Shenzhen CTL Testing Technology Co., Ltd.
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FCC SDoC Test Report

FCC PART 15 Subpart B

Report Reference No. ..... :	**CTL1906244051-F**
Compiled by (position+printed name+signature) . :	File administrators Sandy Yan
Name of the organization performing the tests (position+printed name+signature) . :	Technique principal Ivan Xie
Approved by (position+printed name+signature) . :	Manager Tracy Qi
Date of issue ..... :	Jul. 16, 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 ..... :	**BeagleBoard.org Foundation**
Address ..... :	4467 Ascot Court Oakland Township, Michigan, US 48306
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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FCC ID ..... :	2ATUT-BBONE-AI
Test item description ..... :	**Beaglebone AI**
Trade Mark ..... :	N/A
Test voltage..... :	DC5.0V
Result ..... :	**Pass**

FCC Test Report

Test Report No. :	CTL1906244051-F	Jul. 16, 2019 Date of issue

Equipment under Test	:	Beaglebone AI
Type / Model	:	Beaglebone AI
Listed Models	:	N/A
Applicant	:	**BeagleBoard.org Foundation**
Address	:	4467 Ascot Court Oakland Township, Michigan, US 48306
Manufacturer	:	**Embest Technology Co., Ltd**
Address	:	Tower B 4/F, Shanghai Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave. No.1183, Taoyuan St., Nanshan District, Shenzhen, China.

Test Result	Pass

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
CTL1906244051-F	V1.0	Initial Issued Report	Jul.16, 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	:	Jun. 26, 2019
Sampling and Testing commenced on	:	Jun. 26, 2019
Testing concluded on	:	Jul. 16, 2019

2.2. Equipment Under Test

Power supply system utilised

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

DC5.0V

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

Beaglebone AI.

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

o - supplied by the lab

HDIM	●	Television	O
Adapter	●		

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

This test report is intended for Beaglebone AI. 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 Paragrph	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:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

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	2018/10/08	2019/10/07
2	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2019/05/25	2020/05/24
3	Horn Antenna	Sunol Sciences Corp	DRH-118	A062013	2019/05/25	2020/05/24

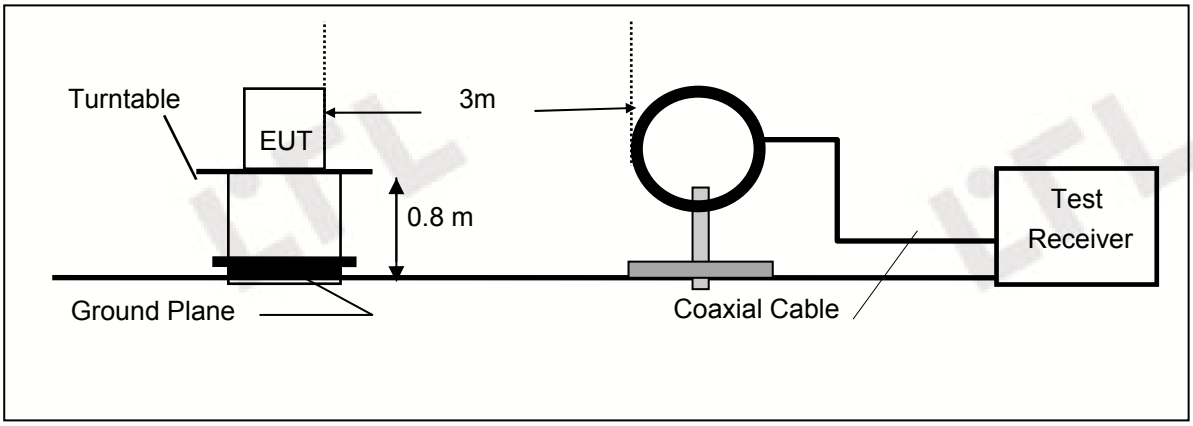
Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2019/05/25	2020/05/24
2	LISN	ROHDE & SCHWARZ	ESH2-Z5	860014/010	2019/05/25	2020/05/24
3	Limitator	HP	VTSD 9561f	N/A	2019/05/25	2020/05/24

4 TEST CONDITIONS AND RESULTS

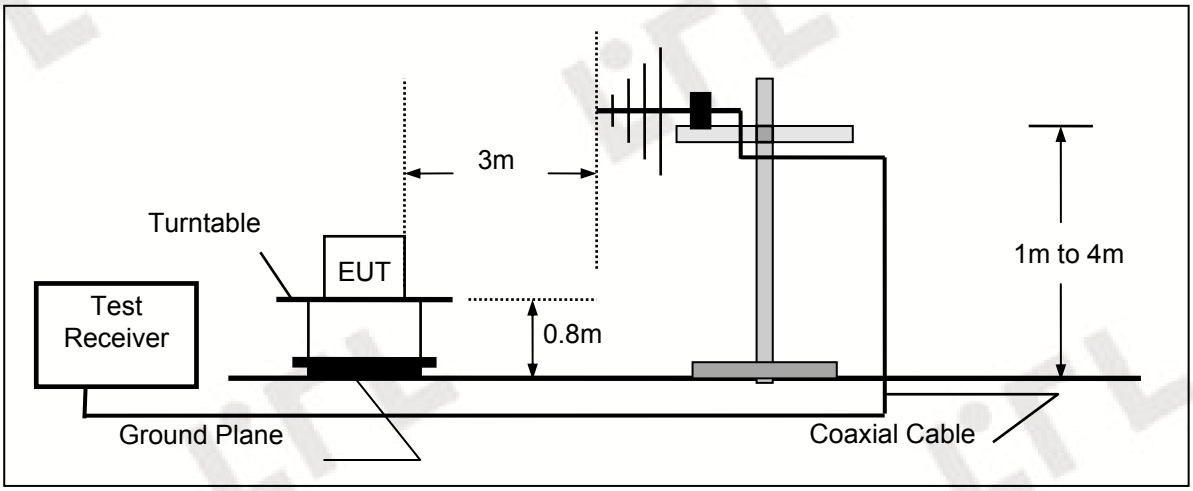
4.1. Radiated Emission Test

TEST CONFIGURATION

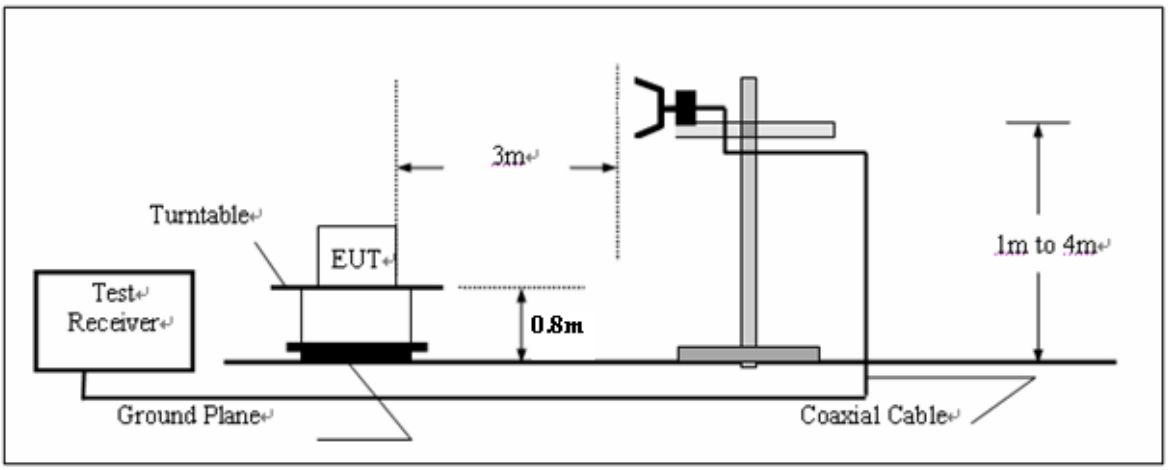
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(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.

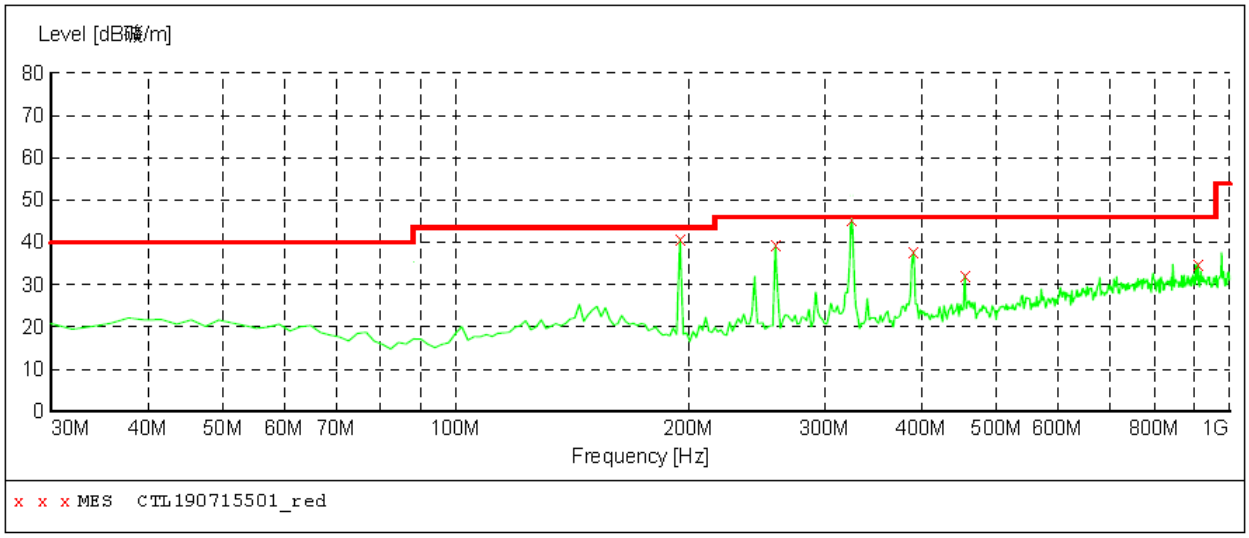
Test Procedure

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 Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	VULB9168



MEASUREMENT RESULT: "CTL190715501_red"

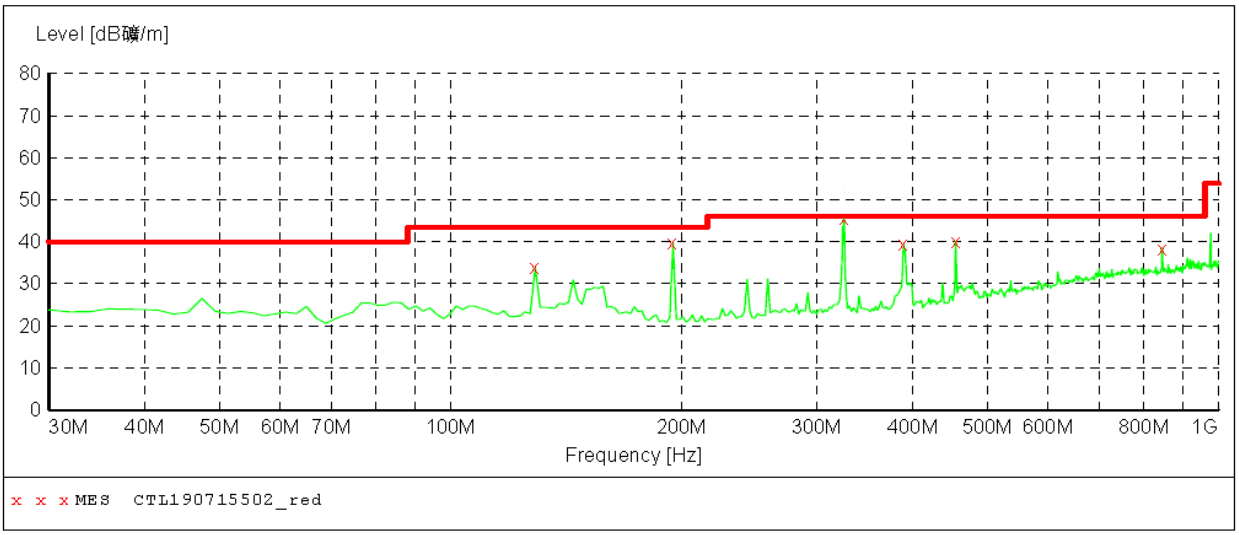
2019-7-15 8:50

Frequency MHz	Level dB礦/m	Transd dB	Limit dB礦/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
194.900000	40.90	11.3	43.5	2.6	QP	0.0	0.00	HORIZONTAL
258.920000	39.40	13.0	46.0	6.6	QP	0.0	0.00	HORIZONTAL
324.880000	45.50	14.8	46.0	0.5	QP	0.0	0.00	HORIZONTAL
390.840000	37.90	16.0	46.0	8.1	QP	0.0	0.00	HORIZONTAL
454.860000	32.30	17.6	46.0	13.7	QP	0.0	0.00	HORIZONTAL
910.760000	35.00	23.9	46.0	11.0	QP	0.0	0.00	HORIZONTAL

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

Short Description: Field Strength

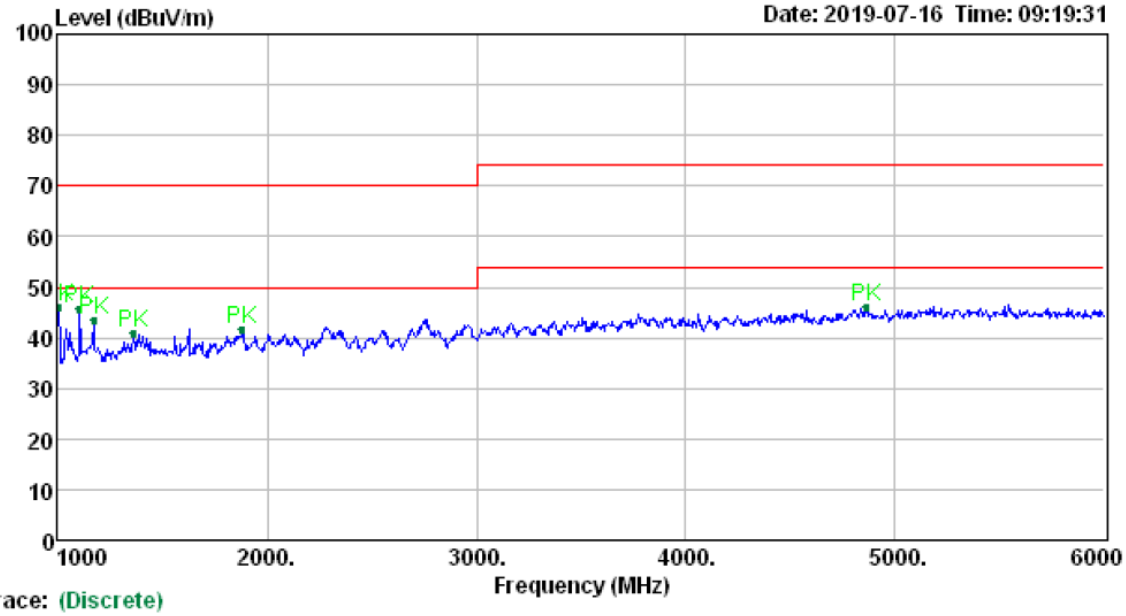
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	VULB9168



MEASUREMENT RESULT: "CTL190715502_red"

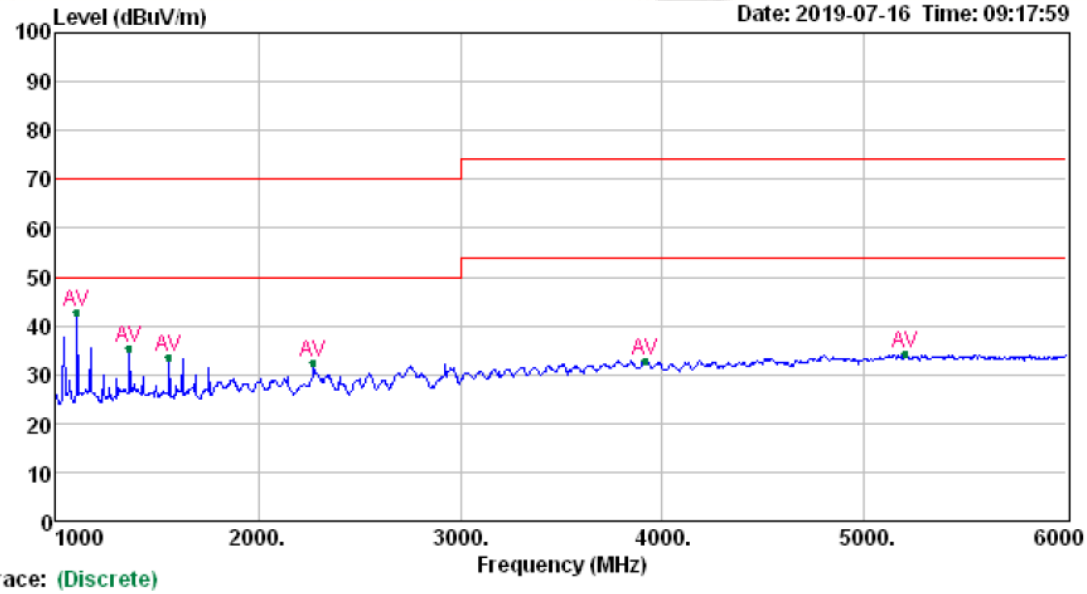
2019-7-15 8:53

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
128.940000	33.80	13.7	43.5	9.7	QP	0.0	0.00	VERTICAL
194.900000	39.80	11.3	43.5	3.7	QP	0.0	0.00	VERTICAL
324.880000	45.70	14.8	46.0	0.3	QP	0.0	0.00	VERTICAL
388.900000	39.40	16.0	46.0	6.6	QP	0.0	0.00	VERTICAL
454.860000	40.10	17.6	46.0	5.9	QP	0.0	0.00	VERTICAL
844.800000	38.40	23.1	46.0	7.6	QP	0.0	0.00	VERTICAL



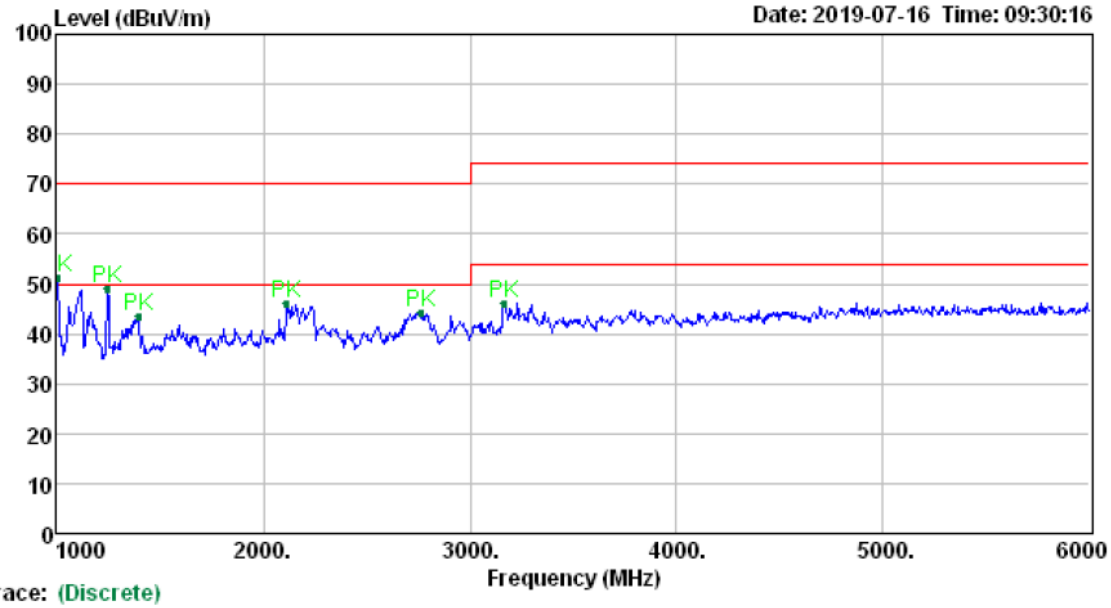
Trace: (Discrete)

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



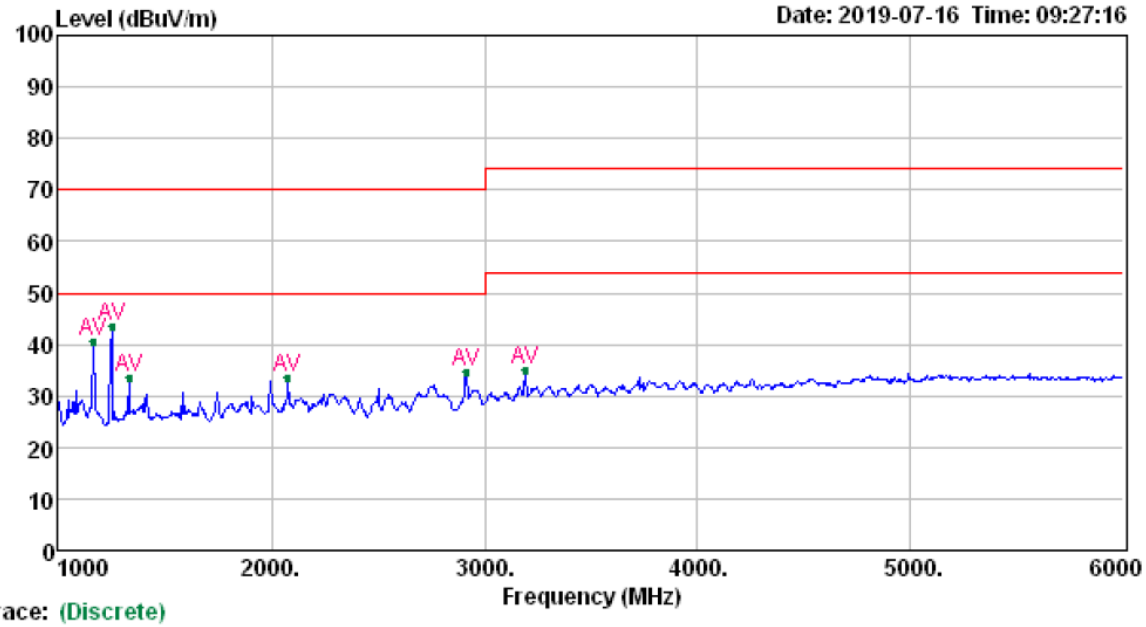
Trace: (Discrete)

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

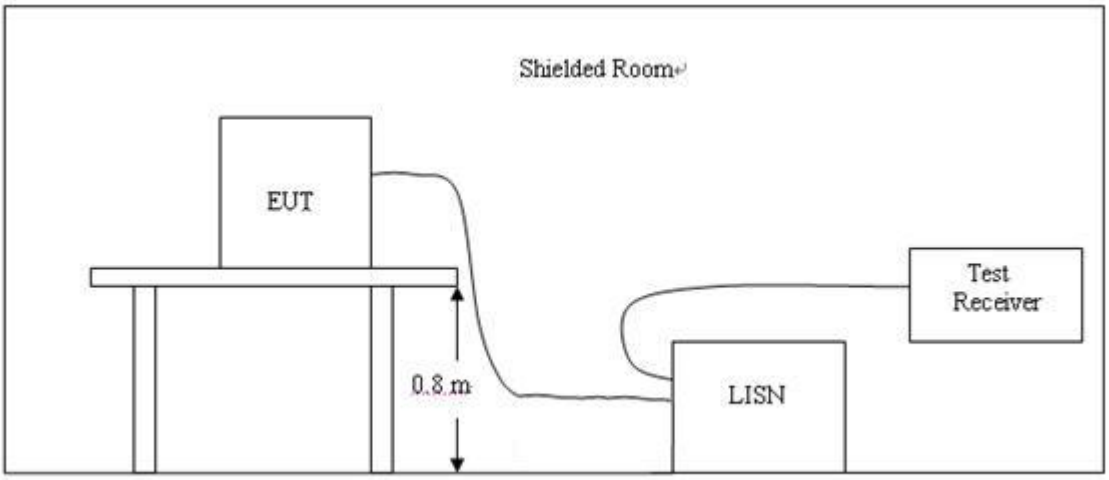


Trace: (Discrete)

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

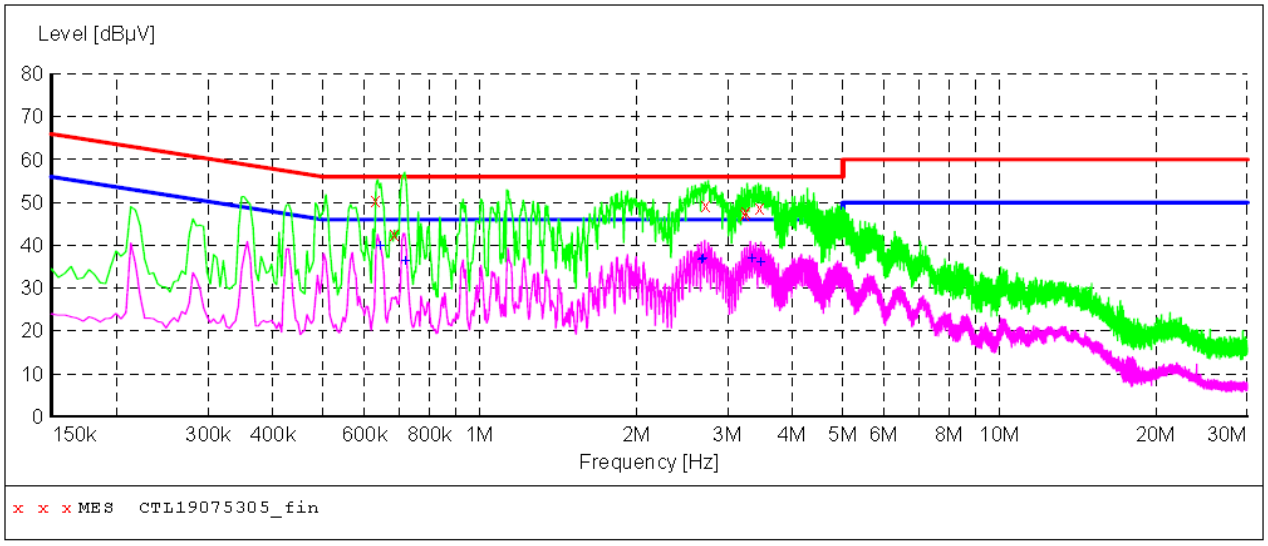
* Decreasing linearly with the logarithm of the frequency

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: "CTL19075305_fin"

2019-7-15 10:09??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.632000	50.40	11.2	56	5.6	QP	L1	GND
0.686000	42.70	11.2	56	13.3	QP	L1	GND
2.732000	49.50	11.4	56	6.5	QP	L1	GND
3.236000	47.40	11.4	56	8.6	QP	L1	GND
3.260000	47.90	11.4	56	8.1	QP	L1	GND
3.464000	48.90	11.4	56	7.1	QP	L1	GND

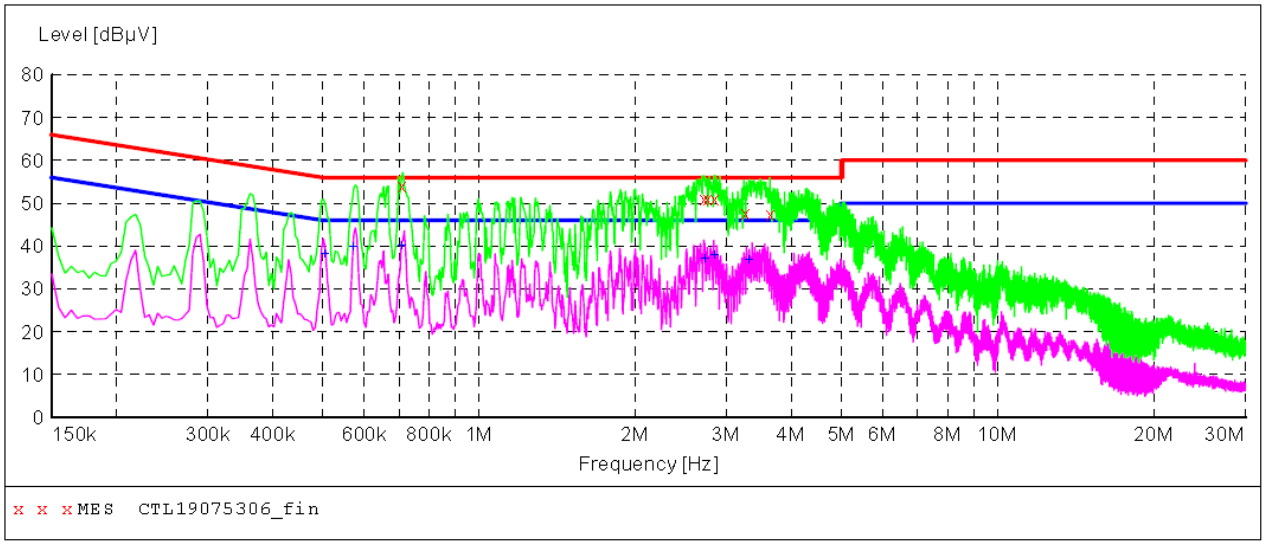
MEASUREMENT RESULT: "CTL19075305_fin2"

2019-7-15 10:09??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.644000	40.10	11.2	46	5.9	AV	L1	GND
0.722000	36.50	11.2	46	9.5	AV	L1	GND
2.678000	36.90	11.4	46	9.1	AV	L1	GND
2.702000	37.20	11.4	46	8.8	AV	L1	GND
3.344000	37.00	11.4	46	9.0	AV	L1	GND
3.488000	36.20	11.4	46	9.8	AV	L1	GND

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL19075306_fin"

2019-7-15 10:01??

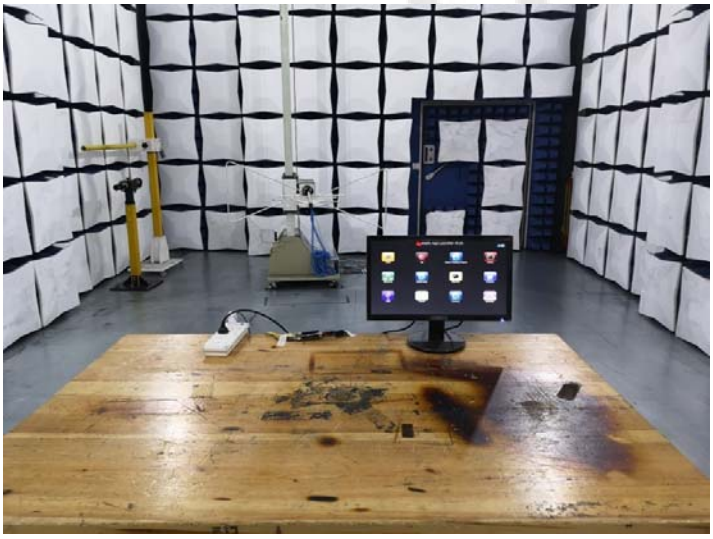
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.710000	54.20	11.2	56	1.8	QP	N	GND
2.726000	51.00	11.4	56	5.0	QP	N	GND
2.768000	51.10	11.4	56	4.9	QP	N	GND
2.846000	51.00	11.4	56	5.0	QP	N	GND
3.266000	47.90	11.4	56	8.1	QP	N	GND
3.662000	47.40	11.4	56	8.6	QP	N	GND

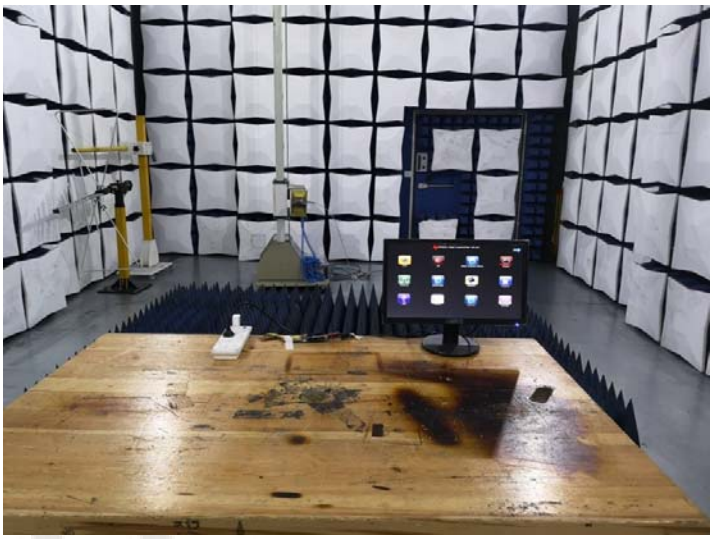
MEASUREMENT RESULT: "CTL19075306_fin2"

2019-7-15 10:01??

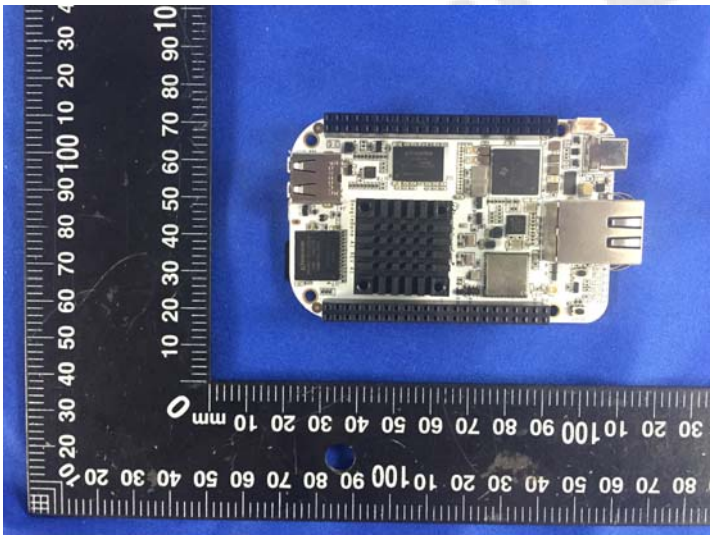
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.506000	38.00	11.2	46	8.0	AV	N	GND
0.572000	39.80	11.2	46	6.2	AV	N	GND
0.710000	40.00	11.2	46	6.0	AV	N	GND
2.738000	37.00	11.4	46	9.0	AV	N	GND
2.852000	37.80	11.4	46	8.2	AV	N	GND
3.326000	36.60	11.4	46	9.4	AV	N	GND

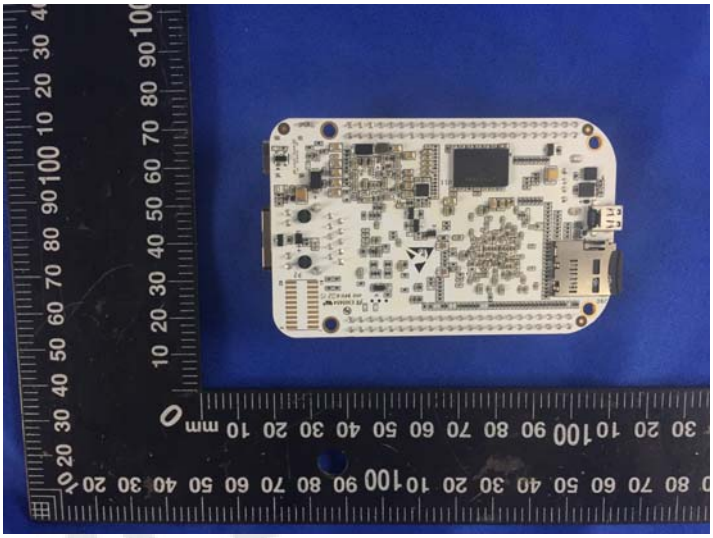
5. Test Setup Photos of the EUT

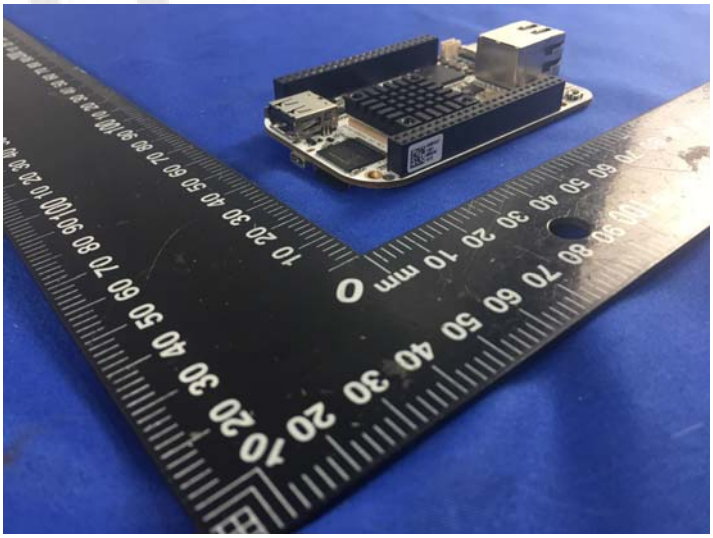


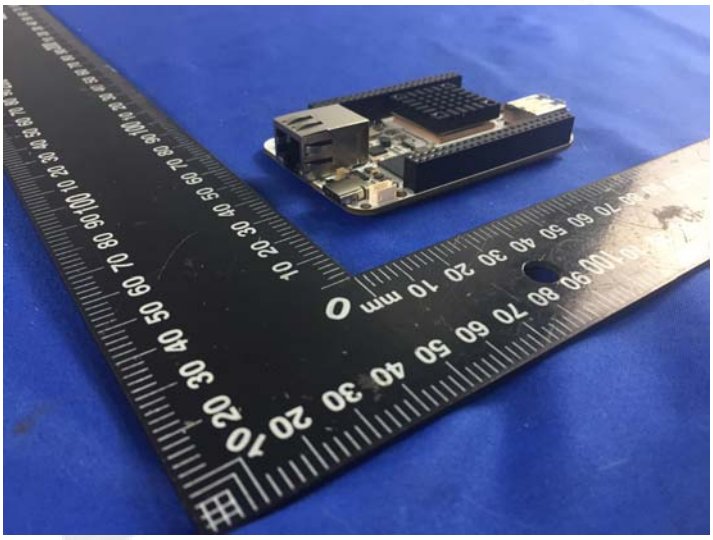


6. Photos of the EUT









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