TEST REPORT

Product Name : hybrid inverter

Model Number : HYD 6000-ES, HYD 5000-ES, HYD 4000-ES, HYD 3600-ES, HYD 3000-ES

Prepared for	:	Shenzhen SOFAR SOLAR Co., Ltd.
Address	:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China
Prepared by	:	EMTEK (SHENZHEN) CO., LTD.
Address	:	Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China Tel: (0755) 26954280 Fax: (0755) 26954282
Report Number	:	ES190710013E
Date of Test	:	July 10, 2019 to July 12, 2019 & January 20, 2021 to January 27, 2021
Date of Report	:	January 28, 2021

TABLE OF CONTENT

TEST REPORT DESCRIPTION

Applicant	:	Shenzhen SOFAR SOLAR Co., Ltd.
Manufacturer	:	Shenzhen SOFAR SOLAR Co., Ltd.
Trademark	:	N/A
EUT	:	hybrid inverter
Model No.	:	HYD 6000-ES, HYD 5000-ES, HYD 4000-ES, HYD 3600-ES, HYD 3000-ES
Remark	:	This Report Shows that the EUT is technically complicant with The EMC (Radiation and Conduction) of SANS 211 requirements.

Measurement Procedure Used:

SANS 211:2010/CISPR 11:2015+A1:2016
(Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement)
IEC 61000-2-2:2002+A1:2017+A2:2018

The device described above is tested by EMTEK (SHENZHEN) CO., LTD. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and EMTEK (SHENZHEN) CO., LTD. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is compliant with the SANS 211/CISPR 11 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of EMTEK (SHENZHEN) CO., LTD.

Date of Test	:	July 10, 2019 to July 12, 2019 & January 20, 2021 to January 27, 2021
Prepared by	:	Jessie Hu/Editor
Reviewer	:	Joe Xia/Supervisor
Approved & Authorized Signer	:	Lisa Wang/Manager

Modified Information

Version	Report No.	Revision Date	Summary
Ver.1.0	ES190710013E	/	Original Report
Ver.2.0	ES190710013E	2021-01-28	Add test Voltage Distortion in Differential mode

1. SUMMARY OF TEST RESULT

EMISSION			
Description of Test Item	Standard	Limits	Results
Conducted Disturbance at Mains Terminals	SANS 211:2010/CISPR 11:2015+A1:2016	Class B	Pass
Voltage Distortion in Differential mode	IEC 61000-2-2: 2002+A1:2017+A2:2018	Table 4	Pass
Radiated Disturbance	SANS 211:2010/CISPR 11:2015+A1:2016	Class B	Pass
Note: 1. N/A is an abbreviation for Not Applicable.			

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

EUT	:	hybrid inverter
Model Number	:	HYD 6000-ES, HYD 5000-ES, HYD 4000-ES, HYD 3600-ES, HYD 3000-ES (Note: All the models are the same, except their output rating. We prepare HYD 6000-ES for test.)
Applicant	:	Shenzhen SOFAR SOLAR Co., Ltd.
Address	:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China
Manufacturer	:	Shenzhen SOFAR SOLAR Co., Ltd.
Address	:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China
Factory	:	Dongguan SOFAR SOLAR Co., Ltd
Address	:	1F-6F, Building E, No.1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City
Date of Received	:	July 10, 2019 & January 20, 2021
Date of Test	:	July 10, 2019 to July 12, 2019 & January 20, 2021 to January 27, 2021

2.2. Independent Operation Modes

A. ON
1. Charging
2. Discharging
3. PV in

2.3. Test Manner

Details of EUT Test Modes:

Test Items	Test Voltage	Function Type	Worst case
Conducted disturbance at mains Terminals	AC 220V/50Hz DC 360V DC 48V	Mode A	Mode A.1
Voltage Distortion in Differential mode	AC 220V/50Hz DC 48V	Mode A.1	Mode A.1
Radiated emissions at frequencies up to 1 GHz	AC 220V/50Hz DC 360V DC 48V	Mode A	Mode A.1

2.4. Description of Test Facility

Site Description

EMC Lab. : Accredited by CNAS, 2018.11.30
The certificate is valid until 2022.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01 (identical to ISO/IEC 17025:2017)
The Certificate Registration Number is L2291.

Accredited by FCC
Designation Number: CN1204
Test Firm Registration Number: 882943

Accredited by A2LA
The Certificate Number is 4321.01.

Accredited by Industry Canada
The Conformity Assessment Body Identifier is CN0008

Name of Firm : EMTEK (SHENZHEN) CO., LTD.

Site Location : Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

2.5. Measurement Uncertainty

Test Item		Uncertainty
Conducted Emission Uncertainty	:	3.16dB(9k~150kHz Conduction 2#) 2.90dB(150k-30MHz Conduction 2#)
Radiated Emission Uncertainty (10m Chamber)	:	4.58dB (30M~1GHz Polarize: H) 4.54dB (30M~1GHz Polarize: V)
Uncertainty for test site temperature and humidity	:	0.6℃ 4%

3. MEASURING DEVICE AND TEST EQUIPMENT

3.1. For Power Line Conducted Emission Measurement

Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☑	EMI Test Receiver	Rohde & Schwarz	ESCI	101045	May 18, 2019	1 Year
☑	PULSE LIMTER	Rohde & Schwarz	ESH3-Z2	100107	May 18, 2019	1 Year
☑	AMN	Rohde & Schwarz	ESH3-Z5	100191	May 18, 2019	1 Year

3.2. For Voltage Distortion in Differential mode Measurement

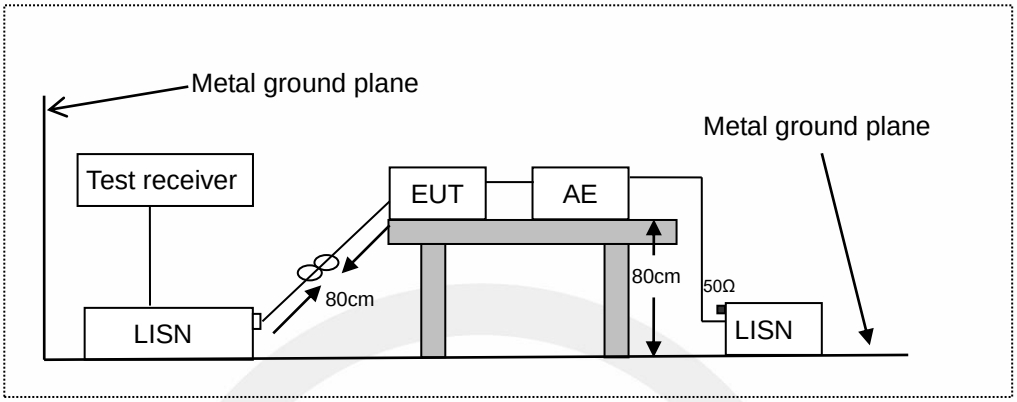
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☑	EMI Test Receiver	Rohde & Schwarz	ESCI	101045	May 16, 2020	1 Year
☑	PULSE LIMTER	Rohde & Schwarz	ESH3-Z2	100107	May 17, 2020	1 Year
☑	AMN	Rohde & Schwarz	ESH3-Z5	100191	May 16, 2020	1 Year

3.3. For Radiated Emission Measurement

Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☑	EMI Test Receiver	Rohde & Schwarz	ESR3	1316.3003K03-101706-HN	May 18, 2019	1 Year
☑	EMI Test Receiver	Rohde & Schwarz	ESR3	1316.3003K03-101707-Z1	May 18, 2019	1 Year
☑	Pre-Amplifier	Lunar EM	LNA10M1G-40	J1011130912001	May 18, 2019	1 Year
☑	Pre-Amplifier	Lunar EM	LNA10M1G-40	J1011131126002	May 18, 2019	1 Year
☑	Bilog Antenna	Schwarzbeck	VULB9163	659	May 19, 2019	1 Year
☑	Bilog Antenna	Schwarzbeck	VULB9163	661	May 19, 2019	1 Year
☑	Cable	Times Microwave	LMR-240 N-N 1m	SS26-P1	May 19, 2019	1 Year
☑	Cable	Times Microwave	LMR-240 N-N 1m	SS26-P2	May 19, 2019	1 Year
☑	Cable	Times Microwave	LMR-240 N-N 1.5m	N/A	May 19, 2019	1 Year
☑	Cable	Times Microwave	LMR-240 N-N 1.5m	N/A	May 19, 2019	1 Year
☑	Cable	Times Microwave	LMR-240 N-N 12m	N/A	May 19, 2019	1 Year
☑	Cable	Times Microwave	LMR-240 N-N 11m	N/A	May 19, 2019	1 Year

4. POWER LINE CONDUCTED EMISSION MEASUREMENT

4.1. Block Diagram of Test Setup



LISN: Artificial Mains Network
AE: Associated equipment
EUT: Equipment under test

4.2. Measuring Standard

SANS 211/CISPR 11

4.3. Power Line Conducted Emission Limits (Group 1 Class B)

Disturbance voltage limits for class B group 1 equipment measured on a test site (a.c. mains power port)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66	56
	Decreasing linearly with logarithm of frequency to	Decreasing linearly with logarithm of frequency to
	56	46
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50
Notes: At the transition frequency, the more stringent limit shall apply.		

4.4. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and connected to the AC mains through Line Impedance Stability Network (L.I.S.N). This provided 50ohm-coupling impedance for the tested equipments. Both sides of AC line are investigated to find out the maximum conducted emission according to the SANS 211/CISPR 11 regulations during conducted emission measurement.
The bandwidth of the field strength meter (R&S Test Receiver ESCS30) is set at 9kHz in 150kHz~30MHz and 200Hz in 9kHz~150kHz.

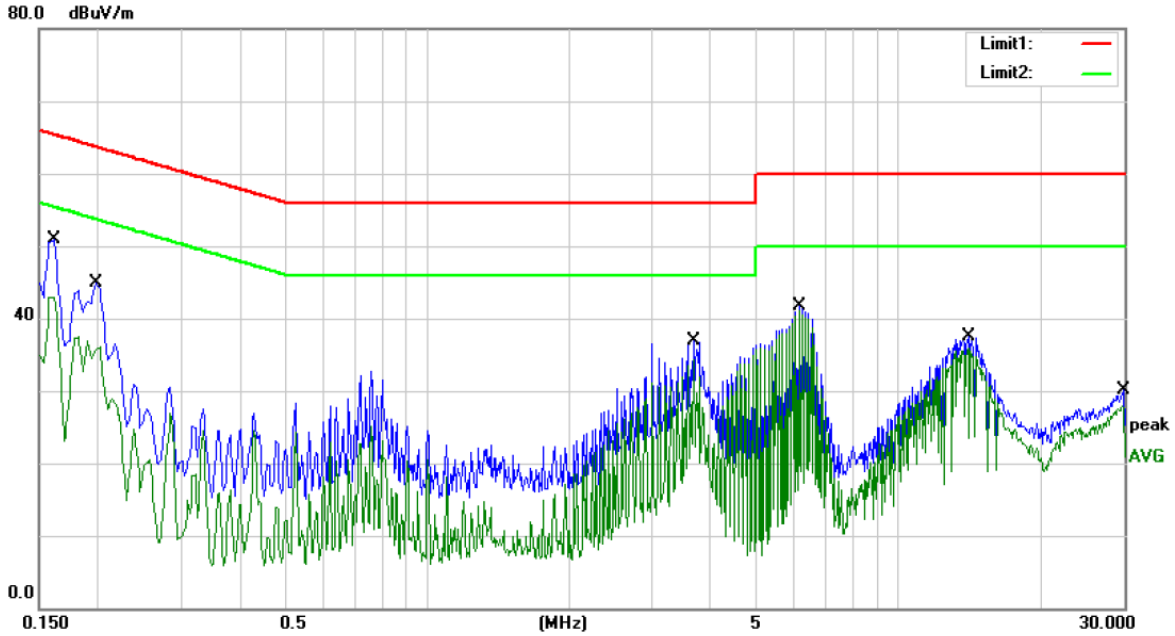
The frequency range from 150kHz to 30MHz is investigated.

Test results were obtained from the following equation:
Emission Level (dBμV) = AMN Factor (dB) + Cable Loss (dB) + Reading (dBμV)
Margin (dB) = Emission Level (dBμV) - Limit (dBμV)

4.5. Measuring Results

PASS.

All the modes were tested and the data of the worst modes are attached the following pages.



Site Conduction #2 Phase: *L1* Temperature: 23.7

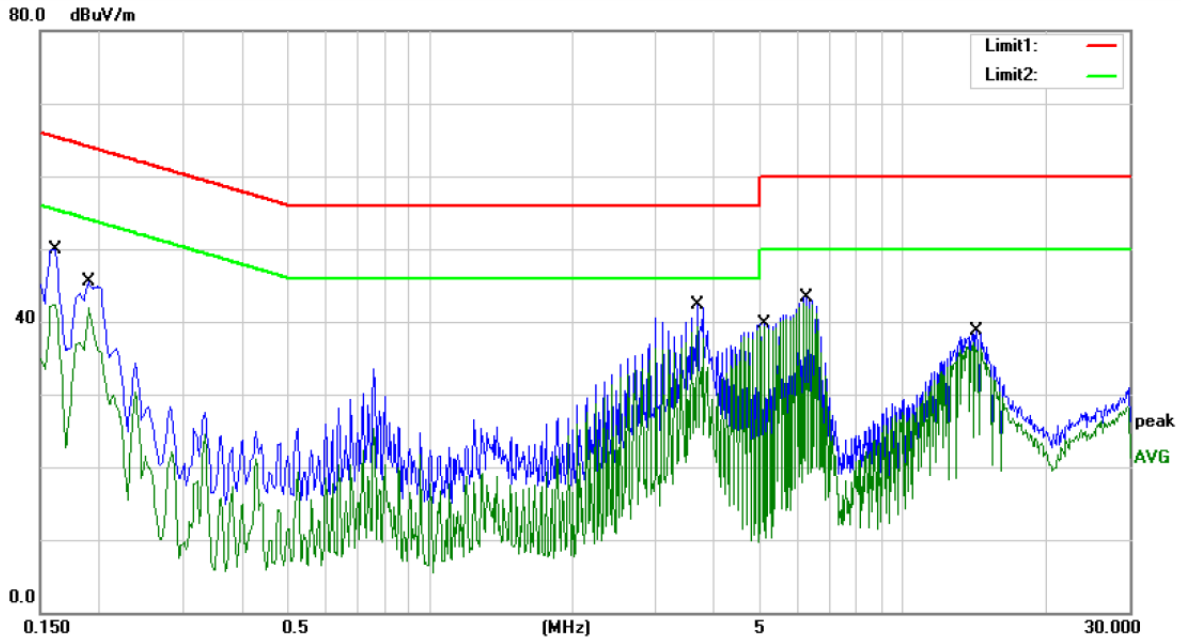
Limit: (CE)CISPR 11 class B_QP Power: AC 220V/50Hz DC48V Humidity: 41 %

Mode: charging

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.1620	40.93	9.90	50.83	65.36	-14.53	QP	
2		0.1620	32.97	9.90	42.87	55.36	-12.49	AVG	
3		0.1980	35.02	9.90	44.92	63.69	-18.77	QP	
4		0.1980	27.56	9.90	37.46	53.69	-16.23	AVG	
5		3.6700	27.02	9.94	36.96	56.00	-19.04	QP	
6		3.6700	24.34	9.94	34.28	46.00	-11.72	AVG	
7		6.1460	31.79	9.97	41.76	60.00	-18.24	QP	
8	*	6.1460	31.06	9.97	41.03	50.00	-8.97	AVG	
9		14.0500	27.48	10.04	37.52	60.00	-22.48	QP	
10		14.0500	25.88	10.04	35.92	50.00	-14.08	AVG	
11		29.9540	19.83	10.31	30.14	60.00	-29.86	QP	
12		29.9540	17.53	10.31	27.84	50.00	-22.16	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WZZ



Site Conduction #2 Phase: N Temperature: 23.7

Limit: (CE)CISPR 11 class B_QP Power: AC 220V/50Hz DC48V Humidity: 41 %

Mode: charging

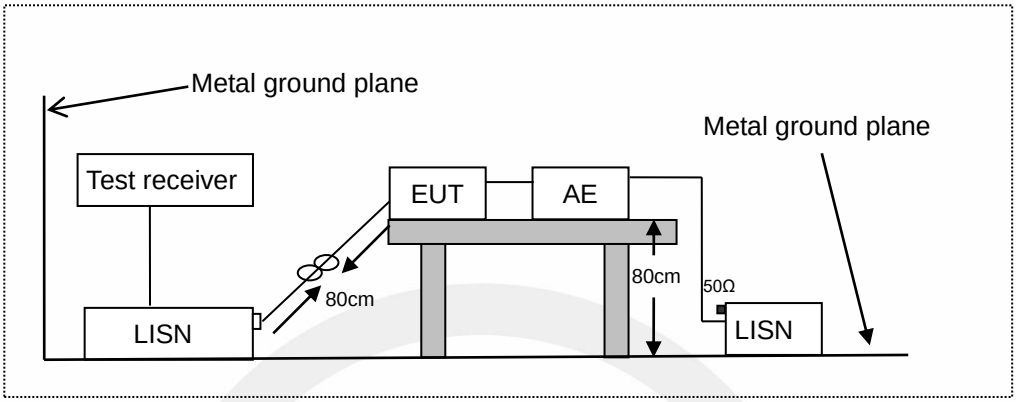
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.1620	40.06	9.90	49.96	65.36	-15.40	QP	
2		0.1620	32.40	9.90	42.30	55.36	-13.06	AVG	
3		0.1900	35.54	9.90	45.44	64.04	-18.60	QP	
4		0.1900	32.09	9.90	41.99	54.04	-12.05	AVG	
5		3.6700	32.26	9.94	42.20	56.00	-13.80	QP	
6	*	3.6700	29.40	9.94	39.34	46.00	-6.66	AVG	
7		5.0980	29.82	9.95	39.77	60.00	-20.23	QP	
8		5.0980	29.37	9.95	39.32	50.00	-10.68	AVG	
9		6.2420	33.32	9.97	43.29	60.00	-16.71	QP	
10		6.2420	32.52	9.97	42.49	50.00	-7.51	AVG	
11		14.2420	28.68	10.04	38.72	60.00	-21.28	QP	
12		14.2420	26.98	10.04	37.02	50.00	-12.98	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WZZ

5. VOLTAGE DISTORTION IN DIFFERENTIAL MODE MEASUREMENT

5.1. Block Diagram of Test Setup



LISN: Artificial Mains Network
AE: Associated equipment
EUT: Equipment under test

5.2. Measuring Standard

IEC 61000-2-2:2002+A1:2017+A2:2018

5.3. Voltage Distortion in Differential mode Limits

Compatibility levels for voltage distortionin differential mode from 30 kHz to 150 kHz[a]

Frequency range kHz	Compatibility levels dB(μV)
30 to 50[b] 50[b] to 150	122 to 119[c] 113 to 89[c]
a For EMC coordination in the setting of emission limits for unsymmetrical voltage distortion, see 4.12.1. b At the transition frequency, the lower level applies. c The level decreases linearly with the logarithm of the frequency in the ranges 30 kHz to 50 kHz and 50 kHz to 150 kHz.	

5.4. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and connected to the AC mains through Line Impedance Stability Network (L.I.S.N).
This provided 50ohm-coupling impedance for the tested equipments. Both sides of AC line are investigated to find out the maximum conducted emission according to the IEC 61000-2-2 regulations during conducted emission measurement.
The bandwidth of the field strength meter (R&S Test Receiver ESCI) is set at 200Hz in 30kHz~150kHz.

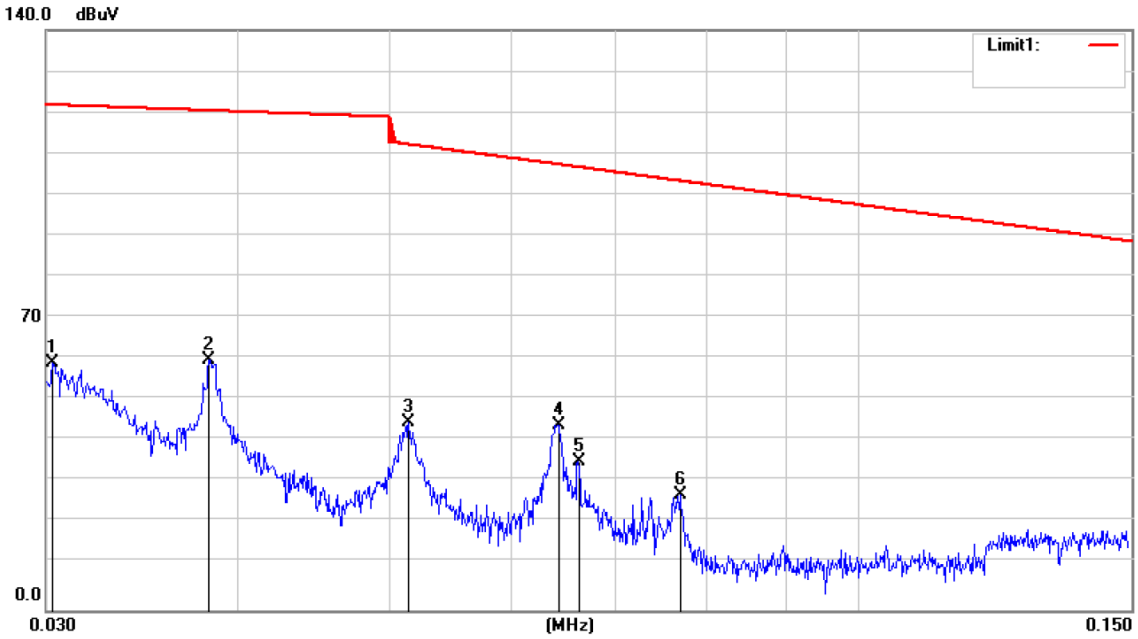
The frequency range from 30kHz to 150kHz is investigated.

Test results were obtained from the following equation:
Emission Level (dBμV) = AMN Factor (dB) + Cable Loss (dB) + Reading (dBμV)
Margin (dB) = Emission Level (dBμV) - Limit (dBμV)

5.5. Measuring Results

PASS.

All the modes were tested and the data of the worst modes are attached the following pages.



Site Conduction #2 Phase: *L1* Temperature: 25.0

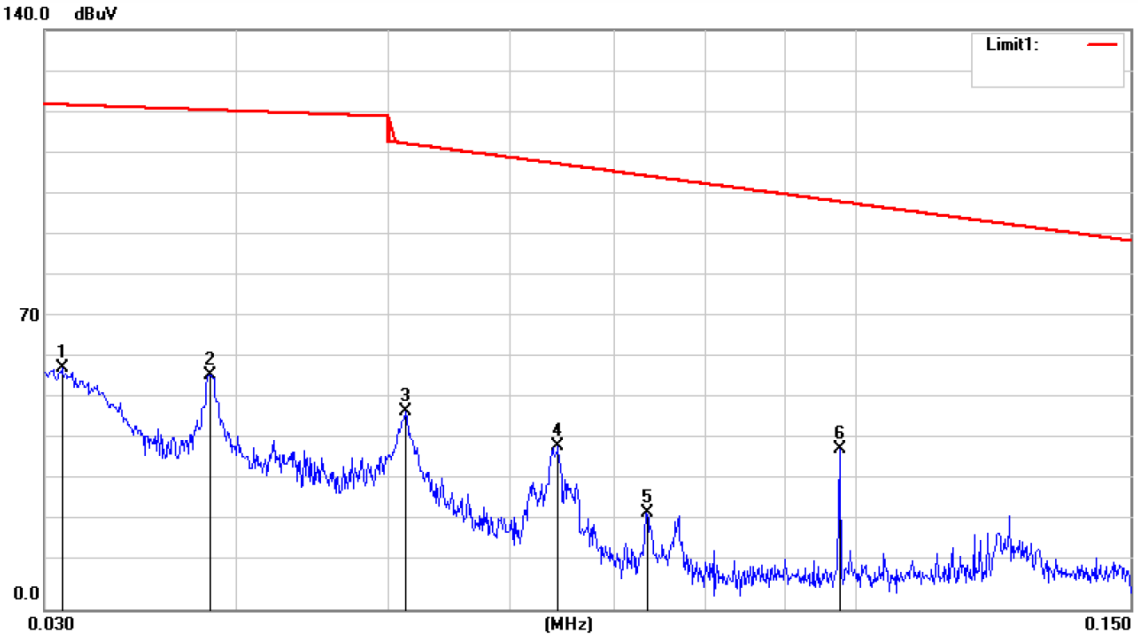
Limit: IEC61000-2-2(30k-150k) Power: AC 230V/50Hz Bat 48V Humidity: 49 %

Mode: Charging

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.0303	49.25	10.47	59.72	121.94	-62.22	QP	
2	*	0.0382	50.07	10.40	60.47	120.58	-60.11	QP	
3		0.0514	34.90	10.26	45.16	112.40	-67.24	QP	
4		0.0642	34.36	10.30	44.66	107.54	-62.88	QP	
5		0.0661	25.75	10.28	36.03	106.90	-70.87	QP	
6		0.0768	17.60	10.29	27.89	103.62	-75.73	QP	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator:



Site Conduction #2 Phase: N Temperature: 25.0

Limit: IEC61000-2-2(30k-150k) Power: AC 230V/50Hz Bat 48V Humidity: 49 %

Mode: Charging

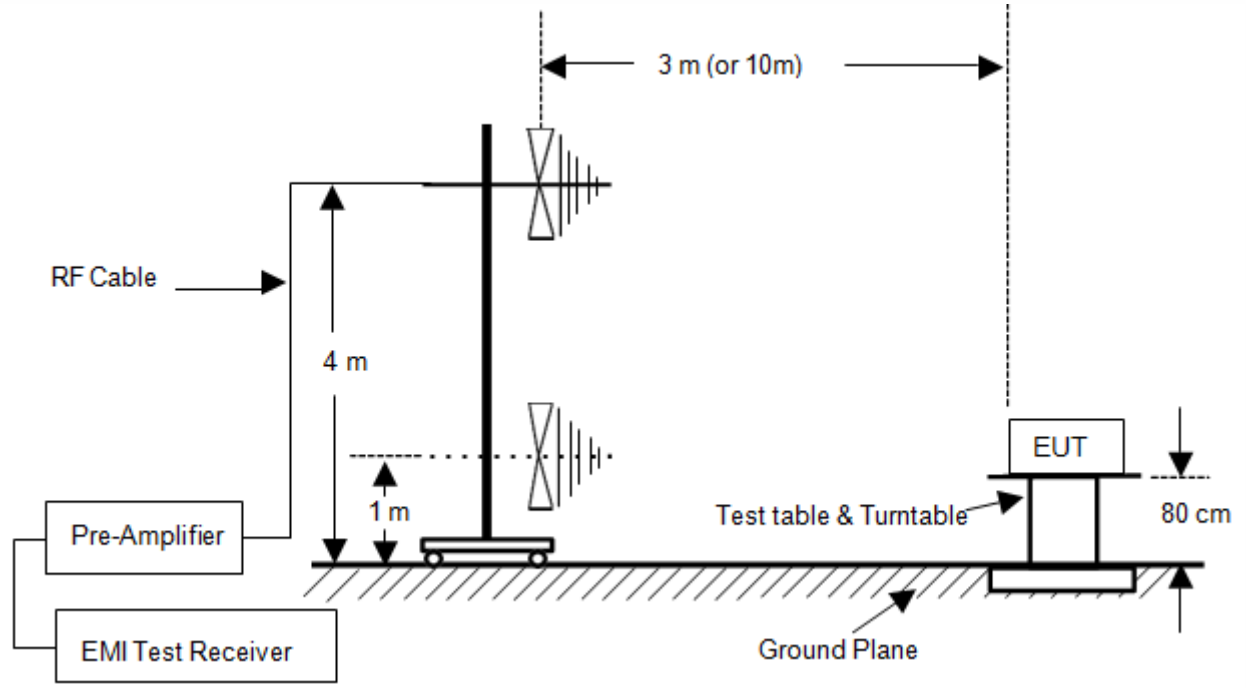
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.0308	47.74	10.46	58.20	121.85	-63.65	QP	
2		0.0383	46.19	10.40	56.59	120.57	-63.98	QP	
3		0.0512	37.65	10.26	47.91	112.48	-64.57	QP	
4		0.0642	29.01	10.30	39.31	107.54	-68.23	QP	
5		0.0733	12.88	10.26	23.14	104.64	-81.50	QP	
6	*	0.0976	28.45	10.28	38.73	98.39	-59.66	QP	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator:

6. RADIATED EMISSION MEASUREMENT (UP TO 1GHz)

6.1. Block Diagram of Test Setup



6.2. Measuring Standard

SANS 211/CISPR 11

6.3. Radiated Emission Limits (Group 1 Class B)

All emanations from a Group 1 Class B device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified below:

FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMIT (dBμV/m)
30 ~ 230	10	30
230 ~ 1000	10	37

Note: (1) The smaller limit shall apply at the combination point between two frequency bands.
(2)Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT.
(3) Intended to be permanently installed in X-ray shielded locations, an increase in the electromagnetic radiation disturbance limits of 12 dB for tests conducted on a test site is allowed.

6.4. Test Procedure

The EUT is placed on a turntable, which is 0.8 meter high above the ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 10 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Bilog antenna (calibrated by Dipole Antenna) is used as a receiving antenna. Both horizontal and vertical polarization of the antenna is set on test.

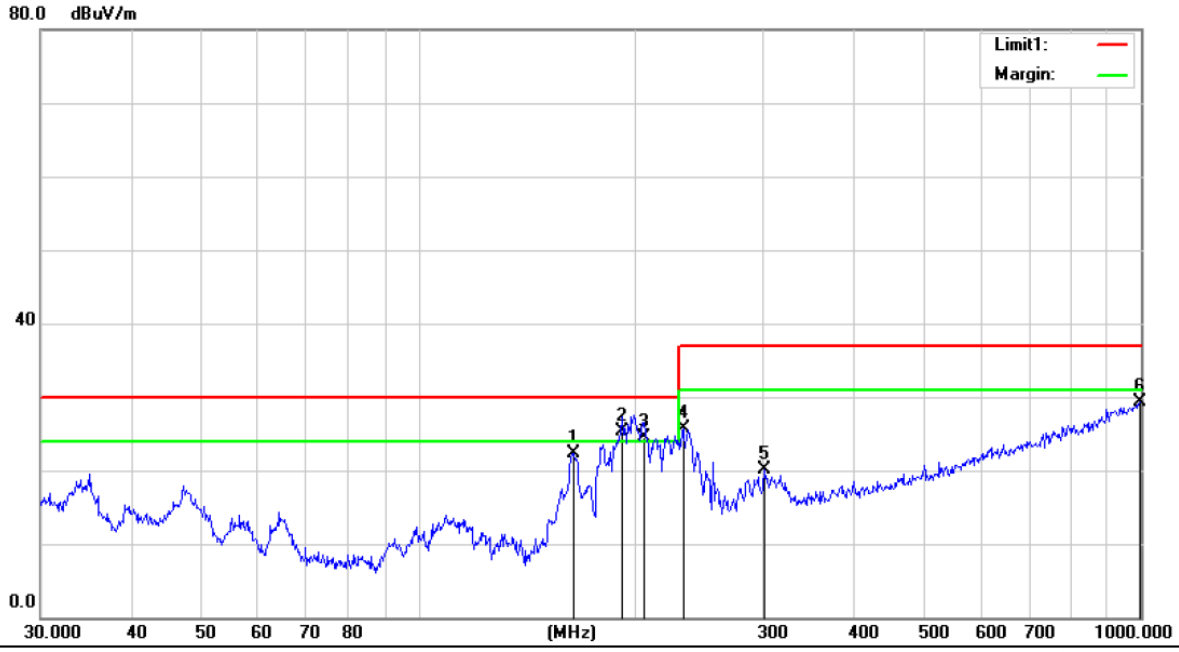
The bandwidth of the Receiver is set at 120kHz.

Test results were obtained from the following equation:
Emission level (dBμV/m) = Antenna Factor -Amp Factor +Cable Loss + Reading
Margin (dB) = Emission Level (dBμV/m) - Limit (dBμV/m).

6.5. Measuring Results

PASS.

All the modes were tested and the data of the worst modes are attached the following pages



Site 10m Chamber 1# Polarization: *Horizontal* Temperature: 26

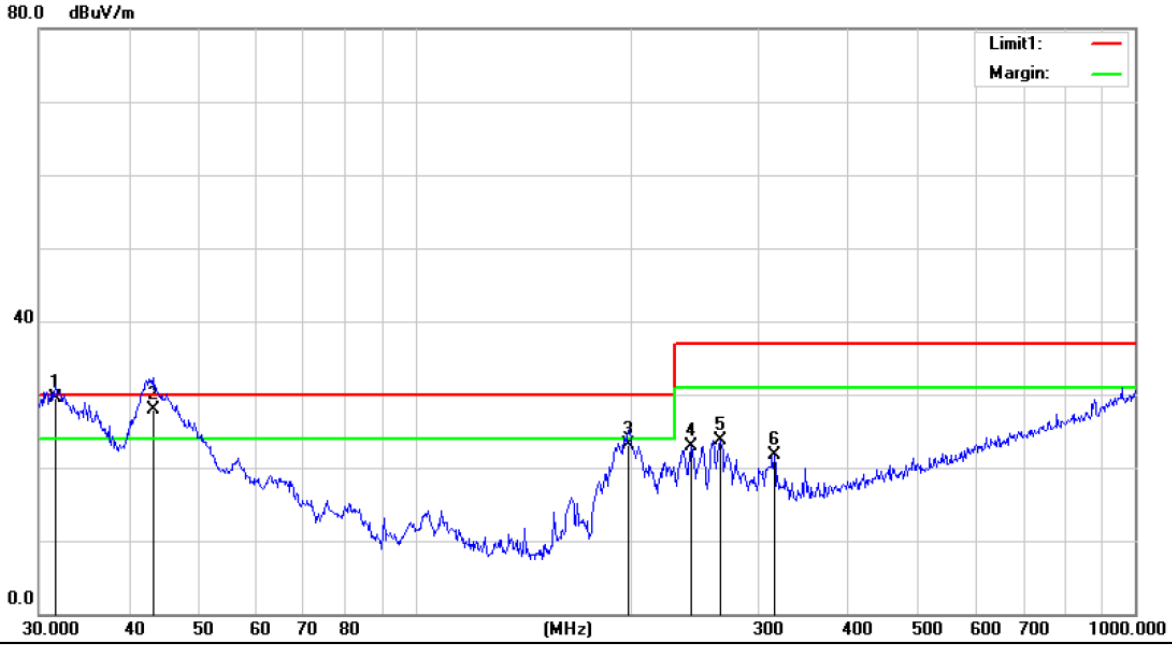
Limit: (RE10M)CISPR 11 Class B Power: AC 220V/50Hz DC48V Humidity: 60 %

Mode:Charging

Note:

No.	Mk.	Freq.	Reading Level	Ant. Factor	Pre Amp Gain	Cable loss	Measure-ment	Limit	Over		HI	Degree	
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	Detector	cm	deg.	Comment
1		164.3301	55.74	8.37	43.28	1.56	22.39	30.00	-7.61	QP	399	134	
2	*	191.7450	56.55	10.38	43.14	1.51	25.30	30.00	-4.70	QP	399	153	
3	!	205.6751	54.97	11.09	43.07	1.51	24.50	30.00	-5.50	QP	399	295	
4		232.5318	55.19	12	42.94	1.55	25.80	37.00	-11.20	QP	399	174	
5		301.4224	46.85	13.49	42.6	2.37	20.11	37.00	-16.89	QP	198	121	
6		996.4996	38.00	23.97	39.72	7.06	29.31	37.00	-7.69	QP	198	151	

*:Maximum data x:Over limit !:over margin Operator: CSL



Site 10m Chamber 1# Polarization: *Vertical* Temperature: 26

Limit: (RE10M)CISPR 11 Class B Power: AC 220V/50Hz DC48V Humidity: 60 %

Mode:Charging

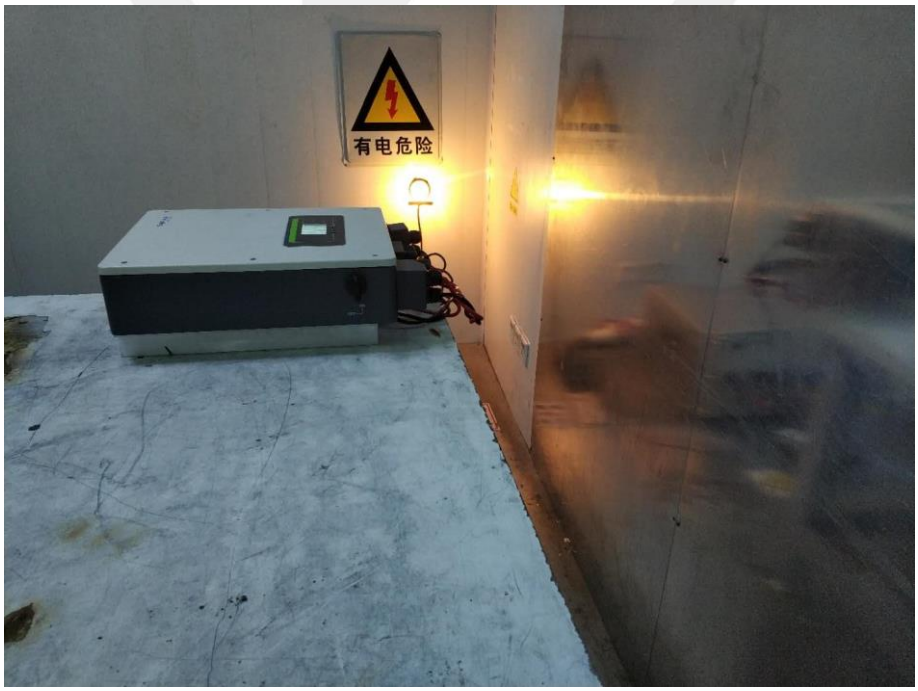
Note:

No.	Mk.	Freq.	Reading Level	Ant. Factor	Pre Amp Gain	Cable loss	Measure-ment	Limit	Over		HI	Degree	
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	Detector	cm	deg.	Comment
1	*	31.6202	60.68	10.84	43.02	1	29.50	30.00	-0.50	QP	199	22	
2	!	43.2017	56.32	13.62	43.08	1.04	27.90	30.00	-2.10	QP	299	359	
3		197.8928	52.87	11.03	43.2	2.4	23.10	30.00	-6.90	QP	100	99	
4		241.6763	50.83	12.4	43.12	2.8	22.91	37.00	-14.09	QP	100	118	
5		265.6757	50.52	12.99	43.07	3.27	23.71	37.00	-13.29	QP	100	204	
6		315.4808	46.36	13.75	42.94	4.44	21.61	37.00	-15.39	QP	100	206	

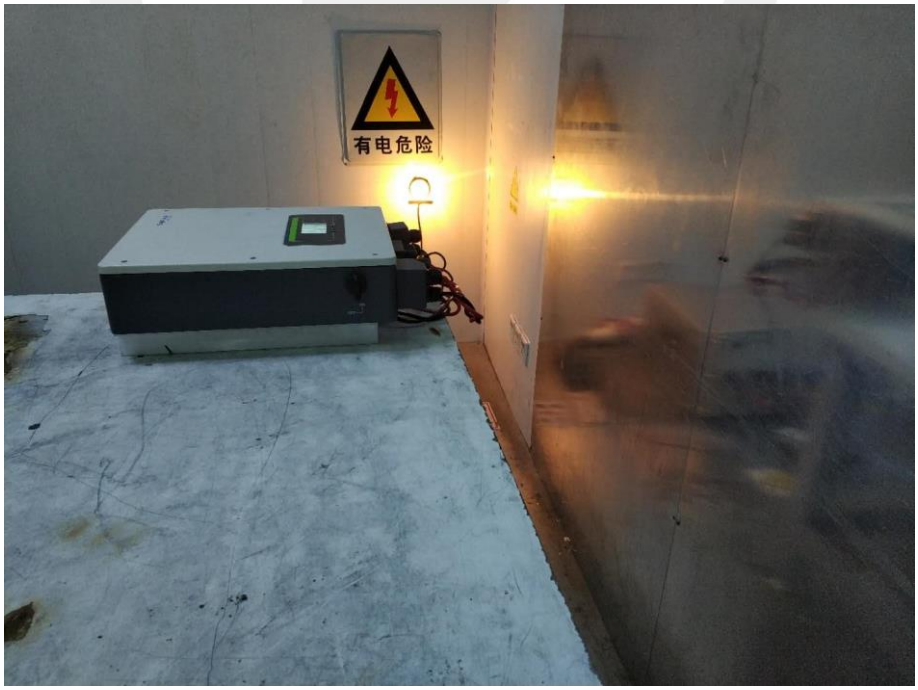
*:Maximum data x:Over limit !:over margin Operator: CSL

7. PHOTOGRAPHS

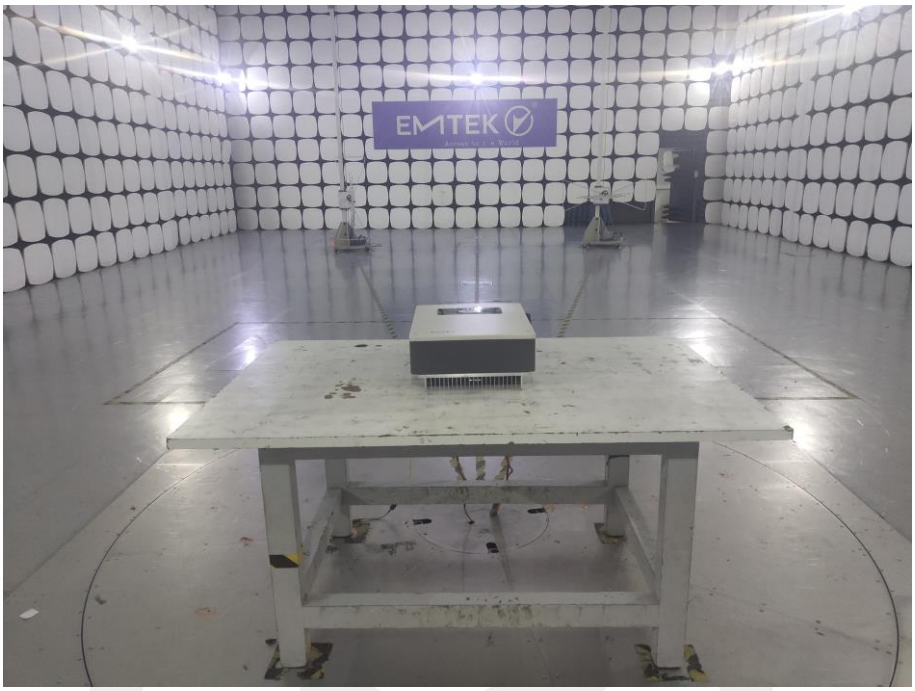
7.1. Photos of Conducted Emission Measurement

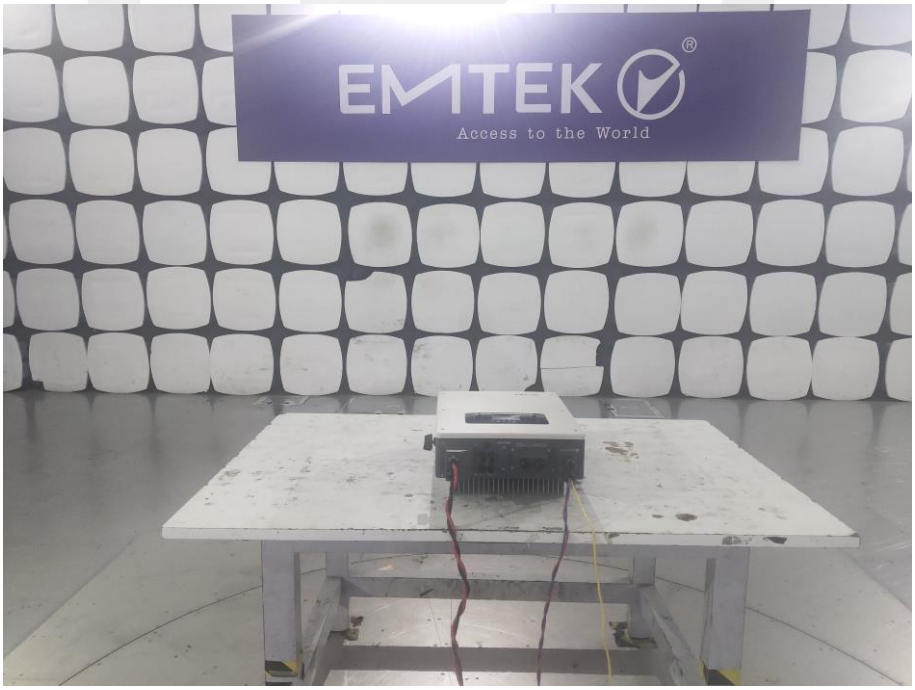


7.2. Photos of Voltage Distortion in Differential mode Measurement



7.3. Photos of Radiation Emission Measurement





----------The end----------