Test Report issued under the responsibility of:

TEST REPORT
IEC 61727
Photovoltaic (PV) systems – Characteristics of the utility interface

Report Number. ..... :	GZES200601936101
Date of issue ..... :	23/06/2020
Total number of pages ..... :	26
Name of Testing Laboratory preparing the Report ..... :	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch
Applicant's name ..... :	Shenzhen SOFAR SOLAR Co., Ltd.
Address ..... :	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China
Test specification:	
Standard ..... :	IEC 61727:2004 (Second Edition)
Test procedure ..... :	Characteristic Examination
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC61727A
Test Report Form(s) Originator .... :	TÜV SÜD Product Service GmbH
Master TRF ..... :	Dated 2014-11

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
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Test item description ..... :	Hybrid Inverter (Three Phase)
Trade Mark ..... :	
Manufacturer..... :	Shenzhen SOFAR SOLAR Co., Ltd.
Address ..... :	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China
Model/Type reference..... :	HYD 5KTL-3PH, HYD 6KTL-3PH, HYD 8KTL-3PH; HYD 10KTL-3PH, HYD 15KTL-3PH, HYD 20KTL-3PH;
Ratings ..... :	See model list in Page 7 to Page 8. **Serial Number:** SP1ES020H71002 **Firmware version:** V2.00

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☐ ~~CB Testing Laboratory:~~		
~~Testing location/ address .....:~~		
☐ ~~Associated CB Testing Laboratory:~~		
~~Testing location/ address .....:~~		
~~Tested by (name, function, signature).....:~~		
~~Approved by (name, function, signature)...:~~		
☑ **Testing procedure: TMP/CTF Stage 1:**	Shenzhen SOFAR SOLAR Co., Ltd.	
Testing location/ address .....:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China	
Tested by (name, function, signature).....:	Hugo Zhang (Project Engineer)	Hugo Zhang
Approved by (name, function, signature....:	Roger Hu (Technical Reviewer)	Roger Hu
☐ ~~Testing procedure: WMT/CTF Stage 2:~~		
~~Testing location/ address .....:~~		
~~Tested by (name, function, signature).....:~~		
~~Witnessed by (name, function, signature) .:~~		
~~Approved by (name, function, signature)...:~~		
☐ ~~Testing procedure: SMT/CTF Stage 3 or 4:~~		
~~Testing location/ address .....:~~		
~~Tested by (name, function, signature).....:~~		
~~Witnessed by (name, function, signature) .:~~		
~~Approved by (name, function, signature)...:~~		
~~Supervised by (name, function, signature) :~~		

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

50 Hz		
Attachment #	Description	Pages
Attachment I	Pictures of the EUT and Electrical Schemes	10 pages
Attachment II	Testing Information	5 pages
Attachment III	Graphs and Screenshots of Test Results	28 pages

Summary of testing:

Tests performed (name of test and test clause):

The equipment has been tested according to the standard:
IEC 61727:2004. Testing has been carried out at 50 Hz

All applicable tests according to the above specified standard have been carried out.

From the result of inspection and tests on the submitted sample, we conclude that it complies with the requirements of the standard.

Testing location:

Shenzhen SOFAR SOLAR Co., Ltd.

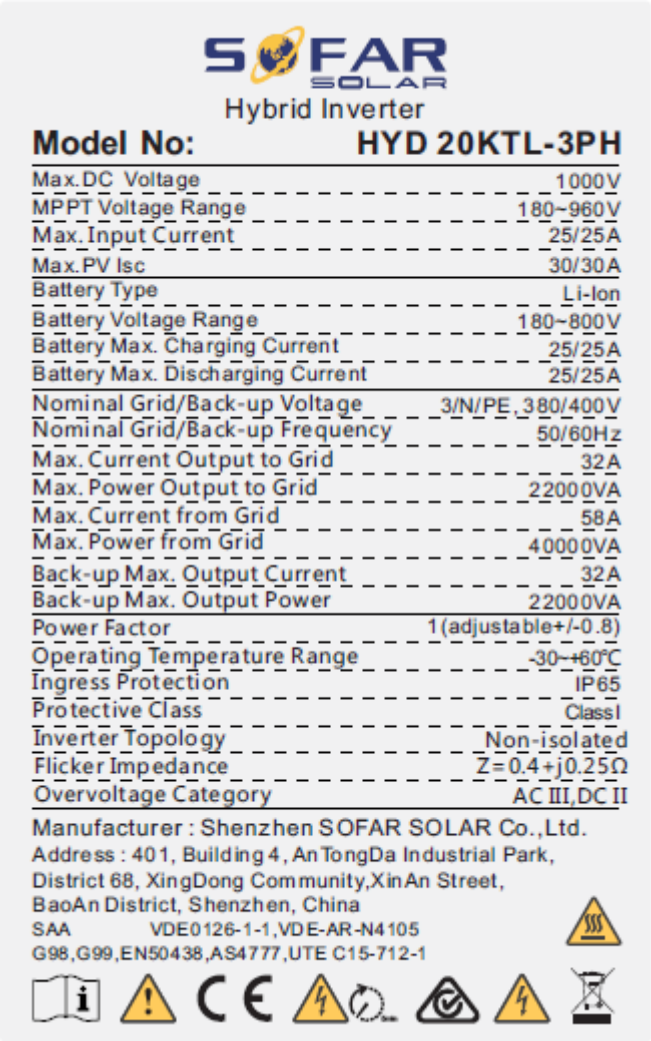
401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China

(All clauses)

Summary of compliance with National Differences:

No National Differences are addressed to this test report

Copy of marking plate(representative):



Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation
3. Labels of other models are as the same with HYD 20KTL-3PH's except the parameters of rating.

Test item particulars ..... :	Hybrid Inverter (Three Phase)
Classification of installation and use ..... :	Fixed (permanent connection)
Supply Connection ..... :	DC; PV
..... :	AC; Grid 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 ..... :	CTF Stage 1 procedure
Date of receipt of test item ..... :	N/A
Date (s) of performance of tests ..... :	From 29/05/2020 to 19/06/2020

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☑ point is used as the decimal separator.

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,Guangdong Province,P.R. China.

General product information:

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through connectors.

The Solar inverter converts DC voltage into AC voltage.
The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that

the opening of the output circuit can operate in case of one error.

Equipment Under Testing:

- HYD 20KTL-3PH;

Variant models:

- HYD 5KTL-3PH;
- HYD 6KTL-3PH;
- HYD 8KTL-3PH;
- HYD 10KTL-3PH;
- HYD 15KTL-3PH;

Model	HYD 5KTL-3PH	HYD 6KTL-3PH	HYD 8KTL-3PH	HYD 10KTL-3PH	HYD 15KTL-3PH	HYD 20KTL-3PH
PV String Input Data						
Recommended-Max.PV power	7500Wp (6000Wp/6000Wp)	9000Wp (6600Wp/6600Wp)	12000Wp (6600Wp/6600Wp)	15000Wp (7500Wp/7500Wp)	22500Wp (11250Wp/11250Wp)	30000Wp (15000Wp/15000Wp)
Max. DC voltage	1000V					
Start-up operating voltage	200V					
MPPT voltage range	180V~960V					
Nominal DC voltage	600V					
Full power MPPT voltage range	250V~850V	320V~850V	360V~850V	220V~850V	350V~850V	450V~850V
Max. input current	12.5A/12.5A	12.5A/12.5A	12.5A/12.5A	25A/25A	25A/25A	25A/25A
Max. short current	15A/15A	15A/15A	15A/15A	30A/30A	30A/30A	30A/30A
Battery Input Data						
Battery voltage range	180V~800V					
Battery voltage range for full load	200V~800V	240V~800V	320V~800V	200V~800V	300V~800V	400V~800V
No. of battery input	1			2		
Nominal charging/dis-charging power	5000W	6000W	8000W	10000W	15000W	20000W
Max. charging/dis-charging current	25A	25A	25A	50A (25A/25A)	50A (25A/25A)	50A (25A/25A)
Peak charging/dis-charging current, Duration	40A, 60s	40A, 60s	40A, 60s	70A (35A/35A), 60s	70A (35A/35A), 60s	70A (35A/35A), 60s
AC Output Data (On-grid)						
Nominal AC power	5000W	6000W	8000W	10000W	15000W	20000W

Max. AC power output to utility grid	5500VA	6600VA	8800VA	11000VA	16500VA	22000VA
Max. AC power from utility grid	10000VA	12000VA	16000VA	20000VA	30000VA	40000VA
Max. AC current output to utility grid	8A	10A	13A	16A	24A	32A
Max. AC Current from utility grid	15A	17A	24A	29A	44A	58A
AC Output Data (Back-up)						
Nominal output power	5000W	6000W	8000W	10000W	15000W	20000W
Max. output power	5500VA	6600VA	8800VA	11000VA	16500VA	22000VA
Peak output power, Duration	10000VA, 60s	12000VA, 60s	16000VA, 60s	20000VA, 60s	22000VA, 60s	22000VA, 60s
Max. output current	8A	10A	13A	16A	24A	32A
Peak output current, Duration	15A, 60s	18A, 60s	24A, 60s	30A, 60s	32A, 60s	32A, 60s
Nominal output voltage	3/N/PE, 220/380Vac, 230/400Vac					
Nominal output freqency	50/60Hz					
Output power factor	~1(0.8 leading to 0.8 lagging)					
Operating temperature range	-30ºC ~60ºC					
Ingress protection	IP65					
Protective class	Class I					
Cooling method	heat sink	heat sink	heat sink	fan	fan	fan

The variants models have been included in this test report without tests because the following features don´t change regarding to the tested model:

- Same connection system and hardware topology
- Same control algorithm.
- Same Firmware Version

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Clause	Requirement + Test	Result - Remark	Verdict

4	**UTILITY COMPATIBILITY**		**P**
	The quality of power provided by the PV system for the on-site AC loads and for power delivered to the utility is governed by practices and standards on voltage, flicker, frequency, harmonics and power factor.		P
	Deviation from these standards represents out-of-bounds conditions and may require the PV system to sense the deviation and properly disconnect from the utility system.		P
4.1	**Voltage, current and frequency**		**P**
	The PV system AC voltage, current and frequency are compatible with the utility system.		P
4.2	**Normal voltage operating range**		**P**
	Utility-interconnected PV systems do not normally regulate voltage, they inject current into the utility. Therefore, the voltage operating range for PV inverters is selected as a protection function that responds to abnormal utility conditions, not as a voltage regulation function.		P
4.3	**Flicker**		**P**
	The operation of the PV system is not cause voltage flicker in excess of limits stated in the relevant sections of IEC 61000-3-3 for systems less than 16 A or IEC 61000-3-5 for systems with current of 16 A and above.	**(see appended table)**	P
4.4	**DC injection**		**P**
	The PV system is not inject DC current greater than 1 % of the rated inverter output current, into the utility AC interface under any operating condition.	**(see appended table)**	P
4.5	**Normal frequency operating range**		**P**
	The PV system operates in synchronism with the utility system, and within the frequency trip limits defined in 5.2.2.		P
4.6	**Harmonics and waveform distortion**		**P**
	Total harmonic current distortion is less than 5 % at rated inverter output. Each individual harmonic is limited to the percentages listed in Table 1.	**(see appended table)**	P
	Even harmonics in these ranges is less than 25 % of the lower odd harmonic limits listed.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Table 1 – Current distortion limits **Odd harmonics** / **Distortion limit** 3rd through 9th — Less than 4,0 % 11th through 15th — Less than 2,0 % 17th through 21st — Less than 1,5 % 23rd through 33rd — Less than 0,6 % **Even harmonics** / **Distortion limit** 2nd through 8th — Less than 1,0 % 10th through 32nd — Less than 0,5 %		P
4.7	The PV system has a lagging power factor greater than 0,9 when the output is greater than 50 % of the rated inverter output power.	**(see appended table)**	P
5	**PERSONNEL SAFETY AND EQUIPMENT PROTECTION**		**P**
	This Clause provides information and considerations for the safe and proper operation of the utility-connected PV systems.		P
5.1	**Loss of utility voltage**		**P**
	To prevent islanding, a utility connected PV system ceases to energize the utility system from a de-energized distribution line irrespective of connected loads or other generators within specified time limits.		P
	A utility distribution line can become de-energized for several reasons. For example, a substation breaker opening due to fault conditions or the distribution line switched out during maintenance.		P
5.2	**Over/under voltage and frequency**		**P**
	The abnormal utility conditions of concern are voltage and frequency excursions above or below the values stated in this Clause, and the complete disconnection of the utility, presenting the potential for a distributed resource island.	**(see appended table)**	P
5.2.1	**Over/under voltage**		**P**
	When the interface voltage deviates outside the conditions specified in Table 2, the photovoltaic system ceases to energize the utility distribution system. This applies to any phase of a multiphase system.	**(see appended table)**	P
	Table 2 – Response to abnormal voltages **Voltage (at point of utility connection)** / **Maximum trip time*** V < 0,5 × Vnominal — 0,1 s 50 % ≤ V < 85 % — 2,0 s 85 % ≤ V ≤ 110 % — Continuous operation 110 % < V < 135 % — 2,0 s 135 % ≤ V — 0,05 s * Trip time refers to the time between the abnormal condition occurring and the inverter ceasing to energize the utility line. The PV system control circuits shall actually remain connected to the utility to allow sensing of utility electrical conditions for use by the "reconnect" feature.		P
5.2.2	**Over/under frequency**		**P**

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	When the utility frequency deviates outside the specified conditions the photovoltaic system ceases to energize the utility line. The unit does not have to cease to energize if the frequency returns to the normal utility continuous operation condition within the specified trip time.	**(see appended table)**	P
	When the utility frequency is outside the range of ±1 Hz, the system ceases to energize the utility line within 0,2 s. The purpose of the allowed range and time delay is to allow continued operation for short-term disturbances and to avoid excessive nuisance tripping in weak-utility system conditions.		P
5.3	**Islanding protection**		**P**
	The PV system must cease to energize the utility line within 2 s of loss of utility.	Test according IEC 62116: 2014 Refer to Test Report No: GZES200601936102	P
5.4	**Response to utility recovery**		**P**
	Following an out-of-range utility condition that has caused the photovoltaic system to cease energizing, the photovoltaic system is not energize the utility line for 20 s to 5 min after the utility service voltage and frequency have recovered to within the specified ranges.	**(see appended table)**	P
5.5	**Earthing**		**P**
	The utility interface equipment is earthed/grounded in accordance with IEC 60364-7-712.		P
5.6	**Short circuit protection**		**P**
	The photovoltaic system has short-circuit protection in accordance with IEC 60364-7-712.		P
5.7	**Isolation and switching**		**P**
	A method of isolation and switching is provided in accordance with IEC 60364-7-712.		P

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Clause	Requirement + Test	Result - Remark	Verdict

4.3	TABLE: Flicker				P
		Starting	Stopping	Running	
Limit		4%	4%	Pst = 1.0	Plt = 0.65
Sample model		HYD 20KTL-3PH			
33%Pn for 50Hz					
Test value (Phase A)		0.176	0.154	0.061	0.053
Test value (Phase B)		0.113	0.115	0.142	0.140
Test value (Phase C)		0.000	0.000	0.053	0.050
66%Pn for 50Hz					
Test value (Phase A)		0.284	0.353	0.044	0.032
Test value (Phase B)		0.113	0.101	0.139	0.137
Test value (Phase C)		0.100	0.112	0.048	0.046
100%Pn for 50Hz					
Test value (Phase A)		0.155	0.173	0.058	0.053
Test value (Phase B)		0.108	0.122	0.135	0.135
Test value (Phase C)		0.000	0.105	0.043	0.041

Supplementary information:
The measurements of voltage fluctuations have been measured at 33 %, 66% and 100 % of the nominal power value of the inverter.
As it can be seen in screenshots in Attachment III, this test has two steps and 10min for each step:

1.Starting operation

2.Stopping operation

The values took of Pst and Plt are the most unfavorable of the two steps.
As it can be seen in the screenshots in Attachment III. The values took of Pst and Plt are the most unfavorable of the twelve steps and 10min for each step for running operation

4.4	TABLE: Direct current injection								P
Rated output current (A)	Ratio of rated output power (VA)	Measured DC output current between terminals (A)						Isolated transfor-mer? (Yes/No)	Limit (A)
		L1-L2	L1-L3	L2-L3	L1-N	L2-N	L3-N		
29.0	33%	--	--	--	0.014	-0.002	-0.013	**No**	0.290
29.0	66%	--	--	--	0.013	-0.001	-0.014	**No**	0.290
29.0	100%	--	--	--	0.012	-0.002	-0.014	**No**	0.290

Supplementary information:
N/A

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Clause	Requirement + Test	Result - Remark	Verdict

4.6(a)	Table: harmonics and waveform distortion (at 33%Pn Phase A, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.111	1	03	0.680	4
04	0.175	1	05	2.521	4
06	0.274	1	07	1.354	4
08	0.188	1	09	0.483	4
10	0.301	0.5	11	1.661	2
12	0.077	0.5	13	1.177	2
14	0.101	0.5	15	0.145	2
16	0.073	0.5	17	0.478	1.5
18	0.049	0.5	19	0.852	1.5
20	0.040	0.5	21	0.102	1.5
22	0.047	0.5	23	0.191	0.6
24	0.026	0.5	25	0.535	0.6
26	0.044	0.5	27	0.035	0.6
28	0.039	0.5	29	0.227	0.6
30	0.023	0.5	31	0.369	0.6
32	0.025	0.5	33	0.034	0.6
THD	3.847	5	--	--	--
Supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

4.6(b)	Table: harmonics and waveform distortion (at 33%Pn Phase B, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.288	1	03	0.358	4
04	0.306	1	05	2.108	4
06	0.469	1	07	0.577	4
08	0.120	1	09	0.440	4
10	0.280	0.5	11	1.384	2
12	0.057	0.5	13	1.015	2
14	0.056	0.5	15	0.185	2
16	0.073	0.5	17	0.501	1.5
18	0.049	0.5	19	0.764	1.5
20	0.050	0.5	21	0.049	1.5
22	0.027	0.5	23	0.229	0.6
24	0.028	0.5	25	0.530	0.6
26	0.036	0.5	27	0.027	0.6
28	0.032	0.5	29	0.189	0.6
30	0.023	0.5	31	0.365	0.6
32	0.019	0.5	33	0.023	0.6
THD	3.151	5	--	--	--
Supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

4.6(c)	Table: harmonics and waveform distortion (at 33%Pn Phase C, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.230	1	03	0.907	4
04	0.246	1	05	1.555	4
06	0.284	1	07	1.054	4
08	0.147	1	09	0.805	4
10	0.177	0.5	11	1.103	2
12	0.052	0.5	13	1.124	2
14	0.129	0.5	15	0.337	2
16	0.037	0.5	17	0.324	1.5
18	0.030	0.5	19	0.808	1.5
20	0.054	0.5	21	0.139	1.5
22	0.039	0.5	23	0.246	0.6
24	0.024	0.5	25	0.523	0.6
26	0.019	0.5	27	0.036	0.6
28	0.034	0.5	29	0.190	0.6
30	0.018	0.5	31	0.363	0.6
32	0.023	0.5	33	0.048	0.6
THD	3.025	5	--	--	--
Supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

4.6(d)	Table: harmonics and waveform distortion (at 66%Pn Phase A, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.127	1	03	0.130	4
04	0.080	1	05	0.971	4
06	0.085	1	07	0.634	4
08	0.115	1	09	0.193	4
10	0.123	0.5	11	0.867	2
12	0.053	0.5	13	0.675	2
14	0.046	0.5	15	0.118	2
16	0.054	0.5	17	0.322	1.5
18	0.021	0.5	19	0.408	1.5
20	0.018	0.5	21	0.050	1.5
22	0.023	0.5	23	0.122	0.6
24	0.019	0.5	25	0.209	0.6
26	0.029	0.5	27	0.025	0.6
28	0.021	0.5	29	0.080	0.6
30	0.014	0.5	31	0.090	0.6
32	0.024	0.5	33	0.022	0.6
THD	1.742	5	--	--	--
Supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

4.6(e)	Table: harmonics and waveform distortion (at 66%Pn Phase B, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.048	1	03	0.466	4
04	0.080	1	05	0.833	4
06	0.177	1	07	0.322	4
08	0.114	1	09	0.209	4
10	0.136	0.5	11	0.620	2
12	0.059	0.5	13	0.587	2
14	0.049	0.5	15	0.103	2
16	0.051	0.5	17	0.253	1.5
18	0.036	0.5	19	0.347	1.5
20	0.018	0.5	21	0.061	1.5
22	0.014	0.5	23	0.142	0.6
24	0.019	0.5	25	0.195	0.6
26	0.025	0.5	27	0.021	0.6
28	0.018	0.5	29	0.087	0.6
30	0.014	0.5	31	0.088	0.6
32	0.017	0.5	33	0.019	0.6
THD	1.465	5	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(f)	Table: harmonics and waveform distortion (at 66%Pn Phase C, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.116	1	03	0.573	4
04	0.094	1	05	0.651	4
06	0.161	1	07	0.599	4
08	0.050	1	09	0.356	4
10	0.113	0.5	11	0.504	2
12	0.042	0.5	13	0.577	2
14	0.073	0.5	15	0.200	2
16	0.028	0.5	17	0.198	1.5
18	0.025	0.5	19	0.367	1.5
20	0.024	0.5	21	0.110	1.5
22	0.020	0.5	23	0.084	0.6
24	0.011	0.5	25	0.209	0.6
26	0.014	0.5	27	0.044	0.6
28	0.019	0.5	29	0.092	0.6
30	0.010	0.5	31	0.092	0.6
32	0.013	0.5	33	0.020	0.6
THD	1.482	5	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(g)	Table: harmonics and waveform distortion (at 100%Pn Phase A, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.107	1	03	0.248	4
04	0.070	1	05	0.868	4
06	0.070	1	07	0.543	4
08	0.122	1	09	0.176	4
10	0.097	0.5	11	0.696	2
12	0.028	0.5	13	0.514	2
14	0.040	0.5	15	0.114	2
16	0.029	0.5	17	0.245	1.5
18	0.024	0.5	19	0.274	1.5
20	0.022	0.5	21	0.050	1.5
22	0.013	0.5	23	0.099	0.6
24	0.017	0.5	25	0.146	0.6
26	0.020	0.5	27	0.021	0.6
28	0.015	0.5	29	0.025	0.6
30	0.010	0.5	31	0.080	0.6
32	0.015	0.5	33	0.018	0.6
THD	1.459	5	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(h)	Table: harmonics and waveform distortion (at 100%Pn Phase B, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.062	1	03	0.268	4
04	0.052	1	05	0.506	4
06	0.111	1	07	0.317	4
08	0.092	1	09	0.187	4
10	0.086	0.5	11	0.398	2
12	0.034	0.5	13	0.441	2
14	0.030	0.5	15	0.063	2
16	0.041	0.5	17	0.142	1.5
18	0.027	0.5	19	0.247	1.5
20	0.015	0.5	21	0.025	1.5
22	0.013	0.5	23	0.078	0.6
24	0.012	0.5	25	0.148	0.6
26	0.015	0.5	27	0.017	0.6
28	0.015	0.5	29	0.033	0.6
30	0.010	0.5	31	0.086	0.6
32	0.012	0.5	33	0.022	0.6
THD	0.990	5	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(i)	Table: harmonics and waveform distortion (at 100%Pn Phase C, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.071	1	03	0.504	4
04	0.071	1	05	0.585	4
06	0.106	1	07	0.577	4
08	0.050	1	09	0.347	4
10	0.066	0.5	11	0.483	2
12	0.031	0.5	13	0.529	2
14	0.053	0.5	15	0.169	2
16	0.030	0.5	17	0.181	1.5
18	0.019	0.5	19	0.282	1.5
20	0.029	0.5	21	0.089	1.5
22	0.015	0.5	23	0.053	0.6
24	0.014	0.5	25	0.153	0.6
26	0.013	0.5	27	0.025	0.6
28	0.017	0.5	29	0.033	0.6
30	0.010	0.5	31	0.084	0.6
32	0.009	0.5	33	0.021	0.6
THD	1.335	5	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.7	TABLE: Power factor							P
	Input			Output				
No	Voltage (V d.c.)	Current (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor	Rated output (V.A)
1	618.2	6.6	4101.5	230.2	5.8	3984.5	0.995 (a) 0.996 (b) N/A (c)	(20±5)%
2	618.0	10.0	6162.4	230.3	8.7	6009.4	0.999 (a) 0.999 (b) N/A (c)	(30±5)%
3	618.3	13.3	8223.8	230.4	11.6	8030.7	0.999 (a) 0.999 (b) N/A (c)	(40±5)%
4	617.9	16.6	10282.5	230.5	14.5	10044.3	0.999 (a) 1.000 (b) N/A (c)	(50±5)%
5	618.5	20.0	12340.3	230.6	17.4	12052.9	1.000 (a) 1.000 (b) N/A (c)	(60±5)%
6	618.6	23.3	14395.2	230.7	20.3	14054.5	1.000 (a) 1.000 (b) N/A (c)	(70±5)%
7	618.7	26.6	16450.6	230.8	23.2	16052.5	1.000 (a) 1.000 (b) N/A (c)	(80±5)%
8	618.9	29.9	18503.7	230.9	26.1	18044.2	0.999 (a) 1.000 (b) N/A (c)	(90±5)%
9	619.0	33.2	20556.7	231.0	28.9	20031.7	1.000 (a) 1.000 (b) N/A (c)	(100±5)%

Supplementary information:
Power factor with “+” indicating leading and “-“ indicating lagging

Each power stage has been maintained during 60 seconds for measurements with a sampling rate of 0.2 s.
Values offered correspond with the 60s average measured with each corresponding stage.
Except for power factor measurements, where:
The value a) indicates the average of measured absolute PF values during each 60s stage of measurement.
The value b) indicates the maximum leading PF value measured during each 60s stage of measurement.
The value c) indicates the maximum lagging PF value measured during each 60s stage of measurement.

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

5.2.1 & 5.4	TABLE: Under-and over-voltage trip settings and reconnection test						P
(1) Under voltage disconnection procedure							
Rated output voltage (V)	**Output power (VA)**	**Required min. voltage (V)**	**Value of PCE trip settings (V)**	**Ratio of decreased (V / s)**	**Inter-val time (ms)**	**Measured tripped voltage (V)**	**Measured disconnec-tion time (ms)**
50 % Vn≤ V < 85 % Vn Phase ABC							
230	20000	195	195	--	2000	194.4	1633
230	20000	155	155	--	2000	154.3	1645
230	20000	117	117	--	2000	115.5	1645
V < 50%Vn Phase ABC							
230	20000	114	114	--	100	112.8	72
(2) Under voltage reconnection procedure							
Ratio of voltage rapidly decreased (V / s)			**Reconnection voltage (V)**			**Reconnection time (s)**	
--			197.6			63.6	
(3) **Over voltage disconnection procedure**							
Rated output voltage (V)	**Output power (VA)**	**Required max. voltage (V)**	**Value of PCE trip settings (V)**	**Ratio of increased (V / s)**	**Inter-val time (ms)**	**Measured tripped voltage (V)**	**Measured disconnec-tion time (ms)**
110 % Vn < V < 135 % Vn Phase ABC							
230	20000	255	255	--	2000	252.9	1624
230	20000	282	282	--	2000	281.2	35
230	20000	309	309	--	2000	285.5(*)	6
(*) Due to the hardware problem of the machine, the voltage has not reached the expected value of trip protection 309V.							
135 % Vn≤ V Phase ABC							
230	20000	312	312	--	50	290.5(*)	6.0
(*) Due to the hardware problem of the machine, the voltage has not reached the expected value of trip protection 312V.							
(4) Over voltage reconnection procedure							
Ratio of voltage rapidly decreased (V / s)			**Reconnection voltage (V)**			**Reconnection time (s)**	
--			251.2			63.2	
Supplementary information: N/A							

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

5.2.2 & 5.4	TABLE: Over/under frequency trip settings and reconnection test	Pass

(1) Under frequency disconnection procedure

Rated output frequency (Hz)	Output power (VA)	Required min. frequency (Hz)	Value of PCE trip settings (Hz)	Ratio of decreased (Hz / s)	Inter-val time (ms)	Measured tripped frequency (Hz)	Measured disconnec-tion time (ms)
50	20000	49	49	--	200	49.0	163

(2) Under frequency reconnection procedure

Ratio of voltage rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
--	49.1	63.4

(3) Over frequency disconnection procedure

Rated output frequency (Hz)	Output power (VA)	Required max. frequency (Hz)	Value of PCE trip settings (Hz)	Ratio of increased (Hz / s)	Inter-val time (ms)	Measured tripped frequency (Hz)	Measured disconnec-tion time (ms)
50	20000	51	51	--	200	51.0	188

(4) Over frequency reconnection procedure

Ratio of voltage rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
--	50.9	64.0

Supplementary information:

N/A

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

5.3	Table: tested condition and run-on time								P
No.	P_{EUT} (% of EUT rating)	Reac-tive load (% of normial)	P_{AC}	Q_{AC}	Run-on time(ms)	P_{EUT} (KW)	Actual Q_f	V_{DC} (d.c.V)	Which load is selected to be adjusted (R or L)
Test condtion A									
1	100	100	0	0	544	20.1	1.01	808.2	--
2	100	100	-5	-5	404	20.2	1.05	808.6	R/L
3	100	100	-5	0	436	20.1	1.05	808.7	R
4	100	100	-5	+5	410	20.2	1.03	808.2	R/L
5	100	100	0	-5	482	20.1	1.02	808.8	L
6	100	100	0	+5	510	20.1	1.05	808.6	L
7	100	100	+5	-5	412	20.1	0.98	809.1	R/L
8	100	100	+5	0	442	20.2	0.96	808.3	R
9	100	100	+5	+5	414	20.1	0.96	808.5	R/L
10	100	100	-10	+10	--	--	--	--	R/L
11	100	100	-5	+10	--	--	--	--	R/L
12	100	100	0	+10	--	--	--	--	L
13	100	100	+10	+10	--	--	--	--	R/L
14	100	100	+10	+5	--	--	--	--	R/L
15	100	100	+10	0	--	--	--	--	R
16	100	100	+10	-5	--	--	--	--	R/L
17	100	100	+10	-10	--	--	--	--	R/L
18	100	100	+5	-10	--	--	--	--	R/L
19	100	100	+5	10	--	--	--	--	R/L
20	100	100	0	-10	--	--	--	--	L
21	100	100	-5	-10	--	--	--	--	R/L
22	100	100	-10	-10	--	--	--	--	R/L
23	100	100	-10	-5	--	--	--	--	R/L
24	100	100	-10	0	--	--	--	--	R/L
25	100	100	-10	+5	--	--	--	--	R/L
Test condtion B									

IEC 61727									
Clause	Requirement + Test					Result - Remark			Verdict
10	66	66	0	0	496	13.2	1.00	571.2	--
11	66	66	0	-5	418	13.2	1.02	571.8	L
12	66	66	0	-4	430	13.2	1.02	571.7	L
13	66	66	0	-3	444	13.2	1.02	571.4	L
14	66	66	0	-2	446	13.2	1.01	572.0	L
15	66	66	0	-1	462	13.2	1.00	571.6	L
16	66	66	0	1	490	13.2	1.00	571.8	L
17	66	66	0	2	468	13.2	0.99	572.1	L
18	66	66	0	3	458	13.2	0.98	571.8	L
19	66	66	0	4	452	13.2	0.98	571.9	L
20	66	66	0	5	404	13.2	0.97	571.3	L
21	66	66	0	6	--	--	--	--	L
Test condition C									
22	33	33	0	0	518	6.6	1.00	328.3	--
23	33	33	0	-5	380	6.6	1.03	328.4	L
24	33	33	0	-4	442	6.6	1.02	328.9	L
25	33	33	0	-3	448	6.6	1.02	329.0	L
26	33	33	0	-2	466	6.6	1.01	328.5	L
27	33	33	0	-1	482	6.6	1.01	328.3	L
28	33	33	0	1	508	6.6	1.00	328.2	L
29	33	33	0	2	444	6.6	0.99	329.1	L
30	33	33	0	3	424	6.6	0.99	328.8	L
31	33	33	0	4	422	6.6	0.98	328.6	L
32	33	33	0	5	396	6.6	0.97	328.4	L
33	33	33	0	6	--	--	--	--	L

Remark:
For test condition A:
If any of the recorded run-on times are longer than the one recorded for the rated balance condition, then the non-shaded parameter combinations also require testing.
For test condition B and C:
If run-on times are still increasing at the 95 % or 105 % points, additional 1 % increments is taken until run-on times begin decreasing.
The compliances with these requirements are stated in the following test report:
IEC 62116: test report nº GZES200601936102

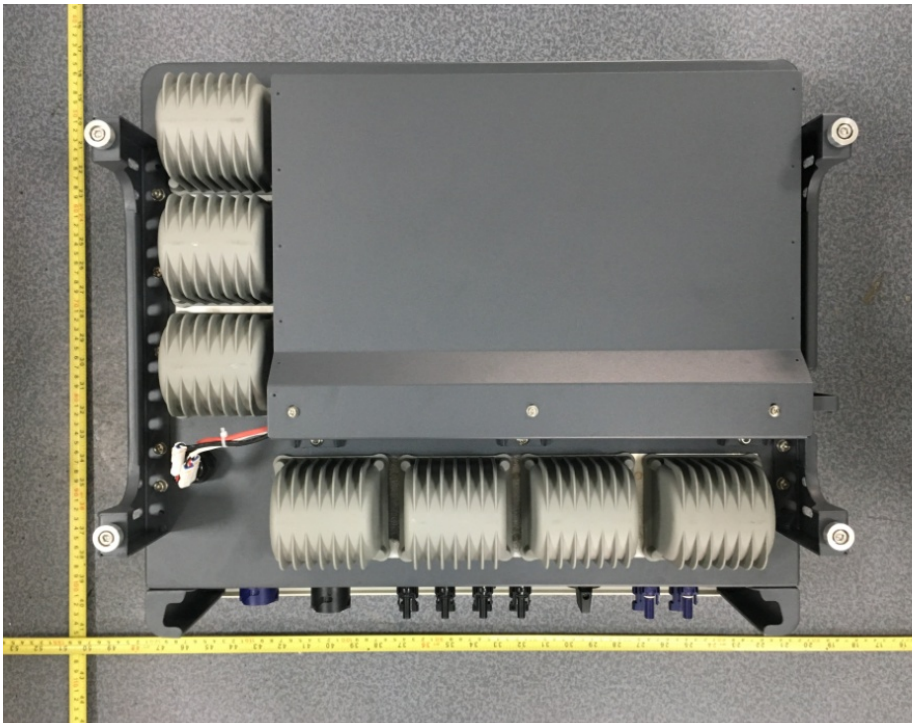
--- End of test report---

Attachment I

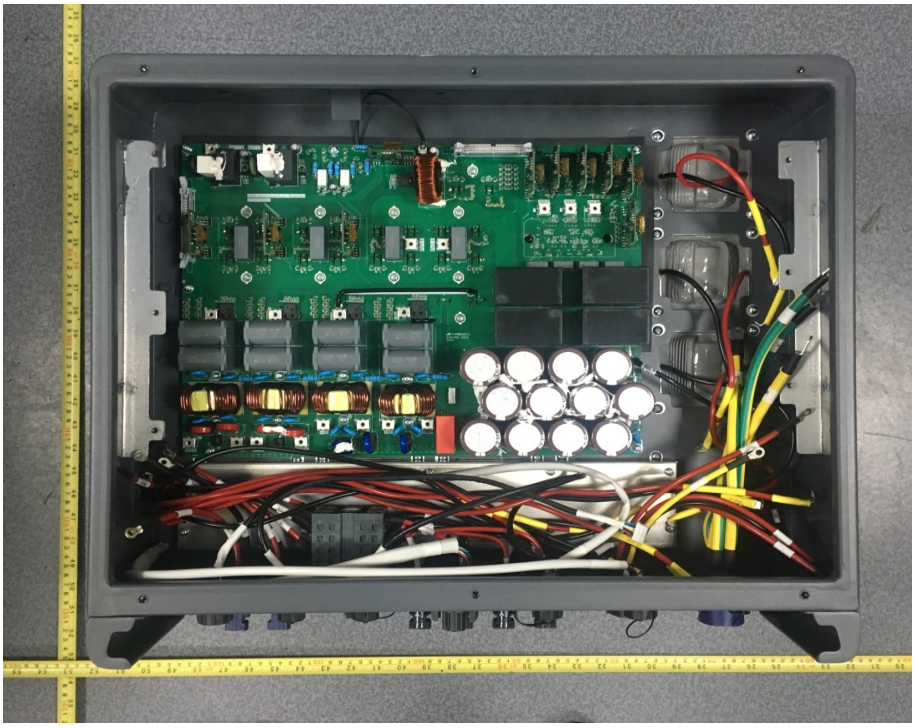
(Pictures of the EUT and Electrical Schemes)

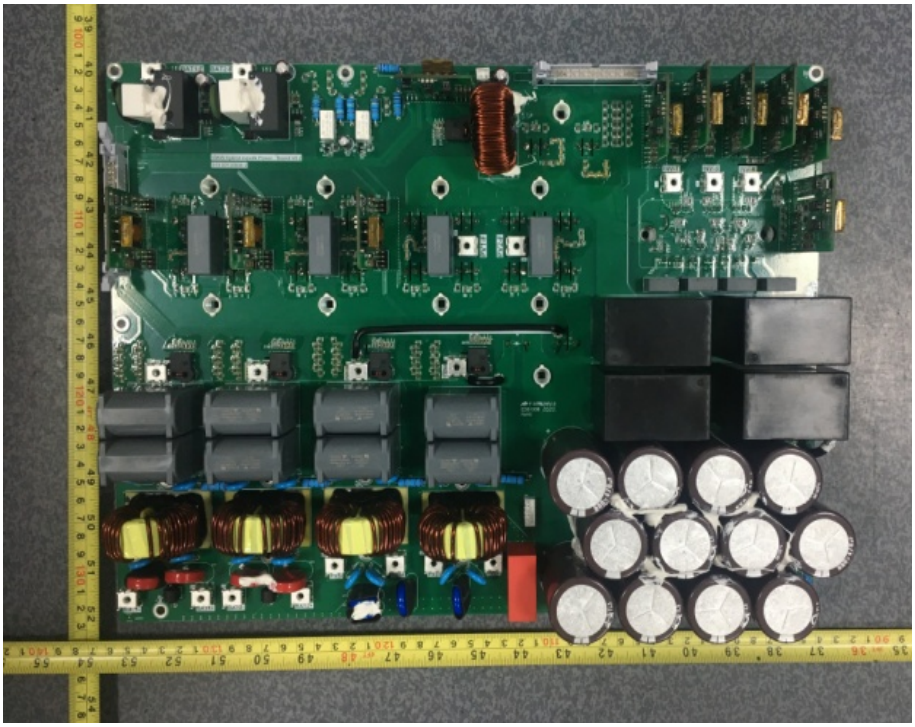
1 PICTURES

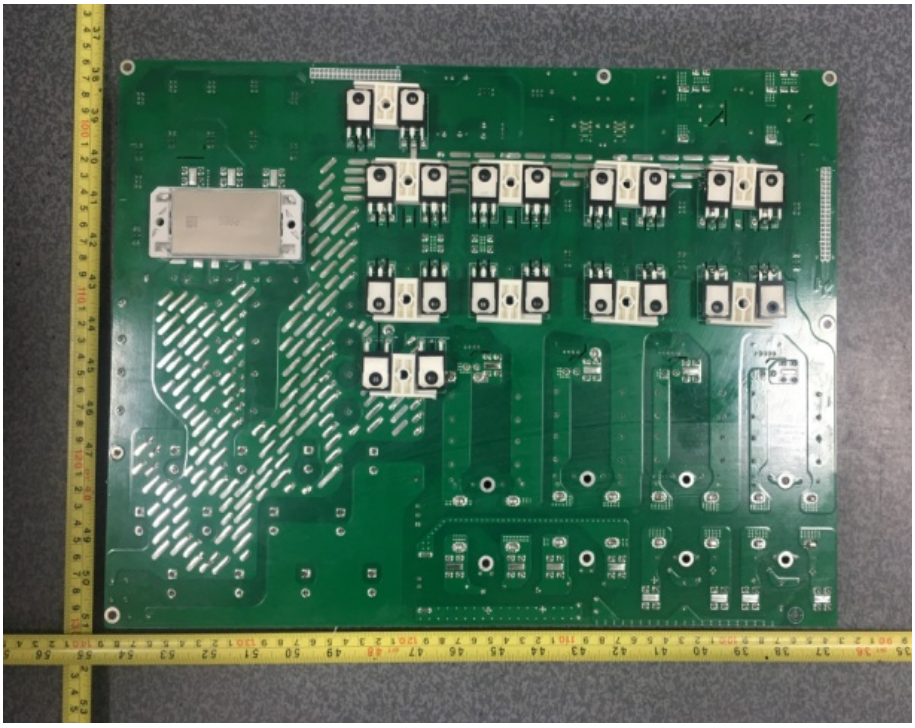
Front view

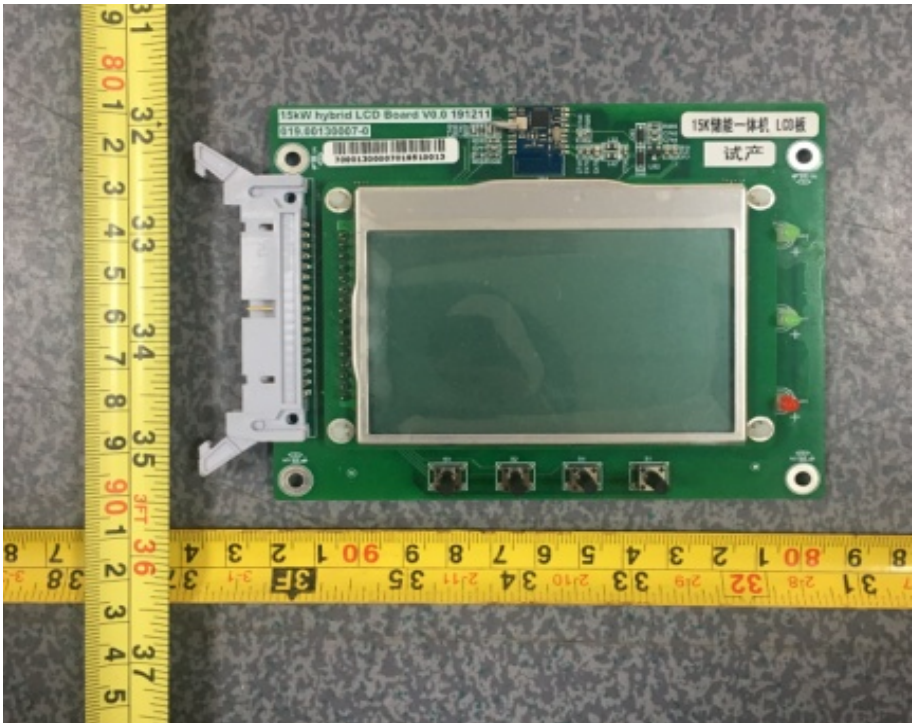
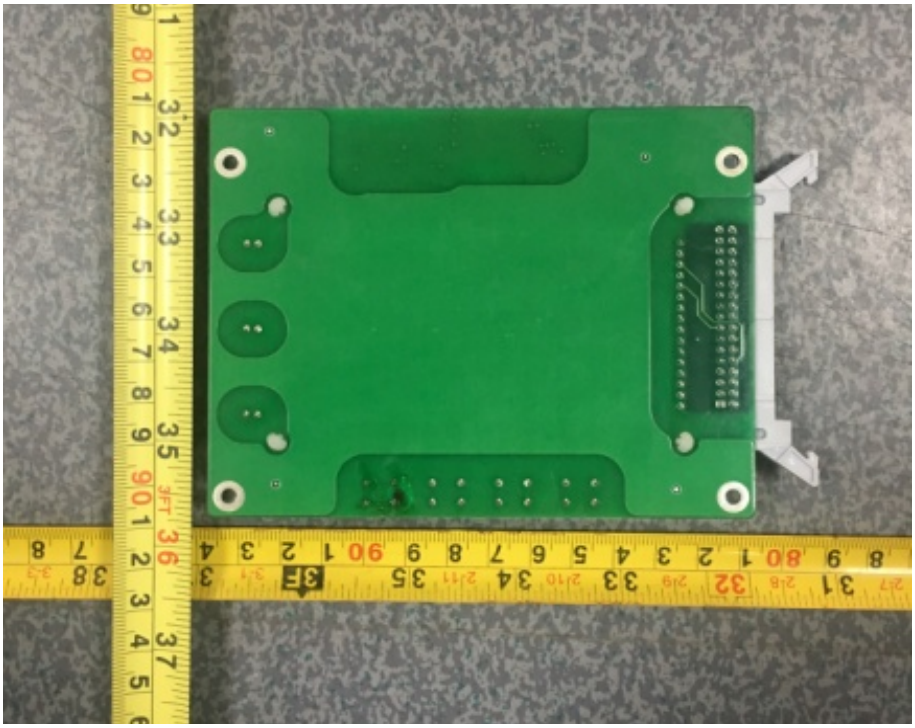

Back view


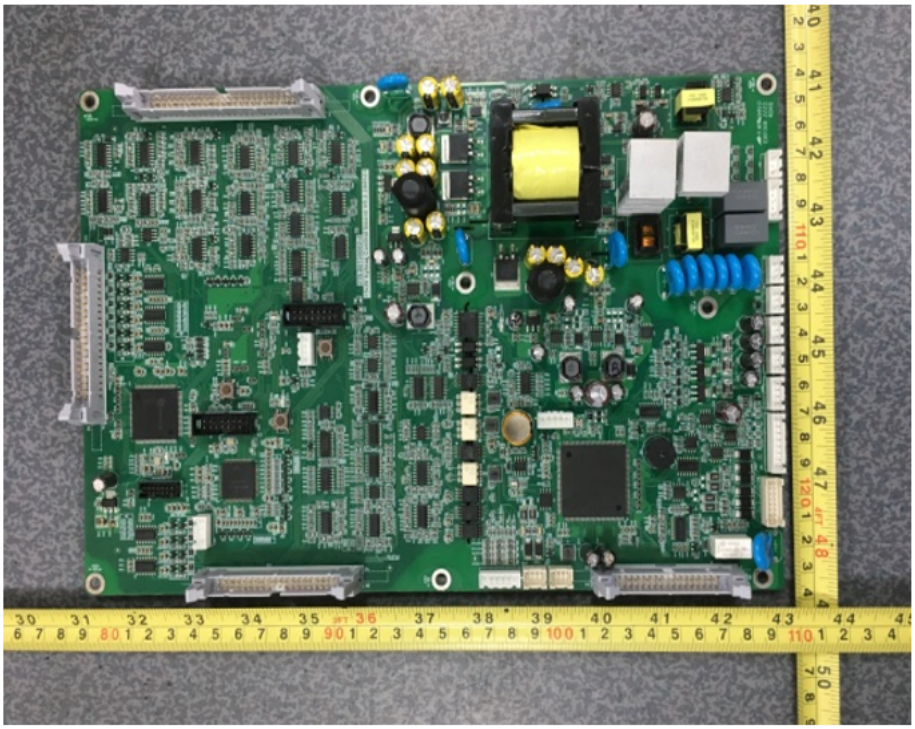
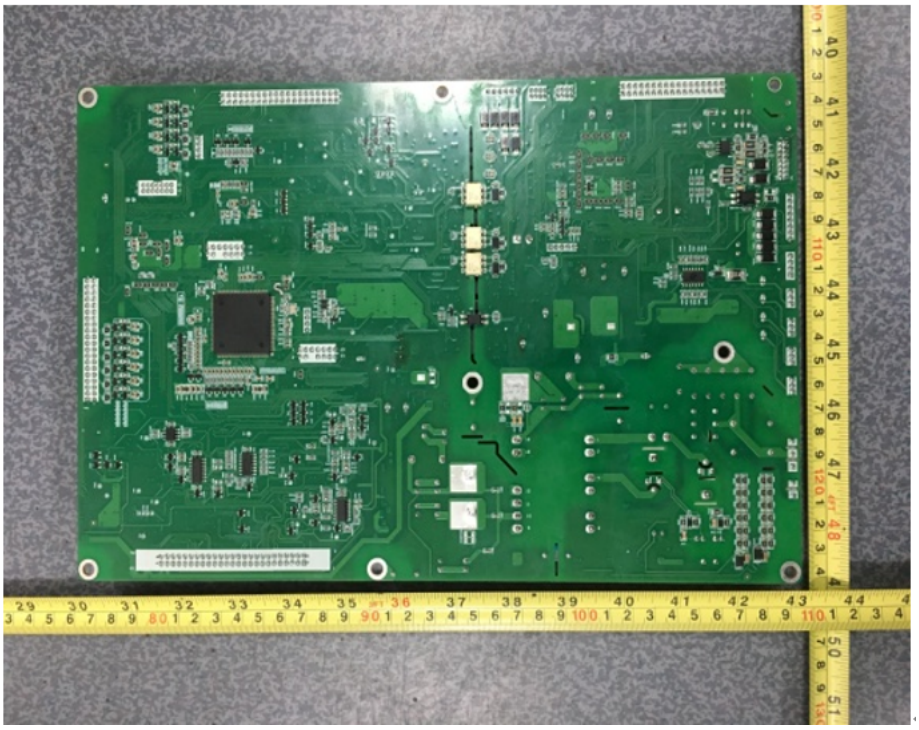
Internal View 1


Internal View 2


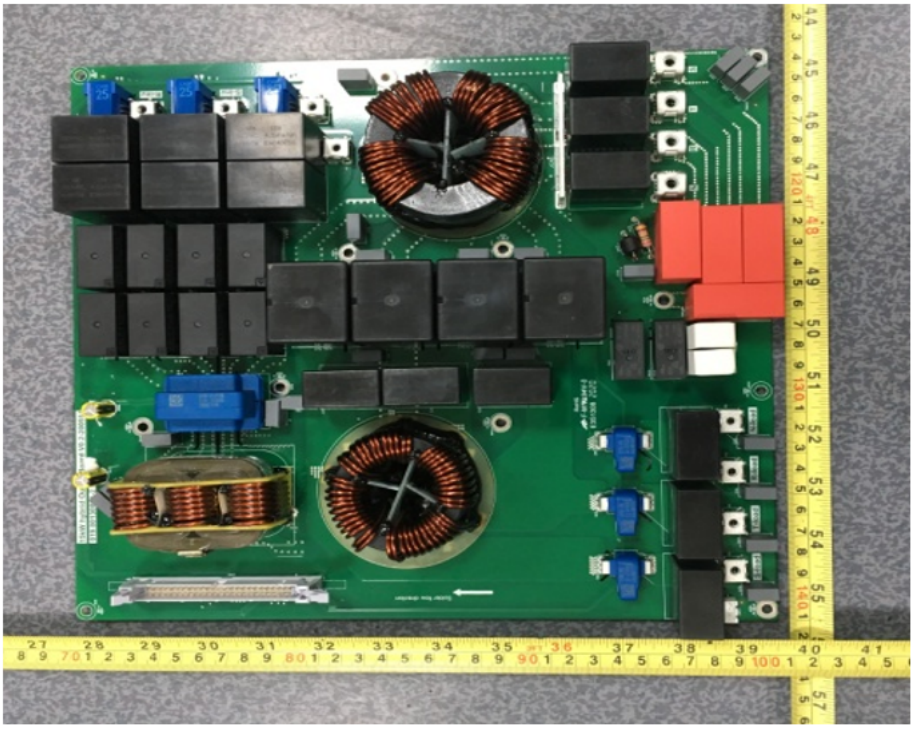
Front side of Power board


Back side of Power board


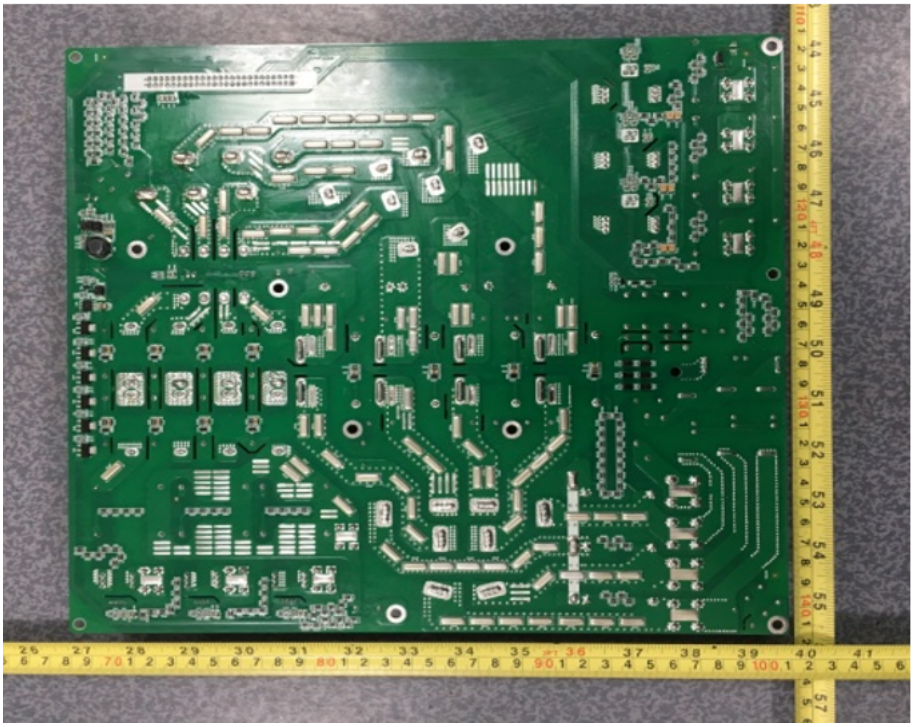
Front side of Display board

Back side of Display board


Front side of Control board

Back side of Control board


Front side of Output board front



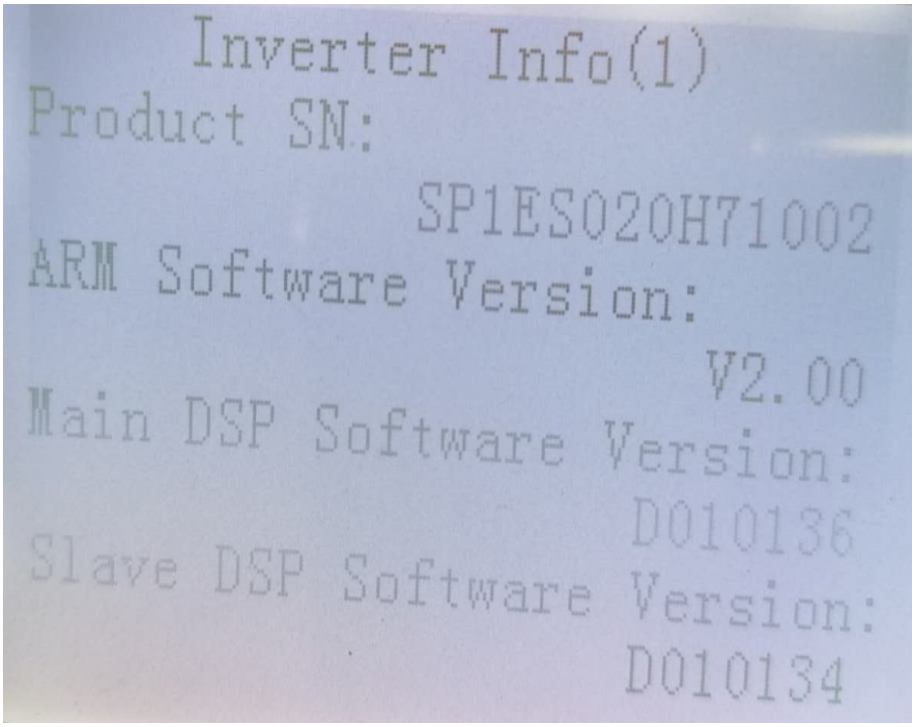
Back side of Output board front



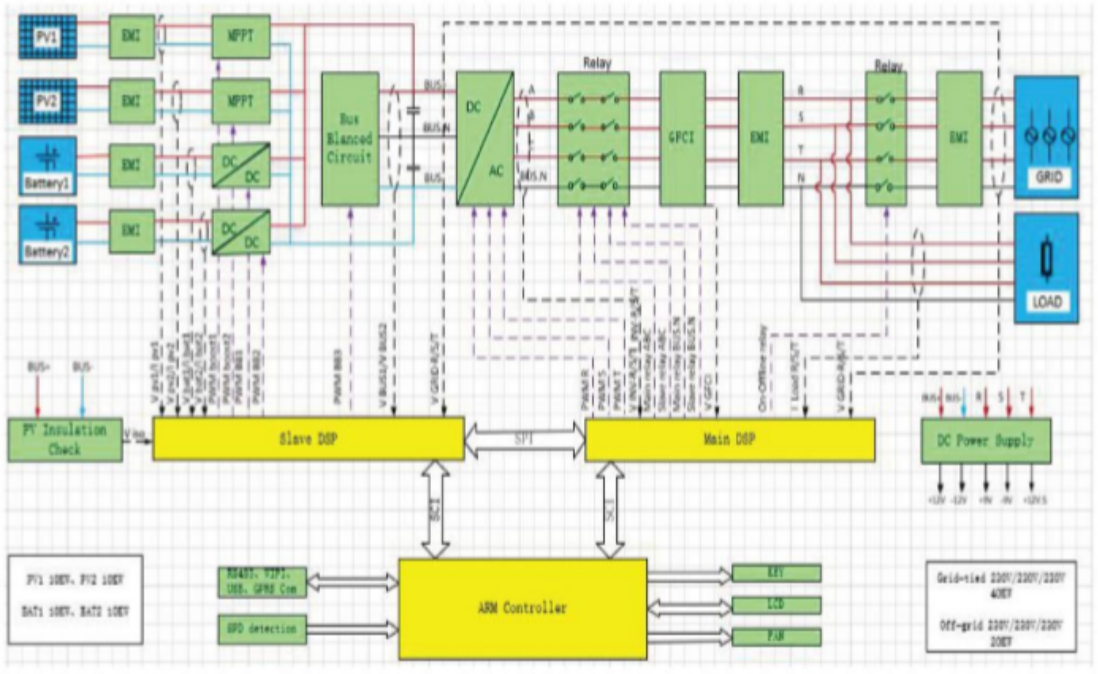
Grounding


Connection interface


Serial Number and Software Version



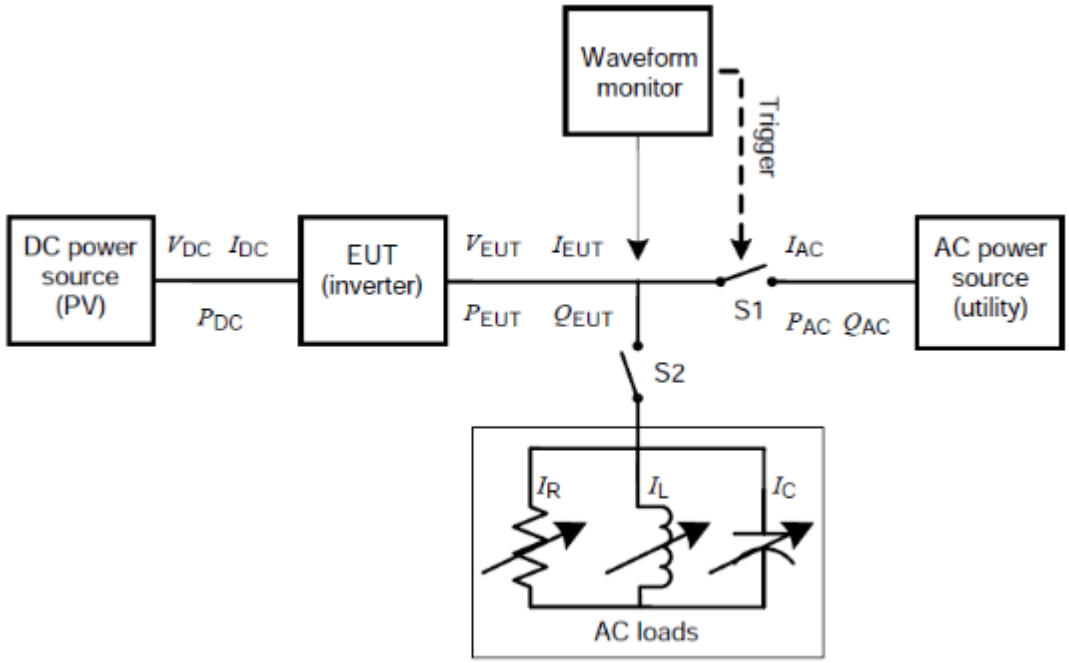
2 ELECTRICAL SCHEMES



Attachment II

(Testing information)

1 TESTING CIRCUIT



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

All the tests and checks have been performed in accordance with the reference standard under testing.

2 TESTING EQUIPMENT

From	No.	Equipment Name	Model No.	Equipment No.	Calibration Date	Equipment calibration due date
Sofar Solar	1	Digital oscilloscope	MD03024	MY58491772	2020/04/24	2021/04/23
	2	Voltage probe	SI-9110	111152	2020/1/14	2021/1/13
	3	Voltage probe	SI-9110	152627	2020/01/14	2021/01/13
	4	Voltage probe	SI-9110	111134	2020/01/14	2021/01/13
	5	Power analyzer	PA5000H	C8202909082002110001	2020/03/02	2021/03/01
	6	Current probe	CP1000A	C181000922	2020/01/14	2021/01/13
	7	Current probe	CP1000A	C181000925	2020/01/14	2021/01/13
	8	Current probe	CP1000A	C181000929	2020/01/14	2021/01/13
	9	Temperature & Humidity meter	TH101B	ZB-WSDJ-001	2020/01/14	2021/01/13
SGS	10	True RMS Multimeter	Fluke / 187	GZE012-8	2019/12/05	2020/12/04

Items	Specifications
1) PV array simulator	
a) Voltage range	0 – 1000Vdc (0.01V step)
b) Current range	0 – 40A (0.01A step)
2) AC power source	
a) Output wiring	Three phase
b) Output capacity	30KVA
c) Output voltage	10-300Vrms
d) Output frequency	45-65Hz
e) Voltage stability	± 100ppm/℃
f) Output voltage distortion	0.05% max.
3) Digital meter	
a) Voltage range	0 – 1000Vdc, 0 – 600Vrms
b) Current range	0 – 30A
c) Frequency range (accuracy)	0.2%
d) Measurement items	Voltage (V) Current (A) Active power (W) Reactive power (Var) Volt-ampere (VA) Power factor (PF) Frequency (Hz) Electric energy (Wh)
4) Waveform recorder	
a) Sampling speed	1M/s
b) Recording device	Memory record and USB reading
c) Time accuracy	± 500ppm
5) AC load	
a) Resistive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KW
b) Inductive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KVA
c) Capacitive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KVA

3 MEASUREMENT UNCERTAINTY

Magnitude	Uncertainty
Voltage measurement	±1.5 %
Current measurement	±2.0 %
Frequency measurement	±0.2 %
Time measurement	±0.2 %
Power measurement	±2.5 %
Phase Angle	±1º
Temperature	±3º C
Note1: Measurements uncertainties showed in this table are maximum allowable uncertainties. The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the petitioner. Note2: Where the standard requires lower uncertainties that those in this table. Most restrictive uncertainty has been considered.	

Attachment III

(GRAPHS AND SCREENSHORTS OF TEST RESULTS)

Flickers

The measurements of voltage fluctuations have been measured at 33 %, 66% and 100 % of the nominal power value of the inverter.

As it can be seen in the next screenshots, this test has two steps:

1.Starting operation
2.Stopping operation

The values took of Dmax of the two steps.

Starting operation and Stopping operation for 50Hz

33% Pn (Phase A)

33% Pn (Phase B)

33% Pn (Phase C)

66% Pn (Phase A)

66% Pn (Phase B)

66% Pn (Phase C)

100% Pn (Phase A)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.105 Pass	0.155 Pass	0.0 Pass	0.061 Pass	
2	0.101 Pass	0.173 Pass	0.0 Pass	0.054 Pass	
Result	Pass	Pass	Pass	Pass	0.058 Pass

100% Pn (Phase B)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.010 Pass	0.108 Pass	0.0 Pass	0.139 Pass	
2	0.012 Pass	0.122 Pass	0.0 Pass	0.139 Pass	
Result	Pass	Pass	Pass	Pass	0.139 Pass

100% Pn (Phase C)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:2	
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass		
2	0.004	Pass	0.105	Pass	0.0	Pass	0.049	Pass		
Result		Pass		Pass		Pass		Pass	0.049	Pass

As it can be seen in the next screenshots is running operation. The values took of Pst and Plt are the most unfavorable of the twelve steps.

Running operation for 50Hz

33% 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

33% 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

33% 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

66% 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

66% 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

66% 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

100% 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

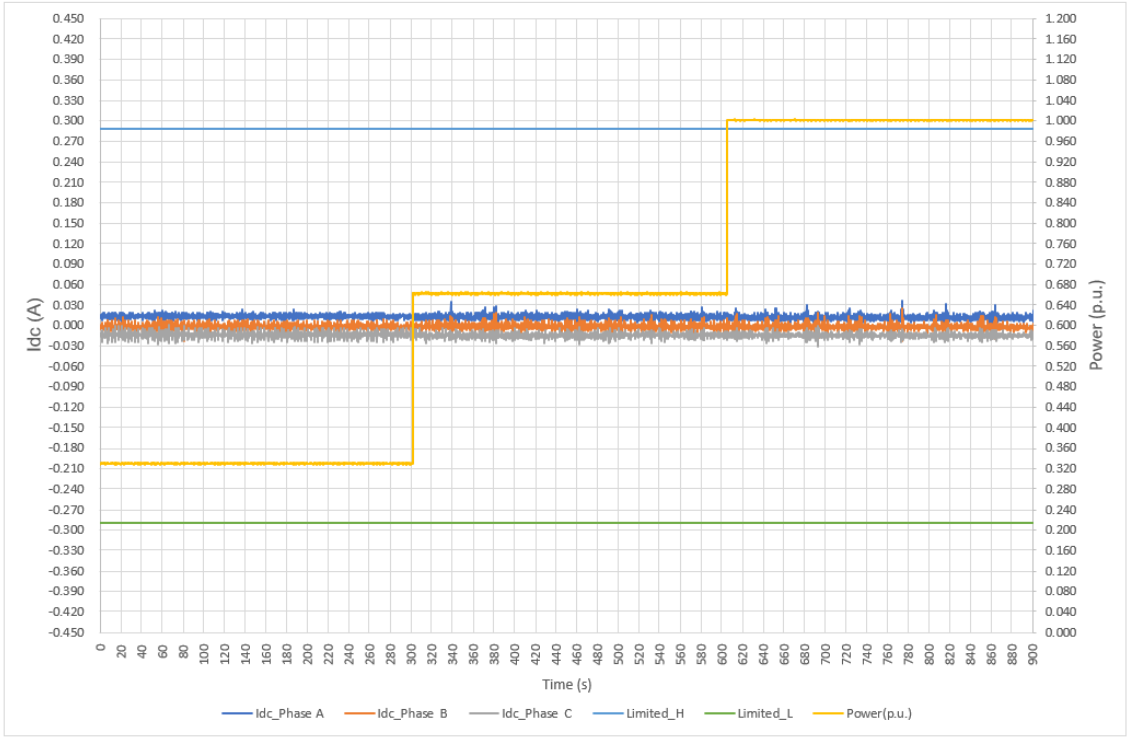
100% Pn (Phase B)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.014	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

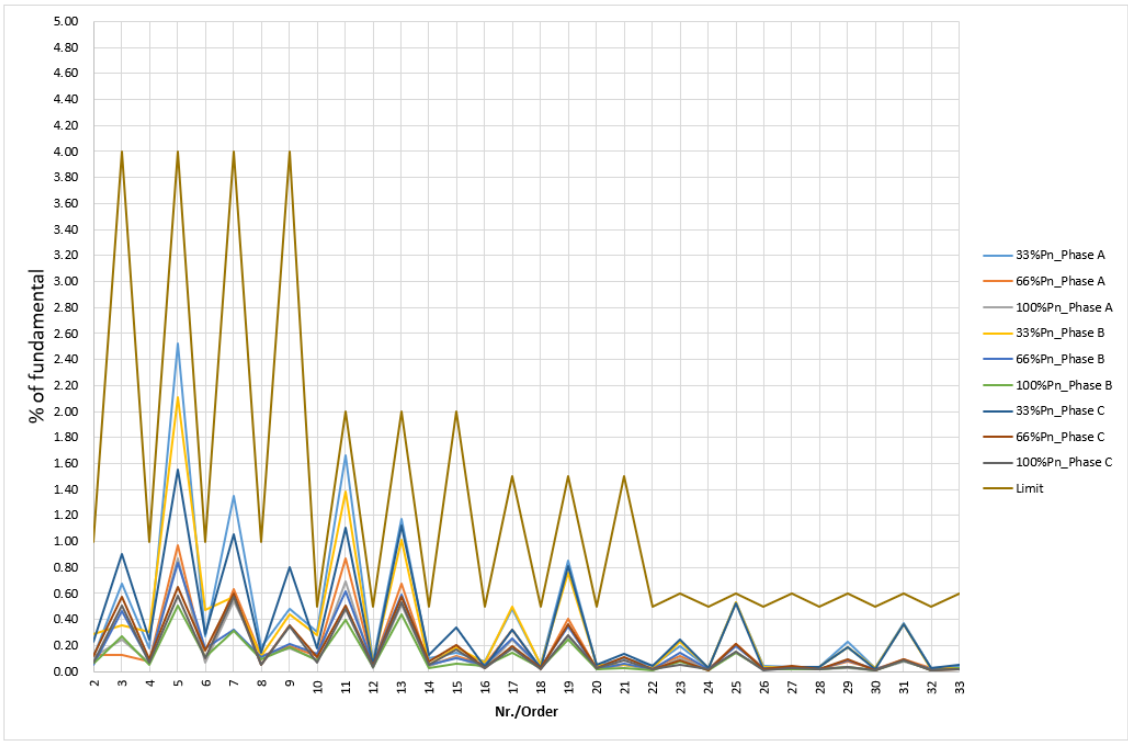
100% Pn (Phase C)

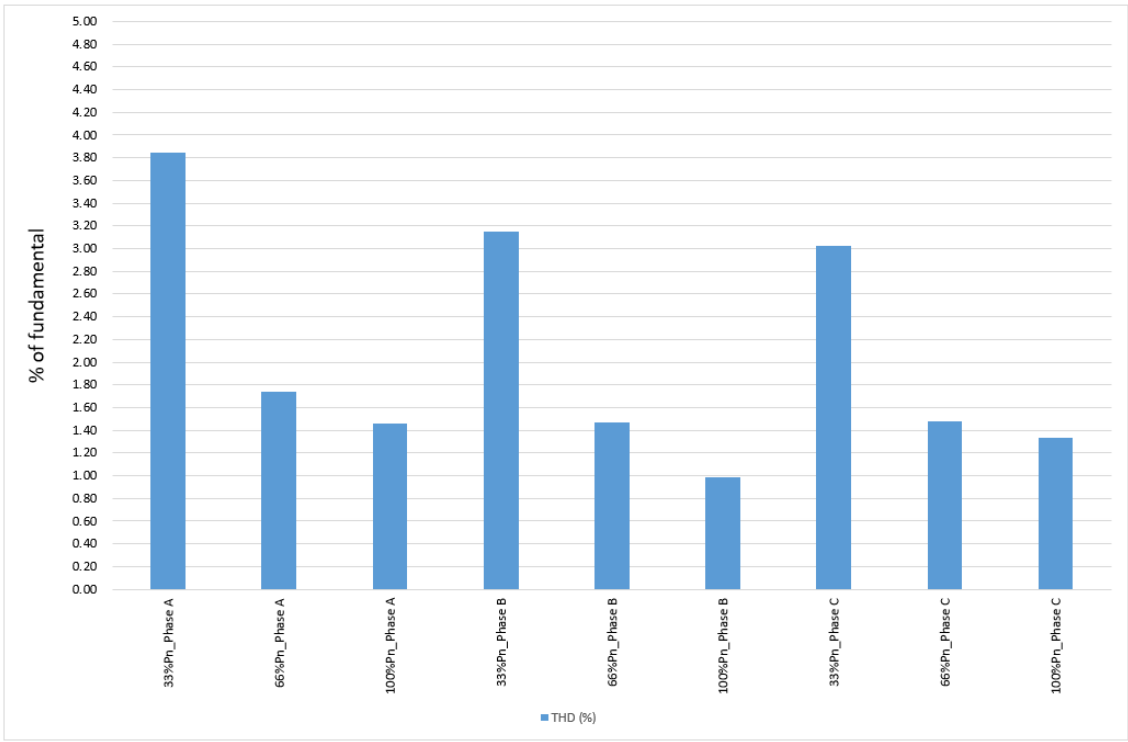
	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.043	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
3	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
4	0.000	Pass	0.000	Pass	0.0	Pass	0.042	Pass		
5	0.000	Pass	0.000	Pass	0.0	Pass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

Direct current injection

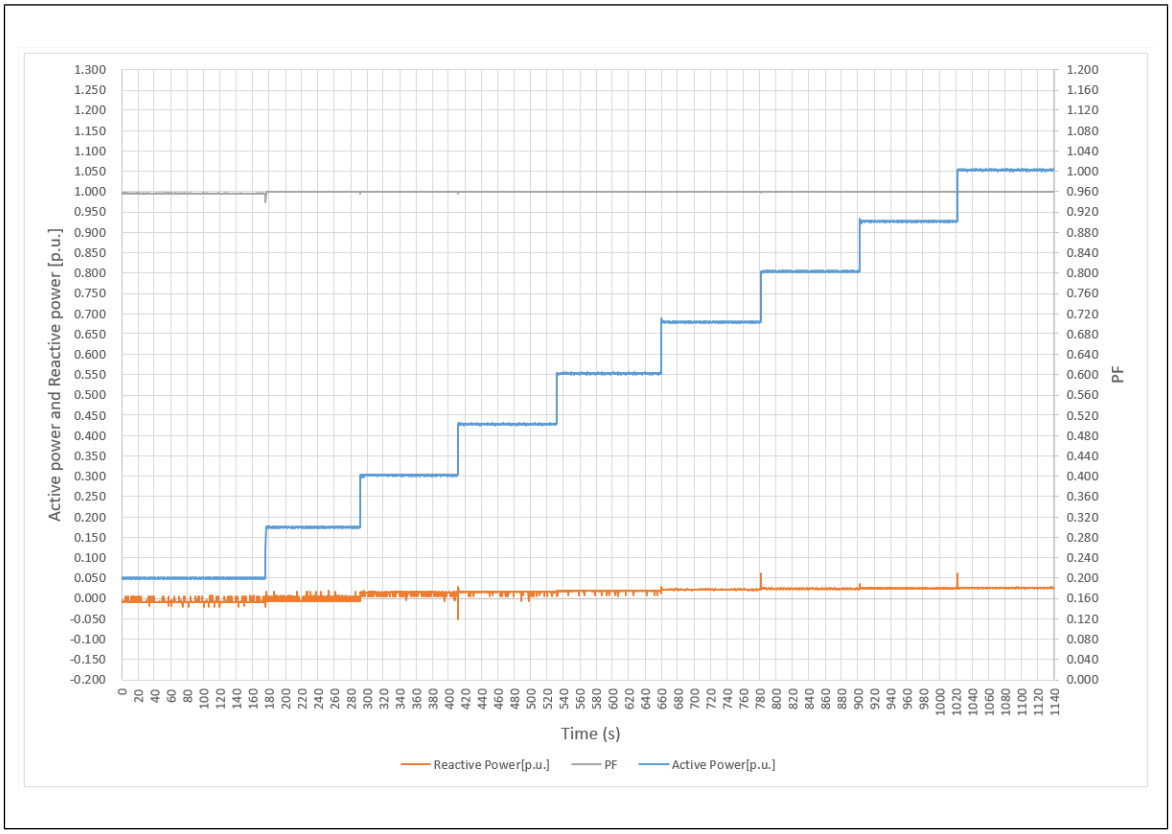
DCI


Harmonics and waveform distortion





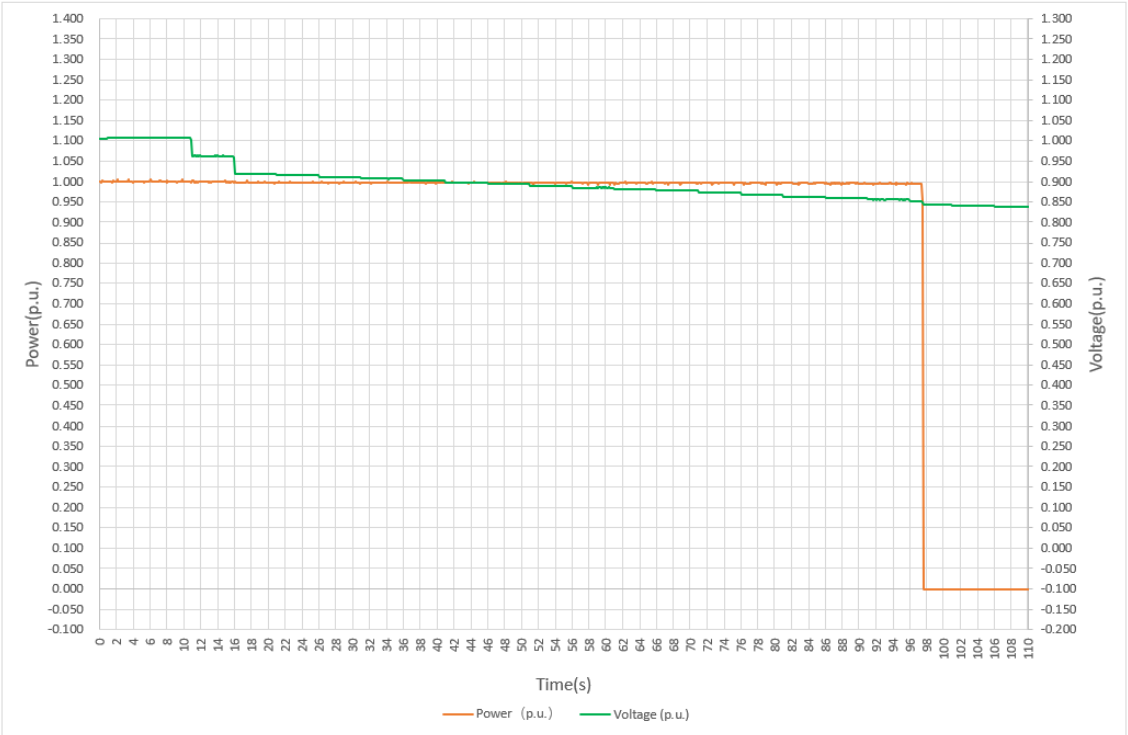
Power factor



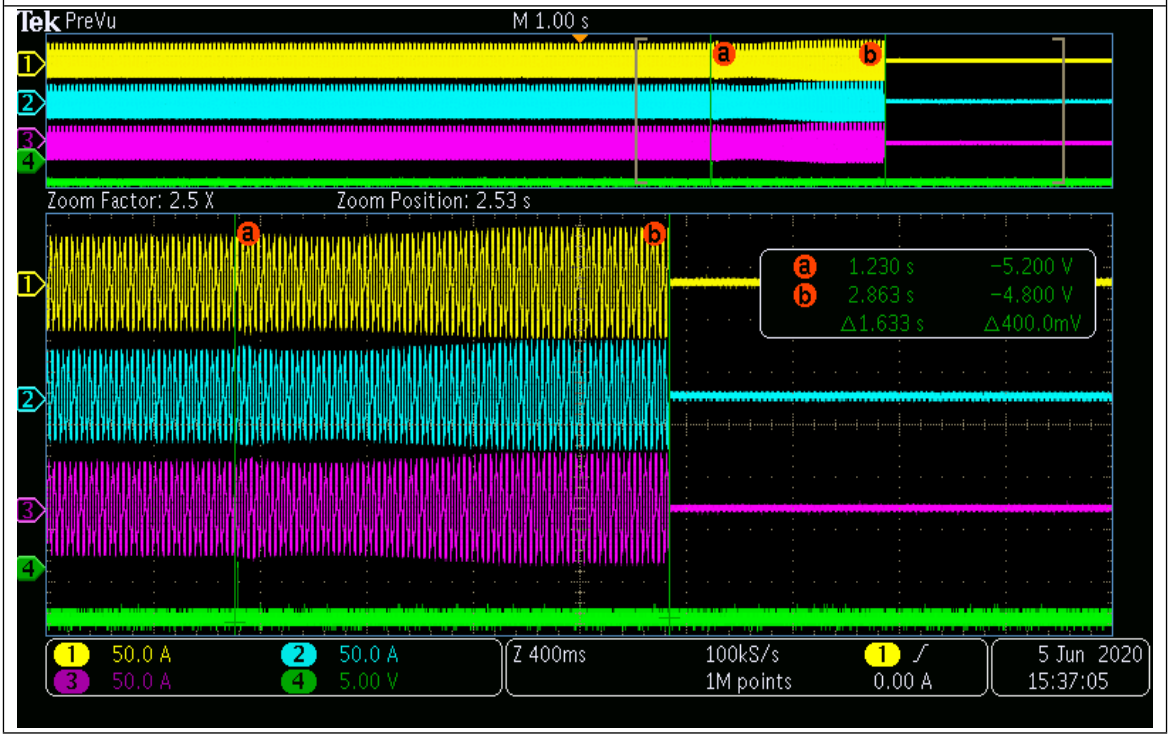
Under-and over-voltage trip settings and reconnection test

50 %Vn ≤ V < 85 %Vn (setting at 195V)

Trip Value

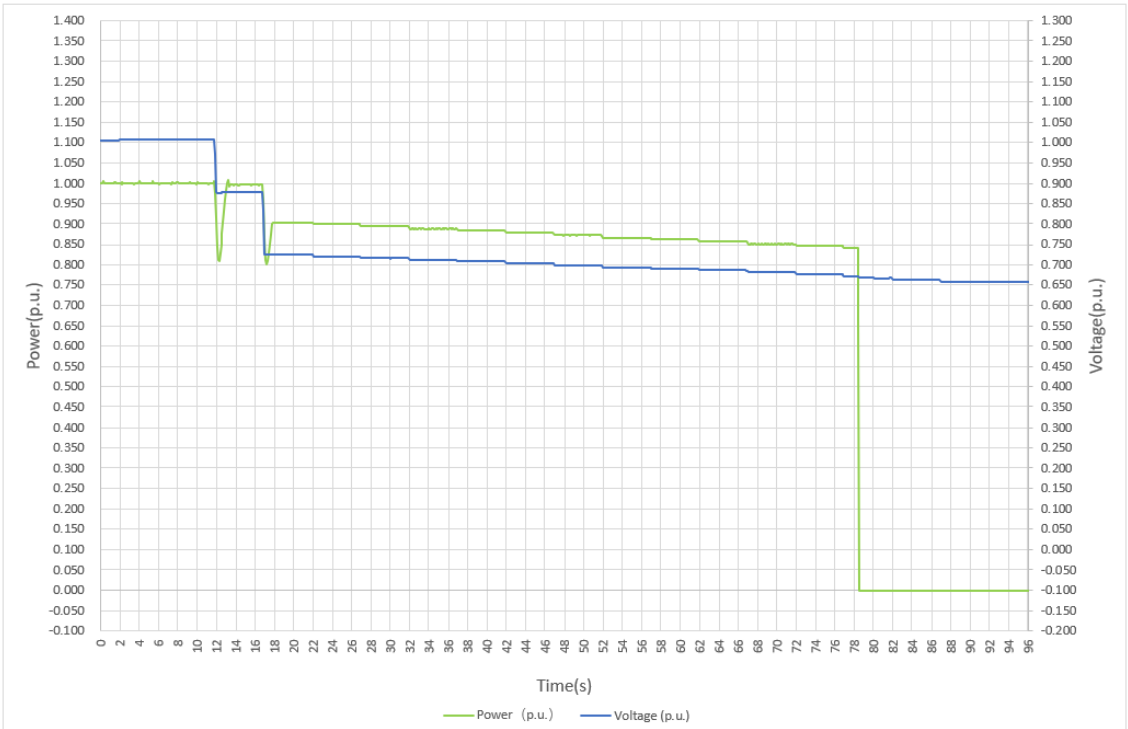


Disconnection Time

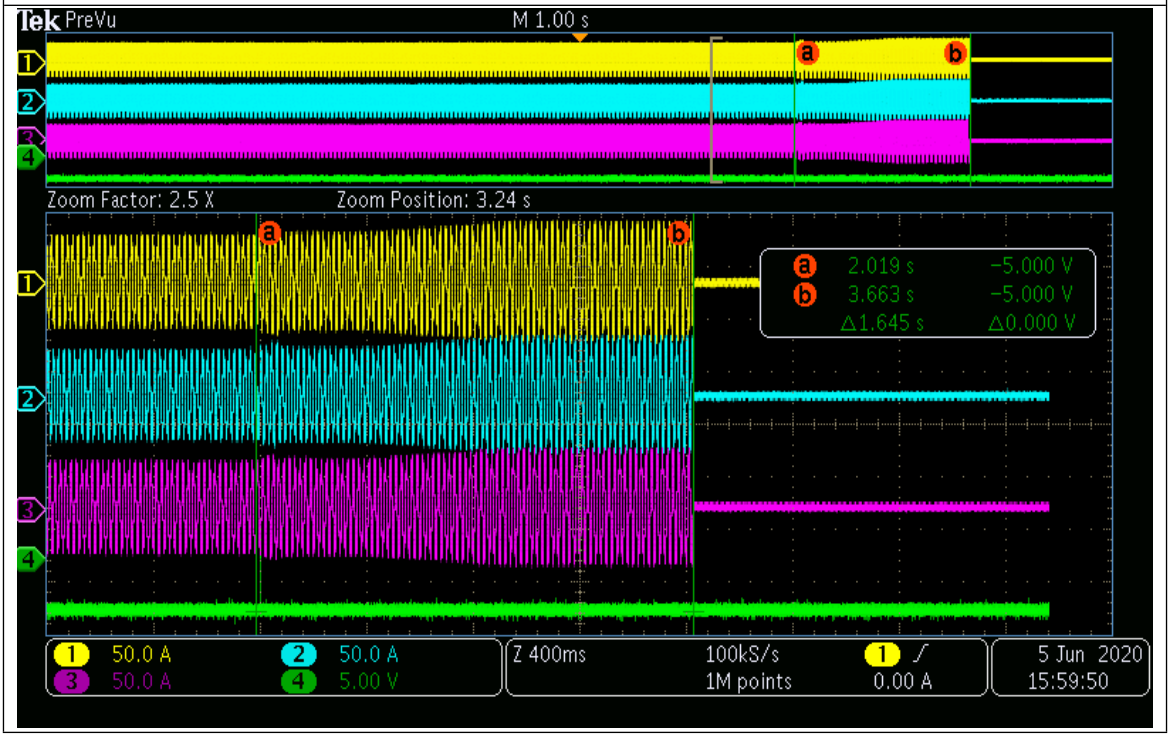


50 % ≤ V < 85 %(setting at 155V)

Trip Value



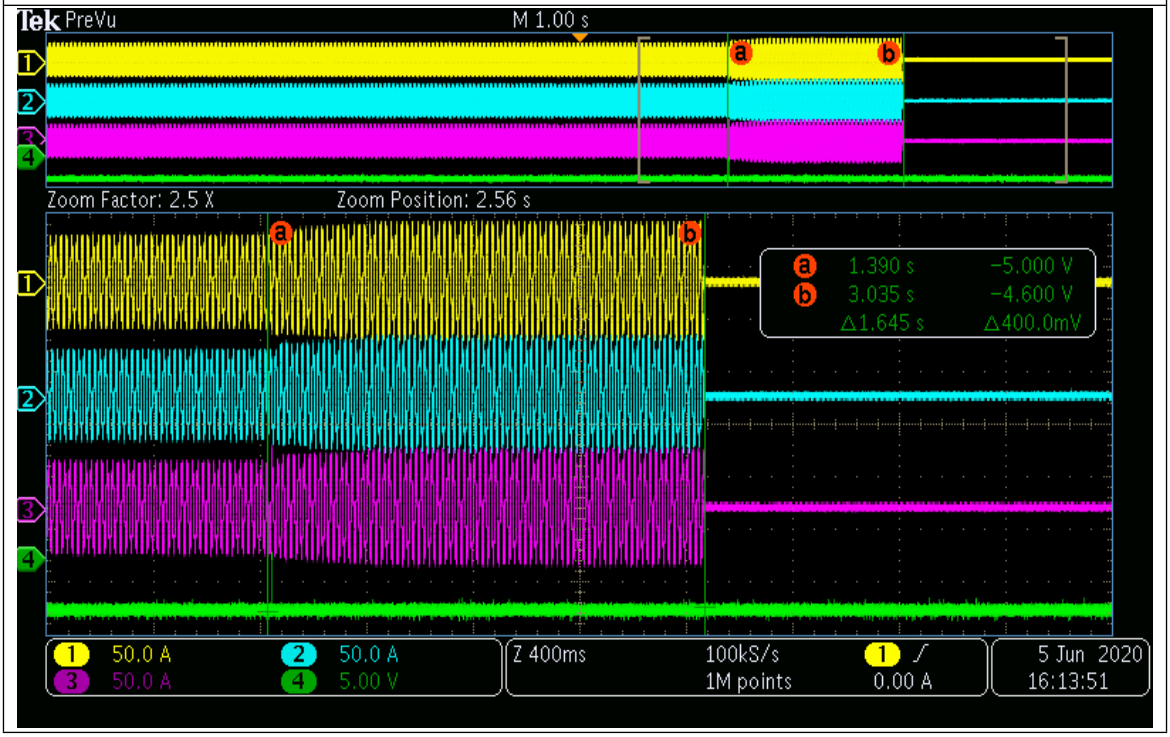
Disconnection Time



50 %Vn ≤ V < 85 %Vn (setting at 117V)

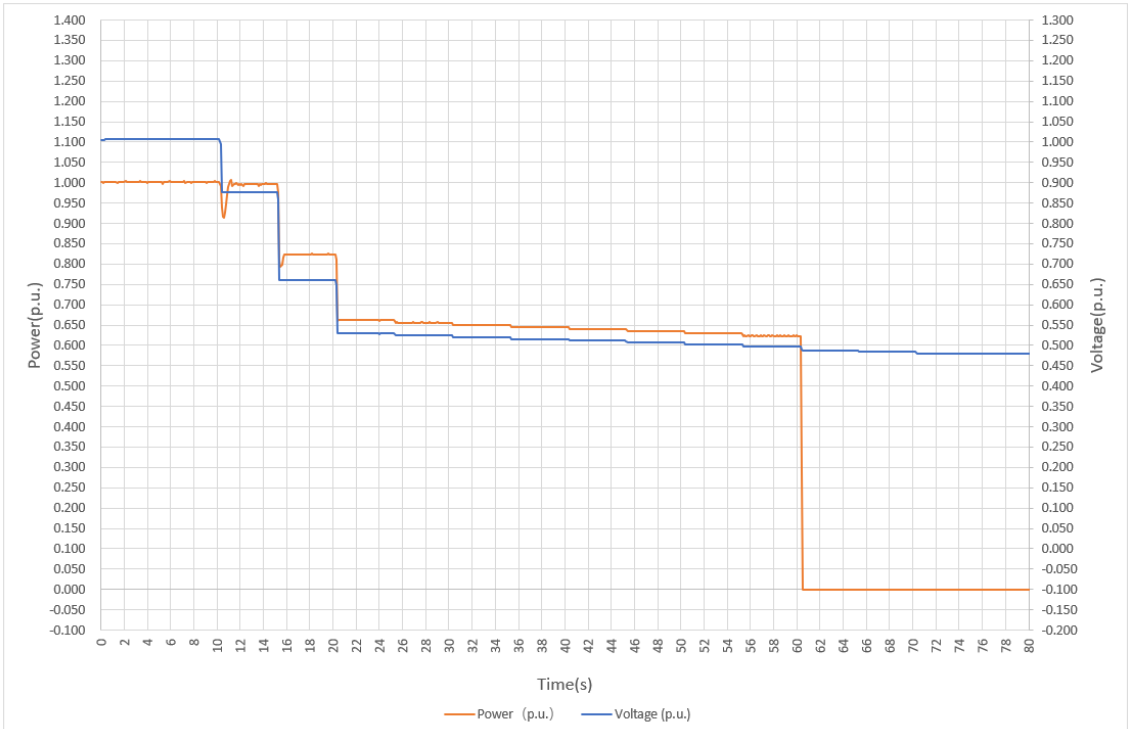
Trip Value

Disconnection Time

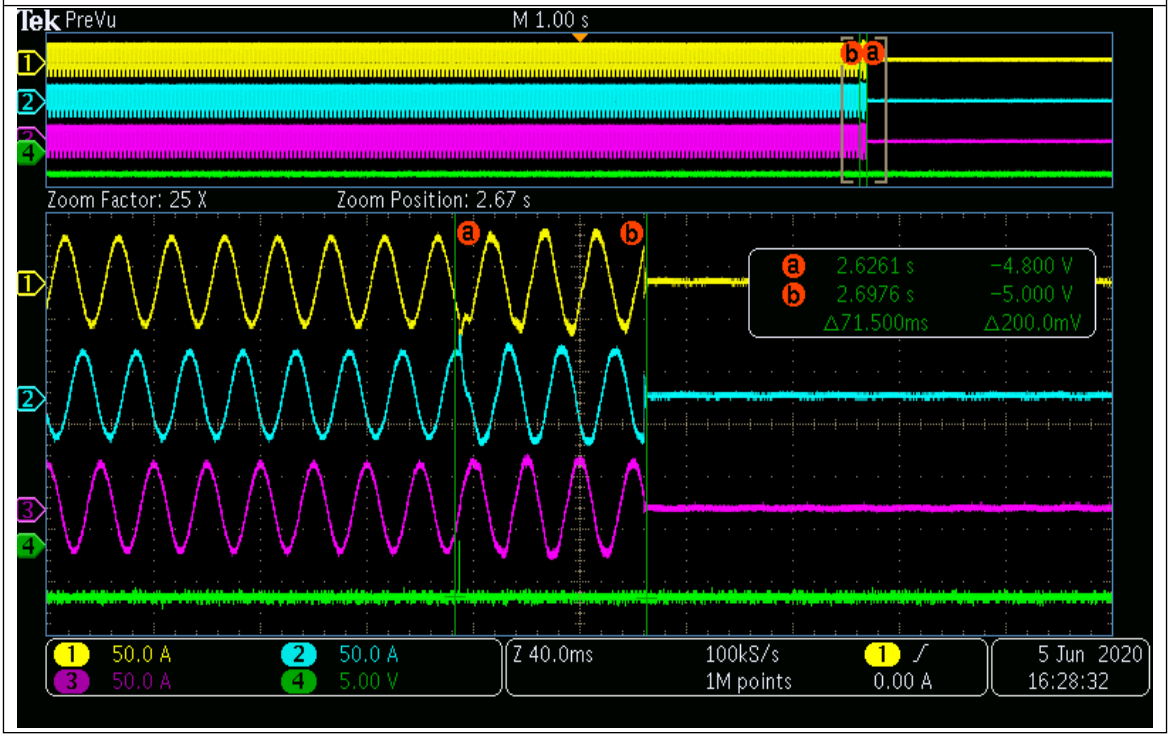


V < 50%Vn

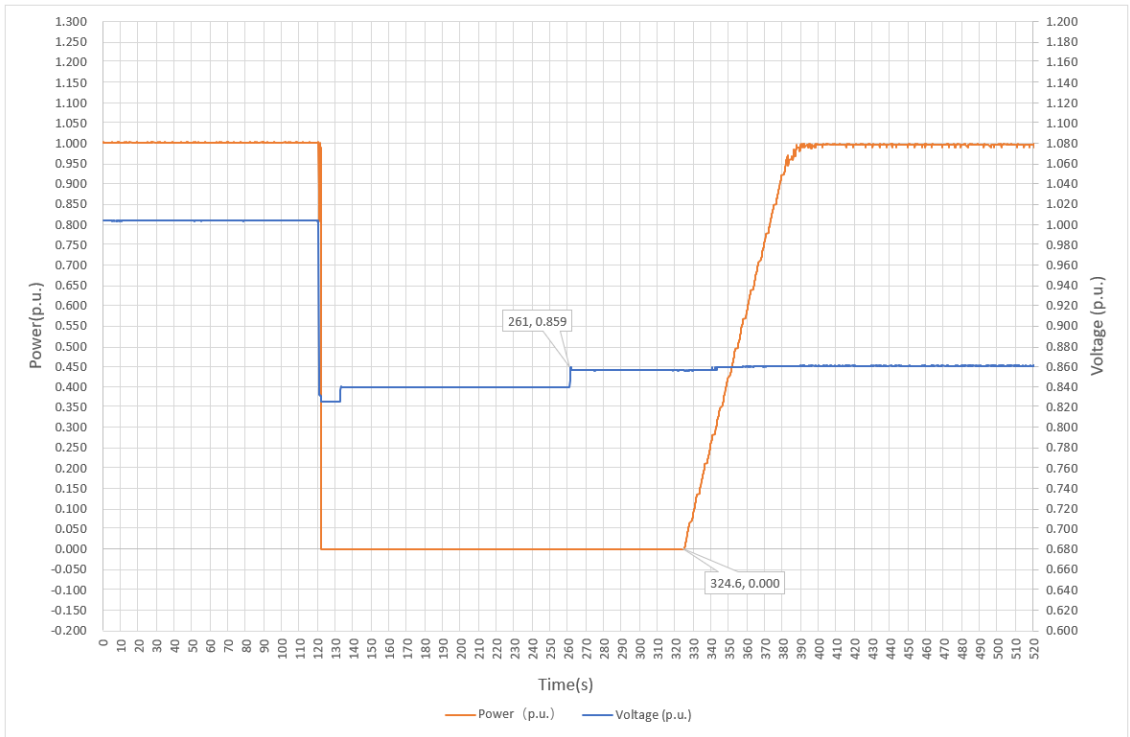
Trip Value



Disconnection Time

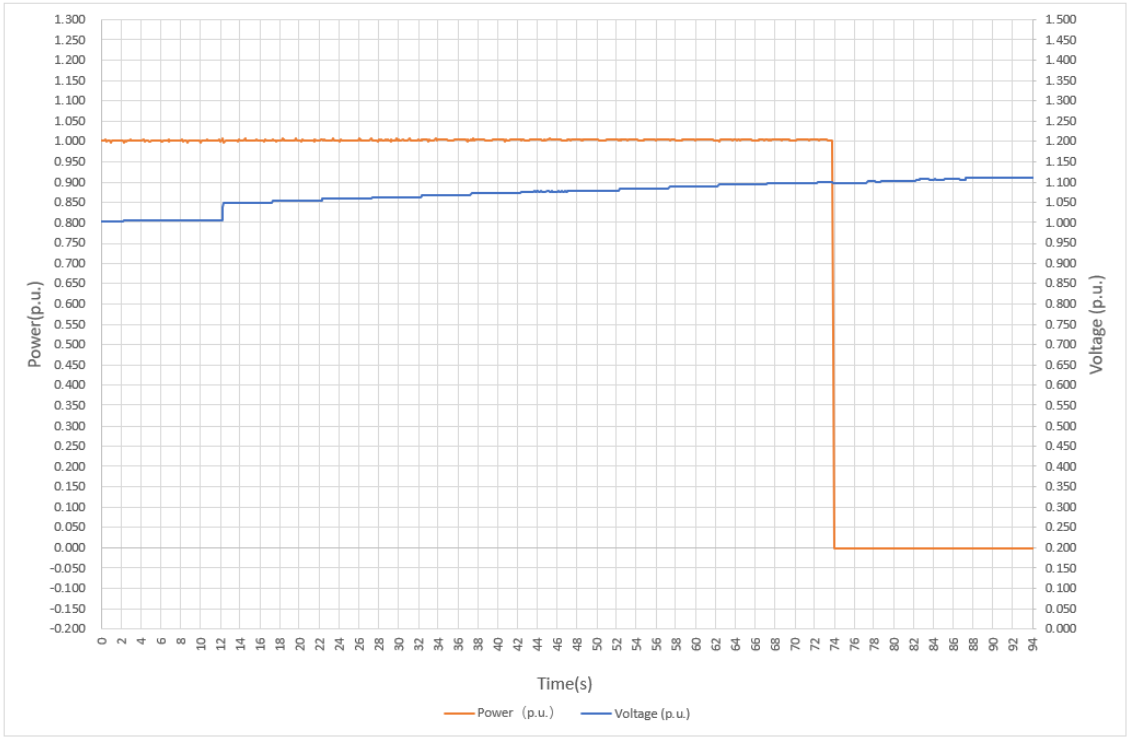


Under voltage Reconnection

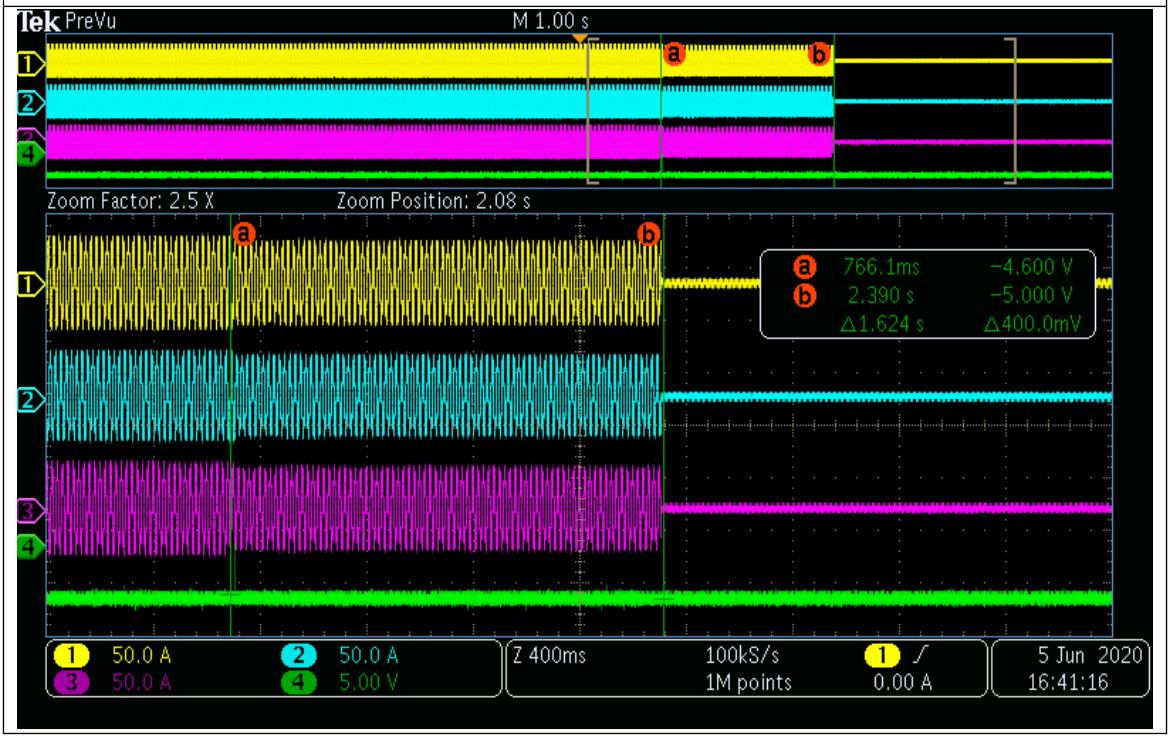


110 %Vn < V < 135 %Vn(setting at 255V)

Trip value

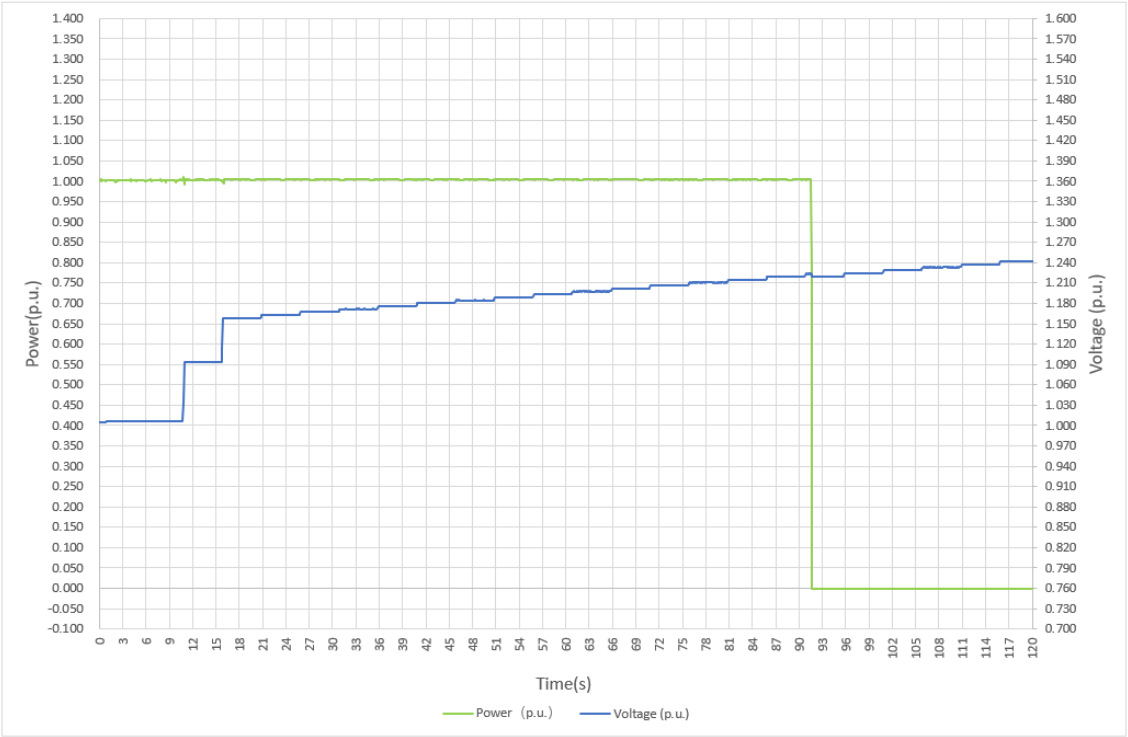


Disconnection Time

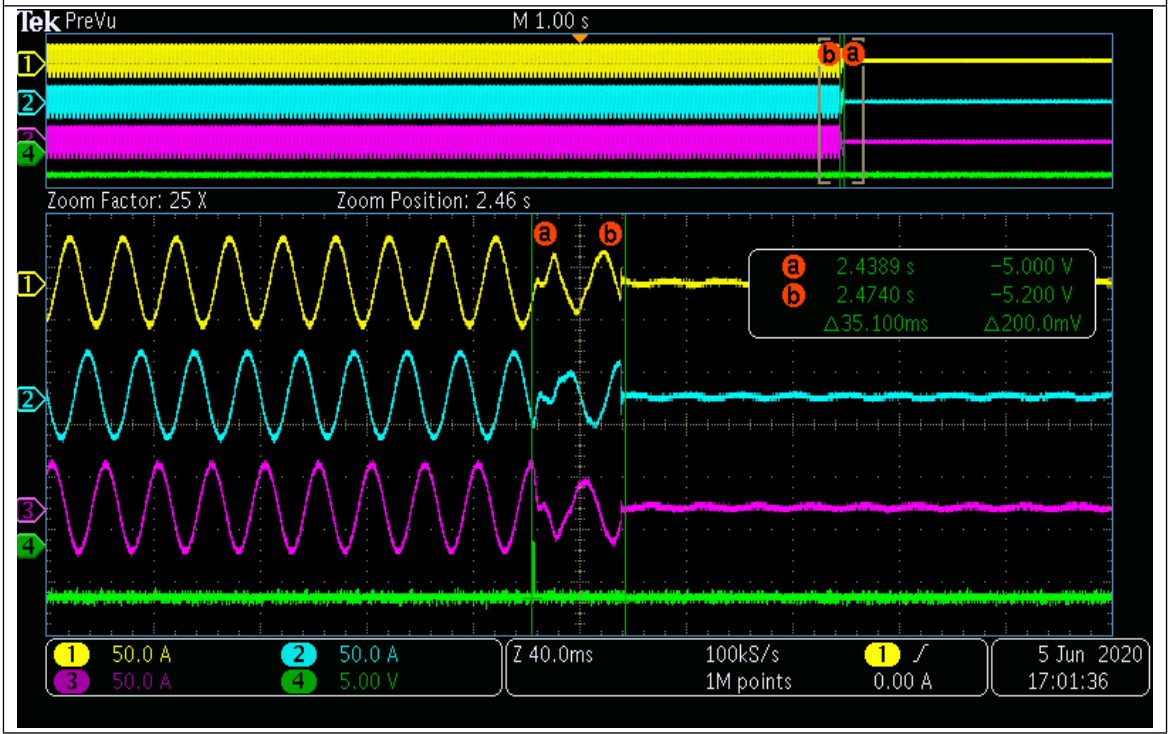


110 %Vn < V < 135 %Vn(setting at 282V)

Trip value

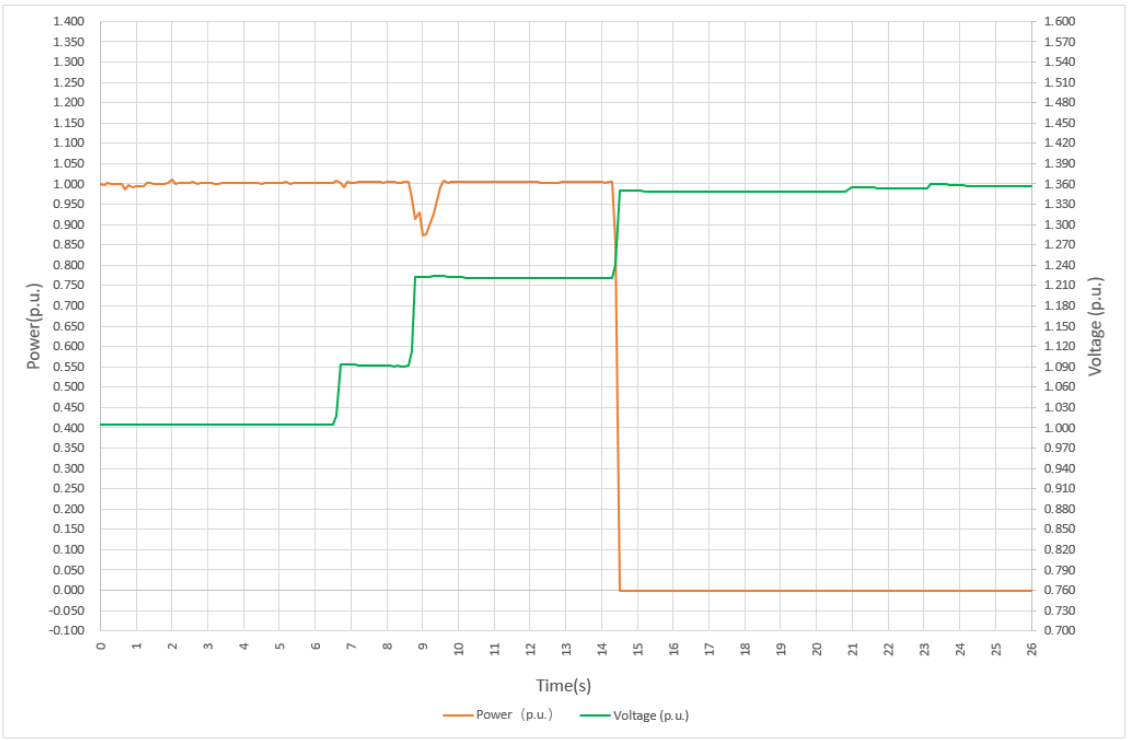


Disconnection Time

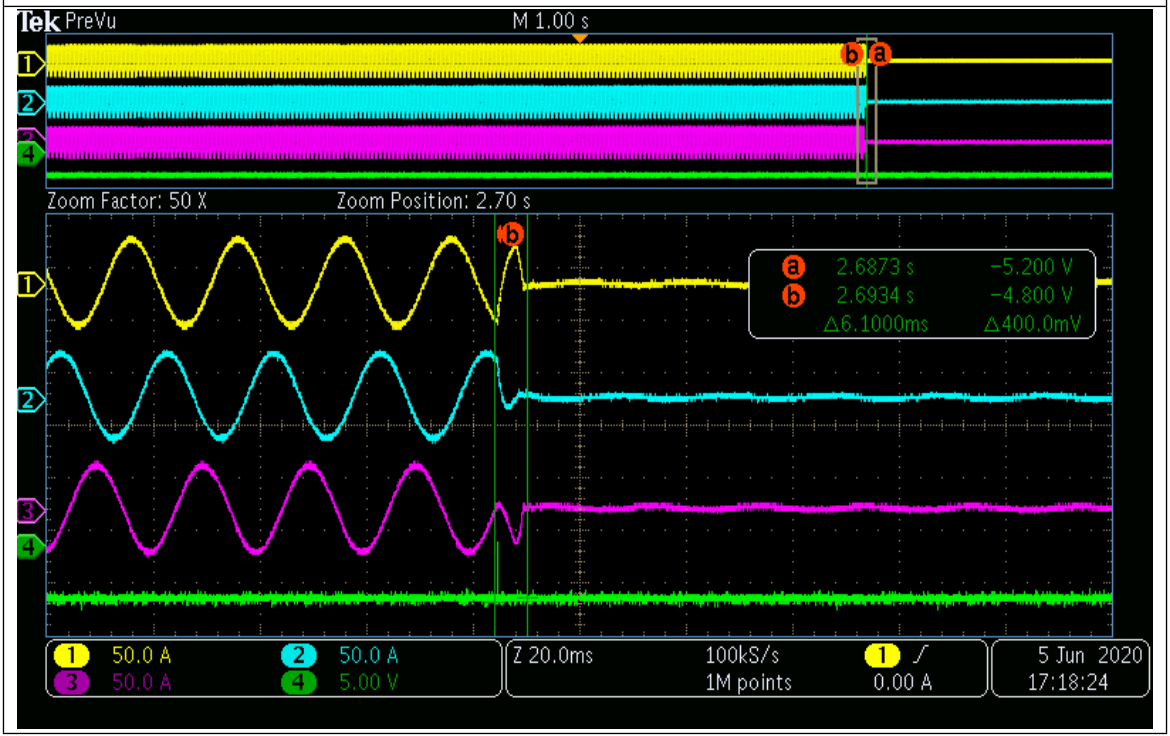


110 %Vn < V < 135 %Vn(setting at 309V)

Trip value

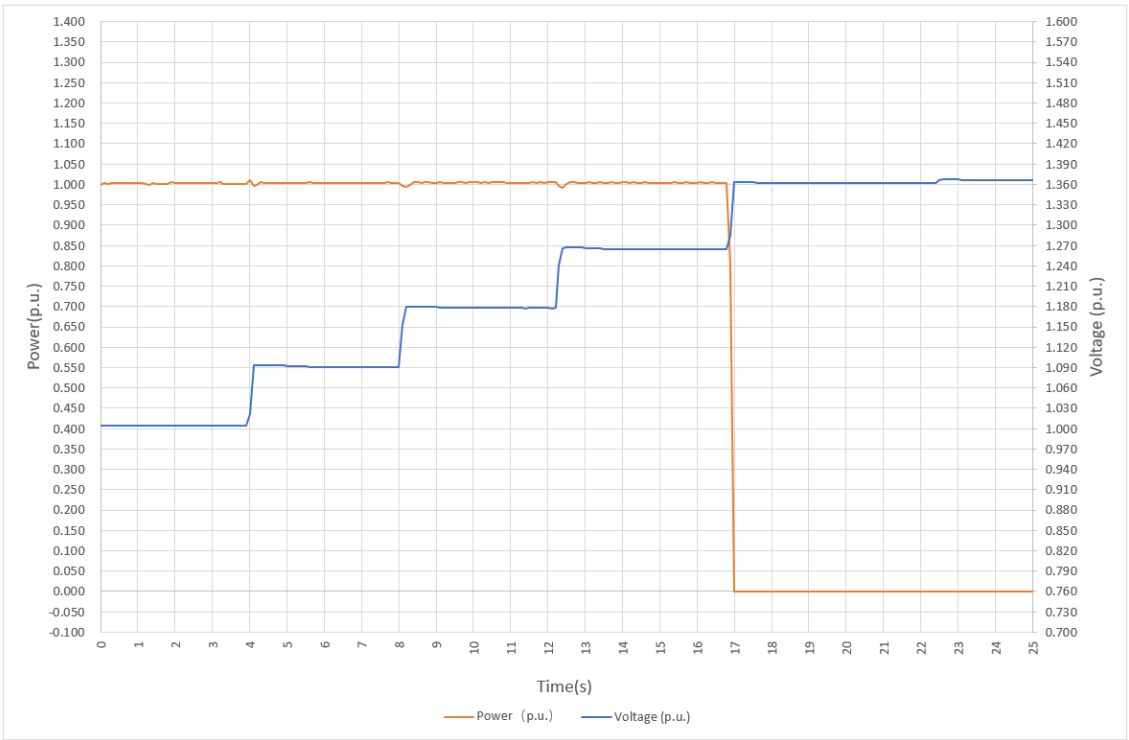


Disconnection Time

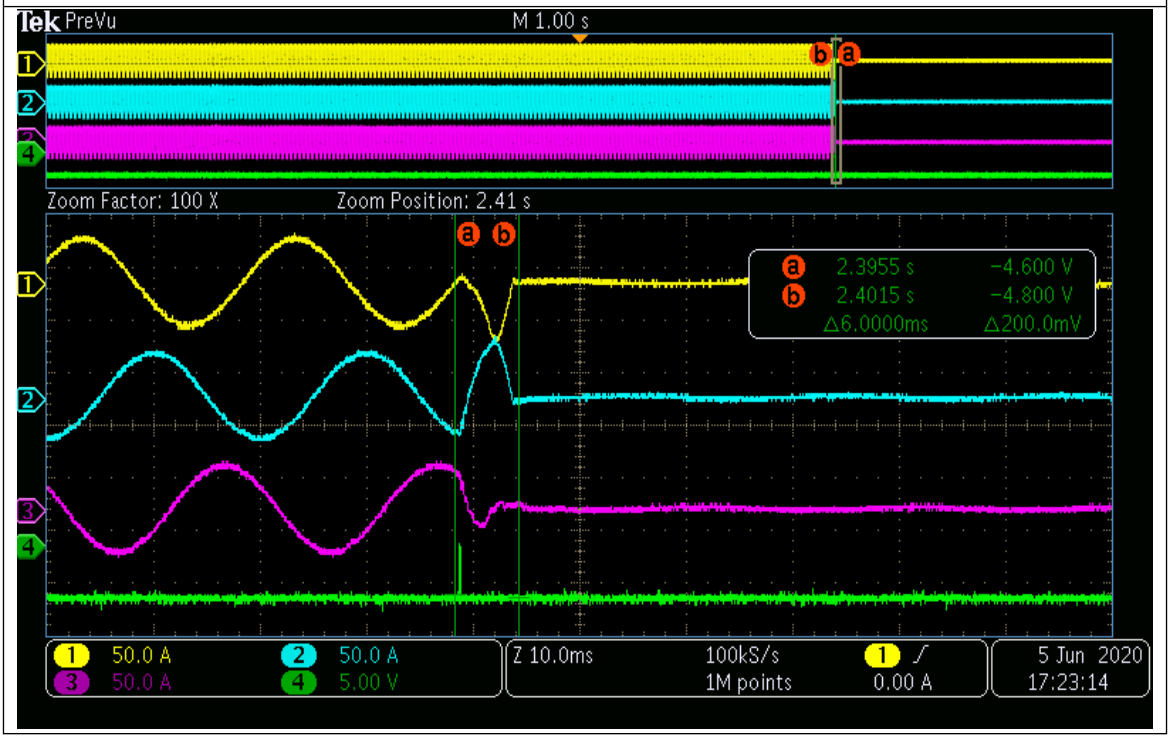


135%Vn ≤ V(setting at 312V)

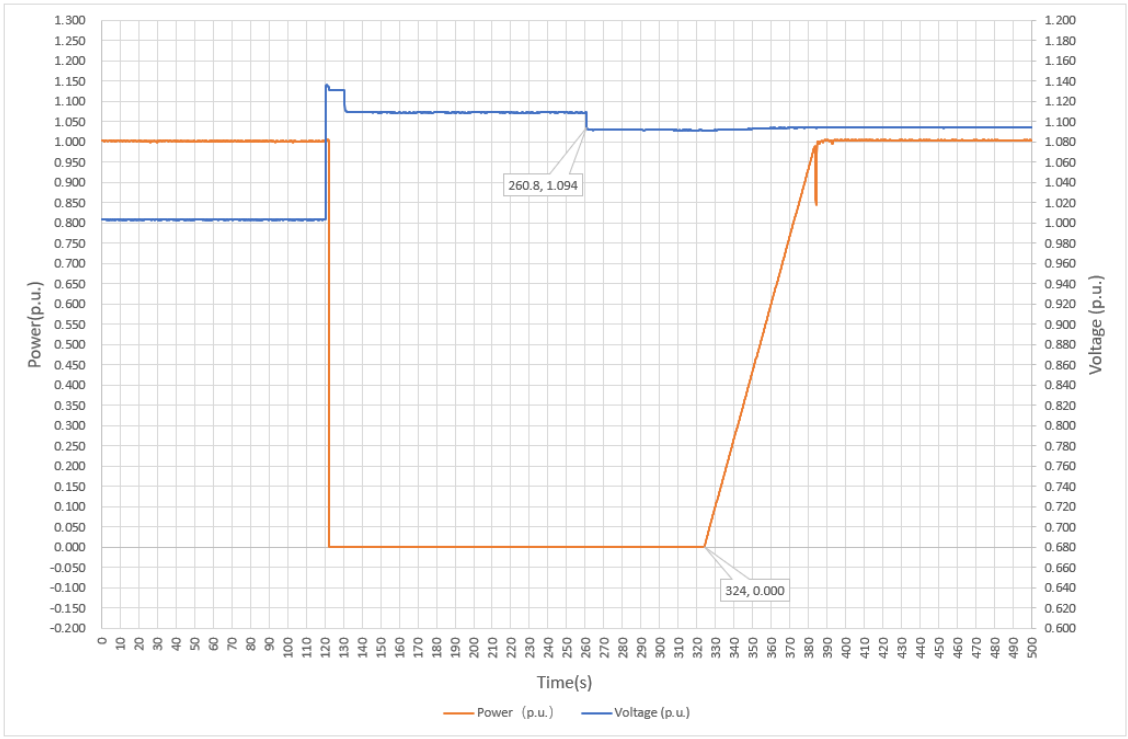
Trip value



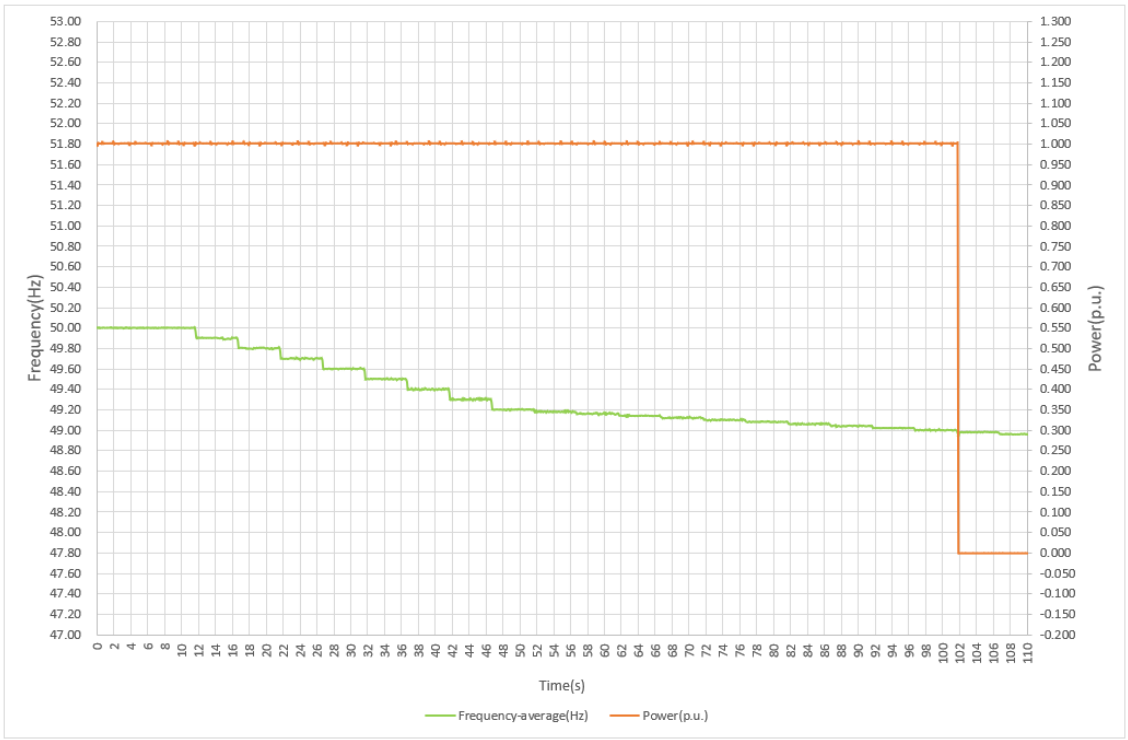
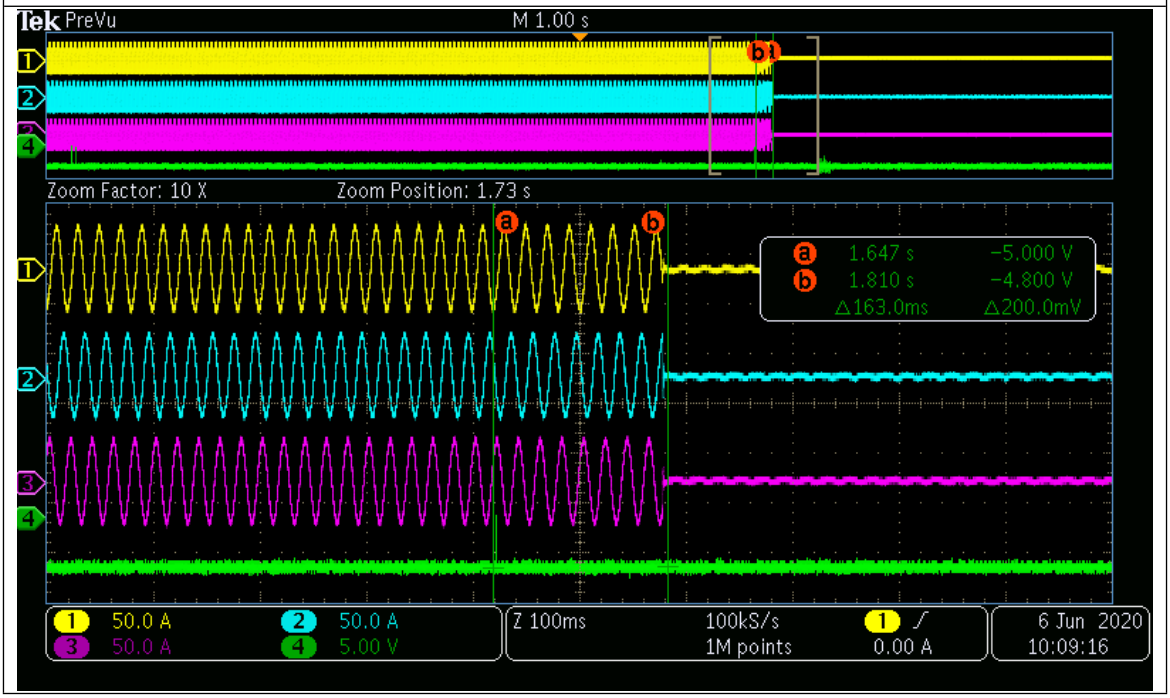
Disconnection Time



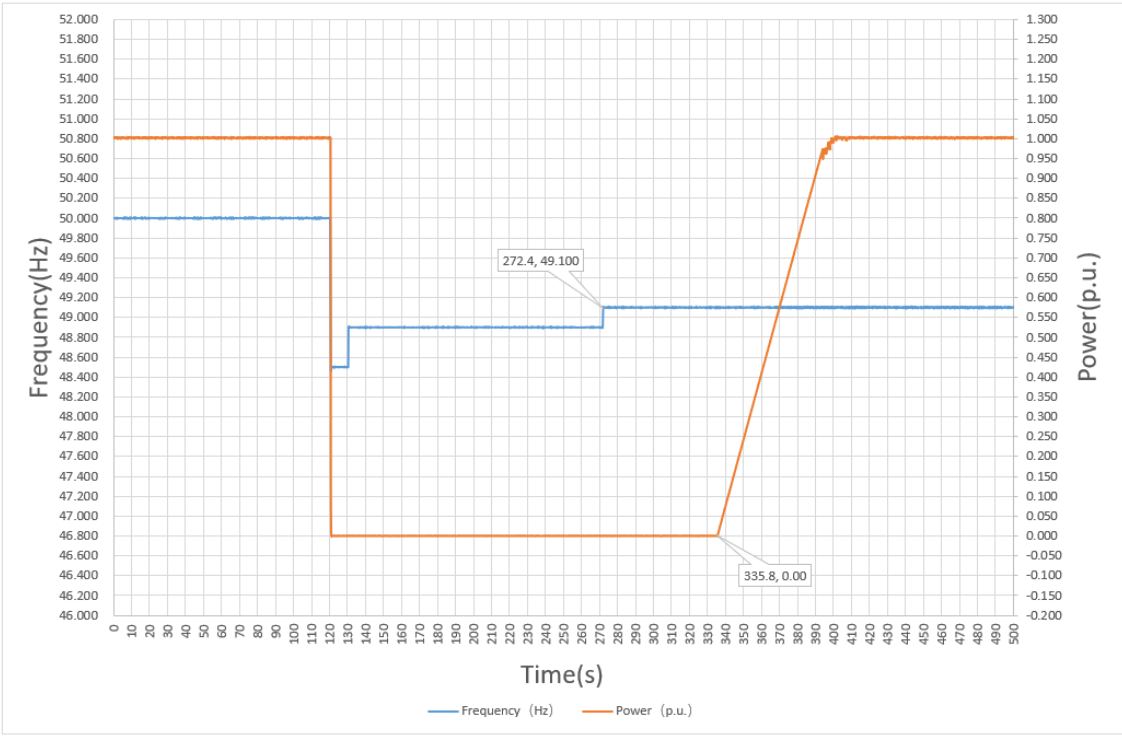
Over voltage reconnection



Over/under frequency trip settings and reconnection test

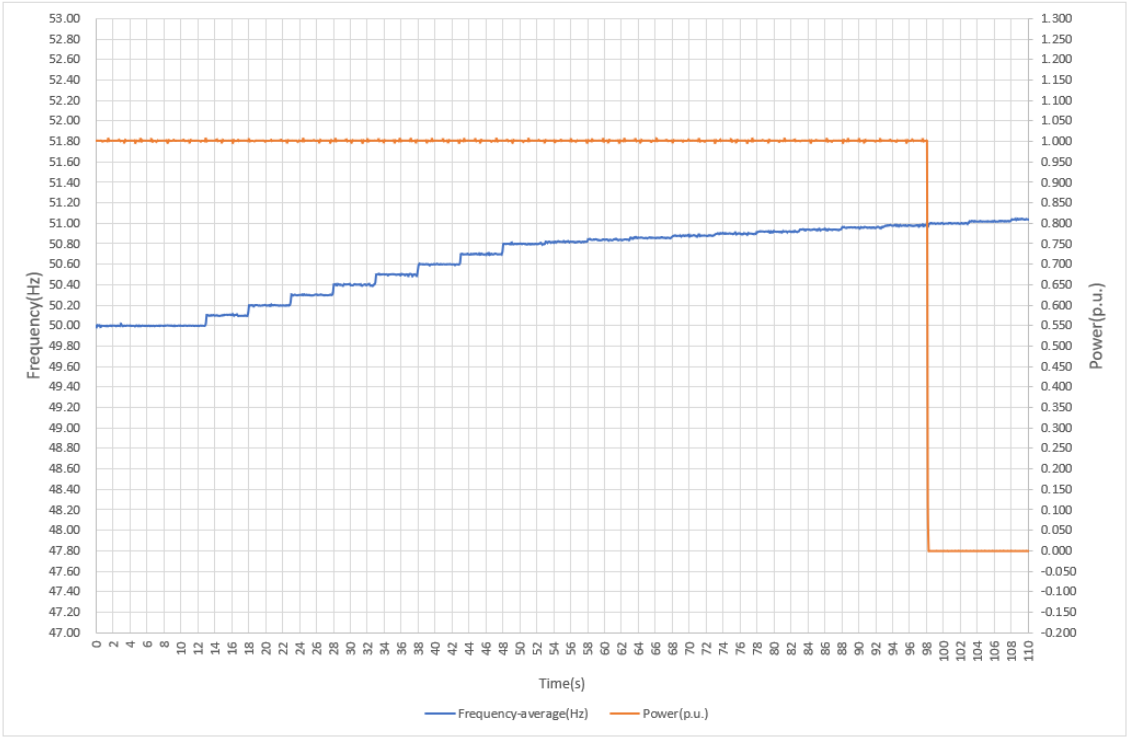
Under frequency
Trip value

Disconnection time


Under frequency reconnection

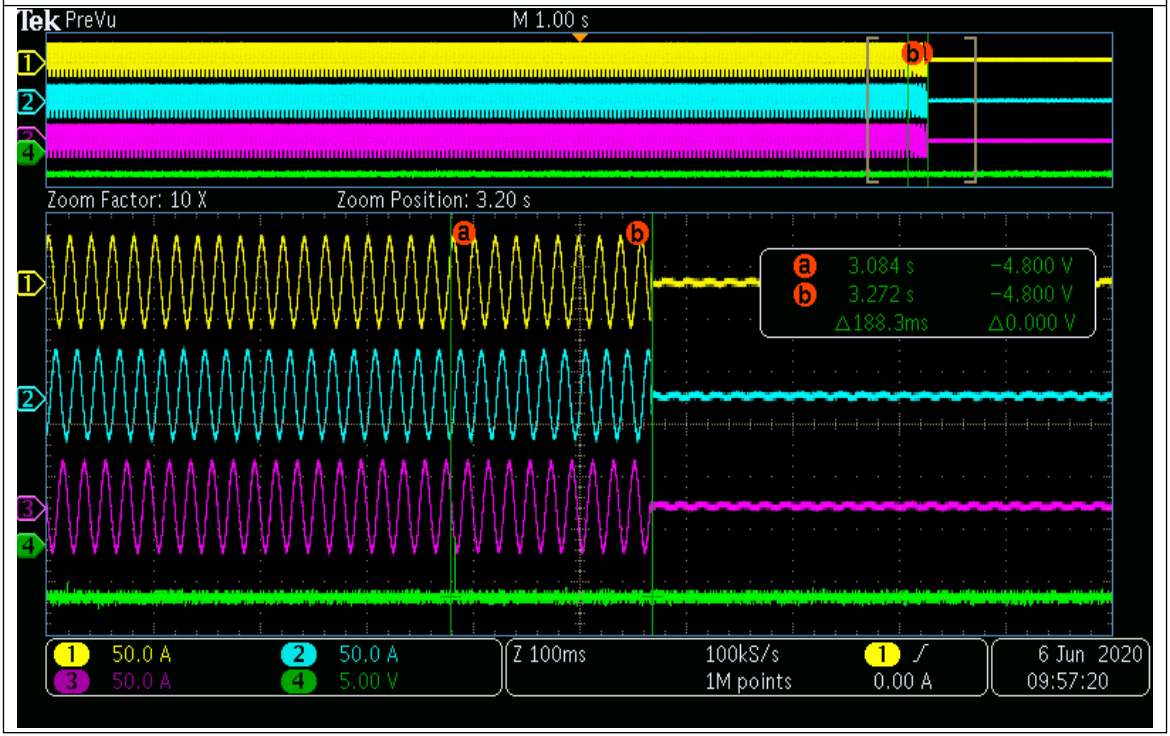


Over frequency

Trip value



Disconnection time



Over frequency reconnection