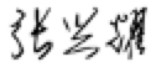
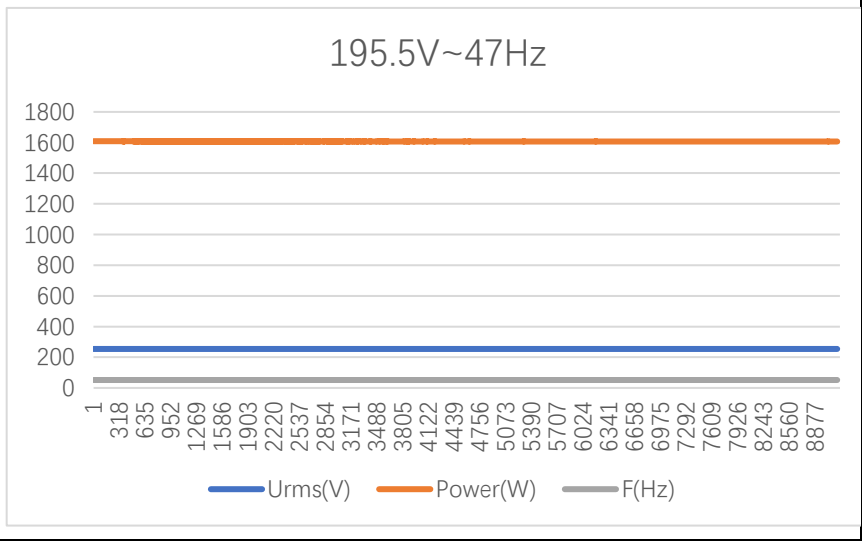
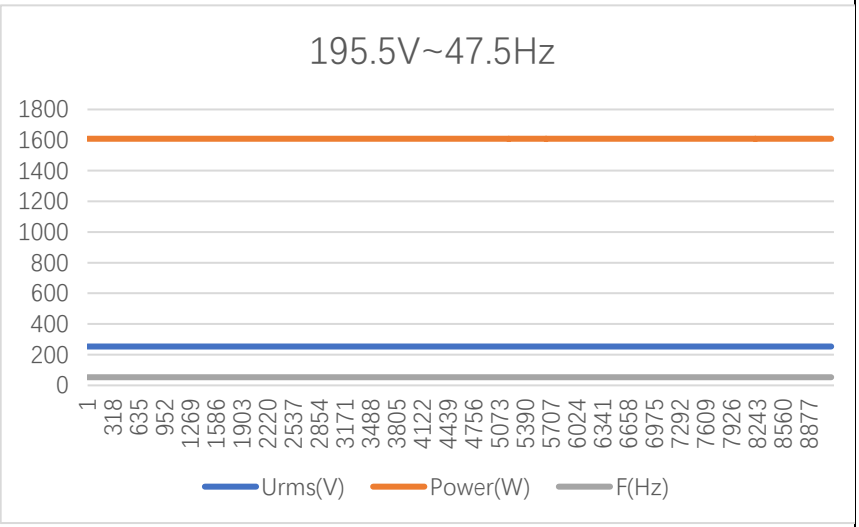
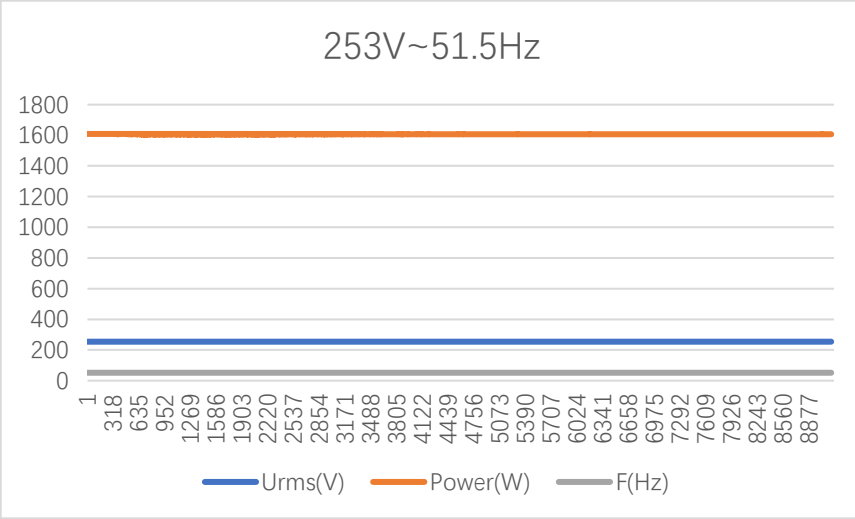
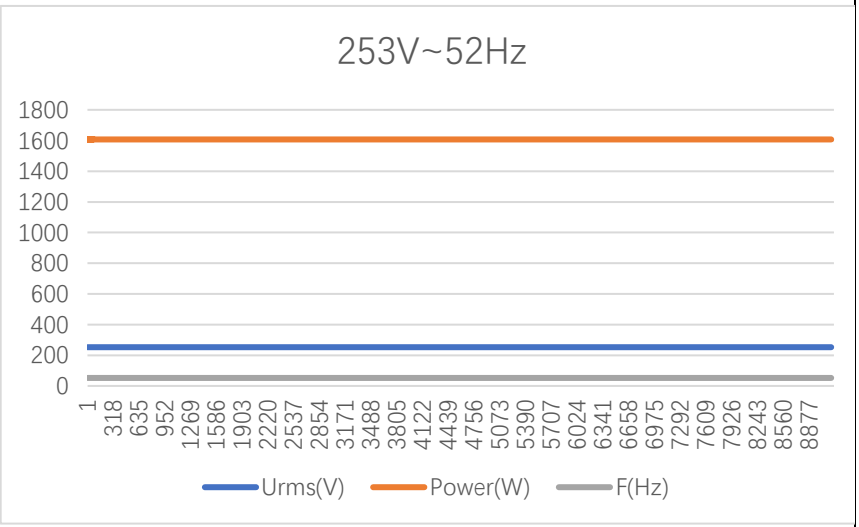
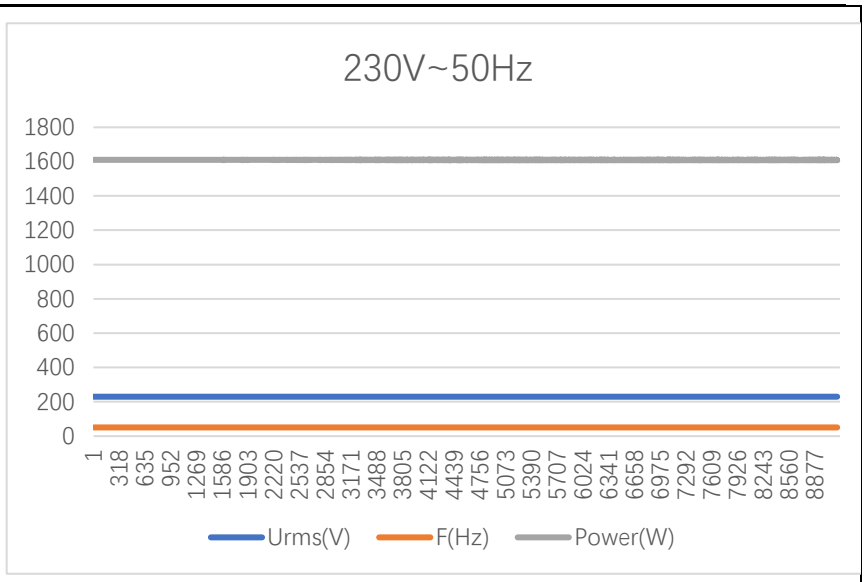
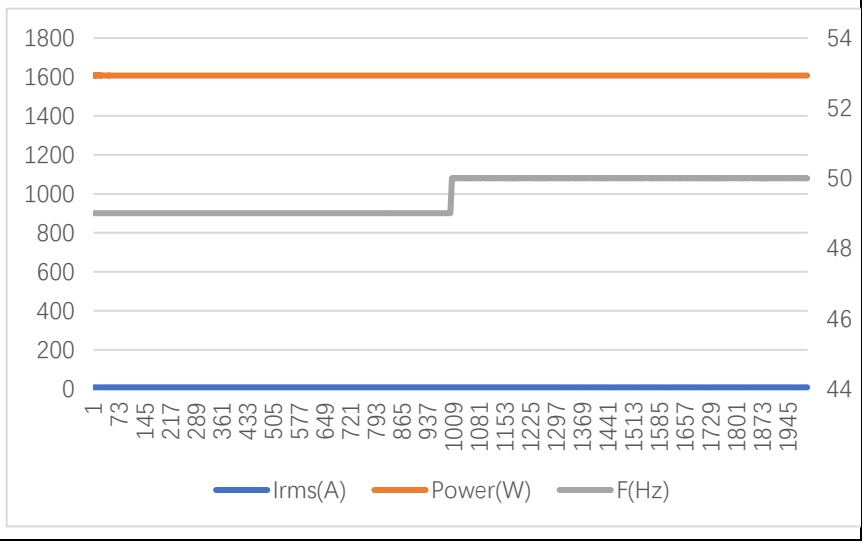
ENA EREC G99/1-4:2019

Type Test reference number		HMS-1600-4T	
Generating Unit technology		Photovoltaic Microinverter	
System Supplier name		Hoymiles Power Electronics Inc.	
Address		No.18 Kangjing Road, Hangzhou, Zhejiang Province, P.R. China.	
Tel	+86 571 28056101	Fax	+86 571 28056137
E:mail	zhangxingyao@hzconverter.com	Web site	www.hoymiles.com
Registered Capacity, use separate sheet if more than one connection option.	1.6 per Unit	kW single phase, single, split or three phase system	
	NA	kW three phase	
	NA	kW two phases in three phase system	
	N`A	kW two phases split phase system	
Manufacturer compliance declaration. - I certify that all products supplied by the company with the above Type Tested Manufacturer's reference number will be manufactured and tested to ensure that they perform as stated in this document, prior to shipment to site and that no site Modifications are required to ensure that the product meets all the requirements of EREC G99.			
Signed		On behalf of	Hoymiles Power Electronics Inc.
Note that testing can be done by the Manufacturer of an individual component or by an external test house. Where parts of the testing are carried out by persons or organizations other than the Manufacturer then that person or organization shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.			

1. Operating Range	
	Test1:195.5V~47Hz, PF=1
HMS-1600-4T	

	Test2:195.5V~47.5Hz, PF=1
HMS-1600-4T	
	Test3:253V~51.5Hz, PF=1
HMS-1600-4T	
	Test4: 253V~52Hz, PF=1
HMS-1600-4T	
	Test5: 230V~50Hz, PF=1

HMS-1600-4T	
	Test6: RoCoF withstand
HMS-1600-4T	

2. Power Quality - Harmonic Generation **Generating Unit tested to BS EN 61000-3-12**						
Generating Unit rating per phase (rpp)			1.6	kW	Harmonic % =Measured Value (Amps) x 23/rating per phase (kVA)	
Harmonic	At 45-55% of rated output		100% of rated output		Limit in BS EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.0115	0.1653	0.0033	0.0474	8%	8%
3	0.0435	0.6253	0.0089	0.1279	21.6%	Not stated

4	0.0087	0.1251	0.0014	0.0201	4%	4%
5	0.0249	0.3579	0.0036	0.0518	10.7%	10.7%
6	0.0036	0.0518	0.001	0.0144	2.67%	2.67%
7	0.0092	0.1323	0.0026	0.0374	7.2%	7.2%
8	0.0032	0.046	0.0009	0.0129	2%	2%
9	0.0099	0.1423	0.0018	0.0259	3.8%	Not stated
10	0.0034	0.0489	0.0008	0.0115	1.6%	1.6%
11	0.0056	0.0805	0.0016	0.023	3.1%	3.1%
12	0.0026	0.0374	0.0004	0.0058	1.33%	1.33%
13	0.0034	0.0489	0.001	0.0144	2%	2%
THD		2.6897		2.9348	23%	13%
PWHD		4.5364		4.6876	23%	22%
The system size is scalable. This is the system size tested by 1 Unit (HMS-1600-4T).						

3. Power Quality. Voltage fluctuations and Flicker

Test to BS EN 61000-3-11

	Starting			Stopping			Running	
	dmax [%]	dc [%]	d(t) [%]	dmax [%]	dc [%]	d(t) [%]	Pst	Plt 2 hours
Measured Values at test impedance	0.1	0	0	0.1	0	0	0.064	0.064
Normalised to standard impedance	0.1	0	0	0.1	0	0	0.064	0.064
Normalised to required maximum impedance	0.1	0	0	0.1	0	0	0.064	0.064
Limits set under BS EN 61000-3-11	4%	3.3%	3.3%	4%	3.3%	3.3%	1	0.65

Test impedance	R	0.4	Ω	XI	0.25	Ω
Standard impedance	R	0.24* 0.4^	Ω	XI	0.15* 0.25^	Ω
Maximum impedance	R	0.4	Ω	XI	0.25	Ω
Test start date		2022-01-31	Test end date		2022-01-31	
Test location		SHANGHAI TESTING & INSPECTION INSTITUTE FOR ELECTRICAL EQUIPMENT CO., LTD.				

4. **Power quality. DC injection**				
Test power level	10%	55%	100%	
Recorded value(mA)	1.225	4.963	2.857	
as % of rated AC current	0.0176%	0.0713%	0.0411%	
Limit	0.25%	0.25%	0.25%	

5. **Power Quality. Power factor**				
	216.2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1.5% of the stated level during the test.
Measured value	0.9981	0.9972	0.9950	
Limit	>0.95	>0.95	>0.95	

6. Protection. Frequency tests						
Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5Hz	20s	47.5Hz	20.07s	47.7Hz/30s	Confirmed
U/F stage 2	47Hz	0.5s	47Hz	0.53s	47.2Hz/19.5s	Confirmed
					46.8Hz/0.45s	Confirmed
O/F stage 1	52Hz	0.5s	52Hz	0.55s	51.8Hz/120s	Confirmed
					52.2Hz/0.45s	Confirmed

7. **Protection. Voltage tests**						
Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V stage 2	184V	2.5s	183.6V	2.56s	188V/5.0s	Confirmed
					180V/2.45s	Confirmed
OV stage 1	262.2V	1.0s	262.6V	1.04s	258.2V/5.0s	Confirmed
O/V stage 2	273.7V	0.5s	274.2V	0.55s	269.7V/0.95s	Confirmed
					277.7V/0.45s	Confirmed

8. **Power Park Modules - Protection – Loss of Mains test**						
Note: Inverter tested according to BS EN 62116.						
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 0.5s	96.4ms	221.2ms	265.2ms	95.1ms	218.7ms	270.3ms

Loss of Mains Protection, Vector Shift Stability test and RoCoF Stability test				
	Start Frequency	Change	End Frequency	Confirm no trip

Positive Vector Shift	49.5Hz	+50 degrees		Confirmed
Negative Vector Shift	50.5Hz	- 50 degrees		Confirmed
	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
Positive Frequency drift	49Hz to 51Hz	+0.95Hz/sec	2.1s	Confirmed
Negative Frequency drift	51Hz to 49Hz	-0.95Hz/sec	2.1s	Confirmed

9. **Limited Frequency Sensitive Mode – Over frequency test**				
Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.8.2.4				**N**
Test sequence at Registered Capacity >80 %	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	1603.7W	50Hz		-
Step b) 50.45Hz ±0.01Hz	1585.3W	50.45Hz		-
Step c) 50.70Hz ±0.10Hz	1506.2W	50.7Hz		-
Step d) 51.15Hz ±0.05Hz	1367.0W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	1505.9W	50.7Hz		-
Step f) 50.45Hz ±0.05Hz	1584.8W	50.45Hz		-
Step g) 50.00Hz ±0.01Hz	1603.3W	50Hz		-
Test sequence at Registered Capacity 40%~60%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	815.2W	50Hz		-
Step b) 50.45Hz ±0.05Hz	809.9W	50.45Hz		-
Step c) 50.70Hz ±0.10Hz	770.2W	50.7Hz		-
Step d) 51.15Hz ±0.05Hz	700.3W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	769.1W	50.7Hz		-

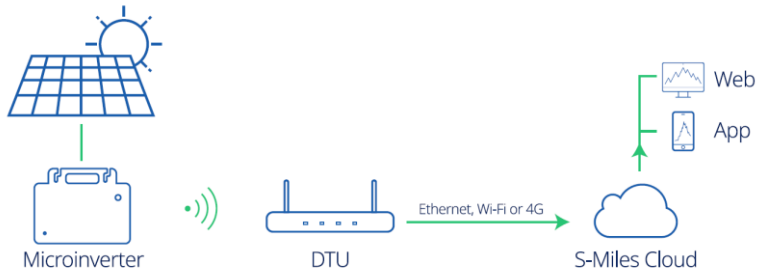
10. **Protection. Re-connection timer**					
Test should prove that the reconnection sequence starts in no less than 20s for restoration of voltage and frequency to within the stage 1 settings of table 10.5.7.1					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 10.5.7.1.			
20s	30s	At 266.2V	At 180V	At 47.4Hz	At 52.1Hz
Confirmation that the **Generating Unit** does not re-connect.		Confirmed	Confirmed	Confirmed	Confirmed

11. Fault level contribution					
For machines with electro-magnetic output			For Inverter output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	ip	N/A	20ms	16.19V	0.513A
Initial Value of aperiodic current	A	N/A	100ms	7.63V	0.202A
Initial symmetrical short-circuit current*	Ik	N/A	250ms	6.33V	0.129A
Decaying (aperiodic) component of short circuit current*	iDC	N/A	500ms	5.70V	0.125A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0.0042s	(in seconds)
For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot					

12. Self-Monitoring solid state switching	Yes/or NA
It has been verified that in the event of the solid state switching device failing to disconnect the **Generating Unit**, the voltage on the output side of the switching device is reduced to a value below 50 Volts within 0.5 seconds	N/A

13. Wiring functional tests: If required by para 15.2.1	Yes/or NA

Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning).	N/A

14. Logic interface (input port)	
Confirm that an input port is provided and can be used to reduce the Active Power output to zero.	Yes
Provide high level description of logic interface, e.g. details in 9.4.3 such as AC or DC signal (the additional comments box below can be used). This inverter does provide a logic interface to cease active power output within 5s. The logic interface works in the way that the end user can send control command from Website or APP to the gateway (DTU) and the gateway will deliver the command to the inverter via Sub-1G signal. Following is the topology of the communication system.  	Yes

15. Cyber security	
Confirm that the Manufacturer or Installer of the Micro-generator has provided a statement describing how the Micro-generator has been designed to comply with cyber security requirements, as detailed in 9.7. This inverter and the associated equipment (such as the gateway and the database of the Cloud) are all designed and developed complied with the cyber security requirements of IEEE1547.	Yes