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A Case Study and Analysis on Low Voltage Air Circuit Breaker Unreasonable Automatically Trip

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OUTLINE

- Background
- Inspection ACB (air circuit breaker) at MDB (main distribution board).
- Install power quality meter to check evaluate power quality and current fault.
- Trip event analysis
- Power quality results
- ACB Trip unit testing
- Solution
- Summary

Background

- We were informed that the electric shutdown around 6 O'clock almost everyday.

- After we discover cause of electric shutdown we found ACB opened circuit. However, after check electric system in the building, not found abnormal things. Then we charged spring for operate closed circuit. ACB either can operate to close circuit within 1 time or need many times to operate close circuit. Despite that when we operate close circuit in a moment it opened .
- We try to figure out the hot spots in electrical systems by using a thermal camera, but don't have any hot spot in electrical system.

Inspection ACB at MDB

- ACB and accessory detail.

ACB: Square D master pact
16M H1, 1600AT, fixed type

Trip unit: STR 38S (Isig)

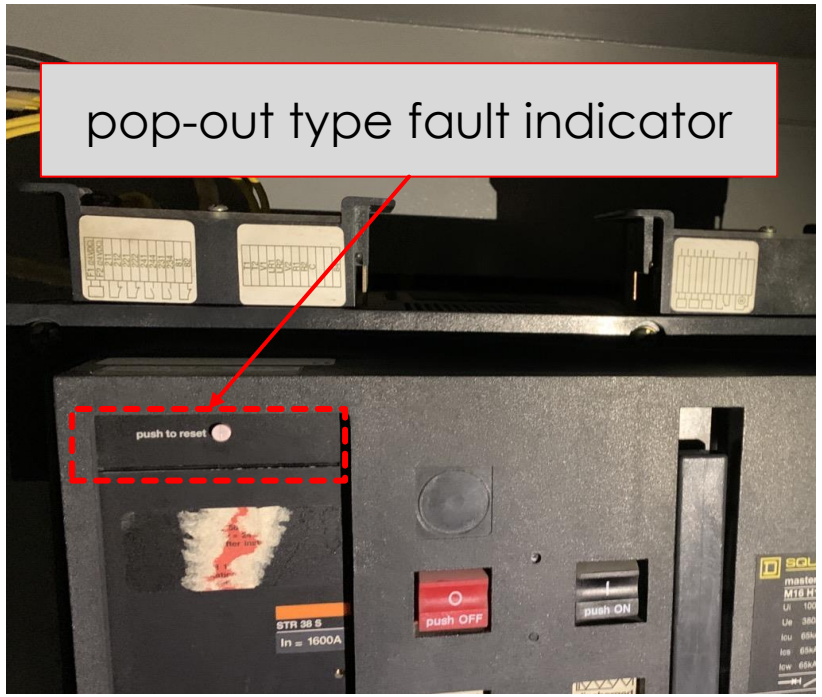
Current protection
- Long time
- Short time
- Instantaneous
- Ground fault

Power supply 24VDC for Trip unit:
Generac AD 240 A VM Relay 200/240 VAC

Without UVR (under voltage release), Shut trip ,voltage protection motor mechanism, and auxiliary contacts.

Inspection ACB at MDB

- Pop-out type fault indicator when ACB trip.



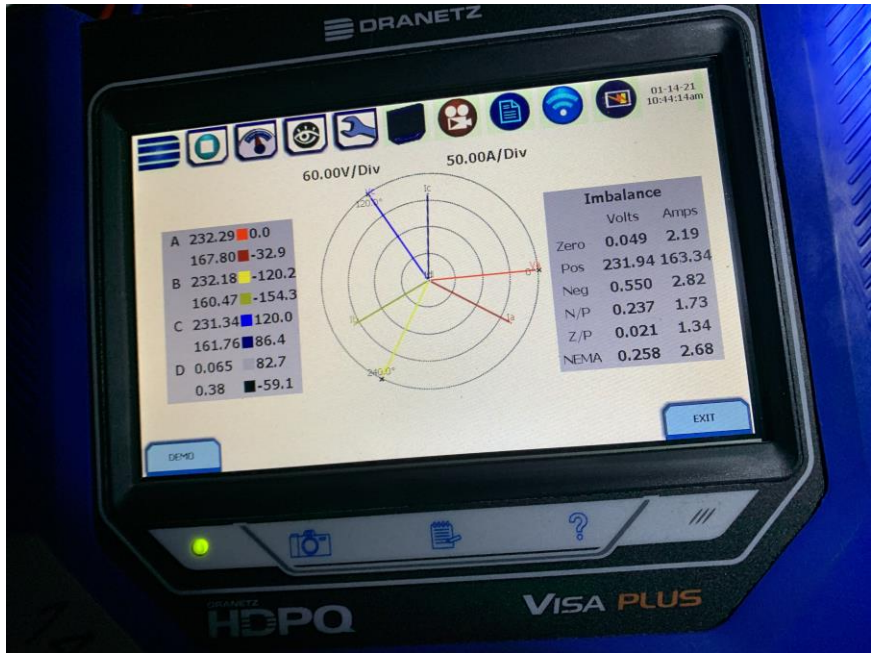
Normal situation

Current fault situation

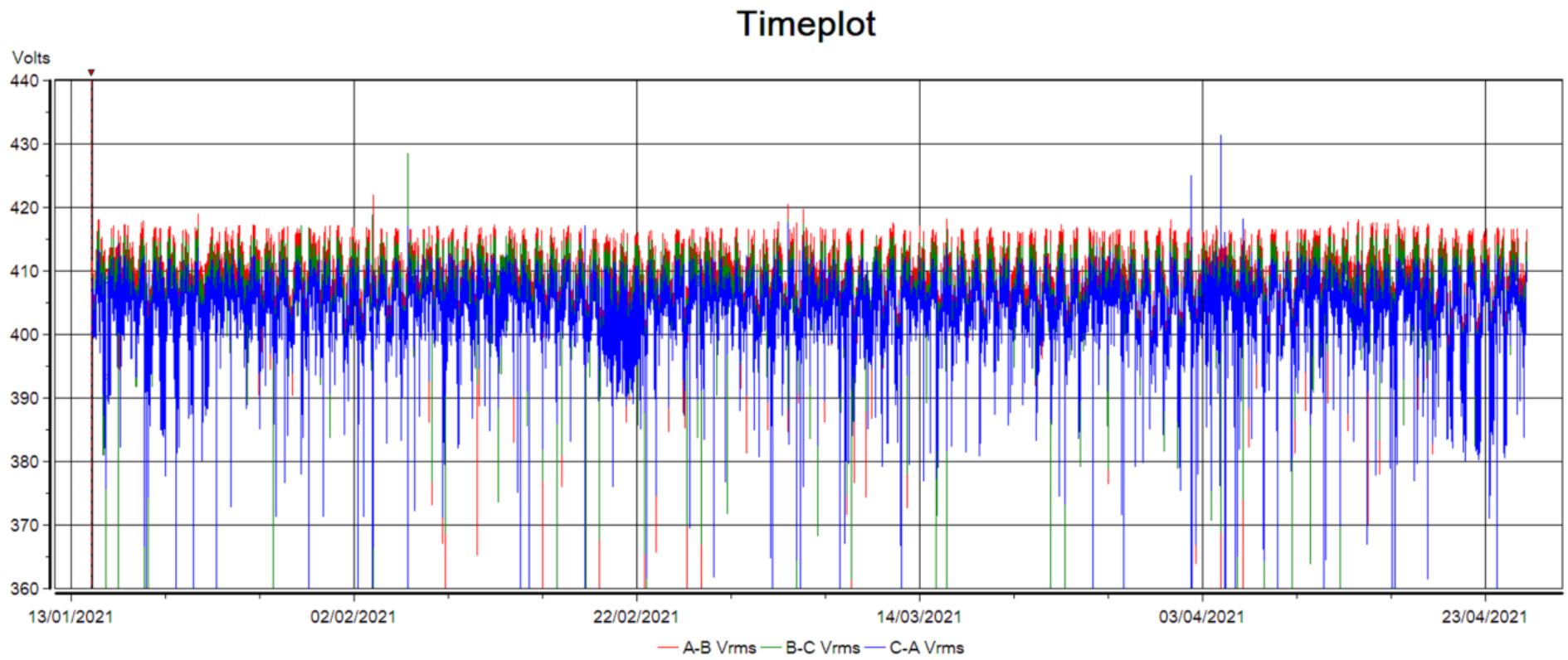
Assume that ACB detect current fault. Due to the fault indicator was display.

Install power quality meter (Dranetz)

- Install power quality meter during 14 Jan to 24 Apr 2021

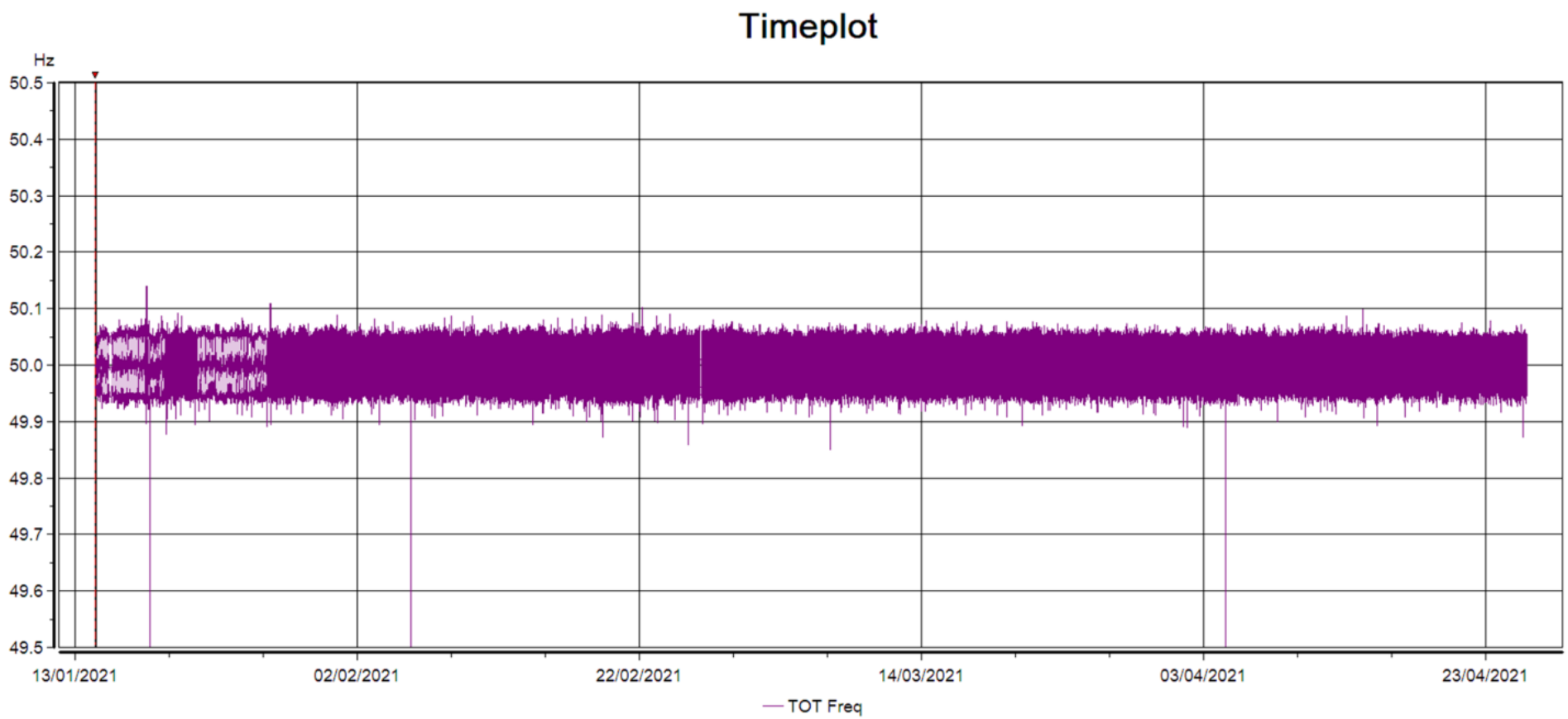


Voltage



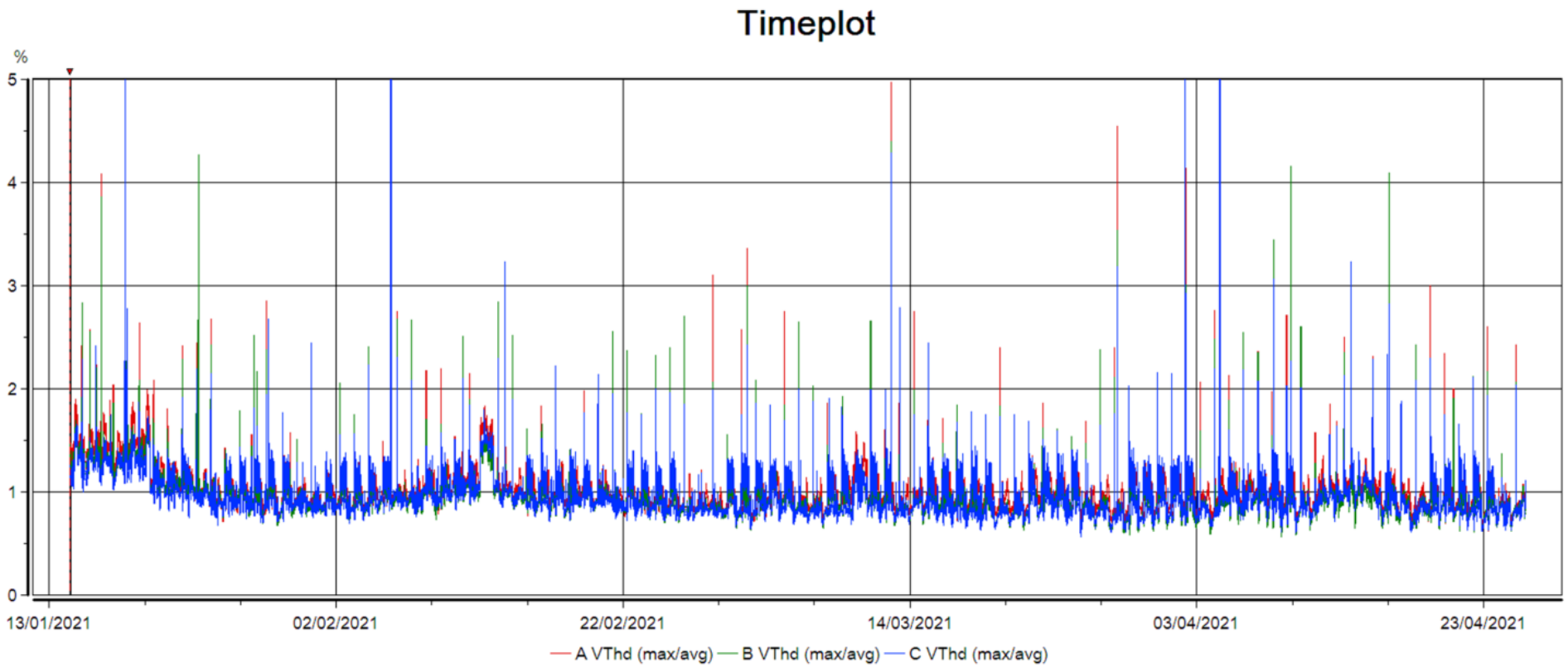
	Min	Max	Avg	95%
A-BVrms	0.1172	422.4	409.1	414.5
B-CVrms	0.07783	428.5	407.3	412.6
C-AVrms	0.07722	431.4	405.0	409.7

Frequency



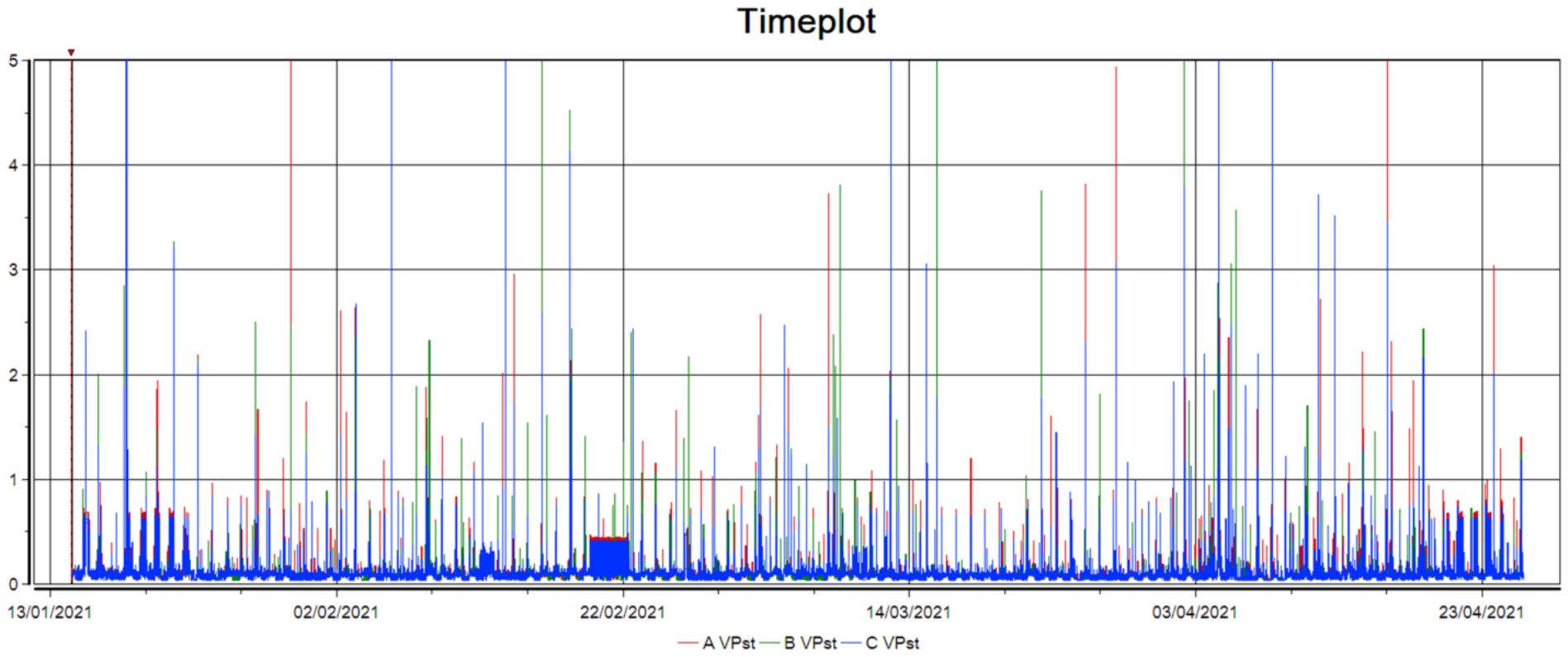
	Min	Max	Avg	99%
TOTFreq	36.04	50.14	50.00	50.05

Total Harmonics Distortion THD_v



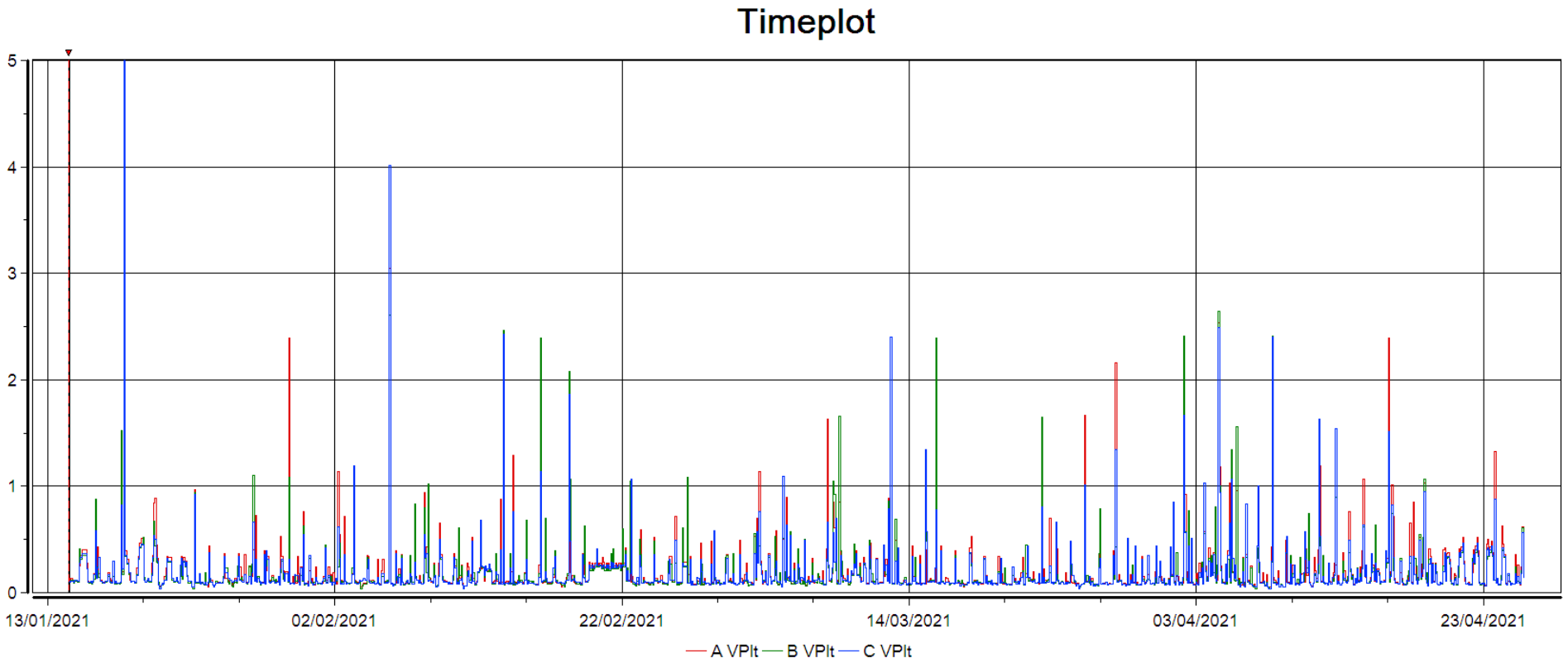
	Min	Max	Avg	95%
AVThd	0.6186	503.9	1.039	1.341
BVThd	0.5664	347.1	0.9520	1.243
CVThd	0.5689	202.2	0.9115	1.192

Voltage Short-term Flicker



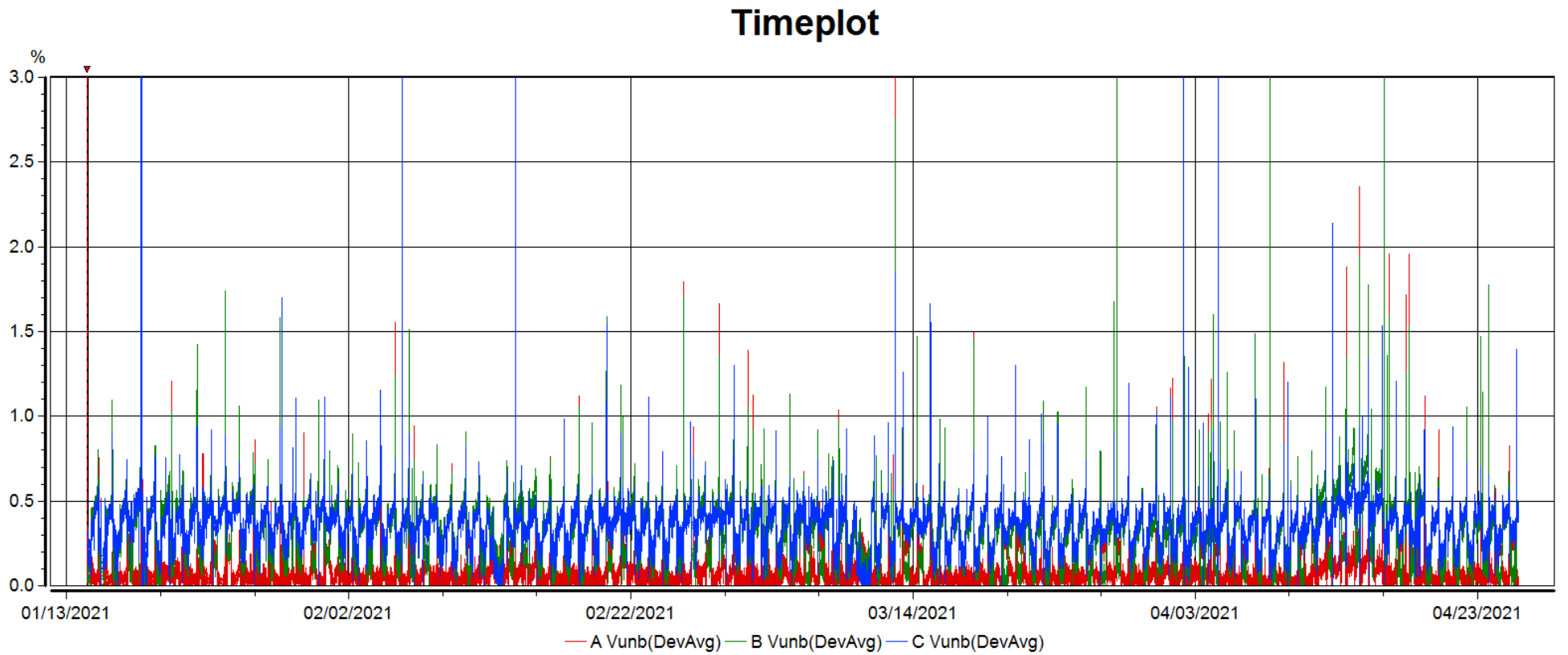
	Min	Max	Avg	95%
AVPst	0.04001	22.46	0.1316	0.3102
BVPst	0.04006	22.10	0.1232	0.2804
CVPst	0.03988	21.63	0.1225	0.2900

Voltage Long-term Flicker



	Min	Max	Avg	95%
AVPlt	0.04979	13.06	0.2077	0.5502
BVPlt	0.03994	12.91	0.1940	0.5600
CVPlt	0.03984	12.50	0.1885	0.5102

Voltage Unbalance

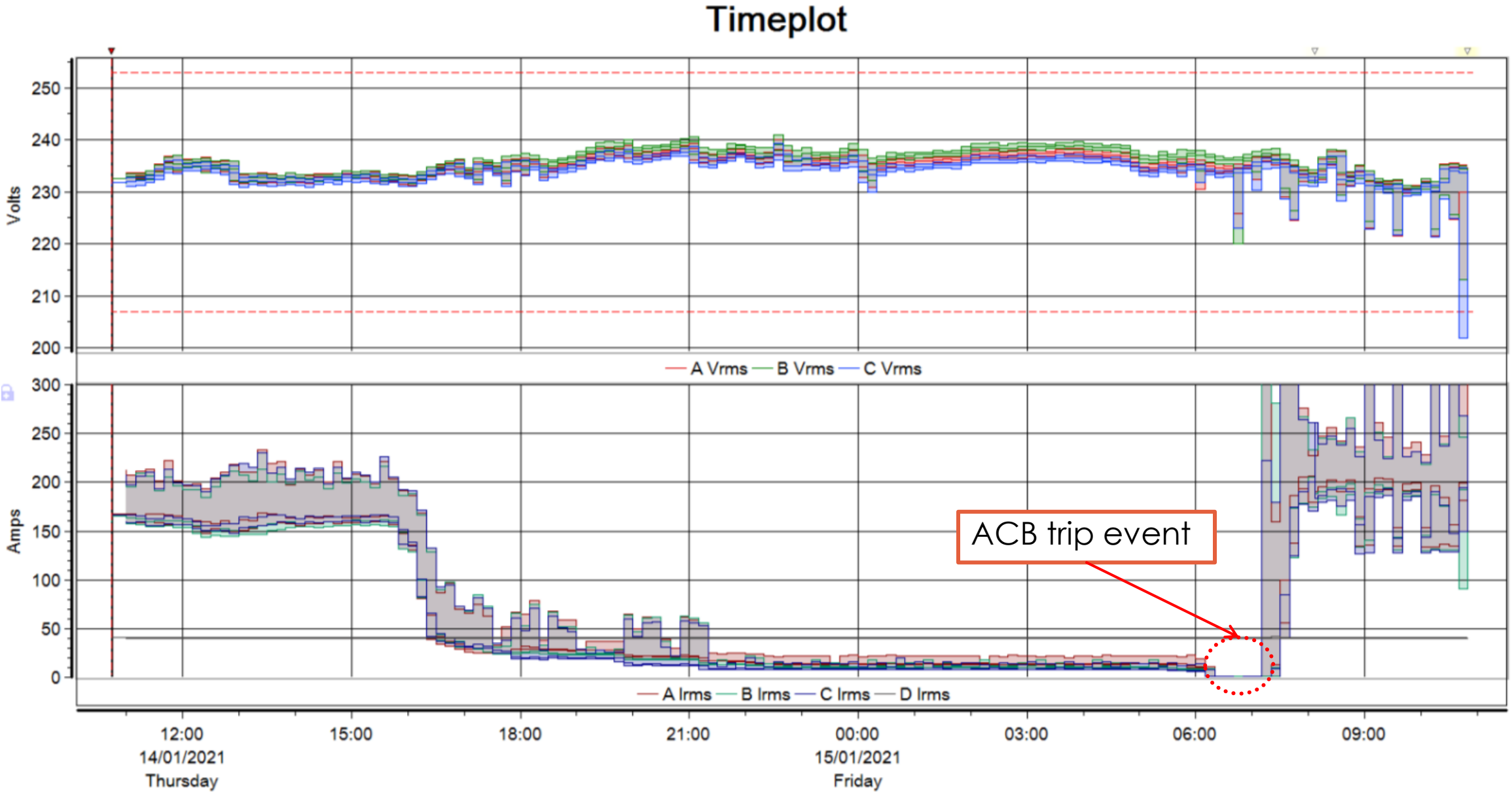


	Min	Max	Avg	95%
AVunb(DevAvg)	0.0	99.58	0.08256	0.2138
BVunb(DevAvg)	0.0	50.43	0.3250	0.5742
CVunb(DevAvg)	0.0	49.14	0.3525	0.5018

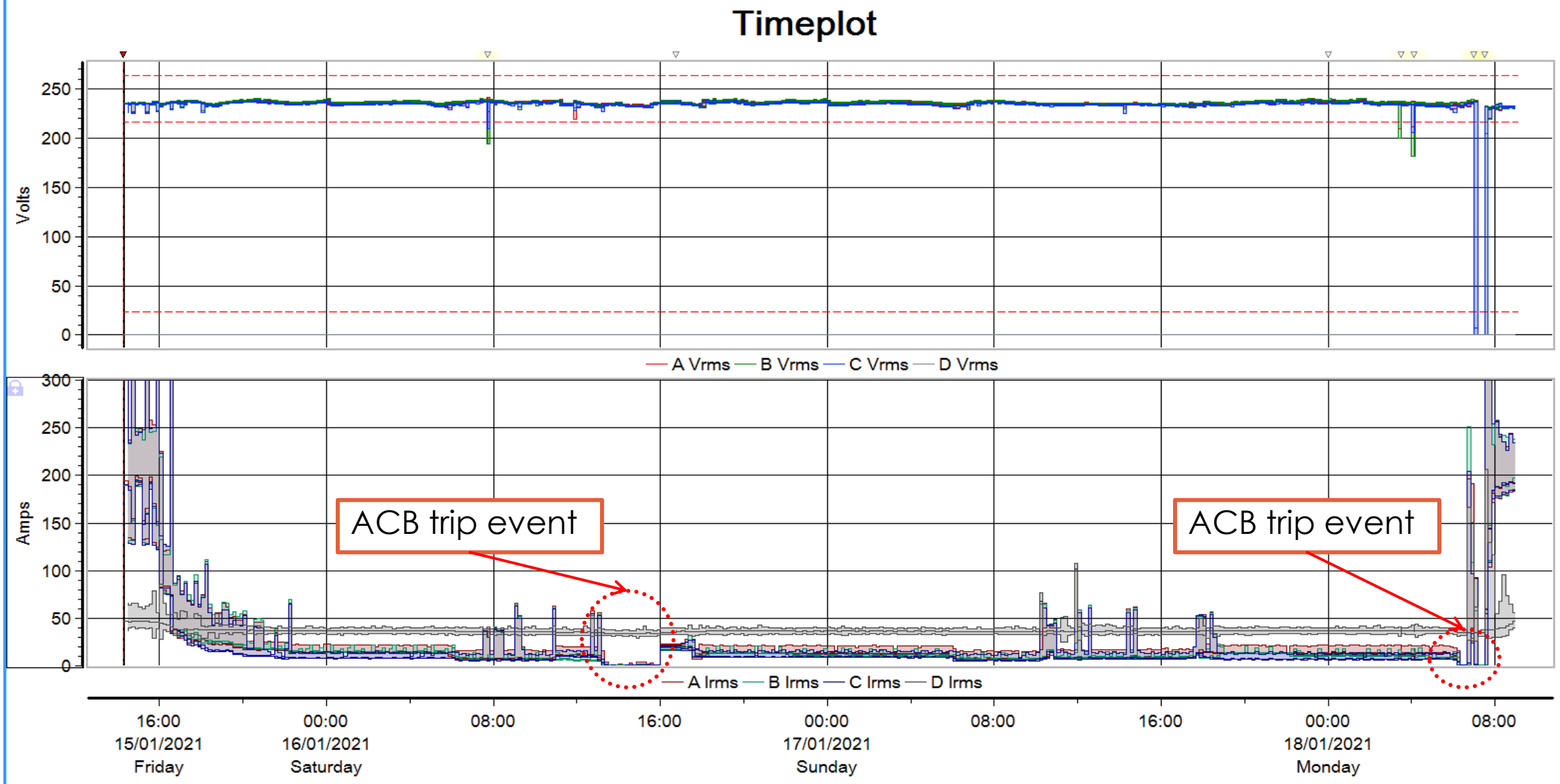
Power quality evaluation

Standard EN50160	Range	Result and evaluation
1. Voltage	342 – 418 V	Pass
2. Frequency	49.5 – 50.5 Hz	Pass
3. Voltage Distortion	$\%THD_v \leq 5\%$	Pass
4. Flicker	$P_{st} \leq 1.0$	Pass
	$P_{lt} \leq 0.8$	Pass
5. Voltage Unbalance	$\%V_{unb} \leq 2.0$	Pass

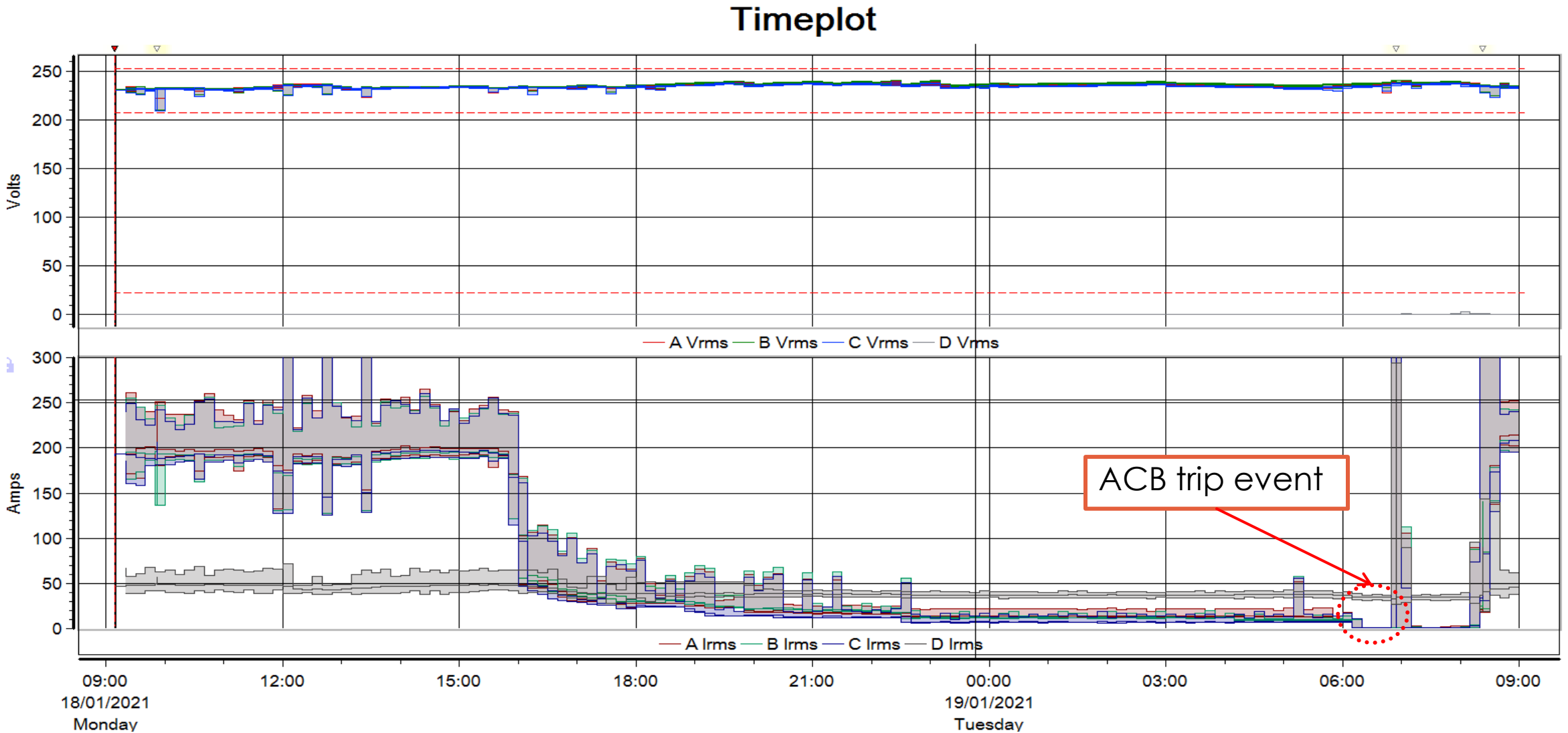
Trip event analysis: current Fault



Trip event analysis: current Fault



Trip event analysis: current Fault



The trip unit: LSIG setting

<u>Trip unit</u>:
STR 38S (Isig)

Current protection setting
- (Ir): setting 1600 A
- (Im): setting 9600 A
- (I): setting off
- (Ih): setting 320 A

The trip unit: LSIG testing results

AIR CIRCUIT BREAKER REPORT

Date : 30/10/2564 Project Name :

Plant : el Name : MDB PANEL

Rate Current : 1600 A ACB Type : M16H1 Serial No. : C36330101 Relay Type STR38S

Manufacture : SQUARE D Interruping Capacity : 65 KA. Pole : 3

☑ ACB Fiexed Type ☐ ACB Draw Type

ACCESSORIES

Undervoltage release	Closing release	Shunt release	Motor drive
-	-	-	-

Relay Setting

Ir : 1 Io : 1 tr : - Sec

Isd : 6 tsd : 0.3 Sec ☑ On ☐ Off

Ii : -

Ig : 0.6 tIg : 0.3 Sec ☑ On ☐ Off

General Inspection :

- Cleaning and Inspestion :	Normal	-	
- Re-tightening torque :	Normal	-	
- Grounding checked :	Normal	-	
- Machanism checked :	-	Abnormal	MECHANIC PART ไม่ทำงาน
- Mounting and conductor connection checked :	-	Abnormal	มีการถอดสายค่าสั่งชุดตัดการทำงานออก
- Cable and wiring checked :	Normal	-	
- Arc chute checked :	Normal	-	
- LV.Auxiliaries plug checked :	Normal	-	

Relay testing :

	Current test (A)	Tiping time (S)	Time Cure (S)	Status
Long time	600	145	-	FAIL
Short time	800	0.54	0.08 - 0.12	Pass
Instaneous	OFF	OFF	OFF	OFF
Groung fualt	100	0.38	0.16 - 0.24	Pass

Contact resistance testing :

Status relay tasting:

Long time : **FAIL**

Short time : **Pass**

Instantaneous : OFF

Ground fault : **Pass**

Solution

Safety first : KYT

New ACB: manufacture Schneider
model Masterpact NW16H1
1600 AT
Fixed type
Trip unit Micrologic 6.0 E

Additional : Phase Protection
Model : W-PR3,
UVR (under voltage release)

Summary

- The preventive maintenance of electrical equipment is very necessary, such as the ACB equipment above, has been in use for 20 years that probably a malfunction with unit trip.
- We should replace the ACB before its life expectancy to avoid a power outage. Because there is very difficult to find spare parts in time, and it will result in power outages for a long time.
- The ACB replacement period is 4-6 hours, requiring us to have the power outage at least for a period of time. Because you have to modify the busbar in order to install a new ACB.
- Voltage protection or Phase protection should be installed in combination with UVR and time-delay to prevent abnormal voltage events. Thus, ACB trips are possible to prevent damage to electrical equipment in the building and there over heat in some electrical equipment. This could result in a fire.

Thank you for your attention

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