Test Report

Requirements of general application resulting from Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (NC RfG)

For the unit(s)	MOD 3000TL3-HU, MOD 4000TL3-HU, MOD 5000TL3-HU, MOD 6000TL3-HU, MOD 7000TL3-HU MOD 8000TL3-HU, MOD 9000TL3-HU, MOD 10KTL3-HU, MOD 11KTL3-HU, MOD 12KTL3-HU, MOD 13KTL3-HU, MOD 15KTL3-HU.
Test report no	240621128GZU-001
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Test specification:	
Standard .....:	PTPiREE 2021 PSE:18 December 2018 (NC RfG) COMMISSION REGULATION (EU) 2016/631 (NC RfG) Type approval for Type A PPMs
Test report form number.....:	NC RfG_V1.0
Test report form(s) originator.....:	Intertek
Master TRF.....:	Dated 2023-01-24
Test item description.....:	Hybrid Inverter & AC Coupled Inverter
Trademark .....:	GROWATT
Manufacturer.....:	Same as applicant
Model / Type reference.....:	MOD 3000TL3-HU, MOD 4000TL3-HU, MOD 5000TL3-HU, MOD 6000TL3-HU, MOD 7000TL3-HU MOD 8000TL3-HU, MOD 9000TL3-HU, MOD 10KTL3-HU, MOD 11KTL3-HU, MOD 12KTL3-HU, MOD 13KTL3-HU, MOD 15KTL3-HU.
Technical data .....:	See section 3.1.1 on p.5 to p.10
Testing location / address.....:	Shenzhen Growatt New Energy Co., Ltd 4-13/F, Building A, Sino-German (Europe) Industrial Park, Hangcheng Ave, Bao'an District, Shenzhen, China
Dates of testing.....:	2024-12-12 – 2025-01-06

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1 General information of test report

1.1 Revision history

Revision	Date	Editor	Modification / Change	Status
1	2025-01-07	Kwang Pan	Initial report was written	active

2 General remarks for documentation

The test results presented in this report relate only to the object(**s**) tested.

Throughout this report a ☒ comma ',' / ☐ point '.' is used as decimal separator and a ☐ point '.' / ☐ comma ',' as thousands separator.

The following **suffixes/indices** are used for variables in tables and figures:

0,2	gliding average values over 200 milliseconds
10	gliding average values over 10 seconds
60	gliding average values over 60 seconds
600	gliding average values over 10 minutes
+	positive sequence system values
-	negative sequence system values
0	zero sequence system values
1	fundamental component (main frequency). In case of power values (P, Q, S) this is the sum of the 3 phase values
Lx	index of phase x
LxLy	phase-to-phase voltages of phase x and phase y
s	apparent
p	active
q	reactive

Abbreviations

AC	:	Alternating Current
DC	:	Direct Current
EUT	:	Equipment Under Test
MP	:	Measurement Point
MPP	:	Maximum Power Point
N_{10}	:	Maximum number of switching operations within a time period of 10 minutes
N_{120}	:	Maximum number of switching operations within a time period of 120 minutes
PGU	:	Power Generating Unit
PGS	:	Power Generating System
PCC	:	Point of Common Coupling (grid connection point)
THC	:	Total Harmonic Current Distortion
$THDS_U$	:	Total demand distortions of voltage harmonics

General remarks for testing

3.1 General product information

3.1.1 Technical data of the unit(s)

Model	MOD 3000TL3-HU	MOD 4000TL3-HU	MOD 5000TL3-HU	MOD 6000TL3-HU
PV				
Max. DC input voltage	1000Vdc			
MPPT voltage range	140 – 1000Vdc			
PV maximum current	20A/20A			
Max. PV Isc	25A/25A			
DC battery				
Compatible battery	APX 5.0-30.0P-S2			
Operating voltage range	600Vdc ~ 980Vdc			
Max. operating current	25A	25A	25A	25A
Max. discharge power	3kW	4kW	5kW	6kW
Max. charge power	9kW	12kW	15kW	15kW
AC parameter				
Rated input/output power	6kW/ 3kW	8kW/ 4kW	10kW/ 5kW	12kW/ 6kW
Max. input/output apparent power	6kVA/ 3.3kVA	8kVA/ 4.4kVA	10kVA/ 5.5kVA	12kVA/ 6.6kVA
Rated output voltage	220V/380V 230V/400V			
Rated output frequency	50/60 Hz			
Max. input/output current	9.1A/ 5A	12.1A/ 6.7A	15.2A/ 8.3A	18.2A/ 10A

Rated power factor (with rated power)	>0.99			
Power factor range	0.8Leading ~ 0.8Lagging			
Type of grid connection	3W+N+PE/3W+PE			
AC output (backup)				
Rated output voltage	220/230Vac			
Nominal frequency	50Hz/60Hz			
Maximum output current	5.5A	7.3A	9.1A	10.9A
Max. apparent power	3.6kVA	4.8kVA	6kVA	7.2kVA
Power factor range	0.8Leading ~ 0.8Lagging			
Others				
Ingress protection	IP66			
Protection class	Class I			
Operating temperature range	-25℃ - +60℃			
Software version	DO1.0			

Model	MOD 7000TL3-HU	MOD 8000TL3-HU	MOD 9000TL3-HU	MOD 10KTL3-HU
PV				
Max. DC input voltage	1000Vdc			
MPPT voltage range	140 – 1000Vdc			
PV maximum current	20A/20A			20A/20A/20A
Max. PV Isc	25A/25A			25A/25A/25A
DC battery				

Compatible battery	APX 5.0-30.0P-S2			
Operating voltage range	600Vdc ~ 980Vdc			
Max. operating current	25A			
Max. discharge power	7kW	8kW	9kW	10kW
Max. charge power	15kW	15kW	15kW	15kW
AC parameter				
Rated input/output power	14kW/ 7kW	16kW/ 8kW	18kW/ 9kW	20kW/ 10kW
Max. input/output apparent power	14kVA/ 7.7kVA	16kVA/ 8.8kVA	18kVA/ 9.9kVA	20kVA/ 11kVA
Rated output voltage	220V/380V 230V/400V			
Rated output frequency	50/60 Hz			
Max. input/output current	21.2A/ 11.7A	24.2A/ 13.3A	27.3A/ 15A	30.3A/ 16.7A
Rated power factor (with rated power)	>0.99			
Power factor range	0.8Leading ~ 0.8Lagging			
Type of grid connection	3W+N+PE/3W+PE			
AC output (backup)				
Rated output voltage	220/230Vac			
Nominal frequency	50Hz/60Hz			
Maximum output current	12.7A	14.5A	16.4A	18.2A

Max. apparent power	8.4kVA	9.6kVA	10.8kVA	12kVA
Power factor range	0.8Leading ~ 0.8Lagging			
Others				
Ingress protection	IP66			
Protection class	Class I			
Operating temperature range	-25℃ - +60℃			
Software version	DO1.0			

Model	MOD 11KTL3-HU	MOD 12KTL3-HU	MOD 13KTL3-HU	MOD 15KTL3-HU
PV				
Max. DC input voltage	1000Vdc			
MPPT voltage range	140 – 1000Vdc			
PV maximum current	20A/20A/20A			
Max. PV Isc	25A/25A/25A			
DC battery				
Compatible battery	APX 5.0-30.0P-S2			
Operating voltage range	600Vdc ~ 980Vdc			
Max. operating current	25A			
Max. discharge power	11kW	12kW	13kW	15kW
Max. charge power	15kW	15kW	15kW	15kW
AC parameter				

Rated input/output power	22kW/ 11kW	24kW/ 12kW	26kW/ 13kW	30kW/ 15kW
Max. input/output apparent power	22kVA/ 12.1kVA	24kVA/ 13.2kVA	26kVA/ 14.3kVA	30kVA/ 16.5kVA
Rated output voltage	220V/380V 230V/400V			
Rated output frequency	50/60 Hz			
Max. input/output current	33.3A/ 18.3A	36.4A/ 20A	39.4A/ 21.7A	45.5A/ 25A
Rated power factor (with rated power)	>0.99			
Power factor range	0.8Leading ~ 0.8Lagging			
Type of grid connection	3W+N+PE/3W+PE			
AC output (backup)				
Rated output voltage	220/230Vac			
Nominal frequency	50Hz/60Hz			
Maximum output current	20A	21.8A	23.6A	27.3A
Max. apparent power	13.2kVA	14.4kVA	15.6kVA	18kVA
Power factor range	0.8Leading ~ 0.8Lagging			
Others				
Ingress protection	IP66			
Protection class	Class I			
Operating temperature range	-25℃ - +60℃			
Software version	DO1.0			

Equipment mobility	:	Permanent connection
Operating condition	:	Continuous
Class of equipment	:	Class I
Protection against ingress of water	:	IP 66

General product information:

The unit is a three-phase PV Hybrid inverter, it can convert the high PV voltage to Grid voltage and feed into Grid or charge the battery, also, the battery can convert to AC voltage and feed into Grid, conversely, the Grid can charge the battery.

The unit is providing EMI filtering at the PV, battery side and AC side. It is transformerless (non-isolated) between the PV, battery circuits and AC circuit.

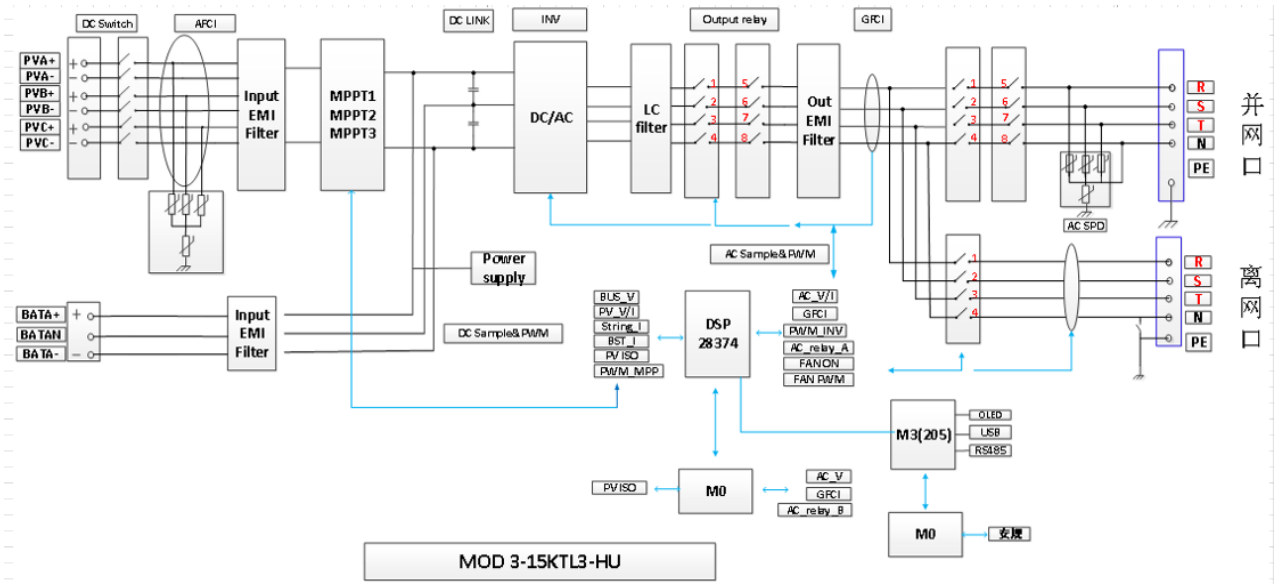
The unit has two controllers. The master controller DSP is monitoring the invert statue; measure the PV voltage and current, bus voltage, AC voltage, current, GFCI and frequency, also communicate with the slave controller MCU

The slave controller MCU is monitoring PV ISO, AC voltage, frequency, GFCI and communicate with the master controller DSP

The relays are designed to redundant structure that controlled by separately.

The master controller and slave controller are used together to control relay open or close, if the single fault on one controller, the other controller can be capable to open the relay, so that still providing safety means.

The topology diagram as following:



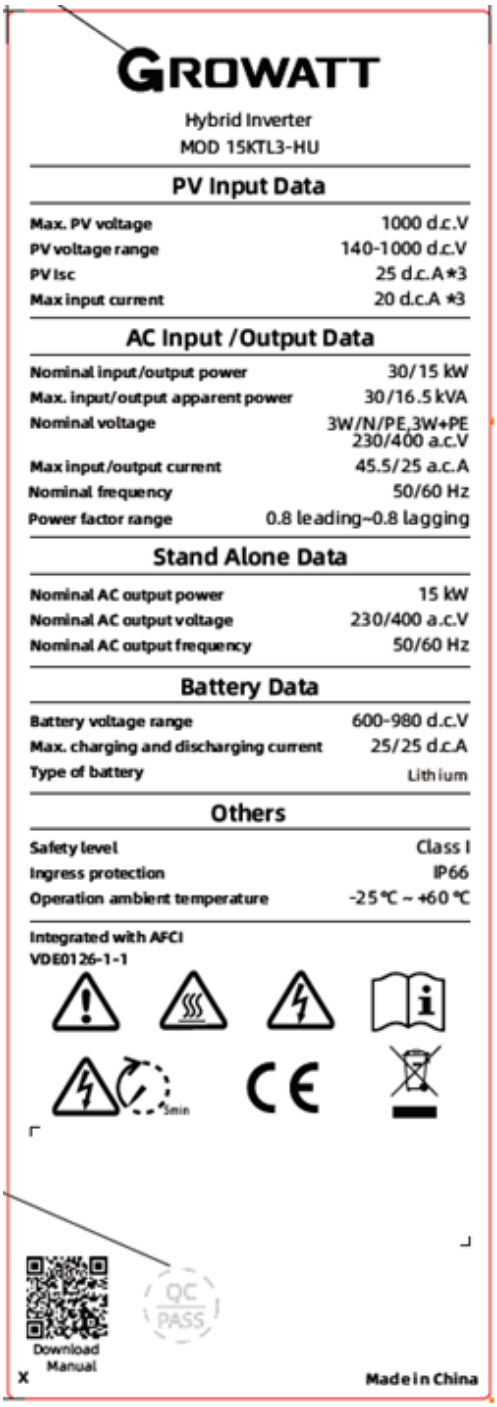
3.1.2 Description of the differences of the models within the product series

Both models have identical mechanical and electrical construction except some parameter of the software architecture to control the max output power.

3.1.3 Copy of marking plate

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation.
3. Other labels are identical to above, except the model's name and ratings.



3.2 Scope of measurements

3.2.1 General

The assessment covers requirements applicable to Types A-B Power Park Modules (PPMs) for which Equipment Certificates are requested in the Polish certification guideline, as further detailed in Section 3.2.2 The assessment covers both exhaustive requirements, fully defined by the NC RfG , and non-exhaustive requirements, for which complementary requirement details have been collected from the national specification for Poland in PSE 2018-12 .
The scope of assessment covers the following:

• The completeness of documents and measurements

• The plausibility of the documents received

• The compliance of the test conditions of the documents with those listed in standard

• The assessment of the measurement results concerning the requirements of the documents listed in standard

3.2.2 Paragraphs of NC RfG within scope

Table 3-1 Scope of assessment and results

Capability	NC RfG /D/	PSE 2018-12 /C/	Type A	Assessment result(**)
Frequency range	13.1(a)	13.1(a)(i)	x	Compliant
Rate of Change of Frequency (RoCoF) withstand capability, df/dt	13.1(b)	13.1(b)	x	Compliant
Remote cessation of active power	13.6	13.6	x	Compliant
Limited Frequency Sensitive Mode – over frequency (LFSM-O)	13.2 (*)	13.2(a), (b), (f)	x	Compliant

(*) Article 13.2(b) only applicable for type A PPMs according to NC RfG
(**) Please note also the corresponding conditions for compliance.

3.3 Reference values

Representative sample for testing

Reference values for the p,u, or percentage calculations:

	MOD 15KTL3-HU
Rated active power, P_n [W]	15000
Max, apparent and active output power, S_{max} / P_{max} [VA]	16500
Rated voltage (phase-to-phase), U_n [V]	220V/380V, 230V/400V
Rated current, I_n [A]	21.74A
Maximum current, I_{max} [A]	25A

3.4 Measurement setup

Tests documented in this test report were performed using the following test configuration:

☐ Measurements in the field on real grid

☐ Test bench tests on real grid

☒ Test bench tests on an AC grid simulator

The PGU is connected on the DC-side to a PV-simulator and on the AC-side to an AC-grid simulator, The AC-grid simulator is operated with nominal conditions of U_n = 230 (phase-to-neutral) and f_n = 50 Hz unless stated otherwise by the applied test requirement,

Available primary power is modified by adapting the short circuit current (I_{sc}) value of the I-V curve, Following example shows a PV-curve (I_{sc} = 61,31 A, U_{oc} = 719,3 V) simulated according to EN50530:

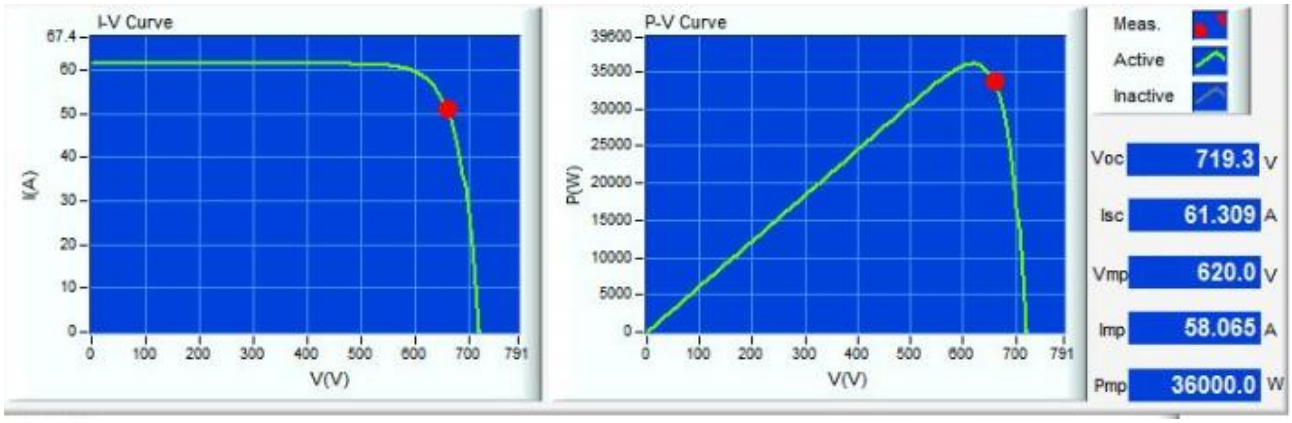


Figure 1 – DC characteristics for testing

The measurement setup is shown in Figure 2, The specific test and measurement devices are stated in section 3.5,

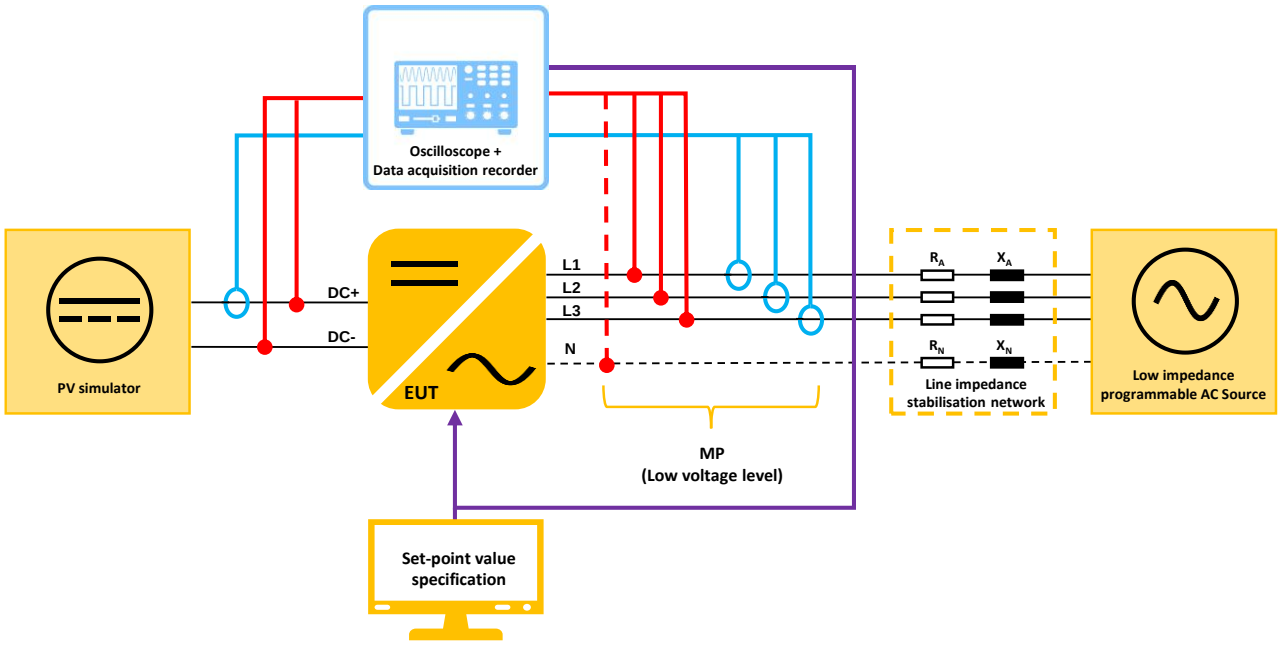


Figure 2 – Measurement setup scheme

3.5 Measurement equipment

Equipment	Internal No,	Manufacturer	Type	Serial No,	Last Calibration
DC power supply [1]	SA200-85	ACTIONPOWER	PRD2006S	B2032F1057	--
AC Simulator [1]	SA200-52	Chroma	61860	618603800386	--
Oscilloscope	SA050-33	YOKOGAWA	DL850E	91S416984	2025-01-04
Power analyser	SA200-17	YOKOGAWA	WT3000	91LB24255	2025-11-19
Current sensor	SA200-17-01	YOKOGAWA	751552	141227	2025-10-14
	SA200-17-02	YOKOGAWA	751552	141232	2025-10-14
	SA200-17-03	YOKOGAWA	751552	143076	2025-10-14
	SA200-01-04	CT1000	CT1000	9112570083	2025-07-04

Note:
All measurement equipment was used within the calibration period, copy of calibration certificates are available at the laboratory for reference,

3.6 Sampling rates

Following sampling rates were used for the measurement:

	Chapter according to	Voltages, currents	Setpoint and actual value signals
Power-frequency regulation mode limited to overfrequency (MRPFL-O)	5,1	10 kHz	10 kHz

[1] The AC simulator and DC sources are not need to be calibrated, since the AC voltage and current is measured and determined using the calibrated oscilloscope and power analyser.

3.7 Measurement uncertainties

Measurement category	Measurement uncertainty (k=2)
AC Current (50 Hz signal)	±0,104%
AC Voltage (50 Hz signal)	±0,097%
AC Powers	±0,38%
DC Current	±0,41%
DC Voltage	±0,50%
DC Power	±0,33%
Frequency	±0,01%

Note:

The data and results within this document are accurate, For the uncertainty calculation a confidence level of 95% is assessed,

All stated uncertainties are worst case values due to the definition of uncertainty calculation, The shown uncertainties are equal or lower than the shown values depending on the equipment used for measurements which is stated in this report,

The variability of the components and processes used for manufacturing of devices similar to the tested one can contribute to additional deviation, It is the responsibility of the manufacturer to assure compliance for these devices,

Conformity statements are decided in accordance with IEC GUIDE 115:2021 Procedure 2 (accuracy method), unless otherwise normatively specified or contractually agreed,

3.8 Test conditions

Condition / Requirement	Determined value / Description	Remarks
Point of measurement	☐ medium-voltage side ☒ low-voltage side	Measurement at output terminals of the PGU, see Figure 2,
Data medium-voltage system (if applicable)	N/A	Measurement on LV side
• Short Circuit Power	N/A	---
• Network impedance phase angle	N/A	---
• Agreed service voltage UC	N/A	---
Transformer data (if existing):	N/A	Measurement on LV side, no transformer existing
• Nominal power of transformer	N/A	---
• rel, short-circuit voltage of transformer uk	N/A	---
• Tap position of transformer	N/A	---
Grid frequency:		
• within $f_n \pm 1\% f_n$	Requirement met	Stable AC source used
• $df/dt < 0{,}2\% f_n$ / (0,2 s)	Requirement met	Stable AC source used
Voltage at PGU terminals within $U_n \pm 10\% U_n$	Requirement met	Checked before testing
The voltage unbalance < 2%	Requirement met: 0,04%	Determined according to IEC 61000-4-30, measured as a 10-minute mean at the PGU terminals,
Environmental conditions must correspond to the manufacturer's requirements of the measuring instruments	Requirement met	During the test period following environmental data were recorded: • Temperature: 20,3 ~ 25,2°C • Rel, humidity: 36,5 ~ 57,3%RH • Air pressure: 985,2 ~ 1003,6 hPa

4 Measurement result

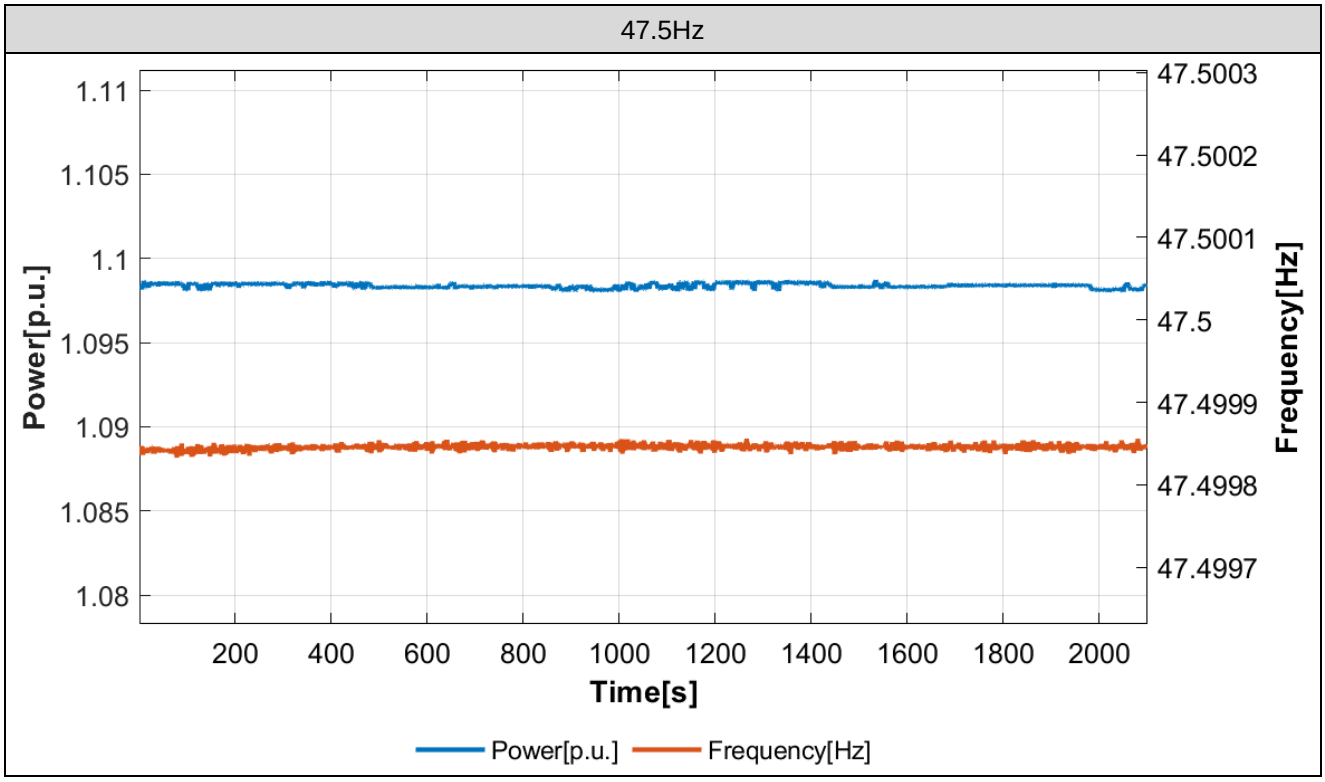
4,1 Frequency Range

The frequency range requirements, as specified for Continental Europe in Article 13 item 1 (a)(i) in NC RfG and the national specification for Poland PSE 2018-12, are summarized in Table 4-1.

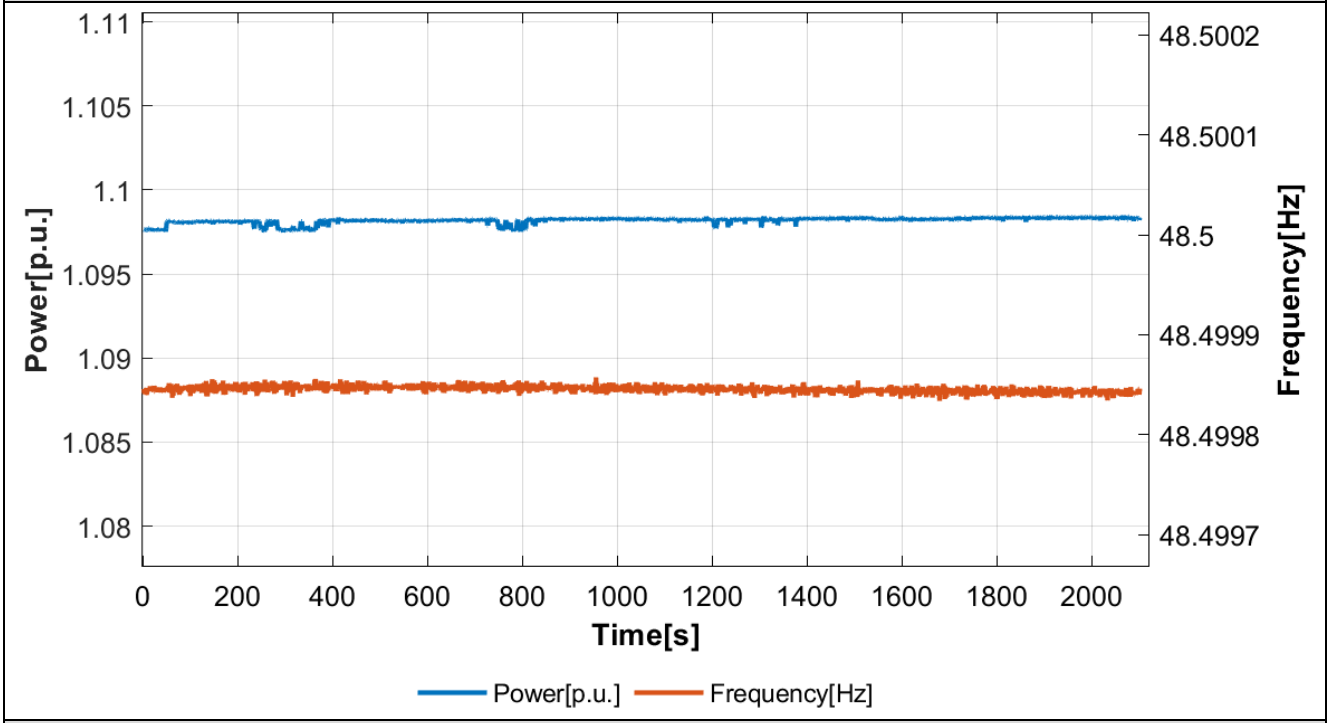
Table 4-1 Frequency range: requirement

Frequency range	Required time for operation
47,5 Hz-48,5 Hz	30 min
48,5 Hz-49,0 Hz	30 min
49,0 Hz-51,0 Hz	Unlimited
51,0 Hz-51,5 Hz	30 min

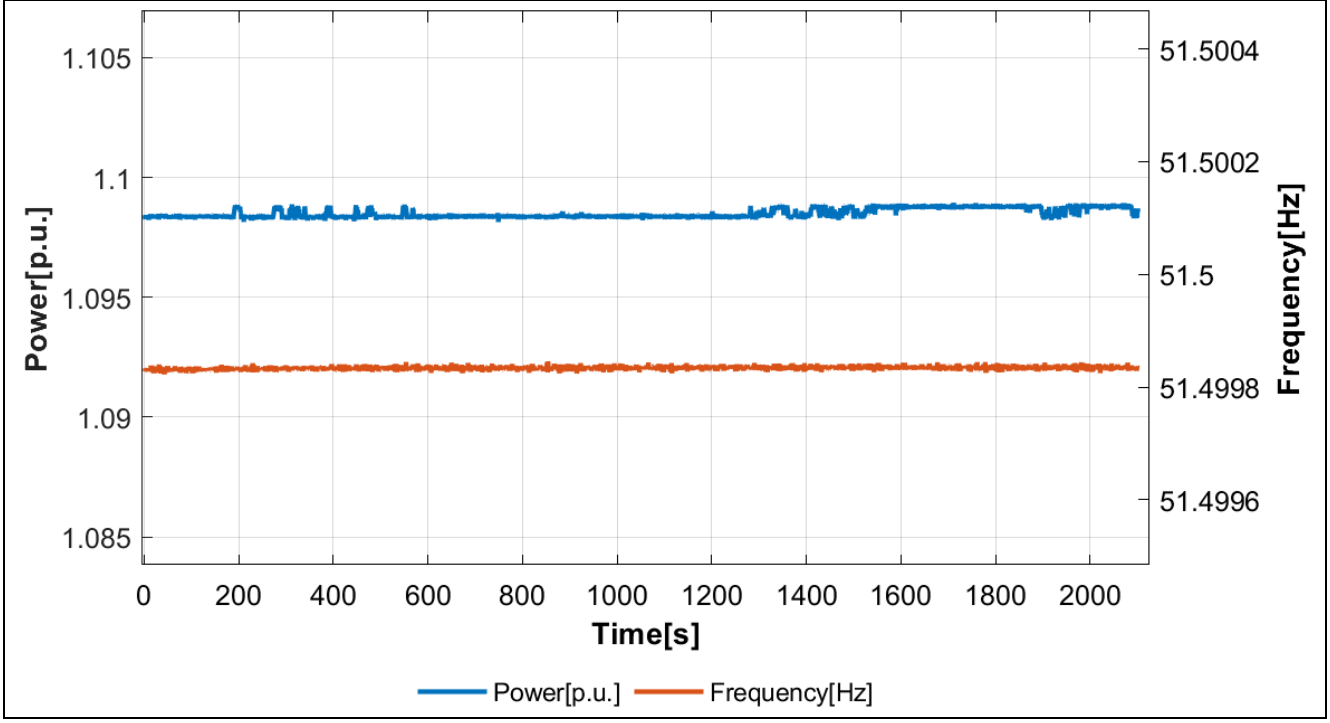
Test result:



48.5 Hz



51.5 Hz



The inverter did not disconnect during this time.

4,2 Rate of Change of Frequency (ROCOF) withstand capability

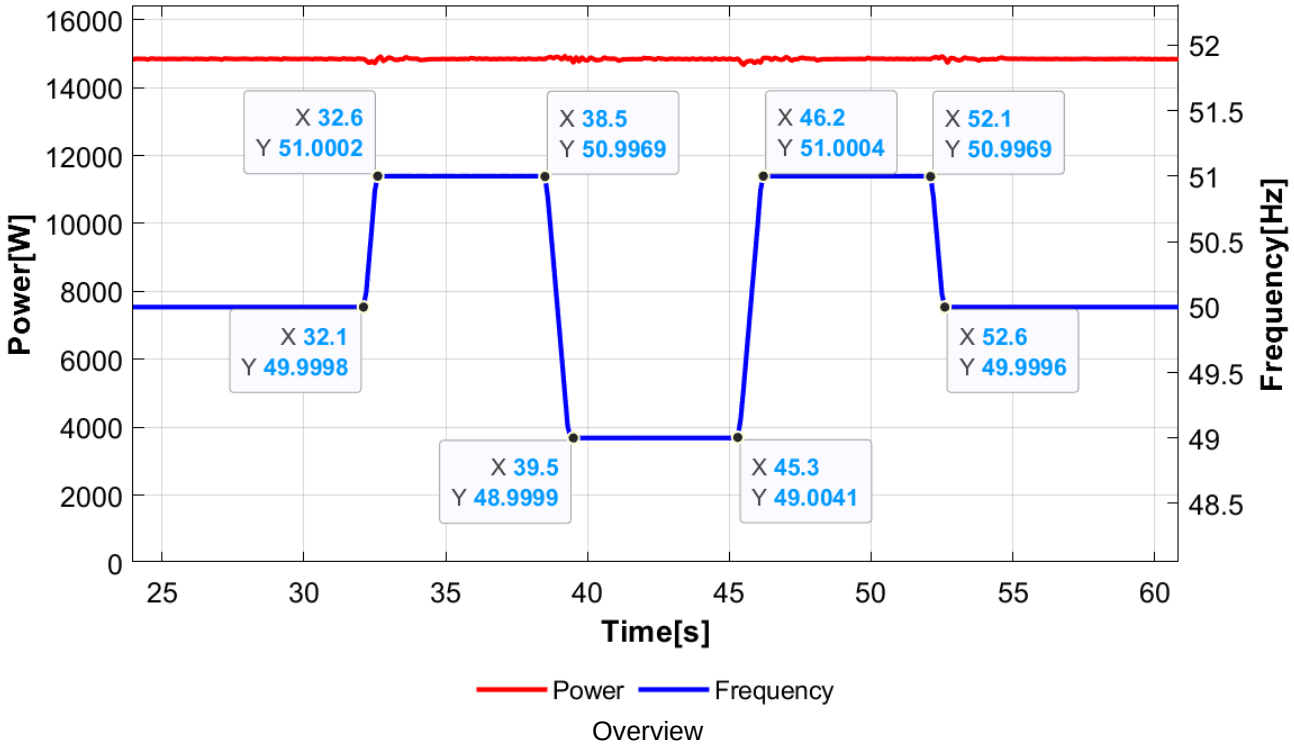
Regarding RoCoF withstand capability, as specified in Article 13 item 1(b) of NC RfG , together with the national specification for Poland in PSE 2018-12 , the Power Generating Unit (PGU) must have the capability of remaining connected to the network and operate at the rate of change of frequency up to:

$$\left|\frac{df_{max}}{dt}\right| = 2.0 \left|\frac{Hz}{s}\right|$$

where this value would be measured as an average value within a shiftable measurement window with a length of 500 ms.

The requirement $\left|\frac{df_{max}}{dt}\right| = 2.0 \left|\frac{Hz}{s}\right|$ constitutes a minimum requirement. If the applied technology allows connection to the network and operation at a higher rate of change of frequency, limiting the operation of the PGU to the value defined above or lower is not allowed, unless it results from the arranged rate-of-change-of-frequency-type loss of mains protection.

Test result:



Overview

The inverter could withstand ROCOF capability and did not disconnect during ROCOF.

4,3 Cessation of Active Power

General requirements relating to Cessation of Active Power are defined by Article 13 item 6 of NC RfG . Further specification for Poland is added by Article 13 item 6 of PSE 2018-12 . The unit shall be equipped with a logic interface (input port) in order to cease active power output within five seconds following an instruction being received at the input port.

It is required that PGU has the capability of remote control of the facility by a relevant SO. The reduction requirement remains active also where the primary source of energy is insufficient to achieve the set limit value. In order to allow remote operation of generated active power by means of additional devices, telecommunication standards determined and published by a relevant SO must be met.

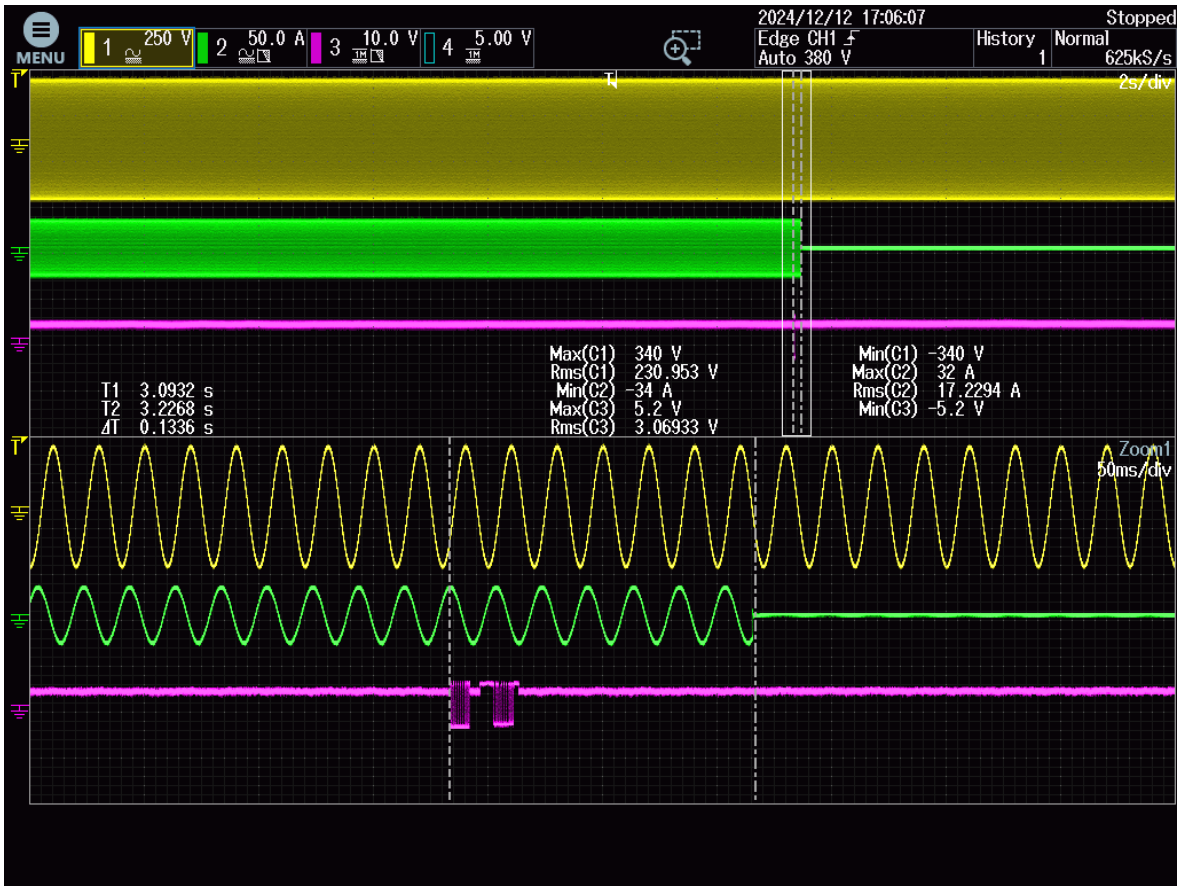
As no specific communication standards have been stated in the assessment criteria used for this certification, listed in section 13(6) of the PSE 2018-12 , the compliance to any telecommunication standards must be further assessed at project level.

The tests were performed using a DC Power supply as a simulation of the PV module and a grid simulator as a simulation of the power grid and the transmission network.

The inverter was operated remotely to validate its capability to cease active power within 5 seconds. To achieve remote control, a RS485 (Modbus) input of the inverter was used. The signal for cessation of active power was then given via PC using Shinebus software. The time period was measured following the cessation command being received till the active power was reduced to zero.

Test result:

Test waveform:

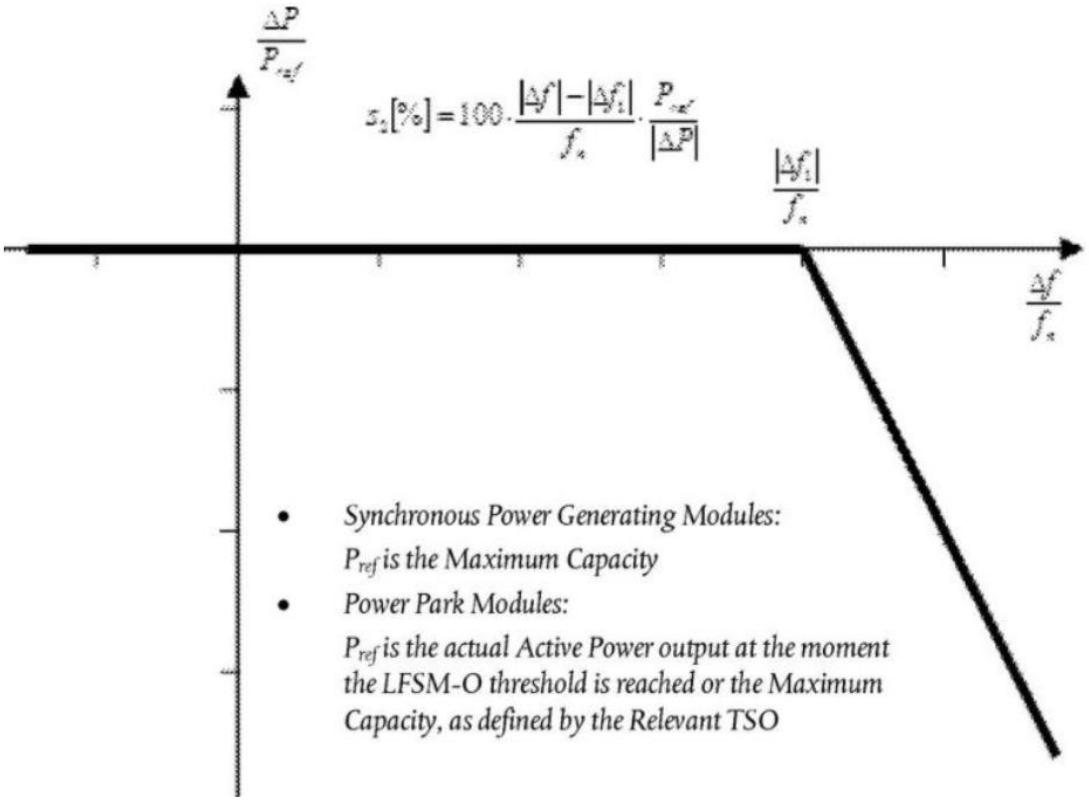


The waveform above shown that the inverter is capable of reducing the active power within 0.1336 s after reception of remote shutdown signal to cease active power.

4,4 Limited Frequency Sensitive Mode – Overfrequency (LFSM-O)

The requirements for LFSM-O capabilities power-generating modules are defined by Article 13 item 2 of NC RfG . Further national specification is added by corresponding article in PSE 2018-12 .
The PGU shall be capable of providing active power frequency response according to the Figure 5-3 with selectable frequency threshold in the range: 50.2 Hz-50.5 Hz, with default value of, 50.2 Hz and a selectable droop settings in the range: 2-12 %, with default value of 5 %. A response time for activation longer than 2 second must be motivated technically, and the unit must be able to operate stably in LFSM-O mode when active power decreases down to its minimum regulating level. As further specified for Poland, the maximum capacity power (rather than the actual power before LFSM-O activation) shall be used as reference value PREF to calculate the droop. Furthermore, it must be possible for the System Operator (SO) to intervene and block the LFSM-O mode.

There is a specific request in Article 13 item 2(g) of NC RfG that when LFSM-O is active, the "LFSM-O setpoint will prevail over any other active power setpoints". This is not further addressed in PSE 2018-12 , but the authors PTPiREE has stated that implementations where the active power setpoint can be further decreased, but never increased, is to be accepted .



The tests were carried out for 3 different parameter sets to confirm ability for parameter changes and proper behaviour with those settings.

Setting for LFSM-O tests

	Setting 1	Setting 2	Setting 3
Activation threshold	50.2 Hz	50.2 Hz	50.5 Hz
Droop	5 %	12 %	2%

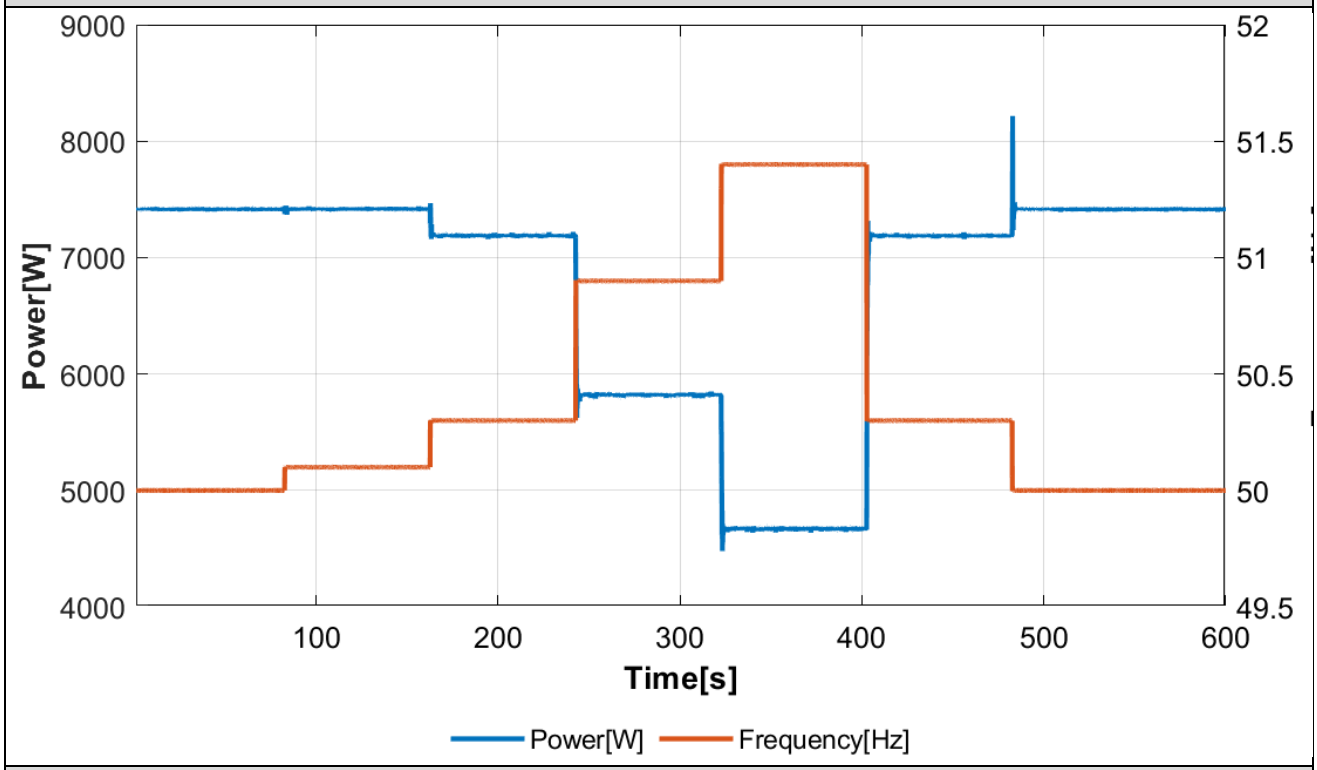
The frequency steps performed were as follows

Frequency step	Simulated grid frequency setting 1 and setting 2	Simulated grid frequency setting 3
1	50.0 Hz ± 0.05 Hz	50.0 Hz ± 0.05 Hz
2	50.1 Hz ± 0.05 Hz	50.4 Hz ± 0.05 Hz
3	50.3 Hz ± 0.05 Hz	50.6 Hz ± 0.05 Hz
4	50.9 Hz ± 0.05 Hz	50.9 Hz ± 0.05 Hz
5	51.4 Hz ± 0.05 Hz	51.4 Hz ± 0.05 Hz
6	50.3 Hz ± 0.05 Hz	50.6 Hz ± 0.05 Hz
7	50.0 Hz ± 0.05 Hz	50.0 Hz ± 0.05 Hz

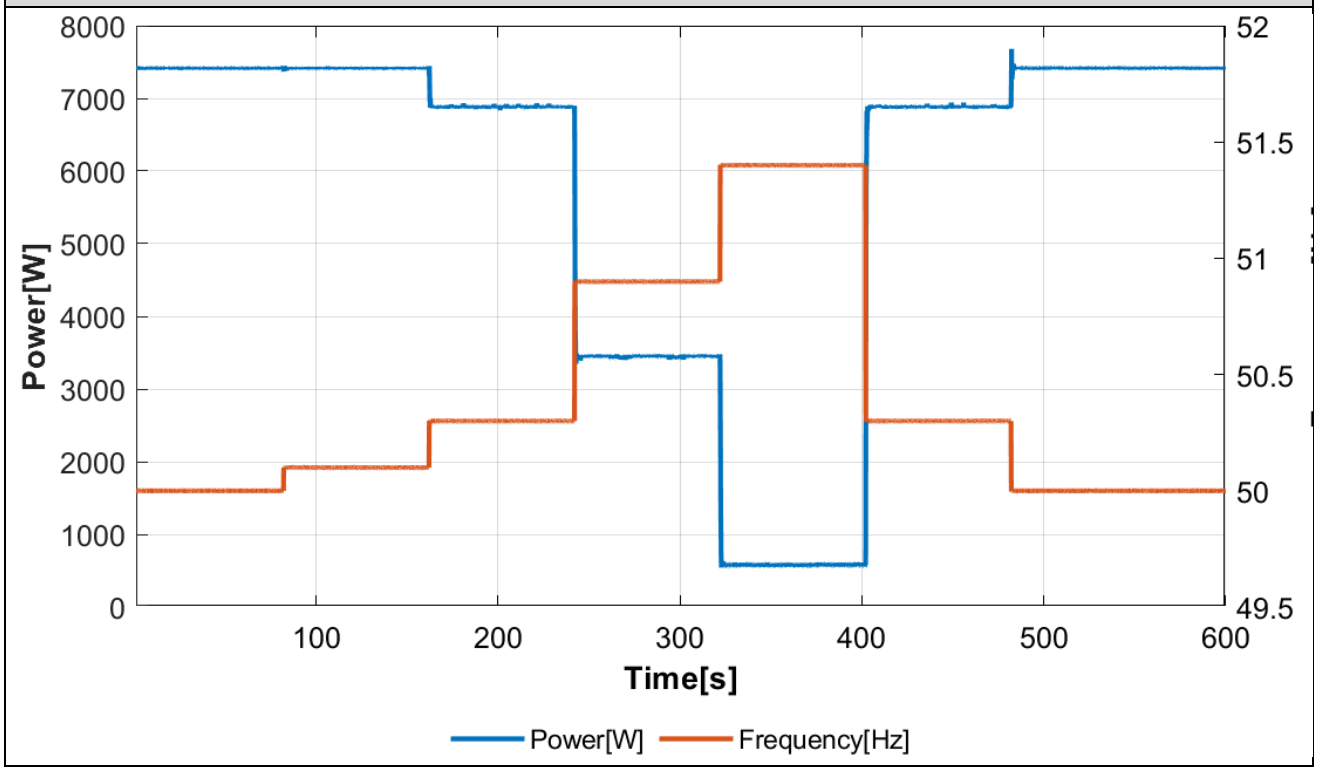
Test result:

Test 1	50% Pn, f1 =50.2Hz; droop=12%; no delay				
	f (Hz)	Measured output Power (W)	Calculated from standard characteristic curve P (W)	Tolerance between measured P and calculated P (W)	Tolerance Limit (W)
50.00Hz ± 0.05Hz	50.00	7416.29	7500.00	--	--
50.10Hz ± 0.05Hz	50.10	7416.17	7500.00	--	--
50.30Hz ± 0.05Hz	50.30	7188.41	7250.00	-61.59	± 1500
50.90Hz ± 0.05Hz	50.90	5818.68	5750.00	68.68	± 1500
51.40Hz ± 0.05Hz	51.40	4670.41	4500.00	170.41	± 1500
50.30Hz ± 0.05Hz	50.30	7188.57	7250.00	-61.43	± 1500
50.00Hz ± 0.05Hz	50.00	7415.73	7500.00	--	--
Test 2	50% Pn, f1 =50.2Hz; droop=5%; no delay				
	f (Hz)	Measured output Power (W)	Calculated from standard characteristic curve P (W)	Tolerance between measured P and calculated P (W)	Tolerance Limit (W)
50.00Hz ± 0.05Hz	50.00	7415.00	7500.00	--	--
50.10Hz ± 0.05Hz	50.10	7415.54	7500.00	--	--
50.30Hz ± 0.05Hz	50.30	6883.95	6900.00	-16.05	± 1500
50.90Hz ± 0.05Hz	50.90	3448.71	3300.00	148.71	± 1500
51.40Hz ± 0.05Hz	51.40	577.04	300.00	277.04	± 1500
50.30Hz ± 0.05Hz	50.30	6885.40	6900.00	-14.60	± 1500
50.00Hz ± 0.05Hz	50.00	7416.37	7500.00	--	--
Test 3	50% Pn, f1 =50.5Hz; droop=2%; no delay				
	f (Hz)	Measured output Power (W)	Calculated from standard characteristic curve P (W)	Tolerance between measured P and calculated P (W)	Tolerance Limit (W)
50.00Hz ± 0.05Hz	50.00	7417.36	7500.00	--	--
50.40Hz ± 0.05Hz	50.10	7417.18	7500.00	--	--
50.60Hz ± 0.05Hz	50.60	5937.55	6000.00	-62.45	± 1500
50.90Hz ± 0.05Hz	50.90	1594.10	1500.00	94.10	± 1500
51.40Hz ± 0.05Hz	51.40	-50.38	0.00	-50.38	± 1500
50.60Hz ± 0.05Hz	50.60	5937.00	6000.00	-63.00	± 1500
50.0Hz ± 0.05Hz	50.00	7417.14	7500.00	--	--

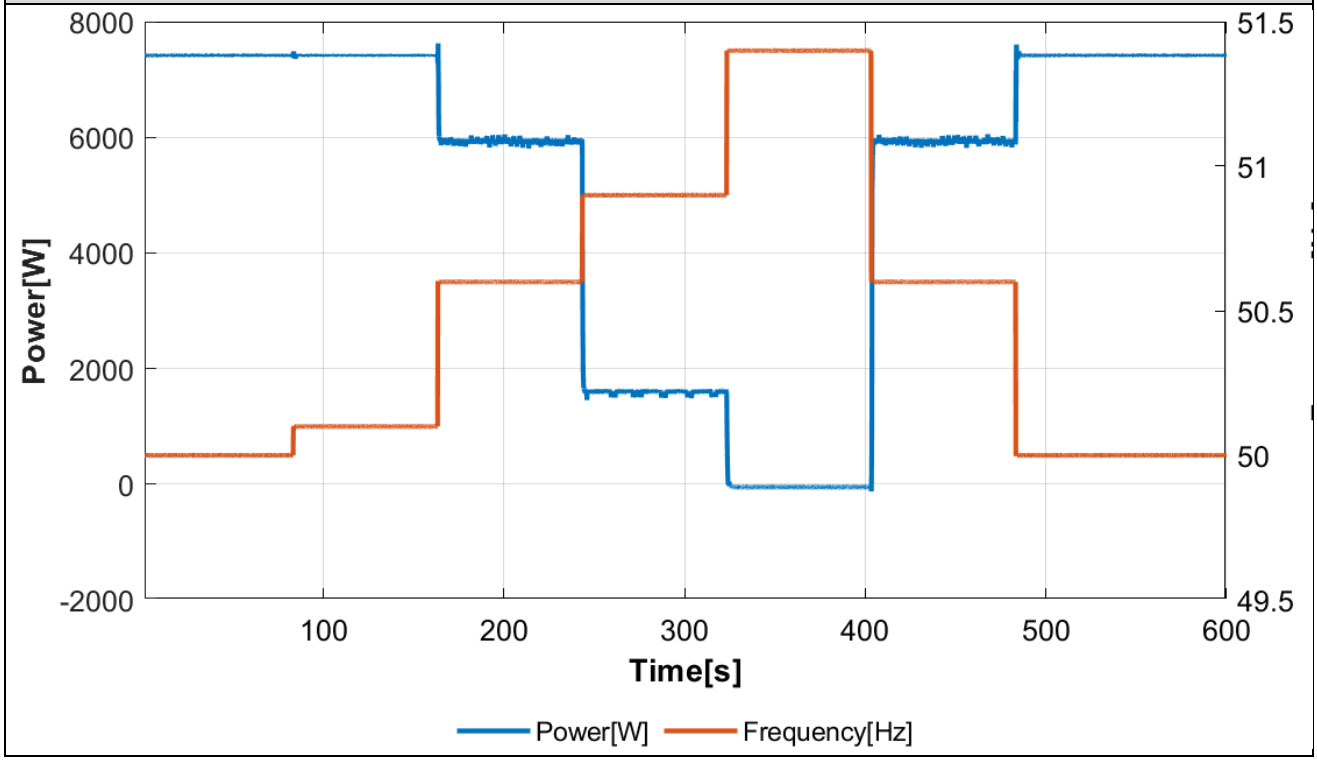
Test 1_Graph



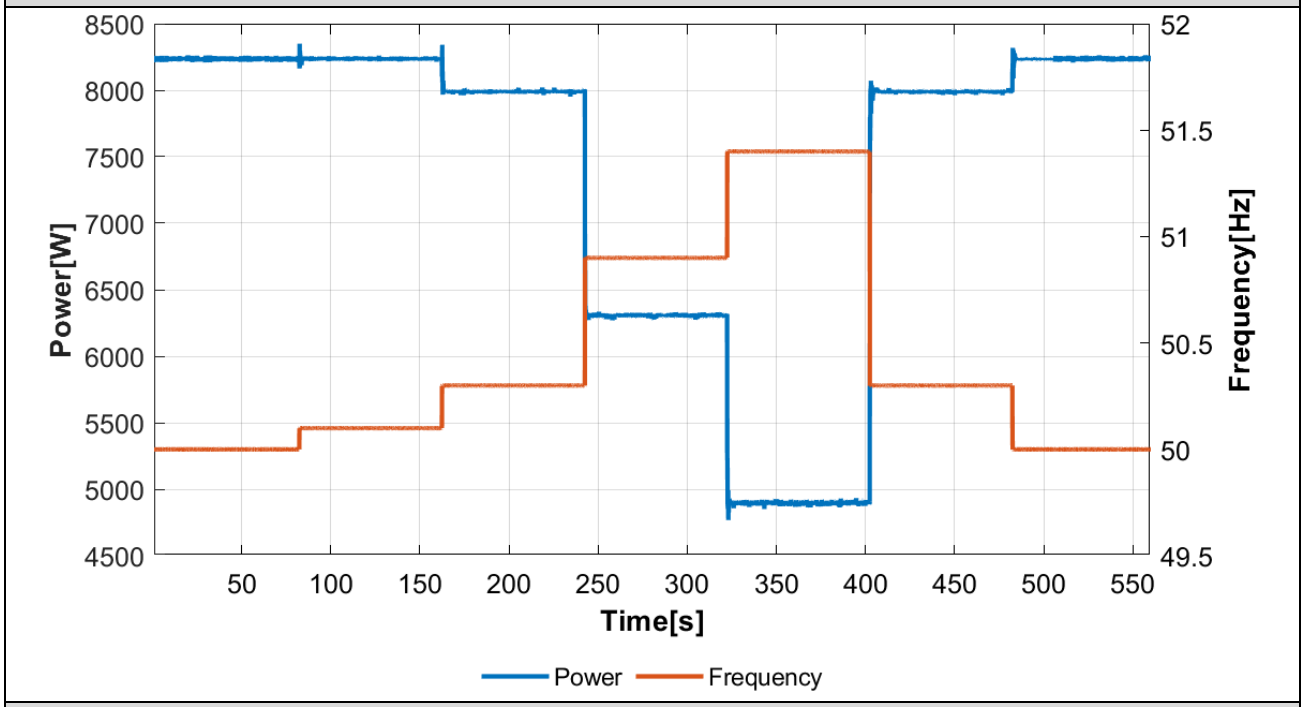
Test 2_Graph

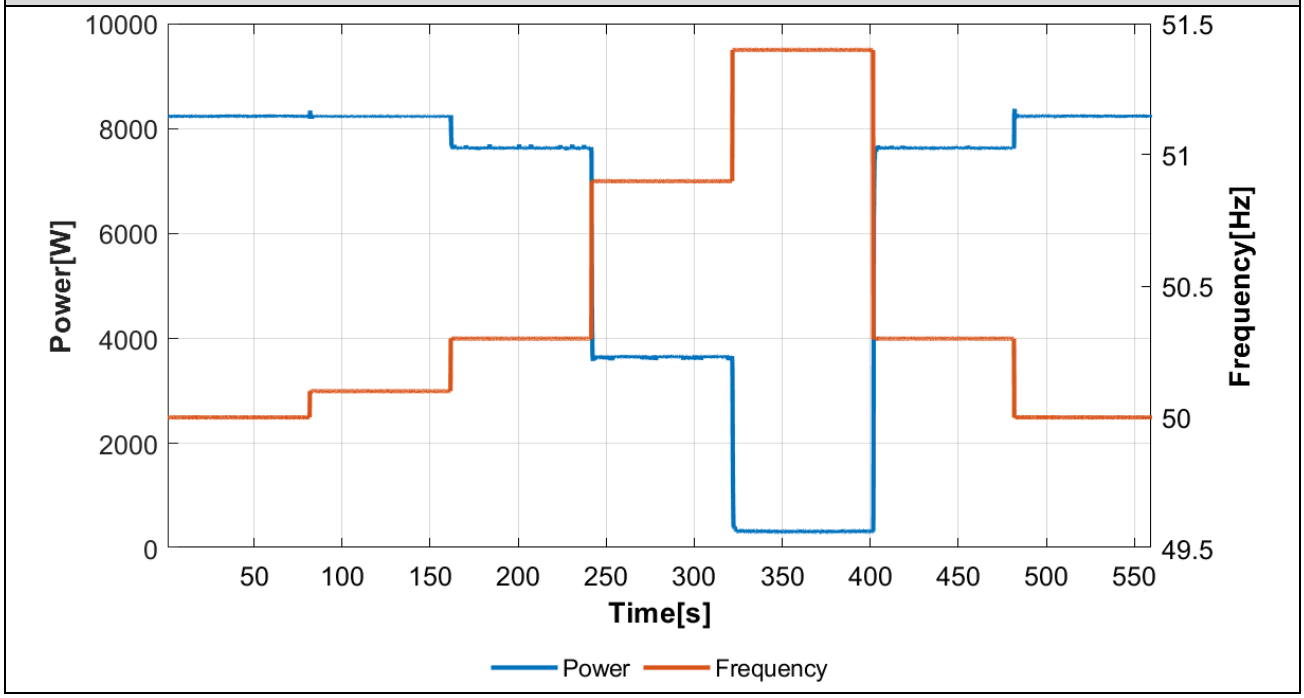


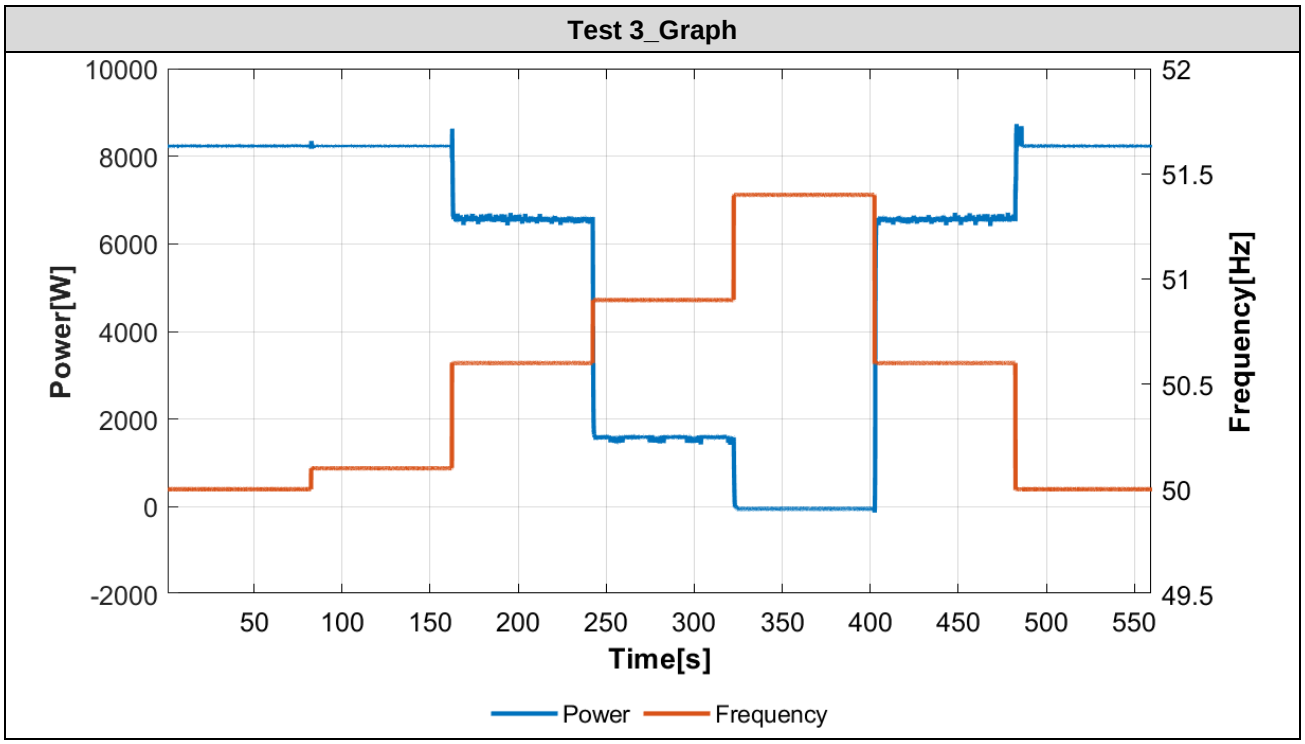
Test 3_Graph


8000
6000
4000
2000
0
-2000
Power[W]
51.5
51
50.5
50
49.5
100
200
300
400
500
600
Time[s]
Power[W]
Frequency[Hz]

Test 1	50% Pmax, f1 =50.2Hz; droop=12%; no delay				
	f (Hz)	Measured output Power (W)	Calculated from standard characteristic curve P (W)	Tolerance between measured P and calculated P (W)	Tolerance Limit (W)
50.00Hz ± 0.05Hz	50.00	8232.33	8250.00	--	--
50.10Hz ± 0.05Hz	50.10	8235.36	8250.00	--	--
50.30Hz ± 0.05Hz	50.30	7990.53	7975.05	15.48	± 1650
50.90Hz ± 0.05Hz	50.90	6306.10	6325.11	-19.01	± 1650
51.40Hz ± 0.05Hz	51.40	4896.43	4950.93	-54.50	± 1650
50.30Hz ± 0.05Hz	50.30	7989.58	7975.03	14.55	± 1650
50.00Hz ± 0.05Hz	50.00	8233.97	8250.00	--	--
Test 2	50% Pmax, f1 =50.2Hz; droop=5%; no delay				
	f (Hz)	Measured output Power (W)	Calculated from standard characteristic curve P (W)	Tolerance between measured P and calculated P (W)	Tolerance Limit (W)
50.00Hz ± 0.05Hz	50.00	8236.39	8250.00	--	--
50.10Hz ± 0.05Hz	50.10	8232.74	8250.00	--	--
50.30Hz ± 0.05Hz	50.30	7632.16	7590.33	41.83	± 1650
50.90Hz ± 0.05Hz	50.90	3649.60	3630.78	18.82	± 1650
51.40Hz ± 0.05Hz	51.40	323.84	332.68	-8.84	± 1650
50.30Hz ± 0.05Hz	50.30	7630.89	7590.39	40.50	± 1650
50.00Hz ± 0.05Hz	50.00	8236.60	8250.00	--	--
Test 3	50% Pmax, f1 =50.5Hz; droop=2%; no delay				
	f (Hz)	Measured output Power (W)	Calculated from standard characteristic curve P (W)	Tolerance between measured P and calculated P (W)	Tolerance Limit (W)
50.00Hz ± 0.05Hz	50.00	8233.34	8250.00	--	--
50.40Hz ± 0.05Hz	50.10	8232.58	8250.00	--	--
50.60Hz ± 0.05Hz	50.60	6566.89	6604.41	-37.52	± 1650
50.90Hz ± 0.05Hz	50.90	1578.70	1651.80	-73.10	± 1650
51.40Hz ± 0.05Hz	51.40	-46.81	0.00	-46.81	± 1650
50.60Hz ± 0.05Hz	50.60	6570.48	6605.88	-35.40	± 1650
50.0Hz ± 0.05Hz	50.00	8232.20	8250.00	--	--

Test 1_Graph


Test 2_Graph



Test 3_Graph
10000
8000
6000
4000
2000
0
-2000
Power[W]
52
51.5
51
50.5
50
49.5
Frequency[Hz]
50
100
150
200
250
300
350
400
450
500
550
Time[s]
Power
Frequency

Annex 1- Photo of the unit

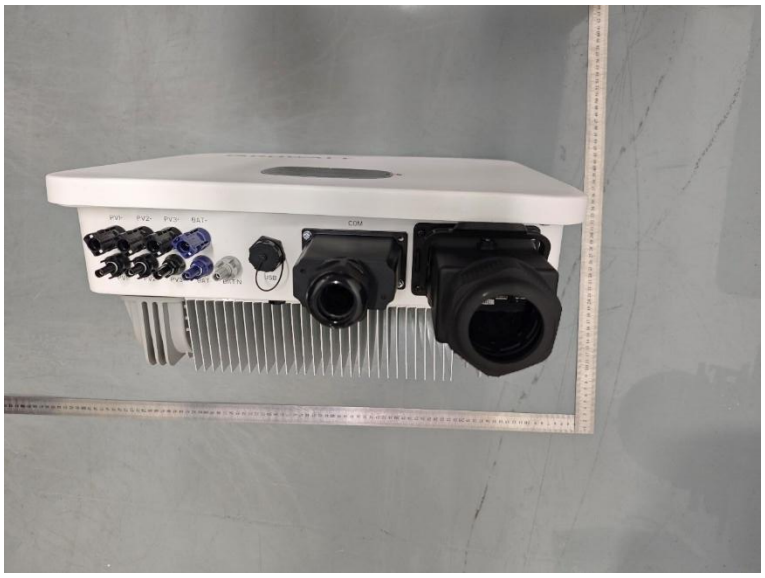
Front view

Rear view-1

Rear view-2

Left view

Right view



Connection view

End of Test Report