

## TEST REPORT

Report No.:	TR120191001001	Issue Date:	Page 1 of 14 01/10/19
Issued To:	SYSTEM LEVEL SOLUTIONS (INDIA) PVT. LTD. PLOT NO. 32, ZONE D-4 PHASE 1, G.I.D.C. ESTATE, VITHAL UDYOGNAGAR - 388121, ANAND, GUJARAT		
Test item:	Solar On Grid Inverter, 1.5kW Capacity, Brand: System Level Solutions		
Identification:	Model: MSI1500	Serial No.:	Nil
Job Order No.:	BTH-R1/EE/190924/1	Date of receipt:	24/09/19
Date(s) of performance of tests:	Date of Starting: 24/09/19	Date of Completion:	25/09/19
Testing laboratory and its address:	BHARAT TEST HOUSE PVT. LTD. 1474, HSIIDC Indl. Estate, Rai, Distt. Sonapat-131001 Haryana.		
Test specification:	IEC 61000-6-1: 2016, IEC 61000-6-2: 2016, IEC 61000-6-3: 2011, IEC 61000-6-4: 2018		
Test Result:	The test item passed the test specification(s).		
Abbreviations:	SAC: Semi Anechoic Chamber, IEC: International Electrotechnical Commission, GRP: Ground Reference Plane, EUT: Equipment Under Test, AE: Auxiliary Equipment, CDN: Coupling/Decoupling Network, SPD: Surge Protection Device, NA: Not Applicable		
Remark:	- Nil		
This test report relates to the test sample submitted			
Tested by:	Issued by:		
B. Rekhanadh.			
B. Rekhanadh (Testing Engineer)	Ravinder Kumar Anandh (Quality Head)		
Date: 01/10/19	Date: 01/10/19		



**INDEX**

LIST OF INSTRUMENTS USED IN TESTING.....	3
LAB LOCATION AND FACILITY:.....	3
1. SUMMARY OF TEST RESULTS .....	4
1.1 PERFORMANCE CRITERIA DURING IMMUNITY TEST:.....	4
2 FACILITY ENVIRONMENTAL CONDITIONS: .....	4
3. TEST RESULTS & DESCRIPTION .....	5
3.1 RADIATED EMISSION TEST .....	5
3.1.1 Block Diagram of Test Setup: .....	5
3.1.2 Test Standard: .....	5
3.1.3 Test Parameters: .....	5
3.1.4 Test Procedure: .....	5
3.1.5 Observations: .....	5
3.1.6 Result: .....	5
3.2 RADIATED EMISSION TEST .....	6
3.2.1 Block Diagram of Test Setup: .....	6
3.2.2 Test Standard: .....	6
3.2.3 Test Parameters: .....	6
3.2.4 Test Procedure: .....	6
3.2.5 Observations: .....	6
3.2.6 Result: .....	6
3.3 HARMONIC CURRENT EMISSION TEST: .....	7
3.3.1 Block Diagram of Set up: .....	7
3.3.2 Test Standard: .....	7
3.3.3 Test Specifications: .....	7
3.3.4 Observations: .....	7
3.3.5 Result: .....	8
3.4 SURGE IMMUNITY TEST .....	9
3.4.1 Block Diagram of Test Setup: .....	9
3.4.2 Test Standard: .....	9
3.4.3 Test Specifications:.....	9
3.4.4 Test Parameters: .....	9
3.4.5 Observations: .....	9
3.4.6 Result: .....	9
ANNEXURE 'A' .....	10
RADIATED EMISSION TEST GRAPHS .....	10
ANNEXURE 'B' .....	12
RADIATED EMISSION TEST GRAPHS .....	12
EUT PHOTOGRAPHS .....	14

**BHARAT TEST HOUSE PVT. LTD.**

1474, HSIIDC Industrial Estate, Raj, Distt-Sonepat, Haryana-131001  
Tel: 0130-2367673, 2974472 | email: bthraj@bharatstesthouse.com



(1) The above results are related only to the Tests/Calibration performed on the product received. Endorsement of product is neither implied nor implied. (2) This report is not to be reproduced wholly or in part & forbidden to be used as an evidence in the court law & ought not to be used in any advertising media without our special permission in writing. (3) Samples will be destroyed after 15 & 30 days from the date of reporting unless otherwise specified. (4) Total liability of our Test House is limited to the invoice amount. (5) Report refers to the product received by Bharat Test House Pvt. Ltd. Unless mentioned otherwise.

**ISO 9001:2008, ISO 14001:2004 & OHSAS 18001 CERTIFIED LAB**



**LIST OF INSTRUMENTS USED IN TESTING**

Sl. No.	Name of Instrument	Make	Model No.	Range & L.C
1.	Semi Anechoic Chamber	Rainford	SAC-3M	26MHz - 40GHz
2.	Turn Table	Maturo	TT 2.0 SI	0° - 400° Deg
3.	Antenna Mast	Maturo	CAM 4.0-P	1.0M - 4.0M
4.	EMI Test Receiver	Keysight	N9038A	3Hz -26.5GHz
5.	Tri-log Antenna	Schwarzbeck	VULB9160	25MHz - 1.8GHz
6.	Active Double Ridged Horn Antenna	Com-Power	AHA-118	1GHz - 18GHz
7.	Pre-Amplifier	Frankonia	FPA-6A	10MHz - 6GHz
8.	Power Quality Analyzer	HIOKI	PQ3198	Voltage rating: 6000Vrms Current rating: 0 – 600A AC
9.	Combined Disturbance Simulator	Prima	PRM61245A	ESD: ± 0.2kV to ± 20kV EFT: ± 0.2kV to ± 4.8kV Surge: ± 0.2kV to ± 6kV

**LAB LOCATION AND FACILITY:**

- Bharat Test House Private Limited is situated at Plot no. 1474 & 1668, HSIIDC Industrial Estate, Rai, Distt.Sonapat, Haryana - 131001.
- EMI/EMC Testing Laboratory of BTHPL has various tests facilities for Emission measurements and Compliance tests. Provision of Pre-compliance R&D facility is also been facilitated.


**BHARAT TEST HOUSE PVT. LTD.**

 1474, HSIIDC Industrial Estate, Rai, Distt-Sonepat, Haryana-131001  
 Tel: 0130-2367673, 2974474 | email: bthrai@bharatstesthouse.com

(1) The above results are related only to the Tests/Calibration performed on the product received. Endorsement of product is neither inferred nor implied. (2) This report is not to be reproduced wholly or in part & forbidden to be used as an evidence in the court law & ought not to be used in any advertising media without our special permission in writing. (3) Samples will be destroyed after 15 & 30 days from the date of reporting unless otherwise specified. (4) Total liability of our Test House is limited to the invoice amount. (5) Report refers to the product received by Bharat Test House Pvt. Ltd. Unless mentioned otherwise.

**ISO 9001:2008, ISO 14001:2004 & OHSAS 18001 CERTIFIED LAB**



**1. SUMMARY OF TEST RESULTS**

S. No.	TEST DESCRIPTION	RESULTS	PERFORMANCE CRITERIA DURING IMMUNITY TEST
1.	Radiated Emission (IEC 61000-6-3: 2011)	PASS	-
2.	Radiated Emission (IEC 61000-6-4: 2018)	PASS	-
3.	Harmonic Current Emission	PASS	-
4.	Surge Immunity	PASS	B

**1.1 PERFORMANCE CRITERIA DURING IMMUNITY TEST:**

- Performance Criterion 'A':** The equipment shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended.
- Performance Criterion 'B':** The equipment shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed.
- Performance Criterion 'C':** Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.

**2 FACILITY ENVIRONMENTAL CONDITIONS:**

The test site was observed at the following ambient environmental conditions during the test:

Ambient Temperature: 25.3°C

Relative Humidity: 68%

Barometric Pressure: 108kPa

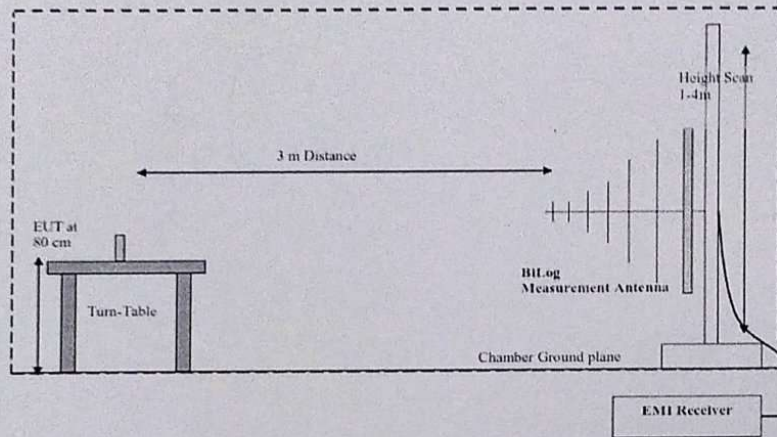




**3. TEST RESULTS & DESCRIPTION**

**3.1 RADIATED EMISSION TEST**

**3.1.1 Block Diagram of Test Setup:**



**3.1.2 Test Standard:**

- IEC 61000-6-3: 2011

**3.1.3 Test Parameters:**

Limits for Emissions – Enclosure port at a Measuring Distance of 3 Meter (30MHz - 6GHz) as per IEC 61000-6-3: 2011

Frequency Range (MHz)	Limits (dB $\mu$ V/m)		
	Quasi-Peak	Average	Peak
30 to 230	40	NA	NA
230 to 1000	47	NA	NA
1000 to 3000	NA	50	70
3000 to 6000	NA	54	74

**3.1.4 Test Procedure:**

The test setup for radiated disturbance followed the guidelines of CISPR 16-2-3. The EUT was placed on a 1m by 1.5m non-conductive table 0.8m above the ground plane and centred on the turntable. The measurement was conducted in the frequency range of 30MHz to 6 GHz. The measurements of the radiated field were made with the antenna located at a distance of 3 meters from the EUT. An inverse proportionality factor of 20 dB per decade was used to normalize the measured data to the specified distance for determining compliance. The antenna is adjusted between 1m and 4m in height above the ground plane and also EUT should be turn around 0° to 360° for maximum meter reading at each test frequency. The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

**3.1.5 Observations:**

- Complies with the 'Emission - Enclosure Port' equipment limits of IEC 61000-6-3: 2011. Kindly refer to ANNEXURE 'A' for graphs and observation table for the maximum observed emission peaks.

**3.1.6 Result:**

- PASS

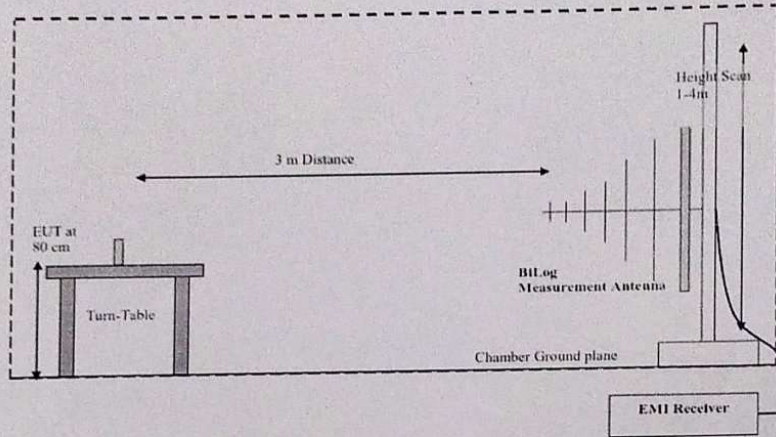




Report No. TR120191001001

**3.2 RADIATED EMISSION TEST**

**3.2.1 Block Diagram of Test Setup:**



**3.2.2 Test Standard:**

- IEC 61000-6-4: 2018

**3.2.3 Test Parameters:**

Limits for Radiated Emissions – Enclosure port at a Measuring Distance of 3 Meter (30MHz - 6GHz) as per IEC 61000-6-4: 2018

Frequency Range (MHz)	Limits (dBµV/m)		
	Quasi-Peak	Average	Peak
30 to 230	50	NA	NA
230 to 1000	57	NA	NA
1000 to 3000	NA	56	76
3000 to 6000	NA	60	80

**3.2.4 Test Procedure:**

The test setup for radiated disturbance followed the guidelines of CISPR 16-2-3. The EUT was placed on a 1m by 1.5m non-conductive table 0.8m above the ground plane and centred on the turntable. The measurement was conducted in the frequency range of 30MHz to 6 GHz. The measurements of the radiated field were made with the antenna located at a distance of 3 meters from the EUT. An inverse proportionality factor of 20 dB per decade was used to normalize the measured data to the specified distance for determining compliance. The antenna is adjusted between 1m and 4m in height above the ground plane and also EUT should be turn around 0° to 360° for maximum meter reading at each test frequency. The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

**3.2.5 Observations:**

- Complies with the 'Radiated Emission – Enclosure Port' equipment limits of IEC 61000-6-4: 2018. Kindly refer to ANNEXURE 'B' for graphs and observation table for the maximum observed emission peaks.

**3.2.6 Result:**

- PASS



**BHARAT TEST HOUSE PVT. LTD.**

1474, HSIIDC Industrial Estate, Rai, Distt-Sonepat, Haryana-131001  
Tel: 0130-2367673, 2974474 | email: bthrai@bharatstesthouse.com

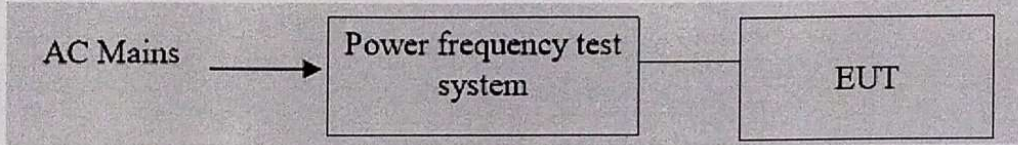
(1) The above results are related only to the Tests/Calibration performed on the product received. Endorsement of product is neither inferred nor implied. (2) This report is not to be reproduced wholly or in part & forbidden to be used as an evidence in the court law & ought not to be used in any advertising media without our special permission in writing. (3) Samples will be destroyed after 15 & 30 days from the date of reporting unless otherwise specified. (4) Total liability of our Test House is limited to the invoice amount. (5) Report refers to the product received by Bharat Test House Pvt. Ltd. Unless mentioned otherwise.

**ISO 9001:2008, ISO 14001:2004 & OHSAS 18001 CERTIFIED LAB**



**3.3 HARMONIC CURRENT EMISSION TEST:**

**3.3.1 Block Diagram of Set up:**



**3.3.2 Test Standard:**

- IEC 61000-6-3: 2011 (Protocol followed as per IEC 61000-3-2: 2014)

**3.3.3 Test Specifications:**

**Limits of 'Class A' Equipment**

Harmonic order (n)	Maximum permissible harmonic current (A)
<b>Odd harmonics</b>	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \leq n \leq 39$	$0.15 \ 15/n$
<b>Even Harmonics</b>	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23 \ 8/n$

**3.3.4 Observations:**

Harmonic order (n)	Observed Harmonic Current (A)
<b>Odd Harmonics</b>	
3	1.91
5	0.84
7	0.49
9	0.33
11	0.29
13	0.15
15	0.06
17	0.05
19	0.02
21	0.072
23	0.046
25	0.034
27	0.060





29	0.025
31	0.055
33	0.041
35	0.055
37	0.061
39	0.043
Even Harmonics	
2	0.91
4	0.35
6	0.22
8	0.16
10	0.15
12	0.06
14	0.09
16	0.052
18	0.08
20	0.021
22	0.045
24	0.065
26	0.052
28	0.03
30	0.028
32	0.02
34	0.041
36	0.04
38	0.018
40	0.025

- Complies with 'Class A' limits of IEC 61000-3-2: 2018.

**3.3.5 Result:**

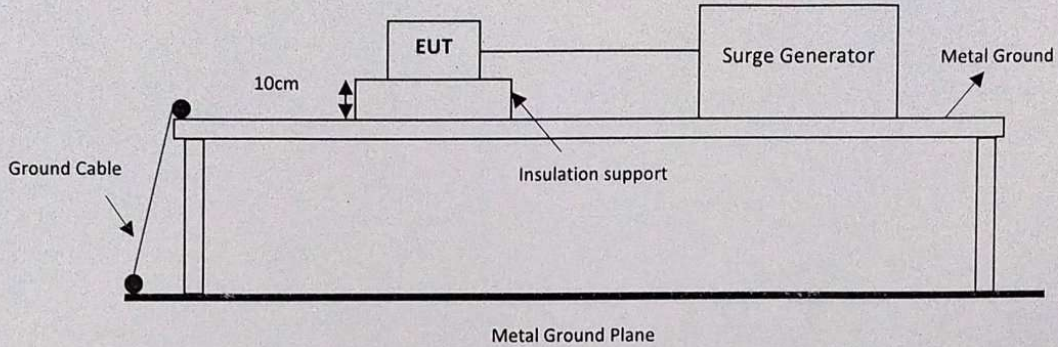
- PASS





### 3.4 SURGE IMMUNITY TEST

#### 3.4.1 Block Diagram of Test Setup:



#### 3.4.2 Test Standard:

- IEC 61000-6-1: 2016
- IEC 61000-6-2: 2016

#### 3.4.3 Test Specifications:

Test Severity:  $\pm 2kV \pm 10\%$  in Common Mode &  $\pm 1kV \pm 10\%$  Differential Mode  
 Output impedance:  $2\Omega \pm 10\%$  for Line-Line (Differential Mode)  
 Output impedance:  $12\Omega \pm 10\%$  for Line-Earth & Neutral-Earth (Common Mode)  
 Open circuit voltage wave shape: 1.2/50 $\mu s$   
 Closed circuit current wave shape: 8/20 $\mu s$   
 Repetition Rate: 1 per minute

#### 3.4.4 Test Parameters:

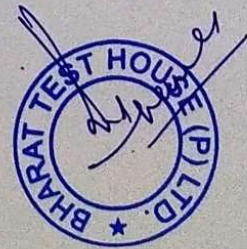
Test Level	Open circuit peak Voltage Level (kV)	No. of Pulses	Mode	Port
1	$\pm 0.5kV$	5 on each polarity	Common (L-G)	DC (Input Port) & AC (Input & Output port)
1	$\pm 0.5kV$	5 on each polarity	Common (N-G)	DC (Input Port) & AC (Input & Output port)
2	$\pm 0.5kV$	5 on each polarity	Differential (L-L)	DC (Input Port) & AC (Input & Output port)
2	$\pm 1kV$	5 on each polarity	Common (L-G)	DC (Input Port) & AC (Input & Output port)
2	$\pm 1kV$	5 on each polarity	Common (N-G)	DC (Input Port) & AC (Input & Output port)
3	$\pm 1kV$	5 on each polarity	Differential (L-L)	AC (Input & Output port)
3	$\pm 2kV$	5 on each polarity	Common (L-G)	AC (Input & Output port)
3	$\pm 2kV$	5 on each polarity	Common (N-G)	AC (Input & Output port)

#### 3.4.5 Observations:

- All the configurations of the above test levels were observed to be under Performance Criterion 'B'.

#### 3.4.6 Result:

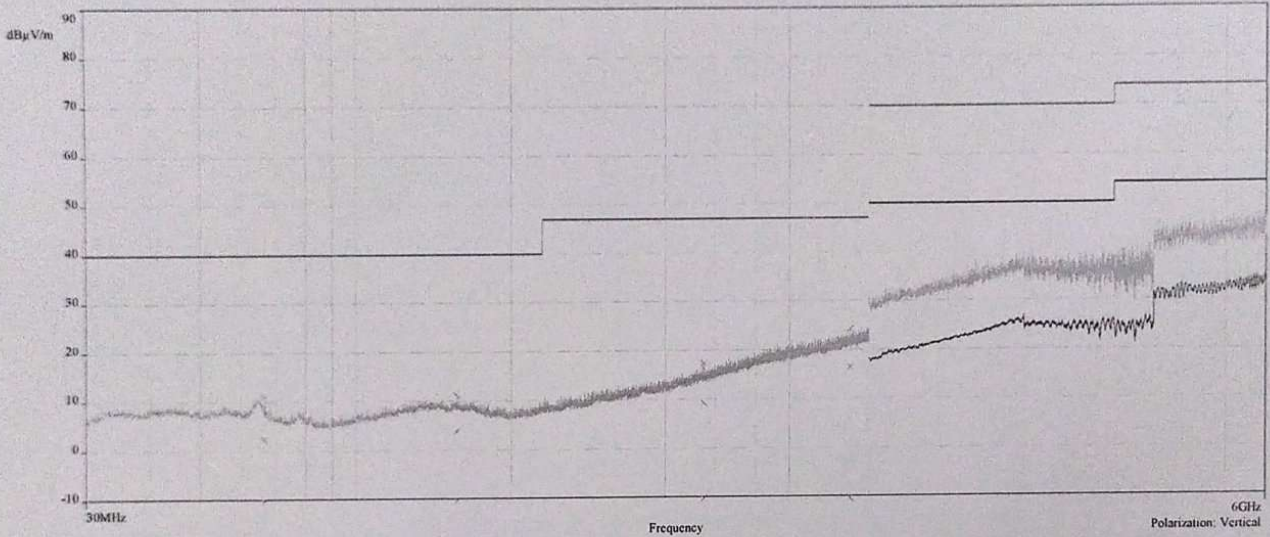
- PASS





**ANNEXURE 'A'**  
**RADIATED EMISSION TEST GRAPHS**

Case I:-  
Configuration: Vertical Polarization



Sl. No.:	Frequency	Quasi-Peak Result	Peak Result	Correction Factor	Limit	Over Limit	Angle	Remarks
	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dB)	(°deg)	
1.	66.6	2.29	NA	-16.25	40.00	-37.71	262.90	PASS
2.	157.0	3.86	NA	-14.49	40.00	-36.14	8.10	PASS
3.	476.2	9.27	NA	-8.93	47.00	-37.73	73.70	PASS
4.	918.0	16.44	NA	-1.23	47.00	-30.56	104.20	PASS
5.	1614.0	NA	37.80	9.83	70.00	-32.2	8.10	PASS
6.	3684.0	NA	45.58	10.26	74.00	-28.42	0.10	PASS

Note: Observe Quasi-Peak & Peak results to verify with the relevant limits as mentioned in section 3.1.3.



**BHARAT TEST HOUSE PVT. LTD.**

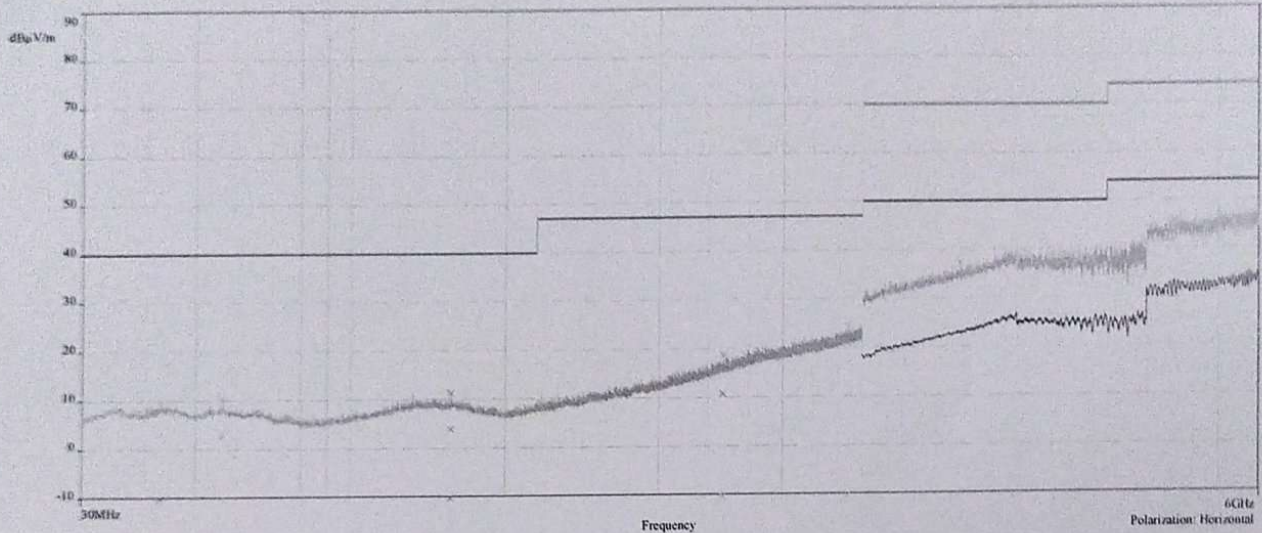
1474, HSIIDC Industrial Estate, Rai, Distt-Sonepat, Haryana-131001  
Tel: 0130-2367673, 2974474 | email: bthrai@bharatstesthouse.com

(1) The above results are related only to the Tests/Calibration performed on the product received. Endorsement of product is neither inferred nor implied. (2) This report is not to be reproduced wholly or in part & forbidden to be used as an evidence in the court law & ought not to be used in any advertising media without our special permission in writing. (3) Samples will be destroyed after 15 & 30 days from the date of reporting unless otherwise specified. (4) Total liability of our Test House is limited to the invoice amount. (5) Report refers to the product received by Bharat Test House Pvt. Ltd. Unless mentioned otherwise.

**ISO 9001:2008, ISO 14001:2004 & OHSAS 18001 CERTIFIED LAB**



**Case II:-**  
**Configuration: Horizontal Polarization**



Sl. No.:	Frequency	Quasi-Peak Result	Peak Result	Correction Factor	Limit	Over Limit	Angle	Remarks
	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dB)	(°deg)	
1.	42.837703	2.99	NA	-15.16	40.00	-37.01	16.50	PASS
2.	56.644636	2.84	NA	-15.35	40.00	-37.16	88.90	PASS
3.	156.48105	3.92	NA	-14.48	40.00	-36.08	5.40	PASS
4.	534.663995	10.82	NA	-7.30	47.00	-36.18	108.70	PASS
5.	938.156539	16.62	NA	-0.94	47.00	-30.38	3.90	PASS
6.	1552	NA	37.39	9.83	70.00	-32.21	89.10	PASS
7.	4150	NA	46.50	10.26	74.00	-27.5	0.80	PASS

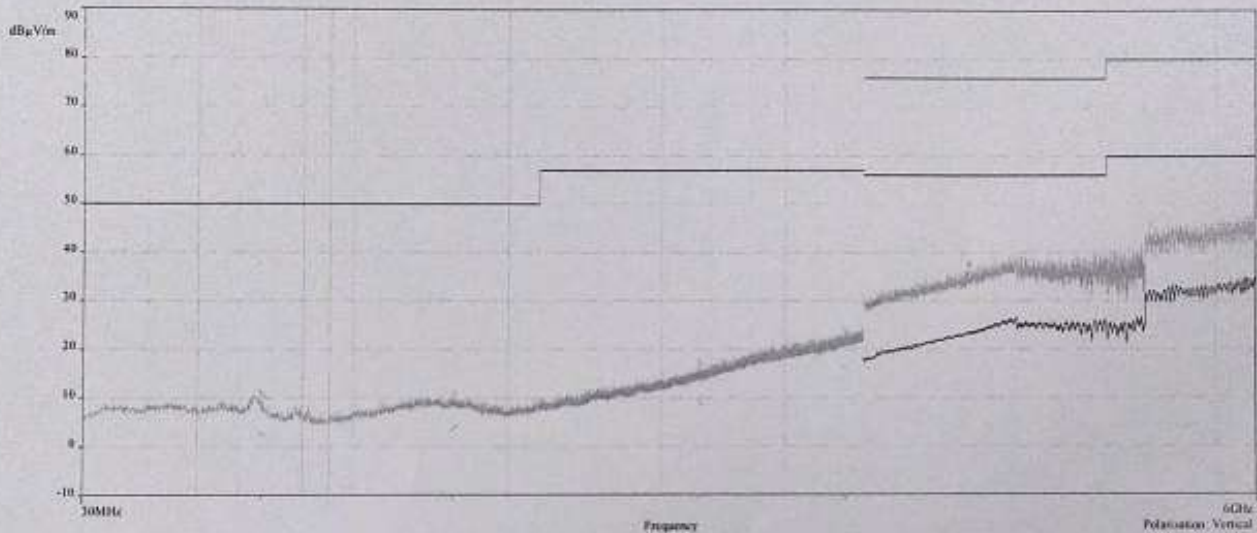
Note: Observe Quasi-Peak & Peak results to verify with the relevant limits as mentioned in section 3.1.3.





**ANNEXURE 'B'**  
**RADIATED EMISSION TEST GRAPHS**

Case I:-  
Configuration: Vertical Polarization



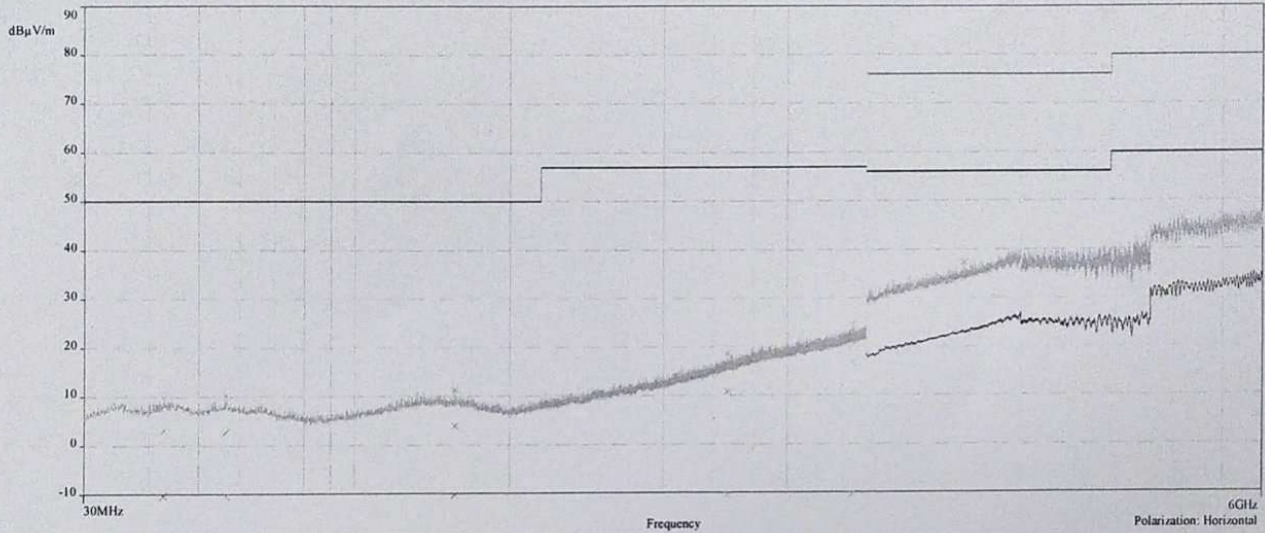
Sl. No.:	Frequency	Quasi-Peak Result	Peak Result	Correction Factor	Limit	Over Limit	Angle	Remarks
	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dB)	(°deg)	
1.	66.6	2.29	NA	-16.25	50.00	-47.71	262.90	PASS
2.	157.0	3.86	NA	-14.49	50.00	-46.14	8.10	PASS
3.	476.2	9.27	NA	-8.93	57.00	-47.73	73.70	PASS
4.	918.0	16.44	NA	-1.23	57.00	-40.56	104.20	PASS
5.	1614.0	NA	37.80	9.83	76.00	-38.2	8.10	PASS
6.	3684.0	NA	45.58	10.26	80.00	-34.42	0.10	PASS

Note: Observe Quasi-Peak & Peak results to verify with the relevant limits as mentioned in section 3.2.3.





**Case II:-  
Configuration: Horizontal Polarization**



Sl. No.:	Frequency	Quasi-Peak Result	Peak Result	Correction Factor	Limit	Over Limit	Angle	Remarks
	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dB)	(°deg)	
1.	42.837703	2.99	NA	-15.16	50.00	-47.01	16.50	PASS
2.	56.644636	2.84	NA	-15.35	50.00	-47.16	88.90	PASS
3.	156.48105	3.92	NA	-14.48	50.00	-46.08	5.40	PASS
4.	534.663995	10.82	NA	-7.30	57.00	-46.18	108.70	PASS
5.	938.156539	16.62	NA	-0.94	57.00	-40.38	3.90	PASS
6.	1552	NA	37.39	9.83	76.00	-38.21	89.10	PASS
7.	4150	NA	46.50	10.26	80.00	-33.5	0.80	PASS

Note: Observe Quasi-Peak & Peak results to verify with the relevant limits as mentioned in section 3.2.3.



**BHARAT TEST HOUSE PVT. LTD.**

1474, HSIIDC Industrial Estate, Rai, Distt-Sonepat, Haryana-131001  
Tel: 0130-2367673, 2974474 | email: bthrai@bharatstesthouse.com

(1) The above results are related only to the Tests/Calibration performed on the product received. Endorsement of product is neither inferred nor implied. (2) This report is not to be reproduced wholly or in part & forbidden to be used as an evidence in the court law & ought not to be used in any advertising media without our special permission in writing. (3) Samples will be destroyed after 15 & 30 days from the date of reporting unless otherwise specified. (4) Total liability of our Test House is limited to the invoice amount. (5) Report refers to the product received by Bharat Test House Pvt. Ltd. Unless mentioned otherwise.

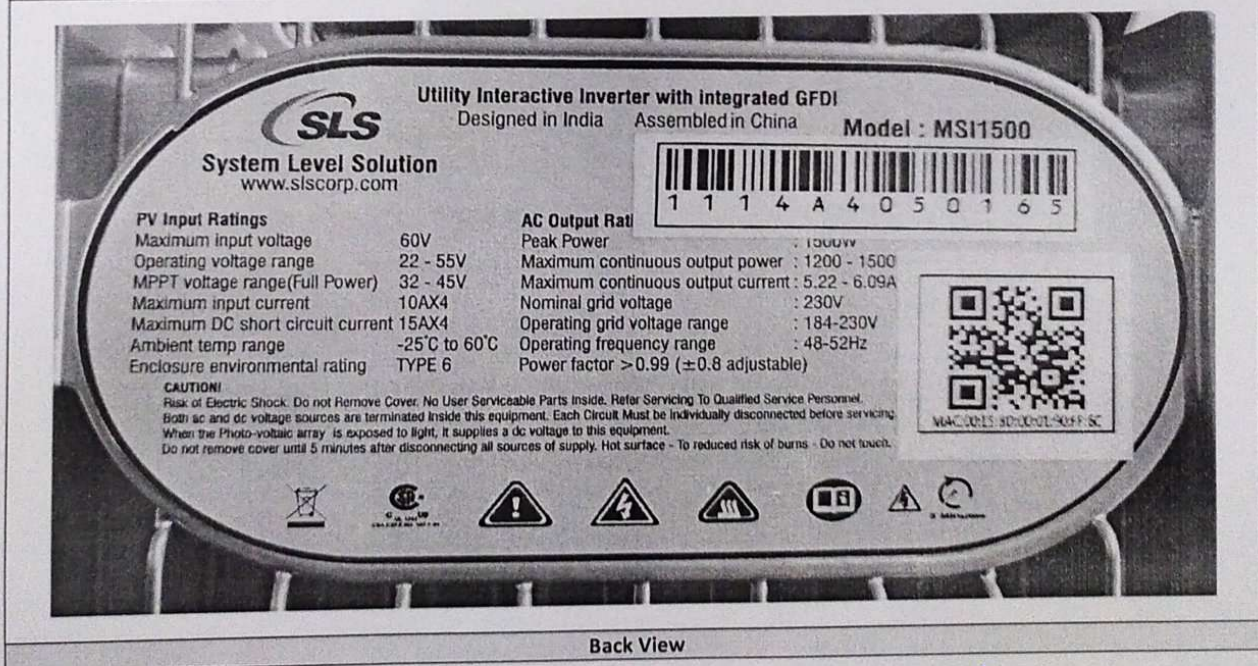
**ISO 9001:2008, ISO 14001:2004 & OHSAS 18001 CERTIFIED LAB**



EUT PHOTOGRAPHS



Top View



Back View



**BHARAT TEST HOUSE PVT. LTD.**

1474, HSIIDC Industrial Estate, Rai, Distt-Sonepat, Haryana-131001  
Tel: 0130-2367673, 2974474 | email: bthrai@bharattesthouse.com

(1)The above results are related only to the Tests/Calibration performed on the product received. Endorsement of product is neither inferred nor implied. (2) This report is not to be reproduced wholly or in part & forbidden to be used as an evidence in the court law & ought not to be used in any advertising media without our special permission in writing. (3) Samples will be destroyed after 15 & 30 days from the date of reporting unless otherwise specified. (4) Total liability of our Test House is limited to the invoice amount. (5) Report refers to the product received by Bharat Test House Pvt. Ltd. Unless mentioned otherwise.

**ISO 9001:2008, ISO 14001:2004 & OHSAS 18001 CERTIFIED LAB**