TESTING FOR THE VERIFICATION OF COMPLIANCE OF STORAGE INVERTER WITH :

UNE 217002: 2020-10, INVERSORES PARA CONEXIÓN A LA RED DE DISTRIBUCIÓN.

ENSAYOS DE LOS REQUISITOS DE INYECCIÓN DE CORRIENTE CONTINUA A LA RED, GENERACIÓN DE SOBRETENSIONES Y SISTEMA DE DETECCIÓN DE FUNCIONAMIENTO EN ISLA.

Protocol. PE.T-LE-62

Test Report Number ..... :	**2222/0374-1**
Type ..... :	Storage Inverter
Tested Model ..... :	**H3-8.0-E**
Variants Models ..... :	H3-5.0-E, H3-6.0-E, H3-10.0-E, H3-12.0-E, AC3-5.0-E, AC3-6.0-E, AC3-8.0-E, AC3-10.0-E, AC3-12.0-E

APPLICANT

Name ..... :	**SGS Tecnos S.A. (Certification Body)**
Address ..... :	C/ Trespaderne, 29 - Edificio Barajas 1 28042 MADRID (Spain)
Hired by ..... :	**FOXESS CO., LTD.**
Address ..... :	No.939, Jinhai Third Road, New Airport Industry Area, Longwan District, Wenzhou, Zhejiang, 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 ..... :	Michael Tong (Technical Reviewer)

SGS Tecnos, S.A.
Trespaderne, 29 - Edificio Barajas 1
Tel: 91 313 80 00 - Fax: 91 313 81 60
28042 MADRID

Date of issue ..... :	2022/08/10
Number of pages ..... :	61

The testing marked with "(*)" is not under ENAC accreditation. No quantitative general conclusion is referred to the accredited testing.

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Test Report Historical Revision:

Test Report Version	Date	Resume
2222/0374-1	2022/08/10	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 to the UNE 217002: 2020-10, “Inversores para conexión a la red de distribución. Ensayos de los requisitos de inyección de corriente continua a la red, generación de sobretensiones y sistema de detección de funcionamiento en isla.” according to requirements of regulation and standard shown on table below:

REGULATION AND STANDARD REQUIREMENTS		TESTING STANDARD
O.M. TED/749/2020	**IEC 62116**	**UNE 217002: 2020-10**
Anexo I, clause 5.3		Limitation of the DC injection into the grid side
Anexo I, clause 2.3.6.		Overvoltage generation
	6.2 (1)	Unintentional islanding

(1) maximum respond time of 2 seconds.

In addition, it has been testing the following clauses considering requirements of RD 647/2020.

- Frequency and Voltage trip limits and trip times
- Self - reconnection
- Power Factor

2 GENERAL INFORMATION

2.1 Testing Period and Climatic Conditions

The necessary testing has been performed between June 9th to July 25th of 2022.

All the tests and checks have been performed at climatic conditions:

Temperature	25 ± 5 ºC
Relative Humidity	50 ± 10 %
Pressure	90 ± 10 kPa

SITE TEST

Name.....: **Dongguan BALUN Technology Co., Ltd.**

Address.....: Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong, China

2.2 Equipment under Testing

Information within this section has been provided by client

Apparatus type.....: Storage Inverter

Installation.....: Three Phase / Fixed installation

Manufacturer.....: FOXESS CO., LTD.

Trademark.....:

Model/ Type .....: AIO-H3-8.0

Serial Number.....: 66SH1230217E006

Serial Number IA.....: 66SH1230217E007

Firmware Version.....: Master: 1.31
Slave: 1.02
Comm: 1.42

Rated Characteristics.....: Refer to pages 8 and 9 of the report

Date of manufacturing: 2022

Test item particulars

Input.....: PV & Battery

Output .....: AC & EPS

Class of protection against electric shock....: Class I

Degree of protection against moisture.....: IP65

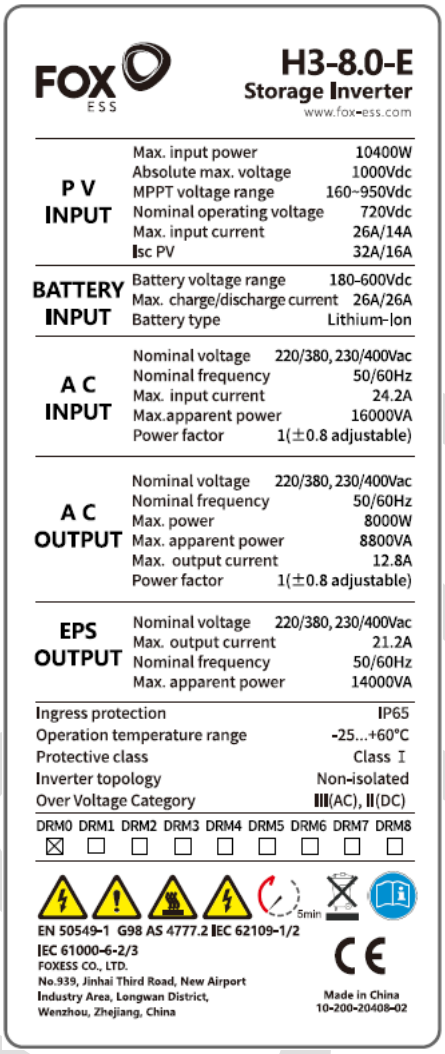
Type of connection to the main supply .....: Three phase – Fixed installation

Cooling group.....: Refer to page 8 and 9

Modular .....: No

Internal Transformer .....: No

Copy of marking plate (representative):



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 back of enclosure and visible after installation.
3. Labels of other models are as the same with **H3-8.0-E**'s except the parameters of rating.

The sample tested is one of the productions select in the moment of the start the test, based on:

Representative selection, random selection and System with all the elements required to do the test.

Equipment under testing:

- **H3-8.0-E**

Variant model:

- H3-5.0-E
- H3-6.0-E
- H3-10.0-E
- H3-12.0-E
- AC3-5.0-E
- AC3-6.0-E
- AC3-8.0-E
- AC3-10.0-E
- AC3-12.0-E

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 models of H3-5.0-E, H3-6.0-E, H3-8.0-E, H3-10.0-E, H3-12.0-E, AC3-5.0-E, AC3-6.0-E, AC3-8.0-E, AC3-10.0-E and AC3-12.0-E are identical on topological schematic circuit diagram and control solution codes except for the input/output ratings. H3 series and AC3 series are same in software and hardware except H3 series provide both PV and battery input ports while AC3 series only provide battery input port.

The results obtained apply only to the particular sample tested that is the subject of the present test report.

The most unfavourable result values of the verifications and tests performed are contained herein. Throughout this report a point (~~comma~~) is used as the decimal separator.

Following table shows the full ratings of all the models referenced in this report, marked in **bold letters** the ones subjected to testing:

Model	H3-5.0-E	H3-6.0-E	**H3-8.0-E**	H3-10.0-E	H3-12.0-E
Input (PV)					
Max. recommended DC power [W]	7500	9000	10400	13000	15000
Max. DC voltage [V]	1000				
Nominal DC operating voltage [V]	720				
Max. input current (input A / input B) [A]	14 / 14	14 / 14	26 / 14	26 / 14	26 / 14
Max. short circuit current (input A / input B) [A]	16 / 16	16 / 16	32 / 16	32 / 16	32 / 16
MPPT voltage range [V]	160-950				
MPPT voltage range (full load) [V]	210-800	250-800	240-800	280-800	320-800
Start-up voltage [V]	160				
No. of MPP trackers	2				
Strings per MPP tracker	1+1	1+1	2+1	2+1	2+1
Max. Inverter backfeed current to the array (A)	0				
Battery					
Battery Type	Lithium battery				
Battery voltage [V]	180-600				
Full AC load Battery voltage [V]	205	250	330	410	480
Max. Charge / discharge current [A]	26				
Communication interface	CAN/RS485				
AC Output					
Nominal AC power [VA]	5000	6000	8000	10000	12000
Max. Active power [W]	5000	6000	8000	10000	12000
Max. apparent AC power [VA]	5500	6600	8800	11000	13200
Rated grid voltage [V]	400/230 , 3L/N/PE				
Rated grid frequency [Hz]	50				
Max. AC current [A] (Per phase)	8.0	9.6	12.8	16.0	19.2
Power Factor	1(Adjustable from 0.8 leading to 0.8 lagging)				
Export Control	YES				
THDI	<3%@rated power				
General data					
Cooling	Natural			FAN cooling	
Topology	Non-isolated				
Ingress protection	IP65 (for outdoor use)				
Protective Class	Class I				
Inverter operating temperature range [°C]	-25…...+60 (derating at +45°C)				

Model	AC3-5.0-E	AC3-6.0-E	AC3-8.0-E	AC3-10.0-E	AC3-12.0-E
Battery					
Battery Type	Lithium battery				
Battery voltage [V]	180-600				
Full AC load Battery voltage [V]	205	250	330	410	480
Max. Charge / discharge current [A]	26				
Communication interface	CAN/RS485				
AC Output					
Nominal AC power [VA]	5000	6000	8000	10000	12000
Max. Active power [W]	5000	6000	8000	10000	12000
Max. apparent AC power [VA]	5500	6600	8800	11000	13200
Rated grid voltage [V]	400/230 , 3L/N/PE				
Rated grid frequency [Hz]	50				
Max. AC current [A] (Per phase)	8.0	9.6	12.8	16.0	19.2
Power Factor	1(Adjustable from 0.8 leading to 0.8 lagging)				
Export Control	YES				
THDI	<3%@rated power				
General data					
Cooling	Natural			FAN cooling	
Topology	Non-isolated				
Ingress protection	IP65 (for outdoor use)				
Protective Class	Class I				
Inverter operating temperature range [°C]	-25…...+60 (derating at +45°C)				

2.3 Reference Values

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

Reference Values for the EUT	
Rated power, **Pn** in VA	8000
Max. Active power, Pmax in W	8000
Maximum apparent power, **Smax** in VA	8800
Rated wind speed (only WT), **vn** in m/s	N/A
Rated current, **In** in A	11.6(1)
Rated output voltage, (Phase to Neutral) **Un** in Vac	230
Note: In this report p.u. values are calculated as follows: -For Active & Reactive Power p.u values are reference to **Pn** -For Currents p.u values, the reference is always **In** -For Voltages p.u values, the reference is always **Un**	

(1) *The rated current is calculated from rated power and voltage* (8000 W / 230Vac /3= 11.6 A).

2.4 Test Equipment List

Owner	No.	EQUIPMENT	TRADEMARK/ MODEL	S/N	CALIBRATION PERIOD
BALUN	1	Power Analyzer	DEWETORN/ DEWE2-PA7	BZ-DGD-L119	2021/11/04 to 2022/11/03
	2	Power Analyzer	YOKOGAWA/ WT3000	SA200-17	2021/11/20 to 2022/11/19
	3	Digital Oscilloscope	YOKOGOWA/ DL850	91M614933	2021/7/28 to 2022/07/27
	4	Digital Oscilloscope	Tektronix / MSO4054B	BZ-DGD-L064	2022/03/01 to 2023/02/28
	5	Voltage Probe	Tektronix / TPP0500	BZ-DGD-L028-1	2022/03/01 to 2023/02/28
	6	Current Clamp	HIOKI / CT6863-05	BZ-DGD-L026-1	2022/02/23 to 2023/02/22
	7	Current Clamp	HIOKI / CT6863-05	BZ-DGD-L026-2	2022/02/23 to 2023/02/22
	8	Current Clamp	HIOKI / CT6863-05	BZ-DGD-L026-3	2021/12/20 to 2022/12/19
	9	Temperature & Humidity meter	CEM / DT-322	BZ-DGD-L005	2022/03/01 to 2023/02/28
SGS	10	True RMS Multimeter	FLUKE / 187	GZE12-8	2021/11/19 to 2022/11/18

Note: Voltage direct measurement through power analyzer, the voltage probes were used with the digital oscilloscope. All measurement equipment was used inside their corresponding calibration period. Copy of all calibration certificates are available at the laboratory for reference.

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 º
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 petitioner. Note2: Where the standard requires lower uncertainties that those in this table. Most restrictive uncertainty has been considered.	

2.6 Factory Information

Factory Name .....: **FOXESS CO., LTD.**

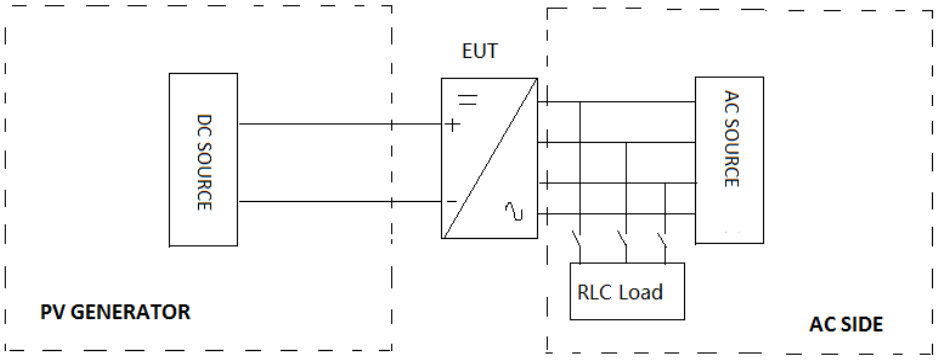
Factory Address.....: No.939, Jinhai Third Road, New Airport Industry Area, Longwan District, Wenzhou, Zhejiang, China

2.7 Definitions

IA	Auxiliary inverter
EUT/ESE	Equipment under testing
In	Nominal Current
M	Change for real power
N	Change for reactive power
OF	Over frequency
OV	Over voltage
Pn	Nominal Power
Q_f	Quality factor
Tm	Time measured
UF	Under frequency
Un	Nominal Voltage
UV	Under voltage
VHOV	Very high over voltage

2.8 Test Set Up

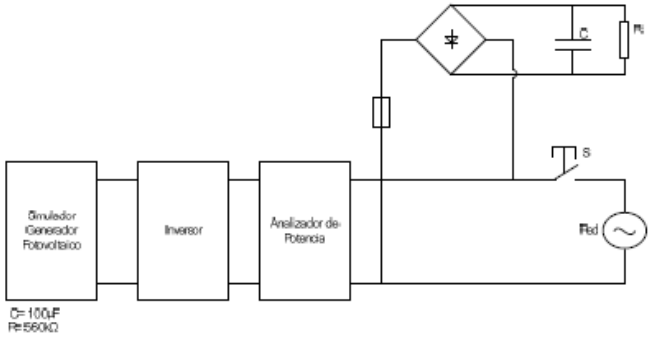
Below is the simplified construction of the test set up.



Current 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 Qf=1.

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



The test bench used includes:

EQUIPMENT	MODEL	RATED CHARACTERISTICS	OWNER / ID.CODE
DC Source	WPLA-150KW	0-1500 V; 200 A MAX	BZ-DGD-L013
AC Source	WPLA-330200KVA	0-400 V; 160 A MAX	BZ-DGD-L204
RLC load	Qunlin / ACLT-3820H	68 kW, 68 kVAr	BZ-DGD-L063
Adjustable resistance	BX8-27	10kΩ-1MΩ	--
Adjustable capacitor box	BC8-13	1uF to 200uF	--

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

O.M.TED/ 749/2020	RD 647/2020	IEC 62116	UNE 217002: 2020 (1)	REPORT SECTION	STANDARD REQUIREMENTS	
Section	**Section**	**Section**	**Section**	**Section**	**Title**	**Results**
Anexo I, clause 5.3	--		4.1	4.1	Limitation of the DC injection into the grid side	P
Anexo, I clause 2.3.6	--	--	4.2	4.2	Overvoltage generation	P
--	--	6.2	4.3	4.3	Unintentional islanding	P
--	RD 647/2020	--	--	4.4	Frequency and Voltage trip limits and trip times	P (*)
--	RD 647/2020	--	--	4.5	Self - reconnection	P (*)
--	RD 647/2020	--	--	4.6	Power Factor	P (*)

(1) The standard 217002 :2020 provides the procedure to be followed while the regulation O.M.TED/749/2020 and standard IEC 62116 provide the requirements to be complied.

(*) This test is not under ENAC accreditation. No quantitative general conclusion is referred to the accredited testing.

Note: Decision rule of the declaration of conformity evaluated according to the ILAC G8: 09/2019 & IEC 115 Guidelines (Proc. 2 “Accuracy Method” based on OD-5014).

Decision rule used: Binary with simple acceptance. (Safety Zone with respect to the limit w = 0).

Specific risk: Probability of False Acceptance or Rejection less than 50%, (PFA / PFR <50%). For more information see ILAC Guide G8 / 09.

4 TEST RESULTS

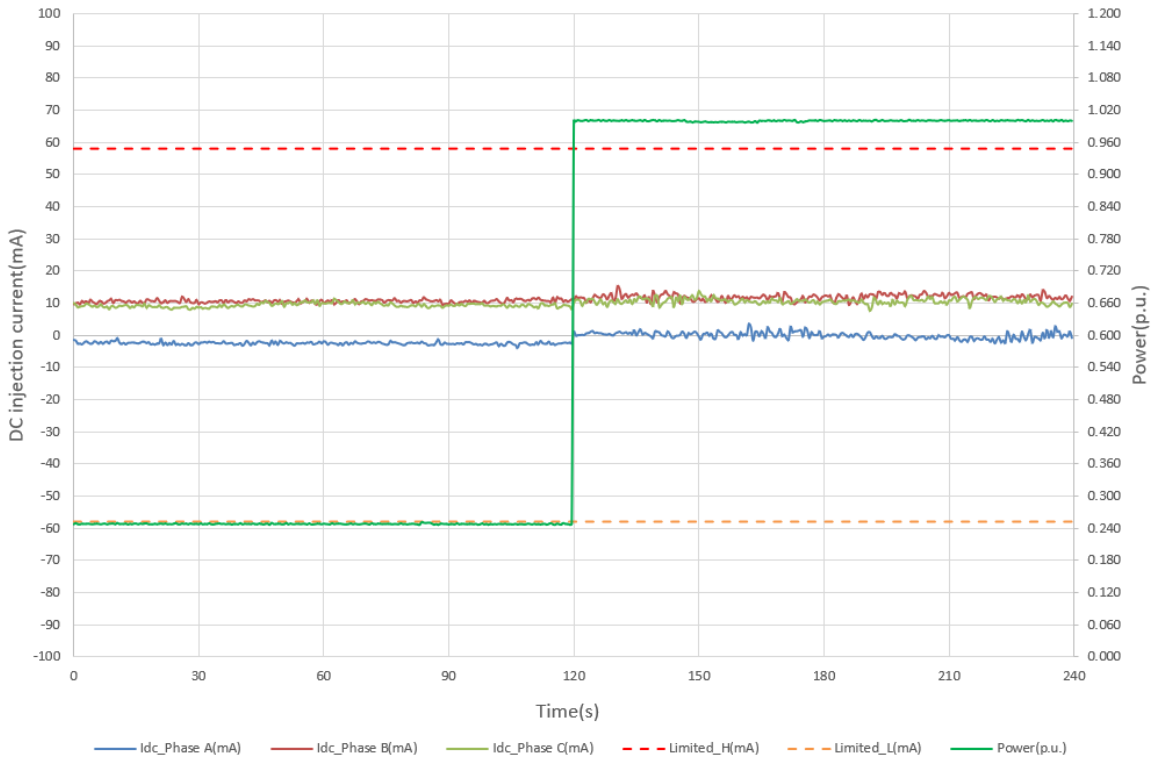
4.1 LIMITATION OF DC INJECTION

The verification of DC component emission test has been measured according to the chapter 4.1 of the testing standard UNE 217002: 2020-10, considering requirements from Anexo I, clause 5.3 of Orden Ministerial TED/749/2020. DC current injection shall be ≤ 0.5 %In which is 57.9 mA per phase.

DC component emission test		
Power Lever	**Min ~ 25%Pn**	**Max ~ 100%Pn**
Watt(W)	1980.9	7998.3
Vrms(V)	230.2	230.5
Arms(A)	2.9 /2.9 /2.9	11.6 /11.6 /11.6
PF	0.998	1.000
Phase A		
d.c.(mA)	-3.9	3.5
d.c (% In) (1)	-0.034	0.030
Phase B		
d.c.(mA)	11.9	15.2
d.c (% In) (1)	0.103	0.131
Phase C		
d.c.(mA)	11.3	13.7
d.c (% In) (1)	0.097	0.118

(1) The values obtained are in percentage with respect to the value of the rated current 11.6 A per phase.

DC component emission test



4.2 OVERVOLTAGE GENERATION

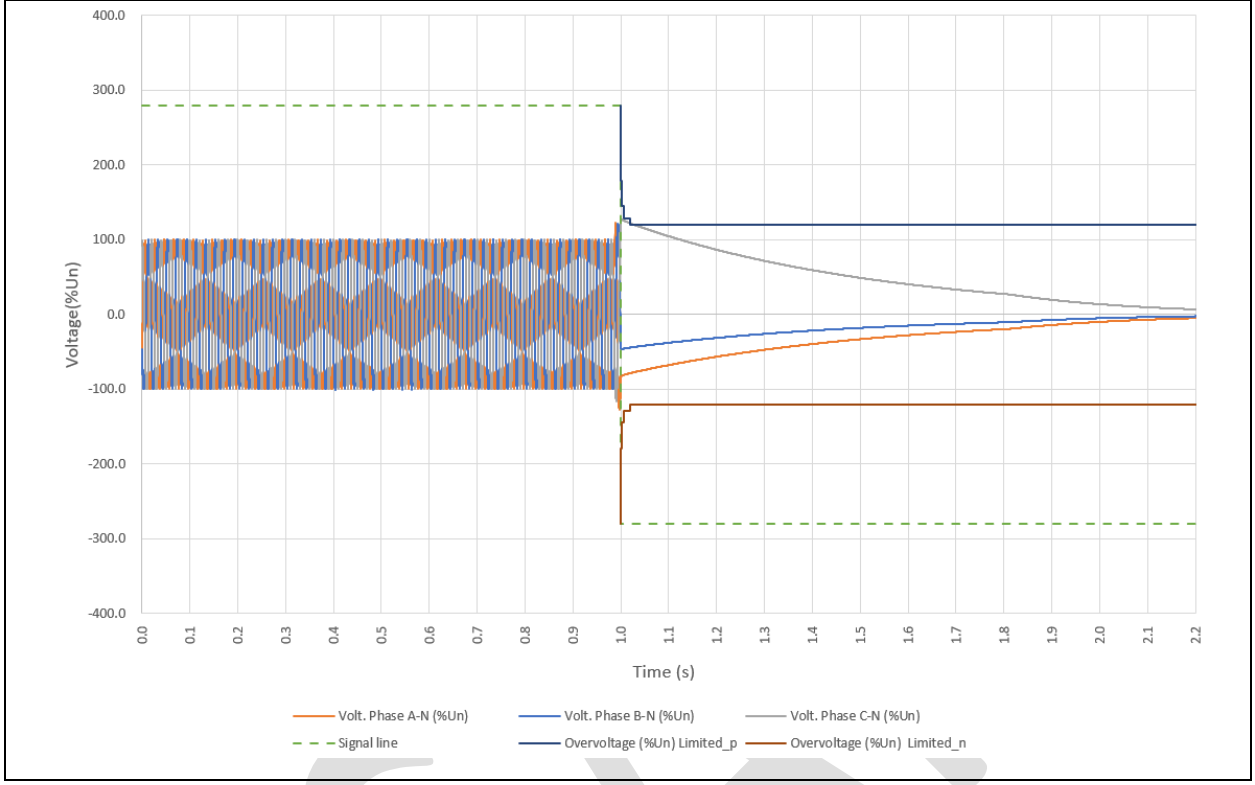
The purpose of this test is to verify that the inverter complies with the transient voltage limits specified below when the grid is disconnected from the inverter. The transient voltage limits have been measured according to the chapter 4.2 of the standard UNE 217002: 2020-10, considering requirements from Anexo I, clause 2.3.6 of Orden Ministerial TED/749/2020.

Overvoltage absolute maximum value ($\%U_{n\text{-}peak}$) Test 1				
Overvoltage duration (s)	**Overvoltage limit value (%Un)**	**Phase A-N**	**Phase B-N**	**Phase C-N**
0.0002	±280	81.6	46.0	128.1
0.0006	±218	81.7	45.9	128.0
0.002	±178	82.2	46.5	127.7
0.006	±145	81.9	46.3	126.9
0.02	±129	81.0	45.7	125.8
0.06	±120	78.4	44.2	121.8
0.2	±120	72.9	40.9	112.8
0.6	±120	56.6	31.3	86.6

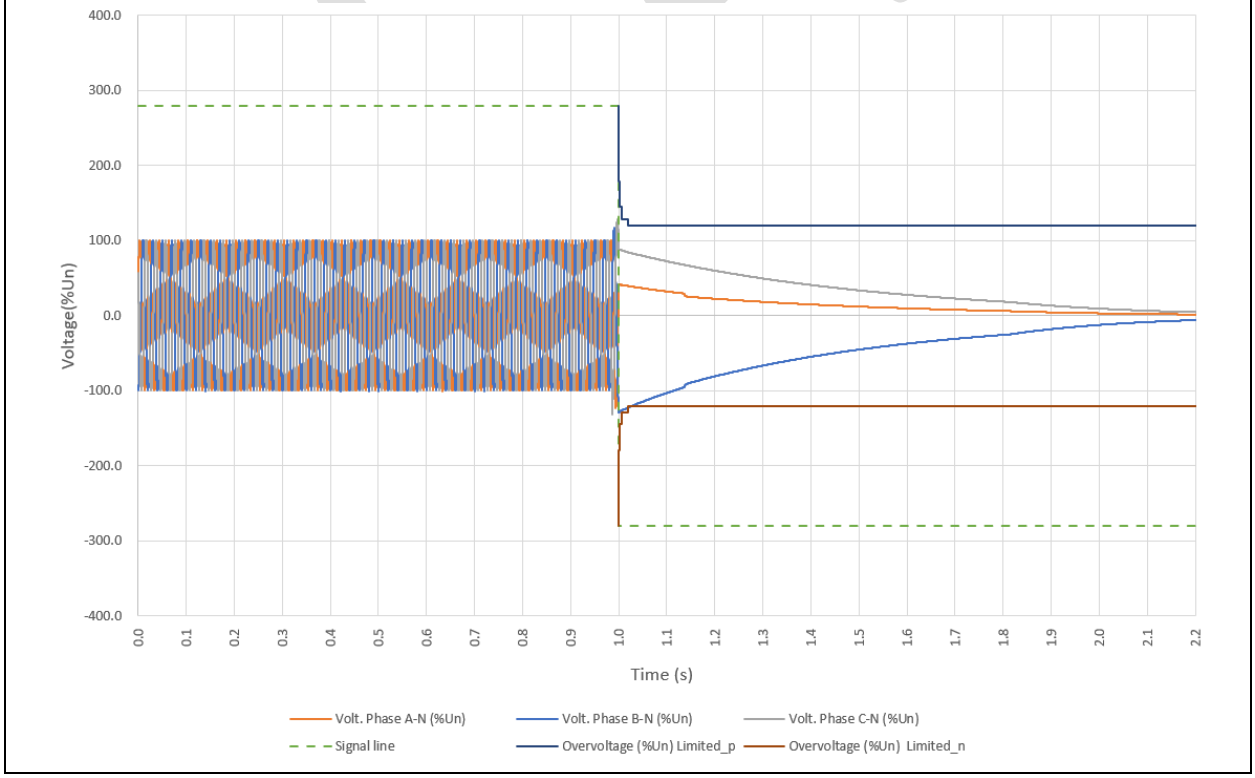
Overvoltage absolute maximum value ($\%U_{n\text{-}peak}$) Test 2				
Overvoltage duration (s)	**Overvoltage limit value (%Un)**	**Phase A-N**	**Phase B-N**	**Phase C-N**
0.0002	±280	42.1	128.0	88.8
0.0006	±218	41.8	128.5	88.6
0.002	±178	41.4	128.6	88.0
0.006	±145	41.5	127.7	88.1
0.02	±129	41.0	126.5	87.2
0.06	±120	39.5	122.4	84.4
0.2	±120	35.5	112.1	78.2
0.6	±120	22.5	80.9	59.9

Overvoltage absolute maximum value ($\%U_{n\text{-}peak}$) Test 3				
Overvoltage duration (s)	**Overvoltage limit value (%Un)**	**Phase A-N**	**Phase B-N**	**Phase C-N**
0.0002	±280	25.4	81.6	31.1
0.0006	±218	25.4	81.6	31.1
0.002	±178	25.2	82.1	30.9
0.006	±145	24.9	81.9	30.6
0.02	±129	24.6	80.9	30.2
0.06	±120	23.8	78.3	29.3
0.2	±120	22.0	71.9	27.1
0.6	±120	17.4	54.2	21.2

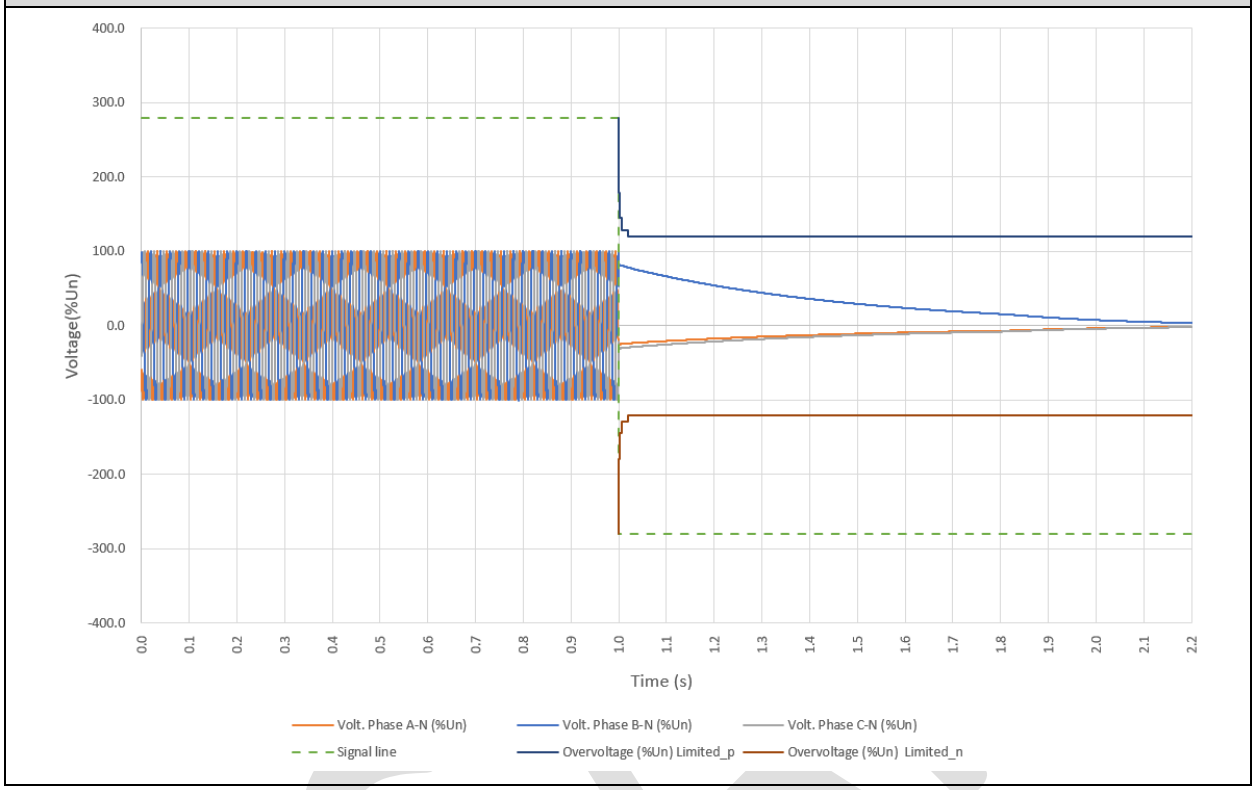
100 %Pn – Test 1



100 %Pn – Test 2



100 %Pn – Test 3


400.0
300.0
200.0
100.0
0.0
-100.0
-200.0
-300.0
-400.0
Voltage(%Un)
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2
Time (s)
Volt. Phase A-N (%Un)
Volt. Phase B-N (%Un)
Volt. Phase C-N (%Un)
Signal line
Overvoltage (%Un) Limited_p
Overvoltage (%Un) Limited_n

4.3 UNINTENTIONAL ISLANDING

Anti-Islanding requirements are detailed in the chapter 4.3 of testing standard UNE 217002: 2020-10.

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 IEC 62116 (maximum respond time of 2 seconds). The following conditions with an IA inverter have been tested:

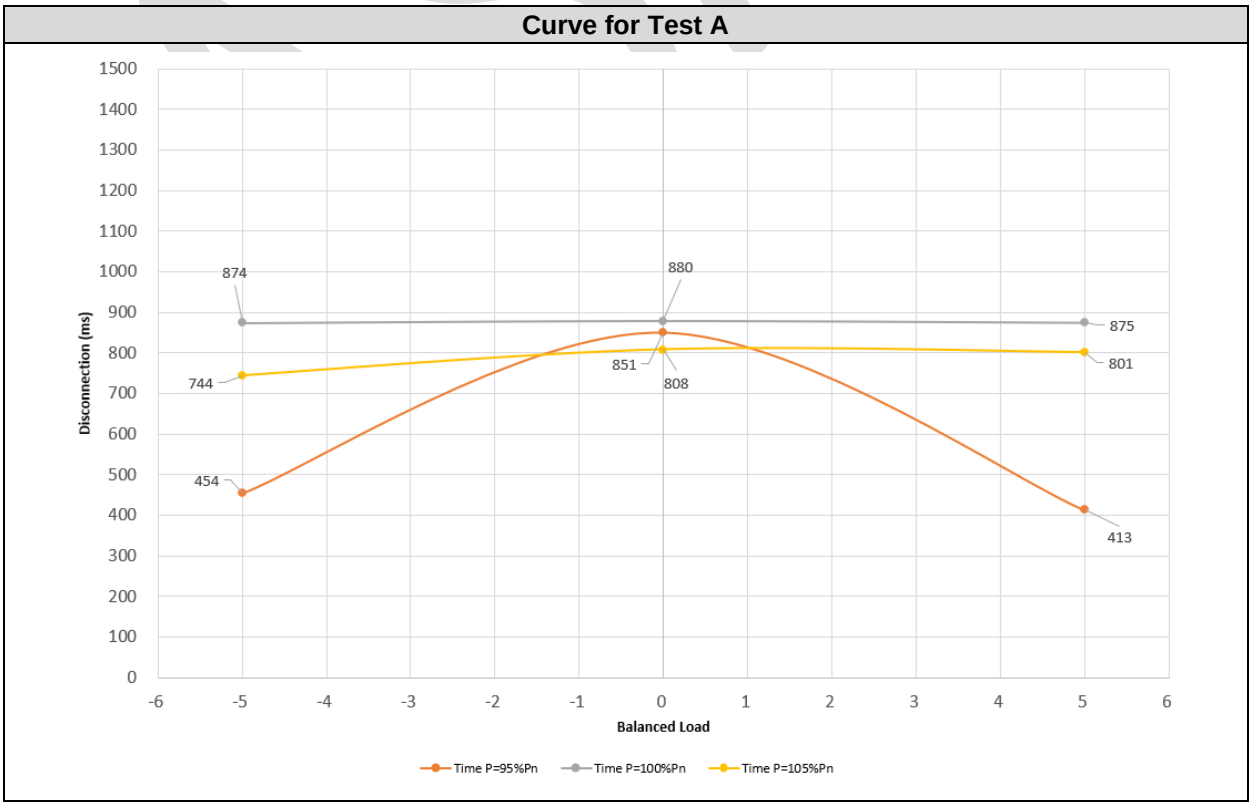
Condition 1: EUT and IA with islanding prevention activated.
Condition 2: EUT with islanding prevention activated and IA deactivated.
Condition 3: EUT and IA with islanding prevention deactivated.

4.3.1 Active Power > 90 %Pn. Test A

4.3.1.1 For one inverter ESE

Balanced Load		
M (%)	**N (%)**	**Disconnection (ms) (limit at t = 2 s)**
-5	+5	413
-5	0	851
-5	-5	454
0	+5	875
0	0	880
0	-5	874
+5	+5	801
+5	0	808
+5	-5	744

Curve for Test A



4.3.1.2 For two inverters ESE and IA

Conditions	P (kW)	Qc (kVAr)	Ql (kVAr)	Time limit (s)	Time measured (ms)
1	8.040	8.060	8.040	< 2	744
1	8.040	8.060	8.040	< 2	801
2	8.040	8.060	8.040	< 2	808
2	8.040	8.060	8.040	< 2	851
3	8.040	8.060	8.040	--	--

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

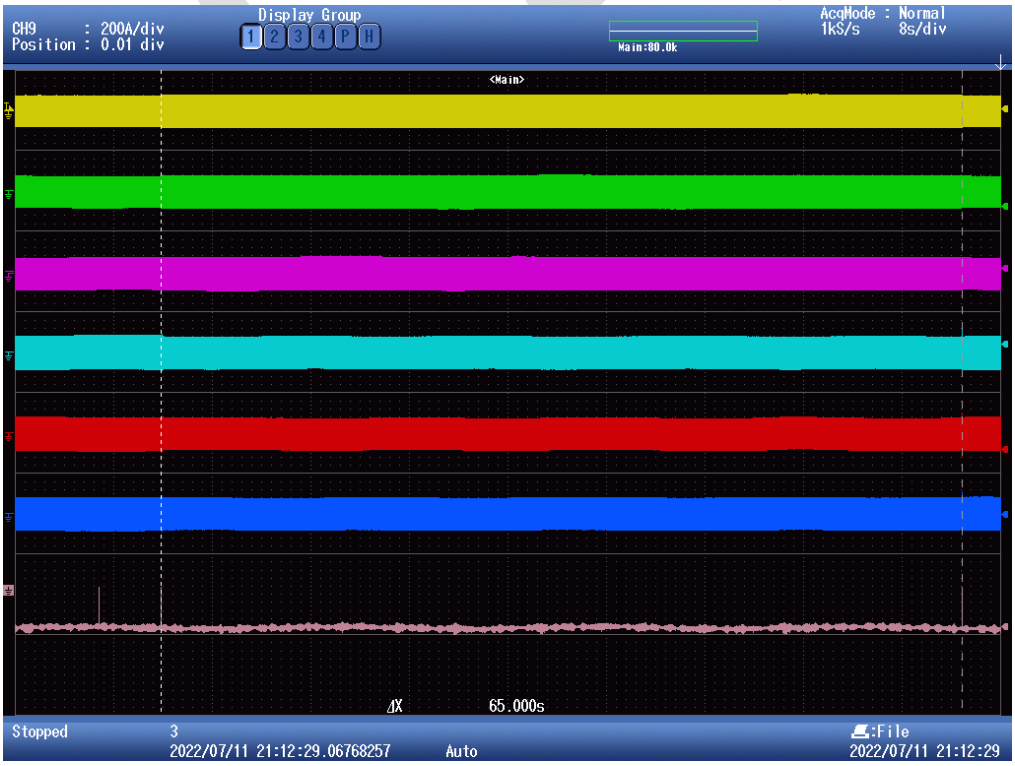
Condition 1, Test 1

Condition 1, Test 2

Condition 2, Test 1

Condition 2, Test 2

Condition 3

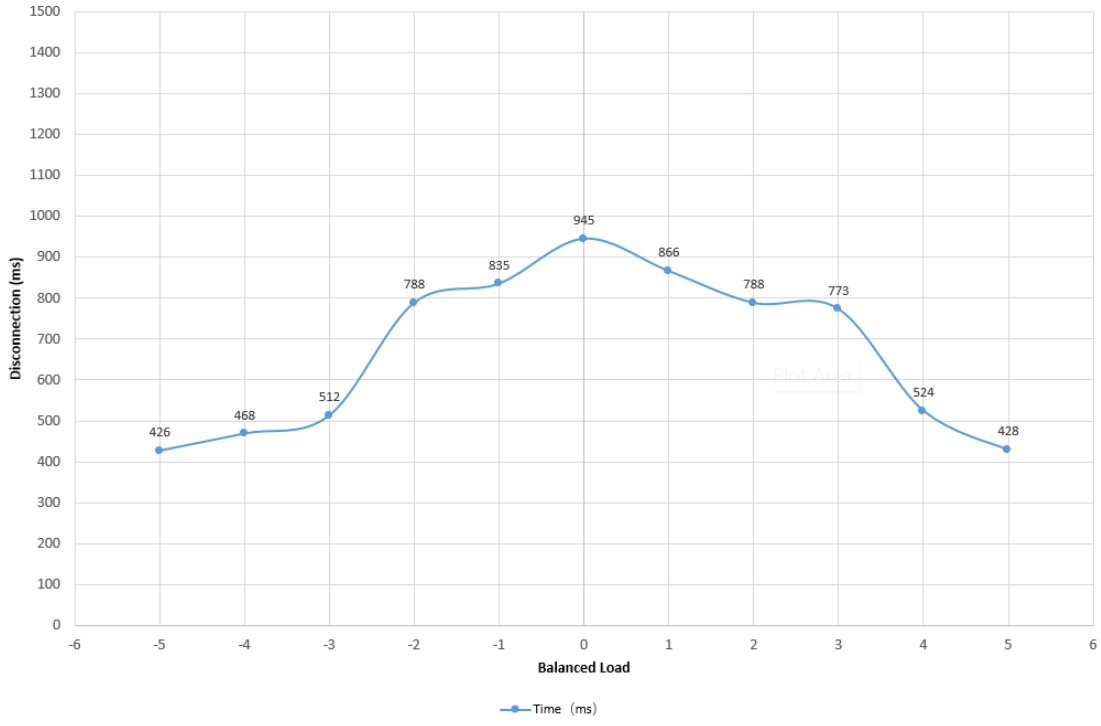


4.3.2 Active Power 50-66 %Pn. Test B

4.3.2.1 For one inverter ESE

Balanced Load		
M (%)	**N (%)**	**Disconnection (ms) (limit at t = 2 s)**
0	-5	462
0	-4	484
0	-3	547
0	-2	843
0	-1	863
0	0	879
0	+1	877
0	+2	765
0	+3	531
0	+4	481
0	+5	462

Curve for Test B



4.3.2.2 For two inverters ESE and IA

Conditions	P (kW)	Qc (kVAr)	Ql (kVAr)	Time limit (s)	Time measured (ms)
1	5.280	5.370	5.280	< 2	788
1	5.280	5.370	5.280	< 2	835
2	5.280	5.370	5.280	< 2	428
2	5.280	5.370	5.280	< 2	512
3	5.280	5.370	5.280	--	--

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

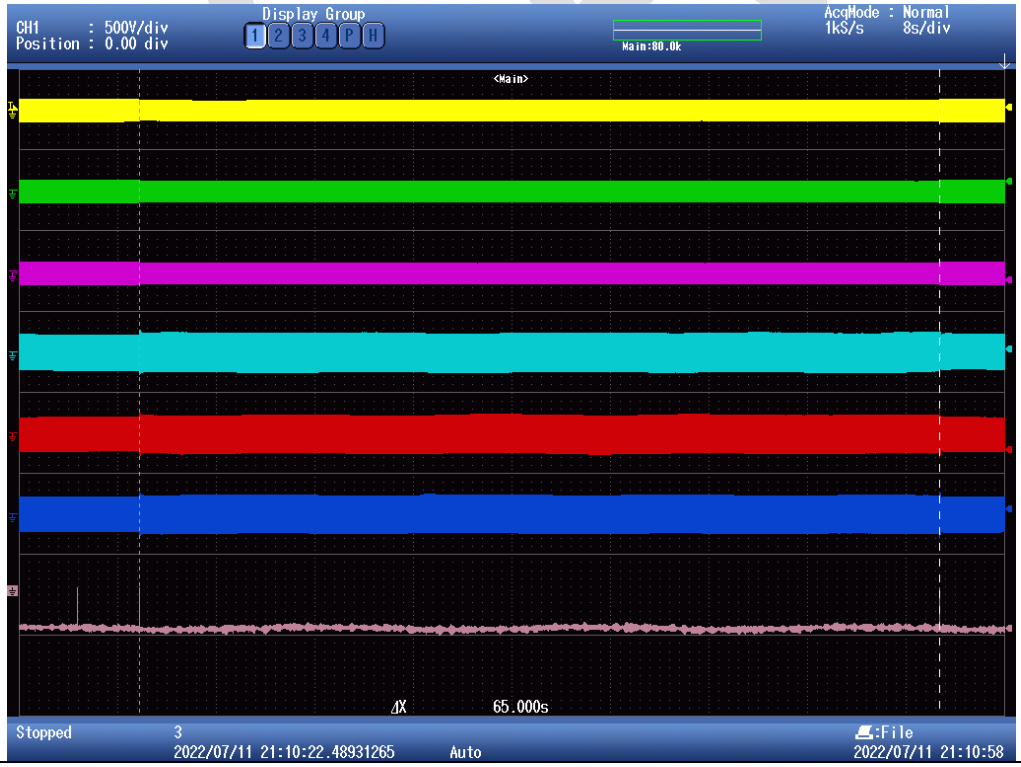
Condition 1, Test 1

Condition 1, Test 2

Condition 2, Test 1

Condition 2, Test 2

Condition 3

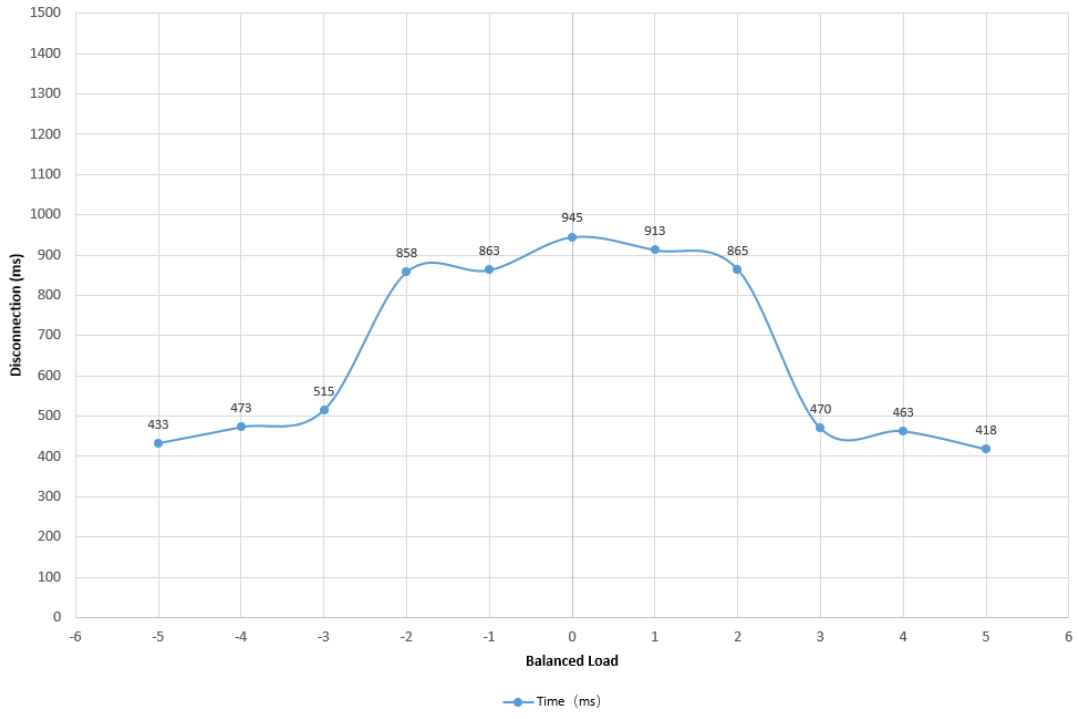


4.3.3 Active Power 25-33 %Pn. Test C

4.3.3.1 For one inverter ESE

Balanced Load		
M (%)	**N (%)**	**Disconnection (ms) (limit at t = 2 s)**
0	-5	433
0	-4	473
0	-3	515
0	-2	858
0	-1	863
0	0	945
0	+1	913
0	+2	865
0	+3	470
0	+4	463
0	+5	418

Curve for Test C



4.3.3.2 For two inverters ESE and IA

Conditions	P (kW)	Qc (kVAr)	Ql (kVAr)	Time limit (s)	Time measured (ms)
1	2.640	2.730	2.640	< 2	863
1	2.640	2.730	2.640	< 2	858
2	2.640	2.730	2.640	< 2	418
2	2.640	2.730	2.640	< 2	470
3	2.640	2.730	2.640	--	--

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

Condition 1, Test 1

Condition 1, Test 2

Condition 2, Test 1

Condition 2, Test 2

Condition 3

4.4 FREQUENCY AND VOLTAGE TRIP LIMITS AND TRIP TIMES(*)

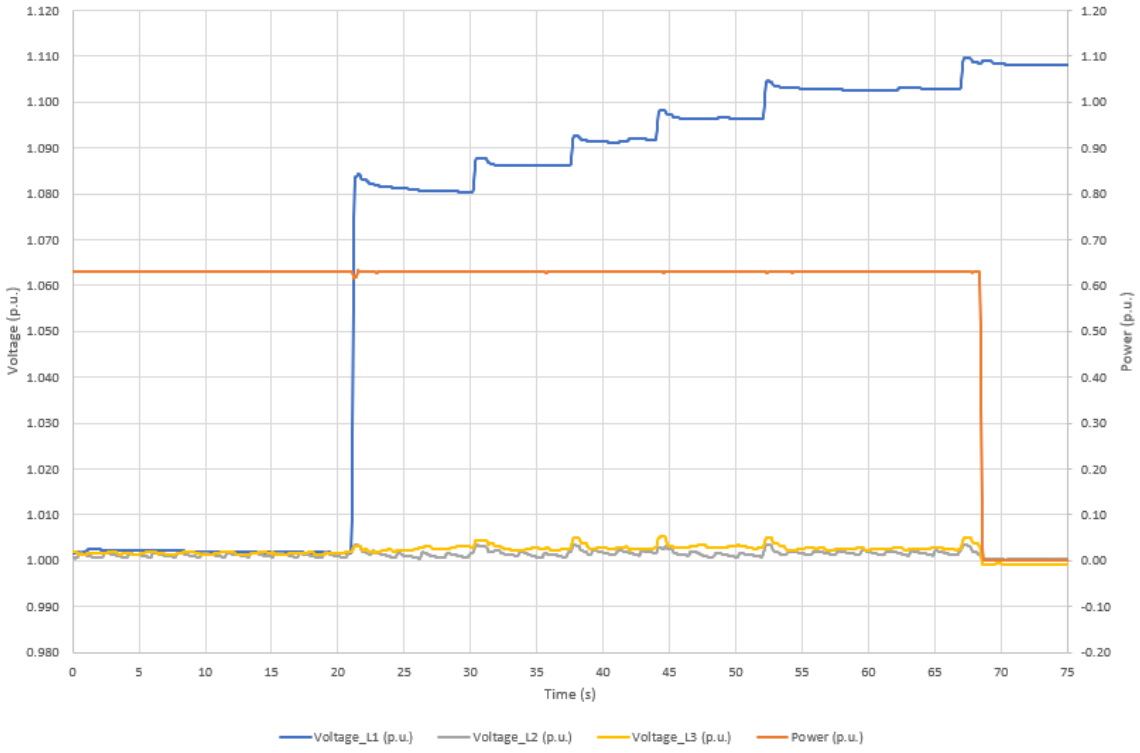
(*) This test is not under ENAC accreditation. No quantitative general conclusion is referred to the accredited testing

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

4.4.1 Voltage

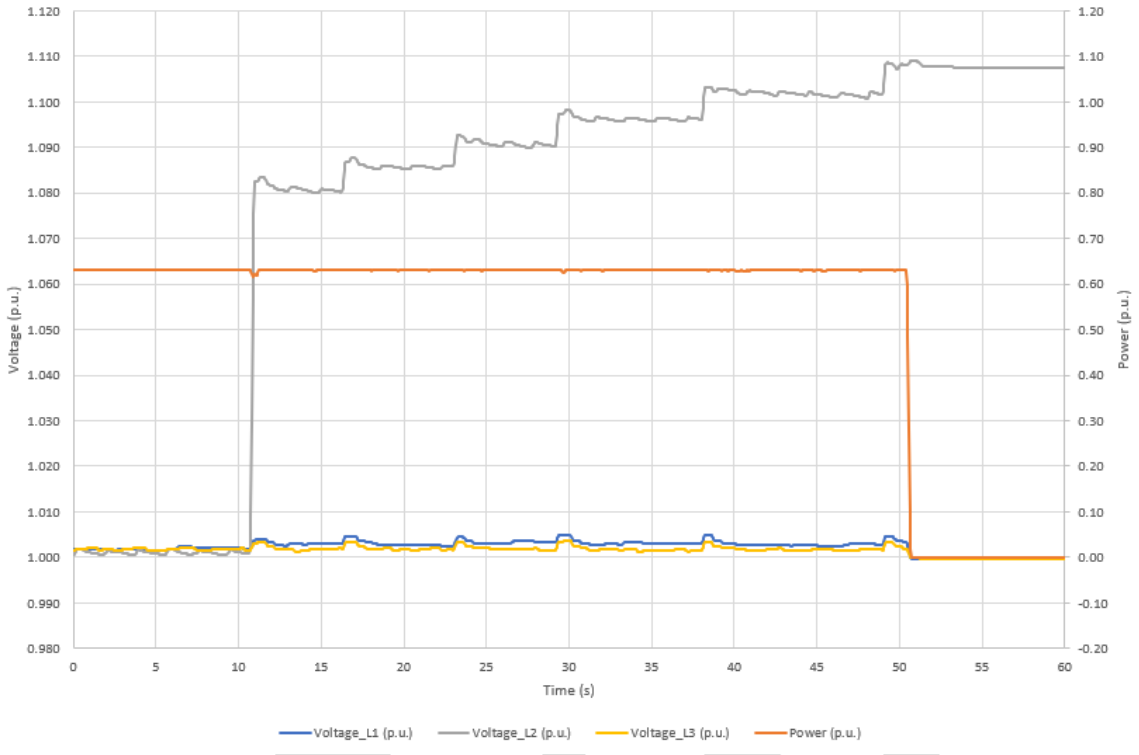
Setting Voltage	Measured Voltage (p.u.)	Disconnection time limits (s)	Phases	Disconnection time measured (s)
Un + 10 %Un	1.109	1.500	Phase L1-N	1.480
	1.108		Phase L2-N	1.469
	1.103		Phase L3-N	1.479
	1.104		Phase L1L2L3-N	1.484
Un + 15 %Un	1.155	0.200	Phase L1-N	0.184
	1.160		Phase L2-N	0.182
	1.154		Phase L3-N	0.164
	1.154		Phase L1L2L3-N	0.162
Un – 15 %Un	0.857	1.500	Phase L1-N	1.474
	0.852		Phase L2-N	1.476
	0.847		Phase L3-N	1.464
	0.857		Phase L1L2L3-N	1.473

Voltage measured: Un +10 %Un Phase L1 to N



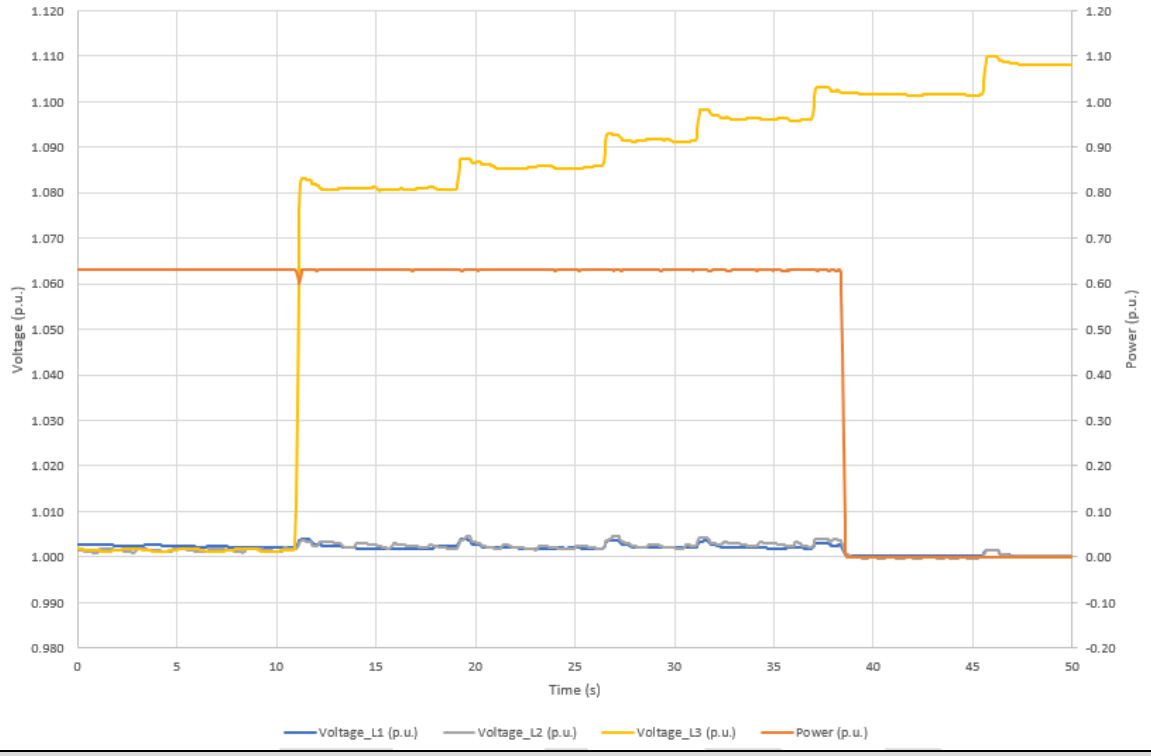
Voltage Trip Time: Un +10 %Un Phase L1 to N

Voltage measured: Un +10 %Un Phase L2 to N



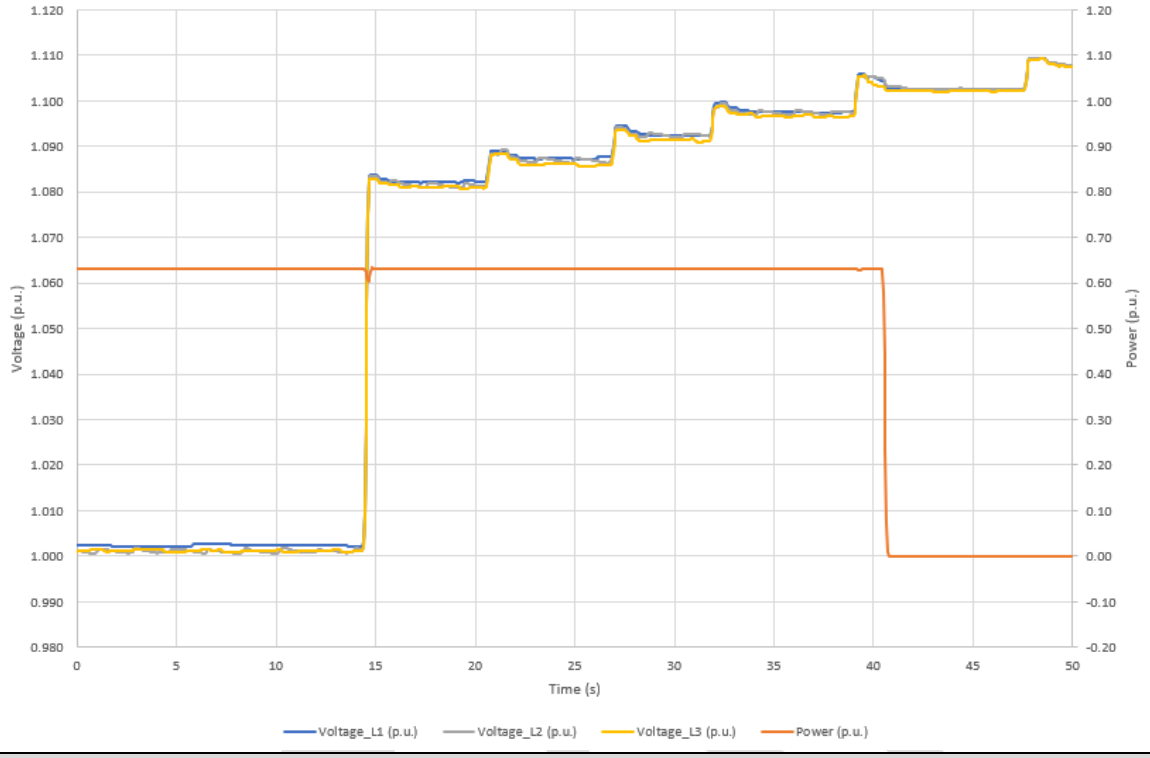
Voltage Trip Time: Un +10 %Un Phase L2 to N

Voltage measured: Un +10 %Un Phase L3 to N

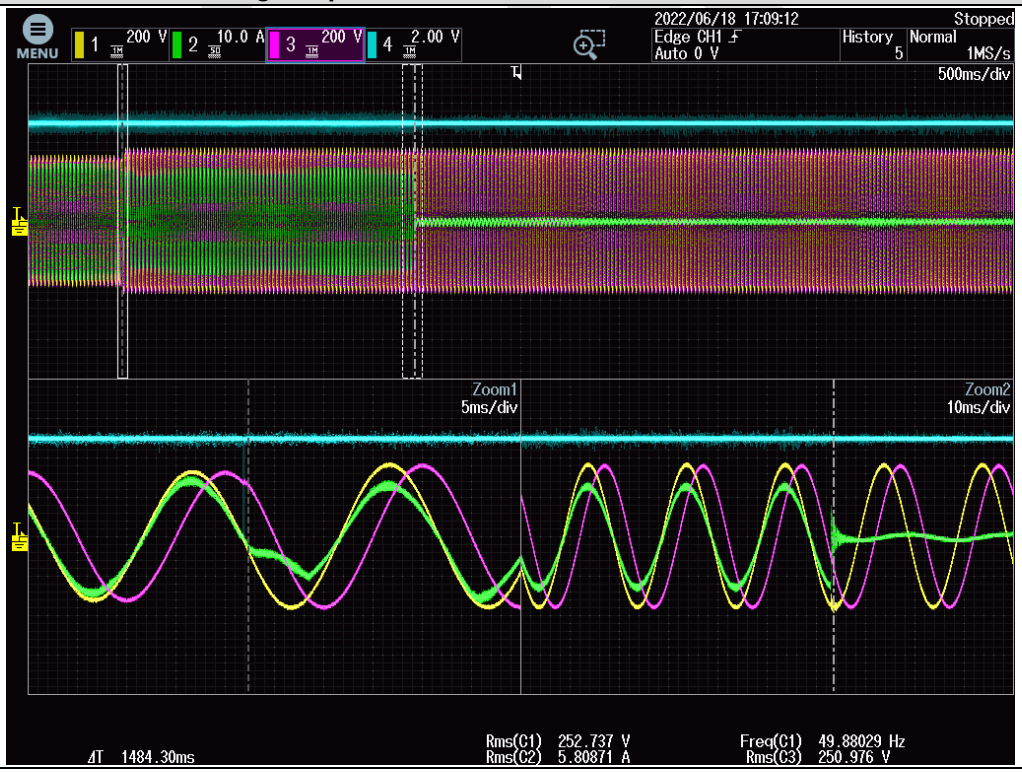


Voltage Trip Time: Un +10 %Un Phase L3 to N

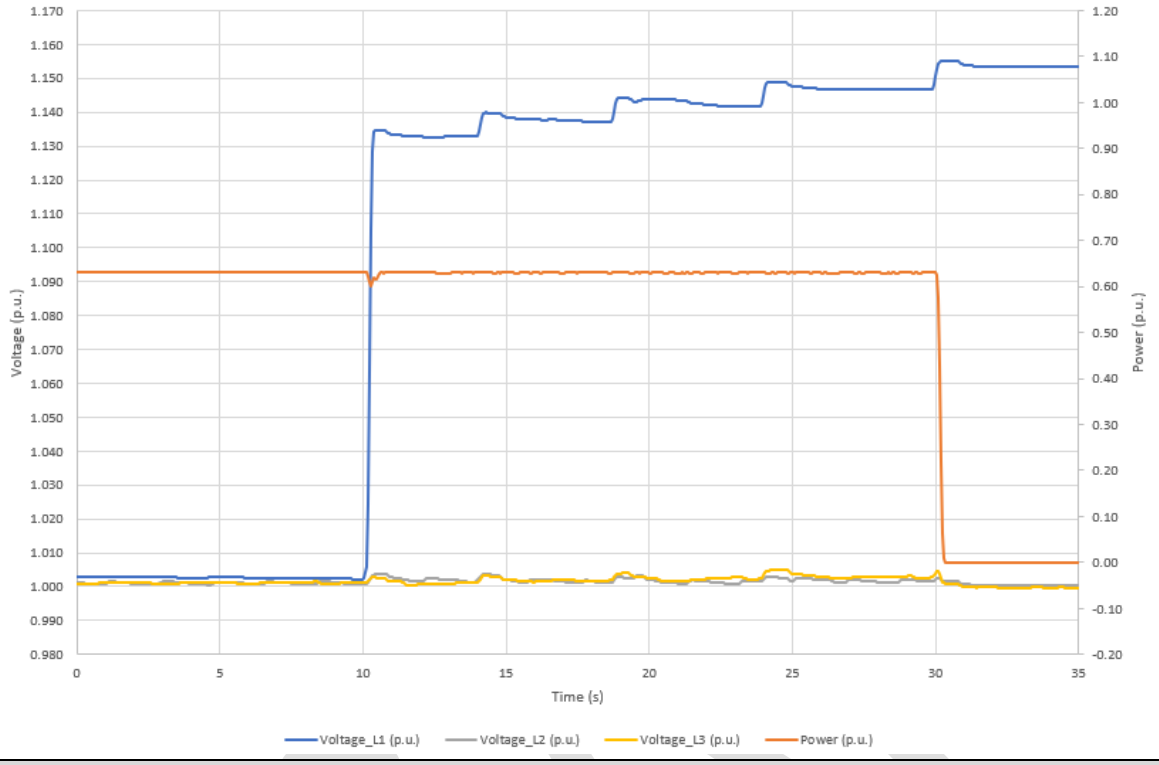
Voltage measured: Un +10 %Un Phase L1L2L3 to N



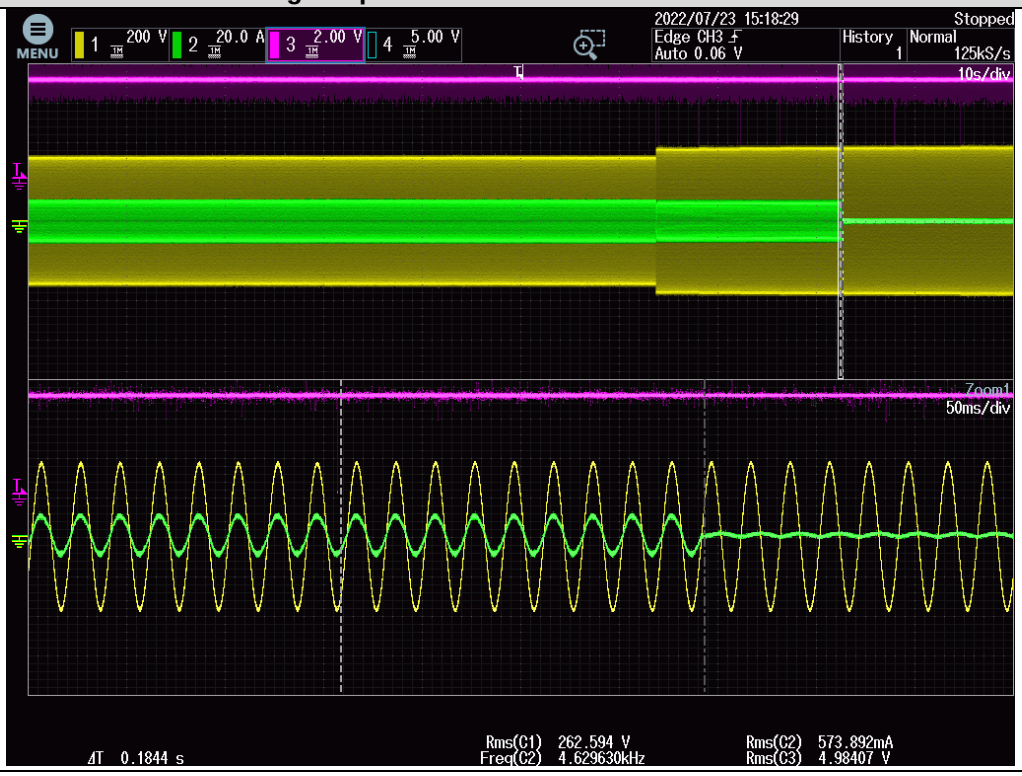
Voltage Trip Time: Un +10 %Un Phase L1L2L3 to N



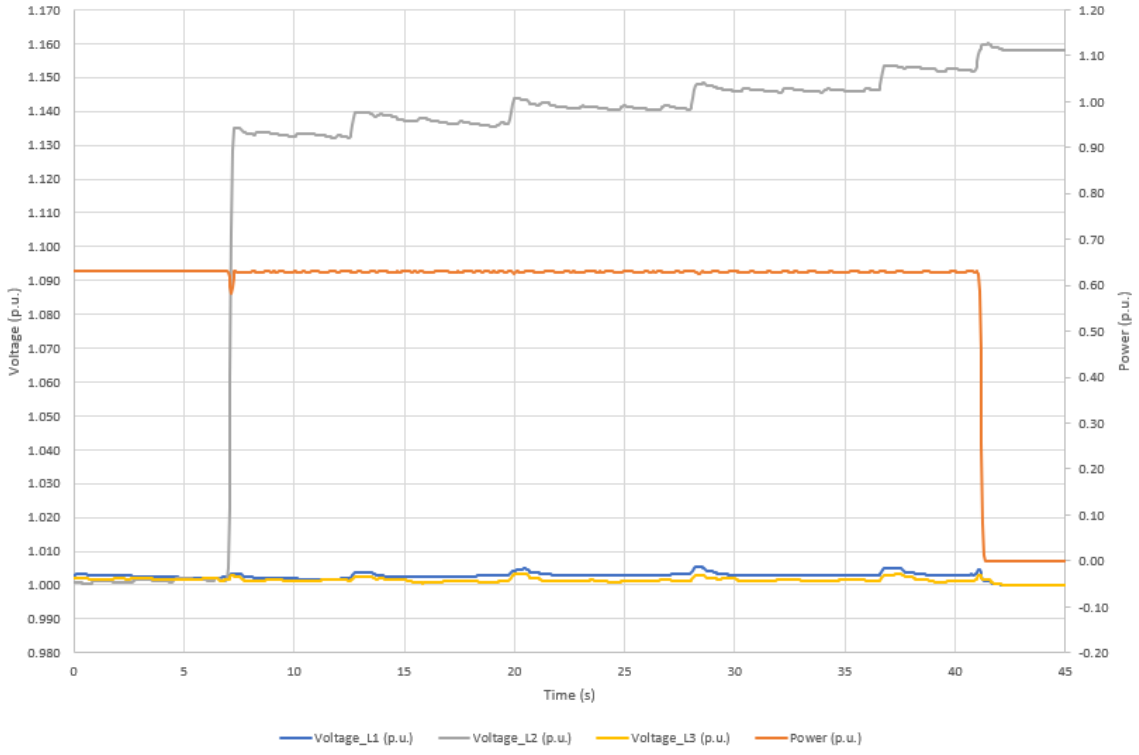
Voltage measured: Un +15 %Un Phase L1 to N



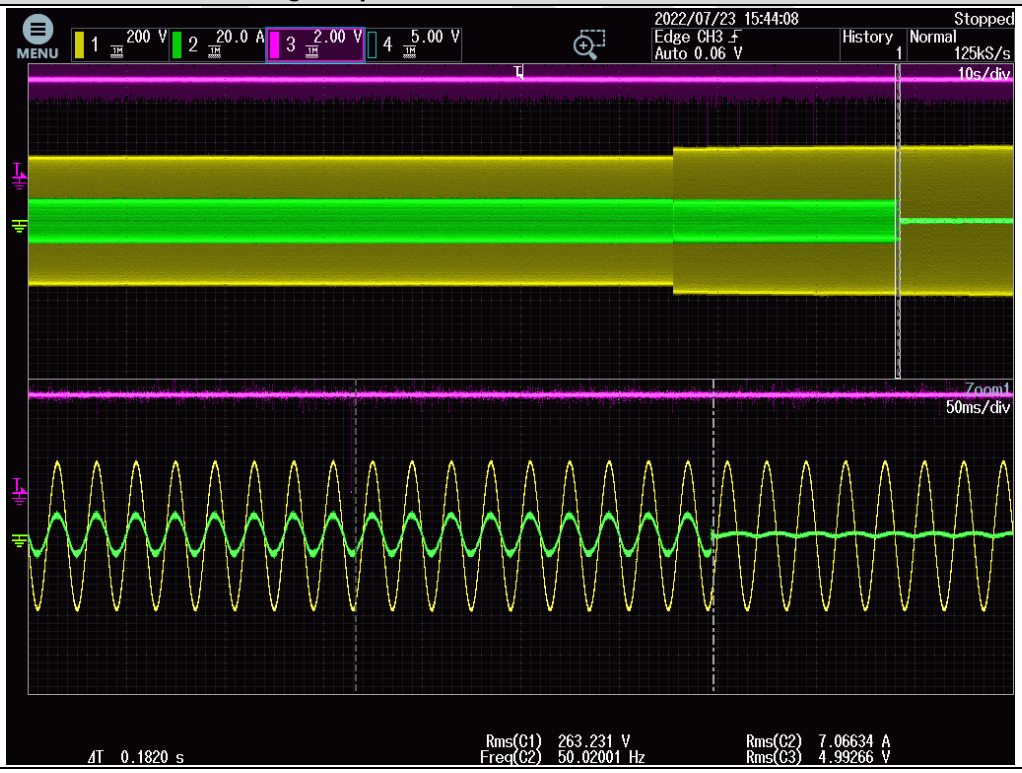
Voltage Trip Time: Un +15 %Un Phase L1 to N



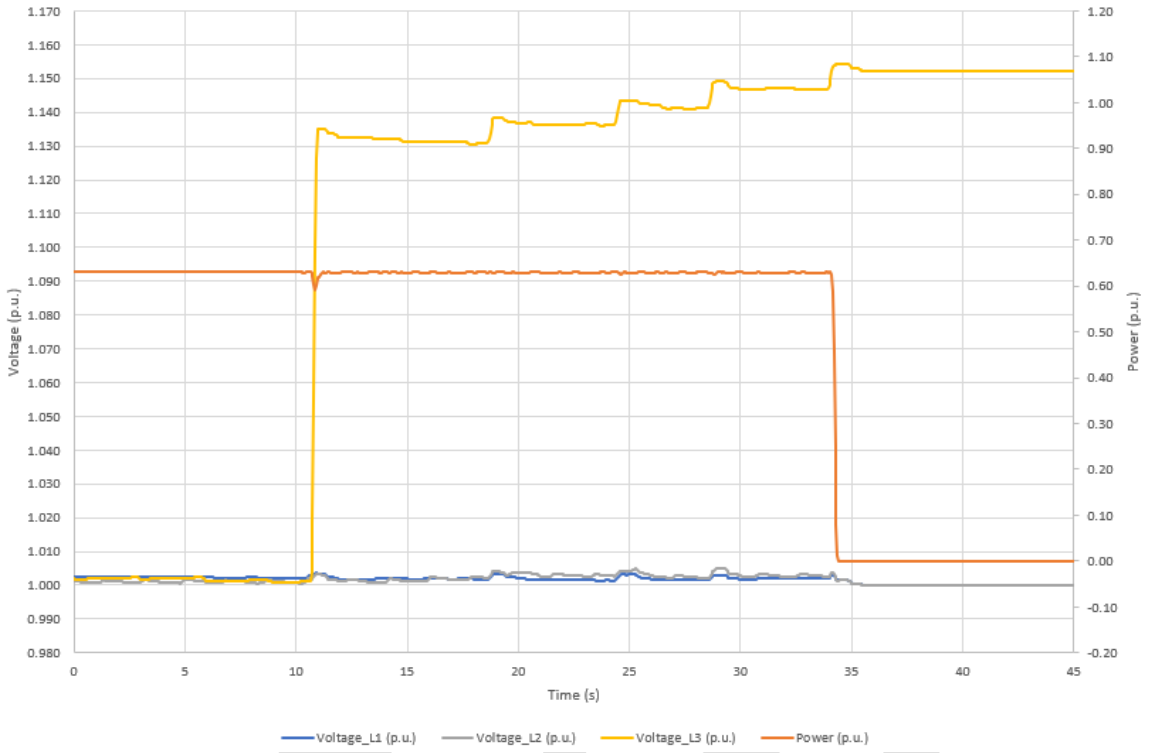
Voltage measured: Un +15 %Un Phase L2 to N



Voltage Trip Time: Un +15 %Un Phase L2 to N

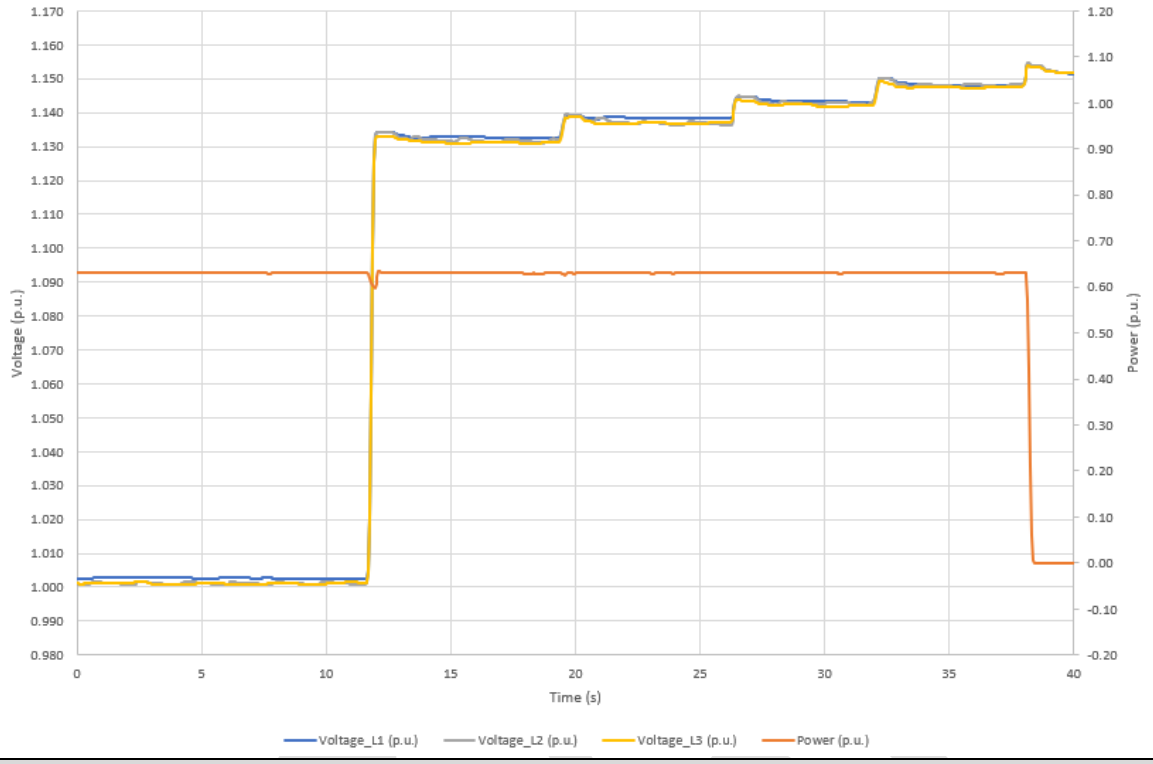


Voltage measured: Un +15 %Un Phase L3 to N



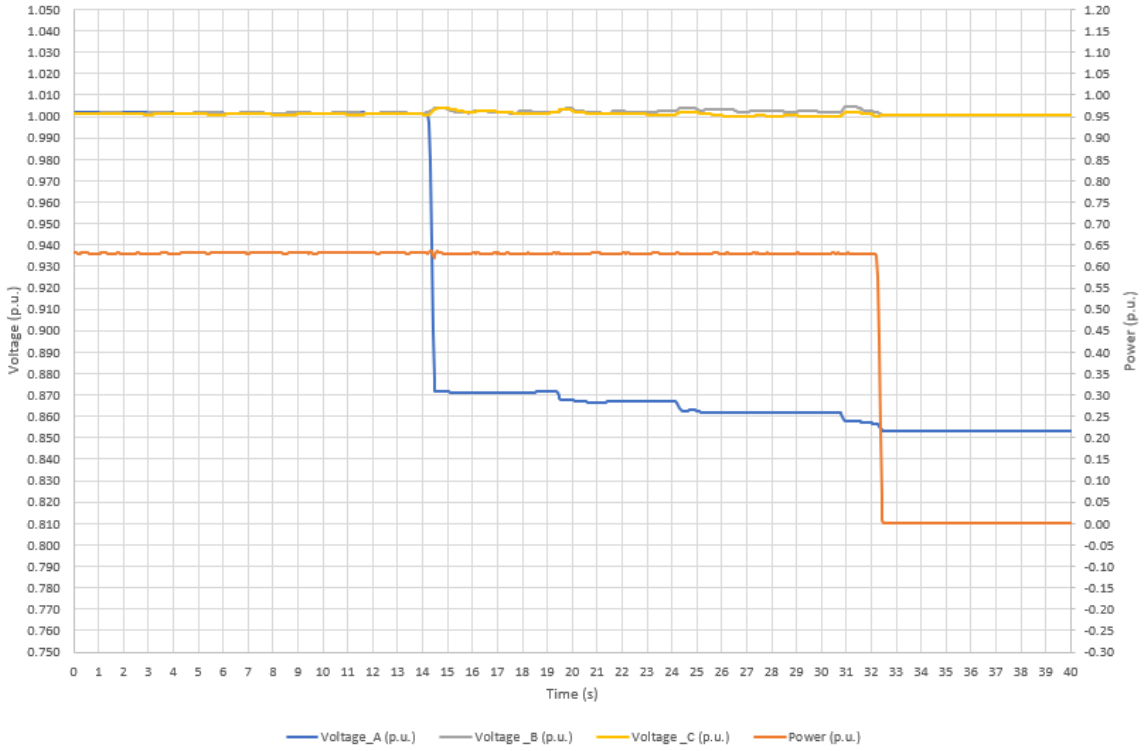
Voltage Trip Time: Un +15 %Un Phase L3 to N

Voltage measured: Un +15 %Un Phase L1L2L3 to N

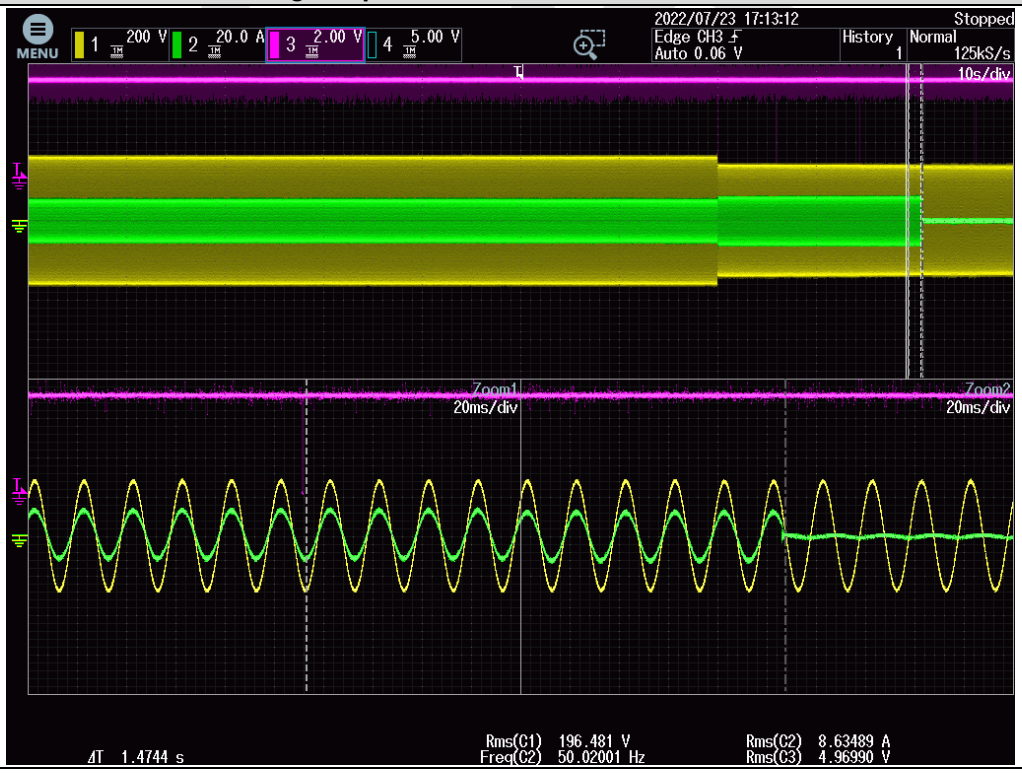


Voltage Trip Time: Un +15 %Un Phase L1L2L3 to N

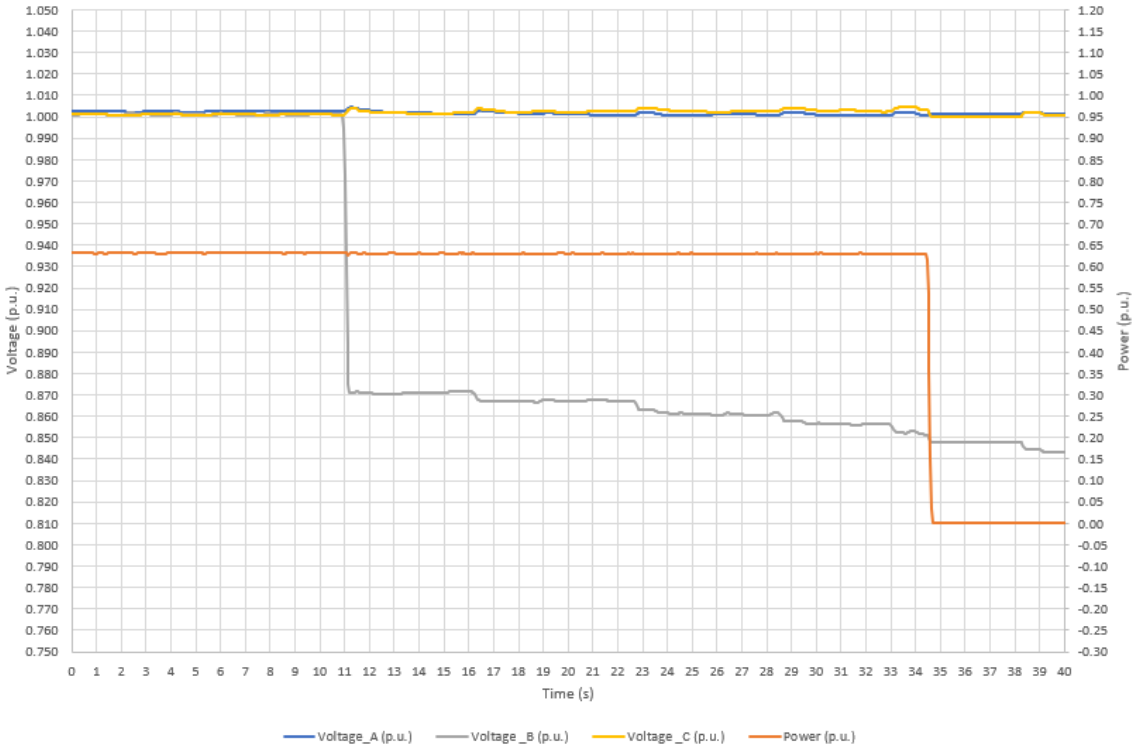
Voltage measured: Un -15 %Un Phase L1 to N



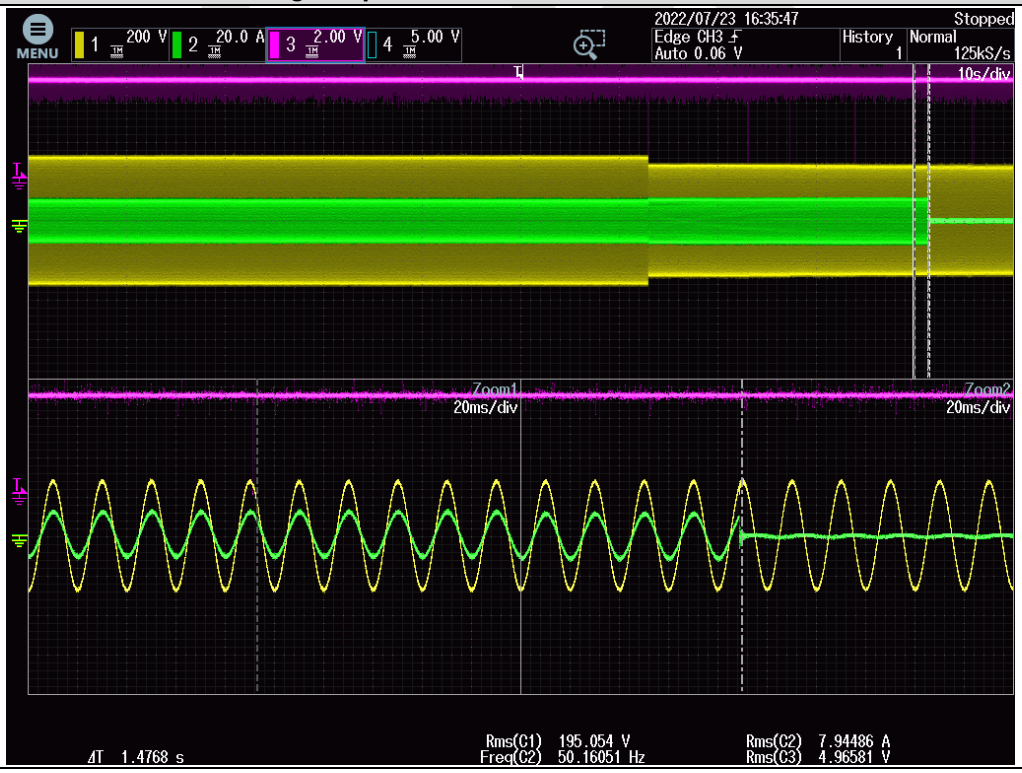
Voltage Trip Time: Un -15 %Un Phase L1 to N



Voltage measured: Un -15 %Un Phase L2 to N



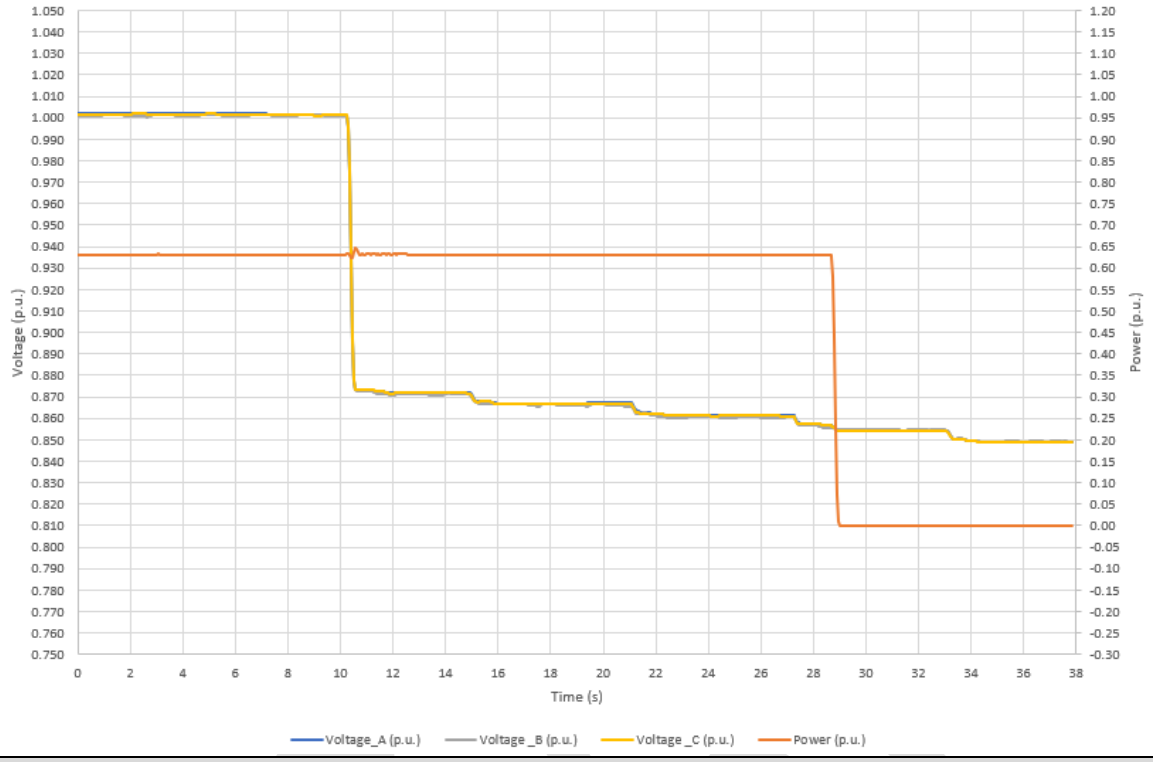
Voltage Trip Time: Un -15 %Un Phase L2 to N



Voltage measured: Un -15 %Un Phase L3 to N

Voltage Trip Time: Un -15 %Un Phase L3 to N

Voltage measured: Un -15 %Un Phase L1L2L3 to N



Voltage Trip Time: Un -15 %Un Phase L1L2L3 to N

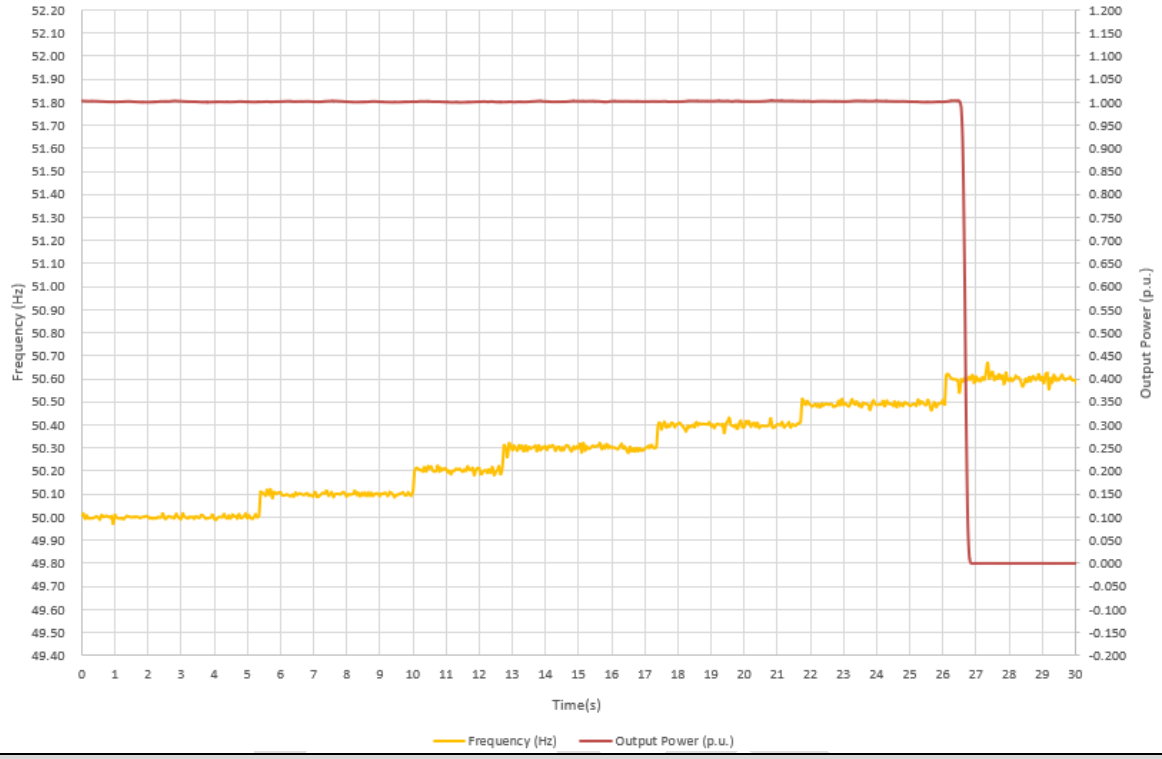
4.4.2 Frequency disconnection

Setting Frequency (Hz)	Measured Frequency (Hz)	Disconnection time limits (s)	Disconnection time measured (s)
51.00	50.59	0.500	0.202
48.00	47.90	>3.000 (1)	3.167

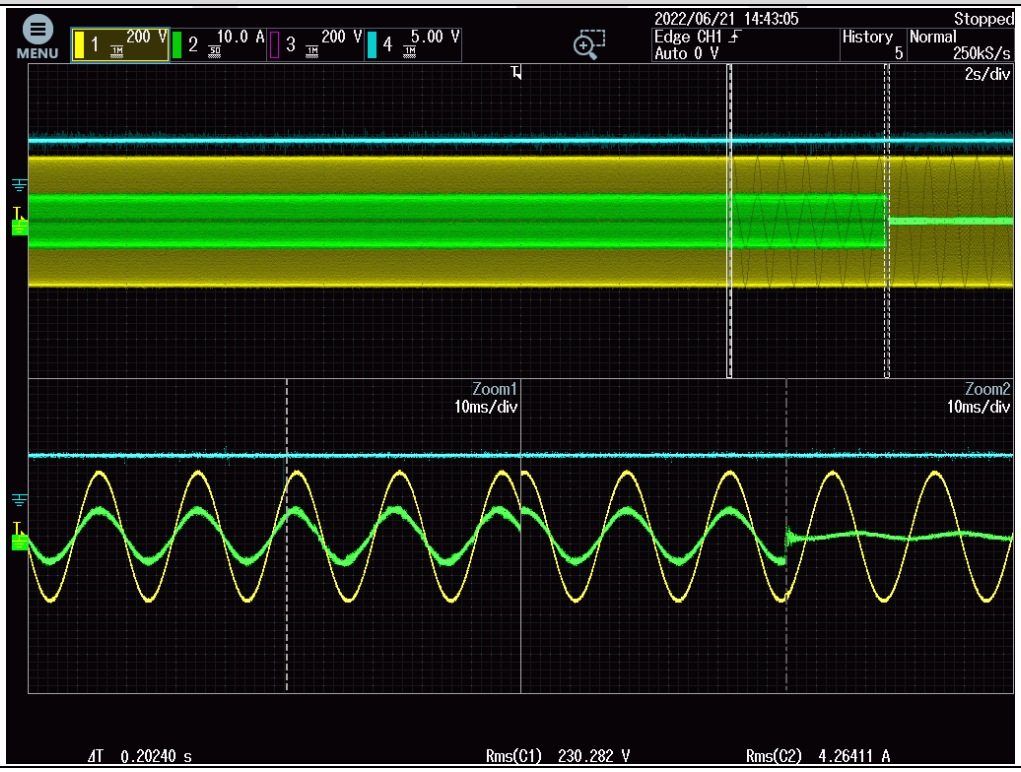
(1) The requirement according to RD 1699/2011 modified by RD 647/2020, the minimum disconnection time is 3s.

Frequency measured: 51.00 Hz

Trip value

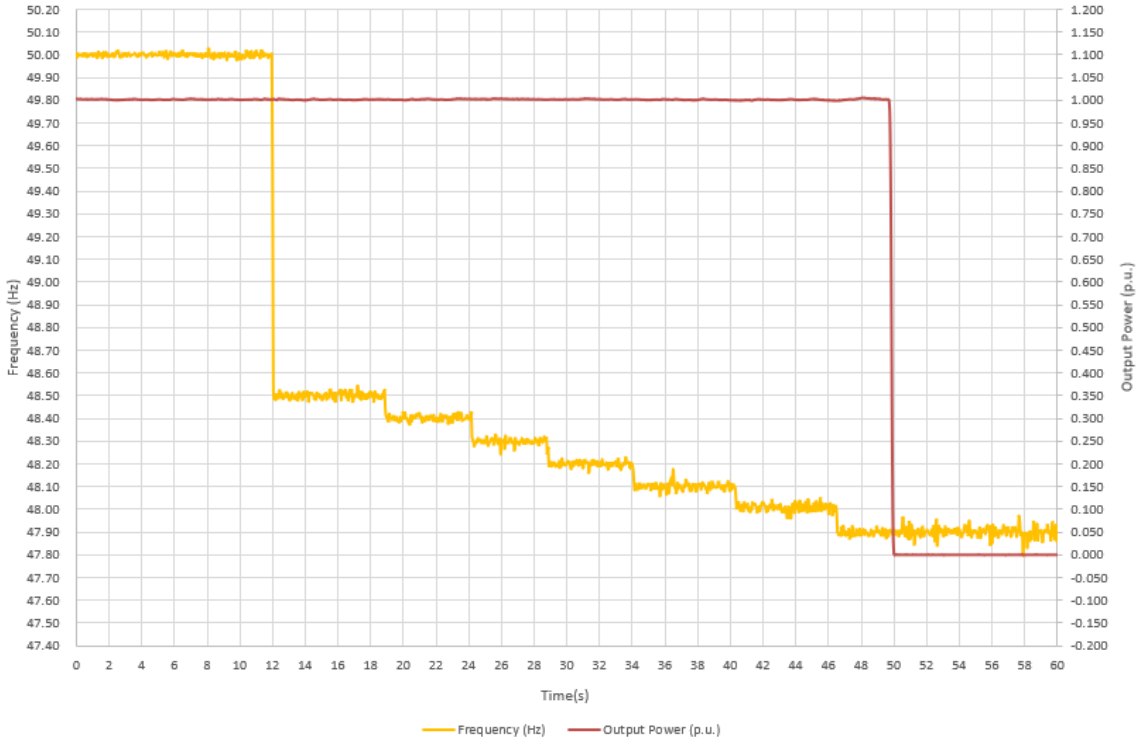


Disconnection time

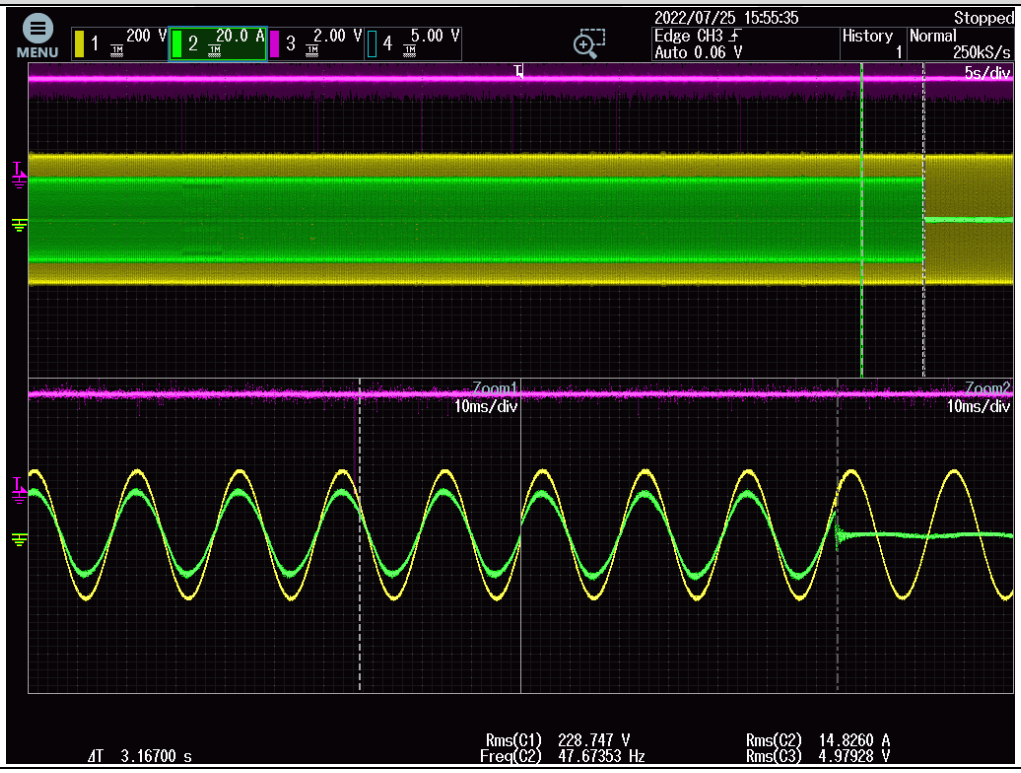


Frequency measured: 48.00 Hz

Trip value



Disconnection time



4.5 SELF-RECONNECTION(*)

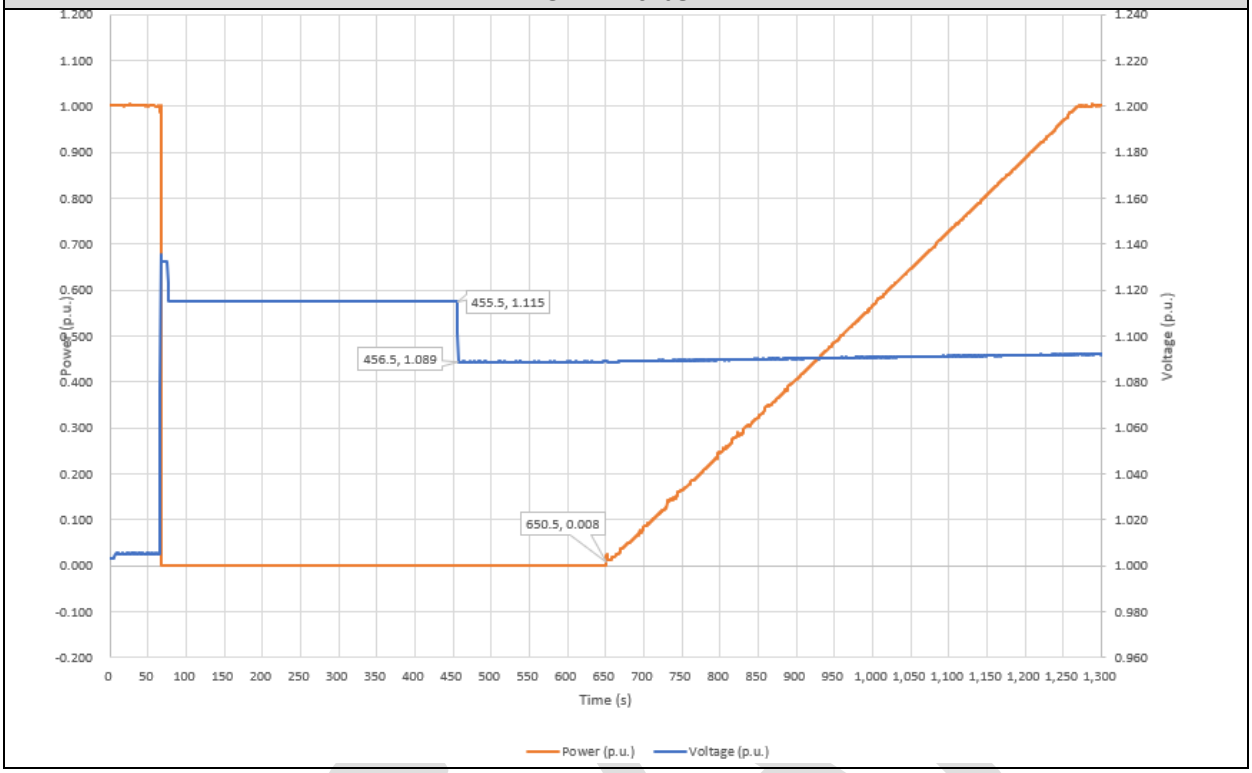
(*) This test is not under ENAC accreditation. No quantitative general conclusion is referred to the accredited testing.

Self-reconnection tests have been performed according to Real Decreto 647/2020.

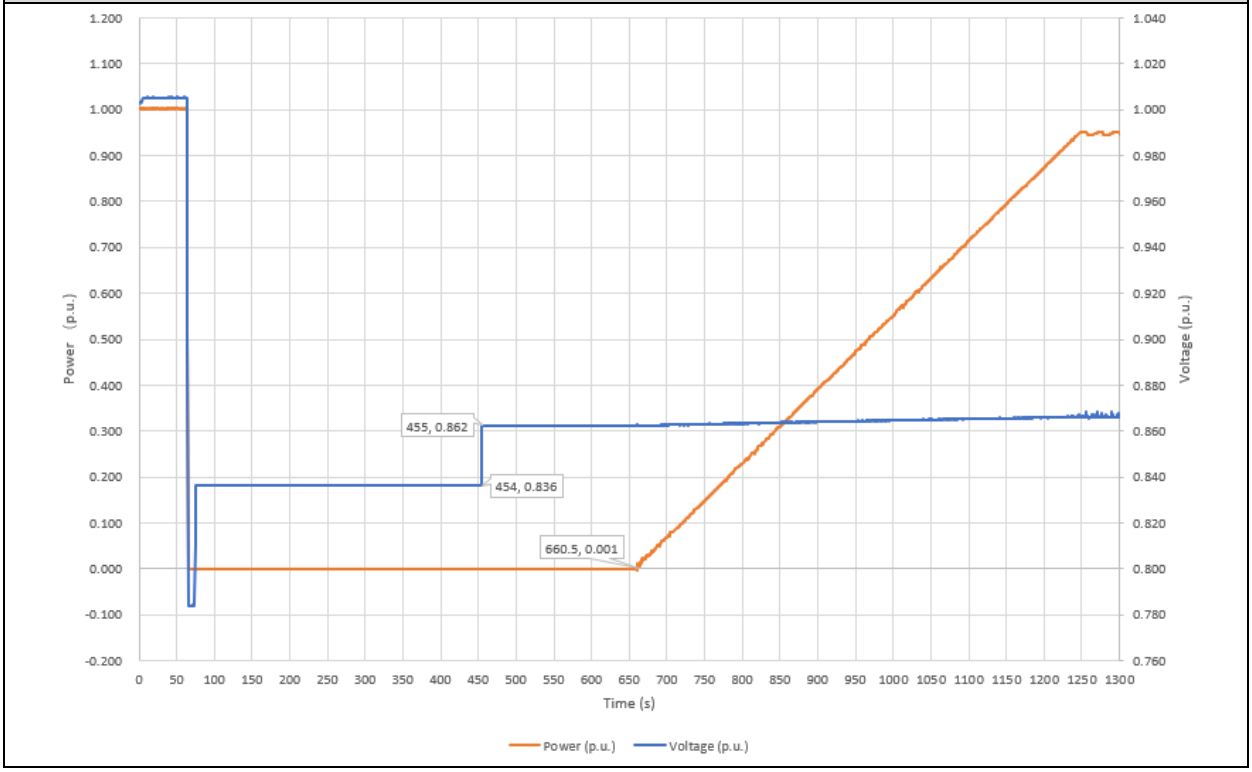
The inverter must be capable to reconnect when voltage and frequency are within the normal ranges according to standard.

Type	Delay time	Time measured (s)
OV: < 10 %Un	>3 min	194.0
UV: > 15 %Un	>3 min	205.5
OF: ≤ 50 Hz	--	193.5
UF: > 48.0 Hz	--	189.5

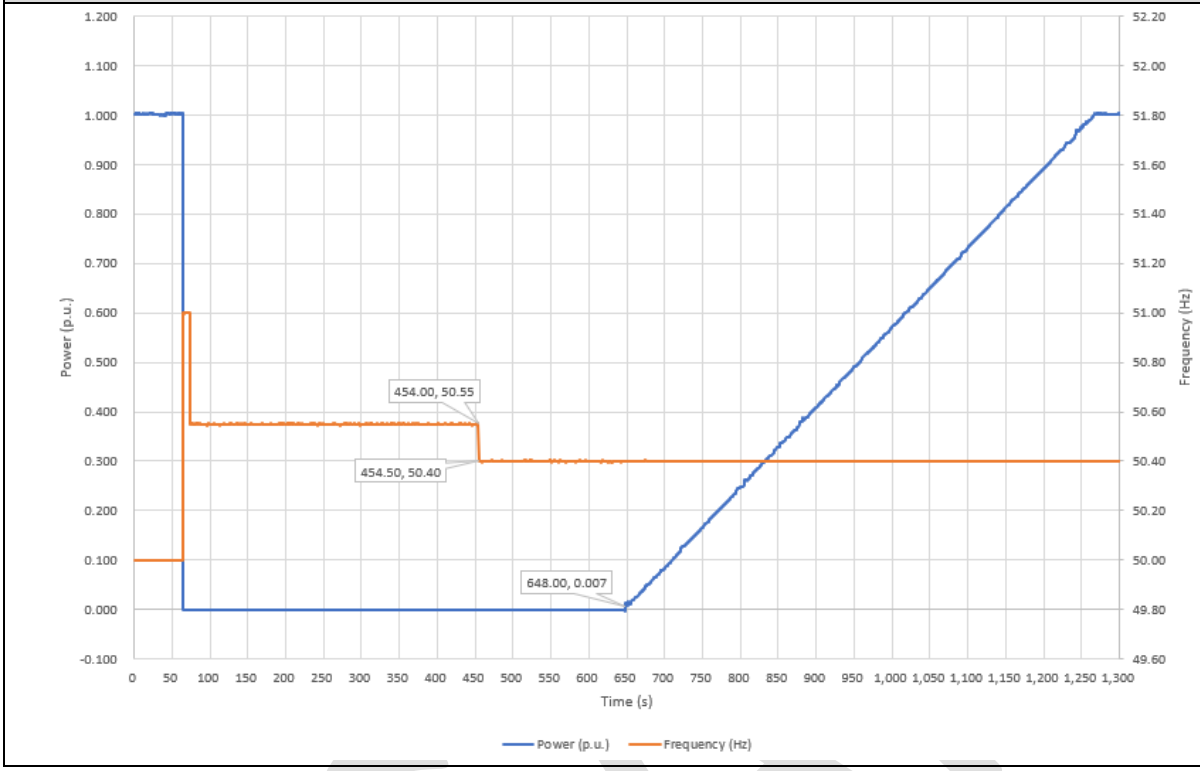
OV: < 10%Un



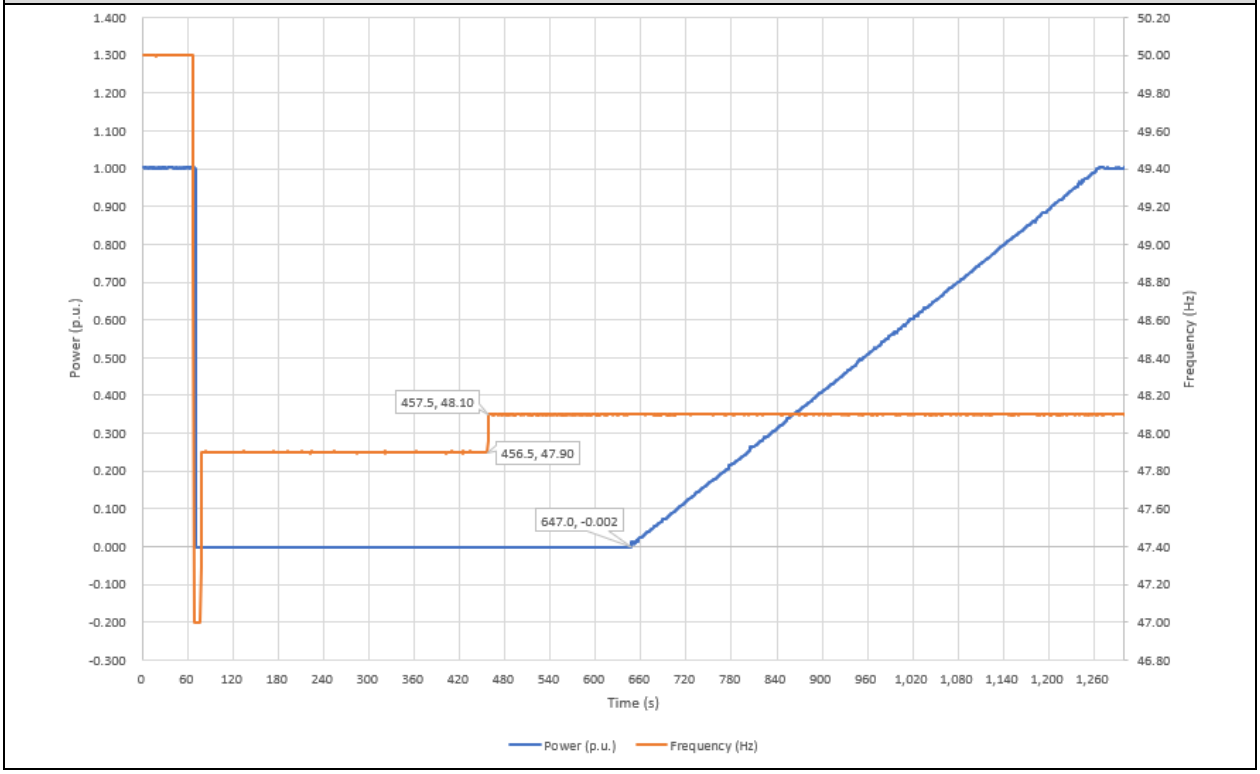
UV: > 15%Un



OF: < 50 Hz



UF: > 48.0 Hz



4.6 POWER FACTOR FIXED(*)

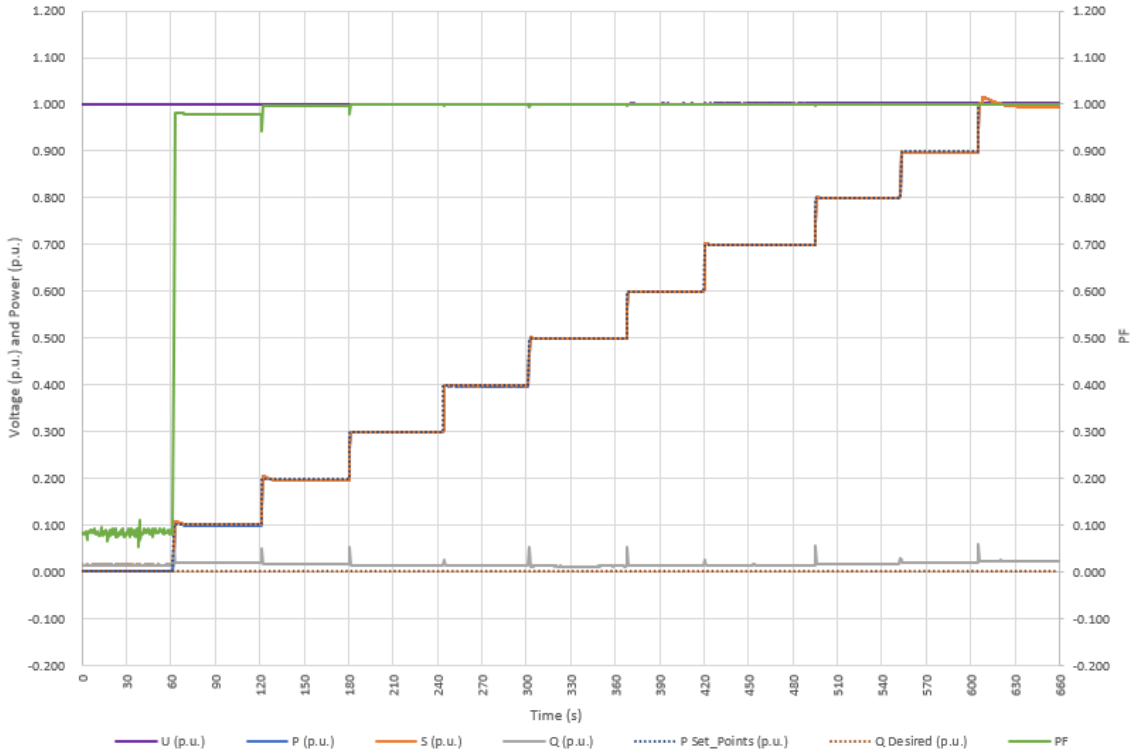
(*) This test is not under ENAC accreditation. No quantitative general conclusion is referred to the accredited testing.

According to Real Decreto 647/2020, the power factor of the energy supplied to the distribution company's network must be as close as possible to unity and, in any case, higher than 0.98, when the installation operates at powers higher than 25 percent of its nominal power.

Power Factor fixed (PF=1 & Q=0%Sn)								
P set (%Sn)	**U measured (p.u.)**	**I measured (p.u.)**	**P measured (p.u.)**	**Q measured (p.u.)**	**S measured (p.u.)**	**PF Desired**	**PF Measured**	**PF Deviation**
5	1.000	0.015	0.001	0.015	0.015	1.000	0.084	---(1)
10	1.000	0.098	0.095	0.020	0.098	1.000	0.945	---(1)
20	1.000	0.194	0.194	0.017	0.194	1.000	0.995	---(1)
30	1.001	0.297	0.297	0.014	0.298	1.000	0.999	-0.001
40	1.001	0.389	0.389	0.013	0.390	1.000	0.999	-0.001
50	1.001	0.494	0.495	0.012	0.495	1.000	1.000	0.000
60	1.001	0.584	0.585	0.013	0.585	1.000	1.000	0.000
70	1.001	0.697	0.698	0.015	0.698	1.000	1.000	0.000
80	1.002	0.771	0.773	0.016	0.773	1.000	1.000	0.000
90	1.002	0.875	0.876	0.019	0.877	1.000	1.000	0.000
100	1.002	0.986	0.989	0.023	0.989	1.000	1.000	0.000

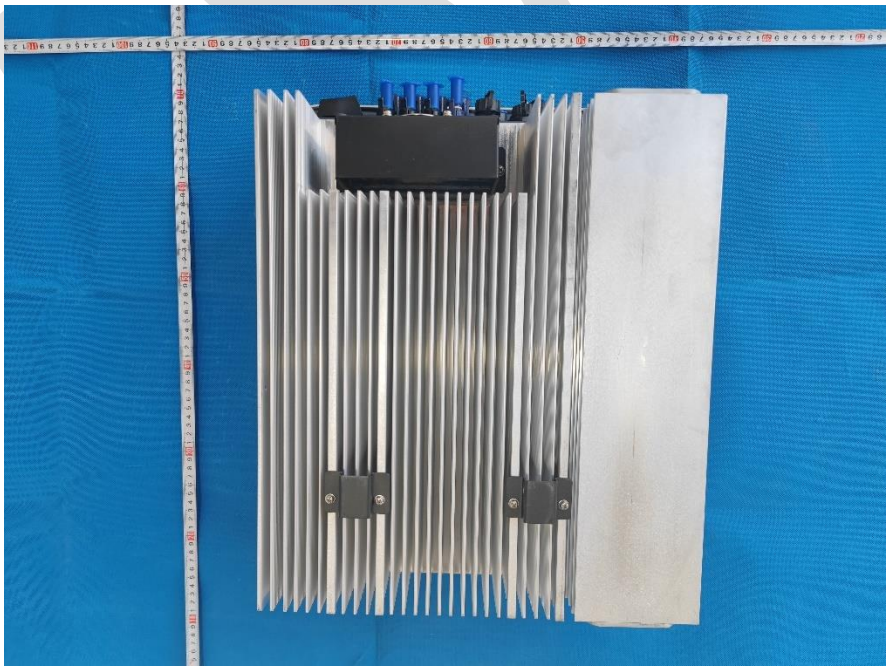
(1) No tolerance of Power Factor was defined when active power level below 25%Sn.

Result Chart over Time

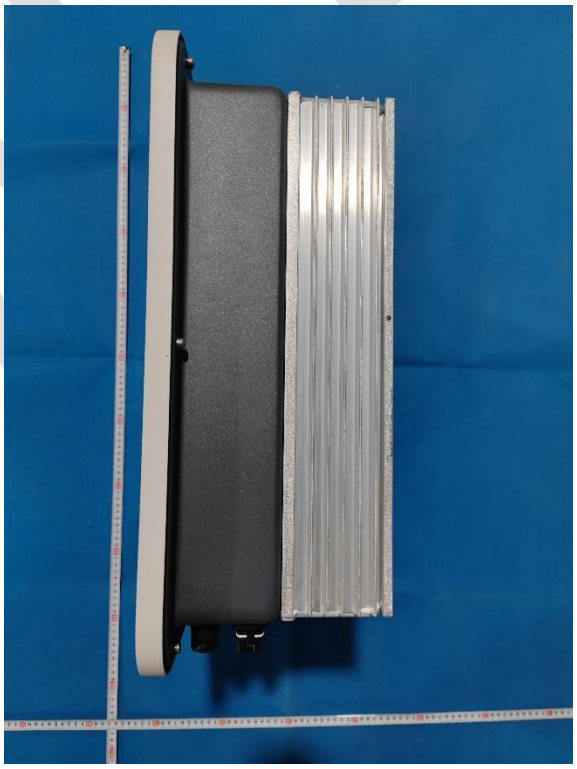


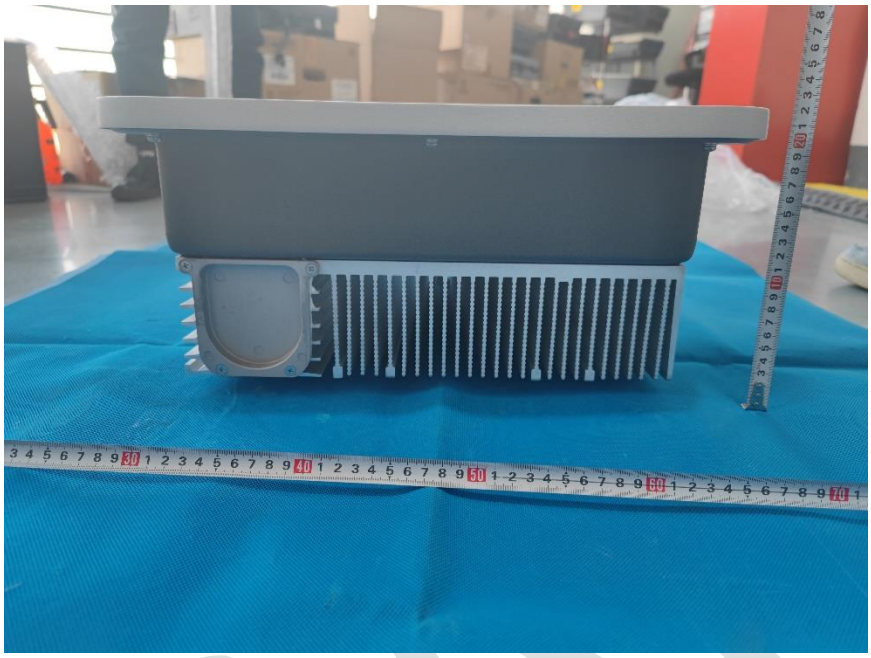
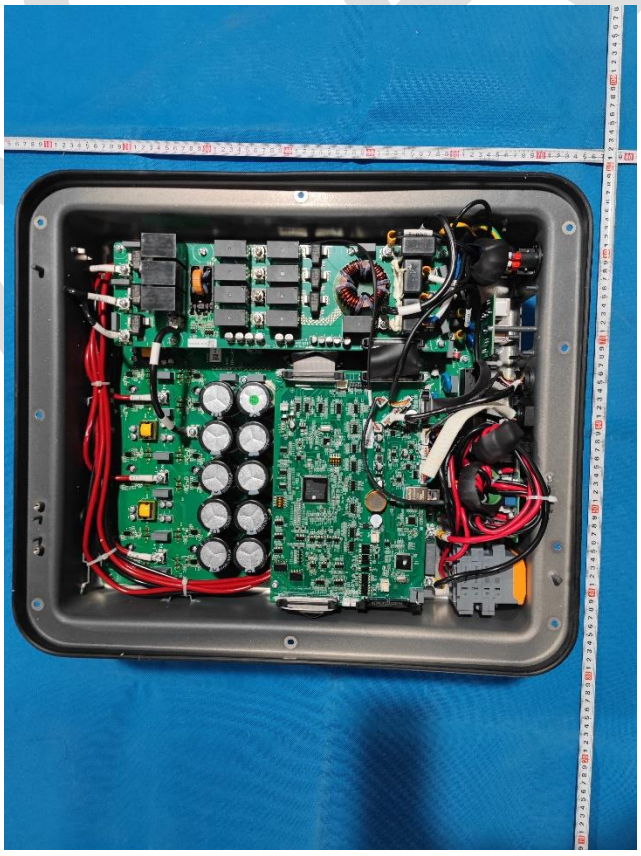
5 PICTURES

Front view

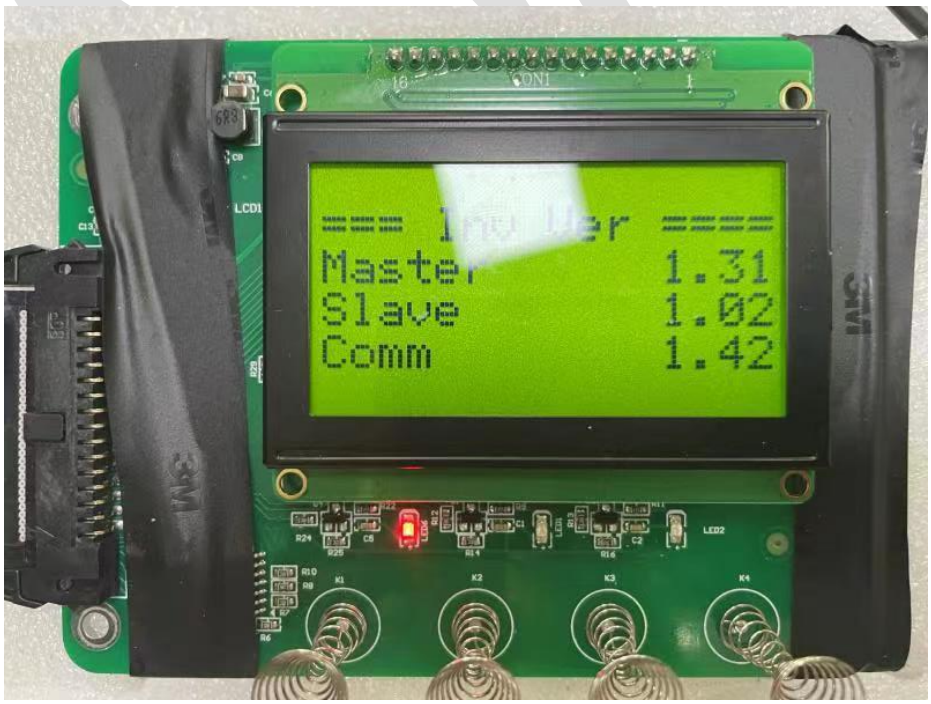

Rear view


Left view


Right view


Top view

Internal view


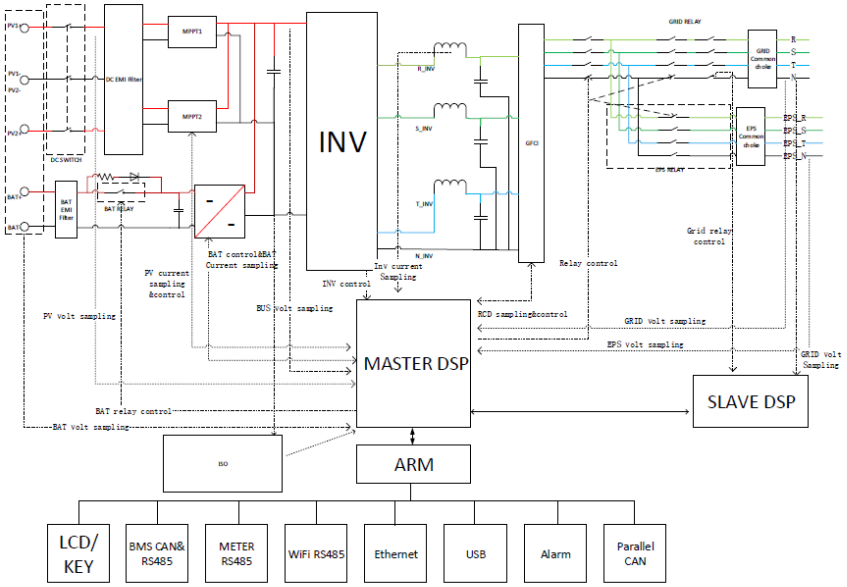
Connectors


Serial Number
   
Software Version


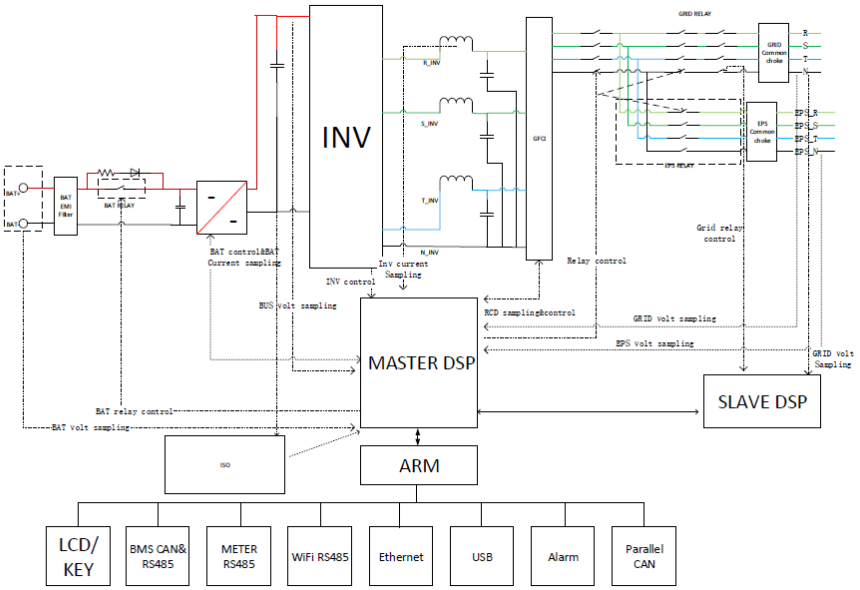
6 ELECTRICAL SCHEMES

Equipment under testing

Model:H3 series



Model:AC3 series



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