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# TEST REPORT

## FCC PART 15.247

Report Reference No. .... : **CTL2008174011-WF02**

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**Product Name** ..... : MaaxBoard Mini

**Model/Type reference** ..... : MaaXBoard Mini

**List Model(s)** ..... : N/A

**Trade Mark** ..... : N/A

**FCC ID** ..... : **2AFLY-MAAX-MINI**

**Applicant's name** ..... : **Embest Technology Co., Ltd**

TowerB 4/F, Shanshui Building, Nanshan Yungu Innovation

**Address of applicant** ..... : Industry Park, Liuxian Ave.No.1183, Nanshan District, ShenZhen, China.

**Test Firm** ..... : **Shenzhen CTL Testing Technology Co., Ltd.**

**Address of Test Firm** ..... : Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

**Test specification** ..... :

Standard ..... : **47 CFR FCC Part 15 Subpart C 15.247**

TRF Originator ..... : Shenzhen CTL Testing Technology Co., Ltd.

Master TRF ..... : Dated 2011-01

**Date of receipt of test item** ..... : Sep. 03, 2020

**Date of sampling** ..... : Sep. 03, 2020

**Date of Test Date** ..... : Sep. 03, 2020-Sep. 18, 2020

**Date of Issue** ..... : Sep. 18, 2020

**Result** ..... : **Pass**

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# TEST REPORT

<b>Test Report No. :</b>	<b>CTL2008174011-WF02</b>	Sep. 18, 2020
<b>Date of issue</b>		

Equipment under Test : MaaxBoard Mini

Model /Type : MaaXBoard Mini

Listed Models : N/A

**Applicant** : Embest Technology Co., Ltd

Address : TowerB 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave.No.1183, Nanshan District, ShenZhen, China.

**Manufacturer** : Embest Technology Co., Ltd

Address : TowerB 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave.No.1183, Nanshan District, ShenZhen, China.

<b>Test result</b>	<b>Pass *</b>
--------------------	---------------

\* In the configuration tested, the EUT complied with the standards specified page 5.

The test results presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

## \*\* Modified History \*\*

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## 1. SUMMARY

### 1.1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

[ANSI C63.10: 2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB558074 D01 15.247 Meas Guidance v05r02](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

### 1.2. Test Description

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.205/ 15.209	Radiated Emissions	PASS

## 1.3. Test Facility

### 1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

### 1.3.2 Laboratory accreditation

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

#### CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### IC Registration No.: 9618B

#### CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B on Jan. 22, 2019.

#### FCC-Registration No.: 399832

#### Designation No.: CN1216

Shenzhen CTL Testing Technology Co., Ltd. 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 399832, December 08, 2017.

## 1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)

Conducted Disturbance0.15~30MHz	±3.20dB	(1)
---------------------------------	---------	-----

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

## 2. GENERAL INFORMATION

### 2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

### 2.2. General Description of EUT

Product Name:	MaaxBoard Mini
Model/Type reference:	MaaXBoard Mini
Power supply:	DC 5.0V
<b>BLE:</b>	
Supported type:	Bluetooth low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz
Antenna type:	Ceramics Antenna
Antenna gain:	1dBi

Note: For more details, please refer to the user's manual of the EUT.

### 2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing.

There are 39 channels provided to the EUT and Channel 00/19/39 were selected for BLE test.

#### Operation Frequency List :

Channel	Frequency (MHz)
00	2402
02	2404
03	2406
:	:
19	2440
:	:
37	2476
38	2478
39	2480

Note: The line display in grey were the channel selected for testing

## 2.4. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ESH2-Z5	860014/010	2020/05/15	2021/05/14
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2020/04/08	2021/04/07
EMI Test Receiver	R&S	ESCI	1166.5950.03	2020/05/18	2021/05/17
Spectrum Analyzer	Agilent	E4407B	MY41440676	2020/05/14	2021/05/13
Spectrum Analyzer	Agilent	N9020A	US46220290	2020/05/14	2021/05/13
Spectrum Analyzer	Keysight	N9020A	MY53420874	2020/05/14	2021/05/13
Controller	EM Electronics	EM 1000	060859	2020/05/20	2021/05/19
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2020/05/20	2021/05/19
Active Loop Antenna	Da Ze	ZN30900A	/	2020/05/20	2021/05/19
Amplifier	Agilent	8449B	3008A02306	2020/05/15	2021/05/14
Amplifier	Agilent	8447D	2944A10176	2020/05/15	2021/05/14
Temperature/Humidity Meter	Gangxing	CTH-608	02	2020/05/16	2021/05/15
Power Sensor	Agilent	U2021XA	MY55130004	2020/05/14	2021/05/13
Power Sensor	Agilent	U2021XA	MY55130006	2020/05/14	2021/05/13
Spectrum Analyzer	RS	FSP	1164.4391.38	2020/05/15	2021/05/14

The calibration interval was one year

## 2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.6. Modifications

No modifications were implemented to meet testing criteria.

### 3. TEST CONDITIONS AND RESULTS

#### 3.1. Conducted Emissions Test

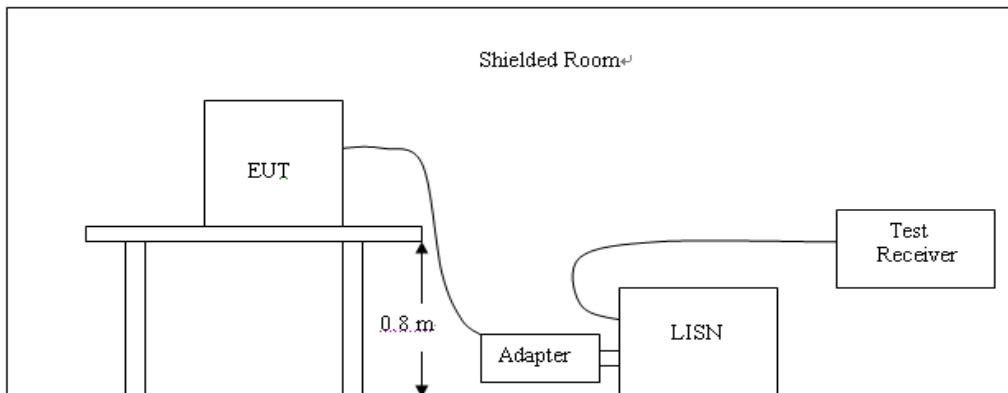
##### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

##### TEST CONFIGURATION

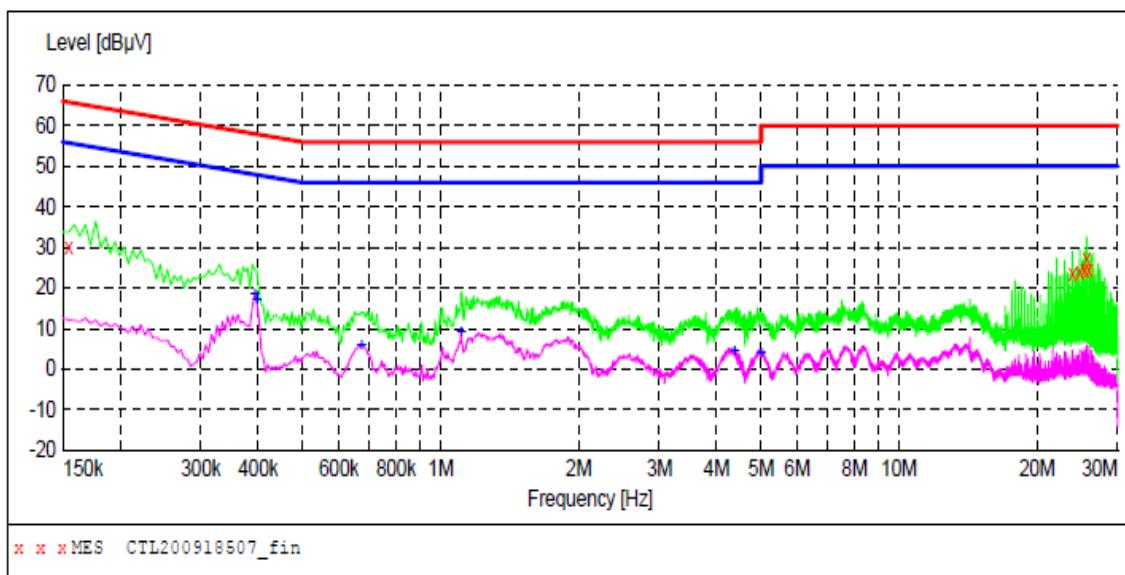


##### TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

##### TEST RESULTS

**SCAN TABLE: "Voltage (9K-30M) FIN"**  
 Short Description: 150K-30M Voltage



**MEASUREMENT RESULT: "CTL200918507\_fin"**

2020-9-18 9:42

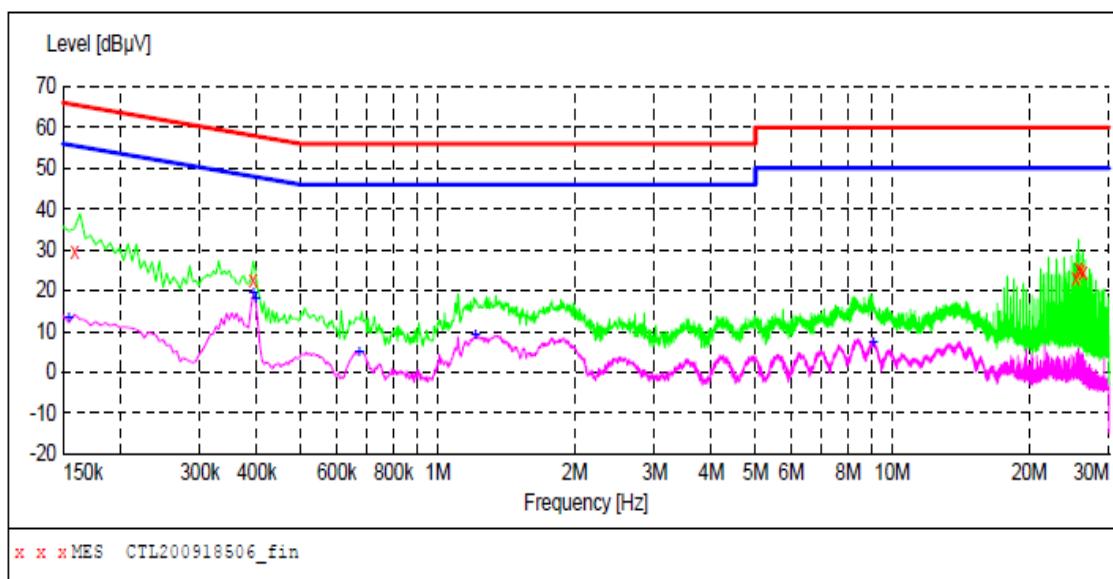
Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.154500	30.00	11.2	66	35.8	QP	L1	GND
23.887500	23.30	11.3	60	36.7	QP	L1	GND
24.783000	23.90	11.3	60	36.1	QP	L1	GND
25.381500	24.30	11.4	60	35.7	QP	L1	GND
25.678500	27.10	11.4	60	32.9	QP	L1	GND
25.971000	24.60	11.4	60	35.4	QP	L1	GND

**MEASUREMENT RESULT: "CTL200918507\_fin2"**

2020-9-18 9:42

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.393000	18.30	11.2	48	29.7	AV	L1	GND
0.397500	16.80	11.2	48	31.1	AV	L1	GND
0.672000	5.60	11.2	46	40.4	AV	L1	GND
1.108500	8.80	11.2	46	37.2	AV	L1	GND
4.366500	4.20	11.3	46	41.8	AV	L1	GND
4.996500	4.10	11.3	46	41.9	AV	L1	GND

**SCAN TABLE: "Voltage (9K-30M) FIN"**  
 Short Description: 150K-30M Voltage



**MEASUREMENT RESULT: "CTL200918506\_fin"**

2020-9-18 9:38

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.159000	29.50	11.2	66	36.0	QP	N	GND
0.393000	22.60	11.2	58	35.4	QP	N	GND
25.372500	22.90	11.4	60	37.1	QP	N	GND
25.674000	25.40	11.4	60	34.6	QP	N	GND
25.975500	24.80	11.4	60	35.2	QP	N	GND
26.286000	24.40	11.4	60	35.6	QP	N	GND

**MEASUREMENT RESULT: "CTL200918506\_fin2"**

2020-9-18 9:38

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.154500	13.30	11.2	56	42.5	AV	N	GND
0.393000	19.30	11.2	48	28.7	AV	N	GND
0.397500	18.10	11.2	48	29.8	AV	N	GND
0.672000	4.90	11.2	46	41.1	AV	N	GND
1.212000	8.90	11.2	46	37.1	AV	N	GND
9.078000	7.00	10.9	50	43.0	AV	N	GND

### 3.2. Radiated Emissions and Band Edge

#### Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

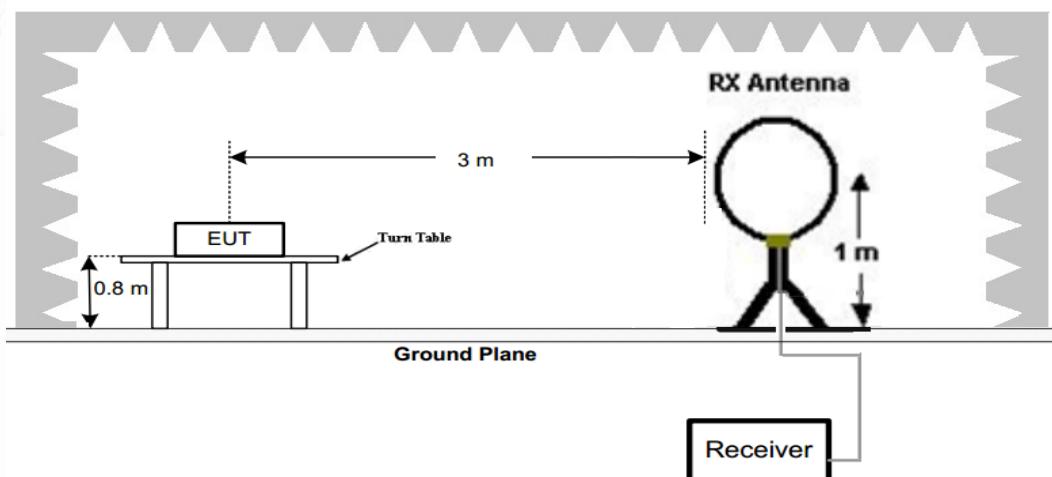
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

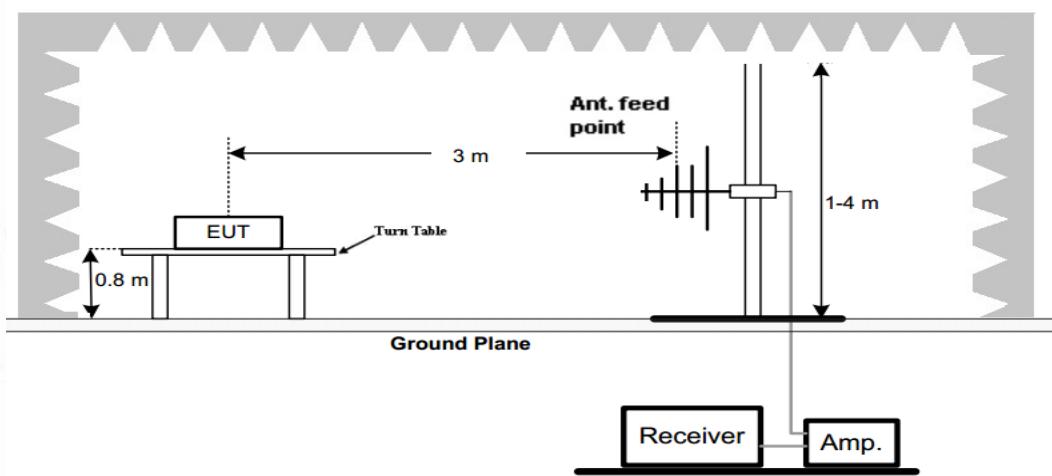
Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz}))+40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz}))+40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30)+40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

#### TEST CONFIGURATION

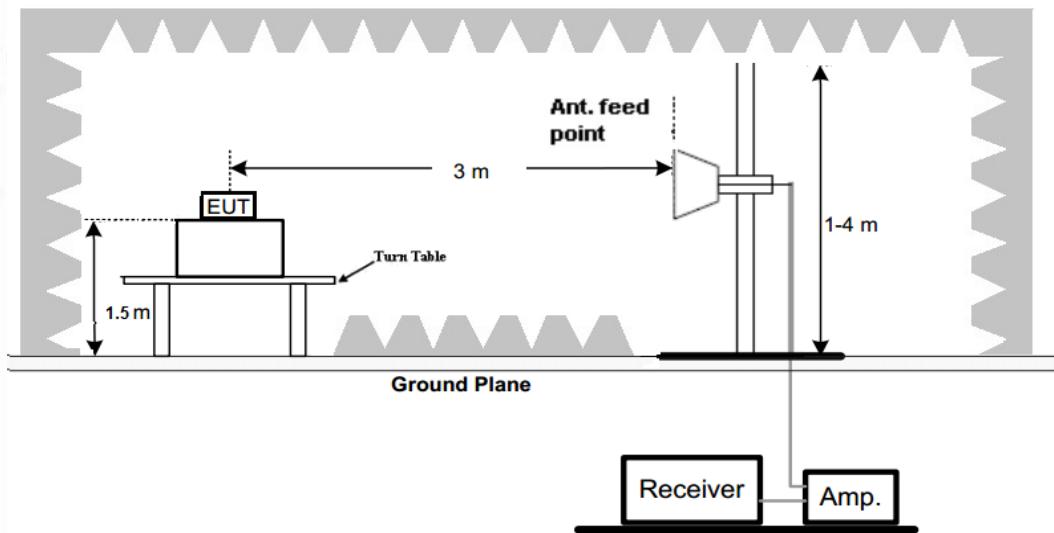
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



### Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.

### TEST RESULTS

Remark:

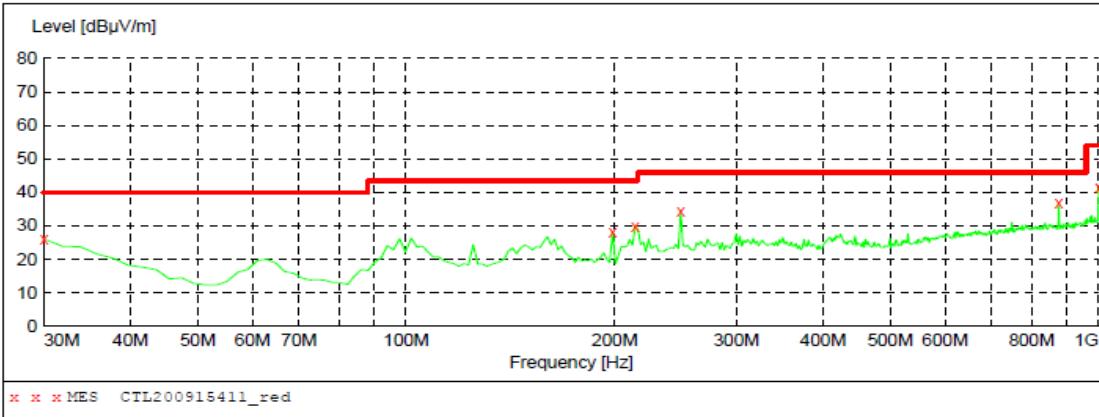
1. For below 1GHz testing recorded worst at BLE low channel.
2. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

## For 30MHz-1GHz

## Horizontal

***SWEET TABLE: "test (30M-1G)"***

Short Description:		Field Strength			
Start Frequency	Stop Frequency	Detector	Meas.	IF	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	100 kHz	JB1

***MEASUREMENT RESULT: "CTL200915411\_red"***

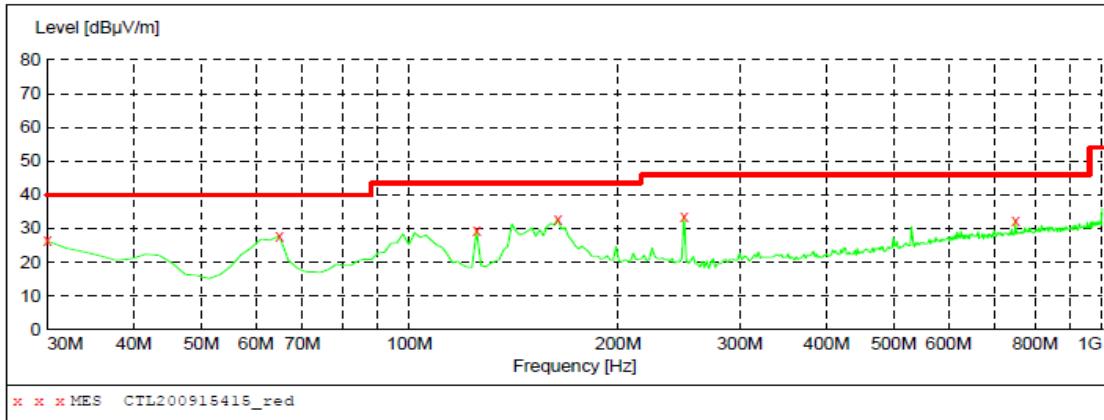
15/09/2020 13:35

Frequency MHz	Level dB $\mu$ V/m	Transd dB	Limit dB $\mu$ V/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	26.10	22.2	40.0	13.9	---	0.0	0.00	HORIZONTAL
198.780000	28.30	14.6	43.5	15.2	---	0.0	0.00	HORIZONTAL
214.300000	29.90	14.4	43.5	13.6	---	0.0	0.00	HORIZONTAL
249.220000	34.20	14.4	46.0	11.8	---	0.0	0.00	HORIZONTAL
875.840000	36.70	26.1	46.0	9.3	---	0.0	0.00	HORIZONTAL
1000.000000	41.20	28.2	53.9	12.7	---	0.0	0.00	HORIZONTAL

## Vertical

***SWEET TABLE: "test (30M-1G)"***

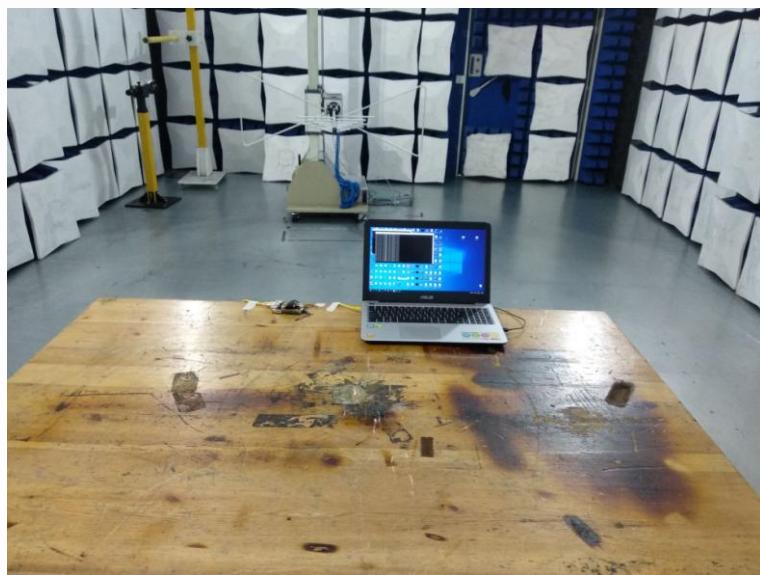
Short Description:		Field Strength			
Start Frequency	Stop Frequency	Detector	Meas.	IF	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	100 kHz	JB1

***MEASUREMENT RESULT: "CTL200915415\_red"***

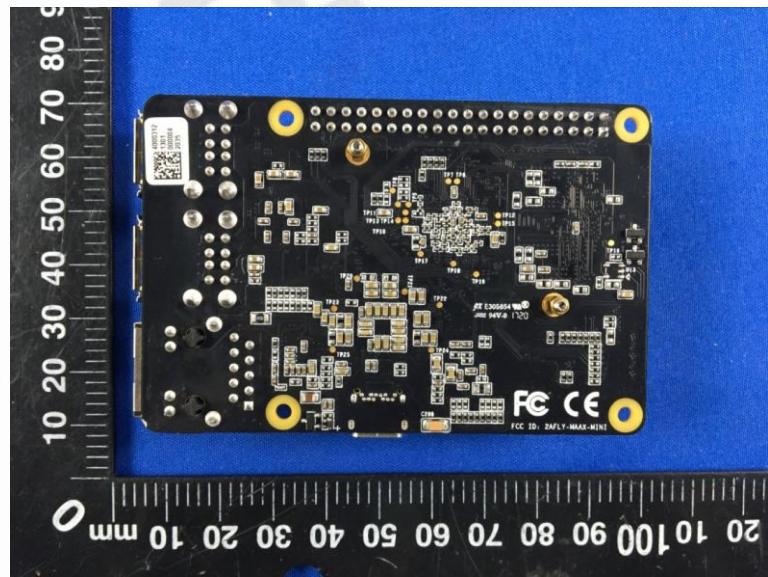
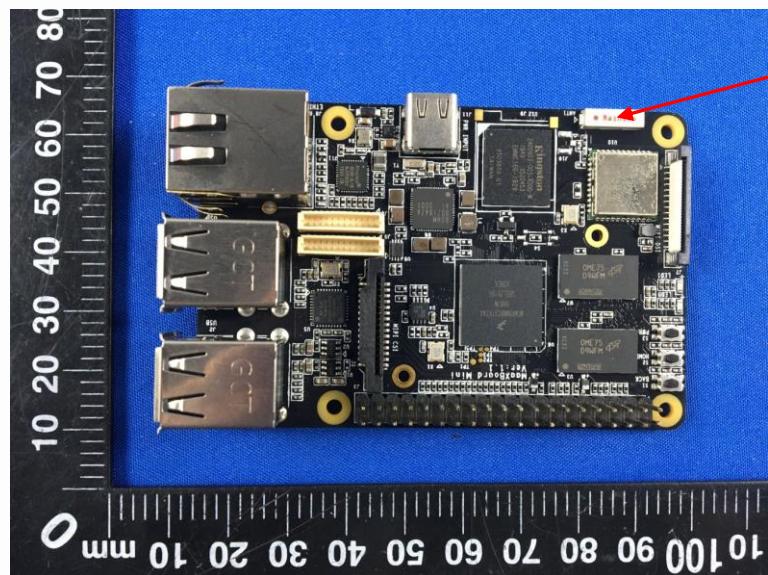
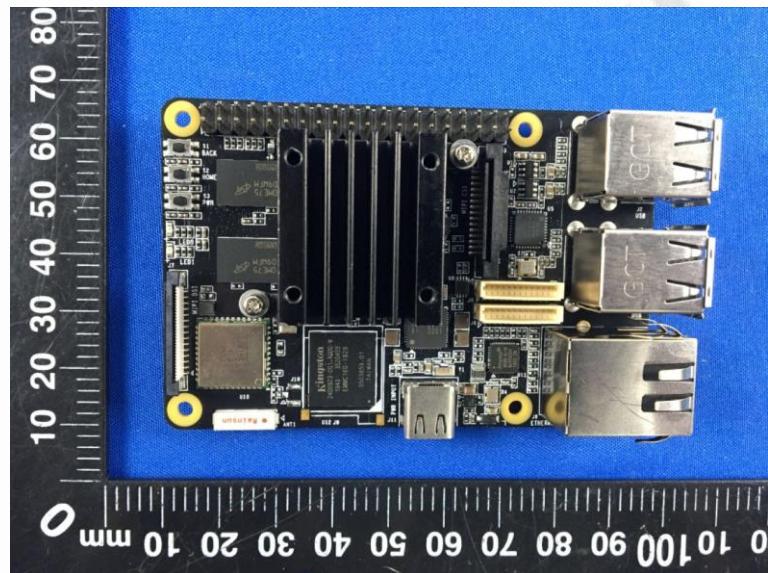
15/09/2020 13:41

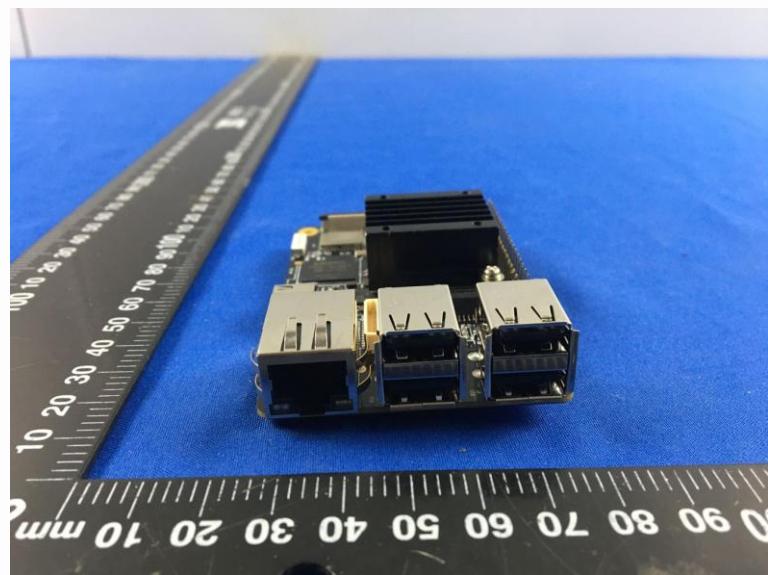
Frequency MHz	Level dB $\mu$ V/m	Transd dB	Limit dB $\mu$ V/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	26.40	22.2	40.0	13.6	---	0.0	0.00	VERTICAL
64.920000	27.80	8.4	40.0	12.2	---	0.0	0.00	VERTICAL
125.060000	29.30	15.3	43.5	14.2	---	0.0	0.00	VERTICAL
163.860000	32.80	14.5	43.5	10.7	---	0.0	0.00	VERTICAL
249.220000	33.60	14.4	46.0	12.4	---	0.0	0.00	VERTICAL
749.740000	32.40	24.9	46.0	13.6	---	0.0	0.00	VERTICAL

#### 4. Test Setup Photos of the EUT



## 5. Photos of the EUT





\*\*\*\*\* End of Report \*\*\*\*\*