



Shenzhen CTL Testing Technology Co., Ltd.
Tel: +86-755-89486194 E-mail: ctl@ctl-lab.com

TEST REPORT

FCC PART 15.247

Report Reference No.: **CTL2008174011-WF01**

Compiled by:
(position+printed name+signature)

Happy Guo
(File administrators)

Happy Guo

Tested by:
(position+printed name+signature)

Nice Nong
(Test Engineer)

Nice Nong

Approved by:
(position+printed name+signature)

Ivan Xie
(Manager)

Ivan Xie

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**

Shenzhen CTL Testing Technology Co., Ltd. All rights reserved.

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen CTL Testing Technology Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen CTL Testing Technology Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

TEST REPORT

Test Report No. :	CTL2008174011-WF01	Sep. 18, 2020
		Date of issue

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.

Test result	Pass *
--------------------	---------------

*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 **

	Table of Contents	Page
1. SUMMARY		5
1.1. TEST STANDARDS.....		5
1.2. TEST DESCRIPTION.....		5
1.3. TEST FACILITY		6
1.4. STATEMENT OF THE MEASUREMENT UNCERTAINTY.....		6
2. GENERAL INFORMATION		8
2.1. ENVIRONMENTAL CONDITIONS.....		8
2.2. GENERAL DESCRIPTION OF EUT		8
2.3. DESCRIPTION OF TEST MODES AND TEST FREQUENCY.....		8
2.4. EQUIPMENTS USED DURING THE TEST		9
2.5. RELATED SUBMITTAL(S) / GRANT (S)		9
2.6. MODIFICATIONS.....		9
3. TEST CONDITIONS AND RESULTS		10
3.1. CONDUCTED EMISSIONS TEST		10
3.2. RADIATED EMISSIONS AND BAND EDGE		13
4. TEST SETUP PHOTOS OF THE EUT.....		16
5. PHOTOS OF THE EUT.....		17

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

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
Bluetooth :	
Supported type:	Bluetooth BR/EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
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 79 channels provided to the EUT and Channel 00/39/78 were selected to test.

Operation Frequency :

Channel	Frequency (MHz)
00	2402
01	2403
:	:
38	2440
39	2441
40	2442
:	:
77	2479
78	2480

Preliminary tests were performed in each mode and packet length of BT, and found worst case as bellow, finally test were conducted at those mode and recorded in this report.

Test Items	Worst case
Conducted Emissions	DH5 Middle channel
Radiated Emissions	DH5

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

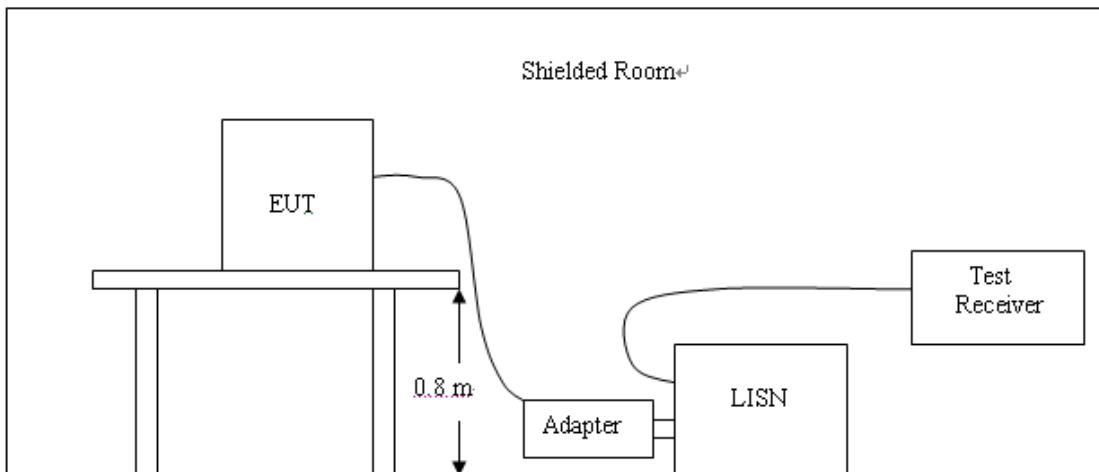
LIMIT

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



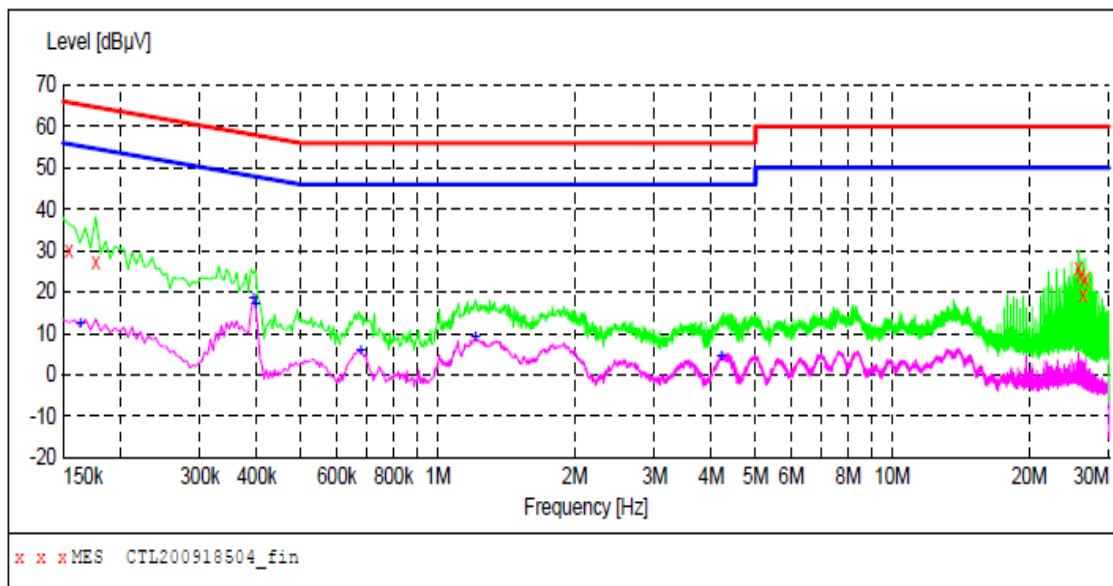
TEST PROCEDURE

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

Remark: All modes of GFSK, Pi/4 DQPSK, and 8DPSK were test at Low, Middle, and High channel; only the worst result of GFSK Middle Channel was reported as below:

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



MEASUREMENT RESULT: "CTL200918504_fin"

2020-9-18 9:31

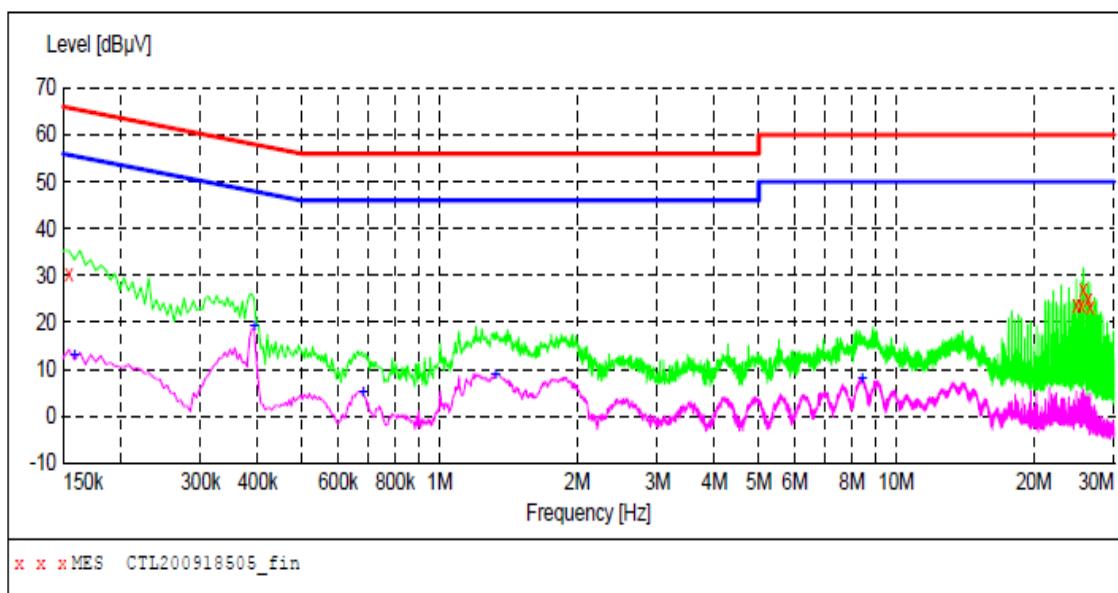
Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.154500	30.00	11.2	66	35.8	QP	L1	GND
0.177000	27.40	11.2	65	37.2	QP	L1	GND
25.683000	25.80	11.4	60	34.2	QP	L1	GND
25.971000	24.10	11.4	60	35.9	QP	L1	GND
26.290500	19.40	11.4	60	40.6	QP	L1	GND
26.578500	23.00	11.4	60	37.0	QP	L1	GND

MEASUREMENT RESULT: "CTL200918504_fin2"

2020-9-18 9:31

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.163500	12.20	11.2	55	43.1	AV	L1	GND
0.393000	18.30	11.2	48	29.7	AV	L1	GND
0.397500	16.80	11.2	48	31.1	AV	L1	GND
0.676500	5.90	11.2	46	40.1	AV	L1	GND
1.212000	9.00	11.2	46	37.0	AV	L1	GND
4.204500	4.20	11.3	46	41.8	AV	L1	GND

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



MEASUREMENT RESULT: "CTL200918505_fin"

2020-9-18 9:35

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.154500	30.30	11.2	66	35.5	QP	N	GND
24.787500	23.80	11.3	60	36.2	QP	N	GND
25.386000	23.80	11.4	60	36.2	QP	N	GND
25.683000	26.90	11.4	60	33.1	QP	N	GND
26.277000	25.10	11.4	60	34.9	QP	N	GND
26.578500	23.10	11.4	60	36.9	QP	N	GND

MEASUREMENT RESULT: "CTL200918505_fin2"

2020-9-18 9:35

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.159000	12.80	11.2	56	42.7	AV	N	GND
0.393000	19.20	11.2	48	28.8	AV	N	GND
0.681000	4.90	11.2	46	41.1	AV	N	GND
1.324500	8.60	11.2	46	37.4	AV	N	GND
8.421000	7.80	11.0	50	42.2	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.

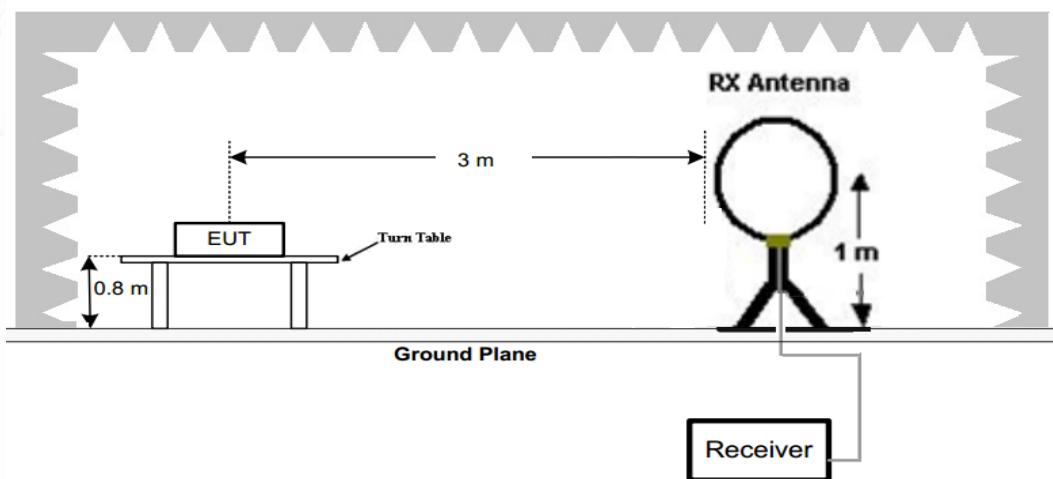
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

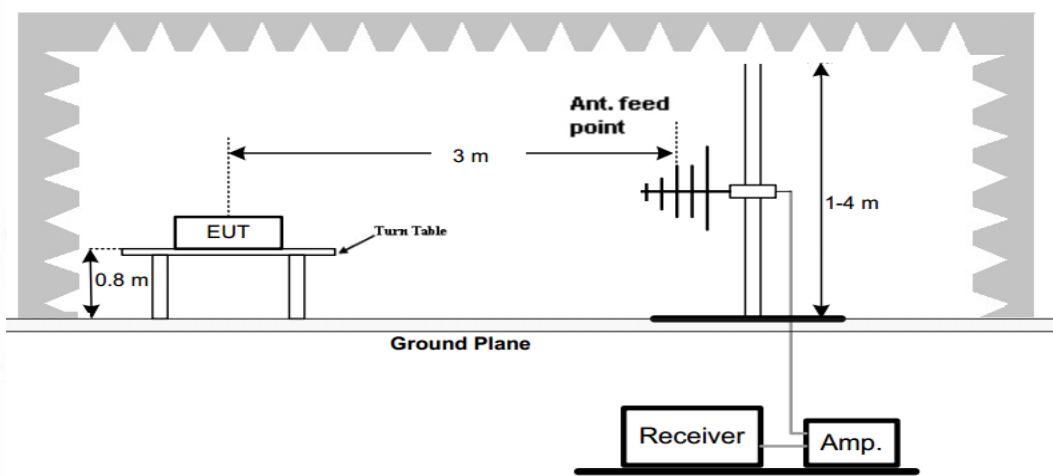
Frequency (MHz)	Distance (Meters)	Radiated (dB μ V/m)	Radiated (μ V/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz}))+40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz}))+40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30)+40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150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

TEST CONFIGURATION

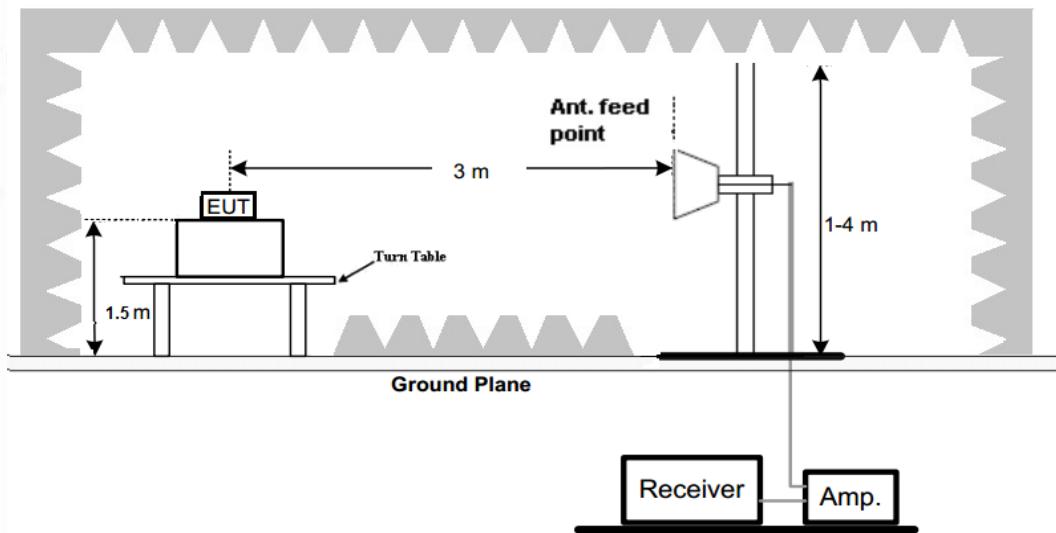
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(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

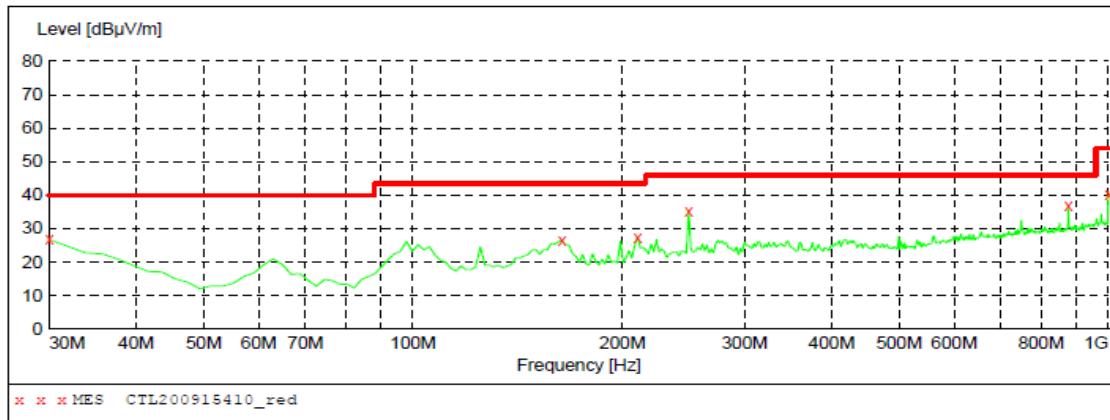
Remark:

1. For below 1GHz testing recorded worst at GFSK DH5 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

SWEEP TABLE: "test (30M-1G)"
 Short Description: Field Strength
 Start Stop Detector Meas. IF Transducer
 Frequency Frequency Time Bandw.
 30.0 MHz 1.0 GHz MaxPeak 300.0 ms 100 kHz JB1



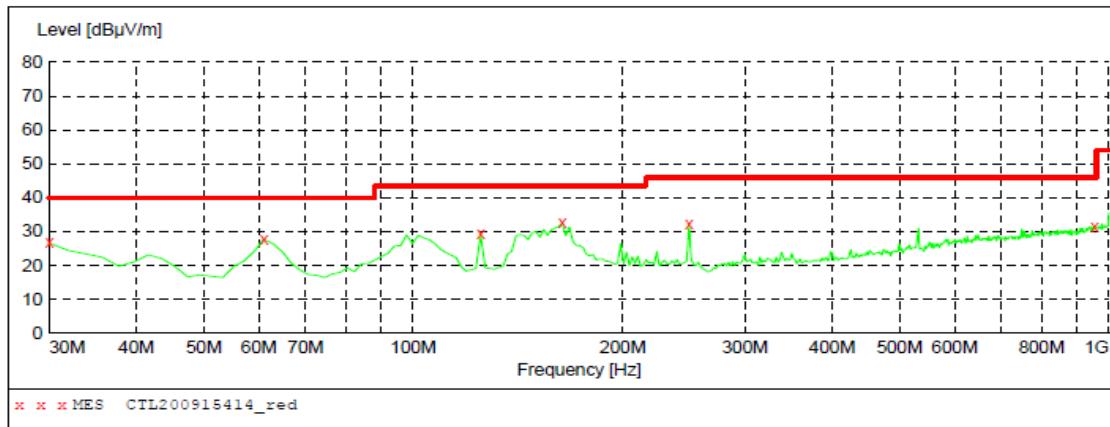
MEASUREMENT RESULT: "CTL200915410_red"

15/09/2020 13:33

Frequency	Level	Transd	Limit	Margin	Det.	Height	Azimuth	Polarization
MHz	dB μ V/m	dB	dB μ V/m	dB		cm	deg	
30.000000	26.80	22.2	40.0	13.2	---	0.0	0.00	HORIZONTAL
163.860000	26.50	14.5	43.5	17.0	---	0.0	0.00	HORIZONTAL
210.420000	27.40	14.5	43.5	16.1	---	0.0	0.00	HORIZONTAL
249.220000	35.10	14.4	46.0	10.9	---	0.0	0.00	HORIZONTAL
875.840000	36.70	26.1	46.0	9.3	---	0.0	0.00	HORIZONTAL
1000.000000	40.10	28.2	53.9	13.8	---	0.0	0.00	HORIZONTAL

Vertical

SWEEP TABLE: "test (30M-1G)"
 Short Description: Field Strength
 Start Stop Detector Meas. IF Transducer
 Frequency Frequency Time Bandw.
 30.0 MHz 1.0 GHz MaxPeak 300.0 ms 100 kHz JB1

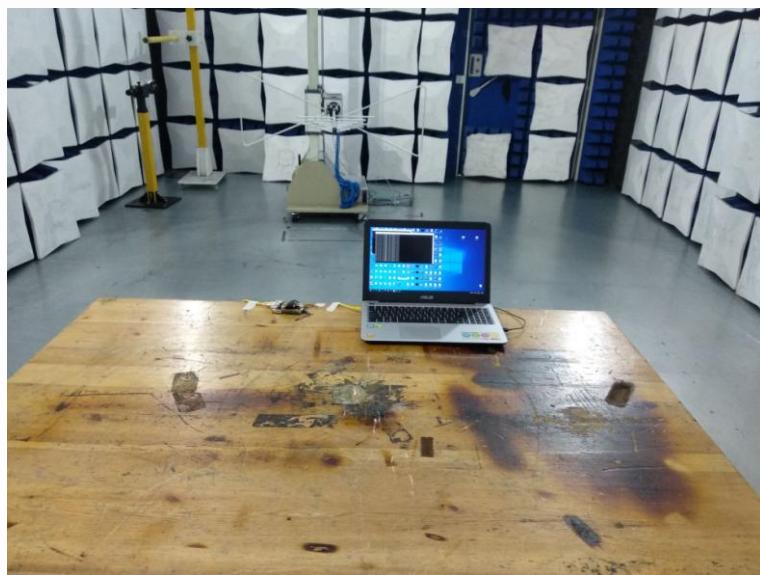


MEASUREMENT RESULT: "CTL200915414_red"

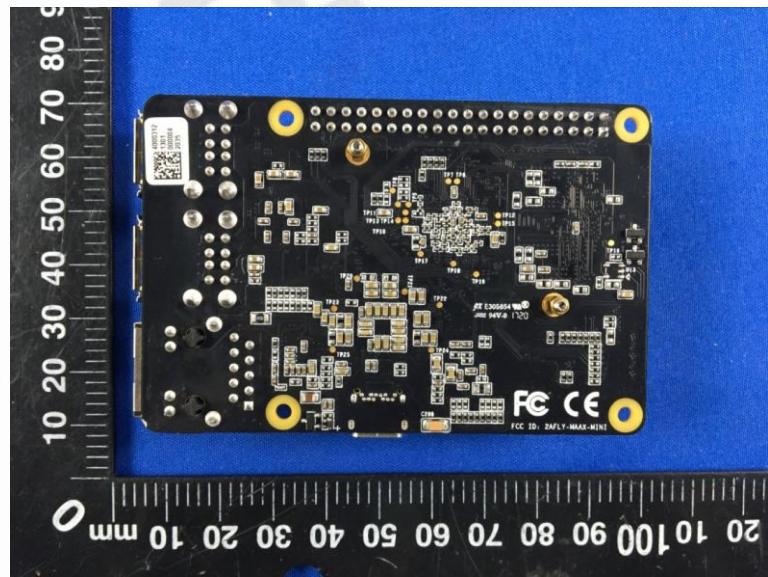
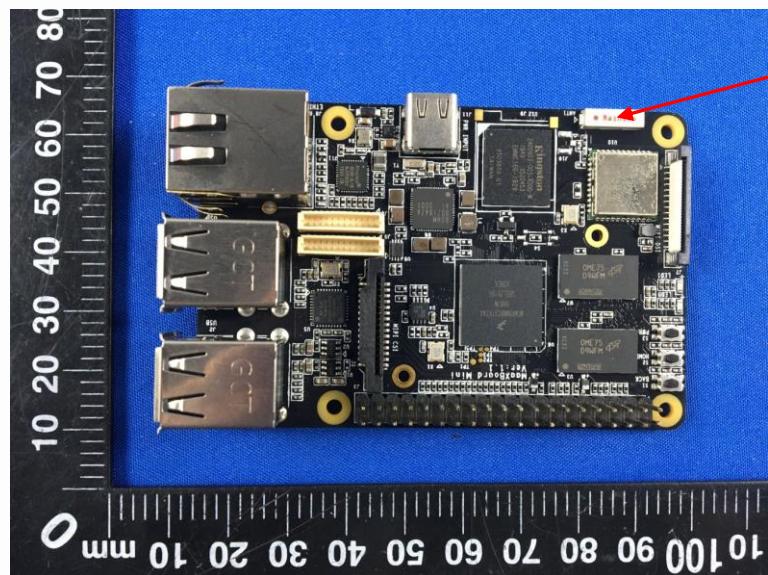
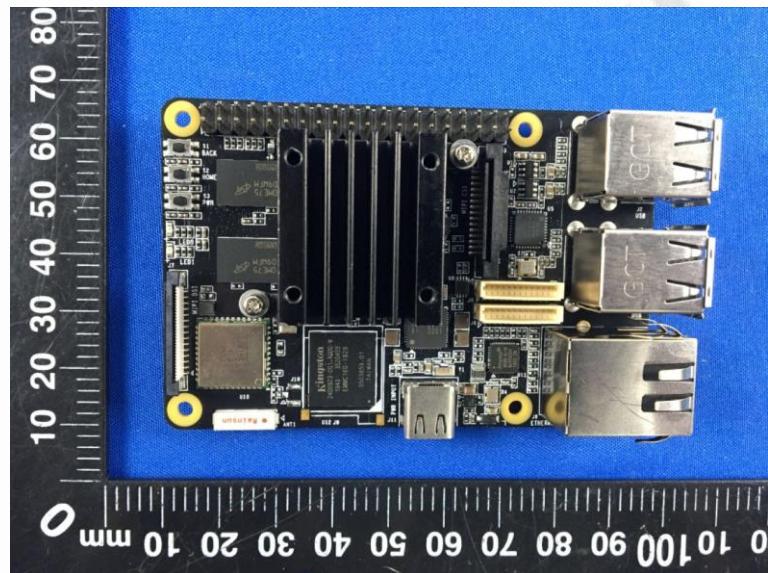
15/09/2020 13:39

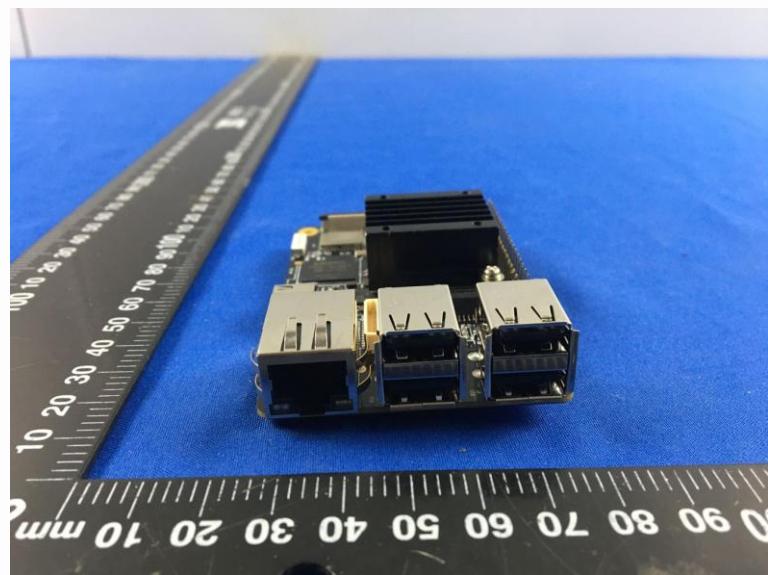
Frequency	Level	Transd	Limit	Margin	Det.	Height	Azimuth	Polarization
MHz	dB μ V/m	dB	dB μ V/m	dB		cm	deg	
30.000000	26.70	22.2	40.0	13.3	---	0.0	0.00	VERTICAL
61.040000	27.80	7.9	40.0	12.2	---	0.0	0.00	VERTICAL
125.060000	29.20	15.3	43.5	14.3	---	0.0	0.00	VERTICAL
163.860000	32.50	14.5	43.5	11.0	---	0.0	0.00	VERTICAL
249.220000	32.10	14.4	46.0	13.9	---	0.0	0.00	VERTICAL
953.440000	31.60	27.3	46.0	14.4	---	0.0	0.00	VERTICAL

4. Test Setup Photos of the EUT



5. Photos of the EUT





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