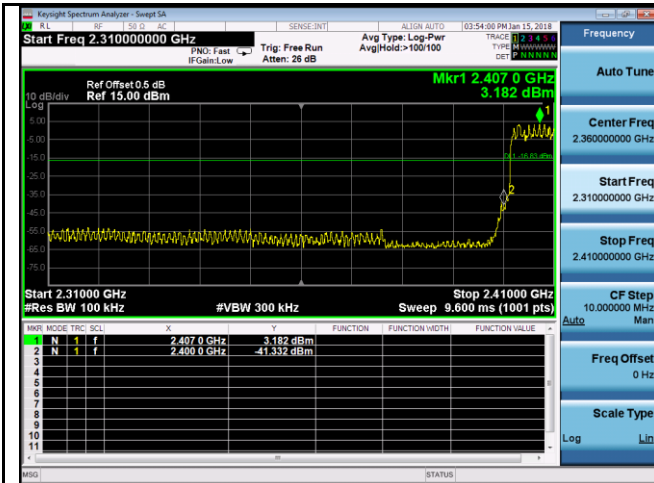
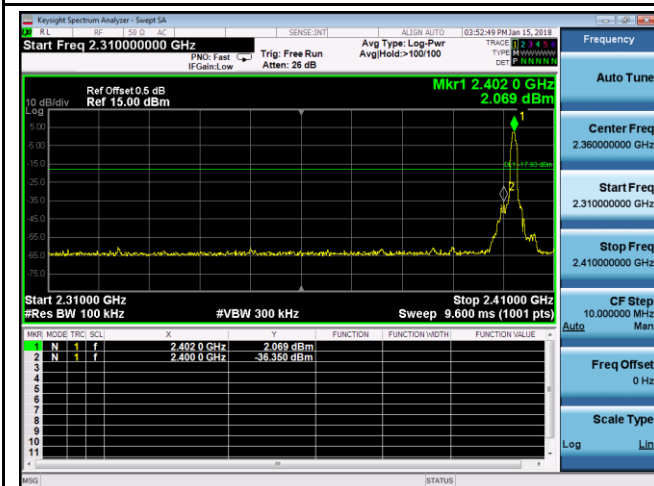


8-DPSK Mode:



8DPSK-Hopping Left Side

8DPSK-Hopping Right Side



8DPSK-Left Side

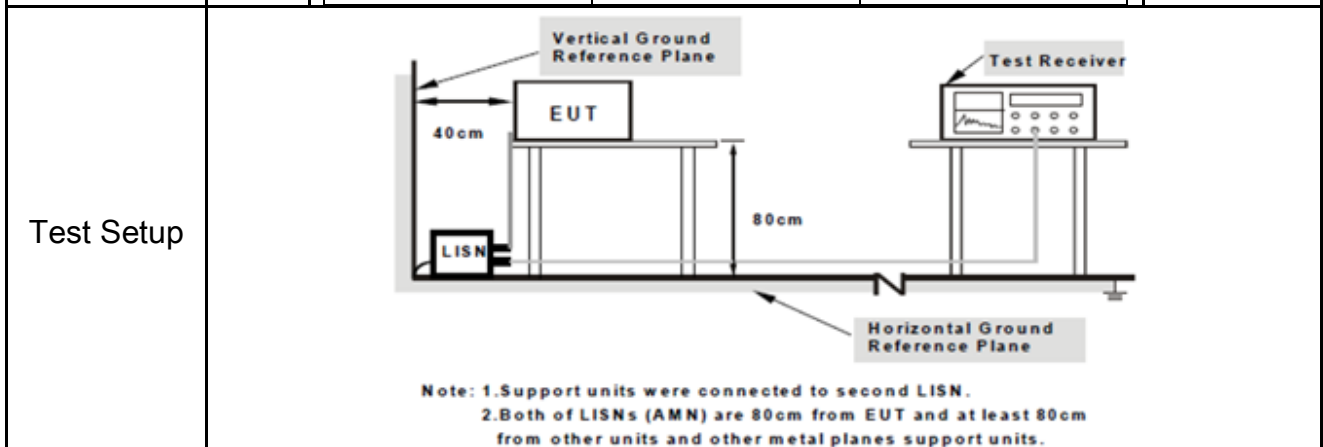
8DPSK-Right Side

## 6.8 AC Power Line Conducted Emissions

Temperature	25 °C
Relative Humidity	51%
Atmospheric Pressure	1020mbar
Test date :	December 14, 2017
Tested By :	Aaron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable														
47CFR§15.207, RSS210 (A8.1)	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 [mu]H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.	<input checked="" type="checkbox"/>														
		<table border="1"> <thead> <tr> <th rowspan="2">Frequency ranges (MHz)</th> <th colspan="2">Limit (dBµV)</th> </tr> <tr> <th>QP</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15 ~ 0.5</td> <td>66 – 56</td> <td>56 – 46</td> </tr> <tr> <td>0.5 ~ 5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5 ~ 30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>		Frequency ranges (MHz)	Limit (dBµV)		QP	Average	0.15 ~ 0.5	66 – 56	56 – 46	0.5 ~ 5	56	46	5 ~ 30	60	50
		Frequency ranges (MHz)			Limit (dBµV)												
				QP	Average												
0.15 ~ 0.5	66 – 56	56 – 46															
0.5 ~ 5	56	46															
5 ~ 30	60	50															

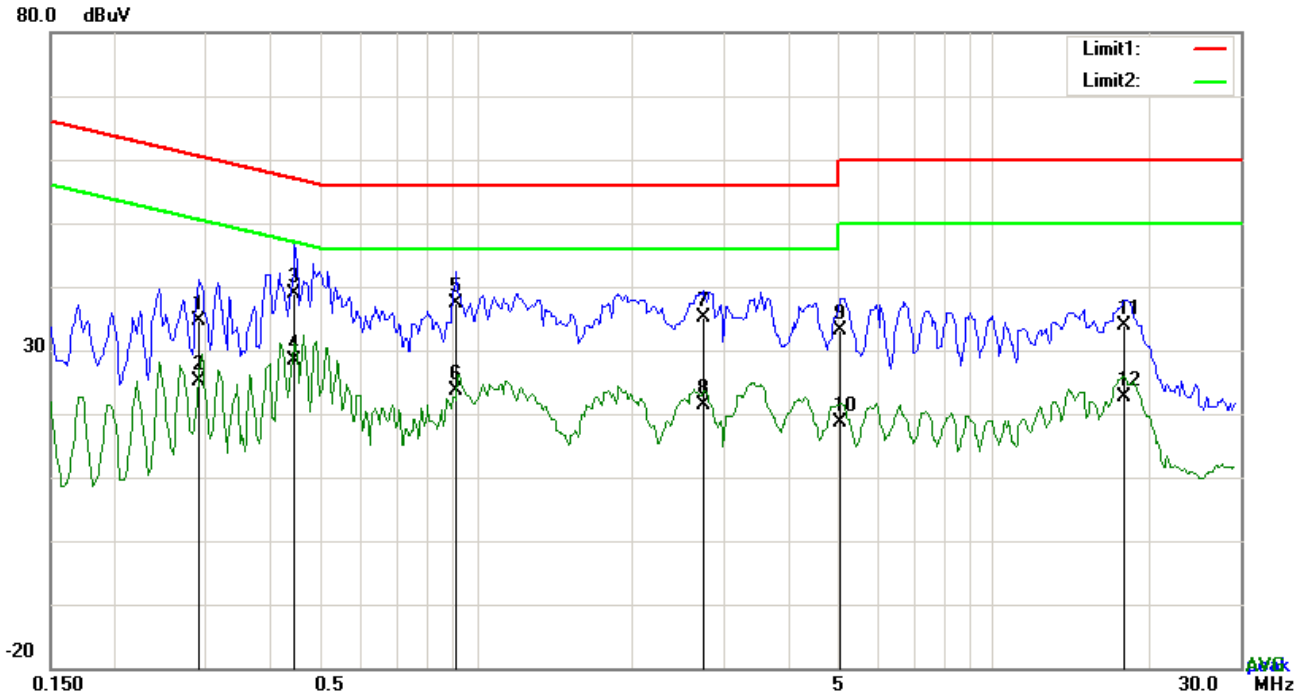


Procedure	<ol style="list-style-type: none"> <li>The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.</li> <li>The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.</li> <li>The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss</li> </ol>
-----------	---

	<p>coaxial cable.</p> <ol style="list-style-type: none"> <li>4. All other supporting equipment were powered separately from another main supply.</li> <li>5. The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.</li> <li>7. High peaks, relative to the limit line, The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz.</li> <li>8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).</li> </ol>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data     Yes                       N/A  
 Test Plot     Yes (See below)             N/A

<b>Test Mode:</b>	<b>Bluetooth Mode</b>
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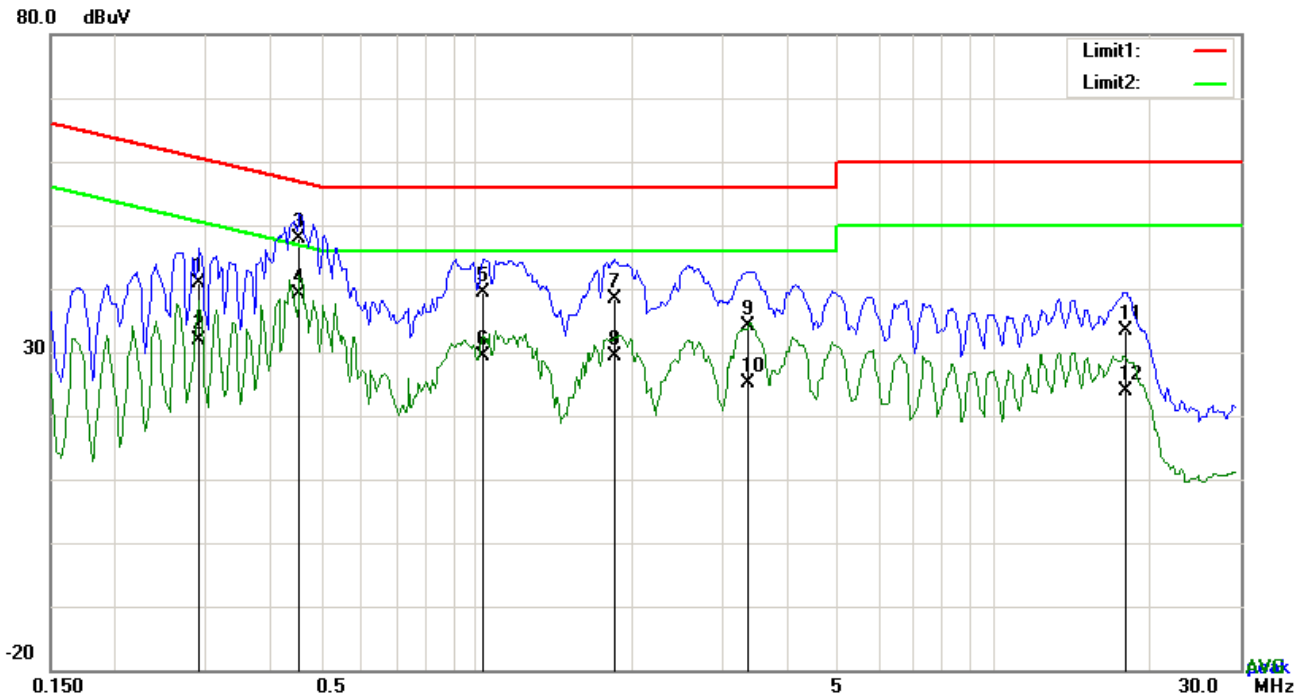


**Test Data**

**Phase Line Plot at 120Vac, 60Hz**

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	L1	0.2904	24.66	QP	10.03	34.69	60.51	-25.82
2	L1	0.2904	15.17	AVG	10.03	25.20	50.51	-25.31
3	L1	0.4464	28.95	QP	10.03	38.98	56.94	-17.96
4	L1	0.4464	18.30	AVG	10.03	28.33	46.94	-18.61
5	L1	0.9144	27.34	QP	10.03	37.37	56.00	-18.63
6	L1	0.9144	13.53	AVG	10.03	23.56	46.00	-22.44
7	L1	2.7396	24.97	QP	10.05	35.02	56.00	-20.98
8	L1	2.7396	11.21	AVG	10.05	21.26	46.00	-24.74
9	L1	5.0553	23.02	QP	10.08	33.10	60.00	-26.90
10	L1	5.0553	8.45	AVG	10.08	18.53	50.00	-31.47
11	L1	17.9019	23.58	QP	10.27	33.85	60.00	-26.15
12	L1	17.9019	12.38	AVG	10.27	22.65	50.00	-27.35

<b>Test Mode:</b>	<b>Bluetooth Mode</b>
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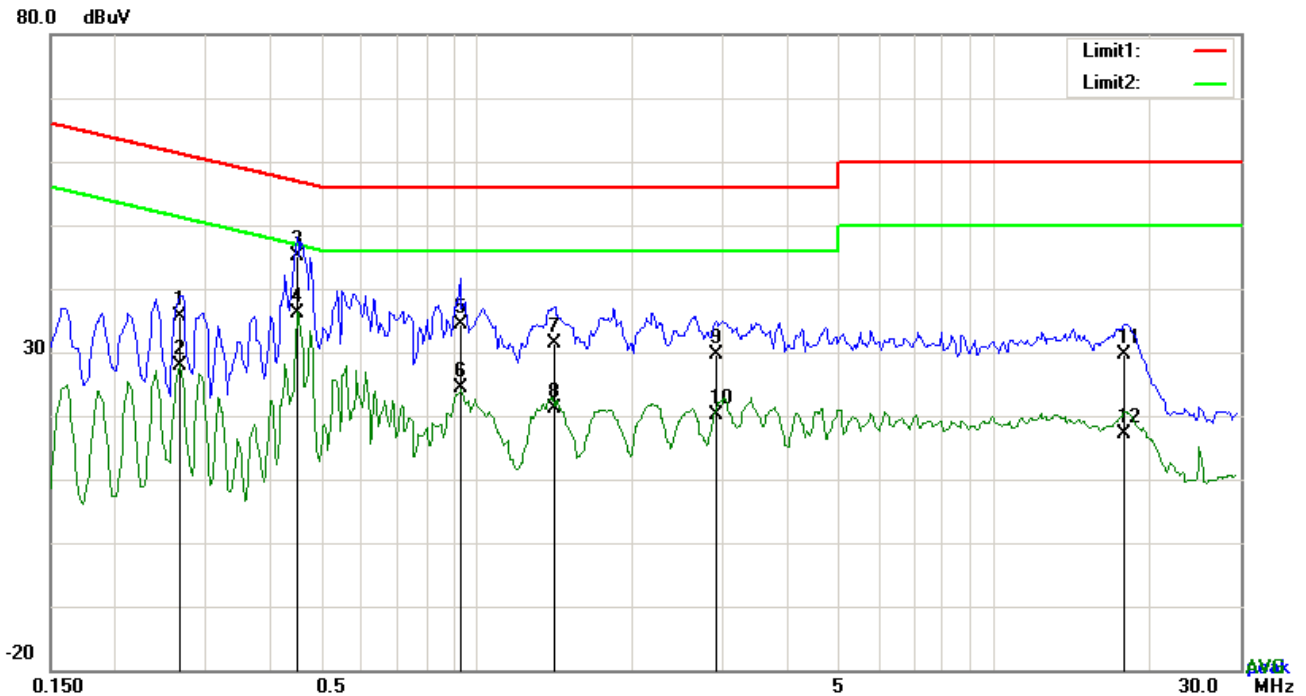


**Test Data**

**Phase Neutral Plot at 120Vac, 60Hz**

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	N	0.2904	30.85	QP	10.03	40.88	60.51	-19.63
2	N	0.2904	21.96	AVG	10.03	31.99	50.51	-18.52
3	N	0.4542	37.92	QP	10.03	47.95	56.80	-8.85
4	N	0.4542	29.20	AVG	10.03	39.23	46.80	-7.57
5	N	1.0275	29.46	QP	10.03	39.49	56.00	-16.51
6	N	1.0275	19.41	AVG	10.03	29.44	46.00	-16.56
7	N	1.8504	28.31	QP	10.04	38.35	56.00	-17.65
8	N	1.8504	19.26	AVG	10.04	29.30	46.00	-16.70
9	N	3.3510	23.95	QP	10.06	34.01	56.00	-21.99
10	N	3.3510	15.06	AVG	10.06	25.12	46.00	-20.88
11	N	17.9448	22.99	QP	10.27	33.26	60.00	-26.74
12	N	17.9448	13.58	AVG	10.27	23.85	50.00	-26.15

<b>Test Mode:</b>	<b>Bluetooth Mode</b>
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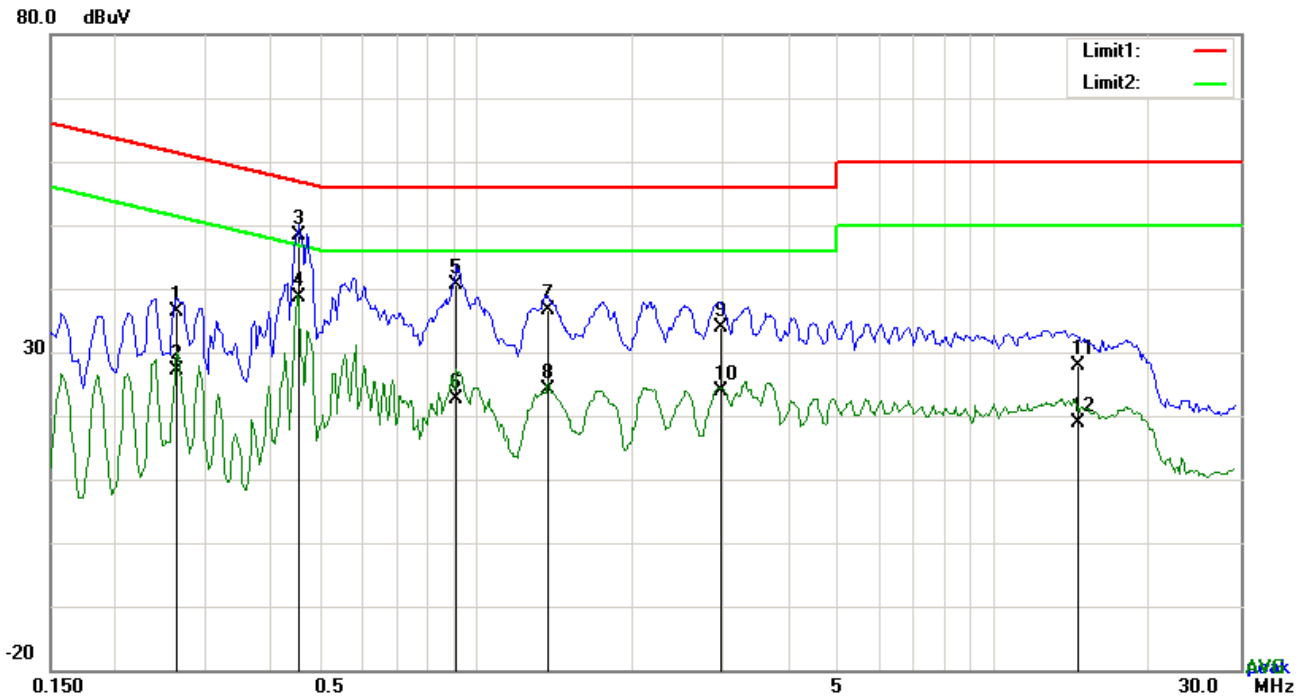


**Test Data**

**Phase Line Plot at 240Vac, 60Hz**

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	L1	0.2670	25.71	QP	10.03	35.74	61.21	-25.47
2	L1	0.2670	17.74	AVG	10.03	27.77	51.21	-23.44
3	L1	0.4503	35.14	QP	10.03	45.17	56.87	-11.70
4	L1	0.4503	26.16	AVG	10.03	36.19	46.87	-10.68
5	L1	0.9300	24.24	QP	10.03	34.27	56.00	-21.73
6	L1	0.9300	14.28	AVG	10.03	24.31	46.00	-21.69
7	L1	1.4175	21.28	QP	10.04	31.32	56.00	-24.68
8	L1	1.4175	11.08	AVG	10.04	21.12	46.00	-24.88
9	L1	2.9034	19.64	QP	10.05	29.69	56.00	-26.31
10	L1	2.9034	10.18	AVG	10.05	20.23	46.00	-25.77
11	L1	17.8824	19.27	QP	10.27	29.54	60.00	-30.46
12	L1	17.8824	6.81	AVG	10.27	17.08	50.00	-32.92

<b>Test Mode:</b>	<b>Bluetooth Mode</b>
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**Test Data**

**Phase Neutral Plot at 240Vac, 60Hz**

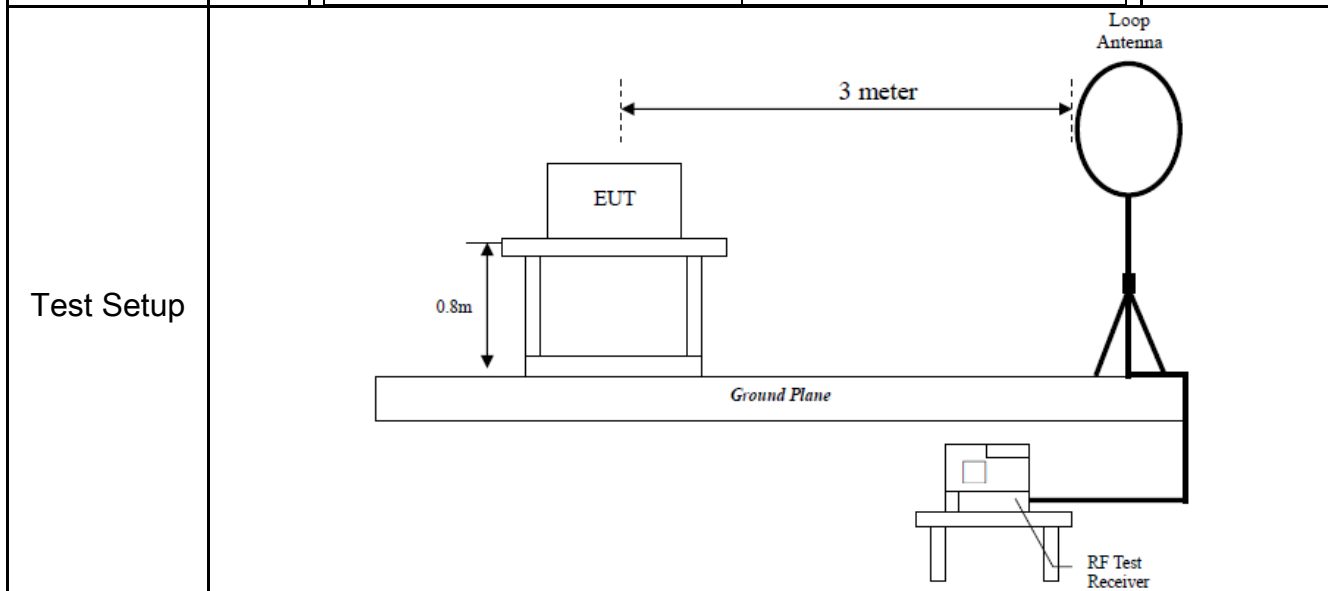
No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	N	0.2631	26.36	QP	10.03	36.39	61.33	-24.94
2	N	0.2631	17.19	AVG	10.03	27.22	51.33	-24.11
3	N	0.4542	38.46	QP	10.03	48.49	56.80	-8.31
4	N	0.4542	28.61	AVG	10.03	38.64	46.80	-8.16
5	N	0.9183	30.59	QP	10.03	40.62	56.00	-15.38
6	N	0.9183	12.64	AVG	10.03	22.67	46.00	-23.33
7	N	1.3746	26.62	QP	10.03	36.65	56.00	-19.35
8	N	1.3746	14.01	AVG	10.03	24.04	46.00	-21.96
9	N	2.9619	23.75	QP	10.05	33.80	56.00	-22.20
10	N	2.9619	13.72	AVG	10.05	23.77	46.00	-22.23
11	N	14.5171	17.74	QP	10.22	27.96	60.00	-32.04
12	N	14.5171	8.54	AVG	10.22	18.76	50.00	-31.24

## 6.9 Radiated Emissions & Restricted Band

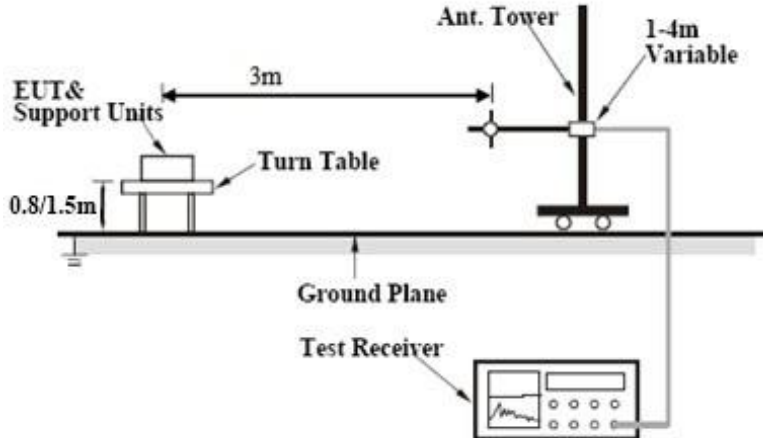
Temperature	24 °C
Relative Humidity	53%
Atmospheric Pressure	1010mbar
Test date :	December 15, 2017
Tested By :	Aaron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable																
47CFR§15.205, §15.209, §15.247(d)	a)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges	<input checked="" type="checkbox"/>																
		<table border="1" style="width: 100%;"> <thead> <tr> <th>Frequency range (MHz)</th> <th>Field Strength (<math>\mu\text{V}/\text{m}</math>)</th> </tr> </thead> <tbody> <tr> <td>0.009~0.490</td> <td>2400/F(KHz)</td> </tr> <tr> <td>0.490~1.705</td> <td>24000/F(KHz)</td> </tr> <tr> <td>1.705~30.0</td> <td>30</td> </tr> <tr> <td>30 – 88</td> <td>100</td> </tr> <tr> <td>88 – 216</td> <td>150</td> </tr> <tr> <td>216 960</td> <td>200</td> </tr> <tr> <td>Above 960</td> <td>500</td> </tr> </tbody> </table>		Frequency range (MHz)	Field Strength ( $\mu\text{V}/\text{m}$ )	0.009~0.490	2400/F(KHz)	0.490~1.705	24000/F(KHz)	1.705~30.0	30	30 – 88	100	88 – 216	150	216 960	200	Above 960	500
		Frequency range (MHz)		Field Strength ( $\mu\text{V}/\text{m}$ )															
		0.009~0.490		2400/F(KHz)															
		0.490~1.705		24000/F(KHz)															
		1.705~30.0		30															
		30 – 88		100															
		88 – 216		150															
216 960	200																		
Above 960	500																		





	
<p>Procedure</p>	<ol style="list-style-type: none"> <li>1. The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:             <ol style="list-style-type: none"> <li>a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.</li> <li>b. The EUT was then rotated to the direction that gave the maximum emission.</li> <li>c. Finally, the antenna height was adjusted to the height that gave the maximum emission.</li> </ol> </li> <li>3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi Peak detection at frequency below 1GHz.</li> <li>4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz.</li> <li>5. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</li> </ol>
<p>Remark</p>	
<p>Result</p>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data     Yes       N/A  
 Test Plot     Yes (See below)       N/A

**Test Result:**

<b>Test Mode:</b>	Transmitting Mode
-------------------	-------------------

Frequency range: 9KHz - 30MHz

Freq. (MHz)	Detection value	Factor (dB/m)	Reading (dBuV/m)	Result (dBuV/m)	Limit@3m (dBuV/m)	Margin (dB)
--	--	--	--	--	--	>20
--	--	--	--	--	--	>20

**Note:**

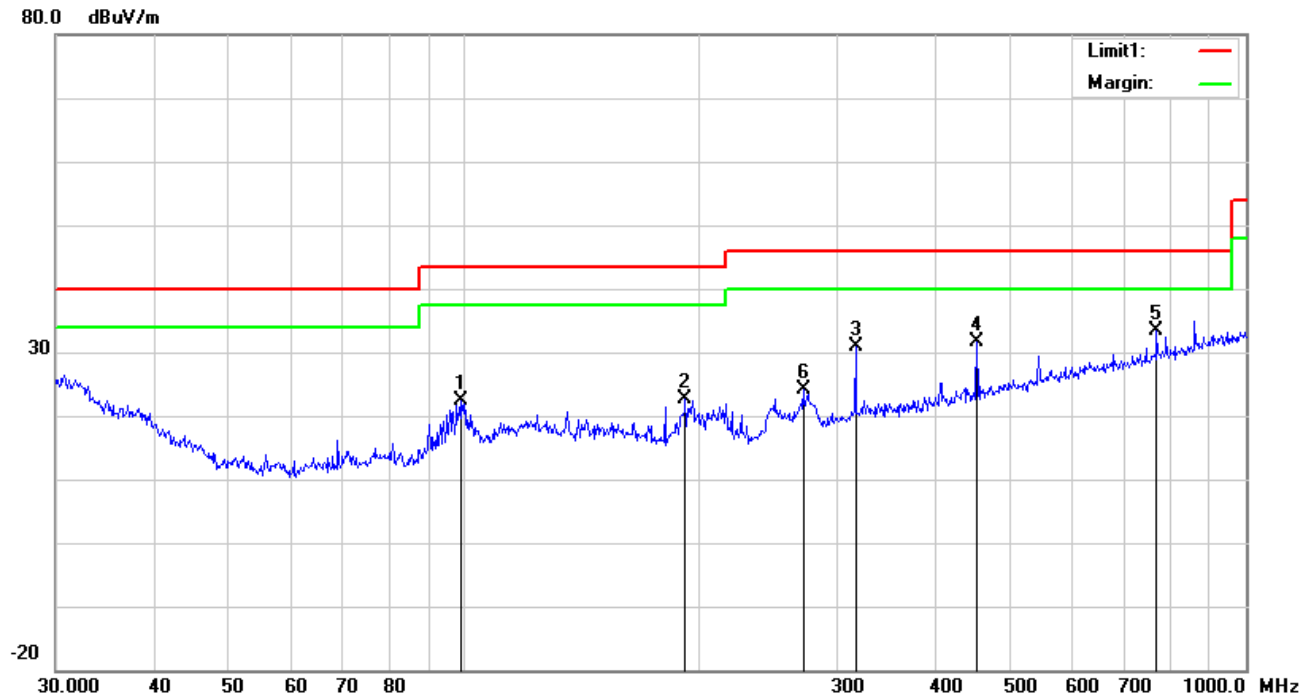
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

**Test Mode:** Bluetooth Mode

**30MHz -1GHz**



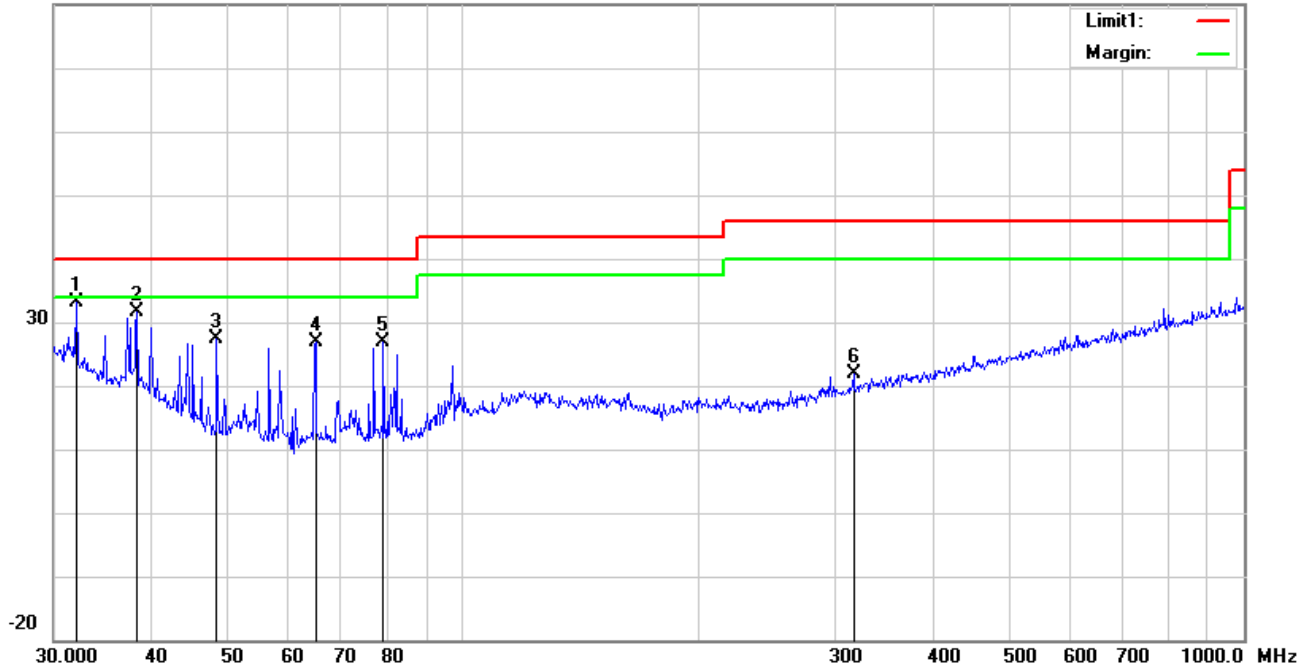
**Test Data**

**Horizontal Polarity Plot @3m**

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	H	98.8326	33.51	peak	10.12	22.32	1.09	22.40	43.50	-21.10	200	225
2	H	191.7450	31.78	peak	11.65	22.33	1.54	22.64	43.50	-20.86	100	132
3	H	316.5890	37.37	peak	13.95	22.24	1.87	30.95	46.00	-15.05	100	324
4	H	452.7197	34.61	peak	16.75	21.90	2.15	31.61	46.00	-14.39	100	201
5	H	768.7482	30.72	peak	21.02	21.22	2.90	33.42	46.00	-12.58	100	208
6	H	271.3246	32.29	peak	12.34	22.29	1.74	24.08	46.00	-21.92	100	272

### 30MHz -1GHz

80.0 dBuV/m



### Test Data

#### Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degr ee
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	V	32.0668	34.89	peak	19.81	22.27	0.68	33.11	40.00	-6.89	100	281
2	V	38.3462	38.05	peak	15.11	22.27	0.78	31.67	40.00	-8.33	100	260
3	V	48.5016	39.84	peak	9.06	22.35	0.79	27.34	40.00	-12.66	100	179
4	V	64.8865	40.87	peak	7.54	22.40	0.88	26.89	40.00	-13.11	100	208
5	V	79.2426	40.72	peak	7.62	22.42	1.04	26.96	40.00	-13.04	100	159
6	V	316.5890	28.20	peak	13.95	22.24	1.87	21.78	46.00	-24.22	100	288

**Above 1GHz**

<b>Test Mode:</b>	<b>Transmitting Mode</b>
-------------------	--------------------------

Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Detector	Polarity
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(PK/AV)	(H/V)
Low Channel:GFSK Mode(Worst Case)-2402MHz									
2390	37.53	28.72	3.36	26.32	43.29	74	-30.71	peak	Vertical
4804	29.11	32.94	3.98	27.49	38.54	54	-15.46	Average	Vertical
4804	40.05	32.94	3.98	27.49	49.48	74	-24.52	peak	Vertical
7206	30.27	25.28	5.51	27.94	33.12	54	-20.88	Average	Vertical
7206	39.75	25.28	5.51	27.94	42.60	74	-31.40	peak	Vertical
2390	38.02	28.72	3.36	26.32	43.78	74	-30.22	peak	Horizontal
4804	29.31	32.94	3.98	27.49	38.74	54	-15.26	Average	Horizontal
4804	40.27	32.94	3.98	27.49	49.70	74	-24.30	peak	Horizontal
7206	30.35	25.28	5.51	27.94	33.20	54	-20.80	Average	Horizontal
7206	40.04	25.28	5.51	27.94	42.89	74	-31.11	peak	Horizontal
Middle Channel:GFSK Mode(Worst Case)-2441MHz									
4882	30.52	32.11	4.04	27.53	39.14	54	-14.86	Average	Vertical
4882	40.23	32.11	4.04	27.53	48.85	74	-25.15	peak	Vertical
7323	30.17	24.33	5.58	27.96	32.12	54	-21.88	Average	Vertical
7323	39.57	24.33	5.58	27.96	41.52	74	-32.48	peak	Vertical
4882	30.56	32.11	4.04	27.53	39.18	54	-14.82	Average	Horizontal
4882	40.28	32.11	4.04	27.53	48.90	74	-25.10	peak	Horizontal
7323	30.33	24.33	5.58	27.96	32.28	54	-21.72	Average	Horizontal
7323	40.01	24.33	5.58	27.96	41.96	74	-32.04	peak	Horizontal
High Channel:GFSK Mode(Worst Case)-2480MHz									
2483.5	38.15	28.79	3.48	26.34	44.08	74	-29.92	peak	Vertical
4960	30.17	31.32	4.12	27.58	38.03	54	-15.97	Average	Vertical
4960	40.31	31.32	4.12	27.58	48.17	74	-25.83	peak	Vertical
7440	30.56	24.38	5.68	27.99	32.63	54	-21.37	Average	Vertical
7440	39.26	24.38	5.68	27.99	41.33	74	-32.67	peak	Vertical
2483.5	38.17	28.79	3.48	26.34	44.10	74	-29.90	peak	Horizontal
4960	30.05	31.32	4.12	27.58	37.91	54	-16.09	Average	Horizontal
4960	40.42	31.32	4.12	27.58	48.28	74	-25.72	peak	Horizontal
7440	31.36	24.38	5.68	27.99	33.43	54	-20.57	Average	Horizontal

Test Report	17071395-FCC-R
Page	44 of 58

**Note:**

- 1, The testing has been conformed to  $10 \times 2480\text{MHz} = 24,800\text{MHz}$*
- 2, All other emissions more than 30 dB below the limit*
- 3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.*
- 4, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.*

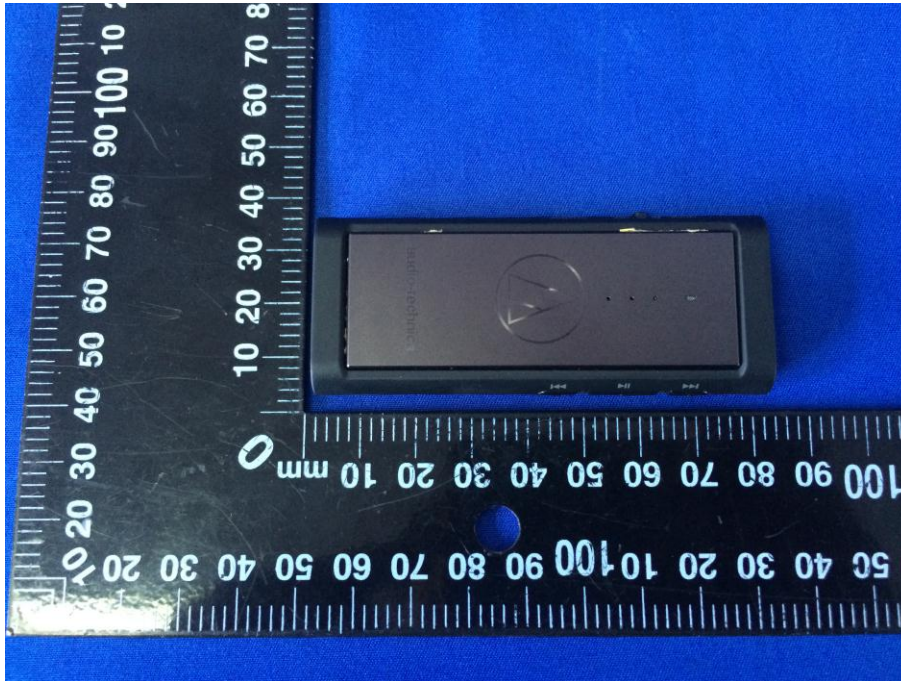
## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191106	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191107	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
ISN	ISN T800	34373	09/23/2017	09/22/2018	<input type="checkbox"/>
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	<input type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/17/2017	11/16/2018	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	<input checked="" type="checkbox"/>
Horn Antenna	BBHA9170	3145226D1	09/27/2017	09/26/2018	<input checked="" type="checkbox"/>
Active Antenna (9kHz-30MHz)	AL-130	121031	10/12/2017	10/11/2018	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>

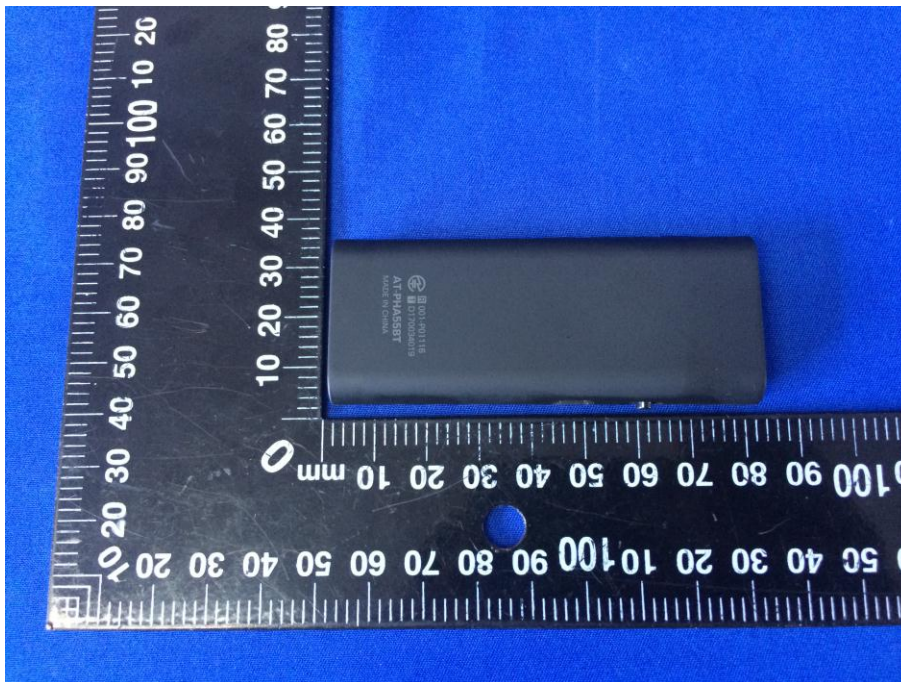
**Annex B. EUT And Test Setup Photographs**

**Annex B.i. Photograph: EUT External Photo**

EUT - Front View

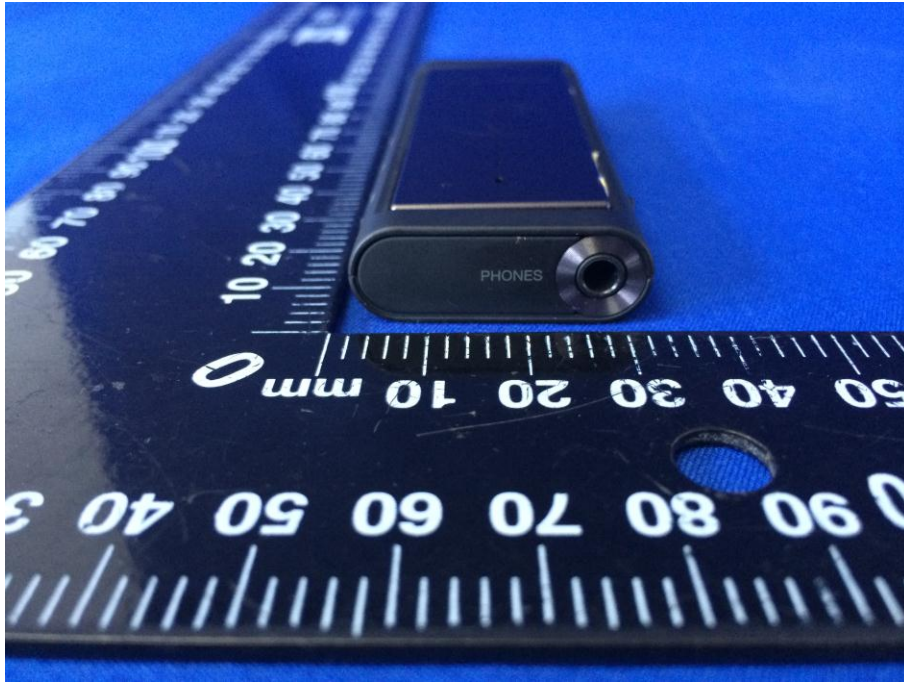


EUT - Rear View

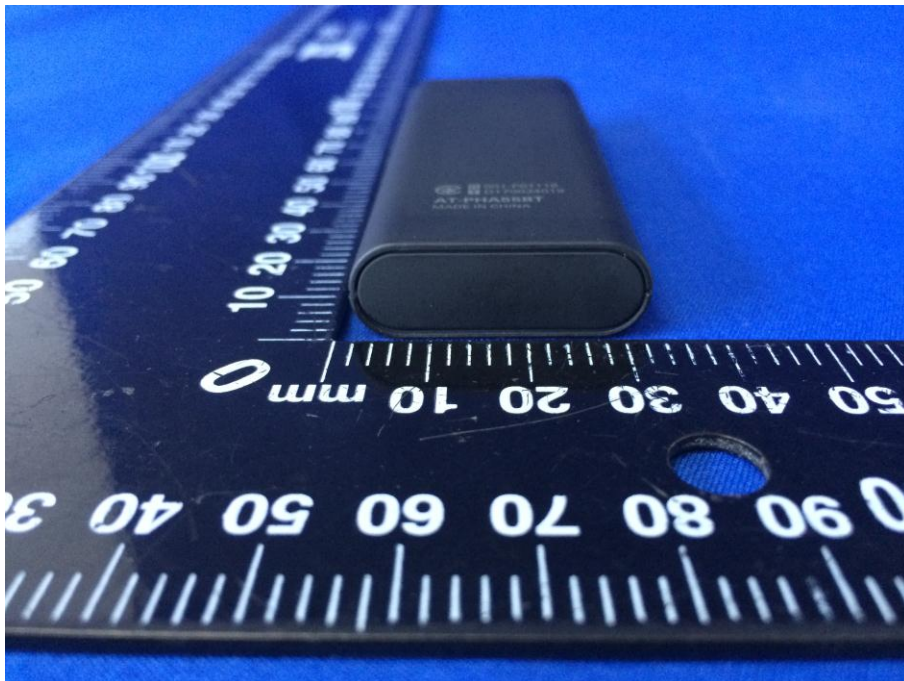




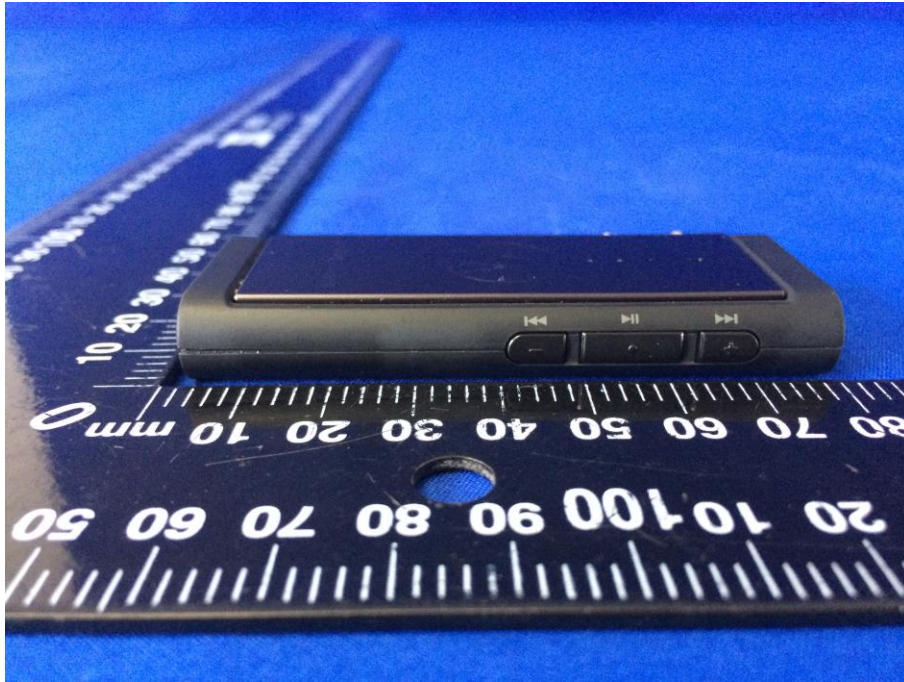
EUT - Top View



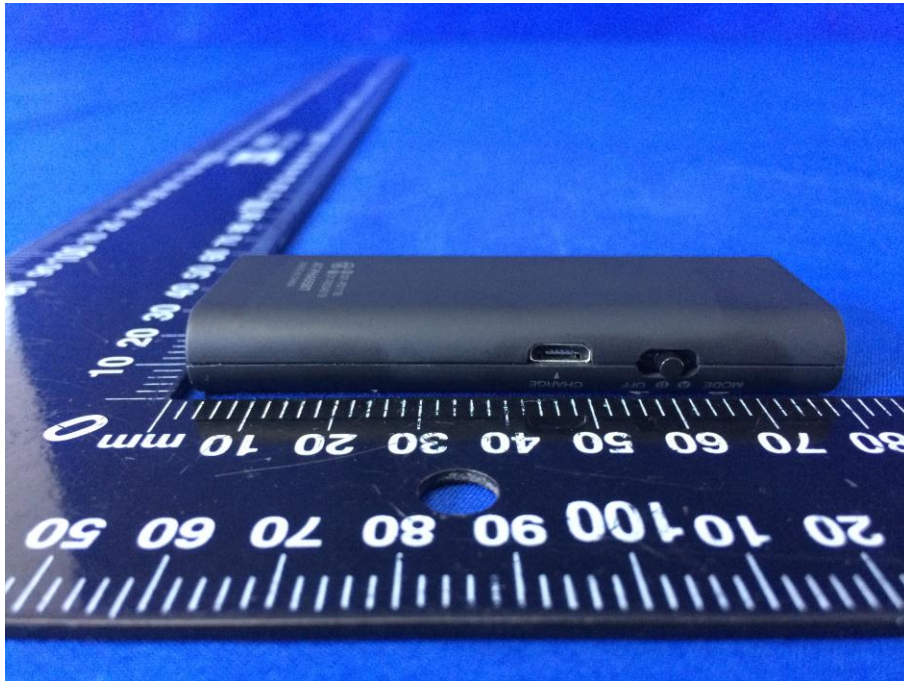
EUT - Bottom View



EUT - Left View



EUT - Right View



**Annex B.ii. Photograph: EUT Internal Photo**

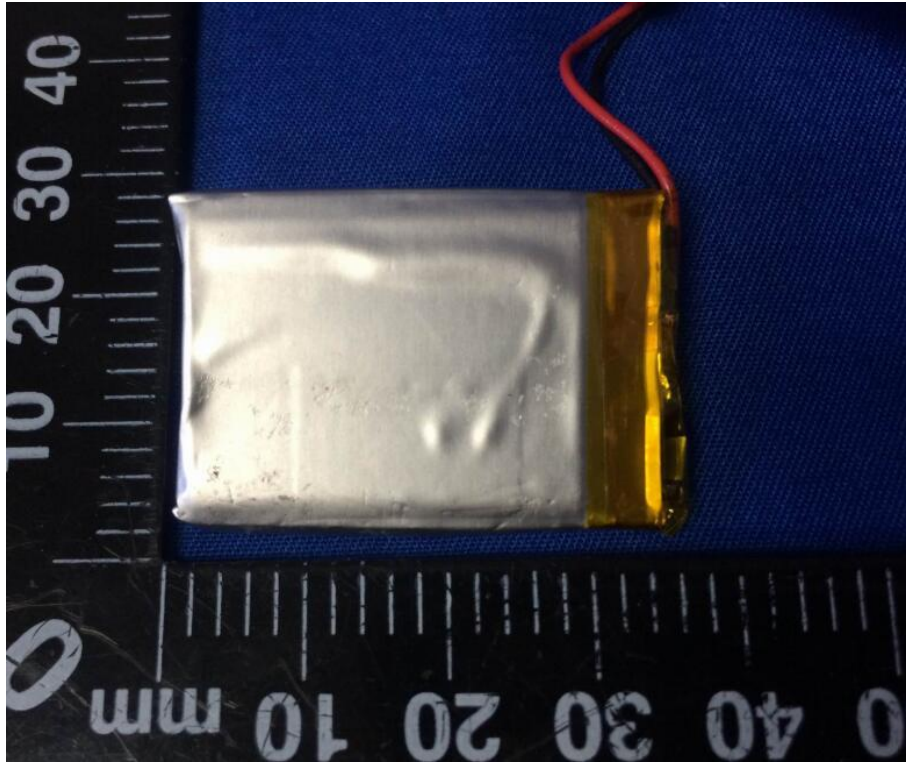
Cover Off - Top View



Battery - Front View



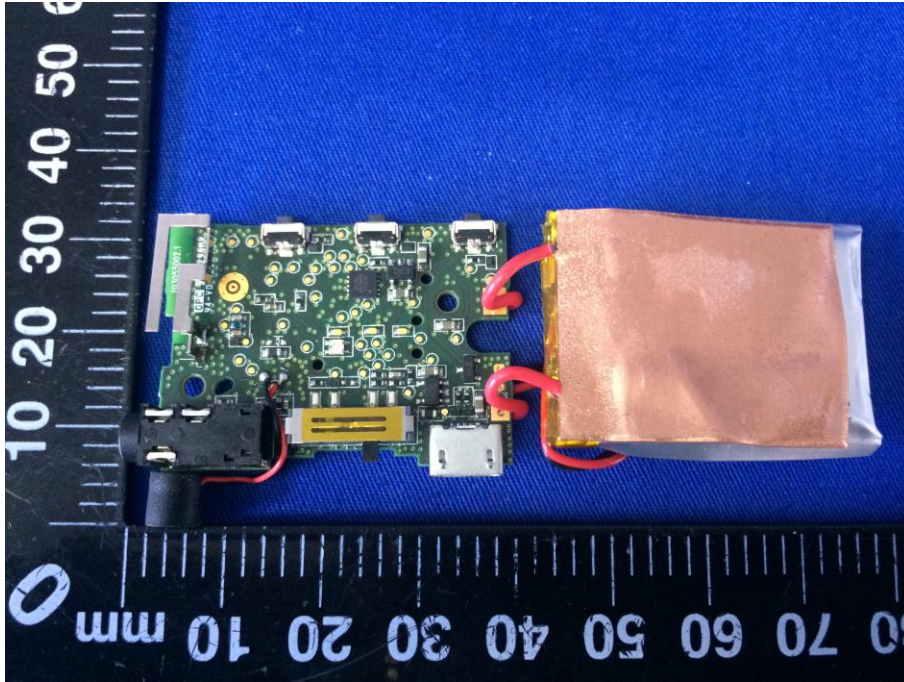
Battery - Rear View



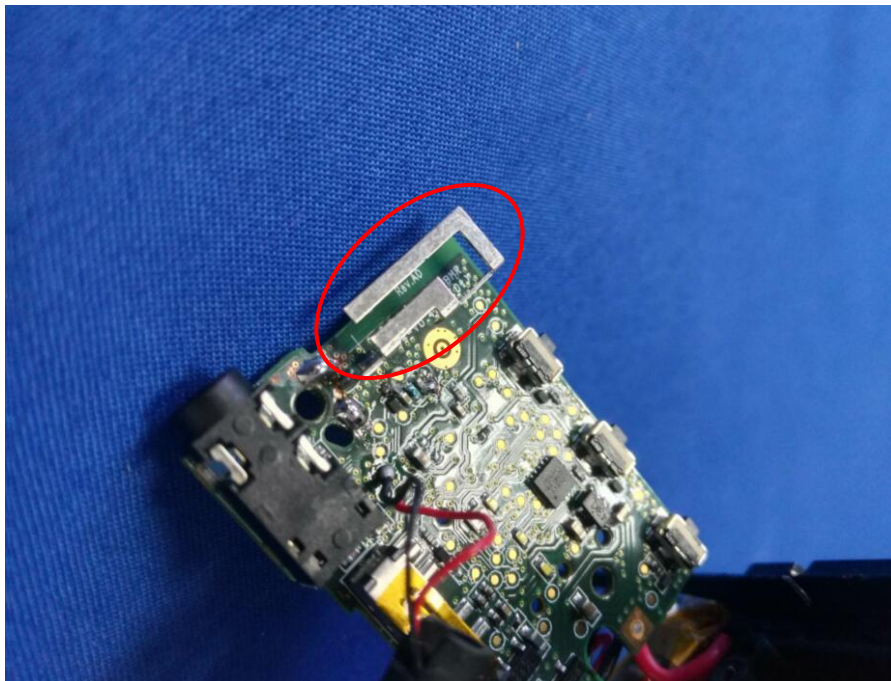
Mainboard - Front View



Mainboard – Rear View



BT - Antenna View



**Annex B.iii. Photograph: Test Setup Photo**



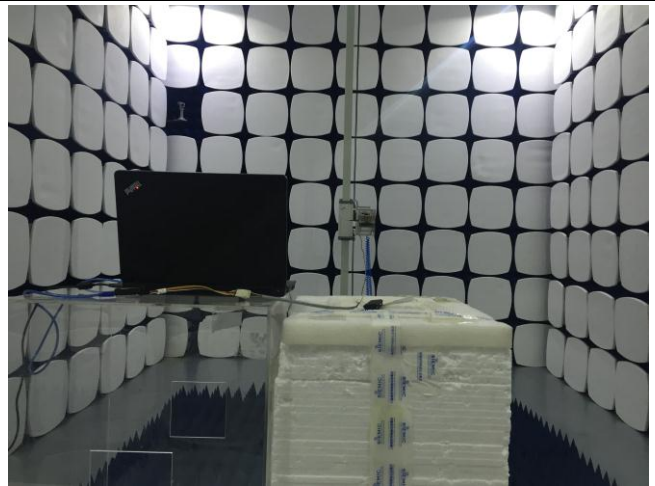
Conducted Emissions Test Setup Front View



Conducted Emissions Test Setup Side View



Radiated Spurious Emissions Test Setup Below 1GHz

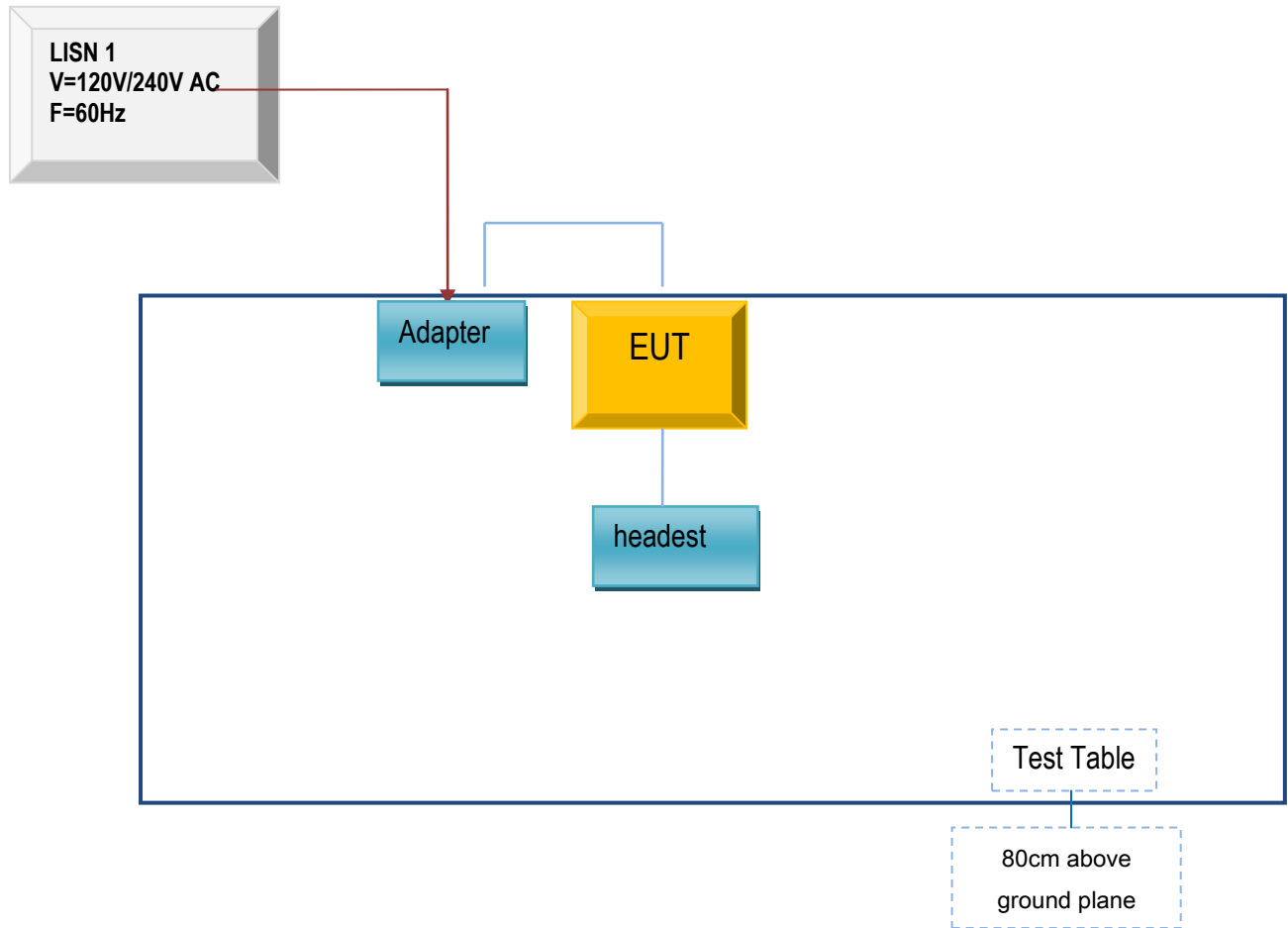


Radiated Spurious Emissions Test Setup Above  
1GHz

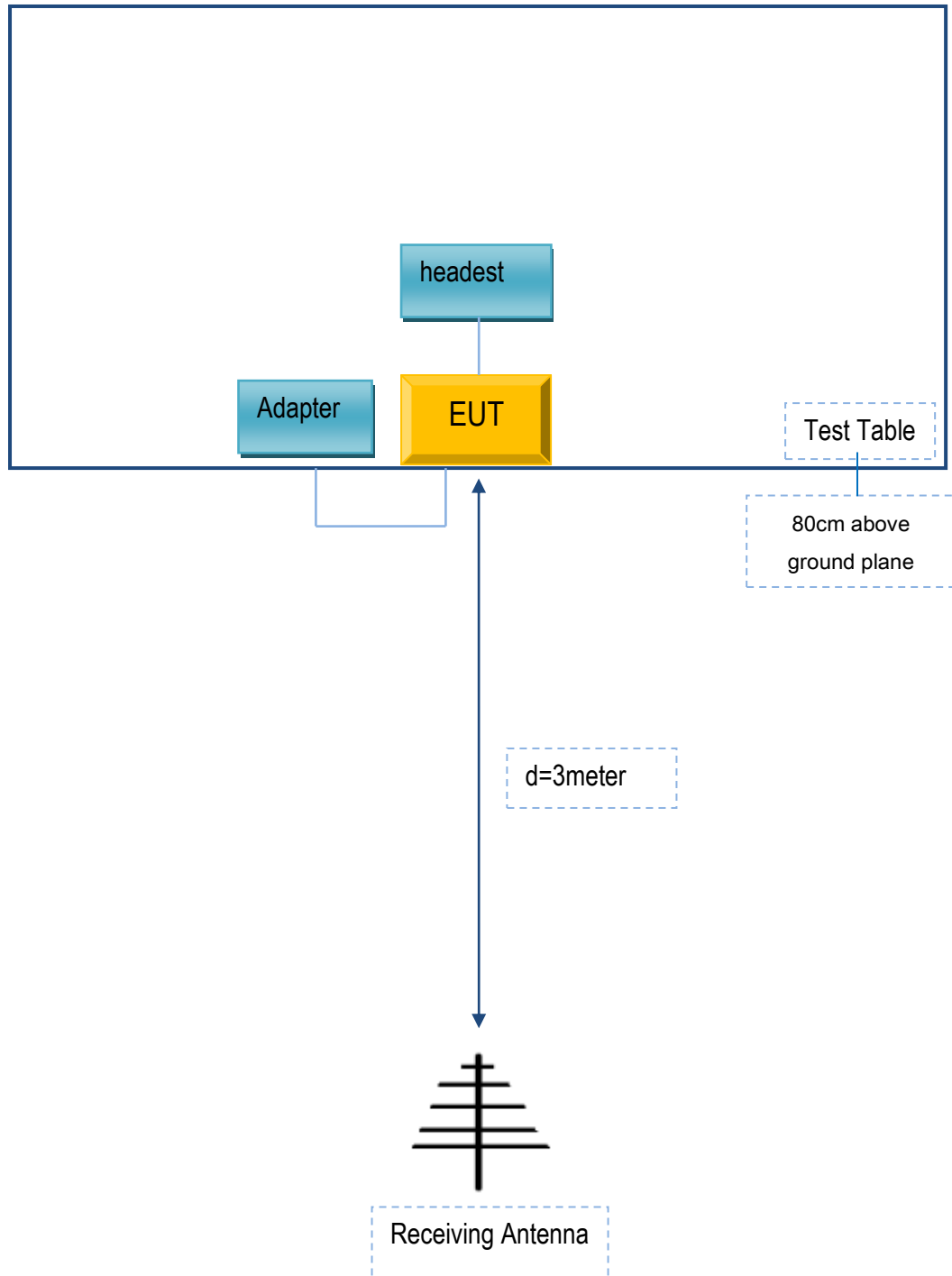
## Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

### Annex C.ii. TEST SET UP BLOCK

#### Block Configuration Diagram for AC Line Conducted Emissions

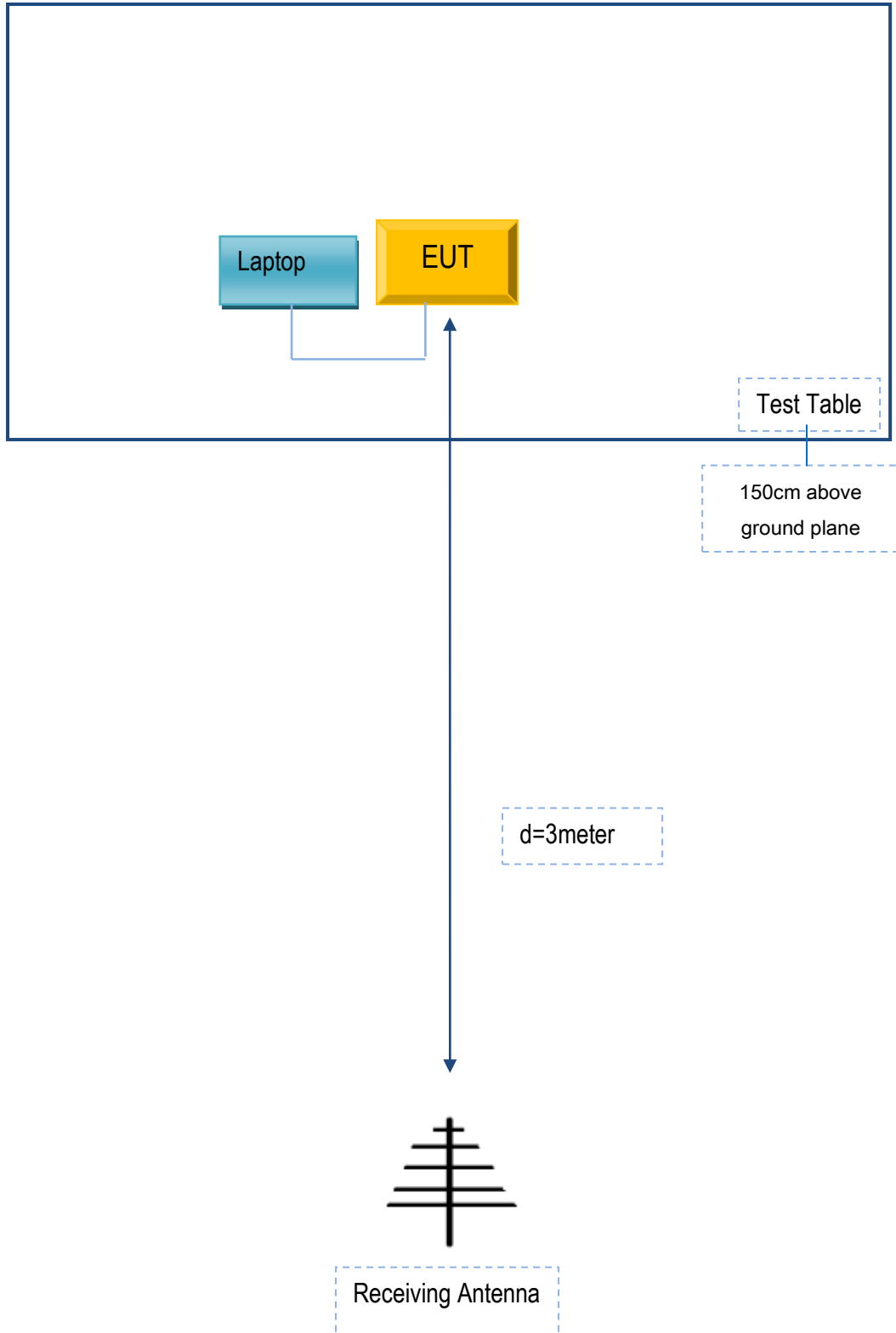


Block Configuration Diagram for Radiated Emissions ( Below 1GHz ) .





**Block Configuration Diagram for Radiated Emissions ( Above 1GHz ) .**



## Annex C. ii. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

### Supporting Equipment:

Manufacturer	Equipment Description	Model	Serial No
Lenovo	Laptop	E40	LR-1EHRX
DCA	Adapter	E2164A	N/A
N/A	headest	N/A	N/A

### Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
N/A	N/A	N/A	N/A	N/A

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## Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see the attachment

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## Annex E. DECLARATION OF SIMILARITY

N/A