



中国认可
国际互认
检测
TESTING
CNAS L14701

TEST REPORT


Application number: PVP01079/22B-03

Applicant: Shenzhen Hopewind Technology Co., Ltd.
A1 Area of Building 6, Jinhaoyuan, No.1 of Yanshan Avenue, Yanchuan Community, Songgang Sub-district, Baoan District, Shenzhen, Guangdong Province China

Address:

Equipment Type: PV Grid-interactive Inverter

Model Name: hopeSun 100KTL, hopeSun 110KTL, hopeSun 125KTL-M

Brand Name:  Hopewind

Ratings: See copy of marking label and model list.

Test Standard: IEC 61727: 2004; IEC 62116: 2014

Test Date: Jan. 11, 2022 to Mar. 31, 2022

Date of Issue: Apr. 12, 2022

ISSUED BY:

Dongguan BALUN Testing Technology Co., Ltd.

Tested by: Ben Liu

Checked by: Xingzhen Man

Approved by: Simon Qi

Ben Liu

Xingzhen Man

Simon Qi



Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
<u>Rev. 01</u>	<u>Apr. 12, 2022</u>	<u>Initial Issue</u>

List of Attachments:

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Summary of testing:**All the tests results confirmed to the requirements of the standard.****Tests performed (name of test and test clause):**

- ☒ 4.1 Voltage, current and frequency
- ☒ 4.3 Flicker
- ☒ 4.4 DC injection
- ☒ 4.6 Harmonics and waveform distortion
- ☒ 4.7 Power factor
- ☒ 5.2.1 Over/under voltage
- ☒ 5.2.2 Over/under frequency
- ☒ 5.3 Islanding protection
- ☒ 5.4 Response to utility recovery



Testing location:

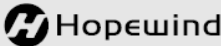
Dongguan BALUN Testing Technology Co., Ltd.
Room 104, 204, 205, Building 1, No. 6, Industrial
South Road, Songshan Lake District, Dongguan,
Guangdong, China.

- ☒ **The product fulfils the requirements of IEC 61727: 2004 and IEC 62116: 2014.**

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

H Hopewind 光伏并网逆变器 PV Grid-interactive Inverter		H Hopewind 光伏并网逆变器 PV Grid-interactive Inverter	
型号 Model:	hopeSun 100KTL	型号 Model:	hopeSun 110KTL
产品序列号 Serial No.:	贴序列号标签	产品序列号 Serial No.:	贴序列号标签
制造日期 Manufacture Date:	制造日期标签	制造日期 Manufacture Date:	制造日期标签
直流侧 DC 最大输入电压 Max. Input Voltage : 1100Vd.c. MPP电压范围 MPP Voltage Range : 200-1000Vd.c. 最大输入电流 Max. Input Current : 65A/65A/65A/65A 最大短路电流 Isc PV : 100A/100A/100A/100A		直流侧 DC 最大输入电压 Max. Input Voltage : 1100Vd.c. MPP电压范围 MPP Voltage Range : 200-1000Vd.c. 最大输入电流 Max. Input Current : 65A/65A/65A/65A 最大短路电流 Isc PV : 100A/100A/100A/100A	
交流侧 AC 输出电压 Nominal Output Voltage : 400Va.c./230Va.c.; 3P+N+PE 输出频率 Nominal Output Frequency : 50Hz/60Hz 额定输出功率 Rated Output Power : 100kW 最大输出功率 Max. Output Power : 110kW 最大输出电流 Max. Output Current : 158.8A 功率因数 Power Factor : 0.9 (lagging) -0.9 (leading)		交流侧 AC 输出电压 Nominal Output Voltage : 400Va.c./230Va.c.; 3P+N+PE 输出频率 Nominal Output Frequency : 50Hz/60Hz 额定输出功率 Rated Output Power : 110kW 最大输出功率 Max. Output Power : 121kW 最大输出电流 Max. Output Current : 174.6A 功率因数 Power Factor : 0.9 (lagging) -0.9 (leading)	
工作环境温度 Operating Ambient Temperature : -40 to +60°C 防护等级 Ingress Protection : IP65 保护等级 Protection Class : I		工作环境温度 Operating Ambient Temperature : -40 to +60°C 防护等级 Ingress Protection : IP65 保护等级 Protection Class : I	
			
深圳市禾望科技有限公司 Shenzhen Hopewind Technology Co., Ltd		深圳市禾望科技有限公司 Shenzhen Hopewind Technology Co., Ltd	
中国制造 MADE IN CHINA		中国制造 MADE IN CHINA	



光伏并网逆变器
PV Grid-interactive Inverter

型号 Model:

hopeSun 125KTL-M

产品序列号 Serial No.:

贴序列号标签

制造日期 Manufacture Date:

制造日期标签

最大输入电压 Max. Input Voltage: 1100Vd.c.

MPP电压范围 MPP Voltage Range: 200-1000Vd.c.

最大输入电流 Max. Input Current: 65A/65A/65A/65A

最大短路电流 Isc PV: 100A/100A/100A/100A

直流侧 DC

输出电压 Nominal Output Voltage: 500Va.c.; 3P+N+PE

输出频率 Nominal Output Frequency: 50Hz/60Hz

额定输出功率 Rated Output Power: 125kW

最大输出功率 Max. Output Power: 137.5kW

最大输出电流 Max. Output Current: 158.8A






功率因数 Power Factor: 0.9 (lagging) -0.9 (leading)

交流侧 AC

工作环境温度 Operating Ambient Temperature: -40 to +60°C

防护等级 Ingress Protection: IP65

保护等级 Protection Class: I



深圳市禾望科技有限公司
Shenzhen Hopewind Technology Co., Ltd

中国制造
MADE IN CHINA

Test item particulars	:	
Equipment mobility	:	Permanent connection
Operating condition	:	Continuous
Enviromental category	:	Outdoor use
Over voltage category Mains	:	OVC III
Over voltage category PV	:	OVC II
Class of equipment	:	Class I
Pollution degree	:	PD3
IP protection class	:	IP65
Mass of equipment (kg)	:	See model list.
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 was not evaluated for the requirement:	:	N/E
- test object does not meet the requirement	:	F (Fail)

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 IEC 60335-1:

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 manufacturer (ies) Shenzhen Hopewind Technology Co., Ltd
A1 Area of Building 6, Jinhaoyuan, No.1 of Yanshan Avenue, Yanchuan Community, Songgang Sub-district, Baoan District, Shenzhen, Guangdong Province China

Name and address of factory (ies) Suzhou Hopewind Electric Co., LTD
555 Songjia Road, wusongjiang science and Technology Industrial Park, wuzhong Economic Development Zone, Suzhou. Jiangsu Province, China

General product information:

The PCE under test (EUT) is a 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.

Differences of the models:

The PCB layout, communication ports, circuits, and electronic control circuits of all models are the same, and the software protection design is similar.

Unless otherwise specified, all tests are performed on the model hopeSun 125KTL-M

Hardware version: hopeSunC4_PCB_A

hopeSunF7_PCB_A

hopeSunHVB2_PCB_B

hopeSunME_PCB_A

hopeSunP7_PCB_A

hopeSunWP_PCB_A

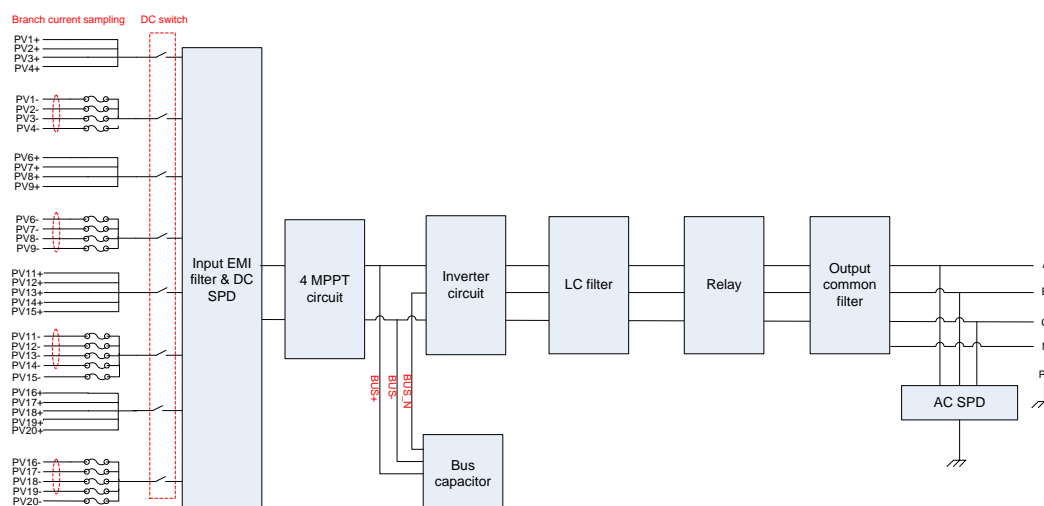
hopeSunWQ_PCB_A

Software version: bootloader: V102.003.000

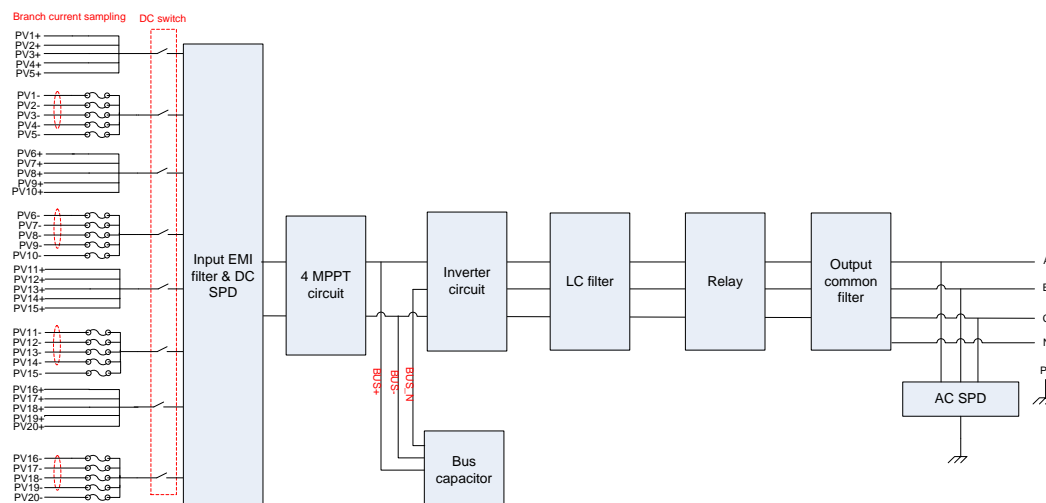
FPGA: 108.000.000

Inverter side: 106.005.000

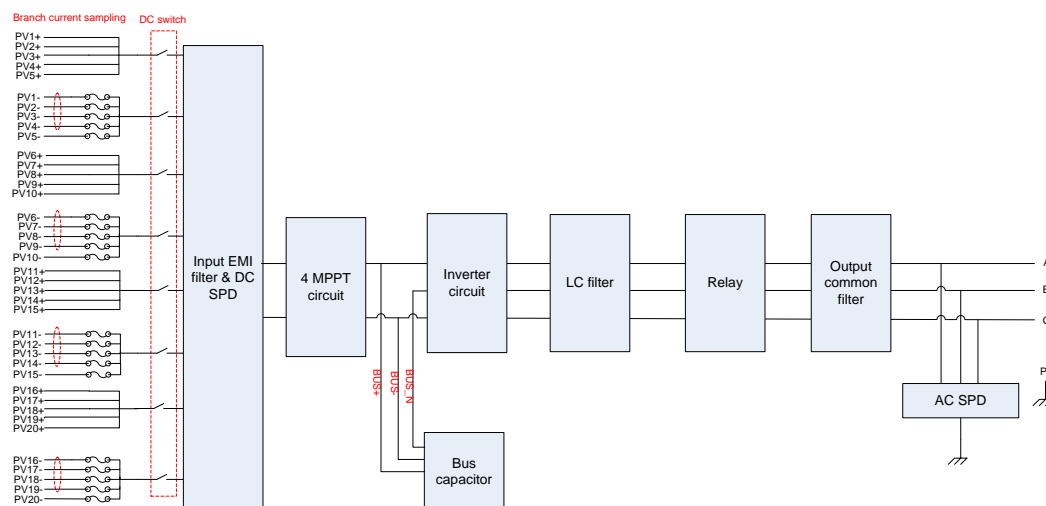
Boost side: 569.004.000

Block diagram of the utility interactive inverter:

Block Diagram of hopeSun 100KTL



Block Diagram of hopeSun 110KTL



Block Diagram of hopeSun 125KTL-M

Model list:

Model or Type designation	hopeSun 100KTL	hopeSun 110KTL	hopeSun 125KTL-M
PV input parameters:			
Max. PV input Voltage [Vd.c.]	1100		
MPP Voltage Range [Vd.c.]	200-1000	200-1000	200-1000
Max. PV Input Current [Ad.c.]	65/65/65/65		
Max.DC Short-circuit current [Ad.c.]	100/100/100/100/100		
AC output (On-Grid) parameters:			
Rated Output Voltage [Va.c.]	230/400, 3P/N/PE	230/400, 3P/N/PE	500, 3P/N/PE
Rated Output Frequency [Hz]	50/60		
Rated Output Power [kW]	100	110	125
Max. Output Power [kVA]	110	121	137.5
Max. Output Current [Aa.c.]	158.8	174.6	158.8
Power Factor cosφ [λ]	0.9 leading to 0.9 lagging	0.9 leading to 0.9 lagging	0.9 leading to 0.9 lagging
Others:			
Protective class	Class I		
Inverter topology	Non-isolated		
Operation temperature range	-40~60° C (>45° C derating)		
Ingress protection	IP65		
Overvoltage-category	DC II, AC III		

IEC 61727			
Clause	Requirement – Test	Measuring 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.	Compliance.	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.	See appended table 4.1.	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.	Compliance.	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 TS 61000-3-5 for systems with current of 16 A and above.	See appended table 4.3.	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 4.4.	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.	Compliance.	P
4.6	Harmonics and waveform distortion		P


IEC 61727																																																																																																																																																																																																													
Clause	Requirement – Test	Measuring result – Remark	Verdict																																																																																																																																																																																																										
	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 4.6.	P																																																																																																																																																																																																										
	Even harmonics in these ranges is less than 25 % of the lower odd harmonic limits listed.	See appended table 4.6.	P																																																																																																																																																																																																										
	<div>Table 1 – Current distortion limits</div> <table><tr><th>Order number</th><th>Standard limit</th></tr><tr><td>1st harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>2nd harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>3rd harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>4th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>5th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>6th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>7th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>8th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>9th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>10th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>11th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>12th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>13th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>14th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>15th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>16th harmonic</td><td>100 % (at 1 %)</td></tr><tr><td>17th harmonic</td><td>100 % 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1 %)	16 th harmonic	100 % (at 1 %)	17 th harmonic	100 % (at 1 %)	18 th harmonic	100 % (at 1 %)	19 th harmonic	100 % (at 1 %)	20 th harmonic	100 % (at 1 %)	21 st harmonic	100 % (at 1 %)	22 nd harmonic	100 % (at 1 %)	23 rd harmonic	100 % (at 1 %)	24 th harmonic	100 % (at 1 %)	25 th harmonic	100 % (at 1 %)	26 th harmonic	100 % (at 1 %)	27 th harmonic	100 % (at 1 %)	28 th harmonic	100 % (at 1 %)	29 th harmonic	100 % (at 1 %)	30 th harmonic	100 % (at 1 %)	31 st harmonic	100 % (at 1 %)	32 nd harmonic	100 % (at 1 %)	33 rd harmonic	100 % (at 1 %)	34 th harmonic	100 % (at 1 %)	35 th harmonic	100 % (at 1 %)	36 th harmonic	100 % (at 1 %)	37 th harmonic	100 % (at 1 %)	38 th harmonic	100 % (at 1 %)	39 th harmonic	100 % (at 1 %)	40 th harmonic	100 % (at 1 %)	41 st harmonic	100 % (at 1 %)	42 nd harmonic	100 % (at 1 %)	43 rd harmonic	100 % (at 1 %)	44 th harmonic	100 % (at 1 %)	45 th harmonic	100 % (at 1 %)	46 th harmonic	100 % (at 1 %)	47 th harmonic	100 % (at 1 %)	48 th harmonic	100 % (at 1 %)	49 th harmonic	100 % (at 1 %)	50 th harmonic	100 % (at 1 %)	51 st harmonic	100 % (at 1 %)	52 nd harmonic	100 % (at 1 %)	53 rd harmonic	100 % (at 1 %)	54 th harmonic	100 % (at 1 %)	55 th harmonic	100 % (at 1 %)	56 th harmonic	100 % (at 1 %)	57 th harmonic	100 % (at 1 %)	58 th harmonic	100 % (at 1 %)	59 th harmonic	100 % (at 1 %)	60 th harmonic	100 % (at 1 %)	61 st harmonic	100 % (at 1 %)	62 nd harmonic	100 % (at 1 %)	63 rd harmonic	100 % (at 1 %)	64 th harmonic	100 % (at 1 %)	65 th harmonic	100 % (at 1 %)	66 th harmonic	100 % (at 1 %)	67 th harmonic	100 % (at 1 %)	68 th harmonic	100 % (at 1 %)	69 th harmonic	100 % (at 1 %)	70 th harmonic	100 % (at 1 %)	71 st harmonic	100 % (at 1 %)	72 nd harmonic	100 % (at 1 %)	73 rd harmonic	100 % (at 1 %)	74 th harmonic	100 % (at 1 %)	75 th harmonic	100 % (at 1 %)	76 th harmonic	100 % (at 1 %)	77 th harmonic	100 % (at 1 %)	78 th harmonic	100 % (at 1 %)	79 th harmonic	100 % (at 1 %)	80 th harmonic	100 % (at 1 %)	81 st harmonic	100 % (at 1 %)	82 nd harmonic	100 % (at 1 %)	83 rd harmonic	100 % (at 1 %)	84 th harmonic	100 % (at 1 %)	85 th harmonic	100 % (at 1 %)	86 th harmonic	100 % (at 1 %)	87 th harmonic	100 % (at 1 %)	88 th harmonic	100 % (at 1 %)	89 th harmonic	100 % (at 1 %)	90 th harmonic	100 % (at 1 %)	91 st harmonic	100 % (at 1 %)	92 nd harmonic	100 % (at 1 %)	93 rd harmonic	100 % (at 1 %)	94 th harmonic	100 % (at 1 %)	95 th harmonic	100 % (at 1 %)	96 th harmonic	100 % (at 1 %)	97 th harmonic	100 % (at 1 %)	98 th harmonic	100 % (at 1 %)	99 th harmonic	100 % (at 1 %)	100 th harmonic	100 % (at 1 %)	See appended table 4.6.	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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 4.7.	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.	Installation, operation and maintain manual provided in English.	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.	See clause 5.3.	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.		N/A																																																																																																																																																																																																										
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.	Compliance.	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 5.2.1 & 5.4	P																																																																																																																																																																																																										

IEC 61727															
Clause	Requirement – Test	Measuring result – Remark	Verdict												
	<div>Table 2 – Response to abnormal voltages</div> <table><thead><tr><th>Voltage (at point of utility connection)</th><th>Maximum trip time*</th></tr></thead><tbody><tr><td>$V < 0,5 \times V_{\text{nominal}}$</td><td>0,1 s</td></tr><tr><td>$50 \% \leq V < 85 \%$</td><td>2,0 s</td></tr><tr><td>$85 \% \leq V \leq 110 \%$</td><td>Continuous operation</td></tr><tr><td>$110 \% < V < 135 \%$</td><td>2,0 s</td></tr><tr><td>$135 \% \leq V$</td><td>0,05 s</td></tr></tbody></table> <div>* 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.</div>	Voltage (at point of utility connection)	Maximum trip time*	$V < 0,5 \times V_{\text{nominal}}$	0,1 s	$50 \% \leq V < 85 \%$	2,0 s	$85 \% \leq V \leq 110 \%$	Continuous operation	$110 \% < V < 135 \%$	2,0 s	$135 \% \leq V$	0,05 s		P
Voltage (at point of utility connection)	Maximum trip time*														
$V < 0,5 \times V_{\text{nominal}}$	0,1 s														
$50 \% \leq V < 85 \%$	2,0 s														
$85 \% \leq V \leq 110 \%$	Continuous operation														
$110 \% < V < 135 \%$	2,0 s														
$135 \% \leq V$	0,05 s														
5.2.2	Over/under frequency		P												
	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 5.2.2 & 5.4.	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.	Compliance.	P												
5.3	Islanding protection		P												
	The PV system must cease to energize the utility line within 2 s of loss of utility.	(see appended table 6.1	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 shall 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 5.2.1 & 5.4 & table 5.2.2 & 5.4	P												
5.5	Earthing		P												
	The utility interface equipment is earthed/grounded in accordance with IEC 60364-7-712.	Compliance.	P												
5.6	Short circuit protection		P												
	The photovoltaic system has short-circuit protection in accordance with IEC 60364-7-712.	Compliance.	P												
5.7	Isolation and switching		P												

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	A method of isolation and switching is provided in accordance with IEC 60364-7-712.	Compliance.	P

IEC 62116			
Clause	Requirement – Test	Measuring result – Remark	Verdict
4	Testing circuit		
	The testing circuit shown in Figure 1 is employed.	Compliance.	P
	Similar circuits are used for three-phase output.		P
	Parameters to be measured are shown in Table 1 and Figure 1. Parameters to be recorded in the test report are discussed in Clause 7.		P
5	Testing equipment		
5.1	Measuring instruments	Compliance.	P
	The waveform measurement/capture device is able to record the waveform from the beginning of the islanding test until the EUT ceases to energize the island.		P
	For multi-phase EUT, all phases are monitored.		P
	A waveform monitor designed to detect and calculate the run-on time may be used.		P
	For multi-phase EUT, the test and measurement equipment is recorded each phase current and each phase-to-neutral or phase-to-phase voltage, as appropriate, to determine fundamental frequency active and reactive power flow over the duration of the test.		P
	A sampling rate of 10 kHz or higher is recommended. The minimum measurement accuracy is 1 % or less of rated EUT nominal output voltage and 1 % or less of rated EUT output current		P
	Current, active power, and reactive power measurements through switch S1 used to determine the circuit balance conditions report the fundamental (50 Hz or 60 Hz) component.		P
5.2	DC power source		
5.2.1	General		P

IEC 62116			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	A PV array or PV array simulator (preferred) may be used. If the EUT can operate in utility-interconnected mode from a storage battery, a DC power source may be used in lieu of a battery as long as the DC power source is not the limiting device as far as the maximum EUT input current is concerned.	PV array simulator used.	P
	The DC power source provides voltage and current necessary to meet the testing requirements described in Clause 6.		P
5.2.2	PV array simulator	Compliance.	P
	The tests are conducted at the input voltage defined in Table 2 below, and the current is limited to 1,5 times the rated photovoltaic input current, except when specified otherwise by the test requirements.		P
	A PV array simulator is recommended, however, any type of power source may be used if it does not influence the test results.	PV array simulator used.	P
5.2.3	Current and voltage limited DC power supply with series resistance		N/A
	A DC power source used as the EUT input source is capable of EUT maximum input power (so as to achieve EUT maximum output power) at minimum and maximum EUT input operating voltage.		N/A
	The power source provides adjustable current and voltage limit, set to provide the desired short circuit current and open circuit voltage when combined with the series and shunt resistance described below.		N/A

IEC 62116			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	<p>A series resistance (and, optionally, a shunt resistance) is selected to provide a fill factor within the range:</p> <p>Output power: Sufficient to provide maximum EUT output power and other levels specified by test conditions of table 5.</p> <p>Response speed: The response time of a simulator to a step in output voltage, due to a 5% load change, results in a settling of the output current to within 10% of its final value in less than 1ms.</p> <p>Stability: Excluding the variations caused by the EUT MPPT, simulator output power remains stable within 2 % of specified power level over the duration of the test: from the point where load balance is achieved until the island condition is cleared or the allowable run-on time is exceeded.</p> <p>Power factor: 0.25 to 0.8</p>		N/A
5.2.4	PV array		N/A
	A PV array used as the EUT input source is capable of EUT maximum input power at minimum and maximum EUT input operating voltage.		N/A
	Testing is limited to times when the irradiance varies by no more than 2 % over the duration of the test as measured by a silicon-type pyranometer or reference device. It may be necessary to adjust the array configuration to achieve the input voltage and power levels prescribed in 6.1.		N/A
5.3	AC power source		
	<p>The utility grid or other AC power source may be used as long as it meets the conditions specified in Table 4.</p> 	Compliance.	P
5.4	AC loads		
	<p>On the AC side of the EUT, variable resistance, capacitance, and inductance are connected in parallel as loads between the EUT and the AC power source. Other sources of load, such as electronic loads, may be used if it can be shown that the source does not cause results that are different than would be obtained with passive resistors, inductors, and capacitors.</p>	Compliance.	P

IEC 62116			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	All AC loads are rated for and adjustable to all test conditions. The equations for Q_f are based upon an ideal parallel RLC circuit. For this reason, non-inductive resistors, low loss (high Q_f) inductors, and capacitors with low effective series resistance and effective series inductance are utilized in the test circuit. Iron core inductors, if used, are not exceed a current THD of 2 % when operated at nominal voltage. Load components are conservatively rated for the voltage and power levels expected. Resistor power ratings are chosen so as to minimize thermally-induced drift in esistance values during the course of the test.	Compliance.	P
	Active and reactive power is calculated (using the measurements provided in Table 1) in each of the R, L and C legs of the load so that these parasitic parameters (and parasitics introduced by variacs or autotransformers) are properly accounted for when calculating Q_f .	Calculated. See appended	P
6	Test for single or multi-phase inverter		
6.1	Test procedure	(see appended table)	P
	The test uses an RLC load, resonant at the EUT nominal frequency (50 Hz or 60 Hz) and matched to the EUT output power.		P
	For multi-phase EUT, the load is balanced across all phases and the switch S1 as in Figure 1 opens all phases		P
	This test is performed with the EUT conditions as in Table 5, where power and voltage values are given as a percent of EUT full output rating.		P
	a) .Determine EUT test output power		P
	b) .Adjusting the DC input source		P
	c) . Turn off the EUT and open S1		P
	d) .Adjust the RLC circuit to have $Q_f = 1.0 \pm 0.05$		P
	e) . Connect the RLC load configured in step d) to the EUT by closing S2		P

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	f) ..Open the utility-disconnect switch S1 to initiate the test, Run-on time is recorded.		P
	g) .For test condition A, adjust the real load and only one of the reactive load components to each of the load imbalance conditions shown in the shaded portion of table 6. 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.		P
	h) For test condition B and C, adjust the only one reactive load components by approximately 1,0% per test, within a total range of 95% to 105% of the operating point. If run-on times are still increasing at the 95% or 105% points, additional 1% increments have to be taken until run-on times begin decreasing.		P
6.2	Pass/fail criteria		
	An EUT is considered to comply with the requirements for islanding protection when each case of recorded run-on time is less than 2 s or meets the requirements of local codes.	Compliance.	P
7	Documentation		
	At a minimum, the following information is recorded and maintained in the test report.		P
	a) Specifications of EUT. Table 8 provides an example of the type of information that is provided.		P
	b) Measurement results. Table 9 provides an example of the type of information that is provided. Actual measured values is to be recorded.		P
	c) Block diagram of test circuit.		P
	d) Specifications of the test and measurement equipment. Table 10 provides an example of the type of information that is provided.		P
	e) Any test configuration or procedure details such as methods of achieving specified load and EUT output conditions.		P
	f) Any additional information required by the testing laboratory's accreditation.		P

IEC 62116			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	g) Specify the evaluation criterion from clause 6.2 that was utilized to determine if the product passed or failed the test.		P
Annex A	Islanding as it applies to PV systems(Informative)		--
A.1	General		--
A.2	Impact of distortion on islanding		--
Annex B	Test for independent islanding detection device (relay)(Informative)		--
B.1	Introduction		--
B.2	Testing circuit		--
B.3	Testing equipment		--
B.4	Testing procedure		--
B.5	Documentation		--

4.1	TABLE: Voltage, current and frequency									P
Power conditions	I/P rated	PV / DC Input			O/P rated	Grid / AC Output				
	I [A]	U [V]	I [A]	P [kW]	I [A]	U [V]	I [A]	P [kW]	Fre. [Hz]	
Test Model: hopeSun 100KTL										
(10±5)%	--	820.79	13.33	10.94	--	L1:230.39	L1:14.26	9.98	50	
						L2:230.52	L2:14.43			
						L3:230.35	L3:14.62			
(50±5)%	--	805.05	64.43	51.87	--	L1:230.78	L1:71.82	49.79	50	
						L2:230.74	L2:71.90			
						L3:230.60	L3:72.08			
(100±5)%	--	764.17	136.84	104.57	--	L1:231.27	L1:144.26	100.06	50	
						L2:231.05	L2:144.24			
						L3:230.93	L3:144.51			
Test Model: hopeSun 110KTL										
(10±5)%	--	820.41	14.99	12.30	--	L1:230.40	L1:16.00	11.17	50	
						L2:230.53	L2:16.16			
						L3:230.35	L3:16.32			
(50±5)%	--	801.86	71.93	57.68	--	L1:230.80	L1:80.64	55.90	50	
						L2:230.80	L2:80.71			
						L3:230.65	L3:80.91			
(100±5)%	--	739.83	156.67	115.91	--	L1:231.38	L1:159.89	110.94	50	
						L2:231.07	L2:159.89			
						L3:231.00	L3:160.19			
Test Model: hopeSun 125KTL-M										
(10±5)%	--	820.35	17.92	14.70	--	L1:500.60	L1:14.65	12.73	50	
						L2:499.58	L2:14.77			
						L3:499.17	L3:14.87			
(50±5)%	--	801.65	81.42	65.27	--	L1:501.18	L1:72.86	63.16	50	
						L2:500.04	L2:72.84			
						L3:499.68	L3:73.03			
(100±5)%	--	735.74	176.20	129.64	--	L1:501.75	L1:145.14	125.94	50	
						L2:500.64	L2:145.07			
						L3:500.41	L3:145.26			
Note:										

4.3

TABLE: Flicker

P

Test Model: hopeSun 100KTL

PHASE A

Limit	Pst	dc(%)	dmax(%)	d(t)
	1.000	3.300	4.000	500 3.3%
	Measurements	0.08	0.00	0.00

Flicker Mode

IEC61000-4-15 Ed2.0

Uover: ■ ■ ■ ■

Iover: ■ ■ ■ ■

U1 : 600V

Flicker:Complete 2:00:00

YOKOGAWA ◀

Count

Interval

12/12

10m00s/10m00s

Element

1

Volt Range

600V(230V/50Hz)

Element1 Judgement: Pass

Un (U1)

399.084 V

Total Judgement: Pass

Freq(U1)

50.000 Hz

(Element1,2,3)

	dc(%)	dmax(%)	Tmax(ms)	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
Result	Pass	Pass	Pass	Pass	0.08 Pass

Plt= 0.08 , Limit=0.65

PHASE B

Limit	Pst	dc(%)	dmax(%)	d(t)
	1.000	3.300	4.000	500 3.3%
	Measurements	0.10	0.00	0.00

Flicker Mode

IEC61000-4-15 Ed2.0

Uover: ■ ■ ■ ■

Iover: ■ ■ ■ ■

U1 : 600V

Flicker:Complete 2:00:00

YOKOGAWA ▶

Count

Interval

12/12

10m00s/10m00s

Element

2

Volt Range

600V(230V/50Hz)

Element2 Judgement: Pass

Un (U2)

398.812 V

Total Judgement: Pass

Freq(U2)

50.000 Hz

(Element1,2,3)

	dc(%)	dmax(%)	Tmax(ms)	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
Result	Pass	Pass	Pass	Pass	0.10 Pass

Plt= 0.10 , Limit=0.65

PHASE C	Limit	Pst	dc(%)	dmax(%)	d(t)
		1.000	3.300	4.000	500 3.3%
	Measurements	0.08	0.00	0.00	0

Flicker Mode Uover: ■ ■ ■ U1 : 600V YOKOGAWA
 IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ Flicker:Complete 2:00:00
 Count 12/12
 Interval 10m00s/10m00s
 Element 3
 Volt Range 600V(230V/50Hz) Element3 Judgement: Pass
 Un (U3) 398.935 V Total Judgement: Pass
 Freq(U3) (Element1,2,3)

	dc(%)	dmax(%)	Tmax(ms)	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
Result	Pass	Pass	Pass	Pass	0.08 Pass

Plt= 0.08 , Limit=0.65

Test Model: hopeSun 110KTL

PHASE A	Limit	Pst	dc(%)	dmax(%)	d(t)
		1.000	3.300	4.000	500 3.3%
	Measurements	0.08	0.00	0.00	0

Flicker Mode Uover: ■ ■ ■ U1 : 600V YOKOGAWA
 IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ Flicker:Complete 2:00:00
 Count 12/12
 Interval 10m00s/10m00s
 Element 1
 Volt Range 600V(230V/50Hz) Element1 Judgement: Pass
 Un (U1) 399.084 V Total Judgement: Pass
 Freq(U1) 50.000 Hz (Element1,2,3)

	dc(%)	dmax(%)	Tmax(ms)	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
Result	Pass	Pass	Pass	Pass	0.08 Pass

Plt= 0.08 , Limit=0.65

PHASE B	Limit	Pst	dc(%)	dmax(%)	d(t)
		1.000	3.300	4.000	500 3.3%
	Measurements	0.10	0.00	0.00	0

Flicker Mode Uover: ■ ■ ■ ■ U1 : 600V YOKOGAWA
IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
Interval 10m00s/10m00s
Element 2
Volt Range 600V(230V/50Hz) Element2 Judgement: Pass
Un (U2) 398.812 V Total Judgement: Pass
Freq(U2) 50.000 Hz (Element1,2,3)

	dc(%)	dmax(%)	Tmax[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.10 Pass	
Result	Pass	Pass	Pass	Pass	0.10 Pass

Plt= 0.10 , Limit=0.65

PHASE C	Limit	Pst	dc(%)	dmax(%)	d(t)
		1.000	3.300	4.000	500 3.3%
	Measurements	0.08	0.00	0.00	0

Flicker Mode Uover: ■ ■ ■ ■ U1 : 600V YOKOGAWA
IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
Interval 10m00s/10m00s
Element 3
Volt Range 600V(230V/50Hz) Element3 Judgement: Pass
Un (U3) 398.935 V Total Judgement: Pass
Freq(U3) ----- (Element1,2,3)

	dc(%)	dmax(%)	Tmax[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
Result	Pass	Pass	Pass	Pass	0.08 Pass

Plt= 0.08 , Limit=0.65

Test Model: hopeSun 125KTL-M

PHASE A	Limit	Pst	dc(%)	dmax(%)	d(t)
		1.000	3.300	4.000	500 3.3%
	Measurements	0.08	0.00	0.00	0

Flicker Mode Uover: ■ ■ ■ ■ U1 : 600V YOKOGA
IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
Interval 10m00s/10m00s

Element 1
Volt Range 600V(230V/50Hz) Element1 Judgement: Pass
Un (U1) 498.033 V Total Judgement: Pass
Freq(U1) 50.000 Hz (Element1,2,3)

	dc[%]	dmax[%]	Tmax[ms]	Pst	PIt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
Result	Pass	Pass	Pass	Pass	0.08 Pass

PIt= 0.08 , Limit=0.65

PHASE B	Limit	Pst	dc(%)	dmax(%)	d(t)
		1.000	3.300	4.000	500 3.3%
	Measurements	0.09	0.00	0.00	0

Flicker Mode Uover: ■ ■ ■ ■ U1 : 600V YOKOGAWA
IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
Interval 10m00s/10m00s

Element 2
Volt Range 600V(230V/50Hz) Element2 Judgement: Pass
Un (U2) 497.522 V Total Judgement: Pass
Freq(U2) 50.000 Hz (Element1,2,3)

	dc[%]	dmax[%]	Tmax[ms]	Pst	PIt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.09 Pass	
Result	Pass	Pass	Pass	Pass	0.09 Pass

PIt= 0.09 , Limit=0.65

PHASE C	Limit	Pst	dc(%)	dmax(%)	d(t)
		1.000	3.300	4.000	500 3.3%
	Measurements	0.08	0.00	0.00	0

Flicker Mode Uover: ■ ■ ■ ■ U1 : 600V YOKOGA
 IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
 Interval 10m00s/10m00s
 Element 3
 Volt Range 600V(230V/50Hz) Element3 Judgement: Pass
 Un (U3) 497.687 V Total Judgement: Pass
 Freq(U3) (Element1,2,3)

	dc[%]	dmax[%]	Tmax[ms]	Pst	P1t
Limit	3.30	4.00	500	1.00	0.65
			3.30(%)		N: 12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.08 Pass	
Result	Pass	Pass	Pass	Pass	0.08 Pass

P1t= 0.08 , Limit=0.65

Note: Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100% power) and flicker. Less than 16A per phase according to IEC61000-3-3, more than 16 A per phase according to IEC61000-3-5

4.4	TABLE: DC Injection						P
Power conditions		33%		66%		100%	
Limits		1%					
Measurement		[A]	[%]	[A]	[%]	[A]	[%]
Test Model: hopeSun 100KTL							
Test value	PHASE A	0.34	0.23	0.58	0.40	0.48	0.33
	PHASE B	0.32	0.22	0.43	0.30	0.49	0.34
	PHASE C	0.38	0.26	0.53	0.36	0.50	0.35
Test Model: hopeSun 110KTL							
Test value	PHASE A	0.53	0.33	0.62	0.39	0.63	0.40
	PHASE B	0.38	0.24	0.43	0.27	0.52	0.33
	PHASE C	0.42	0.26	0.57	0.36	0.54	0.34
Test Model: hopeSun 125KTL-M							
Test value	PHASE A	0.33	0.22	0.44	0.31	0.38	0.26
	PHASE B	0.37	0.26	0.33	0.23	0.37	0.25
	PHASE C	0.27	0.19	0.41	0.28	0.47	0.33
Supplementary information:							

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [100%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 100KTL					
THD (to the 33 th)	0.933	0.979	1.036	5	P
2 nd	0.211	0.494	0.302	1	P
3 rd	0.126	0.096	0.079	4	P
4 th	0.262	0.182	0.332	1	P
5 th	0.590	0.625	0.658	4	P
6 th	0.103	0.112	0.117	1	P
7 th	0.589	0.670	0.689	4	P
8 th	0.048	0.041	0.041	1	P

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [100%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
9 th	0.061	0.074	0.110	4	P
10 th	0.035	0.039	0.038	0.5	P
11 th	0.451	0.368	0.461	2	P
12 th	0.032	0.031	0.036	0.5	P
13 th	0.352	0.315	0.352	2	P
14 th	0.026	0.031	0.029	0.5	P
15 th	0.032	0.041	0.044	2	P
16 th	0.030	0.029	0.033	0.5	P
17 th	0.310	0.312	0.322	1.5	P
18 th	0.026	0.028	0.031	0.5	P
19 th	0.248	0.239	0.246	1.5	P
20 th	0.030	0.027	0.030	0.5	P
21 th	0.029	0.037	0.034	1.5	P
22 th	0.031	0.026	0.032	0.5	P
23 th	0.323	0.292	0.300	0.6	P
24 th	0.026	0.031	0.031	0.5	P
25 th	0.220	0.311	0.448	0.6	P
26 th	0.022	0.045	0.047	0.5	P
27 th	0.027	0.044	0.044	0.6	P
28 th	0.027	0.029	0.045	0.5	P
29 th	0.365	0.310	0.336	0.6	P
30 th	0.026	0.034	0.049	0.5	P
31 th	0.321	0.296	0.321	0.6	P
32 th	0.018	0.039	0.046	0.5	P
33 th	0.019	0.031	0.025	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P	
Harmonics		Measurements (percentage of Rated Current) [66%]			Limits [%]	Verdict
		PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 100KTL						
THD (to the 33 th)		1.223	1.298	1.338	5	P
2 nd		0.175	0.316	0.146	1	P
3 rd		0.064	0.067	0.050	4	P
4 th		0.171	0.184	0.253	1	P
5 th		0.399	0.374	0.409	4	P
6 th		0.061	0.075	0.083	1	P
7 th		0.427	0.503	0.513	4	P
8 th		0.031	0.033	0.026	1	P
9 th		0.040	0.057	0.083	4	P
10 th		0.020	0.023	0.025	0.5	P
11 th		0.322	0.247	0.307	2	P
12 th		0.019	0.021	0.021	0.5	P
13 th		0.217	0.208	0.244	2	P
14 th		0.020	0.023	0.020	0.5	P
15 th		0.021	0.024	0.028	2	P
16 th		0.018	0.020	0.020	0.5	P
17 th		0.190	0.176	0.182	1.5	P
18 th		0.019	0.019	0.021	0.5	P
19 th		0.140	0.134	0.152	1.5	P
20 th		0.021	0.024	0.022	0.5	P
21 th		0.021	0.028	0.026	1.5	P
22 th		0.019	0.023	0.023	0.5	P
23 th		0.145	0.117	0.130	0.6	P
24 th		0.019	0.028	0.025	0.5	P
25 th		0.115	0.197	0.169	0.6	P
26 th		0.019	0.050	0.044	0.5	P

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [66%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
27 th	0.025	0.038	0.043	0.6	P
28 th	0.024	0.039	0.051	0.5	P
29 th	0.144	0.105	0.129	0.6	P
30 th	0.017	0.040	0.042	0.5	P
31 th	0.141	0.127	0.137	0.6	P
32 th	0.016	0.047	0.038	0.5	P
33 th	0.015	0.033	0.031	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P	
Harmonics		Measurements (percentage of Rated Current) [33%]			Limits [%]	Verdict
		PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 100KTL						
THD (to the 33 th)		1.673	1.783	1.762	5	P
2 nd		0.191	0.295	0.115	1	P
3 rd		0.042	0.059	0.063	4	P
4 th		0.164	0.184	0.258	1	P
5 th		0.314	0.298	0.306	4	P
6 th		0.048	0.080	0.092	1	P
7 th		0.234	0.314	0.299	4	P
8 th		0.030	0.049	0.036	1	P
9 th		0.028	0.061	0.068	4	P
10 th		0.023	0.028	0.026	0.5	P
11 th		0.179	0.110	0.161	2	P
12 th		0.017	0.019	0.019	0.5	P
13 th		0.169	0.166	0.183	2	P
14 th		0.017	0.017	0.018	0.5	P
15 th		0.020	0.028	0.027	2	P

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [33%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
16 th	0.019	0.017	0.021	0.5	P
17 th	0.213	0.196	0.209	1.5	P
18 th	0.020	0.021	0.020	0.5	P
19 th	0.186	0.186	0.195	1.5	P
20 th	0.022	0.036	0.032	0.5	P
21 th	0.023	0.026	0.025	1.5	P
22 th	0.024	0.029	0.039	0.5	P
23 th	0.122	0.106	0.126	0.6	P
24 th	0.019	0.044	0.045	0.5	P
25 th	0.158	0.157	0.121	0.6	P
26 th	0.019	0.053	0.059	0.5	P
27 th	0.041	0.041	0.032	0.6	P
28 th	0.019	0.048	0.058	0.5	P
29 th	0.250	0.235	0.244	0.6	P
30 th	0.022	0.047	0.058	0.5	P
31 th	0.192	0.201	0.199	0.6	P
32 th	0.012	0.047	0.046	0.5	P
33 th	0.016	0.021	0.016	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P	
Harmonics		Measurements (percentage of Rated Current) [100%]			Limits [%]	Verdict
		PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 110KTL						
THD (to the 33 th)		1.062	1.111	1.128	5	P
2 nd		0.142	0.272	0.149	1	P
3 rd		0.124	0.077	0.055	4	P
4 th		0.129	0.131	0.200	1	P

4.6	TABLE: Harmonics and waveform distortion (Current)			P	
Harmonics	Measurements (percentage of Rated Current) [100%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
5 th	0.394	0.397	0.423	4	P
6 th	0.072	0.085	0.094	1	P
7 th	0.430	0.517	0.526	4	P
8 th	0.030	0.036	0.029	1	P
9 th	0.035	0.081	0.090	4	P
10 th	0.037	0.030	0.034	0.5	P
11 th	0.303	0.212	0.272	2	P
12 th	0.020	0.019	0.022	0.5	P
13 th	0.229	0.235	0.259	2	P
14 th	0.020	0.027	0.019	0.5	P
15 th	0.021	0.033	0.031	2	P
16 th	0.018	0.016	0.019	0.5	P
17 th	0.197	0.190	0.198	1.5	P
18 th	0.015	0.018	0.020	0.5	P
19 th	0.172	0.168	0.163	1.5	P
20 th	0.015	0.019	0.016	0.5	P
21 th	0.018	0.021	0.020	1.5	P
22 th	0.017	0.016	0.016	0.5	P
23 th	0.198	0.191	0.192	0.6	P
24 th	0.015	0.015	0.015	0.5	P
25 th	0.214	0.159	0.155	0.6	P
26 th	0.015	0.014	0.015	0.5	P
27 th	0.016	0.026	0.027	0.6	P
28 th	0.015	0.013	0.017	0.5	P
29 th	0.202	0.205	0.185	0.6	P
30 th	0.010	0.016	0.018	0.5	P
31 th	0.187	0.201	0.188	0.6	P

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [100%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
32 th	0.009	0.022	0.021	0.5	P
33 th	0.011	0.029	0.025	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P	
Harmonics		Measurements (percentage of Rated Current) [66%]			Limits [%]	Verdict
		PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 110KTL						
THD (to the 33 th)	1.170	1.239	1.217	5	P	
2 nd	0.210	0.303	0.109	1	P	
3 rd	0.068	0.065	0.058	4	P	
4 th	0.153	0.188	0.232	1	P	
5 th	0.371	0.351	0.373	4	P	
6 th	0.060	0.072	0.081	1	P	
7 th	0.431	0.531	0.529	4	P	
8 th	0.033	0.039	0.026	1	P	
9 th	0.036	0.080	0.085	4	P	
10 th	0.028	0.026	0.028	0.5	P	
11 th	0.315	0.222	0.265	2	P	
12 th	0.019	0.019	0.022	0.5	P	
13 th	0.237	0.249	0.266	2	P	
14 th	0.018	0.023	0.018	0.5	P	
15 th	0.021	0.021	0.026	2	P	
16 th	0.015	0.015	0.016	0.5	P	
17 th	0.188	0.175	0.178	1.5	P	
18 th	0.015	0.015	0.016	0.5	P	
19 th	0.157	0.153	0.149	1.5	P	
20 th	0.016	0.018	0.016	0.5	P	

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [66%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
21 th	0.017	0.025	0.021	1.5	P
22 th	0.016	0.015	0.015	0.5	P
23 th	0.145	0.136	0.133	0.6	P
24 th	0.016	0.019	0.020	0.5	P
25 th	0.178	0.132	0.129	0.6	P
26 th	0.014	0.024	0.022	0.5	P
27 th	0.017	0.037	0.030	0.6	P
28 th	0.017	0.021	0.027	0.5	P
29 th	0.131	0.127	0.108	0.6	P
30 th	0.010	0.025	0.027	0.5	P
31 th	0.119	0.128	0.122	0.6	P
32 th	0.009	0.029	0.029	0.5	P
33 th	0.011	0.032	0.026	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [33%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 110KTL					
THD (to the 33 th)	1.467	1.633	1.546	5	P
2 nd	0.213	0.300	0.099	1	P
3 rd	0.042	0.067	0.071	4	P
4 th	0.160	0.188	0.258	1	P
5 th	0.316	0.296	0.302	4	P
6 th	0.049	0.084	0.096	1	P
7 th	0.284	0.383	0.358	4	P
8 th	0.037	0.046	0.025	1	P
9 th	0.031	0.079	0.077	4	P

4.6	TABLE: Harmonics and waveform distortion (Current)			P	
Harmonics	Measurements (percentage of Rated Current) [33%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
10 th	0.019	0.021	0.022	0.5	P
11 th	0.181	0.108	0.130	2	P
12 th	0.020	0.016	0.018	0.5	P
13 th	0.149	0.158	0.163	2	P
14 th	0.020	0.021	0.016	0.5	P
15 th	0.022	0.026	0.027	2	P
16 th	0.014	0.017	0.019	0.5	P
17 th	0.158	0.151	0.150	1.5	P
18 th	0.015	0.015	0.015	0.5	P
19 th	0.163	0.161	0.163	1.5	P
20 th	0.017	0.021	0.025	0.5	P
21 th	0.017	0.030	0.027	1.5	P
22 th	0.019	0.015	0.023	0.5	P
23 th	0.140	0.127	0.142	0.6	P
24 th	0.014	0.026	0.028	0.5	P
25 th	0.097	0.150	0.111	0.6	P
26 th	0.017	0.027	0.026	0.5	P
27 th	0.022	0.034	0.044	0.6	P
28 th	0.013	0.018	0.021	0.5	P
29 th	0.160	0.160	0.144	0.6	P
30 th	0.011	0.031	0.037	0.5	P
31 th	0.161	0.174	0.174	0.6	P
32 th	0.010	0.030	0.035	0.5	P
33 th	0.011	0.017	0.017	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P	
Harmonics		Measurements (percentage of Rated Current) [100%]			Limits [%]	Verdict
		PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 125KTL-M						
THD (to the 33 th)		1.163	1.151	1.126	5	P
2 nd		0.405	0.163	0.385	1	P
3 rd		0.183	0.088	0.167	4	P
4 th		0.393	0.217	0.397	1	P
5 th		0.733	0.792	0.813	4	P
6 th		0.103	0.122	0.140	1	P
7 th		0.811	0.940	0.957	4	P
8 th		0.044	0.058	0.055	1	P
9 th		0.057	0.049	0.083	4	P
10 th		0.036	0.054	0.050	0.5	P
11 th		0.710	0.636	0.731	2	P
12 th		0.034	0.032	0.034	0.5	P
13 th		0.534	0.513	0.544	2	P
14 th		0.031	0.030	0.030	0.5	P
15 th		0.043	0.039	0.057	2	P
16 th		0.034	0.035	0.030	0.5	P
17 th		0.370	0.343	0.354	1.5	P
18 th		0.026	0.029	0.034	0.5	P
19 th		0.319	0.267	0.340	1.5	P
20 th		0.034	0.033	0.033	0.5	P
21 th		0.050	0.034	0.043	1.5	P
22 th		0.041	0.054	0.033	0.5	P
23 th		0.269	0.261	0.250	0.6	P
24 th		0.030	0.028	0.029	0.5	P
25 th		0.152	0.334	0.401	0.6	P
26 th		0.039	0.031	0.030	0.5	P

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [100%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
27 th	0.049	0.053	0.045	0.6	P
28 th	0.026	0.031	0.038	0.5	P
29 th	0.215	0.191	0.165	0.6	P
30 th	0.022	0.023	0.026	0.5	P
31 th	0.184	0.165	0.175	0.6	P
32 th	0.028	0.020	0.028	0.5	P
33 th	0.044	0.052	0.049	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P	
Harmonics		Measurements (percentage of Rated Current) [66%]			Limits [%]	Verdict
		PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 125KTL-M						
THD (to the 33 th)		1.028	1.069	1.164	5	P
2 nd		0.180	0.273	0.168	1	P
3 rd		0.072	0.037	0.058	4	P
4 th		0.190	0.191	0.281	1	P
5 th		0.228	0.200	0.208	4	P
6 th		0.051	0.078	0.097	1	P
7 th		0.322	0.369	0.389	4	P
8 th		0.033	0.044	0.034	1	P
9 th		0.045	0.046	0.080	4	P
10 th		0.027	0.029	0.036	0.5	P
11 th		0.228	0.172	0.249	2	P
12 th		0.022	0.023	0.022	0.5	P
13 th		0.177	0.176	0.204	2	P
14 th		0.024	0.024	0.020	0.5	P
15 th		0.023	0.038	0.041	2	P

4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [66%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
16 th	0.022	0.023	0.023	0.5	P
17 th	0.107	0.093	0.123	1.5	P
18 th	0.021	0.023	0.024	0.5	P
19 th	0.069	0.062	0.088	1.5	P
20 th	0.025	0.023	0.024	0.5	P
21 th	0.027	0.027	0.030	1.5	P
22 th	0.024	0.025	0.025	0.5	P
23 th	0.091	0.097	0.107	0.6	P
24 th	0.024	0.024	0.026	0.5	P
25 th	0.144	0.198	0.190	0.6	P
26 th	0.036	0.032	0.036	0.5	P
27 th	0.031	0.043	0.043	0.6	P
28 th	0.023	0.025	0.026	0.5	P
29 th	0.229	0.202	0.221	0.6	P
30 th	0.017	0.035	0.034	0.5	P
31 th	0.186	0.176	0.201	0.6	P
32 th	0.018	0.029	0.023	0.5	P
33 th	0.020	0.029	0.032	0.6	P
Note(s):					

4.6	TABLE: Harmonics and waveform distortion (Current)				P	
Harmonics		Measurements (percentage of Rated Current) [33%]			Limits [%]	Verdict
		PHASE A [%]	PHASE B [%]	PHASE C [%]		
Test Model: hopeSun 125KTL-M						
THD (to the 33 th)		1.529	1.624	1.721	5	P
2 nd		0.194	0.268	0.148	1	P
3 rd		0.047	0.042	0.046	4	P
4 th		0.198	0.199	0.300	1	P

4.6	TABLE: Harmonics and waveform distortion (Current)			P	
Harmonics	Measurements (percentage of Rated Current) [33%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
5 th	0.152	0.140	0.130	4	P
6 th	0.051	0.084	0.107	1	P
7 th	0.183	0.252	0.240	4	P
8 th	0.030	0.047	0.038	1	P
9 th	0.040	0.050	0.082	4	P
10 th	0.025	0.028	0.033	0.5	P
11 th	0.122	0.061	0.135	2	P
12 th	0.020	0.020	0.020	0.5	P
13 th	0.151	0.159	0.179	2	P
14 th	0.023	0.023	0.021	0.5	P
15 th	0.025	0.039	0.046	2	P
16 th	0.021	0.022	0.025	0.5	P
17 th	0.183	0.161	0.192	1.5	P
18 th	0.021	0.021	0.021	0.5	P
19 th	0.156	0.148	0.181	1.5	P
20 th	0.024	0.026	0.023	0.5	P
21 th	0.027	0.028	0.028	1.5	P
22 th	0.026	0.026	0.027	0.5	P
23 th	0.129	0.132	0.143	0.6	P
24 th	0.024	0.026	0.025	0.5	P
25 th	0.142	0.190	0.164	0.6	P
26 th	0.031	0.040	0.040	0.5	P
27 th	0.050	0.047	0.044	0.6	P
28 th	0.031	0.024	0.038	0.5	P
29 th	0.298	0.281	0.300	0.6	P
30 th	0.019	0.036	0.041	0.5	P
31 th	0.203	0.209	0.229	0.6	P

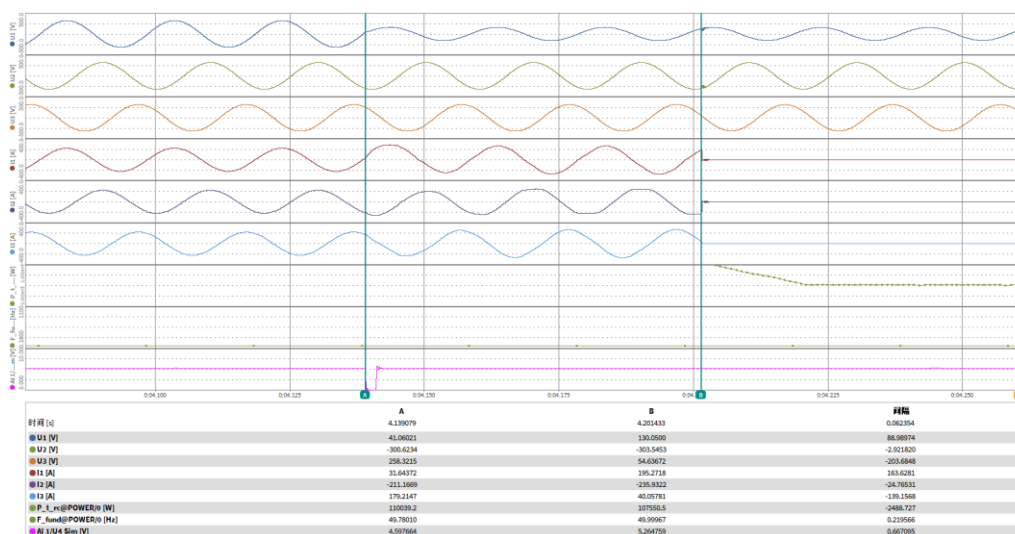
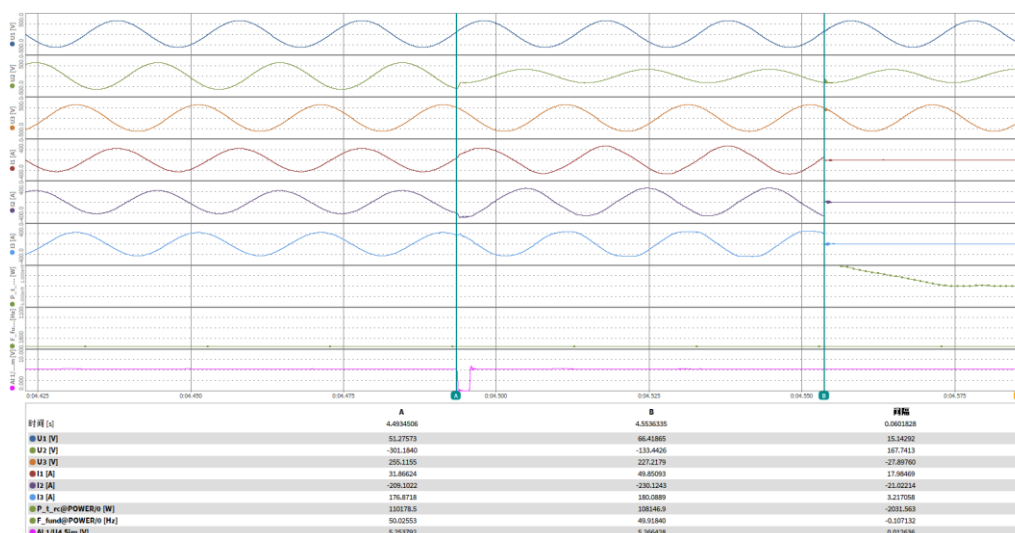
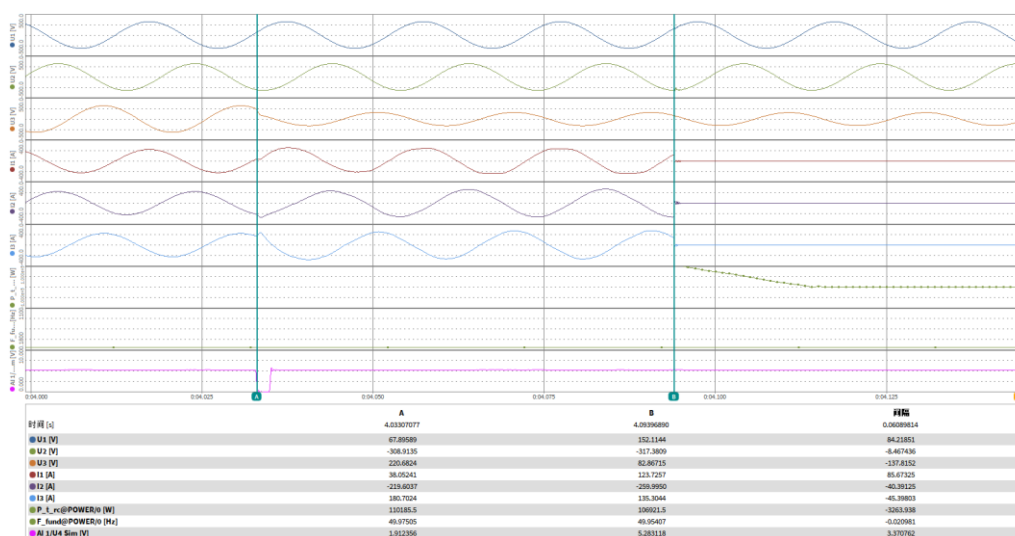
4.6	TABLE: Harmonics and waveform distortion (Current)				P
Harmonics	Measurements (percentage of Rated Current) [33%]			Limits [%]	Verdict
	PHASE A [%]	PHASE B [%]	PHASE C [%]		
32 th	0.015	0.036	0.034	0.5	P
33 th	0.020	0.023	0.022	0.6	P
Note(s):					

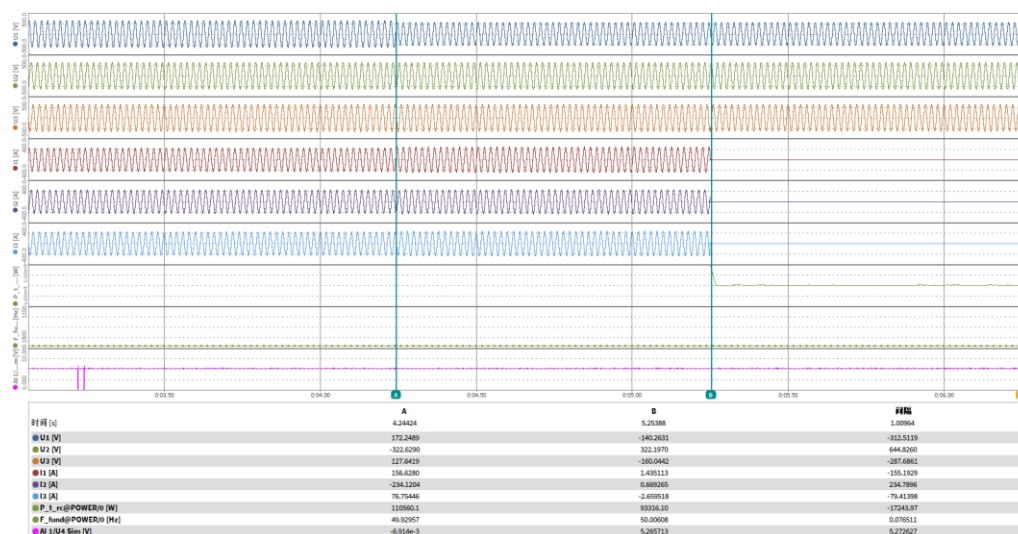
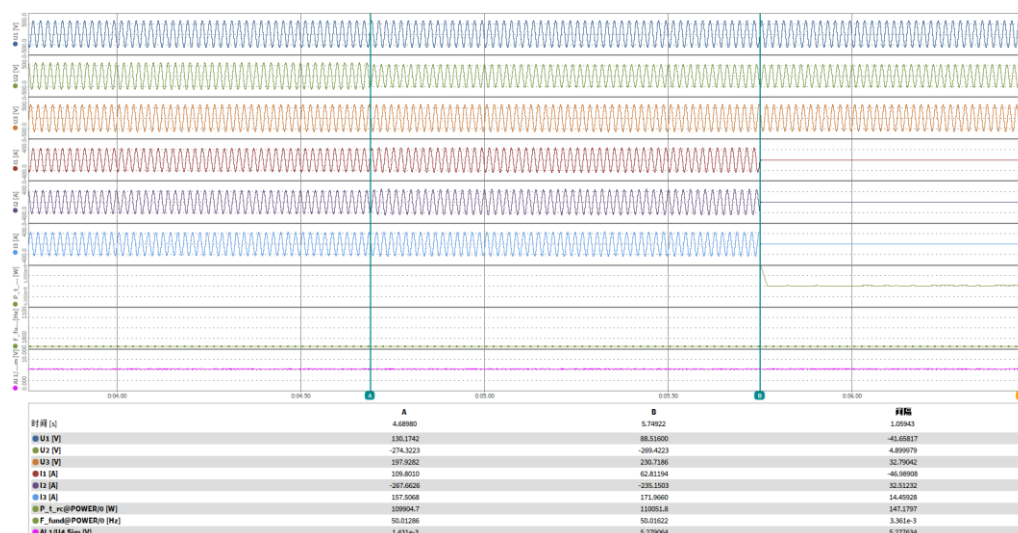
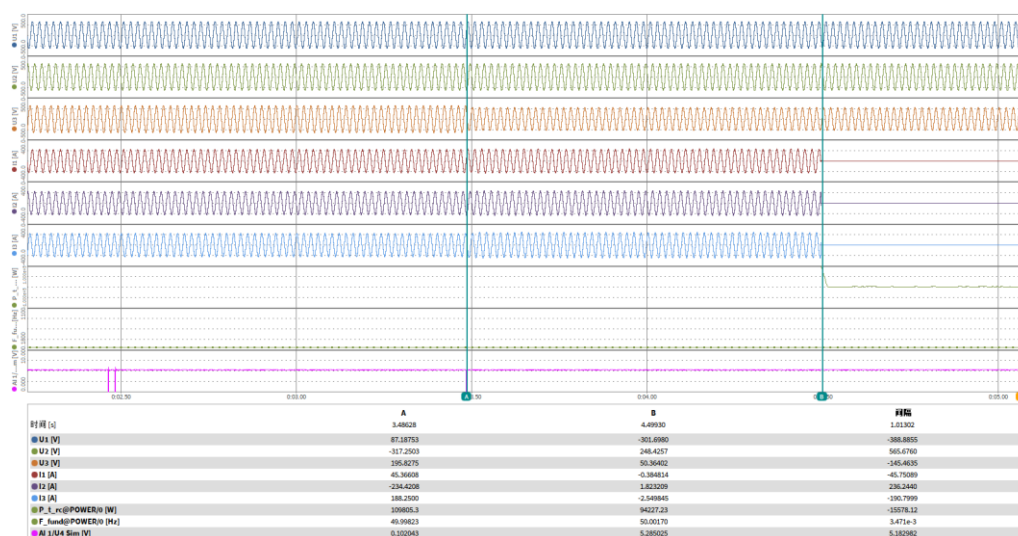
4.7	TABLE: Power Factor					P
Test Model: hopeSun 100KTL						
Power conditions	(50±5) %	(60±5) %	(70±5) %	(80±5) %	(90±5) %	(100±5) %
Limits	Power factor value: [0.9,1.0]					
U [V]	230.82	230.90	230.97	231.05	231.13	231.21
I [A]	72.82	87.22	101.46	115.83	130.11	144.43
Fre. [Hz]	50.00	50.00	50.00	50.00	50.00	50.00
P [W]	50.38	60.36	70.26	80.24	90.18	100.14
Q [VA]	2.26	2.45	2.46	2.56	2.65	2.72
S [VA]	50.43	60.41	70.31	80.29	90.22	100.18
PF [λ]	0.9998	0.9998	0.9998	0.9999	0.9999	0.9999
Test Model: hopeSun 110KTL						
Power conditions	(50±5) %	(60±5) %	(70±5) %	(80±5) %	(90±5) %	(100±5) %
Limits	Power factor value: [0.9,1.0]					
U [V]	230.86	230.95	231.03	231.10	231.17	231.23
I [A]	80.23	96.04	111.87	127.74	143.75	158.45
Fre. [Hz]	50.00	50.00	50.00	50.00	50.00	50.00
P [W]	55.51	66.49	77.49	88.51	99.65	109.87
Q [VA]	2.49	2.64	2.73	2.84	2.93	3.01
S [VA]	55.56	66.54	77.53	88.56	99.70	109.91
PF [λ]	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999

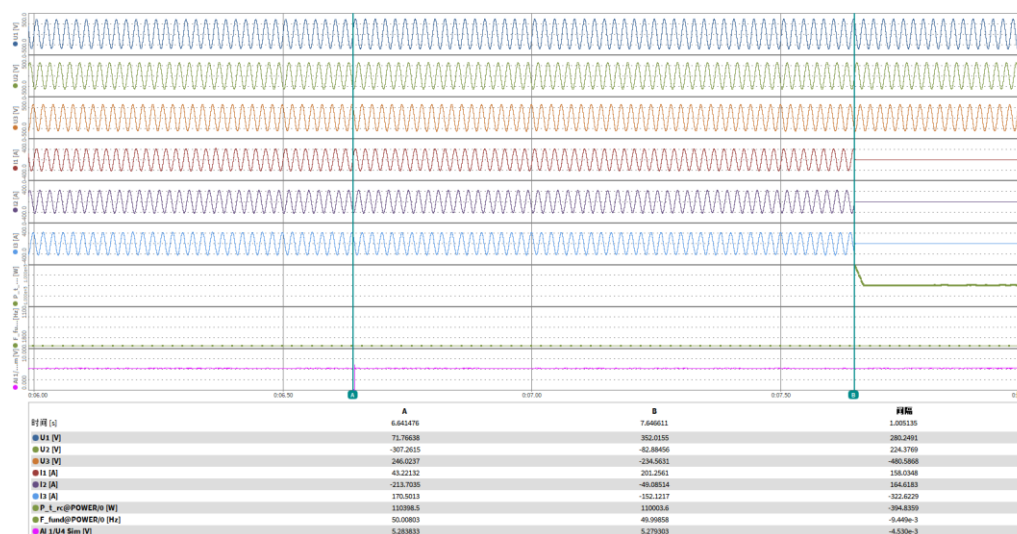
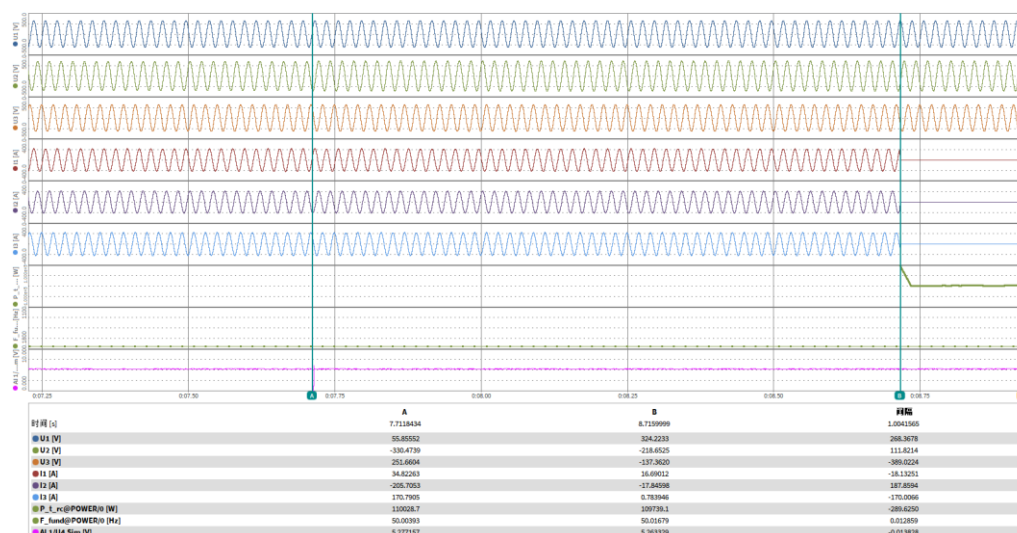
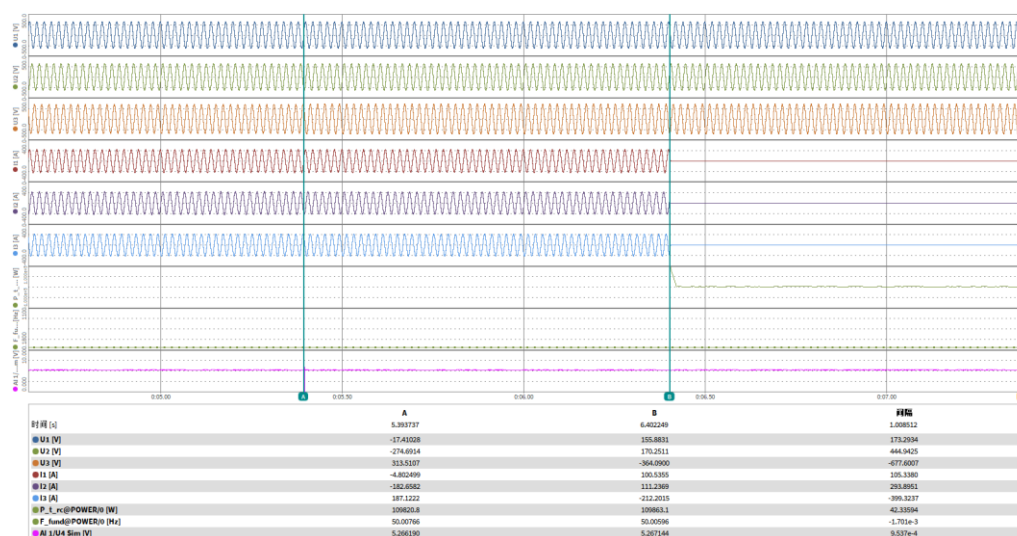
Test Model: hopeSun 125KTL-M						
Power conditions	(50±5) %	(60±5) %	(70±5) %	(80±5) %	(90±5) %	(100±5) %
Limits	Power factor value: [0.9,1.0]					
U [V]	500.48	500.60	500.74	500.87	500.99	501.12
I [A]	72.71	87.14	101.52	115.89	130.22	144.52
Fre. [Hz]	50.00	50.00	50.00	50.00	50.00	50.00
P [W]	62.99	75.52	88.01	100.50	112.96	125.41
Q [VA]	2.19	2.40	2.51	2.57	2.61	2.69
S [VA]	63.03	75.55	88.05	100.54	112.99	125.44
PF [λ]	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999
Note(s):						

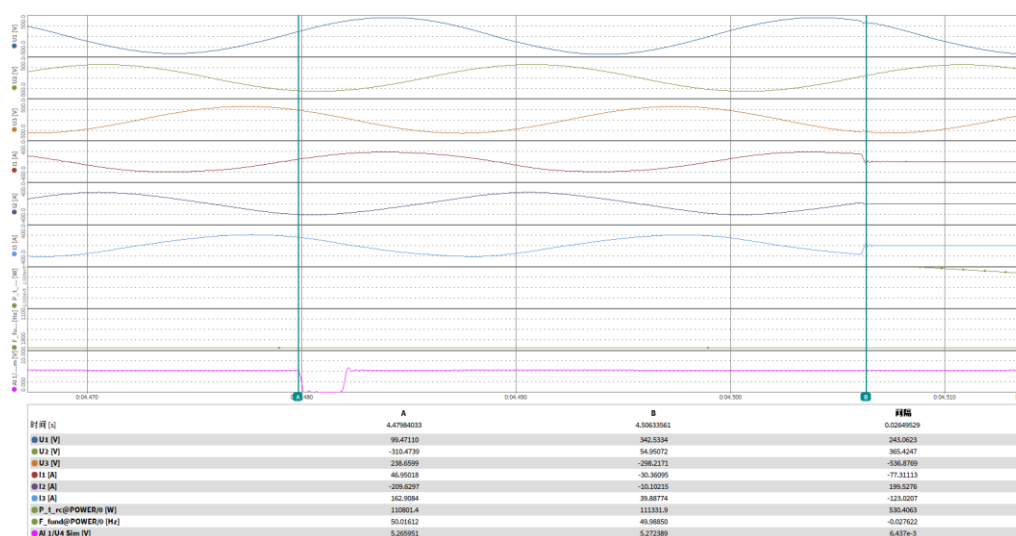
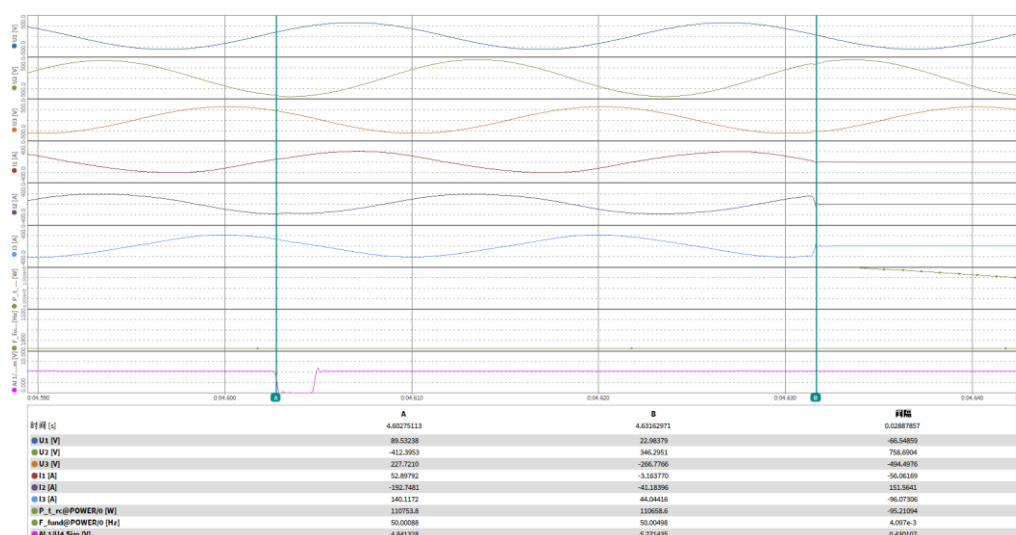
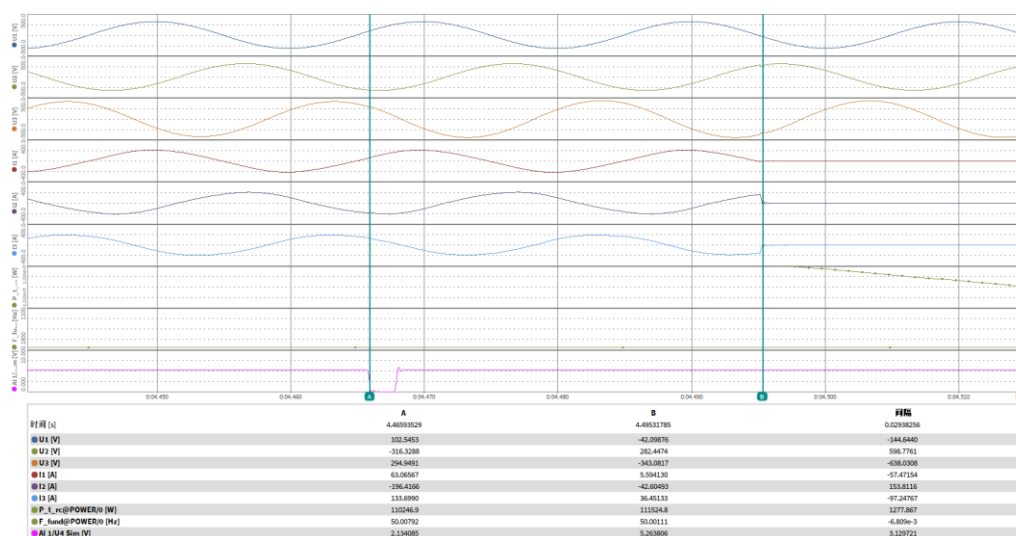
5.2.1	TABLE: Over / Under Voltage			P
Test Model: hopeSun 110KTL				
Rated voltage [Vrms]:	230	Voltage accuracy [ΔV]:	$\pm 1\%$	
Frequency [Hz]	50	Rated recover time [s]:	60	
Power condition:	<input checked="" type="checkbox"/> 100%	<input checked="" type="checkbox"/> (50-66)%	<input type="checkbox"/> (25-33)%	
Trip $U_o \rightarrow U$	Trip value tolerance [V]			
	Measurements			Limits
	L1-N	L2-N	L3-N	
$U < 50\%U_o$	115.78	115.56	114.57	115 \pm 2.3
	115.28	116.19	115.53	
	114.16	115.99	115.46	
$50\%U_o \leq U < 85\%U_o$	196.07	197.18	195.91	195.5 \pm 2.3
	195.89	196.56	194.91	
	195.41	197.78	195.26	
$110\%U_o < U < 135\%U_o$	252.42	252.66	251.67	253 \pm 2.3
	251.93	252.09	251.85	
	252.00	252.17	251.36	
$135\%U_o \leq U$	310.95	310.59	309.50	310 \pm 2.3
	310.92	310.52	310.20	

	310.80	310.13	309.53	
Trip $U_o \rightarrow U$	Trip time [ms]			Limits
	Measurements			
	L1-N	L2-N	L3-N	
$U<50\%U_o$	58.34	59.52	60.90	100
	57.82	59.60	60.11	
	62.35	60.18	59.39	
$50\%U_o\leq U < 85\%U_o$	1006.49	1059.43	1007.80	2000
	1009.64	1024.46	1013.02	
	1003.29	1018.00	1010.39	
$110\%U_o < U < 135\%U_o$	1005.14	1003.70	1002.91	2000
	1004.37	1000.07	1008.51	
	1002.45	1004.16	1005.75	
$135\%U_o \leq U$	25.54	28.10	28.51	50
	26.50	28.88	28.94	
	26.24	28.38	29.38	

U<50%U_o L1-NU<50%U_o L2-NU<50%U_o L3-N

50%U₀≤U < 85%U₀ L1-N50%U₀≤U < 85%U₀ L2-N50%U₀≤U < 85%U₀ L3-N

135%U₀≤U L1-N135%U₀≤U L2-N135%U₀≤U L3-N

110%U₀ < U < 135%U₀ L1-N110%U₀ < U < 135%U₀ L2-N110%U₀ < U < 135%U₀ L3-N

Curve illustration:

Channel 1~3: Waveform of output voltage signal at grid connection terminals.

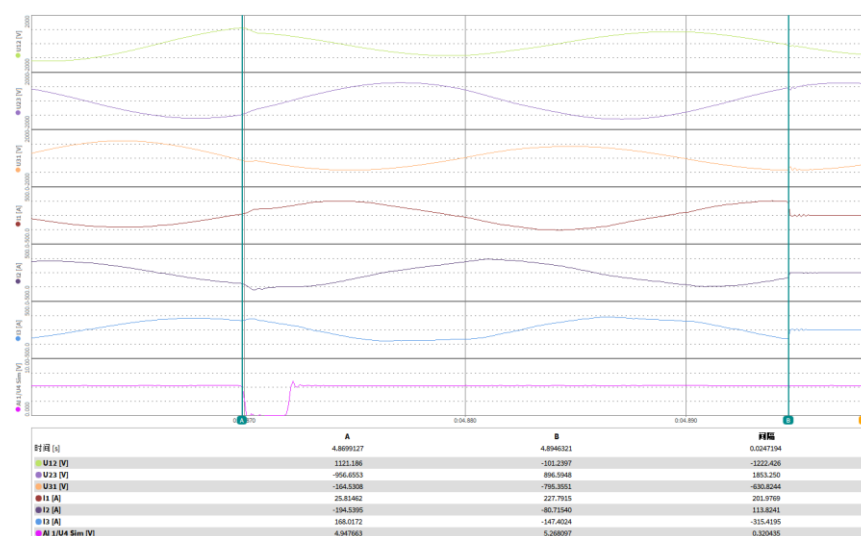
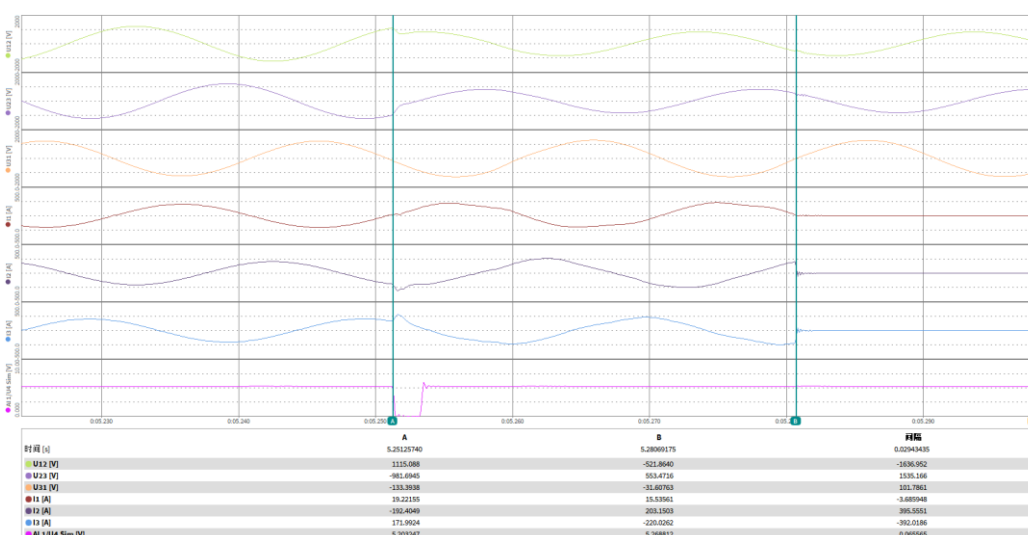
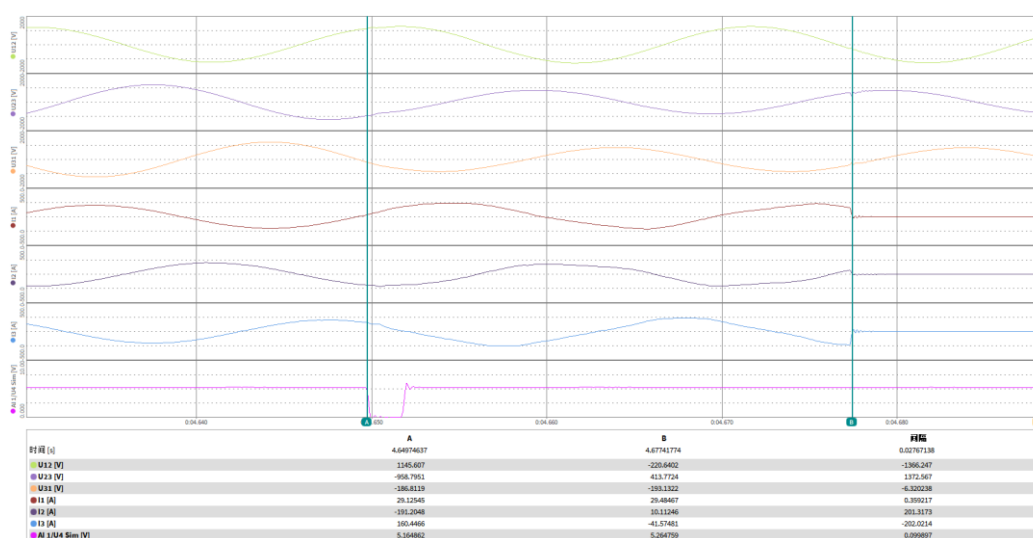
Channel 4~6: Waveform of output current signal at grid connection terminals.

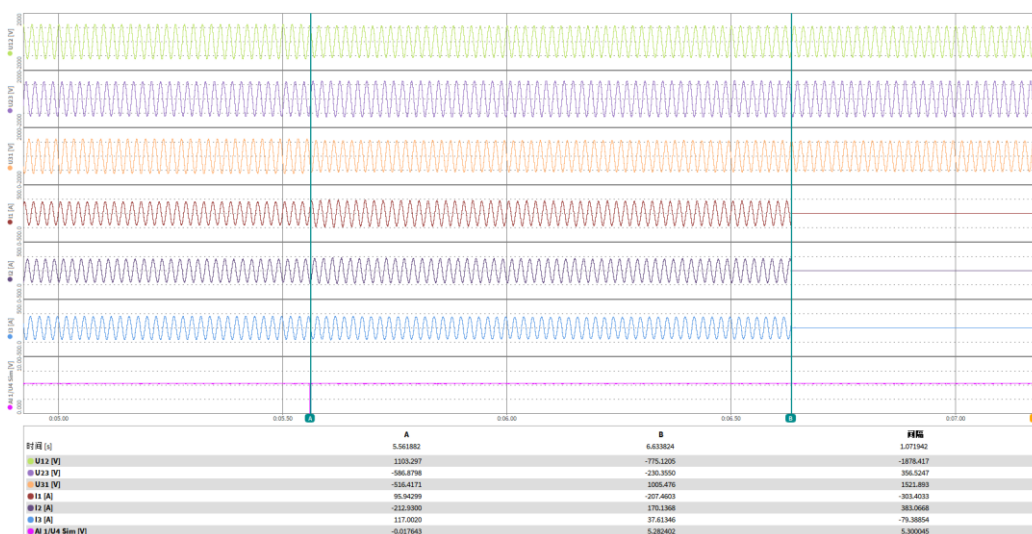
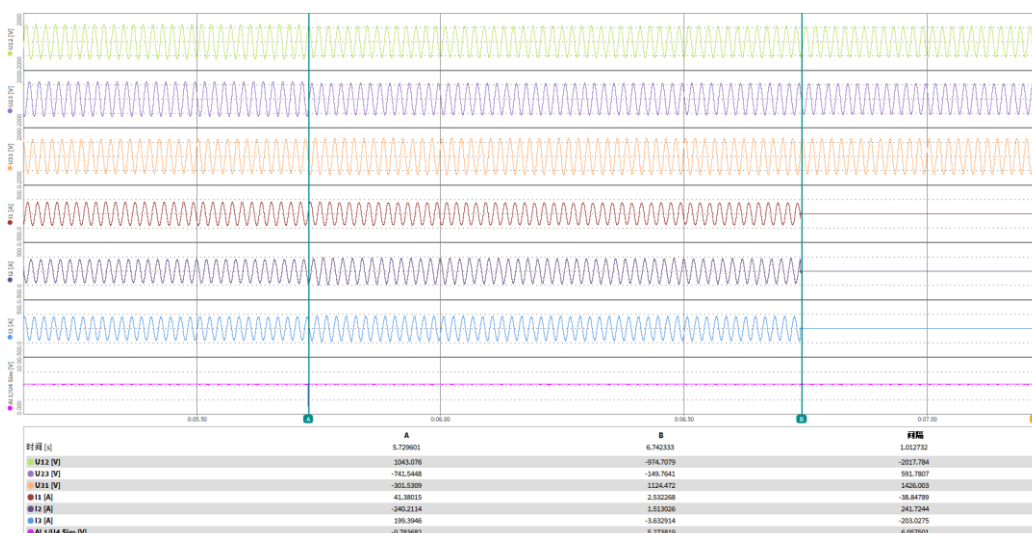
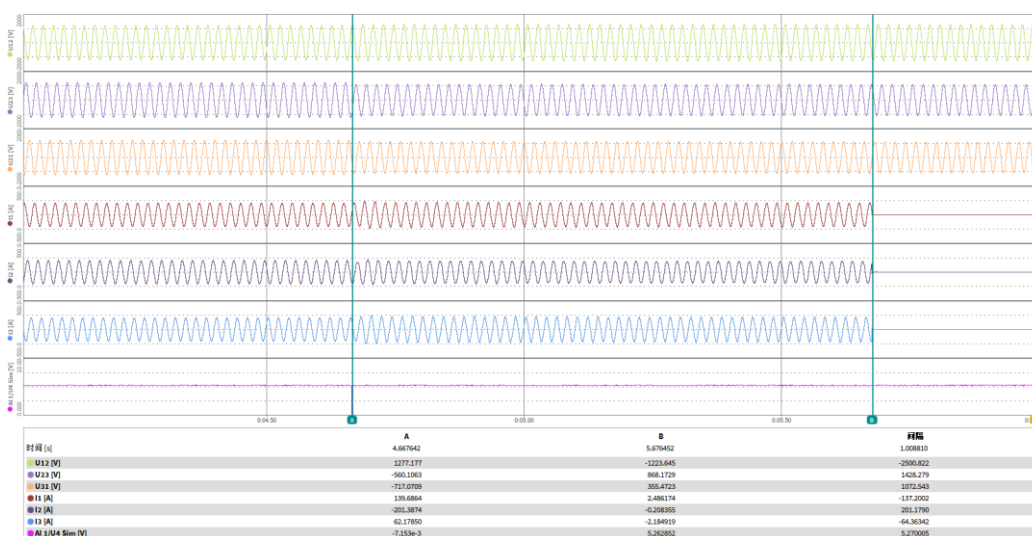
Channel 9: Trigger signal of turning into out limit state to normal frequency range, provided by the programmable AC grid simulator.

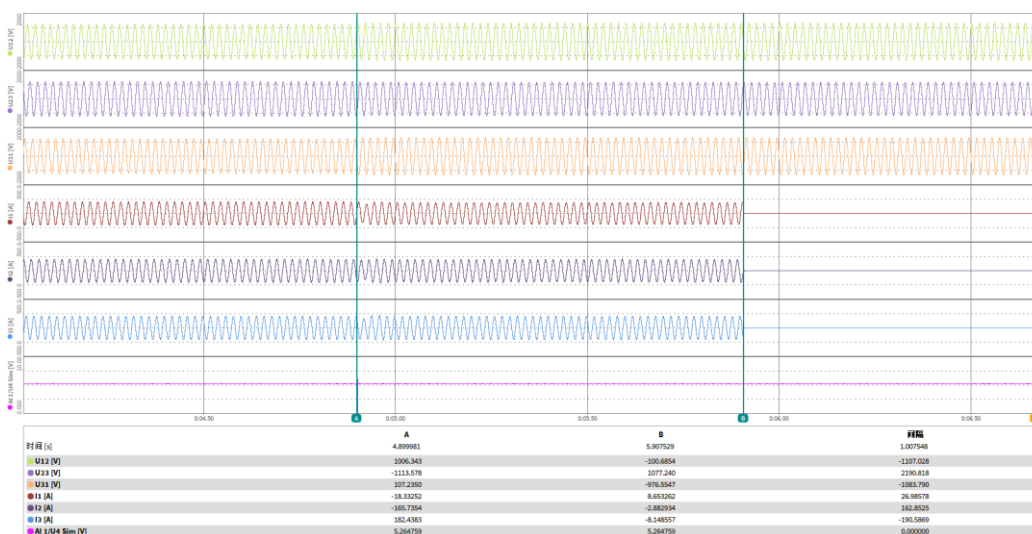
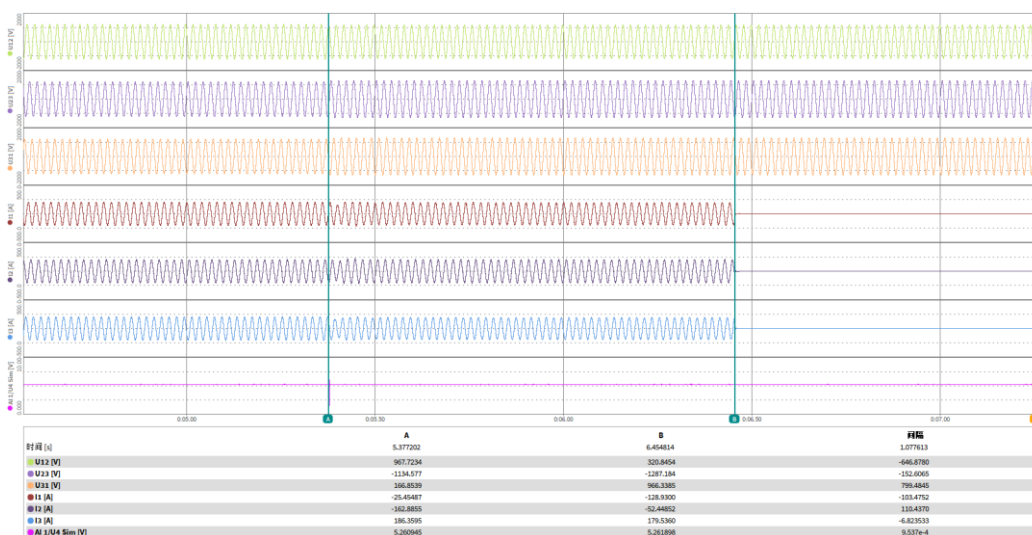
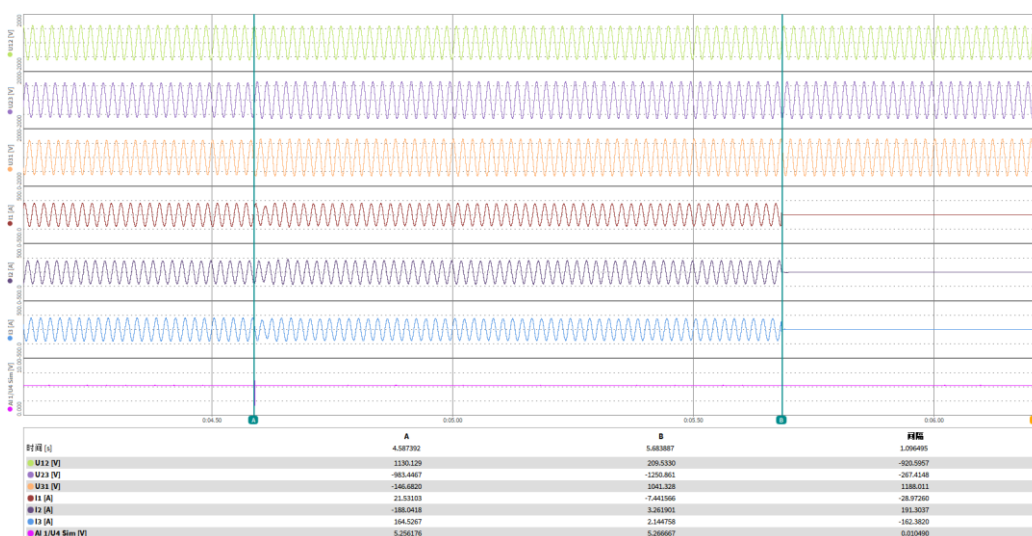
Note(s):

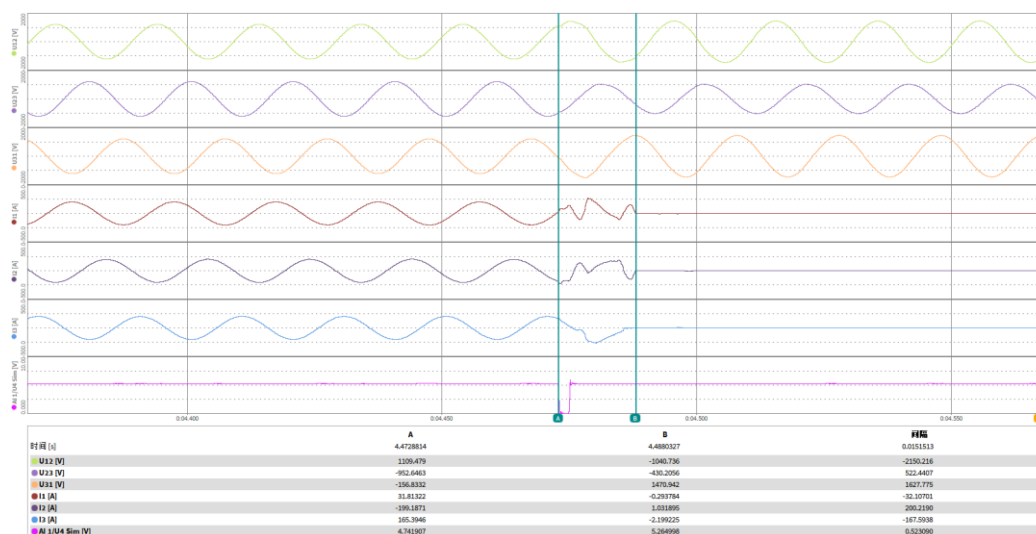
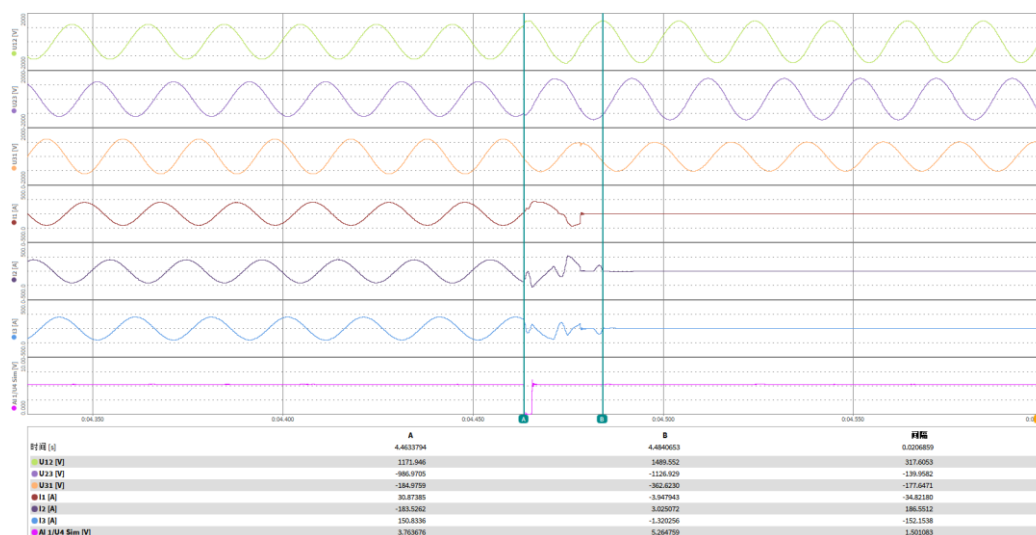
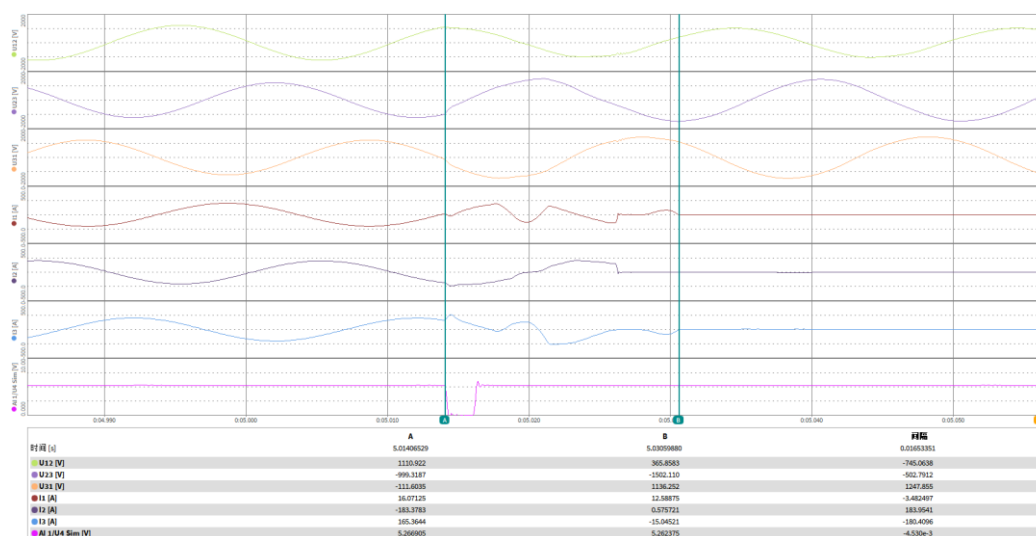
5.2.1	TABLE: Over / Under Voltage			P
Test Model: hopeSun 125KTL-M				
Rated voltage [Vrms]:	500	Voltage accuracy [ΔV]:	$\pm 1\%$	
Frequency [Hz]	50	Rated recover time [s]:	60	
Power condition:	<input checked="" type="checkbox"/> 100%	<input checked="" type="checkbox"/> (50-66)%	<input type="checkbox"/> (25-33)%	
Trip $U_o \rightarrow U$	Trip value tolerance [V]			
	Measurements			Limits
	L1-L2	L2-L3	L3-L1	
$U < 50\%U_o$	250.51	251.85	249.99	250 \pm 5.0
	247.85	251.09	250.79	
	249.13	251.03	248.85	
$50\%U_o \leq U < 85\%U_o$	423.90	423.50	424.50	425 \pm 5.0
	423.64	423.17	424.60	
	424.00	423.21	424.80	
$110\%U_o < U < 135\%U_o$	550.52	551.41	550.74	550 \pm 5.0
	552.12	550.97	550.50	
	551.52	551.01	551.43	
$135\%U_o \leq U$	674.25	672.35	674.26	675 \pm 5.0
	673.24	675.53	675.44	
	675.34	674.93	674.34	
Trip $U_o \rightarrow U$	Trip time [ms]			
	Measurements			Limits
	L1-L2	L2-L3	L3-L1	
$U < 50\%U_o$	24.03	29.43	26.33	100
	24.70	21.03	27.54	
	24.72	28.03	27.67	
$50\%U_o \leq U < 85\%U_o$	1054.08	1012.73	1007.19	2000
	1052.42	1009.14	1008.77	
	1071.94	1010.09	1008.81	
$110\%U_o < U < 135\%U_o$	1005.98	1008.11	1010.78	2000

	1005.46	1010.17	1096.50	
	1007.55	1077.61	1076.01	
135%U ₀ ≤ U	14.85	20.66	16.48	50
	14.93	20.62	16.32	
	15.15	20.69	16.53	

U<50%U₀ L1-NU<50%U₀ L2-NU<50%U₀ L3-N

50%U₀≤U < 85%U₀ L1-N50%U₀≤U < 85%U₀ L2-N50%U₀≤U < 85%U₀ L3-N

135%U₀≤U L1-N135%U₀≤U L2-N135%U₀≤U L3-N

110%U₀ < U < 135%U₀ L1-N110%U₀ < U < 135%U₀ L2-N110%U₀ < U < 135%U₀ L3-N

Curve illustration:

Channel 1~3: Waveform of output voltage signal at grid connection terminals.

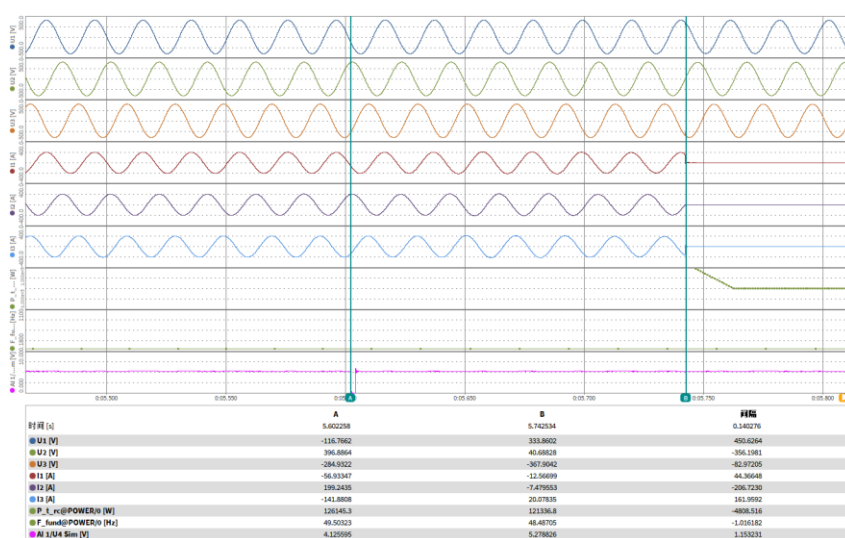
Channel 4~6: Waveform of output current signal at grid connection terminals.

Channel 7: Trigger signal of turning into out limit state to normal frequency range, provided by the programmable AC grid simulator.

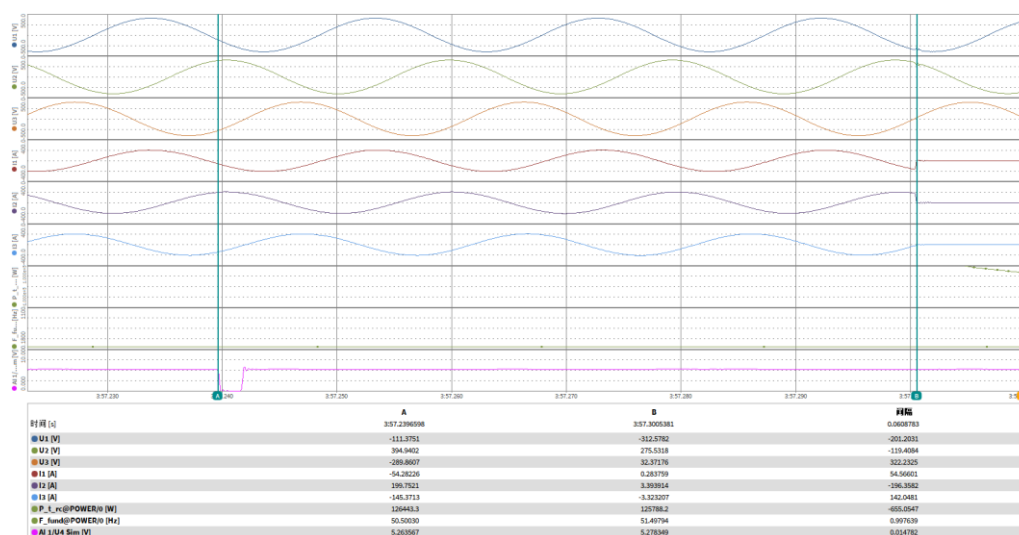
Note(s):

5.2.2	TABLE: Over / Under Frequency			P
Test Model: hopeSun 125KTL-M				
Rated voltage [Vrms]:	230	Frequency accuracy [ΔF]:		$\pm 0.05\text{Hz}$
Frequency [Hz]	50	Rated recover time [s]:		60
Power condition:	<input checked="" type="checkbox"/> 100%	<input type="checkbox"/> (50-66)%		<input type="checkbox"/> (25-33)%
Trip $F_0 \rightarrow F$	Trip time [ms]			
	Measurements			Limits
	M1	M2	M3	
$F_N + \Delta F \rightarrow F_N - \Delta F$ (F<49.0)	48.98	48.99	48.97	49.0 \pm 0.05
$F_N - \Delta F \rightarrow F_N + \Delta F$ (F>51.0)	51.04	51.03	51.04	51.0 \pm 0.05
Trip $F_0 \rightarrow F$	Trip time [ms]			
	Measurements			Limits
	M1	M2	M3	
$F_N + \Delta F \rightarrow F_N - \Delta F$ (F<49.0)	140.28	138.59	137.61	200
$F_N - \Delta F \rightarrow F_N + \Delta F$ (F>51.0)	60.88	56.44	55.17	200

F<49.0Hz



F>51.0Hz



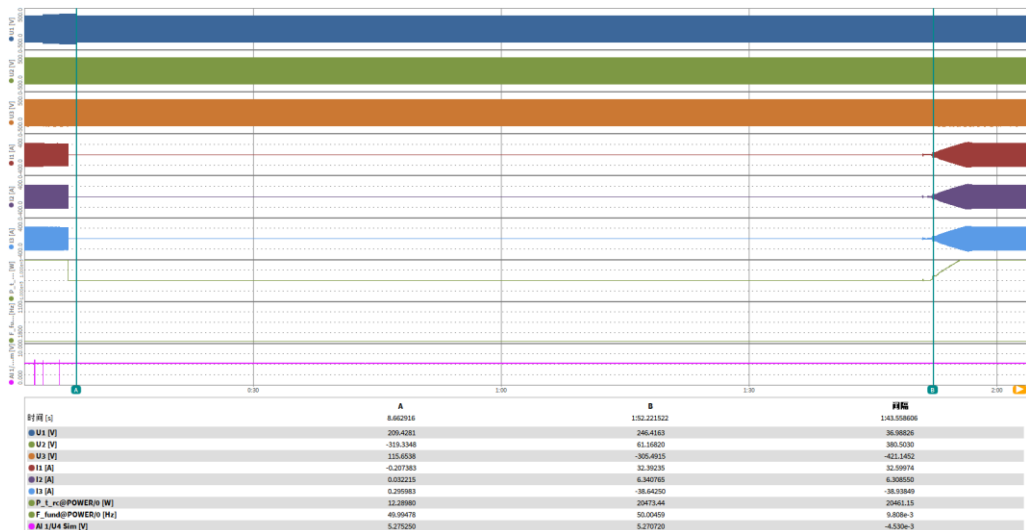
Curve illustration:

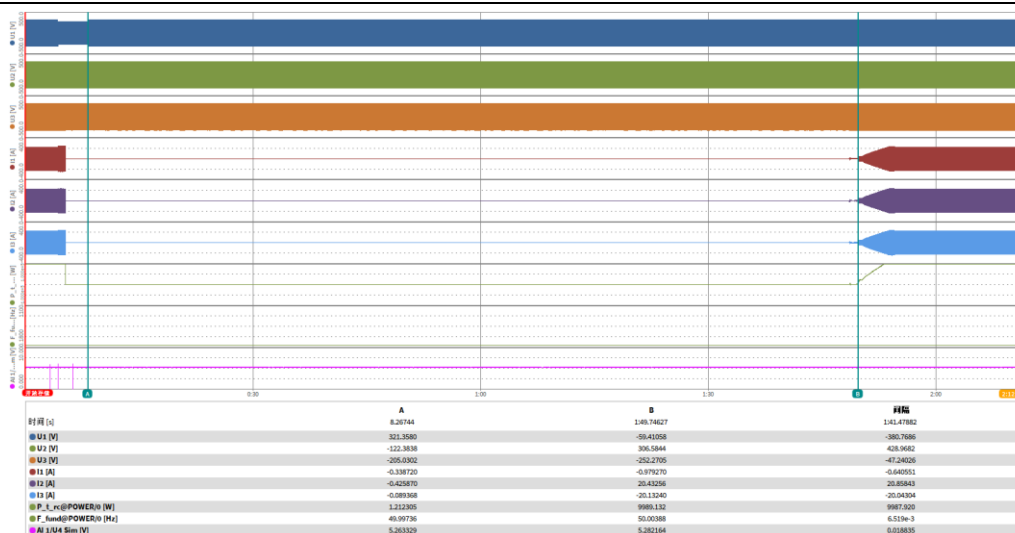
Channel 1~3: Waveform of output voltage signal at grid connection terminals.

Channel 4~6: Waveform of output current signal at grid connection terminals.

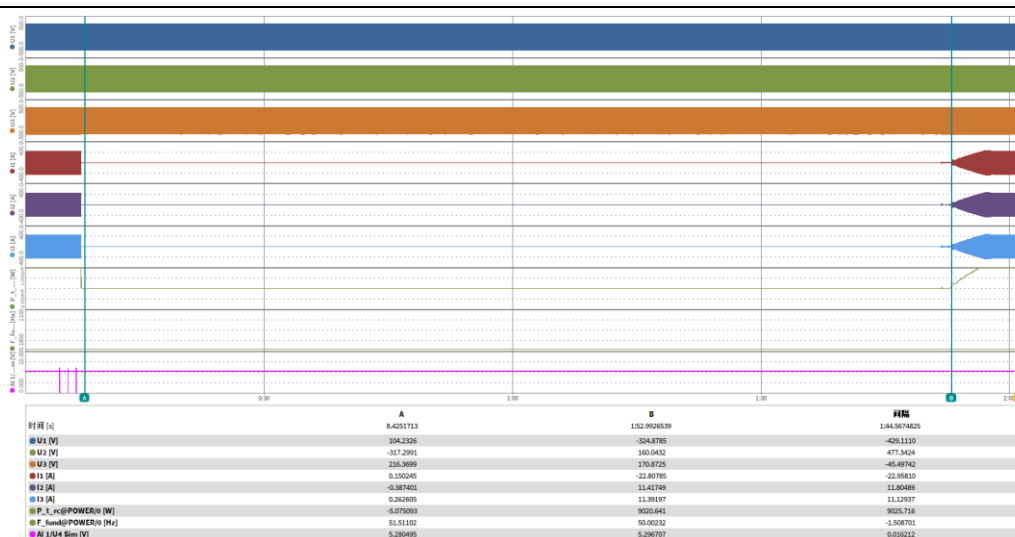
Channel 9: Trigger signal of turning into out limit state to normal frequency range, provided by the programmable AC grid simulator.

Note(s):

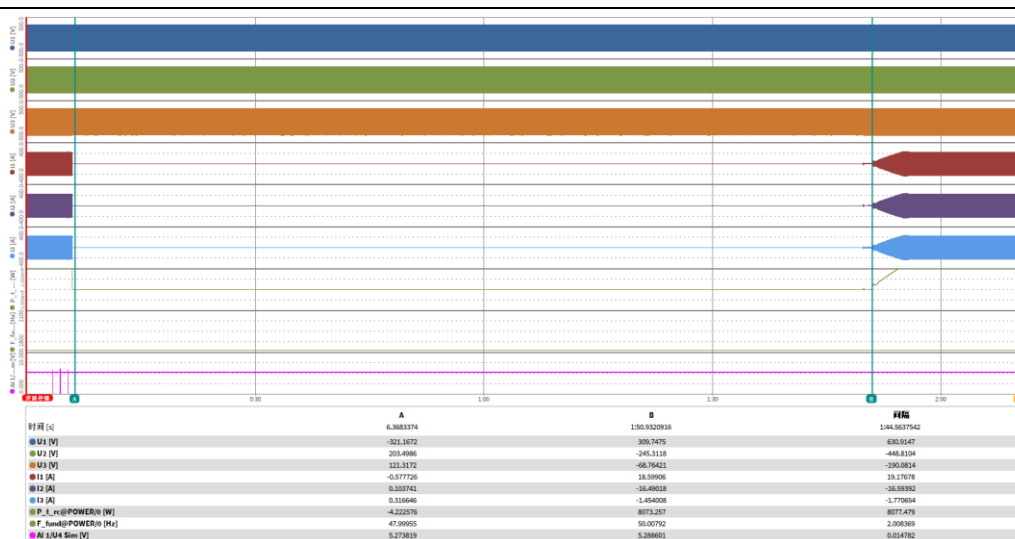
5.4	TABLE: Response to Utility Recovery				P																																												
hopeSun 110KTL																																																	
Conditions ²⁾	UM ¹⁾ back to 255V	UM back to 250V	UM back to 193V	UM back to 198V																																													
Reconnection	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No																																													
Recover time [s]	N/A	103.56	N/A	101.48																																													
Conditions ³⁾	F _M ¹⁾ back to 51.1Hz	F _M back to 50.9Hz	F _M back to 48.9Hz	F _M back to 49.1Hz																																													
Reconnection	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No																																													
Recover time [s]	N/A	104.57	N/A	104.56																																													
Remark:																																																	
1) UM =Mains voltage; F _M =Mains frequency.																																																	
2) After mains voltage tripped the over/under voltage level 1 limit.																																																	
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<div><table><tr><th>时间 (s)</th><th>A</th><th>B</th><th>##</th></tr><tr><td>0.000000</td><td>8.402916</td><td>1.92321522</td><td>1.41155656</td></tr><tr><td>0.000000</td><td>209.4281</td><td>246.4163</td><td>36.98626</td></tr><tr><td>0.000000</td><td>-329.3348</td><td>61.15820</td><td>380.5030</td></tr><tr><td>0.000000</td><td>115.6538</td><td>-305.4925</td><td>-421.1452</td></tr><tr><td>0.000000</td><td>-0.207383</td><td>32.39239</td><td>32.59974</td></tr><tr><td>0.000000</td><td>0.002223</td><td>6.340785</td><td>6.340850</td></tr><tr><td>0.000000</td><td>0.295983</td><td>-38.64250</td><td>-38.93849</td></tr><tr><td>0.000000</td><td>12.28980</td><td>29473.44</td><td>29461.15</td></tr><tr><td>0.000000</td><td>49.59478</td><td>52.09459</td><td>5.000e-3</td></tr><tr><td>0.000000</td><td>5.279250</td><td>5.270720</td><td>-4.590e-3</td></tr></table></div>						时间 (s)	A	B	##	0.000000	8.402916	1.92321522	1.41155656	0.000000	209.4281	246.4163	36.98626	0.000000	-329.3348	61.15820	380.5030	0.000000	115.6538	-305.4925	-421.1452	0.000000	-0.207383	32.39239	32.59974	0.000000	0.002223	6.340785	6.340850	0.000000	0.295983	-38.64250	-38.93849	0.000000	12.28980	29473.44	29461.15	0.000000	49.59478	52.09459	5.000e-3	0.000000	5.279250	5.270720	-4.590e-3
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back to 250V																																																	



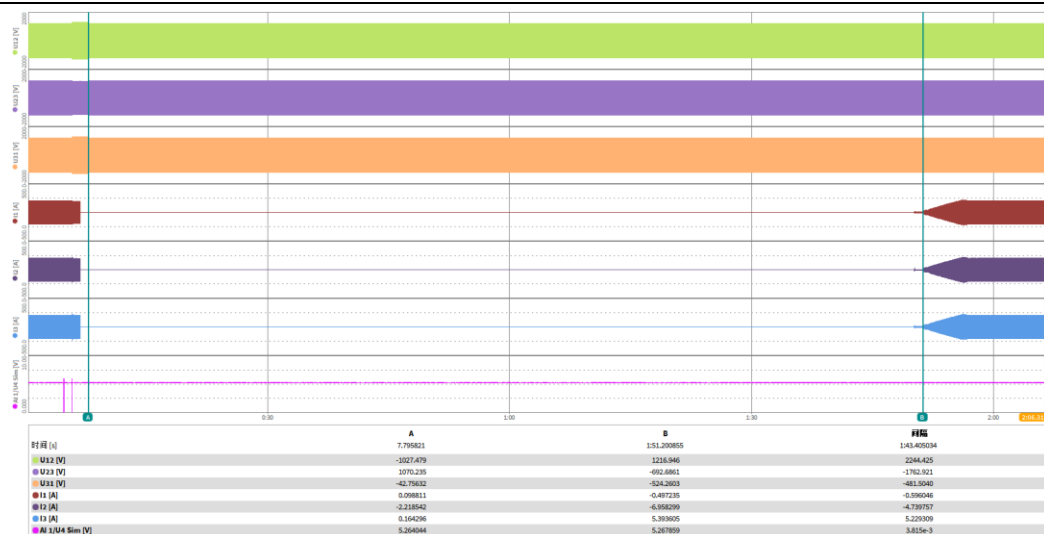
back to 198V

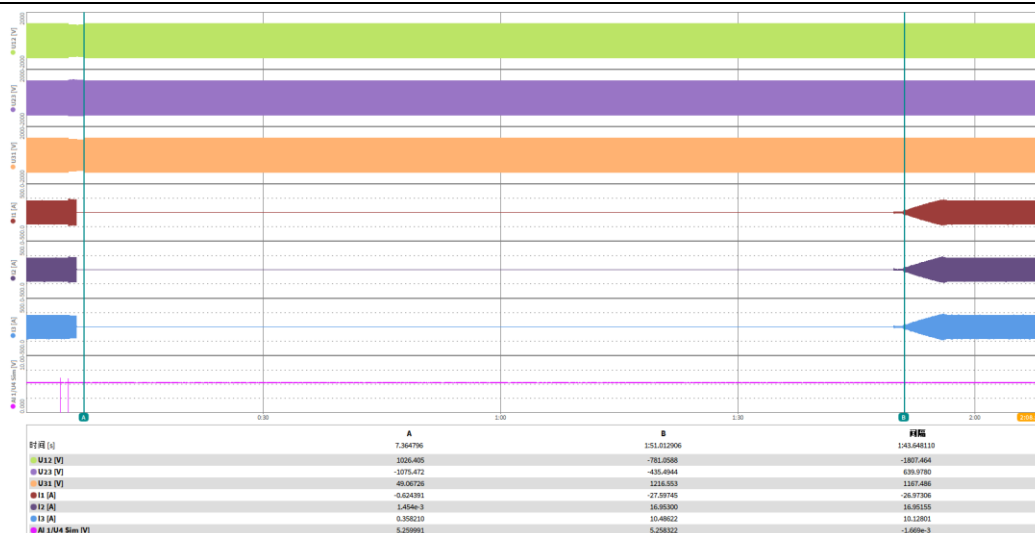


back to 50.9Hz

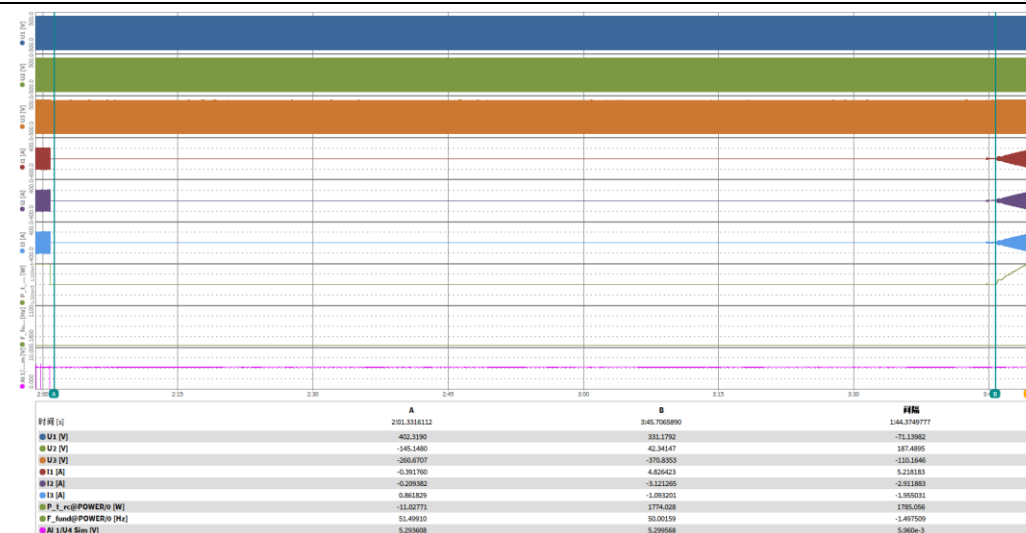


back to 49.1Hz

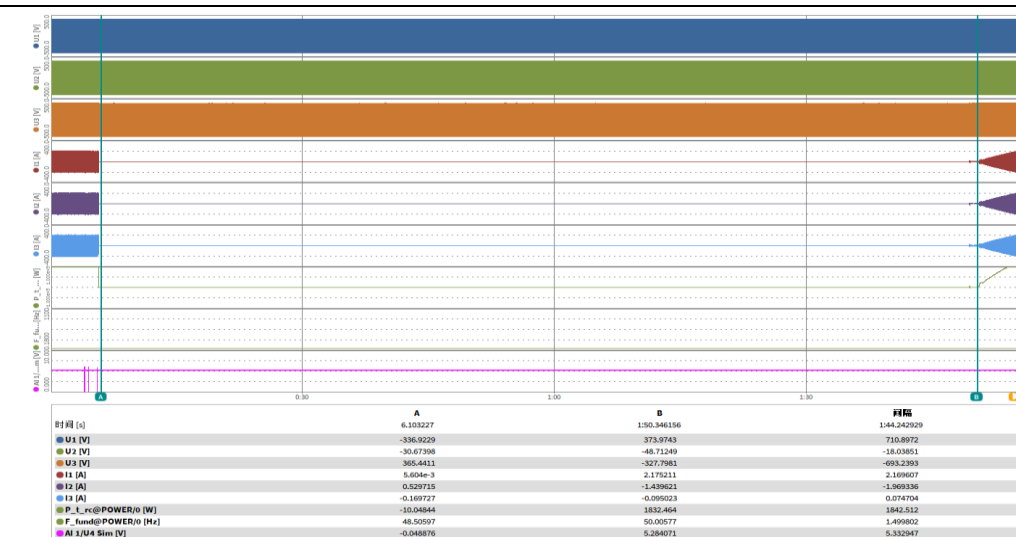
5.4	TABLE: Response to Utility Recovery				P																																				
hopeSun 125KTL-M																																									
Conditions ²⁾	UM ¹⁾ back to 554V	UM back to 543V	UM back to 420V	UM back to 430V																																					
Reconnection	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No																																					
Recover time [s]	N/A	103.40	N/A	103.65																																					
Conditions ³⁾	F _M ¹⁾ back to 51.1Hz	F _M back to 50.9Hz	F _M back to 48.9Hz	F _M back to 49.1Hz																																					
Reconnection	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No																																					
Recover time [s]	N/A	104.37	N/A	104.24																																					
Remark:																																									
1) UM =Mains voltage; F _M =Mains frequency.																																									
2) After mains voltage tripped the over/under voltage level 1 limit.																																									
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<div><table><thead><tr><th>时间 [s]</th><th>A</th><th>B</th><th>注释</th></tr></thead><tbody><tr><td>0.00</td><td>7.795821</td><td>151.200855</td><td>143.405034</td></tr><tr><td>0.10</td><td>-1027.479</td><td>1216.946</td><td>2244.425</td></tr><tr><td>0.20</td><td>1070.235</td><td>-482.0901</td><td>-1762.101</td></tr><tr><td>0.30</td><td>-42.75632</td><td>-504.3403</td><td>-483.1000</td></tr><tr><td>0.40</td><td>0.098811</td><td>-0.487235</td><td>-0.596046</td></tr><tr><td>0.50</td><td>-2.218542</td><td>-6.958209</td><td>-4.739757</td></tr><tr><td>0.60</td><td>0.164206</td><td>5.393625</td><td>5.229309</td></tr><tr><td>0.70</td><td>5.204004</td><td>5.267859</td><td>3.815e-3</td></tr></tbody></table></div>						时间 [s]	A	B	注释	0.00	7.795821	151.200855	143.405034	0.10	-1027.479	1216.946	2244.425	0.20	1070.235	-482.0901	-1762.101	0.30	-42.75632	-504.3403	-483.1000	0.40	0.098811	-0.487235	-0.596046	0.50	-2.218542	-6.958209	-4.739757	0.60	0.164206	5.393625	5.229309	0.70	5.204004	5.267859	3.815e-3
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back to 250V																																									



back to 198V



back to 50.9Hz



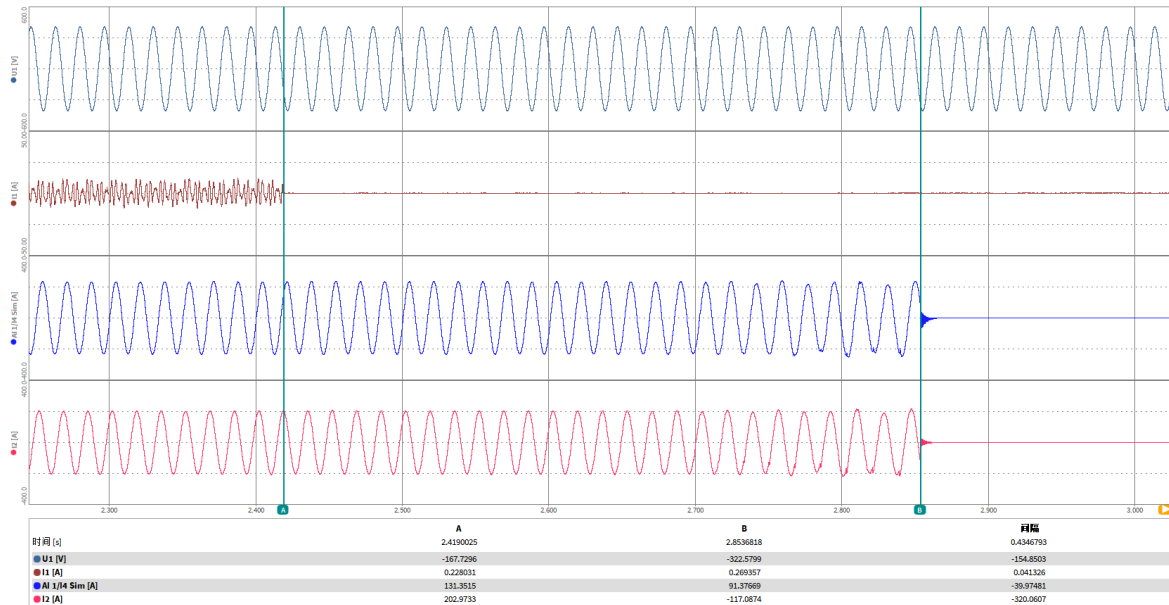
back to 49.1Hz

6.1		TABLE: tested condition and run-on time							P
No.	P _{EUT} (%) of EUT rating)	Reactive load (%) of normal)	P _{AC}	Q _{AC}	Run-on time(ms)	P _{EUT} (kW)	Actual Q _f (Var)	V _{DC}	Which load is selected to be adjusted (R or L)
Test condition A									
1	100	100	0	0	434.68	125	1.011	710	/
2	100	100	-5	-5	274.37	125	0.992	710	RL
3	100	100	-5	0	364.45	125	0.967	710	R
4	100	100	-5	+5	322.71	125	0.941	710	RL
5	100	100	0	-5	380.55	125	1.040	710	L
6	100	100	0	+5	405.19	125	0.988	710	L
7	100	100	+5	-5	301.31	125	1.100	710	RL
8	100	100	+5	0	334.43	125	1.074	710	R
9	100	100	+5	+5	307.72	125	1.048	710	RL
Test condition B									
10	66	66	0	0	426.32	82.5	1.011	540	/
11	66	66	0	-5	216.59	82.5	0.982	540	L
12	66	66	0	-4	225.58	82.5	0.986	540	L
13	66	66	0	-3	233.80	82.5	0.990	540	L
14	66	66	0	-2	242.53	82.5	0.995	540	L
15	66	66	0	-1	253.86	82.5	1.001	540	L
16	66	66	0	1	288.95	82.5	1.010	540	L
17	66	66	0	2	245.17	82.5	1.016	540	L
18	66	66	0	3	221.27	82.5	1.021	540	L
19	66	66	0	4	216.79	82.5	1.026	540	L
20	66	66	0	5	205.00	82.5	1.029	540	L
Test condition C									
21	33	33	0	0	342.03	41.3	0.999	336	/
22	33	33	0	-5	179.21	41.3	0.981	336	L
23	33	33	0	-4	186.42	41.3	0.990	336	L
24	33	33	0	-3	196.99	41.3	0.991	336	L
25	33	33	0	-2	209.78	41.3	0.995	336	L
26	33	33	0	-1	243.13	41.3	0.996	336	L
27	33	33	0	1	207.60	41.3	1.006	336	L
28	33	33	0	2	176.75	41.3	1.011	336	L
29	33	33	0	3	167.53	41.3	1.015	336	L
30	33	33	0	4	157.93	41.3	1.020	336	L

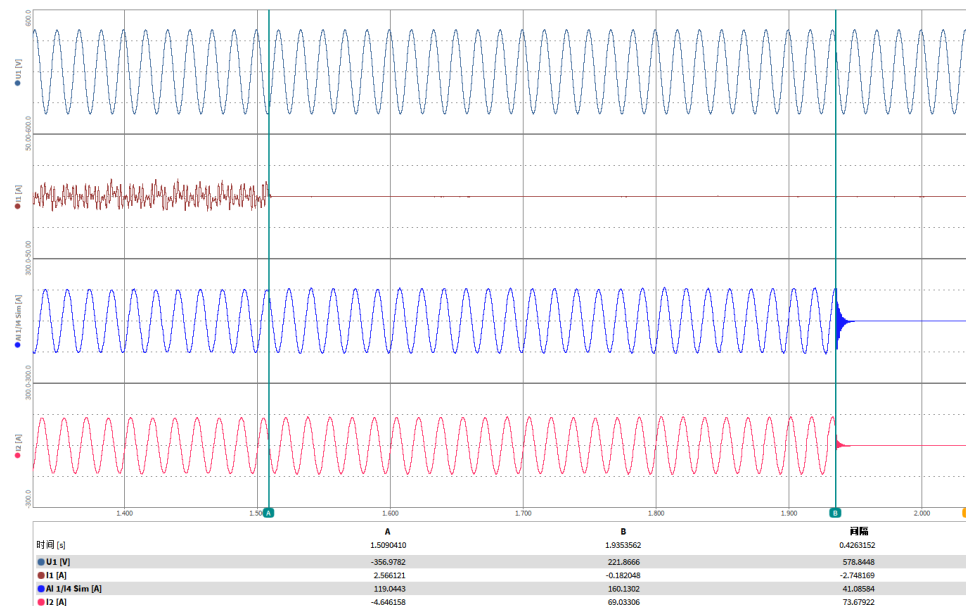
31	33	33	0	5	148.61	41.3	1.033		L
<p>Supplementary information:</p> <p>For test condition A:</p> <p>If any of the recorded run-on times are longer than the one recorded for the rated balance condition, then the non-shaded parameter combinations also require testing.</p> <p>For test condition B and C:</p> <p>If run-on times are still increasing at the 95 % or 105 % points, additional 1 % increments is taken until run-on times begin decreasing.</p>									

Scope pictures of the disconnection time

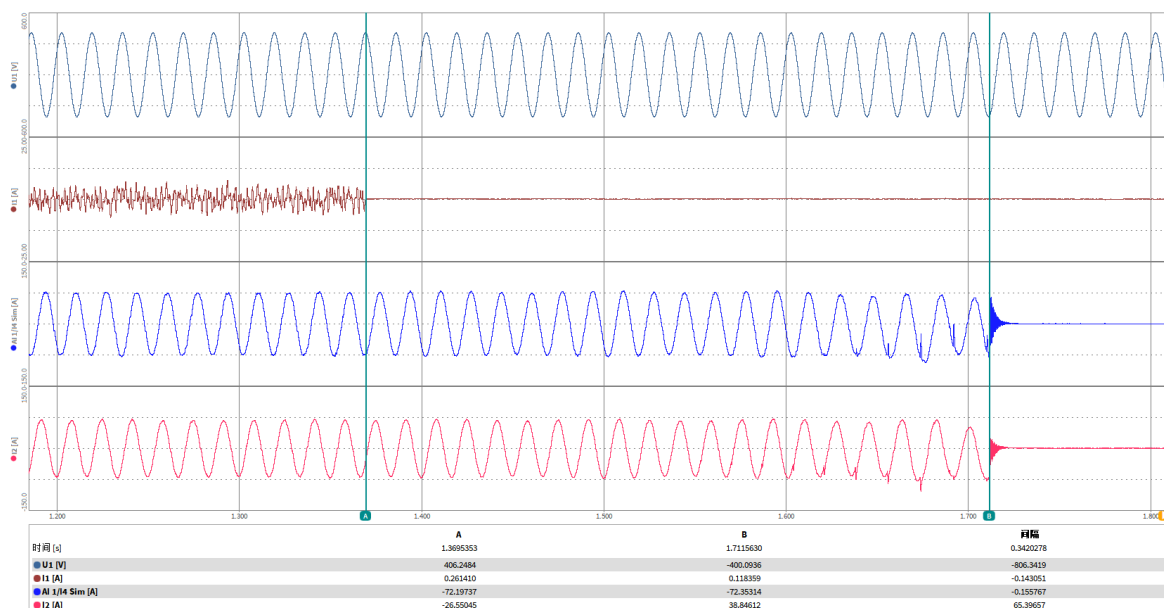
Test condition A - Disconnection at No. 1



Test condition B - Disconnection at No. 10



Test condition C - Disconnection at No. 21

**Note:**

CH2: Trigger signal

CH1: EUT voltage

CH3: EUT current

Pictures of the unit



Figure 1. Overview I



Figure 2. Overview II

Pictures of the unit



Figure 3. Overview III



Figure 4. Overview IV

Pictures of the unit



Figure 5. Overview V



Figure 6. Overview VI

Test Equipment list				
No	Test Equipment	Equipment model	Equipment No.	Calibration due date
1	AC source	KACM-75-33	BZ-DGD-L193	2022/11/02
2	DC source	IVS-60KW	BZ-DGD-L194	2022/06/29
3	RLC island load	ACLT-3820	BZ-DGD-L063	2022/09/15
4	Power analyzer	PA6000H	BZ-DGD-L059	2022/10/21
5	Power analyzer	DEWE2-PA7	BZ-DGD-L119	2022/11/03
6	Power analyzer	CCN1000-3	TE18080052	2022/09/12
7	AC/DC current sensor	CT6863-05	BZ-DGD-L026-1	2023/02/22
8	AC/DC current sensor	CT6863-05	BZ-DGD-L026-2	2023/02/22
9	AC/DC current sensor	CT6863-05	BZ-DGD-L026-3	2023/02/22
10	AC/DC current sensor	CT6863-05	BZ-DGD-L026-4	2023/02/22
11	Oscilloscope	DSO7014B	MY50340361-GCL-035	2022/11/16

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
3. For the report with CNAS mark, the items marked with "☆" are not within the accredited scope.
4. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the "inspection and testing dedicated stamp" or test report stamp.
5. The test data and results are only valid for the tested samples provided by the customer.
6. This report shall not be partially reproduced without the written permission of the laboratory.
7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--- End of test report---