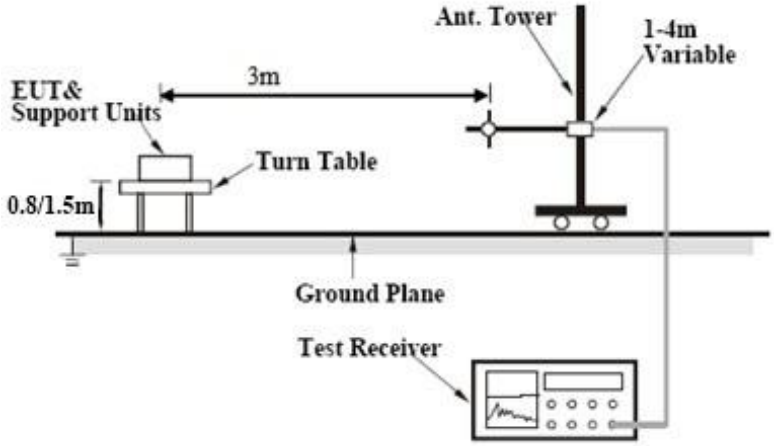
6.7 Radiated Spurious Emissions & Restricted Band

Temperature	23 °C
Relative Humidity	56%
Atmospheric Pressure	1014mbar
Test date :	April 14, 2017
Tested By :	Loren Luo

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td rowspan="3">47CFR§15.247(d), RSS210 (A8.5)</td><td>a)</td><td>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
<table>
<tr><th>Frequency range (MHz)</th><th>Field Strength (μV/m)</th></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>
</table></td><td>☑</td></tr>
<tr><td>b)</td><td>For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required
☒ 20 dB down ☐ 30 dB down</td><td>☑</td></tr>
<tr><td>c)</td><td>or restricted band, emission must also comply with the radiated emission limits specified in 15.209</td><td>☑</td></tr>
</table>

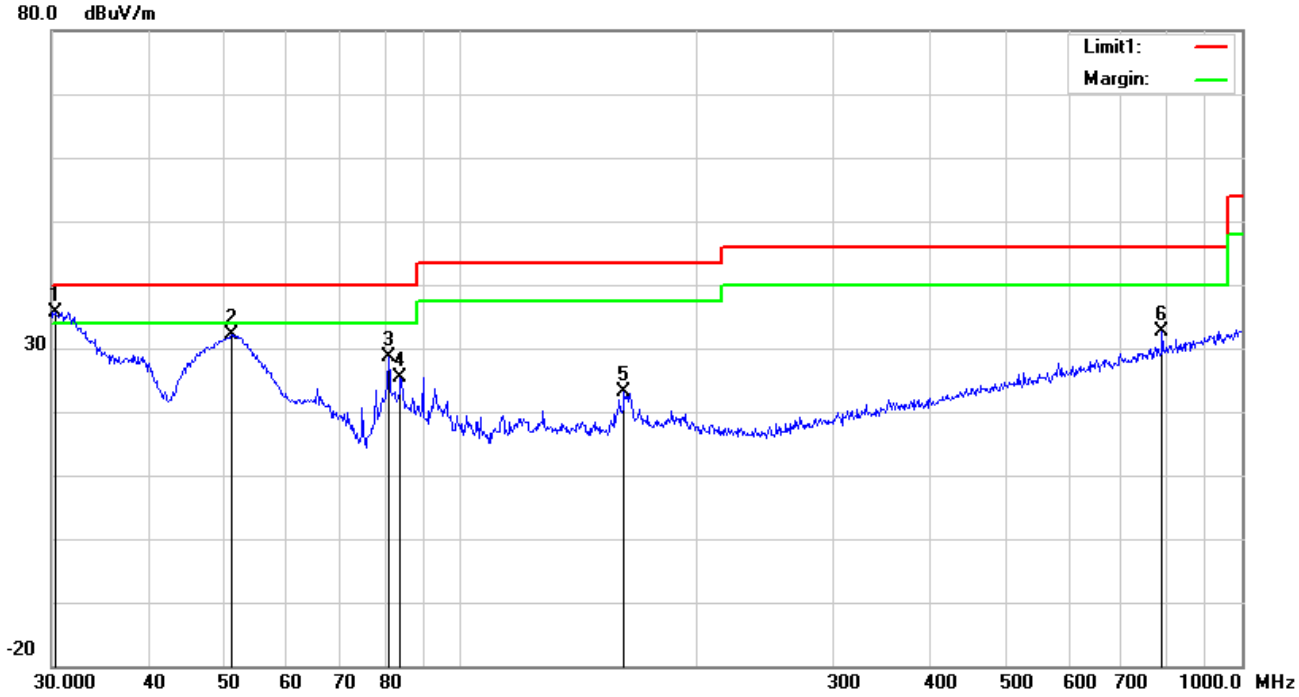
Test Setup	
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz. 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. 5. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	Different RF configuration has been evaluated but not much difference was found. The data presented here is the worst case data with EUT under 802.11n – HT20-2437MHz mode.
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Test Mode:	Transmitting Mode

(Below 1GHz)

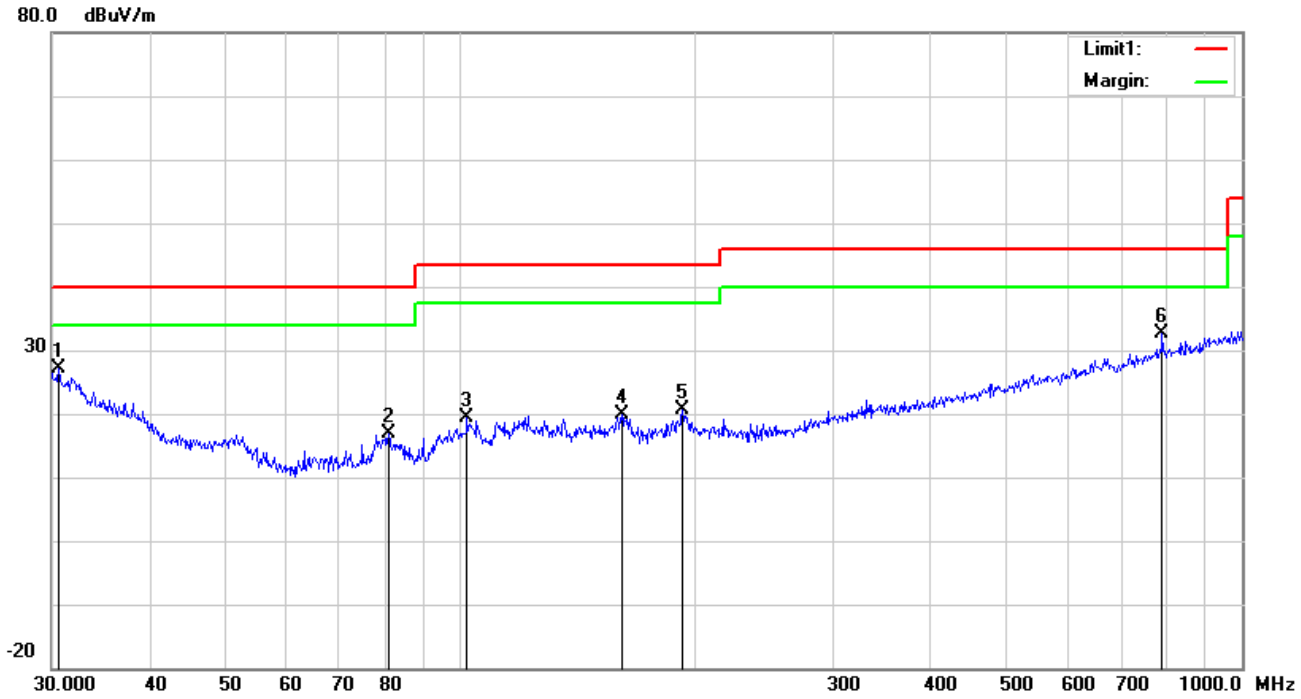


Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	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	V	30.3173	36.18	QP	21.16	22.28	0.63	35.69	40.00	-4.31	100	48
2	V	50.9420	45.42	peak	8.30	22.38	0.80	32.14	40.00	-7.86	200	309
3	V	80.9275	42.45	peak	7.64	22.41	1.05	28.73	40.00	-11.27	100	323
4	V	83.8156	38.99	peak	7.75	22.38	1.07	25.43	40.00	-14.57	100	245
5	V	162.0414	31.68	peak	12.44	22.27	1.38	23.23	43.50	-20.27	100	17
6	V	790.6188	29.50	peak	21.29	21.17	2.94	32.56	46.00	-13.44	100	225

(Below 1GHz)



Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	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	30.6379	27.76	peak	20.91	22.28	0.64	27.03	40.00	-12.97	100	319
2	H	80.9275	30.57	peak	7.64	22.41	1.05	16.85	40.00	-23.15	100	67
3	H	102.0014	29.94	peak	10.75	22.32	1.13	19.50	43.50	-24.00	100	270
4	H	160.9089	28.20	peak	12.53	22.27	1.39	19.85	43.50	-23.65	100	350
5	H	192.4186	29.72	peak	11.68	22.33	1.54	20.61	43.50	-22.89	100	239
6	H	790.6188	29.45	peak	21.29	21.17	2.94	32.51	46.00	-13.49	100	264

Above 1GHz

Test Mode:	Transmitting Mode

Low Channel (2412 MHz) (n20 mode worst case)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824	39.41	AV	V	33.8	6.86	32.69	47.38	54	-6.62
4824	38.76	AV	H	33.8	6.86	32.69	46.73	54	-7.27
4824	47.79	PK	V	33.8	6.86	32.69	55.76	74	-18.24
4824	47.83	PK	H	33.8	6.86	32.69	55.8	74	-18.2
17903	24.29	AV	V	45.12	11.57	32.11	48.87	54	-5.13
17903	22.3	AV	H	45.12	11.57	32.11	46.88	54	-7.12
17903	40.27	PK	V	45.12	11.57	32.11	64.85	74	-9.15
17903	39.59	PK	H	45.12	11.57	32.11	64.17	74	-9.83

Middle Channel (2437 MHz) (b mode worst case)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874	38.66	AV	V	33.6	6.82	32.71	46.37	54	-7.63
4874	39.15	AV	H	33.6	6.82	32.71	46.86	54	-7.14
4874	48.06	PK	V	33.6	6.82	32.71	55.77	74	-18.23
4874	48.35	PK	H	33.6	6.82	32.71	56.06	74	-17.94
17928	24.51	AV	V	45.17	11.63	32.18	49.13	54	-4.87
17928	22.31	AV	H	45.17	11.63	32.18	46.93	54	-7.07
17928	40.28	PK	V	45.17	11.63	32.18	64.9	74	-9.1
17928	39.68	PK	H	45.17	11.63	32.18	64.3	74	-9.7

High Channel (2462 MHz) (n20 mode worst case)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924	39.47	AV	V	33.83	6.95	32.79	47.46	54	-6.54
4924	39.39	AV	H	33.83	6.95	32.79	47.38	54	-6.62
4924	47.74	PK	V	33.83	6.95	32.79	55.73	74	-18.27
4924	47.28	PK	H	33.83	6.95	32.79	55.27	74	-18.73
17918	22.95	AV	V	45.19	11.61	32.24	47.51	54	-6.49
17918	22.91	AV	H	45.19	11.61	32.24	47.47	54	-6.53
17918	40.67	PK	V	45.19	11.61	32.24	65.23	74	-8.77
17918	39.01	PK	H	45.19	11.61	32.24	63.57	74	-10.43

Note:

*1, The testing has been conformed to 10*2462MHz=24,620MHz*

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.

Annex A. TEST INSTRUMENT

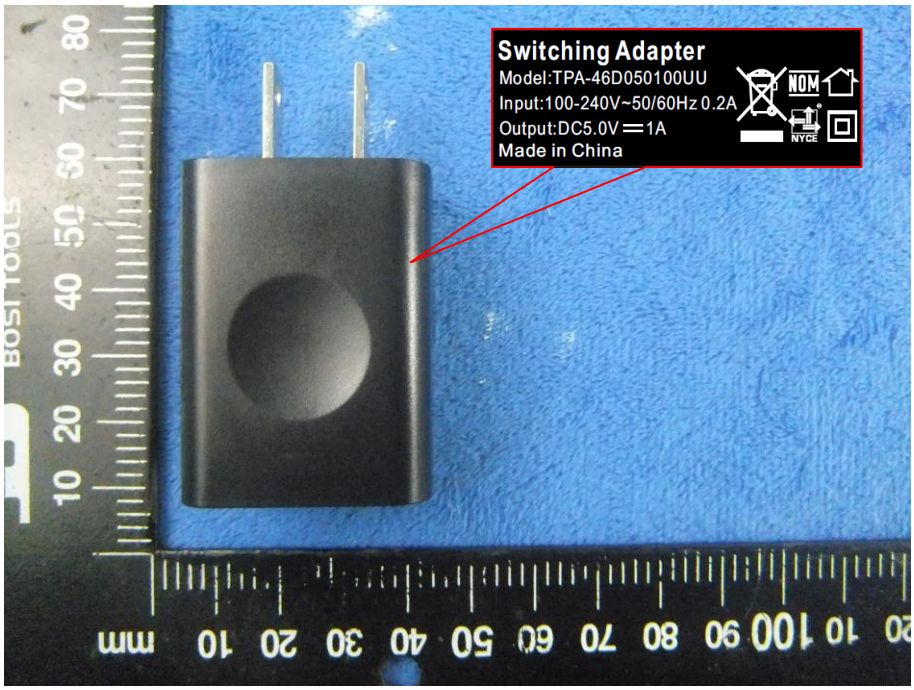
Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted					
EMI test receiver	ESCS30	8471241027	09/16/2016	09/15/2017	☑
Line Impedance	LI-125A	191106	09/24/2016	09/23/2017	☑
Line Impedance	LI-125A	191107	09/24/2016	09/23/2017	☑
LISN	ISN T800	34373	09/24/2016	09/23/2017	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/23/2016	09/22/2017	☑
Transient Limiter	LIT-153	531118	08/31/2016	08/30/2017	☑
RF conducted test					
Agilent ESA-E SERIES	E4407B	MY45108319	09/16/2016	09/15/2017	☑
Power Splitter	1#	1#	08/31/2016	08/30/2017	☑
DC Power Supply	E3640A	MY40004013	09/16/2016	09/15/2017	☑
Radiated Emissions					
EMI test receiver	ESL6	100262	09/16/2016	09/15/2017	☑
Positioning Controller	UC3000	MF780208282	11/18/2016	11/17/2017	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/31/2016	08/30/2017	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/20/2016	09/19/2017	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/23/2016	09/22/2017	☑
Universal Radio Communication Tester	CMU200	121393	09/24/2016	09/23/2017	☑

Annex B. EUT and Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

Whole Package View

Adapter - Front View

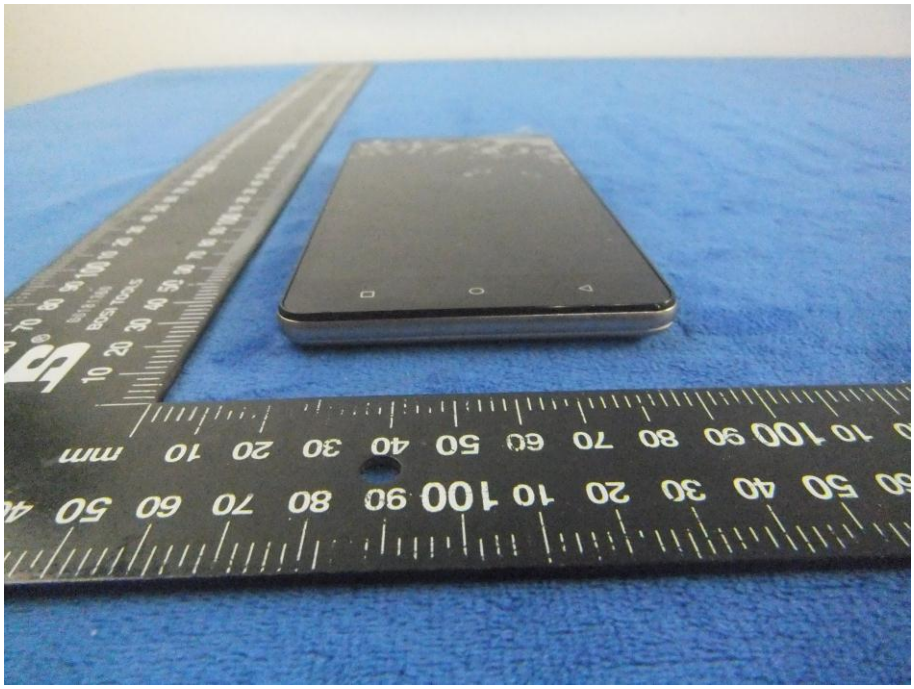


EUT - Front View

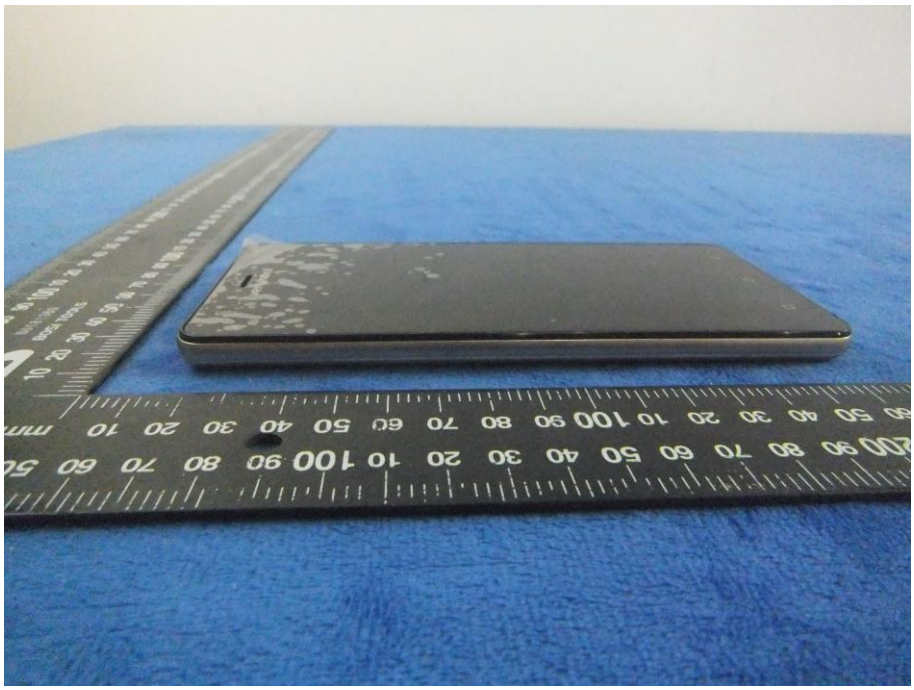
EUT - Rear View

EUT - Top View

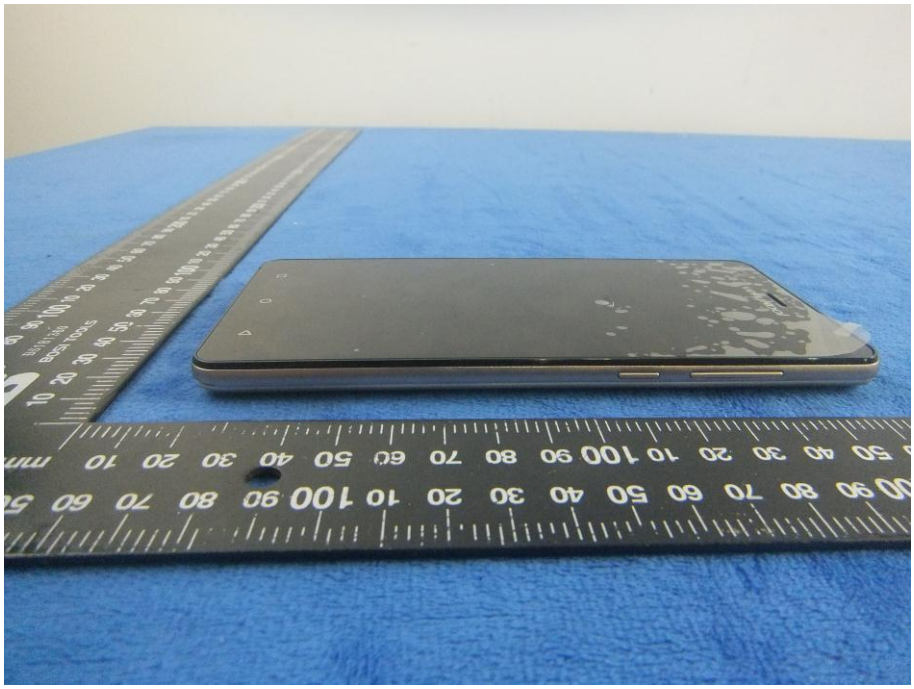
EUT - Bottom View



EUT - Left View



EUT - Right View



Annex B.ii. Photograph: EUT Internal Photo

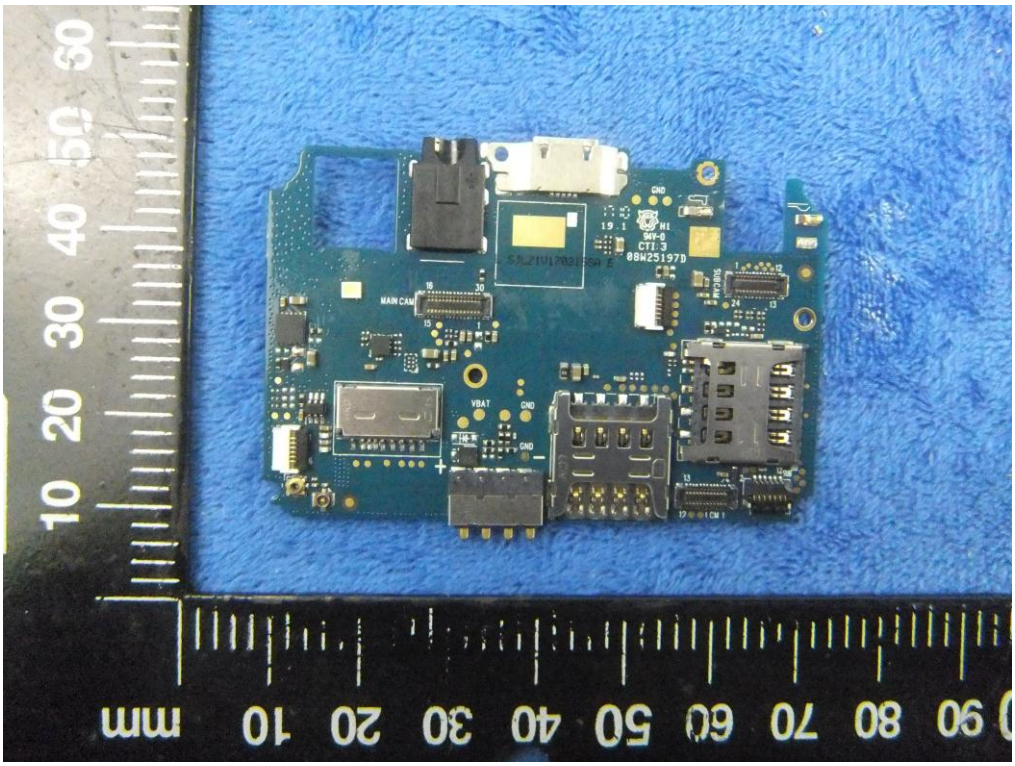
Cover Off - Top View 1

Cover Off - Top View 2

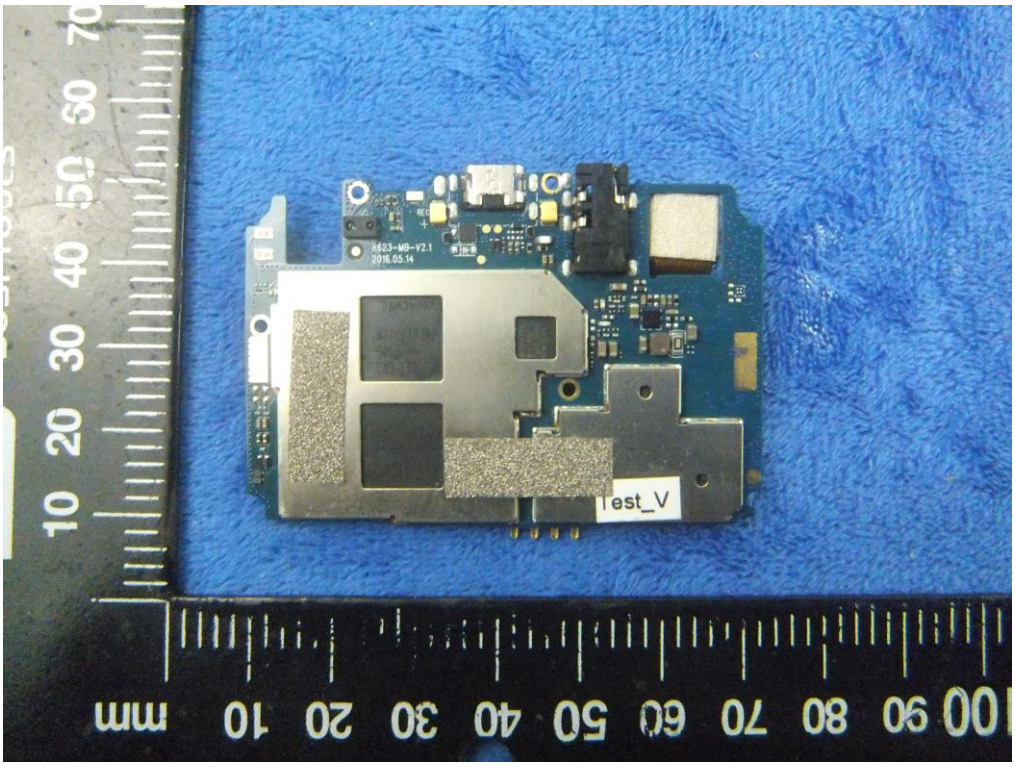
Battery - Front View

Battery - Rear View

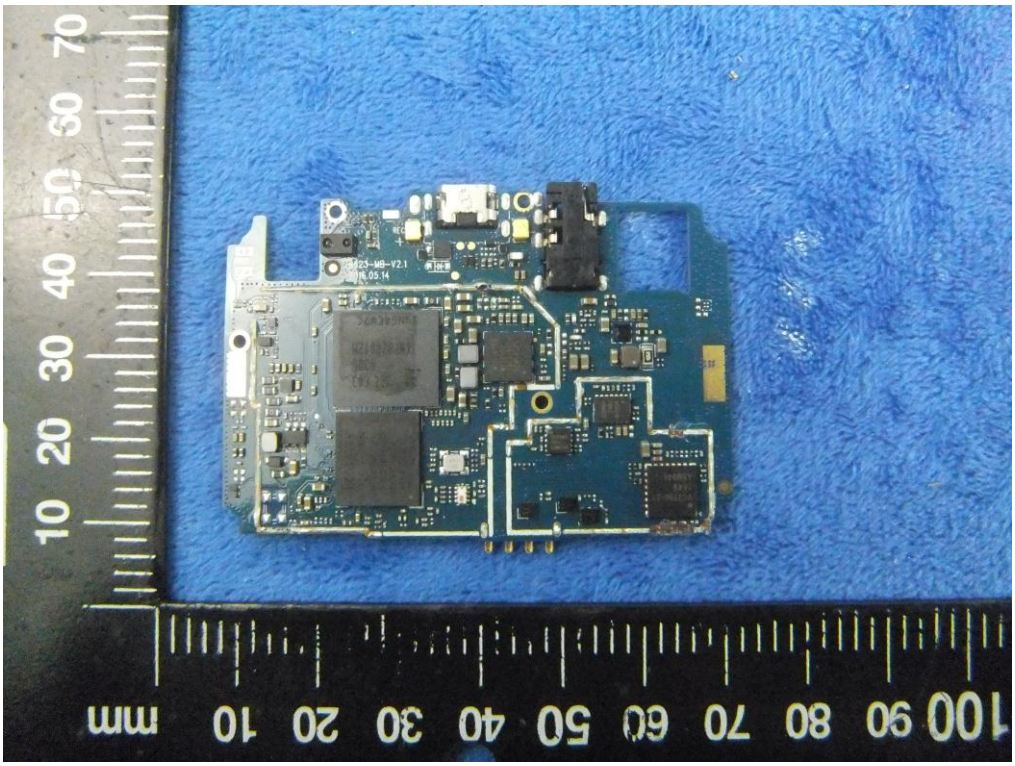
Mainboard – Front View



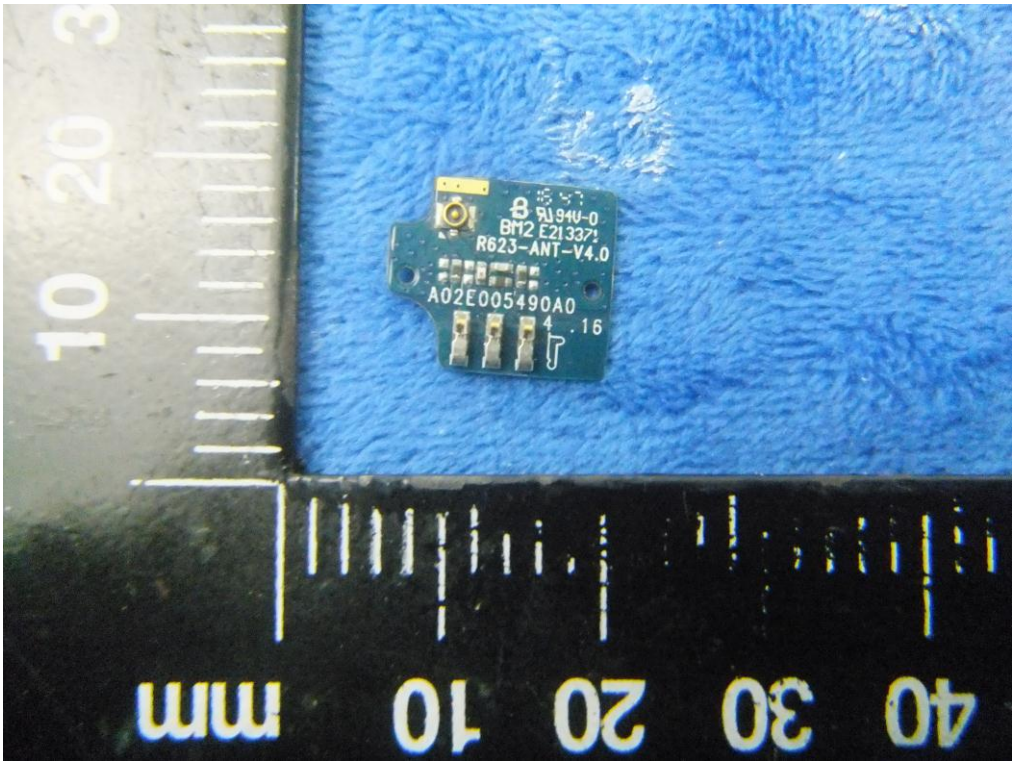
Mainboard with Shielding - Rear View



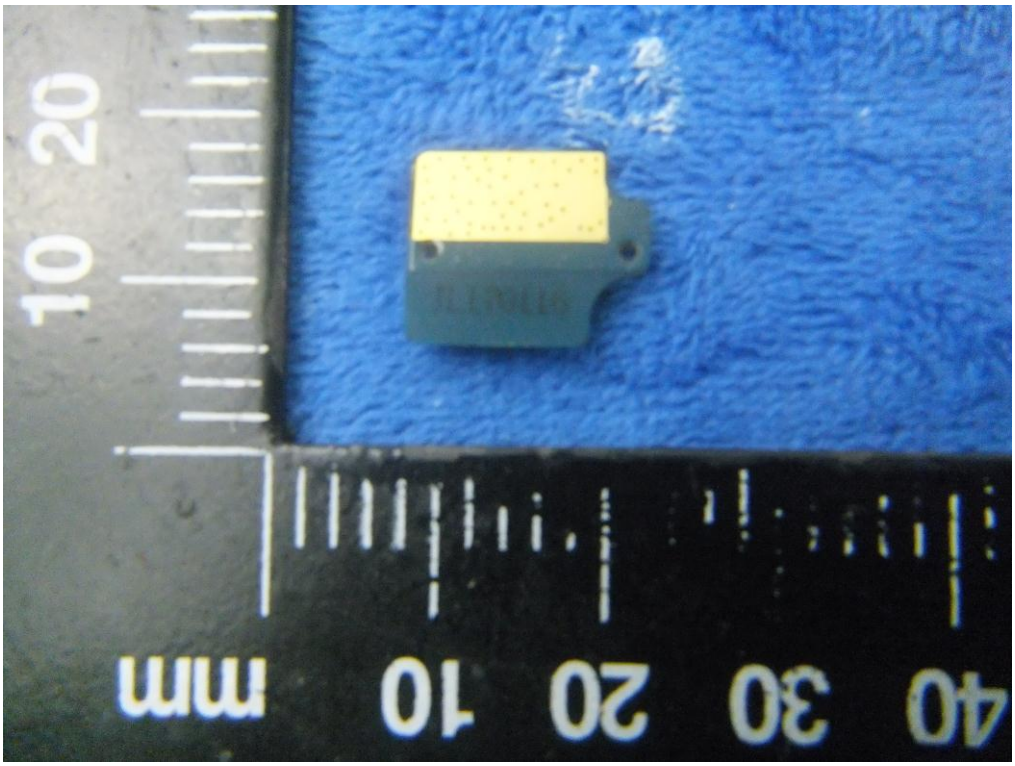
Mainboard without Shielding - Rear View



Small Mainboard – Front View

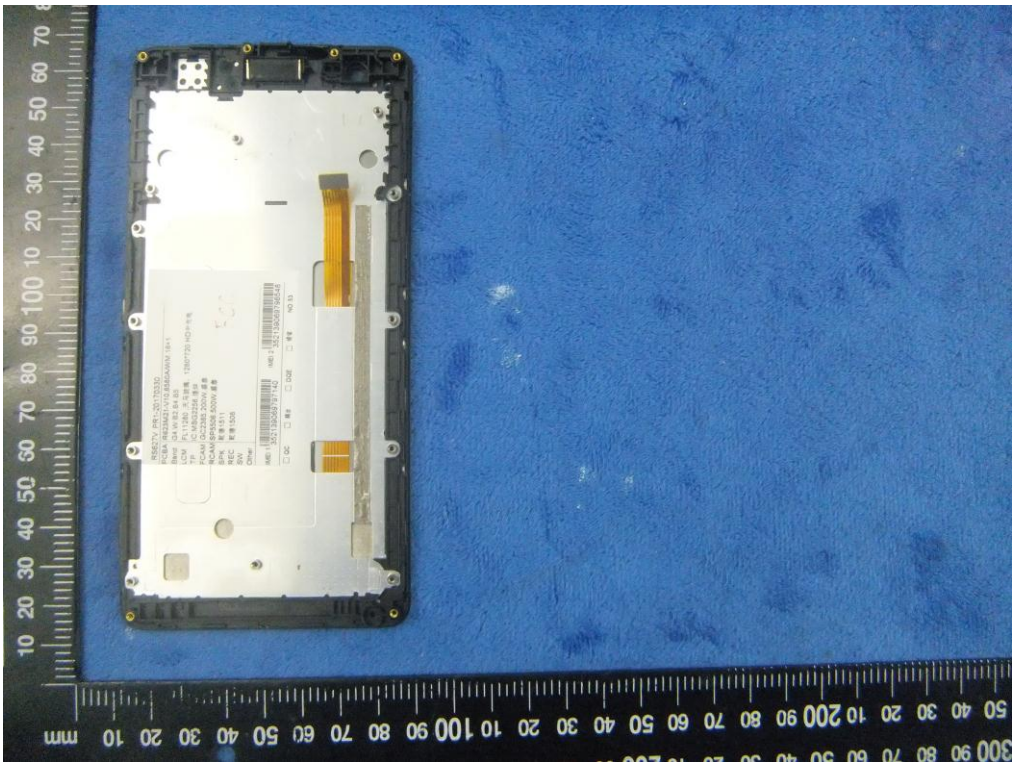


Small Mainboard - Rear View

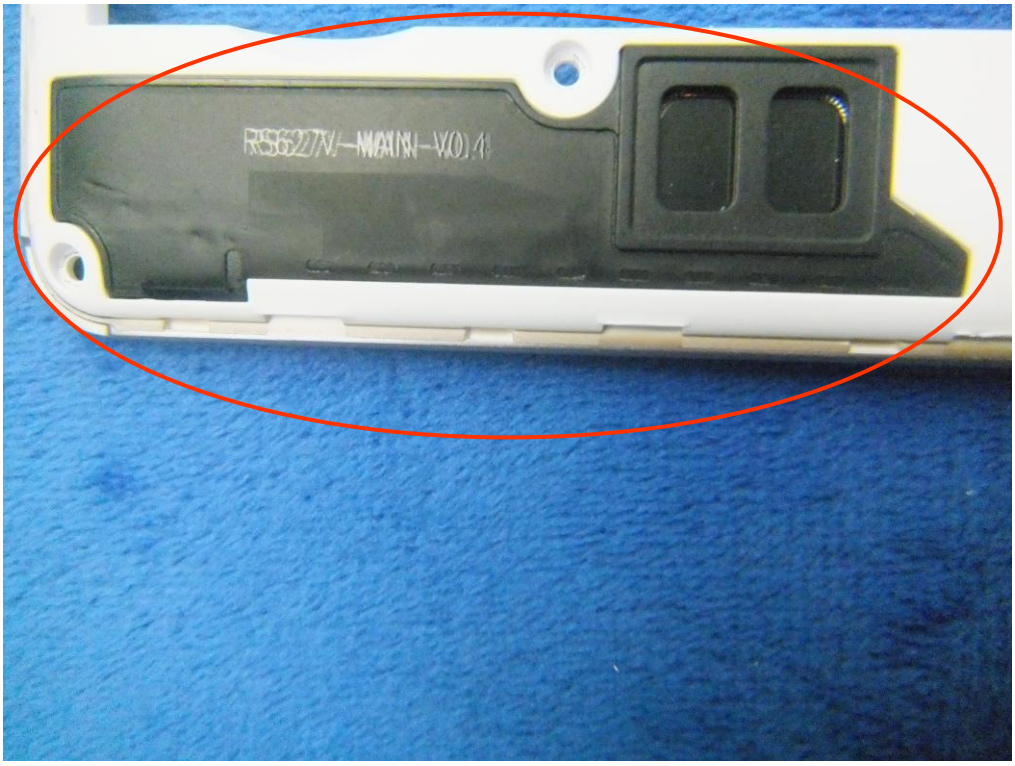


LCD – Front View

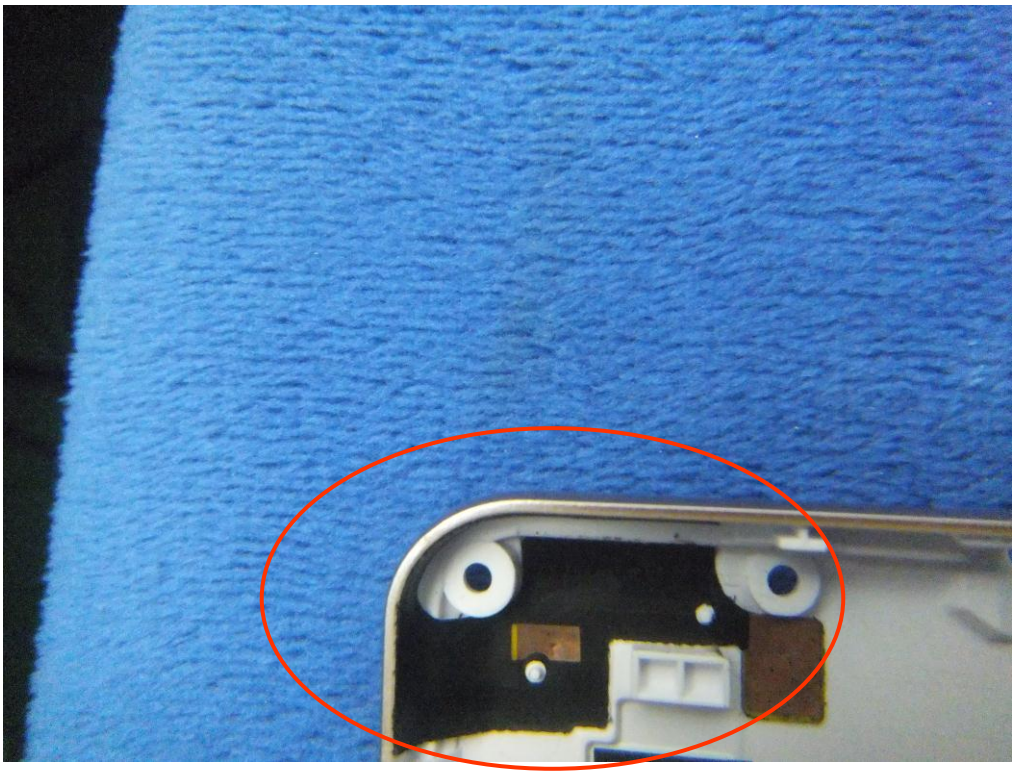
LCD – Rear View



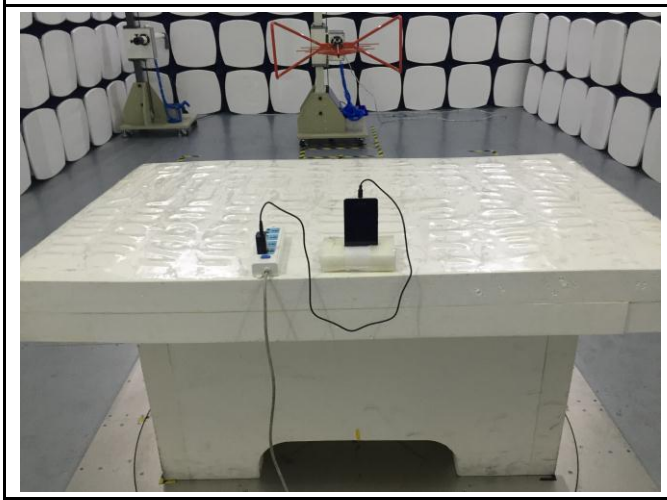
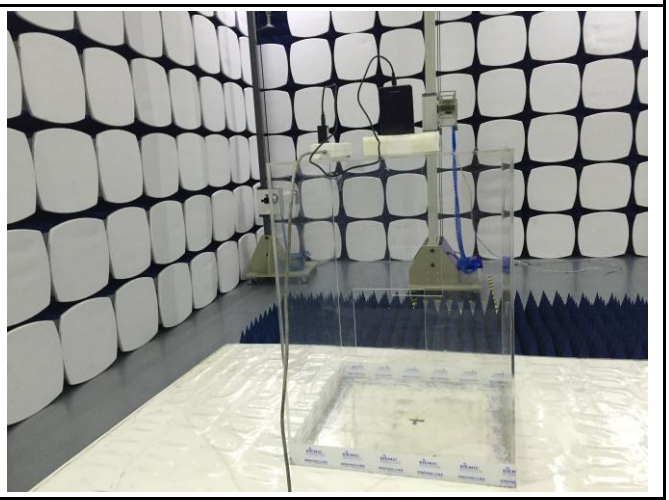
GSM/PCS/UMTS - Antenna View



WIFI/BT/BLE/GPS - Antenna View



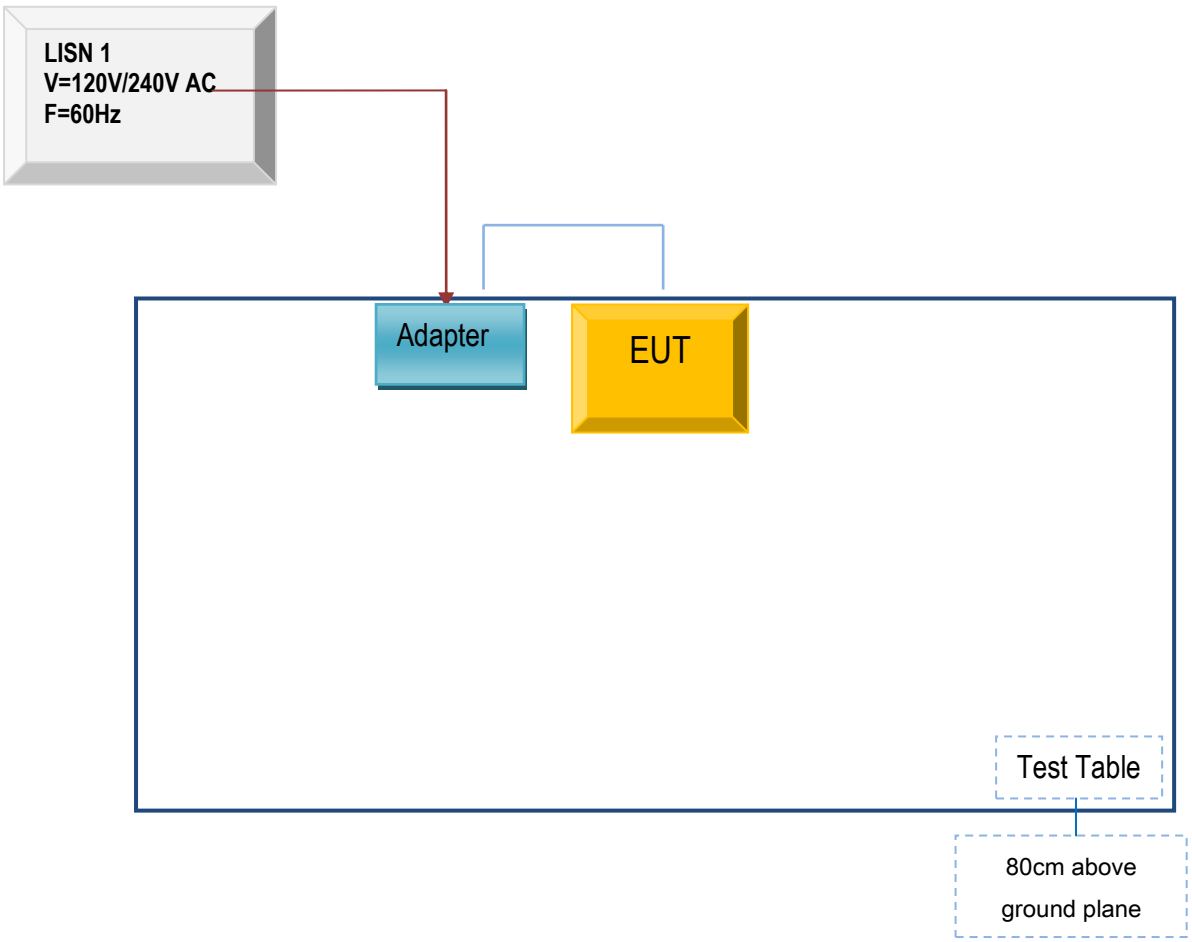
Annex B.iii. Photograph: Test Setup Photo

	
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

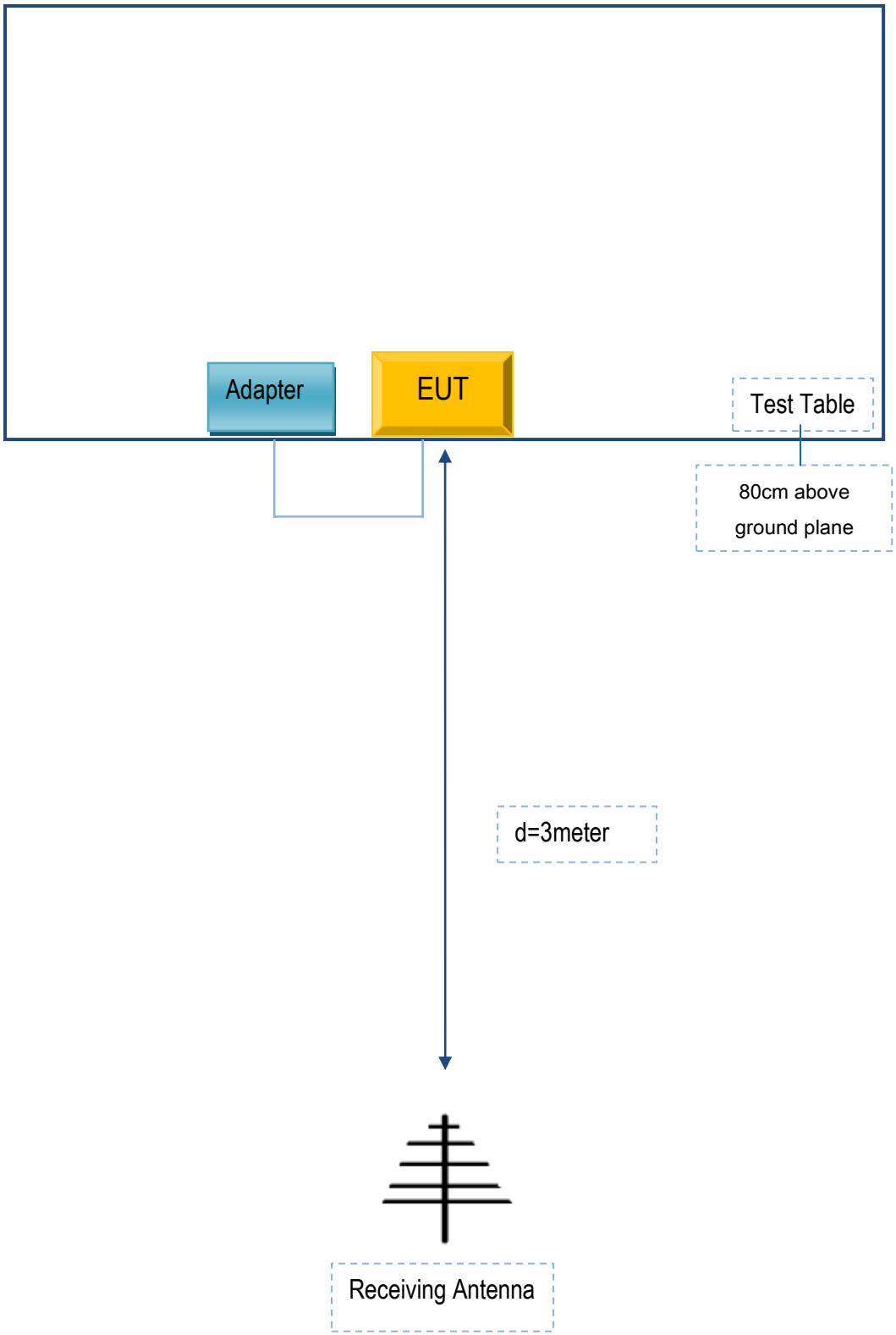
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

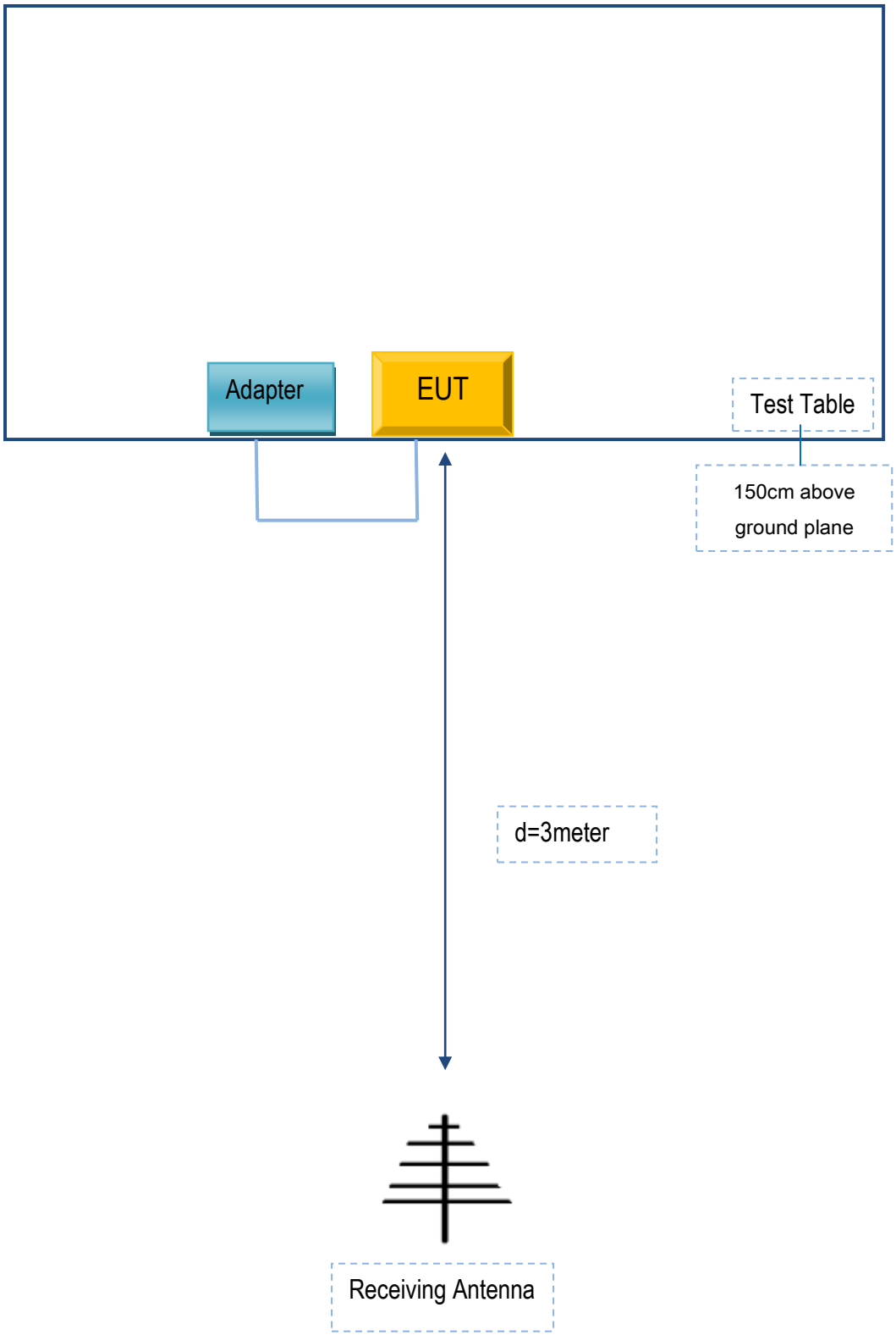
Block Configuration Diagram for AC Line Conducted Emissions



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



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



Annex C. il. 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
Verykool USA Inc	Adapter	TPA-46D050100UU	SA020

Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
USB Cable	Un-shielding	No	0.8m	SA020

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

Please see the attachment

Annex E. DECLARATION OF SIMILARITY

N/A