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TESTING
CNAS L6791

Test Report issued under the responsibility of:

TEST REPORT
NRS 097-2-1:2017
Test report for Grid interconnection of embedded generation
Part 2: Small-scale embedded generation
Section 1: Utility interface

Report Number..............................:	BL-DG2060517-B01
Date of issue..................................:	Jul. 09, 2020
Total number of pages	97
Name of Testing Laboratory preparing the Report ....:	Shenzhen BALUN Technology Co., Ltd
Applicant's name ....:	Shenzhen SOFAR SOLAR Co., Ltd.
Address...:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China.
Test specification:	
Standard ....:	NRS 097-2-1:2017
Test procedure ....:	Commissioned test
Non-standard test method ....:	N/A
Test item description.....................:	Hybrid Inverter
Trade Mark.....................................:	SOFAR SOLAR
Manufacturer ....:	Same as the applicant
Model/Type reference ....:	HYD 20KTL-3PH, HYD 15KTL-3PH, HYD 10KTL-3PH, HYD 8KTL-3PH, HYD 6KTL-3PH, HYD 5KTL-3PH
Ratings ....:	See copy of marking label and model list.
Testing Laboratory ....:	Shenzhen BALUN Technology Co., Ltd.
Testing location/ address ....:	Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong, China
Tested by (name, function, signature)...:	Colin Chen /Engineer Colin Chen
Approved by (name, function, signature)...:	Simon Qi /Chief Engineer Simon Qi

List of Attachments (including a total number of pages in each attachment):

ATTACHMENT 1 –EMC test report BL-DG2060517-401(40 pages)

ATTACHMENT 2 –Satey test report BL-DG2060127-B01 and BL-DG2060127-B01 attachment 1(96 pages)

ATTACHMENT 3 –Islanding Test Report GZES200601936102(14 pages)

ATTACHMENT 4 – Photo documentation (8 pages)

Summary of testing:

Attachments: The attachment 1,2,3 belongs to this main test report, details in below:

EMC test report of NRS 097-2-1:2017 Grid interconnection of embedded generation Part 2: Small-Scale embedded generation Section 1: Utility interface. Report number: BL-DG2060517-401, Issued by Shenzhen BALUN Technology Co., Ltd (CNAS L6791), Dated on Jul 09, 2020, total 40 pages.

Satey test report of IEC 62109-1:2010 Safety of power converters for use in photovoltaic power systems –Part 1: General requirements and IEC 62109-2:2011 Safety of power converters for use in photovoltaic power systems –Part 2: Particular requirements for inverters. Report number: BL-DG2060127-B01 and BL-DG2060127-B01 attachment 1, Issued by Shenzhen BALUN Technology Co., Ltd (CNAS L6791), Dated on Jul 02, 2020, total 40 pages.

Islanding test report of IEC 62116:2014 Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures. Report number: GZES20061936102, Issued by SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch(CNAS L0167), Dated on Jun 23, 2020, total 14 pages.

Tests performed (name of test and test clause):	**Testing location:**
4.1.2 Normal voltage operating range 4.1.3 Reference source impedance and short-circuit levels (fault levels) 4.1.5 Flicker 4.1.6 Voltage unbalance 4.1.7 Commutation notches 4.1.8 DC injection 4.1.9 Normal frequency operating range 4.1.10 Harmonics and waveform distortion 4.1.11 Power factor 4.1.13 Electromagnetic compatibility (EMC) 4.2.2 Safety disconnect from utility network 4.2.4 Response to utility recovery 4.2.5 Isolation 4.2.6 Earthing 4.2.7 Short-circuit protection 4.2.8 Maximum short-circuit contribution - For 4.1.13 and 4.2.2 Partial testing , please refer to the testing report for details.	All tests except Prevention of islanding as described in Test Case and Measurement Sections were performed at the laboratory described on page 1. The Prevention of islanding is conducted in SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch

Summary of compliance with National Differences (List of countries addressed):

None

☒ **The product fulfils the requirements of NRS 097-2-1:2017.**

Copy of marking plate:

SOFAR SOLAR

Hybrid Inverter

Model No:	HYD 20KTL-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	32A
Max. Short Current	32A
Max. Power Output to Grid	22000VA
Max. Current from Grid	58A
Max. Power from Grid	40000VA
Back-up Max. Output Current	32A
Back-up Max. Output Power	22000VA
Power Factor	1(adjustable+/-0.8)
Operating Temperature Range	-30~+60℃
Ingress Protection	IP65
Protective Class	Class I
Inverter Topology	Non-isolated
Z_source	1,05+j 0,32 ohm
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

SOFAR SOLAR

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. Short Current	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℃
Ingress Protection	IP65
Protective Class	Class I
Inverter Topology	Non-isolated
Z_source	1,05+j 0,32 ohm
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

SOFAR SOLAR

Hybrid Inverter

Model No:	HYD 10KTL-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	16A
Max. Short Current	16A
Max. Power Output to Grid	11000VA
Max. Current from Grid	29A
Max. Power from Grid	20000VA
Back-up Max. Output Current	16A
Back-up Max. Output Power	11000VA
Power Factor	1(adjustable+/-0.8)
Operating Temperature Range	-30~+60℃
Ingress Protection	IP65
Protective Class	Class I
Inverter Topology	Non-isolated
Z_source	1,05+j 0,32 ohm
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

SOFAR SOLAR

Hybrid Inverter

Model No:	HYD 8KTL-3PH
Max.DC Voltage	1000V
MPPT Voltage Range	180~960V
Max. Input Current	12.5/12.5A
Max.PV Isc	15/15A
Battery Type	Li-Ion
Battery Voltage Range	180~800V
Battery Max. Charging Current	25A
Battery Max. Discharging Current	25A
Nominal Grid/Back-up Voltage	3/N/PE, 380/400V
Nominal Grid/Back-up Frequency	50/60Hz
Max. Current Output to Grid	13A
Max. Short Current	13A
Max. Power Output to Grid	8800VA
Max. Current from Grid	24A
Max. Power from Grid	16000VA
Back-up Max. Output Current	13A
Back-up Max. Output Power	8800VA
Power Factor	1(adjustable+/-0.8)
Operating Temperature Range	-30~+60℃
Ingress Protection	IP65
Protective Class	Class I
Inverter Topology	Non-isolated
Z_source	1,05+j 0,32 ohm
Overvoltage Category	AC III, DC II

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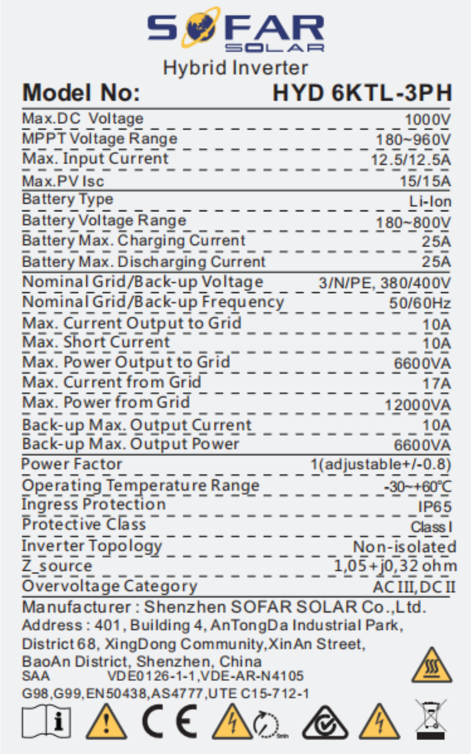
SOFAR SOLAR
Hybrid Inverter
Model No: HYD 6KTL-3PH
Max.DC Voltage 1000V
MPPT Voltage Range 180~960V
Max. Input Current 12.5/12.5A
Max.PV Isc 15/15A
Battery Type Li-Ion
Battery Voltage Range 180~800V
Battery Max. Charging Current 25A
Battery Max. Discharging Current 25A
Nominal Grid/Back-up Voltage 3/N/PE, 380/400V
Nominal Grid/Back-up Frequency 50/60Hz
Max. Current Output to Grid 10A
Max. Short Current 10A
Max. Power Output to Grid 6600VA
Max. Current from Grid 17A
Max. Power from Grid 12000VA
Back-up Max. Output Current 10A
Back-up Max. Output Power 6600VA
Power Factor 1(adjustable+/-0.8)
Operating Temperature Range -30~+60℃
Ingress Protection IP65
Protective Class Class I
Inverter Topology Non-isolated
Z_source 1,05+j0,32 ohm
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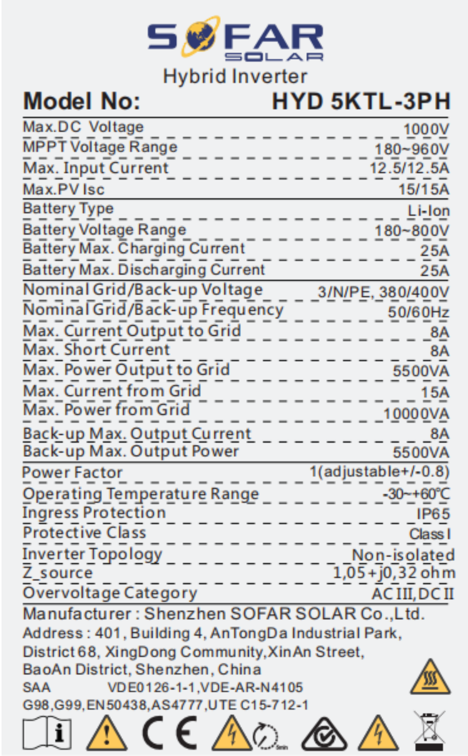
SOFAR SOLAR
Hybrid Inverter
Model No: HYD 5KTL-3PH
Max.DC Voltage 1000V
MPPT Voltage Range 180~960V
Max. Input Current 12.5/12.5A
Max.PV Isc 15/15A
Battery Type Li-Ion
Battery Voltage Range 180~800V
Battery Max. Charging Current 25A
Battery Max. Discharging Current 25A
Nominal Grid/Back-up Voltage 3/N/PE, 380/400V
Nominal Grid/Back-up Frequency 50/60Hz
Max. Current Output to Grid 8A
Max. Short Current 8A
Max. Power Output to Grid 5500VA
Max. Current from Grid 15A
Max. Power from Grid 10000VA
Back-up Max. Output Current 8A
Back-up Max. Output Power 5500VA
Power Factor 1(adjustable+/-0.8)
Operating Temperature Range -30~+60℃
Ingress Protection IP65
Protective Class Class I
Inverter Topology Non-isolated
Z_source 1,05+j0,32 ohm
Overvoltage Category AC III, DC II
Manufacturer : Shenzhen SOFAR SOLAR Co.,Ltd.
Address : 401, Building 4, AnTongDa Industrial Park,
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SAA VDE0126-1-1,VDE-AR-N4105
G98,G99,EN50438,AS4777,UTE C15-712-1

Test item particulars...:	
Classification of installation and use.......................:	Fixed
Supply Connection ....:	Permanent connection
..:	
Possible test case verdicts:	
- test case does not apply to the test object...........:	N/A
- test object does meet the requirement..................:	P (Pass)
- test object does not meet the requirement...........:	F (Fail)
Testing...:	
Date of receipt of test item ....:	Jun. 04, 2019
Date (s) of performance of tests ....:	Jun. 06, 2019 to Jul. 03, 2020
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. The tests results presented in this report relate only to the object tested. This report shall not be reproduced except in full without the written approval of the testing laboratory. List of test equipment must be kept on file and available for review. Additional test data and/or information provided in the attachments to this report. Throughout this report a ☐ comma / ☒ point is used as the decimal separator. Determination of the test results includes consideration of measurement uncertainty from the test equipment and methods.	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided .... :	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) .... :	Dongguan SOFAR SOLAR Co., Ltd 1F-6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City.

General product information:

Brief description:

The PCE under test (EUT) is Grid-connected Grid-Connected PV Inverter which utilizes the advanced power electronics conversion components such as MOSFET, IGBT, IPM to convert the variable DC power generated from the photovoltaic (PV) arrays to the stable utility AC power which can be fed into the commercial electrical grid.

The PCE under test is three-phase grid-connected Grid-Connected PV Inverter for solar power generation with the rating of 5kW, 6kW, 8kW, 10kW, 15kW and 20kW.

The external circuit breakers or fuses for PV array and Grid connection are required which the statements are provided in the installation manual.

The models of HYD 5KTL-3PH, HYD 6KTL-3PH, HYD 8KTL-3PH, HYD 10KTL-3PH, HYD 15KTL-3PH and HYD 20KTL-3PH are identical on topological schematic circuit diagram and control solution codes except for the type designation, the input/output rating. So there are some differences on the related power electronics components such as the inverter module, reactors and bus capacitors, etc. See the model differences list below for details.

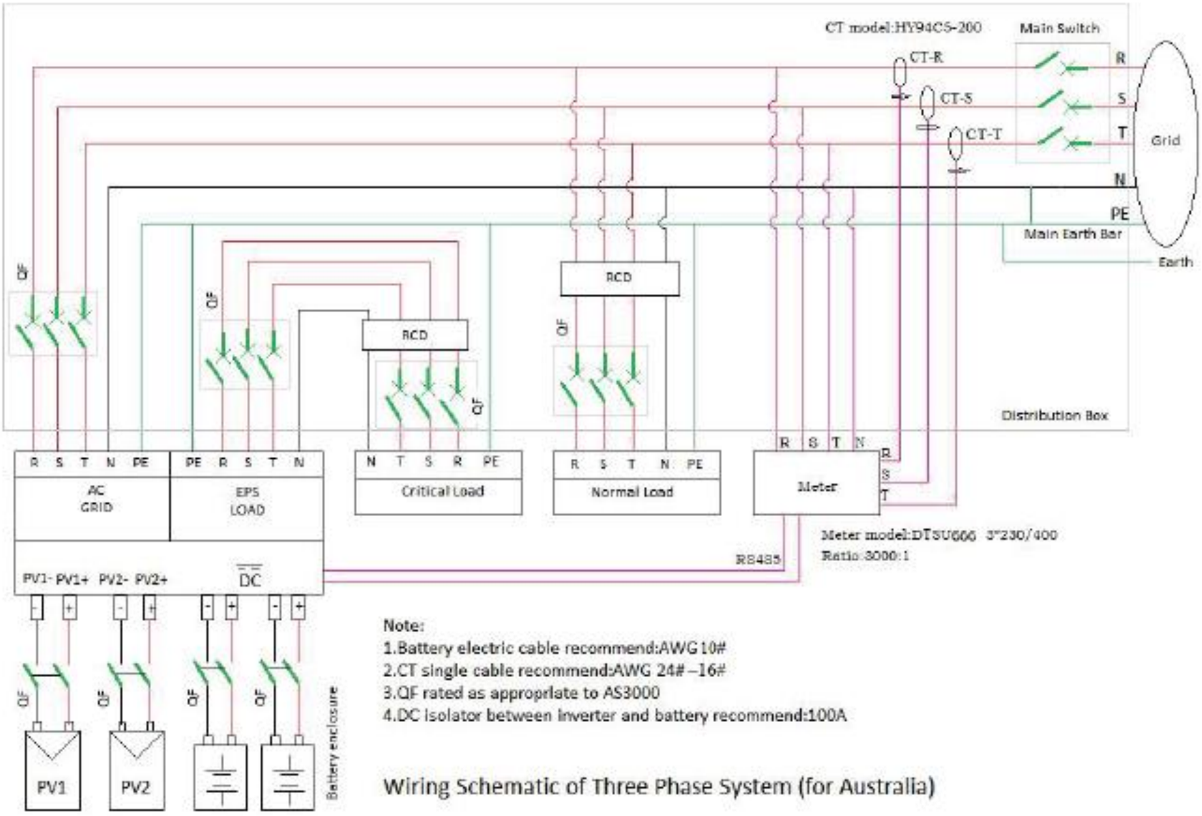
Model / Item	HYD 20KTL-3PH	HYD 15KTL-3PH	HYD 10KTL-3PH	HYD 8KTL-3PH	HYD 6KTL-3PH	HYD 5KTL-3PH
Recommended Max.PV Power	30000Wp (15000Wp/ 15000Wp)	22500 Wp (11250Wp /11250Wp)	15000Wp (7500Wp /7500Wp)	12000Wp (6600Wp/6600Wp)	9000Wp (6600Wp/6600Wp)	7500Wp (6000Wp/6000Wp)
Full power MPPT voltage range	450V~850V	350V~850V	220V~850V	360V~850V	320V~850V	250V~850V
Battery Voltage Range for Full Load	400V~800V	300V~800V	200V~800V	320V~800V	240V~800V	200V~800V
Nominal charging/discharging power	20000W	15000W	10000W	8000W	6000W	5000W
Nominal AC Power	20000W	15000W	10000W	8000W	6000W	5000W
Max. AC Power Output to Utility Grid	22000VA	16500VA	11000VA	8800VA	6600VA	5500VA
Max. AC Power from Utility Grid	40000VA	30000VA	20000VA	16000VA	12000VA	10000VA
Max. AC Current Output to Utility Grid	32A	24A	16A	13A	10A	8A
Max. AC Current from Utility Grid	58A	44A	29A	24A	17A	15A
Max. output power	22000VA	16500VA	11000VA	8800VA	6600VA	5500VA
Inverter inductance	0.876 mH		1.12 mH		1.5mH	

Unless otherwise specified, all the tests were conducted on the basic model of HYD 20KTL-3PH.

The PCE does not provide galvanic separation between the PV input and AC output circuit (Non-isolation or transformer-less type).

The output circuit of each phase can be switched off by two relays in series for the redundant protection. When single-fault occurs to one relay, the other redundant one will still maintain the basic insulation between PV input and AC output circuit to the mains. All the relays have functional self-checking before the PCE starting.

Block Diagram:



Summary table of test items and results			
No.	**Clause**	**Test description**	**Results**
1	4.1.2	Normal voltage operating range	P
2	4.1.3, 4.2.7 and 4.2.8	Maximum short-circuit contribution	P
3	4.1.5	Flicker	P
4	4.1.6	Voltage unbalance	P
5	4.1.7	Commutation notches	P
6	4.1.8 and 4.2.2.5	DC injection	P
7	4.1.9	Normal frequency operating range	P
8	4.1.10	Harmonics and waveform distortion	P
9	4.1.11	Power factor	P
10	4.1.12 and 4.2.4	Synchronization and Response to utility recovery	P
11	4.1.13	Electromagnetic compatibility (EMC)	P
12	4.1.14	Mains signalling (e.g. PLC and ripple control)	N/A
13	4.2.2	Safety disconnect from utility network	P
14	4.2.5	Isolation	P
15	4.2.6	Earthing	P
16	4.2.7	Labelling	P
17	4.2.10	Robustness requirements	P

1. Normal voltage operating range

Normal voltage operating range tests have been measured according to Clause 4.1.2 of the standard.

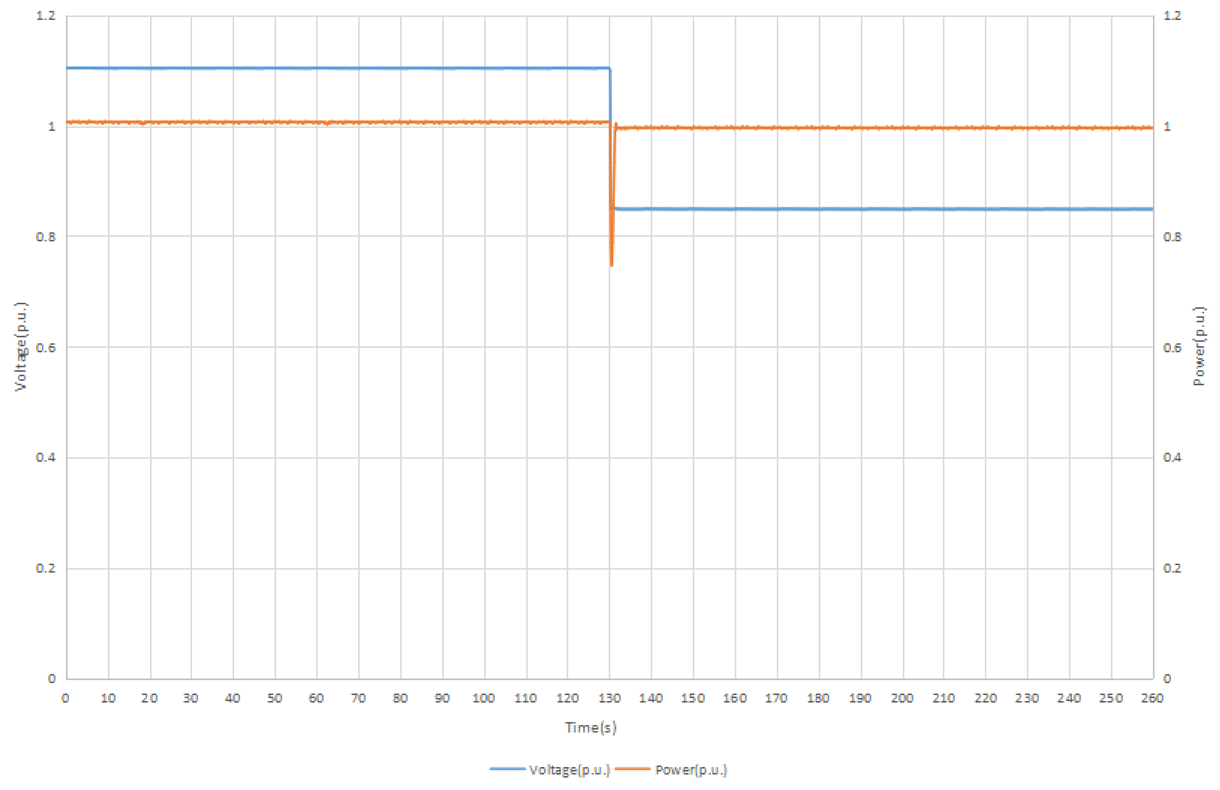
In accordance with IEC 61727, utility-interconnected embedded generators do not normally regulate voltage, they inject current into the utility. Therefore, the voltage operating range for embedded generators is designed as protection which responds to abnormal utility network conditions and not as a voltage regulation function.

Voltage limits (p.u.)	Voltage measured (p.u.)	Disconnection
0.850(*)	0.848	No
1.100	1.104	No

(*) The unit cannot reach the maximum power due to the current limitation.

The results are offered in the table below:

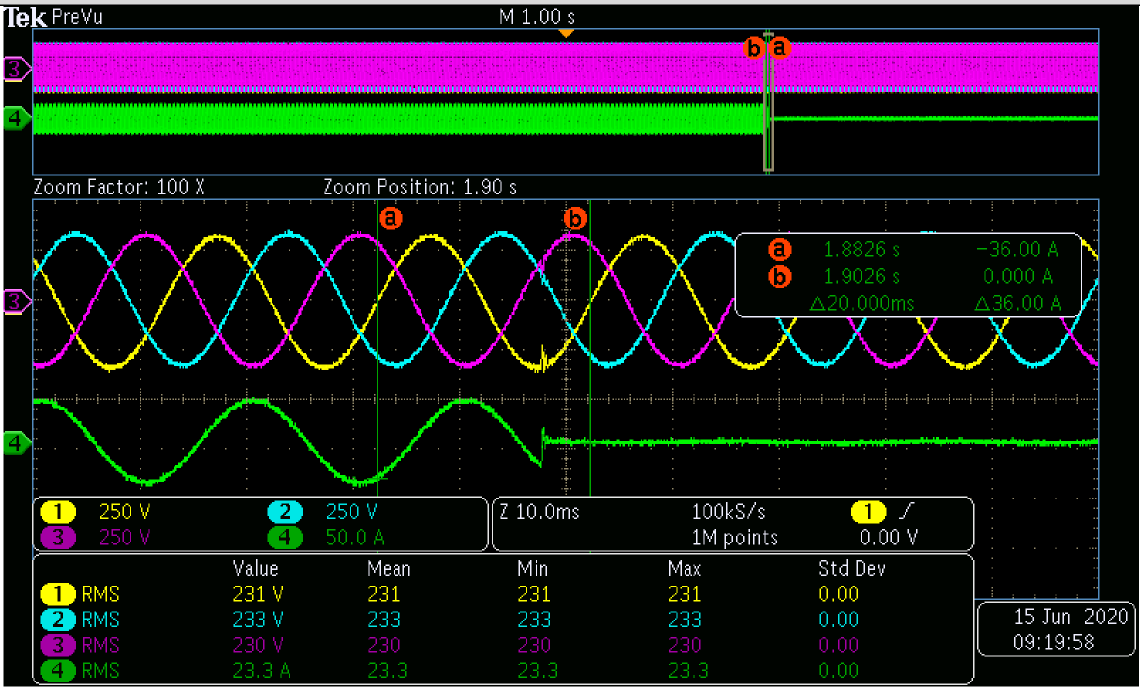
Normal Voltage Operating Range



TEST RESULTS

2. Maximum short-circuit contribution

Maximum Short-circuit tests have been measured according to Clause 4.1.3, Clause 4.2.7 and 4.2.8 of the standard.

Short-circuit Test – Between L1-N

Short-Circuit Current: -36.0 Amax.

3. Flicker

The measurements of voltage fluctuations have been measured according to the paragraph 4.1.5 of the standard. Measurements must be taken for each phase.

The flicker test result as following:

P_n(%)	Limit		10 %	20 %	30%	40 %
PST	≤ 0.35	Phase A	0.06	0.04	0.06	0.06
		Phase B	0.14	0.14	0.14	0.14
		Phase C	0.05	0.05	0.04	0.04
PLT	≤ 0.30	Phase A	0.05	0.03	0.05	0.05
		Phase B	0.14	0.14	0.14	0.14
		Phase C	0.05	0.05	0.04	0.04

P_n(%)	Limit		50 %	60 %	70%	80 %
PST	≤ 0.35	Phase A	0.07	0.04	0.04	0.05
		Phase B	0.14	0.14	0.14	0.14
		Phase C	0.06	0.05	0.05	0.06
PLT	≤ 0.30	Phase A	0.06	0.03	0.04	0.04
		Phase B	0.14	0.14	0.14	0.14
		Phase C	0.05	0.05	0.05	0.05

P_n(%)	Limit		90 %	100 %
PST	≤ 0.35	Phase A	0.08	0.08
		Phase B	0.16	0.15
		Phase C	0.07	0.07
PLT	≤ 0.30	Phase A	0.08	0.07
		Phase B	0.15	0.15
		Phase C	0.07	0.06

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

TEST RESULTS

Power=10% Pn – Phase A

	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

Power=10% Pn – Phase B

	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

TEST RESULTS

Power=10% Pn – Phase C

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 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		Pass	0.050	Pass

Power=20% Pn – Phase A

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 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		Pass	0.032	Pass

TEST RESULTS

Power=20% Pn – Phase B

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 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		Pass	0.137	Pass

Power=20% Pn – Phase C

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 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		Pass	0.046	Pass

TEST RESULTS

Power=30% Pn – Phase A

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.108	Pass	0.149	Pass	0.0	Pass	0.040	Pass		
2	0.109	Pass	0.191	Pass	0.0	Pass	0.043	Pass		
3	0.107	Pass	0.183	Pass	0.0	Pass	0.047	Pass		
4	0.114	Pass	0.279	Pass	0.0	Pass	0.056	Pass		
5	0.109	Pass	0.137	Pass	0.0	Pass	0.057	Pass		
6	0.108	Pass	0.138	Pass	0.0	Pass	0.056	Pass		
7	0.095	Pass	0.139	Pass	0.0	Pass	0.056	Pass		
8	0.100	Pass	0.155	Pass	0.0	Pass	0.056	Pass		
9	0.105	Pass	0.145	Pass	0.0	Pass	0.056	Pass		
10	0.109	Pass	0.135	Pass	0.0	Pass	0.056	Pass		
11	0.105	Pass	0.133	Pass	0.0	Pass	0.056	Pass		
12	0.095	Pass	0.172	Pass	0.0	Pass	0.056	Pass		
Result		Pass		Pass		Pass		Pass	0.054	Pass

Power=30% Pn – Phase B

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.016	Pass	0.101	Pass	0.0	Pass	0.136	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.136	Pass		
3	0.015	Pass	0.116	Pass	0.0	Pass	0.137	Pass		
4	0.009	Pass	0.102	Pass	0.0	Pass	0.136	Pass		
5	0.000	Pass	0.000	Pass	0.0	Pass	0.136	Pass		
6	0.003	Pass	0.101	Pass	0.0	Pass	0.135	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.135	Pass		
8	0.000	Pass	0.000	Pass	0.0	Pass	0.135	Pass		
9	0.008	Pass	0.119	Pass	0.0	Pass	0.135	Pass		
10	0.000	Pass	0.000	Pass	0.0	Pass	0.135	Pass		
11	0.027	Pass	0.112	Pass	0.0	Pass	0.136	Pass		
12	0.024	Pass	0.132	Pass	0.0	Pass	0.135	Pass		
Result		Pass		Pass		Pass		Pass	0.136	Pass

TEST RESULTS

Power=30% Pn – Phase C

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.044	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.044	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.044	Pass		
4	0.000	Pass	0.000	Pass	0.0	Pass	0.044	Pass		
5	0.000	Pass	0.000	Pass	0.0	Pass	0.043	Pass		
6	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
8	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
9	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
10	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
11	0.000	Pass	0.000	Pass	0.0	Pass	0.043	Pass		
12	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
Result		Pass		Pass		Pass		Pass	0.043	Pass

Power=40% Pn – Phase A

	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

TEST RESULTS

Power=40% Pn – Phase B

	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

Power=40% Pn – Phase C

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 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

TEST RESULTS

Power=50% Pn – Phase A

Count 12/12 Complete
Interval 00:00s/10:00s
Element 1
Volt Range 600 V/50Hz
Un (U1) 230.621V
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	0.096	Pass	0.137	Pass	0.0	Pass	0.057	Pass		
2	0.094	Pass	0.143	Pass	0.0	Pass	0.056	Pass		
3	0.101	Pass	0.136	Pass	0.0	Pass	0.058	Pass		
4	0.099	Pass	0.132	Pass	0.0	Pass	0.056	Pass		
5	0.108	Pass	0.150	Pass	0.0	Pass	0.057	Pass		
6	0.112	Pass	0.152	Pass	0.0	Pass	0.057	Pass		
7	0.100	Pass	0.205	Pass	0.0	Pass	0.057	Pass		
8	0.111	Pass	0.300	Pass	0.0	Pass	0.058	Pass		
9	0.108	Pass	0.144	Pass	0.0	Pass	0.059	Pass		
10	0.096	Pass	0.141	Pass	0.0	Pass	0.059	Pass		
11	0.109	Pass	0.219	Pass	0.0	Pass	0.059	Pass		
12	0.101	Pass	0.227	Pass	0.0	Pass	0.074	Pass		
Result		Pass		Pass		Pass		Pass	0.059	Pass

Update: 3637 Runtime: 5:01:28 2020-06-08 13:31:55

Power=50% Pn – Phase B

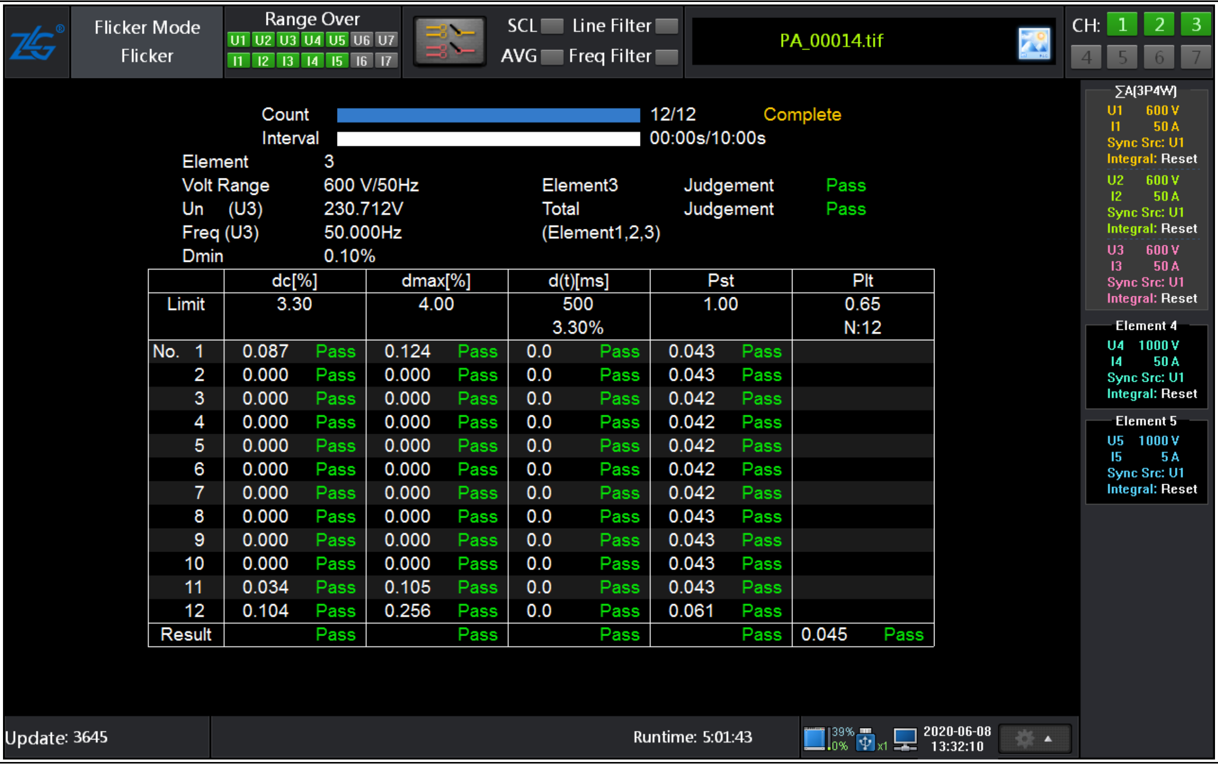
Count 12/12 Complete
Interval 00:00s/10:00s
Element 2
Volt Range 600 V/50Hz
Un (U2) 230.511V
Freq (U2) 50.000Hz
Dmin 0.10%
Element2 Judgement Pass
Total Judgement Pass
(Element1,2,3)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.007	Pass	0.105	Pass	0.0	Pass	0.136	Pass		
2	0.005	Pass	0.101	Pass	0.0	Pass	0.136	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.135	Pass		
4	0.002	Pass	0.105	Pass	0.0	Pass	0.136	Pass		
5	0.004	Pass	0.115	Pass	0.0	Pass	0.135	Pass		
6	0.000	Pass	0.000	Pass	0.0	Pass	0.135	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.135	Pass		
8	0.014	Pass	0.102	Pass	0.0	Pass	0.136	Pass		
9	0.000	Pass	0.000	Pass	0.0	Pass	0.135	Pass		
10	0.034	Pass	0.105	Pass	0.0	Pass	0.136	Pass		
11	0.020	Pass	0.110	Pass	0.0	Pass	0.135	Pass		
12	0.075	Pass	0.277	Pass	0.0	Pass	0.140	Pass		
Result		Pass		Pass		Pass		Pass	0.136	Pass

Update: 3641 Runtime: 5:01:36 2020-06-08 13:32:03

TEST RESULTS

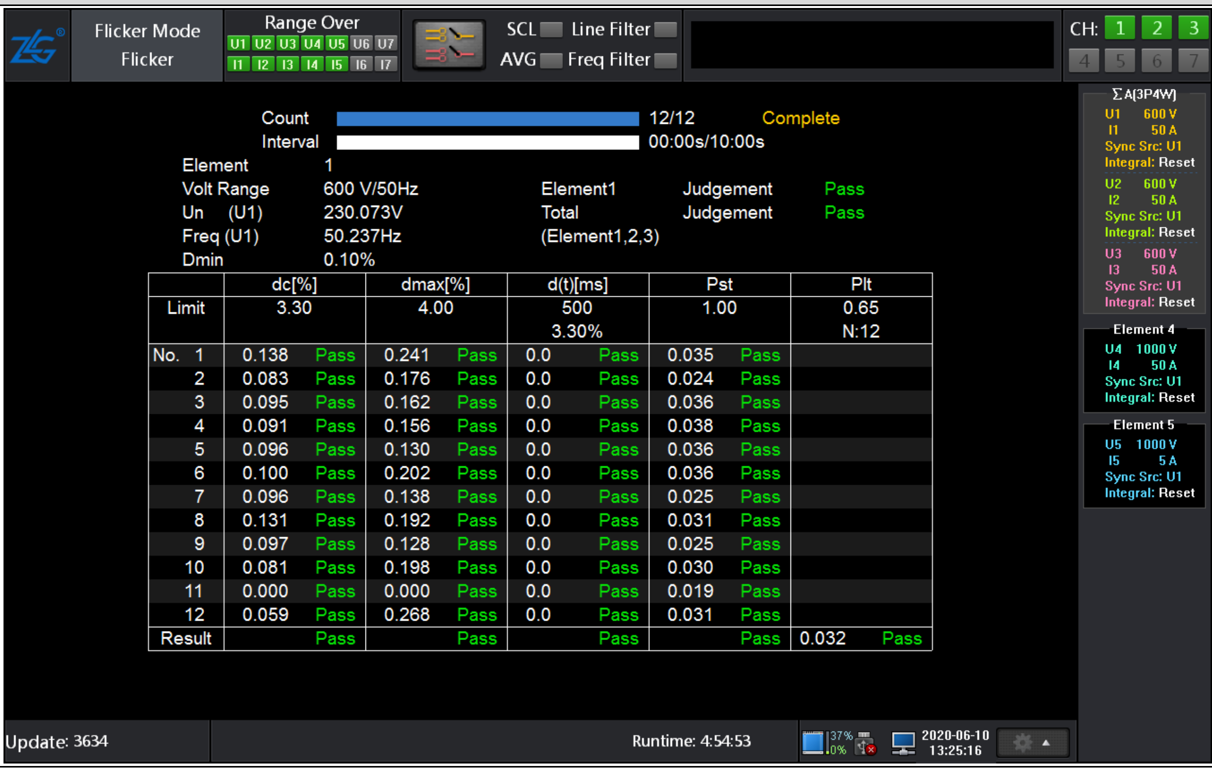
Power=50% Pn – Phase C



Count 12/12 Complete
Interval 00:00s/10:00s
Element 3
Volt Range 600 V/50Hz
Un (U3) 230.712V
Freq (U3) 50.000Hz
Dmin 0.10%
Element3 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	0.124	Pass	0.0	Pass	0.043	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.043	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	0.042	Pass		
6	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
8	0.000	Pass	0.000	Pass	0.0	Pass	0.043	Pass		
9	0.000	Pass	0.000	Pass	0.0	Pass	0.043	Pass		
10	0.000	Pass	0.000	Pass	0.0	Pass	0.043	Pass		
11	0.034	Pass	0.105	Pass	0.0	Pass	0.043	Pass		
12	0.104	Pass	0.256	Pass	0.0	Pass	0.061	Pass		
Result		Pass		Pass		Pass		Pass	0.045	Pass

Power=60% Pn – Phase A



Count 12/12 Complete
Interval 00:00s/10:00s
Element 1
Volt Range 600 V/50Hz
Un (U1) 230.073V
Freq (U1) 50.237Hz
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	0.138	Pass	0.241	Pass	0.0	Pass	0.035	Pass		
2	0.083	Pass	0.176	Pass	0.0	Pass	0.024	Pass		
3	0.095	Pass	0.162	Pass	0.0	Pass	0.036	Pass		
4	0.091	Pass	0.156	Pass	0.0	Pass	0.038	Pass		
5	0.096	Pass	0.130	Pass	0.0	Pass	0.036	Pass		
6	0.100	Pass	0.202	Pass	0.0	Pass	0.036	Pass		
7	0.096	Pass	0.138	Pass	0.0	Pass	0.025	Pass		
8	0.131	Pass	0.192	Pass	0.0	Pass	0.031	Pass		
9	0.097	Pass	0.128	Pass	0.0	Pass	0.025	Pass		
10	0.081	Pass	0.198	Pass	0.0	Pass	0.030	Pass		
11	0.000	Pass	0.000	Pass	0.0	Pass	0.019	Pass		
12	0.059	Pass	0.268	Pass	0.0	Pass	0.031	Pass		
Result		Pass		Pass		Pass		Pass	0.032	Pass

TEST RESULTS

Power=60% Pn – Phase B

Count 12/12 Complete
Interval 00:00s/10:00s
Element 2
Volt Range 600 V/50Hz
Un (U2) 230.074V
Freq (U2) 50.069Hz
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	0.036	Pass	0.126	Pass	0.0	Pass	0.137	Pass		
2	0.013	Pass	0.101	Pass	0.0	Pass	0.138	Pass		
3	0.020	Pass	0.108	Pass	0.0	Pass	0.139	Pass		
4	0.033	Pass	0.103	Pass	0.0	Pass	0.137	Pass		
5	0.000	Pass	0.000	Pass	0.0	Pass	0.138	Pass		
6	0.000	Pass	0.000	Pass	0.0	Pass	0.138	Pass		
7	0.015	Pass	0.127	Pass	0.0	Pass	0.138	Pass		
8	0.005	Pass	0.107	Pass	0.0	Pass	0.138	Pass		
9	0.004	Pass	0.120	Pass	0.0	Pass	0.137	Pass		
10	0.016	Pass	0.117	Pass	0.0	Pass	0.138	Pass		
11	0.007	Pass	0.101	Pass	0.0	Pass	0.137	Pass		
12	0.005	Pass	0.106	Pass	0.0	Pass	0.138	Pass		
Result		Pass		Pass		Pass		Pass	0.138	Pass

Power=60% Pn – Phase C

Count 12/12 Complete
Interval 00:00s/10:00s
Element 3
Volt Range 600 V/50Hz
Un (U3) 230.179V
Freq (U3) 50.000Hz
Dmin 0.10%
Element3 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	0.000	Pass	0.000	Pass	0.0	Pass	0.045	Pass		
2	0.090	Pass	0.128	Pass	0.0	Pass	0.046	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.045	Pass		
4	0.000	Pass	0.000	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	0.053	Pass	0.106	Pass	0.0	Pass	0.045	Pass		
8	0.064	Pass	0.113	Pass	0.0	Pass	0.045	Pass		
9	0.000	Pass	0.000	Pass	0.0	Pass	0.045	Pass		
10	0.000	Pass	0.000	Pass	0.0	Pass	0.046	Pass		
11	0.000	Pass	0.000	Pass	0.0	Pass	0.045	Pass		
12	0.029	Pass	0.102	Pass	0.0	Pass	0.045	Pass		
Result		Pass		Pass		Pass		Pass	0.045	Pass

TEST RESULTS

Power=70% 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 4 5 6 7

Count 12/12 Complete
Interval 00:00s/10:00s
Element 1
Volt Range 600 V/50Hz
Un (U1) 230.539V
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	0.086	Pass	0.119	Pass	0.0	Pass	0.028	Pass		
2	0.112	Pass	0.162	Pass	0.0	Pass	0.043	Pass		
3	0.093	Pass	0.152	Pass	0.0	Pass	0.039	Pass		
4	0.062	Pass	0.146	Pass	0.0	Pass	0.034	Pass		
5	0.101	Pass	0.175	Pass	0.0	Pass	0.031	Pass		
6	0.099	Pass	0.133	Pass	0.0	Pass	0.030	Pass		
7	0.115	Pass	0.164	Pass	0.0	Pass	0.037	Pass		
8	0.103	Pass	0.145	Pass	0.0	Pass	0.043	Pass		
9	0.100	Pass	0.138	Pass	0.0	Pass	0.044	Pass		
10	0.096	Pass	0.141	Pass	0.0	Pass	0.040	Pass		
11	0.092	Pass	0.176	Pass	0.0	Pass	0.039	Pass		
12	0.108	Pass	0.149	Pass	0.0	Pass	0.033	Pass		
Result		Pass		Pass		Pass		Pass	0.037	Pass

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

Update: 3634 Runtime: 3:43:44 2020-06-11 12:11:02

Power=70% 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
PA_00019.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
Un (U2) 230.709V
Freq (U2) 50.000Hz
Dmin 0.10%
Element2 Judgement Pass
Total Judgement Pass
(Element1,2,3)

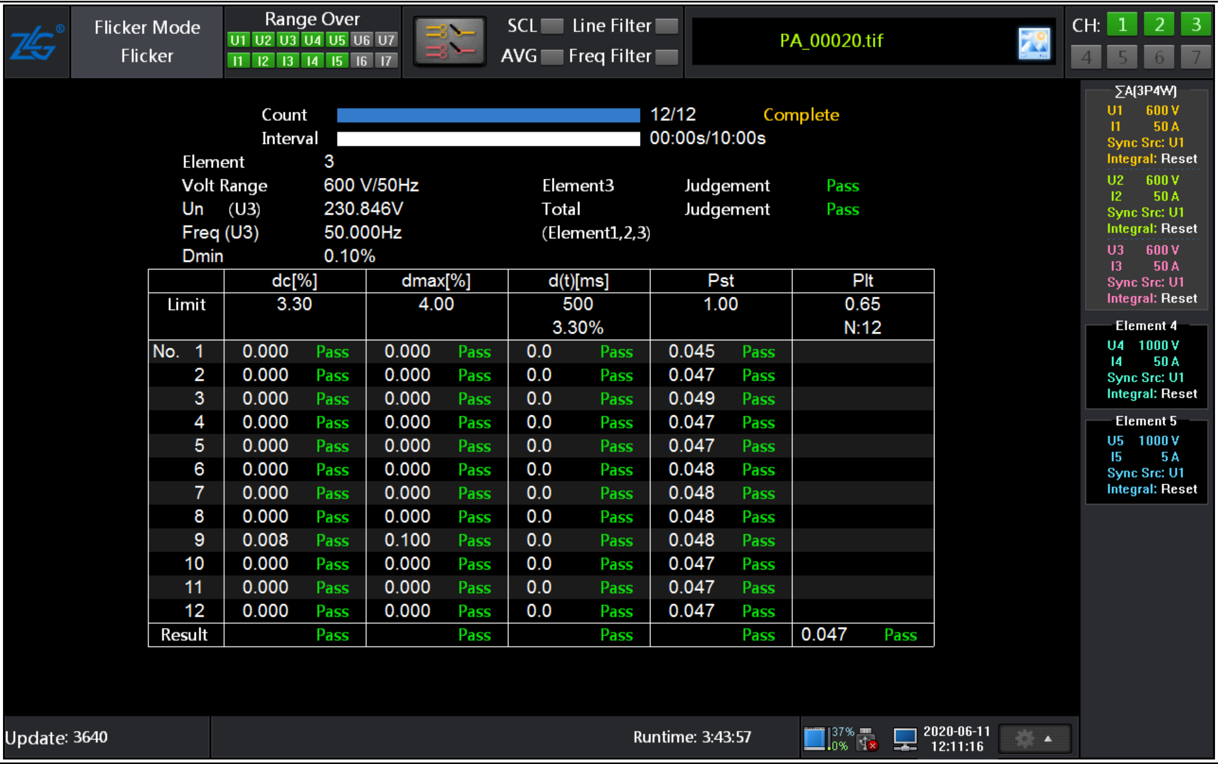
	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.003	Pass	0.103	Pass	0.0	Pass	0.137	Pass		
2	0.004	Pass	0.106	Pass	0.0	Pass	0.137	Pass		
3	0.010	Pass	0.106	Pass	0.0	Pass	0.138	Pass		
4	0.009	Pass	0.102	Pass	0.0	Pass	0.138	Pass		
5	0.010	Pass	0.111	Pass	0.0	Pass	0.138	Pass		
6	0.017	Pass	0.126	Pass	0.0	Pass	0.138	Pass		
7	0.008	Pass	0.136	Pass	0.0	Pass	0.138	Pass		
8	0.013	Pass	0.124	Pass	0.0	Pass	0.139	Pass		
9	0.012	Pass	0.127	Pass	0.0	Pass	0.138	Pass		
10	0.009	Pass	0.118	Pass	0.0	Pass	0.138	Pass		
11	0.011	Pass	0.110	Pass	0.0	Pass	0.137	Pass		
12	0.007	Pass	0.101	Pass	0.0	Pass	0.137	Pass		
Result		Pass		Pass		Pass		Pass	0.138	Pass

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

Update: 3637 Runtime: 3:43:51 2020-06-11 12:11:09

TEST RESULTS

Power=70% Pn – Phase C



	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.045	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.047	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass		
4	0.000	Pass	0.000	Pass	0.0	Pass	0.047	Pass		
5	0.000	Pass	0.000	Pass	0.0	Pass	0.047	Pass		
6	0.000	Pass	0.000	Pass	0.0	Pass	0.048	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.048	Pass		
8	0.000	Pass	0.000	Pass	0.0	Pass	0.048	Pass		
9	0.008	Pass	0.100	Pass	0.0	Pass	0.048	Pass		
10	0.000	Pass	0.000	Pass	0.0	Pass	0.047	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		Pass	0.047	Pass

Power=80% Pn – Phase A

	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	0.149	Pass	0.0	Pass	0.046	Pass		
2	0.106	Pass	0.147	Pass	0.0	Pass	0.045	Pass		
3	0.109	Pass	0.157	Pass	0.0	Pass	0.038	Pass		
4	0.065	Pass	0.146	Pass	0.0	Pass	0.040	Pass		
5	0.094	Pass	0.153	Pass	0.0	Pass	0.045	Pass		
6	0.104	Pass	0.151	Pass	0.0	Pass	0.048	Pass		
7	0.106	Pass	0.147	Pass	0.0	Pass	0.042	Pass		
8	0.060	Pass	0.110	Pass	0.0	Pass	0.034	Pass		
9	0.074	Pass	0.128	Pass	0.0	Pass	0.027	Pass		
10	0.098	Pass	0.151	Pass	0.0	Pass	0.037	Pass		
11	0.118	Pass	0.150	Pass	0.0	Pass	0.041	Pass		
12	0.088	Pass	0.141	Pass	0.0	Pass	0.036	Pass		
Result		Pass		Pass		Pass		Pass	0.041	Pass

TEST RESULTS

Power=80% Pn – Phase B

Flicker Mode Flicker | Range Over | SCL | Line Filter | AVG | Freq Filter | PA_00022.tif | CH: 1 2 3

Count 12/12 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 600 V/50Hz Element2 Judgement Pass

Un (U2) 230.706V Total Judgement Pass

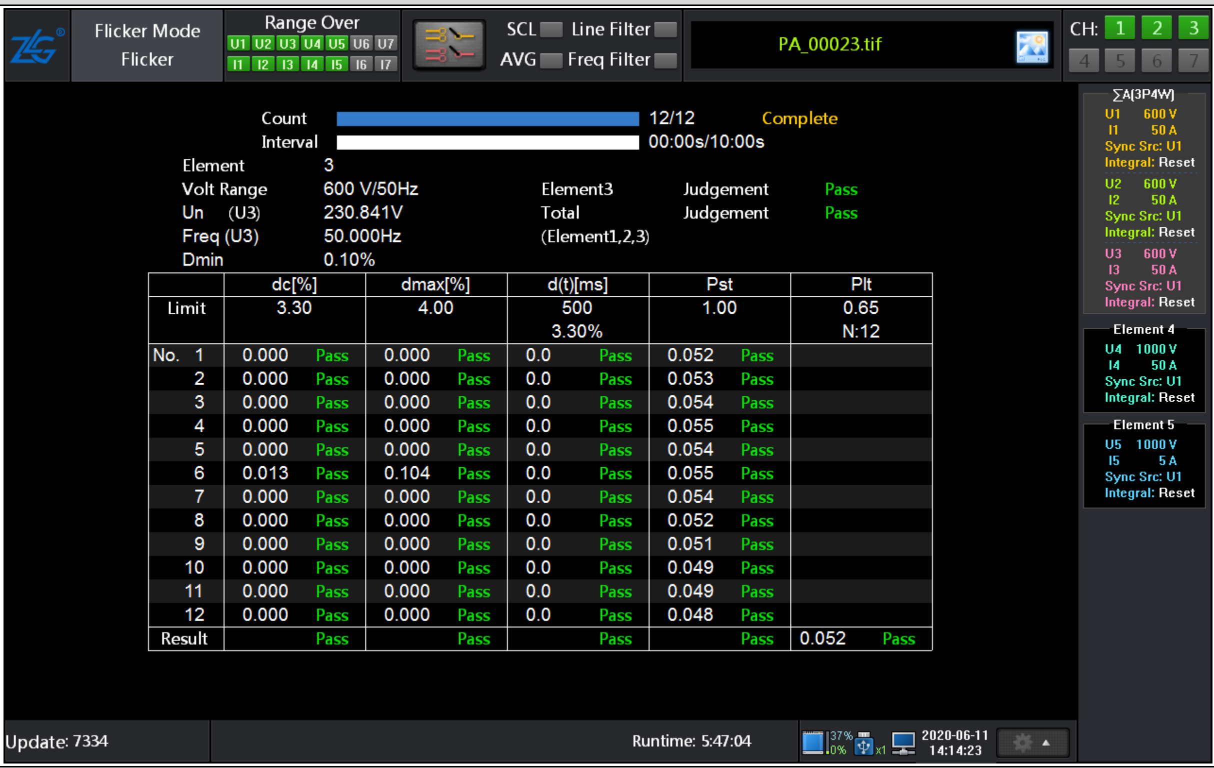
Freq (U2) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.043	Pass	0.130	Pass	0.0	Pass	0.140	Pass		
2	0.036	Pass	0.115	Pass	0.0	Pass	0.140	Pass		
3	0.027	Pass	0.113	Pass	0.0	Pass	0.141	Pass		
4	0.022	Pass	0.107	Pass	0.0	Pass	0.142	Pass		
5	0.019	Pass	0.108	Pass	0.0	Pass	0.142	Pass		
6	0.017	Pass	0.111	Pass	0.0	Pass	0.141	Pass		
7	0.029	Pass	0.113	Pass	0.0	Pass	0.141	Pass		
8	0.012	Pass	0.113	Pass	0.0	Pass	0.143	Pass		
9	0.009	Pass	0.108	Pass	0.0	Pass	0.142	Pass		
10	0.031	Pass	0.118	Pass	0.0	Pass	0.141	Pass		
11	0.034	Pass	0.116	Pass	0.0	Pass	0.142	Pass		
12	0.021	Pass	0.103	Pass	0.0	Pass	0.141	Pass		
Result		Pass		Pass		Pass		Pass	0.141	Pass

Update: 7331 Runtime: 5:46:58 2020-06-11 14:14:16

Power=80% Pn – Phase C



Flicker Mode Flicker | Range Over | SCL | Line Filter | AVG | Freq Filter | PA_00023.tif | CH: 1 2 3

Count 12/12 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 600 V/50Hz Element3 Judgement Pass

Un (U3) 230.841V 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 3.30%		1.00		0.65 N:12	
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.052	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.053	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.054	Pass		
4	0.000	Pass	0.000	Pass	0.0	Pass	0.055	Pass		
5	0.000	Pass	0.000	Pass	0.0	Pass	0.054	Pass		
6	0.013	Pass	0.104	Pass	0.0	Pass	0.055	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.054	Pass		
8	0.000	Pass	0.000	Pass	0.0	Pass	0.052	Pass		
9	0.000	Pass	0.000	Pass	0.0	Pass	0.051	Pass		
10	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass		
11	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass		
12	0.000	Pass	0.000	Pass	0.0	Pass	0.048	Pass		
Result		Pass		Pass		Pass		Pass	0.052	Pass

Update: 7334 Runtime: 5:47:04 2020-06-11 14:14:23

TEST RESULTS

Power=90% Pn – Phase A

Count 12/12 Complete
Interval 00:00s/10:00s
Element 1
Volt Range 600 V/50Hz
Un (U1) 230.834V
Freq (U1) 50.000Hz
Dmin 0.10%
Element1 Judgement Pass
Total Judgement (Element1,2,3) Pass

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.098	Pass	0.152	Pass	0.0	Pass	0.070	Pass		
2	0.090	Pass	0.151	Pass	0.0	Pass	0.071	Pass		
3	0.115	Pass	0.166	Pass	0.0	Pass	0.072	Pass		
4	0.113	Pass	0.165	Pass	0.0	Pass	0.076	Pass		
5	0.112	Pass	0.164	Pass	0.0	Pass	0.075	Pass		
6	0.114	Pass	0.196	Pass	0.0	Pass	0.079	Pass		
7	0.111	Pass	0.167	Pass	0.0	Pass	0.076	Pass		
8	0.101	Pass	0.169	Pass	0.0	Pass	0.075	Pass		
9	0.131	Pass	0.204	Pass	0.0	Pass	0.078	Pass		
10	0.115	Pass	0.171	Pass	0.0	Pass	0.082	Pass		
11	0.116	Pass	0.167	Pass	0.0	Pass	0.079	Pass		
12	0.113	Pass	0.174	Pass	0.0	Pass	0.079	Pass		
Result		Pass		Pass		Pass		Pass	0.076	Pass

Power=90% Pn – Phase B

Count 12/12 Complete
Interval 00:00s/10:00s
Element 2
Volt Range 600 V/50Hz
Un (U2) 230.835V
Freq (U2) 50.000Hz
Dmin 0.10%
Element2 Judgement Pass
Total Judgement (Element1,2,3) Pass

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.035	Pass	0.146	Pass	0.0	Pass	0.152	Pass		
2	0.027	Pass	0.130	Pass	0.0	Pass	0.154	Pass		
3	0.029	Pass	0.140	Pass	0.0	Pass	0.152	Pass		
4	0.030	Pass	0.145	Pass	0.0	Pass	0.154	Pass		
5	0.027	Pass	0.141	Pass	0.0	Pass	0.154	Pass		
6	0.026	Pass	0.130	Pass	0.0	Pass	0.155	Pass		
7	0.030	Pass	0.135	Pass	0.0	Pass	0.154	Pass		
8	0.029	Pass	0.138	Pass	0.0	Pass	0.152	Pass		
9	0.022	Pass	0.128	Pass	0.0	Pass	0.155	Pass		
10	0.024	Pass	0.134	Pass	0.0	Pass	0.157	Pass		
11	0.022	Pass	0.141	Pass	0.0	Pass	0.156	Pass		
12	0.030	Pass	0.140	Pass	0.0	Pass	0.156	Pass		
Result		Pass		Pass		Pass		Pass	0.154	Pass

TEST RESULTS

Power=90% Pn – Phase C


Flicker Mode Flicker

Range Over

SCL Line Filter

AVG Freq Filter

PA_00026.tif

Count	12/12	Complete	
Interval	00:00s/10:00s		
Element	3		
Volt Range	600 V/50Hz	Element3 Judgement	Pass
Un (U3)	231.048V	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 3.30%		1.00		0.65 N:12	
No. 1	0.010	Pass	0.101	Pass	0.0	Pass	0.065	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.066	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.066	Pass		
4	0.000	Pass	0.000	Pass	0.0	Pass	0.066	Pass		
5	0.015	Pass	0.105	Pass	0.0	Pass	0.067	Pass		
6	0.016	Pass	0.102	Pass	0.0	Pass	0.068	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.066	Pass		
8	0.007	Pass	0.101	Pass	0.0	Pass	0.064	Pass		
9	0.018	Pass	0.105	Pass	0.0	Pass	0.066	Pass		
10	0.016	Pass	0.107	Pass	0.0	Pass	0.069	Pass		
11	0.000	Pass	0.000	Pass	0.0	Pass	0.066	Pass		
12	0.012	Pass	0.102	Pass	0.0	Pass	0.067	Pass		
Result		Pass		Pass		Pass		Pass	0.066	Pass

Update: 3690 Runtime: 3:05:30 2020-06-15 11:40:11

Power=100% Pn – Phase A


Flicker Mode Flicker

Range Over

SCL Line Filter

AVG Freq Filter

Count	12/12	Complete	
Interval	00:00s/10:00s		
Element	1		
Volt Range	600 V/50Hz	Element1 Judgement	Pass
Un (U1)	230.674V	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 3.30%		1.00		0.65 N:12	
No. 1	0.110	Pass	0.187	Pass	0.0	Pass	0.075	Pass		
2	0.110	Pass	0.185	Pass	0.0	Pass	0.076	Pass		
3	0.107	Pass	0.180	Pass	0.0	Pass	0.078	Pass		
4	0.108	Pass	0.170	Pass	0.0	Pass	0.078	Pass		
5	0.101	Pass	0.165	Pass	0.0	Pass	0.070	Pass		
6	0.104	Pass	0.166	Pass	0.0	Pass	0.064	Pass		
7	0.104	Pass	0.162	Pass	0.0	Pass	0.065	Pass		
8	0.101	Pass	0.203	Pass	0.0	Pass	0.059	Pass		
9	0.127	Pass	0.186	Pass	0.0	Pass	0.059	Pass		
10	0.115	Pass	0.168	Pass	0.0	Pass	0.058	Pass		
11	0.115	Pass	0.182	Pass	0.0	Pass	0.060	Pass		
12	0.107	Pass	0.168	Pass	0.0	Pass	0.065	Pass		
Result		Pass		Pass		Pass		Pass	0.068	Pass

Update: 7569 Runtime: 5:14:48 2020-06-15 13:49:29

TEST RESULTS

Power=100% Pn – Phase B

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.027	Pass	0.140	Pass	0.0	Pass	0.154	Pass		
2	0.022	Pass	0.132	Pass	0.0	Pass	0.154	Pass		
3	0.029	Pass	0.146	Pass	0.0	Pass	0.153	Pass		
4	0.029	Pass	0.132	Pass	0.0	Pass	0.153	Pass		
5	0.008	Pass	0.129	Pass	0.0	Pass	0.150	Pass		
6	0.029	Pass	0.130	Pass	0.0	Pass	0.145	Pass		
7	0.027	Pass	0.136	Pass	0.0	Pass	0.147	Pass		
8	0.032	Pass	0.130	Pass	0.0	Pass	0.143	Pass		
9	0.030	Pass	0.137	Pass	0.0	Pass	0.143	Pass		
10	0.014	Pass	0.134	Pass	0.0	Pass	0.141	Pass		
11	0.013	Pass	0.128	Pass	0.0	Pass	0.143	Pass		
12	0.025	Pass	0.133	Pass	0.0	Pass	0.148	Pass		
Result		Pass		Pass		Pass		Pass	0.148	Pass

Power=100% Pn – Phase C

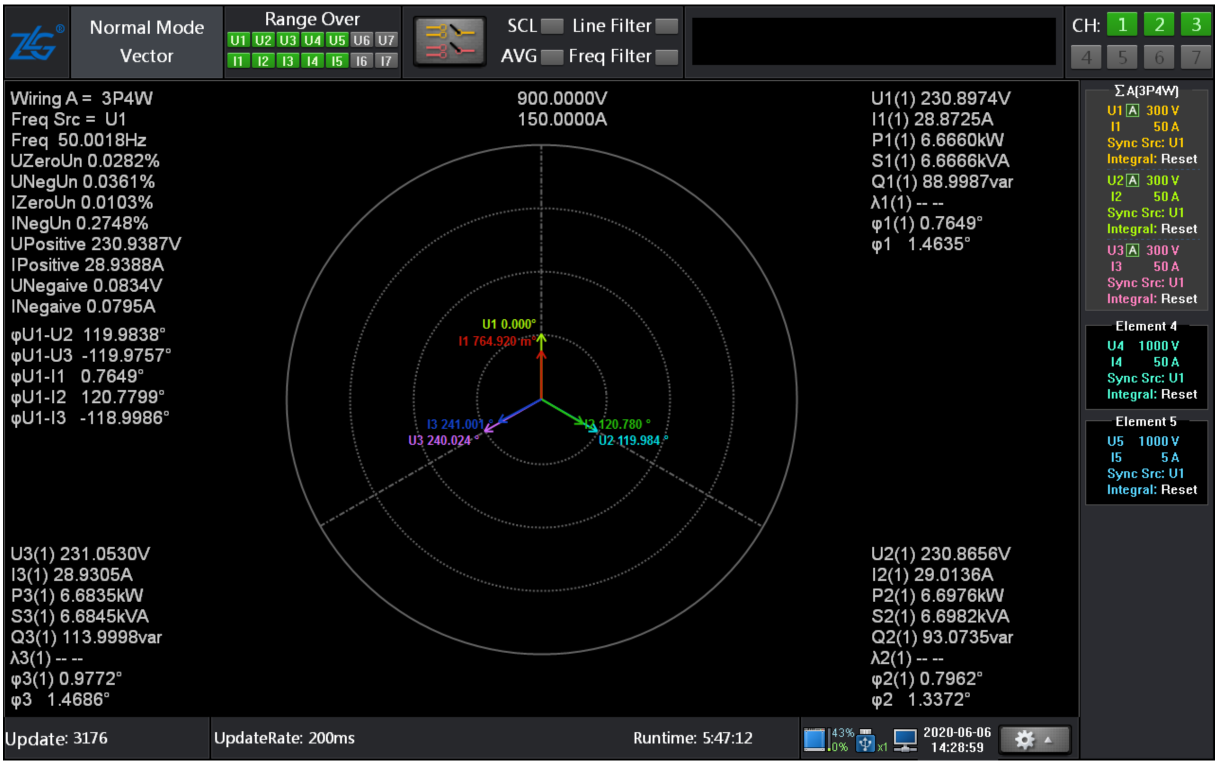
	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.064	Pass		
2	0.018	Pass	0.105	Pass	0.0	Pass	0.065	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.066	Pass		
4	0.028	Pass	0.103	Pass	0.0	Pass	0.067	Pass		
5	0.000	Pass	0.000	Pass	0.0	Pass	0.061	Pass		
6	0.012	Pass	0.101	Pass	0.0	Pass	0.054	Pass		
7	0.009	Pass	0.104	Pass	0.0	Pass	0.057	Pass		
8	0.014	Pass	0.101	Pass	0.0	Pass	0.052	Pass		
9	0.000	Pass	0.000	Pass	0.0	Pass	0.051	Pass		
10	0.000	Pass	0.000	Pass	0.0	Pass	0.050	Pass		
11	0.020	Pass	0.105	Pass	0.0	Pass	0.052	Pass		
12	0.000	Pass	0.000	Pass	0.0	Pass	0.058	Pass		
Result		Pass		Pass		Pass		Pass	0.059	Pass

4. Voltage unbalance

This point refers to the paragraph 4.1.6 of this standard. In this case, it is not applicable due to the inverter being a three-phase inverter.

The voltage unbalance test result as following:

Phase A Measured (V)	Phase B Measured (V)	Phase C Measured (V)	Output Power (kW)
230.9	230.9	231.1	20.0
▲(A-B)	▲(B-C)	▲(C-A)	Limit
0.016%	0.008%	0.024%	0.050%

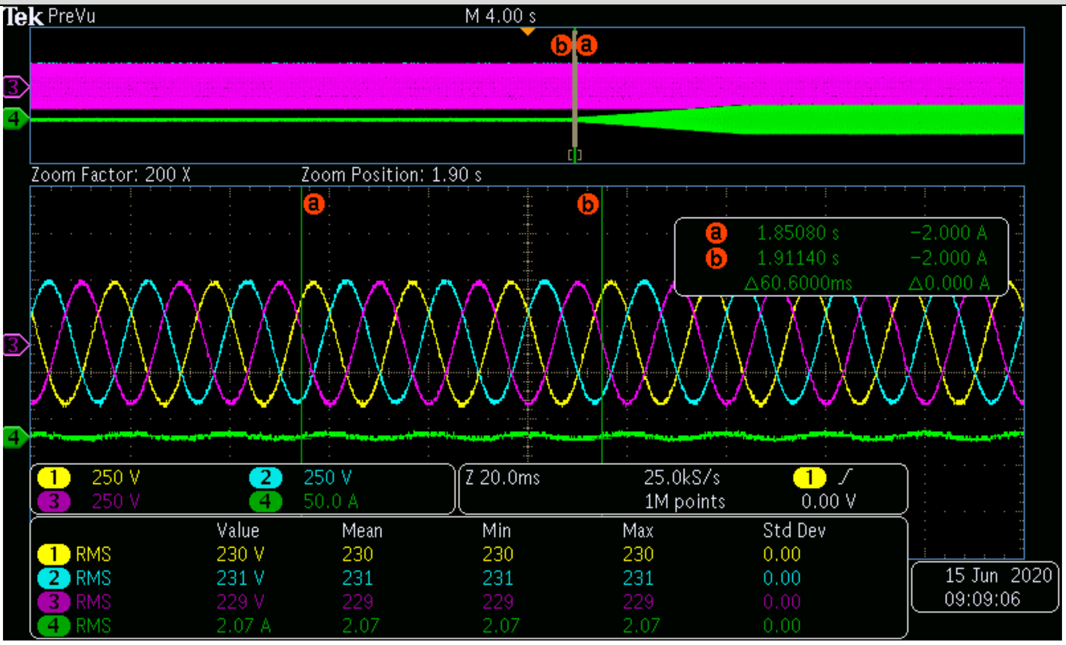


5. Commutation notches

The commutation notches test has been measured according to Clause 4.1.7 of the standard.

By the next picture it is obtained that the process of commutation for this inverter start up from 0%Pn to 100%Pn. The relative depth of commutation is 0.1%.

Commutation notches



TEST RESULTS

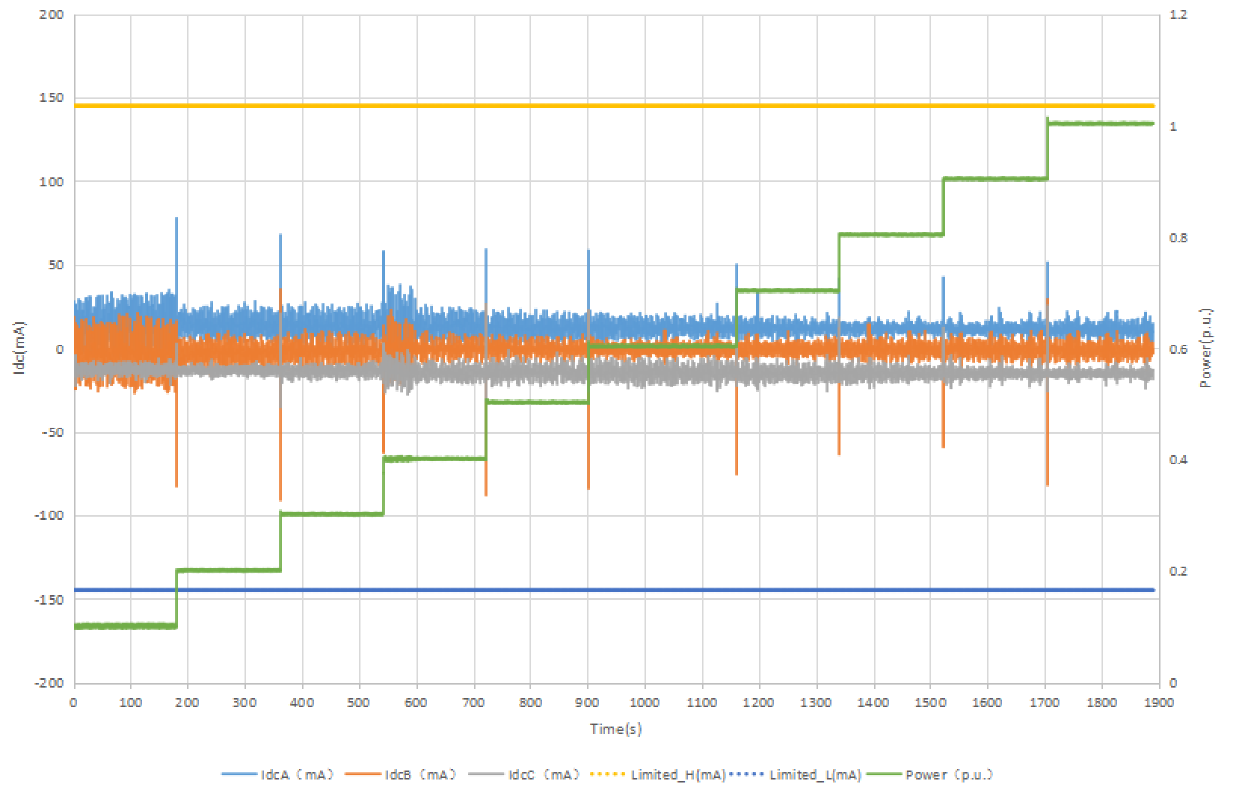
6. DC injection

DC injection test has been measured according to Clause 4.1.8 and Clause 4.2.2.5 of the standard.

The embedded generator shall not inject d.c. current greater than 0.5 % of the rated a.c. output current into the utility interface under any operating condition, measured over a 1-minute interval. The EG shall cease to energize the utility network within 500 ms if this threshold is exceeded. Since the rated a.c. output current is 116A, so the limit is 580mA.

Measured d.c. current						
Power Bin		**10%Pn**	**20%Pn**	**30%Pn**	**40%Pn**	**50%Pn**
d.c. current measured result (mA)	Phase A	33	26	26	36	24
	Phase B	25	15	14	21	21
	Phase C	22	18	20	26	28
Power Bin		**60%Pn**	**70%Pn**	**80%Pn**	**90%Pn**	**100%Pn**
d.c. current measured result (mA)	Phase A	26	32	21	23	22
	Phase B	11	19	14	15	24
	Phase C	25	25	23	24	23

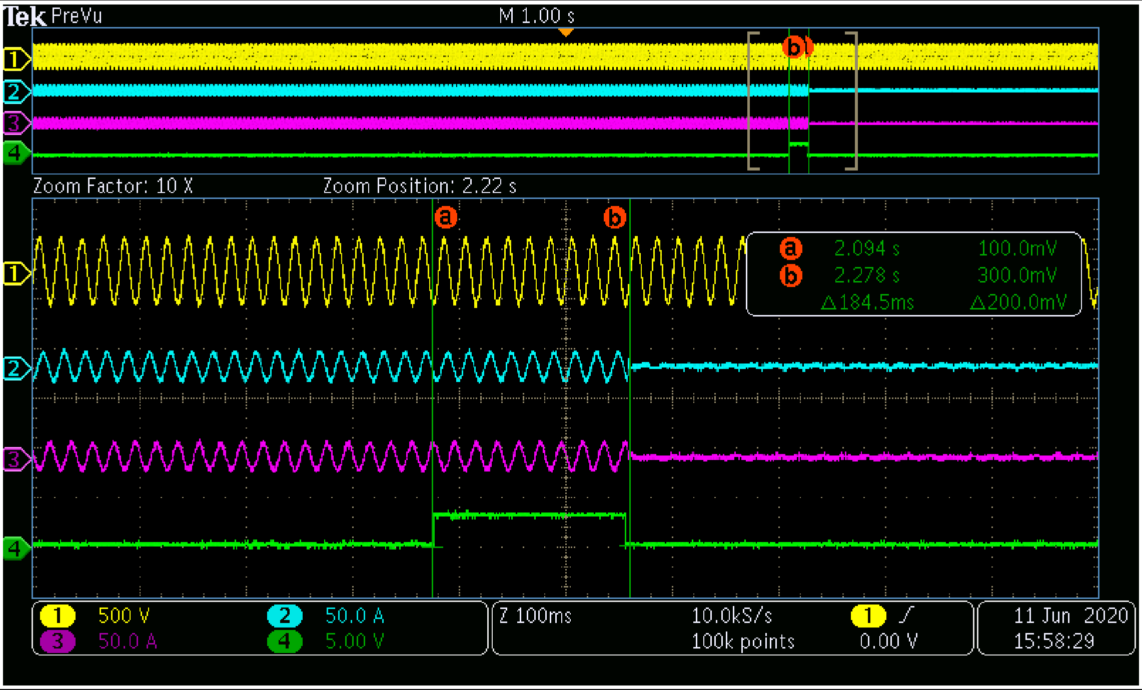
d.c. current test result



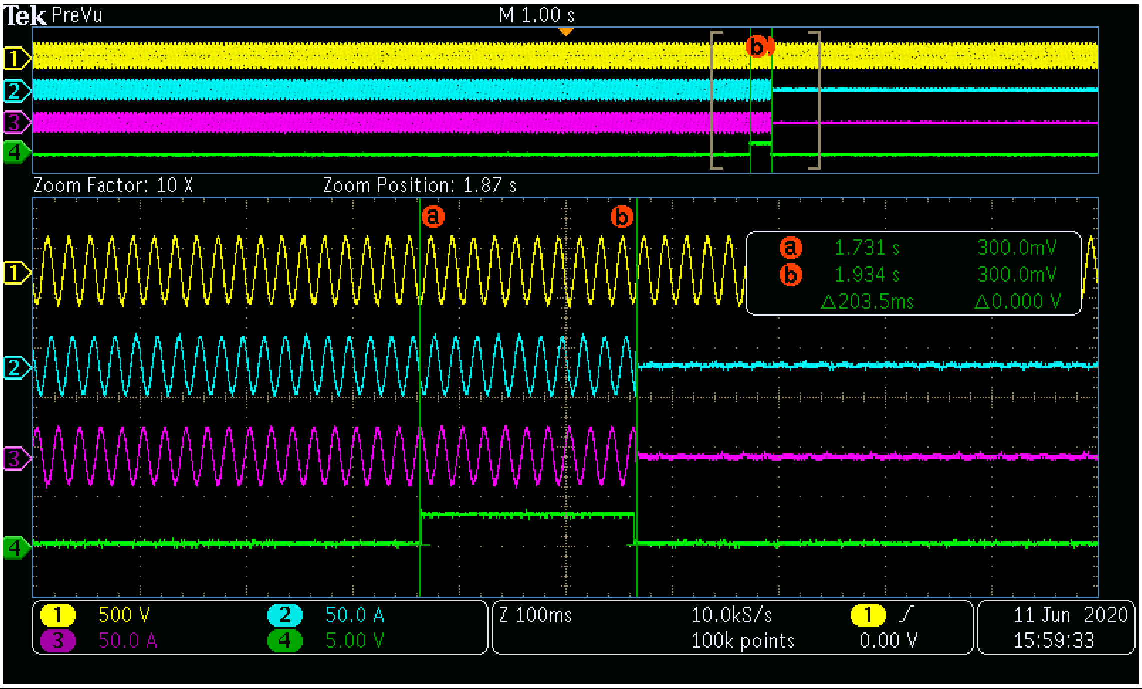
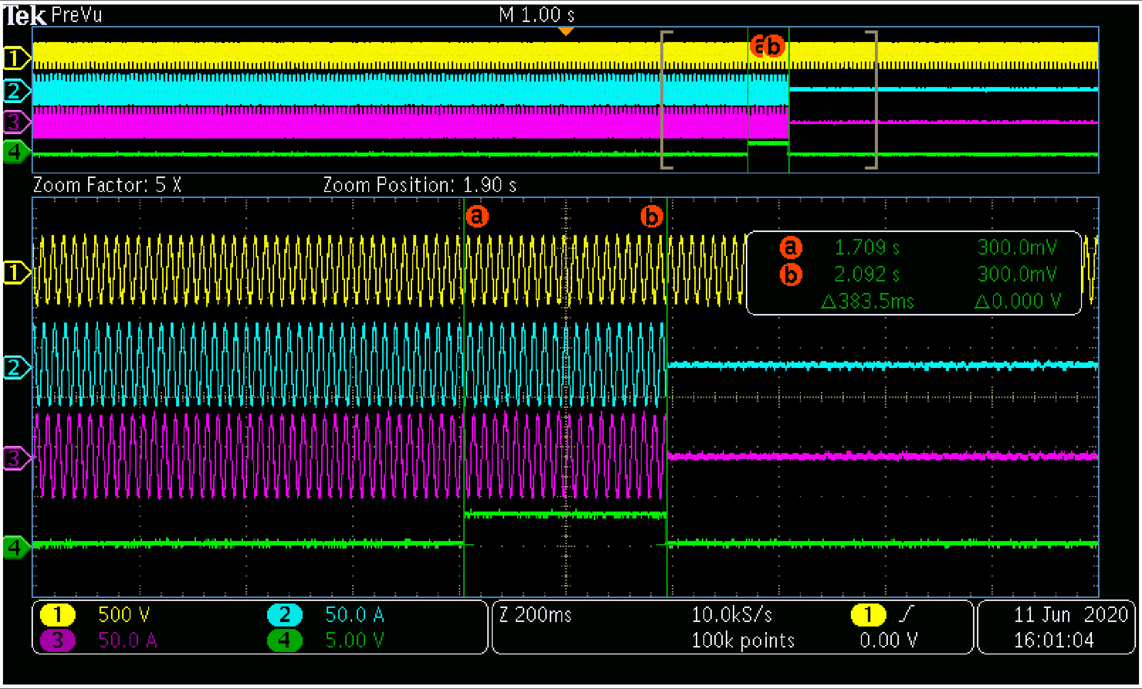
TEST RESULTS

Measured protection time when d.c. current over 0.5%In				
Power Bin	**33%Pn**	**66%Pn**	**100%Pn**	**Limited**
Disconnection time(ms)	184.5	203.5	383.5	500

Disconnection time d.c. current over 0.5%In at 33% Pn



TEST RESULTS

Disconnection time d.c. current over 0.5%In at 66% Pn

Disconnection time d.c. current over 0.5%In at 100% Pn


TEST RESULTS

7. Normal frequency operating range

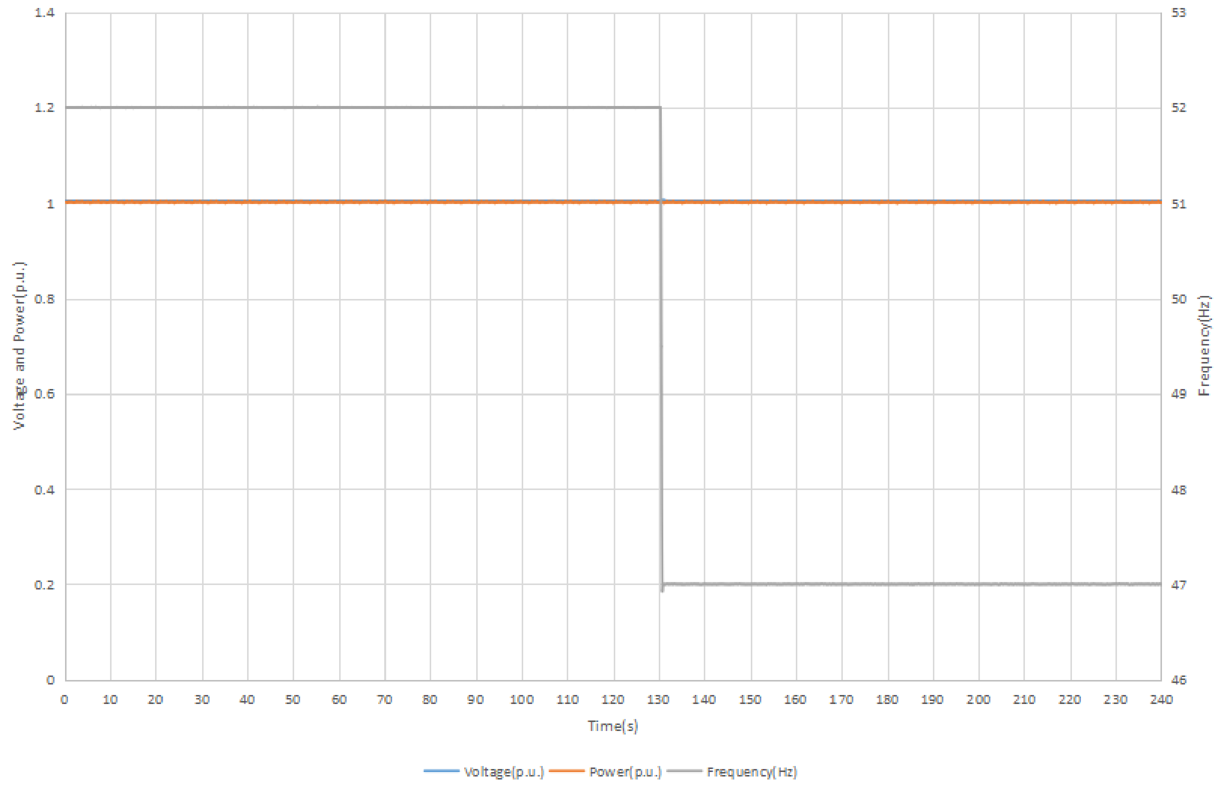
Normal frequency operating range tests have been measured according to Clause 4.1.9 of the standard. While the utility frequency is in the range of 47 Hz and 50.5 Hz, the system shall operate normally.

Frequency limits (Hz)	Frequency measured (Hz)	Disconnection
52.00	52.00	No
47.00 (*)	47.00	No

Note: The test was performed together with normal voltage operating range, the unit can not reach the maximum power due to current limitation.

The results are offered in the table below:

Normal operating at 47Hz and 50.5Hz



TEST RESULTS

8. Harmonic and waveform distortion

Harmonic and waveform distortion tests have been measured according to Clause 4.1.10 of the standard. The values measured for current harmonics is respectively offered in the following points.

	harmonic											
Pn(%)	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max (%)**	**LIMIT (%)**
Nr. /Order	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**		
2	0.045	0.050	0.063	0.076	0.088	0.106	0.109	0.109	0.106	0.117	0.117	1.000
3	0.045	0.039	0.043	0.048	0.057	0.076	0.090	0.103	0.122	0.128	0.128	4.000
4	0.045	0.052	0.055	0.057	0.072	0.078	0.078	0.077	0.077	0.084	0.084	1.000
5	0.252	0.162	0.358	0.365	0.438	0.625	0.751	0.818	0.884	0.919	0.919	4.000
6	0.027	0.028	0.028	0.030	0.032	0.035	0.036	0.034	0.033	0.034	0.036	1.000
7	0.258	0.121	0.104	0.269	0.257	0.236	0.309	0.420	0.534	0.640	0.640	4.000
8	0.033	0.024	0.027	0.024	0.026	0.029	0.031	0.028	0.029	0.027	0.033	1.000
9	0.023	0.024	0.024	0.022	0.025	0.027	0.026	0.025	0.026	0.031	0.031	4.000
10	0.021	0.021	0.021	0.033	0.025	0.025	0.025	0.023	0.022	0.026	0.033	1.000
11	0.142	0.211	0.037	0.256	0.164	0.202	0.178	0.123	0.141	0.224	0.256	2.000
12	0.023	0.022	0.023	0.026	0.026	0.027	0.028	0.028	0.029	0.027	0.029	0.500
13	0.053	0.033	0.225	0.222	0.183	0.072	0.234	0.287	0.283	0.258	0.287	2.000
14	0.021	0.022	0.025	0.028	0.033	0.034	0.028	0.025	0.024	0.026	0.034	0.500
15	0.023	0.021	0.022	0.025	0.025	0.026	0.023	0.024	0.029	0.035	0.035	2.000
16	0.022	0.025	0.025	0.022	0.026	0.022	0.028	0.035	0.031	0.028	0.035	0.500
17	0.122	0.043	0.067	0.241	0.330	0.437	0.211	0.133	0.275	0.366	0.437	1.500
18	0.020	0.021	0.021	0.024	0.024	0.031	0.028	0.027	0.025	0.026	0.031	0.380
19	0.094	0.067	0.061	0.135	0.124	0.439	0.419	0.228	0.117	0.270	0.439	1.500
20	0.022	0.023	0.028	0.029	0.026	0.037	0.028	0.023	0.027	0.029	0.037	0.380
21	0.020	0.020	0.022	0.022	0.022	0.033	0.046	0.050	0.038	0.035	0.050	1.500
22	0.019	0.020	0.022	0.023	0.022	0.045	0.033	0.023	0.035	0.048	0.048	0.380
23	0.029	0.044	0.047	0.077	0.119	0.039	0.324	0.418	0.329	0.148	0.418	0.600
24	0.019	0.020	0.021	0.021	0.022	0.024	0.033	0.029	0.032	0.036	0.036	0.150
25	0.051	0.032	0.064	0.029	0.044	0.122	0.075	0.253	0.357	0.364	0.364	0.600
26	0.021	0.021	0.020	0.023	0.029	0.024	0.027	0.036	0.035	0.034	0.036	0.150
27	0.020	0.021	0.020	0.021	0.021	0.027	0.026	0.026	0.032	0.043	0.043	0.600
28	0.019	0.020	0.020	0.020	0.022	0.021	0.024	0.036	0.033	0.028	0.036	0.150
29	0.058	0.045	0.036	0.034	0.065	0.055	0.118	0.042	0.097	0.188	0.188	0.600
30	0.019	0.019	0.019	0.019	0.019	0.020	0.021	0.021	0.022	0.022	0.022	0.150
31	0.041	0.038	0.026	0.029	0.043	0.050	0.055	0.085	0.080	0.039	0.085	0.600
32	0.019	0.019	0.019	0.020	0.021	0.020	0.020	0.020	0.021	0.025	0.025	0.150
33	0.019	0.019	0.019	0.019	0.019	0.020	0.019	0.020	0.021	0.020	0.021	0.600
34	0.019	0.019	0.019	0.019	0.020	0.021	0.019	0.020	0.019	0.020	0.021	0.150
35	0.021	0.032	0.027	0.023	0.033	0.032	0.037	0.041	0.047	0.045	0.047	0.300
36	0.019	0.019	0.019	0.019	0.019	0.020	0.020	0.019	0.019	0.019	0.020	0.080
37	0.027	0.029	0.026	0.022	0.027	0.030	0.038	0.035	0.039	0.047	0.047	0.300
38	0.019	0.020	0.019	0.020	0.019	0.021	0.021	0.020	0.020	0.021	0.021	0.080
39	0.019	0.020	0.019	0.020	0.019	0.020	0.020	0.019	0.018	0.020	0.020	0.300
40	0.019	0.019	0.020	0.021	0.020	0.020	0.020	0.020	0.020	0.020	0.021	0.080
41	0.030	0.023	0.026	0.020	0.025	0.024	0.026	0.032	0.037	0.035	0.037	0.300
42	0.019	0.019	0.019	0.019	0.019	0.019	0.020	0.020	0.020	0.019	0.020	0.080
43	0.028	0.022	0.026	0.019	0.023	0.022	0.026	0.025	0.027	0.029	0.029	0.300
44	0.020	0.019	0.019	0.019	0.019	0.020	0.020	0.019	0.021	0.020	0.021	0.080

TEST RESULTS

harmonic											
Pn(%)	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max (%)**	**LIMIT (%)**
Nr. /Order	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**		
45	0.019	0.019	0.019	0.020	0.019	0.020	0.019	0.020	0.020	0.020	0.020	0.300
46	0.019	0.020	0.020	0.019	0.019	0.019	0.019	0.019	0.019	0.020	0.020	0.080
47	0.019	0.022	0.028	0.020	0.020	0.020	0.021	0.021	0.023	0.025	0.028	0.300
48	0.019	0.019	0.019	0.019	0.019	0.019	0.020	0.020	0.020	0.019	0.020	0.080
49	0.020	0.024	0.024	0.020	0.024	0.025	0.027	0.028	0.028	0.030	0.030	0.300
50	0.019	0.020	0.021	0.020	0.019	0.020	0.020	0.020	0.020	0.020	0.021	0.080
THD(%)	0.456	0.350	0.484	0.659	0.707	0.972	1.070	1.147	1.252	1.355	1.355	5.000

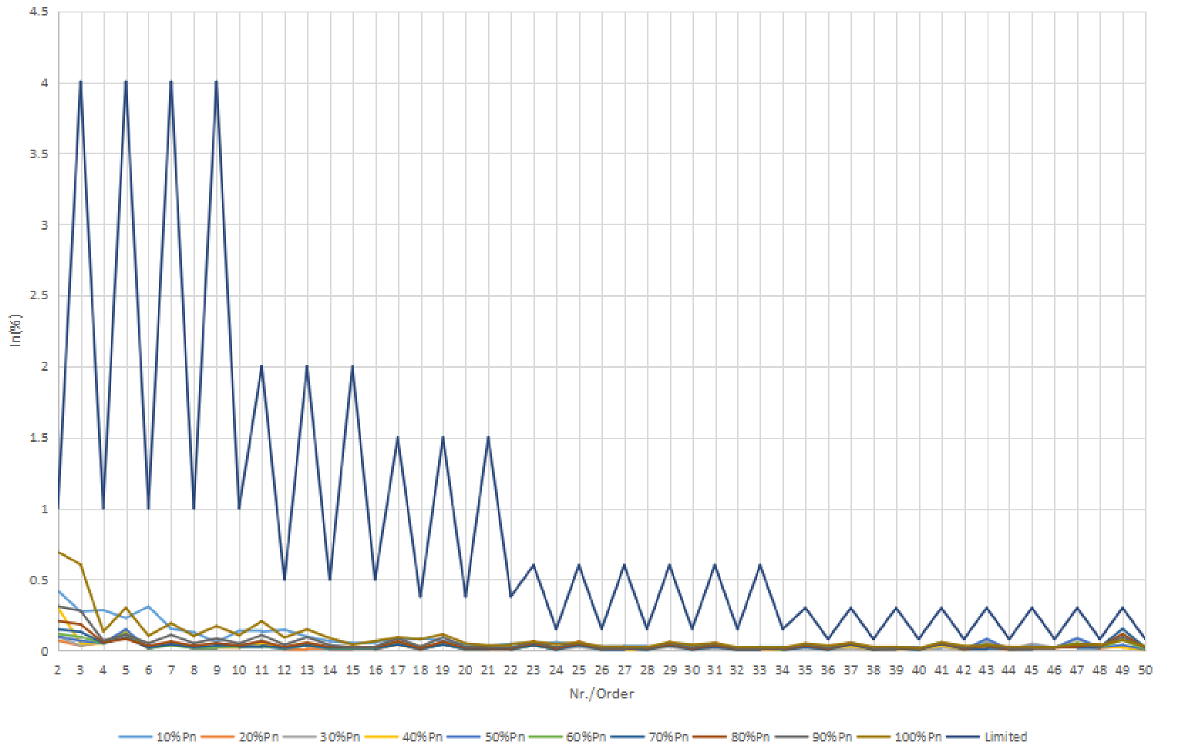
Inter-harmonic												
Pn(%)	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max (%)**	**LIMIT (%)**
Nr. /Order	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**	**I_h(%)**		
75	0.097	0.063	0.062	0.062	0.076	0.064	0.065	0.077	0.083	0.085	0.097	0.1
125	0.039	0.031	0.031	0.030	0.056	0.028	0.028	0.031	0.032	0.032	0.056	0.1
175	0.036	0.032	0.033	0.031	0.032	0.031	0.030	0.032	0.031	0.031	0.036	0.1
225	0.044	0.035	0.035	0.035	0.035	0.036	0.035	0.039	0.039	0.038	0.044	0.1
275	0.039	0.034	0.036	0.036	0.035	0.038	0.036	0.040	0.040	0.040	0.040	0.1
325	0.042	0.029	0.030	0.028	0.034	0.030	0.032	0.037	0.035	0.035	0.042	0.1
375	0.039	0.026	0.025	0.024	0.029	0.028	0.030	0.034	0.034	0.035	0.039	0.1
425	0.023	0.022	0.021	0.021	0.026	0.024	0.026	0.030	0.031	0.032	0.032	0.1
475	0.020	0.018	0.017	0.018	0.021	0.021	0.023	0.027	0.028	0.029	0.029	0.1
525	0.032	0.017	0.016	0.017	0.019	0.019	0.021	0.025	0.026	0.029	0.032	0.1
575	0.033	0.014	0.014	0.016	0.018	0.019	0.020	0.023	0.025	0.027	0.033	0.25
625	0.032	0.013	0.013	0.014	0.017	0.015	0.017	0.020	0.021	0.024	0.032	0.25
675	0.030	0.012	0.013	0.013	0.014	0.015	0.017	0.019	0.021	0.024	0.030	0.25
725	0.015	0.011	0.011	0.012	0.014	0.014	0.015	0.017	0.018	0.021	0.021	0.25
775	0.014	0.011	0.010	0.011	0.013	0.013	0.014	0.016	0.018	0.020	0.020	0.25
825	0.025	0.011	0.010	0.011	0.012	0.013	0.014	0.016	0.017	0.020	0.025	0.25
875	0.021	0.010	0.009	0.010	0.012	0.013	0.014	0.015	0.017	0.020	0.021	0.19
925	0.021	0.010	0.009	0.010	0.012	0.011	0.013	0.014	0.015	0.018	0.021	0.19
975	0.019	0.009	0.009	0.010	0.011	0.011	0.013	0.014	0.015	0.018	0.019	0.19
1025	0.011	0.008	0.009	0.009	0.010	0.011	0.012	0.013	0.014	0.017	0.017	0.19
1075	0.011	0.008	0.008	0.009	0.010	0.010	0.012	0.012	0.014	0.016	0.016	0.19
1125	0.016	0.008	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.017	0.017	0.19
1175	0.014	0.008	0.008	0.008	0.010	0.010	0.012	0.012	0.013	0.016	0.016	0.08
1225	0.016	0.008	0.007	0.009	0.010	0.010	0.011	0.012	0.013	0.015	0.016	0.08
1275	0.014	0.008	0.008	0.008	0.009	0.010	0.011	0.012	0.013	0.016	0.016	0.08
1325	0.009	0.008	0.008	0.009	0.010	0.010	0.011	0.012	0.013	0.015	0.015	0.08
1375	0.009	0.007	0.007	0.008	0.009	0.009	0.011	0.011	0.012	0.014	0.014	0.08
1425	0.013	0.008	0.008	0.008	0.010	0.010	0.011	0.012	0.013	0.015	0.015	0.08
1475	0.010	0.007	0.007	0.008	0.009	0.009	0.011	0.011	0.012	0.014	0.014	0.08
1525	0.012	0.007	0.007	0.008	0.009	0.009	0.011	0.011	0.012	0.014	0.014	0.08
1575	0.011	0.007	0.007	0.008	0.009	0.010	0.011	0.011	0.013	0.015	0.015	0.08
1625	0.009	0.007	0.007	0.008	0.009	0.009	0.010	0.011	0.012	0.013	0.013	0.08
1675	0.009	0.007	0.007	0.008	0.008	0.009	0.010	0.011	0.012	0.014	0.014	0.08
1725	0.009	0.007	0.007	0.008	0.009	0.010	0.011	0.011	0.012	0.014	0.014	0.08
1775	0.010	0.008	0.008	0.008	0.008	0.009	0.010	0.011	0.012	0.014	0.014	0.03
1825	0.009	0.008	0.007	0.008	0.008	0.010	0.010	0.011	0.012	0.014	0.014	0.03
1875	0.009	0.008	0.007	0.008	0.009	0.010	0.011	0.011	0.012	0.014	0.014	0.03

TEST RESULTS

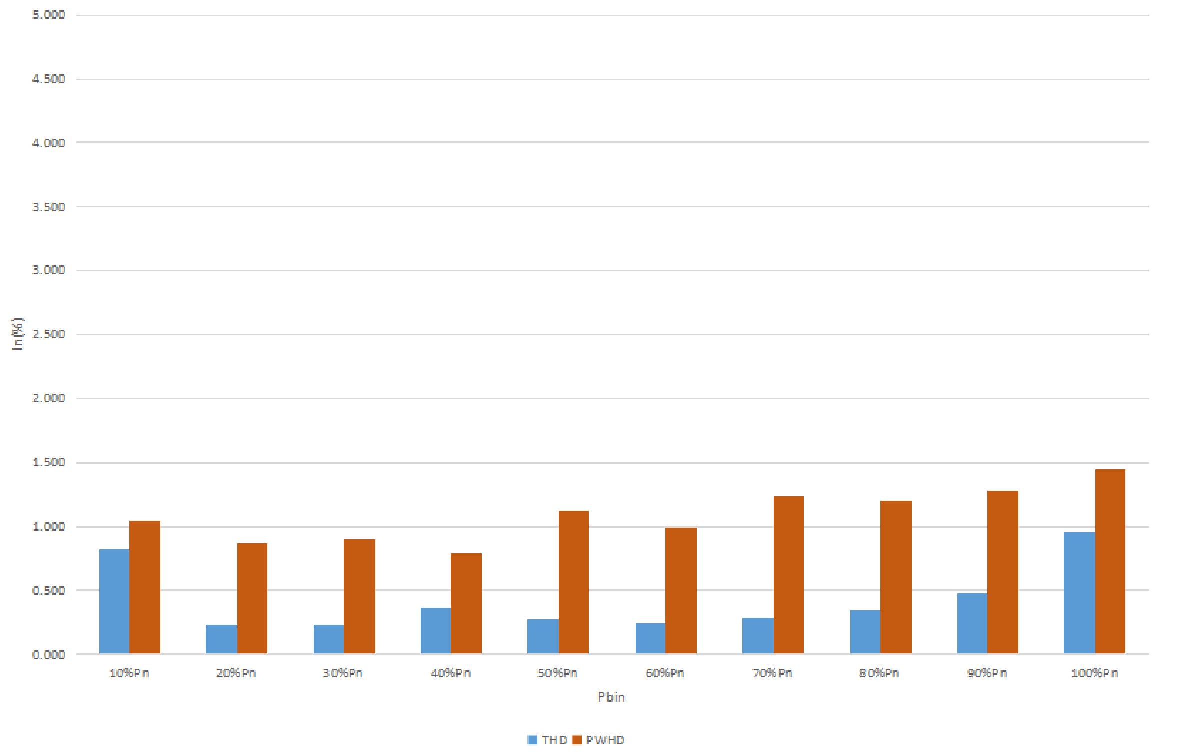
Inter-harmonic												
Pn(%)	10	20	30	40	50	60	70	80	90	100	Max (%)	LIMIT (%)
Nr. /Order	I_h(%)	I_h(%)	I_h(%)	I_h(%)	I_h(%)	I_h(%)	I_h(%)	I_h(%)	I_h(%)	I_h(%)		
1925	0.009	0.008	0.008	0.008	0.009	0.010	0.011	0.011	0.012	0.013	0.013	0.03
1975	0.009	0.008	0.008	0.008	0.009	0.010	0.010	0.011	0.012	0.014	0.014	0.03
2025	0.010	0.008	0.008	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.014	0.03
2075	0.010	0.008	0.008	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.014	0.03
2125	0.010	0.009	0.008	0.009	0.009	0.010	0.011	0.012	0.013	0.014	0.014	0.03
2175	0.010	0.009	0.009	0.009	0.009	0.010	0.011	0.012	0.013	0.015	0.015	0.03
2225	0.010	0.009	0.009	0.009	0.009	0.010	0.011	0.012	0.013	0.014	0.014	0.03
2275	0.010	0.010	0.010	0.010	0.010	0.011	0.012	0.013	0.014	0.015	0.015	0.03
2325	0.014	0.012	0.012	0.012	0.011	0.013	0.013	0.015	0.016	0.017	0.017	0.03
2375	0.012	0.011	0.010	0.011	0.012	0.012	0.013	0.014	0.015	0.016	0.016	0.03
2425	0.015	0.013	0.012	0.013	0.011	0.014	0.014	0.015	0.016	0.017	0.017	0.03
2475	0.013	0.011	0.011	0.011	0.013	0.012	0.013	0.014	0.015	0.016	0.016	0.03
2525	0.012	0.012	0.011	0.012	0.012	0.013	0.013	0.014	0.015	0.016	0.016	0.03
2575	0.013	0.012	0.012	0.012	0.013	0.013	0.014	0.015	0.016	0.017	0.017	0.03
2625	0.015	0.013	0.012	0.013	0.014	0.015	0.015	0.016	0.017	0.018	0.018	0.03
2675	0.017	0.014	0.014	0.015	0.016	0.016	0.016	0.018	0.018	0.019	0.019	0.03
2725	0.017	0.014	0.014	0.015	0.015	0.016	0.016	0.018	0.018	0.019	0.019	0.03
2775	0.018	0.016	0.016	0.017	0.017	0.018	0.018	0.019	0.020	0.021	0.021	0.03
2825	0.016	0.016	0.016	0.017	0.018	0.018	0.019	0.020	0.020	0.021	0.021	0.03
2875	0.017	0.017	0.016	0.018	0.019	0.019	0.020	0.021	0.021	0.022	0.022	0.03
2925	0.019	0.018	0.018	0.020	0.021	0.022	0.022	0.023	0.024	0.025	0.025	0.03
2975	0.019	0.019	0.018	0.020	0.022	0.023	0.023	0.025	0.025	0.026	0.026	0.03

TEST RESULTS

Harmonics Current



THD



9. Power Factor

Power factor tests have been measured according to Clause 4.1.11 of the standard.

Five different tests have been done:

- Test 1: PF=1
- Test 2: Rectangular Curve Q fixed (Q=±66% Sn)
- Test 3: Triangular Curve PF fixed (PF=±0.8)
- Test 4: Semicircular Curve S fixed (S=100% Sn)
- Test 5: Settable to operate according to a characteristic curve

As the inverter is capable of different power factor settings, the test has been repeated varying the power factor within the range 0.8 leading to 0.8(*) lagging.

(*)0.8 leading to 0.8 lagging is more restrictive than 0.95 as the standard required.

The maximum tolerance allowed for the measured Power Factor is ± 0.01, for measurements from 20%Sn.

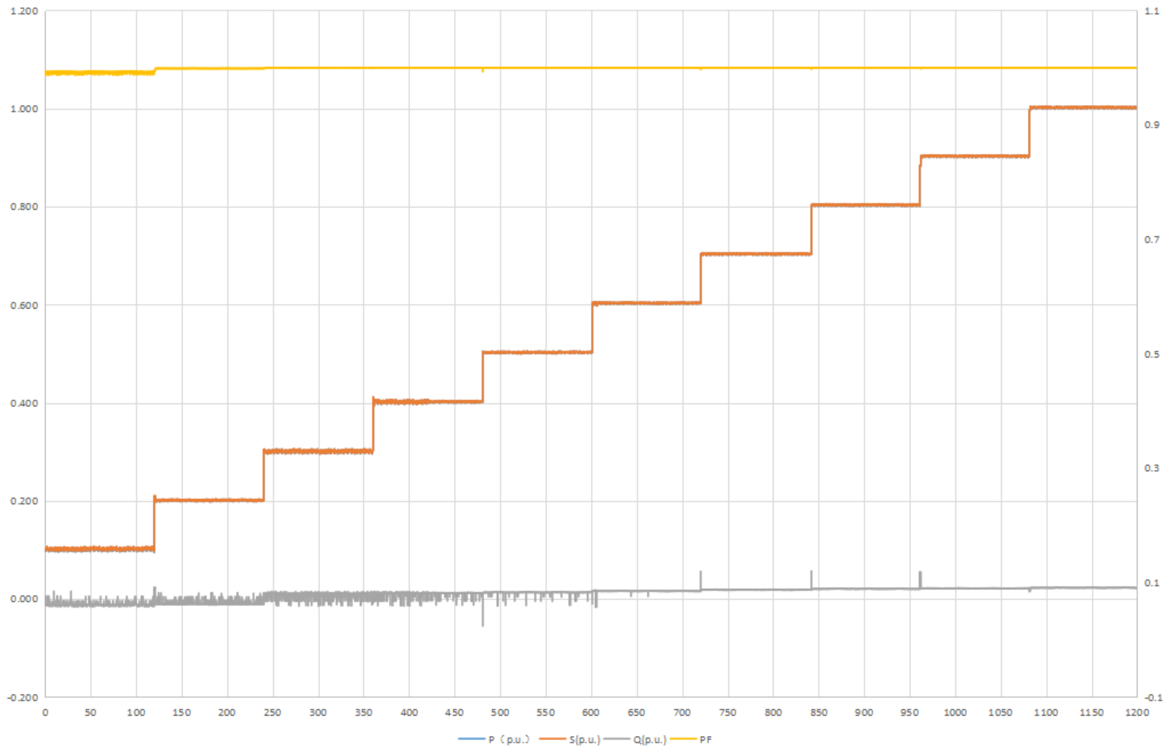
9.1 Test 1: PF=1

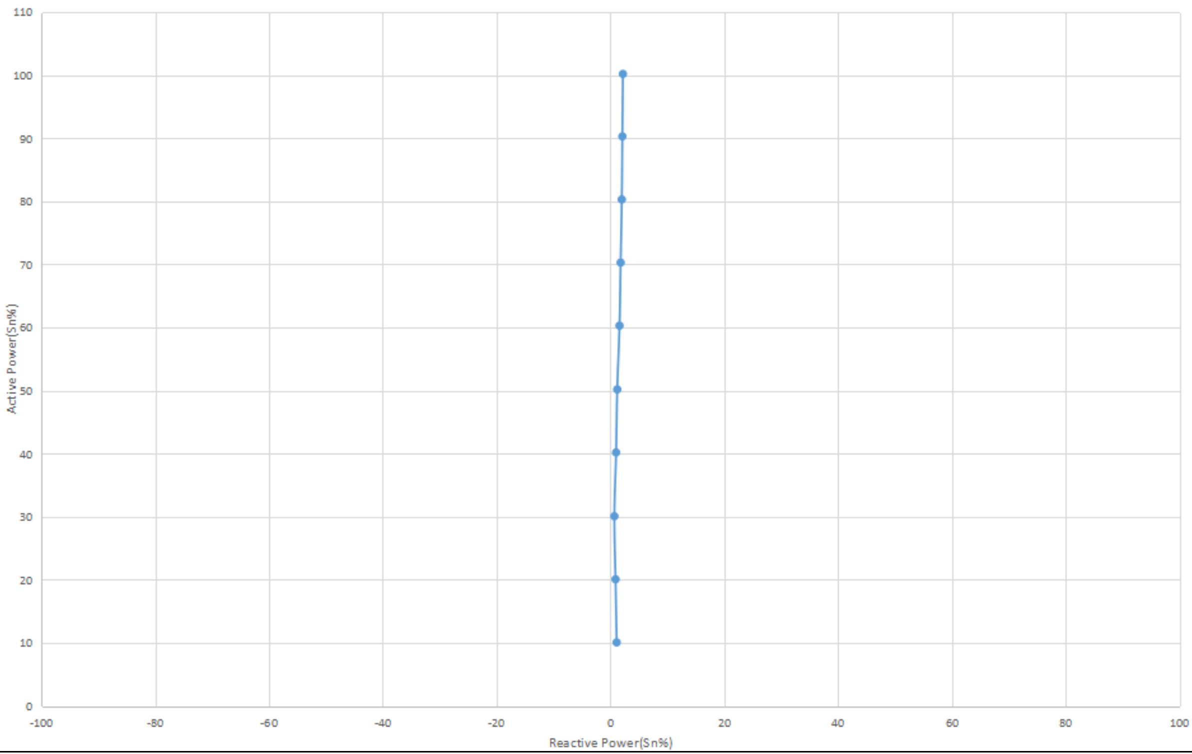
The following table and graphs show test results for measurements of power factor set to unity (PF=1):

Unity Power Factor (PF=1.0)					
P Desired (%Sn)	P measured (%Sn)	Q measured (%Sn)	Power Factor desired (cos φ)	Power Factor measured (cos φ)	Power Factor Deviation (cos φ)
10%	10.1	1.1	1.000	0.993	-0.007
20%	20.1	0.9	1.000	0.998	-0.002
30%	30.1	0.7	1.000	0.999	-0.001
40%	40.2	1.0	1.000	1.000	0.000
50%	50.2	1.2	1.000	1.000	0.000
60%	60.3	1.6	1.000	1.000	0.000
70%	70.3	1.8	1.000	1.000	0.000
80%	80.3	2.0	1.000	1.000	0.000
90%	90.3	2.1	1.000	1.000	0.000
100%	100.2	2.2	1.000	1.000	0.000

TEST RESULTS

Unity Power Factor (PF=1.0)





9.2 Test 2: Rectangular Curve (Q =±66%Sn)

This test verifies the capability of the inverter to provide a fixed value of reactive power. In addition, it is verified the Q control mode.

At high active power levels the reactive power provided by the inverter is automatically limited by the inverter in order to protect against over current.

Allowed tolerance to be considered is 5%Sn when possible.

The following table shows the test results:

Rectangular Curve (Q=66.0%Sn / Inductive)					
P Desired (%Sn)	**P measured (%Sn)**	**Q desired (%Sn)**	**Q measured (%Sn)**	**Q Deviation (%Sn)**	**Power Factor (cos φ)**
10%	9.2	66.0	65.6	-0.4	0.139
20%	19.2	66.0	65.8	-0.2	0.281
30%	29.3	66.0	66.0	0.0	0.406
40%	39.5	66.0	66.2	+0.2	0.512
50%	49.5	66.0	66.5	+0.5	0.598
60%	59.6	66.0	66.7	+0.7	0.666
70%	69.6	66.0	66.9	+0.9	0.721
80%	79.6	66.0	67.1	+1.1	0.765
90%	89.1 (*)	66.0	67.3	+1.3	0.798
100%	89.2 (*)	66.0	67.4	+1.4	0.798P

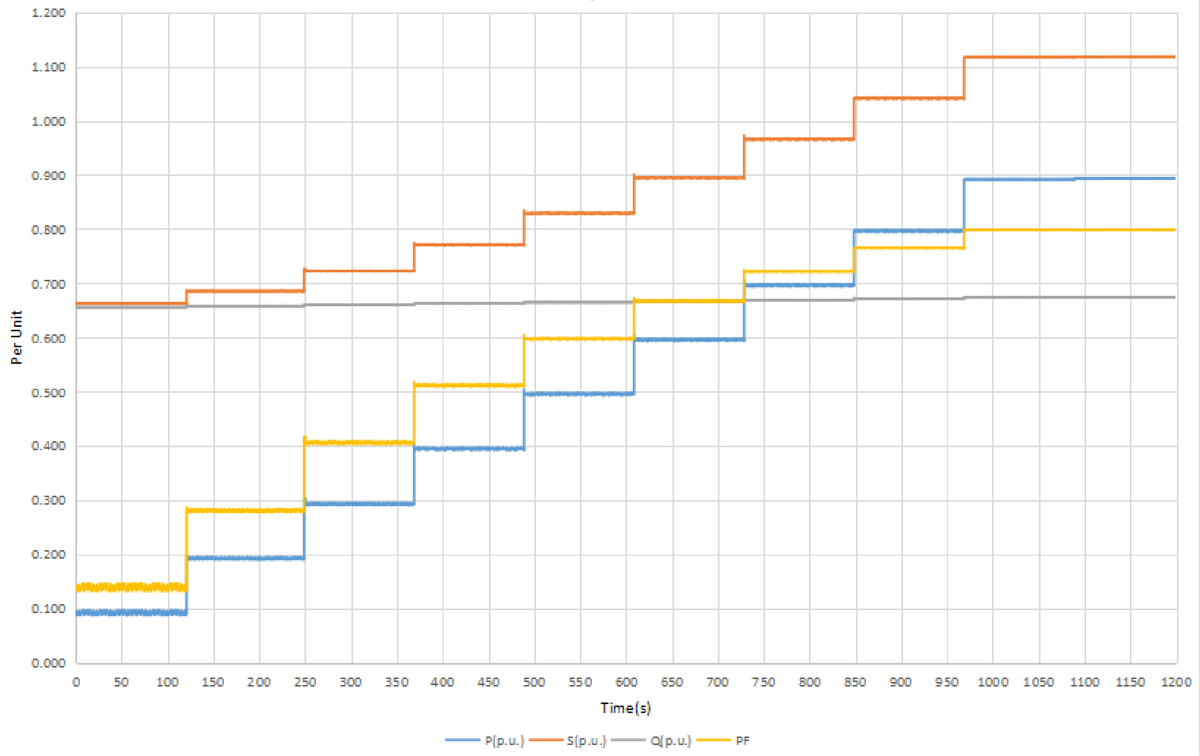
(*) When working in this model, the unit is reactive power priority. The active power is limited due to the current limitation.

Rectangular Curve (Q=66.0%Sn / Capacitive)					
P Desired (%Sn)	**P measured (%Sn)**	**Q desired (%Sn)**	**Q measured (%Sn)**	**Q Deviation (%Sn)**	**Power Factor (cos φ)**
10%	8.9	-66.0	-68.4	-2.4	0.129
20%	19.0	-66.0	-68.3	-2.3	0.268
30%	29.1	-66.0	-68.1	-2.1	0.393
40%	39.2	-66.0	-67.9	-1.9	0.500
50%	49.3	-66.0	-67.7	-1.7	0.589
60%	59.4	-66.0	-66.1	-0.1	0.661
70%	69.4	-66.0	-67.3	-1.3	0.718
80%	79.4	-66.0	-67.2	-1.2	0.764
90%	89.4 (*)	-66.0	-67.0	-1.0	0.800
100%	90.3 (*)	-66.0	-67.1	-1.1	0.803

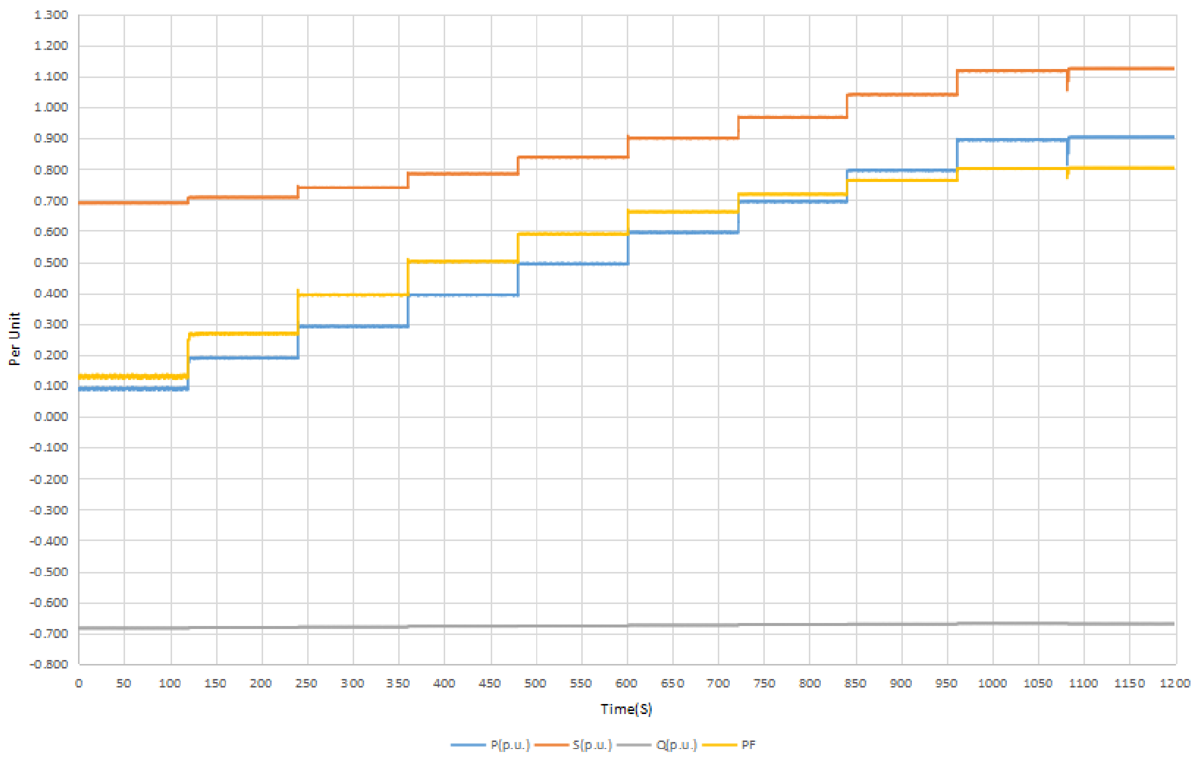
(*) When working in this model, the unit is reactive power priority. The active power is limited due to the current limitation.

TEST RESULTS

Rectangular Curve (Q=66.0%Sn / Inductive)

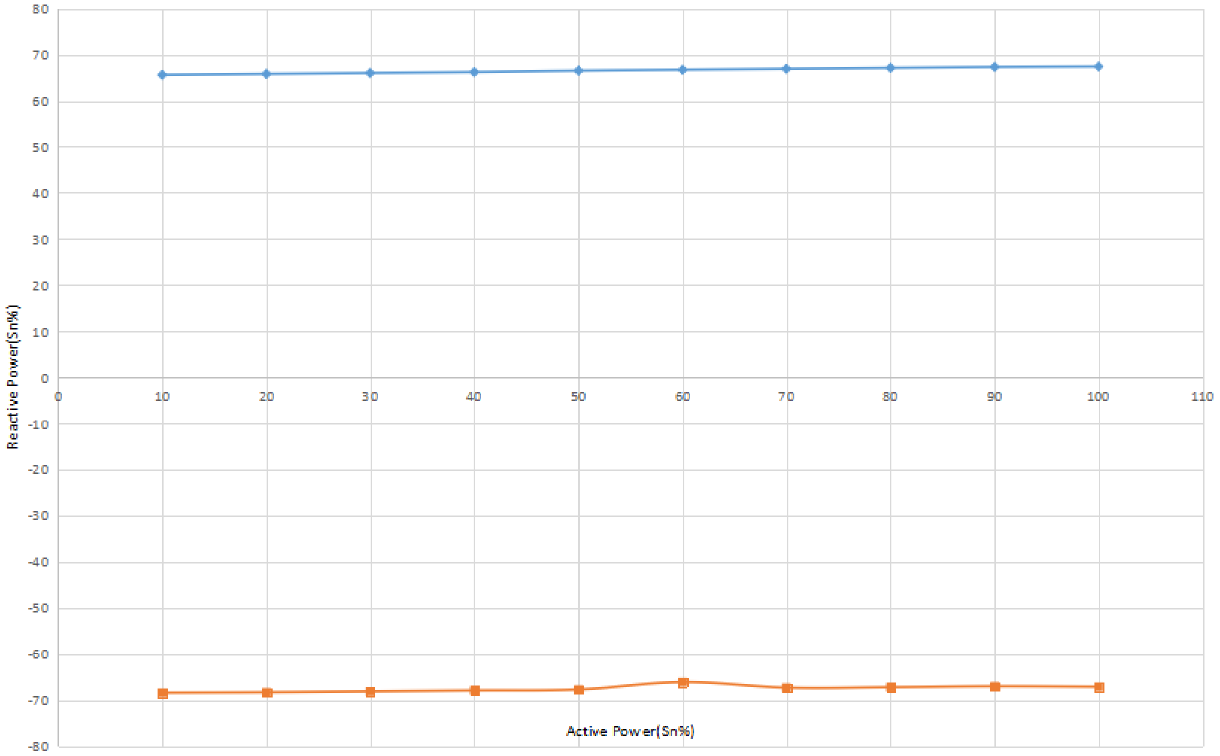


Rectangular Curve (Q=66.0%S_n / Capacitive)



TEST RESULTS

Rectangular Curve (Capacitive vs Inductive)



9.3 Test 3: Triangular Curve (PF=±0.8)

This test verifies the capability of the inverter to provide a fixed value of power factor. In addition it is verified the PF control mode.

At high active power levels the reactive power provided by the inverter is automatically limited by the inverter in order to protect against over current.

The maximum tolerance allowed for the measured Power Factor is ± 0.01, for measurements from 20%Sn.

The following table shows the test results:

Triangular Curve (PF=0.8 / Inductive)					
P Desired (%Sn)	P measured (%Sn)	Q measured (%Sn)	Power Factor desired (cos φ)	Power Factor measured (cos φ)	Power Factor Deviation (cos φ)
10%	10.1	7.1	0.800	0.806	+0.006
20%	20.0	14.8	0.800	0.803	+0.003
30%	30.0	22.5	0.800	0.800	0.000
40%	40.0	30.2	0.800	0.798	-0.002
50%	50.0	38.0	0.800	0.796	-0.004
60%	59.9	45.7	0.800	0.795	-0.005
70%	69.9	53.3	0.800	0.795	-0.005
80%	79.7	61.0	0.800	0.794	-0.006
90%	88.7 (*)	67.9	0.800	0.794	-0.006
100%	88.8 (*)	67.9	0.800	0.794	-0.006

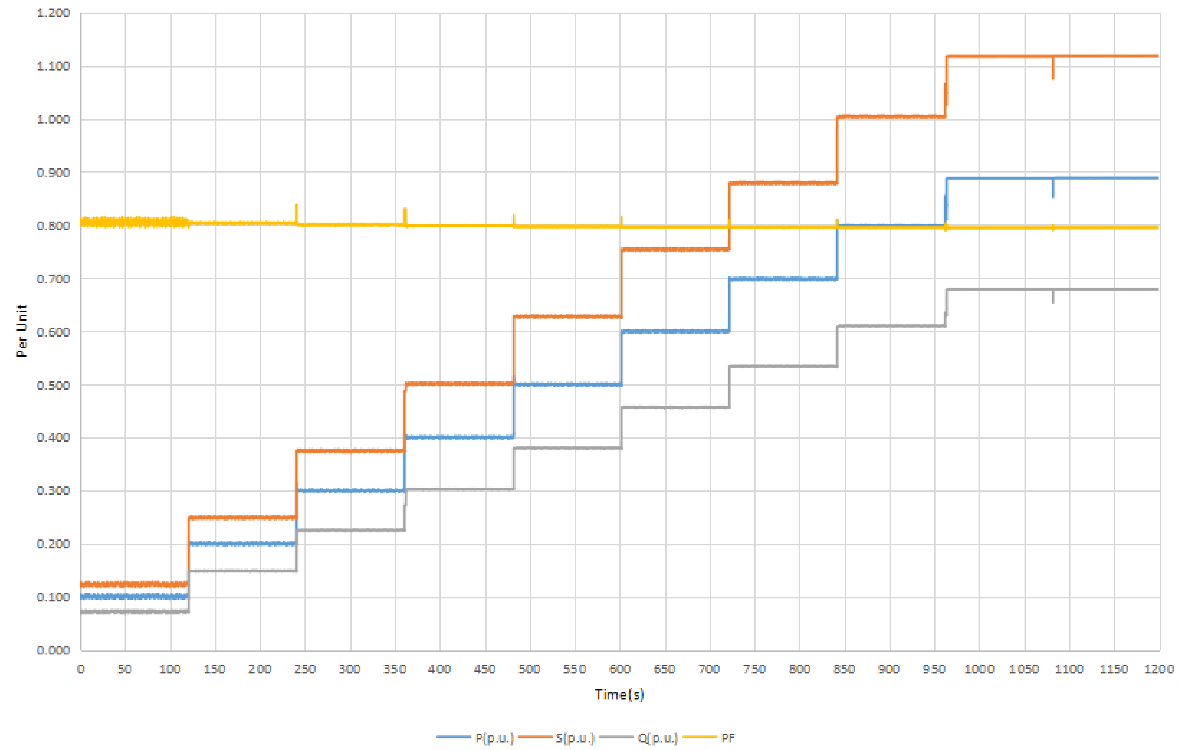
(*) When working in this model, the unit is reactive power priority. The active power is limited due to the current limitation.

Triangular Curve (PF=0.8 / Capacitive)					
P Desired (%Sn)	P measured (%Sn)	Q measured (%Sn)	Power Factor desired (cos φ)	Power Factor measured (cos φ)	Power Factor Deviation (cos φ)
10%	9.8	-6.9	0.800	0.797	-0.003
20%	19.9	-14.7	0.800	0.803	+0.003
30%	30.0	-22.5	0.800	0.800	0.000
40%	40.0	-30.2	0.800	0.798	-0.002
50%	50.0	-38.0	0.800	0.796	-0.004
60%	59.9	-45.7	0.800	0.795	-0.005
70%	69.8	-53.3	0.800	0.795	-0.005
80%	79.7	-61.0	0.800	0.794	-0.006
90%	88.7 (*)	-67.9	0.800	0.794	-0.006
100%	88.8 (*)	-67.9	0.800	0.794	-0.006

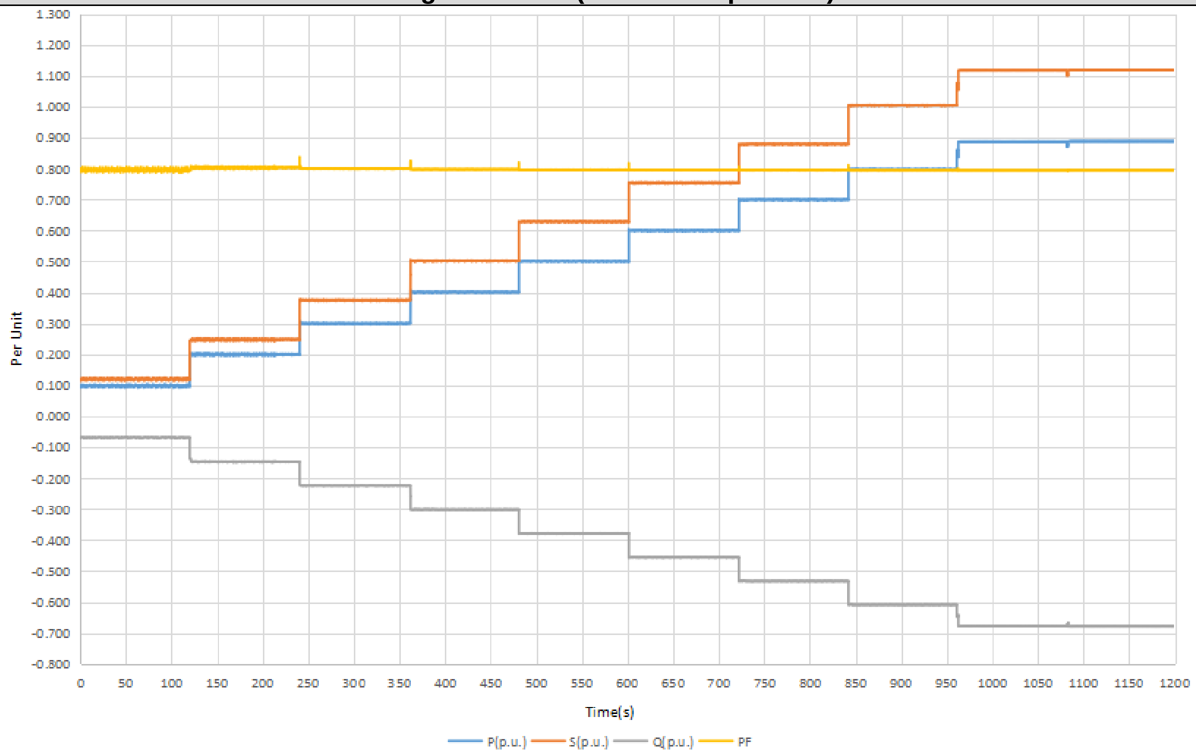
(*) When working in this model, the unit is reactive power priority. The active power is limited due to the current limitation.

TEST RESULTS

Triangular Curve (PF=0.8 / Inductive)

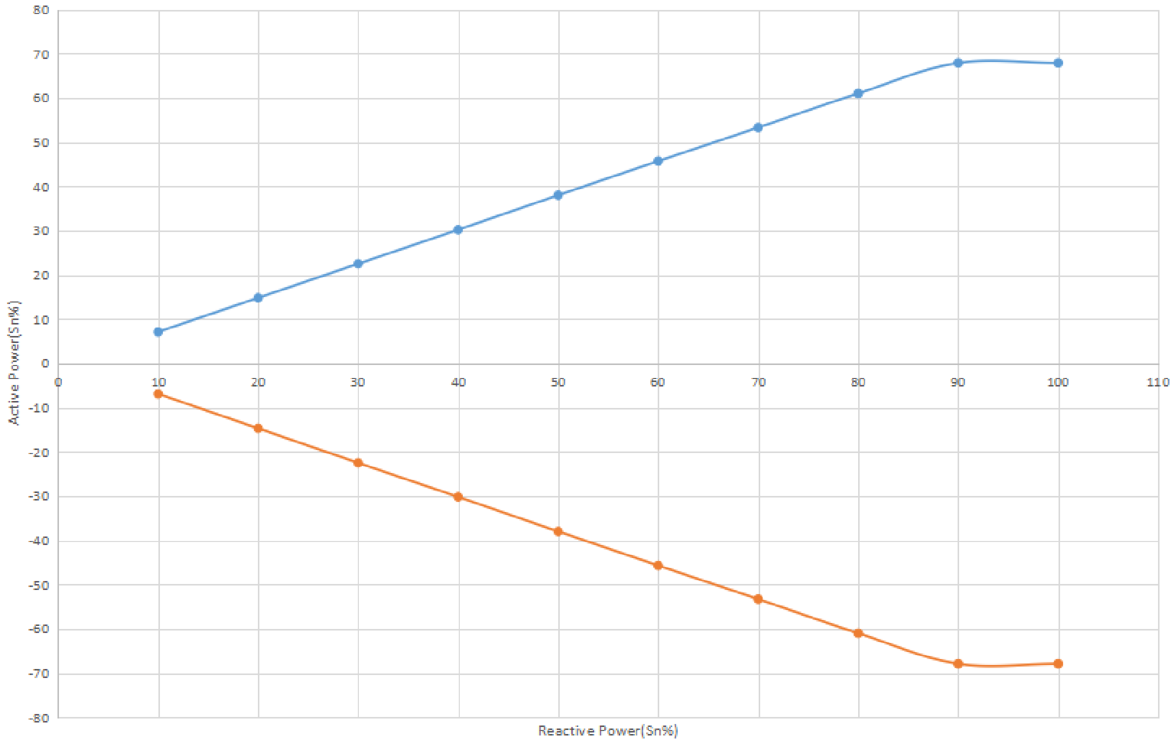


Triangular Curve (PF=0.8 / Capacitive)



TEST RESULTS

Triangular Curve (Inductive vs Capacitive)



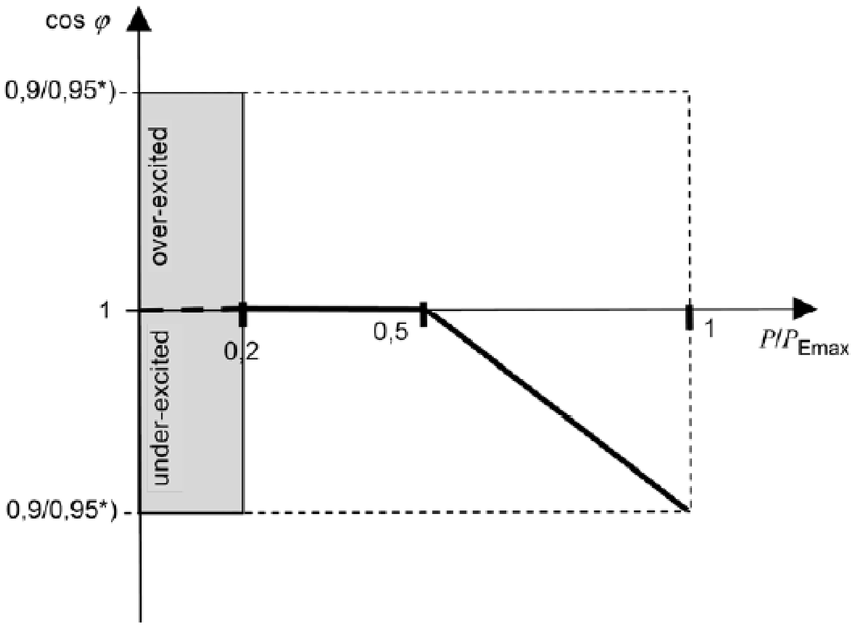
9.4 Test 4: Semicircular Curve (S=100%Sn)

The test was not available due to the manufacturer doesn’t provide this operation model.

9.5 Test 5: Settable to operate according to a characteristic curve

It has also to be verified the capability of the inverter for providing a fixed value of the power factor in function of the active power according to the next picture:

0.9 leading to 0.9 lagging is more restrictive than 0.95 as the standard required.

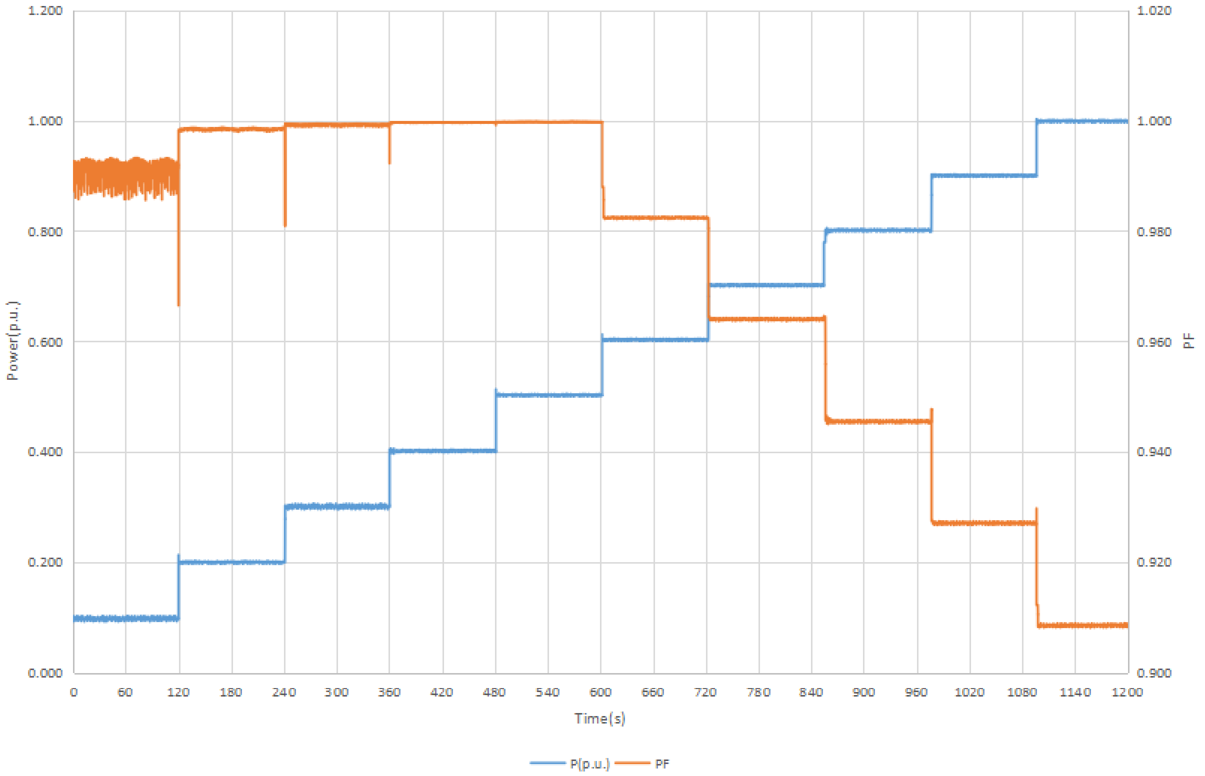


The results are offered in the table below (Note: 10%Pn have not measured in following test):

Setting cos φ(P) with the standard characteristic curve (20%Pn to 100%Pn)						
Active Power Setting (% P_{Emax})	Active Power Measured (p.u.)	Reactive Power Measured (p.u.)	cos φ Measured	Desired cos φ	Δ cos φ (<0.01)	Transient period (<10s)
10	0.098	0.011	0.991	1.000	-0.009	
20	0.200	0.009	0.998	1.000	-0.002	
30	0.301	0.008	0.999	1.000	-0.001	0.2s
40	0.402	0.011	1.000	1.000	0.000	0.2s
50	0.502	0.012	1.000	1.000	0.000	0.2s
60	0.603	-0.114	0.982	0.980	0.002	0.2s
70	0.702	-0.194	0.964	0.960	0.004	0.2s
80	0.801	-0.276	0.945	0.940	0.005	0.2s
90	0.900	-0.364	0.927	0.920	0.007	0.2s
100	0.999	-0.459	0.909	0.900	0.009	0.2s

TEST RESULTS

Setting cos φ(P) with standard characteristic curve (10%Pn to 100%Pn)



10. Synchronization and Response to utility recovery

Synchronization have been measured according to Clause 4.1.12 and Clause 4.2.4 of the standard.

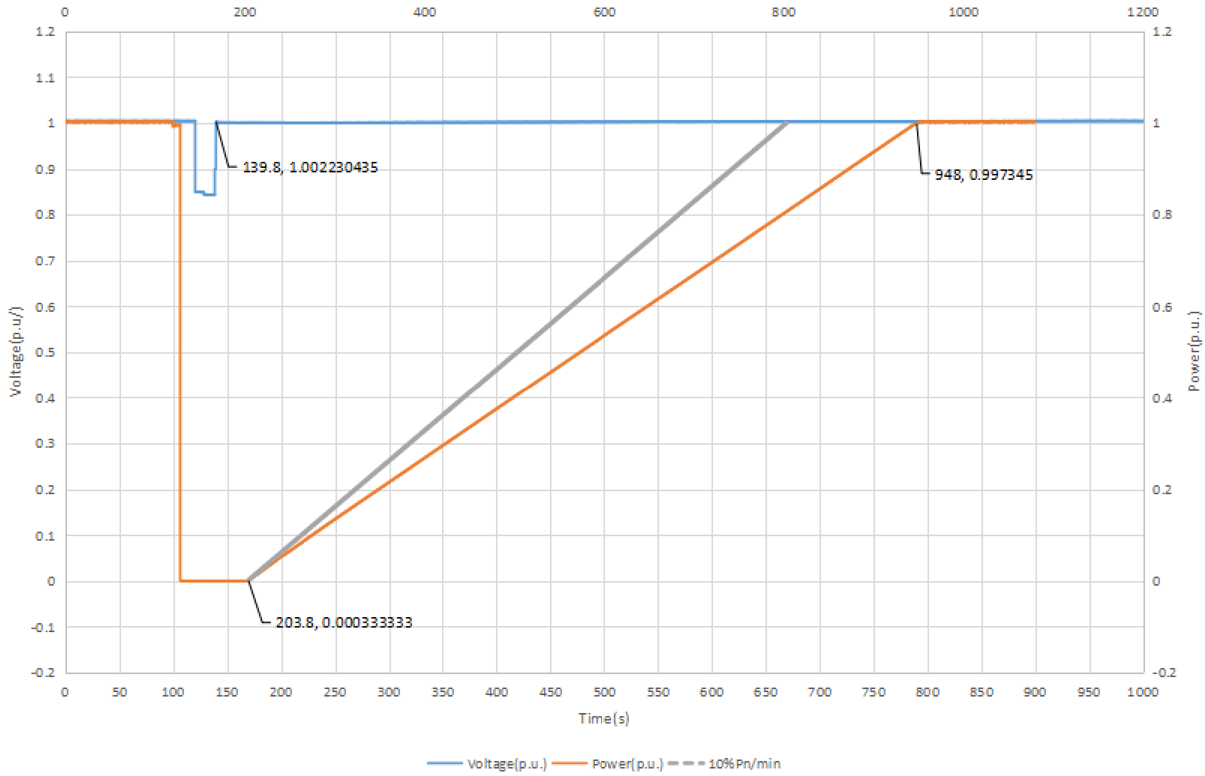
The embedded generator shall ensure synchronisation before re-energizing at all times.

After a voltage or frequency out-of-range condition that has caused the embedded generator to cease energizing the utility network, the generator shall not re-energize the utility network until the utility service voltage and frequency have remained within the specified ranges for a continuous and uninterrupted period of 60 s.

Controllable generators may reconnect immediately after the 60 s delay confirming recovery of the system voltage and frequency at a maximum rate of 10 % of rated power per minute, i.e. full power output will only be reached after 10 minutes.

Reconnection threshold	Gradient (ΔP) desired (%Pn/min)	Gradient measured (%Pn/min)
Overvoltage	≤ 10%	8.0%
Undervoltage	≤ 10%	8.0%
Overfrequency	≤ 10%	8.0%
Underfrequency	≤ 10%	8.0%

Recovery after under voltage

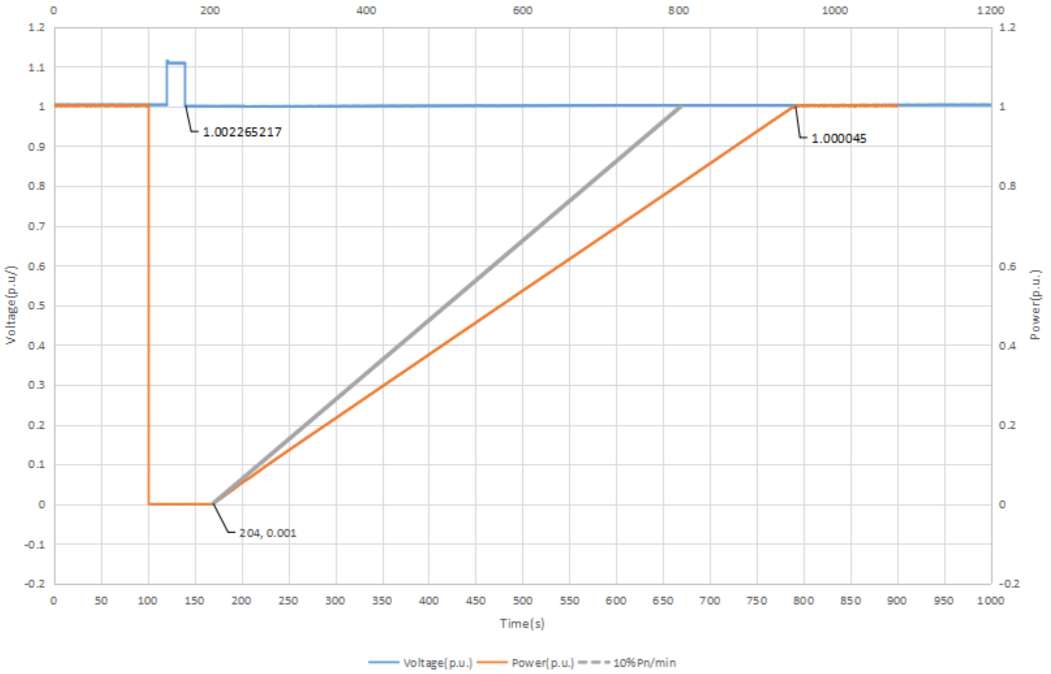


Reconnection delay time: 60 s	Reconnection time measured: 64 s

$$Active\ Power\ Gradient = \frac{100\%Pn}{12.40min} = 8.0\%Pn/min$$

TEST RESULTS

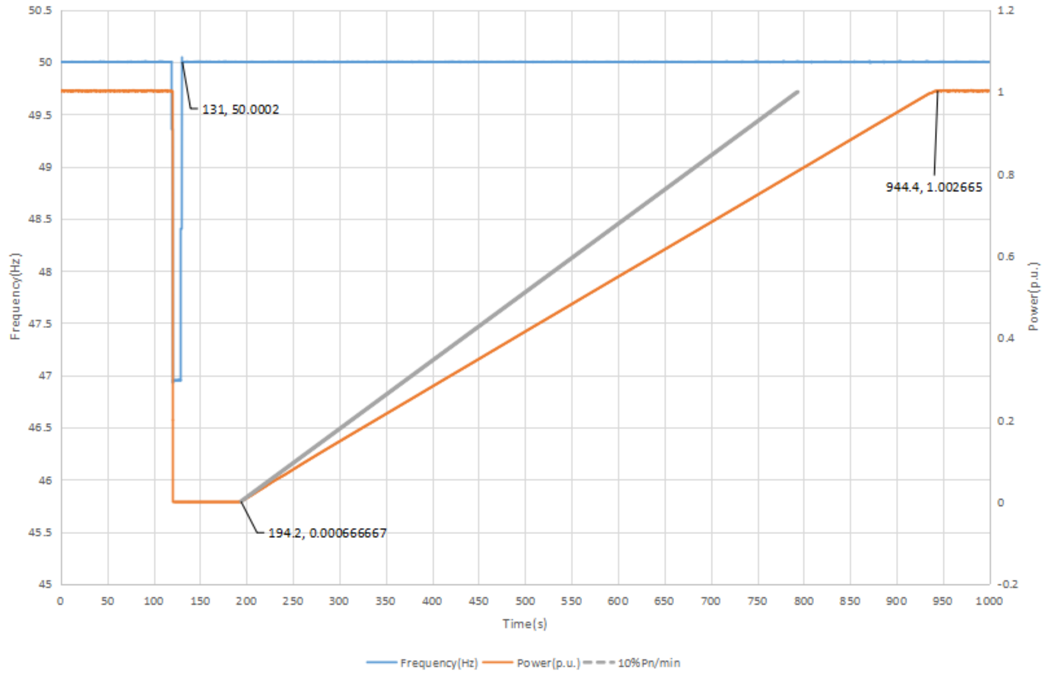
Recovery after Over voltage



Reconnection delay time: 60 s	Reconnection time measured: 63 s

$$\text{Active Power Gradient} = \frac{100\%Pn}{12.45min} = 8.0\%Pn/min$$

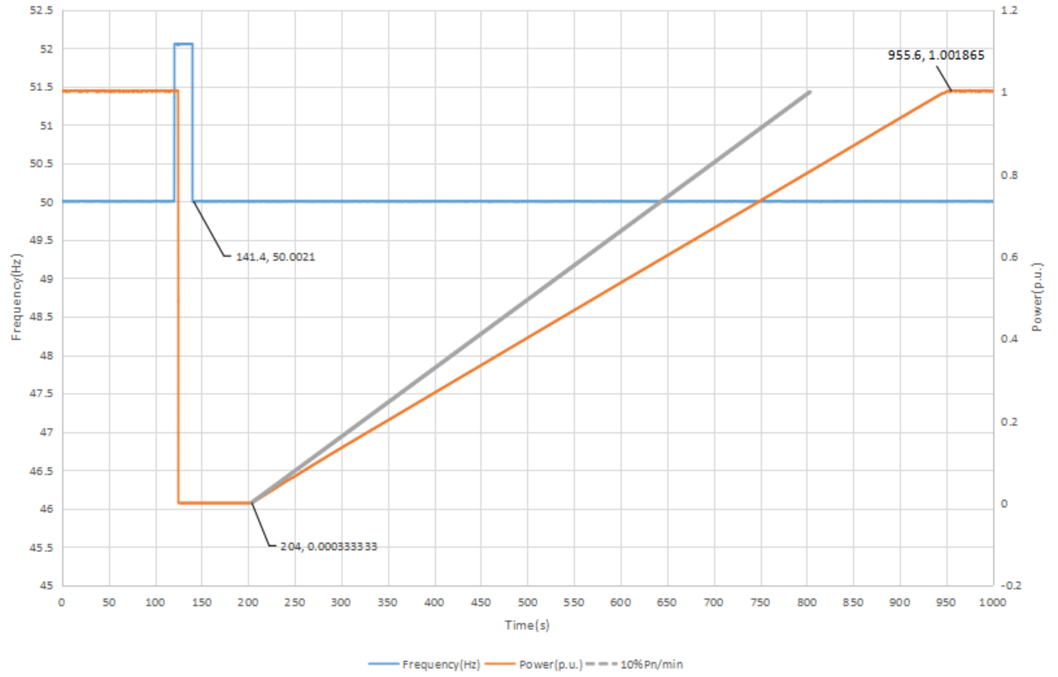
Recovery after Under frequency



Reconnection delay time: 60 s	Reconnection time measured: 63.2 s

$$\text{Active Power Gradient} = \frac{100\%Pn}{12.50min} = 8.0\%Pn/min$$

TEST RESULTS

Recovery after Over frequency	
	
Reconnection delay time: 60 s	Reconnection time measured: 62.6 s
$Active\ Power\ Gradient = \frac{100\%Pn}{12.52min} = 8.0\%Pn/min$	

11. Electromagnetic compatibility (EMC)

This requirement has been considered according to Clause 4.1.13 of the standard.

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

- Test Report BL-DG2060517-401 on 2020/07/09 which issued by Shenzhen BALUN Technology Co., Ltd

12. Mains signalling (e.g. PLC and ripple control)

This requirement has been considered according to Clause 4.1.14 of the standard.

The EUT is not use PLC-based communication. This clause is not applicable.

13. Safety disconnect from utility network

This requirement has been considered according to Clause 4.2.2 of the standard.

The safety requirements in accordance with IEC 62109-1:2010 and IEC 62109-2:2011.

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

- Test Report BL-DG2060127-B01 and BL-DG2060127-B01 attachment 1 on 2020/07/02 which issued by Shenzhen BALUN Technology Co., Ltd

13.1 Disconnection device (previously disconnection switching unit)

Disconnection device have been considered according to Clause 4.2.2.2 of the standard

The output is switched off redundant by two relays in serial on both line and neutral. This assures that the opening of the output circuit can operate in case of single fault.

13.2 Overvoltage and undervoltage

Disconnection device have been considered according to Clause 4.2.2.3.2 of the standard

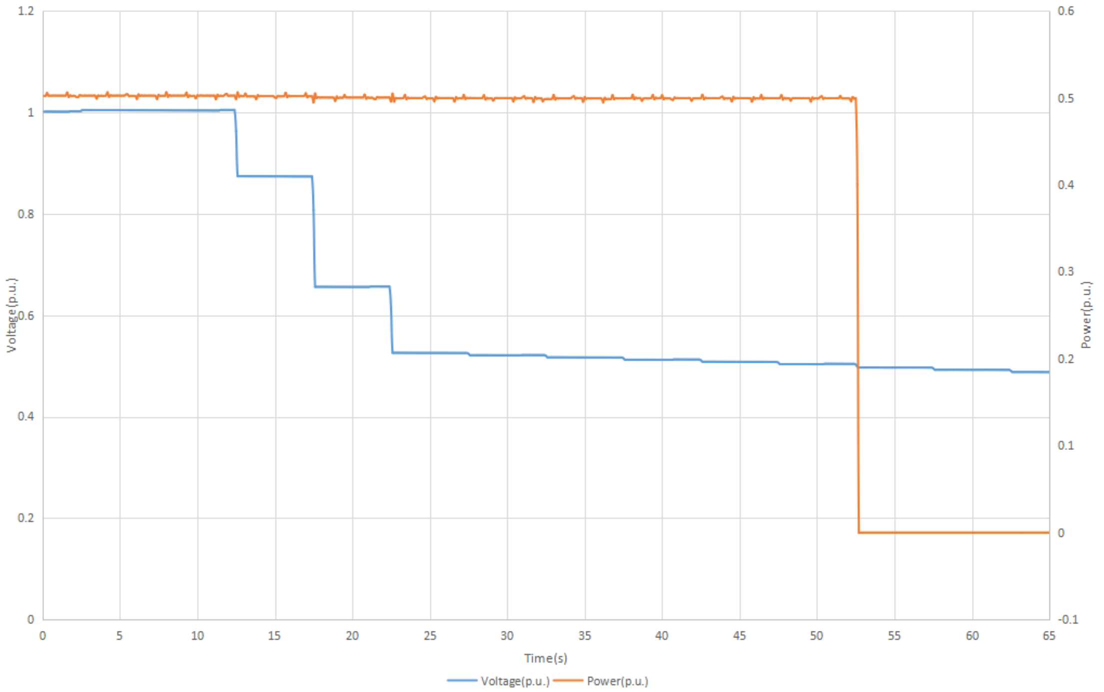
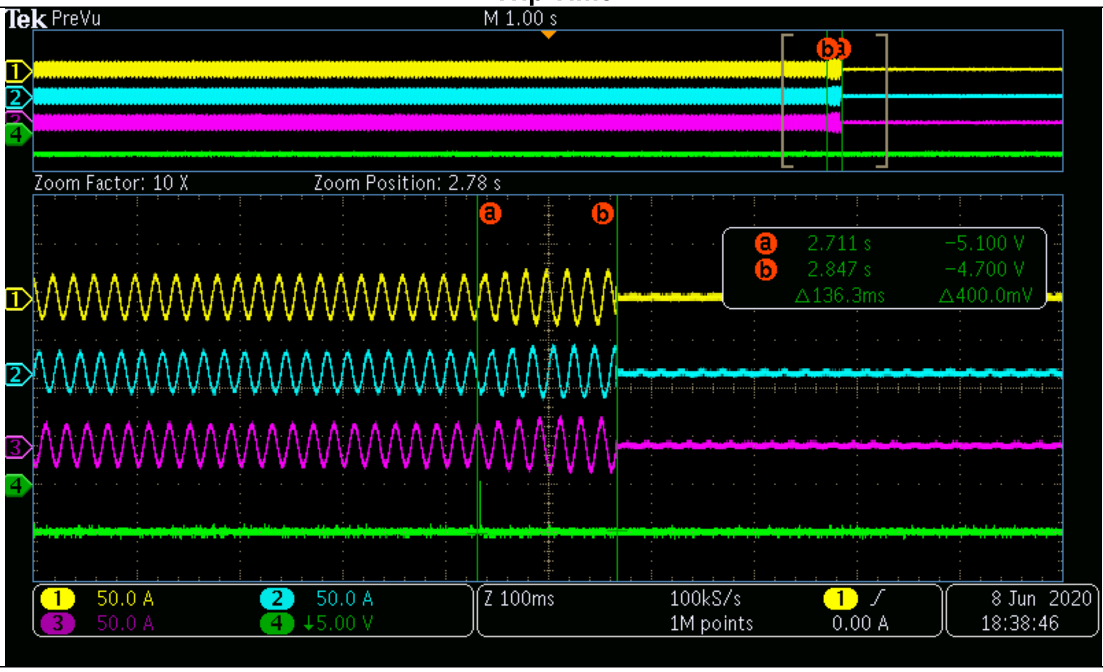
The disconnection time should comply with following table:

1	2
Voltage range (at point of connection)	**Maximum trip time** S
V < 50 %	0,2 s
50 % ≤ V < 85 %	10 s
85 % ≤ V ≤ 110 %	Continuous operation
110 % < V < 115 %	40 s
115% ≤ V < 120%	2 s
120 % ≤ V	0,16 s
NOTE If multi-voltage control settings are not possible, the more stringent trip time should be implemented, e.g. 2 s between 110% and 120% of voltage.	

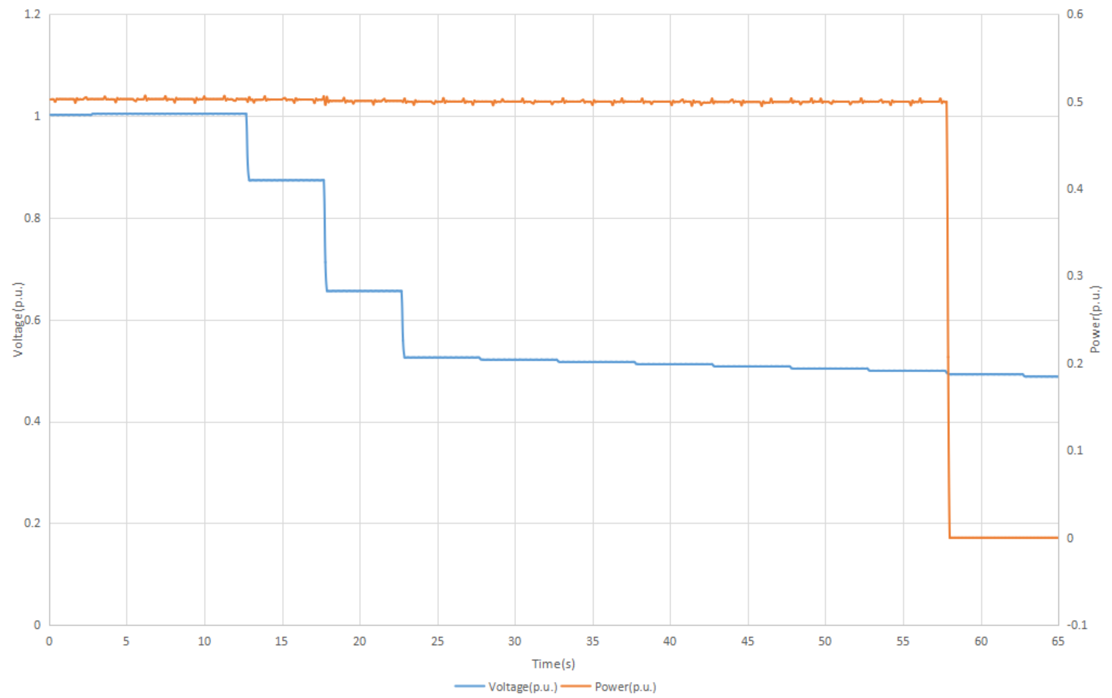
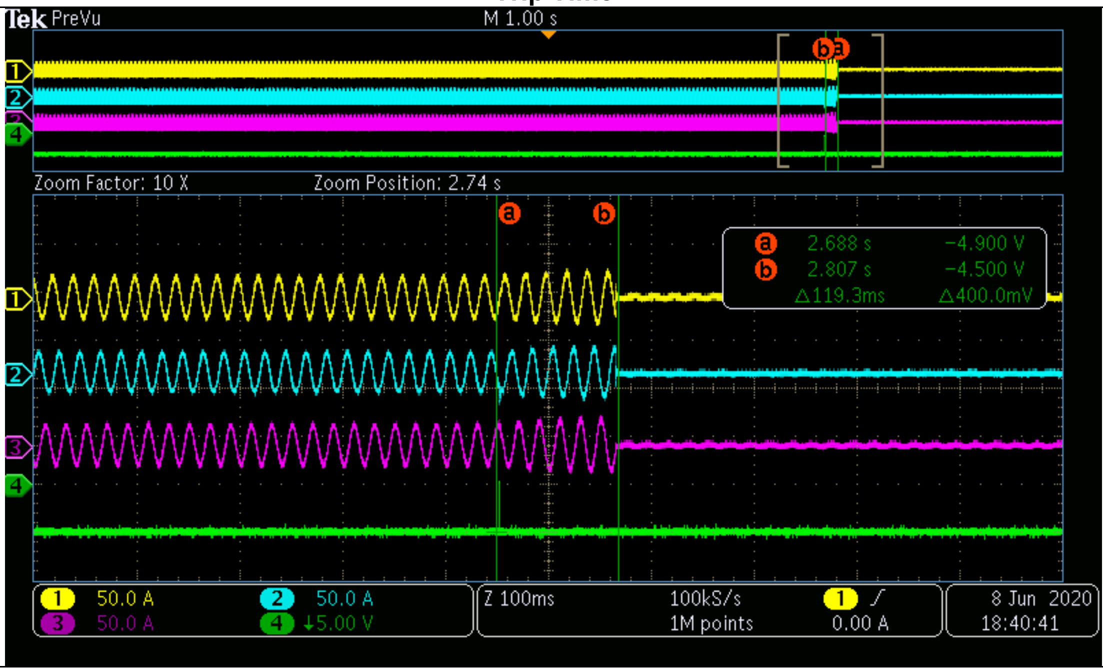
The following table shows the test results:

Voltage level	Phase	Voltage Setting (p.u.)	Voltage Trip (p.u.)	Trip time limit (ms)	Time measured (ms)
U < 50% Un	A	0.500	0.497	200	136
	B		0.493		119
	C		0.494		121
	ABC		0.497		133
U < 85% Un	A	0.850	0.846	10000	9094
	B		0.845		9114
	C		0.846		9102
	ABC		0.845		9106
U > 110% Un	A	1.100	1.102	40000	38300
	B		1.103		38350
	C		1.099		38340
	ABC		1.098		38410
U > 115% Un	A	1.150	1.150	2000	1633
	B		1.150		1627
	C		1.150		1625
	ABC		1.150		1629
U > 120% Un	A	1.200	1.203	160	83
	B		1.202		90
	C		1.198		75
	ABC		1.198		87

TEST RESULTS

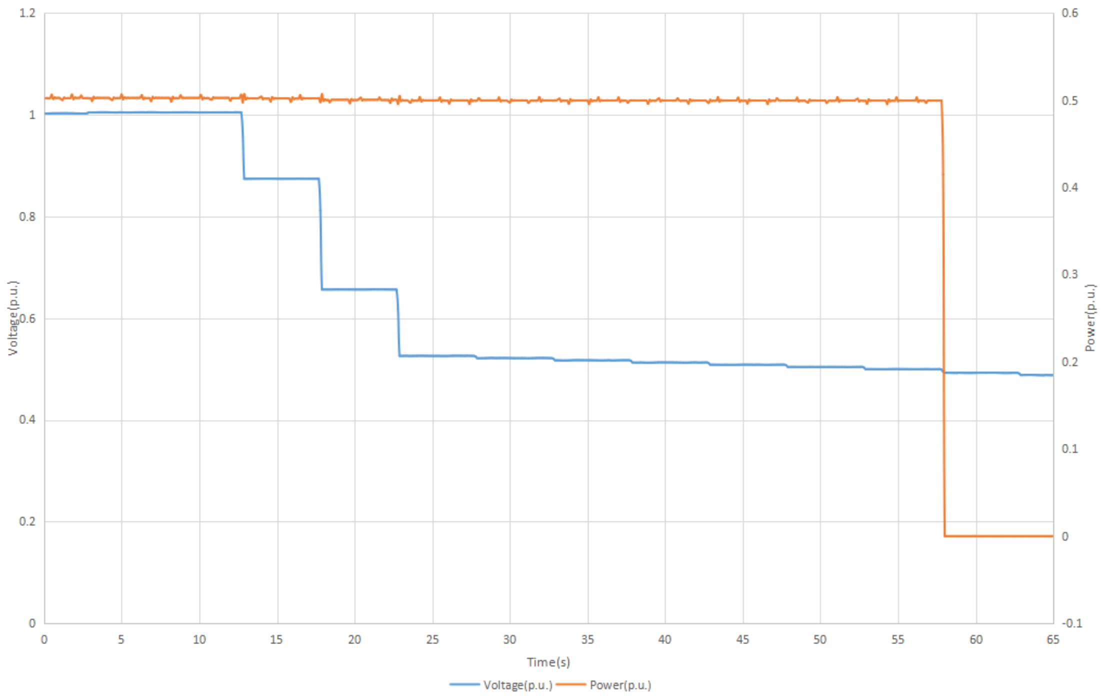
U < 50% Un (Phase A)
Trip Value

Trip Time


TEST RESULTS

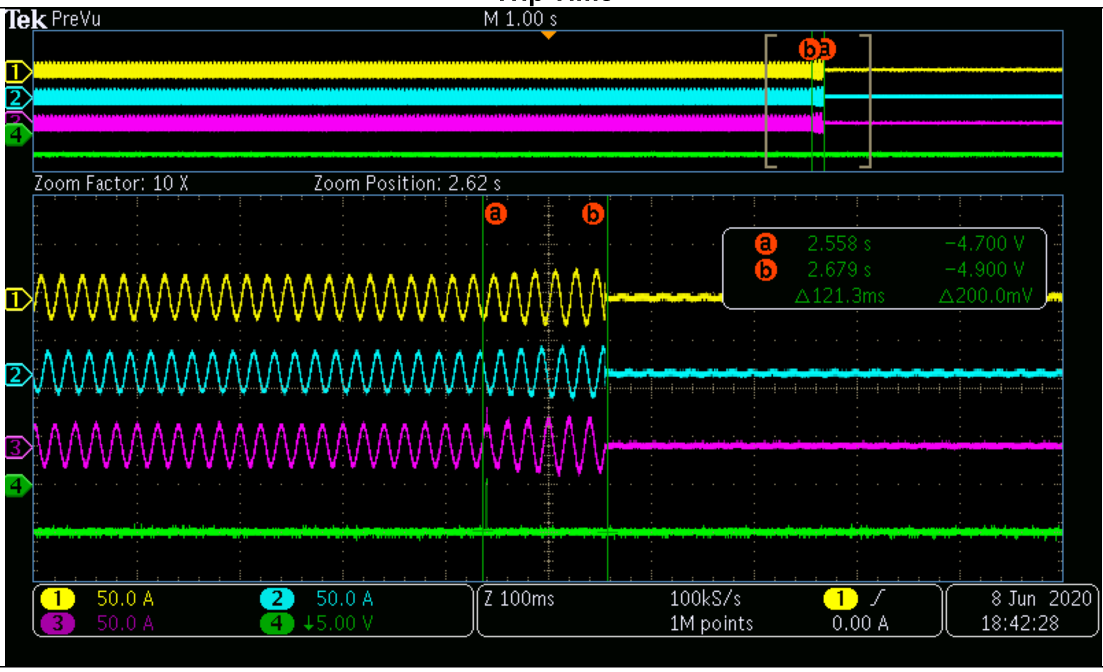
U < 50% Un (Phase B)
Trip Value

Trip Time


TEST RESULTS

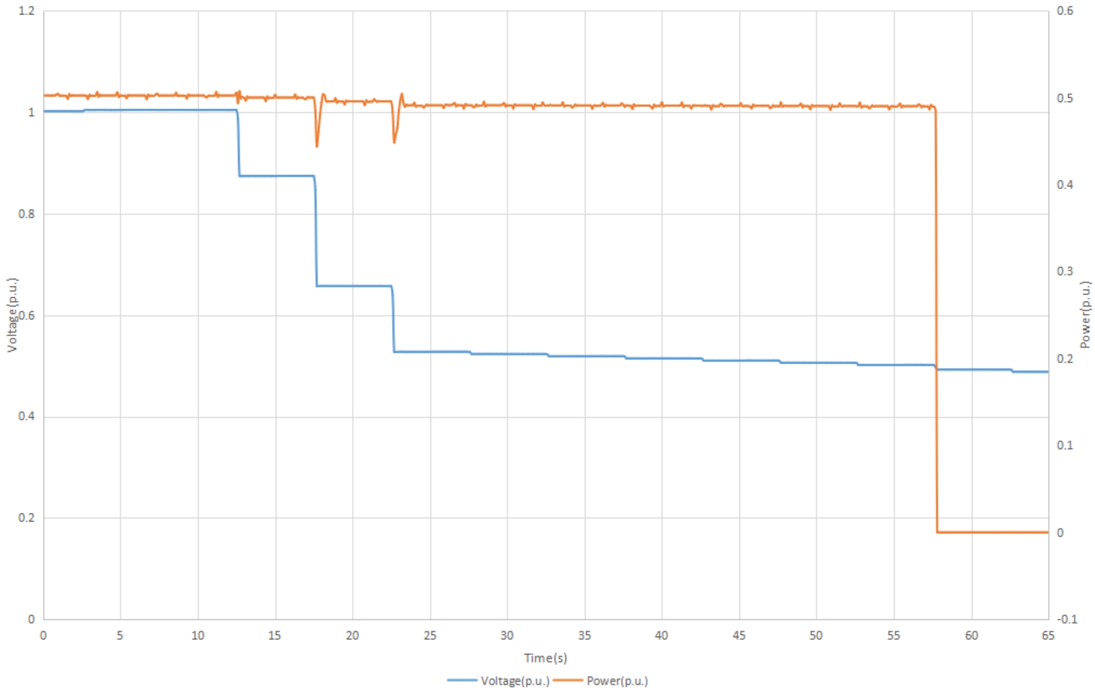
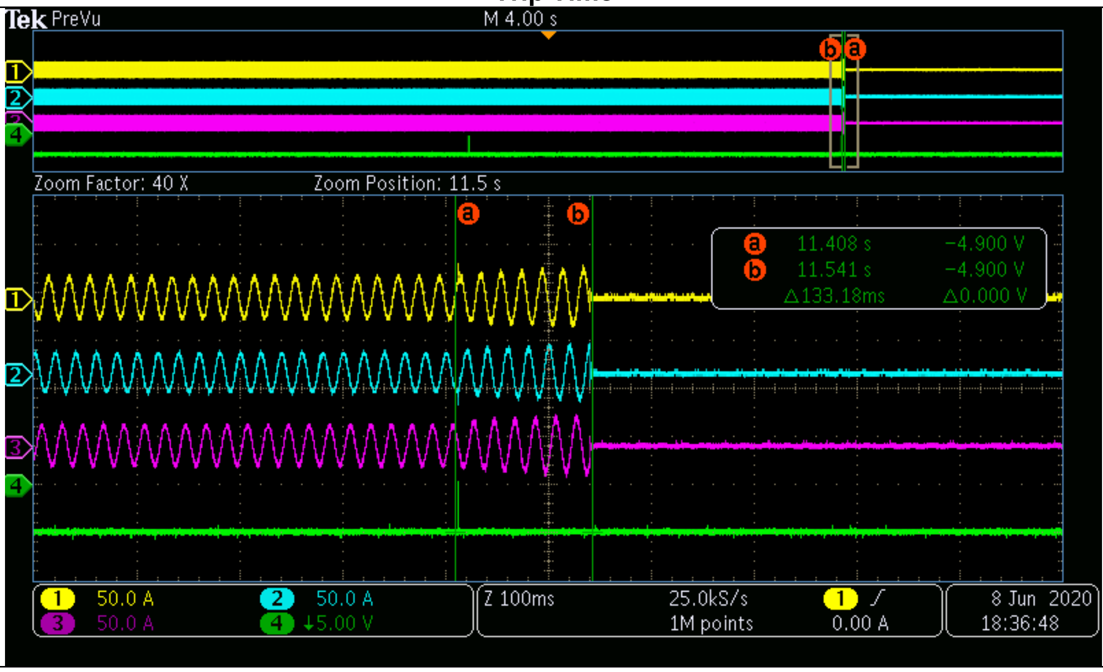
U < 50% Un (Phase C)
Trip Value



Trip Time

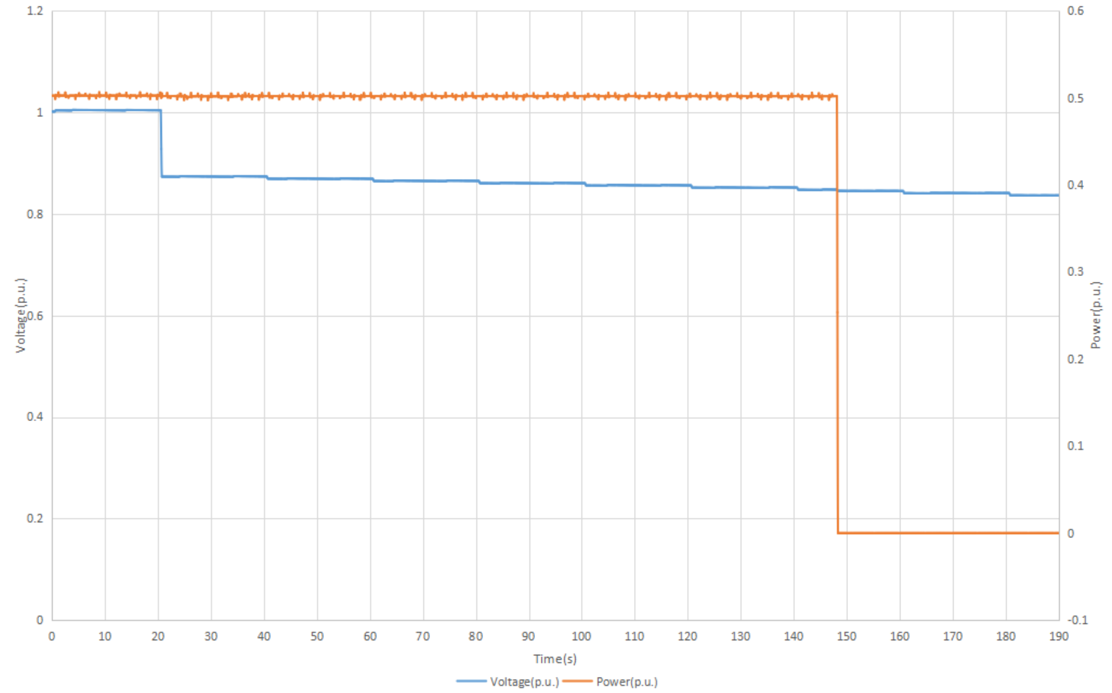


TEST RESULTS

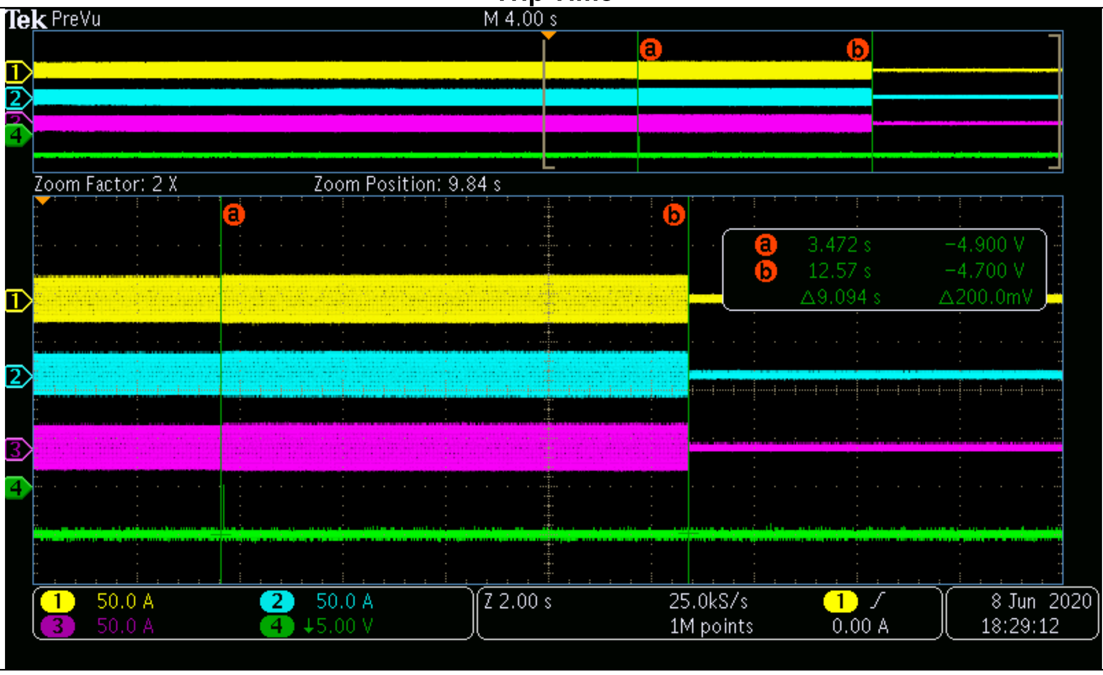
U < 50% Un (Phase ABC)
Trip Value

Trip Time


TEST RESULTS

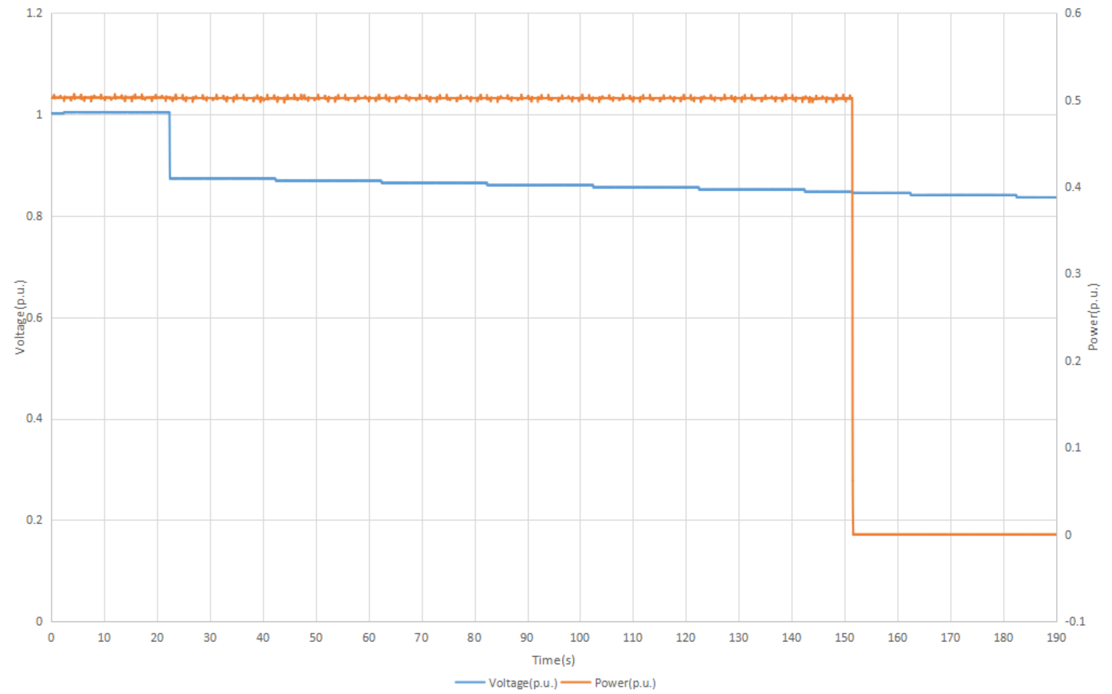
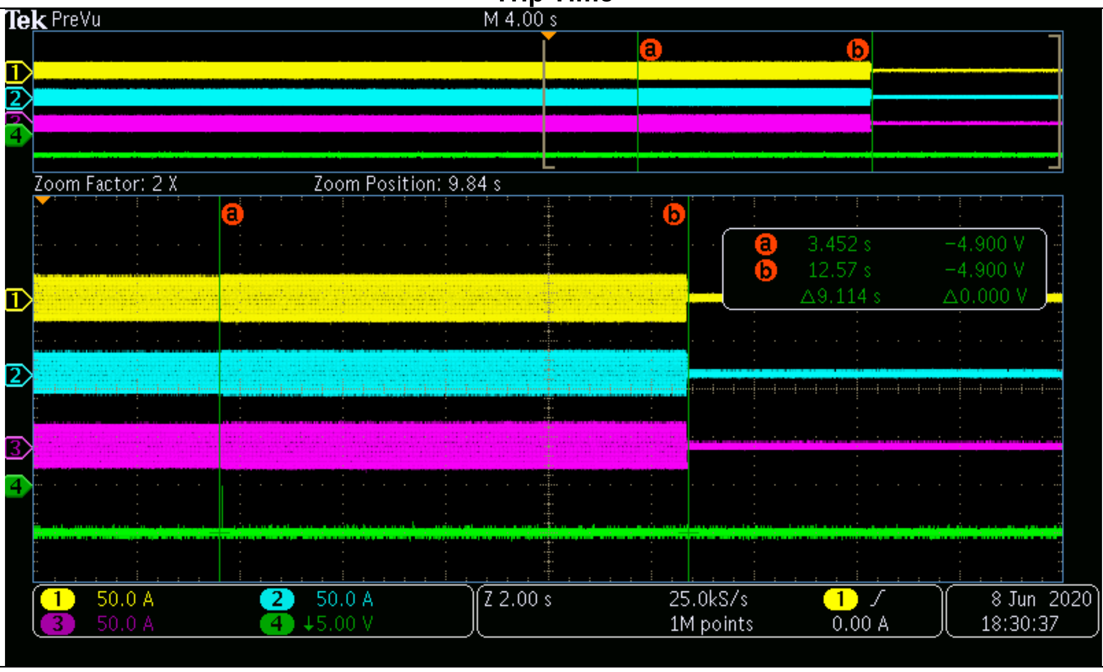
U < 85% Un （Phase A）
Trip Value



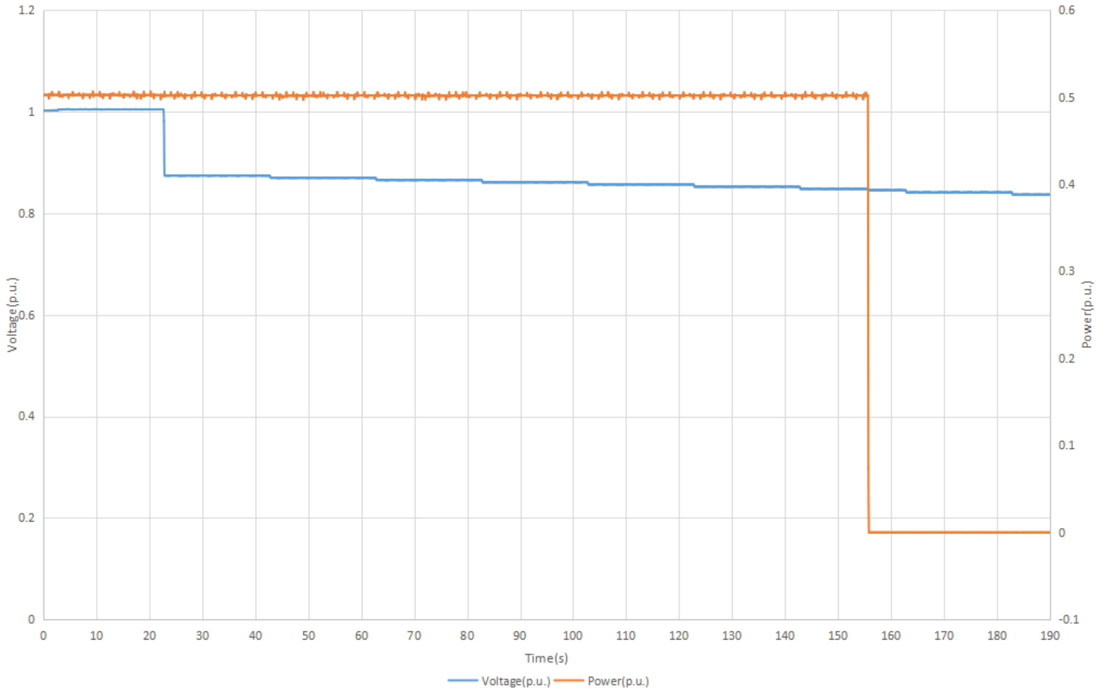
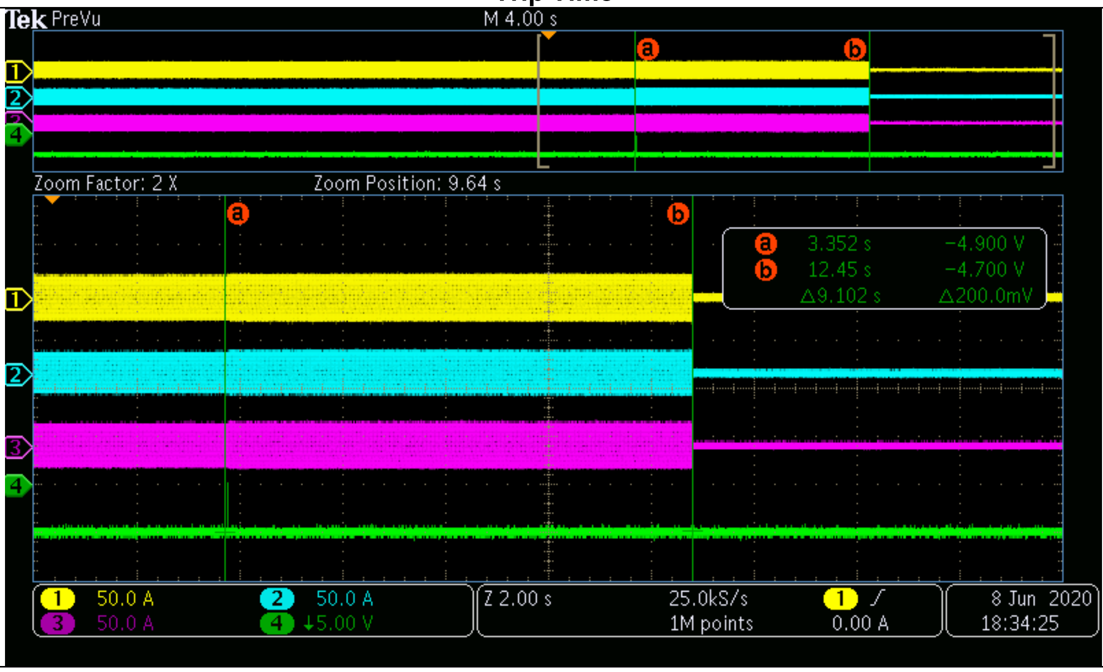
Trip Time



TEST RESULTS

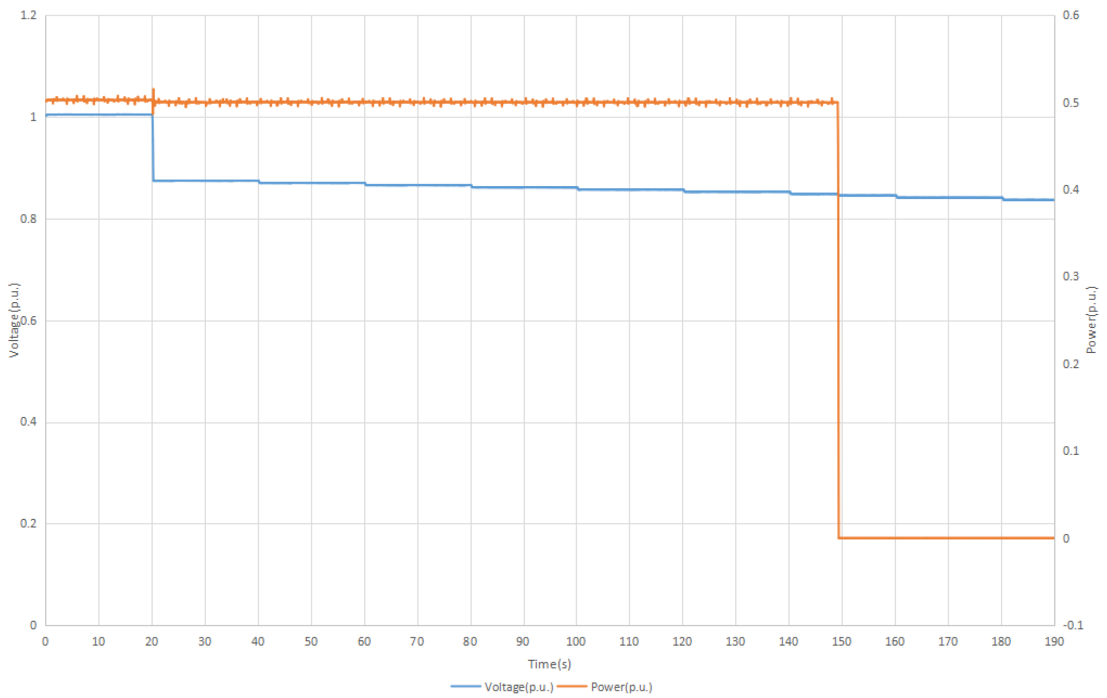
U < 85% Un (Phase B)
Trip Value

Trip Time


TEST RESULTS

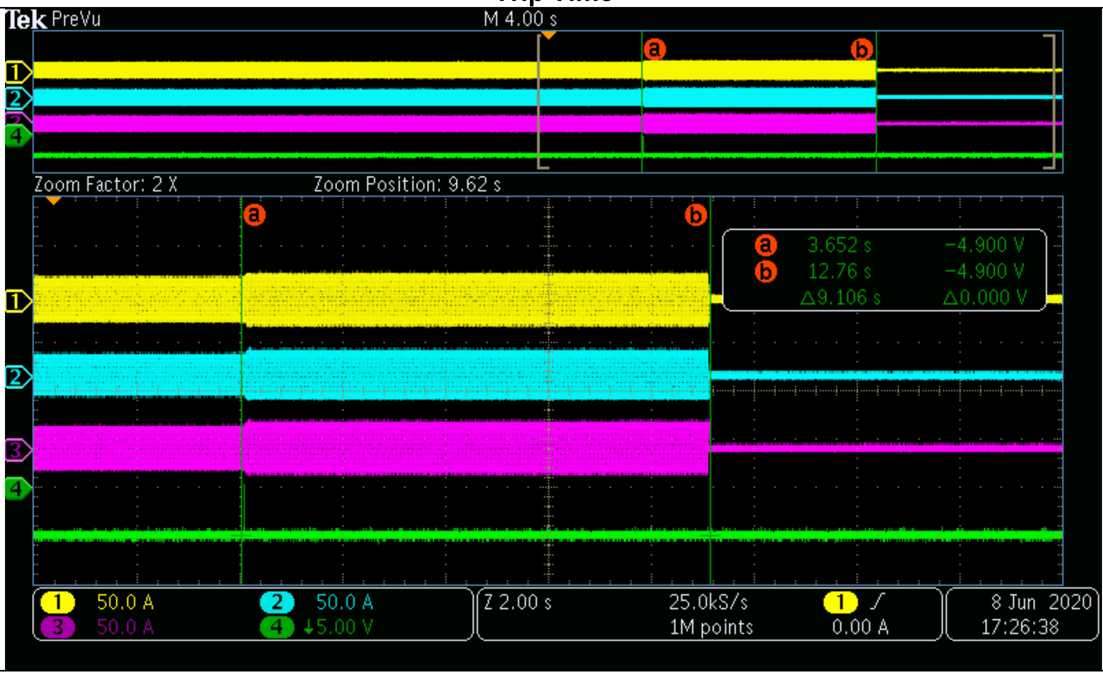
U < 85% Un (Phase C)
Trip Value

Trip Time


TEST RESULTS

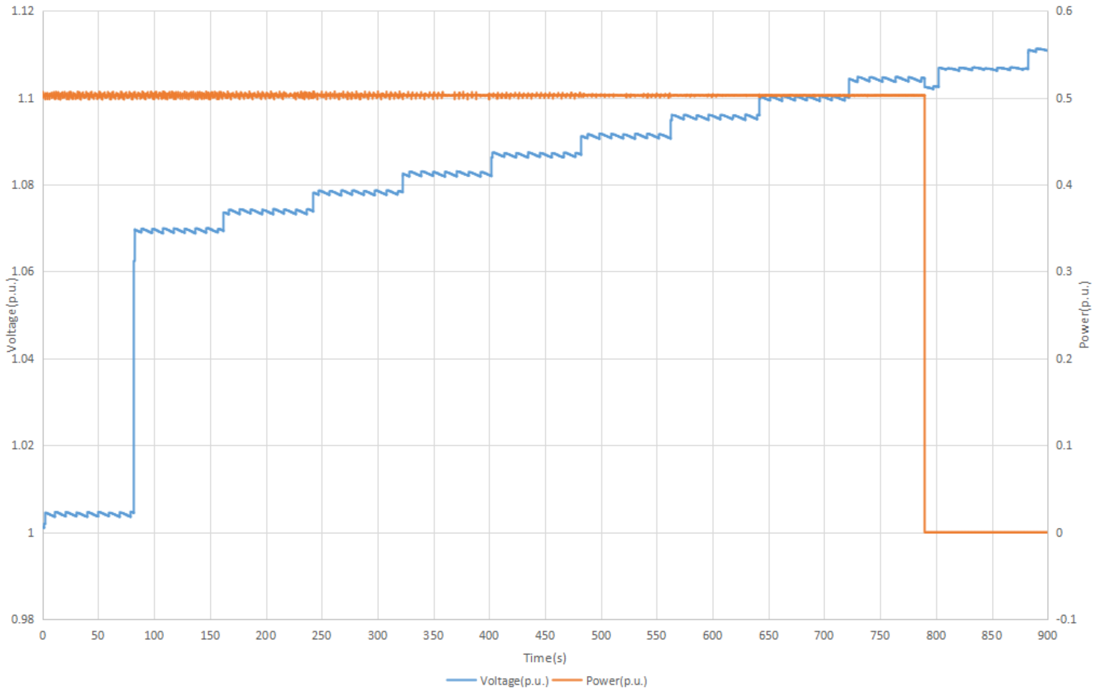
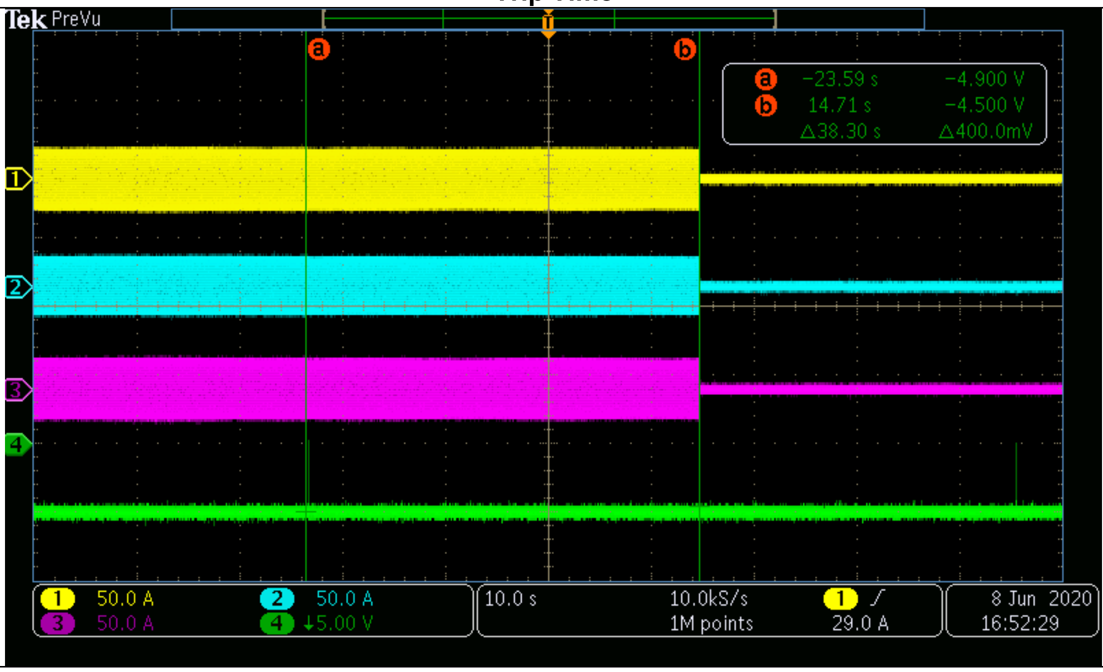
U < 85% Un (Phase ABC)
Trip Value



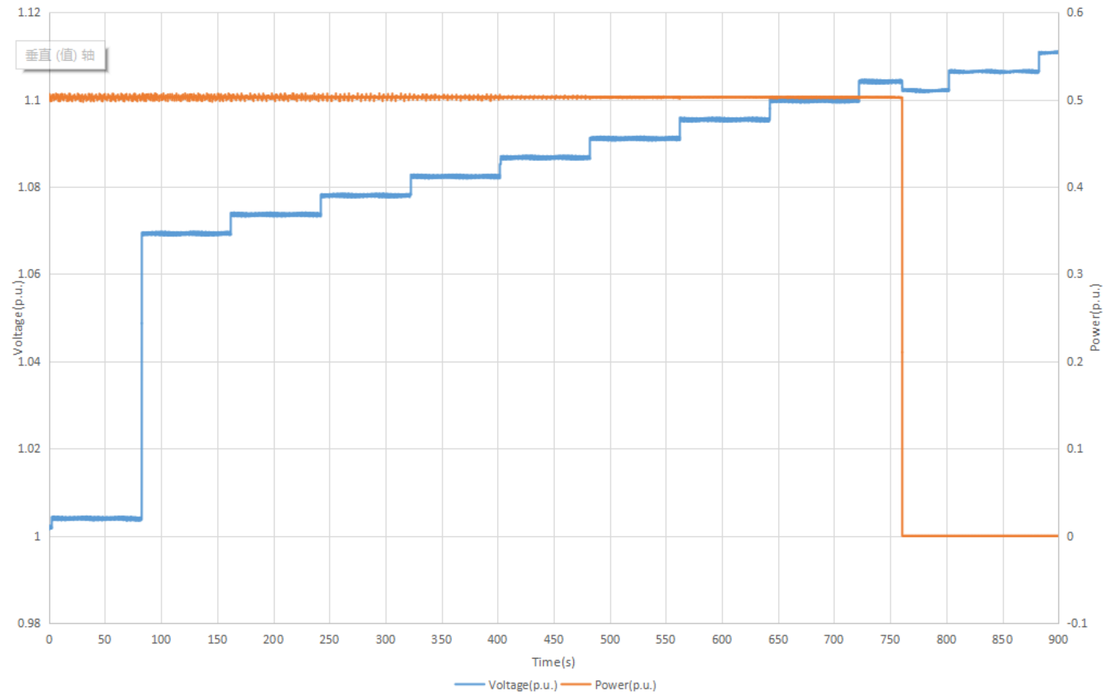
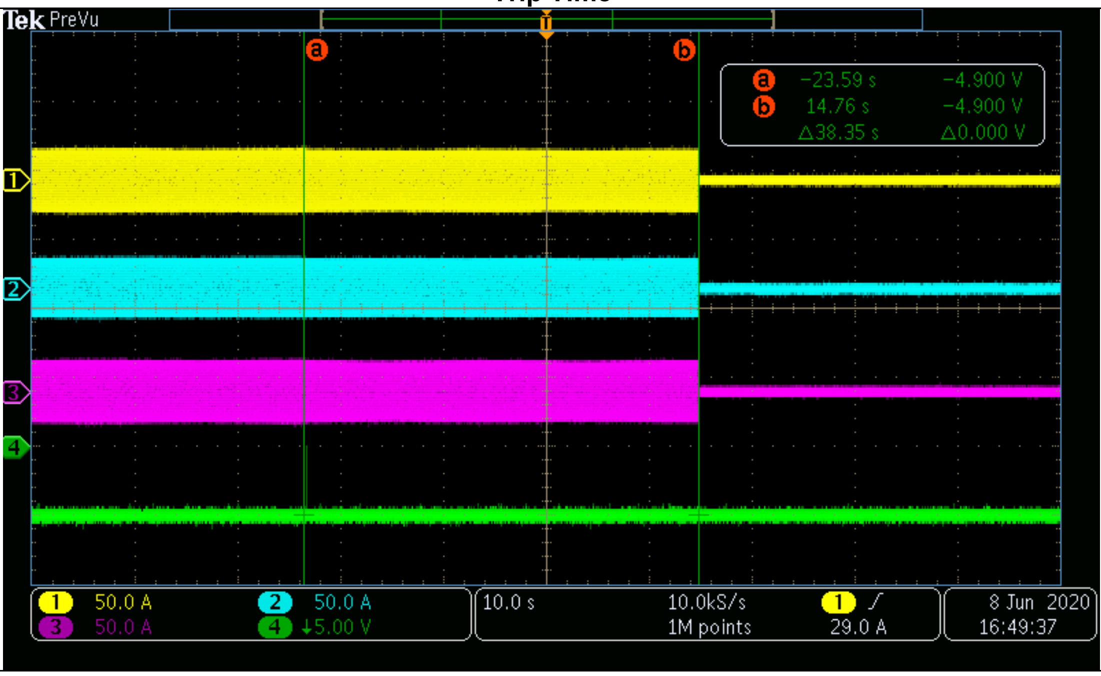
Trip Time



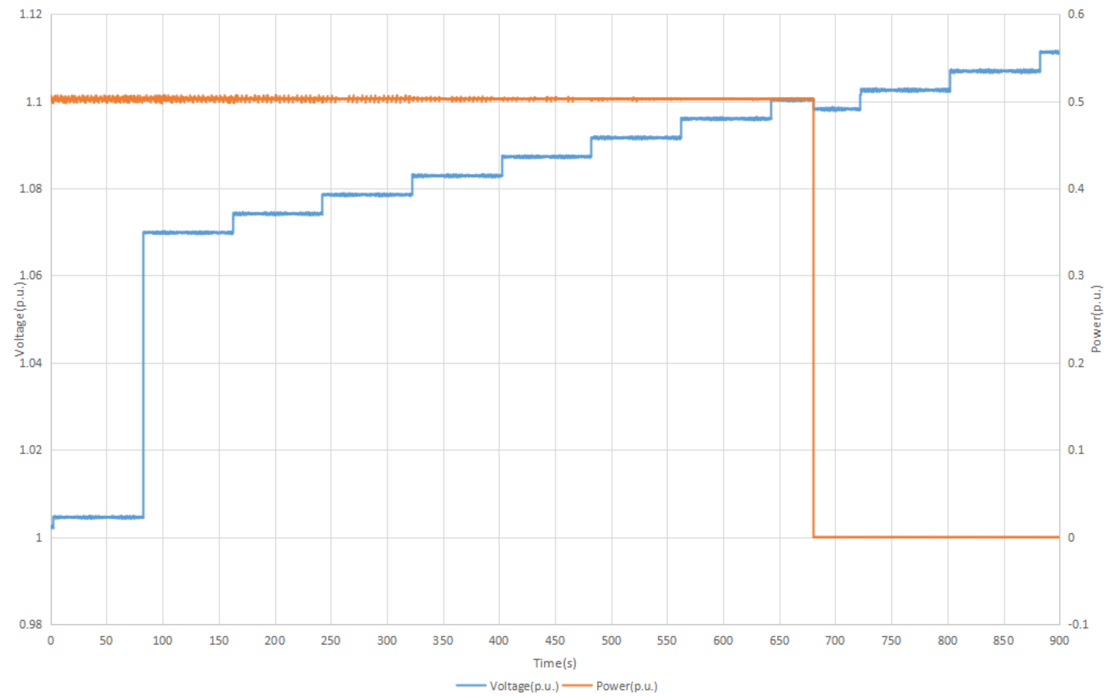
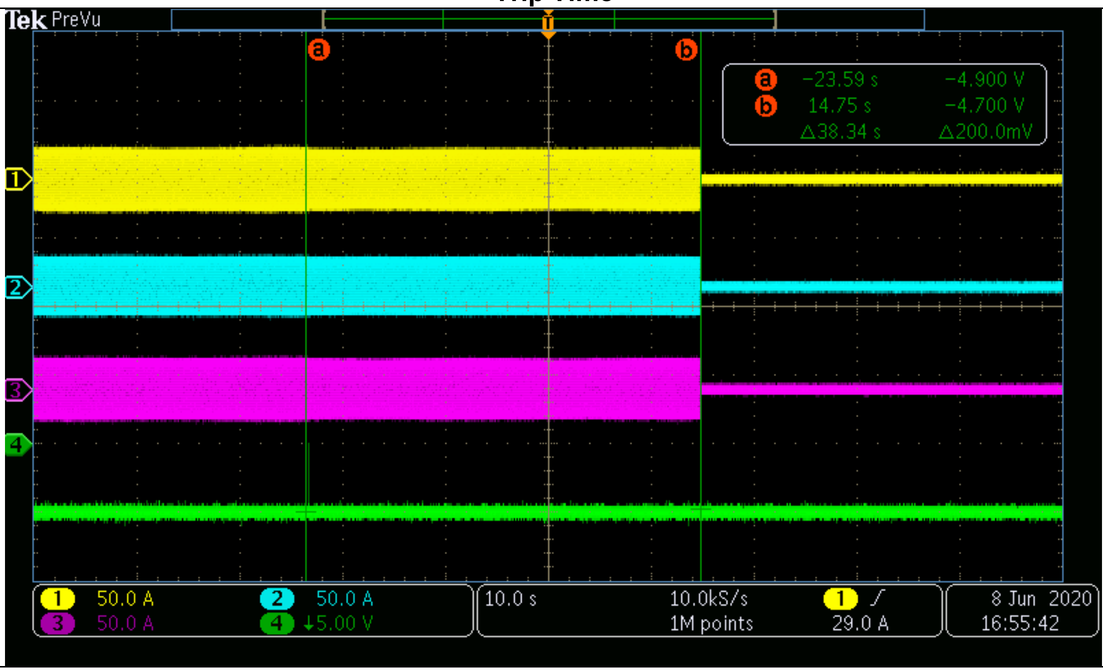
TEST RESULTS

U > 110% Un (Phase A)
Trip Value

Trip Time


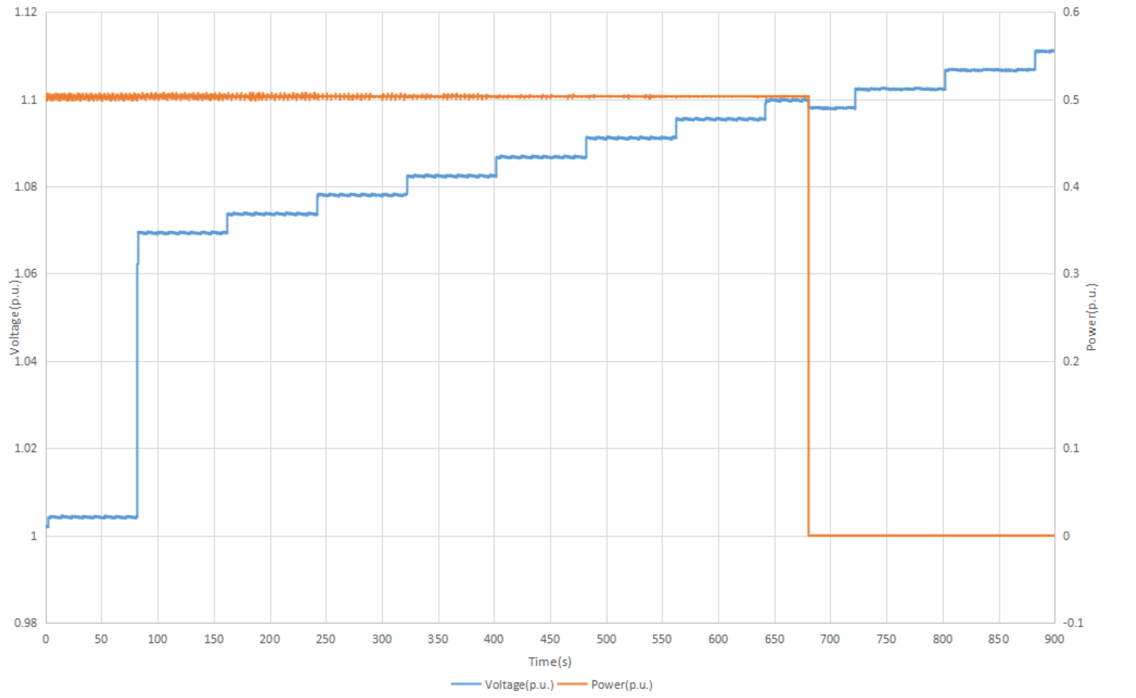
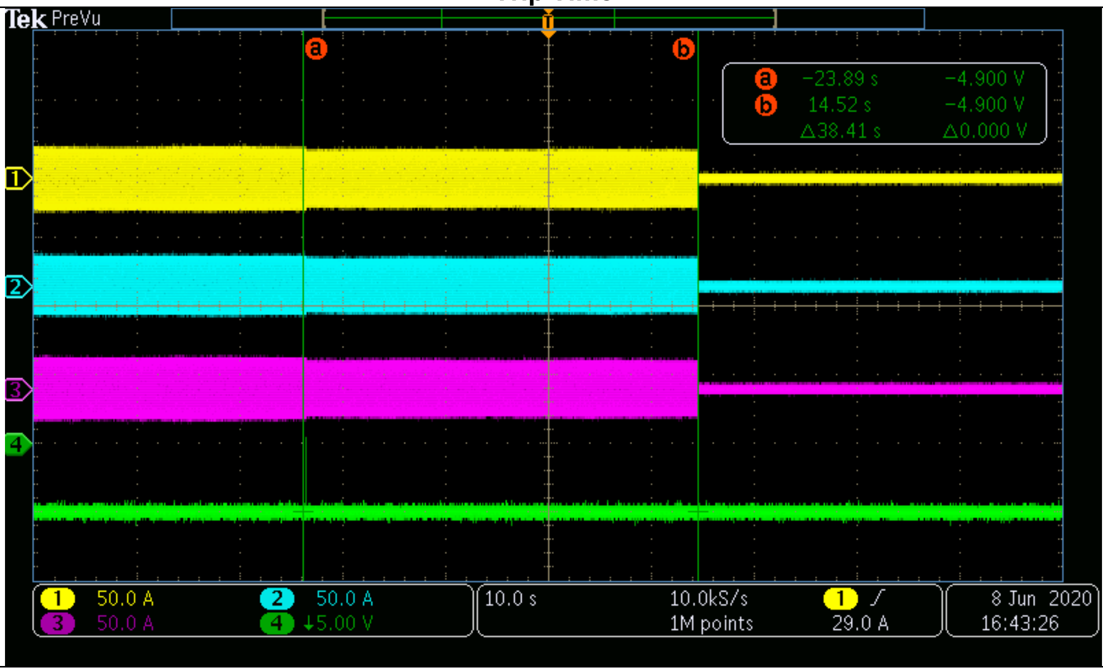
TEST RESULTS

U > 110% Un (Phase B)
Trip Value

Trip Time


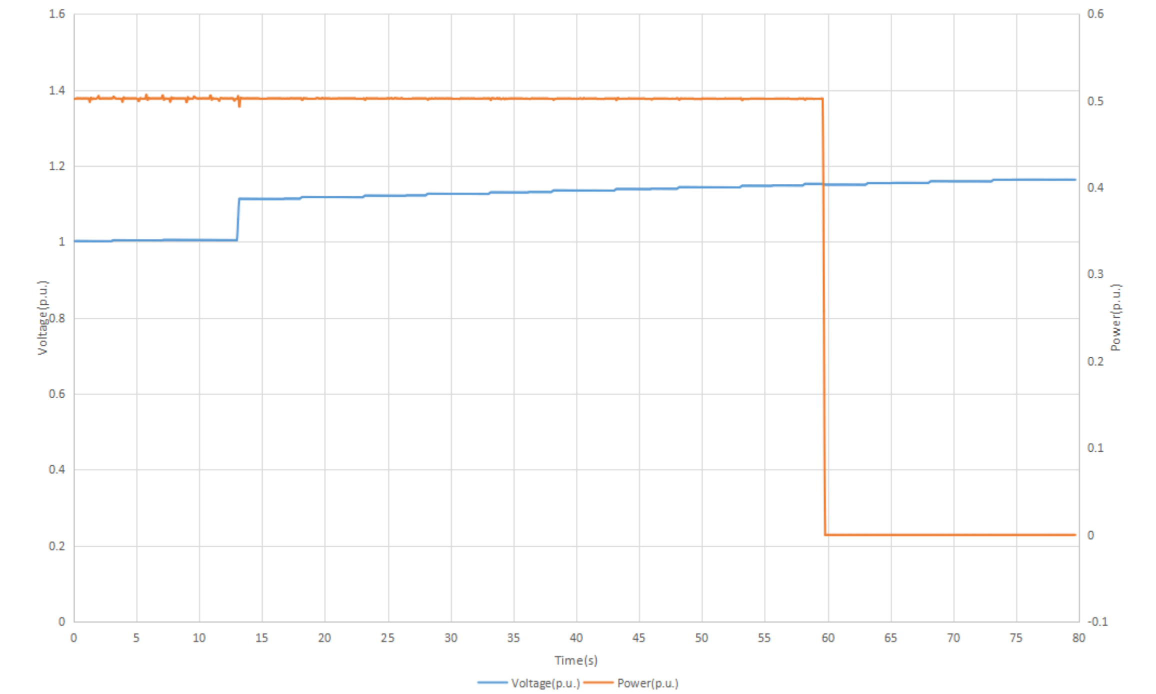
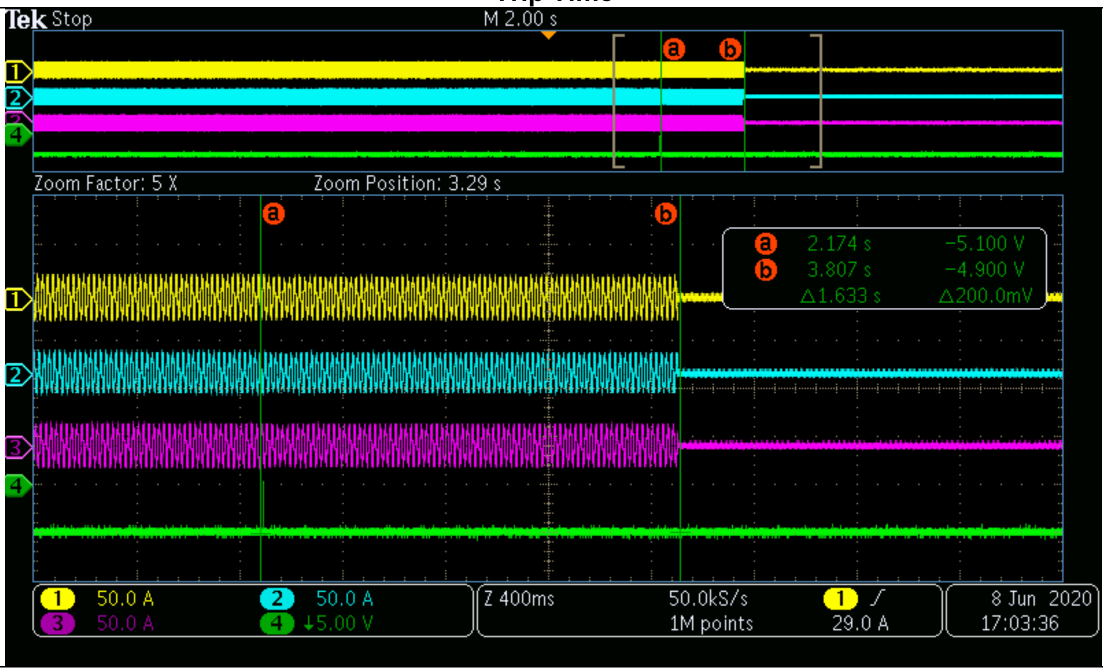
TEST RESULTS

U > 110% Un (Phase C)
Trip Value

Trip Time


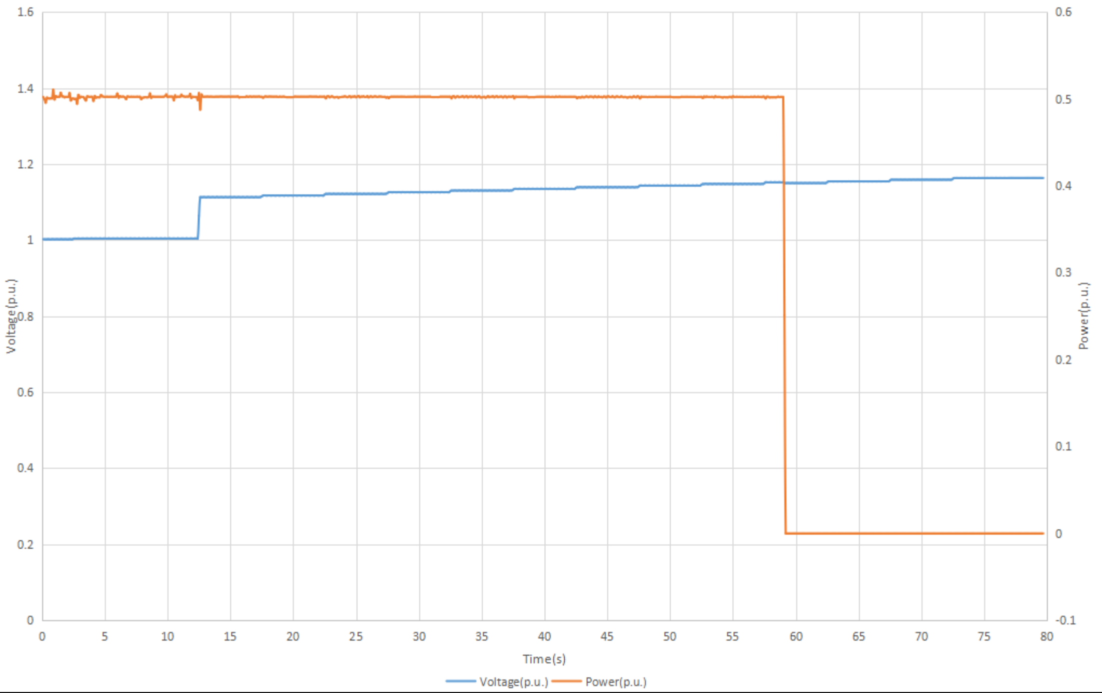
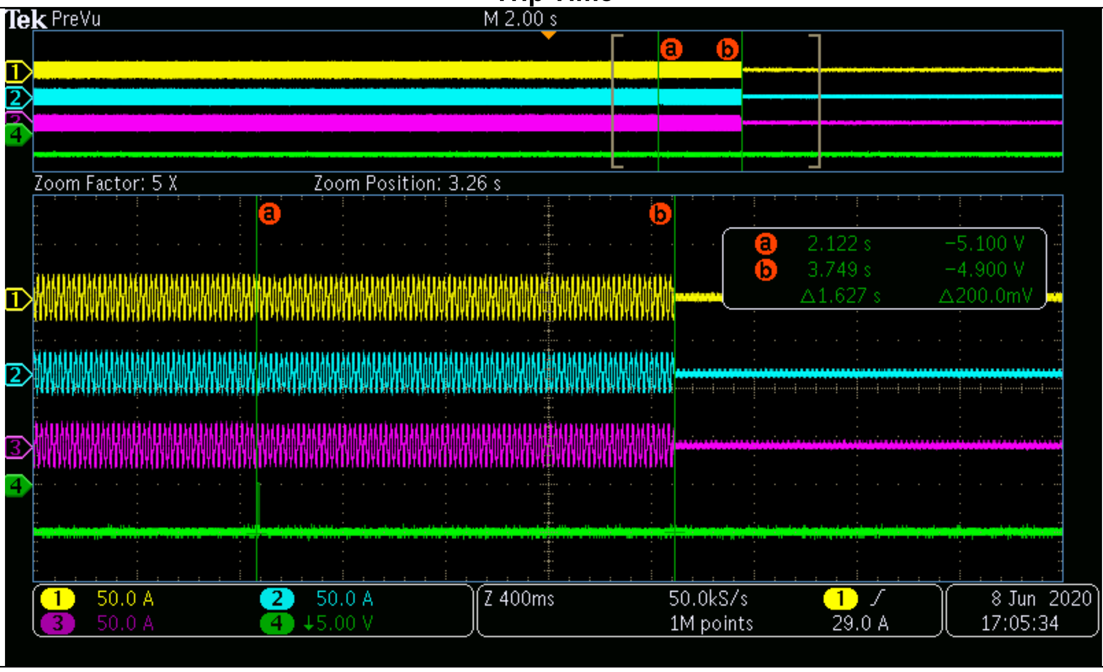
TEST RESULTS

U > 110% Un (Phase ABC)
Trip Value

Trip Time


TEST RESULTS

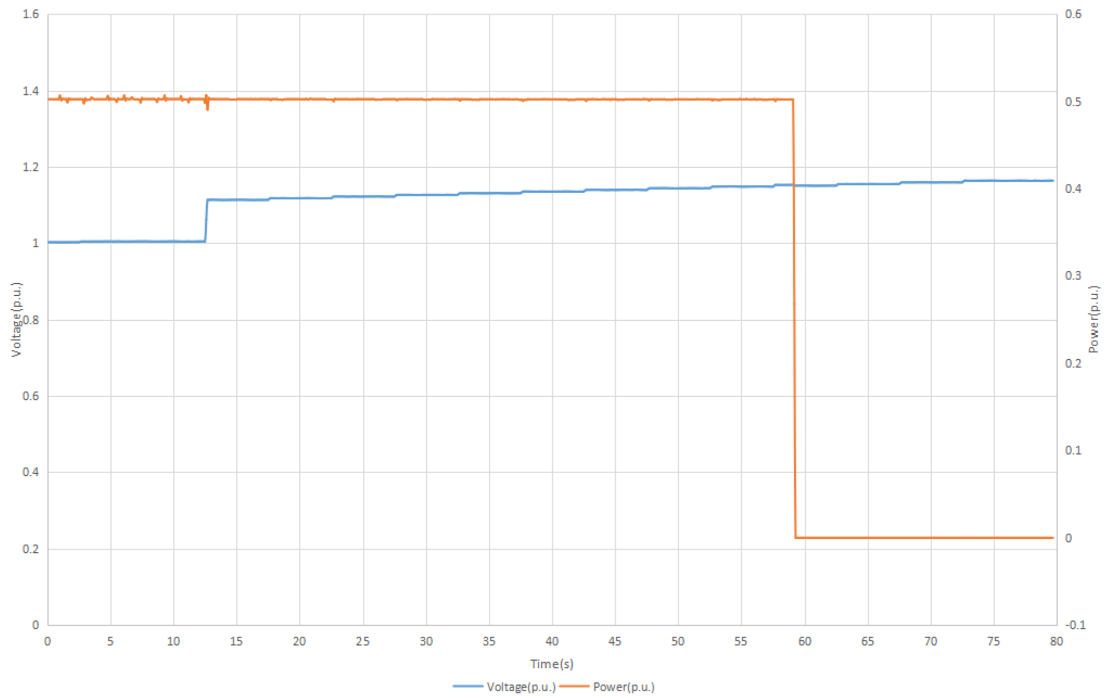
U > 115% Un (Phase A)
Trip Value

Trip Time


TEST RESULTS

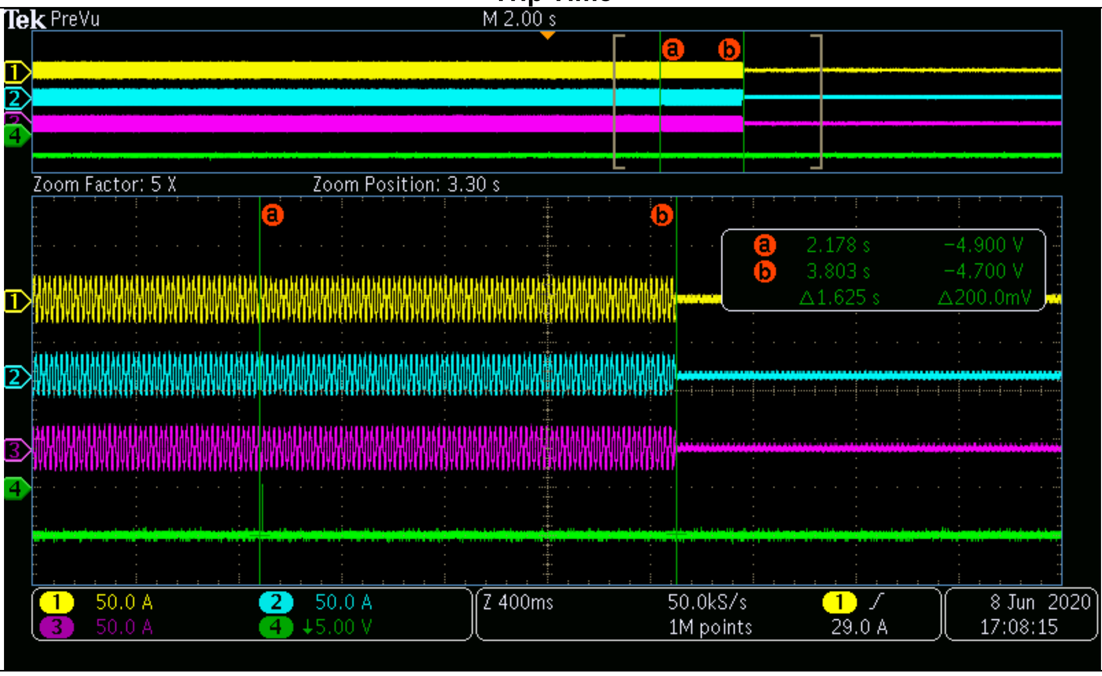
U > 115% Un (Phase B)
Trip Value

Trip Time


TEST RESULTS

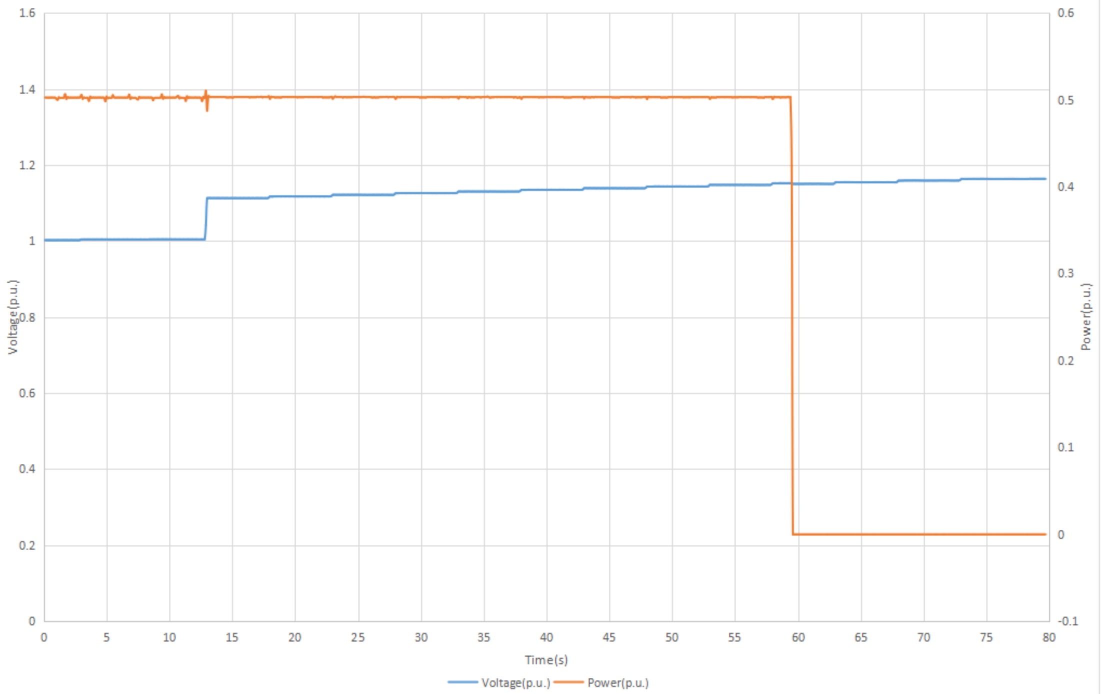
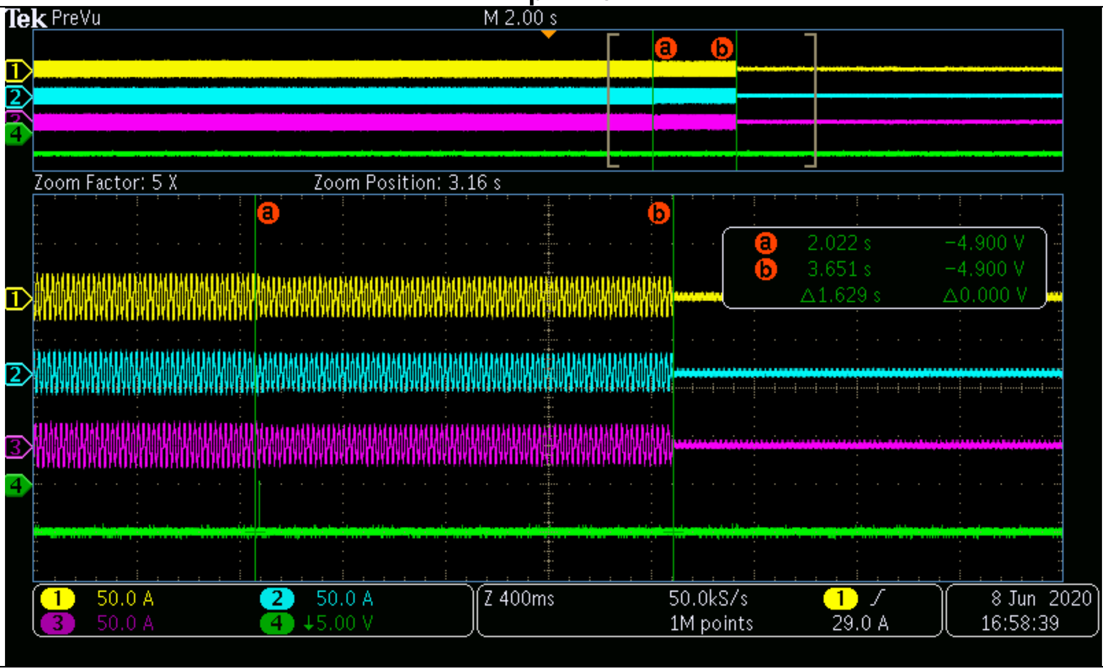
U > 115% Un (Phase C)
Trip Value



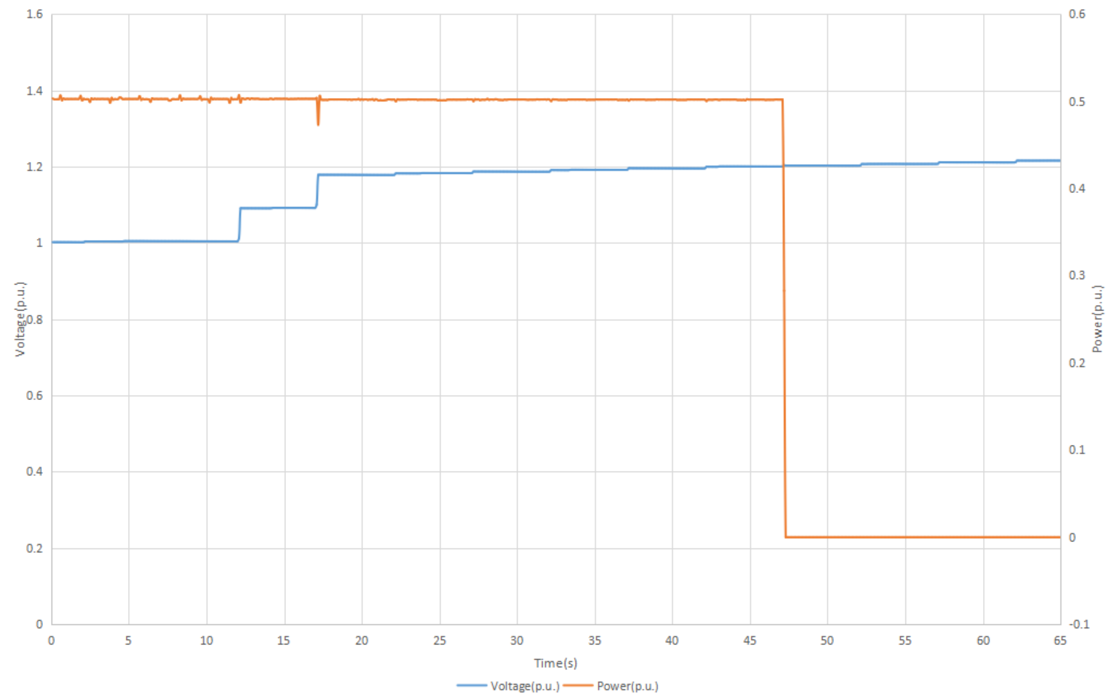
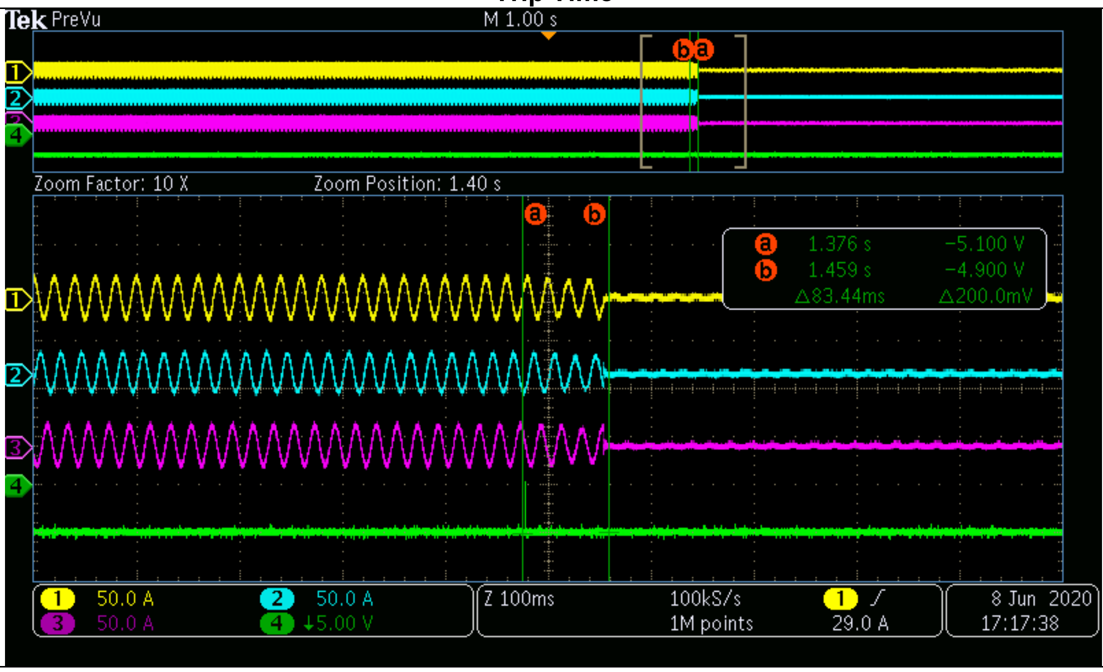
Trip Time



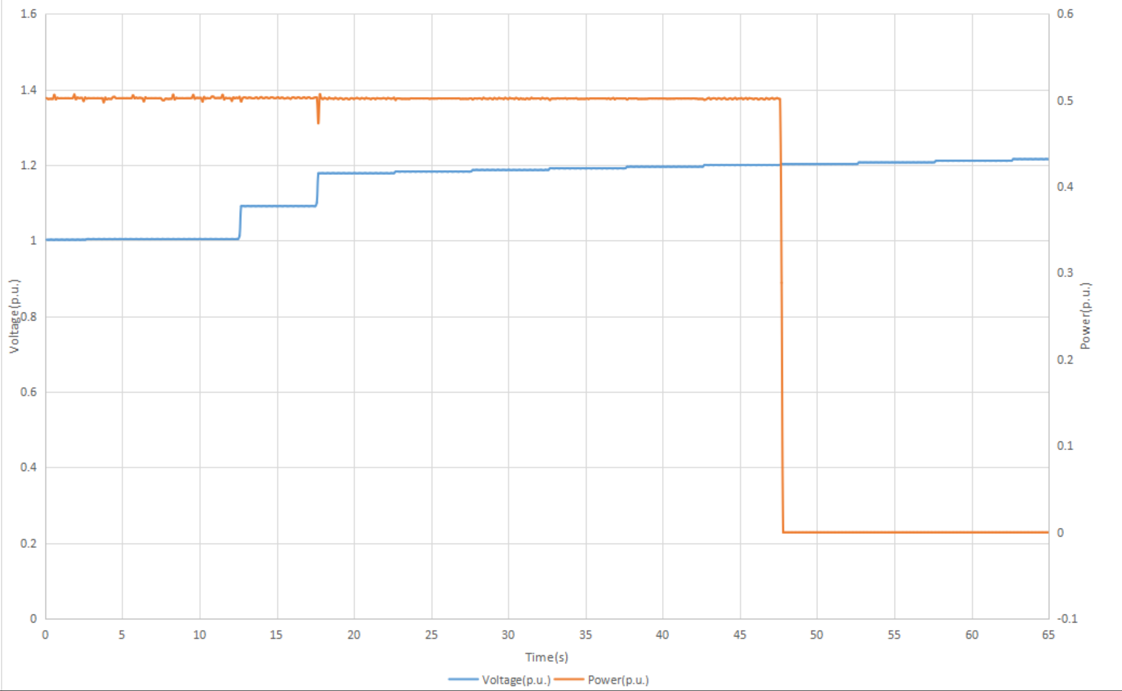
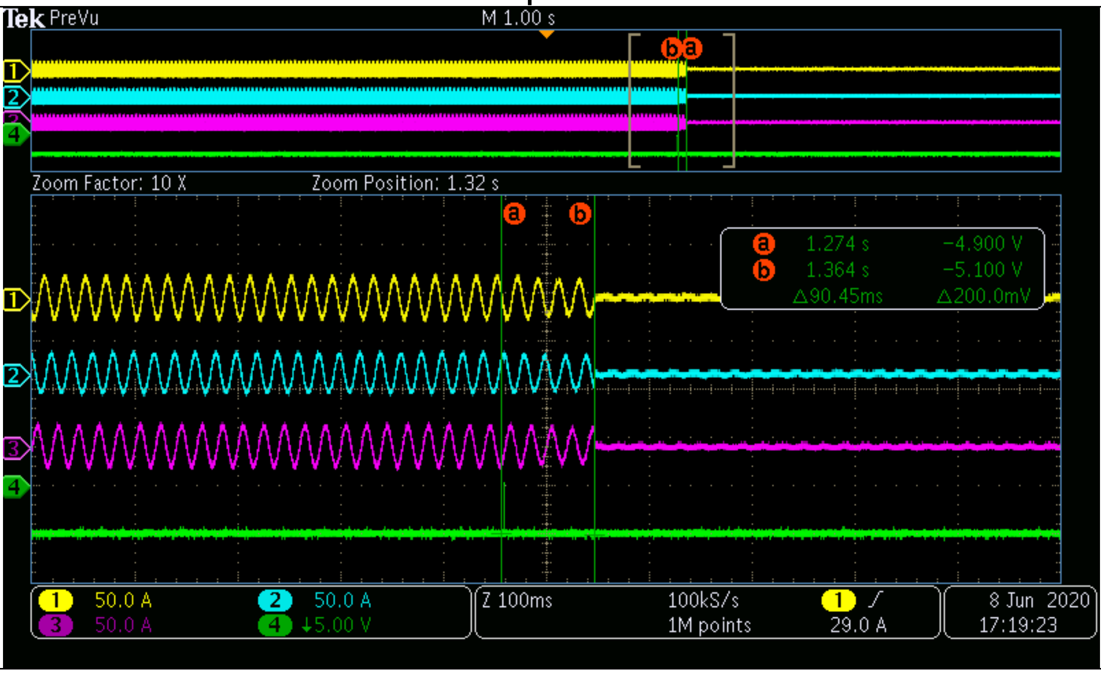
TEST RESULTS

U > 115% Un (Phase ABC)
Trip Value

Trip Time


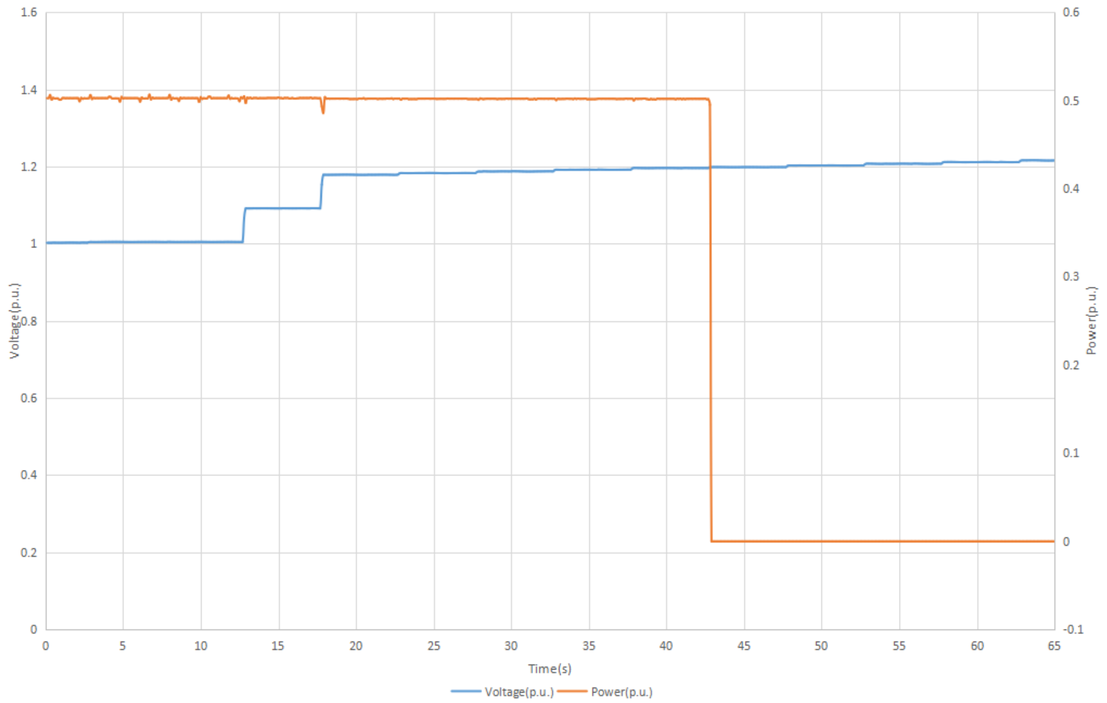
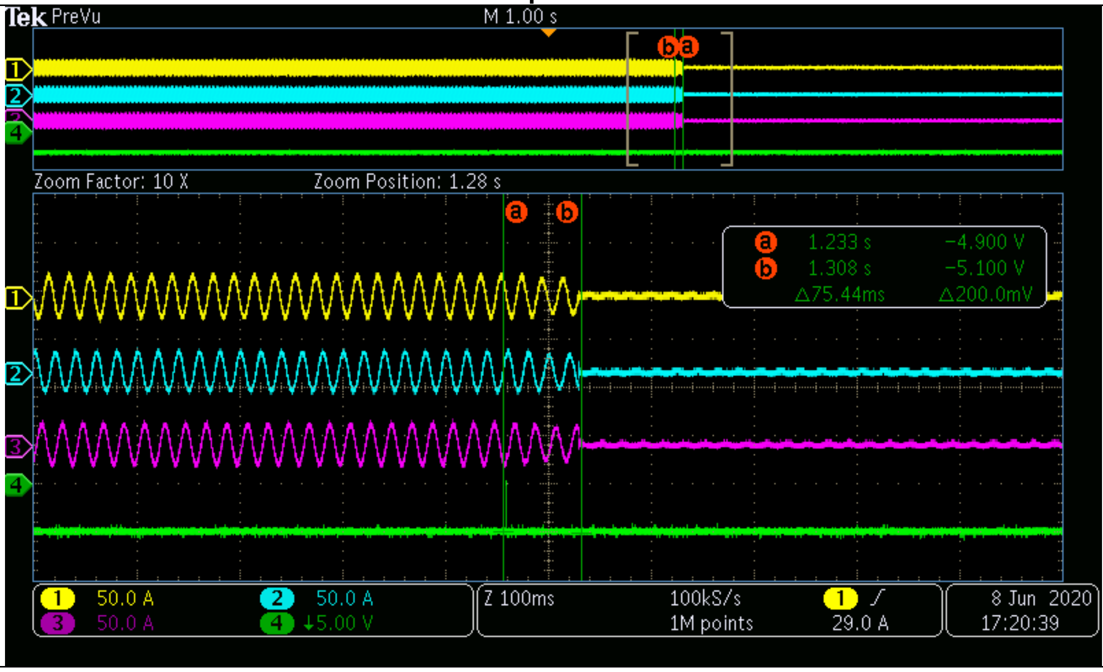
TEST RESULTS

U > 120% Un (Phase A)
Trip Value

Trip Time


TEST RESULTS

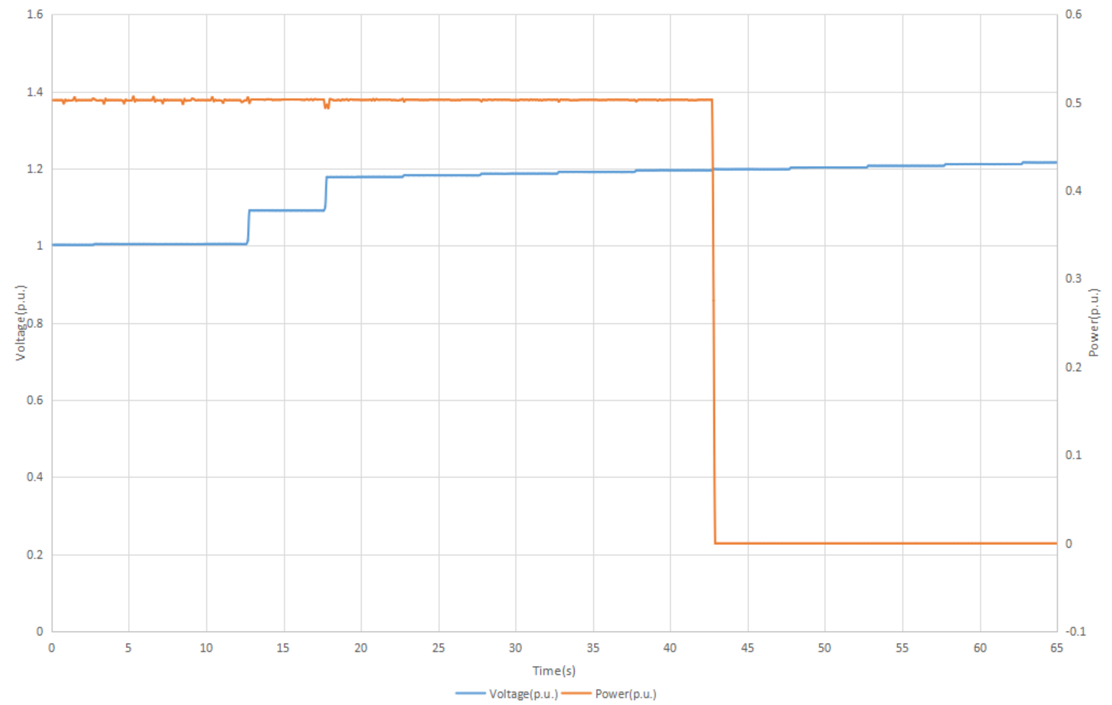
U > 120% Un (Phase B)
Trip Value

Trip Time


TEST RESULTS

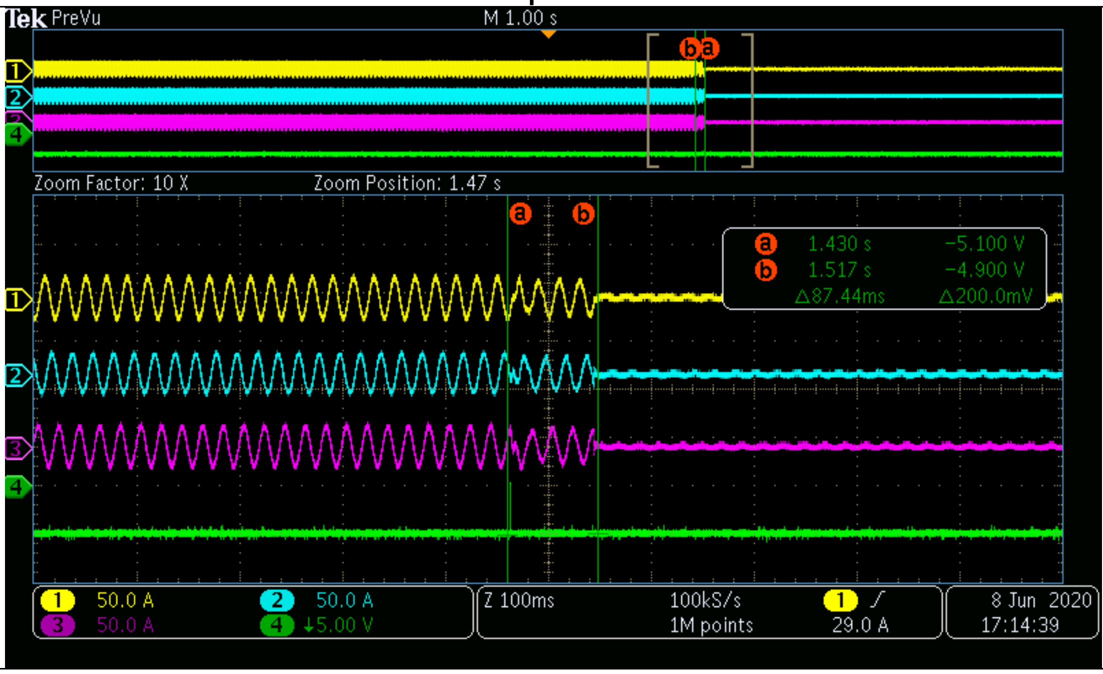
U > 120% Un (Phase C)
Trip Value

Trip Time


TEST RESULTS

U > 120% Un (Phase ABC)
Trip Value



Trip Time



13.3 HLVRT

Disconnection device have been considered according to Clause 4.2.2.3.2 of the standard, the EUT is defined as category A2 and A3. Category A3 SSEG shall be able to ride through low and/or high voltage events in accordance with the RPP Grid Code.

RPPs of *Categories A3, B* and *C* shall be designed to withstand and fulfil, at the *POC*, voltage conditions described in this section and illustrated in Figures 4, 4a, 4b and 5 below. The Area D is only applicable to *category C* RPPs.

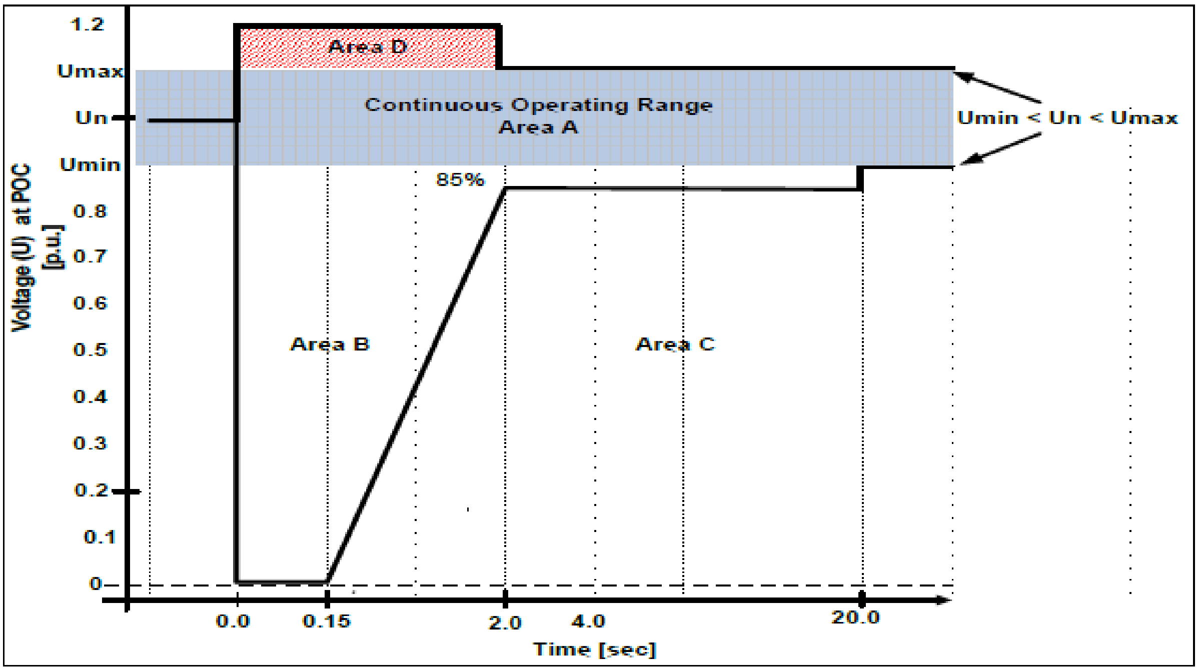


Figure 4: Voltage Ride through Capability for the RPPs of Category A3, B and C utilising non-synchronous machines

In connection with symmetrical fault sequences in areas B and D of Figures 4, 4a and 4b, the *RPP* (other than synchronous generating units) shall have the capability of controlling the reactive current, as illustrated in Figure 5. The following requirements shall be complied with:

(a) Area A: The *RPP* shall stay connected to the network and uphold normal reduction.

(b) Area B: The *RPP* shall stay connected to the network and in addition*:*
(i) *RPPs* of *category* A3 shall not inject any reactive current into the network;
(ii) *RPPs* of *category B* and *category C* shall provide maximum voltage support by supplying a controlled amount of reactive current so as to ensure that the *RPP* assists in stabilizing the voltage as shown in Figure 5;
(iii) Inverter driven *RPPs* of *category B* and *category C* shall be able to disable reactive current support functionality at the request of *SO* or local network operator*.*

(c) Area D: The *RPP* shall stay connected to the network and provide maximum voltage support by absorbing a controlled amount of reactive current so as to ensure that the *RPP* helps to stabilize the voltage within the design capability offered by the *RPP*, see Figure 5.

(d) Area E (Figure 5): Once the voltage at the *POC* is below 20%, the *RPP* shall continue to supply reactive current within its technical design limitations so as to ensure that the *RPP* helps to stabilize the voltage. Disconnection is only allowed after conditions of Figures 4, 4a and 4b have been fulfilled.

Control shall follow Figure 5 so that the reactive current follows the control characteristic with a tolerance of ±20% after 60 ms.

The supply of reactive power has first priority in area B, while the supply of active power has second priority. Active power shall be maintained during voltage drops, but a reduction in active power within the *RPP's* design specifications is required in proportion to voltage drop for voltages below 85%.

Upon clearance of fault each *RPP* shall restore active power production to at least 90% of the level available immediately prior to the fault within 1 second.

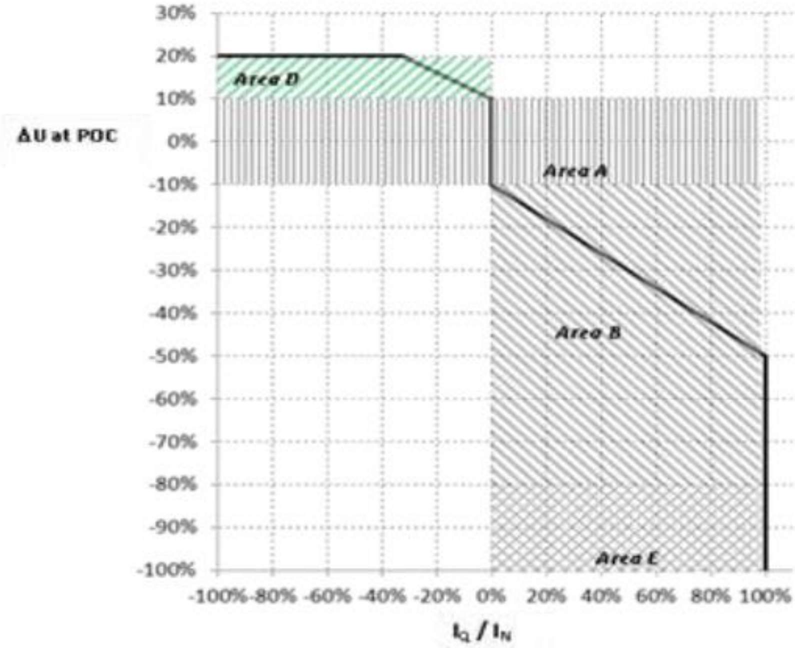


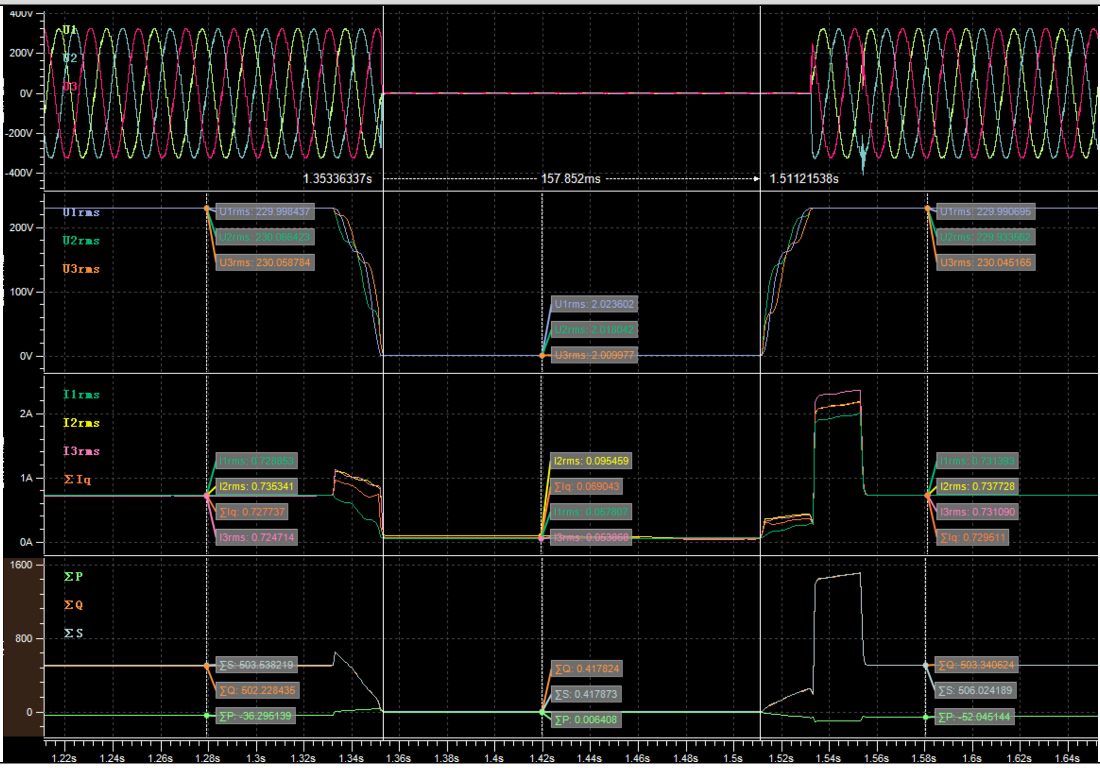
Figure 5: Requirements for Reactive Power Support, I_Q, during voltage drops or peaks at the *POC*

Test Nr.	Fault Type Output Power (%Pn)	Residual Voltage (%Un)		Fault duration (ms)		Time Measured (ms)	
		Desired	Measured	Desired	Measured	Active power recovery	Reactive power rise during fault
Test 1.1	3-Phase Fault No load	0 %	0.9%	> 150	158	NA	NA
Test 1.2	3-Phase Fault Partial load (20%)		2.7%		179	139	NA
Test 1.3	3-Phase Fault Full load		2.7%		178	207	NA
Test 1.4	2-Phase Fault No load		0.9%		158	NA	NA
Test 1.5	2-Phase Fault Partial load (20%)		0.9%		159	216	NA
Test 1.6	2-Phase Fault Full load		0.9%		159	238	NA
Test 1.7	1-Phase Fault No load		0.9%		158	NA	NA
Test 1.8	1-Phase Fault Partial load (20%)		0.8%		159	219	NA
Test 1.9	1-Phase Fault Full load		0.8%		160	267	NA

The results of reactive current in Test 1.2 and 1.3 are showing in the table below:

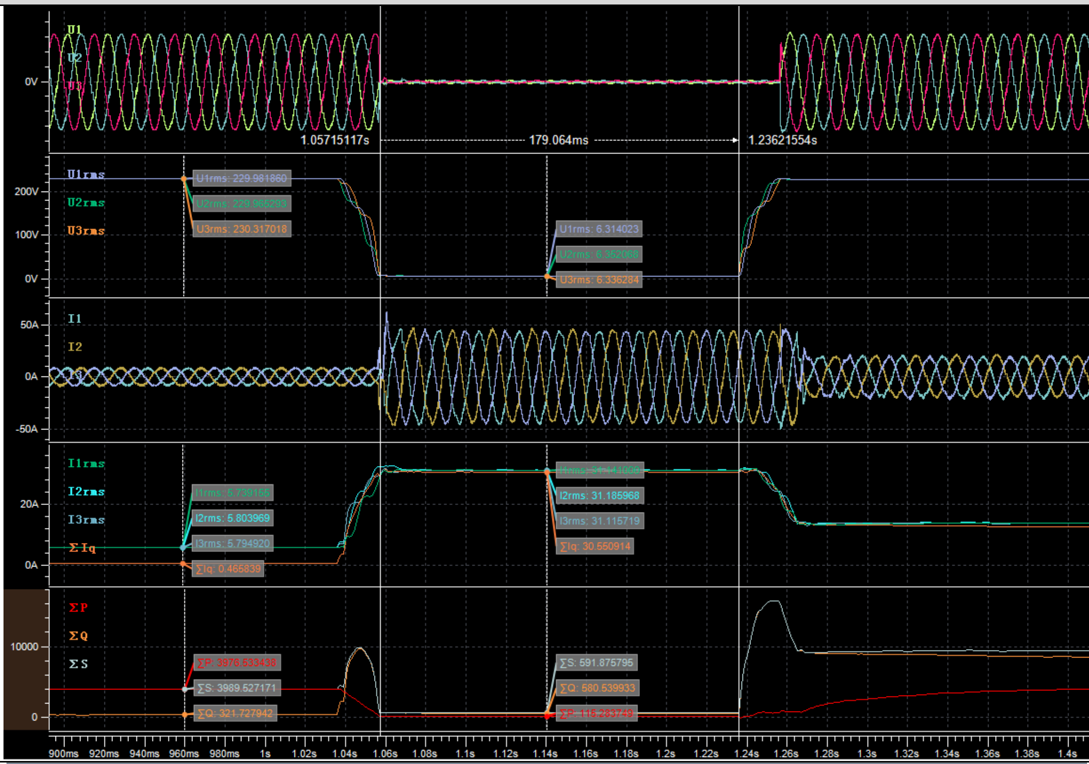
Test Nr.	Fault Type Output Power (%Pn)	Iq required (%In)	Iq measured (%In)
Test 1.2	3-Phase Fault Partial load (20%)	100 % ± 20%	105.4%
Test 1.3	3-Phase Fault Full load		105.4%

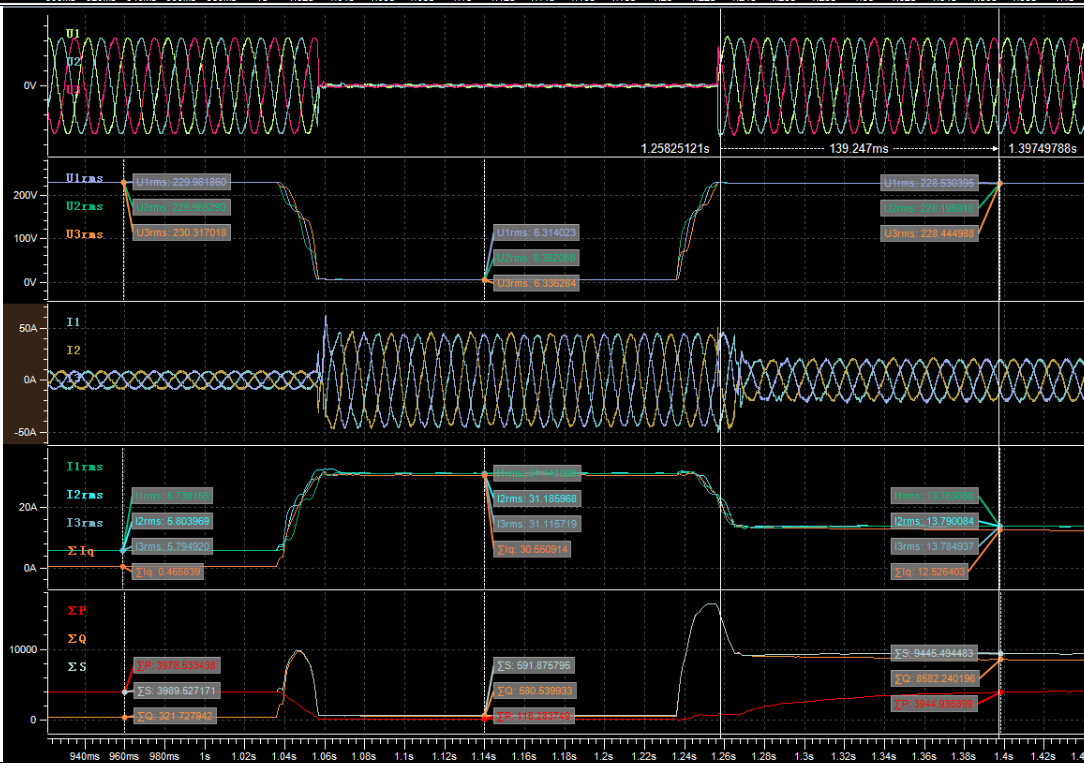
TEST RESULTS

Test 1.1: Symmetric fault at 0% of nominal power, t > 150 ms


TEST RESULTS

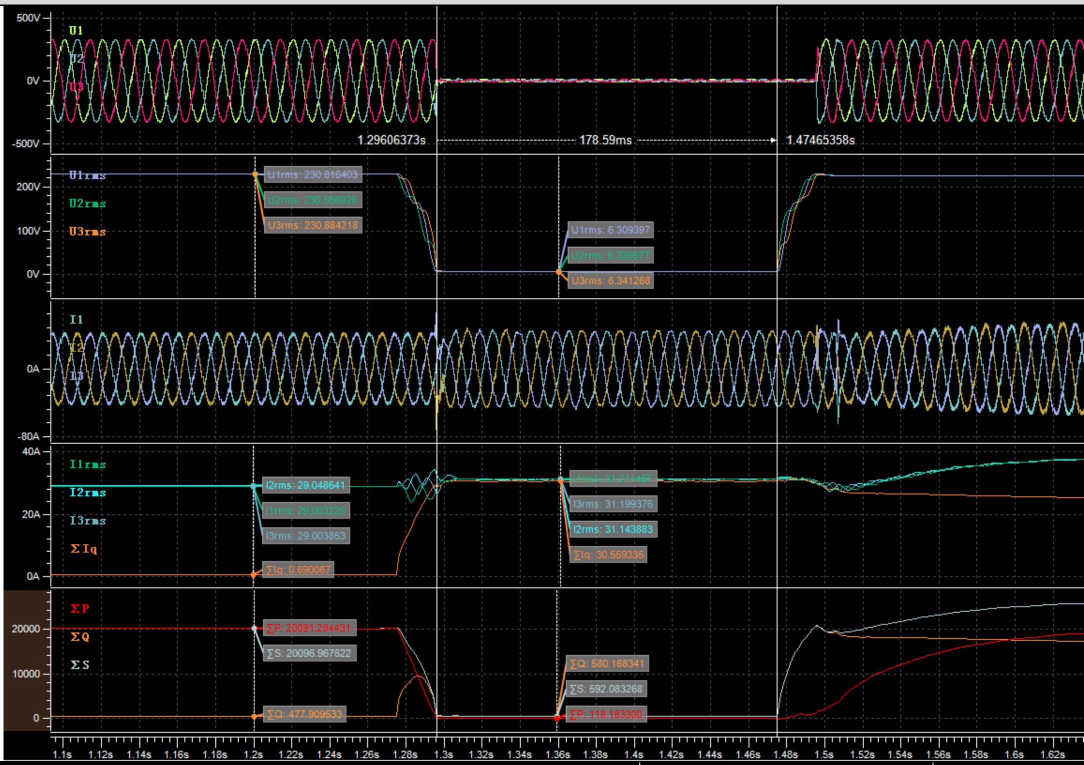
Test 1.2: Symmetric fault at 20% of nominal power, t > 150 ms

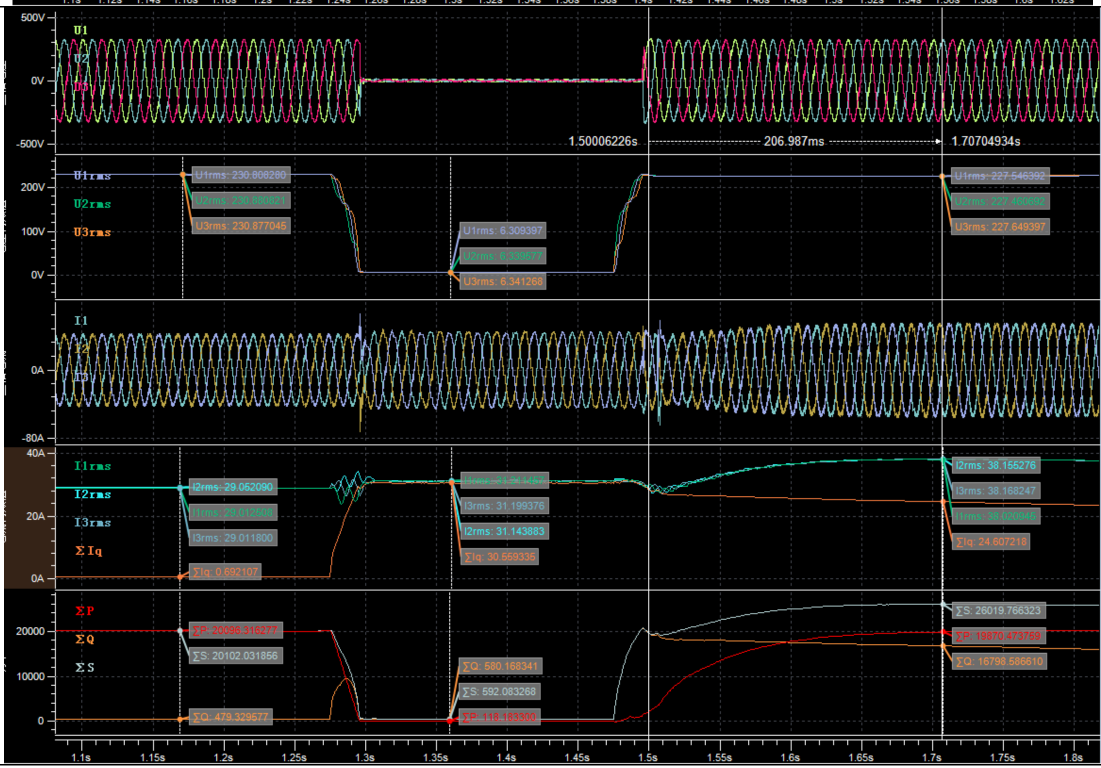




TEST RESULTS

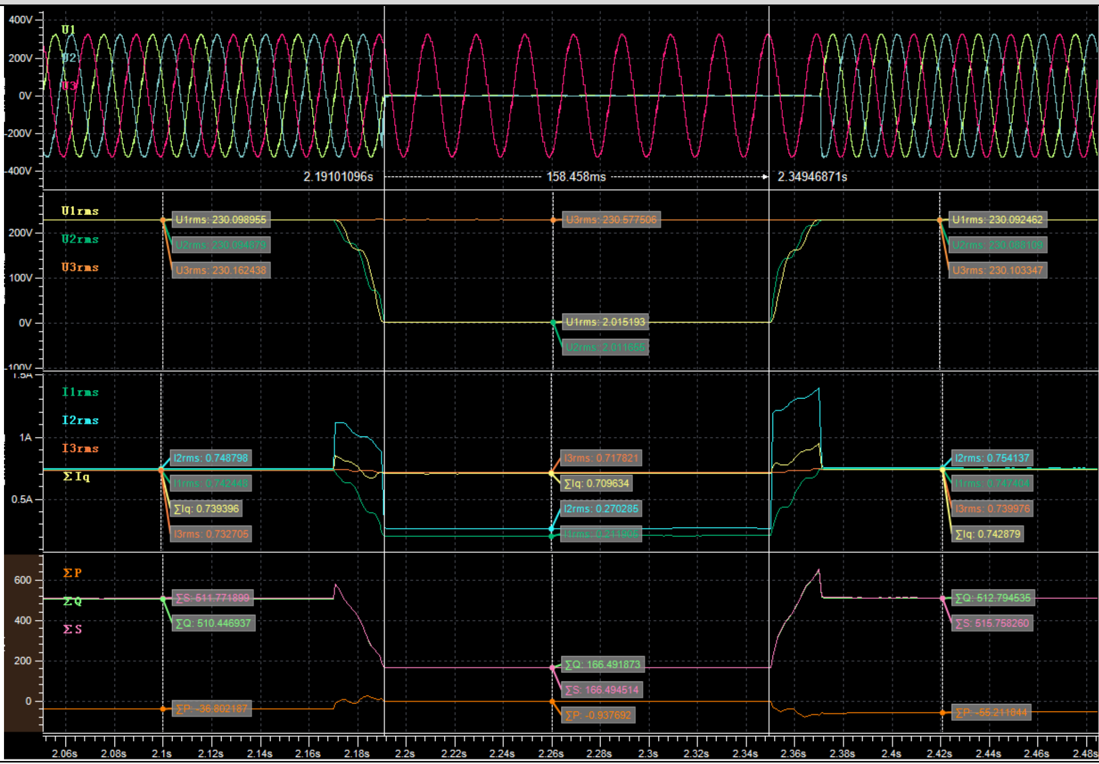
Test 1.3: Symmetric fault at 100% of nominal power, t > 150 ms





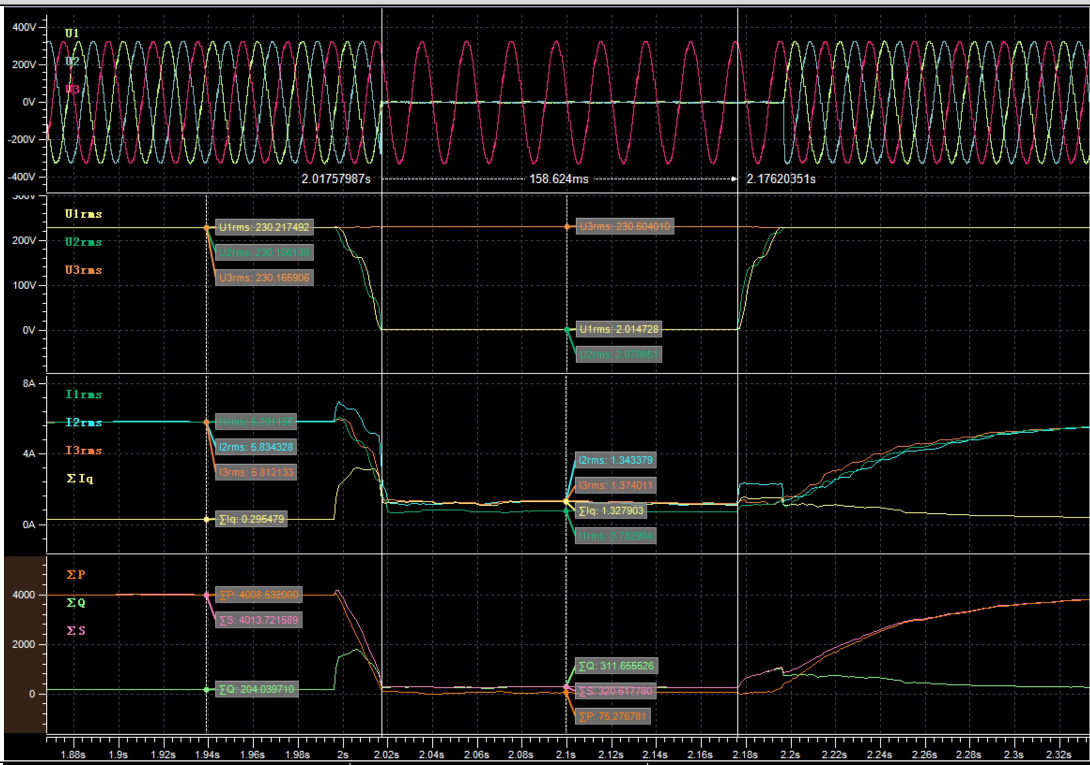
TEST RESULTS

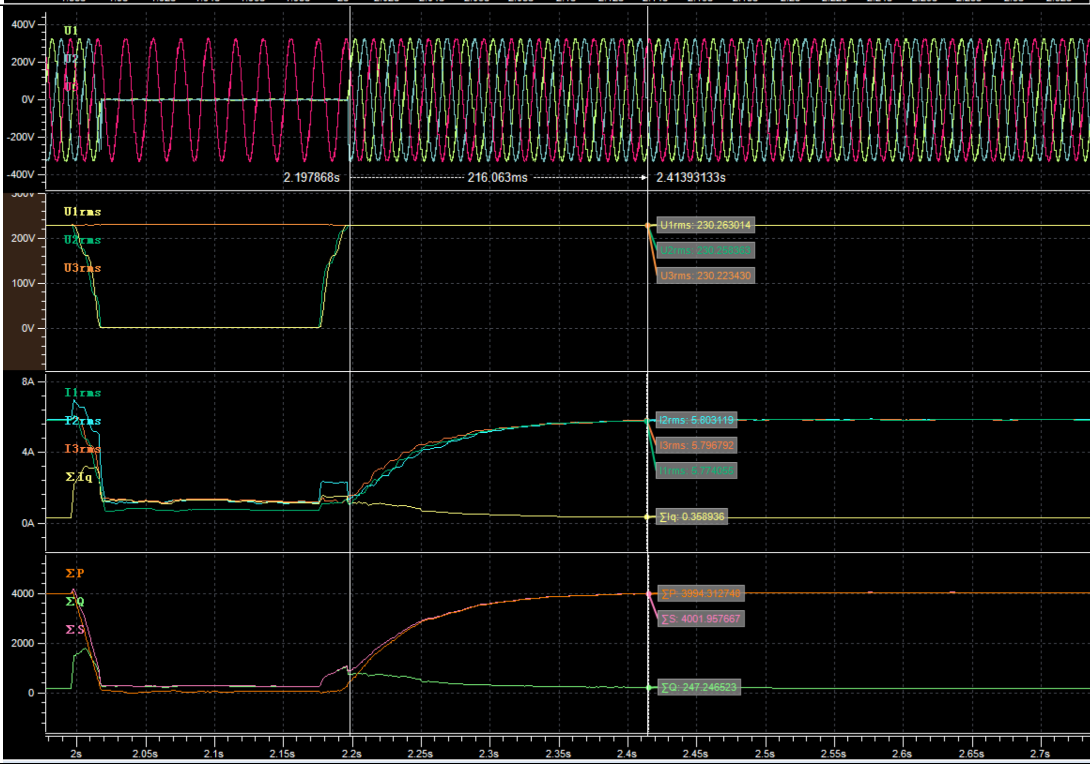
Test 1.4: Asymmetric two phase fault at 0% of nominal power, t > 150 ms



TEST RESULTS

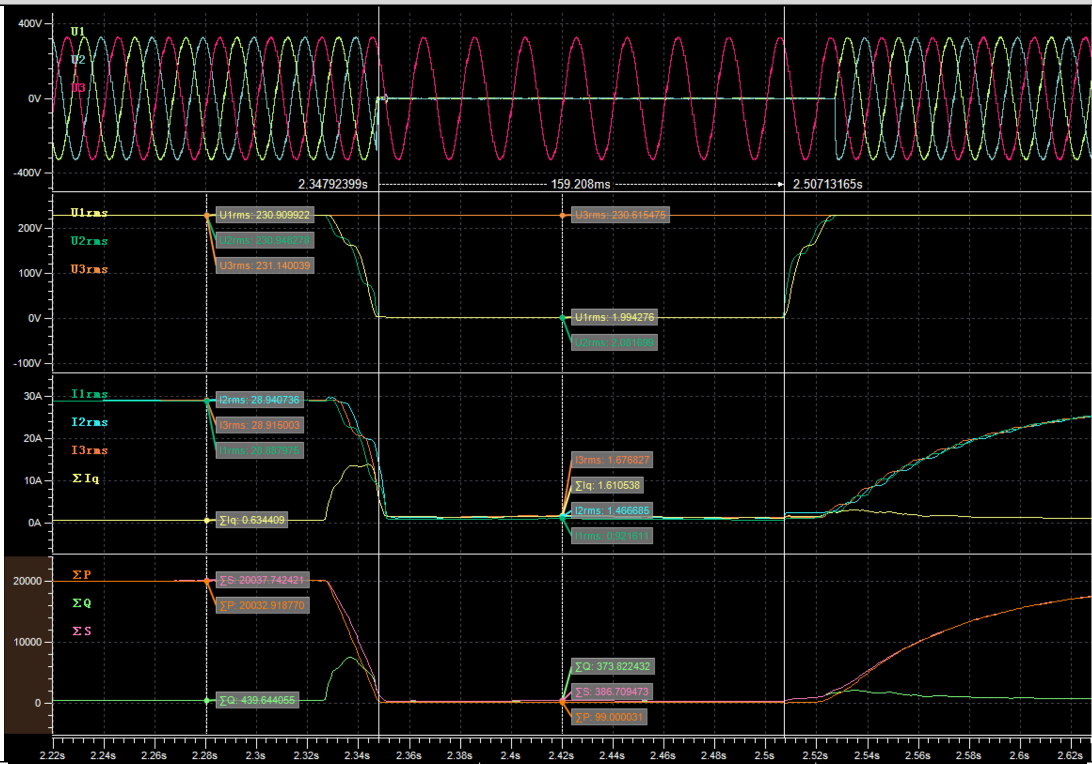
Test 1.5: Asymmetric two phase fault at 20% of nominal power, t > 150 ms

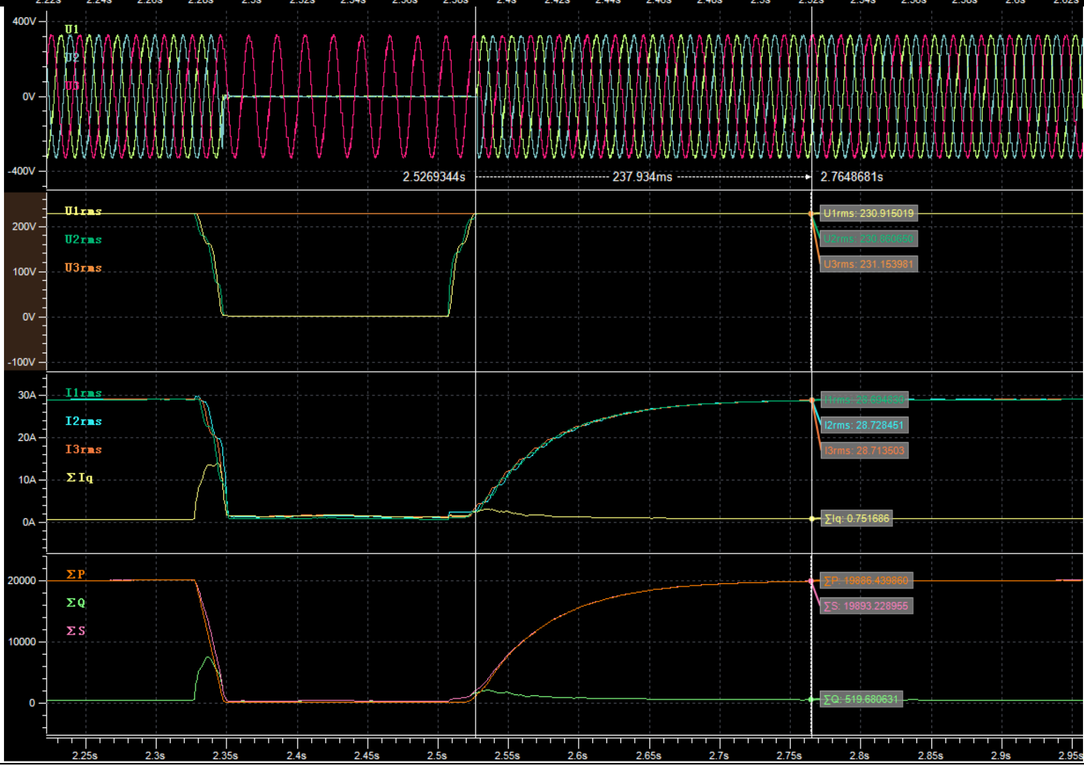




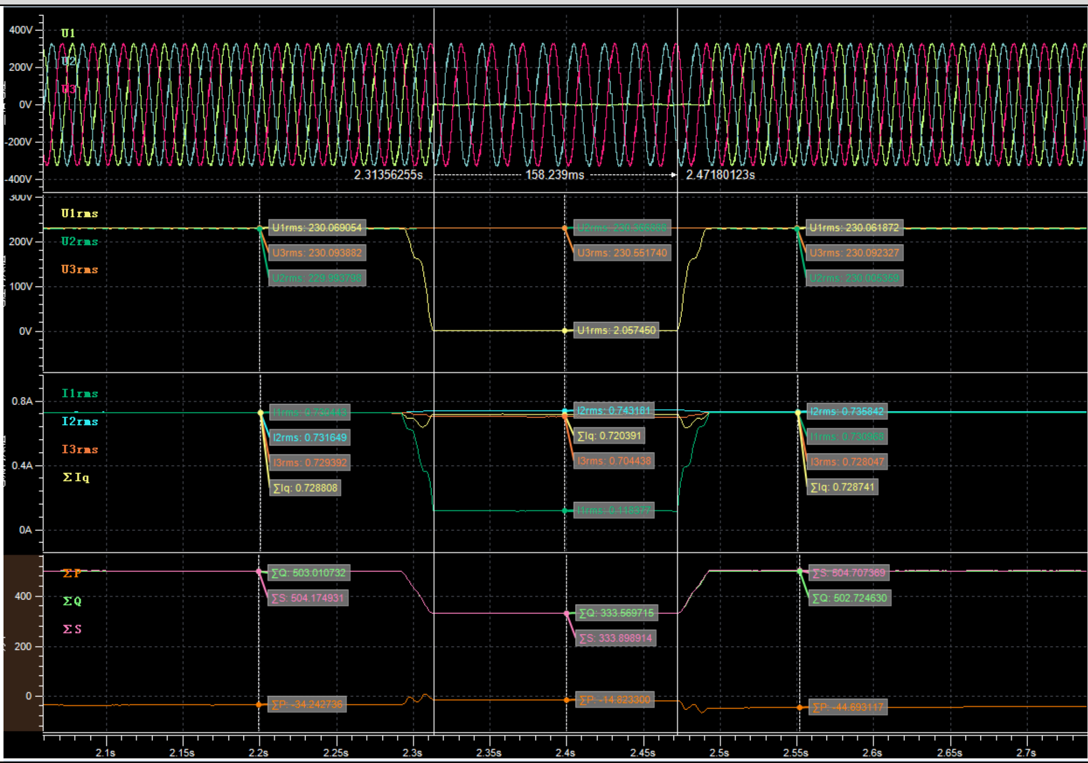
TEST RESULTS

Test 1.6: Asymmetric two phase fault at 100% of nominal power, t > 150 ms



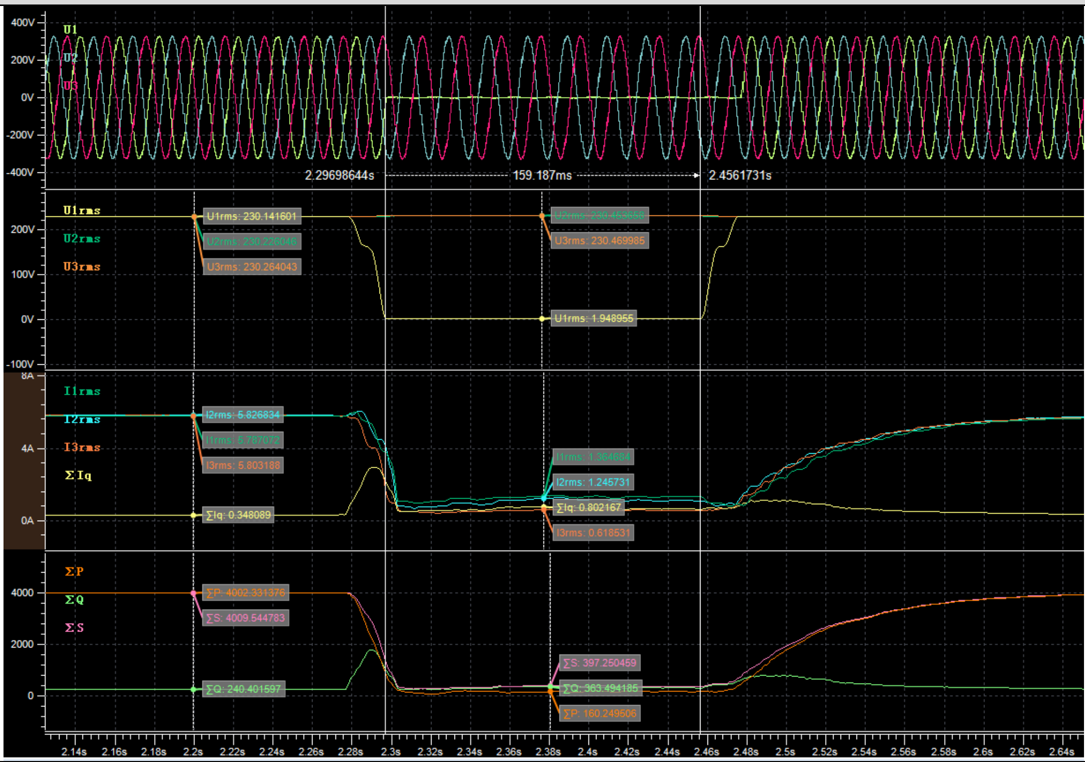


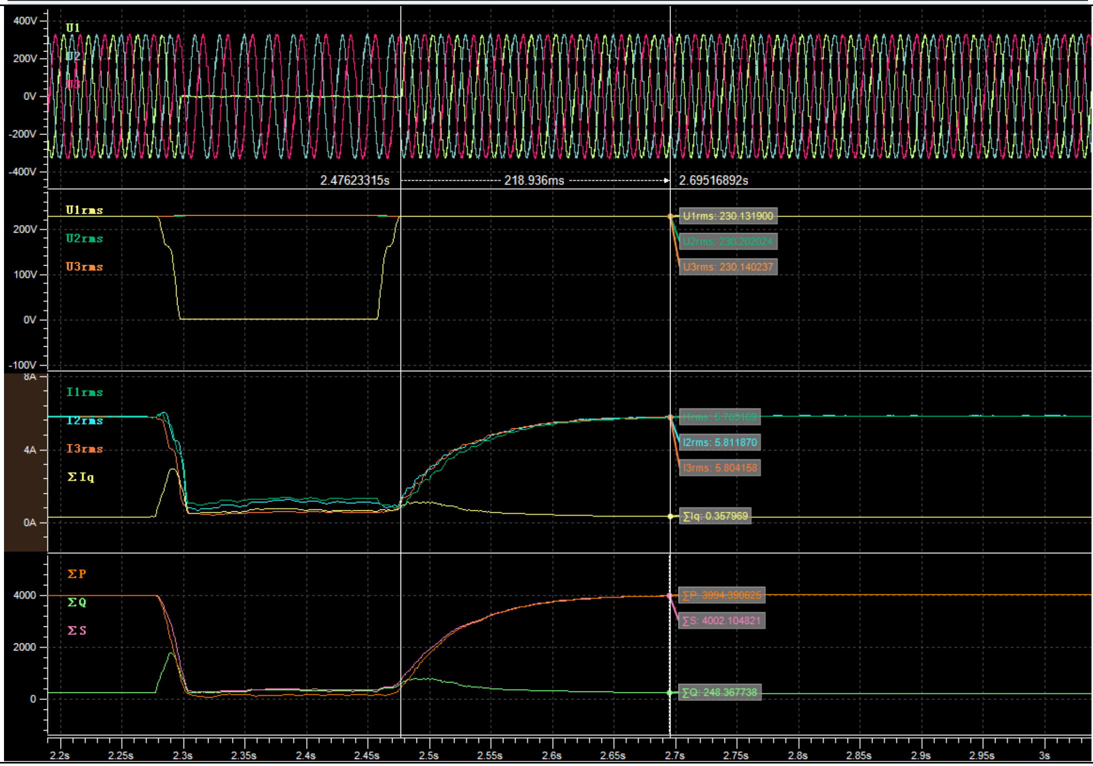
TEST RESULTS

Test 1.7: Asymmetric one phase fault at 0% of nominal power, t > 150 ms


TEST RESULTS

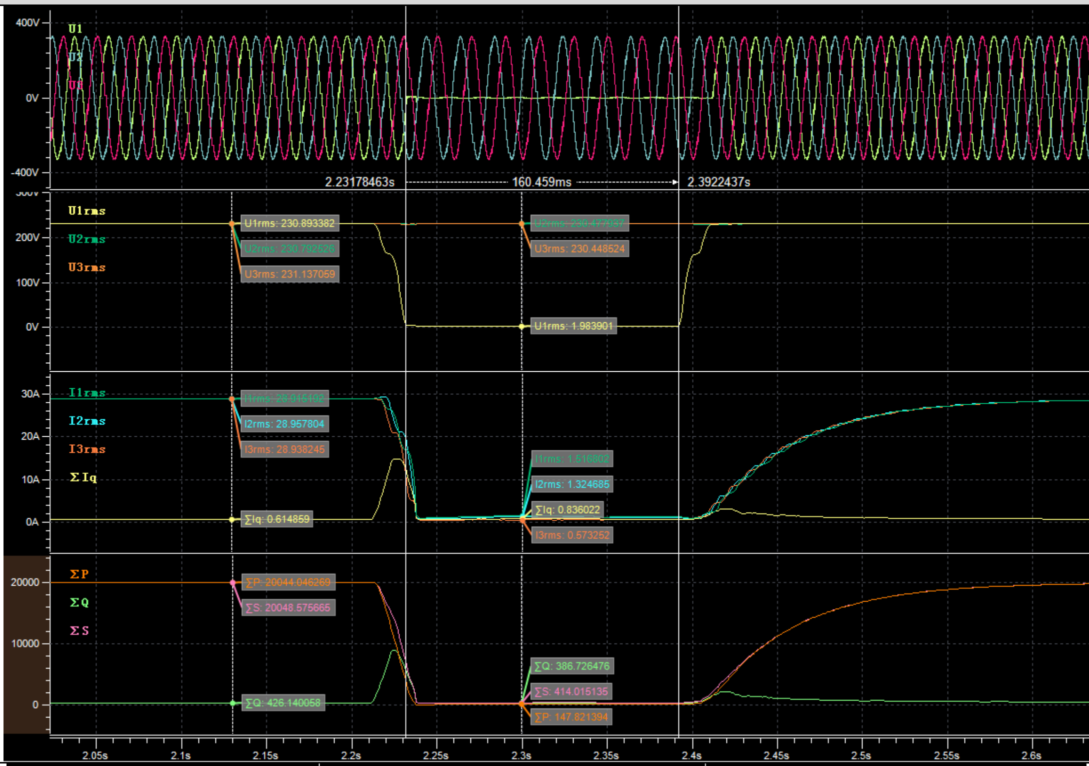
Test 1.8: Asymmetric one phase fault at 20% of nominal power, t > 150 ms

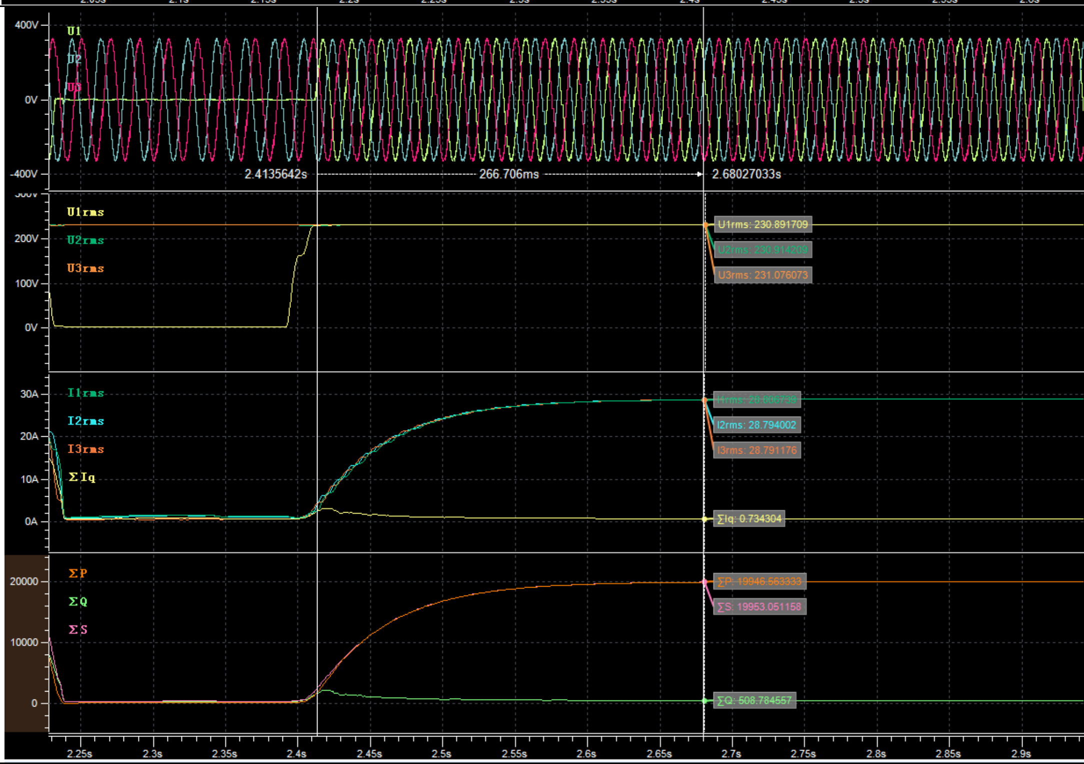




TEST RESULTS

Test 1.9: Asymmetric one phase fault at 100% of nominal power, t > 150 ms





TEST RESULTS

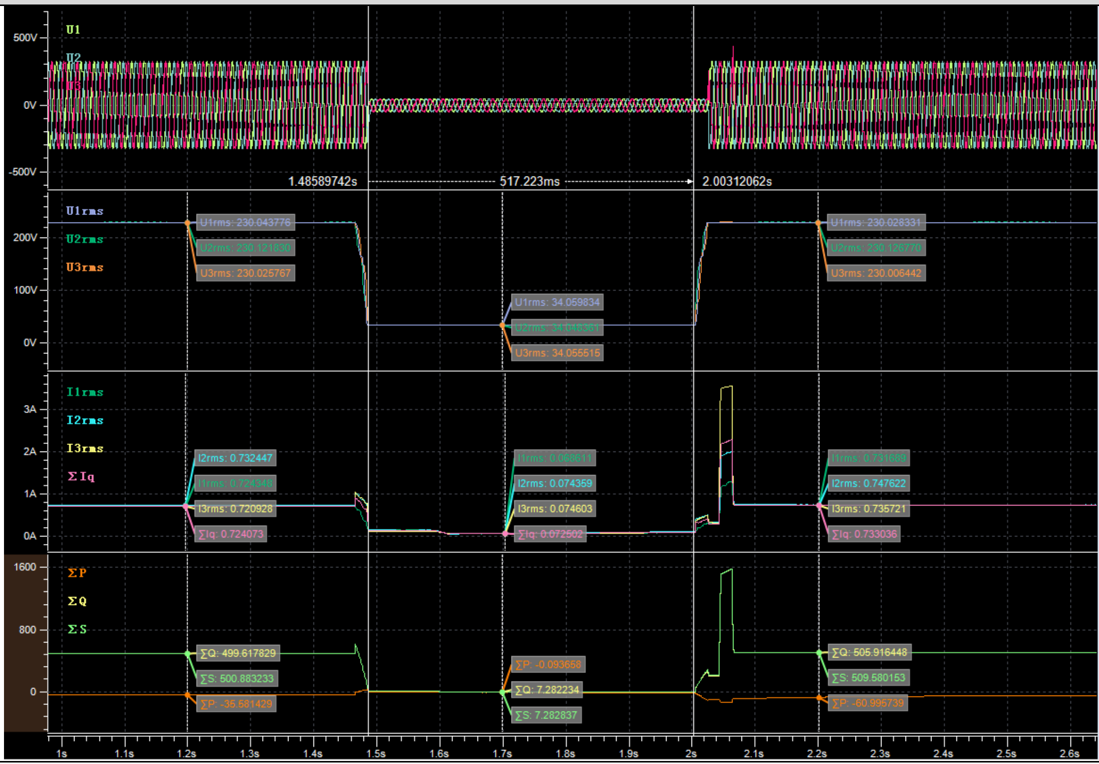
Test Nr.	Fault Type Output Power (%Pn)	Residual Voltage (%Un)		Fault duration (ms)		Time Measured (ms)	
		Desired	Measured	Desired	Measured	Active power recovery	Reactive power rise during fault
Test 2.1	3-Phase Fault No load	15 %	14.8%	> 477	517	NA	NA
Test 2.2	3-Phase Fault Partial load (20%)		16.8%		498	102	33
Test 2.3	3-Phase Fault Full load		16.8%		498	259	31
Test 2.4	2-Phase Fault No load		15.0%		516	NA	NA
Test 2.5	2-Phase Fault Partial load (20%)		15.0 %		516	186	NA
Test 2.6	2-Phase Fault Full load		15.0%		517	255	NA
Test 2.7	1-Phase Fault No load		15.0%		520	NA	NA
Test 2.8	1-Phase Fault Partial load (20%)		15.0%		520	188	NA
Test 2.9	1-Phase Fault Full load		15.0%		519	261	NA

The results of reactive current in Test 2.2 and 2.3 are showing in the table below:

Test Nr.	Fault Type Output Power (%Pn)	Iq required (%In)	Iq measured (%In)
Test 2.2	3-Phase Fault Partial load (20%)	100 % ± 20%	107.3%
Test 2.3	3-Phase Fault Full load		107.1%

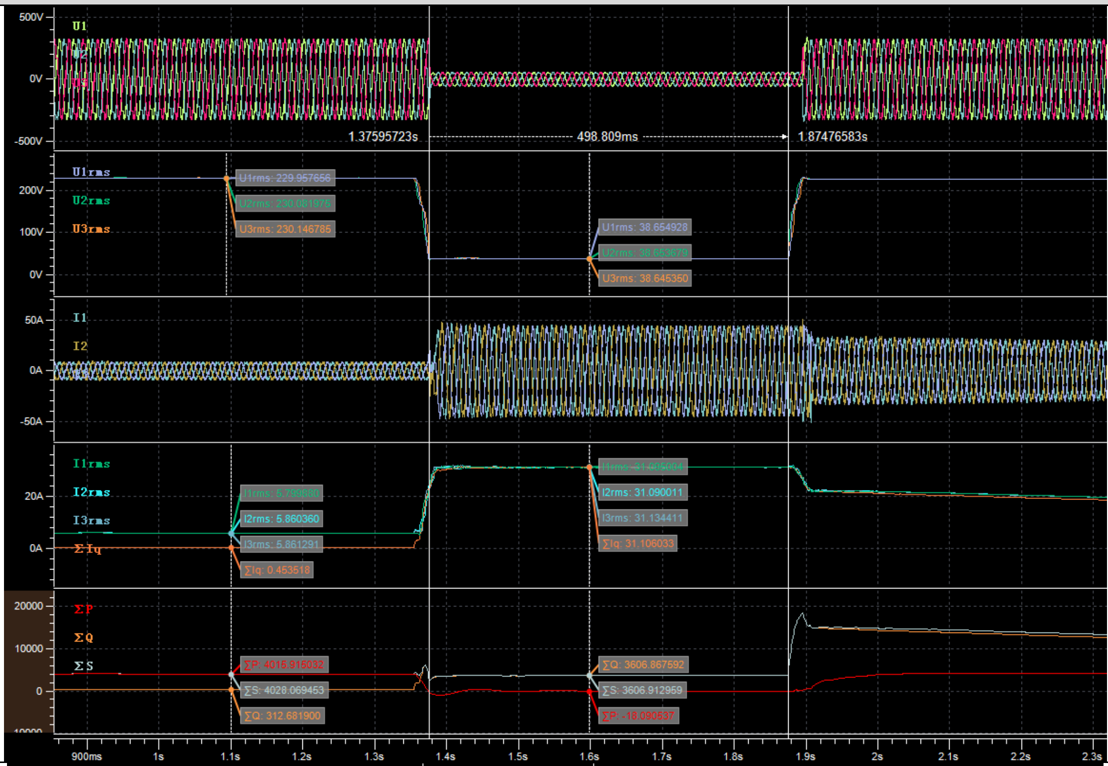
TEST RESULTS

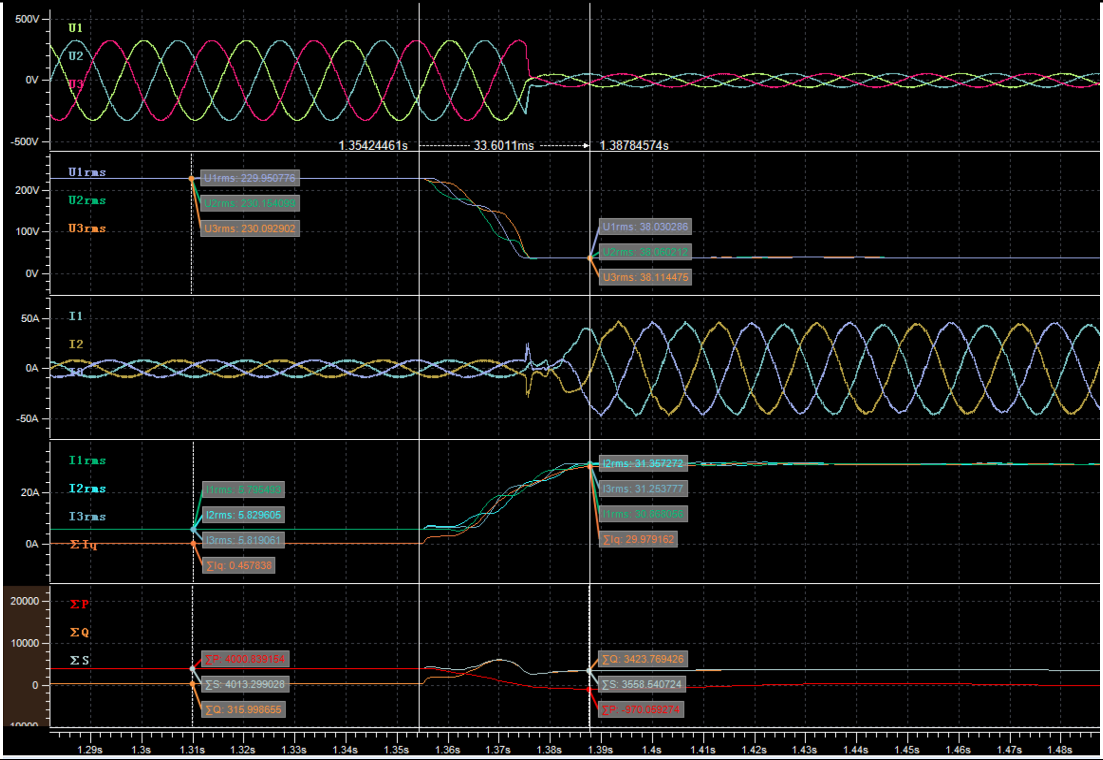
Test 2.1: Symmetric fault at 0% of nominal power, t > 477 **ms**



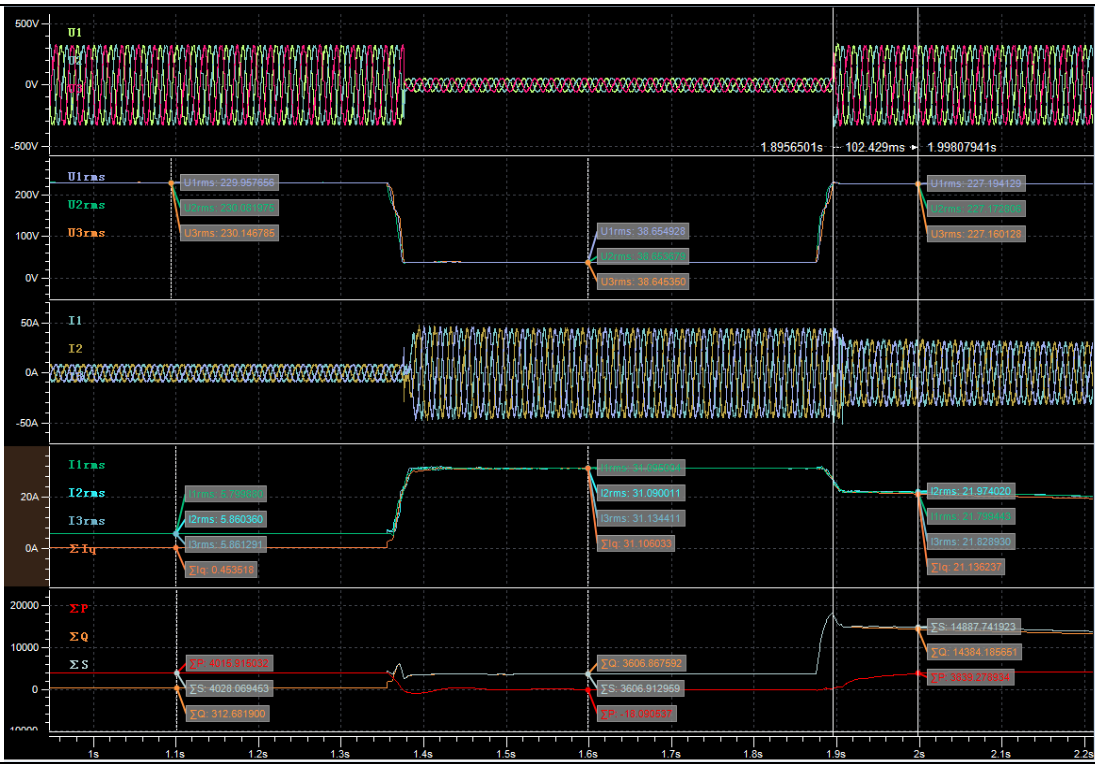
TEST RESULTS

Test 2.2: Symmetric fault at 20% of nominal power, t > 477 ms

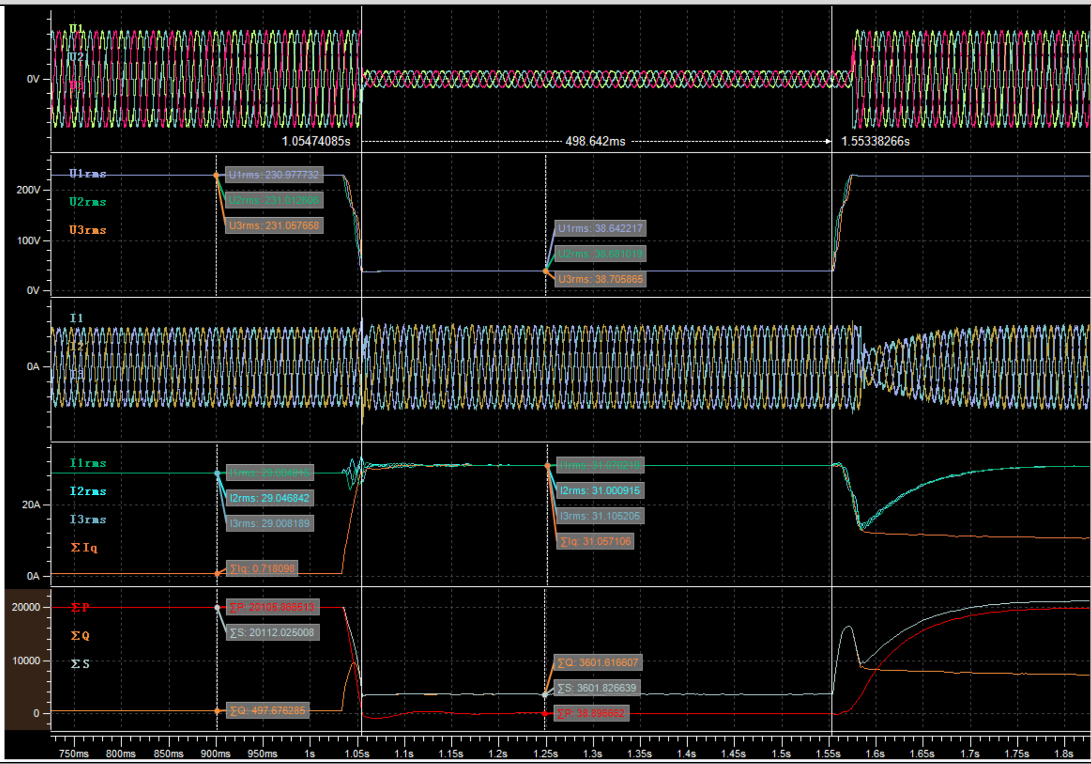




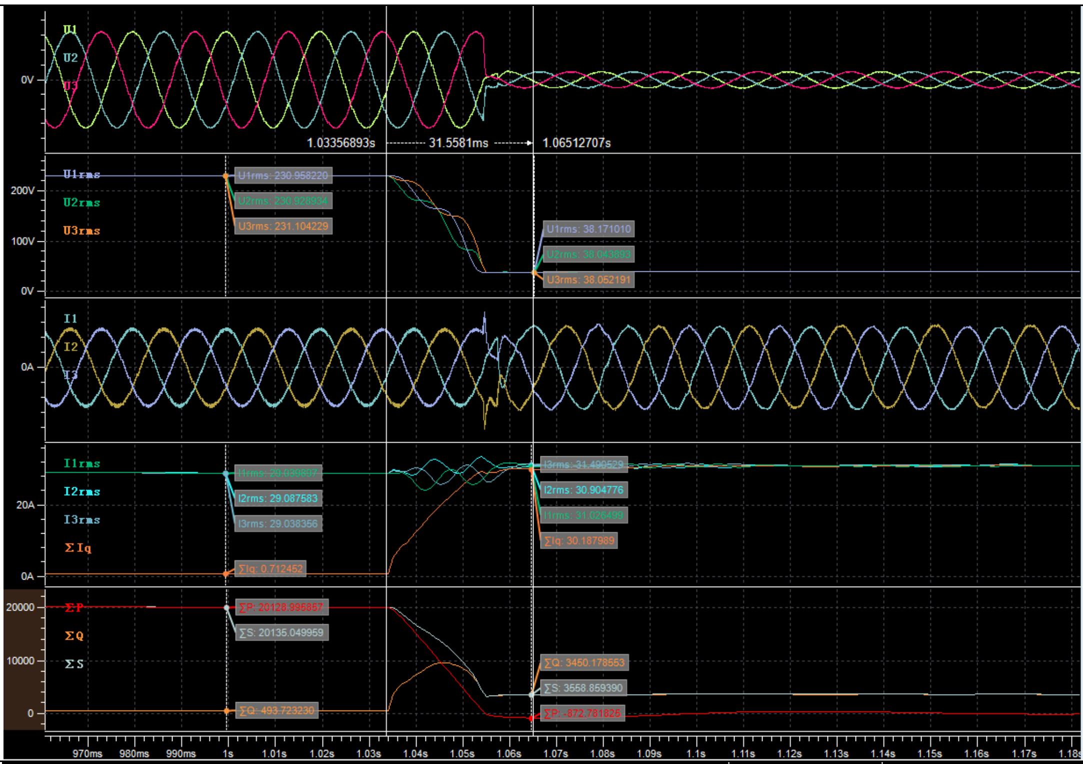
TEST RESULTS

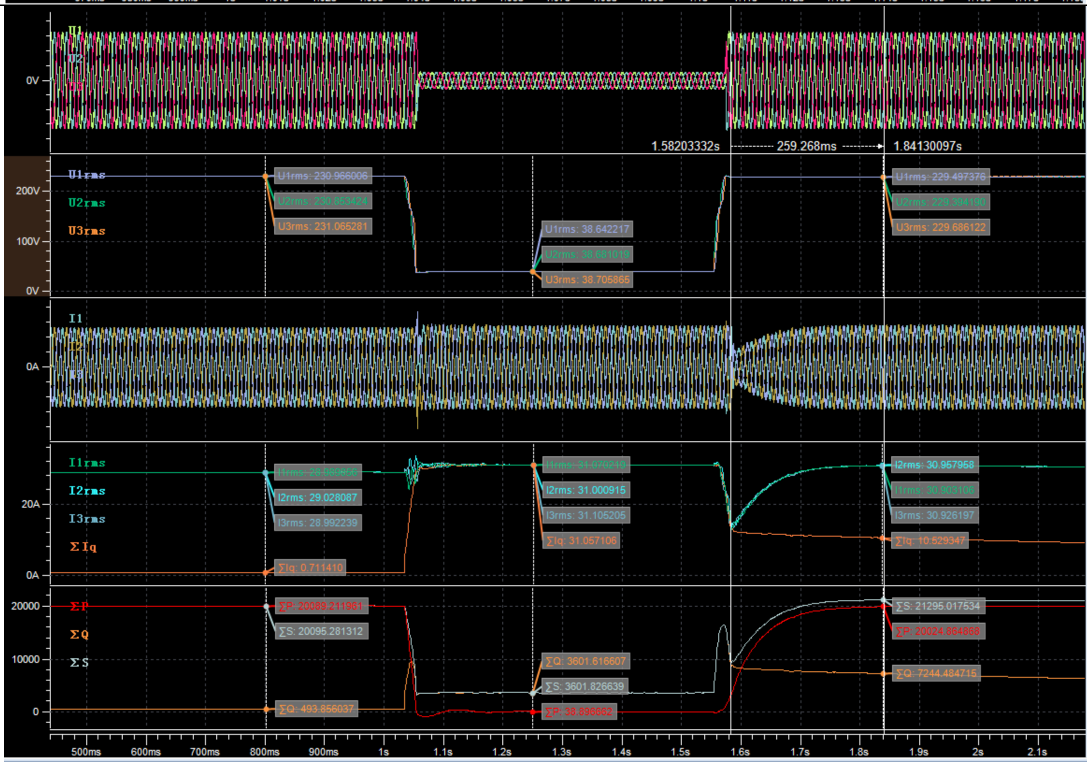


Test 2.3: Symmetric fault at 100% of nominal power, t > 477 ms



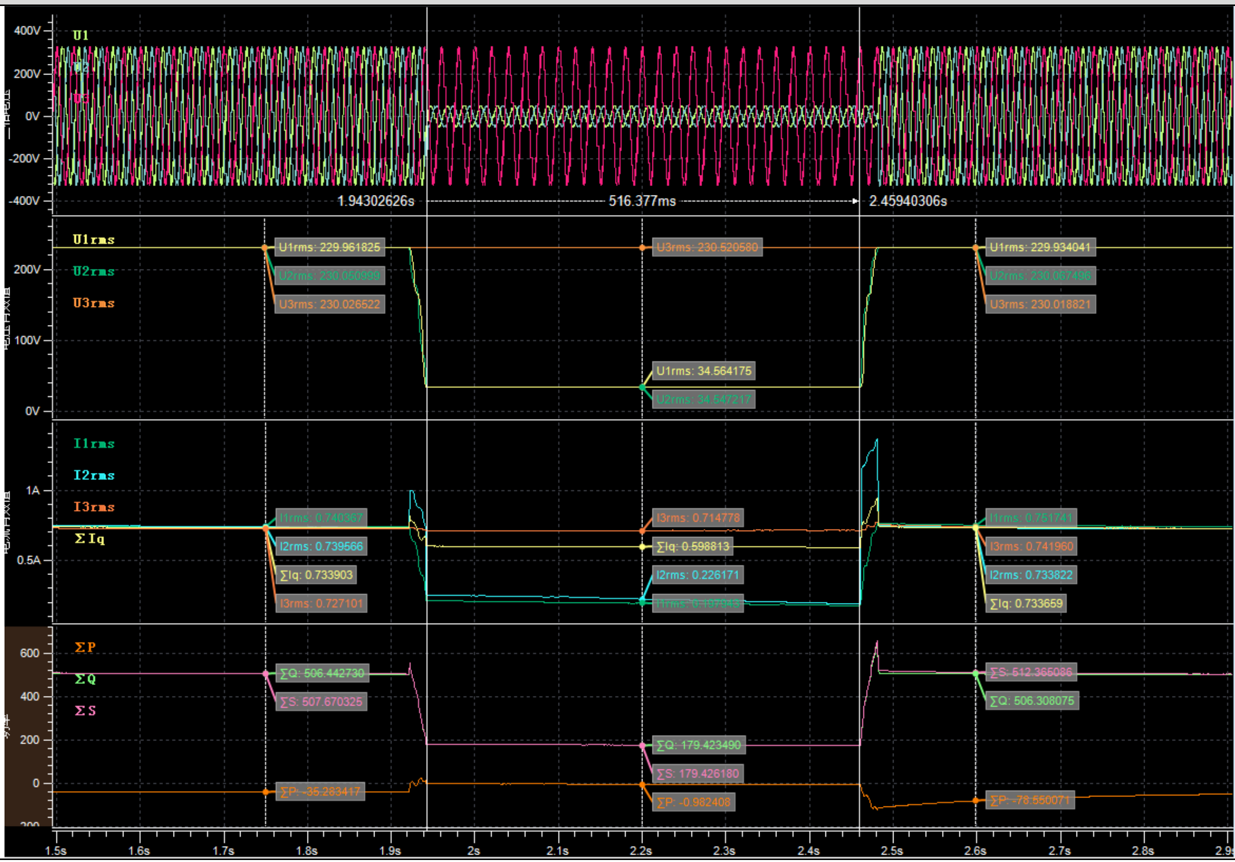
TEST RESULTS



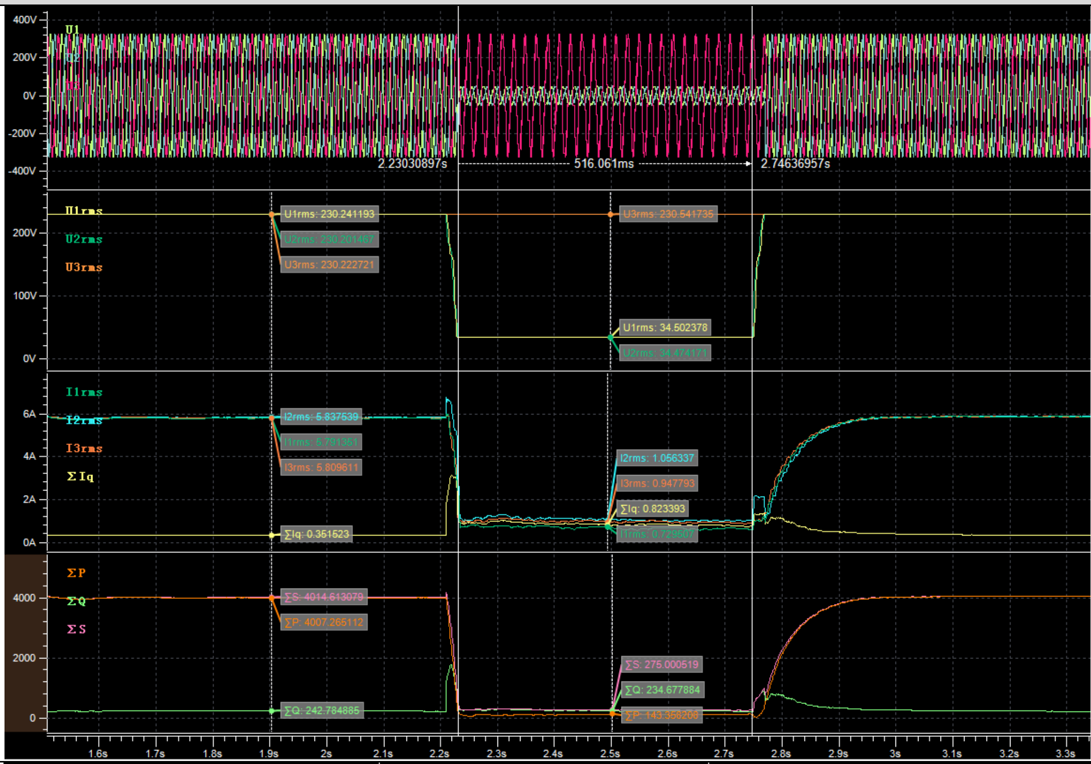
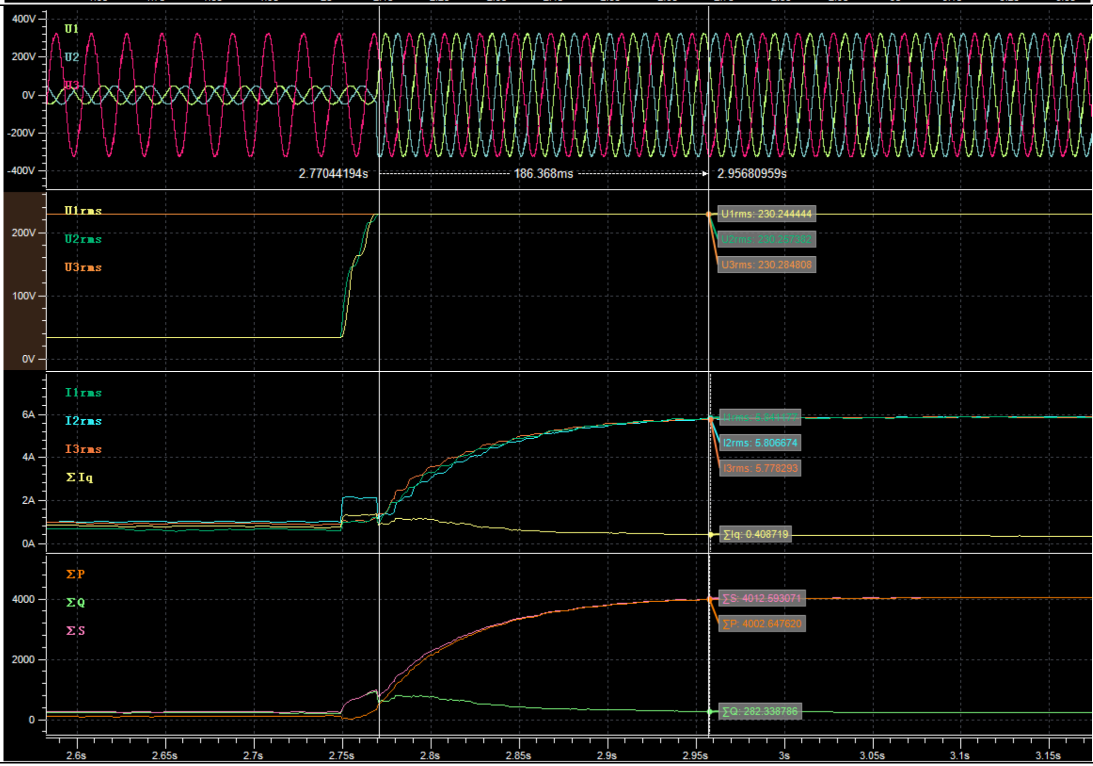


TEST RESULTS

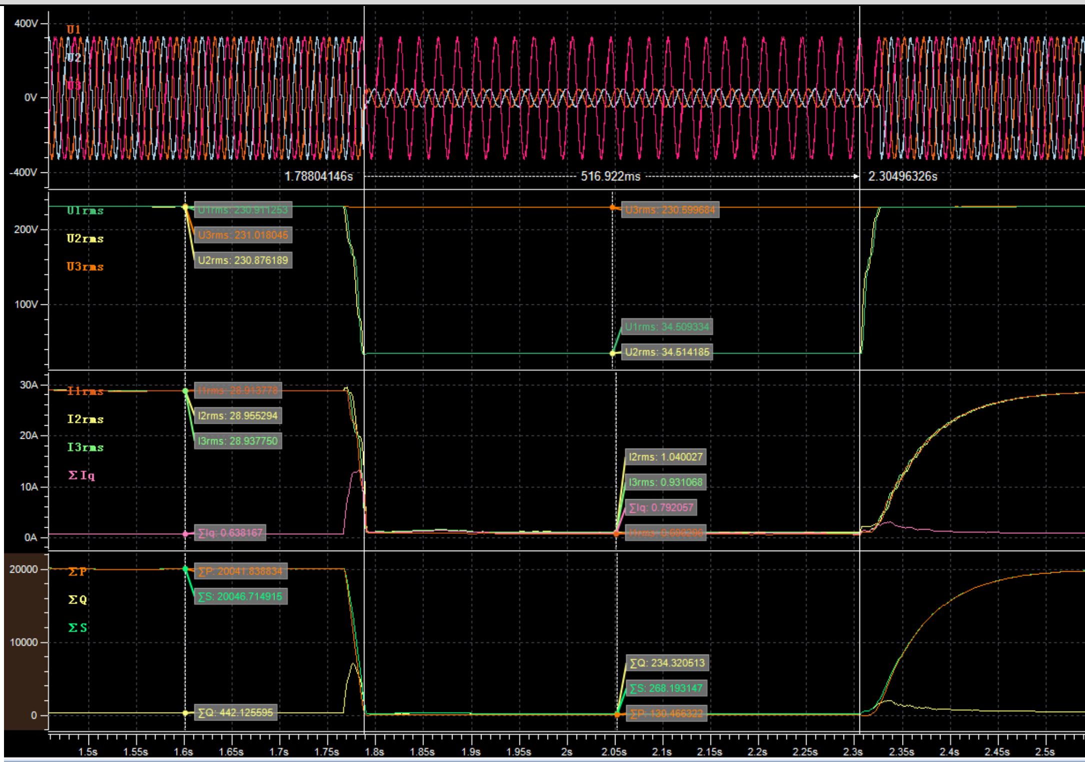
Test 2.4: Asymmetric two phase fault at 0% of nominal power, t > 477 ms

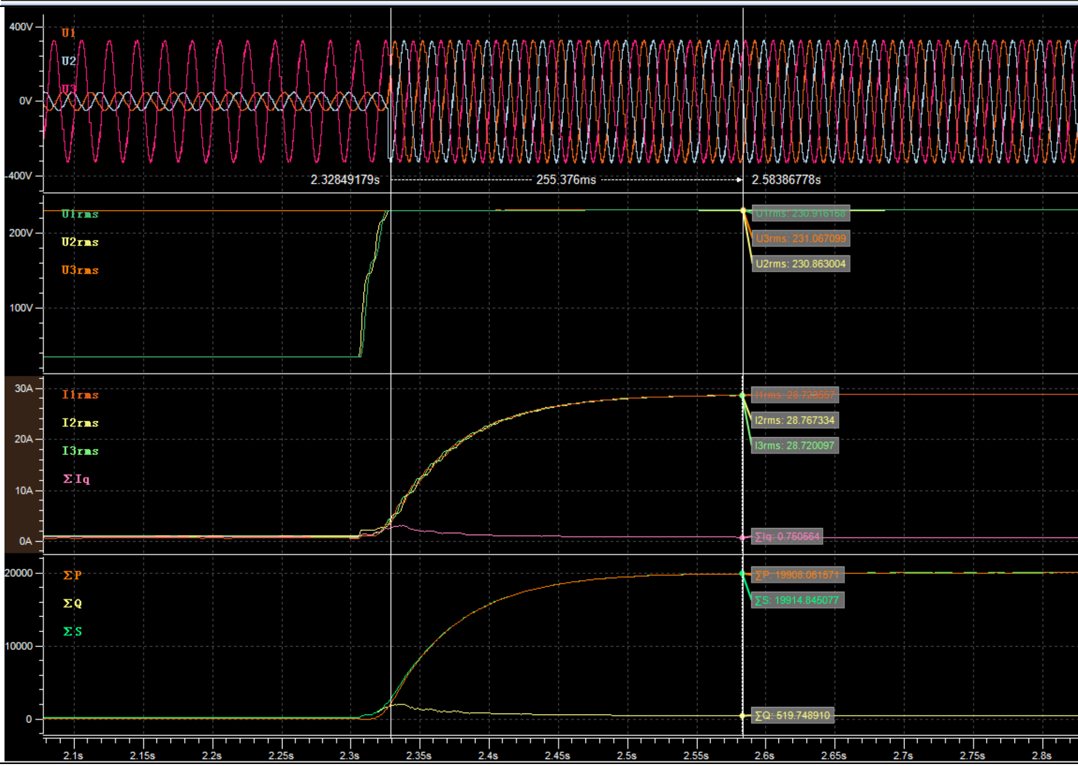


TEST RESULTS

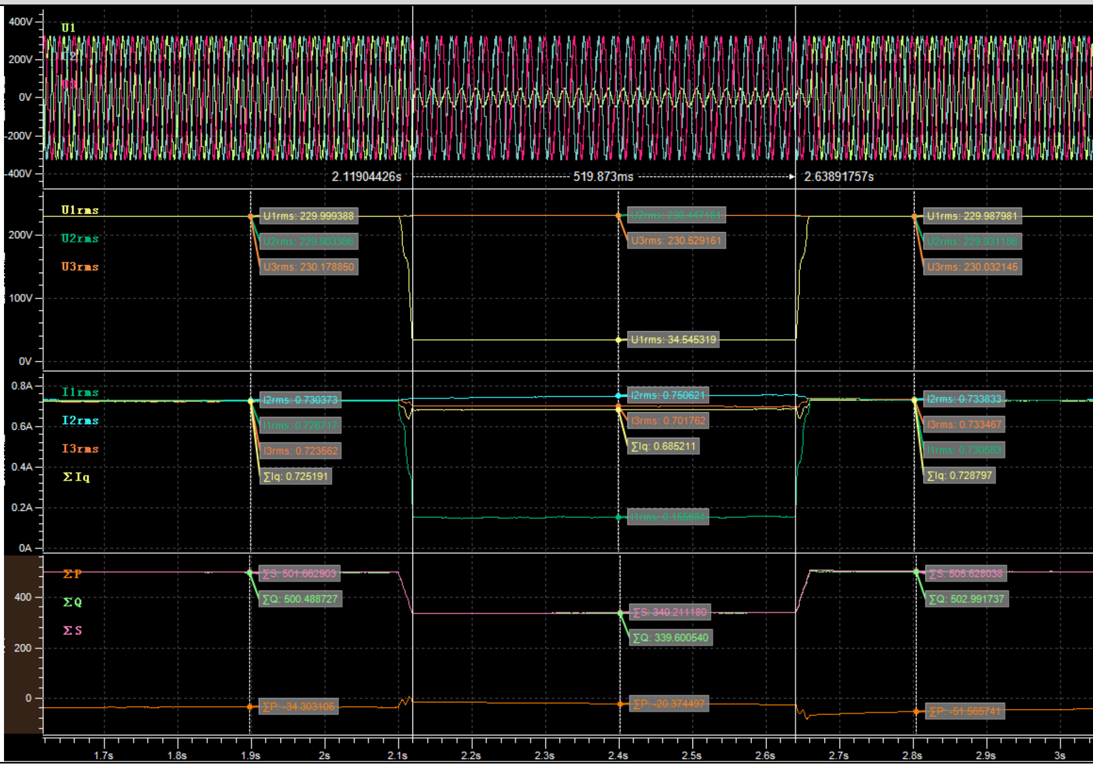
Test 2.5: Asymmetric two phase fault at 20% of nominal power, t > 477 ms



Test 2.6: Asymmetric two phase fault at 100% of nominal power, t > 477 ms



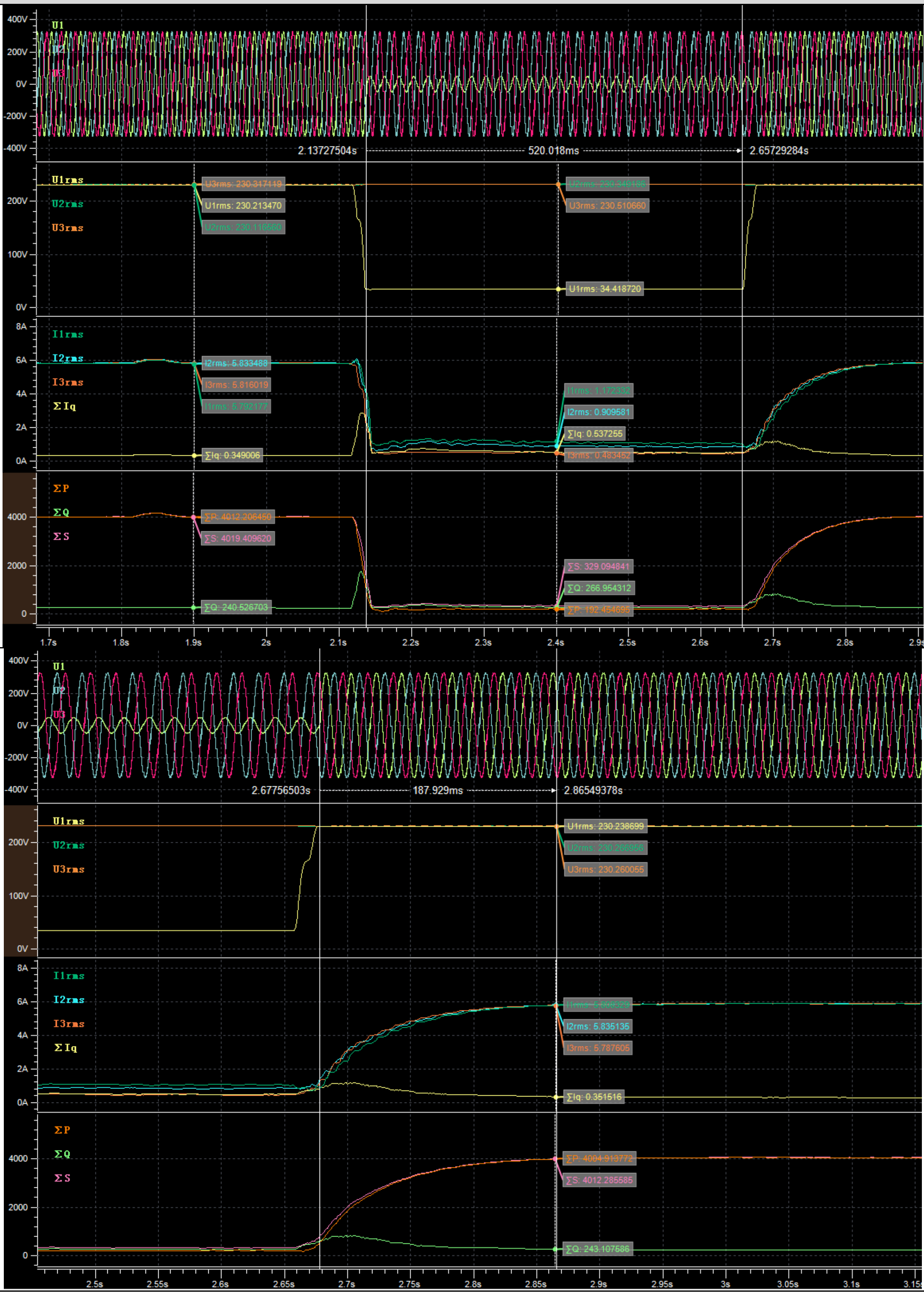


TEST RESULTS

Test 2.7: Asymmetric one phase fault at 0% of nominal power, t > 477 ms


TEST RESULTS

Test 2.8: Asymmetric one phase fault at 20% of nominal power, t > 477 ms



13.4 Prevention of islanding

Prevention of islanding tests have been measured according to Clause 4.2.2.4 of the standard.

An islanding condition shall cause the embedded generator to cease to energize the utility network within 2 s, irrespective of connected loads or other embedded generators.

Active islanding detection used for EUT. The test method according to IEC 62116: 2014. Test A is at full power. Test B is at 50%Pn. Test C is at 30%Pn

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

- Test Report GZES200601936102 on 2020/06/23 which issued by SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch

14. Isolation

Requirements are stated in clause 4.2.5 of this standard.

The inverter has one accessible switch in the DC side with one pole for each phase and accessible switch in the AC side with one pole for each phase

15. Earthing

Requirements are stated in clause 4.2.6 of this standard.

The safety requirements in accordance with IEC 62109-1:2010 and IEC 62109-2:2011.

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

- Test Report BL-DG2060127-B01 and BL-DG2060127-B01 attachment 1 on 2020/07/02 which issued by Shenzhen BALUN Technology Co., Ltd

16. Labelling

All labelling requirements have been checked according with point 4.2.7 of the standard.

All necessary information related to the procedure for disconnection and isolation of the equipment it is correctly included in the inverter manual. A symbol of the obligation to read the manual is included in the inverter label:

17. Robustness requirements

Robustness requirement have been considered according to Clause 4.2.10 of the standard.

The safety requirements in accordance with IEC 62109-1:2010 and IEC 62109-2:2011.

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

- Test Report BL-DG2060127-B01 and BL-DG2060127-B01 attachment 1 on 2020/07/02 which issued by Shenzhen BALUN Technology Co., Ltd

List of test equipment used:

No	Test Equipment	Equipment model	Equipment No.	Calibration due date
1	Simulation of ac power supply	AFC33300T-S	BZ-DGD-L011	--
2	Solar IV simulator	WPVD-30KW	BZ-DGD-L012	--
3	Power analyser	PA6000H	BZ-DGD-L059	2020\11\06
4	Oscilloscope	MSO4054B	BZ-DGD-L064	2021\03\04

--- End of test report---