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FCC SDoC Test Report

FCC PART 15 Subpart B

Report Reference No.: CTL1908054071-F

Compiled by

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Date of issue: Sep. 05, 2019

Representative Laboratory Name. : Shenzhen CTL Testing Technology Co., Ltd.

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

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

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

Applicant's name: Embest Technology Co., Ltd

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

Test specification:

Standard.....: **FCC PART 15 Subpart B**

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

Shenzhen CTL Testing Technology Co., Ltd.

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FCCID.....: 2AFLY-MAAX

Test item description: MaaXBoard

Trade Mark: N/A

Test voltage.....: DC5.0V

Result: Pass

FCC Test Report

Test Report No. :	CTL1908054071-F	Sep. 05, 2019 Date of issue
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Equipment under Test : MaaXBoard

Type / Model : EM-MC-SBC-IMX8M

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
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

History of this test report

Report No.	Version	Description	Issued Date
CTL1908054071-F	V1.0	Initial Issued Report	Sep. 05, 2019

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1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15 Subpart B - Unintentional Radiators](#)

[ANSI C63.4-2014](#)

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample : Aug. 15, 2019

Sampling and Testing commenced on : Aug. 15, 2019

Testing concluded on : Sep. 05, 2019

2.2. Equipment Under Test

Power supply system utilised

Power supply voltage : 120V / 60 Hz 115V / 60Hz
 12 V DC 24 V DC
 Other (specified in blank below)

DC5.0V

2.3. Short description of the Equipment under Test (EUT)

MaaXBoard

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

2.4. EUT operation mode

The EUT has been tested under typical operating condition.

2.5. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- supplied by the manufacturer

- supplied by the lab

Adapter

2.7. Related Submittal(s) / Grant (s)

This test report is intended for MaaXBoard. filing to comply with the FCC Part 15, Subpart B Rules.

2.8. Modifications

No modifications were implemented to meet testing criteria.

2.9. Test Result Summary

Test Item	Test Requirement	Standard Paragraph	Result
Radiated Emission	FCC PART 15 Subpart B	Section 15.109	PASS
Conducted Emission	FCC PART 15 Subpart B	Section 15.107	PASS

3. TEST ENVIRONMENT

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

3.2. Test Facility

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

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

FCC-Registration No.: 399832

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.

Certificated by A2LA, USA

Registration No.:4343.01

Date of registration: December 27, 2017

3.3. Environmental conditions

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

Temperature:	<u>15-35 ° C</u>
Humidity:	<u>30-60 %</u>
Atmospheric pressure:	<u>950-1050mbar</u>

3.4. 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	Range	Measurement Uncertainty	Notes
Radiated Emission(chamber 1)	30~1000MHz	±3.20dB	(1)
Radiated Emission(chamber 2)	30~1000MHz	±3.53dB	(1)
Radiated Emission	1~12.75GHz	±4.32dB	(1)
Conducted Emission	0.15~30MHz	±2.66dB	(1)
Disturbance Power	30~300MHz	±2.90dB	(1)

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

3.5. Equipments Used during the Test

Radiated Emission(Chamber 1)						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	ULTRA-BROADBAND ANTENNA	Sunol Sciences Corp.	JB1	A061713	2019/05/20	2020/05/19
2	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2019/05/20	2020/05/19
3	Horn Antenna	Sunol Sciences Corp	DRH-118	A062013	2019/05/20	2020/05/19

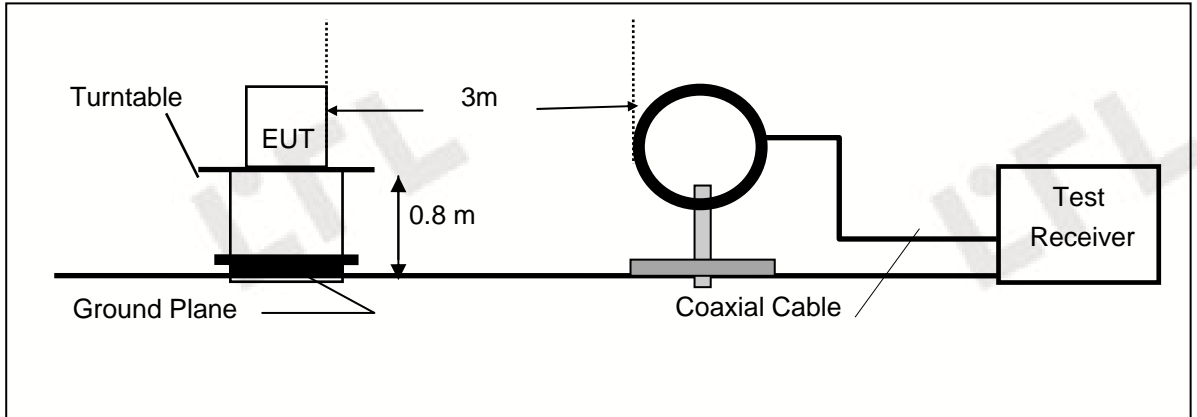
Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2019/05/20	2020/05/19
2	LISN	ROHDE & SCHWARZ	ESH2-Z5	860014/010	2019/05/20	2020/05/19
3	Limitator	HP	VTSD 9561f	N/A	2019/05/20	2020/05/19

4 TEST CONDITIONS AND RESULTS

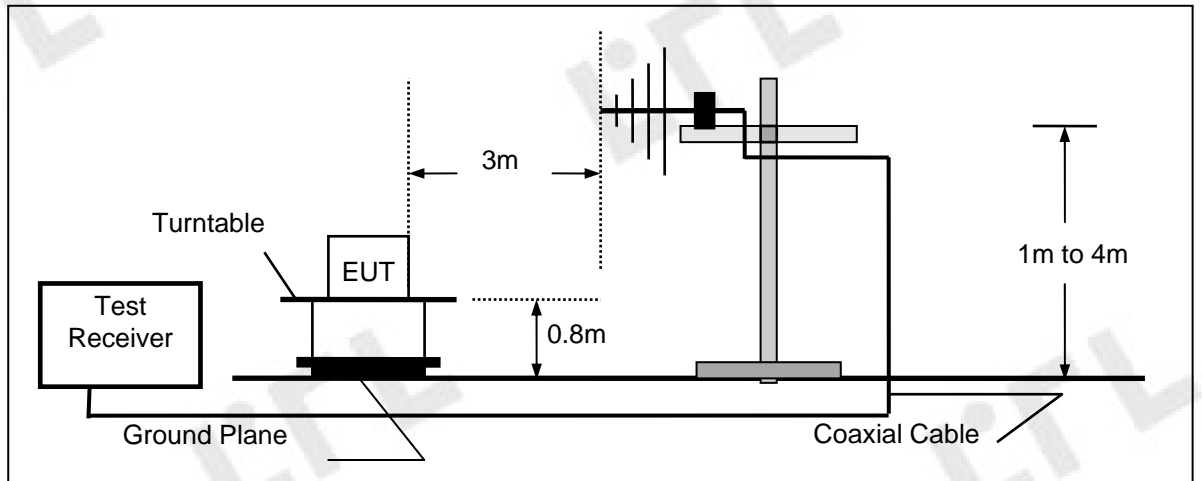
4.1. Radiated Emission Test

TEST CONFIGURATION

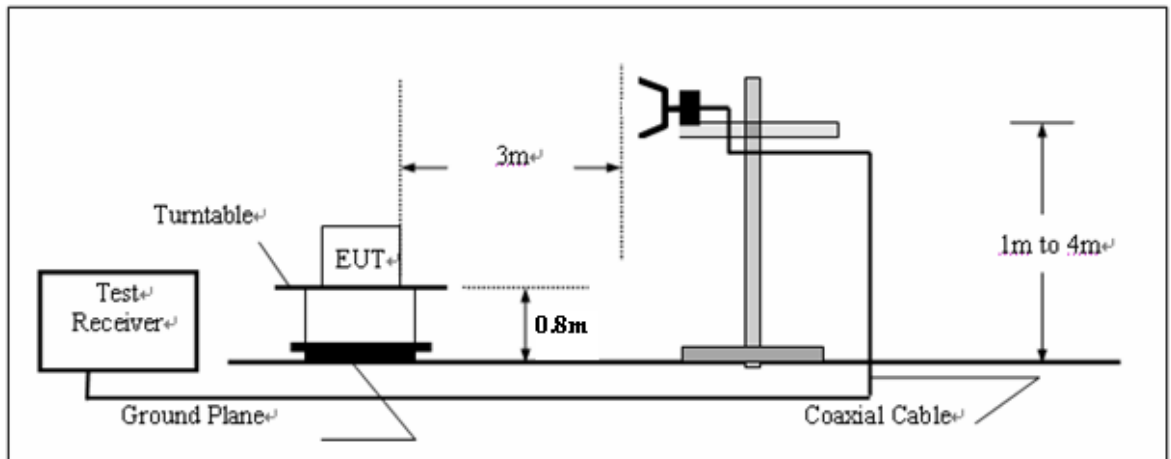
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

RADIATION LIMIT

For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

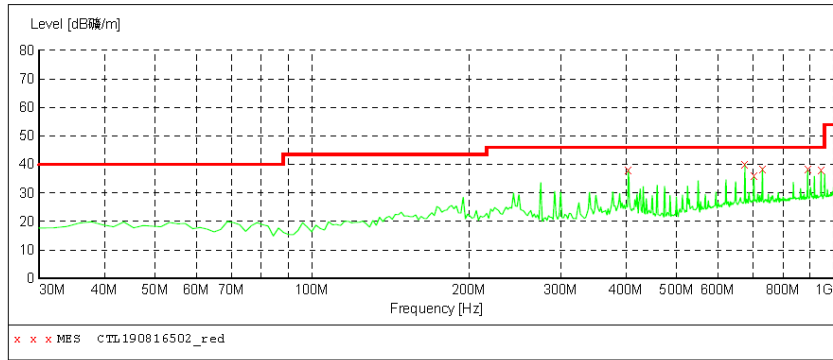
Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Radiation Test Results

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 120 kHz VULB9168



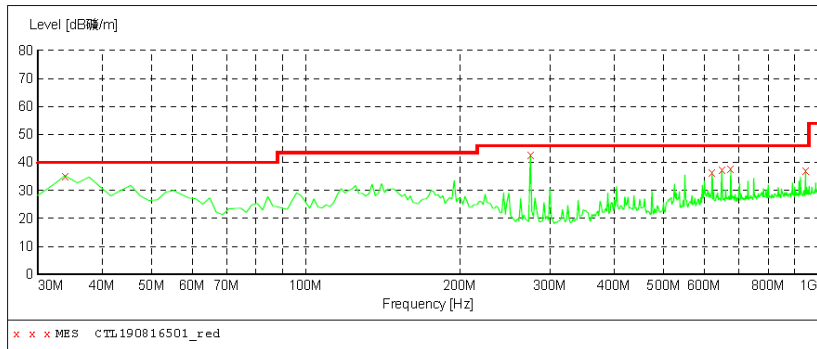
MEASUREMENT RESULT: "CTL190816502_red"

2019-8-16 9:20

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
404.420000	38.10	16.3	46.0	7.9	---	0.0	0.00	HORIZONTAL
676.020000	40.20	21.3	46.0	5.8	---	0.0	0.00	HORIZONTAL
703.180000	36.10	21.6	46.0	9.9	---	0.0	0.00	HORIZONTAL
730.340000	38.60	21.9	46.0	7.4	---	0.0	0.00	HORIZONTAL
891.360000	38.40	23.6	46.0	7.6	---	0.0	0.00	HORIZONTAL
945.680000	38.00	24.2	46.0	8.0	---	0.0	0.00	HORIZONTAL

SWEEP TABLE: "test (30M-1G)"

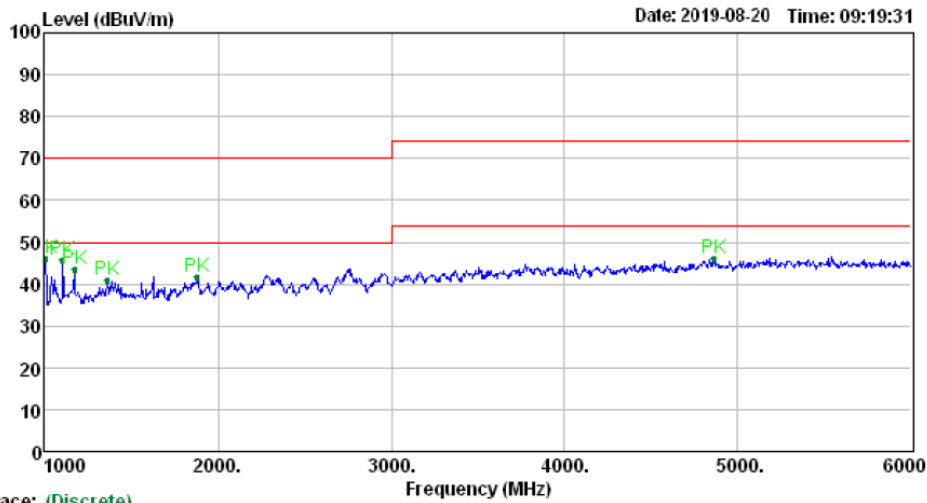
Short Description: Field Strength
 Start Stop Detector Meas. IF Transducer
 Frequency Frequency Time Bandw.
 30.0 MHz 1.0 GHz MaxPeak 300.0 ms 120 kHz VULB9168



MEASUREMENT RESULT: "CTL190816501_red"

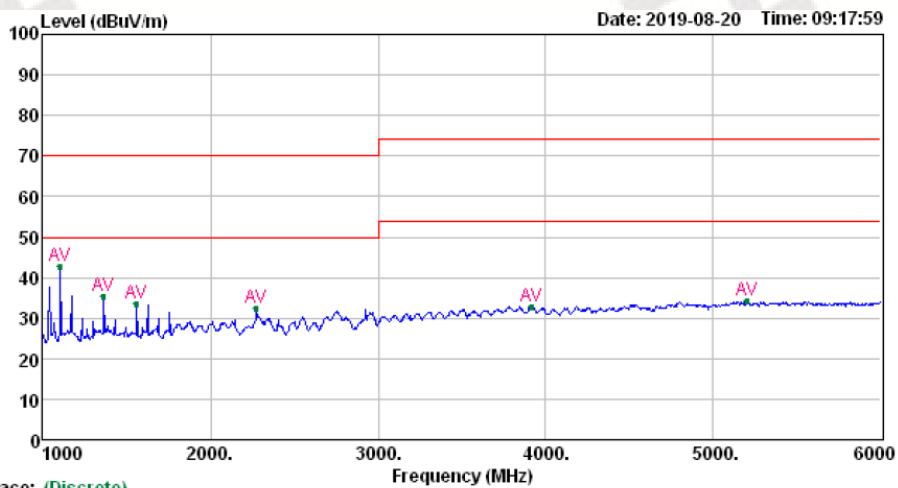
2019-8-16 9:18

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
33.880000	35.30	14.0	40.0	4.7	---	0.0	0.00	VERTICAL
274.440000	42.80	13.5	46.0	3.2	---	0.0	0.00	VERTICAL
621.700000	36.50	20.5	46.0	9.5	---	0.0	0.00	VERTICAL
648.860000	37.40	20.9	46.0	8.6	---	0.0	0.00	VERTICAL
676.020000	37.80	21.3	46.0	8.2	---	0.0	0.00	VERTICAL
945.680000	37.30	24.2	46.0	8.7	---	0.0	0.00	VERTICAL



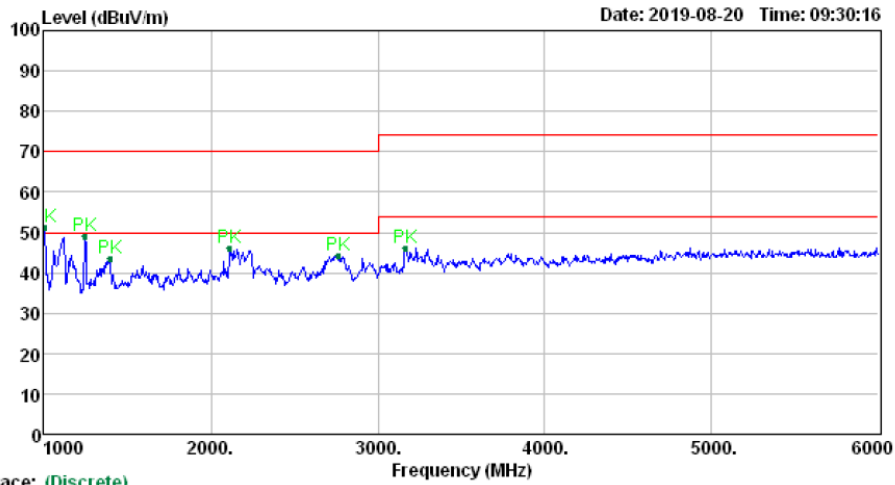
Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	1005.00	55.91	-9.77	46.14	70.00	23.86	Peak	HORIZONTAL
2	1105.00	54.07	-8.39	45.68	70.00	24.32	Peak	HORIZONTAL
3	1170.00	51.63	-7.93	43.70	70.00	26.30	Peak	HORIZONTAL
4	1365.00	48.10	-7.09	41.01	70.00	28.99	Peak	HORIZONTAL
5	1880.00	46.01	-4.37	41.64	70.00	28.36	Peak	HORIZONTAL
6	4865.00	41.25	4.93	46.18	74.00	27.82	Peak	HORIZONTAL



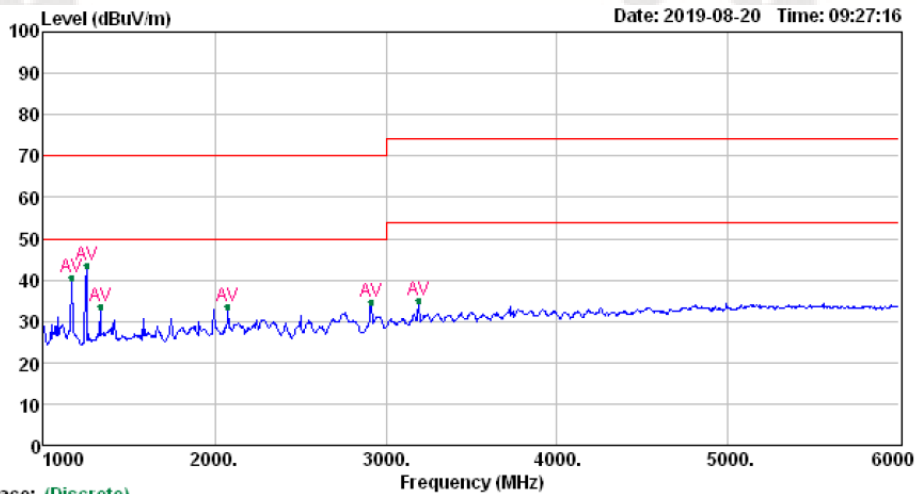
Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	1105.00	51.33	-8.39	42.94	50.00	7.06	Average	HORIZONTAL
2	1365.00	42.44	-7.09	35.35	50.00	14.65	Average	HORIZONTAL
3	1560.00	40.01	-6.61	33.40	50.00	16.60	Average	HORIZONTAL
4	2275.00	36.05	-3.76	32.29	50.00	17.71	Average	HORIZONTAL
5	3915.00	29.49	3.42	32.91	54.00	21.09	Average	HORIZONTAL
6	5200.00	28.32	5.91	34.23	54.00	19.77	Average	HORIZONTAL



Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	1005.00	61.12	-9.77	51.35	70.00	18.65	Peak	VERTICAL
2	1245.00	56.63	-7.50	49.13	70.00	20.87	Peak	VERTICAL
3	1395.00	50.64	-7.06	43.58	70.00	26.42	Peak	VERTICAL
4	2115.00	49.77	-3.81	45.96	70.00	24.04	Peak	VERTICAL
5	2760.00	46.29	-2.04	44.25	70.00	25.75	Peak	VERTICAL
6	3165.00	46.11	0.06	46.17	74.00	27.83	Peak	VERTICAL

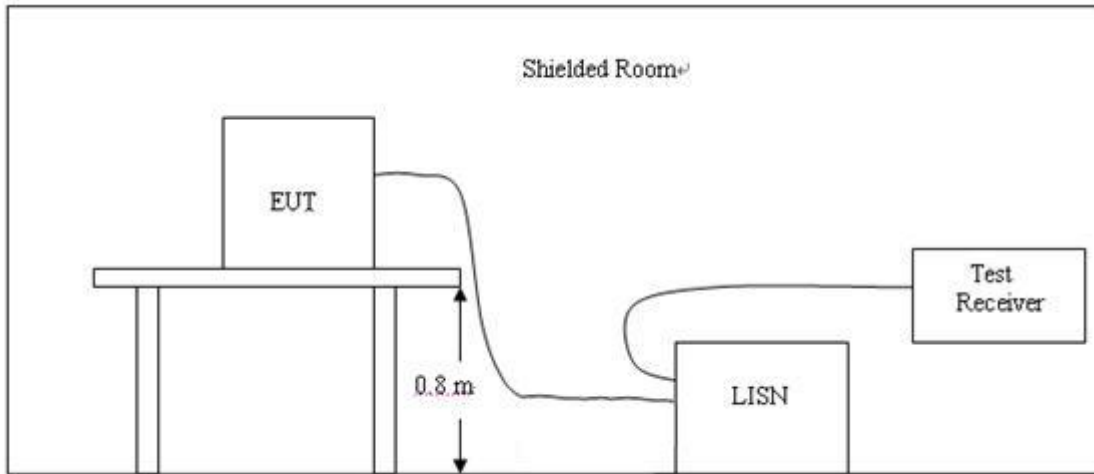


Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	1165.00	48.69	-7.94	40.75	50.00	9.25	Average	VERTICAL
2	1250.00	50.86	-7.45	43.41	50.00	6.59	Average	VERTICAL
3	1330.00	40.87	-7.14	33.73	50.00	16.27	Average	VERTICAL
4	2080.00	37.44	-3.85	33.59	50.00	16.41	Average	VERTICAL
5	2915.00	35.96	-1.12	34.84	50.00	15.16	Average	VERTICAL
6	3190.00	35.02	0.19	35.21	54.00	18.79	Average	VERTICAL

4.2. Conducted Emissions Test

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 C63.4.
- 2 Support equipment, if needed, was placed as per ANSI C63.4.
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
- 4 The EUT received 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.

Conducted Power Line Emission Limit

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following :

Frequency (MHz)	Maximum RF Line Voltage (dBµV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

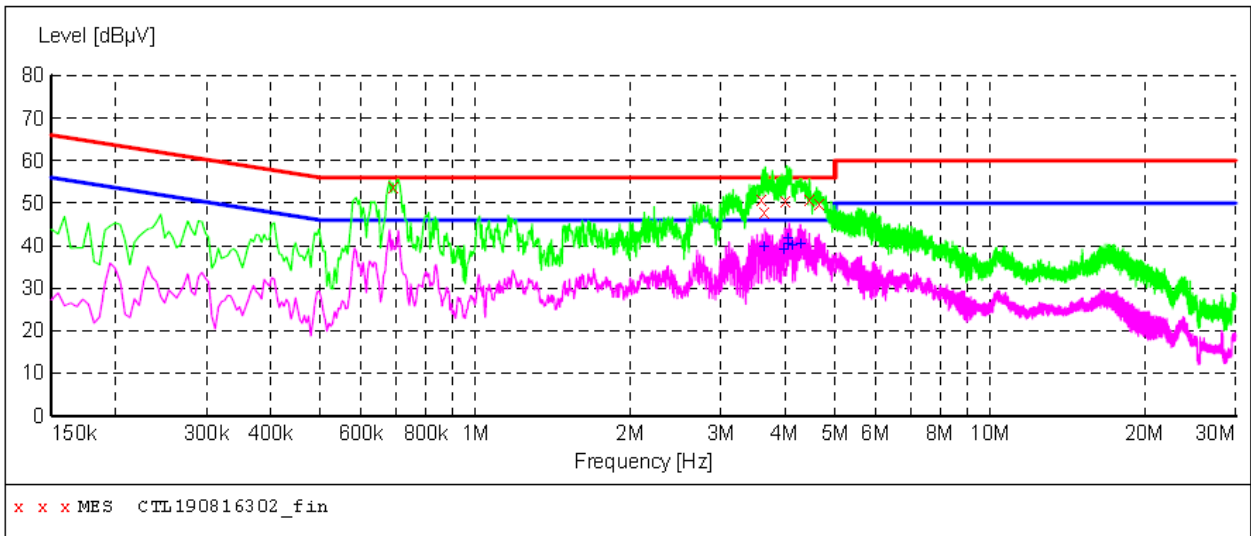
* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

TEST RESULTS

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL190816302_fin"

2019-8-16 01:15??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.690000	53.90	11.2	56	2.1	QP	L1	GND
3.597000	50.90	11.4	56	5.1	QP	L1	GND
3.633000	48.00	11.4	56	8.0	QP	L1	GND
3.988500	50.50	11.4	56	5.5	QP	L1	GND
4.452000	51.00	11.4	56	5.0	QP	L1	GND
4.641000	49.80	11.4	56	6.2	QP	L1	GND

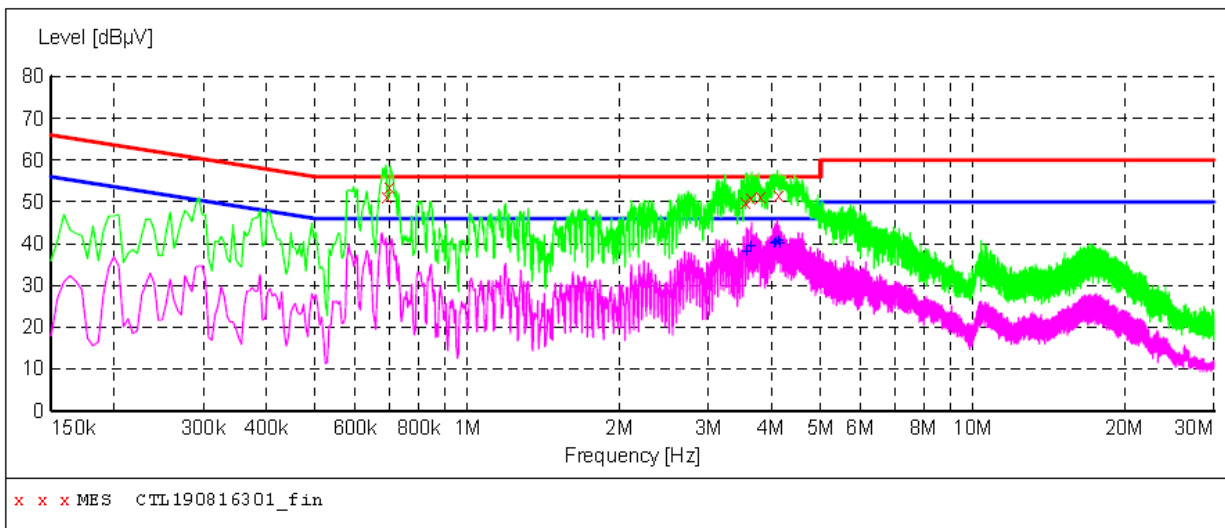
MEASUREMENT RESULT: "CTL190816302_fin2"

2019-8-16 01:15??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
3.633000	39.70	11.4	46	6.3	AV	L1	GND
3.957000	39.00	11.4	46	7.0	AV	L1	GND
4.033500	40.20	11.4	46	5.8	AV	L1	GND
4.051500	41.60	11.4	46	4.4	AV	L1	GND
4.114500	40.10	11.4	46	5.9	AV	L1	GND
4.281000	40.40	11.4	46	5.6	AV	L1	GND

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL190816301_fin"

2019-8-16 01:12??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.690000	51.40	11.2	56	4.6	QP	N	GND
0.699000	53.70	11.2	56	2.3	QP	N	GND
3.552000	50.10	11.4	56	5.9	QP	N	GND
3.628500	50.80	11.4	56	5.2	QP	N	GND
3.808500	51.40	11.4	56	4.6	QP	N	GND
4.132500	51.70	11.4	56	4.3	QP	N	GND

MEASUREMENT RESULT: "CTL190816301_fin2"

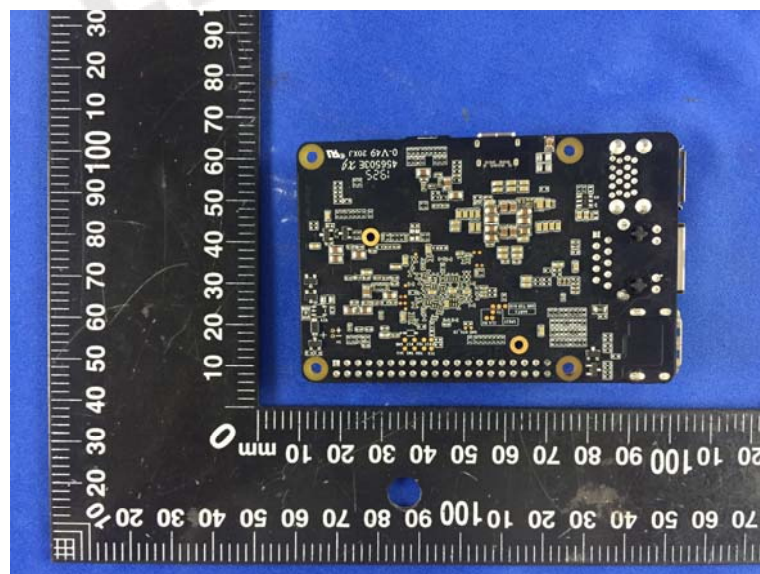
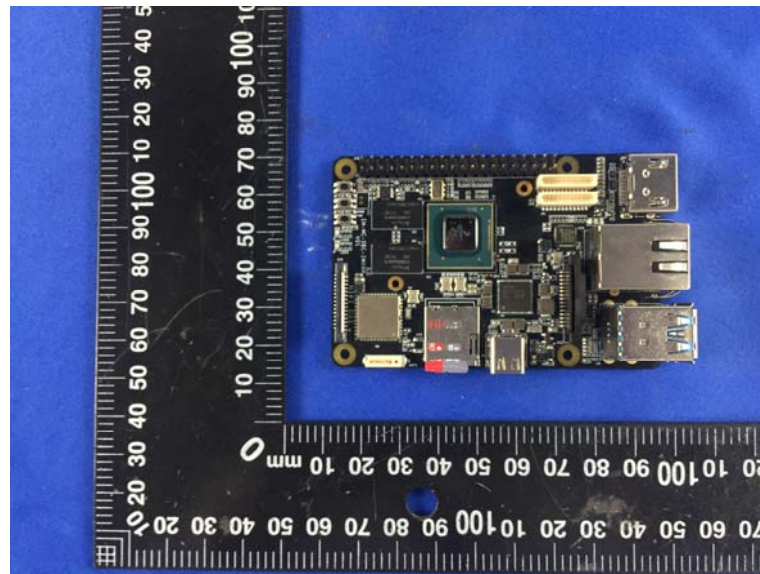
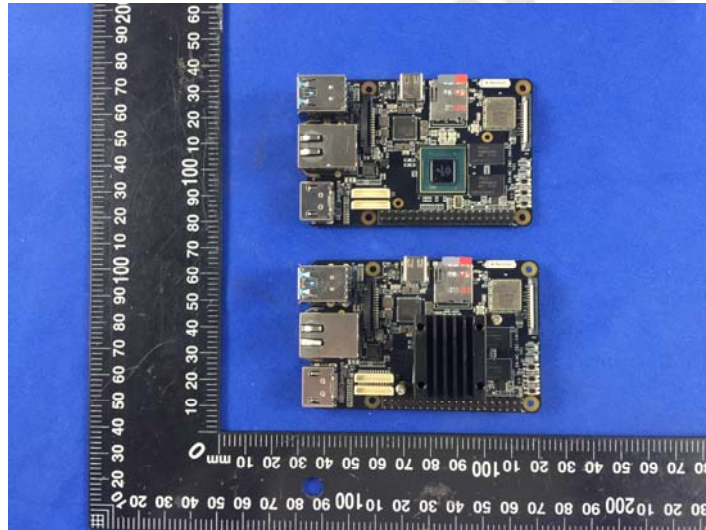
2019-8-16 01:12??

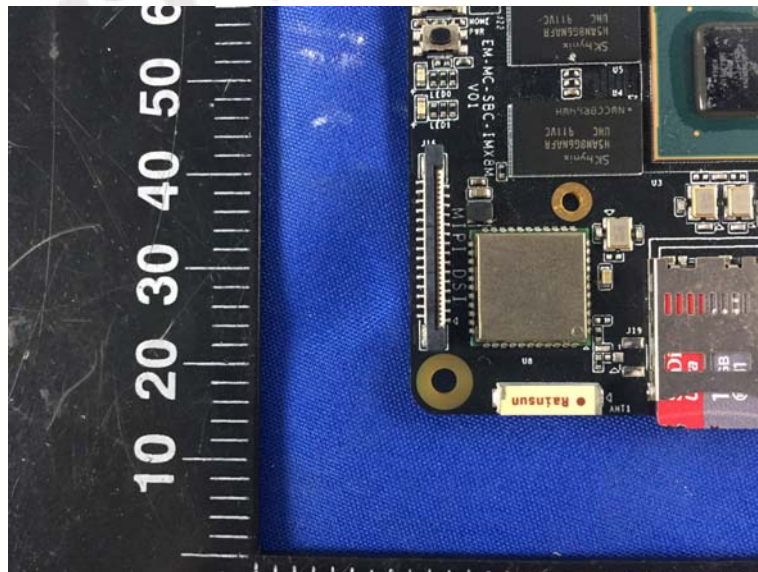
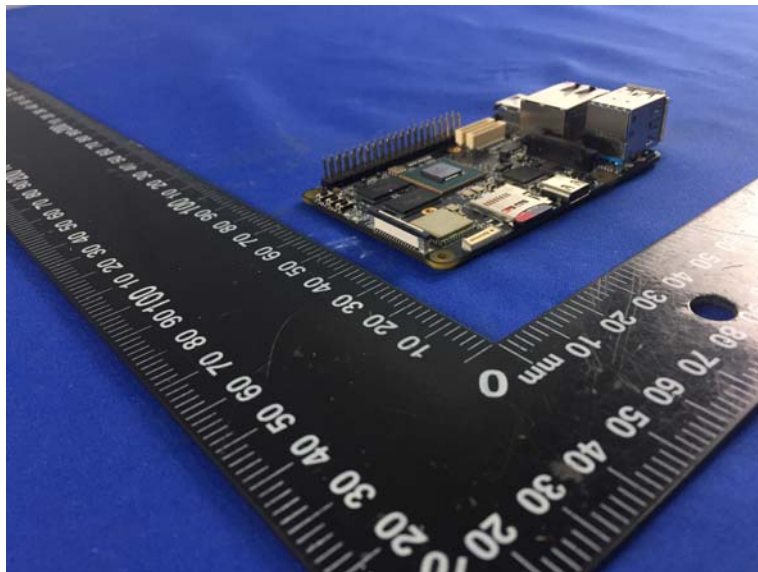
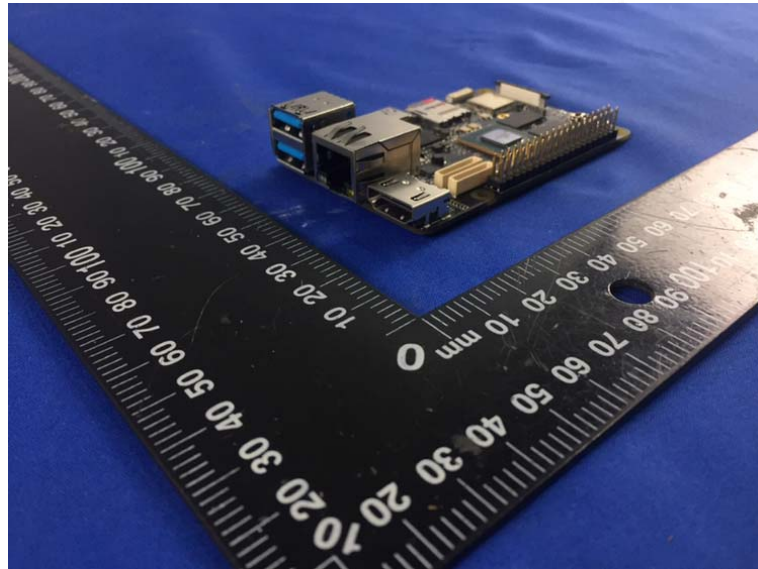
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
3.561000	38.10	11.4	46	7.9	AV	N	GND
3.628500	39.40	11.4	46	6.6	AV	N	GND
4.056000	40.00	11.4	46	6.0	AV	N	GND
4.065000	40.40	11.4	46	5.6	AV	N	GND
4.132500	40.80	11.4	46	5.2	AV	N	GND
4.155000	39.90	11.4	46	6.1	AV	N	GND

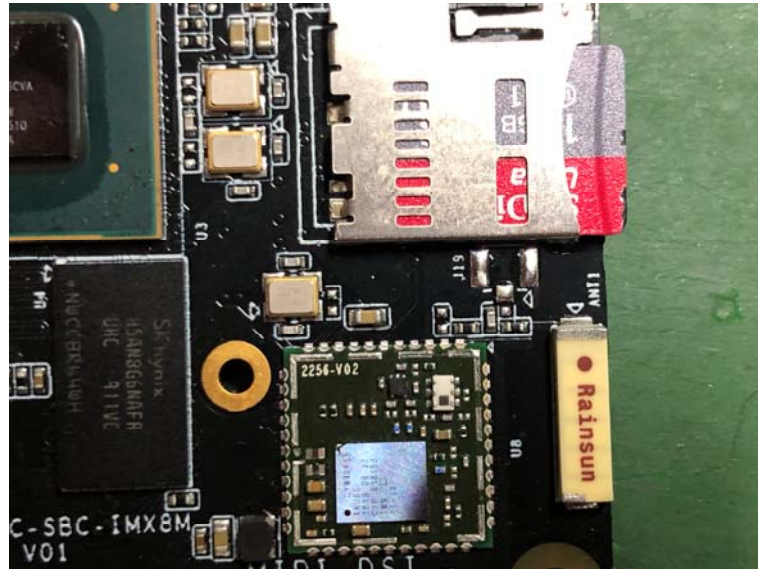
5. Test Setup Photos of the EUT



6. Photos of the EUT







.....End of Report.....