



Product Service

### TEST REPORT

#### Standard G99/1-6: 2020

### TUV SUD Test report for Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019

Report reference No. ....: 64.290.22.31367.01

Date of issue .....: 2023-03-16

Project handler.....: Giesen Wan, Charlie Yang

Testing laboratory .....: TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch

Address .....: TÜV SÜD Testing Center, D1 building, No. 63 Chuangqi Road, Shilou Town, Panyu District, Guangzhou 511447, China

Testing location.....: Same as above

Client .....: Huawei Technologies Co., Ltd

Client number.....: 041829

Address .....: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, Guangdong, 518129, China

Standard.....: This TUV SUD test report form is based on the following requirements:

#### EN A Engineering Recommendation, G99/1-6: 2020

TRF number and revision .....: TRF G99/1-6: 2020 rev.0/2020

TRF originated by. ....: TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch, Mr. Kennen.Wang

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Scheme .....	<input type="checkbox"/> TUV Mark	<input type="checkbox"/> without certification	<input checked="" type="checkbox"/> Type of confirmat
	<input type="checkbox"/> GS Mark	<input type="checkbox"/> NRTL Mark	<input type="checkbox"/> EU-Directive

Non-standard test method.....:  No  Yes, see details under Summary of

National deviations .....: N/A

Number of pages (Report).....: 217 pages

Number of pages (Attachments) .....: N/A

Compiled by ....: Giesen Wan, Charlie Yang

Approved by ....: Yuneng Chen

(+ signature) *Giesen Wan Charlie Yang*

(+ signature) *Yuneng Chen*





Product Service

Test item description .. : Converter (Solar inverter)	
Trade Mark .. :	 HUAWEI
Manufacturer ..... : Huawei Technologies Co., Ltd	
Model/Type reference ..... : SUN2000-330KTL-H1, SUN2000-330KTL-H2	
Rating(s)..... : See page 6	
Manufacturer ..... : Huawei Technologies Co., Ltd	
Manufacturer number..... : 041829	
Address ..... : Administration Building Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA	
Sub-contractors/ tests (clause)..... : N/A	
Name..... : N/A	
Order description..... :	<input checked="" type="checkbox"/> Complete test according to TRF
	<input type="checkbox"/> Partial test according to manufacturer's specifications
	<input type="checkbox"/> Preliminary test
	<input type="checkbox"/> Spot check
	<input type="checkbox"/> Others:
Date of order..... : 2022-10-13	
Date of receipt of test item..... : 2022-10-22	
Date(s) of performance of test..... : 2022-10-22 to 2023-02-20	
General remarks: Defining the sign in the <b>generator</b> sign convention. "(see remark #)" refers to a remark appended to the report. "(see appended table)" refers to a table appended to the report. Throughout this report <b>a point</b> is used as the decimal separator. The test 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.	
<b>Attachments:</b>  N/A	

**Summary of testing:**

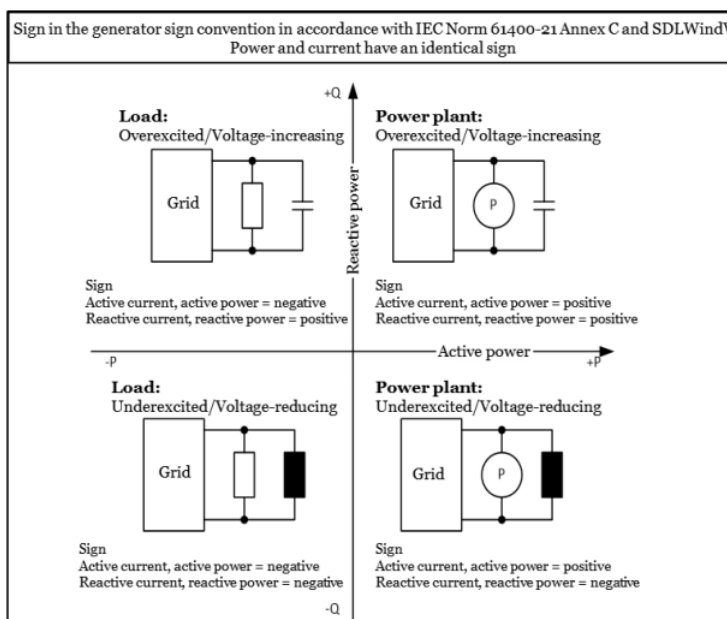
- Abweichung festgestellt / deviation(s) found
- keine Abweichung festgestellt / no deviations found

Tests performed (name of test and test clause):

Requirement + Test
Operating Range
Power Quality – Harmonics:
Power Quality – Voltage Fluctuation and Flicker
Power Quality – DC Injection
Power Factor (PF)
Protection – Frequency tests
Protection – Voltage tests
Protection – Loss of Mains Test, Vector Shift Stability test, RoCoF Stability test
Output power with falling frequency
Limited Frequency Sensitive Mode – Overfrequency
Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)
Frequency Sensitive Mode – (FSM)
Protection – Reconnection Timer
Fault Level Contribution
Self-monitoring Solid State Switch
Logic interface (input port)
Communication interface
Fault Ride Through and Phase Voltage Unbalance
Voltage Limits and Control
Reactive capability

Remark: If not special note, SUN2000-330KTL-H1 is the default test model.

During the below test, sign in the generator sign convention to be considered:













Product Service

	Inductive (under-excited)	Capacitive(over-excited)
Generator (Discharge mode)	IV. Quadrant P > 0, the equipment supplies active power from the mains (Discharge mode) Q < 0, the equipment draws reactive power from the mains (inductive behaviour)	I. Quadrant P > 0, the equipment supplies active power from the mains (Discharge mode) Q > 0, the equipment supplies reactive power to the mains (capacitive behaviour)
Consumer (Charge mode)	III. Quadrant P < 0, the equipment supplies active power from the mains (Charge mode) Q < 0, the equipment draws reactive power from the mains (inductive behaviour)	II. Quadrant P < 0, the equipment draw active power from the mains (Charge mode) Q > 0, the equipment supplies reactive power to the mains (capacitive behaviour)

Copy of marking plate:

 <p>型号 Model: SUN2000-330KTL-H1 名称 Name: 太阳能光伏逆变器 SOLAR INVERTER</p> <p>最大输入电压 d.c.Max.Input Voltage: 1500 Vd.c. 最大输入电流 d.c.Max.Input Current: 6x65 A 输入短路电流 Isc: 6x115 A MPP电压范围 d.c.MPP Range: 500 – 1500 Vd.c. 输出电压 a.c.Output Nominal Voltage: 800 Va.c.; 3 ~ + ⊕ 输出频率 a.c.Nominal Operating Frequency: 50 Hz/60Hz 额定输出功率 a.c.Output Rated Power: 300 kW 最大视在功率 a.c.Output Max.Apparent Power: 330 kVA 最大输出电流 a.c.Output Max.Current: 238.2 A 功率因数 Power Factor: 0.8(lagging) – 0.8(leading) 温度范围 Operating Temperature Range: - 30 – + 60 °C 逆变器拓扑 Inverter Topology: Non – Isolation 防护等级 Enclosure: IP66 保护等级 Protection Class: I 过电压类别 Overvoltage Category: II (DC)/III(AC) 污染等级 Pollution Degree: III 工作海拔 Operating Altitude: 5000 m 通讯方式 Communication: MBUS/RS485</p> <p style="text-align: right;">合格证 QC PASS</p> <p style="text-align: right;">  </p> <p>华为技术有限公司 HUAWEI TECHNOLOGIES CO., LTD. 中国制造 MADE IN CHINA HQ of Huawei, Bantian, Longgang District, Shenzhen, 518129, P.R.C</p>	 <p>型号 Model: SUN2000-330KTL-H2 名称 Name: 太阳能光伏逆变器 SOLAR INVERTER</p> <p>最大输入电压 d.c.Max.Input Voltage: 1500 Vd.c. 最大输入电流 d.c.Max.Input Current: 6x65 A 输入短路电流 Isc: 6x115 A MPP电压范围 d.c.MPP Range: 500 – 1500 Vd.c. 输出电压 a.c.Output Nominal Voltage: 800 Va.c.; 3 ~ + ⊕ 输出频率 a.c.Nominal Operating Frequency: 50 Hz/60Hz 额定输出功率 a.c.Output Rated Power: 275 kW 最大视在功率 a.c.Output Max.Apparent Power: 330 kVA 最大输出电流 a.c.Output Max.Current: 238.2 A 功率因数 Power Factor: 0.8(lagging) – 0.8(leading) 温度范围 Operating Temperature Range: - 30 – + 60 °C 逆变器拓扑 Inverter Topology: Non – Isolation 防护等级 Enclosure: IP66 保护等级 Protection Class: I 过电压类别 Overvoltage Category: II (DC)/III(AC) 污染等级 Pollution Degree: III 通讯方式 Communication: MBUS/RS485</p> <p style="text-align: right;">合格证 QC PASS</p> <p style="text-align: right;">  </p> <p>华为技术有限公司 HUAWEI TECHNOLOGIES CO., LTD. 中国制造 MADE IN CHINA HQ of Huawei, Bantian, Longgang District, Shenzhen, 518129, P.R.C</p>
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Remark: For application of this standard, the nominal voltage is 800 Va.c., nominal frequency is 50 Hz, registered capacity varies with the power factor, default power factor range: 0.9 inductive(under-excited) to 0.9 capacitive(over-excited), add test verify power factor adjustable range up to 0.8 inductive(under-excited) to 0.8 capacitive(over-excited).

### Picture of the product



Front view



Back view



Right side view



Left side view



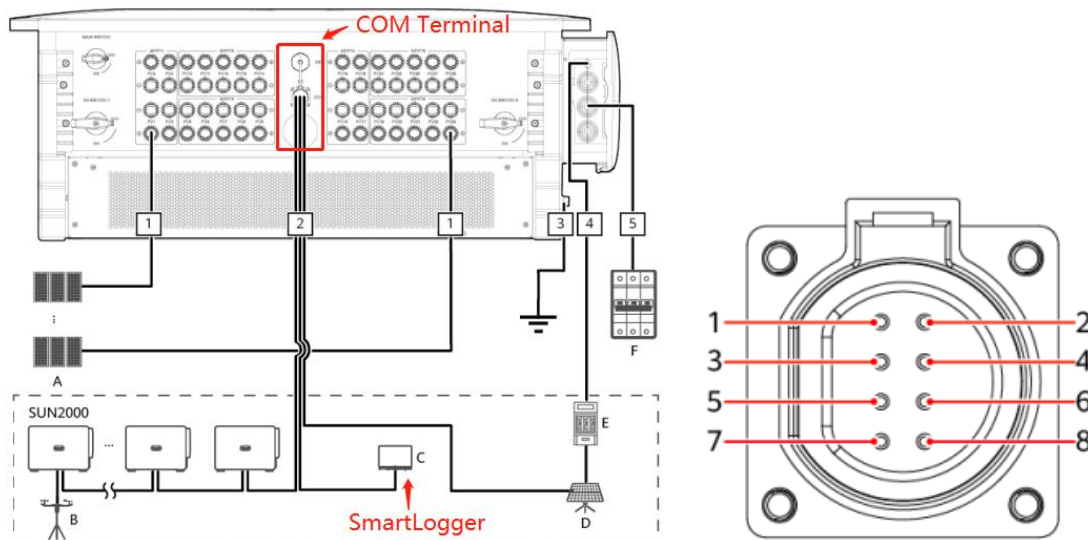
AC side terminal block



DC side terminal block

### Purpose of the product

- (1) The unit is considered as type B, type C, type D Power Generating Modules according to G99/1-6: 2020.
- (2) The test is based on power factor range: 0.8 inductive(under-excited) to 0.8 capacitive(over-excited). The power factor can be adjustable via the control panel on the inverter.
- (3) In order to protect the PCE, user and installer, external DC and AC circuit breakers shall be equipped at the end-use application.
- (4) The inverter is designed for fixed mounted on the wall.
- (5) The firmware version : V500R023  
The software version : V500R023C00
- (6) RS485 communication port is used as logic interface of the unit to control active power reduce the active power to zero within 5 s. By connecting to the SmartLogger which provides display the protection settings and remoted control function. The remoted control function is realized by connection pin 1&pin 3 or pin 2&pin 4 of the COM terminal.



Port	Pin	Definition	Pin	Definition	Description
RS485-1	1	RS485A IN, RS485 differential signal+	2	RS485A OUT, RS485 differential signal+	Used to cascade SUN2000s or connect devices such as the SmartLogger.
	3	RS485B IN, RS485 differential signal-	4	RS485B OUT, RS485 differential signal-	
PE	5	PE, shield layer grounding	6	PE, shield layer grounding	-
RS485-2	7	RS485A, RS485 differential signal+	8	RS485B, RS485 differential signal-	Used to connect an RS485 slave device.

- (7) The setting of type B, type C and type D can be selected by the DNO on the software.



Product Service

Possible test case verdicts:

- test case does not apply to the test object..... : N(N/A) / not included in the order
- test object does meet the requirement ..... : P(Pass)
- test object does not meet the requirement ..... : F(Fail)
- test object was not evaluated for the requirement..... : N/E

Possible suffixes to the verdicts:

- suffix for detailed information for the client.....: - C(Comment)
- suffix for important information for factory inspection...: - M(Manufacturing)



Product Service

ER G99/1-6: 2020			
Clause	Requirement – Test	Result – Remark	Verdict
<b>6</b>	<b>Connection Application</b>		P
<b>7</b>	<b>Connection arrangements</b>		P
<b>8</b>	<b>Earthing</b>		P
<b>9</b>	<b>Network Connection Design and Operation</b>		P
<b>10</b>	<b>Protection</b>		P
<b>11</b>	<b>Type A Power Generating Module Technical Requirements</b>		N/A
11.1	Power Generating Module Performance and Control Requirements – General	The listed models in this report are for connection design as type B, type C and type D	N/A
11.2	Frequency response		N/A
11.3	Fault Ride Through and Phase Voltage Unbalance		N/A
11.4	Voltage Limits and Control		N/A
<b>12</b>	<b>Type B Power Generating Module Technical Requirements</b>		P
12.1	Power Generating Module Performance and Control Requirements - General	Long-term parallel operation is considered	P
12.2	Frequency response		P
12.3	Fault Ride Through and Phase Voltage Unbalance		P
12.4	Voltage Limits and Control		P
12.5	Reactive Capability		P
12.6	Fast Fault Current Injection		P
12.7	Operational monitoring	Considered by DNO	P
<b>13</b>	<b>Type C and Type D Power Generating Module Technical Requirements</b>		
13.1	Power Generating Module Performance and Control Requirements	Long-term parallel operation considered	P
13.2	Frequency response		P
13.3	Fault Ride Through		P
13.4	Voltage Limits and Control		P
13.5	Reactive Capability		P
13.6	Fast Fault Current Injection		P
13.7	Black Start Capability	To be considered at final installation	N/A
13.8	Technical Requirements for Embedded Medium Power Stations		N/A
13.9	Operational monitoring	Considered by DNO	P
13.10	Steady State Load Inaccuracies		P
<b>14</b>	<b>Installation, Operation and Control Interface</b>		N/A
<b>15</b>	<b>Common Compliance and Commissioning Requirements for all Power Generating Modules</b>		P
<b>16</b>	<b>Type A Compliance Testing, Commissioning and Operational Notification</b>		N/A
<b>17</b>	<b>Type B Compliance Testing, Commissioning and Operational Notification</b>		N/A
<b>18</b>	<b>Type C Compliance Testing, Commissioning and Operational Notification</b>		N/A
<b>19</b>	<b>Type D Compliance Testing, Commissioning and Operational Notification</b>		N/A
<b>20</b>	<b>Ongoing Obligations</b>		N/A
<b>21</b>	<b>Manufacturers' Information applicable to Power Park Modules</b>		N/A
<b>22</b>	<b>Type Testing and Annex information</b>		P
<b>Annex A</b>	<b>Type A</b>		N/A
A.0	Type A Power Generating Module Forms Cover Sheet		N/A



ER G99/1-6: 2020			
Clause	Requirement – Test	Result – Remark	Verdict
A.1	Connection Application Forms for Type A Power Generating Facility (< 50 kW) (Form A1-1) and Integrated Micro Generation and Storage (Form A1- 2)		N/A
A.2	Type A Compliance Verification Report		N/A
A.3	Installation Document for Type A Power Generating Modules (Form A3-1) and Integrated Micro Generation and Storage (Form A3-2)		N/A
A.4	Emerging Technologies and other Exceptions		N/A
A.5	Example calculations to determine if unequal generation across different phases is acceptable or not		N/A
A.6	Scenario examples in respect of the application of EREC G59 and EREC G99 to new or modified sites after 27/04/19		N/A
A.7	Requirements for Type Testing Power Generating Modules		N/A
<b>Annex B</b>	<b>Type B</b>		P
B.1	Application		N/A
B.2	Power Generating Module Document Type B	Type testing to the inverter, detail see explanation in Clause 12 and relative type test result	P
B.3	Installation and Commissioning Confirmation Form		N/A
B.4	Simulation Studies for Type B Power Generating Modules	Type test method used.	N/A
B.5	Compliance Testing of Synchronous Power Generating Modules		N/A
B.6	Compliance Testing of Power Park Modules		N/A
<b>Annex C</b>	<b>Type C and Type D</b>		P
C.1	Application		N/A
C.2	Power Generating Module Document Type C and Type D	Type testing to the inverter, detail see explanation in Clause 13 and relative type test result	P
C.3	Installation and Commissioning Confirmation Form		N/A
C.4	Performance Requirements For Continuously Acting Automatic Excitation Control Systems For Type C and Type D Synchronous Power Generating Modules		N/A
C.5	Performance Requirements for Continuously Acting Automatic Voltage Control Systems for Type C and Type D Power Park Modules		N/A
C.6	Functional Specification for Dynamic System Monitoring, Fault Recording and Power Quality Monitoring Equipment for Type C and Type D Power Generating Modules		N/A
C.7	Simulation Studies for Type C and Type D Power Generating Modules	Type test method used.	N/A



Product Service

ER G99/1-6: 2020			
Clause	Requirement – Test	Result – Remark	Verdict
C.8	Compliance Testing of Type C and Type D Synchronous Power Generating Modules		N/A
C.9	Compliance Testing of Type C and Type D Power Park Modules	Type testing to the inverter, detail see explanation in Clause 13 and relative type test result	N/A
C.10	Minimum Frequency Response Capability Requirement Profile and Operating Range for Type C and Type D Power Generating Modules		N/A
<b>Annex D</b>			N/A
D.0	Power Generating Module Decommissioning Confirmation	Considered by Manufacturers	N/A
D.1	Additional Information Relating to System Stability Studies		N/A
D.2	Loss of Mains (LoM) Protection Analysis		N/A
D.3	Main Statutory and Other Obligations		N/A
D.4	Summary of Reactive Power and voltage control requirements for Type A, Type B, Type C and Type D Power Generating Modules		N/A



Product Service

Table: Operating Range					P
Condition	Voltage (V)	Active power (W)	Frequency (Hz)	Power factor	Can operate under the condition?
Test 1* Voltage = 85% of nominal ( <u>680.0 V</u> ), Frequency = 47 Hz, Power Factor = 1, Period of test 20 s	678.2	279607.1	46.98	0.999 ov	Yes
	684.4				
	678.2				
Test 2* Voltage = 85% of nominal ( <u>680.0 V</u> ), Frequency = 47.5 Hz, Power Factor = 1, Period of test 90 minutes	681.2	279445.3	47.49	0.999 ov	Yes
	680.5				
	679.3				
Test 3 Voltage = 110% of nominal ( <u>880.0 V</u> ), Frequency = 51.5 Hz, Power Factor = 1, Period of test 90 minutes	880.1	300908.1	51.50	0.999 ov	Yes
	880.0				
	878.4				
Test 4 Voltage = 110% of nominal ( <u>880.0 V</u> ), Frequency = 52.0 Hz, Power Factor = 1, Period of test 15 minutes	880.4	300869.5	52.00	0.999 ov	Yes
	879.8				
	880.4				
Test 5 Voltage = 100% of nominal ( <u>800.0 V</u> ), Frequency = 50.0 Hz, Power Factor = 1, Period of test = 90 minutes	802.3	300601.5	50.00	0.999 ov	Yes
	800.0				
	798.9				
Test 6 RoCoF withstand Confirm that the Power Generating Module is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs-1 as measured over a period of 500 ms. Note that this is not expected to be demonstrated on site.					Yes
Remark:*This case limited by the maximum current, active power cannot reach registered capacity.					



Product Service

Tabel: Power Quality – Harmonics							P
Power Generating Module tested to BS EN 61000-3-12							
Power Generating Module rating per phase (rpp)				100	kVA	Harmonic % = Measured Value (A) x 23/rating per phase (kVA)	
Harmonic	At 45-55% of Registered Capacity						Limit in BS EN 61000-3-12
	Measured Value MV in Amps			Harmonic %			3 phase
	L1	L2	L3	L1	L2	L3	
2	0.364	0.128	0.307	0.08%	0.03%	0.07%	8%
3	0.047	0.062	0.113	0.01%	0.01%	0.03%	Not stated
4	0.078	0.072	0.088	0.02%	0.02%	0.02%	4%
5	0.304	0.191	0.320	0.07%	0.04%	0.07%	10.7%
6	0.135	0.083	0.104	0.03%	0.02%	0.02%	2.67%
7	0.428	0.413	0.378	0.10%	0.09%	0.09%	7.2%
8	0.089	0.055	0.117	0.02%	0.01%	0.03%	2%
9	0.202	0.086	0.147	0.05%	0.02%	0.03%	Not stated
10	0.066	0.096	0.109	0.02%	0.02%	0.03%	1.6%
11	0.531	0.599	0.530	0.12%	0.14%	0.12%	3.1%
12	0.074	0.068	0.088	0.02%	0.02%	0.02%	1.33%
13	0.510	0.465	0.480	0.12%	0.11%	0.11%	2%
THD	--	--	--	1.74%	1.62%	1.68%	13%
PWHD	--	--	--	8.11%	7.59%	7.76%	22%
Harmonic	At 100% of Registered Capacity						Limit in BS EN 61000-3-12
	Measured Value MV in Amps			Harmonic %			3 phase
	L1	L2	L3	L1	L2	L3	
2	0.393	0.186	0.478	0.09%	0.04%	0.11%	8%
3	0.277	0.177	0.158	0.06%	0.04%	0.04%	Not stated
4	0.128	0.199	0.190	0.03%	0.05%	0.04%	4%
5	0.298	0.333	0.434	0.07%	0.08%	0.10%	10.7%
6	0.151	0.181	0.193	0.03%	0.04%	0.04%	2.67%
7	1.018	1.015	0.723	0.23%	0.23%	0.17%	7.2%
8	0.220	0.259	0.162	0.05%	0.06%	0.04%	2%
9	0.340	0.197	0.209	0.08%	0.05%	0.05%	Not stated
10	0.134	0.157	0.177	0.03%	0.04%	0.04%	1.6%
11	0.408	0.369	0.250	0.09%	0.08%	0.06%	3.1%
12	0.118	0.117	0.120	0.03%	0.03%	0.03%	1.33%
13	0.648	0.636	0.431	0.15%	0.15%	0.10%	2%
THD	--	--	--	1.06%	1.04%	0.95%	13%
PWHD	--	--	--	4.55%	4.48%	4.23%	22%
Inter-Harmonics (current)							
At 45-55% of Registered Capacity				At 100% of Registered Capacity			



Product Service

Active power P/P <sub>n</sub> [%]	L1	L2	L3	L1	L2	L3
F [Hz]	I <sub>v</sub> /I <sub>n</sub> [%]					
75	0.491%	0.489%	0.503%	0.829%	0.784%	0.800%
125	0.178%	0.193%	0.209%	0.220%	0.178%	0.268%
175	0.142%	0.165%	0.167%	0.188%	0.181%	0.215%
225	0.163%	0.183%	0.185%	0.221%	0.235%	0.277%
275	0.202%	0.220%	0.191%	0.186%	0.204%	0.258%
325	0.198%	0.206%	0.192%	0.206%	0.216%	0.267%
375	0.217%	0.234%	0.238%	0.229%	0.323%	0.351%
425	0.176%	0.174%	0.190%	0.135%	0.172%	0.195%
475	0.104%	0.114%	0.108%	0.098%	0.111%	0.122%
525	0.090%	0.083%	0.087%	0.071%	0.079%	0.084%
575	0.083%	0.073%	0.078%	0.075%	0.083%	0.079%
625	0.063%	0.052%	0.060%	0.041%	0.046%	0.046%
675	0.058%	0.050%	0.058%	0.039%	0.035%	0.044%
725	0.046%	0.037%	0.045%	0.036%	0.039%	0.047%
775	0.033%	0.028%	0.032%	0.034%	0.033%	0.041%
825	0.030%	0.028%	0.029%	0.027%	0.027%	0.032%
875	0.024%	0.025%	0.026%	0.026%	0.029%	0.033%
925	0.024%	0.025%	0.025%	0.021%	0.023%	0.023%
975	0.021%	0.021%	0.022%	0.018%	0.019%	0.022%
1025	0.018%	0.018%	0.020%	0.016%	0.018%	0.020%
1075	0.016%	0.015%	0.016%	0.015%	0.016%	0.018%
1125	0.015%	0.014%	0.014%	0.014%	0.014%	0.016%
1175	0.014%	0.014%	0.014%	0.013%	0.014%	0.016%
1225	0.014%	0.013%	0.013%	0.012%	0.013%	0.014%
1275	0.011%	0.010%	0.011%	0.011%	0.011%	0.012%
1325	0.009%	0.009%	0.010%	0.009%	0.010%	0.011%
1375	0.010%	0.009%	0.011%	0.009%	0.009%	0.010%
1425	0.009%	0.009%	0.009%	0.009%	0.009%	0.010%
1475	0.009%	0.009%	0.009%	0.008%	0.009%	0.009%
1525	0.009%	0.009%	0.009%	0.008%	0.009%	0.009%
1575	0.008%	0.007%	0.008%	0.007%	0.008%	0.008%
1625	0.007%	0.007%	0.008%	0.006%	0.007%	0.007%
1675	0.007%	0.007%	0.007%	0.006%	0.007%	0.007%
1725	0.007%	0.007%	0.007%	0.006%	0.007%	0.007%
1775	0.007%	0.007%	0.007%	0.006%	0.007%	0.007%
1825	0.007%	0.007%	0.006%	0.006%	0.007%	0.007%
1875	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%
1925	0.006%	0.006%	0.006%	0.005%	0.006%	0.006%



Product Service

1975	0.006%	0.006%	0.005%	0.005%	0.006%	0.006%
<b>Higher-Harmonics (current)</b>						
Active power P/P <sub>n</sub> [%]	At 45-55% of <b>Registered Capacity</b>			At 100% of <b>Registered Capacity</b>		
	L1	L2	L3	L1	L2	L3
F [kHz]	I <sub>v</sub> /I <sub>n</sub> [%]					
2.1	0.020%	0.019%	0.019%	0.013%	0.015%	0.015%
2.3	0.014%	0.017%	0.017%	0.010%	0.013%	0.015%
2.5	0.011%	0.012%	0.011%	0.010%	0.011%	0.011%
2.7	0.020%	0.021%	0.020%	0.012%	0.012%	0.012%
2.9	0.019%	0.019%	0.019%	0.010%	0.011%	0.012%
3.1	0.020%	0.023%	0.021%	0.010%	0.011%	0.011%
3.3	0.043%	0.044%	0.043%	0.012%	0.012%	0.012%
3.5	0.047%	0.042%	0.040%	0.014%	0.015%	0.015%
3.7	0.041%	0.046%	0.046%	0.019%	0.021%	0.020%
3.9	0.056%	0.059%	0.062%	0.051%	0.055%	0.043%
4.1	0.019%	0.018%	0.019%	0.050%	0.063%	0.069%
4.3	0.024%	0.020%	0.021%	0.086%	0.081%	0.072%
4.5	0.013%	0.012%	0.012%	0.057%	0.051%	0.053%
4.7	0.008%	0.008%	0.009%	0.026%	0.023%	0.027%
4.9	0.010%	0.008%	0.010%	0.014%	0.013%	0.013%
5.1	0.008%	0.007%	0.007%	0.012%	0.011%	0.012%
5.3	0.006%	0.005%	0.006%	0.008%	0.007%	0.008%
5.5	0.007%	0.007%	0.007%	0.008%	0.007%	0.007%
5.7	0.006%	0.006%	0.006%	0.007%	0.006%	0.007%
5.9	0.049%	0.050%	0.049%	0.049%	0.049%	0.048%
6.1	0.006%	0.006%	0.006%	0.007%	0.007%	0.007%
6.3	0.006%	0.005%	0.005%	0.006%	0.006%	0.006%
6.5	0.005%	0.004%	0.005%	0.006%	0.006%	0.006%
6.7	0.004%	0.004%	0.004%	0.006%	0.006%	0.006%
6.9	0.005%	0.004%	0.005%	0.006%	0.005%	0.006%
7.1	0.005%	0.004%	0.005%	0.006%	0.006%	0.006%
7.3	0.004%	0.003%	0.004%	0.006%	0.005%	0.005%
7.5	0.004%	0.004%	0.005%	0.005%	0.005%	0.005%
7.7	0.005%	0.005%	0.005%	0.006%	0.006%	0.006%
7.9	0.005%	0.005%	0.005%	0.008%	0.007%	0.008%
8.1	0.006%	0.005%	0.005%	0.009%	0.008%	0.009%
8.3	0.006%	0.006%	0.006%	0.008%	0.008%	0.008%
8.5	0.007%	0.006%	0.006%	0.008%	0.008%	0.008%
8.7	0.006%	0.006%	0.006%	0.007%	0.007%	0.007%
8.9	0.007%	0.006%	0.007%	0.008%	0.008%	0.008%



Table: Power Quality – Voltage Fluctuation and Flicker									P
These tests should be undertaken in accordance with Annex A.7.2.5.3. Results should be normalised to a standard source impedance, or if this results in figures above the limits set in BS EN 61000-3-11 to a suitable maximum impedance.									
		Starting			Stopping			Running	
		d <sub>max</sub>	d <sub>c</sub>	d <sub>(t)</sub>	d <sub>max</sub>	d <sub>c</sub>	d <sub>(t)</sub>	P <sub>st</sub>	P <sub>It</sub> 2 hours
Measured Values at tested impedance	L1-L2	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.027
	L2-L3	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.028
	L3-L1	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.027
Normalised to standard impedance	L1-L2	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.027
	L2-L3	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.028
	L3-L1	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.027
Limits set under BS EN 61000-3-11		4%	3.3%	3.3%	4%	3.3%	3.3%	1.0	0.65
Test impedance		R	0.24	Ω	XI	0.15	Ω		
Standard impedance		R	0.24 * 0.4 ^	Ω	XI	0.15 * 0.25 ^	Ω		
<p>* Applies to three phase and split single phase <b>Power Generating Modules</b>.</p> <p>^ Applies to single phase <b>Power Generating Module</b> and <b>Power Generating Modules</b> using two phases on a three phase system</p> <p>For voltage change and flicker measurements the following formula is to be used to convert the measured values to the normalised values where the <b>Power Factor</b> of the generation output is 0.98 or above.</p> <p>Normalised value = Measured value x reference source resistance/measured source resistance at test point</p> <p>Single phase units reference source resistance is 0.4 Ω</p> <p>Two phase units in a three phase system reference source resistance is 0.4 Ω</p> <p>Two phase units in a split phase system reference source resistance is 0.24 Ω</p> <p>Three phase units reference source resistance is 0.24 Ω</p> <p>Where the <b>Power Factor</b> of the output is under 0.98 then the XI to R ratio of the test impedance should be close to that of the Standard Impedance.</p> <p>The stopping test should be a trip from full load operation.</p> <p>The duration of these tests need to comply with the particular requirements set out in the testing notes for the technology under test. Dates and location of the test need to be noted below</p>									



Product Service

Table: Power Quality – DC Injection									P
Test power level	10%			55%			100%		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
Recorded value in Amps	0.17	0.12	0.10	0.24	0.21	0.18	0.47	0.36	0.41
as % of rated AC current	0.08%	0.06%	0.04%	0.11%	0.10%	0.08%	0.21%	0.17%	0.19%
Limit	0.25%			0.25%			0.25%		

Table: Power Factor (PF)									P
Voltage	0.94Un ( 752.0 V)			1.0Un ( 800.0 V)			1.1Un ( 880.0 V)		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
Measured value	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
Power Factor Limit	>0.95			>0.95			>0.95		

Table: Protection – Frequency tests							P
For Type B and Type C Power Generating Modules HV Protection Setting							
Function	Setting		Trip test		“No trip tests”		
	Frequency	Time delay	Frequency (Hz)	Time delay (s)	Frequency /time	Confirm no trip	
U/F stage 1	47.5 Hz	20 s	47.45	20.067	47.7 Hz 30.00 s	No trip	
U/F stage 2	47 Hz	0.5 s	46.95	0.546	47.2 Hz 19.5 s	No trip	
					46.8 Hz 0.45 s	No trip	
O/F	52 Hz	0.5 s	52.05	0.551	51.8 Hz 120.0 s	No trip	
					52.2 Hz 0.45 s	No trip	



Product Service

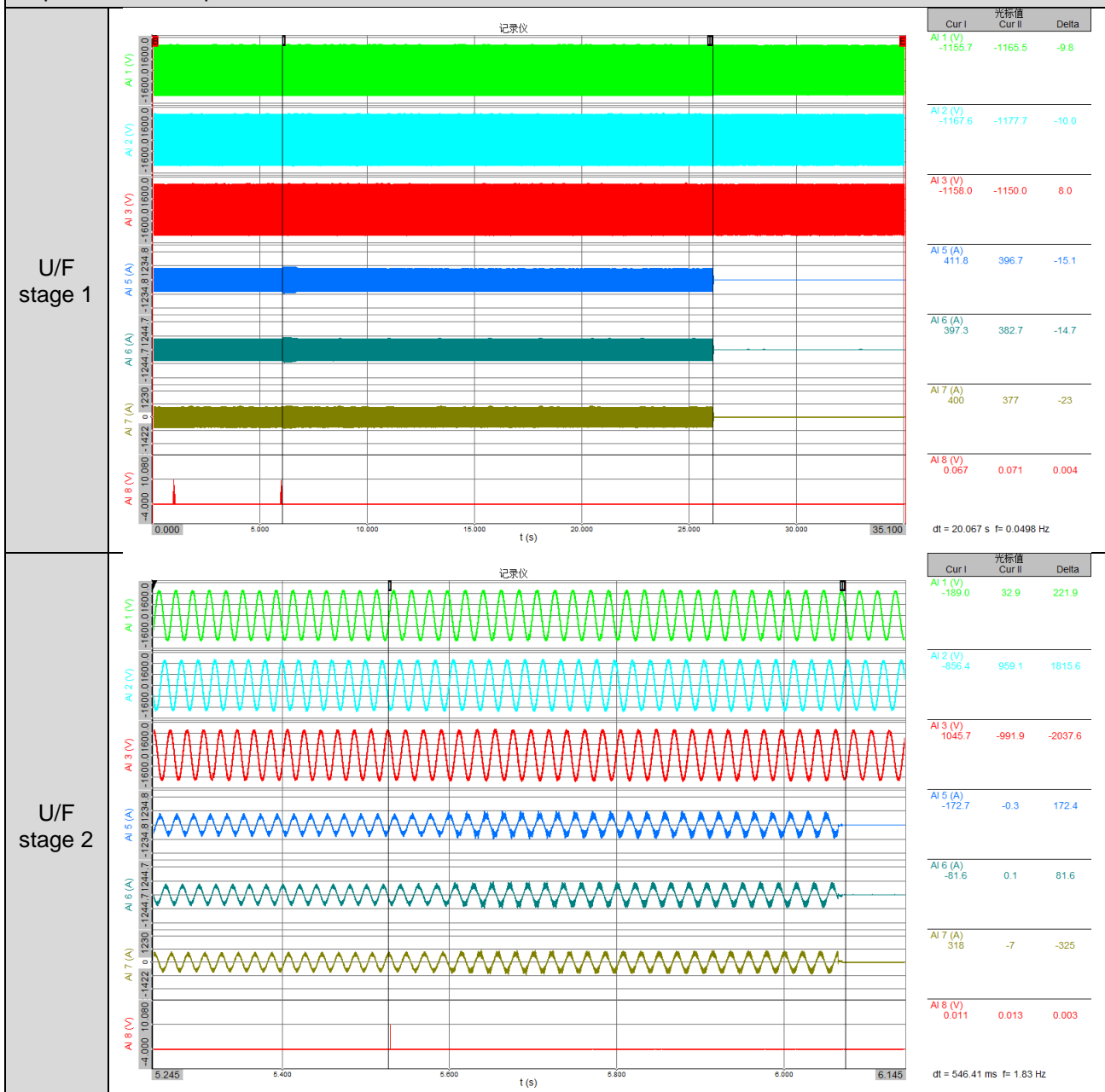
Supplementary information:

Channel 1&2&3: Waveform of three phases voltage signals at grid connection terminals.

Channel 4&5&6: Waveform of inverter three phases output current signals at grid connection terminals.

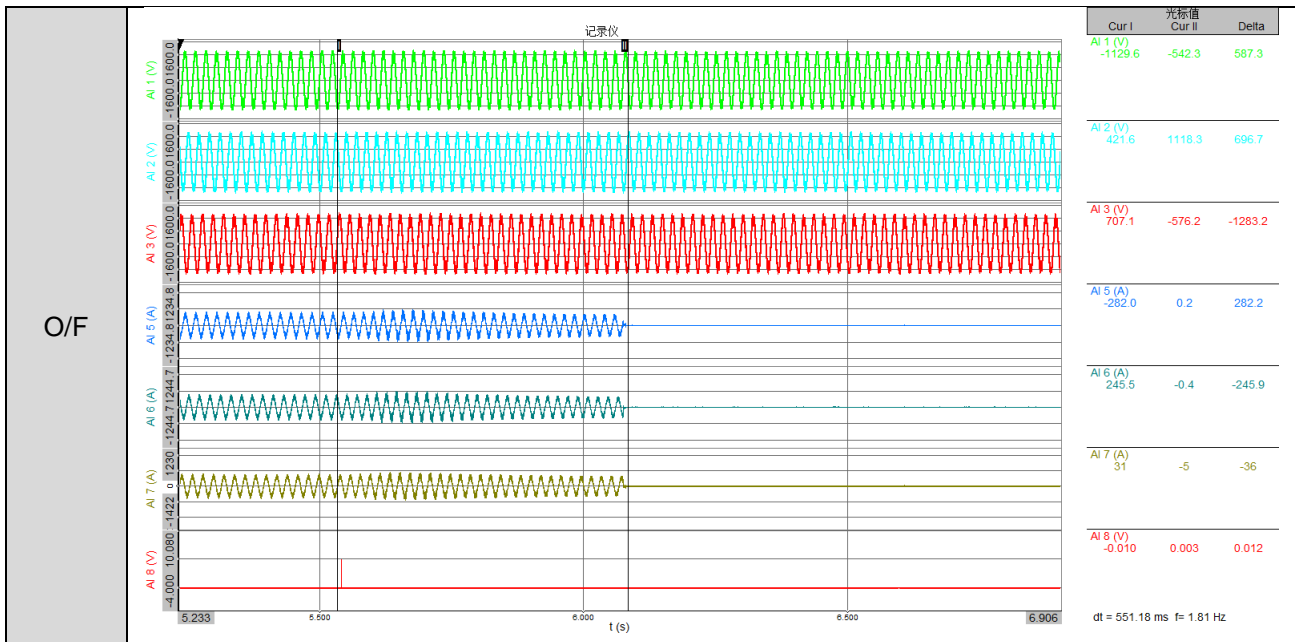
Channel 7: Trigger signal of turning into overfrequency or underfrequency state, provided by the programmable AC grid simulator.

Trip test oscilloscope waveform:

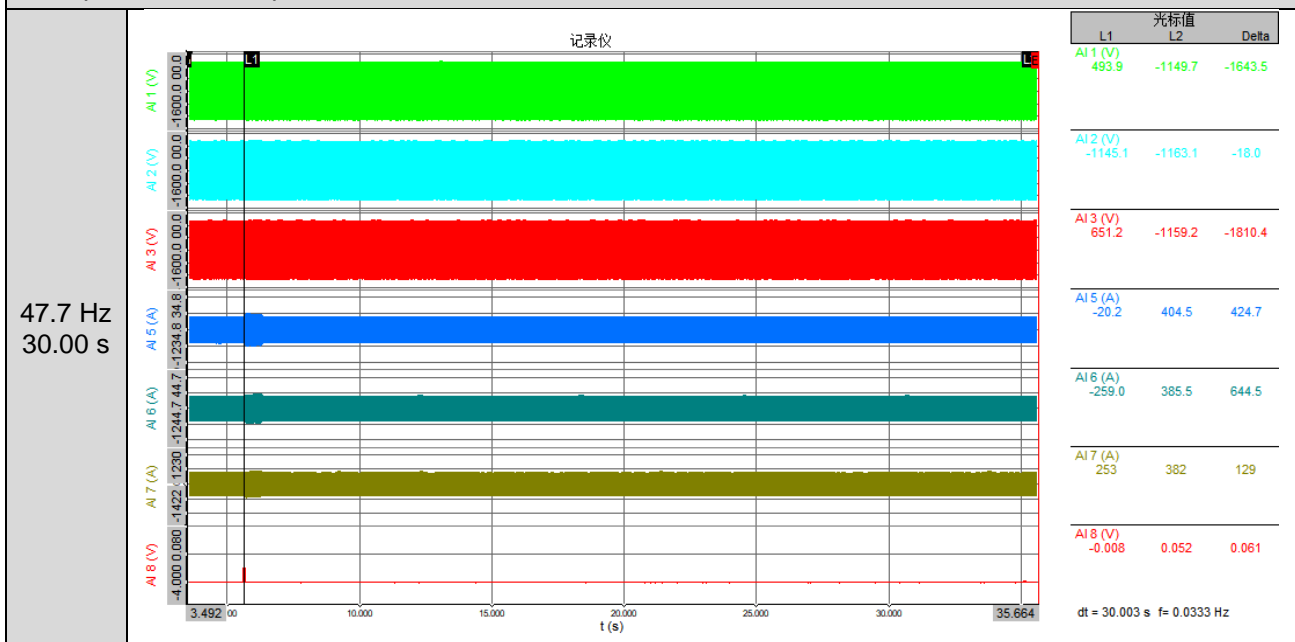




Product Service

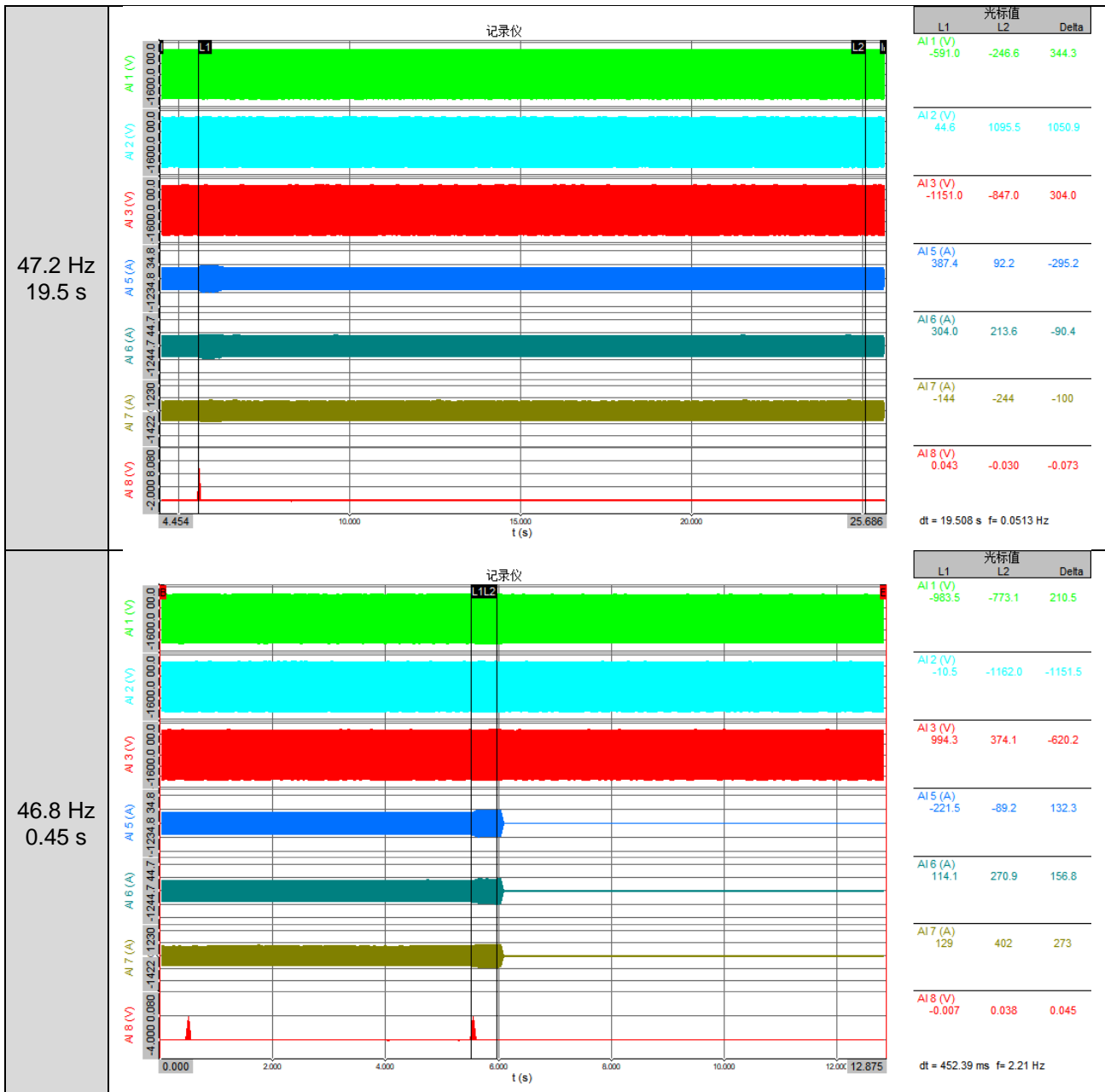


No trip test oscilloscope waveform:



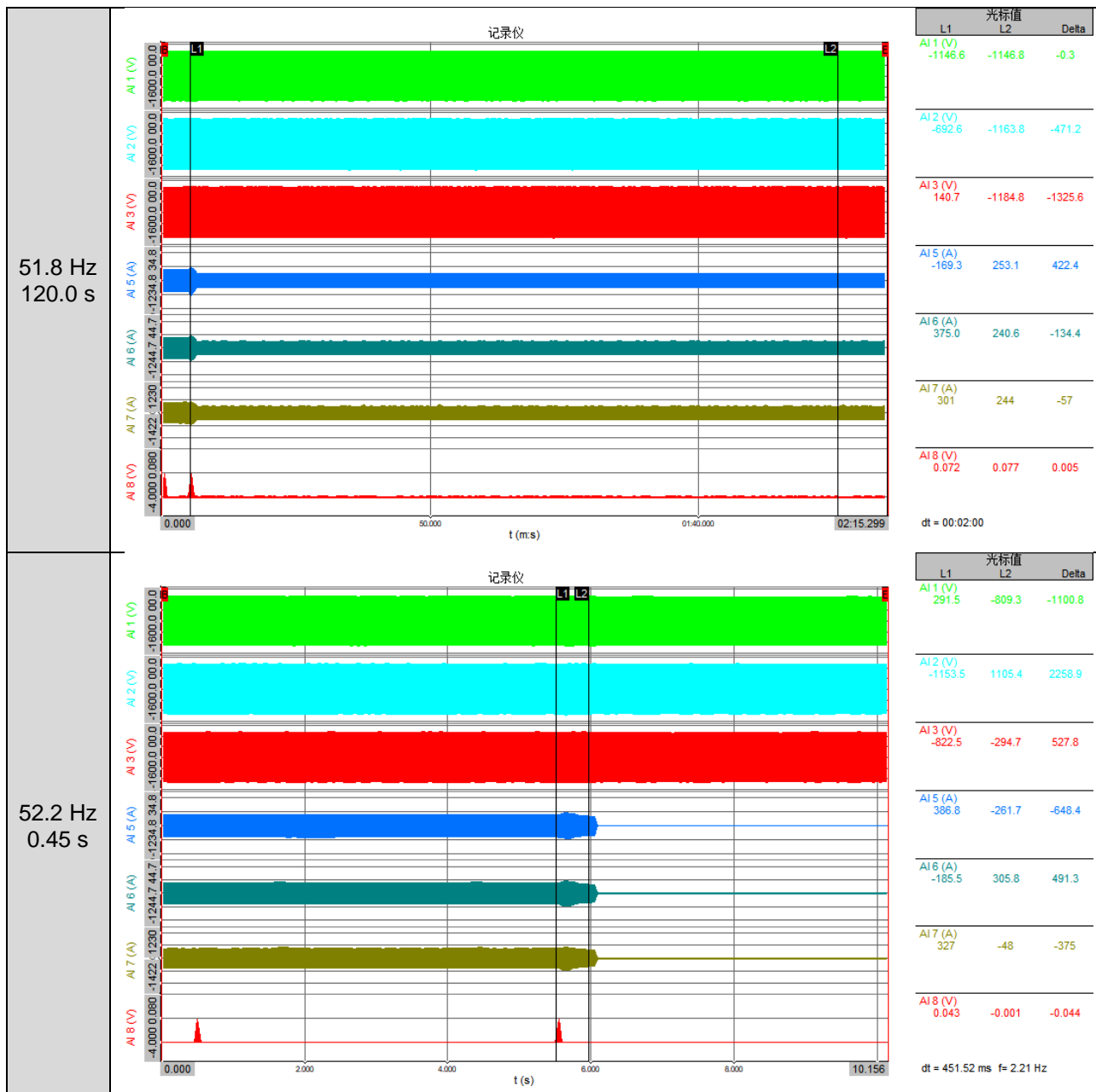


Product Service





Product Service



For Type D Power Generating Modules and Power Generating Facilities with a Registered Capacity > 50 MW Protection Setting

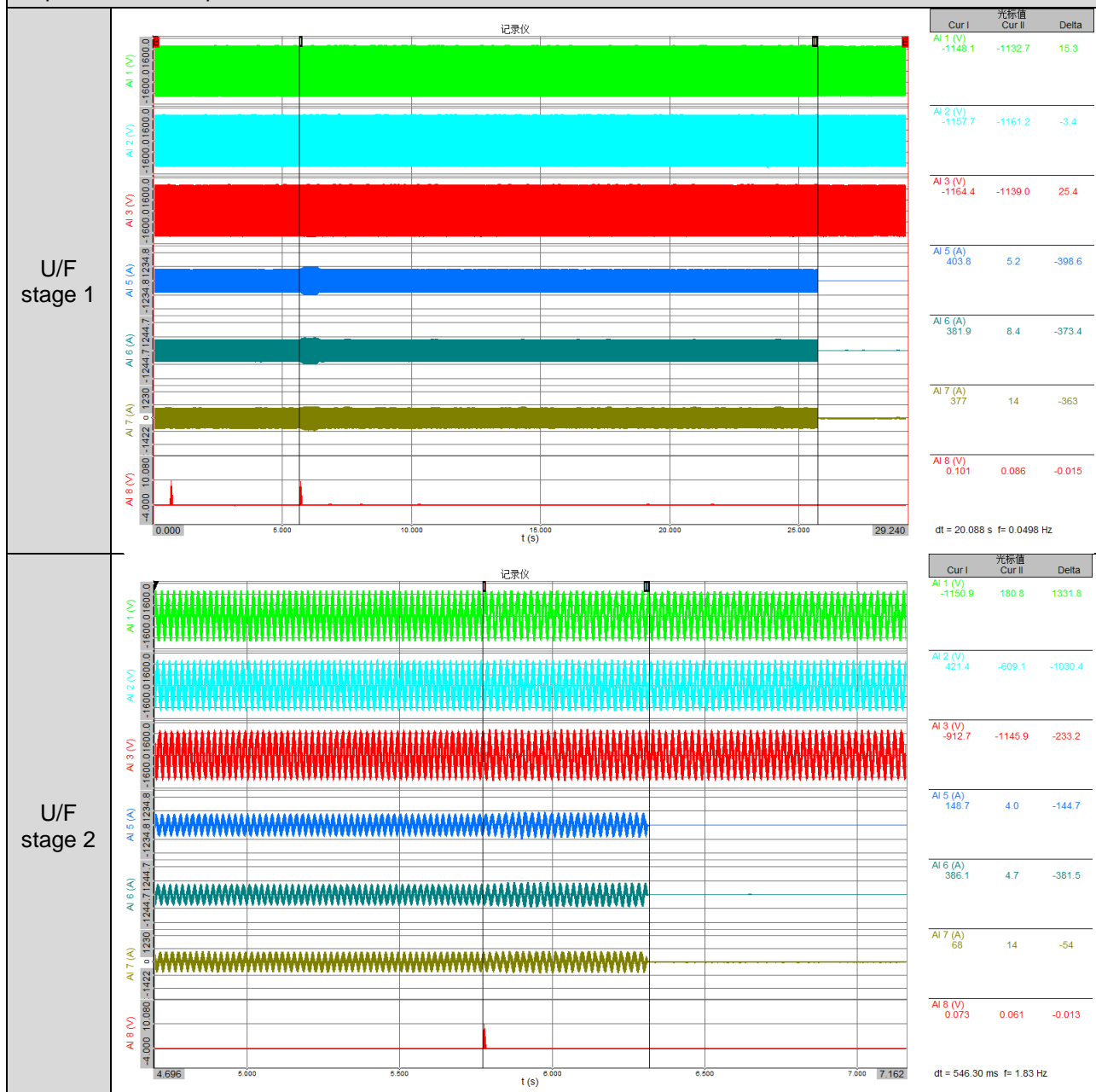
Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency (Hz)	Time delay (s)	Frequency /time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.45	20.088	47.7 Hz 30.00 s	No trip
U/F stage 2	47 Hz	0.5 s	46.95	0.546	47.2 Hz 19.5 s	No trip



Product Service

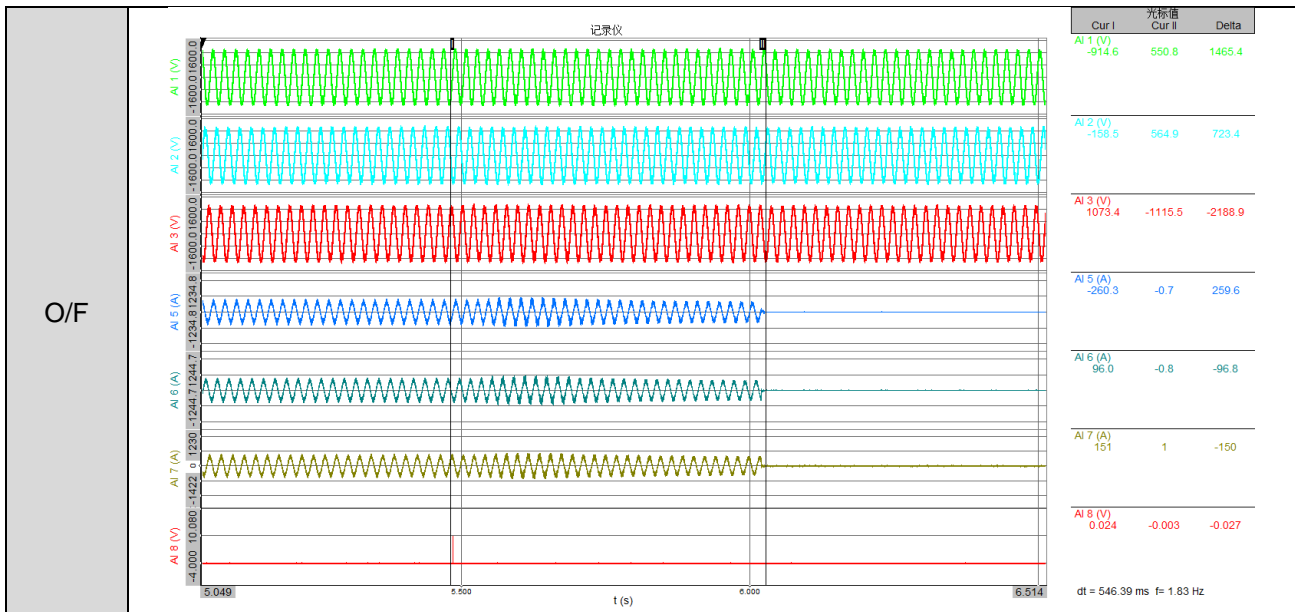
					46.8 Hz 0.45 s	No trip
O/F	52 Hz	0.5 s	52.05	0.546	51.8 Hz 120.0 s	No trip
					52.2 Hz 0.45 s	No trip

Trip test oscilloscope waveform:

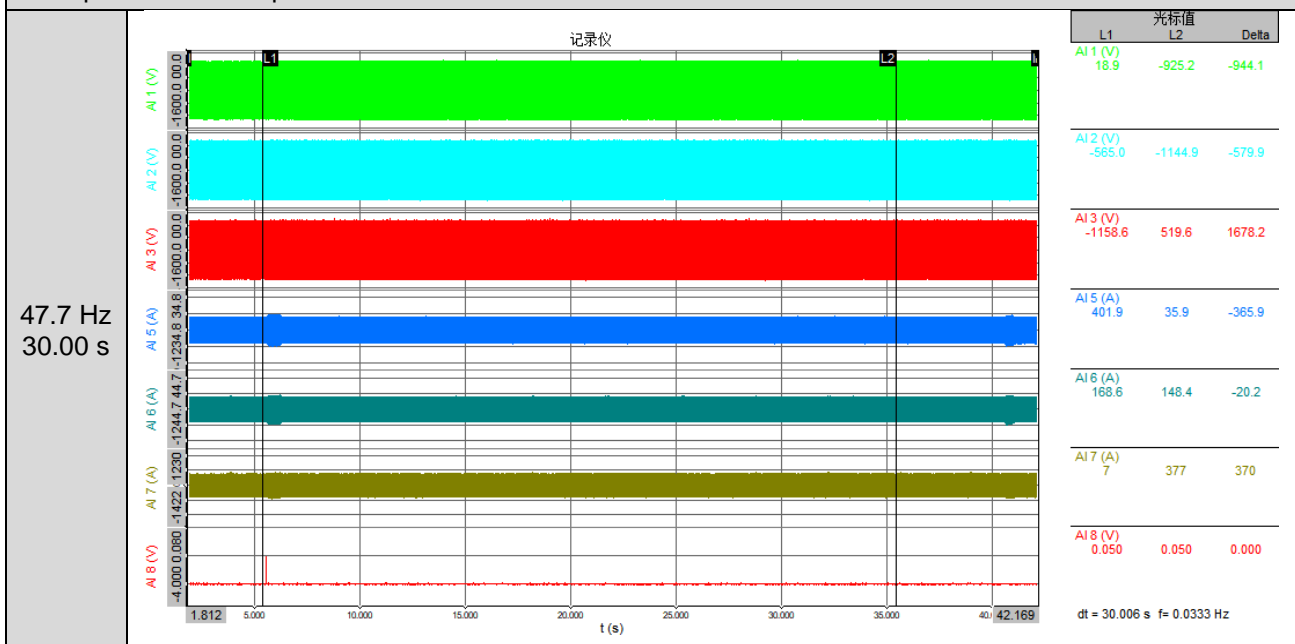




Product Service

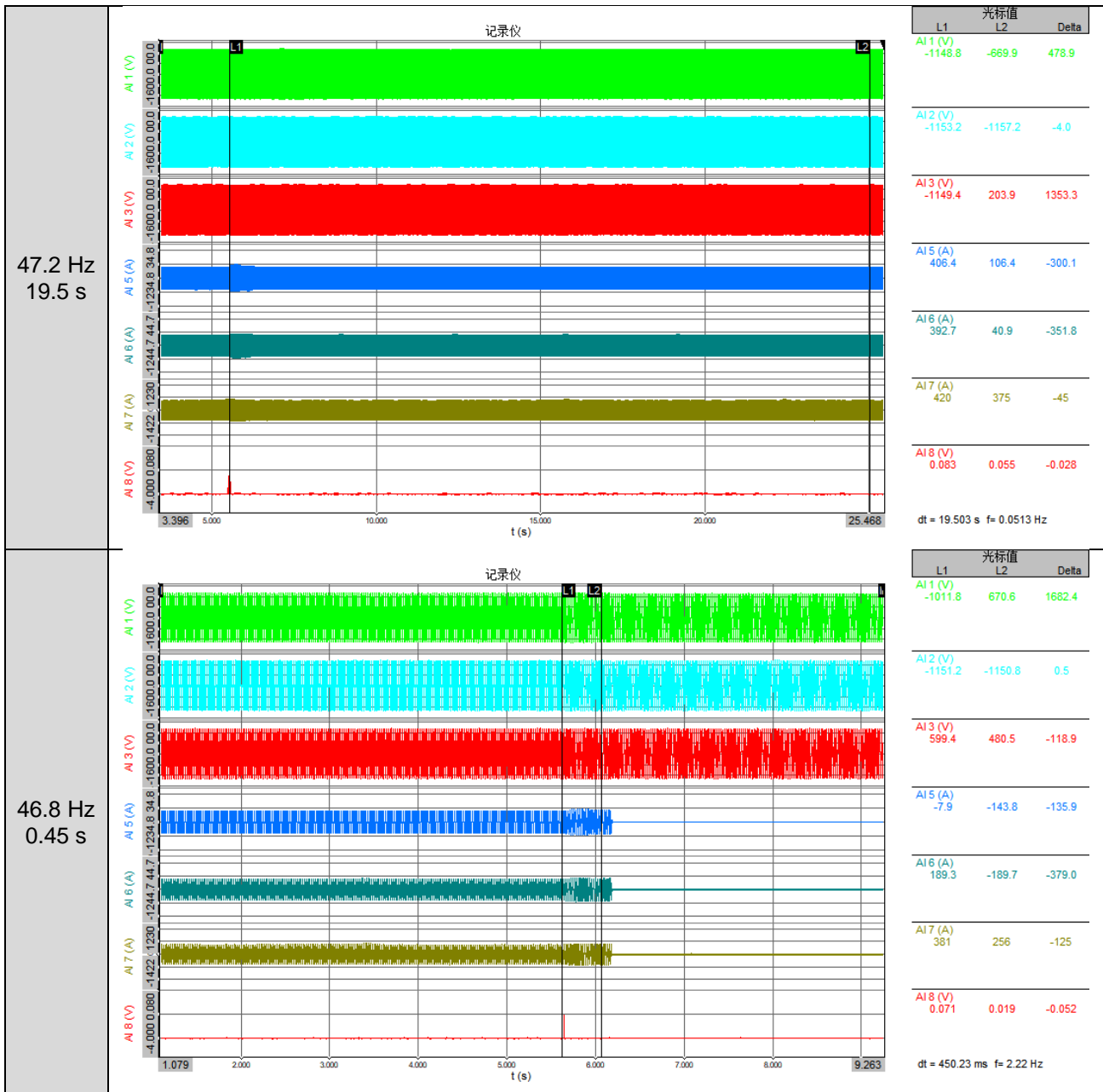


No trip test oscilloscope waveform:



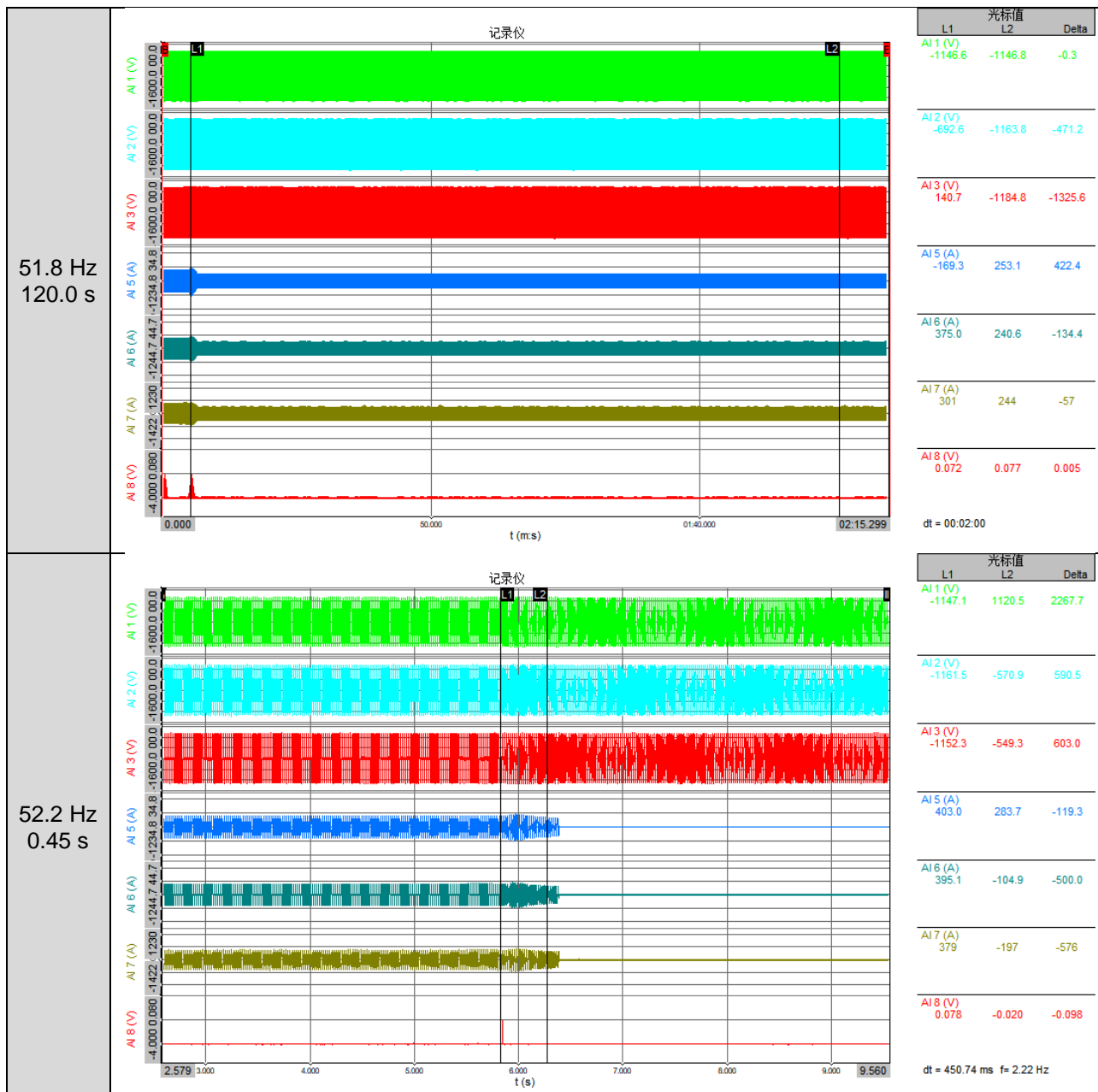


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Remrak:

Note. For frequency trip tests the frequency required to trip is the setting  $\pm 0.1$  Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The “No trip tests” need to be carried out at the setting  $\pm 0.2$  Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

<b>Table: Protection – Voltage tests</b>	<b>P</b>
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Settings for Long-Term Parallel Operation:

Protection Function	Type A, Type B and Type C Power Generating Modules				Type D Power Generating Modules and Power Generating Facilities with a Registered Capacity > 50 MW	
	LV Protection(1)		HV Protection(1)		Trip Setting	Time Delay Setting
	Trip Setting	Time Delay Setting	Trip Setting	Time Delay Setting		
U/V	$V_{\varphi-n}^+ -20\%$	2.5 s*	$V_{\varphi-\varphi^+} -20\%$	2.5 s*	$V_{\varphi-\varphi^+} -20\%$	2.5 s*
O/V st 1	$V_{\varphi-n}^+ +14\%$	1.0 s	$V_{\varphi-\varphi^+} +10\%$	1.0 s	$V_{\varphi-\varphi^+} +10\%$	1.0 s
O/V st 2	$V_{\varphi-n}^+ +19\%^{\ddagger}$	0.5 s	$V_{\varphi-\varphi^+} +13\%$	0.5 s		
U/F st 1	47.5 Hz	20 s	47.5 Hz	20 s	47.5 Hz	20 s
U/F st 2	47.0 Hz	0.5 s	47.0 Hz	0.5 s	47.0 Hz	0.5 s
O/F	52.0 Hz	0.5 s	52.0 Hz	0.5 s	52.0 Hz	0.5 s
LoM (RoCoF)*	1 Hzs <sup>-1</sup> time delay 0.5 s		1 Hzs <sup>-1</sup> time delay 0.5 s		Intertripping expected	

For Type B and Type C Power Generating Modules intend to connected to HV

Function		Setting		Trip test		"No trip tests" All phases at same voltage	
		Voltage	Time delay	Voltage (V)	Time delay (s)	Voltage /time	Confirm no trip
U/V stage	L1-L2	$0.80 U_{L-L}$ (640 V)	2.5 s	635.26	2.557	$0.80 U_n + 4V$ (644 V) 5.0 s	no trip
	L2-L3	$0.80 U_{L-L}$ (640 V)	2.5 s	635.26	2.557		
	L3-L1	$0.80 U_{L-L}$ (640 V)	2.5 s	639.24	2.568		
	All phases	$0.80 U_{L-L}$ (640 V)	2.5 s	639.24	2.565		
						$0.80 U_n - 4V$ (636 V) 2.45 s	no trip
O/V stage 1	L1-L2	$1.10 U_{L-L}$ (880 V)	1.0 s	878.96	1.052	$1.10 U_n - 4V$ (876 V) 5.0 s	no trip
	L2-L3	$1.10 U_{L-L}$ (880 V)	1.0 s	878.96	1.036		
	L3-L1	$1.10 U_{L-L}$ (880 V)	1.0 s	886.91	1.038		
	ALL	$1.10 U_{L-L}$ (880 V)	1.0 s	878.96	1.040		
O/V stage 2	L1-L2	$1.13 U_{L-L}$	0.5 s	903.97	0.548	$1.13 U_n - 4V$	no trip



Product Service

		(904 V)				(900 V) 0.95 s	
	L2-L3	1.13 U <sub>L-L</sub> (904 V)	0.5 s	903.97	0.542		
	L3-L1	1.13 U <sub>L-L</sub> (904 V)	0.5 s	911.94	0.543		
	All phases	1.13 U <sub>L-L</sub> (904 V)	0.5 s	903.97	0.537		
						1.13 U <sub>n</sub> + 4V (908 V) 0.45 s	no trip

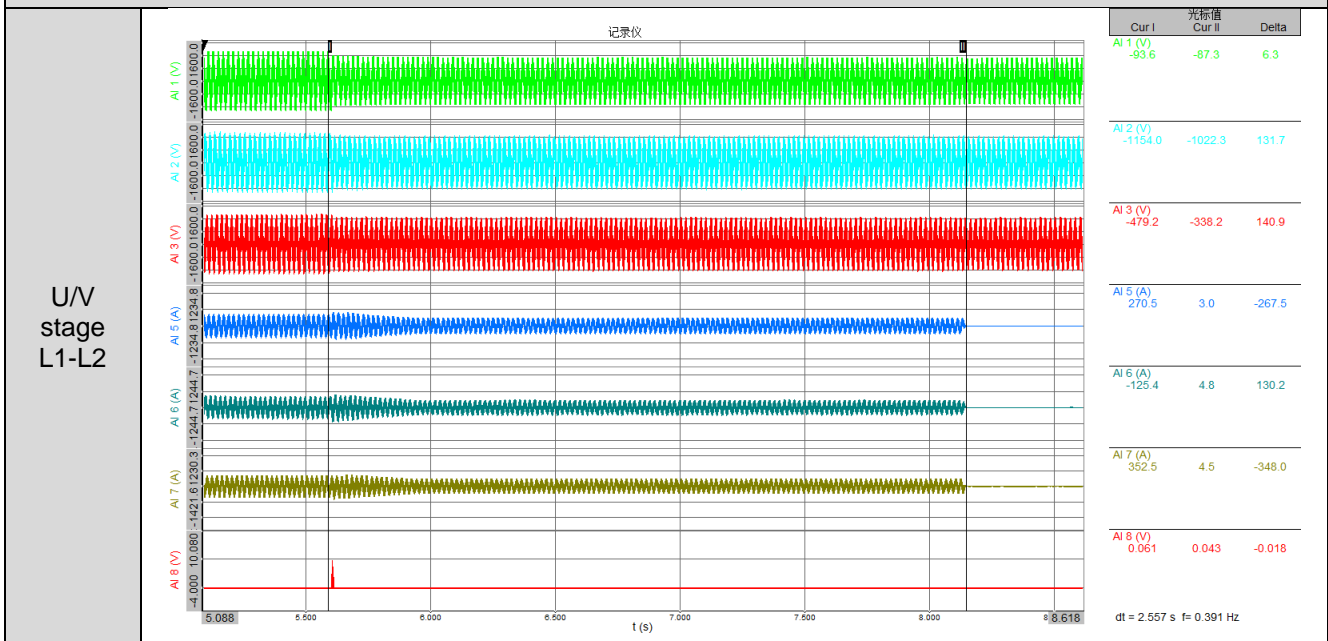
Supplementary information:

Channel 1&2&3: Waveform of three phases voltage signals at grid connection terminals.

Channel 4&5&6: Waveform of inverter three phases output current signals at grid connection terminals.

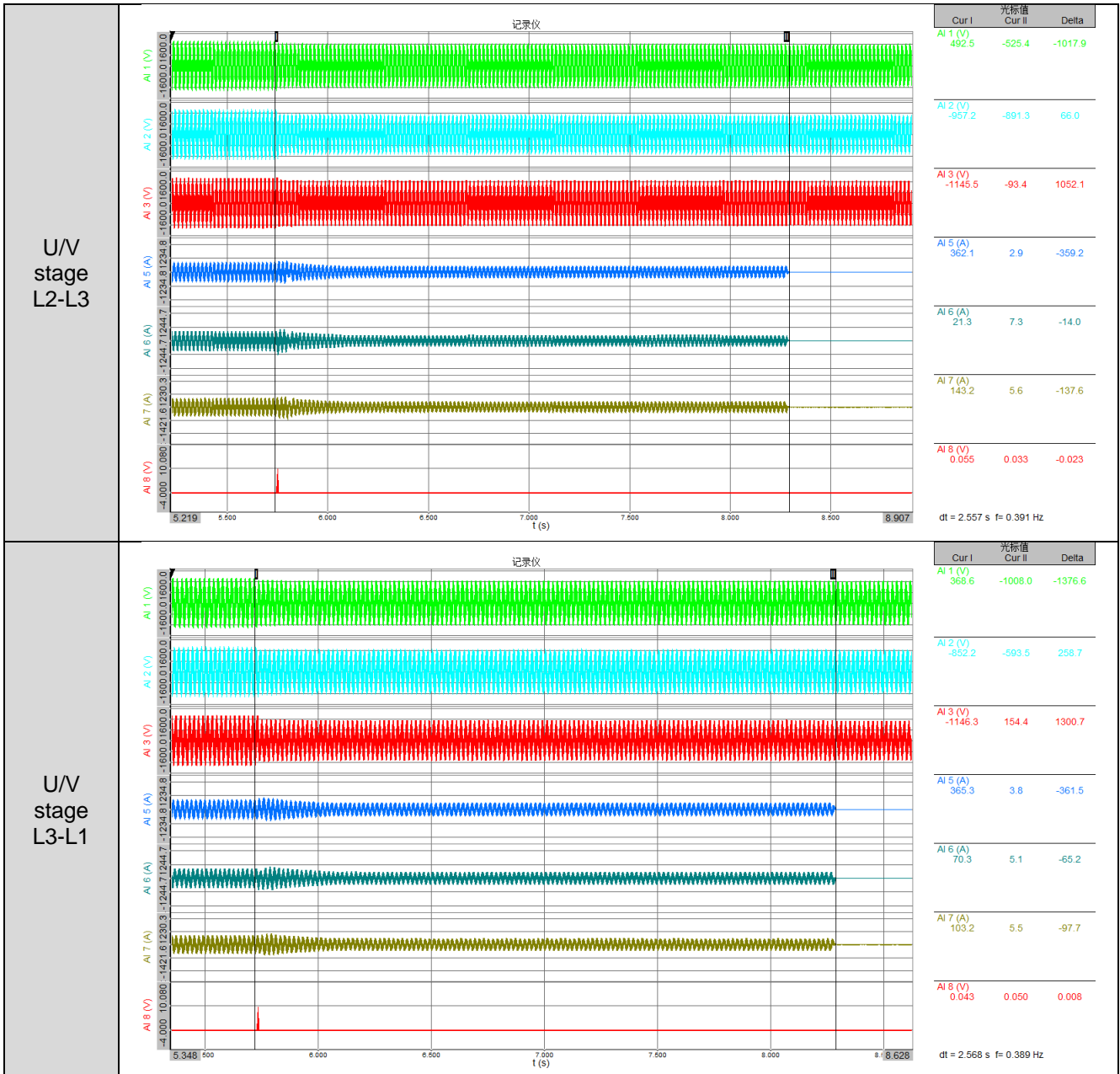
Channel 7: Trigger signal of turning into overvoltage or undervoltage state, provided by the programmable AC grid simulator.

Trip test oscilloscope waveform:



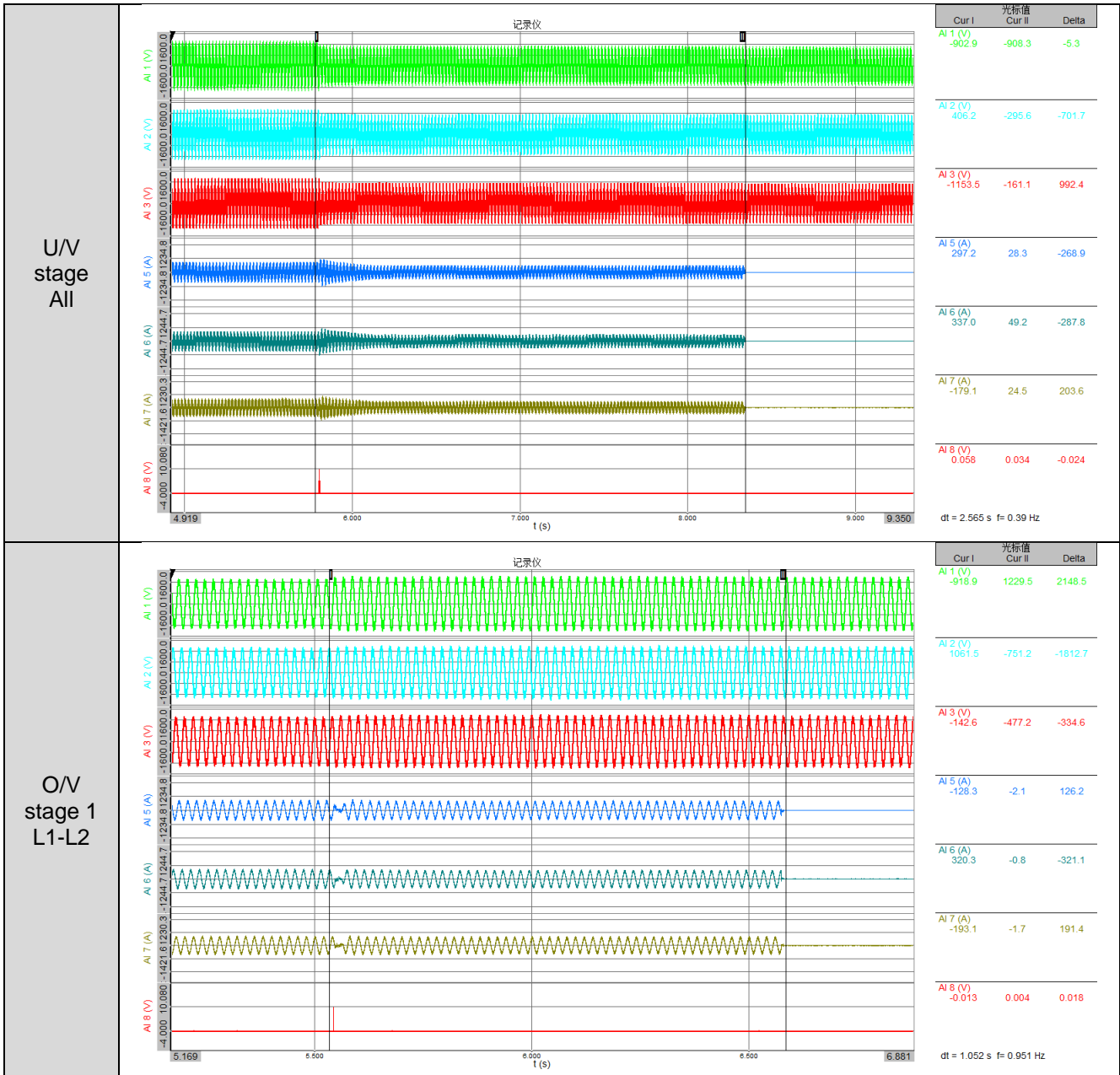


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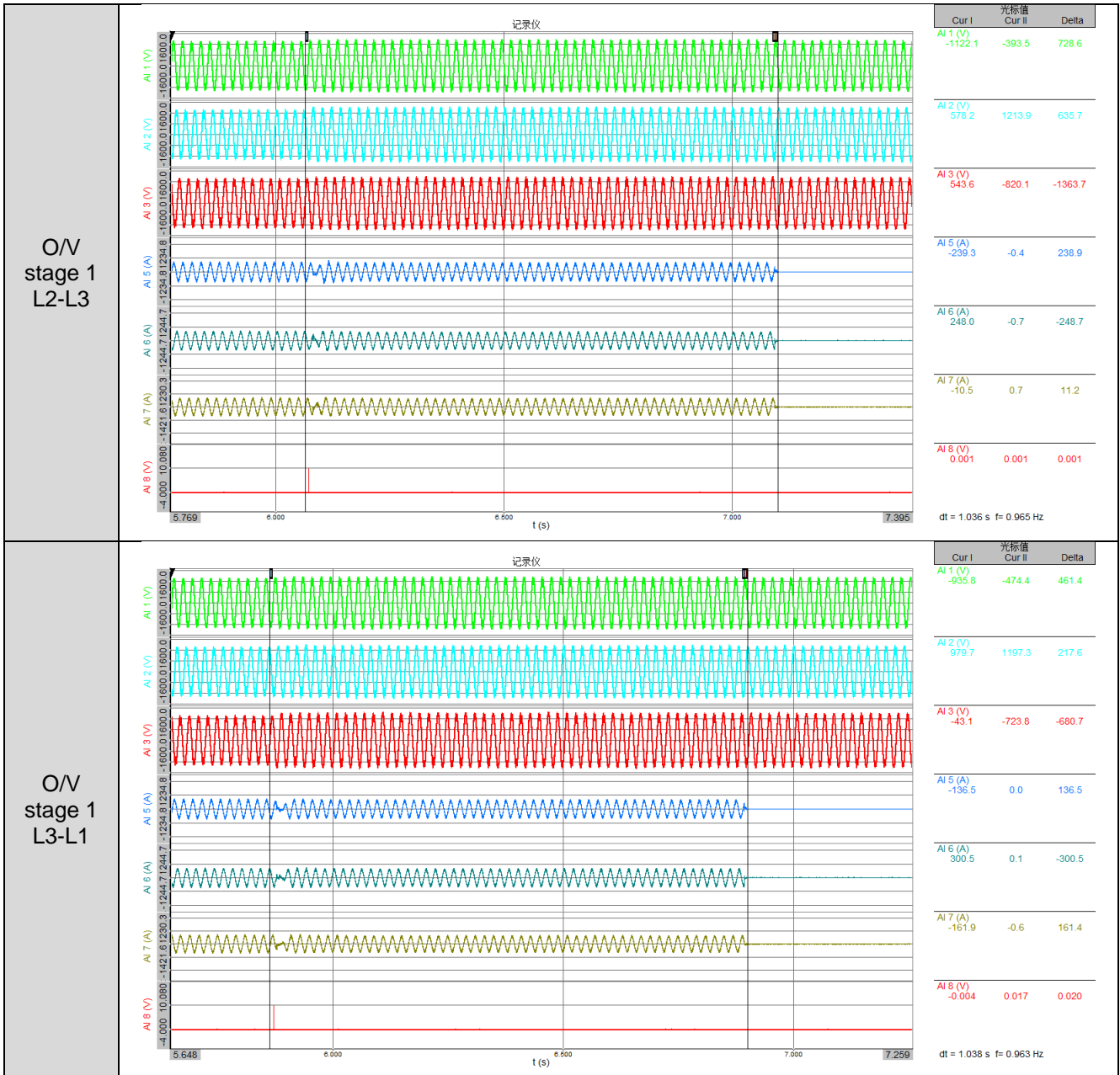


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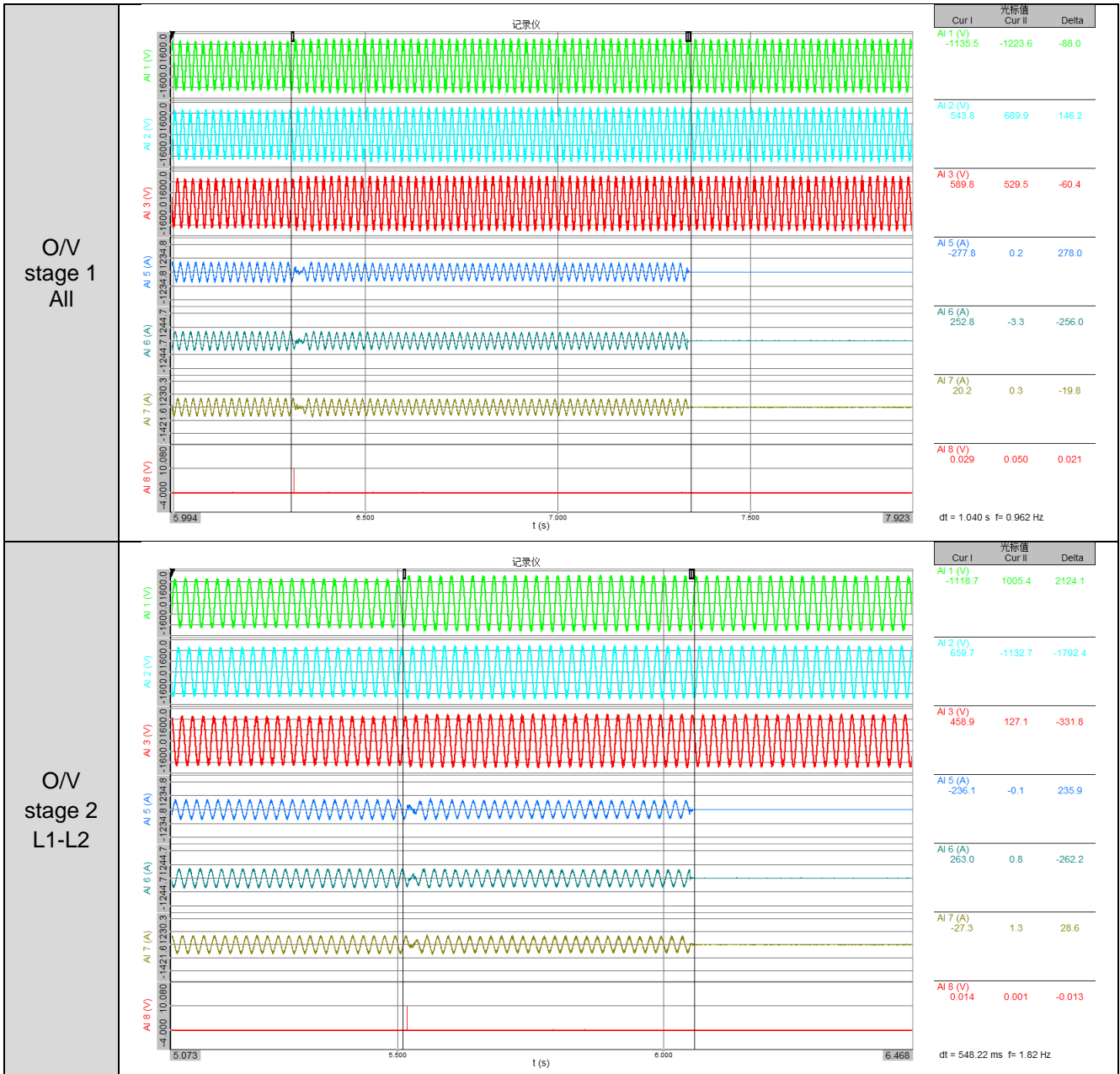


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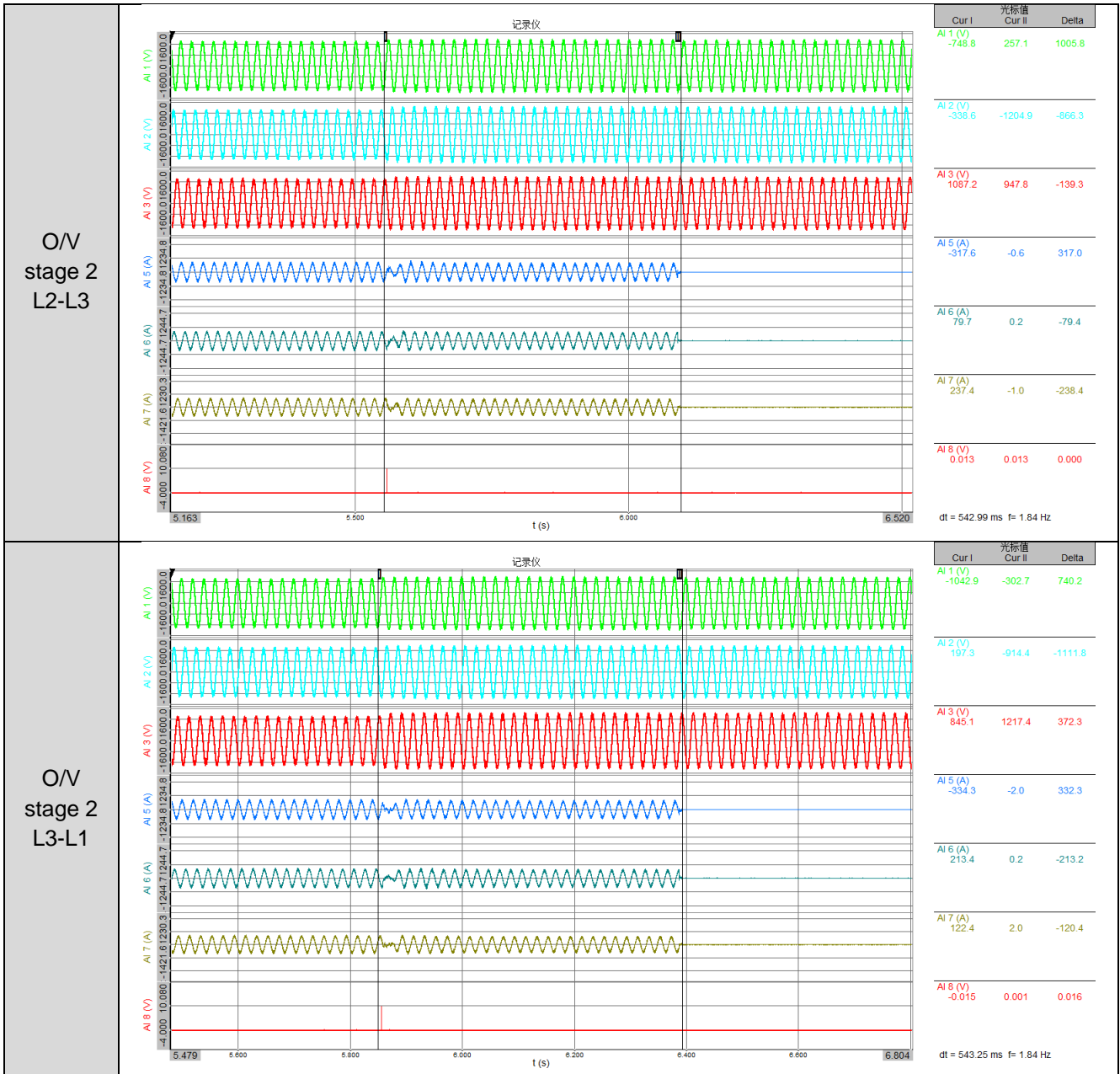


Product Service



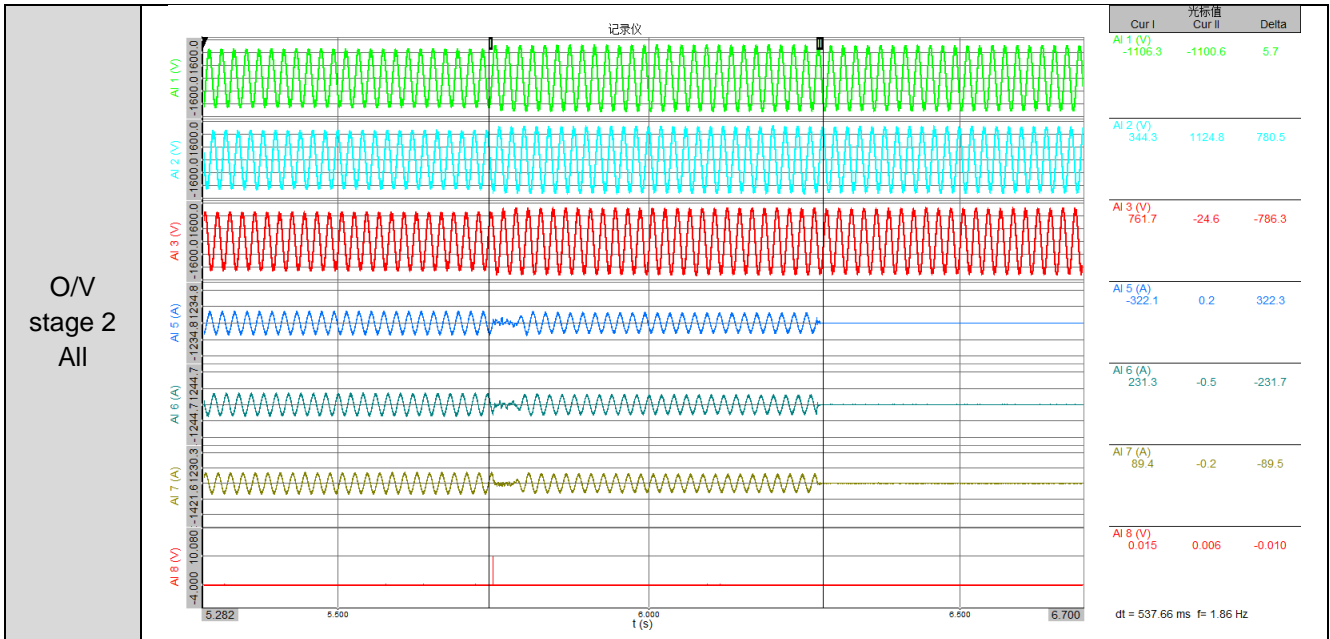


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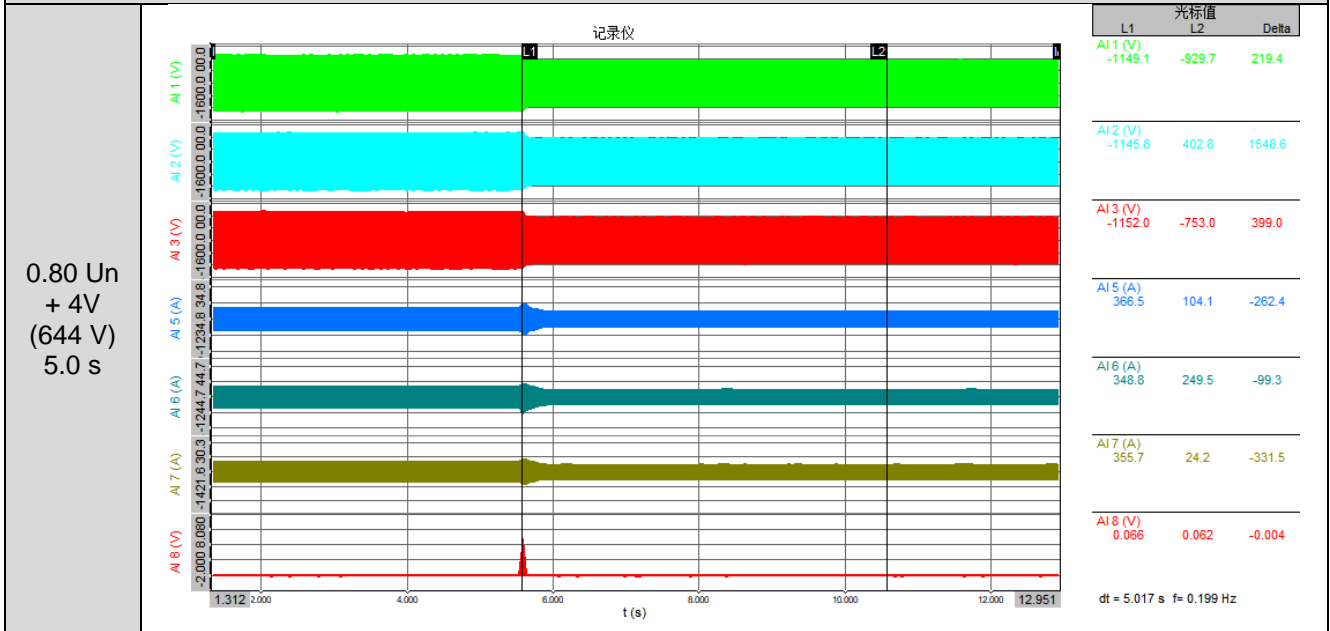




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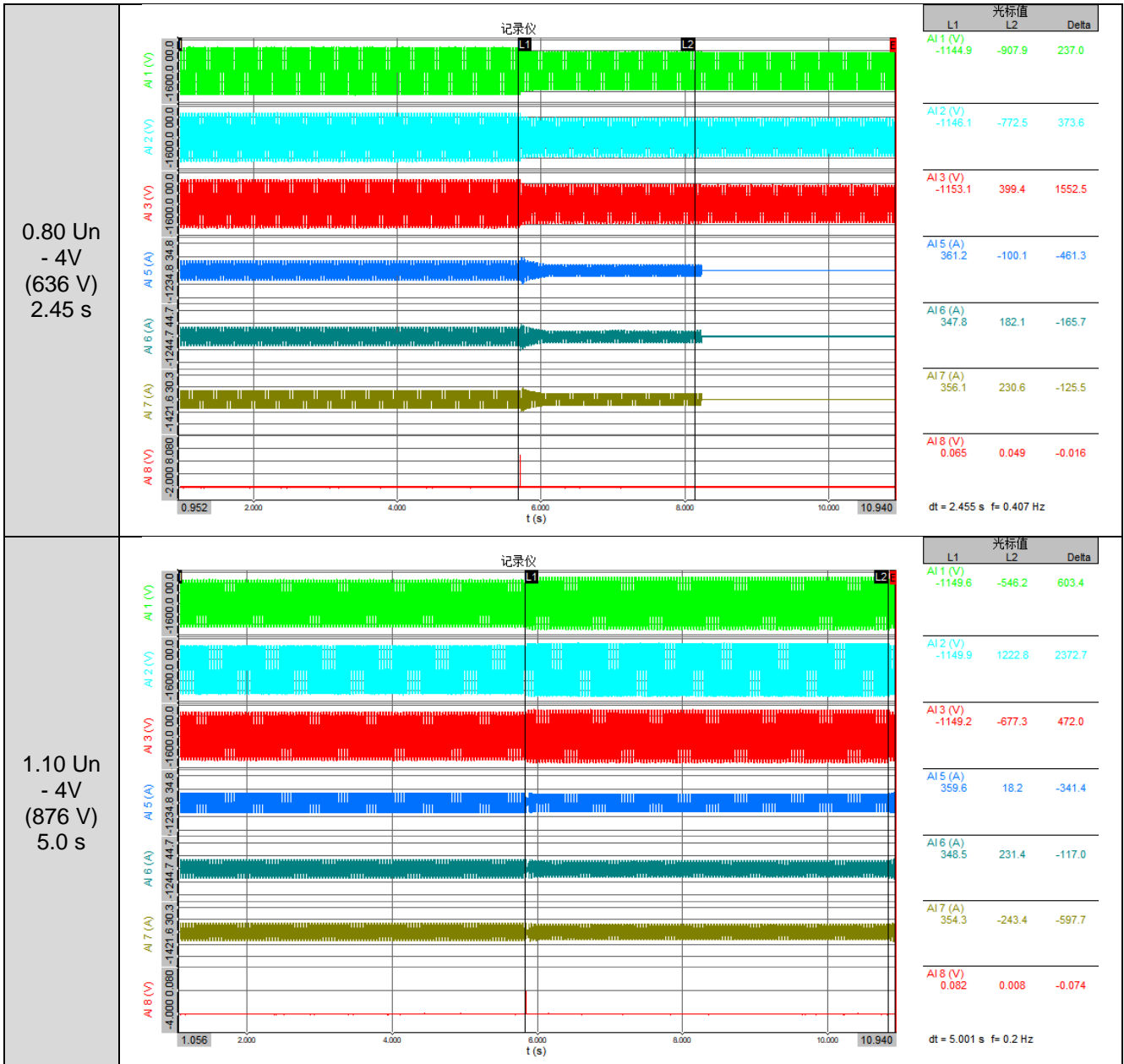


No trip test oscilloscope waveform:



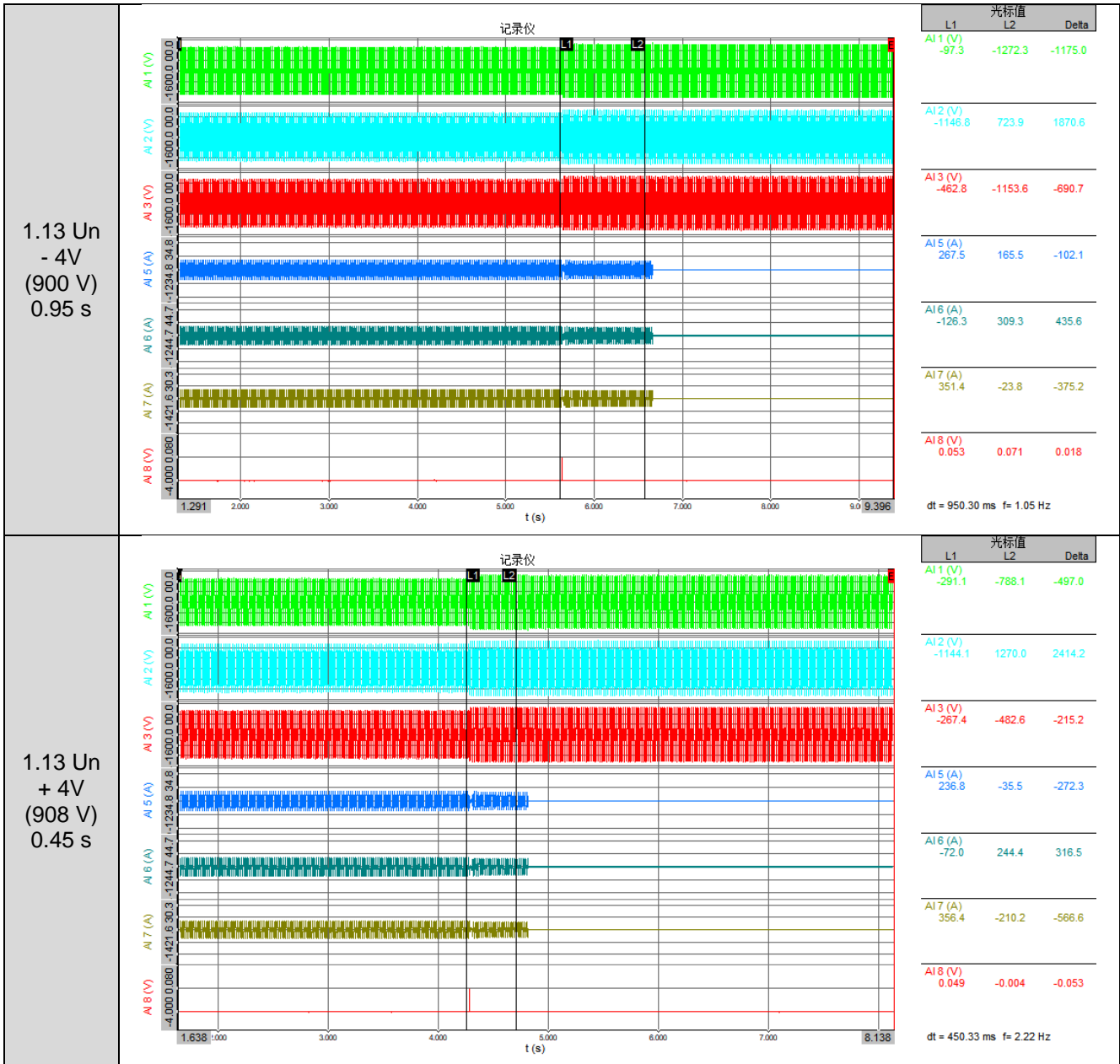


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For **Type D** Power Generating Modules and Power Generating Facilities with a Registered Capacity > 50 MW Protection Setting

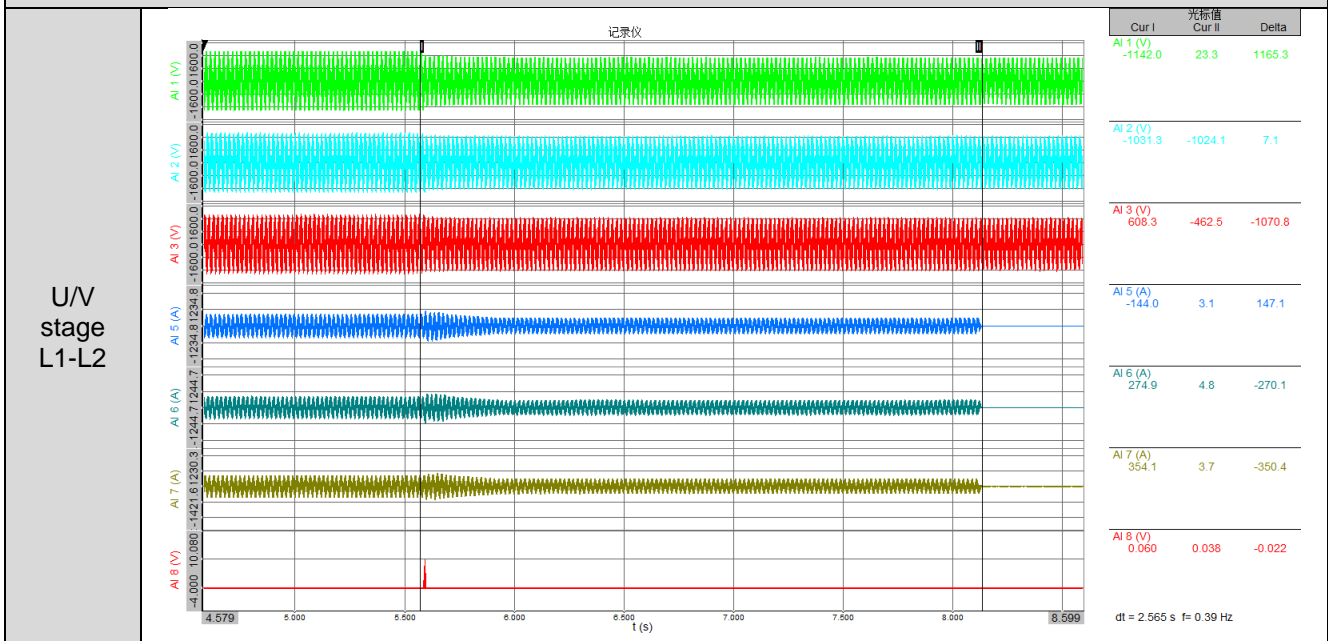
Function		Setting		Trip test		"No trip tests" All phases at same voltage	
		Voltage	Time delay	Voltage (V)	Time delay (s)	Voltage /time	Confirm no trip
U/V stage	L1 – L2	0.80 U <sub>L-L</sub> (640 V)	2.5 s	635.26	2.565	0.80 U <sub>L-L</sub> + 4V() 5.0 s	no trip
	L2 – L3	0.80 U <sub>L-L</sub> (640 V)	2.5 s	635.26	2.569		
	L3 – L1	0.80 U <sub>L-L</sub> (640 V)	2.5 s	639.24	2.556		



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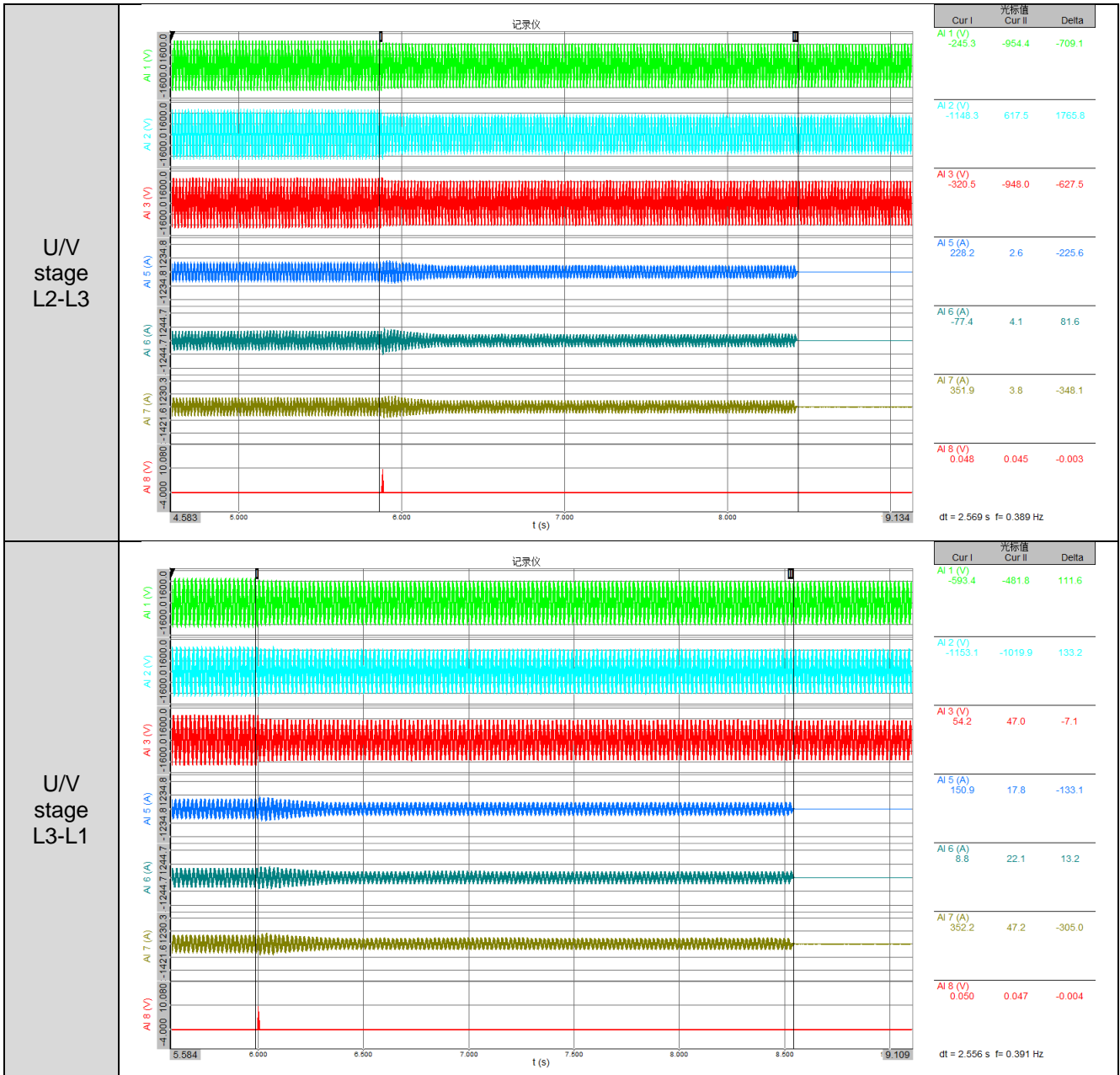
	All phases	0.80 U <sub>L-L</sub> (640 V)	2.5 s	639.24	2.551		
						0.80 U <sub>L-L</sub> - 4V 2.45 s	no trip
O/V stage	L1 - L2	1.10 U <sub>L-L</sub> (880 V)	1.0 s	878.96	1.043	1.10 U <sub>L-L</sub> - 4V 5.0 s	no trip
	L2 - L3	1.10 U <sub>L-L</sub> (880 V)	1.0 s	886.92	1.052		
	L3 - L1	1.10 U <sub>L-L</sub> (880 V)	1.0 s	878.96	1.043		
	All phases	1.10 U <sub>L-L</sub> (880 V)	1.0 s	878.96	1.044	1.10 U <sub>L-L</sub> + 4V 0.95 s	no trip

Trip test oscilloscope waveform:



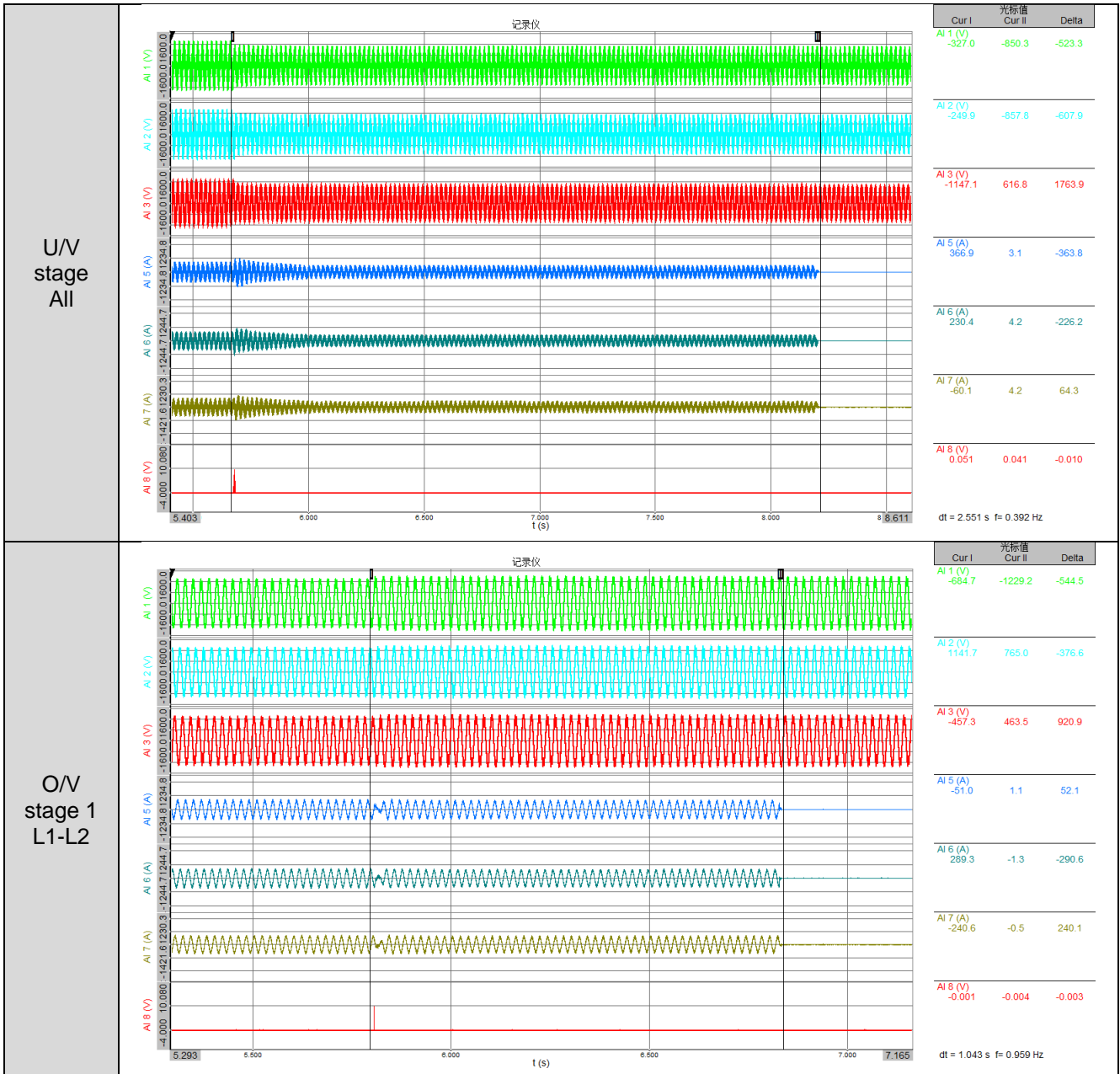


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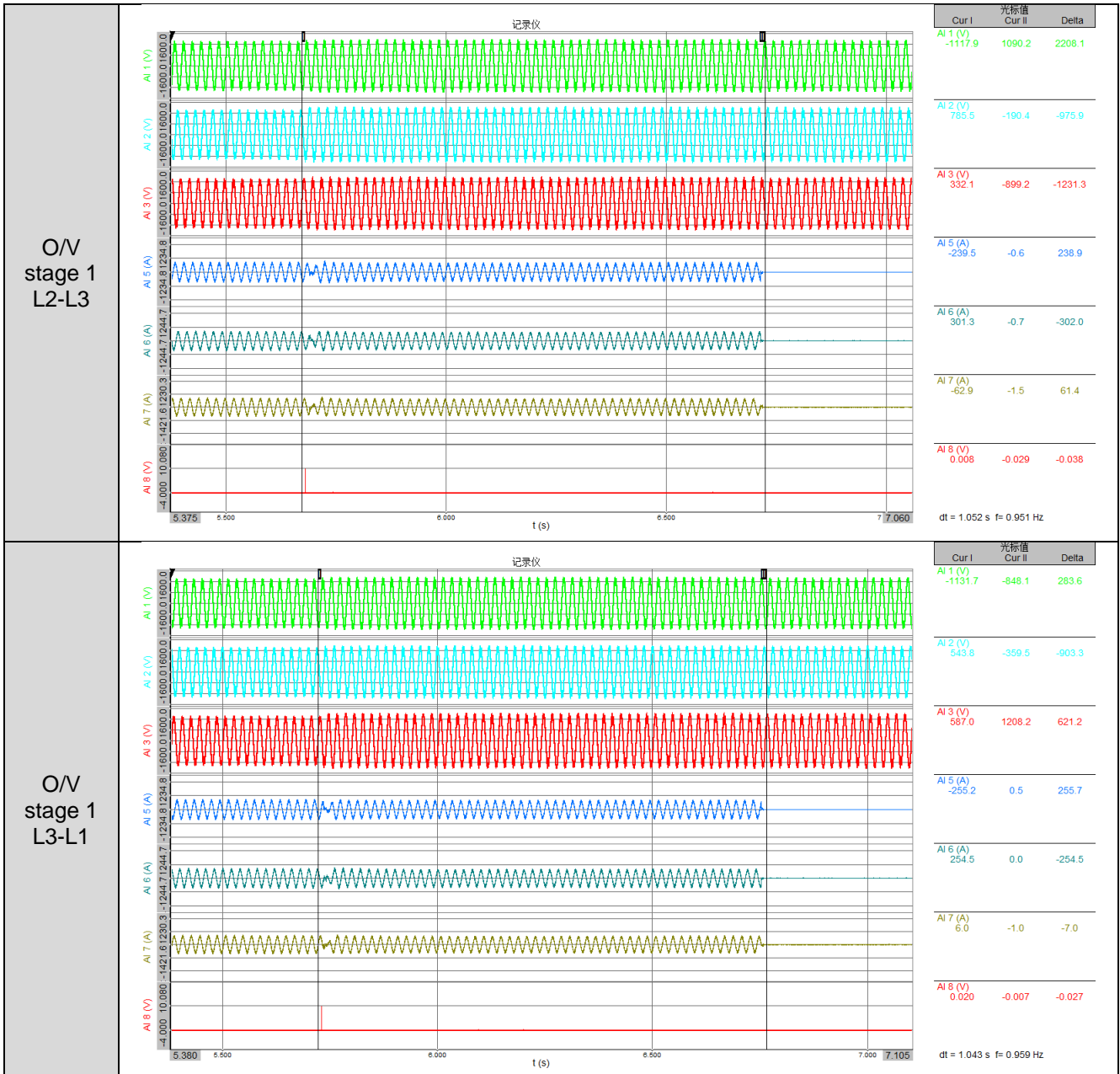


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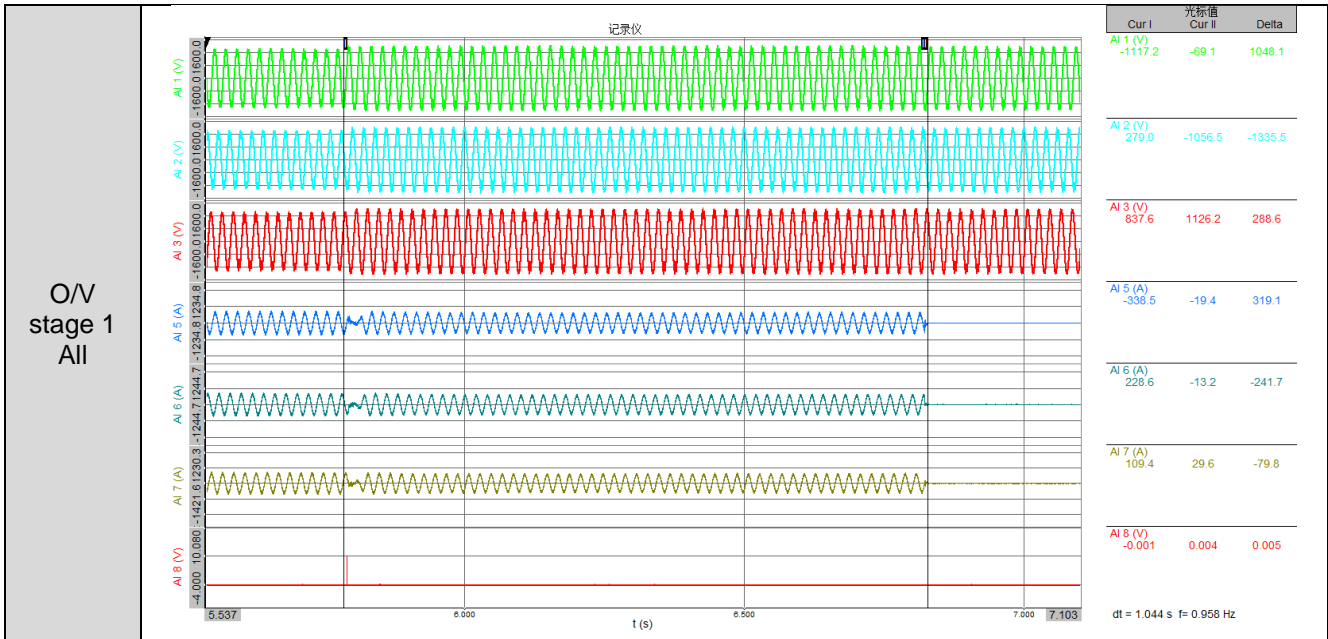


Product Service

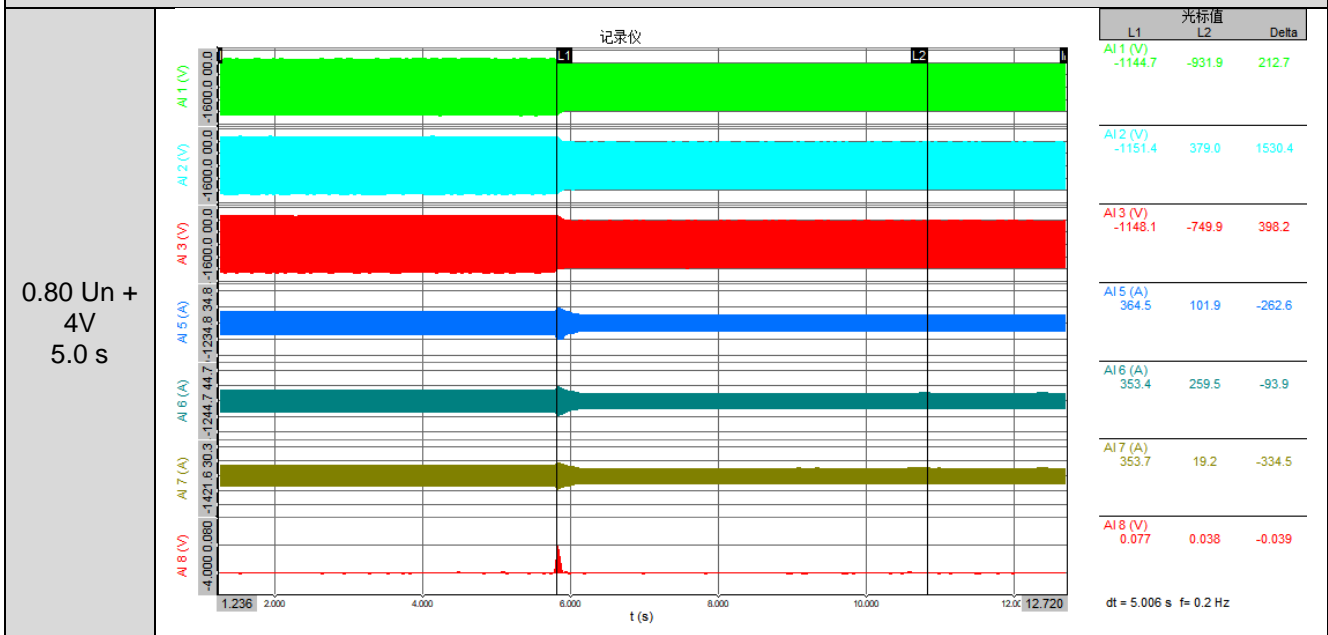




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No trip test oscilloscope waveform:



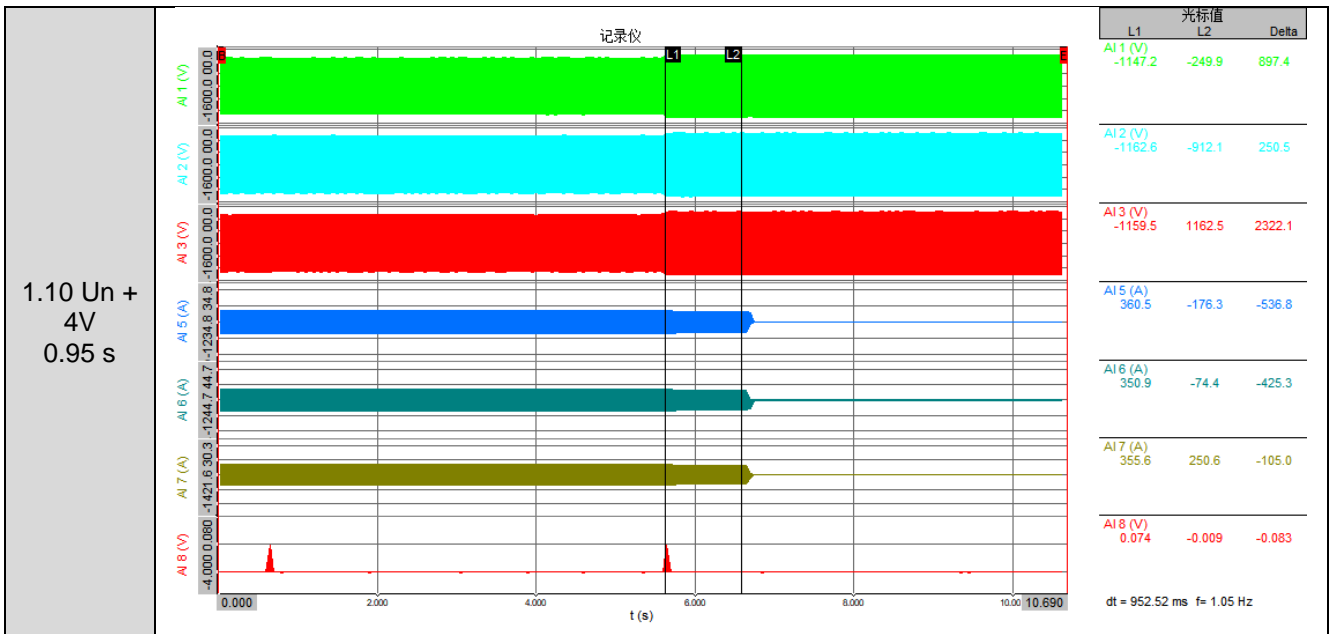


Product Service





Product Service





Product Service

Table: Loss of Mains Protection, Vector Shift Stability test, RoCoF Stability test											P
Protection – Loss of Mains test											
Test Power and imbalance		33% -5% Q Test 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10				
Trip time Limit is 0.5 s		120.0 ms	104.2 ms	244.4 ms	113.6 ms	106.6 ms	198.6 ms				
No.	P <sub>EUT</sub> (% of EUT rating)	Reactive Load (% of Q <sub>L</sub> )	P <sub>AC</sub> (% of nominal)	Q <sub>AC</sub> (% of nominal)	Run on time (ms)	P <sub>EUT</sub> (kW)	Actual Qf L1	Actual Qf L2	Actual Qf L3	V <sub>DC</sub> (Vd.c.)	Remarks
1.	100	100	0	0	252.2	300	0.999	0.999	1.000	1100	Test A at BL
2.	66	66	0	0	265.2	198	1.001	0.999	1.001	855	Test B at BL
3.	33	33	0	0	267.8	99	1.001	1.000	0.999	600	Test C at BL
4.	100	100	-5	-5	164.4	300	1.029	1.028	1.025	1100	Test A at IB
5.	100	100	-5	0	244.4	300	1.052	1.048	1.050	1100	Test A at IB
6.	100	100	-5	+5	218.8	300	1.081	1.075	1.075	1100	Test A at IB
7.	100	100	0	-5	193.2	300	0.990	0.985	0.979	1100	Test A at IB
8.	100	100	0	+5	161.2	300	1.030	1.021	1.023	1100	Test A at IB
9.	100	100	+5	-5	192.0	300	0.940	0.935	0.928	1100	Test A at IB
10.	100	100	+5	0	198.6	300	0.958	0.951	0.953	1100	Test A at IB
11.	100	100	+5	+5	185.6	300	0.984	0.976	0.979	1100	Test B at IB
12.	66	66	0	-5	104.2	198	0.969	0.974	0.970	855	Test B at IB
13.	66	66	0	-4	122.6	198	0.981	0.987	0.984	855	Test B at IB
14.	66	66	0	-3	268.6	198	0.974	0.982	0.978	855	Test B at IB
15.	66	66	0	-2	134.0	198	0.986	0.993	0.990	855	Test B at IB
16.	66	66	0	-1	244.8	198	0.995	0.991	0.996	855	Test B at IB
17.	66	66	0	+1	133.0	198	0.996	0.993	0.996	855	Test B at BL
18.	66	66	0	+2	176.8	198	0.985	0.990	0.990	855	Test B at IB
19.	66	66	0	+3	178.0	198	0.977	0.980	0.974	855	Test B at IB
20.	66	66	0	+4	188.0	198	0.980	0.988	0.984	855	Test B at IB
21.	66	66	0	+5	106.6	198	0.970	0.974	0.972	855	Test B at IB
22.	33	33	0	-5	120.0	99	0.975	0.975	0.974	600	Test C at IB
23.	33	33	0	-4	152.0	99	0.975	0.979	0.981	600	Test C at IB
24.	33	33	0	-3	154.0	99	0.981	0.982	0.981	600	Test C at IB
25.	33	33	0	-2	166.0	99	0.983	0.984	0.984	600	Test C at IB
26.	33	33	0	-1	192.0	99	0.995	0.995	0.996	600	Test C at IB
27.	33	33	0	+1	155.6	99	1.004	1.003	1.005	600	Test C at IB
28.	33	33	0	+2	152.0	99	1.007	1.006	1.007	600	Test C at IB
29.	33	33	0	+3	147.8	99	1.014	1.014	1.012	600	Test C at IB
30.	33	33	0	+4	118.0	99	1.014	1.016	1.014	600	Test C at IB
31.	33	33	0	+5	113.6	99	0.999	0.999	1.000	600	Test C at IB



**Remark (additional info or observation during the test):**

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.

Applies to all types.

<b>Table: Loss of Mains Protection, Vector Shift Stability test</b>			
	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.5 Hz	+50 degrees	No trip
Negative Vector Shift	50.5 Hz	-50 degrees	No trip

<b>Table: Loss of Mains Protection, RoCoF Stability test</b>			
Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0 Hz to 51.0 Hz	+0.95 Hzs-1	2.1 s	No trip
51.0 Hz to 49.0 Hz	-0.95 Hzs-1	2.1 s	No trip

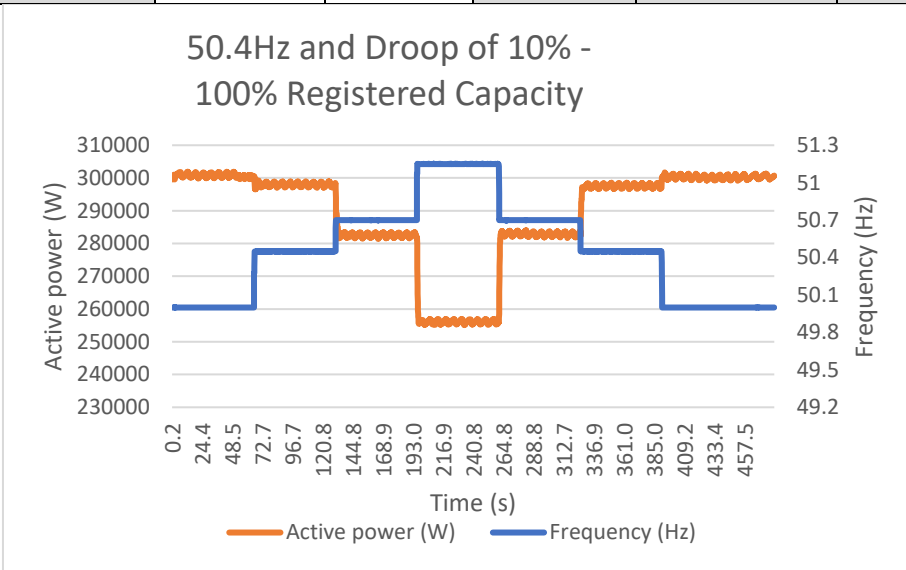
<b>Table: Output power with falling frequency</b>			<b>P</b>
Test sequence	Meanvalue of measured Active Power (W)	Acceptable Active Power (W)	Whether the output active power lower than the acceptable limit?
49.5 Hz for 5 minutes	302450	300000	No
48.8 Hz for 5 minutes	303000	295800	No
48.0 Hz for 5 minutes	302880	291000	No
47.5 Hz for 5 minutes	302920	288000	No
47.1 Hz for 20 seconds	302790	285600	No



<b>Table: Limited Frequency Sensitive Mode – Overfrequency</b>	<b>P</b>
Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.7.2.4.	No

The test should be carried out using the specific threshold frequency of 50.4 Hz and Droop of 10 %.

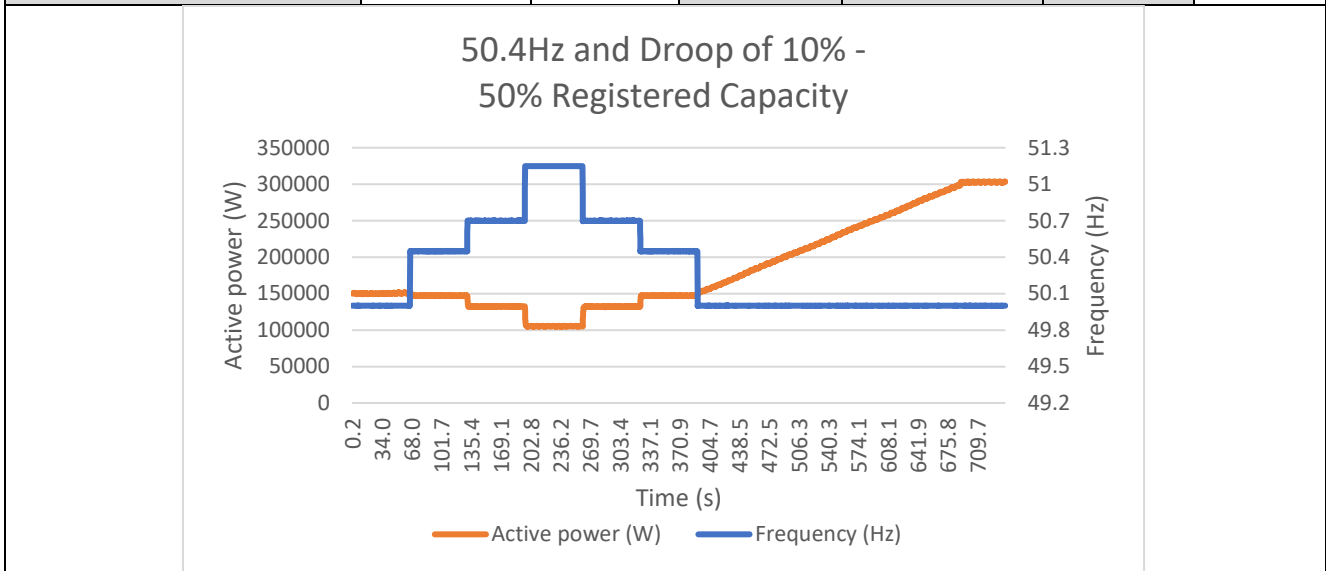
Test sequence at Registered Capacity above 80%			P <sub>ref</sub> (W)	300000		
Test sequence at Registered Capacity >80%	Measured Active Power Output (W)	Actual frequency (Hz)	Expected active power (W)	Calculated ΔP from standard characteristic curve (W)	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ± 0.01Hz	300792.39	50.00	--	--	PV simulator set at 100%Pn	--
Step b) 50.45Hz ± 0.05Hz	297923.94	50.45	297792.39	131.55		
Step c) 50.70Hz ± 0.10Hz	282605.85	50.70	282792.39	-186.54		
Step d) 51.15Hz ± 0.05Hz	256003.22	51.15	255792.39	210.83		
Step e) 50.70Hz ± 0.10Hz	282819.90	50.70	282792.39	27.51		
Step f) 50.45Hz ± 0.05Hz	297541.03	50.45	297792.39	-251.36		
Step g) 50.00Hz ± 0.01Hz	300495.52	50.00	--	--		



Test sequence at Registered Capacity 40% - 60%			P <sub>ref</sub> (W)	300000		
Test sequence	Measured Active Power Output (W)	Actual frequency (Hz)	Expected active power (W)	Calculated ΔP from standard characteristic curve (W)	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	150496.27	50.00	--	--	PV simulator set at 50%Pn	--
Step b) 50.45Hz ±0.05Hz	146927.80	50.45	147496.27	-568.47		
Step c) 50.70Hz ±0.10Hz	132040.66	50.70	132496.27	-455.61	PV simulator	
Step d) 51.15Hz ±0.05Hz	105177.00	51.15	105496.27	-319.27		

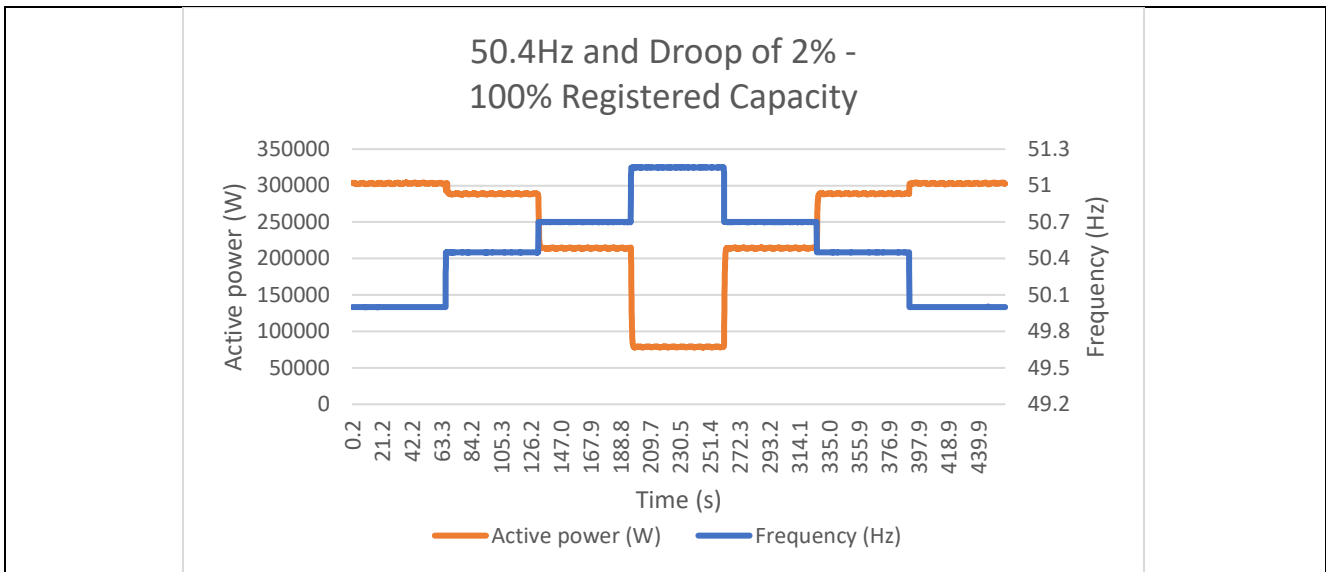


Step e) 50.70Hz ±0.10Hz	132555.29	50.70	132496.27	59.02	set at 100%Pn	9.89%/min
Step f) 50.45Hz ±0.05Hz	147548.30	50.45	147496.27	52.03		
Step g) 50.00Hz ±0.01Hz	303349.61	50.00	--	--		

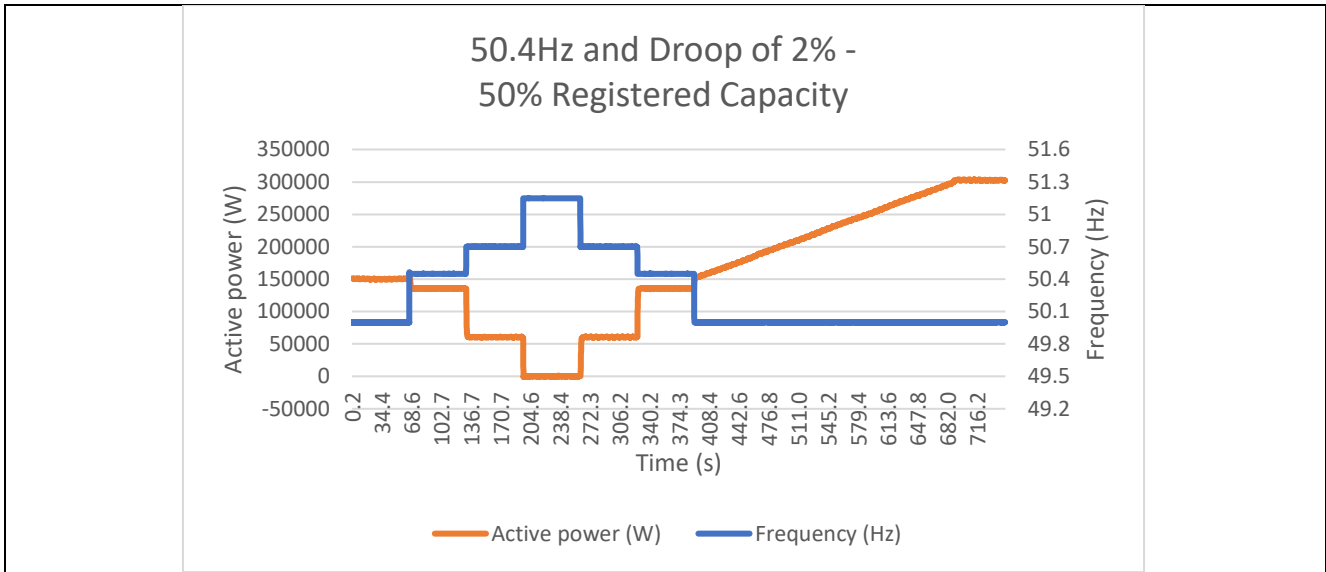


The test should be carried out using the specific threshold frequency of 50.4 Hz and Droop of 2 %. This test should be carried out in accordance with Annex A.7.1.3, which also contains the measurement tolerances.

Test sequence at Registered Capacity above 80%			P <sub>ref</sub> (W)	300000		
Test sequence at Registered Capacity >80%	Measured Active Power Output (W)	Actual frequency (Hz)	Expected active power (W)	Calculated ΔP from standard characteristic curve (W)	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	303165.24	50.00	--	--	PV simulator set at 100%Pn	--
Step b) 50.45Hz ±0.05Hz	289418.50	50.45	288165.24	1253.26		
Step c) 50.70Hz ±0.10Hz	213866.61	50.70	213165.24	701.37		
Step d) 51.15Hz ±0.05Hz	78761.15	51.15	78165.24	595.91		
Step e) 50.70Hz ±0.10Hz	214337.14	50.70	213165.24	1171.9		
Step f) 50.45Hz ±0.05Hz	289445.34	50.45	288165.24	1280.1		
Step g) 50.00Hz ±0.01Hz	303004.22	50.00	--	--		



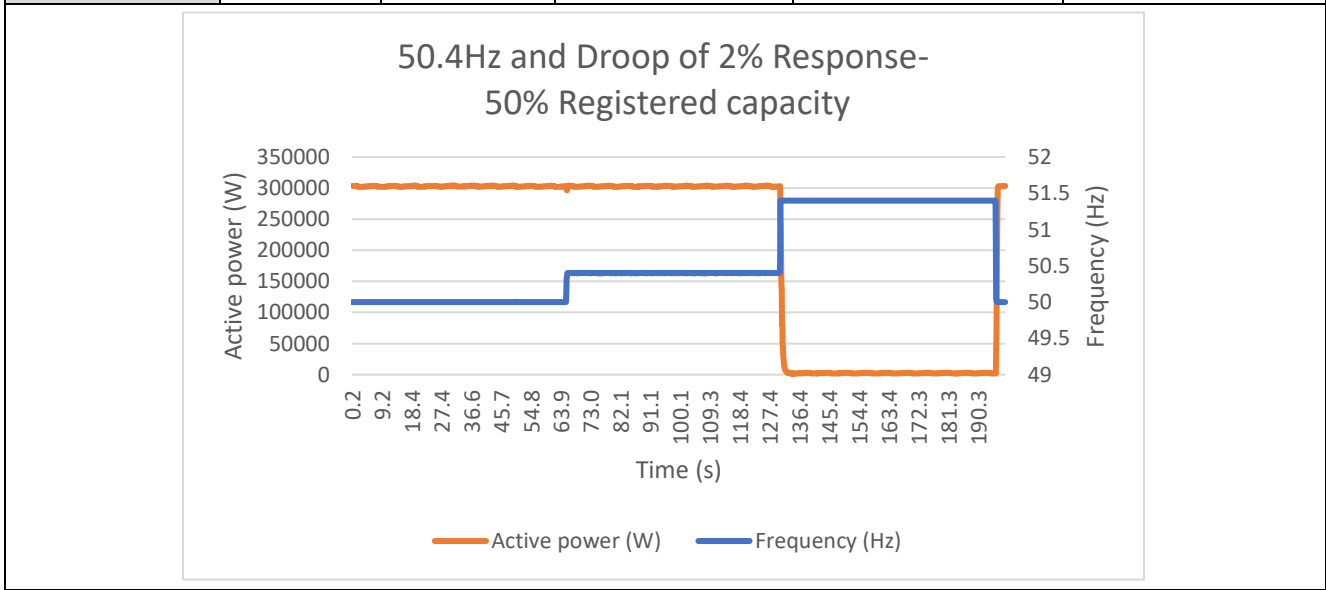
Test sequence at Registered Capacity 40% - 60%			P <sub>ref</sub> (W)	300000		
Test sequence	Measured Active Power Output (W)	Actual frequency (Hz)	Expected active power (W)	Calculated ΔP from standard characteristic curve (W)	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	150571.94	50.00	--	--	PV simulator set at 50%P <sub>n</sub>	--
Step b) 50.45Hz ±0.05Hz	135859.48	50.45	135571.94	287.54		
Step c) 50.70Hz ±0.10Hz	60962.02	50.70	60571.94	390.08	PV simulator set at 100%P <sub>n</sub>	
Step d) 51.15Hz ±0.05Hz	232.15	51.15	0.00	232.15		
Step e) 50.70Hz ±0.10Hz	60501.00	50.70	60571.94	-70.94		
Step f) 50.45Hz ±0.05Hz	135887.54	50.45	135571.94	315.6		
Step g) 50.00Hz ±0.01Hz	303596.44	50.00	--	--		



As much as possible of the proportional reduction in Active Power output must result from the frequency control device (or speed governor) action and must be achieved within 10 s of the time of the frequency increase above 50.4 Hz. The Power Generating Module shall be capable of initiating a power frequency response with an initial delay that is as short as possible. If the delay exceeds 2 s the Generator shall justify the delay, providing technical evidence to the DNO, who will pass this evidence to the NETSO.

gradient  $s=2\%$

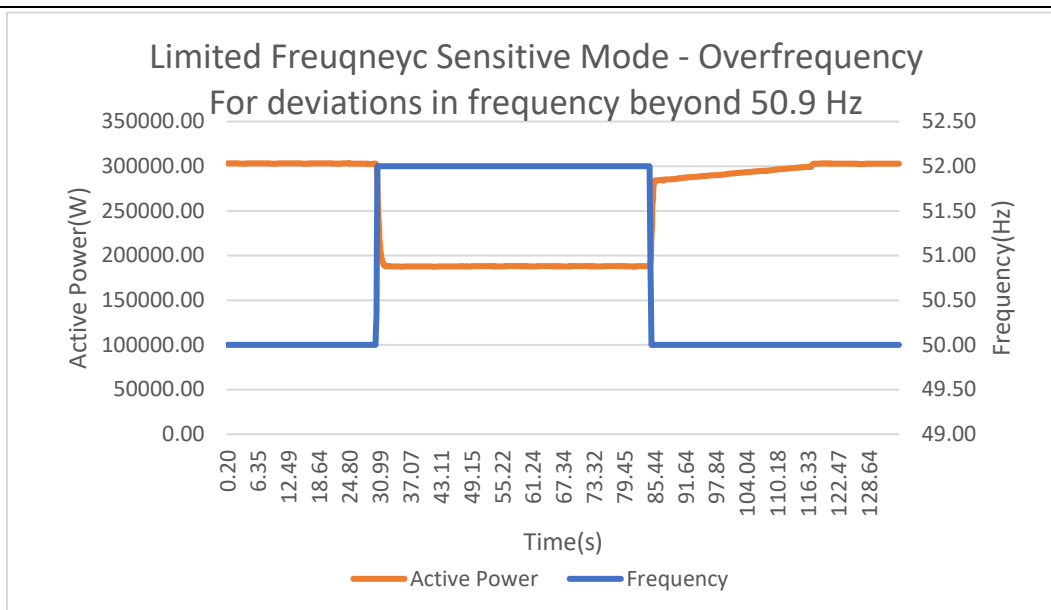
Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{measure}$ (W)	Expected active out power $P_{shall}$ (W)	Response time(s)
1	50.00	50.00	302758.48	--	--
2	50.40	50.40	303606.22	--	--
3	51.40	51.40	2253.15	3606.22	1.67



**Test condition / insallation** Below test just Applies to Type A, B



Alternatively, simulation results should be noted below:					
For deviations in frequency beyond 50.9 Hz the measured rate of change of active Power reduction must exceed 0.5% s <sup>-1</sup> of the initial output.					
Test sequence at <b>Registered Capacity</b> >80%			P <sub>ref</sub> (W)	300000	
Test sequence	Stay time (s)	Actual frequency (Hz)	Measured Active Power Output (W)	Expected active power (W)	Limit
Step a) 50.00Hz ±0.01Hz	30	50.00	303115.55	--	--
Step b) 52.00Hz ±0.01Hz	--	Responding times (s)			0.248
Step b) 52.00Hz ±0.01Hz	0	52.00	264294.30	--	--
Step b) 52.00Hz ±0.01Hz	10	52.00	187913.25	< 288115.55	--
Step b) 52.00Hz ±0.01Hz	20	52.00	188120.14	< 273115.55	--
Step b) 52.00Hz ±0.01Hz	30	52.00	187997.47	< 258115.55	--
Step b) 52.00Hz ±0.01Hz	40	52.00	188089.24	< 243115.55	--
Step b) 52.00Hz ±0.01Hz	50	52.00	188076.50	< 228115.55	--
Step b) 52.00Hz ±0.01Hz	60	52.00	188012.25	< 213115.55	--
Step b) 52.00Hz ±0.01Hz	64	52.00	188085.22	207115.55	--
Step b) 52.00Hz ±0.01Hz to Step g) 50.00Hz ±0.01Hz	70	50.00	188100.42	207115.55	--
When frequency less than 50.4Hz, at least half the increase in Active Power must be achieved in 10 seconds					
Test sequence	Stay time after return to 50.00Hz (s)	Actual frequency (Hz)	Measured Active Power Output (W)	Expected active power (W)	Limit
Step g) 50.00Hz ±0.01Hz	70	50.00	188100.42	207115.55	--
Step g) 50.00Hz ±0.01Hz	--	Responding times (s)			0.216
Step g) 50.00Hz ±0.01Hz	80	50.00	284967.50	> 213115.55	--
Step g) 50.00Hz ±0.01Hz	90	50.00	287205.03	> 228115.55	--
Step g) 50.00Hz ±0.01Hz	100	50.00	289677.33	> 243115.55	--
Step g) 50.00Hz ±0.01Hz	110	50.00	292322.70	> 258115.55	--
Step g) 50.00Hz ±0.01Hz	120	50.00	294769.31	> 273115.55	--
Step g) 50.00Hz ±0.01Hz	130	50.00	299480.02	> 288115.55	--
Step g) 50.00Hz ±0.01Hz	134	50.00	303143.00	≈ 303115.55	--



Alternatively, simulation results should be noted below:

**For deviations in frequency up to 50.9 Hz at least half of the proportional reduction in Active Power output must be achieved within 10 s of the time of the frequency increase above 50.4 Hz.**

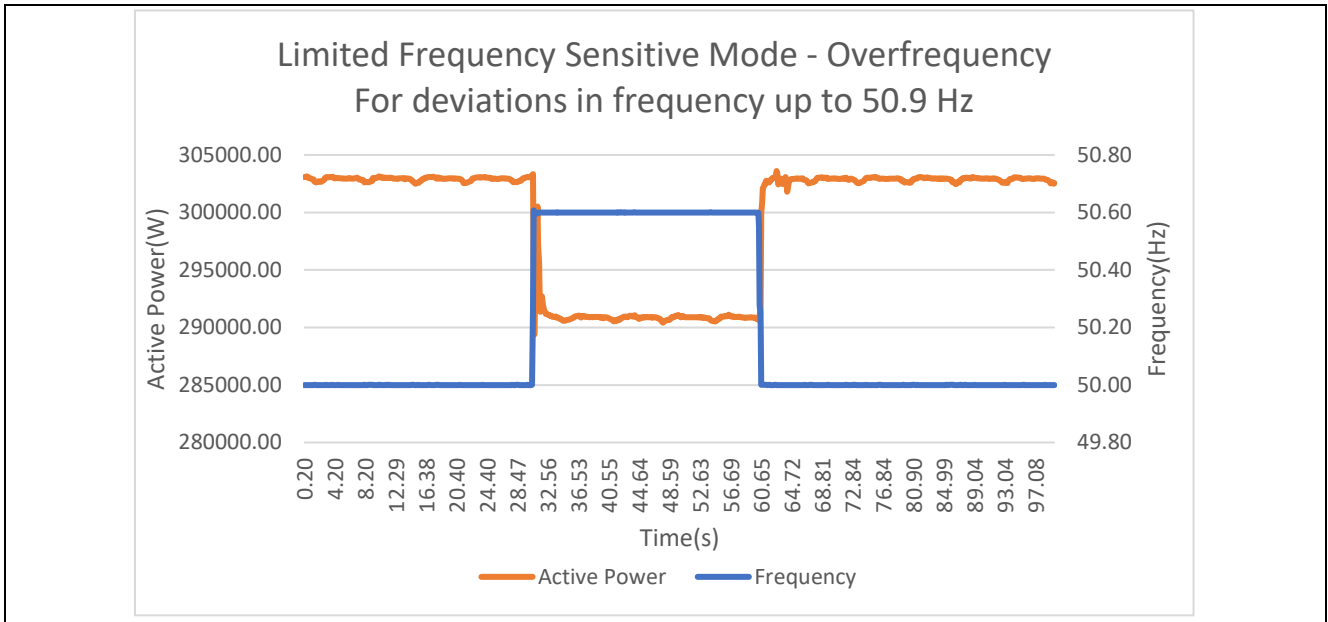
Test sequence at Registered Capacity >80%			P <sub>ref</sub> (W)	300000	
Test sequence	Stay time (s)	Actual frequency (Hz)	Measured Active Power Output (W)	Expected active power (W)	Limit
Step a) 50.00Hz ±0.01Hz	30	50.00	302848.12	--	--
Step b) 50.60Hz ±0.01Hz	--	Responding times (s)			0.235
Step b) 50.60Hz ±0.01Hz	0	50.60	303313.22	--	--
Step b) 50.60Hz ±0.01Hz	10	50.60	292693.61	< 296848.12	--
Step b) 50.60Hz ±0.01Hz	20	50.60	290605.81	290848.12	--
Step b) 50.60Hz ±0.01Hz	30	50.60	290612.04	290848.12	--

When frequency less than 50.4Hz, at least half the increase in Active Power must be achieved in 10 seconds

Test sequence	Stay time after return to 50.00Hz (s)	Actual frequency (Hz)	Measured Active Power Output (W)	Expected active power (W)	Limit
Step g) 50.00Hz ±0.01Hz	30	50.00	290041.22	290848.12	--
Step g) 50.00Hz ±0.01Hz	--	Responding times (s)			0.389
Step g) 50.00Hz ±0.01Hz	40	50.00	302621.44	> 296848.12	--
Step g) 50.00Hz ±0.01Hz	50	50.00	302965.28	296848.12	--
Step g) 50.00Hz ±0.01Hz	60	50.00	302920.84	≈302848.12	--



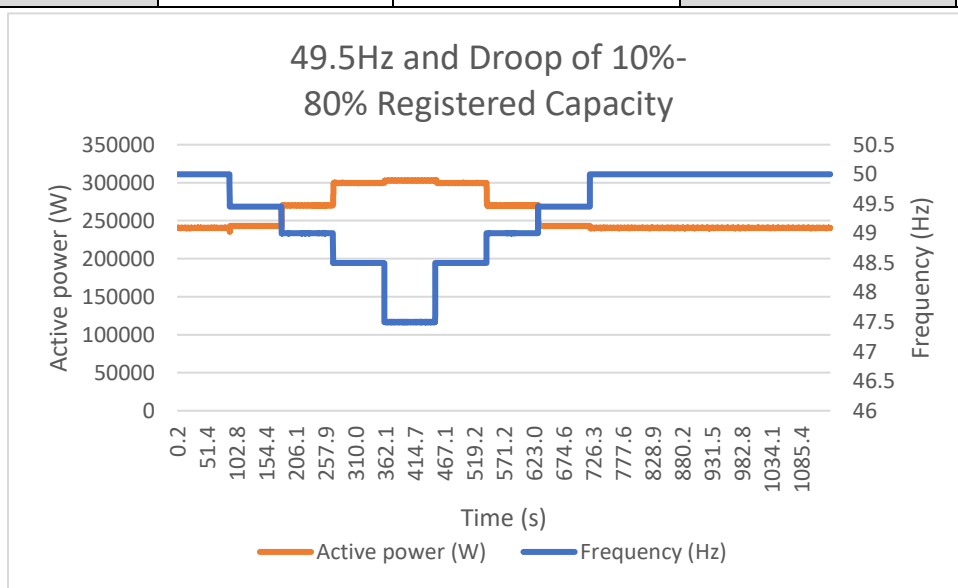
Product Service



**Table: Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)** **P**

DC input power is set to 80% of maximum active output power first. After the **Power Park Modules** step into frequency range under 49.5Hz, the input power is set to 100% of maximum active output. The output active power should regulate the active power with gradient of 20%  $P_{max}/Hz$  (droop=10%) until technical maximum power.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{measure}$ (W)	Expected active out power $P_{shall}$ (W)	Deviation of $P_{measure}$ (W)
1.	50.00	50.00	240556.48	--	--
2.	49.45	49.45	243196.66	243556.48	-359.82
3.	49.00	49.00	270175.81	270556.48	-380.67
4.	48.50	48.50	299727.03	300000.00	-272.97
5.	47.50	47.50	303065.63	300000.00	3065.63
6.	48.50	48.50	299789.91	300000.00	-210.09
7.	49.00	49.00	270342.22	270556.48	-214.26
8.	49.45	49.45	243245.43	243556.48	-311.05
9.	50.00	50.00	240579.89	--	--

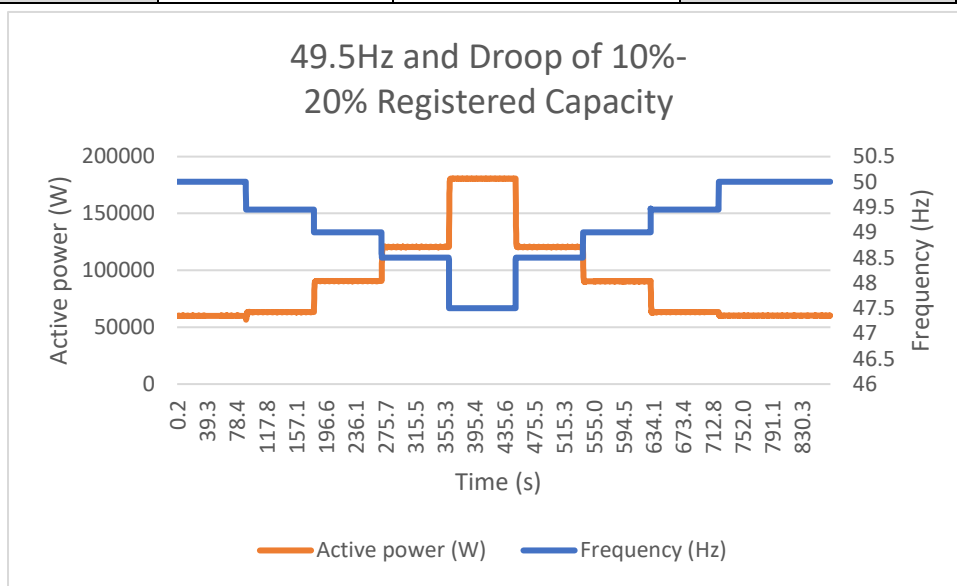


DC input power is set to 20% of maximum active output power first. After the **Power Park Modules** step into frequency range under 49.5Hz, the input power is set to 100% of maximum active output. The output active power should regulate the active power with gradient of 20%  $P_{max}/Hz$  (droop=10%) until technical maximum power.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{measure}$ (W)	Expected active out power $P_{shall}$ (W)	Deviation of $P_{measure}$ and $P_{shall}$ (W)
1.	50.00	50.00	60047.02	60613.13	--



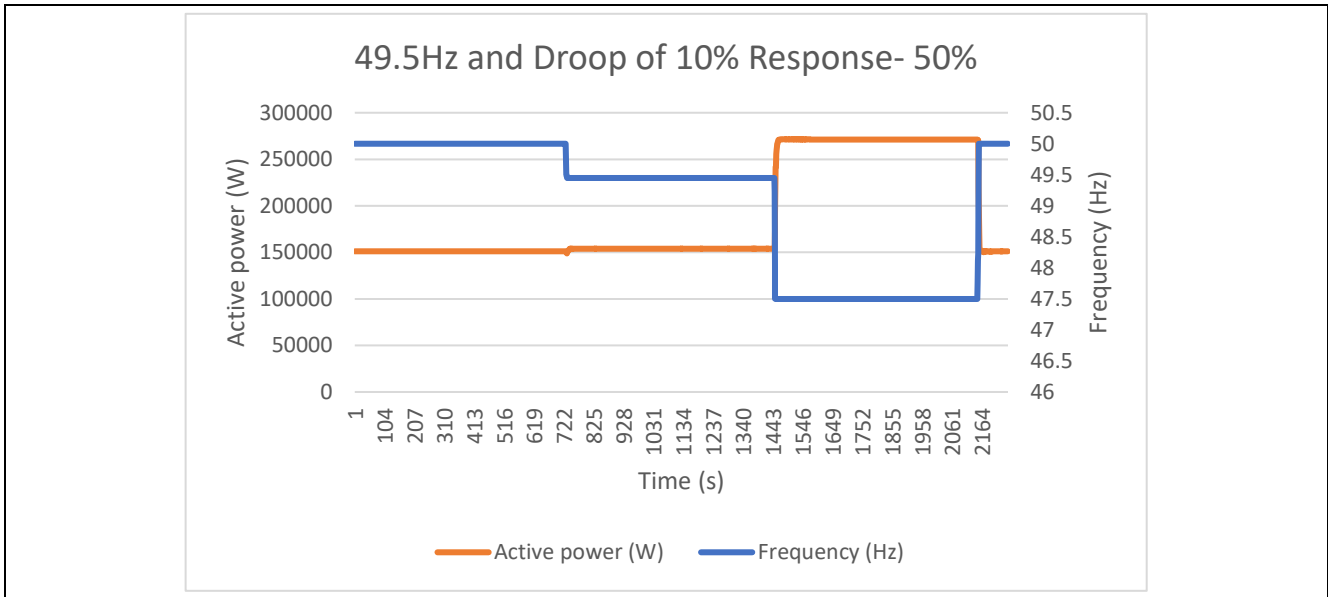
2.	49.45	49.45	63276.55	63047.02	229.53
3.	49.00	49.00	90564.22	90047.02	517.20
4.	48.50	48.50	120557.72	120047.02	510.70
5.	47.50	47.50	180680.49	180047.02	633.47
6.	48.50	48.50	120593.03	120047.02	546.01
7.	49.00	49.00	90500.27	90047.02	453.25
8.	49.45	49.45	63377.43	63047.02	330.41
9.	50.00	50.00	60224.24	--	--



Response time test

DC input power is set to 50% of maximum active output power first. After the **Power Park Modules** step into frequency range under 49.5Hz, the input power is set to 100% of maximum active output.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{measure}$ (W)	Expected active out power $P_{shall}$ (W)	Response time (s)
1	50.00	50.00	151182.22	--	---
2	49.45	49.45	154031.59	154182.22	1.50
3	47.50	47.50	271284.07	271182.22	1.87

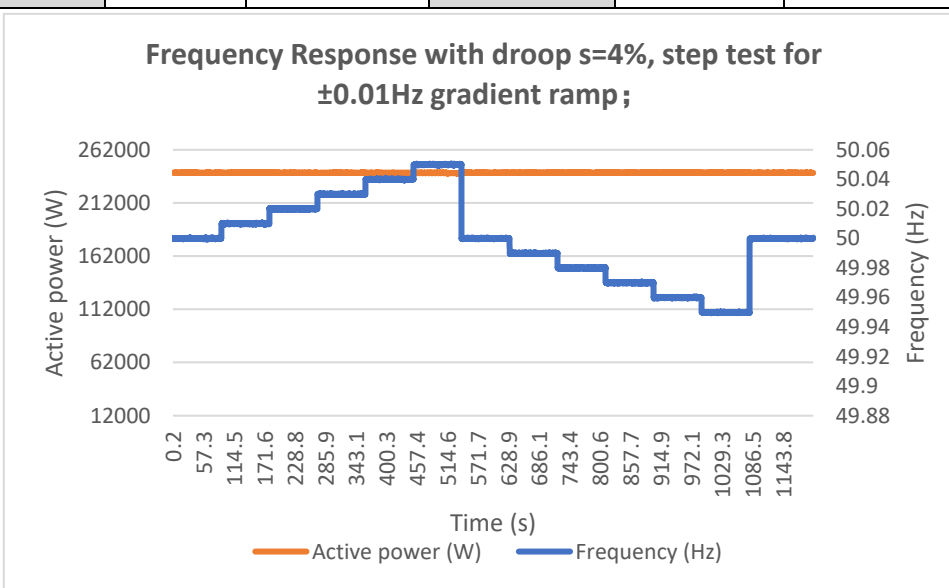




**Table: Frequency Sensitive Mode – (FSM)** **P**

**Frequency Response with droop s=4%, step test for ±0.01Hz gradient ramp**  
 DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

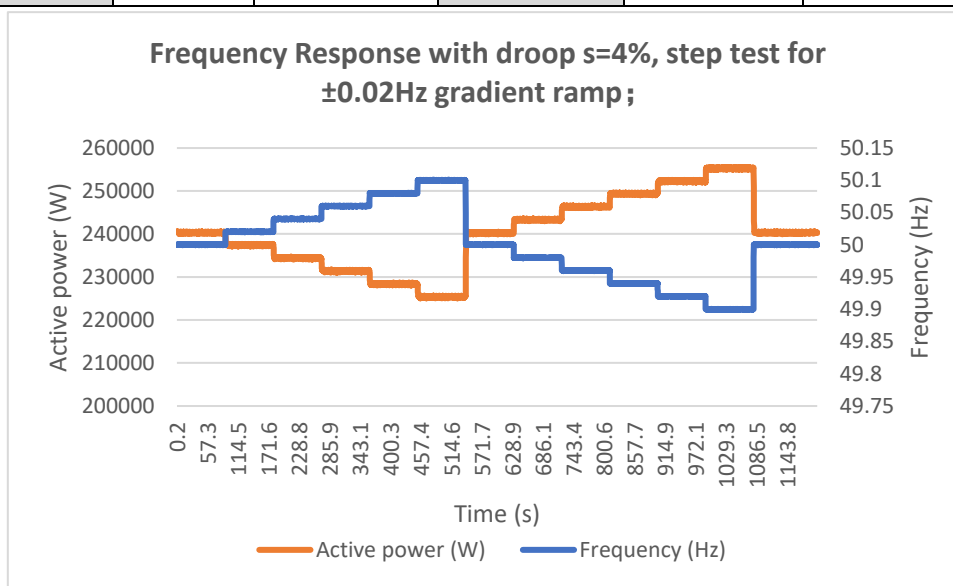
Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power P <sub>measure</sub> (W)	Expected active out power P <sub>shall</sub> (W)	Deviation of P <sub>measure</sub> and P <sub>shall</sub> (W)	Responding times t1 (ms) (Limit: < 2 s)	Reach times t2 (ms) (Limit: < 10 s)
Change the frequency with the step ±0.01Hz, the active power should maintain							
1.	50.00	50.00	240535.22	--	--	--	--
2.	50.01	50.01	240572.60	240535.22	37.38	N/A	N/A
3.	50.02	50.02	240509.66	240535.22	-25.56	N/A	N/A
4.	50.03	50.03	240507.09	240535.22	-28.13	N/A	N/A
5.	50.04	50.04	240526.73	240535.22	-8.49	N/A	N/A
6.	50.05	50.05	240307.86	240535.22	-227.36	N/A	N/A
7.	50.00	50.00	240552.09	240535.22	16.87	N/A	N/A
8.	49.99	49.99	240573.37	240535.22	38.15	N/A	N/A
9.	49.98	49.98	240533.16	240535.22	-2.06	N/A	N/A
10.	49.97	49.97	240501.37	240535.22	-33.85	N/A	N/A
11.	49.96	49.96	240578.40	240535.22	43.18	N/A	N/A
12.	49.95	49.95	240570.93	240535.22	35.71	N/A	N/A
13.	50.00	50.00	240513.68	--	--	N/A	N/A





**Frequency Response with droop s=4%, step test for ±0.02Hz gradient ramp**  
 DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

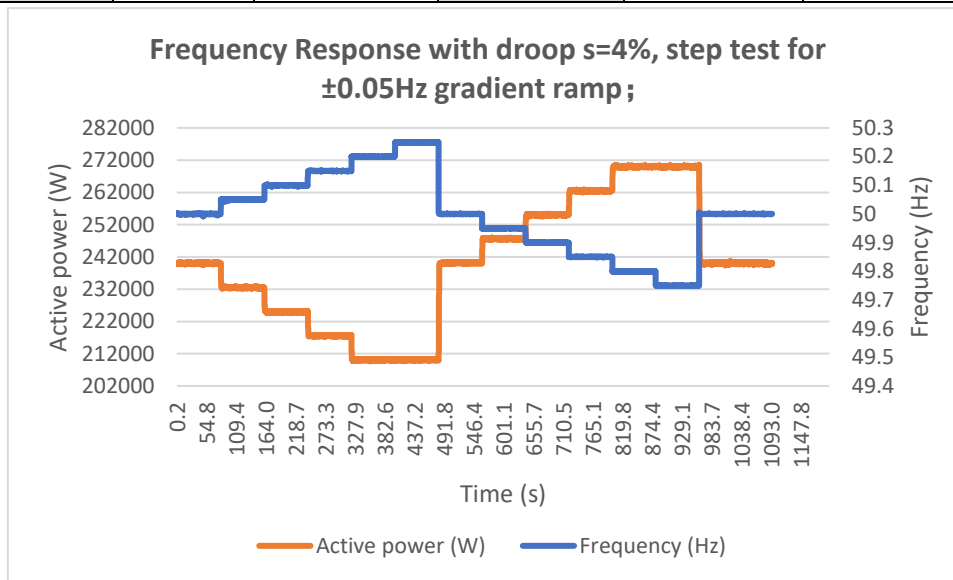
Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power P <sub>measure</sub> (W)	Expected active out power P <sub>shall</sub> (W)	Deviation of P <sub>measure</sub> and P <sub>shall</sub> (W)	Responding times t1 (ms) (Limit: < 2 s)	Reach times t2 (ms) (Limit: < 10 s)
Change the frequency with the step ±0.02Hz, the active power should maintain							
1.	50.00	50.00	240517.33	--	--	--	--
2.	50.02	50.02	237675.89	237517.33	158.56	0.087	0.472
3.	50.04	50.04	234688.09	234517.33	170.76	0.137	0.411
4.	50.06	50.06	231615.50	231517.33	98.17	0.121	0.288
5.	50.08	50.08	228609.94	228517.33	92.61	0.071	0.522
6.	50.10	50.10	225579.31	225517.33	61.98	0.082	0.472
7.	50.00	50.00	240472.36	240517.33	-44.97	0.123	0.512
8.	49.98	49.98	243522.73	243517.33	5.40	0.129	1.828
9.	49.96	49.96	246573.64	246517.33	56.31	0.111	0.472
10.	49.94	49.94	249590.08	249517.33	72.75	0.132	0.511
11.	49.92	49.92	252542.95	252517.33	25.62	0.139	0.474
12.	49.90	49.90	255474.30	255517.33	-43.03	0.126	0.582
13.	50.00	50.00	240500.09	240518.33	-18.24	0.093	1.934



**Frequency Response with droop s=4%, step test for ±0.05Hz gradient ramp**  
 DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.



Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times $t_1$ (ms) (Limit: < 2 s)	Reach times $t_2$ (ms) (Limit: < 10 s)
Change the frequency with the step $\pm 0.05\text{Hz}$ , the active power should maintain							
1.	50.00	50.00	240296.23	--	--	--	--
2.	50.05	50.05	232830.51	232796.23	34.28	0.127	0.974
3.	50.10	50.10	225109.64	225296.23	-186.59	0.123	1.022
4.	50.15	50.15	217644.25	217796.23	-151.98	0.152	0.899
5.	50.20	50.20	210192.46	210296.23	-103.77	0.117	0.779
6.	50.25	50.25	210275.95	210296.23	-20.28	0.122	0.942
7.	50.00	50.00	240737.56	240296.23	441.33	0.193	1.270
8.	49.95	49.95	247730.37	247796.23	-65.86	0.217	0.877
9.	49.90	49.90	255208.16	255296.23	-88.07	0.113	0.776
10.	49.85	49.85	262747.13	262796.23	-49.10	0.143	0.873
11.	49.80	49.80	270303.44	270296.23	7.21	0.115	0.921
12.	49.75	49.75	270180.36	270296.23	-115.87	0.128	0.989
13.	50.00	50.00	240279.56	240296.23	-16.67	0.125	1.197



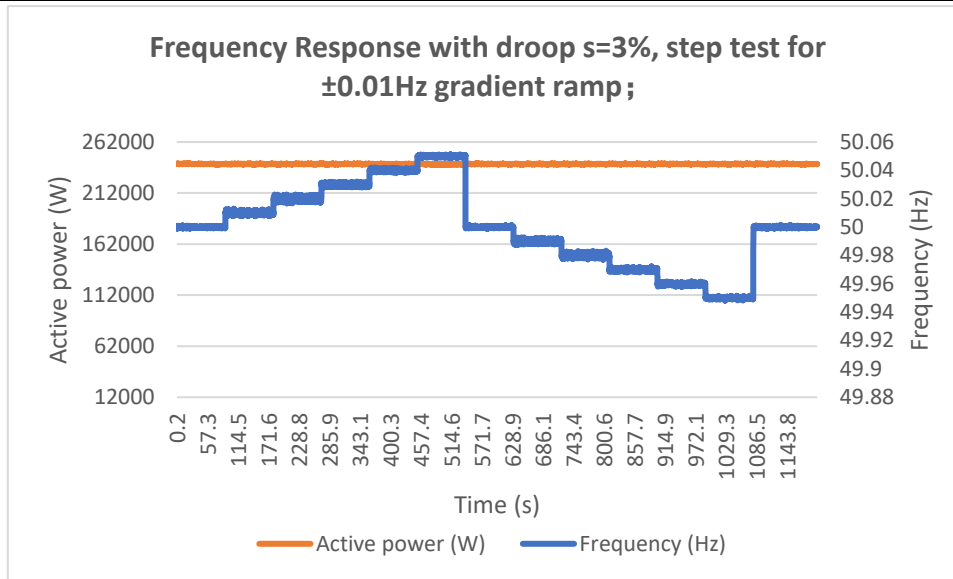
**Frequency Response with droop s=3%, step test for  $\pm 0.01\text{Hz}$  gradient ramp**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times $t_1$ (ms) (Limit: < 2 s)	Reach times $t_2$ (ms) (Limit: < 10 s)
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							s)
Change the frequency with the step $\pm 0.01\text{Hz}$ , the active power should maintain							
1.	50.00	50.00	240652.96	--	--	--	--
2.	50.01	50.01	240540.33	240652.96	-112.63	N/A	N/A
3.	50.02	50.02	240651.29	240652.96	-1.67	N/A	N/A
4.	50.03	50.03	240559.67	240652.96	-93.29	N/A	N/A
5.	50.04	50.04	240404.22	240652.96	-248.74	N/A	N/A
6.	50.05	50.05	240196.16	240652.96	-456.80	N/A	N/A
7.	50.00	50.00	240545.11	240652.96	-107.85	N/A	N/A
8.	49.99	49.99	240624.23	240652.96	-28.73	N/A	N/A
9.	49.98	49.98	240525.62	240652.96	-127.34	N/A	N/A
10.	49.97	49.97	240474.36	240652.96	-178.60	N/A	N/A
11.	49.96	49.96	240490.66	240652.96	-162.30	N/A	N/A
12.	49.95	49.95	240595.82	240652.96	-57.14	N/A	N/A
13.	50.00	50.00	240581.26	240652.96	-71.70	N/A	N/A



**Frequency Response with droop  $s=3\%$ , step test for  $\pm 0.02\text{Hz}$  gradient ramp**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

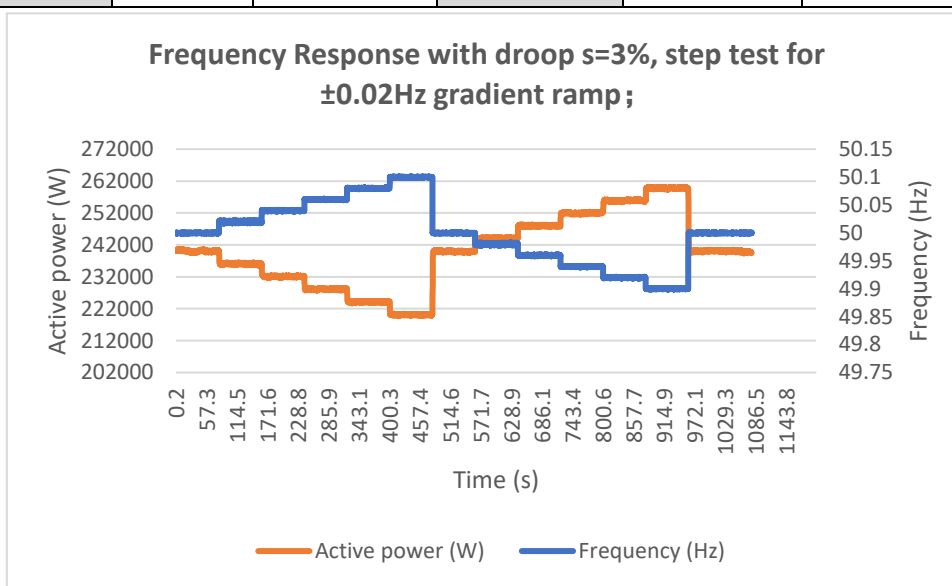
Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times $t_1$ (ms) (Limit: < 2 s)	Reach times $t_2$ (ms) (Limit: < 10 s)
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Change the frequency with the step  $\pm 0.02\text{Hz}$ , the active power should maintain

1.	50.00	50.00	240340.53	--	--	--	--
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2.	50.02	50.02	236306.44	236340.53	-34.09	0.087	1.089
3.	50.04	50.04	232381.55	232340.53	41.02	0.112	0.974
4.	50.06	50.06	228481.02	228340.53	140.49	0.102	0.804
5.	50.08	50.08	224332.08	224340.53	-8.45	0.089	0.770
6.	50.10	50.10	220282.73	220340.53	-57.80	0.095	0.954
7.	50.00	50.00	240117.33	240340.53	-223.20	0.118	1.105
8.	49.98	49.98	244235.46	244340.53	-105.07	0.117	0.871
9.	49.96	49.96	248049.32	248340.53	-291.21	0.125	0.834
10.	49.94	49.94	252070.94	252340.53	-269.59	0.110	0.879
11.	49.92	49.92	255888.09	256340.53	-452.44	0.138	0.794
12.	49.90	49.90	260049.57	260340.53	-290.96	0.108	0.786
13.	50.00	50.00	240467.29	240340.53	126.76	0.121	1.229



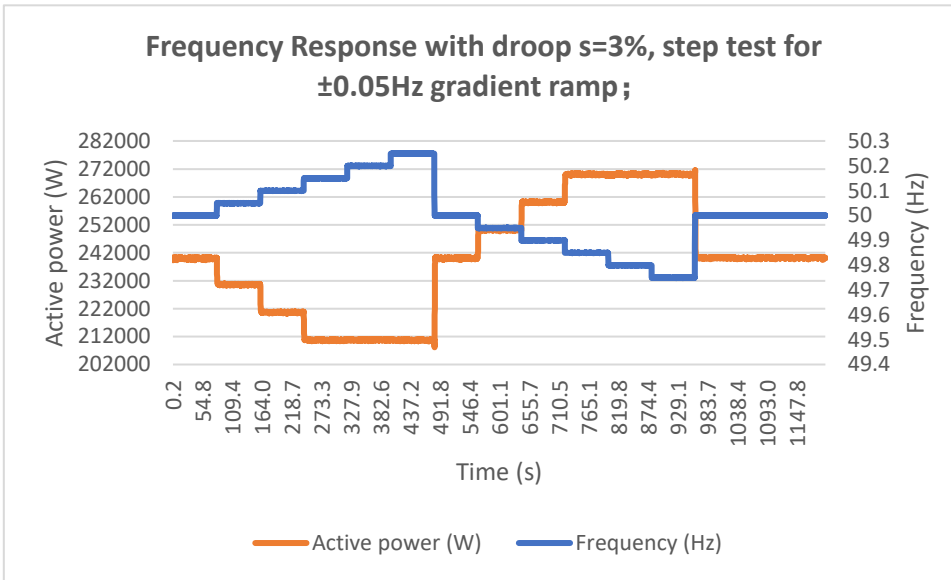
**Frequency Response with droop s=3%, step test for ±0.05Hz gradient ramp.**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power P <sub>measure</sub> (W)	Expected active out power P <sub>shall</sub> (W)	Deviation of P <sub>measure</sub> and P <sub>shall</sub> (W)	Responding times t1 (ms) (Limit: < 2 s)	Reach times t2 (ms) (Limit: < 10 s)
Change the frequency with the step ±0.05Hz, the active power should maintain							
1.	50.00	50.00	240329.66	--	--	--	--
2.	50.05	50.05	230782.94	230329.66	453.28	0.125	0.834
3.	50.10	50.10	220842.36	220329.66	512.70	0.110	0.879



4.	50.15	50.15	210944.62	210329.66	614.96	0.138	0.794
5.	50.20	50.20	211035.09	210329.66	705.43	0.121	0.899
6.	50.25	50.25	210827.66	210329.66	498.00	0.115	0.974
7.	50.00	50.00	240126.33	240329.66	-203.33	0.127	1.262
8.	49.95	49.95	250519.30	250329.66	189.64	0.113	0.776
9.	49.90	49.90	260153.60	260329.66	-176.06	0.143	0.873
10.	49.85	49.85	270253.93	270329.66	-75.73	0.115	0.921
11.	49.80	49.80	270324.19	270329.66	-5.47	0.131	0.864
12.	49.75	49.75	270455.36	270329.66	125.70	0.126	0.915
13.	50.00	50.00	240360.65	240329.66	30.99	0.104	1.179



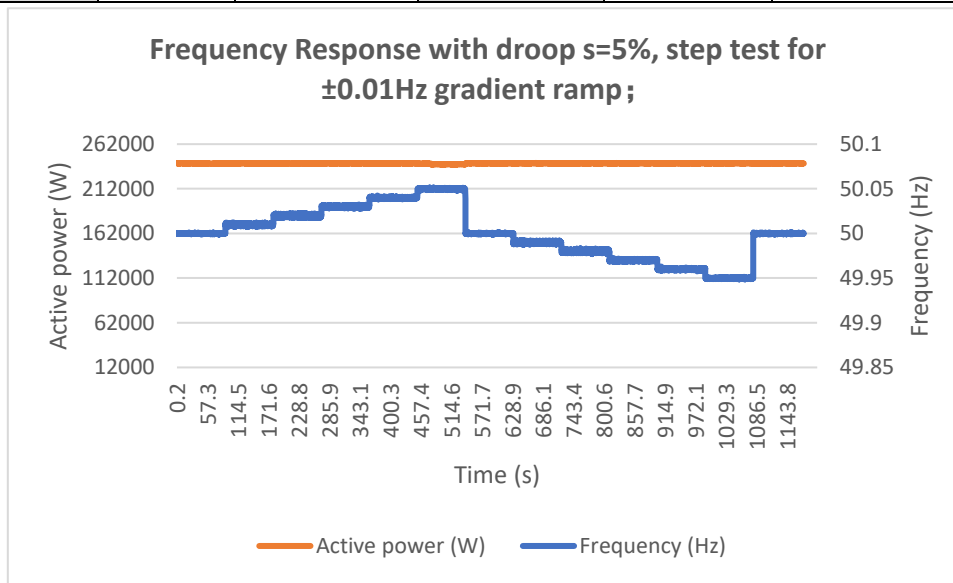
**Frequency Response with droop s=5%, step test for  $\pm 0.01\text{Hz}$  gradient ramp**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times t1 (ms) (Limit: < 2 s)	Reach times t2 (ms) (Limit: < 10 s)
Change the frequency with the step $\pm 0.01\text{Hz}$ , the active power should maintain							
1.	50.00	50.00	240623.63	--	--	--	--
2.	50.01	50.01	240484.90	240623.63	-50.32	N/A	N/A
3.	50.02	50.02	240566.06	240623.63	30.84	N/A	N/A
4.	50.03	50.03	240564.93	240623.63	29.71	N/A	N/A
5.	50.04	50.04	240451.86	240623.63	-83.36	N/A	N/A
6.	50.05	50.05	240198.39	240623.63	-336.83	N/A	N/A



7.	50.00	50.00	240585.60	240623.63	50.38	N/A	N/A
8.	49.99	49.99	240563.77	240623.63	28.55	N/A	N/A
9.	49.98	49.98	240486.33	240623.63	-48.89	N/A	N/A
10.	49.97	49.97	240622.11	240623.63	86.89	N/A	N/A
11.	49.96	49.96	240432.67	240623.63	-102.55	N/A	N/A
12.	49.95	49.95	240422.15	240623.63	-113.07	N/A	N/A
13.	50.00	50.00	240609.50	240623.63	74.28	N/A	N/A



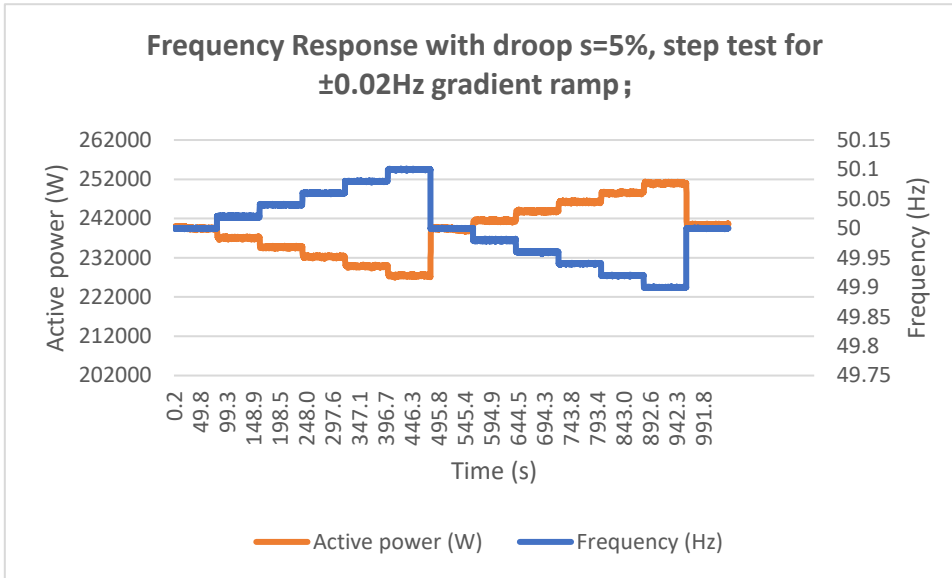
**Frequency Response with droop s=5%, step test for ±0.02Hz gradient ramp**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power P <sub>measure</sub> (W)	Expected active out power P <sub>shall</sub> (W)	Deviation of P <sub>measure</sub> and P <sub>shall</sub> (W)	Responding times t1 (ms) (Limit: < 2 s)	Reach times t2 (ms) (Limit: < 10 s)
Change the frequency with the step ±0.02Hz, the active power should maintain							
1.	50.00	50.00	240092.33	--	--	--	--
2.	50.02	50.02	237292.43	237692.33	-399.90	0.113	0.776
3.	50.04	50.04	234992.13	235292.33	-300.20	0.143	0.873
4.	50.06	50.06	232469.57	232892.33	-422.76	0.115	0.921
5.	50.08	50.08	230105.66	230492.33	-386.67	0.128	0.989
6.	50.10	50.10	227769.84	228092.33	-322.49	0.207	0.977
7.	50.00	50.00	239704.06	240092.33	-388.27	0.164	1.185
8.	49.98	49.98	241619.30	242492.33	-873.03	0.117	0.871
9.	49.96	49.96	244016.08	244892.33	-876.25	0.125	0.834



10.	49.94	49.94	246513.60	247292.33	-778.73	0.110	0.879
11.	49.92	49.92	248717.96	249692.33	-974.37	0.138	0.794
12.	49.90	49.90	251383.39	252092.33	-708.94	0.108	0.786
13.	50.00	50.00	240614.06	240092.33	521.73	0.116	1.256



**Frequency Response with droop s=5%, step test for  $\pm 0.05\text{Hz}$  gradient ramp**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

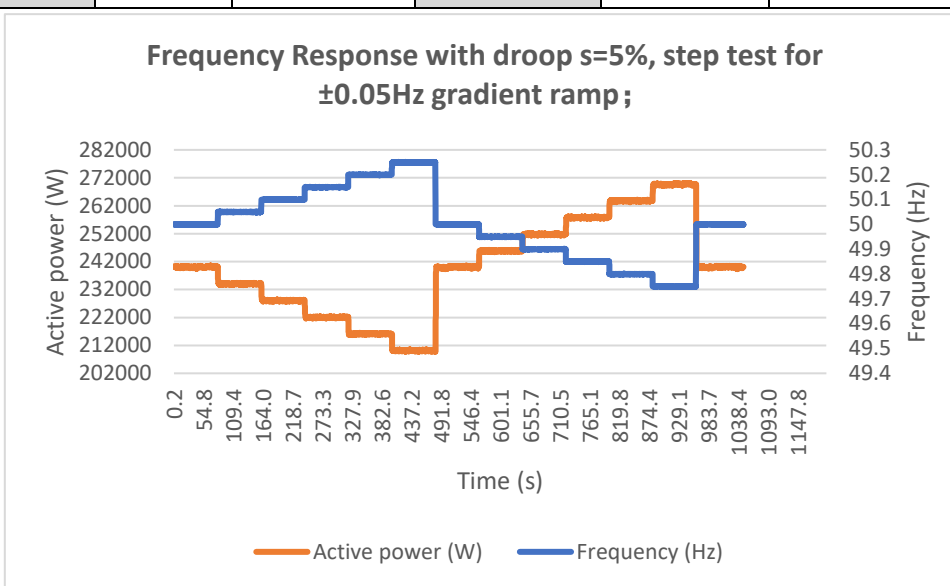
Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times t1 (ms) (Limit: < 2 s)	Reach times t2 (ms) (Limit: < 10 s)
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Change the frequency with the step  $\pm 0.05\text{Hz}$ , the active power should maintain

1.	50.00	50.00	240254.36	--	--	--	--
2.	50.05	50.05	234408.70	234092.33	316.37	0.125	0.834
3.	50.10	50.10	228248.76	228092.33	156.43	0.110	0.879
4.	50.15	50.15	222245.30	222092.33	152.97	0.138	0.794
5.	50.20	50.20	216328.01	216092.33	235.68	0.121	0.899
6.	50.25	50.25	210141.70	210092.33	49.37	0.108	0.994
7.	50.00	50.00	240201.73	240092.33	109.40	0.124	1.023
8.	49.95	49.95	246011.09	246092.33	-81.24	0.127	0.974
9.	49.90	49.90	251888.00	252092.33	-204.33	0.123	1.022
10.	49.85	49.85	258095.36	258092.33	3.03	0.152	0.899
11.	49.80	49.80	263844.73	264092.33	-247.60	0.117	0.779
12.	49.75	49.75	269826.33	270092.33	-266.00	0.115	0.842



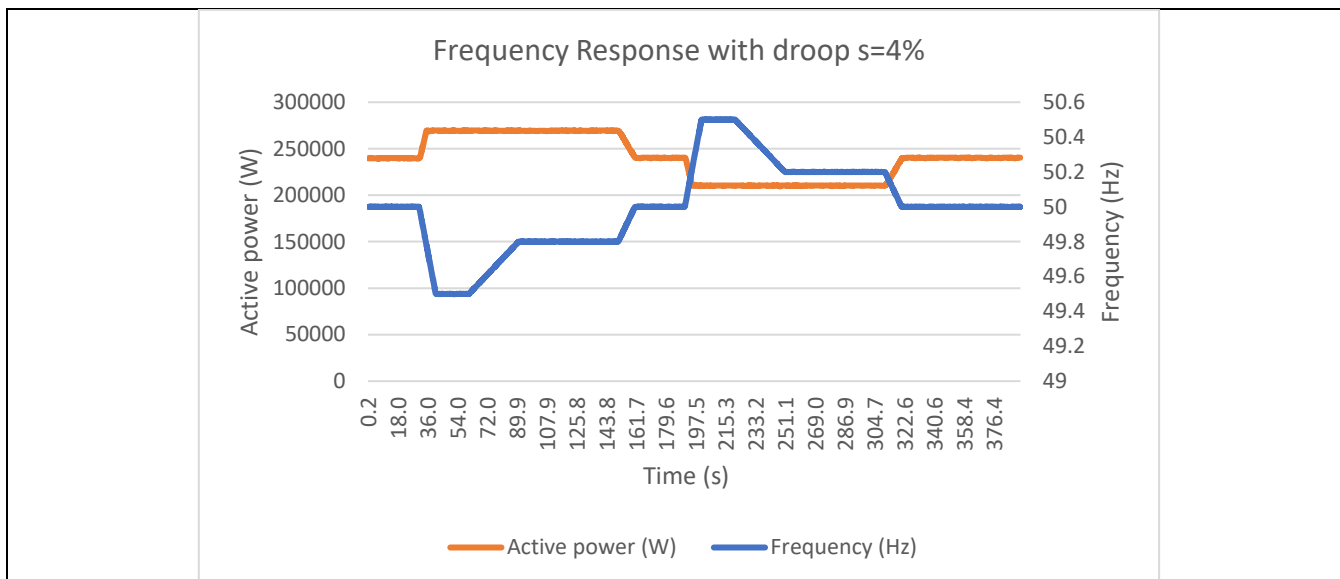
13.	50.00	50.00	240350.77	240092.33	258.44	0.130	1.227
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**Frequency Response with droop s=4%**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

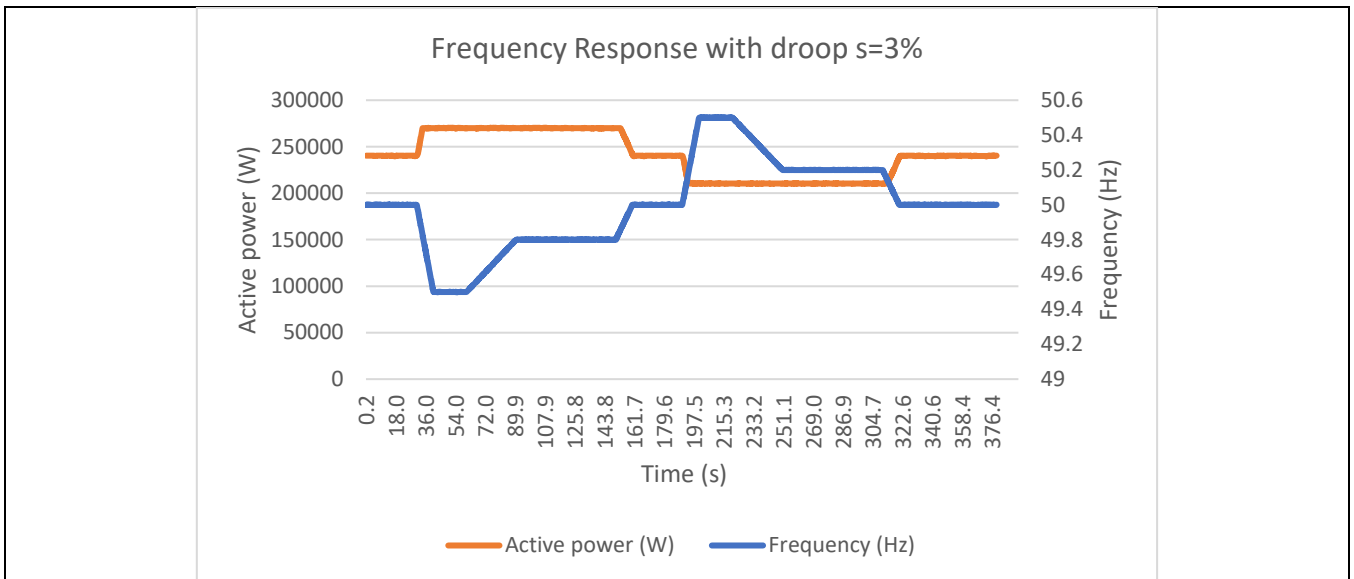
Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times t1 (s) (Limit: < 2 s)	Reach times t2 (s) (Limit: < 10 s)
1.	50.00	50.00	240026.23	--	--	--	--
Reduce the frequency from 50.00 Hz to 49.50 Hz with step 0.05Hz/s in 10 second, then stay for 20 second							
2.	49.50	49.50	269557.10	270026.23	-469.13	0.10	1.58
Increase the frequency from 49.50 Hz to 49.80 Hz with step 0.01Hz/s in 30 second, then stay for 60 second							
3.	49.80	49.80	269345.16	270026.23	-681.07	N/A	N/A
Increase the frequency from 49.80 Hz to 50.00 Hz with step 0.02Hz/s in 10 second, then stay for 30 second							
4.	50.00	50.00	240280.29	240026.23	254.06	0.09	1.32
Increase the frequency from 50.00 Hz to 50.50 Hz with step 0.05Hz/s in 10 second, then stay for 20 second							
5.	50.50	50.50	210412.13	210026.23	385.90	0.14	1.17
Reduce the frequency from 50.50 Hz to 50.20 Hz with step 0.01Hz/s in 30 second, then stay for 60 second							
6.	50.20	50.20	210400.13	210026.23	373.90	N/A	N/A
Reduce the frequency from 50.20 Hz to 50.00 Hz with step 0.02Hz/s in 10 second, then stay for 30 second							
7.	50.00	50.00	240346.83	240026.23	320.60	0.11	1.62



### Frequency Response with droop s=3%

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times t1 (s) (Limit: < 2 s)	Reach times t2 (s) (Limit: < 10 s)
1.	50.00	50.00	240525.03	--	--	--	--
Reduce the frequency from 50.00 Hz to 49.50 Hz with step 0.05Hz/s in 10 second, then stay for 20 second							
2.	49.50	49.50	270197.63	270525.03	-327.40	0.09	0.84
Increase the frequency from 49.50 Hz to 49.80 Hz with step 0.01Hz/s in 30 second, then stay for 60 second							
3.	49.80	49.80	270034.56	270525.03	-490.47	N/A	N/A
Increase the frequency from 49.80 Hz to 50.00 Hz with step 0.02Hz/s in 10 second, then stay for 30 second							
4.	50.00	50.00	240394.15	240525.03	-130.88	0.06	1.64
Increase the frequency from 50.00 Hz to 50.50 Hz with step 0.05Hz/s in 10 second, then stay for 20 second							
5.	50.50	50.50	210477.38	210525.03	-47.65	0.29	1.31
Reduce the frequency from 50.50 Hz to 50.20 Hz with step 0.01Hz/s in 30 second, then stay for 60 second							
6.	50.20	50.20	210548.94	210525.03	23.91	N/A	N/A
Reduce the frequency from 50.20 Hz to 50.00 Hz with step 0.02Hz/s in 10 second, then stay for 30 second							
7.	50.00	50.00	240243.11	240525.03	-281.92	0.09	1.05



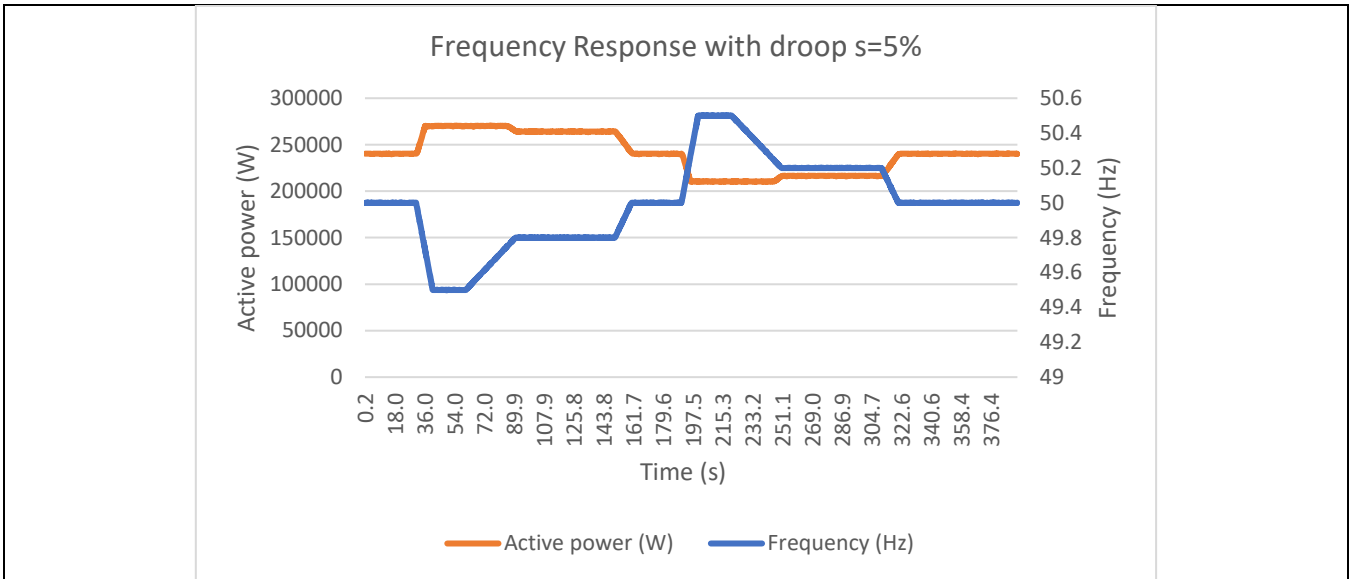
**Frequency Response with droop s=5%**

DC input power is set to 80% of maximum active output power first. After open the Frequency Sensitive Mode – (FSM) function, the input power is set to 100% of maximum active output.

Test sequence	Frequency (Hz)	Actual frequency (Hz)	Measured active output power $P_{\text{measure}}$ (W)	Expected active out power $P_{\text{shall}}$ (W)	Deviation of $P_{\text{measure}}$ and $P_{\text{shall}}$ (W)	Responding times t1 (s) (Limit: < 2 s)	Reach times t2 (s) (Limit: < 10 s)
1.	50.00	50.00	240249.66	--	--	--	--
Reduce the frequency from 50.00 Hz to 49.50 Hz with step 0.05Hz/s in 10 second, then stay for 20 second							
2.	49.50	49.50	270264.15	270249.66	14.49	0.09	1.13
Increase the frequency from 49.50 Hz to 49.80 Hz with step 0.01Hz/s in 30 second, then stay for 60 second							
3.	49.80	49.80	264348.93	264249.66	99.27	0.12	1.79
Increase the frequency from 49.80 Hz to 50.00 Hz with step 0.02Hz/s in 10 second, then stay for 30 second							
4.	50.00	50.00	240354.46	240249.66	104.80	0.14	1.24
Increase the frequency from 50.00 Hz to 50.50 Hz with step 0.05Hz/s in 10 second, then stay for 20 second							
5.	50.50	50.50	210595.17	210249.66	345.51	0.08	1.42
Reduce the frequency from 50.50 Hz to 50.20 Hz with step 0.01Hz/s in 30 second, then stay for 60 second							
6.	50.20	50.20	216583.40	216249.66	333.74	0.06	1.75
Reduce the frequency from 50.20 Hz to 50.00 Hz with step 0.02Hz/s in 10 second, then stay for 30 second							
7.	50.00	50.00	240362.76	240249.66	113.10	0.11	1.43



Product Service



The software setting droop can be set to 3%.



The software setting droop can be set to 5%.





Table: Protection – Re-connection timer					P
For <b>Type A, Type B and Type C</b> Power Generating Modules intend to connected to <b>HV</b> , and <b>Type D</b> Power generating modules					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of Table 10.1.			
20 s	See below	At 1.12 Un L – L (896 V)	At 0.78 Un L – L (624 V)	At 47.4 Hz	At 52.1 Hz
Confirmation that the <b>Power Generating Module</b> does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection
		At 1.08 Un L – L (864 V)	At 0.82 Un L – L (656 V)	At 47.6 Hz	At 51.9 Hz
Confirmation that the <b>Power Generating Module</b> Shall re-connect.		62.1 s	62.2 s	63.1 s	62.9 s

Table: Fault Level Contribution						P
For <b>Inverter</b> output						
Time after fault	Volts (V)			Amps (A)		
	L1-L2	L2-L3	L3-L1	L1-L2	L2-L3	L3-L1
20ms	0	0	0	38.32	39.33	38.21
100ms	0	0	0	0	0	0
250ms	0	0	0	0	0	0
500ms	0	0	0	0	0	0
Time to trip	68 ms			In seconds		



<b>Table: Self-monitoring Solid State Switch</b>	<b>N/A</b>
Whether the Power Park Modules include solid state switching devices ?	N/A
It has been verified that in the event of the solid state switching device failing to disconnect the Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 s.	N/A
Time of power park modules reduce its output power to 50volts after the switch device disconnect	N/A
Note: This test does not apply because the manufacturer selected the relay as the inverter disconnect device, there are not solid-state switching devices.	

<b>Table: Wring functional tests</b>	<b>N/A</b>
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning)	N/A
Note: This test does not apply because connectors were designed error-proof connectors.	

<b>Table: Logic interface (input port)</b>	<b>P</b>
Confirm that an input port is provided and can be used to shut down the module	Yes
Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal (the additional comments box below can be used)	N/A
Time of logic interface to shut down the module	132.2 ms

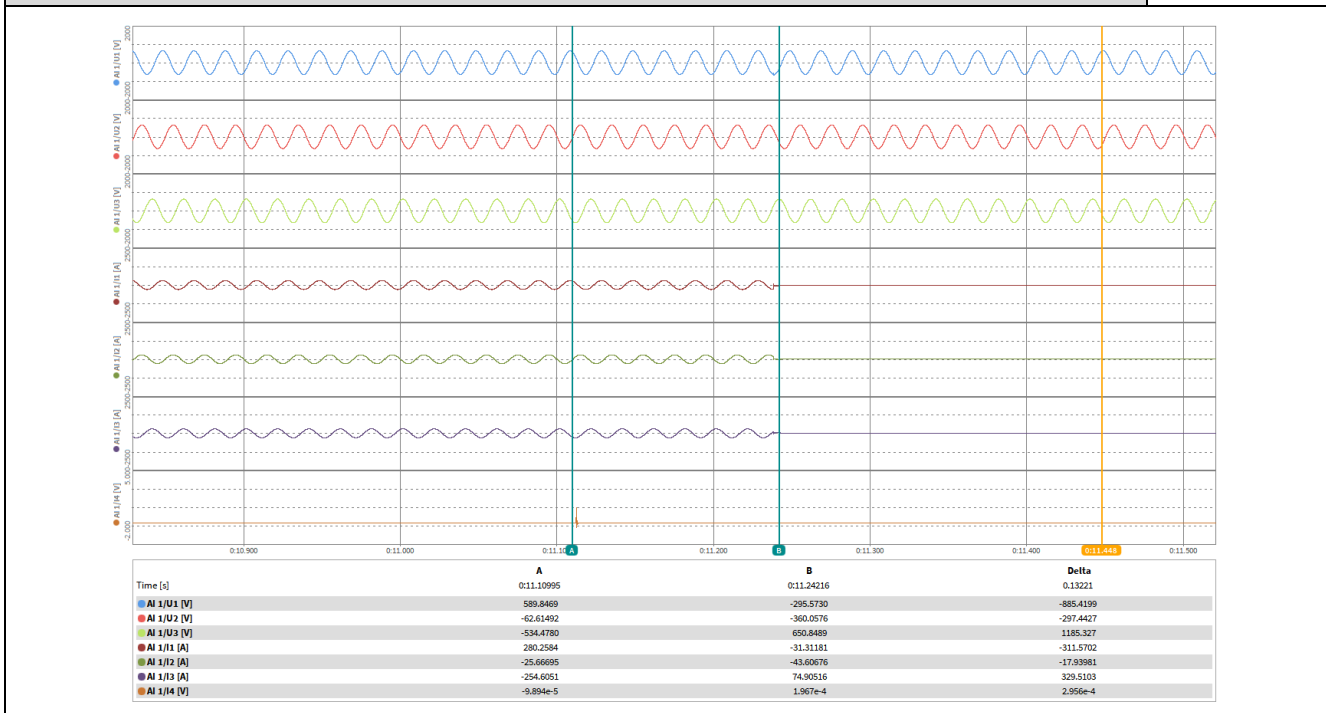




Table: Communication interface											P
Confirm that an input port is provided and Confirm the Active Power set point can be adjusted in accordance with instructions issued by the DNO											Yes
P/ P <sub>max</sub> (%)	100	90	80	70	60	50	40	30	20	10	0
Setting value(kW)	300.00	270.00	240.00	210.00	180.00	150.00	120.00	90.00	60.00	30.00	0.00
Measured value(kW)	302.61	270.26	240.43	210.48	180.41	150.39	120.25	90.08	59.99	29.75	-0.34

Power control curve:

Time (s)	Active Power (W)
0	300000
33	300000
66	270000
99	270000
132	240000
165	240000
198	210000
231	210000
264	180000
297	180000
330	150000
363	150000
396	120000
429	120000
462	90000
495	90000
528	60000
561	60000
594	30000
627	30000
660	0
693	0
726	0
759	0
792	0

Table: Fault Ride Through and Phase Voltage Unbalance			P
Test condition / installation			
Test number	Ratio of fault voltage to rated voltage (U/Un)	Fault duration (ms)	
1	≤0.10	≥ 140	
2	0.50-0.55	≥ 1376	
3	0.75-0.85	≥ 2200	
4	0.86-0.90	≥ 180000	

Test	Voltage during fault	Phase fault type	Fault duration	Load	Cosφ setting	Test Number



1	≤0.10	3 phase	≥ 140 ms	Full load	1	1.1.1.a
		2 phase		Partial load	1	1.1.2.a
				Full load	1	1.2.1.a
		Partial load		1	1.2.2.a	
Test	Voltage during fault	Phase fault type	Fault duration	Load	Cosφ setting	Test Number
2	0.50-0.55	3 phase	≥ 1472 ms	Full load	1	2.1.1.a
				Full load	Qmin	2.1.1.b
				Partial load	1	2.1.2.a
				Partial load	Qmin	2.1.2.b
		2 phase		Full load	1	2.2.1.a
				Full load	Qmax	2.2.1.b
				Partial load	1	2.2.2.a
				Partial load	Qmax	2.2.2.b
Test	Voltage during fault	Phase fault type	Fault duration	Load	Cosφ setting	Test Number
3	0.75-0.85	3 phase	≥ 2200 ms	Full load	1	3.1.1.a
		2 phase		Partial load	1	3.1.2.a
				Full load	1	3.2.1.a
		Partial load		1	3.2.2.a	
Test	Voltage during fault	Phase fault type	Fault duration	Load	Cosφ setting	Test Number
4	0.85-0.90	3 phase	≥ 180000 ms	Full load	1	4.1.1.a
		2 phase		Partial load	1	4.1.2.a
				Full load	1	4.2.1.a
		Partial load		1	4.2.2.a	

**Test Record/Data**

Test Number	1.1.1a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	1.1.1a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26



	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	16060.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	16216.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	141.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.973
	17		Neg. seq.		[p.u.]	N/A
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000
	25		Pos. seq.	t1-1s to t1	[p.u.]	1.000
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.009
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.002
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.002
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	1.009
	32	Active power	Total	t1-10s to t1	[p.u.]	1.008
	33		Total	t1-2s to t1	[p.u.]	1.008
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.008
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.002



t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	30.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	30.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.027
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.951
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	1.008
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.008
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.009
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	253.439
	52		Phase 2	t1+10ms	[A]	230.938
	53		Phase 3	t1+10ms	[A]	228.225
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	237.970
	55		Phase 2	t1 to t1+20ms	[A]	232.170
	56		Phase 3	t1 to t1+20ms	[A]	229.890
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	237.845



	55		Phase 2	t1 to t1+20ms	[A]	232.173
	56		Phase 3	t1 to t1+20ms	[A]	226.844
	57		Phase 1	t1 to t1+100ms	[A]	237.845
	58		Phase 2	t1 to t1+100ms	[A]	232.173
	59		Phase 3	t1 to t1+100ms	[A]	229.893
	60		Phase 1	t1+150ms	[A]	N/A
	61		Phase 2	t1+150ms	[A]	N/A
	62		Phase 3	t1+150ms	[A]	N/A
	63		Phase 1	t1+300ms	[A]	N/A
	64		Phase 2	t1+300ms	[A]	N/A
	65		Phase 3	t1+300ms	[A]	N/A
	66		Phase 1	t1+500ms	[A]	N/A
	67		Phase 2	t1+500ms	[A]	N/A
	68		Phase 3	t1+500ms	[A]	N/A
	69		Phase 1	t1+1000ms	[A]	N/A
	70		Phase 2	t1+1000ms	[A]	N/A
	71		Phase 3	t1+1000ms	[A]	N/A
	72		Phase 1	t2-20ms	[A]	224.664
	73		Phase 2	t2-20ms	[A]	220.939
	74		Phase 3	t2-20ms	[A]	224.369
After t2	75	Active power	Total	t2+5s	[p.u.]	1.009

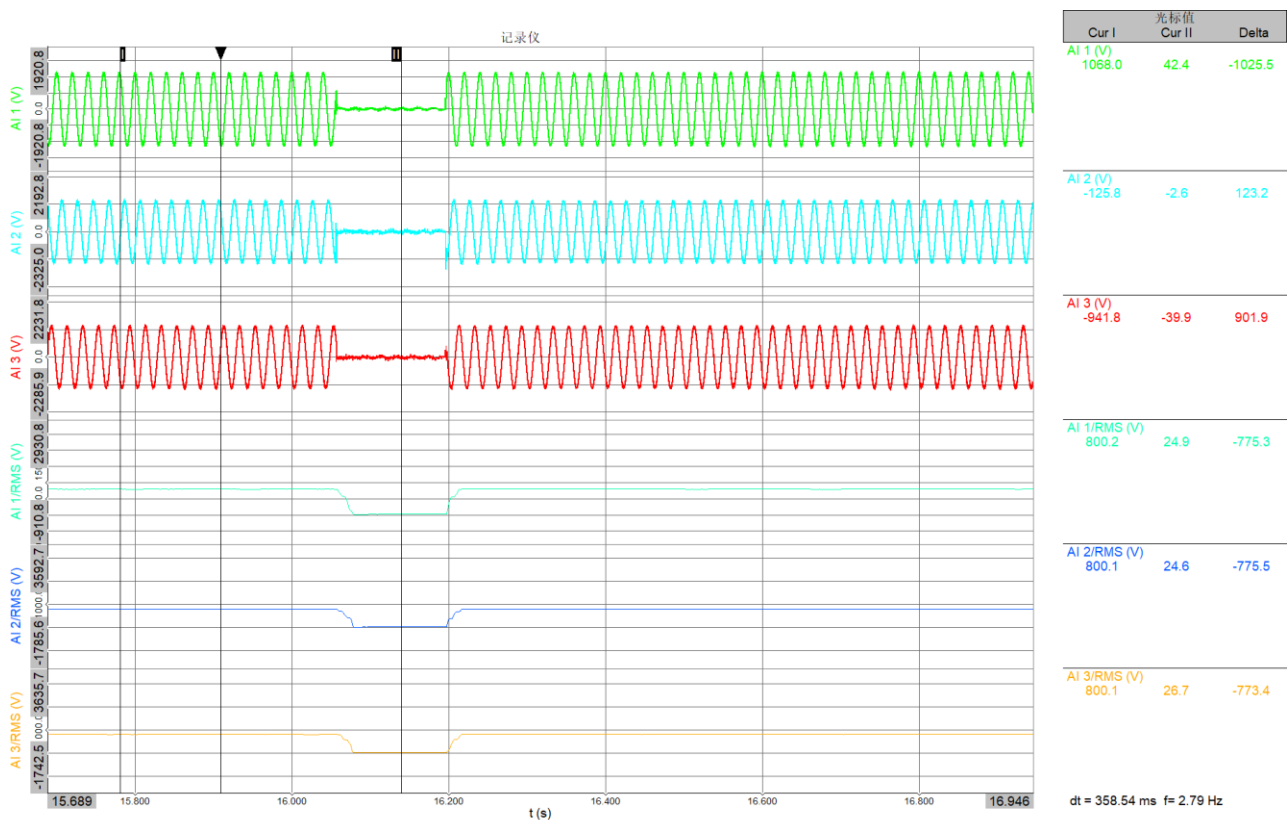


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	76		Total	t2+1s to t2+10s	[p.u.]	1.009
	77		Total	t2+10s	[p.u.]	1.009
	78	Active current rise time	Pos. seq.	-	[ms]	384.000

Graphic:

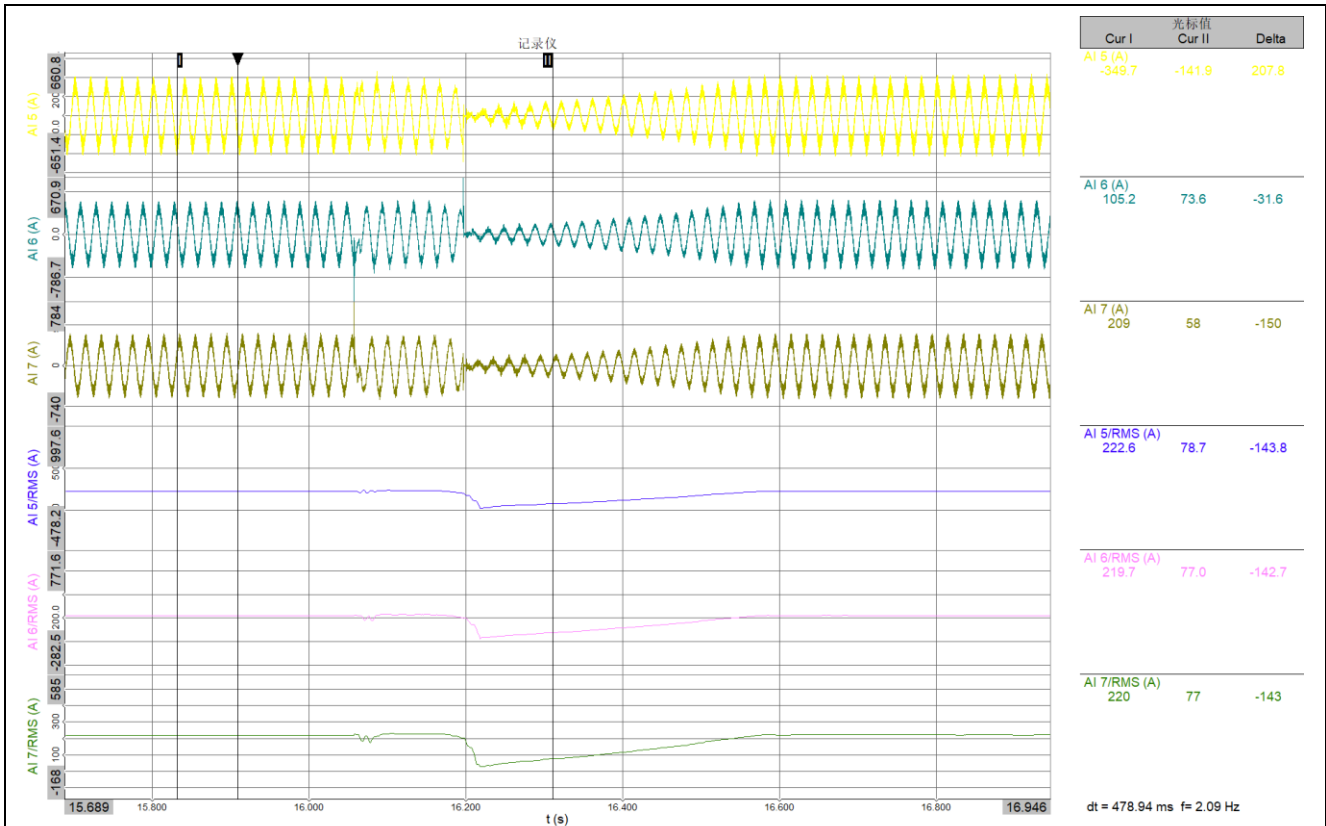
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



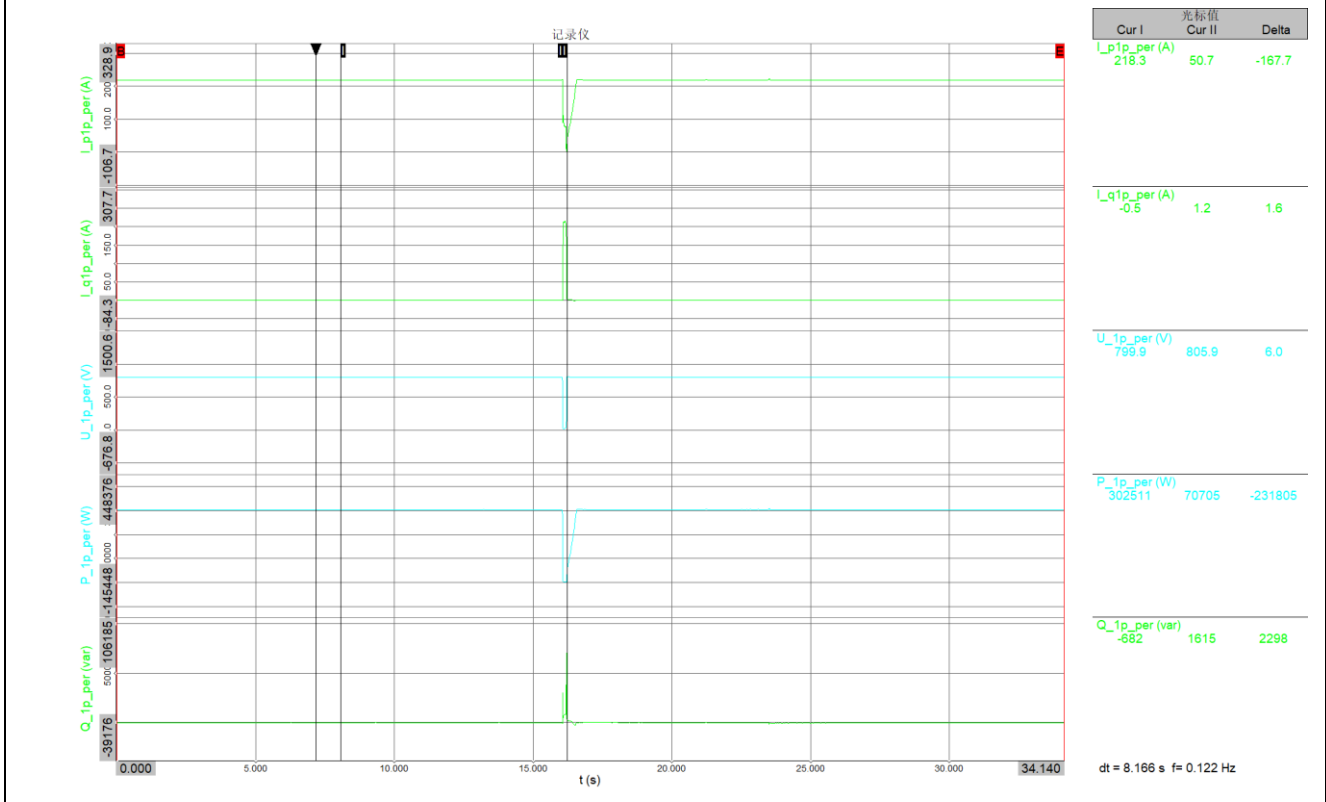
- Phase currents and RMS phase currents as moving averages over 20 ms:



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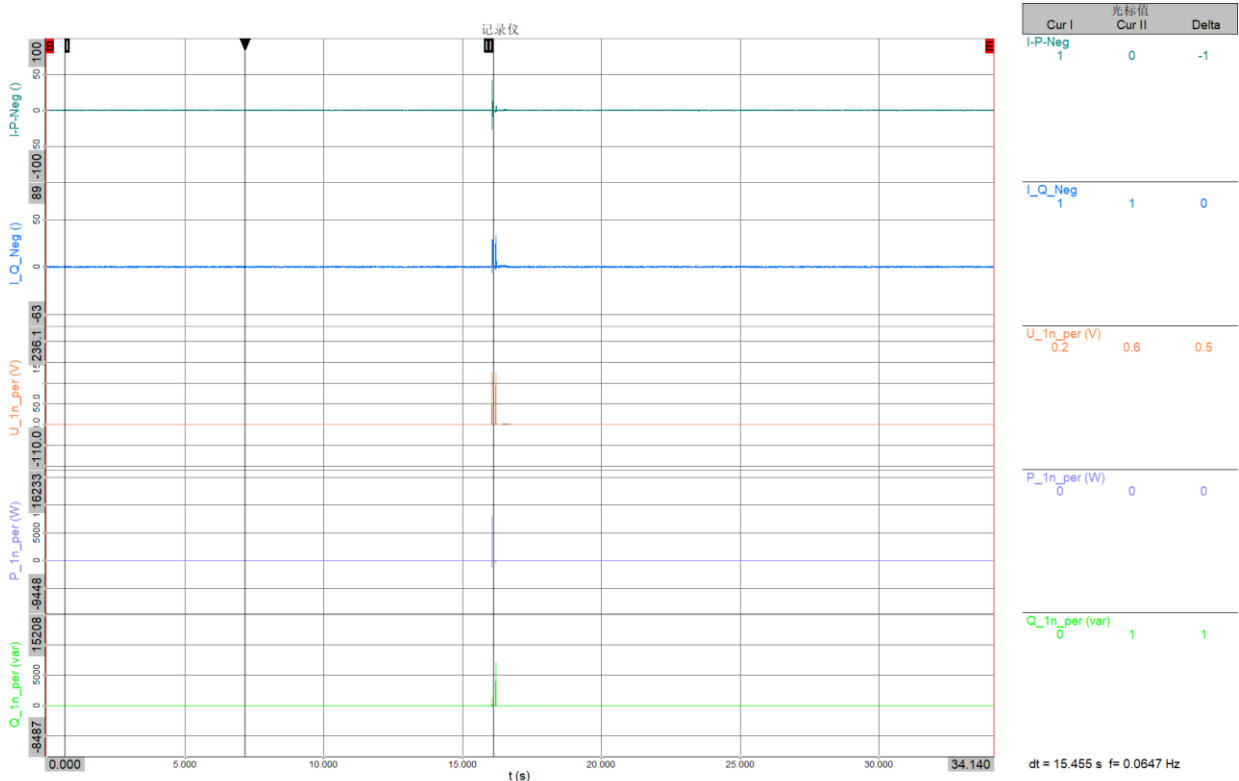
- Positive sequence active & reactive power and voltage, active & reactive current:





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- Negative sequence active & reactive power and voltage, active & reactive current:



Test Number	1.1.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	1.1.2a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	15637.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	15792.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	145.000
16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and	[p.u.]	0.972	



	17		Neg. seq.	t1-10s to t1	[p.u.]	N/A
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.999
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27		Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	0.000
	29		Pos. seq.	t1-1s to t1	[p.u.]	0.000
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.200
	32	Active power	Total	t1-10s to t1	[p.u.]	0.200
	33		Total	t1-2s to t1	[p.u.]	0.200
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.200
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.268
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	27.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	27.000



	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.028
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.993
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	1.049
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.009
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.009
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	224.522
	52		Phase 2	t1+10ms	[A]	215.915
	53		Phase 3	t1+10ms	[A]	214.148
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	240.730
	55		Phase 2	t1 to t1+20ms	[A]	236.760
	56		Phase 3	t1 to t1+20ms	[A]	232.190
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	234.276
	55		Phase 2	t1 to t1+20ms	[A]	229.795
	56		Phase 3	t1 to t1+20ms	[A]	226.653
	57		Phase 1	t1 to t1+100ms	[A]	234.837
	58		Phase 2	t1 to t1+100ms	[A]	229.795
	59		Phase 3	t1 to t1+100ms	[A]	228.065



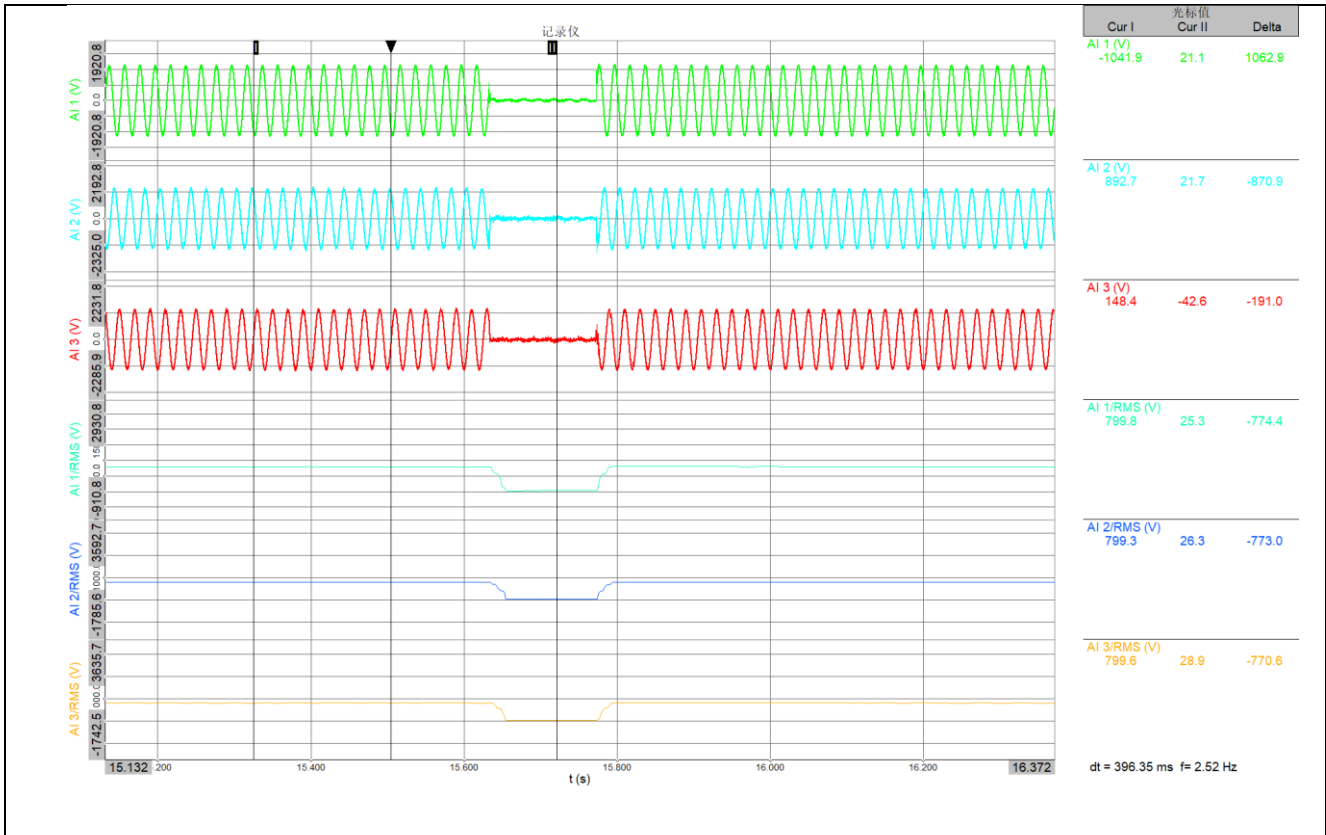
	60		Phase 1	t1+150ms	[A]	N/A
	61		Phase 2	t1+150ms	[A]	N/A
	62		Phase 3	t1+150ms	[A]	N/A
	63		Phase 1	t1+300ms	[A]	N/A
	64		Phase 2	t1+300ms	[A]	N/A
	65		Phase 3	t1+300ms	[A]	N/A
	66		Phase 1	t1+500ms	[A]	N/A
	67		Phase 2	t1+500ms	[A]	N/A
	68		Phase 3	t1+500ms	[A]	N/A
	69		Phase 1	t1+1000ms	[A]	N/A
	70		Phase 2	t1+1000ms	[A]	N/A
	71		Phase 3	t1+1000ms	[A]	N/A
	72		Phase 1	t2-20ms	[A]	240.694
	73		Phase 2	t2-20ms	[A]	236.754
74	Phase 3	t2-20ms	[A]	231.989		
After t2	75	Active power	Total	t2+5s	[p.u.]	0.207
	76		Total	t2+1s to t2+10s	[p.u.]	0.200
	77		Total	t2+10s	[p.u.]	0.200
	78	Active current rise time	Pos. seq.	-	[ms]	683.000

Graphic:

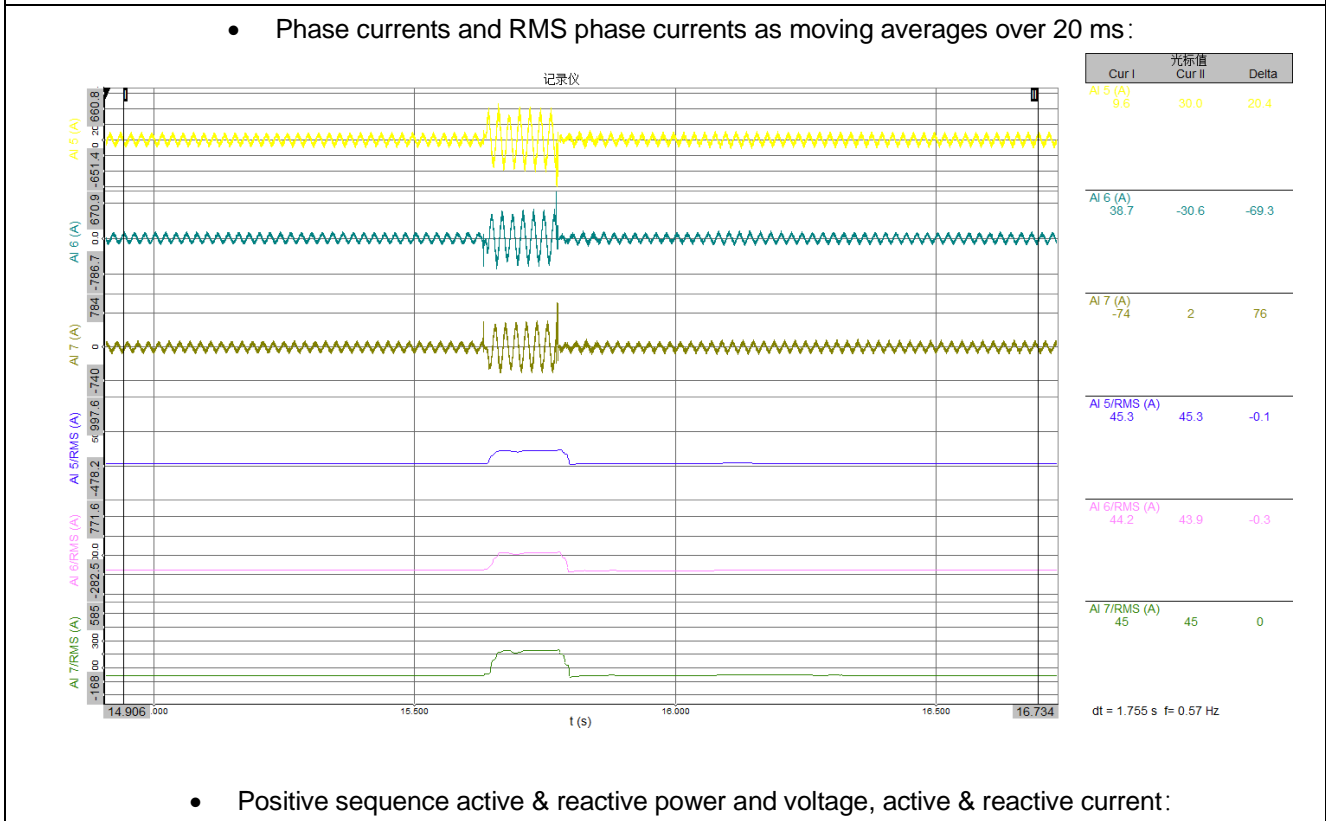
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



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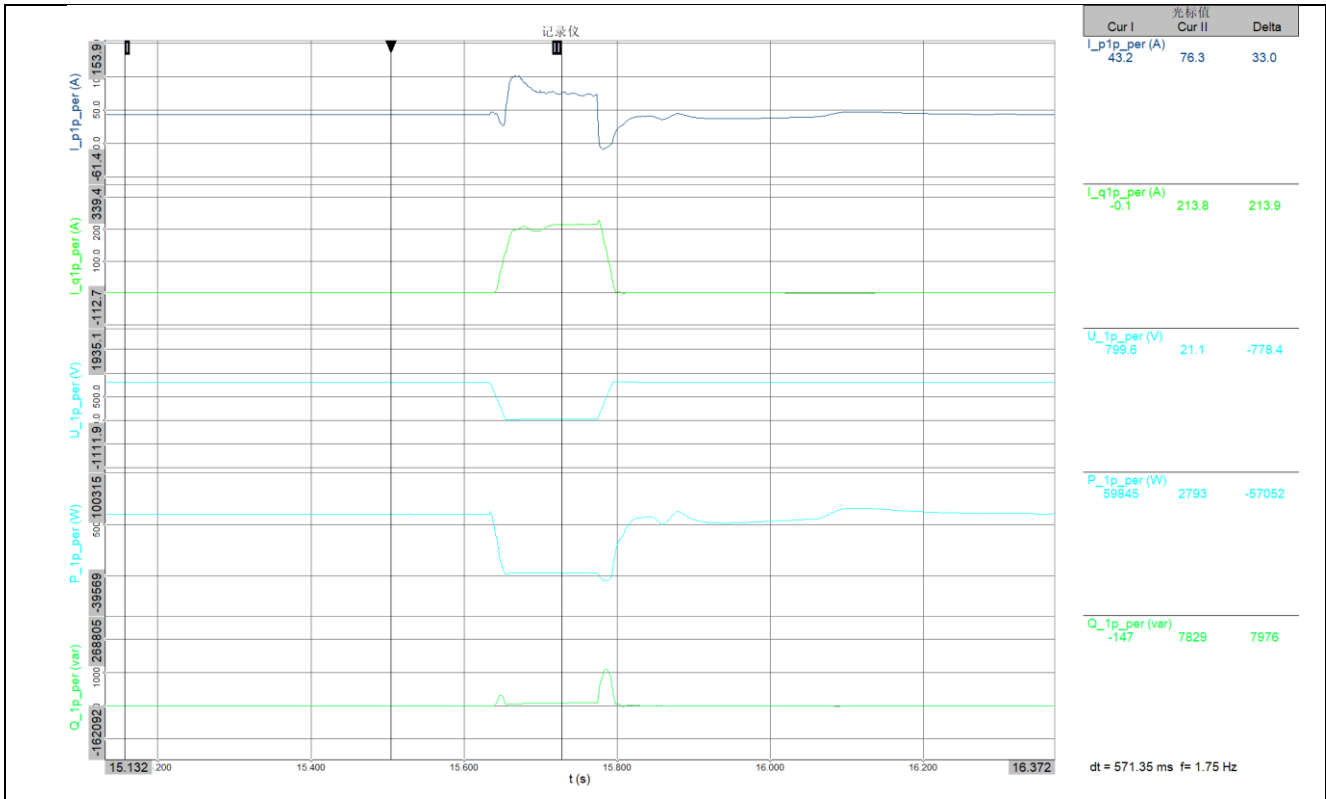
- Phase currents and RMS phase currents as moving averages over 20 ms:



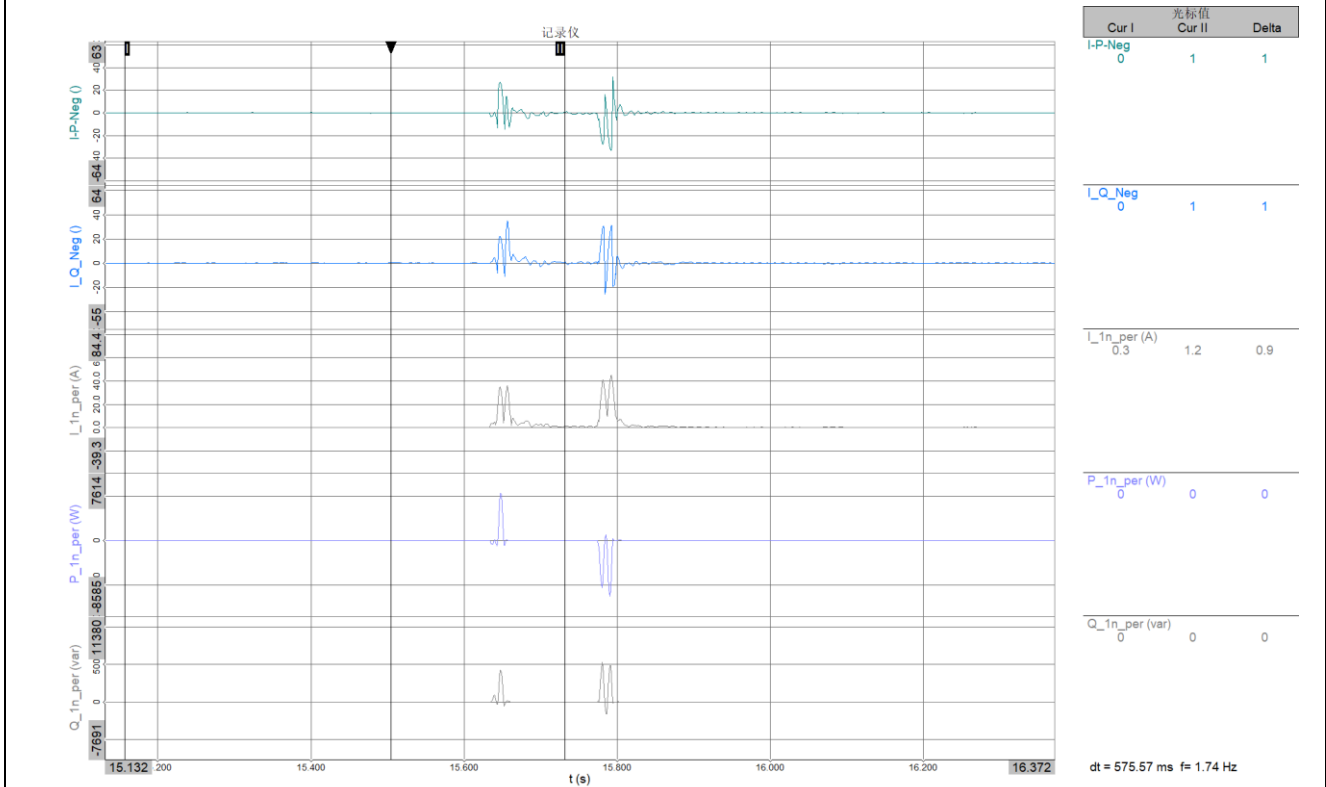
- Positive sequence active & reactive power and voltage, active & reactive current:



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- Negative sequence active & reactive power and voltage, active & reactive current :



Test Number	1.2.1a
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	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	1.2.1a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11782.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	11974.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	172.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.473
	17		Neg. seq.		[p.u.]	0.475
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.001
	23		Neg. seq.	t1-10s to t1	[p.u.]	0.000
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.001
	25		Pos. seq.	t1-1s to t1	[p.u.]	1.001
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.007
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	0.002
	29		Pos. seq.	t1-1s to t1	[p.u.]	0.003
	30		Neg. seq.	t1-1s to t1	[p.u.]	0.002
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	1.007



	32	Active power	Total	t1-10s to t1	[p.u.]	1.001
	33		Total	t1-2s to t1	[p.u.]	1.001
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.001
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.002
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	27.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	27.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.528
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.475
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.498
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.541
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.509
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.552
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.105
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.051
51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	218.868	
52		Phase 2	t1+10ms	[A]	217.578	



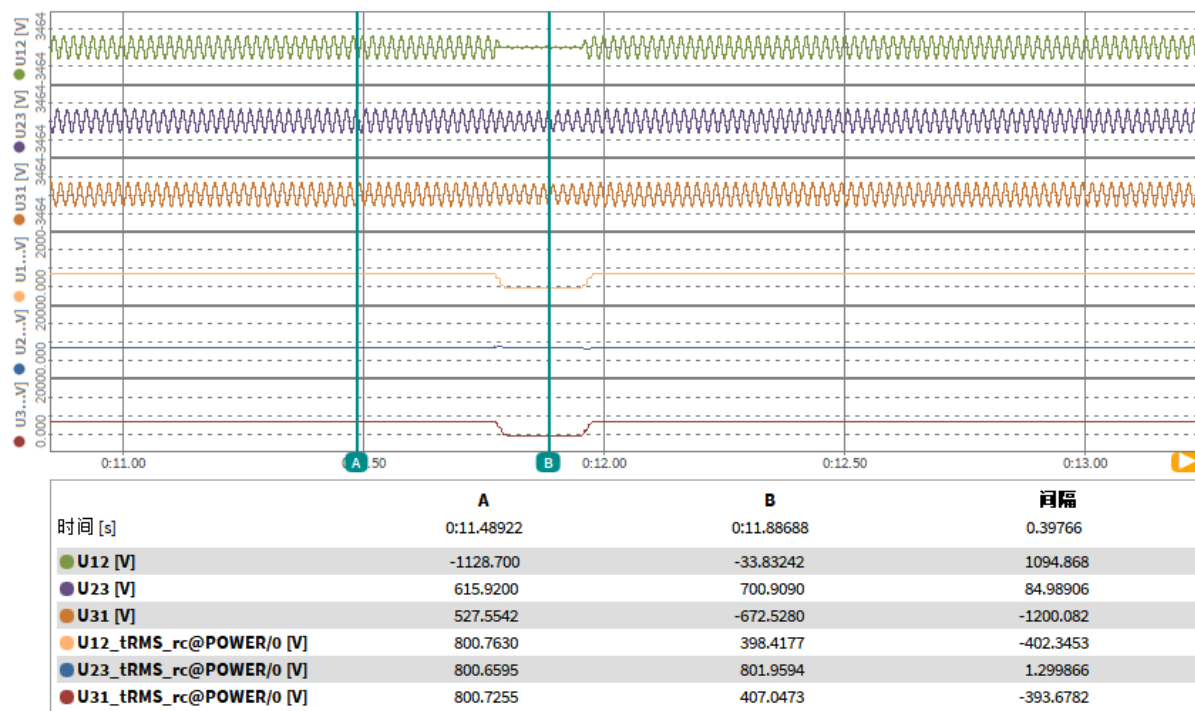
	53		Phase 3	t1+10ms	[A]	217.863
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	227.989
	55		Phase 2	t1 to t1+20ms	[A]	220.199
	56		Phase 3	t1 to t1+20ms	[A]	220.214
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	218.867
	55		Phase 2	t1 to t1+20ms	[A]	217.570
	56		Phase 3	t1 to t1+20ms	[A]	217.852
	57		Phase 1	t1 to t1+100ms	[A]	226.193
	58		Phase 2	t1 to t1+100ms	[A]	217.570
	59		Phase 3	t1 to t1+100ms	[A]	217.852
	60		Phase 1	t1+150ms	[A]	226.193
	61		Phase 2	t1+150ms	[A]	217.570
	62		Phase 3	t1+150ms	[A]	217.852
	63		Phase 1	t1+300ms	[A]	N/A
	64		Phase 2	t1+300ms	[A]	N/A
	65		Phase 3	t1+300ms	[A]	N/A
	66		Phase 1	t1+500ms	[A]	N/A
	67		Phase 2	t1+500ms	[A]	N/A
	68		Phase 3	t1+500ms	[A]	N/A
	69		Phase 1	t1+1000ms	[A]	N/A
	70	Phase 2	t1+1000ms	[A]	N/A	



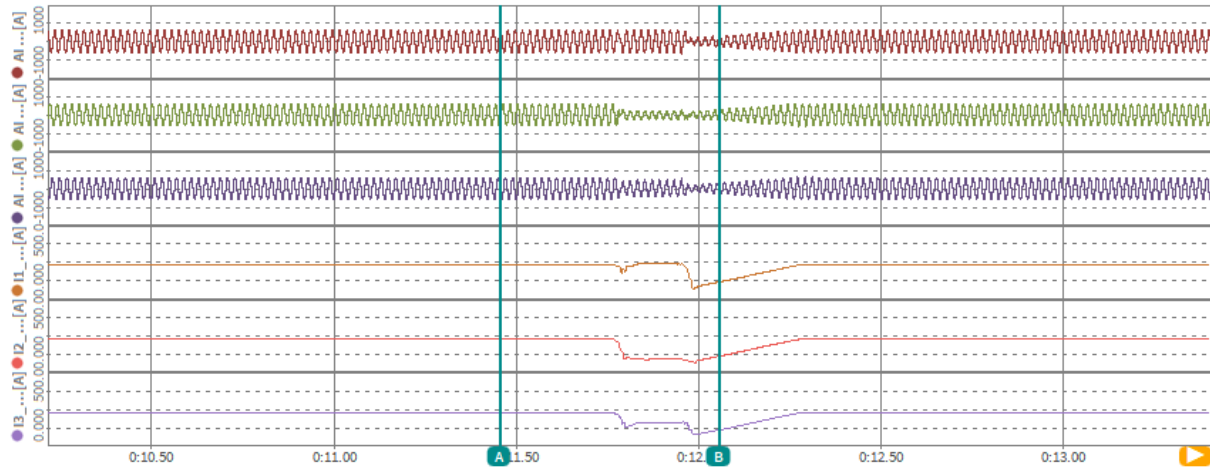
	71		Phase 3	t1+1000ms	[A]	N/A
	72		Phase 1	t2-20ms	[A]	226.062
	73		Phase 2	t2-20ms	[A]	76.380
	74		Phase 3	t2-20ms	[A]	152.395
After t2	75	Active power	Total	t2+5s	[p.u.]	0.101
	76		Total	t2+1s to t2+10s	[p.u.]	0.101
	77		Total	t2+10s	[p.u.]	0.101
	78	Active current rise time	Pos. seq.	-	[ms]	306.000

Graphic:

- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



- Phase currents and RMS phase currents as moving averages over 20 ms :



时间 [s]	A	B	间隔
	0:11.45533	0:12.05632	0.60099
AI 1/I1 [A]	96.06988	89.92941	-6.140471
AI 1/I2 [A]	-304.2728	-146.5497	157.7231
AI 1/I3 [A]	208.1794	56.61816	-151.5612
I1_tRMS_rc@POWER/0 [A]	218.8192	96.85384	-121.9654
I2_tRMS_rc@POWER/0 [A]	217.5390	96.77708	-120.7619
I3_tRMS_rc@POWER/0 [A]	217.8750	97.26009	-120.6149

- Positive sequence active & reactive power and voltage, active & reactive current :

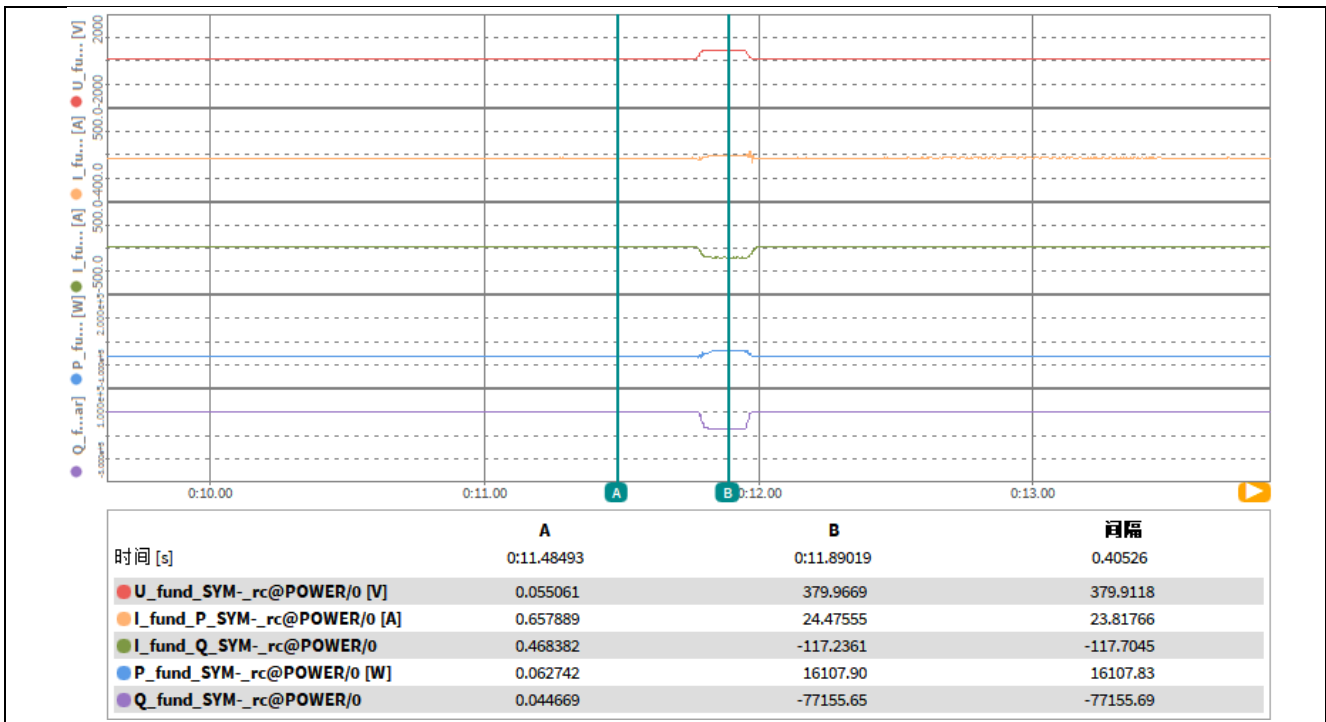


时间 [s]	A	B	间隔
	0:11.43408	0:11.86854	0.43446
U_fund_SYM+_rc@POWER/0 [V]	800.6614	421.5833	-379.0782
I_fund_P_SYM+_rc@POWER/0	218.0652	22.29203	-195.7731
I_fund_Q_SYM+_rc@POWER/0	-0.653685	107.9242	108.5779
P_fund_SYM+_rc@POWER/0 [W]	302409.8	16277.72	-286132.0
Q_fund_SYM+_rc@POWER/0	-906.5217	78806.63	79713.15

- Negative sequence active & reactive power and voltage, active & reactive current :



Product Service





Test Number	1.2.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	1.2.2a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11796.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	11989.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	173.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.471
	17		Neg. seq.		[p.u.]	0.475
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000
	23		Neg. seq.	t1-10s to t1	[p.u.]	0.000
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.999
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.199
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.002
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.002
	30		Neg. seq.	t1-1s to t1	[p.u.]	0.000



	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.199
	32	Active power	Total	t1-10s to t1	[p.u.]	0.199
	33		Total	t1-2s to t1	[p.u.]	0.199
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.199
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.001
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	27.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	27.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.528
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.475
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.498
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.541
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.509
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.553
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.107
50	Pos. seq.		t1+100ms to t2-20ms	[p.u.]	0.053	
51	Short-circuit currents Half-period rms values		Phase 1	t1+10ms	[A]	82.725



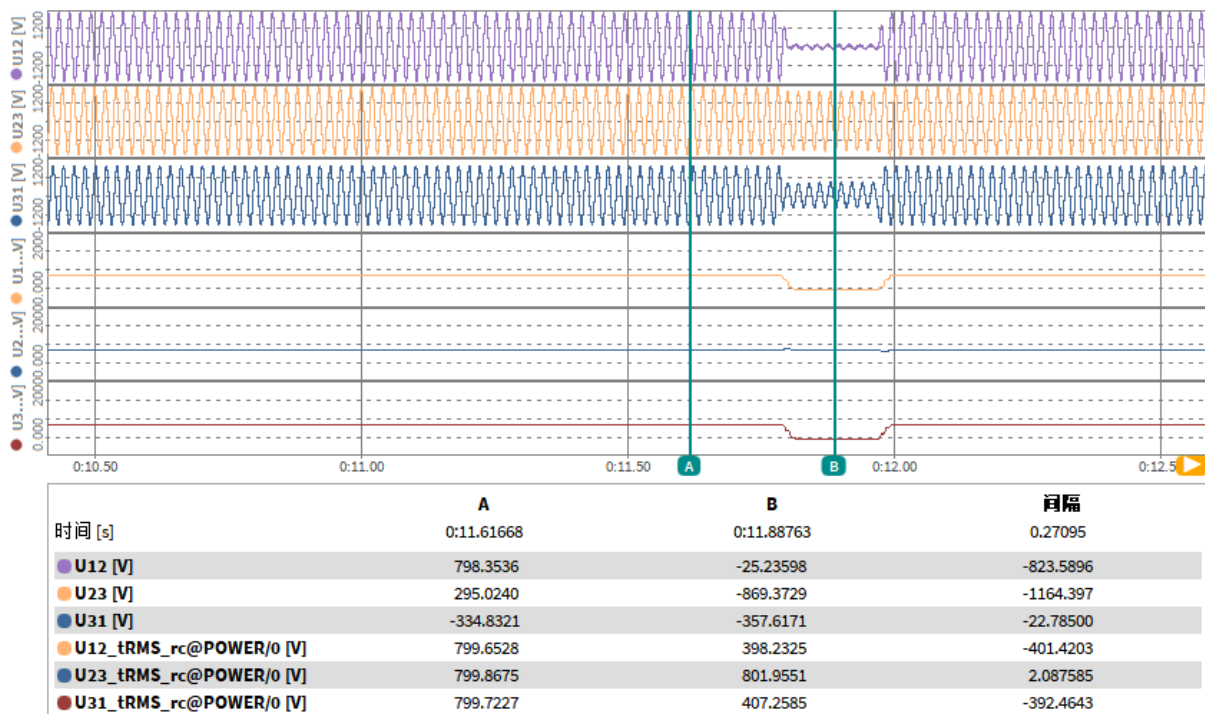
	52		Phase 2	t1+10ms	[A]	43.218
	53		Phase 3	t1+10ms	[A]	58.702
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	227.580
	55		Phase 2	t1 to t1+20ms	[A]	92.520
	56		Phase 3	t1 to t1+20ms	[A]	156.180
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	124.950
	55		Phase 2	t1 to t1+20ms	[A]	57.533
	56		Phase 3	t1 to t1+20ms	[A]	77.820
	57		Phase 1	t1 to t1+100ms	[A]	226.275
	58		Phase 2	t1 to t1+100ms	[A]	87.867
	59		Phase 3	t1 to t1+100ms	[A]	152.051
	60		Phase 1	t1+150ms	[A]	226.275
	61		Phase 2	t1+150ms	[A]	87.867
	62		Phase 3	t1+150ms	[A]	153.270
	63		Phase 1	t1+300ms	[A]	N/A
	64		Phase 2	t1+300ms	[A]	N/A
	65		Phase 3	t1+300ms	[A]	N/A
	66		Phase 1	t1+500ms	[A]	N/A
	67		Phase 2	t1+500ms	[A]	N/A
	68		Phase 3	t1+500ms	[A]	N/A
	69		Phase 1	t1+1000ms	[A]	N/A



	70		Phase 2	t1+1000ms	[A]	N/A
	71		Phase 3	t1+1000ms	[A]	N/A
	72		Phase 1	t2-20ms	[A]	225.884
	73		Phase 2	t2-20ms	[A]	75.013
	74		Phase 3	t2-20ms	[A]	153.804
After t2	75	Active power	Total	t2+5s	[p.u.]	0.199
	76		Total	t2+1s to t2+10s	[p.u.]	0.199
	77		Total	t2+10s	[p.u.]	0.199
	78	Active current rise time	Pos. seq.	-	[ms]	446.000

Graphic:

- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



- Phase currents and RMS phase currents as moving averages over 20 ms:

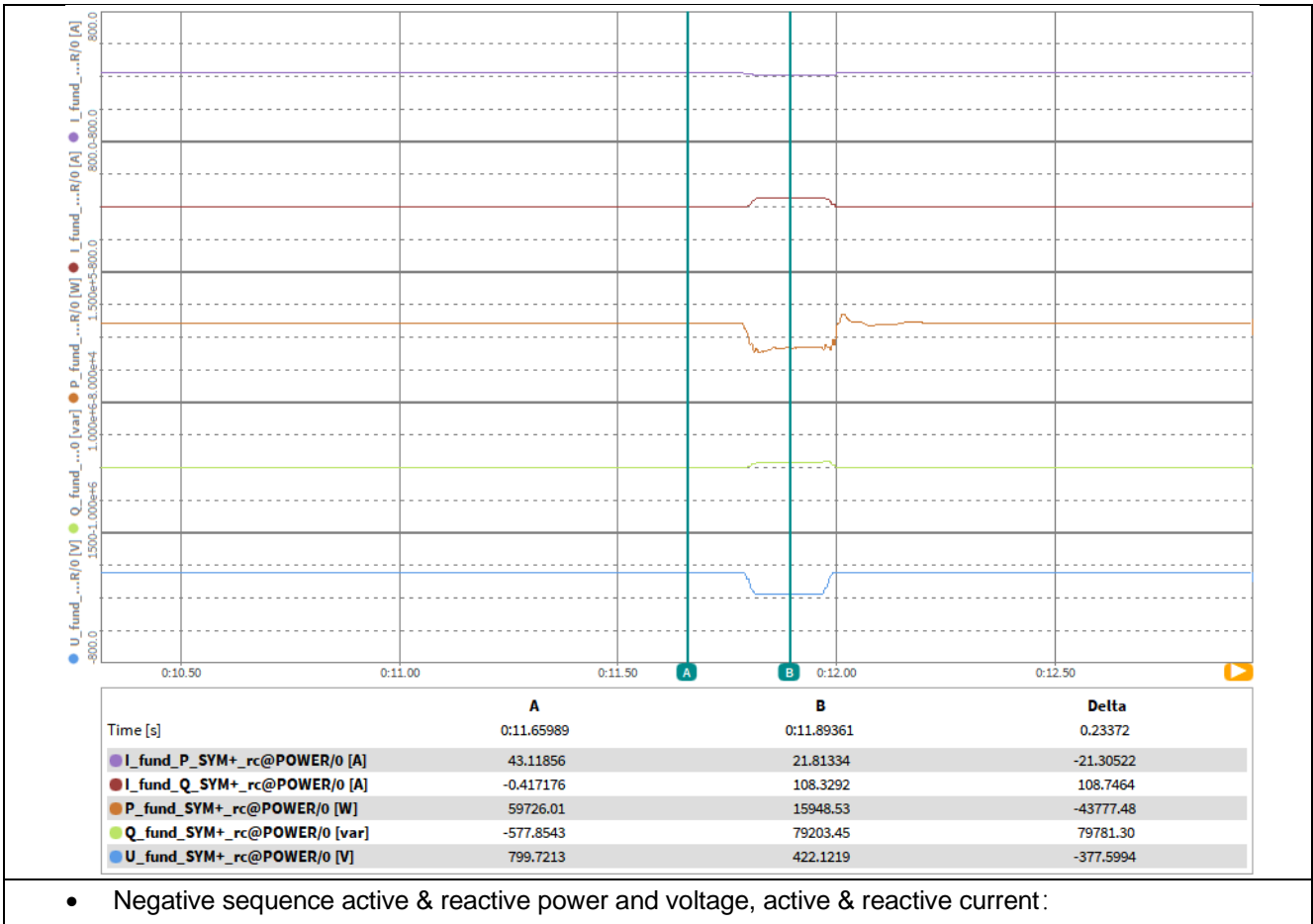


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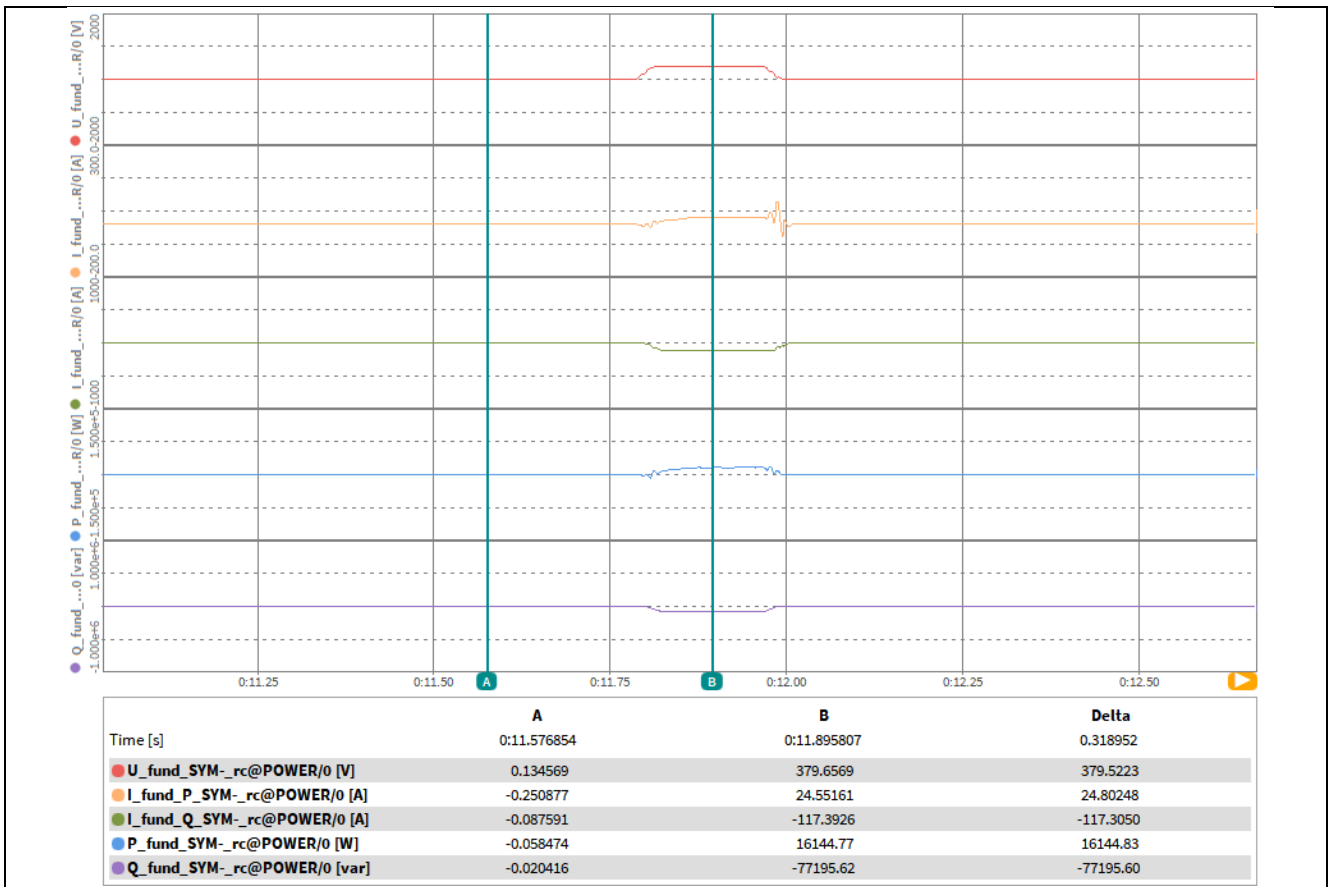
	A	B	Delta
Time [s]	0:11.630437	0:11.896875	0.266438
AI 1/I1 [A]	21.66927	235.6938	214.0245
AI 1/I2 [A]	-57.09738	-80.35630	-23.25893
AI 1/I3 [A]	35.47192	-155.4442	-190.9161
I1_trMS_rc@POWER/0 [A]	43.62248	226.1120	182.4895
I2_trMS_rc@POWER/0 [A]	43.21700	75.65532	32.43832
I3_trMS_rc@POWER/0 [A]	43.22692	152.5749	109.3480

- Positive sequence active & reactive power and voltage, active & reactive current:





Product Service





Test Number	2.1.1a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.1.1a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	15756.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	17248.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1472.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.500
	17		Neg. seq.		[p.u.]	N/A
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000
	25		Pos. seq.	t1-1s to t1	[p.u.]	1.000
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.009
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.003
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.003
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A



	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	1.009
	32	Active power	Total	t1-10s to t1	[p.u.]	1.001
	33		Total	t1-2s to t1	[p.u.]	1.001
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.001
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.002
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	25.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	25.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.500
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.997
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	1.005
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.061
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.062
51	Short-circuit currents Half-period rms values		Phase 1	t1+10ms	[A]	223.335



	52		Phase 2	t1+10ms	[A]	228.778
	53		Phase 3	t1+10ms	[A]	224.061
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	229.590
	55		Phase 2	t1 to t1+20ms	[A]	224.700
	56		Phase 3	t1 to t1+20ms	[A]	226.970
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	229.592
	55		Phase 2	t1 to t1+20ms	[A]	224.194
	56		Phase 3	t1 to t1+20ms	[A]	225.390
	57		Phase 1	t1 to t1+100ms	[A]	229.592
	58		Phase 2	t1 to t1+100ms	[A]	224.194
	59		Phase 3	t1 to t1+100ms	[A]	226.961
	60		Phase 1	t1+150ms	[A]	229.592
	61		Phase 2	t1+150ms	[A]	224.194
	62		Phase 3	t1+150ms	[A]	226.961
	63		Phase 1	t1+300ms	[A]	229.592
	64		Phase 2	t1+300ms	[A]	224.194
	65		Phase 3	t1+300ms	[A]	226.961
	66		Phase 1	t1+500ms	[A]	229.592
	67		Phase 2	t1+500ms	[A]	224.194
	68		Phase 3	t1+500ms	[A]	226.961
	69		Phase 1	t1+1000ms	[A]	229.592

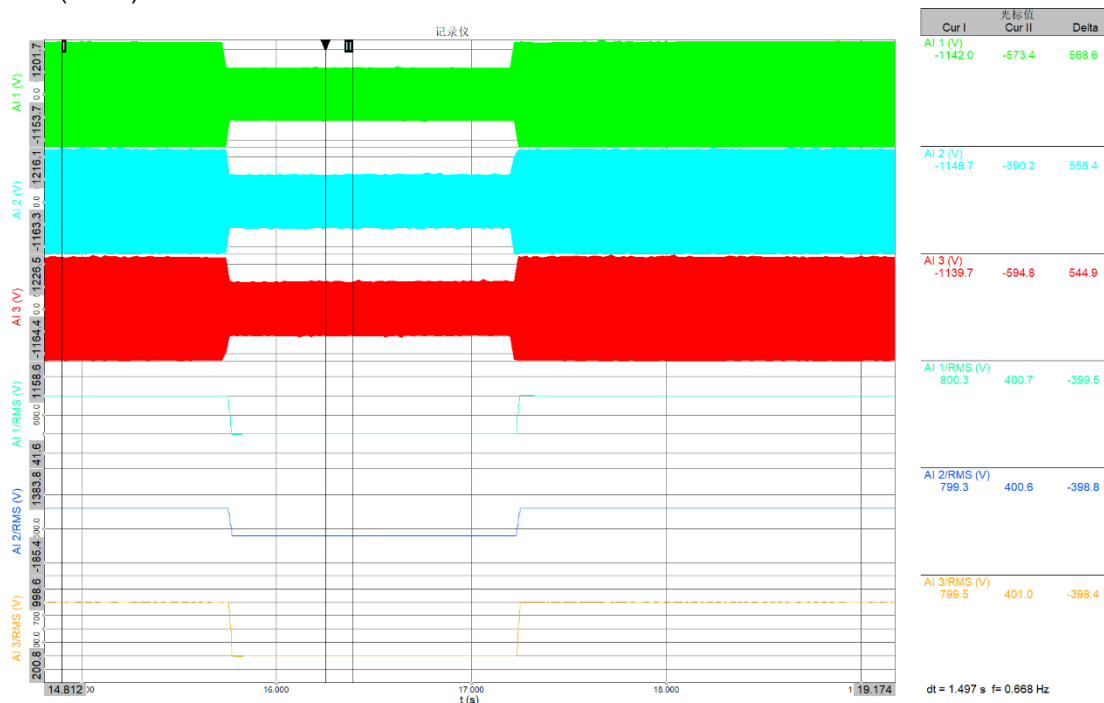


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	70		Phase 2	t1+1000ms	[A]	224.194
	71		Phase 3	t1+1000ms	[A]	226.961
	72		Phase 1	t2-20ms	[A]	227.216
	73		Phase 2	t2-20ms	[A]	224.593
	74		Phase 3	t2-20ms	[A]	220.360
After t2	75	Active power	Total	t2+5s	[p.u.]	1.009
	76		Total	t2+1s to t2+10s	[p.u.]	1.009
	77		Total	t2+10s	[p.u.]	1.009
	78	Active current rise time	Pos. seq.	-	[ms]	370.000

Graphic:

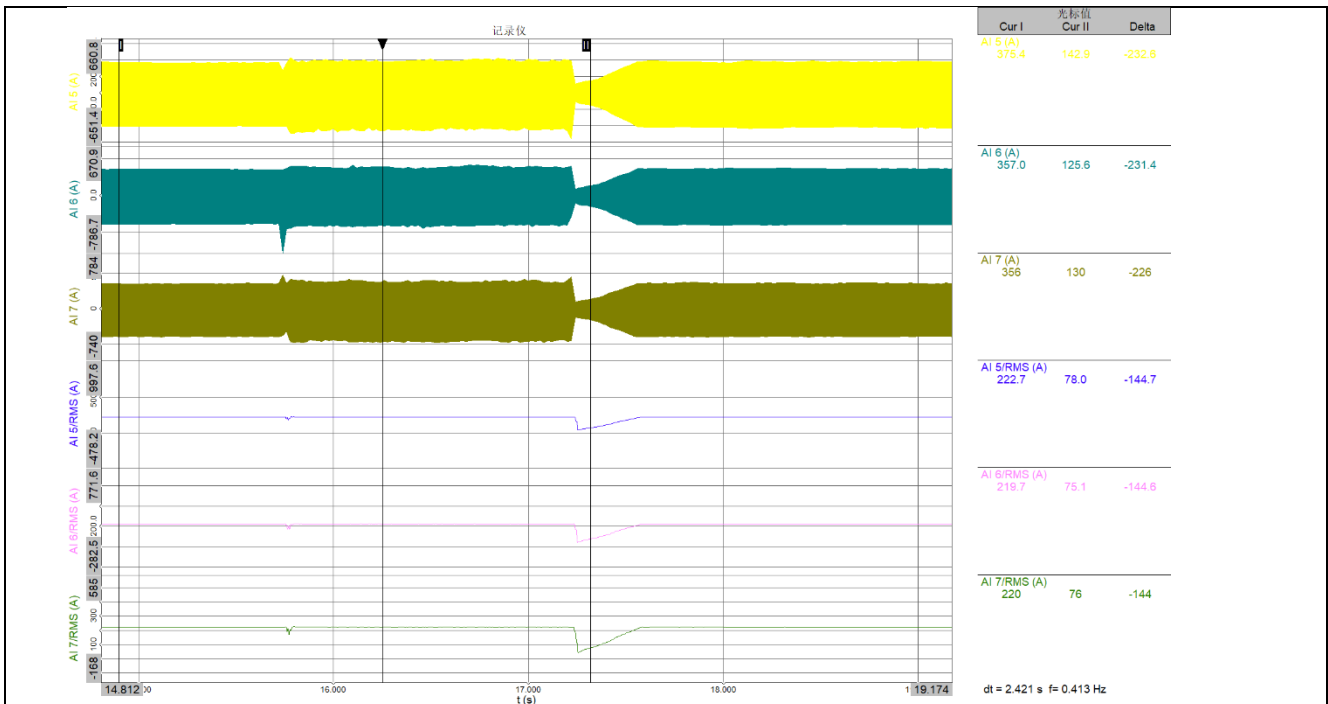
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms : (20ms)



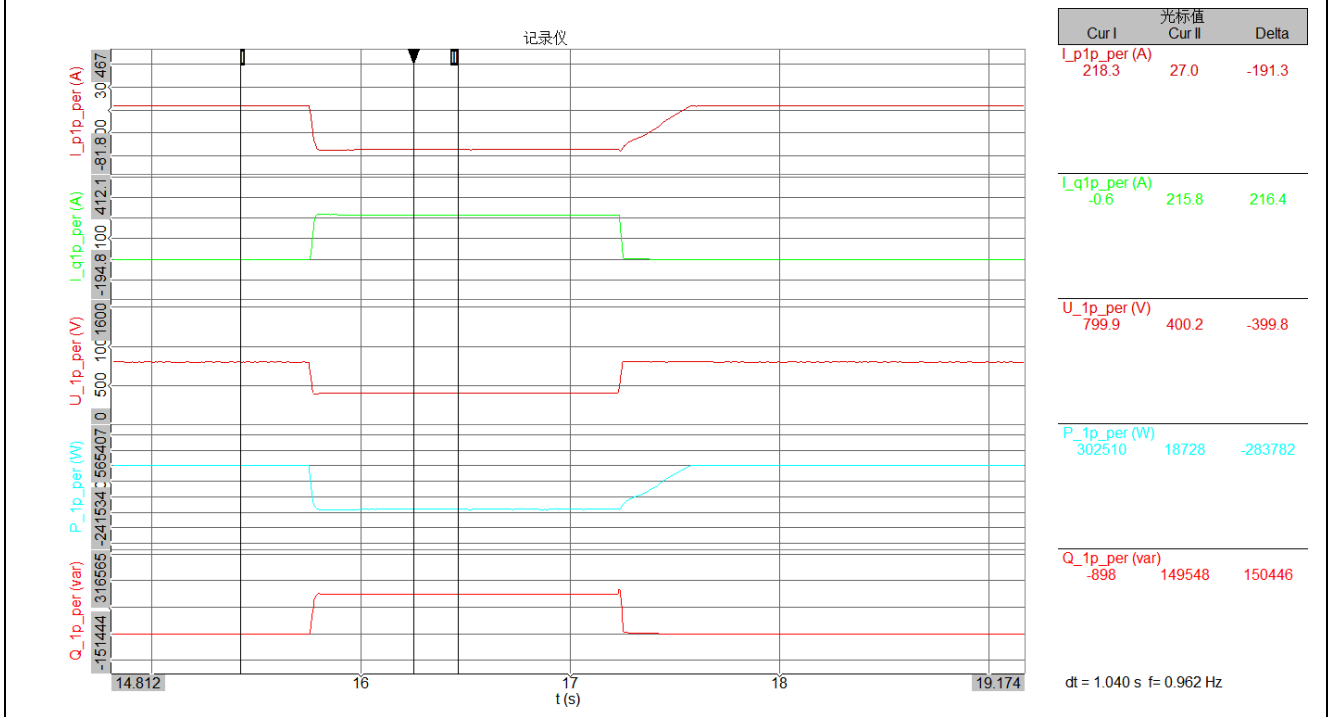
- Phase currents and RMS phase currents as moving averages over 20 ms :



Product Service



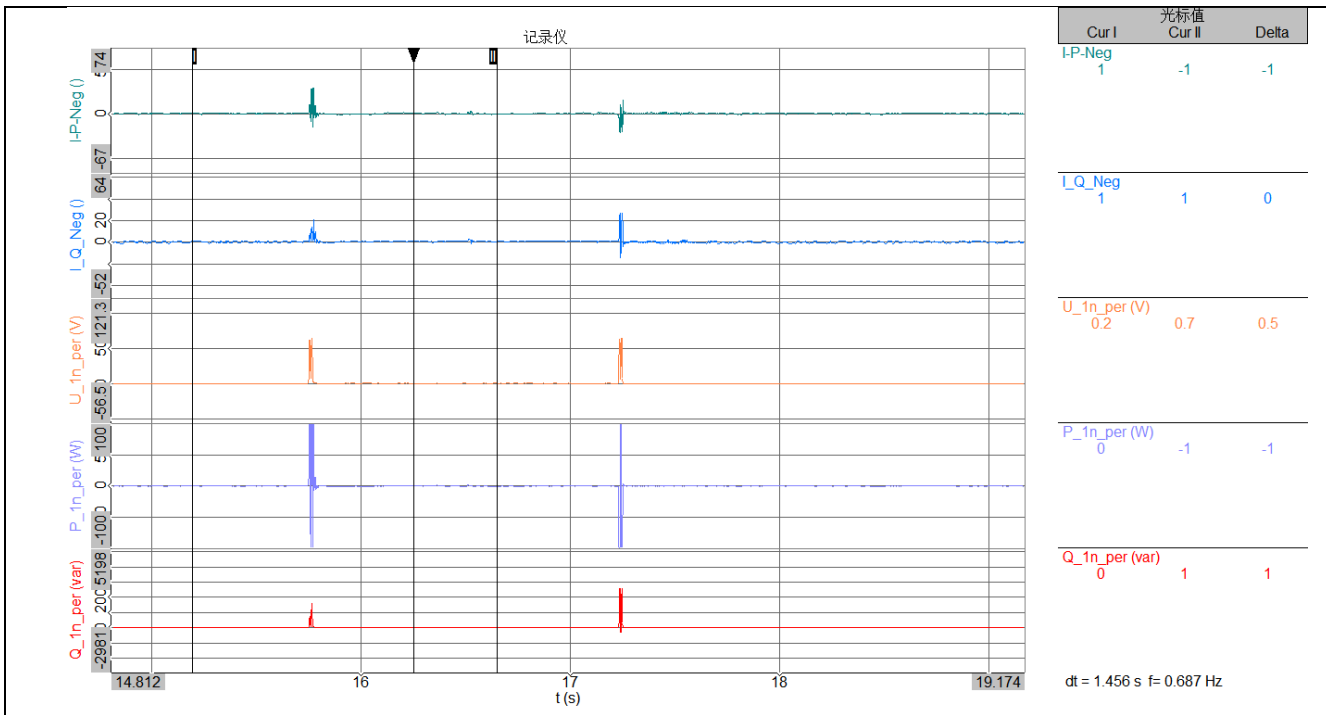
- Positive sequence active & reactive power and voltage, active & reactive current:



- Negative sequence active & reactive power and voltage, active & reactive current:



Product Service



Test Number	2.1.1b					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.1.1b
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11701.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	13213.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1492.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.493
17	Neg. seq.			[p.u.]	N/A	
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	0.997



	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A	
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.997	
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.996	
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A	
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.102	
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.666	
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.666	
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A	
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.877	
	32	Active power	Total	t1-10s to t1	[p.u.]	0.874	
	33		Total	t1-2s to t1	[p.u.]	0.874	
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.874	
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.664	
	t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
		38		Neg. seq.	-	-	2.500
39		Reactive current rise time	Pos. seq.	-	[ms]	25.000	
40			Neg. seq.	-	[ms]	N/A	
41		Reactive current settling time	Pos. seq.	-	[ms]	25.000	
42			Neg. seq.	-	[ms]	N/A	
43		Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.503	



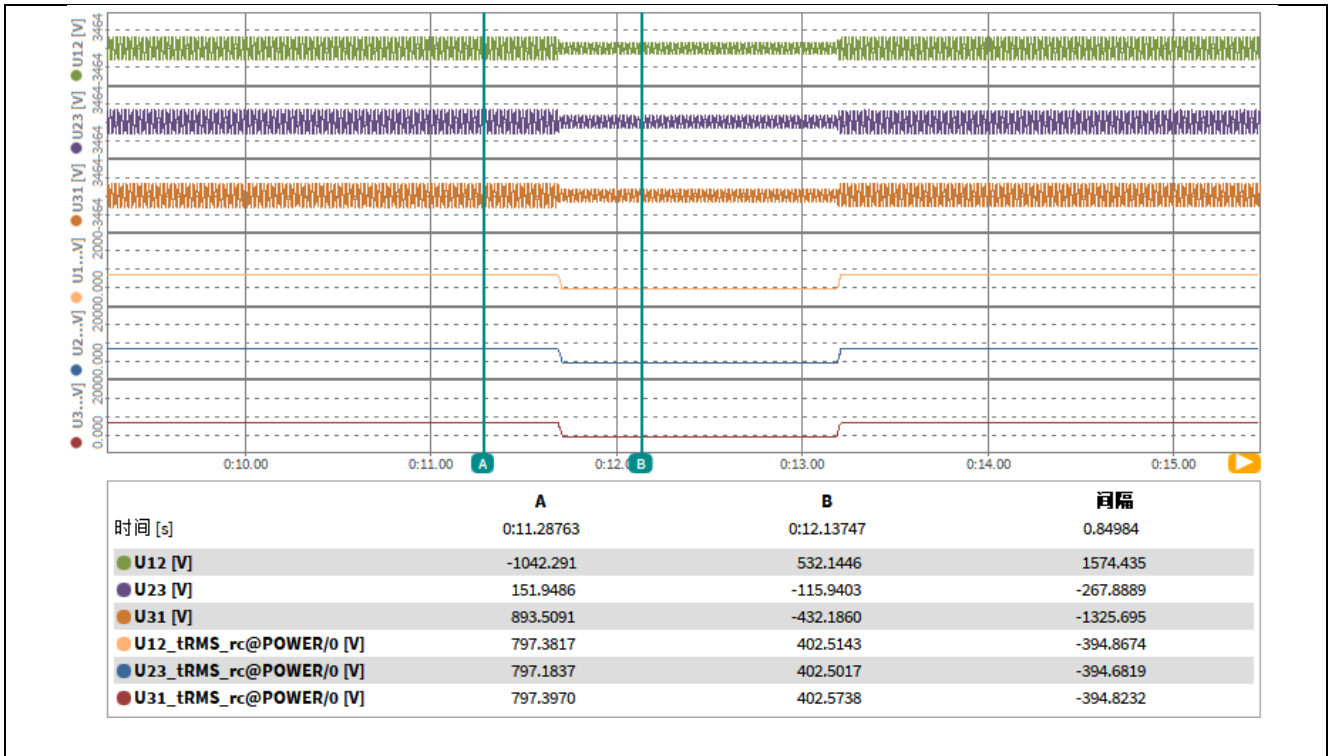
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.329
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	1.006
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.478
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.478
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	239.497
	52		Phase 2	t1+10ms	[A]	240.612
	53		Phase 3	t1+10ms	[A]	239.050
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	242.710
	55		Phase 2	t1 to t1+20ms	[A]	239.880
	56		Phase 3	t1 to t1+20ms	[A]	244.581
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	238.952
	55		Phase 2	t1 to t1+20ms	[A]	239.820
	56		Phase 3	t1 to t1+20ms	[A]	238.695
	57		Phase 1	t1 to t1+100ms	[A]	238.952
	58		Phase 2	t1 to t1+100ms	[A]	239.820
	59		Phase 3	t1 to t1+100ms	[A]	238.695
	60		Phase 1	t1+150ms	[A]	238.952
	61		Phase 2	t1+150ms	[A]	239.820



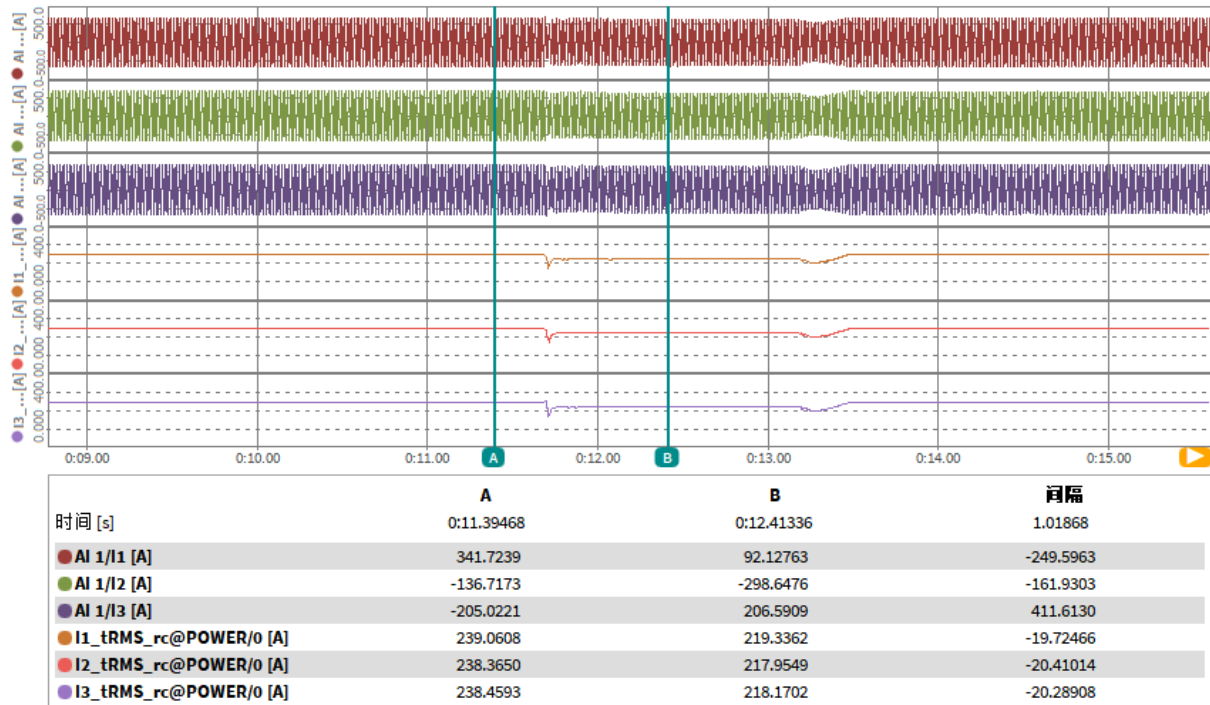
	62		Phase 3	t1+150ms	[A]	238.695
	63		Phase 1	t1+300ms	[A]	238.952
	64		Phase 2	t1+300ms	[A]	239.820
	65		Phase 3	t1+300ms	[A]	238.695
	66		Phase 1	t1+500ms	[A]	238.952
	67		Phase 2	t1+500ms	[A]	239.820
	68		Phase 3	t1+500ms	[A]	238.695
	69		Phase 1	t1+1000ms	[A]	238.952
	70		Phase 2	t1+1000ms	[A]	239.820
	71		Phase 3	t1+1000ms	[A]	238.695
	72		Phase 1	t2-20ms	[A]	218.055
	73		Phase 2	t2-20ms	[A]	219.202
	74		Phase 3	t2-20ms	[A]	217.850
After t2	75	Active power	Total	t2+5s	[p.u.]	0.875
	76		Total	t2+1s to t2+10s	[p.u.]	0.875
	77		Total	t2+10s	[p.u.]	0.875
	78	Active current rise time	Pos. seq.	-	[ms]	368.000

Graphic:

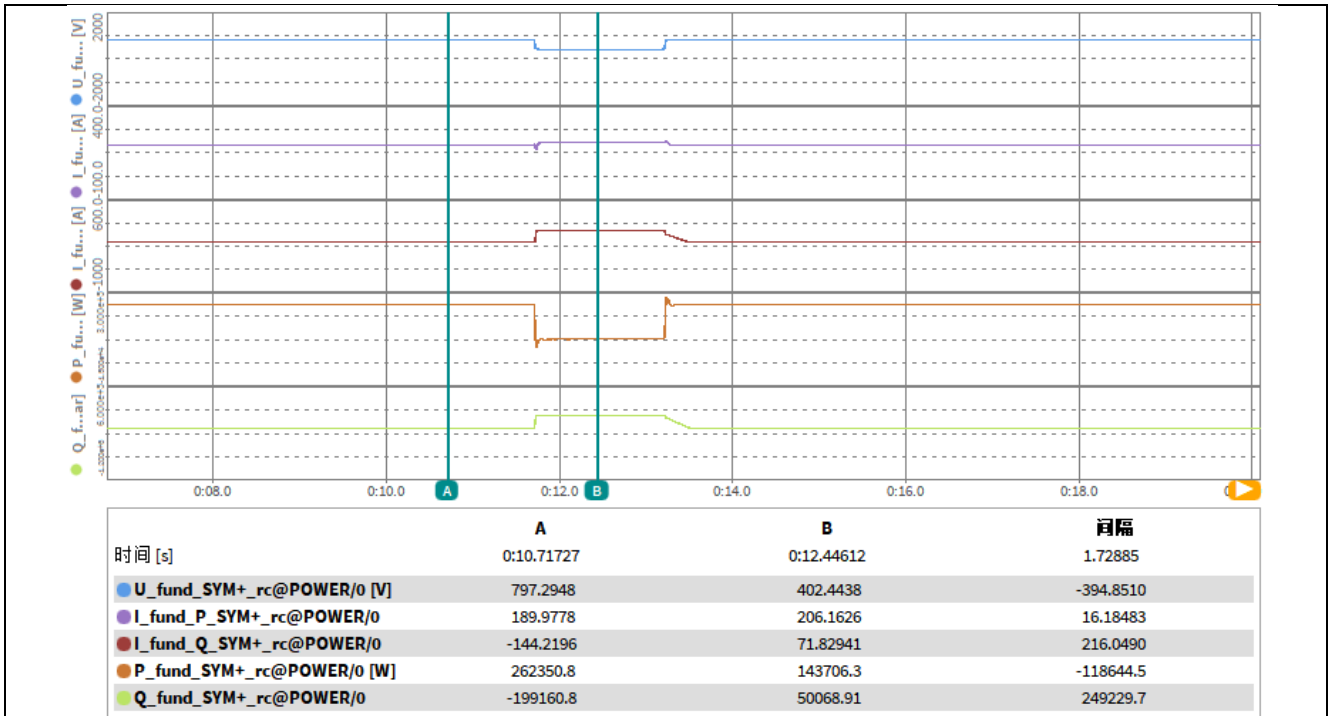
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



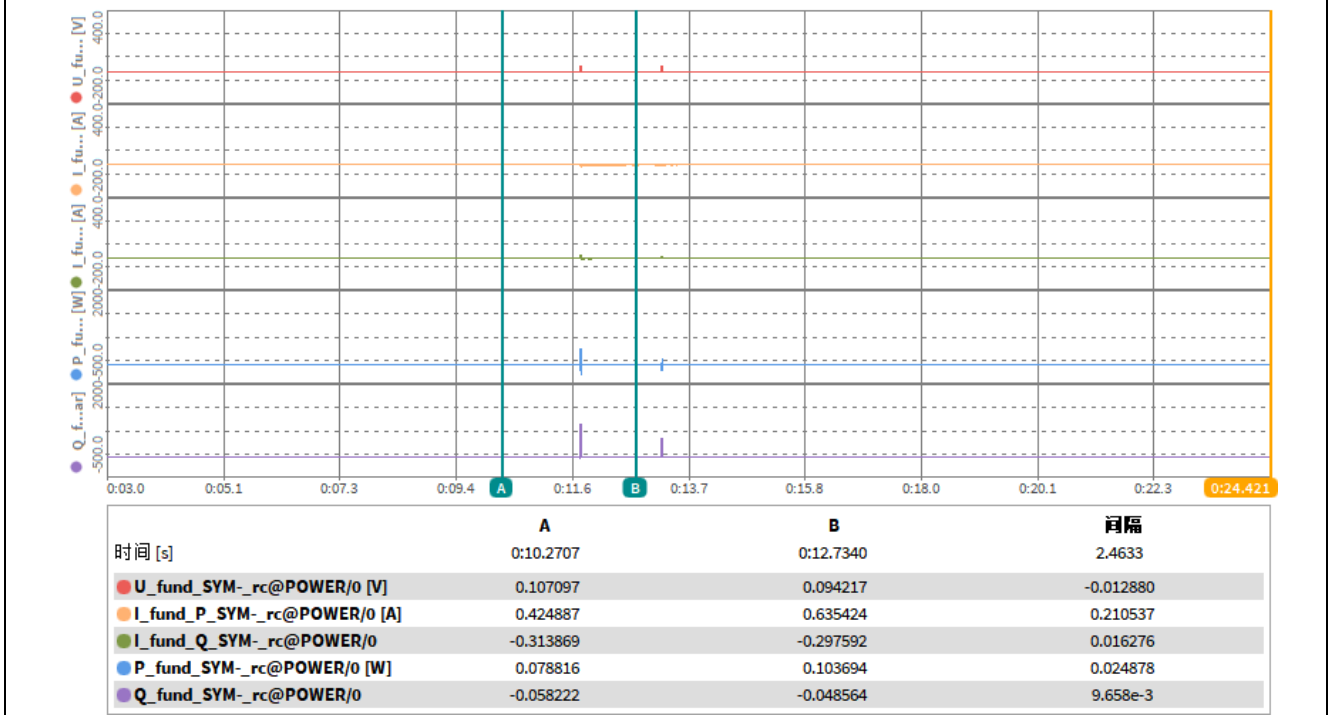
- Phase currents and RMS phase currents as moving averages over 20 ms:



- Positive sequence active & reactive power and voltage, active & reactive current:



- Negative sequence active & reactive power and voltage, active & reactive current :





Test Number	2.1.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.1.2a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	15834.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	17326.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1472.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.499
	17		Neg. seq.		[p.u.]	N/A
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.999
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.200
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.001
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.001
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A



	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.201
	32	Active power	Total	t1-10s to t1	[p.u.]	0.200
	33		Total	t1-2s to t1	[p.u.]	0.200
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.200
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.734
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	25.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	25.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.500
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.991
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	1.005
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.082
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.083
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	213.171



	52		Phase 2	t1+10ms	[A]	199.544
	53		Phase 3	t1+10ms	[A]	208.666
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	229.390
	55		Phase 2	t1 to t1+20ms	[A]	226.790
	56		Phase 3	t1 to t1+20ms	[A]	227.100
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	225.478
	55		Phase 2	t1 to t1+20ms	[A]	222.229
	56		Phase 3	t1 to t1+20ms	[A]	221.621
	57		Phase 1	t1 to t1+100ms	[A]	225.813
	58		Phase 2	t1 to t1+100ms	[A]	223.219
	59		Phase 3	t1 to t1+100ms	[A]	222.941
	60		Phase 1	t1+150ms	[A]	225.813
	61		Phase 2	t1+150ms	[A]	223.219
	62		Phase 3	t1+150ms	[A]	222.941
	63		Phase 1	t1+300ms	[A]	225.813
	64		Phase 2	t1+300ms	[A]	223.219
	65		Phase 3	t1+300ms	[A]	222.941
	66		Phase 1	t1+500ms	[A]	225.813
	67		Phase 2	t1+500ms	[A]	223.219
	68		Phase 3	t1+500ms	[A]	222.941
	69		Phase 1	t1+1000ms	[A]	225.813

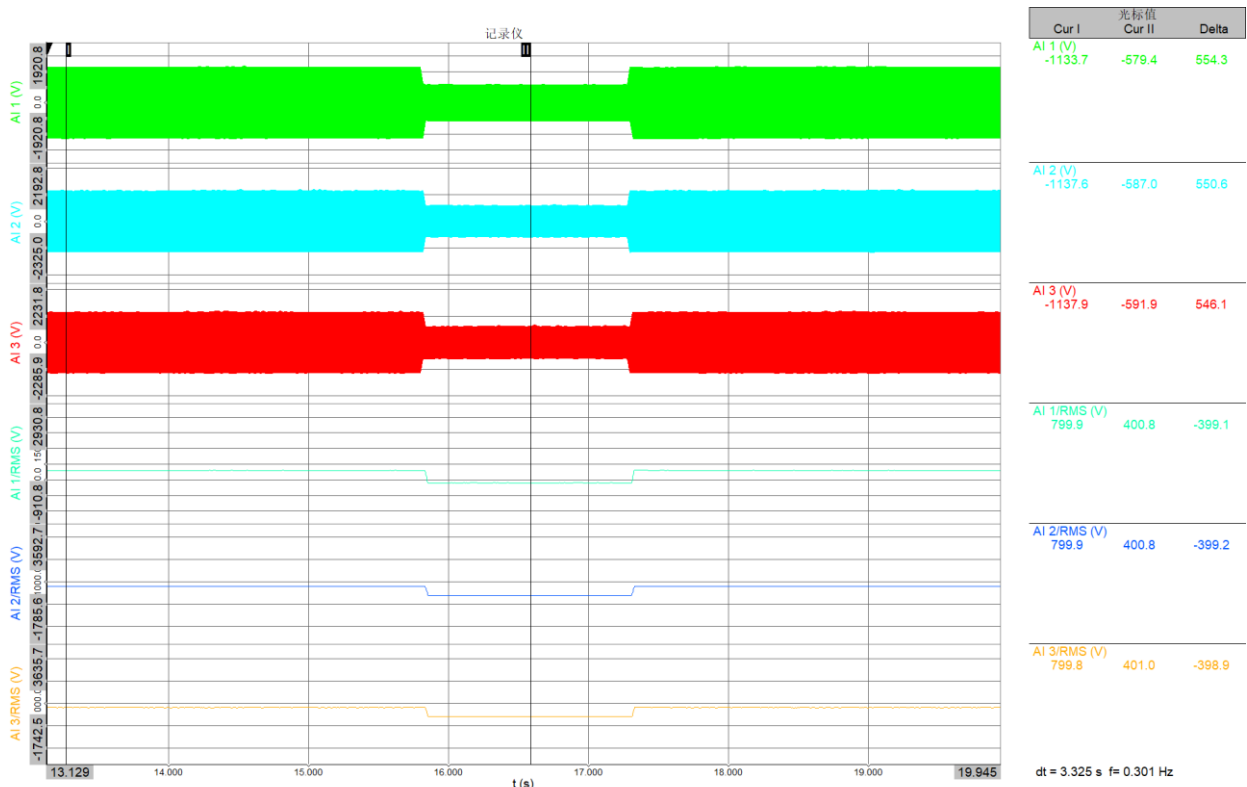


Product Service

	70		Phase 2	t1+1000ms	[A]	223.391
	71		Phase 3	t1+1000ms	[A]	222.941
	72		Phase 1	t2-20ms	[A]	225.819
	73		Phase 2	t2-20ms	[A]	224.594
	74		Phase 3	t2-20ms	[A]	221.087
After t2	75	Active power	Total	t2+5s	[p.u.]	0.205
	76		Total	t2+1s to t2+10s	[p.u.]	0.199
	77		Total	t2+10s	[p.u.]	0.199
	78	Active current rise time	Pos. seq.	-	[ms]	293.000

Graphic:

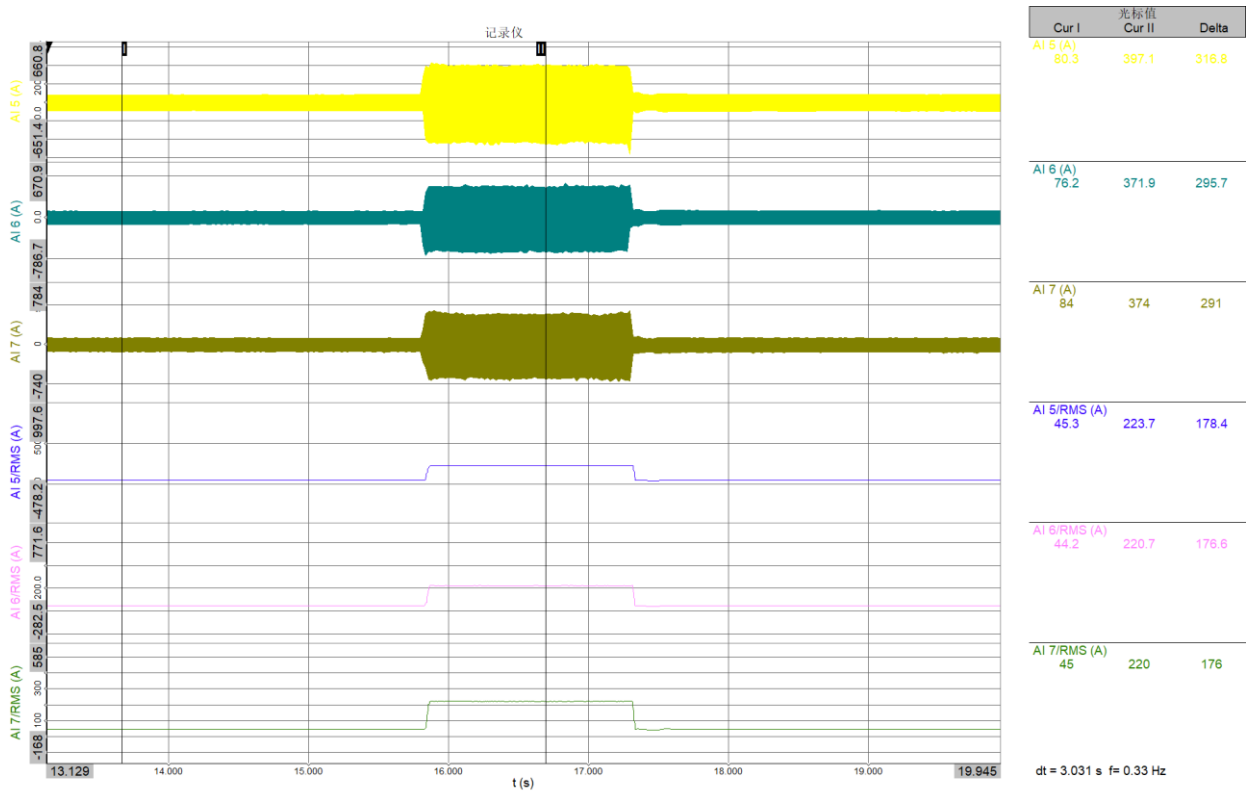
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :





Product Service

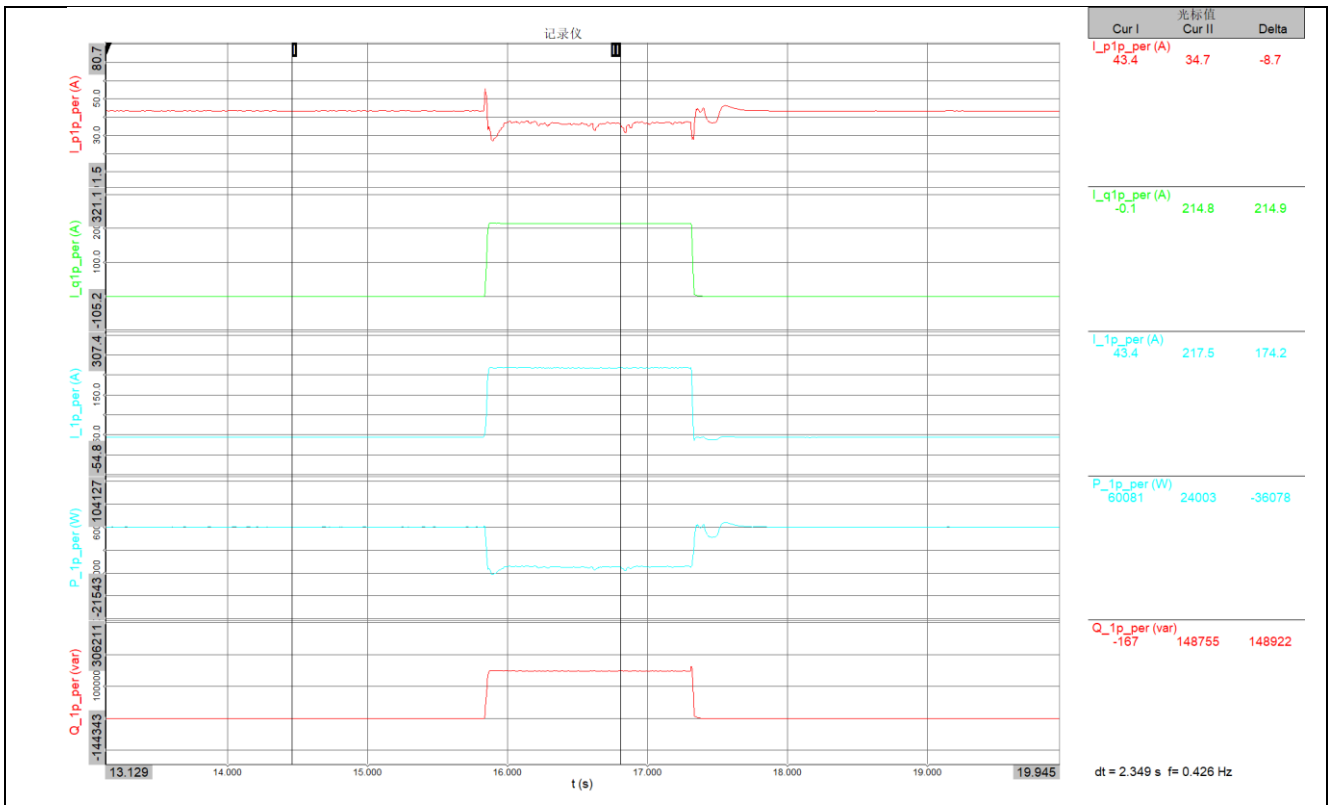
- Phase currents and RMS phase currents as moving averages over 20 ms:



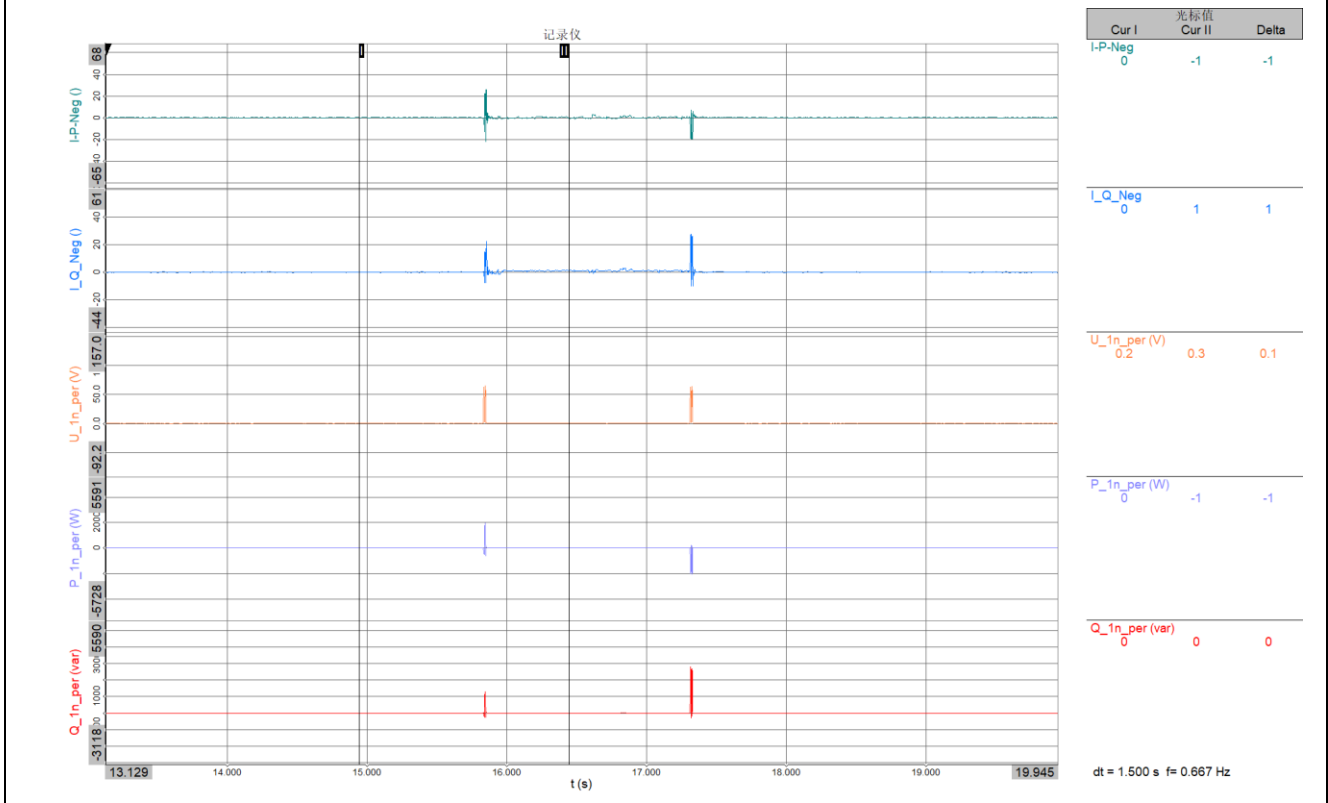
- Positive sequence active & reactive power and voltage, active & reactive current:



Product Service



- Negative sequence active & reactive power and voltage, active & reactive current :





Test Number	2.1.2b					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.1.2b
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11536.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	13048.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1492.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.493
	17		Neg. seq.		[p.u.]	N/A
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	0.996
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.996
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.995
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.697
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.668
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.668
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A



	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.198
	32	Active power	Total	t1-10s to t1	[p.u.]	0.196
	33		Total	t1-2s to t1	[p.u.]	0.196
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.196
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.664
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	25.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	25.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.502
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.315
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.507
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.199
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.199
51	Short-circuit currents Half-period rms values		Phase 1	t1+10ms	[A]	151.915



	52		Phase 2	t1+10ms	[A]	151.032
	53		Phase 3	t1+10ms	[A]	152.042
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	153.661
	55		Phase 2	t1 to t1+20ms	[A]	152.669
	56		Phase 3	t1 to t1+20ms	[A]	154.672
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	151.766
	55		Phase 2	t1 to t1+20ms	[A]	150.721
	56		Phase 3	t1 to t1+20ms	[A]	151.290
	57		Phase 1	t1 to t1+100ms	[A]	151.766
	58		Phase 2	t1 to t1+100ms	[A]	150.721
	59		Phase 3	t1 to t1+100ms	[A]	151.290
	60		Phase 1	t1+150ms	[A]	151.766
	61		Phase 2	t1+150ms	[A]	150.721
	62		Phase 3	t1+150ms	[A]	151.290
	63		Phase 1	t1+300ms	[A]	151.766
	64		Phase 2	t1+300ms	[A]	150.721
	65		Phase 3	t1+300ms	[A]	151.290
	66		Phase 1	t1+500ms	[A]	151.766
	67		Phase 2	t1+500ms	[A]	150.721
	68		Phase 3	t1+500ms	[A]	151.290
	69		Phase 1	t1+1000ms	[A]	151.766

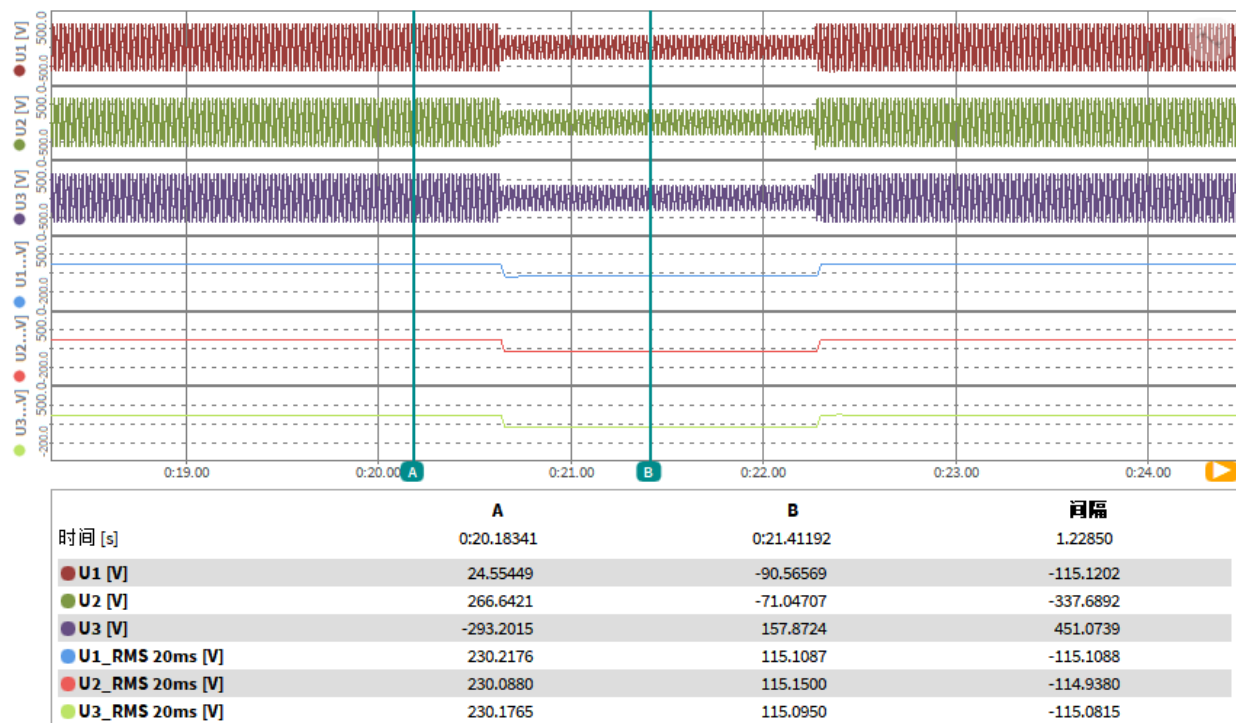


Product Service

	70		Phase 2	t1+1000ms	[A]	150.721
	71		Phase 3	t1+1000ms	[A]	151.290
	72		Phase 1	t2-20ms	[A]	110.173
	73		Phase 2	t2-20ms	[A]	109.190
	74		Phase 3	t2-20ms	[A]	109.455
After t2	75	Active power	Total	t2+5s	[p.u.]	0.197
	76		Total	t2+1s to t2+10s	[p.u.]	0.197
	77		Total	t2+10s	[p.u.]	0.197
	78	Active current rise time	Pos. seq.	-	[ms]	180.000

Graphic:

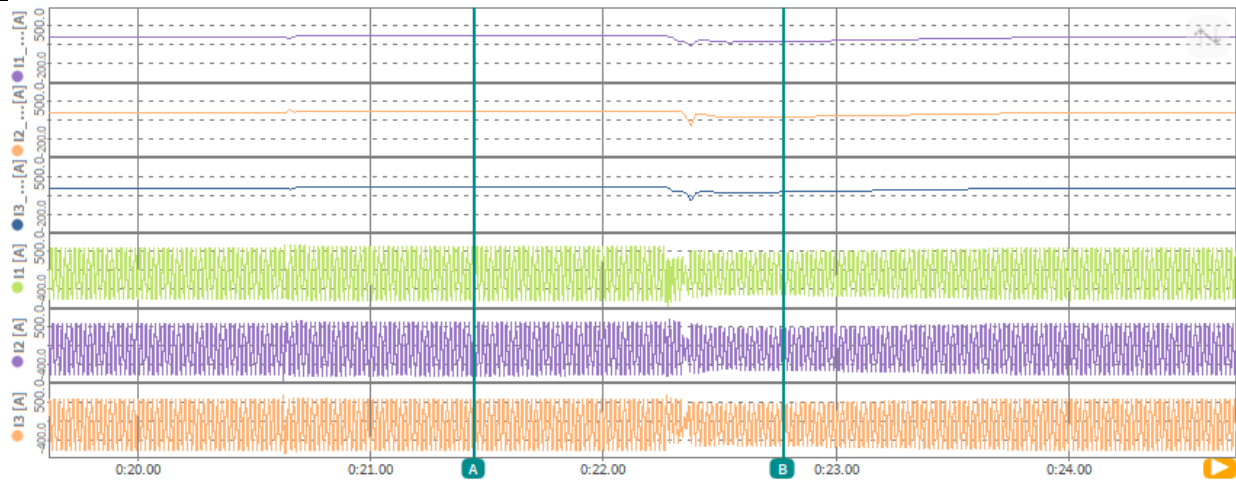
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



- Phase currents and RMS phase currents as moving averages over 20 ms :

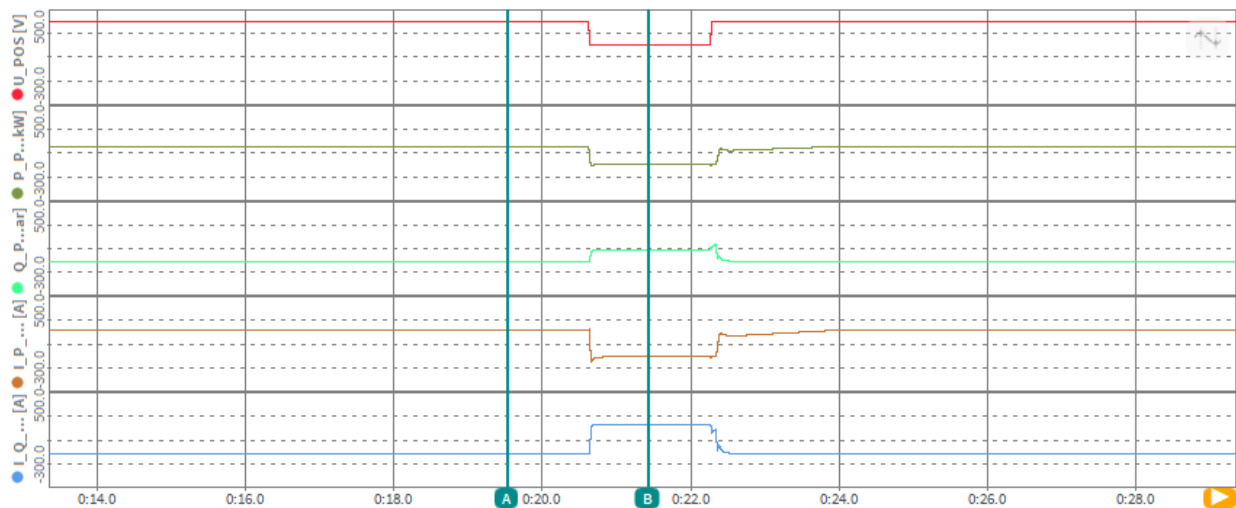


Product Service



时间 [s]	A	B	间隔
I1_RMS 20ms [A]	227.3020	177.0661	-50.23582
I2_RMS 20ms [A]	226.6289	174.9914	-51.63754
I3_RMS 20ms [A]	218.5625	175.7991	-42.76331
I1 [A]	-7.129908	53.84863	60.97854
I2 [A]	255.0358	-192.3561	-447.3919
I3 [A]	-299.3405	228.1082	527.4487

- Positive sequence active & reactive power and voltage, active & reactive current :



时间 [s]	A	B	间隔
U_POS [V]	398.6164	199.3458	-199.2706
P_POS [kW]	148.5270	-2.263983	-150.7910
Q_POS [kvar]	-14.13591	77.18595	91.32185
I_P_POS [A]	215.1244	-6.557004	-221.6814
I_Q_POS [A]	-20.47425	223.5479	244.0221

- Negative sequence active & reactive power and voltage, active & reactive current :



Product Service



	A	B	间隔
时间 [s]	0:20.192945	0:20.912415	0.719469
U_NEG [V]	0.200861	0.511186	0.310326
P_NEG [kW]	3.964e-4	2.006e-4	-1.957e-4
Q_NEG [kvar]	-1.435e-4	-1.153e-4	2.817e-5
I_P_NEG [A]	1.139280	0.227674	-0.911606
I_Q_NEG [A]	-0.412417	-0.130235	0.282182

Test Number	2.2.1a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.2.1a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11564.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	13066.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1482.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.250
17	Neg. seq.			[p.u.]	0.248	
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.001



	23		Neg. seq.	t1-10s to t1	[p.u.]	0.000	
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.001	
	25		Pos. seq.	t1-1s to t1	[p.u.]	1.000	
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001	
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.007	
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.004	
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.004	
	30		Neg. seq.	t1-1s to t1	[p.u.]	-0.024	
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	1.004	
	32	Active power	Total	t1-10s to t1	[p.u.]	1.007	
	33		Total	t1-2s to t1	[p.u.]	1.007	
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.727	
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.002	
	t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
		38		Neg. seq.	-	-	2.500
39		Reactive current rise time	Pos. seq.	-	[ms]	25.000	
40			Neg. seq.	-	[ms]	25.000	
41		Reactive current settling time	Pos. seq.	-	[ms]	27.000	
42			Neg. seq.	-	[ms]	25.000	
43		Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.750	



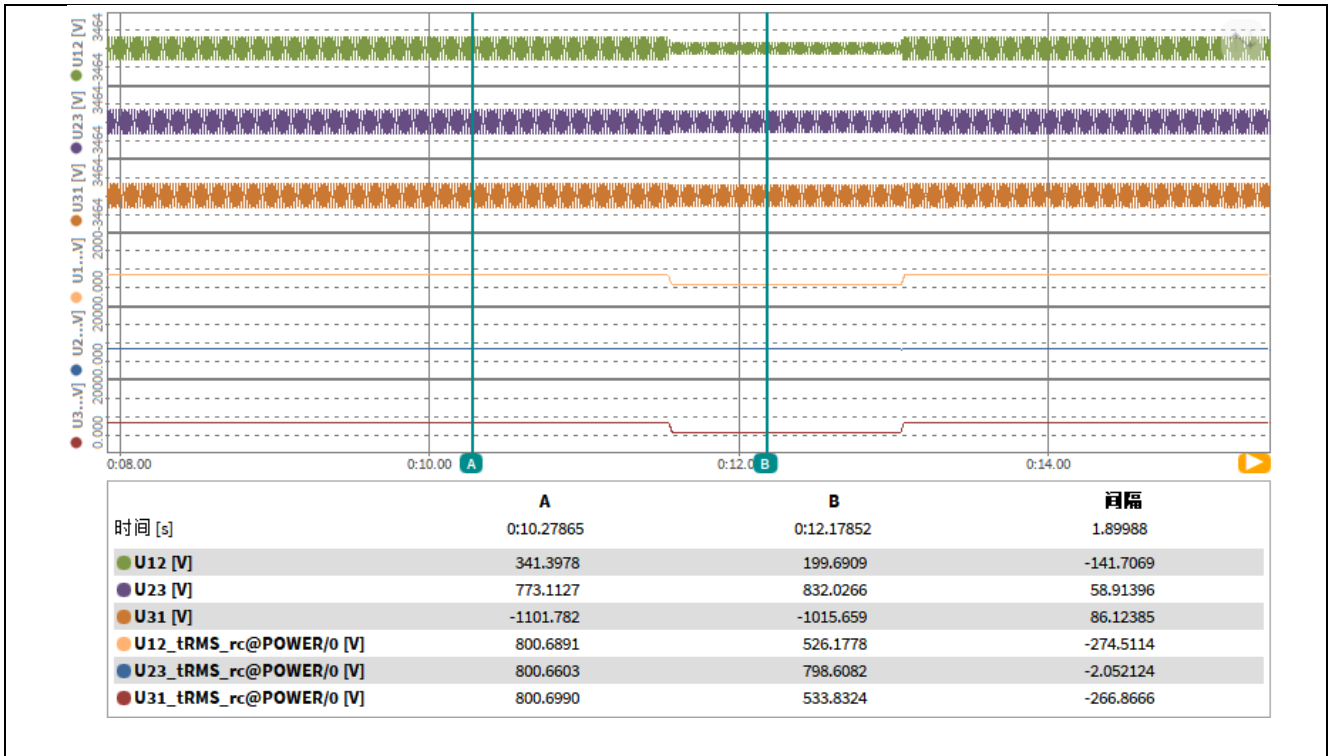
44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.248
45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.384
46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.200
47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.384
48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.598
49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.106
50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.073
51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	220.120
52		Phase 2	t1+10ms	[A]	217.658
53		Phase 3	t1+10ms	[A]	218.060
54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	221.534
55		Phase 2	t1 to t1+20ms	[A]	220.234
56		Phase 3	t1 to t1+20ms	[A]	220.089
54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	219.369
55		Phase 2	t1 to t1+20ms	[A]	217.665
56		Phase 3	t1 to t1+20ms	[A]	218.109
57		Phase 1	t1 to t1+100ms	[A]	219.369
58		Phase 2	t1 to t1+100ms	[A]	217.665
59		Phase 3	t1 to t1+100ms	[A]	218.109
60		Phase 1	t1+150ms	[A]	219.369
61		Phase 2	t1+150ms	[A]	217.665



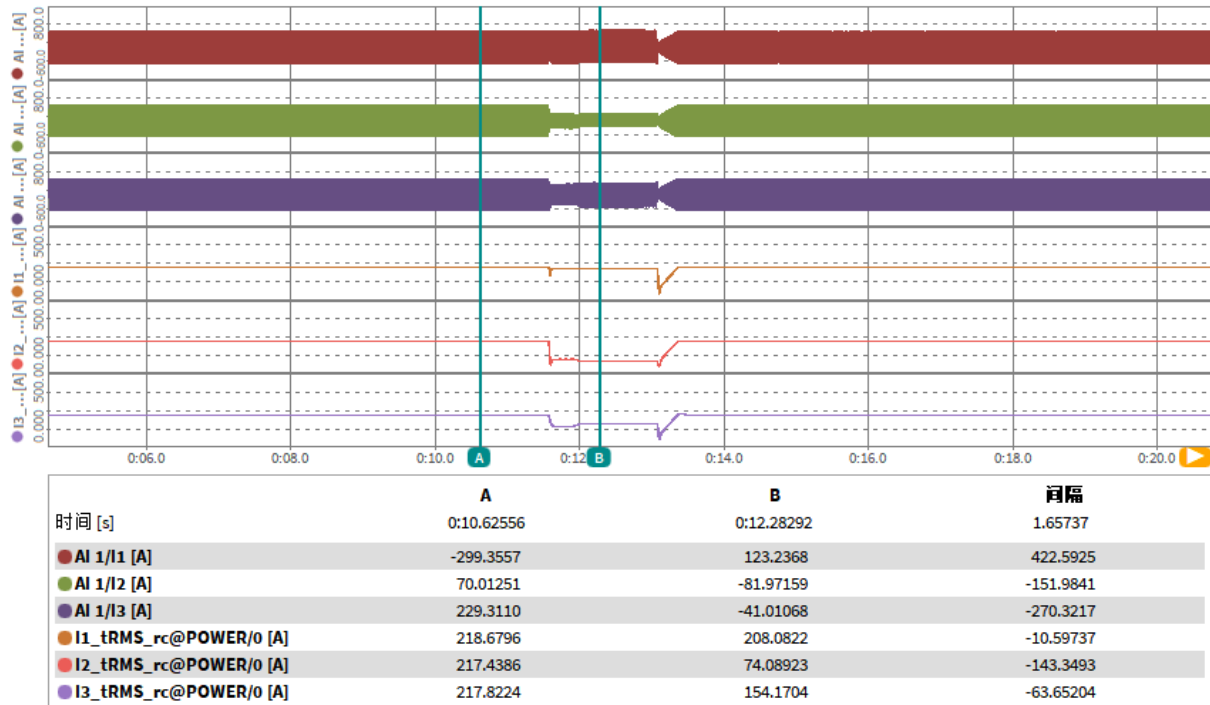
	62		Phase 3	t1+150ms	[A]	218.109
	63		Phase 1	t1+300ms	[A]	219.369
	64		Phase 2	t1+300ms	[A]	217.665
	65		Phase 3	t1+300ms	[A]	218.109
	66		Phase 1	t1+500ms	[A]	219.369
	67		Phase 2	t1+500ms	[A]	217.665
	68		Phase 3	t1+500ms	[A]	218.109
	69		Phase 1	t1+1000ms	[A]	219.369
	70		Phase 2	t1+1000ms	[A]	217.665
	71		Phase 3	t1+1000ms	[A]	218.109
	72		Phase 1	t2-20ms	[A]	207.728
	73		Phase 2	t2-20ms	[A]	75.260
	74		Phase 3	t2-20ms	[A]	152.966
After t2	75	Active power	Total	t2+5s	[p.u.]	1.008
	76		Total	t2+1s to t2+10s	[p.u.]	1.008
	77		Total	t2+10s	[p.u.]	1.008
	78	Active current rise time	Pos. seq.	-	[ms]	747.000

Graphic:

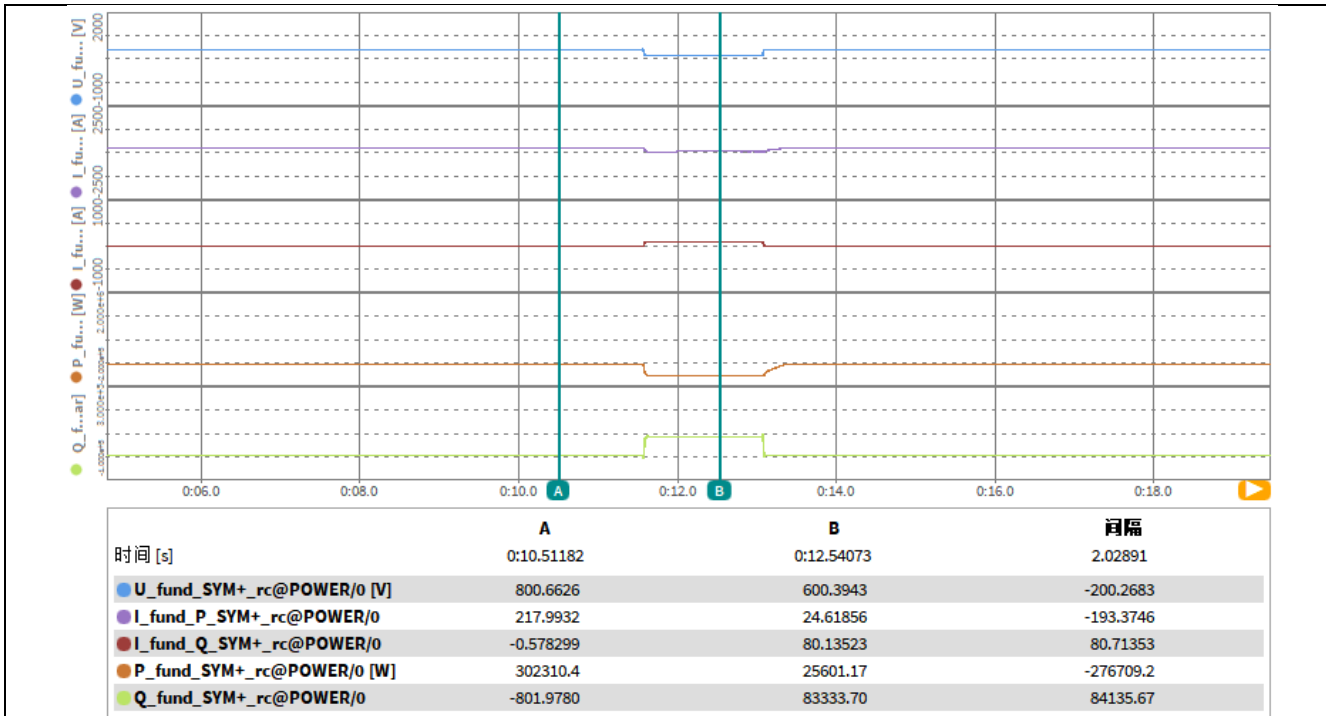
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



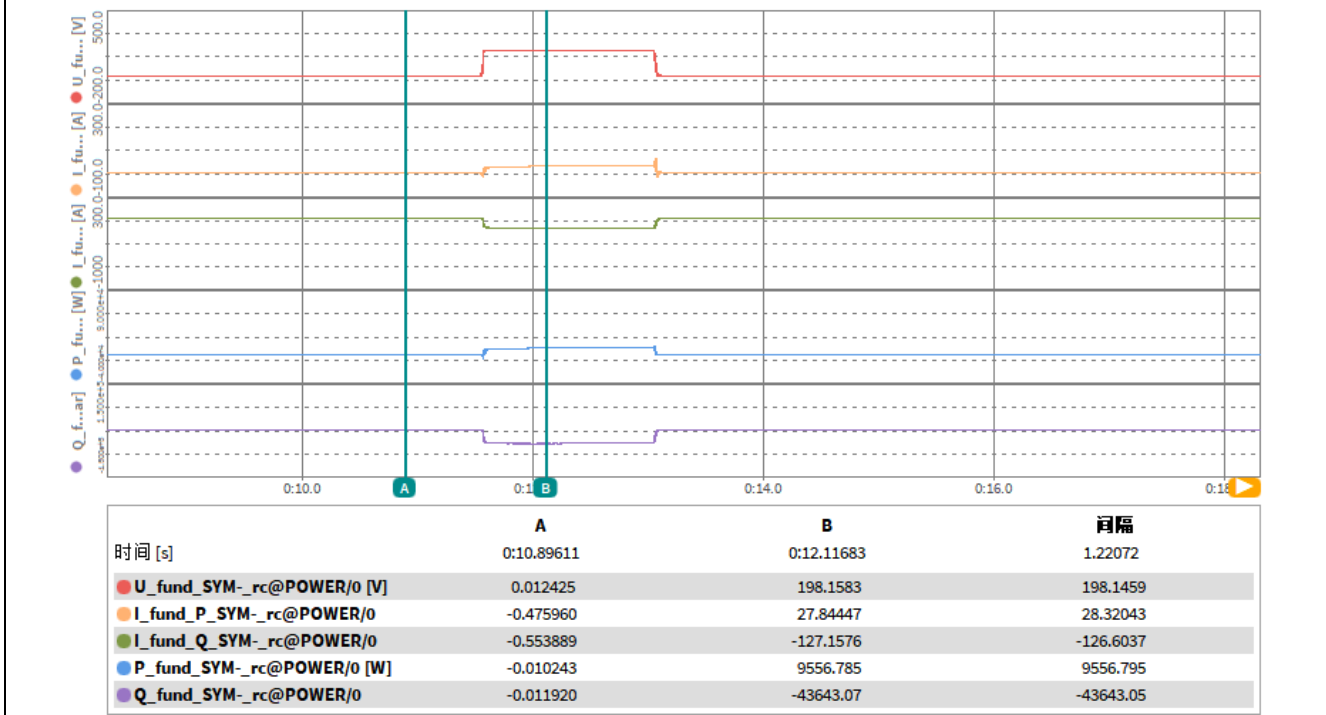
- Phase currents and RMS phase currents as moving averages over 20 ms:



- Positive sequence active & reactive power and voltage, active & reactive current:



- Negative sequence active & reactive power and voltage, active & reactive current :





Test Number	2.2.1b					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.2.1b
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	14098.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	15681.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1563.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.252
	17		Neg. seq.		[p.u.]	0.248
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.004
	23		Neg. seq.	t1-10s to t1	[p.u.]	0.000
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.004
	25		Pos. seq.	t1-1s to t1	[p.u.]	1.004
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.001
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	0.651
	29		Pos. seq.	t1-1s to t1	[p.u.]	0.661
	30		Neg. seq.	t1-1s to t1	[p.u.]	-0.032



	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.092
	32	Active power	Total	t1-10s to t1	[p.u.]	0.877
	33		Total	t1-2s to t1	[p.u.]	0.877
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.631
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.472
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	25.000
	40		Neg. seq.	-	[ms]	25.000
	41	Reactive current settling time	Pos. seq.	-	[ms]	25.000
	42		Neg. seq.	-	[ms]	25.000
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.752
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.248
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.691
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.133
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	1.161
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.686
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.093
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.070
51	Short-circuit currents Half-period rms values		Phase 1	t1+10ms	[A]	240.062



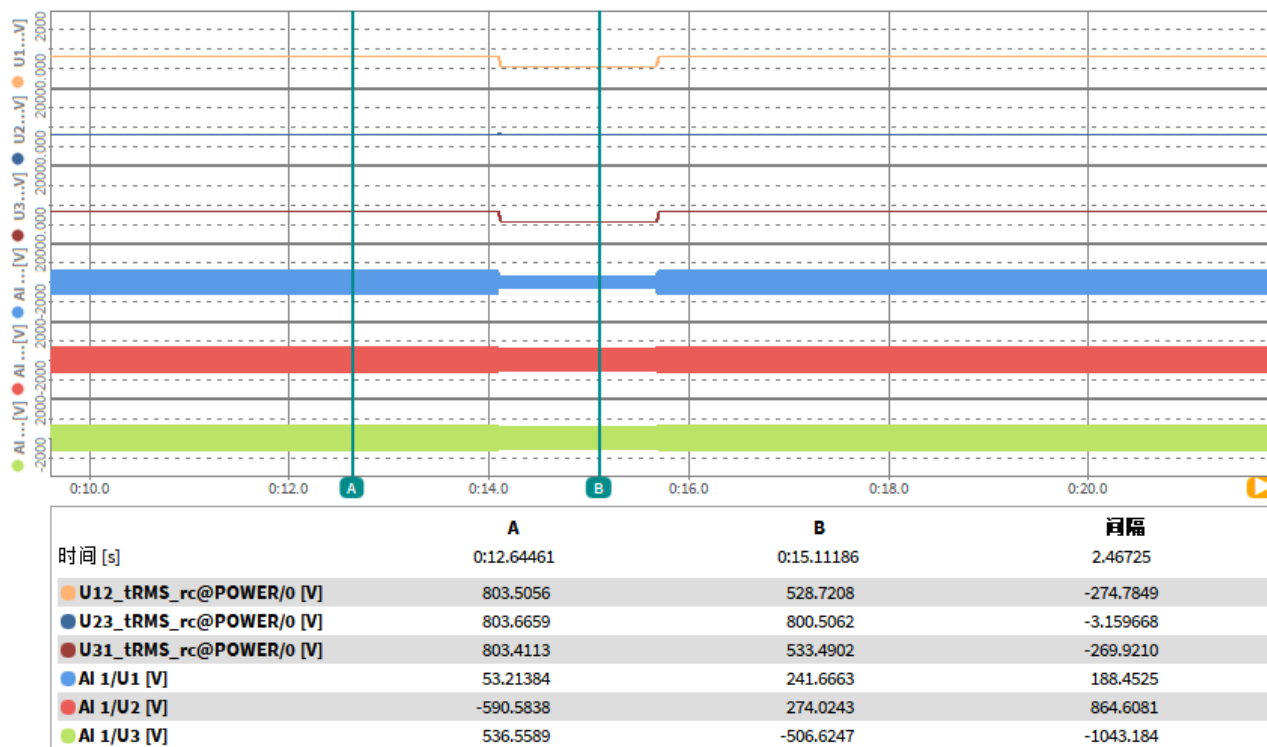
	52		Phase 2	t1+10ms	[A]	236.175
	53		Phase 3	t1+10ms	[A]	236.342
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	244.999
	55		Phase 2	t1 to t1+20ms	[A]	237.368
	56		Phase 3	t1 to t1+20ms	[A]	237.386
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	238.269
	55		Phase 2	t1 to t1+20ms	[A]	236.163
	56		Phase 3	t1 to t1+20ms	[A]	236.334
	57		Phase 1	t1 to t1+100ms	[A]	238.269
	58		Phase 2	t1 to t1+100ms	[A]	236.163
	59		Phase 3	t1 to t1+100ms	[A]	236.334
	60		Phase 1	t1+150ms	[A]	238.269
	61		Phase 2	t1+150ms	[A]	236.163
	62		Phase 3	t1+150ms	[A]	236.334
	63		Phase 1	t1+300ms	[A]	238.269
	64		Phase 2	t1+300ms	[A]	236.163
	65		Phase 3	t1+300ms	[A]	236.334
	66		Phase 1	t1+500ms	[A]	238.269
	67		Phase 2	t1+500ms	[A]	236.163
	68		Phase 3	t1+500ms	[A]	236.334
	69		Phase 1	t1+1000ms	[A]	238.269



	70		Phase 2	t1+1000ms	[A]	236.163
	71		Phase 3	t1+1000ms	[A]	236.334
	72		Phase 1	t2-20ms	[A]	228.216
	73		Phase 2	t2-20ms	[A]	100.242
	74		Phase 3	t2-20ms	[A]	158.350
After t2	75	Active power	Total	t2+5s	[p.u.]	0.876
	76		Total	t2+1s to t2+10s	[p.u.]	0.876
	77		Total	t2+10s	[p.u.]	0.876
	78	Active current rise time	Pos. seq.	-	[ms]	384.000

Graphic:

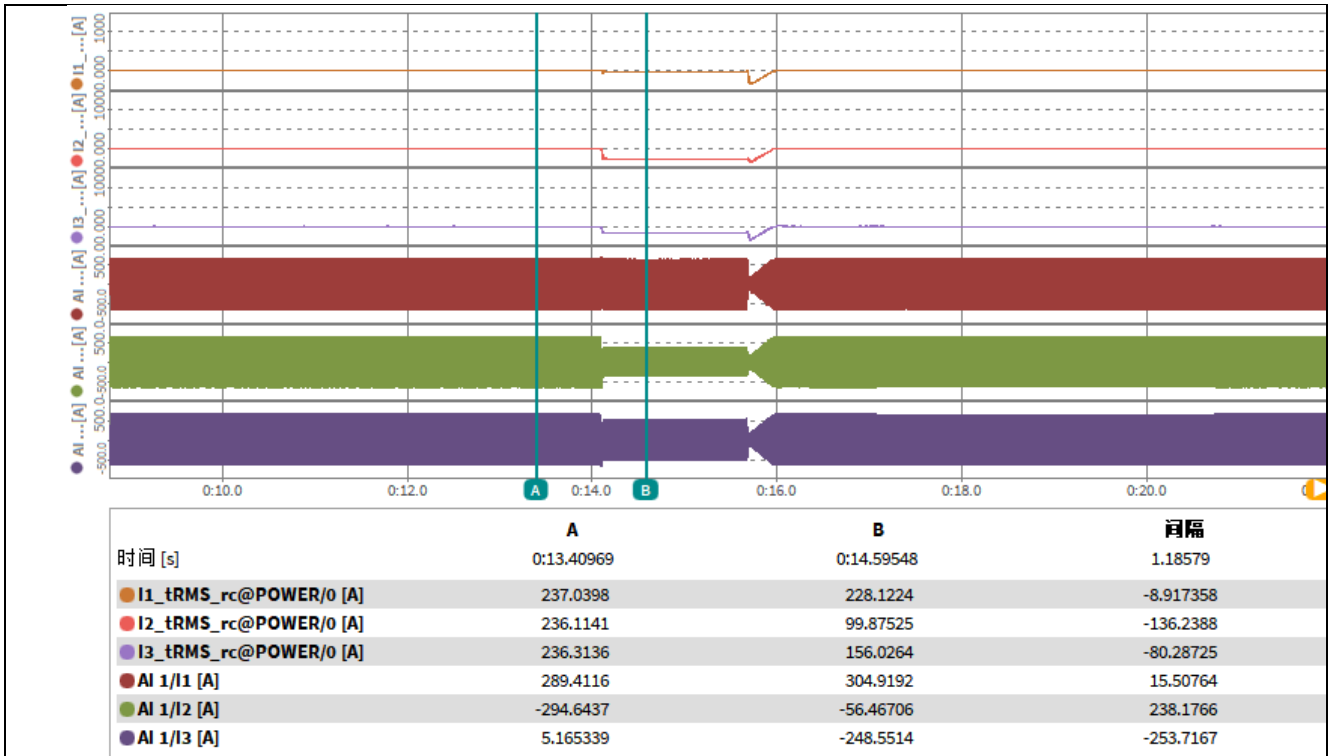
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



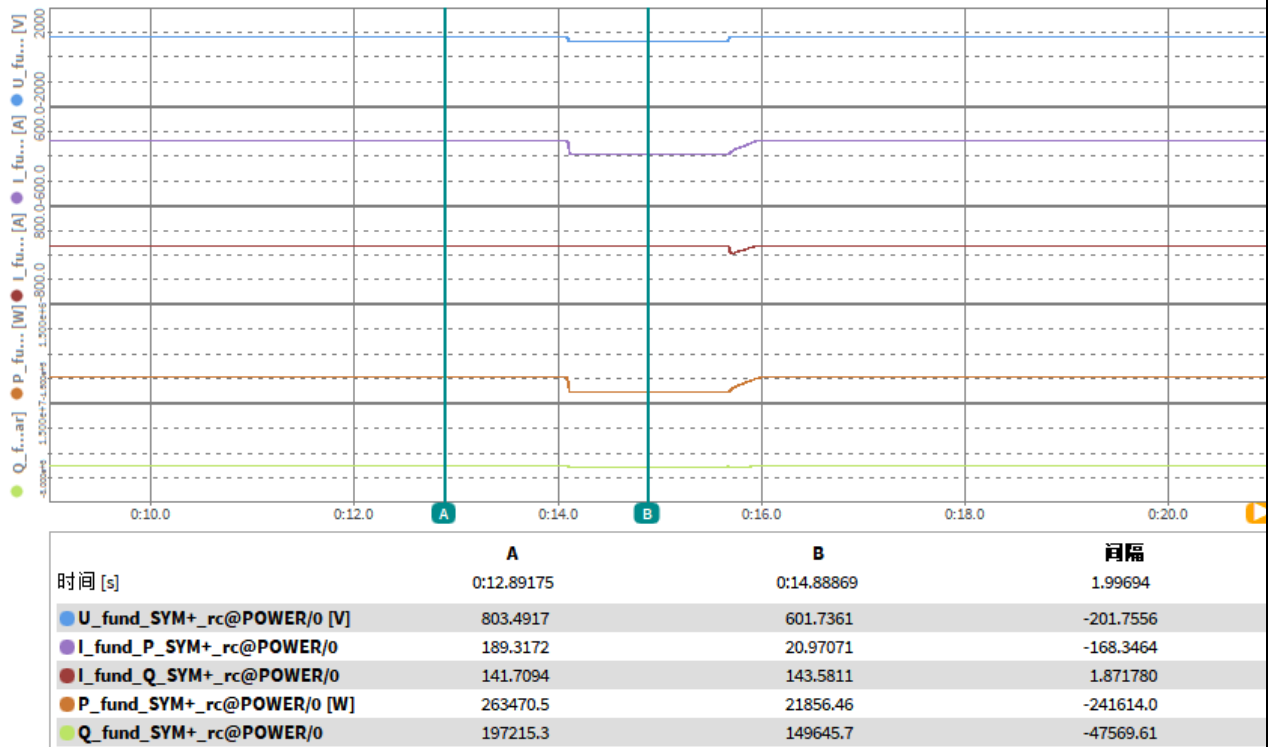
- Phase currents and RMS phase currents as moving averages over 20 ms:



Product Service



- Positive sequence active & reactive power and voltage, active & reactive current:



- Negative sequence active & reactive power and voltage, active & reactive current:



Product Service



Test Number	2.2.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.2.2a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11423.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	12925.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1482.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.249
	17		Neg. seq.		[p.u.]	0.247
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000



	23		Neg. seq.	t1-10s to t1	[p.u.]	0.000	
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000	
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.999	
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001	
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.199	
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.002	
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.002	
	30		Neg. seq.	t1-1s to t1	[p.u.]	0.000	
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.199	
	32	Active power	Total	t1-10s to t1	[p.u.]	0.199	
	33		Total	t1-2s to t1	[p.u.]	0.199	
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.199	
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.001	
	t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
		38		Neg. seq.	-	-	2.500
39		Reactive current rise time	Pos. seq.	-	[ms]	25.000	
40			Neg. seq.	-	[ms]	25.000	
41		Reactive current settling time	Pos. seq.	-	[ms]	25.000	
42			Neg. seq.	-	[ms]	25.000	
43		Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.750	



	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.248
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.372
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.583
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.385
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.596
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.104
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.072
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	146.552
	52		Phase 2	t1+10ms	[A]	44.550
	53		Phase 3	t1+10ms	[A]	117.959
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	212.970
	55		Phase 2	t1 to t1+20ms	[A]	80.141
	56		Phase 3	t1 to t1+20ms	[A]	155.720
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	205.741
	55		Phase 2	t1 to t1+20ms	[A]	70.056
	56		Phase 3	t1 to t1+20ms	[A]	152.853
	57		Phase 1	t1 to t1+100ms	[A]	210.368
	58		Phase 2	t1 to t1+100ms	[A]	77.907
	59		Phase 3	t1 to t1+100ms	[A]	152.853
	60		Phase 1	t1+150ms	[A]	210.368
	61		Phase 2	t1+150ms	[A]	78.294



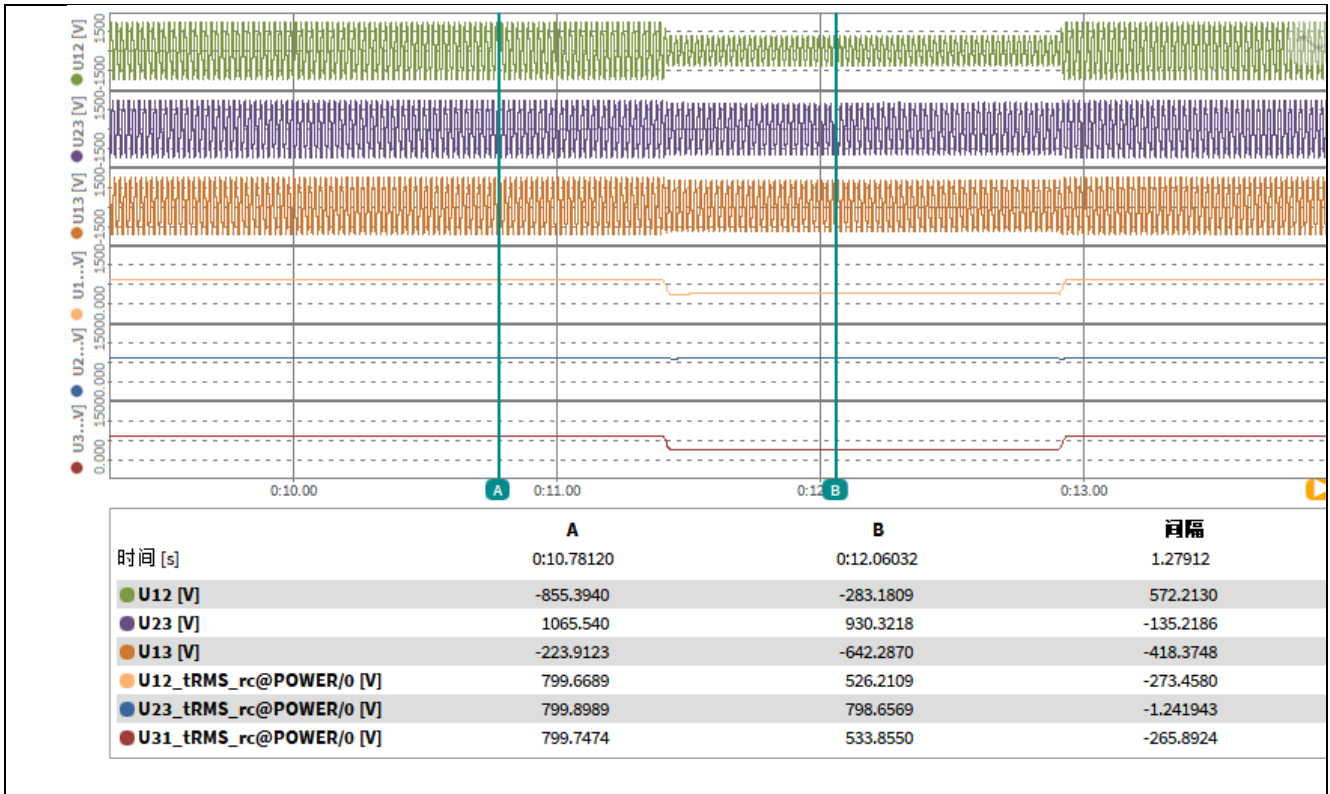
	62		Phase 3	t1+150ms	[A]	152.853
	63		Phase 1	t1+300ms	[A]	210.368
	64		Phase 2	t1+300ms	[A]	79.244
	65		Phase 3	t1+300ms	[A]	152.853
	66		Phase 1	t1+500ms	[A]	210.368
	67		Phase 2	t1+500ms	[A]	79.637
	68		Phase 3	t1+500ms	[A]	152.853
	69		Phase 1	t1+1000ms	[A]	210.368
	70		Phase 2	t1+1000ms	[A]	79.637
	71		Phase 3	t1+1000ms	[A]	152.853
	72		Phase 1	t2-20ms	[A]	207.984
	73		Phase 2	t2-20ms	[A]	77.484
	74		Phase 3	t2-20ms	[A]	150.182
	After t2		75	Active power	Total	t2+5s
76		Total	t2+1s to t2+10s		[p.u.]	0.199
77		Total	t2+10s		[p.u.]	0.199
78		Active current rise time	Pos. seq.	-	[ms]	270.000

Graphic:

- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



Product Service



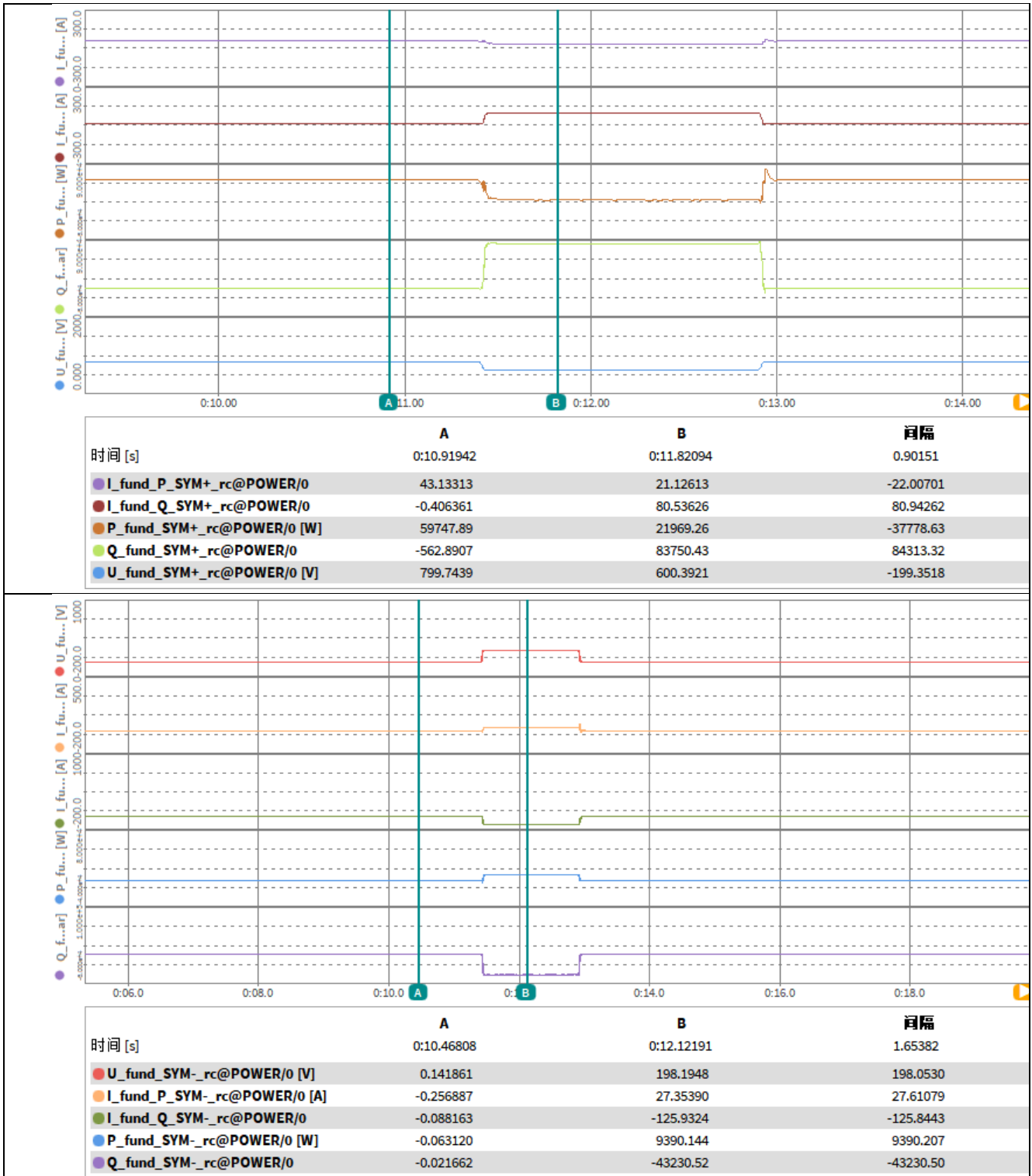
- Phase currents and RMS phase currents as moving averages over 20 ms:



- Positive sequence active & reactive power and voltage, active & reactive current:



Product Service





Test Number	2.2.2b					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	2.2.2b
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11560.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	13142.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	1562.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.251
	17		Neg. seq.		[p.u.]	0.247
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.003
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.003
	25		Pos. seq.	t1-1s to t1	[p.u.]	1.003
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.003
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	0.658
	29		Pos. seq.	t1-1s to t1	[p.u.]	0.664
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A



	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.302
	32	Active power	Total	t1-10s to t1	[p.u.]	0.218
	33		Total	t1-2s to t1	[p.u.]	0.218
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.157
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.476
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	25.000
	40		Neg. seq.	-	[ms]	25.000
	41	Reactive current settling time	Pos. seq.	-	[ms]	25.000
	42		Neg. seq.	-	[ms]	25.000
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.752
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.248
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.694
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.384
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	1.166
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.682
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.092
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.070
51	Short-circuit currents Half-period rms values		Phase 1	t1+10ms	[A]	212.203



	52		Phase 2	t1+10ms	[A]	150.391
	53		Phase 3	t1+10ms	[A]	150.117
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	231.515
	55		Phase 2	t1 to t1+20ms	[A]	151.832
	56		Phase 3	t1 to t1+20ms	[A]	163.738
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	229.087
	55		Phase 2	t1 to t1+20ms	[A]	150.135
	56		Phase 3	t1 to t1+20ms	[A]	150.602
	57		Phase 1	t1 to t1+100ms	[A]	229.087
	58		Phase 2	t1 to t1+100ms	[A]	150.135
	59		Phase 3	t1 to t1+100ms	[A]	155.809
	60		Phase 1	t1+150ms	[A]	229.087
	61		Phase 2	t1+150ms	[A]	150.135
	62		Phase 3	t1+150ms	[A]	155.812
	63		Phase 1	t1+300ms	[A]	229.087
	64		Phase 2	t1+300ms	[A]	150.135
	65		Phase 3	t1+300ms	[A]	155.995
	66		Phase 1	t1+500ms	[A]	229.087
	67		Phase 2	t1+500ms	[A]	150.135
	68		Phase 3	t1+500ms	[A]	155.995
	69		Phase 1	t1+1000ms	[A]	229.087

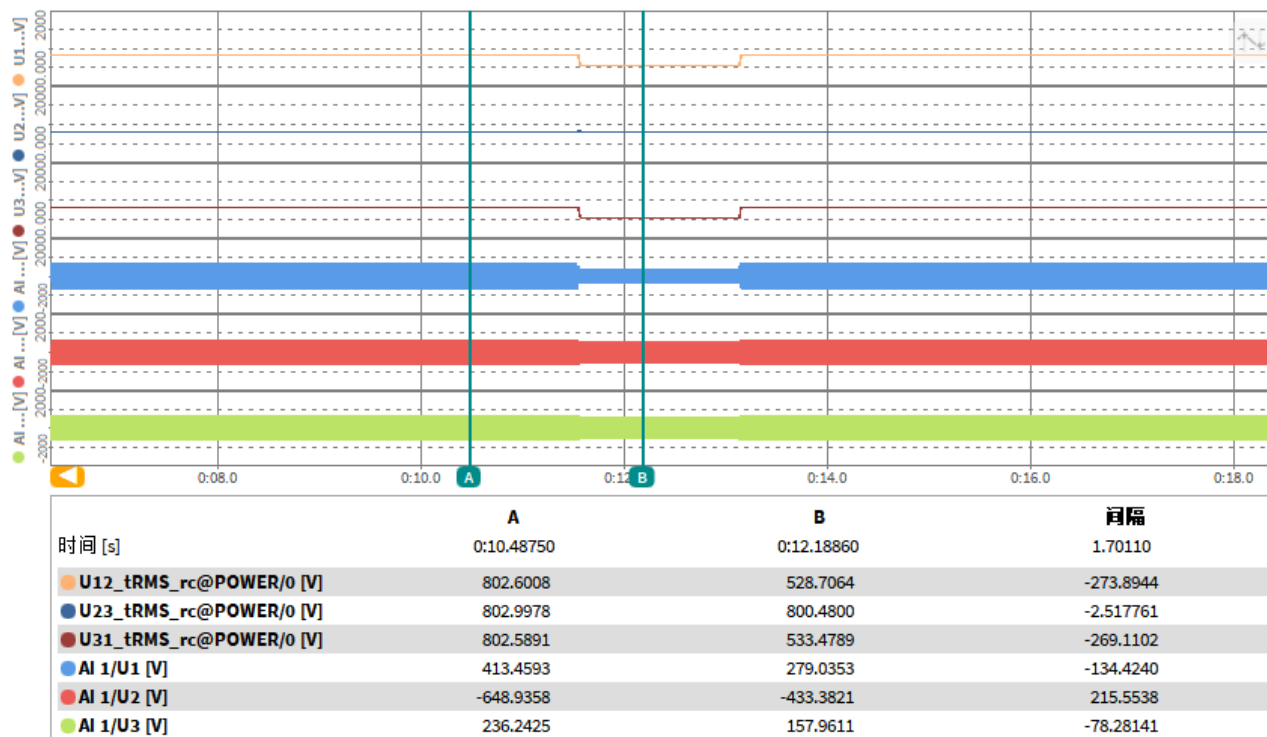


Product Service

	70		Phase 2	t1+1000ms	[A]	150.135
	71		Phase 3	t1+1000ms	[A]	156.428
	72		Phase 1	t2-20ms	[A]	228.351
	73		Phase 2	t2-20ms	[A]	101.249
	74		Phase 3	t2-20ms	[A]	157.629
After t2	75	Active power	Total	t2+5s	[p.u.]	0.217
	76		Total	t2+1s to t2+10s	[p.u.]	0.217
	77		Total	t2+10s	[p.u.]	0.217
	78	Active current rise time	Pos. seq.	-	[ms]	154.000

Graphic:

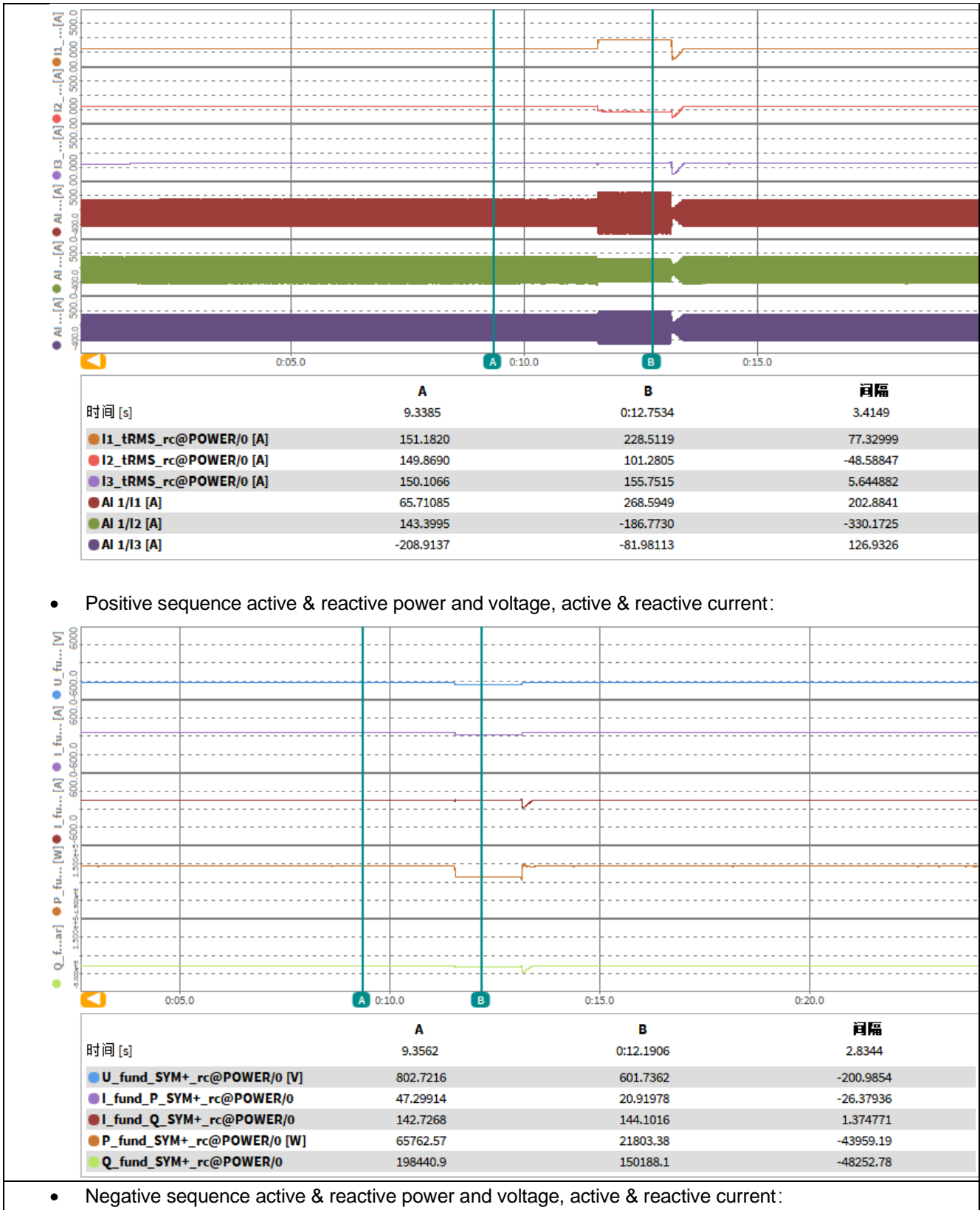
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



- Phase currents and RMS phase currents as moving averages over 20 ms :

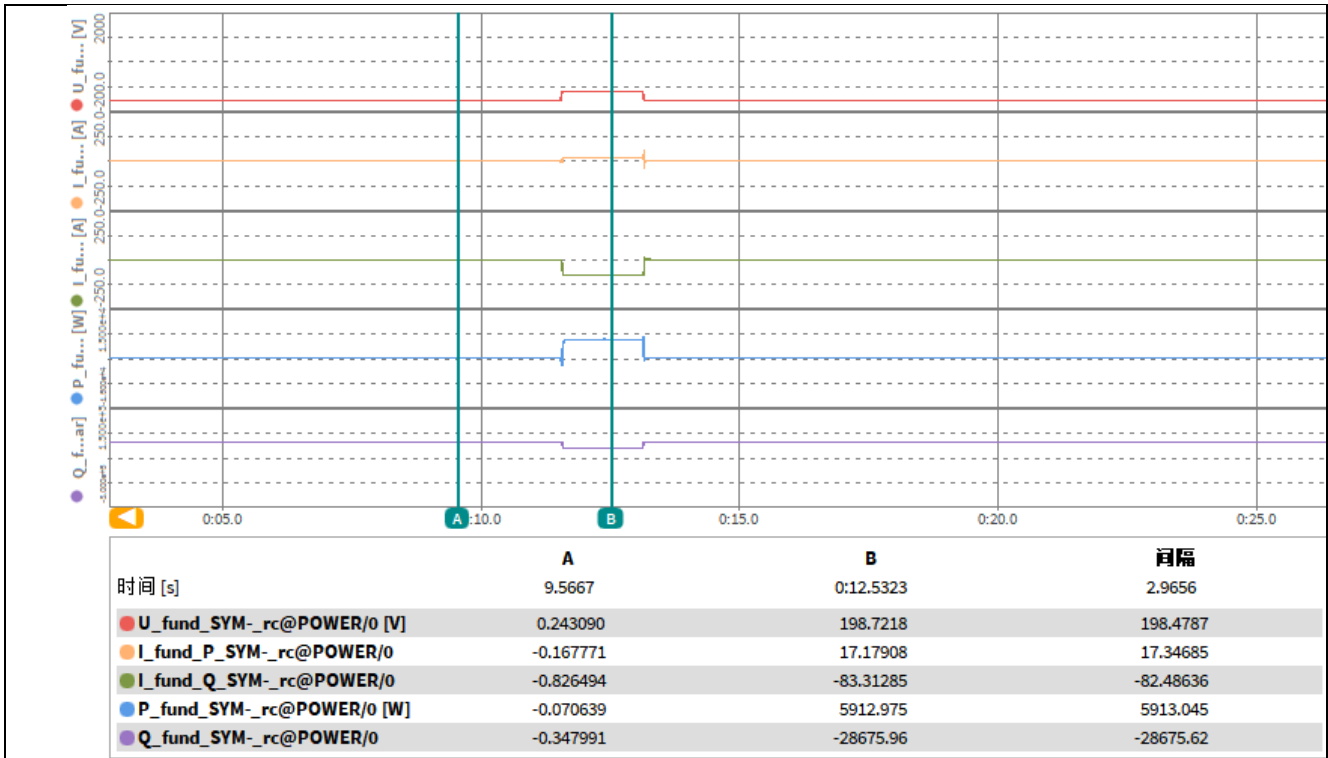


Product Service





Product Service



Test Number	3.1.1a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	3.1.1a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	15863.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	18063.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	2200.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.200
	17		Neg. seq.		[p.u.]	N/A
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000



	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A	
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000	
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.999	
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A	
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.951	
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.002	
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.002	
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A	
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.951	
	32	Active power	Total	t1-10s to t1	[p.u.]	0.950	
	33		Total	t1-2s to t1	[p.u.]	0.950	
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.950	
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.002	
	t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
		38		Neg. seq.	-	-	2.500
39		Reactive current rise time	Pos. seq.	-	[ms]	25.000	
40			Neg. seq.	-	[ms]	N/A	
41		Reactive current settling time	Pos. seq.	-	[ms]	25.000	
42			Neg. seq.	-	[ms]	N/A	
43		Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.800	



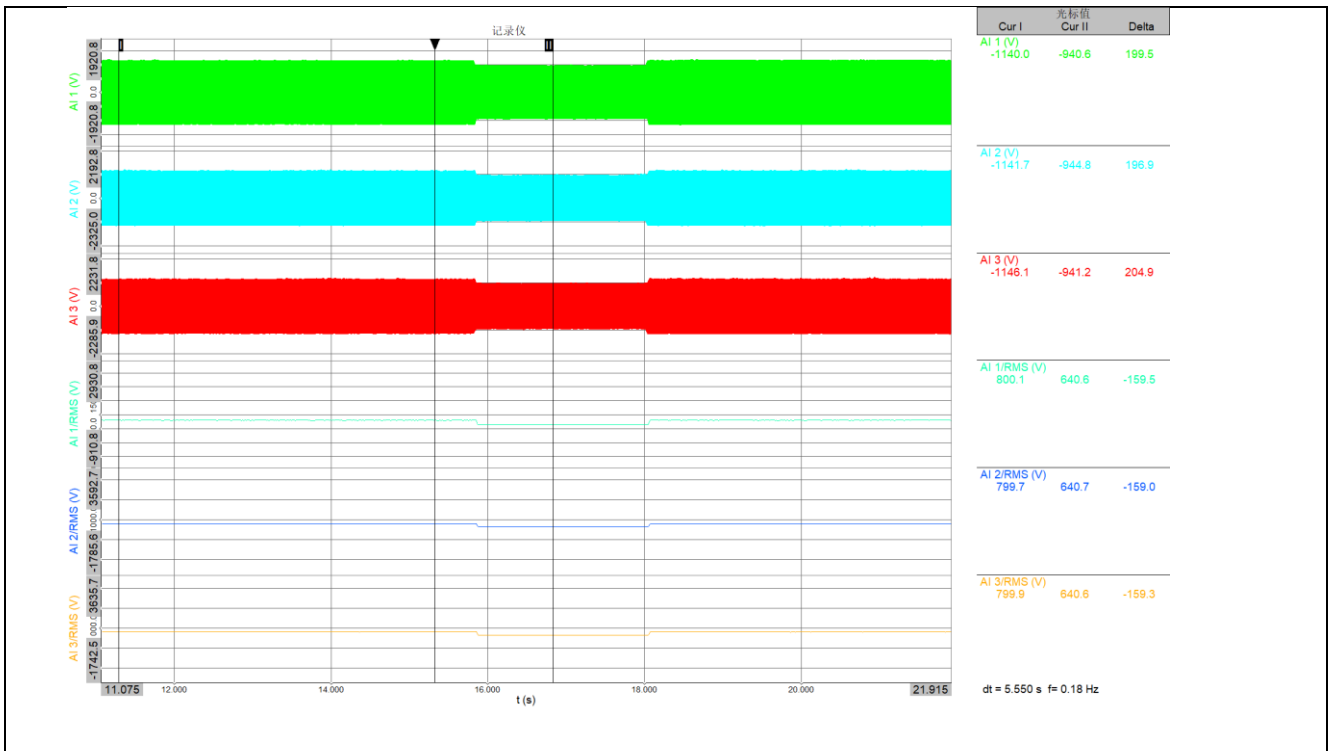
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.240
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.998
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.773
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.775
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	229.627
	52		Phase 2	t1+10ms	[A]	227.058
	53		Phase 3	t1+10ms	[A]	225.684
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	235.320
	55		Phase 2	t1 to t1+20ms	[A]	228.600
	56		Phase 3	t1 to t1+20ms	[A]	227.150
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	235.316
	55		Phase 2	t1 to t1+20ms	[A]	228.598
	56		Phase 3	t1 to t1+20ms	[A]	227.145
	57		Phase 1	t1 to t1+100ms	[A]	235.316
	58		Phase 2	t1 to t1+100ms	[A]	228.598
	59		Phase 3	t1 to t1+100ms	[A]	227.145
	60		Phase 1	t1+150ms	[A]	235.316
	61		Phase 2	t1+150ms	[A]	228.598



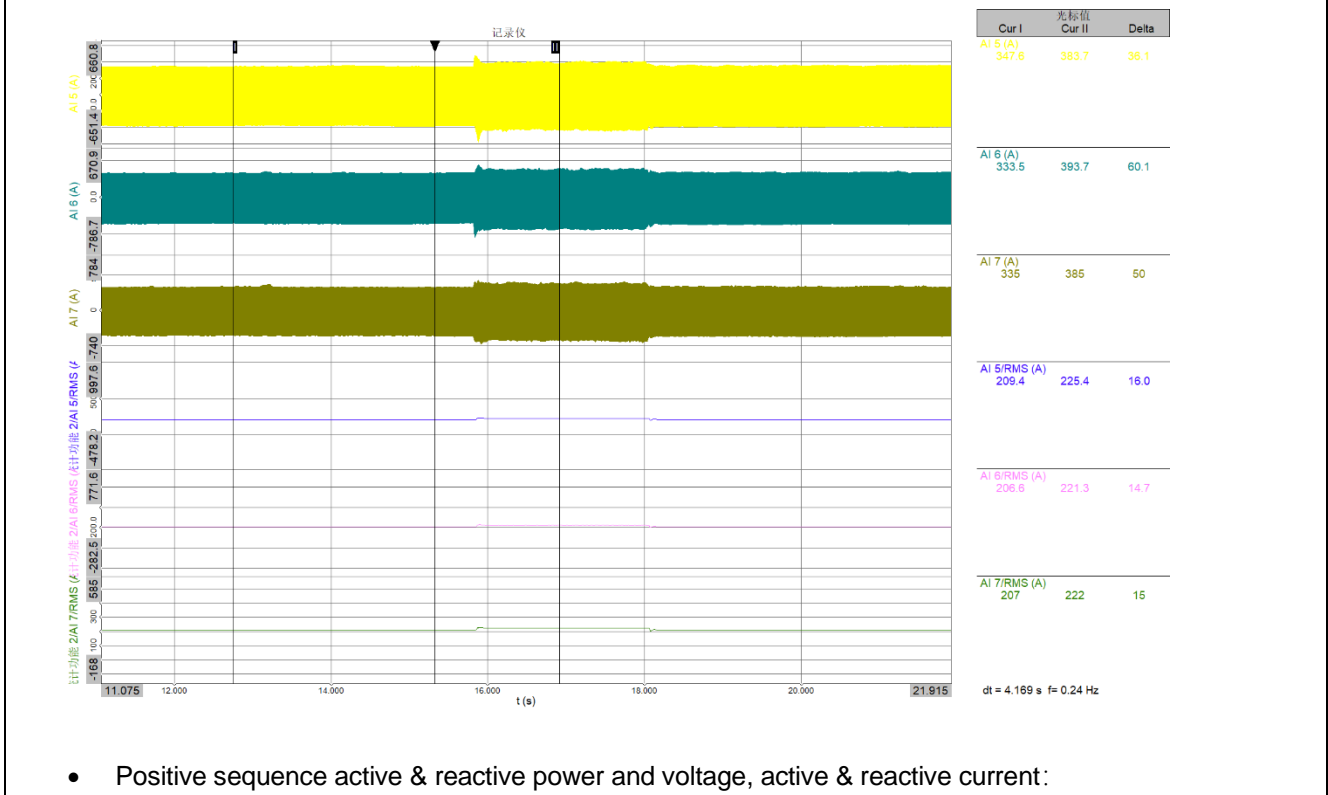
	62		Phase 3	t1+150ms	[A]	227.145
	63		Phase 1	t1+300ms	[A]	235.316
	64		Phase 2	t1+300ms	[A]	228.598
	65		Phase 3	t1+300ms	[A]	227.145
	66		Phase 1	t1+500ms	[A]	235.316
	67		Phase 2	t1+500ms	[A]	228.598
	68		Phase 3	t1+500ms	[A]	227.145
	69		Phase 1	t1+1000ms	[A]	235.316
	70		Phase 2	t1+1000ms	[A]	228.598
	71		Phase 3	t1+1000ms	[A]	227.145
	72		Phase 1	t2-20ms	[A]	226.479
	73		Phase 2	t2-20ms	[A]	221.484
	74		Phase 3	t2-20ms	[A]	222.156
	After t2		75	Active power	Total	t2+5s
76		Total	t2+1s to t2+10s		[p.u.]	0.951
77		Total	t2+10s		[p.u.]	0.952
78		Active current rise time	Pos. seq.	-	[ms]	238.000

Graphic:

- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



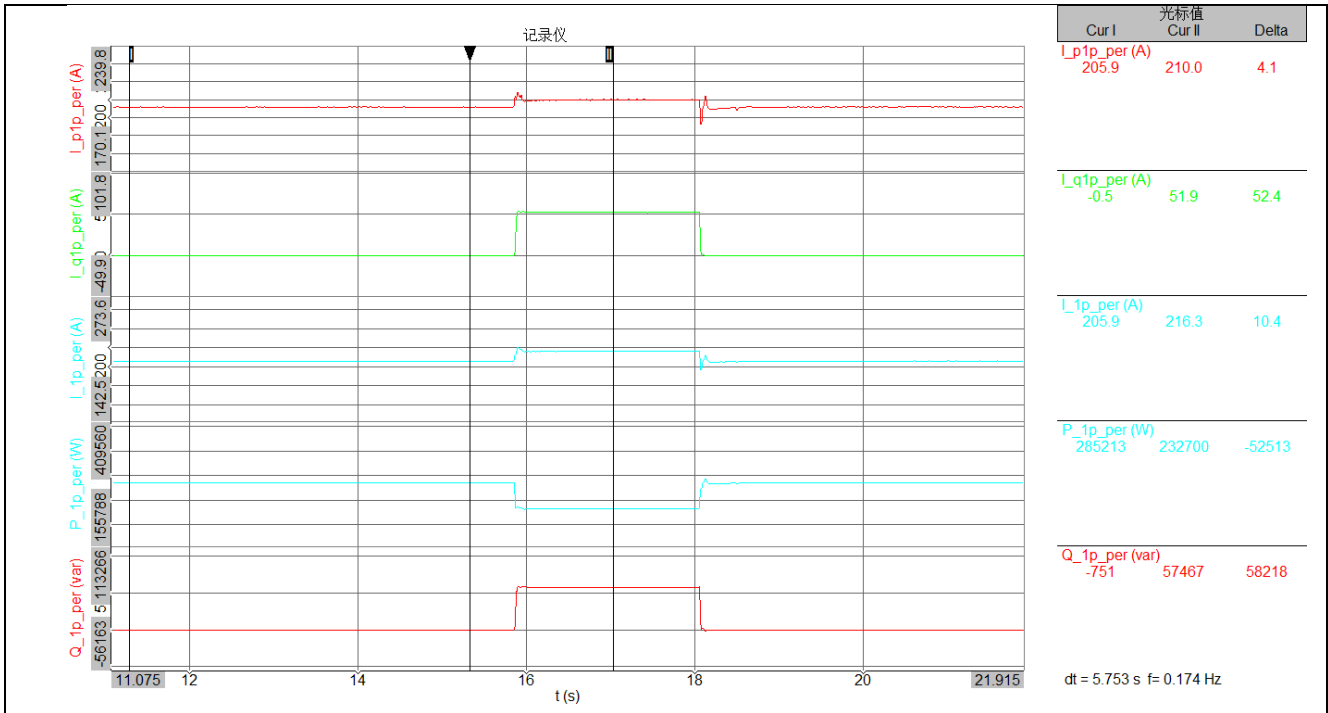
- Phase currents and RMS phase currents as moving averages over 20 ms:



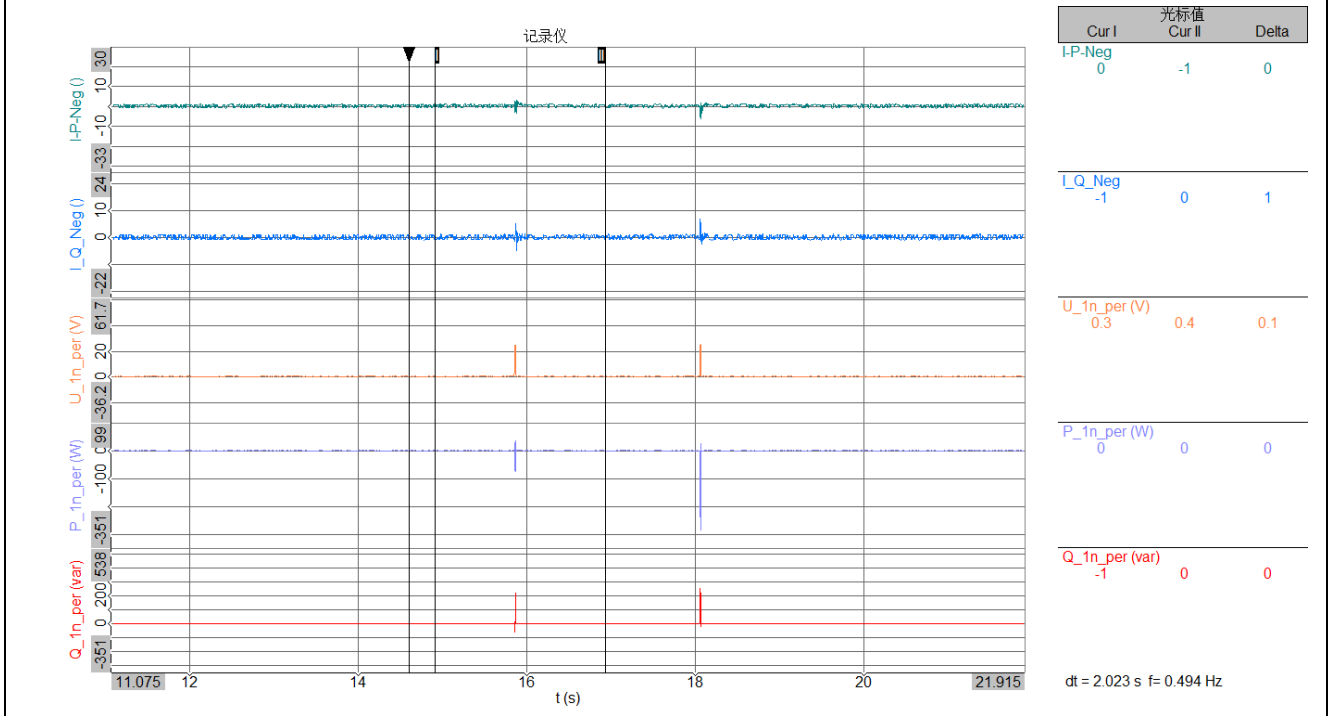
- Positive sequence active & reactive power and voltage, active & reactive current:



Product Service



- Negative sequence active & reactive power and voltage, active & reactive current:



Test Number	3.1.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	3.1.2a



	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	15670.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	17889.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	2299.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.200
17	Neg. seq.		t1-10s to t1	[p.u.]	N/A	
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.999
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.200
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	0.000
	29		Pos. seq.	t1-1s to t1	[p.u.]	0.000
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.200
	32	Active power	Total	t1-10s to t1	[p.u.]	0.200
33	Total		t1-2s to t1	[p.u.]	0.200	



	34		Pos. seq.	t1-500ms to t1- 100ms	[p.u.]	0.200
	35	Reactive power	Pos. seq.	t1-500ms to t1- 100ms	[p.u.]	-0.001
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	25.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	25.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.800
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.247
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.352
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.201
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.201
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	79.167
	52		Phase 2	t1+10ms	[A]	72.465
53	Phase 3		t1+10ms	[A]	74.619	
54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	82.460	



	55		Phase 2	t1 to t1+20ms	[A]	81.500
	56		Phase 3	t1 to t1+20ms	[A]	83.360
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	77.908
	55		Phase 2	t1 to t1+20ms	[A]	75.024
	56		Phase 3	t1 to t1+20ms	[A]	77.387
	57		Phase 1	t1 to t1+100ms	[A]	81.765
	58		Phase 2	t1 to t1+100ms	[A]	81.183
	59		Phase 3	t1 to t1+100ms	[A]	81.290
	60		Phase 1	t1+150ms	[A]	81.765
	61		Phase 2	t1+150ms	[A]	81.183
	62		Phase 3	t1+150ms	[A]	81.290
	63		Phase 1	t1+300ms	[A]	81.765
	64		Phase 2	t1+300ms	[A]	81.183
	65		Phase 3	t1+300ms	[A]	81.290
	66		Phase 1	t1+500ms	[A]	81.765
	67		Phase 2	t1+500ms	[A]	81.183
	68		Phase 3	t1+500ms	[A]	81.290
	69		Phase 1	t1+1000ms	[A]	81.765
	70		Phase 2	t1+1000ms	[A]	81.183
	71		Phase 3	t1+1000ms	[A]	81.290
	72		Phase 1	t2-20ms	[A]	80.101

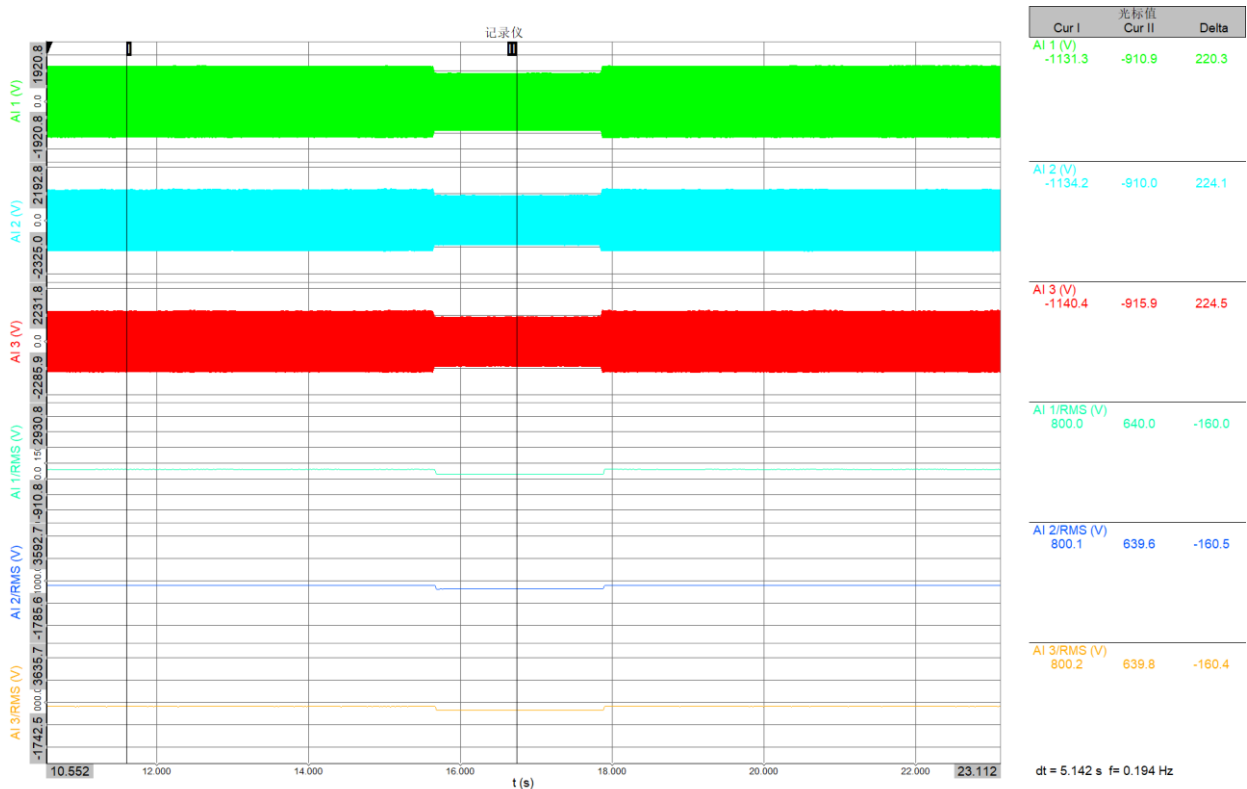


Product Service

	73		Phase 2	t2-20ms	[A]	77.702
	74		Phase 3	t2-20ms	[A]	78.581
After t2	75	Active power	Total	t2+5s	[p.u.]	0.204
	76		Total	t2+1s to t2+10s	[p.u.]	0.200
	77		Total	t2+10s	[p.u.]	0.199
	78	Active current rise time	Pos. seq.	-	[ms]	247.000

Graphic:

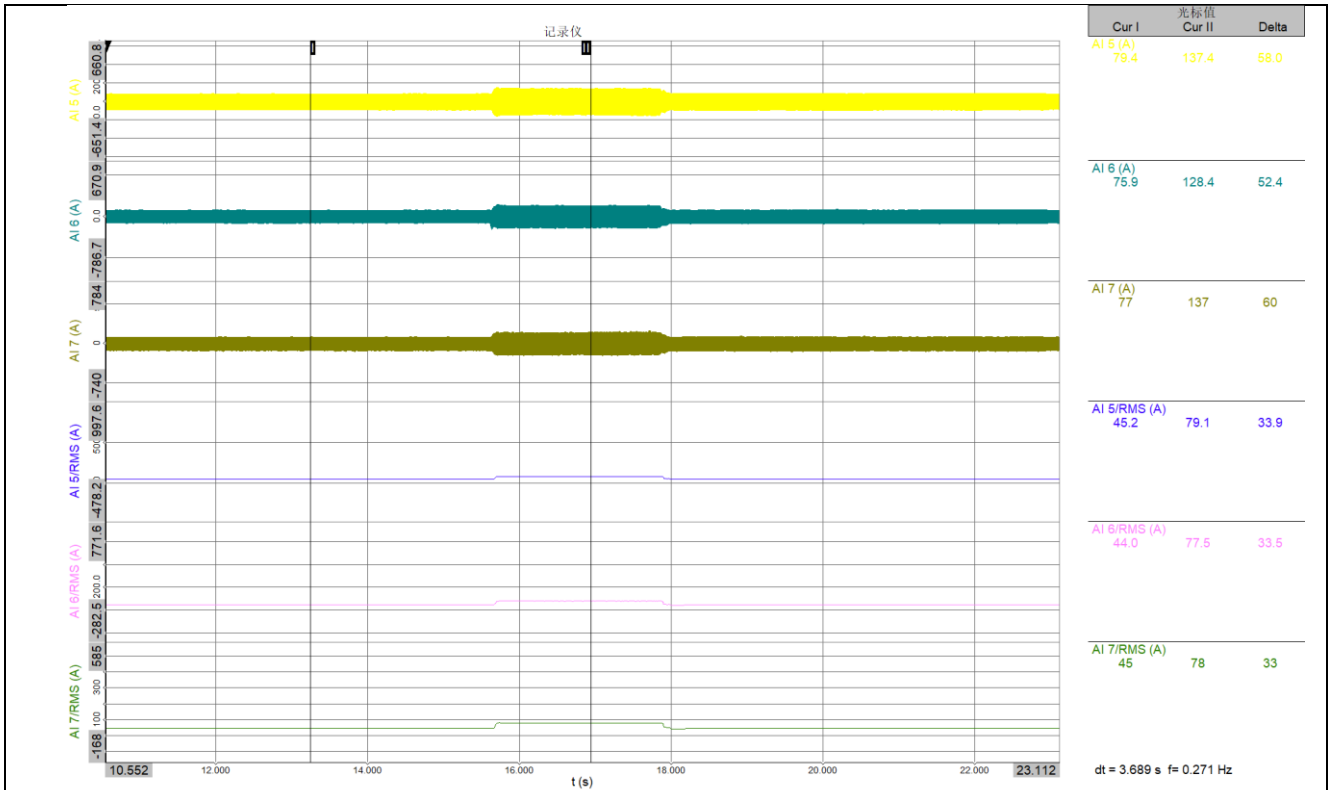
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



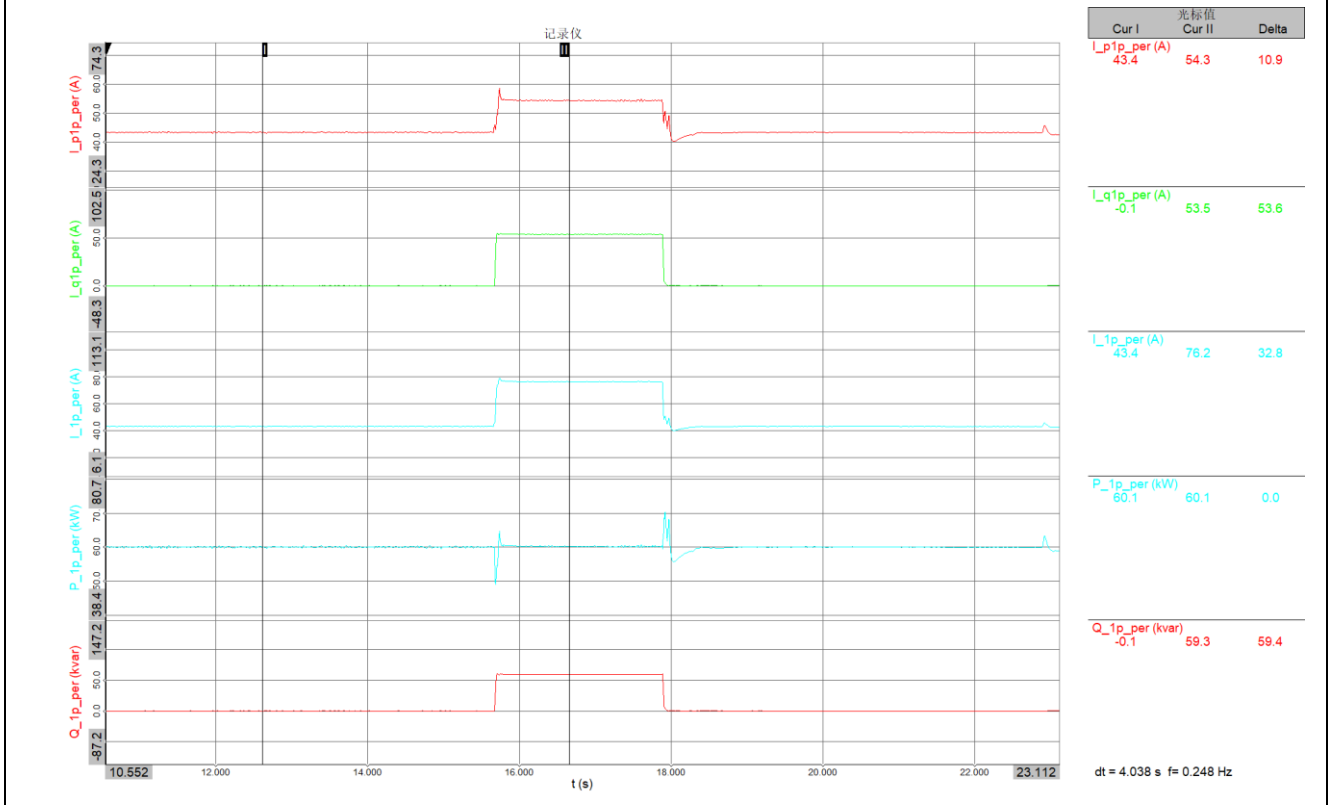
- Phase currents and RMS phase currents as moving averages over 20 ms :



Product Service



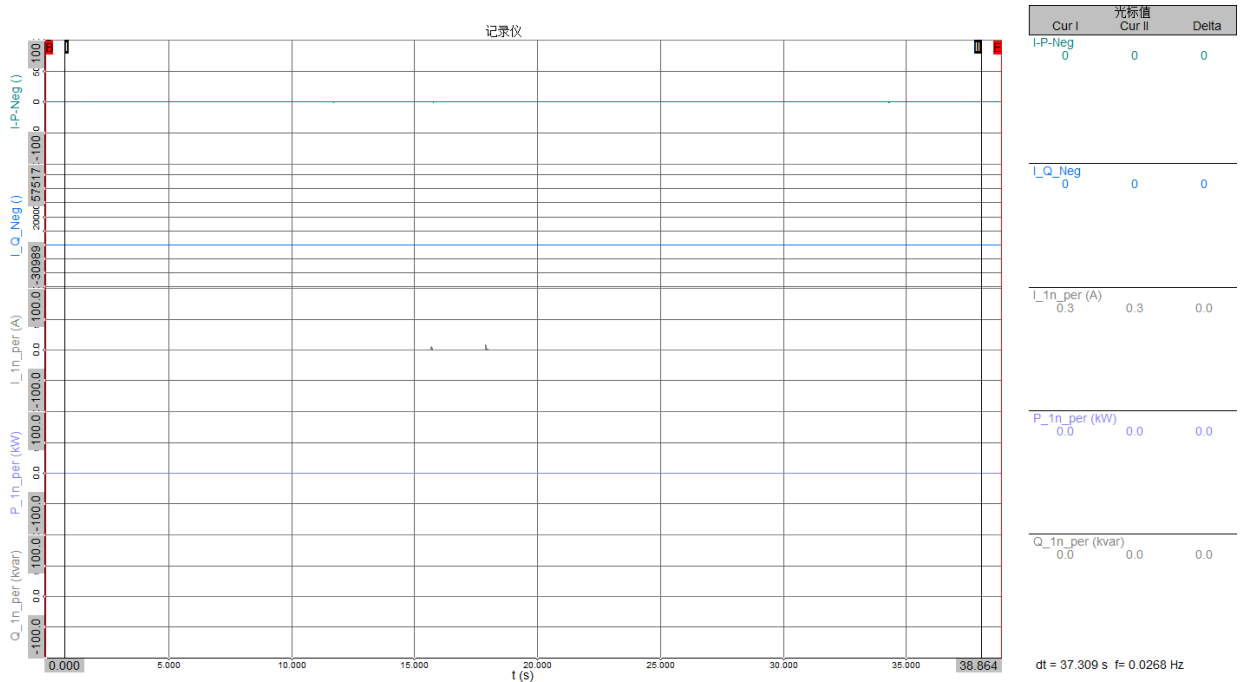
- Positive sequence active & reactive power and voltage, active & reactive current :





Product Service

- Negative sequence active & reactive power and voltage, active & reactive current :



Test Number	3.2.1.a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	3.2.1.a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	11327.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	13567.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	2220.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.128
17	Neg. seq.			[p.u.]	0.124	
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.001



	23		Neg. seq.	t1-10s to t1	[p.u.]	0.000	
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.001	
	25		Pos. seq.	t1-1s to t1	[p.u.]	1.000	
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001	
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.006	
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.003	
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.003	
	30		Neg. seq.	t1-1s to t1	[p.u.]	-0.036	
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	1.006	
	32	Active power	Total	t1-10s to t1	[p.u.]	1.007	
	33		Total	t1-2s to t1	[p.u.]	1.007	
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.007	
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.003	
	t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
		38		Neg. seq.	-	-	2.500
39		Reactive current rise time	Pos. seq.	-	[ms]	25.000	
40			Neg. seq.	-	[ms]	25.000	
41		Reactive current settling time	Pos. seq.	-	[ms]	25.000	
42			Neg. seq.	-	[ms]	25.000	
43		Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.873	



	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.124
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.065
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.299
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.698
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.307
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.614
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.607
	51	Short-circuit currents Half-period rms values	Phase 1	t1+10ms	[A]	219.985
	52		Phase 2	t1+10ms	[A]	217.881
	53		Phase 3	t1+10ms	[A]	217.737
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	220.876
	55		Phase 2	t1 to t1+20ms	[A]	219.982
	56		Phase 3	t1 to t1+20ms	[A]	219.755
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	217.757
	55		Phase 2	t1 to t1+20ms	[A]	219.333
	56		Phase 3	t1 to t1+20ms	[A]	217.590
	57		Phase 1	t1 to t1+100ms	[A]	217.757
	58		Phase 2	t1 to t1+100ms	[A]	219.333
	59		Phase 3	t1 to t1+100ms	[A]	217.590
	60		Phase 1	t1+150ms	[A]	217.757
	61		Phase 2	t1+150ms	[A]	219.333



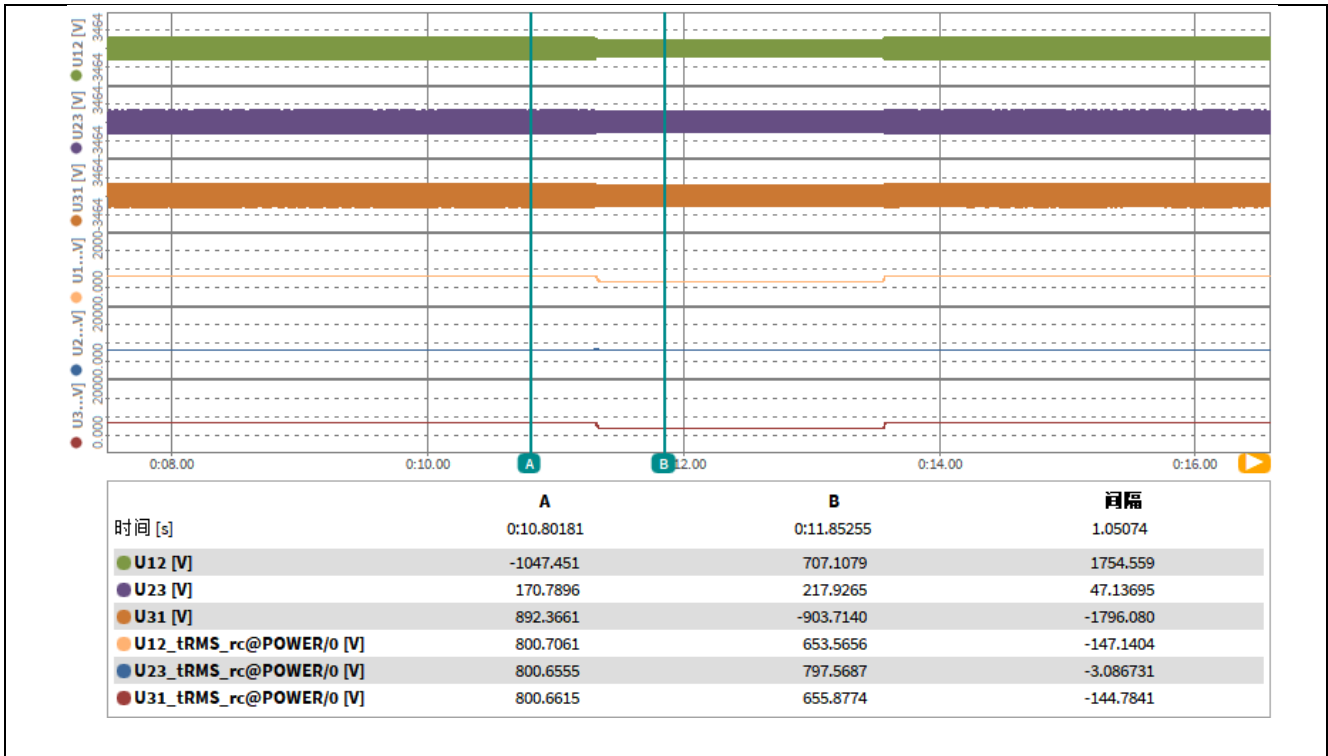
	62		Phase 3	t1+150ms	[A]	217.590
	63		Phase 1	t1+300ms	[A]	217.757
	64		Phase 2	t1+300ms	[A]	219.333
	65		Phase 3	t1+300ms	[A]	217.590
	66		Phase 1	t1+500ms	[A]	217.757
	67		Phase 2	t1+500ms	[A]	219.333
	68		Phase 3	t1+500ms	[A]	217.590
	69		Phase 1	t1+1000ms	[A]	217.757
	70		Phase 2	t1+1000ms	[A]	219.333
	71		Phase 3	t1+1000ms	[A]	217.590
	72		Phase 1	t2-20ms	[A]	213.577
	73		Phase 2	t2-20ms	[A]	188.529
	74		Phase 3	t2-20ms	[A]	187.905
	After t2		75	Active power	Total	t2+5s
76		Total	t2+1s to t2+10s		[p.u.]	1.007
77		Total	t2+10s		[p.u.]	1.007
78		Active current rise time	Pos. seq.	-	[ms]	358.000

Graphic:

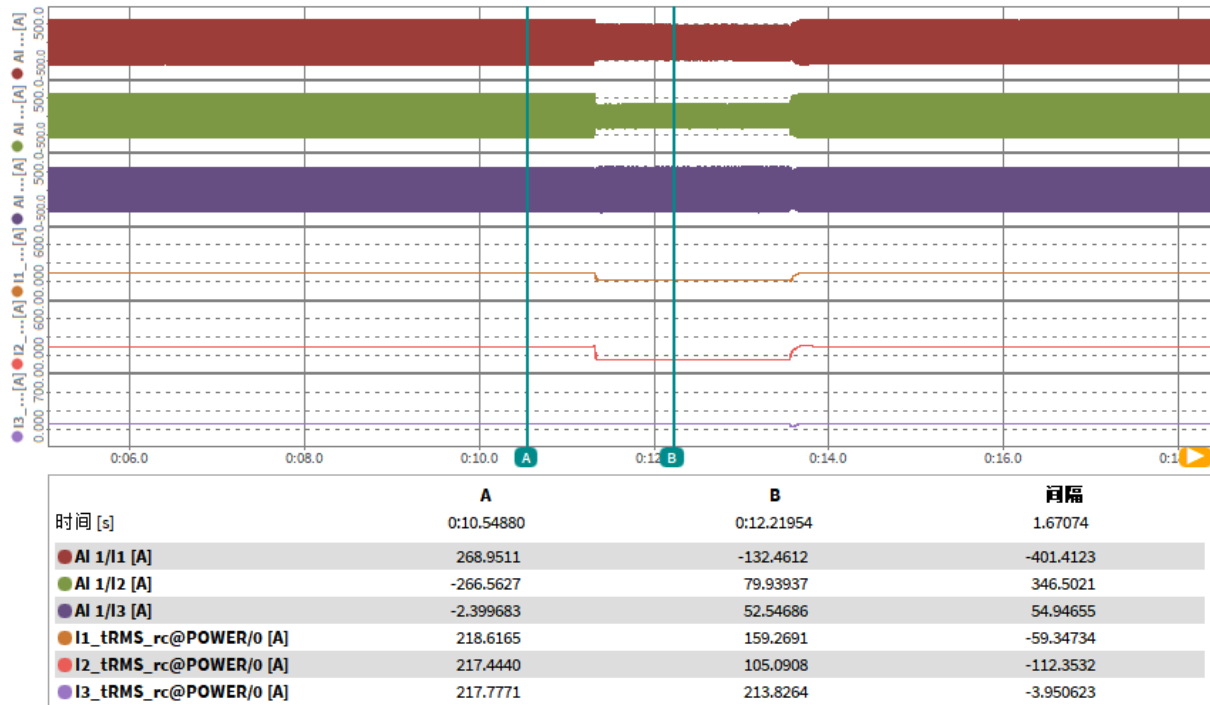
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



Product Service



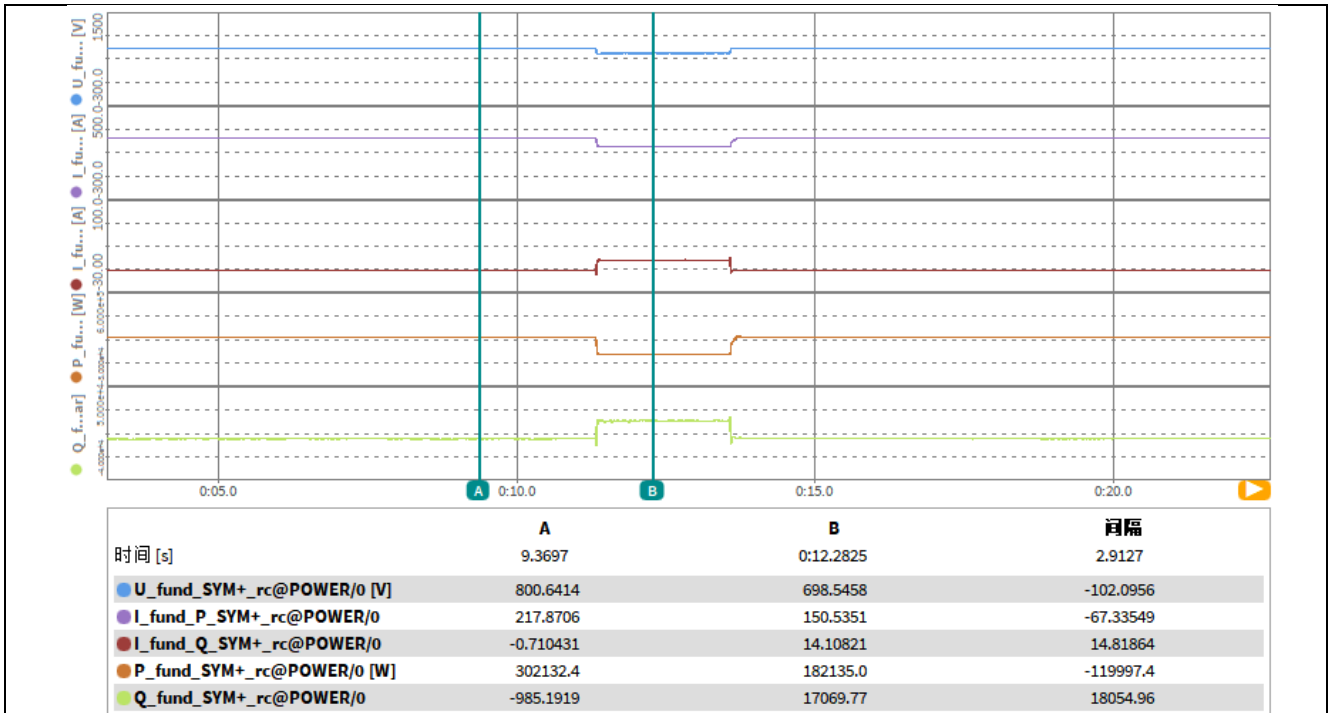
- Phase currents and RMS phase currents as moving averages over 20 ms:



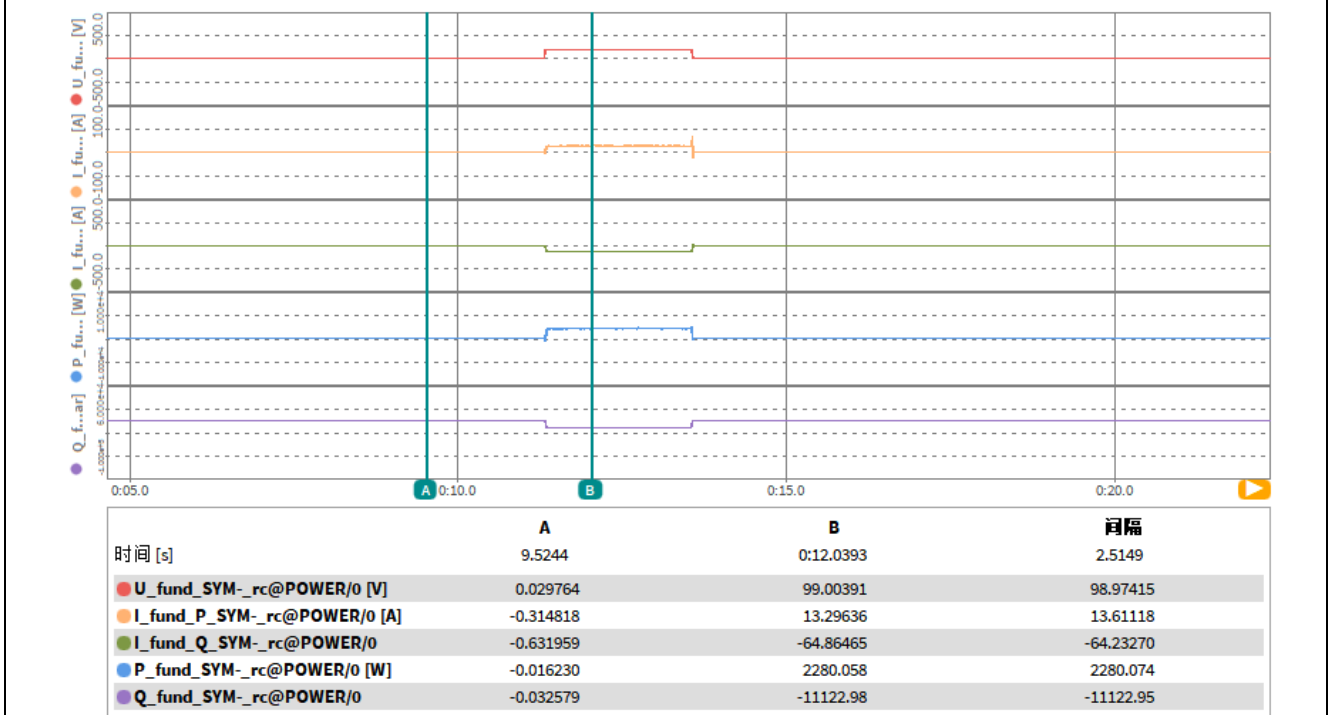
- Positive sequence active & reactive power and voltage, active & reactive current:



Product Service



- Negative sequence active & reactive power and voltage, active & reactive current :





Test Number	3.2.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	3.2.2a
	1	Date	-	-	[dd.mm.yyyy]	2022.09.26
	2	Time	-	-	[hh:mm:ss.f]	10:58:51 to 10:59:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	12232.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	14472.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	2220.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.127
	17		Neg. seq.		[p.u.]	0.124
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	1.000
	23		Neg. seq.	t1-10s to t1	[p.u.]	0.000
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	1.000
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.999
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.198
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.002
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.002
	30		Neg. seq.	t1-1s to t1	[p.u.]	-0.001



	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.199
	32	Active power	Total	t1-10s to t1	[p.u.]	0.198
	33		Total	t1-2s to t1	[p.u.]	0.198
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.198
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.002
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.500
	38		Neg. seq.	-	-	2.500
	39	Reactive current rise time	Pos. seq.	-	[ms]	25.000
	40		Neg. seq.	-	[ms]	25.000
	41	Reactive current settling time	Pos. seq.	-	[ms]	25.000
	42		Neg. seq.	-	[ms]	25.000
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.872
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.125
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.069
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.289
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.214
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.295
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.184
50	Pos. seq.		t1+100ms to t2-20ms	[p.u.]	0.177	
51	Short-circuit currents Half-period rms values		Phase 1	t1+10ms	[A]	82.103



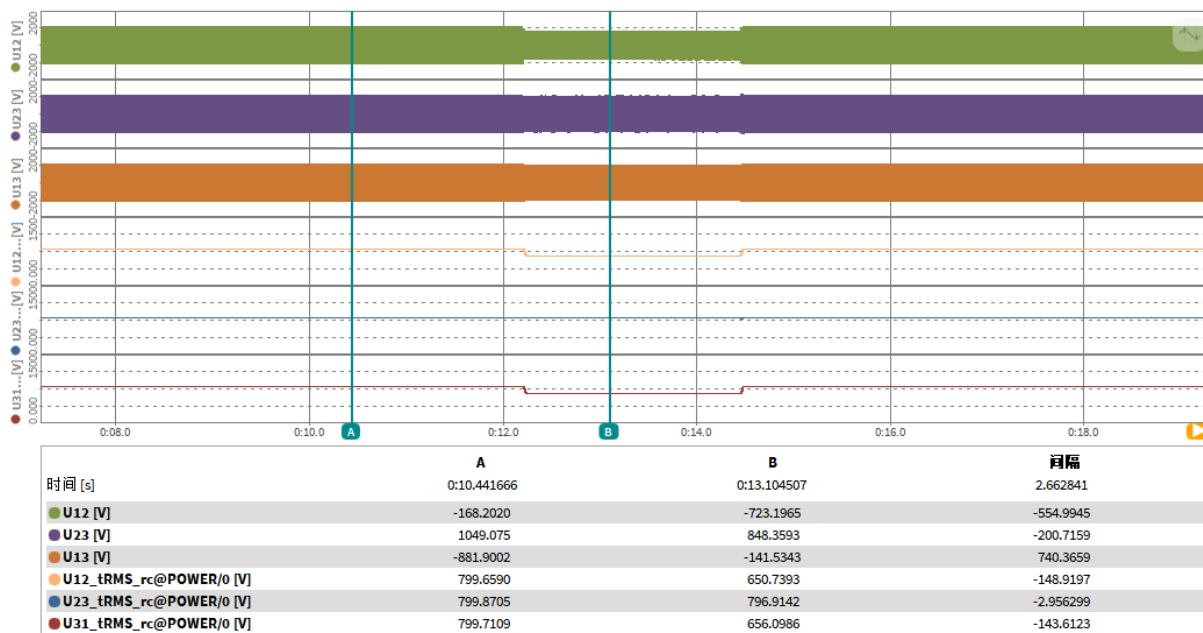
	52		Phase 2	t1+10ms	[A]	43.427
	53		Phase 3	t1+10ms	[A]	96.581
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	89.001
	55		Phase 2	t1 to t1+20ms	[A]	58.646
	56		Phase 3	t1 to t1+20ms	[A]	113.586
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	84.487
	55		Phase 2	t1 to t1+20ms	[A]	43.202
	56		Phase 3	t1 to t1+20ms	[A]	99.556
	57		Phase 1	t1 to t1+100ms	[A]	86.678
	58		Phase 2	t1 to t1+100ms	[A]	43.202
	59		Phase 3	t1 to t1+100ms	[A]	102.256
	60		Phase 1	t1+150ms	[A]	86.678
	61		Phase 2	t1+150ms	[A]	43.202
	62		Phase 3	t1+150ms	[A]	103.234
	63		Phase 1	t1+300ms	[A]	86.678
	64		Phase 2	t1+300ms	[A]	43.202
	65		Phase 3	t1+300ms	[A]	108.269
	66		Phase 1	t1+500ms	[A]	87.736
	67		Phase 2	t1+500ms	[A]	43.202
	68		Phase 3	t1+500ms	[A]	110.555
	69		Phase 1	t1+1000ms	[A]	87.847



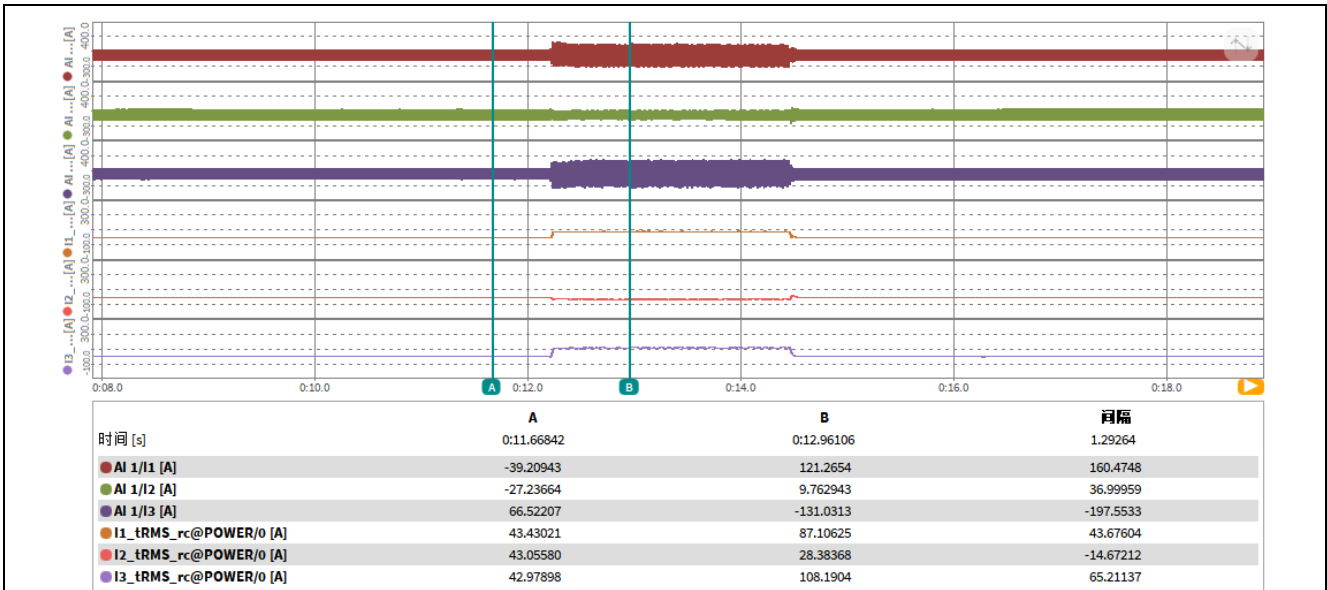
	70		Phase 2	t1+1000ms	[A]	43.202
	71		Phase 3	t1+1000ms	[A]	110.555
	72		Phase 1	t2-20ms	[A]	87.491
	73		Phase 2	t2-20ms	[A]	55.538
	74		Phase 3	t2-20ms	[A]	110.670
After t2	75	Active power	Total	t2+5s	[p.u.]	0.201
	76		Total	t2+1s to t2+10s	[p.u.]	0.198
	77		Total	t2+10s	[p.u.]	0.198
	78	Active current rise time	Pos. seq.	-	[ms]	163.000

Graphic:

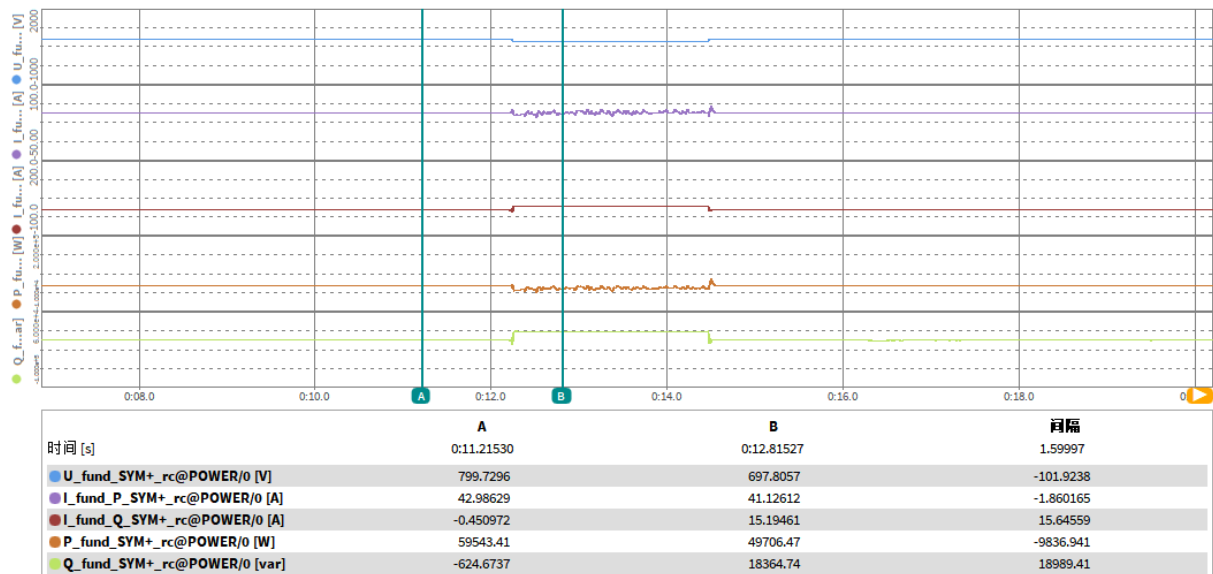
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



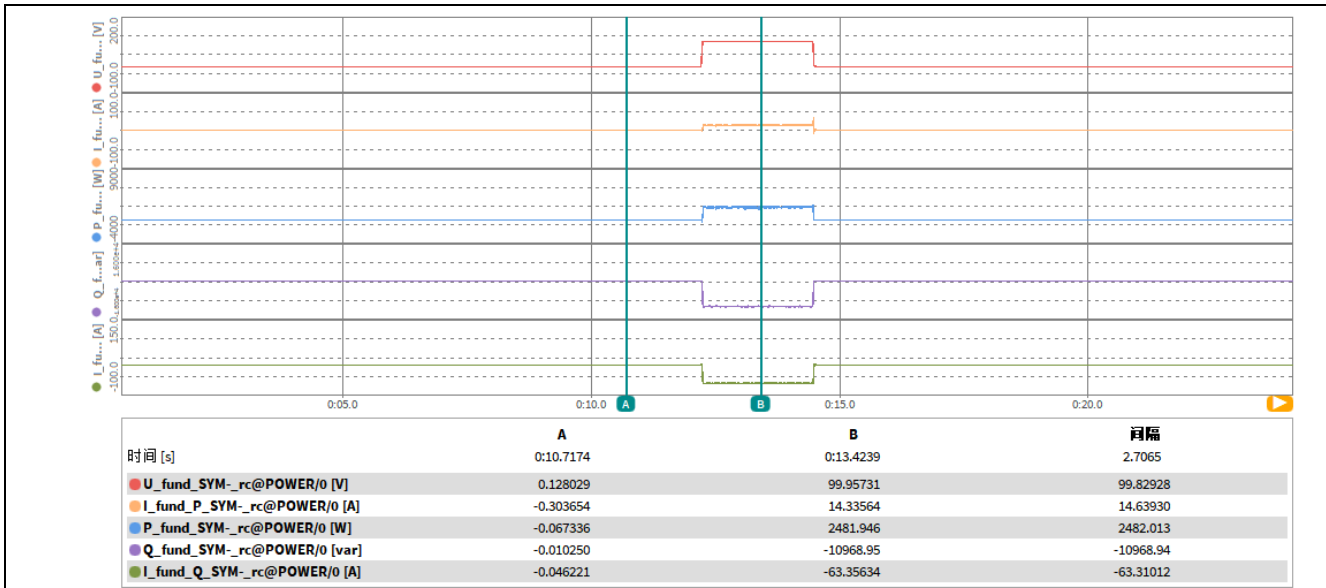
- Phase currents and RMS phase currents as moving averages over 20 ms:



- Positive sequence active & reactive power and voltage, active & reactive current:



- Negative sequence active & reactive power and voltage, active & reactive current:



Test Number	4.1.1a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	4.1.1a
	1	Date	-	-	[dd.mm.yyyy]	2023.03.17
	2	Time	-	-	[hh:mm:ss.f]	16:43:58 to 16:50:15
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	20308.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	2003008.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	180000.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.155
17	Neg. seq.			[p.u.]	N/A	
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	0.997
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A



	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.997	
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.996	
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A	
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.999	
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	0.008	
	29		Pos. seq.	t1-1s to t1	[p.u.]	0.008	
	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A	
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.999	
	32	Active power	Total	t1-10s to t1	[p.u.]	0.996	
	33		Total	t1-2s to t1	[p.u.]	0.996	
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.996	
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.008	
	t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	6.000
		38		Neg. seq.	-	-	6.000
39		Reactive current rise time	Pos. seq.	-	[ms]	20.000	
40			Neg. seq.	-	[ms]	N/A	
41		Reactive current settling time	Pos. seq.	-	[ms]	20.000	
42			Neg. seq.	-	[ms]	N/A	
43		Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.840	
44			Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A	



	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.048
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.973
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	-0.029
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	-0.029
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	231.786
	55		Phase 2	t1 to t1+20ms	[A]	232.001
	56		Phase 3	t1 to t1+20ms	[A]	231.782
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	233.162
	55		Phase 2	t1 to t1+20ms	[A]	226.959
	56		Phase 3	t1 to t1+20ms	[A]	218.793
	57		Phase 1	t1 to t1+100ms	[A]	233.162
	58		Phase 2	t1 to t1+100ms	[A]	226.959
	59		Phase 3	t1 to t1+100ms	[A]	218.793
	60		Phase 1	t1+150ms	[A]	233.162
	61		Phase 2	t1+150ms	[A]	226.959
	62		Phase 3	t1+150ms	[A]	218.793
	63		Phase 1	t1+300ms	[A]	233.162
64	Phase 2		t1+300ms	[A]	226.959	
65	Phase 3		t1+300ms	[A]	218.793	



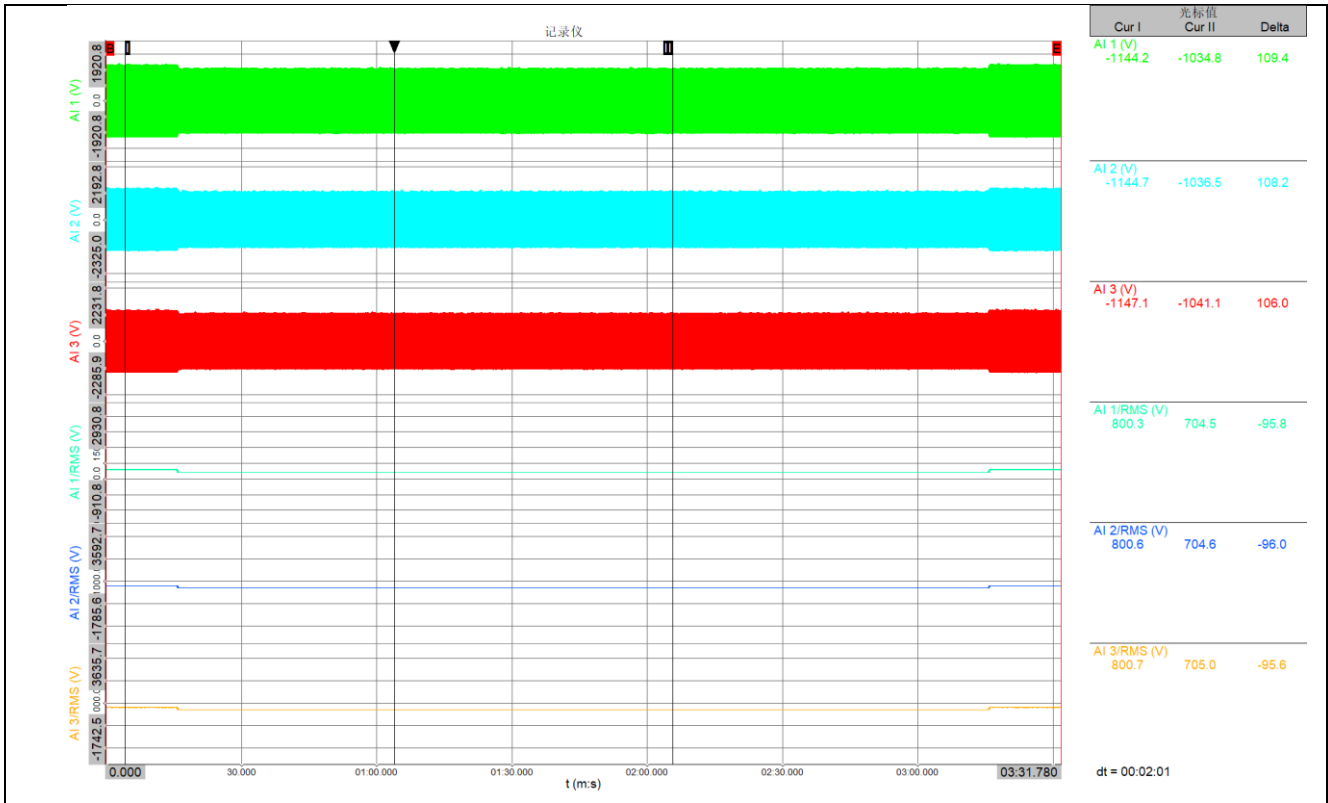
	66		Phase 1	t1+500ms	[A]	233.162
	67		Phase 2	t1+500ms	[A]	226.959
	68		Phase 3	t1+500ms	[A]	218.793
	69		Phase 1	t1+1000ms	[A]	233.162
	70		Phase 2	t1+1000ms	[A]	226.959
	71		Phase 3	t1+1000ms	[A]	218.793
	72		Phase 1	t2-20ms	[A]	217.364
	73		Phase 2	t2-20ms	[A]	216.524
	74		Phase 3	t2-20ms	[A]	206.076
After t2	75	Active power	Total	t2+5s	[p.u.]	0.996
	76		Total	t2+1s to t2+10s	[p.u.]	0.996
	77		Total	t2+10s	[p.u.]	0.996
	78	Active current rise time	Pos. seq.	-	[ms]	119.000

Graphic:

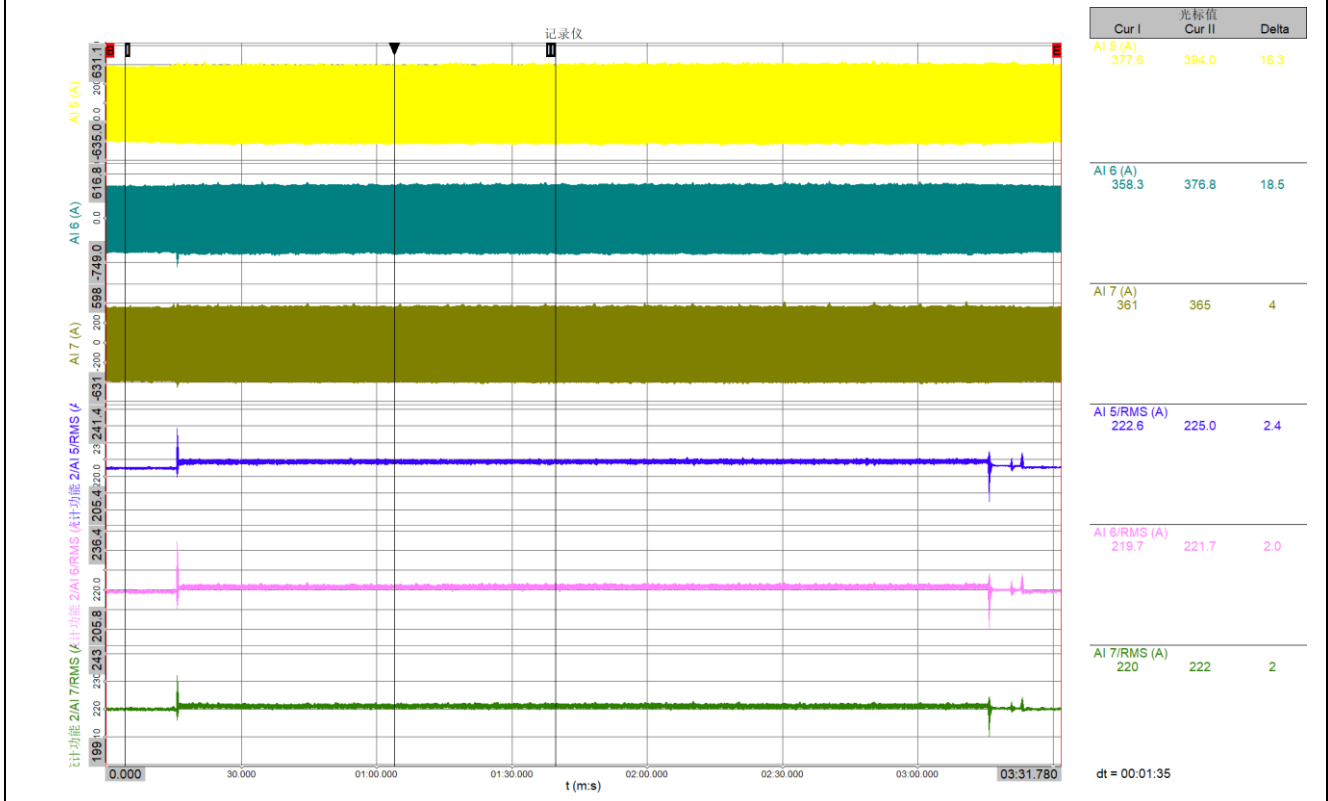
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



Product Service



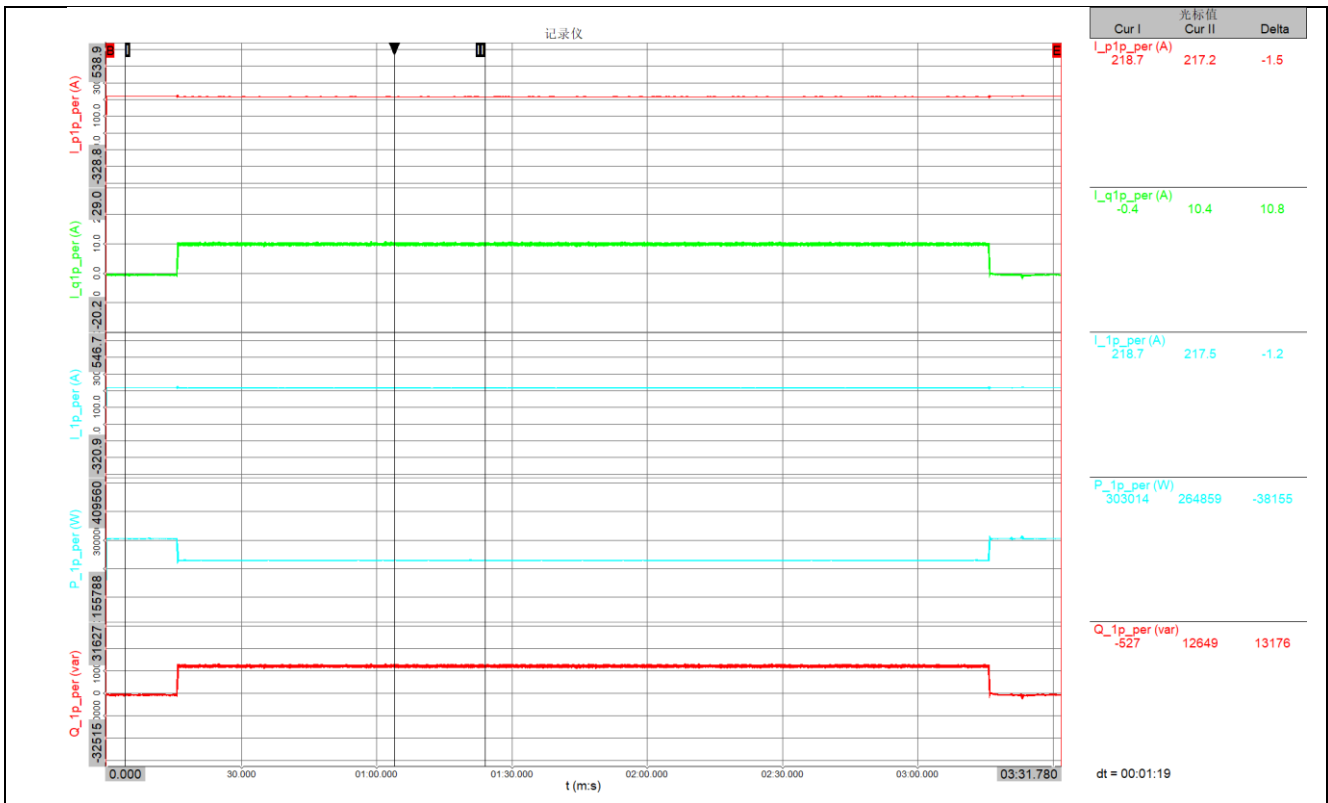
- Phase currents and RMS phase currents as moving averages over 20 ms:



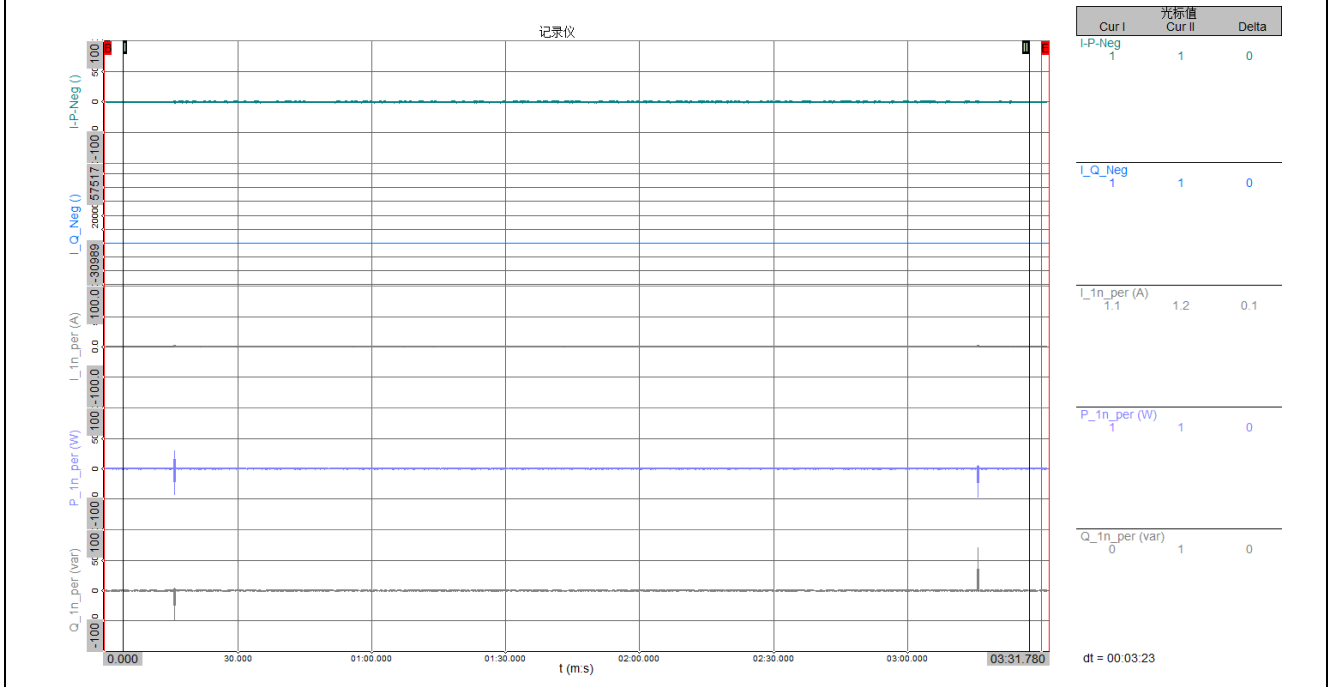
- Positive sequence active & reactive power and voltage, active & reactive current:



Product Service



- Negative sequence active & reactive power and voltage, active & reactive current :





Test Number	4.1.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	4.1.2a
	1	Date	-	-	[dd.mm.yyyy]	2023.03.17
	2	Time	-	-	[hh:mm:ss.f]	17:05:28 to 17:16:18
	3	Fault type (affected phases)	-	-	-	3 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	23122.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	203122.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	180000.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.076
	17		Neg. seq.		[p.u.]	N/A
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	0.996
	23		Neg. seq.	t1-10s to t1	[p.u.]	N/A
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.996
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.995
	26		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.201
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.004
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.004



	30		Neg. seq.	t1-1s to t1	[p.u.]	N/A
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.201
	32	Active power	Total	t1-10s to t1	[p.u.]	0.200
	33		Total	t1-2s to t1	[p.u.]	0.200
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.200
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.004
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.000
	38		Neg. seq.	-	-	N/A
	39	Reactive current rise time	Pos. seq.	-	[ms]	3.000
	40		Neg. seq.	-	[ms]	N/A
	41	Reactive current settling time	Pos. seq.	-	[ms]	3.000
	42		Neg. seq.	-	[ms]	N/A
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.880
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.005
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.405
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	N/A
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	0.199
50	Pos. seq.		t1+100ms to t2-20ms	[p.u.]	0.198	



	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	233.783
	55		Phase 2	t1 to t1+20ms	[A]	255.615
	56		Phase 3	t1 to t1+20ms	[A]	229.226
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	221.573
	55		Phase 2	t1 to t1+20ms	[A]	221.451
	56		Phase 3	t1 to t1+20ms	[A]	220.014
	57		Phase 1	t1 to t1+100ms	[A]	221.573
	58		Phase 2	t1 to t1+100ms	[A]	221.451
	59		Phase 3	t1 to t1+100ms	[A]	220.014
	60		Phase 1	t1+150ms	[A]	221.573
	61		Phase 2	t1+150ms	[A]	221.451
	62		Phase 3	t1+150ms	[A]	220.014
	63		Phase 1	t1+300ms	[A]	221.573
	64		Phase 2	t1+300ms	[A]	221.451
	65		Phase 3	t1+300ms	[A]	220.014
	66		Phase 1	t1+500ms	[A]	221.573
	67		Phase 2	t1+500ms	[A]	221.451
	68		Phase 3	t1+500ms	[A]	220.014
	69		Phase 1	t1+1000ms	[A]	221.573
	70		Phase 2	t1+1000ms	[A]	221.451
	71		Phase 3	t1+1000ms	[A]	220.014

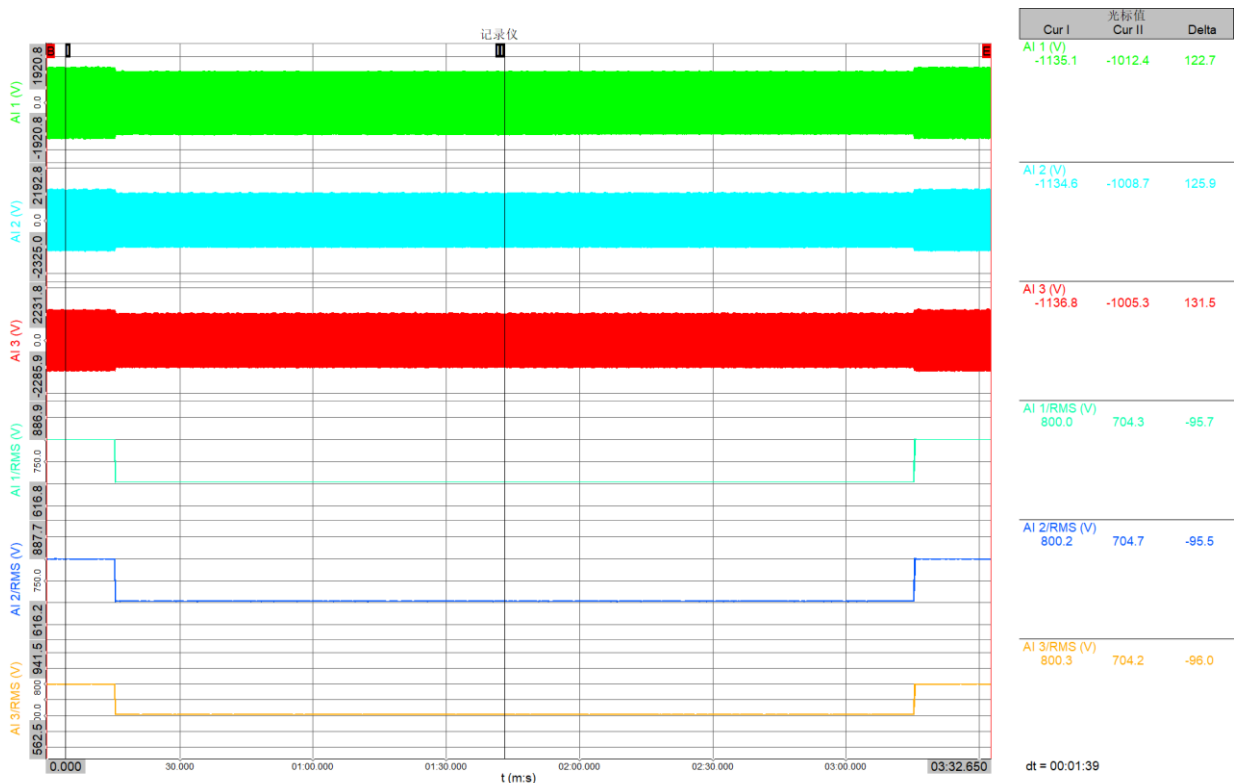


Product Service

	72		Phase 1	t2-20ms	[A]	42.181
	73		Phase 2	t2-20ms	[A]	66.098
	74		Phase 3	t2-20ms	[A]	45.714
After t2	75	Active power	Total	t2+5s	[p.u.]	0.200
	76		Total	t2+1s to t2+10s	[p.u.]	0.200
	77		Total	t2+10s	[p.u.]	0.200
	78	Active current rise time	Pos. seq.	-	[ms]	87.000

Graphic:

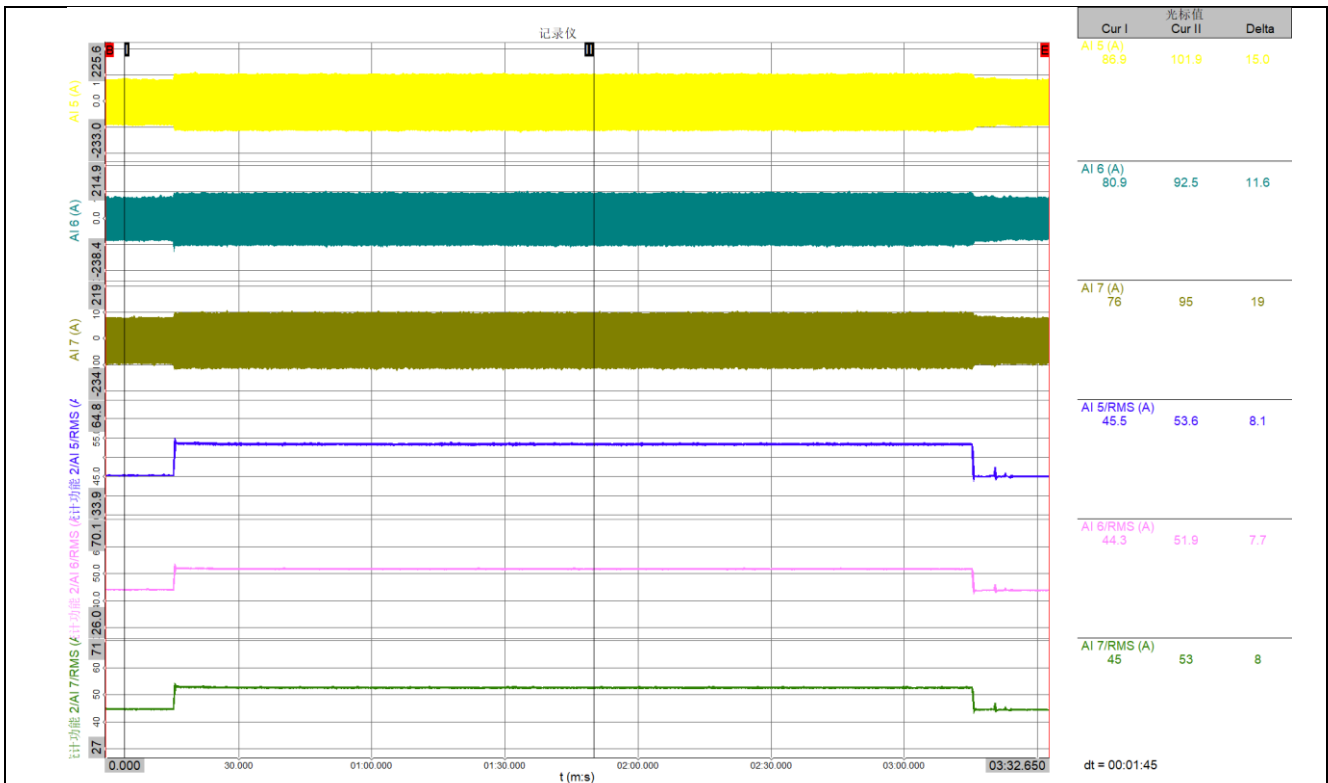
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



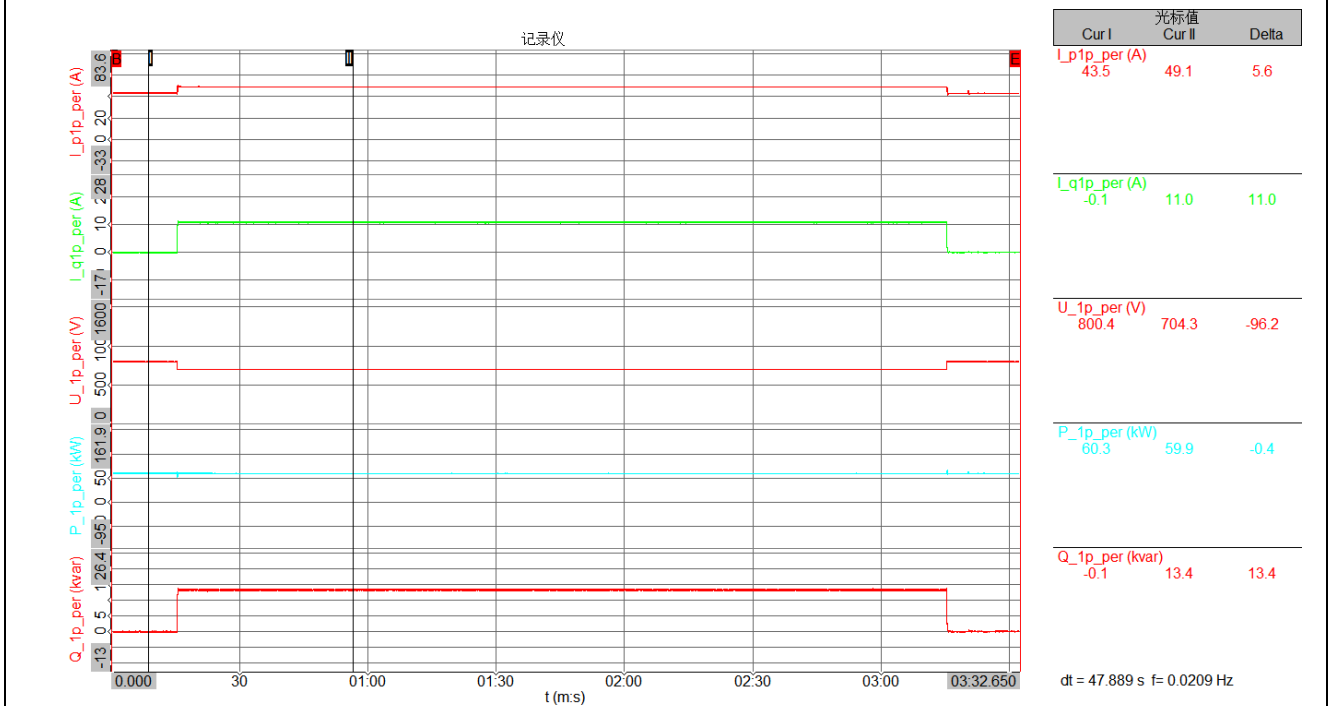
- Phase currents and RMS phase currents as moving averages over 20 ms :



Product Service



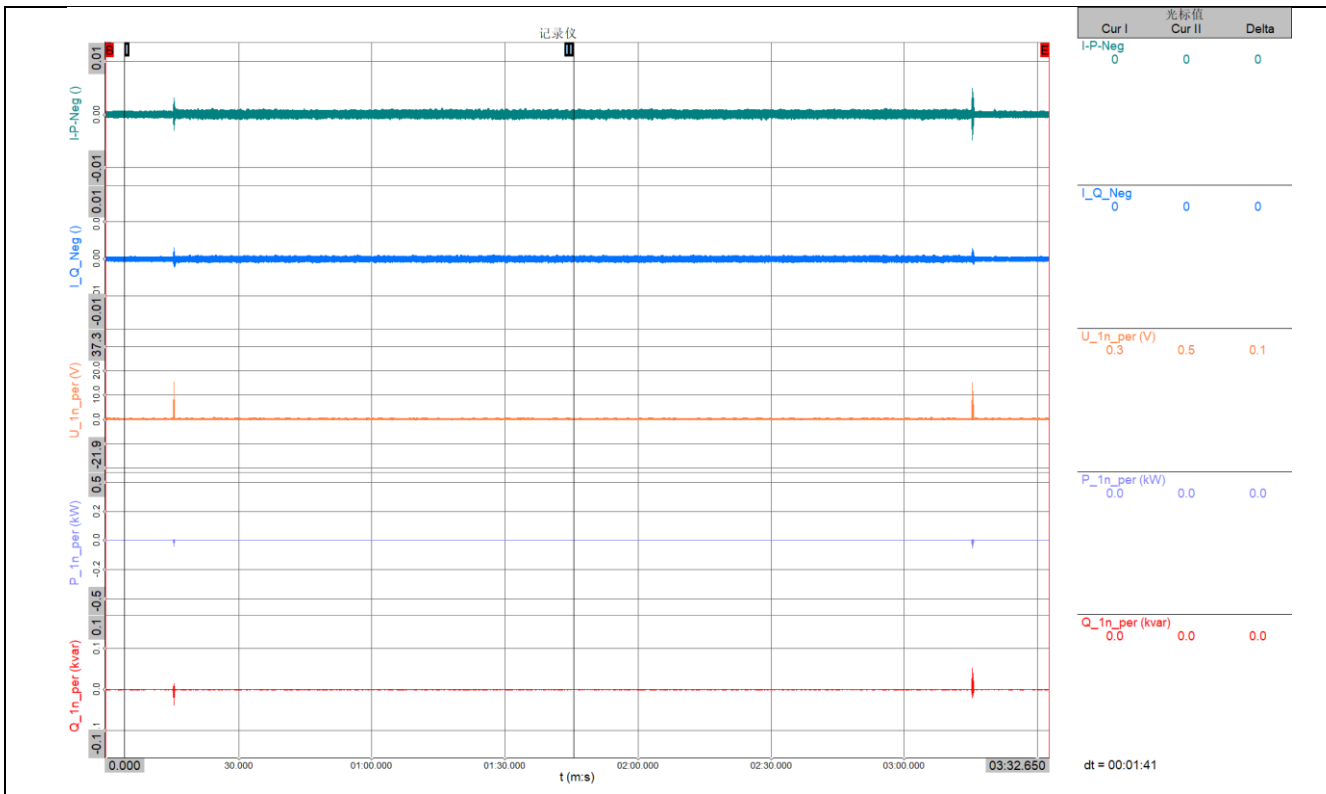
- Positive sequence active & reactive power and voltage, active & reactive current:



- Negative sequence active & reactive power and voltage, active & reactive current:



Product Service



Test Number	4.2.1a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	4.2.1a
	1	Date	-	-	[dd.mm.yyyy]	2023.03.18
	2	Time	-	-	[hh:mm:ss.f]	10:15:25 to 10:36:19
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	19707.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	199707.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	180000.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.075
	17		Neg. seq.		[p.u.]	-0.075



Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	0.996
	23		Neg. seq.	t1-10s to t1	[p.u.]	0.001
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.996
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.995
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.301
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.004
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.004
	30		Neg. seq.	t1-1s to t1	[p.u.]	-0.001
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.301
	32	Active power	Total	t1-10s to t1	[p.u.]	0.300
	33		Total	t1-2s to t1	[p.u.]	0.300
	34		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.300
	35	Reactive power	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	-0.004
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	2.000
	38		Neg. seq.	-	-	2.000
	39	Reactive current rise time	Pos. seq.	-	[ms]	2.000
	40		Neg. seq.	-	[ms]	0.000
	41	Reactive current settling time	Pos. seq.	-	[ms]	2.000
	42		Neg. seq.	-	[ms]	0.000



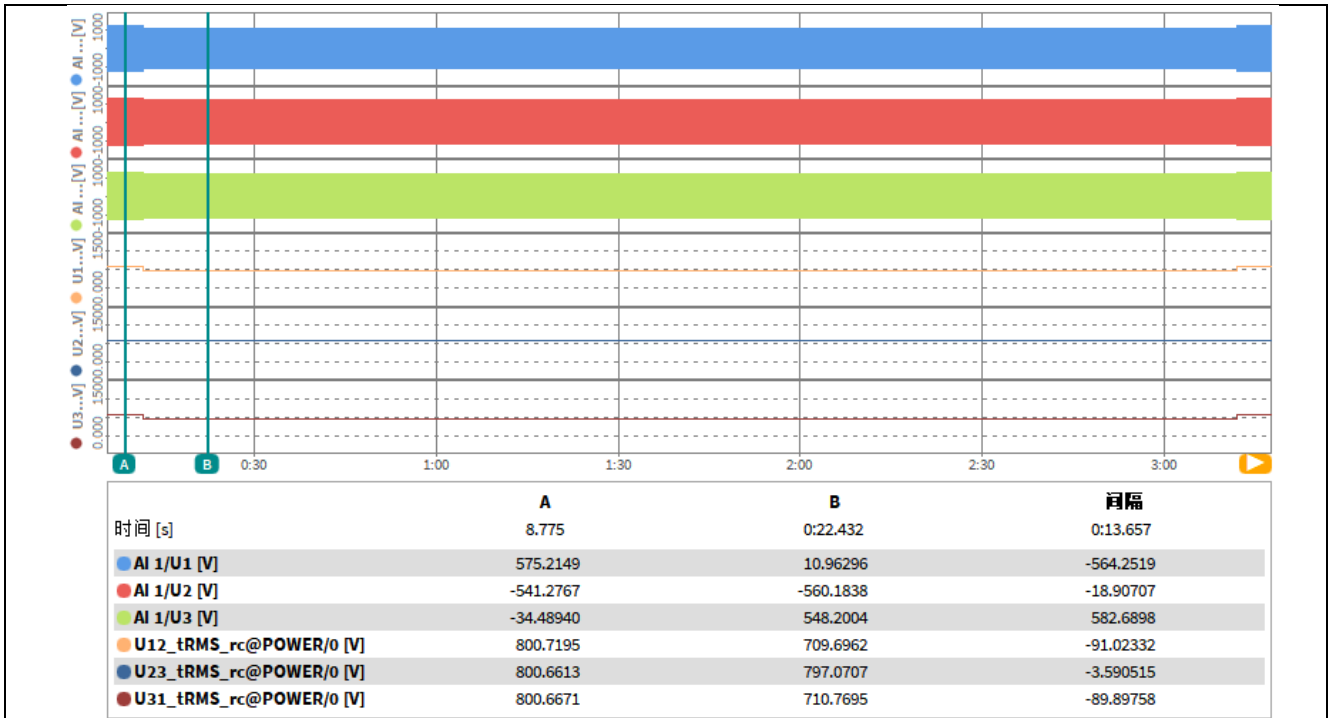
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.921
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.075
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.001
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.153
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.156
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.153
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	-0.010
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	-0.011
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	135.156
	55		Phase 2	t1 to t1+20ms	[A]	139.464
	56		Phase 3	t1 to t1+20ms	[A]	113.289
	54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	71.140
	55		Phase 2	t1 to t1+20ms	[A]	82.762
	56		Phase 3	t1 to t1+20ms	[A]	70.222
57	Phase 1		t1 to t1+100ms	[A]	71.140	
58	Phase 2		t1 to t1+100ms	[A]	82.762	
59	Phase 3		t1 to t1+100ms	[A]	70.222	
60	Phase 1		t1+150ms	[A]	71.140	
61	Phase 2		t1+150ms	[A]	82.762	
62	Phase 3		t1+150ms	[A]	70.222	
63	Phase 1		t1+300ms	[A]	71.140	



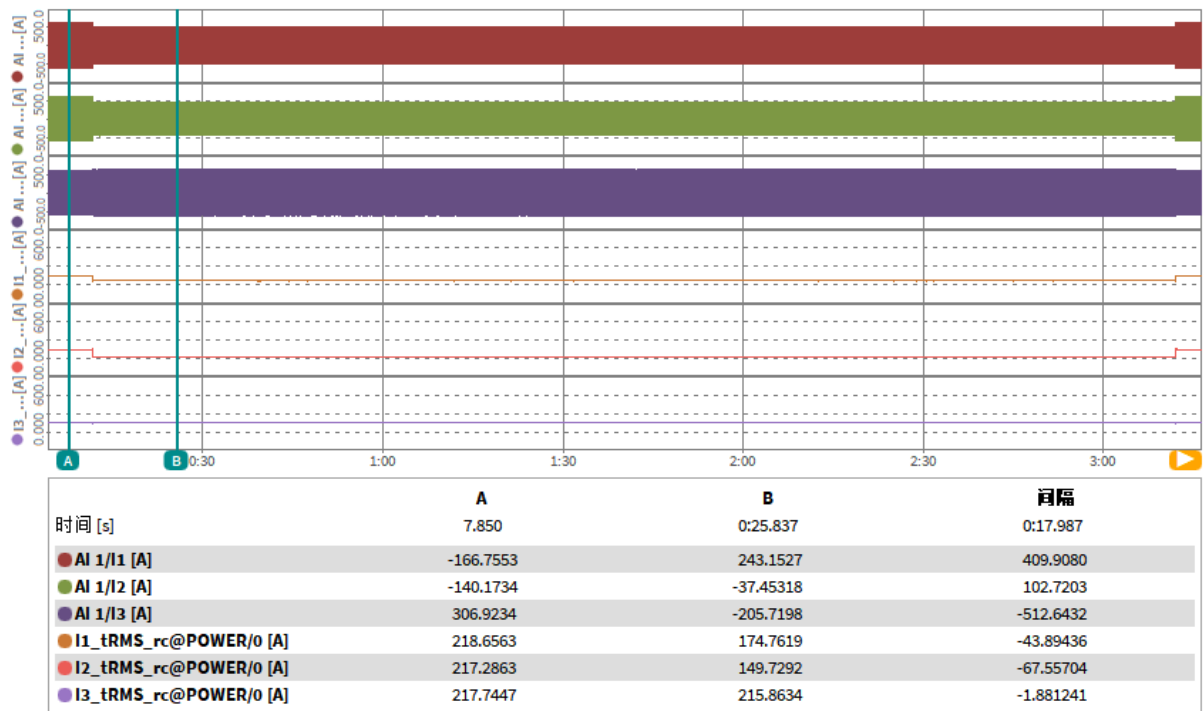
	64		Phase 2	t1+300ms	[A]	82.762
	65		Phase 3	t1+300ms	[A]	70.222
	66		Phase 1	t1+500ms	[A]	71.140
	67		Phase 2	t1+500ms	[A]	82.762
	68		Phase 3	t1+500ms	[A]	70.222
	69		Phase 1	t1+1000ms	[A]	71.140
	70		Phase 2	t1+1000ms	[A]	82.762
	71		Phase 3	t1+1000ms	[A]	70.222
	72		Phase 1	t2-20ms	[A]	42.241
	73		Phase 2	t2-20ms	[A]	65.752
	74		Phase 3	t2-20ms	[A]	45.909
After t2	75	Active power	Total	t2+5s	[p.u.]	0.300
	76		Total	t2+1s to t2+10s	[p.u.]	0.300
	77		Total	t2+10s	[p.u.]	0.299
	78	Active current rise time	Pos. seq.	-	[ms]	118.000

Graphic:

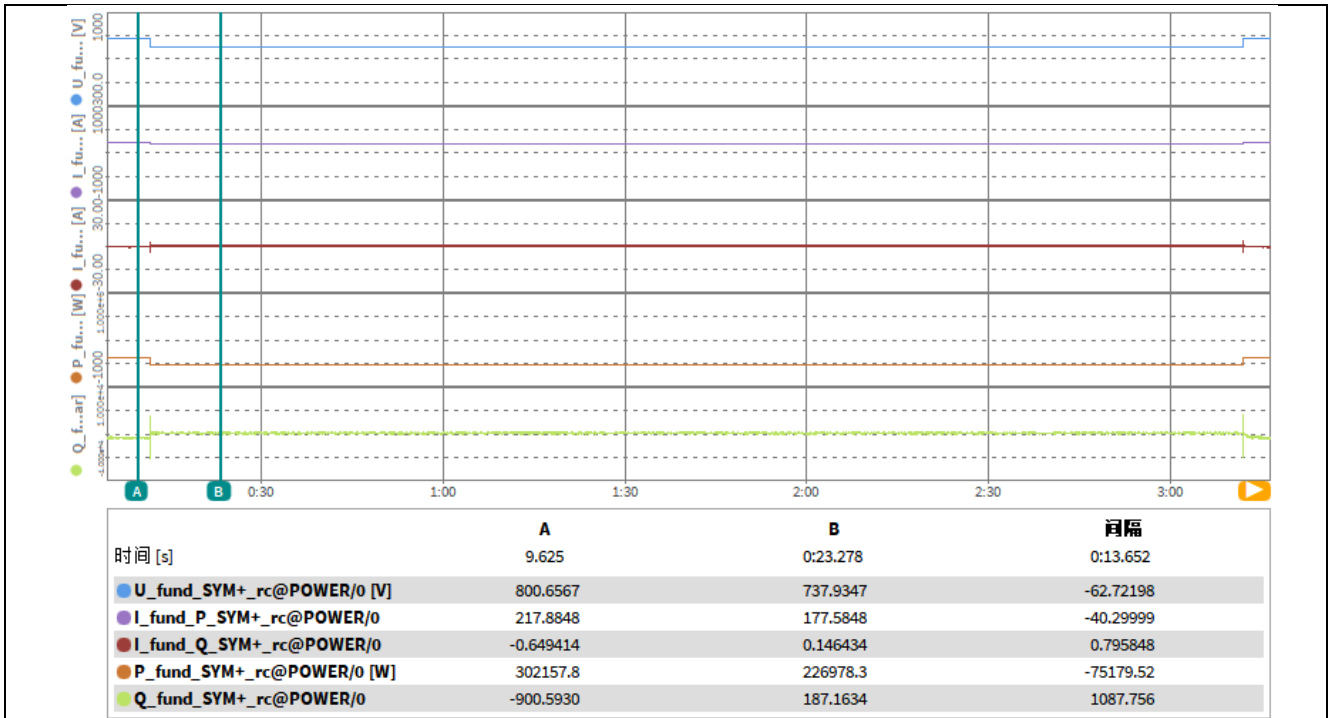
- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :



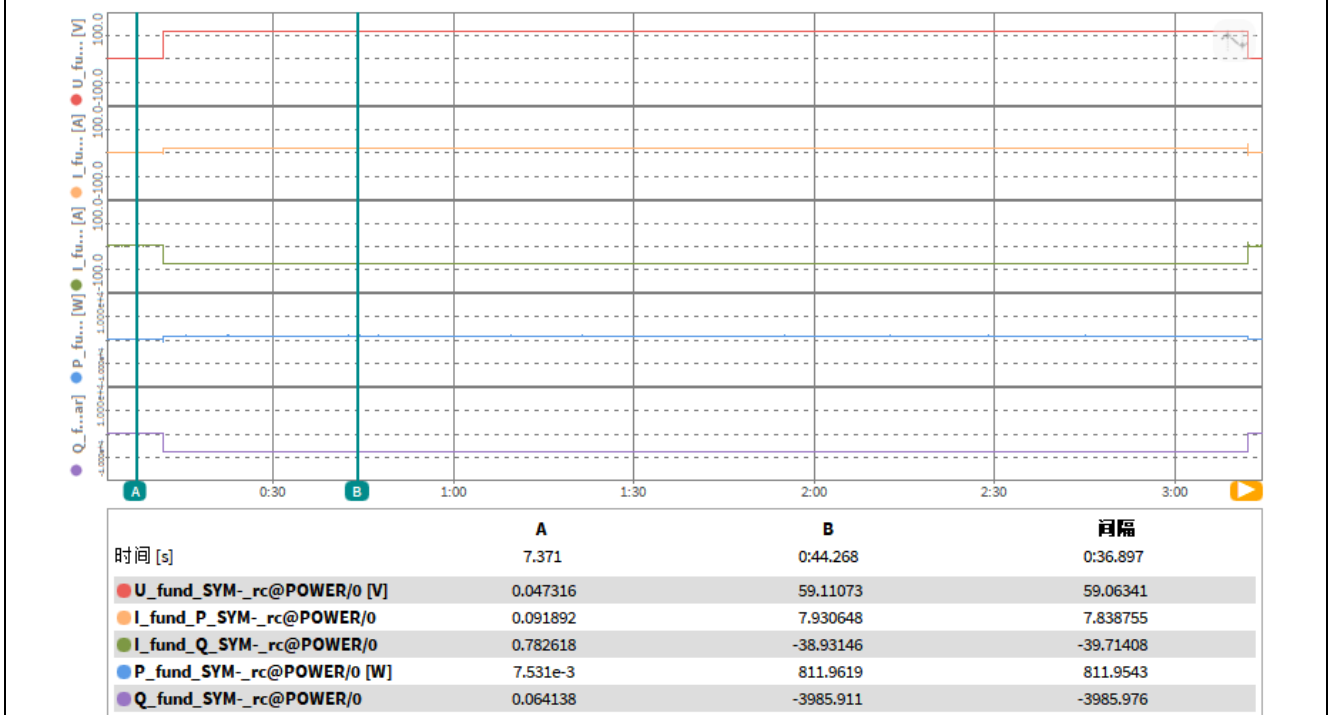
- Phase currents and RMS phase currents as moving averages over 20 ms:



- Positive sequence active & reactive power and voltage, active & reactive current:



- Negative sequence active & reactive power and voltage, active & reactive current :



Test Number	4.2.2a					
	No	Parameter	Phase reference	Reference time	Unit	Value
General information	0	Test Number	-	-	-	4.2.2a



	1	Date	-	-	[dd.mm.yyyy]	2023.03.18
	2	Time	-	-	[hh:mm:ss.f]	10:45:28 to 11:00:11
	3	Fault type (affected phases)	-	-	-	2 phase
	12	Fault occurrence(t1)	Pos. seq.	-	[ms]	20612.000
	13	Fault clearance(t2)	Pos. seq.	-	[ms]	200612.000
	15	Fault duration determined from test	Pos. seq.	-	[ms]	180000.000
	16	Determined voltage dip depth	Pos. seq.	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.074
17	Neg. seq.			[p.u.]	-0.073	
Before t1	22	Voltage	Pos. seq.	t1-10s to t1	[p.u.]	0.996
	23		Neg. seq.	t1-10s to t1	[p.u.]	0.001
	24		Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.996
	25		Pos. seq.	t1-1s to t1	[p.u.]	0.995
	26		Neg. seq.	t1-1s to t1	[p.u.]	0.001
	27	Current	Pos. seq.	t1-500ms to t1-100ms	[p.u.]	0.301
	28	Reactive current	Pos. seq.	t1-10s to t1	[p.u.]	-0.004
	29		Pos. seq.	t1-1s to t1	[p.u.]	-0.004
	30		Neg. seq.	t1-1s to t1	[p.u.]	-0.002
	31	Active current	Pos. seq.	t1-1s to t1	[p.u.]	0.301
	32	Active power	Total	t1-10s to t1	[p.u.]	0.300
33	Total		t1-2s to t1	[p.u.]	0.299	



	34		Pos. seq.	t1-500ms to t1- 100ms	[p.u.]	0.299
	35	Reactive power	Pos. seq.	t1-500ms to t1- 100ms	[p.u.]	-0.004
t1 to t2	37	Determined proportionality constant K-factor	Pos. seq.	-	-	6.000
	38		Neg. seq.	-	-	6.000
	39	Reactive current rise time	Pos. seq.	-	[ms]	11.000
	40		Neg. seq.	-	[ms]	11.000
	41	Reactive current settling time	Pos. seq.	-	[ms]	11.000
	42		Neg. seq.	-	[ms]	11.000
	43	Voltage	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.921
	44		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.074
	45	Reactive current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.001
	46		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	-0.454
	47	Apparent current	Pos. seq.	t1+100ms to t2-20ms	[p.u.]	0.457
	48		Neg. seq.	t1+100ms to t2-20ms	[p.u.]	0.455
	49	Active power	Total	t1+100ms to t2-20ms	[p.u.]	-0.016
	50		Pos. seq.	t1+100ms to t2-20ms	[p.u.]	-0.018
	54	Short-circuit currents Peak values	Phase 1	t1 to t1+20ms	[A]	98.763
	55		Phase 2	t1 to t1+20ms	[A]	219.564
56	Phase 3		t1 to t1+20ms	[A]	102.476	
54	Short-circuit currents 1-period rms value	Phase 1	t1 to t1+20ms	[A]	89.432	



	55		Phase 2	t1 to t1+20ms	[A]	222.057
	56		Phase 3	t1 to t1+20ms	[A]	85.261
	57		Phase 1	t1 to t1+100ms	[A]	94.287
	58		Phase 2	t1 to t1+100ms	[A]	222.057
	59		Phase 3	t1 to t1+100ms	[A]	98.466
	60		Phase 1	t1+150ms	[A]	96.515
	61		Phase 2	t1+150ms	[A]	222.057
	62		Phase 3	t1+150ms	[A]	100.695
	63		Phase 1	t1+300ms	[A]	98.380
	64		Phase 2	t1+300ms	[A]	222.057
	65		Phase 3	t1+300ms	[A]	102.205
	66		Phase 1	t1+500ms	[A]	98.721
	67		Phase 2	t1+500ms	[A]	222.057
	68		Phase 3	t1+500ms	[A]	102.515
	69		Phase 1	t1+1000ms	[A]	98.721
	70		Phase 2	t1+1000ms	[A]	222.057
	71		Phase 3	t1+1000ms	[A]	102.518
	72		Phase 1	t2-20ms	[A]	98.970
	73		Phase 2	t2-20ms	[A]	204.941
	74		Phase 3	t2-20ms	[A]	102.305
After t2	75	Active power	Total	t2+5s	[p.u.]	0.300

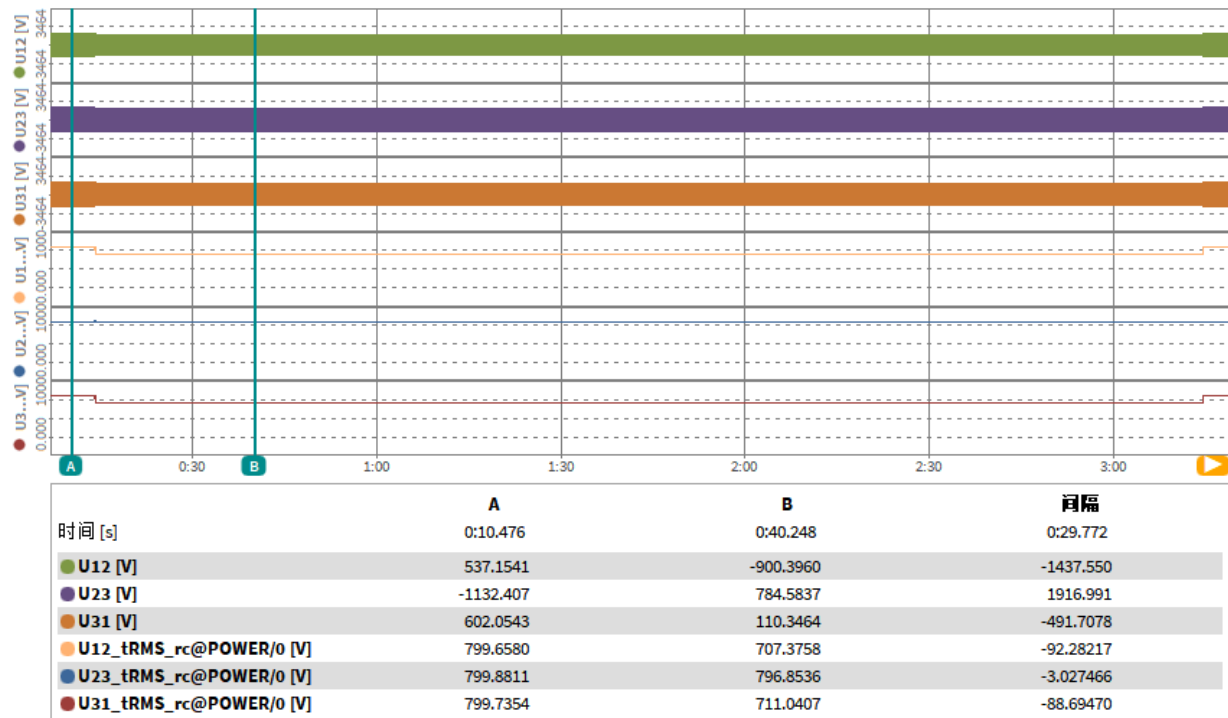


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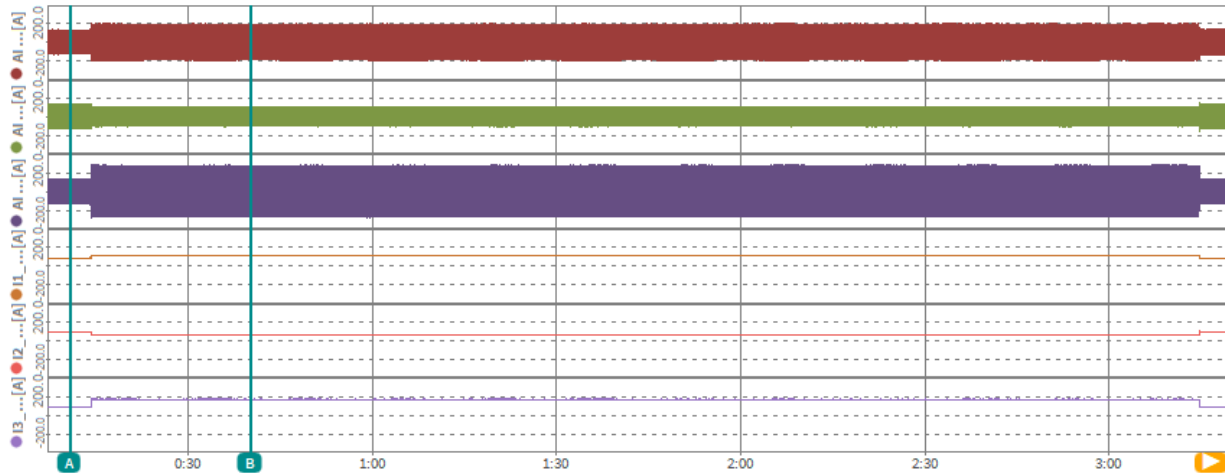
	76		Total	t2+1s to t2+10s	[p.u.]	0.300
	77		Total	t2+10s	[p.u.]	0.300
	78	Active current rise time	Pos. seq.	-	[ms]	99.000

Graphic:

- Phase-to-Phase voltages and RMS Phase-to-Phase voltages as moving averages over 20 ms :

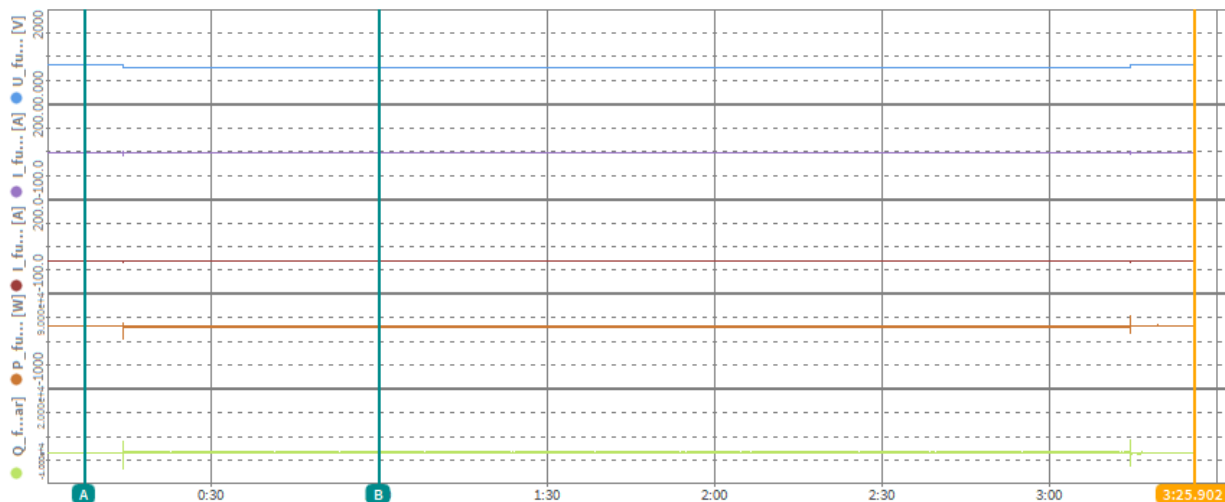


- Phase currents and RMS phase currents as moving averages over 20 ms :



时间 [s]	A	B	间隔
	0:10.935	0:40.320	0:29.385
AI 1/I1 [A]	19.77056	64.21388	44.44331
AI 1/I2 [A]	-55.10629	38.78832	93.89461
AI 1/I3 [A]	35.34645	-102.9915	-138.3379
I1_tRMS_rc@POWER/0 [A]	43.44439	55.84921	12.40482
I2_tRMS_rc@POWER/0 [A]	43.03730	31.56070	-11.47660
I3_tRMS_rc@POWER/0 [A]	43.04885	85.98206	42.93321

- Positive sequence active & reactive power and voltage, active & reactive current:



时间 [s]	A	B	间隔
	7.411	1:00.078	0:52.667
U_fund_SYM+_rc@POWER/0 [V]	799.7359	737.1494	-62.58649
I_fund_P_SYM+_rc@POWER/0	42.96495	45.80278	2.837833
I_fund_Q_SYM+_rc@POWER/0	-0.417572	-0.266611	0.150961
P_fund_SYM+_rc@POWER/0 [W]	59514.32	58480.08	-1034.238
Q_fund_SYM+_rc@POWER/0	-578.4141	-340.4040	238.0100

- Negative sequence active & reactive power and voltage, active & reactive current:



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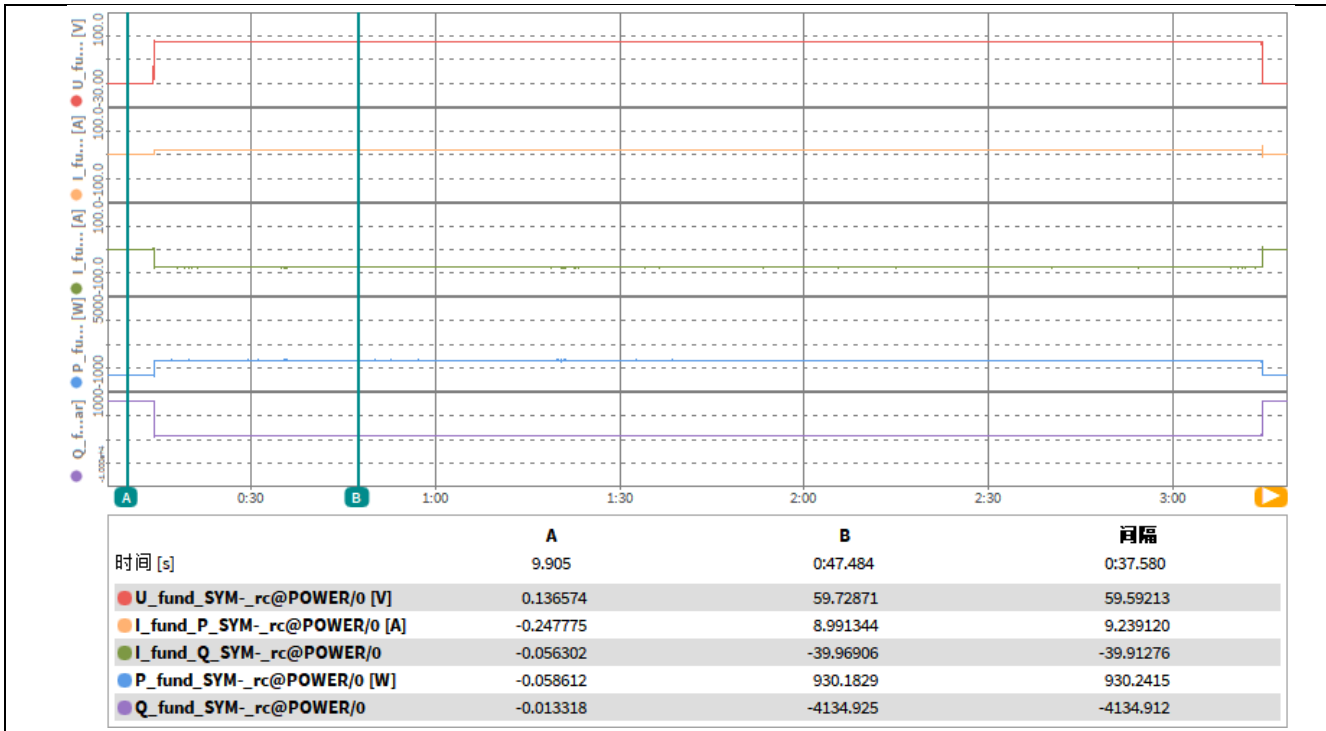


Table: Voltage Limits and Control & Reactive capability						P
a) Reactive power capacity and accuracy measurement – Test #1						
Test Model			SUN2000-330KTL-H1			
Registered capacity P <sub>max</sub> (W)			264000			
Case A: Tested at Nominal voltage Un						
Fixed Power Factor						
Power factor (cosφ= <u>-0.8</u> )						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	26499.98	-20083.01	33250.23	0.785 un	-0.758	-0.015
[20]% P <sub>max</sub>	52951.51	-39729.97	66199.17	0.797 un	-0.750	-0.003
[30]% P <sub>max</sub>	79406.54	-59758.14	99380.37	0.798 un	-0.753	-0.002
[40]% P <sub>max</sub>	105824.75	-79546.88	132387.67	0.798 un	-0.752	-0.002
[50]% P <sub>max</sub>	132233.59	-99322.33	165380.00	0.799 un	-0.751	-0.001



[60]% P <sub>max</sub>	158111.16	-118669.87	197690.86	0.799 un	-0.751	-0.001
[70]% P <sub>max</sub>	184441.03	-138407.21	230597.28	0.799 un	-0.750	-0.001
[80]% P <sub>max</sub>	210731.06	-158094.72	263442.09	0.799 un	-0.750	-0.001
[90]% P <sub>max</sub>	237045.75	-177672.89	296240.63	0.800 un	-0.750	0.000
[100]% P <sub>max</sub>	264110.07	-198196.64	330206.25	0.799 un	-0.750	-0.001
<b>Power factor (cosφ= 0.8 )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	26569.29	19874.82	33180.37	0.787 ov	0.748	0.013
[20]% P <sub>max</sub>	52874.07	39548.66	66028.51	0.796 ov	0.748	0.004
[30]% P <sub>max</sub>	79156.43	59264.47	98883.85	0.798 ov	0.749	0.002
[40]% P <sub>max</sub>	105647.27	78983.27	131907.91	0.799 ov	0.748	0.001
[50]% P <sub>max</sub>	132136.50	98930.91	165067.80	0.799 ov	0.749	0.001
[60]% P <sub>max</sub>	158598.36	118640.02	198062.85	0.800 ov	0.748	0.000
[70]% P <sub>max</sub>	185057.64	138408.80	231091.60	0.800 ov	0.748	0.000
[80]% P <sub>max</sub>	211448.24	158334.38	264159.25	0.800 ov	0.749	0.000
[90]% P <sub>max</sub>	237802.65	178054.62	297074.98	0.800 ov	0.749	0.000
[100]% P <sub>max</sub>	264321.73	197670.76	330059.93	0.800 ov	0.748	0.000
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Q<sub>max</sub> ( 0.6 S<sub>max</sub>)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26979.47	198579.30	200403.60	0.135 ov	0.29%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	52937.61	198495.30	205433.10	0.258 ov	0.25%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	79425.58	198399.60	213707.30	0.371 ov	0.20%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	105874.03	198297.10	224791.10	0.471 ov	0.15%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	132349.00	198218.20	238341.60	0.555 ov	0.11%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	158805.39	198152.60	253936.30	0.625 ov	0.08%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	185204.25	198014.50	271127.90	0.683 ov	0.01%	< ± 5 % Q <sub>max</sub>



[80]% P <sub>max</sub>	211601.51	197935.80	309557.27	0.730 ov	-0.03%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	238006.56	197933.50	289749.90	0.769 ov	-0.03%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	264319.00	197674.20	330060.00	0.800 ov	-0.16%	< ± 5 % Q <sub>max</sub>
<b>Reactive power Q= Qmin ( -0.6 Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26289.50	-198076.00	199812.90	0.131 un	-0.04%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	52773.99	-198443.00	205340.00	0.257 un	-0.22%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	78430.83	-198165.00	213120.80	0.368 un	-0.08%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	104892.89	-198226.00	224267.80	0.467 un	-0.11%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	131349.40	-197951.00	237565.40	0.553 un	0.02%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	157771.96	-197982.00	253157.70	0.623 un	0.01%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	184180.13	-197984.00	270407.10	0.681 un	0.01%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	210535.48	-198018.00	289026.30	0.728 un	-0.01%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	236902.29	-198081.00	308801.40	0.767 un	-0.04%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	264232.69	-198035.00	330207.60	0.800 un	-0.02%	< ± 5 % Q <sub>max</sub>
<b>Reactive power (Q=0)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26510.03	-268.97	26511.41	0.999 un	-0.14%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	52480.24	-387.75	52481.65	0.999 un	-0.20%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	79051.28	-497.65	79052.78	0.999 un	-0.25%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	105546.82	-530.77	105548.20	0.999 un	-0.27%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	132039.48	-550.52	132040.60	0.999 un	-0.28%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	158574.73	-652.30	158576.10	0.999 un	-0.33%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	184988.99	-698.67	184990.30	0.999 un	-0.35%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	211394.17	-701.69	211395.40	0.999 un	-0.35%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	237815.24	-784.07	237816.50	0.999 un	-0.40%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	265930.08	-854.02	265931.50	0.999 un	-0.43%	< ± 5 % Q <sub>max</sub>



Case B: Tested at Nominal voltage 0.95Un						
Fixed Power Factor						
Power factor (cosφ= - 0.8 )						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	26766.54	-20066.40	33453.04	0.789 un	-0.750	0.011
[20]% P <sub>max</sub>	52951.83	-39790.50	66235.87	0.797 un	-0.751	0.003
[30]% P <sub>max</sub>	79132.98	-59252.60	98857.97	0.799 un	-0.749	0.001
[40]% P <sub>max</sub>	105248.24	-78947.10	131566.90	0.799 un	-0.750	0.001
[50]% P <sub>max</sub>	131651.69	-98792.50	164596.80	0.799 un	-0.750	0.001
[60]% P <sub>max</sub>	158032.68	-118514.00	197534.50	0.799 un	-0.750	0.001
[70]% P <sub>max</sub>	184355.17	-138194.00	230400.30	0.800 un	-0.750	0.000
[80]% P <sub>max</sub>	210642.70	-157923.00	263268.10	0.800 un	-0.750	0.000
[90]% P <sub>max</sub>	236827.11	-177600.00	296021.50	0.799 un	-0.750	0.001
*[100]% P <sub>max</sub>	252892.82	-189724.00	316149.10	0.799 un	-0.750	0.001
Power factor (cosφ= 0.8 )						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	26316.33	19762.07	32910.38	0.789 ov	0.751	-0.011
[20]% P <sub>max</sub>	52865.76	39618.19	66063.52	0.797 ov	0.749	-0.003
[30]% P <sub>max</sub>	79407.89	59364.41	99145.08	0.799 ov	0.748	-0.001
[40]% P <sub>max</sub>	105877.05	79229.49	132239.40	0.799 ov	0.748	-0.001
[50]% P <sub>max</sub>	132085.55	98840.78	164973.00	0.800 ov	0.748	0.000
[60]% P <sub>max</sub>	158547.48	118659.60	198033.90	0.800 ov	0.748	0.000
[70]% P <sub>max</sub>	184994.00	138483.50	231085.40	0.800 ov	0.749	0.000
[80]% P <sub>max</sub>	211368.99	158297.00	264073.40	0.800 ov	0.749	0.000
[90]% P <sub>max</sub>	237279.87	177983.90	296614.30	0.799 ov	0.750	-0.001
*[100]% P <sub>max</sub>	253608.80	189997.60	316885.80	0.799 ov	0.749	-0.001



Fixed Reactive power						
Reactive power Q= Qmax ( <u>0.6</u> Smax)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26564.41	198423.20	200193.40	0.133 ov	-0.24%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	53035.42	198366.60	205334.00	0.258 ov	-0.22%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	79241.46	198290.40	213537.50	0.371 ov	-0.04%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	105699.27	198238.30	224656.90	0.470 ov	-0.11%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	132134.46	198128.30	238147.70	0.555 ov	0.06%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	158554.11	198065.90	253711.50	0.625 ov	0.01%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	184959.05	198013.60	270959.80	0.682 ov	0.02%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	211341.03	198066.60	289647.40	0.729 ov	-0.01%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	237235.95	197996.30	309004.10	0.767 ov	-0.04%	< ± 5 % Q <sub>max</sub>
*[100]% P <sub>max</sub>	254575.32	198219.70	317154.60	0.779 ov	-0.03%	< ± 5 % Q <sub>max</sub>
Reactive power Q= Qmin ( <u>-0.6</u> Smax)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26248.34	-198053.00	199784.70	0.131 un	-0.03%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	52698.64	-198108.00	204996.80	0.257 un	-0.05%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	78916.58	-198152.00	213288.90	0.370 un	-0.08%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	105101.43	-198203.00	224344.60	0.468 un	-0.10%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	131091.93	-198285.00	237701.50	0.551 un	-0.14%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	157604.25	-198337.00	253330.40	0.622 un	-0.17%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	184005.48	-198493.00	270661.30	0.679 un	-0.25%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	210382.13	-198566.00	289290.60	0.727 un	-0.29%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	236730.76	-197938.00	308578.20	0.766 un	0.03%	< ± 5 % Q <sub>max</sub>
*[100]% P <sub>max</sub>	252734.98	-197951.00	317107.90	0.780 un	0.02%	< ± 5 % Q <sub>max</sub>
Reactive power (Q=0)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit



Product Service

[10]% P <sub>max</sub>	26242.29	-273.62	26243.69	0.999 Un	-0.14%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	52483.07	-351.41	52484.26	0.999 Un	-0.18%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	79022.15	-451.62	79023.46	0.999 Un	-0.23%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	105521.26	-504.96	105522.50	0.999 Un	-0.26%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	131928.50	-576.34	131929.70	0.999 Un	-0.29%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	158375.20	-561.92	158376.20	0.999 Un	-0.28%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	184813.39	-632.19	184814.50	0.999 Un	-0.32%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	211208.06	-723.09	211209.30	0.999 Un	-0.37%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	237566.83	-850.12	237568.40	0.998 Un	-0.43%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	266505.40	-815.30	266506.70	0.998 Un	-0.41%	< ± 5 % Q <sub>max</sub>
<b>Case C: Tested at Nominal voltage 1.05Un</b>						
<b>Fixed Power Factor</b>						
<b>Power factor (cosφ= <u>-0.8</u> )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	26224.87	-19704.19	32802.44	0.784 un	-0.751	0.016
[20]% P <sub>max</sub>	52675.47	-39606.06	65904.03	0.796 un	-0.752	0.004
[30]% P <sub>max</sub>	79127.74	-59558.44	99037.87	0.797 un	-0.753	0.003
[40]% P <sub>max</sub>	105842.13	-79643.02	132459.93	0.798 un	-0.752	0.002
[50]% P <sub>max</sub>	132280.63	-99373.19	165448.57	0.799 un	-0.751	0.001
[60]% P <sub>max</sub>	158678.44	-119157.31	198437.31	0.799 un	-0.751	0.001
[70]% P <sub>max</sub>	184996.18	-138845.48	231303.89	0.799 un	-0.751	0.001
[80]% P <sub>max</sub>	211304.22	-158766.41	264303.69	0.799 un	-0.751	0.001
[90]% P <sub>max</sub>	237115.38	-177981.86	296480.86	0.799 un	-0.751	0.001
[100]% P <sub>max</sub>	264338.60	-198451.63	330542.06	0.799 un	-0.751	0.001
<b>Power factor (cosφ= <u>0.8</u> )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]



[10]% P <sub>max</sub>	26308.70	19704.64	32869.74	0.781 ov	0.749	-0.019
[20]% P <sub>max</sub>	52890.47	39581.33	66061.24	0.795 ov	0.748	-0.005
[30]% P <sub>max</sub>	79449.67	59317.93	99150.78	0.798 ov	0.747	-0.002
[40]% P <sub>max</sub>	106001.12	79127.32	132277.61	0.799 ov	0.746	-0.001
[50]% P <sub>max</sub>	132281.55	98704.30	165048.32	0.800 ov	0.746	0.000
[60]% P <sub>max</sub>	158776.67	118530.65	198140.23	0.800 ov	0.747	0.000
[70]% P <sub>max</sub>	185212.44	138429.58	231228.04	0.800 ov	0.747	0.000
[80]% P <sub>max</sub>	211639.25	158219.16	264243.20	0.800 ov	0.748	0.000
[90]% P <sub>max</sub>	238035.52	178062.80	297266.28	0.800 ov	0.748	0.000
[100]% P <sub>max</sub>	264263.69	197698.07	330030.53	0.800 ov	0.748	0.000
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Qmax ( <u>0.6</u> Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26666.38	198537.64	200321.00	0.133 ov	0.27%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	53153.26	198462.36	205456.91	0.259 ov	0.23%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	79638.90	198380.07	213768.41	0.372 ov	0.19%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	106047.74	198264.02	224844.09	0.471 ov	0.13%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	132475.68	198167.48	238369.73	0.555 ov	0.08%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	158883.29	198127.57	253965.28	0.625 ov	0.06%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	185256.58	198003.59	271155.45	0.683 ov	0.00%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	211669.50	197922.76	289788.24	0.730 ov	-0.04%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	238040.20	197787.57	309488.04	0.768 ov	-0.11%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	264289.83	197701.86	330053.52	0.800 ov	-0.15%	< ± 5 % Q <sub>max</sub>
<b>Reactive power Q= Qmin ( <u>-0.6</u> Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26248.33	-199218.11	200939.86	0.131 un	-0.62%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	52417.74	-199256.78	206036.10	0.254 un	-0.63%	< ± 5 % Q <sub>max</sub>



[30]% P <sub>max</sub>	79156.14	-199319.42	214461.94	0.369 un	-0.67%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	105656.68	-199349.16	225617.85	0.468 un	-0.68%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	132107.15	-199428.22	239215.17	0.552 un	-0.72%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	158268.66	-199479.31	254638.88	0.621 un	-0.75%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	184712.53	-199551.64	271918.33	0.679 un	-0.78%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	211125.66	-199598.59	290540.23	0.726 un	-0.81%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	237232.02	-199633.09	310052.26	0.765 un	-0.82%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	263375.81	-199723.09	330539.10	0.796 un	-0.87%	< ± 5 % Q <sub>max</sub>
<b>Reactive power (Q=0)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26261.60	-316.97	26263.50	0.966 un	-0.16%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	52745.42	-431.15	52747.16	0.957 un	-0.22%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	79314.73	-433.86	79315.91	0.972 un	-0.22%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	105759.08	-568.22	105760.60	0.998 un	-0.29%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	132220.12	-669.85	132221.78	0.950 un	-0.34%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	158701.19	-738.26	158702.89	0.981 un	-0.37%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	185061.36	-790.61	185063.06	0.924 un	-0.40%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	211428.20	-926.35	211430.22	0.827 un	-0.47%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	237835.40	-1010.80	237837.54	0.882 un	-0.51%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	265982.00	-910.63	265983.53	0.984 un	-0.46%	< ± 5 % Q <sub>max</sub>
<b>a) Reactive power capacity and accuracy measurement – Test #2</b>						
<b>Test Model</b>			<b>SUN2000-330KTL-H1</b>			
<b>Registered capacity P<sub>max</sub> (W)</b>			<b>300000</b>			
<b>Case A: Tested at Nominal voltage Un</b>						
<b>Fixed Power Factor</b>						
<b>Power factor (cosφ= <u>-0.9</u> )</b>						



Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	30114.19	-14567.87	33452.80	0.900 un	-0.484	0.000
[20]% P <sub>max</sub>	60284.14	-28978.94	66887.42	0.901 un	-0.481	-0.001
[30]% P <sub>max</sub>	90463.44	-43343.88	100310.98	0.902 un	-0.479	-0.002
[40]% P <sub>max</sub>	119841.40	-59017.01	133585.12	0.897 un	-0.492	0.003
[50]% P <sub>max</sub>	150612.39	-72369.47	167096.99	0.901 un	-0.481	-0.001
[60]% P <sub>max</sub>	179656.25	-88241.99	200157.51	0.898 un	-0.491	0.002
[70]% P <sub>max</sub>	209519.44	-102914.75	233430.37	0.898 un	-0.491	0.002
[80]% P <sub>max</sub>	239580.83	-116226.31	266284.52	0.900 un	-0.485	0.000
[90]% P <sub>max</sub>	269853.42	-131012.76	299975.45	0.900 un	-0.485	0.000
[100]% P <sub>max</sub>	297412.29	-135301.75	327173.25	0.902 un	-0.479	-0.002
<b>Power factor (cosφ= 0.9 )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	29862.79	14420.96	33162.58	0.900 ov	0.483	0.000
[20]% P <sub>max</sub>	59823.59	29181.29	66561.03	0.899 ov	0.488	-0.001
[30]% P <sub>max</sub>	89849.00	44037.38	100060.86	0.898 ov	0.490	-0.002
[40]% P <sub>max</sub>	120071.13	57538.17	133145.18	0.902 ov	0.479	0.002
[50]% P <sub>max</sub>	149767.87	73516.23	166838.21	0.898 ov	0.491	-0.002
[60]% P <sub>max</sub>	179876.25	86451.53	199572.96	0.901 ov	0.481	0.001
[70]% P <sub>max</sub>	209816.78	100910.03	232821.40	0.901 ov	0.481	0.001
[80]% P <sub>max</sub>	240101.26	117327.08	267234.45	0.898 ov	0.489	-0.002
[90]% P <sub>max</sub>	270138.27	131832.59	300590.37	0.899 ov	0.488	-0.001
[100]% P <sub>max</sub>	295304.88	140964.11	328229.44	0.897 ov	0.494	-0.003
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Q<sub>max</sub> ( 0.484 S<sub>max</sub>)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	△Q / Q <sub>max</sub>	△Q limit
[10]% P <sub>max</sub>	30210.90	137704.41	140979.45	0.214 ov	0.51%	< ± 5 % Q <sub>max</sub>



[20]% P <sub>max</sub>	60269.74	137639.95	150257.09	0.401 ov	0.47%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90318.10	137585.22	164581.45	0.548 ov	0.43%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120299.14	137510.14	182704.46	0.658 ov	0.37%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	150299.15	137454.13	203674.89	0.737 ov	0.33%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180257.68	137376.60	226638.80	0.795 ov	0.27%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210158.85	137303.30	251035.75	0.837 ov	0.22%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	240087.20	137173.36	276511.06	0.868 ov	0.13%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269998.97	137066.80	302798.19	0.891 ov	0.05%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	299794.80	136924.61	329583.32	0.909 ov	-0.06%	< ± 5 % Q <sub>max</sub>
<b>Reactive power Q= Qmin (= -0.484 Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	29533.56	-137088.63	140233.80	0.210 un	-0.06%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	59601.92	-137173.12	149562.21	0.398 un	-0.13%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	89640.05	-137237.90	163919.43	0.546 un	-0.17%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	119670.53	-137307.96	182138.73	0.657 un	-0.22%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	149655.20	-137366.86	203141.12	0.736 un	-0.27%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	179640.91	-137428.11	226179.90	0.794 un	-0.31%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	209529.92	-137442.30	250585.65	0.836 un	-0.32%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	239456.09	-137487.56	276119.59	0.867 un	-0.36%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269389.64	-137519.70	302460.65	0.890 un	-0.38%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	299772.59	-137551.07	329824.04	0.908 un	-0.40%	< ± 5 % Q <sub>max</sub>
<b>Reactive power (Q=0)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	30371.51	-120.12	30371.75	1.000 un	-0.34%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	60294.24	-239.09	60294.71	1.000 un	-0.30%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90148.64	-361.16	90149.36	1.000 un	-0.26%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120524.11	-470.23	120525.02	1.000 un	-0.34%	< ± 5 % Q <sub>max</sub>



[50]% P <sub>max</sub>	150277.30	-606.54	150278.52	1.000 un	-0.44%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180074.26	-645.75	180075.42	1.000 un	-0.47%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210063.86	-696.74	210065.02	1.000 un	-0.51%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	240141.13	-744.45	240142.28	1.000 un	-0.54%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	270159.86	-810.23	270161.08	1.000 un	-0.59%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	300001.23	-861.33	300002.47	1.000 un	-0.63%	< ± 5 % Q <sub>max</sub>
<b>Case B: Tested at Nominal voltage 0.95Un</b>						
<b>Fixed Power Factor</b>						
<b>Power factor (cosφ= -0.9 )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	29901.96	-13425.16	32777.50	0.900 un	-0.449	0.000
[20]% P <sub>max</sub>	59939.32	-28681.23	66447.99	0.902 un	-0.479	-0.002
[30]% P <sub>max</sub>	90001.22	-43099.53	99788.77	0.902 un	-0.479	-0.002
[40]% P <sub>max</sub>	119965.24	-57496.89	133032.19	0.902 un	-0.479	-0.002
[50]% P <sub>max</sub>	149909.32	-72216.07	166397.03	0.901 un	-0.482	-0.001
[60]% P <sub>max</sub>	179797.47	-86655.86	199590.45	0.901 un	-0.482	-0.001
[70]% P <sub>max</sub>	209732.67	-101089.14	232823.52	0.901 un	-0.482	-0.001
[80]% P <sub>max</sub>	239601.26	-115370.45	265930.58	0.901 un	-0.482	-0.001
[90]% P <sub>max</sub>	269423.27	-129618.79	298981.49	0.901 un	-0.481	-0.001
*[100]% P <sub>max</sub>	285388.25	-137324.58	316708.79	0.901 un	-0.481	-0.001
<b>Power factor (cosφ= 0.9 )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	29953.70	13443.96	32832.36	0.912 ov	0.449	0.012
[20]% P <sub>max</sub>	60136.24	28749.15	66654.94	0.902 ov	0.478	0.002
[30]% P <sub>max</sub>	90267.44	43235.03	100087.35	0.902 ov	0.479	0.002
[40]% P <sub>max</sub>	120313.17	57825.38	133487.92	0.901 ov	0.481	0.001



[50]% P <sub>max</sub>	150343.73	72391.80	166864.62	0.901 ov	0.482	0.001
[60]% P <sub>max</sub>	180321.58	86854.57	200148.94	0.901 ov	0.482	0.001
[70]% P <sub>max</sub>	210235.20	101356.97	233392.52	0.901 ov	0.482	0.001
[80]% P <sub>max</sub>	240171.60	115822.23	266640.55	0.901 ov	0.482	0.001
[90]% P <sub>max</sub>	270111.87	130316.85	299904.79	0.901 ov	0.482	0.001
[100]%* P <sub>max</sub>	286128.36	138128.58	317724.62	0.901 ov	0.483	0.001
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Qmax ( <u>0.484</u> Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	30184.87	137706.66	140976.09	0.214 ov	0.52%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	60248.05	137648.00	150255.78	0.401 ov	0.47%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90265.32	137572.47	164541.78	0.549 ov	0.42%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120256.97	137533.47	182694.29	0.658 ov	0.39%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	150211.25	137445.03	203603.92	0.738 ov	0.32%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180188.14	137382.07	226586.82	0.795 ov	0.28%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210057.63	137265.71	250930.40	0.837 ov	0.19%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	239981.04	137158.96	276411.78	0.868 ov	0.12%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269877.35	137041.04	302678.06	0.892 ov	0.03%	< ± 5 % Q <sub>max</sub>
[100]%* P <sub>max</sub>	286686.87	136951.24	317718.39	0.902 ov	-0.04%	< ± 5 % Q <sub>max</sub>
<b>Reactive power Q= Qmin (= <u>-0.484</u> Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	29417.90	-137049.31	140171.04	0.210 un	-0.04%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	59488.04	-137129.17	149476.50	0.398 un	-0.09%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	89493.00	-137189.34	163798.39	0.546 un	-0.14%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	119507.57	-137281.64	182011.80	0.657 un	-0.21%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	149443.36	-137311.12	202947.35	0.736 un	-0.23%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	179465.21	-137361.91	226000.12	0.794 un	-0.26%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	209421.66	-137399.88	250471.85	0.836 un	-0.29%	< ± 5 % Q <sub>max</sub>



[80]% P <sub>max</sub>	239338.68	-137433.28	275990.73	0.867 un	-0.32%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269252.21	-137477.42	302318.98	0.891 un	-0.35%	< ± 5 % Q <sub>max</sub>
[100]%* P <sub>max</sub>	284321.25	-137487.69	315818.66	0.900 un	-0.36%	< ± 5 % Q <sub>max</sub>
<b>Reactive power (Q=0)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	△Q / Q <sub>max</sub>	△Q limit
[10]% P <sub>max</sub>	29913.88	-324.85	29915.68	1.000 un	-0.24%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	60002.00	-408.62	60003.43	1.000 un	-0.30%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90103.31	-484.46	90104.59	1.000 un	-0.35%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120196.94	-537.89	120198.16	1.000 un	-0.39%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	150176.59	-604.22	150177.79	1.000 un	-0.44%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180080.84	-662.00	180082.06	1.000 un	-0.48%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210076.53	-714.76	210077.77	1.000 un	-0.52%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	240041.87	-784.35	240043.17	1.000 un	-0.57%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269927.06	-852.84	269928.37	1.000 un	-0.62%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	302771.97	-943.00	302773.41	1.000 un	-0.69%	< ± 5 % Q <sub>max</sub>
<b>Case C: Tested at Nominal voltage 1.05Un</b>						
<b>Fixed Power Factor</b>						
<b>Power factor (cosφ= -0.9 )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	29883.89	-13017.65	32596.13	0.917 un	-0.436	-0.017
[20]% P <sub>max</sub>	59962.02	-28361.82	66331.30	0.904 un	-0.473	-0.004
[30]% P <sub>max</sub>	90076.81	-43024.49	99824.53	0.902 un	-0.478	-0.002
[40]% P <sub>max</sub>	120112.89	-57563.65	133194.72	0.902 un	-0.479	-0.002
[50]% P <sub>max</sub>	150074.08	-72777.98	166789.88	0.900 un	-0.485	0.000
[60]% P <sub>max</sub>	179989.74	-87252.30	200023.16	0.900 un	-0.485	0.000
[70]% P <sub>max</sub>	209947.28	-101728.72	233295.08	0.900 un	-0.485	0.000
[80]% P <sub>max</sub>	239811.81	-116105.19	266439.63	0.900 un	-0.484	0.000



[90]% P <sub>max</sub>	269656.57	-130671.15	299649.12	0.900 un	-0.485	0.000
[100]% P <sub>max</sub>	297173.31	-143828.76	330149.49	0.900 un	-0.484	0.000
<b>Power factor (cosφ= <u>0.9</u> )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	29930.27	12871.41	32580.60	0.919 ov	0.430	0.019
[20]% P <sub>max</sub>	60086.21	28006.80	66292.77	0.906 ov	0.466	0.006
[30]% P <sub>max</sub>	90011.68	43211.62	99846.62	0.901 ov	0.480	0.001
[40]% P <sub>max</sub>	120305.12	57765.73	133454.86	0.901 ov	0.480	0.001
[50]% P <sub>max</sub>	150337.13	72210.00	166779.86	0.901 ov	0.480	0.001
[60]% P <sub>max</sub>	180282.89	86903.19	200135.48	0.901 ov	0.482	0.001
[70]% P <sub>max</sub>	210343.43	101440.41	233526.39	0.901 ov	0.482	0.001
[80]% P <sub>max</sub>	240335.55	115840.39	266795.97	0.901 ov	0.482	0.001
[90]% P <sub>max</sub>	270286.14	130306.24	300056.90	0.901 ov	0.482	0.001
[100]% P <sub>max</sub>	297242.58	143314.05	329987.88	0.901 ov	0.482	0.001
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Q<sub>max</sub> ( <u>0.484</u> S<sub>max</sub>)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	30242.10	137691.03	140973.09	0.215 ov	0.50%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	60283.17	137607.66	150232.87	0.401 ov	0.44%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90334.24	137586.72	164591.55	0.549 ov	0.43%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120229.45	137502.23	182652.57	0.658 ov	0.37%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	150183.53	137449.39	203586.43	0.738 ov	0.33%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180187.59	137363.91	226575.43	0.795 ov	0.27%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210201.79	137274.42	251055.86	0.837 ov	0.20%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	240139.56	137147.99	276543.93	0.868 ov	0.11%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	270067.32	137048.23	302850.74	0.892 ov	0.04%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	299922.28	136919.42	329697.25	0.910 ov	-0.06%	< ± 5 % Q <sub>max</sub>



Reactive power Q= Qmin ( <u>-0.484</u> Smax)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	29555.84	-137107.59	140257.04	0.211 un	-0.08%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	59610.45	-137183.98	149575.57	0.399 un	-0.13%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	89668.79	-137287.10	163976.32	0.547 un	-0.21%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	119590.39	-137309.99	182087.60	0.657 un	-0.23%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	149573.95	-137401.28	203104.60	0.736 un	-0.29%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	179567.57	-137443.04	226130.66	0.794 un	-0.32%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	209572.76	-137491.65	250648.55	0.836 un	-0.36%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	239527.55	-137528.90	276202.18	0.867 un	-0.39%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269478.84	-137582.21	302568.53	0.891 un	-0.42%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	299894.41	-137620.54	329963.73	0.909 un	-0.45%	< ± 5 % Q <sub>max</sub>
Reactive power (Q=0)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	29895.75	-355.86	29897.89	1.000 un	-0.26%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	60022.49	-452.64	60024.21	1.000 un	-0.33%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90214.06	-539.14	90215.66	1.000 un	-0.39%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120303.18	-594.76	120304.67	1.000 un	-0.43%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	150283.92	-650.19	150285.36	1.000 un	-0.47%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180333.91	-706.37	180335.28	1.000 un	-0.52%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210244.23	-776.40	210245.63	1.000 un	-0.57%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	240223.96	-834.63	240225.45	1.000 un	-0.61%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	270136.91	-902.90	270138.42	1.000 un	-0.66%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	302991.14	-978.09	302992.75	1.000 un	-0.71%	< ± 5 % Q <sub>max</sub>
<b>a) Reactive power capacity and accuracy measurement – Test #3</b>						
<b>Test Model</b>			<b>SUN2000-330KTL-H2</b>			



Registered capacity P <sub>max</sub> (W)		264000				
Case A: Tested at Nominal voltage Un						
Fixed Power Factor						
Power factor (cosφ= <u>-0.9</u> )						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	30114.19	-14567.87	33452.80	0.900 un	-0.484	0.000
[20]% P <sub>max</sub>	60284.14	-28978.94	66887.42	0.901 un	-0.481	-0.001
[30]% P <sub>max</sub>	90463.44	-43343.88	100310.98	0.902 un	-0.479	-0.002
[40]% P <sub>max</sub>	119841.40	-59017.01	133585.12	0.897 un	-0.492	0.003
[50]% P <sub>max</sub>	150612.39	-72369.47	167096.99	0.901 un	-0.481	-0.001
[60]% P <sub>max</sub>	179656.25	-88241.99	200157.51	0.898 un	-0.491	0.002
[70]% P <sub>max</sub>	209519.44	-102914.75	233430.37	0.898 un	-0.491	0.002
[80]% P <sub>max</sub>	239580.83	-116226.31	266284.52	0.900 un	-0.485	0.000
[90]% P <sub>max</sub>	269853.42	-131012.76	299975.45	0.900 un	-0.485	0.000
[100]% P <sub>max</sub>	297412.29	-135301.75	327173.25	0.902 un	-0.479	-0.002
Power factor (cosφ= <u>0.9</u> )						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	29862.79	14420.96	33162.58	0.900 ov	0.483	0.000
[20]% P <sub>max</sub>	59823.59	29181.29	66561.03	0.899 ov	0.488	-0.001
[30]% P <sub>max</sub>	89849.00	44037.38	100060.86	0.898 ov	0.490	-0.002
[40]% P <sub>max</sub>	120071.13	57538.17	133145.18	0.902 ov	0.479	0.002
[50]% P <sub>max</sub>	149767.87	73516.23	166838.21	0.898 ov	0.491	-0.002
[60]% P <sub>max</sub>	179876.25	86451.53	199572.96	0.901 ov	0.481	0.001
[70]% P <sub>max</sub>	209816.78	100910.03	232821.40	0.901 ov	0.481	0.001
[80]% P <sub>max</sub>	240101.26	117327.08	267234.45	0.898 ov	0.489	-0.002
[90]% P <sub>max</sub>	270138.27	131832.59	300590.37	0.899 ov	0.488	-0.001
[100]% P <sub>max</sub>	295304.88	140964.11	328229.44	0.897 ov	0.494	-0.003



Fixed Reactive power						
Reactive power Q= Qmax ( 0.484 Smax)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	30210.90	137704.41	140979.45	0.214 ov	0.51%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	60269.74	137639.95	150257.09	0.401 ov	0.47%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90318.10	137585.22	164581.45	0.548 ov	0.43%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120299.14	137510.14	182704.46	0.658 ov	0.37%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	150299.15	137454.13	203674.89	0.737 ov	0.33%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180257.68	137376.60	226638.80	0.795 ov	0.27%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210158.85	137303.30	251035.75	0.837 ov	0.22%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	240087.20	137173.36	276511.06	0.868 ov	0.13%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269998.97	137066.80	302798.19	0.891 ov	0.05%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	299794.80	136924.61	329583.32	0.909 ov	-0.06%	< ± 5 % Q <sub>max</sub>
Reactive power Q= Qmin (-0.484 Smax)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	29533.56	-137088.63	140233.80	0.210 un	-0.06%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	59601.92	-137173.12	149562.21	0.398 un	-0.13%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	89640.05	-137237.90	163919.43	0.546 un	-0.17%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	119670.53	-137307.96	182138.73	0.657 un	-0.22%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	149655.20	-137366.86	203141.12	0.736 un	-0.27%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	179640.91	-137428.11	226179.90	0.794 un	-0.31%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	209529.92	-137442.30	250585.65	0.836 un	-0.32%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	239456.09	-137487.56	276119.59	0.867 un	-0.36%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	269389.64	-137519.70	302460.65	0.890 un	-0.38%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	299772.59	-137551.07	329824.04	0.908 un	-0.40%	< ± 5 % Q <sub>max</sub>
Reactive power (Q=0)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit



[10]% P <sub>max</sub>	30371.51	-120.12	30371.75	1.000 un	-0.34%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	60294.24	-239.09	60294.71	1.000 un	-0.30%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	90148.64	-361.16	90149.36	1.000 un	-0.26%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	120524.11	-470.23	120525.02	1.000 un	-0.34%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	150277.30	-606.54	150278.52	1.000 un	-0.44%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	180074.26	-645.75	180075.42	1.000 un	-0.47%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	210063.86	-696.74	210065.02	1.000 un	-0.51%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	240141.13	-744.45	240142.28	1.000 un	-0.54%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	270159.86	-810.23	270161.08	1.000 un	-0.59%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	300001.23	-861.33	300002.47	1.000 un	-0.63%	< ± 5 % Q <sub>max</sub>

**a) Reactive power capacity and accuracy measurement – Test #4**

<b>Test Model</b>	<b>SUN2000-330KTL-H2</b>
<b>Registered capacity P<sub>max</sub> (W)</b>	<b>275000</b>

**Case A: Tested at Nominal voltage U<sub>n</sub>**

**Fixed Power Factor**

**Power factor (cosφ=- 0.9 )**

Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	27336.92	-13251.16	30379.29	0.900 un	-0.485	0.000
[20]% P <sub>max</sub>	54897.15	-26568.72	60988.44	0.900 un	-0.484	0.000
[30]% P <sub>max</sub>	82495.08	-39722.36	91560.39	0.901 un	-0.482	0.001
[40]% P <sub>max</sub>	110003.69	-53153.17	122172.28	0.900 un	-0.483	0.000
[50]% P <sub>max</sub>	137529.78	-66311.46	152681.49	0.901 un	-0.482	0.001
[60]% P <sub>max</sub>	165016.16	-79400.47	183124.94	0.901 un	-0.481	0.001
[70]% P <sub>max</sub>	192220.29	-93016.67	213543.31	0.900 un	-0.484	0.000
[80]% P <sub>max</sub>	219661.13	-106197.20	243985.34	0.900 un	-0.483	0.000
[90]% P <sub>max</sub>	247051.27	-119631.98	274492.52	0.900 un	-0.484	0.000



Product Service

[100]% P <sub>max</sub>	277177.71	-134118.50	307920.66	0.900 un	-0.484	0.000
<b>Power factor (cosφ= <u>0.9</u> )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	27393.01	13221.19	30416.78	0.901 ov	0.483	0.001
[20]% P <sub>max</sub>	55033.20	26503.44	61082.63	0.901 ov	0.482	0.001
[30]% P <sub>max</sub>	82654.32	39929.19	91793.70	0.900 ov	0.483	0.000
[40]% P <sub>max</sub>	110237.38	53197.64	122402.55	0.901 ov	0.483	0.001
[50]% P <sub>max</sub>	137794.51	66312.55	152920.42	0.901 ov	0.481	0.001
[60]% P <sub>max</sub>	165275.79	79546.36	183421.94	0.901 ov	0.481	0.001
[70]% P <sub>max</sub>	192718.35	92901.82	213941.70	0.901 ov	0.482	0.001
[80]% P <sub>max</sub>	220157.93	106091.82	244387.52	0.901 ov	0.482	0.001
[90]% P <sub>max</sub>	247562.01	119480.73	274886.79	0.901 ov	0.483	0.001
[100]% P <sub>max</sub>	277716.71	134193.09	308437.33	0.900 ov	0.483	0.000
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Q<sub>max</sub> ( <u>0.553</u> S<sub>max</sub>)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27400.73	183791.79	185822.99	0.147 ov	-0.88%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	54970.63	183747.97	191794.55	0.287 ov	-0.89%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	82536.38	183655.75	201349.83	0.410 ov	-0.86%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110080.60	183580.47	214055.18	0.514 ov	-0.85%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	137607.67	183511.10	229373.89	0.600 ov	-0.82%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	165129.80	183465.98	246835.05	0.669 ov	-0.83%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	192618.47	183396.15	265962.19	0.724 ov	-0.81%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	220110.53	183315.85	286449.37	0.768 ov	-0.76%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	247537.14	183180.10	307943.69	0.804 ov	-0.61%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	274243.65	183092.46	329746.31	0.832 ov	-0.63%	< ± 5 % Q <sub>max</sub>
<b>Reactive power Q= Q<sub>min</sub> ( <u>-0.553</u> S<sub>max</sub>)</b>						



Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27219.79	-183099.53	185111.71	0.147 un	-0.60%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	55071.74	-183137.90	191239.03	0.288 un	-0.63%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	82624.12	-183173.03	200945.50	0.411 un	-0.64%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110153.65	-183205.93	213771.46	0.515 un	-0.66%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	137677.23	-183276.11	229227.29	0.601 un	-0.70%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	164944.31	-183310.74	246595.74	0.669 un	-0.72%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	192436.03	-183319.98	265777.78	0.724 un	-0.73%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	219867.26	-183374.35	286300.11	0.768 un	-0.76%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	247274.62	-183410.20	307870.40	0.803 un	-0.77%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	274298.07	-183528.44	330033.95	0.831 un	-0.84%	< ± 5 % Q <sub>max</sub>
<b>Reactive power (Q=0)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27343.03	-251.68	27344.16	1.000 un	-0.14%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	54964.02	-394.33	54965.43	1.000 un	-0.22%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	82590.59	-400.67	82591.54	1.000 un	-0.22%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110112.08	-521.06	110113.32	1.000 un	-0.29%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	137658.67	-545.75	137659.76	1.000 un	-0.30%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	164921.54	-520.34	164922.38	1.000 un	-0.29%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	192465.57	-639.53	192466.64	1.000 un	-0.35%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	219918.58	-740.44	219919.79	1.000 un	-0.41%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	247408.34	-723.22	247409.38	1.000 un	-0.40%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	277602.89	-727.77	277603.86	1.000 un	-0.40%	< ± 5 % Q <sub>max</sub>
<b>Case B: Tested at Nominal voltage 0.95Un</b>						
<b>Fixed Power Factor</b>						
<b>Power factor (cosφ=- <u>0.9</u> )</b>						



Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	27340.88	-13210.10	30364.95	0.900 un	-0.483	0.000
[20]% P <sub>max</sub>	54958.61	-26596.99	61056.15	0.900 un	-0.484	0.000
[30]% P <sub>max</sub>	82457.38	-39736.31	91532.43	0.901 un	-0.482	0.001
[40]% P <sub>max</sub>	109981.46	-53259.77	122198.54	0.900 un	-0.484	0.000
[50]% P <sub>max</sub>	137244.68	-66536.81	152522.86	0.900 un	-0.485	0.000
[60]% P <sub>max</sub>	164714.78	-79797.67	183025.58	0.900 un	-0.484	0.000
[70]% P <sub>max</sub>	192161.30	-92936.88	213455.15	0.900 un	-0.484	0.000
[80]% P <sub>max</sub>	219558.04	-106277.28	243927.04	0.900 un	-0.484	0.000
[90]% P <sub>max</sub>	246920.13	-119424.19	274284.02	0.900 un	-0.484	0.000
[100]% P <sub>max</sub>	276932.36	-134036.18	307664.02	0.900 un	-0.484	0.000
<b>Power factor (cosφ= <u>0.9</u> )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	27701.06	13325.64	30739.61	0.901 ov	0.481	0.001
[20]% P <sub>max</sub>	55031.49	26455.91	61060.47	0.901 ov	0.481	0.001
[30]% P <sub>max</sub>	82640.48	39881.42	91760.40	0.901 ov	0.483	0.001
[40]% P <sub>max</sub>	110194.69	53155.37	122345.22	0.901 ov	0.482	0.001
[50]% P <sub>max</sub>	137483.74	66349.08	152656.40	0.901 ov	0.483	0.001
[60]% P <sub>max</sub>	165028.87	79712.95	183272.17	0.900 ov	0.483	0.000
[70]% P <sub>max</sub>	192520.76	92794.67	213717.31	0.901 ov	0.482	0.001
[80]% P <sub>max</sub>	220022.52	106183.71	244304.89	0.901 ov	0.483	0.001
[90]% P <sub>max</sub>	247447.50	119358.32	274730.19	0.901 ov	0.482	0.001
[100]% P <sub>max</sub>	277501.76	133884.68	308110.96	0.901 ov	0.482	0.001
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Q<sub>max</sub> ( <u>0.553</u> S<sub>max</sub>)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27439.60	182116.24	184171.80	0.149 ov	0.06%	< ± 5 % Q <sub>max</sub>



[20]% P <sub>max</sub>	54990.84	182047.64	190171.84	0.289 ov	0.03%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	82480.61	182202.16	200001.64	0.412 ov	0.11%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110019.90	182232.96	212869.02	0.517 ov	0.13%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	137548.99	182190.50	228282.93	0.603 ov	0.10%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	165066.90	182136.89	245806.69	0.672 ov	0.08%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	192565.79	182045.80	264994.78	0.727 ov	0.03%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	220019.58	181939.00	285500.27	0.771 ov	-0.03%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	247463.16	182106.54	307247.14	0.805 ov	0.06%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	260867.97	182084.72	318130.37	0.820 ov	0.05%	< ± 5 % Q <sub>max</sub>
<b>Reactive power Q= Qmin ( -0.553 Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27465.42	-182395.95	184452.23	0.149 un	-0.22%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	55006.78	-182417.11	190530.37	0.289 un	-0.23%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	82571.99	-182484.75	200296.38	0.412 un	-0.27%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110101.16	-182523.59	213159.34	0.517 un	-0.29%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	136814.49	-182570.50	228145.08	0.600 un	-0.31%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	164310.03	-182627.14	245663.49	0.669 un	-0.34%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	191789.93	-182657.08	264852.96	0.724 un	-0.36%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	219231.56	-182667.87	285359.20	0.768 un	-0.37%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	246551.03	-182585.98	306798.27	0.804 un	-0.32%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	258191.20	-182655.08	316268.17	0.816 un	-0.36%	< ± 5 % Q <sub>max</sub>
<b>Reactive power (Q=0)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27375.81	-310.89	27377.57	1.000 un	-0.17%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	54991.49	-384.91	54992.90	1.000 un	-0.21%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	82595.48	-512.69	82597.01	1.000 un	-0.28%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110144.75	-486.21	110145.98	1.000 un	-0.27%	< ± 5 % Q <sub>max</sub>



[50]% P <sub>max</sub>	137652.29	-560.96	137653.09	1.000 un	-0.31%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	165140.90	-609.10	165141.93	1.000 un	-0.33%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	192548.01	-710.37	192549.17	1.000 un	-0.39%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	219983.19	-701.10	219984.09	1.000 un	-0.39%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	247385.78	-704.19	247386.68	1.000 un	-0.39%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	277535.68	-728.67	277536.78	1.000 un	-0.40%	< ± 5 % Q <sub>max</sub>
<b>Case C: Tested at Nominal voltage 1.05Un</b>						
<b>Fixed Power Factor</b>						
<b>Power factor (cosφ= <u>0.9</u> )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power [var]	Apparent power [VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	27368.50	-11655.66	29747.13	0.920 un	-0.426	0.020
[20]% P <sub>max</sub>	54901.46	-25658.59	60601.44	0.906 un	-0.467	0.006
[30]% P <sub>max</sub>	82488.53	-39666.85	91530.40	0.901 un	-0.481	0.001
[40]% P <sub>max</sub>	109963.12	-52978.83	122060.21	0.901 un	-0.482	0.001
[50]% P <sub>max</sub>	137426.76	-66566.53	152699.77	0.900 un	-0.484	0.000
[60]% P <sub>max</sub>	164904.24	-79935.64	183256.97	0.900 un	-0.485	0.000
[70]% P <sub>max</sub>	192287.19	-93112.16	213645.13	0.900 un	-0.484	0.000
[80]% P <sub>max</sub>	219641.20	-106388.42	244050.68	0.900 un	-0.484	0.000
[90]% P <sub>max</sub>	246953.00	-119578.25	274380.67	0.900 un	-0.484	0.000
[100]% P <sub>max</sub>	277119.84	-134192.91	307901.17	0.900 un	-0.484	0.000
<b>Power factor (cosφ= <u>0.9</u> )</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	Q/P	Deviation [cosφ ±0.01]
[10]% P <sub>max</sub>	27339.74	11389.92	29617.44	0.923 ov	0.417	0.023
[20]% P <sub>max</sub>	55022.88	25844.08	60790.05	0.905 ov	0.470	0.005
[30]% P <sub>max</sub>	82664.28	39578.25	91650.53	0.902 ov	0.479	0.002
[40]% P <sub>max</sub>	110164.92	52871.93	122195.55	0.902 ov	0.480	0.002



[50]% P <sub>max</sub>	137625.46	66212.98	152724.99	0.901 ov	0.481	0.001
[60]% P <sub>max</sub>	165110.73	79455.53	183234.08	0.901 ov	0.481	0.001
[70]% P <sub>max</sub>	192544.45	92821.34	213750.25	0.901 ov	0.482	0.001
[80]% P <sub>max</sub>	220074.00	106132.43	244329.01	0.901 ov	0.482	0.001
[90]% P <sub>max</sub>	247498.94	119468.23	274824.24	0.901 ov	0.483	0.001
[100]% P <sub>max</sub>	277704.49	133978.67	308334.36	0.901 ov	0.482	0.001
<b>Fixed Reactive power</b>						
<b>Reactive power Q= Qmax ( <u>0.553</u> Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27628.57	182699.80	184777.04	0.150 ov	0.38%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	55176.51	182640.96	190793.59	0.289 ov	0.35%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	55176.51	182640.96	190793.59	0.289 ov	0.35%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110205.68	182505.02	213197.94	0.517 ov	0.28%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	137663.69	182387.18	228509.37	0.602 ov	0.21%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	165171.13	182360.50	246042.62	0.671 ov	0.20%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	192611.66	182256.18	265172.56	0.726 ov	0.14%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	219999.70	182136.78	285611.00	0.770 ov	0.08%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	247444.45	182064.52	307206.84	0.805 ov	0.04%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	274794.62	181929.60	329561.30	0.834 ov	-0.04%	< ± 5 % Q <sub>max</sub>
<b>Reactive power Q= Qmin ( <u>-0.553</u> Smax)</b>						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	26702.32	-182039.92	183987.88	0.145 un	-0.02%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	54262.77	-182095.40	190008.32	0.286 un	-0.05%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	81761.56	-182174.74	199681.24	0.409 un	-0.10%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	109249.40	-182221.73	212462.21	0.514 un	-0.12%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	136768.76	-182258.76	227868.24	0.600 un	-0.14%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	164305.81	-182304.33	245420.56	0.669 un	-0.17%	< ± 5 % Q <sub>max</sub>



[70]% P <sub>max</sub>	191797.41	-182294.57	264608.29	0.725 un	-0.16%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	219250.08	-182381.79	285190.61	0.769 un	-0.21%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	246679.63	-182359.88	306766.92	0.804 un	-0.20%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	274910.60	-182372.96	329902.69	0.833 un	-0.20%	< ± 5 % Q <sub>max</sub>
Reactive power (Q=0)						
Power range (P/ P <sub>max</sub> )	Active power [W]	Reactive power[var]	Apparent power[VA]	Power factor[cosφ]	ΔQ / Q <sub>max</sub>	ΔQ limit
[10]% P <sub>max</sub>	27356.46	-341.68	27358.59	1.000 un	-0.19%	< ± 5 % Q <sub>max</sub>
[20]% P <sub>max</sub>	54916.91	-403.54	54918.39	1.000 un	-0.22%	< ± 5 % Q <sub>max</sub>
[30]% P <sub>max</sub>	82604.52	-464.61	82605.86	1.000 un	-0.26%	< ± 5 % Q <sub>max</sub>
[40]% P <sub>max</sub>	110104.89	-445.35	110105.79	1.000 un	-0.24%	< ± 5 % Q <sub>max</sub>
[50]% P <sub>max</sub>	137629.48	-535.48	137630.54	1.000 un	-0.29%	< ± 5 % Q <sub>max</sub>
[60]% P <sub>max</sub>	165145.67	-604.76	165146.78	1.000 un	-0.33%	< ± 5 % Q <sub>max</sub>
[70]% P <sub>max</sub>	192548.52	-630.42	192549.54	1.000 un	-0.35%	< ± 5 % Q <sub>max</sub>
[80]% P <sub>max</sub>	219972.31	-651.57	219973.26	1.000 un	-0.36%	< ± 5 % Q <sub>max</sub>
[90]% P <sub>max</sub>	247401.19	-694.64	247402.14	1.000 un	-0.38%	< ± 5 % Q <sub>max</sub>
[100]% P <sub>max</sub>	277637.20	-882.42	277638.64	1.000 un	-0.48%	< ± 5 % Q <sub>max</sub>

Remark: \*This case limited by the maximum apparent power, active power cannot reach the set point.

### b) Steady State Voltage Control and Transient Voltage Control – Test #1

$$Q_{max} = \underline{0.6} \ S_{max} \ \& \ Q_{min} = \underline{-0.6} \ S_{max}$$

Test Model				SUN2000-330KTL-H1			
P/ P <sub>max</sub> [%] Set-point				< 10 %			
Vac [V] set-point [Limit< ± 0.25 %Vn]	V <sub>L-L</sub> [V]	Active power [W]	Reactive power[var]	Q [Var] expected	ΔQ / Q <sub>max</sub> (Limit ΔQ < ± 5 % Q <sub>max</sub> )	Response time [ms, <200ms]	Reach time [ms, <1000ms]
100% Vn@10s	799.63	29201.01	-220.90	0	-0.11%	--	--
	799.86						
	799.68						
99% Vn@10s	792.56	29450.30	39560.35	39600	-0.02%	60	120
	792.44						
	792.68						
98% Vn@10s	784.46	29188.14	79164.10	79200	-0.02%	40	110
	784.55						



Product Service

	784.69						
97% Vn@10s	777.59	29535.41	119007.11	118800	0.10%	20	80
	777.93						
	777.67						
96% Vn@10s	768.55	29580.50	158403.40	158400	0.00%	30	60
	768.86						
	768.44						
95% Vn@10s	763.07	29313.25	198403.24	198000	0.20%	20	50
	763.41						
	763.09						
94% Vn@10s	754.99	29321.18	198431.19	198000	0.22%	20	20
	755.30						
	754.99						
95% Vn@10s	763.08	29327.79	198445.46	198000	0.22%	20	20
	763.41						
	763.11						
96% Vn@10s	768.56	29355.90	158805.20	158400	0.20%	40	60
	768.81						
	768.41						
97% Vn@10s	777.61	29393.60	118942.20	118800	0.07%	30	60
	777.94						
	777.69						
98% Vn@10s	784.26	29400.30	79188.59	79200	-0.01%	30	50
	784.45						
	784.29						
99% Vn@10s	792.36	29450.30	39560.35	39600	-0.02%	30	50
	792.54						
	792.28						
100% Vn@10s	799.63	29199.23	-259.01	0	-0.13%	20	30
	799.86						
	799.68						
101% Vn@10s	808.44	29180.55	-39621.09	-39600	-0.01%	30	50
	808.66						
	808.41						
102% Vn@10s	816.22	29175.29	-79188.69	-79200	0.01%	30	40
	816.46						
	816.24						
103% Vn@10s	823.79	28985.00	-118229.95	-118800	0.29%	30	40
	823.95						
	823.80						
104% Vn@10s	832.11	28991.15	-158366.77	-158400	0.02%	20	30
	832.45						
	832.16						
105% Vn@10s	838.36	28536.63	-199021.98	-198000	-0.52%	30	60
	838.51						
	838.42						
106% Vn@10s	846.33	28505.22	-199022.23	-198000	-0.52%	20	20
	846.51						
	846.42						
105% Vn@10s	836.36	28511.31	-199037.75	-198000	-0.52%	20	20
	836.50						
	836.40						



104% Vn@10s	832.12	28991.15	-158366.77	-158400	0.02%	20	30
	832.45						
	832.18						
103% Vn@10s	823.78	28833.36	-118256.69	-118800	0.27%	30	40
	823.94						
	823.78						
102% Vn@10s	816.22	29175.29	-79188.69	-79200	0.01%	30	40
	816.46						
	816.24						
101% Vn@10s	808.44	29180.55	-39625.09	-39600	-0.01%	30	50
	808.66						
	808.41						
100% Vn@10s	799.64	29205.07	-364.90	0	-0.18%	20	30
	799.84						
	799.68						
P/ P <sub>max</sub> [%] Set-point				>50 %			
Vac [V] set-point [Limit< ± 0.25 %Vn]	V <sub>L-L</sub> [V]	Active power [W]	Reactive power[var]	Q [Var] expected	$\Delta Q / Q_{max}$ (Limit $\Delta Q$ < ± 5 % $Q_{max}$ )	Response time [ms, <200ms]	Reach time [ms, <1000ms]
100% Vn@10s	800.19	180254.70	-716.30	0	-0.36%	--	--
	800.35						
	800.21						
99% Vn@10s	792.56	180154.30	39560.35	39600	-0.02%	60	120
	792.44						
	792.68						
98% Vn@10s	784.46	180021.70	79164.10	79200	-0.02%	40	110
	784.55						
	784.69						
97% Vn@10s	788.21	180212.23	118582.55	118800	-0.11%	20	80
	788.42						
	788.21						
96% Vn@10s	768.55	180117.93	158403.40	158400	0.00%	30	60
	768.86						
	768.44						
95% Vn@10s	763.75	180187.90	198025.24	198000	0.01%	20	50
	763.97						
	763.72						
94% Vn@10s	755.67	180123.29	197984.57	198000	-0.01%	20	20
	755.91						
	755.61						
95% Vn@10s	763.70	180151.57	198006.90	198000	0.00%	20	20
	763.92						
	763.72						
96% Vn@10s	768.56	180117.93	158403.40	158400	0.00%	40	60
	768.81						
	768.41						
97% Vn@10s	778.23	180153.56	118673.29	118800	-0.06%	30	60
	778.45						



Product Service

	778.25						
98% Vn@10s	784.26	180021.70	79164.10	79200	-0.02%	30	50
	784.45						
	784.29						
	792.36						
99% Vn@10s	792.54	180154.30	39560.35	39600	-0.02%	30	50
	792.28						
	800.22						
100% Vn@10s	800.33	180233.02	-650.98	0	-0.33%	20	30
	800.31						
	808.44						
101% Vn@10s	808.66	180154.43	-39625.09	-39600	-0.01%	30	50
	808.41						
	816.22						
102% Vn@10s	816.46	180077.76	-79188.69	-79200	0.01%	30	40
	816.24						
	824.35						
103% Vn@10s	824.41	179693.02	-118553.00	-118800	0.12%	30	40
	824.32						
	832.11						
104% Vn@10s	832.45	179458.29	-158403.20	-158400	0.00%	20	30
	832.16						
	838.89						
105% Vn@10s	838.95	179373.20	-199319.09	-198000	-0.67%	30	60
	838.94						
	846.87						
106% Vn@10s	846.94	179397.08	-199311.70	-198000	-0.66%	20	20
	846.92						
	838.92						
105% Vn@10s	838.97	179391.91	-199980.58	-198000	-1.00%	20	20
	838.97						
	832.11						
104% Vn@10s	832.45	179455.29	-158403.20	-158400	0.00%	20	30
	832.16						
	824.33						
103% Vn@10s	824.40	179686.59	-118567.44	-118800	0.12%	30	40
	824.34						
	816.22						
102% Vn@10s	816.46	179899.24	-79188.69	-79200	0.01%	30	40
	816.24						
	808.44						
101% Vn@10s	808.66	179951.05	-39625.09	-39600	-0.01%	30	50
	808.41						
	800.21						
100% Vn@10s	800.36	180227.01	-607.77	0	-0.31%	20	30
	800.19						
	<b>b) Steady State Voltage Control and Transient Voltage Control – Test #2</b>						
<b>Qmax = <u>0.6</u> Smax &amp; Qmin = <u>-0.6</u> Smax</b>							



Product Service

Test Model				SUN2000-330KTL-H2			
P/ P <sub>max</sub> [%] Set-point				< 10 %			
Vac [V] set-point [Limit< ± 0.25 %Vn]	V <sub>L-L</sub> [V]	Active power [W]	Reactive power[var]	Q [Var] expected	ΔQ / Q <sub>max</sub> (Limit Δ Q < ± 5 % Q <sub>max</sub> )	Response time [ms, <200ms]	Reach time [ms, <1000ms]
100% Vn@10s	799.63	24864.27	-308.29	0	-0.16%	--	--
	799.86						
	799.68						
99% Vn@10s	792.56	24966.89	39546.03	39600	-0.03%	60	120
	792.44						
	792.68						
98% Vn@10s	784.46	25013.22	79188.22	79200	-0.01%	40	110
	784.55						
	784.69						
97% Vn@10s	777.59	25133.28	118879.21	118800	0.04%	20	80
	777.93						
	777.67						
96% Vn@10s	768.55	25121.87	158140.36	158400	-0.13%	30	60
	768.86						
	768.44						
95% Vn@10s	763.07	25138.65	198290.44	198000	0.15%	20	50
	763.41						
	763.09						
94% Vn@10s	754.99	24881.54	198308.98	198000	0.15%	20	20
	755.30						
	754.99						
95% Vn@10s	763.08	24913.51	198251.33	198000	0.14%	20	20
	763.41						
	763.11						
96% Vn@10s	768.56	25125.87	158156.36	158400	-0.13%	40	60
	768.81						
	768.41						
97% Vn@10s	777.61	24915.26	118942.55	118800	0.07%	30	60
	777.94						
	777.69						
98% Vn@10s	784.26	25013.22	79178.22	79200	-0.01%	30	50
	784.45						
	784.29						
99% Vn@10s	792.36	24966.89	39536.03	39600	-0.03%	30	50
	792.54						
	792.28						
100% Vn@10s	799.63	24765.80	-311.10	0	-0.16%	20	30
	799.86						
	799.68						
101% Vn@10s	808.44	24699.51	-39422.66	-39600	0.09%	30	50
	808.66						
	808.41						
102% Vn@10s	816.22	24683.11	-79188.60	-79200	0.01%	30	40
	816.46						
	816.24						



103% Vn@10s	823.79	24550.22	-117788.03	-118800	0.51%	30	40
	823.95						
	823.80						
104% Vn@10s	832.11	24543.05	-158048.23	-158400	0.18%	20	30
	832.45						
	832.16						
105% Vn@10s	838.36	24284.59	-198940.88	-198000	-0.48%	30	60
	838.51						
	838.42						
106% Vn@10s	846.33	24100.42	-198961.21	-198000	-0.49%	20	20
	846.51						
	846.42						
105% Vn@10s	836.36	24074.55	-198944.55	-198000	-0.48%	20	20
	836.50						
	836.40						
104% Vn@10s	832.12	24545.05	-158058.23	-158400	0.18%	20	30
	832.45						
	832.18						
103% Vn@10s	823.78	24396.55	-118159.29	-118800	0.32%	30	40
	823.94						
	823.78						
102% Vn@10s	816.22	24683.11	-79192.60	-79200	0.01%	30	40
	816.46						
	816.24						
101% Vn@10s	808.44	24699.51	-39428.66	-39600	0.09%	30	50
	808.66						
	808.41						
100% Vn@10s	799.64	24762.55	-302.80	0	-0.16%	20	30
	799.84						
	799.68						
P/ P <sub>max</sub> [%] Set-point				>50 %			
Vac [V] set-point [Limit< ± 0.25 %Vn]	V <sub>L-L</sub> [V]	Active power [W]	Reactive power[var]	Q [Var] expected	$\Delta Q / Q_{max}$ (Limit $\Delta Q$ < ± 5 % $Q_{max}$ )	Response time [ms, <200ms]	Reach time [ms, <1000ms]
100% Vn@10s	800.19	165291.32	-815.99	0	-0.41%	--	--
	800.35						
	800.21						
99% Vn@10s	792.56	165874.33	39546.03	39600	-0.03%	60	120
	792.44						
	792.68						
98% Vn@10s	784.46	165231.16	79188.22	79200	-0.01%	40	110
	784.55						
	784.69						
97% Vn@10s	788.21	165726.30	118722.31	118800	-0.04%	20	80
	788.42						
	788.21						
96% Vn@10s	768.55	165327.59	158140.36	158400	-0.13%	30	60
	768.86						



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	768.44						
95% Vn@10s	763.75	165298.20	198117.99	198000	0.06%	20	50
	763.97						
	763.72						
	763.72						
94% Vn@10s	755.67	165281.33	198144.71	198000	0.07%	20	20
	755.91						
	755.61						
95% Vn@10s	763.70	165295.81	198121.21	198000	0.06%	20	20
	763.92						
	763.72						
96% Vn@10s	768.56	165211.71	158156.36	158400	-0.13%	40	60
	768.81						
	768.41						
97% Vn@10s	778.23	165277.25	118632.44	118800	-0.08%	30	60
	778.45						
	778.25						
98% Vn@10s	784.26	165214.66	79178.22	79200	-0.01%	30	50
	784.45						
	784.29						
99% Vn@10s	792.36	165321.20	39536.03	39600	-0.03%	30	50
	792.54						
	792.28						
100% Vn@10s	800.22	165173.20	-701.20	0	-0.35%	20	30
	800.33						
	800.31						
101% Vn@10s	808.44	165144.70	-39422.66	-39600	0.09%	30	50
	808.66						
	808.41						
102% Vn@10s	816.22	165188.91	-79188.60	-79200	0.01%	30	40
	816.46						
	816.24						
103% Vn@10s	824.35	164725.25	-118632.71	-118800	0.08%	30	40
	824.41						
	824.32						
104% Vn@10s	832.11	164774.21	-158048.23	-158400	0.18%	20	30
	832.45						
	832.16						
105% Vn@10s	838.89	164458.84	-199417.21	-198000	-0.72%	30	60
	838.95						
	838.94						
106% Vn@10s	846.87	164462.44	-199421.23	-198000	-0.72%	20	20
	846.94						
	846.92						
105% Vn@10s	838.92	164455.20	-199404.21	-198000	-0.71%	20	20
	838.97						
	838.97						
104% Vn@10s	832.11	164711.20	-158058.23	-158400	0.18%	20	30
	832.45						
	832.16						
103% Vn@10s	824.33	164734.11	-118516.30	-118800	0.14%	30	40
	824.40						
	824.34						



102% Vn@10s	816.22	164750.30	-79192.60	-79200	0.01%	30	40
	816.46						
	816.24						
101% Vn@10s	808.44	164780.10	-39428.66	-39600	0.09%	30	50
	808.66						
	808.41						
100% Vn@10s	800.21	165287.30	-694.80	0	-0.35%	20	30
	800.36						
	800.19						

**c) Voltage Limits and Control - reactive power regarding active power reduce – Test#1**

Test Model	SUN2000-330KTL-H1
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**Qmin = -0.66 Pmax**

P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
*100% P <sub>max</sub>	264340.29	-197704.77	-198000	0.15%	-0.749	--
80% P <sub>max</sub>	211544.21	-197998.50	-198000	0.00%	-0.750	--
50% P <sub>max</sub>	132358.18	-198249.68	-198000	-0.13%	-0.751	--
40% P <sub>max</sub>	105923.38	-145260.22	-144000	-0.64%	-0.550	--
30% P <sub>max</sub>	79511.57	-90151.22	-90000	-0.08%	-0.341	--
20% P <sub>max</sub>	53049.01	-36151.29	-36000	-0.08%	-0.137	--
10% P <sub>max</sub>	26569.96	-609.30	0	-0.31%	-0.002	--

**Qmax = 0.66 Pmax**

P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
*100% P <sub>max</sub>	264340.29	197704.77	198000	-0.15%	0.749	--
80% P <sub>max</sub>	211544.28	197998.41	198000	0.00%	0.750	--
50% P <sub>max</sub>	132358.17	198249.65	198000	0.13%	0.751	--
30% P <sub>max</sub>	79512.31	198395.74	198000	0.20%	0.751	--
20% P <sub>max</sub>	53049.23	198460.73	198000	0.23%	0.752	--
10% P <sub>max</sub>	26569.62	-399.30	0	-0.20%	-0.133	--

**c) Voltage Limits and Control - reactive power regarding active power reduce – Test#2**

Test Model	SUN2000-330KTL-H1
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**Qmin = -0.458 Pmax**



P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
100% P <sub>max</sub>	299949.28	-137919.42	-137477	-0.32%	-0.460	--
80% P <sub>max</sub>	239338.68	-137433.28	-137477	0.03%	-0.458	--
50% P <sub>max</sub>	149443.36	-137311.12	-137477	0.12%	-0.458	--
40% P <sub>max</sub>	120570.03	-103490.00	-103600	0.08%	-0.345	--
30% P <sub>max</sub>	90490.70	-69700.26	-69800	0.07%	-0.232	--
20% P <sub>max</sub>	60370.55	-35860.85	-36000	0.10%	-0.120	--
10% P <sub>max</sub>	30130.29	-580.02	0	-0.42%	-0.002	--
<b>Q<sub>max</sub> = 0.33 P<sub>max</sub></b>						
P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
100% P <sub>max</sub>	286686.90	136951.20	137477	-0.04%	0.457	--
80% P <sub>max</sub>	239981.00	137159.00	137477	0.12%	0.457	--
50% P <sub>max</sub>	150211.30	137445.00	137477	0.32%	0.458	--
30% P <sub>max</sub>	90265.32	137572.50	137477	0.42%	0.459	--
20% P <sub>max</sub>	60248.05	137648.00	137477	0.47%	0.459	--
10% P <sub>max</sub>	30184.87	-328.02	0	-0.17%	-0.239	--
<b>c) Voltage Limits and Control - reactive power regarding active power reduce – Test#3</b>						
Test Model			SUN2000-330KTL-H2			
<b>Q<sub>min</sub> = -0.72 P<sub>max</sub></b>						
P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
*100% P <sub>max</sub>	264232.70	-198035.00	-198000	-0.02%	-0.750	--
80% P <sub>max</sub>	210535.50	-198018.00	-198000	-0.01%	-0.750	--
50% P <sub>max</sub>	131349.40	-197951.00	-198000	0.02%	-0.750	--
40% P <sub>max</sub>	105830.00	-143330.00	-143000	0.18%	0.543	--
30% P <sub>max</sub>	79310.00	-88010.00	-88000	0.01%	0.333	--
20% P <sub>max</sub>	52770.00	-33260.00	-33000	0.14%	0.126	--
10% P <sub>max</sub>	26380.00	-580.00	0	-0.32%	-0.002	--



<b>Qmax = 0.72 Pmax</b>						
P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
*100% P <sub>max</sub>	264319.00	197674.20	198000	-0.16%	0.749	--
80% P <sub>max</sub>	211601.50	197935.80	198000	-0.03%	0.750	--
50% P <sub>max</sub>	132349.00	198218.20	198000	0.11%	0.751	--
30% P <sub>max</sub>	79425.58	198399.60	198000	0.20%	0.752	--
20% P <sub>max</sub>	52937.61	198495.30	198000	0.25%	0.752	--
10% P <sub>max</sub>	26979.47	-478.43	0	0.24%	-0.24	--
<b>c) Voltage Limits and Control - reactive power regarding active power reduce – Test#4</b>						
Test Model			SUN2000-330KTL-H2			
<b>Qmin = -0.663 Pmax</b>						
P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
100% P <sub>max</sub>	274298.07	-183528.44	-182414	-0.84%	-0.667	--
80% P <sub>max</sub>	219867.26	-183374.35	-182000	-0.76%	-0.667	--
50% P <sub>max</sub>	137677.23	-183276.11	-182000	-0.70%	-0.666	--
40% P <sub>max</sub>	110320.00	-132670.00	-132550	0.07%	0.482	--
30% P <sub>max</sub>	82900.03	-82640.00	-82775	-0.07%	0.301	--
20% P <sub>max</sub>	55310.00	-33580.00	-33000	0.32%	0.122	--
10% P <sub>max</sub>	27570.00	--580.00	0	-0.32%	-0.002	--
<b>Qmax = 0.33 Pmax</b>						
P [%] set-point	P [W] measured	Q [Var] measured	Q [Var] expected	$\Delta Q (< \pm 5 \% Q_{max})$	Q/P <sub>max</sub>	Remark
100% P <sub>max</sub>	274243.70	183092.50	182414	-0.63%	0.666	--
80% P <sub>max</sub>	220110.50	183315.90	182414	-0.76%	0.667	--
50% P <sub>max</sub>	137607.70	183511.10	182414	-0.82%	0.667	--
30% P <sub>max</sub>	82536.38	183655.80	182414	-0.86%	0.668	--
20% P <sub>max</sub>	54970.63	183748.00	182414	-0.89%	0.668	--
10% P <sub>max</sub>	27400.73	391.80	0	0.21%	0.131	--



Product Service

---- End of test report ----