

# RED-EMC Test Report

Client Name : EcoFlow Inc.  
Address : Plant A202, Founder Technology Industrial Park, Shiyan  
Sub-district, Bao'an District Shenzhen, Guangdong  
518000 China  
Product Name : Portable Power Station  
Date : Jan. 21, 2022

**Shenzhen Anbotek Compliance Laboratory Limited**



# Contents

1. General Information.....	5
1.1. Client Information.....	5
1.2. Description of Device (EUT).....	5
1.3. Auxiliary Equipment Used During Test.....	6
1.4. Description of Test Modes.....	6
1.5. Test Equipment List.....	7
1.6. Description of Test Facility.....	10
1.7. Performance Criteria.....	10
2. Summary of Test Results.....	13
3. Emission Test.....	14
3.1. Conducted Emission Test at Main Ports.....	14
3.1.1. Test Standard and Limit.....	14
3.1.2. Test Setup.....	14
3.1.3. Test Procedure.....	15
3.1.4. Test Data.....	15
3.2. Radiated Emission Test.....	18
3.2.1. Test Standard and Limit.....	18
3.2.2. Test Setup.....	19
3.2.3. Test Procedure.....	19
3.2.4. Test Data.....	20
3.3. Harmonic Current Emissions.....	28
3.3.1. Test Standard and Limit.....	28
3.3.2. Test Setup.....	28
3.3.3. Test Procedure.....	28
3.3.4. Test Data.....	29
3.4. Voltage Fluctuations and Flicker.....	32
3.4.1. Test Standard and Limit.....	32
3.4.2. Test Setup.....	32
3.4.3. Test Procedure.....	32
3.4.4. Test Data.....	33
4. Immunity Test.....	34
4.1. Electrostatic Discharge Test.....	35
4.1.1. Test Standard and Specification.....	35
4.1.2. Test Setup.....	35
4.1.3. Test Procedure.....	36
4.1.4. Test Data.....	37
4.2. Radiated, RF Electromagnetic Fields Test.....	38
4.2.1. Test Standard and Specification.....	38
4.2.2. Test Setup.....	38

4.2.3. Test Procedure.....	38
4.2.4. Test Data.....	39
4.3. Fast Transients, Common Mode Test.....	40
4.3.1. Test Standard and Specification.....	40
4.3.2. Test Setup.....	40
4.3.3. Test Procedure.....	40
4.3.4. Test Data.....	41
4.4. Surges Test.....	42
4.4.1. Test Standard and Specification.....	42
4.4.2. Test Setup.....	42
4.4.3. Test Procedure.....	42
4.4.4. Test Data.....	44
4.5. Radio Frequency, Common Mode Test.....	45
4.5.1. Test Standard and Specification.....	45
4.5.2. Test Setup.....	45
4.5.3. Test Procedure.....	45
4.5.4. Test Data.....	46
4.6. Voltage Dips and Interruptions.....	47
4.6.1. Test Standard and Specification.....	47
4.6.2. Test Setup.....	47
4.6.3. Test Procedure.....	47
4.6.4. Test Data.....	48
APPENDIX I -- TEST SETUP PHOTOGRAPH.....	49
APPENDIX II -- EXTERNAL PHOTOGRAPH.....	53
APPENDIX III -- INTERNAL PHOTOGRAPH.....	57

# TEST REPORT

Applicant : EcoFlow Inc.  
Manufacturer : EcoFlow Inc.  
Product Name : Portable Power Station  
Model No. : EFD500  
Trade Mark : 

Capacity: 3600Wh, 48V=  
AC Input/ AC-Eingang: 220-240V~ 12.5A 50Hz/60Hz  
X-Stream Charge Input/ X-Stream-Ladeeingang: 2875W Max  
Solar/ DC Input/ Solar-/DC-Eingang: 11-150V=  
15A 1600W Max  
Total Output/ Ausgangsleistung Gesamt: 4260W  
Rating(s) : 12V Output/ 12V-Ausgang: 12.6V=  
30A/10A/3A 504W Max  
AC Output/ AC-Ausgang(x4): 230V~ 50Hz 3600W total (Surge 7200W)  
USB-A Output/ USB-A-Ausgang(x2): 5V=  
2.4A 12W Max per port total 24W  
USB-A Fast Charge Output/ USB-A Schnelllade-Ausgang(x2): 5V=  
2.4A 9V=  
2A 12V=  
1.5A 18W Max per port total 36W  
USB-C Output(x2)/ USB-C-Ausgang(x2): 5/9/12/15/20V=  
5A 100W Max per port total 200W

Test Standard(s) : **ETSI EN 301 489-1 V2.2.3 (2019-11)**  
**ETSI EN 301 489-17 V3.2.4 (2020-09)**  
**EN 55032: 2015+A11: 2020; EN 55035: 2017+A11: 2020**  
**EN IEC 61000-3-2: 2019; EN 61000-3-3: 2013+A1:2019**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited 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 Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the EN 301 489-1, EN 301 489-17, EN 55032 and EN 55035 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt

Dec. 28, 2021

Date of Test

Dec. 28, 2021 ~ Jan. 17, 2022

Prepared By

*Nian Xiu Chen*

(Nianxiu Chen)

Approved & Authorized Signer

*Kingkong Jin*


(Kingkong Jin)

## 1. General Information

### 1.1. Client Information

Applicant	:	EcoFlow Inc.
Address	:	Plant A202, Founder Technology Industrial Park, Shiyan Sub-district, Bao'an District Shenzhen, Guangdong 518000 China
Manufacturer	:	EcoFlow Inc.
Address	:	Plant A202, Founder Technology Industrial Park, Shiyan Sub-district, Bao'an District Shenzhen, Guangdong 518000 China
Factory	:	EcoFlow Inc.
Address	:	Plant A202, Founder Technology Industrial Park, Shiyan Sub-district, Bao'an District Shenzhen, Guangdong 518000 China

### 1.2. Description of Device (EUT)

Product Name	:	Portable Power Station	
Model No.	:	EFD500	
Trade Mark	:		
Test Power Supply	:	AC 230V, 50Hz/ DC 12V	
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)	
Product Description	:	Operation Frequency:	BLE: 2402-2480MHz WiFi 2.4G: 2412-2472MHz for 802.11b/g/n(HT20)
		Number of Channel:	BLE: 40 Channels WiFi 2.4G: 11 Channels for 802.11b/g/n(HT20)
		Modulation Type:	BLE: GFSK WiFi 2.4G: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
		Antenna Type:	BLE: PCB Antenna WiFi 2.4G: PCB Antenna
		Antenna Gain(Peak):	BLE: 1 dBi (Provided by customer) WiFi 2.4G: 1 dBi (Provided by customer)
		Adapter:	N/A
<b>Remark:</b> 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.			

### 1.3. Auxiliary Equipment Used During Test

N/A
-----

### 1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	Charging+BLE+WIFI
Mode 2	(AC 230V)Charging+Discharging
Mode 3	(DC 12V)Charging+Discharging

For Conducted Emission	
Final Test Mode	Description
Mode 1	Charging+BLE+WIFI

For Radiated Emission	
Final Test Mode	Description
Mode 1	Charging+BLE+WIFI
Mode 2	(AC 230V)Charging+Discharging
Mode 3	(DC 12V)Charging+Discharging

Note: The EUT was tested on (Mode 1) modes, the Mode 2 and Mode 3 was tested using EN 55032 and EN 55035 standards.

## 1.5. Test Equipment List

### Conducted Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Oct. 22, 2021	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040D T001	Jul 05, 2021	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 22, 2021	1 Year
4.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2021	1 Year
5.	Software Name EZ-EMC	Ferrari Technology	ANB-03A	N/A	N/A	N/A
6.	ISN	Schwarzbeck	NTFM 8158	#172	Oct. 22, 2021	1 Year

### Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 22, 2021	1 Year
2.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Oct. 22, 2021	2 Year
3.	Pre-amplifier	SONOMA	310N	186860	Oct. 22, 2021	1 Year
4.	Software Name EZ-EMC	Ferrari Technology	ANB-03A	N/A	N/A	N/A
5.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Oct. 22, 2021	1 Year
6.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Oct. 22, 2021	2 Year

### Harmonic and Flicker Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Programmable AC Power source	IVYTECH	APS-5005A	632734	Oct. 22, 2021	1 Year
2.	Harmonic and Flicker Analyzer	EMC-PARTNER	HMONICS 1000-1P	164	Oct. 22, 2021	1 Year
3.	Harmonics-1000	N/A	Ed.3.0+4.0	N.A	N/A	N/A

### Electrostatic Discharge Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	ESD Simulators	emtest	ESD NX30.1	11936	Mar. 25, 2021	1 Year

### R/S Immunity Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Signal Generator	Agilent	N5182A	MY48180656	Oct. 22, 2021	1 Year
2.	Amplifier	Micotoop	MPA-80-1000-250	MPA1903096	Oct. 22, 2021	1 Year
3.	Amplifier	Micotoop	MPA-1000-6000-100	MPA1903122	Oct. 22, 2021	1 Year
4.	Log-Periodic Antenna	Schwarzbeck	VULP9118E	00992	N/A	N/A
5.	Horn Antenna	Instruments corporation	GTH-0118	351600	Oct. 22, 2021	2 Year
6.	Power Sensor	Agilent	E9301A	MY41498906	Oct. 22, 2021	1 Year
7.	Power Sensor	Agilent	E9301A	MY41498088	Oct. 22, 2021	1 Year
8.	Power Meter	Agilent	E4419B	GB40202909	Oct. 22, 2021	1 Year
9.	Electric field Probe	Narda	EP 601	811ZX10351	Oct. 22, 2021	1 Year
10.	RS Test software	EMtrace	EM 3	V1.1.7	N/A	N/A

### Surge Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Combined Wave Lightning Surge Simulator	3Ctest	CCS600	ES3771702	Jul. 05, 2021	1 Year
2.	Three Phase Power Coupling Network	3Ctest	SEPN69100T	ES0801757	Jul. 05, 2021	1 Year
3.	Telecom port surge generator	PMI	TW101	190411	May 13, 2021	1 Year

### Electrical Fast Transient/Burst Immunity Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Surge Generator	TESEQ	NSG 3060	1480	Oct. 22, 2021	1 Year
2.	CDN	TESEQ	CDN 3061	1408	Oct. 22, 2021	1 Year
3.	EFT-Clamp	PRIMA	EFT-Clamp	/	Oct. 22, 2021	1 Year



## Injected Currents Susceptibility Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	C/S Conducted Immunity Test System	FRANKONIA	CIT-10	126A1196/2012	Oct. 22, 2021	1 Year
2.	CDN	FRANKONIA	CDN - M2+ M3	A2210178/2012	Oct. 22, 2021	1 Year
3.	6dB Attenuator	FRANKONIA	DAM 26W	1172202	Oct. 22, 2021	1 Year
4.	CIT-10	FRANKONIA	Version1.1.7	N/A	N/A	N/A
5.	EM-Clamp	FRANKONIA	EMCL-20	18101728-0103	May 17,2021	1 Year

## Voltage Dips and Interruptions Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	CYCLE SAG Simulator	PRIMA	DRP61011AG	PR12046234	Oct. 22, 2021	1 Year

## 1.6. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

### FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111.

### ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

### Test Location

Shenzhen Anbotek Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518128

## 1.7. Performance Criteria

### 1.7.1. For EMS Test:

- √ A: Normal performance within the specification limits;
- √ B: Temporary degradation or loss of function or performance which is self-recoverable;
- √ C: Temporary degradation or loss of function or performance which requires operator intervention or system reset;
- √ D: Degradation or loss of function which is not recoverable due to damage of equipment (components) or software, or loss of data

Note: The manufacturer's specification may define effects on the EUT which may be considered insignificant, and therefore acceptable.

This classification may be used as a guide in formulating performance criteria, by committees responsible for generic, product and product-family standards, or as a framework for the agreement on performance criteria between the manufacturer and the purchaser, for example where no suitable generic, product or product-family standard exists.

### 1.7.2. For EN 301 489-17:

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

**Table 1: Performance criteria**

Criteria	During test	After test
A	Shall operate as intended. (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 3). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 2). Shall be no unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3).
<p><b>NOTE 1:</b> Operate as intended during the test allows a level of degradation not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p><b>NOTE 2:</b> Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p><b>NOTE 3:</b> No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p>		

**Performance criteria for Continuous phenomena applied to Transmitters (CT)**

The performance criteria A shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

**Performance criteria for Transient phenomena applied to Transmitters (TT)**

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

**Performance criteria for Continuous phenomena applied to Receivers (CR)**

The performance criteria A shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

**Performance criteria for Transient phenomena applied to Receivers (TR)**

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

## 2. Summary of Test Results

EMC Emission				
Test Items	Standard	Basic Standard	Limit	Results
Conducted Emission	ETSI EN 301 489-1 V2.2.3 Clause 8.3 & 8.4	EN 55032: 2015+A11: 2020	Class A	PASS
Radiated Emission	ETSI EN 301 489-1 V2.2.3 Clause 8.2	EN 55032: 2015+A11: 2020	Class A	PASS
Harmonic Current Emission	ETSI EN 301 489-1 V2.2.3 Clause 8.5	EN IEC 61000-3-2: 2019	Class A	PASS
Voltage Fluctuations & Flicker	ETSI EN 301 489-1 V2.2.3 Clause 8.6	EN 61000-3-3: 2013+A1:2019	/	PASS
EMC Immunity				
Test Items	Standard	Basic Standard	Performance Criteria	Results
Electrostatic Discharge	ETSI EN 301 489-1 V2.2.3 Clause 9.3	EN 61000-4-2:2009	B	PASS
RF Electromagnetic Field	ETSI EN 301 489-1 V2.2.3 Clause 9.2	EN 61000-4-3:2006 +A1:2008+A2:2010	A	PASS
Fast transients, common mode	ETSI EN 301 489-1 V2.2.3 Clause 9.4	EN 61000-4-4:2012	B	PASS
Surges	ETSI EN 301 489-1 V2.2.3 Clause 9.8	EN 61000-4-5: 2014+A1:2017	B	PASS
Radio frequency, common mode	ETSI EN 301 489-1 V2.2.3 Clause 9.5	EN 61000-4-6:2014	A	PASS
Volt. Interruptions Volt. Dips	ETSI EN 301 489-1 V2.2.3 Clause 9.7	EN 61000-4-11: 2014+A1:2017	B / C / C NOTE (3)	PASS
<b>NOTE:</b>				
	(1) "N/A" denotes test is not applicable in this Test Report			
	(2) Alternatively, for equipment intended to be used exclusively in an industrial environment or a telecommunication centre, the class A limits may be used.			
	(3) Voltage dip: 100% reduction – Performance Criteria B			
	Voltage dip: 100% reduction – Performance Criteria B			
	Voltage dip: 70% reduction – Performance Criteria C			
	Voltage Interruption: 0% Interruption – Performance Criteria C			

## 3. Emission Test

### 3.1. Conducted Emission Test at Main Ports

#### 3.1.1. Test Standard and Limit

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 8.3 & 8.4
Basic Standard	EN 55032: 2015+A11: 2020

Limits for conducted emissions

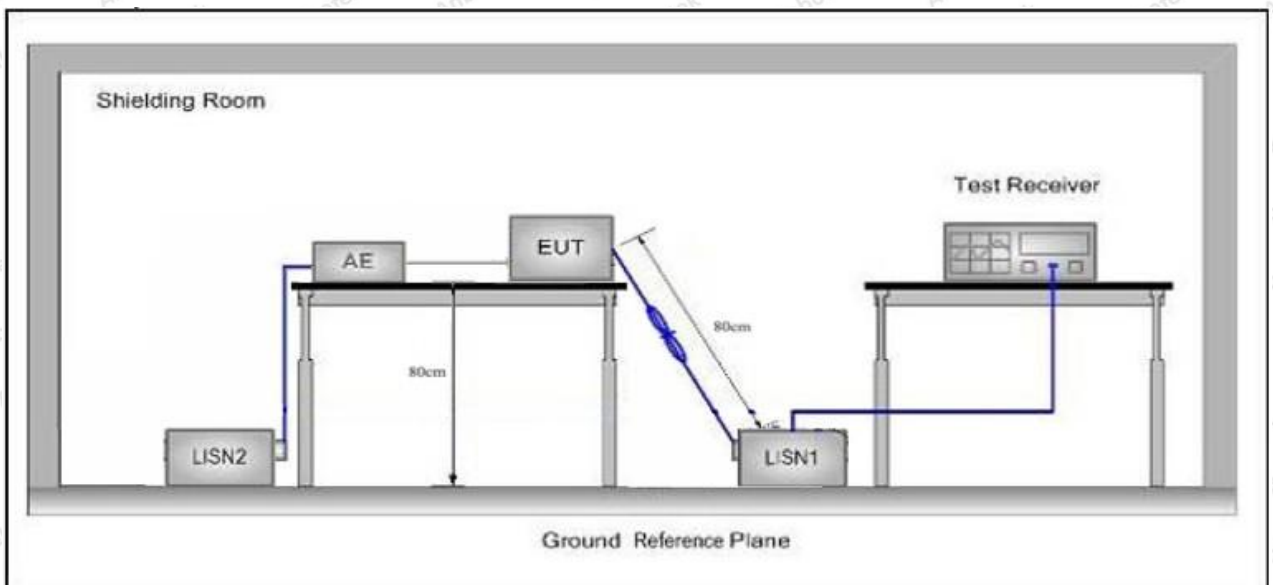
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

**Remark:** \*Decreasing linearly with logarithm of the frequency.

Limits for conducted emissions of equipment intended to be used in telecommunication centre and industrial environment

Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	79	66
	500kHz~30MHz	73	60

#### 3.1.2. Test Setup



### 3.1.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ETSI EN 301 489-1 V2.2.3 & EN 55032: 2015+A11: 2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

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

For the actual test configuration, please refer to the related Item EUT Test Photos.

### 3.1.4. Test Data

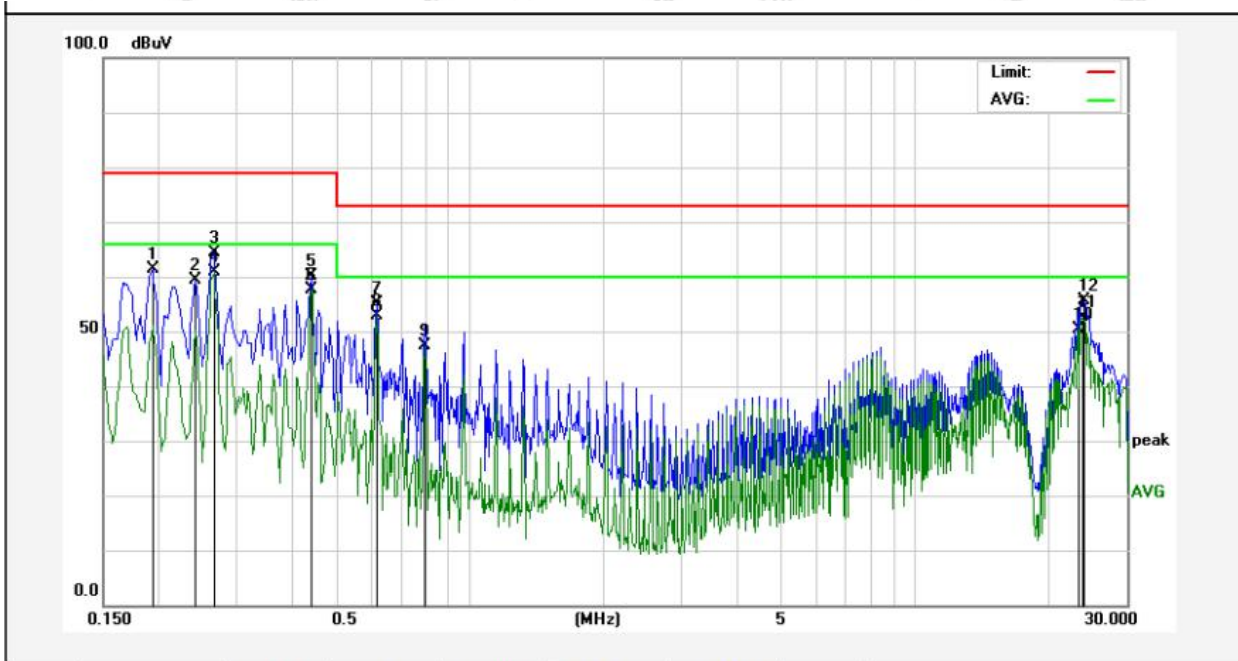
PASS

The EUT should be compliance to the limit of Class A

Only the worst case data was showed in the report, please to see the following pages

### Conducted Emission Test Data

Test Site: 1# Shielded Room  
 Operating Condition: Mode 1  
 Test Specification: AC 230V, 50Hz  
 Comment: Live Line  
 Tem.: 22.6°C Hum.: 48%

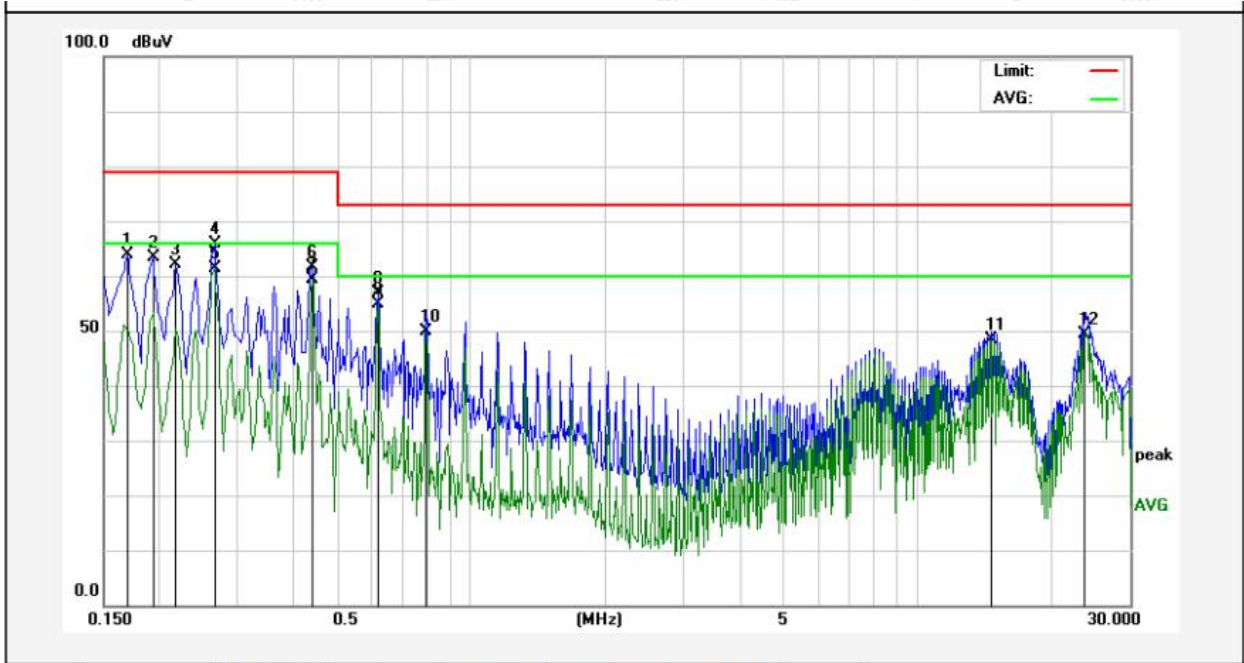


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1940	61.29	0.12	61.41	79.00	-17.59	peak	
2	0.2420	59.22	0.12	59.34	79.00	-19.66	peak	
3	0.2660	64.23	0.13	64.36	79.00	-14.64	peak	
4	0.2660	60.69	0.13	60.82	66.00	-5.18	AVG	
5	0.4420	59.90	0.13	60.03	79.00	-18.97	peak	
6	0.4420	57.56	0.13	57.69	66.00	-8.31	AVG	
7	0.6180	54.88	0.15	55.03	73.00	-17.97	peak	
8	0.6180	52.85	0.15	53.00	60.00	-7.00	AVG	
9	0.7940	47.19	0.15	47.34	60.00	-12.66	AVG	
10	23.3580	50.21	0.18	50.39	60.00	-9.61	AVG	
11	23.8900	52.34	0.18	52.52	60.00	-7.48	AVG	
12	24.0660	55.33	0.18	55.51	73.00	-17.49	peak	



### Conducted Emission Test Data

Test Site: 1# Shielded Room  
 Operating Condition: Mode 1  
 Test Specification: AC 230V, 50Hz  
 Comment: Neutral Line  
 Tem.: 22.6°C Hum.: 48%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1700	63.79	0.12	63.91	79.00	-15.09	peak	
2	0.1940	63.30	0.12	63.42	79.00	-15.58	peak	
3	0.2180	62.04	0.12	62.16	79.00	-16.84	peak	
4	0.2660	65.83	0.13	65.96	79.00	-13.04	peak	
5	0.2660	61.18	0.13	61.31	66.00	-4.69	AVG	
6	0.4420	61.57	0.13	61.70	79.00	-17.30	peak	
7	0.4420	59.27	0.13	59.40	66.00	-6.60	AVG	
8	0.6180	56.85	0.15	57.00	73.00	-16.00	peak	
9	0.6180	54.68	0.15	54.83	60.00	-5.17	AVG	
10	0.7940	49.80	0.15	49.95	60.00	-10.05	AVG	
11	14.7220	48.15	0.17	48.32	60.00	-11.68	AVG	
12	23.7099	49.21	0.18	49.39	60.00	-10.61	AVG	

## 3.2. Radiated Emission Test

### 3.2.1. Test Standard and Limit

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 8.2
Basic Standard	EN 55032: 2015+A11: 2020

#### Radiated Emission Test Limit (Below 1000MHz)

Frequency (MHz)	Limit (dB $\mu$ V/m)	
	Quasi-peak Level	
	Class B	Class A
30MHz~230MHz	40	50
230MHz~1000MHz	47	57

**Remark:** 1. The lower limit shall apply at the transition frequency. 2. The test distance is 3m.

#### Radiated Emission Test Limit (Above 1000MHz)

Frequency (MHz)	Limit (dB $\mu$ V/m)			
	Class B		Class A	
	Peak	Average	Peak	Average
1000 MHz -3000 MHz	70	50	76	56
3000 MHz -6000 MHz	74	54	80	60

**Remark:** 1. The lower limit applies at the transition frequency. 2. The test distance is 3m.

#### Radiated Emission Test Limit for FM Receivers

Frequency (MHz)	Limit (dB $\mu$ V/m)	
	Quasi-peak Level	
	Fundamental	Harmonics
30MHz~230MHz	60	52
230MHz~300MHz	60	52
300MHz~1000MHz	60	56

**Remark:** 1. The lower limit shall apply at the transition frequency. 2. The test distance is 3m.

#### Frequency Range of Radiated Measurement

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	5th harmonic of the highest frequency or 6 GHz, whichever is lower

### 3.2.2. Test Setup

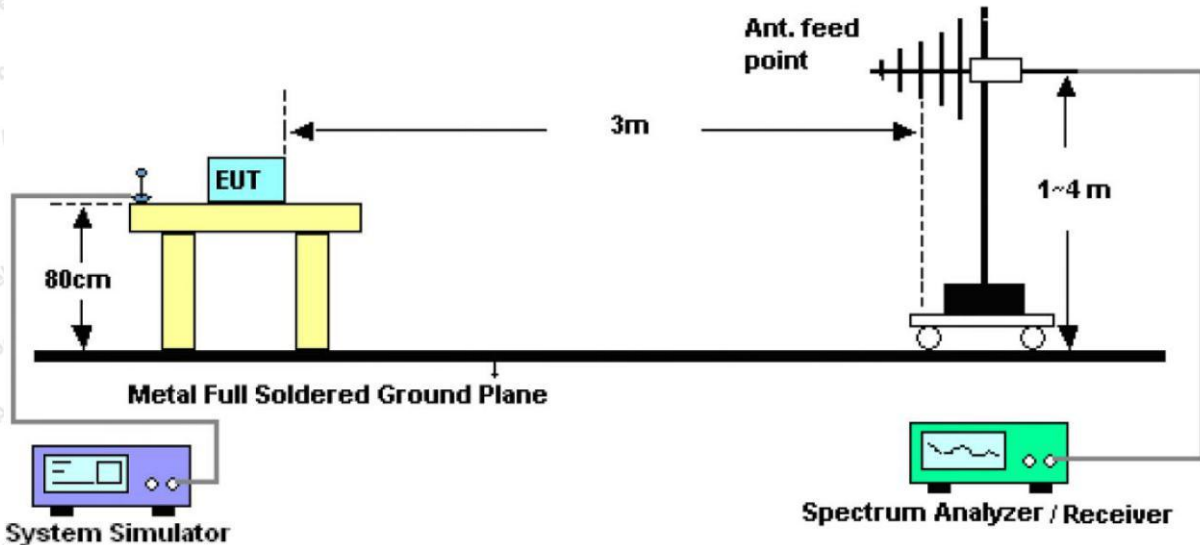


Figure 1. 30MHz to 1GHz

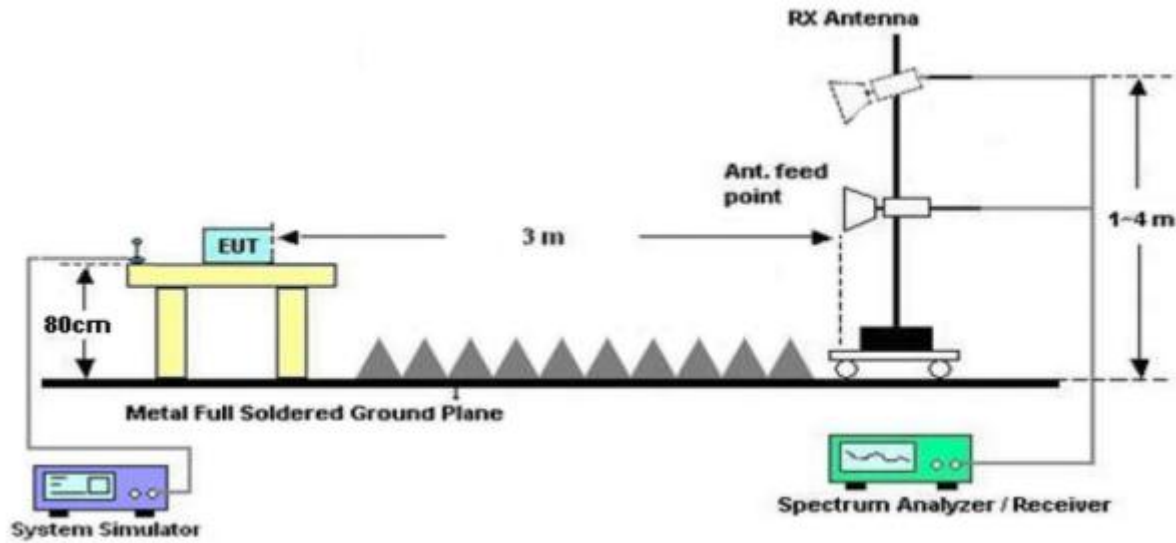


Figure 2. Above 1 GHz

### 3.2.3. Test Procedure

- 1) The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- 2) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- 3) The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4) The initial step in collecting radiated emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

5) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

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 1GHz.

6) For the actual test configuration, please refer to the related Item –EUT Test Photos.

**Note:**

The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak/ Average detection at frequency above 1GHz.

### 3.2.4. Test Data

PASS

The EUT should be compliance to the limit of Class A

Only the worst case data was showed in the report, please to see the following pages

**Test Results (30~1000MHz)**

Test Mode: Mode 1

Temp.(°C)/Hum.(%RH): 23.4°C/50%RH

Polarization: Horizontal

Power Source: AC 230V, 50Hz



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	39.8542	54.16	-16.10	38.06	50.00	-11.94	peak			
2	54.8348	59.23	-17.56	41.67	50.00	-8.33	peak			
3	78.9652	63.03	-23.09	39.94	50.00	-10.06	peak			
4	137.4202	62.95	-22.93	40.02	50.00	-9.98	peak			
5	225.3080	61.09	-21.91	39.18	50.00	-10.82	peak			
6	560.6928	55.67	-11.51	44.16	57.00	-12.84	peak			

**Test Results (30~1000MHz)**

Test Mode: Mode 1

Temp.(°C)/Hum.(%RH): 23.4°C/50%RH

Polarization: Vertical

Power Source: AC 230V, 50Hz



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	39.5757	53.77	-14.78	38.99	50.00	-11.01	QP	100	0	
2	46.5402	53.70	-15.27	38.43	50.00	-11.57	QP	100	360	
3	69.3568	65.47	-19.88	45.59	50.00	-4.41	peak			
4	80.0806	58.45	-19.30	39.15	50.00	-10.85	peak			
5	102.3597	53.85	-16.95	36.90	50.00	-13.10	peak			
6	125.8864	60.57	-20.84	39.73	50.00	-10.27	peak			

**Test Results (30~1000MHz)**

Test Mode: Mode 2

Temp.(°C)/Hum.(%RH): 23.4°C/50%RH

Polarization: Horizontal

Power Source: AC 230V, 50Hz



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	54.6429	59.47	-17.50	41.97	50.00	-8.03	peak			
2	76.5121	63.80	-22.40	41.40	50.00	-8.60	peak			
3	100.9339	59.07	-21.45	37.62	50.00	-12.38	peak			
4	137.9028	63.68	-22.95	40.73	50.00	-9.27	peak			
5	213.7634	61.52	-22.10	39.42	50.00	-10.58	peak			
6	226.0994	57.85	-21.90	35.95	50.00	-14.05	peak			

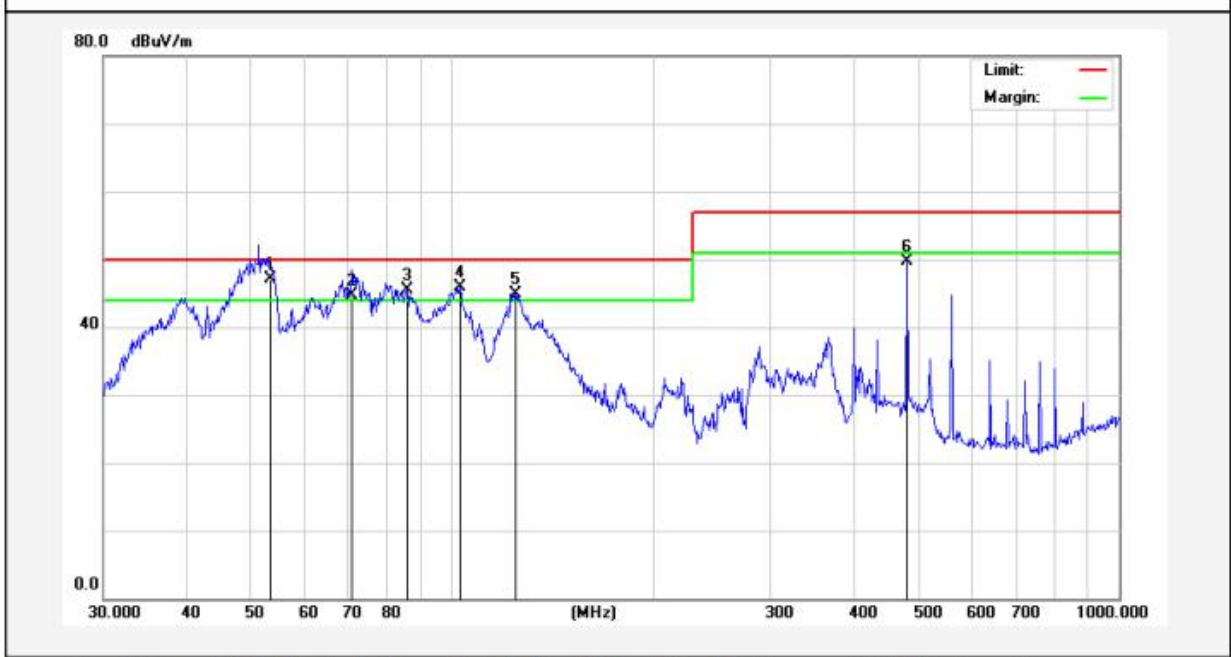
**Test Results (30~1000MHz)**

Test Mode: Mode 2

Temp.(°C)/Hum.(%RH): 23.4°C/50%RH

Polarization: Vertical

Power Source: AC 230V, 50Hz

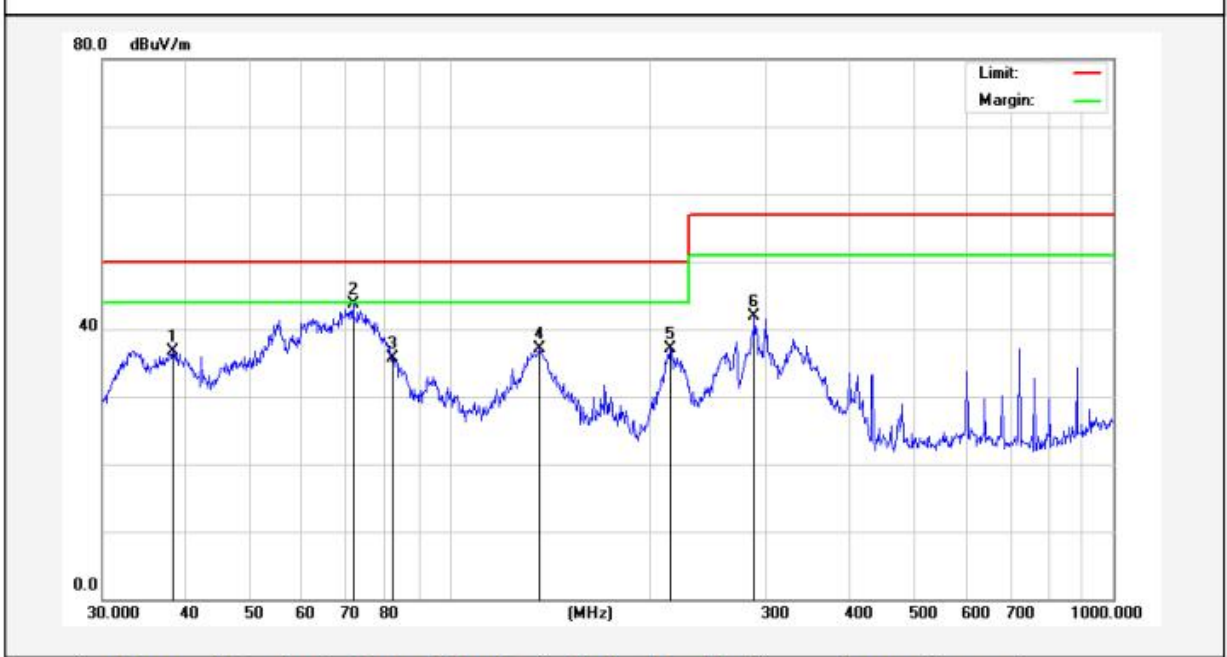


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	53.3685	64.04	-17.03	47.01	50.00	-2.99	QP	100	360	
2	70.8815	64.58	-19.94	44.64	50.00	-5.36	QP	100	0	
3	85.5977	63.94	-18.42	45.52	50.00	-4.48	peak			
4	102.7192	62.90	-17.01	45.89	50.00	-4.11	peak			
5	124.5690	65.61	-20.63	44.98	50.00	-5.02	peak			
6	480.5276	62.51	-12.79	49.72	57.00	-7.28	peak			



**Test Results (30~1000MHz)**

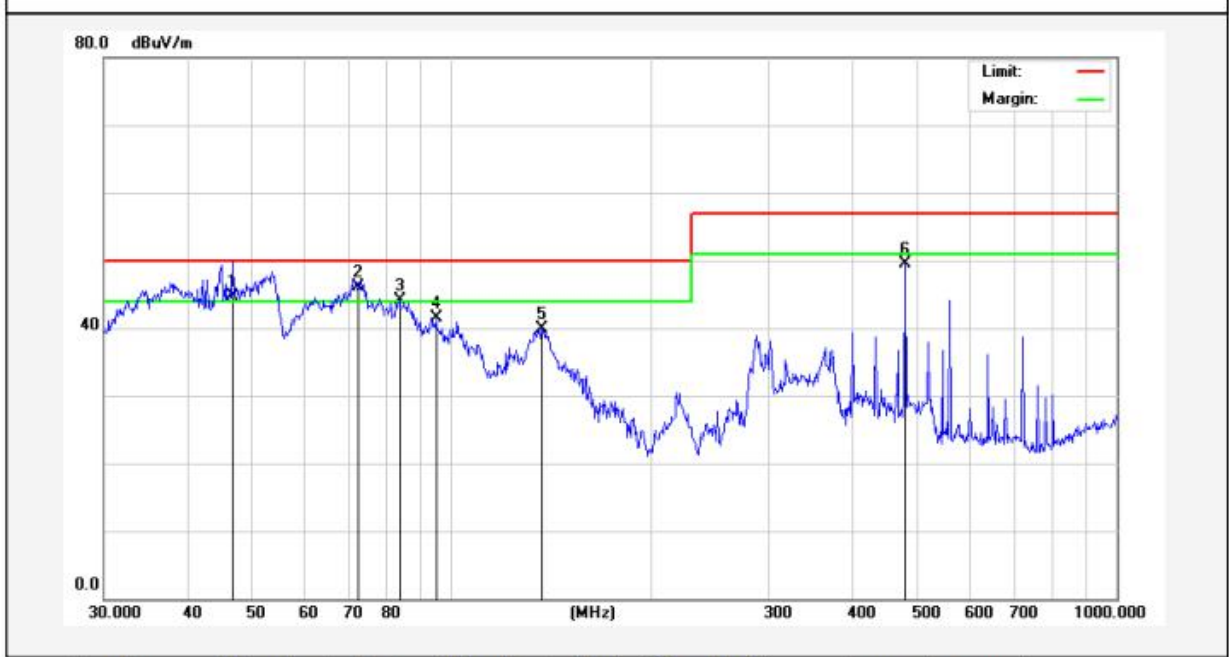
Test Mode: Mode 3      Temp.(°C)/Hum.(%RH): 23.4°C/50%RH  
 Polarization: Horizontal      Power Source: DC 12V



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	38.3462	53.64	-16.84	36.80	50.00	-13.20	peak			
2	71.5806	65.94	-22.17	43.77	50.00	-6.23	peak			
3	82.0706	58.43	-22.77	35.66	50.00	-14.34	peak			
4	136.9391	60.09	-22.90	37.19	50.00	-12.81	peak			
5	215.2678	59.26	-22.08	37.18	50.00	-12.82	peak			
6	287.9904	60.14	-18.20	41.94	57.00	-15.06	peak			

**Test Results (30~1000MHz)**

Test Mode: Mode 3      Temp.(°C)/Hum.(%RH): 23.4°C/50%RH  
 Polarization: Vertical      Power Source: DC 12V



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	46.9203	59.95	-15.33	44.62	50.00	-5.38	QP	100	360	
2	72.5189	65.99	-19.92	46.07	50.00	-3.93	QP	100	0	
3	83.5221	62.83	-18.77	44.06	50.00	-5.94	peak			
4	94.7600	58.75	-17.23	41.52	50.00	-8.48	peak			
5	136.9391	61.89	-21.96	39.93	50.00	-10.07	peak			
6	480.5276	62.30	-12.79	49.51	57.00	-7.49	peak			

**Test Results (1GHz~6GHz)**

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Detector
1610.68	55.09	-2.27	52.82	76.00	-23.18	H	PEAK
2020.21	51.89	-2.52	49.37	76.00	-26.63	H	PEAK
2117.00	52.37	-3.97	48.40	76.00	-27.60	H	PEAK
3900.45	54.61	-5.14	49.46	80.00	-30.54	H	PEAK
4642.58	46.97	-5.23	41.74	80.00	-38.26	H	PEAK
5105.67	52.28	-6.15	46.13	80.00	-33.87	H	PEAK
1610.68	41.30	-2.27	39.03	56.00	-16.97	H	AVG
2020.21	38.43	-2.52	35.92	56.00	-20.08	H	AVG
2117.00	39.34	-3.97	35.37	56.00	-20.63	H	AVG
3900.45	46.75	-5.14	41.60	60.00	-18.40	H	AVG
4642.58	37.33	-5.23	32.10	60.00	-27.90	H	AVG
5105.67	37.28	-6.15	31.13	60.00	-28.87	H	AVG
1416.20	52.18	-2.83	49.35	76.00	-26.65	V	PEAK
1925.28	54.78	-3.03	51.75	76.00	-24.25	V	PEAK
2252.30	52.25	-4.30	47.95	76.00	-28.05	V	PEAK
3986.22	53.55	-4.64	48.91	80.00	-31.09	V	PEAK
4510.77	54.45	-4.56	49.89	80.00	-30.11	V	PEAK
4896.75	55.47	-5.58	49.89	80.00	-30.11	V	PEAK
1416.20	38.65	-2.83	35.82	56.00	-20.18	V	AVG
1925.28	40.59	-3.03	37.56	56.00	-18.44	V	AVG
2252.30	38.79	-4.30	34.49	56.00	-21.51	V	AVG
3986.22	39.20	-4.64	34.55	60.00	-25.45	V	AVG
4510.77	41.88	-4.56	37.32	60.00	-22.68	V	AVG
4896.75	43.51	-5.58	37.94	60.00	-22.06	V	AVG

Remark:

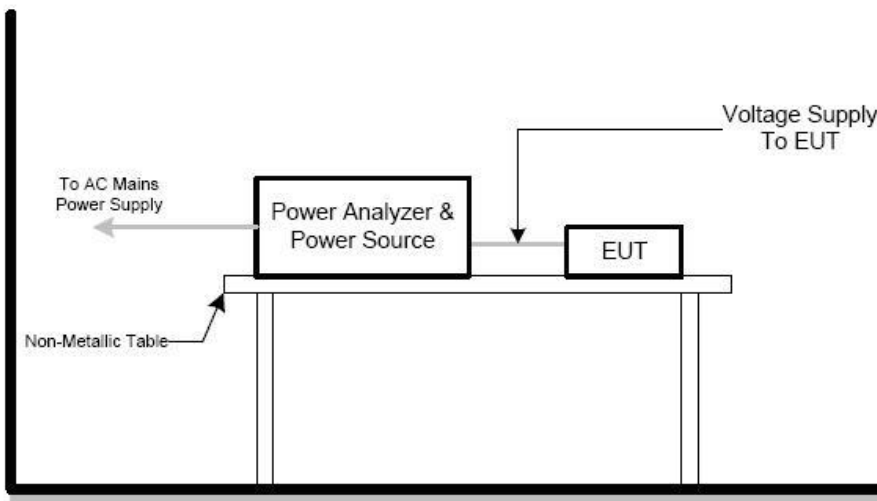
1. Level =Receiver Read level + Antenna Factor

## 3.3. Harmonic Current Emissions

### 3.3.1. Test Standard and Limit

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 8.5
Basic Standard	EN IEC 61000-3-2: 2019
Test Limit	Please to refer to the clause 7 of standard EN IEC 61000-3-2: 2019.

### 3.3.2. Test Setup



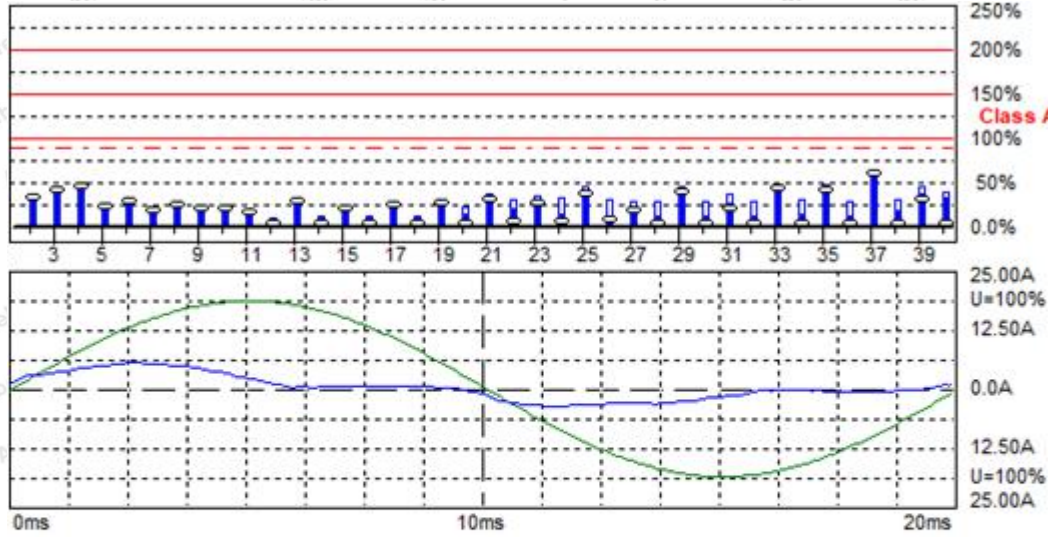
### 3.3.3. Test Procedure

- 1) The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions.
- 2) The classification of EUT is according to section 5 of EN IEC 61000-3-2: 2019. The EUT is classified as follows:
  - Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.
  - Class B: Portable tools; Arc welding equipment which is not professional equipment.
  - Class C: Lighting equipment.
  - Class D: Equipment having a specified power less than or equal to 600W of the following types: Personal computers and personal computer monitors and television.
- 3) The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.
- 4) For the actual test configuration, please refer to the related item –EUT Test Photos.

**3.3.4. Test Data**

Please to see the following pages

Standard: EN 61000-3-2 Temp.(°C)/Hum.(%RH): 22.1°C/50%RH  
 Test Mode: Mode 1 Power Source: AC 230V, 50Hz



Harmonic Emission - IEC 61000-3-2 , EN 61000-3-2 , (EN60555-2)

Urms = 229.5 V P = 443.0 W THC = 1.003 A Range: 25 A  
 Irms = 2.673 A pf = 0.722 V-nom: 230 V

**Test completed, Result: PASSED**

HAR-1000 EMC Partner

Full Bar : Actual Values  
 Empty Bar : Maximum Values  
 Blue : Current , Green : Voltage , Red : Failed

Urms = 229.5V Freq = 50.000 Range: 25 A  
 Irms = 2.673A Ipk = 5.688A cf = 2.128  
 P = 443.0W S = 613.6VA pf = 0.722  
 THDi = 41.0 % THDu = 0.10 %Class A

Test - Time : 3min ( 100 %)

Test completed, Result: PASSED

Order	Freq. [Hz]	Iavg [A]	Iavg%L [%]	Irms [A]	Irms% [%]	Irms%L [%]	Imax [A]	Imax%L [%]	Limit [A]	Status
1	50	2.4450		2.4551	91.838		2.4567			
2	100	0.3193	29.569	0.3204	11.986	29.670	0.3220	29.811	1.0800	
3	150	0.8813	38.318	0.8820	32.991	38.346	0.8820	38.346	2.3000	
4	200	0.1879	43.703	0.1892	7.0776	44.002	0.1892	44.002	0.4300	

5	250	0.2225	19.516	0.2228	8.3333	19.542	0.2243	19.676	1.1400
6	300	0.0812	27.066	0.0824	3.0822	27.466	0.0824	27.466	0.3000
7	350	0.1108	14.389	0.1099	4.1096	14.268	0.1129	14.664	0.7700
8	400	0.0483	20.994	0.0473	1.7694	20.566	0.0504	21.893	0.2300
9	450	0.0734	18.338	0.0732	2.7397	18.311	0.0748	18.692	0.4000
10	500	0.0317	17.221	0.0305	1.1416	16.586	0.0336	18.244	0.1840
11	550	0.0424	12.838	0.0412	1.5411	12.484	0.0443	13.409	0.3300
12	600	0.0000	0.0000	0.0076	0.2854	4.9757	0.0107	6.9660	0.1533
13	650	0.0529	25.178	0.0534	1.9977	25.431	0.0549	26.158	0.2100
14	700	0.0000	0.0000	0.0107	0.3995	8.1270	0.0122	9.2880	0.1314
15	750	0.0276	18.383	0.0275	1.0274	18.311	0.0290	19.328	0.1500
16	800	0.0000	0.0000	0.0092	0.3425	7.9611	0.0092	7.9611	0.1150
17	850	0.0286	21.607	0.0290	1.0845	21.905	0.0305	23.058	0.1324
18	900	0.0000	0.0000	0.0107	0.3995	10.449	0.0107	10.449	0.1022
19	950	0.0276	23.349	0.0290	1.0845	24.482	0.0336	28.347	0.1184
20	1000	0.0003	0.3171	0.0107	0.3995	11.610	0.0183	19.903	0.0920
21	1050	0.0302	28.170	0.0305	1.1416	28.483	0.0381	35.604	0.1071
22	1100	0.0034	4.0465	0.0137	0.5137	16.420	0.0244	29.191	0.0836
23	1150	0.0229	23.412	0.0214	0.7991	21.837	0.0305	31.196	0.0978
24	1200	0.0031	4.0300	0.0092	0.3425	11.942	0.0229	29.854	0.0767
25	1250	0.0320	35.575	0.0305	1.1416	33.908	0.0381	42.386	0.0900
26	1300	0.0031	4.3700	0.0076	0.2854	10.781	0.0198	28.030	0.0708
27	1350	0.0127	15.226	0.0137	0.5137	16.479	0.0229	27.466	0.0833
28	1400	0.0020	3.0412	0.0061	0.2283	9.2880	0.0168	25.542	0.0657
29	1450	0.0291	37.472	0.0290	1.0845	37.367	0.0336	43.267	0.0776
30	1500	0.0011	1.7172	0.0061	0.2283	9.9514	0.0168	27.366	0.0613
31	1550	0.0138	18.997	0.0168	0.6279	23.126	0.0244	33.637	0.0726
32	1600	0.0004	0.7104	0.0046	0.1712	7.9611	0.0153	26.537	0.0575
33	1650	0.0274	40.198	0.0259	0.9703	38.045	0.0305	44.759	0.0682
34	1700	0.0000	0.0000	0.0061	0.2283	11.278	0.0153	28.196	0.0541
35	1750	0.0246	38.318	0.0244	0.9132	37.977	0.0290	45.098	0.0643
36	1800	0.0000	0.0000	0.0046	0.1712	8.9562	0.0137	26.869	0.0511
37	1850	0.0352	57.947	0.0351	1.3128	57.712	0.0381	62.731	0.0608
38	1900	0.0000	0.0000	0.0076	0.2854	15.756	0.0137	28.361	0.0484
39	1950	0.0166	28.795	0.0198	0.7420	34.383	0.0244	42.318	0.0577
40	2000	0.0006	1.2178	0.0137	0.5137	29.854	0.0168	36.488	0.0460

**Calculation of Individual Harmonic Limits**

**Fixed Limits for Class A:**

Order	Limits in Ampere			
	90%	100%	150%	200%
2	0.9723	1.0803	1.6205	2.1606

3	2.0695	2.2995	3.4492	4.5990
4	0.3873	0.4303	0.6454	0.8606
5	1.0258	1.1398	1.7097	2.2797
6	0.2705	0.3006	0.4509	0.6012
7	0.6935	0.7706	1.1559	1.5411
8	0.2074	0.2304	0.3456	0.4608
9	0.3598	0.3998	0.5997	0.7996
10	0.1662	0.1846	0.2769	0.3693
11	0.2966	0.3296	0.4944	0.6592
12	0.1373	0.1526	0.2289	0.3052
13	0.1895	0.2106	0.3159	0.4211
14	0.1181	0.1312	0.1968	0.2625
15	0.1346	0.1495	0.2243	0.2991
16	0.1030	0.1144	0.1717	0.2289
17	0.1195	0.1328	0.1991	0.2655
18	0.0920	0.1022	0.1534	0.2045
19	0.1071	0.1190	0.1785	0.2380
20	0.0824	0.0916	0.1373	0.1831
21 *	0.0961	0.1068	0.1602	0.2136
22	0.0755	0.0839	0.1259	0.1678
23 *	0.0879	0.0977	0.1465	0.1953
24	0.0687	0.0763	0.1144	0.1526
25 *	0.0810	0.0900	0.1350	0.1801
26	0.0632	0.0702	0.1053	0.1404
27 *	0.0755	0.0839	0.1259	0.1678
28	0.0591	0.0656	0.0984	0.1312
29 *	0.0700	0.0778	0.1167	0.1556
30	0.0549	0.0610	0.0916	0.1221
31 *	0.0659	0.0732	0.1099	0.1465
32	0.0522	0.0580	0.0870	0.1160
33 *	0.0618	0.0687	0.1030	0.1373
34	0.0481	0.0534	0.0801	0.1068
35 *	0.0577	0.0641	0.0961	0.1282
36	0.0453	0.0504	0.0755	0.1007
37 *	0.0549	0.0610	0.0916	0.1221
38	0.0439	0.0488	0.0732	0.0977
39 *	0.0522	0.0580	0.0870	0.1160
40	0.0412	0.0458	0.0687	0.0916

## 3.4. Voltage Fluctuations and Flicker

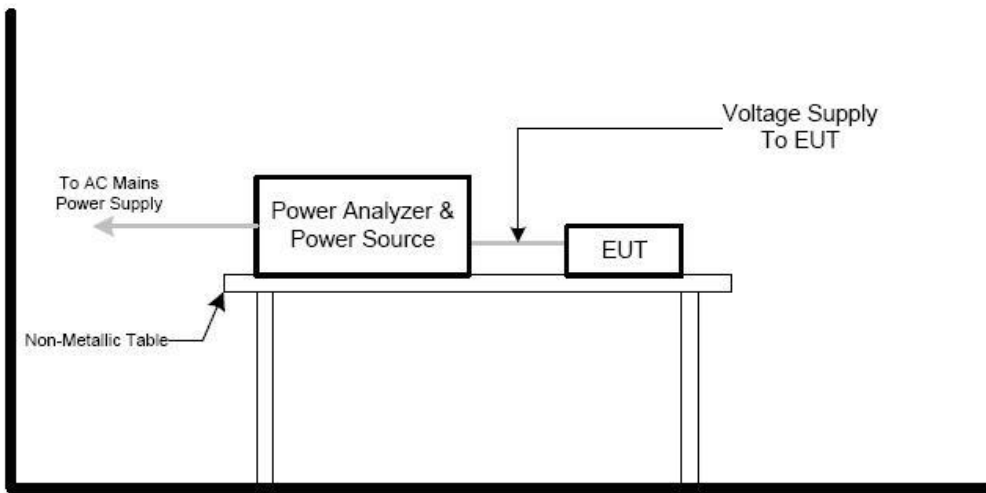
### 3.4.1. Test Standard and Limit

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 8.6
Basic Standard	EN 61000-3-3: 2013+A1:2019

Voltage Fluctuation and Flicker Test Limit

Test Items	Limits
Pst	1.0
Plt	0.65
dc	3.3%
dmax	4.0%
dt	Not exceed 3.3% for 500ms

### 3.4.2. Test Setup



### 3.4.3. Test Procedure

- 1) Tests was performed according to the Test Conditions/Assessment of Voltage Fluctuations specified in Clause 5.0/6.0 of IEC555-3 and/or Clause 6.0/4.0 of IEC/EN 61000-3-3 depend on which standard adopted for compliance measurement.
- 2) All types of harmonic current and/or voltage fluctuation in this report are assessed by direct measurement using flicker-meter.
- 3) For the actual test configuration, please refer to the related Item –EUT Test Photos.

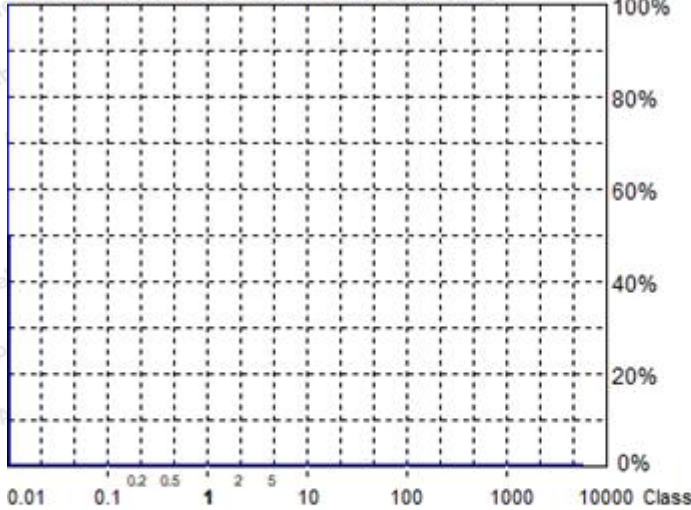


### 3.4.4. Test Data

Please to see the following pages

Standard: EN 61000-3-3      Temp.(°C)/Hum.(%RH): 24.1°C/51%RH  
 Test Mode: Mode 1      Power Source: AC 230V, 50Hz

#### EMC PARTNER AG , Laufen Flicker Emission IEC 61000-4-15 for 230V/50Hz



Actual Flicker (Fli):	0.00
Short-term Flicker (Pst):	0.07
Limit (Pst):	1.00
Long-term Flicker (Plt):	0.00
Limit (Plt):	0.65
Maximum Relative Volt. Change (dmax):	0.00%
Limit (dmax):	4.00%
Relative Steady-state Voltage Change (dc):	0.07%
Limit (dc):	3.00%
Tmax 3.00% (dt):	0.00ms
Limit (dt>Lim):	200ms

#### Flicker Emission - IEC 61000-3-3, EN 61000-3-3

Urms = 228.9 V      P = 438.1 W  
 Irms = 2.588 A      pf = 0.739

Range: 25 A  
 V-nom: 230 V

**Test aborted, Result: PASSED**

HAR-1000 EMC-Partner

Full Bar : Actual Values  
 Empty Bar : Maximum Values  
 Circles : Average Values  
 Blue : Current , Green : Voltage , Red : Failed

Urms = 228.9V      Freq = 50.000      Range: 25 A  
 Irms = 2.588A      Ipk = 5.310A      cf = 2.052  
 P = 438.1W      S = 592.4VA      pf = 0.739

Test - Time : 10 x 1min = 10min ( 100 %)

LIN (Line Impedance Network) : L: 0.24ohm +j0.15ohm N: 0.16ohm +j0.10ohm

Limits : Plt : 0.65      Pst : 1.00  
 dmax : 4.00 %      dc : 3.00 %  
 dtLim: 3.00 %      dt>Lim: 200ms

Test aborted, Result: PASSED

	dmax [%]	dc [%]	dt>Lim [ms]
1	0.000	0.000	0.000

## 4. Immunity Test

### General Performance Criteria

◆ Performance criteria for continuous phenomena applied to transmitters and receivers (CT/CR)

During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.

If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

◆ Performance criteria for transient phenomena applied to transmitters and receivers (TT/TR)

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.

If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

◆ Performance criteria for equipment which does not provide a continuous communication link

For radio equipment which does not provide a continuous communication link, the performance criteria described in CT/CR and TT/TR are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in CT/CR and TT/TR.

◆ Performance criteria for ancillary equipment tested on a stand alone basis

If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in CT/CR and TT/TR are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests.

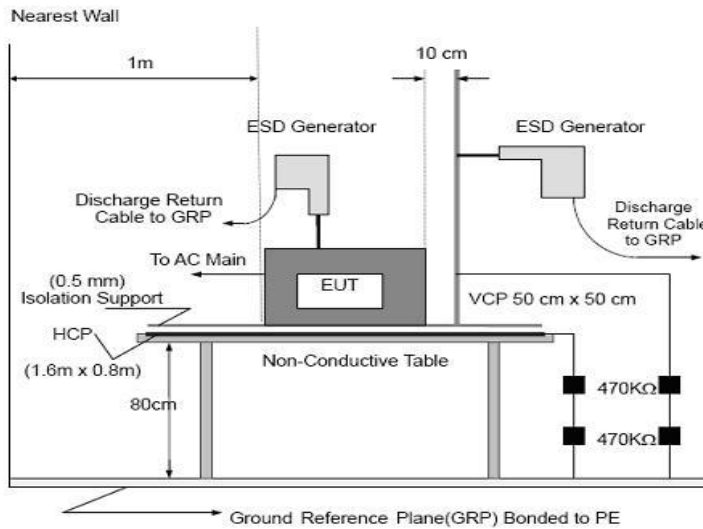
The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in CT/CR and TT/TR.

## 4.1. Electrostatic Discharge Test

### 4.1.1. Test Standard and Specification

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 9.3/ EN 55035 Clause 4.2.1
Basic Standard	EN 61000-4-2:2009
Discharge Impedance:	330 ohm / 150 pF
Performance Criterion:	CT/CR
Discharge Voltage:	Air Discharge: 2kV/4kV/6kV/8kV Contact Discharge: 2kV/4kV (Direct/Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Air Discharge: min. 20 times at each test point Contact Discharge: min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum

### 4.1.2. Test Setup



Note:

#### TABLE-TOP EQUIPMENT:

The configuration consisted of a wooden table 0.8 meters high standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A Horizontal Coupling Plane (1.6m x 0.8m) was placed on the table and attached to the GRP by means of a cable with 940kohm total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC /EN 61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

**FLOOR-STANDING EQUIPMENT:**

The equipment under test was installed in a representative system as described in section 7 of IEC/EN 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

**4.1.3. Test Procedure**

The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

1) Contact discharge was applied to conductive surfaces and coupling planes of the EUT.

During the test, it was performed with single discharges. For the single discharge time between successive single discharges was at least 1 second.

**Vertical Coupling Plane (VCP):**

The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from, the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge.

**Horizontal Coupling Plane (HCP):**

The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge.

2) Air discharges at insulation surfaces of the EUT.

It was at least ten single discharges with positive and negative at the same selected point.

3) For the actual test configuration, please refer to the related Item –EUT Test Photos.

**4.1.4. Test Data**

Test Mode: Mode 1  
 Power Source: AC 230V, 50Hz  
 Temp.(°C)/Hum.(%RH): Tem.: 20.7°C Hum.: 55%

Item	Contact Discharge to conducted surfaces and to coupling planes		Air Discharge at insulating surfaces
	Direct Contact Discharge	Indirect Contact Discharge	
Test Voltage	Reaction of EUT / Result	Reaction of EUT / Result	Reaction of EUT / Result
+2kV	n.r.r. PASS	n.r.r. PASS	n.r.r. PASS
-2kV	n.r.r. PASS	n.r.r. PASS	n.r.r. PASS
+4kV	n.r.r. PASS	n.r.r. PASS	n.r.r. PASS
-4kV	n.r.r. PASS	n.r.r. PASS	n.r.r. PASS
+6kV	-	-	n.r.r. PASS
-6kV	-	-	n.r.r. PASS
+8kV	-	-	n.r.r. PASS
-8kV	-	-	n.r.r. PASS

Remarks: n.r.r. = no reaction recognized

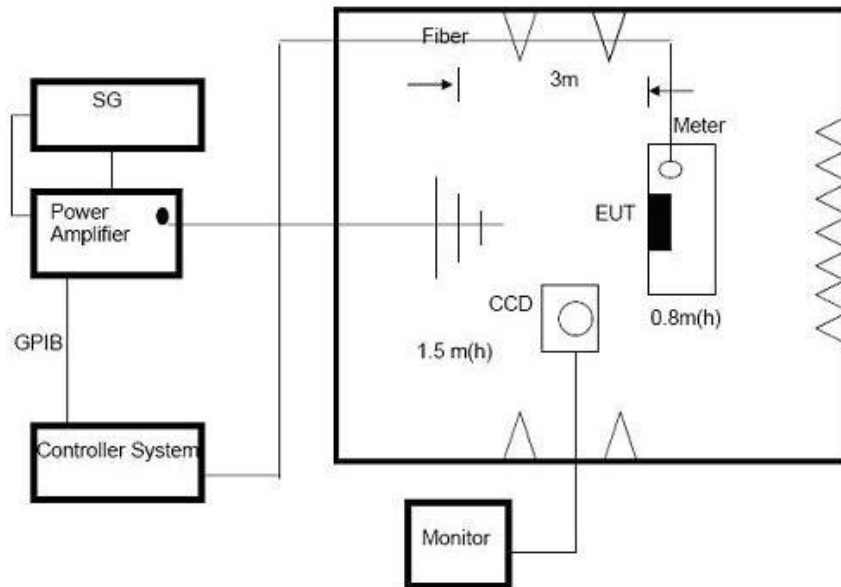
Performace Criteria B observed and No any function degraded during the tests.

## 4.2. Radiated, RF Electromagnetic Fields Test

### 4.2.1. Test Standard and Specification

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 9.2/ EN 55035 Clause 5
Basic Standard	EN 61000-4-3: 2006+A1:2008+A2:2010
Required Performance	A
Frequency Range	80MHz to 6GHz
Field Strength	3 V/m
Modulation	1kHz Sine Wave, 80%, AM Modulation
Frequency Step	1 % of preceding frequency value
Polarity of Antenna	Horizontal and Vertical
Test Distance	3 m
Antenna Height	1.5 m
Dwell Time	at least 3 seconds

### 4.2.2. Test Setup



### 4.2.3. Test Procedure

The EUT and support equipment, which are placed on a table that is 0.8 meter above ground and the testing was performed in a fully-anechoic chamber. The testing distance from antenna to the EUT was 3 meters.

- 1) The field strength level was 3V/m
- 2) The frequency range is swept from 80 MHz to 6000 MHz with the signal 80%amplitude modulated with a 1kHz sine wave.
- 3) The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to

respond, but shall in no case be less than 0.5s.

4) The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

#### 4.2.4. Test Data

Test Mode: Mode 1  
 Power Source: AC 230V, 50Hz  
 Temp.(°C)/Hum.(%RH): Tem.: 20.4°C Hum.: 52%

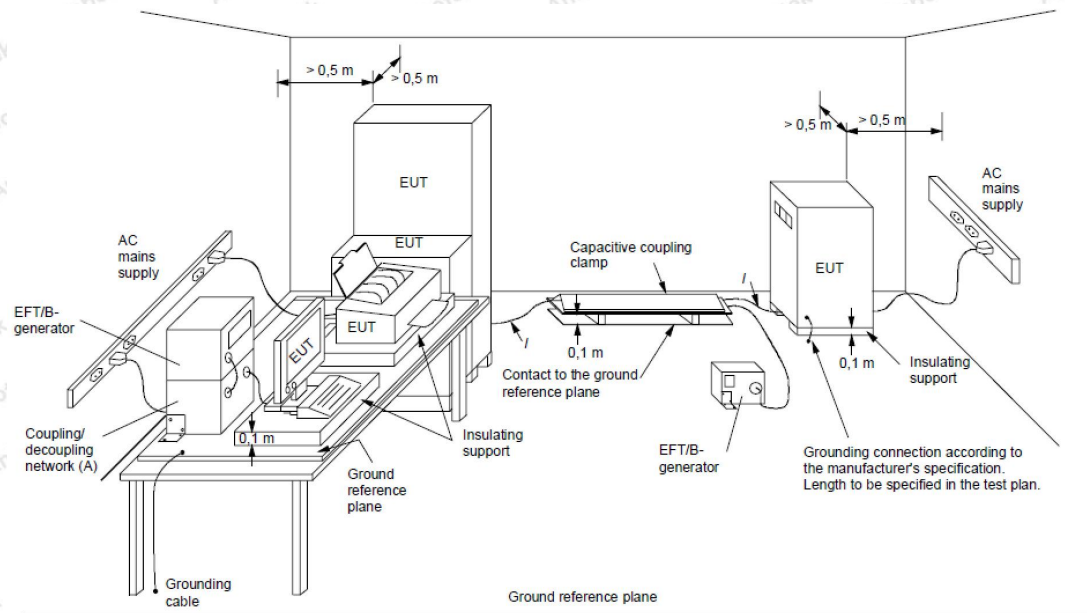
Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Observation	Perform. Criteria	Results
80~6000	H / V	3 V/m (rms) AM Modulated 1000Hz, 80%	Front	CT,CR	A	PASS
			Rear			
			Left			
			Right			

## 4.3. Fast Transients, Common Mode Test

### 4.3.1. Test Standard and Specification

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 9.4/ EN 55035 Clause 4.2.4
Basic Standard	EN 61000-4-4:2012
Required Performance	B
Test Voltage:	Power Line: 1 kV Signal/Control Line: 0.5 kV
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave shape :	Tr/Th 5/50 ns
Burst Duration:	15 ms for 5KHz Repetition Frequency 0.75 ms for 100KHz Repetition Frequency
Burst Period:	300 ms
Test Duration	1 min

### 4.3.2. Test Setup



Note: (A) location for supply line coupling

(B) location for signal lines coupling

For the actual test configuration, please refer to the related item – Photographs of the Test Setup

### 4.3.3. Test Procedure

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m\*1m min. and 0.65mm thick min.

The other condition as following manner:



- 1) The distance between any coupling devices and the EUT should be (0.5-0/+0.1)m for table-top equipment testing, and (1.0±0.1)m for floor standing equipment.
- 2) Both positive and negative polarity discharges were applied.
- 3) The duration time of each test sequential was 1 minute
- 4) For the actual test configuration, please refer to the related Item –EUT Test Photos.

**For Wired Network Ports:**

All associated cabling was configured, on but insulated from, using a 50 mm isolator, the same horizontal coupling plane as the equipment under test.

Using CDNs, EM Clamps or current clamps as appropriate, the power ports and applicable signal and control ports were subjected to the required, pre calibrated RF injected signal strength, modulated as described, swept over the frequency range of test.

During this testing any anomalies in the equipment under tests performance was recorded.

**4.3.4. Test Data**

Test Mode: Mode 1  
 Power Source: AC 230V, 50Hz  
 Temp.(°C)/Hum.(%RH): Tem.: 24.6°C Hum.: 49%

Coupling Line		Test level (kV)								Observation	Criterion	Results
		0.5		1		2		4				
		+	-	+	-	+	-	+	-			
AC Line	L	P	P	P	P					TT,TR	B	PASS
	N	P	P	P	P							PASS
	L+N	P	P	P	P							PASS

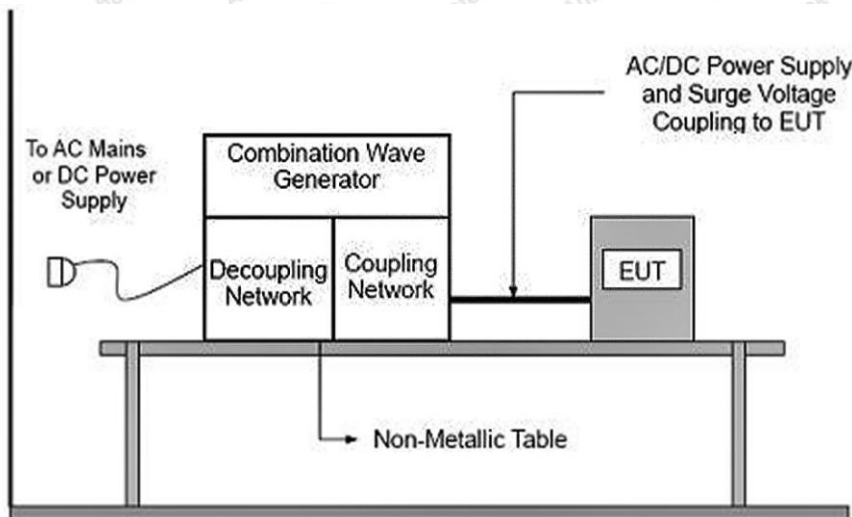
Note: 1)There was not any unintentional transmission in standby mode  
 2) In the table: 'P' represents 'PASS'; 'F' represents 'FAIL'.

## 4.4. Surges Test

### 4.4.1. Test Standard and Specification

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 9.8/ EN 55035 Clause 4.2.5
Basic Standard	EN 61000-4-5: 2014+A1:2017
Required Performance	B
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8 /20 us Short Circuit Current
Test Voltage:	Line to Line: 1 kV; Line to ground: 2kV
Generator Source:	2 ohm between networks
Impedance:	12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0°/90°/180°/270°
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points

### 4.4.2. Test Setup



### 4.4.3. Test Procedure

#### 1) For EUT power supply:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2meters in length (or shorter).

For double-insulated products without PE or external earth connections, the test shall be done in a similar way as for grounded products but without adding any additional external grounded connections. If there are no other possible connections to earth, line-to-ground tests may be omitted.

2) For Unshielded unsymmetrical interconnection lines:

The surge is applied to the lines via the capacitive coupling. The coupling /decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

3) Unshielded symmetrical interconnections communication lines:

The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrester cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

4) For Shielded lines:

Direct application,

The EUT is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port(s) under test is grounded. This test applies to equipment with single or multiple shielded cables.

Rules for application of the surge to shielded lines:

i) Shields grounded at both ends

> The surge injection on the shield.

ii) Shields grounded at one end

> If in the installation the shield is connected only at the auxiliary equipment, test shall be done in that configuration but with the generator still connected to the EUT side. If cable lengths allow, the cables shall be on insulated supports 0.1 m above the ground plane or cable tray.

For products which do not have metallic enclosures, the surge is applied directly to the shielded cable.

- Alternative coupling method for testing single cables in a multi-shield configuration, Surges are applied in close proximity to the interconnection cable under test by a wire. The length of the cable between the port(s) under test and the device attached to the other end of the cable shall be the lesser of the maximum length permitted by the EUT's specification, or 20 m. Where the length exceeds 1 m, excess lengths of cables shall be bundled at the approximate centre of the cables with the bundles 30 cm to 40 cm in length.

### 4.4.4. Test Data

Test Mode: Mode 1  
 Power Source: AC 230V, 50Hz  
 Temp.(°C)/Hum.(%RH): Tem.: 24.6°C Hum.: 49%

Coupling Line			Test level								Observation	Criterion	Result
			0.5 kV		1 kV		2 kV		4 kV				
			+	-	+	-	+	-	+	-			
AC line	L-N	0°	P	P	P	P					TT,TR	B	PASS
		90°	P	P	P	P							
		180°	P	P	P	P							
		270°	P	P	P	P							
	L-GND	0°	P	P	P	P	P	P			TT,TR	B	PASS
		90°	P	P	P	P	P	P					
		180°	P	P	P	P	P	P					
		270°	P	P	P	P	P	P					
	N-GND	0°	P	P	P	P	P	P			TT,TR	B	PASS
		90°	P	P	P	P	P	P					
		180°	P	P	P	P	P	P					
		270°	P	P	P	P	P	P					

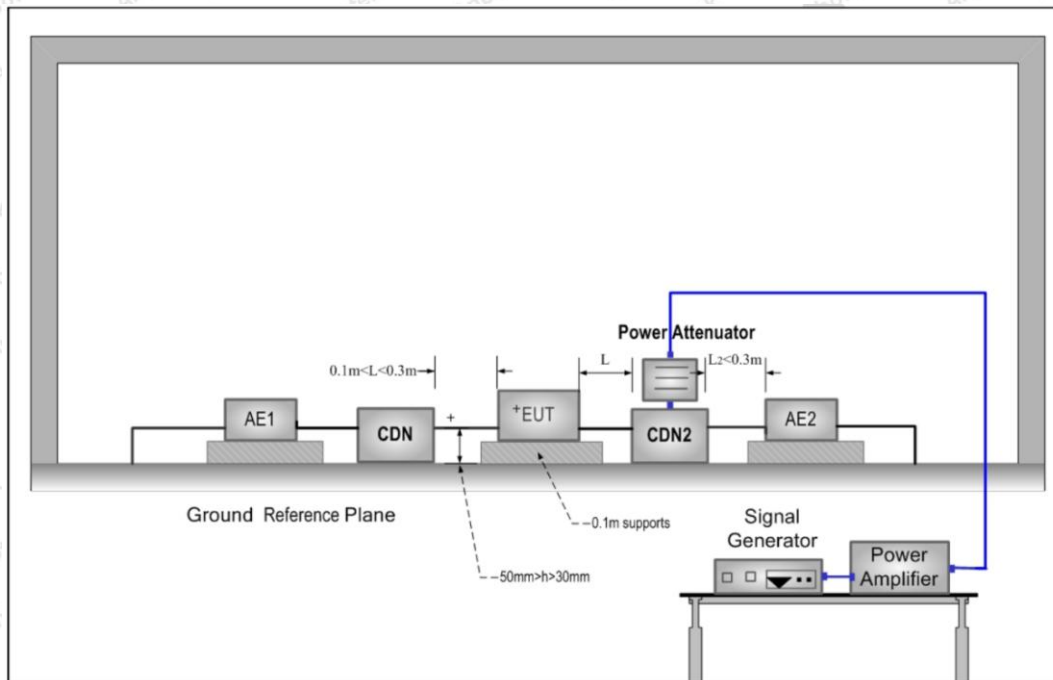
Note: 1) There was not any unintentional transmission in standby mode  
 2) In the table: 'P' represents 'PASS'; 'F' represents 'FAIL'.

## 4.5. Radio Frequency, Common Mode Test

### 4.5.1. Test Standard and Specification

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 9.5/ EN 55035 Clause 5
Basic Standard	EN 61000-4-6:2014
Required Performance	A
Frequency Range:	0.15 MHz - 80 MHz/0.15MHz~10MHz, 10MHz~30MHz, 30MHz~80MHz
Field Strength:	3 Vr.m.s./3V~1Vr.m.s./3Vr.m.s.
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of fundamental
Dwell Time:	at least 3 seconds

### 4.5.2. Test Setup



### 4.5.3. Test Procedure

- 1) The EUT was placed on an insulating support of 0.1m height above a ground reference Plane, arranged and connected to satisfy its functional requirement. All cables exiting the EUT was supported at a height of at least 30 mm above the ground reference plane.
- 2) The coupling and decoupling devices were required, they were located between 0.1 m and 0.3 m from the EUT. This distance was to be measured horizontally from the projection of the EUT on to the ground reference plane to the coupling and decoupling device.
- 3) Each AE, used with clamp injection, shall be placed on an insulating support 0.1 m above the ground reference plane. A decoupling network shall be installed on each cable between the EUT and AE except

the cable under test. All cables connected to each AE, other than those being connected to the EUT, shall be provided with decoupling networks. The decoupling networks connected to each AE (except those on cables between the EUT and AE) shall be applied no further than 0.3 m from the AE. The cable(s) between the AE and the decoupling network (s) or in between the AE and the injection clamp shall not be bundled nor wrapped and shall be kept between 30 mm and 50 mm above the ground reference plane.

4) The frequency range was swept from 150 kHz to 230 MHz, using the signal levels established during the setting process, and with the disturbance signal 80% amplitude modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or to change coupling devices as necessary. Where the frequency was swept incrementally, the step size do not exceed 1% of the preceding frequency

#### 4.5.4. Test Data

Test Mode: Mode 1  
 Power Source: AC 230V, 50Hz  
 Temp.(°C)/Hum.(%RH): Tem.: 24.6°C Hum.: 49%

Voltage (V)	Test Frequency (MHz)	Tested Line	Injection Method.	Performance Criterion	Test Result
3	0.15 – 80	AC line	CDN-M2	CT/CR	PASS

Remark: For normal operating function: There was no change compared with the initial operation during and after the test.

Test Mode: Mode 1  
 Power Source: AC 230V, 50Hz  
 Temp.(°C)/Hum.(%RH): Tem.: 24.6°C Hum.: 49%

Voltage (V)	Test Frequency (MHz)	Tested Line	Injection Method.	Performance Criterion	Test Result
3	0.15 – 10	AC line	CDN-M2	CT/CR	PASS
3~1	10~30	AC line	CDN-M2	CT/CR	PASS
1	30~80	AC line	CDN-M2	CT/CR	PASS

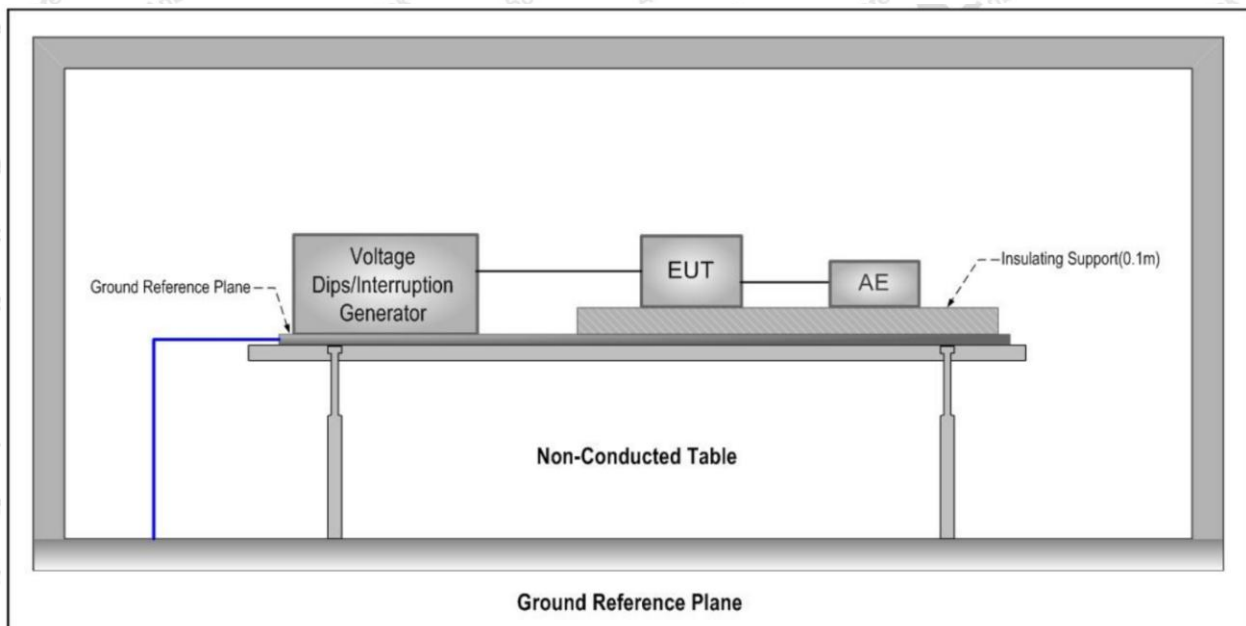
Remark: For normal operating function: There was no change compared with the initial operation during and after the test.

## 4.6. Voltage Dips and Interruptions

### 4.6.1. Test Standard and Specification

Test Standard	ETSI EN 301 489-1 V2.2.3 Clause 9.7/ EN 55035 Clause 4.2.6
Basic Standard	EN 61000-4-11: 2014+A1:2017
Voltage Dips:	0% reduction, 0.5 Cycle 0% reduction, 1.0 Cycle 70% reduction, 25 Cycles
Voltage Interruptions:	0% reduction, 250 Cycles
Interval between Event:	Minimum 10 seconds
Phase Angle:	0°/180°
Test Cycle:	3 times

### 4.6.2. Test Setup



### 4.6.3. Test Procedure

- 1) The EUT was placed on a ground reference plane (GRP) insulated by an insulating support 0.1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2. The test was performed with the EUT connected to the test generator with the shortest power supply cable as specified by the EUT manufacturer.
3. The EUT was tested for each selected combination of test level and duration with a sequence of three dips/interruptions with intervals of 10 s minimum. Each representative mode of operation was tested.
4. For EUT with more than one power cord, each power cord was tested individually.

**4.6.4. Test Data**

Test Mode: Mode 1  
 Power Source: AC 230V, 50Hz  
 Temp.(°C)/Hum.(%RH): Tem.: 24.6°C Hum.: 49%

Ut:230Vac 50Hz	Durations		Event interval (sec)	Total events (time)	Performance Criterion	Result
Voltage residual (%)	(period)	(ms)	10	3	TT/TR	PASS
0	1	20	10	3	TT/TR	PASS
0	0.5	10	10	3	TT/TR	PASS
70	25	500	10	3	TT/TR	PASS
0	250	5000	10	3	TT/TR	PASS
70	0.5	10	10	3	TT or CR	PASS

Ut:100Vac 50Hz	Durations		Event interval (sec)	Total events (time)	Performance Criterion	Result
Voltage residual (%)	(period)	(ms)	10	3	TT/TR	PASS
0	1	20	10	3	TT/TR	PASS
0	0.5	10	10	3	TT/TR	PASS
70	25	500	10	3	TT/TR	PASS
0	250	5000	10	3	TT/TR	PASS
70	0.5	10	10	3	TT or CR	PASS

Ut:240Vac 50Hz	Durations		Event interval (sec)	Total events (time)	Performance Criterion	Result
Voltage residual (%)	(period)	(ms)	10	3	TT/TR	PASS
0	1	20	10	3	TT/TR	PASS
0	0.5	10	10	3	TT/TR	PASS
70	25	500	10	3	TT/TR	PASS
0	250	5000	10	3	TT/TR	PASS
70	0.5	10	10	3	TT or CR	PASS



## APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Conducted Emission Test



Photo of Radiation Emission Test



Photo of Flicker Test



Photo of RF Field Strength Susceptibility Test



Photo of Electrical Fast Transient /Burst Immunity Test



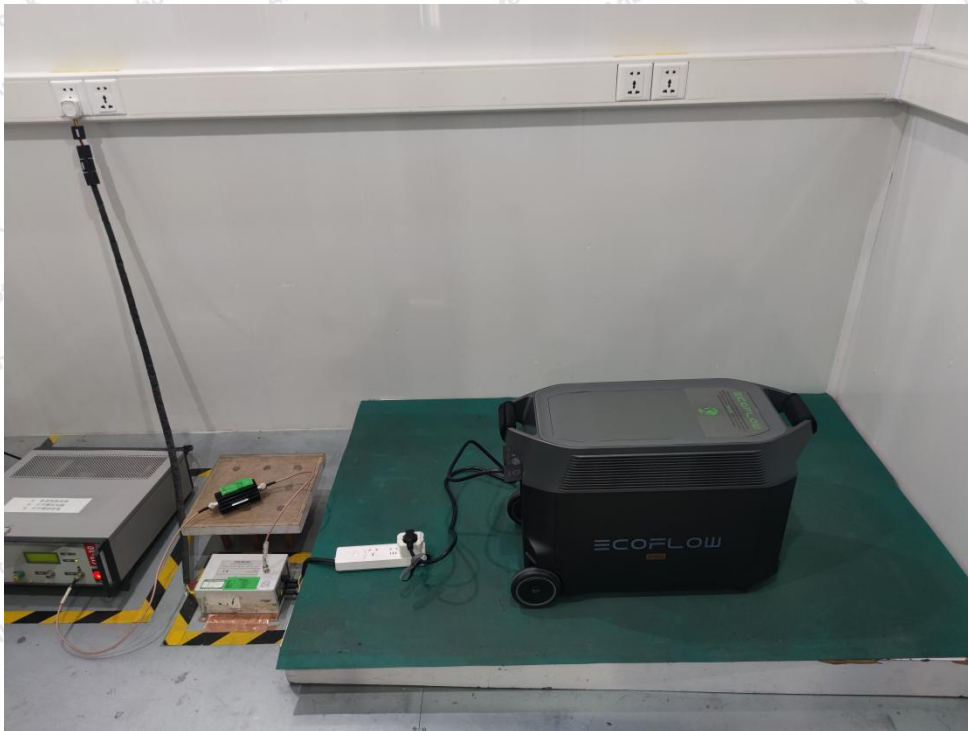
Photo of Surge Test



Photo of Dips Immunity Test



Photo of C/S Test



## APPENDIX II -- EXTERNAL PHOTOGRAPH



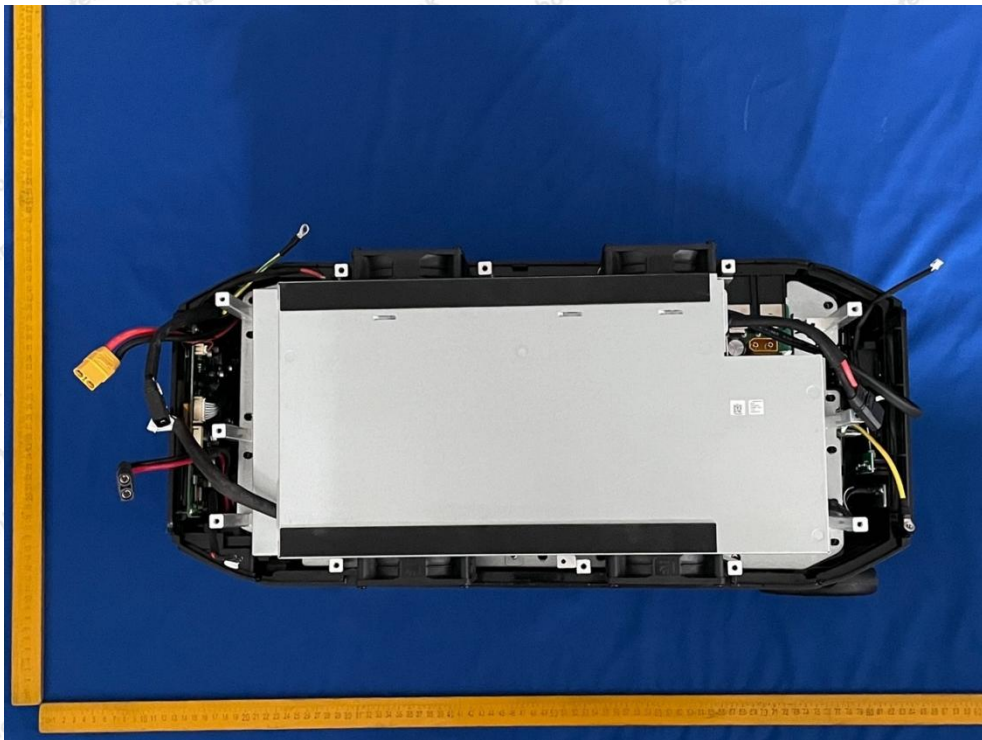


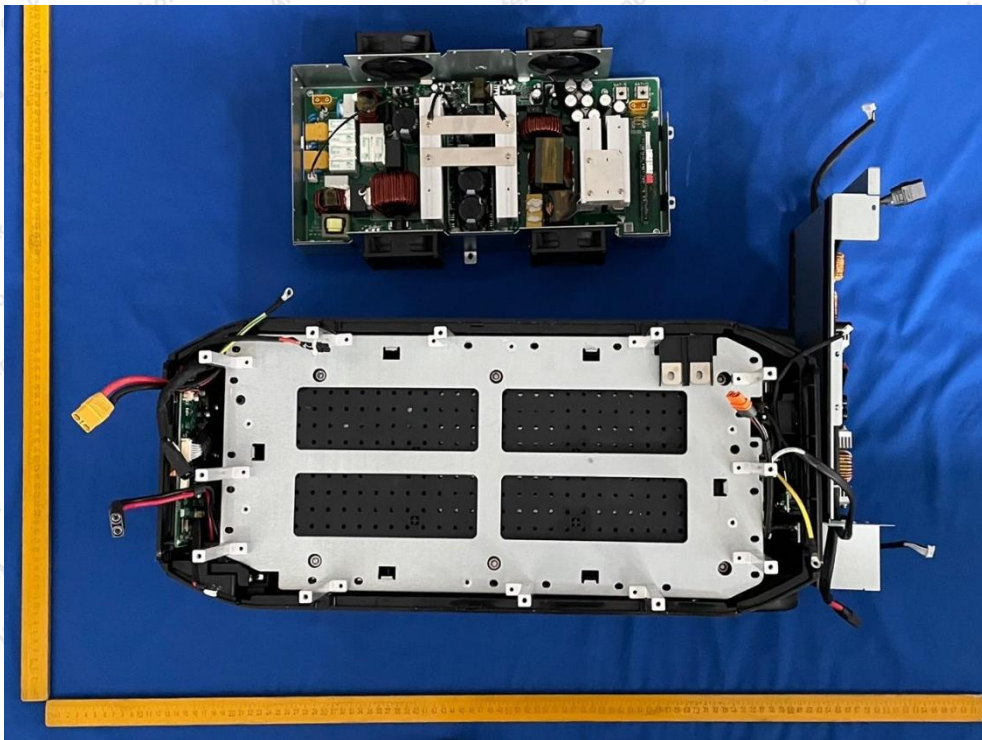
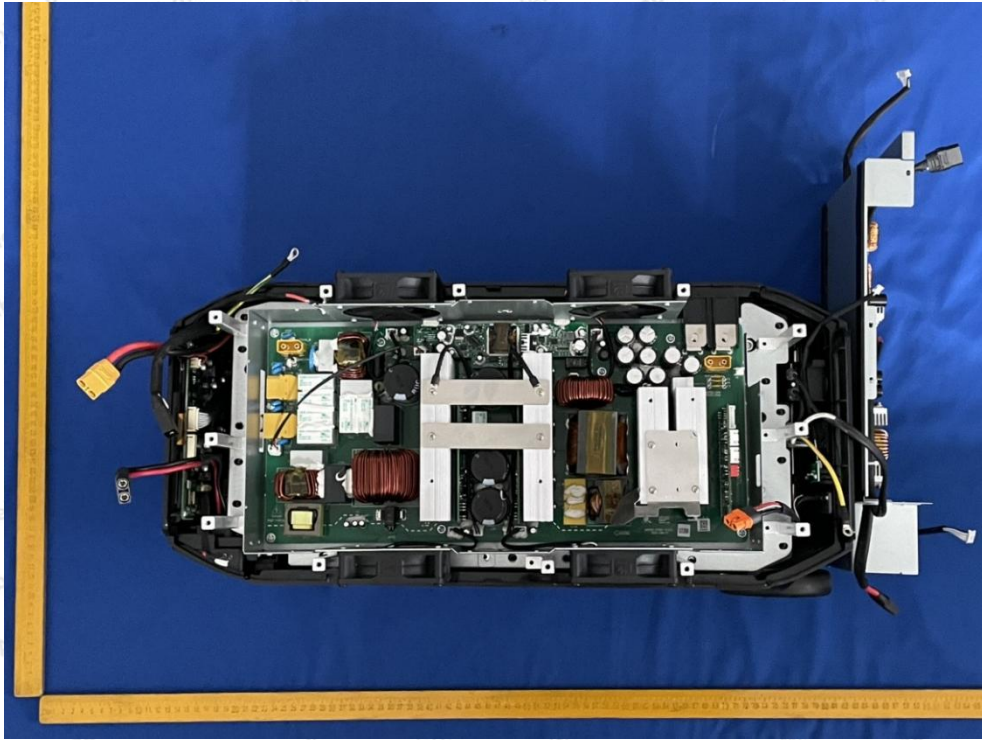


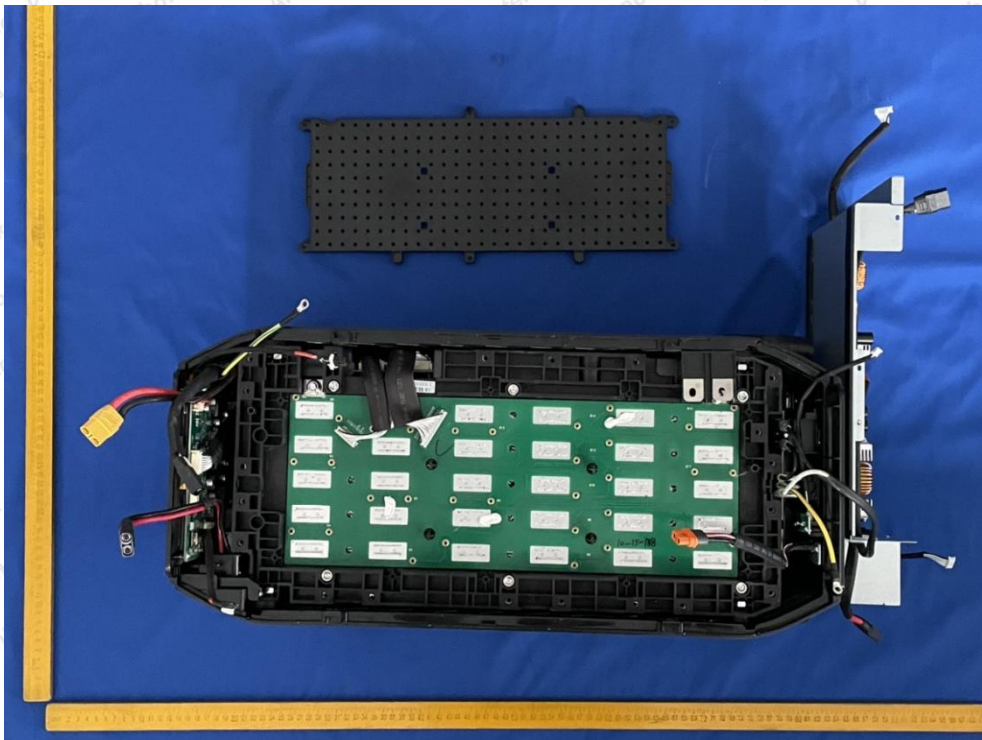
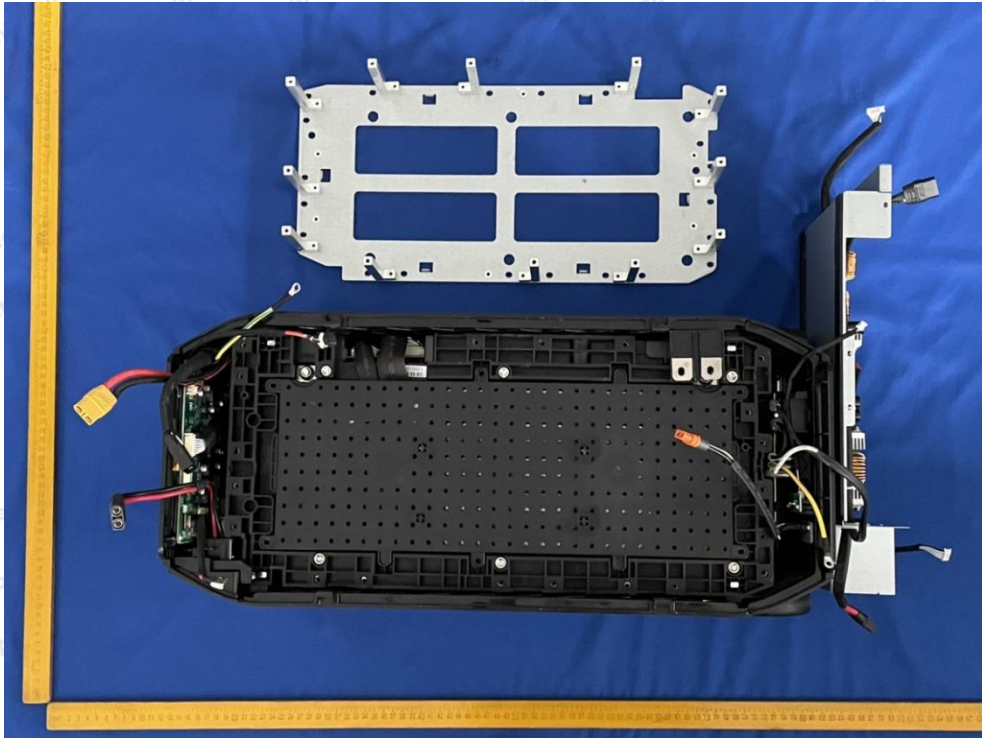


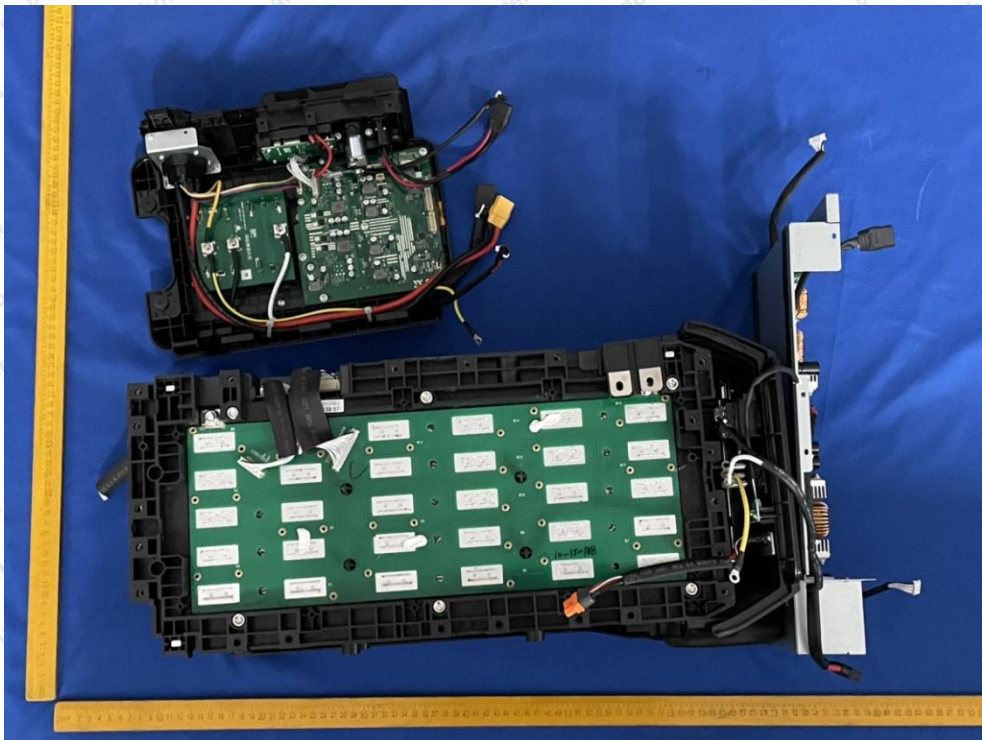
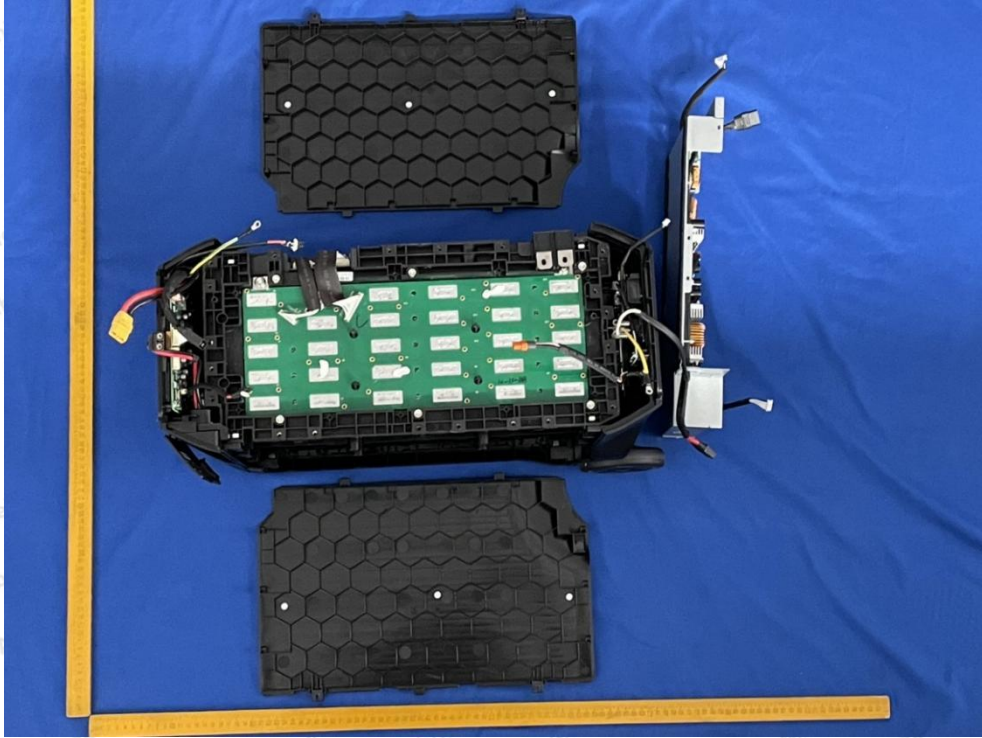


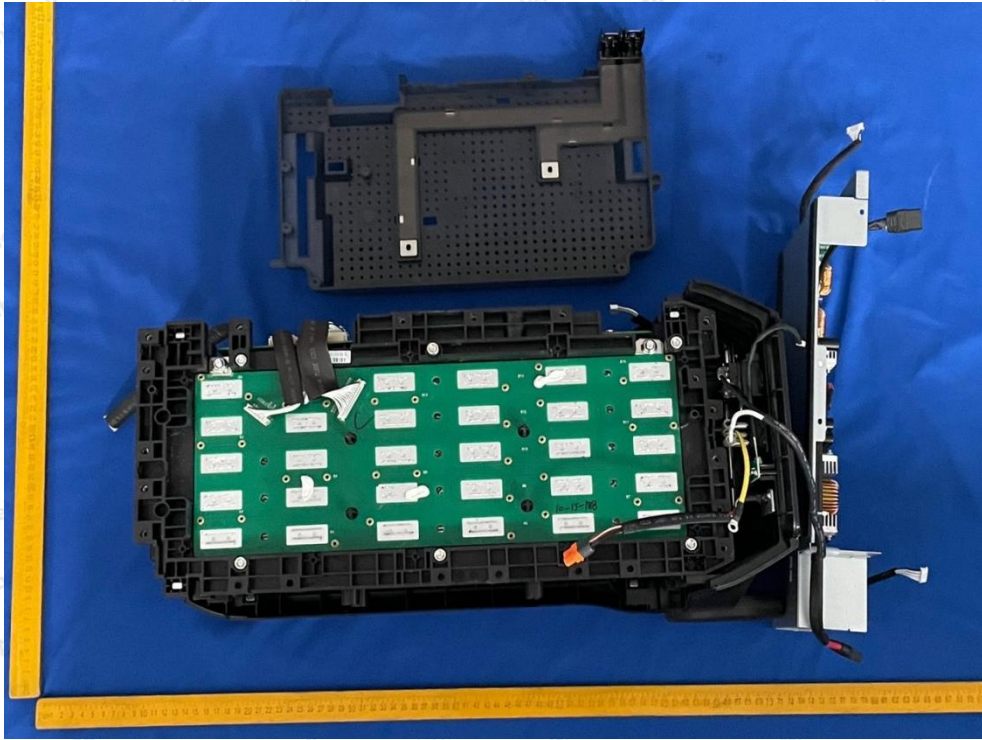
**APPENDIX III -- INTERNAL PHOTOGRAPH**



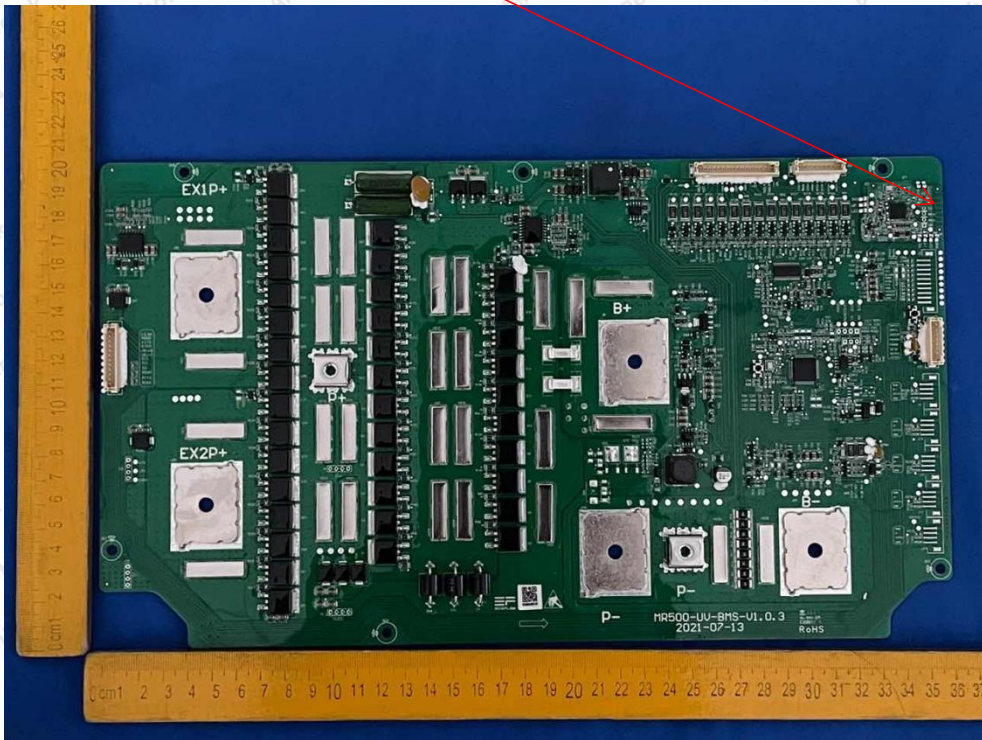


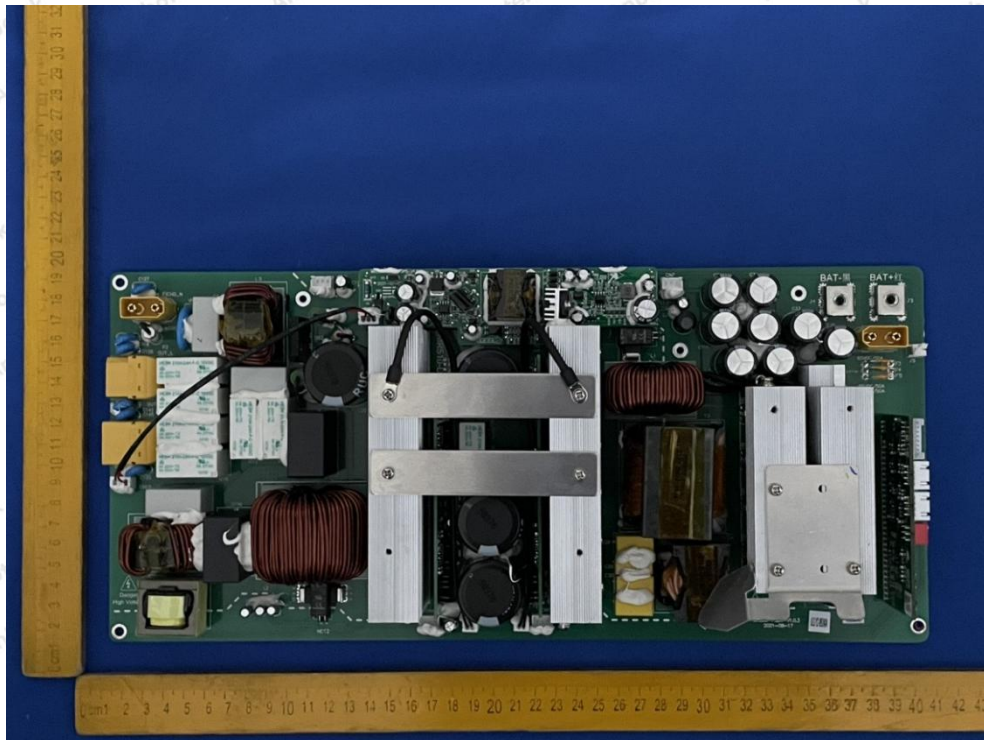
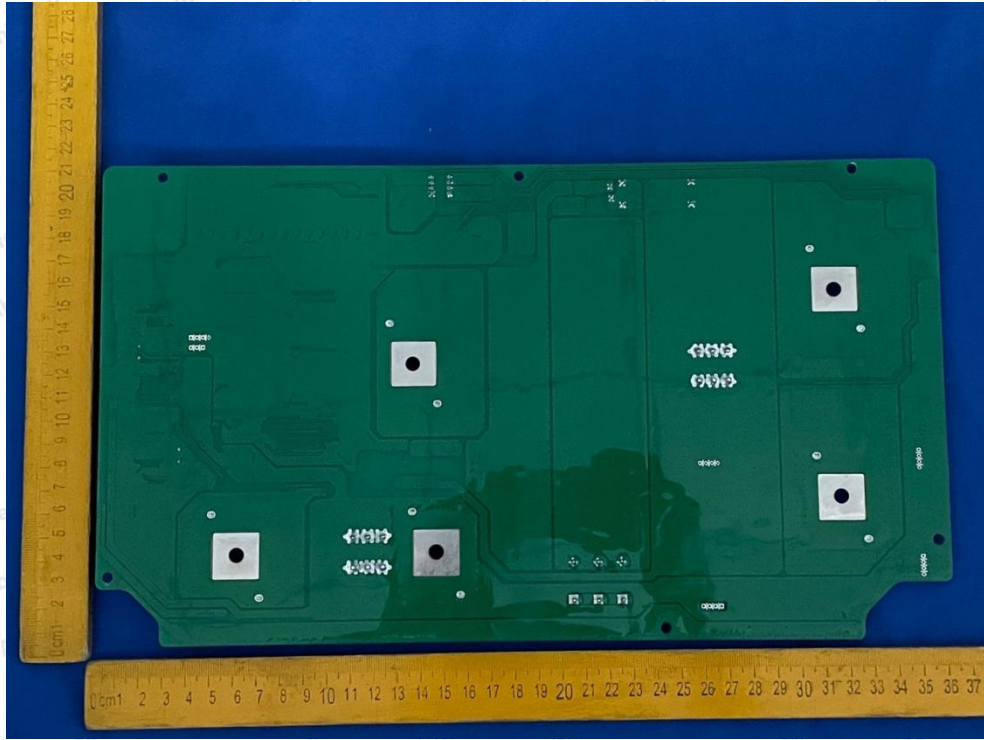


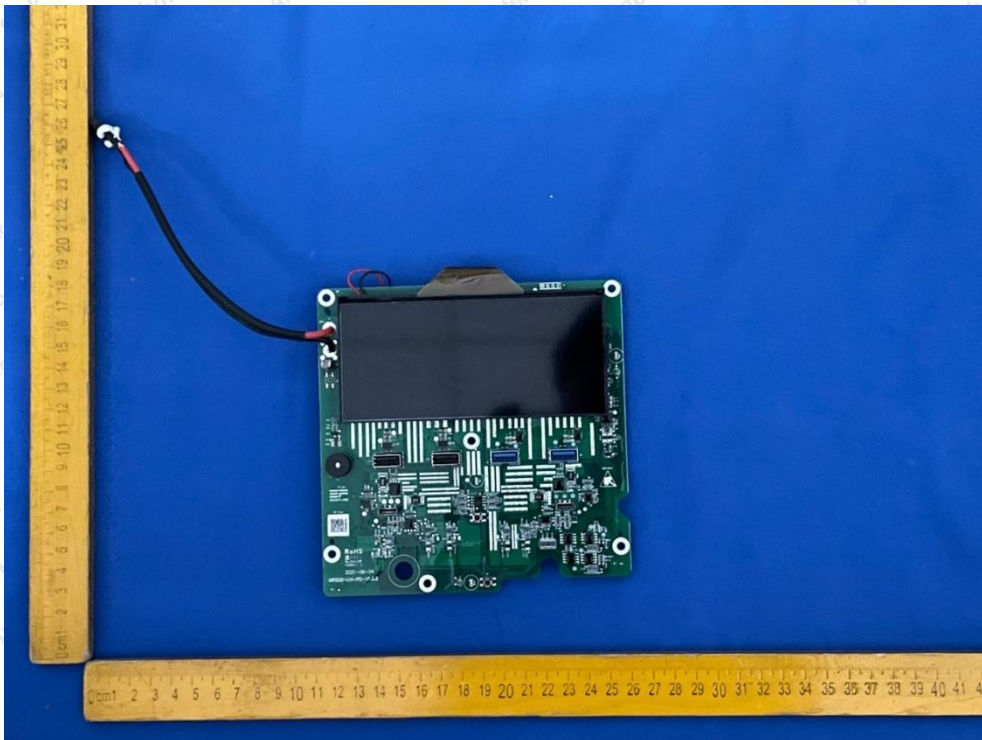
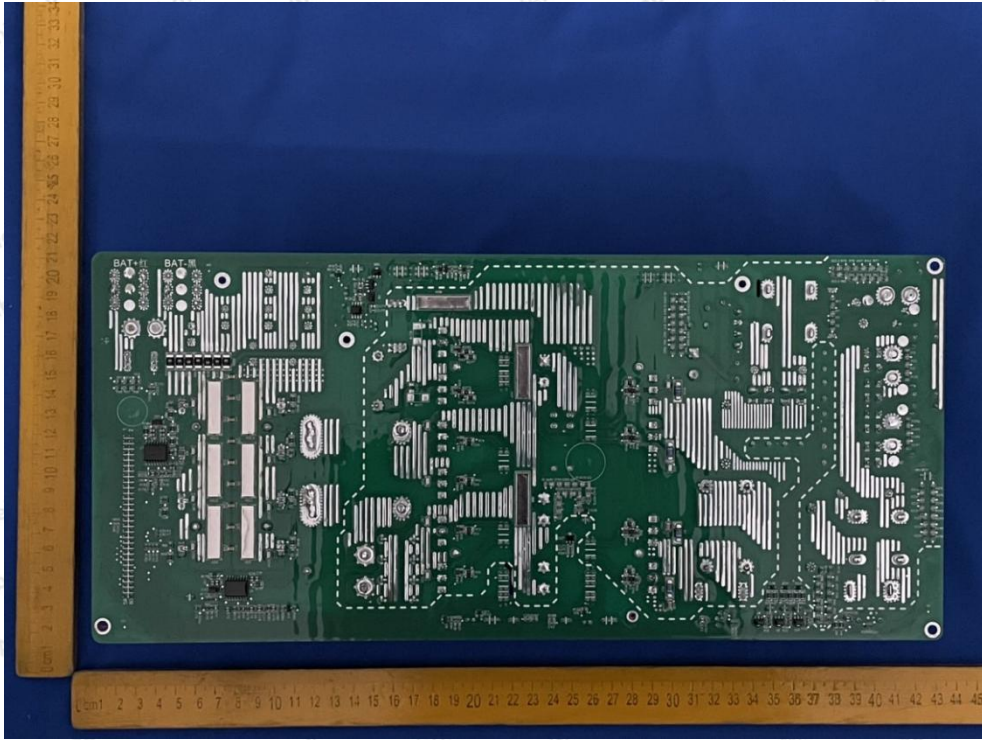




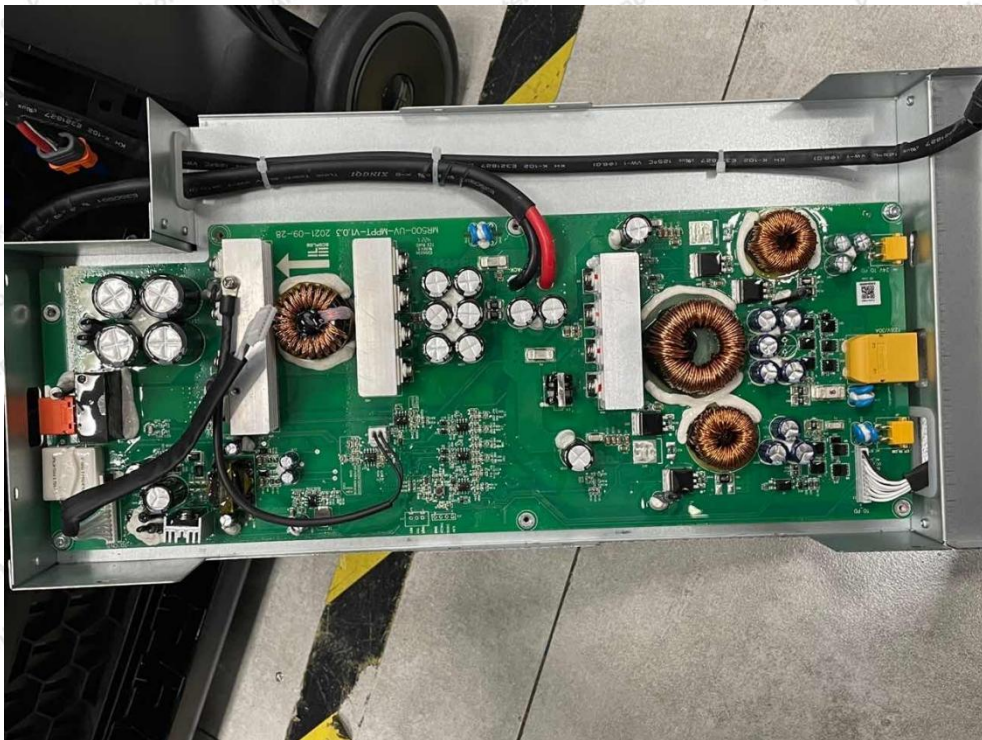
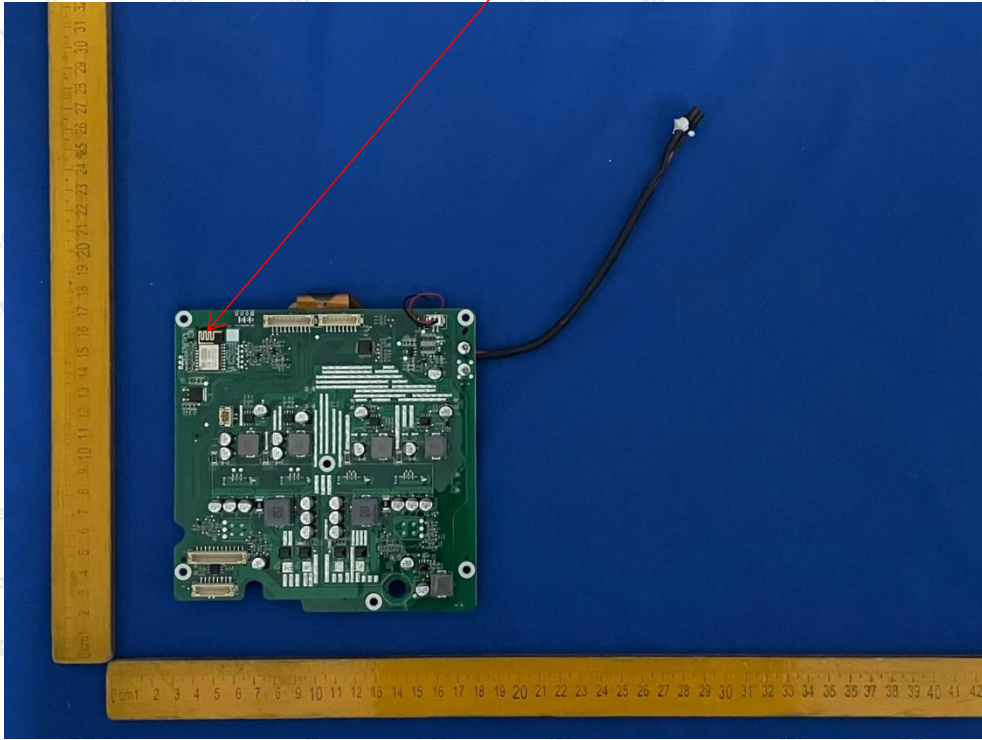
BLE ANT







WiFi ANT







----- End of Report -----