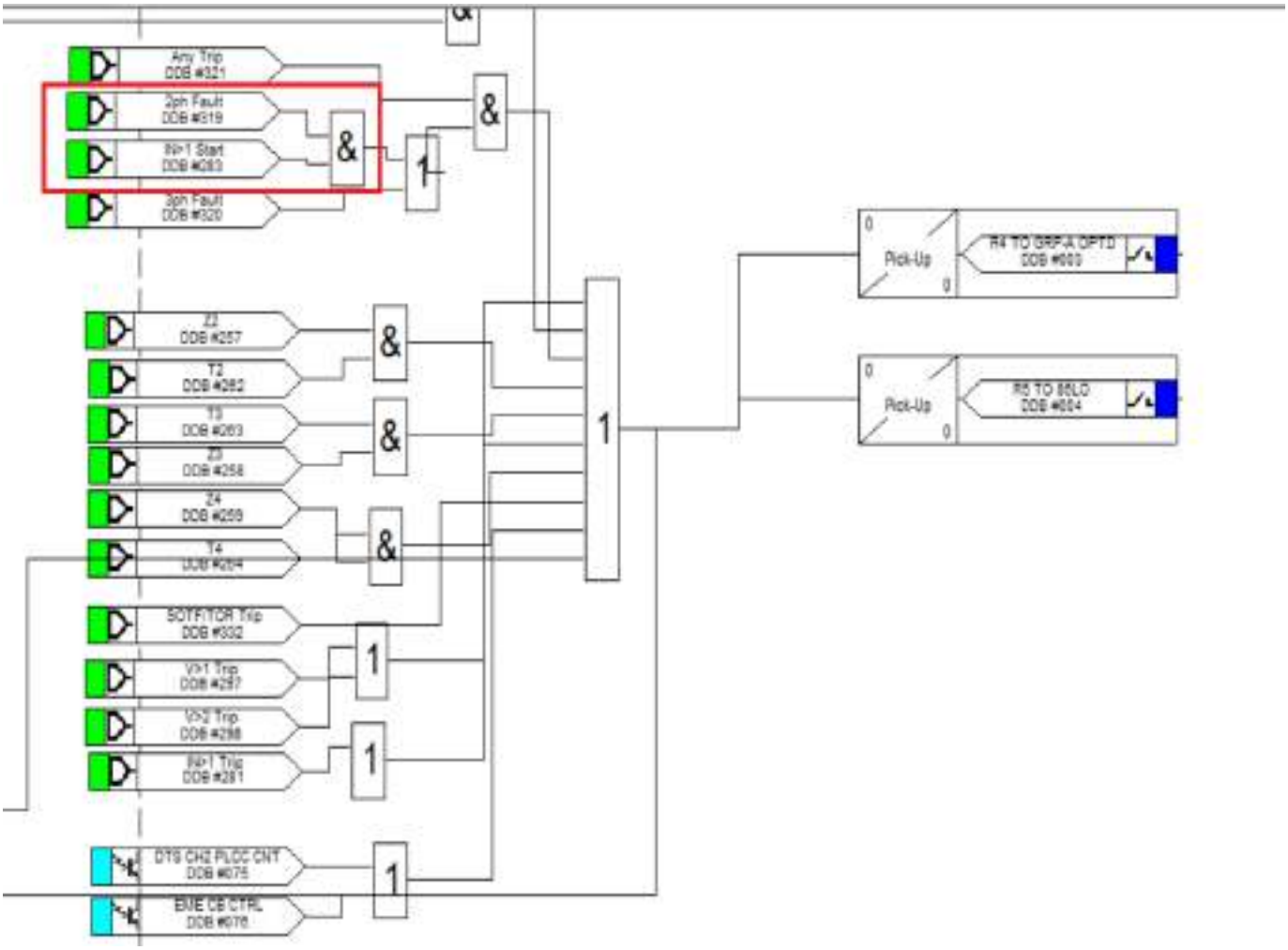
Micom P444modified A/R start logic:



Micom P444 Existing Master Trip and A/R Lockout relay Logic:



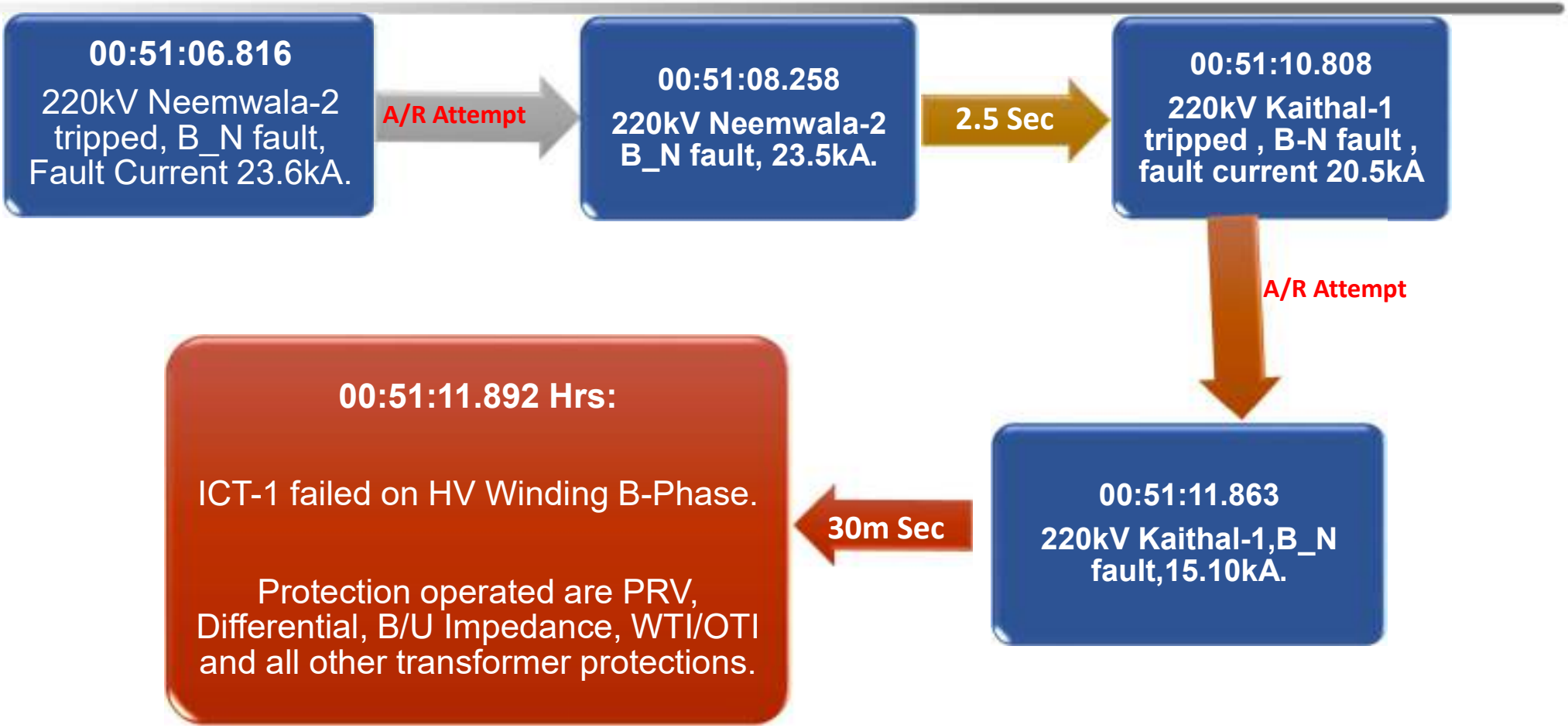
Micom P444 Modified Master Trip and A/R Lockout relay Logic:



Similar A/R initiation logic is modified for other distance protection relays and A/R initiation as well as A/R lockout is checked in Spare relays. During testing all results were found in order.

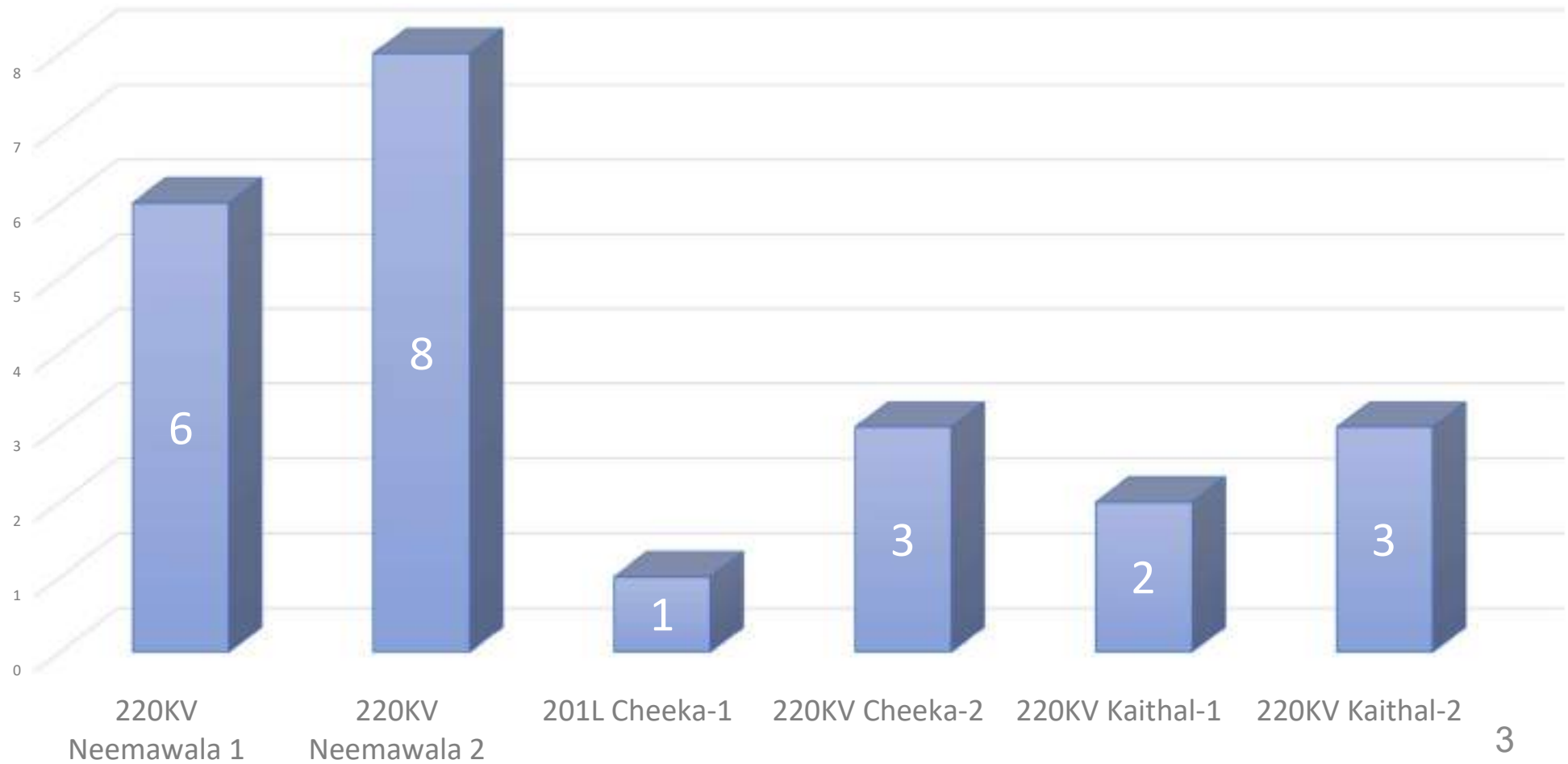
Failure of 400/220/33kV 315MVA ICT-1 on 11-05-2024 at Kaithal SS

Sequence of Events on 11-05-2024 at 00:51Hrs



- **Both Line faults were B-N Faults and ICT failure was also on B-N Fault**

Tripping instances in Kaithal connected lines during last 2 years



Trend of phase wise faults in last 2 years

Fault analysis

- 19 out of 23 line faults were B-N fault.
- In 17 out of 23Line faults, Fault distance was less than 6KM resulting in very high fault current(>22KA).

Inspection of ICT by OEM

Internal inspection by OEM and findings

- Transformer failed during external faults at 220KV Side
- W-Phase winding geometry changed.
- W-Phase Winding outer cylinder broken, CSP dislocated.
- W-Phase, HV side top frame dislocated.
- W- Phase LV side outer cylinder broken.

Date: 14-05-2024

Minutes of Meeting between POWERGRID Kaithal and M/s. CGPISL T3 Division Bhopal.

Member present:-

POWERGRID Kaithal	M/s. CGPISL
Sh. Manish Gupta	Sh. Praveen Singh
Sh. Abhishek Sharma	

Reference: 1. your email dated- 11th May 2024

2. Our quotation- SUPNR2425022_R0 dated 13th May 2024.

Subject: Internal inspection of 315 MVA, 400/220/33 kV Transformer bearing serial no. T9202/2.

Sequence of Events:-

1. The said transformer was commissioned on ____22/02/2007, 16:42 hrs.___.
2. Before tripping, no combustible gases was recorded in DGA report.
3. On date __11/05/2024, 00:51 hrs.__, during the external fault at 220 kV side, the said transformer was tripped on below listed protection.
   - Differential protection
   - Buchholz relay
   - PRV.
   - Over current Earth fault protection.
4. For a detailed investigation and internal inspection, M/s. POWERGRID requested M/s. CGPISL to depute a senior representative to the site via an email dated May 11, 2024.
5. Considering the matter of urgency, M/s. CGPISL deputed the engineer at site on May13, 2024.

Observations:-

a) Transformer main tank, box stiffener on 33kV side wall, found cracked.

b) Minor bulges at 2 to 3 location on the tank bell joints observed.

c) Crack observed on 220 kV (U, V, W-phase) bushings flange.

d) W-phase winding geometry has changed. Top and bottom clamping ring dislocated. CSP dislocated. Winding clamping sectors came out. Winding outer cylinder found broken.

e) W-phase HV side tap frame dislocated.

f) V-phase HV side CSP 01 no. block dislocated from its position. Winding outer cylinder pasting with CSP found broken. Looseness observed in uncut portion.

g) W-phase LV side outer cylinder found broken, copper conductors came out. Tap lead no 1 dislocated from its original position.

h) Due to space constraints in LV side inspection of OLTC cannot be possible.

Considering all of the above findings, M/s. CGPISL is in the opinion that, the said transformer is not possible to repair at site and requires to send back factory works for detail investigation and repair.

M/s. CGPISL representative left the site on May 14th 2024.

Photographs of external & internal damages are enclosed as Annexure-I

Note: On matter of urgency, to honor M/s. POWERGRID words, M/s. CGPISL deputed their representative to POWERGRID Kaithal without PO.

POWERGRID Kaithal confirms to place purchase order to M/s. CGPISL in line with M/s. CGPISL quotation SUPNR2425022_R0 dated 13th May 2024 as early as possible.

Signature:

POWERGRID Kaithal	M/s CGPISL

W-Phase winding geometry changed

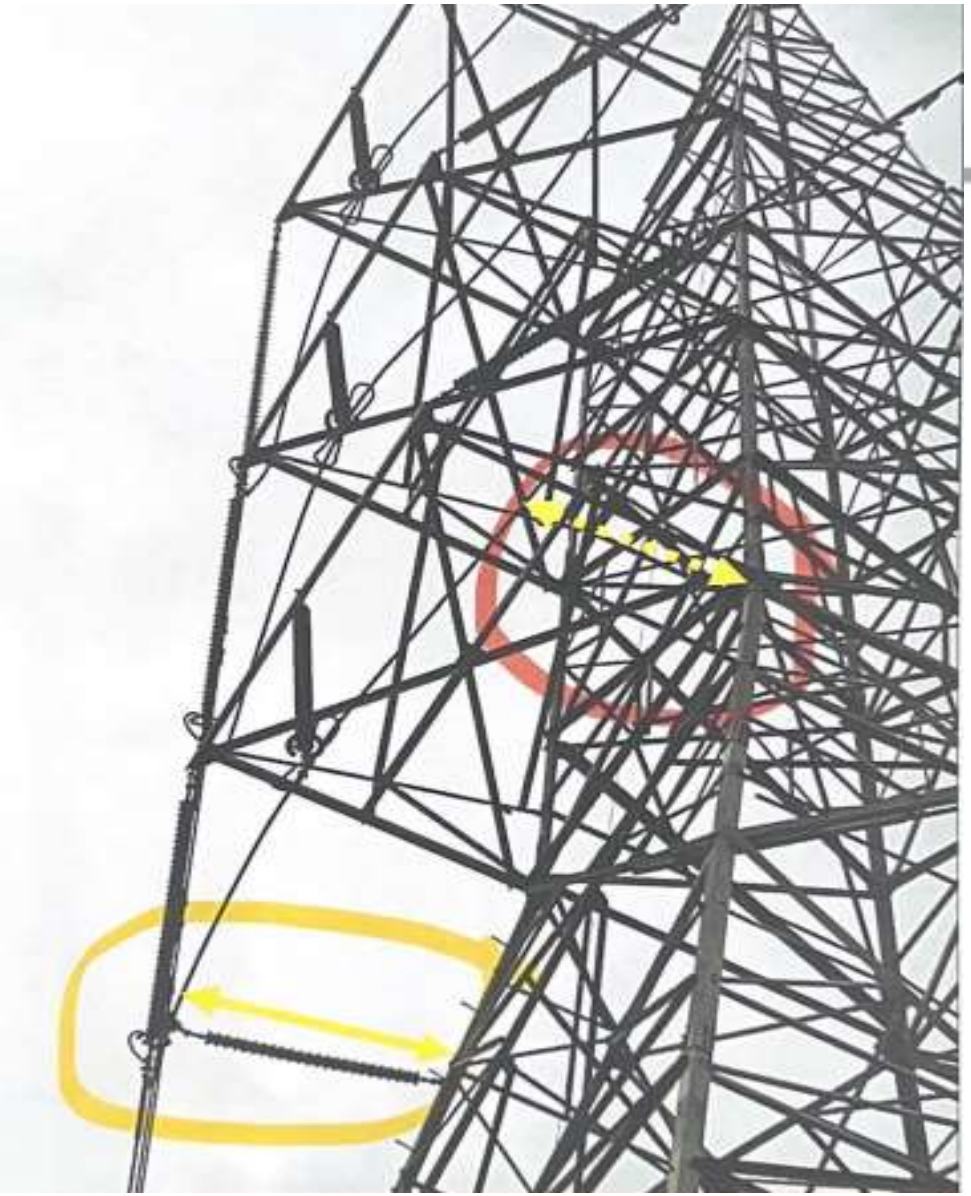
Tripping of 400/220/33kV 315MVA ICT-1 on 11-05-2024

315 MVA ICT-1-Testing

AMP of transformer was carried out as per schedule and all test results were normal.

Sr. No.	Description	Sample date	H2	CH4	C2H4	C2H6	C2H2	Remarks
1	Kaithal- ICT-1	11-05-2024	1364	12	974	174	1928	After Fault
2	Kaithal- ICT-1	10-05-2024	4	18	15	6	0	Before Fault
3	Kaithal- ICT-1	30-03-2024	0	14	16	6	0	Before Fault
4	Kaithal- ICT-1	28-11-2023	0	25	18	6	0	2023
5	Kaithal- ICT-1	12-06-2023	0	18	15	6	0	2023
6	Kaithal- ICT-1	14-03-2023	5	15	18	6	0	2023
7	Kaithal- ICT-1	26-09-2022	9	18	25	9	0	2022
8	Kaithal- ICT-1	02-04-2022	0	16	14	6	0	2022
9	Kaithal- ICT-1	23-09-2021	6	974	18	6	0	2021
10	Kaithal- ICT-1	20-03-2021	4	15	12	4	0	2021

Suggestions for improvement in Line Faults:



- Installation of support insulator in all angle towers in 220KV Kaithal(PG)-Neembali-1&2 Lines especially in B-Phase.

Suggestions for improvement in Line Faults:

Replacement of porcelain insulators with polymer in Cheekha ½ and Kaithal ½ Lines.

Date of commissioning of Lines :

- 220KV Kaithal-1 : 30.10.2005
- 220KV Kaithal-2 : 28.11.2005
- 220KV Cheekha-1: 30.10.2005
- 220KV Cheekha-2 : 28.11.2005

- Issue of replacement of Porcelain insulators with polymer insulators has been discussed a nos of times in previous OCC, NRPC & TCC meetings.

Porcelain insulators in 220KV Kaithal and Cheekha

NRPC minutes for replacement of Antifog insulators with Polymer insulators :

B.4.2.2 He stated that it was also observed that flashovers had taken place at many locations where conventional insulators had been replaced with anti-fog insulators. Based on discussions in the special meetings, the OCC in its meeting held on 17.02.2014 recommended following proposals for approval of TCC/NRPC :

(i) Utilities would take necessary steps such as replacement of conventional insulators with polymer insulators and cleaning of porcelain insulators in already known and newly identified areas to avoid tripping of lines in next winter.

(ii) If cleaning is to be carried out through outsourcing, the bidding process shall be so timed that orders are placed on or before end of September 2014.

(iii) In future all new transmission lines in plain areas would be built with polymer insulators only and also existing anti-fog insulators would be replaced with polymer insulators in phased manner

Financial implication

Financial implication for replacement of old ICT with new ICT is about 20 Crores and POWERGRID had replaced with new one at its own cost.

POWERGRID submission

In view of above, it may be concluded that :

- **ICT failed on B-N fault on 11.05.2024 during persistent B-N Line faults in 220KV Kaithal Neemawala-2 and Kaithal Kaithal-1**
- **Out of 23 No. Line faults in last 02 years, 19 number faults were B-N faults with fault current in 25KA range.**
- **Internal inspection by OEM also reported failure of B-Phase winding on external faults.**
- **Thus failure of ICT was due to repeated faults faults in 220KV Lines particularly in B-phase .**

Thank you

220KV Fault summary in SEB Lines in last 02 Years

Sr. No.	Line name	Date	Time	Fault Type	Fault distance (kM)	Fault Current (kA)
1	220KV Neemawala 2	01.06.2024	16:46:50:223	B-G	0.9	21.1
2	220KV Neemawala 1	01.06.2024	16:46:50:222	B-G	0.7	21.5
3	220KV Neemawala 2	11.05.2024	00:51:06:827	B-G	0.9	23.2
4	220KV Kaithal-1	11.05.2024	00:51:10:818	B-G	0.6	20.2
5	220KV Kaithal-2	13.02.2024	04:43:22:023	B-G	15.6	4.7
6	220KV Kaithal-1	13.02.2024	04:43:21:524	B-G	18.5	4.6
7	201L Cheeka-1	13.10.2023	22:52:25:785	RG	2.1	16.7
8	220KV Neemawala 1	05.07.2023	14:40:15:547	Y-G	23.0	4.8

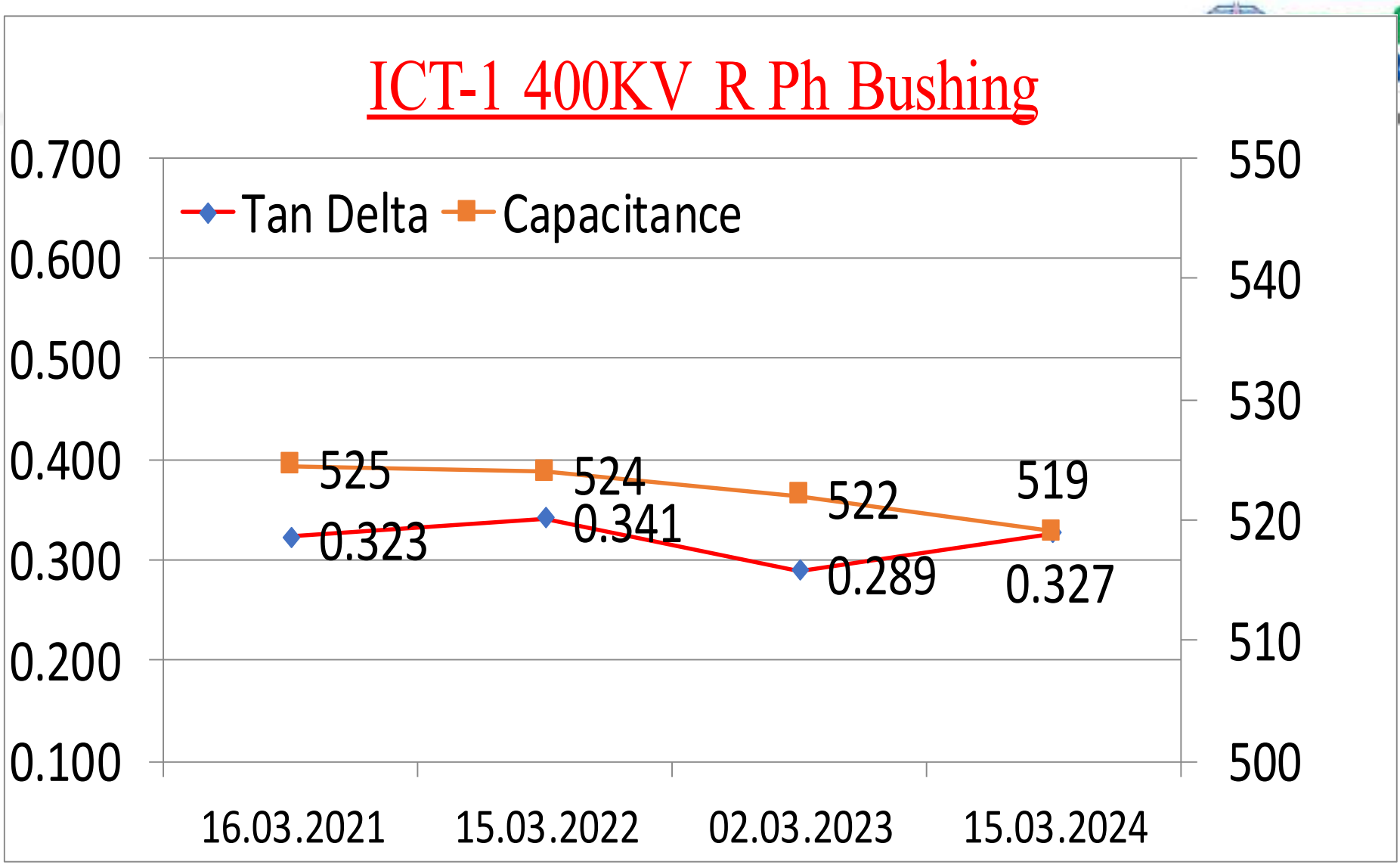
220KV Line Fault summary at Kaithal in last 02 Years

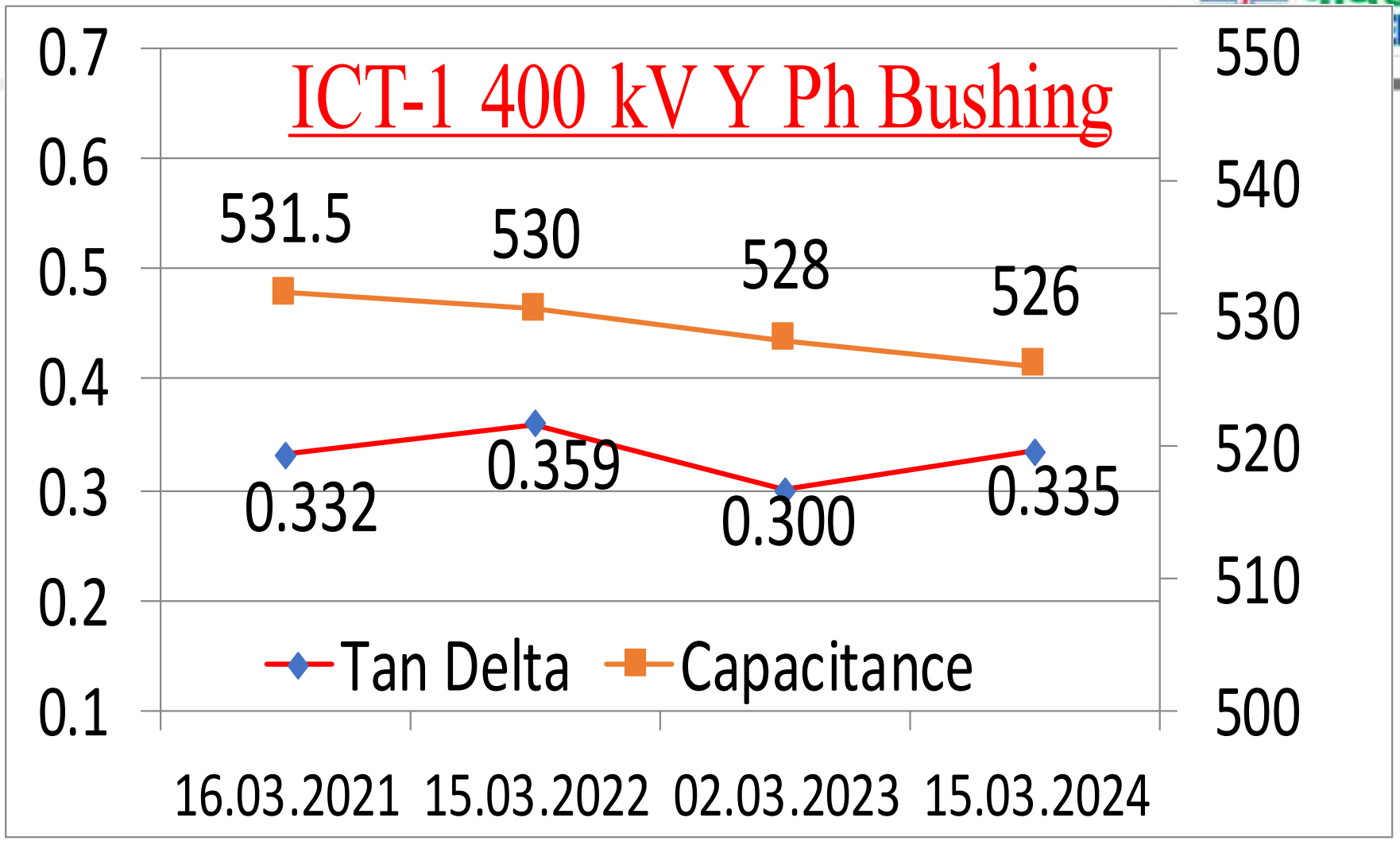
Sr. No.	Line name	Date	Time	Fault Type	Fault distance (kM)	Fault Current (kA)
9	220KV Neemawala 1	24.05.2023	03:51:54:438	B-G	1.9	22.9
10	220KV Neemawala 2	24.05.2023	03:51:43:118	B-G	6.4	23.5
11	220KV Cheeka-2	18.05.2023	00:54:10:377	YB-G	1.8	Iy=17.5 Ib=17.4
12	220KV Neemawala 2	18.05.2023	00:31:04:020	B-G	5.6	23.1
13	220KV Neemawala 1	18.05.2023	00:34:09:296	B-G	11.7	10.6
14	220KV Kaithal-2	13.05.2023	10:27:33:798	B-G	6.1	10.2
15	220KV Kaithal-2	20.12.2022	03:29:52:470	RG	10.3	8.3
16	220KV Cheeka-2	19.12.2022	05:13:17:427	BG	15.8	7.9

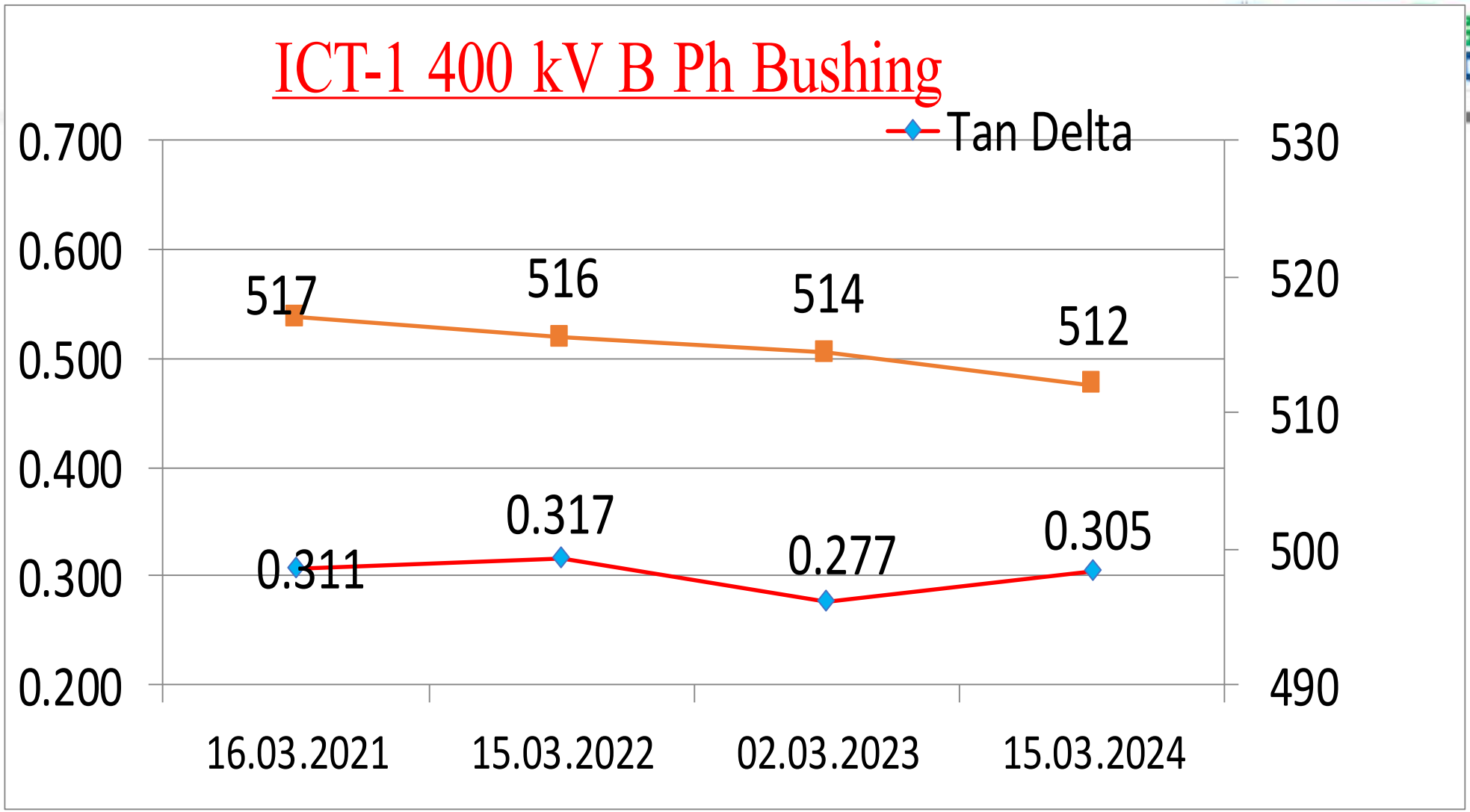
220KV Line Fault summary at Kaithal in last 02 Years

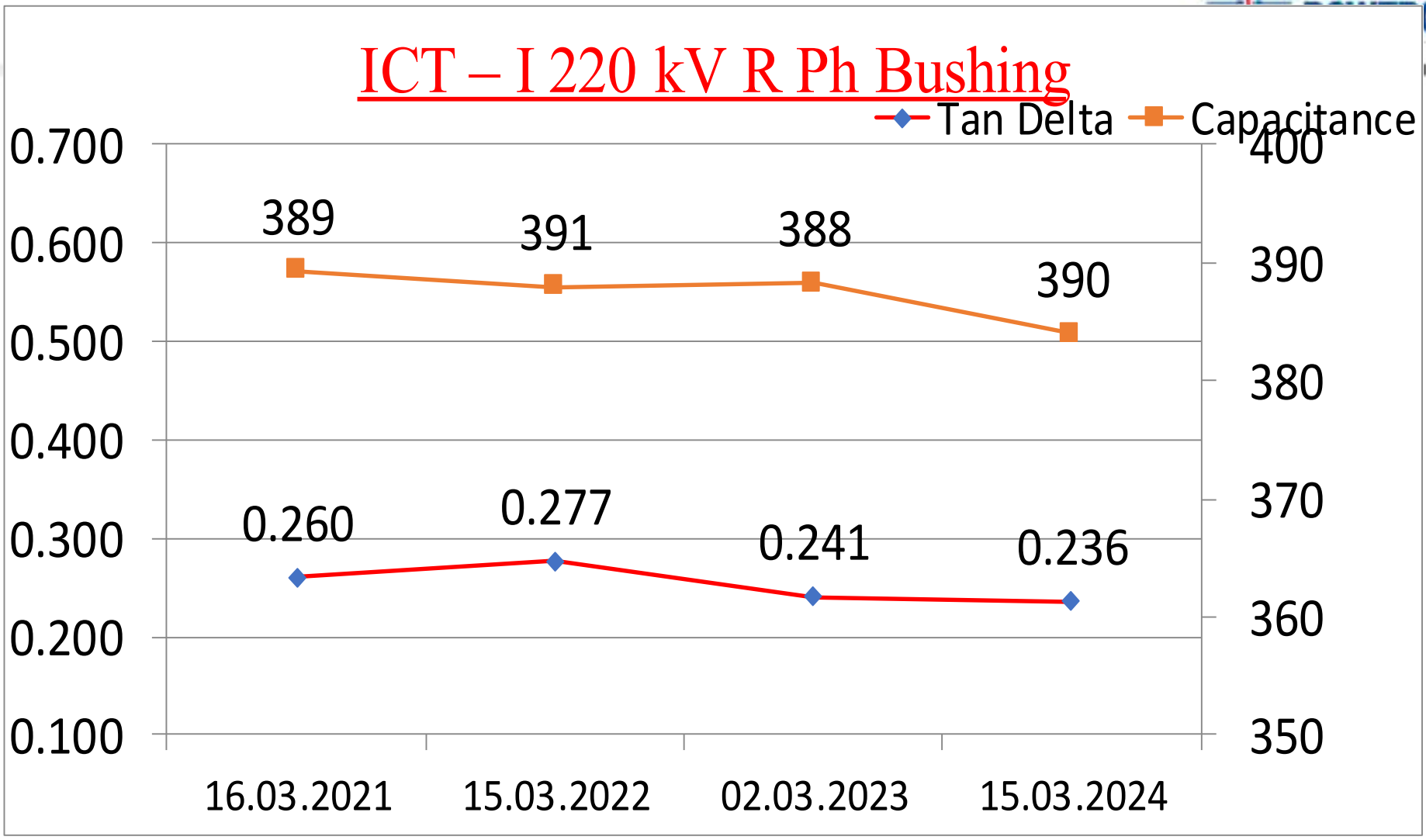
Sr. No.	Line name	Date	Time	Fault Type	Fault distance (kM)	Fault Current (kA)
17	220KV Cheeka-2	23.08.2022	00:20:04:725	RYG	0.0	22.6
18	220KV Neemawala 2	17.06.2022	04:00:57:425	BG	5.6	24.2
19	220KV Neemawala 2	23.05.2022	19:52:04:878	BG	5.7	23.4
20	220KV Neemawala 1	23.05.2022	19:53:03:349	BG	2.0	23.4
21	220KV Neemawala 2	23.05.2022	03:25:47:548	BG	5.4	24.4
22	220KV Neemawala 2	14.04.2022	18:03:56:426	BG	5.2	25.0
23	220KV Neemawala 1	14.04.2022	18:03:57:900	BG	2.0	24.8

ICT-1 400KV R Ph Bushing




ICT-1 400 kV Y Ph Bushing
0.7
0.6
0.5
0.4
0.3
0.2
0.1
550
540
530
520
510
500
531.5
530
528
526
0.332
0.359
0.300
0.335
Tan Delta
Capacitance
16.03.2021
15.03.2022
02.03.2023
15.03.2024


ICT-1 400 kV B Ph Bushing
Tan Delta
0.700
0.600
0.500
0.400
0.300
0.200
530
520
510
500
490
517
516
514
512
0.311
0.317
0.277
0.305
16.03.2021
15.03.2022
02.03.2023
15.03.2024


ICT – I 220 kV R Ph Bushing
Tan Delta
Capacitance
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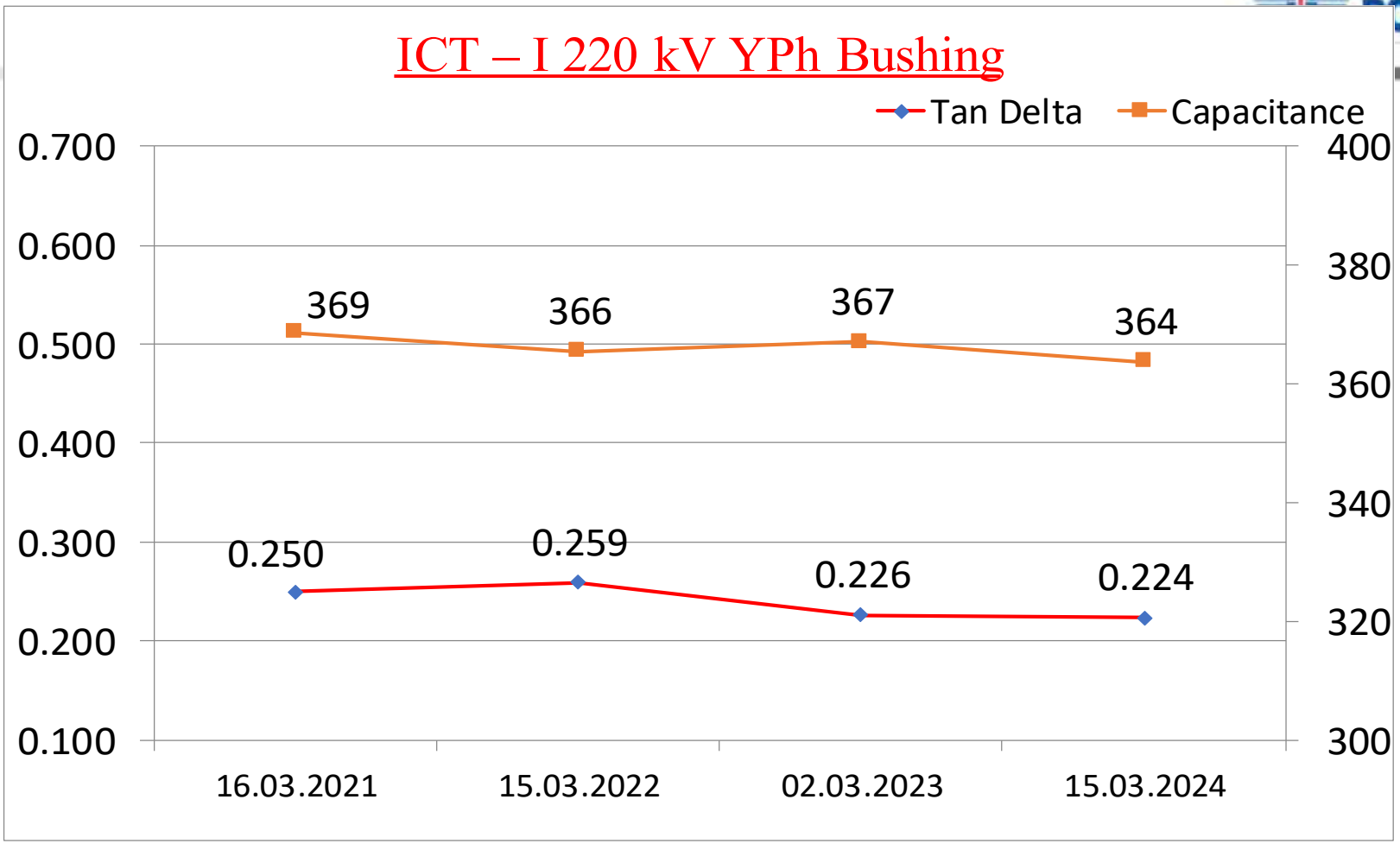
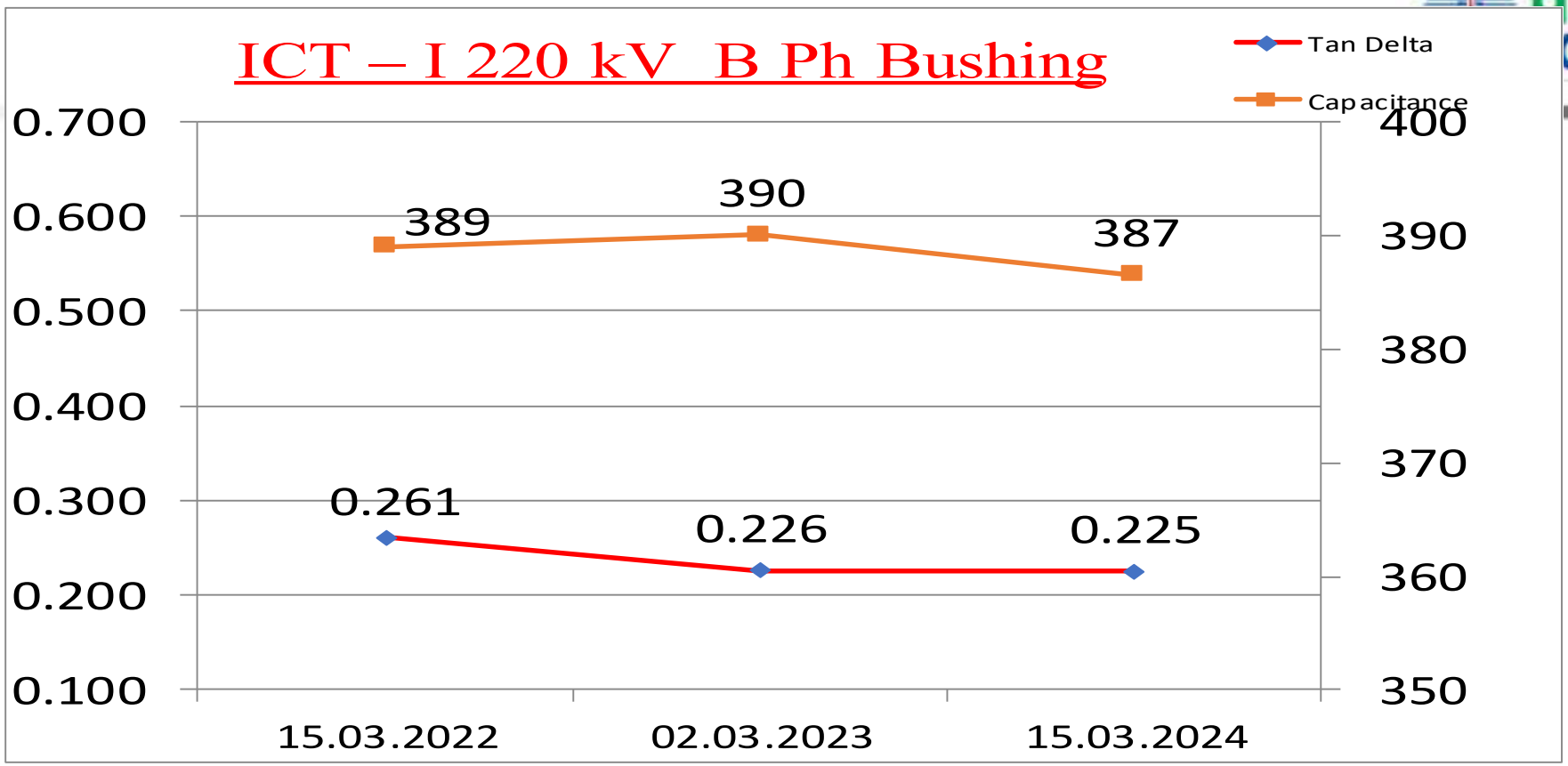
0.500
0.400
0.300
0.200
0.100
400
390
380
370
360
350
389
391
388
390
0.260
0.277
0.241
0.236
16.03.2021
15.03.2022
02.03.2023
15.03.2024

ICT – I 220 kV YPh Bushing




ICT – I 220 kV B Ph Bushing
Tan Delta
Capacitance
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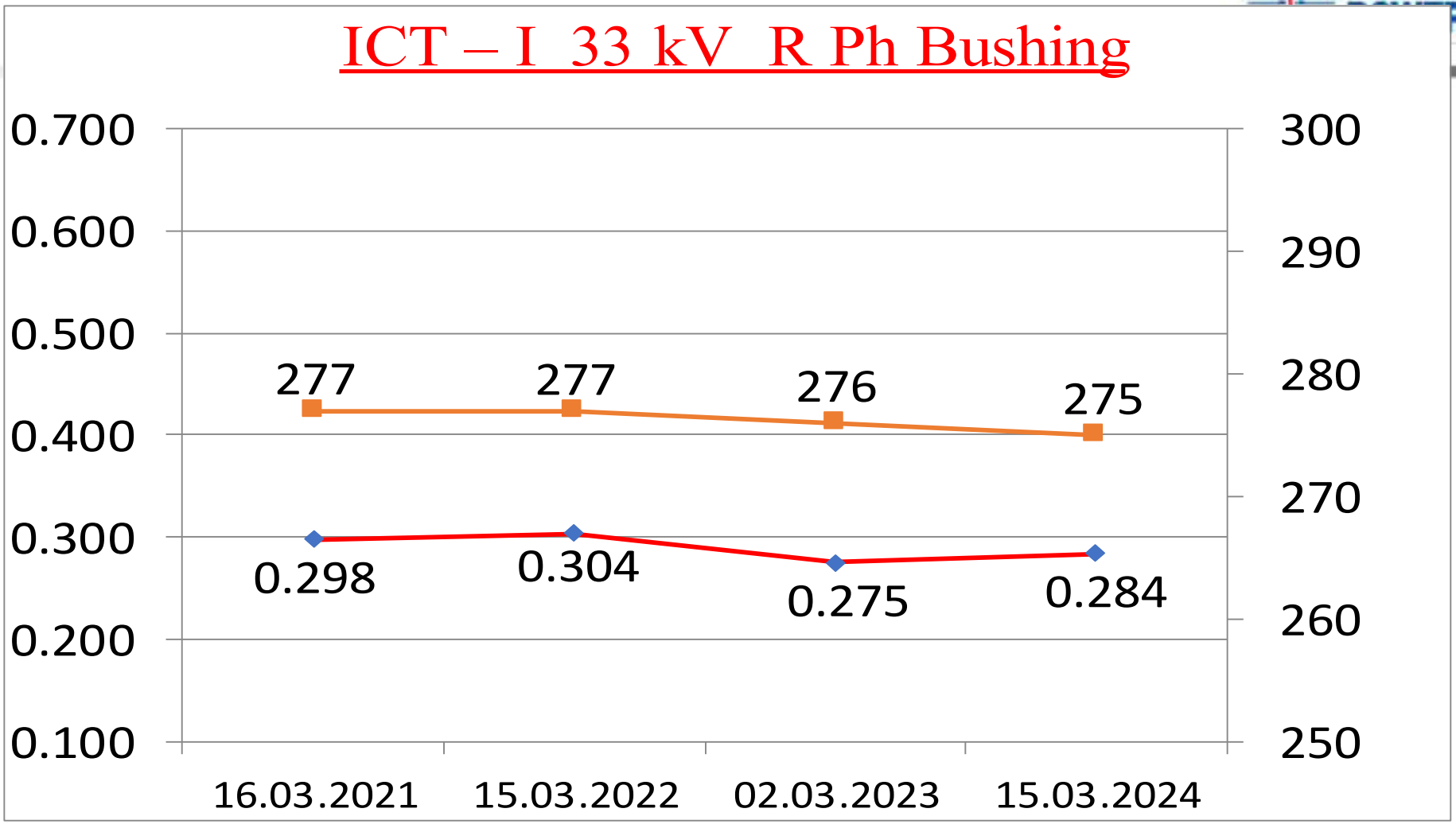
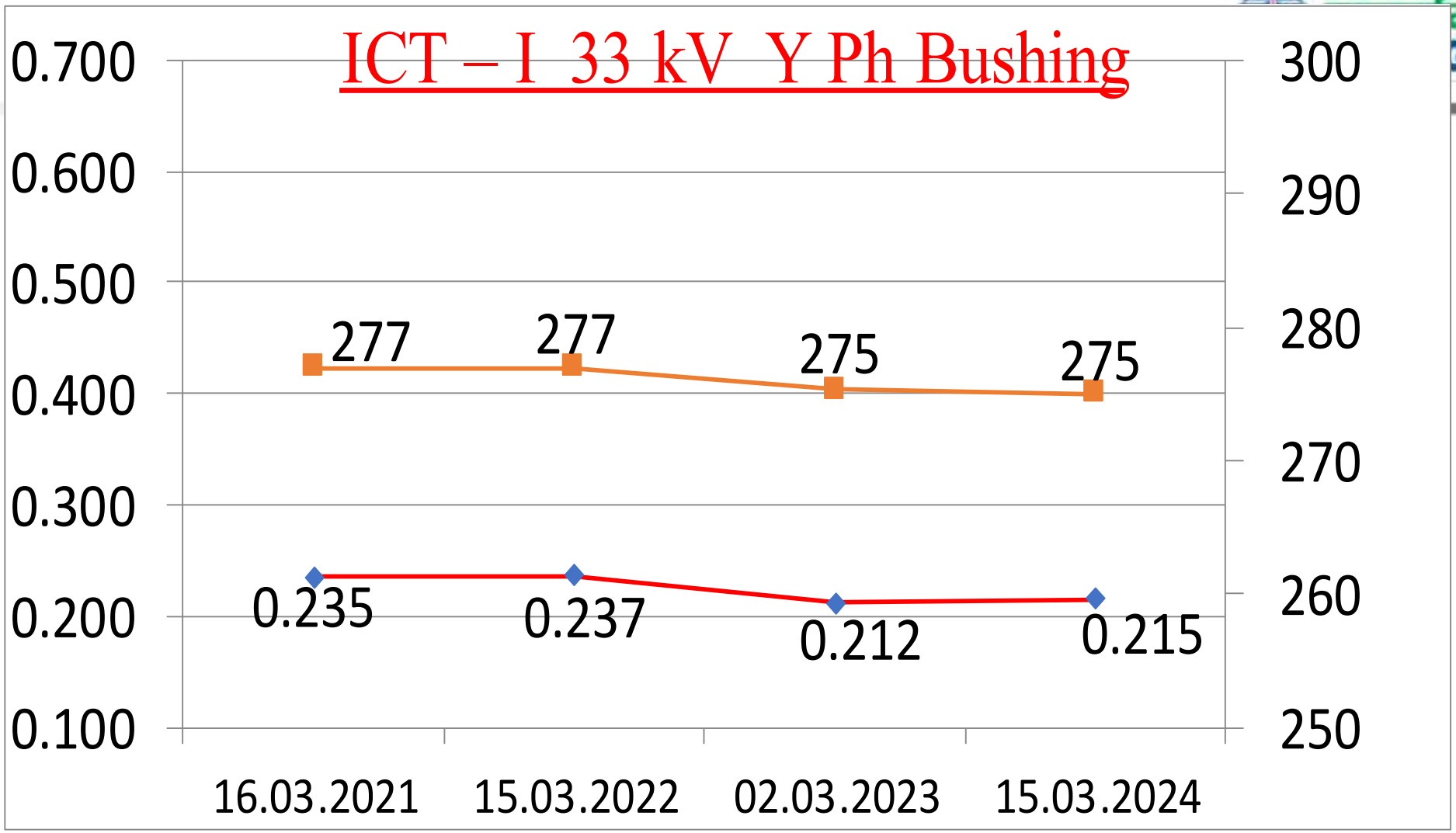
0.500
0.400
0.300
0.200
0.100
400
390
380
370
360
350
389
390
387
0.261
0.226
0.225
15.03.2022
02.03.2023
15.03.2024

ICT – I 33 kV R Ph Bushing




ICT – I 33 kV Y Ph Bushing
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0.600
0.500
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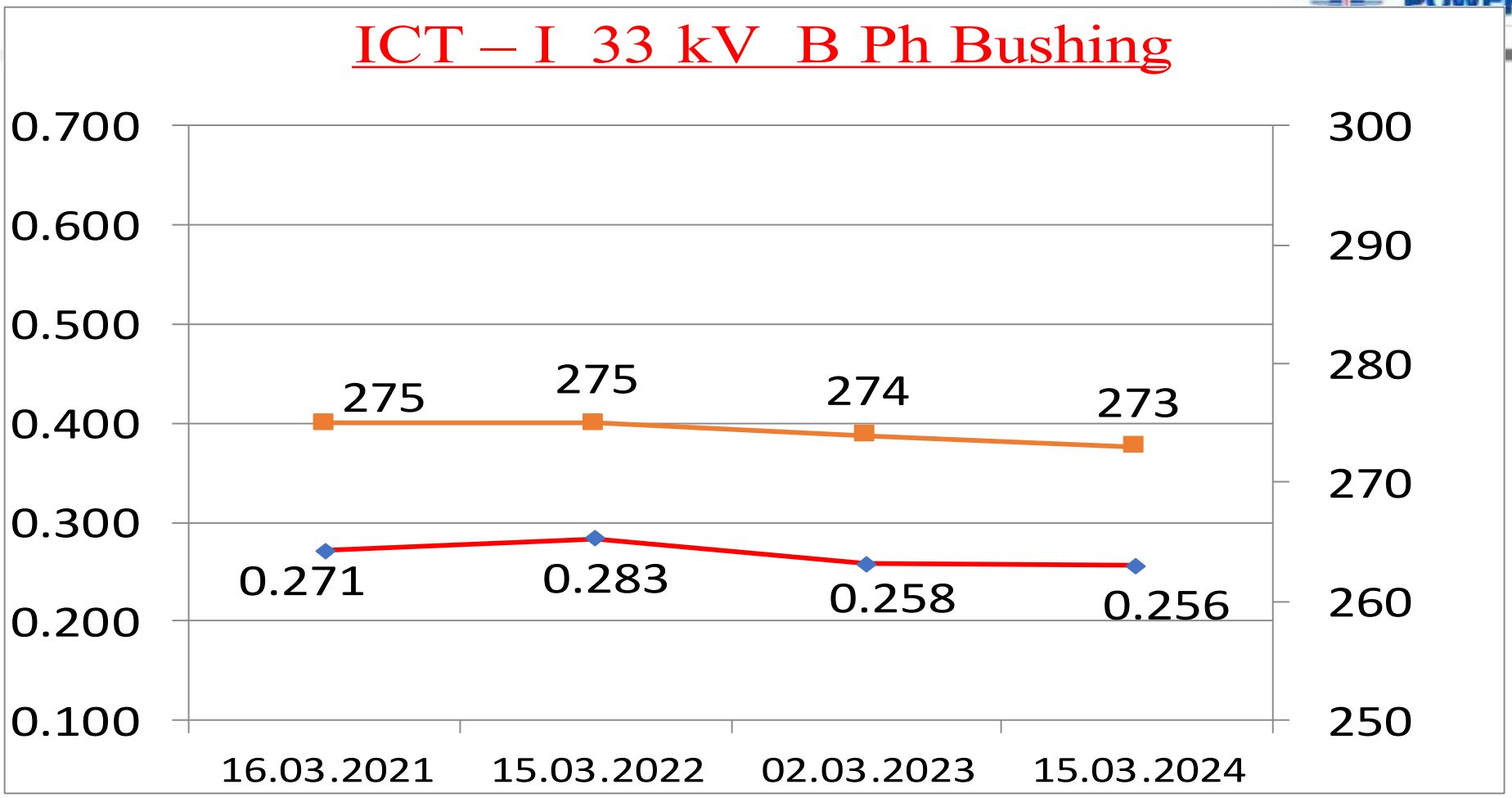
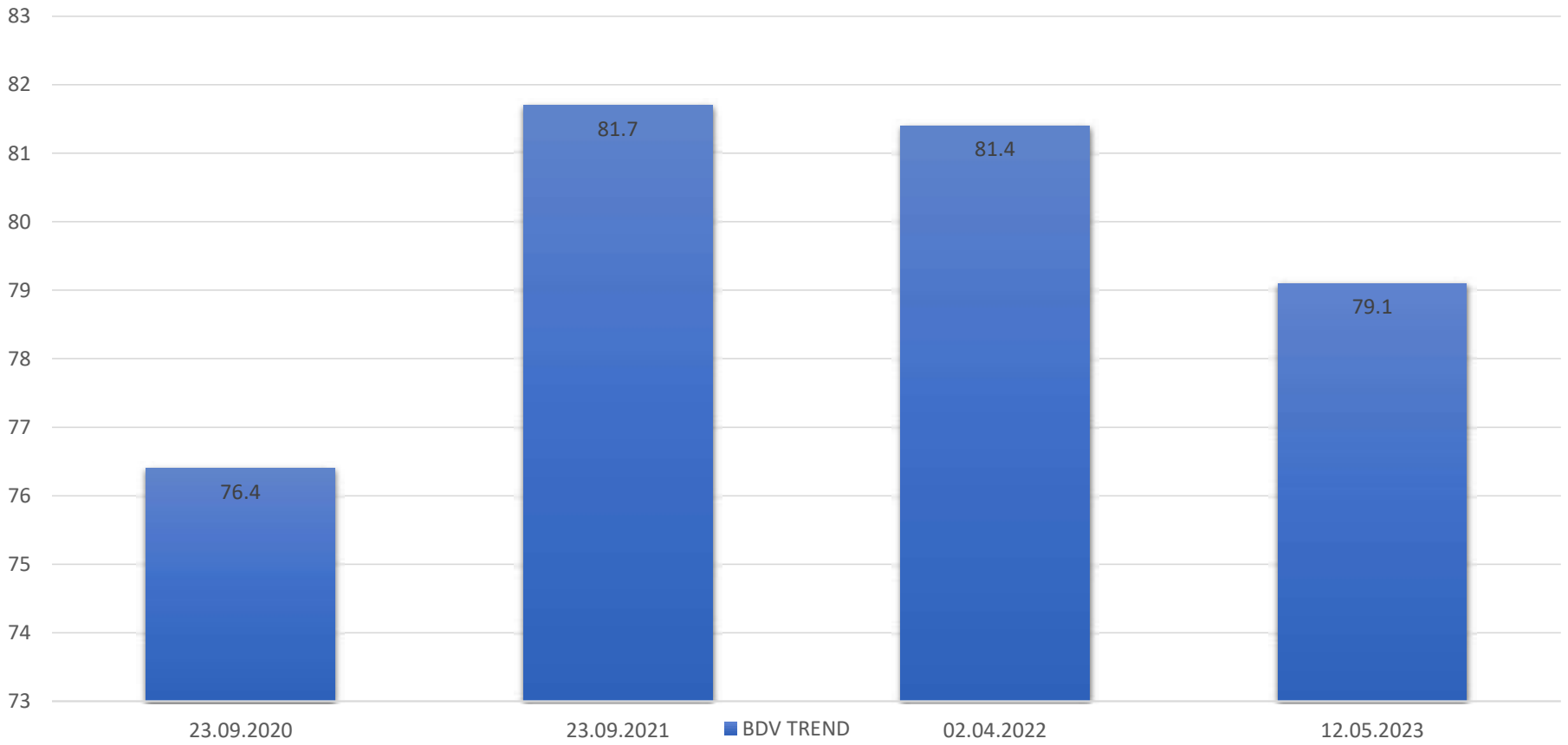
0.300
0.200
0.100
300
290
280
270
260
250
277
277
275
275
0.235
0.237
0.212
0.215
16.03.2021
15.03.2022
02.03.2023
15.03.2024


ICT – I 33 kV B Ph Bushing
0.700
0.600
0.500
0.400
0.300
0.200
0.100
300
290
280
270
260
250
275
275
274
273
0.271
0.283
0.258
0.256
16.03.2021
15.03.2022
02.03.2023
15.03.2024

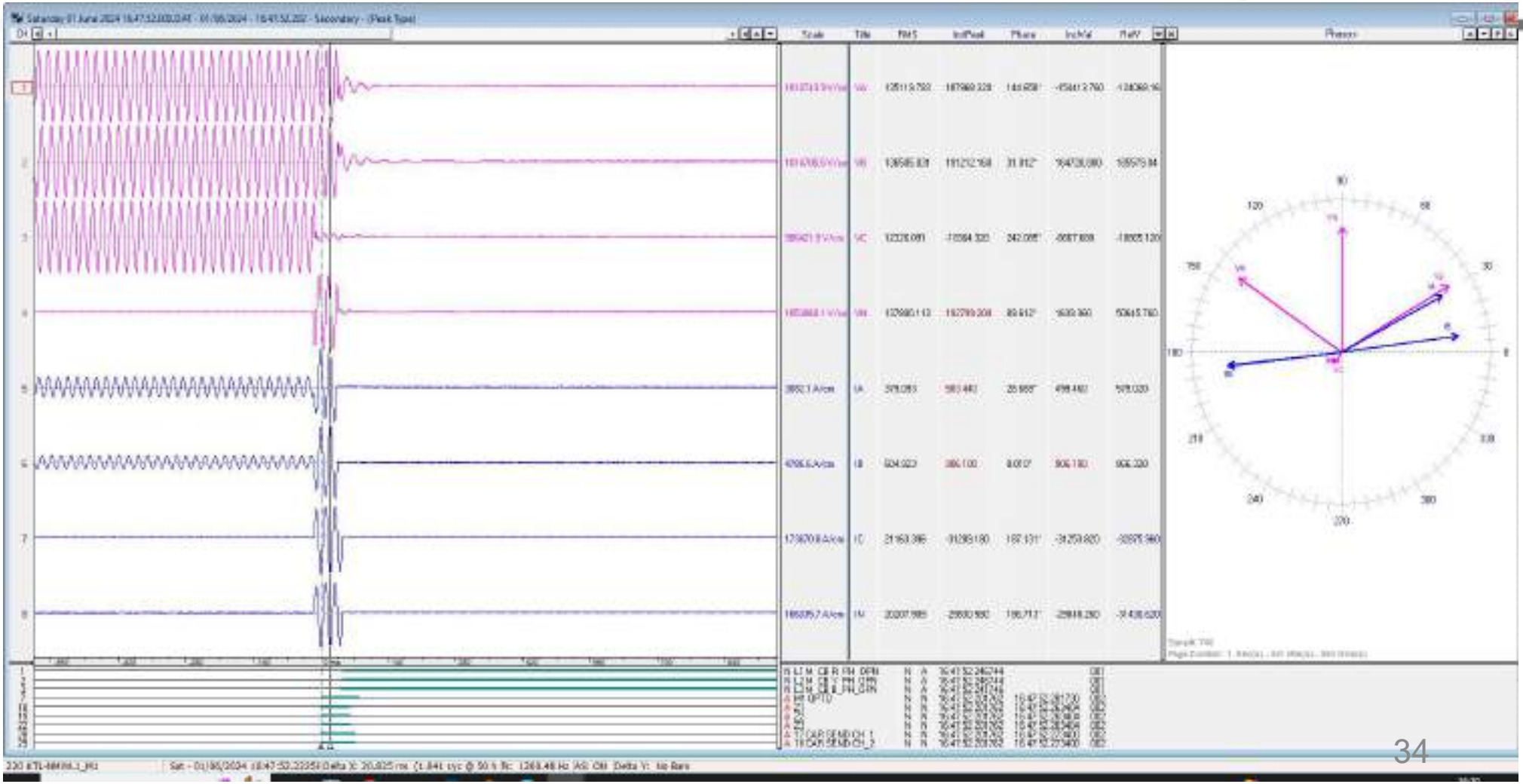
BDV TREND


83
82
81
80
79
78
77
76
75
74
73
76.4
81.7
81.4
79.1
23.09.2020
23.09.2021
BDV TREND
02.04.2022
12.05.2023

CC-CL IR MEASUREMENT

Measurement Position	DOM-15.03.2022	DOM-15.03.2024
CC-G	950 MΩ	960 MΩ
CL-G	1000 MΩ	1012 MΩ
CC-CL	980 MΩ	995 MΩ

DR_Neemawali_1-01.06.2024, 16:47:52:222



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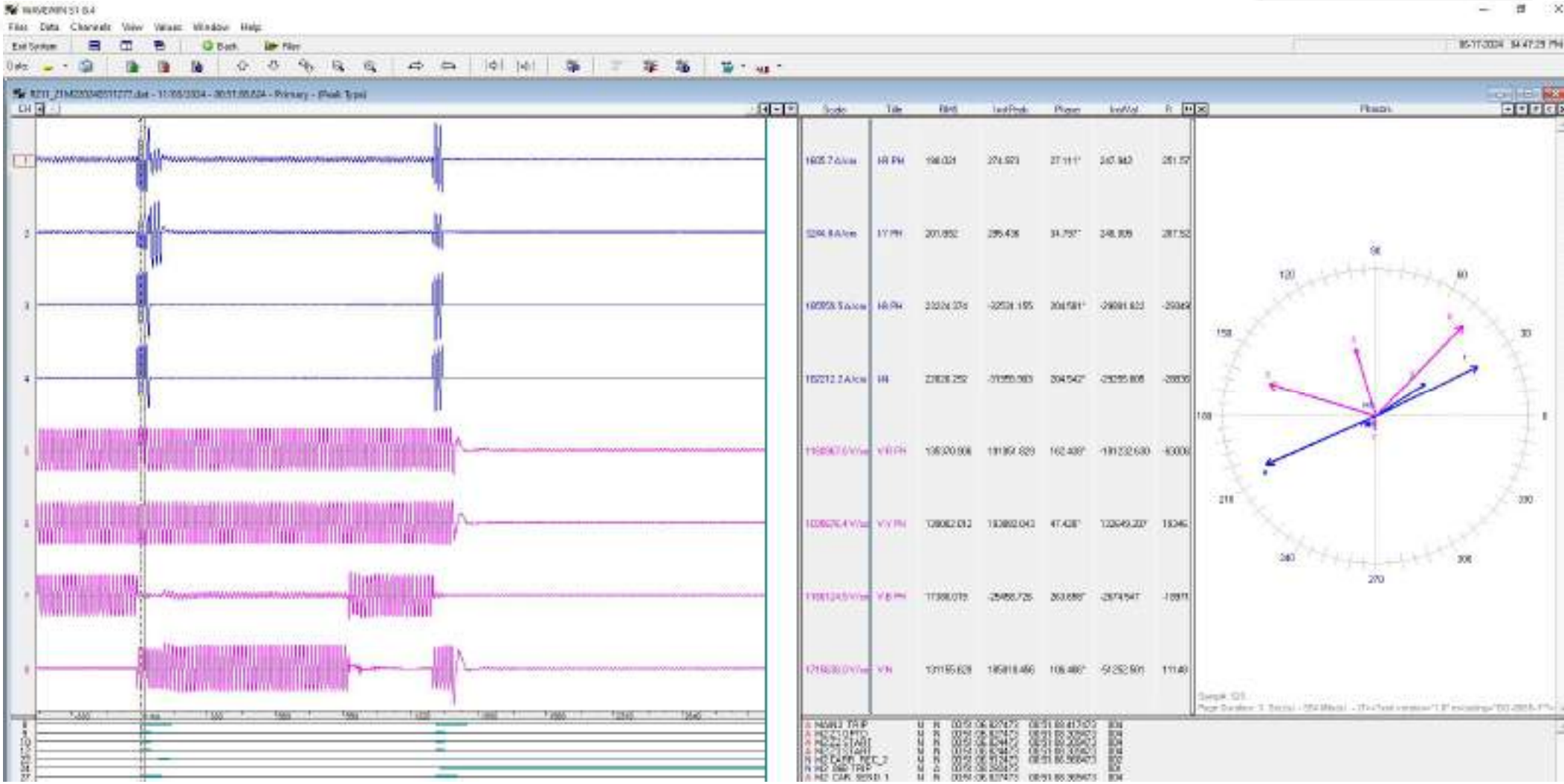
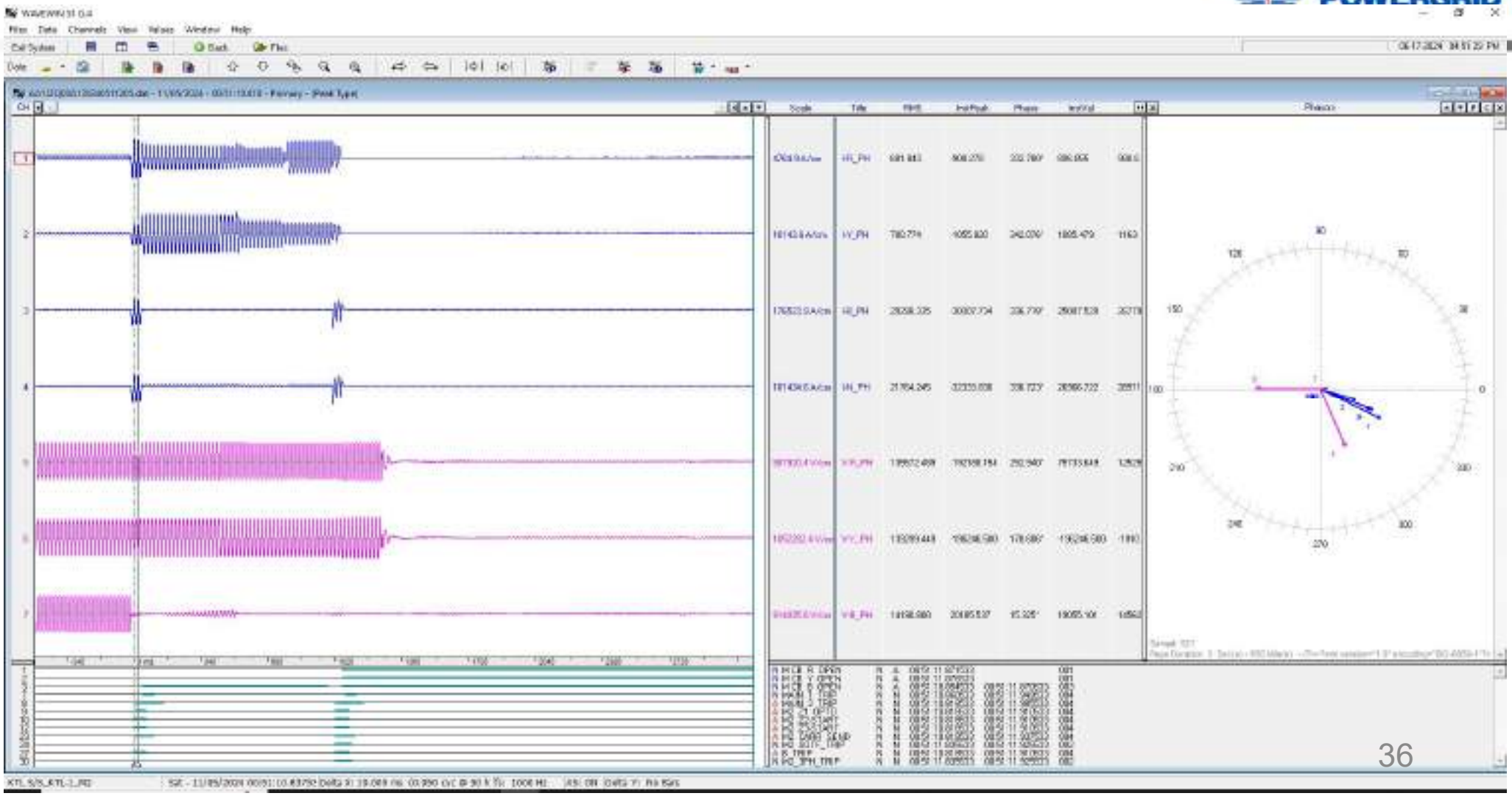


DR_220KV Kaithal-1_11.05.204,00:51:10



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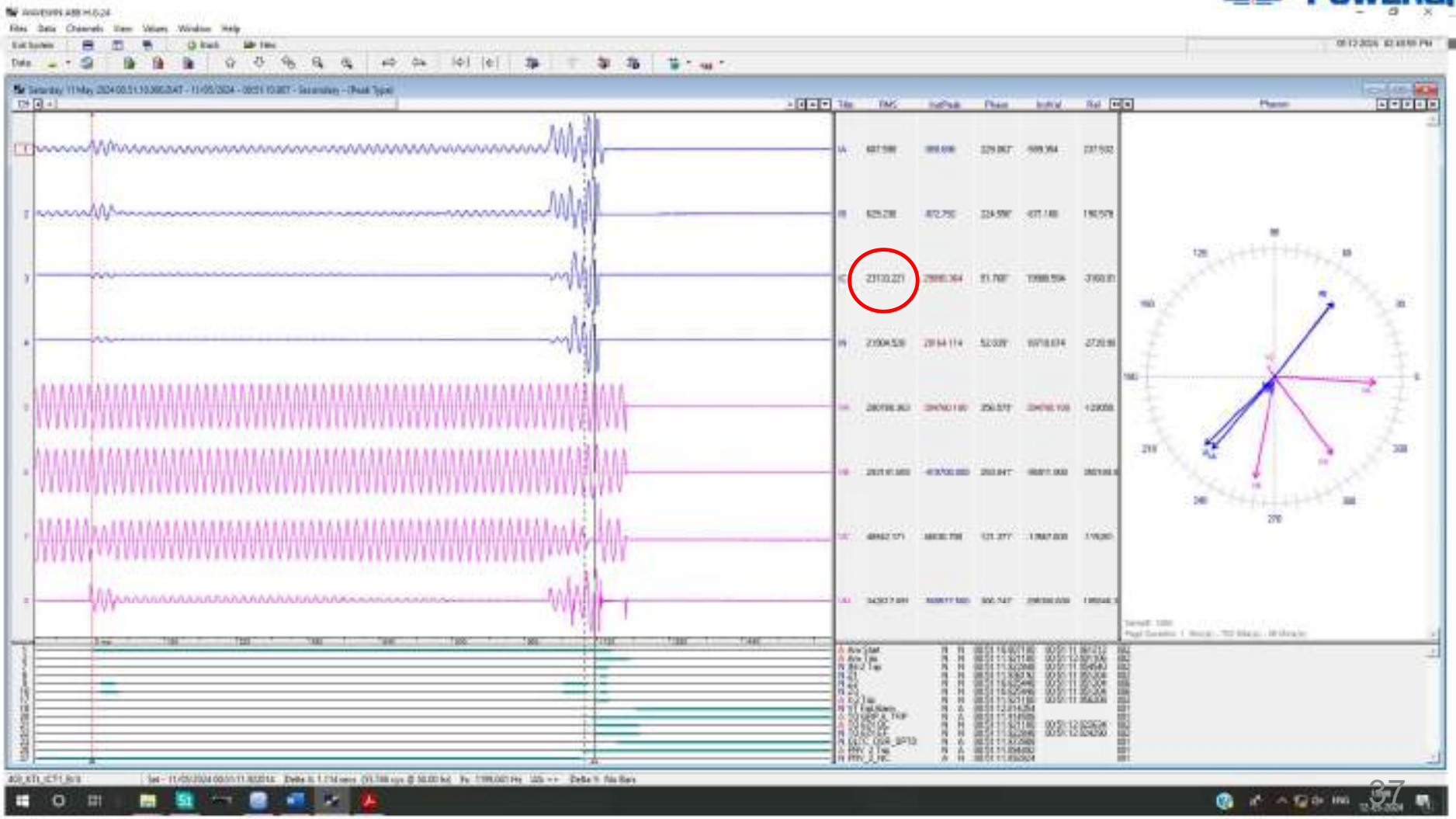
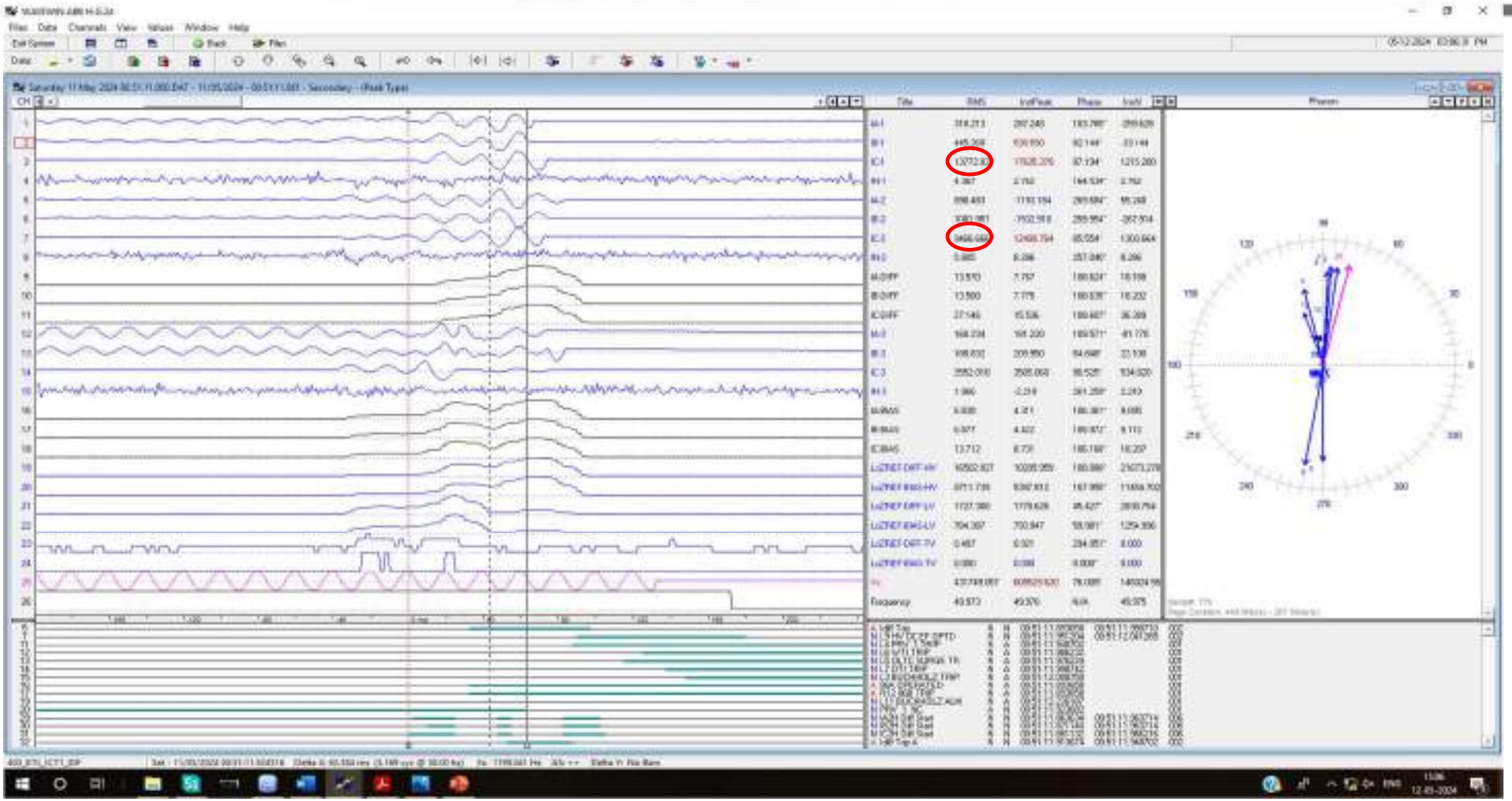


DR_ICT-1 _11-05-2024



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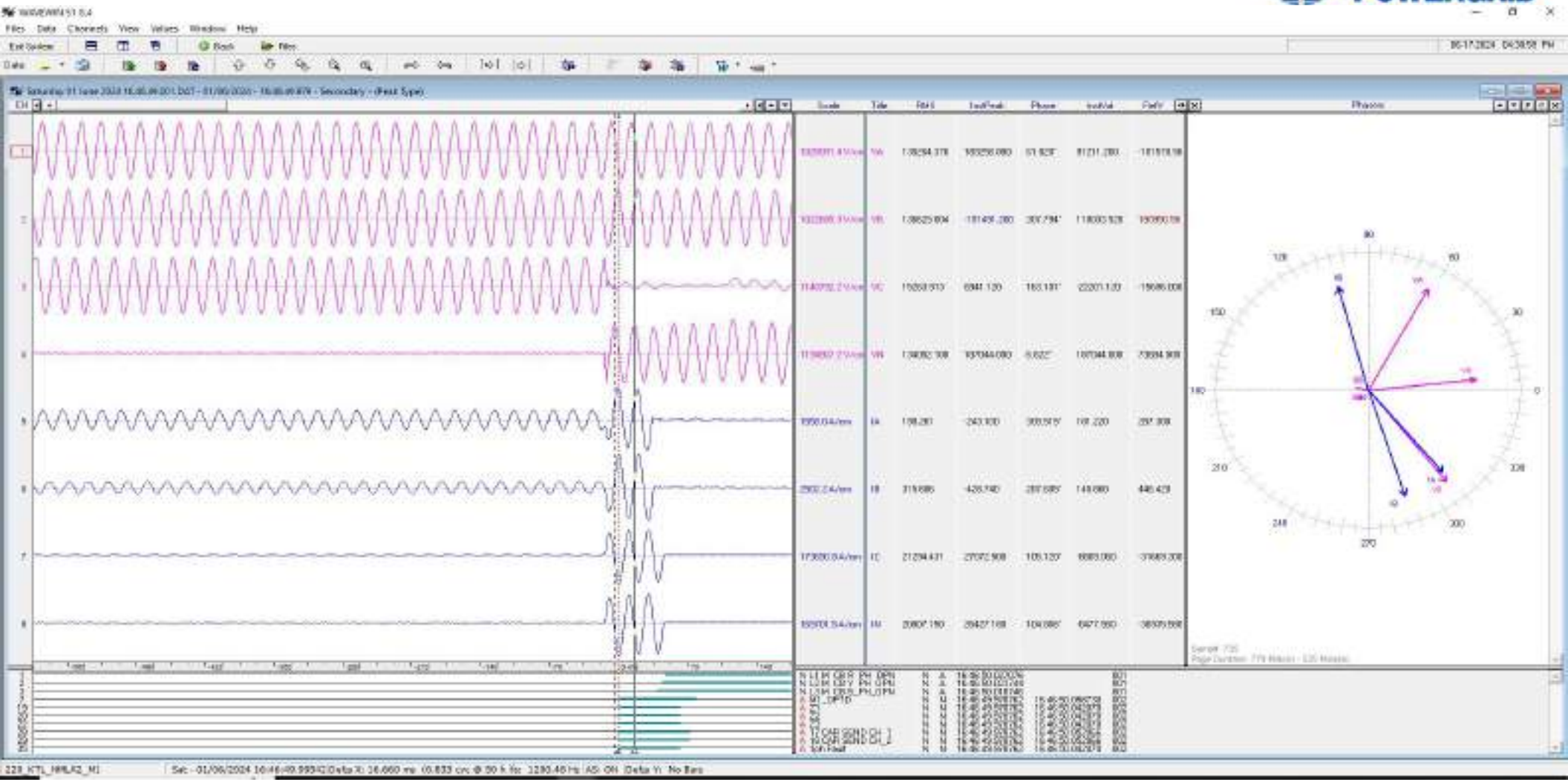
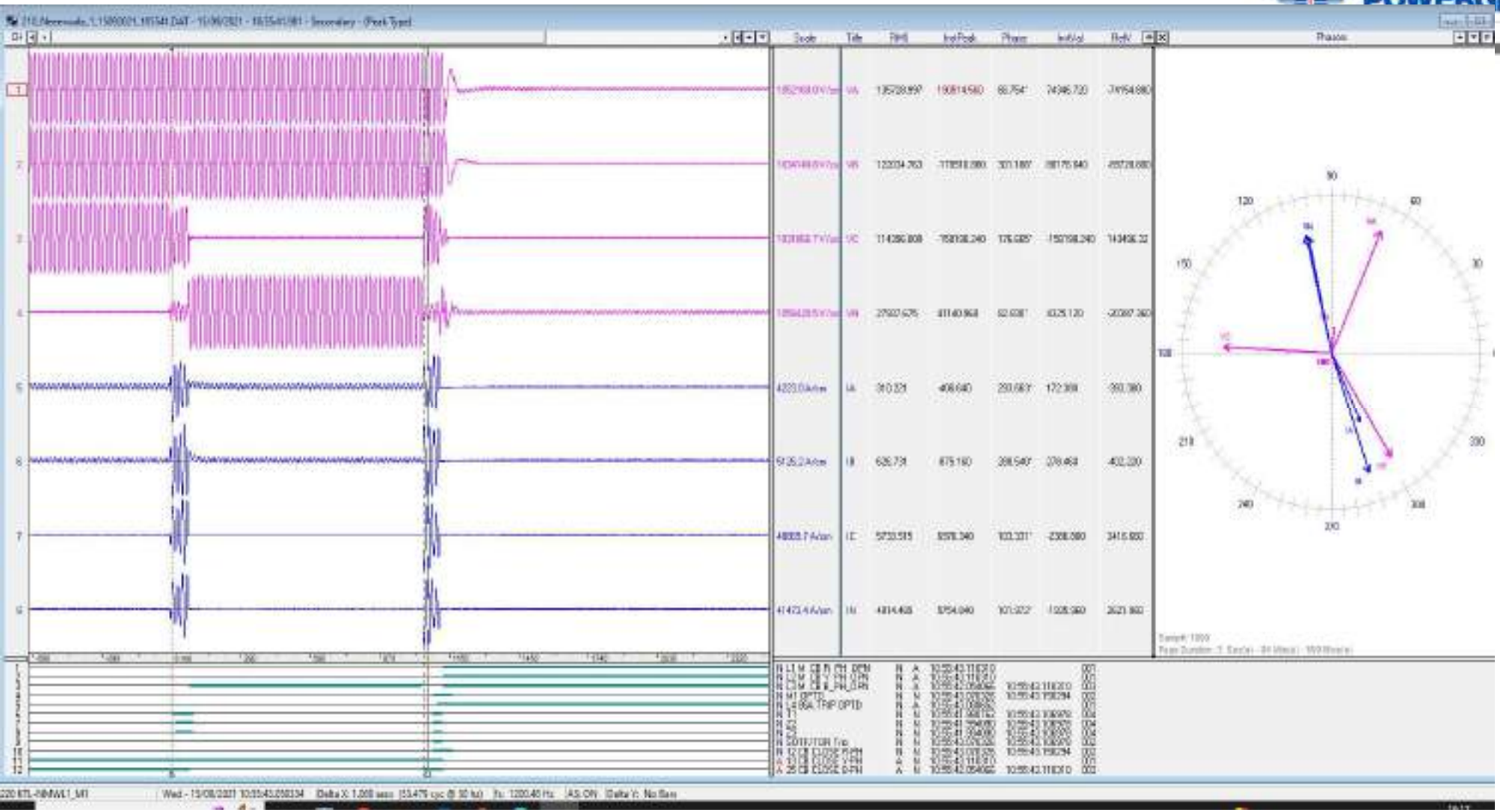
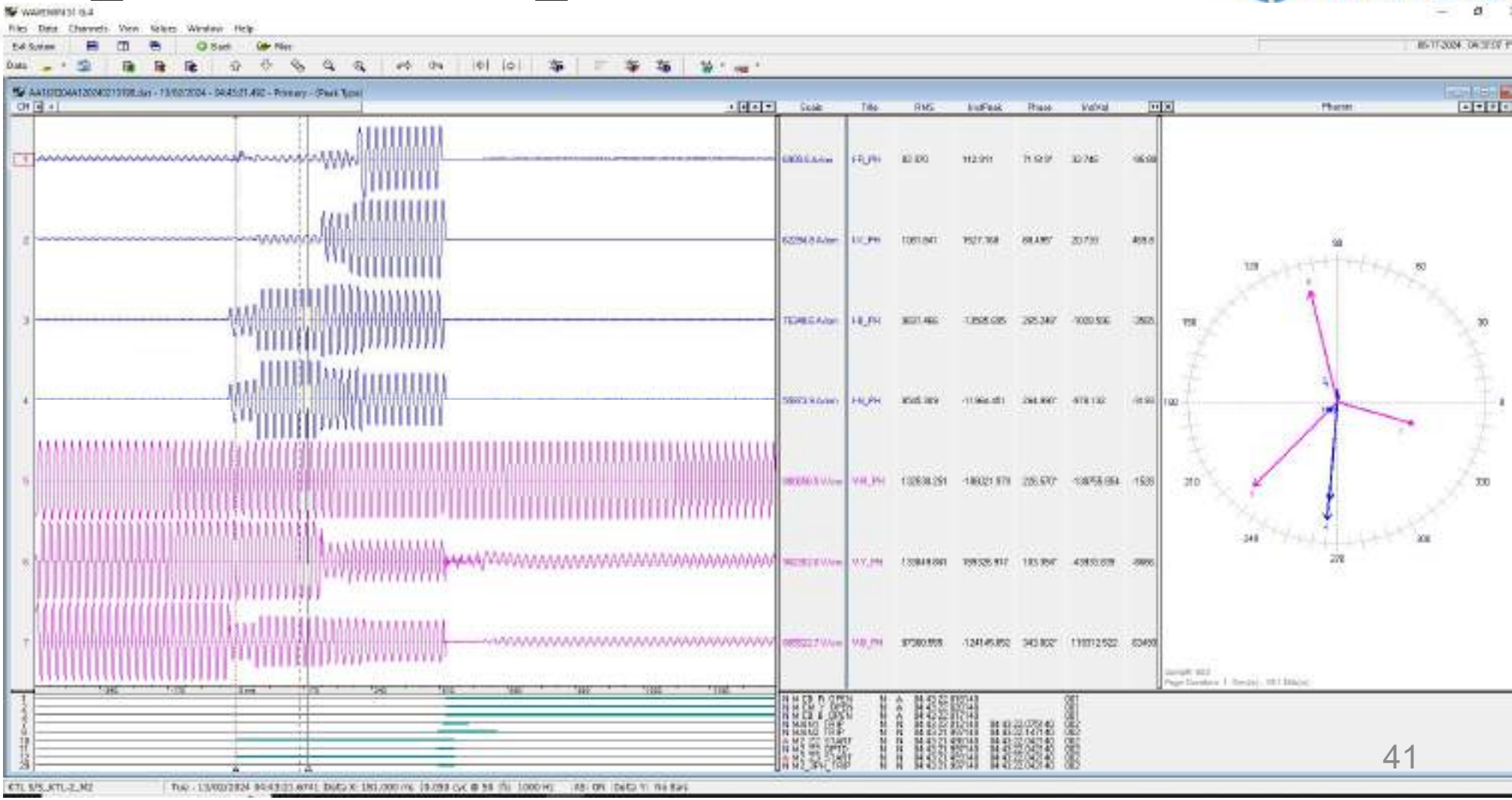




DR_220KV Kaithal 2_ 13.02.2024



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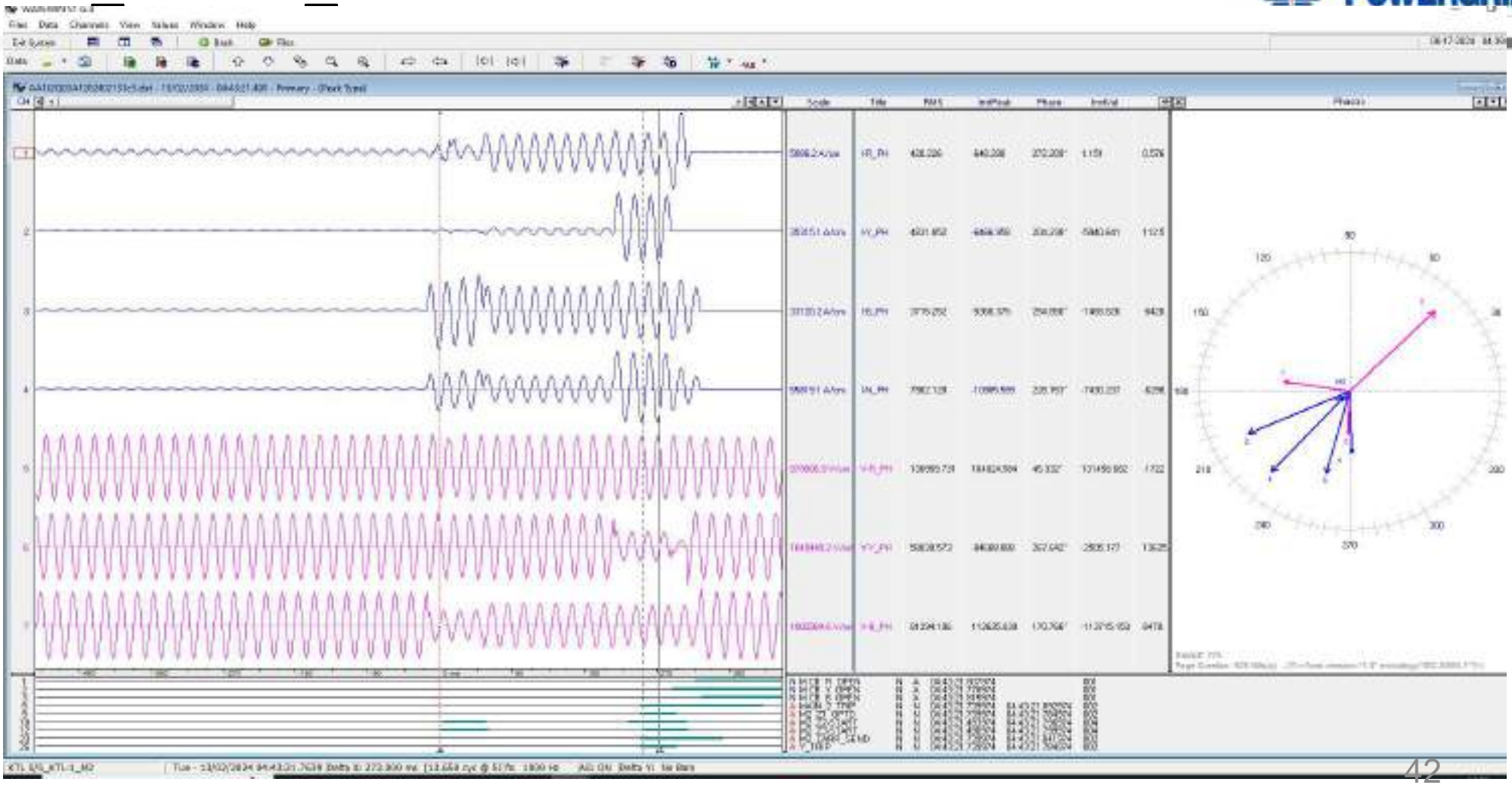
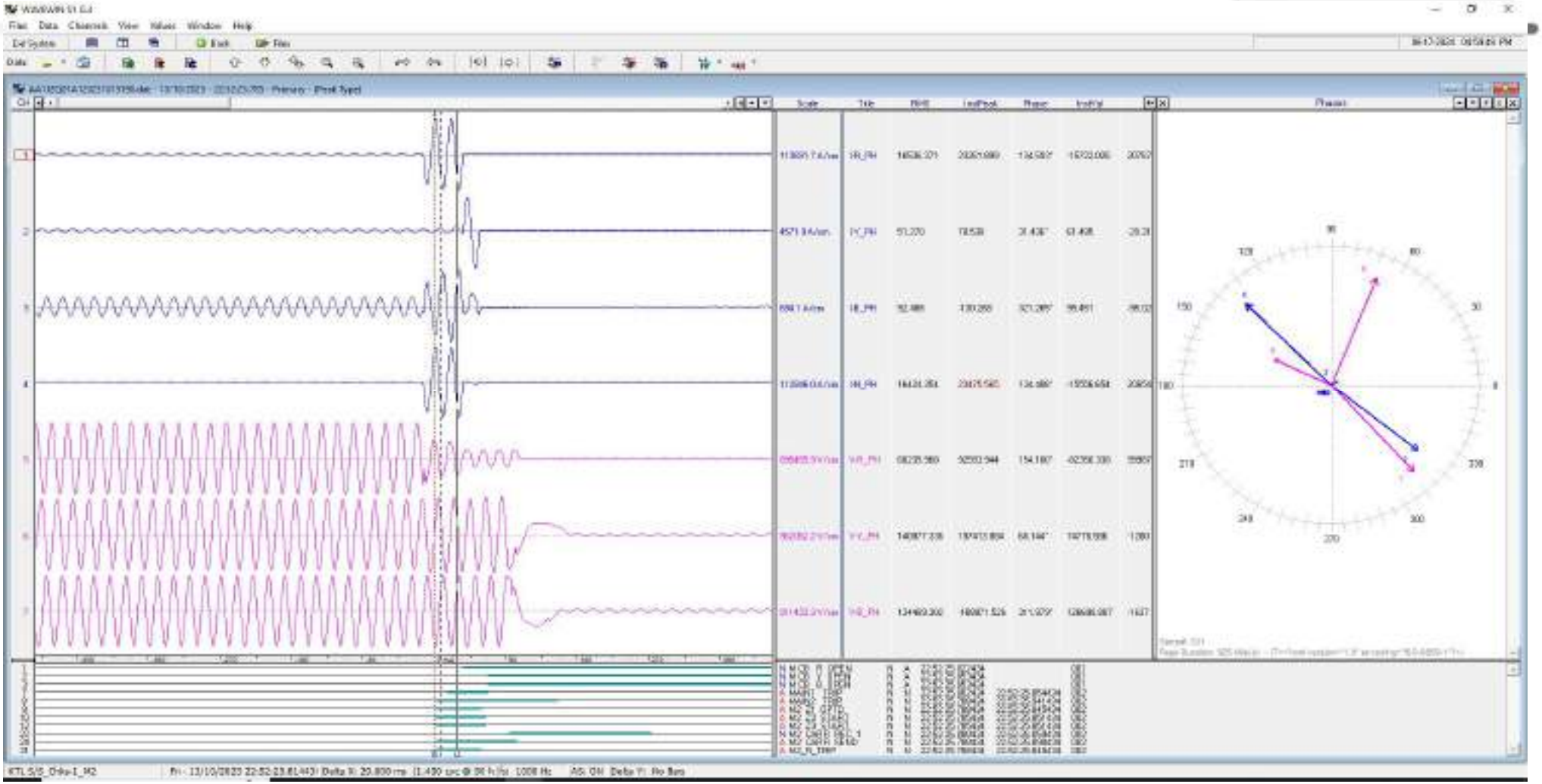


DR_Cheekha-1_13.10.2023



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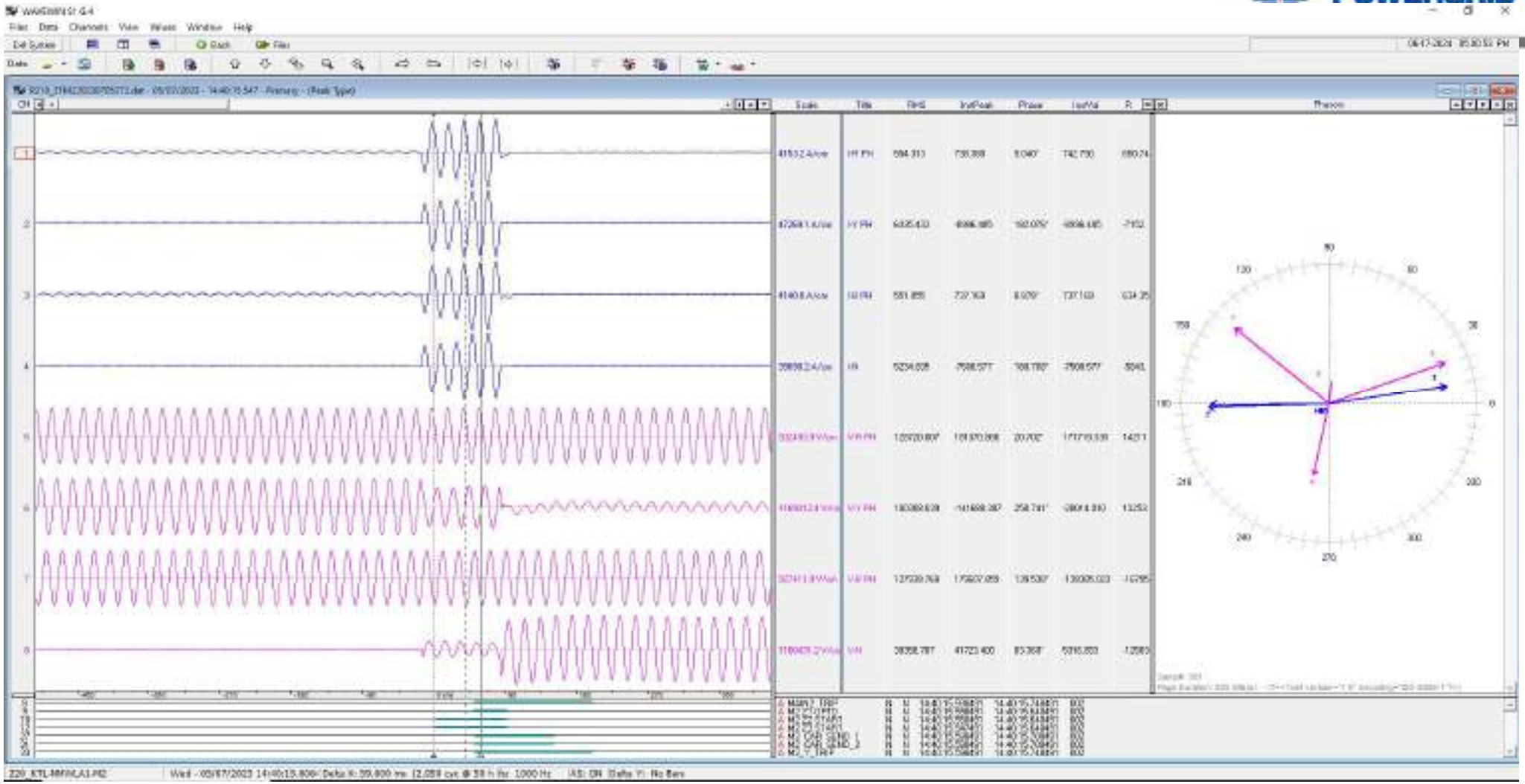
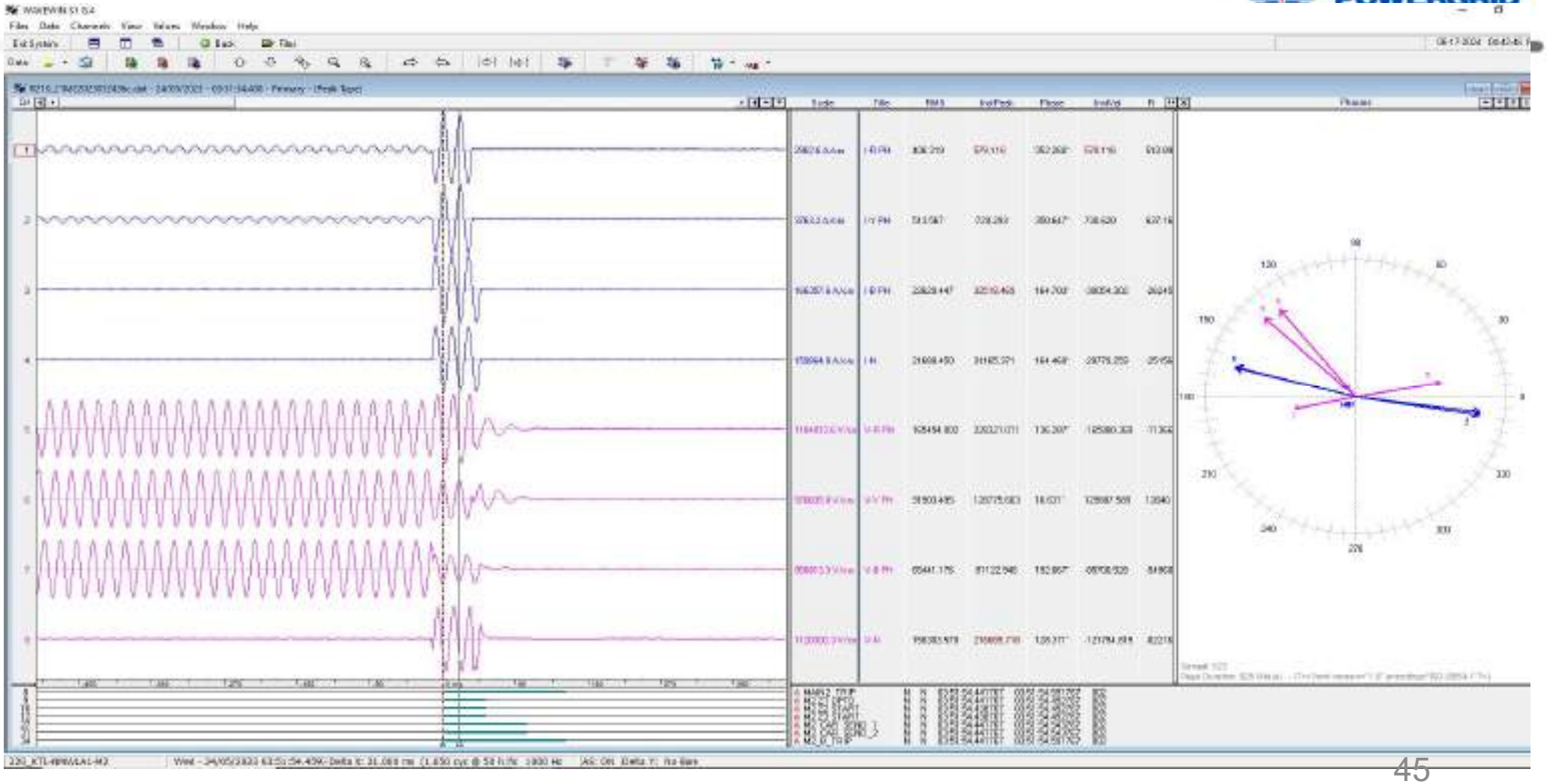
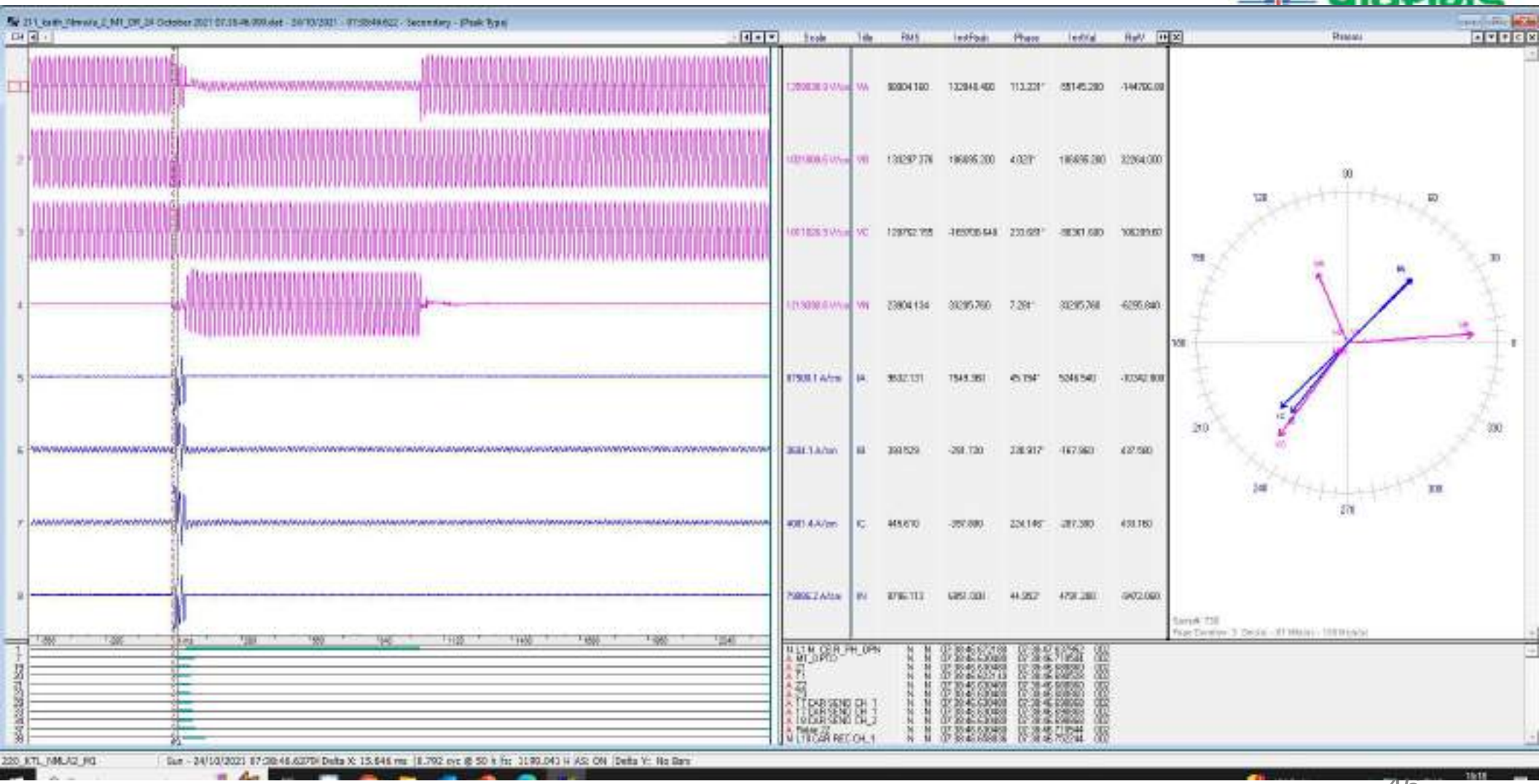
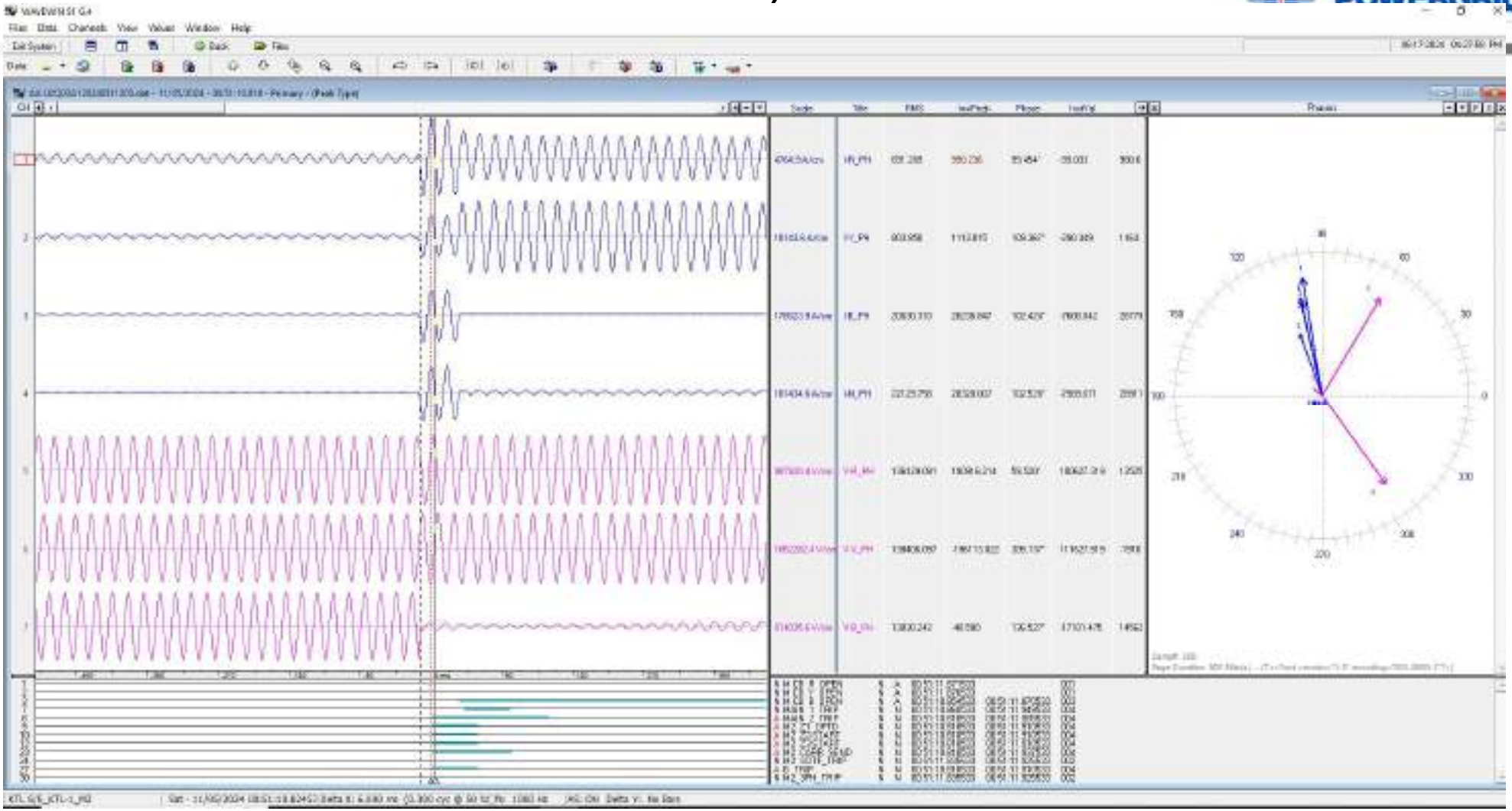


DR 220KV Neemwala-1-24.05.2023





220KV Kaithal-1 11.05.2024, 0051 Hrs



Status of Bus bar protection				
Constituent Name	**Name of Station**	**Status of Bus bar protection(as reported)**	**Expected date of revival(as reported)**	**Present Status**
Uttarakhand	220 KV Substation, Ramnagar, Roorkee	Blocked due to more elements added at 220 KV Voltage level.		
	220 KV Sub Station, SIDCUL, Haridwar			
	220kV Jhajhra, Dehradun	Not commissioned yet		
	400KV Kashipur (220kV side)	Available but Non operational	31-Mar-24	Work is under process.
	220kv Haldwani	Not Available	31 December 2024	Budget for FY 2023-24.
	220kv Pantnagar	Available but Non operational	31-Mar-24	Work is under process.
	220kV Rishikesh	Available but Non operational	31 December 2024	It has been Taken in Budget for FY 2023-24.
	220kV Chamba	Not commissioned yet	31 December 2024	It has been Taken in Budget for FY 2023-24.
Haryana	**220kV S/Stn Badshahpur**	**Installed and Operational**		**Commissioned on 20.02.2023**
	220kV S/Stn Sec-52A, Gurgaon	Not Installed	31.03.2024	Panel has been installed. Commissioning pending due to non- availability of shutdown.
	220kV S/Stn Sec-1 Manesar	**Installed and Operational**		**Commissioned on 26.02.2023**
	220kV S/Stn Panchgaon	**Installed and Operational**		**Commissioned on 05.01.2024**
	220kV S/Stn Rewari	Not Installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV S/Stn Narnaul	Not Installed	31.03.2024	Panel has been installed. Work in progress on turnkey basis. Isolators of 220 kV TFs have to be replaced thereafter the work shall be completed.
	220kV S/Stn Mohinder Garh	**Installed and Operational**		**Commissioned on 28.10.2023**
	220 KV S/Stn Palwal	Not Installed	30.06.2024	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	**Installed and Operational**		**Commissioned on 22.06.2023**
	220 kV Unispur	Installed but Non-Operational	31.03.2024	5 Nos. Peripheral relay of bus bar protection are defective. The same shall be made operational by 31.03.2024.
	220 kV Nissing	Installed but Non-Operational	31.03.2024	Existing Bus bar panel is of old and obsolete design. New Bus Bar protection scheme panel has been drawn from the store & Commissioning& installation are pending. The same shall be made operational by 31.03.2024.
	220KV Pehowa	Installed but Non-Operational	31.03.2024	Old & Obsolete, Allocation of New BBP and allied material awaited.
	220kV Kaithal	Not Installed	31.03.2024	Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220kV Bus-Bar Protection panel is awaited.
	220 KV Sonepat	Not Installed	31.05.2024	220 KV Bus Bar Protection Scheme will be installed / commissioned within 45 days after the availability of the necessary material i.e 220kV Duplex, Directional, Bus Bar Cum Bus Coupler C and R Panel, Auxiliary Voltage 220V DC (without SAS) required for commissioning. It has been gathered from the P&M wing that the material is likely to be available in DD stores by April 2024.
	220 KV REGC, Sonepat	Not Installed	15.03.2024	The 220KV C&R Panel for Bus Bar Protection has been drawn from DD Store on dated 20.04.2023 and the work for installation of Bus Bar protection scheme is under progress. Erection work & wiring work completed with all respect. Testing of relays is pending at the end of Firm M/s Shifang and Bus Bar protection scheme will be commissioned dt 15.03.2024.
	220KV Jind	**Installed and Operational**		**Commissioned on dated 27.06.23.**
	220 KV Fatehabad	**Installed and Operational**		**Commissioned on dated 22.07.23**
	220 KV Hukmawali	Installed but Non-Operational	30.10.2023	Bus-coupler CB defective & new panel withdrawn from DD store. Errection work under progress & the same will be completed 31.08.23.
	220 KV Bhuna	Installed but Non-Operational	31.12.2024	The Siemens make Bus Bar protection Scheme installed at the time of commissioning of the substation went out of order. The higher authority decided to replace with new one. M/s Schneider make new Scheme was then allocated and drawn from DDS Ballabgarh and installed at site, but while testing of same, three out of four relays of the Bus Bar Panel found faulty for which matter is under pursuance with firm.
	220 KV Sirsa	Not Installed		Not required being single source of supply
	220 KV Rania	Not Installed	31.03.2024	Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.
	220 KV Bhiwani	Not Installed	31.03.2024	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.
	220kV Madanpur	Not Installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV Tepla	Installed but Non-Operational	31.03.2024	allocation is awaited.
	220kV Rajokheri	Installed but Non-Operational	31.03.2024	The S/Stn. Is being constructed on turnkey, BBP has been installed. Commissioning is yet to be completed by the firm. Matter is taken up with bus-bar protection firm engineer for commissioning.
BBMB	**220kV Charkhi Dadri**	**Installed and Operational**		**commissioned on 31.01.2023**
	220kV Samaypur	**Installed and Operational**		**made operational on 23.12.2023**
	220kV Dhulkote	Not Installed		Not feasible
	220kV Jagadhari	Not Installed		
	220kV Barnala	Not Installed		
	220kV Parichha	Installed but Non-Operational	30.06.2023	
	220kV Partapur	Installed but Non-Operational	Jan-23	
	220kV Bareilly (400/220kV Bareilly)	Installed but Non-Operational	Dec-23	Old panel capacity exhausted. New relay panel supplied & need to be
	220kV Pilibhit	**Installed and Operational**		**commissioned on 28.10.2023**
	220kV Amariya	**Installed and Operational**		**commissioned on 15th July 2023**
	220kV Sultanpur	**Installed and Operational**		**commissioned on 02.03.2024**
	220kV New Tanda	**Installed and Operational**		**commissioned on 20.04.2024**
	220kV Shahjhanpur	Installed but Non-Operational	30.06.2024	Cable partially received, work will start soon
	220kV Ajijpur	Installed but Non-Operational		1. HV side 220kV CT of 160MVA T/F-I & II has bot proper ratio for bus bar
	220kV Nirpura	Installed but Non-Operational	Jan-23	
	220kV IITGNL	Installed but Non-Operational	Mar-23	
	220kV Rampur	Installed but Non-Operational	31.03.2024	
	220kV Barahua	**Installed and Operational**		**made operational on 28.01.2024**
	220kV Bansi	**Installed and Operational**		**commissioned on 10th August 2023**
	220 KV S/S Azamgarh-2(Bargahan)	**Installed and Operational**		**made operational on 28.01.2024**
	220kV Chandausi	**Installed and Operational**		**made operational on 13.10.2023**
	220kV Rasara	Not Installed		
	220kV Rampur	Installed but Non-Operational	Jun-24	1) Central unit of bus bar protection faulty 2) Bus bar relay fefective of 100MVA T/F-III
	220kV Sec. - 148, Noida	Installed but Non-Operational	31.01.2024	Work has been completed. Testing is due.
	220kV sec. 38A, Botanicla Garden	Not Installed		Panel allotment pending
	220kV sec.-62, Noida	**Installed and Operational**		**made operational on 12.10.2023**
	220kV Dadri	Installed but Non-Operational	Apr-24	Wiring work has been completed.BB relay testing is due.

UP	**400kV S/S Agra**	**Installed and Operational**		**commissioned on 13th September 2023**
	220kV S/S Bah	Not Installed		Requirement sent to design circle, awaited fro allotment.
	220kV Sirsaganj	Not Installed		Requirement sent to design circle, awaited fro allotment.
	220kV S/S Farrukhabad (New)	**Installed and Operational**		**commissioned on 25th August 2023**
	220kV Boner	**Installed and Operational**		**commissioned on 19.03.2024**
	220kV Kasganj (Soron)	**Installed and Operational**		
	220kV Khair	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220kV Kidwainagar	Installed but Non-Operational		
	220kV Chhata	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220kV Harduaganj	Installed but Non-Operational	31.12.2023	
	220kV Lalitpur	**Installed and Operational**		**commissioned on 09.02.2024**
	220kV Mahoba	Installed but Non-Operational		Relay is faulty since 29.01.2024
	220kV Sarnath	Installed but Non-Operational	Nov-23	
	220kV Sirathu, Kaushambi	Not Installed	Mar-23	
	220kV substation Fatehpur	**Installed and Operational**		Operational
	220kV S/S Bhelupur	Not Installed		Radial feeder
	220kV Hardoi Road, Lucknow	**Installed and Operational**		**commissioned on 08th October 2023**
	220kV CG City, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	220kV Barabanki	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided. 02 no. Peripheral unit found defective.
	220kV Kursi Road, Lucknow	Installed but Non-Operational	31.05.2024	Retrofitting work of auxilliary relay completed. Dut to non-functioning of new
	220kV BKT, Lucknow	Installed but Non-Operational	31.05.2024	LOI issued on Dt. 28.02.24
	220kV Gomti Nagar, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	400 KV Substation Sarnath	**Installed and Operational**		**Now operational**
	220kV S/S Raja Talab	Installed but Non-Operational	May-24	Relay Defective, concern firm service engineer is awaited
	20kV S/S Harahua	Installed but Non-Operational	Jun-24	NOT COMMISSIONED
	220kv Rewa Road	Installed but Non-Operational	Jun-24	Due to Isolator & CB status not Proper. Informed to Transmission wing but
	220kV S/S Sahupuri	Installed but Non-Operational	Jun-24	Defective, Requirement for New panel has been raised, not received from
	220kv Robertganj	partillay operational	May-24	Line and bus coupler and T/F-I under cover but T/F-II not cover
	220kV S/S Mirzapur	Not Installed	Jun-24	Bubar Protection Panel has been Recived, construction of
HP	220kV Chamba	**Installed and Operational**	31.03.2024	**commissioned in Jan-2024**
	220kV MattaSidh	Installed but Non-Operational		Work in under progress
	220kv kangoo	Installed but Non-Operational		
	220kV Nangal	Installed but Non-Operational		
	220kV Katha Baddi	Installed but Non-Operational		
Punjab	220 KV S/S Kotlisurat Malhi	Not Installed	30.06.2024	Commissioning is in process.
	220 KV S/S Maur	Not Installed		
	220 KV S/S Science city	Not Installed		
	220 KV S/S Banga	Not Installed		
	220 KV S/S Hoshiarpur	Not Installed		
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Badhni kalan	Not Installed		
	220 KV S/S Bhari	Not Installed		
	220 KV S/S Bhawanigarh	Not Installed		
Rajasthan	765 KV GSS Phagi	Installed but non operational	Jun-24	CU of Alstom make Bus-Bar is defective. Purchas case will be taken up
	220 kV GSS Vatika	Not installed		As M/s ER did not finished the project, so it was awarded to M/s Kaycee infra on risk-cost basis , however the bus bar scheme has not been commissioned yet. Matter has been taken up with firm
	220 kV GSS Niwana	Not installed		To be commissioned shortly
	220 kV GSS Alwar	Not installed		CU defective in existing ABB make Bus bar Scheme. Matter has been taken up with firm
	220 kV GSS Bansur	Not installed		To be commissioned shortly
	220 kV GSS Behror	Not installed		To be commissioned shortly
	220KV GSS Hindaun	Not installed		To be commissioned shortly
	220KV GSS Dooni	Not installed		To be commissioned shortly
	220KV GSS Bhawanimandi	Not installed		**commissioned**
	220 KV GSS Sakatpura, Kota	Not installed	Jun-24	Work is pending on the part of M/s GE and S.E. (T&C), RVPN, Kota due to defective Central Control Unit. CU will be send to firm for repair
	400 KV GSS Ajmer (220 KV BUS)	Installed but non operational		Isolator status of in 87BB of respective 220 KV bay No. 213,214, 215 & 216 was not avaliable due to this 220 KV Main Bus-bar-II is out of ckt. work under progress
	220 kV GSS, Beawar	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. Case has been taken up with firm
	220 KV GSS Jethana	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchaman City	Installed but non operational		due to problem in Central Unit Relay (87CU) Since 28.01.2022 , CU has been removed due to defective & replacement / repair under process at GSS Part. Case has been taken up with firm
	220 KV GSS Bherunda	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchera	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Reengus	Installed but non operational		New Bus Bar Scheme has been proposed and approved for replacement from defective Bus-Bar Scheme. The Replacement work will be carried out by firm shortly
	220 KV GSS Laxmangarh	Not installed		**Commissioned**
	220KV GSS Khetri Nagar	Installed but non operational	Jun-24	The newly Bus bar protection scheme has been proposed and approved for replacement of deffective bus bar scheme. hence the work of replacement will be carried out by the firm shortly
	400 KV GSS, Babai	Installed but non operational		PU of 315 MVA ICT-III is defective with error code 0X83720007. Matter has been taken up with firm
	220 KV GSS Chittorgarh	Installed but non operational		All bay units of the BUS BAR scheme are defective. Matter has been taken up with firm
	400 KV GSS BHILWARA(220 KV BUS)	Installed but non operational		BAY UNIT OF 220 KV TBC DEFECTIVE. Matter has been taken up with firm
	220 KV GSS MANDALGARH	Not installed		**commissioned**
	220KV GSS Debari	Not installed	Jun-24	Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Amberi	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Madri	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	400 KV GSS Surpura (Jodhpur) 220 KV	Installed but non operational		Allotted & Panel Received
	400 KV GSS Akal (Jaisalmer) 220 KV BUS	Installed but non operational		One PU defective. Case has been taken up with firm
	220 KV GSS Jodhpur	Installed but non operational		A&FS and TS issued. Case has been send for approval
	220 KV GSS NPH Jodhpur	Not installed		To be commissioned shortly
	220 KV GSS Badisid	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Bhadla	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Pali	Installed but non operational		New bays to be incorporated and GPS defective. work under progress
	220 KV GSS Ramgarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Balotra	Installed but non operational		Isolator status issue. work under progress
	220 KV GSS Sayla	Not installed		Allotted & Panel Received. To be commissioned shortly
	400 KV GSS Bikaner 400 KV BUS	Installed but non operational		Not operational (Areva Make) Communication fiber error. Matter has been taken
	220 KV GSS Ratangarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Sujangarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Halasar	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Tehandesar	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Rawatsar	Not installed		Allotted & Panel Received. To be commissioned shortly

Status of Bus bar protection				
Constituent Name	**Name of Station**	**Status of Bus bar protection(as reported)**	**Expected date of revival(as reported)**	**Present Status**
Uttarakhand	220 KV Substation, Ramnagar, Roorkee	Blocked due to more elements added at 220 KV Voltage level.		
	220 KV Sub Station, SIDCUL, Haridwar			
	220kV Jhajhra, Dehradun	Not commissioned yet		
	400KV Kashipur (220kV side)	Available but Non operational	31-Mar-24	Work is under process.
	220kv Haldwani	Not Available	31 December 2024	Budget for FY 2023-24.
	220kv Pantnagar	Available but Non operational	31-Mar-24	Work is under process.
	220kV Rishikesh	Available but Non operational	31 December 2024	It has been Taken in Budget for FY 2023-24.
	220kV Chamba	Not commissioned yet	31 December 2024	It has been Taken in Budget for FY 2023-24.
Haryana	**220kV S/Stn Badshahpur**	**Installed and Operational**		**Commissioned on 20.02.2023**
	220kV S/Stn Sec-52A, Gurgaon	Not Installed	31.12.2024	Panel has been installed. Commissioning pending due to non- availability of shutdown.
	220kV S/Stn Sec-1 Manesar	**Installed and Operational**		**Commissioned on 26.02.2023**
	220kV S/Stn Panchgaon	**Installed and Operational**		**Commissioned on 05.01.2024**
	220kV S/Stn Rewari	Not Installed	31.03.2025	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV S/Stn Narnaul	Not Installed	31.10.2024	Panel has been installed. Work in progress on turnkey basis. Isolators of 220 kV TFs have to be replaced thereafter the work shall be completed.
	220kV S/Stn Mohinder Garh	**Installed and Operational**		**Commissioned on 28.10.2023**
	220 KV S/Stn Palwal	Not Installed	31.12.2024	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	**Installed and Operational**		**Commissioned on 22.06.2023**
	220 kV Unispur	Installed but Non-Operational	31.08.2024	5 Nos. Peripheral relay of bus bar protection are defective. The same shall be made operational by 31.03.2024.
	220 kV Nissing	Installed but Non-Operational	31.08.2024	Existing Bus bar panel is of old and obsolete design. New Bus Bar protection scheme panel has been drawn from the store & Commissioning& installation are pending. The same shall be made operational by 31.03.2024.
	220KV Pehowa	Installed but Non-Operational	31.03.2025	Old & Obsolete, Allocation of New BBP and allied material awaited.
	220kV Kaithal	Not Installed	31.03.2025	Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220kV Bus-Bar Protection panel is awaited.
	220 KV Sonepat	Not Installed	31.08.2024	220 KV Bus Bar Protection Scheme will be installed / commissioned within 45 days after the availability of the necessary material i.e 220kV Duplex, Directional, Bus Bar Cum Bus Coupler C and R Panel, Auxiliary Voltage 220V DC (without SAS) required for commissioning. It has been gathered from the P&M wing that the material is likely to be available in DD stores by April 2024.
	220 KV REGC, Sonepat	Not Installed	30.09.2024	The 220KV C&R Panel for Bus Bar Protection has been drawn from DD Store on dated 20.04.2023 and the work for installation of Bus Bar protection scheme is under progress. Erection work & wiring work completed with all respect. Testing of relays is pending at the end of Firm M/s Shifang and Bus Bar protection scheme will be commissioned dt 15.03.2024.
	220KV Jind	**Installed and Operational**		**Commissioned on dated 27.06.23.**
	220 KV Fatehabad	**Installed and Operational**		**Commissioned on dated 22.07.23**
	220 KV Hukmawali	Installed but Non-Operational	30.10.2023	Bus-coupler CB defective & new panel withdrawn from DD store. Errection work under progress & the same will be completed 31.08.23.
	220 KV Bhuna	Installed but Non-Operational	31.12.2024	The Siemens make Bus Bar protection Scheme installed at the time of commissioning of the substation went out of order. The higher authority decided to replace with new one. M/s Schneider make new Scheme was then allocated and drawn from DDS Ballabgarh and installed at site, but while testing of same, three out of four relays of the Bus Bar Panel found faulty for which matter is under pursuance with firm.
	220 KV Sirsa	Not Installed		Not required being single source of supply
	220 KV Rania	Not Installed	31.03.2025	Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.
	220 KV Bhiwani	Not Installed	31.03.2025	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.
	220kV Madanpur	Not Installed	31.08.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV Tepla	Installed but Non-Operational	31.08.2024	material allocation is awaited.
	220kV Rajokheri	**Installed and Operational**	31.03.2024	**Made operational on dated 30.05.2024.**
BBMB	**220kV Charkhi Dadri**	**Installed and Operational**		**commissioned on 31.01.2023**
	220kV Samaypur	**Installed and Operational**		**made operational on 23.12.2023**
	220kV Dhulkote	Not Installed		Not feasible
	220kV Jagadhari	Not Installed		
	220kV Barnala	Not Installed		

	220kV Parichha	Installed but Non-Operational	30.06.2023	
	220kV Partapur	Installed but Non-Operational	Jan-23	
	220kV Bareilly (400/220kV	Installed but Non-Operational	Dec-23	Old panel capacity exhausted. New relay panel supplied & need to be
	220kV Pilibhit	**Installed and Operational**		**commissioned on 28.10.2023**
	220kV Amariya	**Installed and Operational**		**commissioned on 15th July 2023**
	220kV Sultanpur	**Installed and Operational**		**commissioned on 02.03.2024**
	220kV New Tanda	**Installed and Operational**		**commissioned on 20.04.2024**
	220kV Shahjhanpur	Installed but Non-Operational	30.06.2024	Cable partially received, work will start soon
	220kV Ajijpur	Installed but Non-Operational		1. HV side 220kV CT of 160MVA T/F-I & II has bot proper ratio for bus bar
	220kV Nirpura	Installed but Non-Operational	Jan-23	
	220kV IITGNL	Installed but Non-Operational	Mar-23	
	220kV Rampur	Installed but Non-Operational	31.03.2024	
	220kV Barahua	**Installed and Operational**		**made operational on 28.01.2024**
	220kV Bansi	**Installed and Operational**		**commissioned on 10th August 2023**
	220 KV S/S Azamgarh-2(Bargahan	**Installed and Operational**		**made operational on 28.01.2024**
	220kV Chandausi	**Installed and Operational**		**made operational on 13.10.2023**
	220kV Rasara	Not Installed		
	220kV Rampur	Installed but Non-Operational	Jun-24	1) Central unit of bus bar protection faulty 2) Bus bar relay fefective of 100MVA T/F-III
	220kV Sec. - 148, Noida	Installed but Non-Operational	31.01.2024	Work has been completed. Testing is due.
	220kV sec. 38A, Botanicla Garden	Not Installed		Panel allotment pending
	220kV sec.-62, Noida	**Installed and Operational**		**made operational on 12.10.2023**
	220kV Dadri	**Installed and Operational**	Apr-24	**made operational on 23.04.2024**
	400kV S/S Agra	**Installed and Operational**		**commissioned on 13th September 2023**
UP	220kV S/S Bah	Not Installed		Requirement sent to design circle, awaited fro allotment.
	220kV Sirsaganj	Not Installed		Requirement sent to design circle, awaited fro allotment.
	220kV S/S Farrukhabad (New)	**Installed and Operational**		**commissioned on 25th August 2023**
	220kV Boner	**Installed and Operational**		**commissioned on 19.03.2024**
	220kV Kasganj (Soron)	**Installed and Operational**		
	220kV Khair	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220kV Kidwainagar	Installed but Non-Operational		
	220kV Chhata	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220kV Harduaganj	Installed but Non-Operational	31.12.2023	
	220kV Lalitpur	**Installed and Operational**		**commissioned on 09.02.2024**
	220kV Mahoba	Installed but Non-Operational		Relay is faulty since 29.01.2024
	220kV Sarnath	Installed but Non-Operational	Nov-23	
	220kV Sirathu, Kaushambi	Not Installed	Mar-23	
	220kV substation Fatehpur	**Installed and Operational**		Operational
	220kV S/S Bhelupur	Not Installed		Radial feeder
	220kV Hardoi Road, Lucknow	**Installed and Operational**		**commissioned on 08th October 2023**
	220kV CG City, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	220kV Barabanki	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided. 02 no. Peripheral unit found defective.
	220kV Kursi Road, Lucknow	Installed but Non-Operational	31.05.2024	Retrofitting work of auxilliary relay completed. Dut to non-functioning of new
	220kV BKT, Lucknow	Installed but Non-Operational	31.05.2024	LOI issued on Dt. 28.02.24
	220kV Gomti Nagar, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	400 KV Substation Sarnath	**Installed and Operational**		**Now operational**
	220kV S/S Raja Talab	Installed but Non-Operational	May-24	Relay Defective, concern firm service engineer is awaited
	20kV S/S Harahua	Installed but Non-Operational	Jun-24	NOT COMMISSIONED
	220kv Rewa Road	Installed but Non-Operational	Jun-24	Due to Isolator & CB status not Proper. Informed to Transmission wing but
	220kV S/S Sahupuri	Installed but Non-Operational	Jun-24	Defective, Requirement for New panel has been raised, not received from
	220kv Robertganj	partillay operational	May-24	Line and bus coupler and T/F-I under cover but T/F-II not cover
	220kV S/S Mirzapur	Not Installed	Jun-24	Bubar Protection Panel has been Recived, construction of
	220kV Chamba	**Installed and Operational**		**commissioned in Jan-2024**
	220kV MattaSidh	Installed but Non-Operational		
HP	220kV kangoo	Installed but Non-Operational	31.12.2024	Work in under progress, issues are being taken up with ABB
	220kV Nangal	Installed but Non-Operational		
	220kV Katha Baddi	Installed but Non-Operational		
	220 KV S/S Kotlisurat Malhi	Not Installed		
	220 KV S/S Maur	Not Installed		
	220 KV S/S Science city	Not Installed		
	220 KV S/S Banga	Not Installed	Dec-24	Commissioning is in process. Material has arrived, commissioning shall be done as per shutdown availability.
Punjab	220 KV S/S Hoshiarpur	Not Installed		
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Bhawanigarh	Not Installed		
	220 KV S/S Badhni kalan	**Installed and Operational**		**Commissioned**
	220 KV S/S Bhari	**Installed and Operational**		**Commissioned**
	765 KV GSS Phagi	Installed but non operational		CU of Alstom make Bus-Bar is defective. Purchas case will be taken up
	220 kV GSS Vatika	Not installed		As M/s ER did not finished the project, so it was awarded to M/s Kaycee infra on risk-cost basis , however the bus bar scheme has not been commissioned yet. Matter has been taken up with firm
	220 kV GSS Niwana	Not installed	Sep-24	To be commissioned shortly
	220 kV GSS Alwar	Not installed		To be commissioned shortly
	220 kV GSS Bansur	Not installed		To be commissioned shortly
	220 kV GSS Behror	Not installed		To be commissioned shortly
	220KV GSS Hindaun	Not installed		To be commissioned shortly
	220KV GSS Dooni	Not installed		**commissioned**
	220KV GSS Bhawanimandi	Not installed		**commissioned**
	220 KV GSS Sakatpura, Kota	Not installed		**commissioned on 09.07.2024**
	400 KV GSS Ajmer (220 KV BUS)	Installed but non operational		Isolator status of in 87BB of respective 220 KV bay No. 213,214, 215 & 216 was not avaliable due to this 220 KV Main Bus-bar-II is out of ckt. work under progress
	220 kV GSS, Beawar	Not installed		**commissioned**
	220 KV GSS Jethana	Not installed		**commissioned**
	220 KV GSS Kuchaman City	Installed but non operational		Purchase has been taken up with the firm

Rajasthan	220 KV GSS Bherunda	Not installed		**commissioned**
	220 KV GSS Kuchera	Not installed		**commissioned**
	220 KV GSS Reengus	Installed but non operational		**commissioned**
	220 KV GSS Laxmangarh	Not installed		**Commissioned**
	220KV GSS Khetri Nagar	Installed but non operational		**commissioned**
	400 KV GSS, Babai	Installed but non operational		**commissioned**
	220 KV GSS Chittorgarh	Installed but non operational	20.08.2024	To be commissioned shortly
	400 KV GSS BHILWARA(220 KV BUS)	Installed but non operational		BAY UNIT OF 220 KV TBC DEFECTIVE. Matter has been taken up with firm
	220 KV GSS MANDALGARH	Not installed		**commissioned**
	220KV GSS Debari	Not installed	31.08.2024	To be commissioned shortly
	220KV GSS Amberi	Not installed		**commissioned**
	220KV GSS Madri	Not installed	14.08.2024	To be commissioned shortly
	400 KV GSS Surpura (Jodhpur)	Installed but non operational	30.09.2024	To be commissioned shortly
	400 KV GSS Akal (Jaisalmer) 220	Installed but non operational		One PU defective. Case has been taken up with firm
	220 KV GSS Jodhpur	Installed but non operational		A&FS and TS issued. Case has been send for approval
	220 KV GSS NPH Jodhpur	Not installed		Case file moved
	220 KV GSS Badisid	Not installed		**commissioned**
	220 KV GSS Bhadla	Not installed	25.09.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Pali	Installed but non operational		**commissioned**
	220 KV GSS Ramgarh	Not installed	05.09.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Balotra	Installed but non operational		**commissioned**
	220 KV GSS Sayla	Not installed		**commissioned**
	400 KV GSS Bikaner 400 KV BUS	Installed but non operational		to be done with transformer work
	220 KV GSS Ratangarh	Not installed		**commissioned**
	220 KV GSS Sujangarh	Not installed	10.08.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Halasar	Not installed	25.07.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Tehandesar	Not installed	15.09.2024	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Rawatsar	Not installed		**commissioned**

Status of protection relay type				
Constituent Name	**Name of Station**	**Element Name**	**Present Status**	**Remark**
Uttarakhand	220kV Rishikesh	SIDCUL line	Main-II is not installed	
		Chamba line		
		Dharasu line-2		
	220kV Chamba	Rishikesh line		
HP	220kV MattaSidh	220kV transformer bank-1 & 2	Static relay	
Rajasthan	220 kV GSS Sanganer	220 kV HEERAPURA	Static	
	220 kV GSS Phulera	220 KV HEERAPURA	Static	
		220 kV Makrana	Static	
	220 KV GSS CHOMU	220 kV Heerapura	Static	
		220 kV Reengus Line	Static	
	220 kV GSS Kukas	220 kV Manoharpur Line	Static	
		220 kV Alwar Line	Static	
	220kV GSS Dausa	220 kV SawaiMadhopur Line	Static	
		220 kV Bassi-I Line	Static	
		220 kV Bassi-II Line	Static	
		220 kV Alwar Line	Static	
		220 kV Mandawar Line	Static	
	220KV BHARATPUR GSS	220 KV DHOLPUR	Static	
	220 KV GSS SAKATPURA	220 kV ANTA(NTPC)	Static	
	220 KV DAHRA	220 kV BARAN	Static	
		220 kV SAKATPURA	Static	
	220KV GSS MODAK	220 kV RANPUR	Static	
		220 kV Jhalawar	Static	
	220 KV GSS JHALAWAR	220 kV Modak	Static	
	220KV GSS HINDAUN	220KV Sikrai Line	Static	relay defective
	220KV GSS DHOLPUR	220 kV DCPP	Static	
	220 KV GSS Reengus	220 KV Laxmangarh	Static	
	220 KV GSS Nagour	220KV NOKHA	Static	
		220KV KUCHERA	Static	
	220KV GSS Kankroli	220 KV PGCIL-I	Static	
	220 KV GSS SIROHI	220 KV (400) KV PGCIL Bhinmal	Static	
	220 KV GSS SIROHI	220 KV Jalore	Static	
	220 KV GSS BHINMAL	220 KV (400) KV PGCIL Bhinmal-I	Static	
	220 KV GSS BALI	220kV Sirohi	Static	
	220 KV GSS Suratgarh	220 KV STPS-I	Static	
		220 KV STPS-II	Static	
		220 KV Hanumangarh Line	Static	
	220 KV GSS Sri Ganganagar	220 KV Hanumangarh Line	Static	
	220 KV GSS Hanumangarh	220 KV Suratgarh	Static	
	220KV GSS Ratangarh	220KV Rawatsar	Static	
	220KV GSS Ratangarh	220KV Halasar	Static	
	220KV GSS Ratangarh	220KV InterConnector-I	Static	
	220KV GSS Ratangarh	220KV InterConnector-II	Static	
	220KV GSS Sujangarh	220KV Ratangarh	Static	
	220 KV GSS Bikaner	220 KV Badnu Line	Static	
	220 KV GSS Bikaner	220 KV Interconnector-I Line	Static	
	220 KV GSS Bikaner	220 KV Spare Line	Static	
	220kV Madanpur	220/66kV 100 MVA PTF T-1	Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical	Working properly, need to be replace with numerical relay
		220kV Bus-Coupler	Backup relay -Numerical all other relays are Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical Execept Differential relay (Numerical)	Working properly, need to be replace with numerical relay
	220 KV S/Stn Shahbad	100 MVA 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		220 KV Bus Coupler	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-2	Electrostatic	Working properly, need to be replace with numerical relay
	220 KV S/STnTepla	220KV Bus Coupler	Electromechanical	Working properly, need to be replace with numerical relay
	220KV S/Stn Jorian	220KV Jorian -DCRTPP Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay

		220KV Jorian -Abdullapur Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 160MVA T/F T-1	Defferntial Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-2	All Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-3	Defferntial & REF Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
	220 kv Salempur	220 KV BAKANA–SALEMPUR CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BAKANA–SALEMPUR CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BUS-COUPLER	All electromechanical type	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-I	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-2	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
Haryana		220kV Nissing-PTPS Ckt-I	All electromechanical type,except DPR relays	
		100 MVA 220/132kV T-8	All electromechanical type,except Differential relay	Differential relay replcaed with Numerical type
		220 kV Bus-coupler	All electromechanical type	C&R panel will be replaced soon
	TS Division Karnal	220 KV DCRTPP–UNISPUR CKT-I	All electromechanical type,except DPR relays	
		220 KV DCRTPP–UNISPUR CKT-II	All electromechanical type,except DPR relays	
		220 KV KARNAL–UNISPUR LINE	All electromechanical type,except DPR relays	
		220/132 KV 100 MVA T/F T-1	All electromechanical type,except R.E.F & Differential relay	
		220/132 KV 100 MVA T/F T-2	All electromechanical type,except R.E.F & Differential relay	
		220/132 KV 160 MVA T/F T-4	All electromechanical type,except R.E.F & Differential relay	
	220kV S/Stn Palla	100MVA 220/66kV T-1	REF & backup Electromechnical	
		100MVA 220/66kV T-2	REF & backup Electromechnical	
		100MVA 220/66kV T-7	Diff & Backup lectromechnical and REF static	
		220kV Palla - Sector 78	backup Electromechnical	
		220kV Palla - FGPP ckt-II	backup Electromechnical	
	220 kV S/Stn. Pali	100 MVA 220/66 kV T-1	REF & backup Electromechnical	
		100 MVA 220/66 kV T-3	REF & backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 1	backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 65 Ckt 1	backup Electromechnical	
		220 kV Pali-Badshahpur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 2	backup Electromechnical	
	220kV S/Stn Palwal	220/66kV 160MVA T-1 T/F	REF & backup Electromechnical	
		220/66kV 100MVA T-2 T/F	Diff, REF & Backup Electromechnical	
		220kV Prithala Palwal Ckt I	backup Electromechnical	
		220kV Prithala Palwal Ckt II	backup Electromechnical	
	220kv S/Stn. Sector 52A GGM	Sec 56-Sec 52A ckt 1	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 56-Sec 52A ckt 2	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 72-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 57-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
	220KV S/Stn. Sonepat		(Diff.-3 , REF-3, O/C/E/F-4 , Electromechnical Relays	The electromechanical differential and DPR are not available in the store. However, the same shall be replaced after availability in the store.
	220kV Rohtak		(REF-2, O/C/E/F-12) Electromechnical Relays	
	400 KV S/S Moradabad	400 KV MORADABAD - RAMPUR LINE	LBB- ABB(RAICA) / STATIC	UNDER PGCIL
		400 KV MORADABAD - KASHIPUR LINE	LBB- English Electric(CTIG) / Electromechnical	Will be replaced by July24
		400 KV, TRANSFER BUS	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, BUS COUPLER	LBB- English Electric(CTIG) / Electromechnical	
	220kV S/S BARAUT	220/132kV 200MVA TRANSFORMER-1	REF Protection - Electromechanical	
	220kV S/S BAGHPAT	220/132kV 160MVA TRANSORMER-1	Backup (L.V. Side) - Electromechanical	
	220 kV KHURJA	220/132Kv 200MVA Transformer-I	REF-Static	
	220 kV DEBAI	220/132Kv 100MVA Transformer-I	Numerical	
	220 kV Jahangirabad	220/132Kv 160MVA Transformer-I	REF-Static	
	400KV S/S MURAD NAGAR	220KV LONI LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV FARID NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-I MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-II MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV SAHIBABAD LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	

UP		220KV PRATAP VIHAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV ALIGARH LINE	LBB RELAY IS ELECTROMECHANICAL.	
		400KV ATOUR LINE	LBB RELAY IS ELECTROMECHANICAL.	
	220KV S/S MURAD NAGAR	220KV BUS COUPLER	O/C RELAY IS ELECTROMECHANICAL	
	400KV S/S Gorakhpur	400KV TBC	Electromechanical	
		220KV TBC	Electromechanical	
	220KV S/S Barahua	220KV PGCIL	Back up relay electromechenical	
	220KV S/S Basti	220 KV Basti Tanda line	67N(2TJM12)(Electromechanical)	
		63MVA Transformer-II	HV Side directional o/c&e/f(Electromechanical)	
	400 KV SS Kasara,Mau	200MVA, 400/132KV ICT-1st	REF & Over flux relay Electromechanical	
		200MVA, 400/132KV ICT-2nd	REF & Over flux relay Electromechanical	
	220 KV SS Substation Hafizpur Azamgarh	160 MVA ICT -1	Electromechanical(EE Make)	Replaced with Siemens make numerical relay on 16.10.2023
	220kV Khara		Electromechanical	process of replacing electrochemical relay with numerical relay has been started, it will be completed within 2-3 months.
	220kV Gokul	160MVA ICT-1	Electromechanical (Diff and O/C)	New panels are available at S/s and replacement work is under process
	220kV Meetai	200MVA ICT-1	Electromechanical (E/F and O/C), Diff:Static	
		200MVA ICT-2	Electromechanical (E/F and O/C), Diff:Static	
	220kV Atrauli	160MVA ICT-1	Electromechanical + Numerical	Tender process is complete.
		160MVA ICT-2	Electromechanical + Numerical	
	220kV Mainpuri	160MVA ICT-1	Electromechanical(REF) + Numerical	New panels are available at S/s and replacement work is under process
		160MVA ICT-2	Electromechanical(REF) + Numerical	
	220kV Panki	220kV Bus coupler	Electromechanical	Under process
	400kV S/S Sultanpur	240 MVA ICT-II	Non Numerical	
		50 MVAR Obra Line Reactor	Non Numerical	
	220kV S/S Sultanpur	220kV B/C	Non Numerical	
		160 MVA T/F-I	Non Numerical	
NPCIL	220kV RAPPC	220KV Anta line	Backup relay: Static relay(RAPDK3)	Procurement of Numerical relay is in progress for replacement of Static relay (Backup protection).
	220kV NAPP	NAPP-SAMBHAL		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-SIBHOLI		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-DIBAI		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-KHURJA		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-ATRAULI		

Status of protection relay type				
Constituent Name	**Name of Station**	**Element Name**	**Present Status**	**Remark**
Uttarakhand	220kV Rishikesh	SIDCUL line	Main-II is not installed	
		Chamba line		
		Dharasu line-2		
	220kV Chamba	Rishikesh line		
HP	220kV MattaSidh	220kV transformer bank-1 & 2	Static relay	
Rajasthan	220 kV GSS Sanganer	220 kV HEERAPURA	Static	
	220 kV GSS Phulera	220 KV HEERAPURA	Static	Replaced by numerical relay
		220 kV Makrana	Static	
	220 KV GSS CHOMU	220 kV Heerapura	Static	
		220 kV Reengus Line	Static	
	220 kV GSS Kukas	220 kV Manoharpur Line	Static	Replaced by numerical relay
		220 kV Alwar Line	Static	
	220kV GSS Dausa	220 kV SawaiMadhopur Line	Static	
		220 kV Bassi-I Line	Static	
		220 kV Bassi-II Line	Static	
		220 kV Alwar Line	Static	
		220 kV Mandawar Line	Static	
	220KV BHARATPUR GSS	220 KV DHOLPUR	Static	Replaced by numerical relay
	220 KV GSS SAKATPURA	220 kV ANTA(NTPC)	Static	
	220 KV DAHRA	220 kV BARAN	Static	
		220 kV SAKATPURA	Static	
	220KV GSS MODAK	220 kV RANPUR	Static	
		220 kV Jhalawar	Static	
	220 KV GSS JHALAWAR	220 kV Modak	Static	
	220KV GSS HINDAUN	220KV Sikrai Line	Static	relay defective
	220KV GSS DHOLPUR	220 kV DCPP	Static	
	220 KV GSS Reengus	220 KV Laxmangarh	Static	
	220 KV GSS Nagour	220KV NOKHA	Static	
		220KV KUCHERA	Static	
	220KV GSS Kankroli	220 KV PGCIL-I	Static	
	220 KV GSS SIROHI	220 KV (400) KV PGCIL Bhinmal	Static	
	220 KV GSS SIROHI	220 KV Jalore	Static	
	220 KV GSS BHINMAL	220 KV (400) KV PGCIL Bhinmal-I	Static	
	220 KV GSS BALI	220kV Sirohi	Static	Replaced by numerical relay
	220 KV GSS Suratgarh	220 KV STPS-I	Static	
		220 KV STPS-II	Static	
		220 KV Hanumangarh Line	Static	
	220 KV GSS Sri Ganganagar	220 KV Hanumangarh Line	Static	Replaced by numerical relay
	220 KV GSS Hanumangarh	220 KV Suratgarh	Static	
	220KV GSS Ratangarh	220KV Rawatsar	Static	
	220KV GSS Ratangarh	220KV Halasar	Static	
	220KV GSS Ratangarh	220KV InterConnector-I	Static	
	220KV GSS Ratangarh	220KV InterConnector-II	Static	
	220KV GSS Sujangarh	220KV Ratangarh	Static	
	220 KV GSS Bikaner	220 KV Badnu Line	Static	
	220 KV GSS Bikaner	220 KV Interconnector-I Line	Static	
	220 KV GSS Bikaner	220 KV Spare Line	Static	
	220kV Madanpur	220/66kV 100 MVA PTF T-1	Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical	Working properly, need to be replace with numerical relay
		220kV Bus-Coupler	Backup relay -Numerical all other relays are	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical Execept Differential relay (Numerical)	Working properly, need to be replace with numerical relay
	220 KV S/Stn Shahbad	100 MVA 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		220 KV Bus Coupler	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-2	Electrostatic	Working properly, need to be replace with numerical relay
	220 KV S/STnTepla	220KV Bus Coupler	Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay

Haryana	220KV S/Stn Jorian	220KV Jorian -Shahbad Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 160MVA T/F T-1	Defferntial Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-2	All Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-3	Defferntial & REF Relay = Numerical all other	Working properly, need to be replace with numerical relay
	220 kv Salempur	220 KV BAKANA–SALEMPUR CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BAKANA–SALEMPUR CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BUS-COUPLER	All electromechanical type	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-I	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-2	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
	TS Division Karnal	220kV Nissing-PTPS Ckt-I	All electromechanical type,except DPR relays	
		100 MVA 220/132kV T-8	All electromechanical type,except Differential relay	Differential relay replcaed with Numerical type
		220 kV Bus-coupler	All electromechanical type	C&R panel will be replaced soon
		220 KV DCRTPP–UNISPUR CKT-I	All electromechanical type,except DPR relays	
		220 KV DCRTPP–UNISPUR CKT-II	All electromechanical type,except DPR relays	
		220 KV KARNAL–UNISPUR LINE	All electromechanical type,except DPR relays	
		220/132 KV 100 MVA T/F T-1	All electromechanical type,except R.E.F & Differential relay	
		220/132 KV 100 MVA T/F T-2	All electromechanical type,except R.E.F & Differential relay	
		220/132 KV 160 MVA T/F T-4	All electromechanical type,except R.E.F & Differential relay	
	220kV S/Stn Palla	100MVA 220/66kV T-1	REF & backup Electromechnical	
		100MVA 220/66kV T-2	REF & backup Electromechnical	
		100MVA 220/66kV T-7	Diff & Backup lectromechnical and REF static	
		220kV Palla - Sector 78	backup Electromechnical	
		220kV Palla - FGPP ckt-II	backup Electromechnical	
	220 kV S/Stn. Pali	100 MVA 220/66 kV T-1	REF & backup Electromechnical	
		100 MVA 220/66 kV T-3	REF & backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 1	backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 65 Ckt 1	backup Electromechnical	
		220 kV Pali-Badshahpur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 2	backup Electromechnical	
	220kV S/Stn Palwal	220/66kV 160MVA T-1 T/F	REF & backup Electromechnical	
		220/66kV 100MVA T-2 T/F	Diff, REF & Backup Electromechnical	
		220kV Prithala Palwal Ckt I	backup Electromechnical	
		220kV Prithala Palwal Ckt II	backup Electromechnical	
	220kv S/Stn. Sector 52A GGM	Sec 56-Sec 52A ckt 1	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 56-Sec 52A ckt 2	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 72-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 57-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
	220KV S/Stn. Sonepat		(Diff.-3 , REF-3, O/C/E/F-4 , Electromechnical Relays	The electromechanical differential and DPR are not available in the store. However, the same shall be replaced after availability in the store.
	220kV Rohtak		(REF-2, O/C/E/F-12) Electromechnical Relays	

UP	400 KV S/S Moradabad	400 KV MORADABAD - RAMPUR LINE	LBB- ABB(RAICA) / STATIC	UNDER PGCIL
		400 KV MORADABAD - KASHIPUR LINE	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, TRANSFER BUS	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, BUS COUPLER	LBB- English Electric(CTIG) / Electromechnical	
	220kV S/S BARAUT	220/132kV 200MVA TRANSFORMER-1	REF Protection - Electromechanical	
	220kV S/S BAGHPAT	220/132kV 160MVA TRANSORMER-1	Backup (L.V. Side) - Electromechanical	
	220 kV KHURJA	220/132Kv 200MVA Transformer-I	REF-Static	
	220 kV DEBAI	220/132Kv 100MVA Transformer-I	Numerical	
	220 kV Jahangirabad	220/132Kv 160MVA Transformer-I	REF-Static	
	400KV S/S MURAD NAGAR	220KV LONI LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	Will be replaced by July24
		220KV FARID NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-I MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-II MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV SAHIBABAD LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV PRATAP VIHAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV ALIGARH LINE	LBB RELAY IS ELECTROMECHANICAL.	
		400KV ATOUR LINE	LBB RELAY IS ELECTROMECHANICAL.	
	220KV S/S MURAD NAGAR	220KV BUS COUPLER	O/C RELAY IS ELECTROMECHANICAL	
	400KV S/S Gorakhpur	400KV TBC	Electromechanical	
		220KV TBC	Electromechanical	
	220KV S/S Barahua	220KV PGCIL	Back up relay electromechenical	
	220KV S/S Basti	220 KV Basti Tanda line	67N(2TJM12)(Electromechanical)	
		63MVA Transformer-II	HV Side directional o/c&e/f(Electromechanical)	
	400 KV SS Kasara,Mau	200MVA, 400/132KV ICT-1st	REF & Over flux relay Electromechanical	
		200MVA, 400/132KV ICT-2nd	REF & Over flux relay Electromechanical	
	220 KV SS Substation Hafizpur Azamgarh	160 MVA ICT -1	Electromechanical(EE Make)	Replaced with Siemens make numerical relay on 16.10.2023
	220kV Khara		Electromechanical	process of replacing electrochemical relay with numerical relay has been started, it will be completed within 2 3 months.
	220kV Gokul	160MVA ICT-1	Electromechanical (Diff and O/C)	
	220kV Meetai	200MVA ICT-1	Electromechanical (E/F and O/C), Diff:Static	New panels are available at S/s and replacement work is under process
		200MVA ICT-2	Electromechanical (E/F and O/C), Diff:Static	
	220kV Atrauli	160MVA ICT-1	Electromechanical + Numerical	Tender process is complete.
		160MVA ICT-2	Electromechanical + Numerical	
	220kV Mainpuri	160MVA ICT-1	Electromechanical(REF) + Numerical	New panels are available at S/s and replacement work is under process
		160MVA ICT-2	Electromechanical(REF) + Numerical	
	220kV Panki	220kV Bus coupler	Electromechanical	Under process
	400kV S/S Sultanpur	240 MVA ICT-II	Non Numerical	
		50 MVAR Obra Line Reactor	Non Numerical	
	220kV S/S Sultanpur	220kV B/C	Non Numerical	
		160 MVA T/F-I	Non Numerical	
NPCIL	220kV RAPPC	220KV Anta line	Backup relay: Static relay(RAPDK3)	Completed
	220kV NAPP	NAPP-SAMBHAL		Completed
		NAPP-SIBHOLI		Completed
		NAPP-DIBAI		Completed
		NAPP-KHURJA		Completed
		NAPP-ATRAULI		Completed

Grid event at 220kV Kunihar, Baddi & Upperla Nangal complex				
S. No	**Date of grid event**	**Time**	**S/s affected**	**Load of HP affected**
1	02.02.2024	15:37hrs & 15:34hrs	220kV Kunihar, Baddi	785MW
2	08.02.2024	10:41hrs	220kV Kunihar	525MW
3	16.02.2024	11.30hrs	220kV Kunihar, Jeori	400MW
4	18.05.2024	21:32hrs	220kV Kunihar, Baddi, Upperla Nangal	640MW
5	14.06.2024	23:16hrs	220kV Kunihar, Baddi, Upperla Nangal	296MW
6	16.06.2024	15:56hrs	220kV Kunihar, Baddi, Upperla Nangal	240MW

Status of Recording Instruments (220kV & above stations)						
Sr. No	Station Name	Voltage Level	Disturbance Recorder/Station Event logger healthy (Yes or No)	Standardisation (Yes or No)	Time Sync (Yes or No)	Remarks

PUNJAB STATE TRANSMISSION CORPORATION LIMITED
(Punjab Govt. Undertaking, Regd. Office – PSEB Head office, The Mall, Patiala)

OFFICE OF THE Addl. S.E, Protection &OS Division, Ludhiana
(Phone & FAX – 0161-2462303, E mail – srxen-prot2-ldh@pstcl.org)

Memo No. – 2448 ***Dated – 11-06-2024***

To

SLDC - Punjab,
Ablowal, Patiala

Subject : Regarding Station Event Logger at 220 kV Substation PSTCL Dhandhari Kalan

In reference to the subject cited matter it is intimated that:-

a) This substation is about 40 years old and is conventional type. So there is no Station Event Logger installed at this substation. However, case has been prepared for implementation of Substation Automation System (SAS). It will take about 3 months to install Station Event Logger at 220 kV Substation Dhandari Kalan.

b) The PMU will be installed at this substation under URTDSM Project and requirement has been sent to Powergrid.

This is for your kind information and further action please.

Addl S.E
Protection & OS
O/o EIC/ P&M
PSTCL, Ludhiana

PUNJAB STATE TRANSMISSION CORPORATION LIMITED
(Punjab Govt. Undertaking, Regd. Office – PSEB Head office, The Mall, Patiala)
OFFICE OF THE Addl. S.E, Protection &OS Division, Ludhiana
(Phone & FAX – 0161-2462303, E mail – srxen-prot2-ldh@pstcl.org)

Memo No.- 2615 Date- 21-06-2024

To

Power Controller
SLDC, Ablowal
Patiala

Subject : Protection clearance of 220 kV PSTCL Mansa – PTCL (400 kV Patran) Circuit

In reference to the subject cited matter it is intimated that Carrier Inter-tripping for 220 kV PSTCL Mansa – PTCL (400 kV Patran) circuit is working and End to end protection testing has been done. All the relay settings are as per NRPC/NRLDC guidelines. 220 kV PSTCL Mansa – PTCL (400 kV Patran) circuit is clear for charging from protection point of view.

Moreover, this substation is about 40 years old and is conventional type. So there is no Station Event Logger installed at this substation. However, case has been prepared for implementation of Substation Automation System (SAS). It will take about 3 months to install Station Event Logger at 220 kV Substation Mansa.

The PMUs will be installed at this substation under URTDSM Project and requirement has been sent to Powergrid.

This is for your kind information and further action please.

Addl S.E
Protection & OS
PSTCL, Ludhiana

2616-217
21-06-2024
C/C:

1. Dy. C.E/P&M, PSTCL, Bathinda
2. Sr. Xen/P&M, PSTCL, Bathinda

PUNJAB STATE TRANSMISSION CORPORATION LIMITED
(Punjab Govt. Undertaking, Regd. Office – PSEB Head office, The Mall, Patiala)
OFFICE OF THE Addl. S.E, Protection &OS Division, Ludhiana
(Phone & FAX – 0161-2462303, E mail – srxen-prot2-ldh@pstcl.org)

Memo No.- 2618 Date- 24-06-2024

To

Power Controller
SLDC, Ablowal
Patiala

Subject : Protection clearance of 220 kV PSTCL Sunam – PTCL (400 kV Patran) Circuit

In reference to the subject cited matter it is intimated that Carrier Inter-tripping for 220 kV PSTCL Sunam – PTCL (400 kV Patran) circuit is working and End to end protection testing has been done. All the relay settings are as per NRPC/NRLDC guidelines. 220 kV PSTCL Sunam – PTCL (400 kV Patran) circuit is clear for charging from protection point of view.

Moreover, this substation is about 40 years old and is conventional type. So there is no Station Event Logger installed at this substation. However, case has been prepared for implementation of Substation Automation System (SAS). It will take about 3 months to install Station Event Logger at 220 kV Substation Sunam.

The PMUs will be installed at this substation under URTDSM Project and requirement has been sent to Powergrid.

This is for your kind information and further action please.

Addl S.E
Protection & OS
PSTCL, Ludhiana

2619-20
24-06-2024
C/C:

1. Dy. C.E/P&M, PSTCL, Patiala
2. Sr. Xen/P&M, PSTCL, Patran

उत्तर प्रदेश पावर ट्रान्समिशन कारपोरेशन लिमिटेड
U.P. POWER TRANSMISSION CORPORATION LIMITED

कार्यालय अधिशासीअभियन्ता
विद्युत 400 के0वी0 उपकेन्द्र खण्ड
उ0प्र0 पावरट्रान्समिशनकारपोरेशन लि0
दहीचौकी, उन्नाव (उ0प्र0)–209801

Office of the Executive Engineer
Electricity 400 KV Sub-Station Division
U.P. Power Transmission Corporation Ltd.
DahiChowki, Unnao (U.P.)-209801

दूरभाष नं0 (कार्यालय): 09450909439 / **GSTIN No. 09AAACU8823E1Z9/** **E-mail : ee400unnao@upptcl.org**

पत्रांक/ **Ref. No. 247** / ई0एस0डी0यू0 / **ESDU** / दिनांक / **Dated : 22.04.2024**

UNDERTAKING

It is to bring to your kind notice that a P.O. from Chief Engineer (T.C) U.P.P.T.C.L, Lucknow, Dated 19.04.2024 has been placed on M/s GE T&D India Ltd. Chennai for deputation of SCADA Engineer for following works :-

1. updating (re-name) the name of 400 KV Unnao-Lucknow line to 400 KV Unnao-Mohanlalganj line in station event logger at 400 KV Sub-Station Unnao.
2. To resolve the issue of some trouble in software of station Event Logger at 400 KV Sub-Station, Sarojininagar, Lucknow.

I Undertake to get the above work completed at 400 KV Sub-Station Unnao and 400 KV Sub-Station, Sarojininanag, Lucknow within 4 Weeks. It is requested to kindly issue the charging code for 500 MVA, 400/220/33 KV transformer at 400 KV Sub-Station Unnao.

Ashish
22.04.2024

Executed Engineer
Electy. 400 KV Sub-Station Div.
Dahi Chowki, Unnao

1. **Tripping of generating units during the load loss event on 17th June 2024:**

Sr. No.	Generating unit	Control area/Owner	Gen Loss (MW)	Reason of Tripping / Relay flags
1	660 MW Lalitpur TPS - UNIT 2	UP	631	Tripped on high boiler pressure
2	250 MW Karcham Wangtoo HPS - UNIT 2 & 4	HP / JSW	560	On SPS operation (case 2: voltage less than 395kV); Voltage dropped to 382kV at Karcham HEP
3	135 MW Rajwest (IPP) LTPS - UNIT 1	Rajasthan / RVUNL	133	Turbine problem (exact detail yet to be received)
4	50 MW Sainj HEP - UNIT 1 & 2	HP / HPPCL	99	Tripped on over frequency (protection setting yet to be received)
5	126 MW Bhakra HPS (Left) - UNIT 5	HP / BBMB	586	Tripped on field(excitation) failure
6	157 MW Bhakra HPS (Right) - UNIT 6, 8 & 9	HP / BBMB		Tripped on overcurrent protection operation
7	250 MW Panipat TPS - UNIT 8	Haryana / HPGCL	230	Tripped on backup impedance protection.
8	150 MW RSDPH - UNIT 4	Punjab / PSPCL	135	O/C protection operation (51GA). Pole slip relay(78). Auxiliary overflux relay (88x).
9	Mahan Unit 1 & 2 (660 MW each)	WR (ADANI)	1117	Over Frequency
10	OTPC Palatana (363 MW each)	NER (OTPC)	418	Over Frequency

Annexure-XXV

Tripping events to be discussed in 51st PSC Meeting

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)
					Date	Time		Generation Loss(MW)	Load Loss (MW)	
1	GD-1	1)220 KV Sarna(PS)-Dasuya(PS) (PG) Ckt-1 2)220 KV Sarna(PS)-Dasuya(PS) (PG) Ckt-2 3)220 KV Sarna(PS)-Udhampur(PDD) (PDD) Ckt 4)220 KV Sarna(PS)- Hiranagar(PDD) (PG) Ckt 5)220 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-1 6)220 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-2 7)220 KV Sarna(PS)- Wadala(PS) Ckt-1 8)220 KV Sarna(PS)- Wadala(PS) Ckt-2 9)220 KV Sarna(PS)- Wadala(PS) Ckt-3 10)220 KV Sarna(PS)- Wadala(PS) Ckt-4 11)220 KV Sarna(PS)- RSDPH(PS) Ckt-1 12)220 KV Sarna(PS)- RSDPH(PS) Ckt-2 13)220 KV Sarna(PS)- RSDPH(PS) Ckt-3 14)220 KV Sarna(PS)- RSDPH(PS) Ckt-4 15)220 KV Sarna(PS)- Railway Ckt	Punjab	PDD-JK, PSTCL, PGCIL	4-May-24	07:10	i)As reported, at 07:10 hrs, 220kV side R-Ph CT of 220/132kV Auto T/F-1 at Sarna(PS) blasted which created bus fault at both the 220kV buses at Sarna(PS). ii)Bus-bar protection is not available at Sarna(PS). Hence, all the 220kV lines connected to Sarna(PS) tripped on zone-4 protection operation at Sarna(PS) end and lines tripped from remote ends on zone-2 protection operation. From DR at Sarna(PS), it was observed that zone-4 operated after a delay of ~500ms. iii)Due to tripping of all the 220kV lines connected to Sarna(PS), complete blackout occurred at iv)As per PMU at Kishenpur(PG), R-N phase to earth fault with fault clearing time of 120ms followed by R-B phase to phase fault converted to R-Y phase to phase fault with delayed fault clearing time of 560ms is observed. v)As per SCADA, no change in demand is observed in Punjab control area. But as reported by SLDC-Punjab, load loss of approx. 90MW occurred in Punjab Control area. vi)As per SCADA, change in demand of approx. 40MW is observed in J&K control area. But as reported by SLDC-J&K, no load loss occurred in J&K Control area.	0	90	560
2	GI-1	1)220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-2 2)220 KV Sultanpur(PS)- Badshahpur(PS) Ckt 3)220 KV Sultanpur(PS)- Jamsher(PS) Ckt 4)270 MW Goindwal(GVK) - UNIT 1 5)270 MW Goindwal(GVK) - UNIT 2	Punjab	PSTCL, GVK	7-May-24	14:30	i)During antecedent condition, 220 kV Sultanpur(PS)-Chohla Sahib(PS) Ckt, 220 kV Sultanpur(PS)-Patti(PS) Ckt and 220 kV Chohla Sahib(PS)- Patti(PS) Ckt were not in service. ii)As reported, at 14:30 hrs, a piece of stray flexible conductor came within induction zone of 220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-2 as it fell on tower location no. 16 which led to tripping of this circuit with fault distance of 5km from Goindwal TPS end. iii)Distance Protection Relay (DPR) at Goindwal TPS end sensed the fault in zone-1 and line tripped immediately from Goindwal TPS end. But Distance Protection Relay at Sultanpur end detected power swing scenario and due to PSD block of DPR for 2 seconds (de-blocking time) at Sultanpur end, fault continued to feed through 220 KV Sultanpur(PS)- Badshahpur(PS) Ckt, 220 KV Sultanpur(PS)- Jamsher(PS) Ckt and 220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-1. iv)Badshahpur and Jamsher end DPRs issued trip command in zone-3 after 800ms and fault feeding stopped from these ends. But fault feeding continued through 220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-1 as Goindwal TPS end DPR did not pick up the fault in zone-3. v)This led to tripping of 270 MW Goindwal(GVK) - UNIT 1 & 2 on earth-fault protection operation (51 NGT) after 1 sec. vi)As per PMU at Amritsar(PG), R-N phase to earth fault converted to 3-phase fault with delayed fault clearing time of 2120ms is observed. vii)As per SCADA, change in demand of approx. 100MW is observed in Punjab control area. viii)As reported by SLDC-Punjab, generation loss of approx. 500MW occurred at Goindwal TPS(PS).	500	100	2120
3	GD-1	1)220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 2)220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-2 3)220 KV Bhiwani-Hissar (BB) Ckt-1 4)220 KV Bhiwani-Hissar (BB) Ckt-2 5)220 KV Hissar-Sangrur (BB) Ckt-1 6)220 KV Hissar-Sangrur (BB) Ckt-2 7)220 KV Hissar(BB)-Jindal Steel(HR) (HVPNL) Ckt 8)220 KV Hissar(BB)-Chirawa(RS) (BB) Ckt 9)220 KV Barnala-Sangrur(BB) Ckt 10)220KV Bus 1 at Hissar(BB)	Haryana	BBMB, HVPNL, RVPNL	7-May-24	11:16	i)220/132/33kV Hissar(BB) S/s has double main bus scheme at 220kV level. ii)During antecedent Condition, all the 220kV feeders (Chirawa ckt, Jindal Steel ckt, Sangrur ckt-1 & 2, Bhiwani ckt-1 & 2, Hissar I/A ckt-1 & 2) and 220/132kV 100MVA ICT-1, 2 & 3 were connected to 220kV Bus-1. 220kV Bus-2 was not in service. iii)As reported, at 11:16 hrs R-ph jumper of 220 KV Hissar-Sangrur (BB) Ckt-1 snapped from common point of 220kV Bus isolator no. 223 & 224 at Hissar(BBMB) S/s which caused R-N phase to earth fault. iv)As reported, on this fault, Bus bar relay at 220kV Hissar(BBMB) didn't operate. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 & 2 tripped in Zone-4 from Hissar(BB) end and other all 220kV feeders (Chirawa ckt, Jindal Steel ckt, Sangrur ckt-1 & ckt-2, Bhiwani ckt-1 & ckt-2) tripped from the remote ends in Zone-2 protection operation. v)During the same time 220 KV Barnala-Sangrur(BB) Ckt also tripped (exact reason of tripping need to be shared). vi)As per DR of 220 KV Hissar(BB)-Hissar IA(HV)(end) (BBMB) Ckt-2, R-N phase to earth fault (fault current Ir=~7.4kA) is observed in zone-4 with fault clearing time of 360ms. vii)As per DR of 220 KV Hissar-Sangrur(end) (BB) Ckt-1, R-N phase to earth fault converted into R-Y phase to phase fault (fault current Ir=~1.3kA, Iy=~1.3kA) is observed in zone-2 with fault clearing time of 560ms. viii)As reported, Isolator status of 220 KV Hissar-Sangrur (BB) Ckt-2 provided in the Bus bar relay settings were incorrect (status of isolator no. 227 & 228 were incorrect). Due to this, false differential current generated in Bus Bar Z-2 and differential current supervision feature of relay picked up which led to blocking of Bus bar relay. ix) Due to tripping of all the elements connected to 220kV Bus-1 (220kV Bus-2 was not in service) at Hissar(BB), the complete 220/132/33kV Hissar(BB) S/s became dead. x)As per PMU at Hissar(PG), R-N phase to earth fault with fault clearing time of 360ms (delayed) is observed. xi)As per SCADA, change in demand of approx. 150MW is observed in Haryana control area. But as reported by BBMB, load loss of 207MW occured in Haryana control area.	0	270	360
4	GD-1	1)400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt 2)400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt 3)400 KV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt 4)50 MW Unit-1 at Sainj HEP(HP)	Himachal Pradesh	NHPC, HPPTCL, PKTCL, PGCIL	7-May-24	16:17	i)Total generated power of Sainj HEP(HP), Parbati_2(NH) and parbati_3(NH) evacuates through 400 kV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt and 400 kV Parbati_3(NH)- Banala(PG) (PKTCL) Ckt via 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt and 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt. ii)During antecedent condition, only 50MW Unit-1 at Sainj HEP(HP) was running (generating approx. ~30MW) and 50MW Unit-2 at Sainj HEP(HP), all four units (4*250MW) at Parbati_2(NH) and all four units (4*130MW) at Parbati_3(NH) were not in service. iii)As reported, at 16:17hrs, 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt tripped on B-N phase to earth fault with fault distance of 1.808km from Sainj end. From initial patrolling it was observed that a Pine Tree admeasuring approx. 50m fell from an uphill position outside the transmission line corridor. The tree weight resulted in simultaneous failing of cross arm of Tower Location No. 7 of 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt as well as snapping of conductor leading to tripping of line. iv)As per DR of 400 KV Parbati_3(NH) (end)-Sainj(HP) (PKTCL) Ckt, B-N phase to earth fault is observed with delayed fault clearance time of 400ms and fault current of 7.105kA from Parbati_3(NH) end. Fault was sensed in zone-2 from Parbati_3(NH). Due to non-receipt of carrier signal from remote end, three phase trip command issued after Z2 time delay. v)As further reported, 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt also tripped at the same time (exact reason of the same yet to be shared). As per DR (time sync issue observed), B-N phase to earth fault with fault current of 1.212kA from Parbati_2(NH) end is observed. vi)During the same time, 400 KV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt also tripped from Parbati_2(NH) end only on B-N phase to earth fault with fault distance of 22.5km and fault current of 1.304kA from Banala(PG) end. As per DR, fault was sensed in zone-1 at Banala(PG) end and carrier sent to Parbati_2(NH) end and line successfully auto-reclosed from Banala(PG). But as reported by NHPC, fault was sensed in zone-2 at Parbati_2(NH) end and upon receipt of carrier signal from Banala(PG) B-phase CB opened. But reclosing command was not extended to B-phase CB after dead time, hence, line tripped from Parbati_2(NH) on operation of Pole discrepancy relay. vii)As per PMU at Banala(PG), B-N phase to earth fault is observed with delayed fault clearing time of 400ms. viii)As per SCADA, generation loss of approx. 30 MW at Sainj HEP (HP) is observed.	30	0	400
5	GI-2	1)400kV Fatehabad(PG)-Nuhiyawali(HR) ckt 2)400kV Khedar-Kirori (HR) ckt-1 3)400kV Khedar-Kirori (HR) ckt-2 4)400kV Khedar(HR)-Fatehabad(PG) ckt 5)400kV Khedar-Nuhiyawali ckt 6)600MW Unit-1 at Khedar (RGTPS) 7)600MW Unit-2 at Khedar (RGTPS)	Haryana	PGCIL, HVPNL, HPGCL	10-May-24	19:35	i)Generation of 600MW Unit-1 & 2 at Khedar TPS (total ~1072MW) was evacuating through 400kV Khedar(HR)-Fatehabad(PG) ckt (carrying ~858MW), 400kV Khedar-Nuhiyawali (HR) ckt (carrying ~174MW) only. ii)At 19:35:24:255 hrs, R-N phase to earth fault occurred on 400kV Khedar-Nuhiyawali (HR) ckt. As per DR of 400kV Khedar-Nuhiyawali (HR) ckt, distance protection relay at both end sensed R-N fault in Z-1 (Khedar end: Ir=12kA, 75km). R-ph A/R started from both ends. iii)At 19:35:24:291 hrs, as per DR of 400kV Khedar(HR)-Fatehabad(PG) ckt, distance protection relay at Khedar end sensed B-N fault in Z-1(Khedar end: Ib=1.1kA, 8.5km) and initiated A/R in B-ph at Khedar end. Fatehabad(PG) end distance protection relay didn't sense this B-N fault and no operation occurred at Fatehabad end. iv)At 19:35:24:758 hrs, as per DR of 400kV Khedar(HR)-Fatehabad(PG) ckt, distance protection relay at Khedar end initiated 3-ph tripping command and R & Y ph pole also opened. v)As R-ph autoreclosing was also going on in 400kV Khedar-Nuhiyawali (HR) ckt at this time and all 3-ph pole of 400kV Khedar(HR)-Fatehabad(PG) ckt opened, all the power now started evacuating through Y & B phase of 400kV Khedar-Nuhiyawali (HR) ckt. Current in Y & B phase started increasing, it increased to ~1850A by 19:35:25:153 hrs. vi) At 19:35:25:376 hrs, R-ph pole of 400kV Khedar-Nuhiyawali (HR) ckt closed from both ends and line successfully autoreclosed. vii)At 19:35:25:421 hrs, all 3-ph pole at Khedar end of 400kV Khedar(HR)-Fatehabad(PG) ckt closed and line successfully autoreclosed. viii)At the same time, power swing also observed in DR of Unit-1&2 and evacuating lines. ix)At 19:35:25:944hrs, 600MW Unit-1 tripped on pole slip protection operation. x)At 19:35:25:974hrs, 600MW Unit-2 tripped on pole slip protection operation. xi)At 19:35:30:309 hrs and 19:35:30:350 hrs, over frequency protection also operated of Unit-1 & 2 respectively. xii)600MW Unit-1 at Khedar TPS revived at 04:26hrs on 11th May 2024 and Unit-2 have been kept out for inspection purpose.	1072	0	80
6	GI-2	1)400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 2)400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-1 3)400KV Bhiwadi-Neemrana (PG) Ckt-1 4)400 KV Bassi-Bhiwadi (PG) Ckt 5)500 KV HVDC Balia-Bhiwadi (PG) Ckt-1 6)500 KV HVDC Balia-Bhiwadi (PG) Ckt-2 7)220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 8)220 KV Bhiwadi(PG)-Rewari(HV) (HV) Ckt-1 9)220 KV Bhiwadi(PG)-Rewari(HV) (HV) Ckt-2 10)220 KV Bhiwadi(PG)-HSIIDC Bawal(HV) (HVPNL) Ckt 11)220 KV Bhiwadi(RS)-Mau(HV) (HV) Ckt 12)220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt 13)220 KV Neemrana(PG)-Neemrana(RS) (RS) Ckt-1	Rajasthan	RVPNP, POWRGRID	13-May-24	07:11	i)400/220kV Bhiwadi(PG) has one and half breaker bus arrangement at 400kV side and double main and transfer bus scheme at 220kV side. ii)During antecedent condition, 500 KV HVDC Balia-Bhiwadi (PG) ckt-1 & ckt-2 were carrying approx. 200 MW each. iii)As reported, at 07:11hrs, B-N phase to earth fault occurred (exact location of fault yet to be received). iv)As per DR of Bhiwadi(RS) end, 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 and 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt tripped from Bhiwadi(RS) end only on back up E/F protection operation. Line didn't trip from Bhiwadi(PG) end. v)At the same time, 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) D/C, 400KV Bhiwadi-Neemrana (PG) Ckt-1, 400 KV Bassi-Bhiwadi (PG) Ckt, 500 KV HVDC Balia-Bhiwadi (PG) D/C, 220 KV Neemrana(PG)-Neemrana(RS) (RS) Ckt-1 and 220kV lines from Bhiwadi(PG) to Rewari(HV) (HV) D/C, HSIIDC Bawal(HV), Mau(HV) also tripped (exact reason for multiple elements tripping yet to be received). vi)As per PMU at Bhiwadi(PG), at 07:11 hrs, B-N phase to earth fault with no A/R operation is observed with delayed fault clearing time of 1480ms. vii)As per SCADA, change in demand of approx. 136MW in Rajasthan control area is observed.	0	136	1480

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)
					Date	Time		Generation Loss(MW)	Load Loss (MW)	
7	GI-2	1)500 KV HVDC Mahindergarh(APL) Pole-1 2)500 KV HVDC Mahindergarh(APL) Pole-1	Haryana	ADANI	17-May-24	16:21	i)During antecedent condition, 500 KV HVDC Mundra-Mahindergarh(APL) bipole was carrying total ~1500MW. ii)As reported, at 16:21 hrs, 500 kV HVDC Mundra-Mahindergarh(APL) bipole blocked due to RPC No AC Filter alarm raised at Mohindergarh end. After thorough investigation, it was observed that RCI changeover has been initiated from RCI B to RCI A ACTIVE and after that "RPC SET RANGE EXCEED" event triggered followed by RPC NO AC FILTER, which caused blocking of both the Poles. iii)As per PMU at Mahinedergarh(PG), no fault in system is observed, fluctuation voltage is observed. iv)Due to blocking of both the poles of 500 KV HVDC Mundra-Mahindergarh(APL), there was power order reduction of ~1500MW. As per HVDC Mundra-Mahendergarh SPS, SPS case-3 would have operated and as per action in this case, load relief in UP, Haryana, Punjab, Rajasthan & Delhi and generation relief at Mundra Stage-III is desired. v) Details of load relief not received from SLDCs. Communication has been sent to all the SLDCs to share the quantum of load relief occurred in their respective control area due to SPS operation. SCADA data at NRLDC was not healthy during the event time. vi) As per detail BCU log of Mahindergarh end, DTPC fail alarm is recorded except Dhanonda. Any communciation related issue need to be rectified at the earliest to ensure proper SPS operation. vii) Both RCI System was restarted and the system was normalized			NA
8	GD-1	1)400 KV Tehri(THDC)-Koteshwar(PG) (PG) Ckt-1 2)400 KV Tehri(THDC)-Koteshwar(PG) (PG) Ckt-2	Uttarkhand	THDC, POWERGRID	17-May-24	17:21	i)400kV Tehri(THDC) has double main bus scheme. ii)During antecedent condition, 250 MW TEHRI HPS – UNIT- 1, 2, 3 & 4 were not in service. iii)As reported, at 17:21 hrs, 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1 tripped on Y-B phase to phase fault. Fault distance was ~2.8km from Tehri(THDC) end. At the same time, 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2 tripped from Koteshwar(PG) end only. iv)As per DR of Tehri end of 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1, directional earth fault started followed by sensing Y-B-N fault in Z-1. Fault current was Iy=~4.9kA, Ib=~4.2kA. Total fault clearance time was ~760ms.. v)As per DR of Tehri end of 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2, distance protection sensed Y-B-N fault in Z-4, no tripping was initiated. Fault current was Iy=~4.8kA, Ib=~4.0kA. vi)As per PMU at Koteshwar(PG), Y-N phase to earth fault converted into Y-B phase to phase fault is observed with delayed fault clearance time of 760ms is observed. vii) As per SCADA no load loss/generation loss is observed during the tripping event (there was no generation at Tehri HEP during the event).	0	0	760
9	GD-1	1)400/220 kV 315 MVA ICT 6 at Gr.Noida(UP) 2)220kV Gr. Noida – Noida Sec 20 ckt-1 3)220kV Gr. Noida – Noida Sec 20 ckt-2 4)220kV Gr. Noida – Noida Sec 129 ckt 5)220kV Greater Noida - Jalpura ckt	Uttar Pradesh	UPPTCL	18-May-24	17:25	i)400/220kV Gr. Noida S/s has double main transfer bus scheme and feeds 220/132kV Noida Sec20, Noida RC Green, Noida Sec 129 substations through 220kV feeders. ii)As reported, at 17:25hrs, B-ph CT at Gr. Noida end of 220kV Gr. Noida – Noida sec 20 ckt-1 damaged and R-ph isolator arm of 220kV Gr. Noida – Noida sec 20 ckt-1 also broked. iii)As per PMU at Dadri Thermal(NTPC), B-N and R-N fault with delayed clearance in ~600msec is observed. iv)On this fault, 220kV Gr. Noida – Noida sec 20 D/C tripped and supply to Noida Sec 20 S/s lost. v)At the same time, 400/220 kV 315 MVA ICT 6 at Gr.Noida(UP) tripped on of PRD (Pressure Relief Device) and OSR (Oil Surge Relay) protection operation. vi)As per SCADA SOE at NRLDC, 220kV Gr. Noida – Noida Sec 129 ckt and 220kV Greater Noida - Jalpura ckt also tripped at the same time. vii)As per SCADA, total change in demand of approx. 860MW occurred in UP contro, area. viii)Partial supply of Noida Sec 20 restored at 18:00 hrs from 132KV Noida Sec 45 and at 18:06 hrs from Noida Sec 66.	0	860	600
10	GI-2	1) 400/132 kV 200 MVA ICT 1 at Masoli(UP) 2) 400/132 kV 200 MVA ICT 2 at Masoli(UP) 3) 400/132 kV 200 MVA ICT 3 at Masoli(UP) 4) 125 MVAR Bus Reactor No 1 at 400 KV Masoli(UP) 5) 132kV Masoli-Karchhana (UP) ckt 6) 132kV Masoli-Naini (UP) ckt	Uttar Pradesh	UPPTCL	29-May-24	15:57	i)400/132kV Masoli(UP) S/s has one and half breaker bus scheme at 400kV voltage level side. ii)During antecedent condition, loading of 400/132 kV 200 MVA ICT 1,2&3 at 400/132kV Masoli(UP) was approx. 162MW (approx. 54MW for each ICT) (As per SCADA). iii)As reported, at 15:57 hrs, during inclement weather condition, towers of 132kV feeders to Naini and Karchhana from Masoli(UP) damaged which created B-N phase to earth fault on 132kV Masoli-Naini (UP) ckt followed by Y-N phase to earth fault on 132kV Masoli-Karchhana (UP) ckt. iv)B-N phase to earth fault on 132kV Masoli-Naini (UP) ckt cleared instantaneously (within 120msec as per PMU). CB of 132kV Masoli-Karchhana (UP) ckt could not open from Masoli(UP) end on Y-N phase to earth fault. v)As CB of 132kV Masoli-Karchhana (UP) ckt failed to open, fault cleared with the tripping of 400/132 kV 200 MVA ICT 1,2&3 and 125 MVAR Bus Reactor at Masoli(UP) tripped on O/C E/F protection operation. vi)As per PMU at Allahabad(PG), B-N followed by Y-N phase to earth fault is observed with fault clearing time of 120msec and 840msec respectively. vii)As per SCADA, change in demand of approx. 94MW is observed in UP control area. However, 100MW load loss is reported by SLDC-UP in UP control area.	0	100	840
11	GI-1	1)220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-1 2)220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-2 3)220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-3 4)220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-4 5)220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-1 6)220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-2 7)220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-3 8)220 KV Panipat(BB)-Chajpur(HV) (HVPNL) Ckt-1 9)220 KV Panipat(BB)-Chajpur(HV) (HVPNL) Ckt-2 10)220 KV Panipat-Dhulkote (BB) Ckt-1 11)220 KV Panipat-Dhulkote (BB) Ckt-2 12)220 KV Panipat-Charkhi Dadri (BB) Ckt 13)220 KV Panipat(BB)-Pipli Ckt 14)400/220kV 450 MVA ICT-1 at Panipat(BB) 15)400/220kV 500 MVA ICT-2 at Panipat(BB) 16)220/132kV 100 MVA ICT-1 at Panipat(BB) 17)220/132kV 100 MVA ICT-2 at Panipat(BB) 18)220/33kV 60 MVA ICT-1 at Panipat(BB) 19)220/33kV 60 MVA ICT-2 at Panipat(BB)	Haryana	BBMB, HVPNL, DTL	3-Jun-24	00:38	i)As reported, at 00:38 hrs, bursting of B-ph CT of 220kV bus coupler-2 at Panipat(BB) end occurred which created B-N phase to earth fault in busbar differential zone. The reason of bursting of the B-ph CT was observed to be some internal fault in Heptacare make CT installed on the bay on 29th November 2018. ii)The Numerical low Impedance type MiCom P741 Bus-Bar Differential Protection Scheme (ALSTOM make) sensed the fault and operated tripping all the elements on either side of bus coupler i.e. 220kV Bus-1 & Bus-2 at Panipat(BB). iii)As per PMU at Panipat(BBMB), Y-N phase to earth fault is observed with fault clearing time of 120ms. (phase sequence issue observed) iv)As per SCADA, load loss of approx. 565 MW (~445 MW in Haryana and ~120 MW in Delhi control area) is observed. v)As reported by BBMB, 220kV Bus-1 at Panipat(BB) was charged by closing A-17 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-1 at 01:26 hrs and 220kV Bus-2 at Panipat(BB) was charged by closing A-18 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-2 at 01:36 hrs. vi)As remedial action taken, on 03rd June 2024 an old and used Rade Koncar make CT of same ratio i.e. 1200/1-1-1-1-1A was tested thoroughly and installed in place of bursted CT and bus coupler-2 was charged at 17:38 hrs on 03rd June 2024.	0	565	120
12	GI-2	1)400 KV Akal-Jodhpur (RS) Ckt 2)400/220 kV 315 MVA ICT 3 at Akal(RS) 3)400/220 kV 500 MVA ICT 4 at Akal(RS) 4)220kV Akal-Lala (RS) ckt 5)220kV Akal-Mulana (RS) ckt 6)220kV Akal- Rajgarh (RS) ckt 7)220kV Akal- Amarsagar (RS) ckt 8)220kV Akal- Giral (RS) ckt 9)220kV Akal- Bhensara(RS) ckt-1 10)220kV Akal- Dangri (RS) ckt-1 11)220kV Akal- Dangri (RS) ckt-2 12)400 KV Akal-Kankani (RS) Ckt 13)400 KV Akal-Jaisalmer2(Bhainsra) (RS) Ckt 14)400 KV Akal-Barmer (RS) Ckt	Rajasthan	RVPNL	8-Jun-24	19:53	i)As reported, at 19:53hrs, due to heavy thunderstorm weather condition, B-ph jumper of dead end tower of 220 kV Akal-Lala (RS) line got earthed at distance of 46.77 meter from Akal(RS) S/s which caused B-N phase to earth fault on 220 kV Akal-Lala (RS) ckt with fault current of Ib=~25kA from Akal(RS) end. As per DR at Akal(RS) end of 220 kV Akal-Lala (RS) ckt, R-N phase to earth fault in zone-1 with fault current of Ir=~25.4kA is observed (phase sequence issue). ii)As reported, during the same time, due to very high fault current, 400/220 kV 315 MVA ICT-3 and 400/220 kV 500 MVA ICT-4 tripped instantaneously on High Set overcurrent protection operation at Akal (RS) S/s. 400 KV Akal-Jodhpur (RS) Ckt also tripped from Akal(RS) end on zone-5 (reverse) distance protection operation (not tripped from the remote end). Tie CB of 400/220kV 315MVA ICT-3 also opened along with tripping of 400/220kV 315MVA ICT-3 which separated 400kV Bus-1 & Bus-2. iii)As reported, at the same time, Bus coupler of 220kV Bus-1 & Bus-2 and all 220kV lines (Mulana, Rajgarh, Amarsagar, Giral, Bhensara(RS) ckt-1, Dangri ckt-1 & ckt-2) connected to 220kV Bus-2 at Akal(RS) S/s also tripped (exact reason of tripping yet to be shared). Due to tripping of Bus coupler, 220kV Bus-1 and Bus-2 separated at Akal(RS). iv)As reported, further at 19:55 hrs, due to bad weather conditions, Y-N phase to earth fault occurred on 400 KV Akal-Kankani (RS) ckt & 400 KV Akal- Jaisalmer2(Bhainsra) (RS) ckt (D/C lines on same tower) at a distance of approx. 3km from Akal(RS) S/s which led to tripping of both the mentioned lines (exact operation of protection yet to be shared). v)As reported, due to tripping of 400 KV Akal-Kankani (RS) ckt & 400 KV Akal- Jaisalmer2(Bhainsra) (RS) ckt, high voltage was observed on the 400 KV Akal-Barmer (RS) Ckt and line voltage reached up to 436kV on the same line and 400 KV Akal-Barmer (RS) Ckt tripped from Barmer(RS) end on over-voltage protection operation and also from Akal(RS) end on receiving DT from Barmer(RS) end. vi)Due to tripping of 400 KV Akal-Barmer (RS) Ckt, 400kV Bus-1 lost its connectivity from grid and 400kV Bus-1 and elements connected to 400kV Bus-1 (400/220 kV 500 MVA ICT-1 & 2, 220kV Bus-1 and 220kV lines connected to 220kV Bus-1) became dead at Akal(RS) S/s. vii)After all the above mentioned tripping events, only 400kV Bus-2 remain charged through 400kV Akal-Ramgarh (RS) D/C. viii)As per PMU at Jodhpur(RS), B-N phase to earth fault with delayed fault clearance time of 1080ms @19:53hrs and Y-B phase to phase fault followed by Y-N phase to earth fault with fault clearance time of 80msec and 240msec (delayed) respectively are observed. ix)As per SCADA, change in Rajasthan wind generation of approx. 168MW is observed	168	0	1080
13	GD-1	1)400/220 kV 500 MVA ICT 1 at Mandaula(PG) 2)400/220 kV 500 MVA ICT 2 at Mandaula(PG) 3)400/220 kV 500 MVA ICT 3 at Mandaula(PG) 4)400/220 kV 500 MVA ICT 4 at Mandaula(PG)	Delhi	PGCIL	11-Jun-24	14:10	i)During antecedent condition, 400/220kV 500MVA ICT-1, 2, 3 and 4 at Mandaula(PG) were carrying approx. 337MW, 337MW, 336MW and 337MW respectively with total loading of 1347MW (as reported by CPCC1, Power Grid). 104 MW GTG-1 & 2 and 122 MW STG at Pragati were generating approx. 85MW, 85MW and 109MW respectively with total generation of 279MW (as reported by SLDC Delhi). 212 MAIN BAY - 400/220 kV 500 MVA ICT-3 at Mandaula(PG) was under planned shutdown and ICT-3 was charged from transfer bus through isolator. ii)As reported, at 14:10 hrs, fire was observed in isolator (transfer bus side) of 400/220 kV 500 MVA ICT-3 at Mandaula(PG). As per DR, Ir is reduced upto ~97.2A while Iy and Ib increased upto ~1.092kA and 1.107kA respectively and imbalance occurred in the system. iii)As reported by CPCC1, Power Grid, the sequence of the event is as follows: a.At 14:10:24hrs: 400/220 kV 500 MVA ICT 2 at Mandaula(PG) tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=~615.8A, Iy=~488.8A and Ib=~498.3A before tripping of ICT-2. b.Due to tripping of ICT-2, loading of 400/220kV 500MVA ICT-1, 3 and 4 at Mandaula(PG) were increased to 457MW each. c.At 14:10:27hrs: 400/220 kV 500 MVA ICT 1 at Mandaula(PG) also tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=~1.668kA, Iy=~1.214kA and Ib=~1.237kA before tripping of ICT-1. d.Due to tripping of both ICT-1 & 2, loading of 400/220kV 500MVA ICT-3 and 4 at Mandaula(PG) were increased to 696MW each. e.At 14:10:29hrs: 400/220 kV 500 MVA ICT 3 at Mandaula(PG) hand-tripped due to melting of isolator which led to heavy sparking. f.Due to unavailability of ICT-1, 2 & 3, loading of 400/220kV 500MVA ICT-4 at Mandaula(PG) was increased to 1454MW. g.At 14:10:30hrs: 400/220 kV 500 MVA ICT 4 at Mandaula(PG) tripped on back-up over-current protection operation due to excess over-loading. As per DR, maximum current recorded was: Ir=~2.09kA, Iy=~2.136kA and Ib=~2.124kA (max MW loading of approx. 1480MW as per DR). iv)As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed. v)As per SCADA, change in demand of approx. 1572 MW in Delhi Control area and change in generation of approx. 284 MW at Pragati are observed. vi).As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed.	279	1601	2320

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)
					Date	Time		Generation Loss(MW)	Load Loss (MW)	
14	GI-2	1.135 MW Rajwest (IPP) LTPS - UNIT 2 2.135 MW Rajwest (IPP) LTPS - UNIT 4 3.135 MW Rajwest (IPP) LTPS - UNIT 5 4.135 MW Rajwest (IPP) LTPS - UNIT 6 5.135 MW Rajwest (IPP) LTPS - UNIT 8	Rajasthan, Uttar Pradesh & Punjab	RVUNL	19-Jun-24	12:42	i)During antecedent condition, low voltage scenario was prevailing in mainly Rajasthan, Delhi and UP control area. As per SCADA, voltage at 400kV Bikaner(RS), Bhadla(RS), Bhinmal(RS) and Kankani(RS) were 377kV, 382kV, 379kV and 375kV respectively. i)As per PMU at Bhadla(PG), at 12:42:03:760 hrs, 3-phase to ground fault ia observed with fault clearing time of (exact location of the fault yet to be shared). Voltage dipped upto 0.835 p.u. at Bhadla(PG). ii)As per SCADA, total NR RE generation drop/loss was approx. 4930MW (ISTS Solar: ~3490 MW, Rajasthan Solar: ~843 MW, Rajasthan Wind: ~597 MW). iii)As per SCADA, total change in demand of approx. 1215 MW (Punjab: ~730 MW, UP: ~180 MW, Rajasthan: ~305 MW) is observed in NR control area. iv)As per PMU at Bassi(PG), frequency dropped by 0.409Hz (from 50.062 Hz to 49.653 Hz) due to significant dip in RE generation. Frequency recovered upto 49.865 Hz within 1 minute. v)As per details received from SLDCs, total load relief of approx. 1050 MW observed in NR region (Punjab: ~723 MW, UP: ~220MW, Rajasthan: ~107 MW) on df/dt operation. vi)Due to significant dip in RE generation (as RE generation failed to recover 90% of pre-fault active power within 1 sec and further inverters tripping on OV, LVRT/HVRT Non-compliant), over voltage (1.075pu at 400kV Bhadla(PG)) scenario occured immediately after the fault. vii)At the same time, 135 MW Rajwest (IPP) LTPS - UNIT 2, 4, 5, 6 and 8 also tripped due to "sudden change in speed protection" in turbine operated (protection logic: if 2 out of 3 sensors in turbine senses change in speed more than 20 rpm within 10ms then it sends tripping signal to turbine), as reported (further details yet to be received). viii)As per SCADA, generation loss of approx. 600 MW occurred at Rajwest(RS) LTPS.	5530	1050	80
15	GI-1	1)220 KV KSTPS-Ranpur (RS) ckt 2)220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 3)220 KV KSTPS-Kota Sakatpura (RS) ckt-3 4)110 MW Unit-1 at KTPS(RS) 5)210 MW Unit-3 at KTPS(RS) 6)210 MW Unit-4 at KTPS(RS) 7)210 MW Unit-5 at KTPS(RS) 8)195 MW Unit-7 at KTPS(RS) 9)220 KV Duni(RS)-Kota(PG) (RS) Ckt	Rajasthan	RVPNL, RVUNL, PGCIL	21-Jun-24	11:37	i)220kV KTPS(RS) has double main Bus arrangement at 220kV side. ii)During antecedent condition, power generation of 110 MW Unit-1 & 2, 210 MW Unit-3, 4 & 5 and 195 MW Unit-6 & 7 were 81MW, 95MW, 174MW, 150MW, 167MW, 171MW & 172MW respectively. 210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3 & station transformer (ST)-3 were connected to 220kV Bus-3 and 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 were connected to 220kV Bus-5 at KTPS(RS). 220kV Bus-3 and Bus-5 were coupled through isolator only. iii)As reported, at 11:37hrs, due to inclement weather conditions, 220 KV KSTPS-Ranpur (RS) ckt tripped on R-Y phase to phase fault at a distance of 12.49km from KTPS(RS) end. Zone-1 distance protection operated from both ends. As per PMU, R-N followed by Y-N phase to earth fault is observed with fault clearing time of 120ms and 120ms. iv)As reported, at 11:39hrs, due to inclement weather conditions, 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 tripped on B-N phase to earth fault (Ib=~ 14.1kA & Ib=~11.7kA from Kota(PG) and KTPS(RS) ends respectively) at a distance of 2.96km from Kota(PG) end. Zone-1 distance protection operated from Kota(PG) end. However, B-phase CB pole lagged in opening while clearing the fault from KTPS(RS) end which led to LBB protection operation at KTPS(RS). As per PMU, B-N phase to earth fault with delayed fault clearing time of 320msec is observed. v)Sine 220kV bus-3 & bus-5 were coupled through isolator only, due to LBB operation all elements connected to 220kV bus-3 & bus-5 tripped (210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3, ST-3, 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1). vi)Due to tripping of ST-3, auxiliary supply of 110 MW Unit-1 and 210 MW Unit-3 & 4 disrupted which led to tripping of Unit-1, 3 & 4 at KTPS(RS) vii)At the same time, 220 KV Duni(RS)-Kota(PG) (RS) Ckt also tripped on R-N phase to earth fault (Ir=~21kA & Ir=~1.3kA from Kota(PG) and Duni(RS) end respectively) with fault distance of 75.2km from Kota(PG) end. Fault sensed in zone-1 from both ends. As per PMU, multiple R-N phase to earth fault with fault clearing time of 120ms, 120ms and 80ms. viii)As per SCADA, no change in demand in Rajasthan control area is observed. ix) As per SCADA, approx. 714 MW generation loss at KTPS(RS). However, 744 MW generation loss at KTPS(RS) is reported by SLDC-Rajasthan. x)As reported, the case for installation of bus coupler CB between 220kV Bus-3 and Bus-5 at KTPS(RS) is under process.	0	744	320

Utilities are requested to prepare detailed analysis report and present the event details during 51st PSC meeting. Events involving more than one utility may be jointly prepared and presented.

Multiple elements tripping at 220kV Hissar(BB) 07th May 2024

Brief of event:

i. 220/132/33kV Hissar(BB) S/s has double main bus scheme at 220kV level.
ii. During antecedent Condition, all the 220kV feeders (Chirawa ckt, Jindal Steel ckt, Sangrur ckt-1 & 2, Bhiwani ckt-1 & 2, Hissar I/A ckt-1 & 2) and 220/132kV 100MVA ICT-1, 2 & 3 were connected to 220kV Bus-1. 220kV Bus-2 was not in service.
iii. As reported, at 11:16 hrs R-ph jumper of 220 KV Hissar-Sangrur (BB) Ckt-1 snapped from common point of 220kV Bus isolator no. 223 & 224 at Hissar(BBMB) S/s which caused R-N phase to earth fault.
iv. As reported, on this fault, Bus bar relay at 220kV Hissar(BBMB) didn't operate. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 & 2 tripped in Zone-4 from Hissar(BB) end and other all 220kV feeders (Chirawa ckt, Jindal Steel ckt, Sangrur ckt-1 & ckt-2, Bhiwani ckt-1 & ckt-2) tripped from the remote ends in Zone-2 protection operation.
v. During the same time 220 KV Barnala-Sangrur(BB) Ckt also tripped (exact reason of tripping need to be shared).
vi. As per DR of 220 KV Hissar(BB)-Hissar IA(HV)(end) (BBMB) Ckt-2, R-N phase to earth fault (fault current Ir=~7.4kA) is observed in zone-4 with fault clearing time of 360ms.
vii. As per DR of 220 KV Hissar-Sangrur(end) (BB) Ckt-1, R-N phase to earth fault converted into R-Y phase to phase fault (fault current Ir=~1.3kA, Iy=~1.3kA) is observed in zone-2 with fault clearing time of 560ms.
viii. As reported, Isolator status of 220 KV Hissar-Sangrur (BB) Ckt-2 provided in the Bus bar relay settings were incorrect (status of isolator no. 227 & 228 were incorrect). Due to this, false differential current generated in Bus Bar

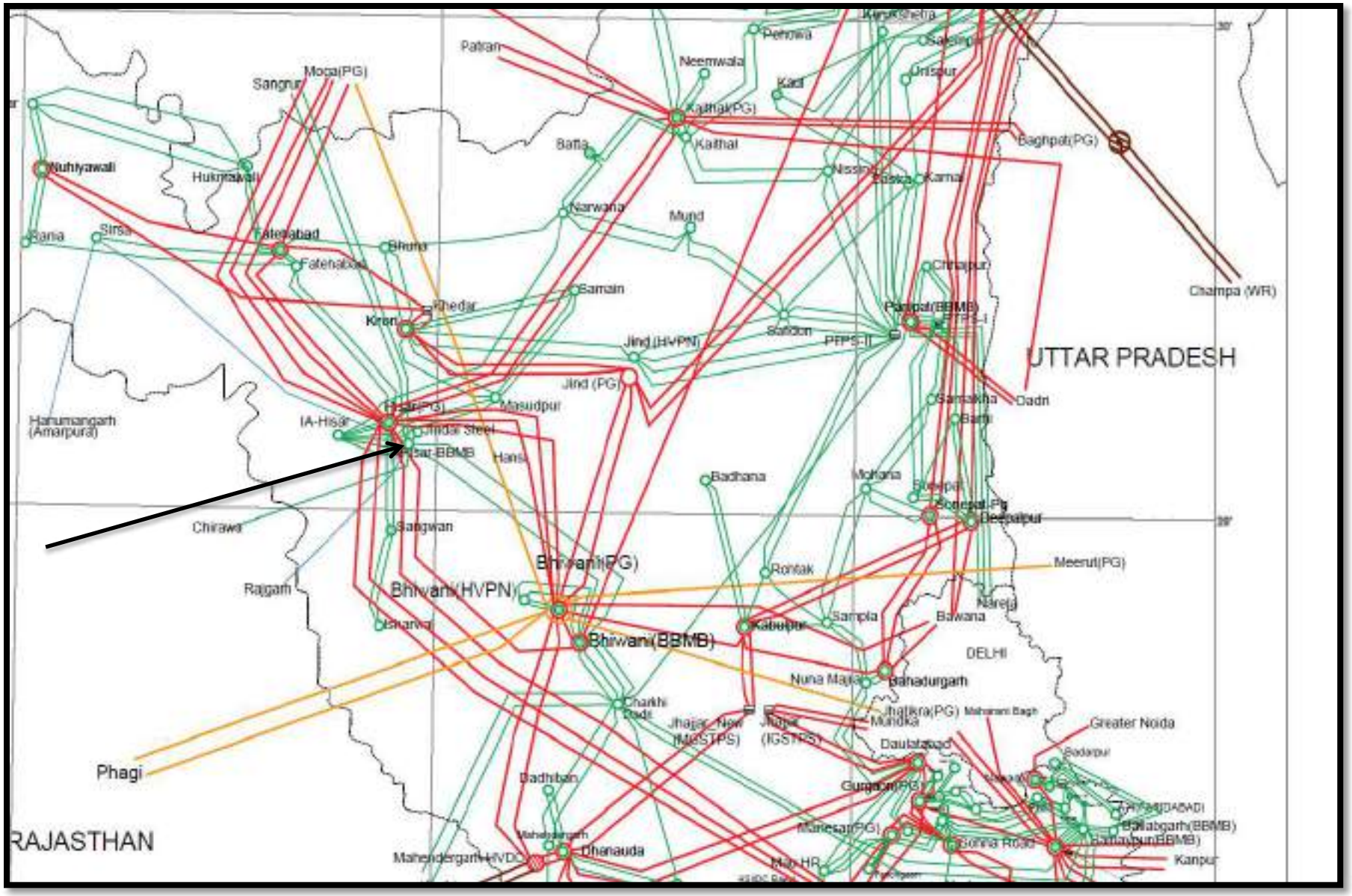
Brief of event:

ix. Z-2 and differential current supervision feature of relay picked up which led to blocking of Bus bar relay.
x. Due to tripping of all the elements connected to 220kV Bus-1 (220kV Bus-2 was not in service) at Hissar(BB), the complete 220/132/33kV Hissar(BB) S/s became dead.
xi. As per PMU at Hissar(PG), R-N phase to earth fault with fault clearing time of 360ms (delayed) is observed.
xii. As per SCADA, change in demand of approx. 150MW is observed in Haryana control area. But as reported by BBMB, load loss of 207MW occured in Haryana control area.

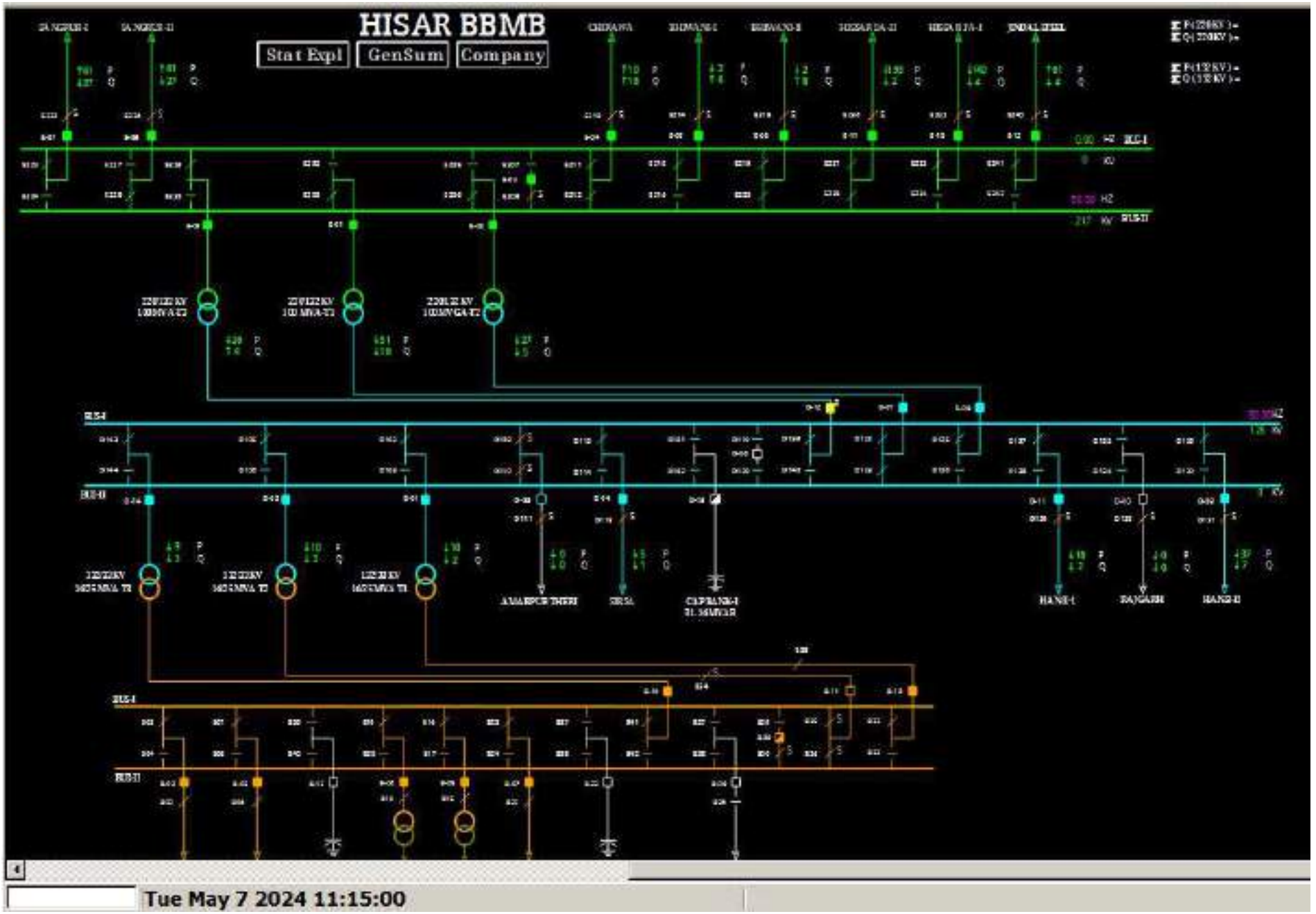
Elements tripped:

i. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1
ii. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-2
iii. 220 KV Bhiwani-Hissar (BB) Ckt-1
iv. 220 KV Bhiwani-Hissar (BB) Ckt-2
v. 220 KV Hissar-Sangrur (BB) Ckt-1
vi. 220 KV Hissar-Sangrur (BB) Ckt-2
vii. 220 KV Hissar(BB)-Jindal Steel(HR) (HVPNL) Ckt
viii. 220 KV Hissar(BB)-Chirawa(RS) (BB) Ckt
ix. 220 KV Barnala-Sangrur(BB) Ckt
x. 220KV Bus 1 at Hissar(BB)

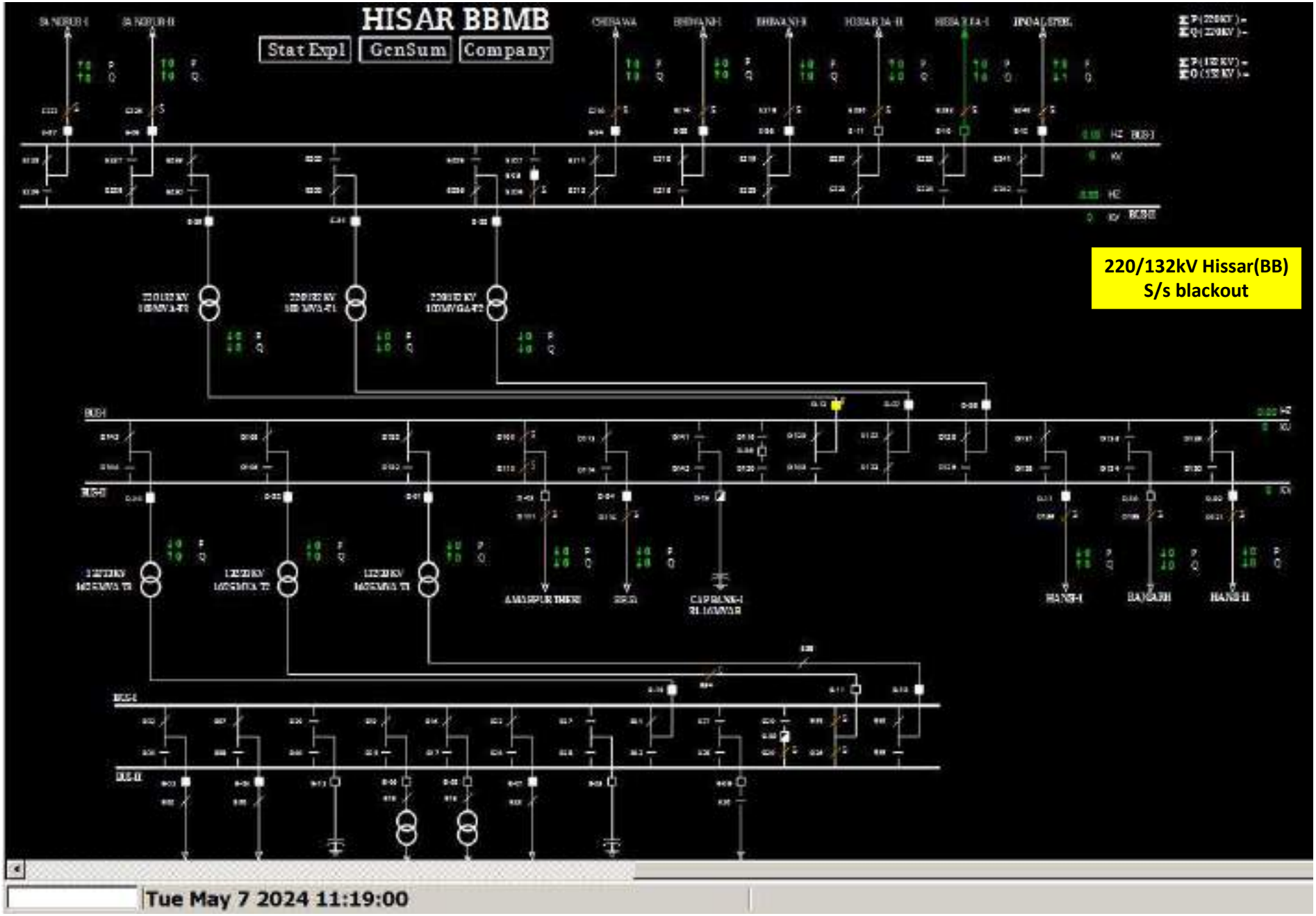
Network diagram



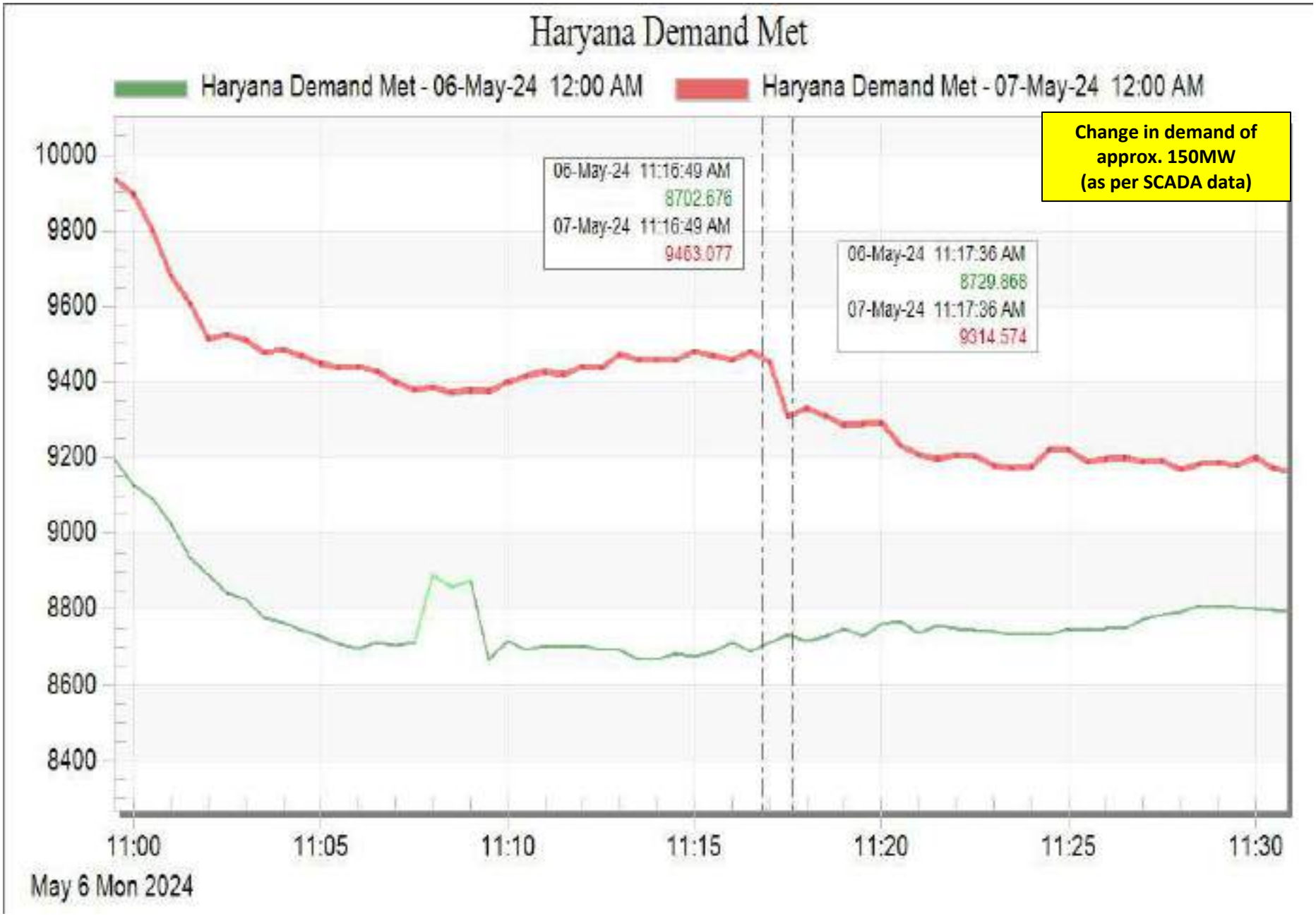
SLD of 220/132kV Hissar(BB) before the event



SLD of 220/132kV Hissar(BB) after the event



Haryana demand during the event

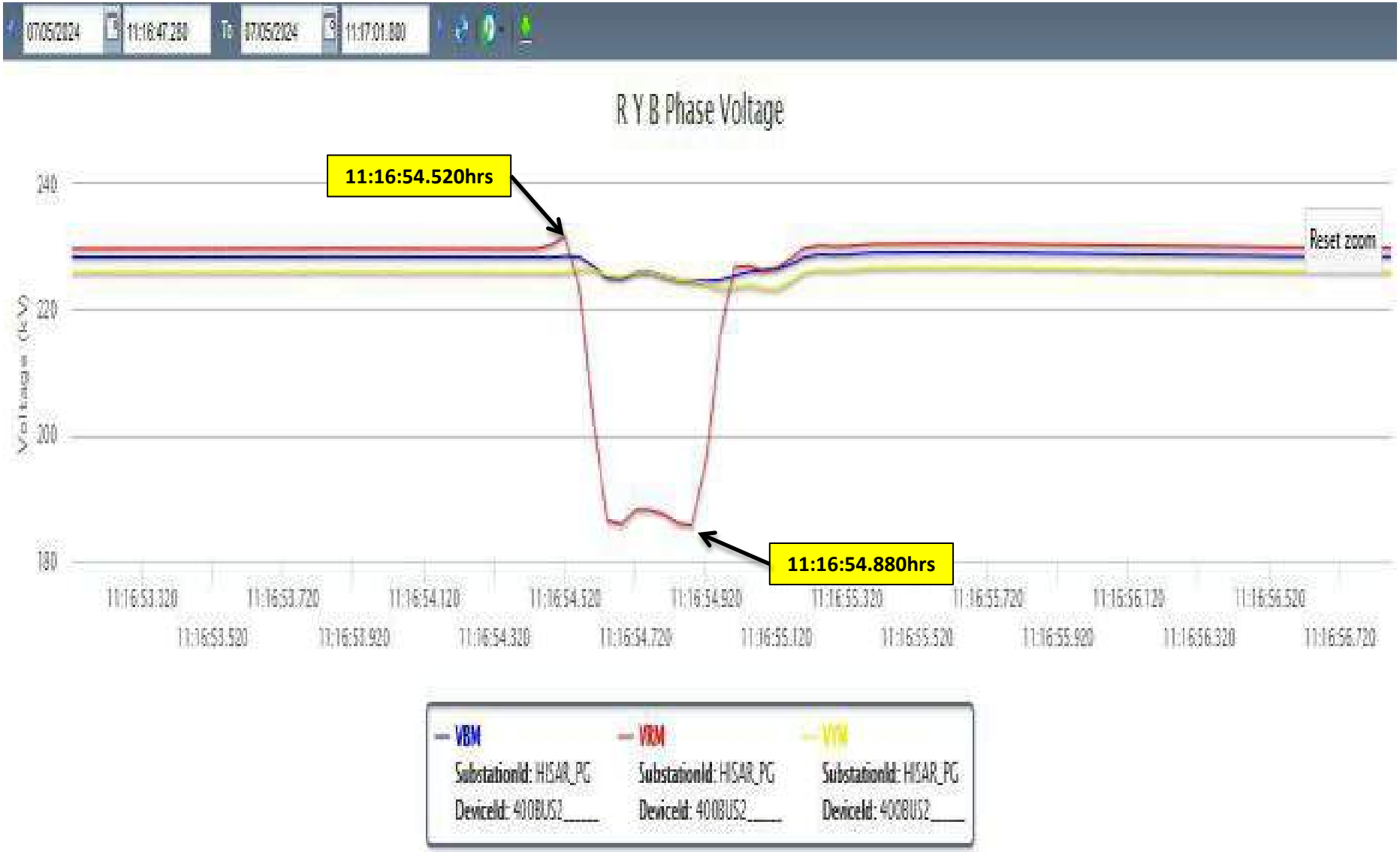


PMU Plot of frequency at Hissar(PG)

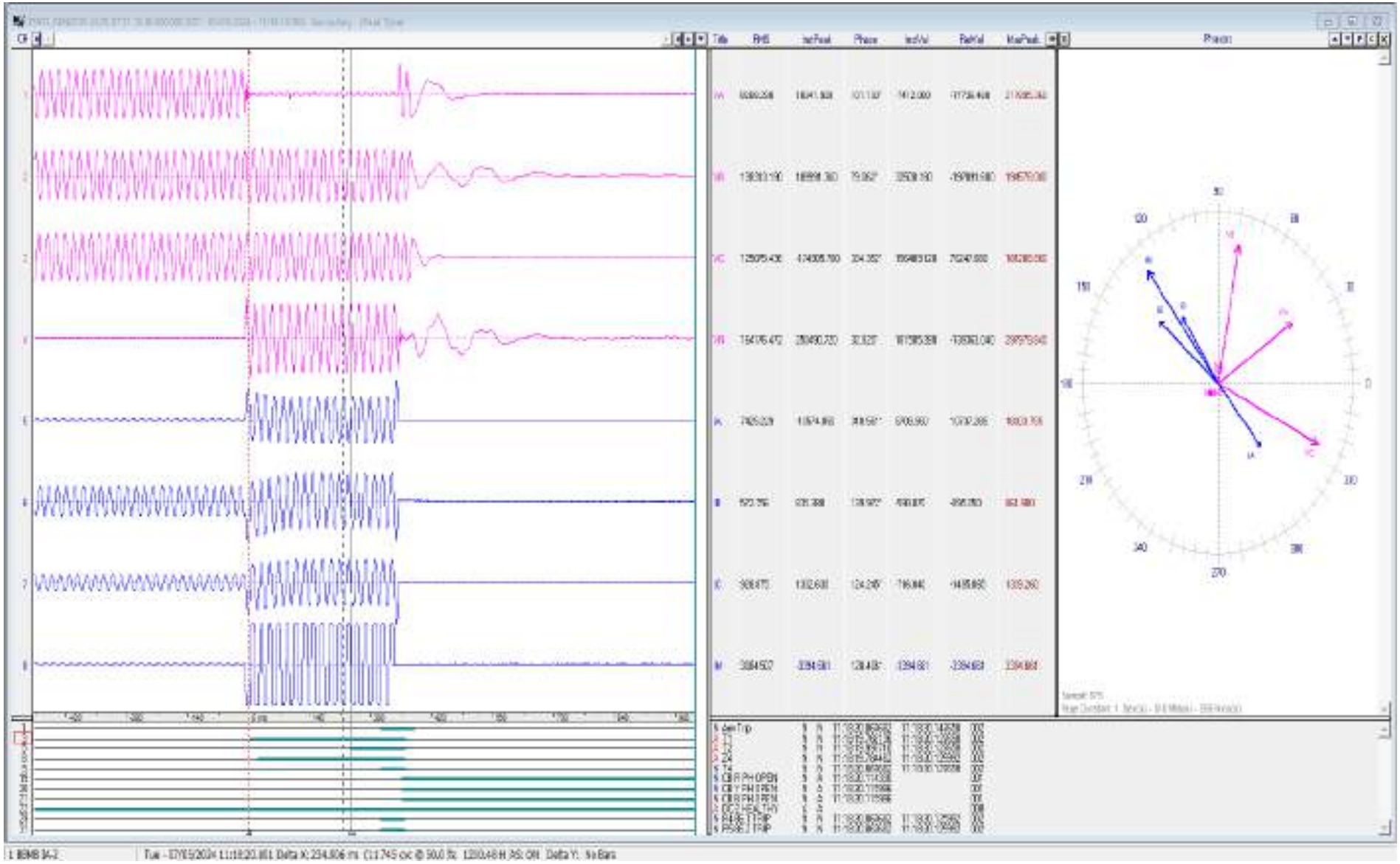
11:16hrs/07-May-24

PMU Plot of phase voltage magnitude at Hissar(PG)

11:16hrs/07-May-24

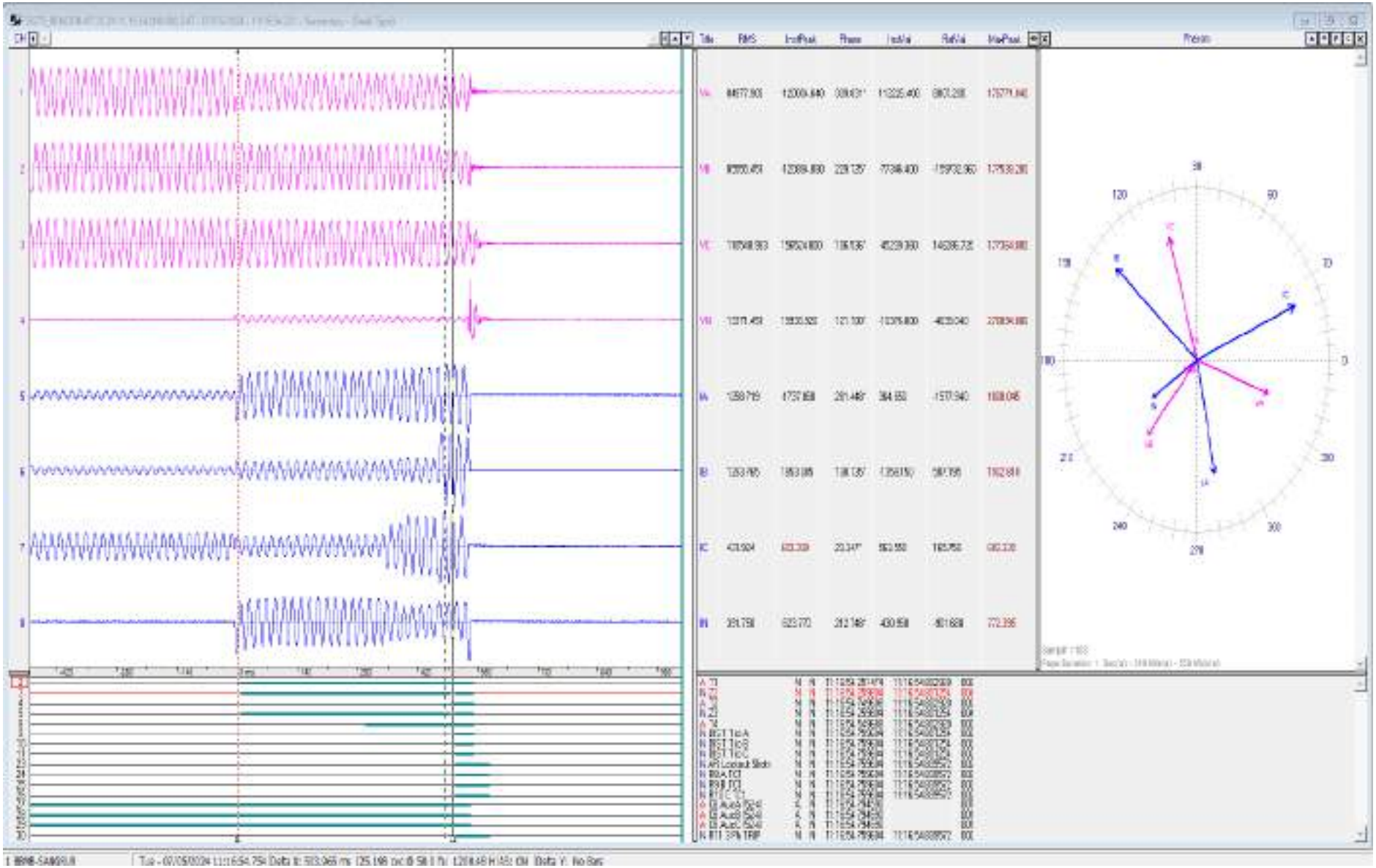


DR of 220 KV Hissar(BB)-Hissar IA(HV)(end) (BBMB) Ckt-2 (11:16hrs)



R-N phase to earth fault. Ir=~7.4kA. Fault clearing time=360ms. Fault sensed in zone-4.

DR of 220 KV Hissar-Sangrur(end) (BB) Ckt-1 (11:16hrs)



R-N phase to earth fault converted into R-Y phase to phase fault. Ir=~1.3kA, Iy=~1.3kA. Fault clearing time=560ms. Fault sensed in zone-2.

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
11:16:54,876	HISAR_BB	33kV	06TRFR	Circuit Breaker	Open	CB at Hissar(BB) end of 4MVA 33/11kV ICT opened from 33kV side
11:16:54,982	HISAR_BB	220kV	10HISAR1	Circuit Breaker	Open	Line CB at Hissar(BB) end of 220 KV Hissar(BB)-Hissar IA(HV) (BBMB) Ckt-1 opened
11:16:54,987	HISAR_BB	220kV	11HISAR2	Circuit Breaker	Open	Line CB at Hissar(BB) end of 220 KV Hissar(BB)-Hissar IA(HV) (BBMB) Ckt-2 opened
11:16:54,987	HISAR_HS	220kV	04HISBB2	Circuit Breaker	Open	Line CB at Hissar IA(HV) end of 220 KV Hissar(BB)-Hissar IA(HV) (BBMB) Ckt-2 opened
11:16:54,989	HISAR_BB	33kV	05TRFR	Circuit Breaker	Open	CB at Hissar(BB) end of 2MVA 33/11kV ICT opened from 33kV side
11:16:55,036	BHIWN_BB	220kV	01HISAR1	Circuit Breaker	Open	Line CB at Bhiwani(BB) end of 220 KV Bhiwani(BB)-Hissar(BB) (BBMB) Ckt-1 opened
11:16:55,207	SNGRU_BB	220kV	04HISAR2	Circuit Breaker	Open	Line CB at Sangrur(BB) end of 220 KV Hissar-Sangrur (BB) Ckt-2 opened
11:16:55,207	SNGRU_BB	220kV	03HISAR1	Circuit Breaker	Open	Line CB at Sangrur(BB) end of 220 KV Hissar-Sangrur (BB) Ckt-1 opened
11:16:55,256	BHIWN_BB	220kV	02HISAR2	Circuit Breaker	disturbe	
11:16:55,270	BRNLA_BB	220kV	01SNGRR	Circuit Breaker	Open	Line CB at Barnala(BB) end of 220 KV Barnala-Sangrur (BB) Ckt opened

Point of discussion

- Bus bar differential relay settings need to be reviewed and correct operation of the same need to be ensured.
- Reason of delayed clearance of fault need to be analysed and shared.
- Exact reason of tripping of 220 KV Barnala-Sangrur(BB) Ckt need to be shared.
- DR/EL (.dat/.cfg file) of all the tripped elements along with tripping report of the event need to be shared (from Haryana end).
- Remedial action taken report to be shared.

MULTIPLE TRIPPING ANALYSIS REPORT

ANALYSIS REPORT OF MULTIPLE TRIPPING AT BBMB HISAR SUB- STATION ON DATED 07/05/2024

BRIEF INTRODUCTION

- At 11:18 hrs. of dated 07/05/2024, 07 nos. 220 kV feeders i.e. 220 kV Hisar IA Ckt. I & II, 220 kV Hisar-Bhiwani Ckt. I & II, 220 kV Hisar-Sangrur Ckt. I & II, 220KV Hisar-Chirawa S/C tripped due to snapping of Red phase jumper of 220 kV Hisar-Sangrur Ckt.-I from common point of 220 kV Bus isolator no. 223 & 224.
- 220 kV Bus-II was under approved shutdown.

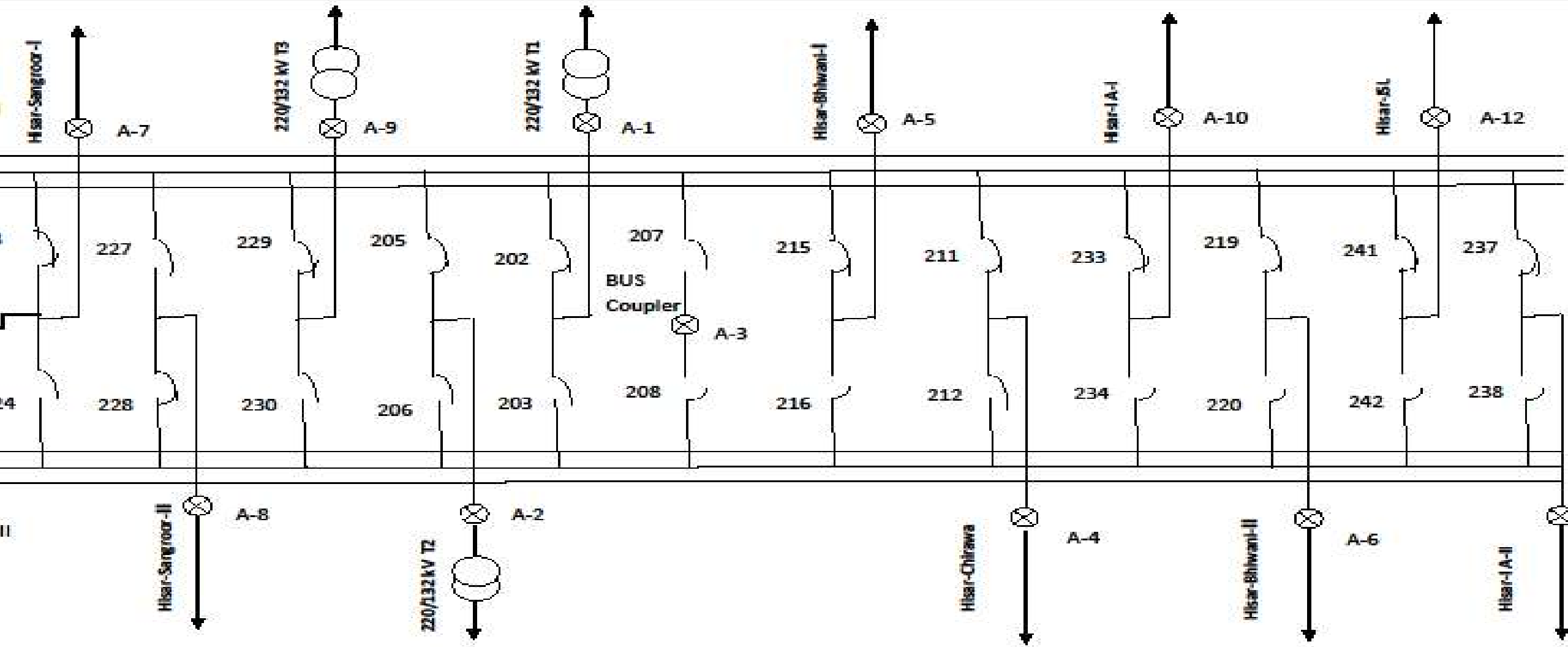
Tripped Grid Element

Sr. No.	Tripped Grid Element	Date / Time of Tripping (As per Event report)
1.	220kV HISAR- IA Ckt-1&2	07/05/2024 / 11:18 hrs.
2.	220kV HISAR- Bhiwani Ckt-1& 2	07/05/2024 / 11:18 hrs.
3.	220kV HISAR-SANGRUR CKT-1&2	07/05/2024 / 11:18 hrs.
4.	220kV HISAR-CHIRAWA S/C	07/05/2024 / 11:18 hrs.

NGLE LINE DIAGRAM SHOWING POSITION OF 220 KV MULTIPLE FEEDER TRIPPED DUE T

SNAPPING OF RED PHASE JUMPER of 220 kV HISAR SANGRUR CKT-1 ON THE COMMON

POINT OF 220 KV BUS ISOLATOR AT 11:18 HRS DATED : 07/05/2024 AT 220 KV SUB-STATION, BBMB, HISAR



Location and type of fault

- Tripping occurred due to snapping of Red Phase jumper from common point of 220 kV Bus isolator no. 223 & 224 of 220 kV Hisar-Sangrur Ckt.-I.

Detailed Analysis

- On dated 07/05/2024, there was an approved shut down on 220 kV Bus-2 along with 220 kV Bus Coupler at 220 kV Hisar Sub Station. The operations for load shifting to 220 kV Bus-1 were completed at 09:00 hrs. (approx.). At 11:18 hrs, Red Phase jumper of 220 kV Hisar-Sangrur ckt-1 on common point of Bus isolater no. 224 of Bus-2 and Bus isolator no. 223 of Bus-1 was snapped thereby creating earth fault.

- Bus-Bar relay at 220 kV Sub Station BBMB Hisar was not operated at that time. The fault was cleared by tripping of Hisar-IA Ckt-1&2 from this end due to operation of DP relay in Z-4 and other 220 KV ckts. from other end in Z-2. As per the DR extracted from Bus-Bar relay, max. differential current in R-phase measured by Check Zone, Main Zone-1 & Main Zone-2 was 23.347, 22.479 and 1.060 respectively.

- Bus-Bar DR\.CFG

- Max. restraining current in R-phase measured by Check Zone, Main Zone-1 & Main Zone-2 was 0.572, 19.11 and 0.838 respectively. Check Zone was operated instantly. However Bus-Bar Main zone was not operated. After checking from the events of Bus-Bar relay, it has been found that isolator status for 220 kV Hisar-Sangrur ckt.-II provided in Bus-Bar relay were incorrect i.e. isolator no. 228 was close (connected to Bus-II) and isolator 227 was open (connected to Bus-I).

- Bus-Bar events\.csv

- In actual Bus-II was under Shutdown i.e. isolator no. 228 was open and isolator 227 was close which were showing correct in BCU status. Due to this, false differential current was generated in Bus Bar Z-2 and Differential current supervision feature of Bus-Bar relay picked up thereby blocking the operation of Bus Bar relay. However, other protection system operated correctly as per their settings.

Summary

- Damaged Red Phase jumper of common point of 220 kV Hisar-Sangrur ckt.-I replaced with new jumper. The problem of auxiliary contacts of Bus-isolators of 220 kV Hisar-Sangrur ckt.-II was resolved and correct isolator status have been provided to Bus-Bar relays.

PREPARED & PESENTED BY :

DEPUTY DIRECTOR P&T CELL BBMB BHIWANI

Multiple elements tripping at 400/220kV Akal (RS) 08th June 2024

Brief of event:

i. 400/220kV Akal(RS) has one and half breaker scheme at 400kV level and double main transfer bus scheme at 220kV level.

ii. During antecedent condition, at 400kV side of Akal(RS) S/s, out of all Tie CBs only Tie CB of 400/220kV 500MVA ICT-2 and 400/220kV 315MVA ICT-3 was in close condition, other all Tie CBs were in open condition. 400kV lines from Akal(RS) to Jodhpur, Ramgarh ckt-1 & 2, 400/220 kV 315 MVA ICT-3 & 400/220 kV 500 MVA ICT-4 were connected to 400kV Bus-2 and Barmer, Kankani, Jaisalmer2(Bhainsra), 400/220 kV 500 MVA ICT-1 & 2 were connected to 400kV Bus-1 at Akal(RS) S/s. 220kV line from Akal(RS) to Lala(RS) was connected to 220kV Bus-2 at Akal(RS) S/s.

iii. As reported, at 19:53hrs, due to heavy thunderstorm weather condition, B-ph jumper of dead end tower of 220 kV Akal-Lala (RS) line got earthed at distance of 46.77 meter from Akal(RS) S/s which caused B-N phase to earth fault on 220 kV Akal-Lala (RS) ckt with fault current of Ib=~25kA from Akal(RS) end. As per DR at Akal(RS) end of 220 kV Akal-Lala (RS) ckt, R-N phase to earth fault in zone-1 with fault current of Ir=~25.4kA is observed (phase sequence issue).

iv. As reported, during the same time, due to very high fault current, 400/220 kV 315 MVA ICT-3 and 400/220 kV 500 MVA ICT-4 tripped instantaneously on High Set overcurrent protection operation at Akal (RS) S/s. 400 KV Akal-Jodhpur (RS) Ckt also tripped from Akal(RS) end on zone-5 (reverse) distance protection operation (not tripped from the remote end). Tie CB of 400/220kV 315MVA ICT-3 also opened along with tripping of 400/220kV 315MVA ICT-3 which separated 400kV Bus-1 & Bus-2.

Brief of event:

v. As reported, at the same time, Bus coupler of 220kV Bus-1 & Bus-2 and all 220kV lines (Mulana, Rajgarh, Amarsagar, Giral, Bhensara(RS) ckt-1, Dangri ckt-1 & ckt-2) connected to 220kV Bus-2 at Akal(RS) S/s also tripped (exact reason of tripping yet to be shared). Due to tripping of Bus coupler, 220kV Bus-1 and Bus-2 separated at Akal(RS).

vi. As reported, further at 19:55 hrs, due to bad weather conditions, Y-N phase to earth fault occurred on 400 KV Akal-Kankani (RS) ckt & 400 KV Akal- Jaisalmer2(Bhainsra) (RS) ckt (D/C lines on same tower) at a distance of approx. 3km from Akal(RS) S/s which led to tripping of both the mentioned lines (exact operation of protection yet to be shared).

vii. As reported, due to tripping of 400 KV Akal-Kankani (RS) ckt & 400 KV Akal-Jaisalmer2(Bhainsra) (RS) ckt, high voltage was observed on the 400 KV Akal-Barmer (RS) Ckt and line voltage reached up to 436kV on the same line and 400 KV Akal-Barmer (RS) Ckt tripped from Barmer(RS) end on over-voltage protection operation and also from Akal(RS) end on receiving DT from Barmer(RS) end.

viii. Due to tripping of 400 KV Akal-Barmer (RS) Ckt, 400kV Bus-1 lost its connectivity from grid and 400kV Bus-1 and elements connected to 400kV Bus-1 (400/220 kV 500 MVA ICT-1 & 2, 220kV Bus-1 and 220kV lines connected to 220kV Bus-1) became dead at Akal(RS) S/s.

ix. After all the above mentioned tripping events, only 400kV Bus-2 remain charged through 400kV Akal-Ramgarh (RS) D/C.

x. As per PMU at Jodhpur(RS), B-N phase to earth fault with delayed fault clearance time of 1080ms @19:53hrs and Y-B phase to phase fault followed by Y-N phase to earth fault with fault clearance time of 80msec and 240msec (delayed) respectively are observed.

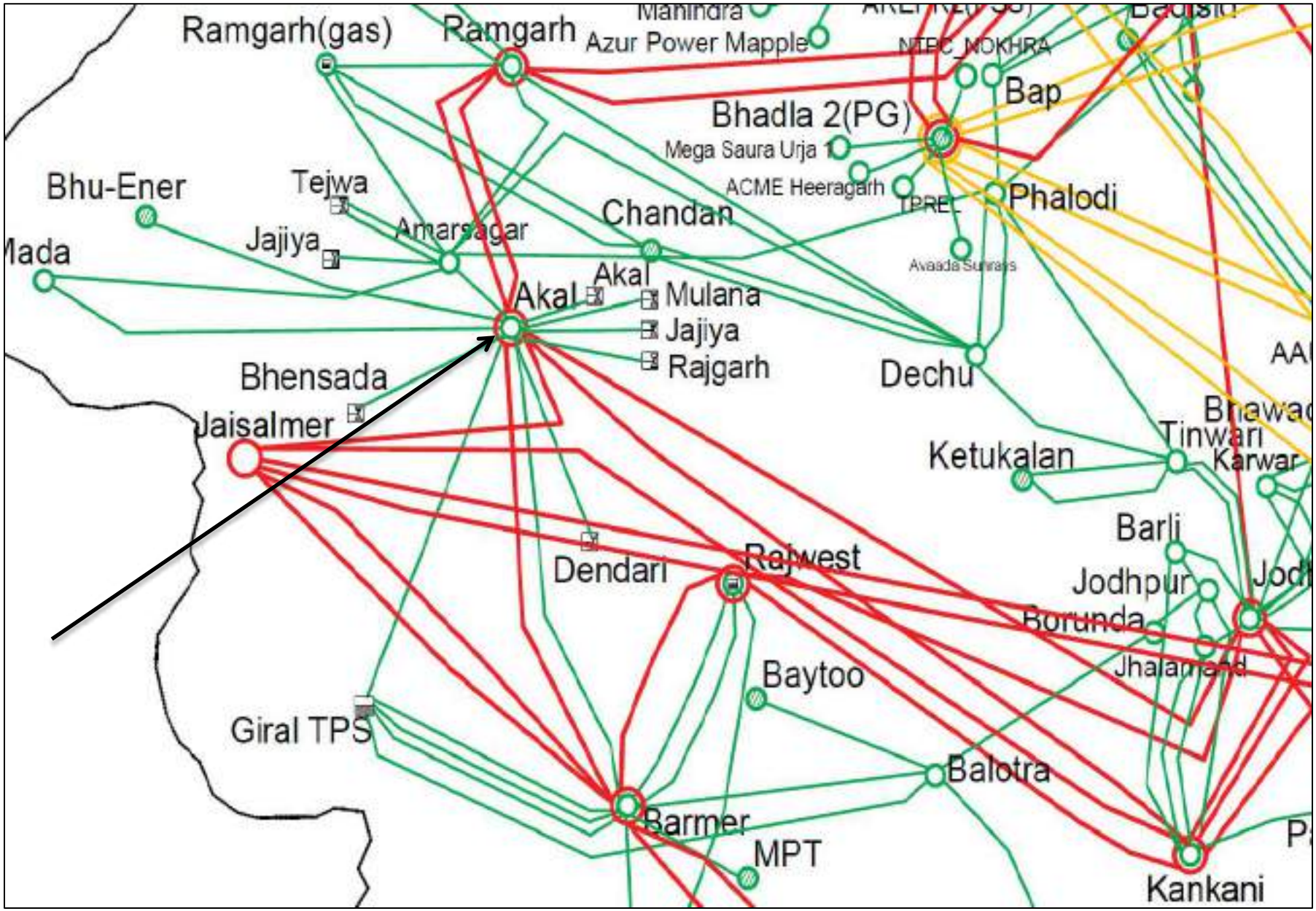
xi. As per SCADA, no change in demand is observed in Rajasthan control area.

xii. As per SCADA, change in Rajasthan wind generation of approx. 168MW is observed.

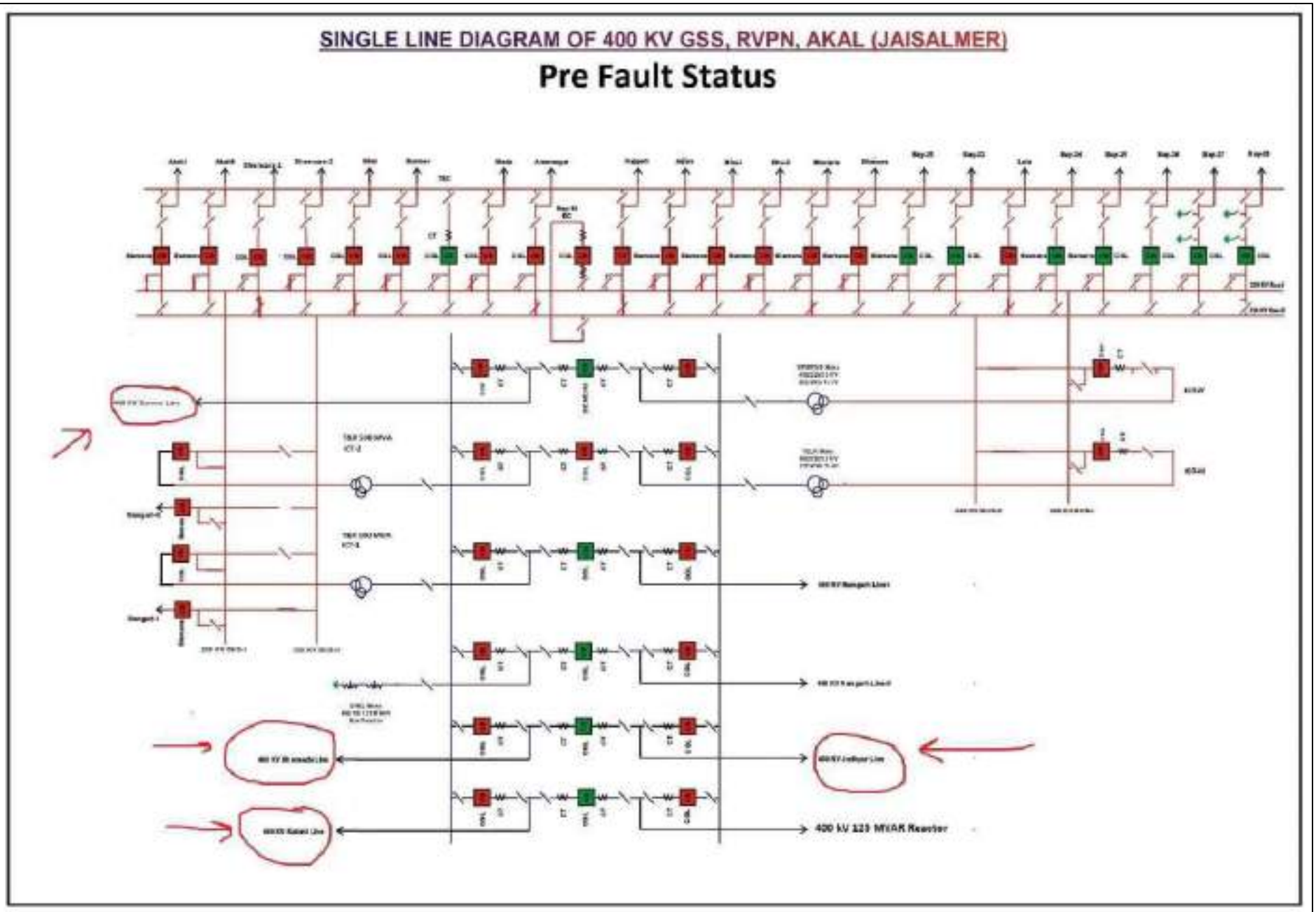
Elements tripped:

1) 400 KV Akal-Jodhpur (RS) Ckt
2) 400/220 kV 315 MVA ICT 3 at Akal(RS)
3) 400/220 kV 500 MVA ICT 4 at Akal(RS)
4) 220kV Akal-Lala (RS) ckt
5) 220kV Akal-Mulana (RS) ckt
6) 220kV Akal- Rajgarh (RS) ckt
7) 220kV Akal- Amarsagar (RS) ckt
8) 220kV Akal- Giral (RS) ckt
9) 220kV Akal- Bhensara(RS) ckt-1
10) 220kV Akal- Dangri (RS) ckt-1
11) 220kV Akal- Dangri (RS) ckt-2
12) 400 KV Akal-Kankani (RS) Ckt
13) 400 KV Akal-Jaisalmer2(Bhainsra) (RS) Ckt
14) 400 KV Akal-Barmer (RS) Ckt

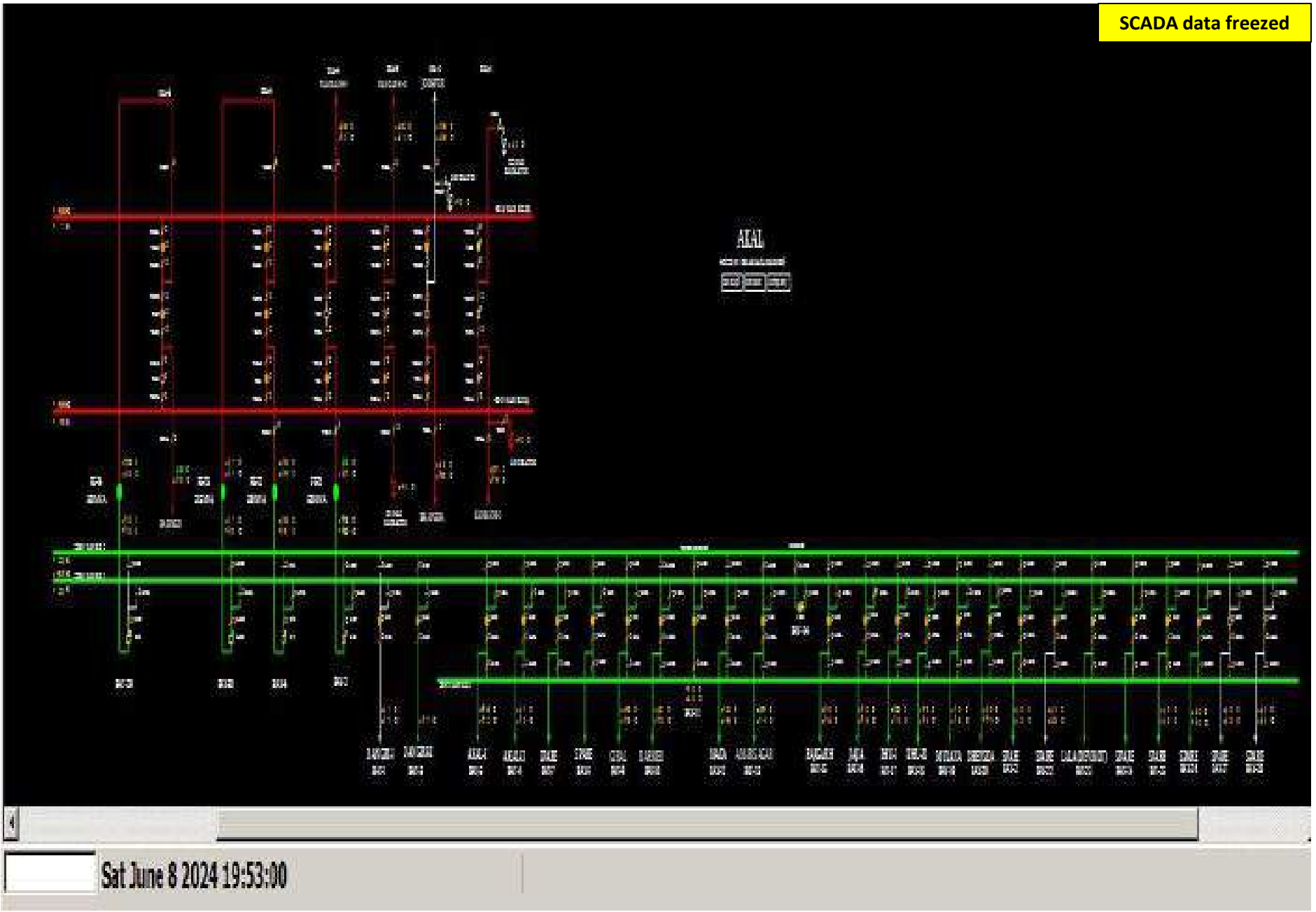
Network Diagram



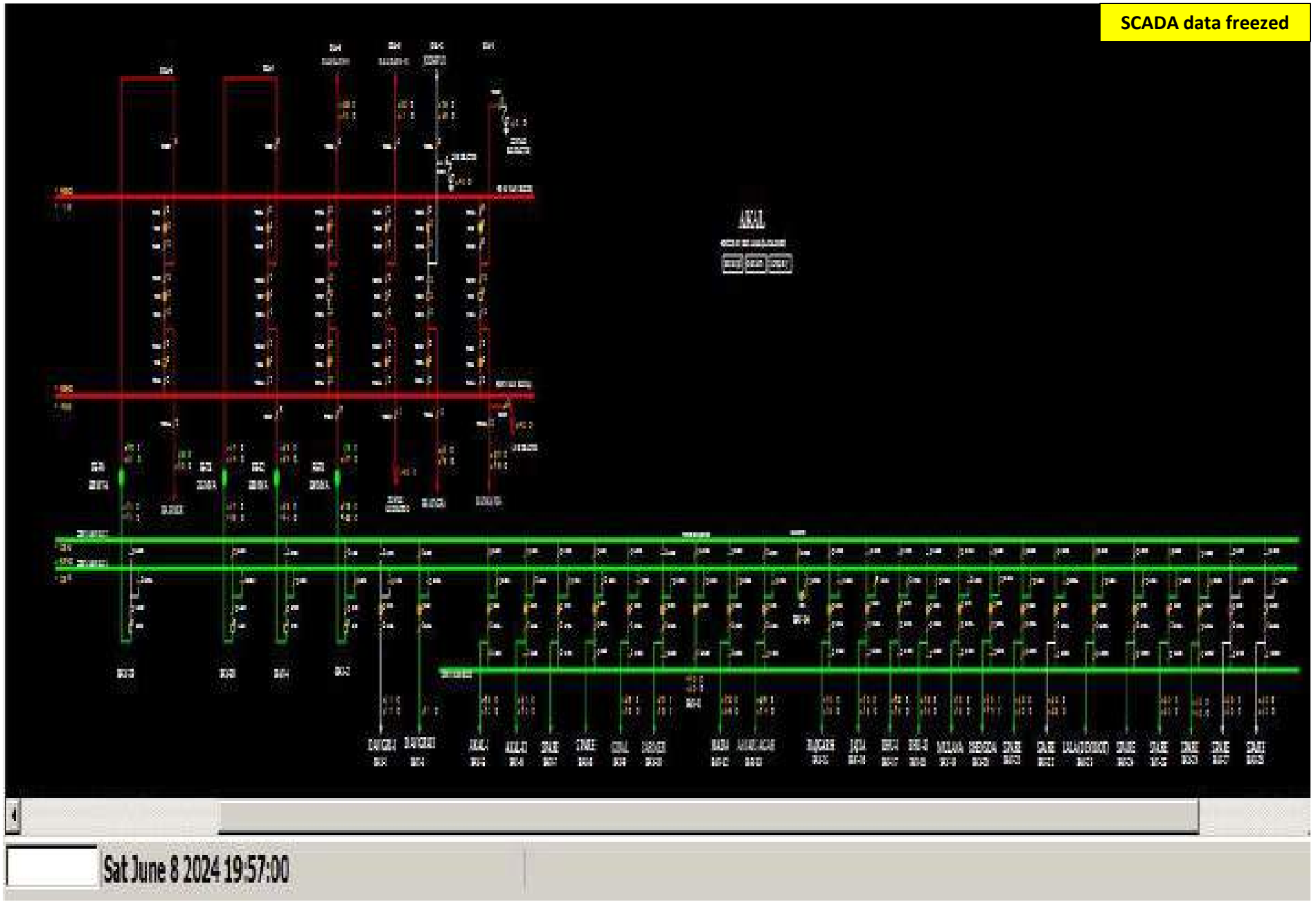
SLD of 400/220kV Akal(RS)



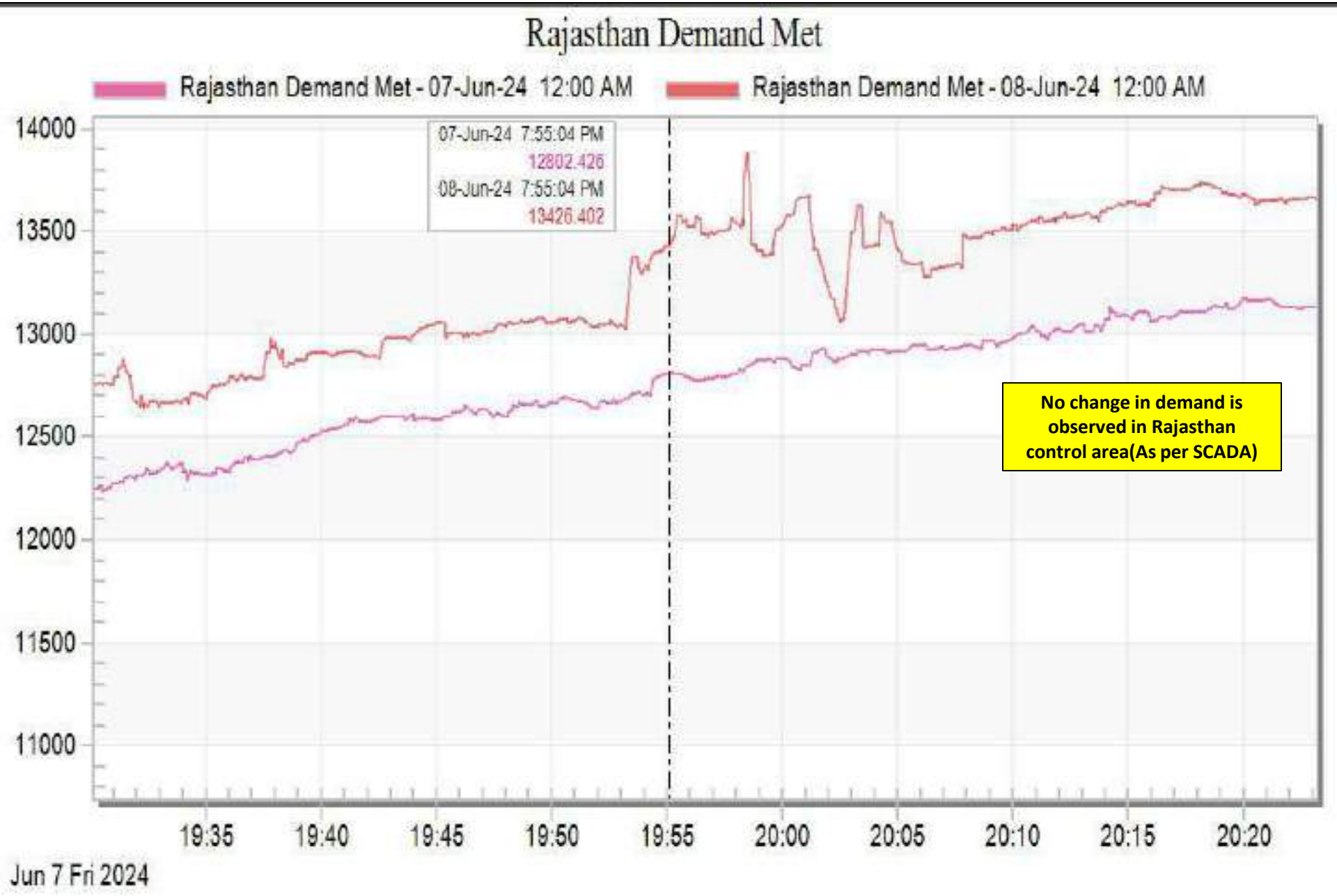
SLD of 400/220kV Akal(RS) before the event



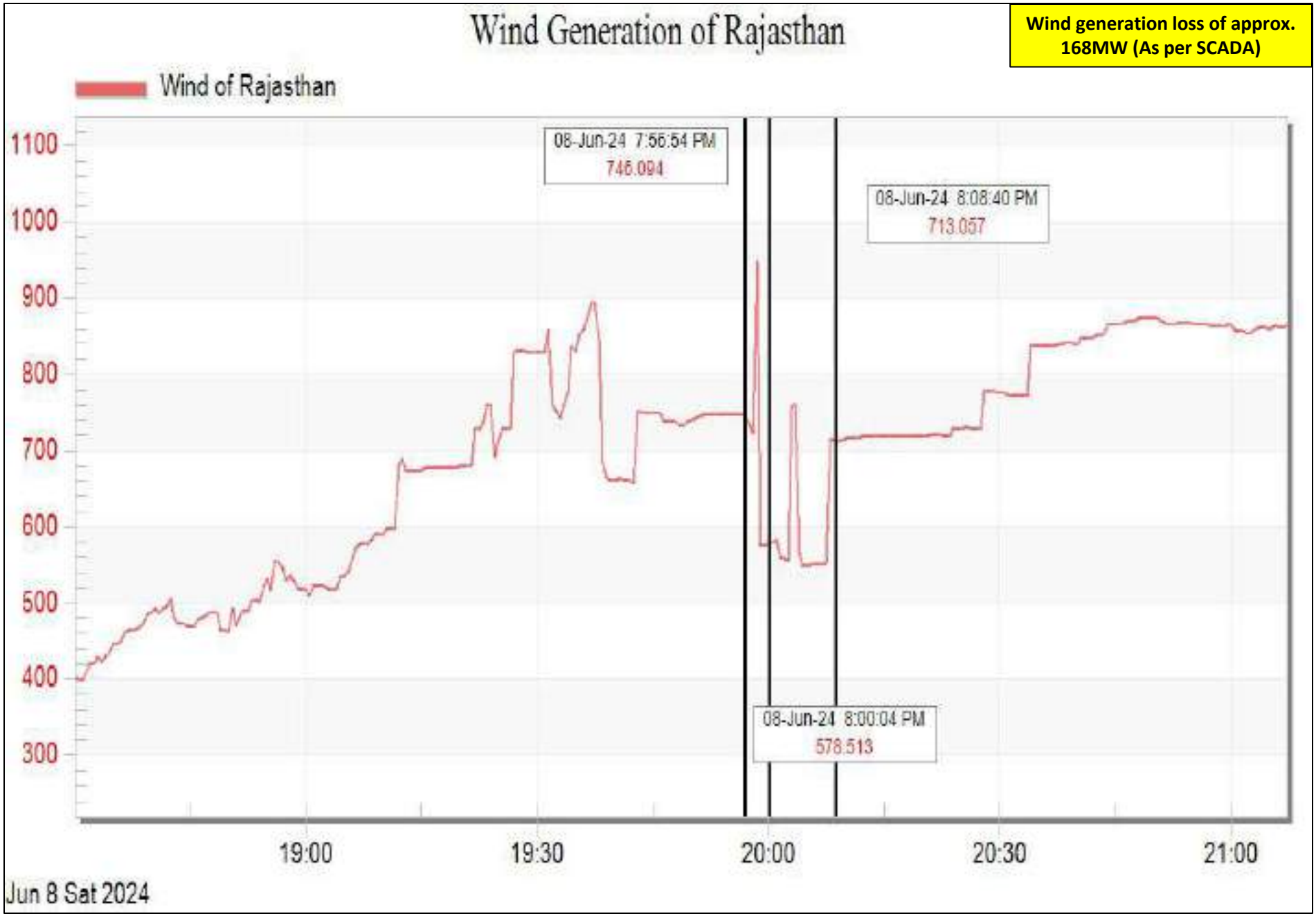
SLD of 400/220kV Akal(RS) after the event



Rajasthan Demand during the event



Rajasthan Wind Generation during the event

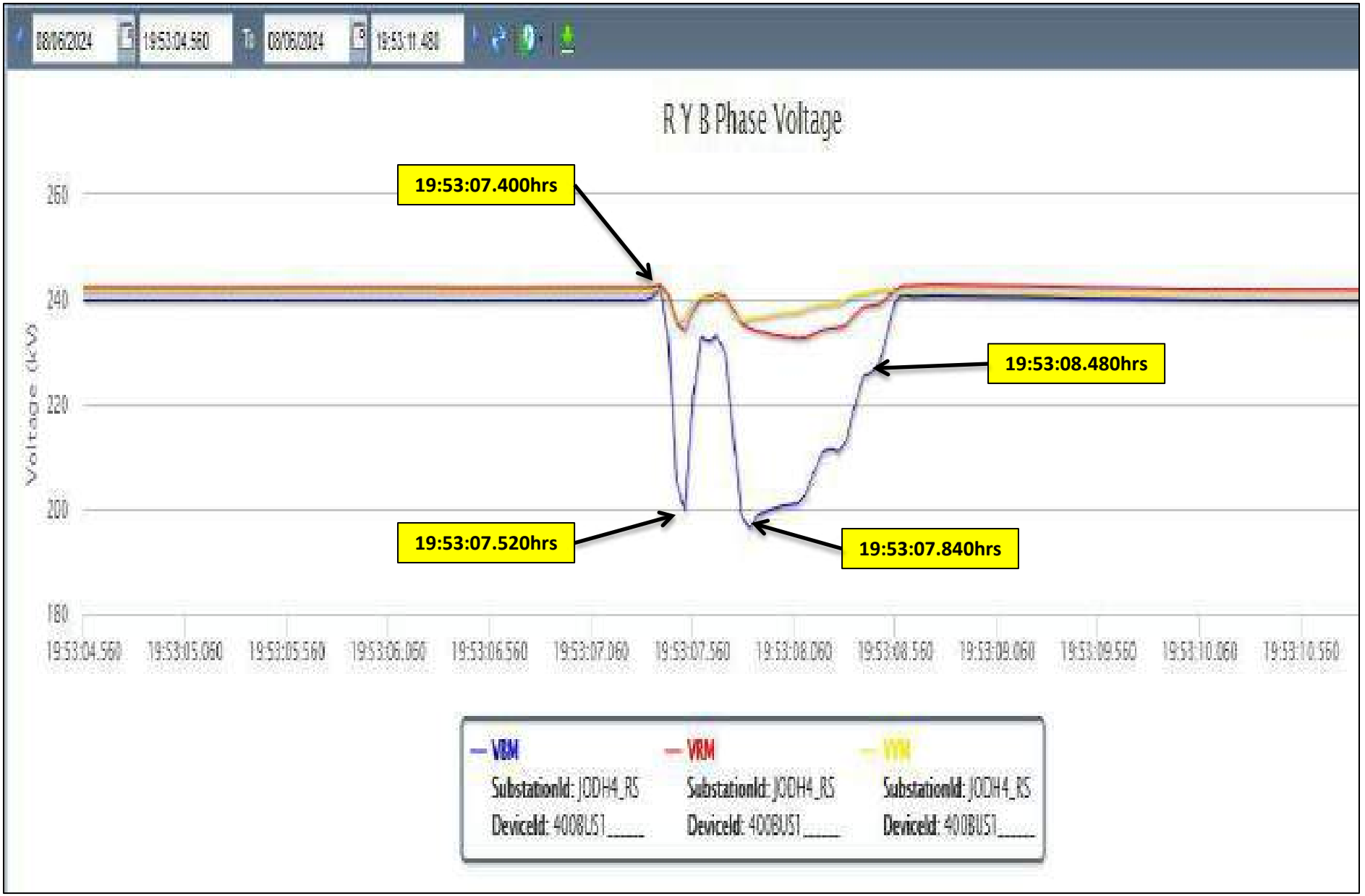


PMU Plot of frequency at Jodhpur(RS)

19:55 hrs/08-June-24

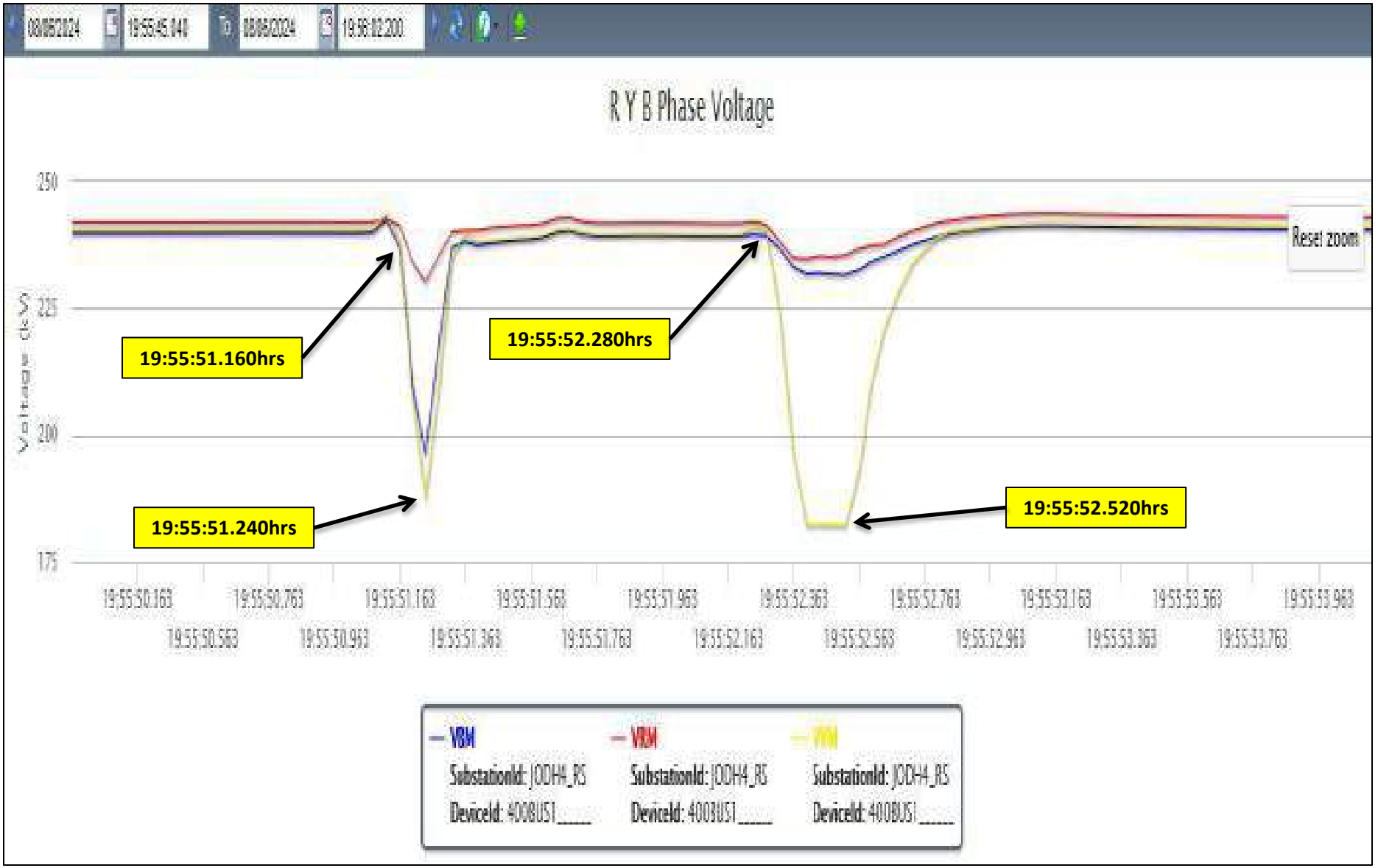
PMU Plot of phase voltage magnitude Jodhpur(RS)

19:53 hrs/08-June-24

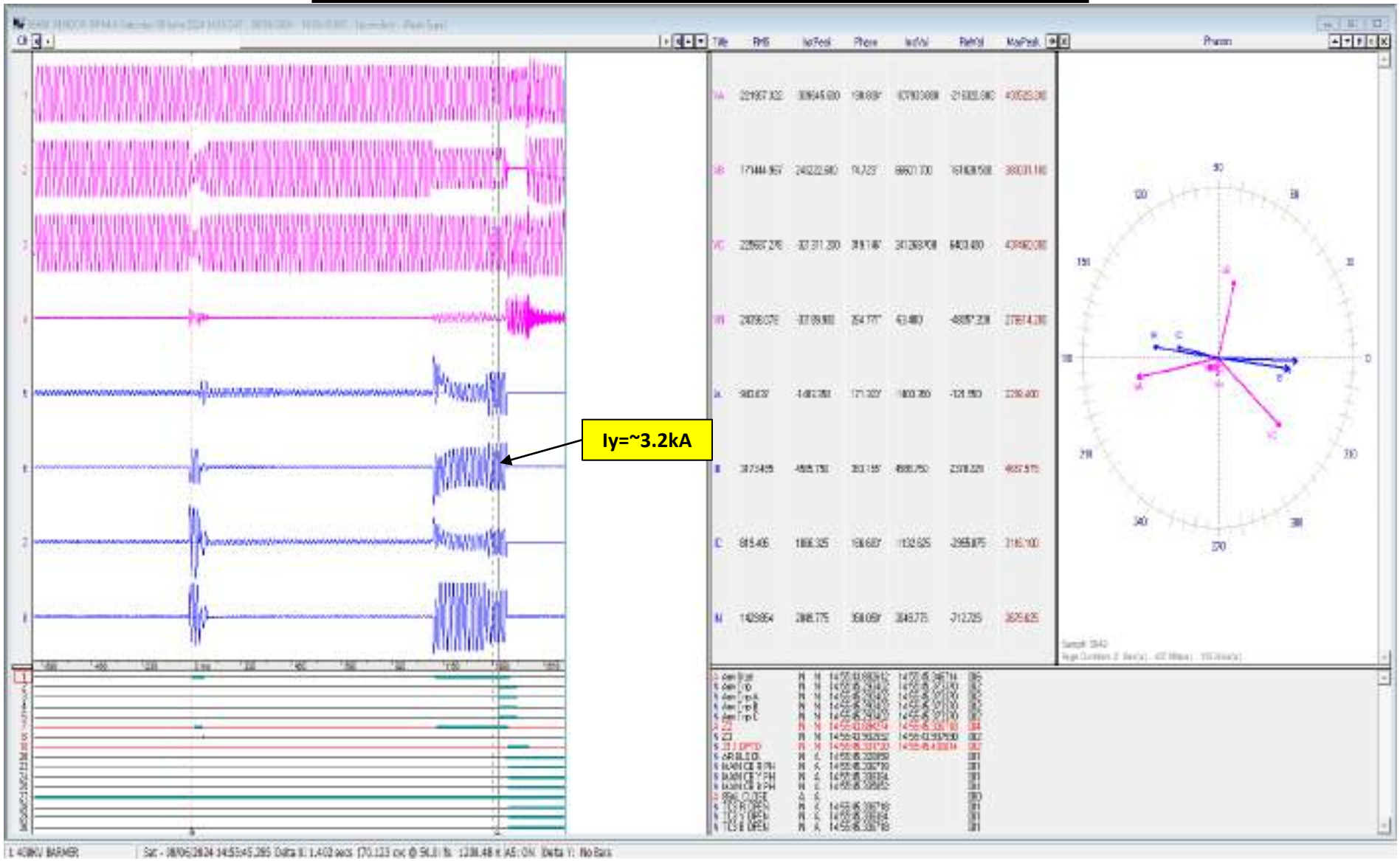


PMU Plot of phase voltage magnitude Jodhpur(RS)

19:55 hrs/08-June-24

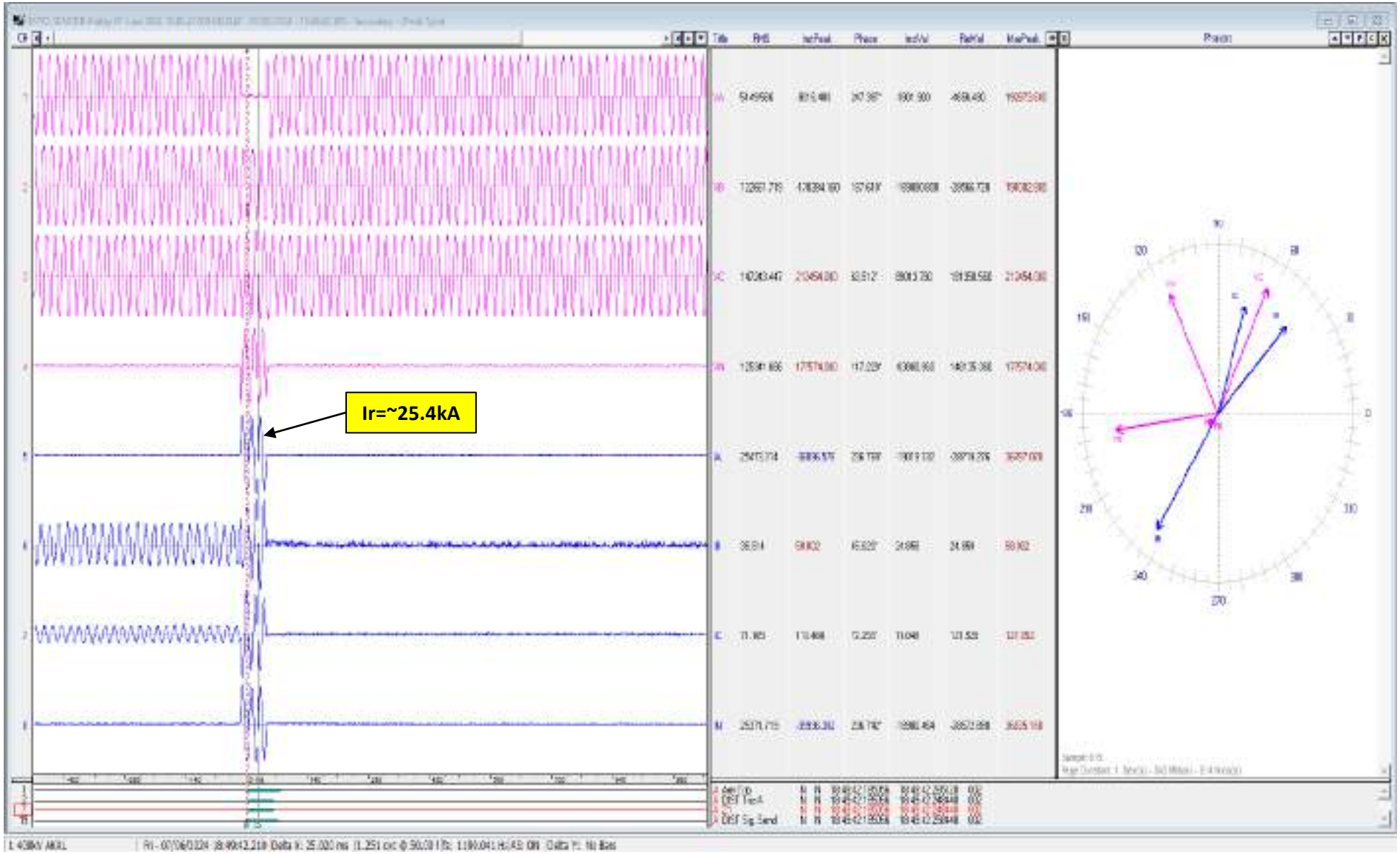


DR of 400 KV Akal-Barmer(end) (RS) Ckt



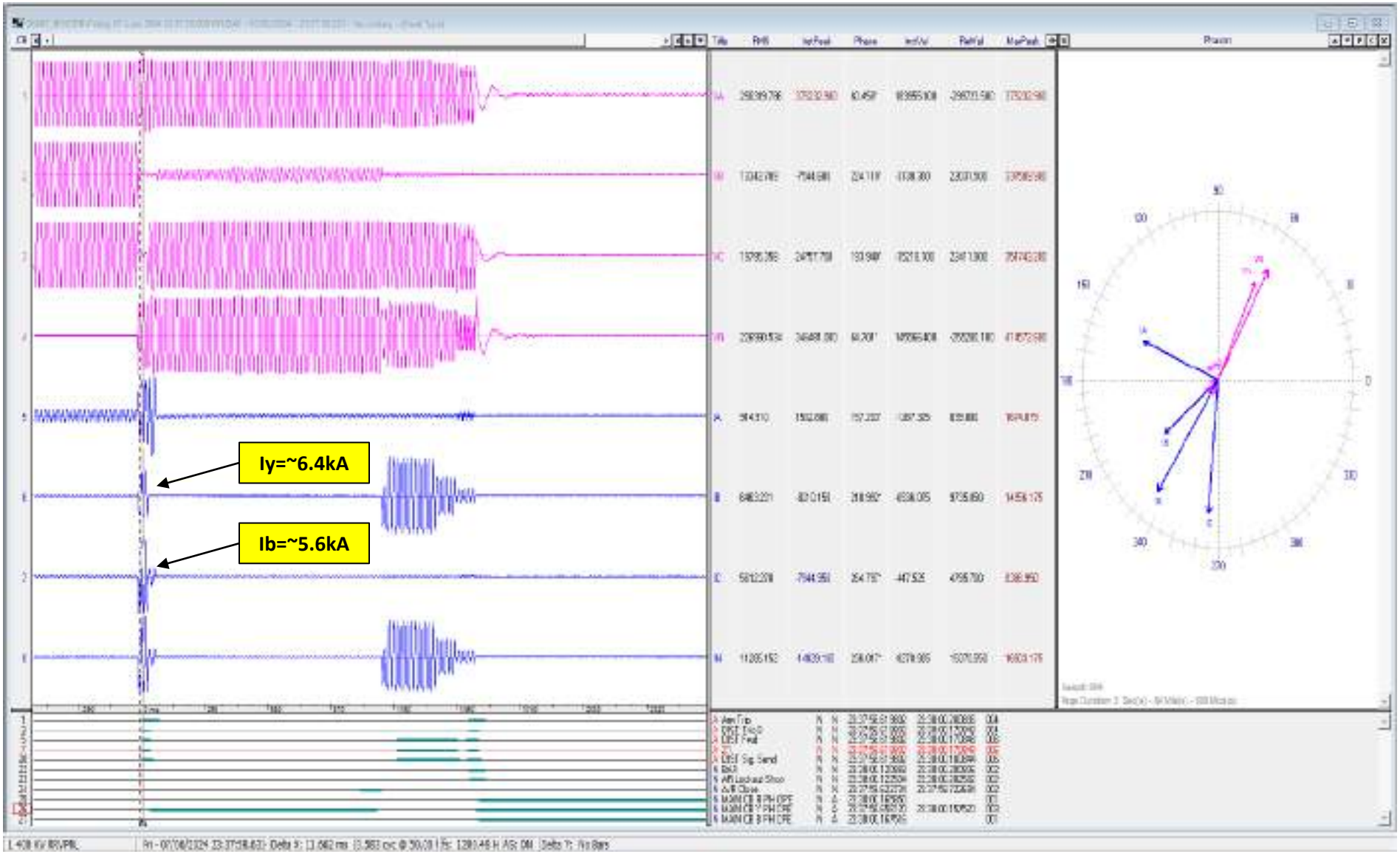
- ✓ Y-B-N double phase to earth fault (Iy=~2.4kA,Ib=~2.1kA)followed by Y-N fault (Iy=~3.2kA).
- ✓ Fault sensed in zone-2. Distance protection operated.
- ✓ Time Sync issue in DR.

DR of 220kV Akal(end)-Lala (RS) ckt



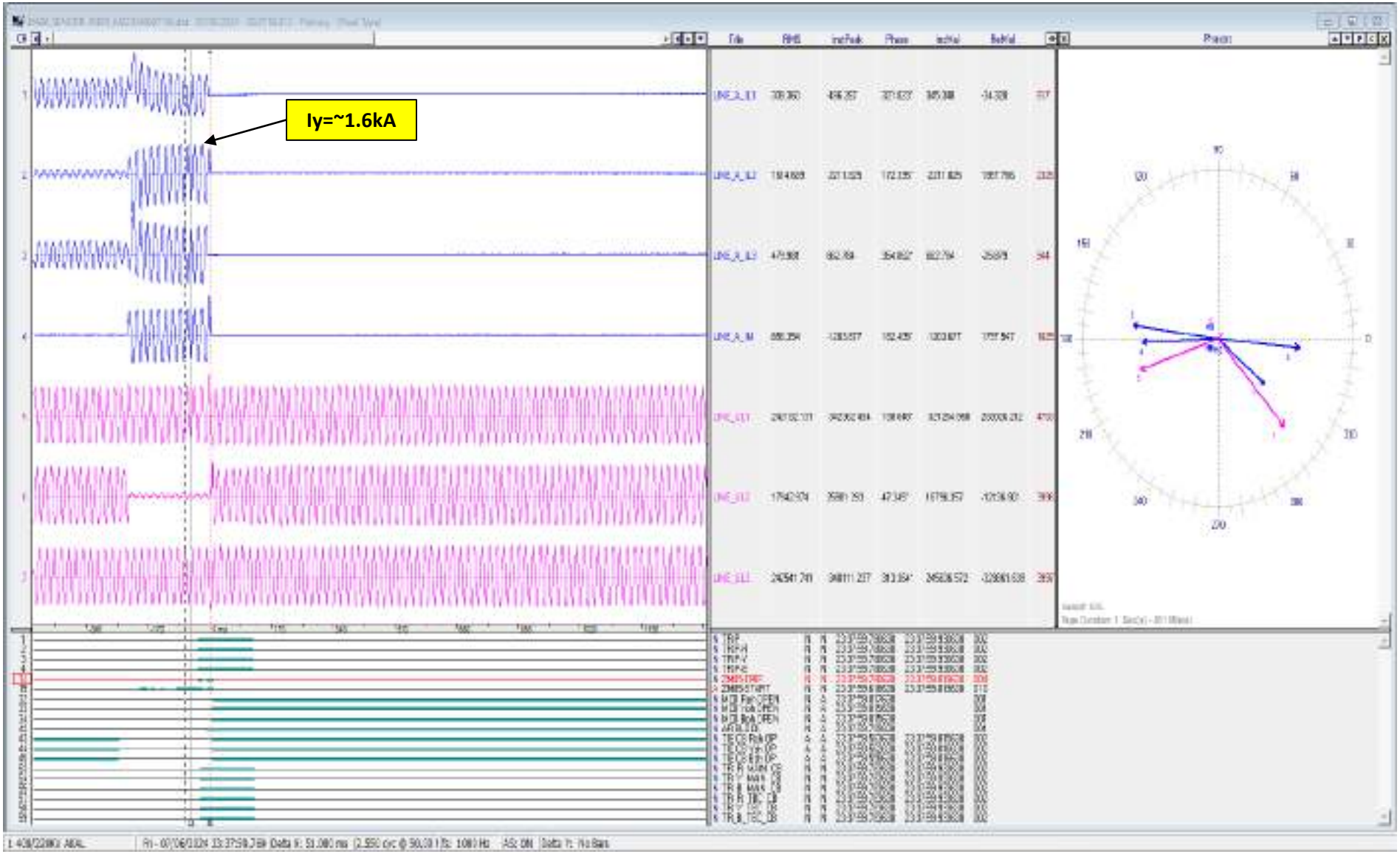
- ✓ R-N phase to earth fault (Ir=~25.4kA)
- ✓ Fault sensed in zone-1. Distance protection operated.
- ✓ Date and Time Sync issue in DR.

DR of 400 KV Akal(end)-Jaisalmer2(Bhainsra) (RS) Ckt



- ✓ Y-B fault (Iy=~6.4kA, Ib=~5.6kA) followed by Y-N (Iy=~10.1kA) phase to earth fault.
- ✓ Fault sensed in zone-1. Distance protection operated.
- ✓ Date and Time Sync issue in DR.

DR of 400 KV Akal(end)-Jodhpur (RS) Ckt



- ✓ Y-N phase to earth fault (Iy=~1.6kA)
- ✓ Line tripped on zone-5 distance protection operation. Line didn't trip from remote end.
- ✓ Date and Time Sync issue in DR.

SCADA SOE

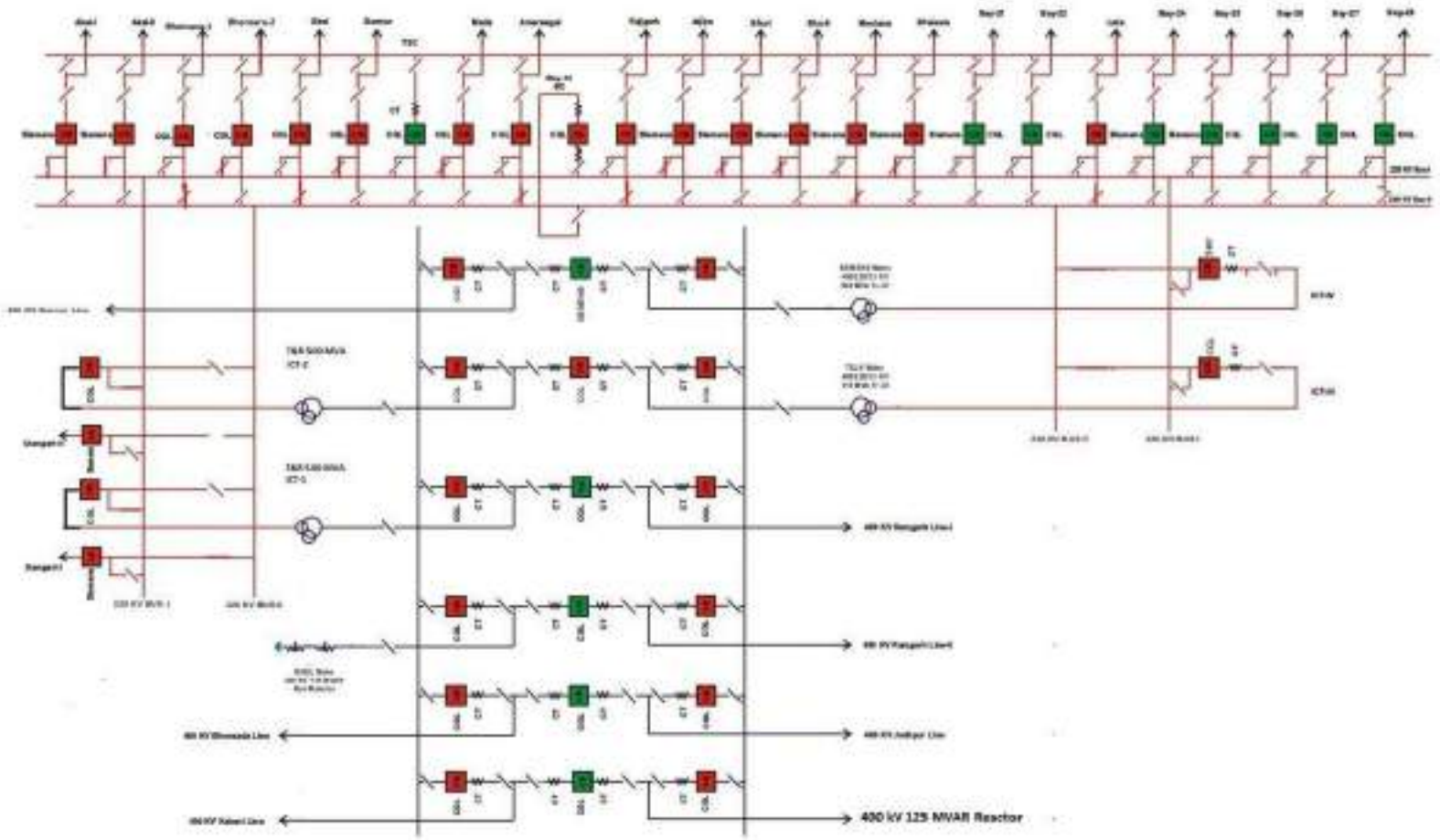
Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
19:55:51,287	JASL4_RS	400kV	14AKT1	Circuit Breaker	Open	Tie CB at Bhainsra(Jaisalmer)(RS) end of 400kV Akal-Bhainsra (RS) ckt and 400/220kV 500MVA ICT-1 opened
19:55:51,291	JASL4_RS	400kV	13AKAL	Circuit Breaker	Open	Main CB at Bhainsra(Jaisalmer)(RS) end of 400kV Akal-Bhainsra (RS) ckt opened
19:58:02,487	AKAL4_RS	400kV	06BHSRA	Circuit Breaker	Open	Main CB at Akal(RS) end of 400kV Akal-Bhainsra (RS) ckt opened
19:58:02,487	AKAL4_RS	400kV	12TIE	Circuit Breaker	Open	Tie CB at Akal(RS) end of 400/220kV 500MVA ICT-2 and 400/220kV 315MVA ICT-3 opened
19:58:12,040	AKAL4_RS	400kV	03KNKNI	Circuit Breaker	Open	Main CB at Akal(RS) end of 400kV Akal-Kankani (RS) ckt opened
19:58:12,040	AKAL4_RS	400kV	04JODHPR	Circuit Breaker	Open	Main CB at Akal(RS) end of 400kV Akal-Jodhpur (RS) ckt opened
19:58:12,040	AKAL4_RS	400kV	17TIE	Circuit Breaker	Open	Tie CB at Akal(RS) end of 400/220kV 500MVA ICT-4 and 400kV Akal-Barmer (RS) ckt opened
19:58:12,040	AKAL4_RS	400kV	16T4	Circuit Breaker	Open	Main CB at Akal(RS) end of 400/220kV 500MVA ICT-4 opened from 400kV side
19:58:12,040	AKAL4_RS	400kV	13T3	Circuit Breaker	Open	Main CB at Akal(RS) end of 400/220kV 315MVA ICT-3 opened from 400kV side

Point of discussion

- O/C protection settings of ICTs need to be shared.
- Reason of delayed clearance of fault need to be shared.
- Exact reason of tripping of all 220kV lines connected to 220kV Bus-2 (Mulana, Rajgarh, Amarsagar, Giral, Bhensara(RS) ckt-1, Dangri ckt-1 & ckt-2) at Akal(RS) S/s need to be shared.
- SCADA data was freezed during the event. Availability and healthiness of SCADA data need to be ensured.
- Date and time sync issue is observed in the given DRs of the tripped elements. Issue need to be resolved.
- Remedial action taken report to be shared.

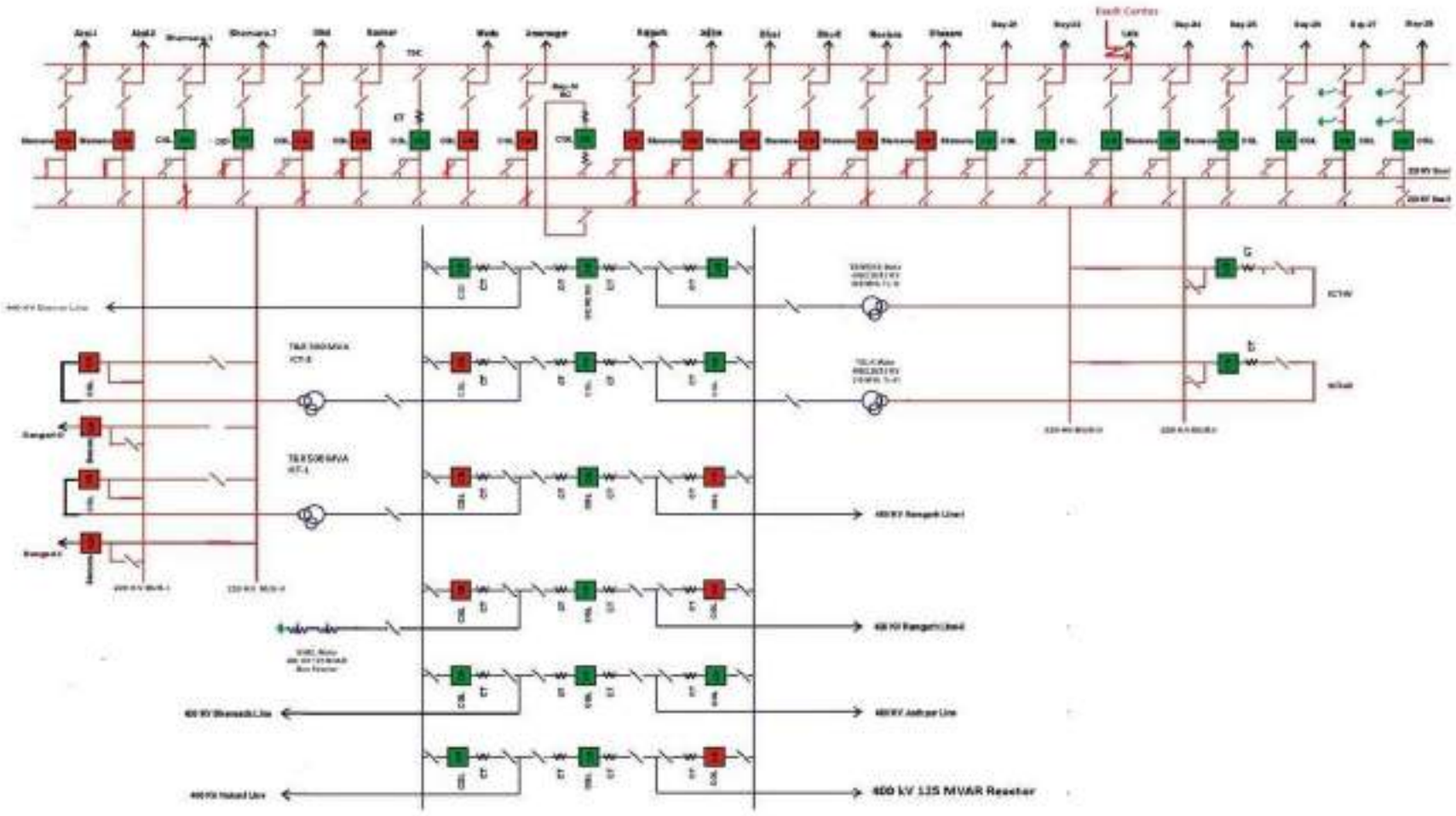
SINGLE LINE DIAGRAM OF 400 KV GSS, RVPN, AKAL (JAISALMER)

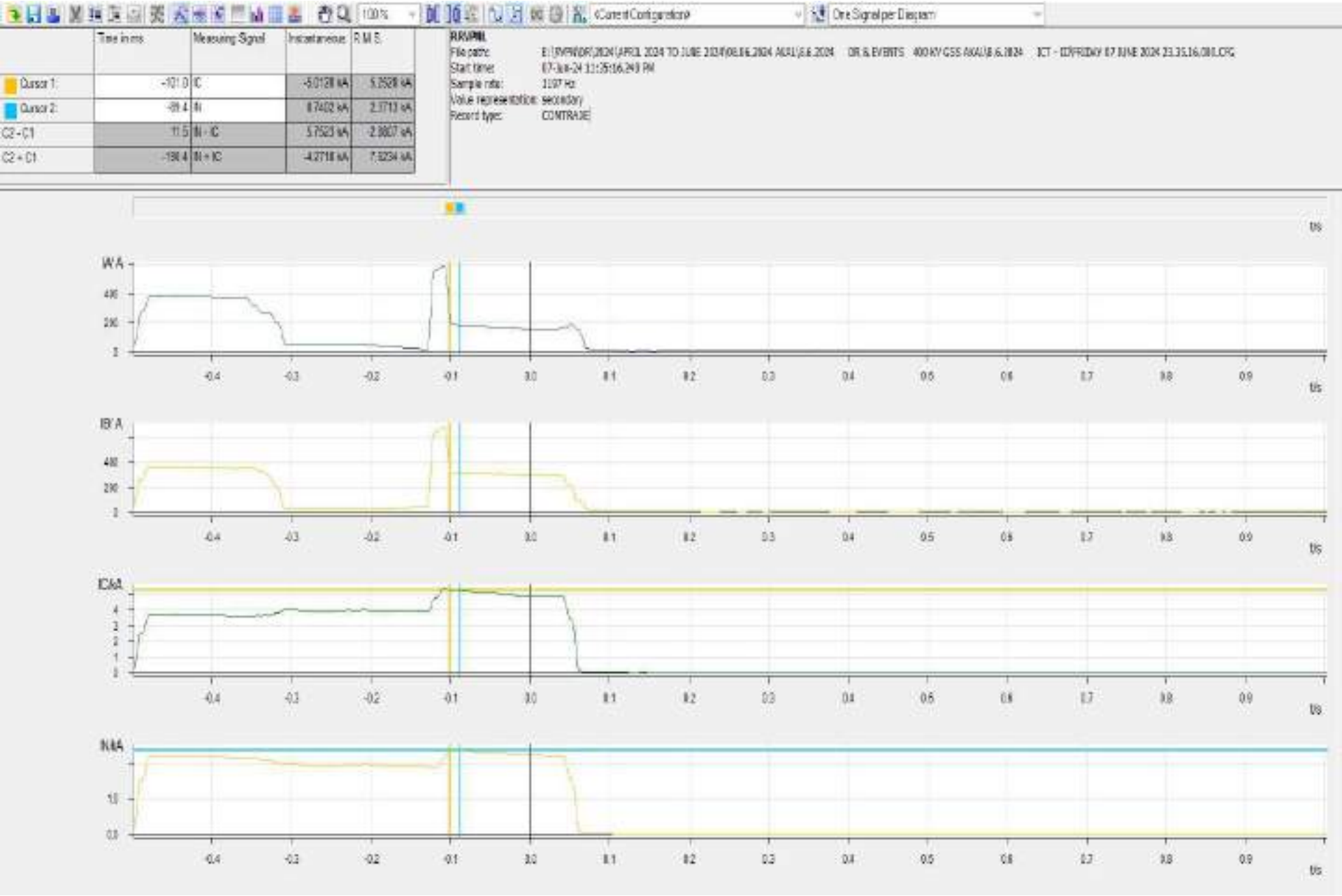
Pre Fault Status

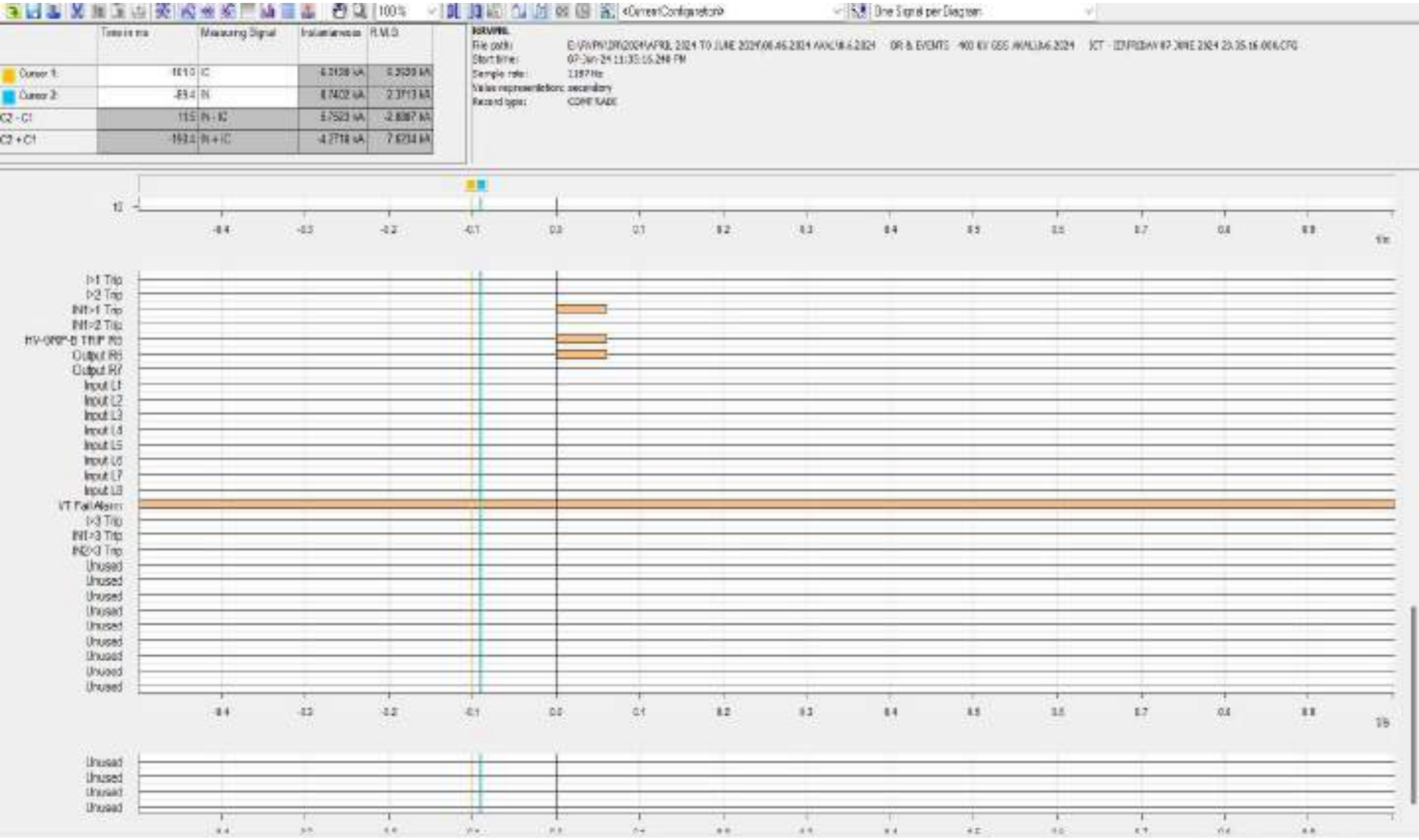


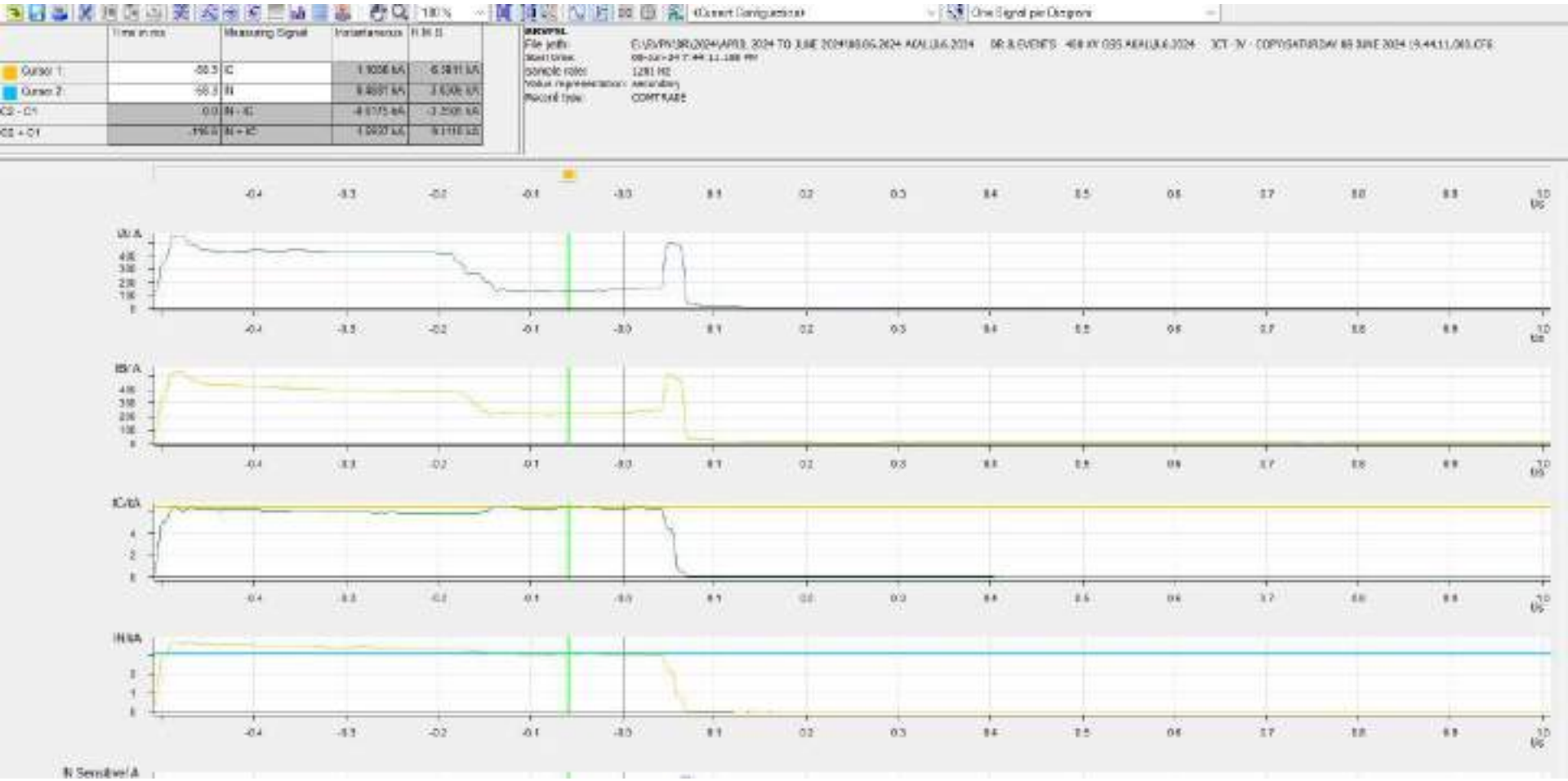
SINGLE LINE DIAGRAM OF 400 KV GSS, RVPN, AKAL (JAISALMER)

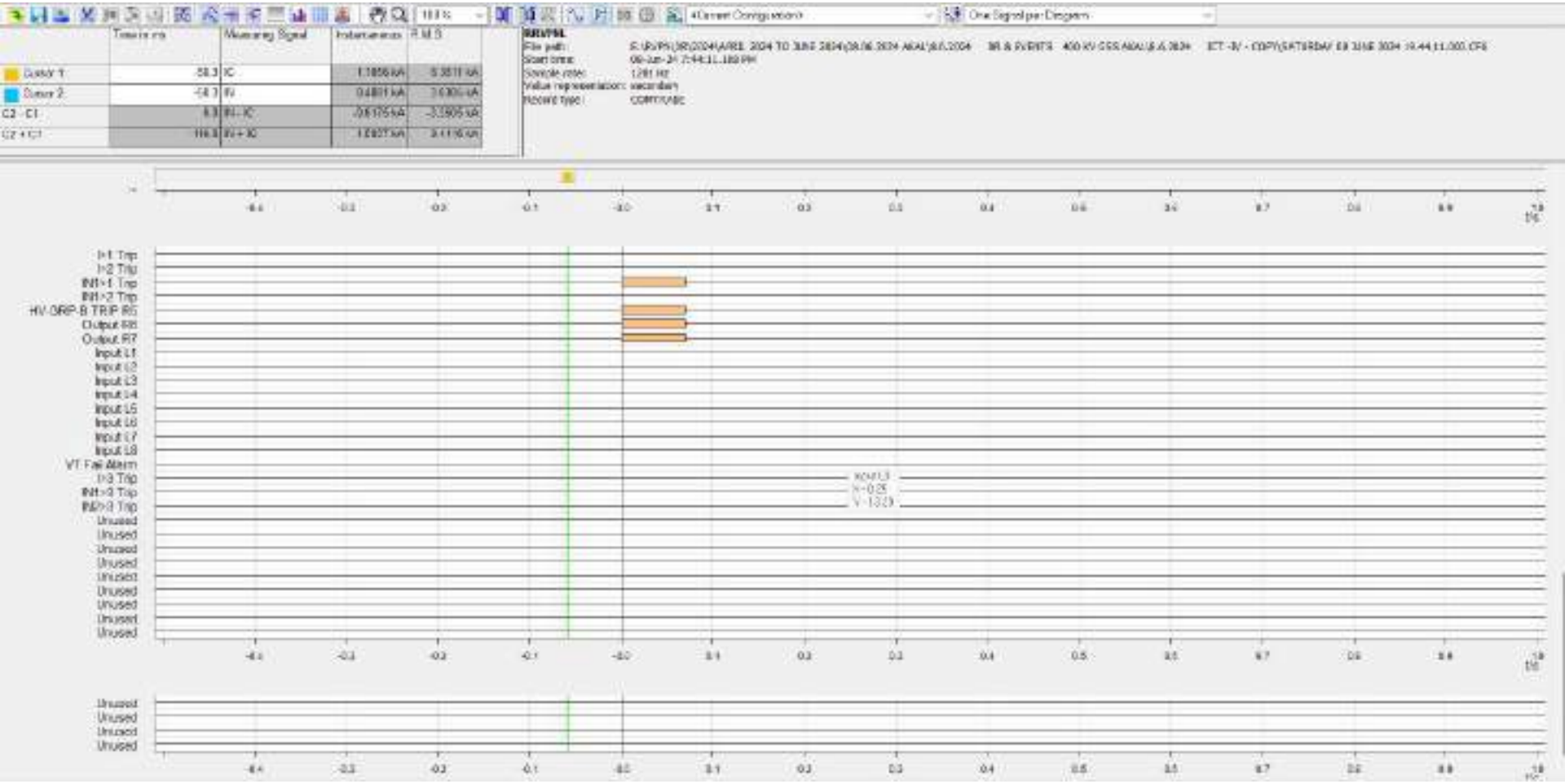
Post Fault Status

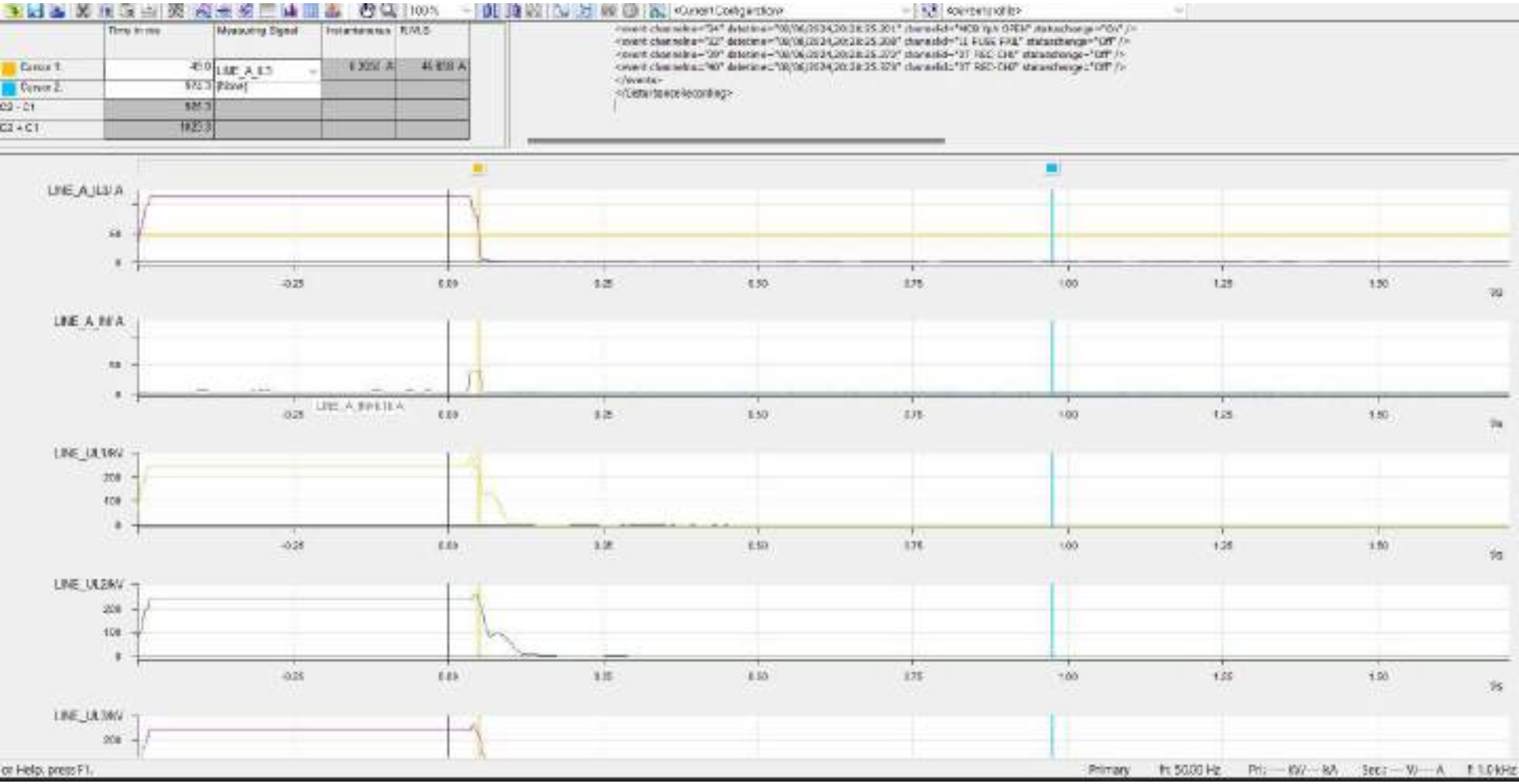


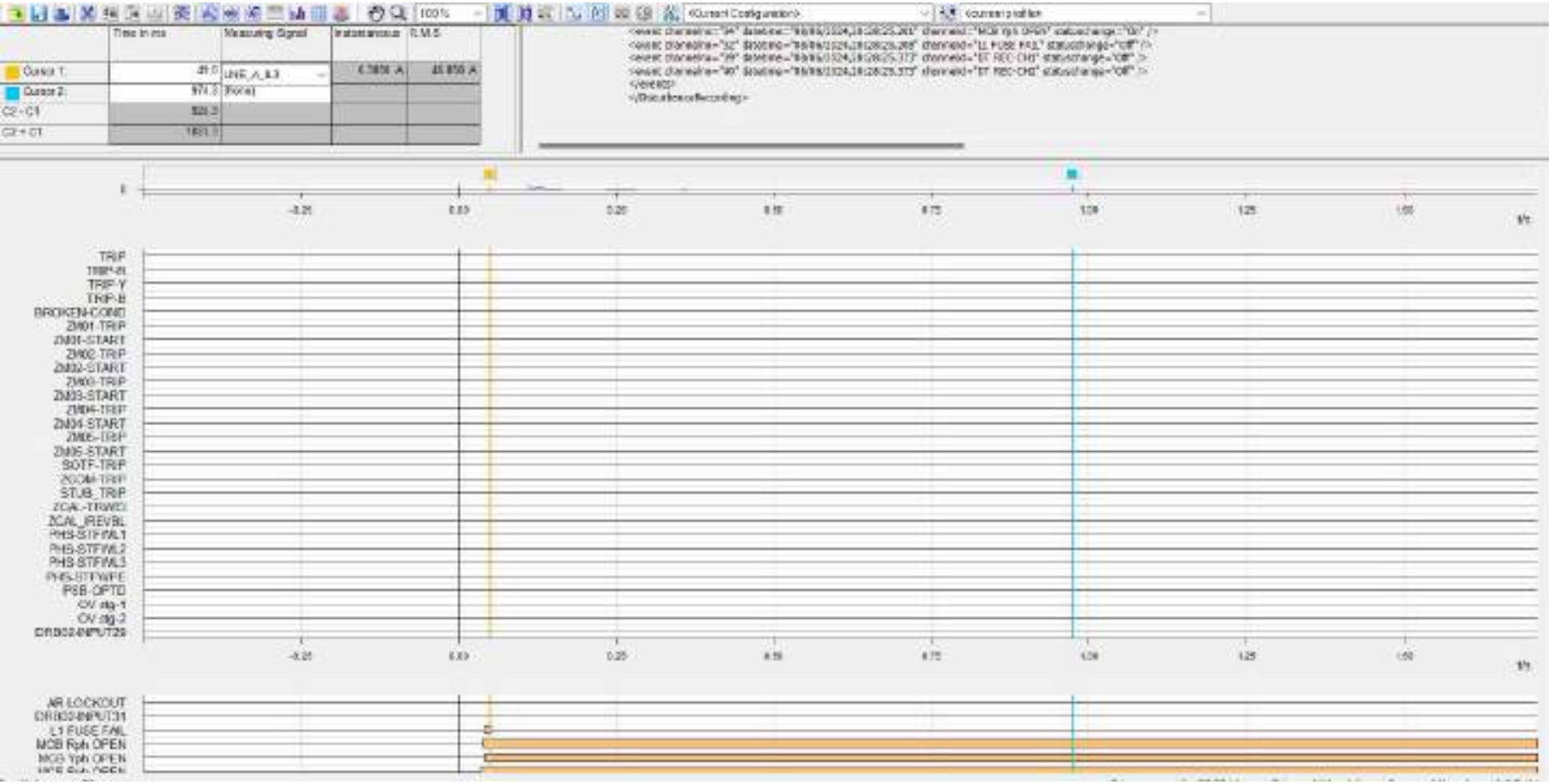

Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1:
-101.0
IC
-5.0128 kA
5.2528 kA
Cursor 2:
-89.4
IN
0.7402 kA
2.3713 kA
C2 - C1
11.5
IN - IC
5.7523 kA
-2.8807 kA
C2 + C1
-190.4
IN + IC
-4.2716 kA
7.9234 kA
RAVIPAL
File name:
Start time:
07-Jun-24 11:35:16.240 PM
Sample rate:
2197 Hz
Value representation:
secondary
Record type:
CONTINUE
OR & EVENTS
400 KV GSS AKAU
ICT - 02
IA
IB
IC&A
IN&A
ms

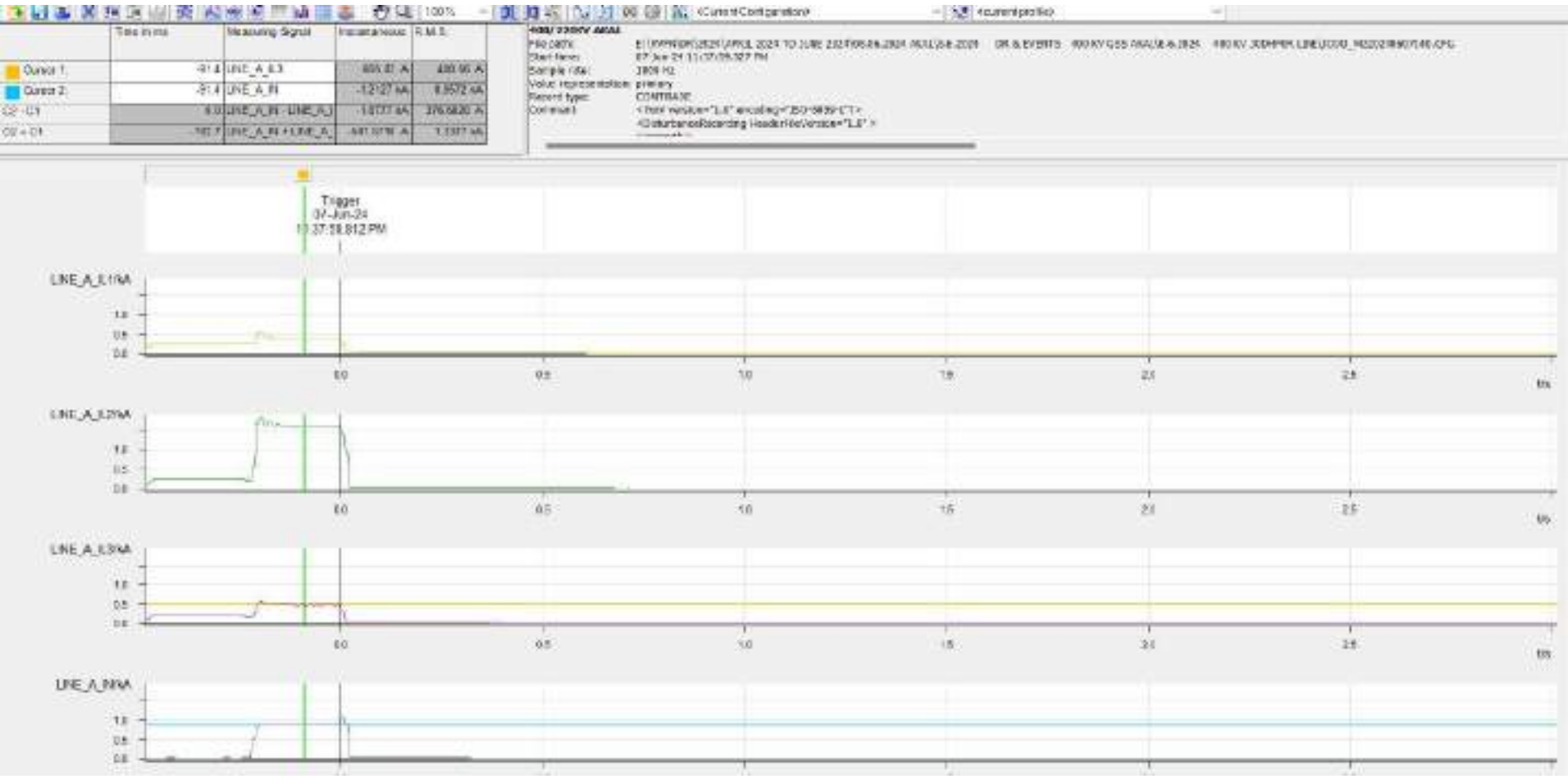

100%
<Current Configuration>
One Signal per Diagram
Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1:
Cursor 2:
IC
IN
IN - IC
IN + IC
Record type:
I1
I>1 Trip
I>2 Trip
INI>1 Trip
INI>2 Trip
Output R6
Output R7
Input L1
Input L2
Input L3
Input L4
Input L5
Input L6
Input L7
Input L8
VT Fail Alarm
I>3 Trip
INI>3 Trip
IN2>3 Trip
Unused

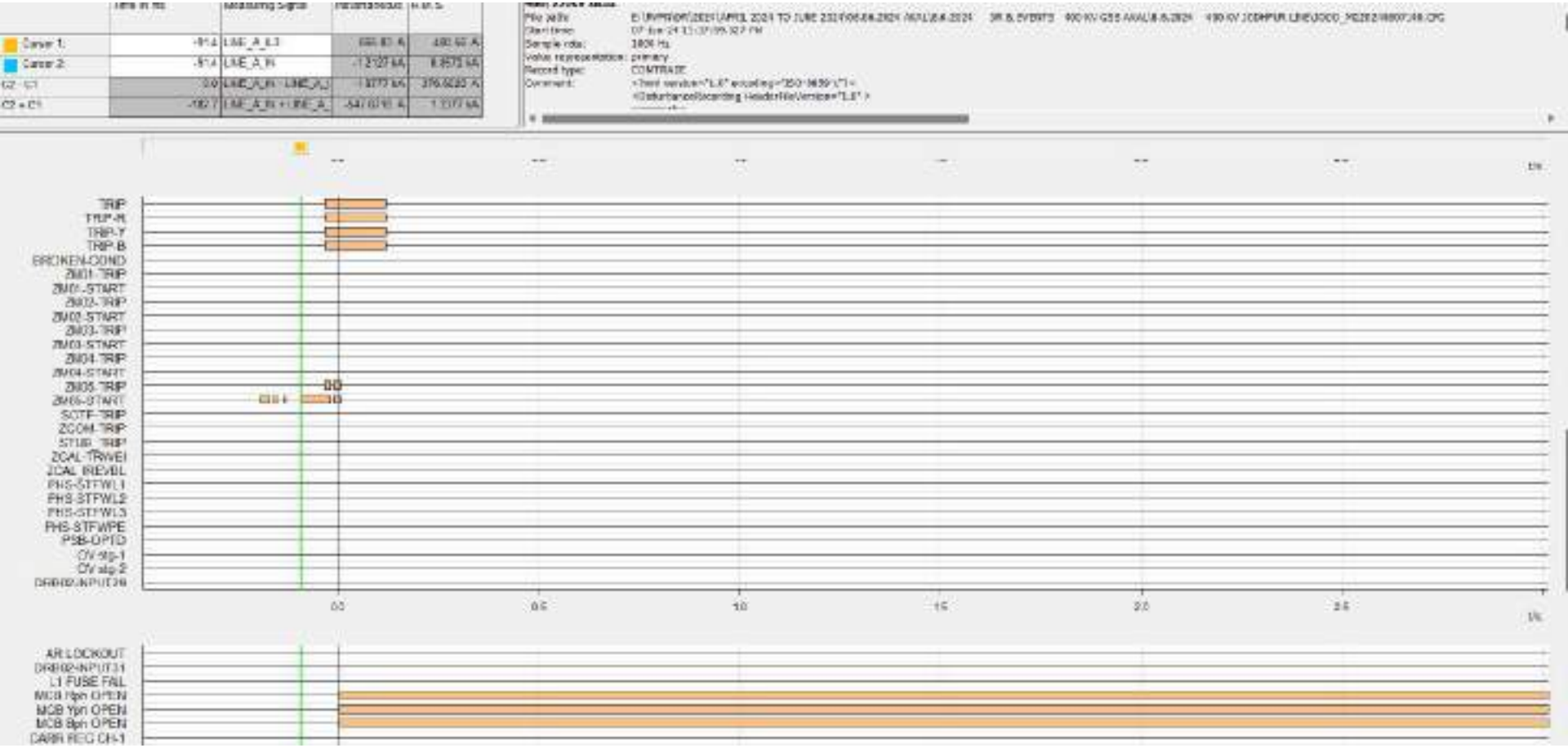

Time in ms
Measuring Signal
Instantaneous
Cursor 1
Cursor 2
C2 - C1
C2 + C1
IA
IB
IC
IN
IA/A
IB/A
IC/A
IN/A
IN Sensitive/A

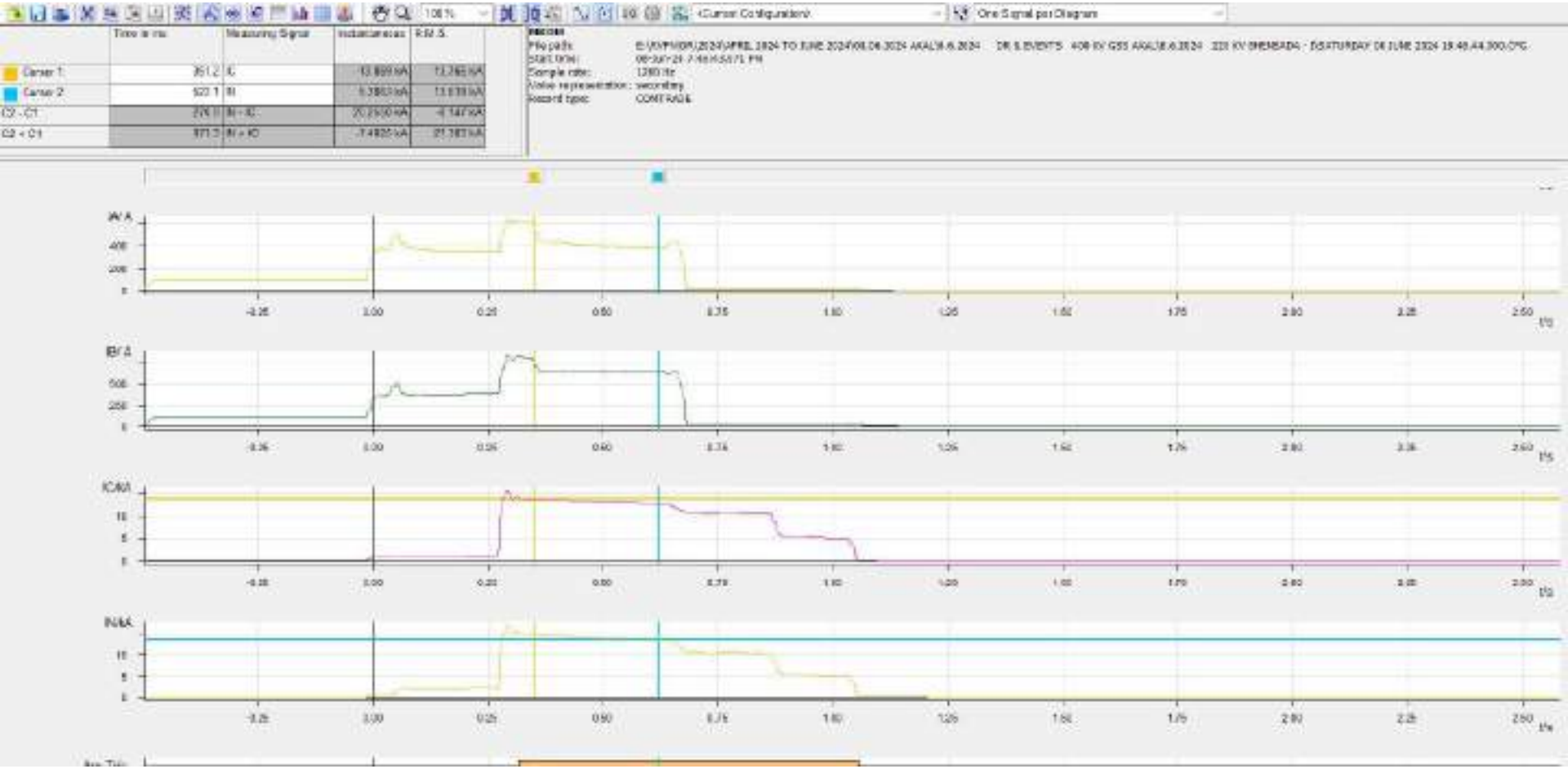

Cursor 1
Cursor 2
C2 - C1
C2 + C1
IC
IN
IN - IC
IN + IC
I>1 Trip
I>2 Trip
IN1>1 Trip
IN1>2 Trip
HV GRP-B TRIP RS
Output R6
Output R7
Input L1
Input L2
Input L3
Input L4
Input L5
Input L6
Input L7
Input L8
VT Fail Alarm
I>3 Trip
IN1>3 Trip
IN2>3 Trip
Unused

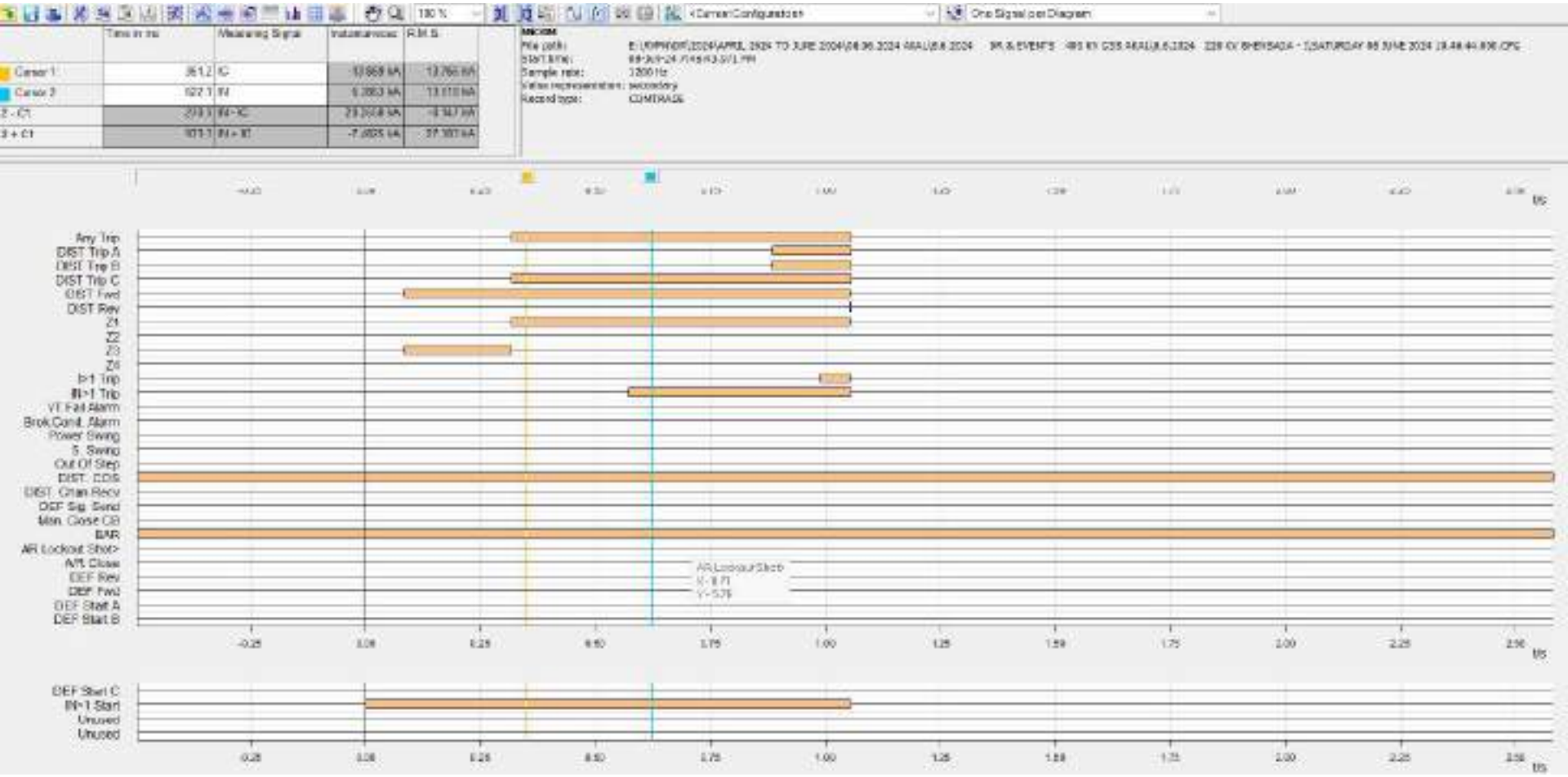

Time in ms
Measuring Signal
Instantaneous
RMS
Cursor 1
Cursor 2
C2 - C1
C2 + C1
LINE_A_IL3 A
LINE_A_IN A
LINE_UL1kV
LINE_UL2kV
LINE_UL3kV
Primary
fn 50.00 Hz

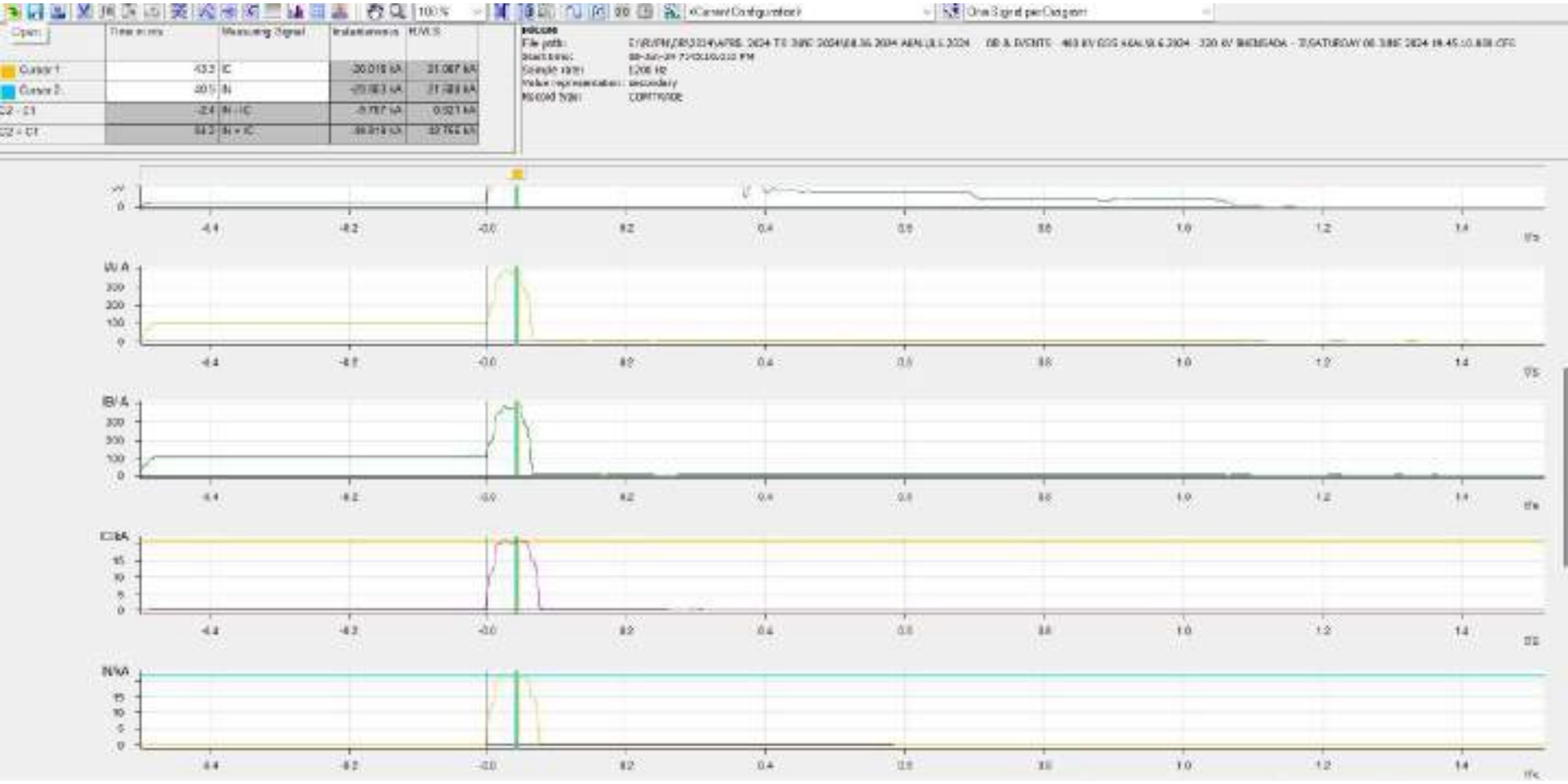

Time in ms
Measuring Signal
Instantaneous
R.M.S
Cursor 1:
Cursor 2:
C2 - C1
C2 + C1
UNF_A_B3
Normal
TRIP
TRIP-R
TRIP-Y
TRIP-B
BROKEN-COND
ZM01-TRIP
ZM01-START
ZM02-TRIP
ZM02-START
ZM03-TRIP
ZM03-START
ZM04-TRIP
ZM04-START
ZM05-TRIP
ZM05-START
SOTF-TRIP
STUB_TRIP
PHS-STF-FAIL1
PHS-STF-FAIL2
PHS-STF-FAIL3
PSB-OPTD
OV stg-1
OV stg-2
AR LOCKOUT
L1 FUSE FAIL
MCB Rph OPEN
MCB Yph OPEN

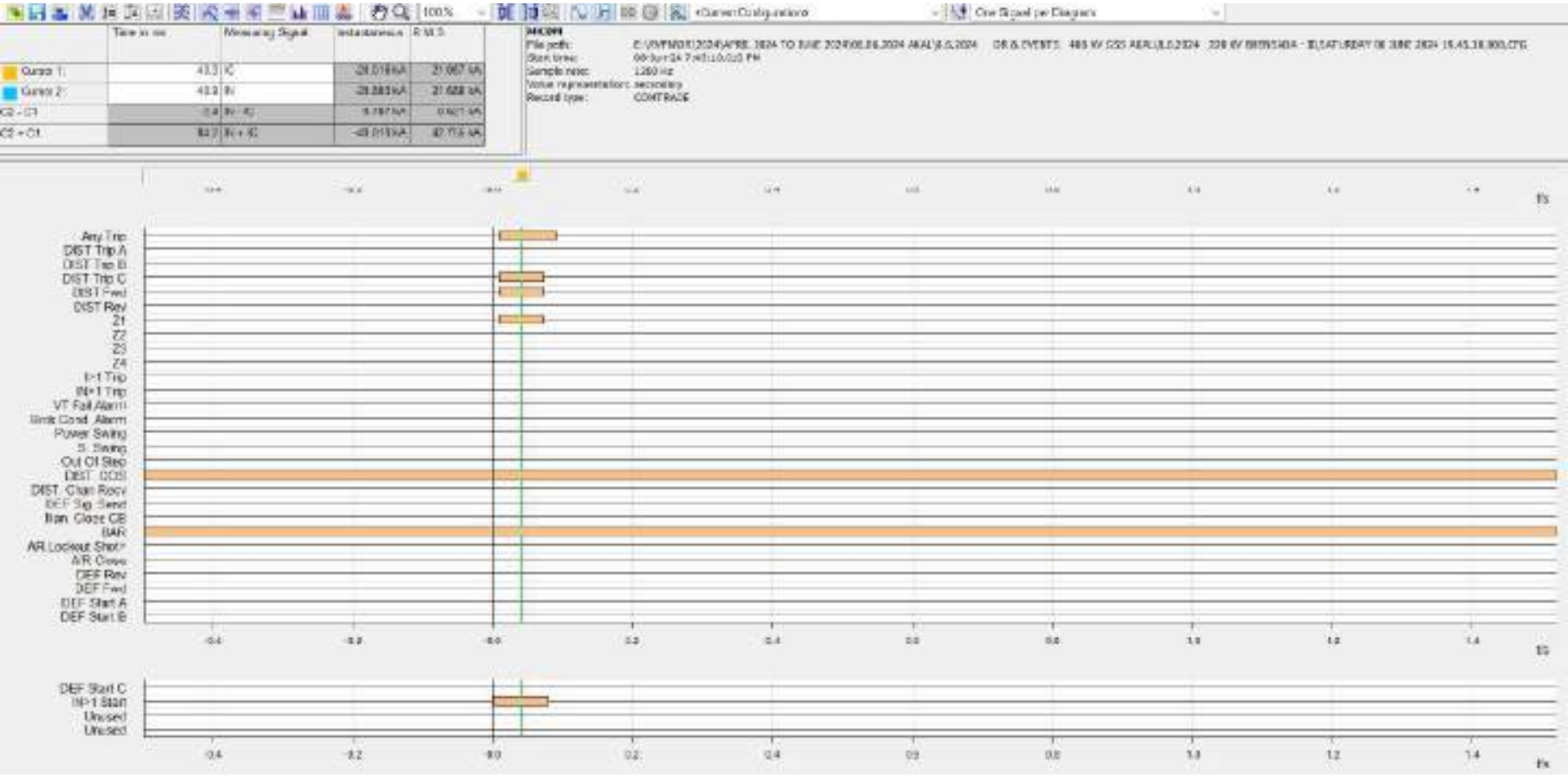

Trigger
07-Jun-24
LINE_A_EL1NA
LINE_A_EL2NA
LINE_A_EL3NA
LINE_A_INNA

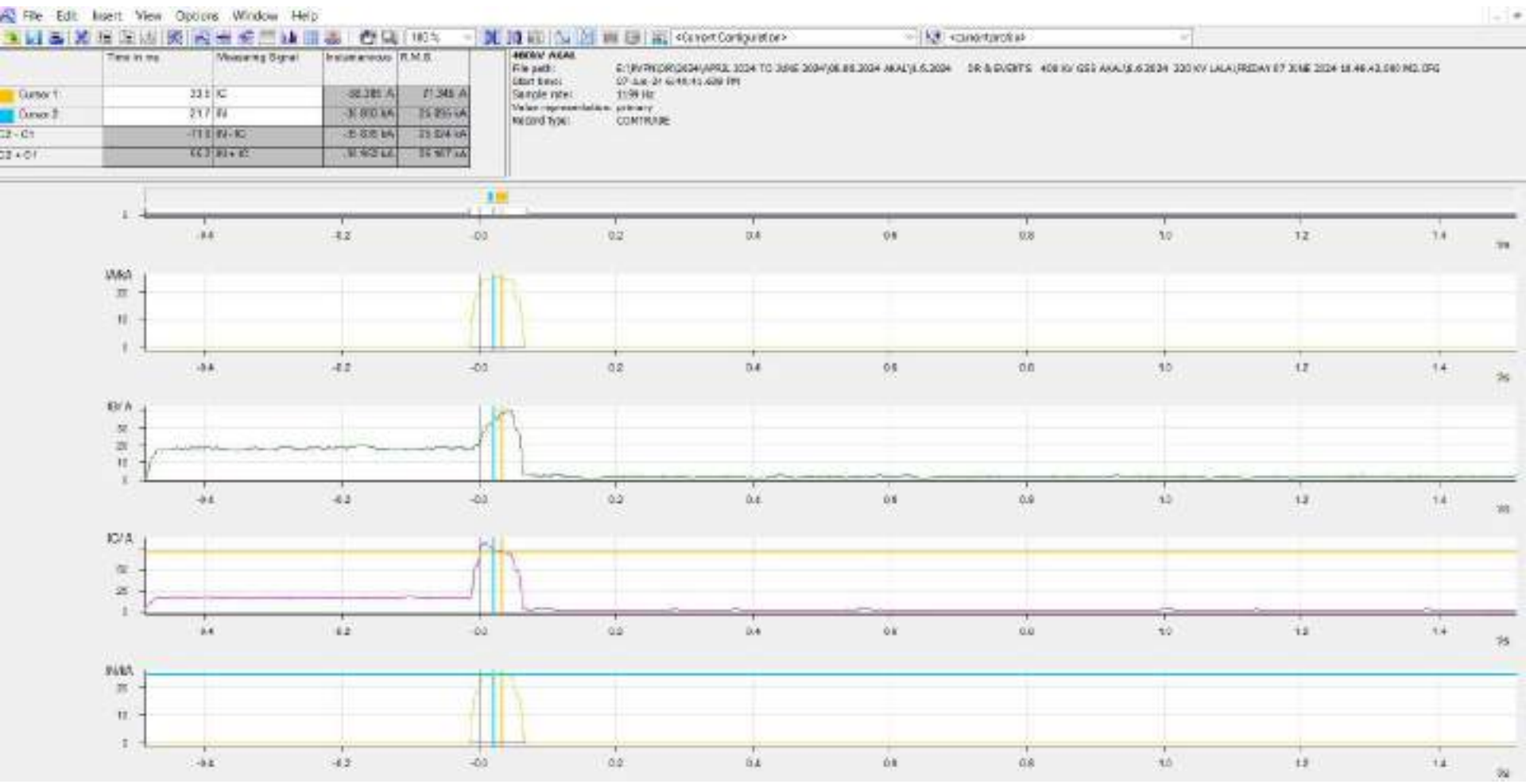

Cursor 1:
Cursor 2:
Sample rate:
Value representation:
Record type:
Comment:
TRIP
TRIP-R
TRIP-Y
TRIP-B
BROKEN-COND
ZM01-TRIP
ZM01-START
ZM02-TRIP
ZM02-START
ZM03-TRIP
ZM03-START
ZM04-TRIP
ZM04-START
ZM05-TRIP
ZM05-START
SOTF-TRIP
ZCOM-TRIP
STUB-TRIP
ZCAL-TRWEI
ZCAL-PREVBL
PHS-STFWL1
PHS-STFWL2
PHS-STFWL3
PHS-STFWPE
PSB-OPTD
OV stg-1
OV stg-2
DRB02-INPUT36
0.0
0.5
1.0
1.5
2.0
2.5
AR LOCKOUT
DRB02-INPUT31
L1 FUSE FAIL
MCB Rpn OPEN
MCB Ypn OPEN
MCB Bpn OPEN
CARR REC CH-1

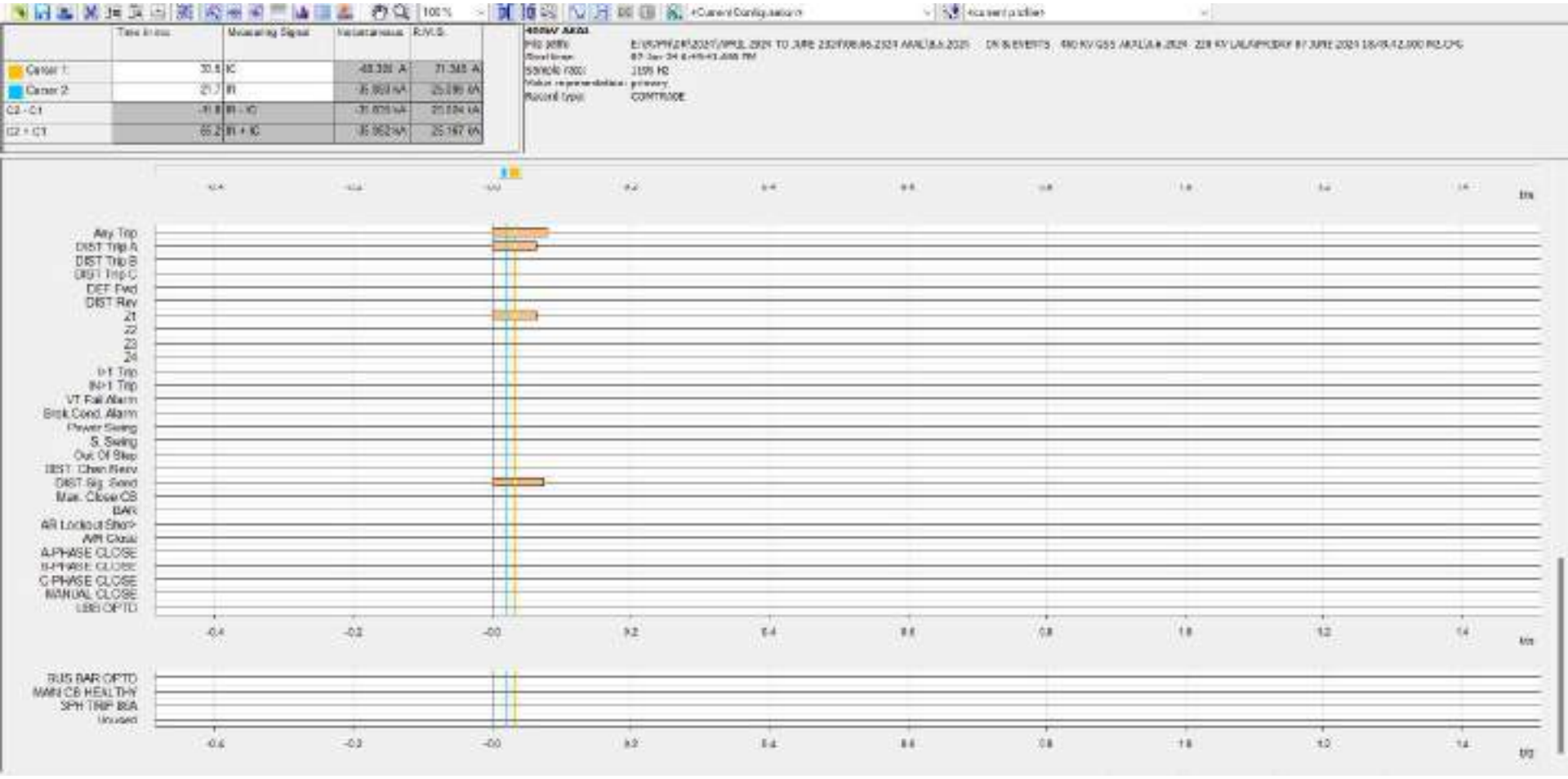

Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1
Cursor 2
C2 - C1
C2 + C1
IA/A
IB/A
IC/A
IN/A

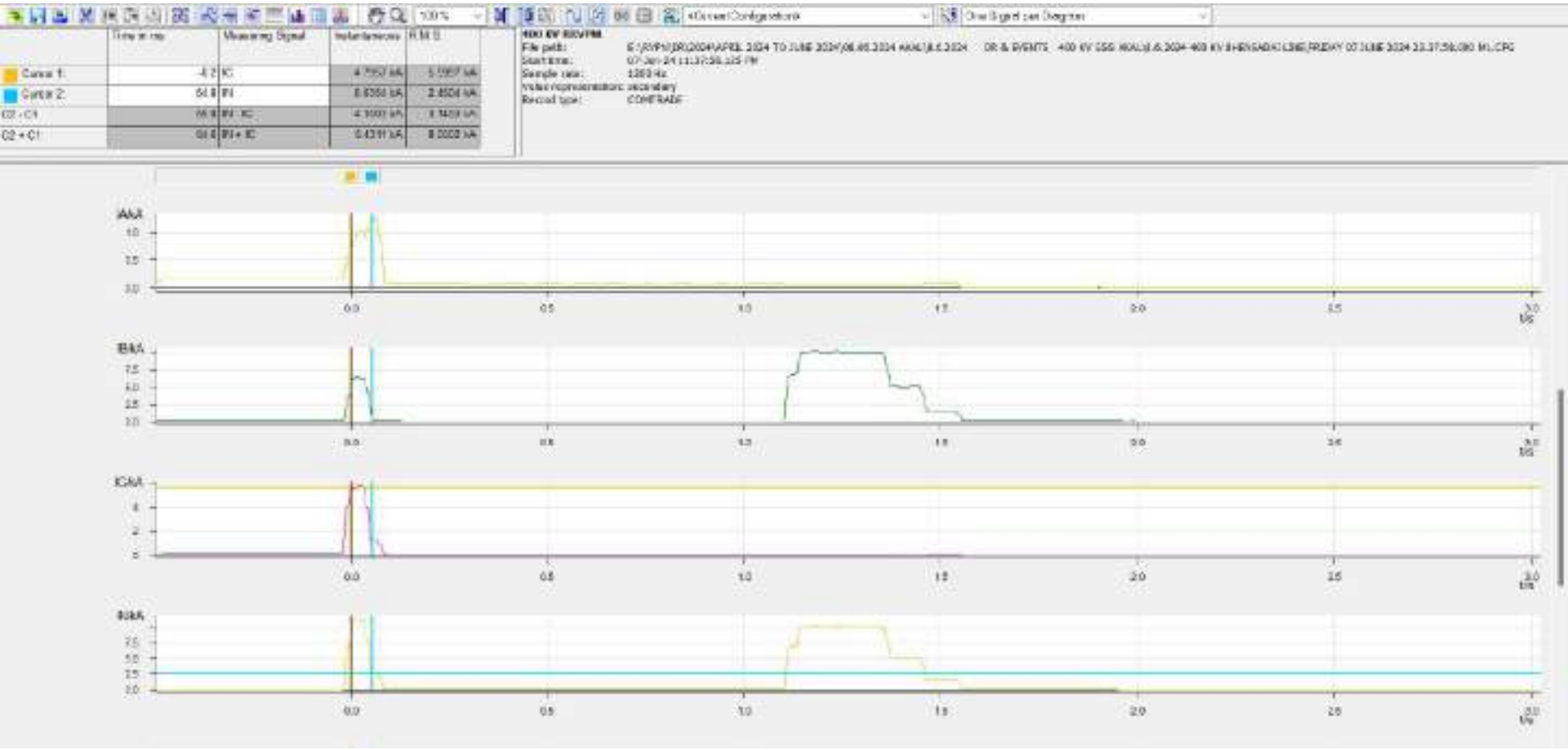

Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1
Cursor 2
2 - C1
3 + C1
IC
IV
IN - IC
IN + IE
MiCOM
Sample rate:
Record type:
COMTRADE
Any Trip
DIST Trip A
DIST Trip B
DIST Trip C
DIST Fwd
DIST Rev
Z1
Z2
Z3
Z4
I>1 Trip
IN>1 Trip
VT Fail Alarm
Brok.Cond. Alarm
Power Swing
I> Swing
Out Of Step
DIST. CCIS
DIST. Chan Recv
DEF Sig. Send
Min. Close CB
BAR
AR Lockout Shot>
A/R Close
DEF Rev
DEF Fwd
DEF Start A
DEF Start B
DEF Start C
IN>1 Start
Unused
Unused
ms

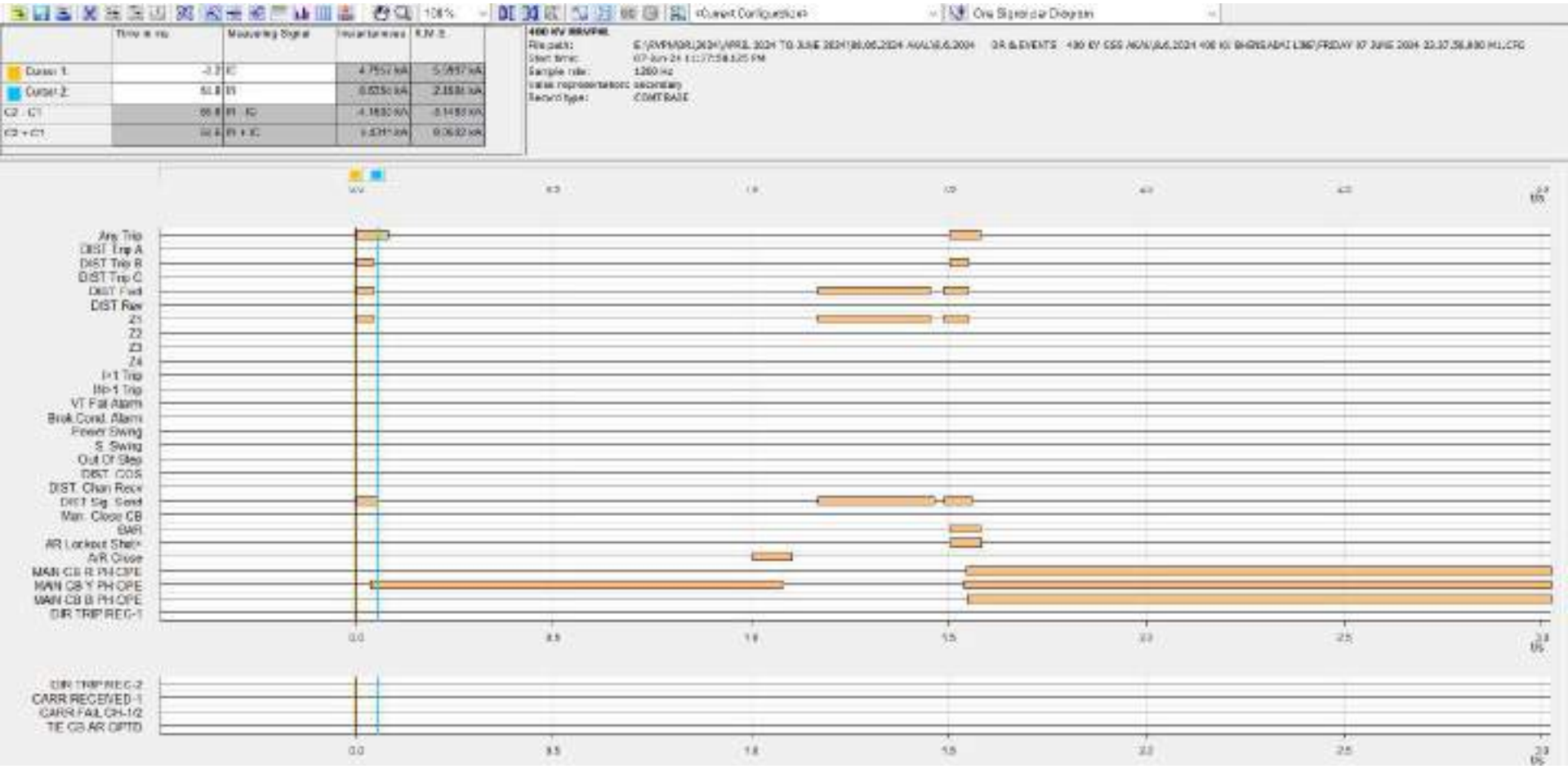

Open
Time in ms
Measuring Signal
Instantaneous
RMS
Cursor 1
-43.2
IC
-20.016 kA
21.087 kA
Cursor 2
-20.1
IN
-20.083 kA
21.089 kA
C2 - C1
-0.4
IN - IC
-0.767 kA
0.521 kA
C2 + C1
84.2
IN + IC
-40.914 kA
42.702 kA
100 %
Current Configuration
One Signal per Diagram
Info
File path:
Start time:
Sample rate:
Value representation:
Record type:
1200 Hz
secondary
CONTINUOUS
IV
IA
IB
IC
IN

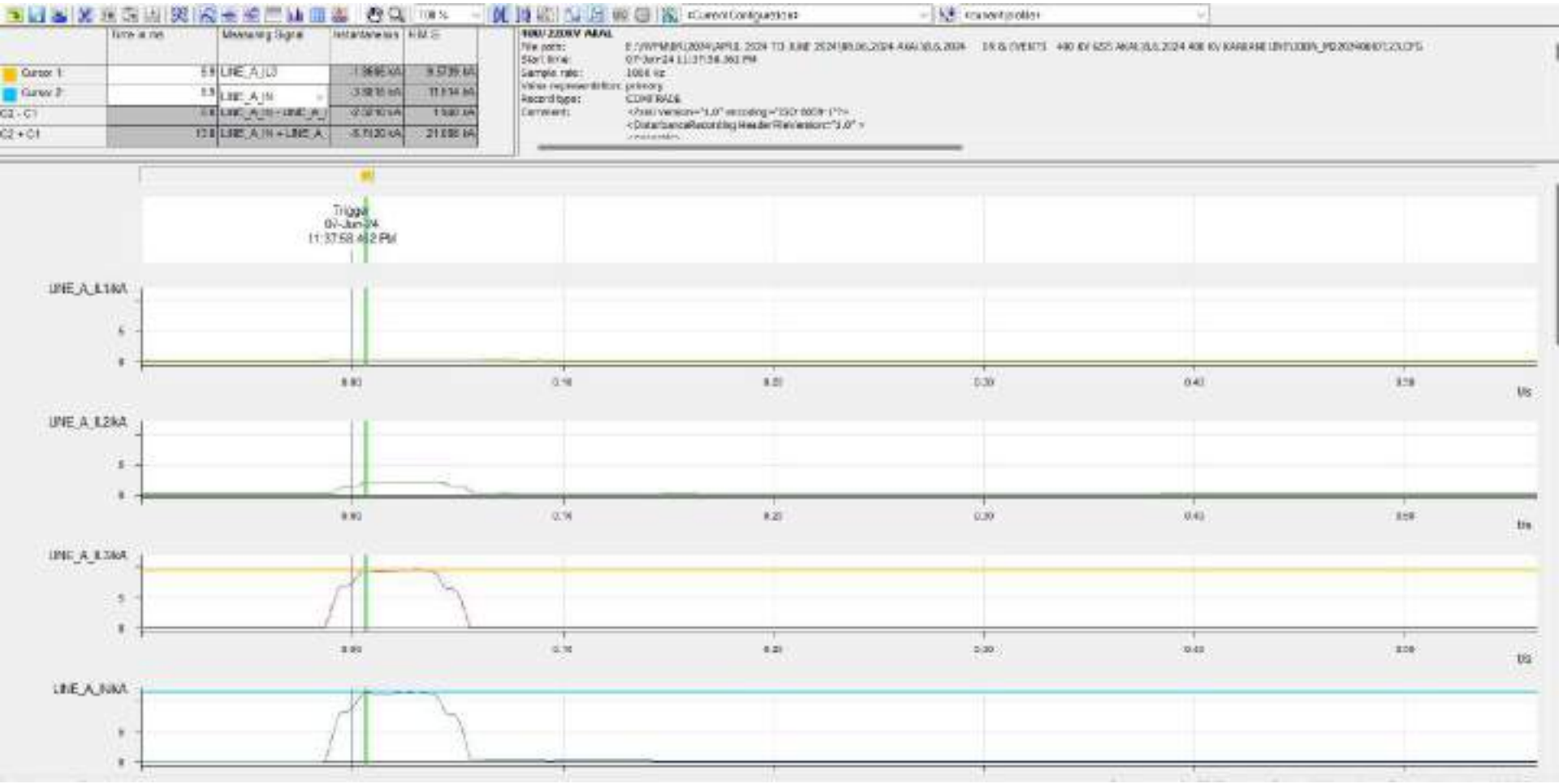

Time in ms
Measuring Signal
Instantaneous
R.M.S.
Curve 1:
Curve 2:
IC
IN
Any Trip
DIST Trip A
DIST Trip B
DIST Trip C
DIST Fwd
DIST Rev
Z1
Z2
Z3
Z4
I>1 Trip
IN>1 Trip
VT Fail Alarm
Limit Cond. Alarm
Power Swing
S. Swing
Out Of Step
DIST. CCS
DIST. Chan Recv
DEF Sig. Send
Man. Close CB
BAR
AR Lockout Shot
A/R Close
DEF Rev
DEF Fwd
DEF Start A
DEF Start B
DEF Start C
IN>1 Start
Unused
Unused

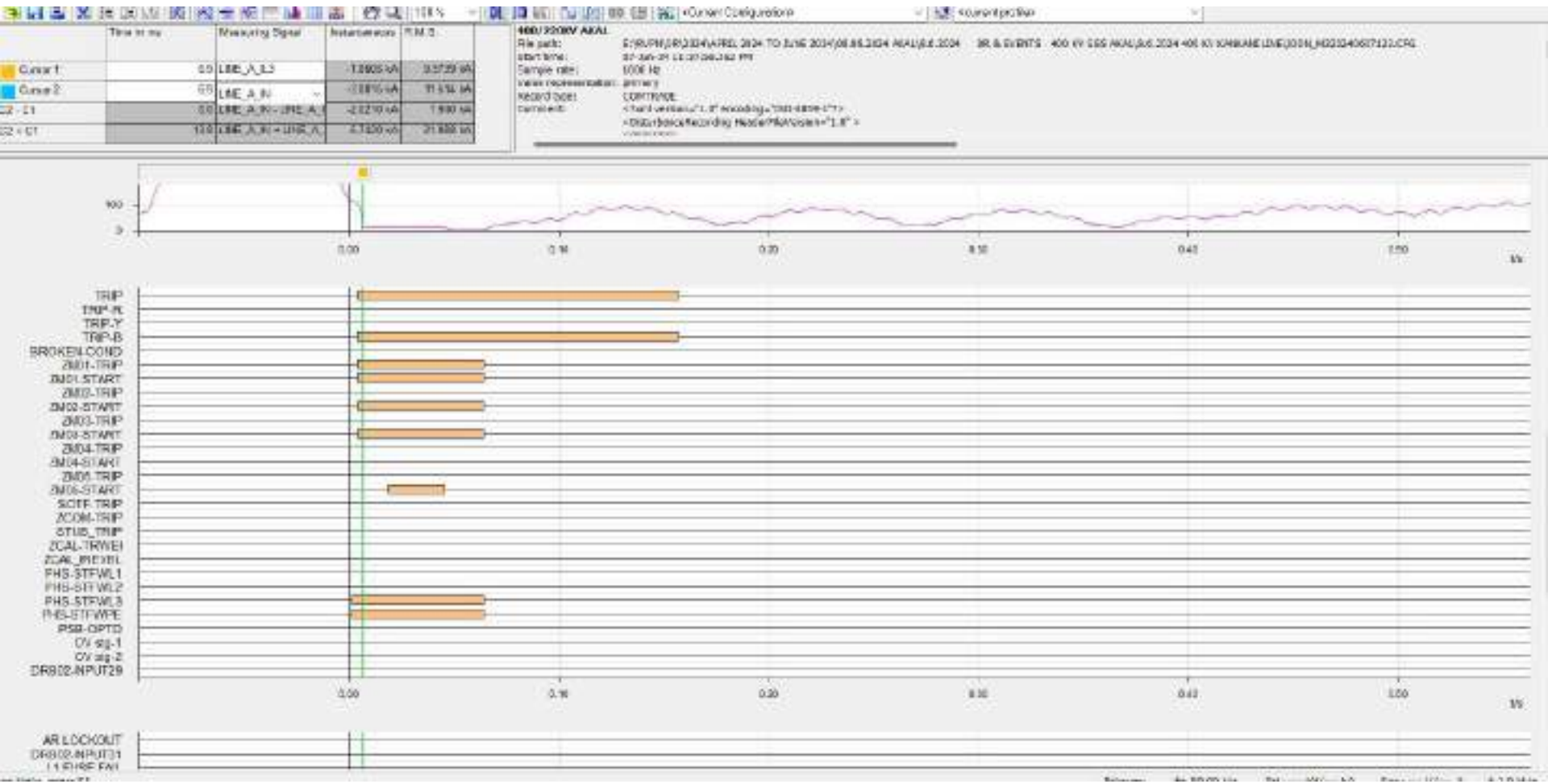

File Edit Insert View Options Window Help
Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1
Cursor 2
IC
IN
IN - IC
IN + IC
400kV AKAL
VMkV
IN/ A
IC/ A
IN/A

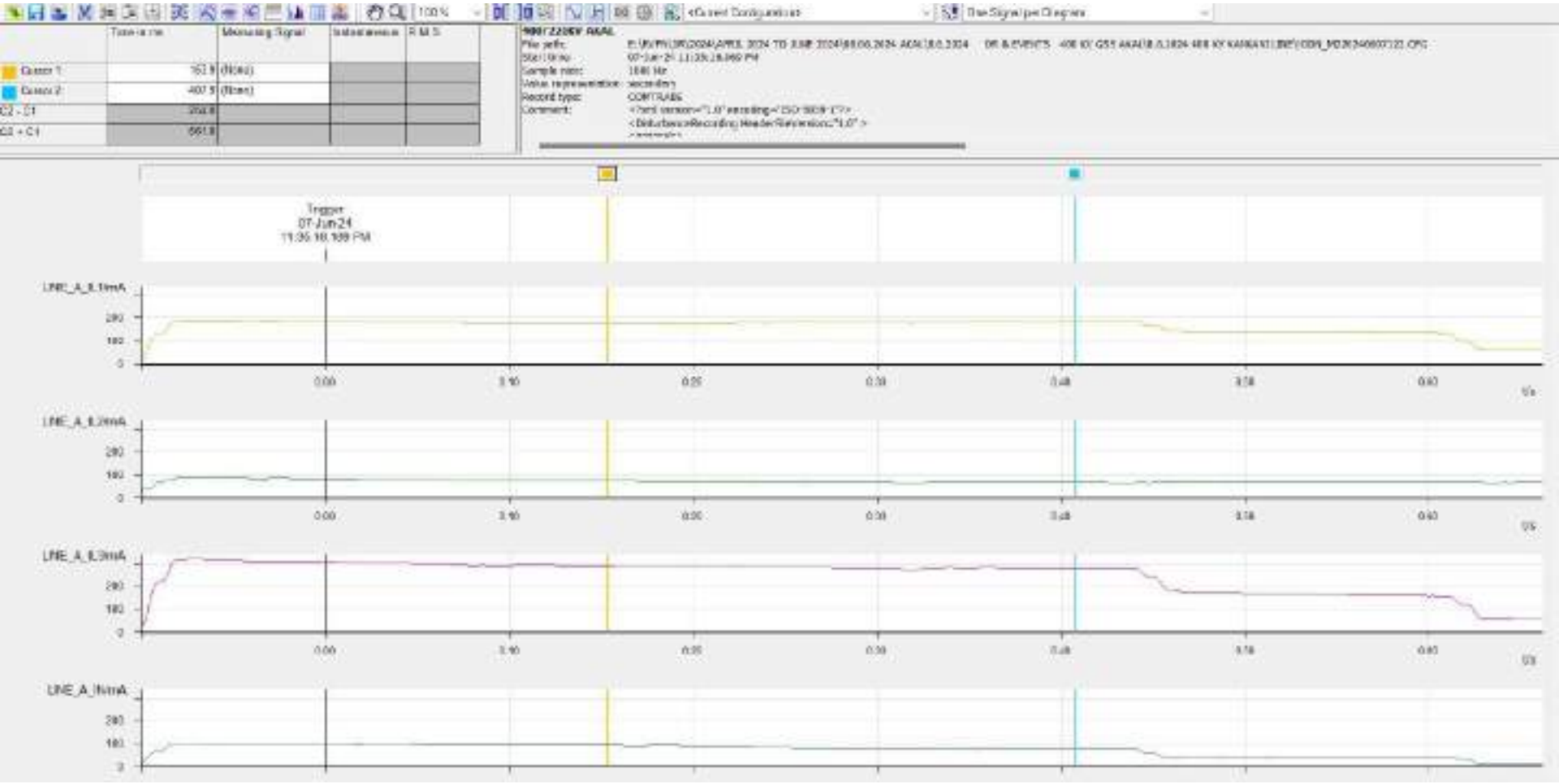

Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1:
30.5
IC
-48.338 A
31.348 A
Cursor 2:
21.7
IB
-35.803 kA
25.196 kA
C2 - C1
-8.8
IB - IC
-31.675 kA
25.104 kA
C2 + C1
65.2
IB + IC
-35.952 kA
25.167 kA
Sample rate:
2199 Hz
Record type:
CONTINUE
Any Trip
DIST Trip A
DIST Trip B
DIST Trip C
DEF Fwd
DIST Rev
Z1
Z2
Z3
Z4
I>1 Trip
IN>1 Trip
VT Fail Alarm
Brok Cond. Alarm
Power Swing
S. Swing
Out Of Step
DIST Chan Recv
DIST Sig. Send
Man. Close CB
BAR
AR Lockout Short
AR Close
A-PHASE CLOSE
B-PHASE CLOSE
C-PHASE CLOSE
MANUAL CLOSE
USER OPTD
-0.4
-0.2
-0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
ms
BUS BAR OPTD
MAN CB HEALTHY
SPH TRIP BUS
Unused
-0.4
-0.2
-0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
ms

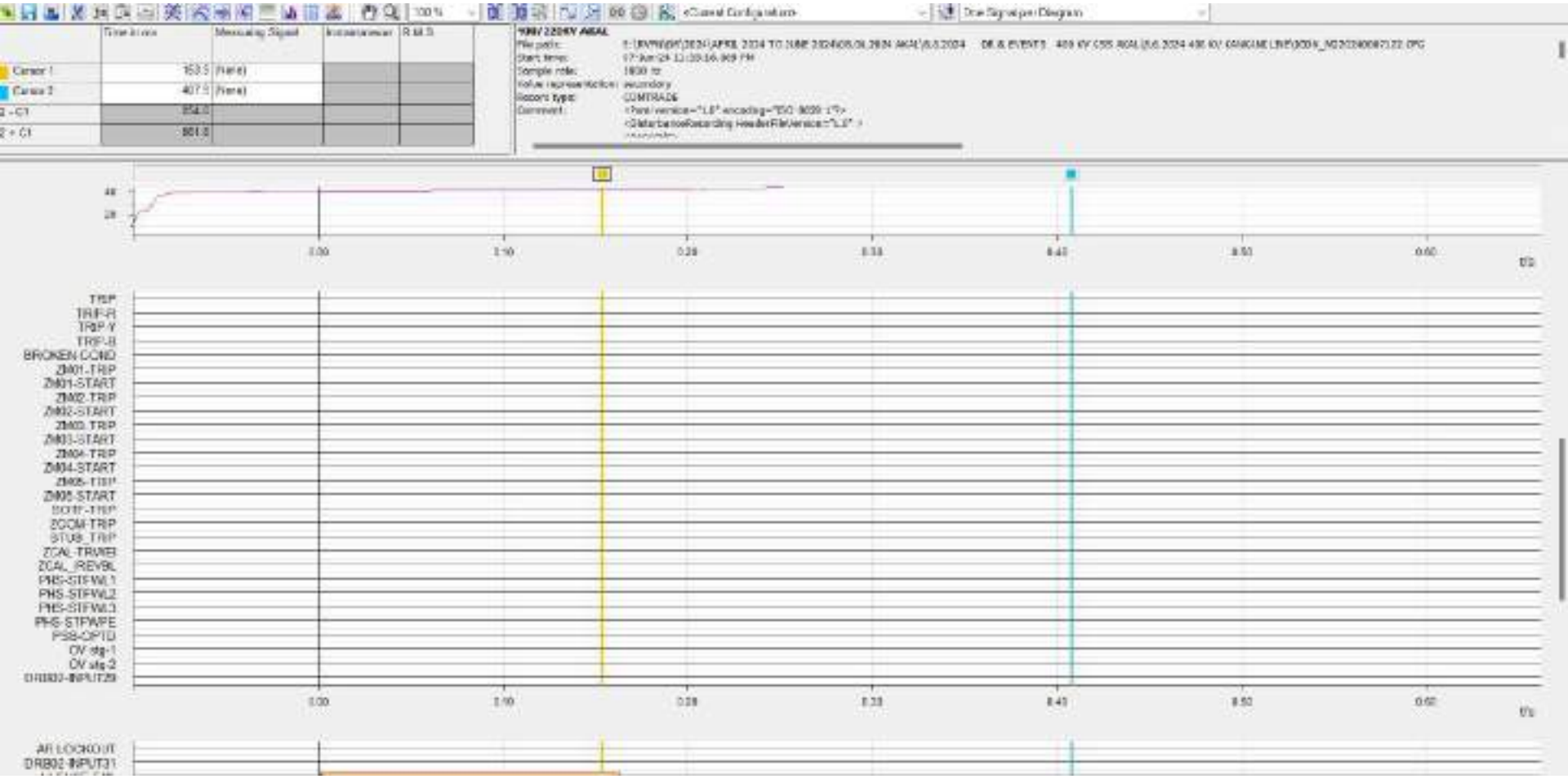

Time in ms
Measuring Signal
Instantaneous
R.M.S.
Curve 1:
Curve 2:
C2 - C1
C2 + C1
400 KV BSVPM
File path:
Start time:
Sample rate:
Instantaneous:
Record type:
CONTINUOUS
IAAA
IBAA
ICAA
IRAA
0.0
0.5
1.0
1.5
2.0
2.5
3.0
ms


Cursor 1:
Cursor 2:
C2 - C1
C2 + C1
Any Trip
DIST Trip A
DIST Trip B
DIST Trip C
DIST Fwd
DIST Rev
Z1
Z2
Z3
Z4
I>1 Trip
Ir>1 Trip
VT Fail Alarm
Brok.Cond. Alarm
Power Swing
S. Swing
Out Of Step
DIST. COS
DIST. Chan Recv
DIST Sig. Send
Man. Close CB
BAR
AR Lockout Start
A/R Close
MAIN CB R PH OPE
MAIN CB Y PH OPE
MAIN CB B PH OPE
DIR TRIP REC-1
DIR TRIP REC-2
CARR RECEIVED-1
CARR FAIL CH-1/2
TIE CB AR OPTD


Time a rea
Measuring Signal
Instantaneous
RMS
Cursor 1:
LINE_A_IL3
Cursor 2:
LINE_A_IN
C2 - C1
C2 + C1
LINE_A_IN + LINE_A_
Trigger
07-Jun-24
LINE_A_IL1kA
LINE_A_IL2kA
LINE_A_IL3kA
LINE_A_INkA
ms


Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1
Cursor 2
C2 - C1
C2 + C1
LINE_A_L3
LINE_A_N
LINE_A_N - LINE_A_L
LINE_A_N + LINE_A_L
400/220kV AKAL
Sample rate:
1000 Hz
Record type:
CONTINUE
Comment:
900
0
0.00
0.10
0.20
0.30
0.40
0.50
ms
TRIP
TRIP_R
TRIP_Y
TRIP_B
BROKEN COND
ZM01-TRIP
ZM01-START
ZM02-TRIP
ZM02-START
ZM03-TRIP
ZM03-START
ZM04-TRIP
ZM04-START
ZM05-TRIP
ZM06-START
SOTF-TRIP
ZCOM-TRIP
STUB_TRIP
ZCAL-TRWEI
ZCAL_BKEIBL
PHS-STFWL1
PHS-STFWL2
PHS-STFWL3
PHS-STFWPE
PSB-OPTD
CV sig-1
CV sig-2
DR802-INPUT29
AR LOCKOUT
DR802-INPUT31


Trigger
07-Jun-24
11:35:18.169 PM


Time in ms
Measuring Signal
Instantaneous
R.M.S.
Cursor 1
153.5
(None)
Cursor 2
407.5
(None)
2 - C1
254.0
2 + C1
661.0
400 kV BAY 220KV AKAL
Sample rate:
1800 Hz
Value representation:
secondary
Record type:
COMTRADE
Comment:
TRIP
TRIP-R
TRIP-Y
TRIP-B
BROKEN COND
ZM01-TRIP
ZM01-START
ZM02-TRIP
ZM02-START
ZM03-TRIP
ZM03-START
ZM04-TRIP
ZM04-START
ZM05-TRIP
ZM05-START
ZCOM-TRIP
ZCAL-TRIP
ZCAL_REVBL
PHS-STFWL1
PHS-STFWL2
PHS-STFWL3
PHS-STFWPE
PSB-OPTD
OV stg-1
OV stg-2
AR LOCKOUT
DRB02-INPUT31

OFFICE OF THE EXECUTIVE ENGINEER (MPT&S), RVPNL, JAISALMER

Details of tripping occurred on 8 6.2024

Tripping Report			Name of Sub-Division: Jaisalmer						
S. No	Name of GSS	Name of Line / Equipment	Trip		Close		Relay indication		Remarks
			Date	Time	Date	To	One end/ HV	Other end/ LV	
1	400KV GSS AKAL	220 KV AKAL-BENSADA - II LINE	8.6.2024	19:54	11.06.2024	20:14	M1 - Z1 , C-Ph , 1.106 Km		
2	400KV GSS AKAL	220 KV AKAL-BENSADA - I LINE	8.6.2024	19:46	11.06.2024	20:16	M1 - Z1 , C-Ph , 1.232 Km		
3	400KV GSS AKAL	400 KV AKAL-JODHPUR	8.6.2024	19:56	8.5.2024	23:29	Z5 , Y-Ph	NO TRIPPING	
4	400KV GSS AKAL	400 KV AKAL-BARMER LINE	8.6.2024	19:59	9.5.2024	0:25	DT RECEIVED		
5	400KV GSS AKAL	500 MVA ICT -IV	8.6.2024	19:54	8.5.2024	22:02	INTER TRIP	C-Ph (E/F)	
6	400KV GSS AKAL	315 MVA ICT -III	8.6.2024	19:54	8.5.2024	22:01	INTER TRIP	C-Ph (E/F)	
7	400KV GSS AKAL	220 KV BUS COUPLER	8.6.2024	19:54	08.06.2024	21:56	C-Ph E/F		
8	400KV GSS AKAL	220 KV AKAL-LALA LINE	8.6.2024	19:54	09.06.2024	0:50	M2-Z1 , R-Ph , 46.77 Meter M2-Z1, R-Ph , 383 Meter		FAULT CURRENT 25 KA
9	400KV GSS AKAL	400 KV AKAL-BHENSADA	8.6.2024	19:56	9.5.2024	9:45	Z1 , Y-Ph , 3.472 Km		ONCE LINE AUTO RECLOSED
10	400KV GSS AKAL	400 KV AKAL-KANKANI	8.6.2024	19:55	9.5.2024	9:56	Z1 , C-Ph , 3.065 Km	Z1 , Y-Ph , 179.6 Km	

Multiple elements tripping at 220kV Sainj(HP), Parbati_2&3(NHPC) 07th May 2024

Brief of event:

i. Total generated power of Sainj HEP(HP), Parbati_2(NH) and parbati_3(NH) evacuates through 400 kV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt and 400 kV Parbati_3(NH)-Banala(PG) (PKTCL) Ckt via 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt and 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt.

ii. During antecedent condition, only 50MW Unit-1 at Sainj HEP(HP) was running (generating approx. ~30MW) and 50MW Unit-2 at Sainj HEP(HP), all four units (4*250MW) at Parbati_2(NH) and all four units (4*130MW) at Parbati_3(NH) were not in service.

iii. As reported, at 16:17hrs, 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt tripped on B-N phase to earth fault with fault distance of 1.808km from Sainj end. From initial patrolling it was observed that a Pine Tree admeasuring approx. 50m fell from an uphill position outside the transmission line corridor. The tree weight resulted in simultaneous failing of cross arm of Tower Location No. 7 of 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt as well as snapping of conductor leading to tripping of line.

iv. A s per DR of 400 KV Parbati_3(NH) (end)-Sainj(HP) (PKTCL) Ckt, B-N phase to earth fault is observed with delayed fault clearance time of 400ms and fault current of 7.105kA from Parbati_3(NH) end. Fault was sensed in zone-2 from Parbati_3(NH). Due to non-receipt of carrier signal from remote end, three phase trip command issued after Z2 time delay.

v. As further reported, 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt also tripped at the same time (exact reason of the same yet to be shared). As per DR (time sync issue observed), B-N phase to earth fault with fault current of of 1.212kA from Parbati_2(NH) end is observed.

Brief of event:

vi. During the same time, 400 KV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt also tripped from Parbati_2(NH) end only on B-N phase to earth fault with fault distance of 22.5km and fault current of 1.304kA from Banala(PG) end.

vii. As per DR, fault was sensed in zone-1 at Banala(PG) end and carrier sent to Parbati_2(NH) end and line successfully auto-reclosed from Banala(PG). But as reported by NHPC, fault was sensed in zone-2 at Parbati_2(NH) end and upon receipt of carrier signal from Banala(PG) B-phase CB opened. But reclosing command was not extended to B-phase CB after dead time, hence, line tripped from Parbati_2(NH) on operation of Pole discrepancy relay.

viii. As per PMU at Banala(PG), B-N phase to earth fault is observed with delayed fault clearing time of 400ms.

ix. As per SCADA, generation loss of approx. 30 MW at Sainj HEP (HP) is observed.

Elements tripped:

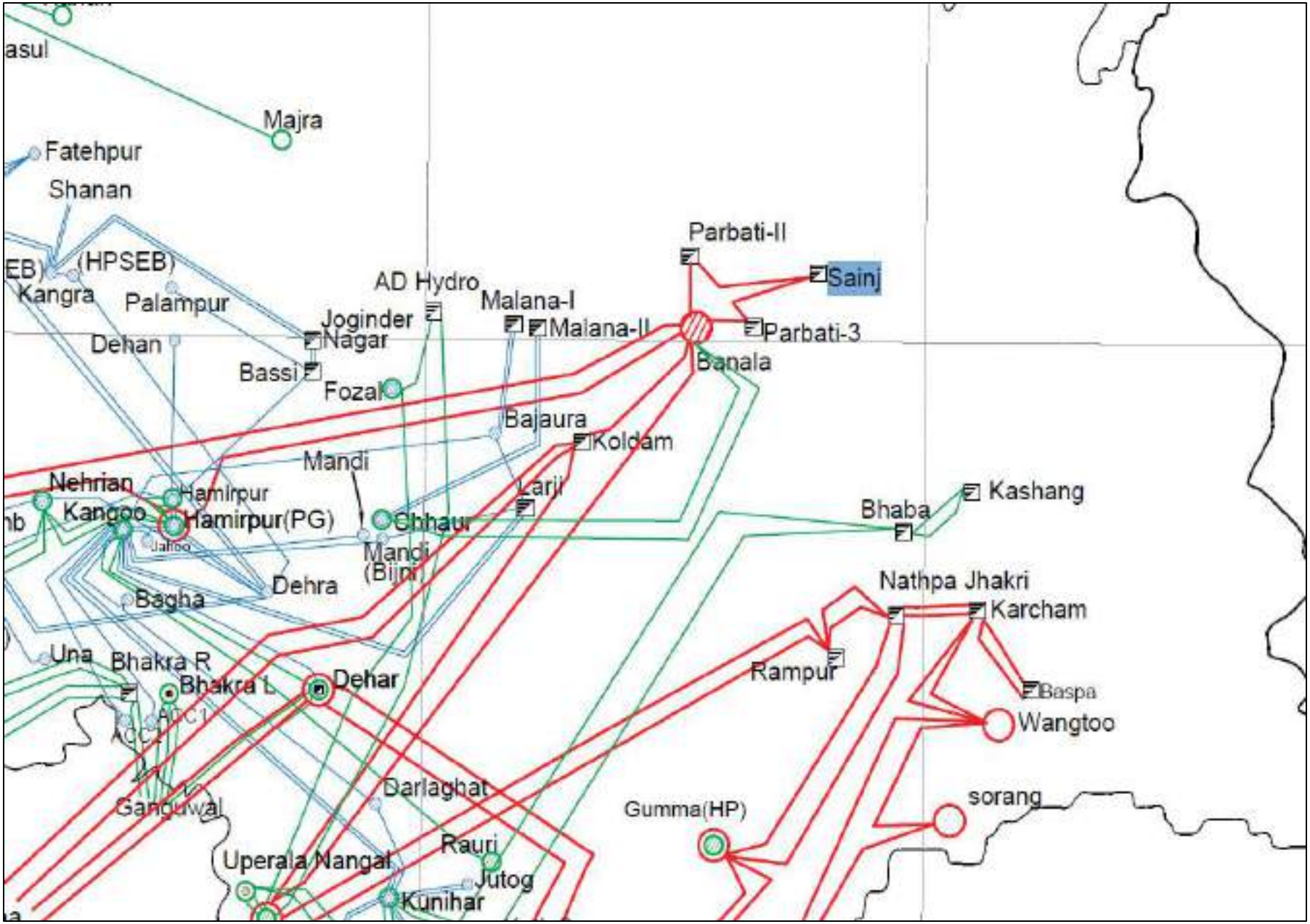
i. 400 KV Parbati_2(NH)-Sainj(HP) (PKTCL) Ckt

ii. 400 KV Parbati_3(NH)-Sainj(HP) (PKTCL) Ckt

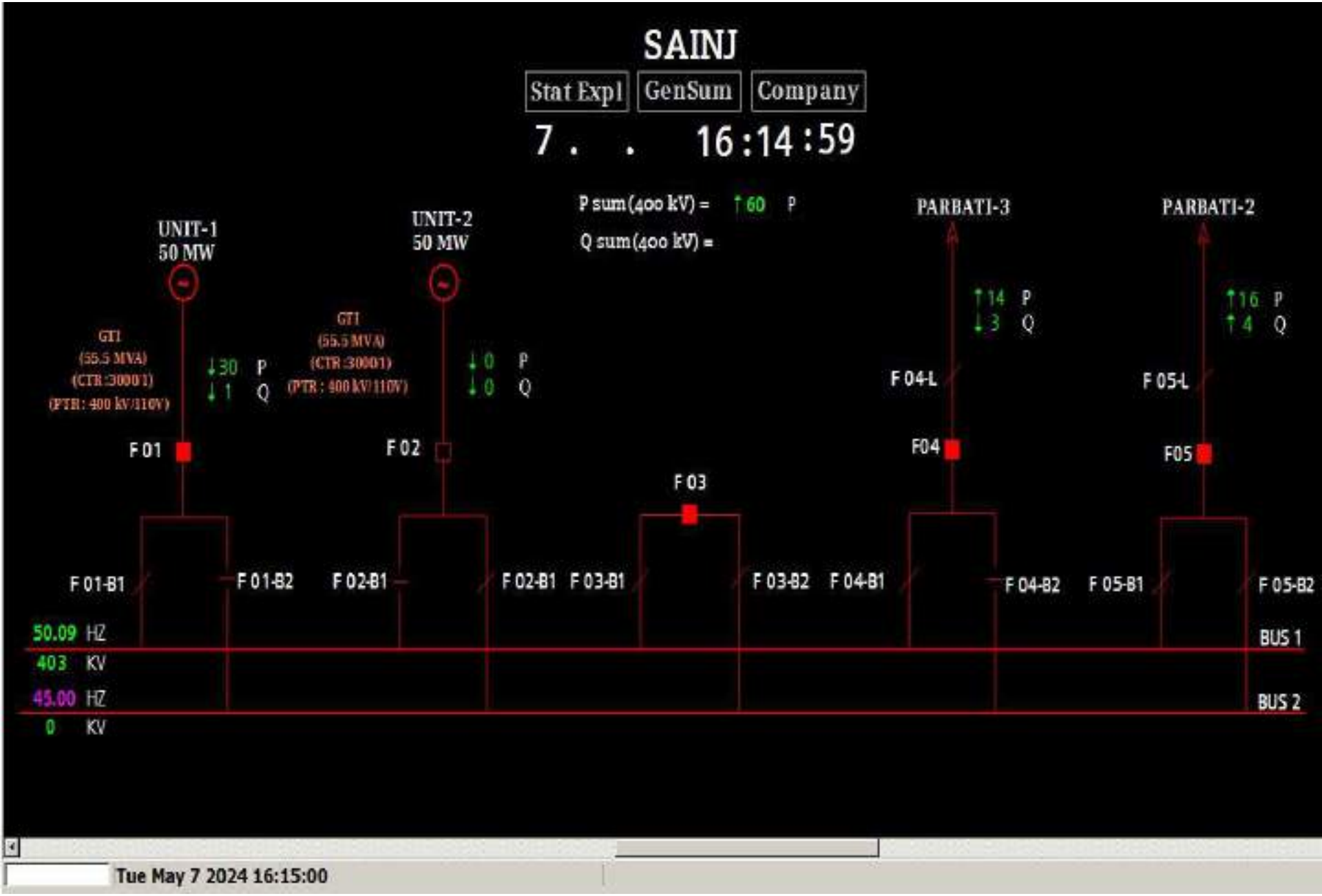
iii. 400 KV Parbati_2(NH)- Banala(PG) (PKTCL) Ckt

iv. 50 MW Unit-1 at Sainj HEP(HP)

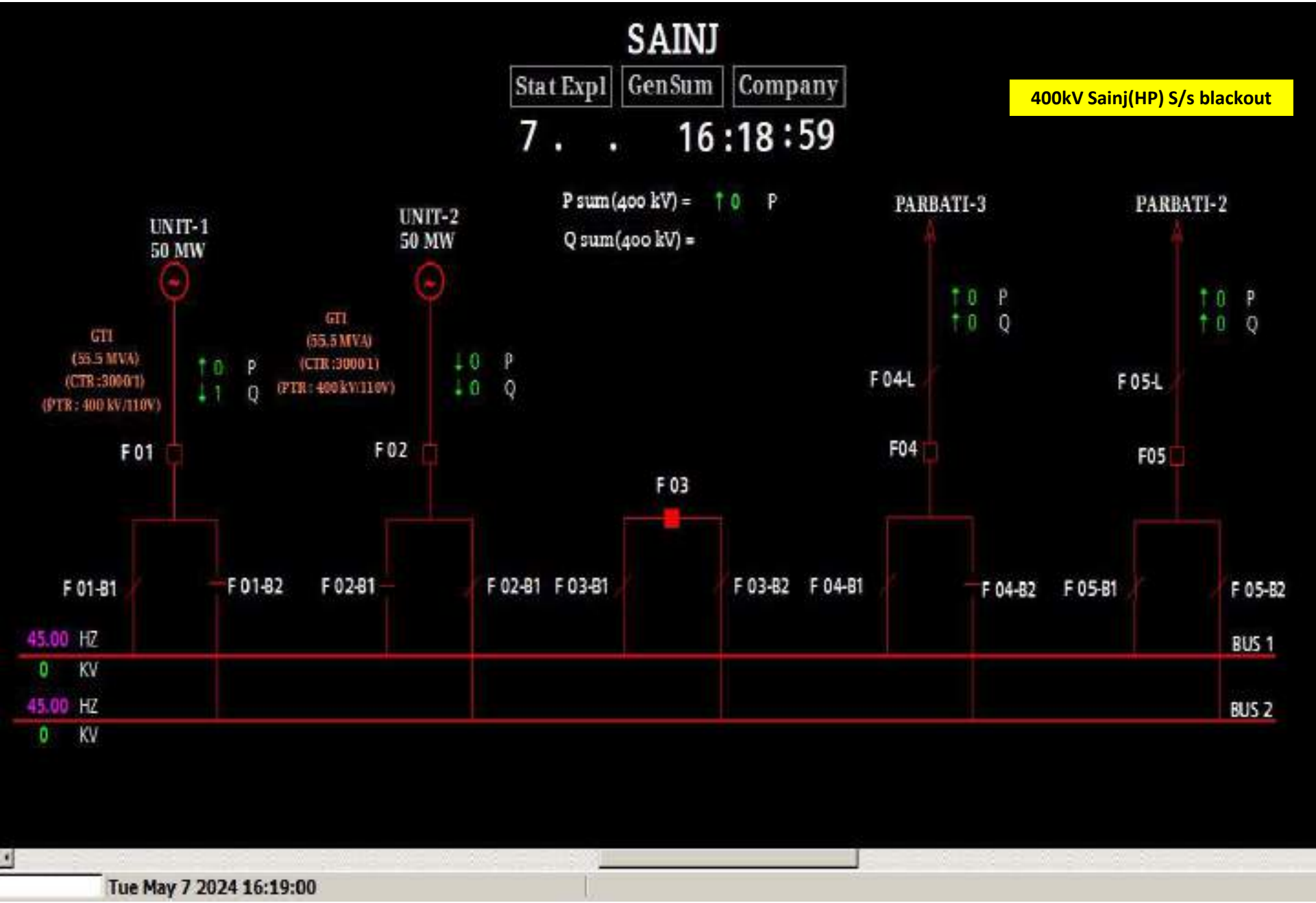
Network Diagram



SLD of 400kV Sainj(HP) before the event

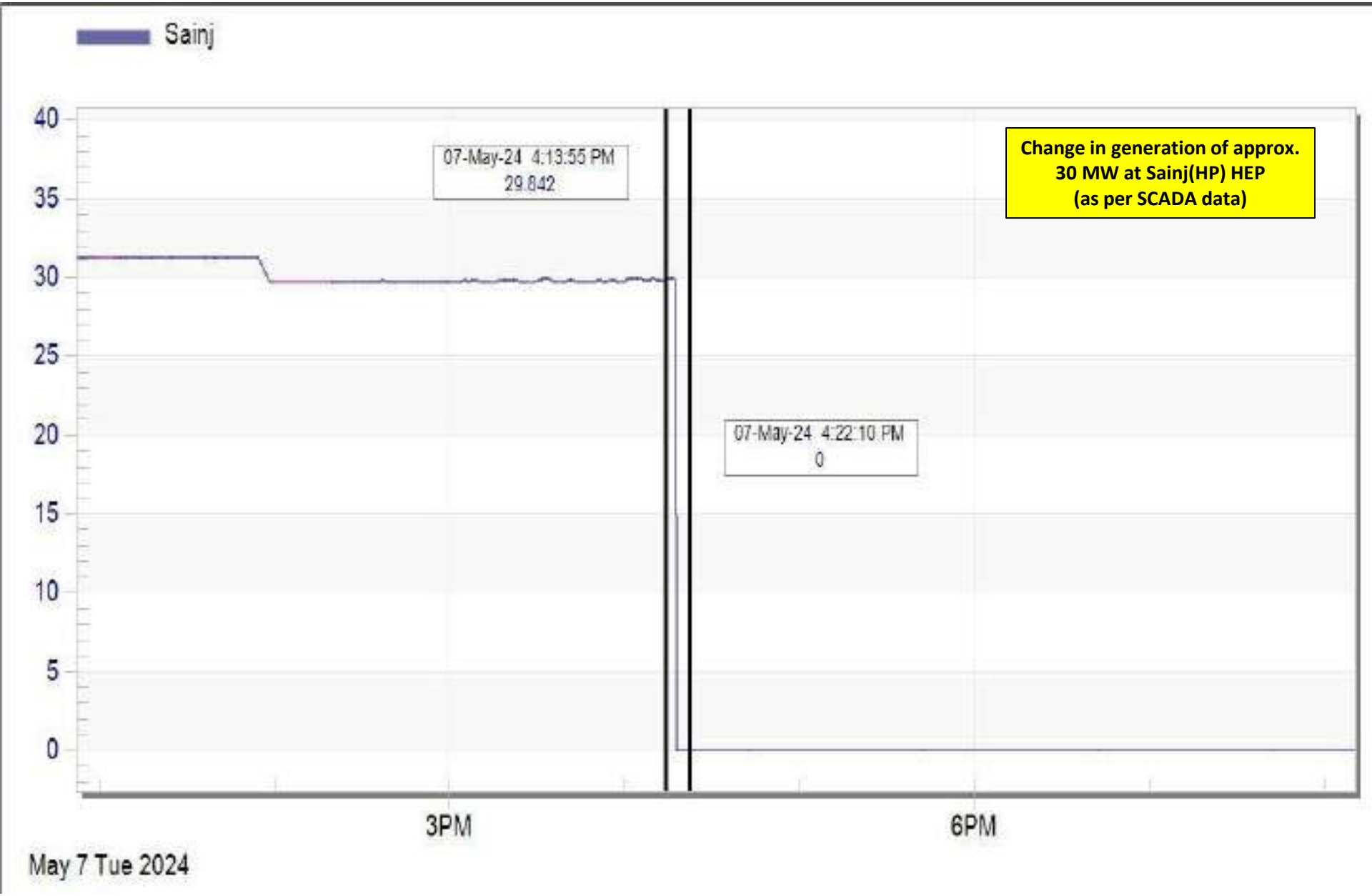


SLD of 400kV Sainj(HP) after the event



Tue May 7 2024 16:19:00

Sainj(HP) HEP generation during the event

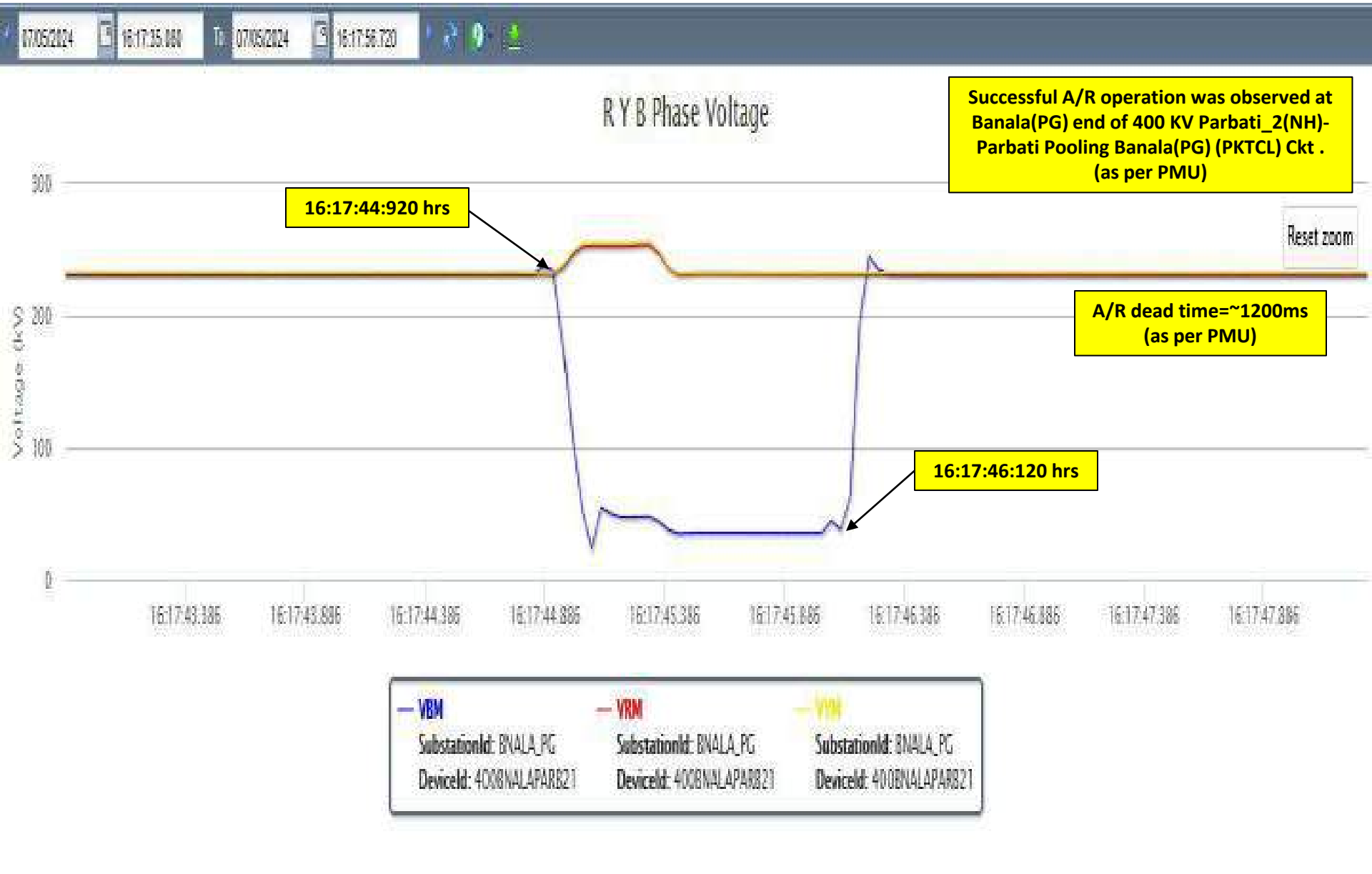


PMU Plot of frequency at Banala(PG)

16:17hrs/07-May-24

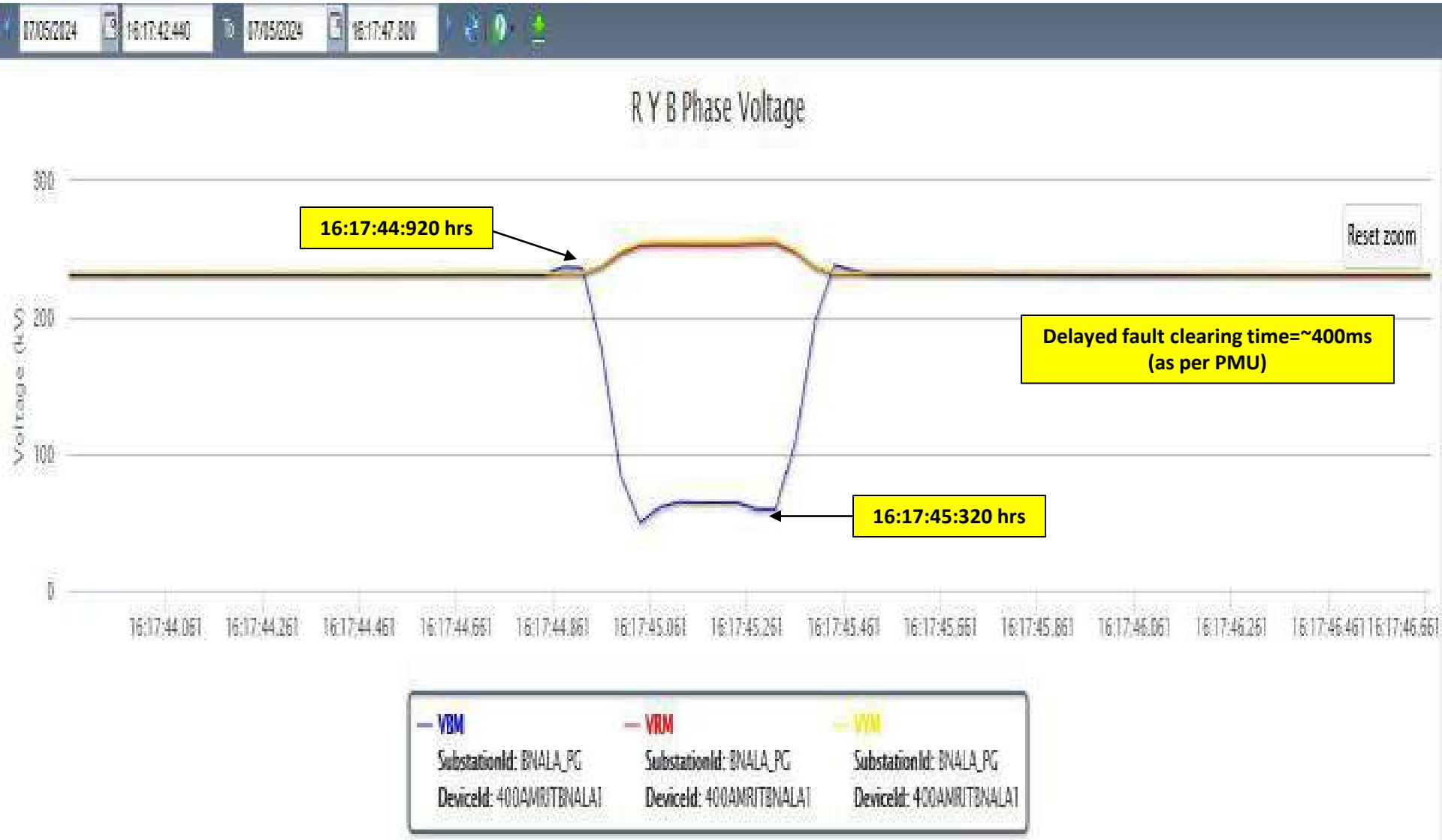
PMU Plot of phase voltage magnitude at Banala(PG)

16:17hrs/07-May-24

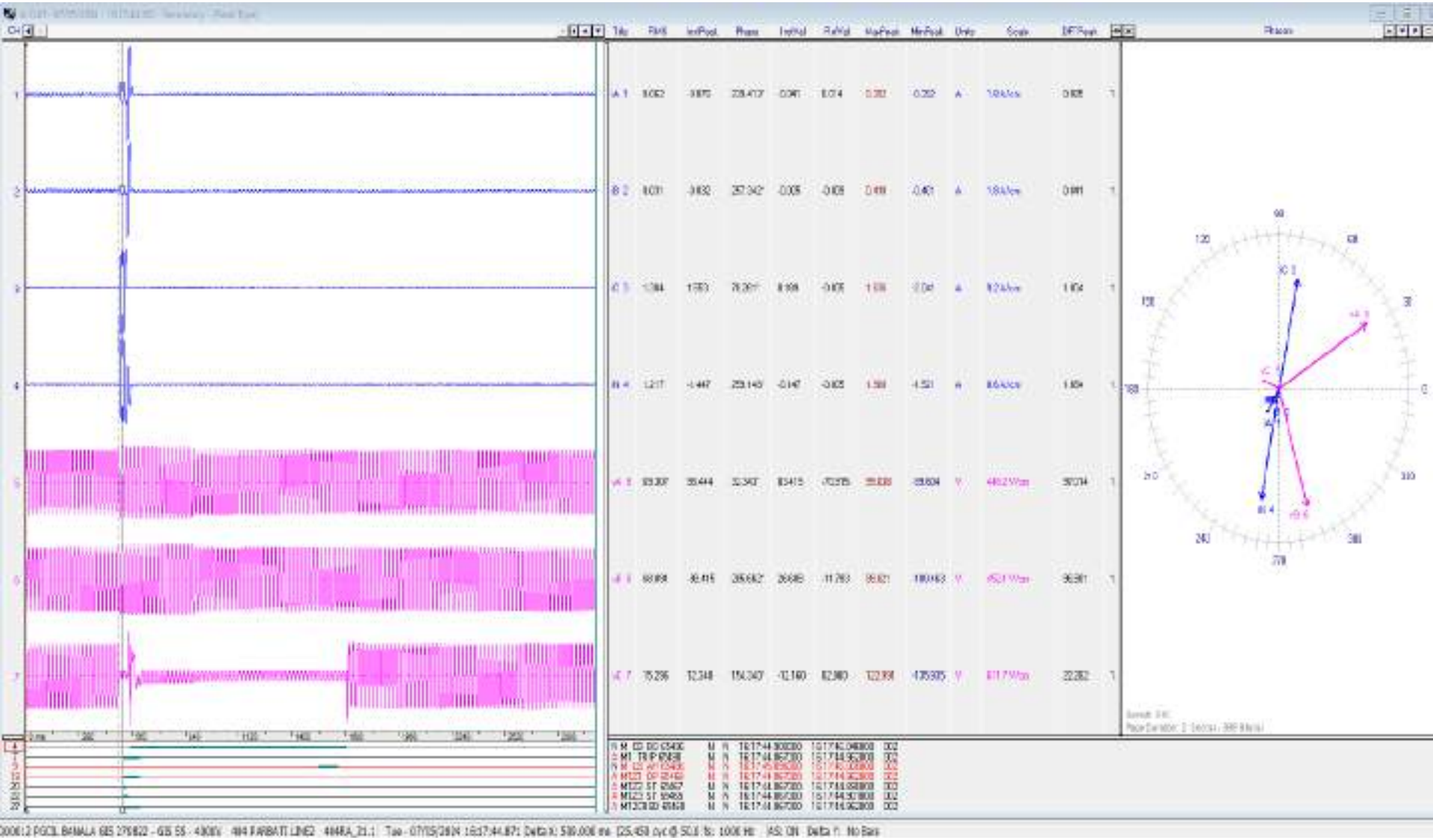


PMU Plot of phase voltage magnitude at Banala(PG)

16:17hrs/07-May-24

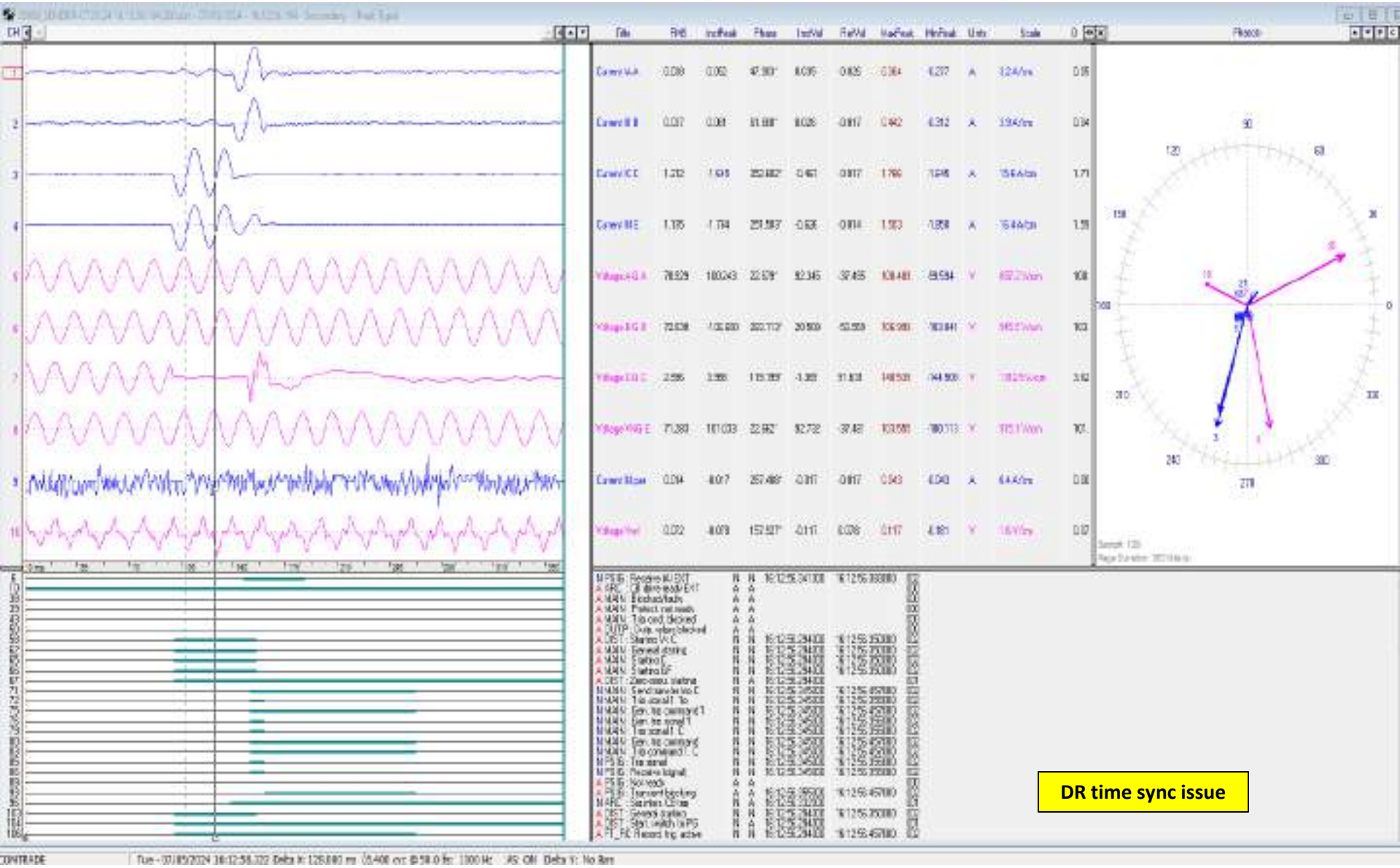


DR of 400 KV Parbati_2(NH)- Banala(PG) (end) (PKTCL) Ckt



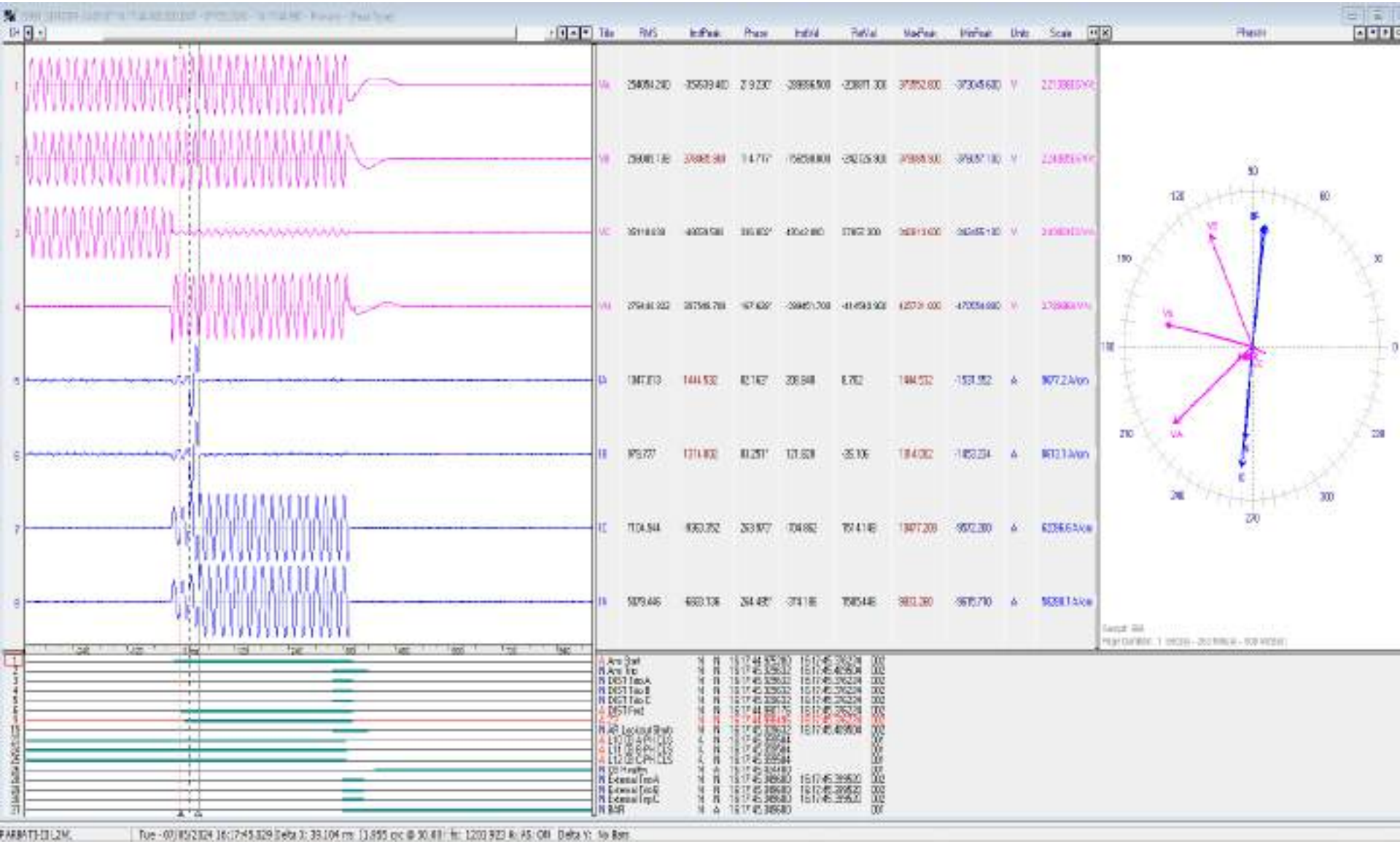
- ✓ B-N phase to earth fault; Ib=~1.304kA; fault sensed in zone-1
- ✓ Carrier sent from Banala(PG)
- ✓ Line successfully auto-reclosed from Banala(PG) end

DR of 400 KV Parbati_2(NH) (end)-Sainj(HP) (PKTCL) Ckt



- ✓ B-N phase to earth fault; Ib=~1.212kA

DR of 400 KV Parbati_3(NH) (end)-Sainj(HP) (PKTCL) Ckt



- ✓ B-N phase to earth fault; Ib=~7.105kA; fault sensed in zone-2 from Parbati_3(NH)
- ✓ Fault clearing time=~400ms

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
16:17:46,566	PRBT2_NH	400kV	01BNLA	Circuit Breaker	Open	Line CB at Parbati_2(NH) end of 400 KV Parbati_2(NH)-Parbati Pooling Banala(PG) (PKTCL) Ckt opened
16:17:50,207	PRBT3_NH	400kV	05MBC	Circuit Breaker	Open	Main Bus Coupler CB at Parbati_3(NH) opened

Point of discussion

- Reason of delayed clearance of fault need to be shared.
- DR time sync issue at Parbati_2(NH) need to be resolved.
- A/R issue at Parbati_2(NH) need to be resolved at the earliest.
- DR/EL (.dat/.cfg file) along with tripping report need to be shared from HP end. Main-2 DR of lines from NHPC end need to be shared.
- Remedial action taken report to be shared.

51th

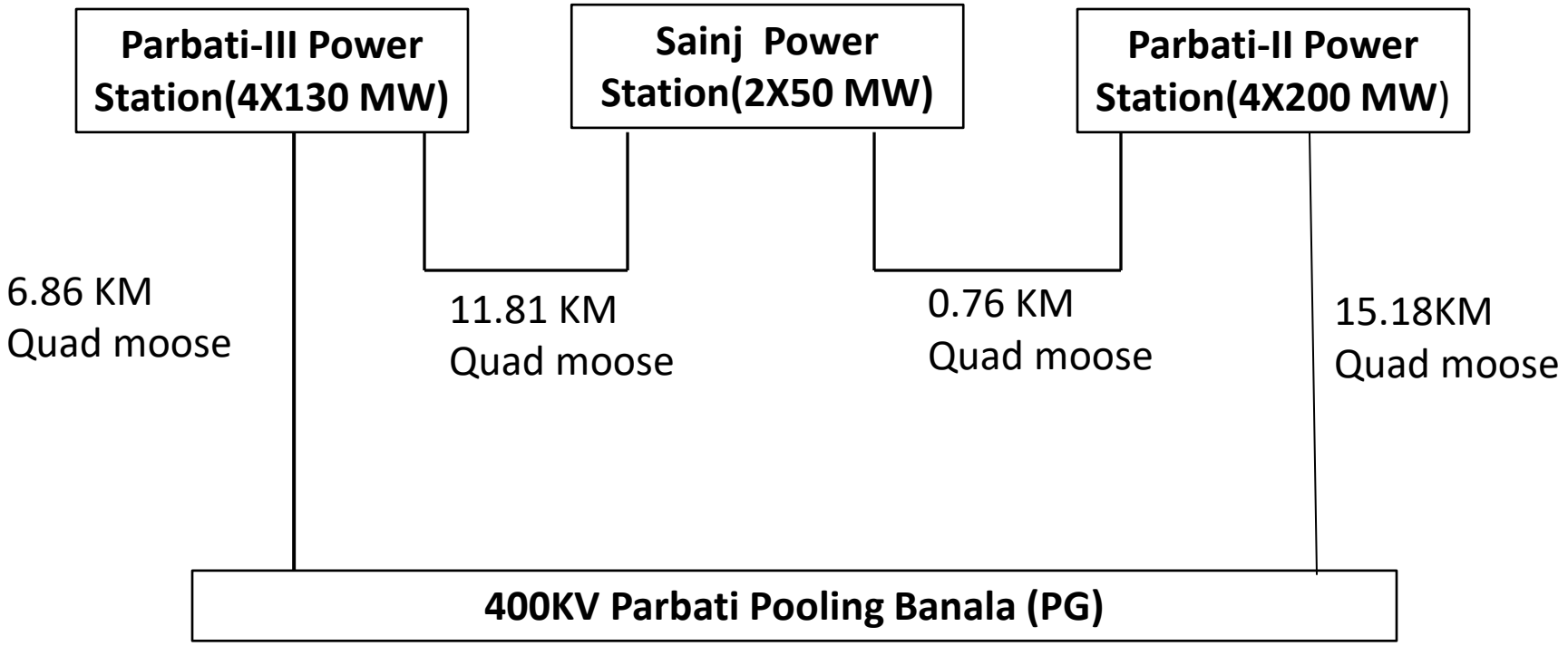
PCC meeting of NRPC

NHPC Limited

Tripping at Point No.-4

Tripping of Parbati-II-Sainj Line, Parbati-II-Banala Line & Parbati-III-Sainj Line **(NHPC)** at 11:16 hrs on 07-May-2024

Network Diagram of Parbati Complex



Parbati-III-Sainj Line (NHPC) at 11:16 hrs on 07-May-2024

Elements Tripped on 07/05/2024

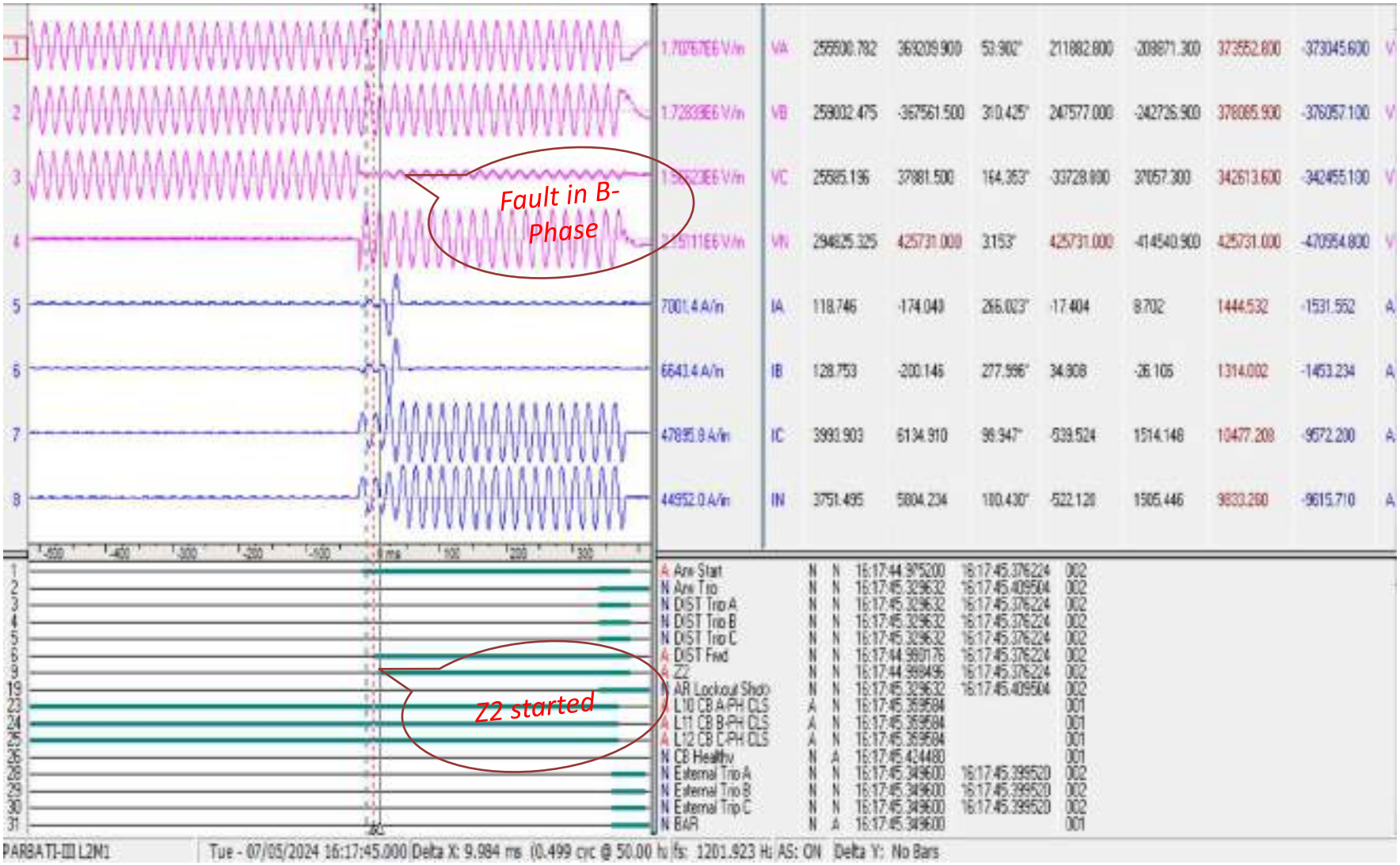
क्रम सं	यूनिट / लाइन नाम	से		तक		कुल आउटेज समय	आउटेज के कारण	ऊर्जा नुकसान (मेगावाट)
		तारीख	समय	तारीख	समय			
1	400 KV Parbati-III-Sainj Line#2	7-May-24	16:17:00	17-May-24	18:03	241:46	Distance Protection operated in Z2	0

Detail Analysis

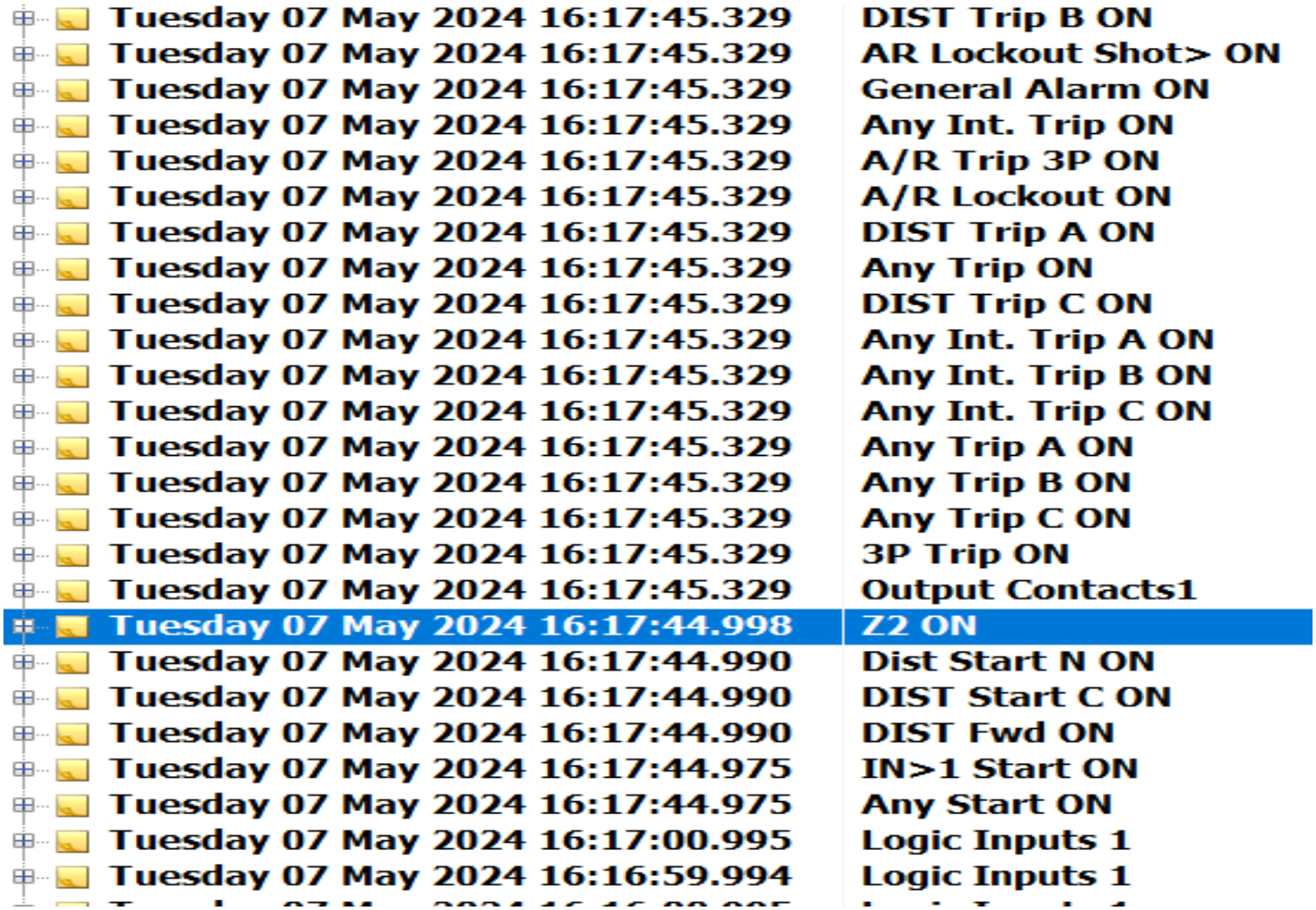
1. It is evident from the DR of Distance Protection relay installed at Parbati-III end that the B-Phase Voltage reduced to 25.5 KV and B-Phase current increased to 3995 A. Accordingly relay sense the fault in Z2 at 16:17:44.998 Hrs. and due to non receive of carrier signal from remote end, three phase trip command issued after Z2 time delay i.e. at 16:17:44.344 Hrs.

2. No Units were in running condition.

DR of Parbati-III-Sainj Line



EL of Parbati-III-Sainj Line



Tuesday 07 May 2024 16:17:45.329	DIST Trip B ON
Tuesday 07 May 2024 16:17:45.329	AR Lockout Shot> ON
Tuesday 07 May 2024 16:17:45.329	General Alarm ON
Tuesday 07 May 2024 16:17:45.329	Any Int. Trip ON
Tuesday 07 May 2024 16:17:45.329	A/R Trip 3P ON
Tuesday 07 May 2024 16:17:45.329	A/R Lockout ON
Tuesday 07 May 2024 16:17:45.329	DIST Trip A ON
Tuesday 07 May 2024 16:17:45.329	Any Trip ON
Tuesday 07 May 2024 16:17:45.329	DIST Trip C ON
Tuesday 07 May 2024 16:17:45.329	Any Int. Trip A ON
Tuesday 07 May 2024 16:17:45.329	Any Int. Trip B ON
Tuesday 07 May 2024 16:17:45.329	Any Int. Trip C ON
Tuesday 07 May 2024 16:17:45.329	Any Trip A ON
Tuesday 07 May 2024 16:17:45.329	Any Trip B ON
Tuesday 07 May 2024 16:17:45.329	Any Trip C ON
Tuesday 07 May 2024 16:17:45.329	3P Trip ON
Tuesday 07 May 2024 16:17:45.329	Output Contacts1
Tuesday 07 May 2024 16:17:44.998	Z2 ON
Tuesday 07 May 2024 16:17:44.990	Dist Start N ON
Tuesday 07 May 2024 16:17:44.990	DIST Start C ON
Tuesday 07 May 2024 16:17:44.990	DIST Fwd ON
Tuesday 07 May 2024 16:17:44.975	IN>1 Start ON
Tuesday 07 May 2024 16:17:44.975	Any Start ON
Tuesday 07 May 2024 16:17:00.995	Logic Inputs 1
Tuesday 07 May 2024 16:16:59.994	Logic Inputs 1

Remedial Action Taken

- Some cards are in faulty condition and for the same already order is placed to M/s BPL. The material is supposed to deliver by May’24. However yet the same is not received at site. Within 1 month the cards will receive at site & same shall be replaced.

Parbati-II-Sainj Line & Parbati-II- Banala Line(NHPC) at 11:16 hrs on 07-May-2024

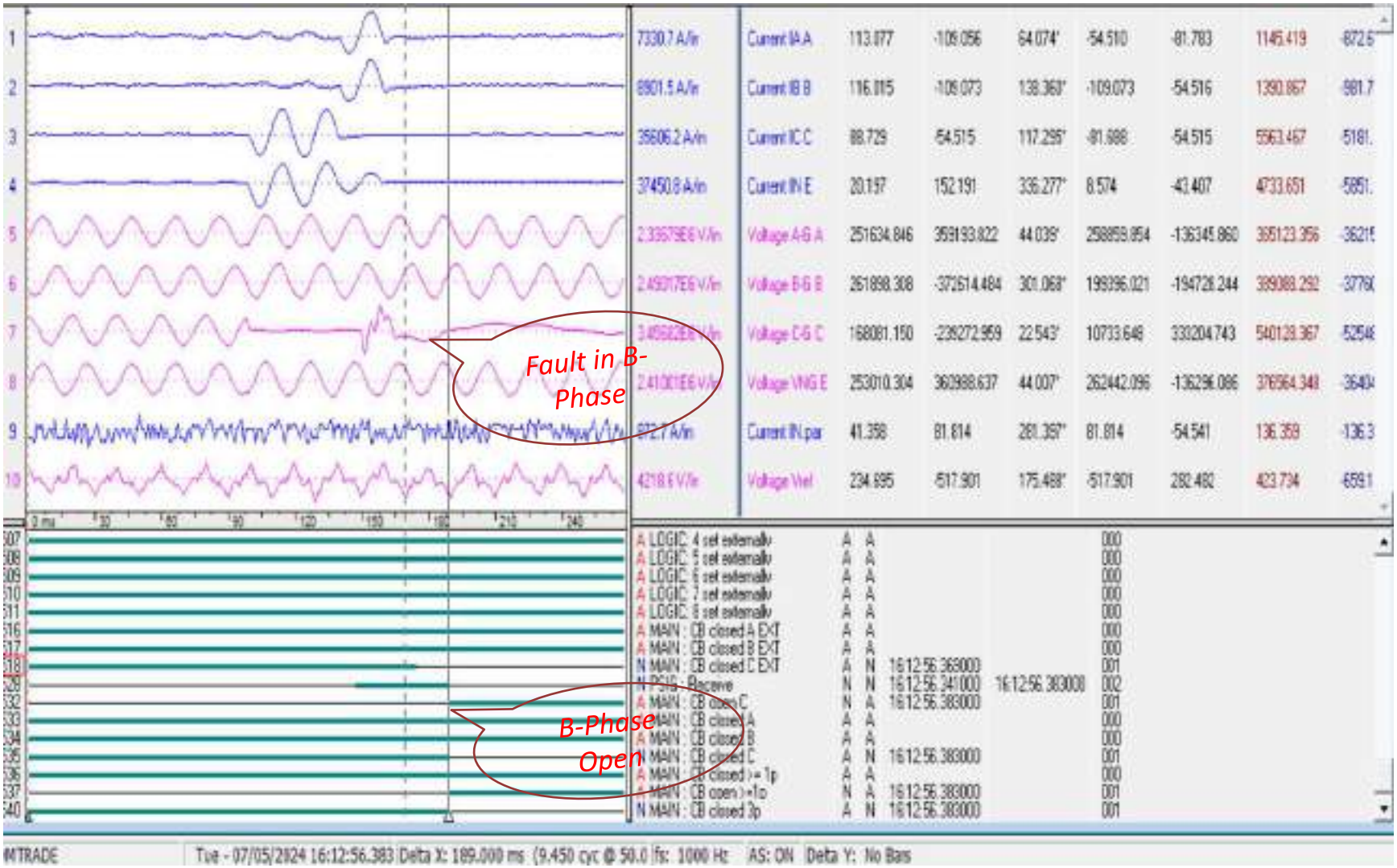
Elements Tripped on 07/05/2024

क्रम सं	यूनिट / लाइन नाम	से		तक		कुल आउटेज समय	आउटेज के कारण	ऊर्जा नुकसान (मेगावाट)
		तारीख	समय	तारीख	समय			
1	400 KV Parbati-II-Banala Line#1	7-May-24	16:12:00	7-May-24	23:29:00	7:17:00	Distance Protection operated in Z2	0
2	400 KV Parbati-II-Sainj Line#2	7-May-24	16:12:00	7-May-24	23:29:00	7:17:00	Line CB remain in closed condition	0

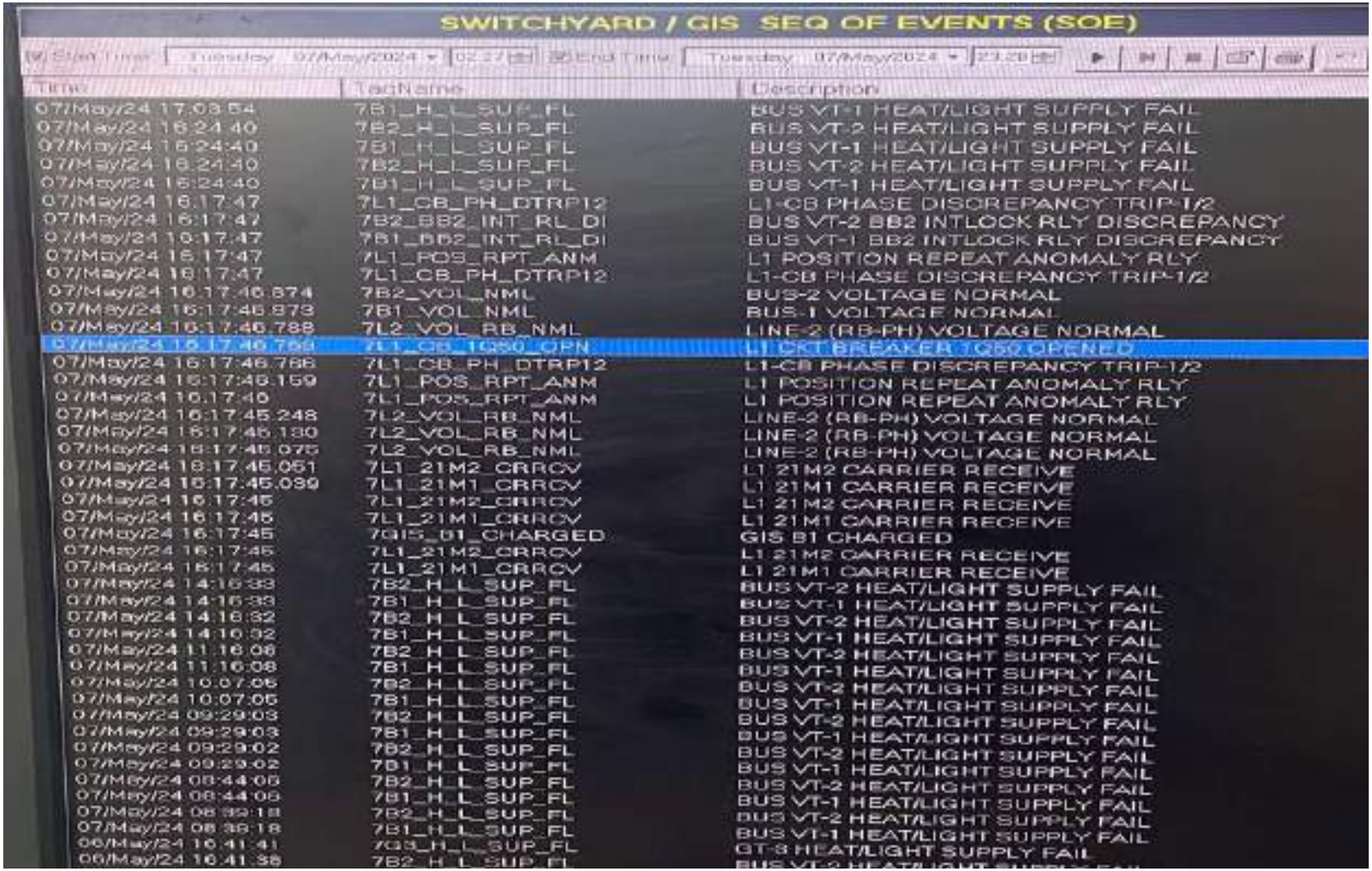
Detail Analysis

1. It is evident from the DR of Main-2 Distance Protection relay (MICOM P437) installed at Parbati-II end that the B-Phase Voltage reduced to 196.5 KV and B-Phase current increased to 608 A. Accordingly relay sense the fault in Z2 at 16:12:56.296 Hrs. and receiving of carrier signal at 16:12:56.341 Hrs., the B-Phase CB opened at 16:12:56.381 Hrs.
2. The Main-1 Relay (MICOM P442) relay did not sense any fault. As per existing scheme, auto reclose function was enabled in Main-1 relay. However after dead time the reclosing command from Main-1 relay has not extended to B-Phase CB.
3. Accordingly after dead time, the other two CB i.e. R-Phase & Y-Phase tripped on operation of Pole discrepancy relay.

DR of Parbati-II-Banala Line



EL of Parbati-II-Banala Line



SWITCHYARD / GIS SEQ OF EVENTS (SOE)

Time	TagName	Description
07/May/24 17:03:54	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 16:24:40	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 16:24:40	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 16:24:40	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 16:24:40	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 16:17:47	7L1_CB_PH_DTRP12	L1-CB PHASE DISCREPANCY TRIP-1/2
07/May/24 16:17:47	7B2_BB2_INT_RL_DI	BUS VT-2 BB2 INTLOCK RLY DISCREPANCY
07/May/24 16:17:47	7B1_BB2_INT_RL_DI	BUS VT-1 BB2 INTLOCK RLY DISCREPANCY
07/May/24 16:17:47	7L1_POS_RPT_ANM	L1 POSITION REPEAT ANOMALY RLY
07/May/24 16:17:47	7L1_CB_PH_DTRP12	L1-CB PHASE DISCREPANCY TRIP-1/2
07/May/24 16:17:46.874	7B2_VOL_NML	BUS-2 VOLTAGE NORMAL
07/May/24 16:17:46.873	7B1_VOL_NML	BUS-1 VOLTAGE NORMAL
07/May/24 16:17:46.788	7L2_VOL_RB_NML	LINE-2 (RB-PH) VOLTAGE NORMAL
07/May/24 16:17:46.769	7L1_CB_1Q50_OPN	L1 CKT BREAKER 1Q50 OPENED
07/May/24 16:17:46.766	7L1_CB_PH_DTRP12	L1-CB PHASE DISCREPANCY TRIP-1/2
07/May/24 16:17:46.159	7L1_POS_RPT_ANM	L1 POSITION REPEAT ANOMALY RLY
07/May/24 16:17:46	7L1_POS_RPT_ANM	L1 POSITION REPEAT ANOMALY RLY
07/May/24 16:17:45.248	7L2_VOL_RB_NML	LINE-2 (RB-PH) VOLTAGE NORMAL
07/May/24 16:17:45.130	7L2_VOL_RB_NML	LINE-2 (RB-PH) VOLTAGE NORMAL
07/May/24 16:17:45.075	7L2_VOL_RB_NML	LINE-2 (RB-PH) VOLTAGE NORMAL
07/May/24 16:17:45.061	7L1_21M2_CRRCV	L1 21M2 CARRIER RECEIVE
07/May/24 16:17:45.039	7L1_21M1_CRRCV	L1 21M1 CARRIER RECEIVE
07/May/24 16:17:45	7L1_21M2_CRRCV	L1 21M2 CARRIER RECEIVE
07/May/24 16:17:45	7L1_21M1_CRRCV	L1 21M1 CARRIER RECEIVE
07/May/24 16:17:45	7GIS_B1_CHARGED	GIS B1 CHARGED
07/May/24 16:17:45	7L1_21M2_CRRCV	L1 21M2 CARRIER RECEIVE
07/May/24 16:17:45	7L1_21M1_CRRCV	L1 21M1 CARRIER RECEIVE
07/May/24 14:16:33	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 14:16:33	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 14:16:32	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 14:16:32	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 11:16:08	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 11:16:08	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 10:07:05	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 10:07:05	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 09:29:03	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 09:29:03	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 09:29:02	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 09:29:02	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 08:44:08	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 08:44:08	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
07/May/24 08:39:18	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL
07/May/24 08:39:18	7B1_H_L_SUP_FL	BUS VT-1 HEAT/LIGHT SUPPLY FAIL
06/May/24 16:41:41	7GT_H_L_SUP_FL	GT-8 HEAT/LIGHT SUPPLY FAIL
06/May/24 16:41:38	7B2_H_L_SUP_FL	BUS VT-2 HEAT/LIGHT SUPPLY FAIL

Parbati-II-Sainj Line

- Due to tripping of Parbati-II-Banala Line and already no units were running, so there was no source left for Parbati-II-Sainj Line. Acoordingly Parbati-II-Sainj Line CB remained in closed condition from Parbati-II end.

Remedial Action Taken

- Auto Reclose operation did not happened. The functionality test of relay and checking the A/R scheme could be carried out at the earliest opportunity. Order is already placed to M/s GE and waiting for the OEM expert.
- Relays were not properly GPS synchronized. Now it is rectified.
- Line Differential Relay is to be installed in Parbati-II-Sainj Line. Materials already reached at site. Commissioning is to be done at the earliest after arrival of OEM representative.

Thanks

Multiple elements tripping at 220kV Khedar(HR) On 10th May 2024

Brief of event:

i. Generation of 600MW Unit-1 & 2 at Khedar TPS (total ~1072MW) was evacuating through 400kV Khedar(HR)-Fatehabad(PG) ckt (carrying ~858MW), 400kV Khedar-Nuhiyawali (HR) ckt (carrying ~174MW) only.

ii. At 19:35:24:255 hrs, R-N phase to earth fault occurred on 400kV Khedar-Nuhiyawali (HR) ckt. As per DR of 400kV Khedar-Nuhiyawali (HR) ckt, distance protection relay at both end sensed R-N fault in Z-1 (Khedar end: Ir=12kA, 75km). R-ph A/R started from both ends.

iii. At 19:35:24:291 hrs, as per DR of 400kV Khedar(HR)-Fatehabad(PG) ckt, distance protection relay at Khedar end sensed B-N fault in Z-1(Khedar end: Ib=1.1kA, 8.5km) and initiated A/R in B-ph at Khedar end. Fatehabad(PG) end distance protection relay didn't sense this B-N fault and no operation occurred at Fatehabad end.

iv. At 19:35:24:758 hrs, as per DR of 400kV Khedar(HR)-Fatehabad(PG) ckt, distance protection relay at Khedar end initiated 3-ph tripping command and R & Y ph pole also opened.

v. As R-ph autoreclosing was also going on in 400kV Khedar-Nuhiyawali (HR) ckt at this time and all 3-ph pole of 400kV Khedar(HR)-Fatehabad(PG) ckt opened, all the power now started evacuating through Y & B phase of 400kV Khedar-Nuhiyawali (HR) ckt. Current in Y & B phase started increasing, it increased to ~1850A by 19:35:25:153 hrs.

vi. At 19:35:25:376 hrs, R-ph pole of 400kV Khedar-Nuhiyawali (HR) ckt closed from both ends and line successfully autoreclosed.

vii. At 19:35:25:421 hrs, all 3-ph pole at Khedar end of 400kV Khedar(HR)-Fatehabad(PG) ckt closed and line successfully autoreclosed.

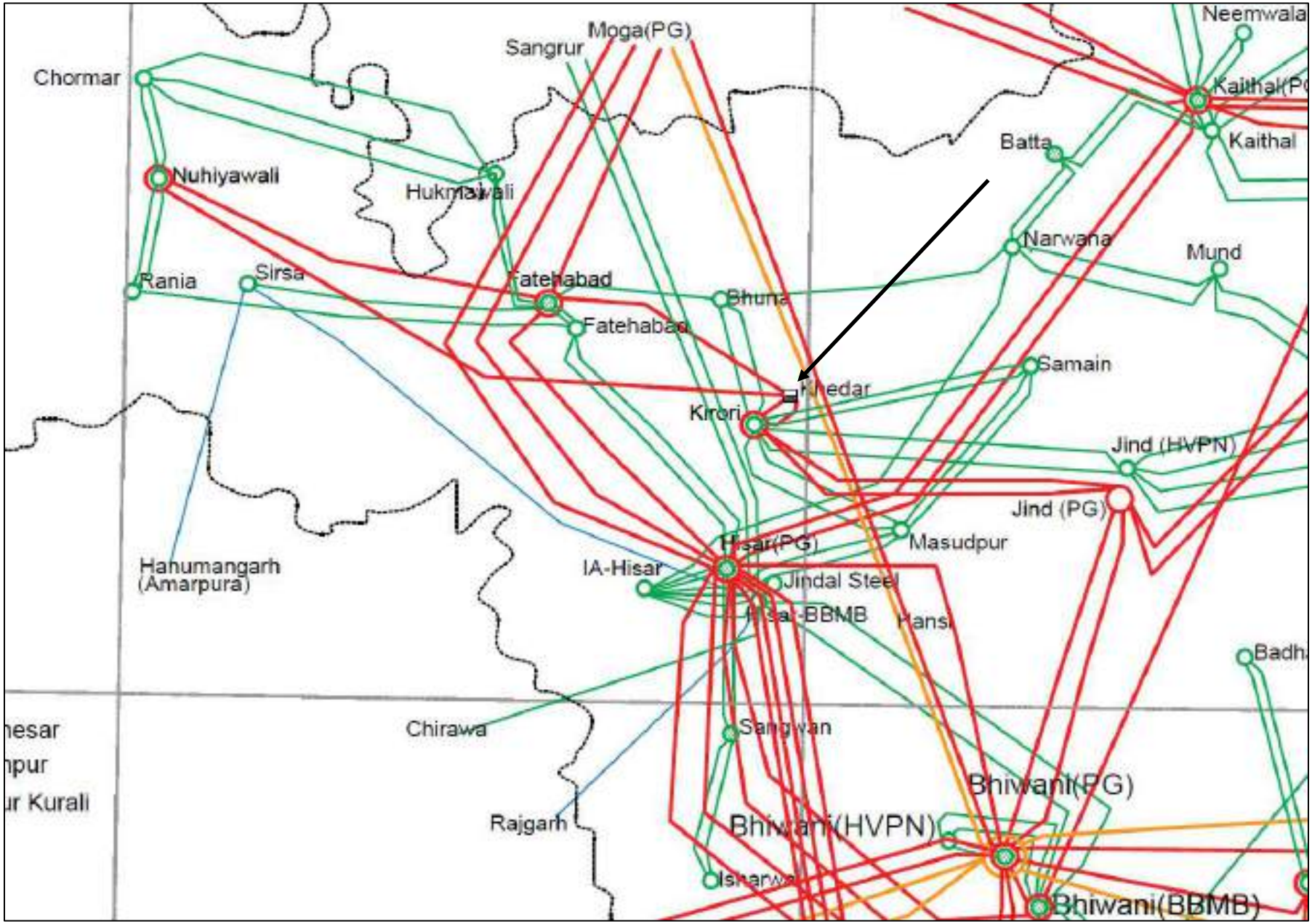
Brief of event:

viii. At the same time, power swing also observed in DR of Unit-1&2 and evacuating lines.
ix. At 19:35:25:944hrs, 600MW Unit-1 tripped on pole slip protection operation.
x. At 19:35:25:974hrs, 600MW Unit-2 tripped on pole slip protection operation.
xi. At 19:35:30:309 hrs and 19:35:30:350 hrs, over frequency protection also operated of Unit-1 & 2 respectively.
xii. 600MW Unit-1 at Khedar TPS revived at 04:26hrs on 11th May 2024 and Unit-2 have been kept out for inspection purpose.

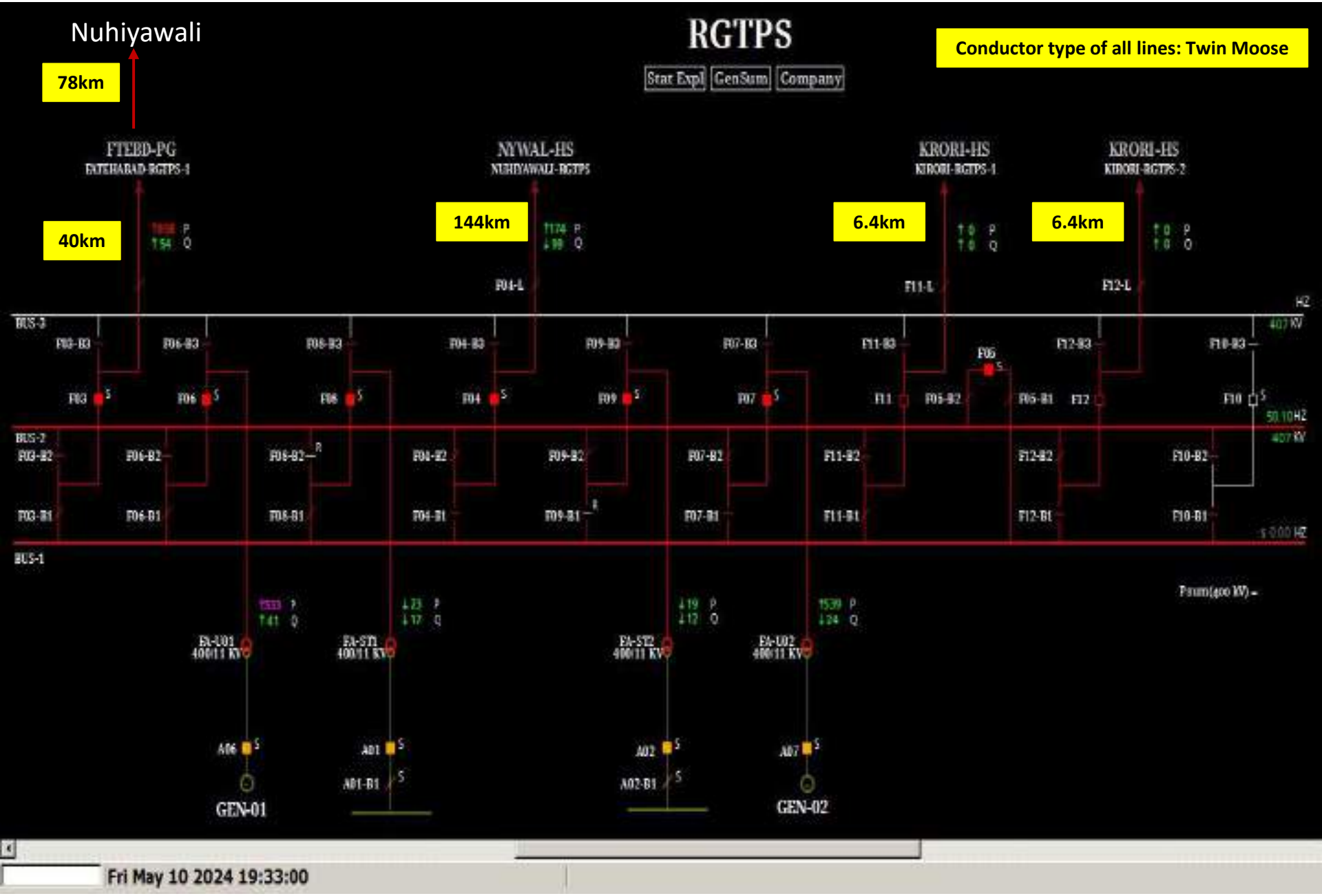
Elements tripped:

i. 400kV Fatehabad(PG)-Nuhiyawali(HR) ckt
ii. 400kV Khedar-Kirori (HR) ckt-1
iii. 400kV Khedar-Kirori (HR) ckt-2
iv. 400kV Khedar(HR)-Fatehabad(PG) ckt
v. 400kV Khedar-Nuhiyawali ckt
vi. 600MW Unit-1 at Khedar (RGTPS)
vii. 600MW Unit-2 at Khedar (RGTPS)

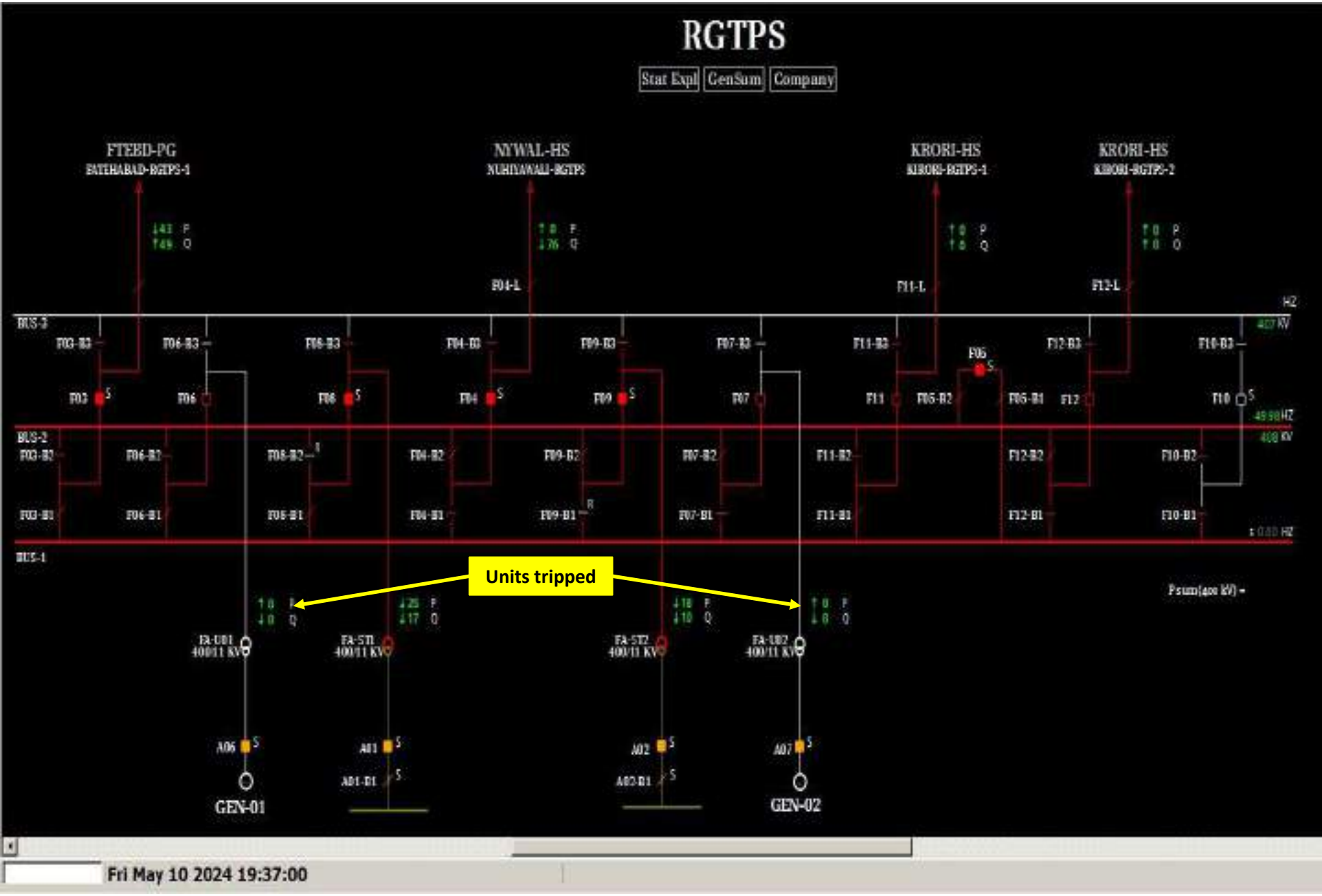
Network Diagram



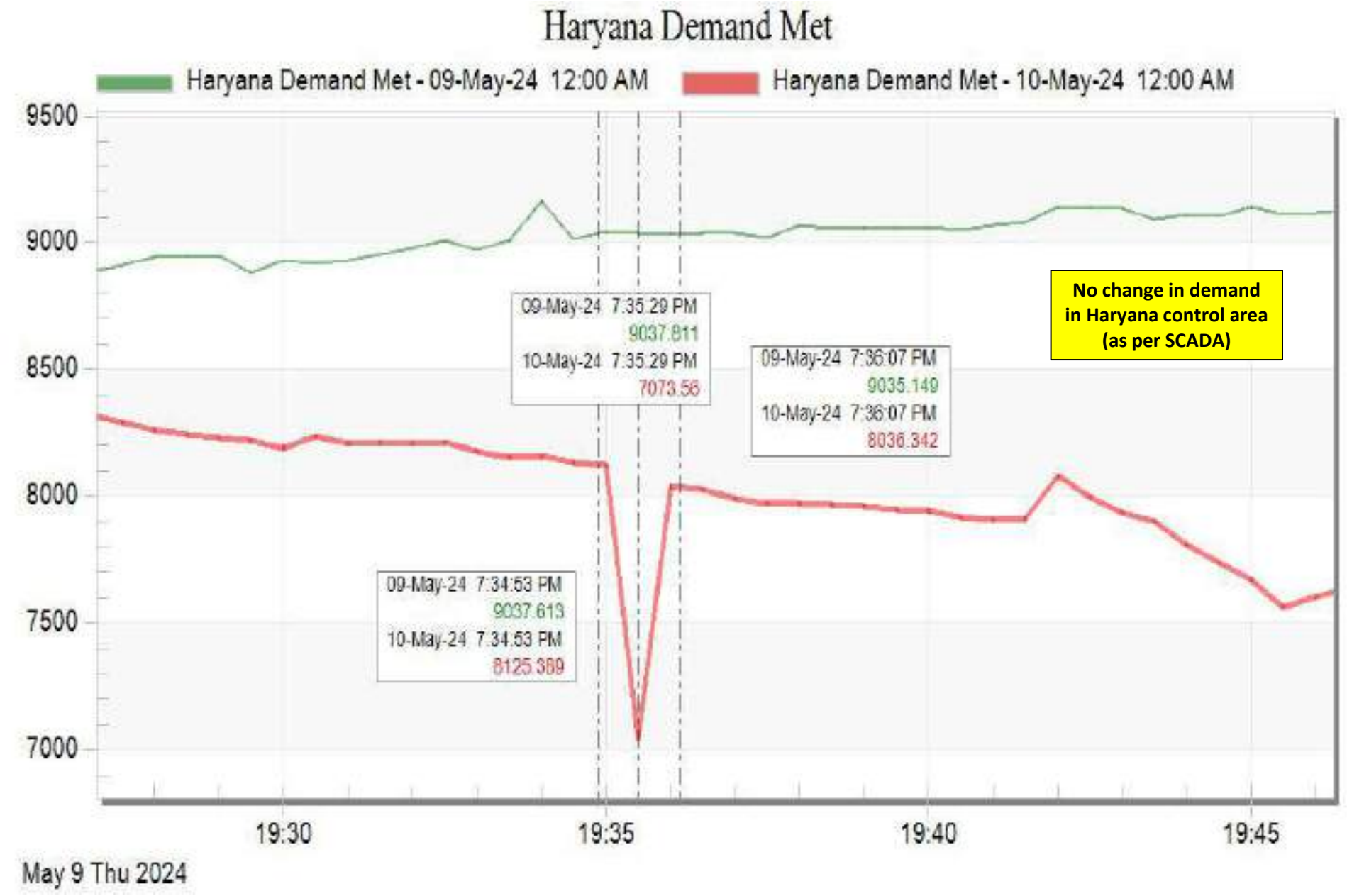
SLD of 400kV Khedar(RGTPS) before the event



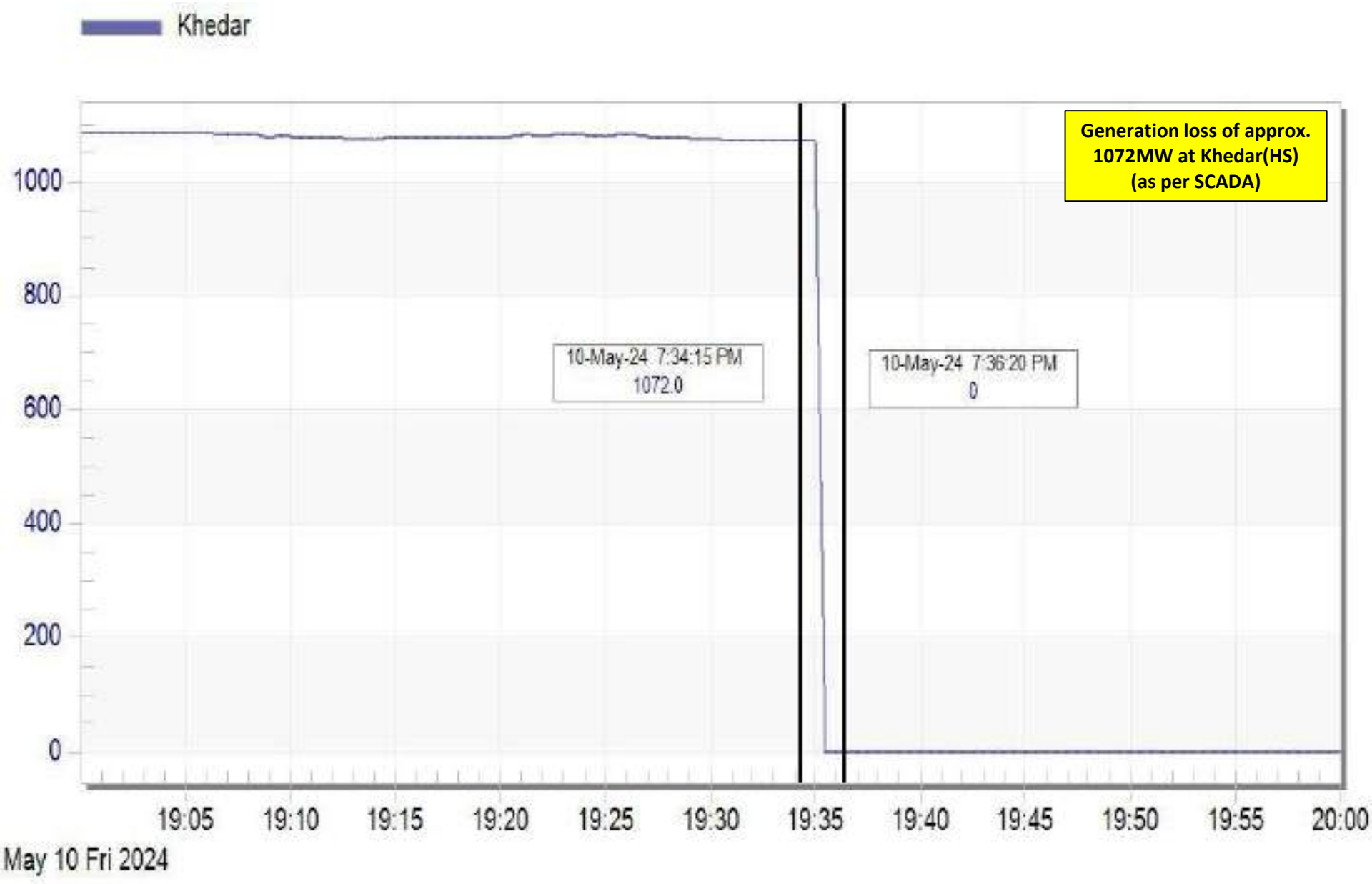
SLD of 400kV Khedar(RGTPS) after the event



Haryana demand during the event

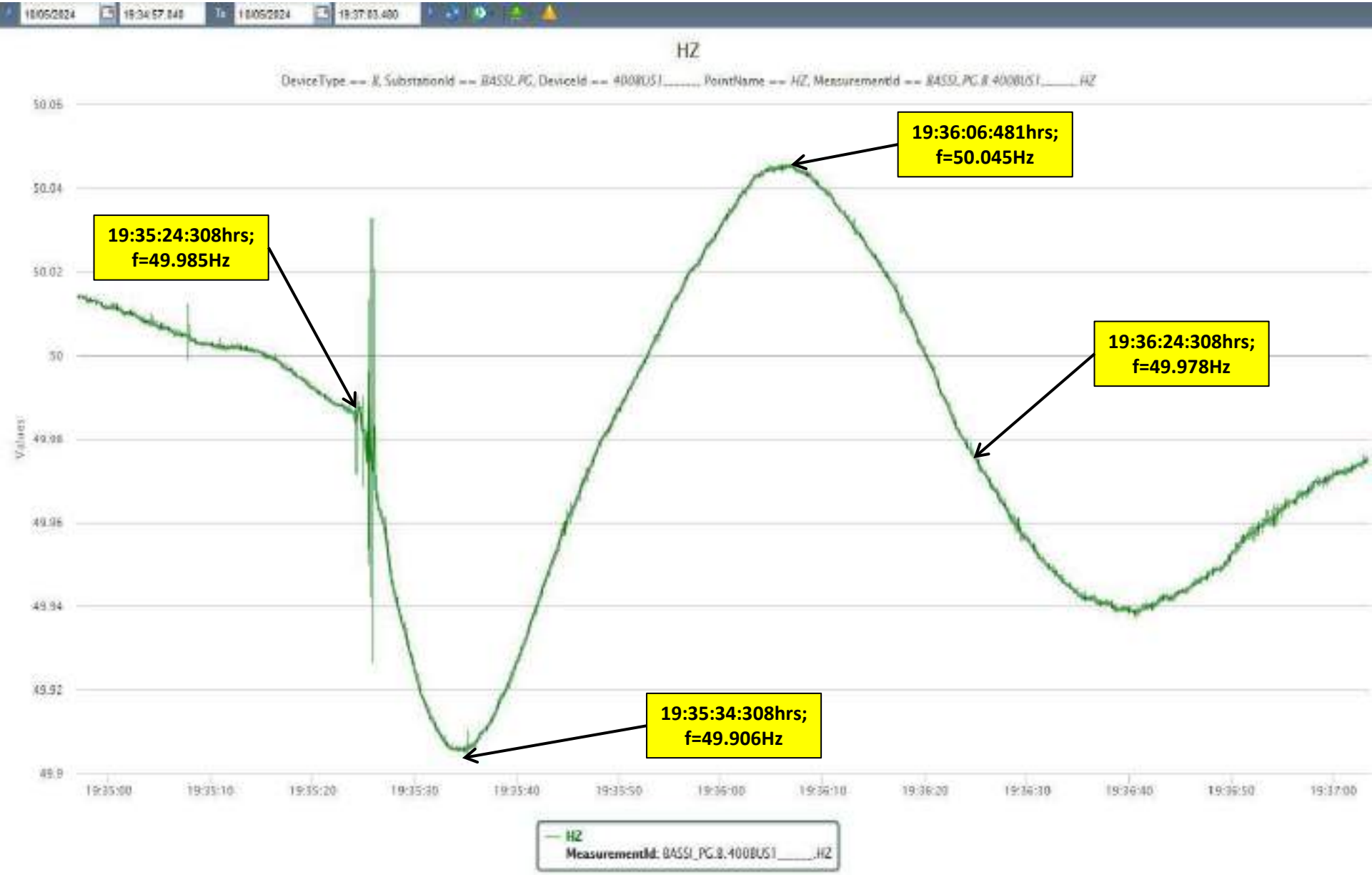


Khedar(HPG) Generation during the event



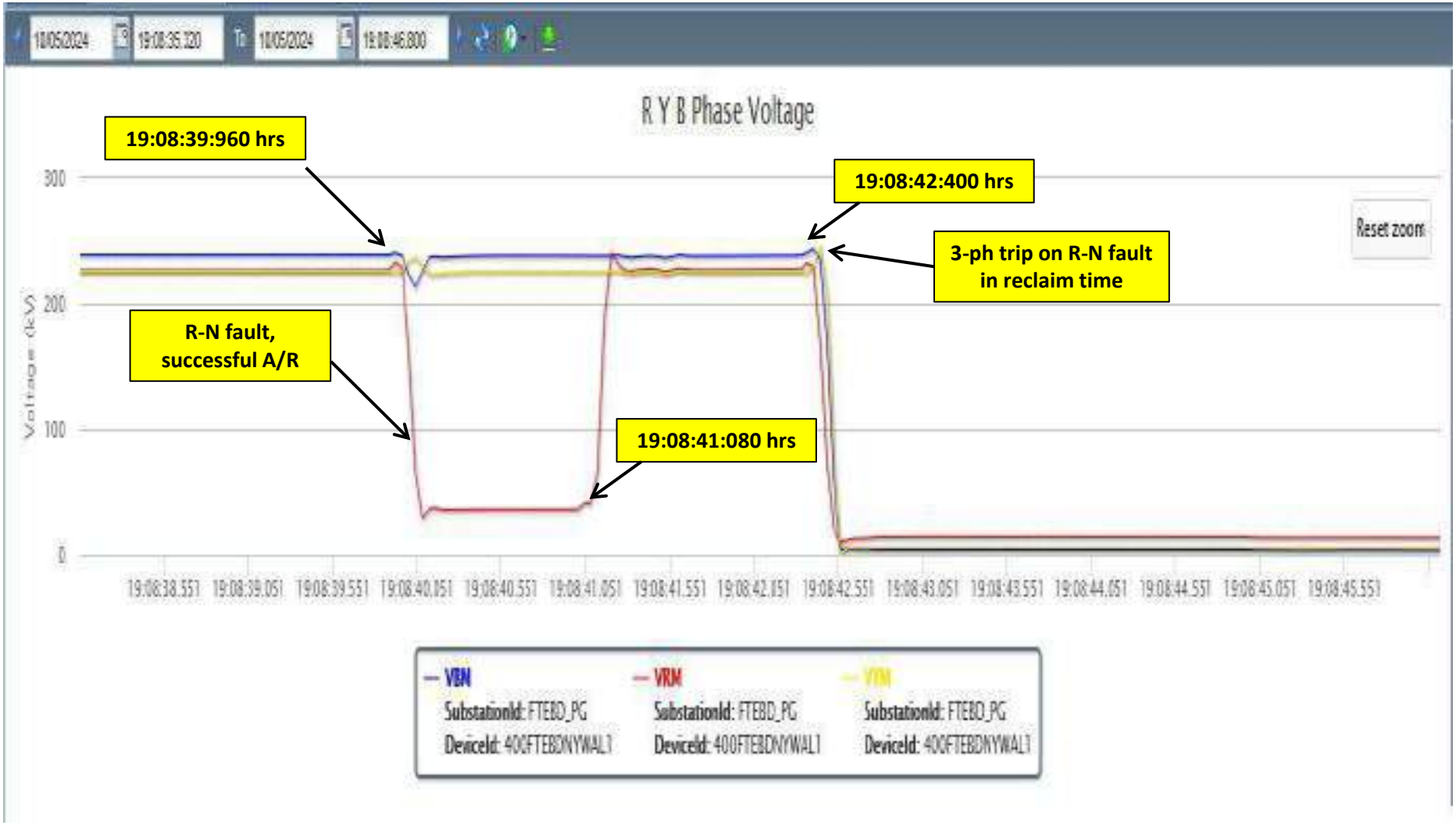
PMU Plot of frequency at Bassi(PG)

19:35hrs/10-May-24



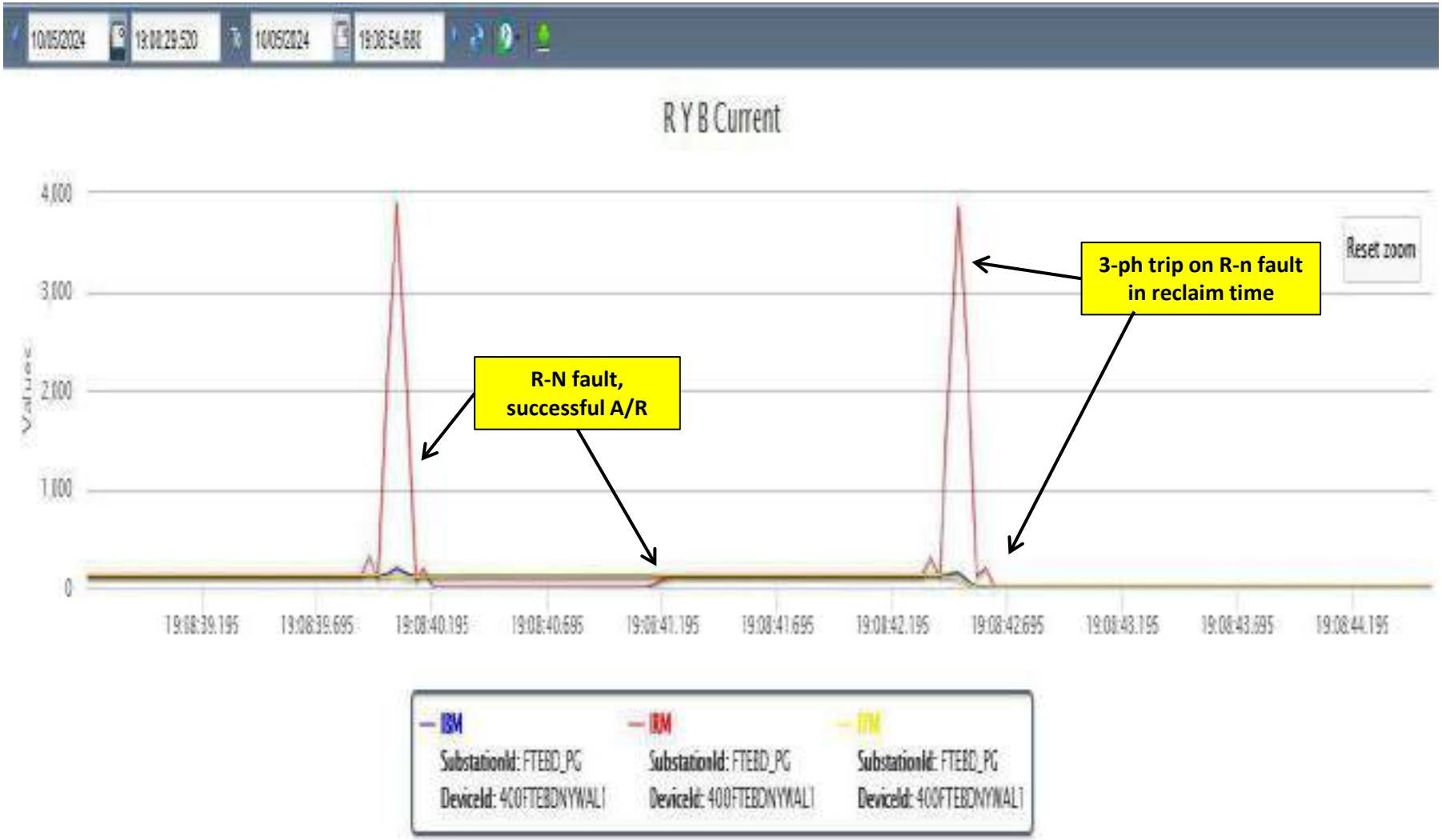
PMU Plot of Phase voltage magnitude of 400kV Fatehabad(PG)-Nuhiyawali(HR) ckt at Fatehabad(PG) end

19:08hrs/10-May-24



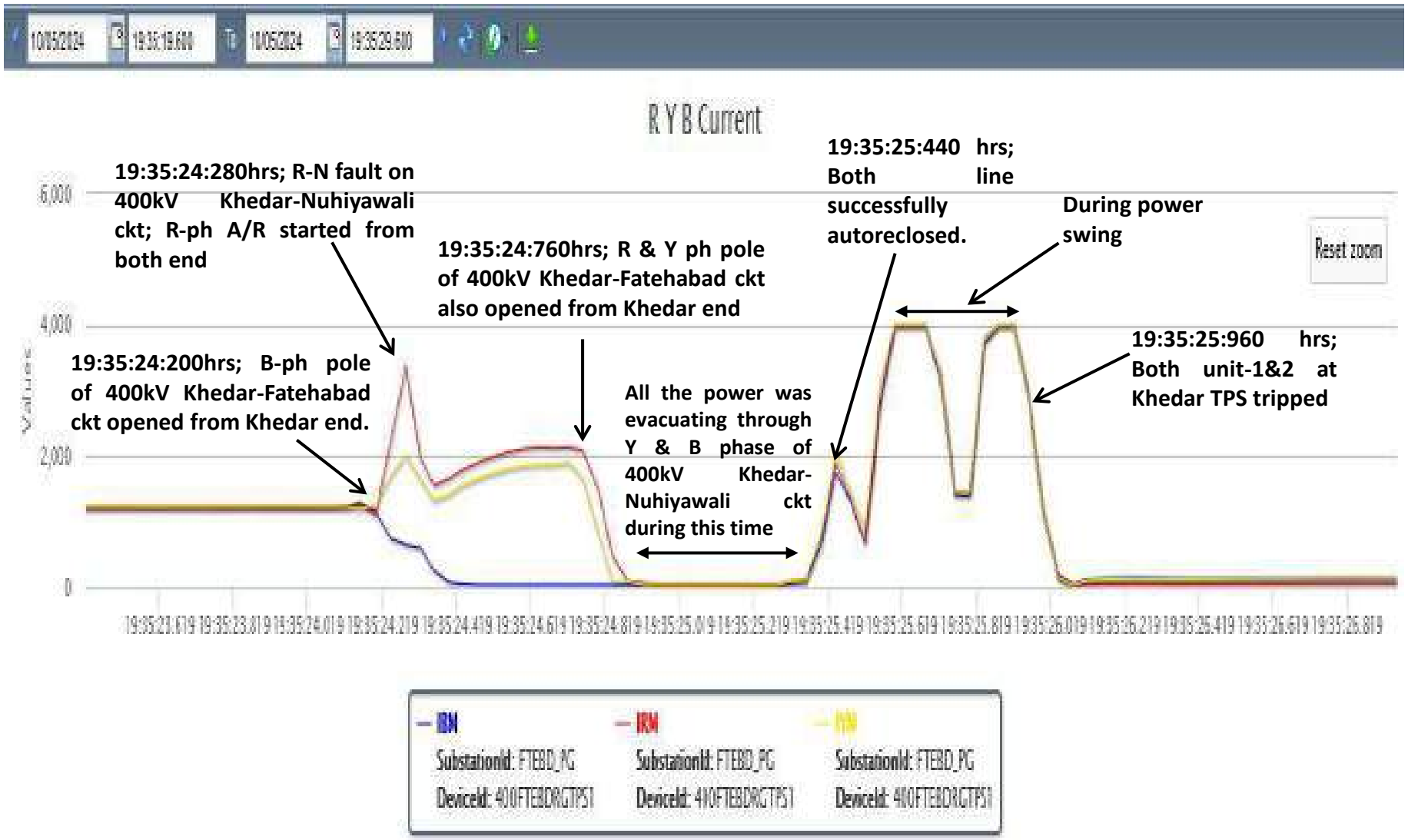
PMU Plot of Phase current magnitude of 400kV Fatehabad(PG)-Nuhiyawali(HR) ckt at Fatehabad(PG) end

19:08hrs/10-May-24



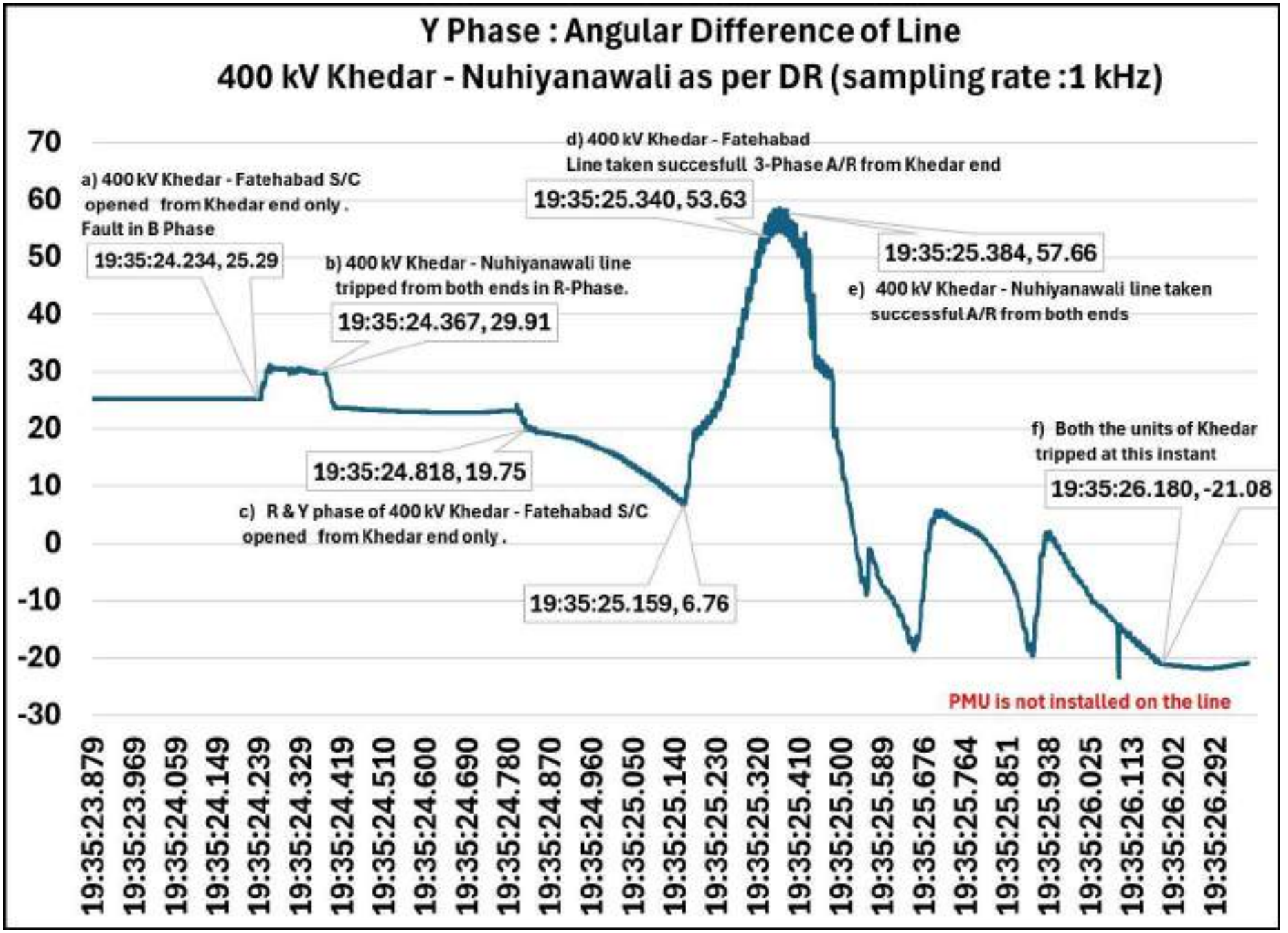
PMU Plot of Phase current magnitude of 400kV Fatehabad(PG)-Khedar(HR) ckt at Fatehabad(PG) end

19:35:24hrs/10-May-24



PMU Plot of Phase voltage magnitude of 400kV Fatehabad(PG)-Khedar(HR) ckt at Fatehabad(PG) end

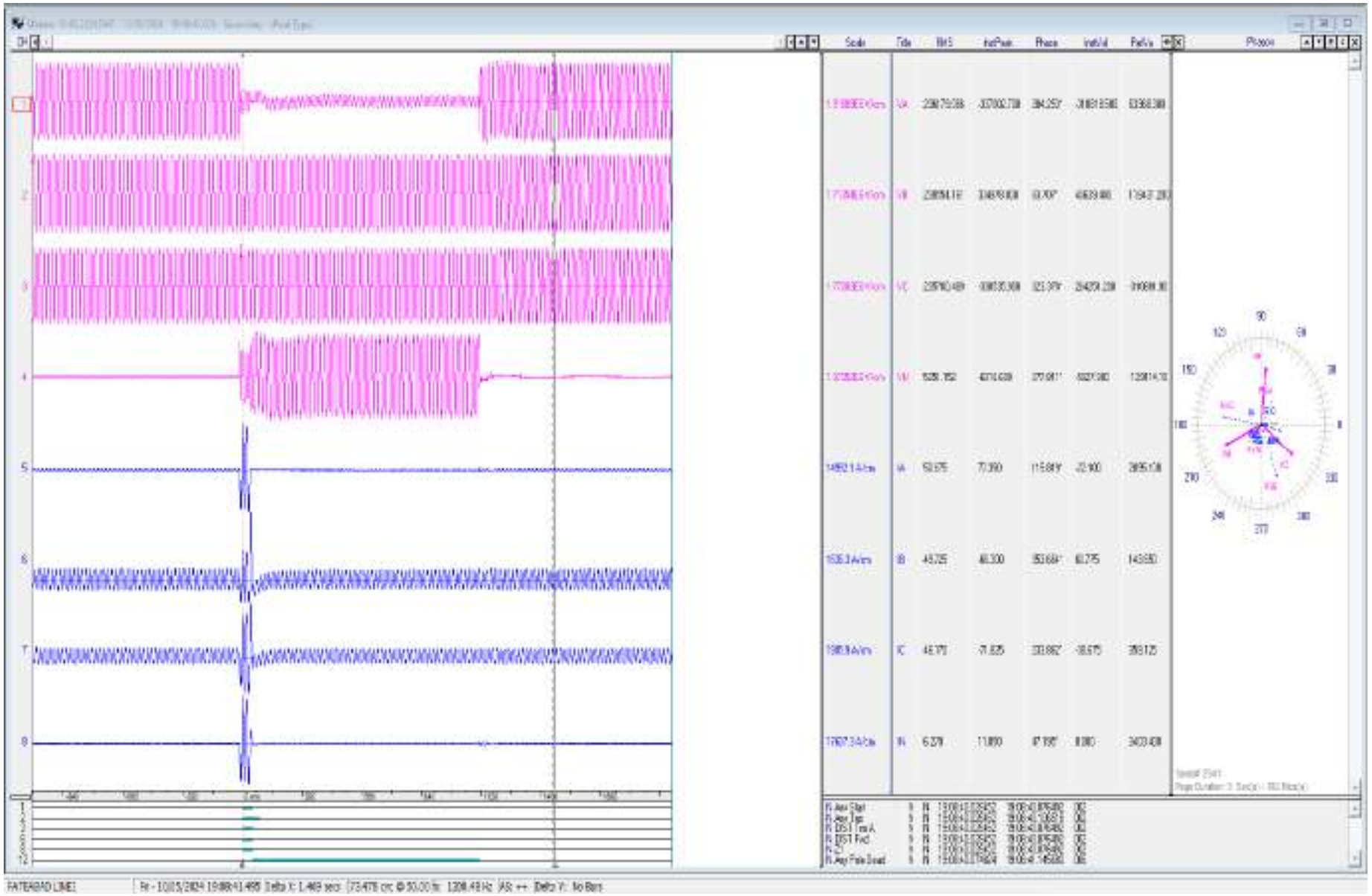
19:35hrs/10-May-24


Y Phase : Angular Difference of Line
400 kV Khedar - Nuhiyanawali as per DR (sampling rate :1 kHz)
70
60
50
40
30
20
10
0
-10
-20
-30
a) 400 kV Khedar - Fatehabad S/C opened from Khedar end only . Fault in B Phase
19:35:24.234, 25.29
b) 400 kV Khedar - Nuhiyanawali line tripped from both ends in R-Phase.
19:35:24.367, 29.91
19:35:24.818, 19.75
c) R & Y phase of 400 kV Khedar - Fatehabad S/C opened from Khedar end only .
19:35:25.159, 6.76
d) 400 kV Khedar - Fatehabad Line taken succesfull 3-Phase A/R from Khedar end
19:35:25.340, 53.63
19:35:25.384, 57.66
e) 400 kV Khedar - Nuhiyanawali line taken successful A/R from both ends
f) Both the units of Khedar tripped at this instant
19:35:26.180, -21.08
PMU is not installed on the line
19:35:23.879
19:35:23.969
19:35:24.059
19:35:24.149
19:35:24.239
19:35:24.329
19:35:24.419
19:35:24.510
19:35:24.600
19:35:24.690
19:35:24.780
19:35:24.870
19:35:24.960
19:35:25.050
19:35:25.140
19:35:25.230
19:35:25.320
19:35:25.410
19:35:25.500
19:35:25.589
19:35:25.676
19:35:25.764
19:35:25.851
19:35:25.938
19:35:26.025
19:35:26.113
19:35:26.202
19:35:26.292

SCADA SOE

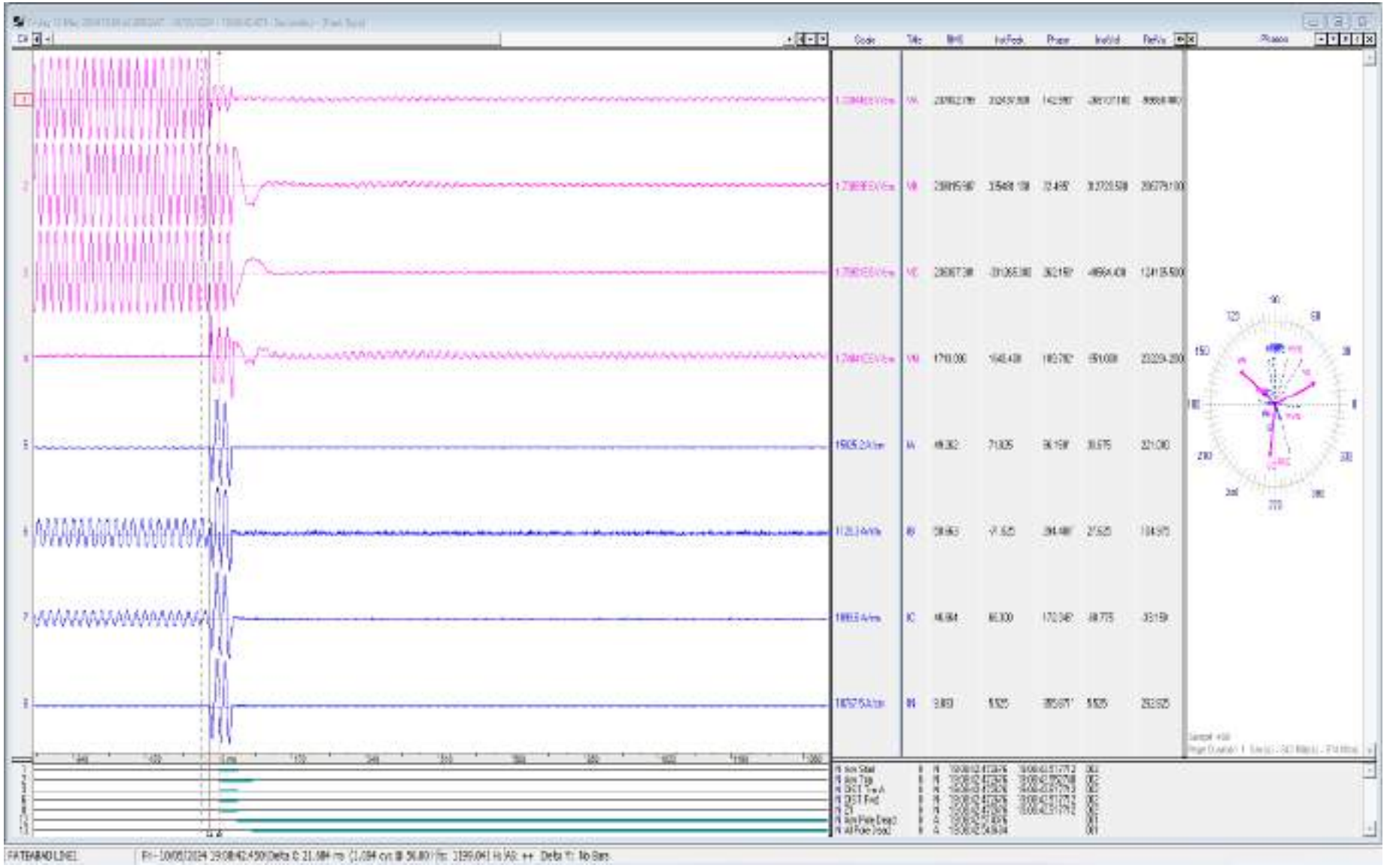
Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
19:35:25,163	NYWAL_HS	220kV	11RANIA1	Circuit Breaker	Open	Line CB at Nuhiyawali(HS) end of 220kV Nuhiyawali-Rania Ckt-1 opened
19:35:26,359	RGTPS_HS	400kV	06U01	Circuit Breaker	Open	CB at 400kV side of 600MW Unit-1 at RGTPS(HS) opened
19:35:26,516	RGTPS_HS	400kV	07U02	Circuit Breaker	Open	CB at 400kV side of 600MW Unit-2 at RGTPS(HS) opened
19:35:29,022	NYWAL_HS	400kV	5RGTPT2	Circuit Breaker	Open	Line CB at Nuhiyawali(HS) end of 400kV Nuhiyawali(HS)-Khedar(RGTPS) Ckt opened

DR of 400kV Fatehabad(PG)-Nuhiyawali(HR) ckt at Nuhiyawali end (19:08:40hrs)



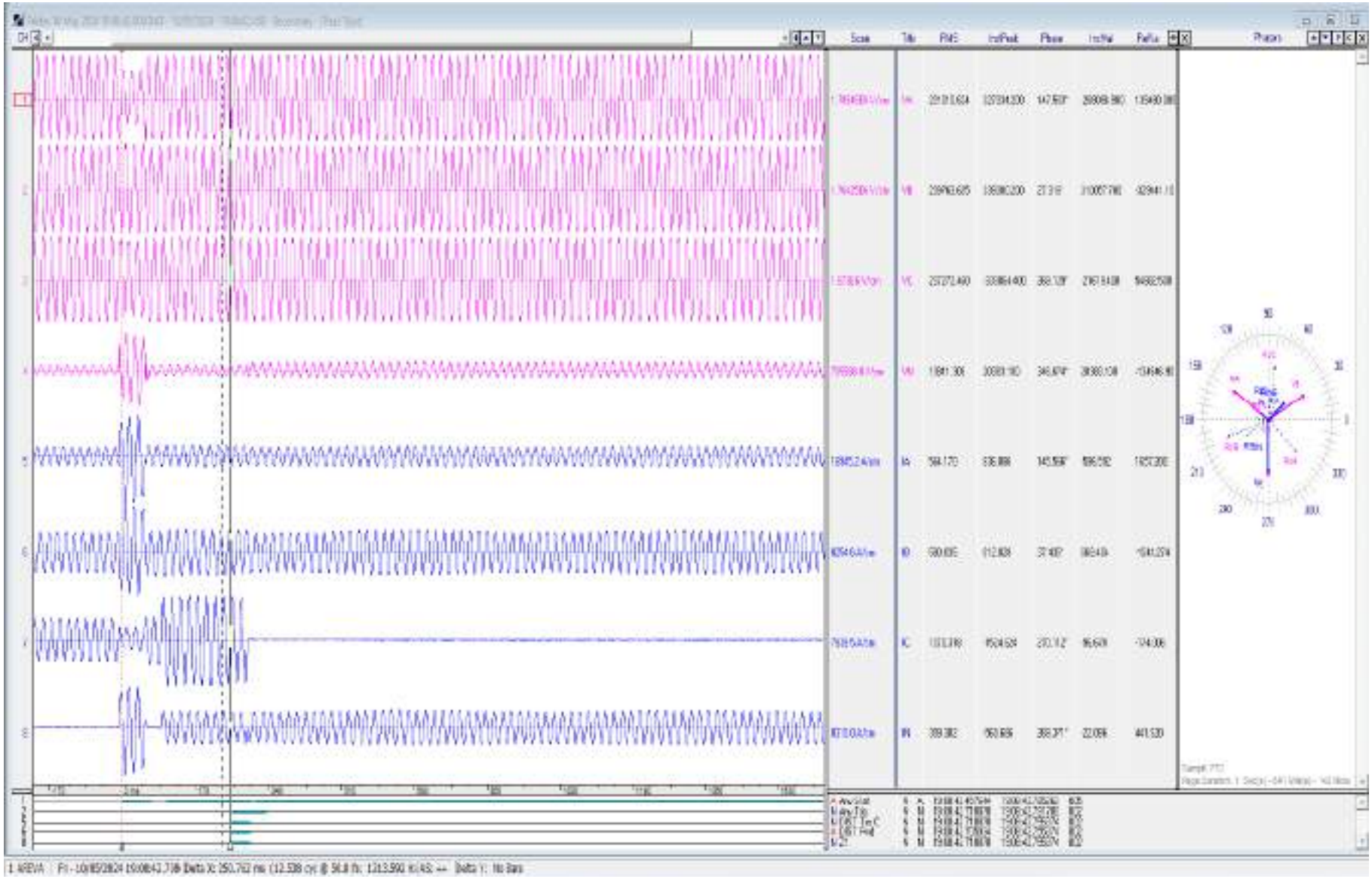
Line successfully autoreclosed on R-N fault

DR of 400kV Fatehabad(PG)-Nuhiyawali(HR) ckt at Nuhiyawali end (19:08:42hrs)



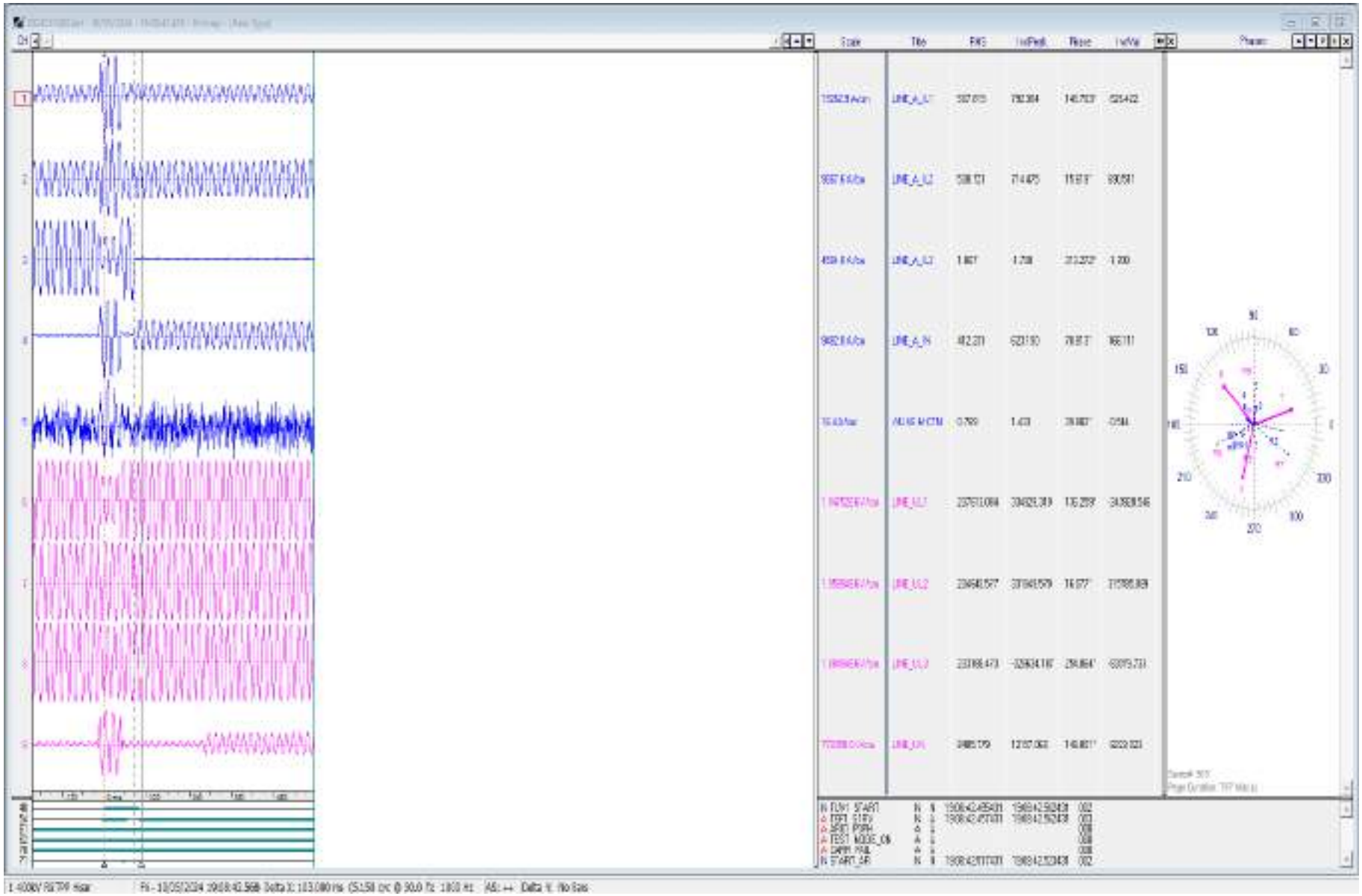
Line tripped on R-N fault in reclaim time

DR of 400kV Khedar-Kirori(HR) ckt-1 of Khedar end (19:08:42hrs)



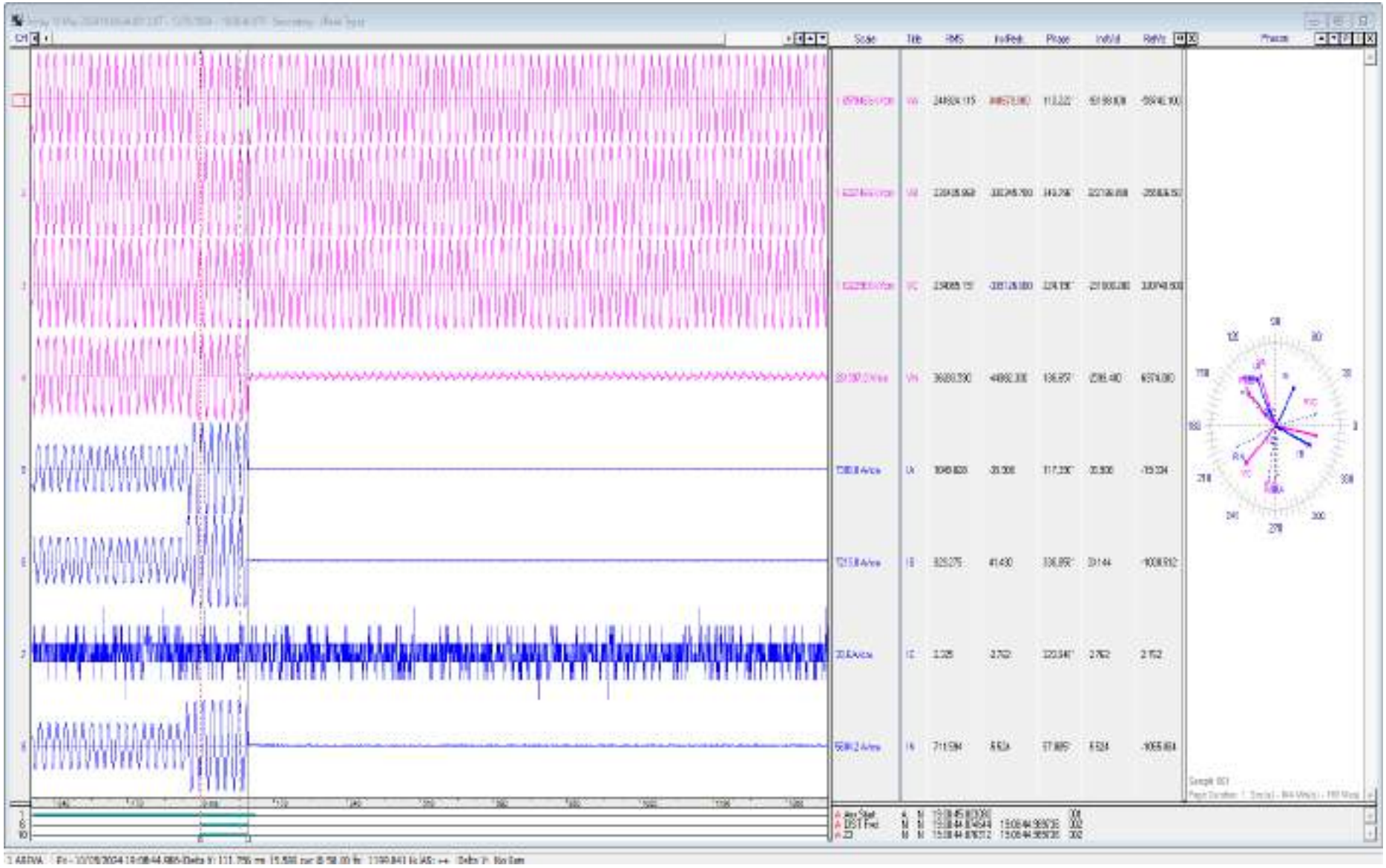
B-N fault, Z-1, A/R started but didn’t close after dead time. As reported line later tripped on pole discrepancy relay operation.

DR of 400kV Khedar-Kirori(HR) ckt-2 of Khedar end (19:08:42hrs)



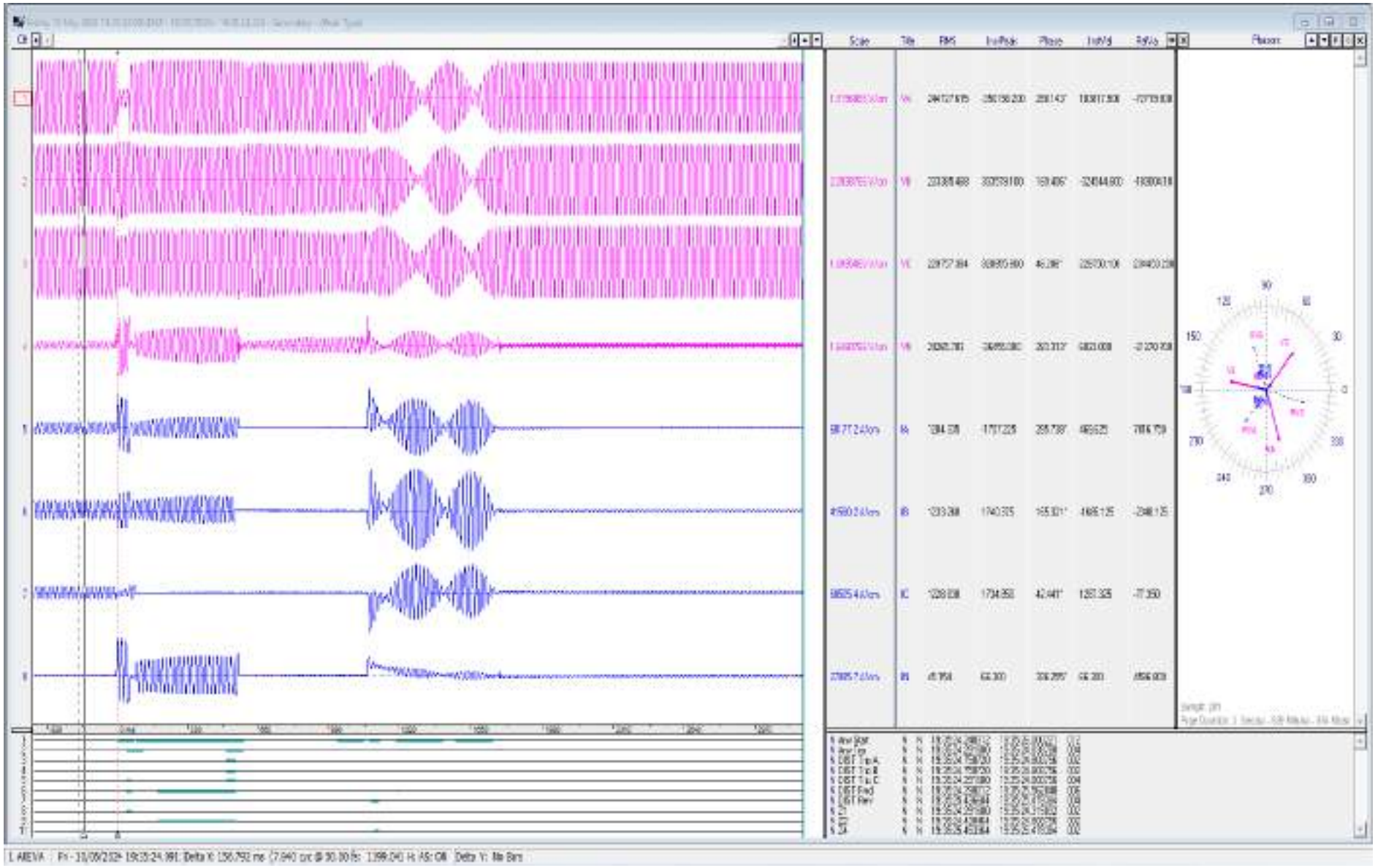
B-ph pole opened, reason of A/R start not identified

DR of 400kV Khedar-Kirori(HR) ckt-2 of Khedar end (19:08:45hrs)



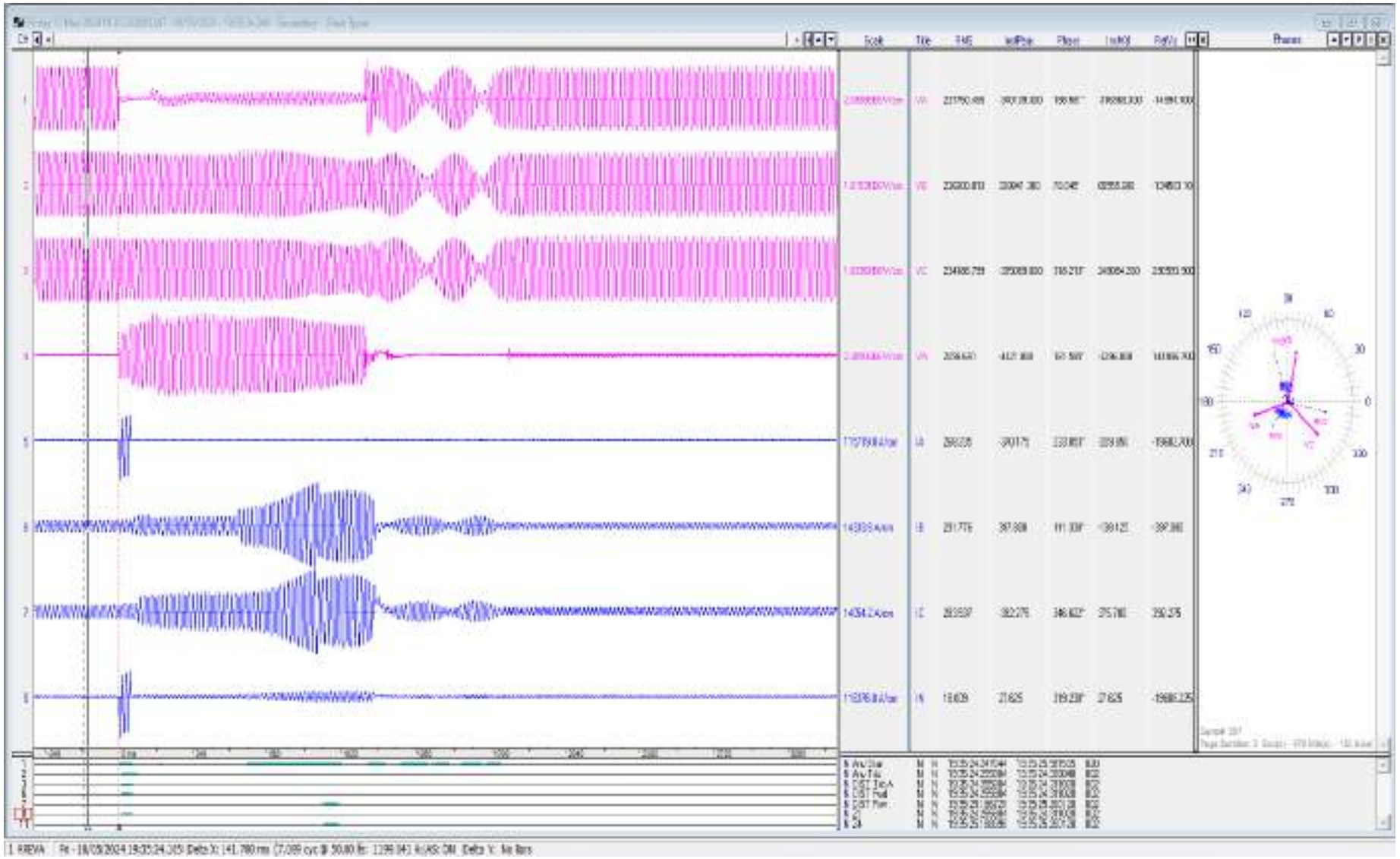
As reported, line tripped on pole discrepancy relay.

DR of 400kV Khedar(HR)-Fatehabad(PG) ckt of Khedar end



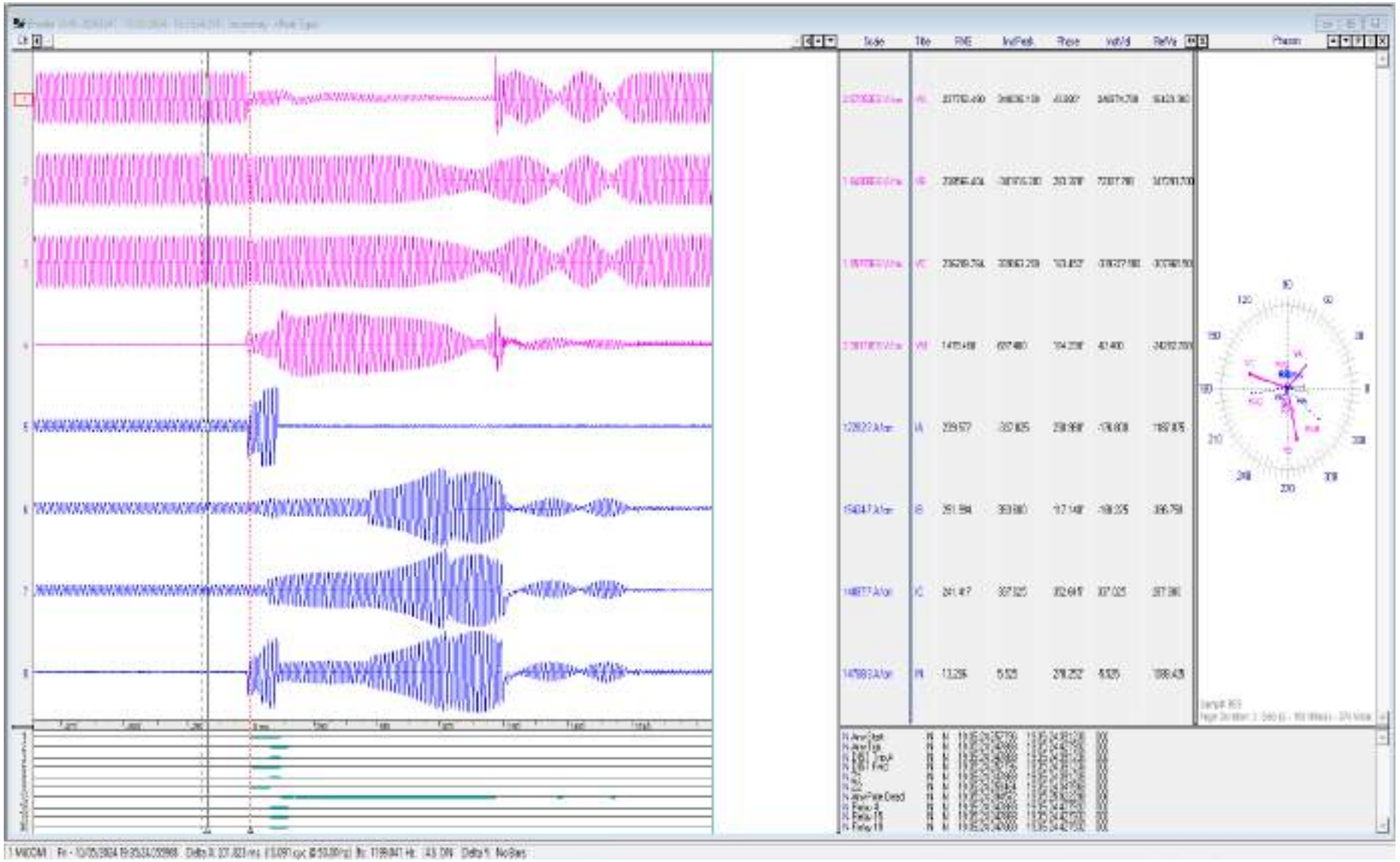
Line was carrying ~1200-1240A before the fault. (antecedent loading:858 as per SCADA)

DR of 400kV Khedar(HR)-Nuhiyawali ckt of Khedar end



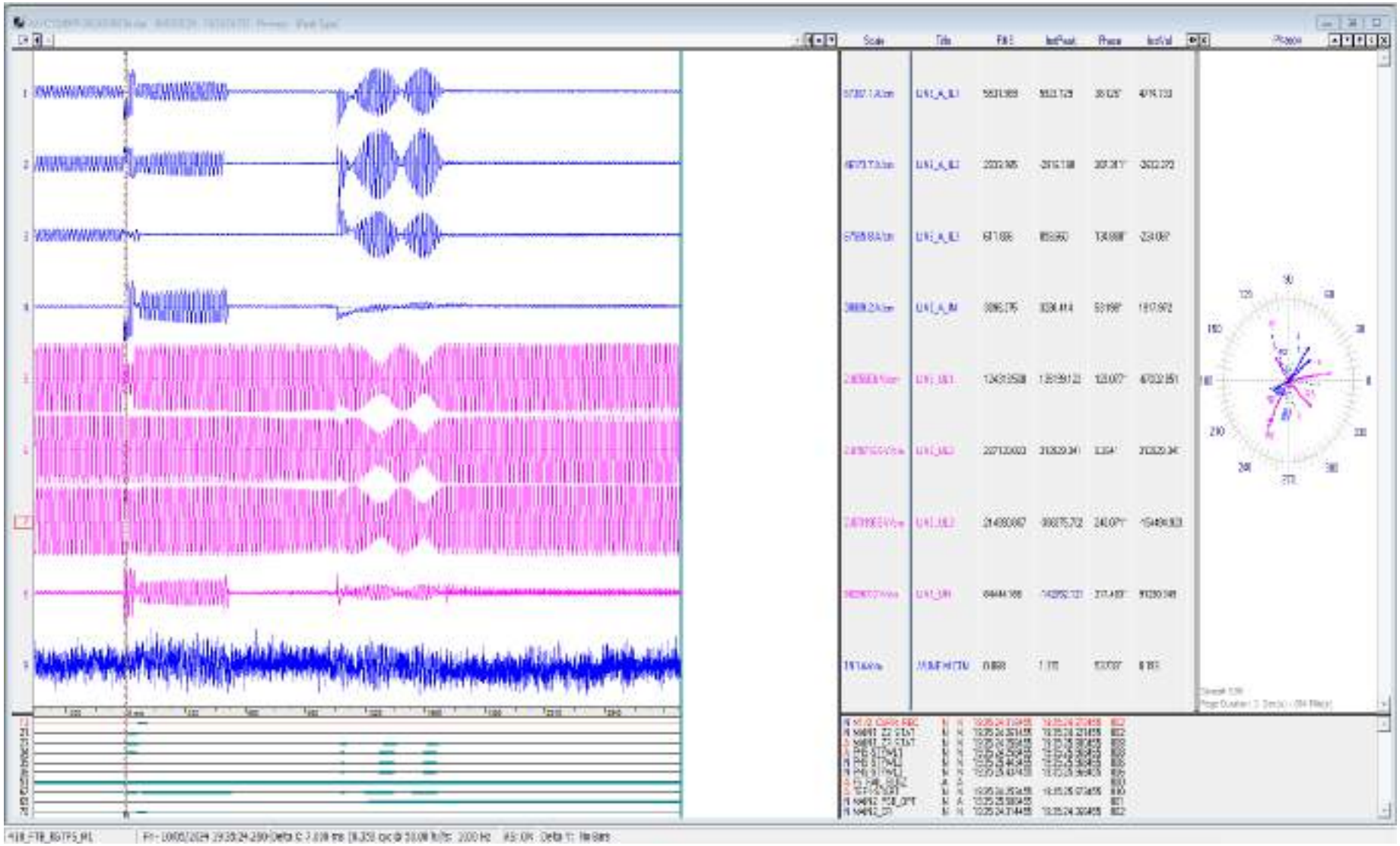
Line was carrying ~270-290A before the fault. (antecedent loading :174 asper SCADA)

DR of 400kV Khedar-Nuhiyawali (HR) ckt of Nuhiyawali end



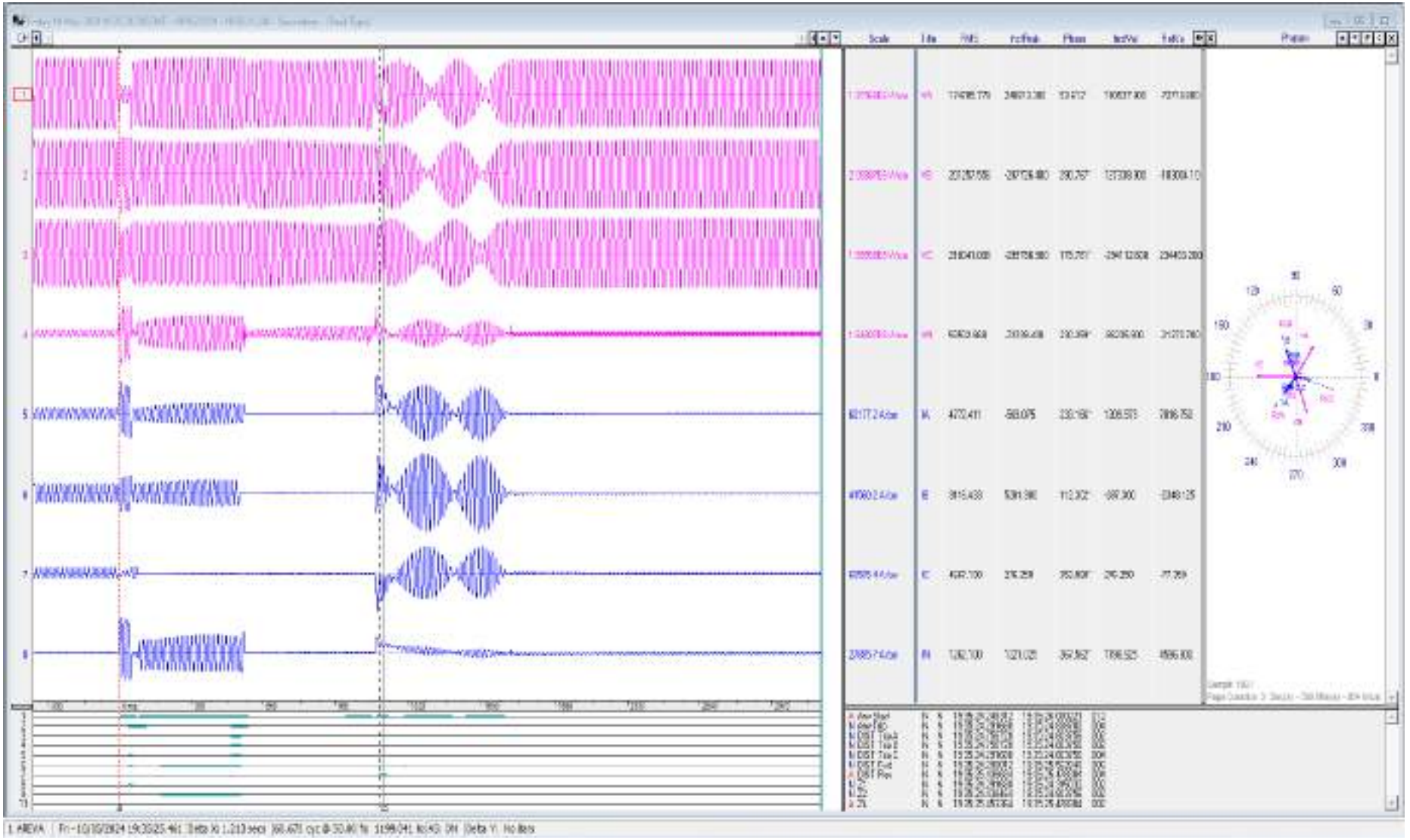
Line was carrying ~240-250A before the fault. (antecedent loading:174 asper SCADA)

DR of 400kV Khedar(HR)-Fatehabad(PG) ckt of Fatehabad end



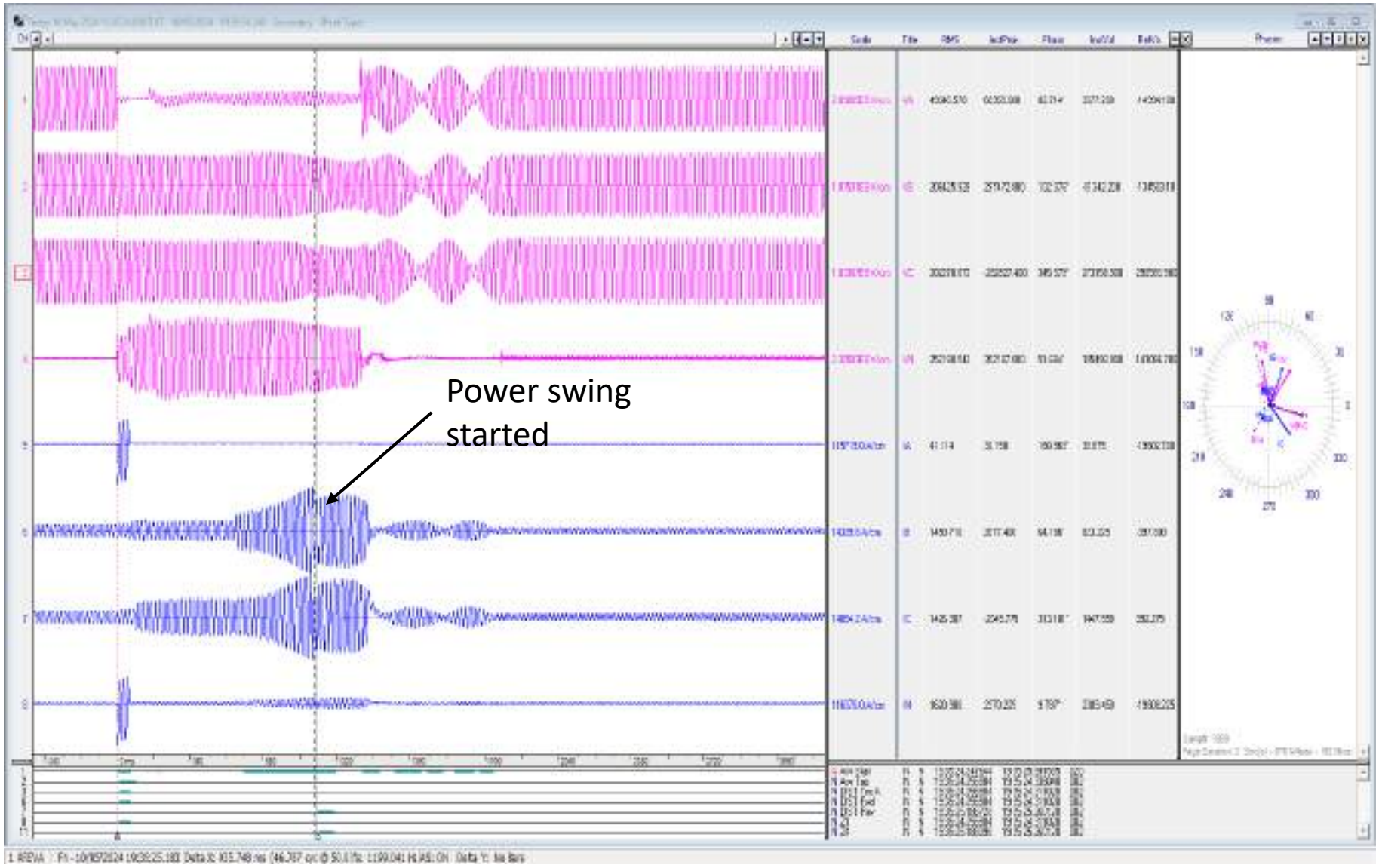
Fatehabad end sensed R-N fault in Z-2. It didn't sense B-N fault. No breaker opened at this end. Power swing detected.

DR of 400kV Khedar(HR)-Fatehabad(PG) ckt of Khedar end



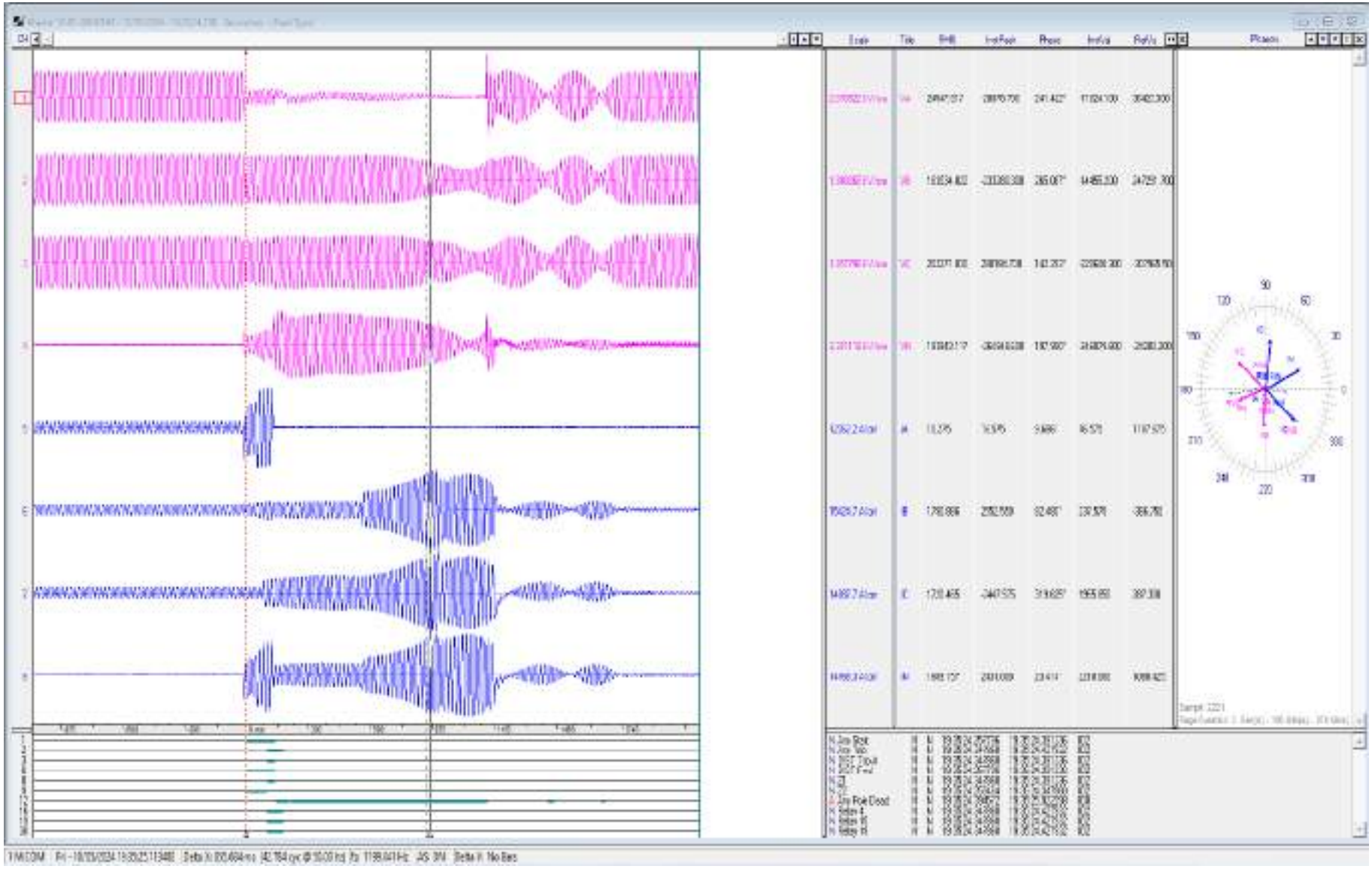
B-N fault, Z-1, A/R started, After ~500msec, R & Y pole also opened. All three phase autoreclosed after dead time. Line didn't trip

DR of 400kV Khedar-Nuhiyawali(HR) ckt of Khedar end



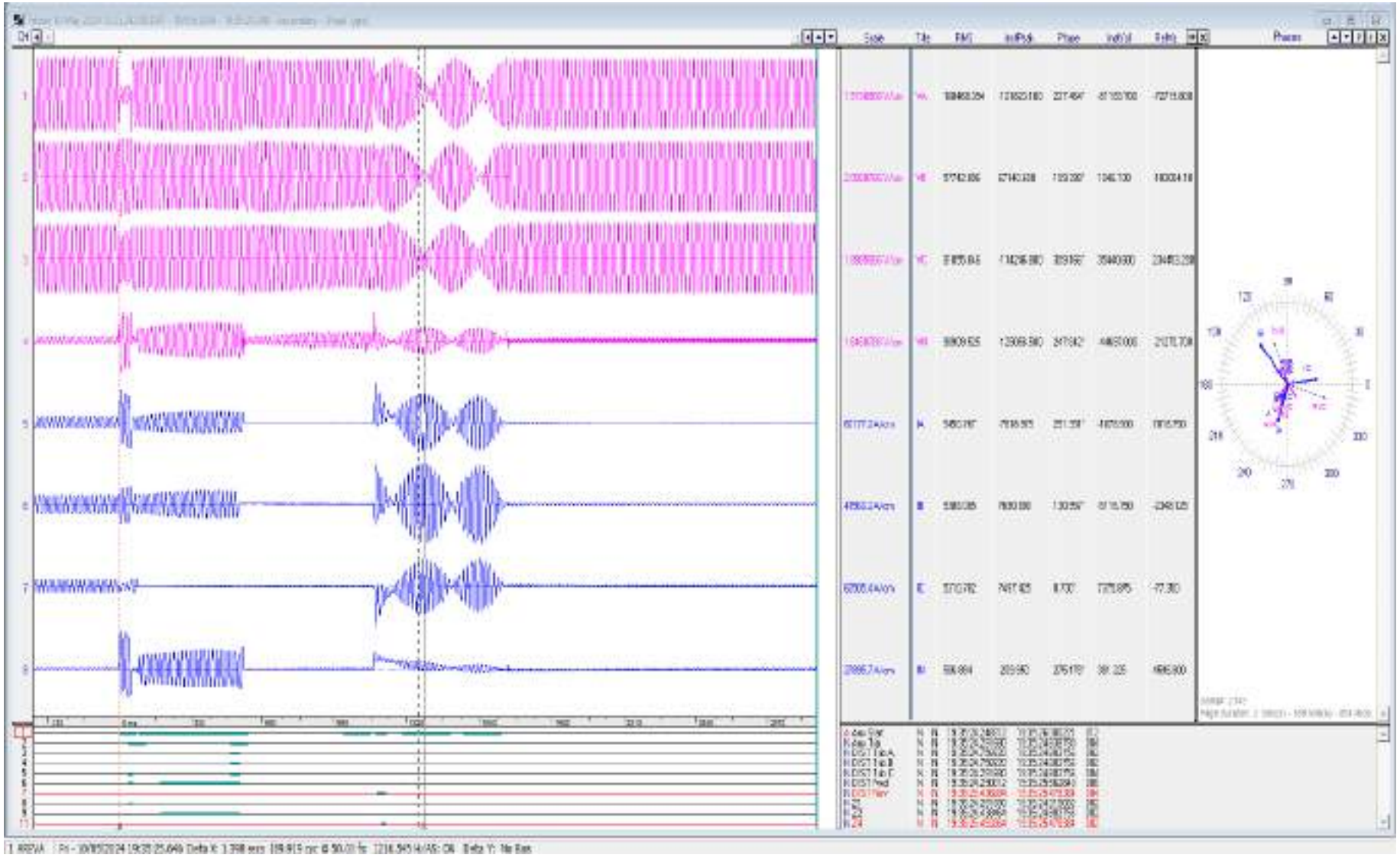
R-N fault, Z-1, A/R started, R-ph current reduced to Zero; After ~500msec current is Y & B phase started increasing (increased to ~1800A); After dead time, line successfully autoreclosed. Line didn't trip

DR of 400kV Khedar-Nuhiyawali(HR) ckt of Nuhiyawali end



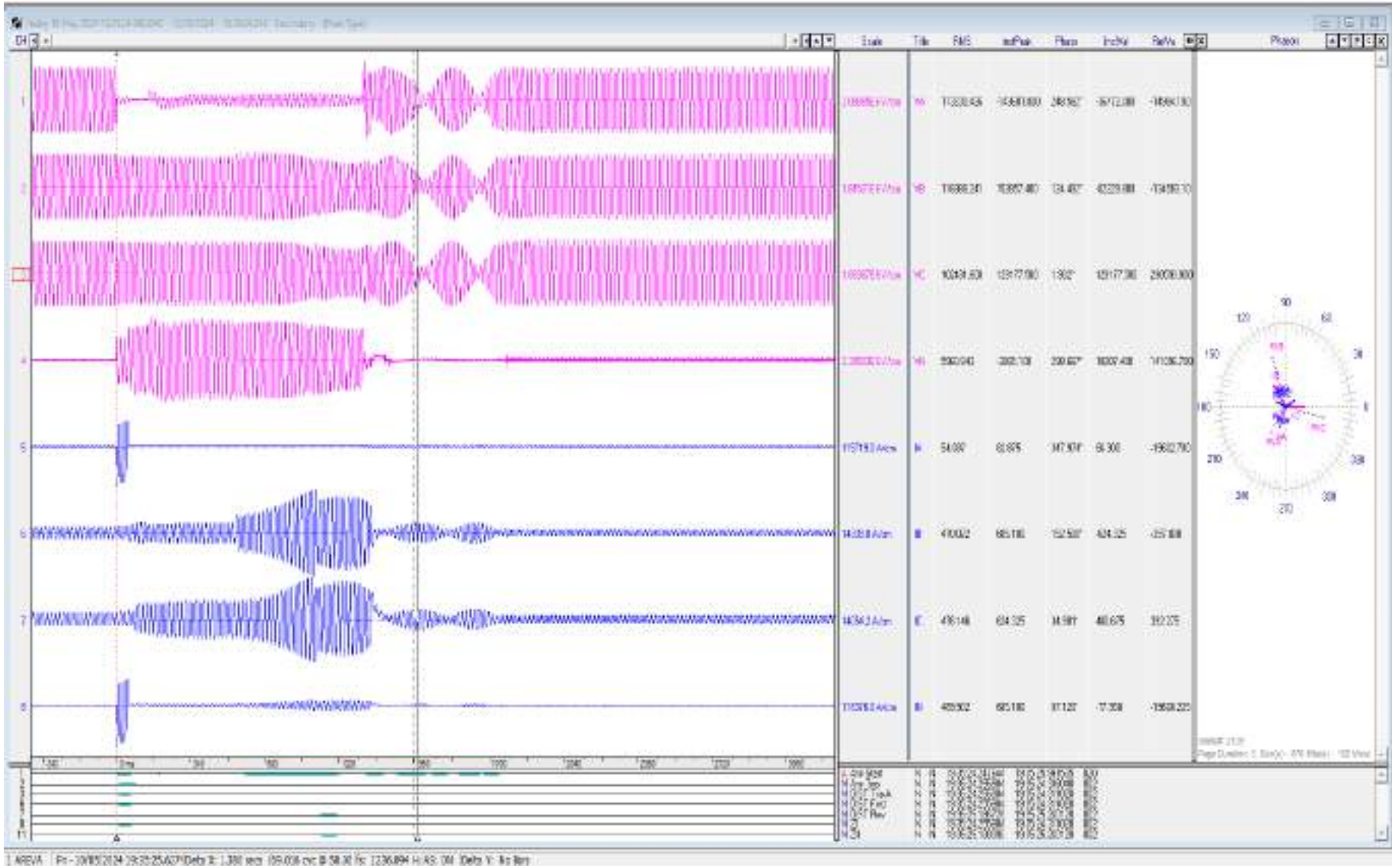
Nuhiyawali end also sensed R-N fault in Z-1, A/R successful

DR of 400kV Khedar(HR)-Fatehabad(PG) ckt of Khedar end



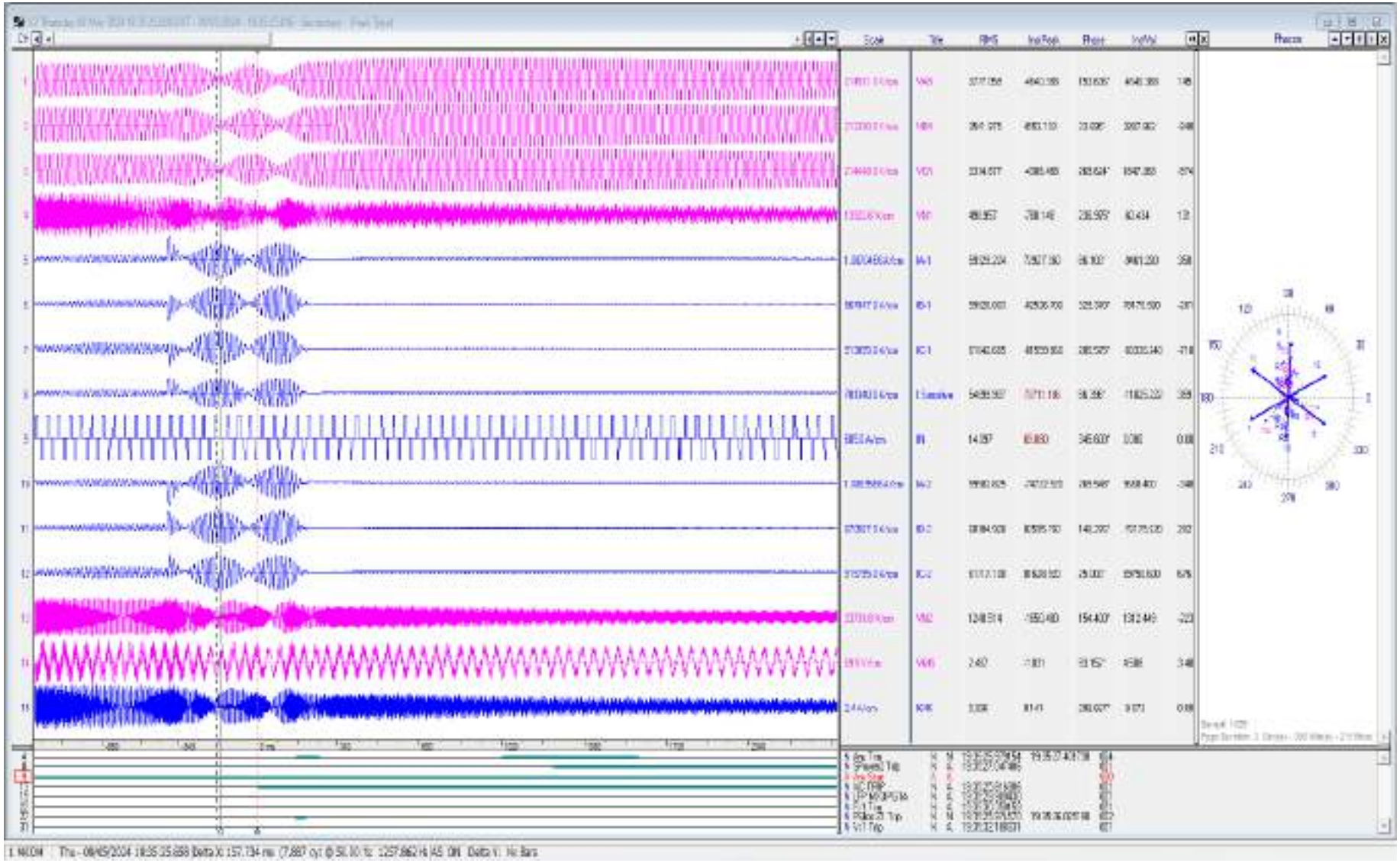
Power swing observed

DR of 400kV Khedar-Nuhiyawali(HR) ckt of Khedar end



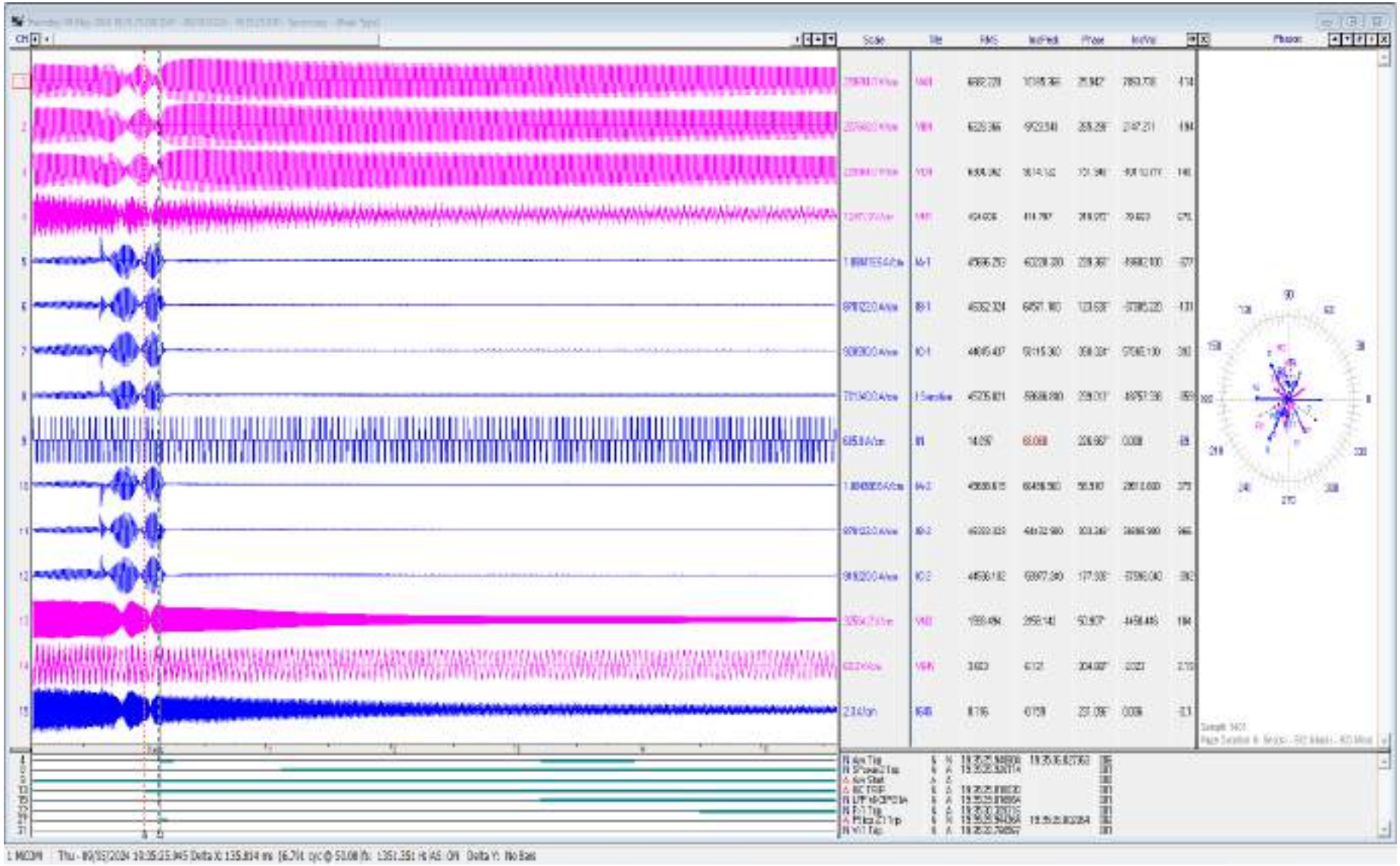
Power swing observed;

DR of 600MW Unit-2 at Khedar TPS



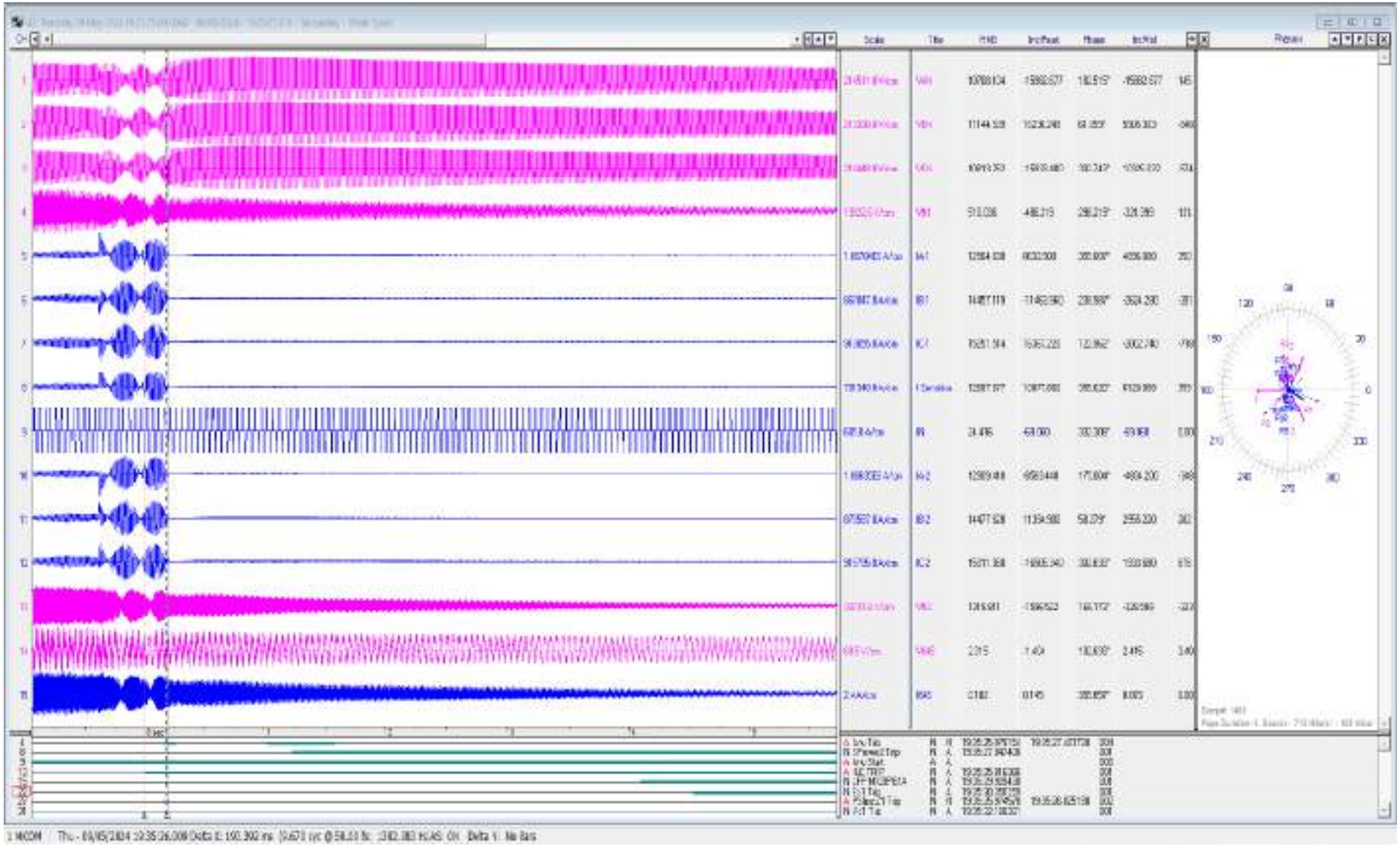
Power swing observed

DR of 600MW Unit-1 at Khedar TPS



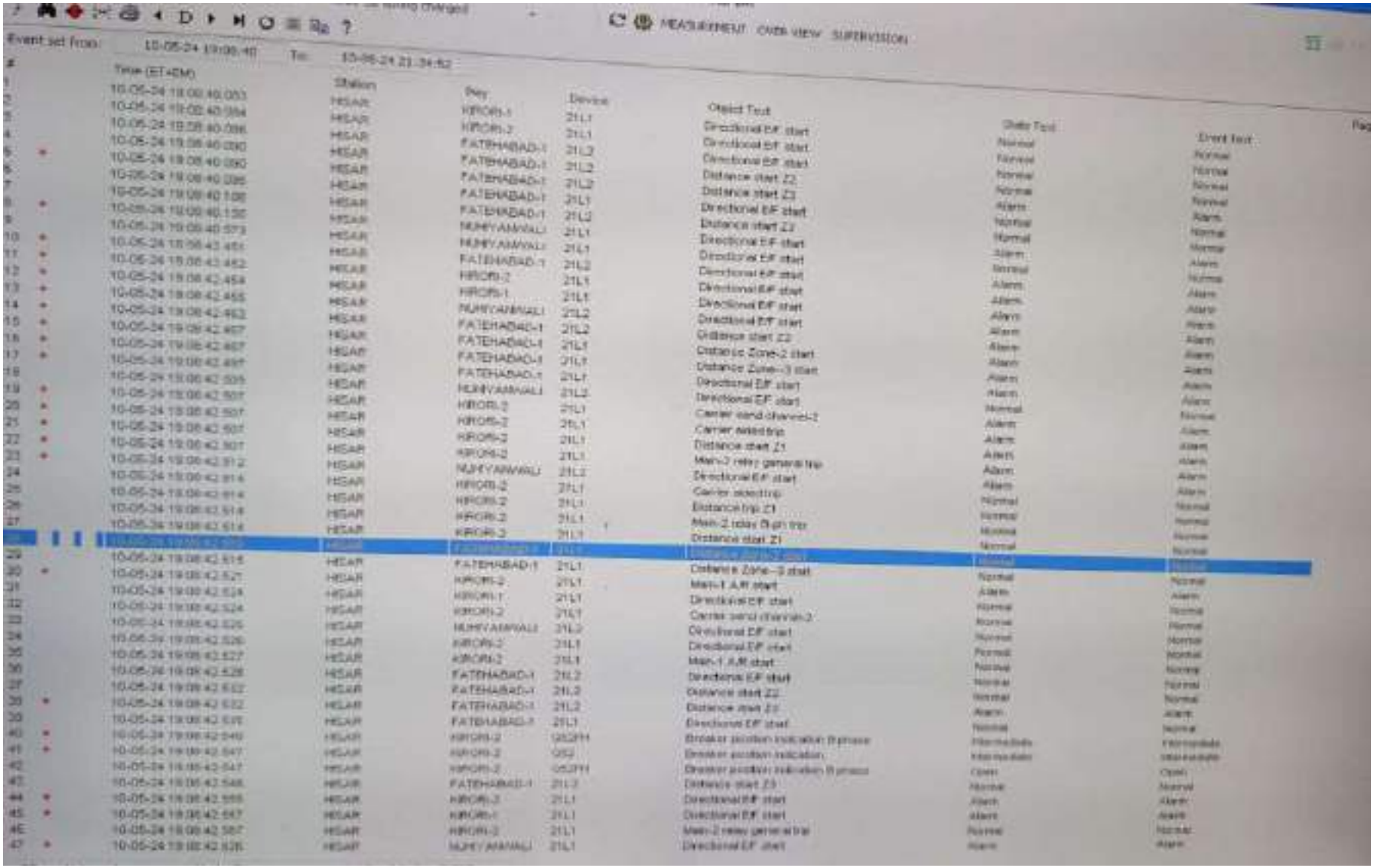
Unit-1 tripped on pole slip after ~400msec of power swing, over frequency trip also detected after ~4sec.

DR of 600MW Unit-2 at Khedar TPS

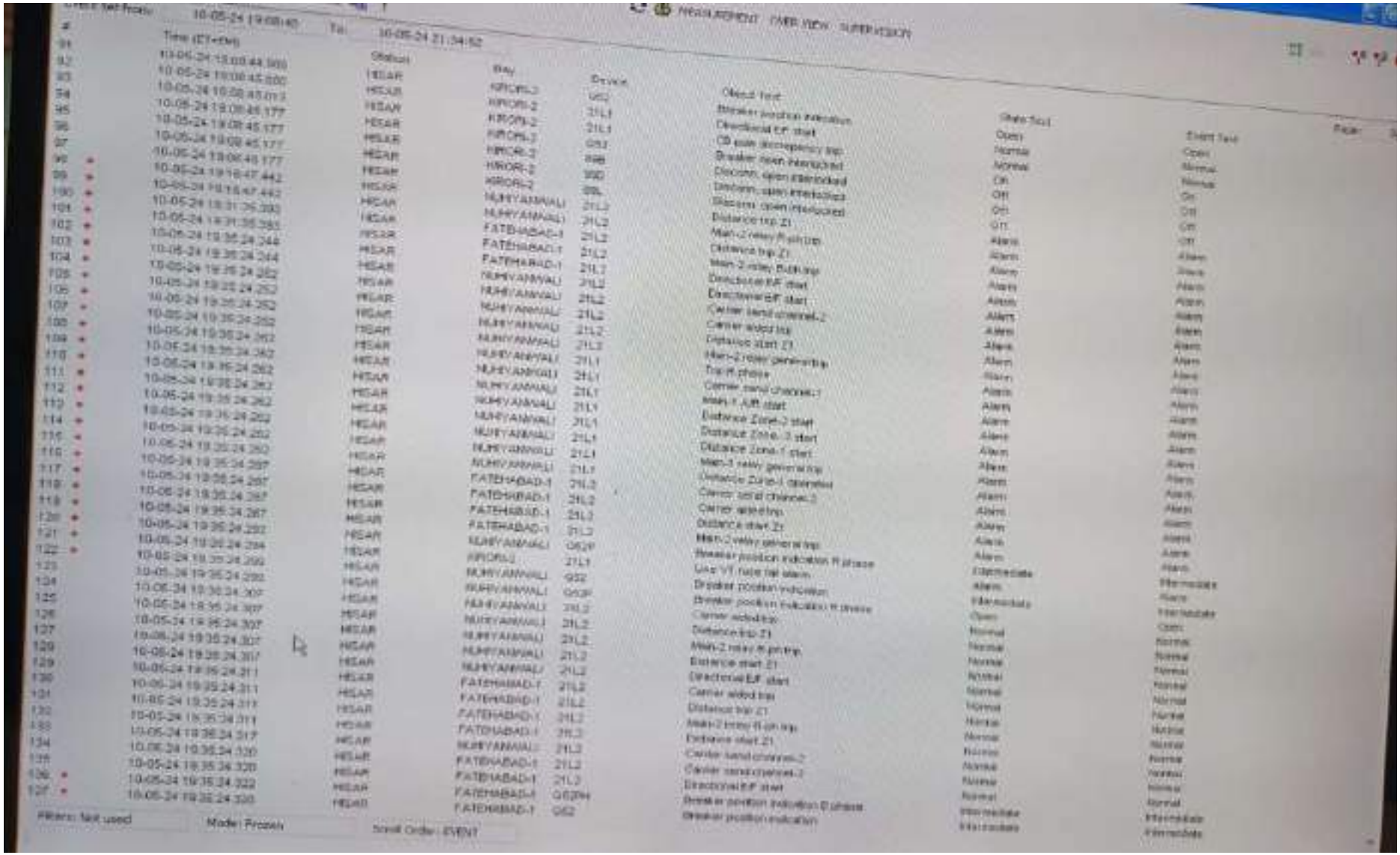


Unit-2 tripped on pole slip after ~400msec of power swing, over frequency trip also detected after ~4sec.

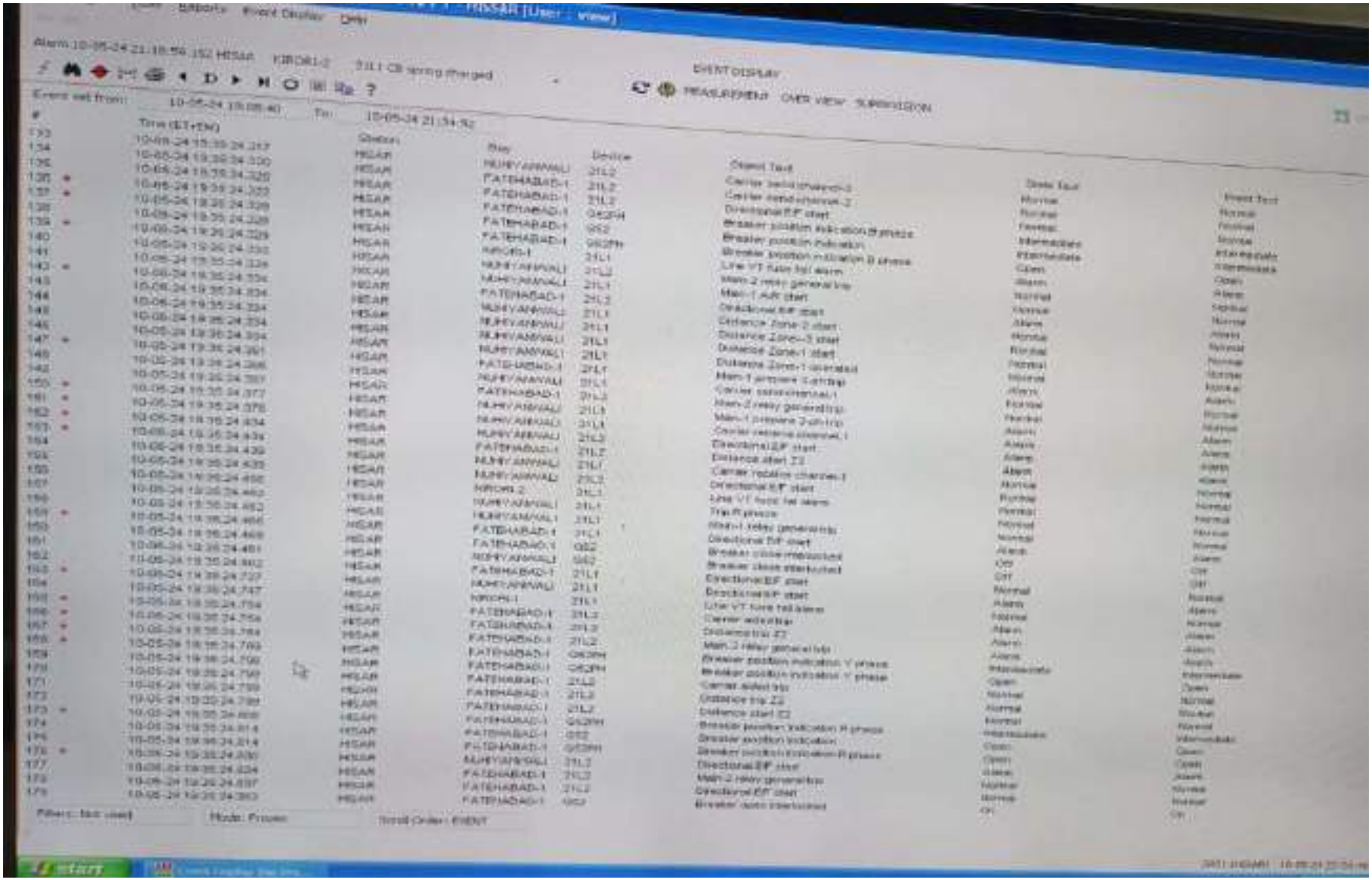
Event logger file received from Khedar TPS



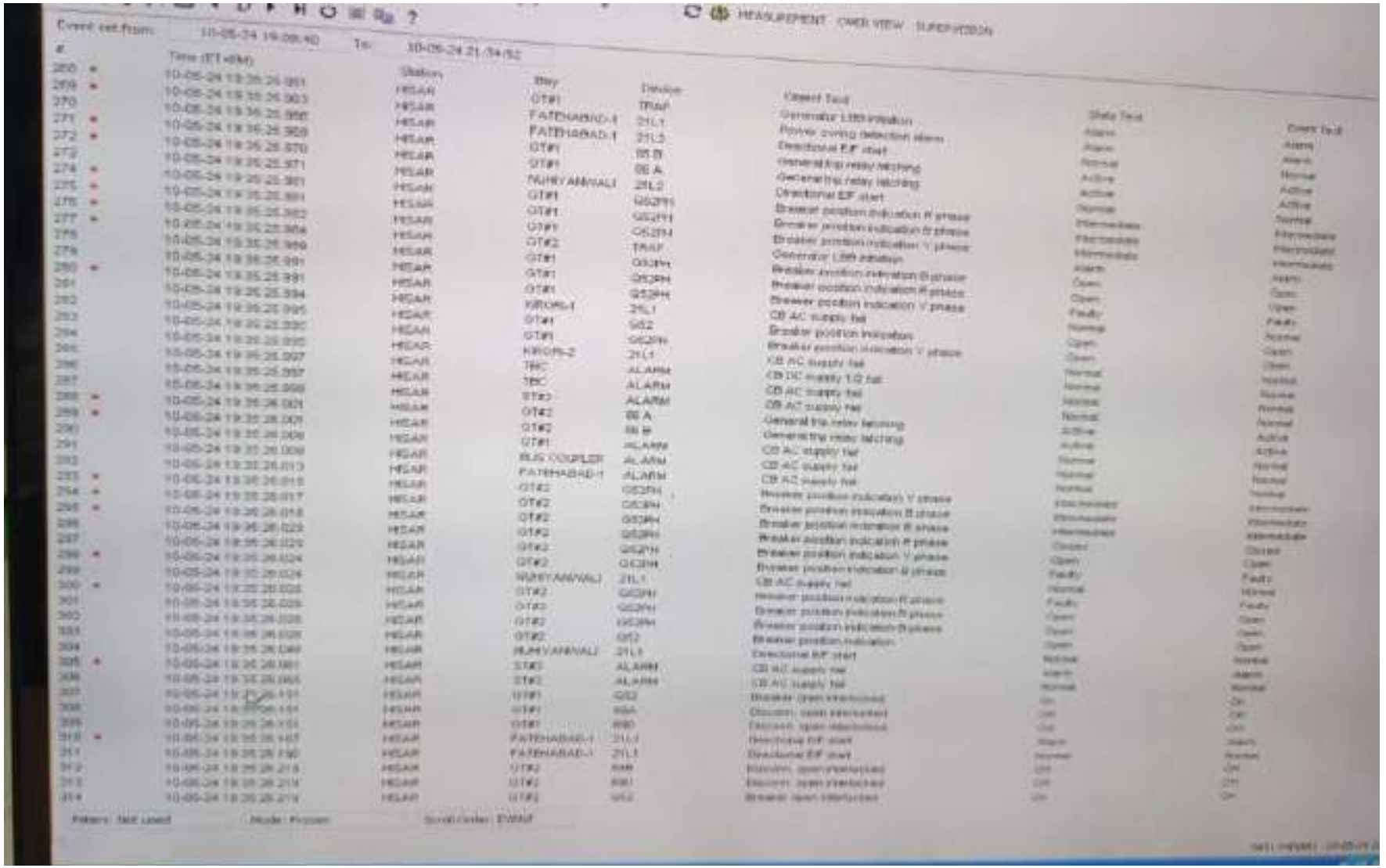
Event logger file received from Khedar TPS



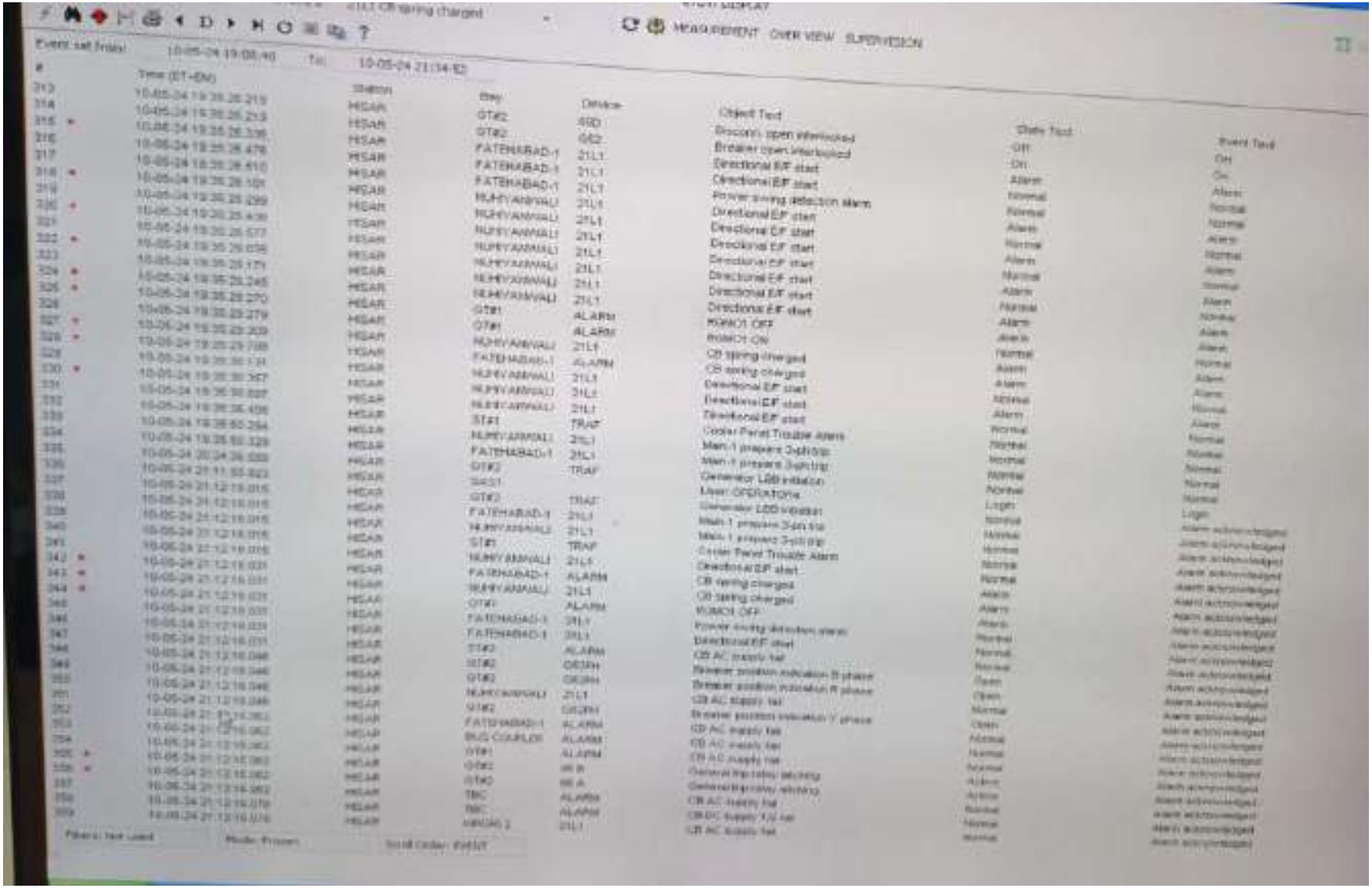
Event logger file received from Khedar TPS



Event logger file received from Khedar TPS



Event logger file received from Khedar TPS



Point of discussion

i) Reason of tripping of 400kV Khedar-Kirori (HR) D/C from Khedar end only need to be investigated further. Operation of distance protection relay doesn't not seem correct. Proper A/R operation was also not occurred. Distance protection relay at Khedar end of both circuits need to be reviewed.

ii) 400kV Khedar(HR)-Fatehabad(PG) ckt:

- Only Khedar(HR) end distance protection relay of 400kV Khedar(HR)-Fatehabad(PG) ckt sensed B-N fault. During initiation of Z-1 in B-Ph, current in B-ph was ~600A and voltage was ~175kv (0.75pu). Whether distance protection relay have operated correctly?
- During B-ph A/R operation at Khedar end, distance protection relay initiated tripping command for R & Y phase. As there was no fault in system during that time instant, reason of 3-ph tripping initiation need to be identified.
- Further, after 1sec (dead time) of B-ph A/R start, all three phase autoreclosed. After 3-ph tripping, A/R lockout should have operated.

In view of aforementioned points, operation of distance protection relay at Khedar end in 400kV Khedar(HR)-Fatehabad(PG) ckt need to be reviewed. Autoreclosed scheme also need to be shared.

iii. Details of remedial action taken also need to be shared.

A. Report on multiple trippings occurred at 400 kV S/Stn., RGTPP Khedar on dated 10.05.2024

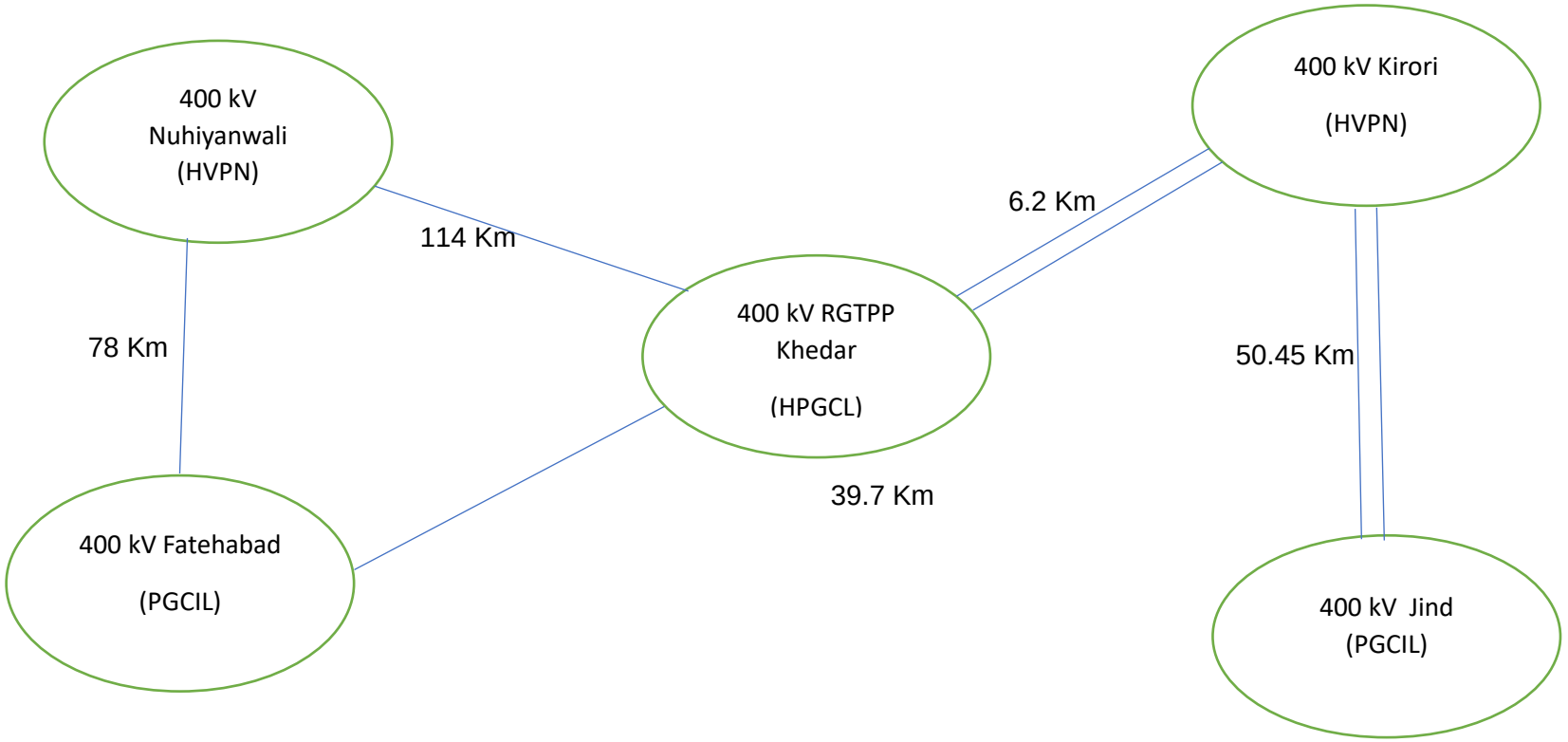
1. History

The RGTPP, Khedar is having installed capacity of 2x600 MW and is connected with following 4 no 400 KV circuits of HVPNL through which power evacuation is done:

a. 400 KV RGTPP to Kirori Circuit I.
b. 400 KV RGTPP to Kirori Circuit II
c. 400 KV RGTPP to Fatehabad PG Circuit
d. 400 KV RGTPP to Nuhianwali Circuit

Further, 400 kV Nuhianwali is connected to 400 kV Fatehabad PG through S/C line and
400 kV Kirori is connected to 400 kV Jind through D/C line.

2. Connectivity Diagram of 400 kV RGTPP, HPGCL Khedar



Note: All conductors are Twin-moose for all lines.

3. Description of Disturbance

There was heavy wind storm occurred in the entire Northern region during evening hours on dated 10.05.2024. At 19:08 Hrs & 19:35 Hrs on dated 10.05.2024, the following transmission elements were tripped & 600 MW RGTPS unit 1 & unit 2 also tripped:

Sr. No.	Name of Element	Time of Tripping (Hrs)		Relay Operated	
		From		This end	Other End
1	400 kV PG Fatehabad-Nuhiyanwali S/C line	19:08 Hrs		Zone 1, R phase tripped. AR operated successfully but same fault sensed again within reclaim time and all 3 pole tripped.	Zone 1, R phase tripped, Fault location =55.83 km, If= 2.068kA. AR operated successfully but same fault sensed again within reclaim time and all 3 pole tripped.
2	400 kV Khedar- Kirori Ckt 1	19:08 Hrs		Main-2, Zone 1, B phase tripped. (IA= 555 A, IB= 564.0 A, IC=1043 A, VA=233.0 kV, VB= 238.5 kV, VC= 236.1 kV, Fault location= 0m, Fault duration =197.7 ms) Then about 2 Sec later, Remaining poles tripped on PD.	Not tripped
3	400 kV Khedar- Kirori Ckt 2	19:08 Hrs		Main-2, Zone 1, B phase tripped. Then about 2 Sec later, Remaining poles tripped on PD.	Not tripped
4	400 kV Khedar- Fatehabad S/C line	19:35 Hrs		Main-2, Tripped in Zone 1, B phase (Ib=1.1kA, 8.5km) & A/R successful.	Not tripped
5	400 kV Khedar-Nuhiyanwali S/C line	19:35 Hrs		Tripped in Zone 1, R phase (Ir=12 kA, Dist=75 KM) & A/R successful.	Tripped in Zone 1, R phase (Ir=1.5 kA) & A/R successful.
6	600 MW RGTPS Unit 1	19:35 Hrs		Generator protection	-
7	600 MW RGTPS Unit 2	19:35 Hrs		Generator protection	-

3. Sequence of Events:

The whole disturbance of dated 10.05.2024 broadly can be divided into two incidents. Sequence of event is illustrated below:

Event -1	**10.05.2024 At 19:08 hrs:**
19:08:40:021	400 Kv Fatehabad -Nuhiyanwali R phase tripped on R-N fault from both end.
19:08:41:135	400 Kv Fatehabad -Nuhiyanwali R phase successfully Auto reclosed from both end.
19:08:42:469	400 Kv Fatehabad -Nuhiyanwali three phase tripped on R-N fault and initiate AR lockout at both end due to recurring fault in reclaim time.
19:08:42:710	400kV Khedar-Kirori(HR) ckt-1 B phase tripped on BN fault from Khedar end.
19:08:42:518	400kV Khedar-Kirori(HR) ckt-2 B phase tripped on BN fault from Khedar end.
19:08:4X"xx	400kV Khedar-Kirori(HR) ckt-1 remaining R & Y phase tripped on PD relay operation at Khedar end
19:08:44.979	400kV Khedar-Kirori(HR) ckt-2 remaining R & Y phase tripped on PD relay operation at Khedar end.
Due to this disturbance, the Fatehabad-Nuhiyanwali and Khedar-Kirori lines were isolated from the system. Consequently, the RGTPP Khedar remained connected to the grid via the Khedar-Fatehabad and Khedar-Nuhiyanwali lines.	
Event -2	**10.05.2024 At 19:35 hrs:**
19:35:24:255	R phase to earth fault occurred on 400kV Khedar- Nuhiyanwali (HR) ckt. and tripped R-ph only at 19:35:24:348 Hrs . R-ph A/R started from both ends.
19:35:24:291	400kV Khedar(HR)-Fatehabad(PG) ckt; distance protection relay (Main-2, Micom P442) of at Khedar end sensed B-N fault in Z-1 & tripped B-ph at 19:35:24:348 Hrs, A/R also initiated in B-ph at Khedar end. Fatehabad (PG) end distance protection relay didn't sense this B-N fault and no operation occurred at Fatehabad end.
19:35:24:758	400kV Khedar(HR)-Fatehabad(PG) ckt; distance protection relay at Khedar end initiated 3-ph tripping command and R & Y ph pole also opened.
	As R-ph autoreclosing was also going on in 400kV Khedar-Nuhiyanwali (HR) ckt at this time and all 3-ph pole of 400kV Khedar(HR)-Fatehabad(PG) ckt opened, all the power now started evacuating through Y & B phase of 400kV Khedar-Nuhiyanwali (HR) ckt. Current in Y & B phase start increasing, it increased to ~1850A by 19:35:25:153 hrs.
19:35:25:376	R-ph pole of 400kV Khedar-Nuhiyanwali (HR) ckt closed from both ends and line successfully autoreclosed.
19:35:25:421	All 3-ph pole at Khedar end of 400kV Khedar(HR)- Fatehabad(PG) ckt closed and line successfully autoreclosed. At the same time, power swing also observed in DR of Unit-1&2 and evacuating lines.
19:35:25:944	600MW Unit-1 tripped on pole slip protection operation.
19:35:25:974	600MW Unit-2 tripped on pole slip protection operation. At 19:35:30:309 hrs and 19:35:30:350 hrs, over frequency protection also operated of Unit-1 & 2 respectively.

i) DR/EL of the lines are attached in **Annexure-I.**

4. Observation/Root Cause Analysis:

a) Tripping of 400kV Fatehabad-Nuhianwali S/C from both ends:

No abnormality was observed in the tripping of the Fatehabad-Nuhiyanwali line.

b) Tripping of 400kV Khedar-Kirori D/C from Khedar end only:

At first glance, the tripping of the Khedar-Kirori 1 and 2 lines from one end (the Khedar end) appears to be due to an erroneous relay operation.

It was focused on identifying the root cause of the following issues:

1. Tripping of the Micom P442 relay with a Zone 1 (Z1) on far ended reverse (RN) fault.

2. Failure of the auto-reclose function during the Z1 and RN fault relay operation.

All available disturbance records, Sequence of Events (SOE), relay events, trip logs, and other relevant data was thoroughly examined. The observations are as follows:

1. Only Khedar end distance protection relay of 400kV Khedar- Kirori D/C line sensed B-N fault. During initiation of Z-1 in B-Ph, current in B-ph was ~1000A and voltage was healthy. The relay recorded fault data as under: (IA= 555 A, IB= 564.0 A, IC=1043 A, VA=233.0 kV, VB= 238.5 kV, VC= 236.1 kV, Zone 1, Fault location= 0m, Fault duration =197.7 ms). No major changes observed in the voltage & current parameter reflect that there was no fault in this line & line remain charged from 400 kV Kirori end. The Micom P442 relay initiated BN tripping in Zone 1 (Z1) on a reverse direction fault, the actual fault occurred on the Fatehabad-Nuhiyanwali line. This was caused by the high resistive reach setting & PSB blocking setting disabled. Simulation studies confirmed that the fault locus entered Z1 at a distant fault due to the high resistive reach setting. In contrast, the Main-2 REL 670 relay for the same line, which had comparatively a low resistive reach setting, did not initiate any tripping.

2. Since the lines were tripped on a single phase fault, a successful auto-reclose operation could have preserved the system. However, it is observed that 'Carrier fail' alarm persists during the tripping, which led to the disabling of the Auto-Reclose (AR) function. It is further observed that the remaining phases (R & Y) were opened with the operation of Pole discrepancy relay. Further, the failure of the AR relay to initiate a three-phase trip command under Block AR conditions was due to the logic implemented in the REL 670 relay, which is configured to disable the AR function upon PLCC failure instead of activating the Block AR.

c) Tripping of 400kV Khedar-Nuhianwali ckt from both ends:

No abnormality was observed in the tripping of the Khedar-Nuhiyanwali line.

d) Tripping of 400kV Khedar-Fatehabad ckt from Khedar end only:

Only Khedar end distance protection relay of 400kV Khedar- Fatehabad ckt sensed B-N fault. During initiation of Z-1 in B-Ph, current in B-ph was ~600A and voltage was ~175kv (0.75pu). The Micom P442 relay initiated BN tripping in Zone 1 (Z1) on a reverse direction fault, the actual fault occurred on the Khedar-Nuhiyanwali line. This was caused by the high resistive reach setting & PSB blocking setting allowed for tripping in Zone-1. Simulation studies confirmed that the fault locus entered Z1 at a distant fault due to the high resistive reach setting. In contrast, the Main-2 REL 670 relay for the same line, which had comparatively a low resistive reach setting, did not initiate any tripping.

During B-ph A/R operation at Khedar end, distance protection relay initiated tripping command for R & Y phase also. Further, after 1sec (dead time) of B-ph A/R start, all three phase auto-reclosed as per settings of auto-reclose in the relay (allowed for 1/2/3 ph).

e) Tripping of 600 MW RGTPP Unit 1 & Unit 2:

With the disturbance of 400 kV Fatehabad-Nuhianwali line at 19.08.42.469 Hrs, 400 kV Khedar-Kirori D/C lines were isolated from the system from Khedar end only due to wrong operation of Distance Protection Relays (Micom P442). Consequently, the RGTPP Khedar remained connected to the grid via 400 kV Khedar-Fatehabad and 400 kV Khedar-Nuhiyanwali lines.

At 19:35:24:255, a transient fault occurred on 400kV Khedar- Nuhiyawali ckt. Simultaneously 400 kV Khedar-Fatehabad line tripped from Khedar end only due to wrong operation of Distance Protection Relay (Micom P442). With this tripping Power Swing observed in the system which resulted in tripping of 600 MW RGTPP Unit 1 & Unit 2 at 19:35:25:944 & 19:35:25:974 Hrs respectively. However, both lines i.e. 400 kV Khedar- Nuhiyanwali & 400 kV Khedar-Fatehabad were auto re-closed.

5. Review of Protection relay Settings at both ends:

Settings of both end were analyzed and following discrepancies were observed:

i) CT Ratios of 400 kV Khedar-Kirori Circuits at Khedar end needs to be changed to 2000 A instead of 1000 A and accordingly implement in the relay settings.

ii) The auto-reclose scheme at Khedar end should be reviewed (presently allowed for 1/2/3-ph AR), and appropriate corrections should be made to the configuration as per NRPC guidelines.

iii) Some discrepancies such as Zone reach, time coordination, resistive reach etc. of Distance protection observed in implemented settings.

iv) DEF settings to be coordinated with Zone settings.

v) Power swing and overvoltage settings at RGTP end may be implemented in consultation with the grid controller (NRLDC).

vi) The relay settings, which are currently based on old fault levels, must be revised to reflect the latest fault levels.

6. Remedial Measures/Suggestion for corrective action:

i) All relay protection Settings of both ends needs to be updated as per latest Protection philosophy circulated by NRPC in January-2024.

ii) The health of the PLCC system must be given top priority. The possibility of replacing the BPL make PLCC with a more reliable make should be explored and implemented.

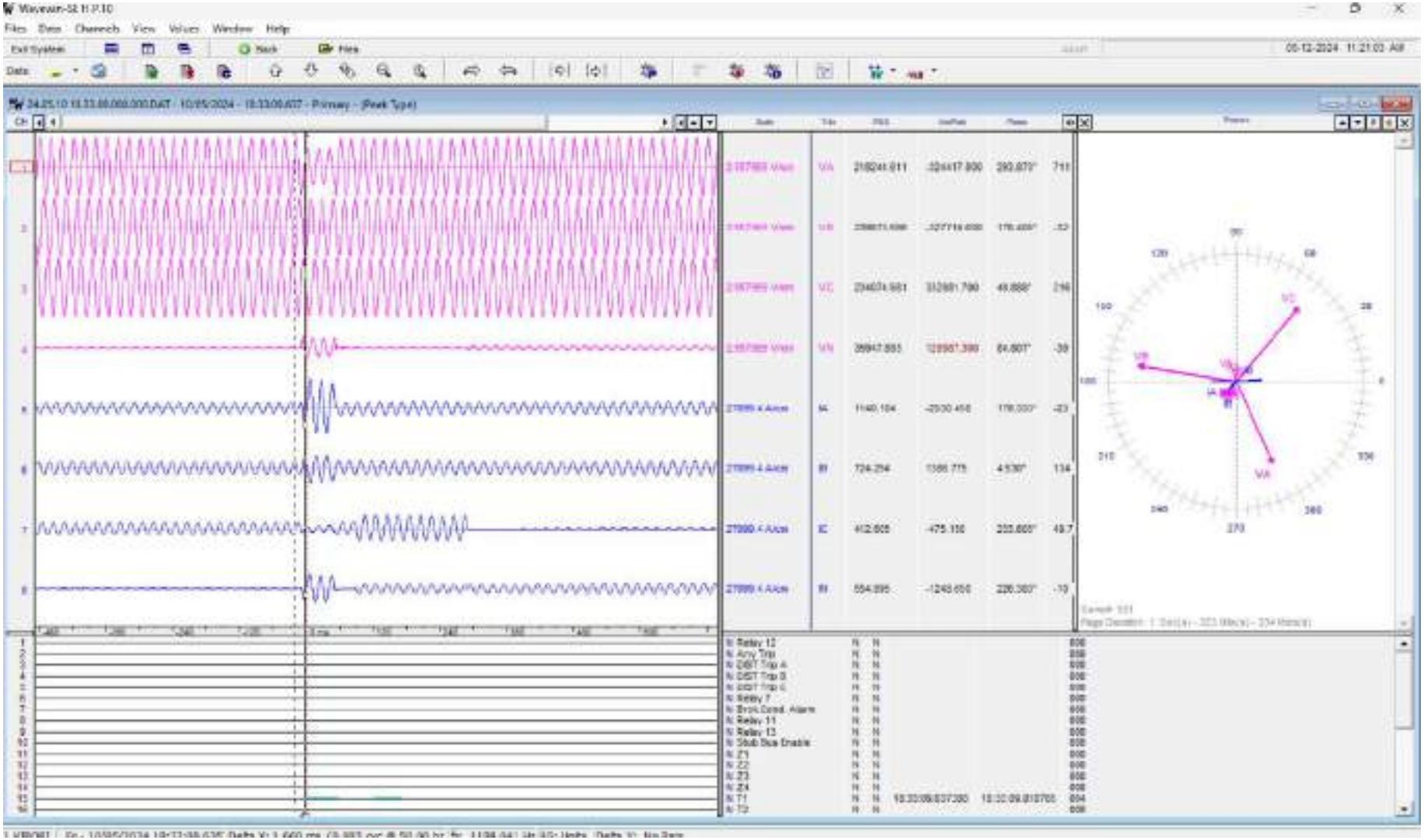
iii) Time synchronization, Disturbance Recorder (DR) PC and SCADA systems need to be maintained in good condition and regularly updated. Accurate time-synchronized event and DR data provide valuable inputs for analyzing complex tripping incidents.

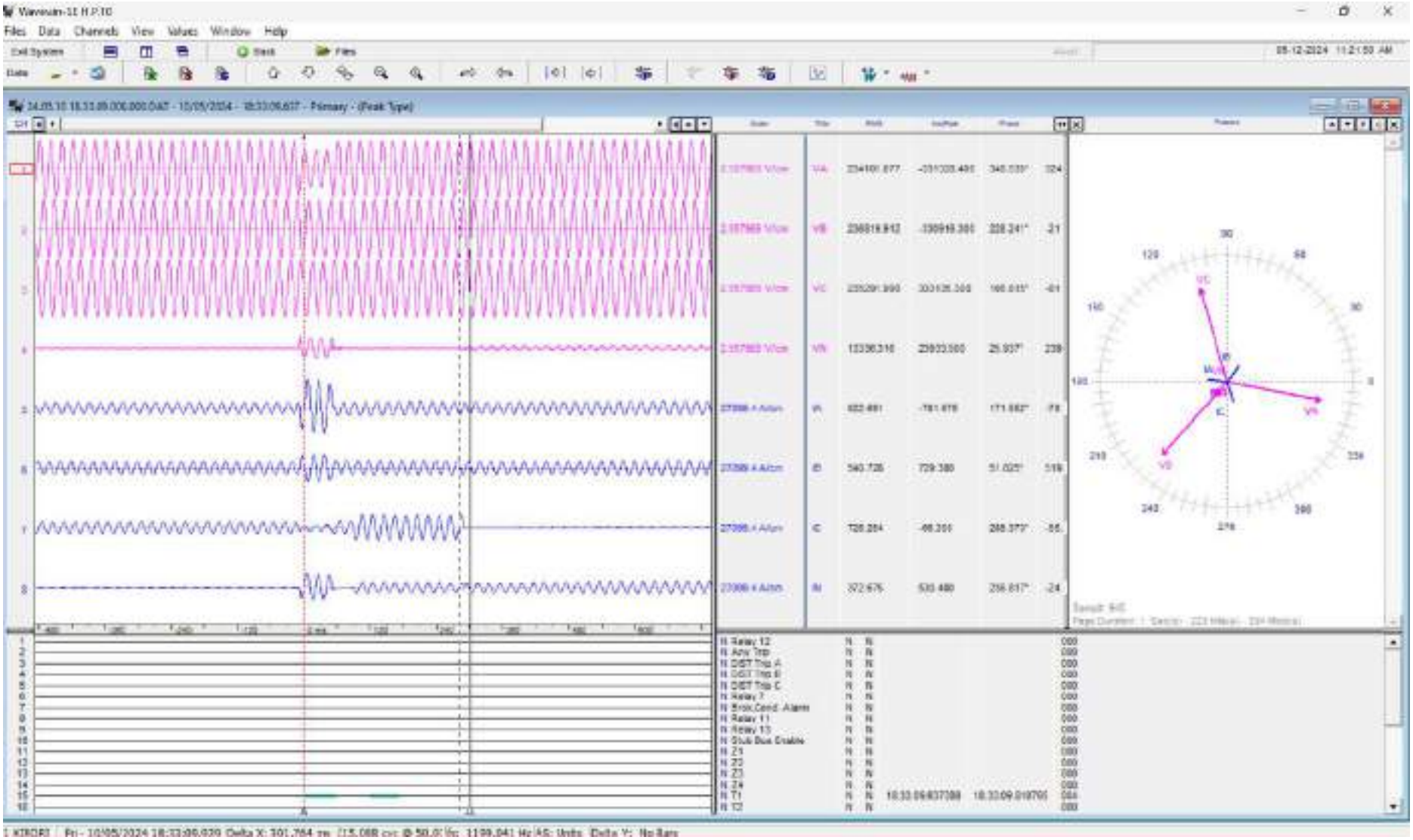
ANNEXURE-I

400 kV Kirori- Khedar Ckt 1

At 400 kV Kirori End Data (Main1) 19:08 Hrs

Relay Time lag approx. 36 min with the real time

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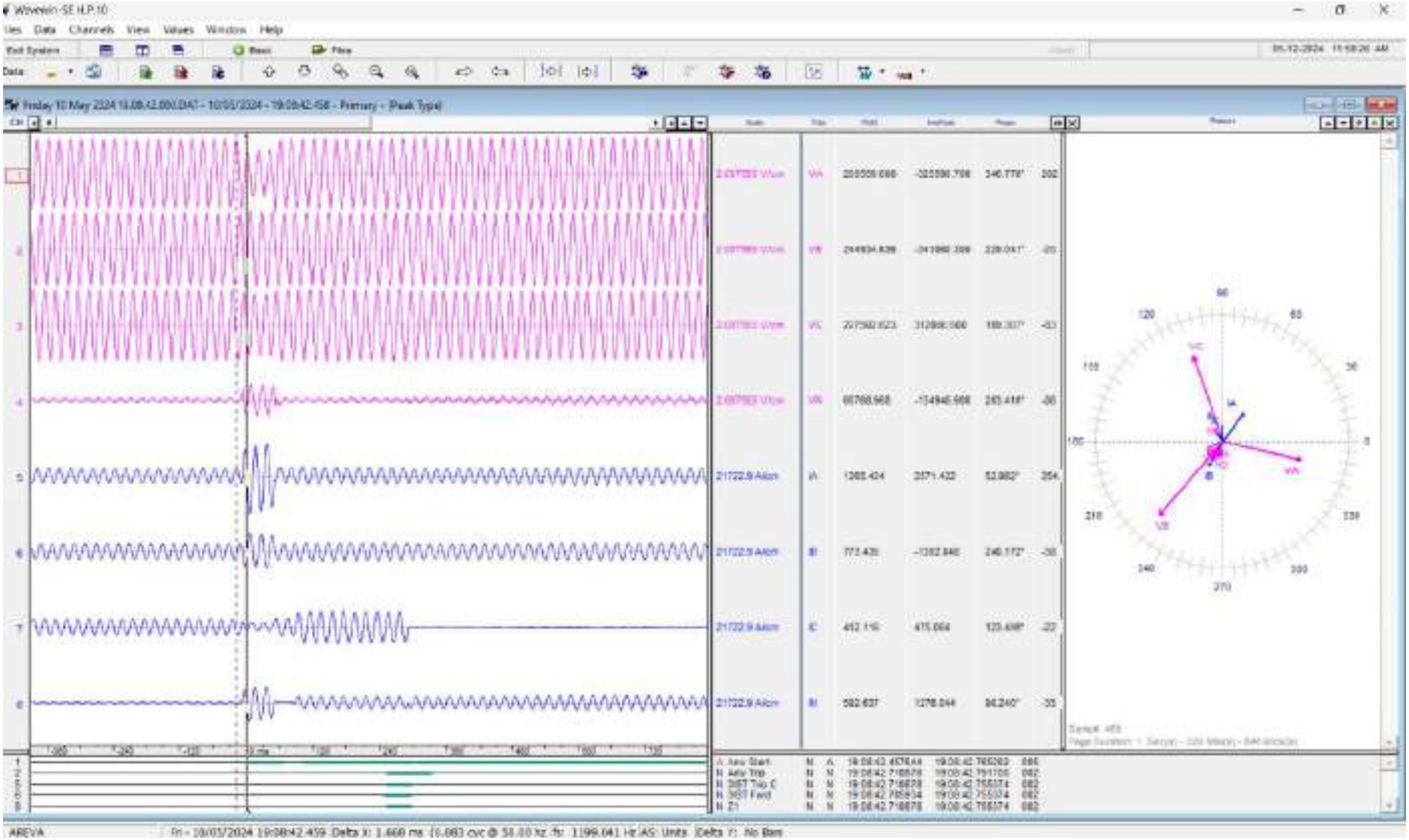
DIST Trip C
Relay 7
Brkr Cond. Alarm
Relay 11
Relay 13
Stub Bus Enable
Z1
Z2
Z3
Z4
T1
T2

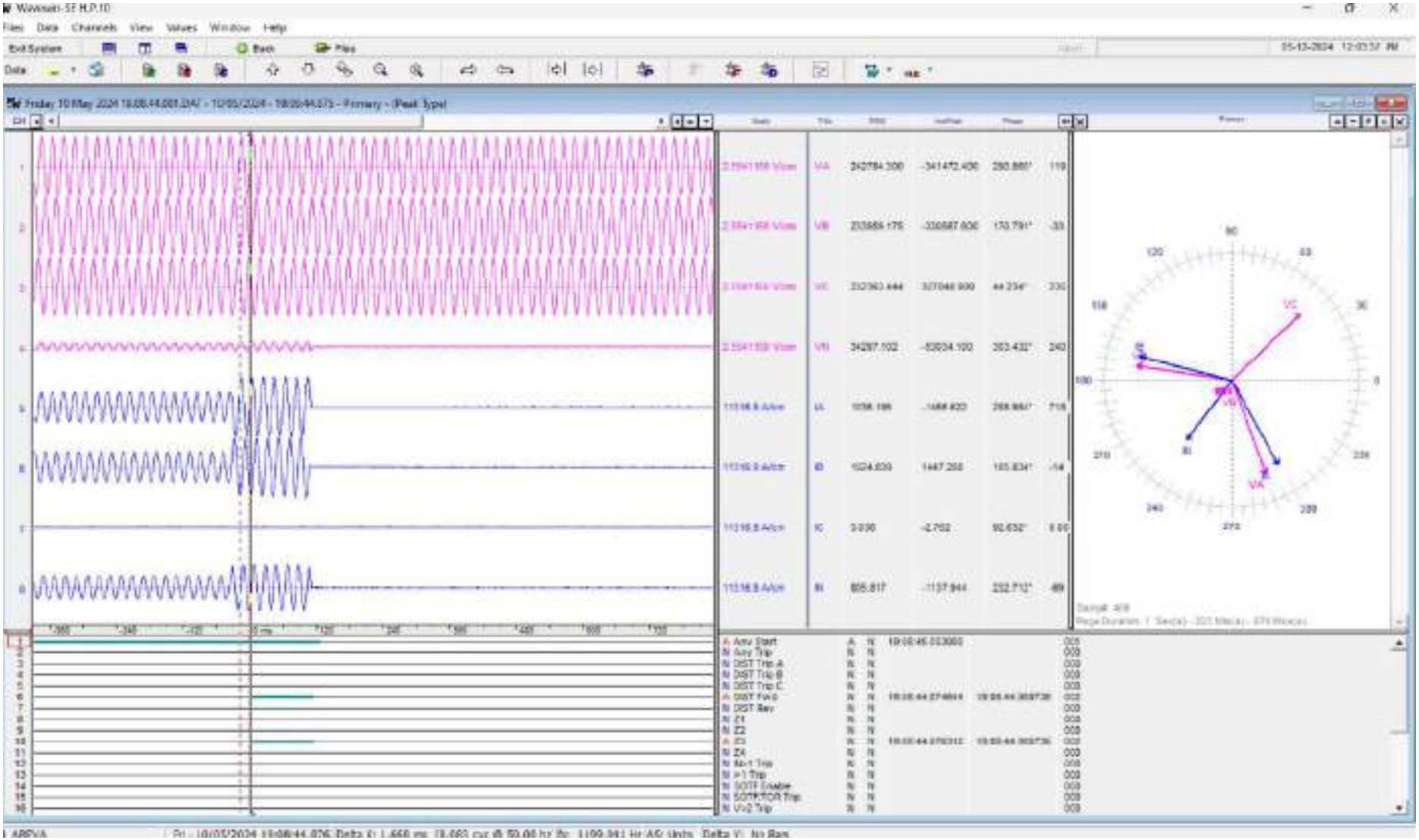
400 kV Kirori- Khedar Ckt 1

At 400 kV RGTPS_End Data (Main2) 19:08 Hrs



400 kV Kirori- Khedar Ckt 2

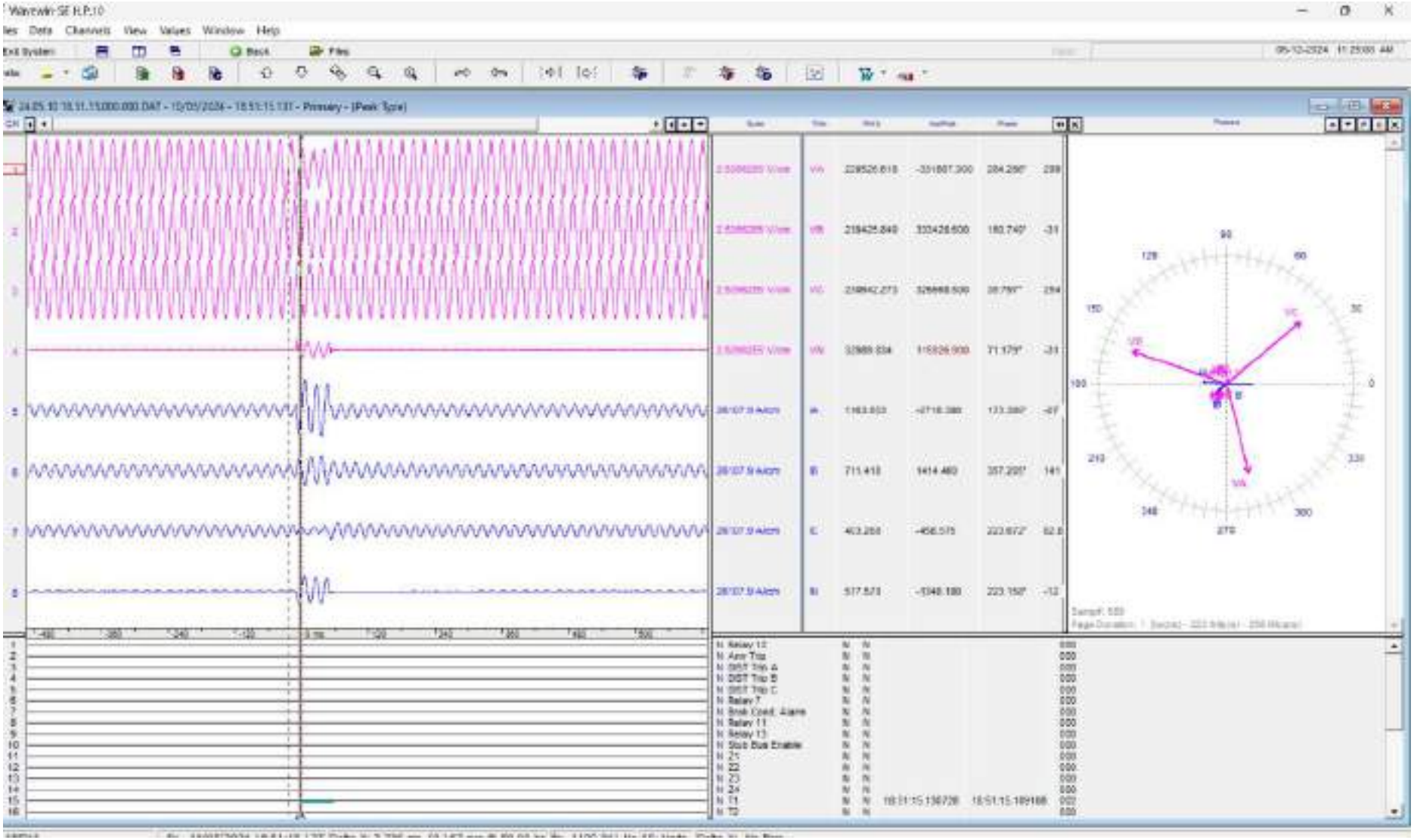
At 400 kV RGTPS_End Data (Main2) 19:08 Hrs

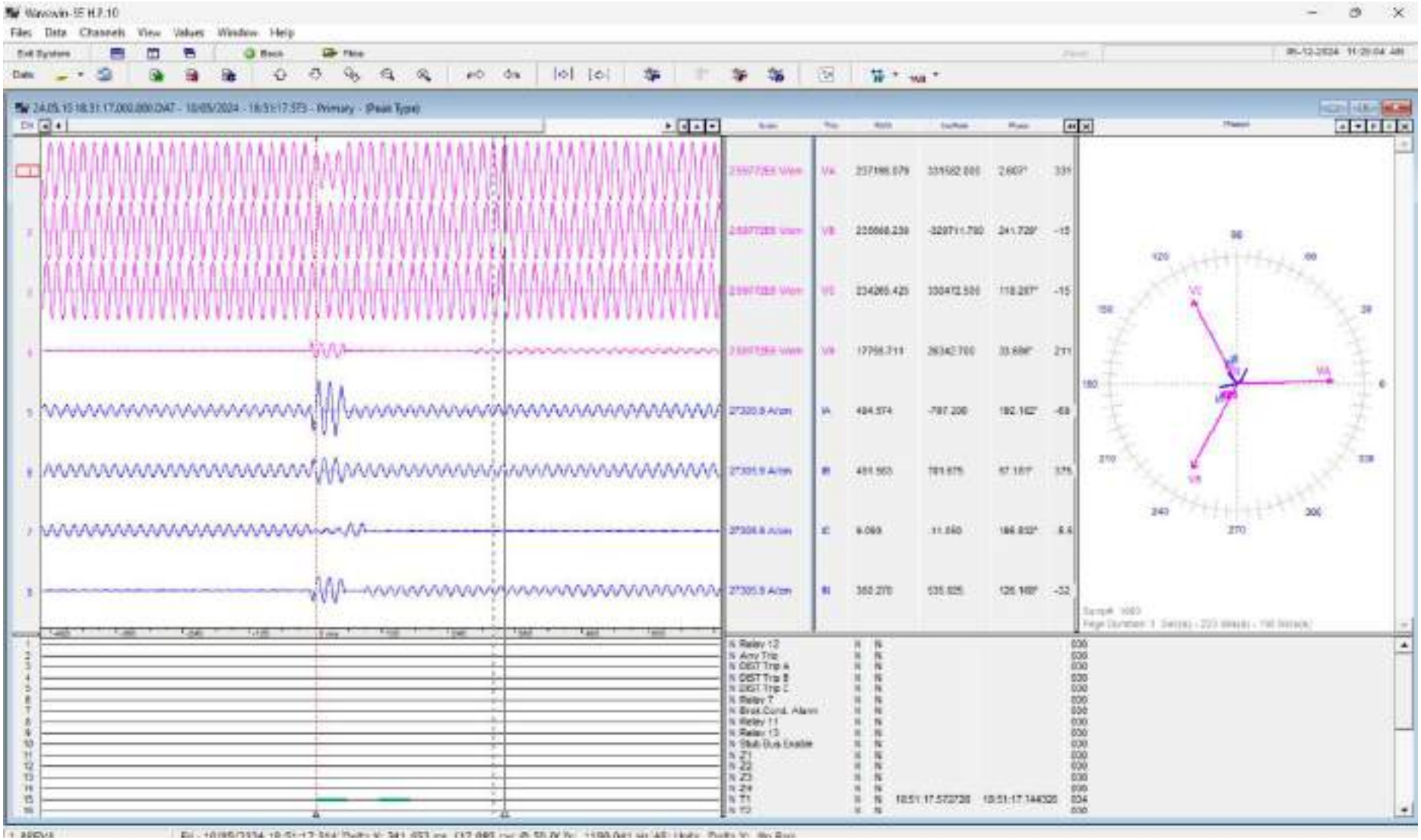


400 kV Kirori- Khedar Ckt 2

At 400 kV Kirori End Data (Main-1) 19:08 Hrs

Relay Time lag approx. 16 min with the real time

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Ic
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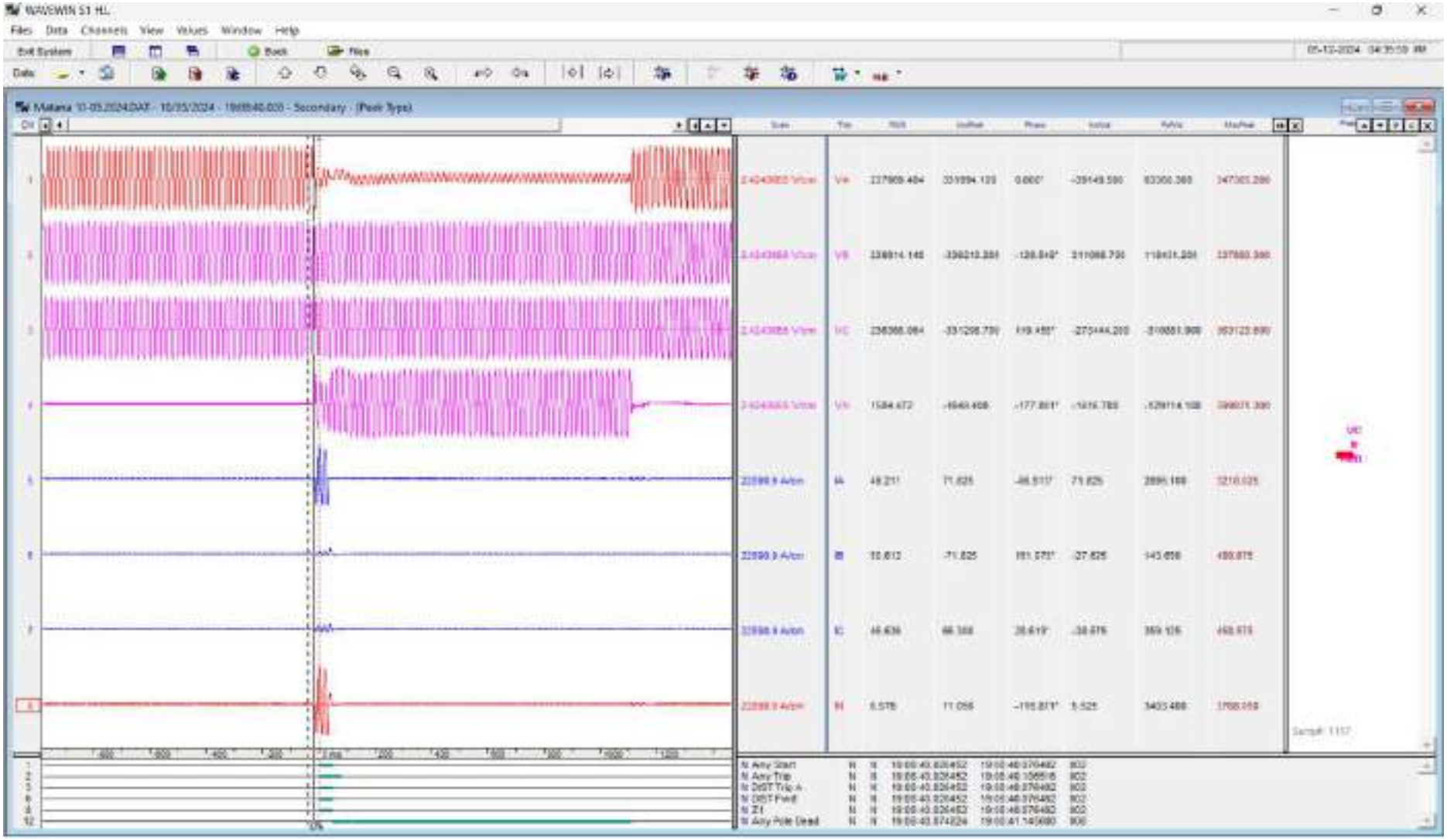
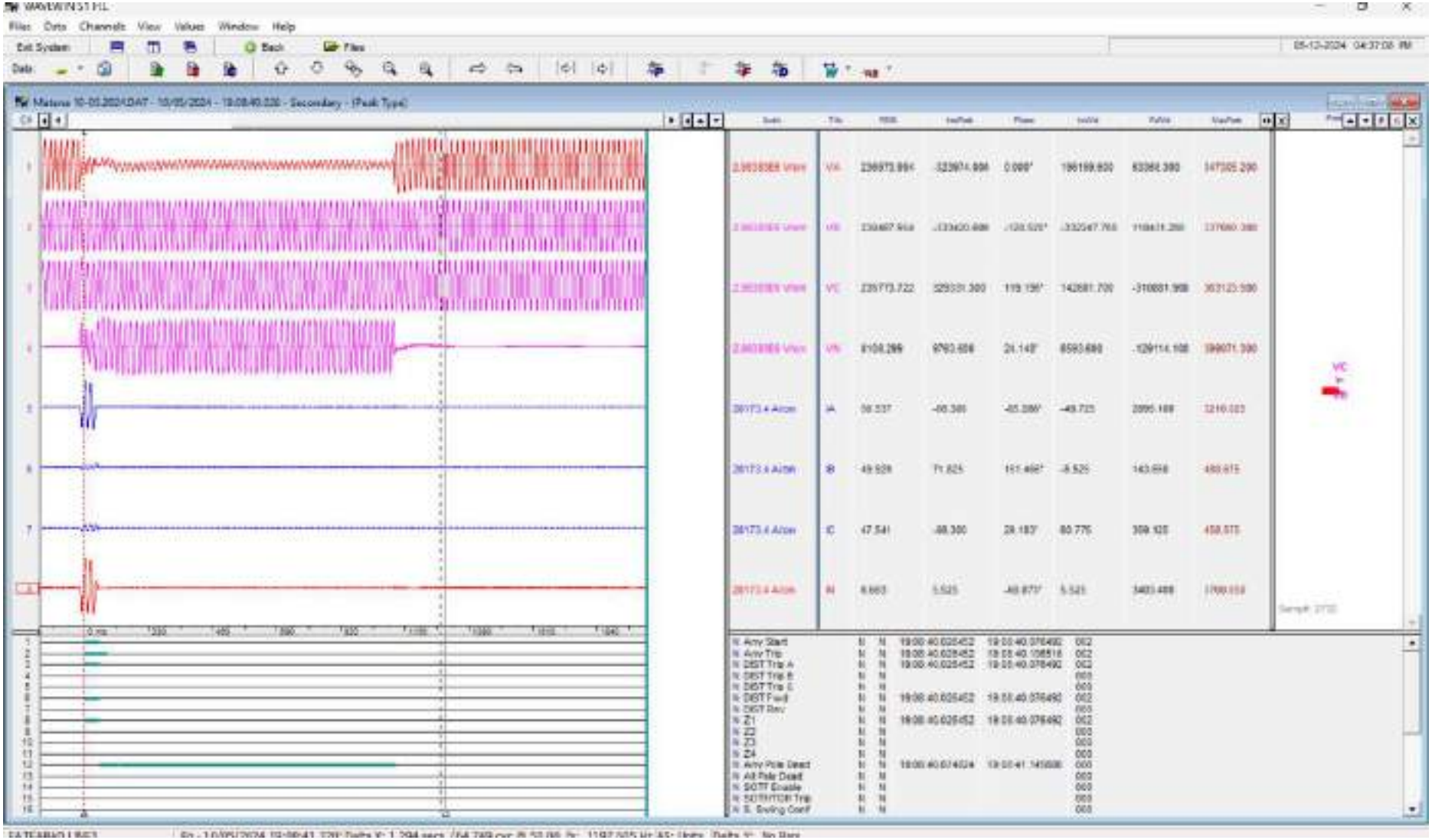
DBT Trip A
DBT Trip B
DBT Trip C
Relay 7
Brok.Cond. Alarm
Relay 11
Relay 13
Stub Bus Enable
Z1
Z2
Z3
Z4
T1

400 kV PG Fatehabad- Nunhiyanwali line

At 400 kV Nunhiyanwali End Data (Main1) 19:08 Hrs

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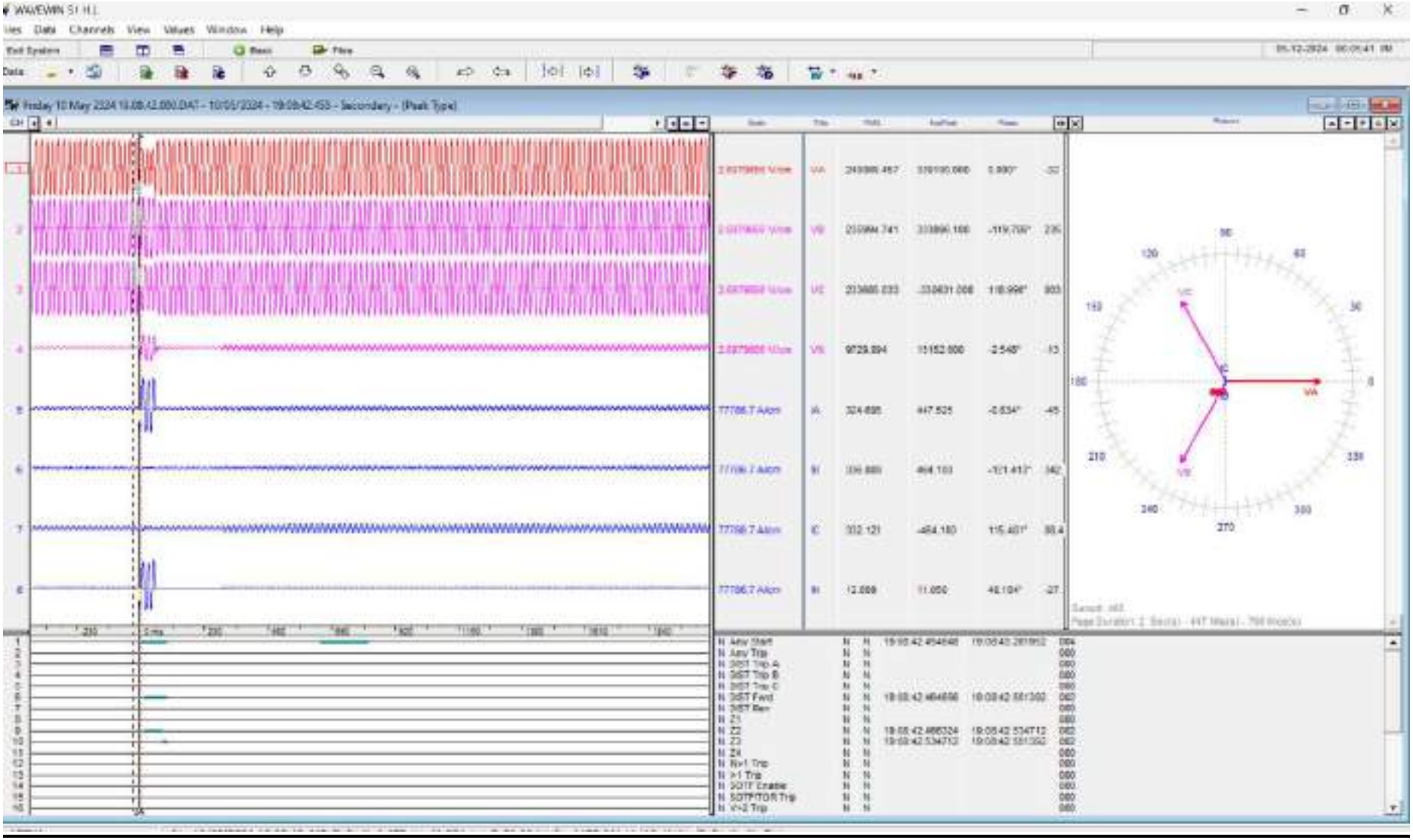
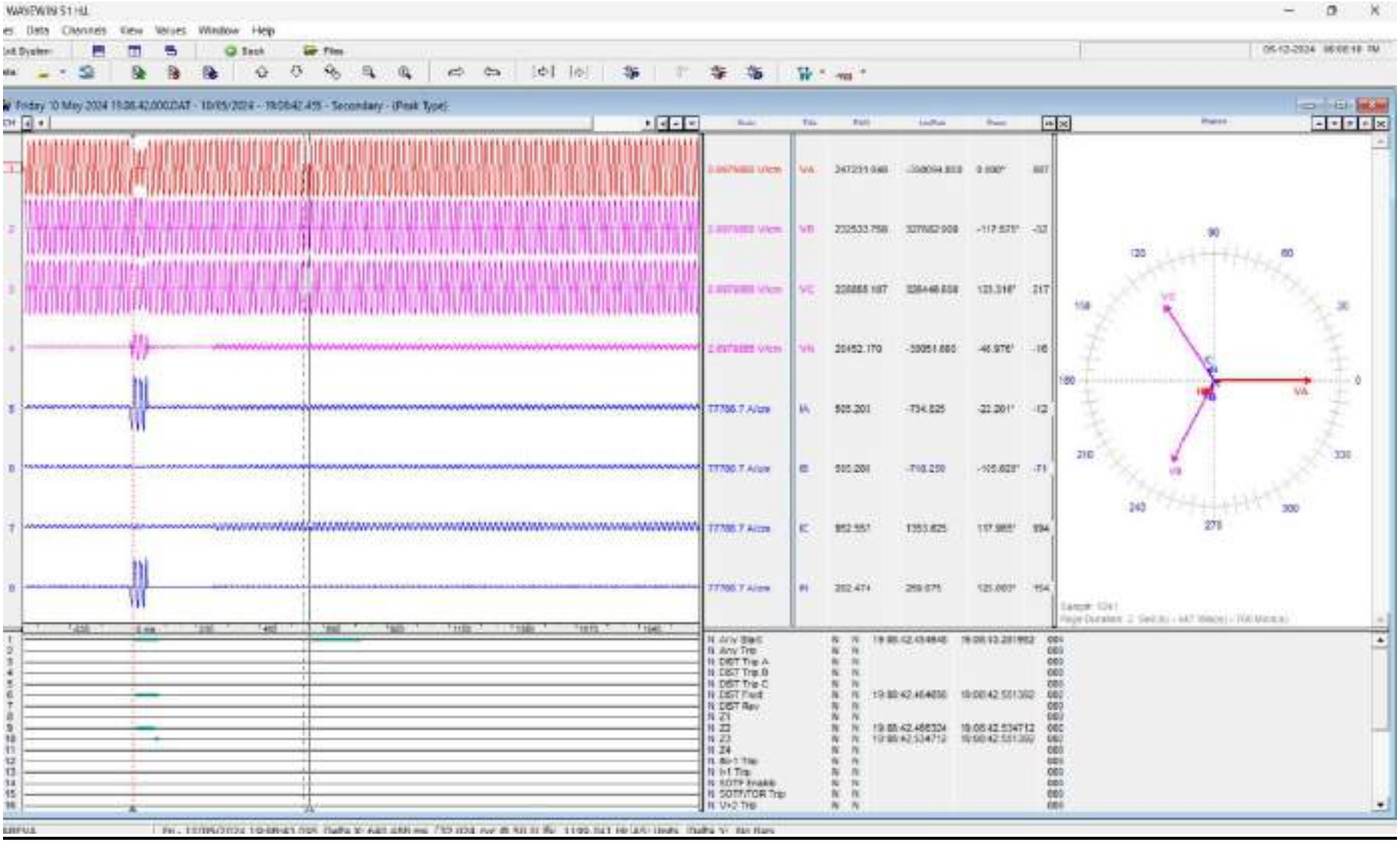
Data
05-12-2024 04:37:05 PM
Matana 10-05-2024.DAT - 10/05/2024 - 19:08:40.020 - Secondary - (Peak Type)
VA
VB
VC
VN
IA
IB
IC
IN
VC
Arm Start
Arm Trip
DIST Trip A
DIST Trip B
DIST Trip C
DIST Fwd
DIST Rev
Z1
Z2
Z3
Z4
Arm Pole Dead
All Pole Dead
SOTF Enable
50TP/TOR Trip
S. Swing Conf

400 kV PG Fatehabad- Khedar

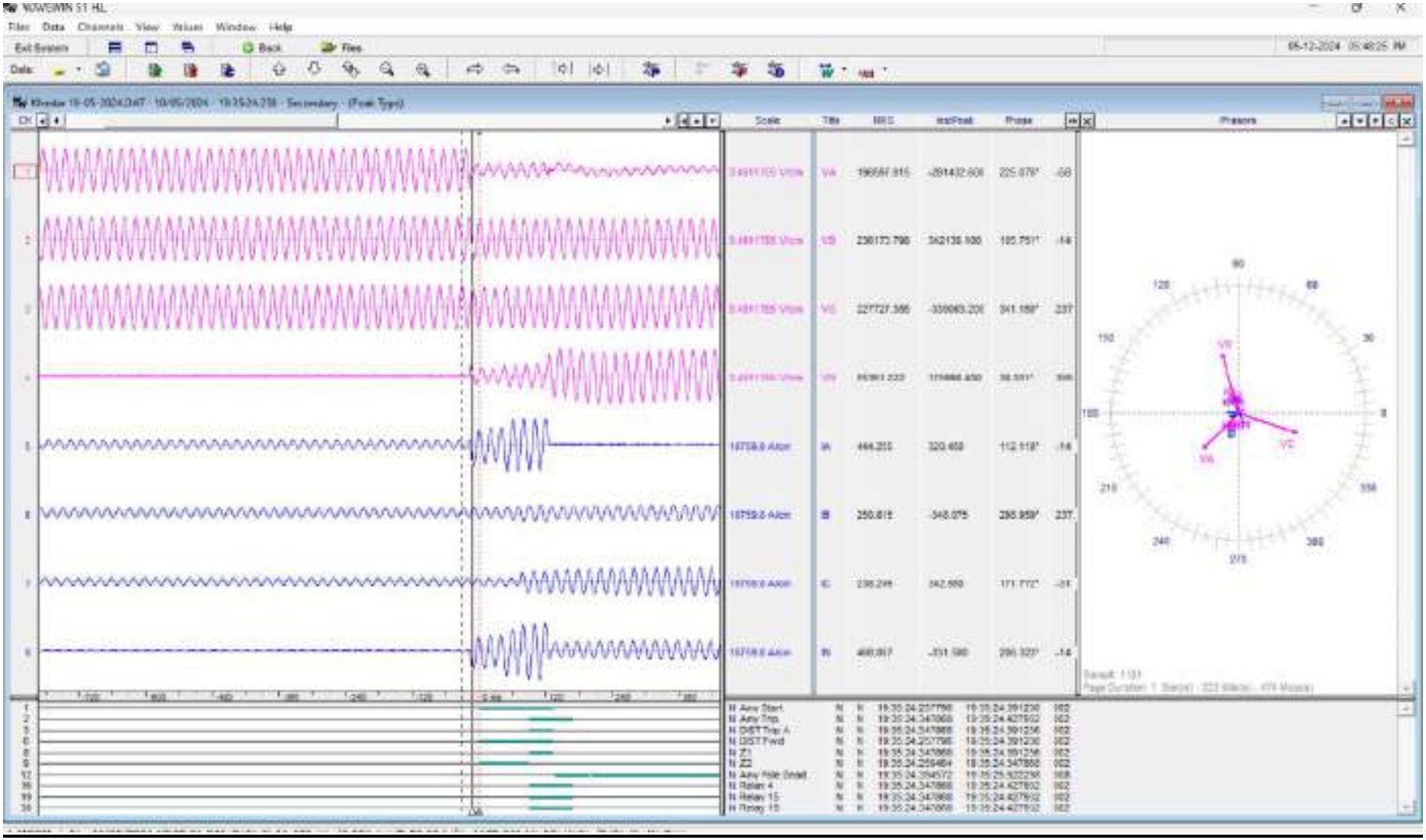
At 400 kV Khedar End Data (Main-2) 19:08 Hrs





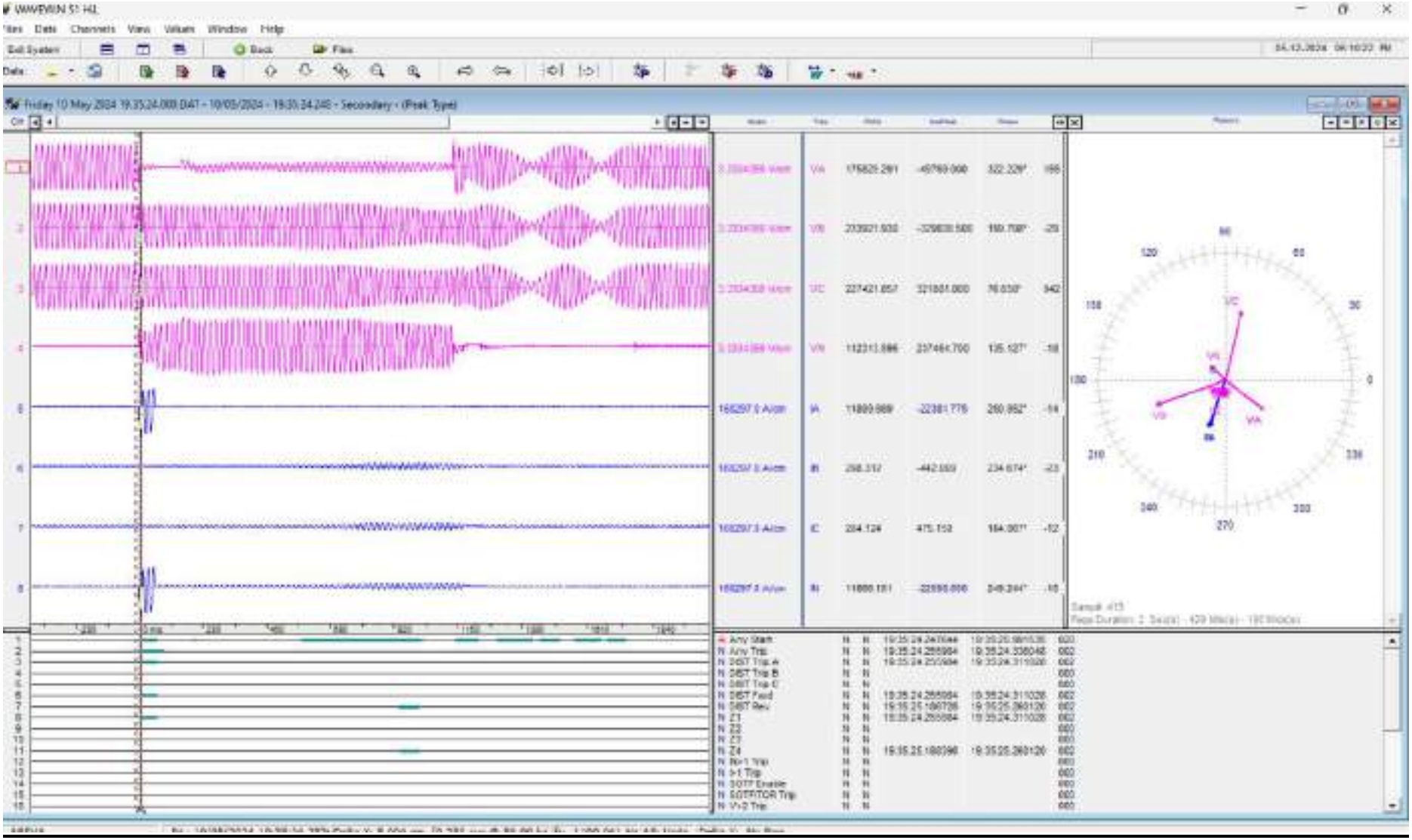
400 kV Khedar- Nunhiyanwali line

At 400 kV Nunhiyanwali End Data (Main1) 19:35 Hrs



400 kV Khedar- Nunhiyanwali line

At 400 kV Khedar End Data (Main2) 19:35 Hrs



Multiple elements tripping at 220kV Bhiwadi(PG) On 13th May 2024

Brief of event:

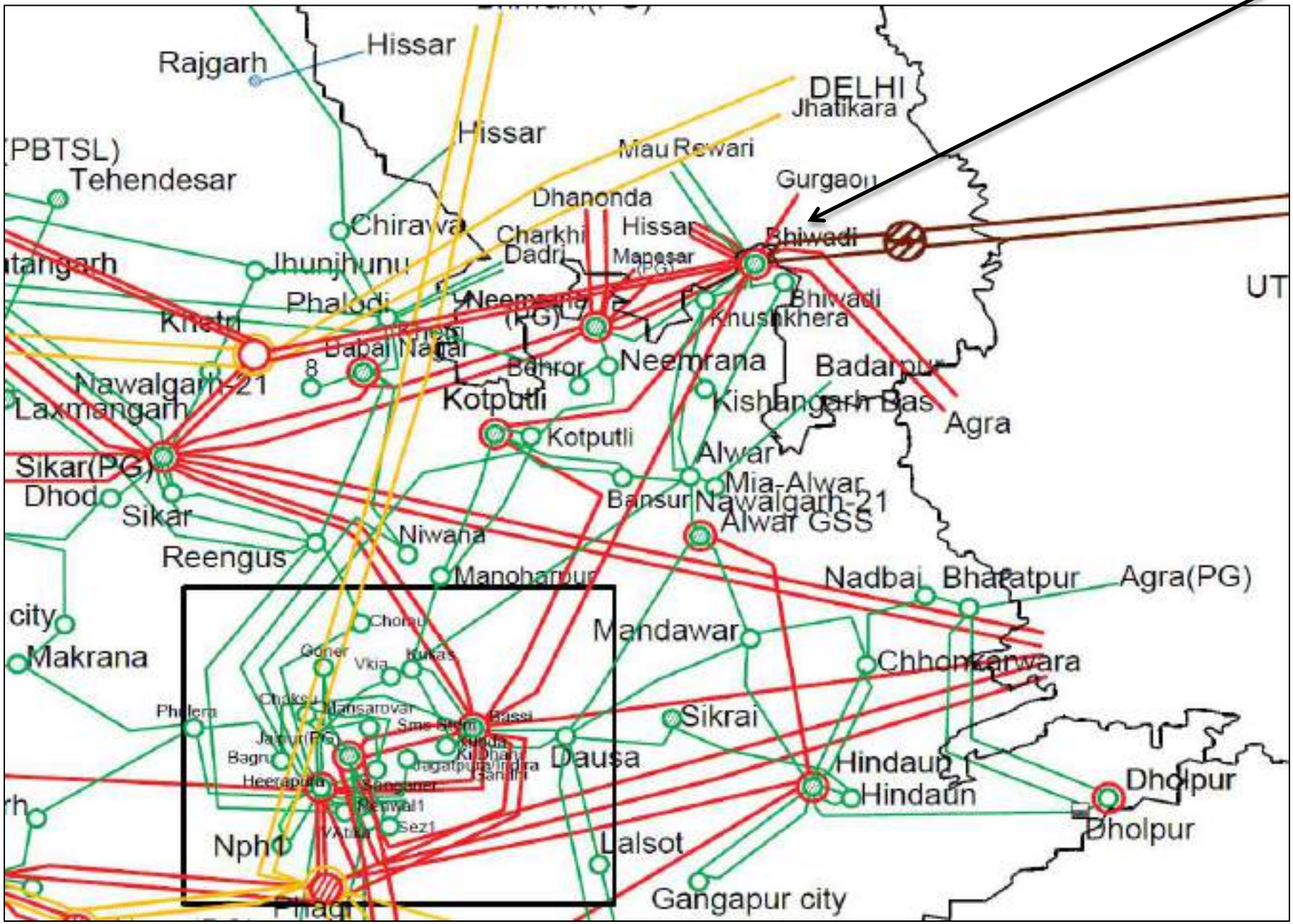
i. 400/220kV Bhiwadi(PG) has one and half breaker bus arrangement at 400kV side and double main and transfer bus scheme at 220kV side.
ii. During antecedent condition, 500 KV HVDC Balia-Bhiwadi (PG) ckt-1 & ckt-2 were carrying approx. 200 MW each.
iii. As reported, at 07:11hrs, B-N phase to earth fault occurred (exact location of fault yet to be received).
iv. As per DR of Bhiwadi(RS) end, 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 and 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt tripped from Bhiwadi(RS) end only on back up E/F protection operation. Line didn't trip from Bhiwadi(PG) end.
v. At the same time, 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) D/C, 400KV Bhiwadi-Neemrana (PG) Ckt-1, 400 KV Bassi-Bhiwadi (PG) Ckt, 500 KV HVDC Balia-Bhiwadi (PG) D/C, 220 KV Neemrana(PG)-Neemrana(RS) (RS) Ckt-1 and 220kV lines from Bhiwadi(PG) to Rewari(HV) (HV) D/C, HSIIDC Bawal(HV), Mau(HV) also tripped (exact reason for multiple elements tripping yet to be received).
vi. As per PMU at Bhiwadi(PG), at 07:11 hrs, B-N phase to earth fault with no A/R operation is observed with delayed fault clearing time of 1480ms.
vii. As per SCADA, change in demand of approx. 136MW in Rajasthan control area is observed.

Brief of event:

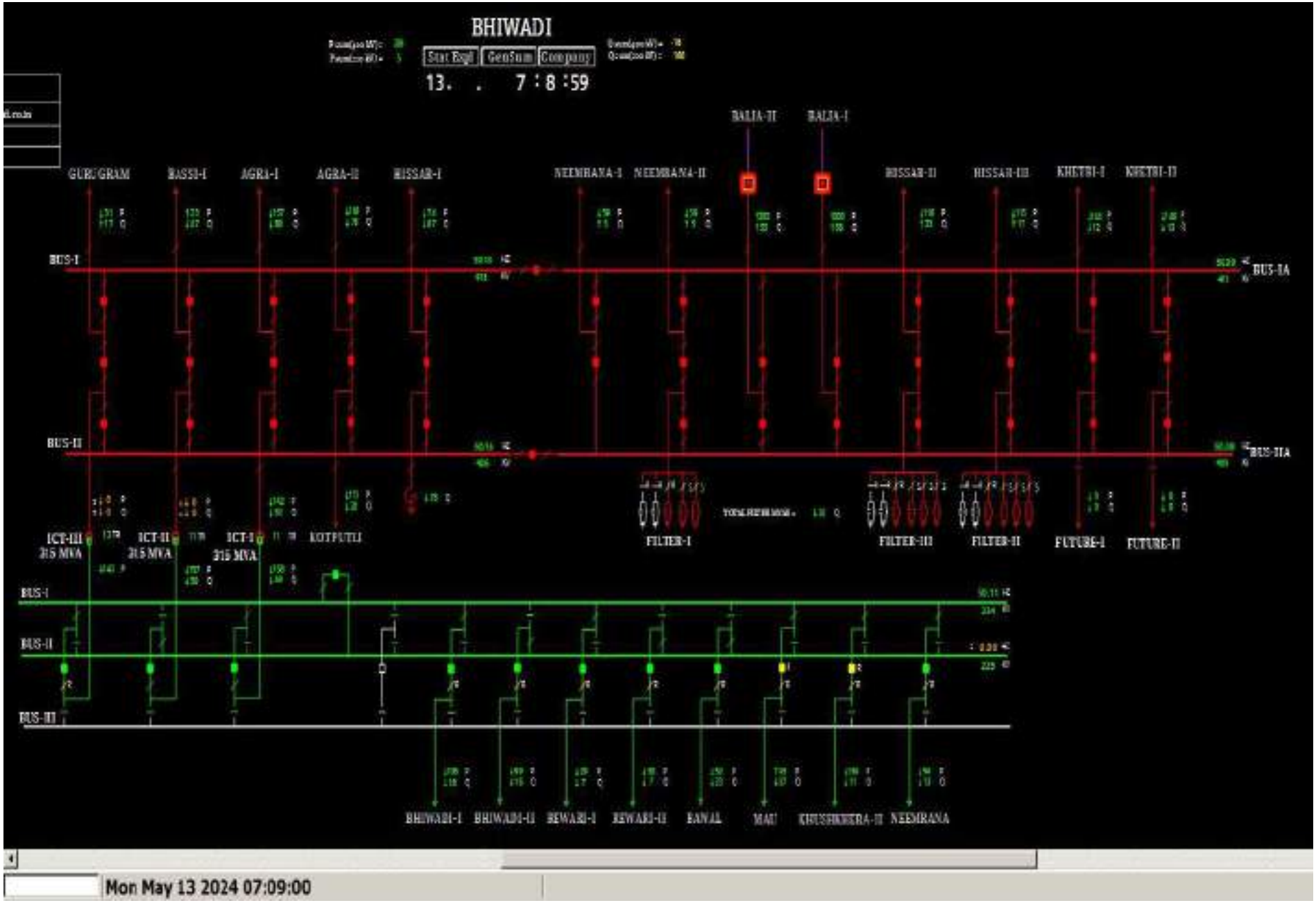
Elements tripped:

i. 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2
ii. 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-1
iii. 400KV Bhiwadi-Neemrana (PG) Ckt-1
iv. 400 KV Bassi-Bhiwadi (PG) Ckt
v. 500 KV HVDC Balia-Bhiwadi (PG) Ckt-1
vi. 500 KV HVDC Balia-Bhiwadi (PG) Ckt-2
vii. 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1
viii. 220 KV Bhiwadi(PG)-Rewari(HV) (HV) Ckt-1
ix. 220 KV Bhiwadi(PG)-Rewari(HV) (HV) Ckt-2
x. 220 KV Bhiwadi(PG)-HSIIDC Bawal(HV) (HVPNL) Ckt
xi. 220 KV Bhiwadi(RS)-Mau(HV) (HV) Ckt
xii. 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt
xiii. 220 KV Neemrana(PG)-Neemrana(RS) (RS) Ckt-1

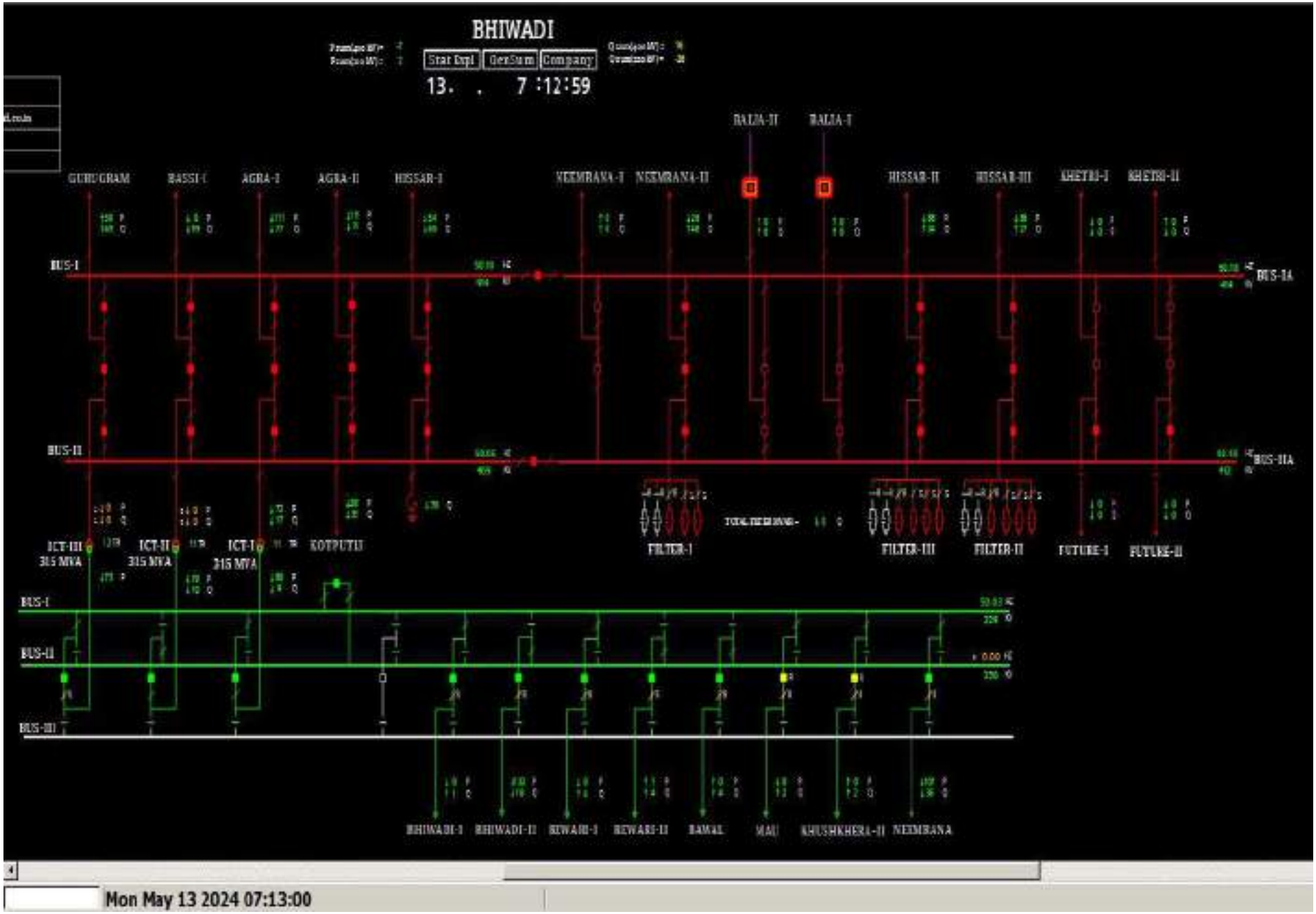
Network Diagram before the event



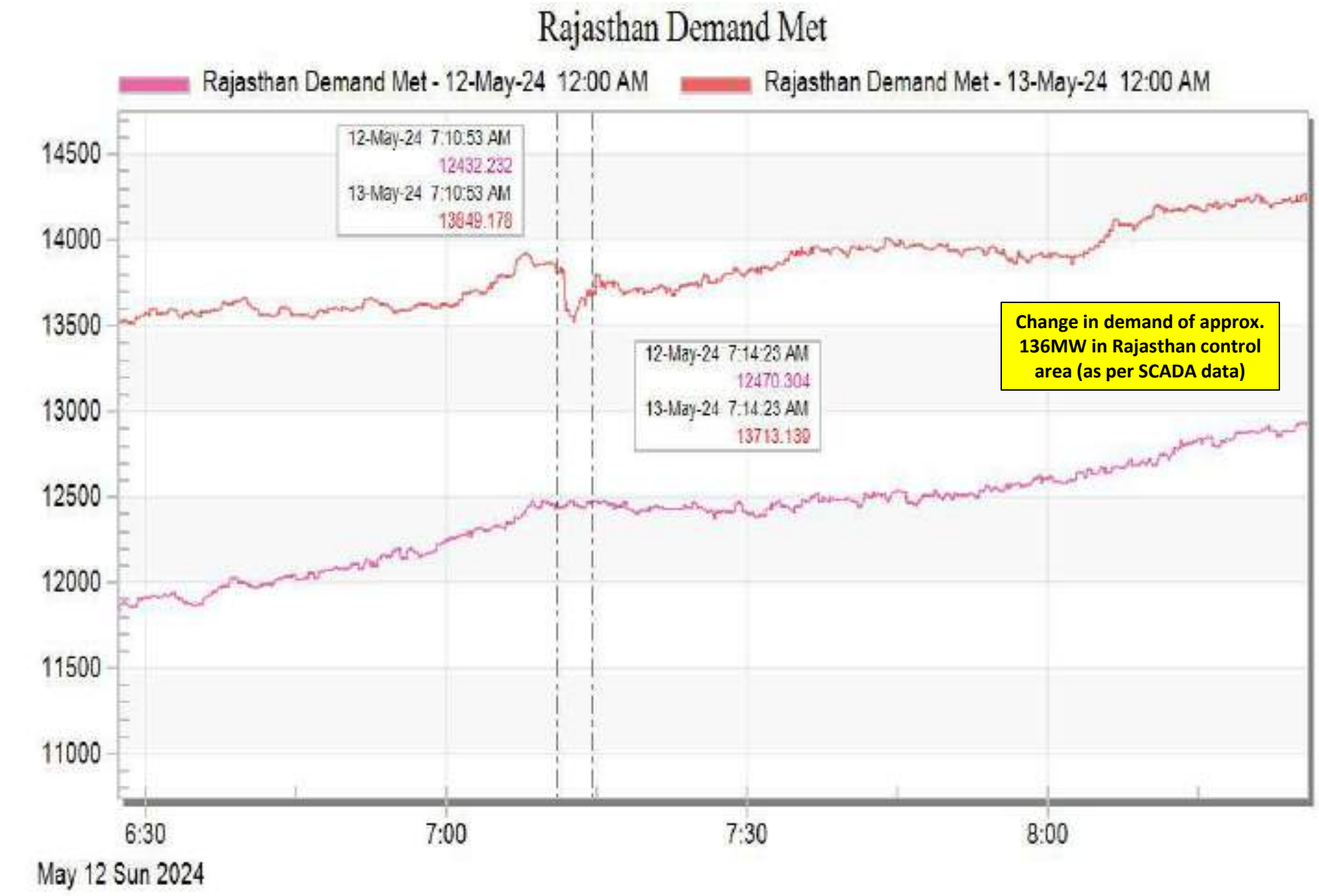
SLD of 400/220kV Bhiwadi(PG) before the event



SLD of 400/220kV Bhiwadi(PG) after the event



Rajasthan demand during the event



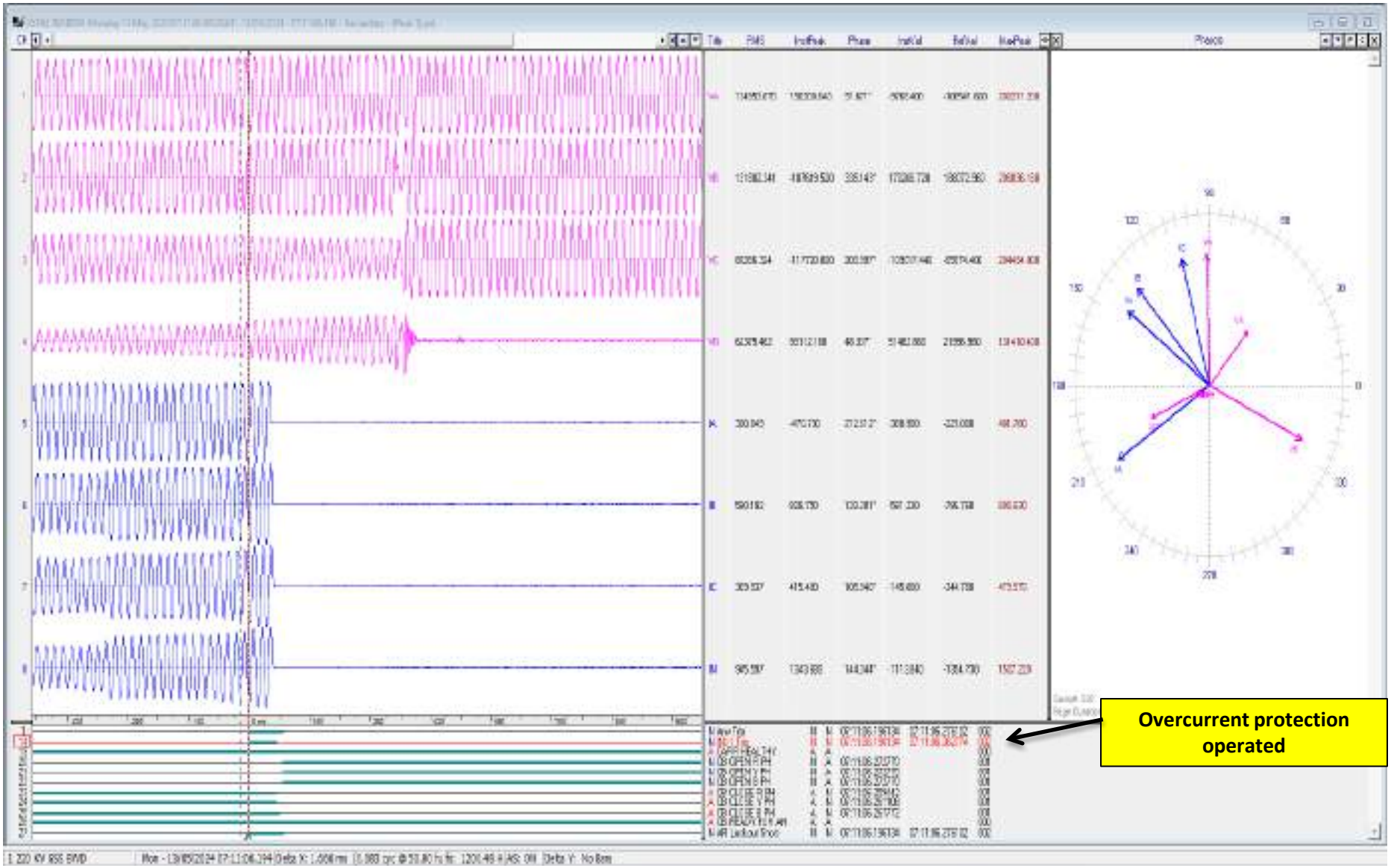
PMU Plot of frequency at Bhiwadi(PG)

07:11hrs/13-May-24

PMU Plot of phase voltage magnitude at Bhiwadi(PG)

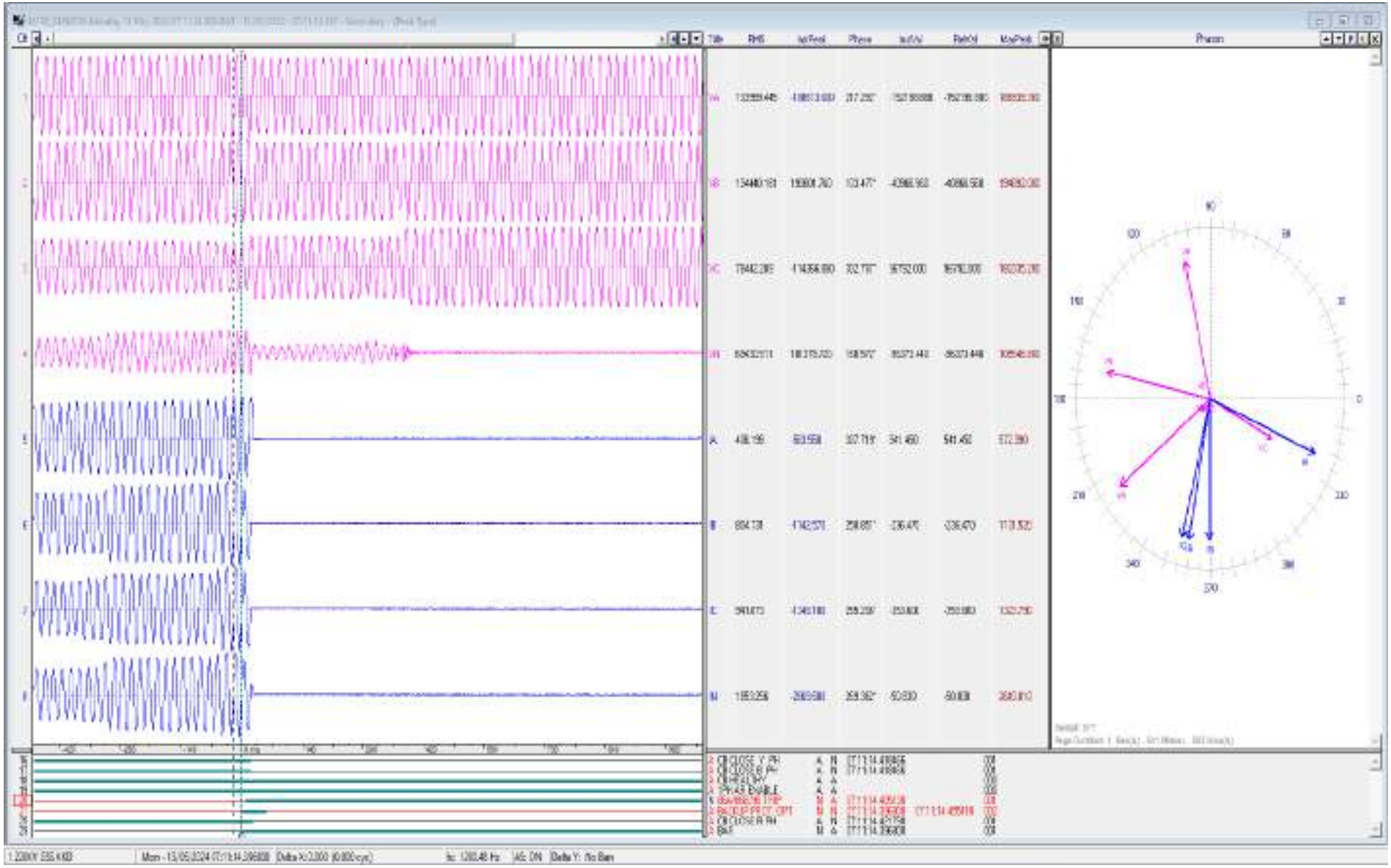
07:11hrs/13-May-24

DR of 220 KV Bhiwadi(PG)-Bhiwadi(RS)(end) (RS) Ckt-1



- ✓ Line tripped on earth fault overcurrent protection operation from Bhiwadi(RS) end.
- ✓ Line didn't open from Bhiwadi(PG) end.

DR of 220 KV Bhiwadi(PG)-Khushkhera(RS)(end) (RS) Ckt



- ✓ Line tripped on earth fault backup protection operation from Khushkhera(RS) end.
- ✓ Line didn’t open from Bhiwadi(PG) end.

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
07:11:14,020	MAU___HS	220kV	01BHWAD	Circuit Breaker	Open	Line CB at Mau(HS) end of 220 KV Bhiwadi(PG)-Mau(HV) (HVPNL) Ckt opened
07:11:14,077	NMRNA_PG	400kV	20T1BH1	Circuit Breaker	Open	Tie CB at Neemrana(PG) end of 400 KV Bhiwadi-Neemrana (PG) Ckt-1 and 400/220kV ICT-1 opened
07:11:14,084	BHWHV_PG	400kV	27CBLHV1	Circuit Breaker	Open	CB of 400kV Bus-2A at Bhiwadi(PG) end of 500 KV HVDC Balia-Bhiwadi (PG) Ckt-1 opened
07:11:14,085	BHWHV_PG	400kV	26TIE	Circuit Breaker	Open	CB of 400kV Bus-1A at Bhiwadi(PG) end of 500 KV HVDC Balia-Bhiwadi (PG) Ckt-1 opened
07:11:14,094	BHWHV_PG	400kV	23TIE	Circuit Breaker	Open	CB of 400kV Bus-1A at Bhiwadi(PG) end of 500 KV HVDC Balia-Bhiwadi (PG) Ckt-2 opened
07:11:14,099	BHWHV_PG	400kV	24CBLHV2	Circuit Breaker	Open	CB of 400kV Bus-2A at Bhiwadi(PG) end of 500 KV HVDC Balia-Bhiwadi (PG) Ckt-2 opened
07:11:14,380	BASSI_PG	400kV	5AGR3BH1	Circuit Breaker	Open	Tie CB at Bassi(PG) end of 400 KV Bassi-Bhiwadi (PG) Ckt and 400 KV Agra-Bassi (PG) Ckt opened
07:11:14,440	NMRNA_RS	220kV	02NMRNA	Circuit Breaker	Open	Line CB at Neemrana(RS) end of 220 KV Bhiwadi(PG)-Neemrana(RS) (RS) Ckt opened
07:11:14,764	KHTRI_PG	400kV	20TIE	Circuit Breaker	Open	CB of 400kV Bus-1 at Khetri(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-1 opened
07:11:14,768	KHTRI_PG	400kV	21BHIWD1	Circuit Breaker	Open	CB of 400kV Bus-2 at Khetri(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-1 opened
07:11:14,769	KHTRI_PG	400kV	24BHIWD2	Circuit Breaker	Open	Main CB at Khetri(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
07:11:14,770	KHTRI_PG	400kV	23TIE	Circuit Breaker	Open	CB of 400kV Bus-1 at Khetri(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
07:11:14,795	BHWHV_PG	400kV	34KHTRI1	Circuit Breaker	Open	Main CB at Bhiwadi(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-1 opened
07:11:14,795	BHWHV_PG	400kV	35TIE	Circuit Breaker	Open	CB of 400kV Bus-2A at Bhiwadi(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-1 opened
07:11:14,799	BHWHV_PG	400kV	38TIE	Circuit Breaker	Open	Tie CB at Bhiwadi(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
07:11:14,800	BHWHV_PG	400kV	37KHTRI2	Circuit Breaker	Open	Main CB at Bhiwadi(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
07:11:14,947	BHWHV_PG	400kV	16NMRNA1	Circuit Breaker	Open	CB of 400kV Bus-1A at Bhiwadi(PG) end of 400 KV Bhiwadi-Neemrana (PG) Ckt-1 opened
07:11:15,007	BHWHV_PG	400kV	17NM1TIE	Circuit Breaker	Open	CB of 400kV Bus-2A at Bhiwadi(PG) end of 400 KV Bhiwadi-Neemrana (PG) Ckt-1 opened
07:11:16,969	NMRNA_PG	400kV	19BHWHV1	Circuit Breaker	Open	Main CB at Neemrana(PG) end of 400 KV Bhiwadi-Neemrana (PG) Ckt-1 opened
07:11:18,107	BHIWR_RS	220kV	01BHIWA1	Circuit Breaker	Open	Line CB at Bhiwadi(RS) end of 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 opened
07:11:18,107	BHIWR_RS	220kV	04T1	Circuit Breaker	Open	CB at 220kV side of 220/132kV 160MVA ICT-1 at Bhiwadi(RS) opened

Point of discussion

i) Exact reason, nature and location of fault need to be shared.
ii) Reason for multiple elements tripping need to be shared.
iii) Reason for delayed clearance of fault need to be shared.
iv) DR/EL (.dat/.cfg file) along with tripping report for each element need to be shared from both the ends.
v) Remedial action taken report to be shared.

Multiple elements tripping at 400kV Tehri(THDC) & Koteshwar(PG) On 17th May 2024

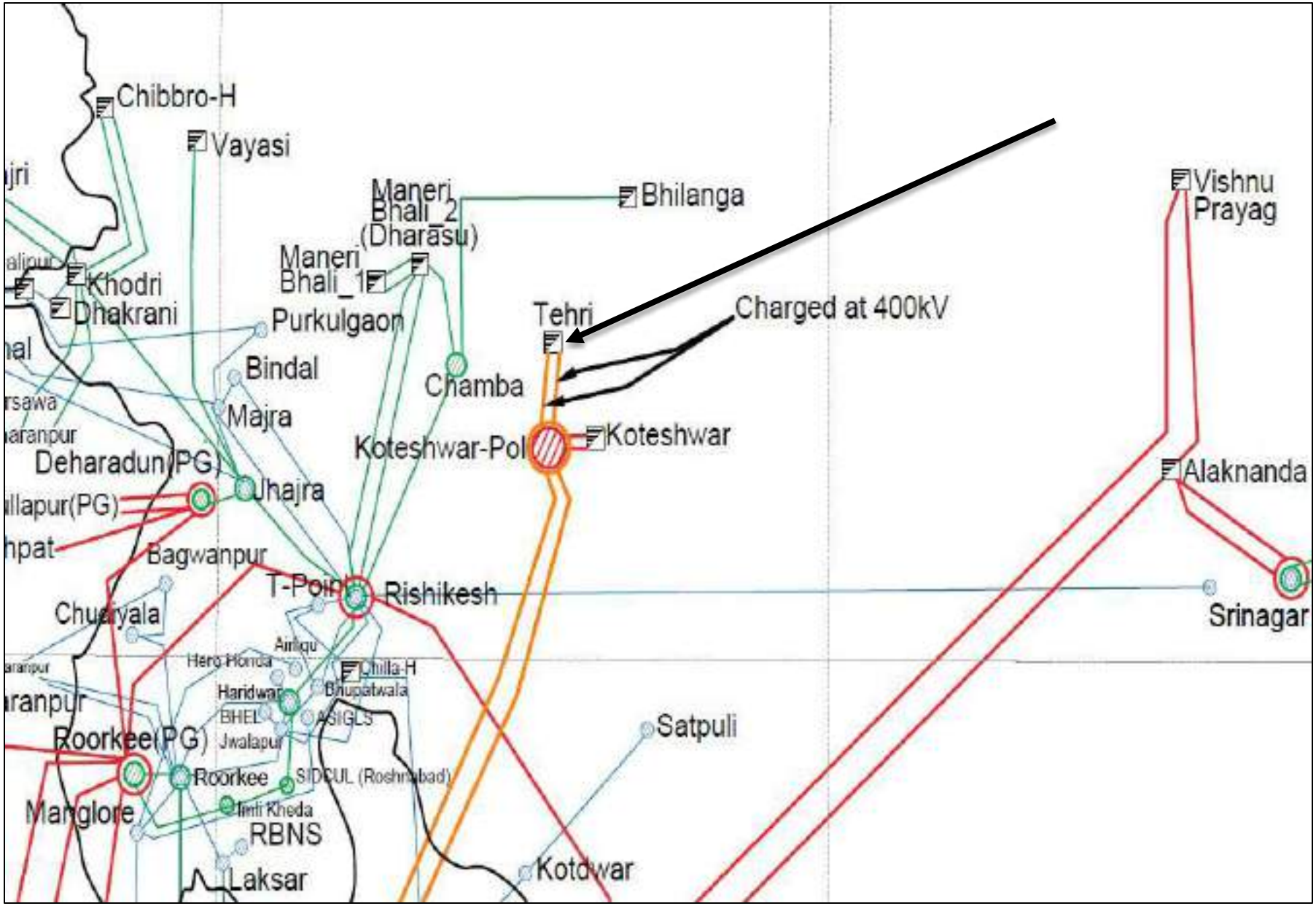
Brief of event:

i. 400kV Tehri(THDC) has double main bus scheme.
ii. ii)D uring antecedent condition, 250 MW TEHRI HPS – UNIT- 1, 2, 3 & 4 were not in service.
iii. As reported, at 17:21 hrs, 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1 tripped on Y-B phase to phase fault. Fault distance was ~2.8km from Tehri(THDC) end. At the same time, 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2 tripped from Koteshwar(PG) end only.
iv. As per DR of Tehri end of 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-1, directional earth fault started followed by sensing Y-B-N fault in Z-1. Fault current was Iy=~4.9kA, Ib=~4.2kA. Total fault clearance time was ~760ms..
v. As per DR of Tehri end of 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2, distance protection sensed Y-B-N fault in Z-4, no tripping was initiated. Fault current was Iy=~4.8kA, Ib=~4.0kA.
vi. As per PMU at Koteshwar(PG), Y-N phase to earth fault converted into Y-B phase to phase fault is observed with delayed fault clearance time of 760ms is observed.
vii. As per SCADA no load loss/generation loss is observed during the tripping event (there was no generation at Tehri HEP during the event).

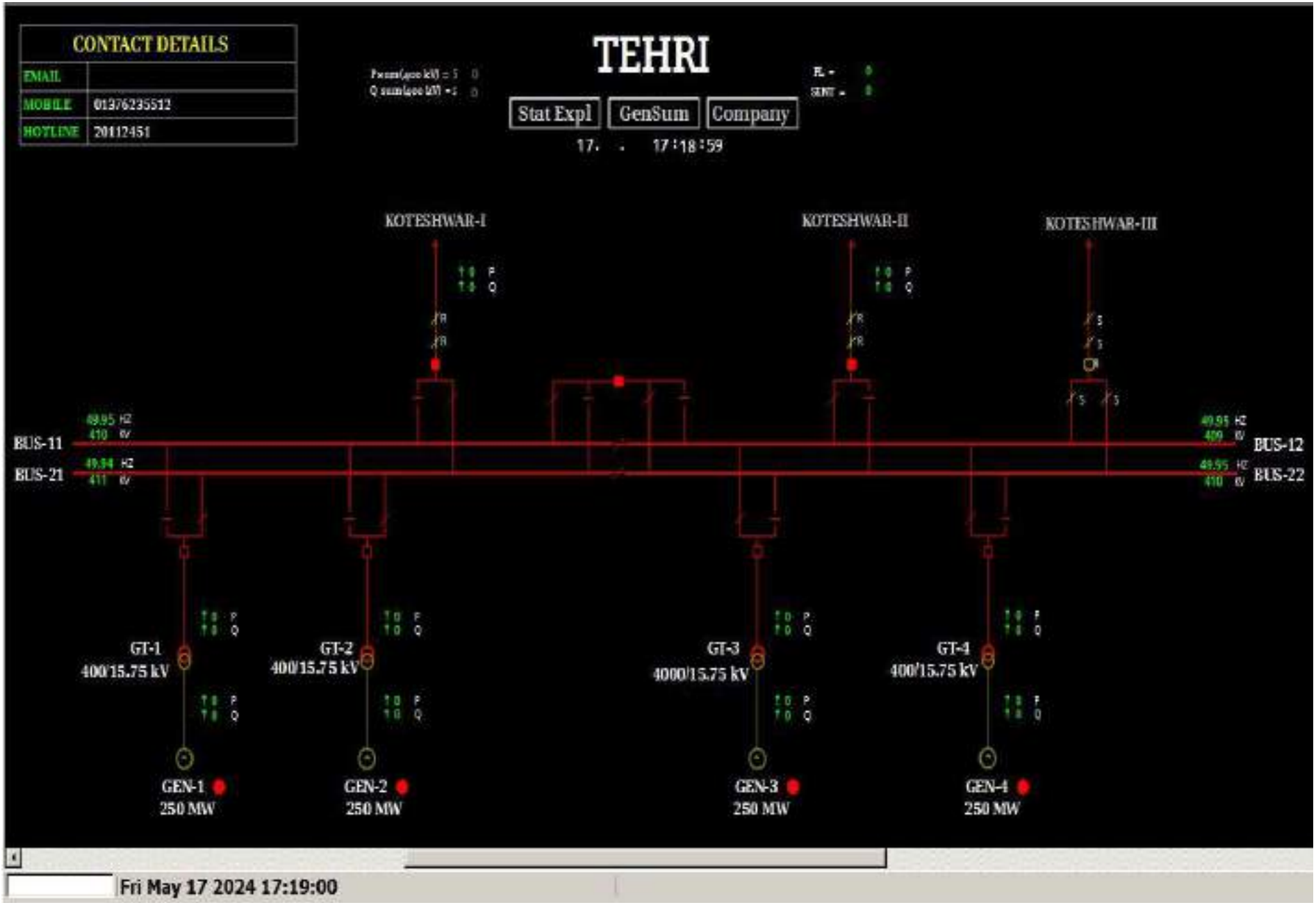
Elements tripped:

i. 400 KV Tehri(THDC)-Koteshwar(PG) (PG) Ckt-1
ii. 400 KV Tehri(THDC)-Koteshwar(PG) (PG) Ckt-2

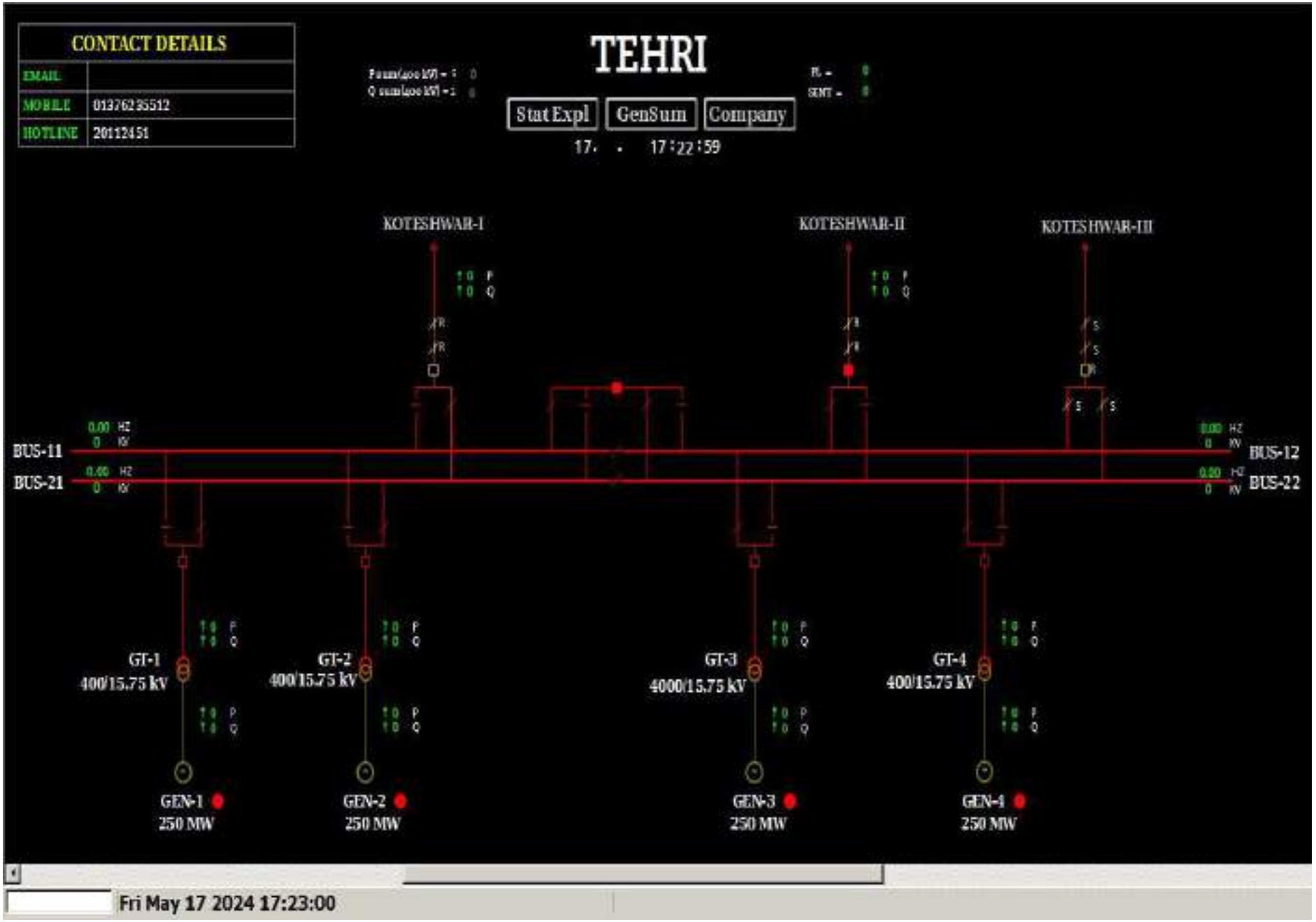
Network Diagram



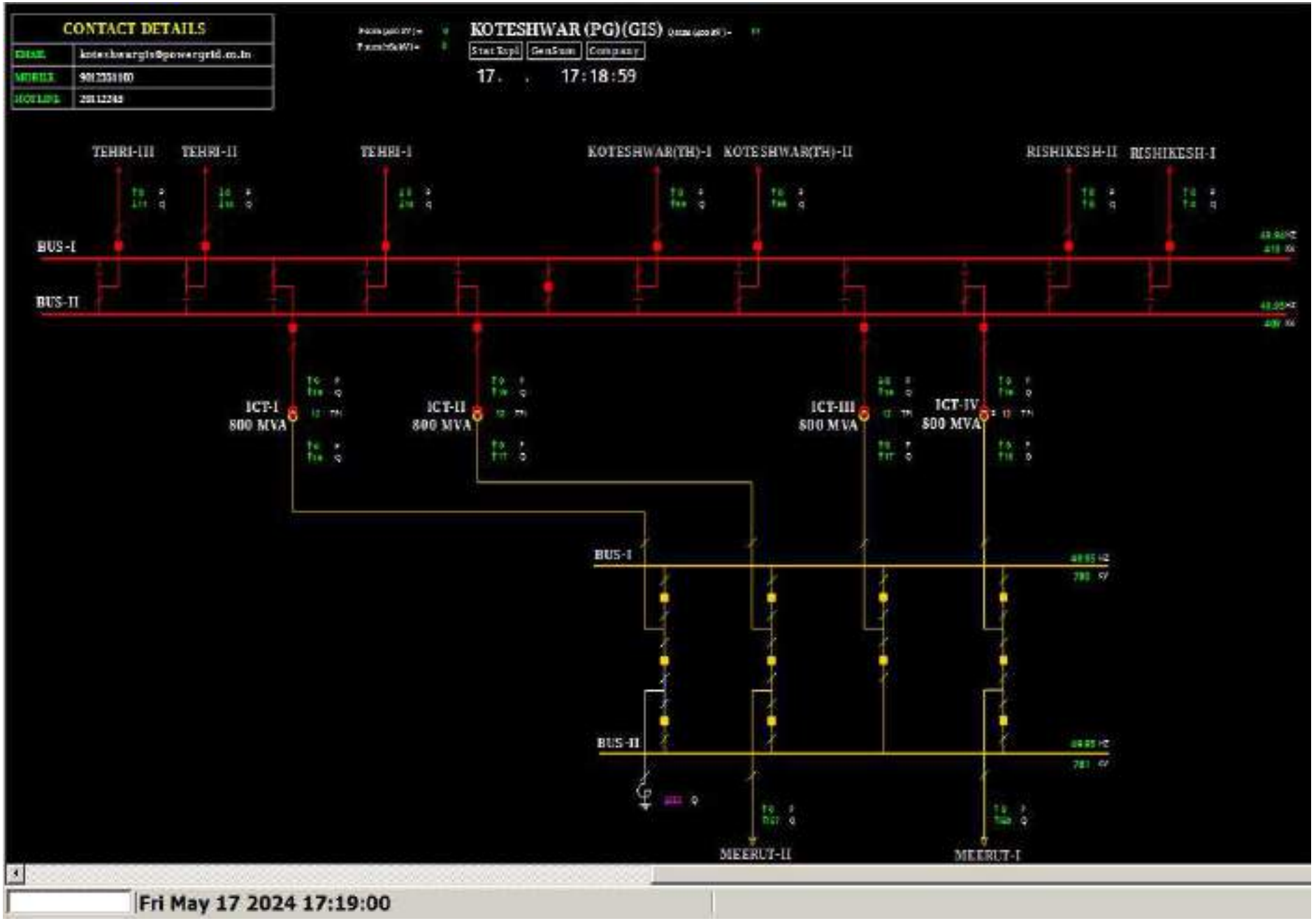
SLD of 400kV Tehri(THDC) before the event @17:19hrs



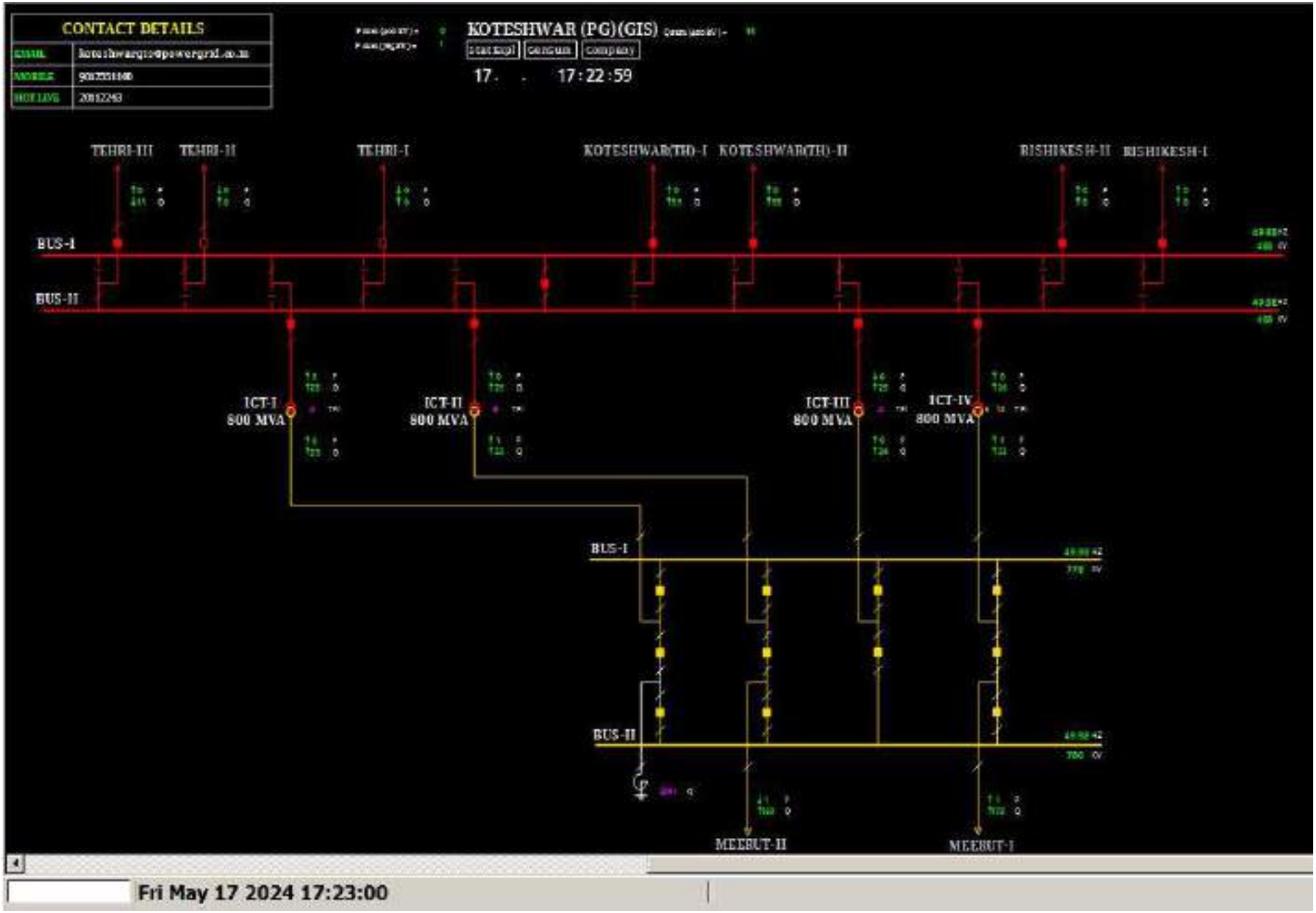
SLD of 400kV Tehri(THDC) after the event @17:23hrs



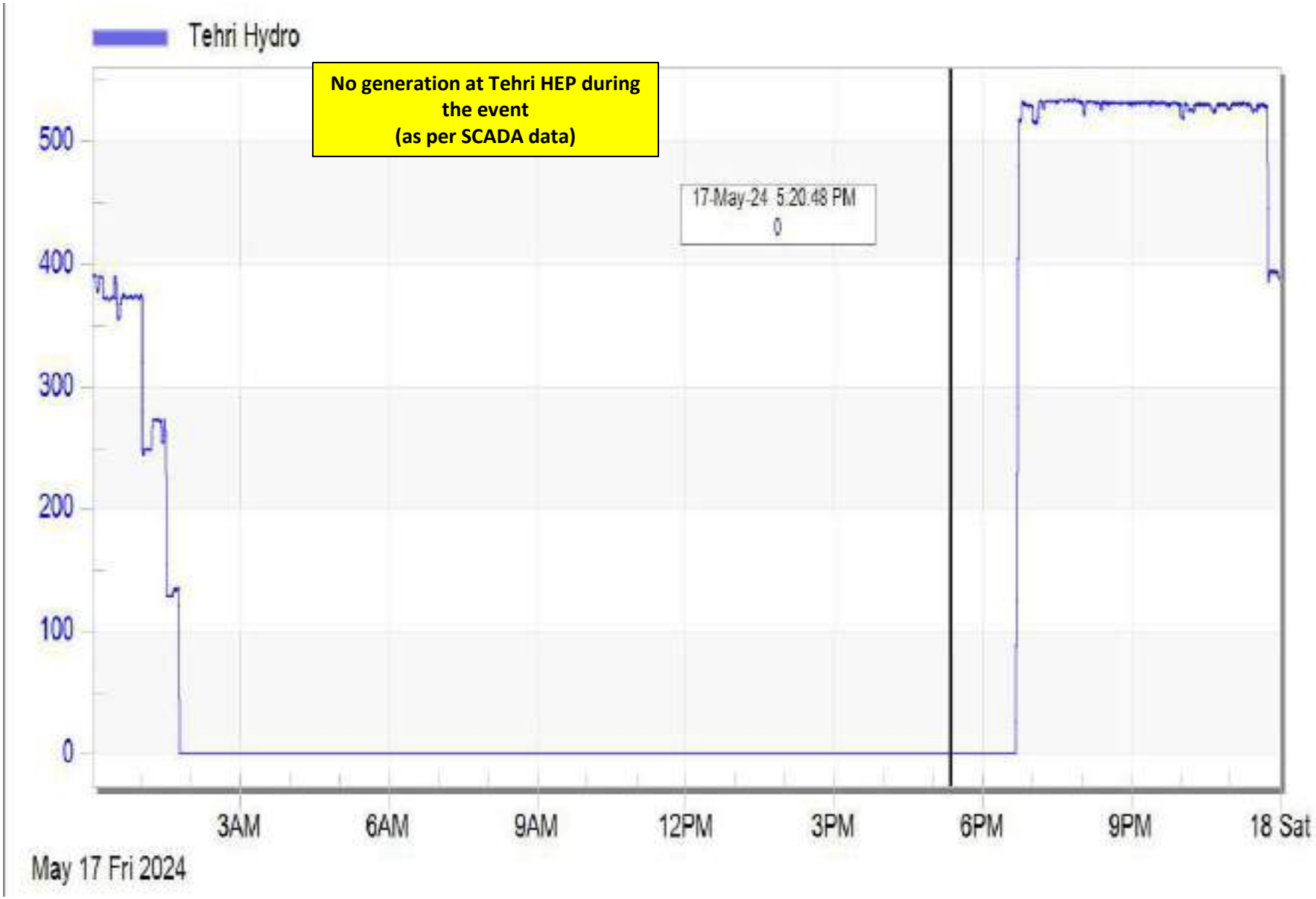
SLD of 765/400kV Koteshwar(PG) before the event @17:19hrs



SLD of 765/400kV Koteshwar(PG) after the event @17:23hrs

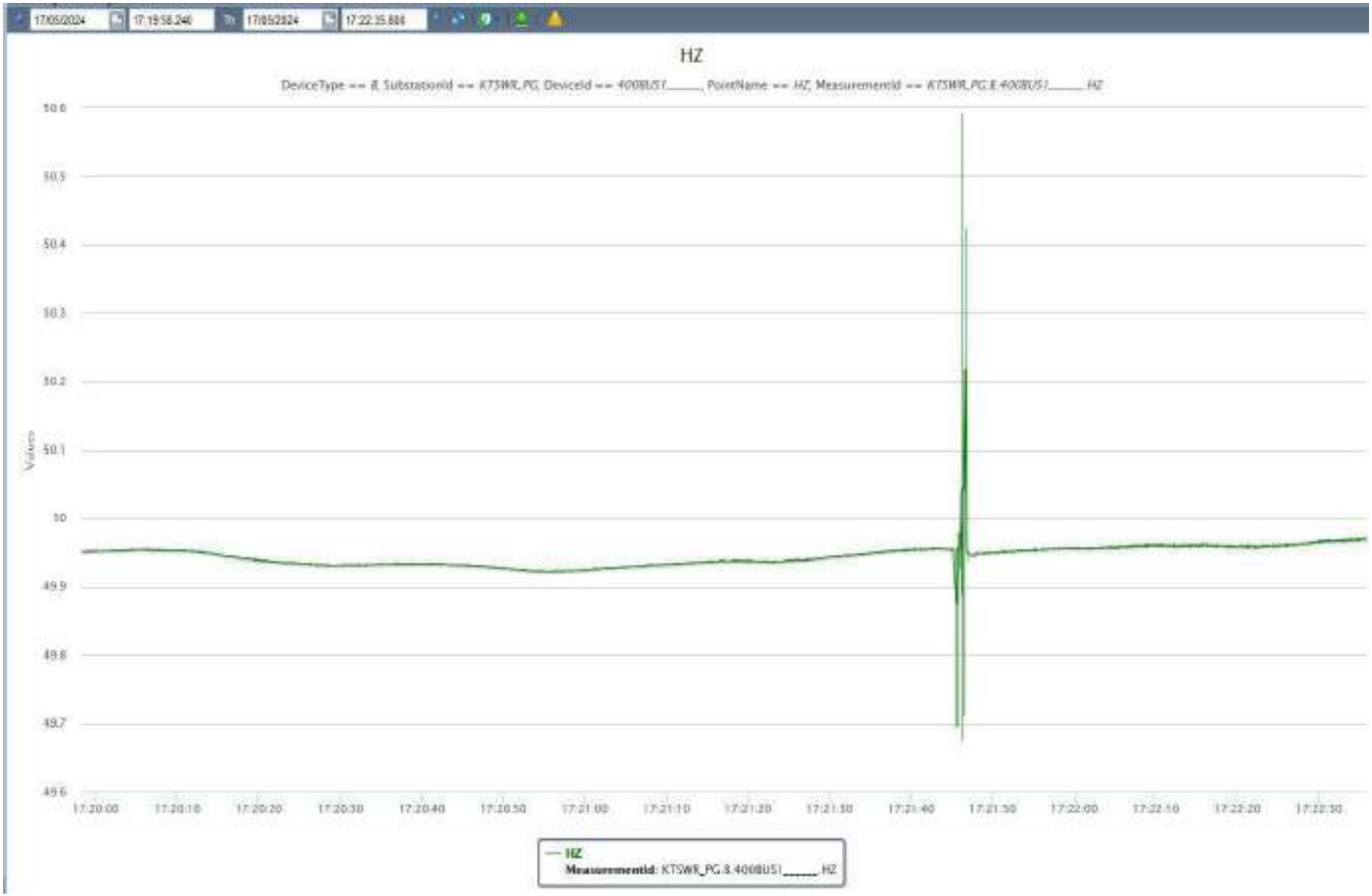


Tehri HEP generation during the event



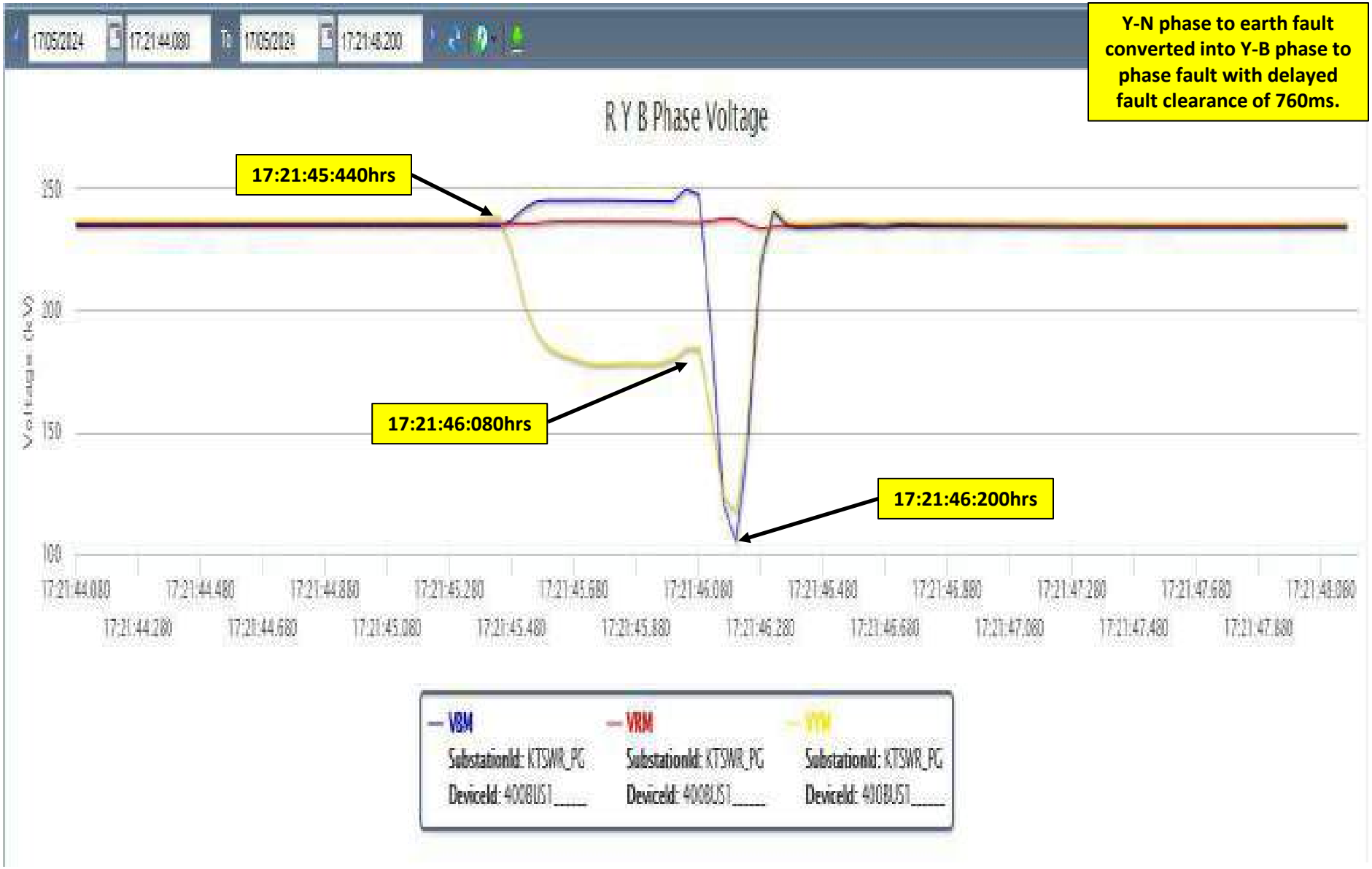
PMU Plot of frequency at Koteshwar(PG)

17:21 hrs/17-May-24

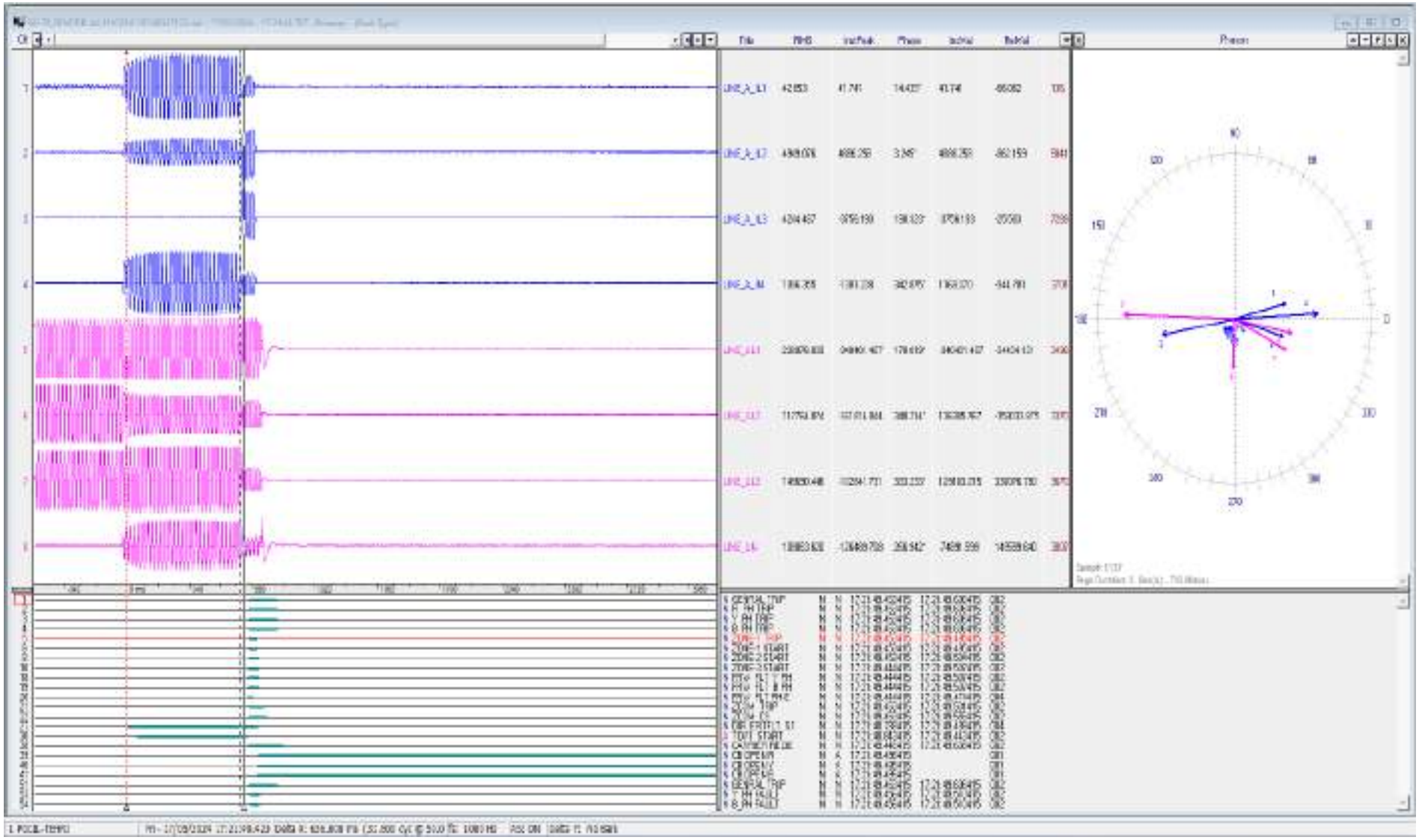


PMU Plot of phase voltage magnitude at Koteshwar(PG)

17:21 hrs/17-May-24



DR of 400 KV Tehri(THDC)(end)-Koteshwar(PG) Ckt-1 (17:21hrs)



- ✓ Y-N phase to earth fault converted into Y-B phase to phase fault. Iy=~4.9kA, Ib=~4.2kA.
- ✓ Fault sensed and operated in zone-1.
- ✓ Delayed fault clearing time=760ms.

DR of 400 KV Tehri(THDC)(end)-Koteshwar(PG) Ckt-2 (17:21hrs)

- ✓ Y-N phase to earth fault converted into Y-B phase to phase fault. Iy=~4.8kA, Ib=~4.0kA.
- ✓ Carrier received from the remote end.

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
17:21:46,209	KTSWR_PG	400kV	02TEHRI2	Circuit Breaker	disturbe	
17:21:46,229	KTSWR_PG	400kV	02TEHRI2	Circuit Breaker	Open	Line CB at Koteshwar(PG) end of 400 KV Tehri(TH)-Koteshwar(PG) (PG) Ckt-2 opened
17:21:46,240	KTSWR_PG	400kV	04TEHRI1	Circuit Breaker	disturbe	
17:21:46,247	KTSWR_PG	400kV	04TEHRI1	Circuit Breaker	Open	Line CB at Koteshwar(PG) end of 400 KV Tehri(TH)-Koteshwar(PG) (PG) Ckt-1 opened
17:21:49,931	TEHRI_TH	400kV	05KTSWR1	Circuit Breaker	Open	Line CB at Tehri(THDC) end of 400 KV Tehri(TH)-Koteshwar(PG) (PG) Ckt-1 opened

Point of discussion

i) Exact location and nature of fault need to be shared.

ii) Detail of protection operation in 400kV Tehri(THDC)-Koteshwar(PG)(PG) ckt-2 at Koteshwar(PG) end along with DR/EL (.dat/.cfg file) of Koteshwar(PG) end need to be shared.

iii) Reason for delayed clearance of fault need to shared.

iv) Tripping report of the event need to be shared.

v) Remedial action taken report to be shared.

Multiple elements tripping at 400/220kV Mandaula(PG) 11th June 2024

Brief of event:

i. During antecedent condition, 400/220kV 500MVA ICT-1, 2, 3 and 4 at Mandaula(PG) were carrying approx. 337MW, 337MW, 336MW and 337MW respectively with total loading of 1347MW (as reported by CPCC1, Power Grid). 104 MW GTG-1 & 2 and 122 MW STG at Pragati were generating approx. 85MW, 85MW and 109MW respectively with total generation of 279MW (as reported by SLDC Delhi).

ii. Load of 220kV Gopalpur S/s and 220kV Subzi Mandi S/s was connected through 220kV Mandaula-Gopalpur Ckt 1 & 2, load of 220kV Narela S/s was connected through 220kV Mandaula – Narela Ckt 1 & 2 and load of Wazirabad, Kashmiri Gate, Geeta Colony, Preet Vihar, Harsh Vihar, I.P. and Rajghat was connected through 220kV Mandaula – Wazirabad Ckt 1, 2, 3 & 4.

iii. 212 MAIN BAY - 400/220 kV 500 MVA ICT-3 at Mandaula(PG) was under planned shutdown and ICT-3 was charged from transfer bus through isolator.

iv. As reported, at 14:10 hrs, fire was observed in isolator (transfer bus side) of 400/220 kV 500 MVA ICT-3 at Mandaula(PG). As per DR, Ir is reduced upto ~97.2A while Iy and Ib increased upto ~1.092kA and 1.107kA respectively and imbalance occurred in the system.

v. As reported by CPCC1, Power Grid, the sequence of the event is as follows:

a) At 14:10:24hrs: 400/220 kV 500 MVA ICT 2 at Mandaula(PG) tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=~615.8A, Iy=~488.8A and Ib=~498.3A before tripping of ICT-2.

b) Due to tripping of ICT-2, loading of 400/220kV 500MVA ICT-1, 3 and 4 at Mandaula(PG) were increased to 457MW each.

c) At 14:10:27hrs: 400/220 kV 500 MVA ICT 1 at Mandaula(PG) also tripped on back-up earth fault protection operation due to system imbalance. As per DR, Ir=~1.668kA, Iy=~1.214kA and Ib=~1.237kA before tripping of ICT-1.

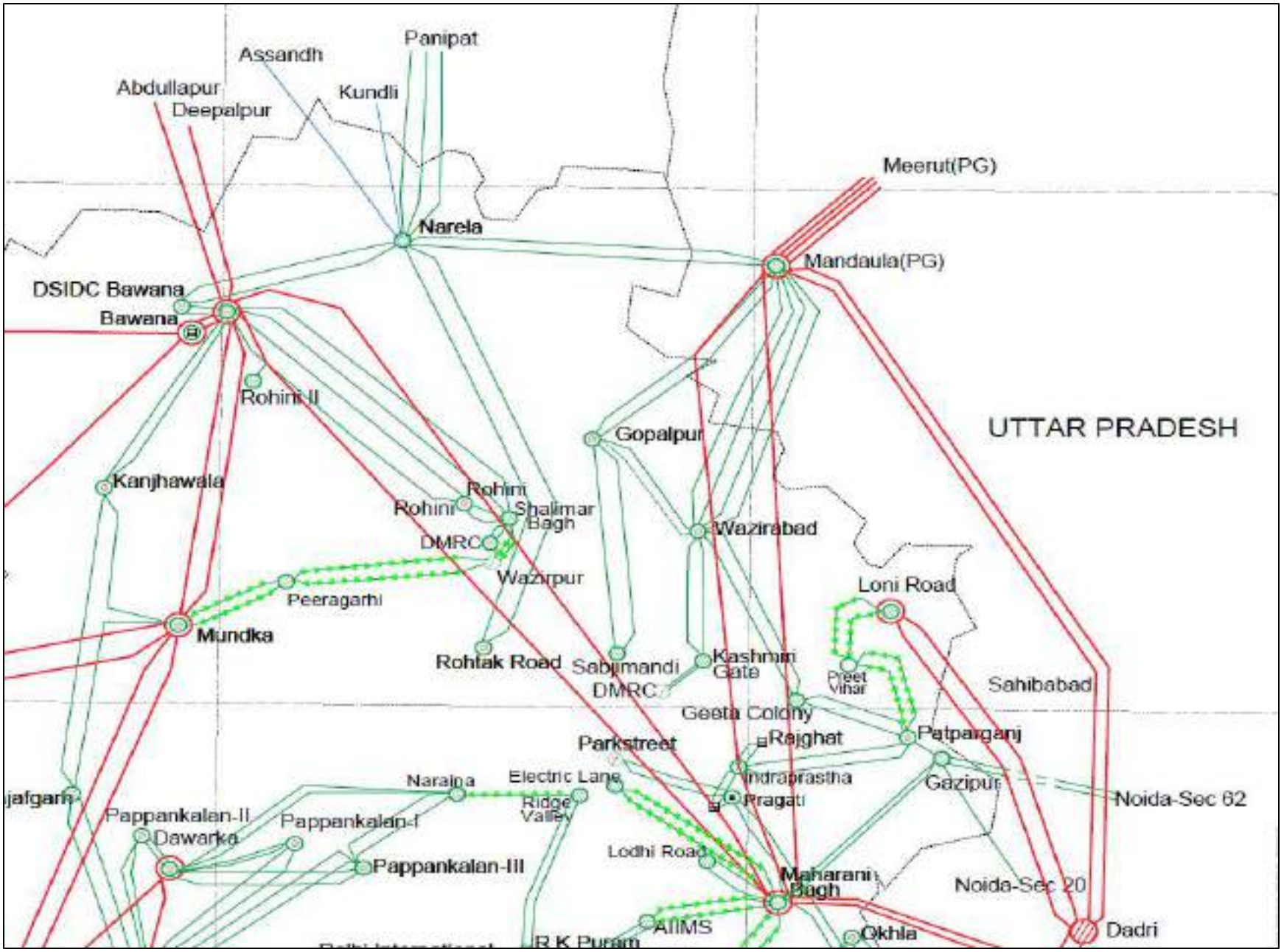
Brief of event:

d. Due to tripping of both ICT-1 & 2, loading of 400/220kV 500MVA ICT-3 and 4 at Mandaula(PG) were increased to 696MW each.
e. At 14:10:29hrs: 400/220 kV 500 MVA ICT 3 at Mandaula(PG) hand-tripped due to melting of isolator which led to heavy sparking.
f. Due to unavailability of ICT-1, 2 & 3, loading of 400/220kV 500MVA ICT-4 at Mandaula(PG) was increased to 1454MW.
g. At 14:10:30hrs: 400/220 kV 500 MVA ICT 4 at Mandaula(PG) tripped on back-up over-current protection operation due to excess over-loading. As per DR, maximum current recorded was: Ir=~2.09kA, Iy=~2.136kA and Ib=~2.124kA (max MW loading of approx. 1480MW as per DR).
vi. As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed.
vii. As per SCADA, change in demand of approx. 1572 MW in Delhi Control area and change in generation of approx. 284 MW at Pragati are observed.
viii. As reported by SLDC Delhi, total load loss of approx. 1601 MW occurred at Narela (~220MW), Gopalpur (~213MW), Subzi Mandi (~129MW), Wazirabad (~272MW), Kashmiri Gate (~67MW), Geeta Colony (~120MW), Preet Vihar (~120MW), Harsh Vihar (~151MW), I.P. (~193MW) and Rajghat (~116MW) S/s in Delhi control area. Again, generation loss of approx. 279 MW occurred at Pragati (104 MW GTG-1 & 2 and 122 MW STG at Pragati were generating approx. 85MW, 85MW and 109MW respectively as reported by SLDC Delhi).As per PMU at Mandaula(PG), B-N phase to earth fault converted to Y-B-N double phase to earth fault with delayed fault clearing time of 2320ms is observed.

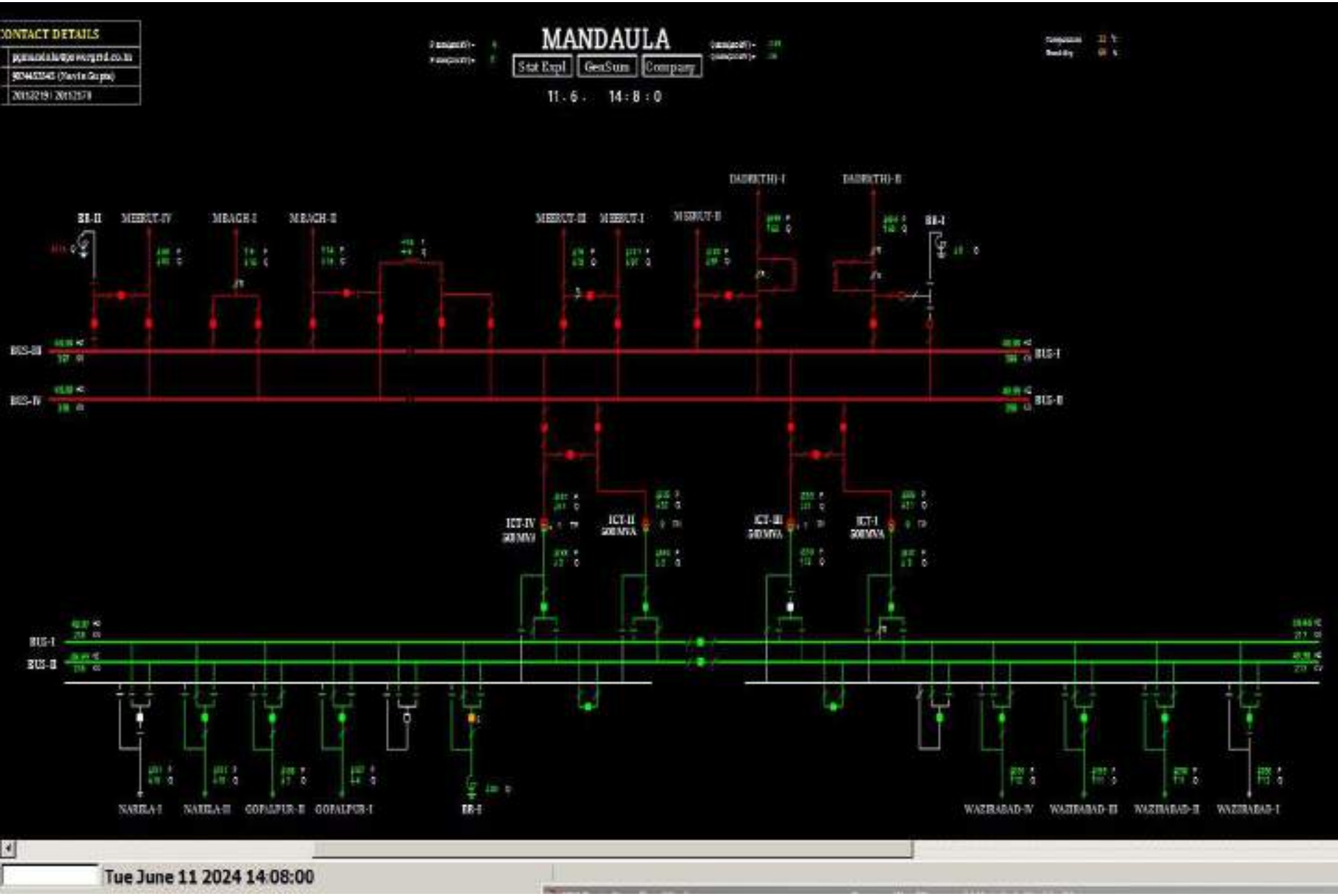
Elements tripped:

1) 400/220 kV 500 MVA ICT 1 at Mandaula(PG)
2) 400/220 kV 500 MVA ICT 2 at Mandaula(PG)
3) 400/220 kV 500 MVA ICT 3 at Mandaula(PG)
4) 400/220 kV 500 MVA ICT 4 at Mandaula(PG)

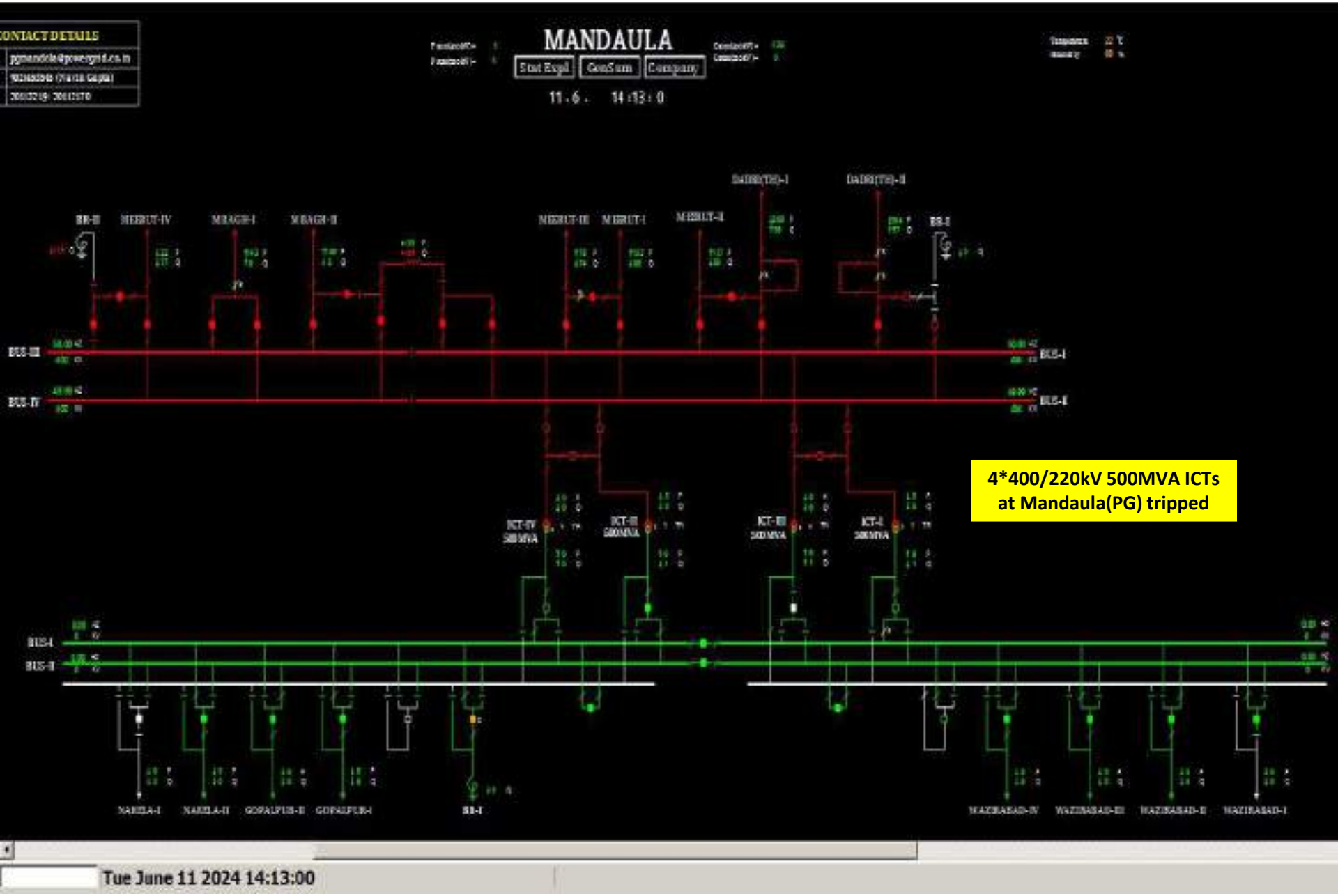
Network Diagram



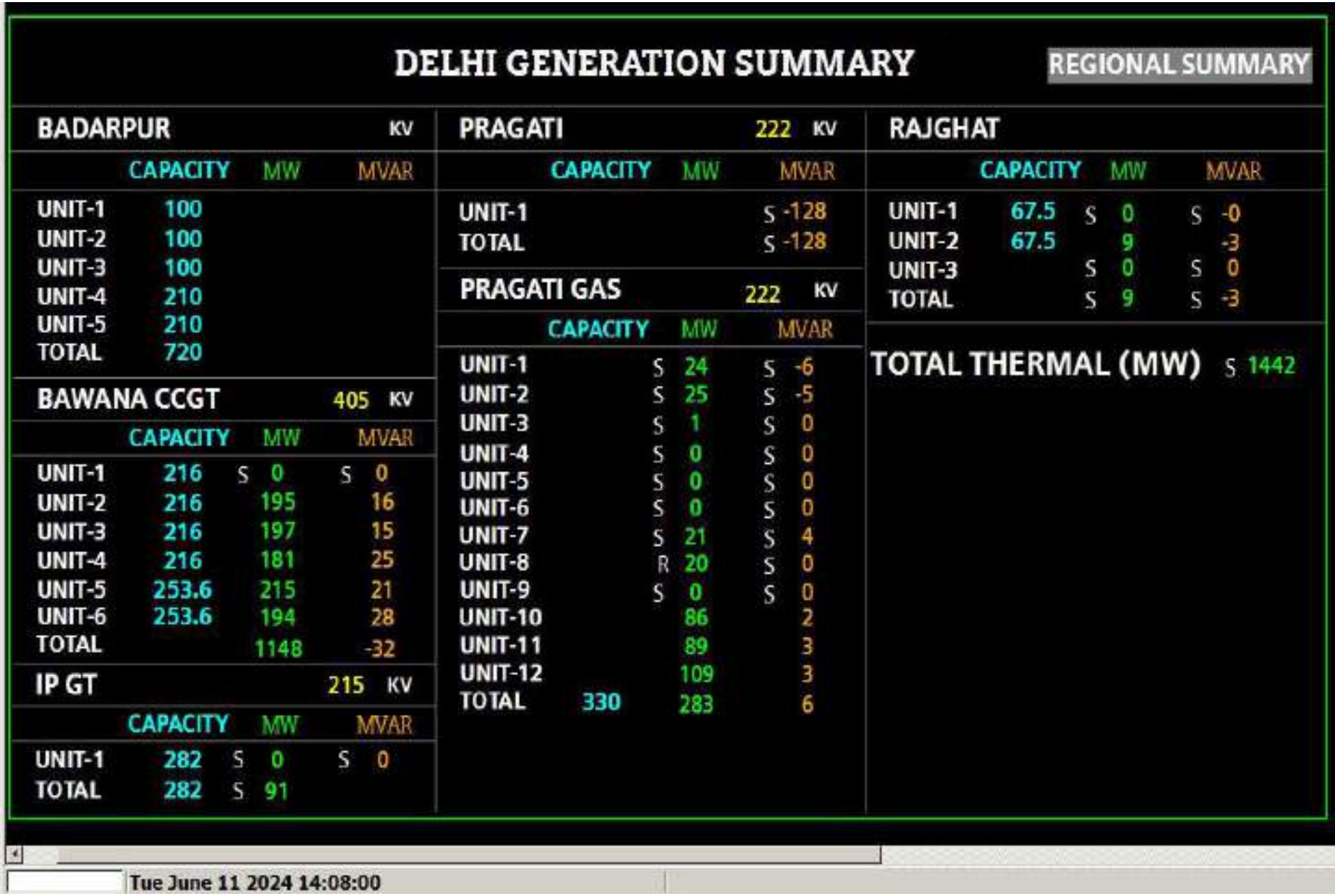
SLD of 400/220kV Mandaula(PG) before the event



SLD of 400/220kV Mandaula(PG) after the event



Delhi Generation Summary before the event



DELHI GENERATION SUMMARY

REGIONAL SUMMARY

BADARPUR — KV

	CAPACITY	MW	MVAR
UNIT-1	100		
UNIT-2	100		
UNIT-3	100		
UNIT-4	210		
UNIT-5	210		
TOTAL	720		

BAWANA CCGT — 405 KV

	CAPACITY	MW	MVAR
UNIT-1	216	S 0	S 0
UNIT-2	216	195	16
UNIT-3	216	197	15
UNIT-4	216	181	25
UNIT-5	253.6	215	21
UNIT-6	253.6	194	28
TOTAL		1148	-32

IP GT — 215 KV

	CAPACITY	MW	MVAR
UNIT-1	282	S 0	S 0
TOTAL	282	S 91	

PRAGATI — 222 KV

	CAPACITY	MW	MVAR
UNIT-1		S -128	
TOTAL		S -128	

PRAGATI GAS — 222 KV

	CAPACITY	MW	MVAR
UNIT-1		S 24	S -6
UNIT-2		S 25	S -5
UNIT-3		S 1	S 0
UNIT-4		S 0	S 0
UNIT-5		S 0	S 0
UNIT-6		S 0	S 0
UNIT-7		S 21	S 4
UNIT-8		R 20	S 0
UNIT-9		S 0	S 0
UNIT-10		86	2
UNIT-11		89	3
UNIT-12		109	3
TOTAL	330	283	6

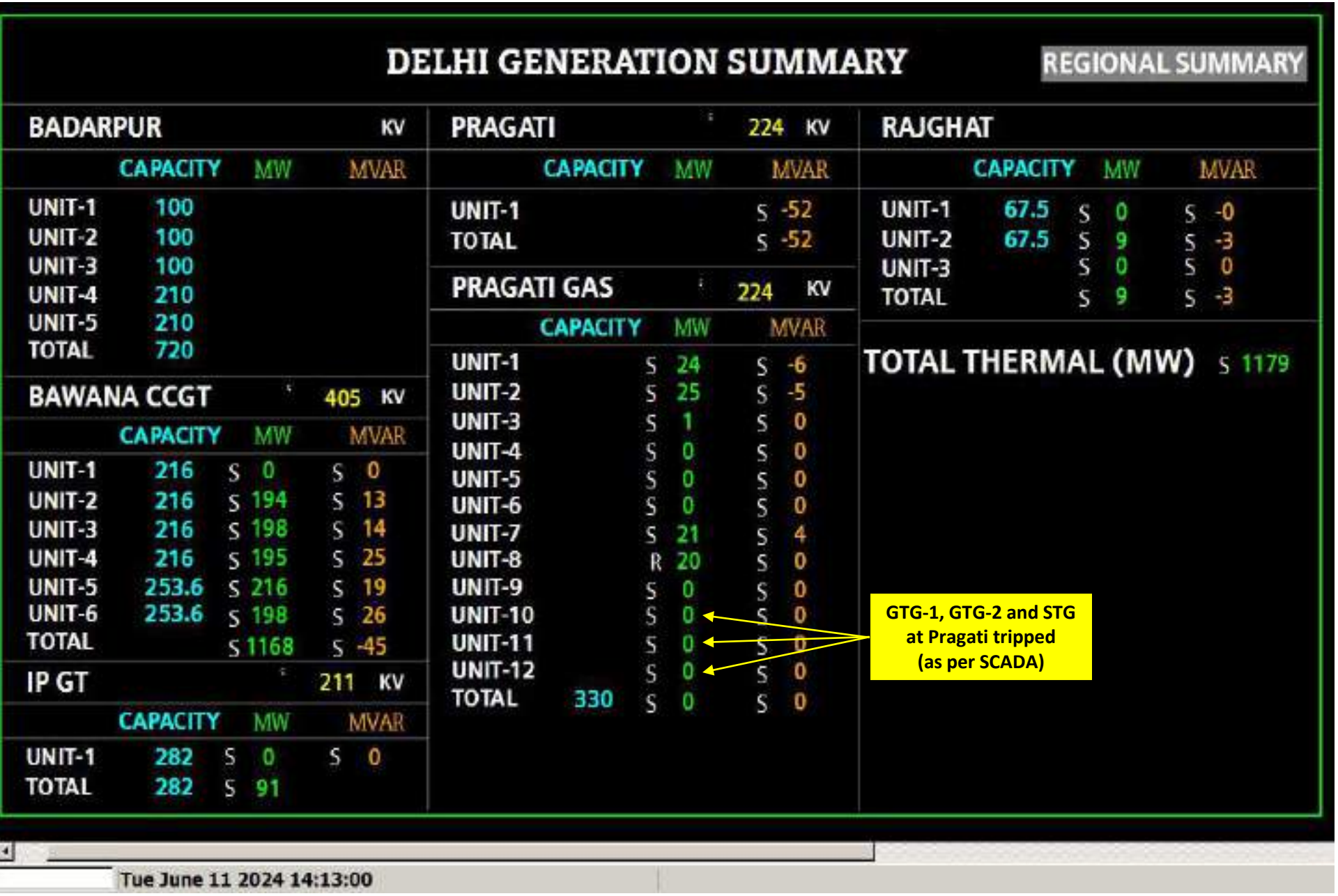
RAJGHAT

	CAPACITY	MW	MVAR
UNIT-1	67.5	S 0	S -0
UNIT-2	67.5	9	-3
UNIT-3		S 0	S 0
TOTAL		S 9	S -3

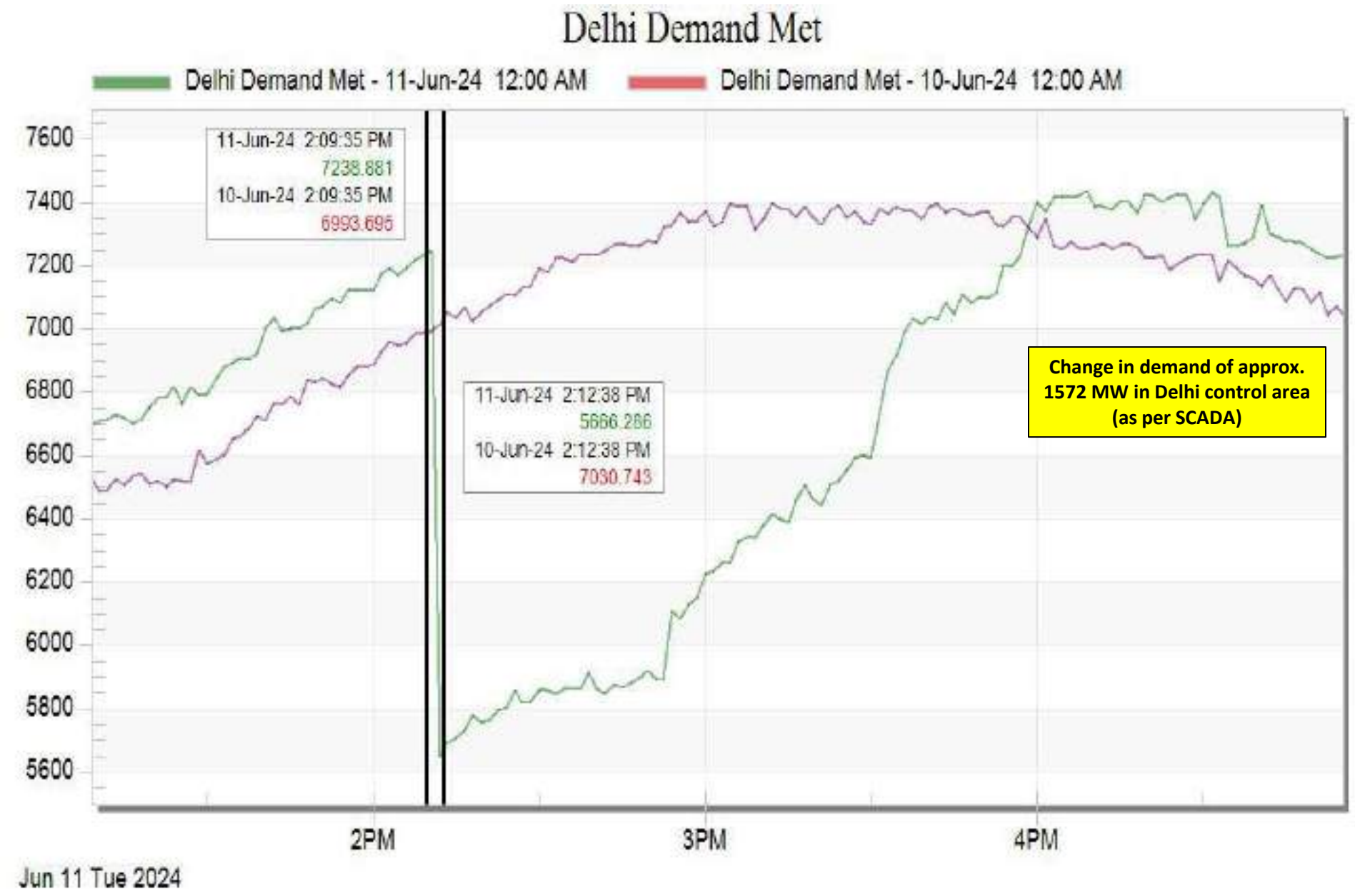
TOTAL THERMAL (MW) S 1442

Tue June 11 2024 14:08:00

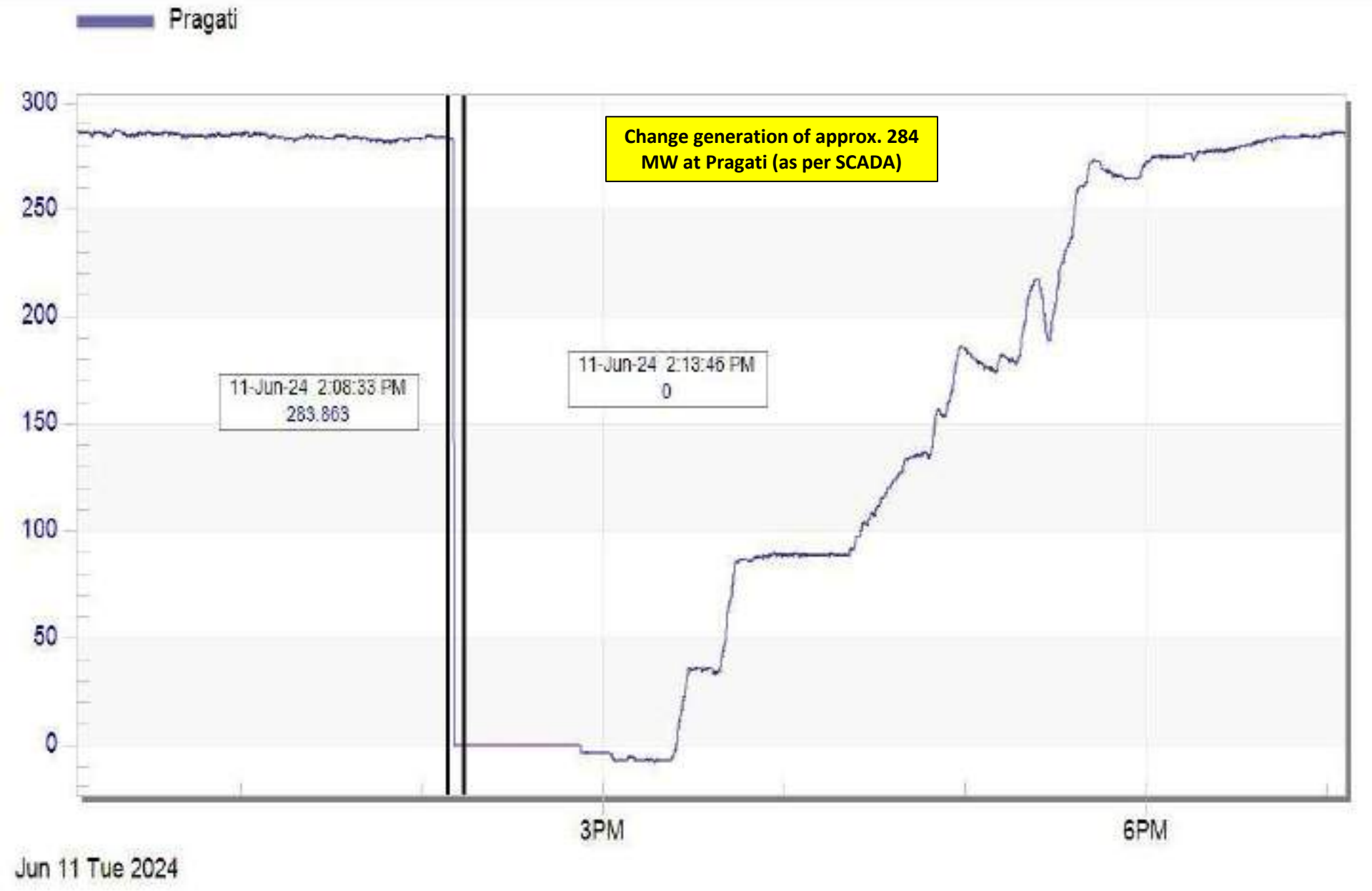
Delhi Generation Summary after the event



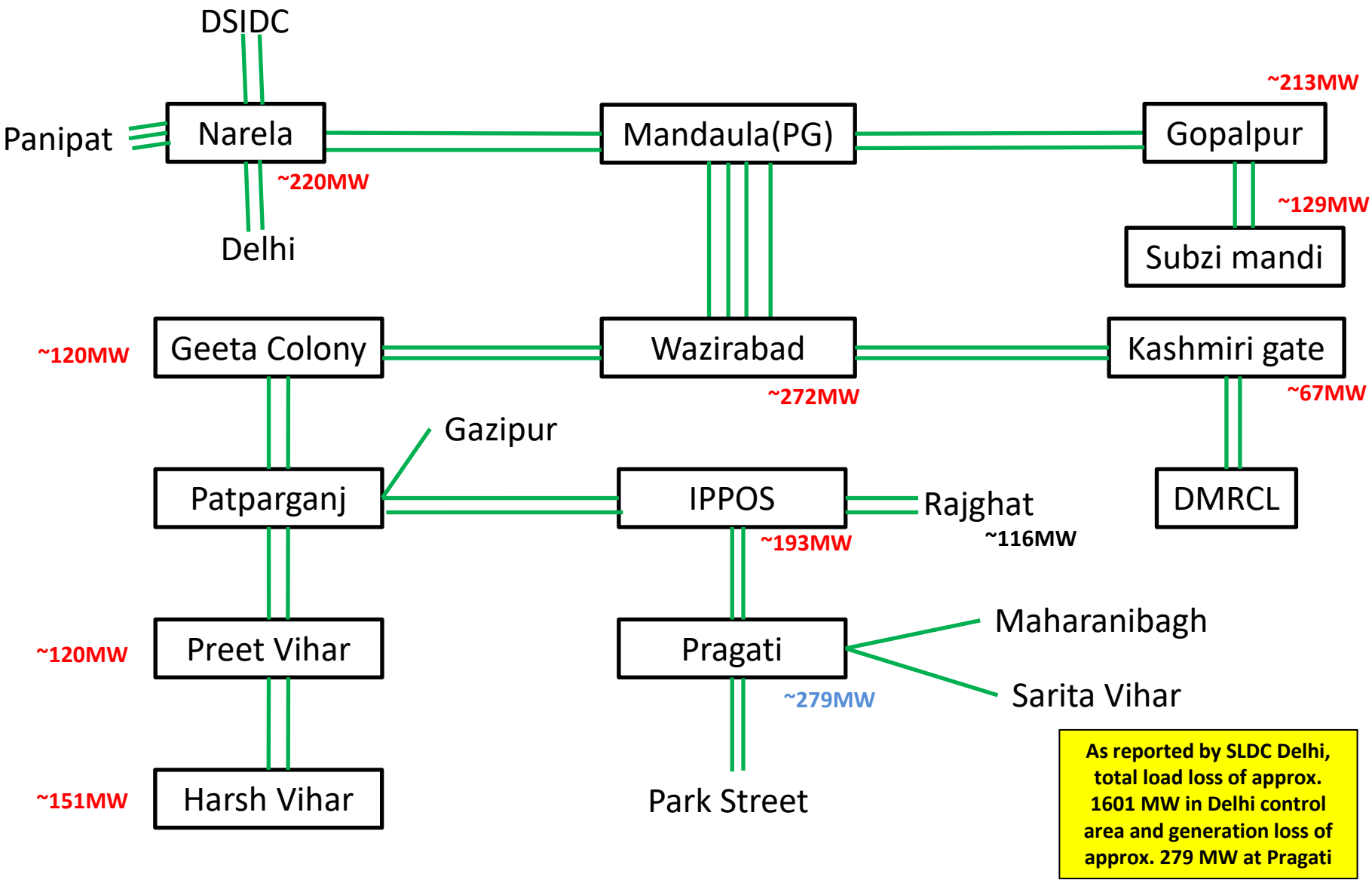
Delhi Demand during the event



Pragati Generation during the event

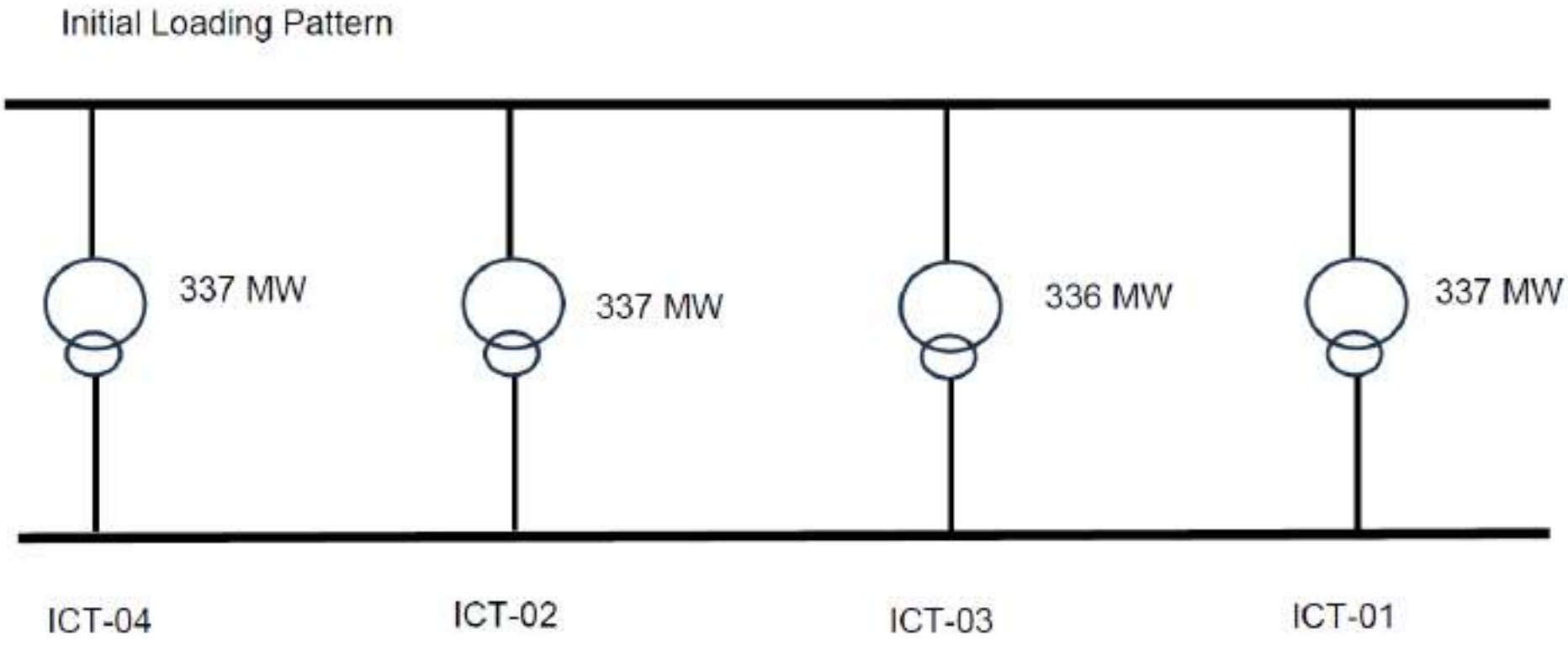


220kV Connectivity Diagram from Mandaula(PG)
(With load/generation loss Quantum as reported by SLDC Delhi)



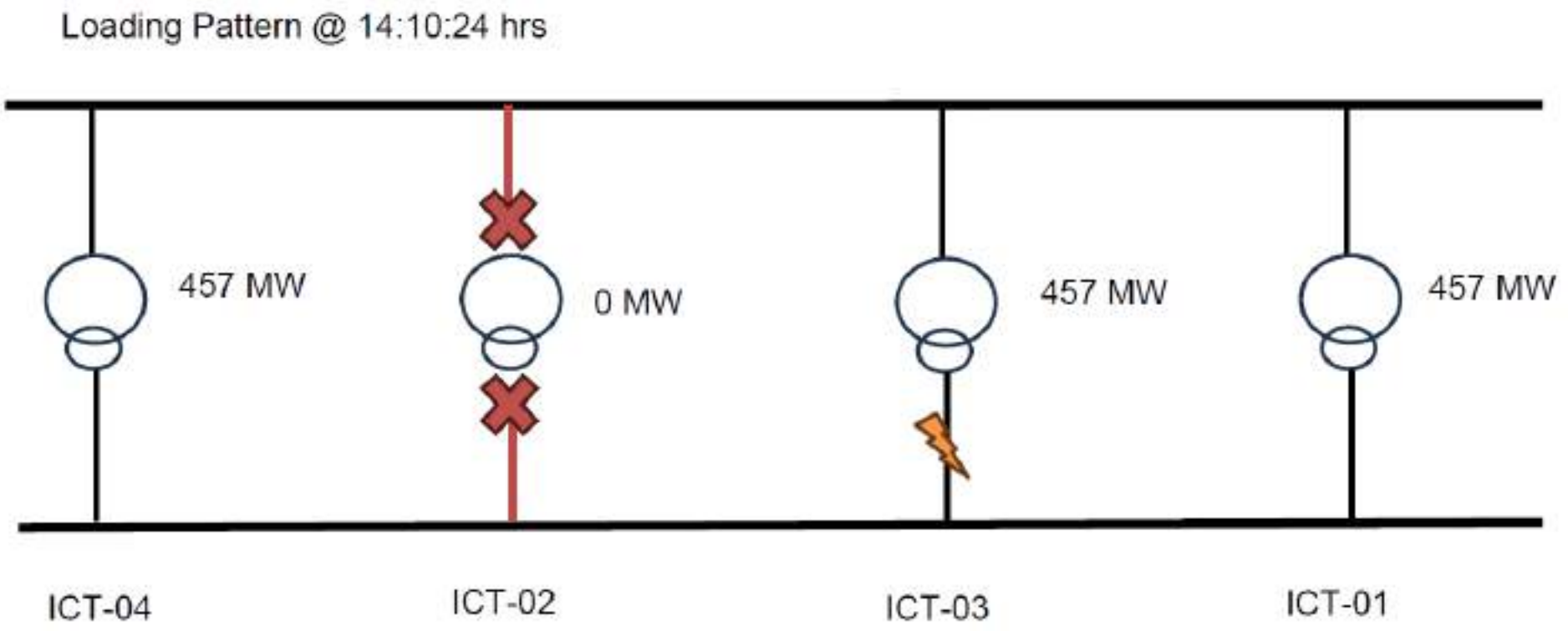
As reported by SLDC Delhi, total load loss of approx. 1601 MW in Delhi control area and generation loss of approx. 279 MW at Pragati

Initial loading pattern of ICTs at Mandaula(PG)



Total Loading = 1347 MW

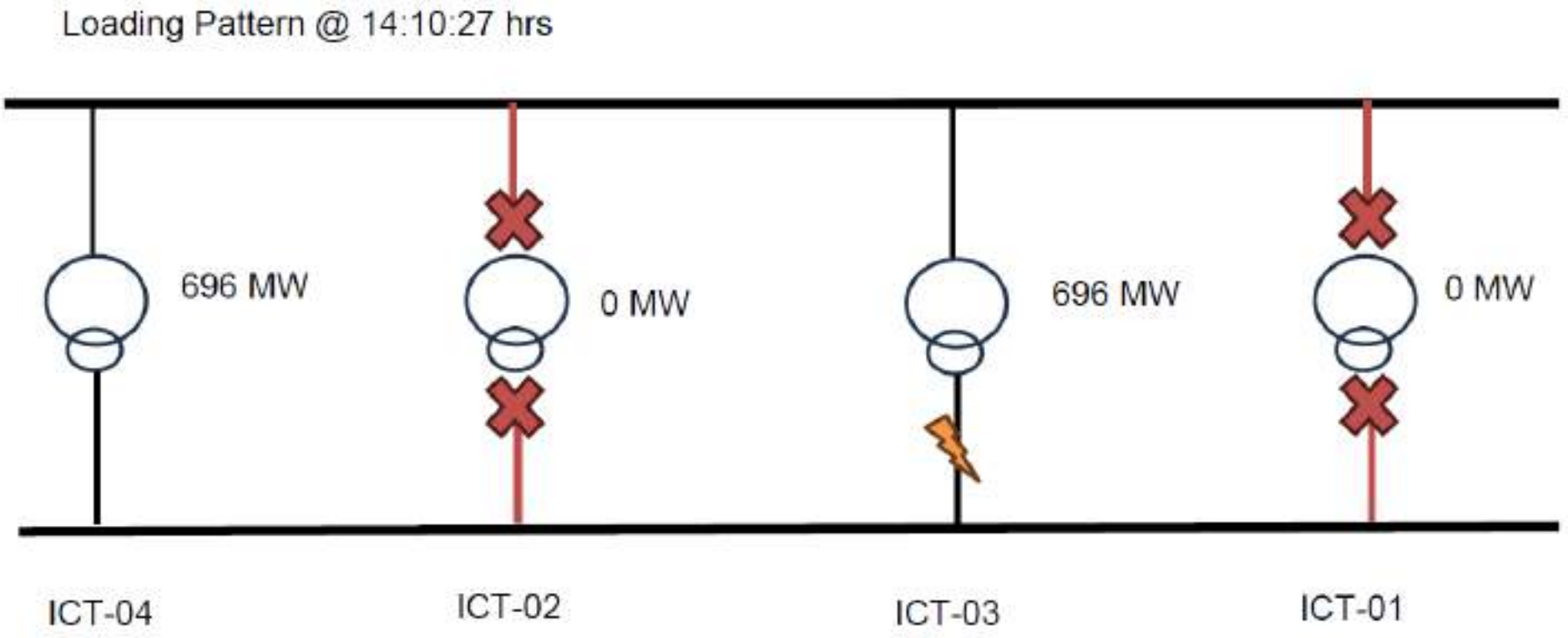
Loading pattern of ICTs at Mandaula(PG) @ 14:10:24hrs



Total Loading = 1371 MW

ICT-02 Tripped on B/U E/F protection due to system im-balance.

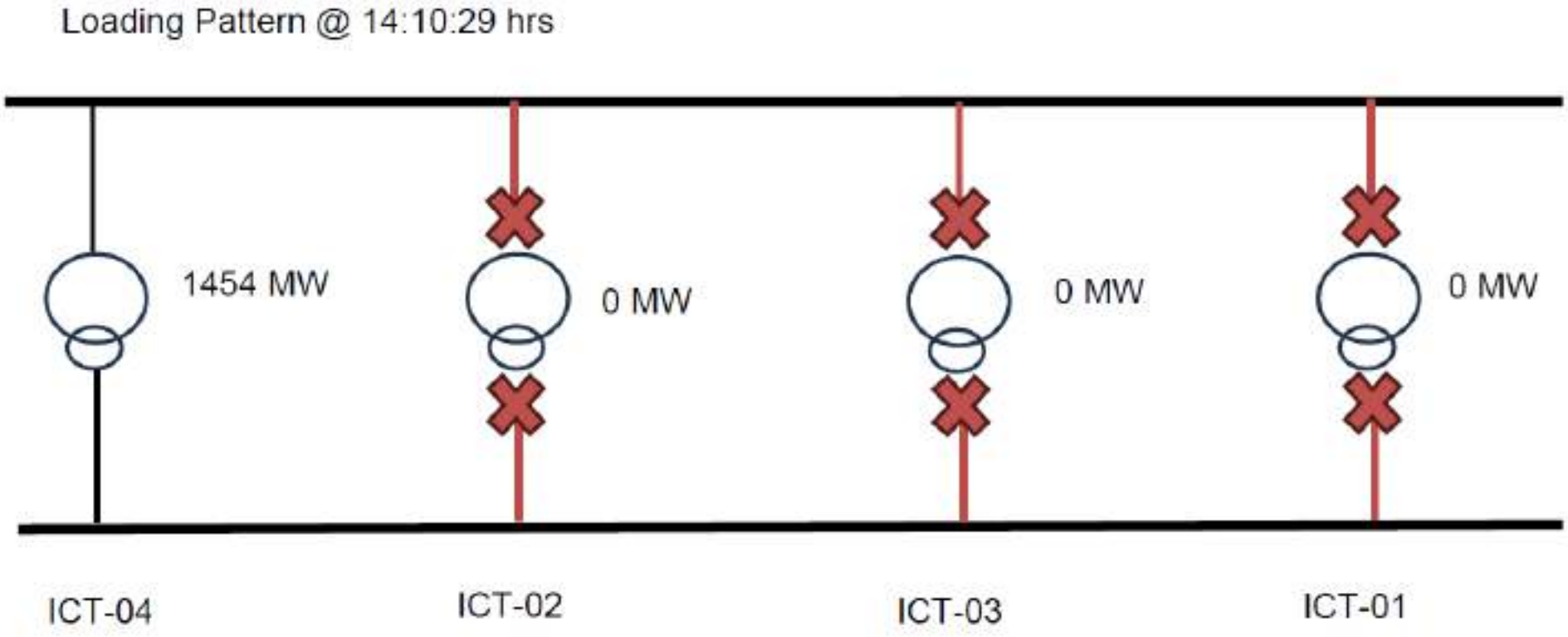
Loading pattern of ICTs at Mandaula(PG) @ 14:10:27hrs



Total Loading = 1392 MW

ICT-01 Tripped on B/U E/F protection due to system im-balance.

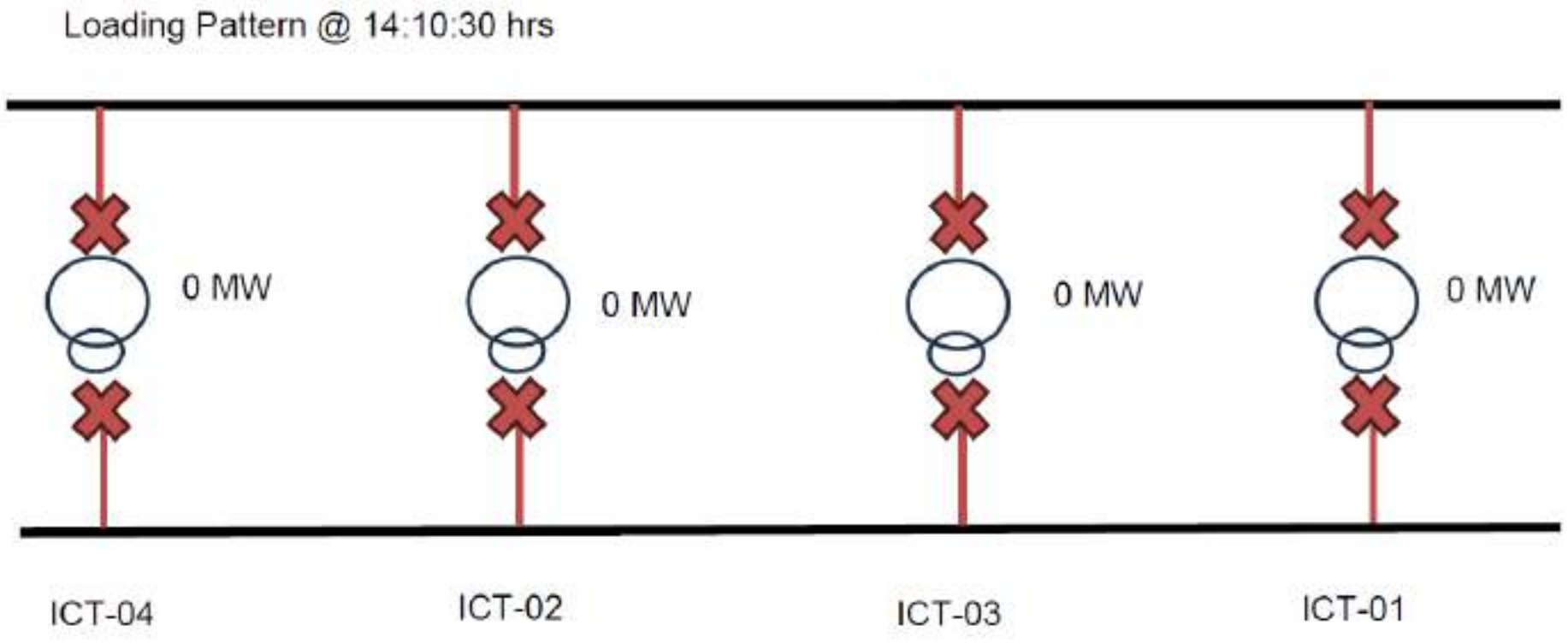
Loading pattern of ICTs at Mandaula(PG) @ 14:10:29hrs



Total Loading = 1454 MW

ICT-03 Hand Tripped due to heavy sparking due to melting of Isolator

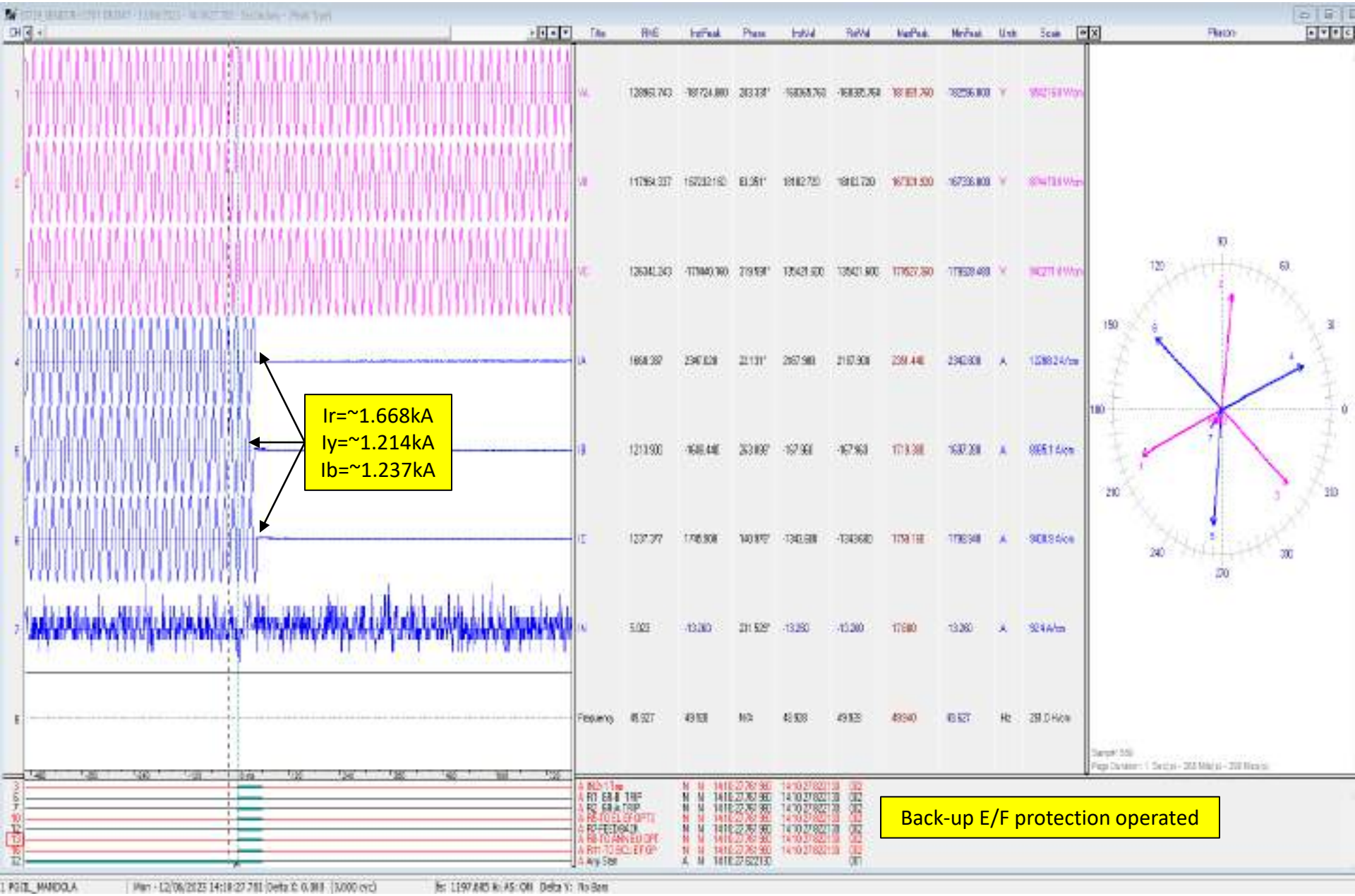
Loading pattern of ICTs at Mandaula(PG) @ 14:10:30hrs



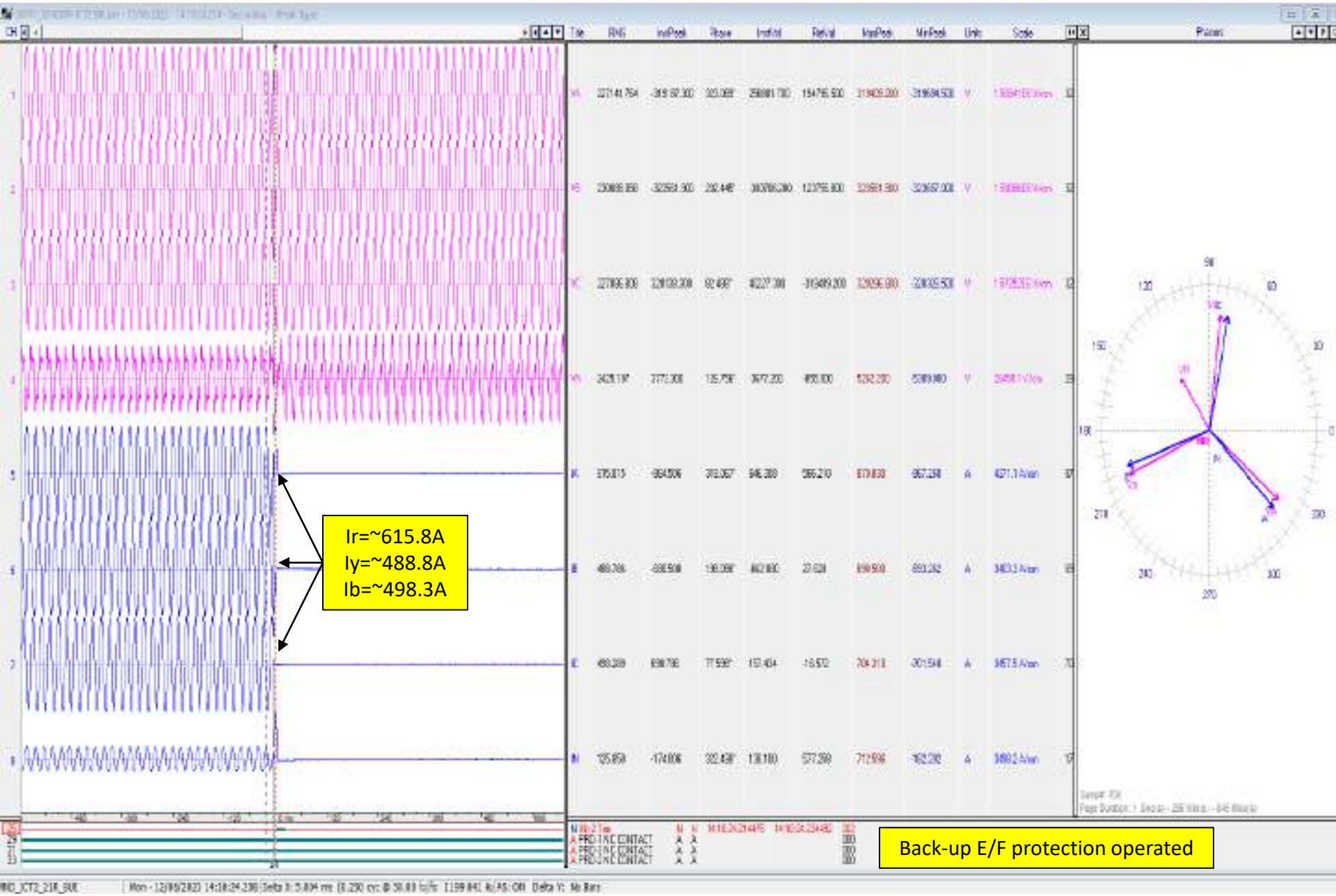
Total Loading = 0 MW

ICT-04 Tripped on B/U Over Current Protection of 400 kV side (Due to excess overloading).

DR of 400/220 kV 500 MVA ICT 1 at Mandaula(PG)

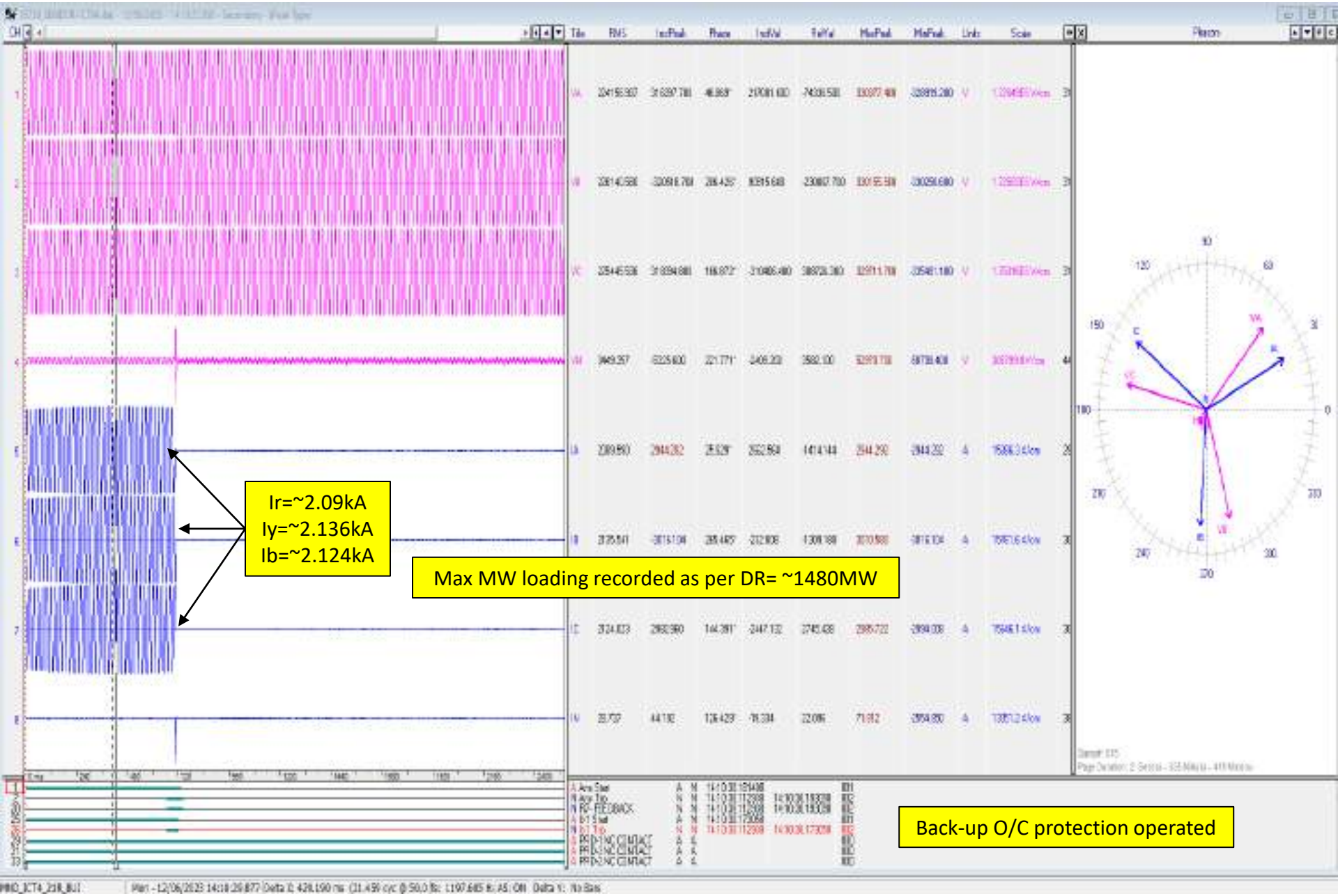


DR of 400/220 kV 500 MVA ICT 2 at Mandaula(PG)



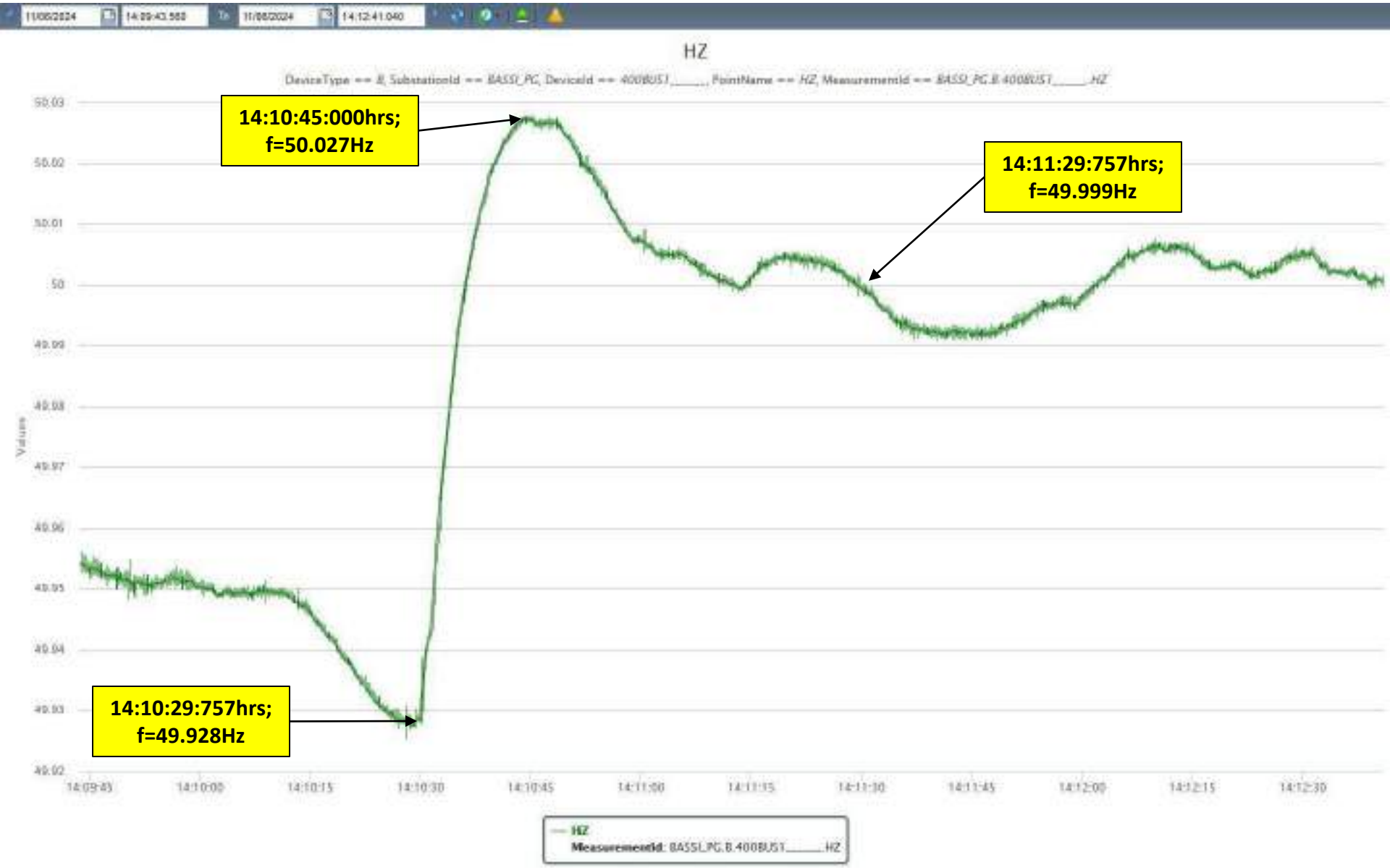
DR of 400/220 kV 500 MVA ICT 3 at Mandaula(PG)

DR of 400/220 kV 500 MVA ICT 4 at Mandaula(PG)



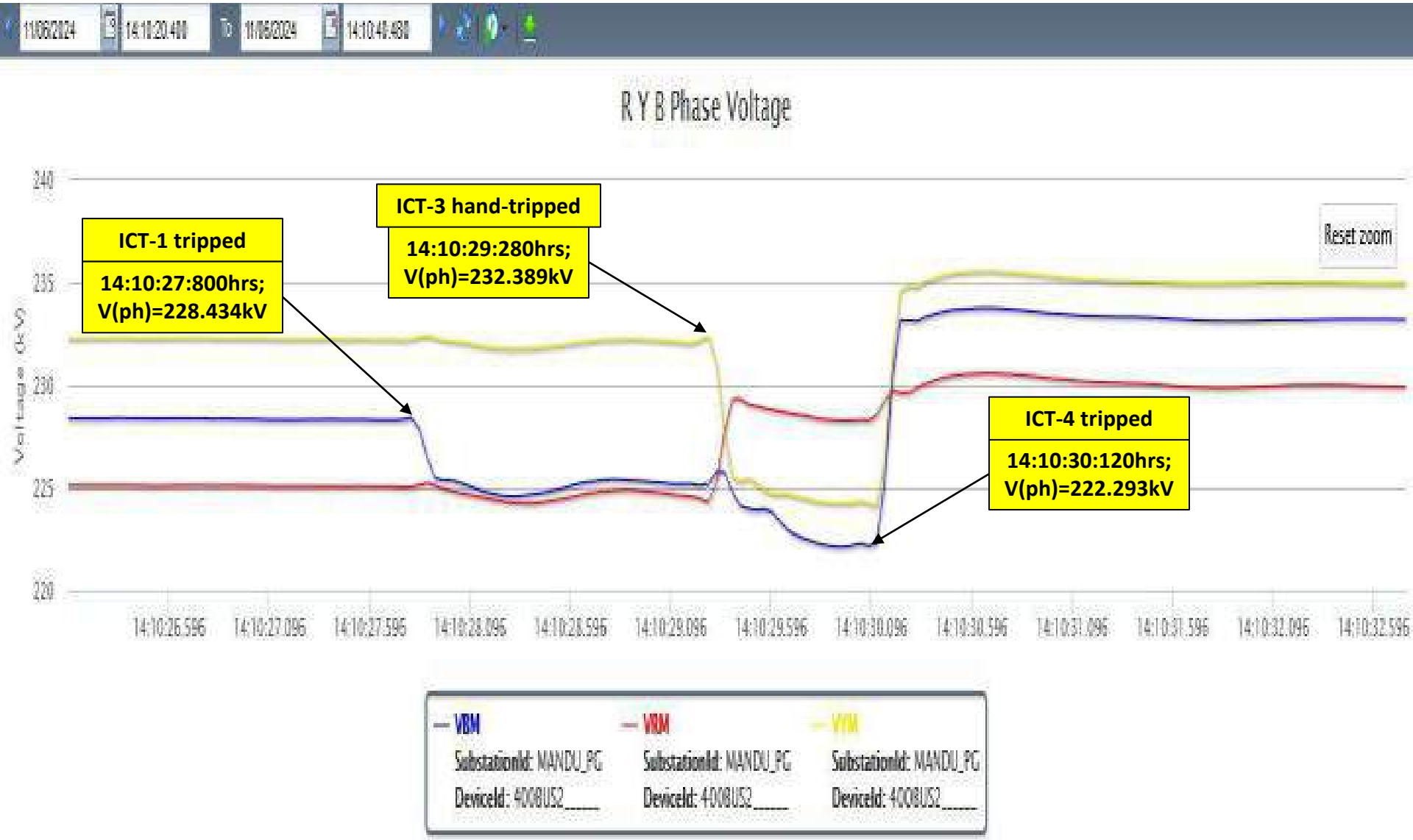
PMU Plot of frequency at Bassi(PG)

14:10 hrs/11-June-24



PMU Plot of Phase voltage magnitude at Mandaula(PG)

14:10 hrs/11-June-24



SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
14:09:29,268	MANDU_PG	400kV	11T2T4	Circuit Breaker	Open	Tie CB at 400kV side of 400/220kV 500 MVA ICT 2 at Mandaula(PG) opened
14:10:13,410	MANDU_PG	400kV	12T2	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 500 MVA ICT 2 at Mandaula(PG) opened
14:10:28,000	MANDU_PG	400kV	14T1T3	Circuit Breaker	Open	Tie CB at 400kV side of 400/220kV 500 MVA ICT 1 at Mandaula(PG) opened
14:10:28,000	MANDU_PG	220kV	15T1	Circuit Breaker	Open	CB at 220kV side of 400/220kV 500 MVA ICT 1 at Mandaula(PG) opened
14:10:28,000	MANDU_PG	400kV	15T1	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 500 MVA ICT 1 at Mandaula(PG) opened
14:10:29,497	MANDU_PG	220kV	16TBC	Circuit Breaker	Open	Transfer Bus Coupler CB at 220kV Mandaula(PG) opened
14:10:29,793	MANDU_PG	400kV	13T3	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 500 MVA ICT 3 at Mandaula(PG) opened
14:10:30,298	MANDU_PG	220kV	07T4	Circuit Breaker	Open	CB at 220kV side of 400/220kV 500 MVA ICT 4 at Mandaula(PG) opened
14:10:30,298	MANDU_PG	400kV	10T4	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 500 MVA ICT 4 at Mandaula(PG) opened

Point of discussion

- Reason of delayed clearance of fault need to be shared.
- Healthiness of protection system and equipments need to be ensured at Mandaula(PG).
- Scheme for protection switch-over in case of switching any element to transfer bus need to be shared.
- Back-up E/F and back-up O/C settings of each ICT need to be shared.
- Remedial action taken report need to be shared.

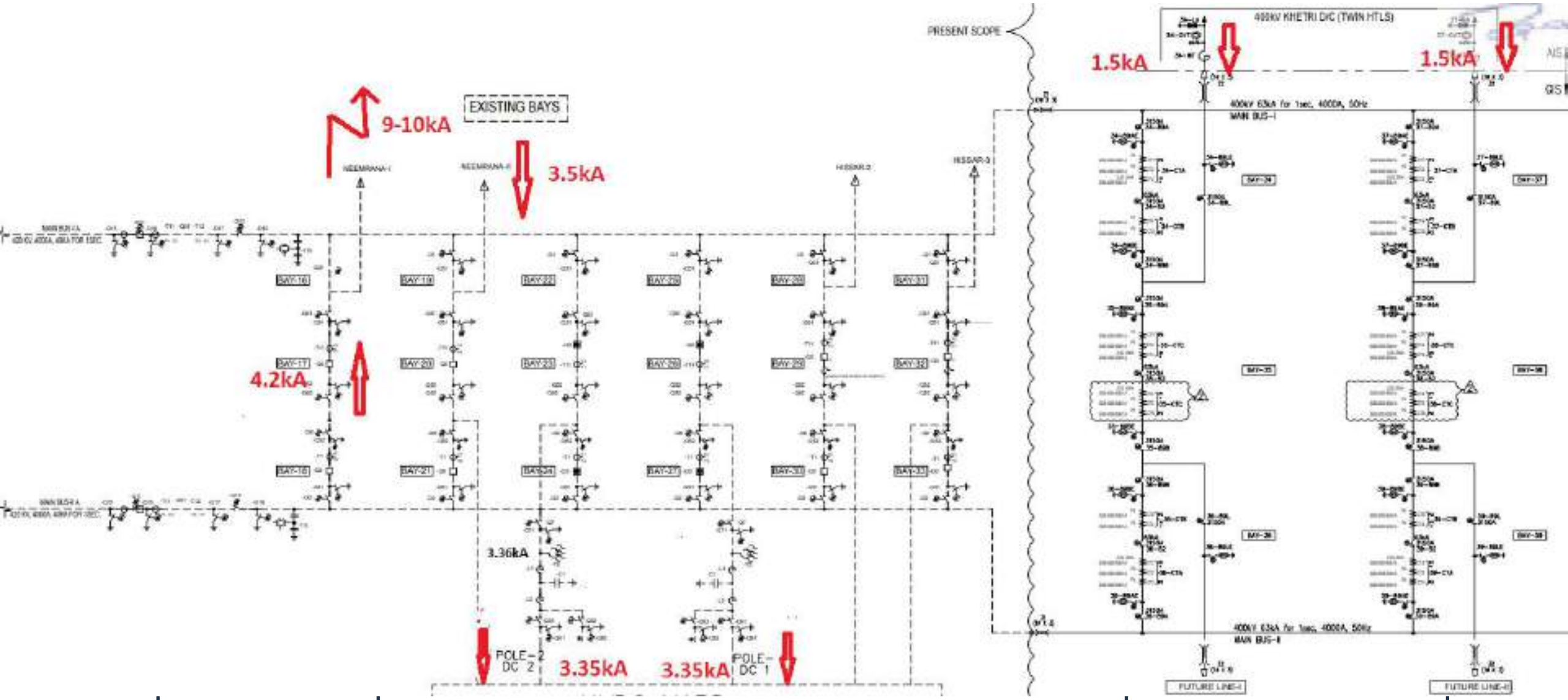
Tripping Analysis report of Northern Region-1 for 51st PSC Meeting

Tripping Analysis report of Multiple Elements tripping at Bhiwadi substation on 13.05.2024

Tripping details

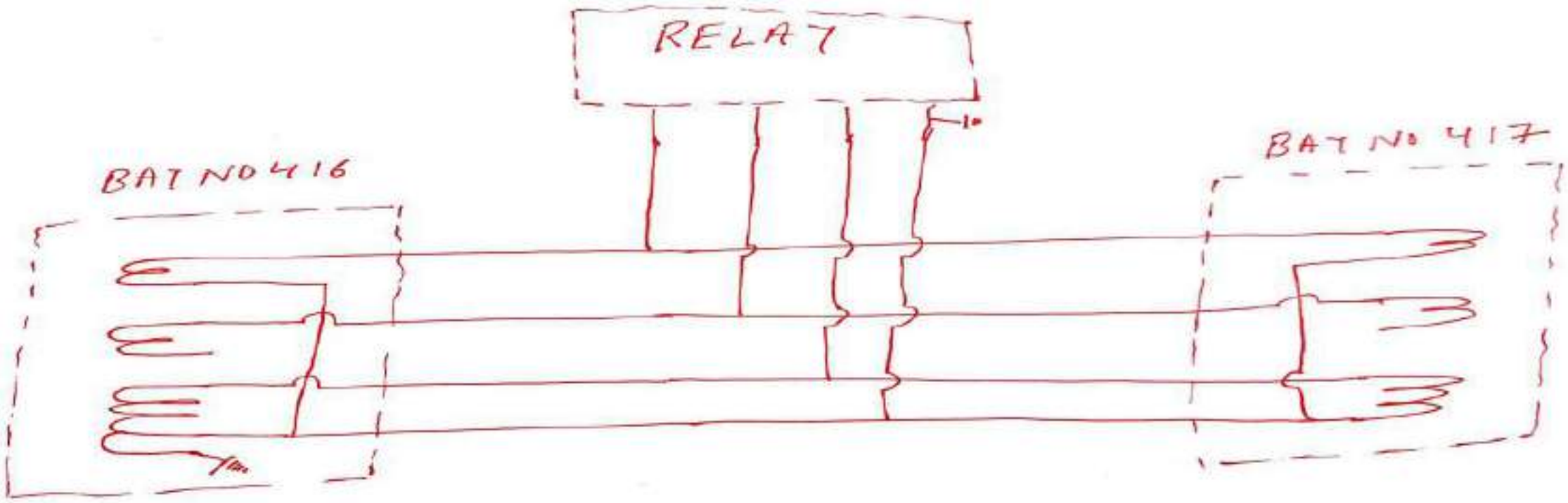
Description	Tripping time	Tripping Detail
400kV Bhiwadi-Neemrana-1	13-05-2024, 07:11	Line fault B phase to ground fault current 1.3 KA Cleared after 1.3s on DT received from other end.
400kV Bhiwadi-Khetri-1 & 2	13-05-2024, 07:11	DT receive from other end due to DEF operated at Khetri-1 & 2 end.
± 500 kV HVDC Pole-1 & Pole- 2	13-05-2024, 07:11	Both poles tripped on Converter Transformer Directional O/C protection(67N).

BHIWADI SINGLE LINE DIAGRAM



Reason for Non-operation of Main-I relay of Bhiwadi – Neemrana-I Line

1. Non-Operation of Distance Main-1 relay 7SA522 – Low infeed from Bhiwadi end (1.3 Kamp) resulted in nonoperation of distance zones.
2. The DR in other numerical relays (Main-2, Bus bar PUs) didn't trigger leading to delayed fault identification
3. Issue was observed in earthing of

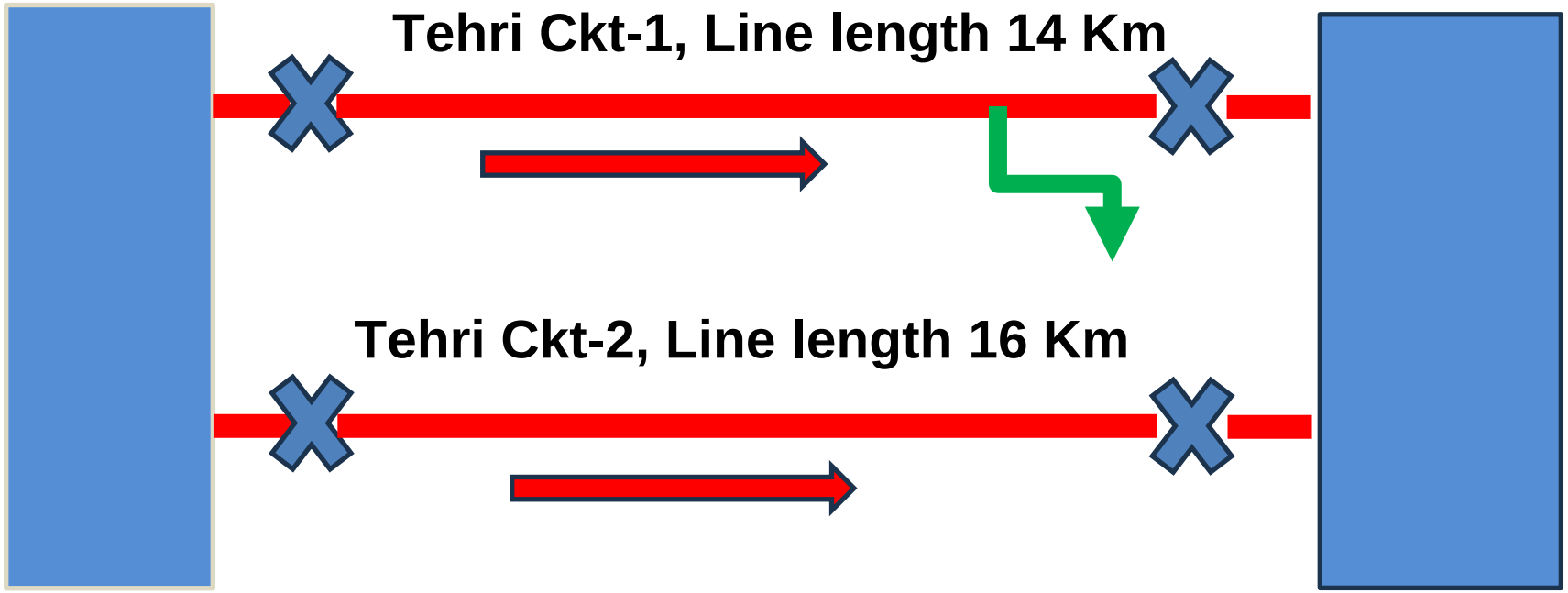


Tripping Analysis report of 400 kV Koteshwar-Tehri Ckt-1&2 at 17:21:44 hrs on 17.05.2024

Tripping Sequence

765/400 KV Koteshwar PS

Tehri GSS 2*600 MW



Cause of concern :- Tripping of 400 kV Koteshwar-Tehri Ckt-2 on Ckt-1 fault

Tripping Sequence

Main-1 Relay – 7SA522
Main-2 Relay – REL 670

Line	Description	Time Sequence
Tehri Ckt-1 Fault Current- (Y-B) – 6.3 KA	Main-2 Zone-2 Start Main-1 Zone-2 Start Main-1 Carr Rec **Main-1 Z1B mf**	05:21:46:152 05:21:46:152 05:21:46:198 **05:21:46:198**
Tehri Ckt-2 Fault Current (Y-B) – 5.0 KA	Main-2 Zone-2 Start Main-2 Carr Rec **Main-2 Carr aided trip** Main-1 Zone-2 Start CB Open	05:21:46:167 05:21:46:182 **05:21:46:185** 05:21:46:156 05:21:46:222

Tripping Analysis

Reason for tripping of Tehri Ckt-1 is Carrier receive at Koteshwar end, Details of PLCC Codes is tabulated below

PLCC - ETL 412									PLCC Frequencies
	Channel-1				Channel-2				Ckt-1 Ch-1 Tx-264 Rx- 252 Ch-2 Tx- 208 Rx -204
	Code-1		Code-2		Code-1		Code-2		Ckt-2 Ch-1 Tx -440 Rx - 444 Ch-2 Tx - 448 Rx - 452
	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	
	Koteshwar End								
Ckt-1	1	1	1	0	1	0	1	1	
Ckt-2	1	1	1	1	1	1	1	1	
	Tehri End								
Ckt-1	1	1	0	1	0	1	1	1	
Ckt-2	0	1	0	1	0	1	0	1	

Reasons for Tripping & Remedial actions

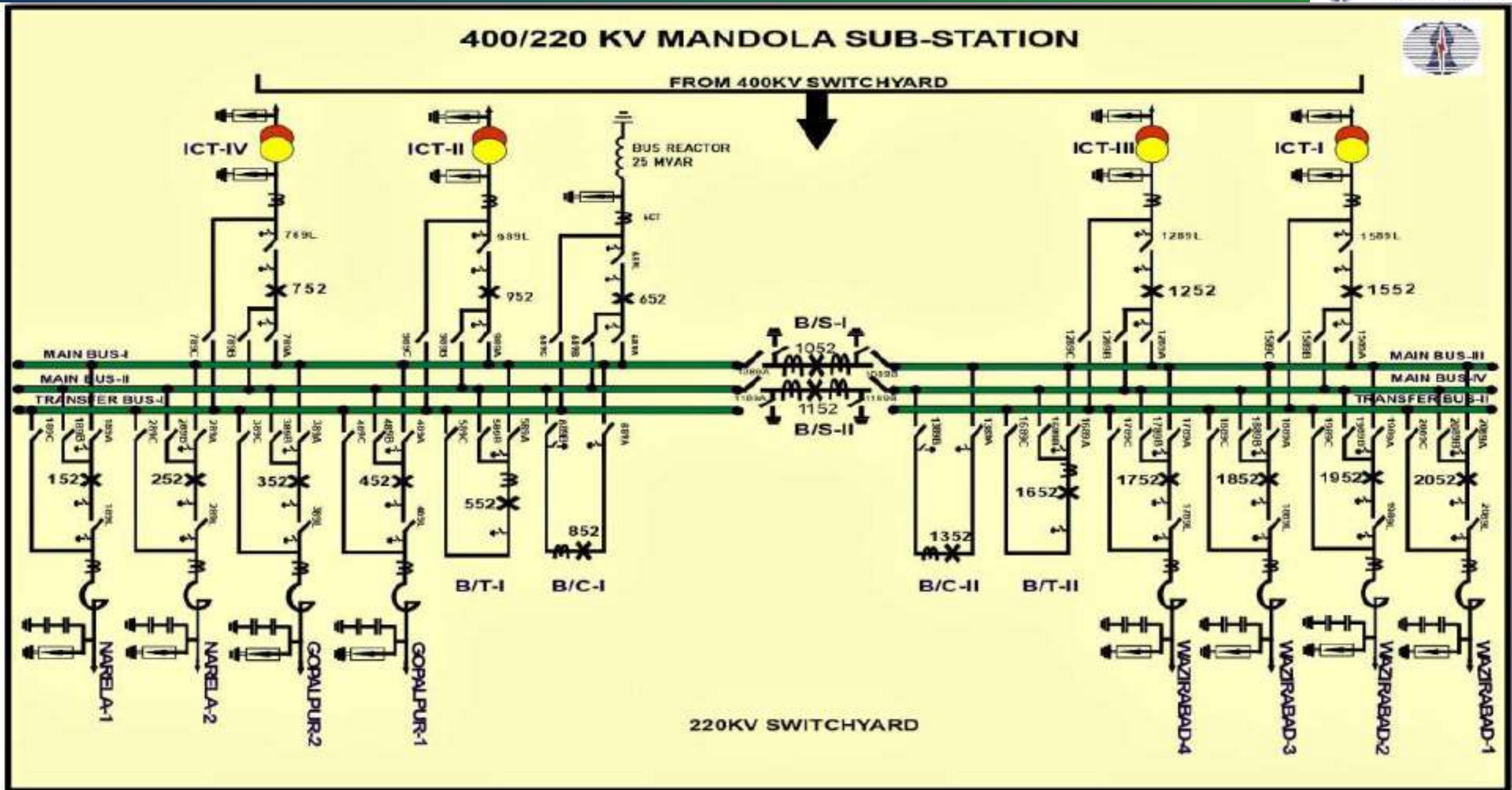
Reasons	Investigation
Ckt-1 & Ckt-2 Relay to PLCC panel wiring interchange at Tehri/Koteshwar end	End to end testing of both Ckts carried out on 08th May and found OK
Interference due to Similar Frequencies	Tehri Ckt-1 & 2 frequencies have wide gap & no interference has been observed during end to end testing
Blocking Carrier Communication scheme at Tehri end	Setting of Main-1 & Main-2 relay checked and found Ok
Receive back of Trasmit signal in Tehri Ckt-2 from Koteshwar end due to low gap in bandwidth	The transmit signal was found to be receive back when simultaneous transmit situation is happening in Ch-1&2 The frequency of Ch-2 has been changed at both end & issue has been resolved.

Tripping Analysis report of 04 no. ICTs at Mandola S/s at 14:10 hrs on 11.06.2024

Sequence of Events

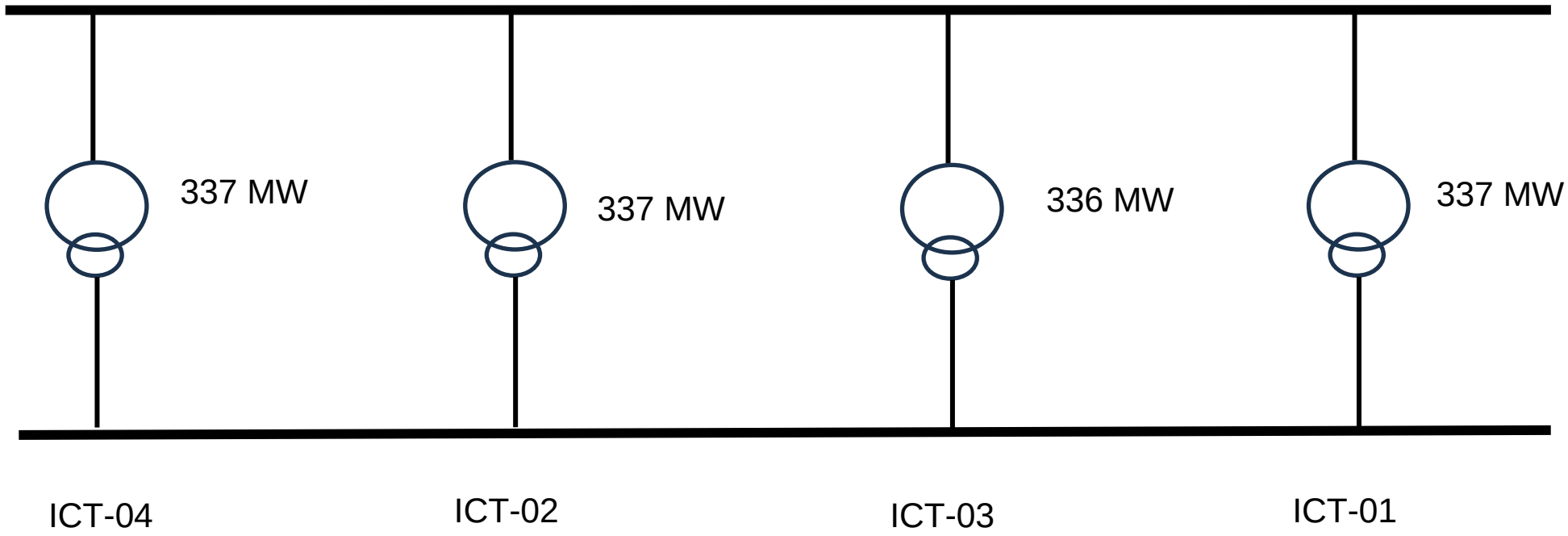
Sl. No.	Equipment	Tripping Time	Protection Operated
1	ICT-02	14:10:24	BU E/F due to imbalance
2	ICT-01	14:10:27	BU E/F due to imbalance
3	ICT-03	14:10:29	Hand Tripped
4	ICT-04	14:10:30	HV Side BU O/C

Overall SLD


400/220 KV MANDOLA SUB-STATION
FROM 400KV SWITCHYARD
ICT-IV
ICT-II
BUS REACTOR
25 MVAR
ICT-III
ICT-I
752
952
652
1252
1552
B/S-I
1052
1152
B/S-II
MAIN BUS-I
MAIN BUS-II
TRANSFER BUS-I
MAIN BUS-III
MAIN BUS-IV
TRANSFER BUS-II
152
252
352
452
552
852
1352
1652
1752
1852
1952
2052
B/T-I
B/C-I
B/C-II
B/T-II
NARELA-1
NARELA-2
GOPALPUR-2
GOPALPUR-1
WAZIRABAD-4
WAZIRABAD-3
WAZIRABAD-2
WAZIRABAD-1
220KV SWITCHYARD

Sequence of Events

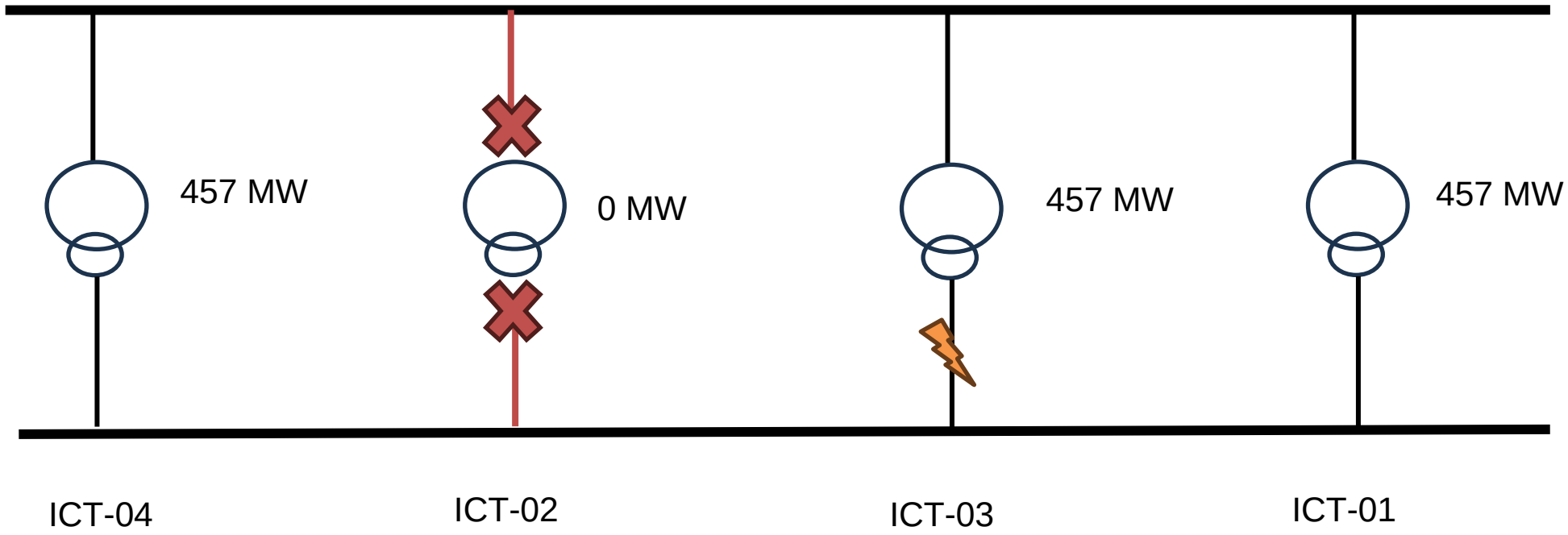
Initial Loading Pattern



Total Loading = 1347 MW

Sequence of Events

Loading Pattern @ 14:10:24 hrs

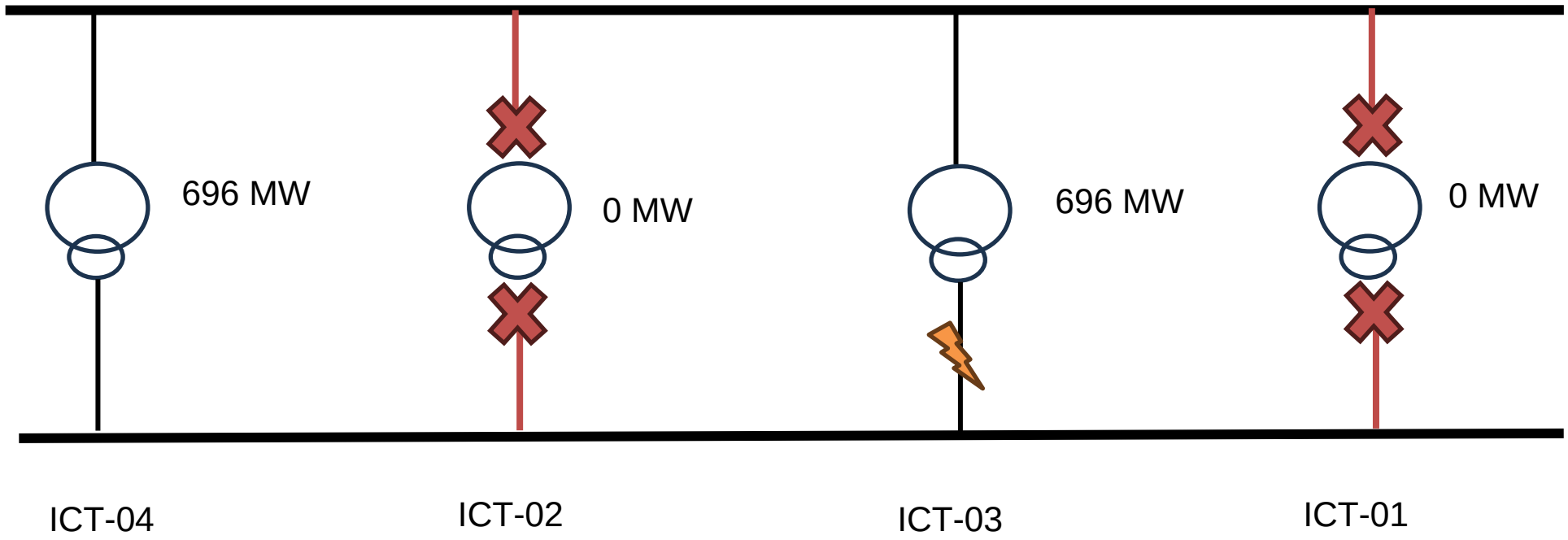


Total Loading = 1371 MW

ICT-02 Tripped on B/U E/F protection due to system im-balance.

Sequence of Events

Loading Pattern @ 14:10:27 hrs

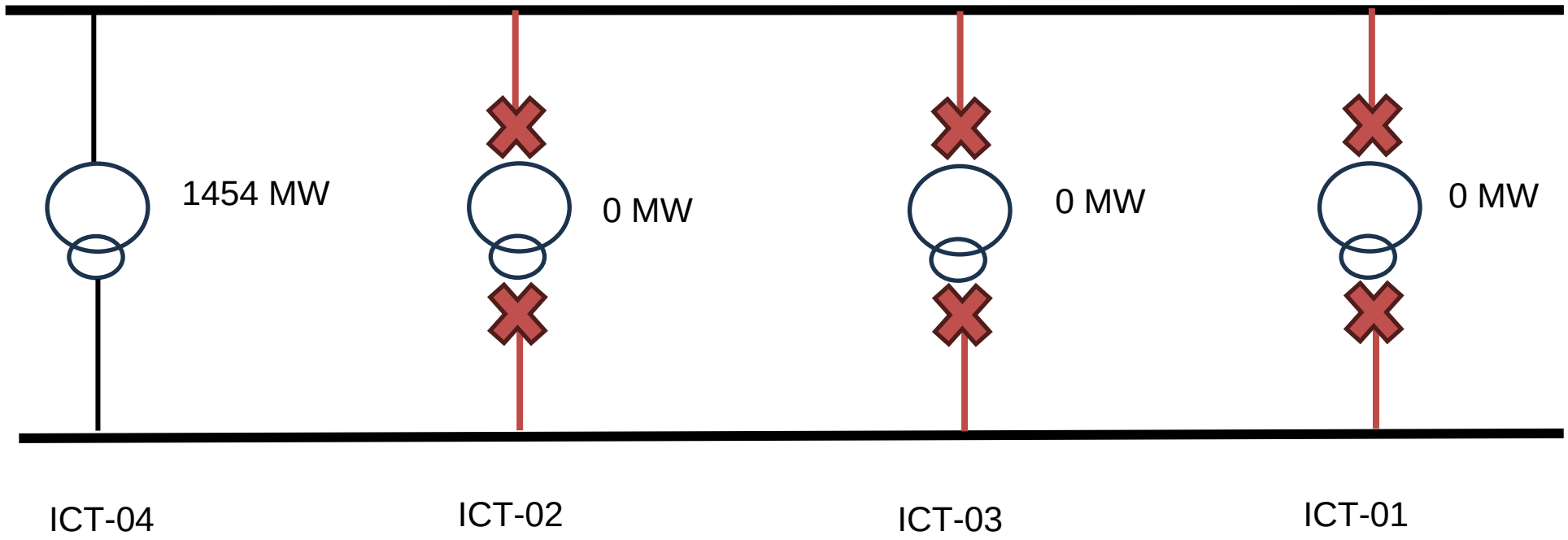


Total Loading = 1392 MW

ICT-01 Tripped on B/U E/F protection due to system im-balance.

Sequence of Events

Loading Pattern @ 14:10:29 hrs

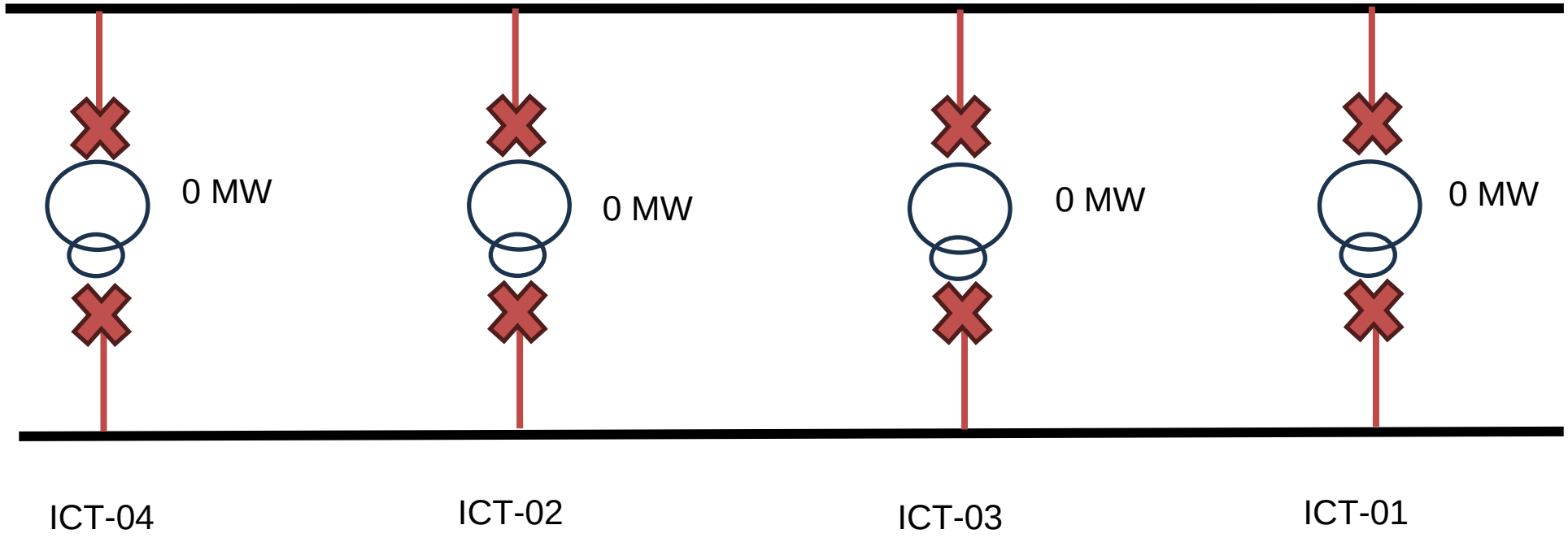


Total Loading = 1454 MW

ICT-03 Hand Tripped due to heavy sparking due to melting of Isolator

Sequence of Events

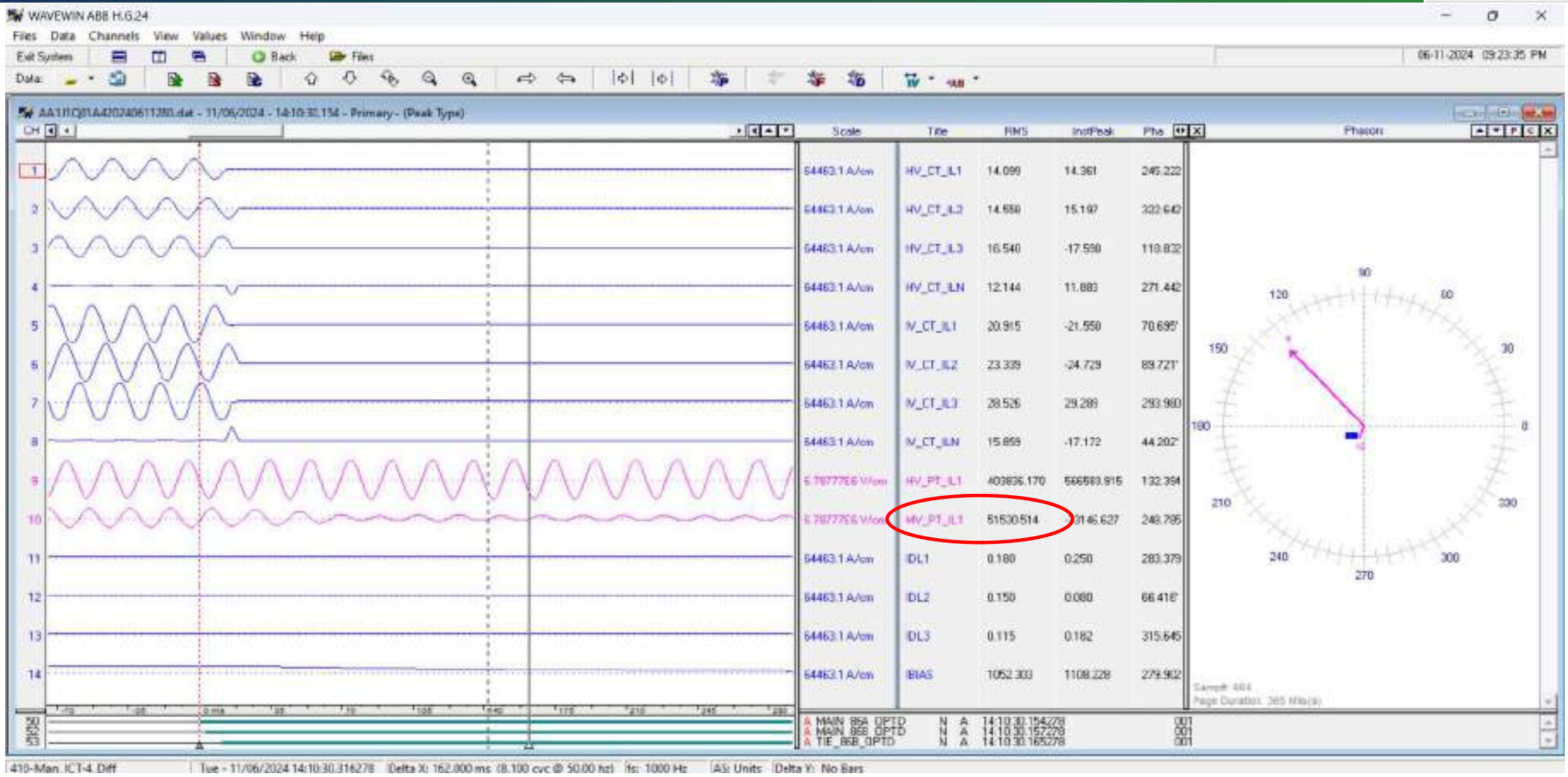
Loading Pattern @ 14:10:30 hrs



Total Loading = 0 MW

ICT-04 Tripped on B/U Over Current Protection of 400 kV side (Due to excess overloading).

Loss of 220 kV Bus Voltage after tripping of Last ICT [ICT-04]




THANK YOU

Multiple elements tripping at 500kV Mahindergarh HVDC On 17th May 2024

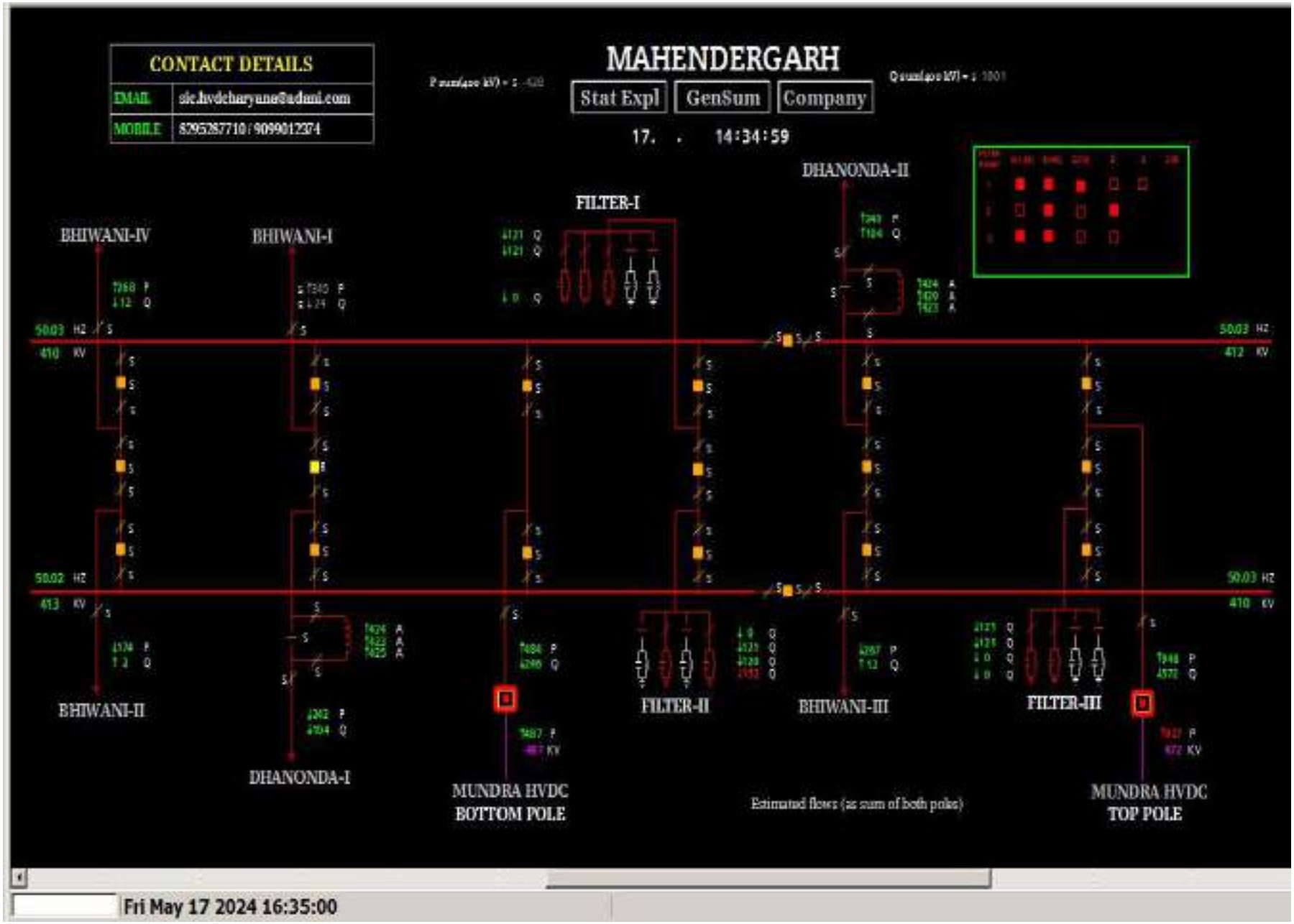
Brief of event:

i. During antecedent condition, 500 KV HVDC Mundra-Mahindergarh(APL) bipole was carrying total ~1500MW.
ii. As reported, at 16:21 hrs, 500 KV HVDC Mundra-Mahindergarh(APL) bipole blocked due to RPC No AC Filter alarm raised at Mahinedergarh end. After thorough investigation, it was observed that RCI changeover has been initiated from RCI B to RCI A ACTIVE and after that "RPC SET RANGE EXCEED" event triggered followed by RPC NO AC FILTER, which caused blocking of both the Poles.
iii. As per PMU at Mahindergarh(PG), no fault in system is observed, fluctuation voltage is observed.
iv. Due to blocking of both the poles of 500 KV HVDC Mundra-Mahindergarh(APL), there was power order reduction of ~1500MW. As per HVDC Mundra-Mahindergarh SPS, SPS case-3 would have operated and as per action in this case, load relief in UP, Haryana, Punjab, Rajasthan & Delhi and generation relief at Mundra Stage-III is desired.
v. Details of load relief not received from SLDCs. Communication has been sent to all the SLDCs to share the quantum of load relief occurred in their respective control area due to SPS operation. SCADA data at NRLDC was not healthy during the event time.
vi. As per detail BCU log of Mahindergarh end, DTPC fail alarm is recorded except Dhanonda. Any communication related issue need to be rectified at the earliest to ensure proper SPS operation.
vii. Both RCI System was restarted, and the system was normalized

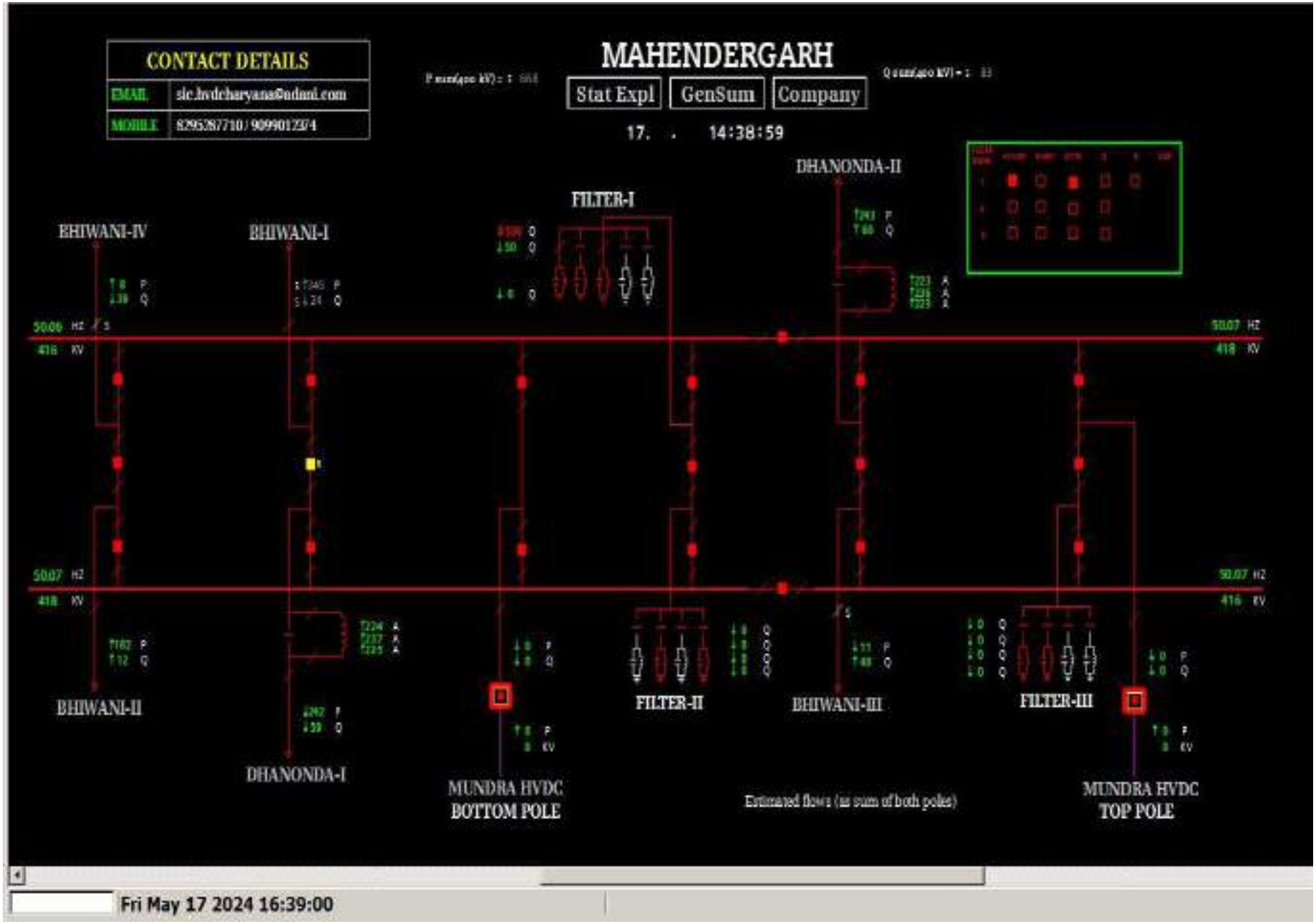
Elements tripped:

i. 500 KV HVDC Mahindergarh(APL) Pole-1
ii. 500 KV HVDC Mahindergarh(APL) Pole-1

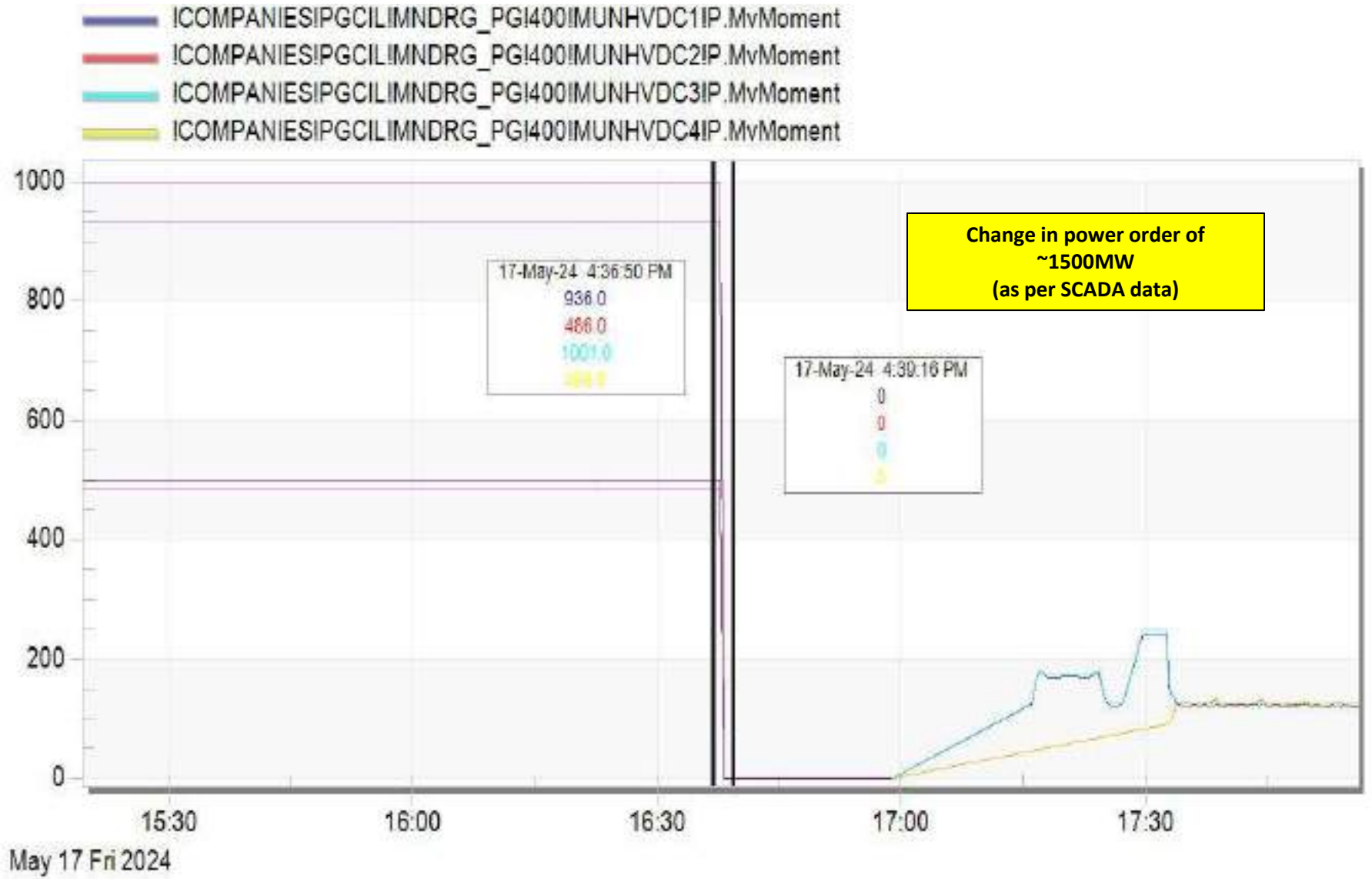
SLD of 400kV Mahindergarh(APL) before the event



SLD of 400kV Mahindergarh(APL) after the event

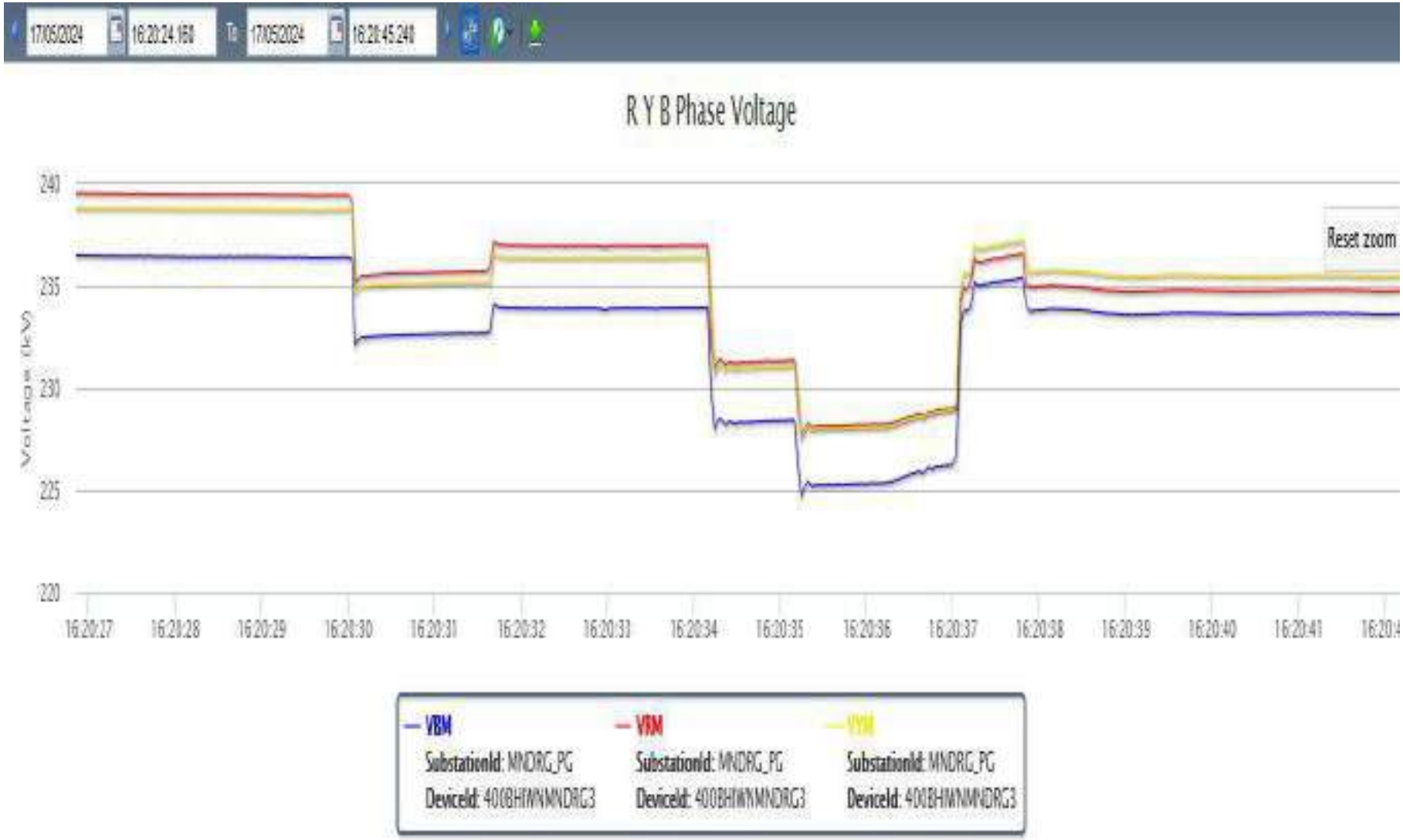


Power flow on 500kV Mundra-Mahindergarh HVDC during the event



PMU Plot of phase voltage magnitude at Mahinderagrh(PG)

16:20 hrs/17-May-24



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status
16:38:08	MAHINDERGARH	400kV	BKC1_2	Line Isolator	Open
16:38:11	MAHINDERGARH	400kV	BKC3_2	Line Isolator	Open
16:38:11	MAHINDERGARH	400kV	BKC3_1	Line Isolator	Open
16:38:11	MAHINDERGARH	400kV	BKC2_4	Line Isolator	Open
16:38:11	MAHINDERGARH	400kV	BKC2_2	Line Isolator	Open

Point of discussion

i) Why did SPS not operate?
ii) Remedial action taken report to be shared.

Multiple elements tripping at 220kV Sarna(PS) 04th May 2024

Brief of event:

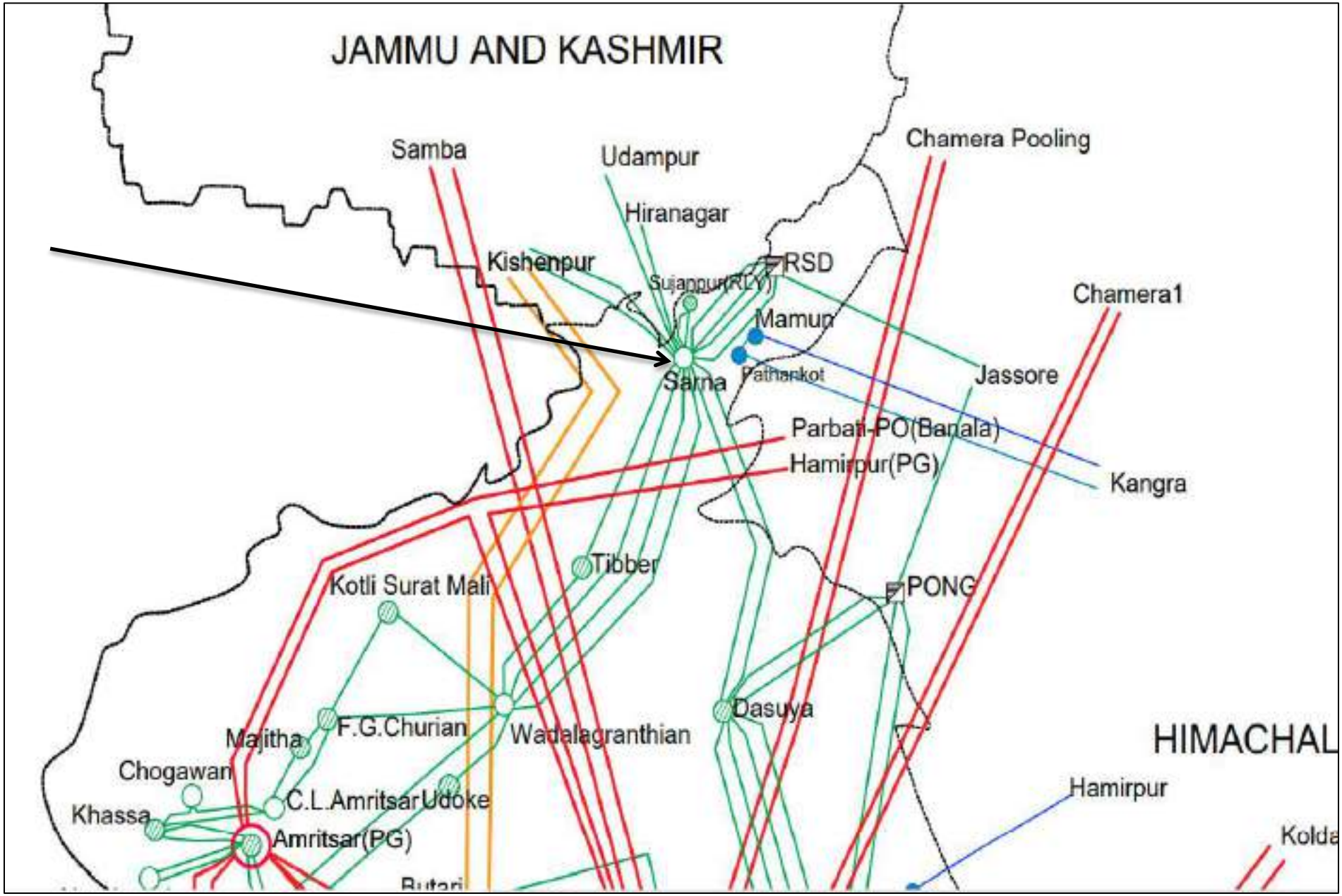
i. As reported, at 07:10 hrs, 220kV side R-Ph CT of 220/132kV Auto T/F-1 at Sarna(PS) blasted which created bus fault at both the 220kV buses at Sarna(PS).
ii. Bus-bar protection is not available at Sarna(PS). Hence, all the 220kV lines connected to Sarna(PS) tripped on zone-4 protection operation at Sarna(PS) end and lines tripped from remote ends on zone-2 protection operation.
iii. From DR at Sarna(PS), it was observed that zone-4 operated after a delay of ~500ms.
iv. Due to tripping of all the 220kV lines connected to Sarna(PS), complete blackout occurred at
v. As per PMU at Kishenpur(PG), R-N phase to earth fault with fault clearing time of 120ms followed by R-B phase to phase fault converted to R-Y phase to phase fault with delayed fault clearing time of 560ms is observed.
vi. As per SCADA, no change in demand is observed in Punjab control area. But as reported by SLDC-Punjab, load loss of approx. 90MW occurred in Punjab Control area.
vii. As per SCADA, change in demand of approx. 40MW is observed in J&K control area. But as reported by SLDC-J&K, no load loss occurred in J&K Control area.

Brief of event:

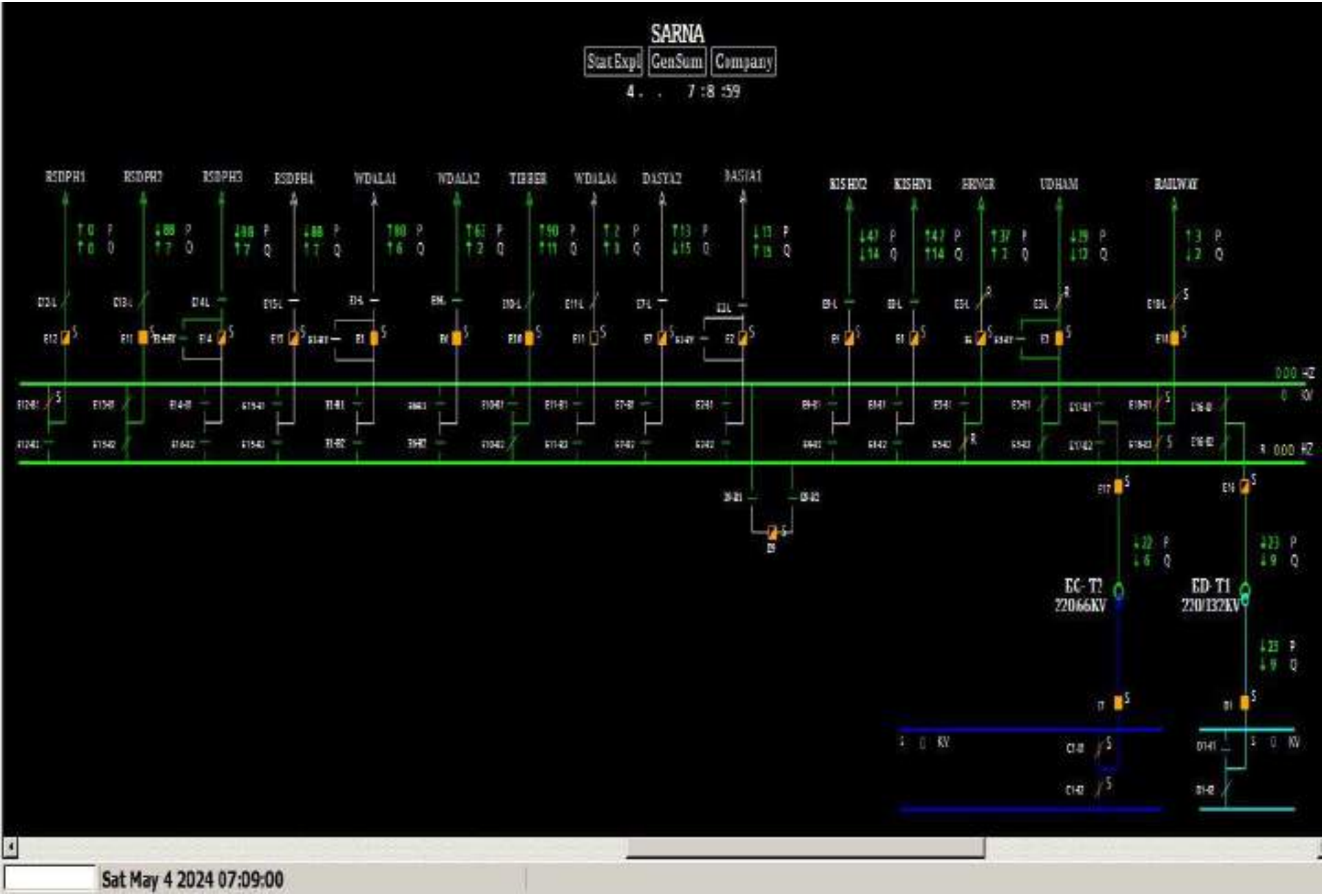
Elements tripped:

i. 1)2 20 KV Sarna(PS)-Dasuya(PS) (PG) Ckt-1
ii. 2)2 20 KV Sarna(PS)-Dasuya(PS) (PG) Ckt-2
iii. 3)2 20 KV Sarna(PS)-Udhampur(PDD) (PDD) Ckt
iv. 4)2 20 KV Sarna(PS)- Hiranagar(PDD) (PG) Ckt
v. 5)2 20 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-1
vi. 6)2 20 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-2
vii. 7)2 20 KV Sarna(PS)- Wadala(PS) Ckt-1
viii. 8)2 20 KV Sarna(PS)- Wadala(PS) Ckt-2
ix. 9)2 20 KV Sarna(PS)- Wadala(PS) Ckt-3
x. 10)2 20 KV Sarna(PS)- Wadala(PS) Ckt-4
xi. 11)2 20 KV Sarna(PS)- RSDPH(PS) Ckt-1
xii. 12)2 20 KV Sarna(PS)- RSDPH(PS) Ckt-2
xiii. 13)2 20 KV Sarna(PS)- RSDPH(PS) Ckt-3
xiv. 14)2 20 KV Sarna(PS)- RSDPH(PS) Ckt-4
xv. 15)2 20 KV Sarna(PS)- Railway Ckt

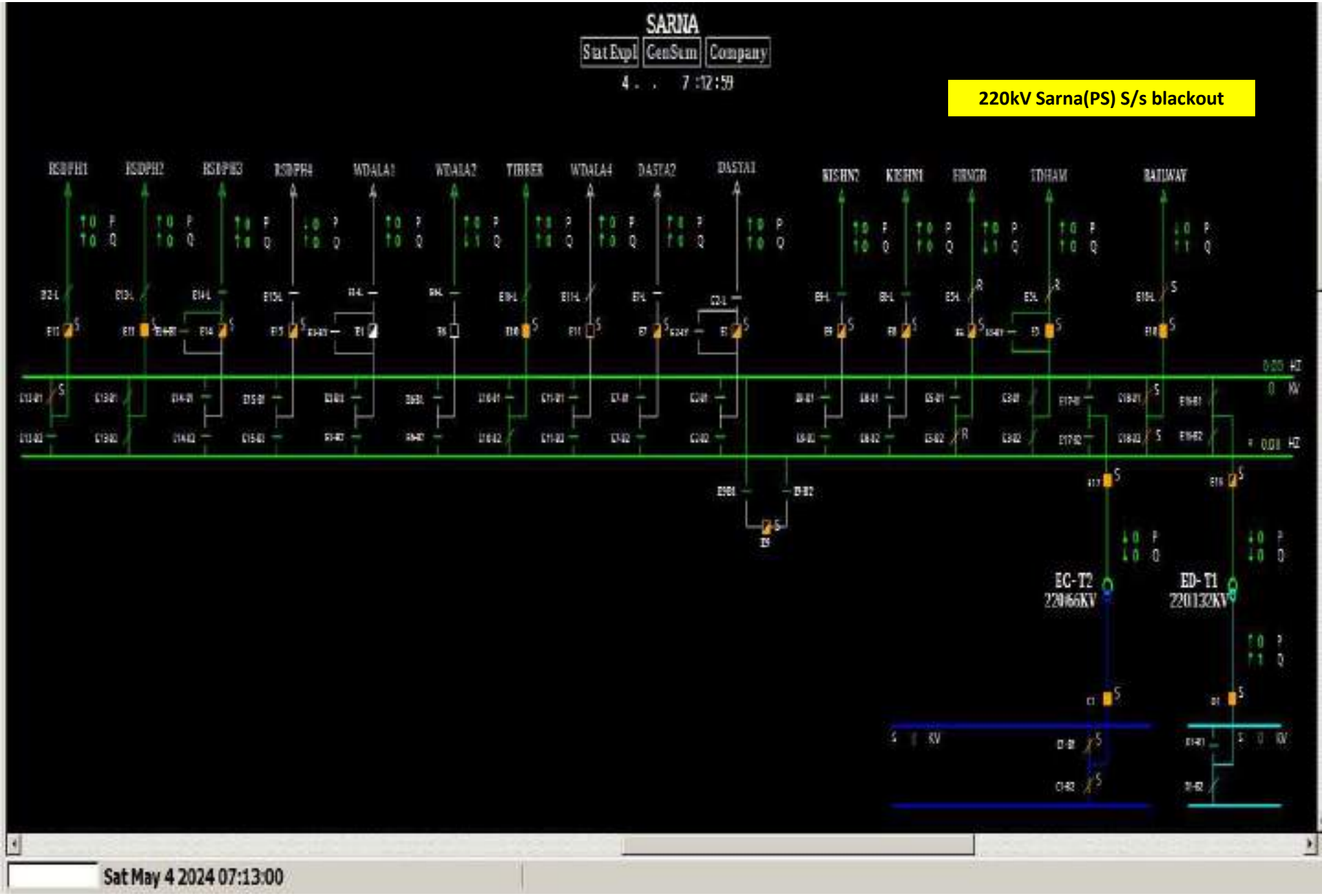
Network Diagram



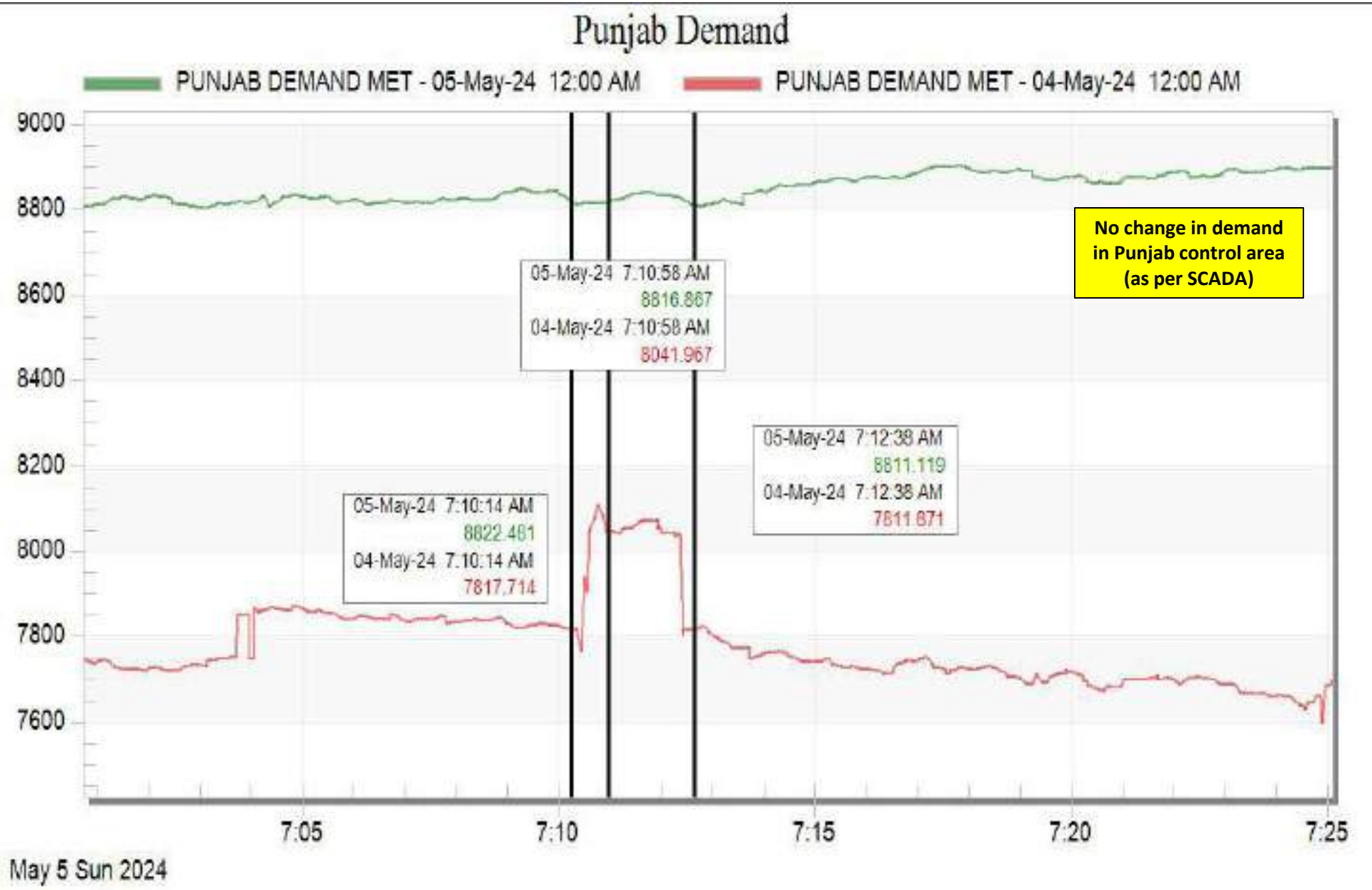
SLD of 220kV Sarna(PS) before the event



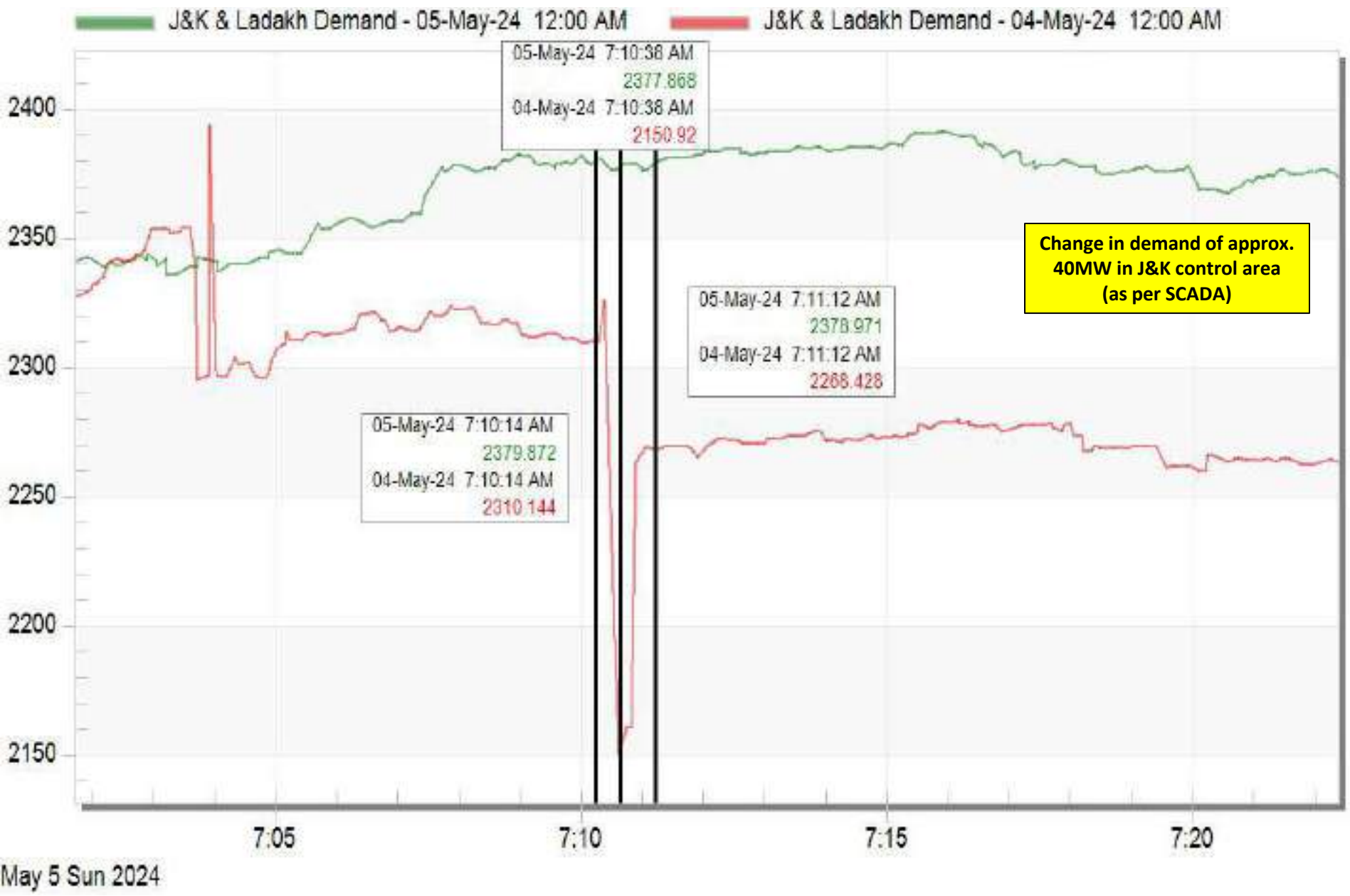
SLD of 220kV Sarna(PS) after the event



Punjab Demand during the event



J&K Demand during the event



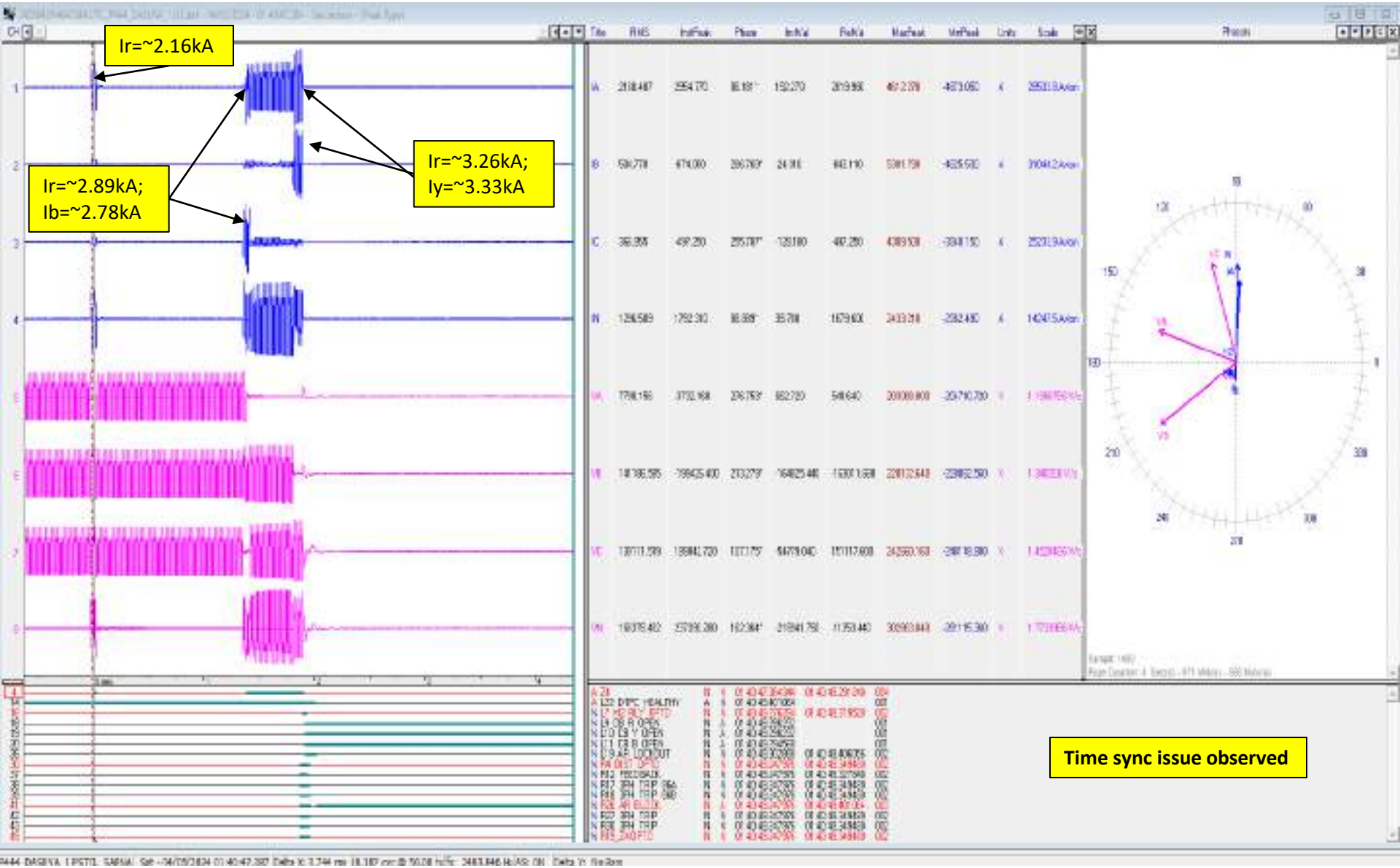
PMU Plot of frequency at Kishenpur(PG)

07:10 hrs/04-May-24

PMU Plot of phase voltage magnitude at Kishenpur(PG)

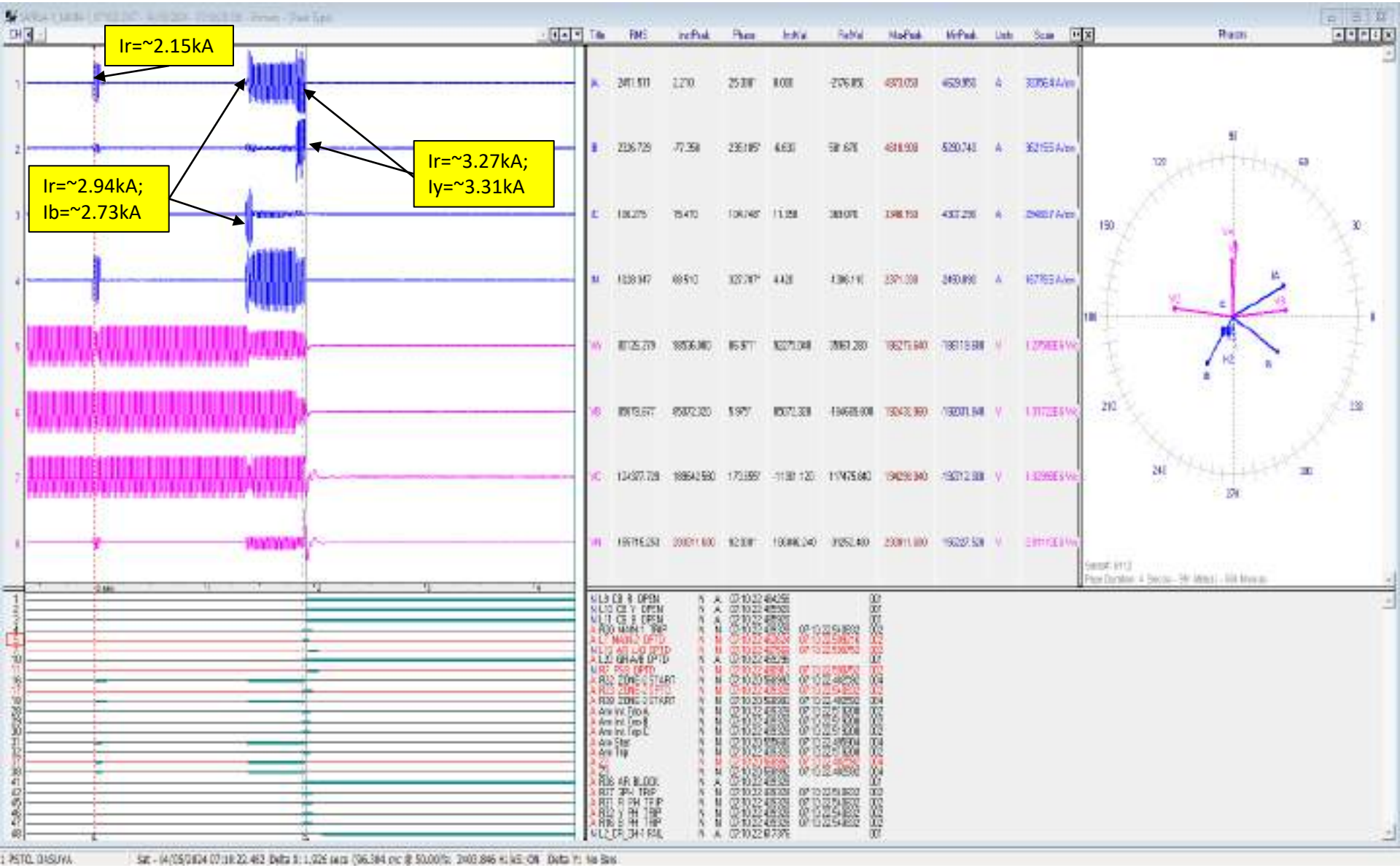
07:10 hrs/04-May-24

DR of 220 kV Sarna(PS) (end)-Dasuya(PS) (PG) Ckt-1



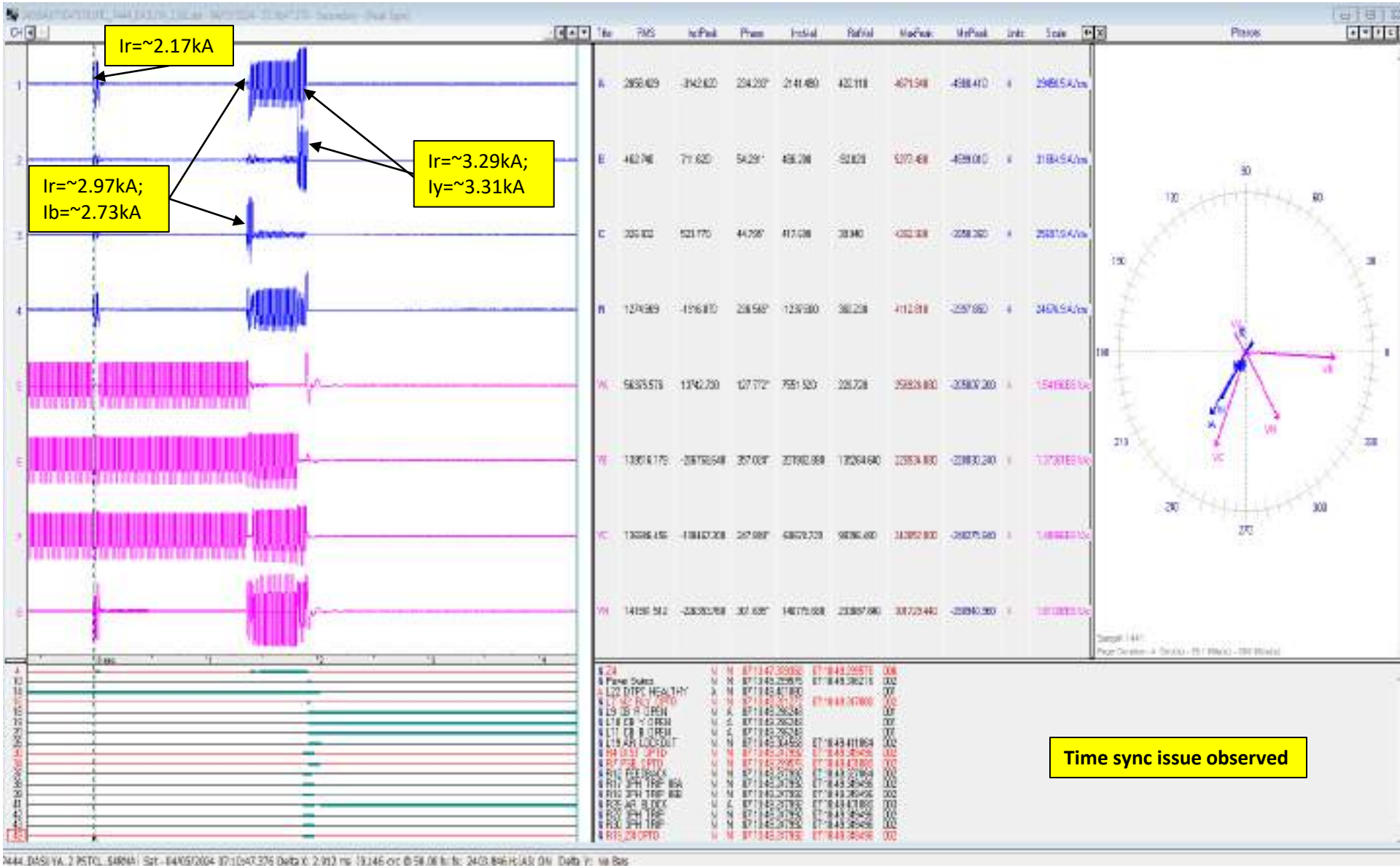
- ✓ R-N phase to earth fault followed by R-B-N double phase to earth fault converted to R-Y-N double phase to earth fault
- ✓ Zone-4 operated after a delay of ~528 ms at Sarna(PS) end

DR of 220 kV Sarna(PS) -Dasuya(PS) (end) (PG) Ckt-1



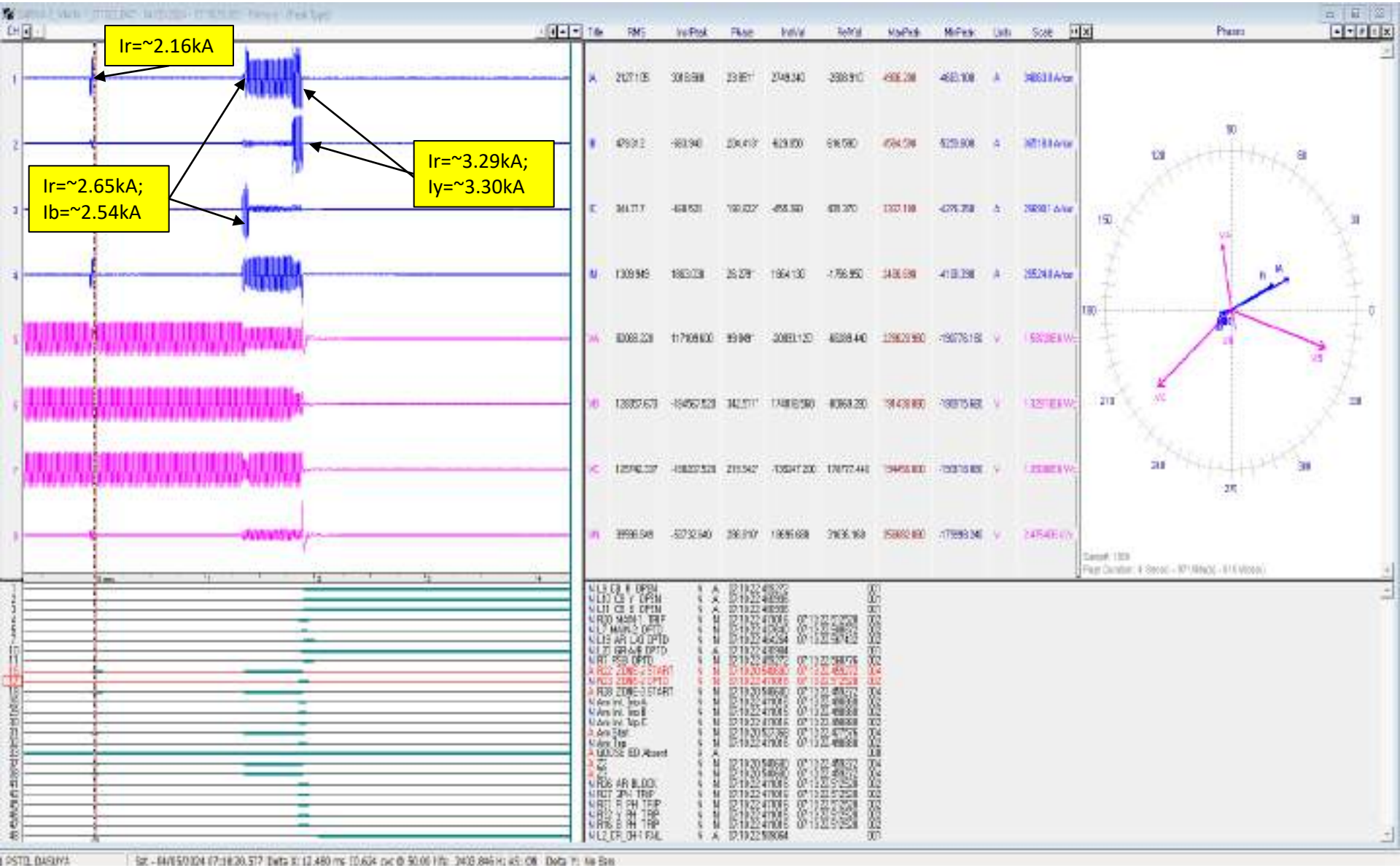
- ✓ R-N phase to earth fault followed by R-B-N double phase to earth fault converted to R-Y-N double phase to earth fault
- ✓ Zone-2 operated after a delay of ~532 ms at Dasuya(PS) end

DR of 220 kV Sarna(PS) (end)-Dasuya(PS) (PG) Ckt-2



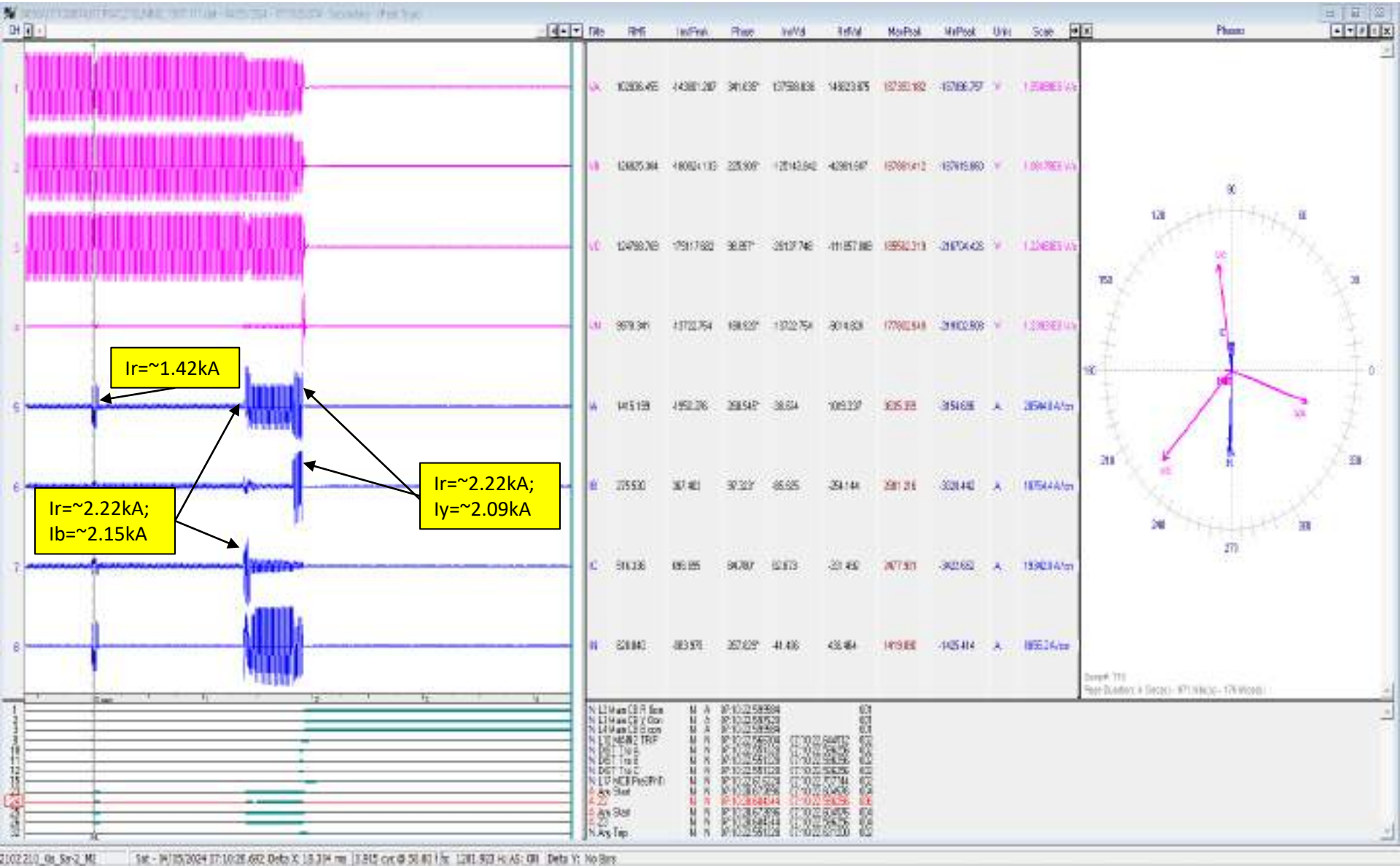
- ✓ R-N phase to earth fault followed by R-B-N double phase to earth fault converted to R-Y-N double phase to earth fault
- ✓ Zone-4 operated after a delay of ~526 ms at Sarna(PS) end

DR of 220 kV Sarna(PS) -Dasuya(PS) (end) (PG) Ckt-2



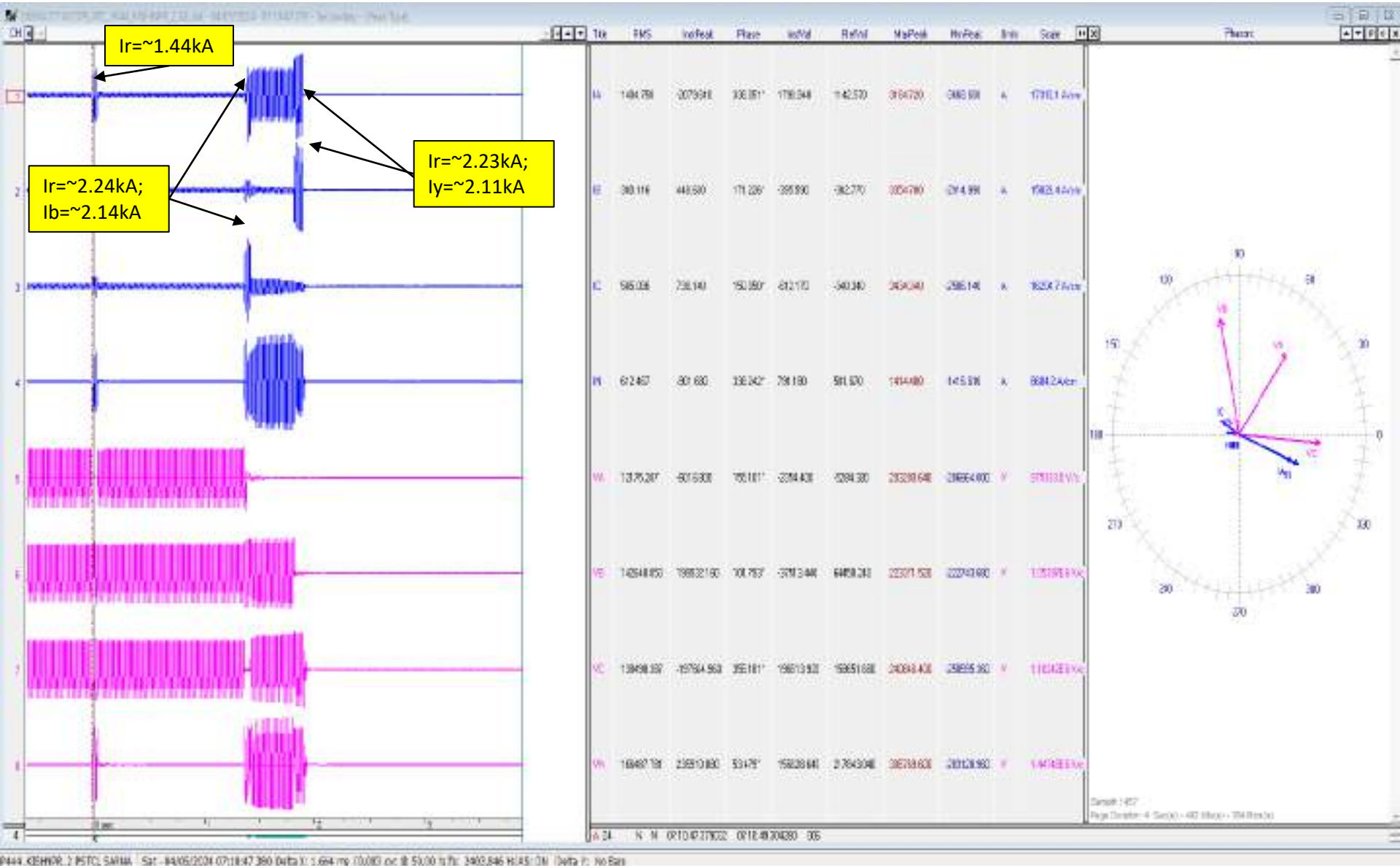
- ✓ R-N phase to earth fault followed by R-B-N double phase to earth fault converted to R-Y-N double phase to earth fault
- ✓ Zone-2 operated after a delay of ~538 ms at Dasuya(PS) end

DR of 220 kV Kishenpur(PG) (end)-Sarna(PS) (PG) Ckt-2



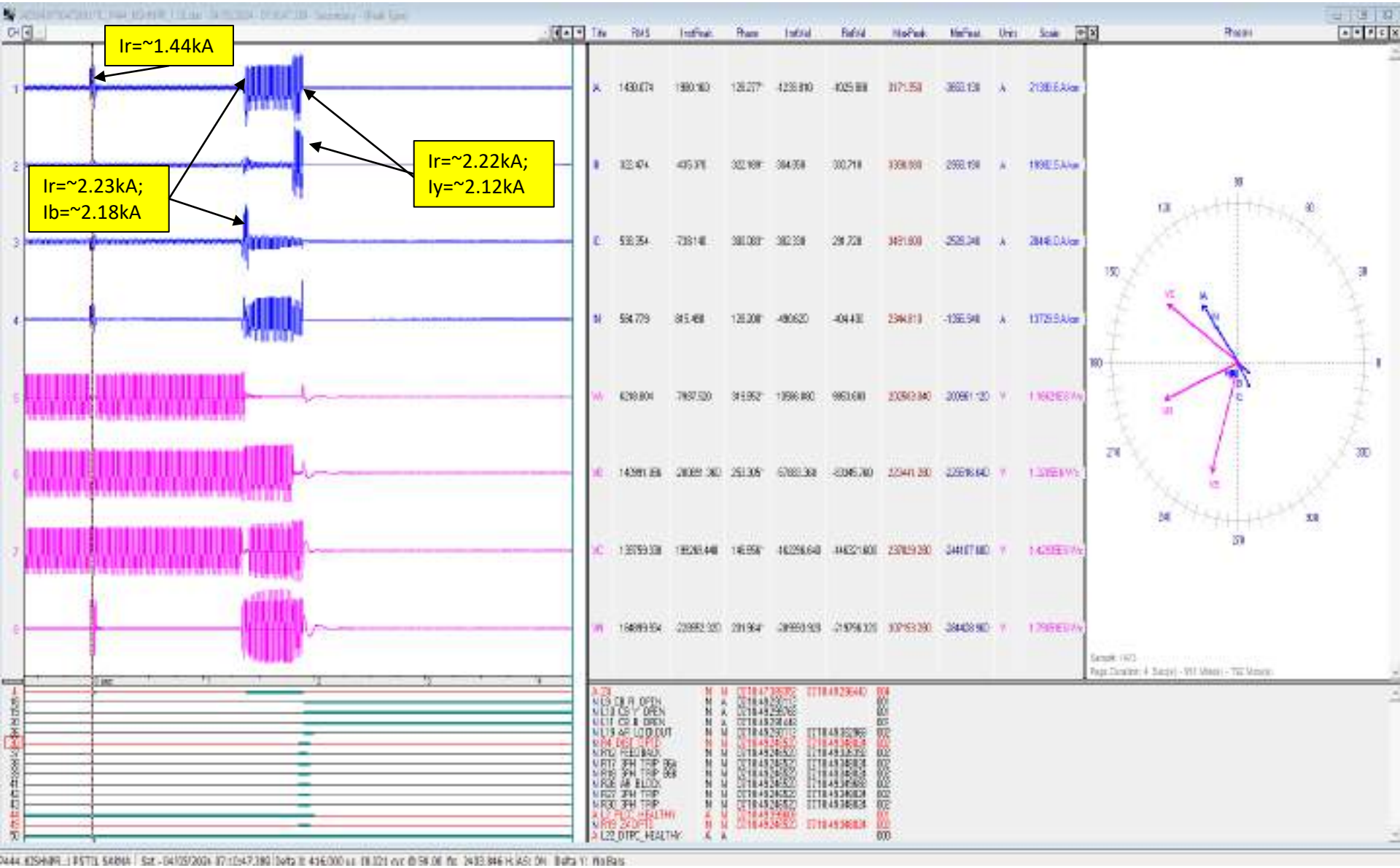
- ✓ R-N phase to earth fault followed by R-B-N double phase to earth fault converted to R-Y-N double phase to earth fault
- ✓ Zone-2 operated after a delay of ~538 ms at Kishenpur(PG) end

DR of 220 kV Kishenpur(PG) -Sarna(PS) (end) (PG) Ckt-2



- ✓ R-N phase to earth fault followed by R-B-N double phase to earth fault converted to R-Y-N double phase to earth fault
- ✓ Zone-4 operated after a delay of ~540 ms at Sarna(PS) end

DR of 220 kV Kishenpur(PG) -Sarna(PS) (end) (PG) Ckt-1



- ✓ R-N phase to earth fault followed by R-B-N double phase to earth fault converted to R-Y-N double phase to earth fault
- ✓ Zone-4 operated after a delay of ~526 ms at Sarna(PS) end

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
07:10:21,992	WDALA_PS	220kV	1SARNA1	Circuit Breaker	Open	Line CB at Wadala(PS) end of 220kV Wadala(PS)-Sarna(PS) Ckt-1 opened
07:10:22,150	RSDPH_PS	220kV	03SARNA2	Circuit Breaker	Open	Line CB at RSDPH(PS) end of 220kV RSDPH(PS)-Sarna(PS) Ckt-2 opened
07:10:22,152	RSDPH_PS	220kV	04SARNA3	Circuit Breaker	Open	Line CB at RSDPH(PS) end of 220kV RSDPH(PS)-Sarna(PS) Ckt-3 opened
07:10:22,549	SARNA_PS	220kV	6WDALA2	Circuit Breaker	Open	Line CB at Wadala(PS) end of 220kV Wadala(PS)-Sarna(PS) Ckt-2 opened
07:10:22,585	KISHN_PG	220kV	10SARNA2	Circuit Breaker	Open	Line CB at Kishenpur(PG) end of 220 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-2 opened
07:10:22,587	KISHN_PG	220kV	11SARNA1	Circuit Breaker	Open	Line CB at Kishenpur(PG) end of 220 KV Kishenpur(PG)-Sarna(PS) (PG) Ckt-1 opened

Point of discussion

- As per Protection Philosophy of Northern Region, Zone-4 time delay setting should be 160ms where busbar protection is not available. Zone-4 time delay settings of lines at Sarna(PS) need to be reviewed.
- Exact reason, location and nature of fault need to be shared.
- DR time sync issue at Sarna(PS) need to be resolved at the earliest.
- Reason of delayed clearance of fault need to be shared.
- DR/EL along with tripping report need to be shared from both the ends.
- Remedial action taken report need to be shared.

TRIPPING ON DT 04.05.2024 AT 220 KV S/S SARNA

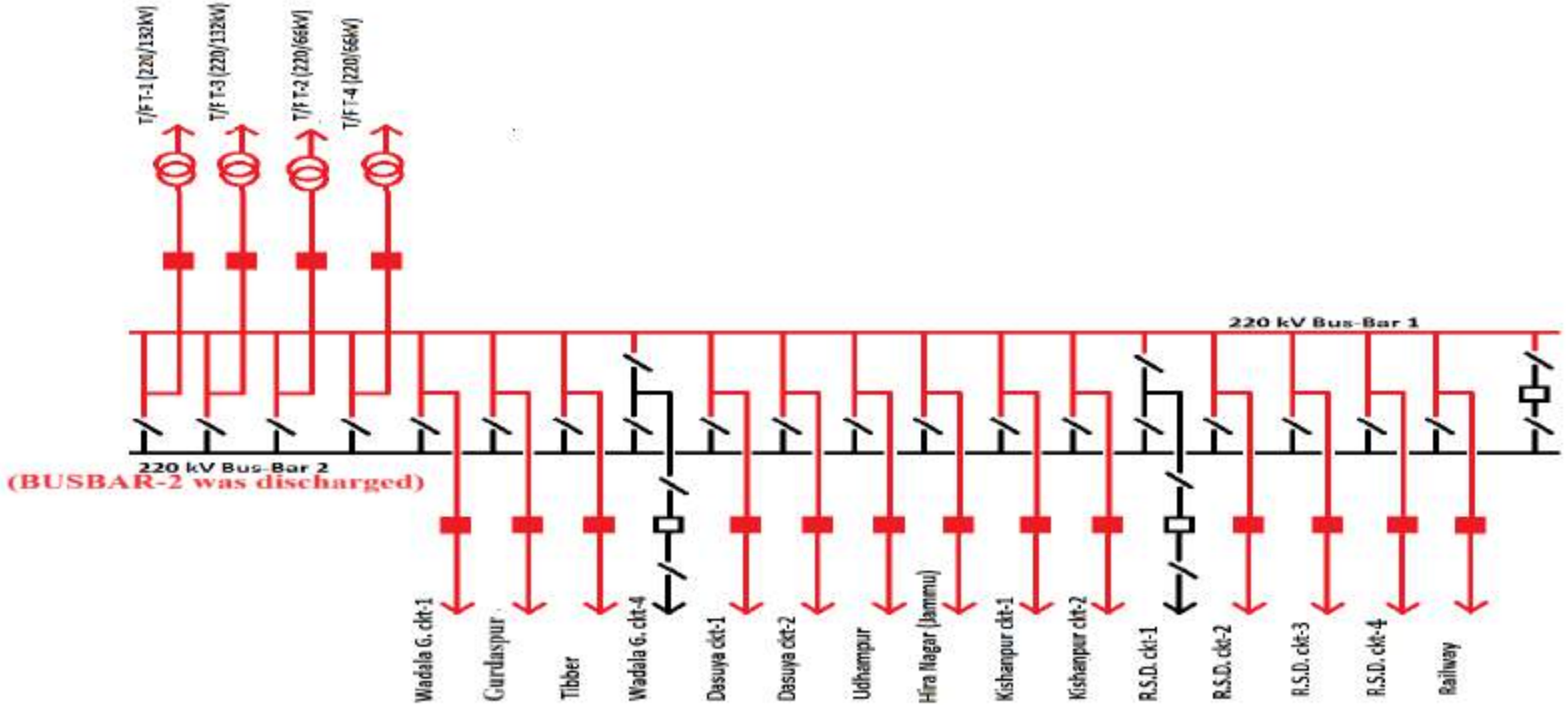
PUNJAB STATE TRANSMISSION CORPORATION LIMITED

BEFORE AND AFTER FAULT LOAD CONDITION AT 220 KV SARNA

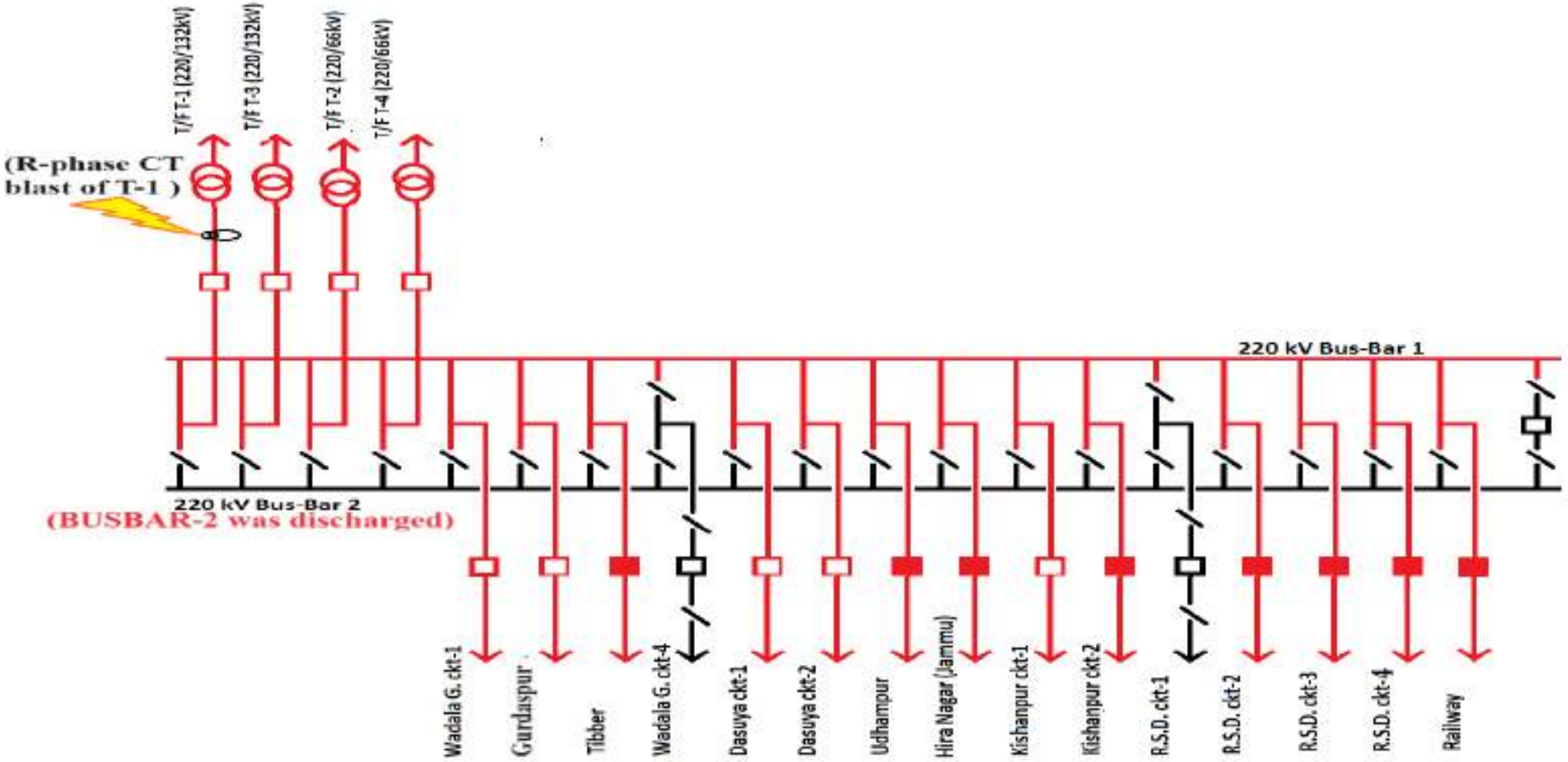
FAULT DT – 04.05.2024 FAULT TIME : - 07:11 HRS.

Sr No	T/Line or ICT Description	Load in Amp (at 07:00 Hrs.)	Load in Amp (at 08:00 Hrs.)
1	220 kV Sarna – Dasuya ckt-1	15	Trip
2	220 kV Sarna – Dasuya ckt-2	15	Trip
3	220 kV Sarna – Wadala Granthian ckt- 1	80	70
4	220 kV Sarna – Gurdaspur	60	Trip
5	220 kV Sarna - Tibber	90	75
6	220 kV Sarna – Wadala Granthian ckt- 4	PTW	PTW
7	220 kV Sarna – Udhampur	30	OFF
8	220 kV Sarna – Hiranagar	35	OFF
9	220 kV Sarna – Kishanpur-1	45	OFF
10	220 kV Sarna – Kishanpur-2	45	OFF
11	220 kV Sarna – RSD ckt - 1	PTW	PTW
12	220 kV Sarna – RSD ckt - 2	90	OFF
13	220 kV Sarna – RSD ckt - 3	90	75
14	220 kV Sarna – RSD ckt – 4	90	75
15	220/132 kV 100 MVA T/F T -1	20	Faulty
16	220/66 kV 100 MVA T/F T -2	25	OFF
17	220/132 kV 100 MVA T/F T- 3	20	OFF
18	220/66 kV 100 MVA T/F T- 4	25	OFF
19	220 kV Railway	5	5
20	220 kV Bus - coupler	OFF	OFF

BEFORE FAULT AT 220 KV S/S SARNA



AFTER FAULT AT 220 KV S/S SARNA



TRIPPING SEQUENCE AT 220 KV S/ SARNA

(ELEMENTS TRIPPED FROM SARNA END)

- **220/132 kV Transformer T-3** (**Differential Trip**, **Fault clearing time – 72 msec**)
- **220 kV Sarna - Gurdaspur** (**Zone-4 Trip**, **Fault clearing time – 220 msec**, **Z4 setting – 160 msec**)
- **220 kV Sarna – Wadala G. ckt-1** (**Zone-4 Trip**, **Fault clearing time – 210 msec, Z4 setting – 160 msec**)
- **220 kV Sarna - Dasuya ckt – 1** (**Zone-4 Trip, , Fault clearing time – 540 msec, Z4 setting – 500 msec**)
- **220 kV Sarna - Dasuya ckt – 2** (**Zone-4 Trip , Fault clearing time – 541 msec, Z4 setting – 500 msec**)
- **220 kV Sarna - Kishanpur ckt – 1** (**Zone-4 Trip , Fault clearing time – 540 msec, Z4 setting – 500 msec**)

TRIPPING SEQUENCE AT 220 KV S/ SARNA

(CIRCUITS TRIPPED FROM REMOTE END)

- **220 kV Sarna – RSD ckt -2, 3 & 4 (over-reached , Zone-1 Trip)**
- **220 kV Sarna – Tibber (over-reached , Zone-1 Trip)**
- **220 kV Sarna – Dasuya ckt – 1 (Zone-2 Trip, Fault clearing time – 535 msec, Z2 setting – 500 msec)**
- **220 kV Sarna – Dasuya ckt – 2 (Zone-2 Trip, Fault clearing time – 552 msec, Z2 setting – 500 msec)**
- **220 kV Sarna – Hiranagar**
- **220 kV Sarna – Udhampur**
- **220 kV Sarna – Kishanpur ckt - 1 & 2**

TRIPPING SEQUENCE AT 220 KV S/ SARNA
(CIRCUIT NOT TRIPPED)

- **<u>220 kV Sarna – Railway</u>** **(Not tripped due to Raidial feeder)**

220 KV BUSBAR PROTECTION AT SARNA

- ABB make Busbar protection relay installed at 220 kV Sarna is kept of out circuit due to no. of bays exceeds the limit of AB-18 type panel.
- Work Order for augmentation has been issued to M/s ABB (Now M/s Hitachi) but work is yet to be started by the firm

CONCLUSION

- R-ph CT of 220/132 kV Transformer T-1 got blast at 07:11 Hrs. at 220 kV S/s Sarna but no trip data available in T-1 relays for analysis.
- Transformer T-3 Tripped due to B-phase differential protection operation as B-phase jumper was adjacent to R-phase of T-1 and came in impact zone when Transformer T-1 R-phase CT blast.
- 220 kV Sarna – Gurdaspur and Sarna – Wadala Granthian ckt-1 tripped from sarna end with Zone-4 indication under 220 msec.
- 220 kV Dasuya ckt-1 & 2 tripped from both ends as setting of Zone-4 at Sarna was 500 msec and Zone-2 setting at Dasuya was also 500 msec. So fault was cleared from both ends under appr. 550 msec.)
- 220 kV Kishanpur ckt-1 also tripped from Sarna end with Zone-4 indications but took appr 550 msec as Zone-4 setting was 500 msec.
- All other 220 kV lines i.e. RSD ckt-2,3 &4 , Kishanpur ckt-2, Hiranagar, Udhampur, Tibber, were picked in Zone-4 but did not completed zone-4 time and line remain charged from sarna end but tripped from other ends under zone-2 or over-reached and tripped in zone-1.

Multiple elements tripping at 220kV Sultanpur(PS) & Goindwal(PS) 07th May 2024

Brief of event:

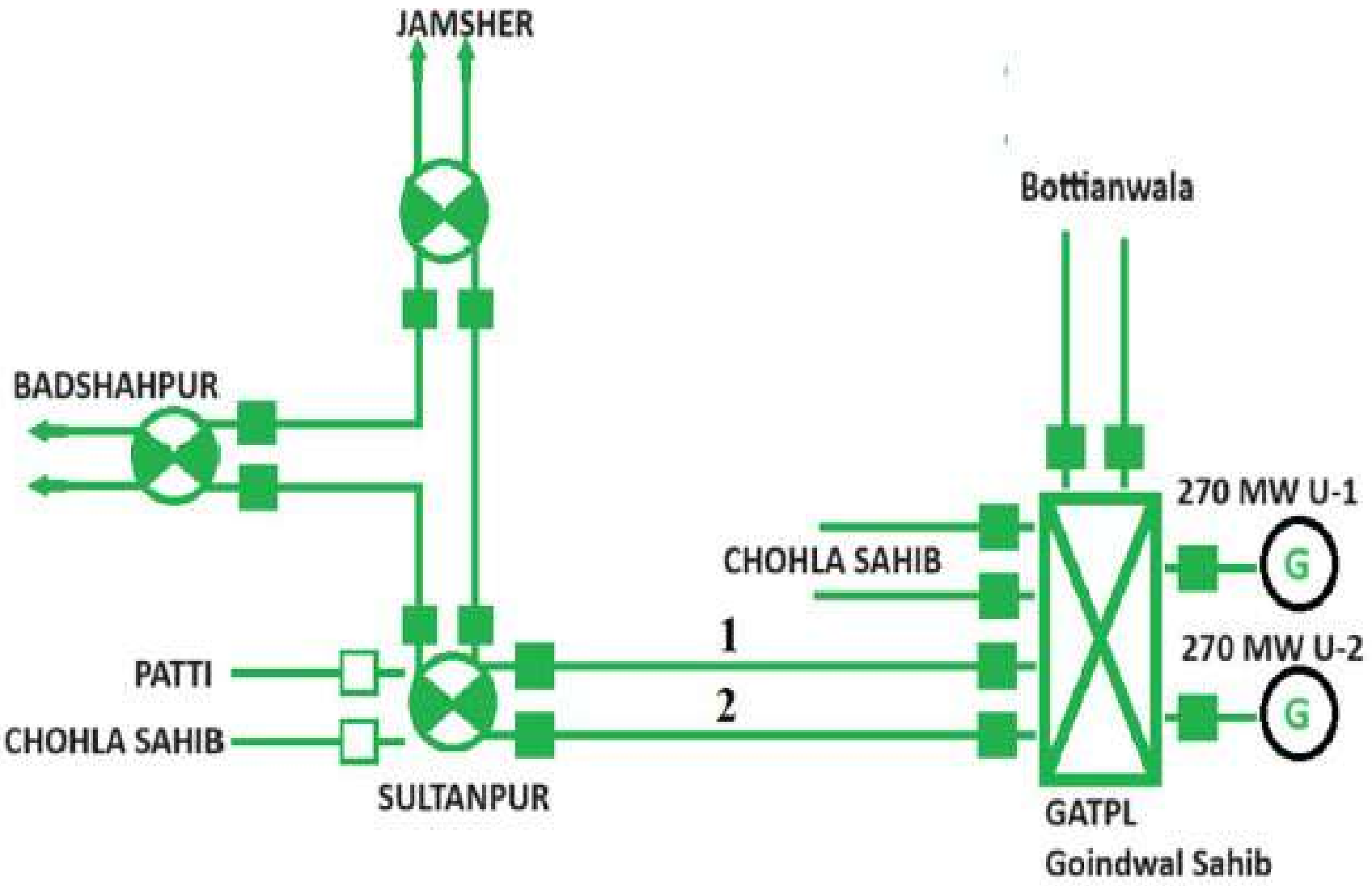
i. During antecedent condition, 220 kV Sultanpur(PS)-Chohla Sahib(PS) Ckt, 220 kV Sultanpur(PS)-Patti(PS) Ckt and 220 kV Chohla Sahib(PS)- Patti(PS) Ckt were not in service.
ii. As reported, at 14:30 hrs, a piece of stray flexible conductor came within induction zone of 220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-2 as it fell on tower location no. 16 which led to tripping of this circuit with fault distance of 5km from Goindwal TPS end.
iii. Distance Protection Relay (DPR) at Goindwal TPS end sensed the fault in zone-1 and line tripped immediately from Goindwal TPS end. But Distance Protection Relay at Sultanpur end detected power swing scenario and due to PSD block of DPR for 2 seconds (de-blocking time) at Sultanpur end, fault continued to feed through 220 KV Sultanpur(PS)-Badshahpur(PS) Ckt, 220 KV Sultanpur(PS)- Jamsher(PS) Ckt and 220 KV Sultanpur(PS)-Goindwal TPS(PS) Ckt-1.
iv. Badshahpur and Jamsher end DPRs issued trip command in zone-3 after 800ms and fault feeding stopped from these ends. But fault feeding continued through 220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-1 as Goindwal TPS end DPR did not pick up the fault in zone-3.
v. This led to tripping of 270 MW Goindwal(GVK) - UNIT 1 & 2 on earth-fault protection operation (51 NGT) after 1 sec.
vi. As per PMU at Amritsar(PG), R-N phase to earth fault converted to 3-phase fault with delayed fault clearing time of 2120ms is observed.
vii. As per SCADA, change in demand of approx. 100MW is observed in Punjab control area.
viii. As reported by SLDC-Punjab, generation loss of approx. 500MW occurred at Goindwal TPS(PS).

Brief of event:

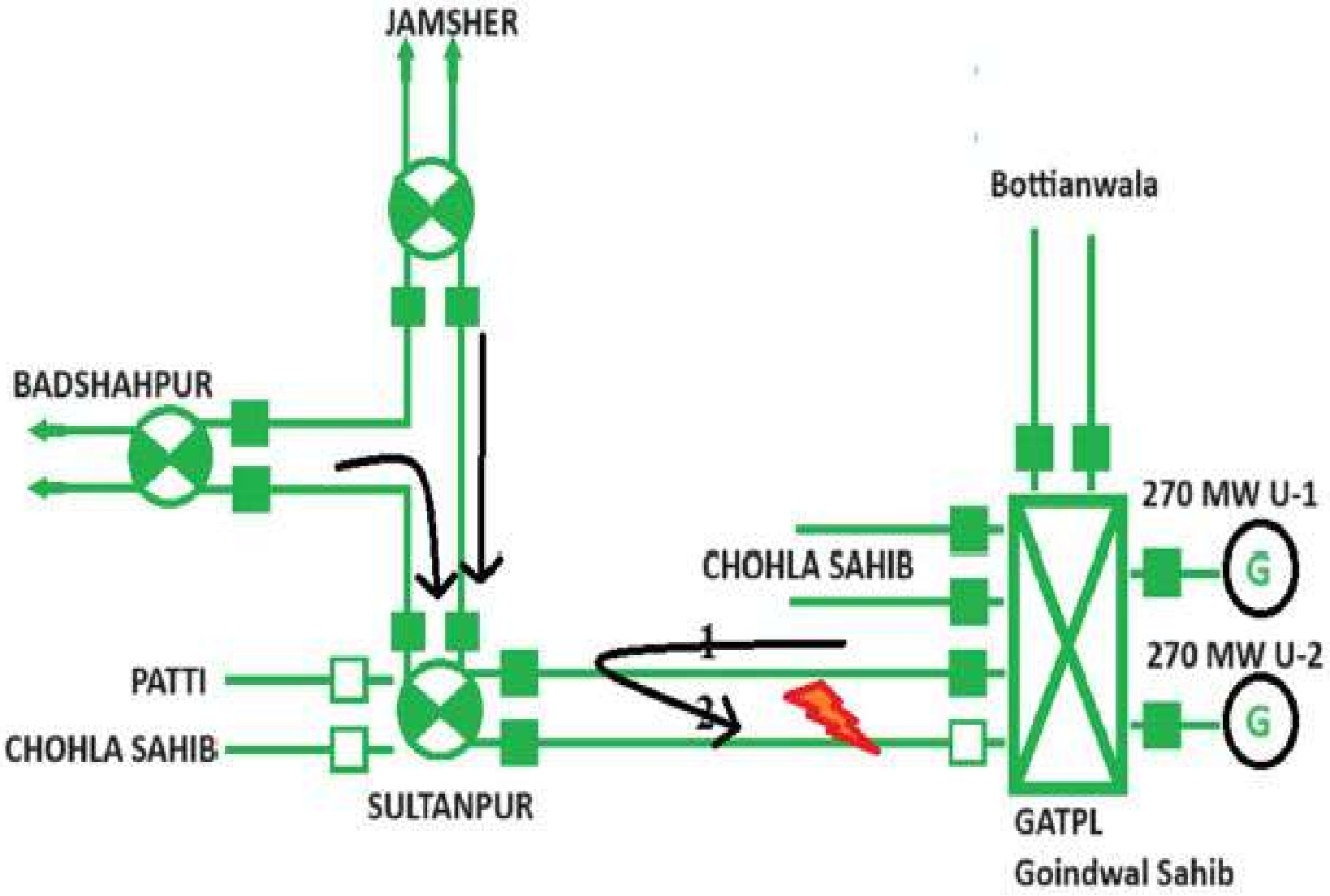
Elements tripped:

1) 220 KV Sultanpur(PS)- Goindwal TPS(PS) Ckt-2
2) 220 KV Sultanpur(PS)- Badshahpur(PS) Ckt
3) 220 KV Sultanpur(PS)- Jamsher(PS) Ckt
4) 270 MW Goindwal(GVK) - UNIT 1
5) 270 MW Goindwal(GVK) - UNIT 2

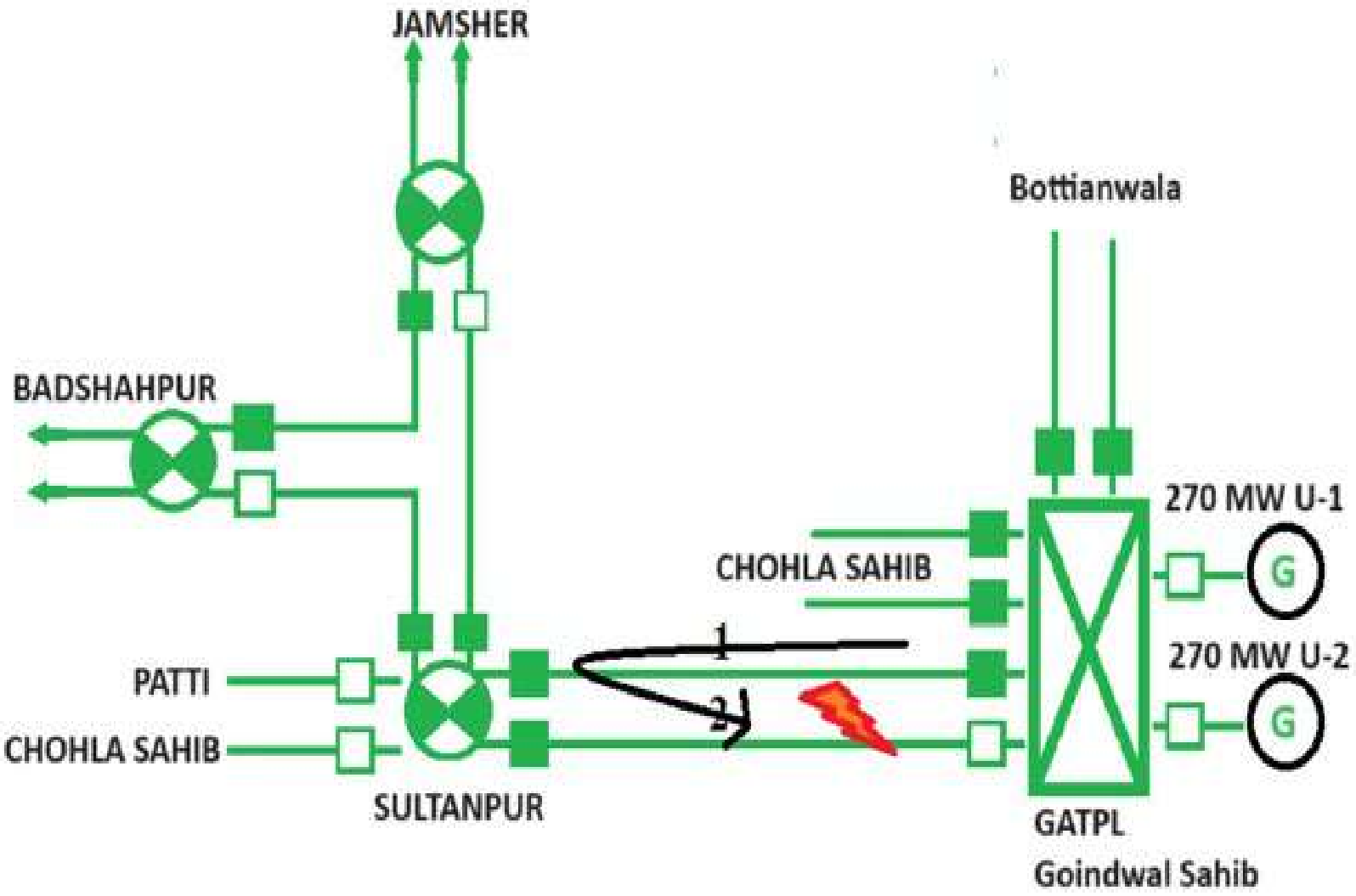
Connectivity Diagram before the event



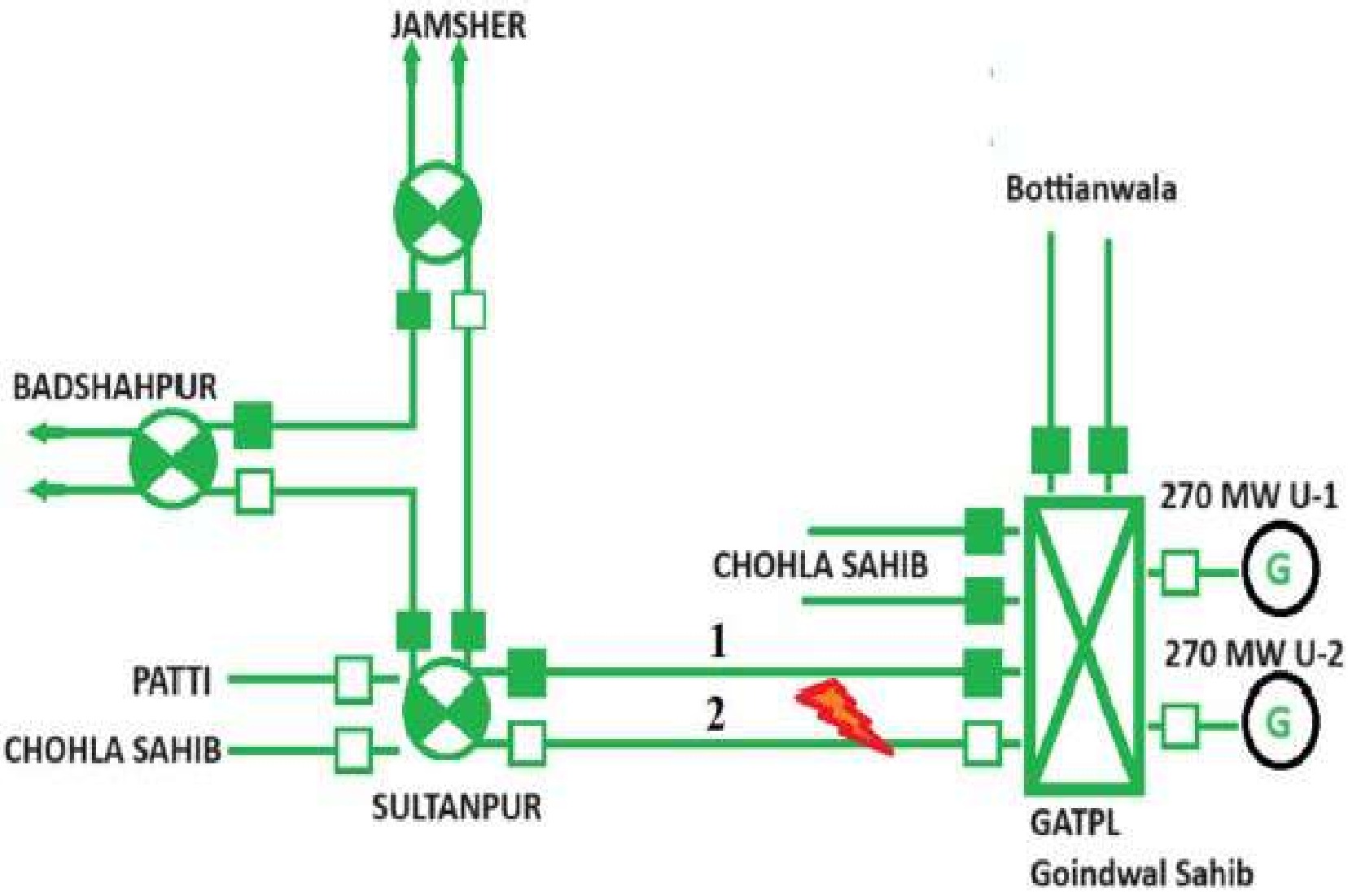
Fault feeding due to power swing block at Sultanpur end



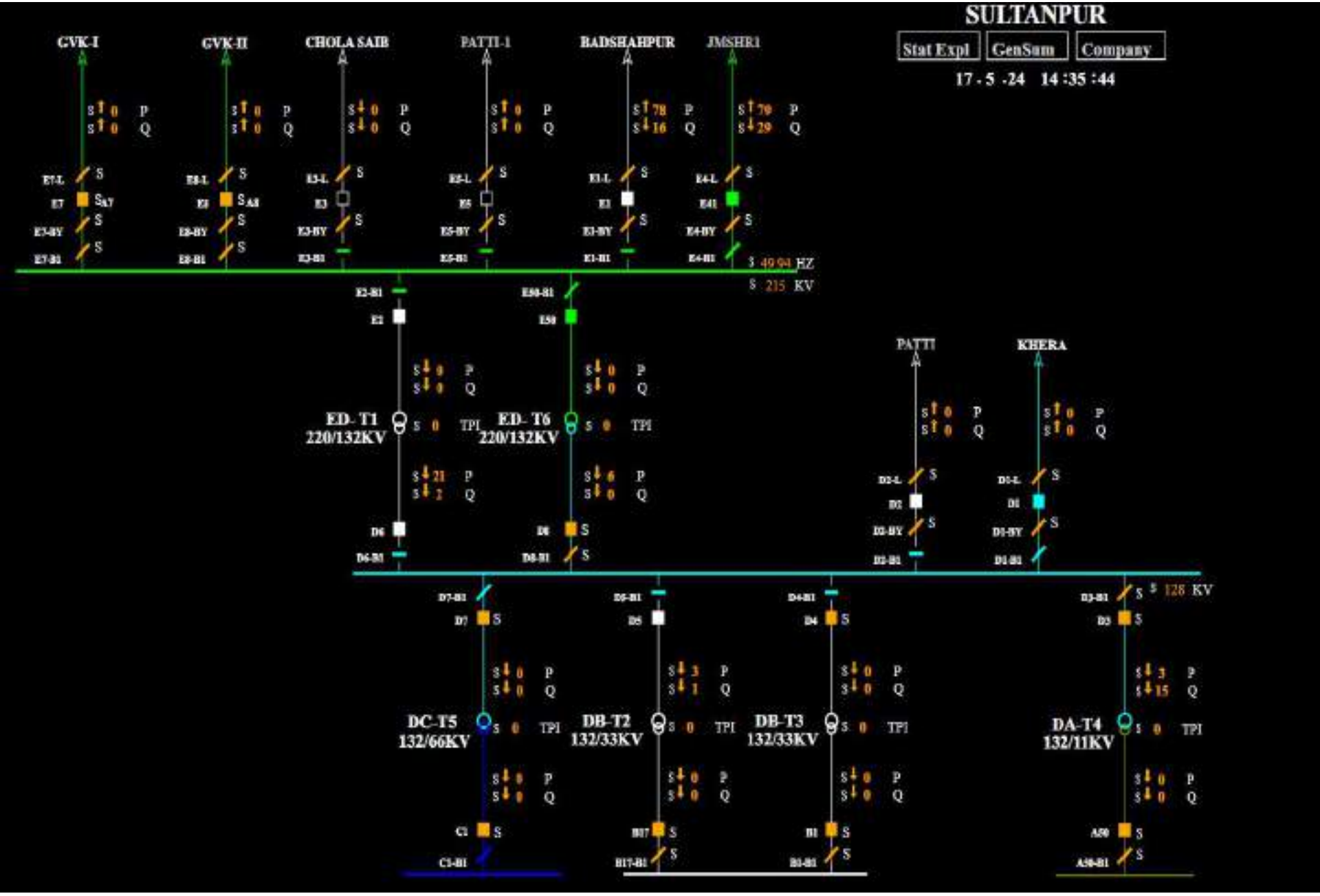
Trippings from Remote end in zone-3



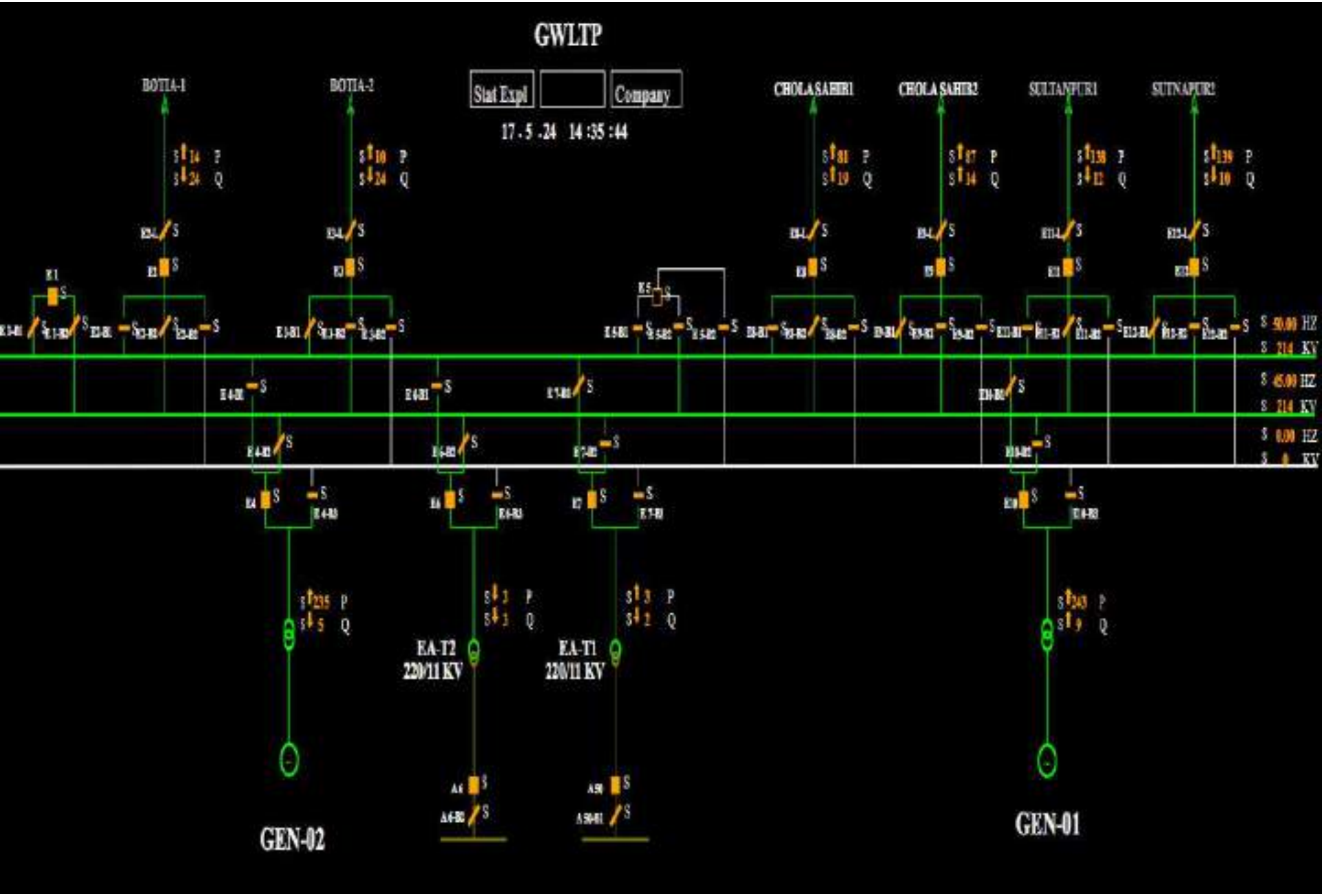
Fault clearance after deblocking of PSD at Sultanpur end



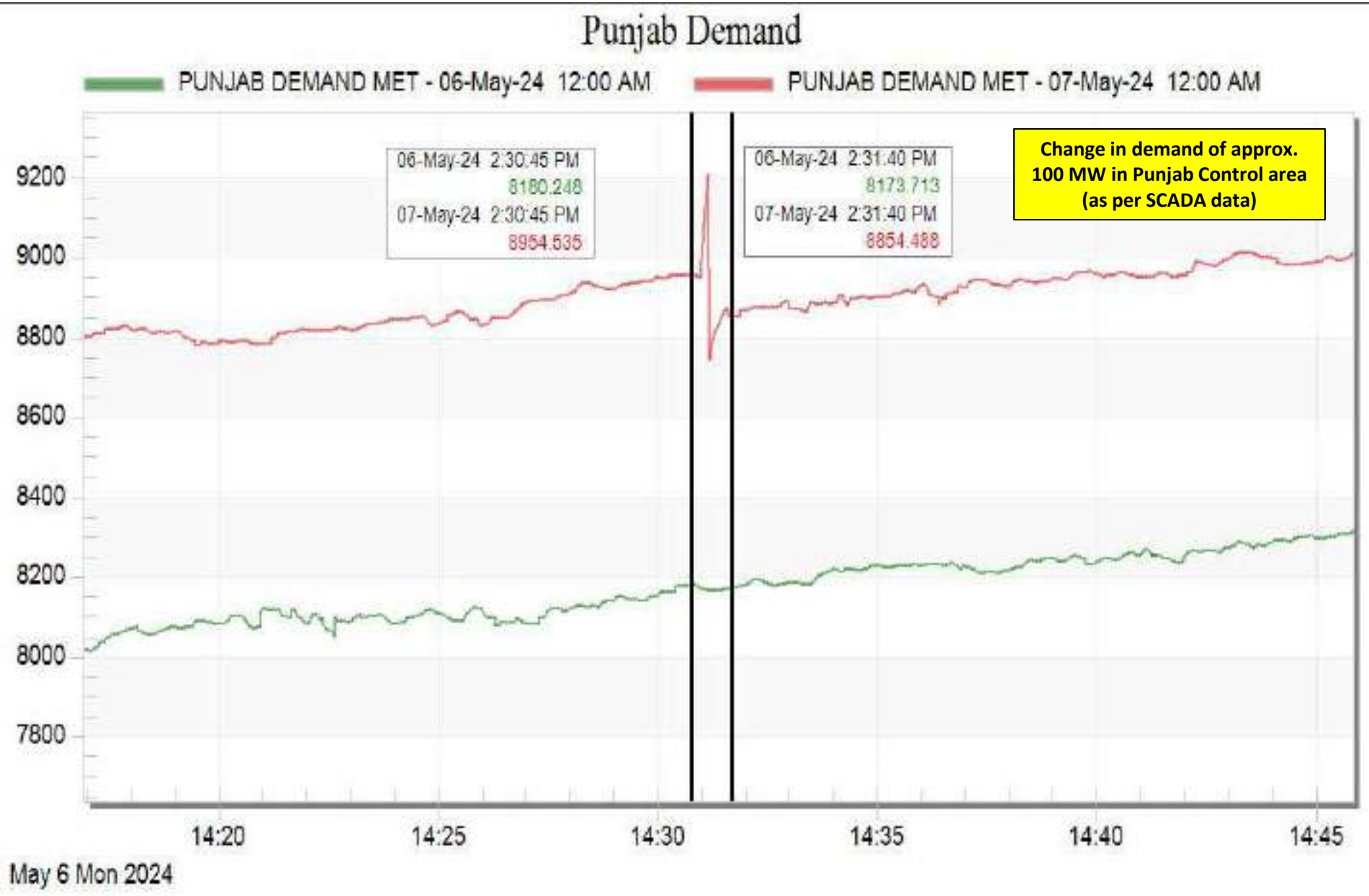
SCADA SLD of 220/132kV Sultanpur(PS)



SCADA SLD of 220kV Goindwal TPS(PS)



Punjab demand during the event



PMU Plot of frequency at Amritsar(PG)

14:30hrs/07-May-24

PMU Plot of phase voltage magnitude at Amritsar(PG)

14:30hrs/07-May-24

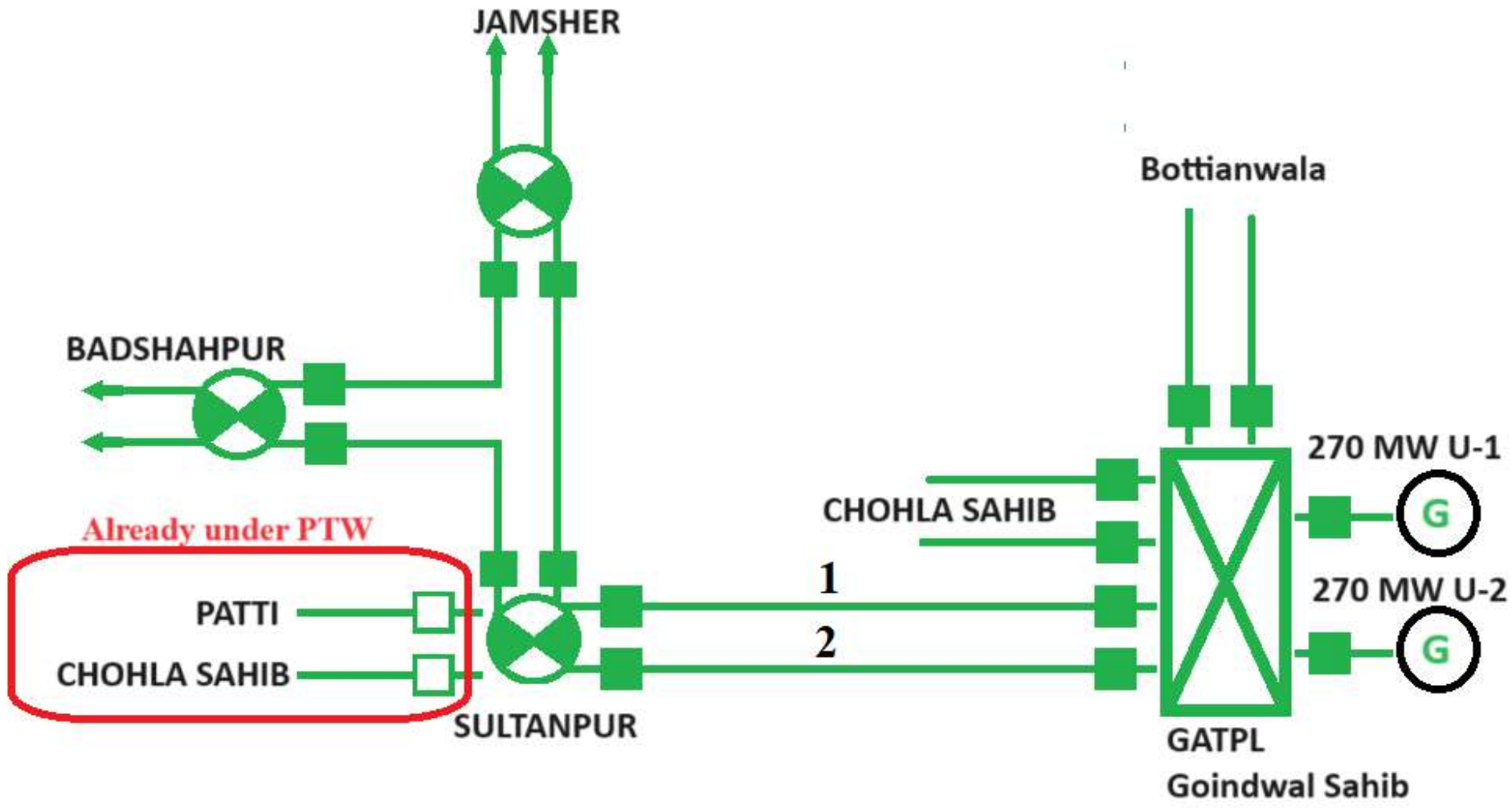
Point of discussion

- Exact nature of fault need to be shared.
- Reason of delayed clearance of fault need to be shared.
- Protection co-ordination need to be ensured at Sultanpur(PS) and Goindwal TPS(PS).
- Zone-3 settings at Goindwal TPS(PS) need to be shared and reviewed.
- Earth-fault protection settings (51 NGT) of units at Goindwal TPS(PS) need to be shared and reviewed.
- DR/EL along with tripping report need to be shared from both the ends.
- Remedial action taken report need to be shared.

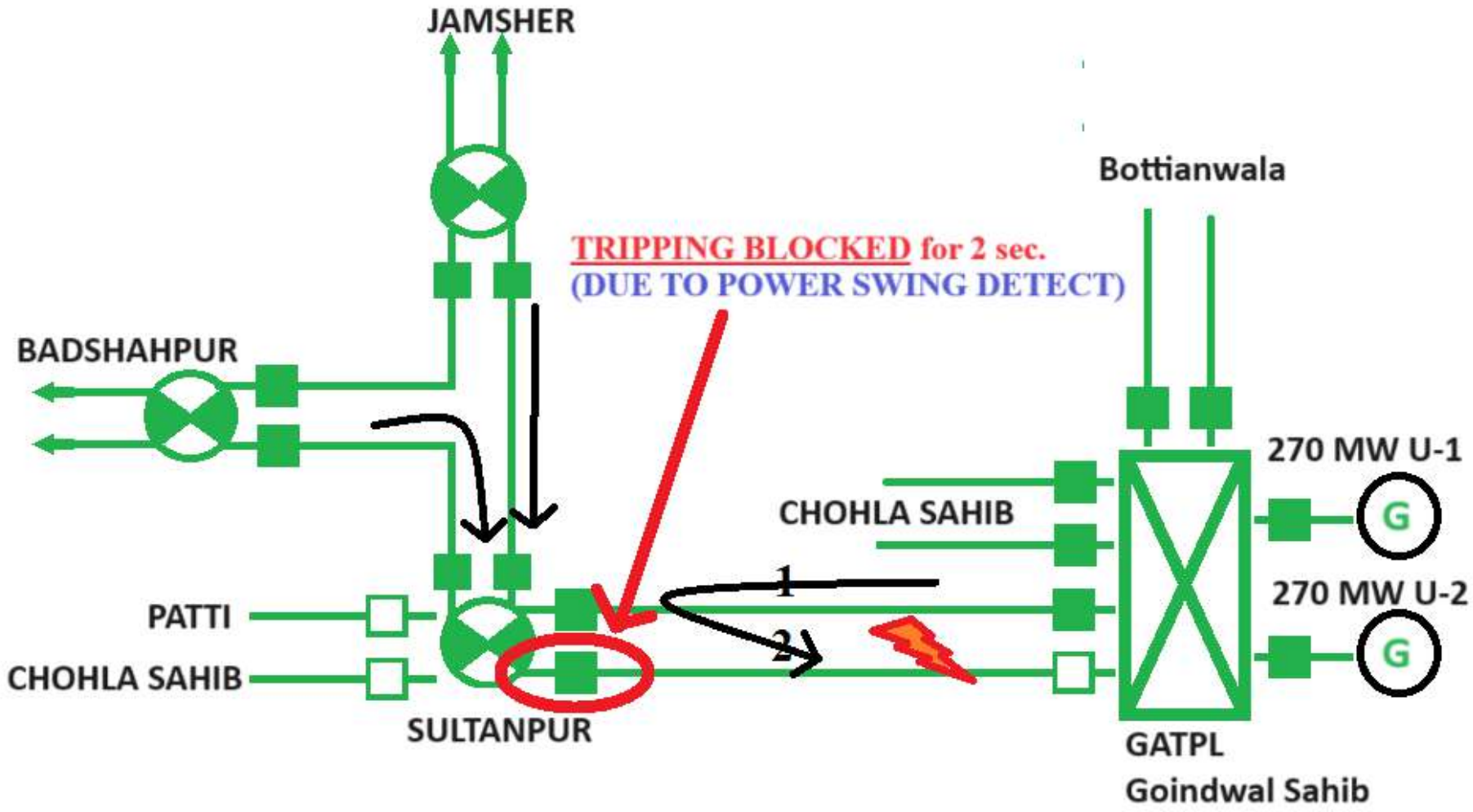
Multiple Tripping on dt 07-05-2024

ELEMENT TRIPPED :-	270 MW UNITS #1 & #2 GATPL (GVK), GOINDWAL SAHIB
	220 KV SULTANPUR – GVK CIRCUIT NO. 2
	220 KV SULTANPUR – BADSHAHPUR CIRCUIT
	220 KV SULTANPUR – JAMSHER CIRCUIT

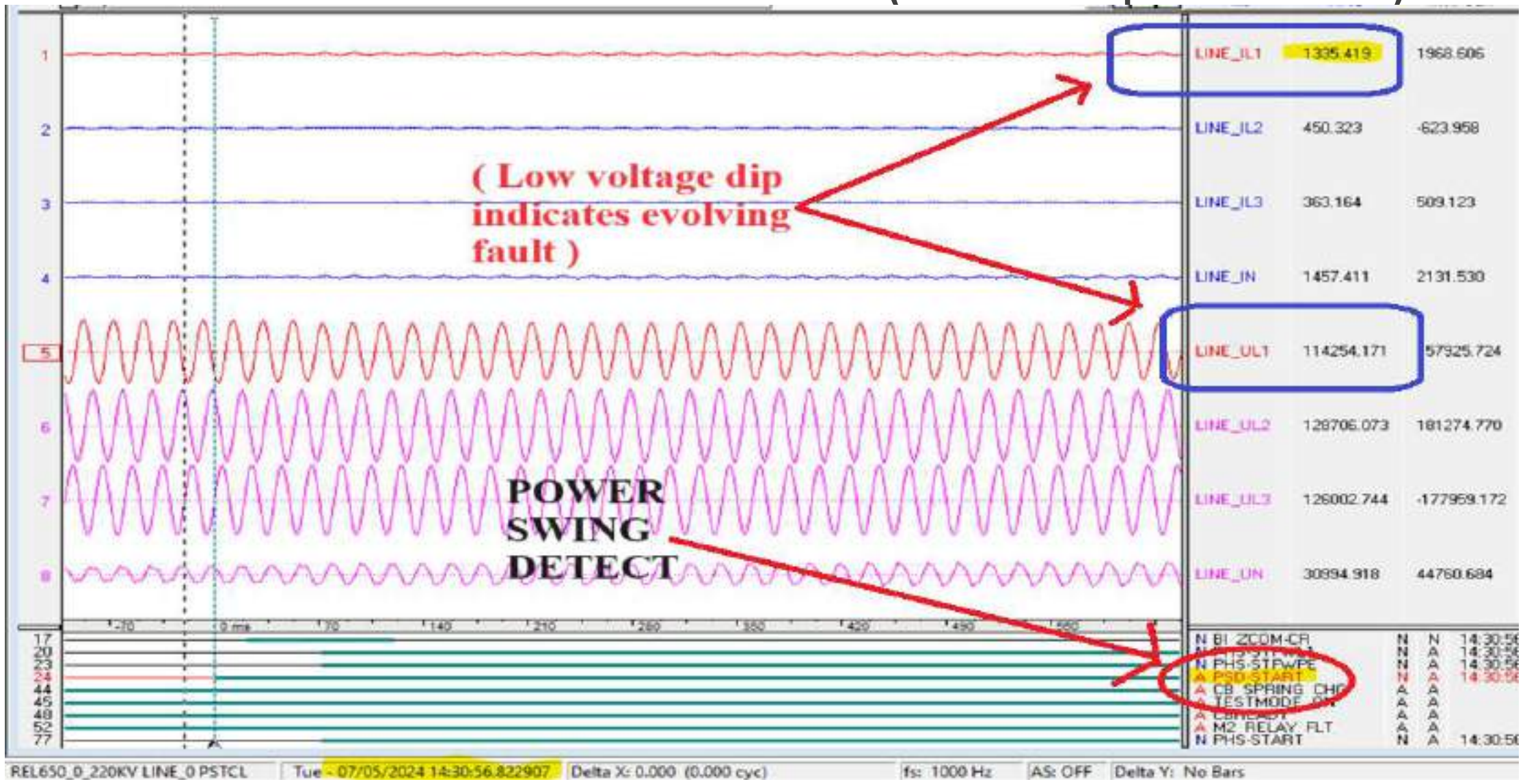
BEFORE FAULT



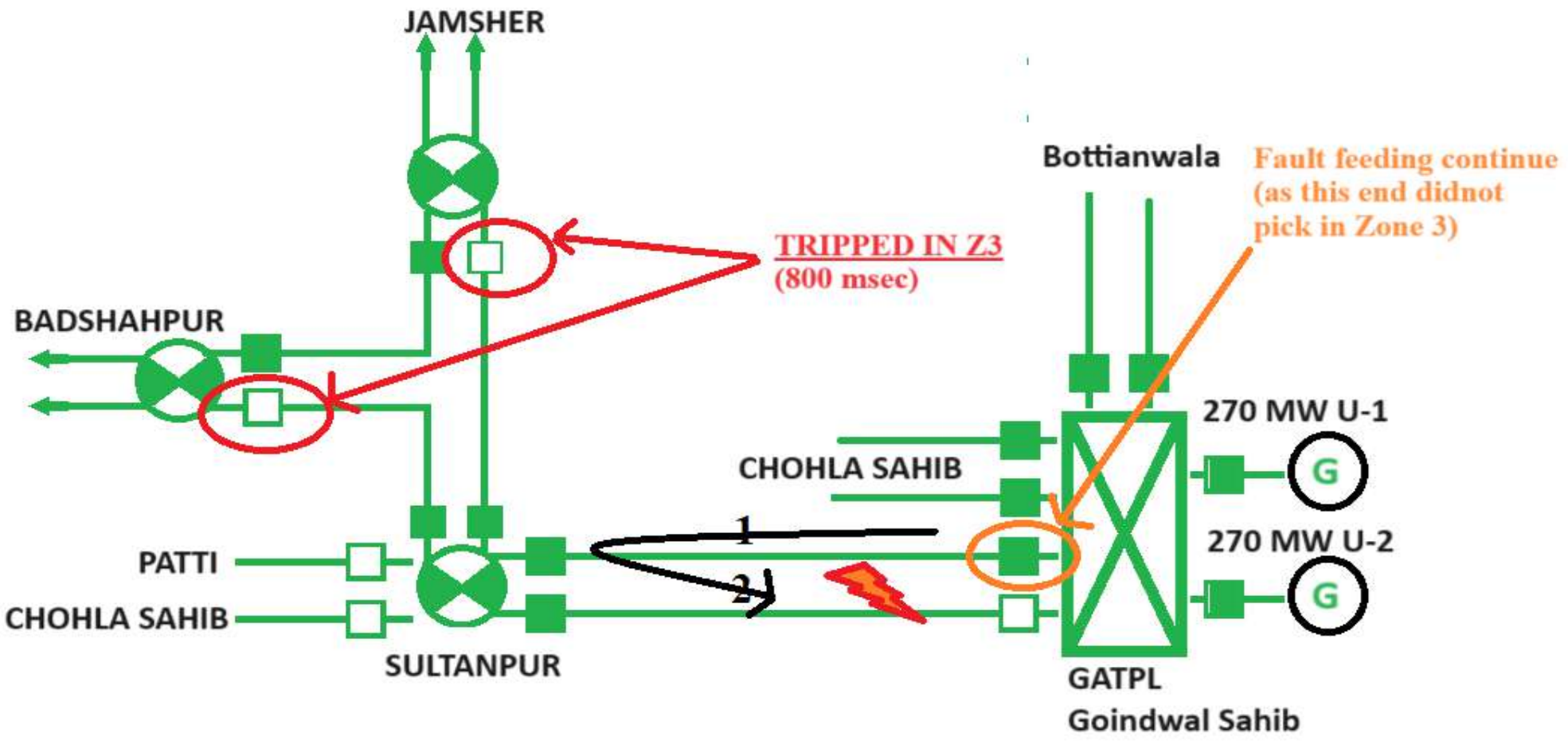
FAULT FEEDING



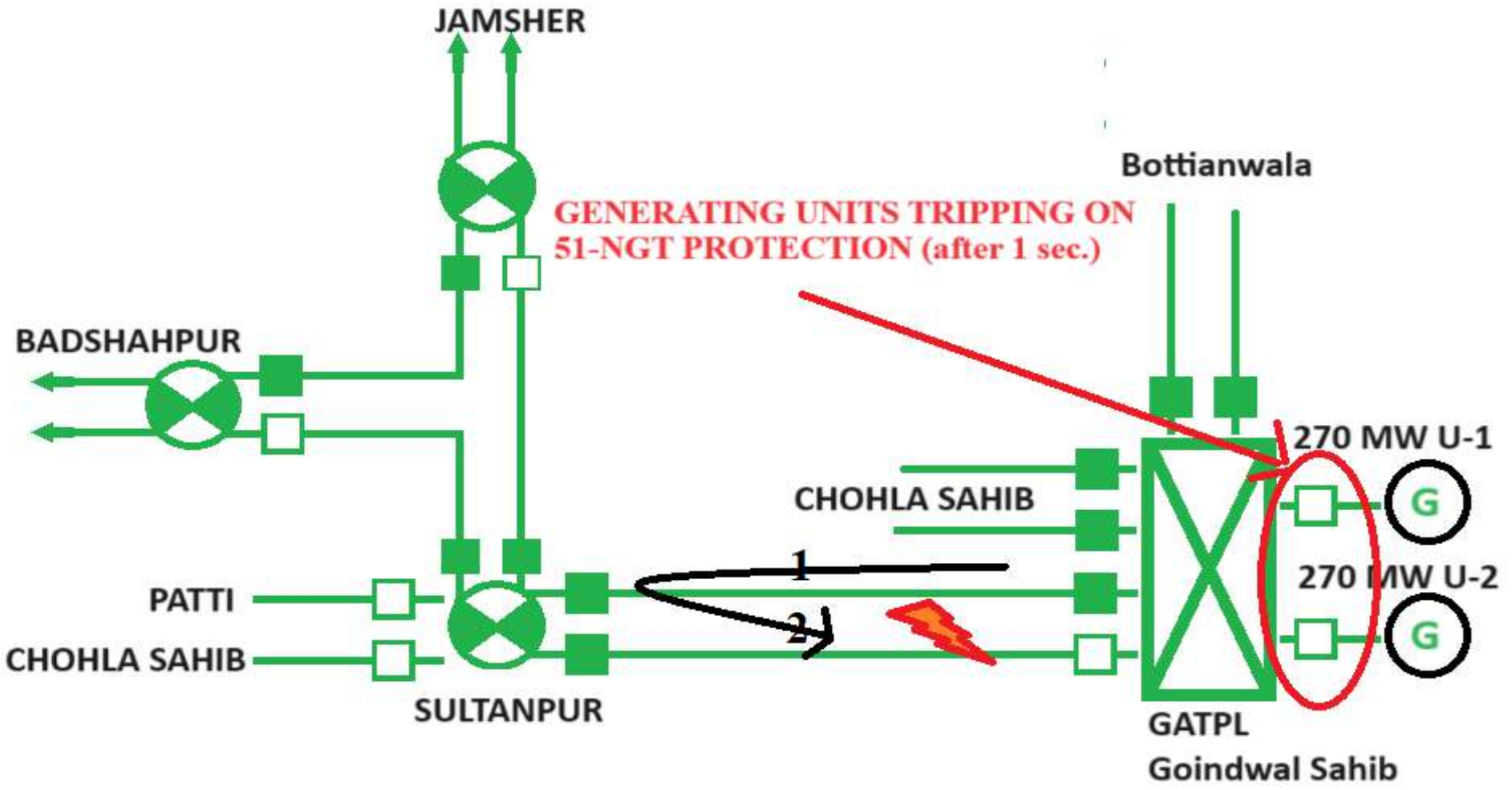
POWER SWING DETECT (Sultanpur end)



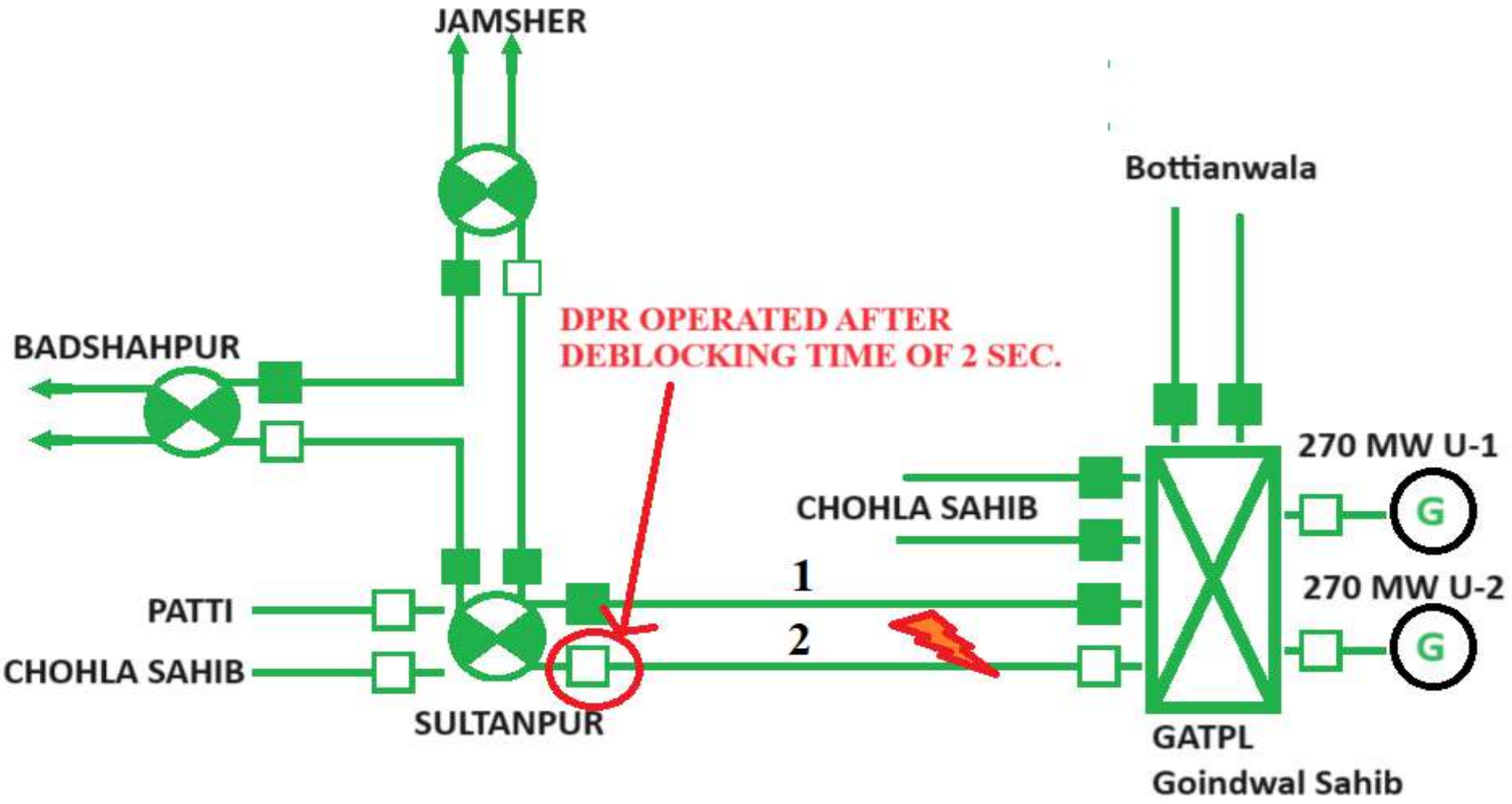
ZONE-3 TRIPPING FROM REMOTE END



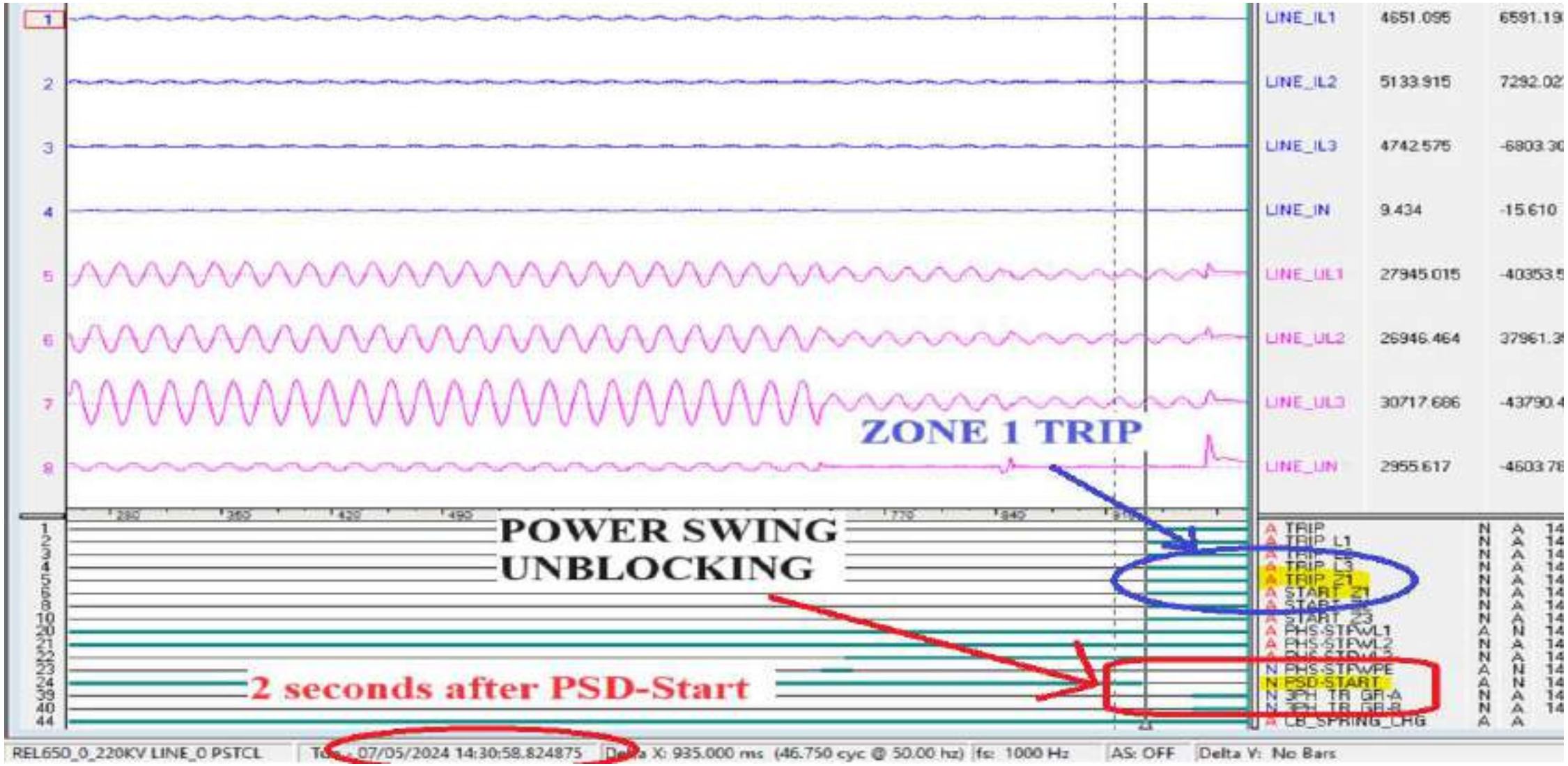
GENERATING UNITS TRIPPING AT GATPL



FAULT CLEARANCE



POWER SWING UN-BLOCKING



CONCLUSION

- Low voltage dips during fault inception observed in both end relay waveforms indicates that it was low intensity fault (Piece of stray flexible conductor found on T/m line at 5 km)

- PSB detect led to blocking of Main 2 relay at Sultanpur end for 2 seconds, thus it could not operate when this evolving fault became a full fledged fault.
- Main 1 Protection relay was Faulty, hence did not operate.
- Thus, Fault feeding from Sultanpur continued through Badshahpur, Jamsher & GATPL (GVK) Circuit No. 1.
- Sultanpur - Badshahpur & Sultanpur - Jamsher circuits tripped from remote ends in Zone 3 (after 800 msec.)
- Sultanpur - GATPL (GVK) Circuit No. 1 at GVK end did not pick the fault in Zone 3 and continued fault feeding.
- 270 MW Units # 1 & # 2 at GATPL (GVK) tripped after 1 second by 51-NGT Protection.
- Fault feeding continued through Sultanpur - GATPL (GVK) Circuit No. 1 until Sultanpur end DPR got unblocked and tripped in Z1.

ACTIONS/ REMEDIAL MEASURES

- Both DPRs healthiness to be ensured on all 220 kV Circuits.
- Revision of Zone -3 settings at GATPL (GVK) end.
- Revision of 51-NGT settings for Generating Units at GATPL (GVK).

  51 NGT Setting at GATPL (GVK) – DT with pickup In = 0.1 Inom after delay Tin = 1 sec.

400kV Greater Noida Sub-Station
UPPTCL

18.05.2024

Multiple trippings due to damage of 220kV CTs at 400kV Gr.Noida.

- **Date & Time of event**:18.05.2024 at17:25:054hrs.
- **Sub-Station affected**: 400kV Gr.Noida,220kV Sec-20 Noida and 220kV Botanical Garden.
- **Date & Time of restoration**: 19.05.2024 at 03:39hrs & 20.05.2024 at 01:04 hrs.

Antecedent Conditions

Before the incidence, loading of 400/220kV ICTs at 400kV Gr. Noida was as given below:-

- 315MVA ICT-1 = 175MW
- 315MVA ICT-2 = 188MW
- 500 MVA ICT-3 = 256MW
- 500MVA ICT-4 = 263MW

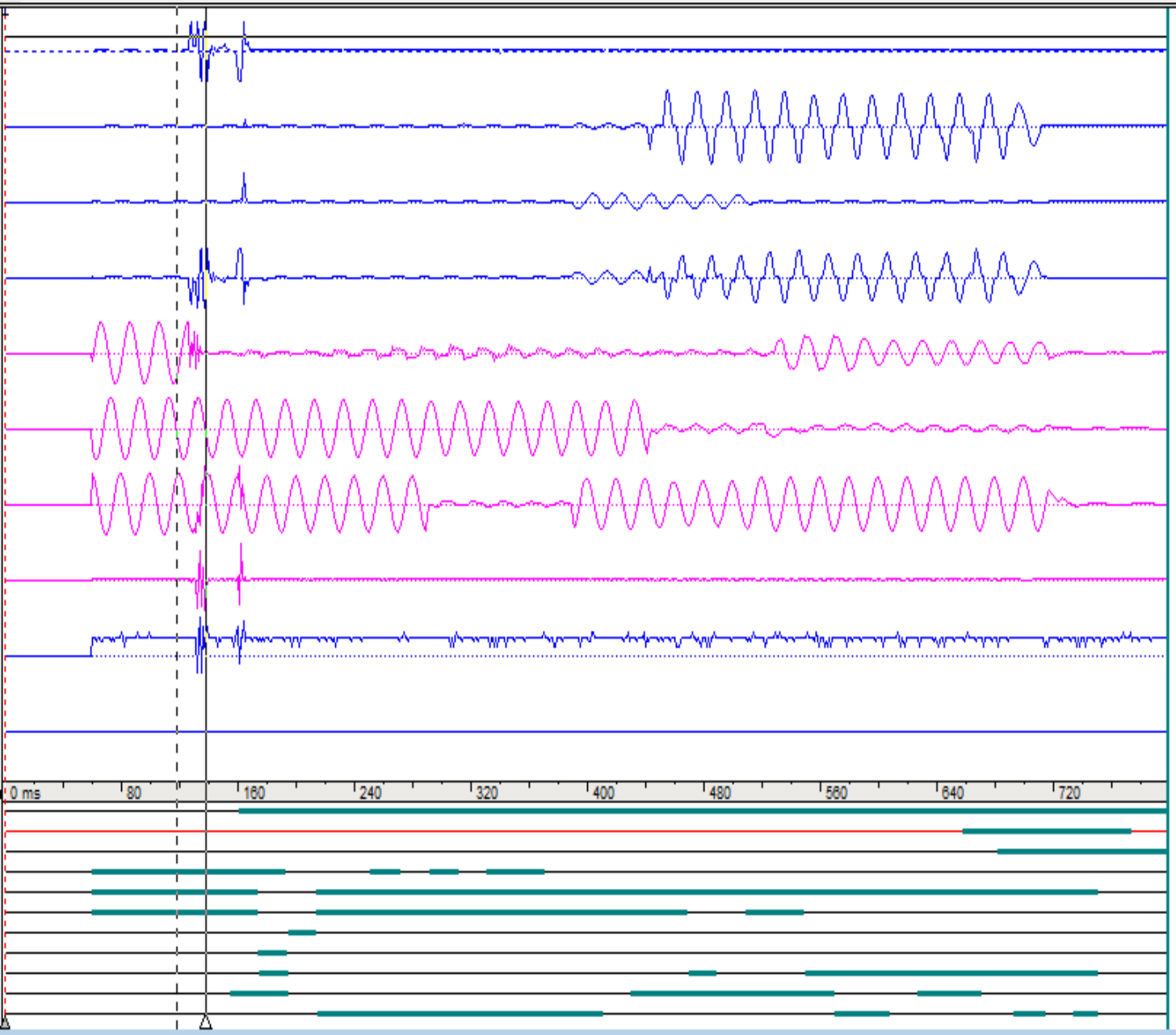
Sr.No.	Tripping Date/Time	Closing Date/Time	Name of Substation	C.B.No./ Direction	Type Of Protection Scheme	FLAGS OBSERVED				Analysis
						This End		Other End		
						Relay Flags	Fault locator with Percentage	Relay Flags	Fault locator with Percentage	
1	2	3	4	5	6	7	8	9	10	11
1	18.05.2024 17:25hrs	20.05.24 00:48hrs	400KV Gr.Noida	T-986/886 500MVA 400/220kV ICT-4	P-643 P14D P14N	C/P:- PRD Trip,Grp A/B trip R/P:- PRD Trip,86A,86B				ICT tripped on PRD,OSR along with CT Damage on 220kV Lines,ICT tested,results verified and put back into service.
2	18.05.2024 17:25hrs	20.05.2024 01:04hrs	400KV Gr.Noida	T-87 220KV Gr.Noida-Noida Sec.62	CSC-101 CSC-211	CP-E/F Prot optd,general trip RP- HS OC optd,Imax-11.5kA,86		CP-Dist prot optd, RP-Z1,AR,Ph-R	12.35Km	Lines tripped on CT blast on R phases of noida sec-62 line and B phase of noida sec-20 line.CTs replaced and line put back into service .
3	18.05.2024 17:25hrs	19.05.2024 03:39hrs	400KV Gr.Noida	T-86 220KV Gr.Noida-Noida Sec-20	P444 P14D	CP-Dist prot optd,CS RP- Z-1 trip,Ph-B,X=0.1035 ohm,R=0.12 ohm, 21XR,XY,XB	0.50KM (1.6%)	CP-Dist prot optd,General trip RP-Z1,Ph-B,86A,86B	21.96Km.	
4	18.05.2024 17:25 hrs	18.05.2024 18:04 hrs	220 KV S/S SEC 129 NOIDA	220KV SEC-129 TO 400KV Gr. Noida LINE	ABB REL650, SIEMENS SIPROTEC	Tripped Phase R,Y&B ZONE 2, Trip time = 355ms Ir= 4.24KA Iy= 3.76KA Ib= 1.0KA	-	-	-	Lines tripped from remote end due to CT blast at 400kV Gr.Noida end.
5	18.05.2024 17:25 hrs	18.05.2024 18:05 hrs	220KV S/S RC GREEN	220 KV RC GREEN TO GREATER NOIDA LINE I	Siemens Siprotec 7SR611	DISTANCE PICK UP L3-1 ON, DISTANCE LOOP L3-1 ON, DISTANCE TRIP 3PHASE -ON, IL1= 3.05 KA, IL2= 0.35 KA, IL3= 3.15 KA, DISTANCE = 8.6 KM, 86I, 86 II, zone1	8.6KM	-		
6	18.05.2024 17:25 hrs	18.05.2024 18:05 hrs	220KV S/S RC GREEN	220 KV RC GREEN TO GREATER NOIDA LINE II	Siemens Siprotec 7SR611	Distance pickup- L1 1ms Ia-0.23kA, Ib-0.21 kA, Ic-0.30 kA,Zone 2 O/c E/F relay, Relay pickup - ON, 67N- on cp 86-1,86-2		--		
7	18.05.2024 17:25 hrs	18.05.2024 18:04 hrs	220KV Substation Jalpura	220 KV JALPURA TO GREATER NOIDA LINE	ABB REL 650	Zone1, 86optd, IR=475A, IY=296A, IB=527A,IN=1280A VR=12KV, VY=115kV, VB=111KV,VN=73KV		--		

Event Description

Following is the description of events based on site observation and DR analysis.

1. R-phase CT of 220kV Gr.Noida-Noida Sec-20 ckt-2 was first to blast at 400kV Gr.Noida end, Distance relay along with back up relay detected the fault and line was tripped on High set/Inv OC backup protection from this end and on distance protection from remote end.
2. Subsequently, B phase CT of 220kV Gr.Noida-Noida Sec-20 ckt-1 also got damaged due to impact of shattered pieces from R phase CT of Ckt-1,this resulted into single phase tripping of this line on distance protection in zone-1 followed by three phase tripping due to failed AR attempt. This line also got tripped from remote end in Zone-1.
3. 220kV Gr.Noida-Jalpura,Sec-129 Noida,RC Green ckt-I and ckt-II Line tripped from remote end.
4. 400/220kV 500MVA ICT-4 also tripped on PRD and OSR due to turbulence of oil caused by very close fault. CT was later tested, results verified and put back into service.
4. The case was later discussed in detail and remedial actions were taken accordingly.

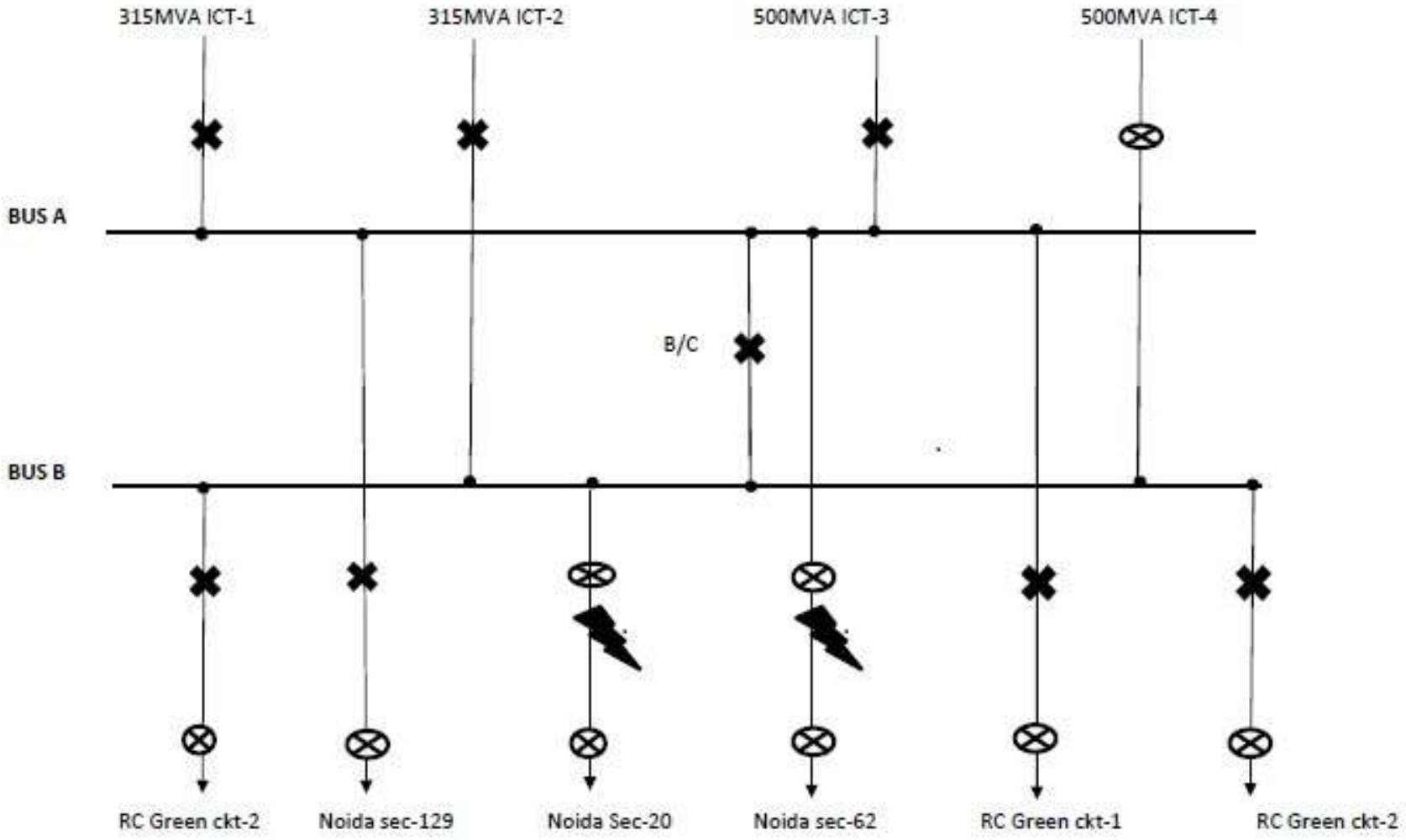
DR of Noida ckt-2



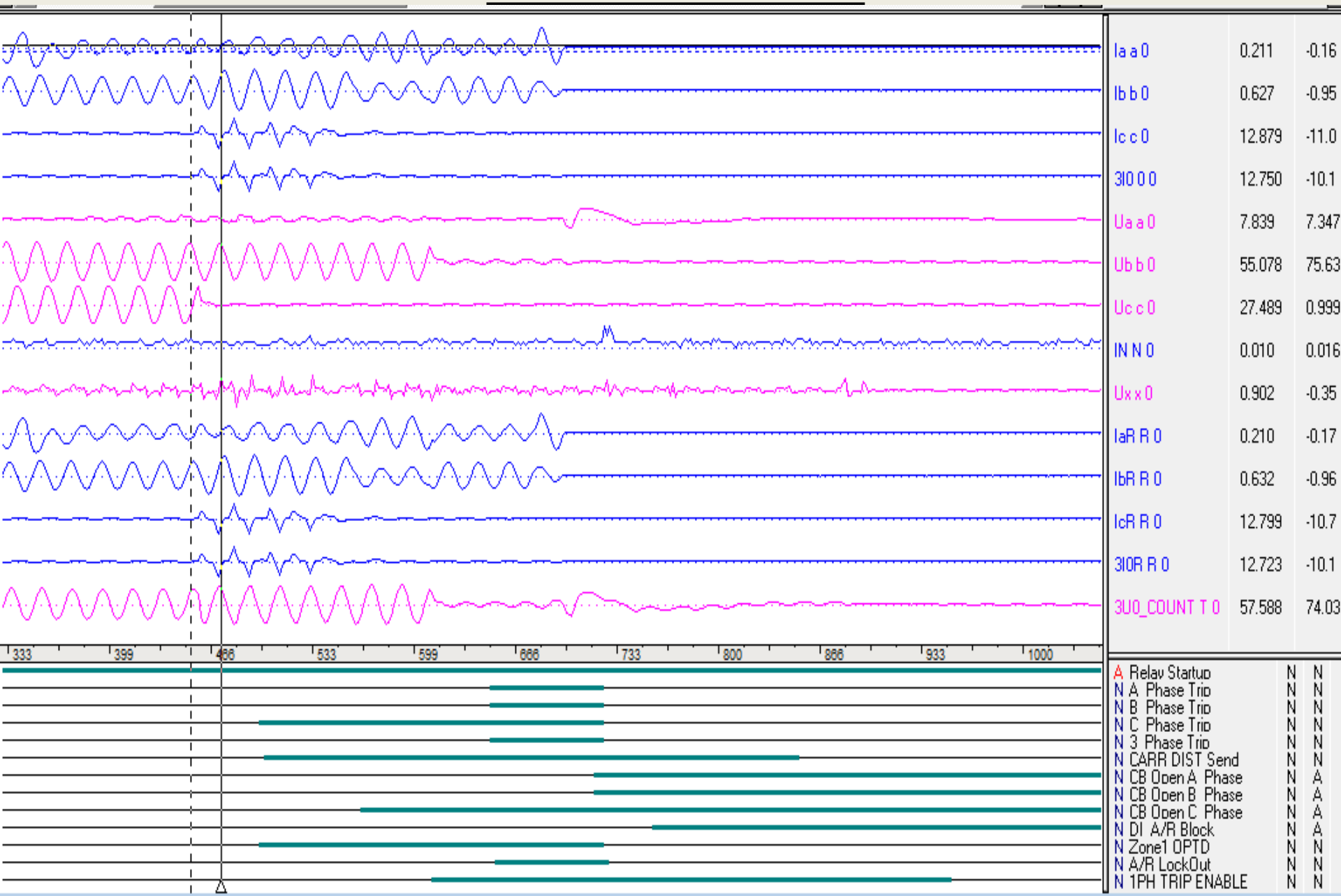
Ia A	10.883	10.695	161.
Ib B	0.403	0.464	78.3
Ic C	0.466	-0.704	319.
In N	10.993	-11.781	340.
Ua A	31.422	-3.623	214.
Ub B	44.557	61.106	98.7
Uc C	46.249	-58.538	337.
U0 N	5.380	-2.670	234.
IS N	0.010	0.004	262.
IS1 N	0.000	0.000	0.00

N STARTUP	N	A
N HS/INV OC	N	N
N START CBF 3ph DI	N	A
A Zone of FWD Aph	N	N
A Zone of FWD Bph	N	N
A Zone of FWD Cph	N	N
N Zone of RVD Aph	N	N
N Zone of RVD Bph	N	N
N Zone of RVD Cph	N	N
N Zone of FWD EF	N	N
N Zone of RVD_EF	N	N

220kV Bus Configuration at the time of Fault



DR of Noida ckt-1



Remedial Measures

Following remedial measures were taken afterwards:-

- Damaged CTs were replaced and supply was normalised.
- Partial discharge test of CTs more than 10 year old is planned in first phase. Later, on the basis of PD results, Tan Delta testing of selected CTs will be done and if required, old CTs will be replaced.
- Instructions have been issued to maintenance teams regarding regular checking of CT oil levels, thermography of CT primary terminals and better maintenance of CT junction boxes and associated cables.

THANK YOU.

Multiple elements tripping at 400/132kV Masoli(UP) 29th May 2024

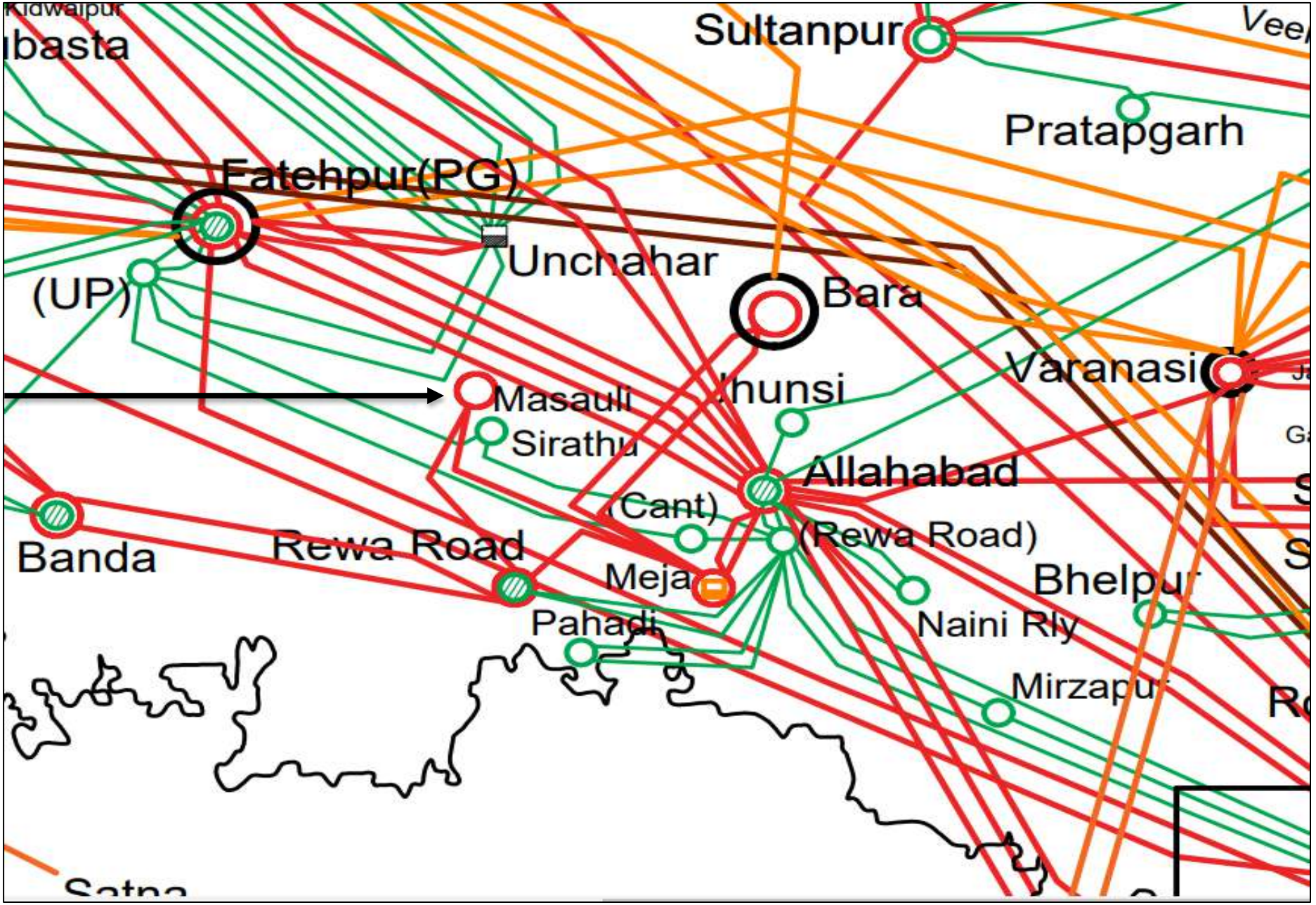
Brief of event:

i. 400/132kV Masoli(UP) S/s has one and half breaker bus scheme at 400kV voltage level side.
ii. During antecedent condition, loading of 400/132 kV 200 MVA ICT 1,2&3 at 400/132kV Masoli(UP) was approx. 162MW (approx. 54MW for each ICT) (As per SCADA).
iii. As reported, at 15:57 hrs, during inclement weather condition, towers of 132kV feeders to Naini and Karchhana from Masoli(UP) damaged which created B-N phase to earth fault on 132kV Masoli-Naini (UP) ckt followed by Y-N phase to earth fault on 132kV Masoli-Karchhana (UP) ckt.
iv. B-N phase to earth fault on 132kV Masoli-Naini (UP) ckt cleared instantaneously (within 120msec as per PMU). CB of 132kV Masoli-Karchhana (UP) ckt could not open from Masoli(UP) end on Y-N phase to earth fault.
v. As CB of 132kV Masoli-Karchhana (UP) ckt failed to open, fault cleared with the tripping of 400/132 kV 200 MVA ICT 1,2&3 and 125 MVAR Bus Reactor at Masoli(UP) tripped on O/C E/F protection operation.
vi. As per PMU at Allahabad(PG), B-N followed by Y-N phase to earth fault is observed with fault clearing time of 120msec and 840msec respectively.
vii. As per SCADA, change in demand of approx. 94MW is observed in UP control area. However, 100MW load loss is reported by SLDC-UP in UP control area.

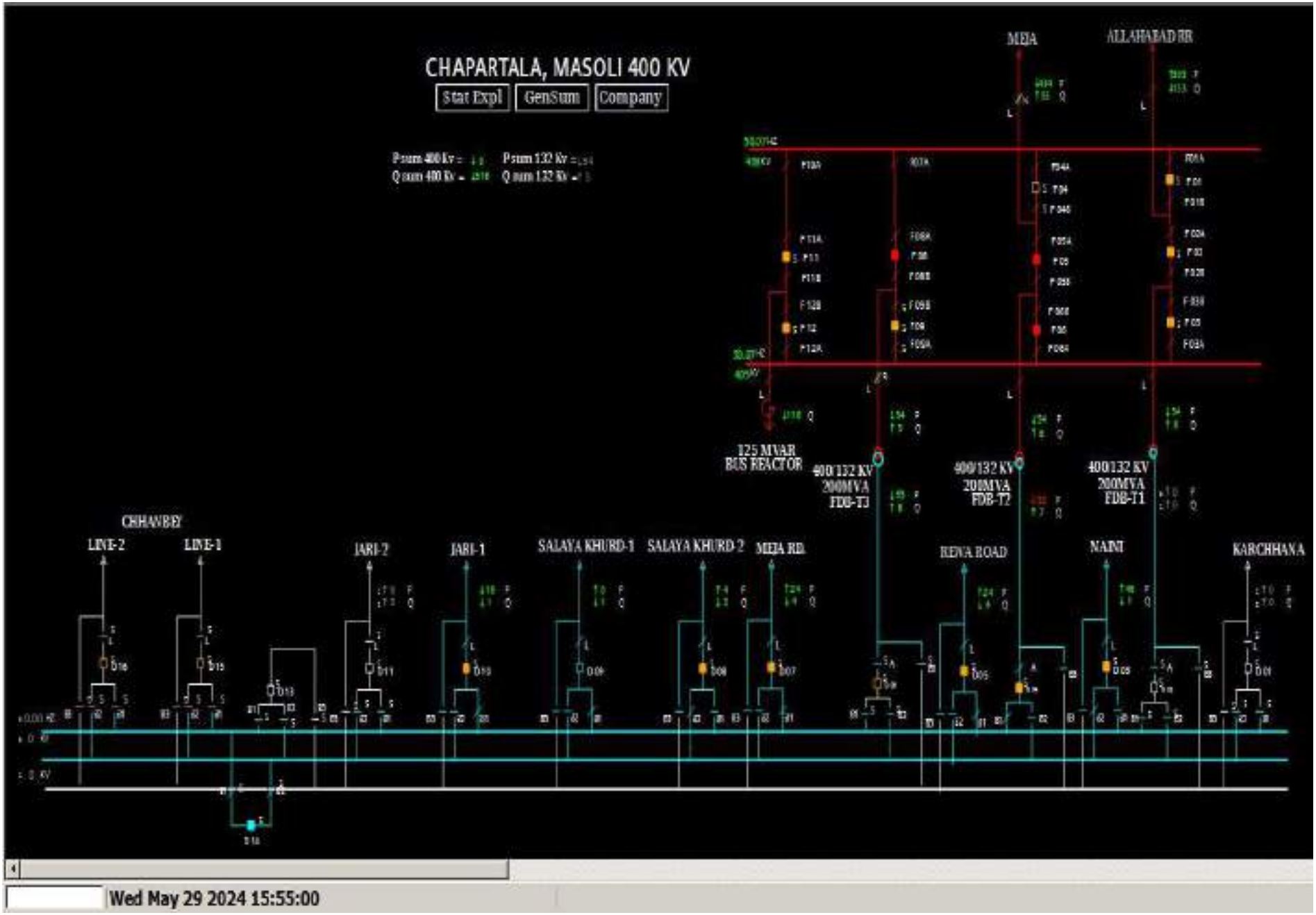
Elements tripped:

1) 400/132 kV 200 MVA ICT 1 at Masoli(UP)
2) 400/132 kV 200 MVA ICT 2 at Masoli(UP)
3) 400/132 kV 200 MVA ICT 3 at Masoli(UP)
4) 125 MVAR Bus Reactor No 1 at 400 KV Masoli(UP)
5) 132kV Masoli-Karchhana (UP) ckt
6) 132kV Masoli-Naini (UP) ckt

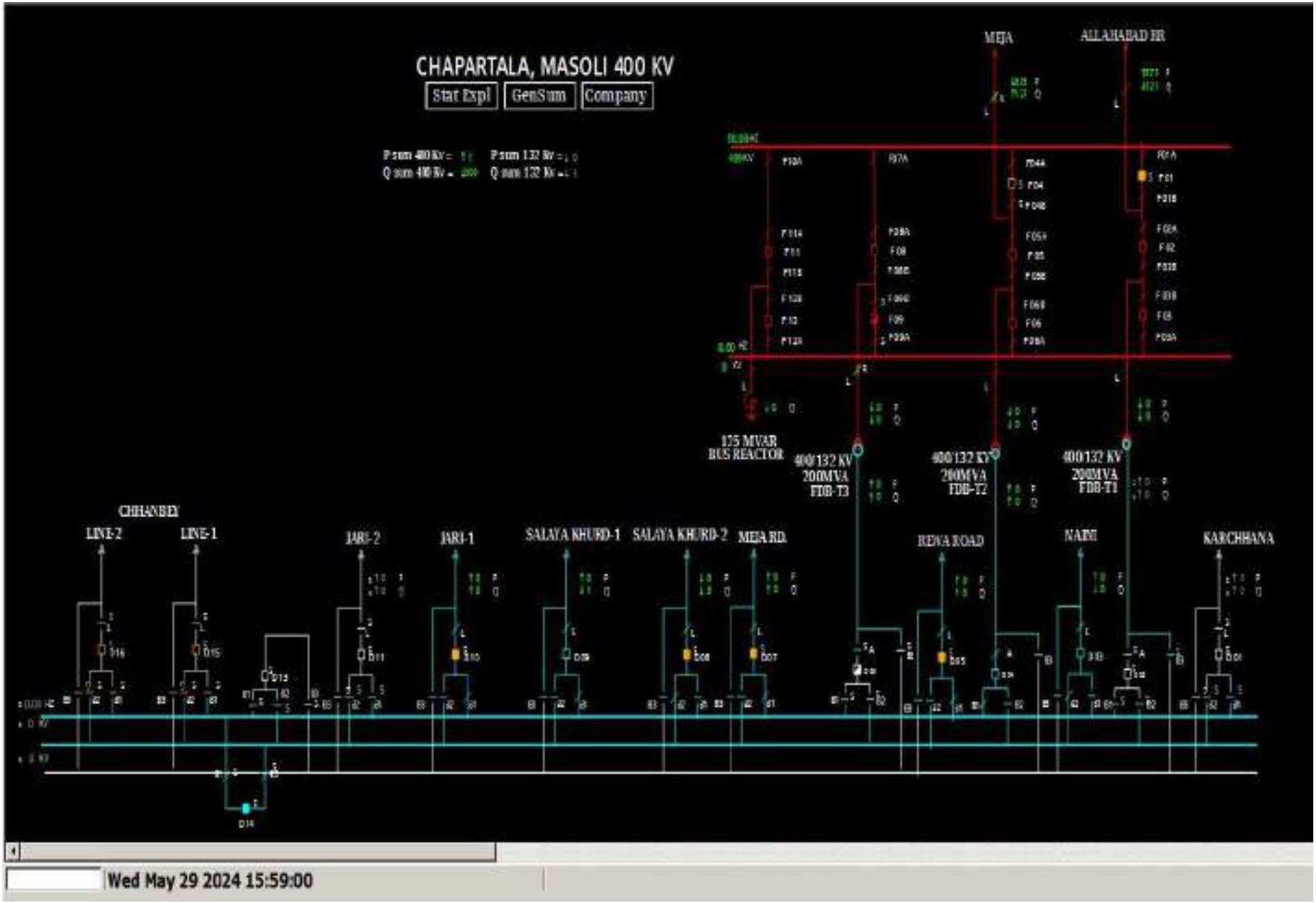
Network Diagram



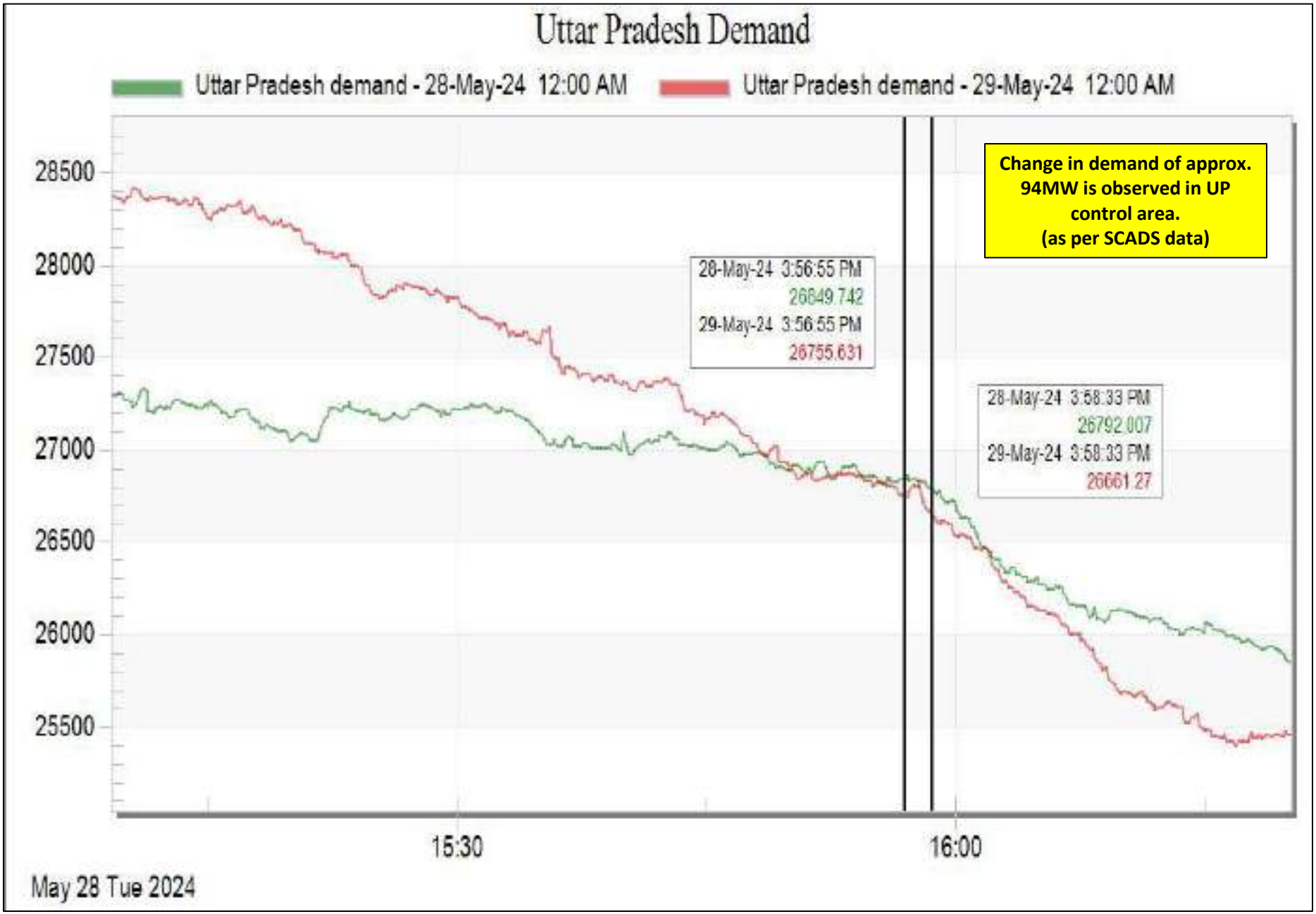
SLD of 400/132kV Masoli(UP) before the event



SLD of 400/132kV Masoli(UP) after the event



UP demand during the event

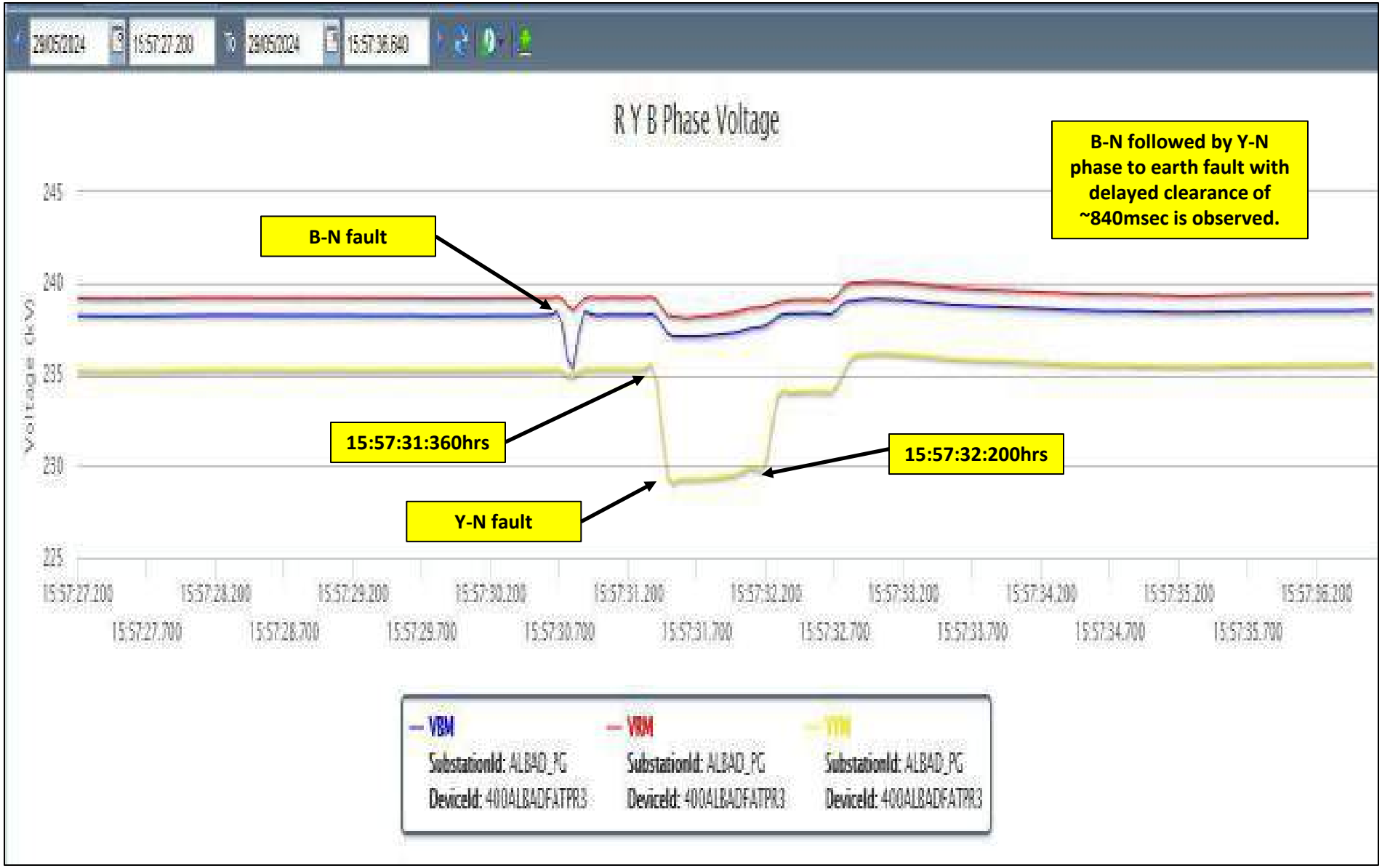


PMU Plot of frequency at 400kV Allahabad(PG)

15:57 hrs/29-May-24

PMU Plot of phase voltage magnitude at 400kV Allahabad(PG)

15:57 hrs/29-May-24



SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
15:57:30,846	CHPAR_UP	132kV	03NAINI	Circuit Breaker	Open	Line CB at Masoli(UP) end of 132kV Masoli-Naini(UP) ckt opened
15:57:32,258	CHPAR_UP	400kV	08FTUT3	Circuit Breaker	Open	
15:57:32,261	CHPAR_UP	400kV	03T1	Circuit Breaker	Open	Main CB at Masoli(UP) end of 400/132kV 200MVA ICT-1 at 400kV level opened
15:57:32,267	CHPAR_UP	400kV	02ALHT1	Circuit Breaker	Open	Tie CB at Masoli(UP) end of 400/132kV 200MVA ICT-1 and 400 KV Allahbad RR-Masoli (UP) Ckt opened
15:57:32,272	CHPAR_UP	400kV	06T2	Circuit Breaker	Open	Main CB at Masoli(UP) end of 400/132kV 200MVA ICT-2 at 400kV level opened
15:57:32,278	CHPAR_UP	400kV	05MEJT2	Circuit Breaker	Open	Tie CB at Masoli(UP) end of 400/132kV 200MVA ICT-2 and 400 KV Meja TPS(MUN)-Masoli(UP) (UP) Ckt opened
15:57:32,279	CHPAR_UP	400kV	09T3	Circuit Breaker	disturbe	
15:57:32,301	CHPAR_UP	132kV	06T3	Circuit Breaker	disturbe	
15:57:32,304	CHPAR_UP	132kV	04T2	Circuit Breaker	Open	CB at Masoli(UP) end of 400/132kV 200MVA ICT-2 at 132kV level opened
15:57:32,750	CHPAR_UP	400kV	11FTUBR	Circuit Breaker	Open	
15:57:32,757	CHPAR_UP	400kV	12BR	Circuit Breaker	Open	CB at Masoli(UP) end of 125 MVAR BR opened from 400kV Bus-2 side

Point of discussion

- DR/EL (.dat/.cfg) for all the tripped elements need to be shared.
- Reason for delayed clearance of Y-N phase to earth fault need to be shared.
- Detailed report along with remedial action taken details need to be shared.

400/132kV Masauli Sub-Station
UPPTCL

29.05.2024

Multiple trippings due to non tripping of 132 kV Karchhana fdr CB

at 400 kV Masauli.

- **Date & Time of event**:29-05-2024

at15:57 hrs.

- **Sub-Station affected**: 400kV Masauli,132kV Naini complex,132kV Karchana .
- **Date & Time of restoration**:

200MVA ICT-I: 17:11Hrs (29-05-2024),
200MVA ICT-II: 17:12Hrs (29-05-2024),
200MVA ICT-III: 17:16Hrs (29-05-2024),
125MVAR BUS REACTOR: 19:01Hrs (29-05-2024),
132KV KARCHHANA LINE: 15:30Hrs on dated 07.06.2024

132KV NAINI LINE: 14:44Hrs on dated 07.06.2024

Antecedent Conditions

Before the incidence, loading of 400/132 kV ICTs at 400kV Masauli was as given below:-

- 200MVA ICT-1 = 50MW
- 200MVA ICT-2 = 50MW
- 200 MVA ICT-3 = 50MW

Weather - stormy and lightning conditions.

Details of Relay Flags :

ICT-I,ICT-II,ICT-III,125MVAR BUS REACTOR Tripped on Back up E/F protection 86 MTR operated.

132KV Naini line: Zone-I,Ir-194A,Iy-443.5A,Ib-6330A,In-5804A, Distance-12.54Km, 86 MTR.

132KV Karchhana line: Zone-I,Ir-435A,Iy-6942.5A,Ib-420A,In-6088.5A, Distance-10.62Km, 86 MTR(**C.B not opened due to mechanical problem in C.B)**

Event Description

Following is the description of events based on site observation and DR analysis.

Due to tower damage of outgoing lines namely 132kV Masauli-Naini line and 132kV Masauli-Karchhana line, fault created on 132kV side of ICTs.

Following this C.B of 132kV Naini line opened on line fault but due to **C.B mechanical problem,132kV Karchhana line did not open although relay operated**. Since fault persisted on 132kV side so all three ICTs running in parallel along with 125MVAR Bus Reactor tripped on E/F protection.

. The case was later discussed in detail and remedial actions were taken accordingly.

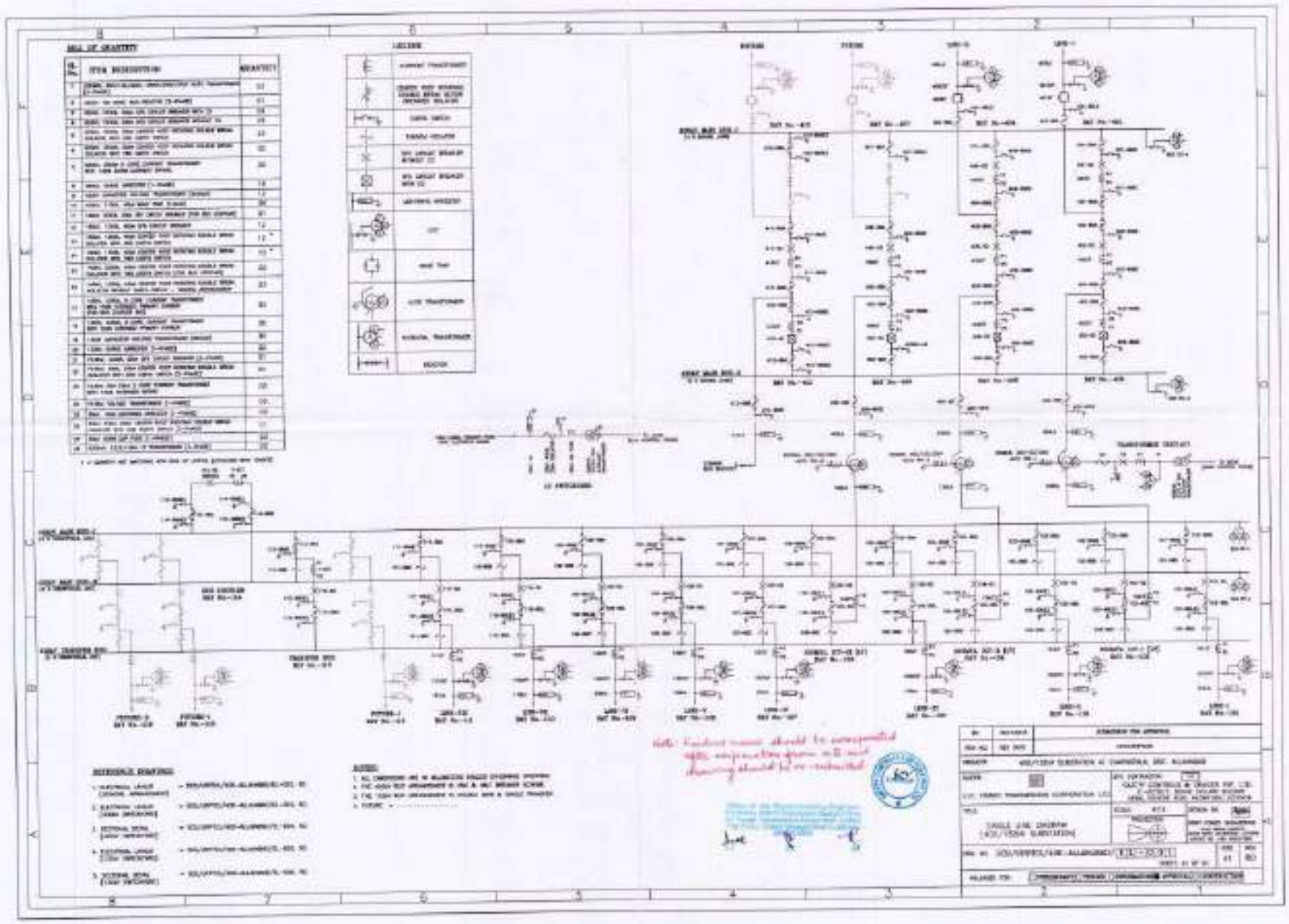
Events of 132 kv Karchana line

Time	Event	IA (A)	IB (A)	IC (A)	IN (A)	VA (V)	VB (V)	VC (V)
05/29/2024 17:34:57.219 ms	ON BG Fault	0.100 A	1.323 A	0.064 A	1.190 A	64.021 V	60.766 V	64.031 V
05/29/2024 17:34:57.219 ms	ON Ground Fault	0.100 A	1.323 A	0.064 A	1.190 A	64.021 V	60.766 V	64.031 V
05/29/2024 17:34:57.219 ms	ON Open Phase Detector Pick Up	0.100 A	1.323 A	0.064 A	1.190 A	64.021 V	60.766 V	64.031 V
05/29/2024 17:34:57.223 ms	ON Any Unit Picked Up	0.250 A	4.292 A	0.272 A	3.780 A	63.598 V	58.898 V	64.131 V
05/29/2024 17:34:57.223 ms	ON BG Zone 3 Unit Pick Up	0.250 A	4.292 A	0.272 A	3.780 A	63.598 V	58.898 V	64.131 V
05/29/2024 17:34:57.223 ms	ON Zone 3 Ground Unit Pick Up	0.250 A	4.292 A	0.272 A	3.780 A	63.598 V	58.898 V	64.131 V
05/29/2024 17:34:57.225 ms	ON BG Zone 2 Unit Pick Up	0.261 A	4.290 A	0.262 A	3.778 A	63.697 V	57.418 V	63.865 V
05/29/2024 17:34:57.225 ms	ON Zone 2 Ground Unit Pick Up	0.261 A	4.290 A	0.262 A	3.778 A	63.697 V	57.418 V	63.865 V
05/29/2024 17:34:57.227 ms	OFF Open Phase Detector Pick Up	0.368 A	5.771 A	0.338 A	5.073 A	63.686 V	53.793 V	63.461 V
05/29/2024 17:34:57.229 ms	ON BG Zone 1 Unit Pick Up	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 10	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 11	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 16	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 17	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 18	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 19	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 20	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 5	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 6	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Digital Output 9	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Phase A Trip	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Phase B Trip	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Phase C Trip	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Pole A Open Command	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Pole B Open Command	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Pole C Open Command	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Stepped Distance Trip	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Three Phase Open Command	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Three Phase Trip	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Trip	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Zone 1 Ground Unit Pick Up	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.229 ms	ON Zone 1 Trip	0.527 A	8.341 A	0.497 A	7.321 A	63.406 V	49.769 V	63.248 V
05/29/2024 17:34:57.231 ms	ON Digital Output 13	0.668 A	10.691 A	0.652 A	9.374 A	63.002 V	47.590 V	63.410 V
05/29/2024 17:34:57.231 ms	ON Digital Output 14	0.668 A	10.691 A	0.652 A	9.374 A	63.002 V	47.590 V	63.410 V
05/29/2024 17:34:57.231 ms	ON Digital Output 21	0.668 A	10.691 A	0.652 A	9.374 A	63.002 V	47.590 V	63.410 V
05/29/2024 17:34:57.231 ms	ON Digital Output 22	0.668 A	10.691 A	0.652 A	9.374 A	63.002 V	47.590 V	63.410 V
05/29/2024 17:34:57.231 ms	ON Digital Output 23	0.668 A	10.691 A	0.652 A	9.374 A	63.002 V	47.590 V	63.410 V
05/29/2024 17:34:57.231 ms	ON Oscillography External Trigger	0.668 A	10.691 A	0.652 A	9.374 A	63.002 V	47.590 V	63.410 V
05/29/2024 17:34:57.253 ms	ON Digital Input 17	0.868 A	13.856 A	0.838 A	12.152 A	63.318 V	43.364 V	62.682 V
05/29/2024 17:34:57.259 ms	ON External Three Phase Trip Input	0.868 A	13.856 A	0.838 A	12.152 A	63.318 V	43.364 V	62.682 V
05/29/2024 17:34:57.331 ms	ON Open Command Failure	0.867 A	13.824 A	0.837 A	12.124 A	63.264 V	43.325 V	62.648 V
05/29/2024 17:34:57.331 ms	ON Pole A Open Command Failure	0.867 A	13.824 A	0.837 A	12.124 A	63.264 V	43.325 V	62.648 V
05/29/2024 17:34:57.331 ms	ON Pole B Open Command Failure	0.867 A	13.824 A	0.837 A	12.124 A	63.264 V	43.325 V	62.648 V
05/29/2024 17:34:57.331 ms	ON Pole C Open Command Failure	0.867 A	13.824 A	0.837 A	12.124 A	63.264 V	43.325 V	62.648 V
05/29/2024 17:34:57.571 ms	ON Zone 2 Trip	0.579 A	13.672 A	0.545 A	12.552 A	63.367 V	43.520 V	62.865 V
05/29/2024 17:34:58.022 ms	ON Zone 3 Trip	0.009 A	11.733 A	0.016 A	11.745 A	59.613 V	37.562 V	62.402 V
05/29/2024 17:34:58.592 ms	OFF Any Unit Picked Up	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF BG Zone 1 Unit Pick Up	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF BG Zone 2 Unit Pick Up	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF BG Zone 3 Unit Pick Up	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Digital Output 16	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Digital Output 17	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Digital Output 18	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Digital Output 19	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Digital Output 5	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Digital Output 6	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Stepped Distance Trip	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Zone 1 Ground Unit Pick Up	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Zone 1 Trip	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Zone 2 Ground Unit Pick Up	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Zone 2 Trip	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Zone 3 Ground Unit Pick Up	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.592 ms	OFF Zone 3 Trip	0.007 A	0.791 A	0.012 A	0.794 A	32.762 V	1.898 V	46.004 V
05/29/2024 17:34:58.594 ms	OFF Oscillography External Trigger	0.004 A	0.792 A	0.008 A	0.794 A	24.705 V	1.837 V	31.211 V
05/29/2024 17:34:58.596 ms	ON Open Phase Detector Pick Up	0.004 A	0.576 A	0.005 A	0.575 A	22.812 V	1.041 V	22.992 V
05/29/2024 17:34:58.598 ms	OFF BG Fault	0.005 A	0.088 A	0.006 A	0.086 A	24.791 V	0.290 V	24.296 V
05/29/2024 17:34:58.598 ms	OFF Ground Fault	0.005 A	0.088 A	0.006 A	0.086 A	24.791 V	0.290 V	24.296 V

132KV Karchhana fdr V and I values

Magnitudes				
	Pre-Fault		Fault	
VA	64.252	V	63.115	V
ANG VA	0	º	359	º
VB	64.869	V	43.141	V
ANG VB	239.7	º	235	º
VC	64.188	V	62.889	V
ANG VC	119.3	º	122.3	º
IA	0.058	A	0.87	A
ANG IA	87.3	º	351.3	º
IB	0.058	A	13.885	A
ANG IB	327.5	º	168.3	º
IC	0.056	A	0.84	A
ANG IC	212	º	344.6	º
IN	0.005	A	12.177	A
ANG IN	323.9	º	168.3	º
IPOL	0.001	A	0.002	A
ANG IPOL	119.5	º	97.2	º
IGPAR	0	A	0.002	A
ANG IGPA	346.2	º	220.2	º
VN	0.126	V	17.315	V
ANG VN	338.2	º	74.1	º
VSYNC	0.005	V	0.058	V
ANG VSYN	200.9	º	250	º
VAB	112.008	V	94.27	V
VBC	112.008	V	88.924	V
VCA	110.855	V	110.934	V
PSC	0.055	A	4.892	A
NSC	0	A	4.937	A
ZSC	0	A	4.053	A
PSV	64.426	V	56.295	V
NSV	0.44	V	7.885	V
ZSV	0.039	V	5.762	V
General				
TRIP ZON	Zone 1			
DISTk	10.625	Km		
FAULTTIM	1.401	s		
ACTGRP	1			
FREQ	49.902	Hz		
THERMAL	0	%		
REE MON	0			
THRE PH R	0			

Attending C.B Problem of 132KV Karchhana Feeder


BILL OF QUANTITY
LEGEND
NOTES:
REFERENCE DRAWING
Note: Feeder name should be interchanged with interconnection given in 66 kV drawing should be re-submitted

Remedial Measures

Following remedial measures were taken afterwards:-

- Timely Overhauling and testing of all the Circuit Breakers should be done for proper functioning of C.B and to avoid unwanted trippings due to failure of C.B functioning.
- Overhauling and testing of 132 kv Karchhana fdr CB was done before charging of 132 kv Karchhana fdr.
- Instructions have been issued to maintenance teams regarding timely Overhauling and testing of all the Circuit Breakers.

THANK YOU.

Multiple elements tripping at 400/220/132kV Panipat(BB) 03rd June 2024

Brief of event:

i. As reported, at 00:38 hrs, bursting of B-ph CT of 220kV bus coupler-2 at Panipat(BB) end occurred which created B-N phase to earth fault in busbar differential zone. The reason of bursting of the B-ph CT was observed to be some internal fault in Heptacare make CT installed on the bay on 29th November 2018.

ii. The Numerical low Impedance type MiCom P741 Bus-Bar Differential Protection Scheme (ALSTOM make) sensed the fault and operated tripping all the elements on either side of bus coupler i.e. 220kV Bus-1 & Bus-2 at Panipat(BB).

iii. As per PMU at Panipat(BBMB), Y-N phase to earth fault is observed with fault clearing time of 120ms. (phase sequence issue observed)

iv. As per SCADA, load loss of approx. 565 MW (~445 MW in Haryana and ~120 MW in Delhi control area) is observed.

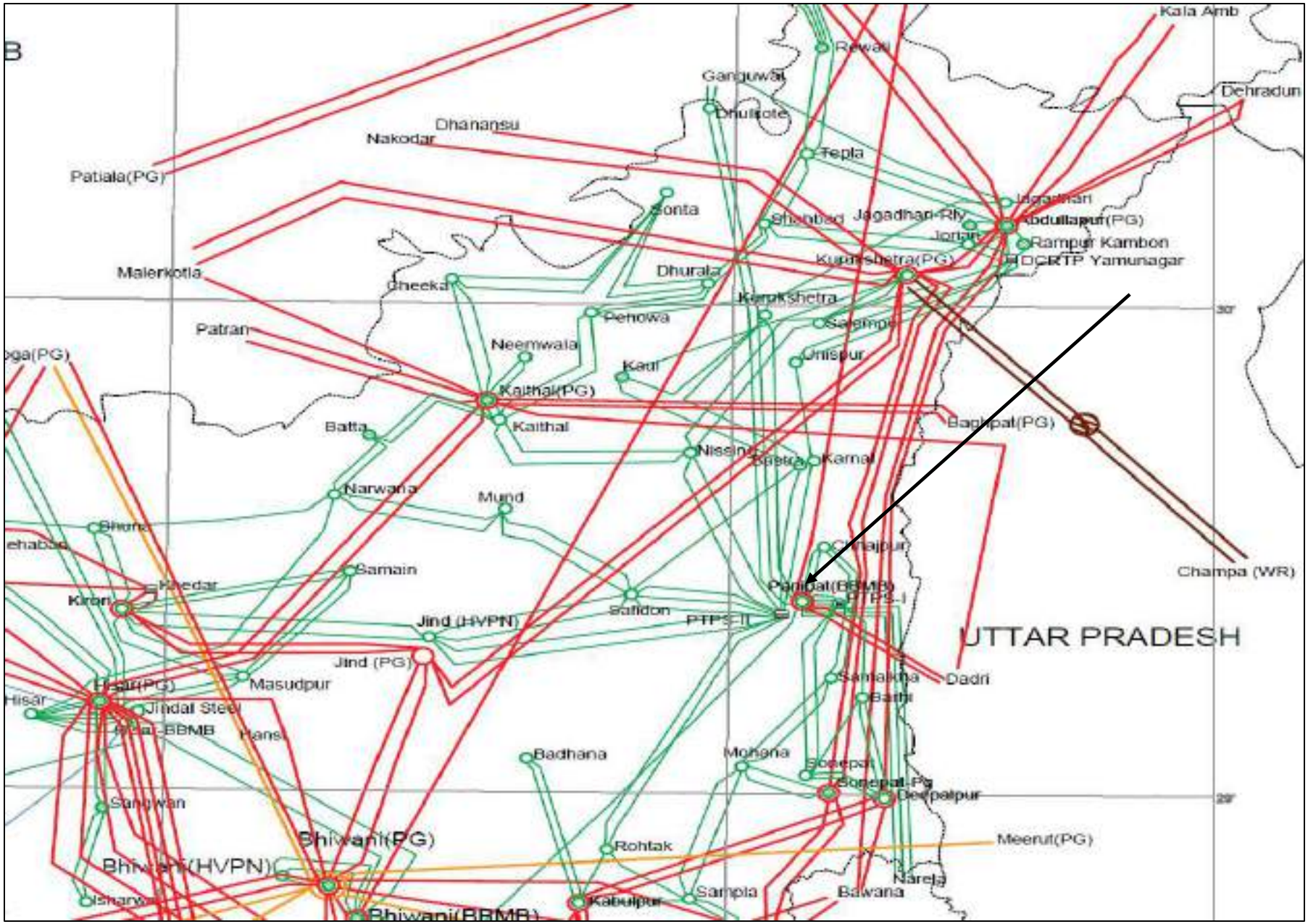
v. As reported by BBMB, 220kV Bus-1 at Panipat(BB) was charged by closing A-17 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-1 at 01:26 hrs and 220kV Bus-2 at Panipat(BB) was charged by closing A-18 Breaker of 220 KV Panipat-Dhulkote (BB) Ckt-2 at 01:36 hrs.

vi. As remedial action taken, on 03rd June 2024 an old and used Rade Koncar make CT of same ratio i.e. 1200/1-1-1-1-1A was tested thoroughly and installed in place of bursted CT and bus coupler-2 was charged at 17:38 hrs on 03rd June 2024.

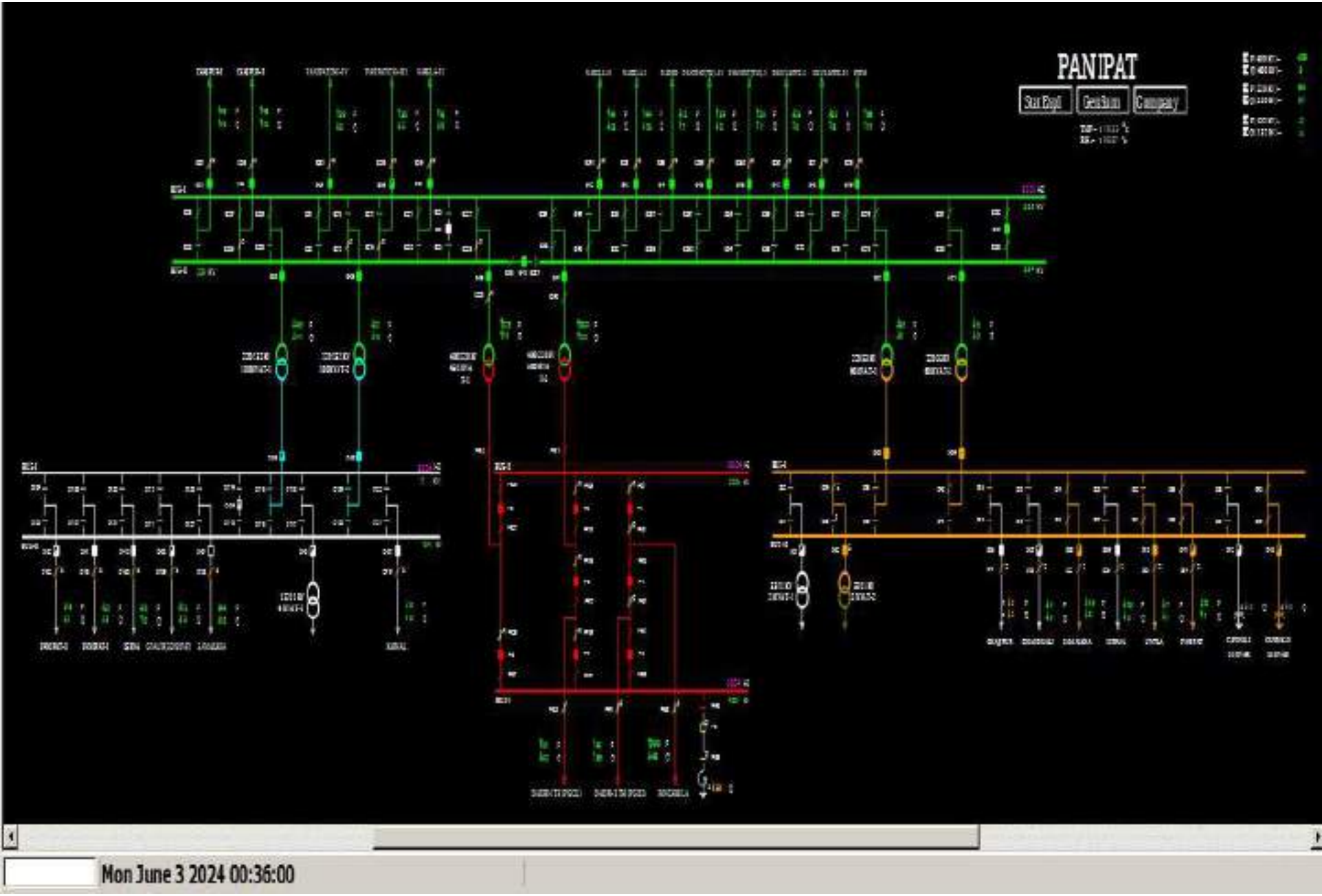
Elements tripped:

1) 220KV Bus 1 at Panipat(BB)
2) 220KV Bus 2 at Panipat(BB)
3) 220KV Bus 3 at Panipat(BB)
4) 220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-1
5) 220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-2
6) 220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-3
7) 220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-4
8) 220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-1
9) 220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-2
10) 220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-3
11) 220 KV Panipat(BB)-Chajpur(HV) (HVPNL) Ckt-1
12) 220 KV Panipat(BB)-Chajpur(HV) (HVPNL) Ckt-2
13) 220 KV Panipat-Dhulkote (BB) Ckt-1
14) 220 KV Panipat-Dhulkote (BB) Ckt-2
15) 220 KV Panipat-Charkhi Dadri (BB) Ckt
16) 220 KV Panipat(BB)-Pipli Ckt
17) 400/220kV 450 MVA ICT-1 at Panipat(BB)
18) 400/220kV 500 MVA ICT-2 at Panipat(BB)
19) 220/132kV 100 MVA ICT-1 at Panipat(BB)
20) 220/132kV 100 MVA ICT-2 at Panipat(BB)
21) 220/33kV 60 MVA ICT-1 at Panipat(BB)
22) 220/33kV 60 MVA ICT-2 at Panipat(BB)

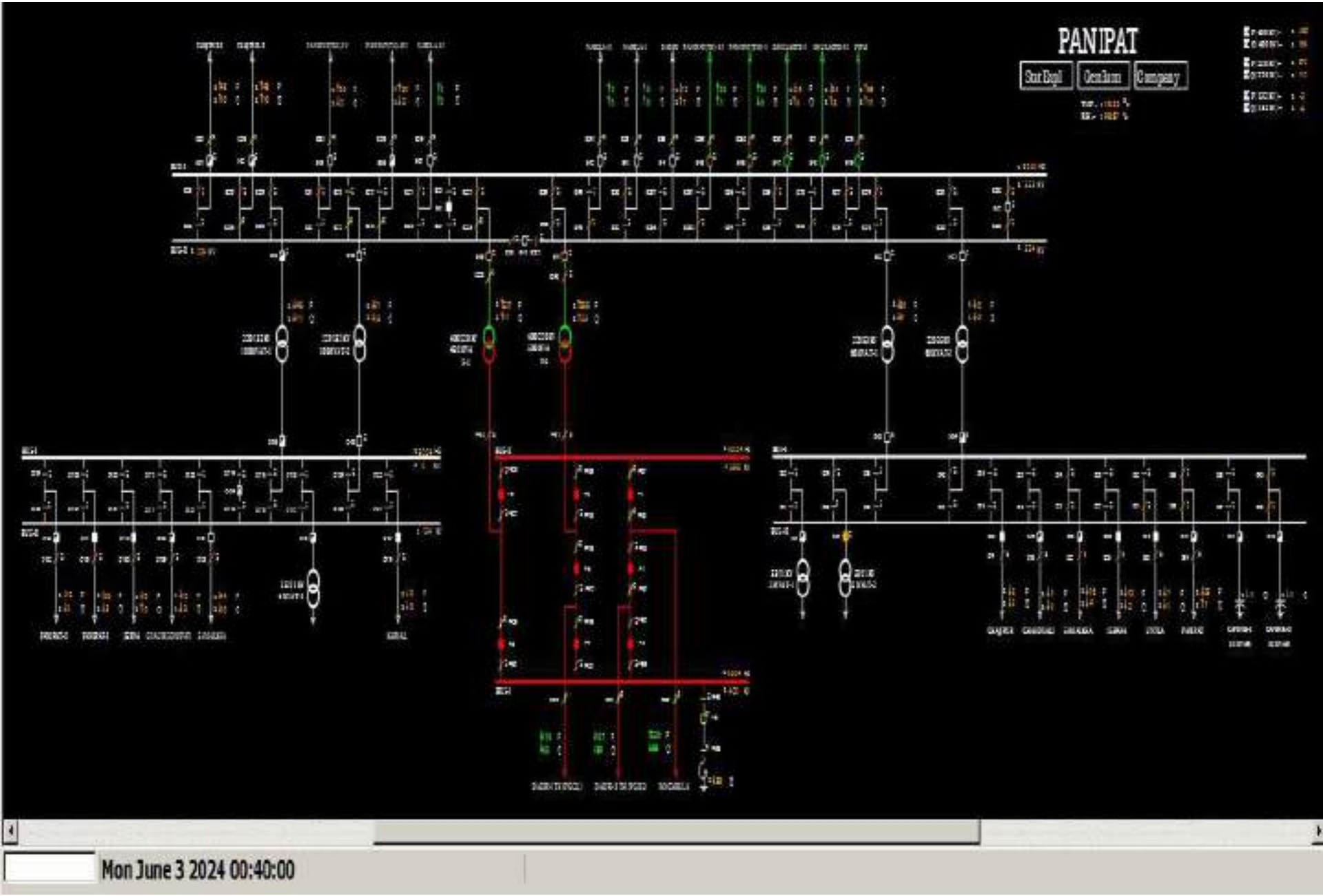
Network Diagram



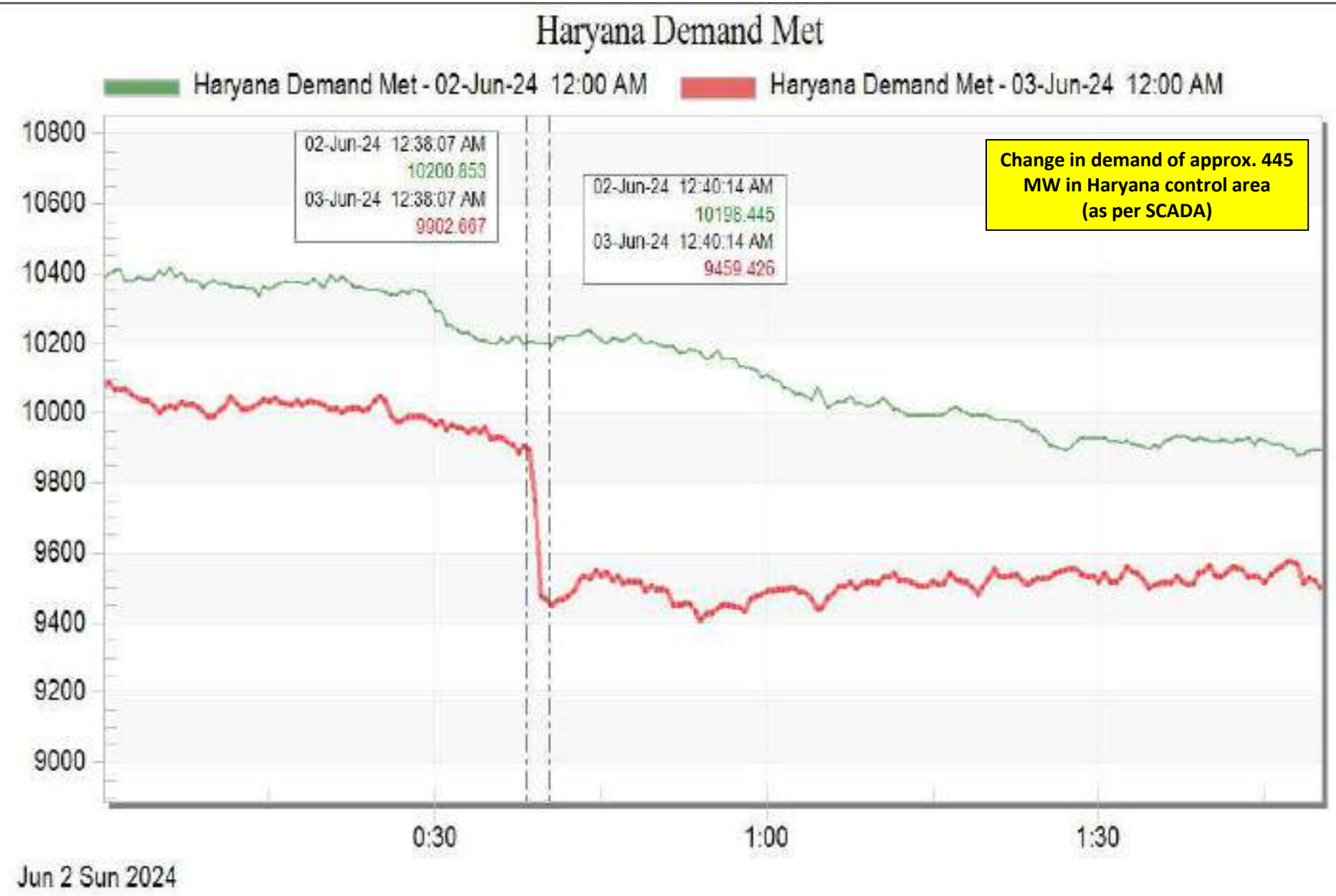
SLD of 400/220/132kV Panipat(BB) before the event



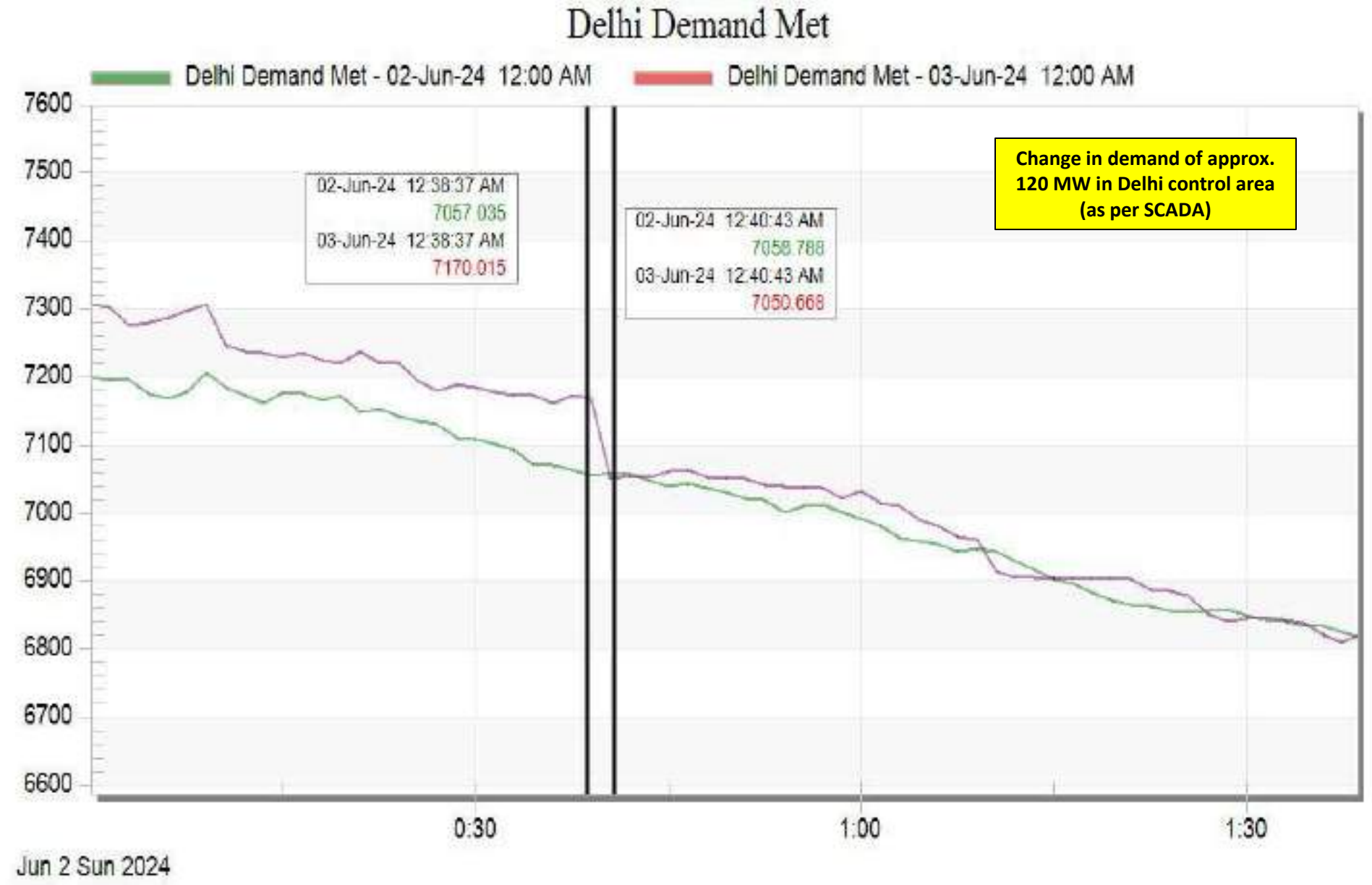
SLD of 400/220/132kV Panipat(BB) after the event



Haryana demand during the event



Delhi demand during the event



PMU Plot of frequency at Panipat(BBMB)

00:38hrs/03-Jun-24

PMU Plot of phase voltage magnitude at Panipat(BBMB)

00:38hrs/03-Jun-24

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
00:38:54,177	PANPT_BB	220kV	05T2	Circuit Breaker	Open	CB at 220kV side of 220/33kV 60 MVA ICT-2 at Panipat(BB) opened
00:38:54,187	PANPT_BB	220kV	16PANTH1	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-1 opened
00:38:54,206	PANPT_BB	220kV	07NAREL3	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-3 opened
00:38:54,209	PANPT_BB	33kV	03T1	Circuit Breaker	Open	CB at 33kV side of 220/33kV 60 MVA ICT-1 at Panipat(BB) opened
00:38:54,217	PANPT_BB	220kV	15PANTH2	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-2 opened
00:38:54,231	PANPT_BB	132kV	08T4	Circuit Breaker	Open	CB at 132kV side of 220/132kV 100 MVA ICT-2 at Panipat(BB) opened
00:38:54,237	PANPT_BB	220kV	21T2	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100 MVA ICT-2 at Panipat(BB) opened
00:38:54,247	PANPT_BB	220kV	04PANTH4	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV PanipatTH(HV)-Panipat(BB) (HVPNL) Ckt-4 opened
00:38:54,269	PANPT_BB	220kV	01CHJPR1	Circuit Breaker	disturbe	
00:38:54,269	PANPT_BB	33kV	04T2	Circuit Breaker	disturbe	
00:38:54,269	PANPT_BB	220kV	22MBC	Circuit Breaker	Open	Main Bus Coupler CB at 220kV Panipat(BB) opened
00:38:54,278	PANPT_BB	220kV	12NAREL2	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-2 opened
00:38:54,297	PANPT_BB	220kV	02CHJPR2	Circuit Breaker	disturbe	
00:38:54,297	PANPT_BB	220kV	20T1	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100 MVA ICT-1 at Panipat(BB) opened
00:38:54,307	PANPT_BB	220kV	14DADRI	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV Panipat-Charkhi Dadri (BB) Ckt opened
00:38:54,327	PANPT_BB	220kV	10BS	Circuit Breaker	Open	Bus Sectionalizer CB at 220kV Panipat(BB) opened
00:38:54,337	PANPT_BB	220kV	13NAREL1	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV Panipat(BB)-Narela(DV) (BBMB) Ckt-1 opened
00:38:54,357	PANPT_BB	220kV	11T2	Circuit Breaker	Open	CB at 220kV side of 400/220kV 500 MVA ICT-2 at Panipat(BB) opened
00:38:54,367	PANPT_BB	220kV	18DHULK2	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV Panipat-Dhulkote (BB) Ckt-2 opened
00:38:54,388	PANPT_BB	220kV	19PIPLI	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV Panipat(BB)-Pipli Ckt opened
00:38:54,397	PANPT_BB	220kV	17DHULK1	Circuit Breaker	Open	Line CB at Panipat(BB) end of 220 KV Panipat-Dhulkote (BB) Ckt-1 opened
00:38:54,417	PANPT_BB	220kV	09T1	Circuit Breaker	Open	CB at 220kV side of 400/220kV 450 MVA ICT-1 at Panipat(BB) opened
00:38:54,447	PANPT_BB	220kV	03T1	Circuit Breaker	disturbe	

Point of discussion

- Phase sequence issue need to be resolved at the earliest.
- DR/EL (.dat/.cfg file) along with tripping report of all the tripped elements need to be shared from both the ends.

Multiple Tripping Analysis Report

Analysis of Multiple Grid Elements Tripping

at 400kV BBMB Panipat Sub-Station

on dated 03.06.2024

BRIEF INTRODUCTION

At 00:38 Hrs. dated 03.06.2024, Blue phase CT of 220kV Bus Coupler-2 toward BUS-2 side bursted and thus made phase to earth Bus-bar Differential fault. The Numerical low Impedance type MiCom P741 Bus-Bar Differential Protection Scheme of ALSTOM make sensed the fault & operated and tripped all the feeders connected on either side of Bus Coupler i.e. Bus-1 & Bus-2.

Tripped elements :

Tripped Element	Time of Tripping
220/33kV, 60MVA T/F T-1 & T-2	03.06.2024 ,00:38 Hrs.
220kV Panipat-Kurukshetra	03.06.2024 ,00:38 Hrs.
220kV Panipat-Dhulkot Ckt.- 1 & 2	03.06.2024 ,00:38 Hrs.
220kV Panipat-Thermal Ckt.-1,2,3 & 4	03.06.2024 ,00:38 Hrs.
220kV Panipat-Narela Ckt.-1,2& 3	03.06.2024 ,00:38 Hrs.
220kV Panipat-Chajjpur Ckt.- 1&2	03.06.2024 ,00:38 Hrs.
220kV Panipat-Ch. Dadri	03.06.2024 ,00:38 Hrs.
400/220kV, 450MVA ICT Bank-1	03.06.2024 ,00:38 Hrs.
400/220kV, 500MVA ICT -2	03.06.2024 ,00:38 Hrs.
220/132kV,100MVA T/F T-1 & T-2	03.06.2024 ,00:38 Hrs.
220kV Bus Coupler-1 & 2	03.06.2024 ,00:38 Hrs.
220kV Bus Sectionalizer	03.06.2024 ,00:38 Hrs.

SLD:

BUS-2
BUS-1
220kV Chajjpur-2
220/132kV 100MVA T-2
220kV Thermal-4
Bus Sectionalizer
400/220kV 500MVA ICT-2
220kV Narela-2
220kV Ch. Dadri
220kV Thermal-2
220kV Dhulkot-2
220/33kV 60MVA T-2
ISO 264
ISO 265
Bus Coupler-2
Bus Coupler-1
220/33kV 60MVA T-1
220kV Kurukshetra
220kV Dhulkot-1
220kV Thermal-1
220kV Narela-1
400/220kV 500MVA ICT-2
220kV Narela-3
220kV Thermal-3
220/132kV 100MVA T-1
220kV Chajjpur-1

Detailed Analysis:

- At 00:38 Hrs. dated 03.06.2024, Blue phase CT of 220kV Bus Coupler-2 toward BUS-2 side bursted and thus made phase to earth Bus-bar Differential fault. The Numerical low Impedance type MiCom P741 Bus-Bar Differential Protection Scheme of ALSTOM make sensed the fault & operated and tripped all the feeders connected on either side of Bus Coupler i.e. Bus-1 & Bus-2.
- The operation staff isolated the Bus Coupler-2 Bay, breaker A-22 and charged 220kV Bus-1 by closing A-17 Breaker of Panipat-Dhulkote circuit-1 at 01:26 hrs. Bus-2 was charged by closing the A-18 Breaker of Panipat-Dhulkote circuit-2 at 01:36 Hrs.
- After this, all the feeders of 220kV Bus-1 & Bus-2 were charged one by one.
- The reason of bursting of the blue phase CT was observed to be some internal fault in Heptacare make CT installed on the bay on dated 29.11.2018.

Location & type of Fault:

- The fault was on Blue Phase CT of Bus Coupler-2 , towards Bus-2 Side. The CT got bursted causing Blue Phase to ground fault.

..\..\DR 2024\BC2 PU-22B\Saturday 04 June 2022 00.38.53.000.CFG

Reason for Tripping of 220kV BUS-1 :

- Later on after detailed analysis of DRs in view of "Status of BUS ISOLATOR", it was found that at the time of Bus-Bar fault on Bus-2, the status of Bus Isolators of 220kV Thermal-1 were checked and found that the status of isolators of both buses i.e. Bus-1 and Bus-II were appearing as closed but in actual it should have been closed for BUS-1 & open for BUS-II because Thermal-1 feeder was connected to Bus-1.

- As per existing logic in the numerical Bus-Bar Protection scheme in case of appearing both isolators closed , both Buses tripped even fault in one of the Bus.

- ..\..\DR 2024\Thermal-1\Saturday 04 June 2022 00.38.53.000.CFG

Remedial Action :

- On dated 03.06.2024 an old and used Rade Koncar make CT of same raϴo i.e. 1200/1-1-1-1-1A was tested thoroughly and found OK. This CT was installed in place of bursted CT and Bus Coupler-2 was charged at 17:38 Hrs. on dated 03.06.2024.
- Also proper status of Bus Isolators will be maintained in association with O&M staff.

Thank You

Prepared & Presented by :
Dy. Director
Protection & Testing Cell
BBMB Panipat

Multiple elements tripping at 220kV KTPS(RS) 21st June 2024

Brief of event:

i. 220kV KTPS(RS) has double main Bus arrangement at 220kV side.

ii. During antecedent condition, power generation of 110 MW Unit-1 & 2, 210 MW Unit-3, 4 & 5 and 195 MW Unit-6 & 7 were 81MW, 95MW, 174MW, 150MW, 167MW, 171MW & 172MW respectively. 210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3 & station transformer (ST)-3 were connected to 220kV Bus-3 and 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 were connected to 220kV Bus-5 at KTPS(RS). 220kV Bus-3 and Bus-5 were coupled through isolator only.

iii. As reported, at 11:37hrs, due to inclement weather conditions, 220 KV KSTPS-Ranpur (RS) ckt tripped on R-Y phase to phase fault at a distance of 12.49km from KTPS(RS) end. Zone-1 distance protection operated from both ends. As per PMU, R-N followed by Y-N phase to earth fault is observed with fault clearing time of 120ms and 120ms.

iv. As reported, at 11:39hrs, due to inclement weather conditions, 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 tripped on B-N phase to earth fault (Ib=~ 14.1kA & Ib=~11.7kA from Kota(PG) and KTPS(RS) ends respectively) at a distance of 2.96km from Kota(PG) end. Zone-1 distance protection operated from Kota(PG) end. However, B-phase CB pole lagged in opening while clearing the fault from KTPS(RS) end which led to LBB protection operation at KTPS(RS). As per PMU, B-N phase to earth fault with delayed fault clearing time of 320msec is observed.

v. Sine 220kV bus-3 & bus-5 were coupled through isolator only, due to LBB operation all elements connected to 220kV bus-3 & bus-5 tripped (210 MW Unit-5, 220 KV KSTPS-Kota Sakatpura (RS) ckt-3, ST-3, 195 MW Unit-7 and 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1).

vi. Due to tripping of ST-3, auxiliary supply of 110 MW Unit-1 and 210 MW Unit-3 & 4 disrupted which led to tripping of Unit-1, 3 & 4 at KTPS(RS).

Brief of event:

vii. At the same time, 220 KV Duni(RS)-Kota(PG) (RS) Ckt also tripped on R-N phase to earth fault (Ir=~21kA & Ir=~1.3kA from Kota(PG) and Duni(RS) end respectively) with fault distance of 75.2km from Kota(PG) end. Fault sensed in zone-1 from both ends. As per PMU, multiple R-N phase to earth fault with fault clearing time of 120ms, 120ms and 80ms.

viii. As per SCADA, no change in demand in Rajasthan control area is observed.

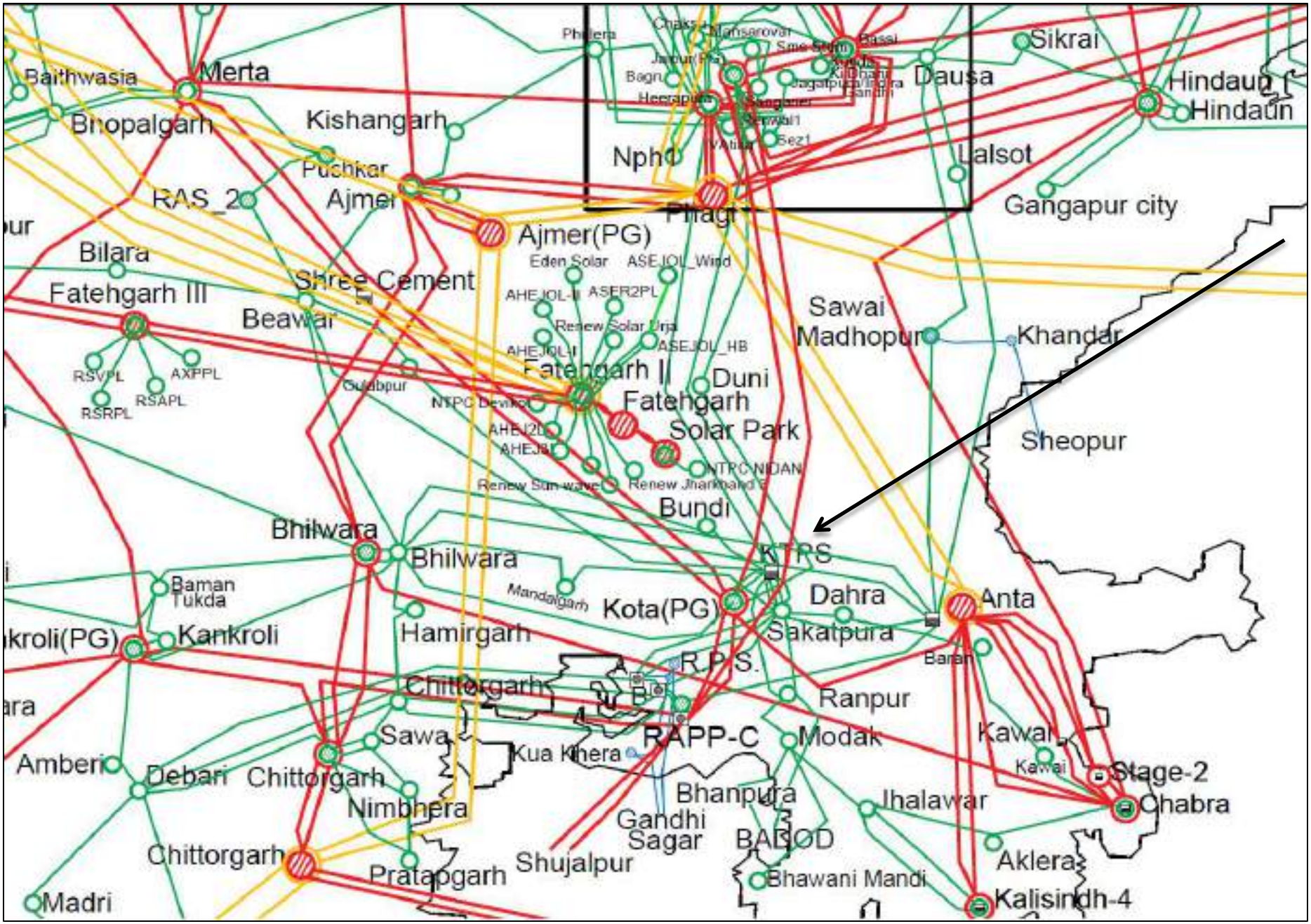
ix. As per SCADA, approx. 714 MW generation loss at KTPS(RS). However, 744 MW generation loss at KTPS(RS) is reported by SLDC-Rajasthan.

x. As reported, the case for installation of bus coupler CB between 220kV Bus-3 and Bus-5 at KTPS(RS) is under process.

Elements tripped:

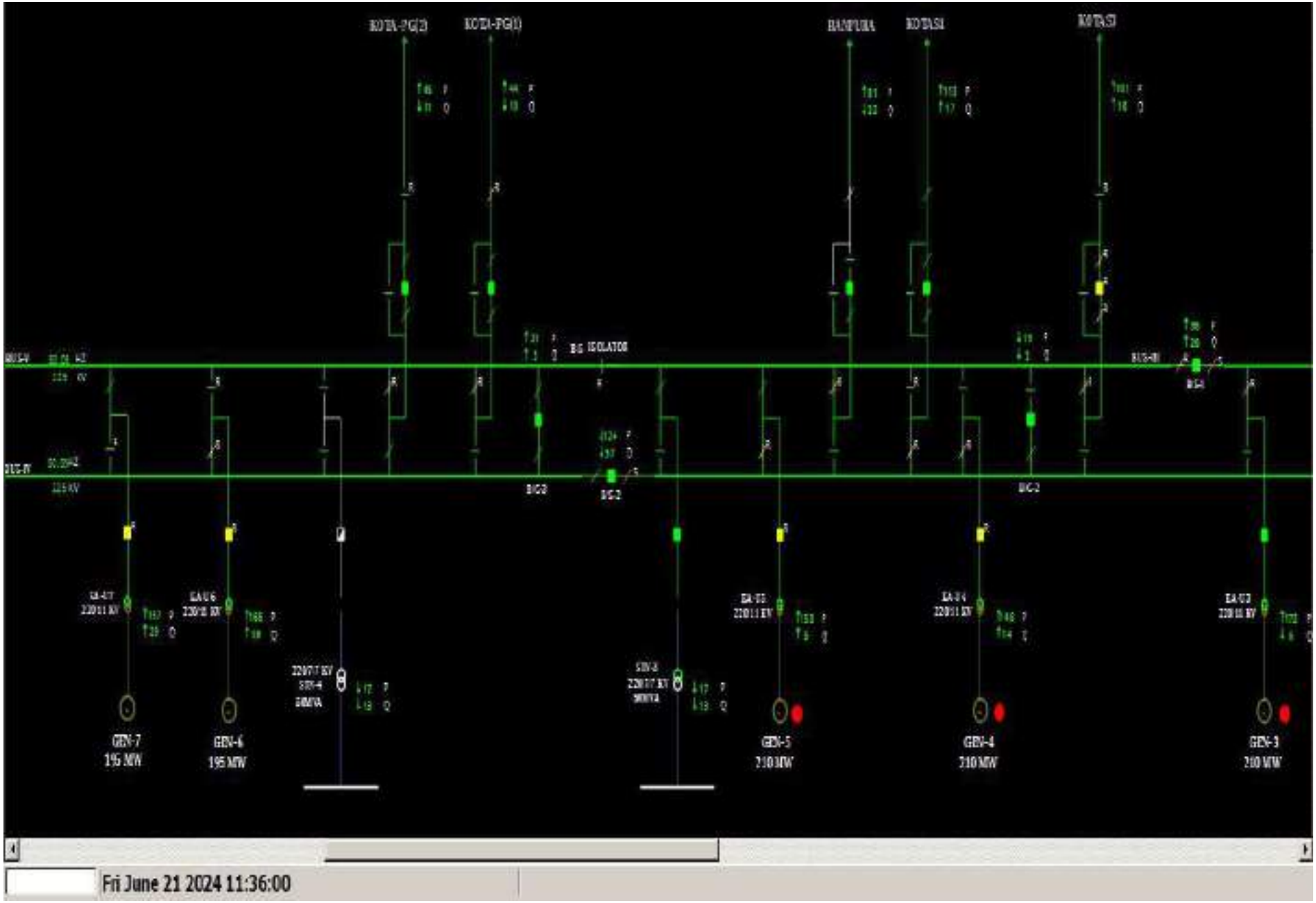
1) 220 KV KSTPS-Ranpur (RS) ckt
2) 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1
3) 220 KV KSTPS-Kota Sakatpura (RS) ckt-3
4) 110 MW Unit-1 at KTPS(RS)
5) 210 MW Unit-3 at KTPS(RS)
6) 210 MW Unit-4 at KTPS(RS)
7) 210 MW Unit-5 at KTPS(RS)
8) 195 MW Unit-7 at KTPS(RS)
9) 220 KV Duni(RS)-Kota(PG) (RS) Ckt

Network Diagram before the event

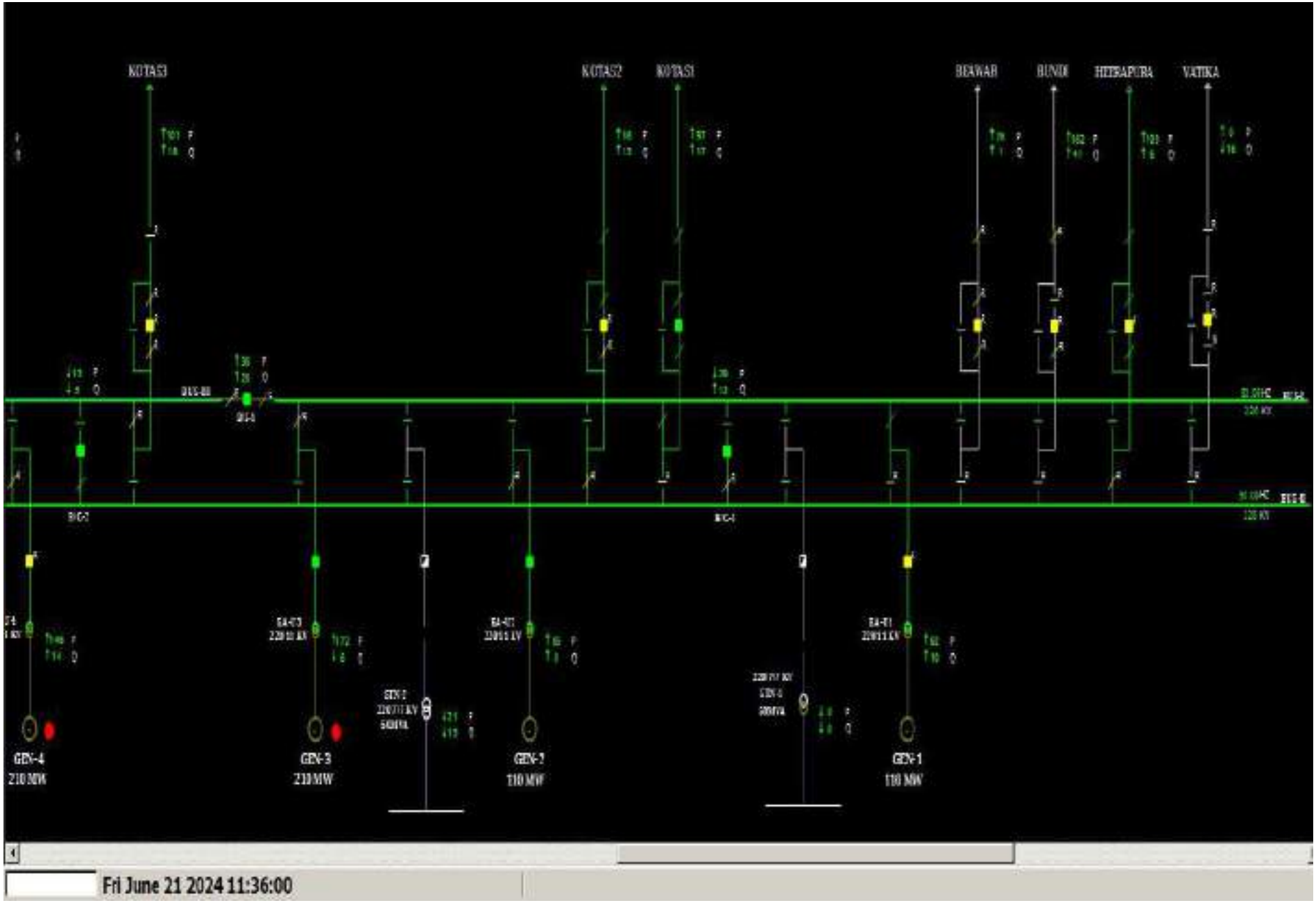


SLD of 220kV KTPS(RS) before the event

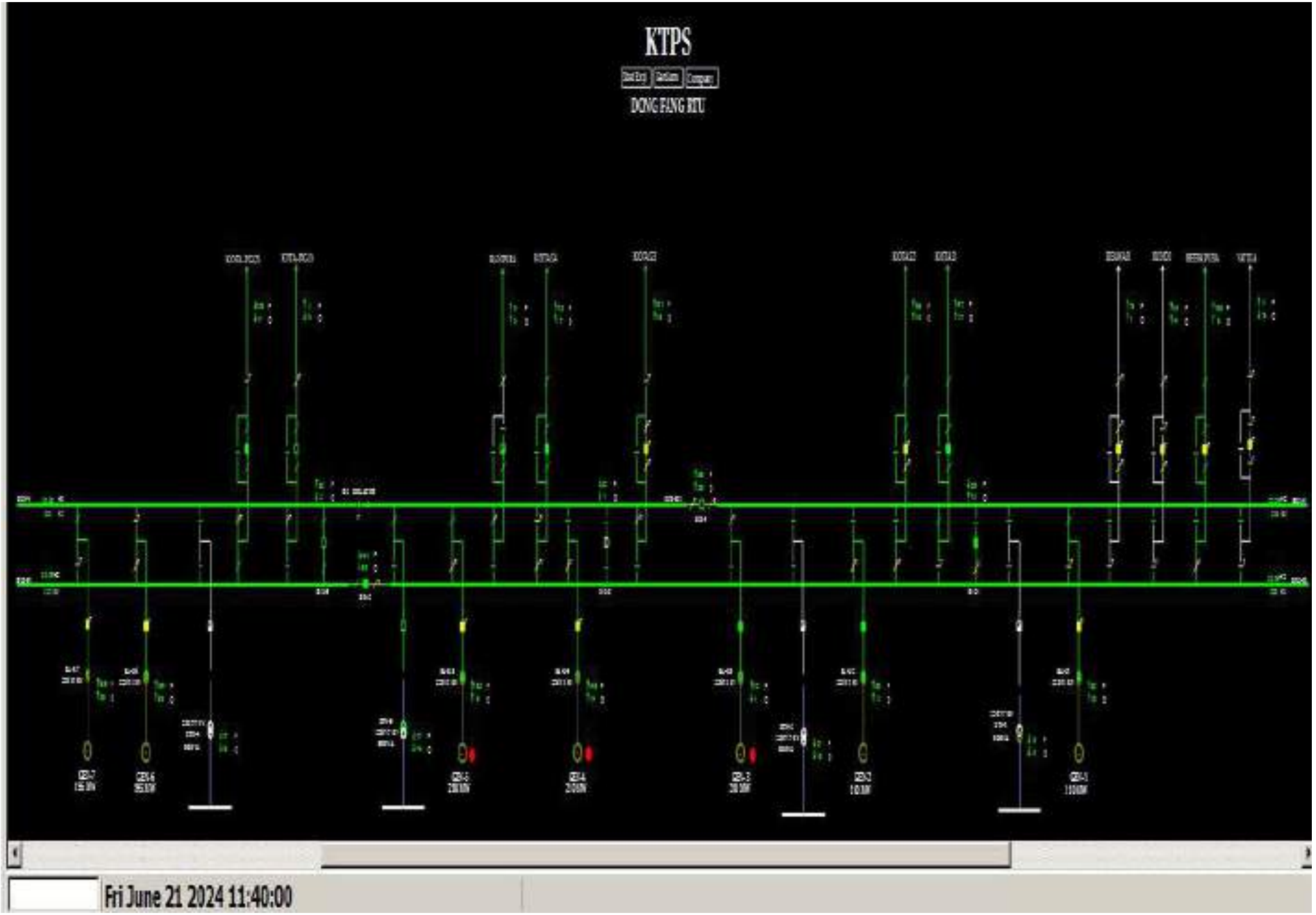
SLD of 220kV KTPS(RS) before the event



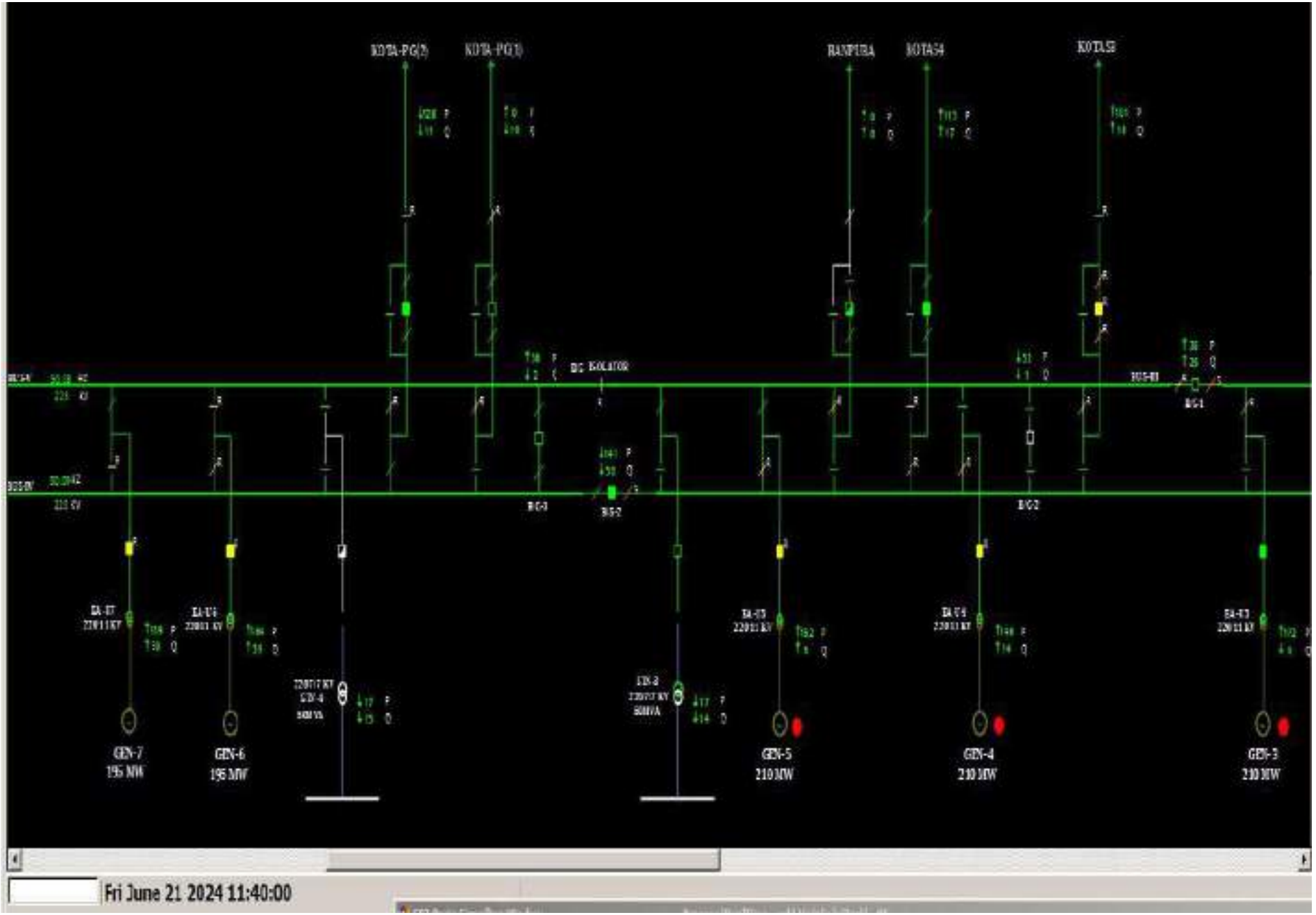
SLD of 220kV KTPS(RS) before the event



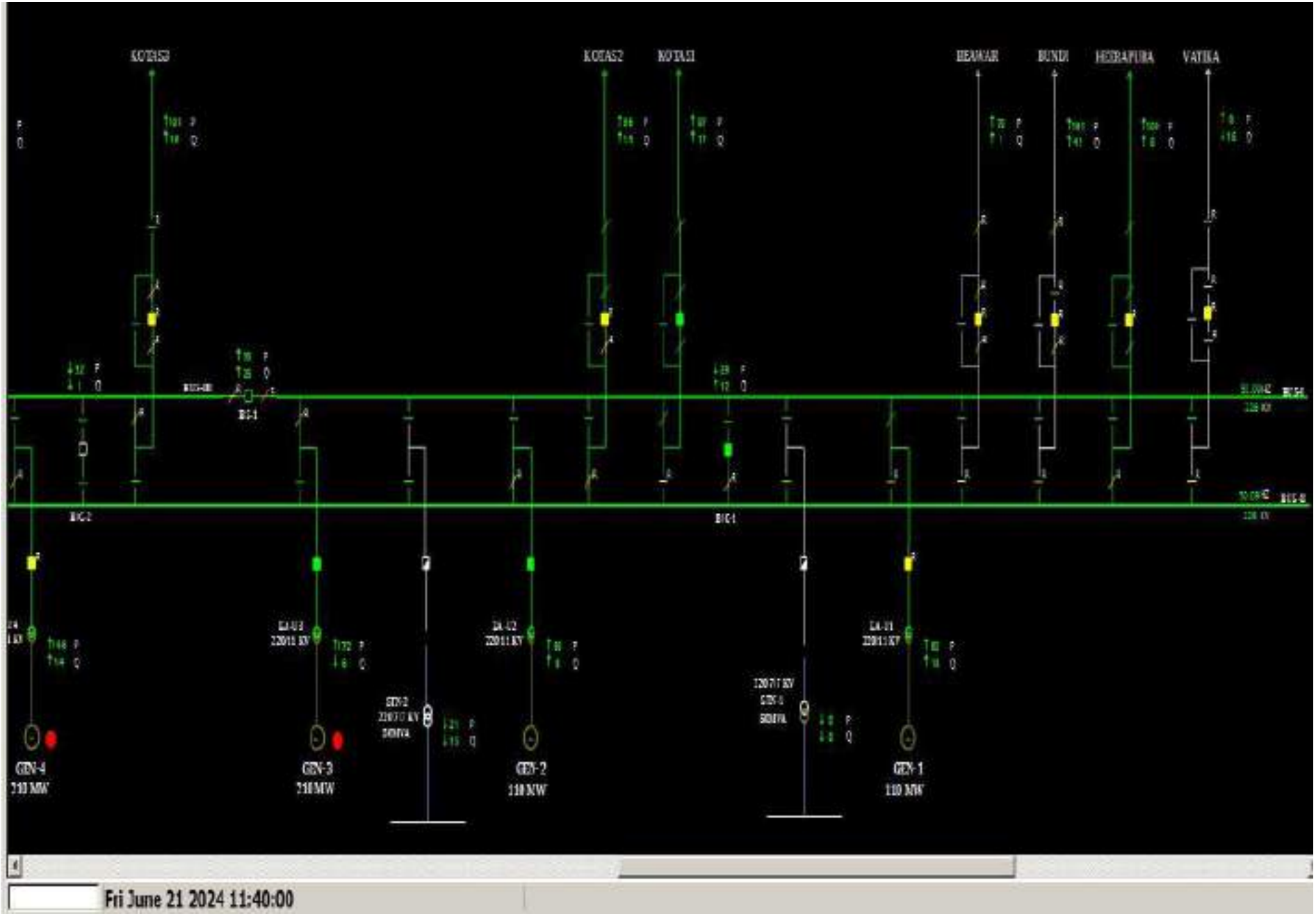
SLD of 220kV KTPS(RS) after the event



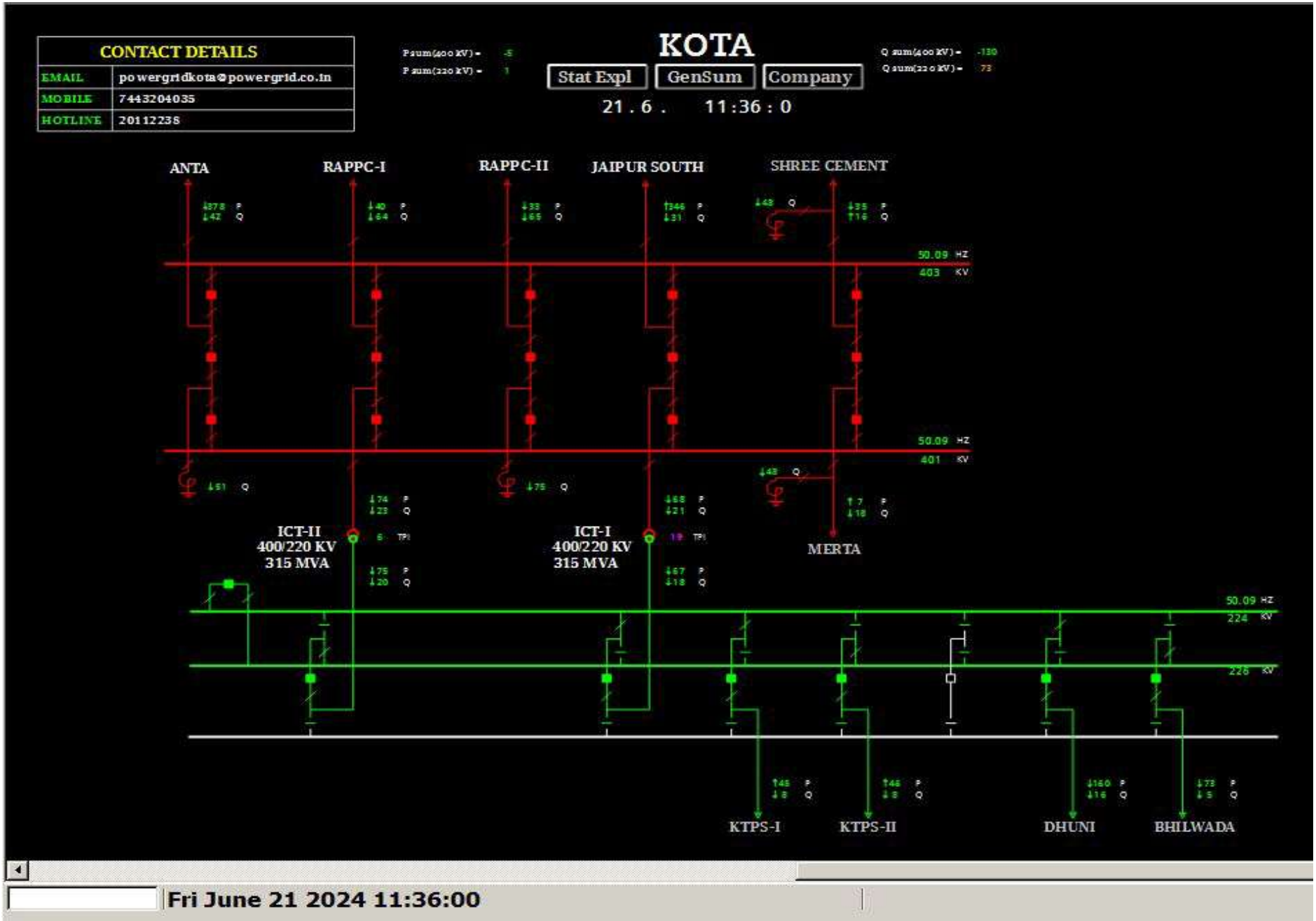
SLD of 220kV KTPS(RS) after the event



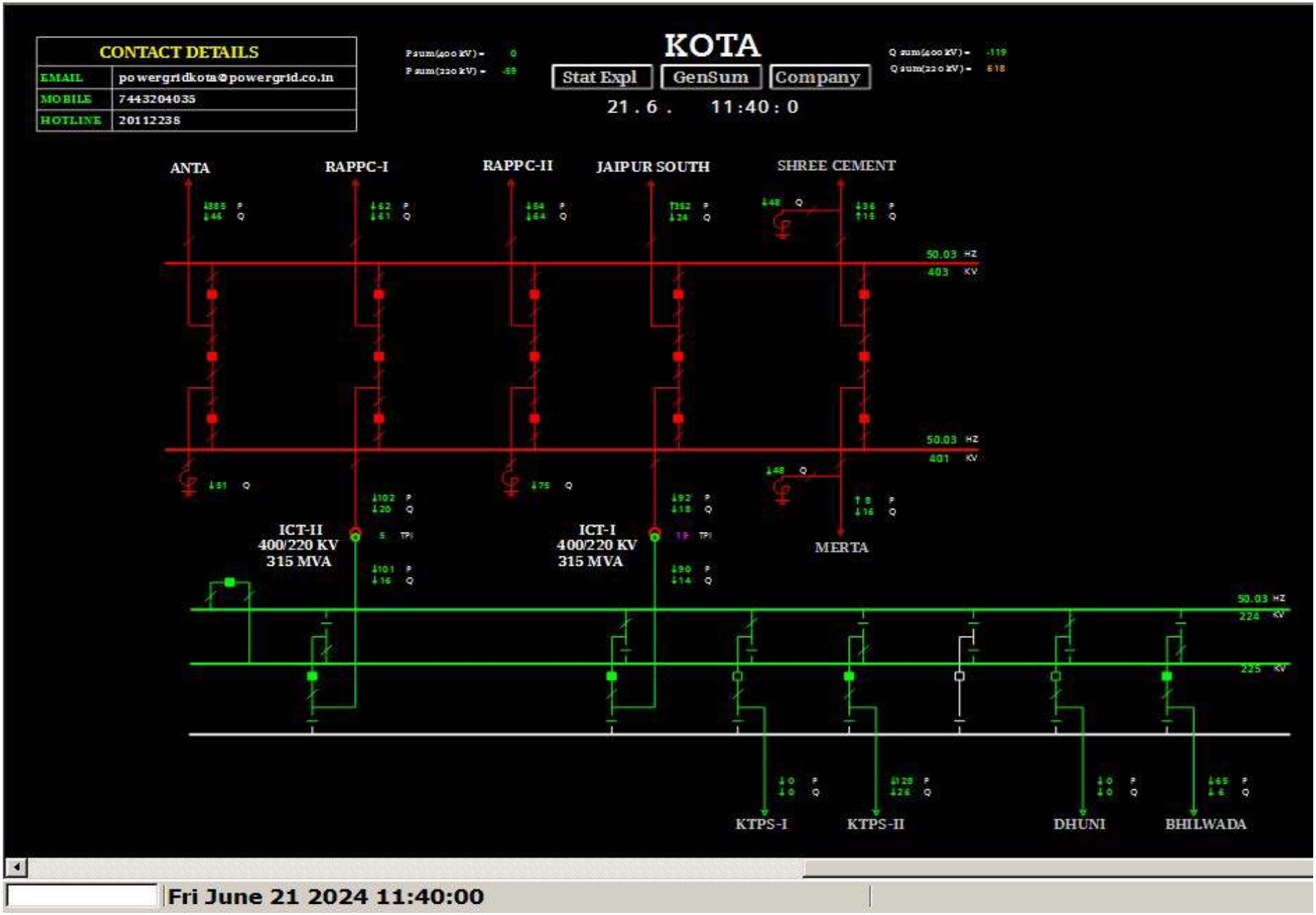
SLD of 220kV KTPS(RS) after the event



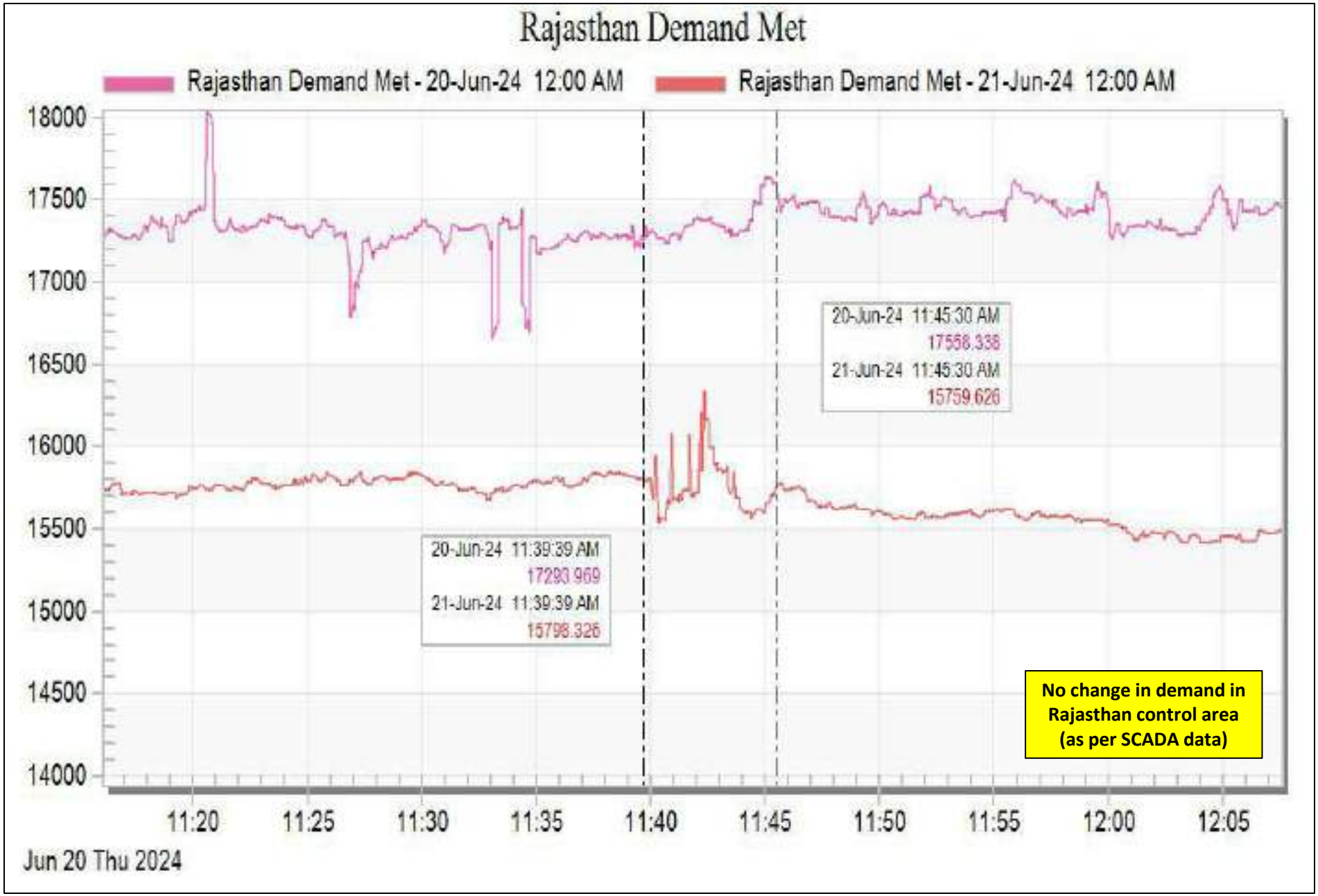
SLD of 400/220kV Kota(PG) before the event



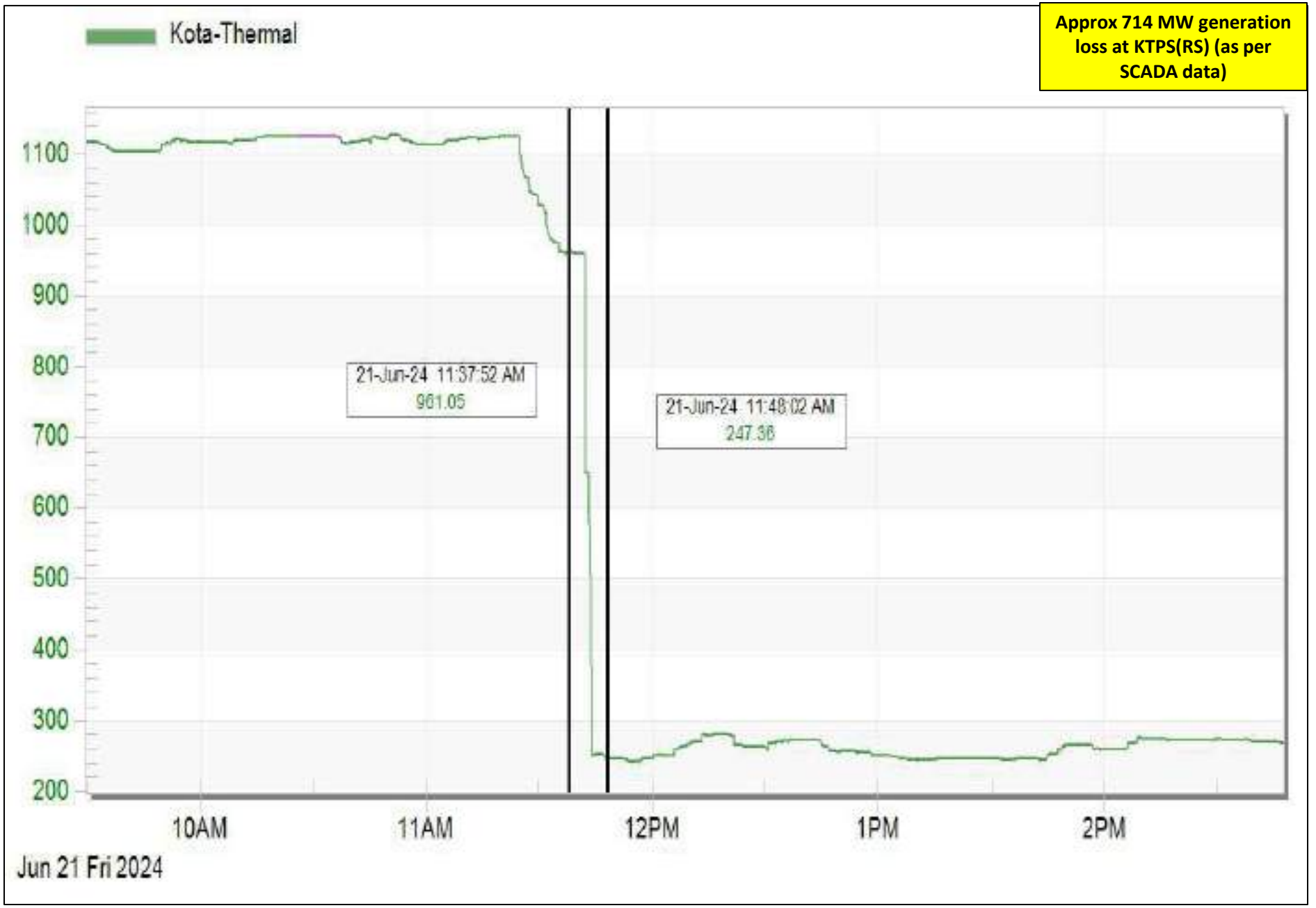
SLD of 400/220kV Kota(PG) after the event



Rajasthan demand during the event

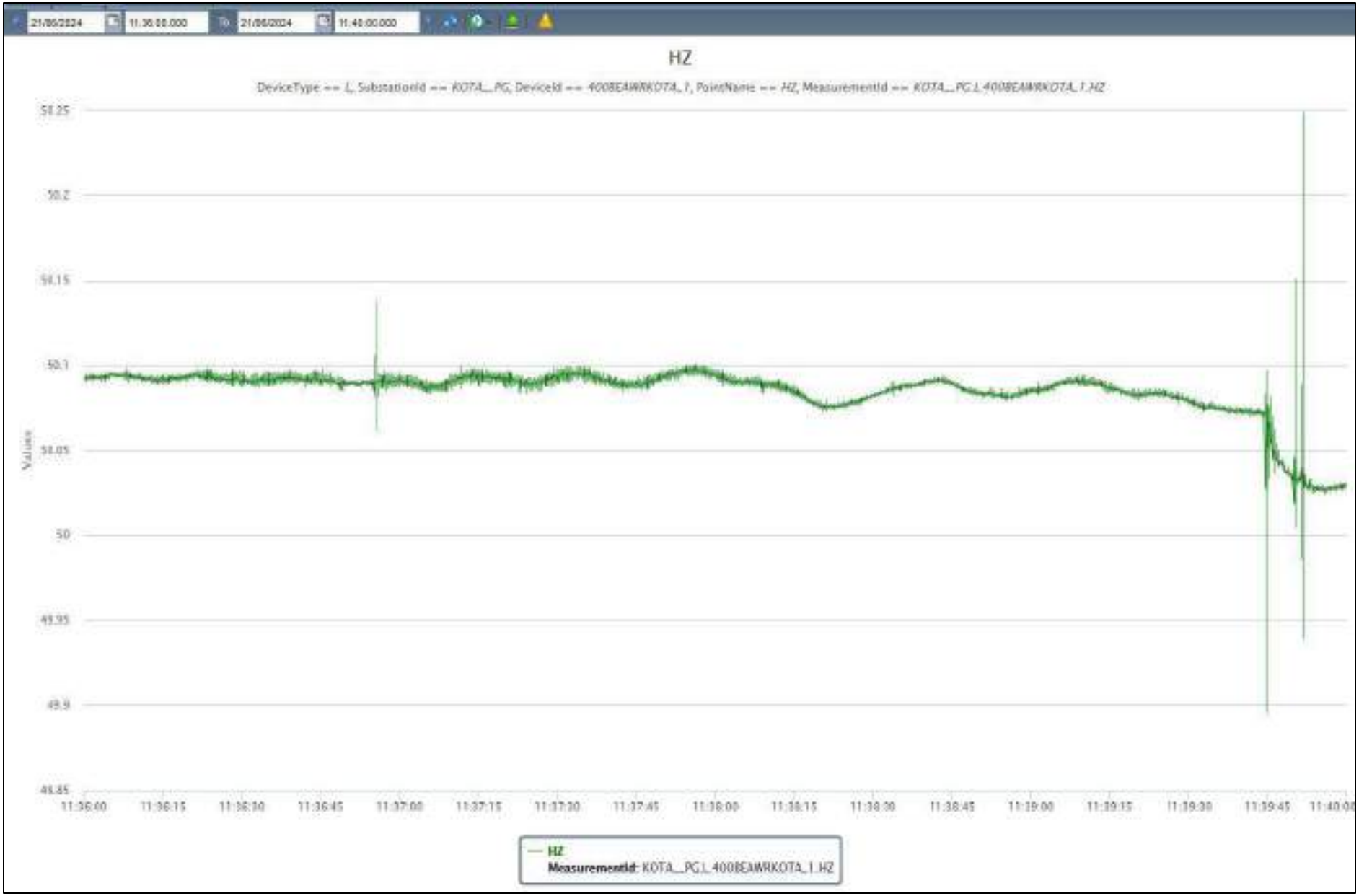


KTPS(RS) generation during the event



PMU Plot of frequency at Kota(PG)

11:37hrs/21-June-24

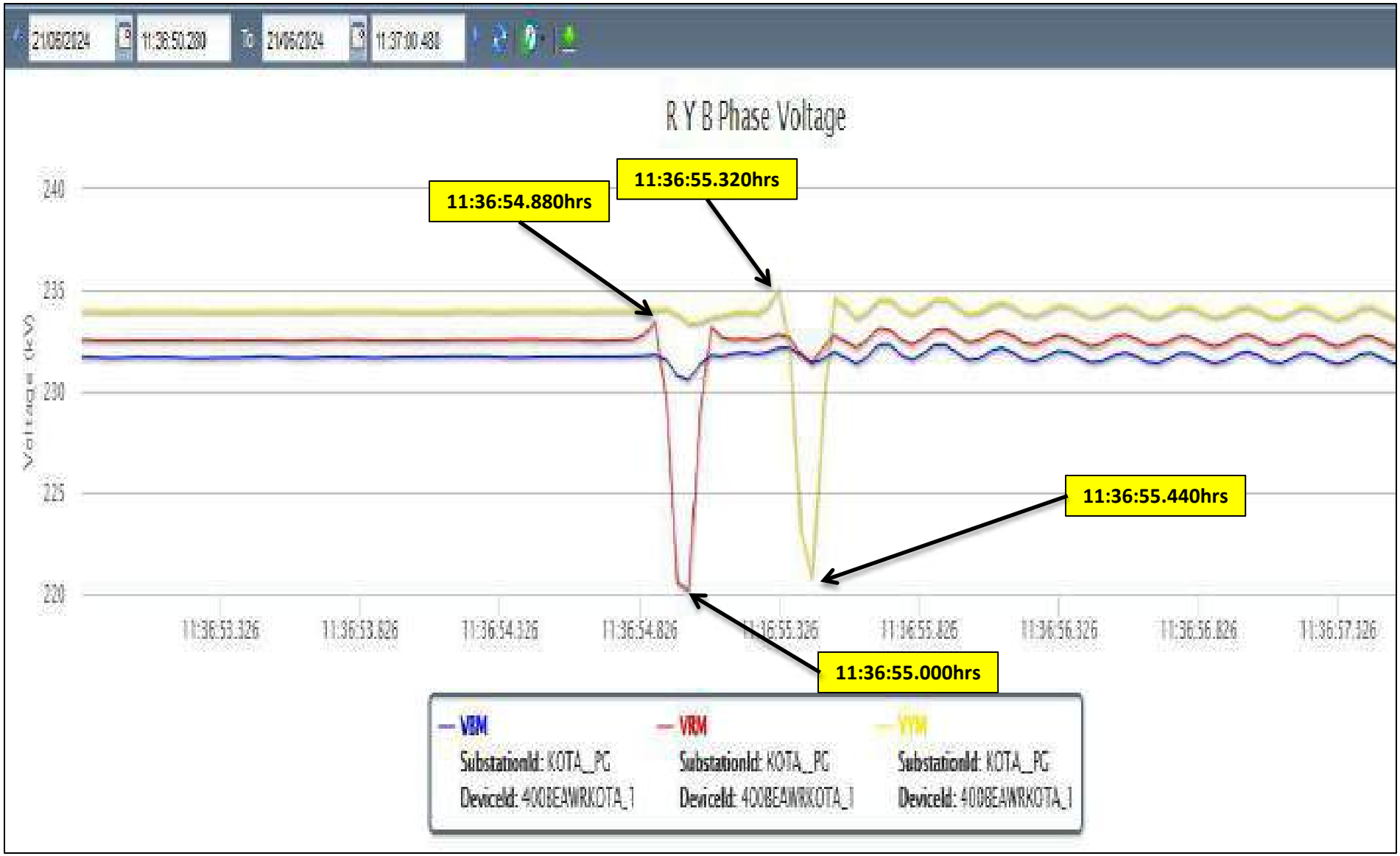


PMU Plot of phase voltage magnitude at Kota(PG)

11:37hrs/21-June-24

PMU Plot of phase voltage magnitude at Kota(PG)

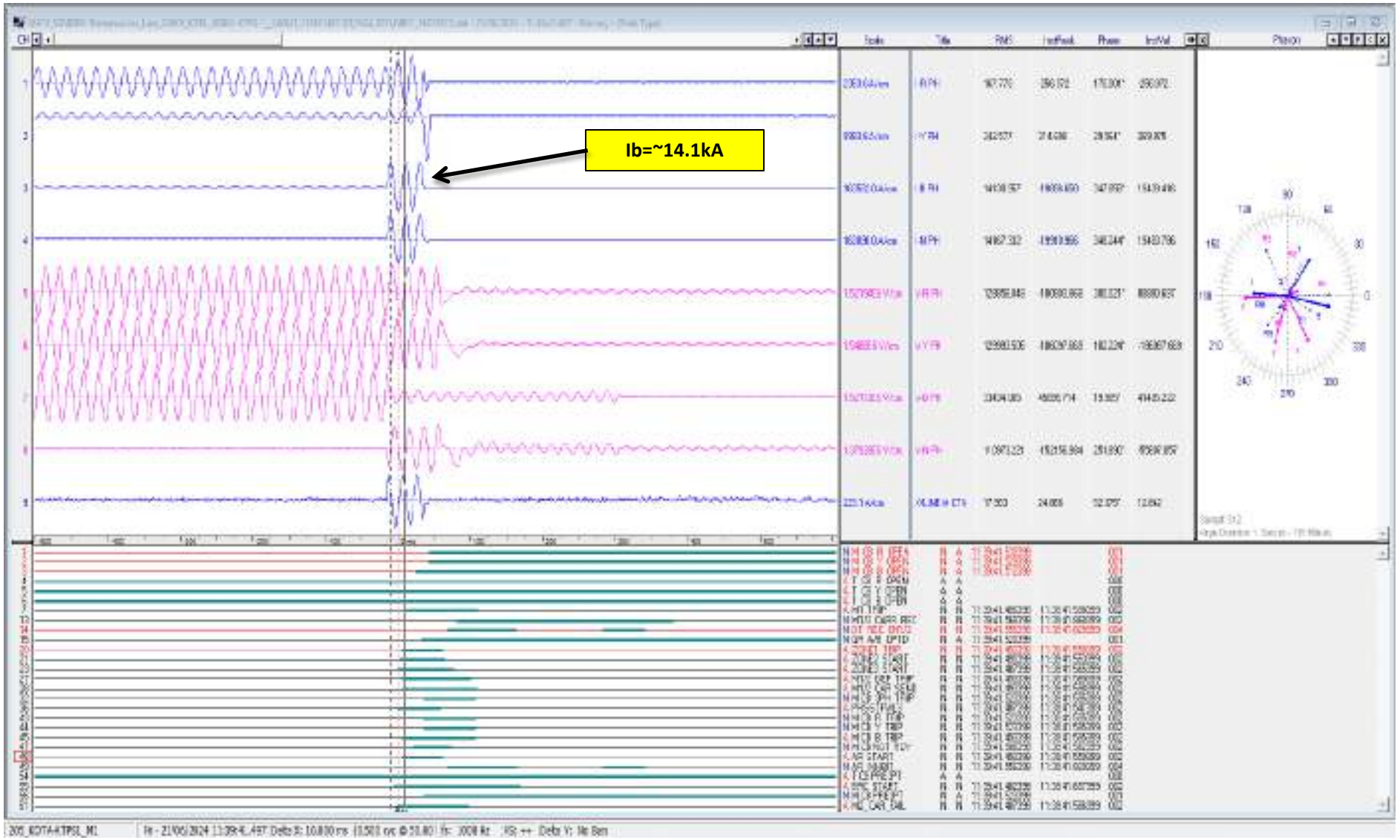
11:37hrs/21-June-24



PMU Plot of phase voltage magnitude at Kota(PG)

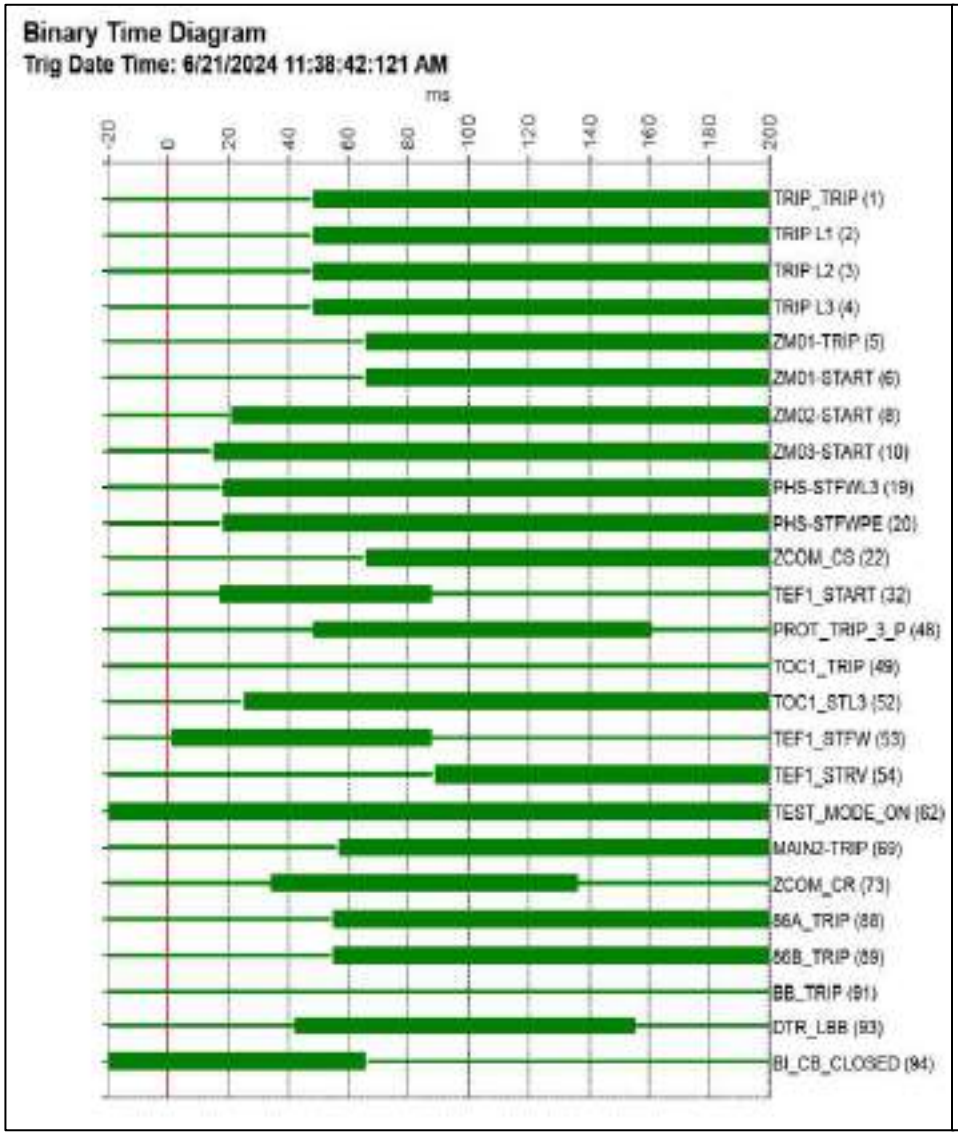
11:39hrs/21-June-24

DR of 220 KV Kota(PG)(end)-KTPS(RVUN) (RS) Ckt-1



- ✓ B-N phase to earth fault; Ib=~14.1kA.
- ✓ Zone-1 distance protection operated.
- ✓ No Auto-recloser operation detected.

DR of 220 KV Kota(PG)-KTPS(RVUN)(end) (RS) Ckt-1



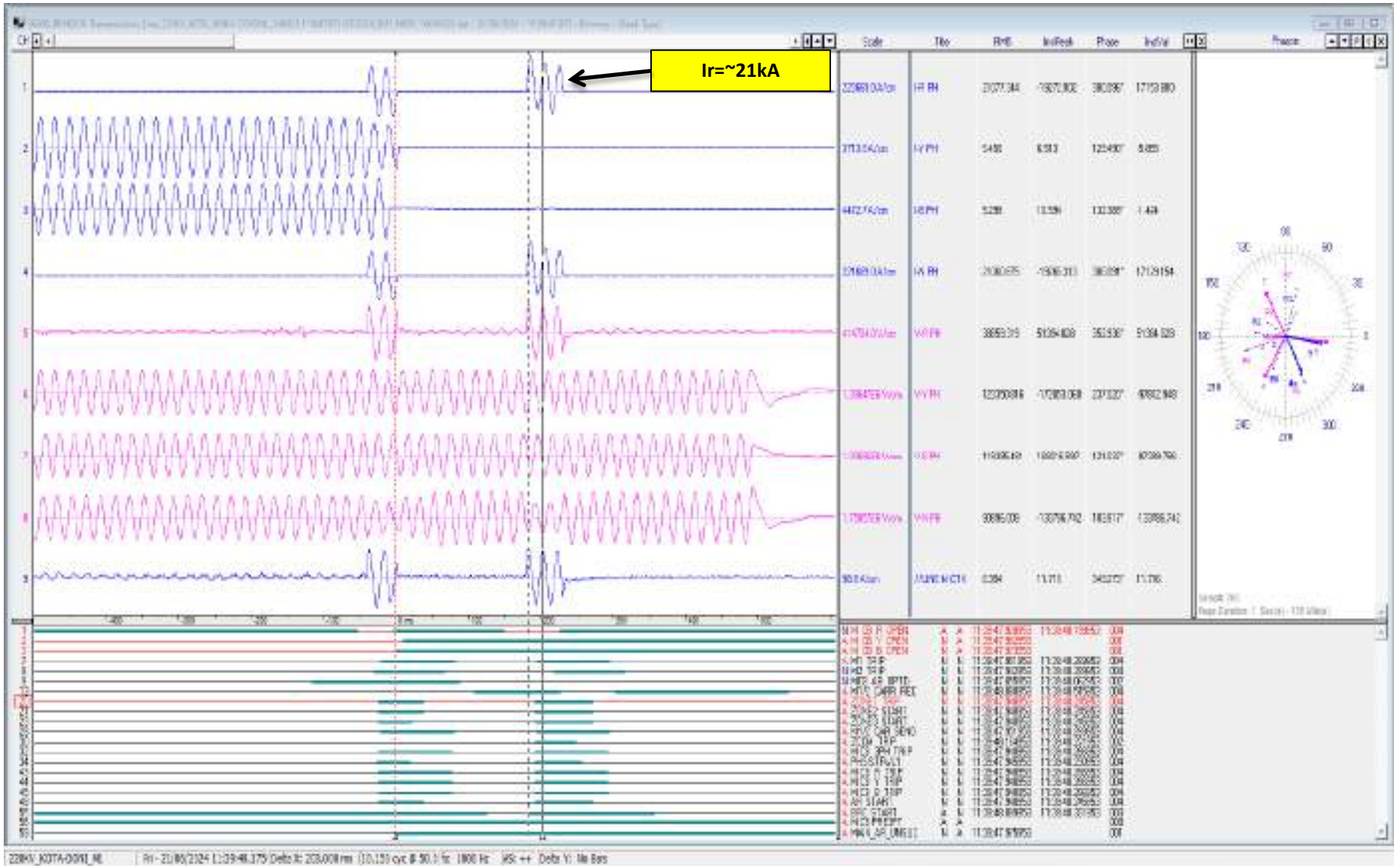
No.	Name	RMS	Angle	No.	Name	RMS	Angle
1	LINE_UL1	121036.2(V)	359.1°	1	LINE_A_IL1	190.296(A)	55.8°
2	LINE_UL2	120807.9(V)	231.1°	2	LINE_A_IL2	248.193(A)	269.8°
3	LINE_UL3	54084.33(V)	98.5°	3	LINE_A_IL3	11732.75(A)	44.7°
4	LINE_UN	56385.01(V)	311.2°	4	LINE_A_IN	11744.95(A)	44.0°
				5	LINE_B_IL1	193.384(A)	55.5°
				6	LINE_B_IL2	245.579(A)	270.0°
				7	LINE_B_IL3	11729.2(A)	44.7°
				8	LINE_B_IN	11747.27(A)	44.1°

Events List

Channel Number	Name	Status	Time
53	TEF1_STFW	On	6/21/2024 11:38:42:121 AM
10	ZM03-START	On	6/21/2024 11:38:42:135 AM
32	TEF1_START	On	6/21/2024 11:38:42:137 AM
19	PHS-STFWL3	On	6/21/2024 11:38:42:138 AM
20	PHS-STFWPE	On	6/21/2024 11:38:42:138 AM
8	ZM02-START	On	6/21/2024 11:38:42:141 AM
52	TOC1_STL3	On	6/21/2024 11:38:42:145 AM
73	ZCOM_CR	On	6/21/2024 11:38:42:155 AM
93	DTR_LBB	On	6/21/2024 11:38:42:163 AM
1	TRIP_TRIP	On	6/21/2024 11:38:42:168 AM
2	TRIP L1	On	6/21/2024 11:38:42:168 AM
3	TRIP L2	On	6/21/2024 11:38:42:168 AM
4	TRIP L3	On	6/21/2024 11:38:42:168 AM
48	PROT_TRIP_3_P	On	6/21/2024 11:38:42:168 AM
88	86A_TRIP	On	6/21/2024 11:38:42:176 AM
89	86B_TRIP	On	6/21/2024 11:38:42:176 AM
69	MAIN2-TRIP	On	6/21/2024 11:38:42:177 AM
5	ZM01-TRIP	On	6/21/2024 11:38:42:186 AM
6	ZM01-START	On	6/21/2024 11:38:42:186 AM
22	ZCOM_CS	On	6/21/2024 11:38:42:186 AM
94	BI_CB_CLOSED	Off	6/21/2024 11:38:42:188 AM
32	TEF1_START	Off	6/21/2024 11:38:42:209 AM
53	TEF1_STFW	Off	6/21/2024 11:38:42:209 AM
54	TEF1_STRV	On	6/21/2024 11:38:42:209 AM
73	ZCOM_CR	Off	6/21/2024 11:38:42:258 AM
93	DTR_LBB	Off	6/21/2024 11:38:42:277 AM
48	PROT_TRIP_3_P	Off	6/21/2024 11:38:42:282 AM
1	TRIP_TRIP	Off	6/21/2024 11:38:42:339 AM

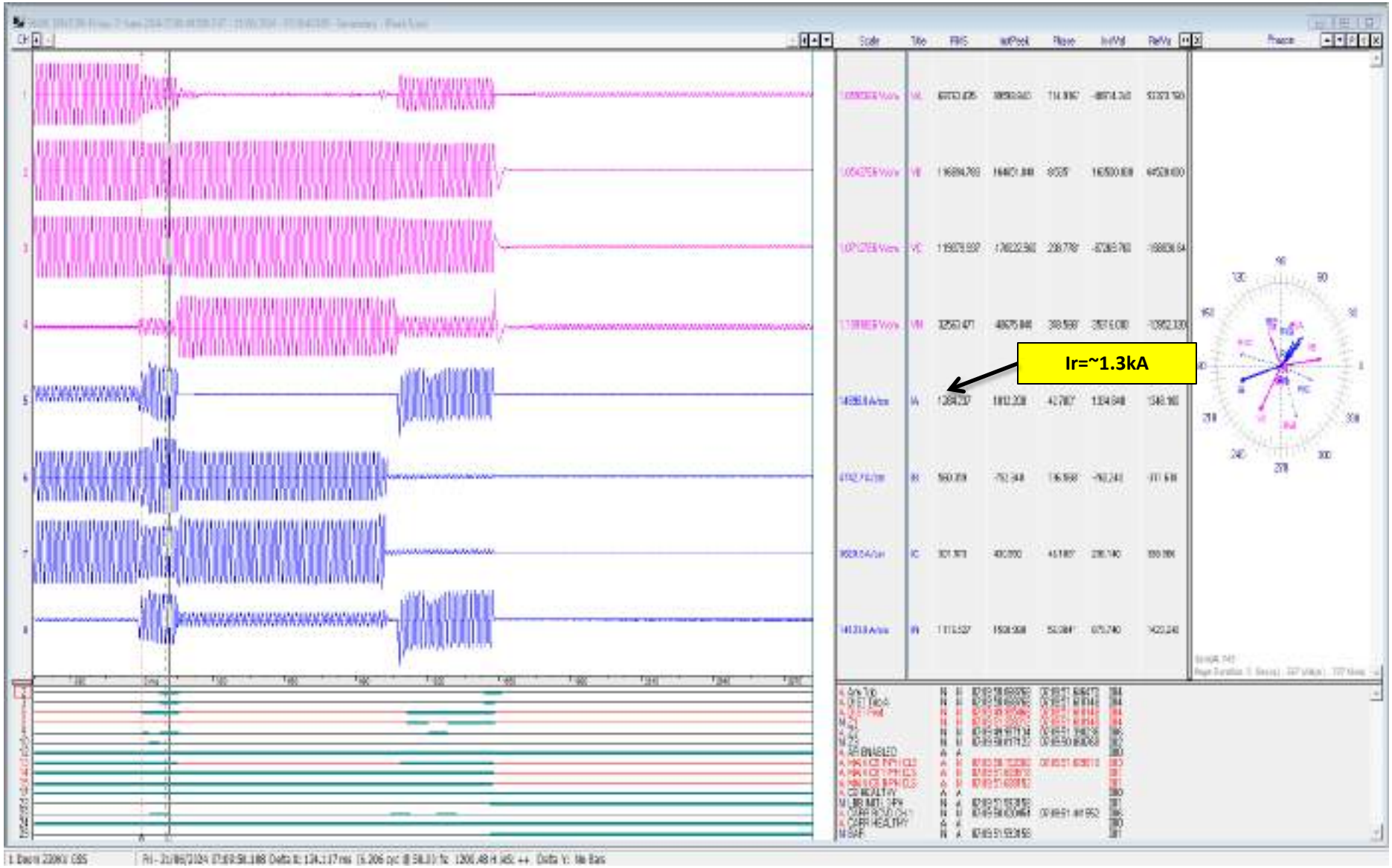
- ✓ B-N phase to earth fault; Ib=~11.7kA.
- ✓ Zone-1 distance protection operated.
- ✓ No Auto-recloser operation detected.

DR of 220 KV Duni(RS)-Kota(PG)(end) (RS) Ckt



- ✓ Multiple R-N phase to earth fault; with fault currents Ir=~18kA, Ir=~21kA.
- ✓ Zone-1 distance protection operated.
- ✓ No Auto-recloser operation detected.

DR of 220 KV Duni(RS)(end)-Kota(PG) (RS) Ckt



- ✓ R-N phase to earth fault; with fault currents Ir=~1.3kA.
- ✓ Fault sensed in zone-1.
- ✓ Unsuccessful auto-recloser operation detected. Time Sync issue in DR.

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
11:37:07,581	KTPS__RS	220kV	18RANPUR	Circuit Breaker	disturbe	
11:39:05,252	KOTAS_RS	220kV	10MBC	Circuit Breaker	Close	Bus coupler at Kota Sakatpura(RS) end of 220kV Bus-A & Bus-D closed.
11:39:41,513	KOTA__PG	220kV	05KTPS1	Circuit Breaker	disturbe	
11:39:41,530	KOTA__PG	220kV	05KTPS1	Circuit Breaker	Open	Line CB at Kota(PG) end of 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 opened
11:39:46,870	KOTA__PG	220kV	08DHUNI1	Circuit Breaker	disturbe	
11:39:48,007	KOTA__PG	220kV	08DHUNI1	Circuit Breaker	Open	Line CB at Kota(PG) end of 220 KV Duni(RS)-Kota(PG) (RS) Ckt opened
11:39:49,749	KTPS__RS	220kV	23PGCIL1	Circuit Breaker	Open	Line CB at KTPS(RS) end of 220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 opened
11:39:49,749	KTPS__RS	220kV	22MBC	Circuit Breaker	Open	Bus coupler at KTPS(RS) end of 220kV Bus-4 & Bus-5 opened.
11:39:49,749	KTPS__RS	220kV	20STN3	Circuit Breaker	Open	CB at KTPS(RS) end of 220/7/7kV 50MVA ST-3 opened
11:39:49,749	KTPS__RS	220kV	15MBC	Circuit Breaker	Open	Bus coupler at KTPS(RS) end of 220kV Bus-2 & Bus-3 opened.
11:39:49,749	KTPS__RS	220kV	13BS	Circuit Breaker	Open	Bus coupler at KTPS(RS) end of 220kV Bus-3 & Bus-1 opened.
11:39:51,463	DUNI__RS	220kV	04KOTA1	Circuit Breaker	Open	Line CB at Duni(RS) end of 220 KV Duni(RS)-Kota(PG) (RS) Ckt opened

Point of discussion

- 220kV Bus-3 and Bus-5 should be coupled using bus coupler CB instead of isolator.
- Tripping report along with remedial action taken report need to be shared.
- Time sync issue in DR of 220 KV Duni(RS)-Kota(PG) (RS) Ckt from Duni(RS) end.

Multiple elements tripping at 220kV KTPS(RS) 21st June 2024

Brief of event:

i. During antecedent condition, low voltage scenario was prevailing in mainly Rajasthan, Delhi and UP control area. As per SCADA, voltage at 400kV Bikaner(RS), Bhadla(RS), Bhinmal(RS) and Kankani(RS) were 377kV, 382kV, 379kV and 375kV respectively.

ii. As per PMU at Bhadla(PG), at 12:42:03:760 hrs, 3-phase to ground fault is observed with fault clearing time of (exact location of the fault yet to be shared). Voltage dipped upto 0.835 p.u. at Bhadla(PG).

iii. As per SCADA, total NR RE generation drop/loss was approx. 4930MW (ISTS Solar: ~3490 MW, Rajasthan Solar: ~843 MW, Rajasthan Wind: ~597 MW).

iv. As per SCADA, total change in demand of approx. 1215 MW (Punjab: ~730 MW, UP: ~180 MW, Rajasthan: ~305 MW) is observed in NR control area.

v. As per PMU at Bassi(PG), frequency dropped by 0.409Hz (from 50.062 Hz to 49.653 Hz) due to significant dip in RE generation. Frequency recovered upto 49.865 Hz within 1 minute.

vi. As per details received from SLDCs, total load relief of approx. 1050 MW observed in NR region (Punjab: ~723 MW, UP: ~220MW, Rajasthan: ~107 MW) on df/dt operation.

vii. Due to significant dip in RE generation (as RE generation failed to recover 90% of pre-fault active power within 1 sec and further inverters tripping on OV, LVRT/HVRT Non-compliant), over voltage (1.075pu at 400kV Bhadla(PG)) scenario occured immediately after the fault.

viii. At the same time, 135 MW Rajwest (IPP) LTPS - UNIT 2, 4, 5, 6 and 8 also tripped due to “sudden change in speed protection” in turbine operated (protection logic: if 2 out of 3 sensors in turbine senses change in speed more than 20 rpm within 10ms then it sends tripping signal to turbine), as reported (further details yet to be received).

ix. As per SCADA, generation loss of approx. 600 MW occurred at Rajwest(RS) LTPS.

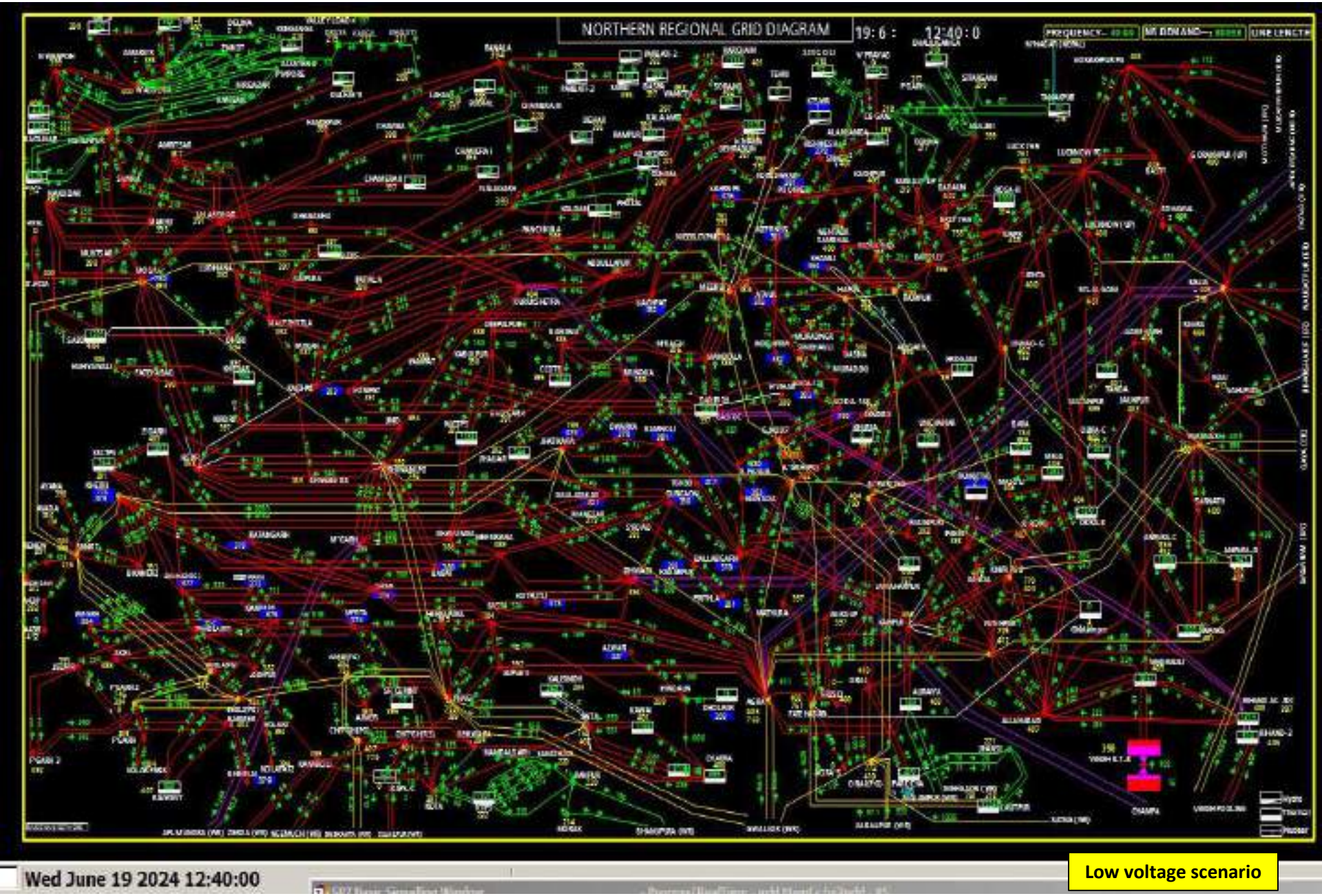
Brief of event:

Elements tripped:

i. 135 MW Rajwest (IPP) LTPS - UNIT 2
ii. 135 MW Rajwest (IPP) LTPS - UNIT 4
iii. 135 MW Rajwest (IPP) LTPS - UNIT 5
iv. 135 MW Rajwest (IPP) LTPS - UNIT 6
v. 135 MW Rajwest (IPP) LTPS - UNIT 8

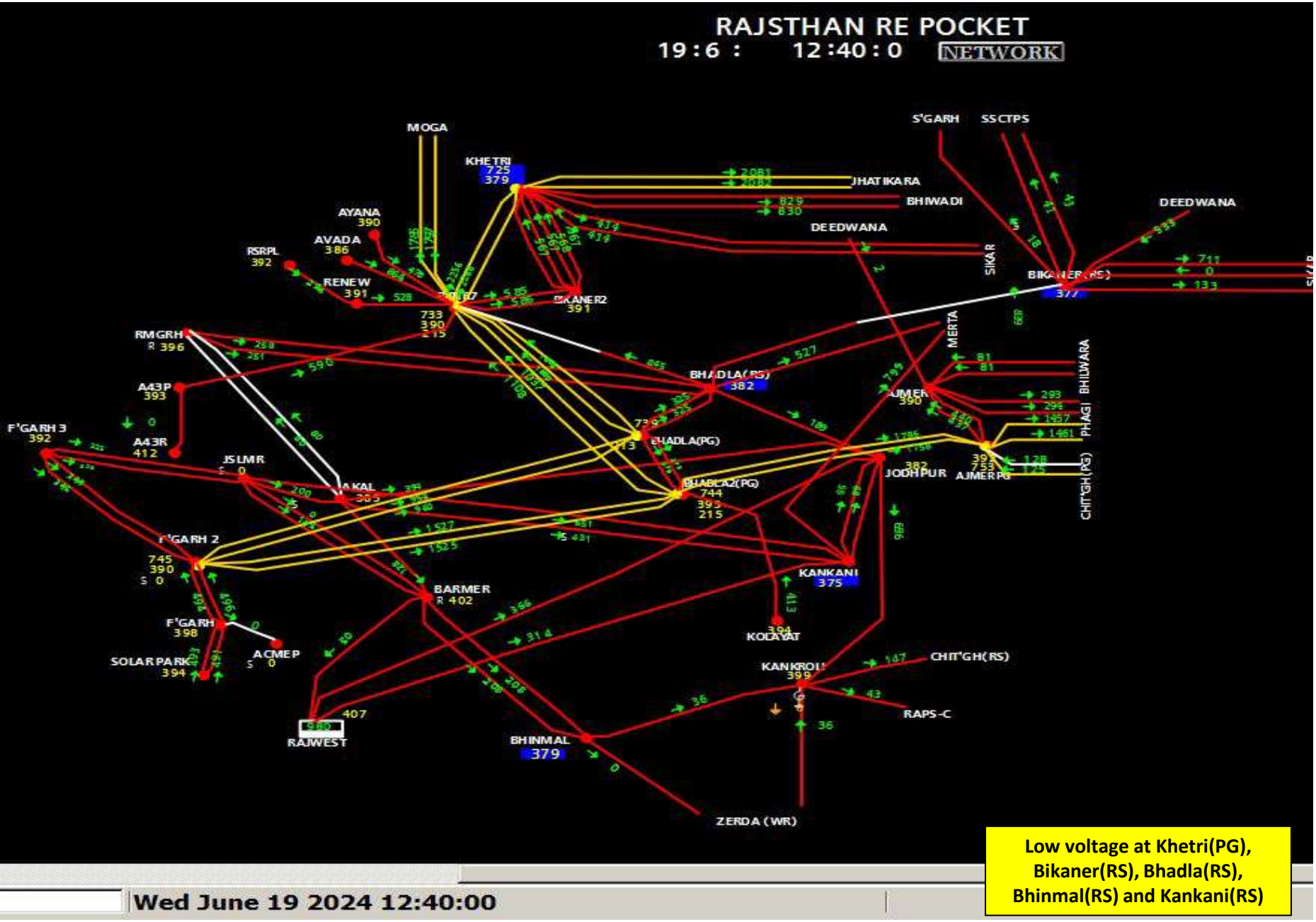
Antecedent Condition

NR network diagram before the event



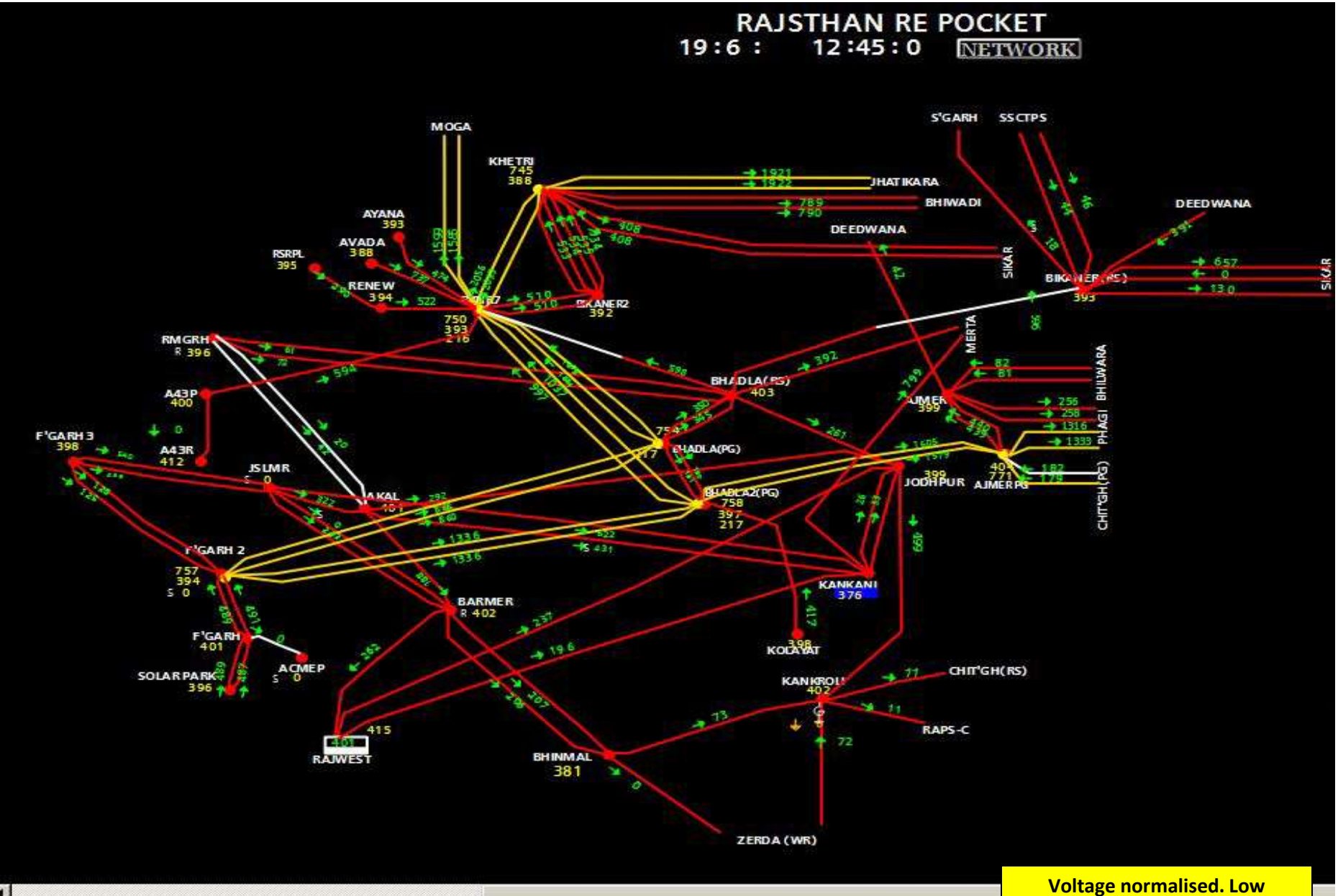
NR network diagram after the event

Rajasthan RE Pocket network diagram before the event



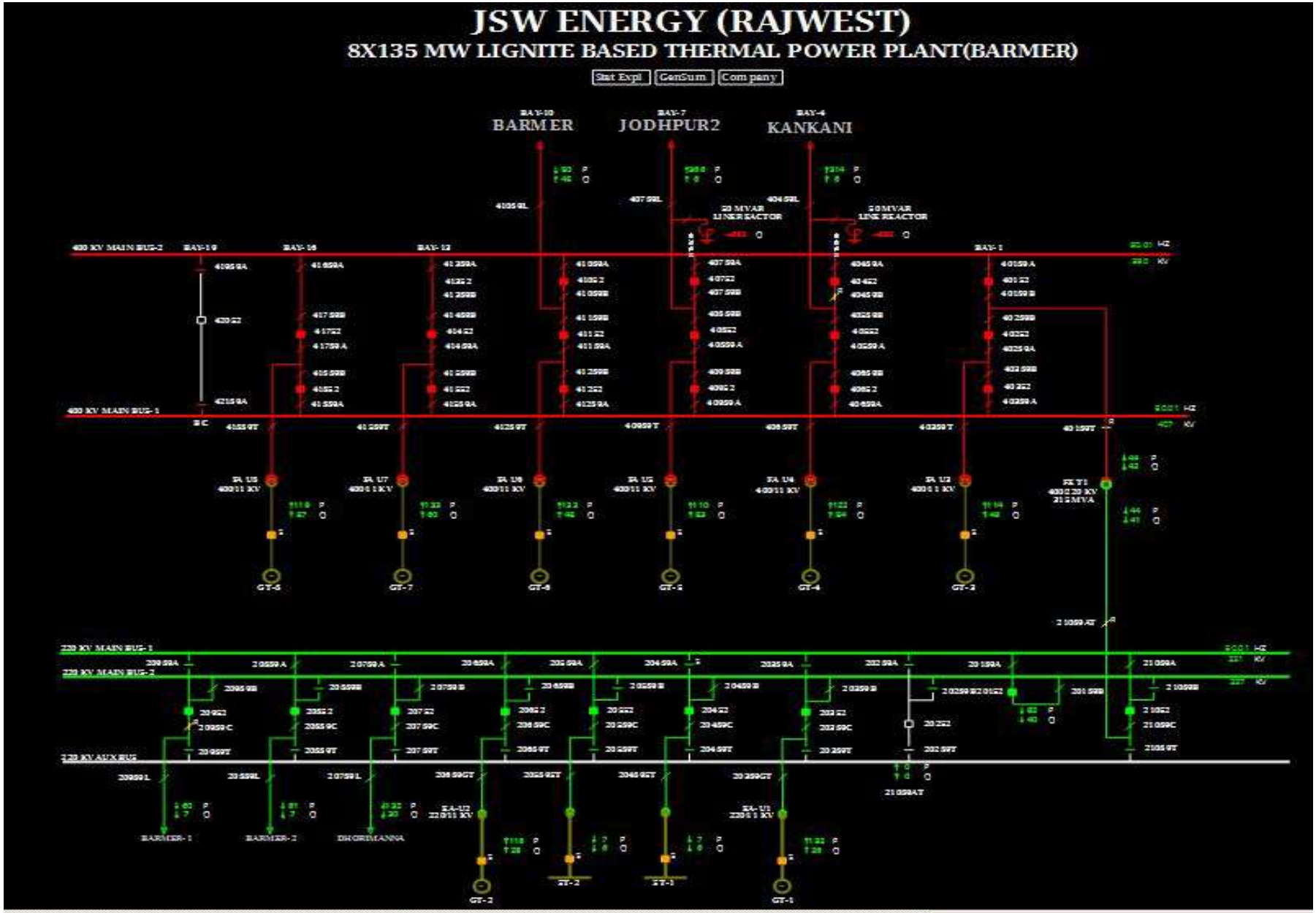
Low voltage at Khetri(PG), Bikaner(RS), Bhadla(RS), Bhinmal(RS) and Kankani(RS)

Rajasthan RE Pocket network diagram after the event

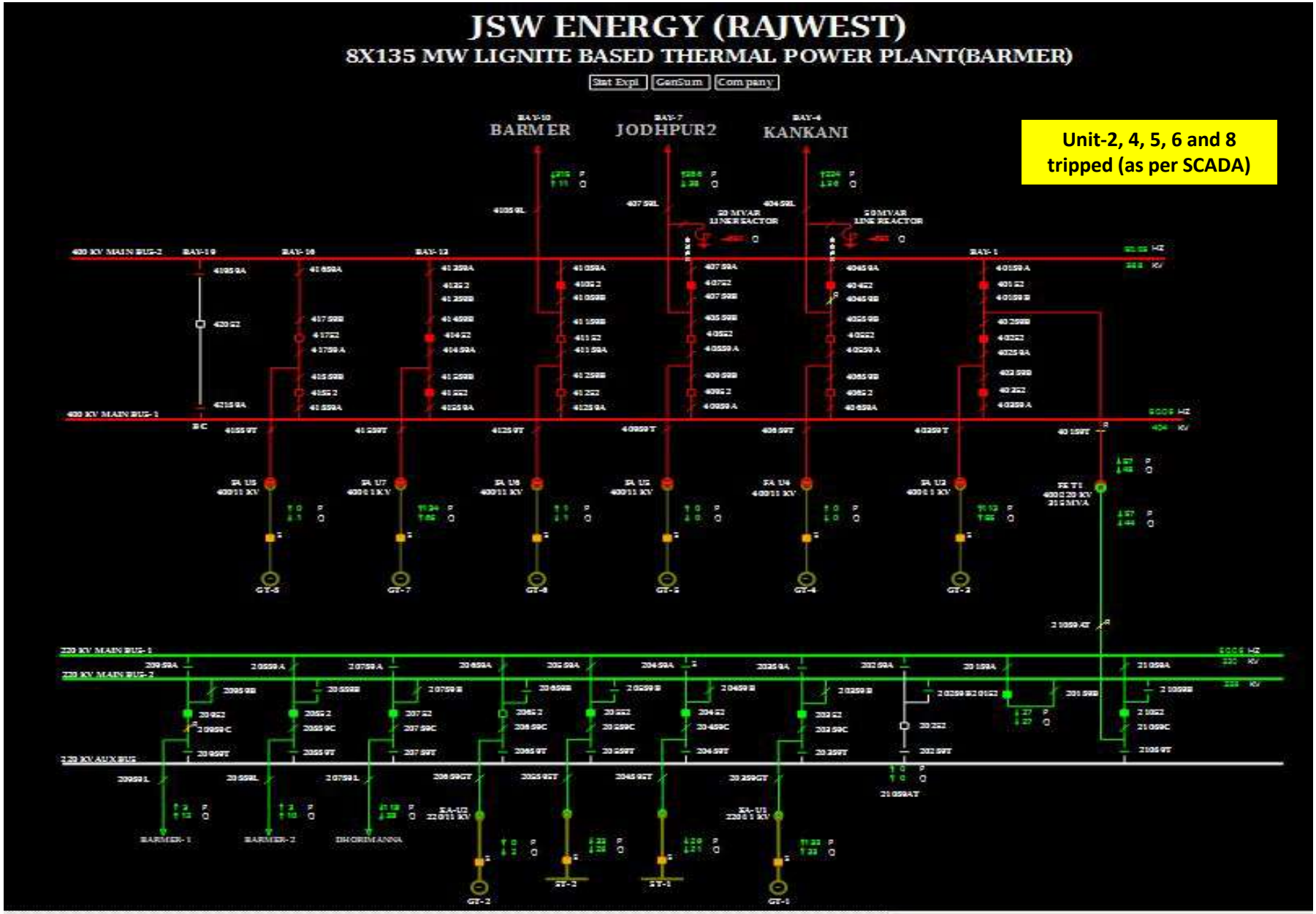


Voltage normalised. Low voltage at Kankani(RS) only.

SLD of 400/220kV Rajwest(RS) LTPS before the event



SLD of 400/220kV Rajwest(RS) LTPS after the event



Rajasthan generation Summary before the event

RAJASTHAN GENERATION SUMMARY

REGIONAL SUMMARY

THERMAL GENERATION

BARSINGSAR (HV) 193 KV

	CAPACITY	MW	MVAR
UNIT-1	125	100	100
UNIT-2	125	100	100
TOTAL	250	184	184

CHHABRA (HV) 406 KV

	CAPACITY	MW	MVAR
UNIT-1	250	217	-18
UNIT-2	250	176	-3
UNIT-3	250	230	6
UNIT-4	250	232	8
UNIT-5	660	391	53
UNIT-6	660	520	56
TOTAL	2320	R 1817	

DHOLPUR (LV) 203 KV

	CAPACITY	MW	MVAR
UNIT-1	110	-0	-0
UNIT-2	110	16	75
UNIT-3	110	-0	-0
TOTAL	330	15	

KALISINDH (HV) 394 KV

	CAPACITY	MW	MVAR
UNIT-1	600	250	69
UNIT-2	600	-5	-4
TOTAL	1200	240	

KAWAI (HV) 401 KV

	CAPACITY	MW	MVAR
UNIT-1	660	577	25
UNIT-2	660	583	24
TOTAL	1320	1160	

KOTA (HV) 222 KV

	CAPACITY	MW	MVAR
UNIT-1	110	81	23
UNIT-2	110	85	19
UNIT-3	210	183	-3
UNIT-4	210	175	25
UNIT-5	210	182	15
UNIT-6	195	200	54
UNIT-7	195	195	24
TOTAL	1240	1101	156

RAJWEST (LV) 407 KV

	CAPACITY	MW	MVAR
UNIT-1	135	132	26
UNIT-2	135	116	28
UNIT-3	135	114	49
UNIT-4	135	122	54
UNIT-5	135	110	53
UNIT-6	135	138	45
UNIT-7	135	133	60
UNIT-8	135	119	57
TOTAL	1080	980	

RAMGARH (HV) 127 KV

	CAPACITY	MW	MVAR
UNIT-1	35.5	28	13
UNIT-2	37.5	-0	-0
UNIT-3	37.5	R 12	S 8
UNIT-4	110	0	0
UNIT-5	50		0
TOTAL	270.5	R 40	13

RAPS-A 214 KV

	CAPACITY	MW	MVAR
UNIT-1	100	0	0
UNIT-2	200	177	31
TOTAL	300	178	31

SURATGARH (HV) 403 KV

	CAPACITY	MW	MVAR
UNIT-1	250	188	125
UNIT-2	250	184	125
UNIT-3	250	184	-85
UNIT-4	250	208	-99
UNIT-5	250	221	-112
UNIT-6	250	217	-112
TOTAL	1500	1203	S 0

SURAT-SCTPS (HV) 391 KV

	CAPACITY	MW	MVAR
UNIT-1	660	388	159
UNIT-2	660	355	158
TOTAL	1320	744	

VSLP BIKANER (HV) 192 KV

	CAPACITY	MW	MVAR
UNIT-1	135	0	0

HYDRO GENERATION

RANAPRATAP SAGAR(HV) S 133 KV

	CAPACITY	MW	MVAR
UNIT-1	43	0	0
UNIT-2	43	S 0	S 19
UNIT-3	43	S 0	S 0
UNIT-4	43	0	0
TOTAL	172	S 43	S 19

JAWAHAR SAGAR (HV) 131 KV

	CAPACITY	MW	MVAR
UNIT-1	33	0	-1
UNIT-2	33	S 0	S 0
UNIT-3	33	0	0
TOTAL	99	S 0	S -1

MAHI BAJAJ SAGAR (HV) 130 KV

	CAPACITY	MW	MVAR
UNIT-1	25	0	0
UNIT-2	25	0	0
UNIT-3	45	0	-0
UNIT-4	45		S -0
TOTAL	140	0	0

TOTAL THERMAL (MW) S 7445

TOTAL HYDRO (MW) S 43

Wed June 19 2024 12:40:00

Rajasthan generation Summary after the event

RAJASTHAN GENERATION SUMMARY

REGIONAL SUMMARY

THERMAL GENERATION

BARSINGSAR (HV) 196 KV

	CAPACITY	MW	MVAR
UNIT-1	125	100	100
UNIT-2	125	100	100
TOTAL	250	183	158

CHHABRA (HV) 409 KV

	CAPACITY	MW	MVAR
UNIT-1	250	183	-20
UNIT-2	250	160	-11
UNIT-3	250	195	3
UNIT-4	250	201	2
UNIT-5	660	392	13
UNIT-6	660	503	17
TOTAL	2320	R 1688	

DHOLPUR (LV) 208 KV

	CAPACITY	MW	MVAR
UNIT-1	110	-0	-0
UNIT-2	110	16	60
UNIT-3	110	-0	-0
TOTAL	330	16	

KALISINDH (HV) 394 KV

	CAPACITY	MW	MVAR
UNIT-1	600	266	22
UNIT-2	600	-6	-4
TOTAL	1200	257	

KAWAI (HV) 405 KV

	CAPACITY	MW	MVAR
UNIT-1	660	572	-13
UNIT-2	660	591	-13
TOTAL	1320	1163	

KOTA (HV) 222 KV

	CAPACITY	MW	MVAR
UNIT-1	110	80	18
UNIT-2	110	86	14
UNIT-3	210	183	-14
UNIT-4	210	173	14
UNIT-5	210	182	6
UNIT-6	195	200	45
UNIT-7	195	191	16
TOTAL	1240	1096	99

RAJWEST (LV) 404 KV

	CAPACITY	MW	MVAR
UNIT-1	135	132	33
UNIT-2	135	0	-2
UNIT-3	135	113	55
UNIT-4	135	0	-0
UNIT-5	135	0	-0
UNIT-6	135	1	-1
UNIT-7	135	134	65
UNIT-8	135	0	-1
TOTAL	1080	379	

RAMGARH (HV) 128 KV

	CAPACITY	MW	MVAR
UNIT-1	35.5	28	13
UNIT-2	37.5	-0	-0
UNIT-3	37.5	R 12	S 8
UNIT-4	110	0	0
UNIT-5	50		0
TOTAL	270.5	R 40	13

RAPS-A 215 KV

	CAPACITY	MW	MVAR
UNIT-1	100	0	0
UNIT-2	200	177	22
TOTAL	300	177	22

SURATGARH (HV) 408 KV

	CAPACITY	MW	MVAR
UNIT-1	250	180	102
UNIT-2	250	184	96
UNIT-3	250	188	-73
UNIT-4	250	211	-76
UNIT-5	250	222	-90
UNIT-6	250	217	-93
TOTAL	1500	1203	S 0

SURAT-SCTPS (HV) 394 KV

	CAPACITY	MW	MVAR
UNIT-1	660	392	111
UNIT-2	660	357	110
TOTAL	1320	747	

VSLP BIKANER (HV) 195 KV

	CAPACITY	MW	MVAR
UNIT-1	135	0	0

HYDRO GENERATION

RANAPRATAP SAGAR (HV) S 133 KV

	CAPACITY	MW	MVAR
UNIT-1	43	0	0
UNIT-2	43	S 0	S 19
UNIT-3	43	S 0	S 0
UNIT-4	43	0	0
TOTAL	172	S 43	S 19

JAWAHAR SAGAR (HV) 131 KV

	CAPACITY	MW	MVAR
UNIT-1	33	0	-1
UNIT-2	33	S 0	S 0
UNIT-3	33	0	0
TOTAL	99	S 0	S -1

MAHI BAJAJ SAGAR (HV) 131 KV

	CAPACITY	MW	MVAR
UNIT-1	25	0	0
UNIT-2	25	0	0
UNIT-3	45	0	-0
UNIT-4	45		S -0
TOTAL	140	0	0

TOTAL THERMAL (MW) S 6789

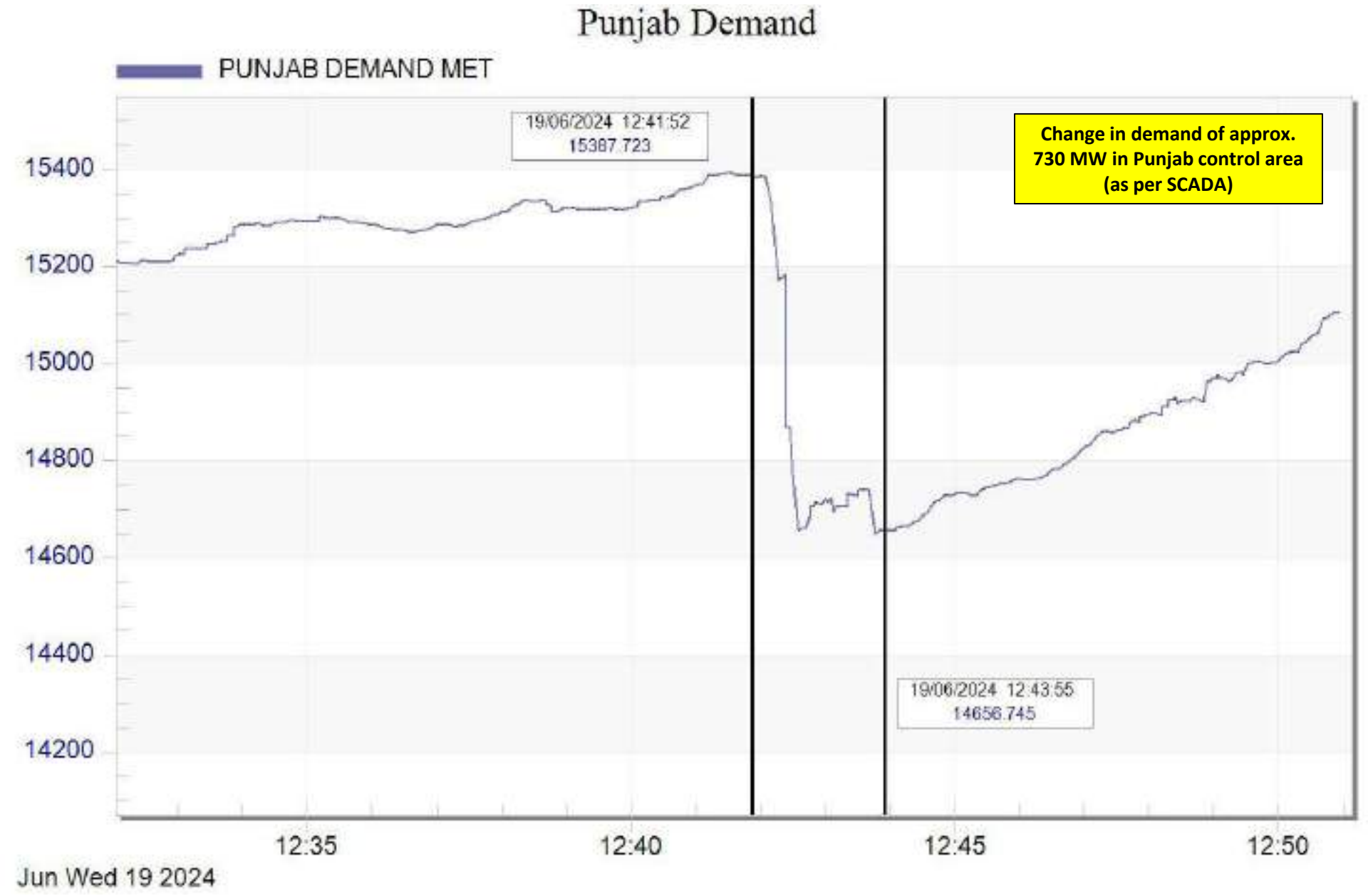
TOTAL HYDRO (MW) S 43

Wed June 19 2024 12:49:00

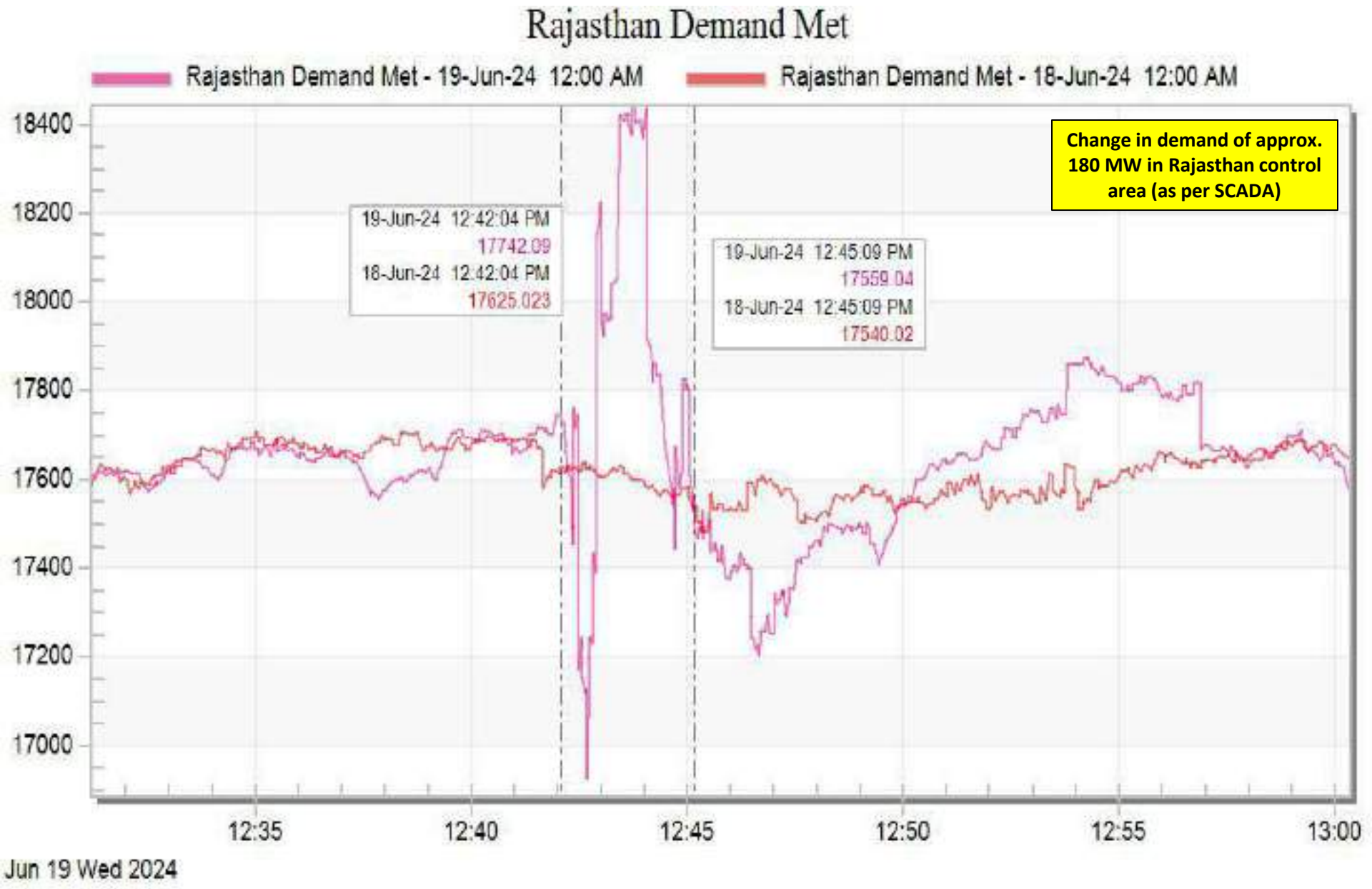
Change in ISTS connected RE generation

Generation Loss in ISTS connected RE Plants in Rajasthan at 12:42 hrs of 19.06.2024				
Pooling station	Plant name-from RE_SCADA	Generation (MW) before the event (12:41:30)	Generation (MW) after the event (12:43:30)	Change in generation (MW)
BHADLA	ACME	225.2	197.6	27.6
	AZURE 41	292.7	197.1	95.5
	CSP JODHPUR	238.3	39.2	199.2
	BHADLA SBE	189.0	140.9	48.1
	SBE6PL	253.5	213.2	40.3
	TPREL	288.5	183.9	104.6
FATEHGARH 3	AXPPL	387.8	-1.0	388.8
	RSAPL	287.1	269.0	18.1
BIKANER 2	GEPL	95.2	-0.2	95.4
	OVEPL	85.2	1.6	83.5
	AAPL	98.5	3.5	95.1
BHADLA 2	ABCRL	307.7	277.0	30.7
	ACME HEERAGARH	308.8	148.4	160.4
	ASEPL	320.1	259.3	60.9
	NOKHRA	283.3	245.6	37.7
	RSEKPL	191.4	166.7	24.7
	AEGPL	208.0	138.3	69.8
FATEHGARH 2	ADANI HYBRID 2	302.5	74.2	228.3
	ADANI HYBRID 3	310.9	223.8	87.1
	ASEJ1SL	408.9	319.5	89.4
	DEVIKOT	196.7	108.5	88.2
	RENEW JHARKHAND	277.0	118.2	158.8
	RENEW SUNBRIGHT	287.5	272.8	14.6
	RENEW SOLAR URJA	293.0	163.2	129.8
	RENEW SUN WAVE	287.1	8.1	279.0
BIKANER	AVAADA SUST.	296.0	183.5	112.6
	AZURE43	590.2	347.4	242.8
	RSRPL	293.8	171.8	122.1
	RENEW BIKANER	589.8	451.4	138.4
	SBSR POWER	302.0	284.7	17.3
	TPGEL	295.6	183.0	112.7
	TPSL	85.1	-0.1	85.3
	Total Gen Loss in ISTS connected RE Plants (Rajasthan)			**3487**

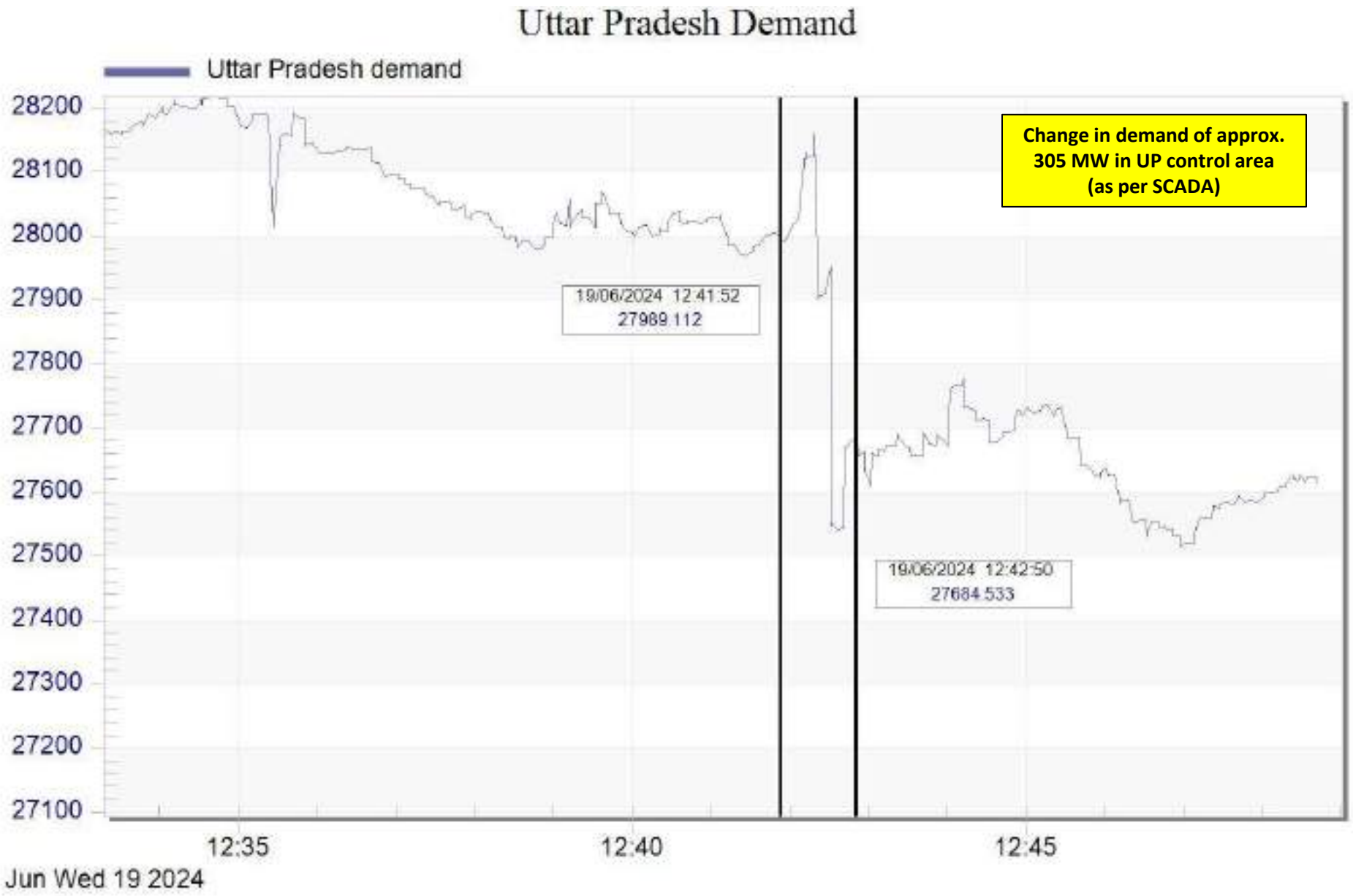
Punjab Demand during the event



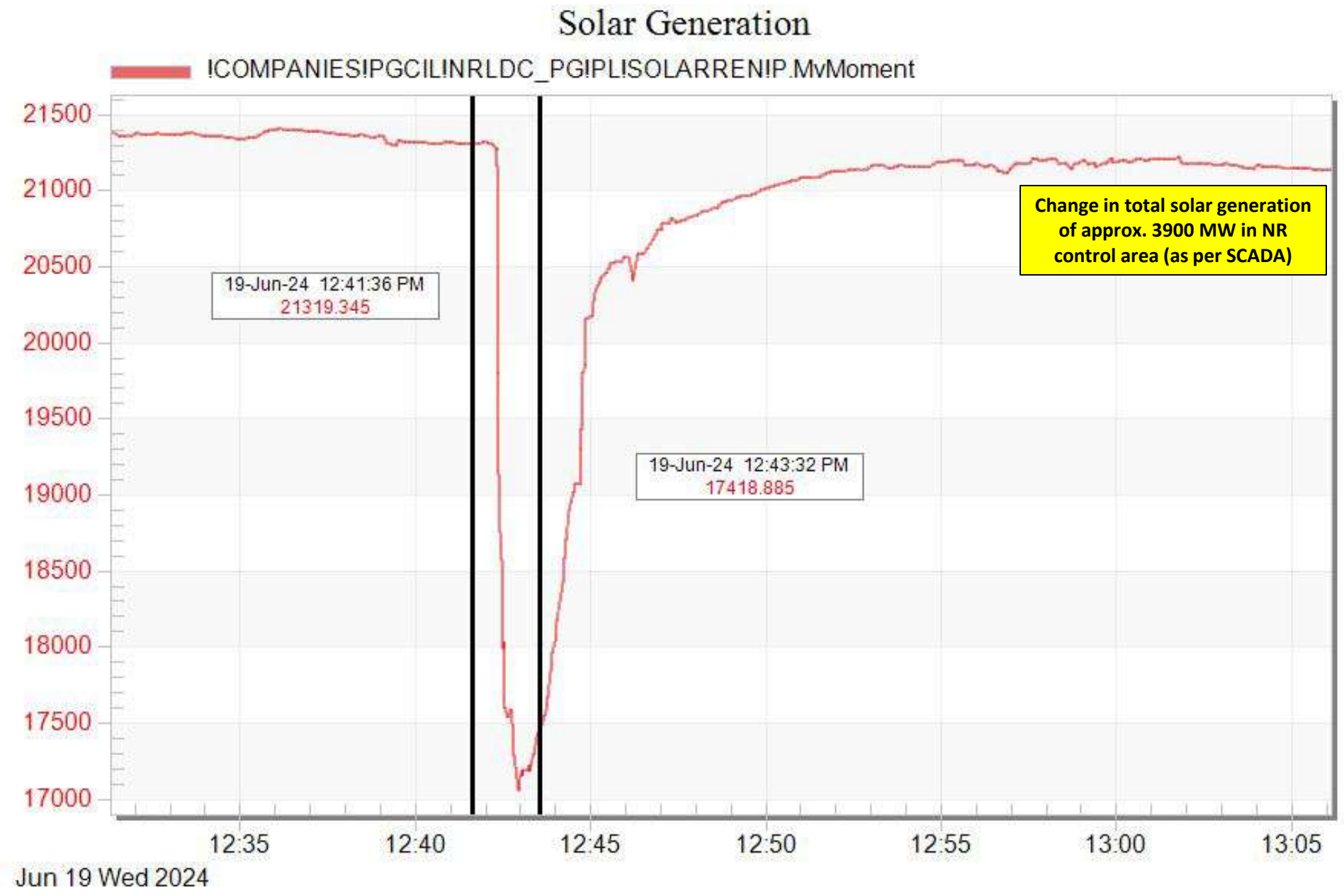
Rajasthan Demand during the event



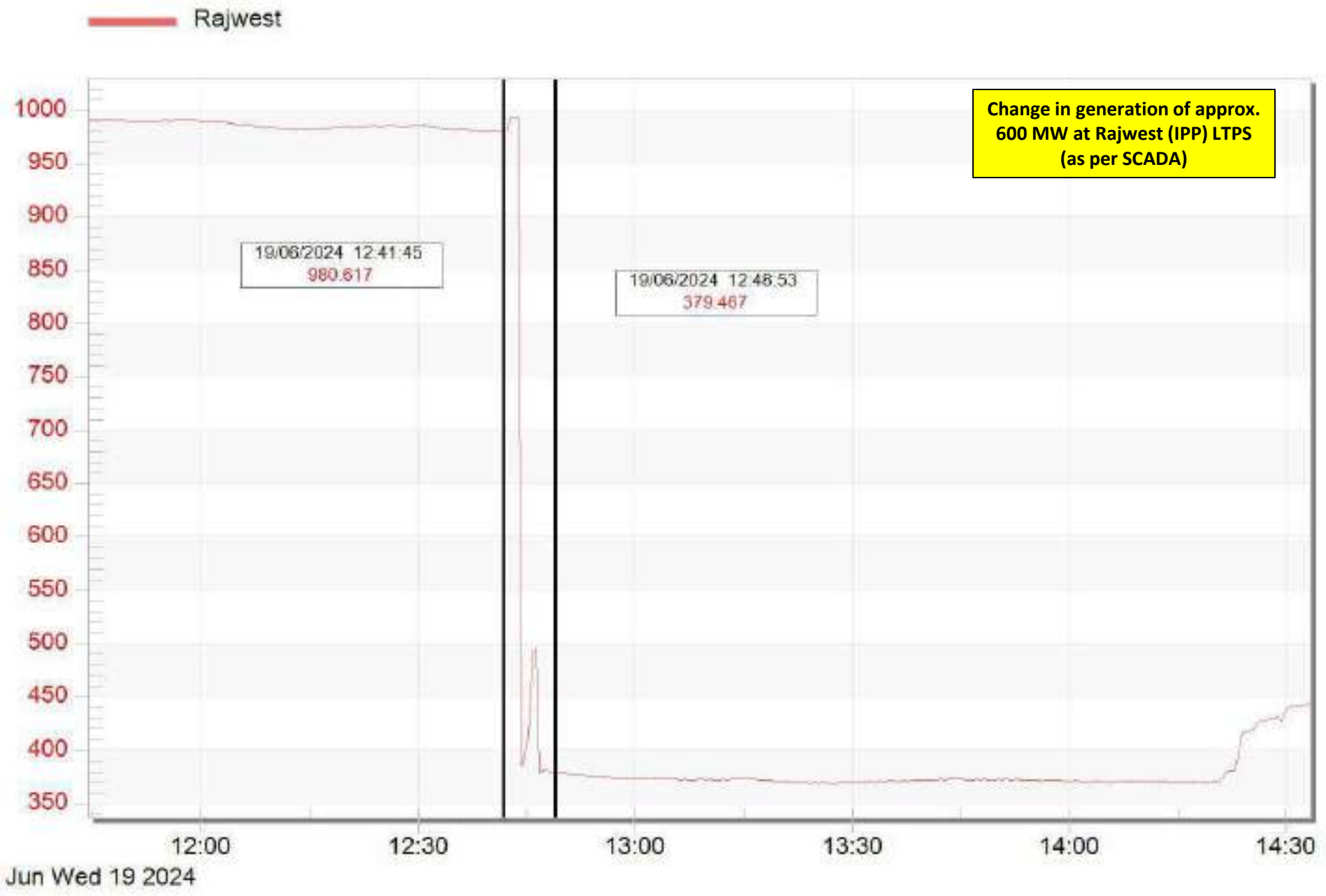
Uttar Pradesh Demand during the event



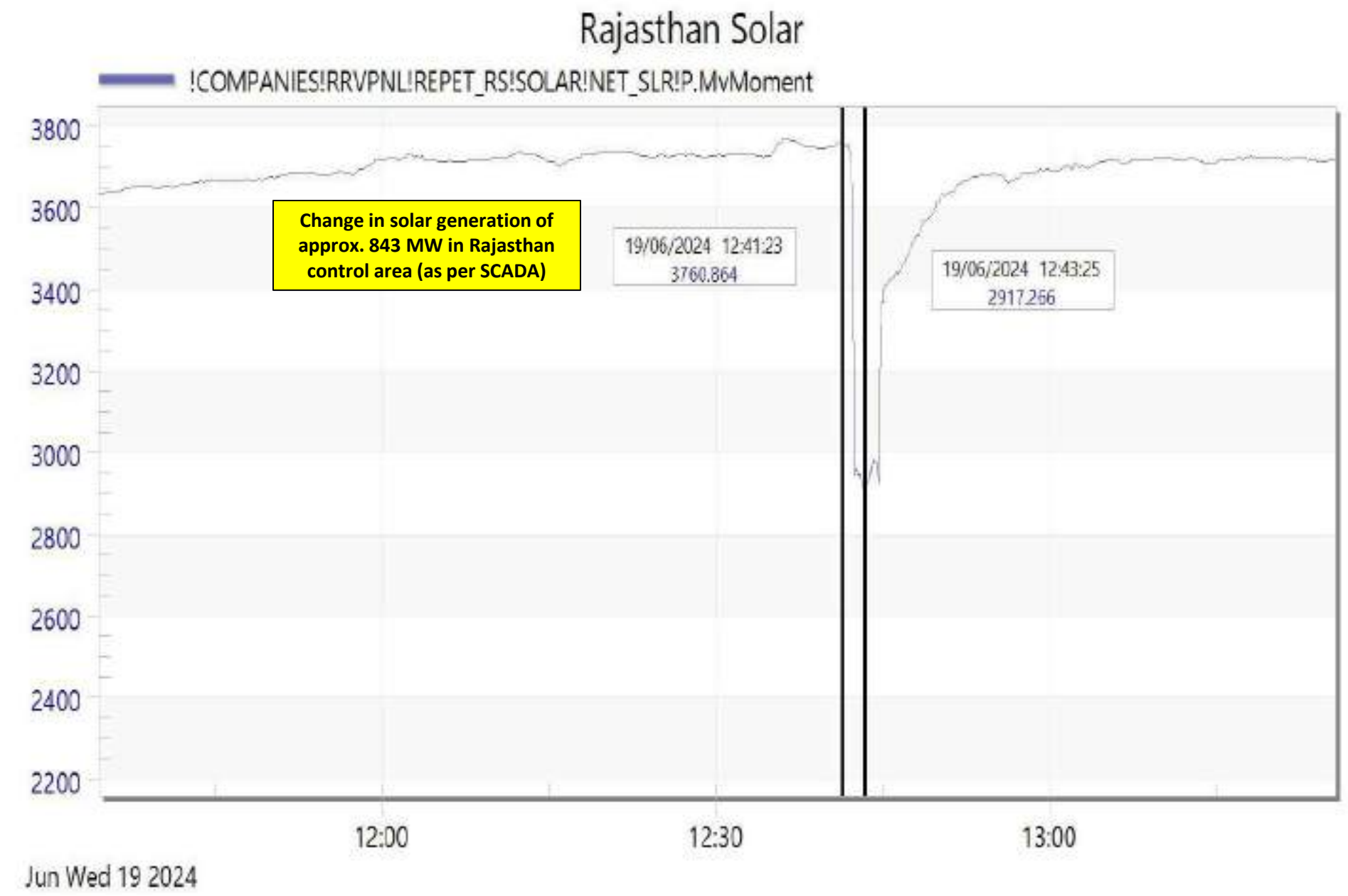
NR total Solar generation during the event



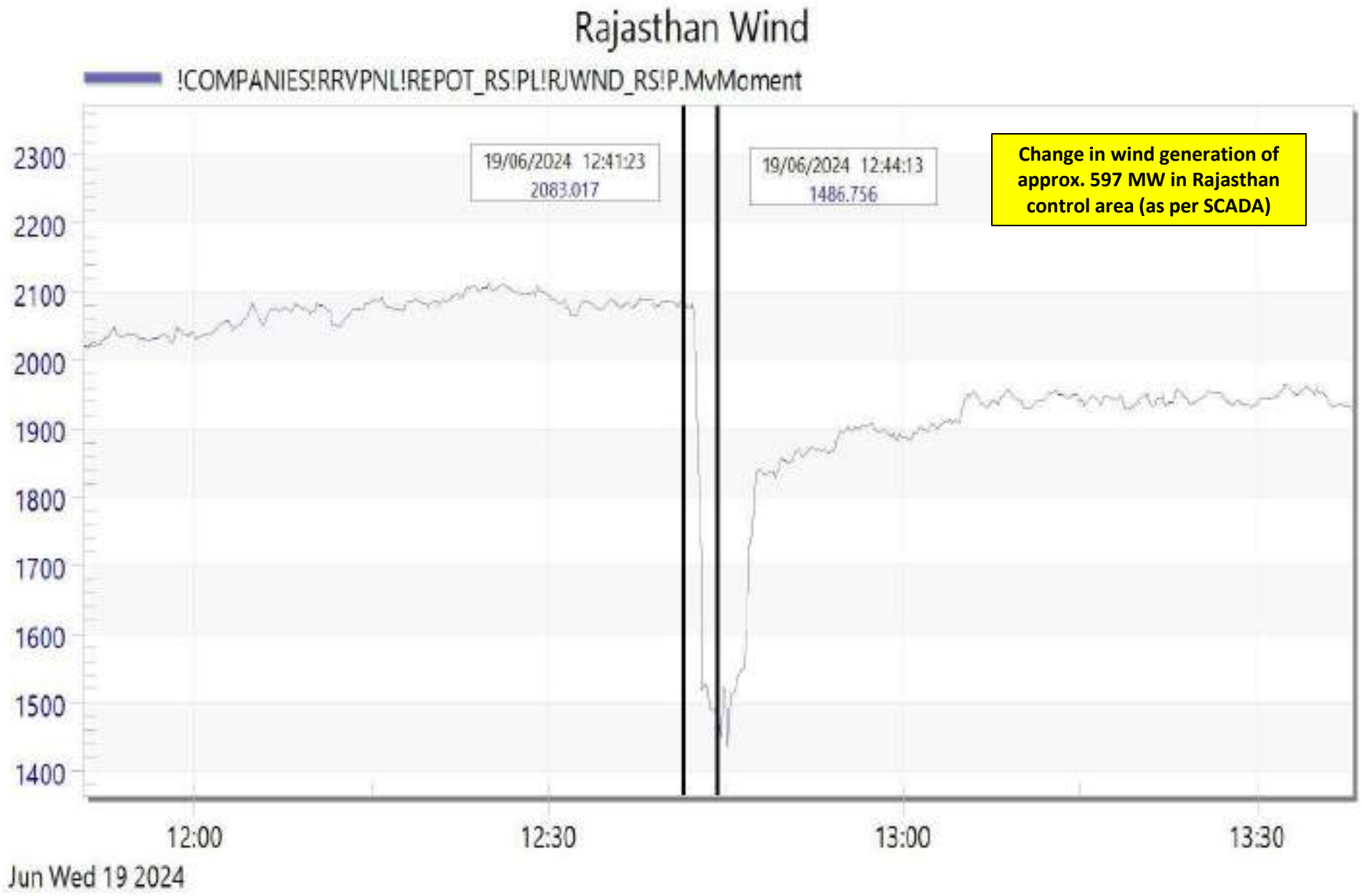
Rajwest (RS) LTPS generation during the event



Rajasthan Solar generation during the event

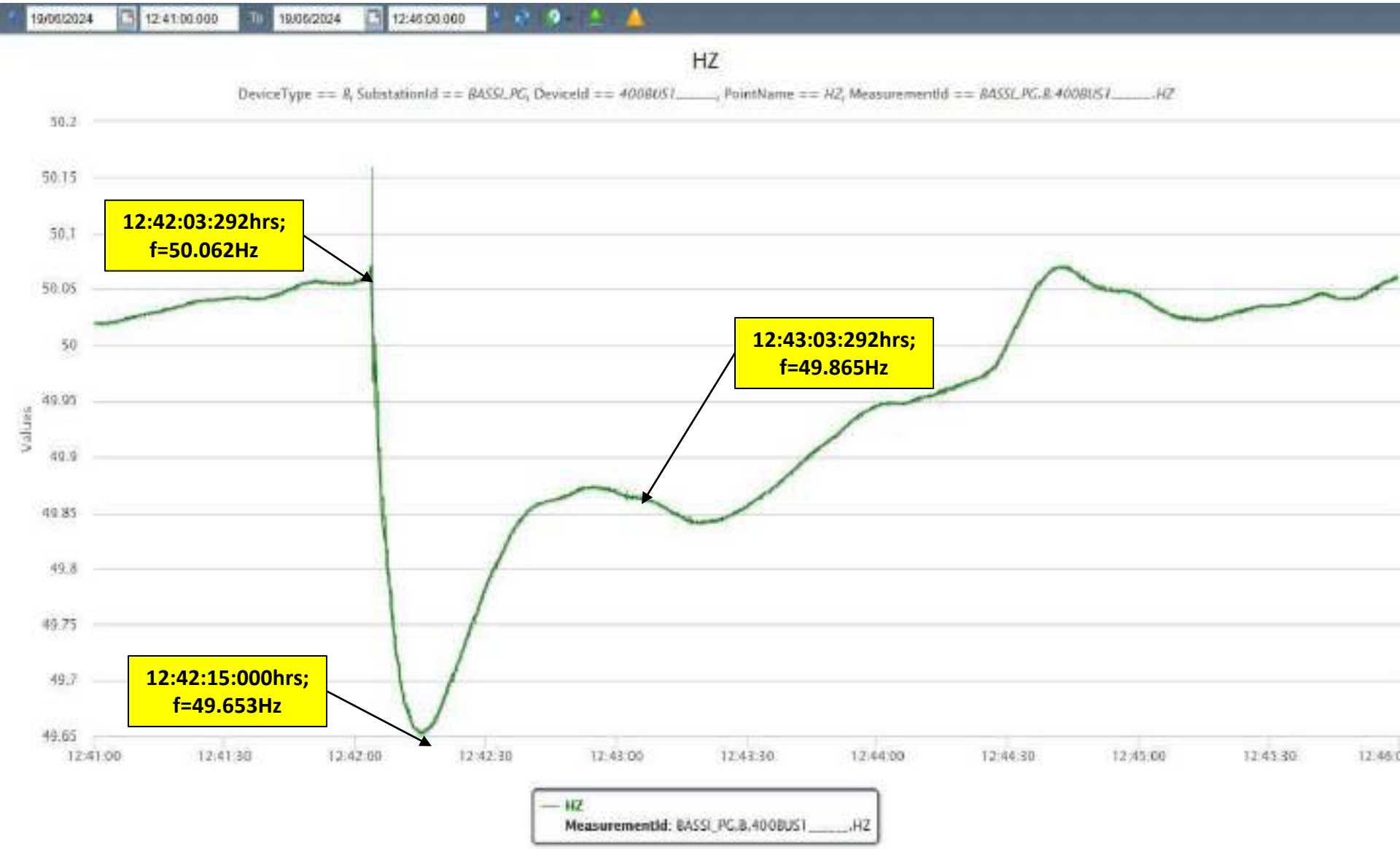


Rajasthan Wind generation during the event



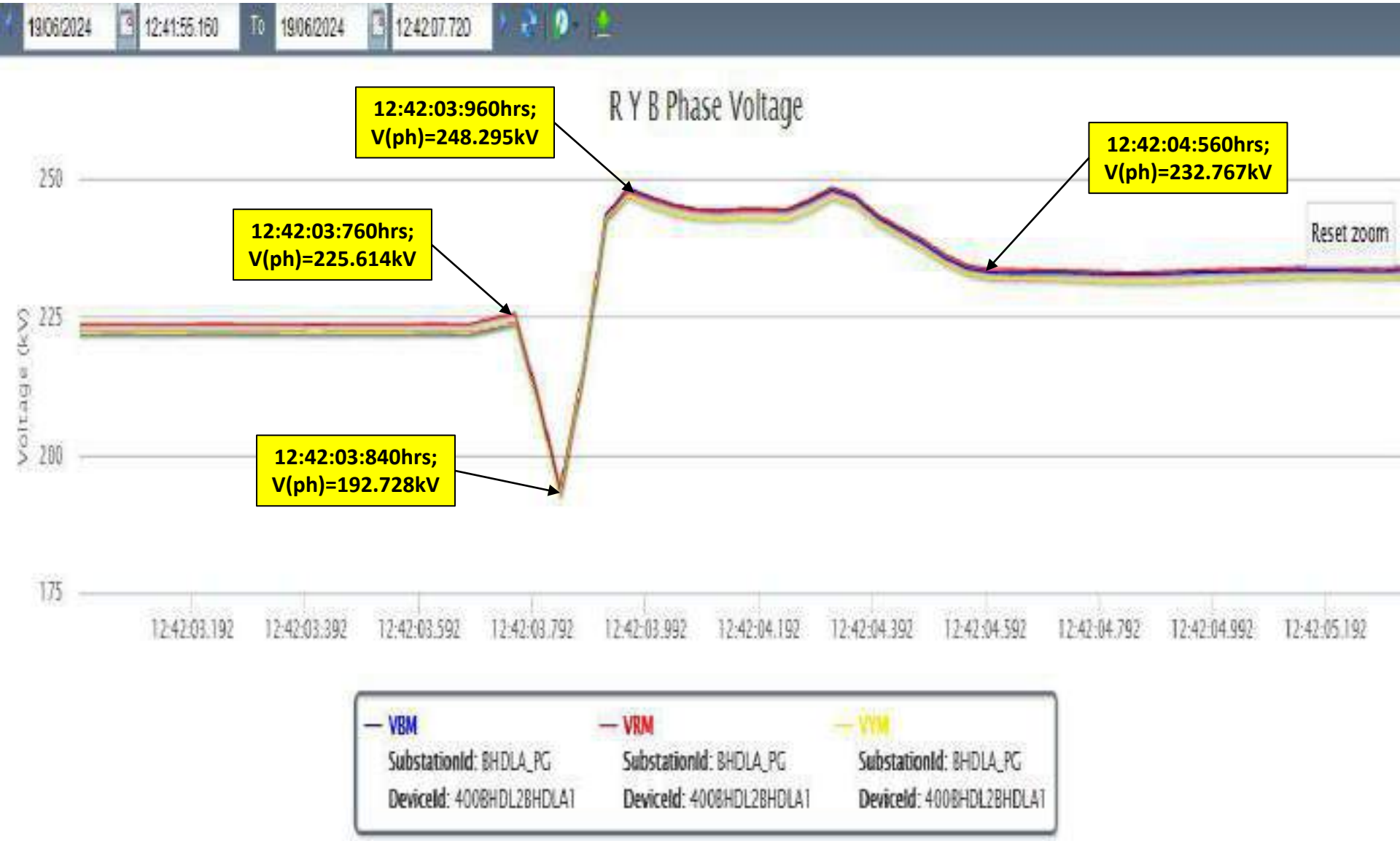
PMU Plot of frequency at Bassi(PG)

12:42 hrs/19-June-24



PMU Plot of Phase voltage magnitude at Bhadla(PG)

12:42 hrs/19-June-24



Details of df/dt operation on 19.06.2024

S.NO	Name of Station	df/dt setting	Feeder Details	Load throw off Quantum (MW)
1	220KV CHOLA SAHIB	0.1	66KV SARHALI	37.57
		0.1	66KV GANDIPIND,HARIKE	
2	220KV Udoke	0.1	66 kV Tarsika	20.11
		0.1	66 kV Said Mubarak	8.94
3	220KV ALGAON KOTHI	0.1	66 KV LAKHNA LINE	19.36
		0.1	AMARKOT/ MARI MEGHA	19.36
4	220KV SULTANPUR	0.1	BHAGOBUDHA	24.35
		0.1	LOHIAN	19.44
		0.1	JAKOPUR	20.11
		0.1	TALWANDI CHOUDRIYAN	20.78
		0.1	TAWWANDI MADHOKE	24.35
5	220KV RASHIANA	0.1	66KV FATHEBAD & Rassurpur	54.65
		0.1	66 Kv Jabal	
		0.1	66KV FOCAL POINT	
		0.1	DEO BATH	
6	220 KV RAJPURA	0.2	20 MVA T/F	6.30
		0.2	66 KV Sirhind(Sarain punjab)	13.28
		0.2	66 KV GAJJUKHERA	19.25
		0.2	66 KV OLD RAJPURA CKT-1	20.15
7	220KV REHANA JATTAN	0.2	T/F T-2	7.54
		0.2	66 KV Atowal	7.09
		0.2	Patara	19.07
		0.2	66 KV Panchtan	14.63
		0.2	66 KV Darolli	20.06
8	220KV SADIQ	0.2	66KV Golewala	76.71
		0.2	66KV Jhoketehal singh	
9	220KV CIVIL LINE	0.1	66kv Ranjit Avenue 1	89.85
		0.1	66kv Ranjit Avenue 2	
		0.1	66KV Harsha Cheena 1	
		0.1	66KV Harsha Cheena 2	
10	220KV NARAINGAH	0.1	66KV gawal mandi	30.62
		0.1	66KV ocm1&2	28.15

S.NO	Name of Station	df/dt setting	Feeder Details	Load throw off Quantum (MW)
11	220KV MAJITHA	0.1	66KV Nag Kalan 1	24.83
		0.1	66KV Nag Kalan 2	24.83
12	220KV SANDHWA	0.1	11KV Incomer 1	14.73
		0.1	11KV Incomer 2	
13	220KV KANJALI	0.1	66 KV Dainwind-1	7.18
		0.1	66 KV Dainwind-2	7.18
		0.1	66 KV Surkhpur	18.41
		0.1	66 Kv Hothian	3.70
A. Punjab load throw off Quantum				**722.60**
14	220KV GSS BALOTRA	0.1	132KV BALOTRA-SAMDARI LINE	12.56
		0.1	132KV BALOTRA-SINDHARI LINE	26.00
		0.1	132KV BALOTRA-SIWANA LINE	21.12
		0.1	132/33 KV TELK TRF,40/50 MVA	20.61
		0.1	132/33 KV IMP TRF,20/25 MVA	13.31
		0.1	132/33 KV C.G. TRF, 20/25 MVA	13.31
B. Rajasthan load throw off Quantum				**106.91**
15	220/132/33 KV S/S Moradabad	0.1	132KV SAMBHAL	0.00
		0.1	132KV AWAS-VIKAS	47.78
		0.1	132KV RAMPUR-II	0.00
		0.1	132KV GULABBARI	44.52
		0.1	132KV AMROHA	0.00
		0.1	132KV KUNDARKI	20.63
		0.1	132KV KANTH ROAD	67.33
		0.1	33KV NEW MDA	5.14
		0.1	33KV SITAPURI	11.67
		0.1	33KV DELHI ROAD (NAGAR ONE)	7.71
		0.1	33KV MANDI SAMITI	5.55
		0.1	33KV LOCO SHED	1.74
		0.1	33KV TOWN HALL	9.15
C. Uttar Pradesh load throw off Quantum				**221.22**
D. Total load throw off Quantum due to df/dt operation (A+B+C)				**1050.73**

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
12:42:04,366	TEJUA_RS	220kV	01RMGR1	Cirircuit Breaker	Open	Line CB at Suzlon(Tejwa) end of 220kV Ramgarh-Suzlon (Tejwa) (RS) Ckt opened
12:42:04,412	GRASM_RS	132kV	01KOTPL1	Circuit Breaker	Open	Line CB at Grasim(RS) end of 132kV Grasim-Kotputli (RS) Ckt opened
12:42:04,760	MHNDR_RS	132kV	01BAP1	Circuit Breaker	Open	Line CB at Mahindra Solar(RS) end of 132kV Mahindra Solar-Baap (RS) Ckt opened
12:42:05,473	MORA2_UP	132kV	17GLBRI2	Circuit Breaker	Open	Line CB at Moradabad(UP) end of 132kV Moradabad-Gulabbari (UP) Ckt opened
12:42:05,475	MORA2_UP	132kV	11AMROH1	Circuit Breaker	Open	Line CB at Moradabad(UP) end of 132kV Moradabad-Amroha (UP) Ckt opened
12:42:05,477	MORA2_UP	132kV	16RAMPR2	Circuit Breaker	Open	Line CB at Moradabad(UP) end of 132kV Moradabad-Rampur (UP) Ckt-2 opened
12:42:05,477	MORA2_UP	132kV	09AWVKS2	Circuit Breaker	Open	Line CB at Moradabad(UP) end of 132kV Moradabad-Awas Vikas (UP) Ckt opened
12:42:05,479	MORA2_UP	132kV	21BLARI1	Circuit Breaker	Open	Line CB at Moradabad(UP) end of 132kV Moradabad-Kundarki (UP) Ckt opened
12:42:06,232	BLOTR_RS	132kV	5T3	Circuit Breaker	Open	CB at 132kV side of 132/33kV 40/50MVA ICT-3 at Balotra (RS) opened
12:42:06,285	BLOTR_RS	132kV	1T1	Circuit Breaker	Open	CB at 132kV side of 132/33kV 20/25MVA ICT-1 at Balotra (RS) opened
12:42:29,086	RAJWT_RS	400kV	6TIE	Circuit Breaker	Open	Main CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 5 opened
12:42:29,094	RAJWT_RS	400kV	7JODH42	Circuit Breaker	Open	Tie CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 5 opened
12:42:29,215	RAJWT_RS	400kV	4JODH41	Circuit Breaker	Open	Tie CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 4 opened
12:42:29,215	RAJWT_RS	400kV	3TIE	Circuit Breaker	Open	Main CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 4 opened
12:42:29,678	RAJWT_RS	400kV	14TIE	Circuit Breaker	Open	Tie CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 8 opened
12:42:29,682	RAJWT_RS	400kV	15TIE	Circuit Breaker	Open	Main CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 8 opened
12:42:36,423	KTSWR_TH	400kV	04KTSWR1	Circuit Breaker	Open	Line CB at Koteshwar(TH) end of 400kV Koteshwar(TH)-Koteshwar(PG) Ckt-1 opened
12:43:18,082	MHNDR_RS	132kV	03T2	Circuit Breaker	Open	CB at 132kV side of 132/33kV ICT-2 at Mahindra Solar(RS) opened
12:43:34,562	MHNDR_RS	132kV	02T1	Circuit Breaker	Open	CB at 132kV side of 132/33kV ICT-1 at Mahindra Solar(RS) opened
12:43:47,597	RAJWT_RS	220kV	04U2	Circuit Breaker	Open	CB at 220kV side of 135 MW Rajwest (IPP) LTPS - UNIT 2 opened
12:46:01,799	RAJWT_RS	400kV	10BARMR1	Circuit Breaker	Open	Tie CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 6 opened
12:46:01,799	RAJWT_RS	400kV	9TIE	Circuit Breaker	Open	Main CB at 400kV side of 135 MW Rajwest (IPP) LTPS - UNIT 6 opened

Point of discussion

- Exact reason and location of fault need to be shared.
- DR/EL need to be shared for all the units of Rajwest.
- Many RE plants were found LVRT non-complaint during the fault. Root cause analysis report along with inverter logs data need to be shared.
- Remedial action taken report to be shared.

Summary of df/dt operation during May-June 2024

Annexure-XXVII

Date	Time	Load throw-off quantum (State-wise)						Total Load throw-off quantum	Remarks
		Delhi	Punjab	Haryana	Rajasthan	UP	Uttarakhand		
25-05-2024	12:46	82	1375	0	140	172	0	1769	as reported by SLDCs
27-05-2024	14:36	280	0	540	0	140	100	1060	as per SCADA data at NRLDC, SLDCs have not confirmed yet
01-06-2024	13:26	0	440	0	0	100	0	540	as per SCADA data at NRLDC, SLDC-Punjab have confirmed
01-06-2024	13:44	270	580	120	0	220	0	1190	SLDC-Punjab & UP have confirmed
03-06-2024	05:28	0	300	0	0	0	0	300	as reported by SLDC-Punjab
04-06-2024	12:35	0	400	0	0	0	0	400	as per SCADA data at NRLDC, SLDC-Punjab have confirmed
09-06-2024	11:21	0	435	0	0	0	0	435	as per SCADA data at NRLDC, SLDC-Punjab have not confirmed yet
19-06-2024	12:42	0	723	0	107	220	0	1050	as reported by SLDCs
23-06-2024	09:11	0	880	0	0	0	0	0	as reported by SLDC-Punjab

Annexure-XXVIII

~~Annexure-XXI~~

Procedure for Approval of Protection Settings in Northern Region

(Finalized in 50th PSC meeting held on 29.04.2024)

1. ISTS users shall submit proposal for new/revised protection settings to NRLDC and similarly non-ISTS users shall submit to concerned SLDCs in the prescribed formats (of NRLDC/SLDC) in 2 weeks advance.
2. Further, NRLDC/SLDC (as the case may be) will scrutinize the proposal and any deficiency/additional data may be asked by NRLDC/NLDC. If required, NRLDC/SLDC may convene a meeting/interaction with stakeholders.
3. After scrutiny, NRLDC/SLDC will convey to user within 10 days (after receiving proposal) the accepted settings for implementation at site.
4. After implementation of approved settings, stakeholder will intimate to NRPC Secretariat via e-mail at seo-nrpc@nic.in within a fortnight.
5. NRLDC/SLDCs shall place all accepted settings as agenda in upcoming PSC meeting for final approval of forum.

*****

Procedure for Approval of Protection Settings in Northern Region

A. For new element charging:

1. ISTS users shall submit the protection settings to NRPC and NRLDC for every new element to be commissioned one month in advance through mail.
   In case of intrastate elements, users shall submit the protection settings to concerned SLDC and NRPC for every new element to be commissioned one month in advance through mail.
2. NRLDC based on the above information and the First Time Charging (FTC) request by user through Outage Management System (OMS) portal of NRLDC, shall allow integration of new element in the system as per NRLDC FTC procedure with the prevailing practice to avoid any delay in charging of the new element. The settings shall be treated as provisional arrangement.
   In case of intrastate elements, SLDC shall scrutinize the proposal and allow integration of new element in the system within …… days. The settings shall be treated as provisional arrangement.
3. The concerned utility shall forward the agreed settings of its new element to NRPC within 15 days of implementation of provisional arrangement.
4. The concerned utility (both ISTS and intrastate) shall also put up an agenda for getting final approval in next PSC.
5. NR PSC will review and approve the final settings based on the inputs submitted by the utility. In case of any change required in protection settings of the new element than the provisional one, as decided by the committee, the same shall be implemented within 7 days by the concerned utility.
6. Utility shall intimate to NRLDC/SLDC (as applicable) and NRPC within 7 days after implementation of final approved settings.

B. For change in protection settings of any existing element:

1. Any change in the existing protection settings shall be carried out only after prior approval from NRPC.
2. The concerned utility (both ISTS and intrastate) shall put up an agenda regarding any changes required in existing protection settings due to integration of new element in the existing system or otherwise in next PSC.
3. Utility shall intimate to NRLDC/SLDC (as applicable) and NRPC about the changes implemented in protection system or protection settings within 15 days of such changes.

Annexure-XXX

सत्यमेव जयते

उत्तर क्षेत्रीय विद्युत समिति

NORTHERN REGIONAL POWER COMMITTEE

Procedure for Approval of Protection Settings in Northern Region

Version: 1.0

(Approved in 51st PSC meeting held on 23.07.2024)

August, 2024

Procedure for Approval of Protection Settings in Northern Region

A. Delegated Authority:

NRLDC/SLDCs may accept protection settings and allow charging, if settings are as per protection philosophy of NRPC. However, approval of PSC forum shall be taken when protection settings require deviation from NRPC philosophy.

B. Procedure in case of new element charging

1. ISTS users shall submit the protection settings to NRPC and NRLDC for every new element to be commissioned one month in advance through mail.
   In case of intrastate elements, users shall submit the protection settings to concerned SLDC and NRPC for every new element to be commissioned one month in advance through mail.

2. NRLDC shall allow integration of new element in the system based on the protection settings submitted by ISTS user during First Time Charging (FTC) request through Outage Management System (OMS) portal of NRLDC, after scrutiny of settings for compliance of NRPC protection philosophy.
   In case of intrastate elements, SLDC shall scrutinize the settings for compliance of NRPC protection philosophy and allow integration of new element in the system.

3. NRLDC/SLDCs may ask any other relevant data/information from concerned utilities during scrutiny of settings.

4. While accepting protection settings and allowing charging clearance, NRLDC/SLDCs shall convey other concerned utility of existing element, for revision of settings at their end, if required due to charging of new element.

5. If settings are not in line with NRPC protection philosophy, NRLDC/SLDC may reject the settings and the concerned utility (both ISTS and intrastate) shall put up an agenda for getting approval of settings in next PSC.

6. Utility shall intimate to NRPC Secretariat and NRLDC/SLDC (as applicable) within fortnight after implementation of settings for record in regional protection settings database.

C. Procedure in case of revision of settings of any existing element:

1. Concerned utilities shall submit the proposal to NRLDC/SLDC (as applicable) for revision of protection settings arising due to any issue.

2. NRLDC/SLDC (as applicable) shall allow the revision if settings are as per NRPC protection philosophy. If settings are not in line with NRPC protection philosophy, NRLDC/SLDC may reject the settings and the concerned utility (both ISTS and intrastate) shall put up an agenda for getting approval of settings in next PSC.

3. Utility shall intimate to NRLDC/SLDC (as applicable) and NRPC Secretariat within fortnight after implementation of settings for record in database.

*****

Annexure - A & B.

Annexure-XXXI & XXXII

HARYANA VIDYUT PRASARAN NIGAM LIMITED

REGD. OFFICE: - Shakti Bhawan, Sector-6, Panchkula
Corporate Identity Number: U40101HR1997SGC033683
O/o Chief Engineer/PD&C, HVPNL, Panchkula-134109
Website: www.hvpn.gov.in E-mail – cepdc@hvpn.org.in

To

Superintending Engineer/Monitoring,
UHBVN, Panchkula.

Memo. No. R-1988 /Ch-81/HAP-184/Vol-I Dated: 02.04.2024

Subject: (i) Approval for extension of load of 220KV S/Stn IOCL (now IOCL-I) from 78MVA to 320MVA to be fed from 220KV S/Stn Mund.
(ii) Approval for separate connectivity at 220 KV level for a load of 320MVA of 220KV Sub-station IOCL-II from 220KV Sub-station HVPNL, Nain.

This is in reference to your office memo no. Ch-63/SE/MON/case-file No.-1277/PNP/21-22 dated 27.06.2023 conveying the subject cited proposals duly approved by UHBVNL for separate connectivity at 220kV level for a load of 320MVA of 220KV sub-station IOCL-II from 220KV sub-station HVPNL, Nain and extension of load of 220KV S/Stn IOCL (now IOCL-I) from 78MVA to 320MVA to be fed from 220KV S/Stn Mund. The second source for both IOCL-I & IOCL-II shall be from new proposed HVPNL 400KV sub-station Munak (under consideration) at the cost of IOCL.

The proposal placed before WTDs HVPNL, through e-office file no. HVPNL-6001826/15//2021-Area Planning-1-HVPNL (Computer No. 518478), has been considered and approved as under:

Sr. No.	Description	Code
1.	To allow extension of load of 220KV S/Stn IOCL (now IOCL-I) from 78MVA to 320MVA to be fed from 220KV S/Stn Mund.	----------
2.	To allow separate connectivity at 220 KV level for an additional load of 320MVA of 220KV Sub-station IOCL-II to be fed from 220KV sub-station HVPNL, Nain.	----------
3.	To allow the creation of a new 220 KV S/Stn. IOCL-II with a capacity of 4X125 MVA, 220 KV / 66 KV transformers by M/s IOCL under self-execution mode.	----------
4.	Amendment in existing approval conveyed vide Chief Engineer / PD&C, HVPNL Panchkula vide Memo. No. R-1843/Ch-88/HAP-184 dated 03.01.2022 in view of sanctioned 320MVA load of 220kV S/Stn IOCL-II from new 220KV S/Stn Nain at 220KV level. (i) Cancellation of already approved creation of 220KV D/C Nain-IOCL (now IOCL-I) line with 0.5 Sq Inch ACSR conductor at the cost of M/s IOCL, Panipat. (mentioned at Sr. No. 2 of R-1843, Approval Code: 2L3821*) (ii) Cancellation of already approved creation of 2 no. 220kV line bays at 220kV sub-station Nain to accommodate 220KV D/C Nain-IOCL (now IOCL-I) line at the cost of M/s IOCL, Panipat. (mentioned at Sr. No. 3 of R-1843, Approval Code: 2B3822*)	2L3821A 2B3822A
5.	Creation of new 220KV D/C Nain-IOCL-II line with HTLS conductor equivalent to 0.5 Sq Inch ACSR conductor having capacity 1200 Ampere (approx. line length 22.5KMs) as per request of IOCL for better reliability of power supply on 220KV Double Circuit/Multi circuit /Monopole towers/cables (as the case may be) at the cost of M/s IOCL matching with commissioning of 220kV S/Stn Nain in FY 2026-27.	2D4256*
6.	Creation of 2 No. 220 KV line bays at 220KV S/Stn., Nain to accommodate 220KV D/C Nain-IOCL-II line at the cost of M/S IOCL in FY 2026-27.	2D4257*
7.	The second source for both IOCL-I & IOCL-II would be from the proposed 400kV sub-station Munak at the cost of IOCL and approval would be conveyed along with the approval of 400kV sub-station Munak (Karnal).	----------

Note:
(i) All provisions of CE/PD&C, UHBVNL, Panchkula conveyed vide memo no. Ch-63/SE/MON/case-file No.-1277/PNP/21-22 dated 27.06.2023 shall be complied by M/s Indian Oil Corporation Limited (IOCL), Panipat.

(ii) All the guidelines/instructions issued by the Nigam from time to time for Deposit Work must be adhered to.

(iii) TS/HVPNL Panipat shall ensure compliance with the provisions contained in Deputy Secretary/Operation, HVPN office memo no. Ch-24/DSO-214/L-154/Vol-II dated 12.05.2017 & amendments thereafter.

(iv) The charges involved for releasing the connection will be payable by M/s Indian Oil Corporation Limited (IOCL), Panipat as per Haryana Electricity Regulatory Commission (duty to supply electricity, Power to recover expenditure incurred in providing supply and power to require security) regulations, 2016 dated July 11, 2016 amended from time to time.

(v) M/s Indian Oil Corporation Limited (IOCL), Panipat shall comply all the guidelines for self-execution of the deposit works issued vide memo no. Ch-17/DSO-214/L-11 dated 25.04.2012 and subsequently revised vide memo no. Ch-237/DSO-513 dated 11.11.2021.

(vi) M/s Indian Oil Corporation Limited (IOCL), Panipat shall submit an undertaking with UHBVN and HVPNL to the fact that any cost chargeable from them (if worked out later on), shall be paid by them within 15 days from the date of issue on such demand by UHBVN and HVPNL.

(vii) M/s Indian Oil Corporation Limited (IOCL), Panipat shall provide metering arrangements at the sending end and receiving end as per HERC Regulation of metering and in line with specifications & design requirements of UHBVNL & HVPNL.

(viii) Chief Engineer (SO & Commercial), HVPNL, Panchkula being nodal to ensure the compliance of all Nigam's regulations/formalities including required metering equipment.

(ix) M/s Indian Oil Corporation Limited (IOCL), Panipat shall seek all mandatory approvals necessitated prior to & post execution of work from respective authorities of HVPNL, UHBVNL, HSIIDC, HERC, Civic bodies NHAI, Forest dept., railways, other agencies, and office of Chief Electrical Inspector, Haryana. M/s IOCL shall assist TS Wing/ HVPNL for clearing of ROW.

(x) The instructions issued by FA/HQs, HVPNL, Panchkula on "GST incidence on the transaction of the sum received from external agencies for execution of Deposit Work" vide Memo No. GST20-21/05 dated 22.05.2020 may also be adhered to.

The unique identification number CS/WTDs/Xen/Area Planning-I/RBC- 29.03.2024/April-1231 has been appended by Company Secretary, HVPNL, Panchkula.

Chief Engineer/PD&C,
HVPNL, Panchkula.

Copy to:

1. Chief Engineer/TS, HVPNL, Hisar & Panchkula.
2. Chief Engineer /P&M, HVPNL, Panchkula.
3. Chief Engineer/SO & Commercial, HVPNL, Panchkula.
4. Chief Engineer /PD&C, UHBVNL, Panchkula.
5. Chief Engineer /Operation, UHBVNL, Rohtak.
6. Superintending Engineer /Contracts, HVPNL, Panchkula.
7. Superintending Engineer, NCR Planning, HVPNL, Gurugram.
8. Superintending Engineer, Planning, HVPNL, Panchkula.
9. Superintending Engineer/Design, HVPNL, Panchkula.
10. Superintending Engineer /Civil Design, HVPNL, Panchkula.
11. Superintending Engineer /TS, HVPNL, Rohtak & Karnal.
12. Superintending Engineer /P&M, HVPNL, Panchkula.
13. Superintending Engineer /Operation, UHBVNL, Panipat & Karnal.
14. Superintending Engineer /P&D, UHBVNL, Panchkula.
15. Company Secretary, HVPNL, Panchkula.
16. S.P.S. to MD, HVPNL, Panchkula for kind information of Managing Director, HVPNL.
17. S.P.S. to MD, UHBVNL, Panchkula for kind information of MD, UHBVNL.
18. S.P.S. to Director (Technical), HVPNL, Panchkula for kind information of Director (Tech.).
19. S.P.S. to Director (Projects), HVPNL, Panchkula for kind information of Director (Projects).
20. S.P.S. to Director (Finance), HVPNL, Panchkula for kind information of Director (Finance).
21. S.P.S to Director (Projects), UHBVNL, Panchkula for kind information of Director (Projects).
22. S.P.S. to Director (Operations), UHBVNL, Panchkula for kind information of Director (Operations).
23. Deputy Secretary /Projects, HVPNL, Panchkula.
24. Deputy Secretary /Opertaions, HVPNL, Panchkula.
25. Executive Engineer/TS, HVPNL, Panipat & Karnal.
26. Executive Engineer /System Study, HVPNL, Panchkula.
27. Executive Engineer /Planning, HVPNL, Panchkula.

Annexure-XXXIII
Annexo - C

इंडियन ऑयल कॉर्पोरेशन लिमिटेड
पानीपत रिफाइनरी एवं पेट्रोकेमिकल कॉम्प्लेक्स
पानीपत, हरियाणा - 132140
Indian Oil Corporation Limited
Panipat Refinery & Petrochemical Complex
Panipat, Haryana - 132140
वेबसाइट : www.iocl.com; ई-मेल : panipatrefinery@indianoil.in
दूरभाष : 0180-2524001; फैक्स : 0180-2576833

रिफाइनरीज प्रभाग
Refineries Division

Ref. No.: IOCL/HVPNL/AF/64

Date: 22.03.2024

To
The Superintending Engineer (PDC)
Haryana Vidyut Prasaran Nigam Limited
Panchkula

Subject: Permission for operating the existing captive generation system of IOCL Panipa Refinery & Petrochemical Complex(PRPC) with 220 KV Grid sourced from HVPNL Mundl in parallel in line with Net Zero Initiatives of the Govt. of India.

Ref. No.: 1. R-1650 / Ch-32/HAP-184 dt.10.7.19: WTD approval
2. Letter Ref. No.: IOCL/HVPNL/AF/63

Respected Sir,

With reference to meeting held at the good office of Director(projects) an Director(Technical) on date: 21.03.2024, we are hereby providing the required details fc carrying out the required analysis for accordance of the synchronization permission of ou CPP with newly commissioned 220 KVB Grid.

The detailed technical attributes of our system is provided below:

S.N.	Technical Attributes	Remarks
1	Sanctioned Maximum demand capacity	70 MW (78 MVA)
2	Load Extension Proposal	288 MW (320 MVA) (under WTD approval)
2	Captive generation Level	33 KV level
3	In house Generation Capacity	462.5 MW
4	Total Operating Load of system	310 MW
5	Base operating condition of Generating Machines	5 GTs (30 MW) + 5 GTs (25 MW)
6	Connectivity of 220 KV with 33 KV generation level	4 Nos. of 220/33 KV; 50/65 MVA Trafos.
7	Continuous operating load	50 MW-70 MW
8	Ultimate load in case of multiple machine contingencies at IOCL end	260 MVA (restricted by transformer capacities.)
9	Load Shedding	Available.
10	Momentary load during contingencies before actuation of load shedding.	310 MW
10	Load post actuation of load shedding	Limited by transformer capacities.
11	Power export Conditions (if any)	No

इंडियन ऑयल कॉर्पोरेशन लिमिटेड
पानीपत रिफाइनरी एवं पेट्रोकेमिकल कॉम्पलेक्स
पानीपत, हरियाणा - 132140
Indian Oil Corporation Limited
Panipat Refinery & Petrochemical Complex
Panipat, Haryana - 132140
वेबसाइट : www.iocl.com; ई-मेल : panipatrefinery@indianoil.in
दूरभाष : 0180-2524001; फैक्स : 0180-2578833

रिफाइनरीज प्रभाग
Refineries Division

Additionally we are hereby enclosing the transient stability study carried out at our end fo different severe faults as well as load throw off conditions.

With reference to above we would like to propose to your good office to kindly grant us th requisite approval for operating the grid with our captive generation in parallel at th earliest. We urgently need to synchronize our CPP with Grid order to stop additional ST(in view of Net Zero directives by the Govt. of India within Mar'24.

Thanking you

Yours sincerely

Ravi Ranjan 22/0

Ravi Ranjan
Senior Maintenance Manager (Electrical)

रवि रंजन
Ravi Ranjan
वरिष्ठ प्रबंधक अनुरक्षण (विद्युत)
Senior Manager Maintenance Elect
पानीपत रिफाइनरी (आई.ओ.सी.एल.)13
Panipat Refinery(I.O.C.L.)132

CC: a. Director(Projects)
b. Director(Technical)
c. Chief Engineer (SO & Commercial)
d. Chief Engineer (PDC)
e. Executive Engineer (System Study)

Annexure - D

CEA-PS-II-22(13)/1/2019-PSPA-I Division

I/40782/2024

Annexure-XXXIV

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली योजना एवं मूल्यांकन-I प्रभाग
Power System Planning & Appraisal-I Division

सेवा में / To,

1. Member Secretary, NRPC, 18-A, Qutab Institutional Area, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110 016
2. COO (CTUIL), Saudamini, Plot no. 2, Sector -29, Gurgaon-122 001
3. Director (System Operation), Grid- India, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi- 110010
4. Managing Director, Haryana Vidyut Prasaran Nigam Limited, Shakti Bhawan, Sector-6, Panchkula- 134109
5. Managing Director, Uttar Haryana Vitaran Nigam Limited, Panchkula- 134109
6. Chief General Manager, Indian Oil Corporation Limited, Panipat Refinery & Petrochemical Complex, Panipat, Haryana - 132140

विषय /Subject: Minutes of the meeting held on 03.06.2024 through video conferencing to discuss HVPNL's proposal regarding synchronization of IOCL's captive generation at Panipat refinery with the grid.

महोदय/ Sir,

Please find enclosed the minutes of the meeting held on 03.06.2024 through video conferencing to discuss HVPNL's proposal regarding synchronization of IOCL's captive generation at Panipat refinery with the grid.

भवदीय / Yours faithfully,

Kushwaha
13.06.2024

(कन्हैया सिंह कुशवाहा/ Kanhaiya Singh Kushwaha)

सहायक निदेशक/ Assistant Director

सेवा भवन, आर. के. पुरम-I, नई दिल्ली-110066 टेलीफैक्स: 011-26102045 ईमेल:cea-pspa1@gov.in वेबसाइट:www.cea.nic.in
Sewa Bhawan, R.K Puram-I, New Delhi-110066Telefax: 011-26102045 email: cea-pspa1@gov.inWebsite: www.cea.nic.in

Minutes of the meeting held on 03.06.2024 through video conferencing to discuss HVPNL's proposal regarding synchronisation of IOCL's captive generation at Panipat refinery with the grid

List of participants is enclosed as **Annexure-I.**

Background:

(i) HVPNL had granted connectivity for 78 MVA drawl to IOCL for their Panipat refinery load (viz Township, Project construction power, Ethanol-2G, Ethanol-3G loads) through Mundh (HVPNL) – IOCL-I 220 kV D/c line (already commissioned).

(ii) In view of the expansions planned at Panipat refinery, IOCL submitted the proposal to HVPN for revised connectivity of 320 MVA (288 MW) and intimated that out of 320 MVA load, 180 MVA load is expected by 2026-27 (50 MVA load already connected, 130 MVA additional load expected by 2026-27) and remaining 140 MVA load is expected to be connected beyond 2026-27. HVPNL forwarded IOCL's proposal to CEA for concurrence.

(iii) CEA vide letter dated 08.02.2024 had concurred the proposal for revised IOCL load of 180 MVA with Mundh-IOCL-I 220 kV D/c line and for remaining load, additional connectivity of IOCL with 400/220 kV Munak substation of HVPNL was agreed through Munak- IOCL-I 220 kV D/c line in the first meeting of Standing Committee on Short Term & Perspective Power System Planning- Northern Region (SCSTPPSP-NR) held on 14.03.2024

(iv) Subsequently, IOCL has submitted new proposal to HVPNL vide which they intimated that they have captive generation at Panipat refinery which is used to feed some load of Panipat refinery in islanded mode and they want to synchronize the captive generation with the grid. IOCL has also submitted the Transient Stability Study Report dated December, 2020.

Deliberations in the meeting:

(I) IOCL gave a presentation regarding their proposal, summary of which is given below:

(a) At present, total generation capacity of IOCL's captive power plant (CPP) at Panipat refinery is 462.5 MW (5x30 MW GTs + 5x25 MW GTs + 3x25 MW STG +3x37.5 MW STG)

(b) Total load of Panipat refinery is 320 MW out of which 50 MW is being met from the grid (for which IOCL has taken connectivity of 70 MW/ 78 MVA) and remaining 270 MW load is being fed from CPP in islanded mode, for which IOCL needs to run 1 STG unit (25 MW) along with 10 GT units (275 MW). However, as STGs are inefficient and uneconomical, IOCL intends to stop the generation from STG unit and meet the commensurate load from the grid for which synchronization of CPP with the grid is proposed.

(c) IOCL has also envisaged additional load of 210 MW which is expected by September 2025. This load would be met from the grid supply. With this, the total demand of Panipat refinery would become 530 MW out of which 288 MW would be met from the grid and remaining through captive generation.

(ii) HVPNL stated that IOCL has taken connectivity for drawl of 288 MW only, whereas, with the synchronization of captive generation unit and associated load with the grid, total connected load of IOCL would become 530 MW (320 MW+ 210 MW) by September 2025 and in case of tripping of IOCL's captive generation units, entire 530

MW load would be drawn from grid only, which may overload the HVPNL's transmission network.

(iii) Regarding the above apprehension of HVPNL, IOCL gave the following clarifications:

(a) Simultaneous failure of all the 10 Nos. generation units is very unlikely. However, in case of tripping of generation units, commensurate load of IOCL would be shed off and ultimate drawl from the grid would be limited to 288 MW only for which load shedding scheme has been implemented at IOCL end.

(b) The load shedding scheme has the facility of keeping the system ready in pre-armed mode for tripping low priority excessive loads during any contingencies. This load shedding scheme is followed by under-frequency load shedding scheme as back-up.

(c) Protection scheme and islanding scheme have also been implemented at IOCL switchgears up to the 220 kV GIS level.

(d) For sustained operation of captive plant with the grid, a comprehensive system study have been carried out through M/s Tata Consultancy Engineering.

(iv) Grid-India suggested for implementation of SPS for protection of grid against overloading during outage of multiple captive generating units of IOCL.

(v) CTUIL and Grid-India stated that connectivity was granted to IOCL for 288 MW (320 MVA) with Mundh- IOCL-I 220 kV D/c line and Munak- IOCL-I 220 kV D/c line. However, as intimated by IOCL, additional load of IOCL is expected by September 2025 whereas Munak substation and associated lines may take at least 3-4 years for implementation. In the absence of Munak-IOCL-I 220 kV D/c line, Mundh-IOCL-I 220 kV D/c line and Jind (PG) - Mundh 220 kV D/c line may get overloaded and there would be requirement for reconductoring of the same with high capacity conductor.

(vi) Chief Engineer (PSPA-I), CEA, opined that protection settings at IOCL end also needs to be reviewed and requested HVPNL to put forth the agenda for the same to protection committee of NRPC.

(vii) After deliberations, IOCL's proposal regarding synchronization of IOCL's captive plant at Panipat refinery with the national grid was technically agreed subject to following:

(a) IOCL's load to be met from grid would be 70 MW/ 78 MVA till September, 2025 and 288 MW/ 320 MVA beyond September, 2025.

(b) HVPNL to check the requirement of reconductoring of Mundh-IOCL-I 220 kV D/c line and Jind (PG) - Mundh 220 kV D/c lines and implement the same in the time frame of IOCL's additional load i.e. by September 2025.

(c) HVPNL to put up the agenda to protection committee of NRPC for deliberation on the protection settings and implementation of SPS.

(d) Implementation of Munak 400 kV S/s to be expedited by HVPNL.

Annexure I

List of participants:

S.No.	Name (Ms/Shri)	Designation
CEA		
1	A. K. Rajput	Member (Power Systems)
2	Ishan Sharan	Chief Engineer
3	Kanhaiya Singh Kushwaha	Asst. Director
NRPC		
4	Dharmendra Kumar Meena	SE (Operation)
CTUIL		
5	Sandeep Kumawat	DGM
Grid - India		
6	Akash Tomar	Deputy Manager
HVPNL		
7	Sushil Kumar	SE, SLDC
8	Sanjay Verma	SE (Planning)
9	Rohtas Kaushik	SE (STU)
10	Anita Chaudhary	XEN AP-I
11	Akash Deep Sharma	XEN M&P
12	Munish Satija	XEN LPDC
13	Ashok Kumar Muthria	XEN Open Access
14	Deepak Sarit	XEN SS
15	Palak Sinha	AE SS
IOCL		
16	Mukul Aggrawal	CGM
17	Rajesh Shukla	DGM
18	Ravi Ranjan	Senior Maintenance Manager Electrical

Annexure E

Annexure-XXXV

HARYANA VIDYUT PARSARAN NIGAM LIMITED

Regd. Office: Shakti Bhawan, Sector-6, Panchkula
Corporate Identity Number: U40101HR1997SGC033683
Website: www.hvpn.org.in E-mail: sempccdkt@hvpn.org.in
Tel No: 0171-2540014
Superintending Engineer/M&P-CC Circle
HVPNL, Dhulkote, (Ambala City-134007)

HVPNL

To

The Superintending Engineer/Planning
HVPNL, Panchkula

Memo No.: Ch- 135 /MPA/M-107A Dated:- 27.06.2024

Subject: **Permission of operating the existing captive generation system of IOCL Panipat Refinery & Petrochemical Complex (PRPC) with 220kV Grid sourced from HVPNL Mundh in parallel in line with Net Zero Initiative of Govt. of India.**

Please refer to your office Memo No. Ch-59/HSS-404 dated 07.06.2024 on the subject cited matter vide which it was requested to supply the agenda for placing in the Committee of NRPC meeting for delibration on Protection settings and SPS System.

Enclosed please find herewith the agenda regarding Grid Sync Philosophy and Protection Scheme installed at IOCL PRPC end for your information and taking further necessary action please.

DA/As above

27/06/24.

Superintending Engineer
M&P-CC Circle, HVPNL,
Dhulkote

CC:

1. CE/PD&C, HVPNL, Panchkula for kind information please.
2. CE/TS, HVPNL, Panchkula for kind information please.
3. SE/TS, HVPNL, Karnal.
4. XEN /TS, HVPNL, Karnal.
5. XEN / M&P-CC Divn., HVPNL, Karnal
6. SPS to Director/ Technical, HVPNL, Panchkula for the kind information of Director / Technical, HVPNL, Panchkula please.
7. SPS to Director/ Projects, HVPNL, Panchkula for the kind information of Director / Projects, HVPNL, Panchkula please.
8. M/s. IOCL, Panipat.

Agenda for Grid Sync Philosophy and Protection Scheme installed at IOCL PRPC end.

The meeting was held between members from CEA, CTUIL, Grid India, NRPC, HVPNL and IOCL on 03.06.2024 related to synchronization of Grid with IOCL PRPC. As directed by CEA, the agenda was required to be submitted by HVPNL.
Accordingly, the meeting was called at the office of HVPNL TS division Karnal and detailed discussion was held related to the protection philosophy being followed. The agenda discussed is as follows:

Introduction:

The 220 KV Grid infrastructure from IOCL PRPC to HVPNL Mundh has been developed to cater the refinery expansion loads which has envisaged to be operated in parallel with the captive power plant. With commissioning of Grid, IOCL have shifted around 50 MW of less critical loads on Grid (viz Township, Project construction power, Ethanol-2G, Ethanol-3G loads) in islanded mode.

IOCL emphasized that it is required to synchronize the Grid with CPP of IOCL PRPC for operating additional load of process unit with Grid to maximize Grid power import upto the maximum demand capacity limit (78 MVA) and stopping uneconomical STG operation.

IOCL requested to consider the scenario of Grid synchronization in two phases:

a. Phase-1:(upto commissioning of P-25 units)- Grid import of upto 70 MW only. Under this condition, IOCL requested to provide provisional approval for Grid synchronization.
b. Phase-2: (Post P-25 commissioning)- Grid import shall be upto 288 MW, contract demand 320MVA as per the scheme discussed. The protection scheme at Grid end can be planned accordingly.

Protection and Operating Philosophy:

a. IOCL team informed that for sustained operation of 220 KV Grid with IOCL PRPC CPP, the comprehensive system study have been carried out through M/s TCE (M/s Tata Consultancy Engineering).

b. IOCL deliberated that the protection scheme and islanding scheme have been implemented at IOCL switchgears up to the 220 KV GIS level.

- The ***protection schemes*** is already approved by HVPNL design wing. The following major minimum protection schemes have been considered:
  i. Main-1 Numerical Distance Protection
  ii. Main-2 Numerical Distance Protection
  iii. Directional Back up O/C and E/F protection scheme
  iv. Overload Alarm Scheme
  v. Voltage protection scheme
  vi. LBB protection scheme
- The copy of the approval documents is attached as Annexure-1
- The robust ***grid islanding protection scheme*** based on the system study carried out by our system consultant M/s TCE has been approved andattached as **Annxure-2**. Following major Grid islanding protection scheme is

being followed for effective islanding of grid from our end in case of any disturbances.

i. Directional Overcurrent plus Undervoltage:
This protection is primarily defined for islanding of IOCL CPP from Grid in case direction of current is observed to be towards Grid with under voltage conditions indicating fault on Grid side.

ii. Vector Jump Protection:
This protection is primarily provided to detect out of phase closing of remote end breaker of the 220kV line.

iii. Reverse Power plus Under-Frequency:
For small systems like IOCL CPP, this setting is proposed to safely island in case of power flow in reverse direction towards Grid combined with under-frequency indicating overloading of Grid side.

iv. Under-Frequency plus Df/Dt
For small systems like IOCL CPP, this setting is proposed to safely island in case of under-frequency conditions combined with drastic rate of fall of frequency indicating loss of major prime movers on Grid side.

v. Plain Under-Frequency:
It is a plain under-frequency-based islanding protection.

vi. Plain Over-Frequency:
It is a plain over-frequency-based islanding protection.

vii. Plain Under-Voltage
It is a plain under-voltage-based islanding protection.

- Protection Scheme for 220 KV GIS at IOCL PRPC:
  i. The switchboard is provided with instantaneous low impedance based redundant bus differential protection scheme for both buses in standard main and check zone configuration.
  ii. The back-up over current and earth fault protection to bus differential and downstream feeders is also provided in all incomers and outgoing feeders.
  iii. The 220 KV power transformers are also provided instantaneous unit based protections (transformer differential and REF for both primary and secondary winding.)

c. ***Grid Synchronization Philosophy:*** The standard Grid synchronization with the incoming line source with the existing bus is being followed as is done in all synchronization philosophies. The standard synchronizing scheme with matching of voltage, frequency and phasor is being done using bright lamp and check synchronizing relay. The provision of guard relay for avoidance of beyond the sync window is also provided for guarding against prolonged close command or async close command. The standard sync trolley drawing is attached as Annexure-3

d. ***Load Shedding Scheme:*** IOCL also emphasized that both contingencies based as well as under-frequency-based load shedding scheme has been implemented at IOCL end. Both are fully equipped to take care of Grid trip contingency as well as GT trip contingency.

The load shedding scheme has the facility of keeping the system ready in pre-armed mode for tripping low priority excessive loads during any contingencies. This load shedding scheme is followed by under-frequency load shedding scheme as back-up.

e *Grid Power Evacuation Single Line Drawings:* The grid synchronization as power evacuation SLD is being attached for deliberation and further discussion on the agenda point.

At 220KV Substation Mund :-
The 220KV Mund-IOCL D/C line was commissioned on 13.10.2023. The length of line 33.8KM and type of conductor is ACSR Moose(0.5Sq"). The current carrying capacity of conductor is 620Amp. 220KV Substation Mund is connected with 220KV Safidon D/C and 400KV Jind (PGCIL) D/C.

The ***protection schemes*** adopted by HVPN is as under:-

i. Main-1 Numerical Distance Protection (Make-ZIV)
ii. Main-2 Numerical Distance Protection (Make-Micom442)
iii. Directional Back up O/C and E/F protection scheme
iv. LBB protection scheme

Submitted for kind consideration please.

Ravi Ranjan
SMNMEL
M/s IOCL

XEN TS Division
HVPNL, Karnal

XEN M&P cum CC Division
HVPNL, Karnal

SE/TS Circle, HVPNL, Karnal

SE/M&P cum CC Circle, HVPNL, Dhulkote

1. Protection SLD A1

RAVI, RANJAN (रवि, रजन)

From: Naveen Chauhan (sdoconstpnp@gmail.com)
Sent: Wednesday, February 10, 2021 10:59 AM
To: RAVI, RANJAN (रवि, रजन)
Subject: Fwd: Fwd: 220kV Switchyard IOCL Panipat Refinery.- Protection Single Line Diagram(SLD) drawings
Attachments: Scan0380.pdf

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To: <sdoconstpnp@gmail.com>

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Sent: Wed, 10 Feb 2021 09:42:52 +0530 (IST)
Subject: Fwd: 220kV Switchyard IOCL Panipat Refinery.- Protection Single Line Diagram(SLD) drawings

From: "Executive Engineer Protection DESIGN" <xenpldesign@hvpn.org.in>
To: "Superintending Engineer TS Rohtak" <setsrtk@hvpn.org.in>
Cc: "Superintending Engineer Purchase" <sepurchase@hvpn.org.in>, "Executive Engineer TS Panipat" <xen-tspnp@hvpn.org.in>
Sent: Tuesday, February 9, 2021 12:07:46 PM
Subject: 220kV Switchyard IOCL Panipat Refinery.- Protection Single Line Diagram(SLD) drawings

PFA

HARYANA VIDYUT PRASARAN NIGAM LIMITED
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SAVE ENERGY FOR THE BENEFIT OF SELF AND NATION

To

The Superintending Engineer/TS Circle,
HVPNL, Rohtak

Memo No.: Ch- II / IR-680 / Prot. Dated: 04.02.2021

Subject:- 220kV Switchyard IOCL Panipat Refinery.- Protection Single Line Diagram(SLD) *drawings*.

Please refer to your email dated 27.01.2021 vide which SLD drawings (TB-3-411-510-002 rev 4 sheet 1 to 8) were submitted for approval.

The SLD drawings (TB-3-411-510-002 rev 4 sheet 2) are approved subject to the following -

i) Drawings/Relay should strictly meet with the requirement of HVPNL technical Specification.
ii) Incorporation of comments & corrections made in red ink on drawing itself & attending of below mentioned observations :-

1. The Distance Protection Scheme and Line Differential Protection Scheme as proposed (With Pilot Wire Protection preferably OPGW) shall be compatible to each other w.r.t. receiving end and sending end. Further, the sending end differential protection relay and communication between receiving end and sending end relays(both end) shall also to be provided by IOCL.
2. As per technical specification of CR Panel with SAS cl 1.4.1,distance protection schemes on each 220 kV feeder C&R panel shall be of different make in view of fact that both the distance protection scheme (Main-I & Main-II) should have different measuring techniques.
3. As per technical specification of CR Panel with SAS cl 5.14, the provision of single and three phase auto reclosing and check synchronizing, and dead line charging is also to be made. The auto reclosing scheme built with numerical distance protection relay is acceptable provided it is available in both main-I and main-II distance protection scheme. And meet HVPNL specification.
4. The relay's shall meet all protection requirement and minimum protection to be provided as under-

Sr.No.	Description	Qty
1	Main-1 Numerical Distance protection Scheme	1 Set
2	Main-2 Numerical Distance protection Scheme	1 Set
3	Directional back up O/C and E/F protection scheme	1 Set
4	Overload alarm scheme	1 Set
5	3 phase Trip Relays	2 Nos
6	1 phase Trip Relays	6 Nos
7	Voltage selection scheme	1 set
8	Flag relays, carrier receive relays ,aux Relays, timers etc as per scheme Requirements	Lot
9.	Under Voltage relay for isolator/earth switch	2 Nos
10.	LBB Protection Scheme	1 set
11.	DC supply Supervision scheme	1 set
12.	Trip Circuit supervision relays	6 Nos
13.	Auto reclose scheme with check synchronising and dead line charging scheme	1 set
14	Bay control unit, Ethernet switch etc. as per technical specification enclosed as annex.1	1 Set

5. The core arrangement shall be done as under:
   - Core-1: Main-1 Distance
   - Core-2: Main II Distance.
   - Core-3: Bus Differential Main
   - Core-4: Bus Differential Check
   - Core-5: Measurement/Metering for BCU

6. Feeder overload alarm scheme is also to be provided. The feeder overload alarm relay in built with numerical distance protection relay or over current and earth fault protection relay is acceptable provided it meets HVPNL requirement.
7. The main protection relays provided should be as per relevant IS:3231/ IEC-61850 complaint with optical ports or other upto date relevant standards applicable in HVPNL.
8. Interlocking may be provided for isolators/ CB/ Earth Switches operation as per protection philosophy adopted in HVPNL.
9. The coordination and setting of relays shall be done in consultation with concerned M&P (Both for receiving end and sending end).
10. Burden of CTs, PTs & CVTs shall be strictly as per technical specification of equipments in HVPNL.
11. The provision of window on fascia annunciations provided on C&R Panels shall be strictly as per technical specification of C&R Panels in HVPNL.
12. SLD has been approved for Protection Point of view only for Line bay at IOCL end only.
13. Setting of all relays should be done in coordination of setting of relays at the HVPNL end.
14. For metering purpose latest guidelines of HVPNL and UHBVNL for Interutility Metering be followed for & metering arrangement shall be strictly adhered as per approval of UHBVNL further the HVPNL specification of energy meter shall be strictly adhered.
15. The provision of indication of lamp i.e. ON, OFF, TRIP, Spring charge, Auto Trip & over load alarm shall be provided on C&R Panels.
16. Drawings of all the metering equipments will be approved separately.
17. Technical Parameters of equipments shall be strictly as per HVPNL Technical Specifications.
18. All the CEA/ Haryana Grid Code Regulations amended upto date shall be strictly adhered by the firm and any equipment required to adhere those instructions at any point of time shall be provided by the firm.
19. Exchange of data/ information with HVPNL, necessary to maintain reliability and security of the grid will be ensured by IOCL and all relevant & mandatory equipments for communication of data/ information shall be provided & ensured by the IOCL.
20. Main and stand by data communication shall be provided with SLDC Panipat.
21. All the electrical clearances shall be ensured by the firm as per Indian Electricity Rules/ Codes.
22. All the terms & conditions as mentioned in the CE/Planning HVPNL, Panchkula memo no. R-1674/Ch-25/HAP-123 Dated 17.10.2019 and execution guidelines issued by Deputy Secretary/Operation, HVPNL, Panchkula vide memo no. Ch-17/DSO-214/L-154/L-2 dated 25.04.2012 shall be strictly adhered and complied with.
23. VT Fuse failure protection scheme shall be provided.
24. Wave trap shall be provided for communication and PLCC protection coupler (PLCC carrier trip) shall also be provided.
25. The final as built set of above approved SLD Drawings alongwith soft copy (CD) as per technical specification of HVPNL for reference and record to this office.

Further drawings of SLD for Transformer bay and bus coupler bay etc (drawing NoTB-3-411-510-002 rev 4 sheet 3 to 8) is not considered.

DA/Approved SLD for 220kV Line Bay.

Superintending Engineer/ Design
for CE/ PD&C, HVPNL, Panchkula.

Cc to -

1. The Superintending Engineer/Purchase, HVPNL, Panchkula. (D/A as above)
2. The Executive Engineer/TS Divn. HVPNL, Panipat. (D/A as above)
3. Master file.

3. **df/dt and underfrequency setting**

After the loss of grid when CPP generator continue to feed IOCL loads, the fall in frequency is observed to be at the rate of 0.8Hz/s through ETAP simulation. Therefore, the df/dt setting is done at 0.7Hz/s at 49.2Hz with a delay of 1sec.

4. **Reverse power relay setting**

Reverse power setting is set is set as below:

Stage 1: Reverse power threshold at 40MW (towards grid), UF threshold at 49.5 with a delay of 0.5sec

Stage 2: Reverse power threshold at 40MW (towards grid), UF threshold at 49.8Hz with delay of 5 sec.

As informed by IOCL officials, it is anticipated that 200MW of load is assumed to fall on IOCL generator in addition to IOCL in plant loads in case of sudden loss of grid at the substation falls on IOCL generators.

13 PROPOSED SETTINGS FOR ISLANDING RELAY

a) U/V + DOC scheme

U/V setting	:	40%
Time delay	:	0.0 sec (Instantaneous)
DOC	:	1000 A (Towards Grid)
Time delay	:	0.5 sec

b) Plain grid U/F Isolation scheme

U/F setting	:	49 Hz
Time delay	:	0.1 sec

c) df/dt + Under Frequency scheme

Under frequency	:	49.2 Hz
Rate of change of frequency	:	-0.7 Hz/sec
Time delay	:	1 sec

d) RP + UF scheme

Stage-1

Reverse power	40.0 MW
Time delay	0.5 sec
Under frequency	49.5 Hz

Stage-2

Reverse power	40.0 MW
Time delay	5.0 sec
Under frequency	49.8 Hz

e) Plain grid O/F Isolation scheme

O/F setting	:	51.5 Hz
Time delay	:	1.0 sec

f) Plain grid U/V Isolation scheme

U/V setting	:	80%
Time delay	:	1.5 sec

g) Plain grid O/V Isolation scheme

O/V setting	:	115%
Time delay	:	0.5 sec

14 BASIS OF LOAD SHEDDING SCHEME

In addition to above load shedding scheme to isolate the grid disturbance, a robust load shedding scheme shall be implemented to maintain the load generation unbalance and ensuring the stability of CPP generators post islanding.

IOCL has shared the load priority table for PR and PNCP in line with the criticality of the process. As per the load priority table there are 16 load groups at PR and 17 load groups at PNCP, where first group is of least priority and last group has the highest priority.

It is observed that during normal operating condition 70MW was imported from the grid. Therefore, in case of grid underfrequency situation, if no loads are shed prior to the islanding (at 49Hz), the captive generators will experience a sudden jerk at the point of islanding due to additional 70MW of loads over and above the CPP generation capacity falling on the generators thus resulting in further fall in frequency.

Therefore, in case of loss of grid, to avoid jerk and further fall in frequency post islanding, it is recommended to shed the least priority load before the islanding occurs at different frequency stages before the system frequency reaches 49Hz. Suitable load shedding scheme to be initiated prior to grid islanding (in case of fall in frequency) in order to maintain the load near to generation capacity during the moment of islanding to avoid sudden jerk in CPP generator.

BHDLA-II_SS / 765kV / LINE WITH REACTOR / LINE / BAY_713 / MAIN-1_DIST_PROT_21.1

MLFB:	7SA52216CB904QB4
Parameter-set version:	V04.73.03
Device path:	D:\Bhadla-II Relay Configuration\TATA PROJECTS & STATCOM-II\SIPROTEC_4 \BHADLA-II\P7DI\GV\SD\00000071
Author:	
Creation date:	21.11.23 14:13:32
Last modified:	19.07.24 14:40:12
Operating mode:	Offline
Comment:	
Setting values in:	Secondary value description

P R I N T - C O N T E N T S

1 Settings groups

1.1 Group Power System Data 2; Group Power System

Group Power System Data 2; Group Power System

No.	Settings	Value	Group
1103	Measurement: Full Scale Voltage (100%)	765.0 kV	A
1104	Measurement: Full Scale Current (100%)	3000 A	A
1105	Line Angle	87 °	A
1211	Angle of inclination, distance charact.	87 °	A
1107	P,Q operational measured values sign	not reversed	A
1110	x' - Line Reactance per length unit	0.1101 Ohm / km	A
1111	Line Length	202.2 km	A
1116	Zero seq. comp. factor RG/RL for Z1	2.00	A
1117	Zero seq. comp. factor XG/XL for Z1	0.87	A
1118	Zero seq. comp.factor RG/RL(> Z1)	2.00	A
1119	Zero seq. comp.factor XG/XL(> Z1)	0.87	A
1126	Mutual Parallel Line comp. ratio RM/RL	6.29	A
1127	Mutual Parallel Line comp. ratio XM/XL	0.88	A
1128	Neutral current RATIO Parallel Line Comp	85 %	A

1.2 Group Power System Data 2; Group Line Status

Group Power System Data 2; Group Line Status

No.	Settings	Value	Group
1130A	Pole Open Current Threshold	0.05 A	A
1131A	Pole Open Voltage Threshold	44 V	A
1132A	Seal-in Time after ALL closures	0.20 sec	A
1133A	minimal time for line open before SOTF	0.50 sec	A
1134	Recognition of Line Closures with	Current OR Voltage or Manual close BI	A
1135	RESET of Trip Command	Pickup Reset	A
1136	open pole detector	with measurement (V/I,trip, pickup, 52a	A
1140A	CT Saturation Threshold	6.0 A	A
1150A	Seal-in Time after MANUAL closures	0.20 sec	A
1151	Manual CLOSE COMMAND generation	NO	A
1152	MANUAL Closure Impulse after CONTROL	<none>	All

1.3 Group Power System Data 2; Group Trip 1-/3-pole

Group Power System Data 2; Group Trip 1-/3-pole

No.	Settings	Value	Group
1155	3 pole coupling	with Trip	A
1156A	Trip type with 2phase faults	3pole	A

1.4 Group 21 Distance protection, general settings; Group General

Group 21 Distance protection, general settings; Group General

No.	Settings	Value	Group
1201	21 Distance protection is	ON	A
1202	Phase Current threshold for dist. meas.	0.10 A	A
1211	Angle of inclination, distance charact.	87 °	A
1208	Series compensated line	NO	A
1215	Mutual coupling parall.line compensation	NO	A
1232	Instantaneous trip after SwitchOnToFault	with Zone Z1B	A
1241	R load, minimum Load Impedance (ph-g)	10.100 Ohm	A
1242	PHI load, maximum Load Angle (ph-g)	30 °	A
1243	R load, minimum Load Impedance (ph-ph)	30.300 Ohm	A
1244	PHI load, maximum Load Angle (ph-ph)	30 °	A
1317A	Single pole trip for faults in Z2	NO	A
1357	Z1B enabled before 1st AR (int. or ext.)	NO	A

1.5 Group 21 Distance protection, general settings; Group Ground faults

Group 21 Distance protection, general settings; Group Ground faults

No.	Settings	Value	Group
1203	3I0 threshold for neutral current pickup	0.10 A	A
1204	3V0 threshold zero seq. voltage pickup	5 V	A
1207A	3I0>-pickup-stabilisation (3I0>/ Iphmax)	0.15	A
1209A	Criterion of ground fault recognition	3I0> OR 3V0>	A
1221A	Loop selection with 2Ph-G faults	all loops	A

1.6 Group 21 Distance protection, general settings; Group Time Delays

Group 21 Distance protection, general settings; Group Time Delays

No.	Settings	Value	Group
1210	21 Condition for zone timer start	with zone pickup	A
1305	T1-1phase, delay for single phase faults	0.00 sec	A
1306	T1multi-ph, delay for multi phase faults	0.00 sec	A
1315	T2-1phase, delay for single phase faults	0.35 sec	A
1316	T2multi-ph, delay for multi phase faults	0.35 sec	A
1325	T3 delay	1.50 sec	A
1335	T4 delay	0.50 sec	A
1345	T5 delay	oo sec	A
1365	T6 delay	oo sec	A
1355	T1B-1phase, delay for single ph. faults	0.00 sec	A
1356	T1B-multi-ph, delay for multi ph. faults	0.00 sec	A

1.7 Group 21 Distance zones (quadrilateral); Group Zone Z1

Group 21 Distance zones (quadrilateral); Group Zone Z1

No.	Settings	Value	Group
1301	Operating mode Z1	Forward	A
1302	R(Z1), Resistance for ph-ph-faults	11.010 Ohm	A
1303	X(Z1), Reactance	17.810 Ohm	A
1304	RG(Z1), Resistance for ph-gnd faults	11.010 Ohm	A
1305	T1-1phase, delay for single phase faults	0.00 sec	A
1306	T1multi-ph, delay for multi phase faults	0.00 sec	A
1307	Zone Reduction Angle (load compensation)	5 °	A

1.8 Group 21 Distance zones (quadrilateral); Group Zone Z1B-exten.

Group 21 Distance zones (quadrilateral); Group Zone Z1B-exten.

No.	Settings	Value	Group
1351	Operating mode Z1B (overrreach zone)	Forward	A
1352	R(Z1B), Resistance for ph-ph-faults	12.940 Ohm	A
1353	X(Z1B), Reactance	33.390 Ohm	A
1354	RG(Z1B), Resistance for ph-gnd faults	11.010 Ohm	A
1355	T1B-1phase, delay for single ph. faults	0.00 sec	A
1356	T1B-multi-ph, delay for multi ph. faults	0.00 sec	A
1357	Z1B enabled before 1st AR (int. or ext.)	NO	A

1.9 Group 21 Distance zones (quadrilateral); Group Zone Z2

Group 21 Distance zones (quadrilateral); Group Zone Z2

No.	Settings	Value	Group
1311	Operating mode Z2	Forward	A
1312	R(Z2), Resistance for ph-ph-faults	12.940 Ohm	A
1313	X(Z2), Reactance	33.390 Ohm	A
1314	RG(Z2), Resistance for ph-gnd faults	11.010 Ohm	A
1315	T2-1phase, delay for single phase faults	0.35 sec	A
1316	T2multi-ph, delay for multi phase faults	0.35 sec	A
1317A	Single pole trip for faults in Z2	NO	A

1.10 Group 21 Distance zones (quadrilateral); Group Zone Z3

Group 21 Distance zones (quadrilateral); Group Zone Z3

No.	Settings	Value	Group
1321	Operating mode Z3	Forward	A
1322	R(Z3), Resistance for ph-ph-faults	16.180 Ohm	A
1323	X(Z3), Reactance	53.430 Ohm	A
1324	RG(Z3), Resistance for ph-gnd faults	17.970 Ohm	A
1325	T3 delay	1.50 sec	A

1.11 Group 21 Distance zones (quadrilateral); Group Zone Z4

Group 21 Distance zones (quadrilateral); Group Zone Z4

No.	Settings	Value	Group
1331	Operating mode Z4	Reverse	A
1332	R(Z4), Resistance for ph-ph-faults	12.940 Ohm	A
1333	X(Z4), Reactance	2.230 Ohm	A
1334	RG(Z4), Resistance for ph-gnd faults	11.010 Ohm	A
1335	T4 delay	0.50 sec	A

1.12 Group 21 Distance zones (quadrilateral); Group Zone Z5

Group 21 Distance zones (quadrilateral); Group Zone Z5

No.	Settings	Value	Group
1341	Operating mode Z5	Non-Directional	A
1342	R(Z5), Resistance for ph-ph-faults	19.410 Ohm	A
1343	X(Z5)+, Reactance for Forward direction	64.120 Ohm	A
1344	RG(Z5), Resistance for ph-gnd faults	21.570 Ohm	A
1345	T5 delay	oo sec	A
1346	X(Z5)-, Reactance for Reverse direction	64.120 Ohm	A

1.13 Group 21 Distance zones (quadrilateral); Group Zone Z6

Group 21 Distance zones (quadrilateral); Group Zone Z6

No.	Settings	Value	Group
1361	Operating mode Z6	Inactive	A
1362	R(Z6), Resistance for ph-ph-faults	15.000 Ohm	A
1363	X(Z6)+, Reactance for Forward direction	15.000 Ohm	A
1364	RE(Z6), Resistance for ph-g faults	15.000 Ohm	A
1365	T6 delay	oo sec	A
1366	X(Z6)-, Reactance for Reverse direction	4.000 Ohm	A

1.14 Group 68 Power Swing detection

Group 68 Power Swing detection

No.	Settings	Value	Group
2002	Power Swing Operating mode	all zones blocked	A
2006	68T Power swing trip	NO	A

1.15 Group 85-21 Pilot Prot. for Distance prot.

Group 85-21 Pilot Prot. for Distance prot.

No.	Settings	Value	Group
2101	85-21 Pilot Prot. for Distance prot.	ON	A
2102	Type of Line	Three Terminals	A
2103A	Time for send signal prolongation	0.07 sec	A
2112A	DIS transient block by EF	YES	A
2113	Memorize receive signal	NO	A

1.16 Group DTT Direct Transfer Trip

Group DTT Direct Transfer Trip

No.	Settings	Value	Group
2201	Direct Transfer Trip (DTT)	OFF	A
2202	Trip Time Delay	0.01 sec	A

1.17 Group 50HS Instantaneous SOTF

Group 50HS Instantaneous SOTF

No.	Settings	Value	Group
2401	50HS Instantaneous SOTF-O/C is	ON	A
2404	50HS SOTF-O/C PICKUP	1.50 A	A

1.18 Group 50(N)/51(N) Backup OverCurrent; Group General

Group 50(N)/51(N) Backup OverCurrent; Group General

No.	Settings	Value	Group
2601	Operating mode	ON:only active with Loss of VT sec. cir.	A
2680	Trip time delay after SOTF	0.20 sec	A

1.19 Group 50(N)/51(N) Backup OverCurrent; Group 50(N)-B1

Group 50(N)/51(N) Backup OverCurrent; Group 50(N)-B1

No.	Settings	Value	Group
2610	50-B1 Pickup	oo A	A
2611	50-B1 Delay	oo sec	A
2612	50N-B1 Pickup	oo A	A
2613	50N-B1 Delay	oo sec	A
2614	Instantaneous trip via BI	NO	A
2615	Instantaneous trip after SwitchOnToFault	NO	A

1.20 Group 50(N)/51(N) Backup OverCurrent; Group 50(N)-B2

Group 50(N)/51(N) Backup OverCurrent; Group 50(N)-B2

No.	Settings	Value	Group
2620	50-B2 Pickup	oo A	A
2621	50-B2 Delay	oo sec	A
2622	50N-B2 Pickup	oo A	A
2623	50N-B2 Delay	oo sec	A
2624	Instantaneous trip via Pilot Prot./BI	NO	A
2625	Instantaneous trip after SwitchOnToFault	NO	A

1.21 Group 50(N)/51(N) Backup OverCurrent; Group 51(N)-B

Group 50(N)/51(N) Backup OverCurrent; Group 51(N)-B

No.	Settings	Value	Group
2640	51-B Pickup	oo A	A
2642	51-B Time Dial	oo sec	A
2646	51-B Additional Time Delay	0.00 sec	A
2650	51N-B Pickup	oo A	A
2652	51N-B Time Dial	oo sec	A
2656	51N-B Additional Time Delay	0.00 sec	A
2660	IEC Curve	Normal Inverse	A
2670	Instantaneous trip via Pilot Prot./BI	NO	A
2671	Instantaneous trip after SwitchOnToFault	NO	A

1.22 Group 50(N)/51(N) Backup OverCurrent; Group 50(N)-STUB

Group 50(N)/51(N) Backup OverCurrent; Group 50(N)-STUB

No.	Settings	Value	Group
2630	50-STUB Pickup	1.50 A	A
2631	50-STUB Delay	0.05 sec	A
2632	50N-STUB Pickup	1.00 A	A
2633	50N-STUB Delay	0.05 sec	A
2634	Instantaneous trip via Pilot Prot./BI	NO	A
2635	Instantaneous trip after SwitchOnToFault	NO	A

1.23 Group Measurement Supervision; Group Balance / Summ.

Group Measurement Supervision; Group Balance / Summ.

No.	Settings	Value	Group
2901	Measurement Supervision	OFF	A
2902A	Voltage Threshold for Balance Monitoring	50 V	A
2903A	Balance Factor for Voltage Monitor	0.75	A
2904A	Current Threshold for Balance Monitoring	0.50 A	A
2905A	Balance Factor for Current Monitor	0.50	A
2906A	Summated Current Monitoring Threshold	0.10 A	A

Group Measurement Supervision; Group Balance / Summ.(2)

No.	Settings	Value	Group
2907A	Summated Current Monitoring Factor	0.10	A
2908A	T Balance Factor for Voltage Monitor	5 sec	A
2909A	T Current Balance Monitor	5 sec	A

1.24 Group Measurement Supervision; Group Meas.Volt.Fail

Group Measurement Supervision; Group Meas.Volt.Fail

No.	Settings	Value	Group
2910	Fuse Failure Monitor	ON	A
2911A	Minimum Voltage Threshold V>	40 V	A
2912A	Maximum Current Threshold I<	0.10 A	A
2913A	Maximum Voltage Threshold V< (3phase)	25 V	A
2914A	Differential Current Threshold (3phase)	0.10 A	A
2915	Voltage Failure Supervision	with current supervision	A
2916A	Delay Voltage Failure Supervision	3.00 sec	A

1.25 Group Measurement Supervision; Group VT mcb

Group Measurement Supervision; Group VT mcb

No.	Settings	Value	Group
2921	VT mcb operating time	0 ms	A

1.26 Group Measurement Supervision; Group Load Angle

Group Measurement Supervision; Group Load Angle

No.	Settings	Value	Group
2941	Limit setting PhiA	200 °	A
2942	Limit setting PhiB	340 °	A
2943	Minimum value I1>	0.05 A	A

Group Measurement Supervision; Group Load Angle(2)

No.	Settings	Value	Group
2944	Minimum value U1>	20 V	A

1.27 Group 50N/51N Ground OverCurrent; Group General

Group 50N/51N Ground OverCurrent; Group General

No.	Settings	Value	Group
3101	50N/51N Ground Overcurrent	ON	A
3102	Block 50N/51N for Distance protection	with every Pickup	A
3174	Block 50N/51N for Pickup 21	in zone Z1/Z1B	A
3103	Block 50N/51N for 1pole Dead time	YES	A
3104A	Stabilisation Slope with Iphase	10 %	A
3109	Single pole trip with ground flt.prot.	NO	A
3170	2nd harmonic ratio for inrush restraint	15 %	A
3171	Max.Current, overriding inrush restraint	7.50 A	A
3172	Instantaneous mode after SwitchOnToFault	with Pickup and direction	A
3173	Trip time delay after SOTF	0.00 sec	A

1.28 Group 50N/51N Ground OverCurrent; Group 50N-1

Group 50N/51N Ground OverCurrent; Group 50N-1

No.	Settings	Value	Group
3110	Operating mode	Inactive	A
3111	Pickup	0.50 A	A
3112	Time Delay	0.10 sec	A
3113	Instantaneous trip via Pilot Prot./BI	NO	A
3114	Instantaneous trip after SwitchOnToFault	NO	A
3115	Inrush Blocking	NO	A

1.29 Group 50N/51N Ground OverCurrent; Group 50N-2

Group 50N/51N Ground OverCurrent; Group 50N-2

No.	Settings	Value	Group
3120	Operating mode	Inactive	A
3121	Pickup	2.00 A	A
3122	Time Delay	0.60 sec	A
3123	Instantaneous trip via Pilot Prot./BI	NO	A
3124	Instantaneous trip after SwitchOnToFault	NO	A
3125	Inrush Blocking	NO	A

1.30 Group 50N/51N Ground OverCurrent; Group 50N-3

Group 50N/51N Ground OverCurrent; Group 50N-3

No.	Settings	Value	Group
3130	Operating mode	Inactive	A
3131	Pickup	1.00 A	A
3132	Time Delay	0.90 sec	A
3133	Instantaneous trip via Pilot Prot./BI	NO	A
3134	Instantaneous trip after SwitchOnToFault	NO	A
3135	Inrush Blocking	NO	A

1.31 Group 50N/51N Ground OverCurrent; Group 51N InverseTime

Group 50N/51N Ground OverCurrent; Group 51N InverseTime

No.	Settings	Value	Group
3140	Operating mode	Forward	A
3141	Pickup	0.10 A	A
3143	Time Dial	0.45 sec	A
3147	Additional Time Delay	0.00 sec	A
3148	Instantaneous trip via Pilot Prot./BI	NO	A
3149	Instantaneous trip after SwitchOnToFault	NO	A
3150	Inrush Blocking	NO	A
3151	IEC Curve	Normal Inverse	A

1.32 Group 50N/51N Ground OverCurrent; Group Direction

Group 50N/51N Ground OverCurrent; Group Direction

No.	Settings	Value	Group
3160	Polarization	with V2 and I2 (negative sequence)	A
3162A	ALPHA, lower angle for forward direction	338 °	A
3163A	BETA, upper angle for forward direction	122 °	A
3164	Min. zero seq.voltage 3Vo for polarizing	2.0 V	A
3166	Min. neg. seq. polarizing voltage 3V2	5.0 V	A
3167	Min. neg. seq. polarizing current 3I2	0.10 A	A
3168	Compensation angle PHI comp. for Sr	255 °	A
3169	Forward direction power threshold	0.3 VA	A
3186A	3V0 min for forward direction	0.0 V	A
3187A	Reactance X of series capacitor	0.000 Ohm	A

1.33 Group 27/59 Under/Over Voltage; Group 59 Vph-gnd

Group 27/59 Under/Over Voltage; Group 59 Vph-gnd

No.	Settings	Value	Group
3701	Operating mode Vph-g overvoltage prot.	ON	A
3702	59-1 Pickup Overvoltage (phase-ground)	69.2 V	A
3703	59-1 Time Delay	9.00 sec	A
3704	59-2 Pickup Overvoltage (phase-ground)	89.0 V	A
3705	59-2 Time Delay	0.10 sec	A
3709A	Reset ratio	0.99	A

1.34 Group 27/59 Under/Over Voltage; Group 59 Vph-ph

Group 27/59 Under/Over Voltage; Group 59 Vph-ph

No.	Settings	Value	Group
3711	Operating mode Vph-ph overvoltage prot.	OFF	A
3712	59-1 Pickup Overvoltage (phase-phase)	121.0 V	A
3713	59-1 Time Delay	2.00 sec	A

Group 27/59 Under/Over Voltage; Group 59 Vph-ph(2)

No.	Settings	Value	Group
3714	59-2 Pickup Overvoltage (phase-phase)	135.0 V	A
3715	59-2 Time Delay	1.00 sec	A
3719A	Reset ratio	0.98	A

1.35 Group 27/59 Under/Over Voltage; Group 59:3Vo or 59 Vx

Group 27/59 Under/Over Voltage; Group 59:3Vo or 59 Vx

No.	Settings	Value	Group
3721	Operating mode 3V0 (or Vx) overvoltage	OFF	A
3722	59G-1 Pickup 3V0 (or Vx) (zero seq.)	30.0 V	A
3723	59G-1 Time Delay	2.00 sec	A
3724	59G-2 Pickup 3V0 (or Vx) (zero seq.)	50.0 V	A
3725	59G-2 Time Delay	1.00 sec	A
3728A	59G: Stabilization 3Vo-Measurement	ON	A
3729A	Reset ratio	0.95	A

1.36 Group 27/59 Under/Over Voltage; Group 59 V1 (pos.seq)

Group 27/59 Under/Over Voltage; Group 59 V1 (pos.seq)

No.	Settings	Value	Group
3731	Operating mode V1 overvoltage prot.	OFF	A
3732	59-1 Pickup Overvoltage (pos. seq.)	150.0 V	A
3733	59-1 Time Delay	2.00 sec	A
3734	59-2 Pickup Overvoltage (pos. seq.)	175.0 V	A
3735	59-2 Time Delay	1.00 sec	A
3739A	Reset ratio	0.98	A

1.37 Group 27/59 Under/Over Voltage; Group 59 V2 (neg.seq)

Group 27/59 Under/Over Voltage; Group 59 V2 (neg.seq)

No.	Settings	Value	Group
3741	Operating mode V2 overvoltage prot.	OFF	A
3742	59-1 Pickup Overvoltage (neg. seq.)	30.0 V	A
3743	59-1 Time Delay	2.00 sec	A
3744	59-2 Pickup Overvoltage (neg. seq.)	50.0 V	A
3745	59-2 Time Delay	1.00 sec	A
3749A	Reset ratio	0.98	A

1.38 Group 27/59 Under/Over Voltage; Group 27 Vph-gnd

Group 27/59 Under/Over Voltage; Group 27 Vph-gnd

No.	Settings	Value	Group
3751	Operating mode Vph-g undervoltage prot.	OFF	A
3752	27-1 Pickup Undervoltage (phase-neutral)	30.0 V	A
3753	27-1 Time Delay	2.00 sec	A
3754	27-2 Pickup Undervoltage (phase-neutral)	10.0 V	A
3755	27-2 Time Delay	1.00 sec	A
3758	Current supervision (Vph-g)	ON	A
3759A	Reset ratio	1.05	A

1.39 Group 27/59 Under/Over Voltage; Group 27 Vph-ph

Group 27/59 Under/Over Voltage; Group 27 Vph-ph

No.	Settings	Value	Group
3761	Operating mode Vph-ph undervoltage prot.	OFF	A
3762	27-1 Pickup Undervoltage (phase-phase)	50.0 V	A
3763	27-1 Time Delay	2.00 sec	A
3764	27-2 Pickup Undervoltage (phase-phase)	17.0 V	A
3765	27-2 Time Delay	1.00 sec	A
3768	Current supervision (Vph-ph)	ON	A
3769A	Reset ratio	1.05	A

1.40 Group 27/59 Under/Over Voltage; Group 27 V1 (pos.seq)

Group 27/59 Under/Over Voltage; Group 27 V1 (pos.seq)

No.	Settings	Value	Group
3771	Operating mode V1 Undervoltage prot.	OFF	A
3772	27-1 Pickup Undervoltage (pos. seq.)	30.0 V	A
3773	27-1 Time Delay	2.00 sec	A
3774	27-2 Pickup Undervoltage (pos. seq.)	10.0 V	A
3775	27-2 Time Delay	1.00 sec	A
3778	Current supervision (V1)	ON	A
3779A	Reset ratio	1.05	A

1.41 Group Fault Locator; Group Fault Locator

Group Fault Locator; Group Fault Locator

No.	Settings	Value	Group
3802	Start fault locator with	TRIP	A
3805	Mutual coupling parall.line compensation	NO	A
3806	Load Compensation	YES	A

Annexure-XXXVII

RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LIMITED.

[Corporate Identity Number (CIN):U40109RJ2000SGC016485]

(Regd. Office: Vidyut Bhawan, Jan Path, Jyoti Nagar, Jaipur - 302 005)

OFFICE OF THE SUPERINTENDING ENGINEER (PROJECT & PLANNING)

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RVPN

An ISO 9001:2000 Certified Company

No. RVPN/SE(P&P)/XEN-3(P&P)/AE-2/ F. /D 144 Jaipur, Dt. 28/06/24

To

The General Manager (NRLDC)
Grid Controller of India Limited,
18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai
New Delhi-110016.

Sub:- Revised SPS for 2x315 MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur.
Ref:- MOM of 197th OCC meeting held on dated 22.07.2022.

On the above captioned subject, it is submitted that SPS for 2x315 MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura) was approved in the 197th OCC meeting held on dated 22.07.2022. Due to increased loading in the Bilara, Jodhpur and Bhawad region, operational arrangement of lines and transformers has been changed at 400 kV GSS Jodhpur. This has necessitated the revisison of the approved and implemented SPS. In this regard, please find attached the Revised SPS for 2x315 MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura) with request to please include in the next meeting of OCC for discussion and to accord necessary approval of the OCC forum. This SPS has been finalized after detailed deliberations with the officers of RVPN and Rajasthan SLDC in a meeting held on dated 07.06.2024.

Encl: As above

(S.C. Meena)
Chief Engineer (PP&D)
RVPNL, Jaipur.

Copy to the following for information and necessary action please-

1. The Member Secretary (NRPC), 18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110016
2. The Chief Engineer (LD/T&C/MPT&S), RVPN, Jaipur/Jodhpur.
3. The Chief Engineer, Power System Planning & Appraisal-I Division, CEA, Sewa Bhawan, RK Puram-I, New Delhi-110066
4. The Superintending Engineer (Operation), NRPC, 18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110016.
5. The System Operator-2, NRLDC, 18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110016

Encl: As above

1/7/24
SURESH, AE(P&P)

Chief Engineer (PP&D)
RVPNL, Jaipur

SE(O) 8/7/24 EE(P) 09/7/24

RajKaj Ref 8413407

Document certified by SURESH CHAND MEENA <mhi4371@gmail.com>.

Digitally Signed by SURESH CHAND MEENA
Designation: Chief Engineer
Date :27-06-2024 07:24:49

उ.रा.वि.प्र.नि. जोधपुर
वि./No. 697
दिनांक/Date 8/7/2024

Proposed Revised SPS for 2x315 MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur

A. **Transmission Network Associated with 400 kV GSS Jodhpur (Surpura)**

- There are two 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura) each having capacity of 315 MVA.
- Percentage impedance of 315 MVA, 400/220 kV ILT-I is 12.50% (HV to IV) & 45% (HV to LV) & 30% (IV to LV) and Percentage impedance of 315 MVA, 400/220 kV ILT-II is 12.50% (HV to IV) & 60% (HV to LV) & 45% (IV to LV).
- 400 kV GSS Jodhpur is connected to 400 kV GSS Kankani, 400 kV GSS Bhadla, 400 kV GSS Kankroli, 400 kV GSS Akal, and Rajwest LTPS through 400 kV lines. There are following 220 kV lines emanating from 400 kV GSS Jodhpur:-
  - 220 kV D/C Jodhpur-Bhawad line
  - 220 kV D/C Jodhpur-Tinwari line
  - 220 kV S/C Jodhpur-Barli line
  - 220 kV S/C Jodhpur-Jhalamand line
  - 220 kV S/C Jodhpur-Bilara line
  - 100MVA, 220/132 kV Transformer at Surpura.
- 220 kV GSS Bhawad is connected to the 220 kV GSS Bhaithwasia through 220 kV D/C line and 220 kV GSS Bhaithwasia is further connected to the 220 kV GSS Aau through 220 kV D/C line.
- 132 kV GSS Mandore is fed from the 100MVA, 220/132 kV Transformer at Surpura and connected to 132 kV GSS Banar, and 132 kV GSS Mathania through 132 kV S/C lines. There are (20/25 MVA+10/12.5MVA) 132/33 kV transformers at 132 kV GSS Mandore.
- There is split bus arrangement at 220 kV GSS Banar for 132/33 kV Transformers on the 132 kV side and on 33 kV bus is coupled.
- Power Map of Transmission System at 400kV GSS Jodhpur is shown in Fig. 1.

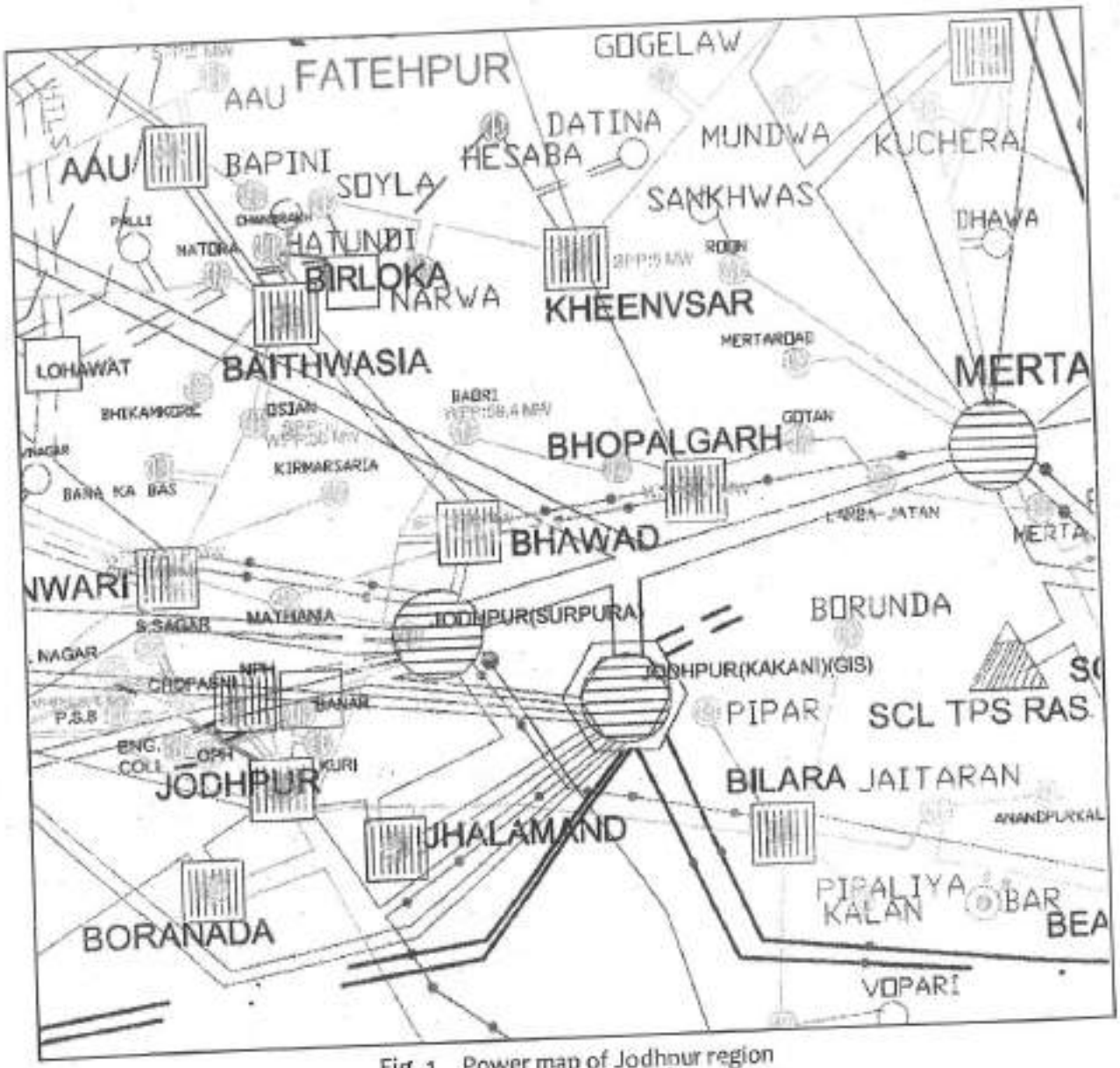

Fig. 1 Power map of Jodhpur region

B. Recorded Loads on the Transmission Elements

Recorded peak loads on the transmission lines and transformers are included in Table 1. Critical remarks are also included in the Table 1.

Table 1: Load Details of Peak and Average Loads on Transformers and Transmission Lines Associated with 400 kV GSS Jodhpur (Surpura) and Associated 220 kV GSS Considered for SPS

S. No.	Name of 220 kV line/ICTs	Peak Load	Average Load	Bus to Which connected	SPS Group/Remark
1	315 MVA, 400/220 kV ILT-I	262MVA	240 MVA	Bus-A	
2	315 MVA, 400/220 kV ILT-II	264 MVA	244 MVA	Bus-A	
3	100MVA, 220/132 kV Transformer	85 MVA	78 MVA	Bus-A	
4	220 kV Jodhpur-Bilara line	157 MVA	133 MVA	Bus-A	220 kV GSS Bilara is also connected with 220 kV GSS Beawer. There is DFCC feeder on 220 kV voltage level.

5	220 kV Jodhpur-Bhawad Ckt-I line	210 MVA	190 MVA	Bus-A	These circuits feed power to 220 kV GSS Bhawad, Bhoplagarh, Aau, Baithwasia, Badisid and Bhadla. Tripping of these lines will create load shedding in large area. Further, tripping of these lines will also increase loading on the 2x315 MVA, 400/220 kV ILTs at 400 kV GSS Merta during off RE hours. Further, during high RE scenario, RE power is evacuated to Jodhpur from the Bhadla, Badisid and Bap through 220 kV GSS at Aau , Baithwasia and Bhawad. Considering these lines in the SPS may impact the RE evacuation. There is 106 MW SPP at 220 kV GSS Bhawad connected on 132 kV voltage level and 59.40 MW WPP connected at 132 kV GSS Baori which is evacuated through 220 kV GSS Bhawad. In the event of tripping of (1x160+1x100) MVA, 220/132 kV Transformer at Bhawad, this RE will not be evacuated. Hence, ripping of transformers cannot be considered.
6	220 kV Jodhpur- Bhawad Ckt-II line	210 MVA	190 MVA	Bus-A	
7	220 kV Jodhpur-Tinwari Ckt-I line	174 MVA	95 MVA	Bus-B	These circuits feed power to 220 kV GSS Tinwari, Dechu, Phalodi, Bap, Amarsagar and Bhadla.
8	220 kV Jodhpur- Tinwari Ckt-II line	155 MVA	115 MVA	Bus-B	
9	220 kV Jodhpur- Barli line	176 MVA	110 MVA	Bus-B	
10	220 kV Jodhpur- Jhalamand line	185 MVA	123 MVA	Bus-B	
11	100 MVA, 220/132 kV Transformer-I at 220 kV GSS Bilara	95 MVA	75 MVA		
12	100 MVA, 220/132 kV Transformer-I at 220 kV GSS Bilara	95 MVA	75 MVA		
13	220 kV S/C Bilara-Beawer line	166 MVA	140 MVA		Generally, this line is kept

					opened from 220 kV GSS Beawer end.
14	220 kV S/C Bilara-DFCC line-I	10MVA	10MVA		Only one feeder takes load at a time
15	220 kV S/C Bilara-DFCC line-II	10 MVA	10 MVA		
16	220 kV Bhawad-Baithwasia line-I	240.21 MVA	134.19 MVA		
17	220 kV Bhawad-Baithwasia line-II	221.76 MVA	133.44 MVA		
18	220 kV Baithwasia-Aau line-I	226.33MVA	99.48 MVA		SPS Group-2
19	220 kV Baithwasia-Aau line-II	194.57MVA	98.48 MVA		SPS Group-2
20	160MVA, 220/132 kV Transformer-I at 220 kV GSS Baithwasia	132.37 MVA	95.80 MVA		SPS Group-1
21	160MVA, 220/132 kV Transformer-II at 220 kV GSS Baithwasia	128.60 MVA	95.80 MVA		SPS Group-1
22	132 kV S/C Mandore-Banar line	72.93 MVA	55.59 MVA		SPS Group-4
23	132 kV S/C Mandore-Mathania line	46.86 MVA	32.035 MVA		SPS Group-3
24	20/25 MVA, 132/33 kV Transformer at 132 kV GSS Mandore	20.24 MVA	19.83 MVA		SPS Group-3
25	10/12.5 MVA, 132/33 kV Transformer at 132 kV GSS Mandore	10.12 MVA	9.93 MVA		SPS Group-3
26	40/50 MVA, 132/33 kV Transformer-I at 132 kV GSS Banar	41.70 MVA	32.51 MVA		
27	40/50 MVA, 132/33 kV Transformer-II at 132 kV GSS Banar	43.69 MVA	32.67 MVA		
28	132 kV S/C Banar-Kuri Bhagtasani line	74.95 MVA	51.52 MVA		
29	132 kV S/C Banar-OPH line	64.21 MVA	42.25 MVA		

C. Approved SPS

The SPS for 2x315MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura) was approved in the 197th OCC meeting held on dated 22.07.2022. Approved SPS is placed at Annexure-A.

D. Operational Arrangements at 400 kV GSS Jodhpur

There are two main Bus-A & B at 400 kV GSS Jodhpur. Following 220 kV feeders and transformers are connected to Main Bus-A:-

- 315 MVA, 400/220 kV ILT-I
- 315 MVA, 400/220 kV ILT-II
- 100MVA, 220/132 kV Transformer
- 220 kV Jodhpur-Bhawad line-I
- 220 kV Jodhpur-Bhawad line-II
- 220 kV Jodhpur-Bilara line

Following 220 kV feeders and transformers are connected to Main Bus-B:-

- 220 kV Jodhpur-Barli line
- 200 kV Jodhpur-Jhalamand line
- 200 kV Jodhpur-Tinwari line-I
- 200 kV Jodhpur- Tinwari line-II

Generally, power in taken from 400 kV GSS Kankani to Main Bus-B through 220 kV GSS Jhalamand and 220 kV GSS Barli which is transmitted to 220 kV GSS Tinwari.

E. **Need of Revision in the Approved SPS**

- After implementation of the SPS for 2x315MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura), 315MVA, 400/220 kV ILT-II burnt on dated 29.05.2023. Subsequently the configuration of lines were changed to manage the power supply from the healthy ILT and ILTs at 400 kV GSS Kankani. Burnt ILT was replaced by the healthy 315MVA, 400/220 kV ILT on dated 11.12.2023.
- Due to increased loading in the Bilara, Jodhpur and Bhawad region, operational arrangement of lines and transformers as detailed in Section-D is used at 400 kV GSS Jodhpur (Surpura).

F. **Revised SPS for 2x315MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura)**

- Communication channel is available on the 220 kV D/C Jodhpur-Bhawad transmission line and 220 kV D/C Bhawad-Baithwasia line which can be used to communicate the trip command from 400 kV GSS Jodhpur (Surpura) to trip the transformers installed on the 220 kV GSS Baithwasia. A looping arrangement at 220 kV GSS Bhawad will be made to transfer trip command from the 400 kV GSS Jodhpur (Surpura) to the 220 kV GSS Baithwasia.
- 220 kV D/C Jodhpur-Bhawad line is used to feed power to 220 kV GSS Bhawad, Bhopalgarh, Aau, Baithwasia, Badisid and Bhadla. Tripping of these lines will create load shedding in large area.
- Tripping of 220 kV D/C Jodhpur-Bhawad line will also increase loading on the 2x315 MVA, 400/220 kV ICTs at 400 kV GSS Merta during off RE hours.
- During high RE scenario, RE power is evacuated to Jodhpur from the Bhadla, Badisid and Bap through 220 kV GSS at Aau, Baithwasia and Bhawad. Considering 220 kV D/C Jodhpur-Bhawad line in the SPS may impact the RE evacuation.
- There is dedicated 220kV feeder from 220 kV GSS Bilara to cater load of DFCC and TSS load is also connected on the 132 kV GSS Piparcity which is fed from the 220 kV GSS Bilara.
- The 1x40/50MVA, 132/33 kV Transformer at 132 kV GSS Banar is fed from the 132 kV GSS Mandore and another 1x40/50MVA, 132/33 kV Transformer at 132 kV GSS Banar is fed from the 132 kV GSS Kuri. LV side bus of these transformers is combined.
- There are 2x160MVA, 220/132 kV Transformers at 220 kV GSS Baithwasia which are operated in parallel.
- After detailed analysis of loading conditions, power injection, available communication channels, RE evacuation & grid interconnection issues, following universal logics are proposed for the 2x315MVA, 400/220 kV ICTs at 400 kV GSS Jodhpur (Surpura) which will work for all the operating scenarios:-

1. **SPS Group-1:** Trip commands are generated at time delay of 1.0 second to trip the following transformers when 105% loading [105% current in all the three phases] on any one of the 2x315MVA, 220/132 kV Transformers at 400 kV GSS Jodhpur (Surpura) is reached due to tripping of one of the transformer or any of the 220 kV lines associated with 400 kV GSS Jodhpur or the overloading of transformers:-
   - 160 MVA, 220/132 kV Transformer-I at 220 kV GSS Baithwasia
   - 160MVA, 220/132 kV Transformer-II at 220 kV GSS Baithwasia

   Implementation of SPS Logic-1: This logic will be implemented by taking reference from overcurrent relays of both 315MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura). Trip

command will be initiated at time delay of 1.0 second when current reached the 105% loading of the ILTs [105% current in all three phases]. This trip command will be communicated to the 220 kV GSS Baithwasia when status of any of one of the Circuit Breaker of 220 kV Jodhpur-Bhawad Ckt-I & II line is closed at 400 kV GSS Jodhpur end and trip command will not be communicated when the status of both of the Circuit Breaker of 220 kV Jodhpur-Bhawad Ckt-I & II line is open at 400 kV GSS Jodhpur end.

At 220 kV GSS Bhawad:-

- Trip command received from 400 kV GSS Jodhpur (Surpura) will be communicated to the 220 kV GSS Baithwasia by looping at 220 kV GSS Bhawad in such a manner that trip command (through carrier) received from 400 kV GSS Jodhpur is reached at 220 kV GSS Bhaithwasia in all conditions.

At 220 kV GSS Baithwasia:-

- Trip command along with status of both the Circuit breakers of 220 kV D/C Baithwasia-Bhawad line at 220 kV GSS Baithwasia end will be used to trip the 02X160 MVA, 220/132 KV Transformers at 220 KV GSS Baithwasia when any of one of CB status of 220 kV D/C Bhawad-Baithwasia line Ckt-I & II is closed at 220 KV Baithwsaia. When CB status of both lines i.e. 220 kV Bhawad-Baithwasia line Ckt-I & II are open then no action will be taken.

2. **SPS Group-2:** Trip command is generated at time delay of 1.2 second to trip the following transmission line at 220 kV GSS Baithwasia when 105% loading [105% current is all the three phases] on any one of the 2x315MVA, 400/220 kV Transformers at 400 kV GSS Jodhpur (Surpura) is reached due to tripping of one of the transformer or any of the 220 kV lines associated with 400 kV GSS Jodhpur or the overloading of transformers:-

   - 220 KV D/C Baithwasia- Aau Line

Implementation of SPS Logic-2: This logic will be implemented by taking reference from overcurrent relays of both 315MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura). Trip command will be initiated at time delay of 1.2 second when current reached the 105% loading of the ILTs [105% current in all the three phases]. This trip command will be communicated to the 220 kV GSS Baithwasia when status of any of one of the Circuit Breaker of 220 kV Jodhpur-Bhawad Ckt-I & II line is closed at 400 kV GSS Jodhpur end and trip command will not be communicated when the status of both of the Circuit Breaker of 220 kV Jodhpur-Bhawad Ckt-I & II line is open at 400 kV GSS Jodhpur end.

At 220 kV GSS Bhawad:-

- Trip command received from 400 kV GSS Jodhpur (Surpura) will be communicated to the 220 kV GSS Baithwasia by looping at 220 kV GSS Bhawad in such a manner that trip command (through carrier) received from 400 kV GSS Jodhpur is reached at 220 kV GSS Bhaithwasia in all conditions.

At 220 kV GSS Bhaithwasia:-

- Trip command along with status of any one of the Circuit breakers of 220 kV D/C Baithwsaia- Bhawad line at 220 kV GSS Baithwsaia end will be used to trip both the circuits of 220 KV Baithwasia –Aau line from 220 kV GSS Baithwasia. When circuit breakers of 220 kV D/C Baithwsaia- Bhawad line are open then no action will be

initiated at 220 kV GSS Aau. When circuit breakers of 220 kV D/C Baithwsaia-Bhawad line are closed then then trip command will used to trip the both circuits of 220 KV Baithwasla--Aau line.

3. **SPS Group-3:** Trip command is generated at time delay of 1.4 second to trip the following transmission elements at 132 kV GSS Manore when 105% loading [105% current in all the three phases] on any one of the 2x315MVA, 400/220 kV Transformers at 400 kV GSS Jodhpur (Surpura) is reached due to tripping of one of the transformer or any of the 220 kV lines associated with 400 kV GSS Jodhpur or the overloading of transformers:-

   - 10/12.5 MVA, 132/33 kV Transformer-I at 132 kV GSS Mandore
   - 20/25 MVA, 132/33 kV Transformer-II at 132 kV GSS Mandore
   - 132 KV S/C Mandore –Mathania Line

   Implementation of SPS Logic-3:-This logic will be implemented by taking reference from overcurrent relays of both 315MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura). Trip command will be initiated at time delay of 1.4 second when current reached the 105% loading of the ILTs [105% current in all the three phases]. This trip command will be communicated to the 132 kV GSS Mandore when status of LV side Circuit Breaker of 100MVA, 220/132 kV Transformer at 400 kV GSS Jodhpur (Surpura) is closed at 400 kV GSS Jodhpur and trip command will not be communicated when the status of LV side Circuit Breaker of 100MVA, 220/132 kV Transformer at 400 kV GSS Jodhpur (Surpura) is open.

   At 132 kV GSS Mandore:-

   - Trip command will used to trip both transformers at 132 KV GSS Mandore and 132 KV S/C Mandore –Mathania Line.

4. **SPS Group-4:**-Trip command is generated at time delay of 1.6 second to trip the following transmission line at 132 kV GSS Mandore when 105% loading [105% current in all the three phases] on any one of the 2x315MVA, 400/220 kV Transformers at 400 kV GSS Jodhpur (Surpura) is reached due to tripping of one of the transformer or any one of the 220 kV lines associated with 400 kV GSS Jodhpur or the overloading of transformers

   - 132 KV S/C Mandore- Banar Line

   Implementation of SPS Logic-4: This logic will be implemented by taking reference from overcurrent relays of both 315MVA, 400/220 kV ILTs at 400 kV GSS Jodhpur (Surpura). Trip command will be initiated at time delay of 1.6 second when current exceeds the 105% loading of the ILTs [105% current in all the three phases]. This trip command will be communicated to the 132 kV GSS Mandore when status of LV side Circuit Breaker of 100MVA, 220/132 kV Transformer at 400 kV GSS Jodhpur (Surpura) is closed at 400 kV GSS Jodhpur and trip command will not be communicated when the status of LV side Circuit Breaker of 100MVA, 220/132 kV Transformer at 400 kV GSS Jodhpur (Surpura) is open.

   At 132 kV GSS Mandore:-

   - Trip command will used to trip 132 KV S/C Mandore –Banar Line

- Schematic diagram of proposed SPS is shown in Fig. 2.

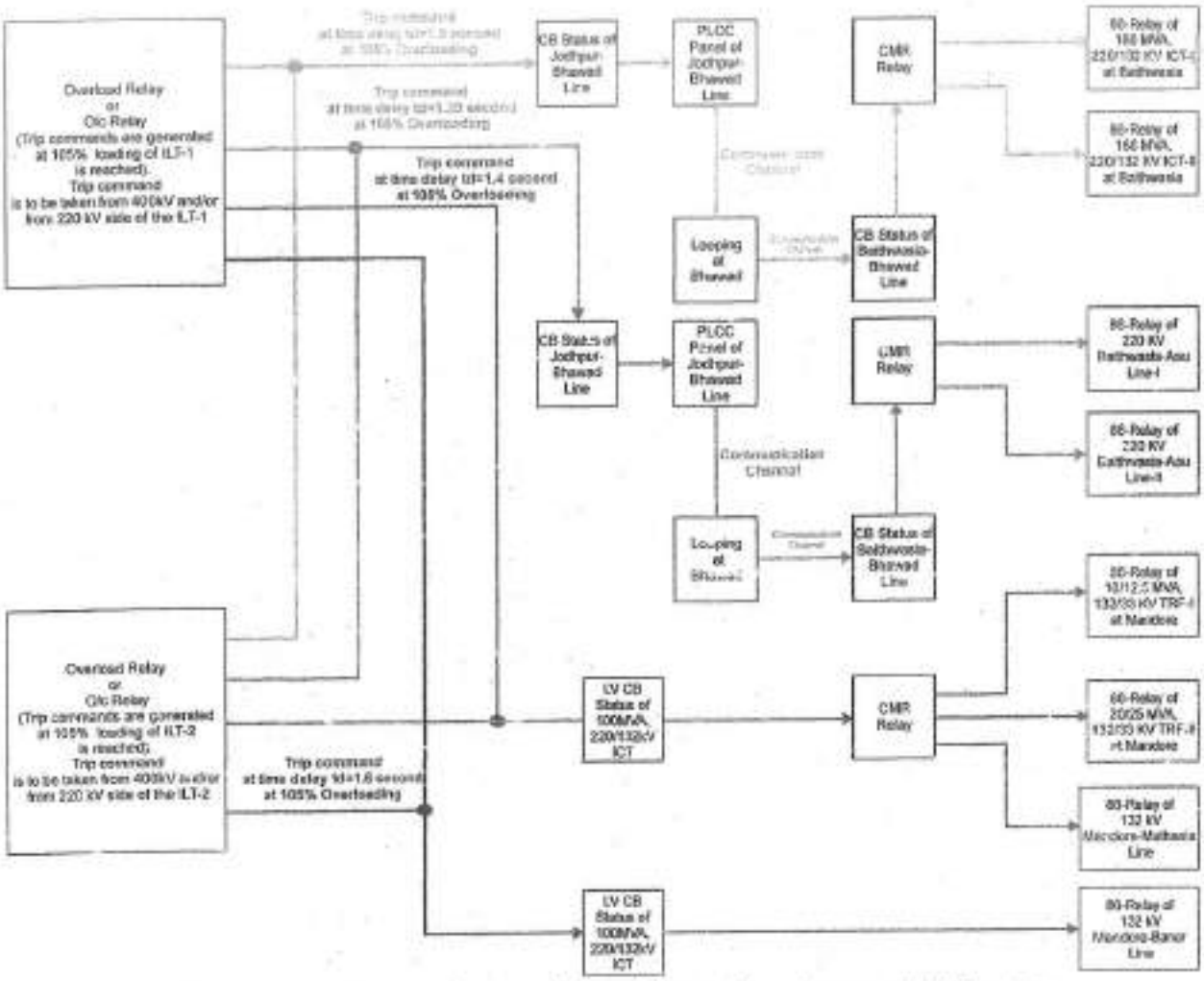

Fig. 2 Schematic diagram for implementation of proposed SPS Logics

- To maintain supply of critical loads connected to all the GSS in the region, tripped transformers and lines may be re-connected after applying load shedding on all the GSS in the region in such a quantum to maintain loadings on the both the 315MVA, 400/220 kV ILTs or the healthy 315MVA, 400/220 kV ILT at 400 kV GSS Jodhpur (Suprura) within permissible limits.

G. Requirement of Healthiness of the SPS

This SPS will function only if both the transformers and 220 kV transmission lines connected on Bus-A at 400 kV GSS Jodhpur as indicated in Table 1 are remain intact. Any change in configuration of lines and transformers connected on Bus-A will lead to mal-operation of the SPS. Further, LD Control room and SE(T&C), RVPN, Jodhpur may ensure to take prior approval of NRLDC if any change is required in the configuration for which SPS is designed. Any change in configuration may be restored after the loading conditions are normalized.

Annexure-XXXVIII

Email **LokeshAgrawal**

Comments on proposed revised 400/220kV Jodhpur SPS

From : Gaurav Malviya (गौरव मालवीय) <gauravmalviya@grid-india.in> Thu, Jul 18, 2024 12:31 PM

Subject : Comments on proposed revised 400/220kV Jodhpur SPS

To : se ldrvpnl <se.ldrvpnl@rvpn.co.in>, se pp <se.pp@rvpn.co.in>

Cc : Santosh Kumar <seo-nrpc@nic.in>, somara lakra <somara.lakra@grid-india.in>, skaharwal@grid-india.in, bikaskjha@grid-india.in, deepak kr <deepak.kr@grid-india.in>

Sir,

As per agenda A.15 of 221 OCC meeting, related to Revised SPS for 2X315 MVA, 400/220kV ICTs at 400kV GSS Jodhpur, following are comments from NRLDC side:

- Group-1 logic seems ok
- Group-2 logic seems to increase loading
- Group-3 logic seems ok
- Group-4 logic seems ok

- Group-1 and Group-4 logics seems to cause load loss
- RVPN may confirm no important load connecting these groups

Further, between different groups there is difference of only 200ms, it is suggested that this difference may be kept as 500ms/1sec, so that line flows become stable after 1st logic operation

Simulations were done on latest basecase shared by SLDC on 15.07.2024.

Regards
Gaurav Malviya
NRLDC, Grid-India
(Formerly known as POSOCO)
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