

**TESTING FOR THE VERIFICATION OF
COMPLIANCE OF PV INVERTER WITH :
UNE 206007-1 IN: 2013, REQUISITOS DE CONEXIÓN
A LA RED ELÉCTRICA.
PARTE 1: INVERSORES PARA CONEXIÓN A LA
RED DE DISTRIBUCIÓN
(MAYO 2013)**

Protocol. PE.T-LE-62

Test Report Number : 2220 / 0293
 Type..... : Hybrid Inverter
 Tested Model : HYD 15KTL-3PH
 Variants Models : HYD 5KTL-3PH, HYD 6KTL-3PH, HYD 8KTL-3PH,
 HYD 10KTL-3PH, HYD 20KTL-3PH

APPLICANT

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 Hired by..... : Shenzhen SOFAR SOLAR Co., Ltd.
 Address : 401, Building 4, AnTongDa Industrial Park, District 68,
 XingDong Community, XinAn Street, BaoAn District,
 Shenzhen City, Guangdong Province, P.R. China

TESTING LABORATORY

Name..... : SGS Tecnos, S.A. (Electrical Testing Laboratory)
 Address : C/ Trespaderne, 29 - Edificio Barajas 1
 28042 Madrid (Spain)

Conducted (tested) by..... : Roger Hu
 (Project Engineer)



Reviewed & Approved by..... : Jacobo Tevar
 (Technical Reviewer)

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Test Report Historical Revision:

Test Report Version	Date	Resume
2220 / 0293	23/09/2020	First issuance

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1 SCOPE

SGS Tecnos, S.A. (Electrical Testing Laboratory) has been contracted by SGS Tecnos, S.A. (Certification body), in order to perform the testing according the following standard: "UNE 206007-1 IN, Requisitos de conexión a la red eléctrica. Parte 1: Inversores para conexión a la red de distribución" (mayo 2013).

2 GENERAL INFORMATION

2.1 Testing Period and Climatic conditions


The necessary testing has been performed along between 3rd June and 26th August of 2020

All the tests and checks have been performed in accordance with the reference Standard (the tests were done at $\approx 25\text{ }^{\circ}\text{C}$).

SITE TEST

Name: Shenzhen SOFAR SOLAR Co., Ltd.
 Address.....: 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China

2.2 Equipment under Testing

Apparatus type: Hybrid Inverter
 Installation.....: Fixed (permanent connection)
 Manufacturer/ Supplier/ Installer: Shenzhen SOFAR SOLAR Co., Ltd.
 Trade mark: 
 Model/ Type: HYD 15KTL-3PH
 Serial Number.....: SP1ES015L86139
 Serial Number ESE: SP1ES015L86140
 Software Version: V2.00
 Rated Characteristics: PV input: 180~960V_{mppt} (350~850V_{mpp} with full power), Max.25A/25A, Max.PV I_{sc} 30A/30A;
 Battery side: 180-800Vdc, 25/25Ad.c. Maximum for both charging and discharging.
 AC output (On-grid): 3/N/PE 230/400Va.c, 50Hz, 21.7A_{rated} (*) (24A_{max}) to grid, 15KW_{rated} (16.5KVA_{max})
 AC output (Back-up): 3/N/PE 230/400Va.c, 50Hz, 24A_{max}, 16.5KVA_{max}
 (*) *The rated output current is calculated using rated voltage and rated power.*

Date of manufacturing: 2020

Test item particulars

Input.....: PV, AC and Batteries
 Output.....: 3~N/PE
 Class of protection against electric shock ...: Class I
 Degree of protection against moisture: IP 65
 Type of connection to the main supply: Three phase – Fixed installation
 Cooling group: Fans:(Model HYD 20KTL-3PH, HYD 15KTL-3PH, HYD 10KTL-3PH);
 Heatsink:(Model HYD 8KTL-3PH, HYD 6KTL-3PH, HYD 5KTL-3PH)
 Modular.....: No
 Internal Transformer: No

Copy of marking plate (representative):

 Hybrid Inverter	
Model No:	HYD 15KTL-3PH
Max. DC Voltage	1000V
MPPT Voltage Range	180~960V
Max. Input Current	25/25A
Max. PV Isc	30/30A
Battery Type	Li-Ion
Battery Voltage Range	180~800V
Battery Max. Charging Current	25/25A
Battery Max. Discharging Current	25/25A
Nominal Grid/Back-up Voltage	3/N/PE, 380/400V
Nominal Grid/Back-up Frequency	50/60Hz
Max. Current Output to Grid	24A
Max. Power Output to Grid	16500VA
Max. Current from Grid	44A
Max. Power from Grid	30000VA
Back-up Max. Output Current	24A
Back-up Max. Output Power	16500VA
Power Factor	1 (adjustable +/- 0.8)
Operating Temperature Range	-30~+60°C
Ingress Protection	IP65
Protective Class	Class I
Inverter Topology	Non-isolated
Overvoltage Category	AC III, DC II
Manufacturer : Shenzhen SOFAR SOLAR Co., Ltd. Address : 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China	
SAA VDE0126-1-1, VDE-AR-N4105 G98, G99, EN50438, AS4777, UTE C15-712-1	

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation
3. Labels of other models are as the same with **HYD 15KTL-3PH's** except the parameters of rating.

Tested model:

- HYD 15KTL-3PH

The variants models are:

- HYD 5KTL-3PH
- HYD 6KTL-3PH
- HYD 8KTL-3PH
- HYD 10KTL-3PH
- HYD 20KTL-3PH

The variants models have been included in this test report without tests because the following features don't change regarding to the tested model:

- Same connection system and hardware topology
- Same control algorithm.
- Output power within 1/√10 and 2 times of the rated output power of the EUT or Modular inverters.
- Same Firmware Version

The parameter of each model as following:

Model	HYD 5KTL-3PH	HYD 6KTL-3PH	HYD 8KTL-3PH
PV String Input Data			
Recommended Max.PV power	7.5KW	9KW	12KW
Max. DC voltage	1000V		
Start-up operating voltage	200V		
MPPT voltage range	180V~960V		
Full power MPPT voltage range	250V~850V	320V~850V	360V~850V
Nominal DC voltage	600V		
No. of MPP trackers	2		
No. of strings per MPP tracker	1	1	1
Max. input current	12.5A/12.5A	12.5A/12.5A	12.5A/12.5A
Max. short current	15A/15A	15A/15A	15A/15A
Battery Input Data			
No. of battery input	1	1	1
Battery voltage range	180V~800V		
Battery voltage range for full load	200V~800V	240V~800V	320V~800V
Nominal charging/discharging power	5000W	6000W	8000W
Max. charging/discharging current	25A	25A	25A
AC Output Data (On-grid)			
Nominal grid voltage	3/N/PE, 230/400Vac		
Nominal grid frequency	50Hz		
Nominal AC power	5KW	6KW	8KW
Max. AC power output to utility grid	5.5KVA	6.6KVA	8.8KVA
Max. AC power from utility grid	10KVA	12KVA	16KVA
Max. AC current output to utility grid	8A	10A	13A
Rated. AC current output to utility grid	7.2A	8.7A	11.6A
Max. AC Current from utility grid	15A	17A	24A
Output power factor	~1(0.8 leading to 0.8 lagging)		
AC Output Data (Back-up)			
Nominal grid voltage	3/N/PE, 230/400Vac		
Nominal grid frequency	50Hz		
Nominal output power	5KW	6KW	8KW
Max. output power	5.5KVA	6.6KVA	8.8KVA
Max. output current	8A	10A	13A

Output power factor	~1(0.8 leading to 0.8 lagging)
Feature	
Operating temperature range	-30°C~60°C
Protection degree	IP65
Protective class	Class I
Cooling method	Heat sink

Model	HYD 10KTL-3PH	HYD 15KTL-3PH	HYD 20KTL-3PH
PV String Input Data			
Recommended Max.PV power	15KW	22.5KW	30KW
Max. DC voltage	1000V		
Start-up operating voltage	200V		
MPPT voltage range	180V~960V		
Full power MPPT voltage range	220V~850V	350V~850V	450V~850V
Nominal DC voltage	600V		
No. of MPP trackers	2		
No. of strings per MPP tracker	2	2	2
Max. input current	25A/25A	25A/25A	25A/25A
Max. short current	30A/30A	30A/30A	30A/30A
Battery Input Data			
No. of battery input	2	2	2
Battery voltage range	180V~800V		
Battery voltage range for full load	200V~800V	300V~800V	400V~800V
Nominal charging/discharging power	10000W	15000W	20000W
Max. charging/discharging current	50A(25A/25A)	50A(25A/25A)	50A(25A/25A)
AC Output Data (On-grid)			
Nominal grid voltage	3/N/PE, 230/400Vac		
Nominal grid frequency	50Hz		
Nominal AC power	10KW	15KW	20KW
Max. AC power output to utility grid	11KVA	16.5KVA	22KVA
Max. AC power from utility grid	20KVA	30KVA	40KVA
Max. AC current output to utility grid	16A	24A	32A
Rated. AC current output to utility grid	14.5A	21.7A	29A
Max. AC Current from utility grid	29A	44A	58A
Output power factor	~1(0.8 leading to 0.8 lagging)		
AC Output Data (Back-up)			
Nominal grid voltage	3/N/PE, 230/400Vac		
Nominal grid frequency	50Hz		
Nominal output power	10KW	15KW	20KW
Max. output power	11KVA	16.5KVA	22KVA
Max. output current	16A	24A	32A
Output power factor	~1(0.8 leading to 0.8 lagging)		
Feature			
Operating temperature range	-30°C~60°C		
Protection degree	IP65		
Protective class	Class I		
Cooling method	Fan		

The results obtained apply only to the particular sample tested that is the subject of the present test report. The most unfavorable result values of the verifications and tests performed are contained herein. Throughout this report a point (comma) is used as the decimal separator.

The values presented in the following table have been used for calculation of referenced values (p.u.; %) though the report if not otherwise indicated.

Reference Values	
Rated power, P_n in W	15000
Rated apparent power, S_n in VA	15000
Maximum apparent power, S_{max} in VA	16500
Rated wind speed (only WT), v_n in m/s	N/A
Rated current (determined), I_n in A	21.7
Rated output voltage, (phase to phase) U_n in Vac	230/400
Note: In this report p.u. values are calculated as follows: -For Active & Reactive Power p.u. values, are referenced to P_n . -For Currents p.u. values, the reference is always I_n . -For Voltages p.u. values, the reference is always U_n .	

2.3 Test Equipment List

From	No.	Equipment Name	Model No./ Manufacturer	Equipment No.	Calibration Date	Equipment calibration due date
Sofar solar	1	Digital oscilloscope	DSOX3014A / KEYSIGHT	MY58491772	2020/01/14	2021/01/13
	2	Digital oscilloscope	Tektronix / MD03024	C055210	2020/04/24	2021/04/23
	3	Voltage probe	SI-9110 / SANTINT	111152	2020/01/14	2021/01/13
	4	Voltage probe	SI-9110 / SANTINT	152627	2020/01/14	2021/01/13
	5	Voltage probe	SI-9110 / SANTINT	111134	2020/01/14	2021/01/13
	6	Current probe	CP1000A / CYBERTEK	C181000922	2020/01/14	2021/01/13
	7	Current probe	CP1000A / CYBERTEK	C181000925	2020/01/14	2021/01/13
	8	Current probe	CP1000A / CYBERTEK	C181000929	2020/01/14	2021/01/13
	9	Power analyzer	PA5000H / ZLG	C8202909082 002110001	2020/03/02	2021/03/01
	10	Power analyzer	PA3000 / ZLG	PA3005- P0005-1246	2020/01/14	2021/01/13
	11	Temperature & Humidity meter	TH101B / Anymetre	ZB-WSDJ-001	2020/01/14	2021/01/13
	12	Temperature & Humidity Chamber	WHTH-150-40-880 / BRIGHTTEK	20171130001	2020/01/14	2021/01/13
	13	Data Logger	SIRIUSI-HS-4XIIV-4XLV / DEWEsoft	DB19100777	2020/03/04	2021/03/03
SGS	14	True RMS Multimeter	187 / Fluke	GZE012-8	2019/12/05	2020/12/04

2.4 Factory information

Manufacturer Name: Shenzhen SOFAR SOLAR Co., Ltd.
 Manufacturer Address: 401, Building 4, AnTongDa Industrial Park,
 District 68, XingDong Community, XinAn Street,
 BaoAn District, Shenzhen City, Guangdong
 Province, P.R. China

Factory Name: Dongguan SOFAR SOLAR Co., Ltd.
 Factory Address: 1F - 6F, Building E, No. 1 JinQi Road, Bihu
 Industrial Park, Wulian Village, Fenggang Town,
 Dongguan City, Guangdong Province, P.R. China.

2.5 Measurement Uncertainty

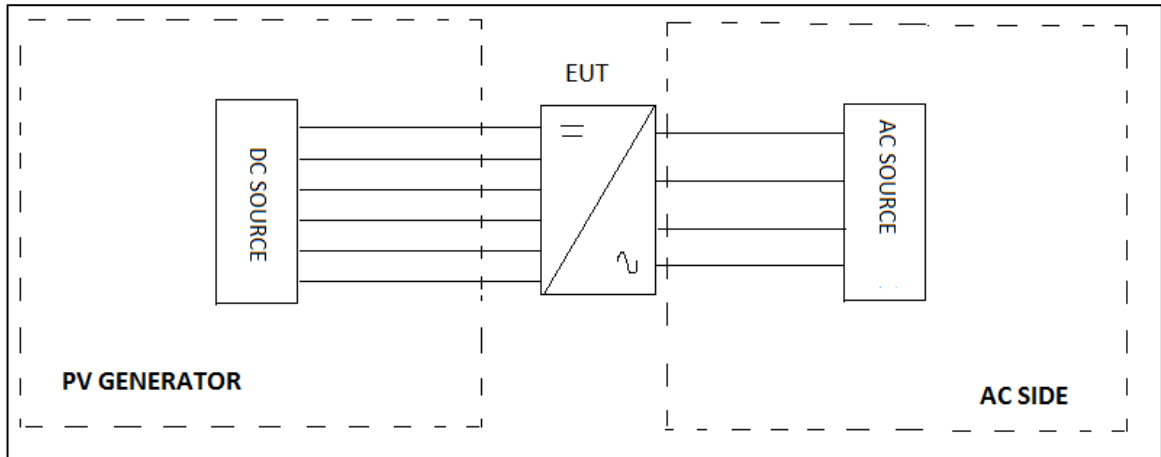
Magnitude	Uncertainty
Voltage measurement uncertainty	±1.5 %
Current measurement uncertainty	±2.0 %
Frequency measurement uncertainty	±0.2 %
Time measurement uncertainty	±0.2 %
Power measurement uncertainty	±2.5 %
Phase Angle	±1 °
cosφ	±0.01
Note1: Measurements uncertainties showed in this table are maximum allowable uncertainties. The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the solicitant. Note2: Where the standard requires lower uncertainties that those in this table. Most restrictive uncertainty has been considered.	

2.6 Definitions

ESE	Auxiliary inverter	P _n	Nominal Power
EUT	Equipment under testing	Q _f	Quality factor
I _n	Nominal Current	UF	Under frequency
OF	Over frequency	U _n	Nominal Voltage
OV	Over voltage	UV	Under voltage

2.7 Test set up.

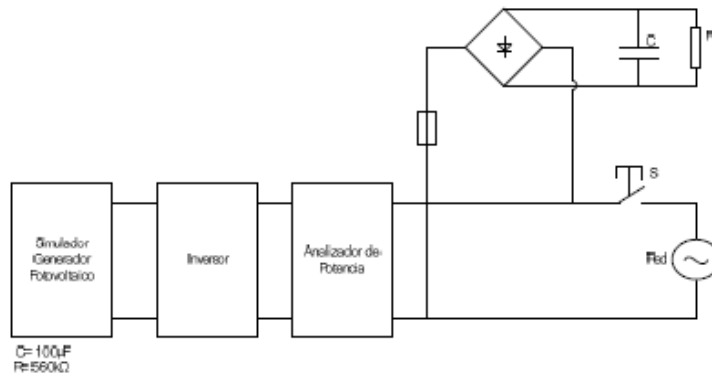
Below is the simplified construction of the test set up.



Current and voltage clamps have been connected to the inverter output for all the tests.

All the tests and checks have been performed in accordance with the reference Standard as specified previously. The used quality factor of resonant load was $Q_f=2$.

For overvoltage generation test, the following test set up has been done.



The test bench used includes:

EQUIPMENT	MARK / MODEL	RATED CHARACTERISTICS	OWNER / ID.CODE
AC source	Kwell / AFG-S-33800	Voltage: 0-600 V 600Kw	Sofar solar / EP-026
PV source	Kwell / TVS-630Kw	Voltage: 0 – 1000 V 630Kw	Sofar solar / EP-027
RLC load	Qunlin / ACLT3820H	68 kW, 68 kVAr	Sofarsolar / EP-029

3 RESUME OF TEST RESULTS

INTERPRETATION KEYS

- Test object does meet the requirement: **P** Pass
 Test object does not meet the requirement: **F** Fails
 Test case does not apply to the test object: **N/A** Not applicable
 To make a reference to a table or an annex.....: See additional sheet
 To indicate that the test has not been realized.: **N/R** Not realized

STANDARD SECTION	STANDARD REQUIREMENTS	
	UNE 206007-1 IN: 2013	
5	Technical requirements	
5.1	Limitation of the DC injection into the grid side	P
5.2	Requirements base on inverter isolation and array grounding	N/R (*)
5.3	Fault tolerance of residual current monitoring	N/R (*)
5.4	Frequency and Voltage trip limits and trip times	P
5.5	Self-reconnection	P
5.6	Unintentional islanding	P
5.7	Overvoltage generation	P
5.8	Grid quality	P
5.9	Reconnection out of synchronism	P

(*) The compliances with these requirements are stated in the following test reports:

- IEC 62109-2:2011: test report n° BL-DG2060127-B01 attachment 1 on 2020/07/02 which issued by Shenzhen BALUN Technology Co., Ltd.

Note: The declaration of conformity has been evaluated taking into account the IEC Guide 115.

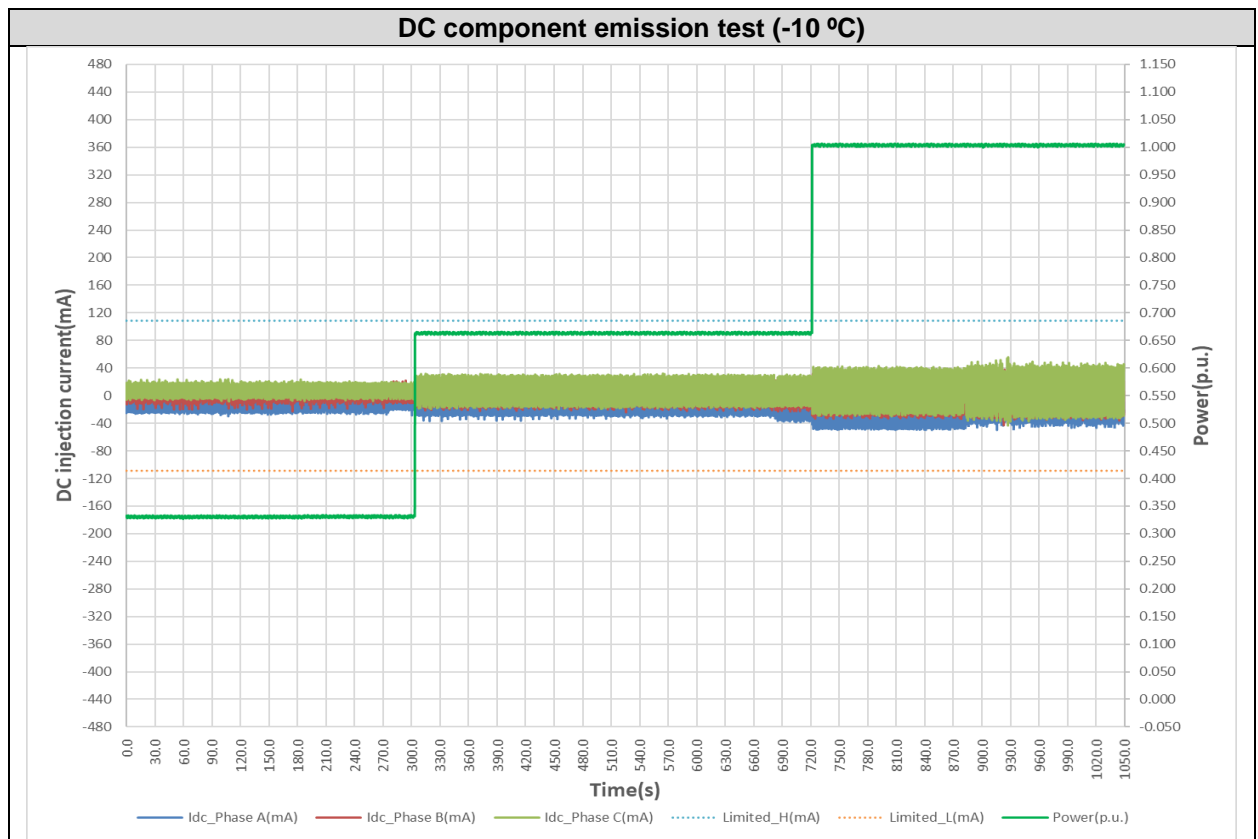
4 TEST RESULTS

4.1 LIMITATION OF DC INJECTION

The verification of DC component emission test has been measured according to the chapter 5.1 of the standard. DC current injection shall be $\leq 0.5 \%I_n$ which is 109mA.

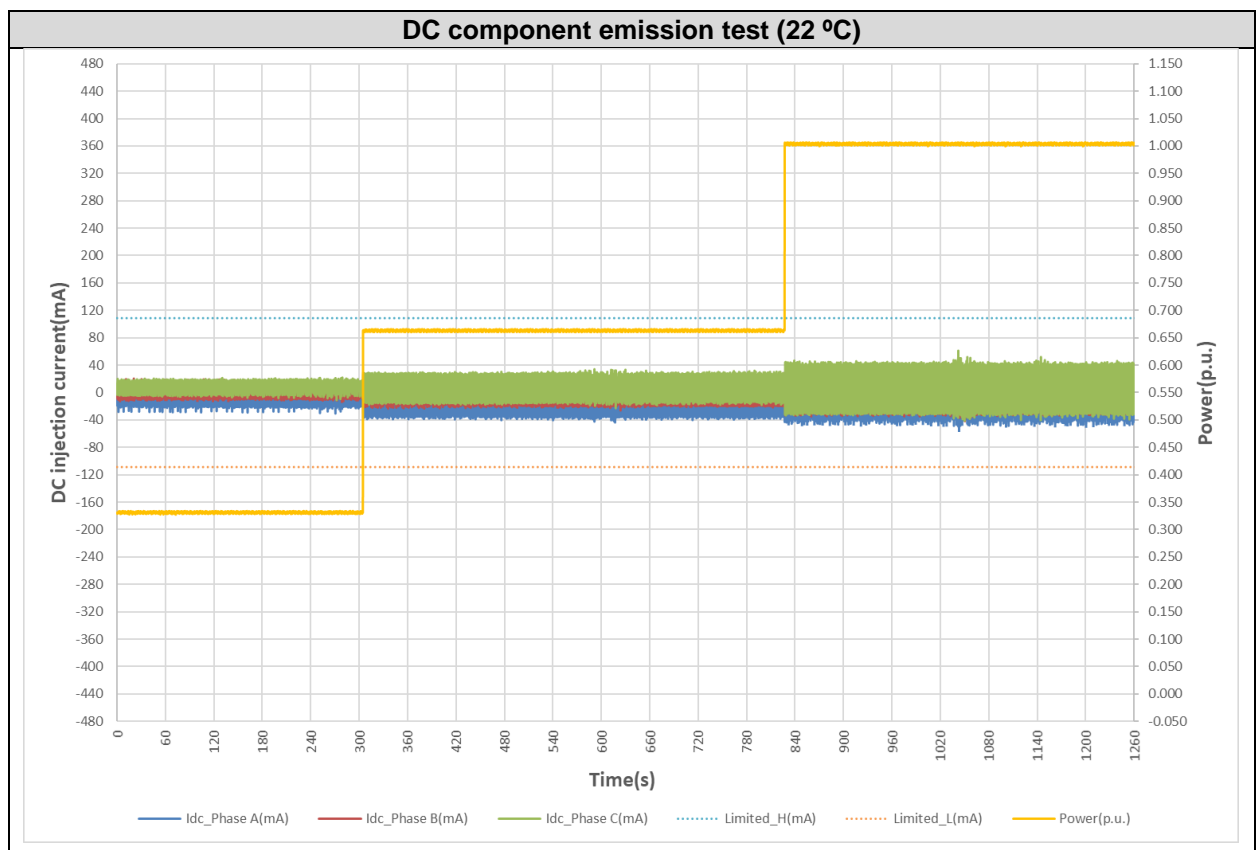
DC component emission test (-10 °C)			
Power Lever	Min ~ 33 %Pn	Medium ~ 66 % Pn	Max ~ 100 % Pn
Watt (W)	4961.5	9950.2	15060.0
Vrms (V)	230.2	230.4	230.6
Arms (A)	7.2	14.4	21.8
PF	0.999	0.999	1.000
Phase A			
d.c. (mA)	12	15	23
d.c. (%In) (*)	0.05	0.07	0.11
Phase B			
d.c. (mA)	5	11	18
d.c. (%In) (*)	0.02	0.05	0.08
Phase C			
d.c. (mA)	9	13	19
d.c. (%In) (*)	0.04	0.06	0.09

(*) The values obtained are in percentage with respect to the value of 21.7 A



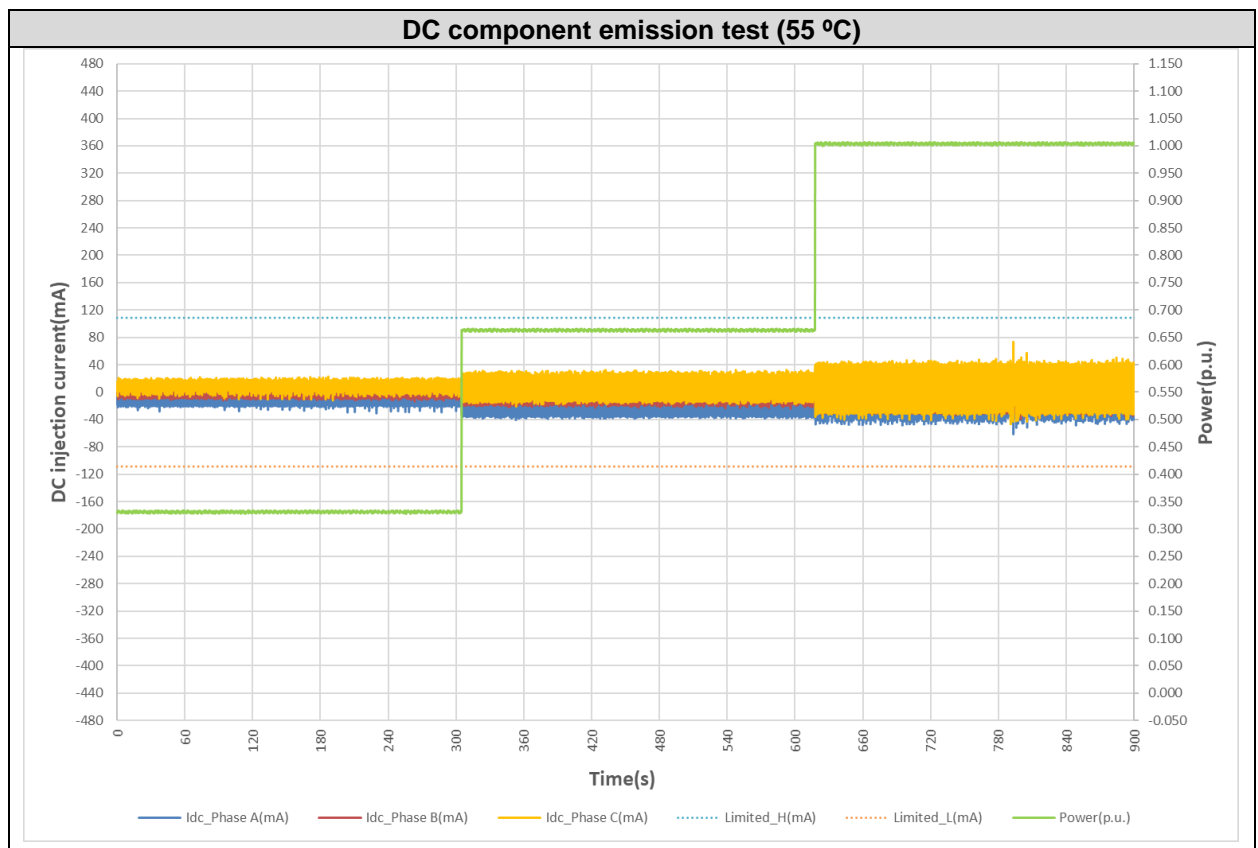
DC component emission test (22 °C)			
Power Lever	Min ~ 33 %	Medium ~ 66 %	Max ~ 100 %
Watt (W)	4967.4	9949.9	15060.7
Vrms (V)	230.2	230.4	231.0
Arms (A)	7.2	14.4	21.8
PF	0.999	0.999	1.000
Phase A			
d.c. (mA)	12	19	19
d.c. (%In) (*)	0.06	0.09	0.09
Phase B			
d.c. (mA)	6	11	20
d.c. (%In) (*)	0.03	0.05	0.09
Phase C			
d.c. (mA)	9	12	20
d.c. (%In) (*)	0.04	0.06	0.09

(*) The values obtained are in percentage with respect to the value of 21.7 A



DC component emission test (55 °C)			
Power Lever	Min ~ 33 %	Medium ~ 66 %	Max ~ 100 %
Watt (W)	4967.9	9949.8	15060.9
Vrms (V)	230.2	230.4	231.0
Arms (A)	7.2	14.4	21.8
PF	0.999	0.999	1.000
Phase A			
d.c. (mA)	12	19	20
d.c. (%In) (*)	0.06	0.09	0.09
Phase B			
d.c. (mA)	6	11	20
d.c. (%In) (*)	0.03	0.05	0.09
Phase C			
d.c. (mA)	9	12	20
d.c. (%In) (*)	0.04	0.06	0.09

(*) The values obtained are in percentage with respect to the value of 21.7 A



4.2 REQUIREMENTS BASE ON THE INVERTER ISOLATION AND ARRAY GROUNDING

According to chapter 5.2 the inverter should not start unless the resistance between ground and PV input terminal is higher than the required insulation resistance.

The compliances with these requirements are stated in section 4.8.2 of the following test report:

- IEC 62109-2:2011: test report n° BL-DG2060127-B01 attachment 1 on 2020/07/02 which issued by Shenzhen BALUN Technology Co., Ltd.

4.3 DETECTION OF RESIDUAL CURRENT MONITORING IN THE PV

This test is required according to the chapter 5.3 of the standard.

The compliances with these requirements are stated in section 4.8.3 of following test report:

- IEC 62109-2:2011: test report n° BL-DG2060127-B01 attachment 1 on 2020/07/02 which issued by Shenzhen BALUN Technology Co., Ltd.

4.4 FREQUENCY AND VOLTAGE TRIP LIMITS AND TRIP TIMES

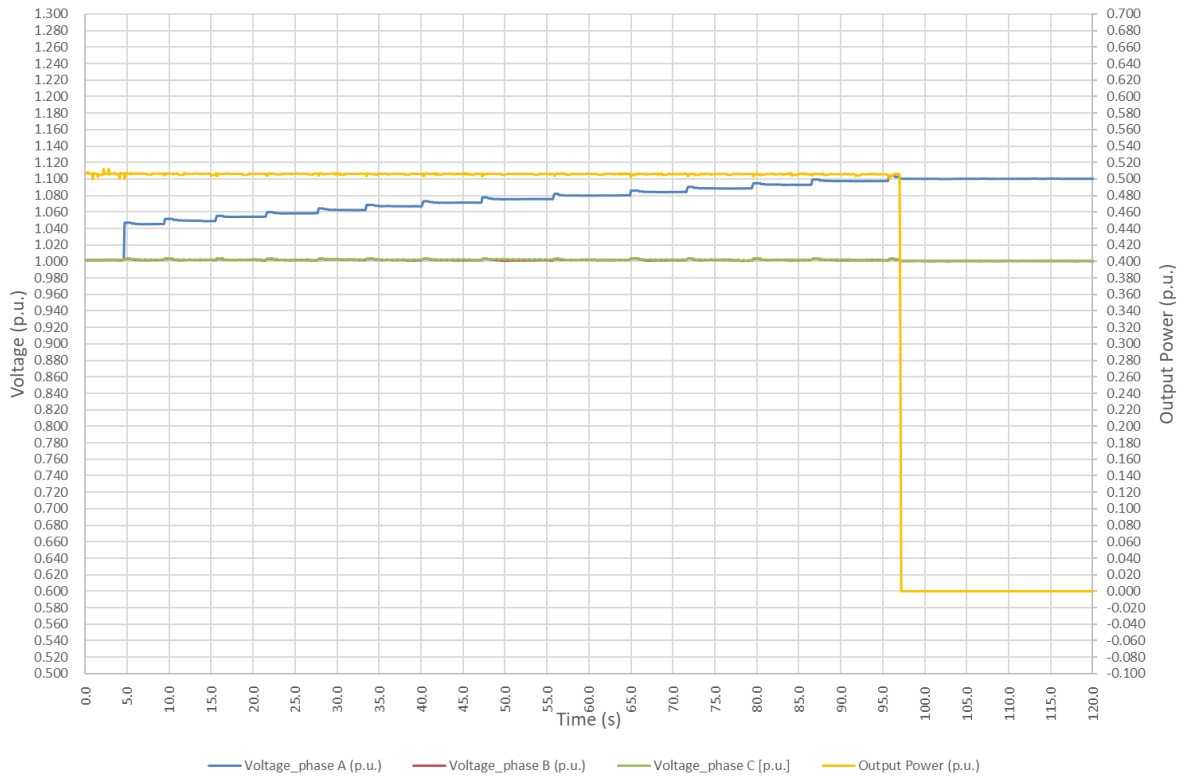
Abnormal conditions tests have been performed according to ranges and requirements stated in chapter 5.4 of the standard.

Thresholds stated in the Real Decreto 1699/2011 modified by RD 647: 2020 have been considered.

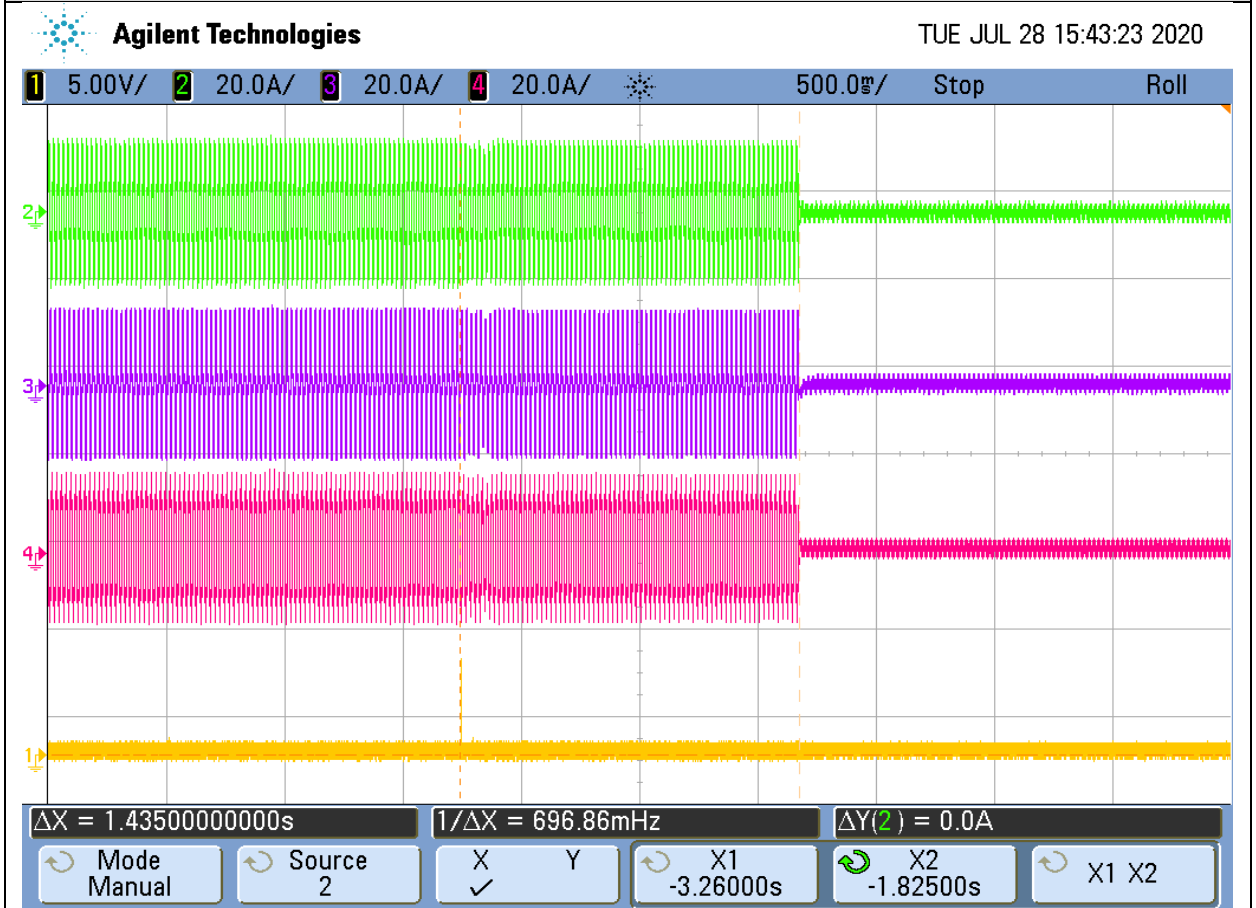
4.4.1 Voltage

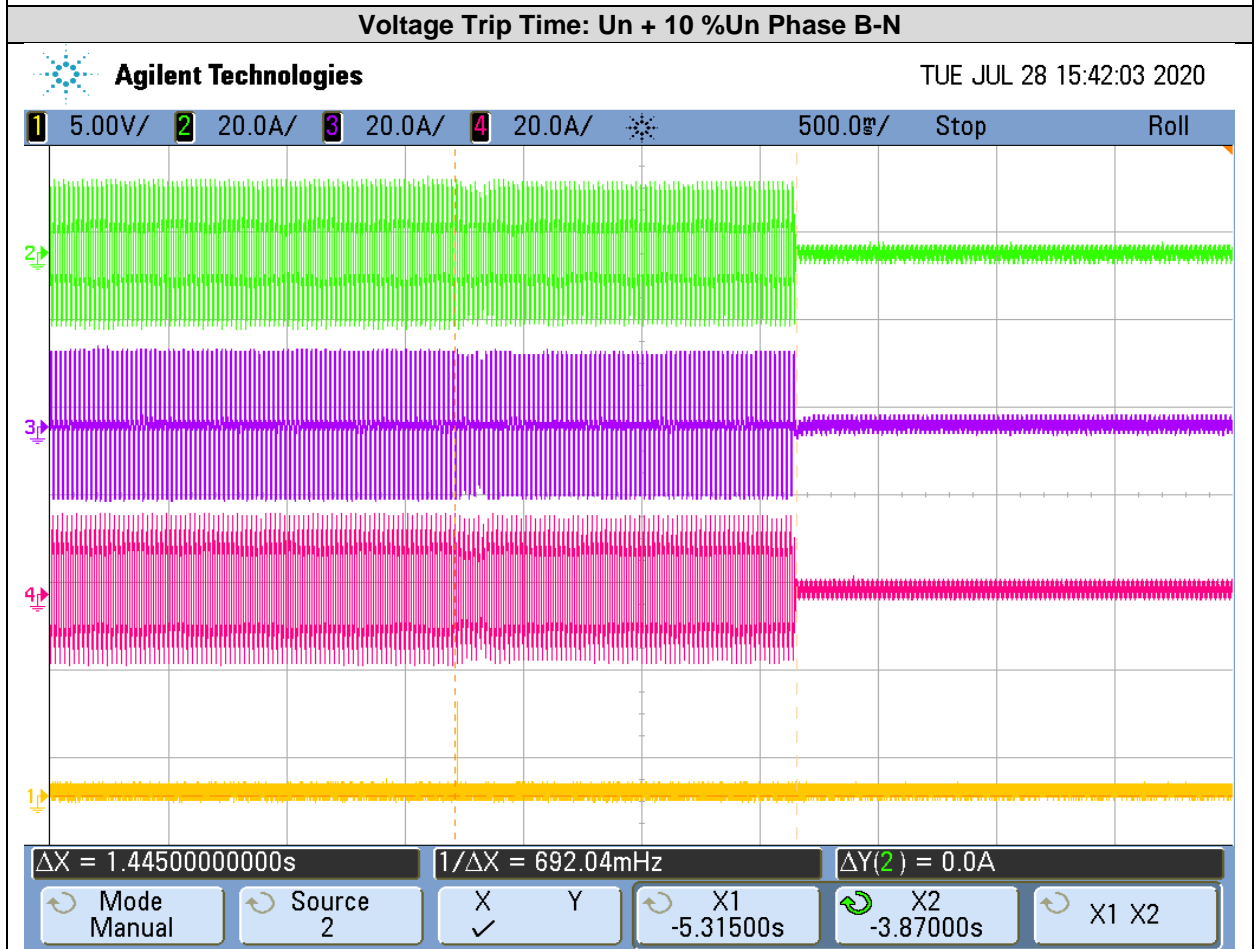
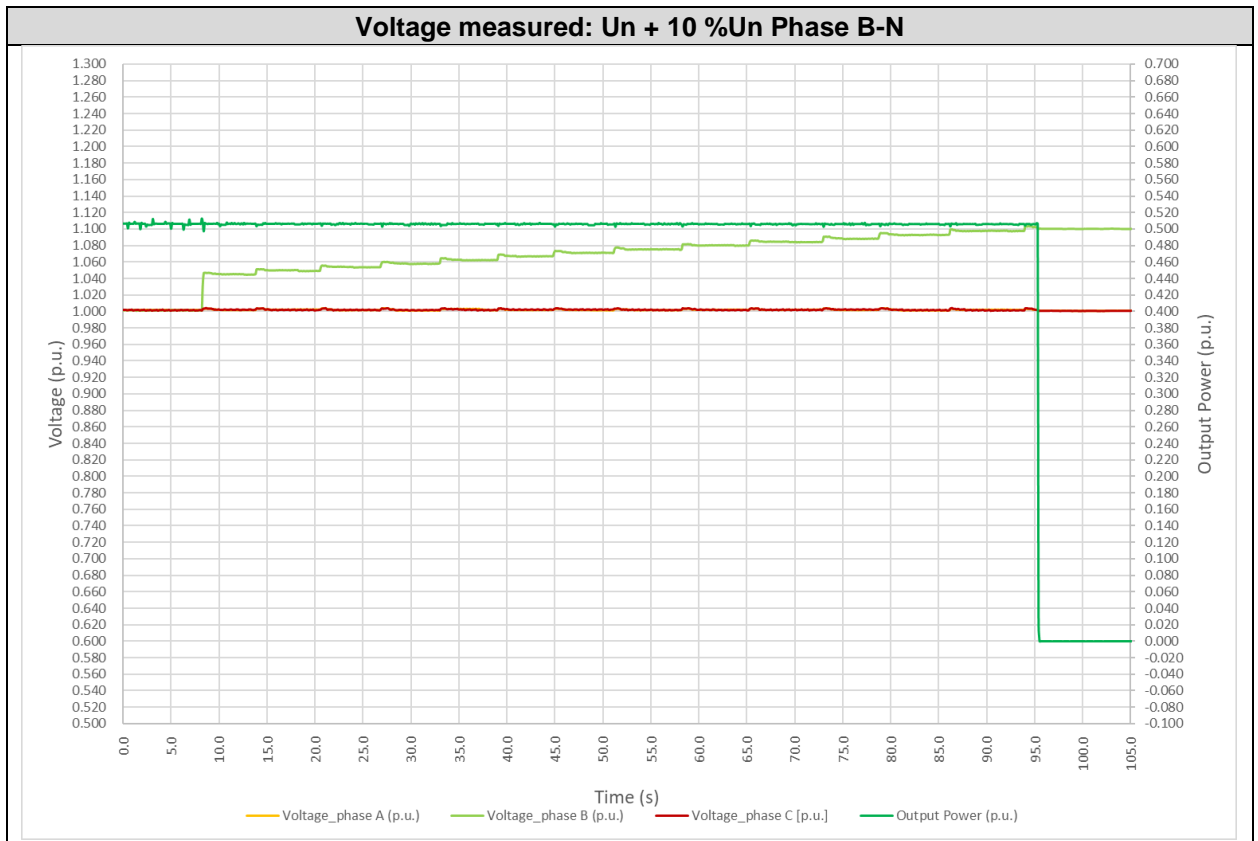
Setting Voltage	Measured Voltage (p.u.)	Disconnection time limits (s)	Disconnection time measured (s)	
Un + 10 %Un	1.102	1.5	Phase A-N	1.435
	1.103		Phase B-N	1.445
	1.102		Phase C-N	1.440
	1.103		Phase ABC-N	1.445
Un + 15 %Un	1.152	0.2	Phase A-N	0.193
	1.151		Phase B-N	0.194
	1.152		Phase C-N	0.185
	1.151		Phase ABC-N	0.192
Un – 15 %Un	0.847	1.5	Phase A-N	1.450
	0.849		Phase B-N	1.435
	0.847		Phase C-N	1.425
	0.847		Phase ABC-N	1.435

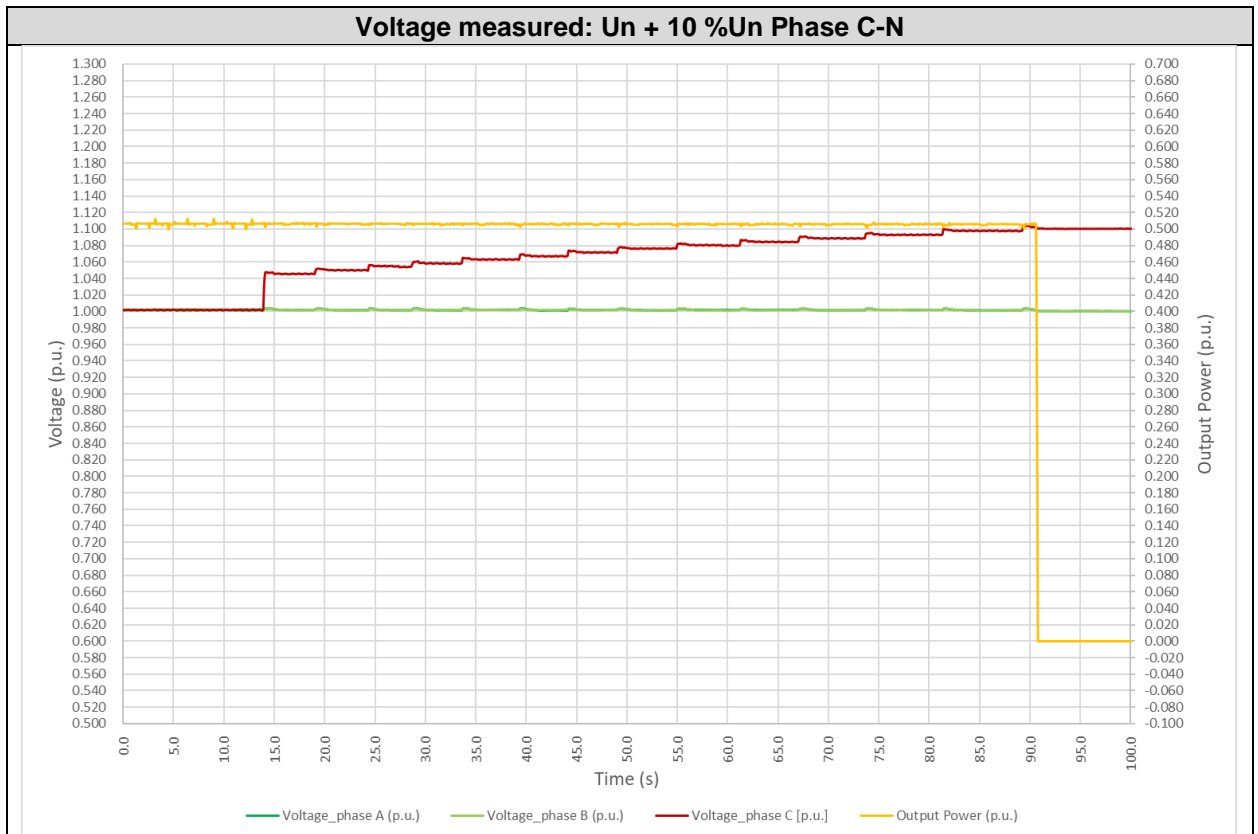
Voltage measured: Un +10 %Un Phase A-N



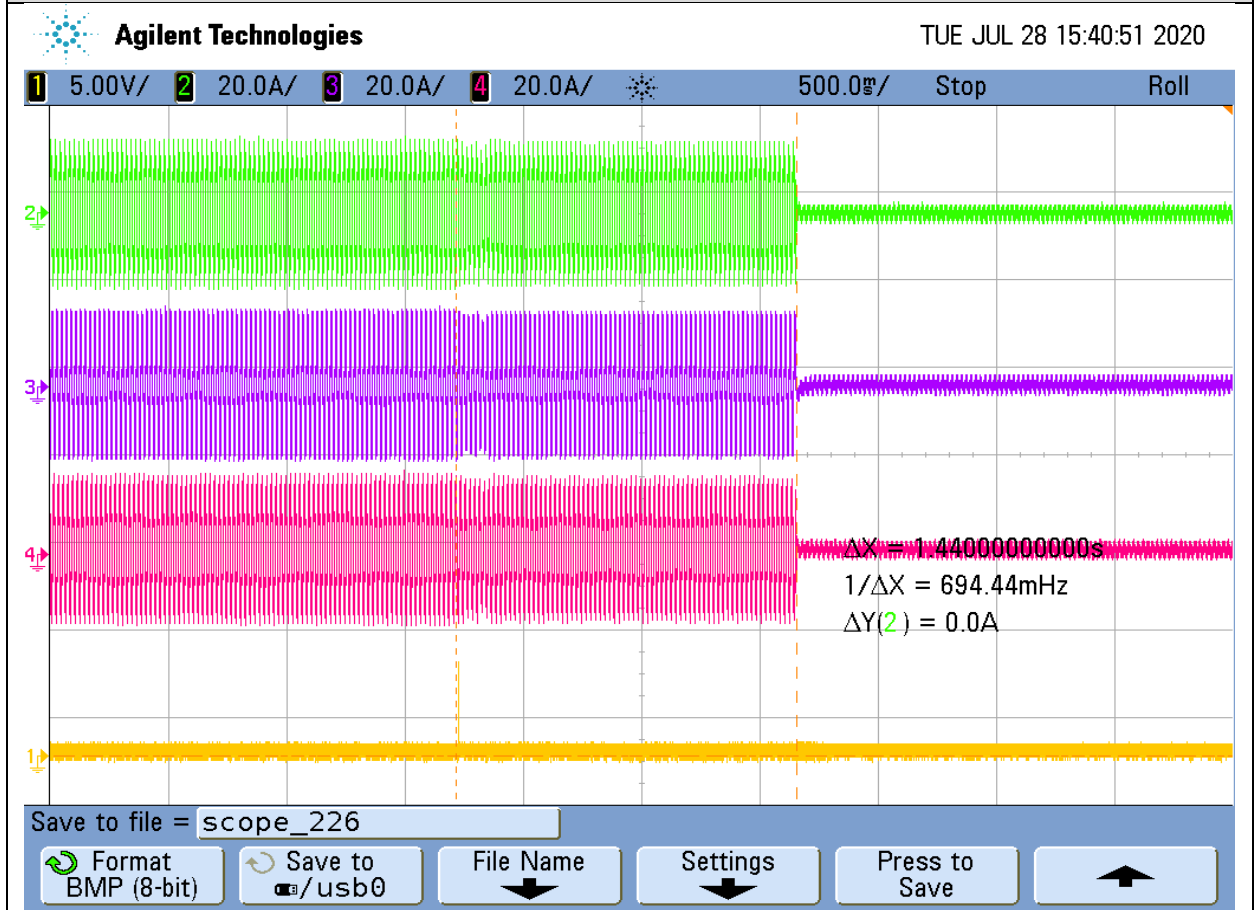
Voltage Trip Time: Un +10 %Un Phase A-N

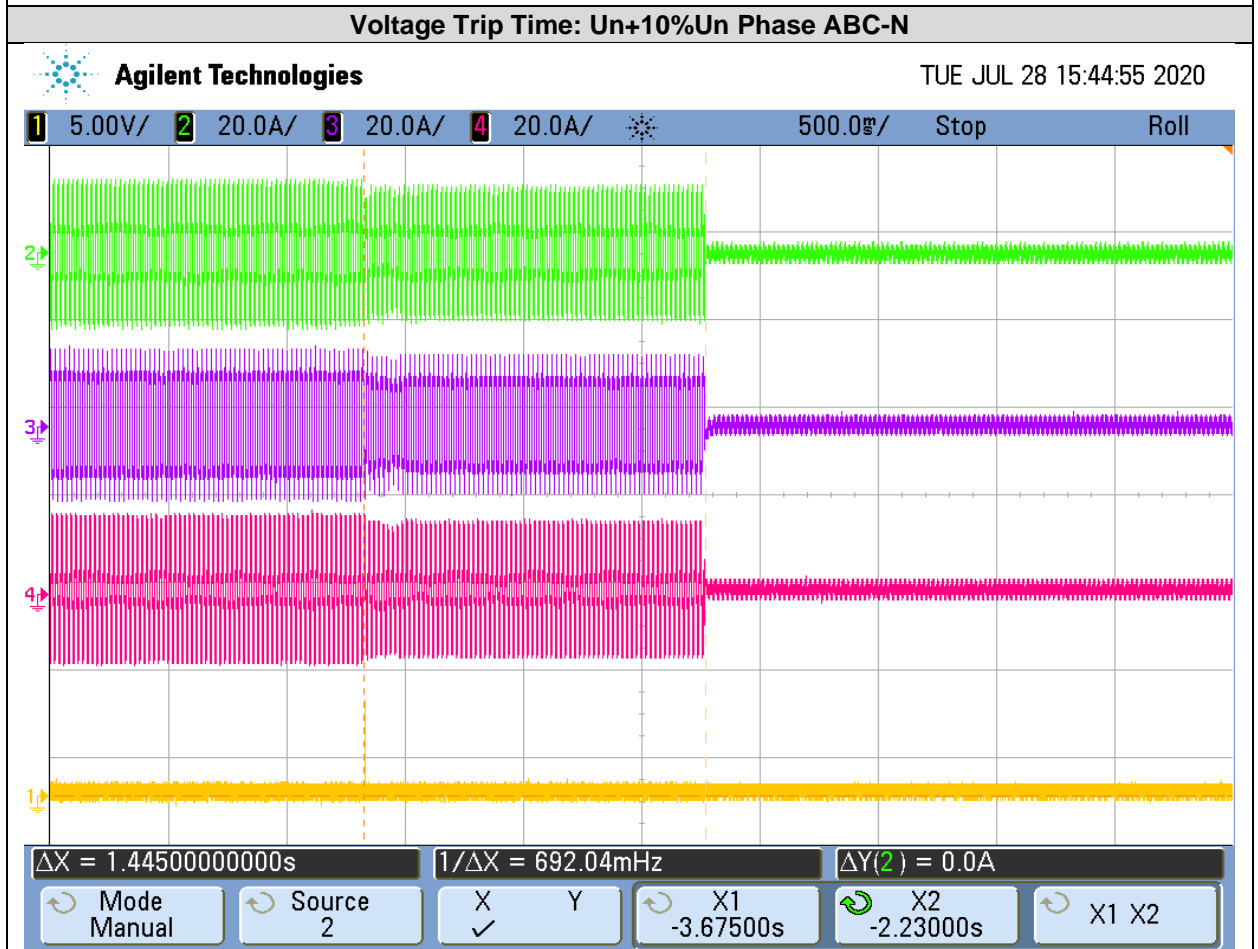
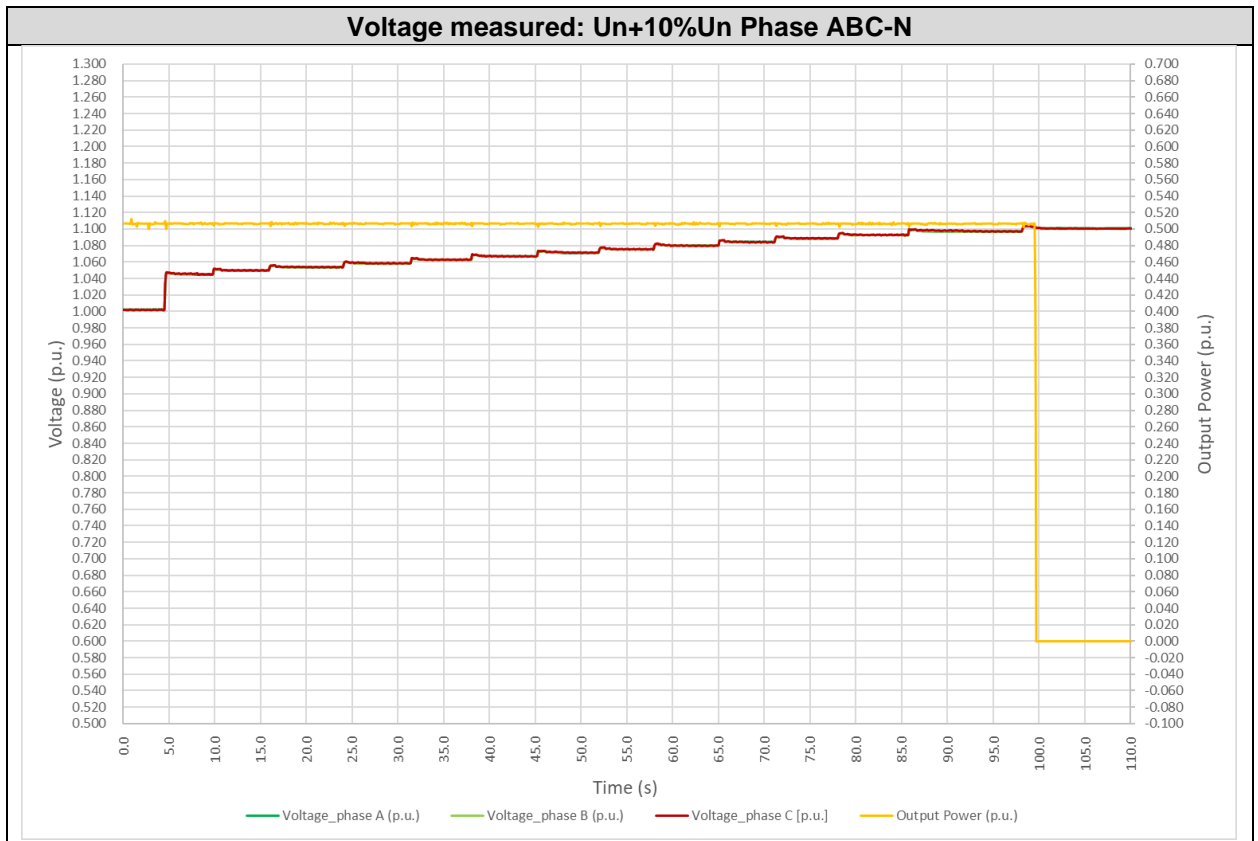


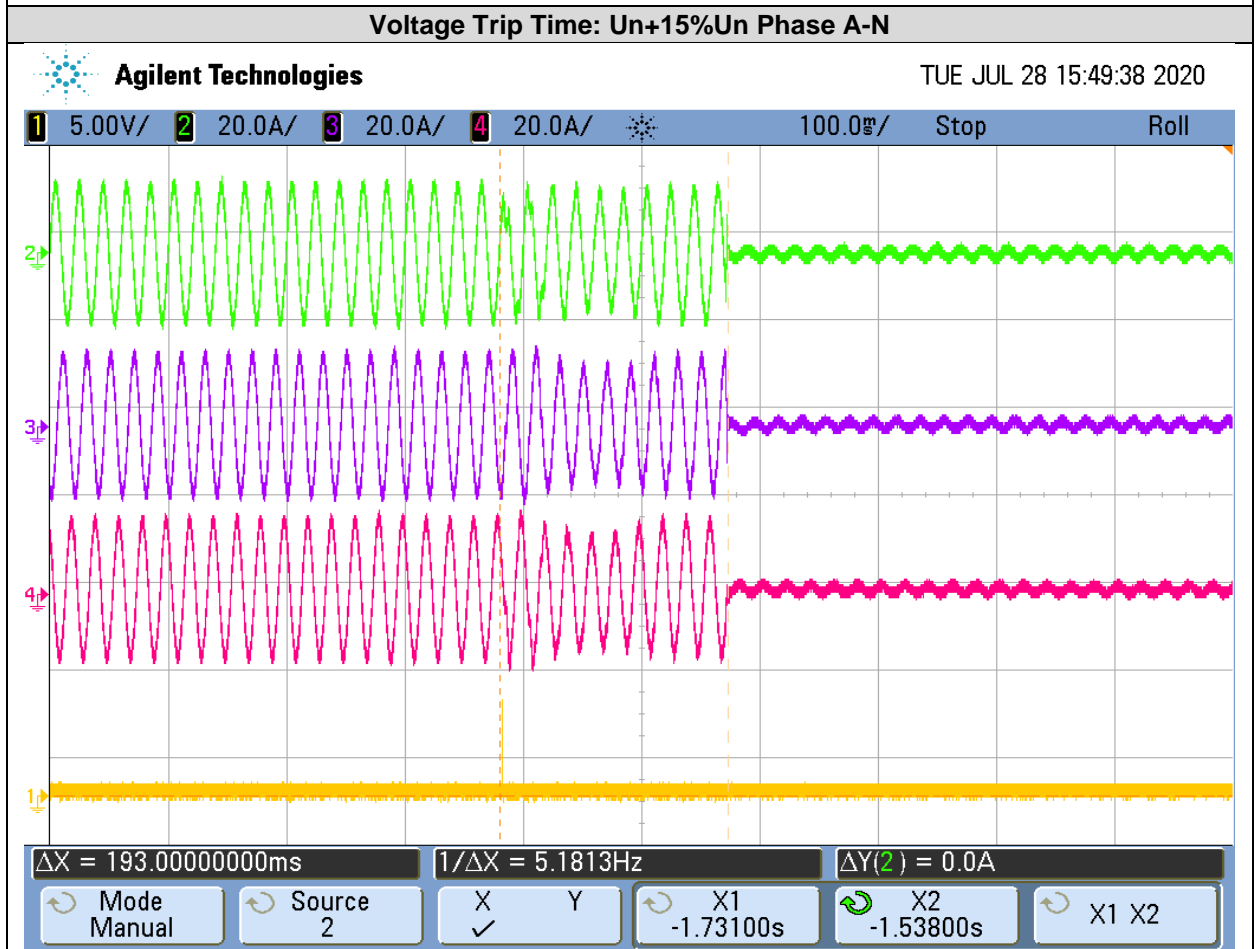
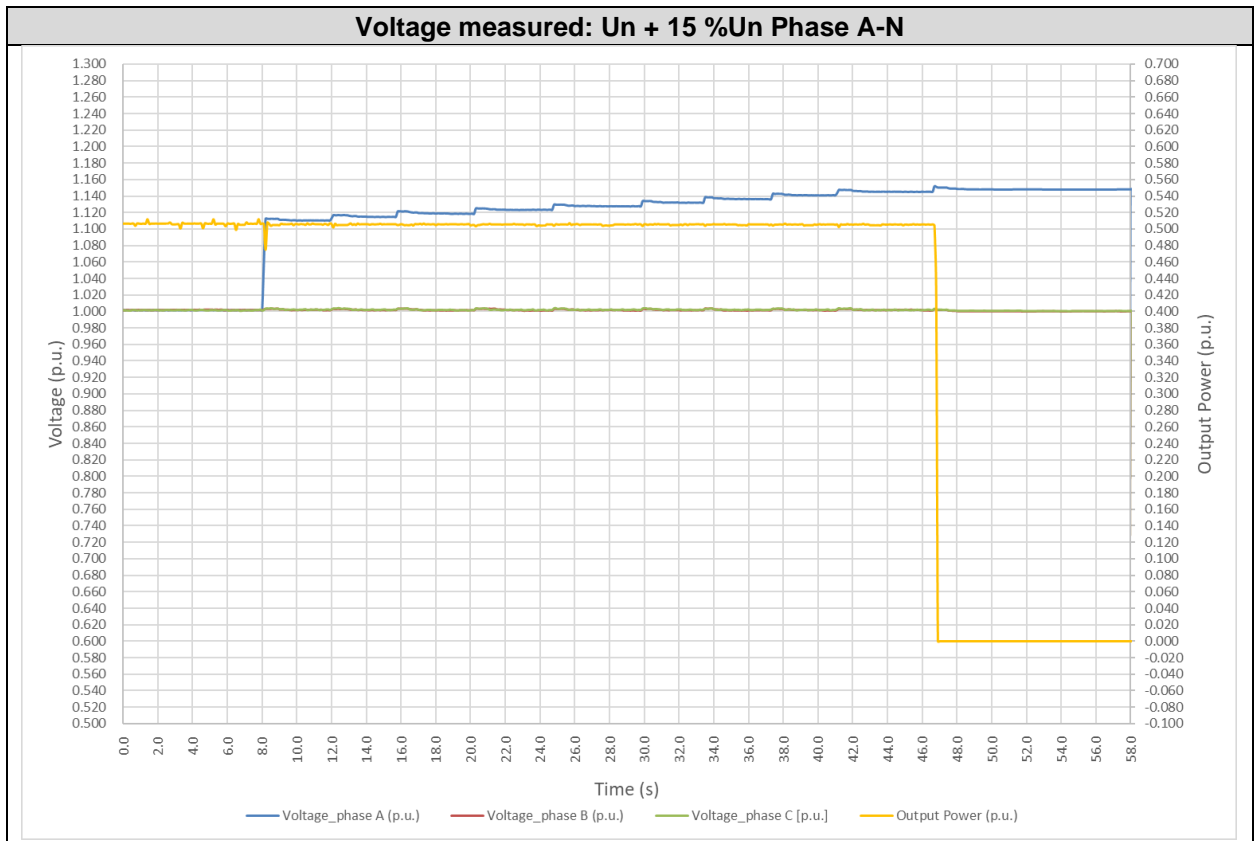




Voltage Trip Time: Un + 10 %Un Phase C-N



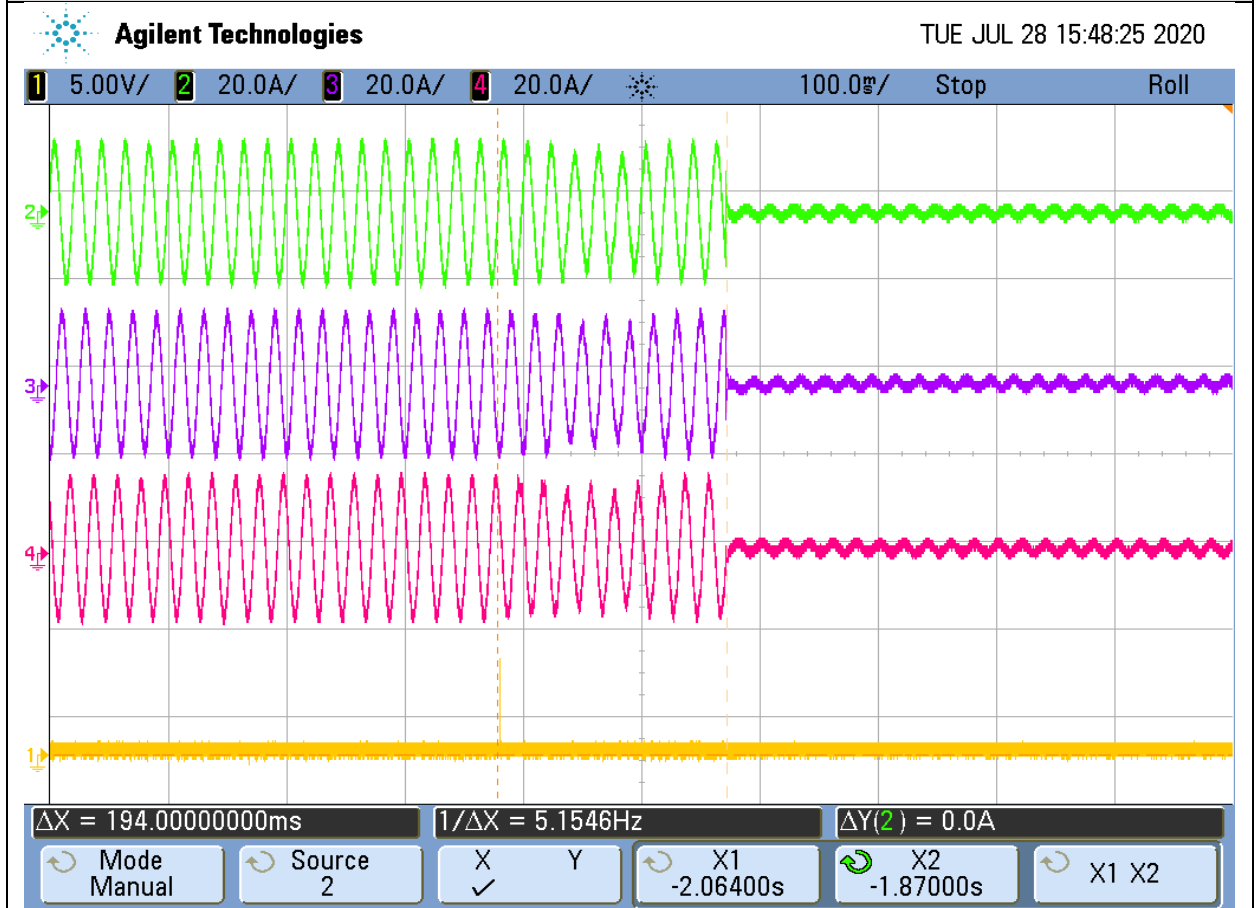




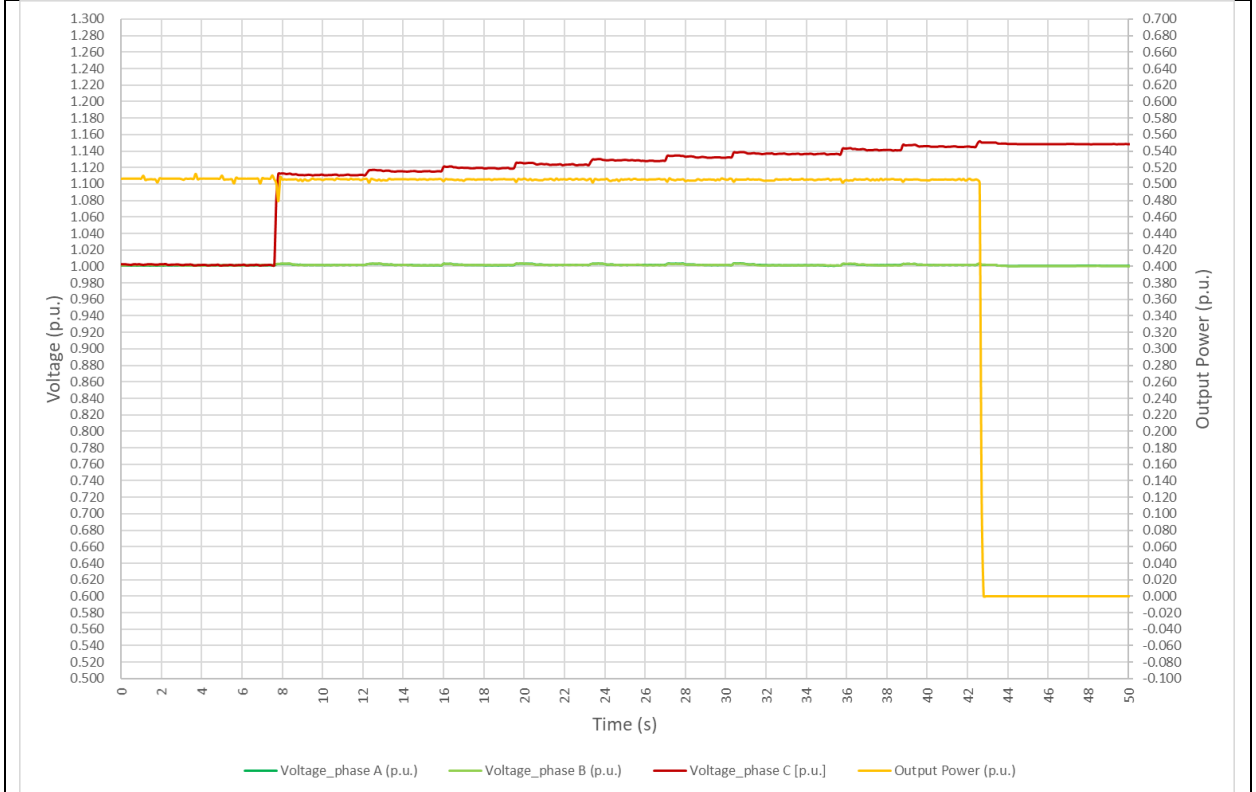
Voltage measured: Un + 15 %Un Phase B-N



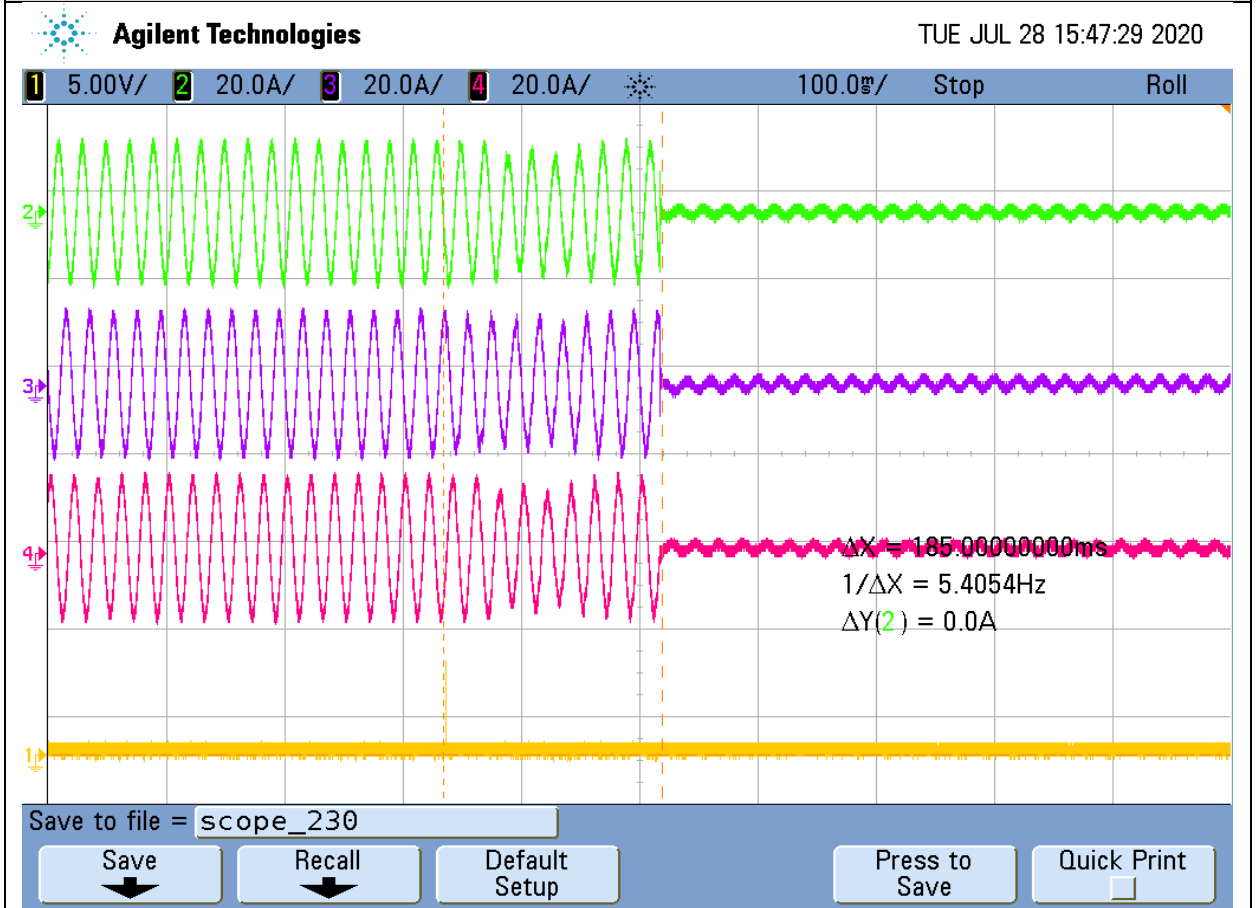
Voltage Trip Time: Un + 15 %Un Phase B-N

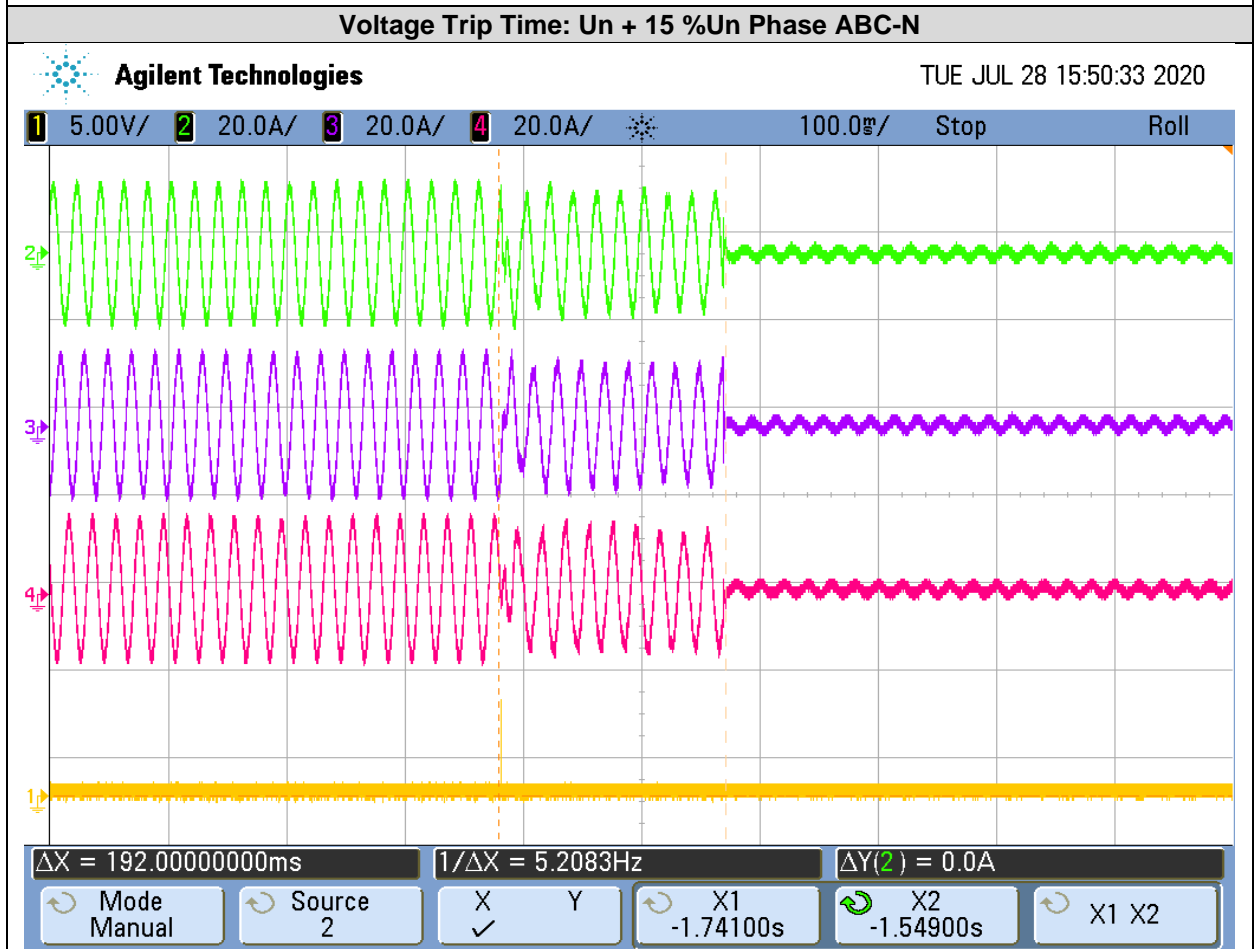
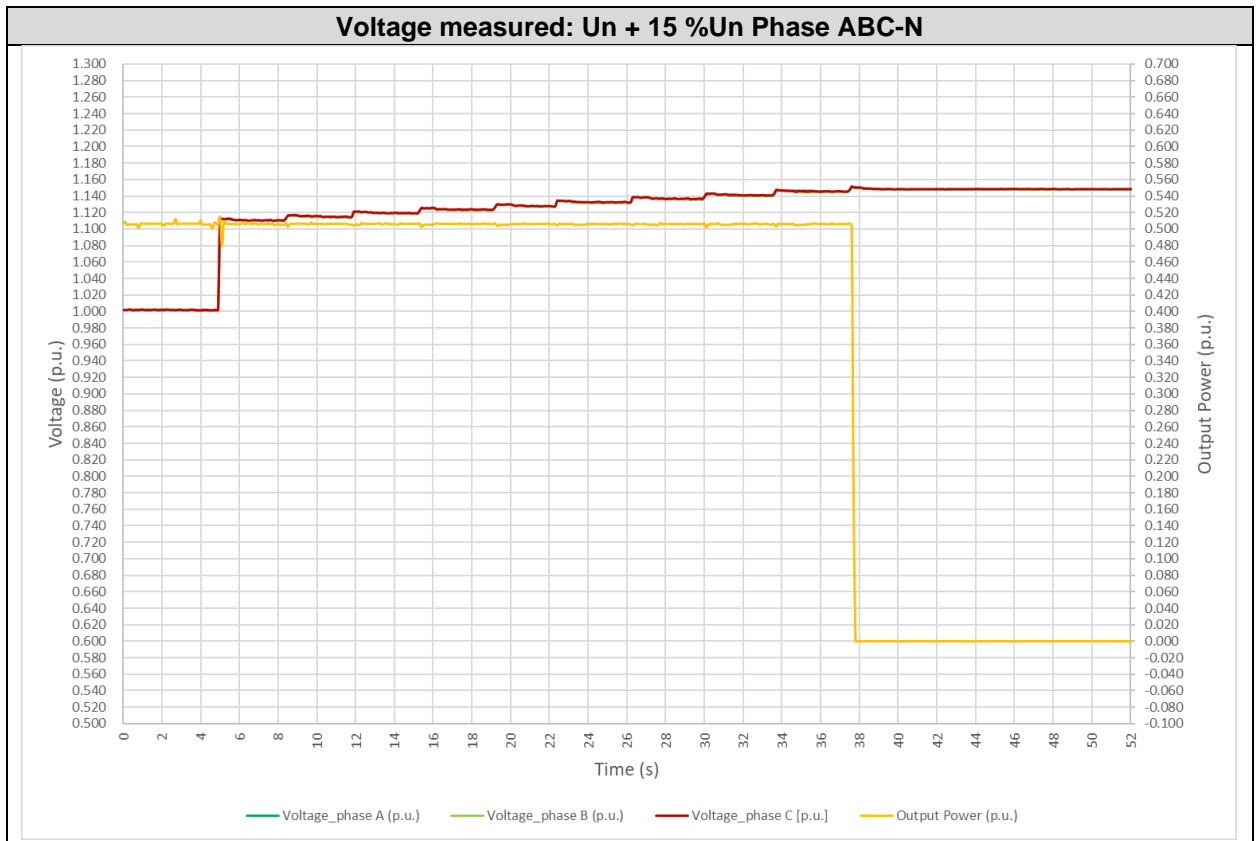


Voltage measured: Un + 15 %Un Phase C-N

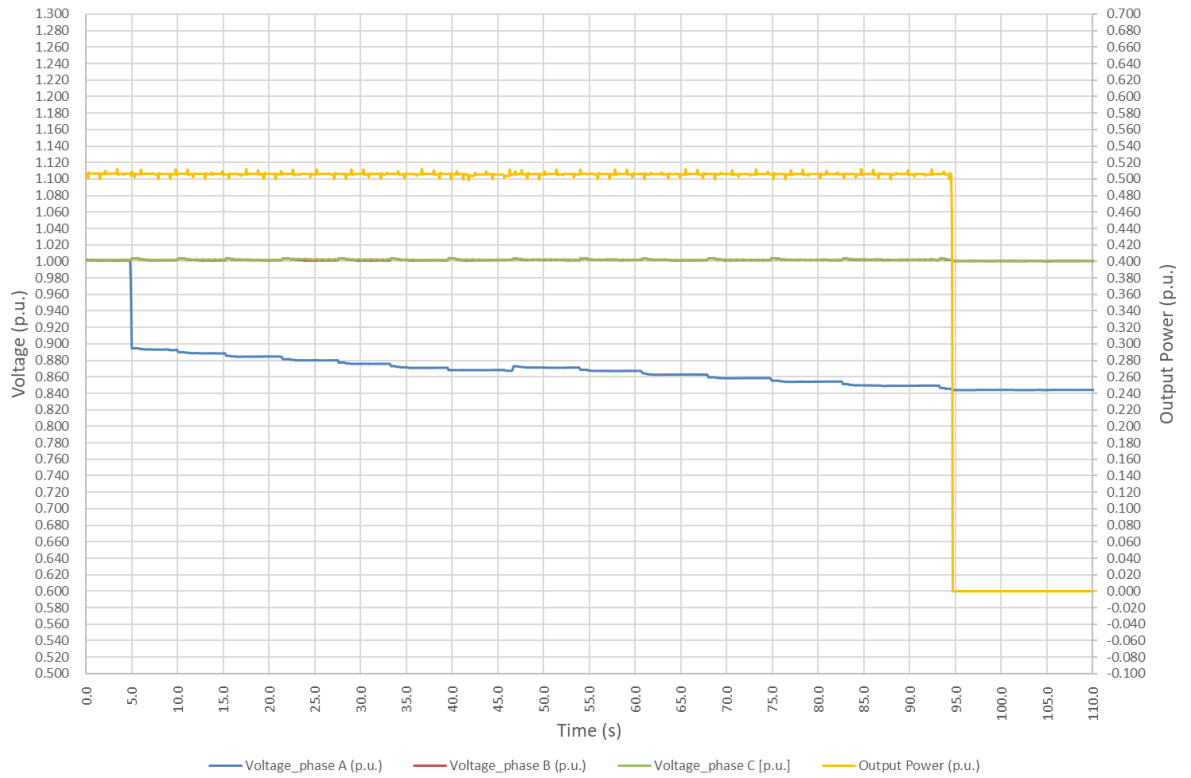


Voltage Trip Time: Un + 15 %Un Phase C-N

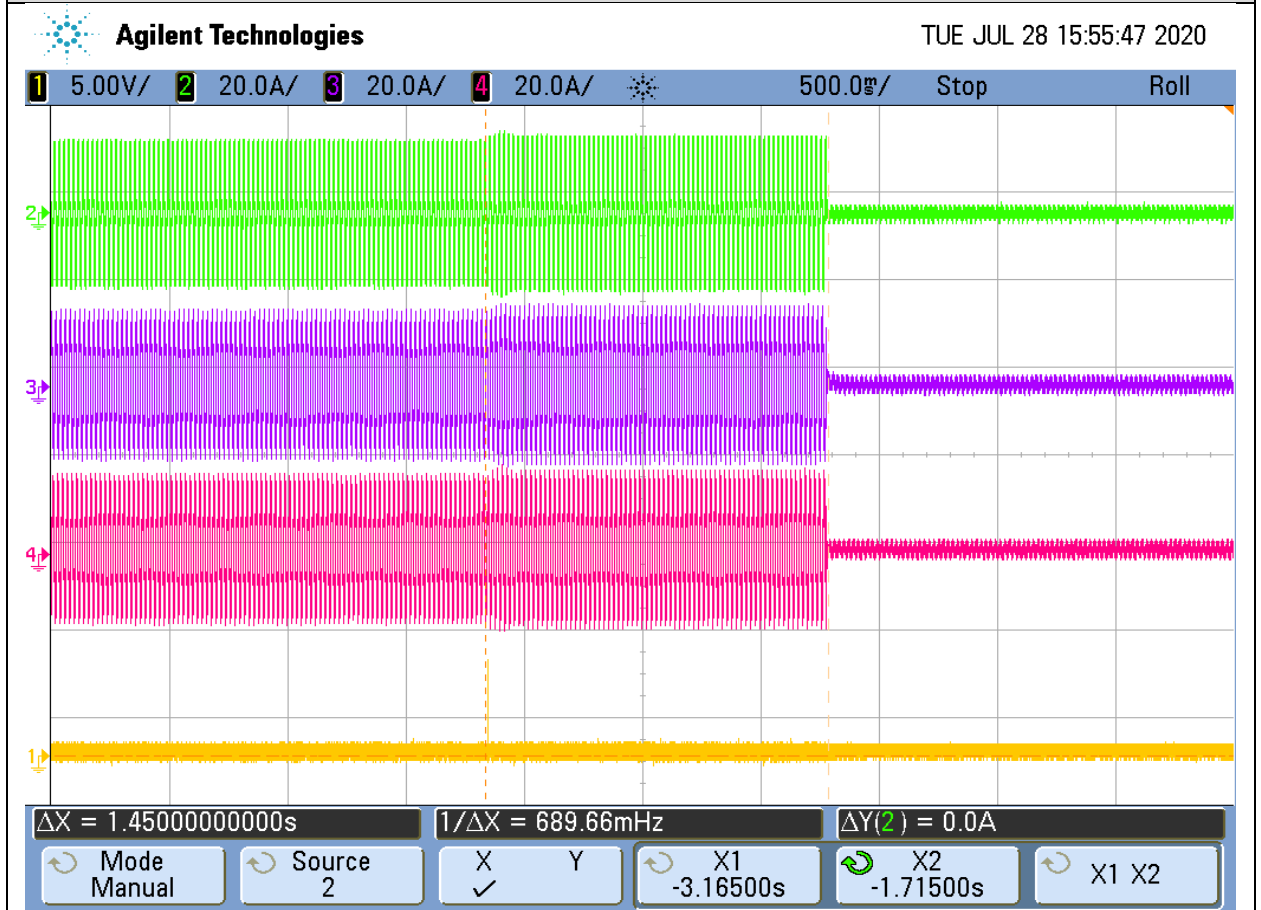


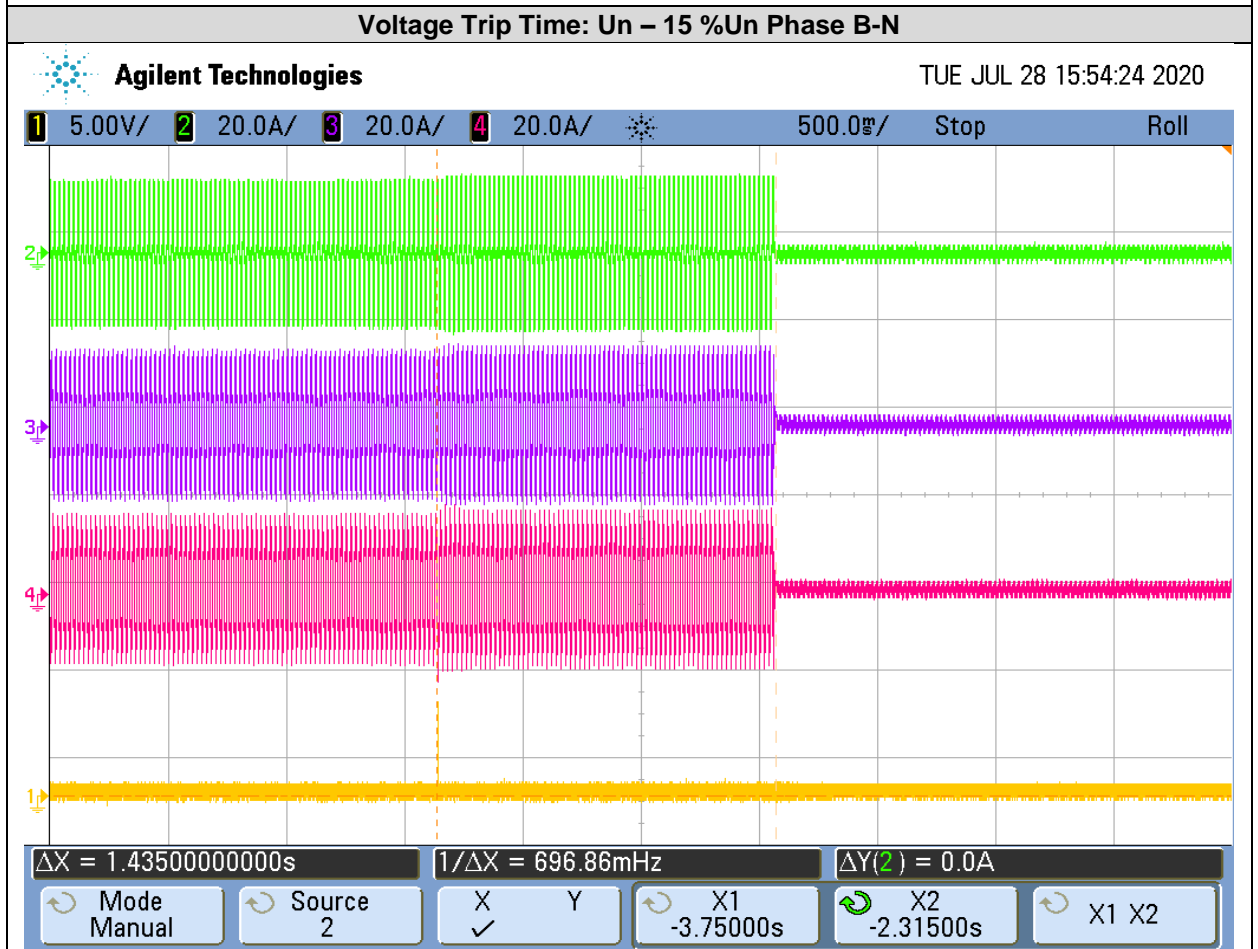
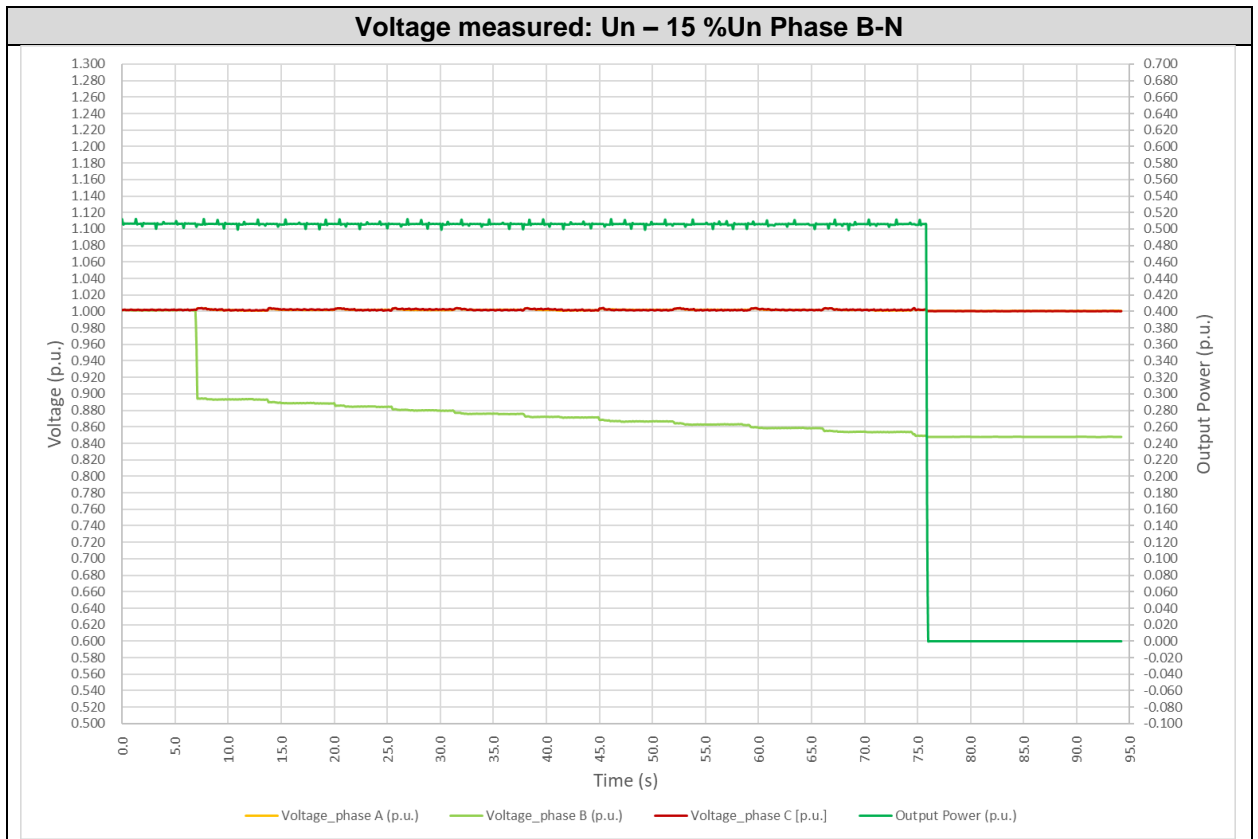


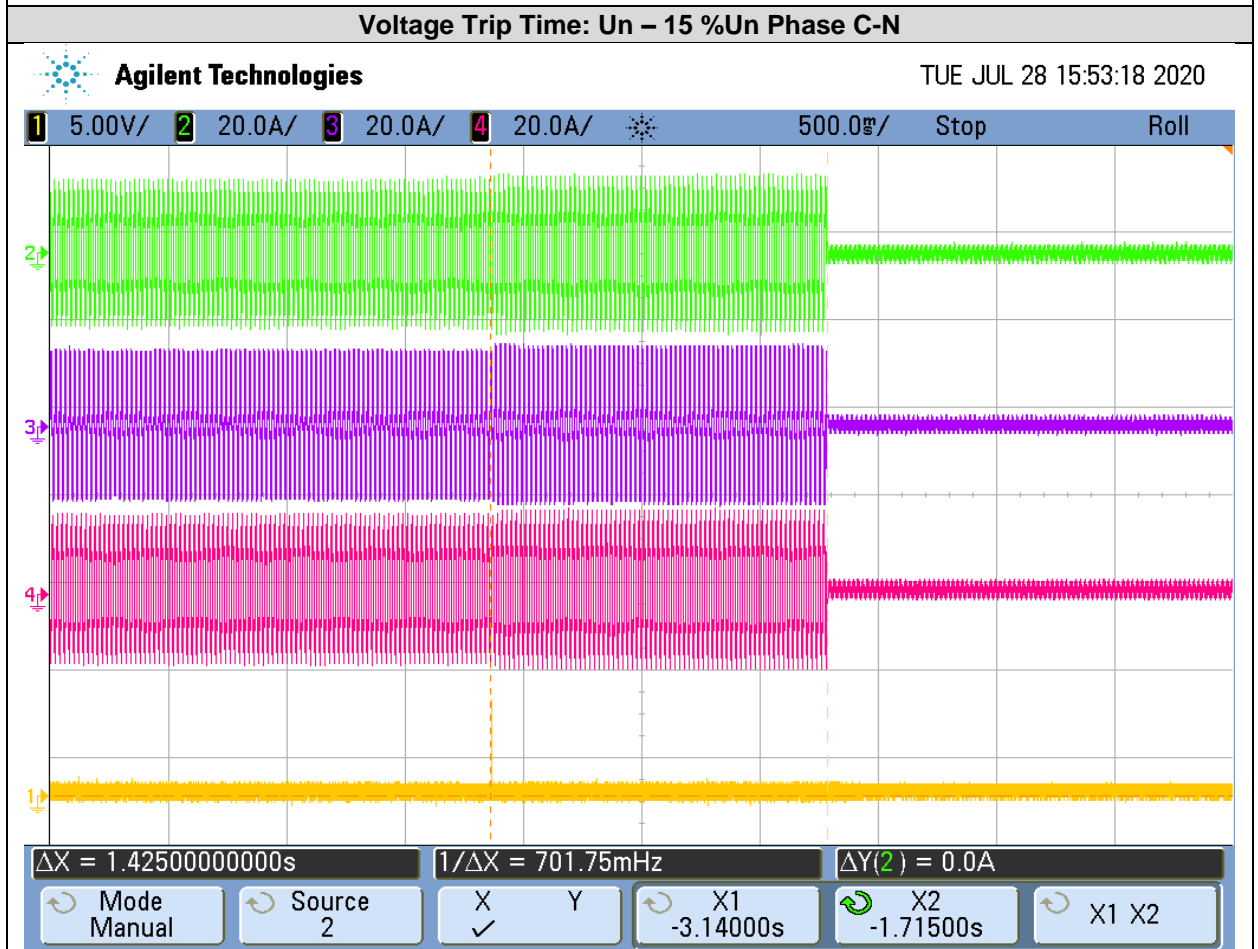
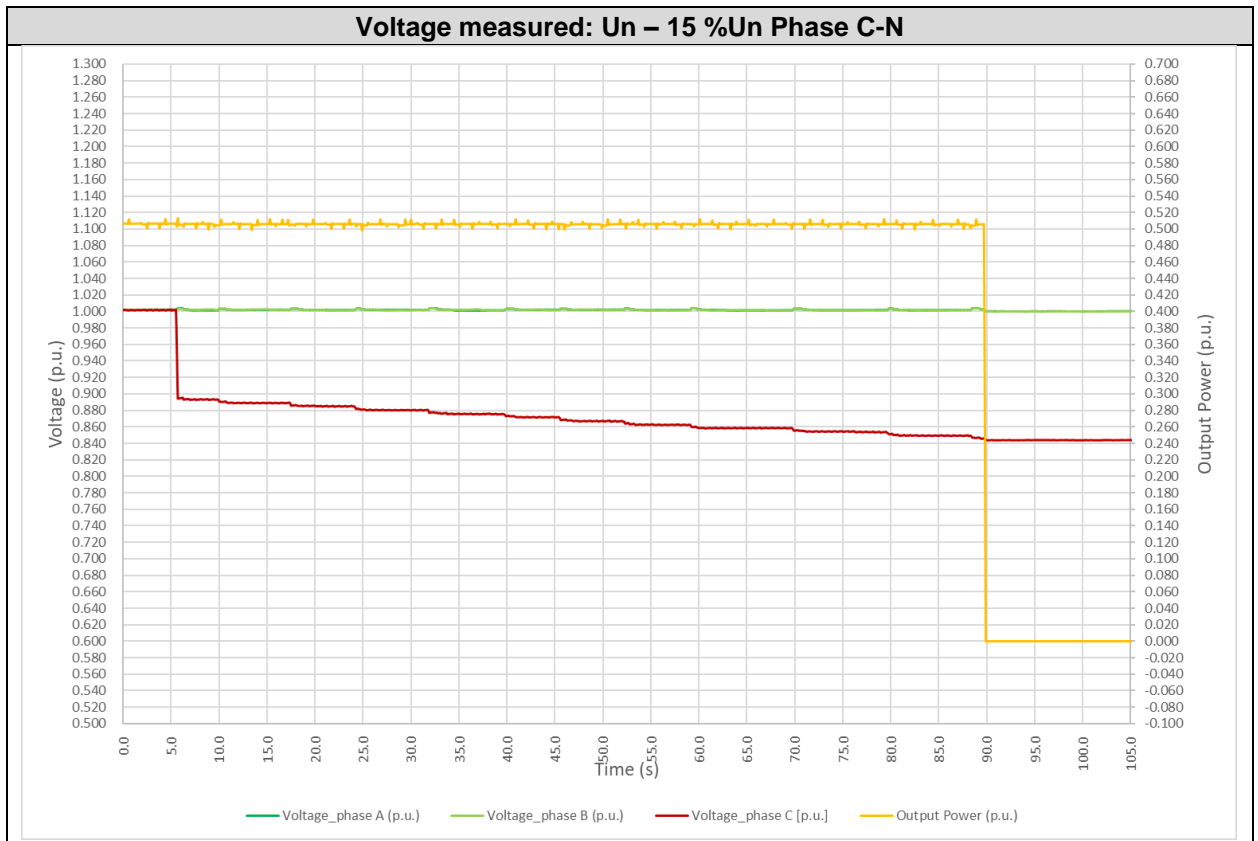
Voltage measured: Un – 15 %Un Phase A-N

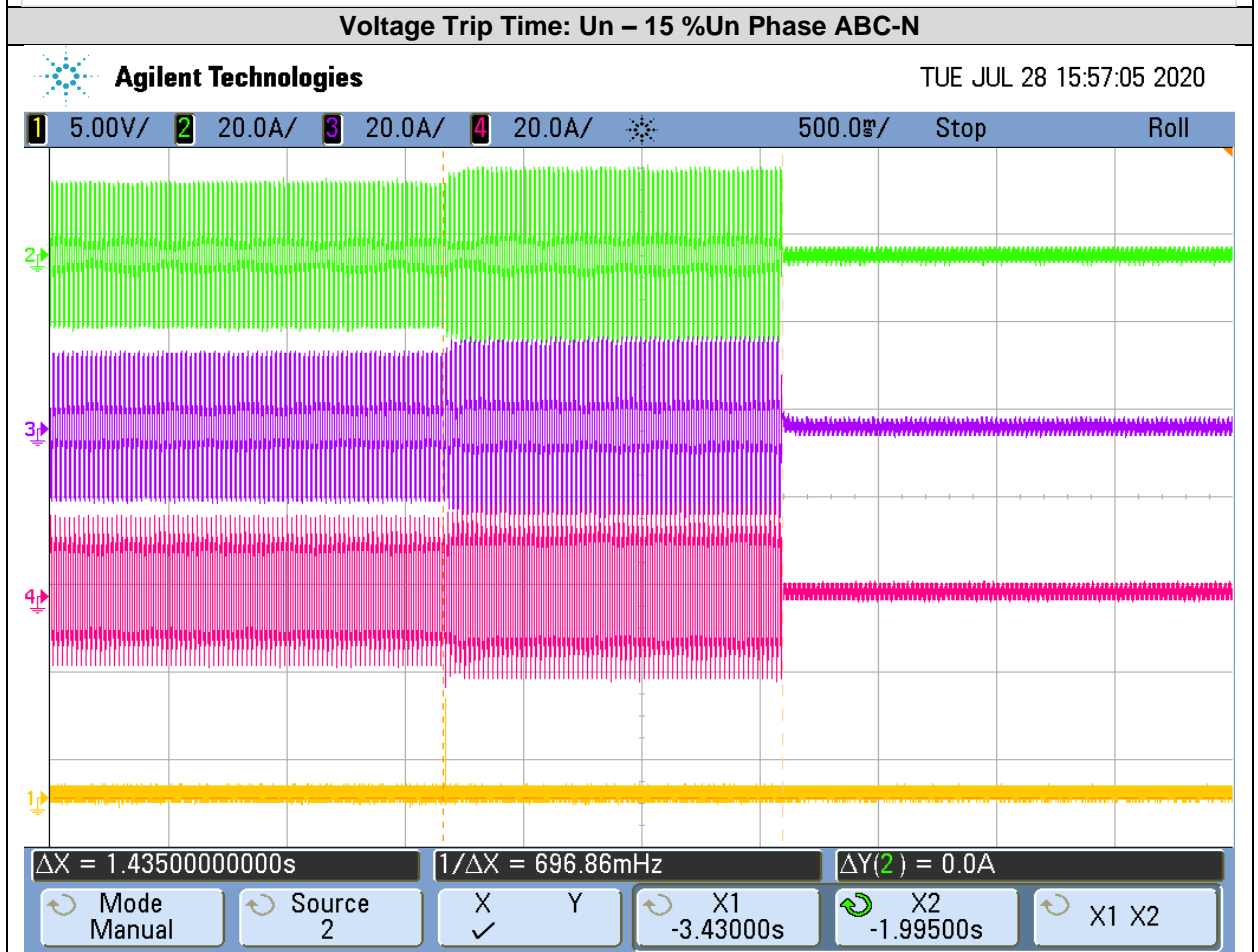
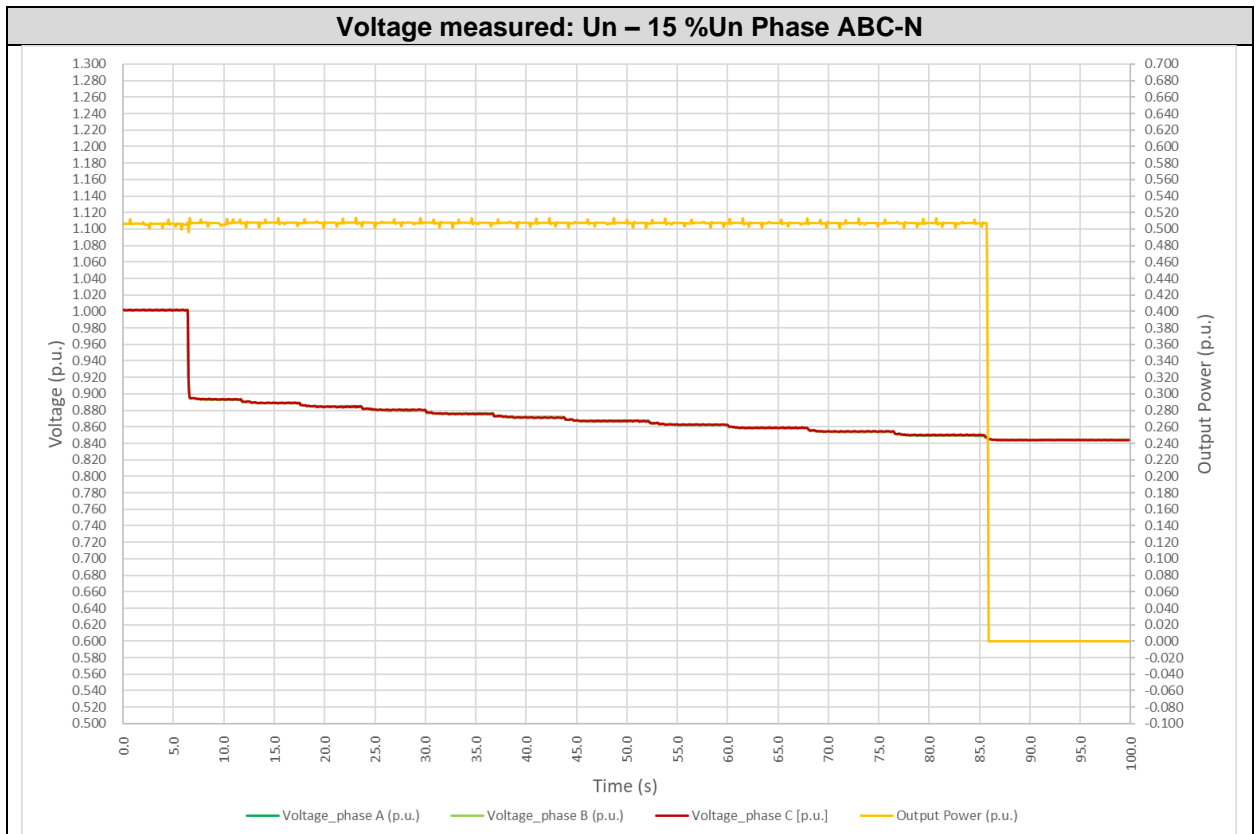


Voltage Trip Time: Un – 15 %Un Phase A-N









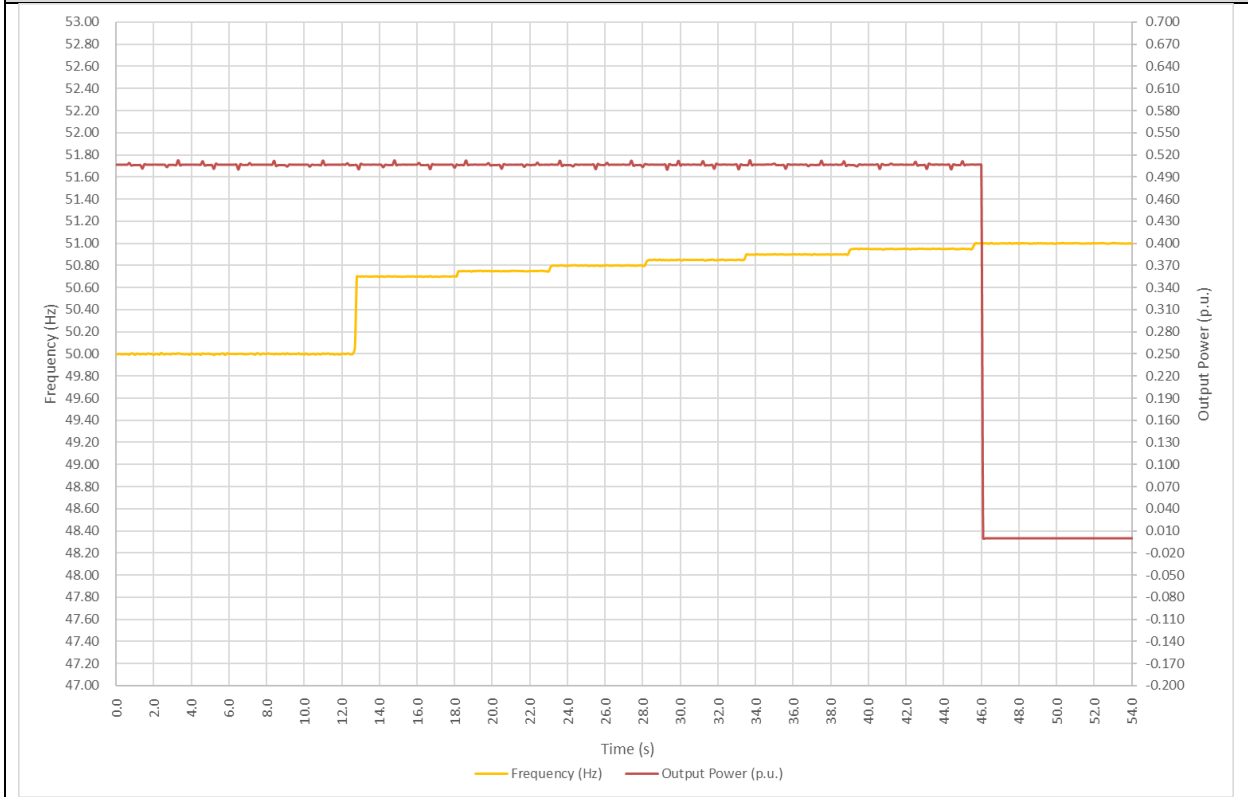
4.4.2 Frequency disconnection

Setting Frequency (Hz)	Measured Frequency (Hz)	Disconnection time limits (s)	Disconnection time measured (s)
51	51.00	0.5	0.458
48	47.95	>3.0(*)	3.150

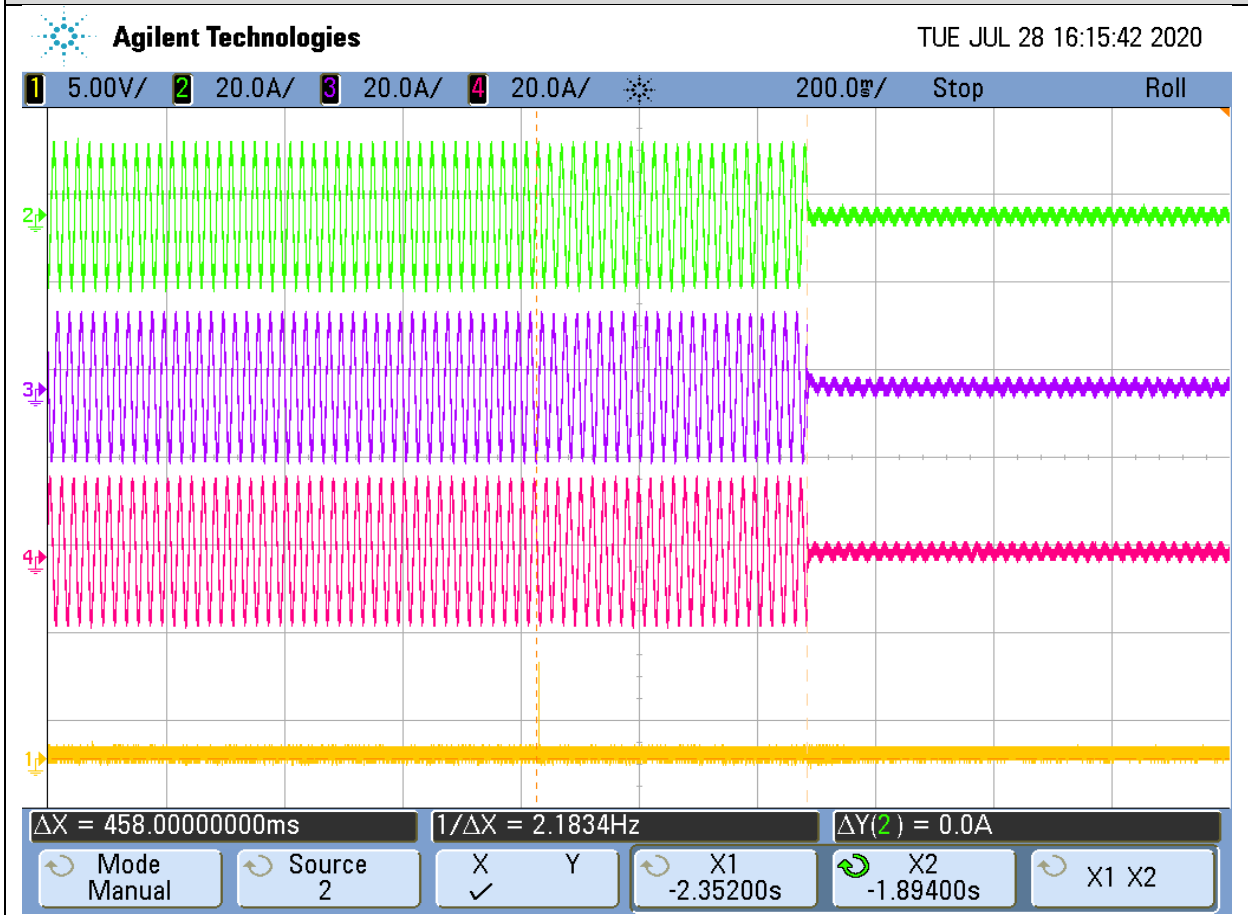
(*) The requirement according to modified by RD 647: 2020, the minimum disconnection time is 3s

Frequency measured: 51 Hz

Trip value

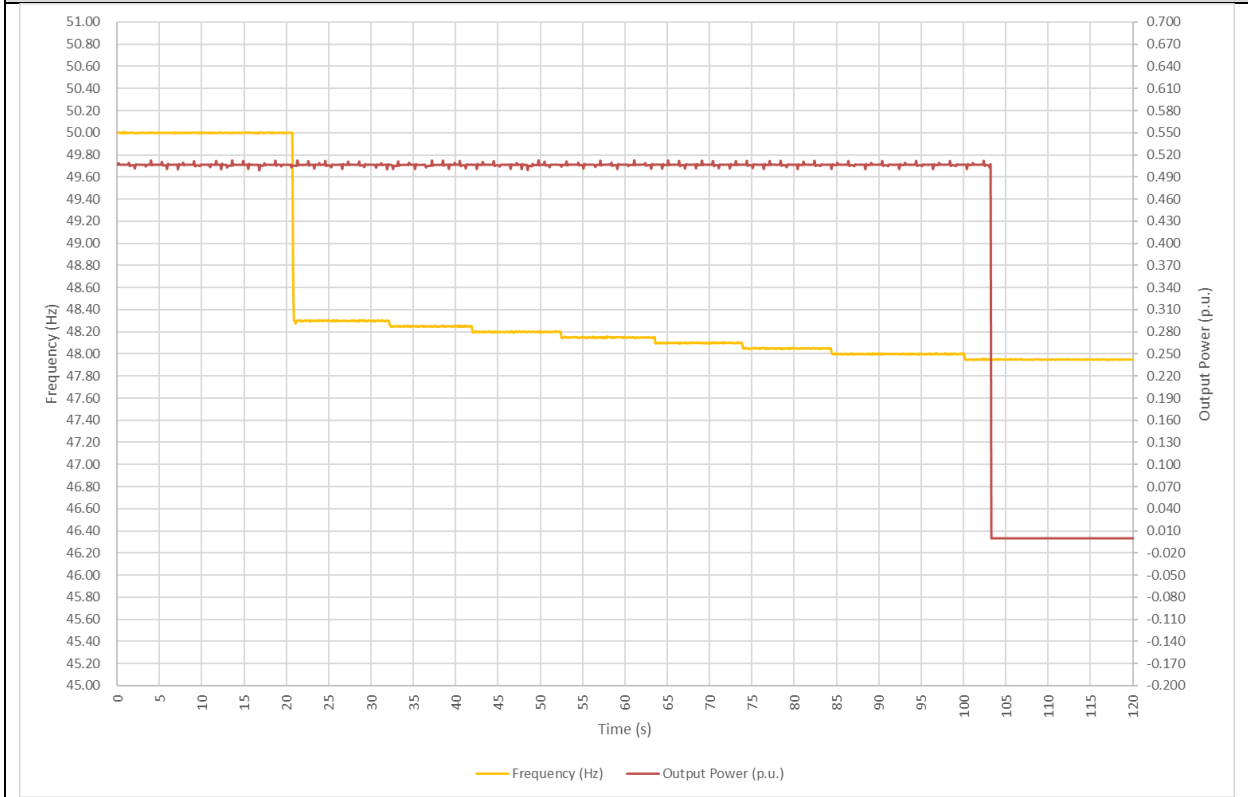


Disconnection time

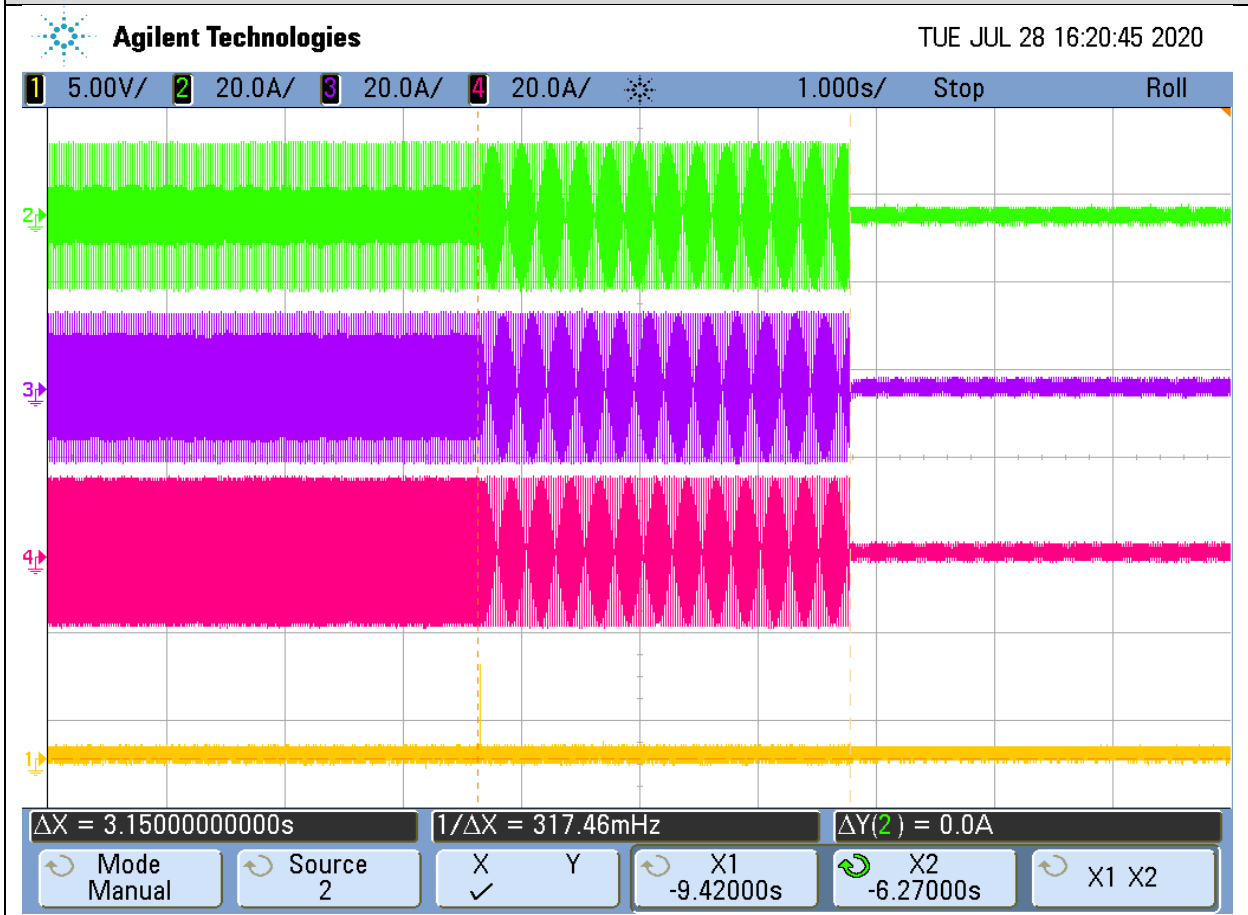


Frequency measured: 48 Hz

Trip value



Disconnection time

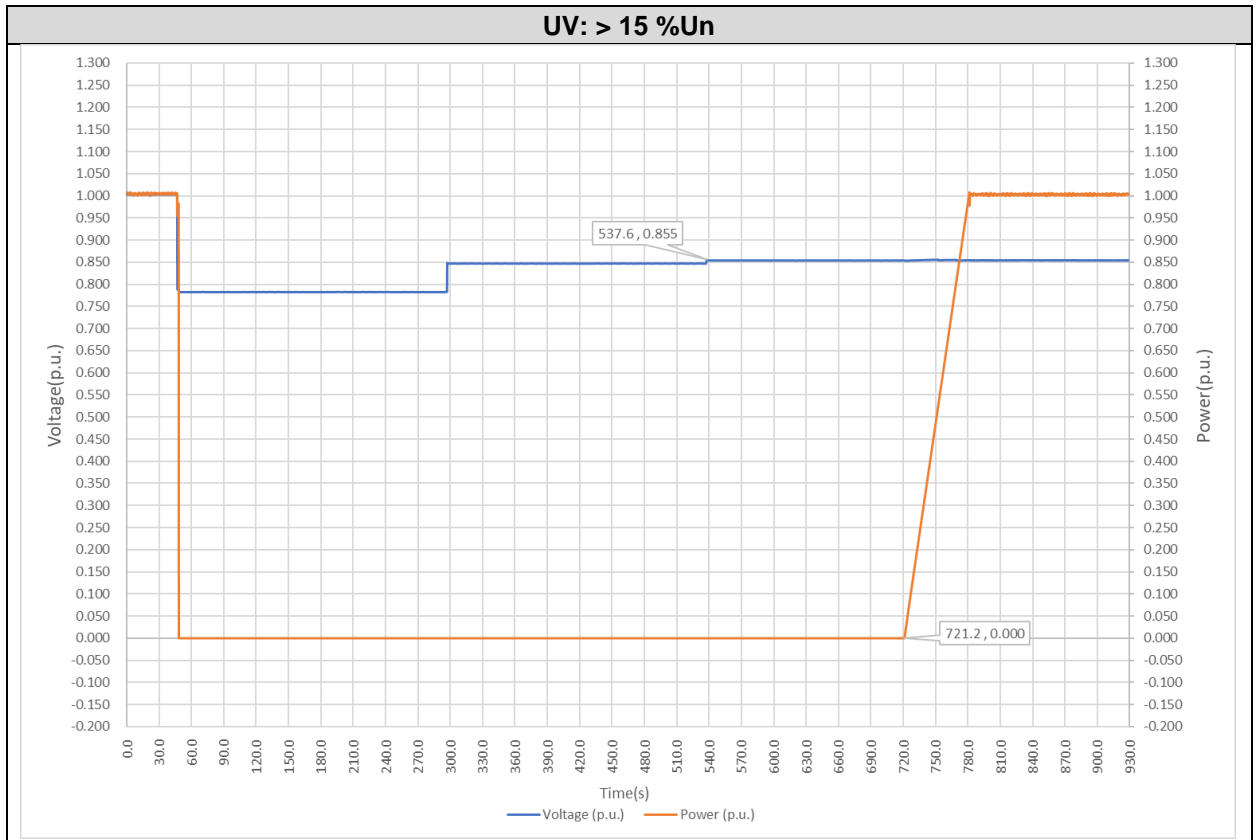
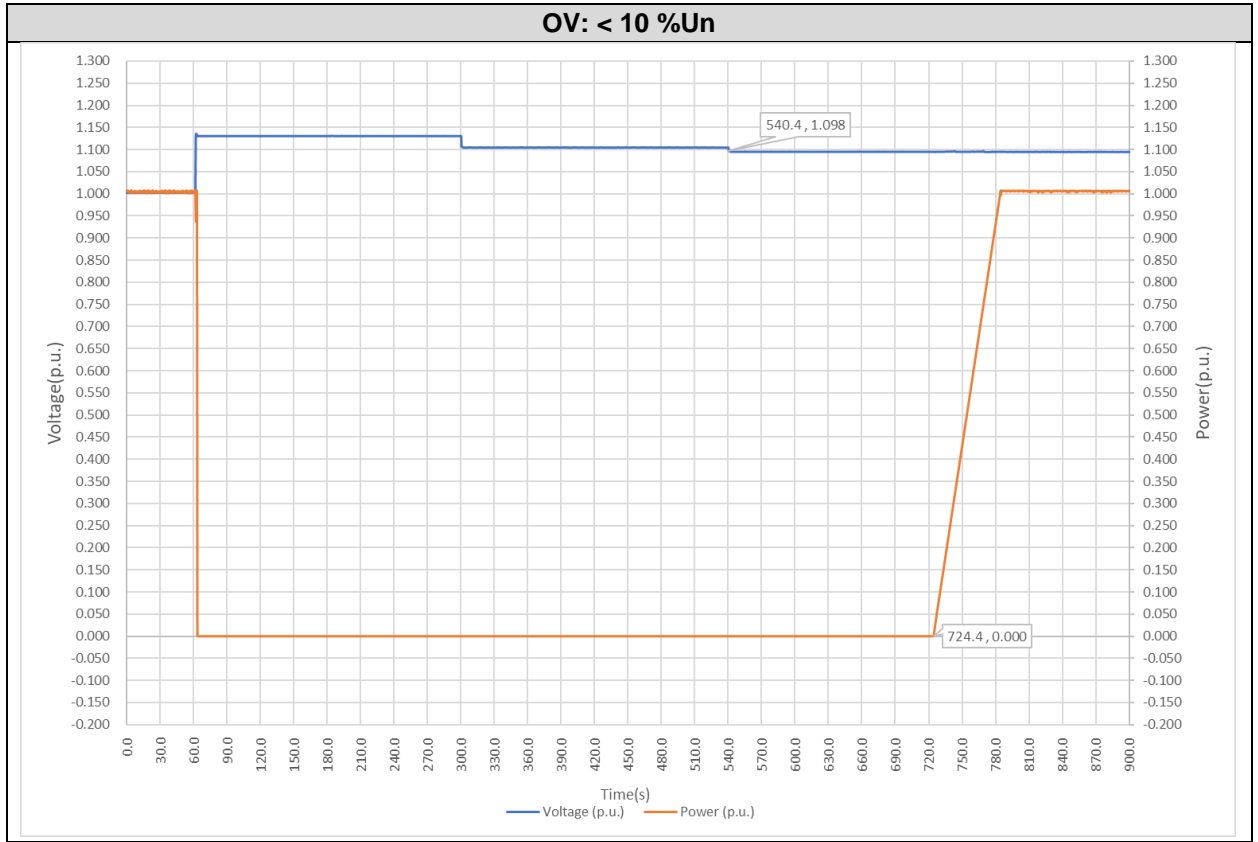


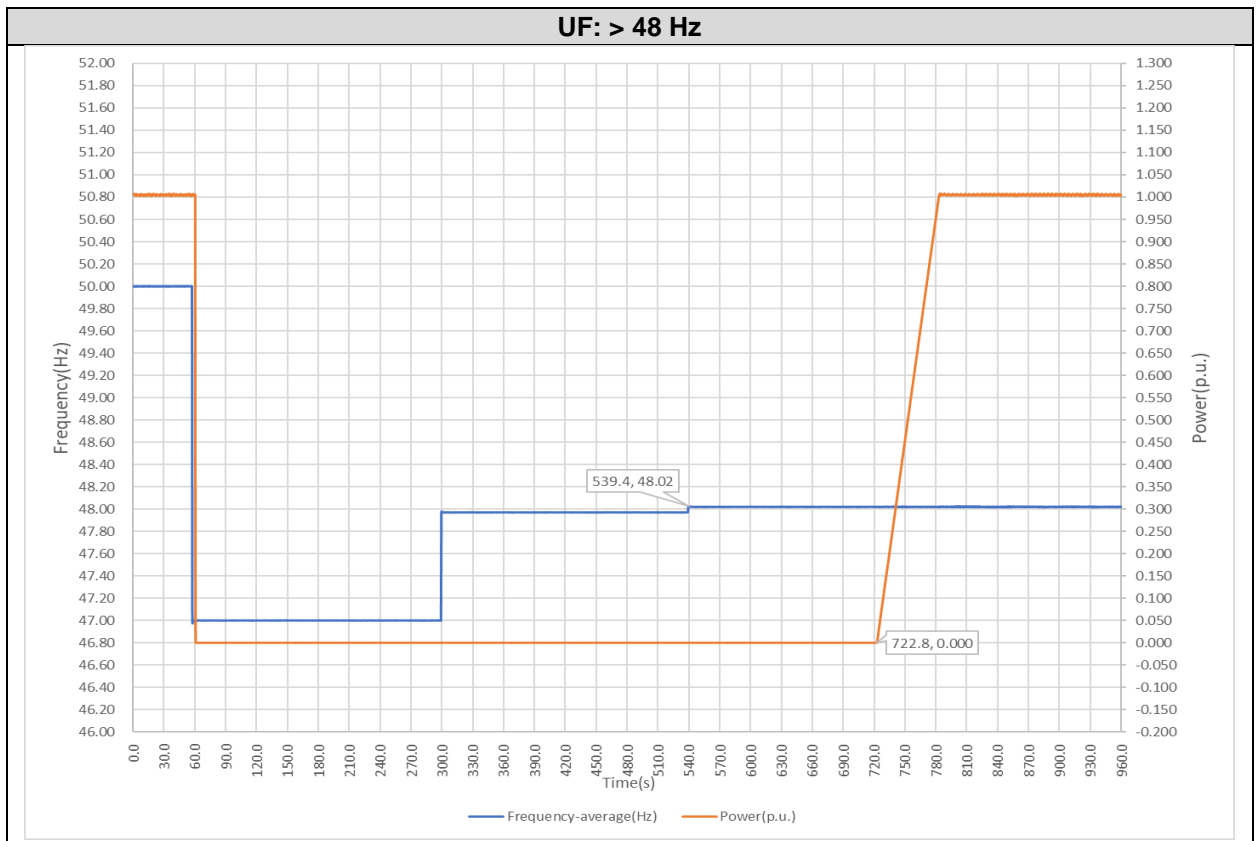
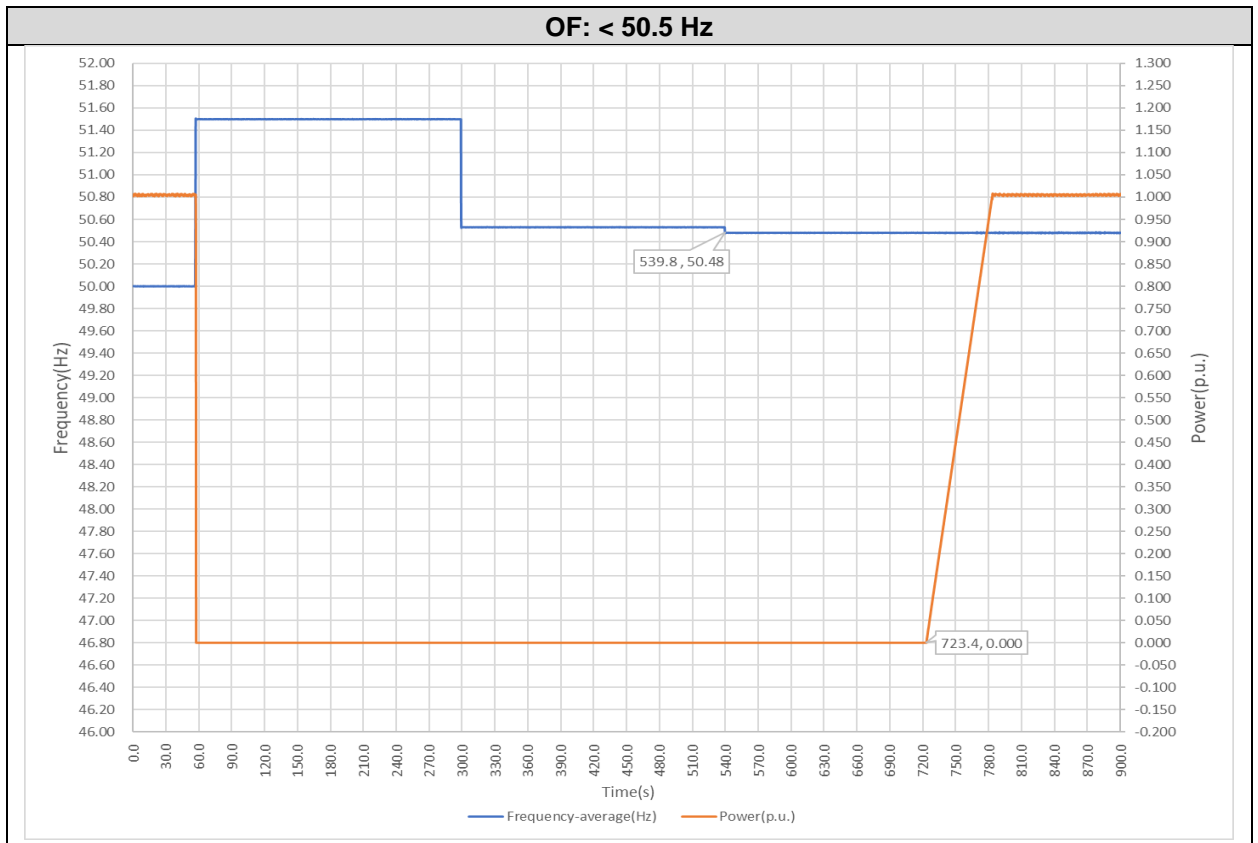
4.5 SELF-RECONNECTION

Self-reconnection tests have been performed according to the chapter 5.5 of the standard.

The inverter must be capable to reconnect when voltage and frequency are within the normal ranges according to standard.

Type	Delay time	Time measured (s)
OV: < 10 %Un	>3 min	184.0
UV: > 15 %Un	>3 min	183.6
OF: < 50.5 Hz	--	183.6
UF: > 48.0 Hz	--	183.4





4.6 UNINTENTIONAL ISLANDING

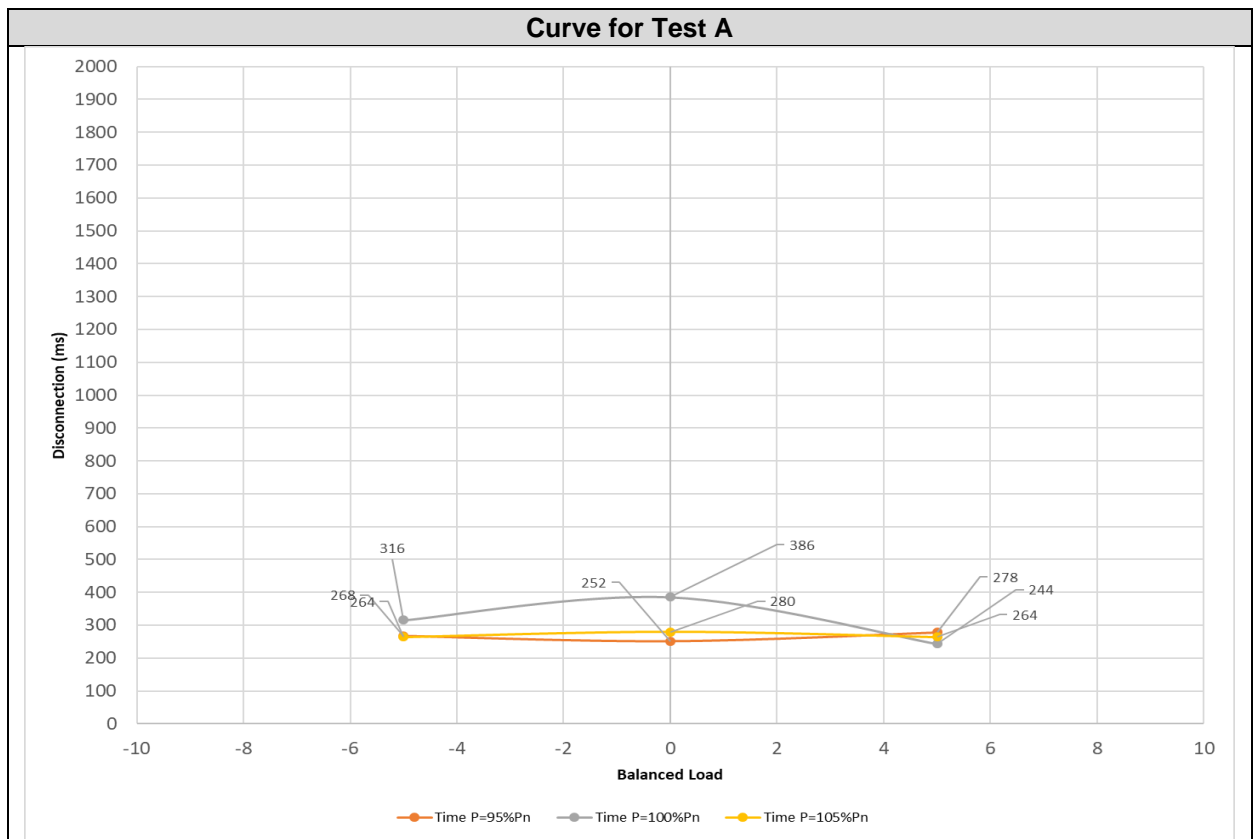
Anti-Islanding requirements are detailed in the chapter 5.6 of the standard. Test A is at full power, Test B is at 66 %Pn, Test C is at 33 %Pn.

As the inverter can be connected to the LV network, compliance with these requirements have been verified according to the standard UNE 206006. The following conditions with an ESE inverter has been tested:

- Condition 1: EUT and ESE with islanding prevention activated.
- Condition 2: EUT with islanding prevention activated and ESE deactivated.
- Condition 3: EUT and ESE with islanding prevention deactivated.

4.6.1 Active Power > 90 %Pn. Test A

Balanced Load		
M (%)	N (%)	Disconnection (ms) (limit at t=2s)
-5	+5	264
-5	0	316
-5	-5	268
0	+5	280
0	0	386
0	-5	252
+5	+5	264
+5	0	244
+5	-5	278

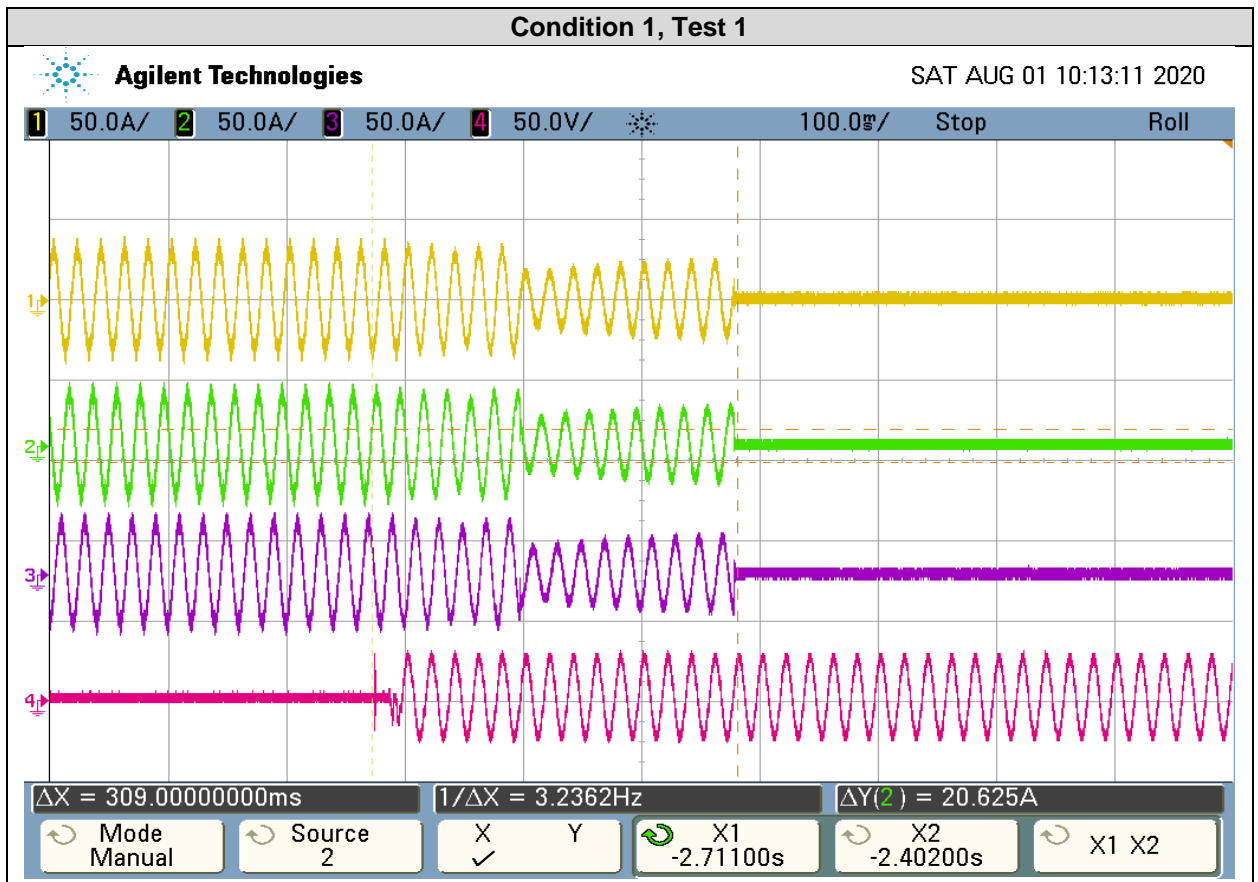


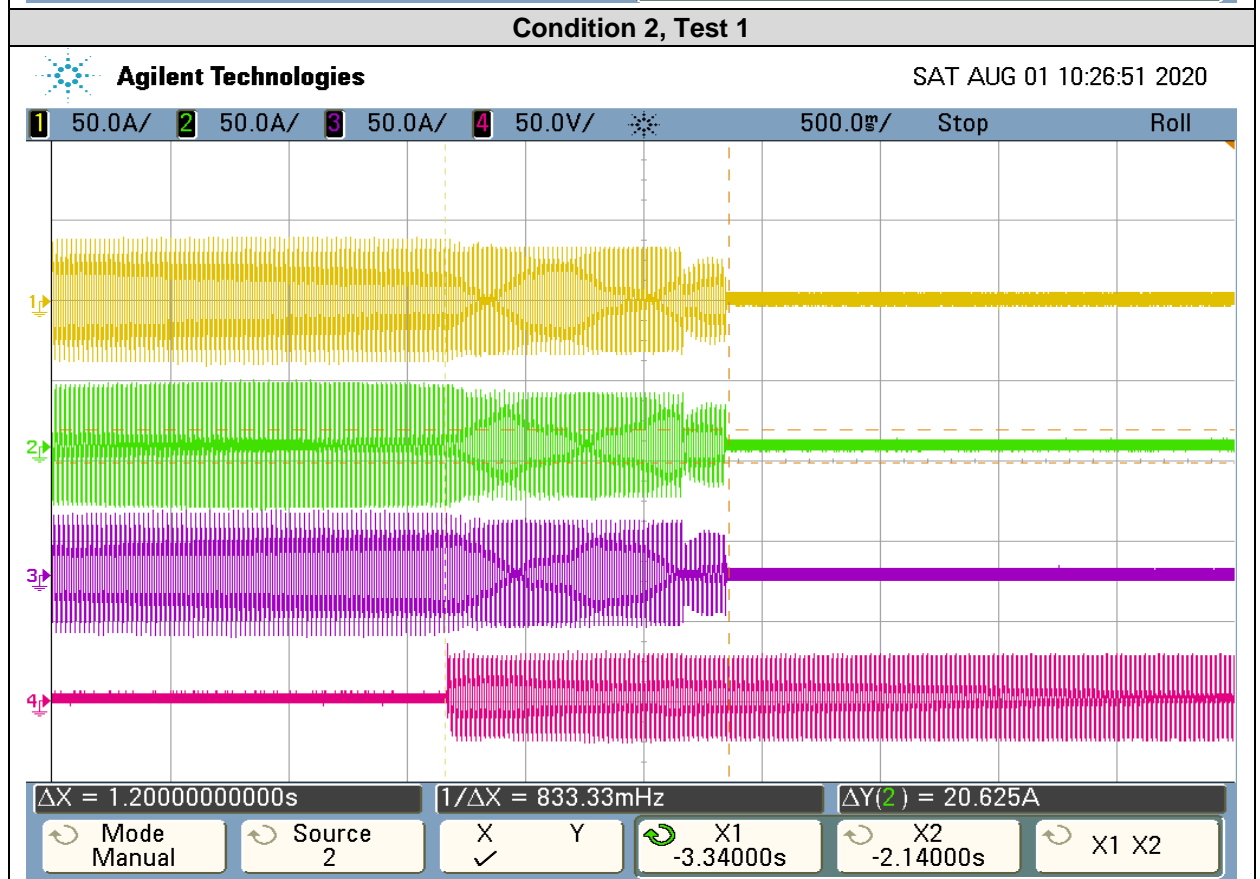
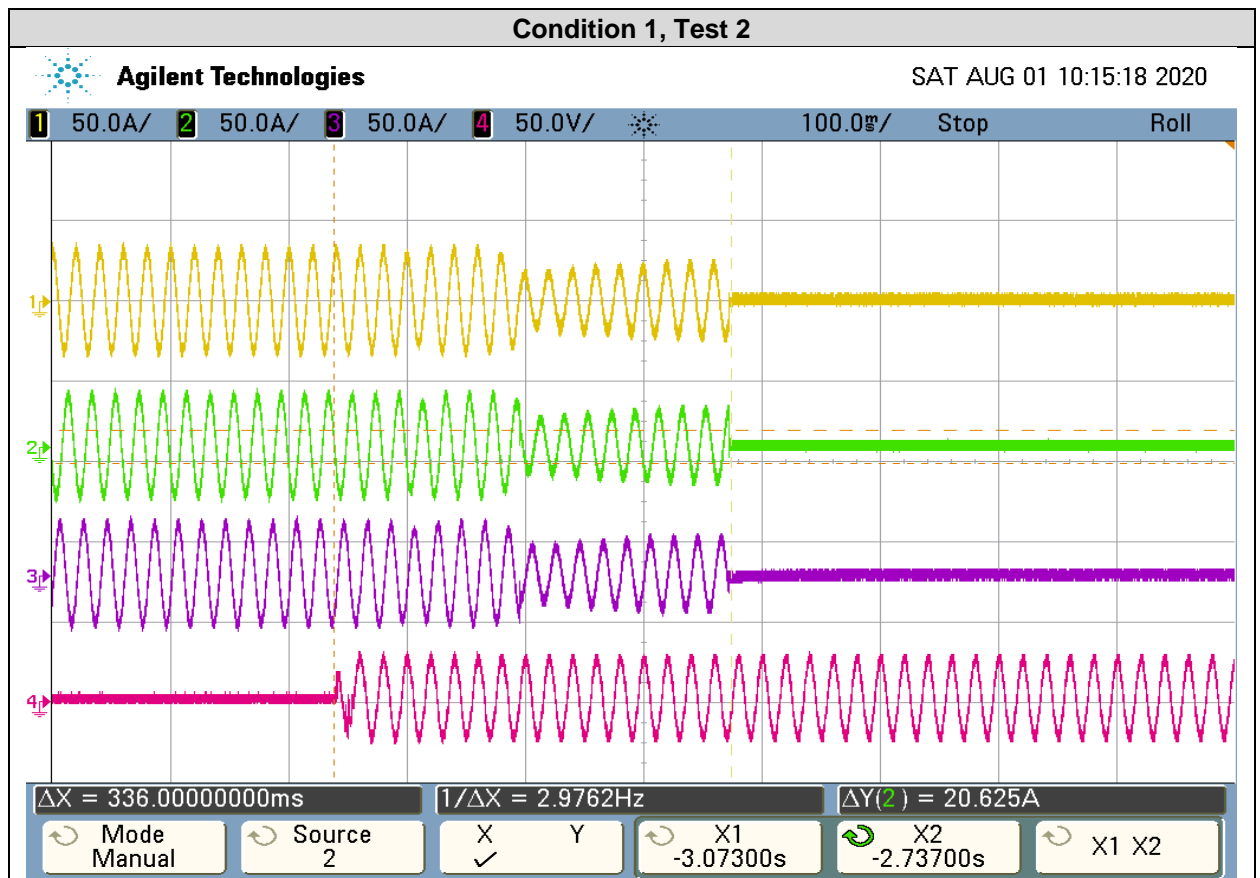
Conditions	P (kW)	Qc (kVAr)	Ql (kVAr)	Time limit (s)	Time measured (ms)
1	15.011	15.035	15.005	< 2	309
1	15.011	15.035	15.005	< 2	336
2	15.011	15.035	15.005	< 2	1200
2	15.011	15.035	15.005	< 2	1155
3	15.011	15.035	15.005	--	--

Condition 1: EUT and ESE with islanding prevention activated.

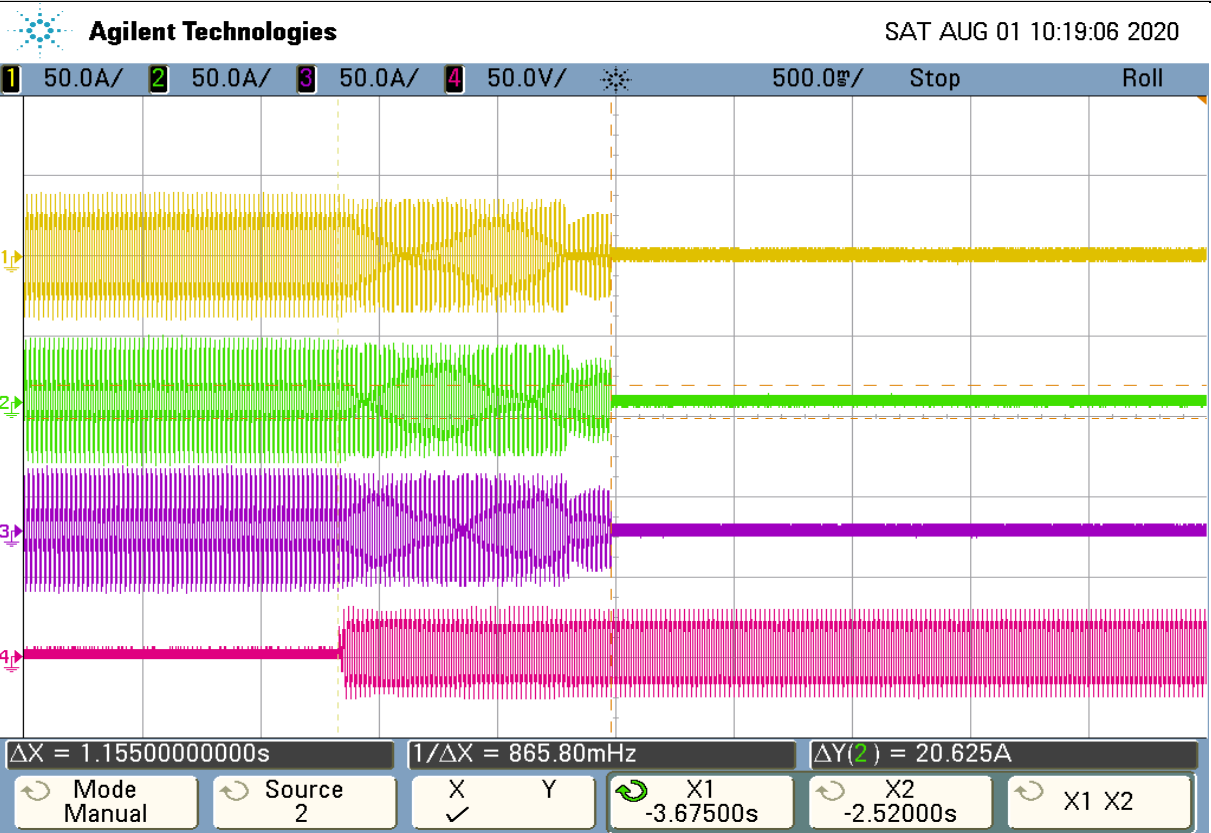
Condition 2: EUT with islanding prevention activated and ESE deactivated.

Condition 3: EUT and ESE with islanding prevention deactivated.

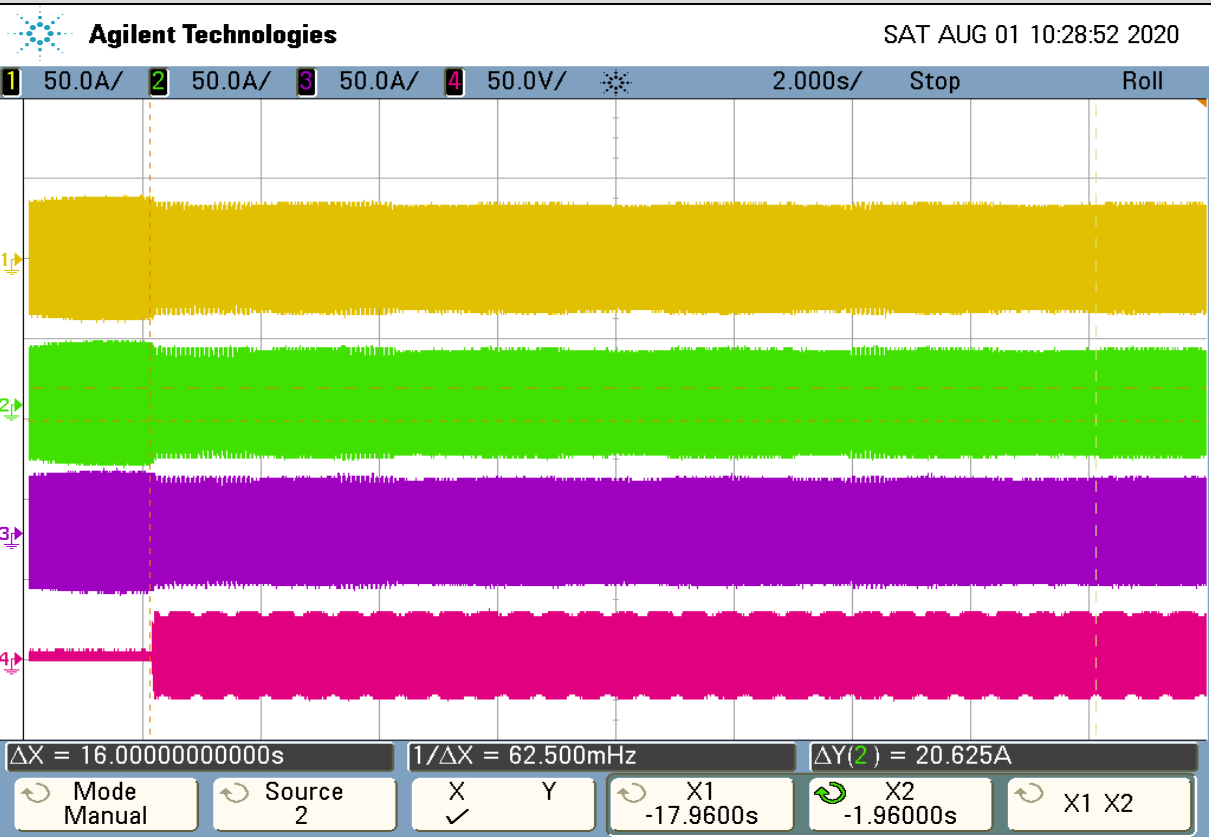




Condition 2, Test 2

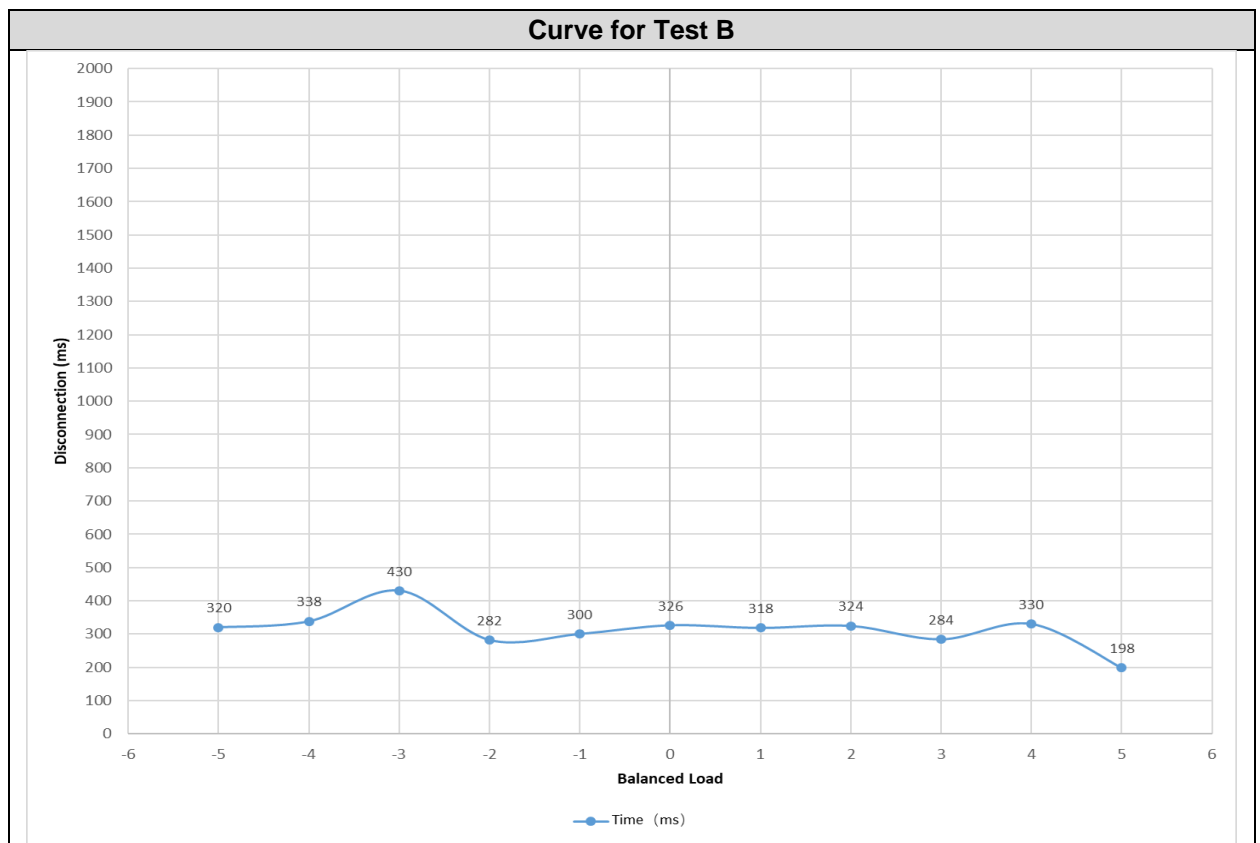


Condition 3



4.6.2 Active Power 50-66 %Pn. Test B

Balanced Load		Disconnection (ms) (limit at t=2s)
M (%)	N (%)	
0	-5	320
0	-4	338
0	-3	430
0	-2	282
0	-1	300
0	0	326
0	+1	318
0	+2	324
0	+3	284
0	+4	330
0	+5	198

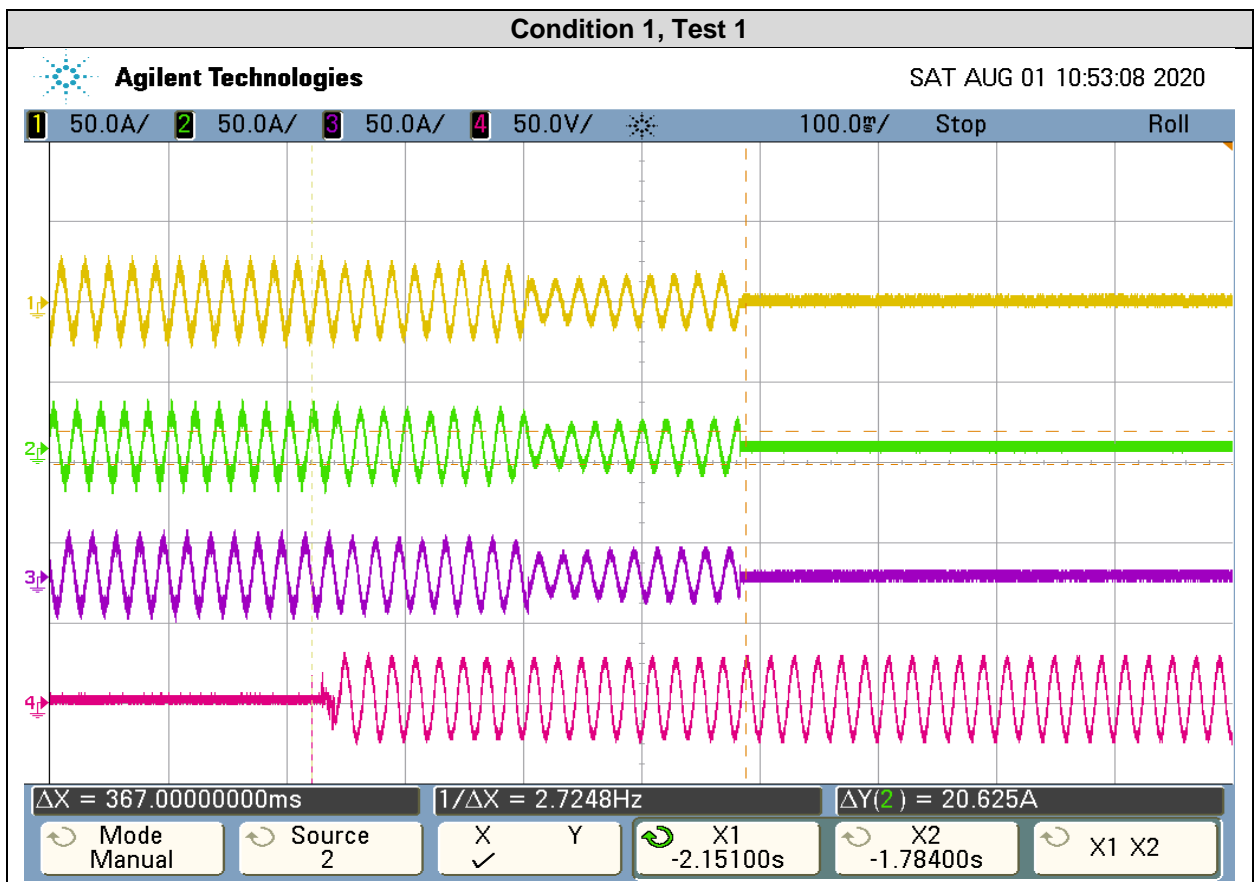


Conditions	P (kW)	Qc (kVAr)	QI (kVAr)	Time limit (s)	Time measured (ms)
1	9.918	9.921	9.928	< 2	367
1	9.918	9.921	9.928	< 2	322
2	9.918	9.921	9.928	< 2	1135
2	9.918	9.921	9.928	< 2	1330
3	9.918	9.921	9.928	--	--

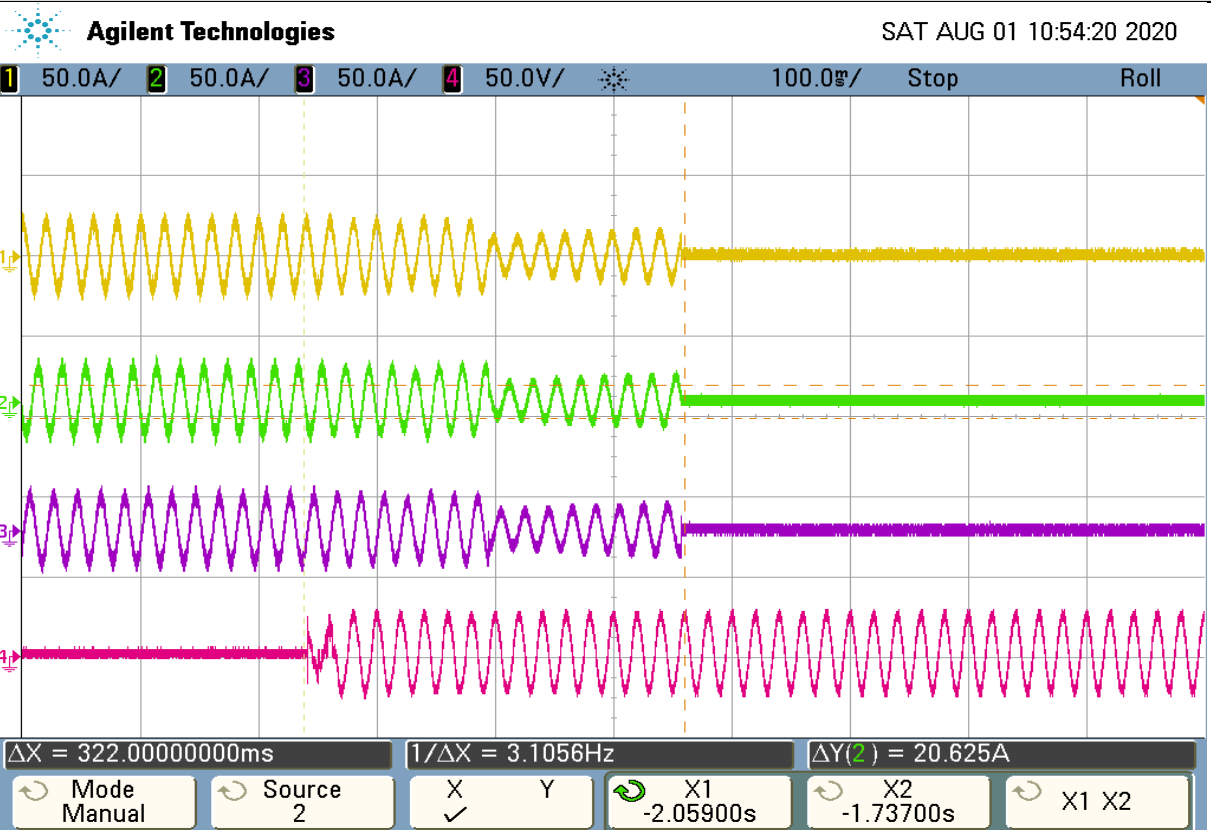
Condition 1: EUT and ESE with islanding prevention activated.

Condition 2: EUT with islanding prevention activated and ESE deactivated.

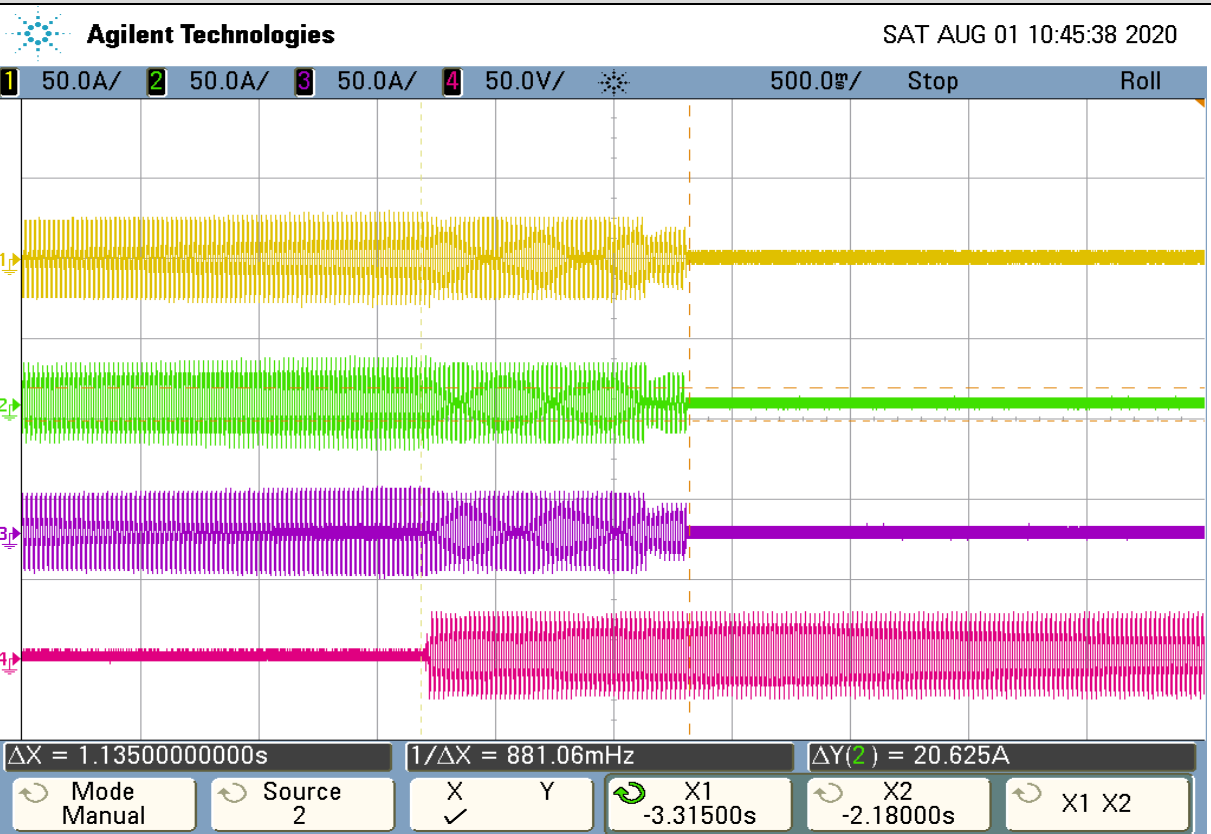
Condition 3: EUT and ESE with islanding prevention deactivated.



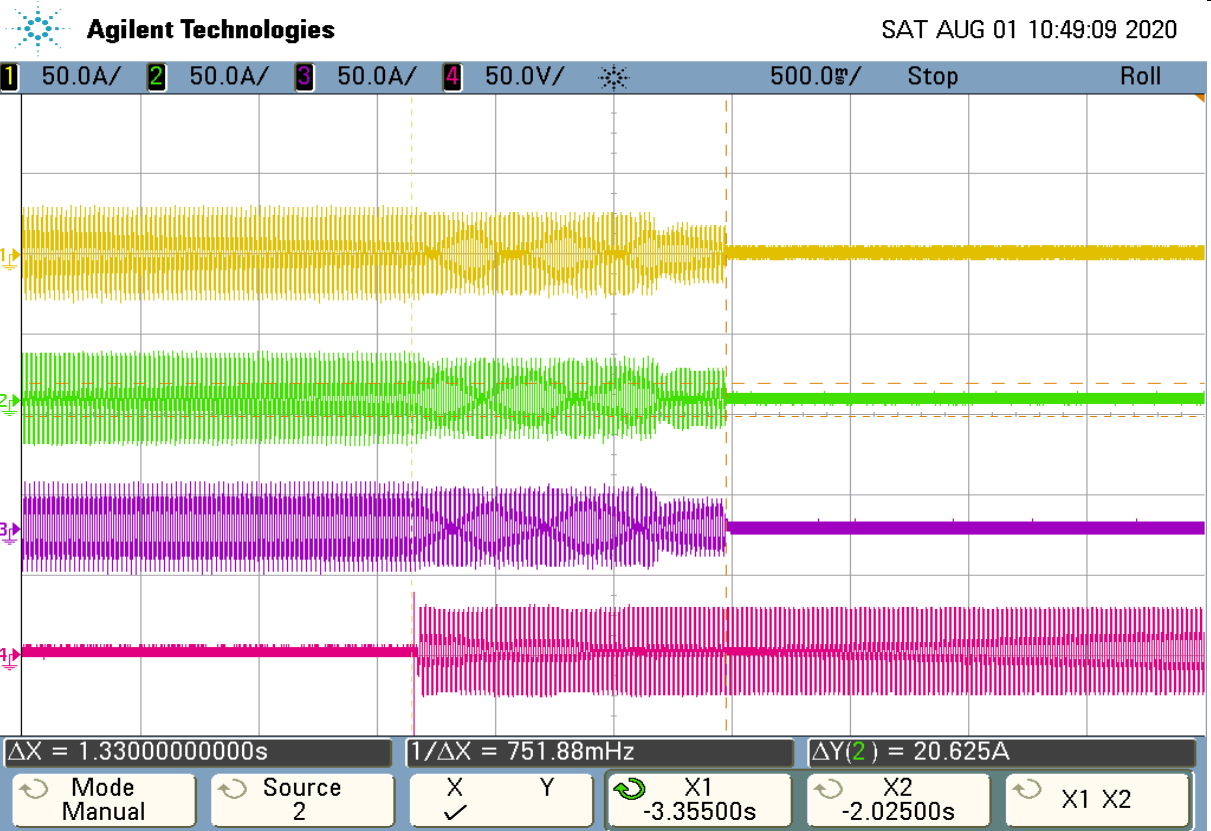
Condition 1, Test 2



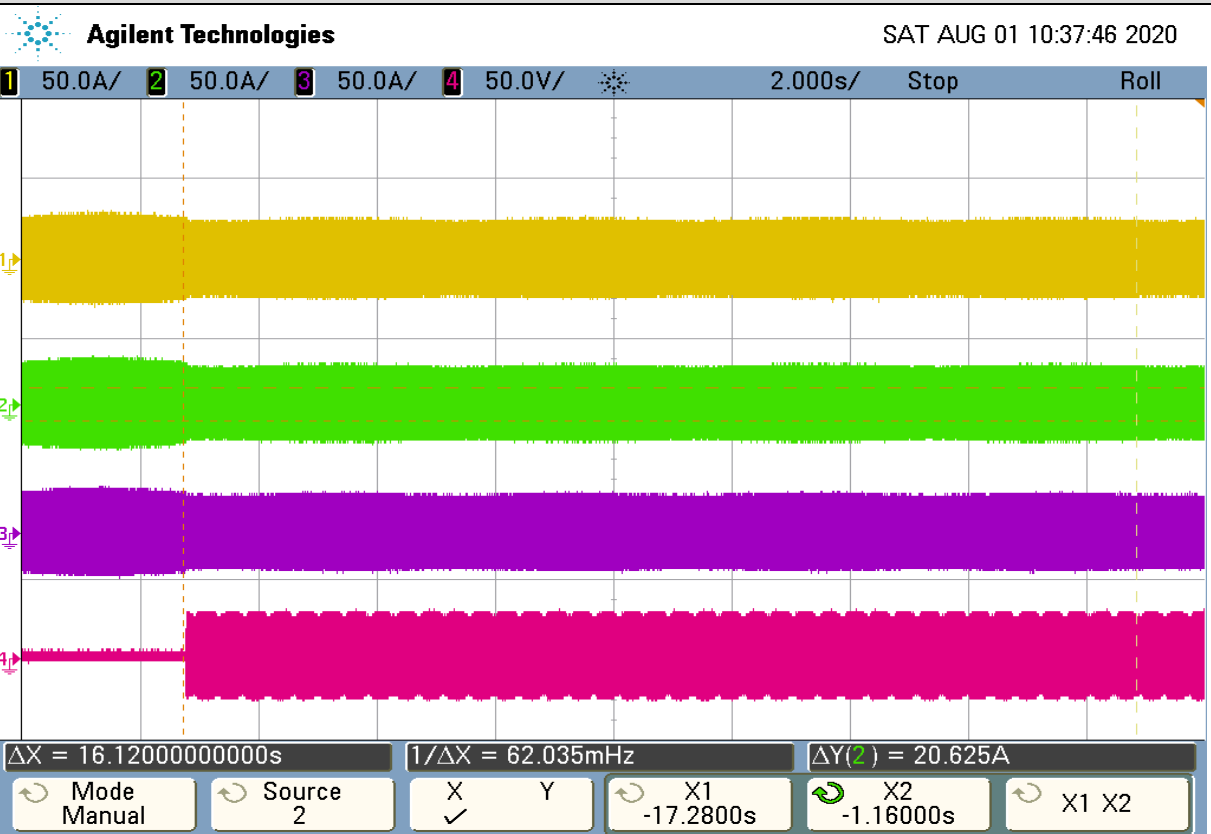
Condition 2, Test 1



Condition 2, Test 2

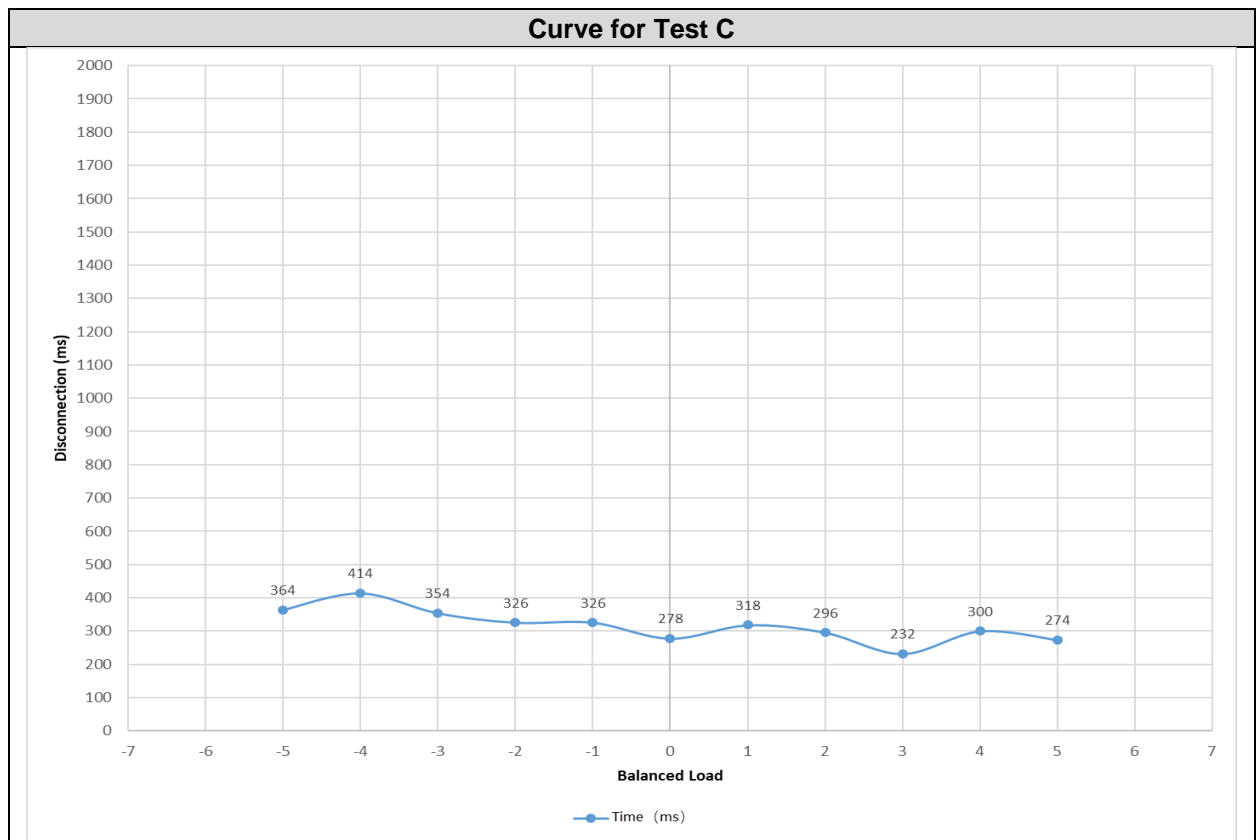


Condition 3



4.6.3 Active Power 25-33 %Pn. Test C

Balanced Load		Disconnection (ms) (limit at t=2s)
M (%)	N (%)	
0	-5	364
0	-4	414
0	-3	354
0	-2	326
0	-1	326
0	0	278
0	+1	318
0	+2	296
0	+3	232
0	+4	300
0	+5	274

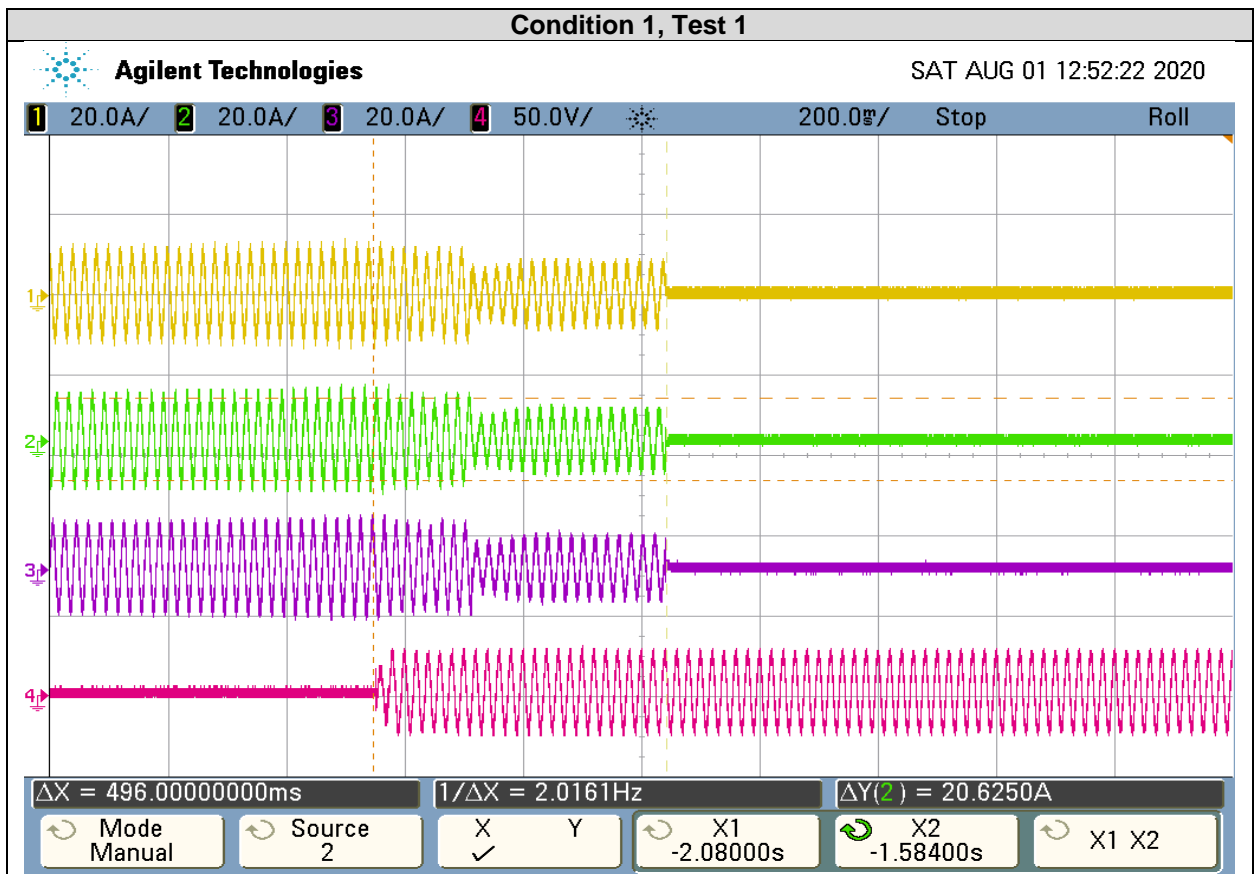


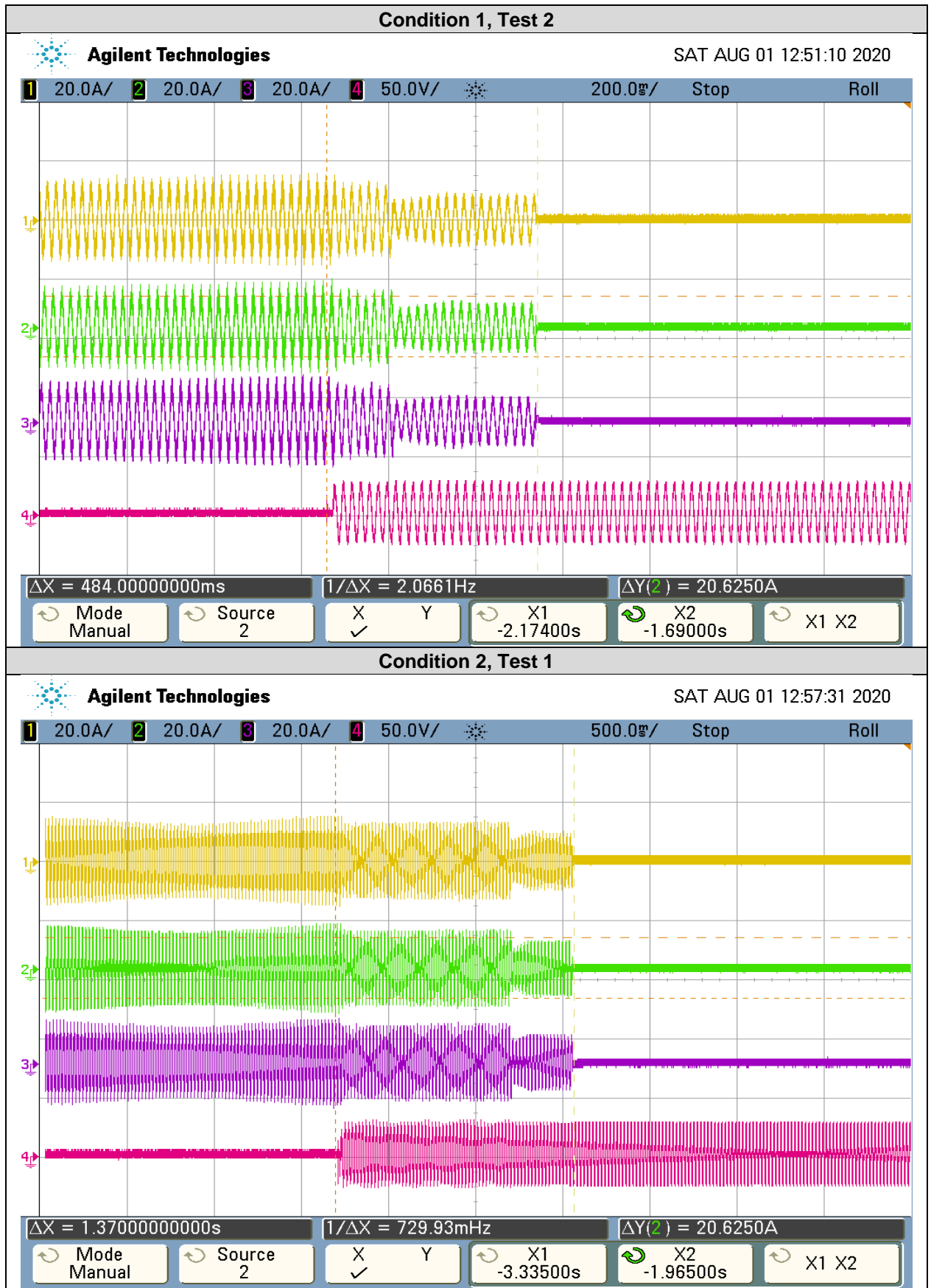
Conditions	P (kW)	Qc (kVAr)	QI (kVAr)	Time limit (s)	Time measured (ms)
1	4.956	4.973	4.961	< 2	496
1	4.956	4.973	4.961	< 2	484
2	4.956	4.973	4.961	< 2	1370
2	4.956	4.973	4.961	< 2	1335
3	4.956	4.973	4.961	--	--

Condition 1: EUT and ESE with islanding prevention activated.

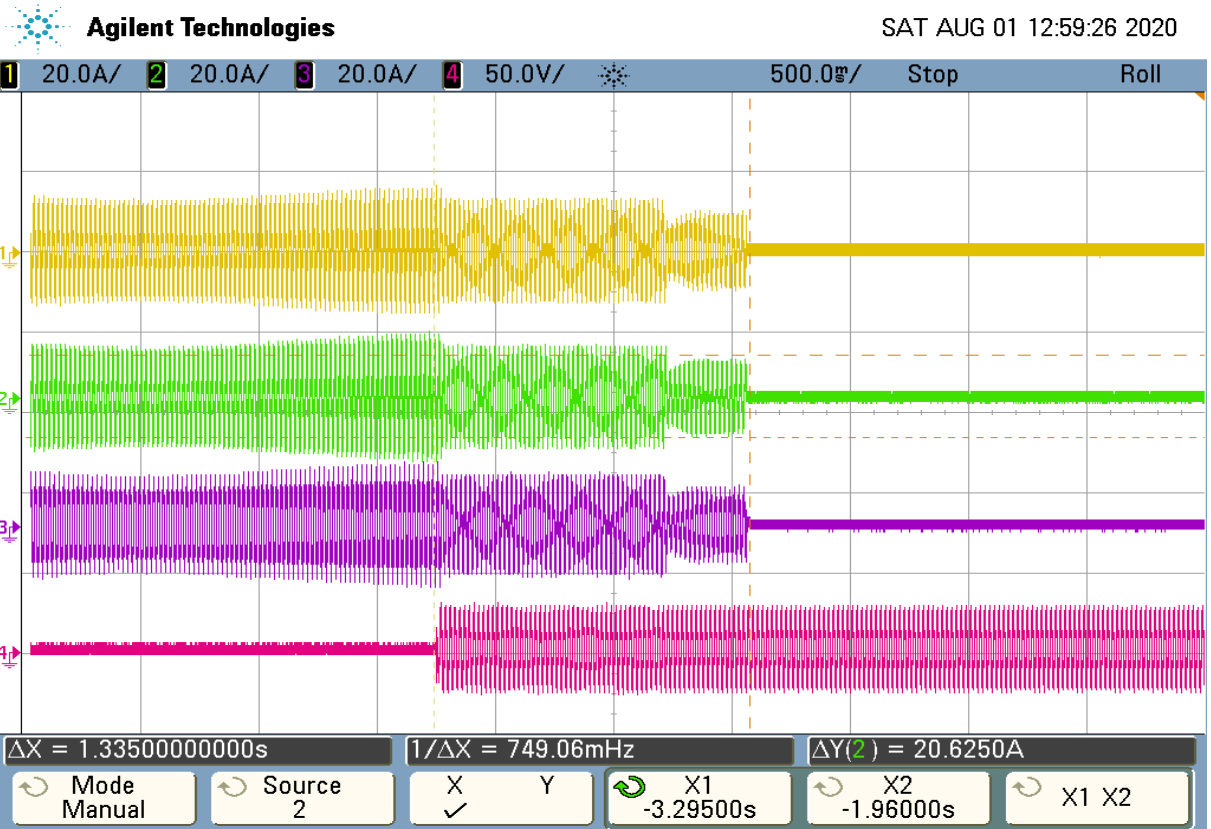
Condition 2: EUT with islanding prevention activated and ESE deactivated.

Condition 3: EUT and ESE with islanding prevention deactivated.

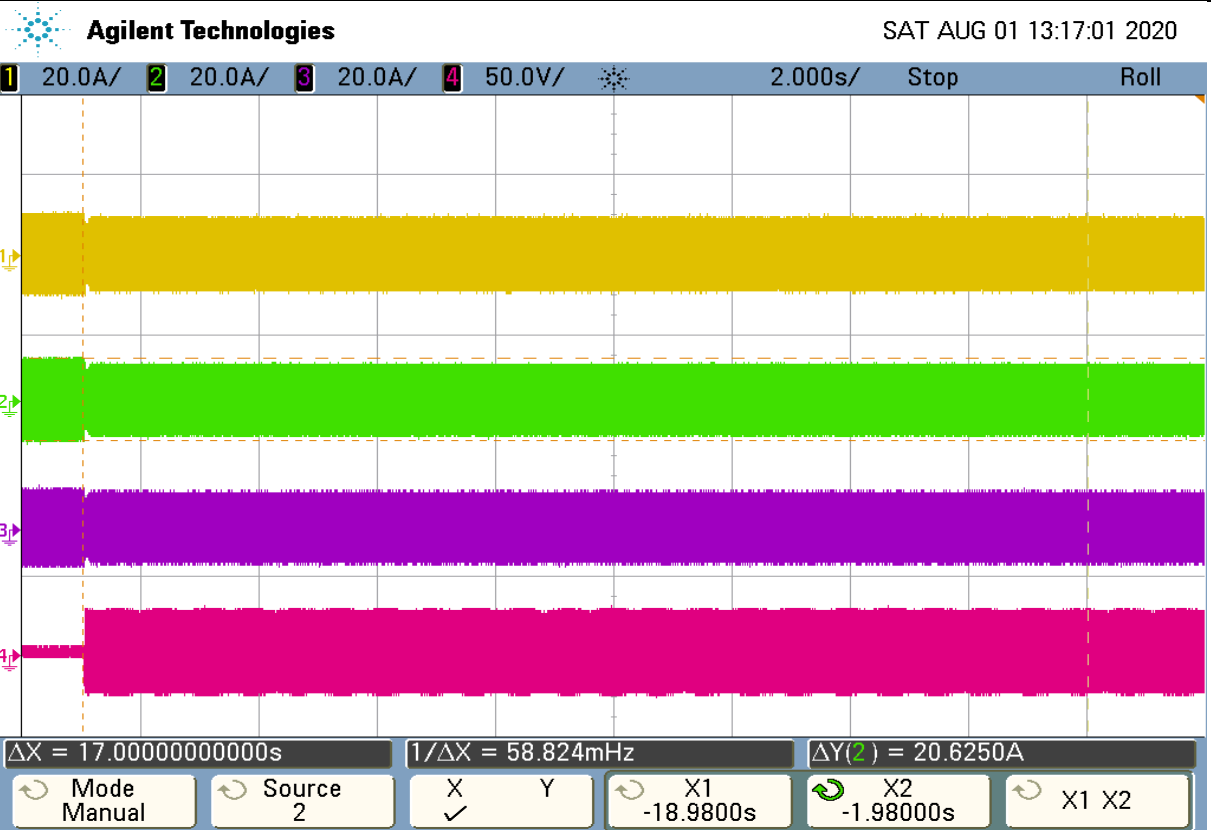




Condition 2, Test 2



Condition 3

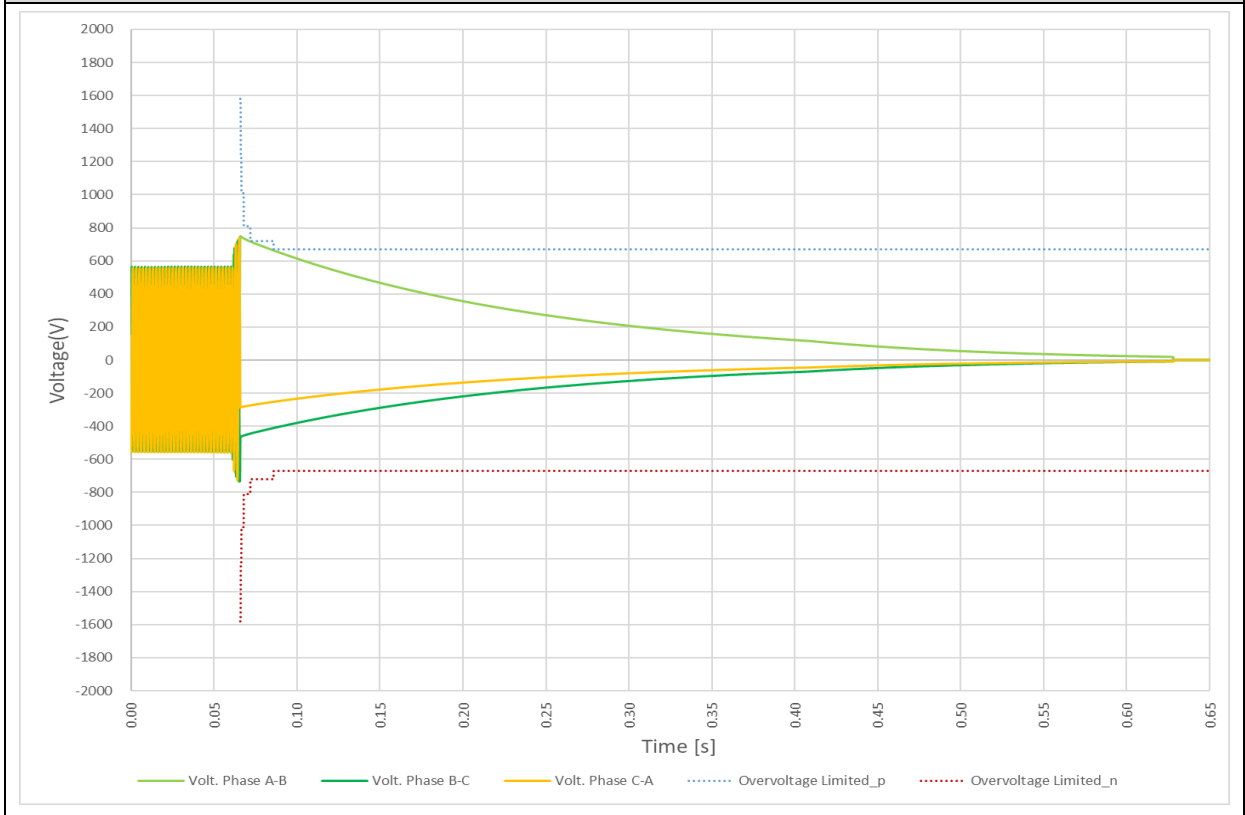


4.7 OVERVOLTAGE GENERATION

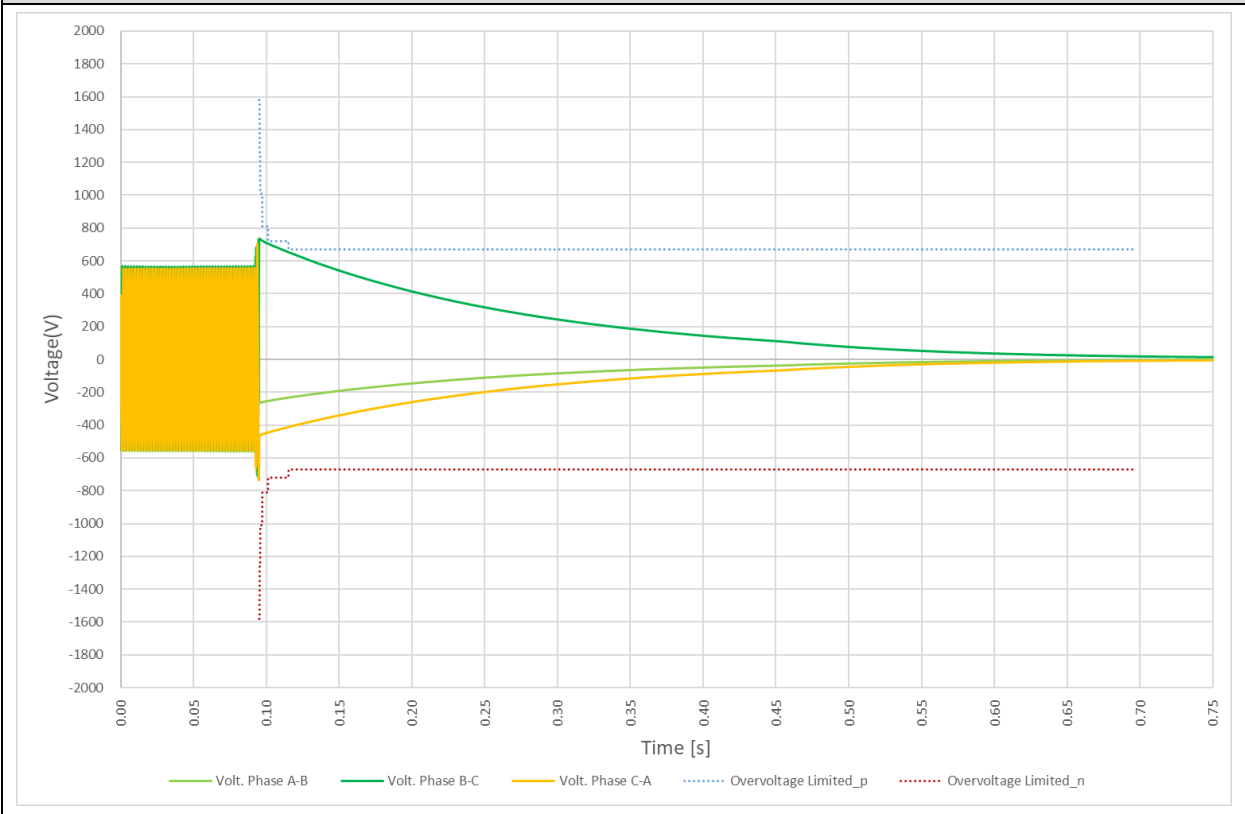
The purpose of this test is to verify that the inverter complies with the transient voltage limits specified below when the grid is disconnected from the inverter. The transient voltage limits have been measured according to the chapter 5.7 of the standard.

Overvoltage duration (s)	Overvoltage limit value (%Un)	Overvoltage value measured (%Un) at 50 %Pn	Overvoltage value measured (%Un) at 75 %Pn	Overvoltage value measured (%Un) at 100 %Pn
Phase A – Phase B				
0.0002	±280	132	-47	-58
0.0006	±218	132	-47	-58
0.002	±178	130	-46	-58
0.006	±145	127	-45	-56
0.02	±129	117	-41	-52
0.06	±120	94	-33	-42
0.2	±120	44	-15	-20
0.6	±120	3	-1	-1
Phase B – Phase C				
0.0002	±280	-82	130	-69
0.0006	±218	-82	129	-69
0.002	±178	-81	128	-68
0.006	±145	-79	125	-66
0.02	±129	-73	116	-61
0.06	±120	-58	93	-49
0.2	±120	-27	44	-23
0.6	±120	-1	3	0
Phase C – Phase A				
0.0002	±280	-50	-82	129
0.0006	±218	-50	-82	129
0.002	±178	-50	-81	127
0.006	±145	-48	-79	124
0.02	±129	-45	-73	115
0.06	±120	-36	-59	92
0.2	±120	-17	-28	43
0.6	±120	-1	-2	2

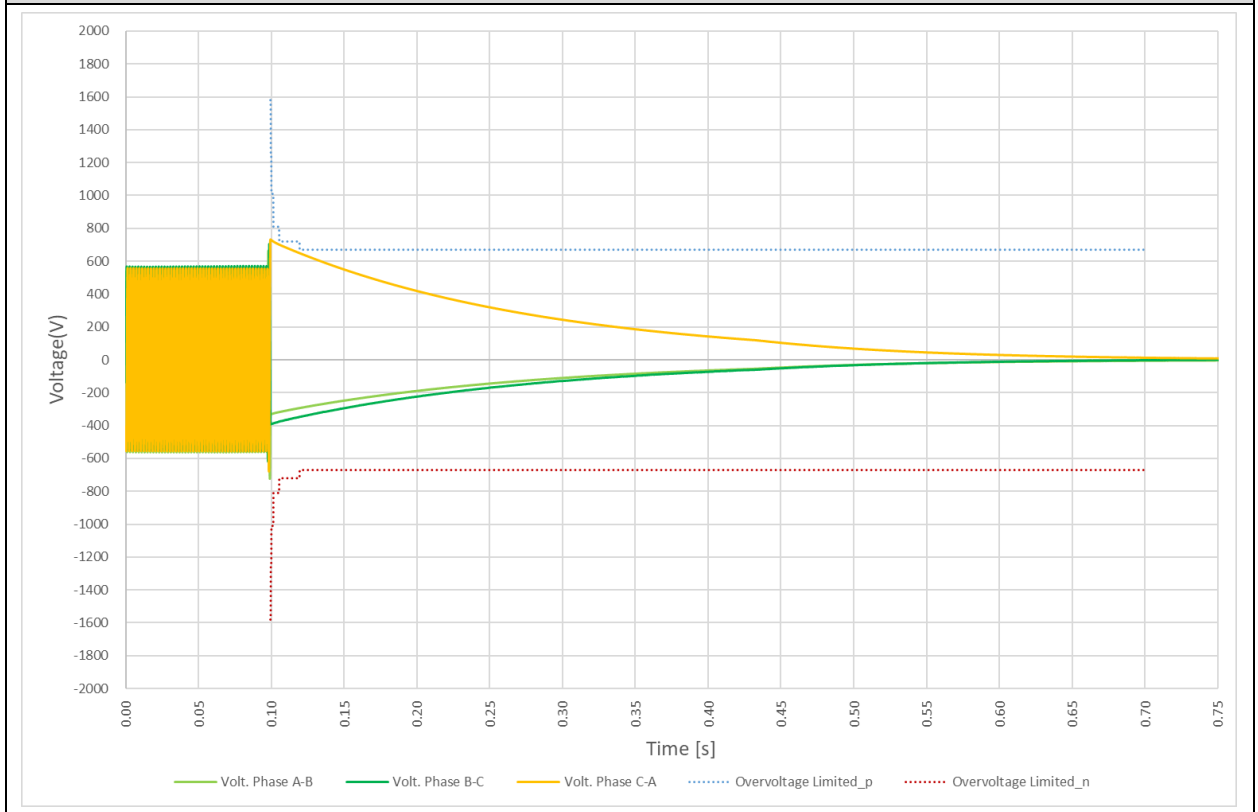
50 %Pn



75 %Pn

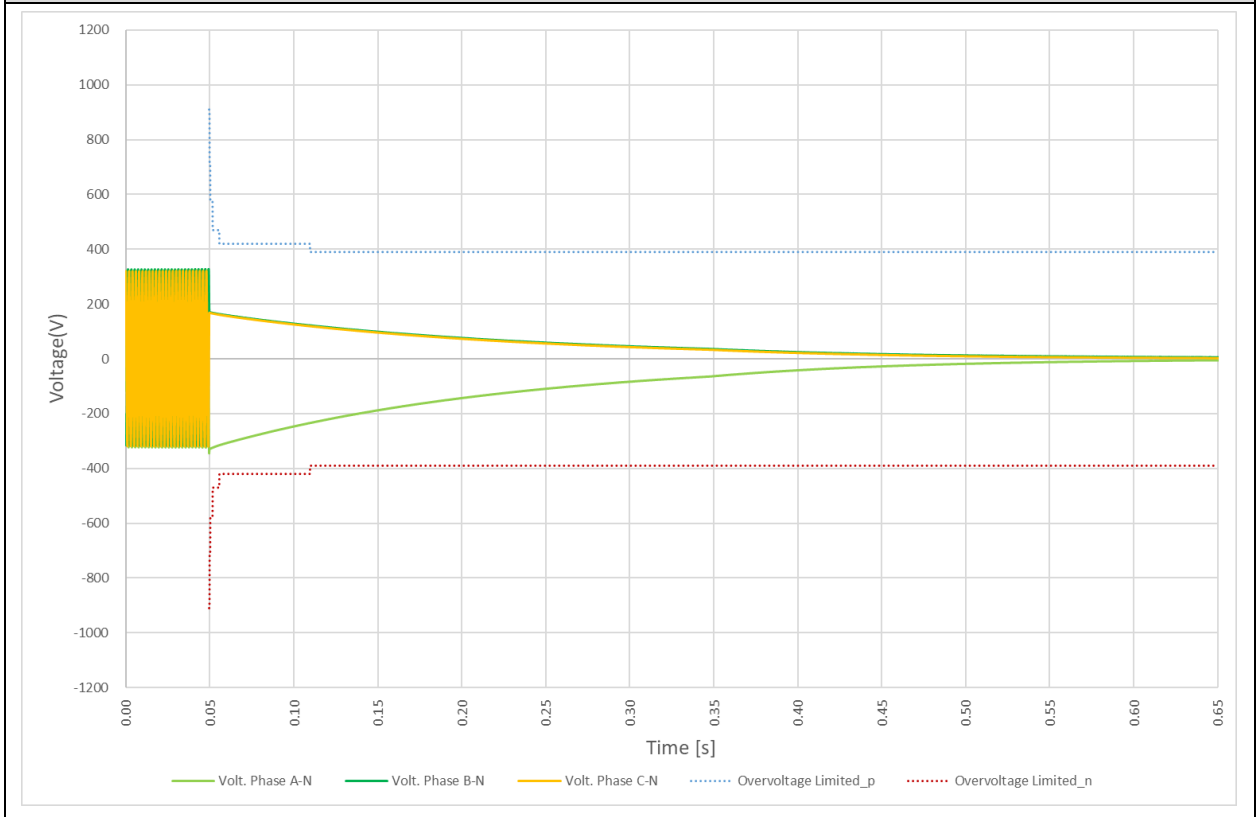


100 %Pn

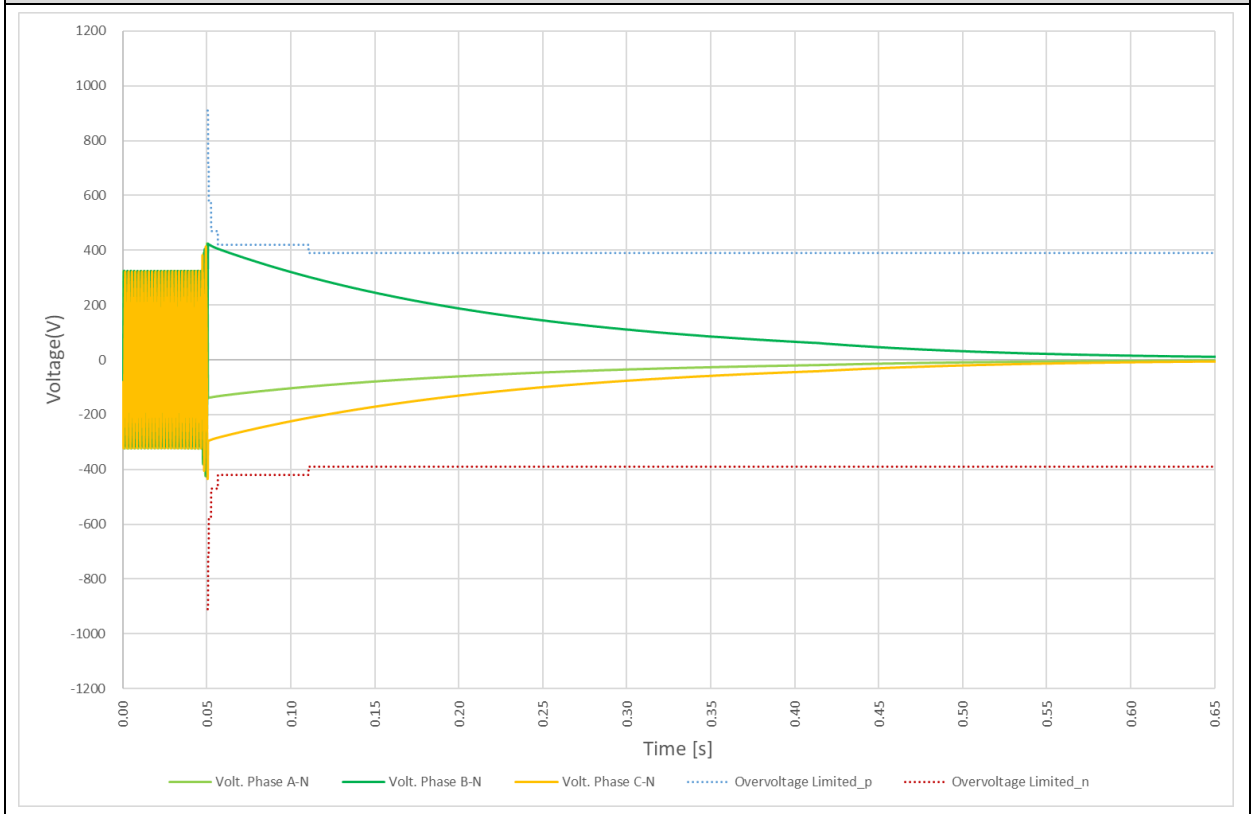


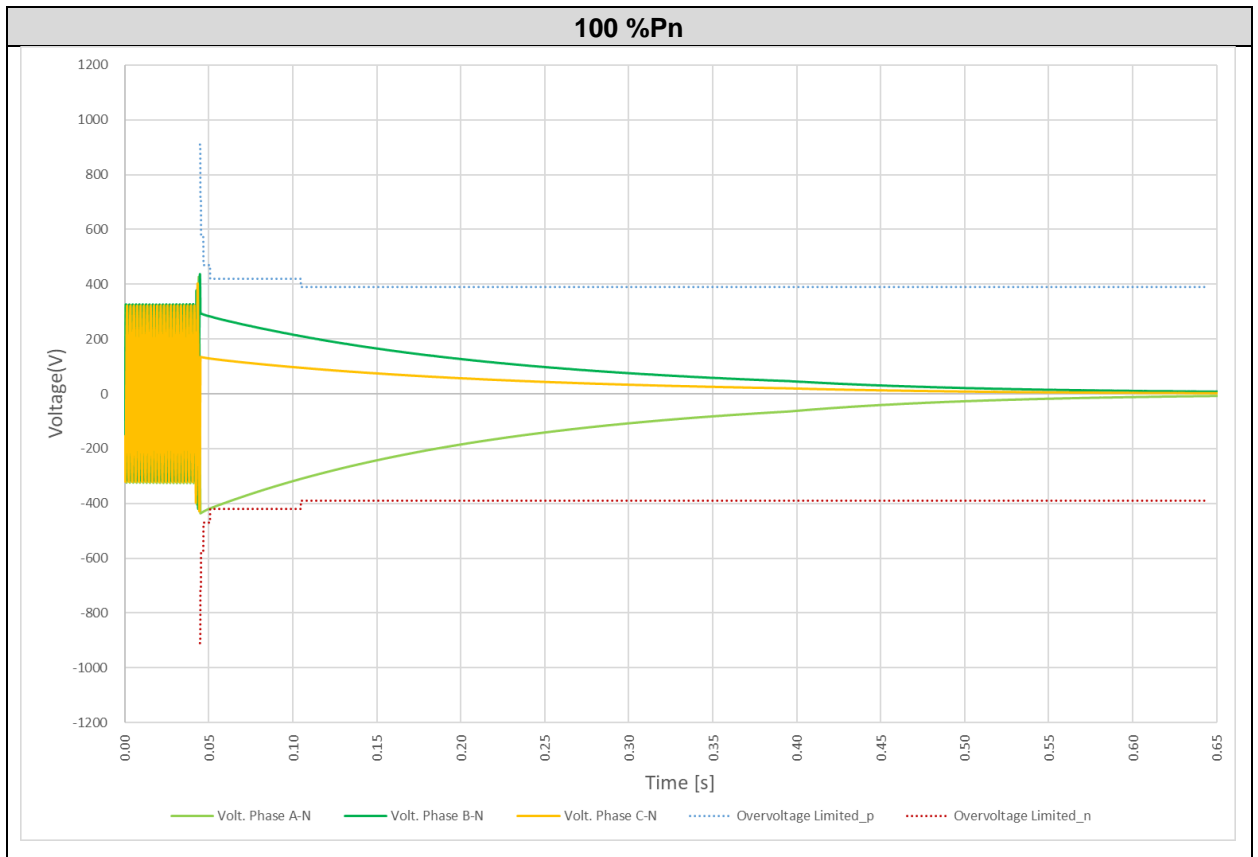
Overvoltage duration (s)	Overvoltage limit value (%Un)	Overvoltage value measured (%Un) at 50 %Pn	Overvoltage value measured (%Un) at 75 %Pn	Overvoltage value measured (%Un) at 100 %Pn
Phase A – N				
0.0002	±280	-101	-38	-120
0.0006	±218	-101	-43	-134
0.002	±178	-100	-42	-132
0.006	±145	-97	-41	-129
0.02	±129	-90	-38	-119
0.06	±120	-72	-30	-95
0.2	±120	-34	-14	-45
0.6	±120	-2	-1	-2
Phase B – N				
0.0002	±280	52	130	108
0.0006	±218	52	130	90
0.002	±178	52	128	89
0.006	±145	50	125	87
0.02	±129	46	116	80
0.06	±120	38	93	65
0.2	±120	18	44	31
0.6	±120	2	3	3
Phase C – N				
0.0002	±280	52	-96	9
0.0006	±218	52	-91	41
0.002	±178	51	-90	41
0.006	±145	50	-87	40
0.02	±129	46	-81	37
0.06	±120	37	-65	29
0.2	±120	17	-31	14
0.6	±120	1	-2	1

50 %Pn



75 %Pn





4.8 GRID QUALITY

4.8.1 Harmonics

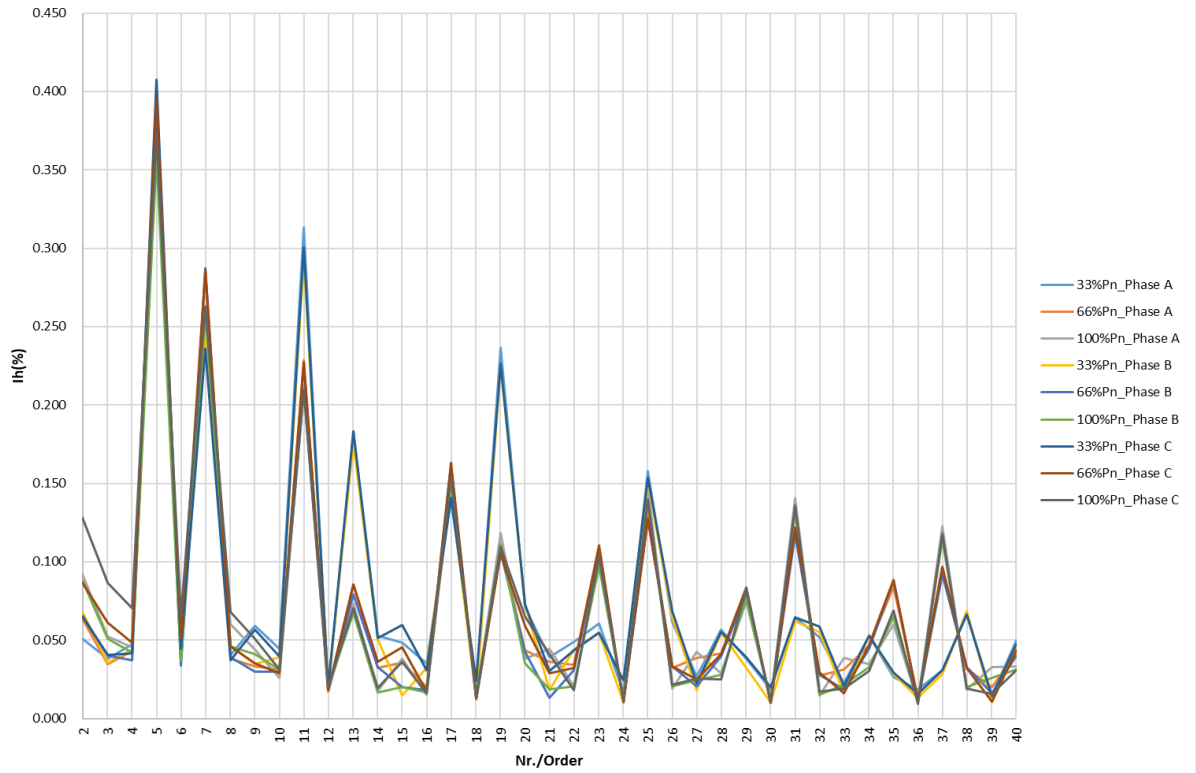
The test has been done according to the standard EN 61000-3-12.

Phase A				
P_{bin} (%)	33	66	100	LIMIT (%)
Nr./Order	I_h (%)	I_h (%)	I_h (%)	
2	0.051	0.064	0.092	8.000
3	0.038	0.035	0.052	5.300
4	0.047	0.043	0.045	4.000
5	0.402	0.395	0.369	10.700
6	0.035	0.040	0.052	2.700
7	0.252	0.284	0.253	7.200
8	0.040	0.038	0.060	2.000
9	0.059	0.033	0.044	1.800
10	0.045	0.031	0.026	1.600
11	0.313	0.229	0.213	3.100
12	0.018	0.017	0.017	1.300
13	0.183	0.086	0.073	2.000
14	0.053	0.032	0.018	--
15	0.048	0.036	0.038	--
16	0.035	0.020	0.015	--
17	0.141	0.155	0.151	--
18	0.020	0.012	0.013	--
19	0.237	0.110	0.118	--
20	0.071	0.044	0.038	--
21	0.039	0.036	0.044	--
22	0.049	0.034	0.020	--
23	0.061	0.107	0.099	--
24	0.017	0.010	0.012	--
25	0.158	0.133	0.147	--
26	0.062	0.033	0.019	--
27	0.027	0.038	0.043	--
28	0.057	0.042	0.029	--
29	0.038	0.079	0.075	--
30	0.019	0.011	0.011	--
31	0.064	0.122	0.141	--
32	0.052	0.027	0.014	--
33	0.023	0.031	0.039	--
34	0.053	0.047	0.035	--
35	0.027	0.084	0.060	--
36	0.019	0.013	0.011	--
37	0.031	0.096	0.123	--
38	0.066	0.032	0.019	--
39	0.015	0.020	0.033	--
40	0.050	0.042	0.033	--
THD (%)	0.722	0.656	0.633	13.000
PWHD (%)	1.827	1.758	1.812	22.000

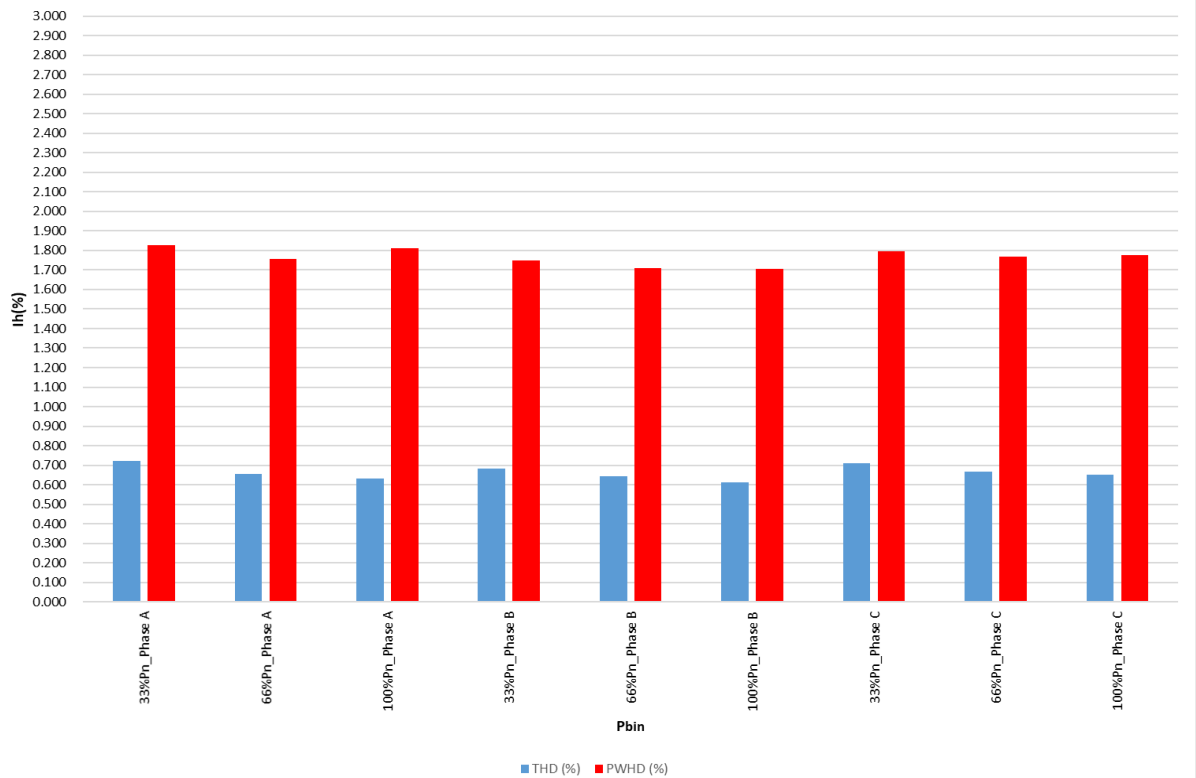
Phase B				
P_{bin} (%)	33	66	100	LIMIT (%)
Nr./Order	I_h (%)	I_h (%)	I_h (%)	
2	0.068	0.065	0.088	8.000
3	0.036	0.040	0.051	5.300
4	0.044	0.037	0.042	4.000
5	0.373	0.382	0.358	10.700
6	0.048	0.034	0.037	2.700
7	0.246	0.287	0.259	7.200
8	0.047	0.039	0.046	2.000
9	0.035	0.030	0.041	1.800
10	0.039	0.030	0.031	1.600
11	0.294	0.226	0.210	3.100
12	0.020	0.019	0.020	1.300
13	0.176	0.079	0.068	2.000
14	0.050	0.033	0.017	--
15	0.015	0.020	0.020	--
16	0.032	0.018	0.017	--
17	0.144	0.161	0.151	--
18	0.013	0.013	0.015	--
19	0.225	0.106	0.111	--
20	0.073	0.042	0.035	--
21	0.018	0.013	0.019	--
22	0.044	0.031	0.021	--
23	0.055	0.106	0.097	--
24	0.010	0.011	0.012	--
25	0.151	0.127	0.138	--
26	0.065	0.033	0.020	--
27	0.018	0.021	0.024	--
28	0.055	0.040	0.028	--
29	0.033	0.080	0.076	--
30	0.010	0.010	0.012	--
31	0.062	0.117	0.132	--
32	0.055	0.028	0.015	--
33	0.016	0.018	0.021	--
34	0.053	0.045	0.033	--
35	0.029	0.088	0.065	--
36	0.013	0.011	0.011	--
37	0.029	0.092	0.114	--
38	0.069	0.033	0.020	--
39	0.010	0.016	0.026	--
40	0.045	0.040	0.031	--
THD (%)	0.684	0.643	0.613	13.000
PWHD (%)	1.749	1.708	1.705	22.000

Phase C				
P_{bin} (%)	33	66	100	LIMIT (%)
Nr./Order	I_h (%)	I_h (%)	I_h (%)	
2	0.065	0.087	0.128	8.000
3	0.041	0.061	0.086	5.300
4	0.041	0.048	0.071	4.000
5	0.408	0.395	0.373	10.700
6	0.045	0.052	0.066	2.700
7	0.236	0.286	0.263	7.200
8	0.037	0.046	0.068	2.000
9	0.057	0.035	0.051	1.800
10	0.040	0.029	0.031	1.600
11	0.300	0.227	0.210	3.100
12	0.020	0.018	0.020	1.300
13	0.183	0.085	0.070	2.000
14	0.051	0.036	0.020	--
15	0.060	0.046	0.036	--
16	0.031	0.017	0.016	--
17	0.141	0.163	0.155	--
18	0.024	0.013	0.014	--
19	0.226	0.105	0.109	--
20	0.073	0.059	0.065	--
21	0.030	0.029	0.041	--
22	0.043	0.033	0.018	--
23	0.055	0.111	0.103	--
24	0.024	0.010	0.012	--
25	0.153	0.127	0.140	--
26	0.068	0.033	0.021	--
27	0.023	0.025	0.025	--
28	0.055	0.041	0.025	--
29	0.039	0.083	0.083	--
30	0.020	0.010	0.010	--
31	0.065	0.122	0.136	--
32	0.059	0.029	0.017	--
33	0.020	0.016	0.019	--
34	0.053	0.047	0.030	--
35	0.029	0.088	0.069	--
36	0.015	0.011	0.010	--
37	0.031	0.097	0.118	--
38	0.066	0.032	0.019	--
39	0.014	0.011	0.016	--
40	0.047	0.043	0.031	--
THD (%)	0.711	0.665	0.650	13.000
PWHD (%)	1.796	1.770	1.775	22.000

Current Harmonics



THD and PWHD



4.8.2 Flickers

The measurements of voltage fluctuations have been measured at 33%, 66% and 100% of the nominal power value of the inverter according to the standard IEC 61000-3-11:2017.

Limits considered are: 1.0 for Pst, 0.65 for Plt, 3.3% for dc and 4% for dmax measurements

Test Results for Phase A				
Pn(%)	Limit	33 %	66 %	100 %
PST	≤ 1.0	0.061	0.044	0.058
PLT	≤ 0.65	0.053	0.032	0.053
dc [%]	≤ 3.30	0.115	0.114	0.127
dmax [%]	4	0.188	0.213	0.180

Test Results for Phase B				
Pn(%)	Limit	33 %	66 %	100 %
PST	≤ 1.0	0.142	0.139	0.135
PLT	≤ 0.65	0.140	0.137	0.135
dc [%]	≤ 3.30	0.018	0.011	0.051
dmax [%]	4	0.158	0.119	0.152

Test Results for Phase C				
Pn(%)	Limit	33 %	66 %	100 %
PST	≤ 1.0	0.053	0.048	0.043
PLT	≤ 0.65	0.050	0.046	0.041
dc [%]	≤ 3.30	0.057	0.020	0.000
dmax [%]	4	0.109	0.108	0.000

As it can be seen in the next screenshots, this test has 12 steps. The values took of Pst, Plt, dc and dmax are the most unfavorable of the 12 steps.

Running operation 33% Pn – Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL

AVG

Line Filter

Freq Filter

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 600 V/50Hz

Un (U1) 230.149V

Freq (U1) 50.000Hz

Dmin 0.10%

Element1 Judgement Pass

Total Judgement Pass

(Element1,2,3)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.087 Pass	0.188 Pass	0.0 Pass	0.041 Pass	
2	0.085 Pass	0.159 Pass	0.0 Pass	0.039 Pass	
3	0.110 Pass	0.159 Pass	0.0 Pass	0.048 Pass	
4	0.113 Pass	0.161 Pass	0.0 Pass	0.054 Pass	
5	0.113 Pass	0.153 Pass	0.0 Pass	0.053 Pass	
6	0.115 Pass	0.136 Pass	0.0 Pass	0.058 Pass	
7	0.106 Pass	0.162 Pass	0.0 Pass	0.061 Pass	
8	0.103 Pass	0.137 Pass	0.0 Pass	0.057 Pass	
9	0.104 Pass	0.156 Pass	0.0 Pass	0.056 Pass	
10	0.097 Pass	0.134 Pass	0.0 Pass	0.054 Pass	
11	0.103 Pass	0.162 Pass	0.0 Pass	0.054 Pass	
12	0.099 Pass	0.154 Pass	0.0 Pass	0.057 Pass	
Result	Pass	Pass	Pass	Pass	0.053 Pass

Update: 3646

Runtime: 5:04:42

150%
10%

x1

2020-06-03
13:30:54

⚙️

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 33% Pn – Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL

AVG

Line Filter

Freq Filter

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 600 V/50Hz

Un (U2) 230.110V

Freq (U2) 50.000Hz

Dmin 0.10%

Element2 Judgement Pass

Total Judgement Pass

(Element1,2,3)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.004 Pass	0.111 Pass	0.0 Pass	0.142 Pass	
2	0.003 Pass	0.119 Pass	0.0 Pass	0.141 Pass	
3	0.011 Pass	0.101 Pass	0.0 Pass	0.140 Pass	
4	0.012 Pass	0.111 Pass	0.0 Pass	0.140 Pass	
5	0.000 Pass	0.000 Pass	0.0 Pass	0.140 Pass	
6	0.000 Pass	0.000 Pass	0.0 Pass	0.140 Pass	
7	0.000 Pass	0.000 Pass	0.0 Pass	0.139 Pass	
8	0.018 Pass	0.158 Pass	0.0 Pass	0.140 Pass	
9	0.014 Pass	0.123 Pass	0.0 Pass	0.139 Pass	
10	0.009 Pass	0.107 Pass	0.0 Pass	0.140 Pass	
11	0.006 Pass	0.102 Pass	0.0 Pass	0.139 Pass	
12	0.009 Pass	0.117 Pass	0.0 Pass	0.140 Pass	
Result	Pass	Pass	Pass	Pass	0.140 Pass

Update: 3650

Runtime: 5:04:51

150%
10%

x1

2020-06-03
13:31:03

⚙️

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 33% Pn – Phase C

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter
 AVG Freq Filter

PA_00002.tif

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 600 V/50Hz Element3 Judgement Pass

Un (U3) 230.213V Total Judgement Pass

Freq (U3) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt			
Limit	3.30	4.00	500	1.00	0.65			
			3.30%		N:12			
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.053	Pass
2	0.000	Pass	0.000	Pass	0.0	Pass	0.051	Pass
3	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass
4	0.000	Pass	0.000	Pass	0.0	Pass	0.050	Pass
5	0.017	Pass	0.108	Pass	0.0	Pass	0.050	Pass
6	0.020	Pass	0.106	Pass	0.0	Pass	0.049	Pass
7	0.014	Pass	0.104	Pass	0.0	Pass	0.050	Pass
8	0.057	Pass	0.109	Pass	0.0	Pass	0.050	Pass
9	0.049	Pass	0.108	Pass	0.0	Pass	0.049	Pass
10	0.002	Pass	0.106	Pass	0.0	Pass	0.048	Pass
11	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass
12	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass
Result		Pass		Pass		Pass	0.050	Pass

Update: 3655 Runtime: 5:05:00 50% 10% x1 2020-06-03 13:31:12

ΣA[3P4W]

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 66% Pn – Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter
 AVG Freq Filter

PA_00000.tif

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 600 V/50Hz Element1 Judgement Pass

Un (U1) 230.272V Total Judgement Pass

Freq (U1) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt			
Limit	3.30	4.00	500	1.00	0.65			
			3.30%		N:12			
No. 1	0.114	Pass	0.159	Pass	0.0	Pass	0.044	Pass
2	0.068	Pass	0.109	Pass	0.0	Pass	0.037	Pass
3	0.092	Pass	0.132	Pass	0.0	Pass	0.027	Pass
4	0.017	Pass	0.165	Pass	0.0	Pass	0.033	Pass
5	0.098	Pass	0.213	Pass	0.0	Pass	0.025	Pass
6	0.071	Pass	0.133	Pass	0.0	Pass	0.025	Pass
7	0.078	Pass	0.171	Pass	0.0	Pass	0.026	Pass
8	0.104	Pass	0.199	Pass	0.0	Pass	0.032	Pass
9	0.036	Pass	0.151	Pass	0.0	Pass	0.027	Pass
10	0.095	Pass	0.152	Pass	0.0	Pass	0.028	Pass
11	0.081	Pass	0.146	Pass	0.0	Pass	0.030	Pass
12	0.090	Pass	0.144	Pass	0.0	Pass	0.033	Pass
Result		Pass		Pass		Pass	0.032	Pass

Update: 3716 Runtime: 7:39:47 51% 10% x1 2020-06-03 16:06:00

ΣA[3P4W]

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 66% Pn – Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
U1	U2	U3	U4	U5	U6	U7

SCL Line Filter
 AVG Freq Filter

PA_00004.tif

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 600 V/50Hz Element2 Judgement Pass

Un (U2) 230.157V Total Judgement Pass

Freq (U2) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt			
Limit	3.30	4.00	500	1.00	0.65			
			3.30%		N:12			
No. 1	0.010	Pass	0.119	Pass	0.0	Pass	0.139	Pass
2	0.007	Pass	0.111	Pass	0.0	Pass	0.138	Pass
3	0.006	Pass	0.114	Pass	0.0	Pass	0.137	Pass
4	0.000	Pass	0.000	Pass	0.0	Pass	0.136	Pass
5	0.007	Pass	0.104	Pass	0.0	Pass	0.136	Pass
6	0.009	Pass	0.103	Pass	0.0	Pass	0.137	Pass
7	0.000	Pass	0.000	Pass	0.0	Pass	0.136	Pass
8	0.006	Pass	0.105	Pass	0.0	Pass	0.137	Pass
9	0.000	Pass	0.000	Pass	0.0	Pass	0.137	Pass
10	0.011	Pass	0.104	Pass	0.0	Pass	0.136	Pass
11	0.010	Pass	0.119	Pass	0.0	Pass	0.137	Pass
12	0.000	Pass	0.000	Pass	0.0	Pass	0.137	Pass
Result		Pass		Pass		Pass	0.137	Pass

Update: 3722 Runtime: 7:40:00 2020-06-03 16:06:13

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 66% Pn – Phase C

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
U1	U2	U3	U4	U5	U6	U7

SCL Line Filter
 AVG Freq Filter

PA_00005.tif

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 600 V/50Hz Element3 Judgement Pass

Un (U3) 230.253V Total Judgement Pass

Freq (U3) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt			
Limit	3.30	4.00	500	1.00	0.65			
			3.30%		N:12			
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.048	Pass
2	0.000	Pass	0.000	Pass	0.0	Pass	0.047	Pass
3	0.013	Pass	0.101	Pass	0.0	Pass	0.046	Pass
4	0.009	Pass	0.101	Pass	0.0	Pass	0.045	Pass
5	0.000	Pass	0.000	Pass	0.0	Pass	0.046	Pass
6	0.000	Pass	0.000	Pass	0.0	Pass	0.046	Pass
7	0.000	Pass	0.000	Pass	0.0	Pass	0.046	Pass
8	0.000	Pass	0.000	Pass	0.0	Pass	0.046	Pass
9	0.000	Pass	0.000	Pass	0.0	Pass	0.046	Pass
10	0.020	Pass	0.108	Pass	0.0	Pass	0.046	Pass
11	0.000	Pass	0.000	Pass	0.0	Pass	0.047	Pass
12	0.000	Pass	0.000	Pass	0.0	Pass	0.047	Pass
Result		Pass		Pass		Pass	0.046	Pass

Update: 3726 Runtime: 7:40:07 2020-06-03 16:06:20

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 100% Pn – Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter
 AVG Freq Filter

CH: 1 2 3

Count 12/12 Complete
 Interval 00:00s/10:00s

Element 1
 Volt Range 300 V/50Hz
 Un (U1) 230.339V
 Freq (U1) 50.000Hz
 Dmin 0.10%

Element1 Judgement Pass
 Total Judgement Pass
 (Element1,2,3)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.103 Pass	0.139 Pass	0.0 Pass	0.058 Pass	
2	0.100 Pass	0.140 Pass	0.0 Pass	0.056 Pass	
3	0.112 Pass	0.141 Pass	0.0 Pass	0.055 Pass	
4	0.103 Pass	0.132 Pass	0.0 Pass	0.054 Pass	
5	0.091 Pass	0.144 Pass	0.0 Pass	0.054 Pass	
6	0.100 Pass	0.168 Pass	0.0 Pass	0.053 Pass	
7	0.096 Pass	0.139 Pass	0.0 Pass	0.052 Pass	
8	0.107 Pass	0.180 Pass	0.0 Pass	0.053 Pass	
9	0.107 Pass	0.173 Pass	0.0 Pass	0.052 Pass	
10	0.127 Pass	0.173 Pass	0.0 Pass	0.052 Pass	
11	0.112 Pass	0.137 Pass	0.0 Pass	0.052 Pass	
12	0.102 Pass	0.155 Pass	0.0 Pass	0.052 Pass	
Result	Pass	Pass	Pass	Pass	0.053 Pass

Update: 3757

Runtime: 4:42:50

138%
10%

2020-06-06
13:24:37

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 100% Pn – Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter
 AVG Freq Filter

CH: 1 2 3

Count 12/12 Complete
 Interval 00:00s/10:00s

Element 2
 Volt Range 300 V/50Hz
 Un (U2) 230.370V
 Freq (U2) 50.000Hz
 Dmin 0.10%

Element2 Judgement Pass
 Total Judgement Pass
 (Element1,2,3)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.014 Pass	0.106 Pass	0.0 Pass	0.135 Pass	
2	0.008 Pass	0.105 Pass	0.0 Pass	0.135 Pass	
3	0.010 Pass	0.110 Pass	0.0 Pass	0.134 Pass	
4	0.005 Pass	0.120 Pass	0.0 Pass	0.135 Pass	
5	0.032 Pass	0.112 Pass	0.0 Pass	0.135 Pass	
6	0.051 Pass	0.152 Pass	0.0 Pass	0.135 Pass	
7	0.000 Pass	0.000 Pass	0.0 Pass	0.134 Pass	
8	0.007 Pass	0.101 Pass	0.0 Pass	0.134 Pass	
9	0.003 Pass	0.109 Pass	0.0 Pass	0.134 Pass	
10	0.008 Pass	0.112 Pass	0.0 Pass	0.135 Pass	
11	0.000 Pass	0.000 Pass	0.0 Pass	0.134 Pass	
12	0.000 Pass	0.000 Pass	0.0 Pass	0.134 Pass	
Result	Pass	Pass	Pass	Pass	0.135 Pass

Update: 3761

Runtime: 4:42:58

138%
10%

2020-06-06
13:24:45

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Running operation 100% Pn – Phase C

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter
 AVG Freq Filter

PA_00011.tif

CH:

1

2

3

Count 12/12 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 300 V/50Hz Element3 Judgement Pass

Un (U3) 230.422V Total Judgement Pass

Freq (U3) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500	1.00	0.65
			3.30%		N:12
No. 1	0.000 Pass	0.000 Pass	0.0 Pass	0.043 Pass	
2	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
3	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
4	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
5	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
6	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
7	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
8	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
9	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
10	0.000 Pass	0.000 Pass	0.0 Pass	0.039 Pass	
11	0.000 Pass	0.000 Pass	0.0 Pass	0.040 Pass	
12	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
Result	Pass	Pass	Pass	Pass	0.041 Pass

Σ A(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Update: 3766

Runtime: 4:43:07

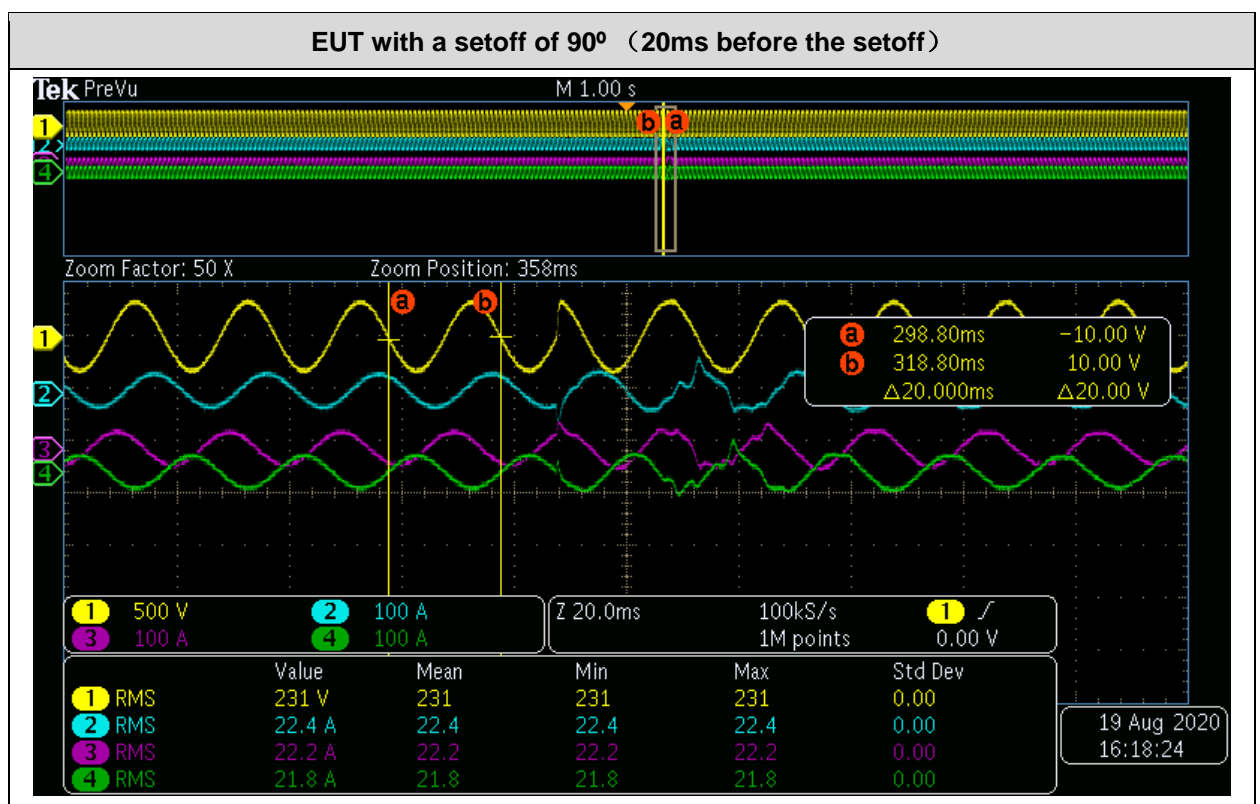
138%
10%

2020-06-06
13:24:54

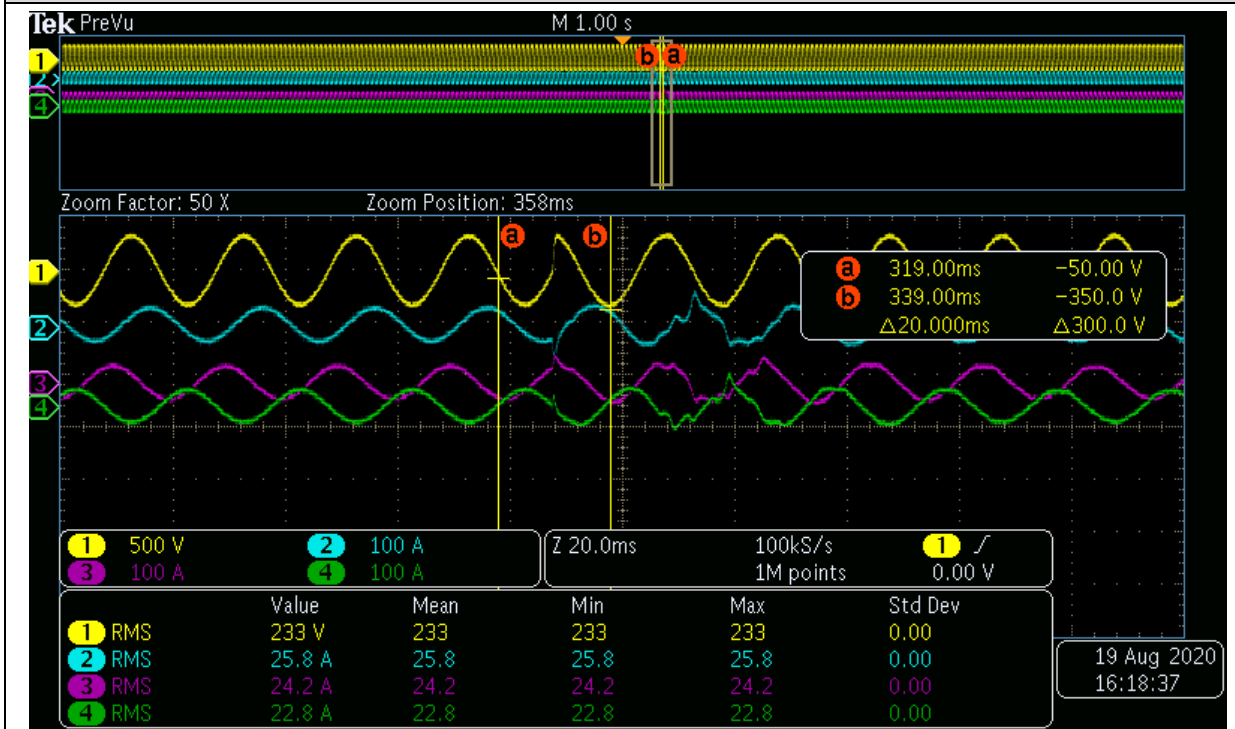
4.9 RECONNECTION OUT OF SYNCHRONISM

The compliance with these requirements is stated in following test report:

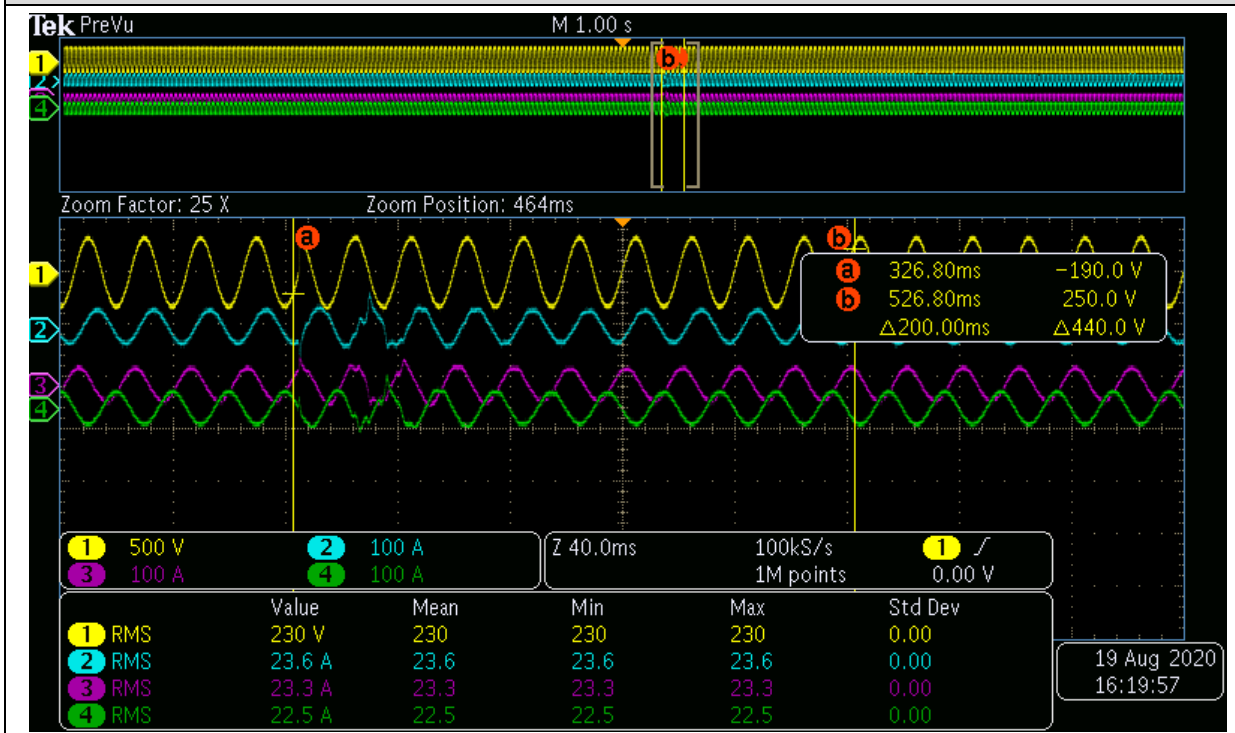
Setoff	Angle before the setoff	Angle after the setoff	Current 20 ms before the setoff	Current 200 ms after the setoff
90°	0°	90°	Phase A: 22.4 A Phase B: 22.2 A Phase C: 21.8 A	Phase A: 23.6 A Phase B: 23.3 A Phase C: 22.5 A
180°	0°	180°	Phase A: 22.3 A Phase B: 22.1 A Phase C: 21.8 A	Phase A: 9.9 A Phase B: 10.1 A Phase C: 8.6 A



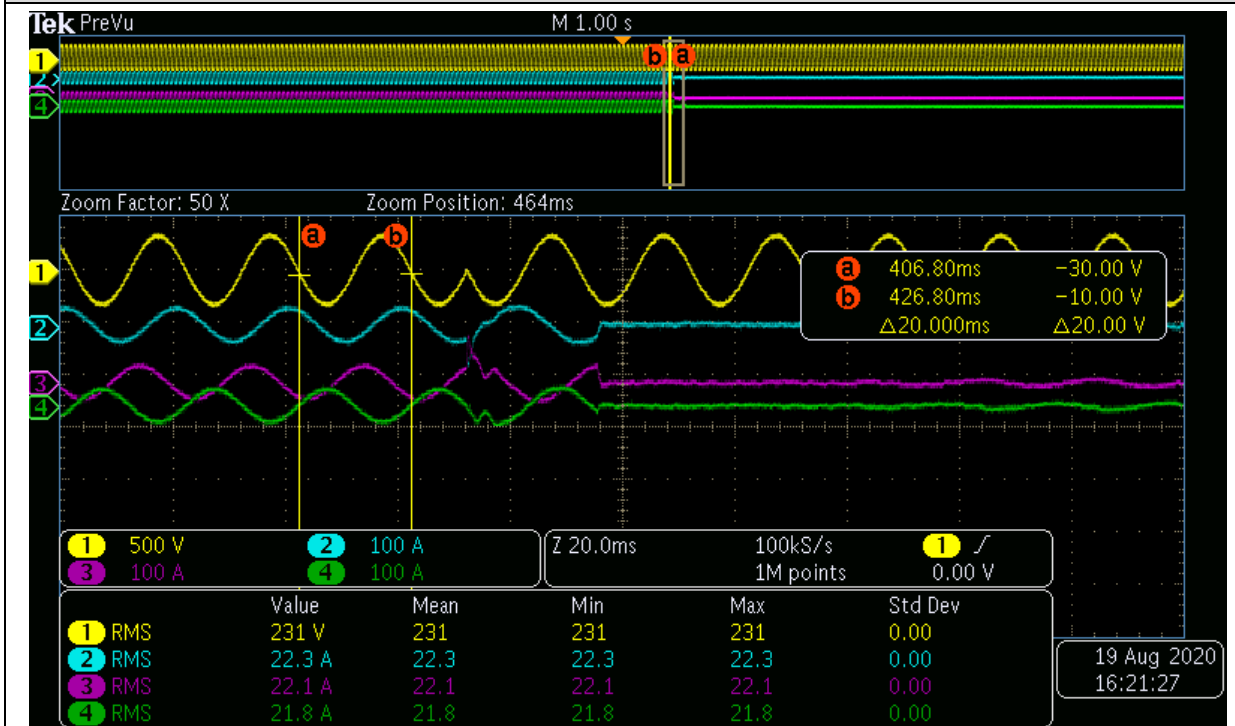
EUT with a setoff of 90° (during the setoff)



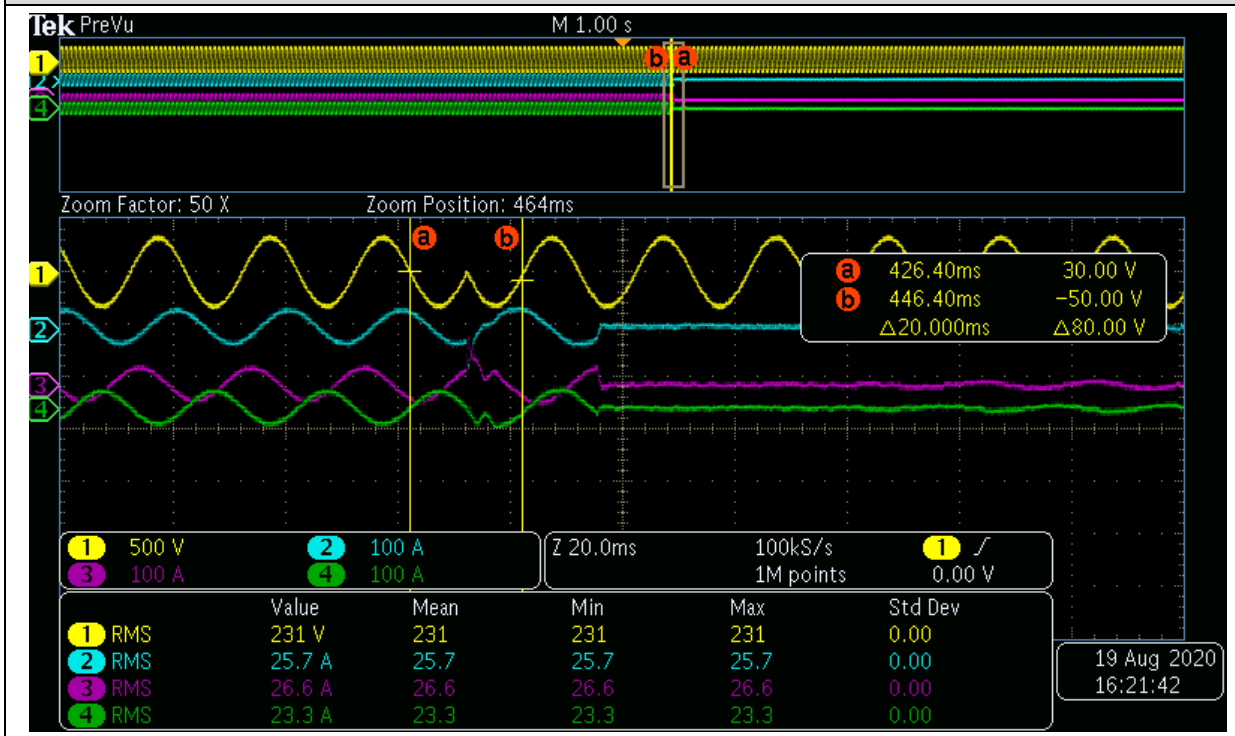
EUT with a setoff of 90° (200ms after the setoff)



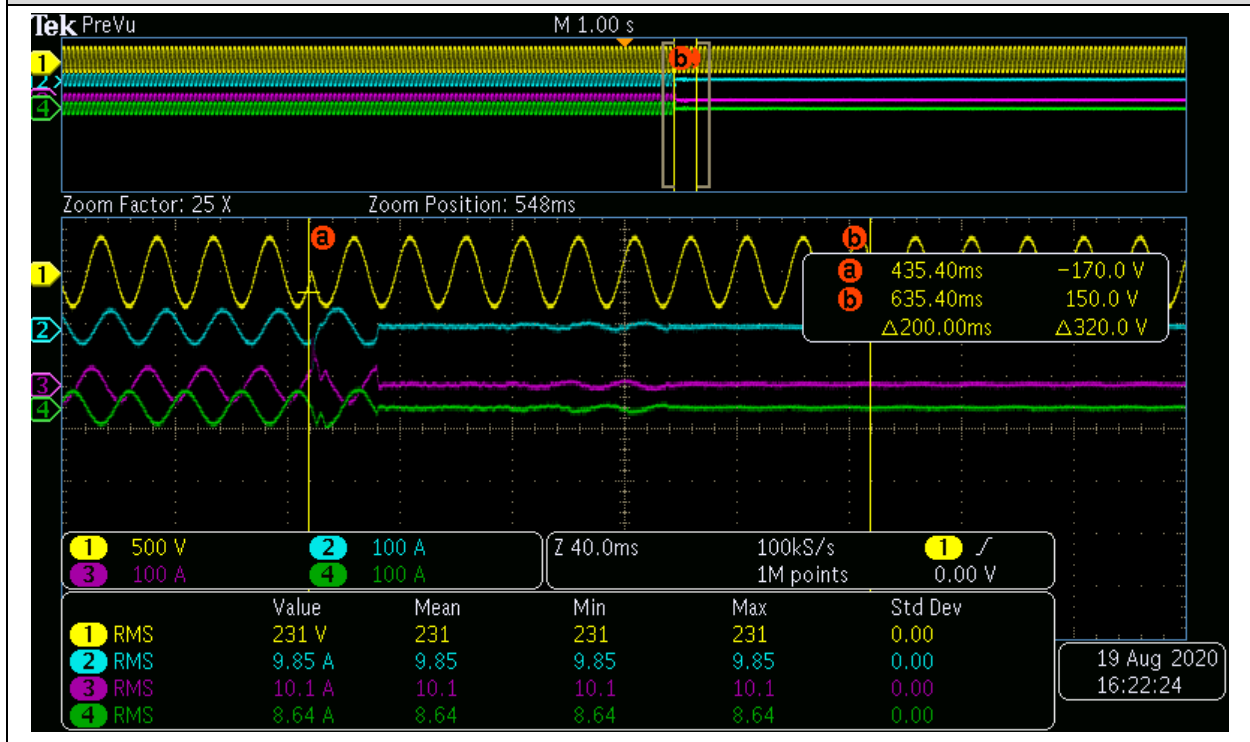
EUT with a setoff of 180° (20ms before the setoff)



EUT with a setoff of 180° (during the setoff)



EUT with a setoff of 180° (200ms after the setoff)



5 PICTURES

Front view



Back view



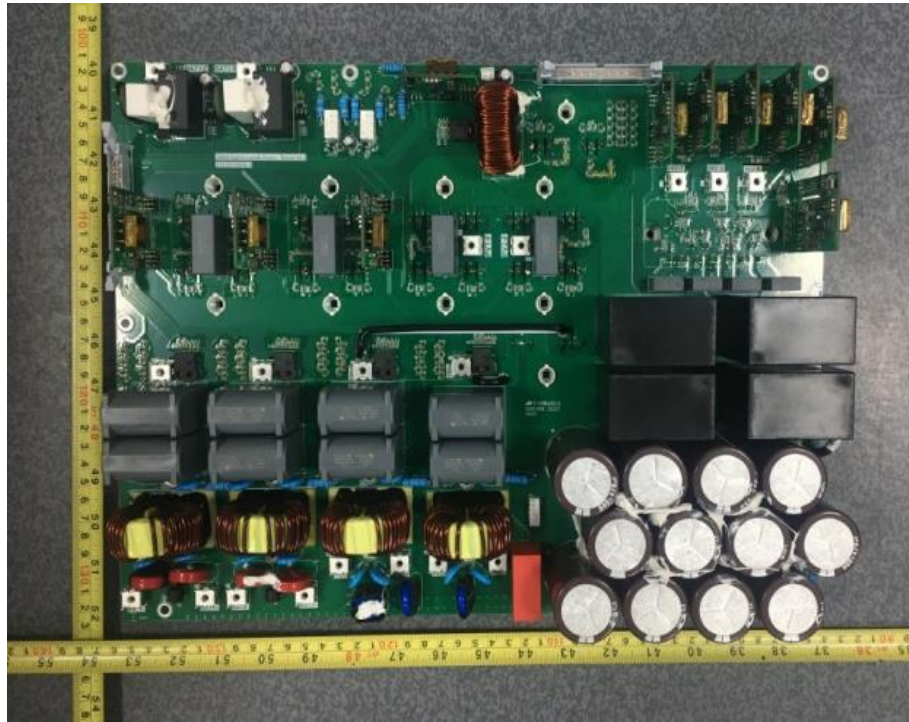
Internal View 1



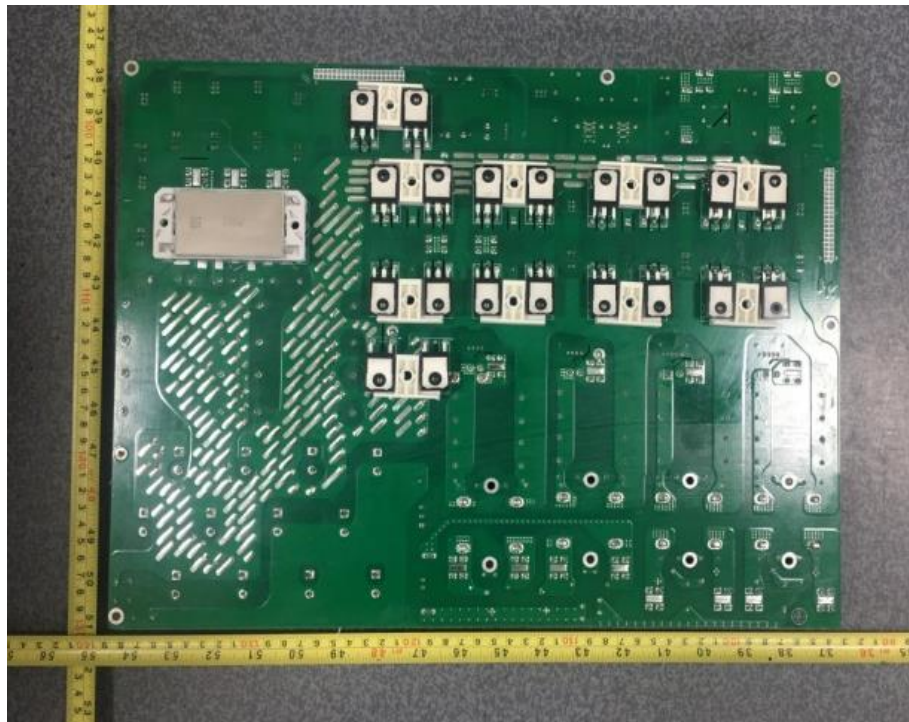
Internal View 2



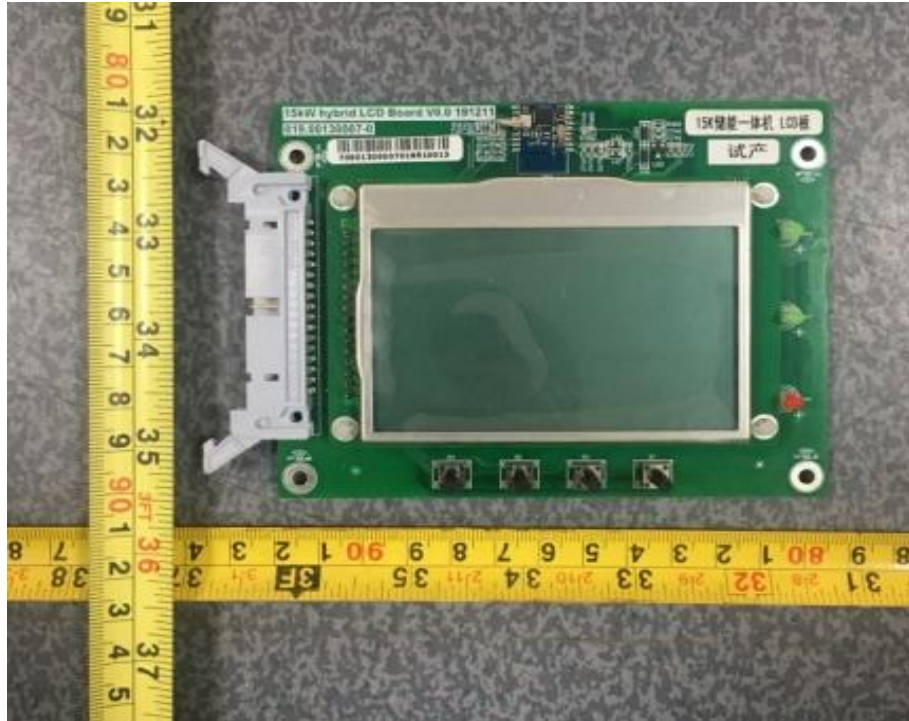
Front side of Power board



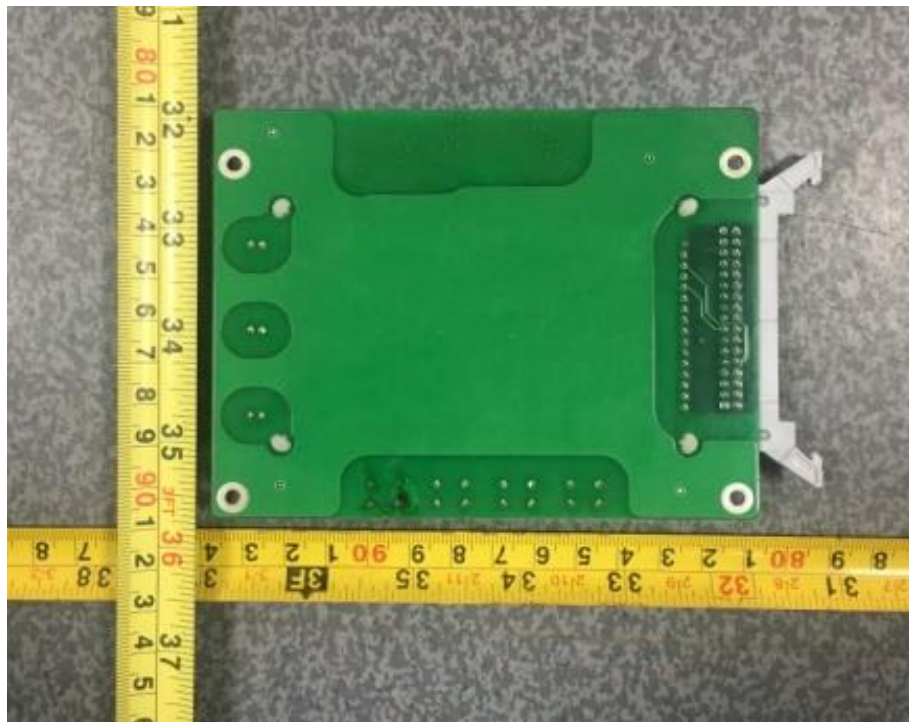
Back side of Power board



Front side of Display board



Back side of Display board



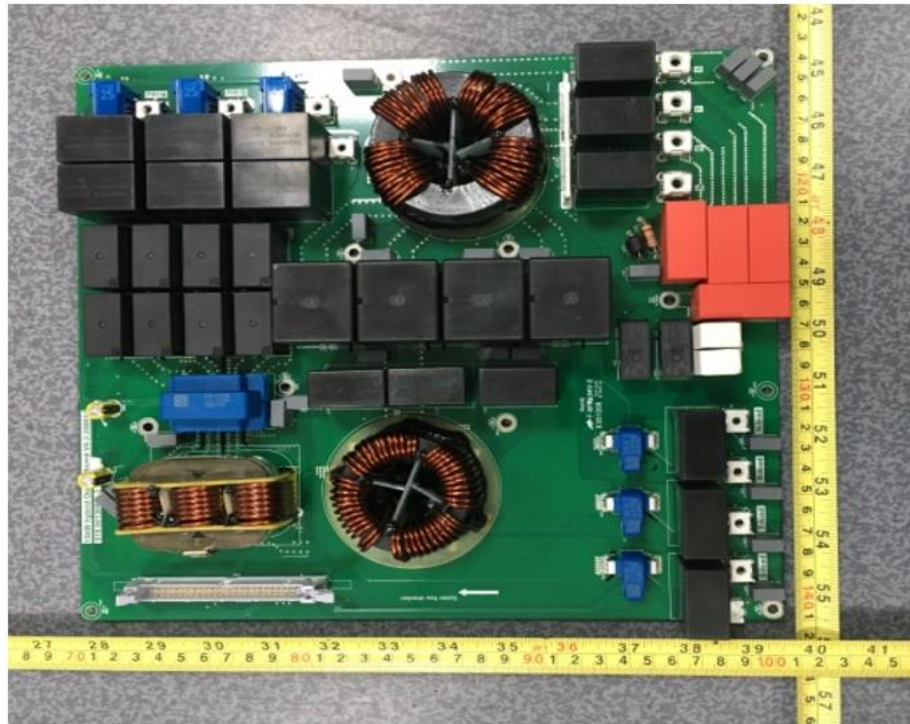
Front side of Control board



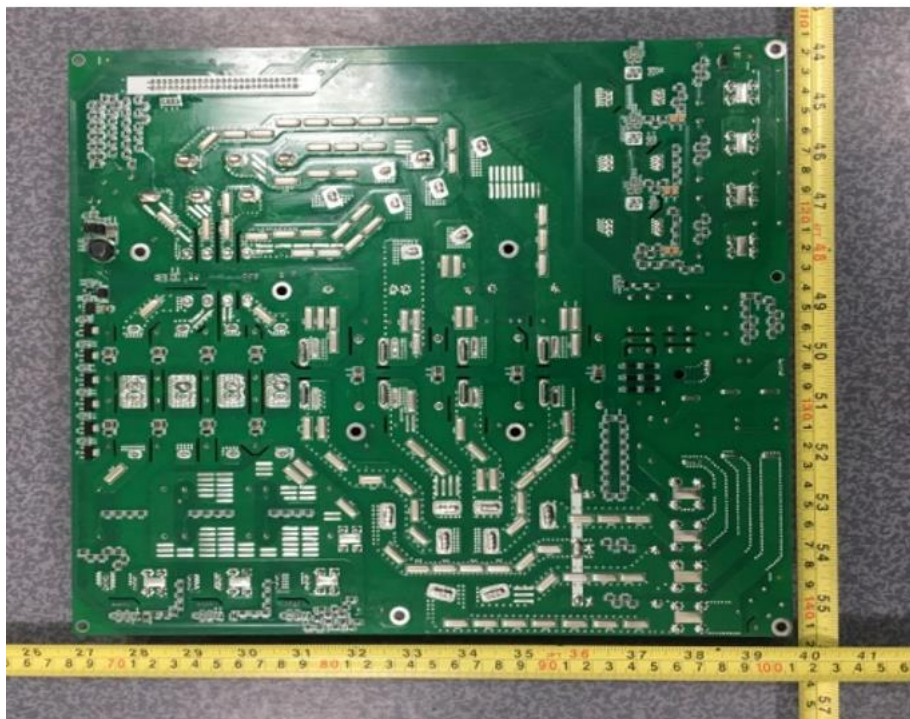
Back side of Control board



Front side of Output board front



Back side of Output board front

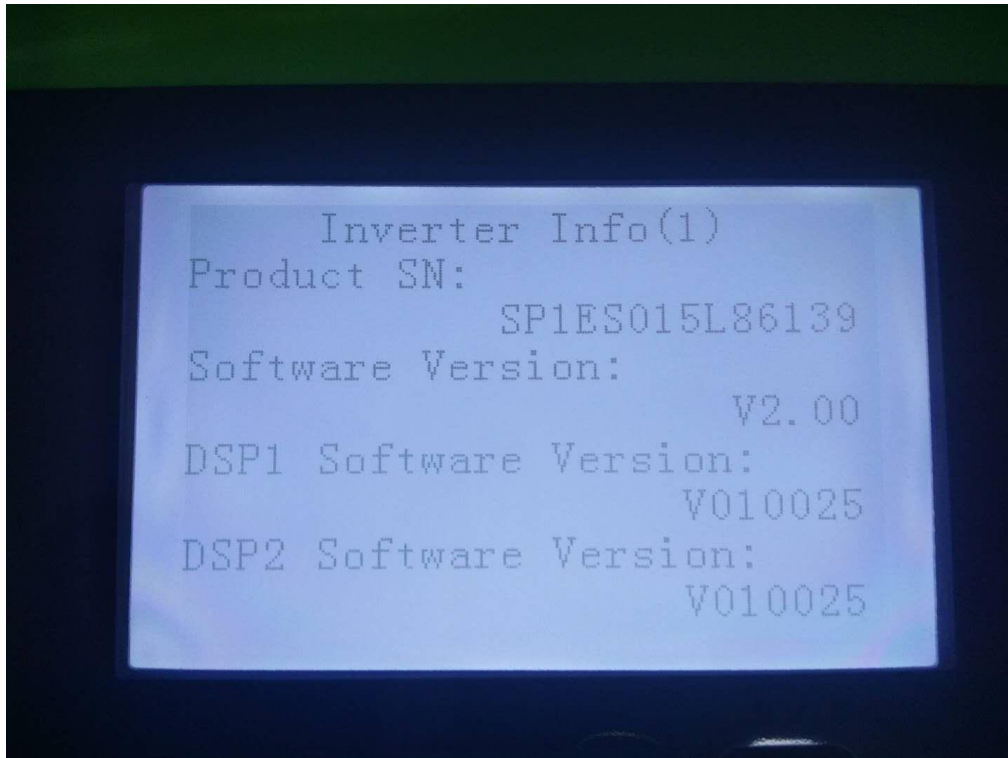
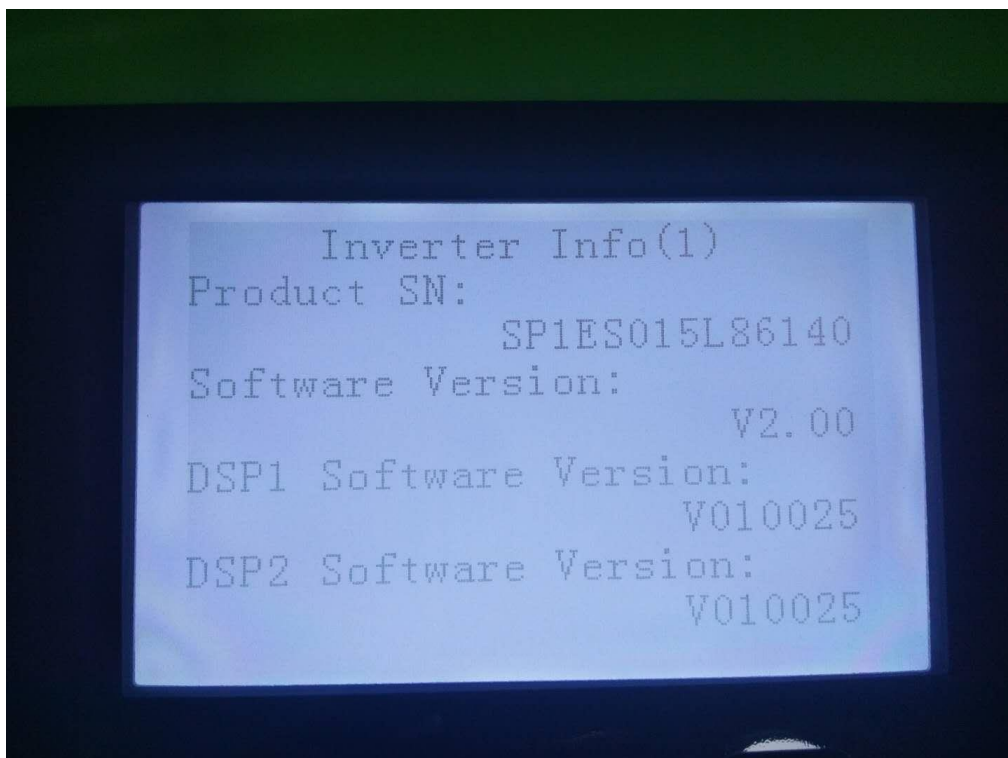


Grounding

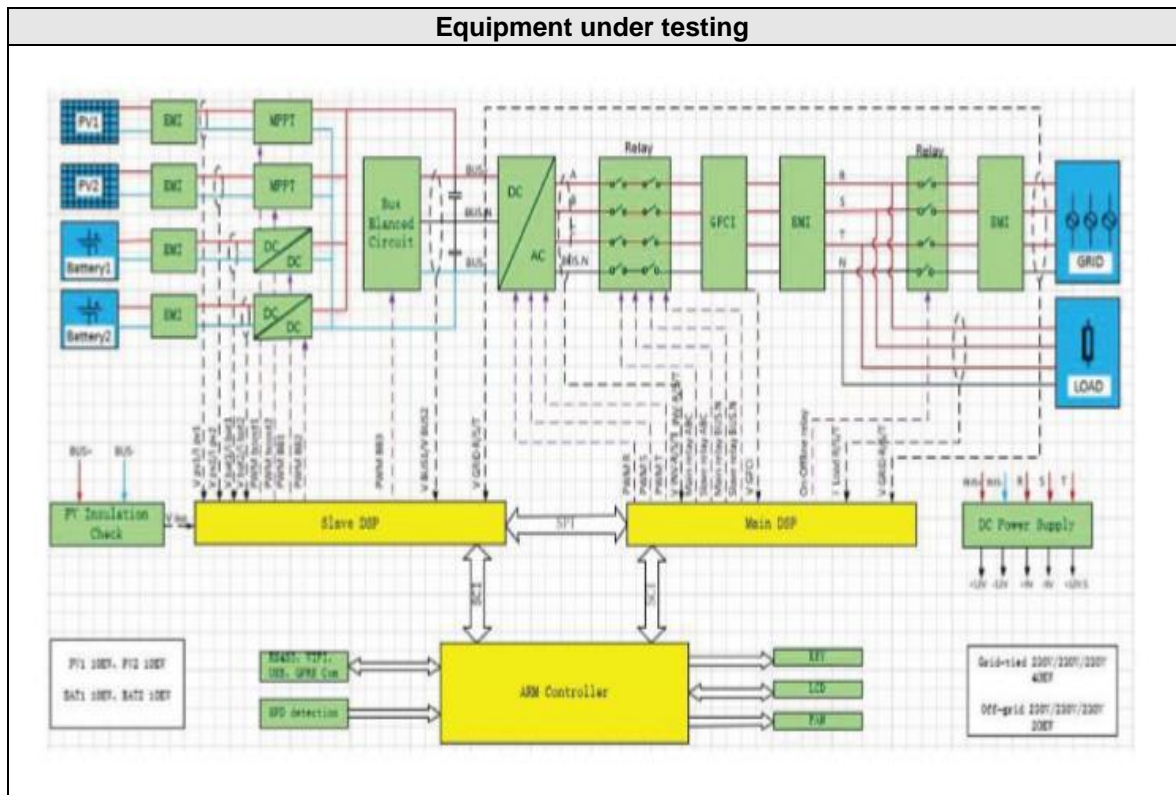


Connection interface



EUT Serial Number and Software Version**ESE Serial Number and Software Version**

6 ELECTRICAL SCHEME



-----END OF REPORT-----