



# Shenzhen Huaxia Testing Technology Co., Ltd.

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Report Template Version: V05  
Report Template Revision Date: 2021-11-03

## TEST REPORT

**Report No.:** CQASZ20221202217E

**Applicant:** Shenzhen Longan Technology Co., Ltd.

**Address of Applicant:** Room 1211, Unit C, No. 37 Baoshi West Road, Shiyan Street, Baoan District, Shenzhen, Guangdong, China

**Equipment Under Test (EUT):**

**EUT Name:** CANBed - Arduino CAN-Bus RP2040 development board

**Model No.:** 1030018

**Test model No.:** 1030018

**Brand Name:** Longan Labs

**Standards:** EN 55032:2015/A11:2020

EN 55035:2017/A11:2020

EN IEC 61000-3-2:2019

EN 61000-3-3:2013/A1:2019

**Date of Receipt:** 2022-12-28

**Date of Test:** 2022-12-28 to 2022-12-30

**Date of Issue:**

**Test Result:** **PASS\***

\*In the configuration tested, the EUT complied with the standards specified above

**Tested By:** \_\_\_\_\_

( Joe Wang )

**Reviewed By:** \_\_\_\_\_

( Timo Lei )

**Approved By:** \_\_\_\_\_

( Jack Ai )



## 1 Version

**Revision History of Report**

Report No.	Version	Description	Issue Date
CQASZ20221202217E	Rev.01	Initial report	

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## 2 Test Summary

<b>Electromagnetic Compatibility (EMC) Part</b>				
<b>Electromagnetic Interference (EMI)</b>				
<b>Test item</b>	<b>Test Requirement</b>	<b>Test Method</b>	<b>Class / Severity</b>	<b>Result</b>
Radiated Emission (30MHz to 6GHz)	EN 55032:2015/A11:2020	EN 55032:2015/A11:2020	Class B	PASS
Conducted Emission (150kHz to 30MHz)	EN 55032:2015/A11:2020	EN 55032:2015/A11:2020	Class B	PASS
Harmonic Emission on AC, 50Hz	EN IEC 61000-3-2:2019	EN IEC 61000-3-2:2019	Table 1 of EN IEC 61000-3-2	N/A <sup>2)</sup>
Flicker Emission on AC	EN 61000-3- 3:2013/A1:2019	EN 61000-3- 3:2013/A1:2019	Clause 5 of EN 61000-3-3	PASS
<b>Electromagnetic Susceptibility (EMS)</b>				
Electrostatic discharges (ESD)	EN 55035:2017/A11:2020	EN 61000-4-2:2009	Clause 5	PASS
Radiated Immunity	EN 55035:2017/A11:2020	EN 61000-4-3:2006 /A2:2010	Clause 5	PASS
Power frequency magnetic field	EN 55035:2017/A11:2020	EN 61000-4-8:2010	Clause 5	N/A <sup>1)</sup>
Electrical Fast Transients (EFT)	EN 55035:2017/A11:2020	EN 61000-4-4:2012	Clause 5	PASS
Surge Immunity	EN 55035:2017/A11:2020	EN 61000-4-5:2014	Clause 5	PASS
Injected Currents, 150kHz to 80MHz	EN 55035:2017/A11:2020	EN 61000-4-6:2014	Clause 5	PASS
Voltage Dips and Interruptions	EN 55035:2017/A11:2020	EN 61000-4-11:2004	Clause 5	PASS

Remark:

- § If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. (Refer to EN 55032:2015/A11:2020 Clause 8 table 1 Conditional testing procedure)
- § If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. (Refer to EN 55032:2015/A11:2020 Clause 8 table 1 Conditional testing procedure)
- § If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. (Refer to EN 55032:2015/A11:2020 Clause 8 table 1 Conditional testing procedure)
- § If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less. (Refer to EN 55032:2015/A11:2020 Clause 8 table 1 Conditional testing procedure)

N/A<sup>1)</sup>: Because this test EUT is not belonging to apparatus containing devices susceptible to magnetic fields, therefore, it is not applicable.

N/A<sup>2)</sup>: Because the rated power of this product is less than 75W.

### 3 Contents

	Page
<b>1 VERSION .....</b>	<b>2</b>
<b>2 TEST SUMMARY .....</b>	<b>3</b>
<b>3 CONTENTS .....</b>	<b>4</b>
<b>4 GENERAL INFORMATION .....</b>	<b>5</b>
4.1 CLIENT INFORMATION .....	5
4.2 GENERAL DESCRIPTION OF EUT .....	5
4.3 DESCRIPTION OF SUPPORT UNITS .....	6
4.4 TEST LOCATION .....	6
4.5 DEVIATION FROM STANDARDS .....	6
4.6 ABNORMALITIES FROM STANDARD CONDITIONS .....	6
4.7 OTHER INFORMATION REQUESTED BY THE CUSTOMER .....	6
4.8 MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2) .....	6
<b>5 EQUIPMENT LIST .....</b>	<b>7</b>
<b>6 EMISSION TEST RESULTS .....</b>	<b>9</b>
6.1 RADIATED EMISSIONS .....	9
6.2 CONDUCTED EMISSION .....	12
6.3 HARMONICS TEST RESULTS .....	15
6.4 FLICKER TEST RESULTS .....	16
<b>7 IMMUNITY TEST RESULTS .....</b>	<b>18</b>
7.1 RADIATED IMMUNITY .....	19
7.2 ESD .....	21
7.3 RF COMMON MODE 0.15MHz TO 80MHz .....	23
7.4 ELECTRICAL FAST TRANSIENTS (EFT) .....	25
7.5 SURGE .....	27
7.6 VOLTAGE DIPS AND INTERRUPTIONS .....	29
<b>APPENDIX 1 PHOTOGRAPHS OF TEST SETUP .....</b>	<b>31</b>
<b>APPENDIX 2 PHOTOGRAPHS OF EUT .....</b>	<b>34</b>

## 4 General Information

### 4.1 Client Information

Applicant:	Shenzhen Longan Technology Co., Ltd.
Address of Applicant:	Room 1211, Unit C, No. 37 Baoshi West Road, Shiyan Street, Baoan District, Shenzhen, Guangdong, China
Manufacturer:	Shenzhen Longan Technology Co., Ltd.
Address of Manufacturer:	Room 1211, Unit C, No. 37 Baoshi West Road, Shiyan Street, Baoan District, Shenzhen, Guangdong, China
Factory:	Shenzhen Longan Technology Co., Ltd.
Address of Factory:	Room 1211, Unit C, No. 37 Baoshi West Road, Shiyan Street, Baoan District, Shenzhen, Guangdong, China

### 4.2 General Description of EUT

Product Name:	CANBed - Arduino CAN-Bus RP2040 development board
Model No.:	1030018
Test model No.:	1030018
Trade Mark:	Longan Labs
Power Supply:	DC 5V, 1A
Test Mode:	
Normal working	Keep the EUT in Normal working

### 4.3 Description of Support Units

The EUT has been tested with associated equipment below.

1) support equipment

Description	Manufacturer	Model No.	Certification	Supplied by
Adapter	XIAOMI	MDY-08-EF	/	CQA

### 4.4 Test Location

Shenzhen Huaxia Testing Technology Co., Ltd.

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

### 4.5 Deviation from Standards

None.

### 4.6 Abnormalities from Standard Conditions

None.

### 4.7 Other Information Requested by the Customer

None.

### 4.8 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Conduction emission	3.74dB (9kHz to 150kHz)
		3.34dB (150kHz to 30MHz)
2	Radiated emission	5.12dB (30MHz-1GHz )
		4.60dB (1GHz-6GHz )
3	Radiated Immunity	1.61dB
4	Conducted Immunity	0.92dB
5	Temperature test	0.8°C
6	Humidity test	2.0%
7	DC power test	0.5 %

## 5 Equipment List

<b>Conducted Emissions (150kHz-30MHz)</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No.</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
EMI Test Receiver	R&S	ESPI3	CQA-013	2022/9/9	2023/9/8
LISN	R&S	ENV216	CQA-003	2022/9/9	2023/9/8
Coaxial cable (9KHz~300MHz)	CQA	N/A	C021	2022/9/9	2023/9/8

<b>Radiated Emissions</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No.</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
Loop antenna	SCHWARZBECK	FMZB 1516	CQA-060	2021/9/16	2024/9/15
Horn Antenna	R&S	BBHA 9170	CQA-088	2021/9/16	2024/9/15
Horn Antenna	R&S	HF906	CQA-012	2021/9/16	2024/9/15
Bilog Antenna	R&S	HL562	CQA-011	2021/9/16	2024/9/15
EMI Test Receiver	R&S	ESR7	CQA-005	2022/9/9	2023/9/8
Spectrum analyzer	R&S	FSU26	CQA-038	2022/9/9	2023/9/8
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2022/9/9	2023/9/8
Coaxial cable (1GHz~40GHz)	CQA	N/A	C007	2022/9/9	2023/9/8
Coaxial cable (9KHz~1GHz)	CQA	N/A	C013	2022/9/9	2023/9/8

<b>Harmonic Current &amp; Voltage Fluctuation and Flicker</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No.</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
Harmonic And Flicker Analyzer	CI	PACS-3	CQA-021	2022/9/9	2023/9/8
AC Power Supply	CI	5001 ix	CQA-073	2022/9/9	2023/9/8

<b>Electrostatic Discharge</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No.</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
ESD Simulator	EM TEST	DITO	CQA-001	2022/9/9	2023/9/8

**Electrical Fast Transients/Burst & Surge & Voltage Dips and Interruptions at Power Port**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No.</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
EMS test system	HTEC	ECOMPACT 7	CQA-002	2022/9/9	2023/9/8
Communications surge generator	HTEC	HTSG 70	CQA-063	2022/9/9	2023/9/8
Capacitive Coupling Clamp	HTC	H3C	CQA-018	2022/9/9	2023/9/8

**Conducted Immunity (150kHz-80MHz)**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No.</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
RF-Generator	EM TEST	CWS 500	CQA-016	2022/9/9	2023/9/8
6db Attenuator	EM TEST	ATT6/75	CQA-049	2022/9/9	2023/9/8
CDN	SCHWARZBECK	CDN M2/M3PE	CQA-050	2022/9/9	2023/9/8

**Radiated Immunity (80MHz-6GHz)**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No.</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
3m Anechoic Chamber	Albatross	APC13102-SAC	Z-064	2021/9/11	2024/10/10
Signal Generator	R&S	SMB100A	Z-063-01	2022/9/9	2023/9/8
Power amplifier	R&S	BBA150-BC1000	Z-140	2022/9/9	2023/9/8
Power amplifier	R&S	BBA150-D200+E200	Z-144	2022/9/9	2023/9/8
log-periodic antenna	R&S	HL046E	Z-063-18	2021/9/16	2024/9/15
Stacked Double Log-periodic Antenna	Schwarzbeck	STLP 9149	Z-063-19	2021/9/16	2024/9/15
Power Meter	R&S	NRP2	Z-063-06	2022/9/9	2023/9/8
Audio mouth	BK	BK-4227	Z-063-23	2022/9/9	2023/9/8
Audio Box	BK	ACO-B0X	Z-063-24	2022/9/9	2023/9/8
Audio analyzer	R&S	UPL	Z-063-76	2022/9/9	2023/9/8

## 6 Emission Test Results

### 6.1 Radiated Emissions

<b>Test Requirement:</b>	EN 55032		
<b>Test Method:</b>	EN 55032		
<b>Measurement Distance:</b>	3m		
<b>Ambient:</b>	Temp.:25.5°C	Humid.: 53%	Press.: 1009mbar
<b>Test Mode:</b>	Normal working		

<b>Receive Setup:</b>	Frequency range (MHz)	Detector	RBW	VBW
	30-1000	Quasi-peak	120kHz	300kHz
	Above 1000	Peak	1MHz	3MHz

Table 1: Requirements for radiated emissions for Class B equipment

Frequency	Limit(@3m)	Detector
30MHz-230MHz	40dB $\mu$ V/m	QP
230MHz-1GHz	47dB $\mu$ V/m	QP
1GHz-3GHz	50dB $\mu$ V/m	Average
	70dB $\mu$ V/m	PK
3GHz-6GHz	54dB $\mu$ V/m	Average
	74dB $\mu$ V/m	PK

#### Test Setup:

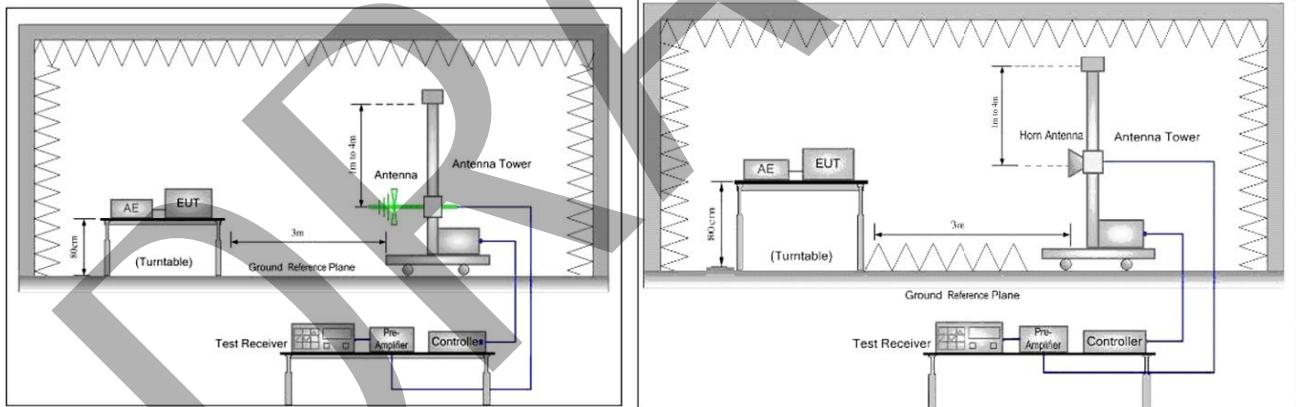


Figure 1. 30MHz to 1GHz

Figure 2. Above 1 GHz

#### Test Procedure:

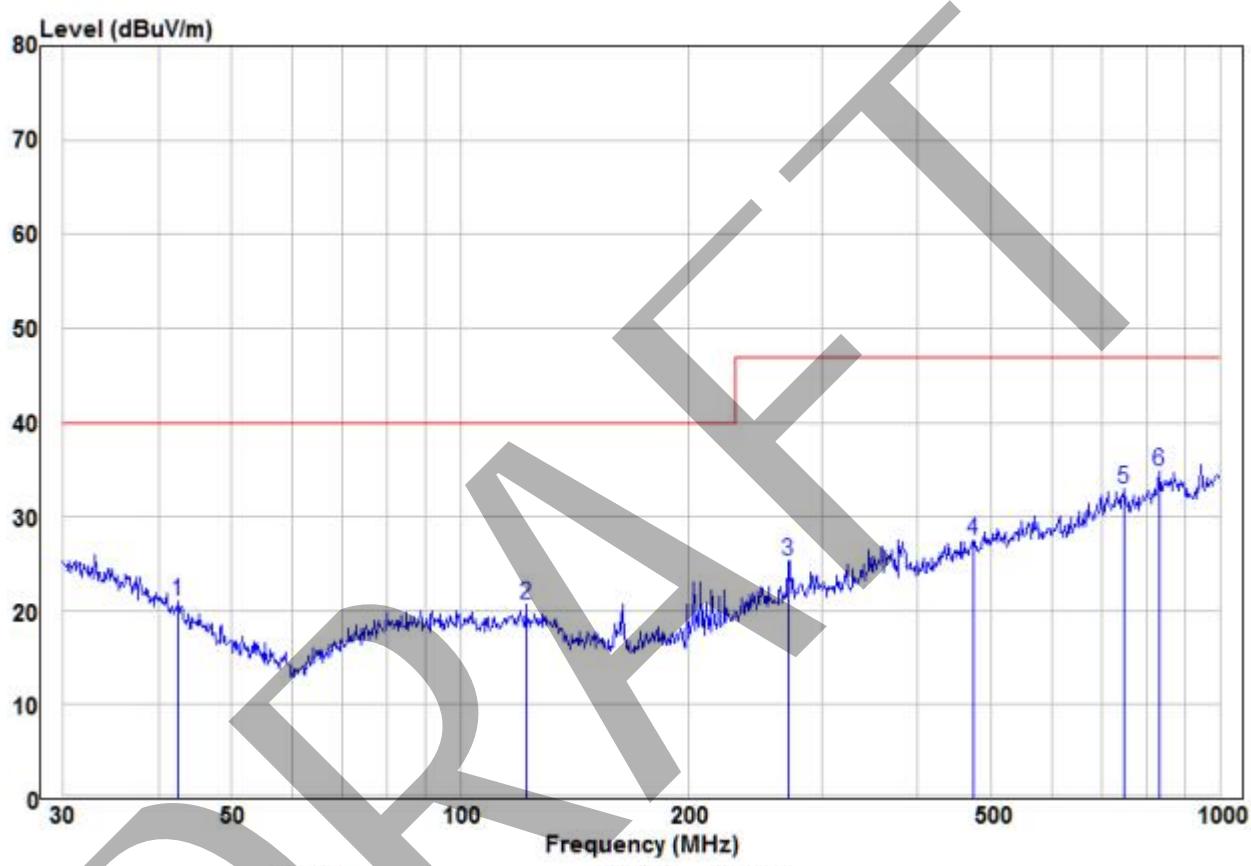
- From 30 MHz to 1GHz test procedure as below:
  - The radiated emissions were tested in a semi-anechoic chamber.
  - The EUT is placed on a turntable, which is 0.8m above ground plane.
  - The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
  - EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
  - Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
  - And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
  - Repeat above procedures until the measurements for all frequencies are complete.
- Above 1GHz test procedure as below:
  - Different between above is the test site, change from Semi- Anechoic Chamber

**Equipment Used:** to fully Anechoic Chamber  
**Test result:** Refer to section 5 for details.  
**PASS**

**Measurement Data:**

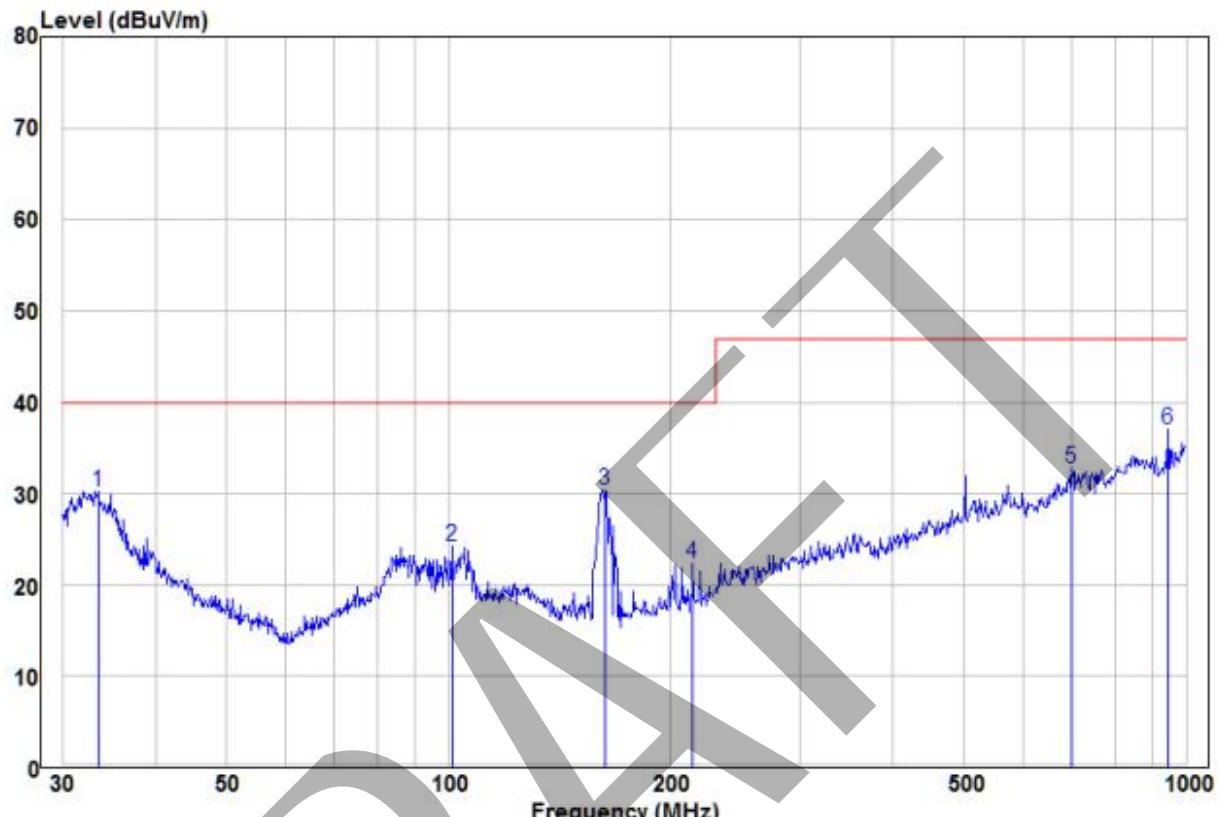
**Below 1GHz:**

Horizontal:



Freq	Read Level	Factor	Limit		Over Line	Limit	Remark	Pol/Phase
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB
1	42.60	9.45	11.58	21.03	40.00	-18.97	Peak	HORIZONTAL
2	121.98	10.08	10.62	20.70	40.00	-19.30	Peak	HORIZONTAL
3	270.37	12.58	12.75	25.33	47.00	-21.67	Peak	HORIZONTAL
4	472.18	10.13	17.41	27.54	47.00	-19.46	Peak	HORIZONTAL
5	747.48	11.06	21.90	32.96	47.00	-14.04	Peak	HORIZONTAL
6 pp	833.32	10.87	23.97	34.84	47.00	-12.16	Peak	HORIZONTAL

Vertical:



Freq MHz	Read			Limit Line	Over Line	Remark	Pol/Phase
	Freq MHz	Level dBuV	Factor				
1 33.44	15.22	15.01	30.23	40.00	-9.77	Peak	VERTICAL
2 100.93	13.56	10.60	24.16	40.00	-15.84	Peak	VERTICAL
3 pp 162.61	22.70	7.75	30.45	40.00	-9.55	Peak	VERTICAL
4 214.51	13.44	8.95	22.39	40.00	-17.61	Peak	VERTICAL
5 699.30	11.73	21.08	32.81	47.00	-14.19	Peak	VERTICAL
6 945.44	13.48	23.62	37.10	47.00	-9.90	Peak	VERTICAL

## 6.2 Conducted Emission

## For AC Main Port

## **Test Requirement: EN 55032**

**Test Method:** EN 55032

**Detector:** Peak for pre-scan (9kHz Resolution Bandwidth)

Quasi-Peak if maximized peak within 6dB of Quasi-Peak limit

Ambient: Temp.: 25.5°C Humid.: 55% Press.: 1009 mbar

**Test Mode:** Normal working

Press.: 1009mbar

**Test Mode:** Normal working

## Normal working

**Equipment Used:** Refer to section 5 for details.

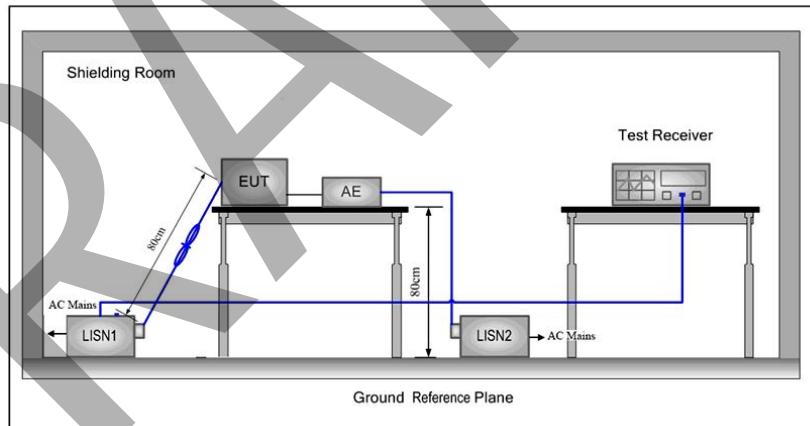
Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	Class B Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

**NOTE 1:** The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

NOTE 2: The lower limit is applicable at the transition frequency.

## Test Setup:



- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
  - 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a  $50\Omega/50\mu\text{H} + 5\Omega$  linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
  - 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
  - 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

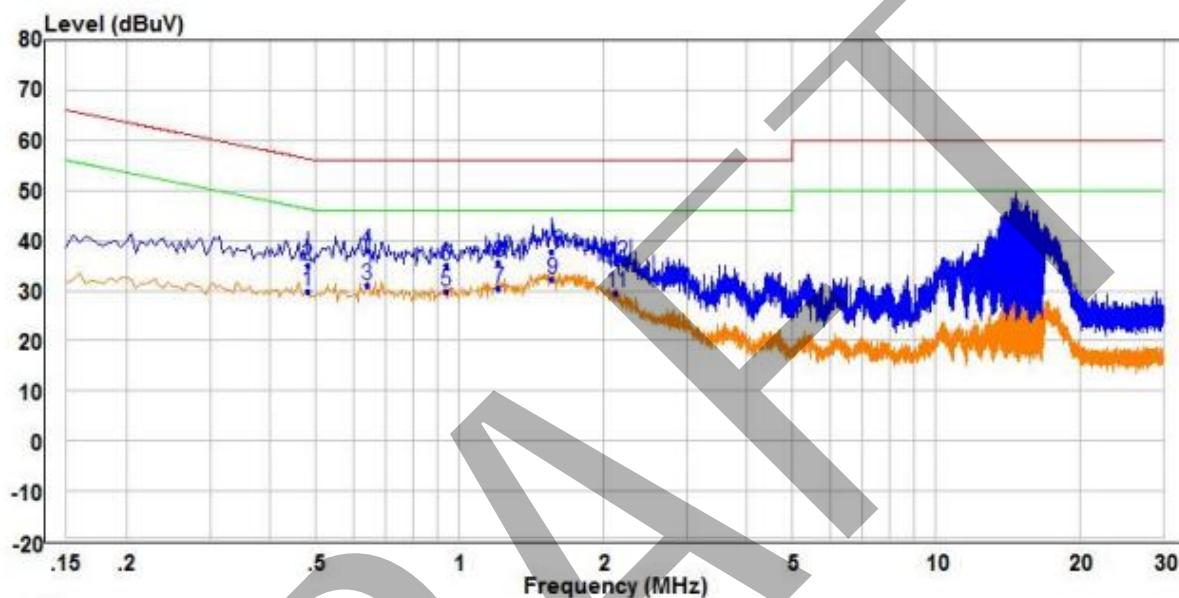
**Test result:** PASS

**Measurement Data:**

An initial pre-scan was performed on the live and neutral lines with peak detector.

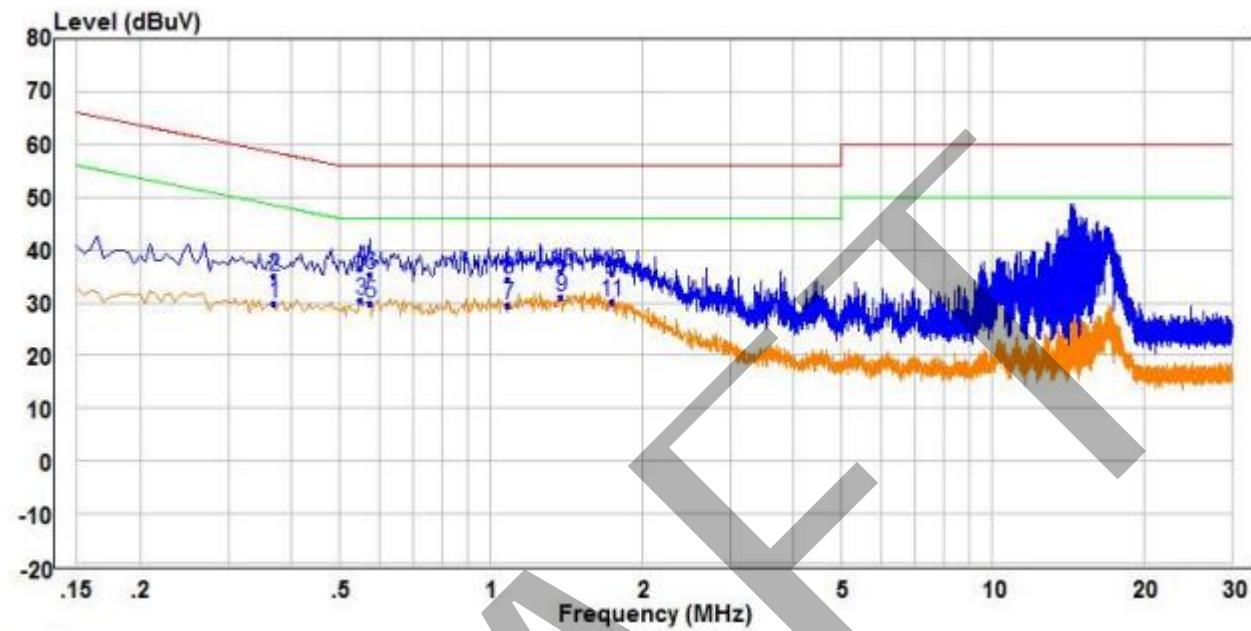
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

**Live Line:**



Freq	Read		Limit	Over	Remark	Pol/Phase
	Freq	Level				
	MHz	dBuV	dB	dBuV	dB	
1	0.480	20.06	9.68	29.74	46.34	-16.60 Average Line
2	0.480	25.46	9.68	35.14	56.34	-21.20 QP Line
3	0.640	21.14	9.84	30.98	46.00	-15.02 Average Line
4 QP	0.640	28.28	9.84	38.12	56.00	-17.88 QP Line
5	0.940	20.04	9.74	29.78	46.00	-16.22 Average Line
6	0.940	25.29	9.74	35.03	56.00	-20.97 QP Line
7	1.210	20.24	10.23	30.47	46.00	-15.53 Average Line
8	1.210	25.38	10.23	35.61	56.00	-20.39 QP Line
9 PP	1.565	21.47	10.96	32.43	46.00	-13.57 Average Line
10	1.565	26.80	10.96	37.76	56.00	-18.24 QP Line
11	2.130	17.98	11.52	29.50	46.00	-16.50 Average Line
12	2.130	24.13	11.52	35.65	56.00	-20.35 QP Line

Neutral Line:



Freq	Read		Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.370	20.17	9.57	29.74	48.50	-18.76	Average
2	0.370	25.47	9.57	35.04	58.50	-23.46	QP
3	0.550	20.78	9.75	30.53	46.00	-15.47	Average
4 QP	0.550	26.91	9.75	36.66	56.00	-19.34	QP
5	0.575	19.97	9.78	29.75	46.00	-16.25	Average
6	0.575	25.50	9.78	35.28	56.00	-20.72	QP
7	1.085	19.78	9.70	29.48	46.00	-16.52	Average
8	1.085	24.80	9.70	34.50	56.00	-21.50	QP
9 PP	1.380	21.34	9.72	31.06	46.00	-14.94	Average
10	1.380	26.31	9.72	36.03	56.00	-19.97	QP
11	1.740	20.54	9.74	30.28	46.00	-15.72	Average
12	1.740	25.83	9.74	35.57	56.00	-20.43	QP

### 6.3 Harmonics Test Results

**Test Requirement:** EN IEC 61000-3-2

**Test Method:** EN IEC 61000-3-2

**Measurement Time:** 3 mins

**Classification:** Class D

**Remark:**

There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN IEC 61000-3-2.

For further details, please refer to Clause 7 of EN IEC 61000-3-2 which states:

“For the following categories of equipment, limits are not specified in this standard.

- equipment with a rated power of 75W or less, other than lighting equipment.”

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## 6.4 Flicker Test Results

**Test Requirement:** EN 61000-3-3  
**Test Method:** EN 61000-3-3  
**Measurement Time:** 10 mins  
**Limit:** EN 61000-3-3 Clause 5

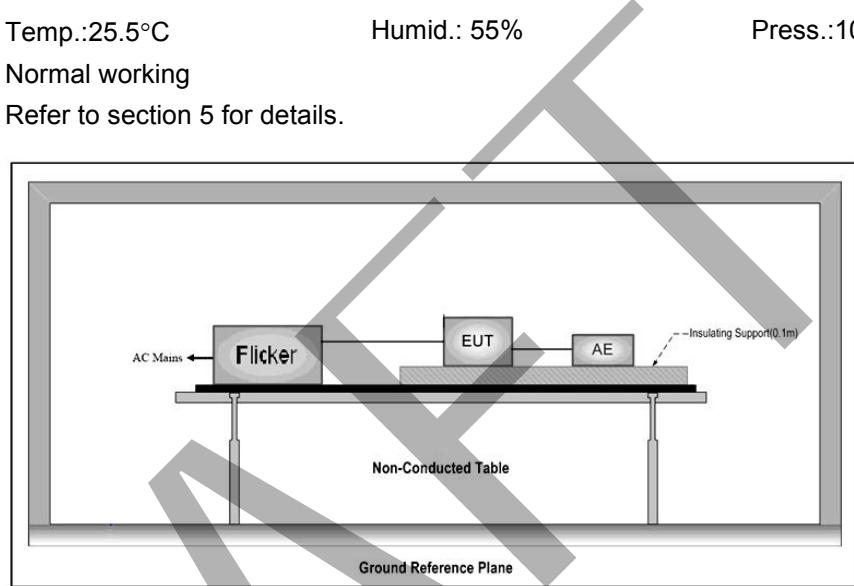
**Operating Environment:**

**Ambient:** Temp.:25.5°C                                  Humid.: 55%                                  Press.:1009mbar

**Test Mode:** Normal working

**Equipment Used:** Refer to section 5 for details.

**Test Setup:**

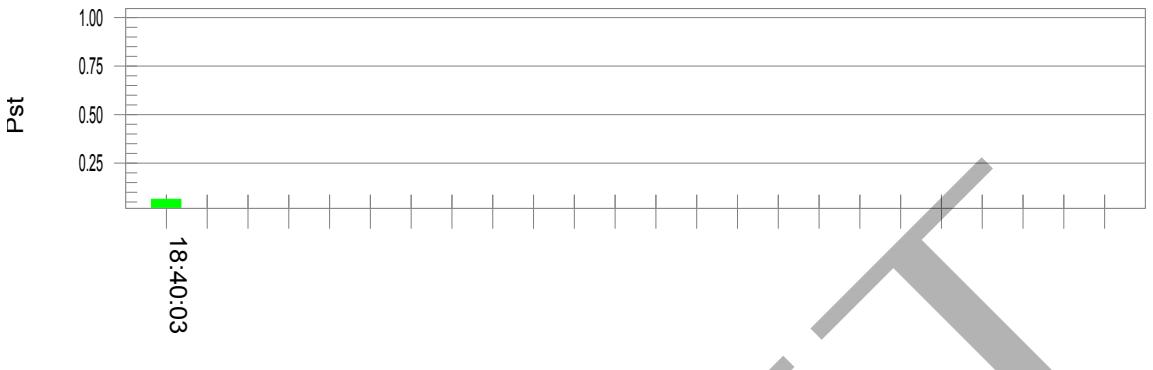


**Test result:**

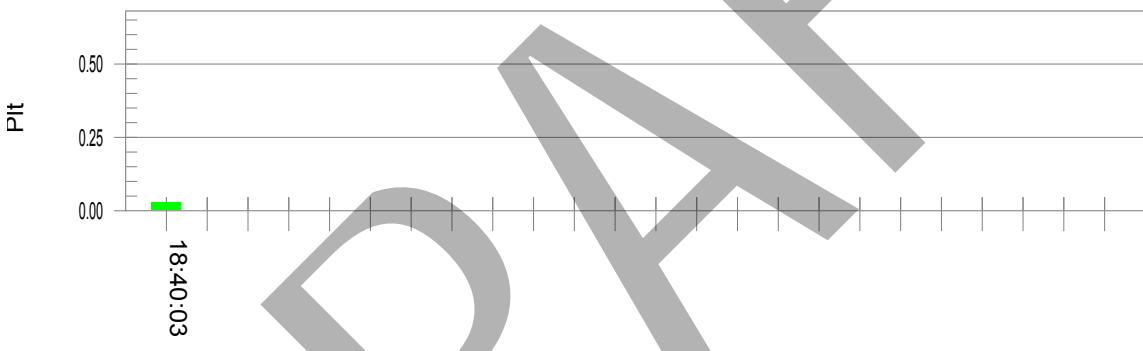
PASS

**Measurement Date:**  
Pst and limit line

European Limits



Plt and limit line



**Parameter values recorded during the test:**

Vrms at the end of test (Volt): 229.72

T-max (mS): 0

Highest dc (%): 0.00

Highest dmax (%): 0.00

Highest Pst (10 min. period): 0.064

Highest Plt (2 hr. period): 0.028

Test limit (mS):	500.0	Pass
Test limit (%):	3.30	Pass
Test limit (%):	4.00	Pass
Test limit:	1.000	Pass
Test limit:	0.650	Pass

## 7 Immunity Test Results

### Performance Criteria Description in Clause 8 of EN 55035

**Criterion A:**

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function or change of operation state 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. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

During the test application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.

**Criterion B:**

After the test, the equipment shall continue to operate as intended without operator intervention. 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.

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

**Criterion C:**

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. A reboot or re-start operation is allowed.

Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

## 7.1 Radiated Immunity

**Test Requirement:** EN 55035

**Test Method:** EN 61000-4-3

**EUT Operation:**

**Ambient:** Temp.:25.5°C

**Humid.:** 55%

**Press.:** 1009mbar

**Test Mode:** Normal working

**Criterion Required:** A

**Equipment Used:** Refer to section 5 for details.

**Test Setup:**

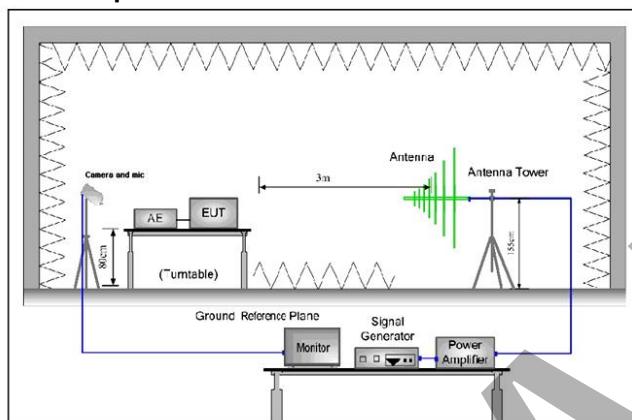


Figure 1. 80MHz to 1GHz

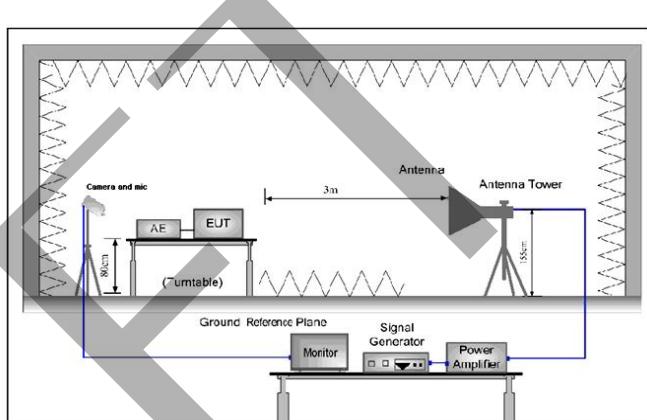


Figure 2. 1GHz to 6GHz

**Test Procedure:**

- 1) For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items.
- 2) If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length.
- 3) The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area).
- 4) The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value.
- 5) The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0.5 s.
- 6) The test normally was performed with the generating antenna facing each side of the EUT.
- 7) The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally.
- 8) The EUT was performed in a configuration to actual installation conditions, a video camera and/or an audio monitor were used to monitor the performance of the EUT.

**Test result:**

PASS

**Test result:**

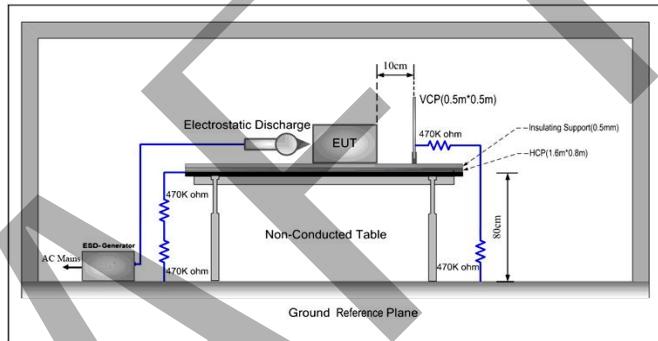
Frequency	Level	Modulation	EUT Face	Antenna Polaxis	Result / Observations
80MHz-1GHz, 1800MHz 2600MHz 3500MHz 5000MHz	3V/m	1kHz, 80% Amp. Mod, 1% increment Dwell time: 3 seconds	Front	V	A
				H	A
			Back	V	A
				H	A
			Left	V	A
				H	A
			Right	V	A
				H	A
			Top	V	A
				H	A
			Under	V	A
				H	A

**Remarks:**

A: No performance degradation during test.

## 7.2 ESD

<b>Test Requirement:</b>	EN 55035		
<b>Test Method:</b>	EN 61000-4-2		
<b>EUT Operation:</b>			
<b>Ambient:</b>	Temp.:25.5°C	Humid.: 55%	Press.: 1009mbar
<b>Test Mode:</b>	Normal working		
<b>Discharge Impedance:</b>	330 Ω / 150 pF		
<b>Polarity:</b>	Positive & Negative		
<b>Number of Discharge:</b>	Minimum 10 times at each test point		
<b>Discharge Mode:</b>	Single Discharge		
<b>Discharge Period:</b>	1 second minimum		
<b>Equipment Used:</b>	Refer to section 5 for details.		
<b>Test Setup:</b>			



### Test Procedure:

- 1) Contact discharges to the conductive surfaces and to coupling planes:  
The EUT was exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points (a minimum of 50 discharges at each point). One of the test points was subjected to at least 50 indirect discharges (contact) to the centre of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points were available, then at least 200 indirect discharges were applied in the indirect mode. Tests were performed at a maximum repetition rate of one discharge per second.
- 2) Air discharge at slots and apertures, and insulating surfaces:  
On those parts of the EUT where it was not possible to perform contact discharge testing, the equipment was investigated to identify user accessible points where breakdown may occur. This investigation was restricted to those areas normally handled by the user. A minimum of 10 single air discharges were applied to the selected test point for each such area.  
The application of electrostatic discharges to the contacts of open connectors was not required by this standard.
- 3) The EUT was put on a 0.8m high wooden table for table-top equipment or 0.1m high for floor standing equipment standing on the ground reference plane(GRP).
- 4) A horizontal coupling plane(HCP) 1.6m by 0.8m in size was placed on the table, and the EUT with its cables were isolated from the HCP by an insulating support thick than 0.5mm. The VCP 0.5m by 0.5m in size & HCP were constructed from the same material type & thinkmess as that of the GRP, and connected to the GRP via a 470kΩ resistor at each end. The distance between EUT and any of the other metallic surfaces accepted the GRP, HCP and VCP was greater than 1m.
- 5) During the contact discharges, the tip of the discharge electrode was touch the EUT before the discharge switch is operated. During the air discharges, the

round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT.

- 6) After each discharge, the ESD generator was removed from the EUT, the generator was then retriggered for a new single discharge. For ungrounded product, a discharge cable with two resistances was used after each discharge to remove remnant electrostatic voltage. 10 times of each polarity single discharge were applied to HCP and VCP.

**Test result:** PASS

**Test data:**

**Observations:** Test Point:  
 1. All insulated enclosure and seams.  
 2. All accessible metal parts of the enclosure.

Direct Application Test Results				
Direct Application			Test Results	
Discharge Level (kV)	Pulse No.	Test Point	Contact Discharge	Air Discharge
± 8	10 for every level	1	N/A	A
± 4	10 for every level	2	A	N/A

Indirect Application for tabletop equipment Test Results				
Indirect Application			Test Results	
Discharge Level (kV)	Pulse No.	Horizontal Coupling	Vertical Coupling	
± 4	10 for every level	A	A	

**Remark:**

A: No performance degradation during test.

N/A: Not applicable

### 7.3 RF Common Mode 0.15MHz to 80MHz

**Test Requirement:** EN 55035

**Test Method:** EN 61000-4-6

**Test level:** 3V rms

**Modulation:** 80%, 1kHz Amplitude Modulation

**Test port:** AC port.

**Criterion Required:** A

**EUT Operation:**

**Ambient:** Temp.:25.5°C

Humid.: 55%

Press.: 1009mbar

**Test Mode:** Normal working

**Equipment Used:** Refer to section 5 for details.

**Test Setup:**

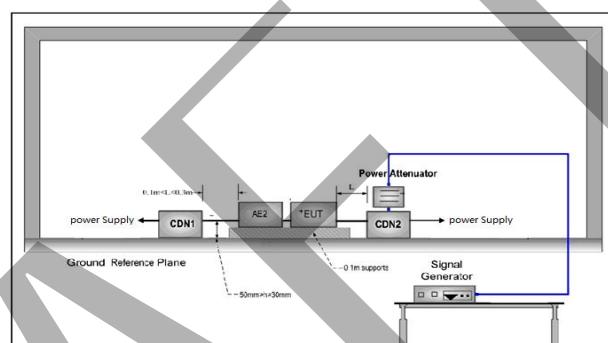


Figure 1. For AC port

**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 80 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 does not exceed 1 % of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency was not less than the time necessary for the EUT to be exercised and to respond, and was not less than 0.5 s.

**Test result:**

PASS

**Test data:**

Frequency	Line	Test Level	Modulation	Step Size	Dwell Time	Observation (Performance Criterion)
150kHz to 10MHz	AC port (2 Line)	3Vrms	80%, 1kHz Amp. Mod.	1%	2 S	A
10MHz to 30MHz		3 to 1Vrms	80%, 1kHz Amp. Mod.	1%	2 S	A
30MHz to 80MHz		1Vrms	80%, 1kHz Amp. Mod.	1%	2 S	A

**Remark:**

A: No performance degradation during test.

DRAFT

## 7.4 Electrical Fast Transients (EFT)

**Test Requirement:** EN 55035  
**Test Method:** EN 61000-4-4  
**Test Level:**  $\pm 1.0\text{kV}$  5/50 ns 5 kHz on AC port.  
**Polarity:** Positive & Negative  
**Criterion Required:** A  
**Repetition Frequency:** 5kHz (For CPE xDSL ports repetition frequency is 100kHz)  
**Burst Period:** 300ms  
**Test Duration:** 2 minute per level & polarity  
**EUT Operation:**

**Ambient:** Temp.: $25.5^{\circ}\text{C}$

Humid.: 55%

Press.: 1009mbar

**Test Mode:** Normal working

**Equipment Used:** Refer to section 5 for details.

**Test Setup:**

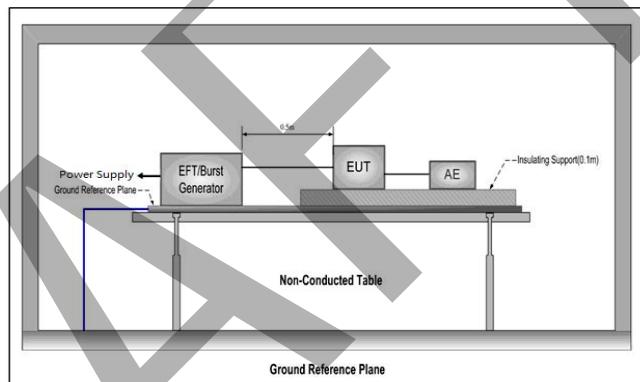


Figure 1. For AC port

**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 GRP shall project beyond the EUT and the clamp by at least 0.1m on all sides. The distance between the EUT and any other of the metallic surface except the GRP was greater than 0.5m. All cables to the EUT was placed on the insulation support 0.1m above GRP. A cable not subject to EFT was routed as far as possible from cable under test to minimize the coupling between the cables.
- 3) The length of signal and power cable between the EUT and EFT generator was 0.5m. If the cable is a non-detachable supply cable more than 0.5m, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1m above the GRP.
- 4) The EUT was conducted the below specified test voltages for line and neutral or line, neutral and earth simultaneously (for telecommunication, single, control and DC port line with capacitive coupling clamp), 120 seconds duration. If the equipment contains identical ports, only one was tested; multicomputer cables, such as a 50-pair telecommunication cable, were tested as a single cable. Cables did not be split or divided into groups of conductors for this test; interface ports, which were intended by the manufacturer to be connected to data cables not longer than 3 m, did not be tested.

**Test result:** PASS

**Test data:**

Lead under Test	Level (kV)	Coupling Direct/Clamp	Observations (Performance Criterion)
Live	$\pm 1.0$	Direct	A
Neutral	$\pm 1.0$	Direct	A
Live, Neutral	$\pm 1.0$	Direct	A

**Remark:**

A: No performance degradation during test.

DRAFT

## 7.5 Surge

**Test Requirement:** EN 55035

**Test Method:** EN 61000-4-5

For AC port

**Test Level:**

- 1) 1kV 1.2/50(8/20)  $\mu$ s Live to Neutral
- 2) 2kV 1.2/50(8/20)  $\mu$ s Live, Neutral to Earth

**Criterion Required:** for AC mains power ports: B

**Polarity:** Positive & Negative

**Interval:** 60s between each surge

**EUT Operation:**

**Ambient:** Temp.:25.5°C

Humid.: 55%

Press.: 1009mbar

**Test Mode:** Normal working

**Equipment Used:** Refer to section 5 for details.

**Test Setup:**

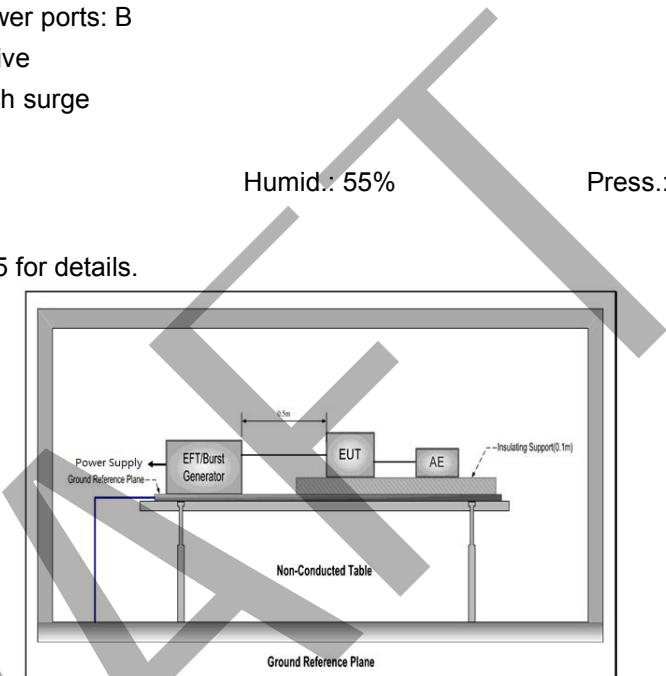


Figure 1. For AC port

**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 1.2/50  $\mu$ s surge was to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks were 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 so that the specified wave may be applied on the lines under test.
- 3) The power cord between the EUT and the coupling/decoupling network was not exceed 2 m in length. The interconnection line between the EUT and the coupling/decoupling network shall not exceed 2 m in length.
- 4) The EUT was conducted 1 kV test voltage for line to line and line to neutral and conducted 2 kV test voltage for line to earth and neutral to earth, five positive pulses and five negative pulses each at 90°and 270° for a.c. power ports and five positive pulses and five negative surge pulses for d.c. power ports (for analogue/digital data ports (unshielded symmetrical) port, It was 1 kV and 4KV for cable longer than 3m line to ground, for analogue/digital data ports (coaxial or shielded), It was 0.5 kV for cable longer than 3m line to ground, five positive pulses and five negative surge pulses), for DC network power ports (outdoor cables, cable lengths greater than 3m), It was 0.5 kV for cable longer than 3m line to reference ground, The test levels were applied on the EUT with a 2  $\Omega$  generator source impedance for power supply terminals and 40 $\Omega$  output impedance for interconnection lines. The tests were done at repetition rate one per minute.,

**Test Results:**

PASS

**Test Data:**

For AC port (3 line)					
Pulse No	Line-Line	Level (kV)	Surge interval	phase (deg)	Observation (Performance Criterion)
1-5	L-N	+1	60s	90°	A
6-10	L-N	-1	60s	270°	A

**Remark:**

A: No performance degradation during test.

DRAFT

## 7.6 Voltage Dips and Interruptions

**Test Requirement:** EN 55035

**Test Method:** EN 61000-4-11

Voltage dip: >95% reduction voltage for 0.5 period; B

**Test Level:** Voltage dip: 30 % reduction voltage for 25 cycles,50Hz and 30 cycles,60Hz; C

Voltage interruption: >95% reduction voltage for 250 cycles,50Hz and 300 cycles,60Hz; C

**No. of Dips / Interruptions:** 3 per Level

**EUT Operation:**

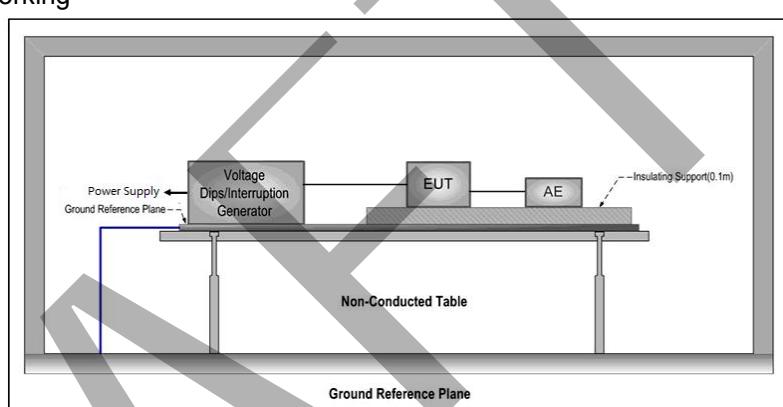
**Ambient:** Temp.:25.5°C

Humid.: 55%

Press.: 1009mbar

**Test Mode:** Normal working

**Test Setup:**



**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.

**Equipment Used:**

**Test result:**

Refer to section 5 for details.

PASS

**Test data:**

EUT operating mode	% U <sub>T</sub>	Phase	Duration of dropout in Periods (50Hz&60Hz)	No. of dropout	Time between dropout	Observations (Performance Criterion)
Above modes	0	0° & 90°&270	0.5 cycles (50Hz&60Hz)	3	10s	A
Above modes	70	0° & 90°&270	25 cycles for 50Hz 30 cycles for 60Hz	3	10s	A
Above modes	0	0° & 90°&270	250 cycles for 50Hz 300 cycles for 60Hz	3	10s	C

**Remark:**

A: No performance degradation during test.

C: During the test, the EUT shut down, after the test, it reset by user.

**DRAFT**

## APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

Radiated emission Test Setup (30MHz~1GHz)



Conducted emission Test Setup



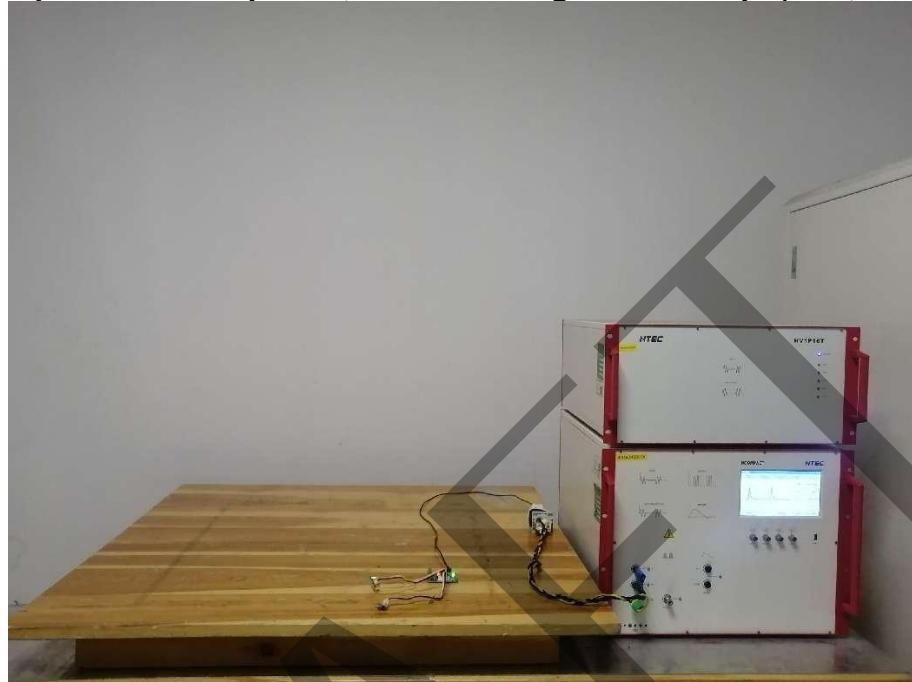
**Voltage fluctuations and flicker Test Setup(Flicker)**



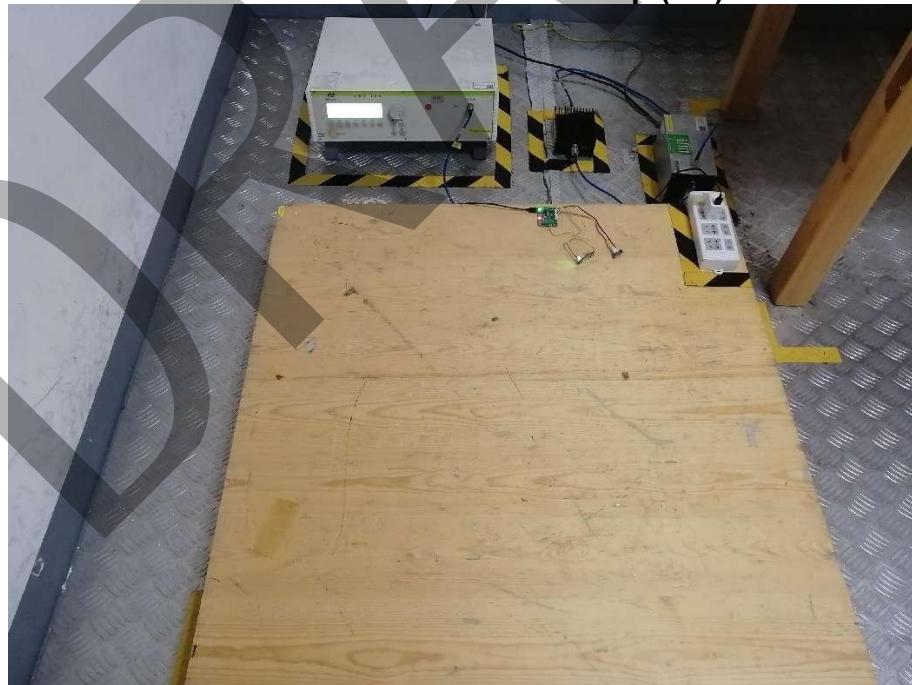
**Electrostatic discharge Test Setup(ESD)**



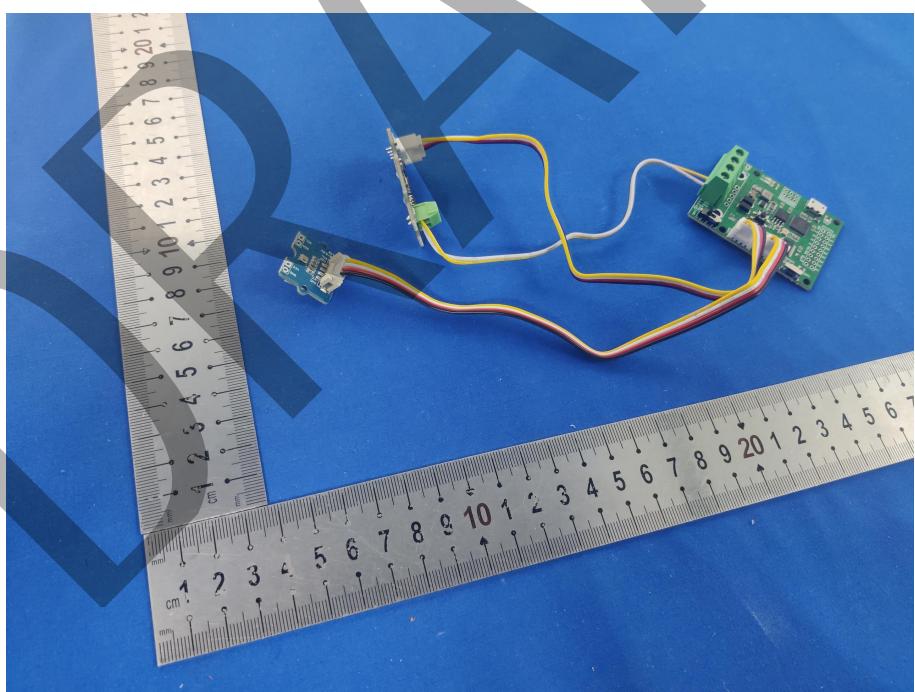
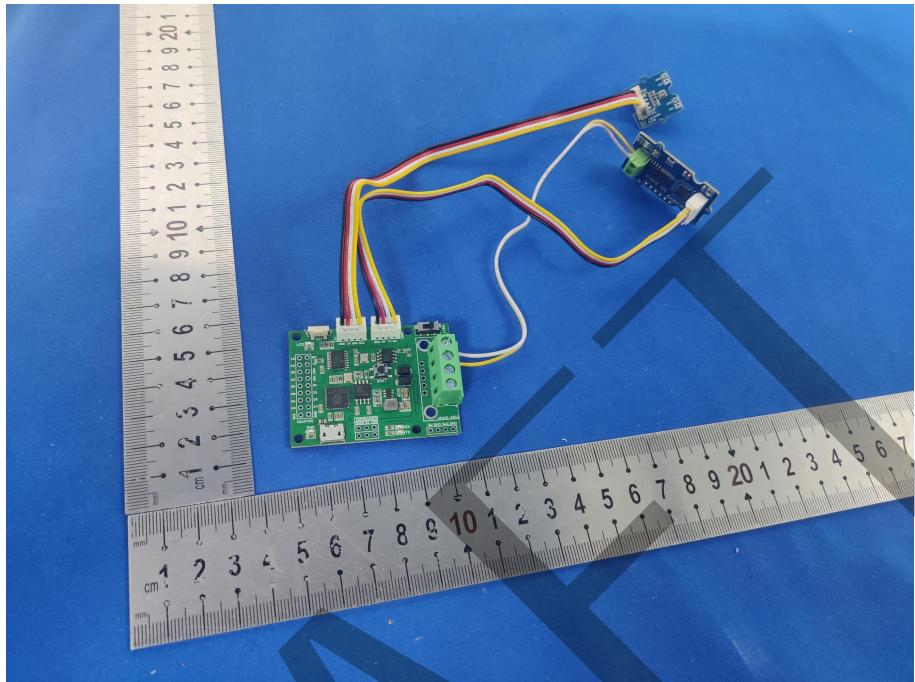
**Voltage dips and interruptions, EFT and Surge Test Setup (EFT,DIPS,Surge)**

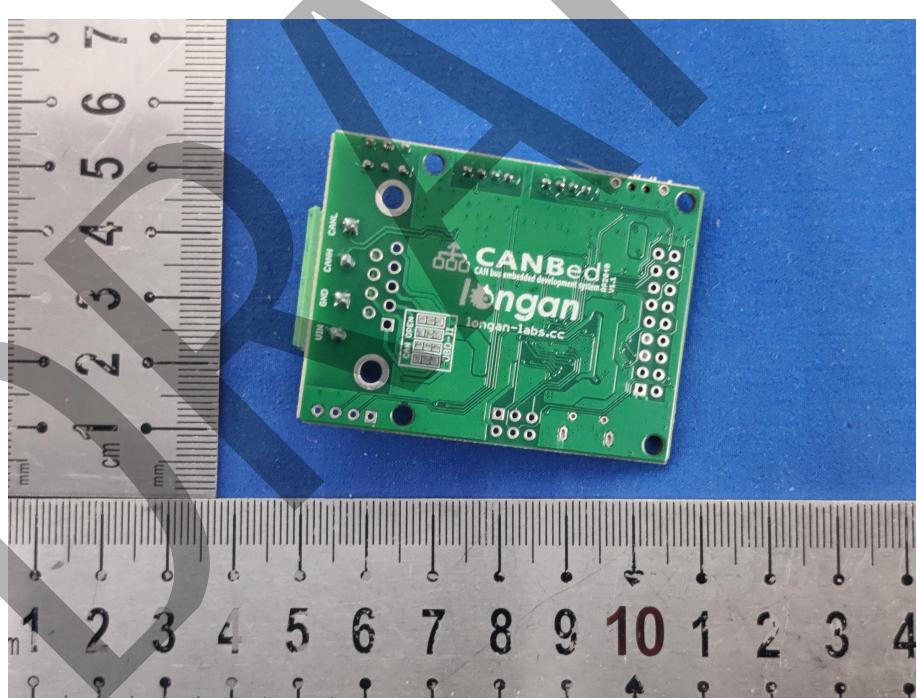
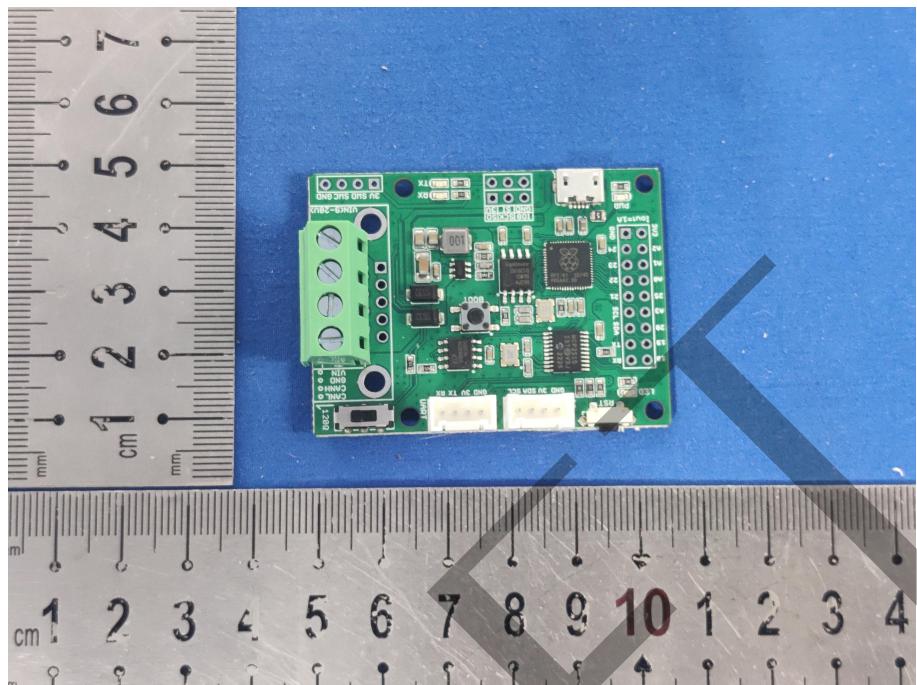


**RF common mode Test Setup (CS)**



## APPENDIX 2 PHOTOGRAPHS OF EUT





\*\*\* END OF REPORT \*\*\*