

Annexure A

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42.	Gagan Kumar		Bihar SLDC		
43.	Dharm Das Murmu	JE	CRITL JUSNL		
44.	Aditya Kumar Jha				
45.	Deepak		PRDC		
46.	Dilip Kant Jha				

Tripping of 400 kV Meramundali - JSPL Ckt 1& 2

On 09/03/2021 at 07:50 Hrs 400 Kv Meramundali –JSPL -2 tripped and at 08:02 Hrs Line -1 tripped due to Y –Earth fault ,some protection discrepancy are found as mentioned below ,

Low Dead time of Auto Reclose: There was Y-earth fault in the line at 35Km from meramundali , Y phase breaker got opened within 100 Ms but again after 350 ms Y phase breaker got closed and again it fed the fault for next 300 ms and then all 3 poles got opened.

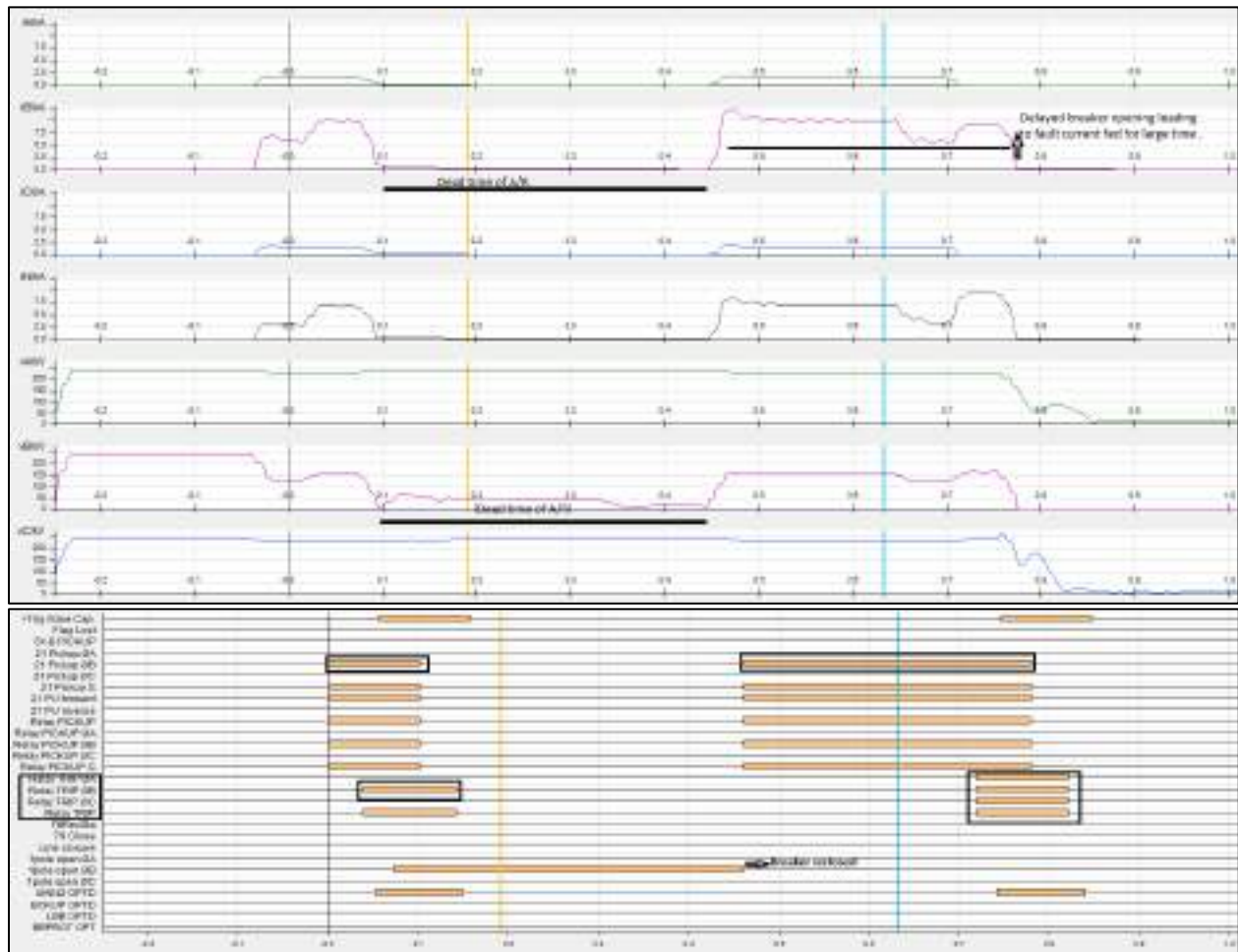
From DR as well as PMU it appears that A/R dead time is kept only 350 ms as after 350 ms ,Y pole breaker got closed in both the cases of line tripping.

Reason may please be explained and **such low dead time is not recommended as it will cause secondary arcing** and in case of transient faults also ,chances of successful auto reclose is very low and also will cause unnecessary stress on breaker.

Delayed breaker opening at the instance of reclose:

At the instance of reclose Y pole opened after 400 ms which should not occur and should trip instantaneously, reason for this may be looked. **Proper carrier communication may be ensured** to avoid delayed tripping from any end .**SOTF feature may be used to avoid** this delayed opening of breaker at the A/R instance.

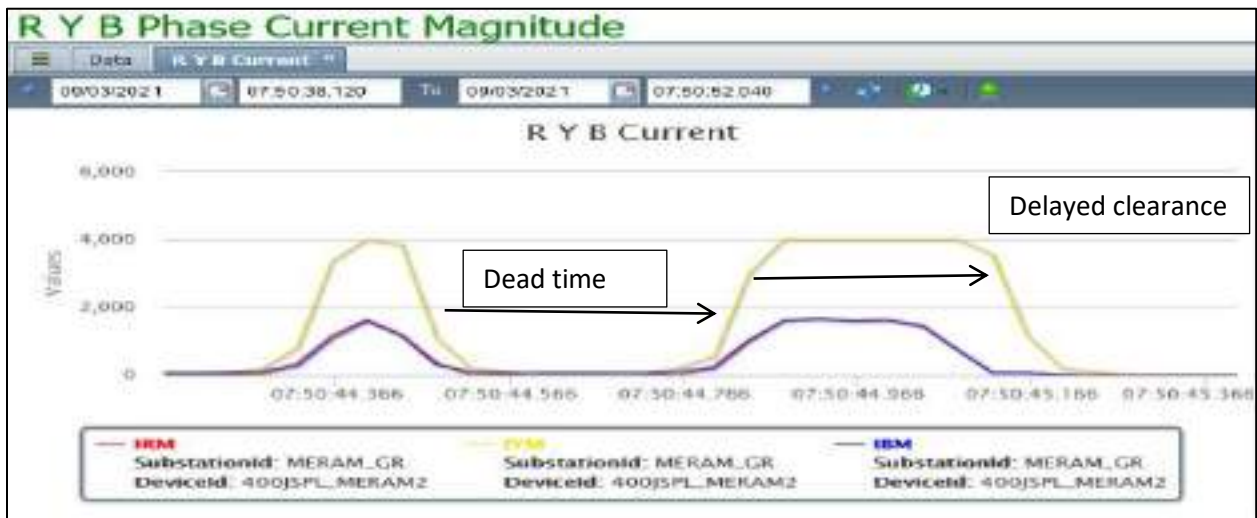
Above issues may be checked and rectified .Kindly update regarding above issues .



PMU plot of line current for Circuit -1:



PMU plot of line current for Circuit -2:



पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.

CIN: U40105DL2009GOI188682

फ़ोन: 033- 24235755, 24174049 फैक्स : 033-24235809/5029 Website: www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: 10-03-2021/1

दिनांक: 11-03-2021

Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)

Summary of the event (घटना का सारांश):

400 kV Rangpo – Binaguri D/C were not in service due to recondutoring work. Power generated by all the generating stations in Sikkim complex were being evacuated through 400 kV Rangpo – Kishangunj S/C and 400 kV Teesta III – Kishangunj S/C.

At 10th March 2021 at 19:35 Hrs both the 400 kV circuits tripped due to R and B phase to earth fault resulted in islanding operation of 1560 MW generation at Sikkim hydro complex with 54 MW load at Gangtok. Consequently all the generators tripped and total power failure occurred at following major generating stations or Substations.

At 400 kV voltage level: **Rangpo, Dikchu HEP, Teesta III HEP, Teesta V HEP**

At 220 kV voltage level: **Jorethang HEP, New Melli, Tashiding HEP**

At 132 kV voltage level: **Chujachen HEP, Gangtok**

- **Date / Time of disturbance:** 10-03-2021 at 19:35 hrs.
- **Event type:** GD - 1
- **Load and Generation loss during the event:**

Generating station/ Area	Amount of Load Loss (MW)	Amount of Generation Loss (MW)
Teesta III HEP	-	974
Teesta V HEP	-	338
Jorethang HEP	-	38
Chuzachen HEP	-	113
Tashiding HEP	-	43
Dikchu HEP	-	54
Sikkim	54	-
Total	54	1560

Major elements tripped (प्रमुख ट्रिपिंग):

- 400 kV Rangpo – Kishangunj S/C
- 400 kV Teesta III – Kishangunj S/C

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

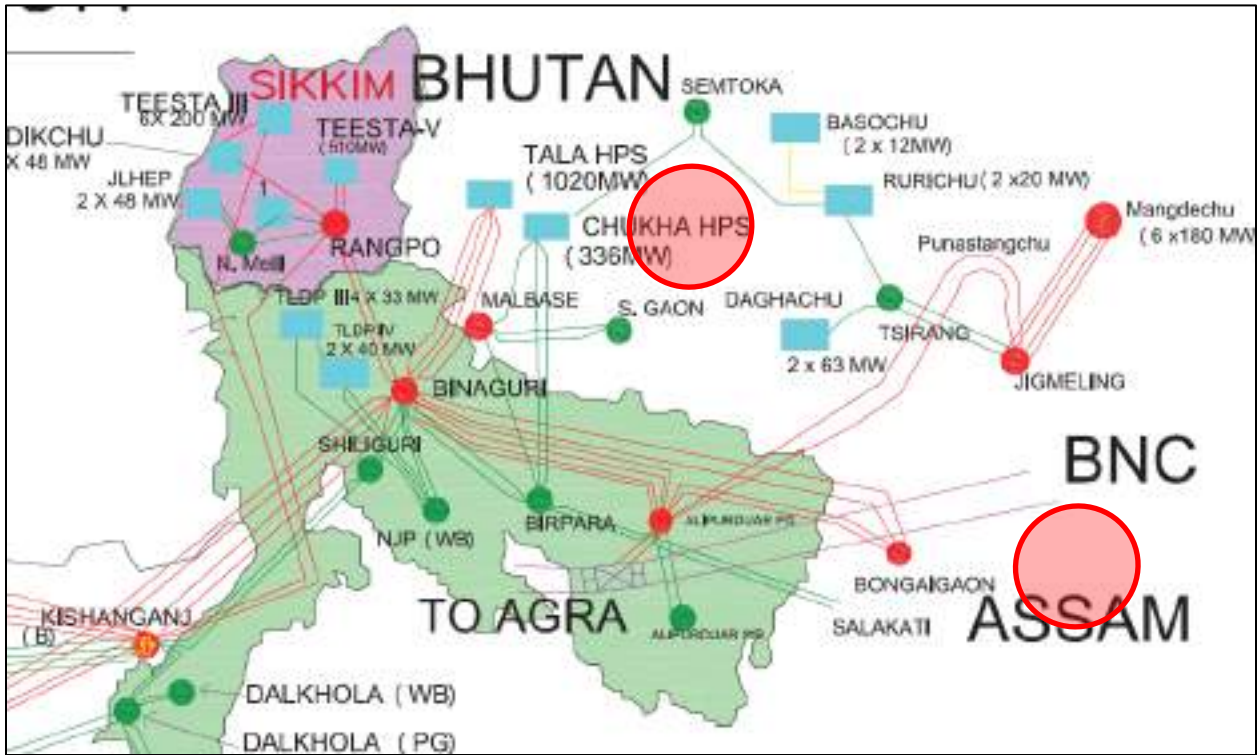


Figure 1: Network across the affected area



Figure 2: SCADA snapshot of the affected network

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण):

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
19:35 Hrs	400 kV Rangpo - Kishangunj S/C	R-B-N, Zone - 1, F/C 3.2kA, 82.657Km from Rangpo	R-B, Zone - 1, 117 km from Kishangunj, F/C 5.2kA	Around 75 kV dip has been observed in R and B phase voltage at Rangpo PMU data. The fault clearing time was less than 100 ms. After the fault; power swing has been captured at three

19:35 Hrs.	400 kV Teesta III – Kishangunj S/C	R-B, Zone – 1, 102 km from Teesta III, $I_R=2.2$ kA, $I_B=1.1$ kA	R-B, Zone – 1, 121 km from Kishangunj, F/C 4.9kA	phase voltage at Rangpo S/S followed by voltage collapse within 90 seconds. Rest of the grid frequency dropped from 50.01 Hz to 49.87 Hz. Later it stabilized to 49.95 Hz.
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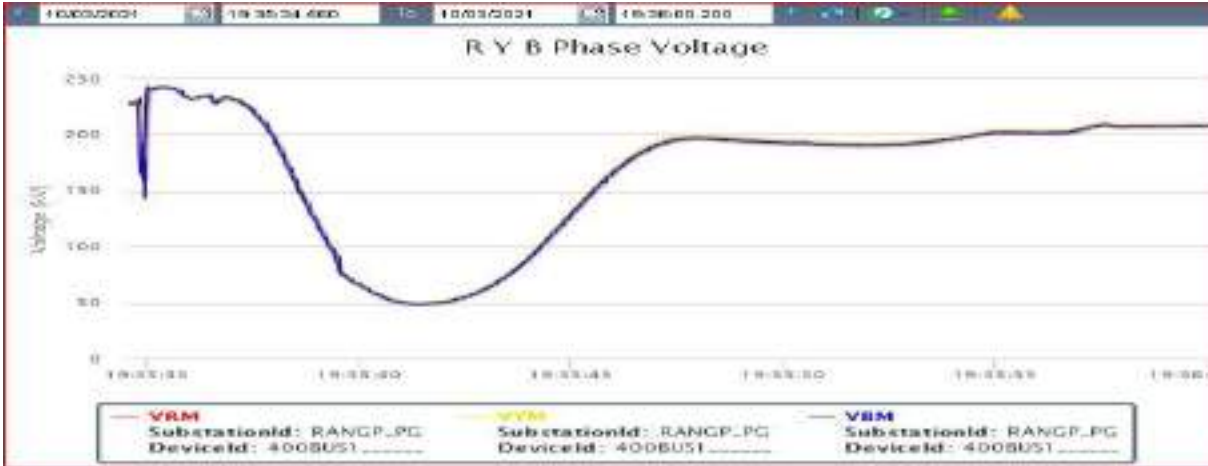
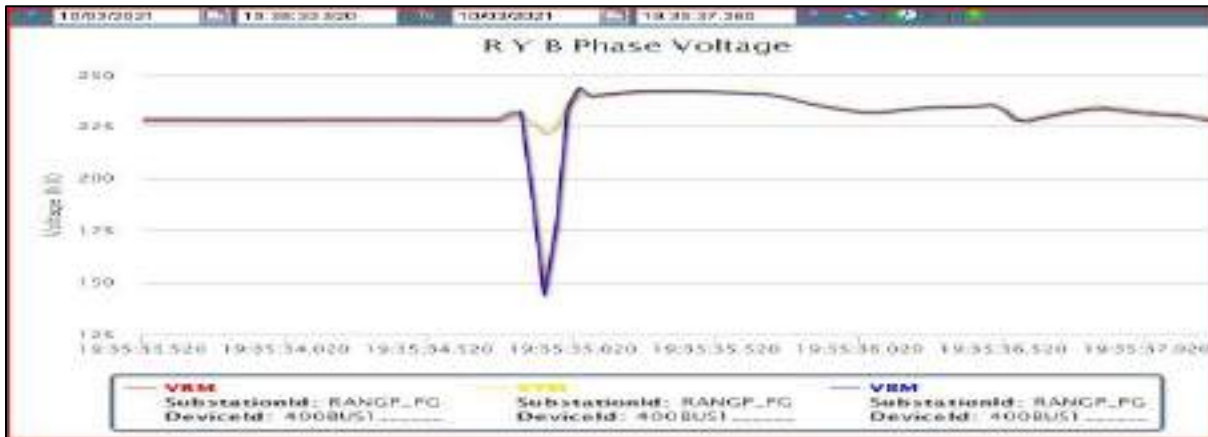


Figure 3: Three phase voltage captured at Rangpo S/S shows the existence of R and B phase fault at 19:35:34 hrs. Around 75 kV dip has been observed in R and B phase voltage at Rangpo PMU data. The fault clearing time was less than 100 ms. After the fault, power swing has been captured at three phase voltage at Rangpo S/S followed by voltage collapse within 90 seconds.

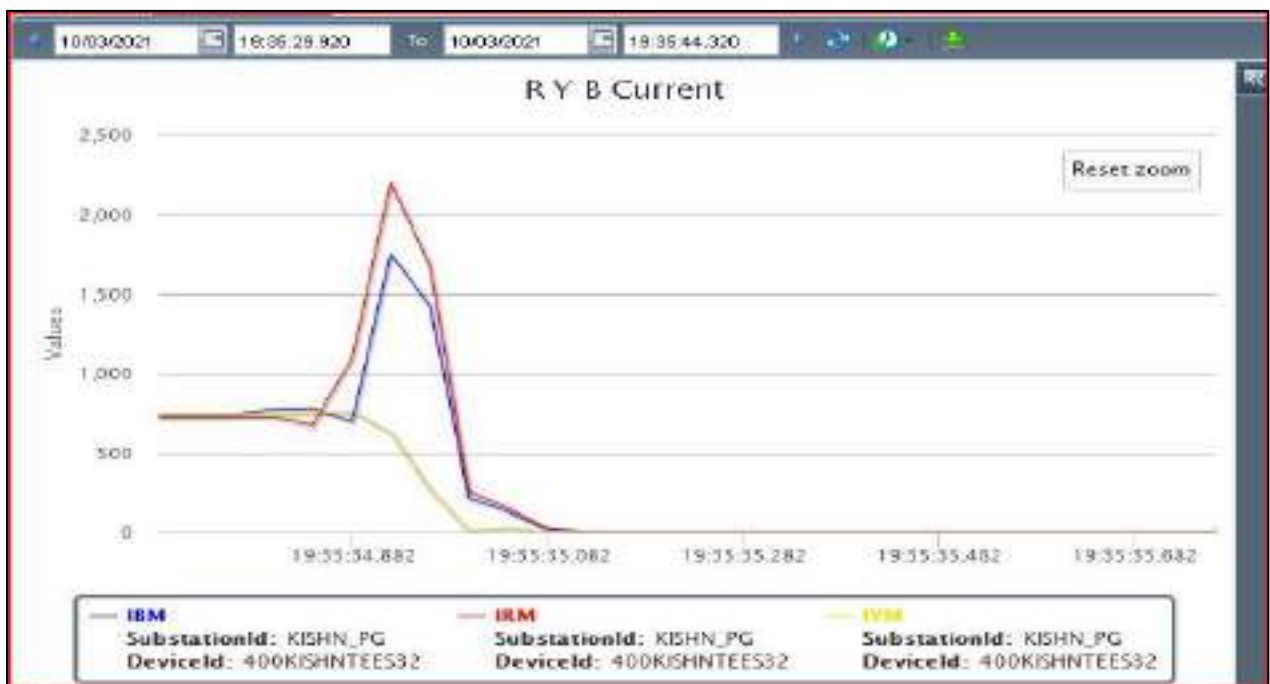
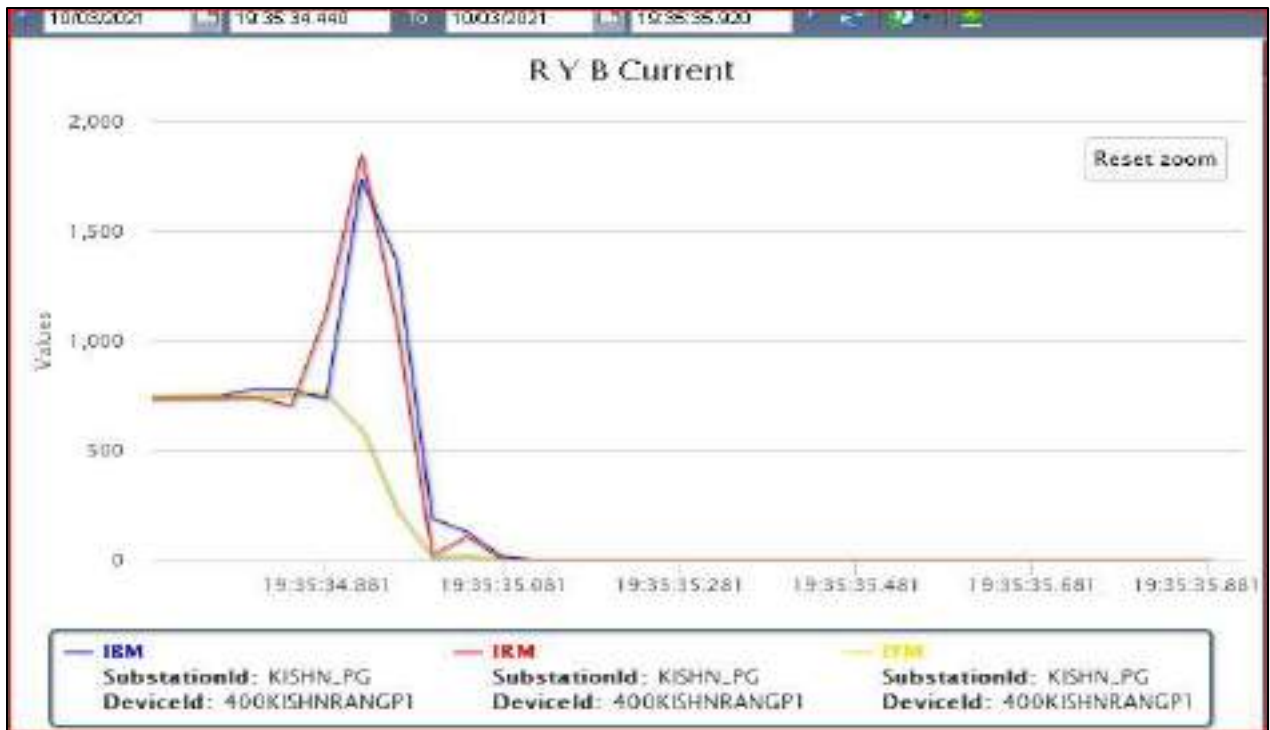


Figure 4: Three phase current captured at Kishangunj S/S of 400 kV Kishangunj Rangpo S/C and 400 kV Kishangunj Teesta III shows the existence of short circuit fault in R and B phase to earth fault at 19:35 hrs. The fault clearing time was less than 100 ms.

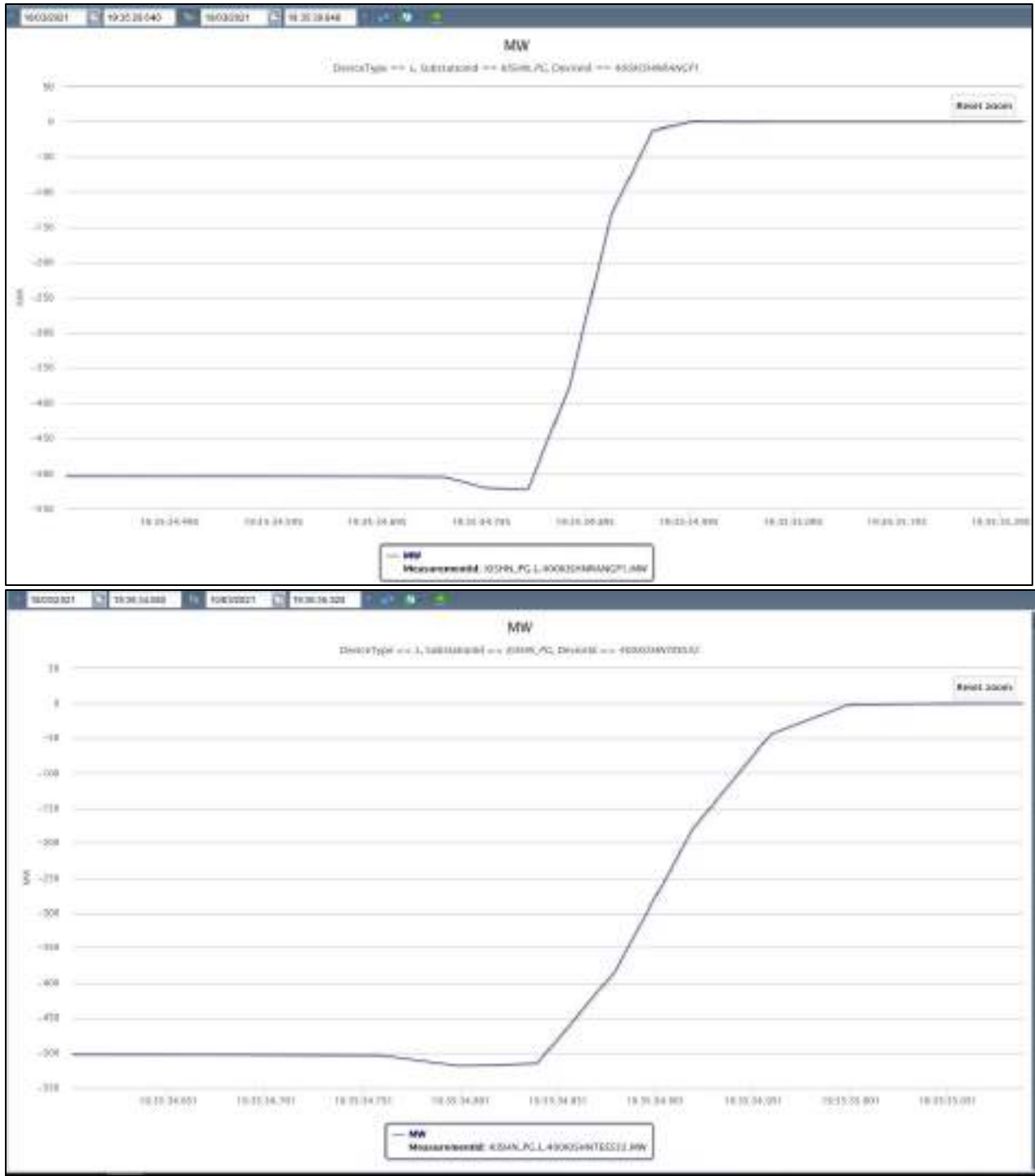


Figure 5: Three phase power flow captured at Kishangunj for 400 kV Teesta III and Rangpo feeders. Power flow through both the circuits was around 500 MW before the incident.



Figure 6: Frequency variation captured at Kishangunj PMU during the event. Rest of the grid frequency dropped from 50.01 Hz to 49.87 Hz. Later it stabilized to 49.95 Hz.

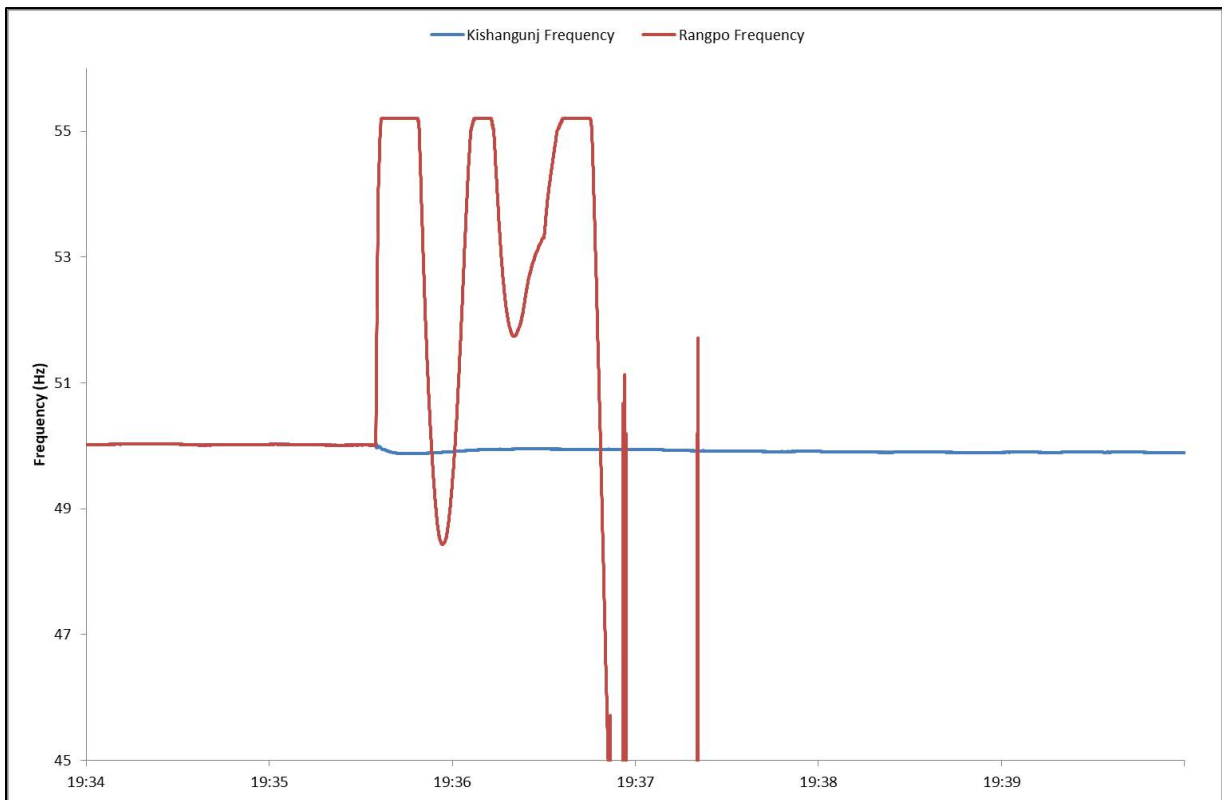


Figure 7: Frequency variation captured at Kishangunj and Rangpo PMU during the event shows frequency variation after forming islanding with Sikkim complex generation and Sikkim load. PMU frequency data gets capped between 55 and 45 Hz. Hence frequency value more than 55 Hz gets capped at 55 Hz. Island survived around 90 seconds.

Restoration (पूर्वावस्था की प्रप्ति):

- 400 kV Rangpo – Kishangunj S/C was charged at 19:56 Hrs and power supply to Gangtok was restored at same time.
- 400 kV Teesta III-Kishangunj S/C was charged at 20:06 Hrs.
- All the generating stations were revived by 20:09 Hrs.

Sequence of the event as per DR

Time	Details	Line Name	End
19:35:34.884	Distance trip fault	400 kV Teesta III Kishangunj S/C	Teesta III
19:35:34.919	CB open	400 kV Teesta III Kishangunj S/C	Teesta III
19:35:34.926	Zone - 1 trip	400 kV Teesta III Kishangunj S/C	Kishangunj
19:35:34.927	Zone - 1 trip	400 kV Rangpo Kishangunj S/C	Kishangunj
19:35:34.930	Zone - 1 trip	400 kV Rangpo Kishangunj S/C	Rangpo
19:35:34.950	CB open	400 kV Rangpo Kishangunj S/C	Rangpo
19:35:34.956	Tie CB open	400 kV Teesta III Kishangunj S/C	Kishangunj
19:35:34.957	Tie CB open	400 kV Rangpo Kishangunj S/C	Kishangunj
19:35:34.968	Main CB open	400 kV Teesta III Kishangunj S/C	Kishangunj
19:35:34.969	Main CB open	400 kV Rangpo Kishangunj S/C	Kishangunj

Analysis of the event (घटना का विश्लेषण):

- At 19:35 Hrs both 400 kV Rangpo – Kishangunj S/C and 400 kV Teesta III-Kishangunj S/C tripped due to R and B phase to earth fault at 117-121 km from Kishangunj end. Fault was sensed in Zone – 1 by both ends of the circuits and cleared within 100 ms. Thunderstorm was reported during the event.
- Both the circuits tripped at same time due to short circuit fault. So there was no scope of operation of any SPS.
- Prior to the event around 1500 MW power was being exported from Sikkim hydro generation complex. After tripping of both the evacuation circuits, islands get formed with around 1560 MW generation at various hydro plants and 54 MW load in Sikkim. Due to high load generation Imbalance, Island collapsed after around 90 seconds.
- Rest of grid frequency dropped from 50.01 Hz to 49.87 Hz. Later it stabilized to 49.95 Hz.

Operational issues Observed (प्रचालन समस्या) :

- Power and current measured for 400 kV Kishangunj – Rangpo S/C and 400 kV Kishangunj – Teesta III S/C at Kishangunj end may be checked. (POWERGRID ER-1 to update)

Status of Reporting (रिपोर्टिंग की स्थिति):

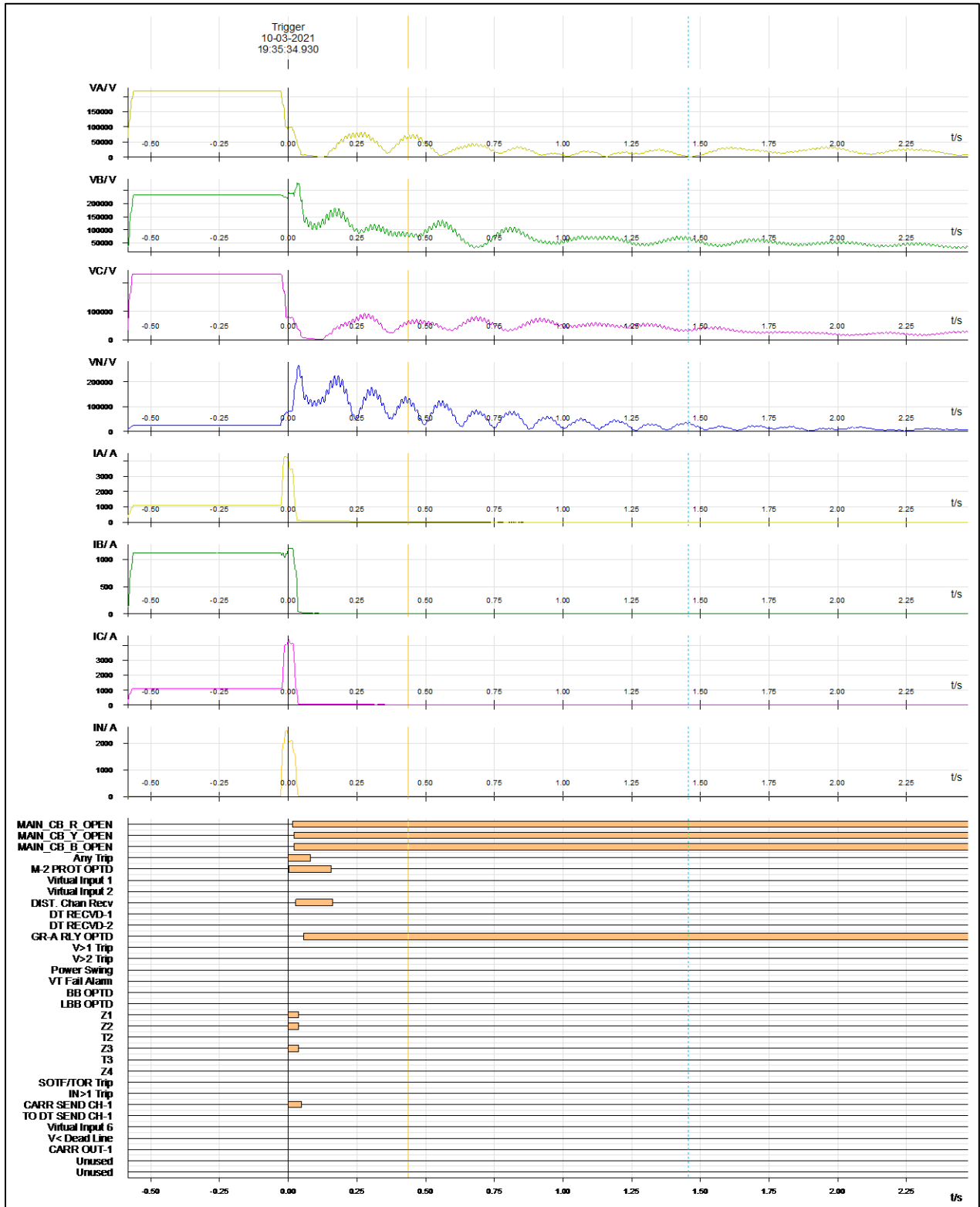
- DR/EL has been received from Teesta III HEP, Kishangunj and Rangpo S/S.

- DR/EL and report have been received from JLHEP.

Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of both the events.

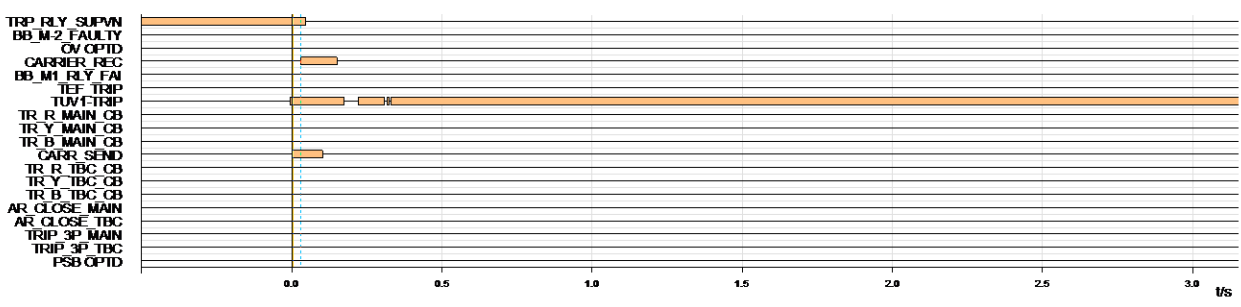
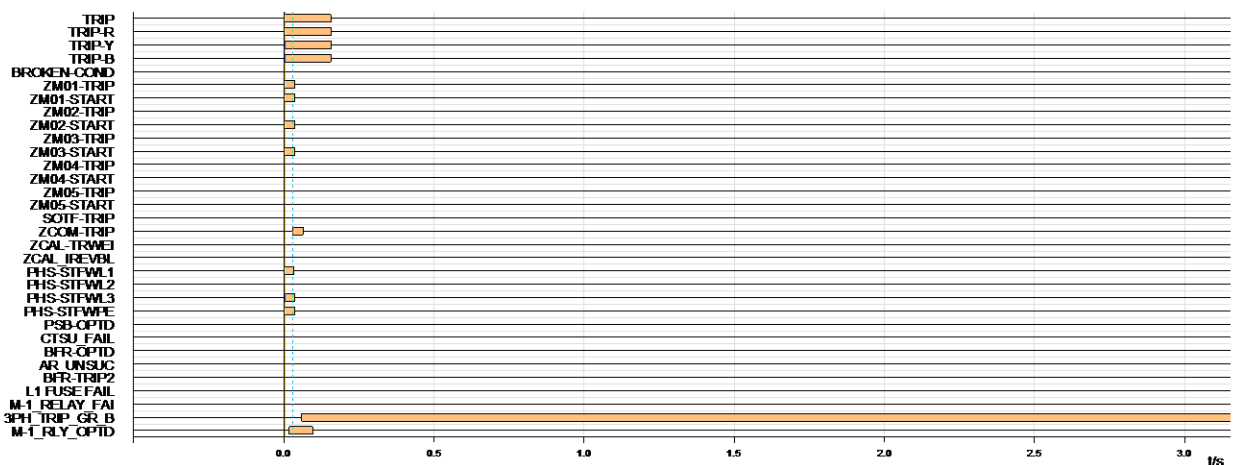
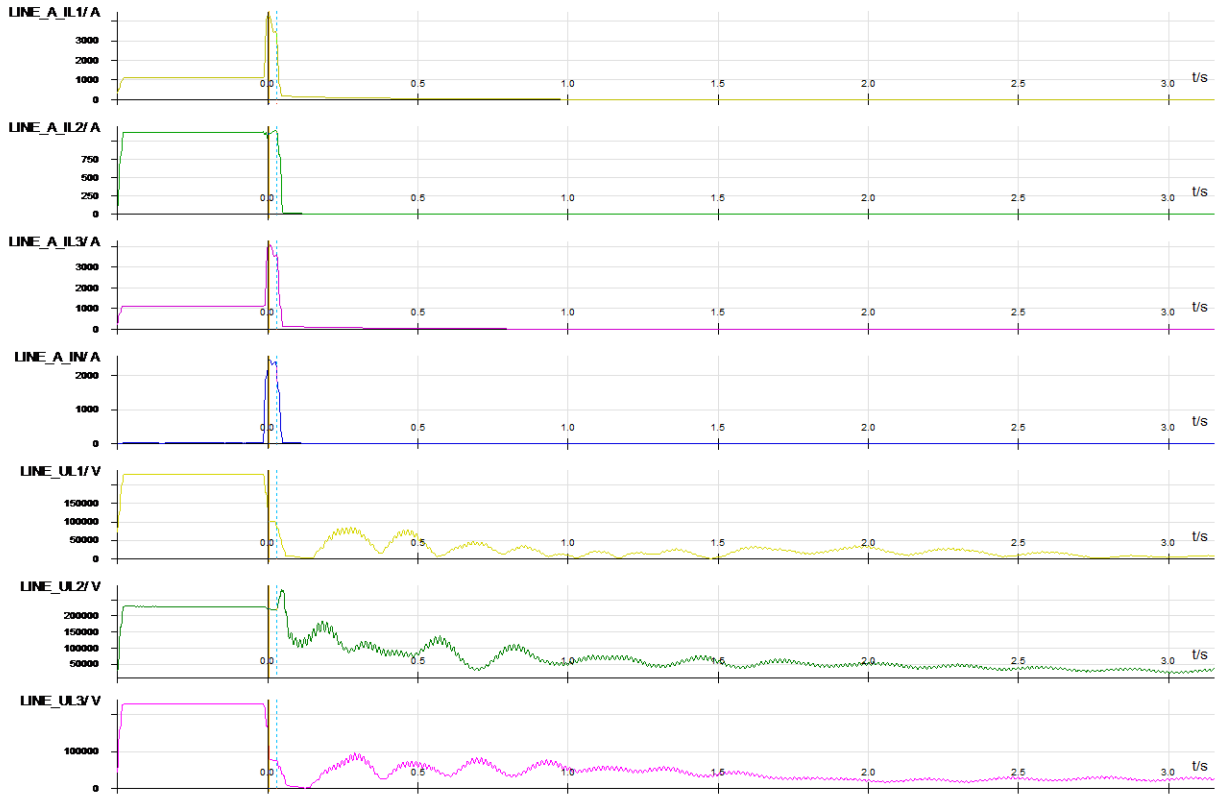
TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
19:30:00	970	TEES3_PG	400_UNIT3_H_CB	Closed
19:30:00	890	TEES3_PG	400_UNIT2_H_CB	Open
19:31:00	470	TEES3_PG	400_UNIT4_H_CB	Closed
19:31:00	530	TEES3_PG	400_UNIT5_H_CB	Closed
19:31:00	90	TEES3_PG	400_UNIT2_H_CB	Open
19:35:00	950	RANGP_PG	400_KISHN_PG_CB	Open
19:35:00	965	KISHN_PG	400_TEES3_MAIN_CB	Open
19:35:00	972	KISHN_PG	400_RANGP_PG_1_Main_CB	Open
19:35:00	979	KISHN_PG	400_RANGP_PG_1_ICT2_Tie	Open
19:35:00	991	KISHN_PG	400_STATCOM_TEES3_PG_2_Tie	Open
19:35:00	60	TEEST_PG	400_Unit3_CB	Open
19:35:00	438	TEEST_PG	400_Unit2_CB	Open
19:36:00	430	TEES3_PG	400_KISHN_PG_CB	Open
19:36:00	870	TEES3_PG	400_KISHN_PG_CB	Closed
19:36:00	258	JORET_PG	220_UNIT_H_2_CB	Open
19:36:00	745	TASHI_PG	220_UNIT_H_2_CB	Open
19:42:00	170	TEES3_PG	400_UNIT4_H_CB	Open
19:44:00	930	TEES3_PG	400_UNIT5_H_CB	Open
19:44:00	834	TEEST_PG	400_RANGP_PG_2_CB	Open
19:44:00	21	TEEST_PG	400_RANGP_PG_1_CB	Open
19:53:00	850	KISHN_PG	400_RANGP_PG_1_Main_CB	Closed
19:56:00	787	RANGP_PG	400_KISHN_PG_CB	Closed
19:58:00	251	KISHN_PG	400_RANGP_PG_1_ICT2_Tie	Open
19:58:00	270	KISHN_PG	400_RANGP_PG_1_ICT2_Tie	Closed
19:59:00	679	TEEST_PG	400_RANGP_PG_2_CB	Closed
19:59:00	690	TEES3_PG	400_UNIT3_H_CB	Open
19:59:00	50	TEES3_PG	400_UNIT3_H_CB	Open
19:59:00	30	TEES3_PG	400_UNIT6_H_CB	Open

Annexure 2: DR output at Rangpo end for tripping of 400 kV Rangpo – Kishangunj S/C

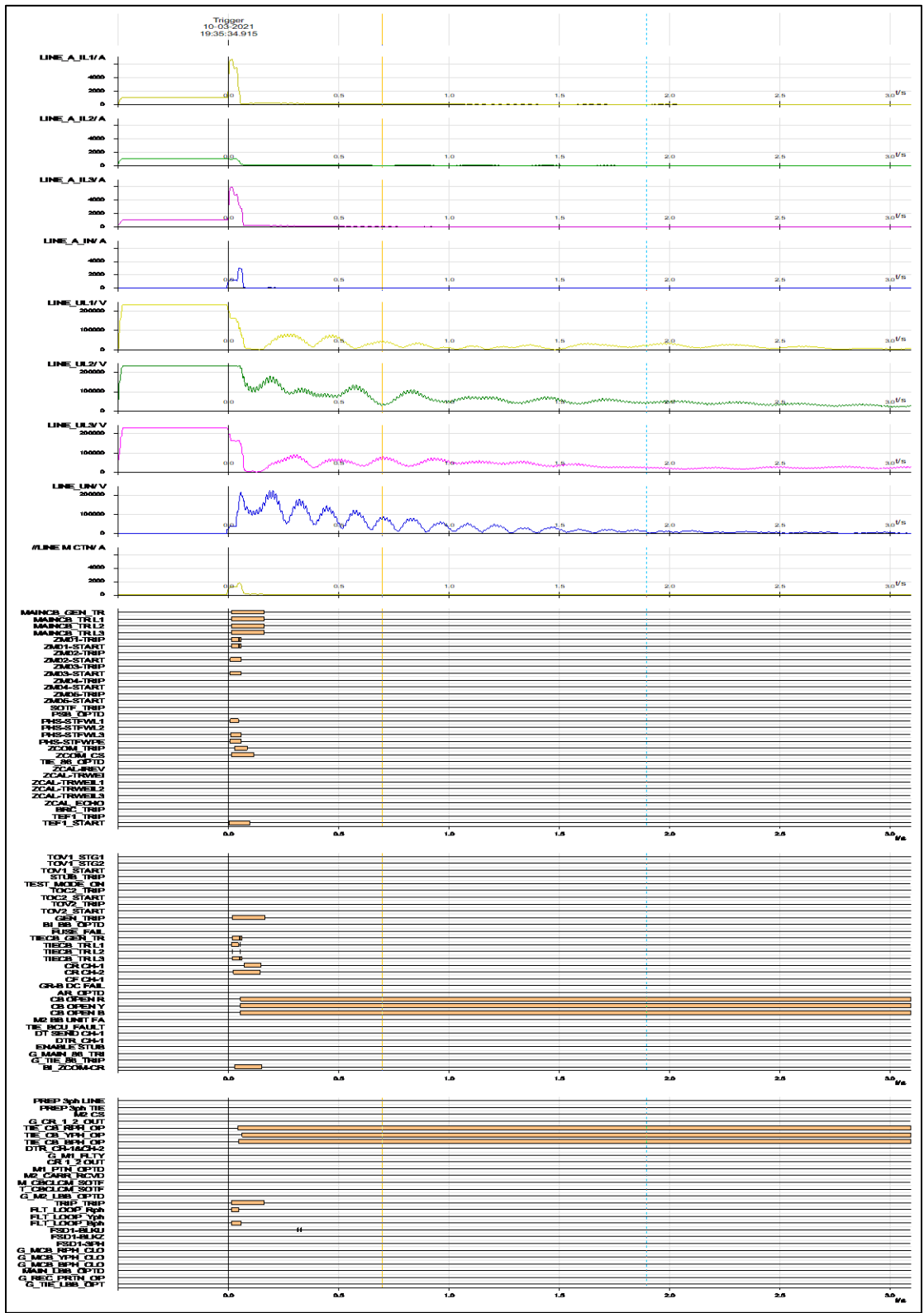


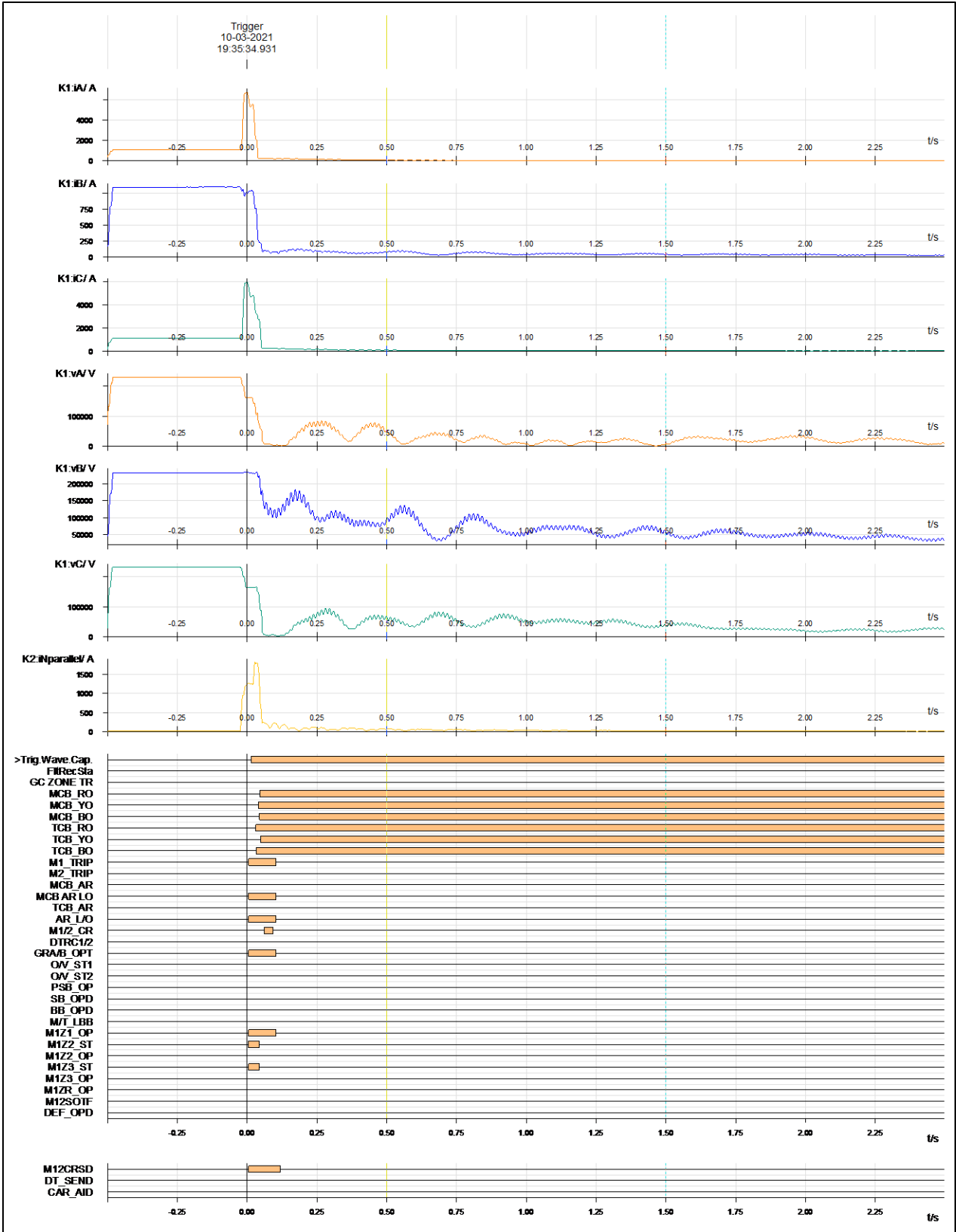
R-B-N, ZONE – 1

Trigger
10-03-2021
19:35:34.917

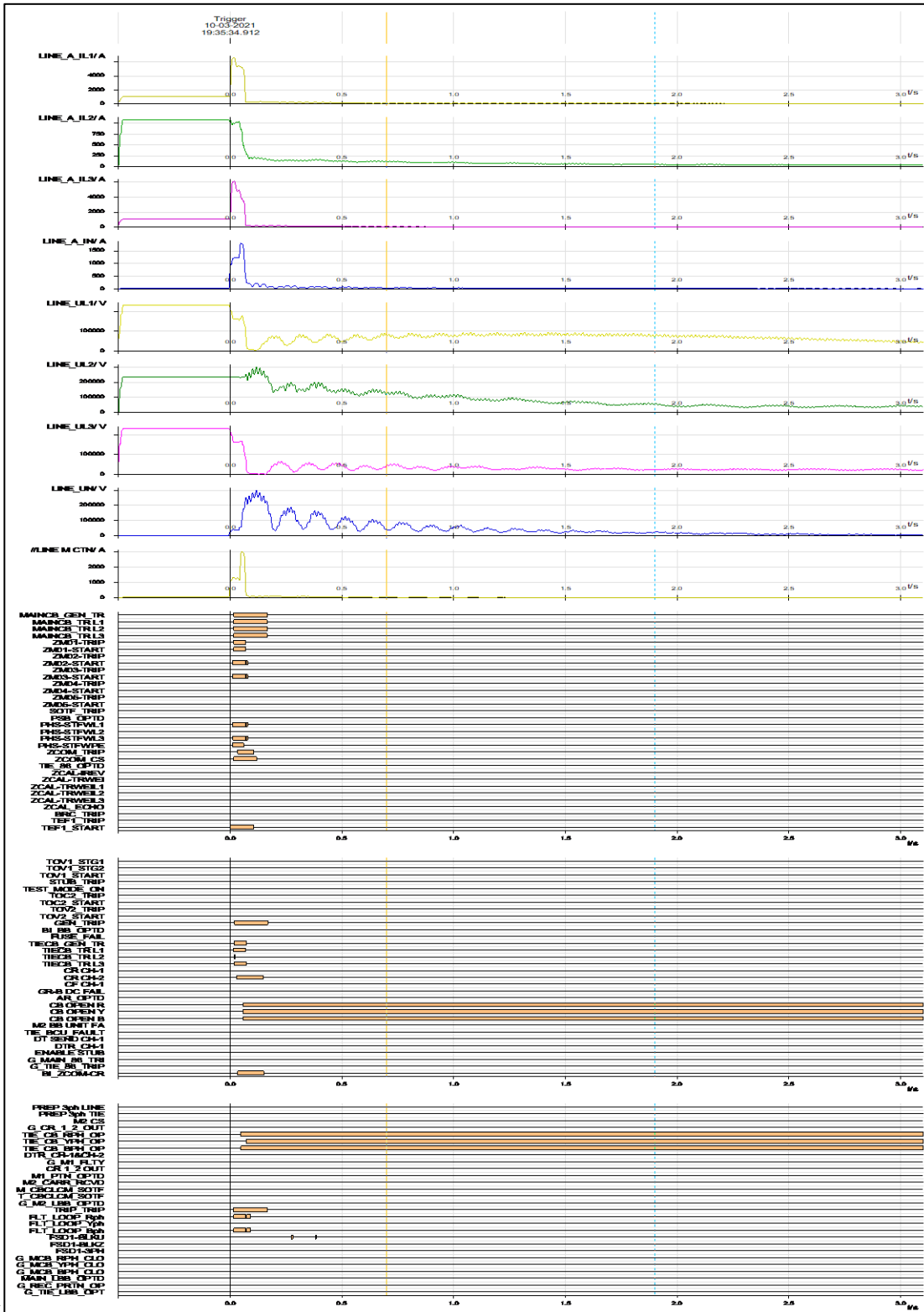


Annexure 3: DR output at Kishangunj end for tripping of 400 kV Rangpo – Kishangunj S/C

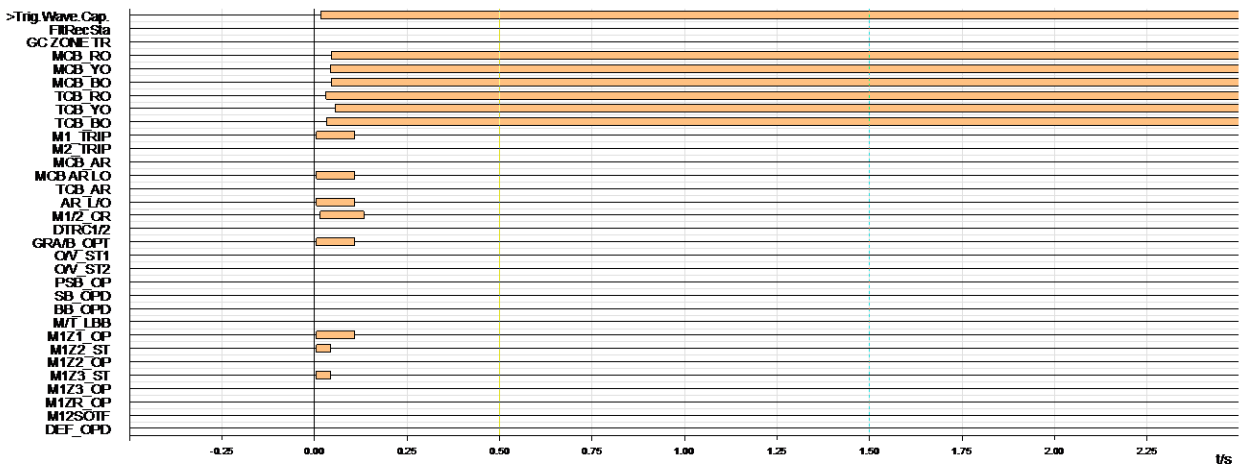
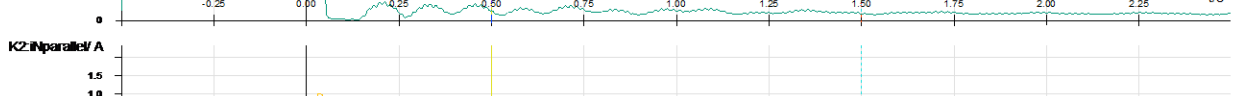
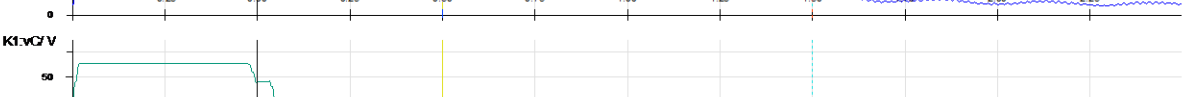
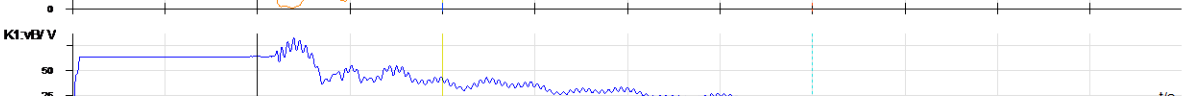
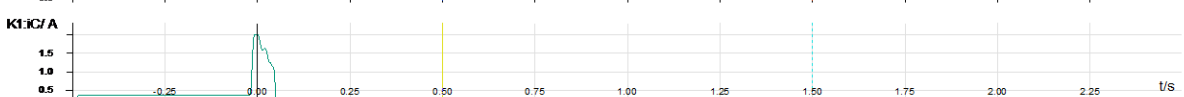
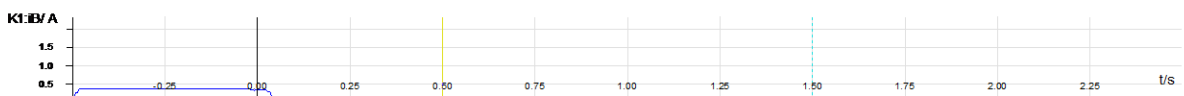
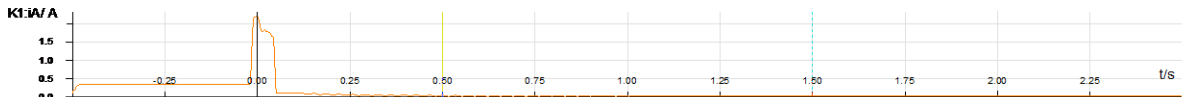




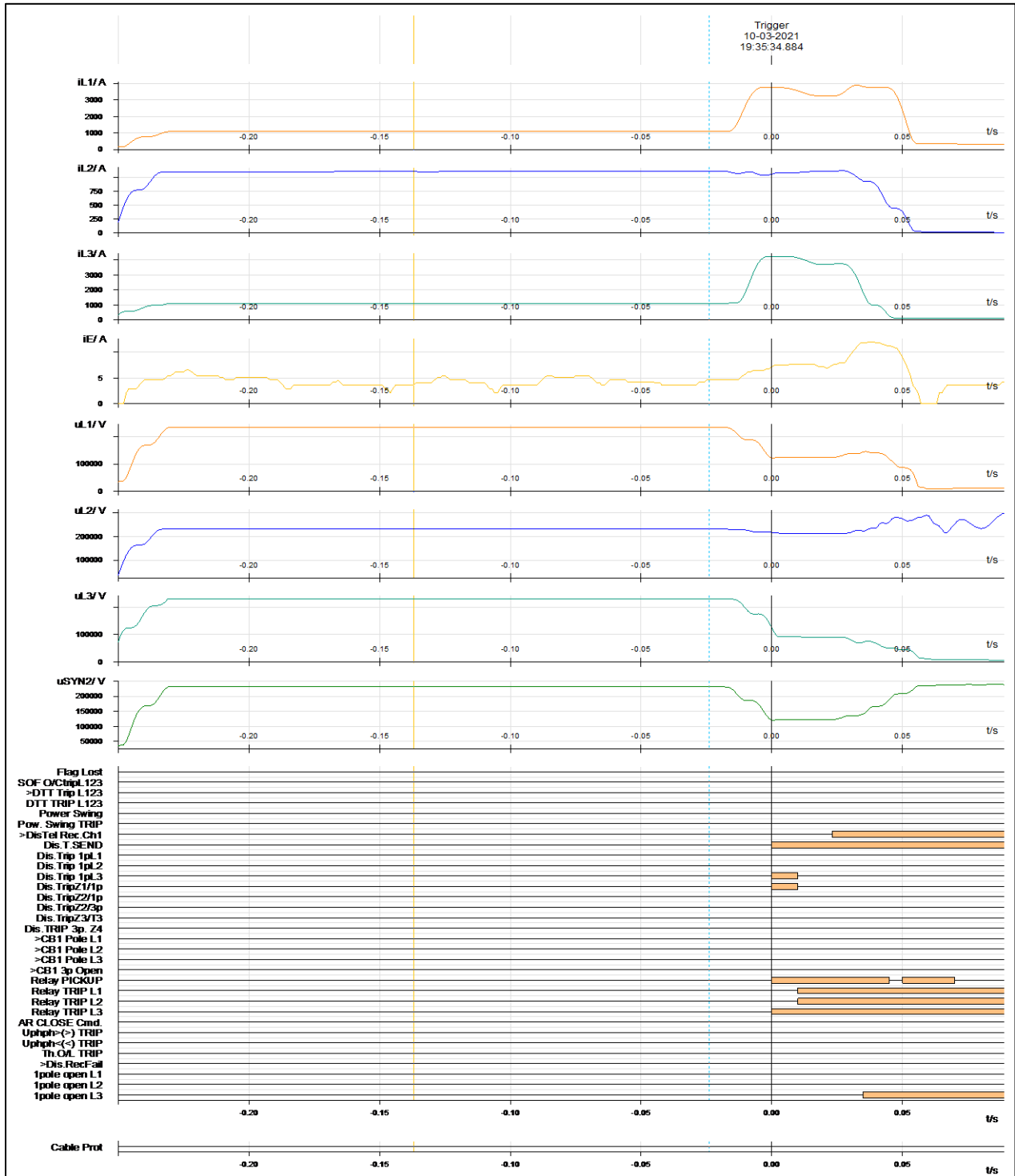
Annexure 4: DR output at Kishangunj end for tripping of 400 kV Teesta III – Kishangunj S/C



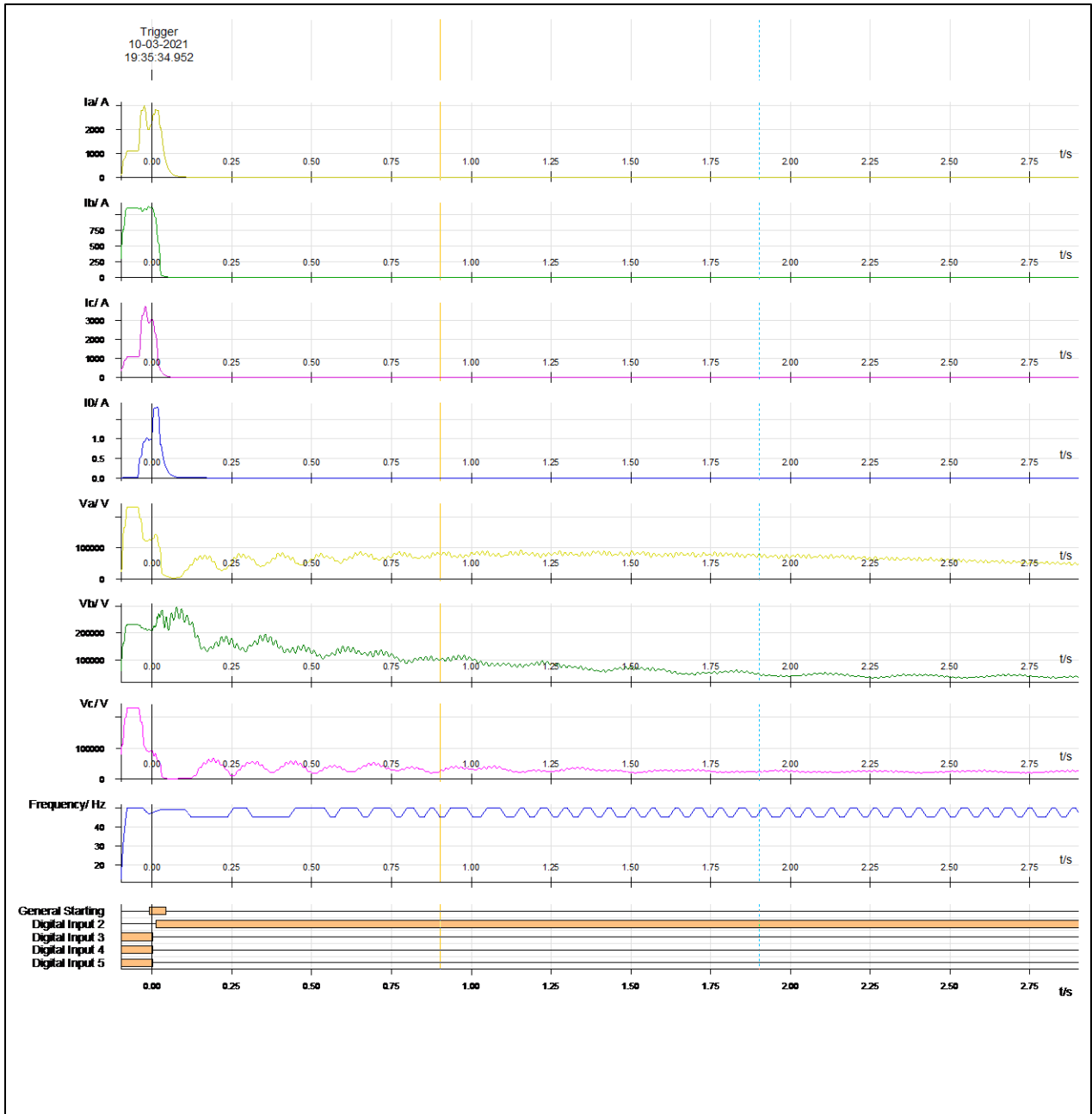
Trigger
10-03-2021
19:35:34.930



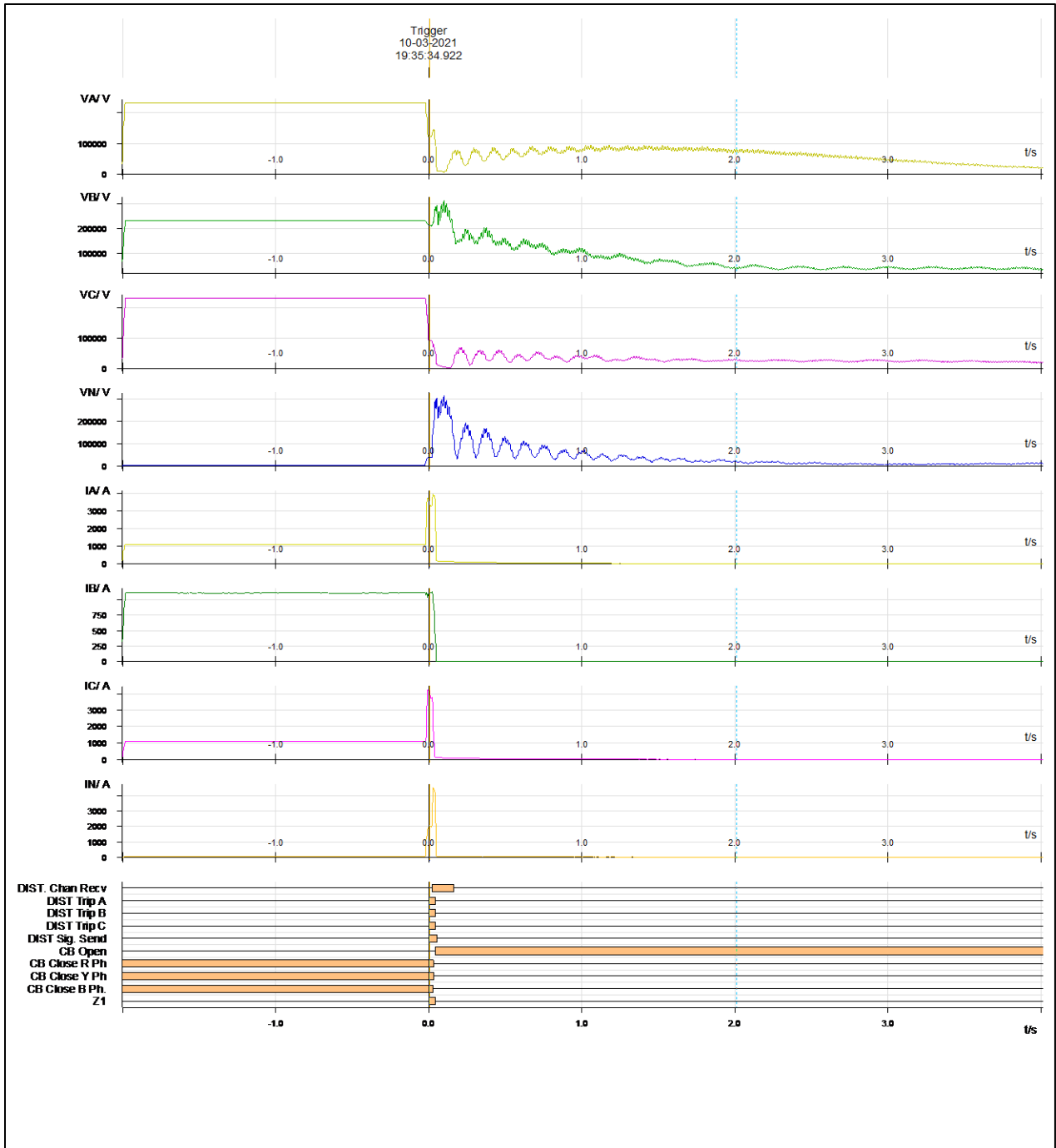
Annexure 5: DR output at Teesta III end for tripping of 400 kV Teesta III – Kishangunj S/C



Time window is not properly configured.

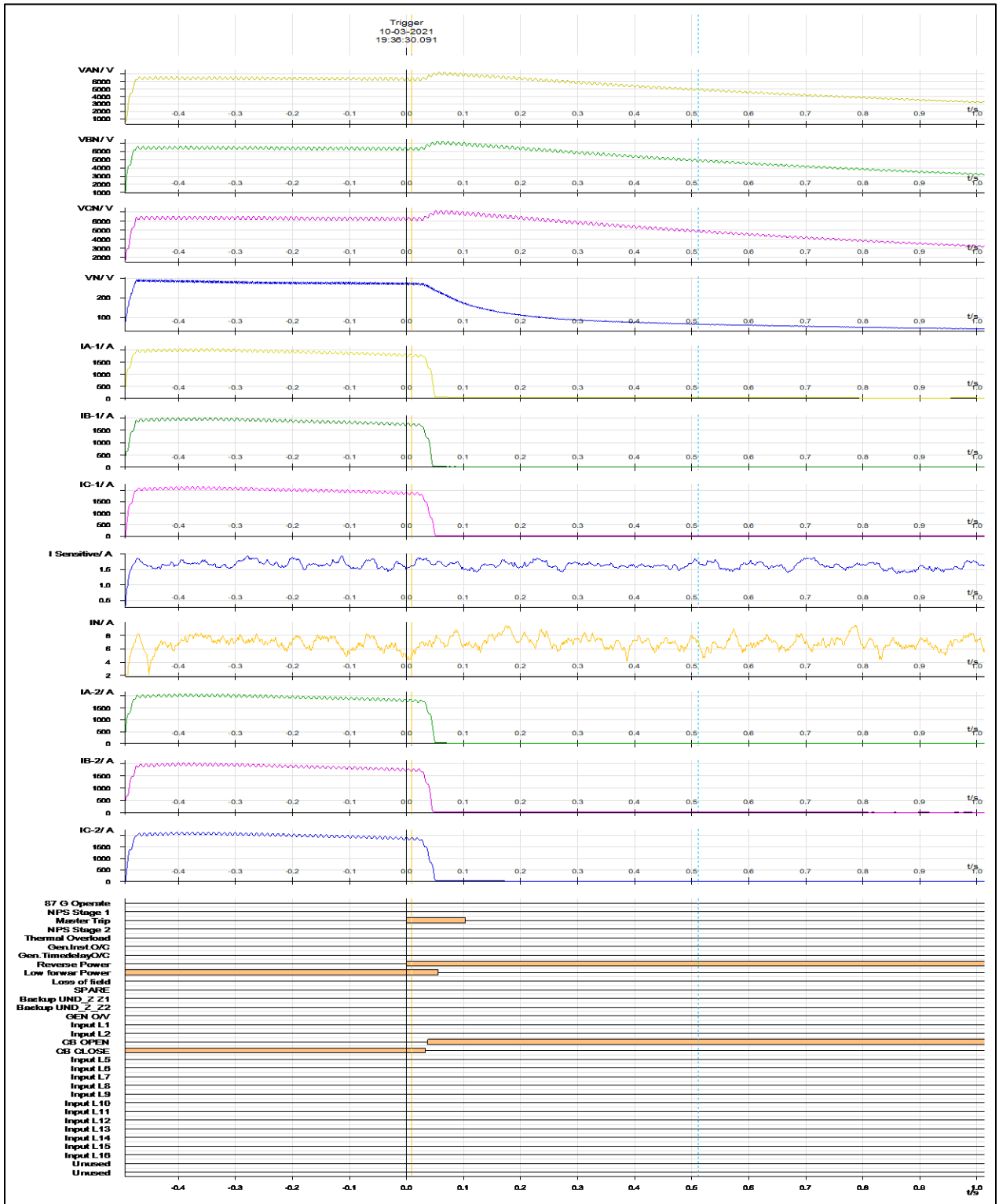


Digital channel is not configured as per ERPC's guidelines



Digital channel is not configured as per ERPC's guidelines

Annexure 6: DR output recorded at Jorethang end for unit tripping



Flash Report by SLDC/GENERATOR/ISTS/USER/UTILITY

(As per IEGC section 5.9.5, 5.9.6 (a), (b) & (c))

1. Name of the reporting entity:BSPTCL
2. Date and time of the Incident:01.03.2021
3. Antecedent Conditions (Just Prior to Event):
 - a. Frequency:50.03 TO 50.04 Hz
 - b. Demand/Generation Met:4374 to 4551 MW
 - c. Lines/units/elements under shutdown : Non
 - d. Weather condition:Normal
4. Details of tripping (Along with cause of the event and relay flag, whatever available):

Sl. No	Area/ Region	Loss of Load(MW)	Loss of Generation(MW)
1	Katihar,Manihari,Dhamdaha,Banmankhi,Nuagachhia,Barsoi, purnea	177 MW	nil

Transmission/Generation Elements tripped during event:

Sl. No.	Name of the Element	Tripping Time	Restoration Time	Relay Indication (if avbl)
1	132 KvPurnea(PG)-Purnea ckt-1	20:08	21:45	132 Kv Y-Phase PT has been blasted at BSPTCL end .Thereafter hand tripped at Purnea(Bseb)
2	132 KvPurnea(PG)-Purnea ckt-2	20:08	21:53	132 Kv Y-Phase PT has been blasted at BSPTCL end .Thereafter hand tripped at Purnea(Bseb)
3	132 KvPurnea(PG)-Purnea ckt-3	20:08	21:55	132 Kv Y-Phase PT has been blasted at BSPTCL end .Thereafter hand tripped at Purnea(Bseb)
4	220KV/132KV 160 MVA ICT 1 AT PURNEA PG	20:08	21:31	Back up impedance protection at PG end
5	220KV/132KV 160 MVA ICT 2 AT PURNEA PG	20:08	21:36	Back up impedance protection at PG end
6	220KV/132KV 160 MVA ICT 3 AT PURNEA PG	20:08	21:37	Back up impedance protection at PG end

5. Action Taken/Remedial measures taken:Co-ordinated with RTAMC,Patna.
6. Restoration details:(a) Manihari availed power from saharsha and extended to Dhamdaha.(b)Triveniganj power extended to Manihari and Katihar via T.B at Purnea.(c)Naugachhia availed power from Khagaria

7. Duration of the disturbance: Approx :1 and half an hour.
8. Amount of energy unserved:Approx: 0.255Munit

SCE

Copy to:MS, ERPC

Form No. 302
Region: Odisha Projects
Trip Report No:

Substation: Rengali

45

18/03/21

LINE TRIPPING REPORT
(TO BE FILLED BY SHIFT INCHARGE)

1. Date and Time of Occurrence	220 KV BUS # 1 at 16:02 hrs on 16-03-2021
2. Date and Time of Restoration	17:01 hrs on 16-03-2021
3. Outage Duration (hrs:mins)	00:59
4. Particulars of Tripping:	16:02 hrs on 16-03-2021
<p>Main I</p> <p>(Relay flags as per 303 and PLCC Counter readings as per 304)</p> <p>Main II</p>	<p>Diff: YN Fault; NA km; R=4kA/NAkV, Y=26kA/NAkV, B=3 kA/NAkV</p> <p>Diff: YN Fault; NA km; R=4kA/NAkV, Y=26.2kA/NAkV, B=3.1 kA/NAkV</p>
5. Connection of line Occurrence (indicate line/ICT connected to)	BUS-I and BUS-II
6. System Condition immediately before occurrence	
a). Frequency	50 Hz
b). Voltage	NA kV
c). Load MW & MVAR (On Line/ICT)	NA MW/NA MVAe
d). Whether any line/equipment was under maintenance.	No
e). Whether any protection was bypassed/not available.	No
7. Tripping Sequence: (Indicate time of tripping of each feeder)	220 KV BUS # 1 at 16:02 hrs on 16-03-2021 (Diff:YN Fault)
8. Equipment damage, if any	None
9. Sequence of normalization.	220 KV BUS # 1 restored at 17:01 hrs on 16-03-2021
10. Reasons for unsuccessful auto re-closure or auto restart.	AR out of Service Before Fault NA
11. Analysis	
a). Cause of occurrence.	The Y-phase Clamp from the 20252 CB towards the BUS Isolator side broke and fell on the ground creating Earth fault of BUS # 1 during operation checking 20289 A. This may be due to aging of Clamp and connectors as these were in service for more than 25 years. further clamp and connector of other bays will be checked during AMP of the respective bay to avoid such kind of incidence in future.
b). Suggestion for improvement	Due to aging and under continuous service for more than 25 years the clamp and connector may be deteriorated which is not evident in schedule thermovision scanning due to its incipient nature, hence the healthiness of clamp and connector to be ensured during AMP.
12. Any other relevant information	Bay No. 202 was in out condition for rectification of the defective CB ; AFAS Details: NA km; Analysis Type: NA
13. Review of Protection by T&C Engineer	The fault has occurred in BUS # 1 and both the main 1 and Main 2 relay initiated trip to the respective bay connected to BUS # 1 the protection scheme worked correctly.


T & C


Shift In-Charge

Note : Photocopies of the relevant portions of Disturbance Recorders and Event Logger are enclosed along with tripping report.

POWER GRID CORPORATION OF INDIA LTD

Form No. 303
Region: Odisha Projects

Substation: Rengali

Relay Flag details after Line/ICT/Reactor Tripping

Sl No	Date & Time of tripping	Name of Line/ICT	Local Relay Flag Details			Remote End Relay Flag Details			LA Counter Reading			
			Control Panel	Main I	Main II	Other Relays	Control Panel	Main I	Main II	Other Relays	Before Tripping	After Tripping
1	16:02 hrs on 16-03-2021	220 KV BUS # 1		Diff: YN Fault: NA km: 26 kA	Diff: YN Fault: NA km: 26.2 kA			ZA: Fault: km: 0 kA	ZA: Fault: km: 0 kA		R Ph: NA Y Ph: NA B Ph: NA	R Ph: NA Y Ph: NA B Ph: NA

Form No. 304

PLCC Counter Increment Reading After Line Tripping

Sl No	Date & Time of tripping	Name of Line/ICT	Channel I Increment						Channel II Increment							
			Code 1		Code 2		DT		Code 1		Code 2		DT			
			T ₁	R ₁	T ₂	R ₂	T ₃	R ₃	T ₄	R ₄	T ₅	R ₅	T ₆	R ₆		
1	16:02 hrs on 16-03-2021	220 KV BUS # 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA




Multiple tripping of STPS-CHANDIL

Sr No	Element Name	Tripping Date	Tripping Time	Relay Chandil end	Relay STPS end
1	220KV-CHANDIL-STPS(WBPDCL)-1	23/03/2021	5:34	Zone-2 ,RN FC-1.58kA FD-95.4km	Zone - 1, R - phase, 12.81 KM, 6.548 KA
2	220KV-CHANDIL-STPS(WBPDCL)-1	20/03/2021	5:04	Zone-2 ,R_N 1.52 kA, 96.3 KM	Zone - 1, R_N, 6.99 kA, 11.04 KM
3	220KV-CHANDIL-STPS(WBPDCL)-1	18/03/2021	4:57	Zone-2 ,IY =1.53 KA, DIST -94.3 Z2	Zone - 1,Y-N Z1 7.98 Ka 11.16 KM
4	220KV-CHANDIL-STPS(WBPDCL)-1	12/3/2021	18:32	Zone-2 , B-N, FC- 1.43KA, 98KM	Zone - 1, B-N, 8.8KA , 6.8 KM;

It is observed that frequent single phase faults are occurring at the same location which is 98 km from chandil end and at 11 Km from STPS end .Row issue and proper line patrolling and maintenance may be ensured to avoid such frequent faults at same location.

Protection related issue:**Non- Auto reclose at STPS END:**

In all cases of tripping it is observed that from Santaldih end, fault is in zone-1 and 3 phase tripping is occurring at the instant of single phase fault. So no auto reclose is observed in any event from Santaldih end ,if Auto reclose would have operated some tripping's of transient fault could have been avoided. Whether Auto reclose scheme is implemented and functional may please be communicated.

Carrier communication scheme failure : All faults were in zone-2 from Chandil end and delayed tripping observed after zone-2 time in each case, and all 3 phases from Chandil end tripped after z- 2time . Seems also carrier communication scheme not working as STPS end is sensing z-1 so it should send carrier signal to remote end to trip instantaneously faulty phase in case of zone-2 start at remote end and will further proceed for auto reclose after dead time .Delayed clearance also could have been avoided along with line tripping.

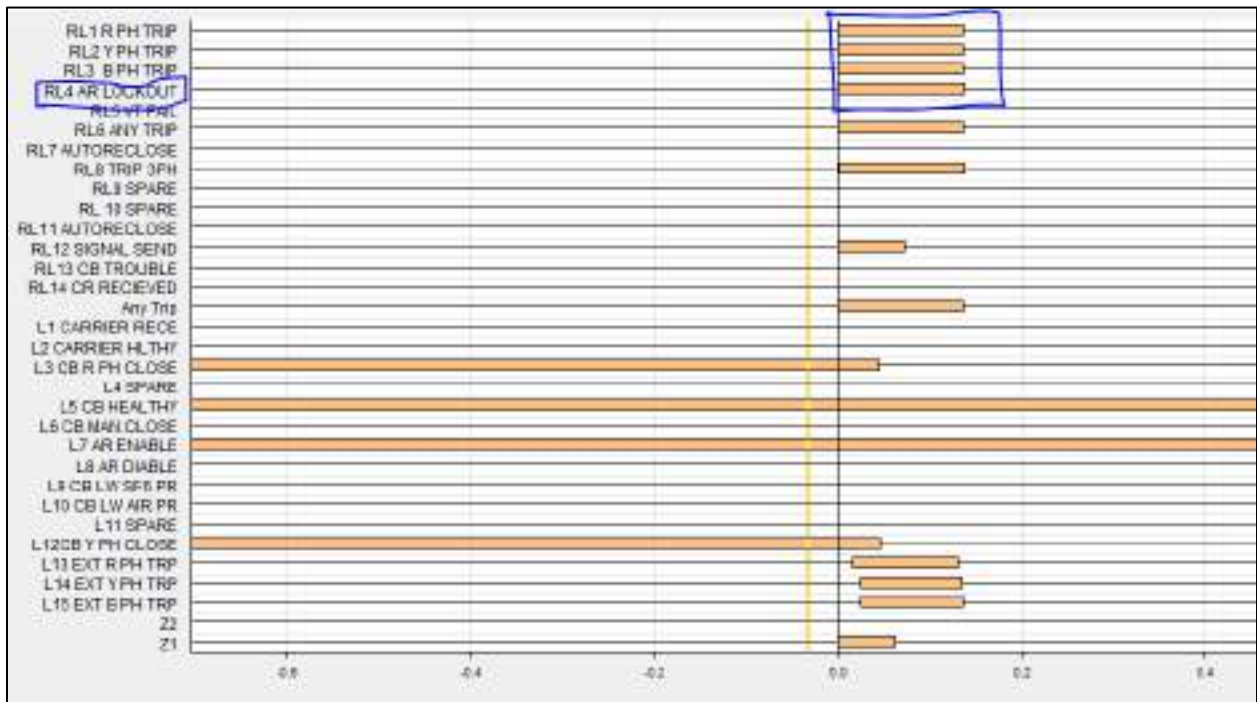
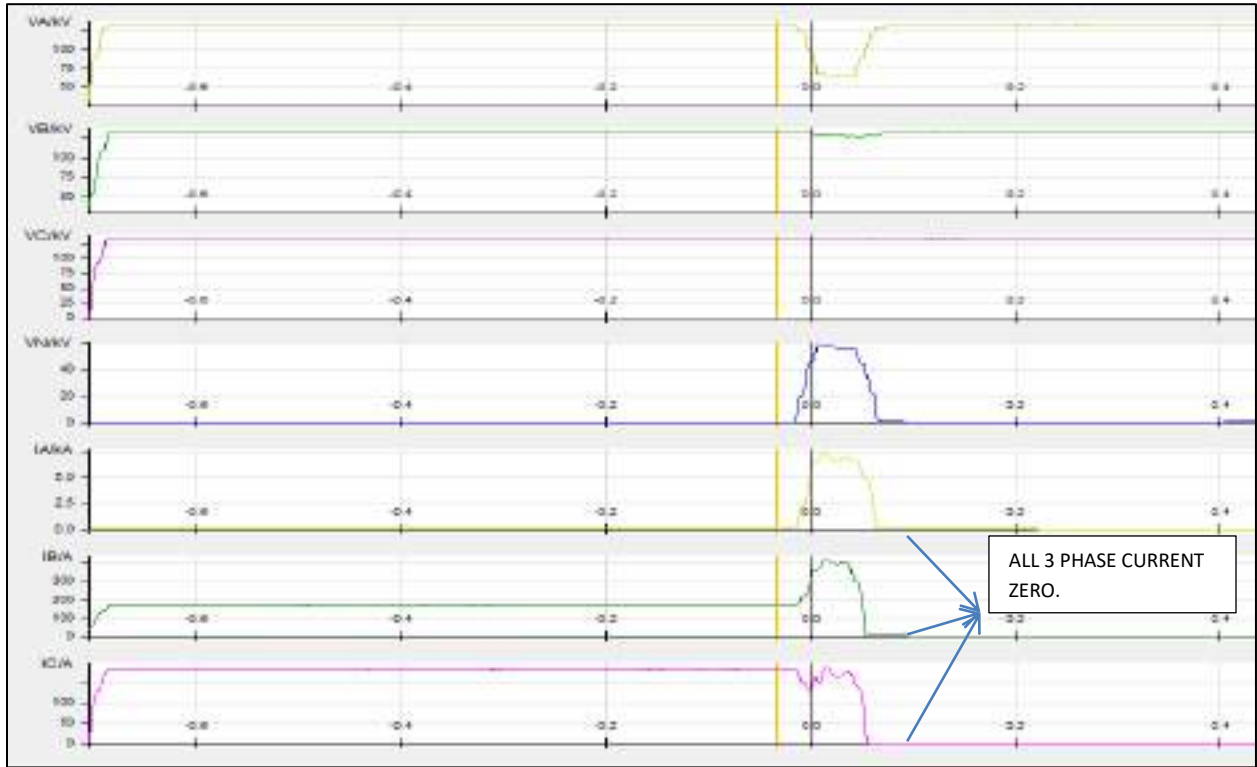
Healthiness of carrier communication scheme may also be checked and communicated.

DR of both ends for two events are attached below for reference .In all events similar things are observed.

Kindly update regarding above mentioned issues and do necessary for rectification of the same to avoid such tripping's in future.

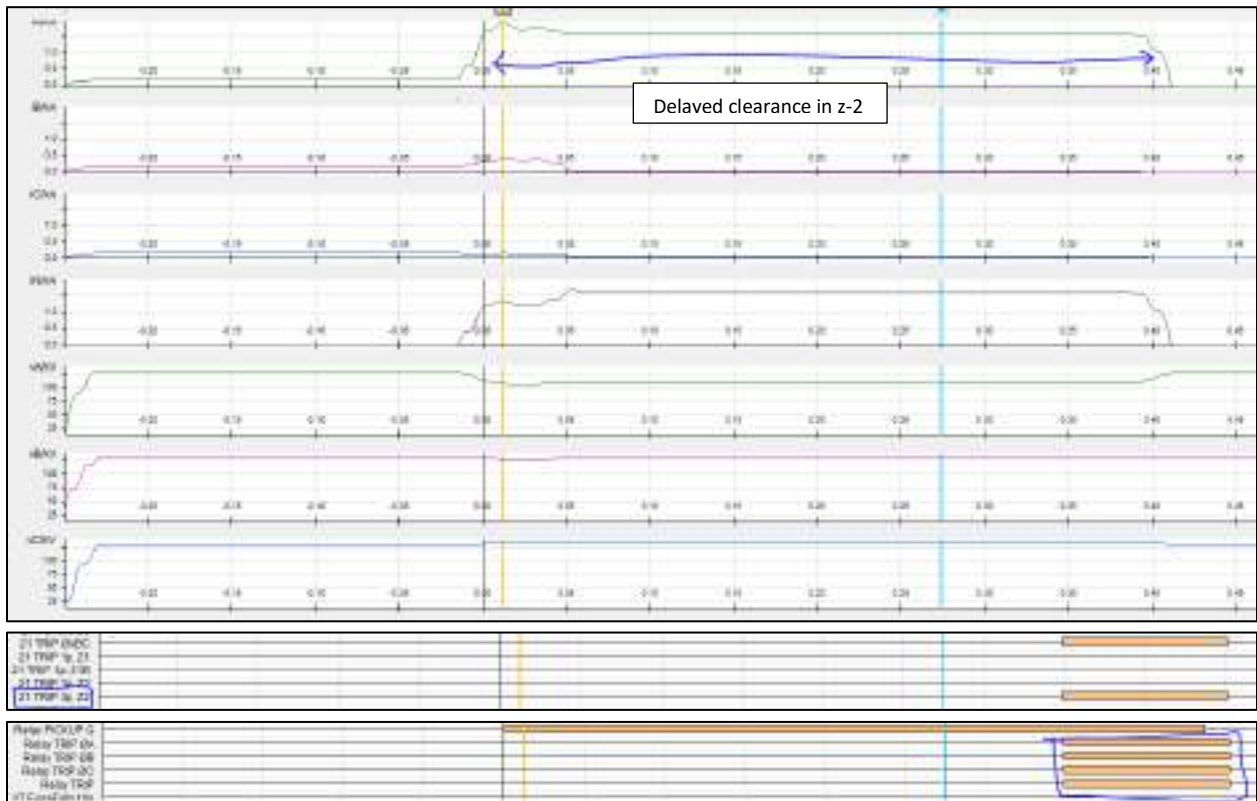
Multiple tripping of STPS-CHANDIL

DR at STSPS END FOR 23/03/2021



Multiple tripping of STPS-CHANDIL

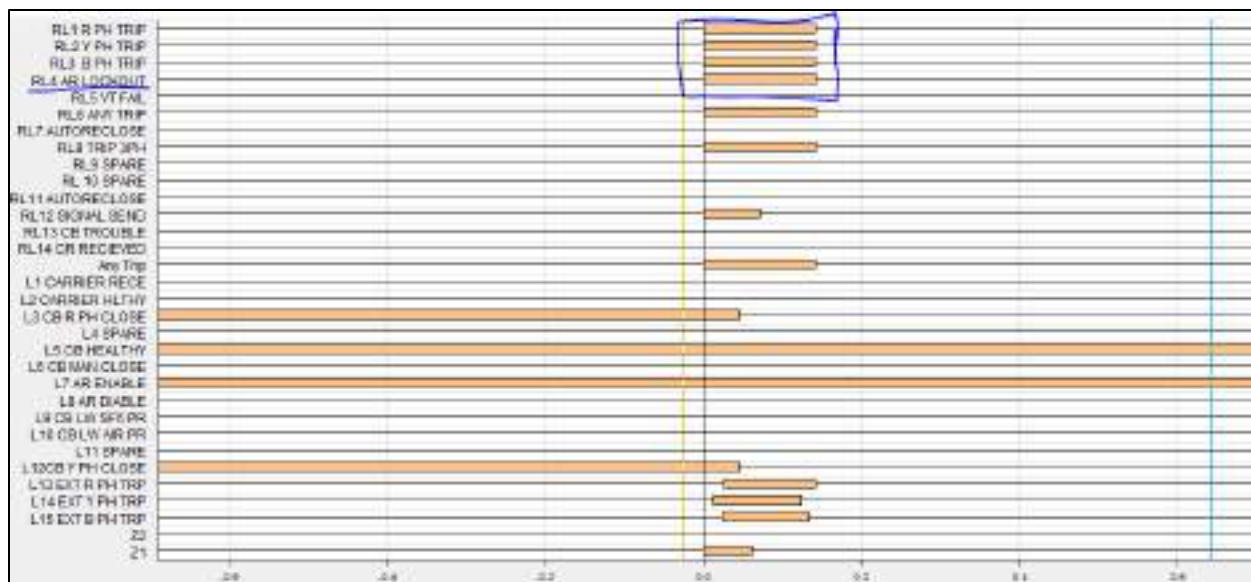
DR at CHANDIL END FOR 23/03/2021:



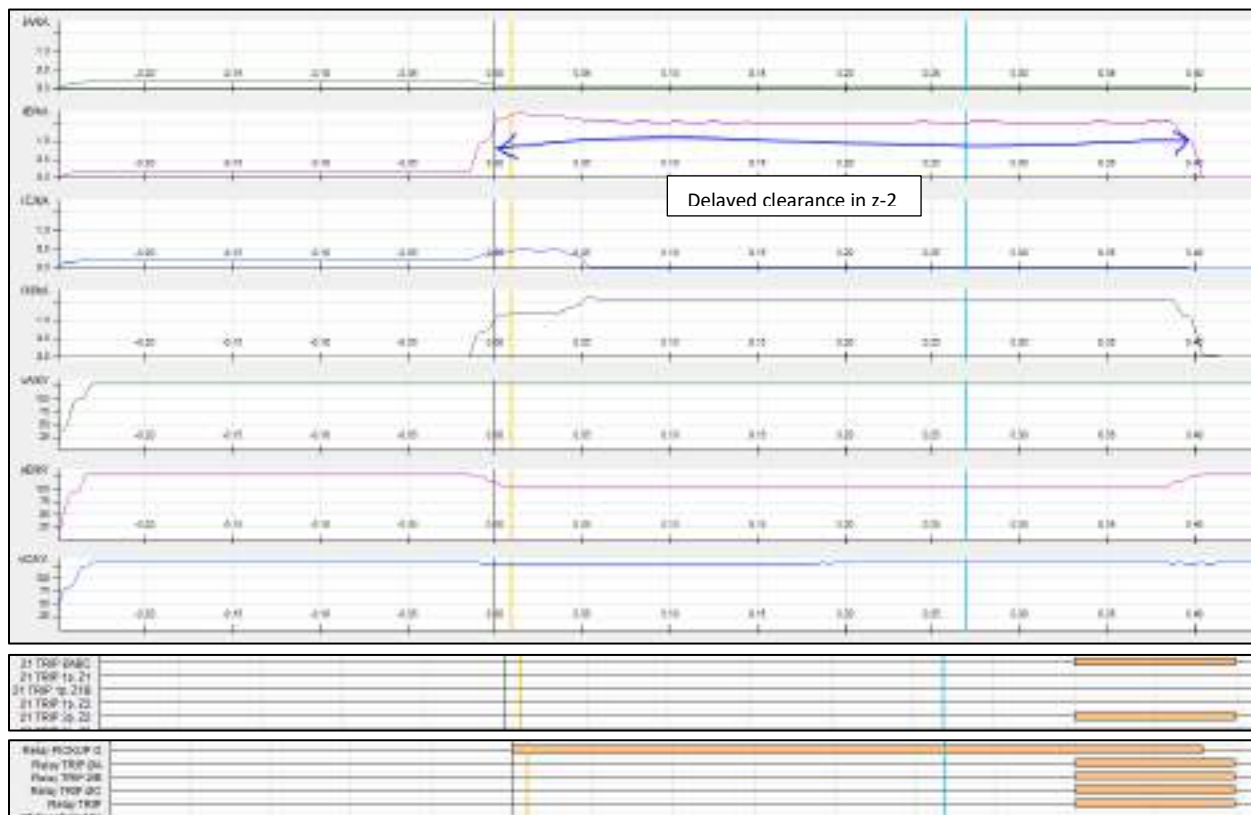
DR at STSPS END FOR 18/03/2021



Multiple tripping of STPS-CHANDIL



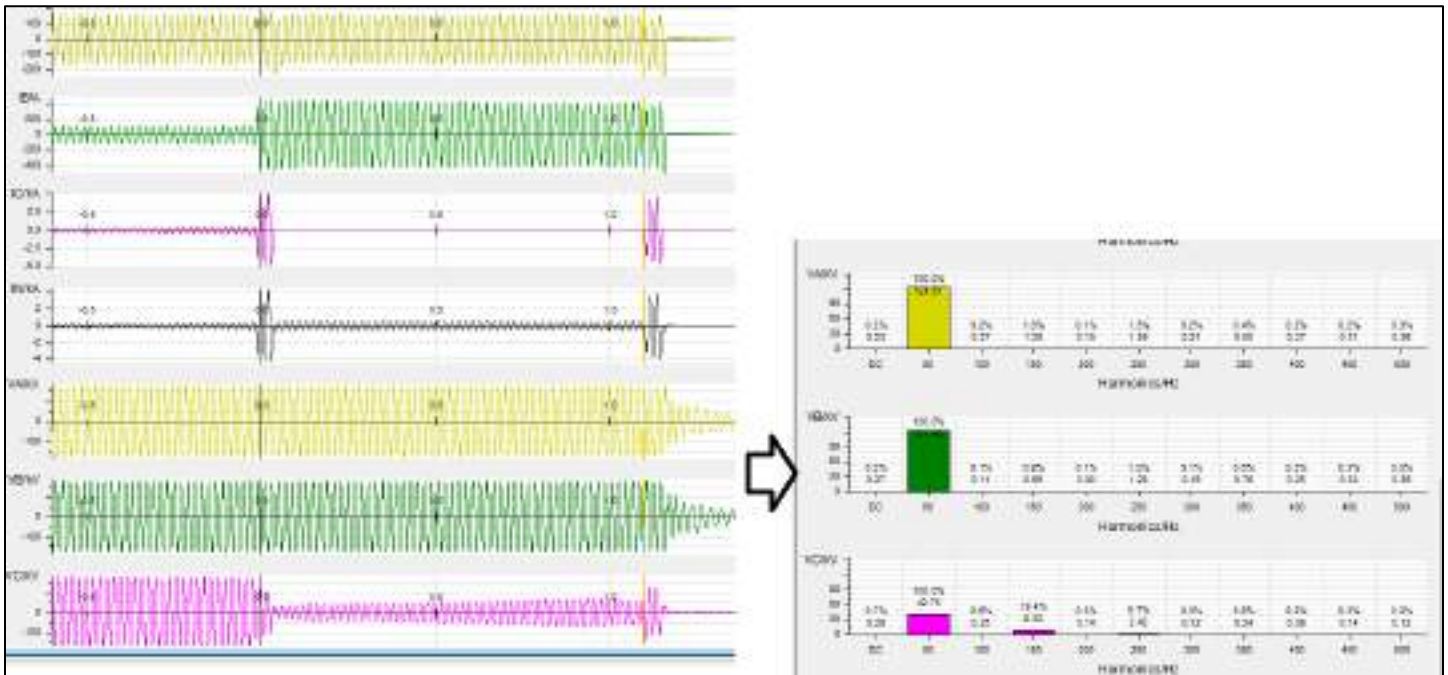
DR at CHANDIL END FOR 18/03/2021:



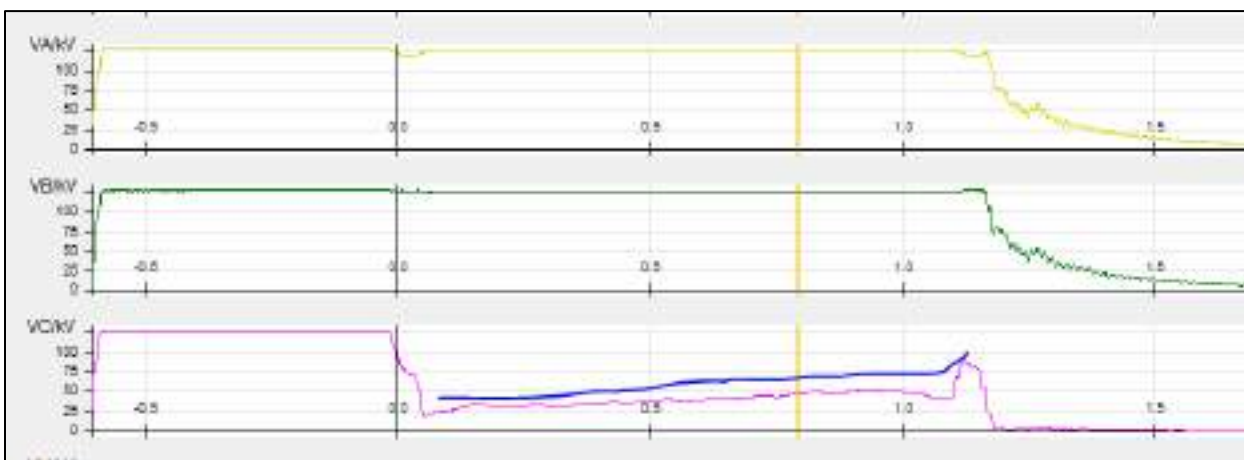
Annexure B.8

Element Name	Tripping Date	Tripping Time	Reason
220KV-DALTONGUNJ-GARWAH (NEW)-1	31/03/2021	9:49	DALTONGUNJ: B_N, Z-1, FD-47.8KM, FC-2.1KA
220KV-DALTONGUNJ-GARWAH (NEW)-2	30/03/2021	11:47	DALTONGUNJ: Y-B, 61KM, 2.36KA
220KV-DALTONGUNJ-GARWAH (NEW)-1	30/03/2021	9:35	Y-B Fault, Y: 1.7 KA B: 1.65 KA, Zone 2, 80.607 km from Daltongunj Garwah: Iy 0.495 KA Ib: 0.541 KA z1 23 km
220KV-DALTONGUNJ-GARWAH (NEW)-2	30/03/2021	11:26	DALTONGUNJ: B-N, 18KM, 3.46KA,
220KV-DALTONGUNJ-GARWAH (NEW)-1	15/03/2021	14:45	DT RECEIVED

220 kv Daltonganj –Garwa –II tripped on 30 March with B phase to ground fault and during dead time of Auto reclose B, Phase voltage was existing with approx. 90Kv showing persistent arcing kind of phenomenon. Then at the charging instance after few milli-seconds line tripped due to Y-B fault and it appears from DR that prior to tripping B phase fault converted to Y-B fault which was pre-existing in the line with small magnitude which after charging increased in few ms and got detected by Distance protection and tripping issued .

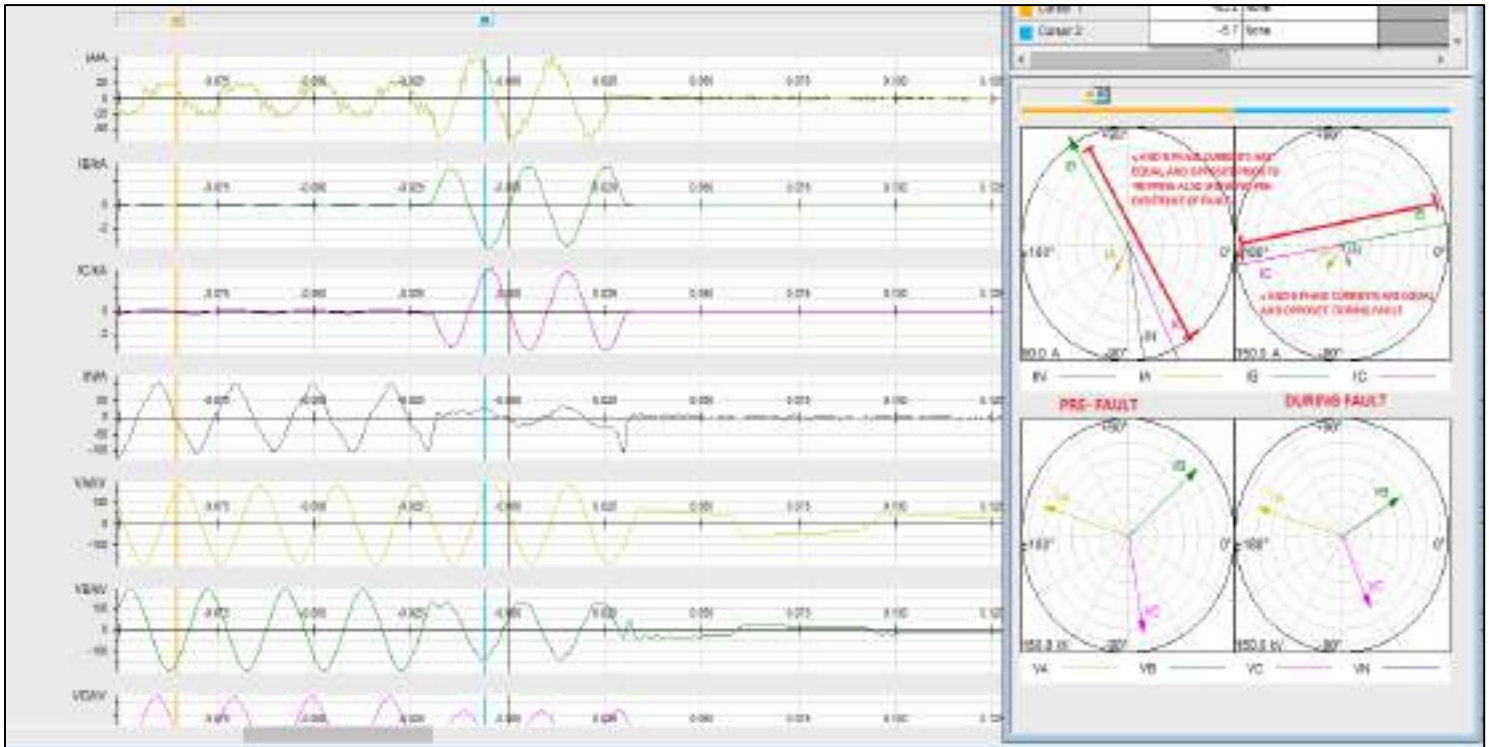


RMS VALUE:



AT CHARGING INSTANCE: Then at the charging instance after few milli line tripped due to Y-B fault and it appears from DR that prior to tripping B phase fault converted to Y-B fault and was existing in the line with small magnitude which increased in few milli seconds and got detected and tripping issued .

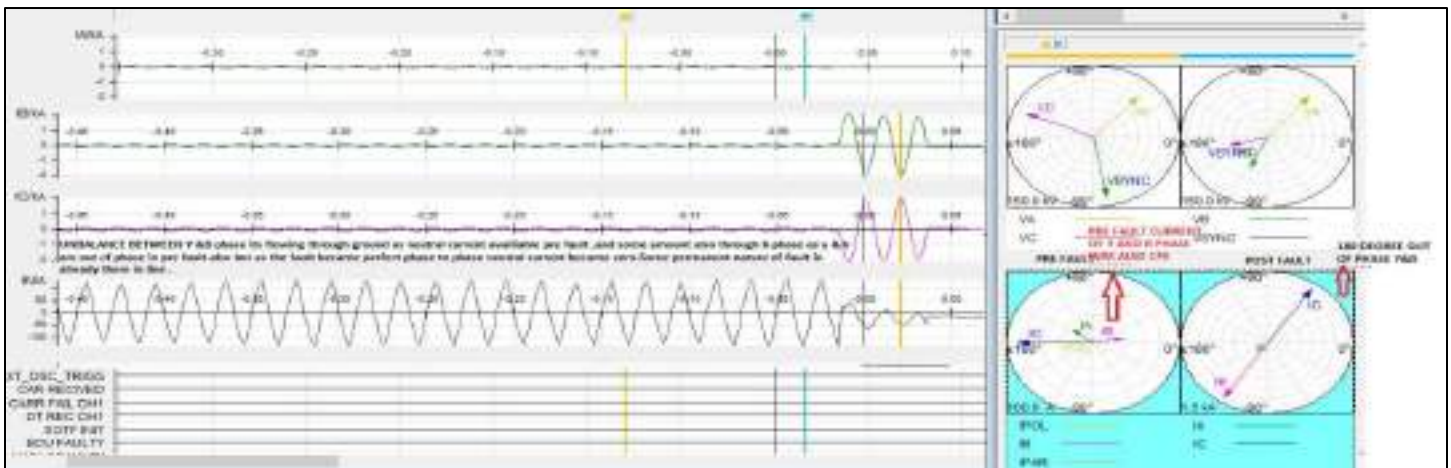
Similar phenomenon is also observed in the past this may be checked that what nature of fault is occurring where first B phase fault is being converted to Y-B phase fault with some small arcing kind of phenomenon leading to Phase to phase conversion. Whether any Row or clearance issue is there?



Tripping of ckt-2 on 19th August

Similar incident was also observed in one past case also where line tripped on B phase fault and while charging Y-B phase fault observed .At the charging instance similar phenomenon observed where Y-B fault was pre-existing it was already having some permanent nature of fault shorting both phases but after few milliseconds it got converted to perfect phase to phase Y-B fault with Y & B currents 180 degree out of phase and current also increased up to 1.5 ka and line tripped.

.Please refer DR as shown below for 19th august tripping at the time of charging.



Major points to be considered for rectification and Root cause analysis and mitigation :

Most of the faults are of Y-B fault (Phase to phase) No ground involved ,which shows some phase to phase shorting is occurring slowly with arcing kind of phenomenon.

Initially B phase fault is getting converted to Y-B phase fault at the charging instance slowly where some arcing is been observed and at the charging instance before tripping it is observed line is already having Y-B fault whose magnitude is slowly increasing and getting detected by relay and tripped .

Whether any clearance issue is there needs to be checked .Initially also at the time of First time charging of this line this same sequence of tripping was observed several times.

**Outage of 220KV Bus-1 along with system disturbance occurred at
Budhipadar Grid S/s on dt. 08.04.2021.**

Annexure B9

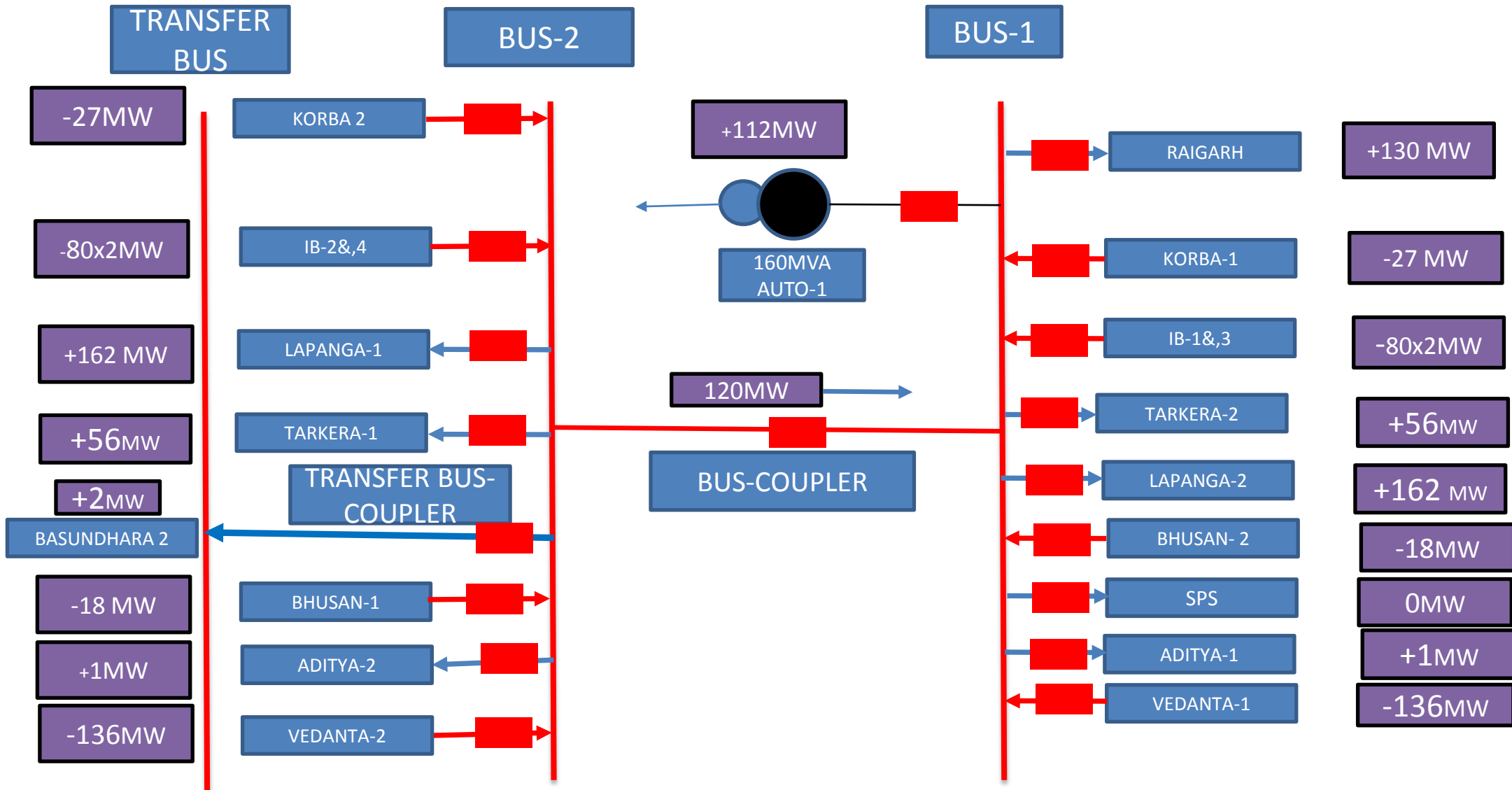
- **Date 08.04.2021 ,Time- 14:07 Hrs.**
- **Station : Budhipadar 220/132/33kV GSS**
- **Weather : Sunny.**
- **220KV Basundhara feeder was on TBC for replacement of old breaker.**
- **160MVA, Auto Transformer-1 was only in service.**
- **At 14.07hrs. A heavy sound observed at switchyard and outage of 220KV Bus-1 occurred due to operation of Bus bar protection. All feeders/Auto TRF connected to Bus-1 tripped. At the same time total power failure/black out occurred.**

OBSERVATION/ physical finding:

From the switchyard inspection, it was reported with snapping of R-Ph pipe bus from isolator to Breaker of 220KV Budhipadar- Tarkera Ckt-2.

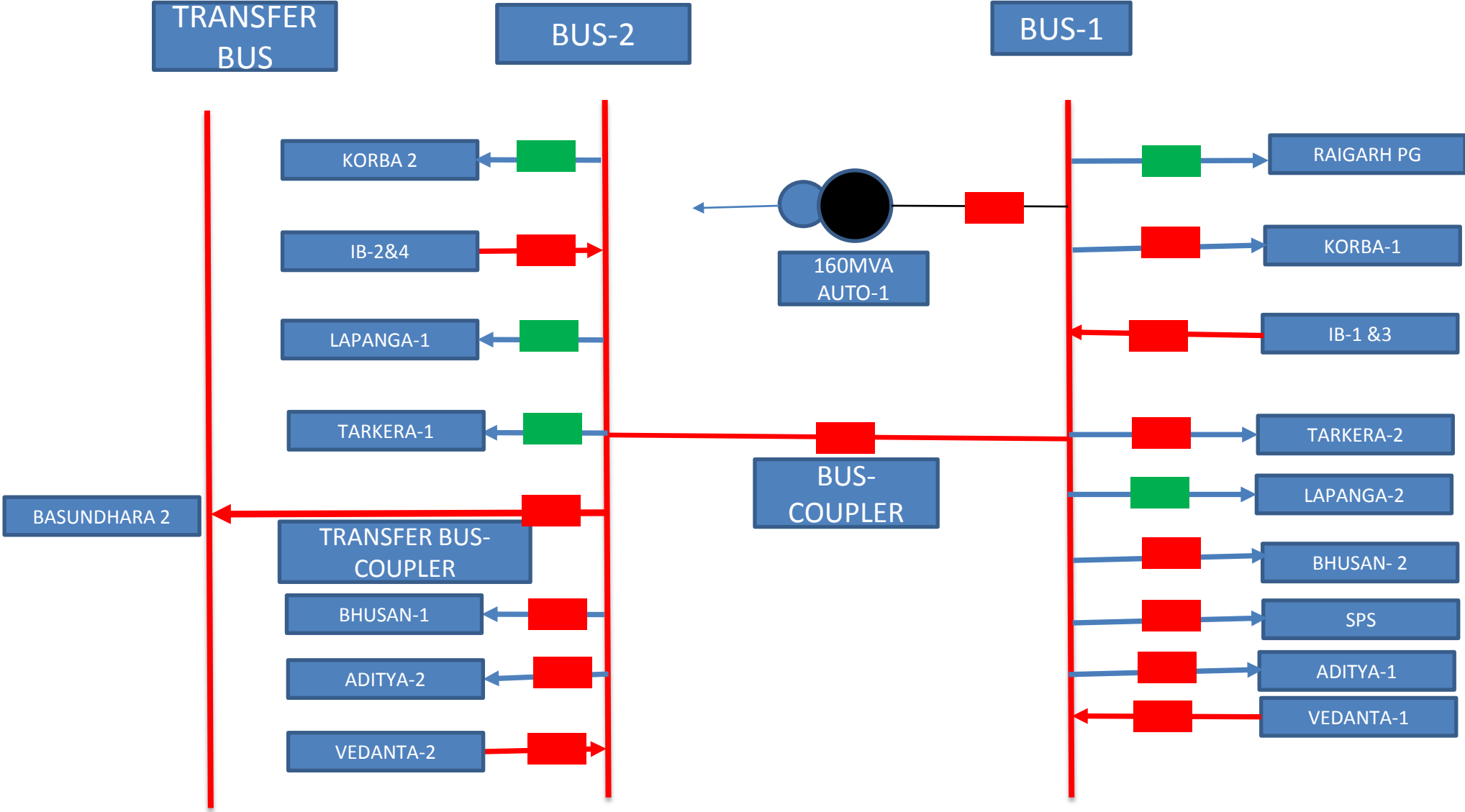
PRE-FAULT CONDITION

LOAD PATTERN OF DIFFERENT FEEDERS AT 13.00 HRS. DT.08.04.21



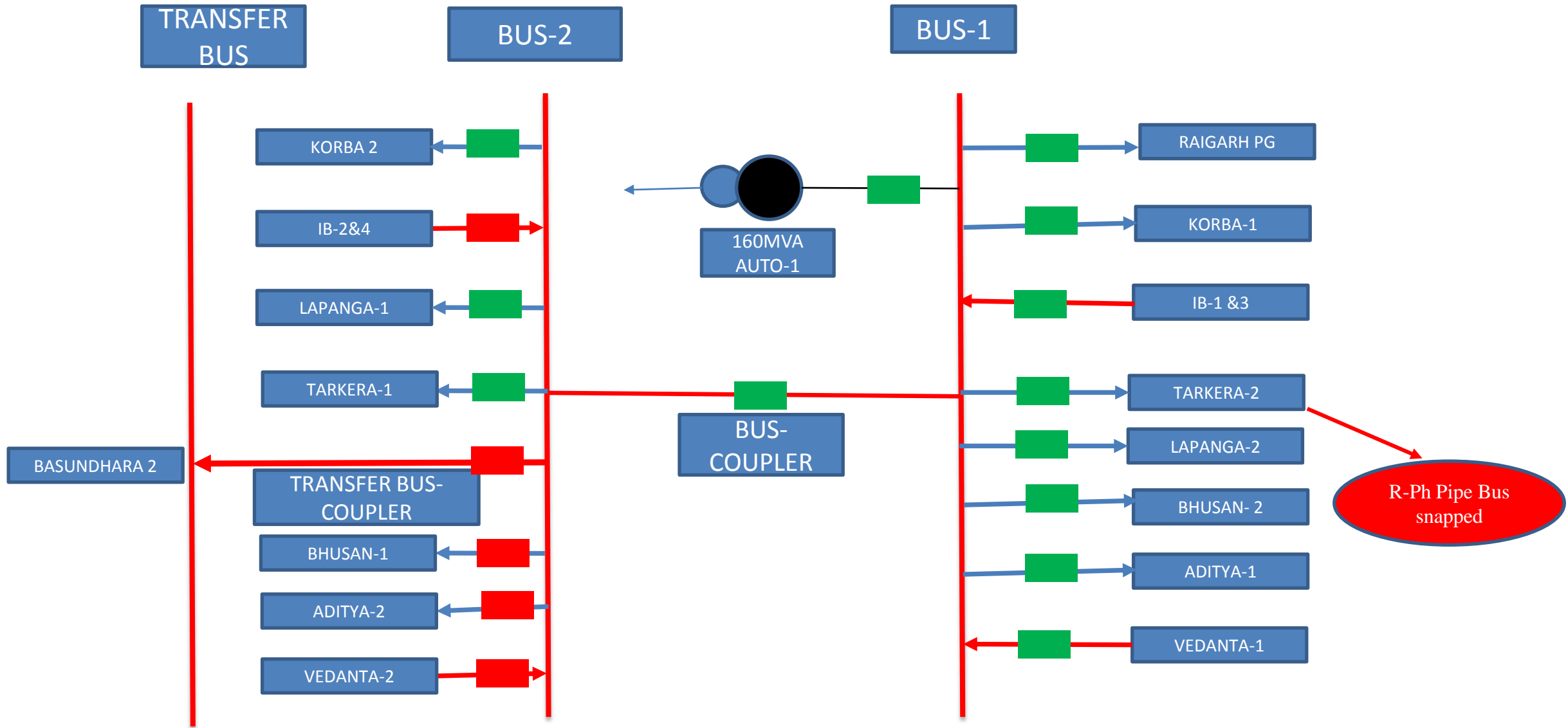
BEFORE BUS-1 FAULT CONDITION

(LAPANGA-1, LAPANGA-2, RAIGARH-PG, KORBA-3, TARKERA-1 WERE IN TRIPPED CONDITION)



POST-FAULT CONDITION

(ALL FEEDERS IN BUS-1 TRIPPED ALONG WITH BUS- COUPLER)



Date & Time of Occurrence:08.04.21

Sl.No.	Name of feeder	Relay Indication	
		B.Padar End	Remote End
1	220KV B.Padar-Lapanga-1 (13.50Hrs)	(Siemens-7SA522) Zone-1,L2-L3, FD=6.057Km, IL2=17.03KA,IL3=16.42KA	Zone-1,L2-L3,FD=10.2km,IL2=9.2KA,IL3=9.91kA
2	220KV B.Padar-Lapanga-2 (13.50Hrs)	(Siemens-7SA522) Zone-1,L2-L3-E, FD=7.567Km, IL2=18.48KA,IL3=8.057KA	Zone-1,L2-L3-E,FD=10km,IL2=9.69KA,IL3=7.57kA
3	220KV Raigarh PG (14.02Hrs)	(B/U-7SJ62) O/C& E/F Trip, IL1=0.53KA, IL2=0.57KA, IL3=1.81KA	
4	220KV Tarkera-1 (14.05Hrs)	(Siemens-7SA522) Zone-1,L3-E, FD=79.3Km, IL2=17.IL3=2.04KA	Zone-1,L3-E,FD=7.2km,IL3=6.62kA
5	220KV Korba-3 (14.07Hrs)	PSB optd., IL3=1.76KA,In=1.76KA	No Tripping
6	220 kV Bus-1 (14.07Hrs) (korba-1,IB-1&3, Tarkera-2, B/C,Bhusan-2, SPS,AAL-1,VAL-1)	<u>BB-SIEMENS-7SS522</u> Trip Bus-1 L1, Trip Bus-1 L123	NA

Analysis:-

- 1. The 220KV Budhipadar-Lapanga Ckt-1 &2 tripped on Distance protection with Y-B phase fault. The load flow of Lapanga-1 & 2 during that period is around 320MW and total power flow was 682MW.**
- 2. After tripping of the 220KV Lapanga-1 & 2, the power flow started to Lapanga through 132KV Budhipadar-Lapanga ckt. Via 160MVA Auto TRF-1. Hence, the Auto-1 became overloaded. To prevent the overload of Auto-1, the 132KV Budhipadar-Lapanga and Budhipadar- Jharsuguda ckt-2 hand tripped.**
- 3. The 220KV Budhipadar- Raigarh PG tripped on O/c & E/F protection due to unbalance power flow.**
- 4. The 220KV Budhipadar-Tarkera ckt-1 tripped on distance protection with B-N fault and 220KV Budhipadar-Korba-3 tripped on power swing protection.**
- 5. For evacuation of huge quantity of power the only path remained were Korba-1 & 2, Tarkera-2 and 160MVA Auto-1. Unfortunately, the R-ph pipe bus from isolator to breaker of 220KV Budhipadar-Tarkera ckt-2 snapped & resulted a Bus fault. Therefore, all feeders/Auto TRF connected to Bus-1 tripped on Bus-bar protection and Bus-1 became dead. During such an incident the vedanta,Aditya Aluminium, Bhusan islanded but CPP units tripped at Vedanta end. The generating units of IBTPS also tripped on over frequency protection. So, total power failure/black out occurred at Budhipadar GSS.**

REMEDIAL MEASURES:

- 1. The damaged R-Ph pipe bus from isolator to breaker of 220KV Budhipadar-Tarkera-2 replaced and the feeder charged on 09.04.21 at 22.47hrs & stood ok .**

LC Resonance observed in 400KV BNG-ALPD D/C

Name of the Substation: 400/220kV Binaguri SS

Date of occurrence: (i) 400KV Binaguri-Alipurduar Ckt.-I : 05.09.2018 @ 14:11 hrs.,
(ii) 400KV Binaguri-Alipurduar Ckt.-II : 30.08.2020 @ 13:33 hrs.

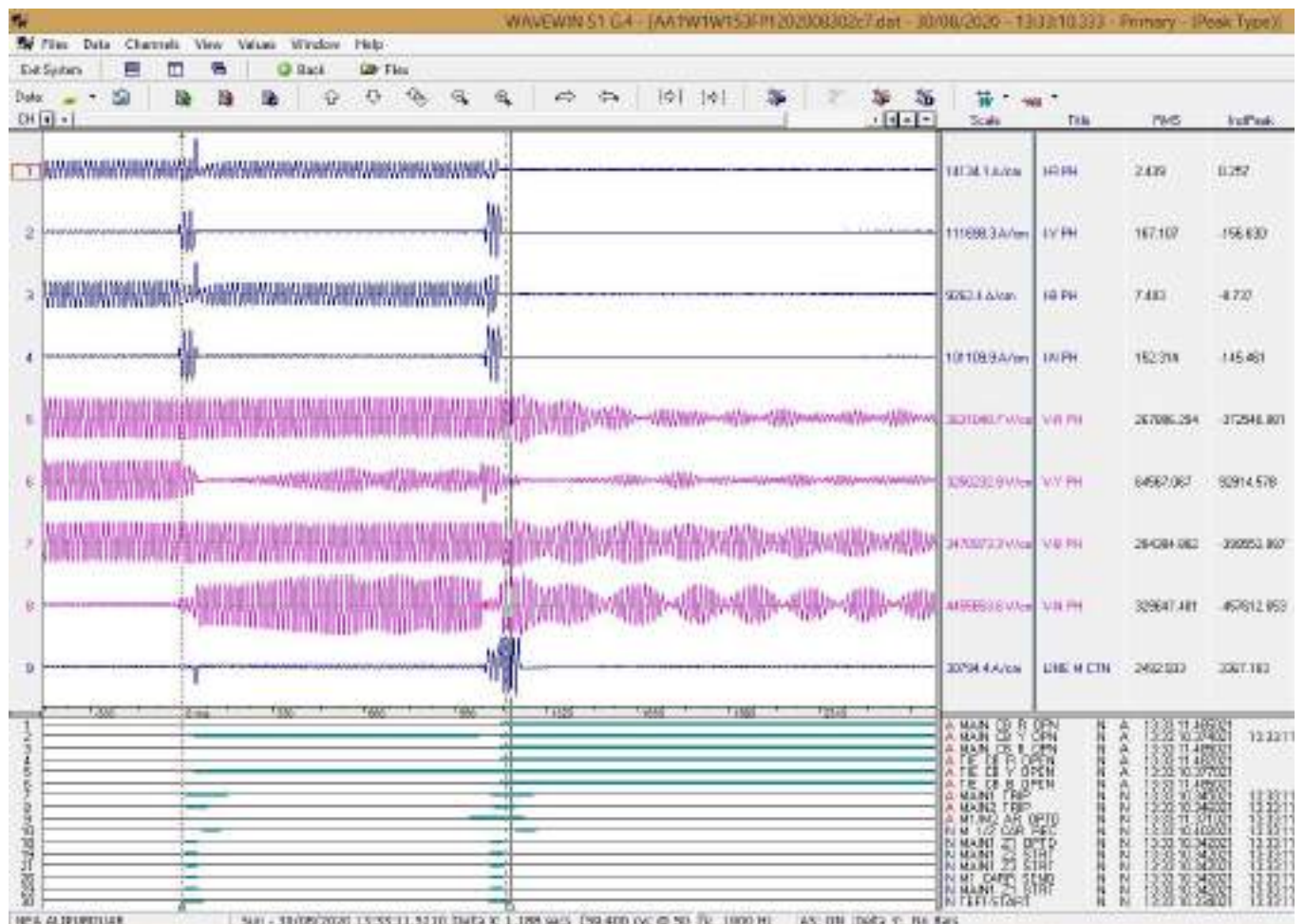
Brief History:

Problem of ferro-resonance observed during Single phase tripping of 400KV Binaguri-Alipurduar Ckt.-I&II due to over compensation. Initially those lines are as 400KV Binaguri-Bongaigaon D/C having distance of 217KM with Line Reactors of 50MVAR in each circuits at Binaguri end; later both the lines are LILO at 400KV/220KV Alipurduar substation having new distance of 123.7KM from Binaguri end.

Observation:

Due to ferro-resonance problem, the voltage in healthy phases shoot up to 291 KV (Ph-N) i.e. approx. 1.26 times of normal voltage and the neutral voltage up to 366KV. This will create stress in healthy equipment like- CT, CVT, WT, LA etc and may deteriorate the life of costly equipment.

Disturbance Recorder:



Proposed remedial action:

Both the 50MVAR Line Reactors are switchable in nature and hence Reactor CB to be given 3-ph trip command in case any single phase operation of Line Protection, so that Line Reactor will be out of service to avoid resonance problem.

This type of scheme modification has been carried out in other regions to eliminate the ferro-resonance issues. Therefore, it is proposed to consider the opening of Line Reactor due to single phase tripping of Line and it should not be booked in equipment outage. However, if Reactors tripped due to its own protection relays / body protection etc same will be consider as Outage. It can be summarized as follows:

Case-I:

Line Reactors tripped due to system constrain as mentioned above, a mail will be forwarded to ERLDC / POSOCO for closing of the Line Reactor mentioning tripping due to system constrained.

- It should not be booked in outage,

Case-II:

Line Reactors tripped due to its own protection like – protection relay operation, body protection etc. - it will booked for outage.