


TEST REPORT



Applicant	Shenzhen SOFAR SOLAR Co., Ltd.
Address	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China.

Manufacturer or Supplier	Dongguan SOFAR SOLAR Co.,Ltd.	
Address	1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City	
Product	Hybrid Inverter	
Brand Name	SOFARSOLAR	
Model	HYD 6000-ES, HYD 4000-ES, HYD 3000-ES	
Additional Model & Model Difference	HYD 5000-ES, HYD 3600-ES, HYD 4600-ES; See items 2.1	
Date of tests	Sep. 03, 2018 ~Oct. 09, 2018	

The submitted sample of the above equipment has been tested according to the requirements of the following standards:

AS/NZS 61000.6.3:2012

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

<p>Tested by Ryan Lu Project Engineer / EMC Department</p>	<p>Approved by Glyn He Assistant Manager / EMC Department</p>
	
<p>Date: Jan. 06, 2020</p>	

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**BUREAU
VERITAS**

Test Report No.: C190808N030

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
CE180903N042	Original release	Oct. 16, 2018
CE190808N030	Based on the original report CE180903N042 changed the information of applicant/ manufacturer, added additional model, but it doesn't need to be retested after engineer evaluated.	Sep. 20, 2019
C190808N030	Based on the original report CE190808N030 changed the standards EN to AS/NZS, but it doesn't need to be retested after engineer evaluated.	Jan. 06, 2020

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

EMISSION			
Standard	Test Type	Result	Remarks
AS/NZS 61000.6.3:2012	Conducted test	PASS	Meets Limits Minimum passing margin is -2.28dB at 13.57031 MHz
	Radiated test (30MHz~1GHz)	PASS	Meets limits minimum passing margin is -0.60dB at 30.000 MHz

1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

MEASUREMENT	FREQUENCY	UNCERTAINTY
Mains Terminal Disturbance Voltage Test	0.15MHz ~ 30MHz	+ /-2.70 dB
Radiated Disturbance Test	30MHz ~ 1000MHz	+ /-4.04 dB



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Hybrid Inverter
MODEL NO.	HYD 6000-ES, HYD 4000-ES, HYD 3000-ES
ADDITIONAL MODELS	HYD 5000-ES, HYD 3600-ES, HYD 4600-ES
POWER SUPPLY	For HYD 6000-ES:DC input: 300V-520V AC output: 184V-276V, Battery: DC 40-60V For HYD 4000-ES:DC input: 200V-520V AC output: 184V-276V, Battery: DC 40-60V For HYD 3000-ES:DC input: 160V-520V AC output: 184V-276V, Battery: DC 40-60V
THE HIGHEST OPERATING FREQUENCY	Below 108MHz
DATA CABLE SUPPLIED	N/A

NOTE:

1. For the test results, the EUT had been tested with all conditions. But only the worst case was showed in test report.
2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
3. Please refer to the EUT photo document (Reference No.: 190808N030) for detailed product photo.
4. Additional models HYD 5000-ES, HYD 3600-ES, HYD 4600-ES are identical with the test models HYD 6000-ES, HYD 4000-ES, HYD 3000-ES except the model number, power rating and software for trading purpose. The difference has been considered during this test, full test was performed for the model HYD 6000-ES, partial test was performed for the model HYD 4000-ES, test conduction emission and radiated emission, other partial test was performed for the model HYD 3000-ES, test conduction emission, radiated emission, harmonics and flicker.



2.2 DESCRIPTION OF TEST MODES

The EUT was tested under the following modes' the final worst mode was marked in boldface and recorded in this report.

◆ For Conducted Emission Test

Description of Test Mode	Test Model	Test Voltage
Grid	HYD 6000-ES	Input: DC 520V/12.69A,Output: AC 230V/50Hz Input: DC 410V/16.10A,Output: AC 230V/50Hz Input: DC 300V/22A,Output: AC 230V/50Hz
Grid+ Battery charging		Input: DC 520V/12.69A,Output: AC 230V/50Hz
Battery charging from AC input		AC230V/50Hz
Battery discharging+ Grid		Input: DC 48V from battery, Output: AC 230V/50Hz
Battery discharging+ AC output		Input: DC 48V from battery, Output: AC 230V/50Hz
Grid	HYD 4000-ES	Input: DC 520V/8.46A,Output: AC 230V/50Hz Input: DC 360V/12.22A,Output: AC 230V/50Hz
Grid+ Battery charging		Input: DC 520V/8.46A,Output: AC 230V/50Hz
Battery charging from AC input		AC230V/50Hz
Battery discharging+ Grid		Input: DC 48V from battery, Output: AC 230V/50Hz
Battery discharging+ AC output		Input: DC 48V from battery, Output: AC 230V/50Hz
Grid	HYD 3000-ES	Input: DC 520V/6.35A,Output: AC 230V/50Hz Input: DC 340V/9.71A,Output: AC 230V/50Hz
Grid+ Battery charging		Input: DC 520V/6.35A,Output: AC 230V/50Hz
Battery charging from AC input		AC230V/50Hz
Battery discharging+ Grid		Input: DC 48V from battery, Output: AC 230V/50Hz
Battery discharging+ AC output		Input: DC 48V from battery, Output: AC 230V/50Hz



◆ For Radiated Emission Test

Description of Test Mode	Test Model	Test Voltage
Grid	HYD 6000-ES	Input: DC 520V/12.69A,Output: AC 230V/50Hz Input: DC 410V/16.10A,Output: AC 230V/50Hz Input: DC 300V/22A,Output: AC 230V/50Hz
Grid+ Battery charging		Input: DC 300V/22A,Output: AC 230V/50Hz
Battery charging from AC input		AC230V/50Hz
Battery discharging+ Grid		Input: DC 48V from battery, Output: AC 230V/50Hz
Battery discharging+ AC output		Input: DC 48V from battery, Output: AC 230V/50Hz
Grid	HYD 4000-ES	Input: DC 520V/8.46A,Output: AC 230V/50Hz Input: DC 360V/12.22A,Output: AC 230V/50Hz
Grid+ Battery charging		Input: DC 360V/12.22A,Output: AC 230V/50Hz
Battery charging from AC input		AC230V/50Hz
Battery discharging+ Grid		Input: DC 48V from battery, Output: AC 230V/50Hz
Battery discharging+ AC output		Input: DC 48V from battery, Output: AC 230V/50Hz
Grid	HYD 3000-ES	Input: DC 520V/6.35,Output: AC 230V/50Hz Input: DC 340V/9.71A,Output: AC 230V/50Hz
Grid+ Battery charging		Input: DC 340V/9.71A,Output: AC 230V/50Hz
Battery charging from AC input		AC230V/50Hz
Battery discharging+ Grid		Input: DC 48V from battery, Output: AC 230V/50Hz
Battery discharging+ AC output		Input: DC 48V from battery, Output: AC 230V/50Hz



◆ **For Harmonics and Flicker Tests**

Description of Test Mode	Test Model	Test Voltage
Grid	HYD 6000-ES	Input: DC 520V/12.69A,Output: AC 230V/50Hz
	HYD 3000-ES	Input: DC 520V/8.46A,Output: AC 230V/50Hz

◆ **For Immunity Tests**

Description of Test Mode	Test Model	Test Voltage
Grid	HYD 6000-ES	Input: DC 520V/12.69A,Output: AC 230V/50Hz Input: DC 410V/16.10A,Output: AC 230V/50Hz Input: DC 300V/22A,Output: AC 230V/50Hz
Grid+ Battery charging		Input: DC 300V/22A,Output: AC 230V/50Hz
Battery charging from AC input		AC230V/50Hz
Battery discharging+ Grid		Input: DC 48V from battery, Output: AC 230V/50Hz
Battery discharging+ AC output		Input: DC 48V from battery, Output: AC 230V/50Hz

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT has been tested and complied with the requirements of the following standards:

AS/NZS 61000.6.3:2012

All applicable tests have been performed and recorded as per the above standards

2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit without any other necessary accessory or support units.



3 EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY (MHz)	dBuV	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

- Note:** (1) The lower limit shall apply at the transition frequencies.
(2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

3.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Mar. 21,18	Mar. 20,19
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Mar. 03,18	Mar. 02,19
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Apr. 11,18	Apr. 10,19
Voltage probe	SCHWARZBEC K	TK 9421	TK 9421-176	Jan. 17,18	Jan. 16,19
Test software	ADT	ADT_Cond_V 7.3.7	N/A	N/A	N/A

- NOTE:** 1. The test was performed in shielding Room 843.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA

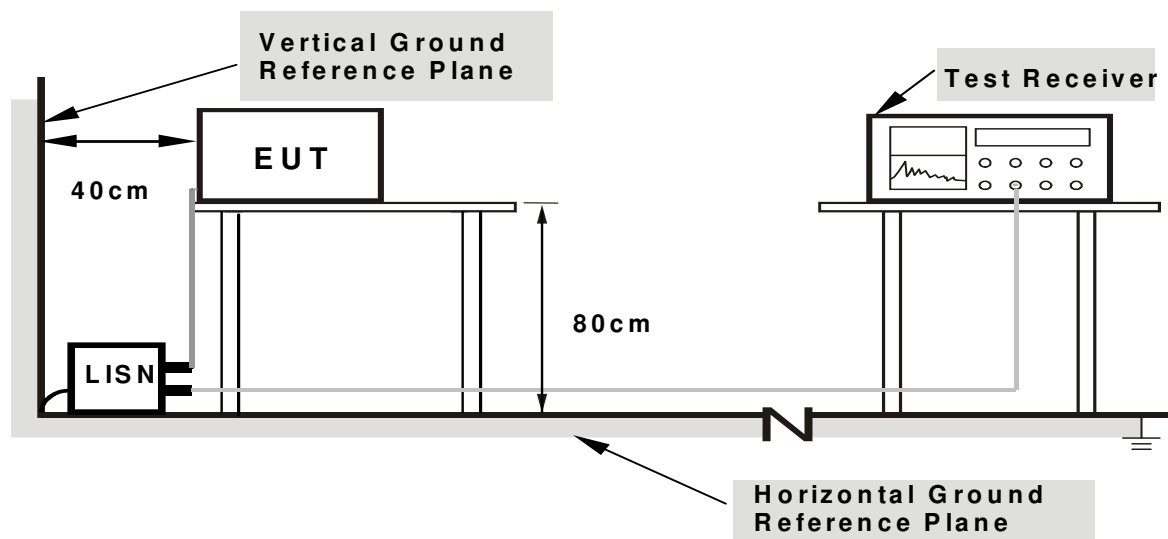
3.1.3 TEST PROCEDURE

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20dB) were not recorded.

3.1.4 DEVIATION FROM TEST STANDARD

No deviation

3.1.5 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

3.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power of all equipment.
- b. EUT was operated according to the type description in manufacturer's specifications or the User's Manual.

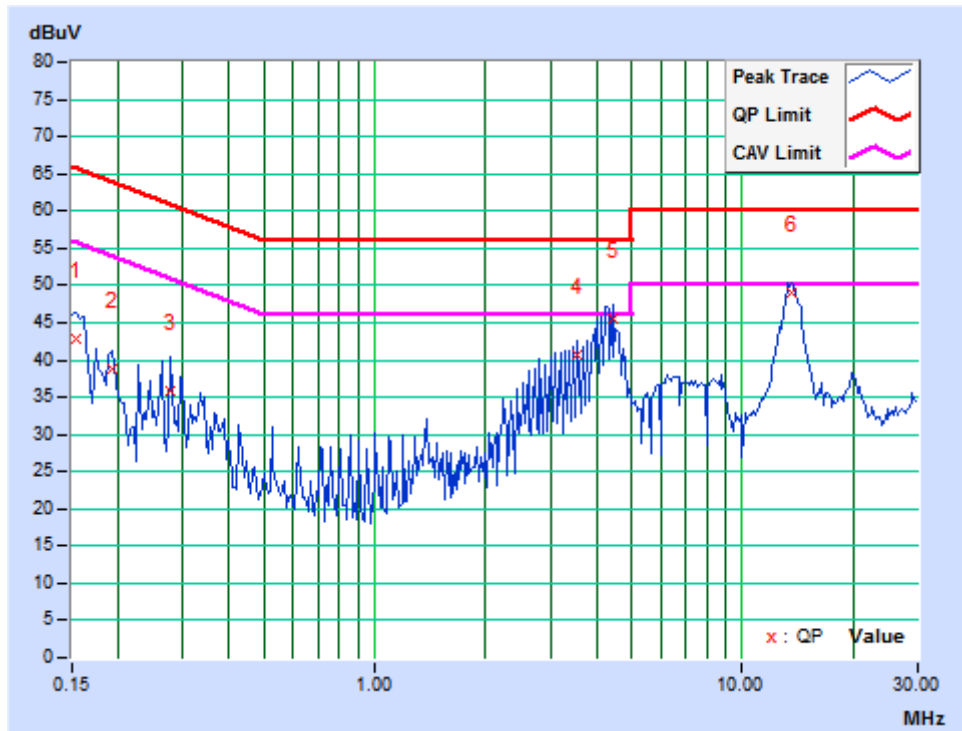


3.1.7 TEST RESULTS

TEST MODE	Battery charging from AC input	6dB BANDWIDTH	9 kHz
TEST VOLTAGE	AC230V/50Hz	PHASE	Line
ENVIRONMENTAL CONDITIONS	25 deg. C, 55% RH	TESTED BY: Jack	

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	3.66	39.21	32.46	42.87	36.12	65.79	55.79	-22.92	-19.67
2	0.19297	7.70	31.08	27.66	38.78	35.36	63.91	53.91	-25.13	-18.55
3	0.27891	8.54	27.21	15.66	35.75	24.20	60.85	50.85	-25.10	-26.65
4	3.57031	9.23	31.57	30.82	40.80	40.05	56.00	46.00	-15.20	-5.95
5	4.42578	9.29	36.23	34.42	45.52	43.71	56.00	46.00	-10.48	-2.29
6	13.57031	9.48	39.57	38.24	49.05	47.72	60.00	50.00	-10.95	-2.28

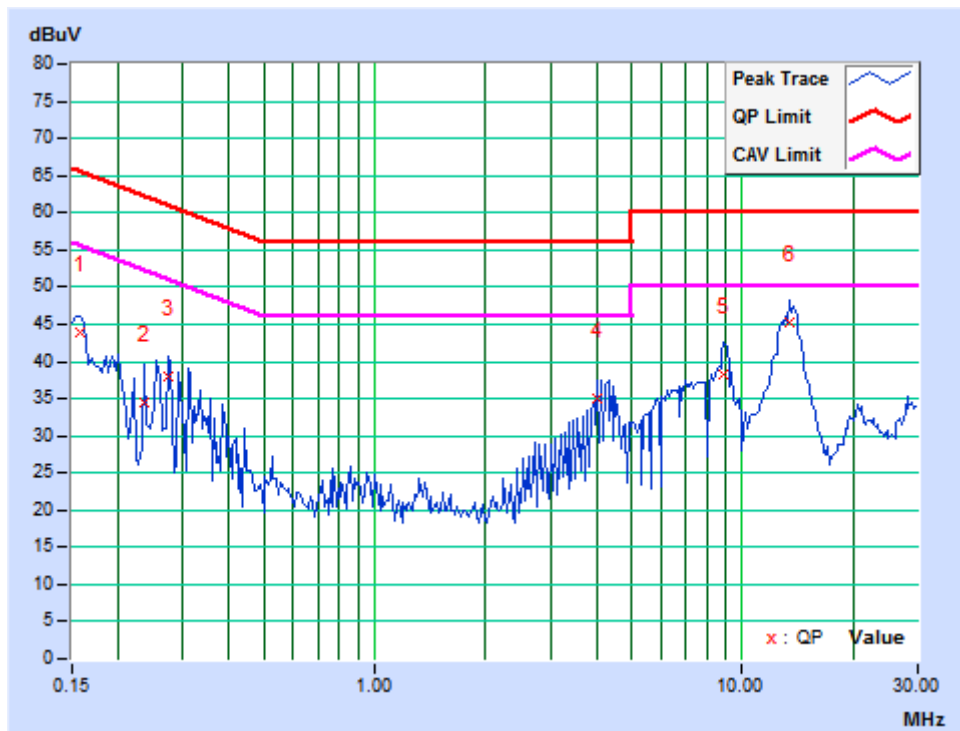
REMARKS: The emission levels of other frequencies were very low against the limit.



TEST MODE	Battery charging from AC input	6dB BANDWIDTH	9 kHz
TEST VOLTAGE	AC230V/50Hz	PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	25 deg. C, 55% RH	TESTED BY: Jack	

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	4.07	39.89	35.45	43.96	39.52	65.58	55.58	-21.62	-16.06
2	0.23594	8.40	25.98	19.85	34.38	28.25	62.24	52.24	-27.86	-23.99
3	0.27500	8.49	29.59	16.41	38.08	24.90	60.97	50.97	-22.89	-26.07
4	4.04688	9.26	25.76	25.18	35.02	34.44	56.00	46.00	-20.98	-11.56
5	8.90625	9.37	28.88	26.81	38.25	36.18	60.00	50.00	-21.75	-13.82
6	13.47656	9.49	35.70	34.48	45.19	43.97	60.00	50.00	-14.81	-6.03

REMARKS: The emission levels of other frequencies were very low against the limit.





3.2 RADIATED EMISSION MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	Up to 5 times of the highest frequency or 6 GHz, whichever is less

FOR FREQUENCY BELOW 1000 MHz

FREQUENCY (MHz)	3m	10m
	Quasi-Peak (dBuV/m)	Quasi-Peak (dBuV/m)
30 – 230	40	30
230 – 1000	47	37

FOR FREQUENCY ABOVE 1000 MHz

FREQUENCY (GHz)	3m	
	PEAK(dBuV/m)	AVERAGE(dBuV/m)
1 to 3	70	50
3 to 6	74	54

- NOTE:** (1) The lower limit shall apply at the transition frequencies.
(2) Emission level (dBuV/m) = 20 log Emission level (uV/m).



3.2.2 TEST INSTRUMENTS

FOR FREQUENCY BELOW 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU26	100005	Aug. 24,18	Aug. 23,19
EMI Test Receiver	Rohde&Schwarz	ESR7	101564	Jan. 18,18	Jan. 17,19
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-555	Nov. 10, 17	Nov. 09, 18
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-554	Dec. 10, 17	Dec. 09, 18
Preamplifier	EMCI	EMC1135	980378	Mar. 19,18	Mar. 18,19
Preamplifier	EMCI	EMC1135	980423	Mar. 19,18	Mar. 18,19
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8.8m	NSEMC006	Feb. 10,18	Feb. 09,19
Test Software	ADT	ADT_Radiated V8.7.07	N/A	N/A	N/A

- NOTES:** 1. The test was performed in 10m Chamber.
2. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

FREQUENCY RANGE ABOVE 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	ETS-Lindgren	3117	00085519	Dec. 10, 17	Dec. 09, 18
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170242	May 05,18	May 04,19
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101003	Apr. 21,18	Apr. 20,19
Broadband Preamplifier (1~18GHz)	SCHWARZBECK	BBV9718	266	Apr. 18,18	Apr. 18,19
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Nov. 08,17	Nov. 07,18
Test Software	ADT	ADT_Radiated V8.7.07	N/A	N/A	N/A

- NOTES:** 1. The test was performed in 10m Chamber.
2. The calibration interval of the above test instruments are 12 months. And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

3.2.3 TEST PROCEDURE

<Frequency Range below 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
4. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier).
5. Margin value = Emission level – Limit value.

<Frequency Range above 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter Semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna can be varied from one meter-to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test receiver/spectrum was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

NOTE:

1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.
2. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
3. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
4. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier).
5. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain (dB) (if the raw value contains the amplifier).
6. Margin value = Emission level – Limit value.

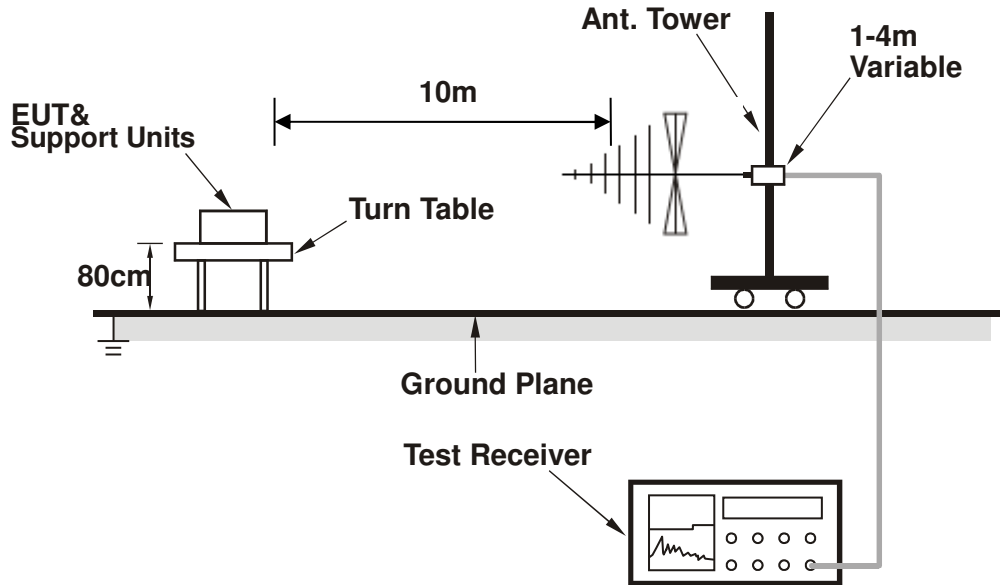
3.2.4 DEVIATION FROM TEST STANDARD

No deviation

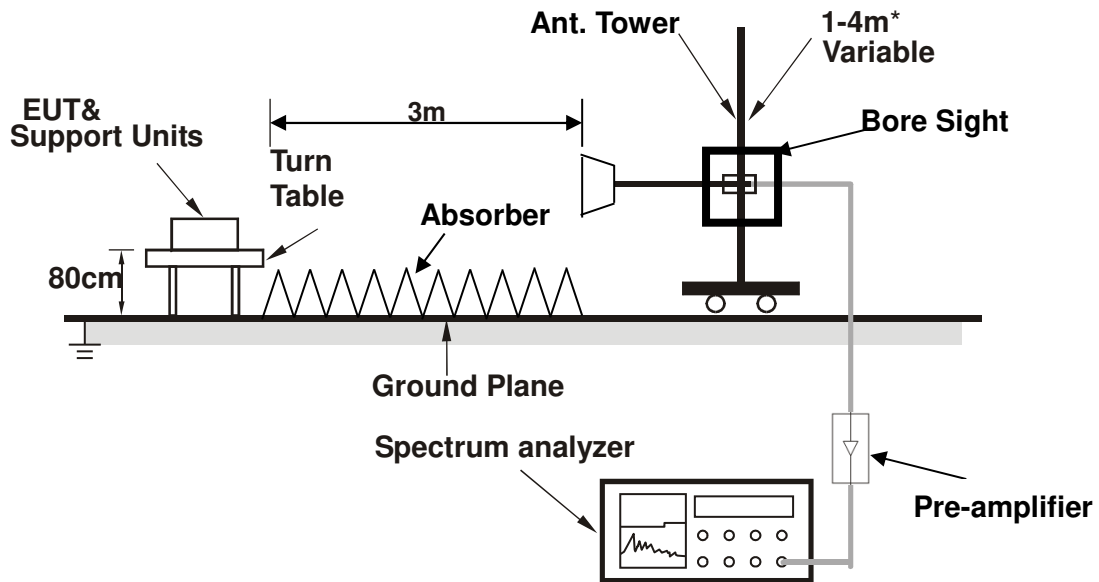


3.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



* :depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

3.2.6 EUT OPERATING CONDITIONS

Same as item 3.1.6

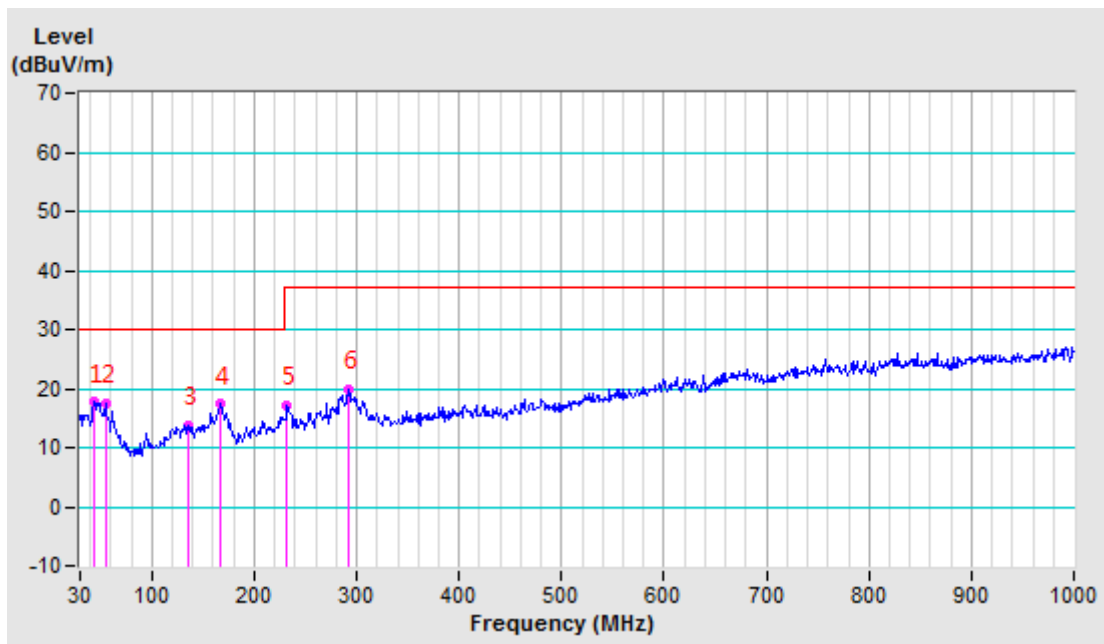


3.2.7 TEST RESULTS

TEST MODE	Battery charging from AC input	FREQUENCY RANGE	30-1000 MHz
TEST VOLTAGE	AC230V/50Hz	DETECTOR FUNCTION & BANDWIDTH	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	23 deg. C, 67% RH	TESTED BY: Luke	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 10 M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	43.944	-17.32	35.01	17.69	30.00	-12.31	400	145
2	54.856	-17.83	35.40	17.57	30.00	-12.43	200	329
3	135.973	-18.11	31.92	13.81	30.00	-16.19	400	154
4	167.255	-17.22	34.58	17.36	30.00	-12.64	400	150
5	232.366	-17.85	35.14	17.29	37.00	-19.71	400	81
6	292.991	-15.55	35.54	19.99	37.00	-17.01	400	3

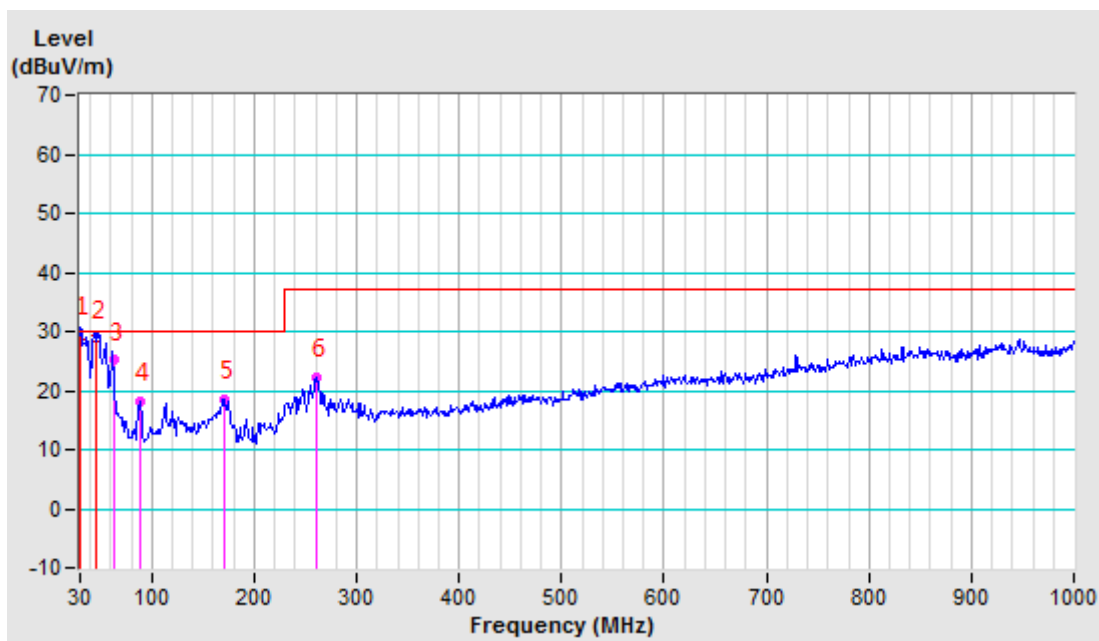
- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 30MHz to 1000MHz.
 4. Only emissions significantly above equipment noise floor are reported



TEST MODE	Battery charging from AC input	FREQUENCY RANGE	30-1000 MHz
TEST VOLTAGE	AC230V/50Hz	DETECTOR FUNCTION & BANDWIDTH	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	23 deg. C, 67% RH	TESTED BY: Luke	

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 10 M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	30.000	-19.01	48.41	29.40	30.00	-0.60	100	124
2	44.784	-17.91	46.61	28.70	30.00	-1.30	100	125
3	62.497	-19.37	44.47	25.10	30.00	-4.90	100	98
4	87.718	-21.65	39.93	18.28	30.00	-11.72	100	73
5	170.027	-16.63	35.07	18.44	30.00	-11.56	100	124
6	260.726	-15.95	38.30	22.35	37.00	-14.65	100	301

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 30MHz to 1000MHz.
 4. Only emissions significantly above equipment noise floor are reported

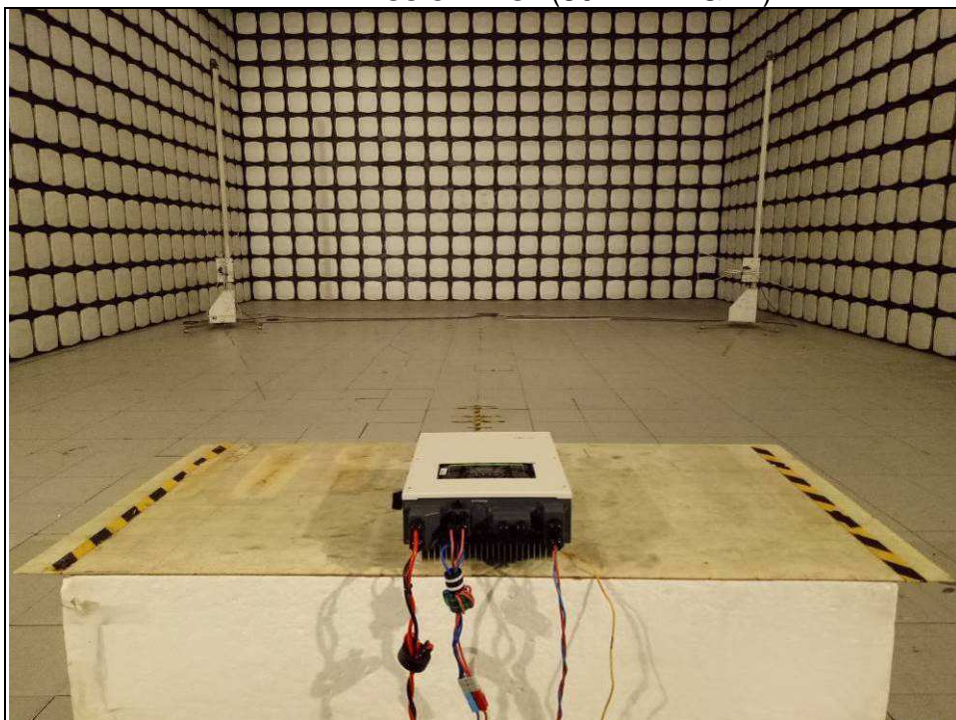


4 PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST



RADIATED EMISSION TEST (30MHz~1GHz)





Test Report No.: C190808N030

5 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

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