RF TEST REPORT

Report No.: 16050028-FCC-R4

Supersede Report No.: N/A

Applicant	Quectel Wireless Solutions Co., Ltd.
Product Name	Wifi& BT Module
Model No.	FC20
Serial No.	N/A
Test Standard	FCC Part 15.247: 2016, ANSI C63.10: 2013
Test Date	February 07 to March 20, 2017
Issue Date	March 21, 2017
Test Result	☑ Pass ☐ Fail
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Loren Luo	David Huang	
Loren Luo Test Engineer	David Huang Checked By	

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Test result presented in this test report is applicable to the tested sample only

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

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Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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CONTENTS

1. REPORT REVISION HISTORY 5

2. CUSTOMER INFORMATION 5

3. TEST SITE INFORMATION 5

4. EQUIPMENT UNDER TEST (EUT) INFORMATION 6

5. TEST SUMMARY 8

6. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS 9

6.1 ANTENNA REQUIREMENT 9

6.2 DTS (6 DB) CHANNEL BANDWIDTH 10

6.3 MAXIMUM OUTPUT POWER 12

6.4 POWER SPECTRAL DENSITY 14

6.5 BAND-EDGE & UNWANTED EMISSIONS INTO RESTRICTED FREQUENCY BANDS 16

6.6 AC POWER LINE CONDUCTED EMISSIONS 19

6.7 RADIATED EMISSIONS & RESTRICTED BAND 25

ANNEX A. TEST INSTRUMENT 31

ANNEX B. EUT AND TEST SETUP PHOTOGRAPHS 32

ANNEX C. TEST SETUP AND SUPPORTING EQUIPMENT 37

ANNEX D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PARTLIST 41

ANNEX E. DECLARATION OF SIMILARITY 42

1. Report Revision History

Report No.	Report Version	Description	Issue Date
16050028-FCC-R4	NONE	Original	March 21, 2017

2. Customer information

Applicant Name	Quectel Wireless Solutions Co., Ltd.
Applicant Add	RM501,Building 13,No.99 TianZhou Road,Xuhui District,Shanghai,China
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer Add	RM501,Building 13,No.99 TianZhou Road,Xuhui District,Shanghai,China

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	718246
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

4. Equipment under Test (EUT) Information

Description of EUT:	Wifi& BT Module
Main Model:	FC20
Serial Model:	N/A
Date EUT received:	February 06, 2017
Test Date(s):	February 07 to March 20, 2017
Equipment Category：	DTS
Antenna Gain:	Bluetooth/BLE: 3dBi WIFI(2.4G): 3 dBi WIFI(5150-5250MHz): 3 dBi WIFI(5250-5350MHz): 3 dBi WIFI(5470-5725MHz): 3 dBi WIFI(5725-5850MHz): 3 dBi **（Note: The radio module will be sold without antenna, this antenna only used limited to ERP/EIRP or radiated spurious emission test.）**
Antenna Type:	Fixed External antenna
Type of Modulation:	Bluetooth: GFSK, π /4DQPSK, 8DPSK BLE: GFSK 802.11b: DSSS 802.11g/n20/n40/ac20/ac40/ac80: OFDM
RF Operating Frequency (ies):	WIFI: 802.11b/g/n(20M): 2412-2462 MHz(TX/RX) WIFI: 802.11n(40M): 2422-2452 MHz(TX/RX) 802.11ac 20: 5180-5240 MHz; 5260-5320 MHz; 5500-5700 MHz; 5745-5825 MHz； (TX/RX) 802.11ac 40: 5190-5230 MHz; 5270-5310 MHz; 5510-5710 MHz; 5755-5795 MHz；(TX/RX) 802.11ac 80: 5210 MHz; 5290 MHz; 5530-5690 MHz; 5775 MHz；(TX/RX) Bluetooth& BLE: 2402-2480 MHz

Max. Output Power:	1.358dBm
Number of Channels:	WIFI :802.11b/g/n(20M): 11CH WIFI :802.11n(40M): 7CH WIFI :802.11ac20: 24CH WIFI :802.11ac40: 12CH WIFI :802.11ac80: 6CH Bluetooth: 79CH BLE: 40CH
Port:	N/A
Trade Name :	Quectel
Input Power:	Main supply voltage: 3.3V, 500mA IO supply voltage: 1.8V
FCC ID:	XMR201703FC20

5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.247 (a)(2)	DTS (6 dB) CHANNEL BANDWIDTH	Compliance
§15.247(b)(3)	Conducted Maximum Output Power	Compliance
§15.247(e)	Power Spectral Density	Compliance
§15.247(d)	Band-Edge & Unwanted Emissions into Restricted Frequency Bands	Compliance
§15.207 (a),	AC Power Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	Compliance

Measurement Uncertainty

Emissions		
Test Item	**Description**	**Uncertainty**
Band-Edge & Unwanted Emissions into Restricted Frequency Bands and Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
-	-	-

6. Measurements, Examination And Derived Results

6.1 Antenna Requirement

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.
The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.

b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

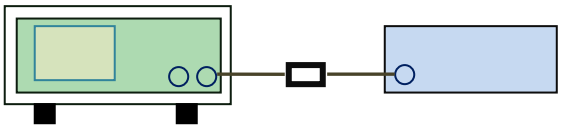
The EUT has 1 antenna:
An non-standard and Reverse polarity interface attached Fixed External antenna for Bluetooth/BLE/2.4G WIFI/5G WIFI, the gain is 3dBi for Bluetooth/BLE/2.4G WIFI, the gain is 3dBi for 5150-5250MHz/5250-5350MHz/5470-5725 MHz / 5725-2850MHz MHz 5G WIFI.

The antenna meets up with the ANTENNA REQUIREMENT.

Result: Compliance.

6.2 DTS (6 dB) Channel Bandwidth

Temperature	24℃
Relative Humidity	55%
Atmospheric Pressure	1010mbar
Test date :	March 17, 2017
Tested By :	Loren Luo

Spec	Item	Requirement	Applicable
§ 15.247(a)(2)	a)	6dB BW≥ 500kHz;	☑
RSS Gen(4.6.1)	b)	99% BW: For FCC reference only; required by IC.	☑
Test Setup			
Test Procedure	558074 D01 DTS MEAS Guidance v03r03, 8.1 DTS bandwidth 6dB Emission bandwidth measurement procedure - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ≥ 3 RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.		
Remark			
Result	☑ Pass ☐ Fail		

Test Data ☑ Yes ☐ N/A

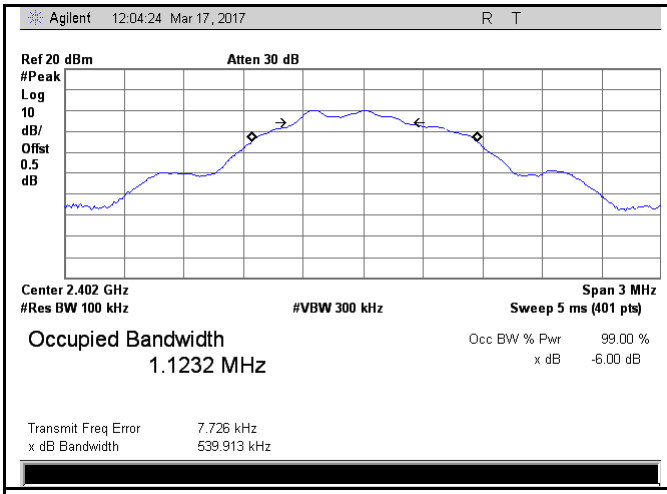
Test Plot ☑ Yes (See below) ☐ N/A

6dB Bandwidth measurement result

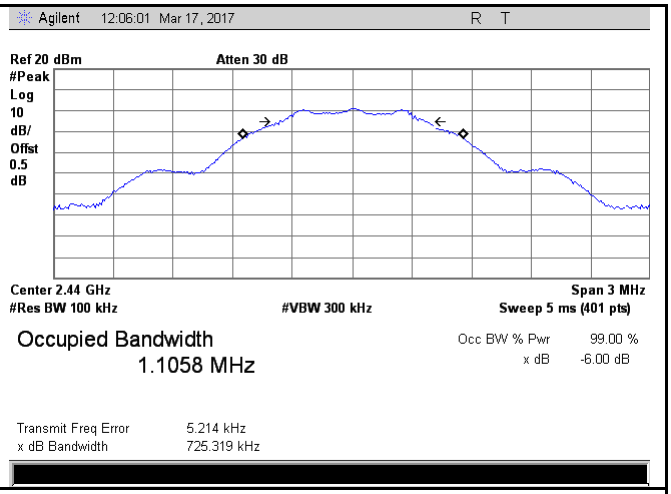
Test Data

CH	Frequency (MHz)	6dB Bandwidth (kHz)	99% Occupied Bandwidth (MHz)
Low	2402	539.913	1.1232
Mid	2440	725.319	1.1058
High	2480	731.380	1.1123

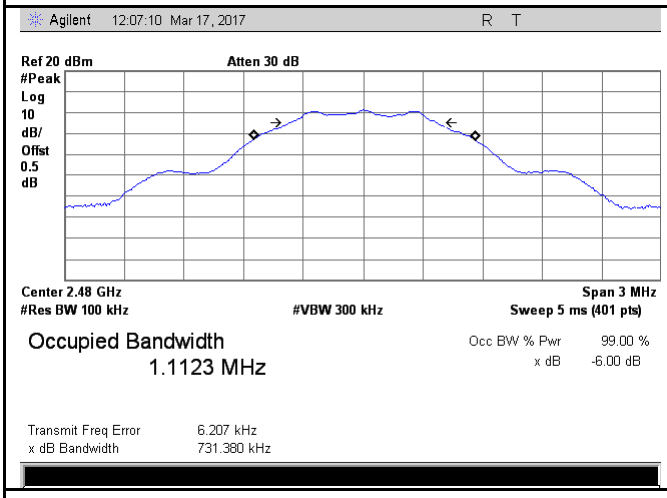
Test Plots



6dB Bandwidth - Low CH 2402



6dB Bandwidth - Mid CH 2440

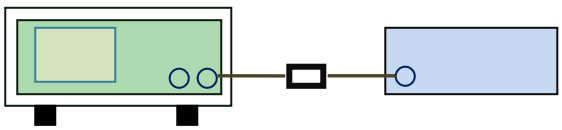


6dB Bandwidth - High CH 2480

6.3 Maximum Output Power

Temperature	24℃
Relative Humidity	55%
Atmospheric Pressure	1010mbar
Test date :	March 17, 2017
Tested By :	Loren Luo

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(b)(3),RSS210(A8.4)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤ 1 Watt	☐
	b)	FHSS in 5725-5850MHz: ≤ 1 Watt	☐
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤ 0.125 Watt.	☐
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤ 1 Watt	☐
	e)	FHSS in 902-928MHz with ≥ 25 & <50 channels: ≤ 0.25 Watt	☐
	f)	DTS in 902-928MHz, 2400-2483.5MHz: ≤ 1 Watt	☑
Test Setup	 Spectrum Analyzer EUT		
Test Procedure	558074 D01 DTS MEAS Guidance v03r03, 9.1.2 Integrated band power method Maximum output power measurement procedure a) Set the RBW ≥ DTS bandwidth. b) Set VBW ≥ 3 × RBW. c) Set span ≥ 3 x RBW d) Sweep time = auto couple. e) Detector = peak. f) Trace mode = max hold. g) Allow trace to fully stabilize. h) Use peak marker function to determine the peak amplitude level.		
Remark			
Result	☑ Pass ☐ Fail		

Test Data ☑ Yes ☐ N/A

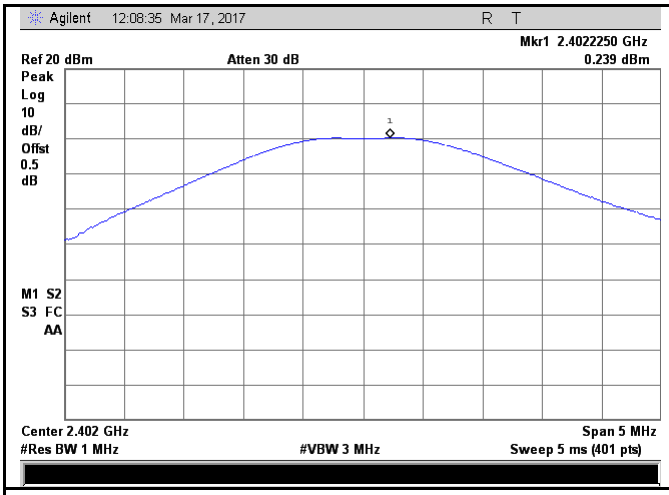
Test Plot ☑ Yes (See below) ☐ N/A

Output Power measurement result

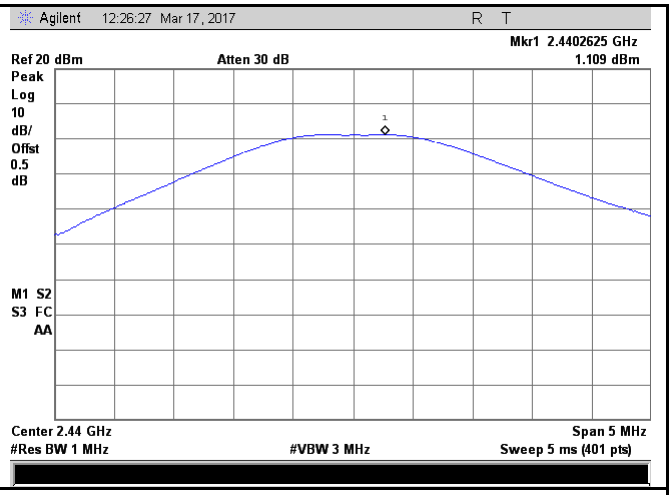
Test Data

Type	CH	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Result
Output power	Low	2402	0.239	30	Pass
	Mid	2440	1.109	30	Pass
	High	2480	1.358	30	Pass

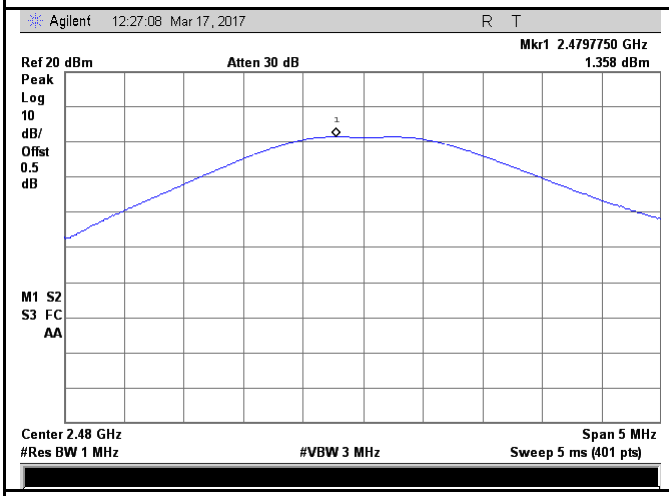
Test Plots



AV Output power - Low CH 2402



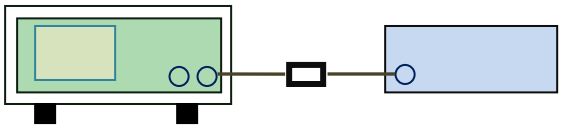
AV Output power - Mid CH 2440



AV Output power - High CH 2480

6.4 Power Spectral Density

Temperature	24℃
Relative Humidity	55%
Atmospheric Pressure	1010mbar
Test date :	March 17, 2017
Tested By :	Loren Luo

Spec	Item	Requirement	Applicable
§15.247(e)	a)	The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.	☑
Test Setup	 Spectrum Analyzer EUT		
Test Procedure	558074 D01 DTS MEAS Guidance v03r03, 10.2 power spectral density method power spectral density measurement procedure - a) Set analyzer center frequency to DTS channel center frequency. - b) Set the span to 1.5 times the DTS bandwidth. - c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. - d) Set the VBW ≥ 3 × RBW. - e) Detector = peak. - f) Sweep time = auto couple. - g) Trace mode = max hold. - h) Allow trace to fully stabilize. - i) Use the peak marker function to determine the maximum amplitude level within the RBW. - j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Remark			
Result	☑ Pass ☐ Fail		

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

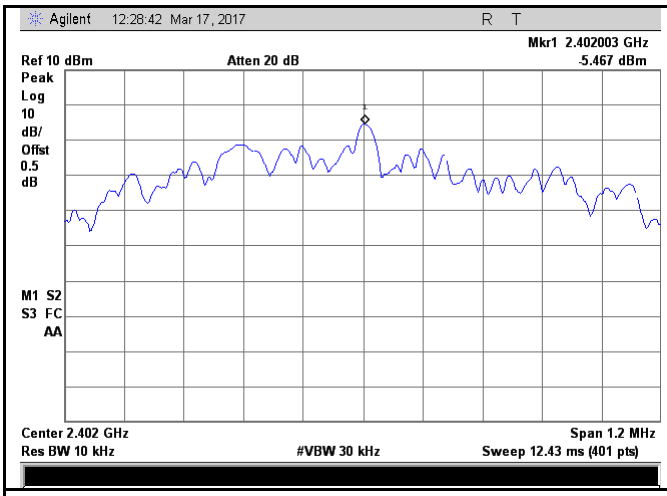
Power Spectral Density measurement result

Test Data

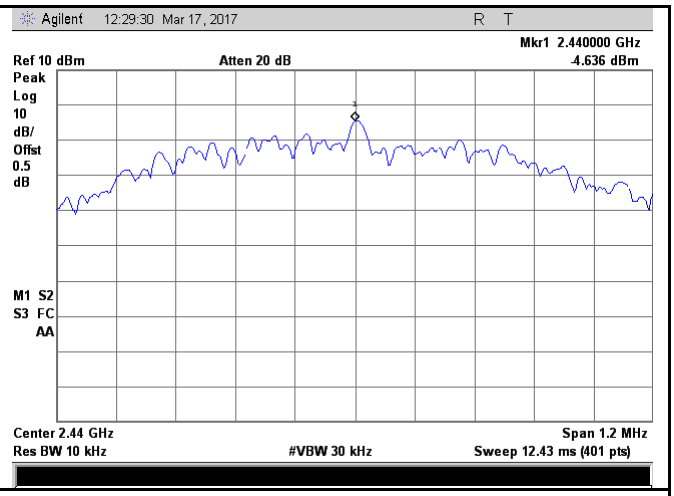
Type	CH	Freq (MHz)	Reading (dBm)	Factor (dB)	Result (dBm)	Limit (dBm)	Result
PSD	Low	2402	-5.467	-5.23	-10.697	8	Pass
	Mid	2440	-4.636	-5.23	-9.866	8	Pass
	High	2480	-4.409	-5.23	-9.639	8	Pass

Note: factor=10log(3/10)=-5.23

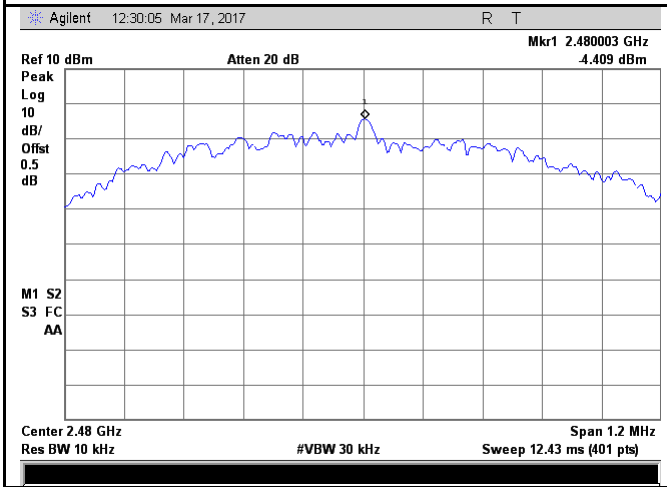
Test Plots



PSD - Low CH 2402



PSD - Mid CH 2440

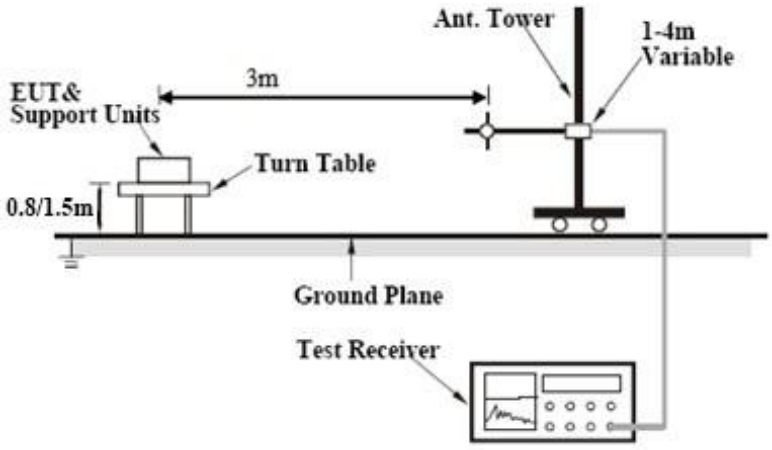


PSD - High CH 2480

6.5 Band-Edge & Unwanted Emissions into Restricted Frequency Bands

Temperature	24℃
Relative Humidity	55%
Atmospheric Pressure	1010mbar
Test date :	March 17, 2017
Tested By :	Loren Luo

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(d)	a)	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 below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.	☑
Test Setup			
Test Procedure	Radiated Method Only - 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator. - 2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.		

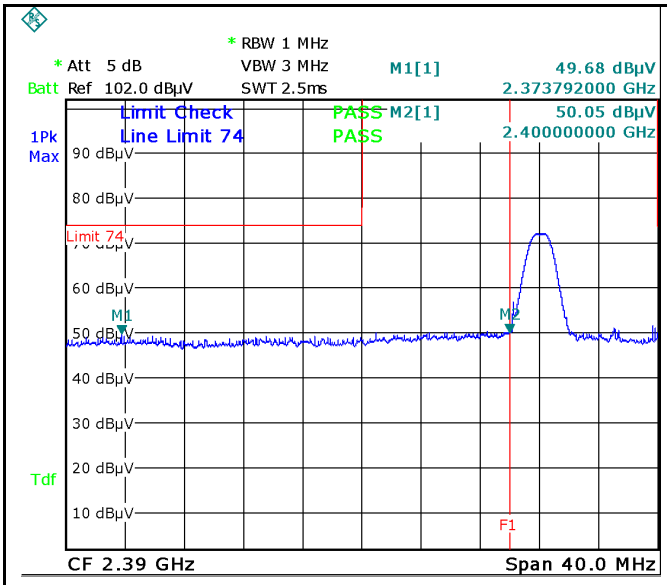
	- 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below: a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz. b. 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. c. 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. - 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency. - 5. Repeat above procedures until all measured frequencies were complete.
Remark	
Result	☑ Pass ☐ Fail

Test Data ☐ Yes ☑ N/A

Test Plot ☑ Yes (See below) ☐ N/A

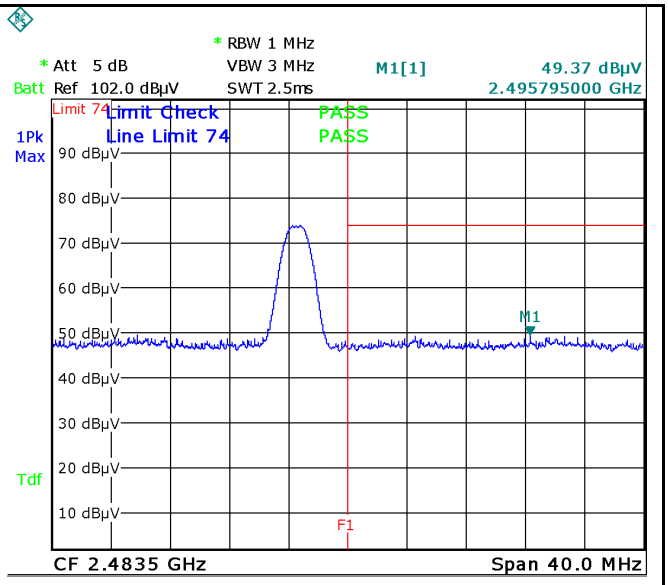
Test Plots

Band Edge measurement result



Band Edge, Left Side (Peak)

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Band Edge, Right Side (Peak)

Note: F1 is frequency 2483.5MHz

Note: (no need if PK value less than the AV limit)

Note: (no need if PK value less than the AV limit)

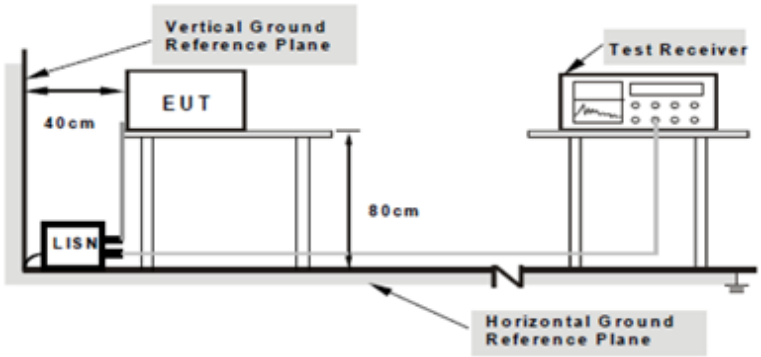
Band Edge, Left Side-AV

Band Edge, Right Side-AV

6.6 AC Power Line Conducted Emissions

Temperature	24℃
Relative Humidity	55%
Atmospheric Pressure	1010mbar
Test date :	March 17, 2017
Tested By :	Loren Luo

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§15.207, RSS210 (A8.1)</td><td>a)</td><td>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.
<table>
<tr><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBμV)</th></tr>
<tr><th>QP</th><th>Average</th></tr>
<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>
</table></td><td>☑</td></tr>
<tr><td>Test Setup</td><td colspan="3"> 

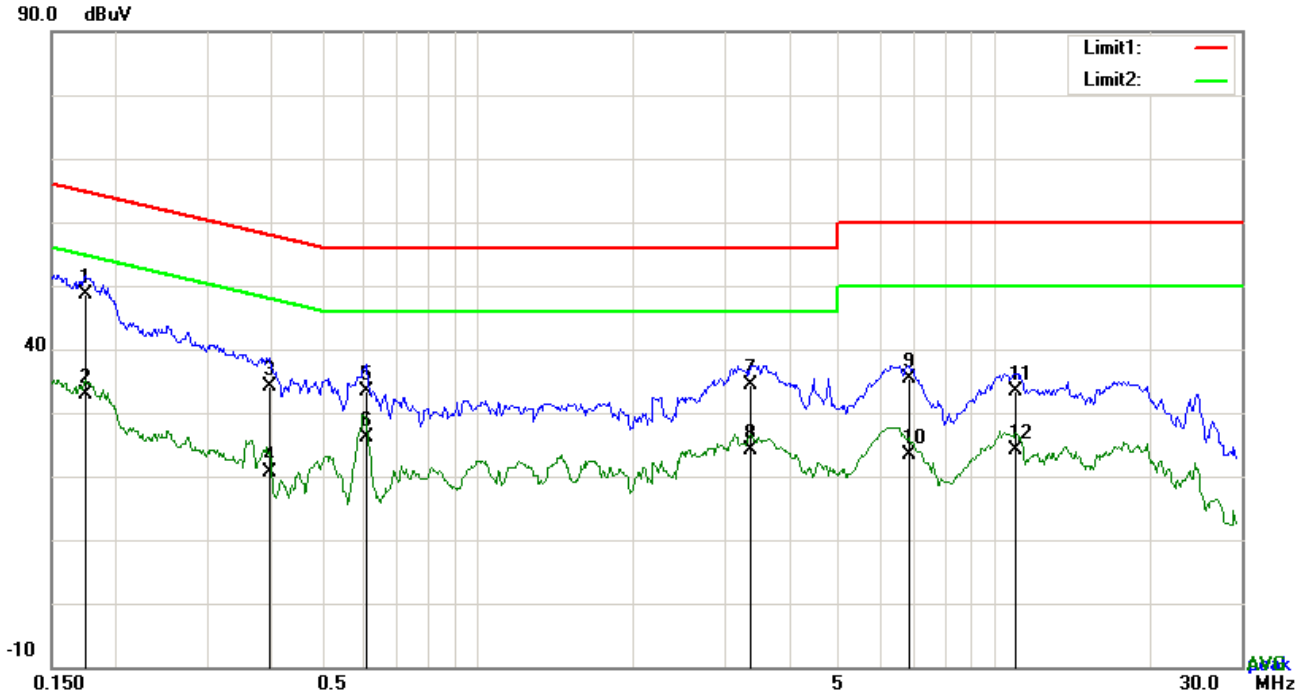
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</td></tr>
<tr><td>Procedure</td><td colspan="3">1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss</td></tr>
</table>

	coaxial cable. 4. All other supporting equipment were powered separately from another main supply. 5. The EUT was switched on and allowed to warm up to its normal operating condition. 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. 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. 8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).
Remark	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Test Mode:	Transmitting Mode

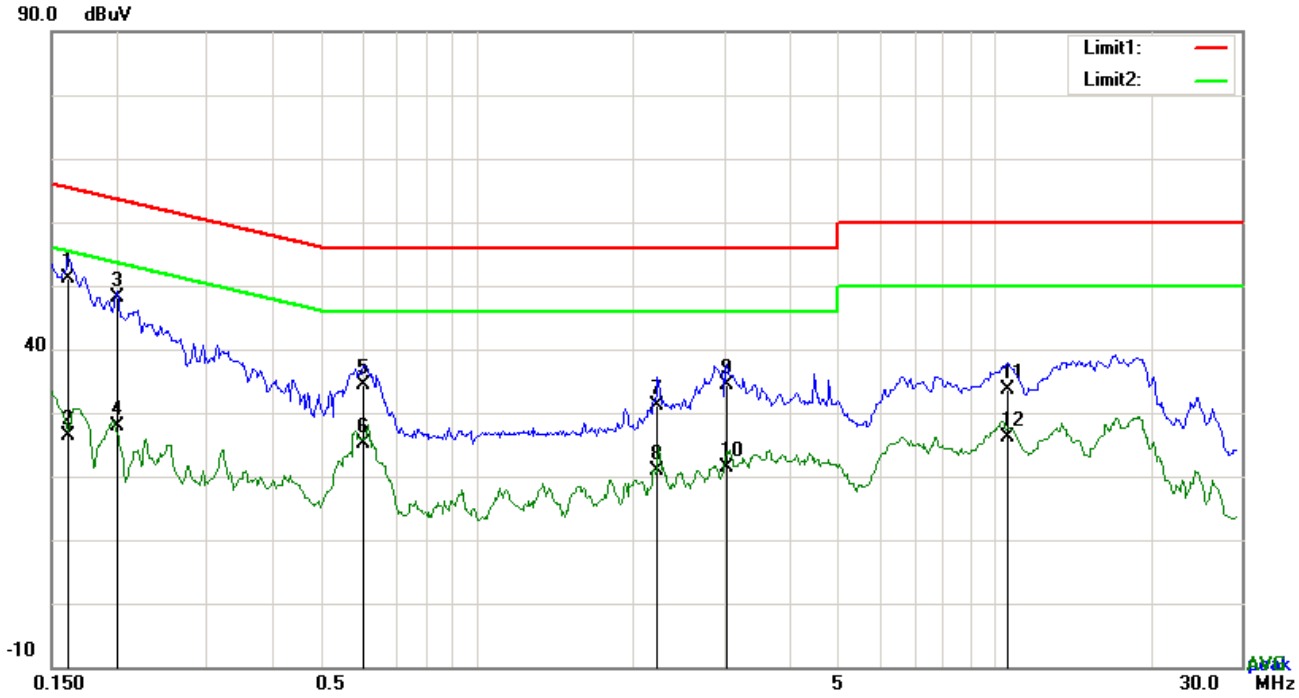


Test Data

Phase Line Plot at 120Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	L1	0.1740	38.68	QP	10.03	48.71	64.77	-16.06
2	L1	0.1740	22.83	AVG	10.03	32.86	54.77	-21.91
3	L1	0.3955	24.15	QP	10.03	34.18	57.95	-23.77
4	L1	0.3955	10.70	AVG	10.03	20.73	47.95	-27.22
5	L1	0.6075	23.33	QP	10.03	33.36	56.00	-22.64
6	L1	0.6075	16.13	AVG	10.03	26.16	46.00	-19.84
7	L1	3.3635	24.27	QP	10.06	34.33	56.00	-21.67
8	L1	3.3635	14.07	AVG	10.06	24.13	46.00	-21.87
9	L1	6.8412	25.20	QP	10.11	35.31	60.00	-24.69
10	L1	6.8412	13.37	AVG	10.11	23.48	50.00	-26.52
11	L1	10.9629	23.27	QP	10.16	33.43	60.00	-26.57
12	L1	10.9629	13.97	AVG	10.16	24.13	50.00	-25.87

Test Mode:	Transmitting Mode

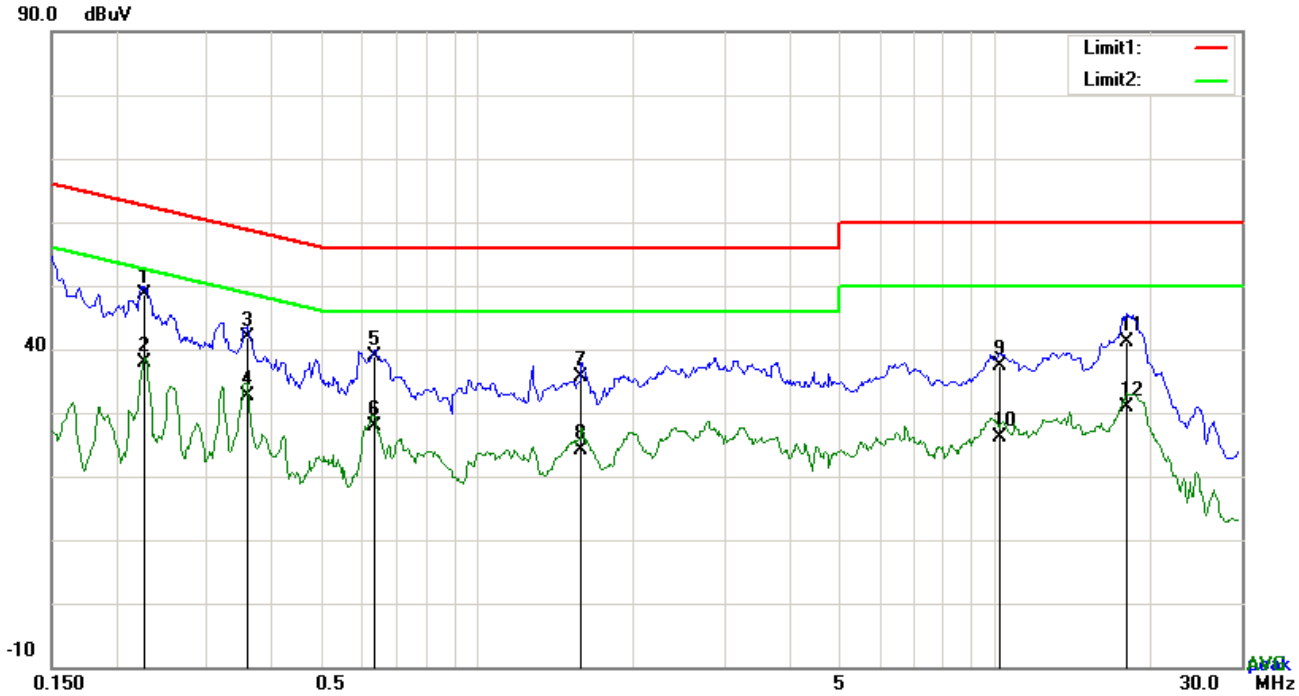


Test Data

Phase Neutral Plot at 120Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	N	0.1617	41.17	QP	10.02	51.19	65.38	-14.19
2	N	0.1617	16.37	AVG	10.02	26.39	55.38	-28.99
3	N	0.2007	38.20	QP	10.02	48.22	63.58	-15.36
4	N	0.2007	17.80	AVG	10.02	27.82	53.58	-25.76
5	N	0.6024	24.42	QP	10.02	34.44	56.00	-21.56
6	N	0.6024	15.14	AVG	10.02	25.16	46.00	-20.84
7	N	2.2287	21.18	QP	10.04	31.22	56.00	-24.78
8	N	2.2287	10.94	AVG	10.04	20.98	46.00	-25.02
9	N	3.0253	24.29	QP	10.05	34.34	56.00	-21.66
10	N	3.0253	11.34	AVG	10.05	21.39	46.00	-24.61
11	N	10.5699	23.50	QP	10.15	33.65	60.00	-26.35
12	N	10.5699	16.01	AVG	10.15	26.16	50.00	-23.84

Test Mode:	Transmitting Mode

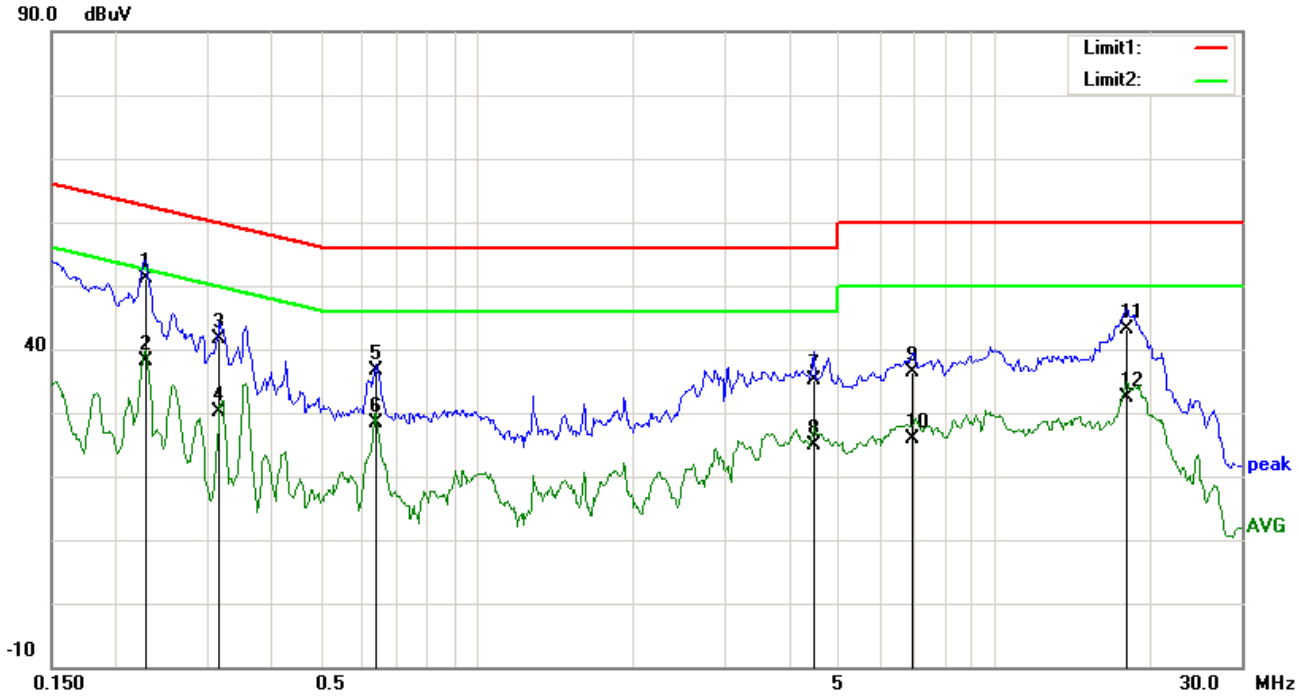


Test Data

Phase Line Plot at 240Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	L1	0.2268	38.60	QP	10.03	48.63	62.57	-13.94
2	L1	0.2268	27.76	AVG	10.03	37.79	52.57	-14.78
3	L1	0.3577	31.77	QP	10.03	41.80	58.78	-16.98
4	L1	0.3577	22.59	AVG	10.03	32.62	48.78	-16.16
5	L1	0.6336	28.90	QP	10.03	38.93	56.00	-17.07
6	L1	0.6336	17.83	AVG	10.03	27.86	46.00	-18.14
7	L1	1.5930	25.61	QP	10.04	35.65	56.00	-20.35
8	L1	1.5930	14.12	AVG	10.04	24.16	46.00	-21.84
9	L1	10.2072	27.17	QP	10.15	37.32	60.00	-22.68
10	L1	10.2072	15.90	AVG	10.15	26.05	50.00	-23.95
11	L1	17.9441	30.98	QP	10.27	41.25	60.00	-18.75
12	L1	17.9441	20.53	AVG	10.27	30.80	50.00	-19.20

Test Mode:	Transmitting Mode



Test Data

Phase Neutral Plot at 240Vac, 60Hz

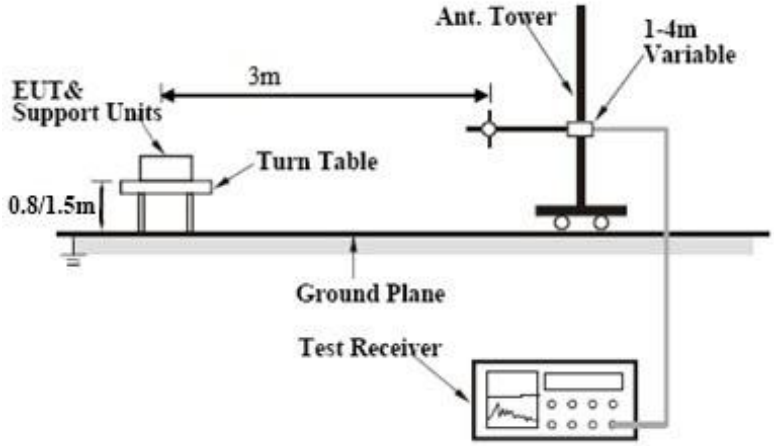
No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	N	0.2280	41.15	QP	10.02	51.17	62.52	-11.35
2	N	0.2280	28.22	AVG	10.02	38.24	52.52	-14.28
3	N	0.3177	31.58	QP	10.02	41.60	59.77	-18.17
4	N	0.3177	20.06	AVG	10.02	30.08	49.77	-19.69
5	N	0.6375	26.67	QP	10.02	36.69	56.00	-19.31
6	N	0.6375	18.42	AVG	10.02	28.44	46.00	-17.56
7	N	4.4625	25.07	QP	10.06	35.13	56.00	-20.87
8	N	4.4625	14.86	AVG	10.06	24.92	46.00	-21.08
9	N	6.9312	26.28	QP	10.10	36.38	60.00	-23.62
10	N	6.9312	15.87	AVG	10.10	25.97	50.00	-24.03
11	N	17.9799	32.81	QP	10.24	43.05	60.00	-16.95
12	N	17.9799	22.14	AVG	10.24	32.38	50.00	-17.62

6.7 Radiated Emissions & Restricted Band

Temperature	24℃
Relative Humidity	55%
Atmospheric Pressure	1010mbar
Test date :	March 17, 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>

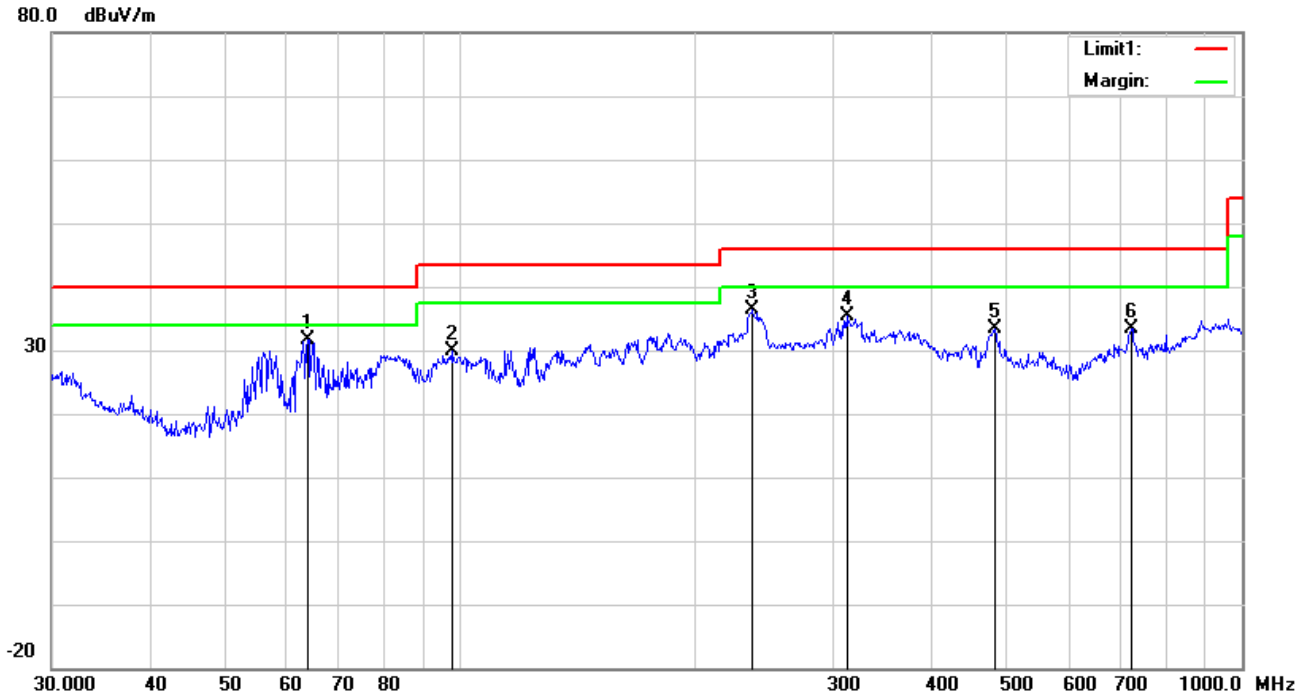
Test Setup	
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, 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

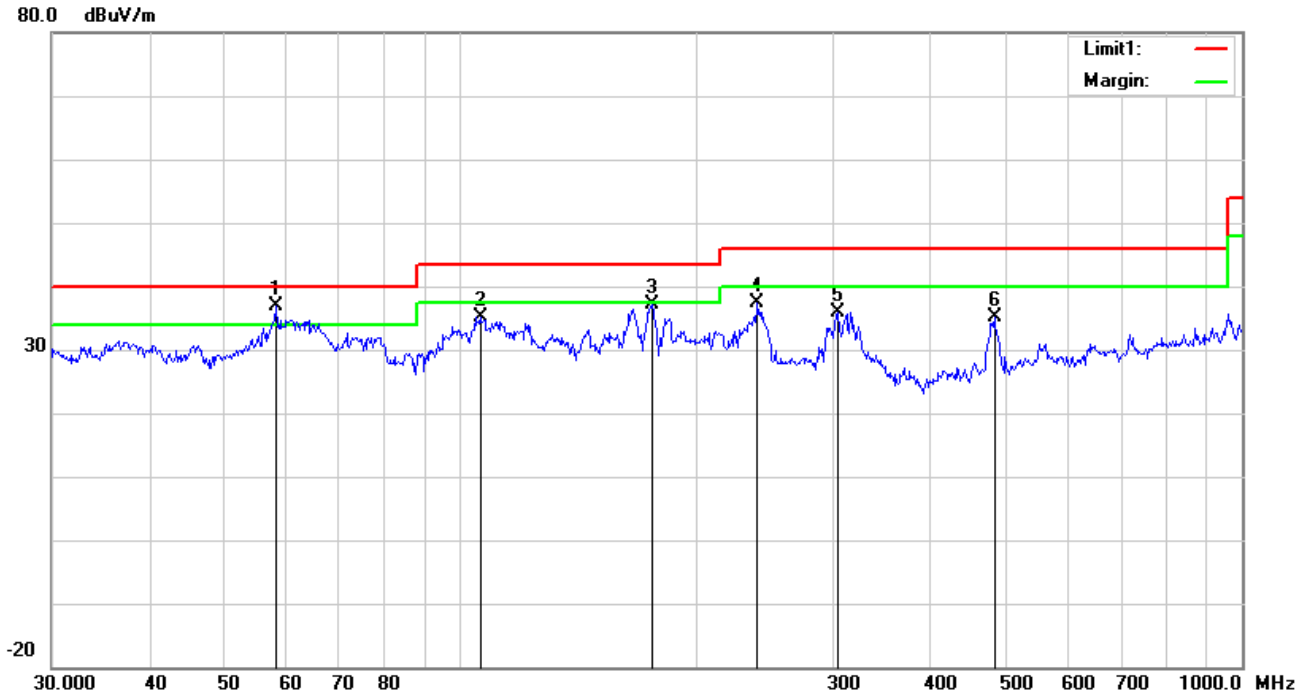


Test Data

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	H	63.7588	45.74	peak	7.49	22.40	0.85	31.68	40.00	-8.32	100	112
2	H	97.7983	41.19	peak	9.87	22.32	1.06	29.80	43.50	-13.70	100	51
3	H	236.6447	45.35	peak	11.59	22.31	1.66	36.29	46.00	-9.71	200	20
4	H	312.1794	41.85	peak	13.86	22.26	1.85	35.30	46.00	-10.70	100	161
5	H	483.9094	35.60	peak	17.38	21.84	2.33	33.47	46.00	-12.53	100	8
6	H	721.7259	31.64	peak	20.46	21.31	2.68	33.47	46.00	-12.53	100	90

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	V	58.2030	50.96	QP	7.50	22.40	0.76	36.82	40.00	-3.18	100	62
2	V	106.0126	44.91	peak	11.45	22.33	1.15	35.18	43.50	-8.32	100	262
3	V	176.2686	46.69	QP	11.30	22.25	1.36	37.10	43.50	-6.40	100	5
4	V	239.9873	46.43	peak	11.54	22.31	1.67	37.33	46.00	-8.67	200	307
5	V	303.5437	42.80	peak	13.67	22.28	1.81	36.00	46.00	-10.00	100	212
6	V	482.2156	37.36	peak	17.34	21.85	2.32	35.17	46.00	-10.83	100	56

Above 1GHz

Test Mode:	Transmitting Mode

Low Channel (2402 MHz)

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)
4804	38.47	AV	V	33.83	6.86	31.72	47.44	54	-6.56
4804	38.25	AV	H	33.83	6.86	31.72	47.22	54	-6.78
4804	48.64	PK	V	33.83	6.86	31.72	57.61	74	-16.39
4804	47.43	PK	H	33.83	6.86	31.72	56.4	74	-17.6
17790	24.81	AV	V	45.03	11.21	32.38	48.67	54	-5.33
17790	24.59	AV	H	45.03	11.21	32.38	48.45	54	-5.55
17790	41.27	PK	V	45.03	11.21	32.38	65.13	74	-8.87
17790	40.89	PK	H	45.03	11.21	32.38	64.75	74	-9.25

Middle Channel (2440 MHz)

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)
4880	38.55	AV	V	33.86	6.82	31.82	47.41	54	-6.59
4880	38.31	AV	H	33.86	6.82	31.82	47.17	54	-6.83
4880	48.73	PK	V	33.86	6.82	31.82	57.59	74	-16.41
4880	48.06	PK	H	33.86	6.82	31.82	56.92	74	-17.08
17811	24.49	AV	V	45.15	11.18	32.41	48.41	54	-5.59
17811	24.15	AV	H	45.15	11.18	32.41	48.07	54	-5.93
17811	41.33	PK	V	45.15	11.18	32.41	65.25	74	-8.75
17811	40.94	PK	H	45.15	11.18	32.41	64.86	74	-9.14

High Channel (2480 MHz)

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)
4960	38.76	AV	V	33.9	6.76	31.92	47.5	54	-6.5
4960	38.44	AV	H	33.9	6.76	31.92	47.18	54	-6.82
4960	48.68	PK	V	33.9	6.76	31.92	57.42	74	-16.58
4960	48.2	PK	H	33.9	6.76	31.92	56.94	74	-17.06
17802	25.11	AV	V	45.22	11.35	32.38	49.3	54	-4.7
17802	24.73	AV	H	45.22	11.35	32.38	48.92	54	-5.08
17802	41.55	PK	V	45.22	11.35	32.38	65.74	74	-8.26
17802	40.91	PK	H	45.22	11.35	32.38	65.1	74	-8.9

Note:

*1, The testing has been conformed to 10*2480MHz=24,800MHz*
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.

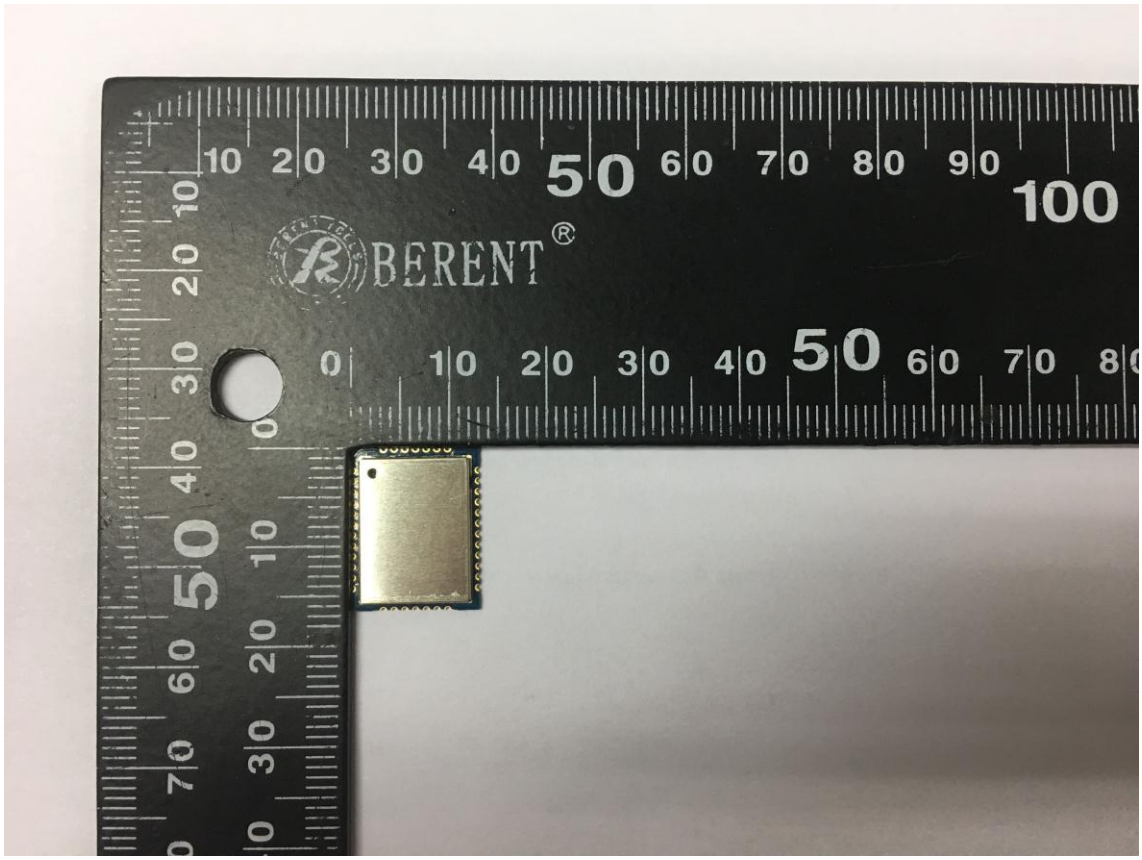
Annex A. TEST INSTRUMENT

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	03/24/2016	03/23/2017	☑
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	☑

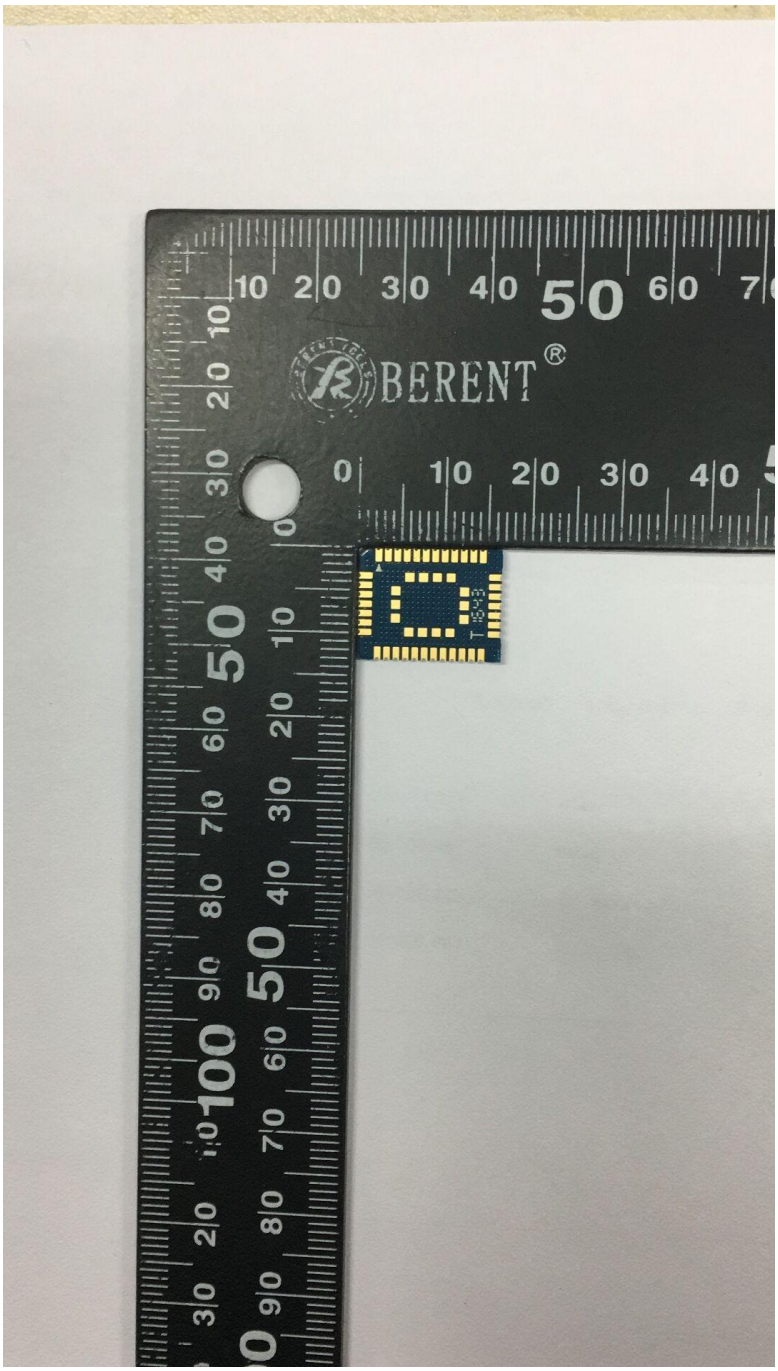
Annex B. EUT And Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

EUT - Front View

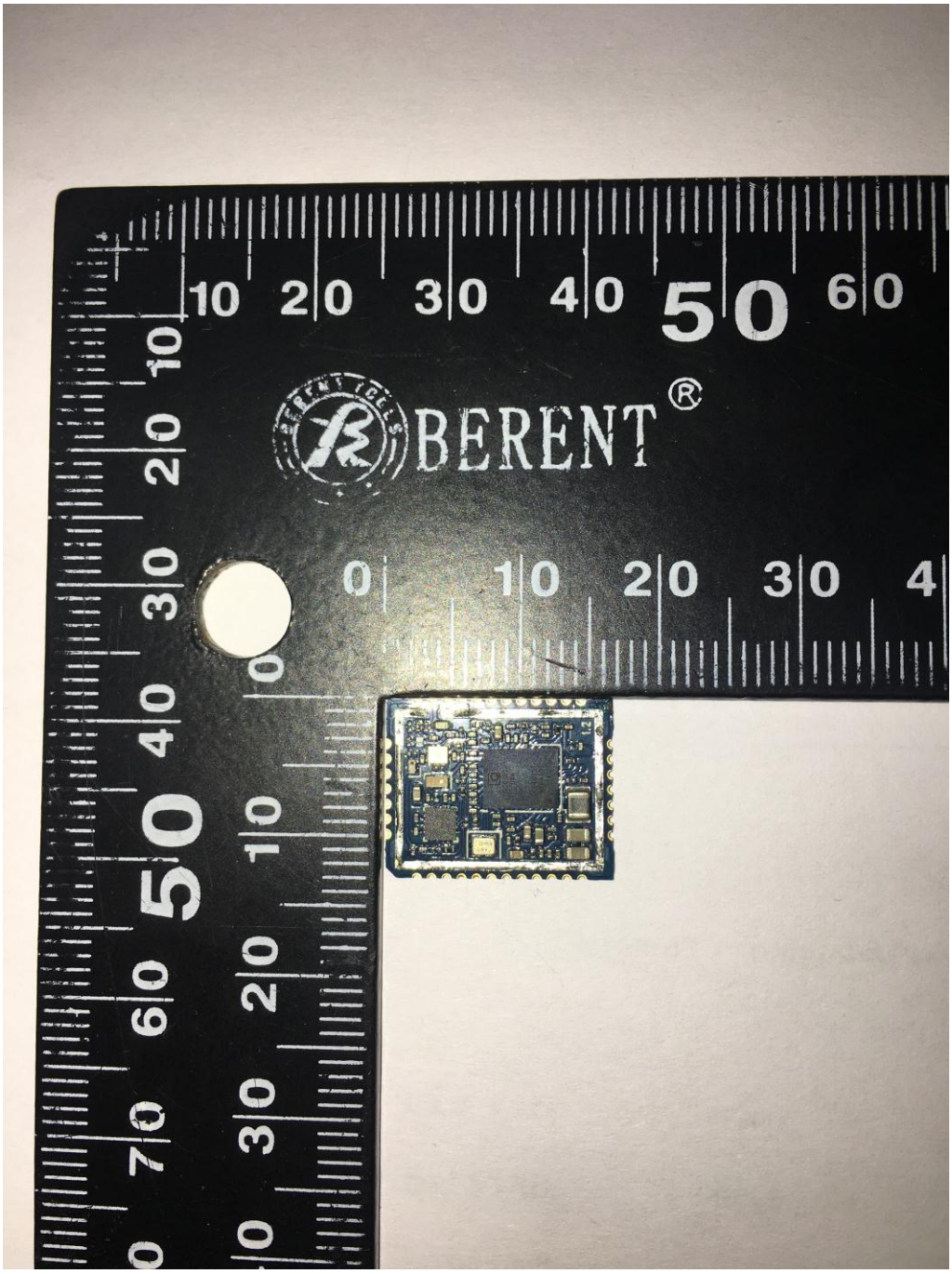


EUT - Rear View

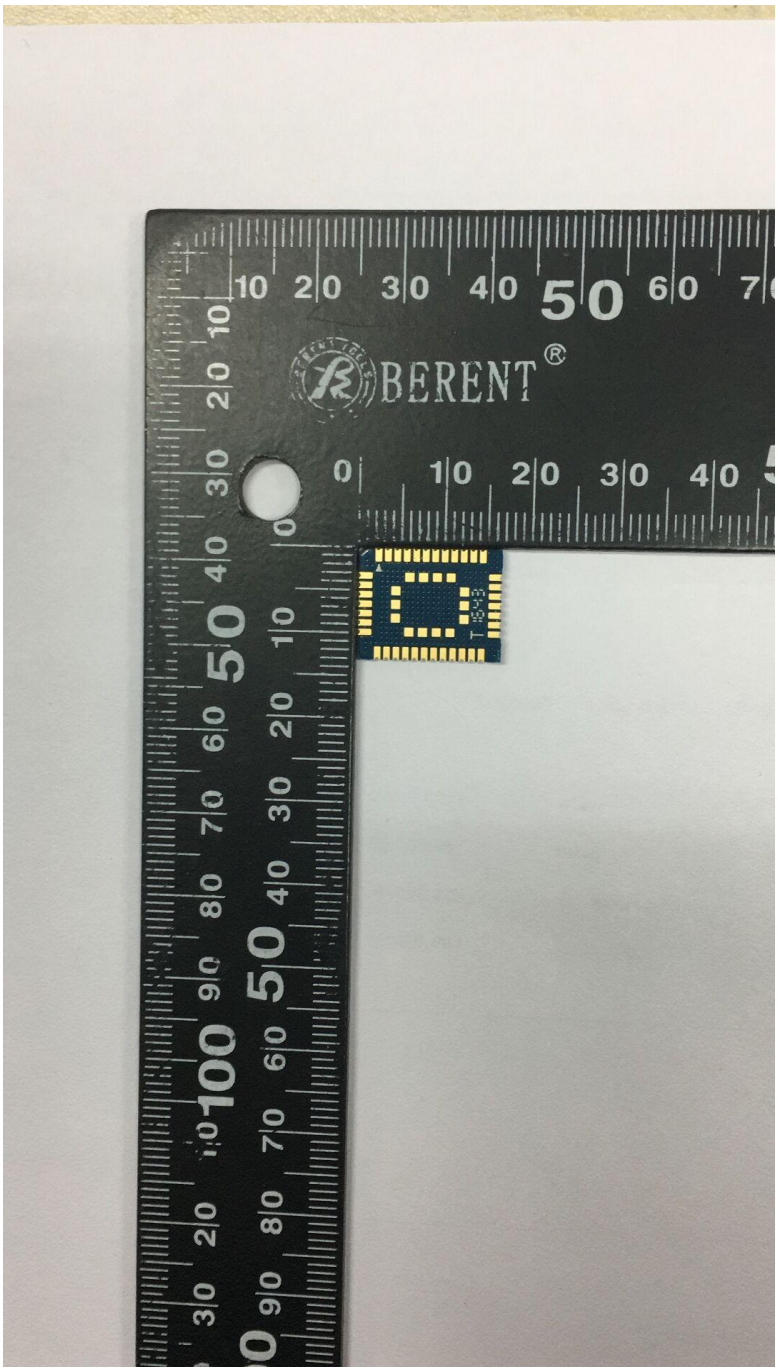


Annex B.ii. Photograph: EUT Internal Photo

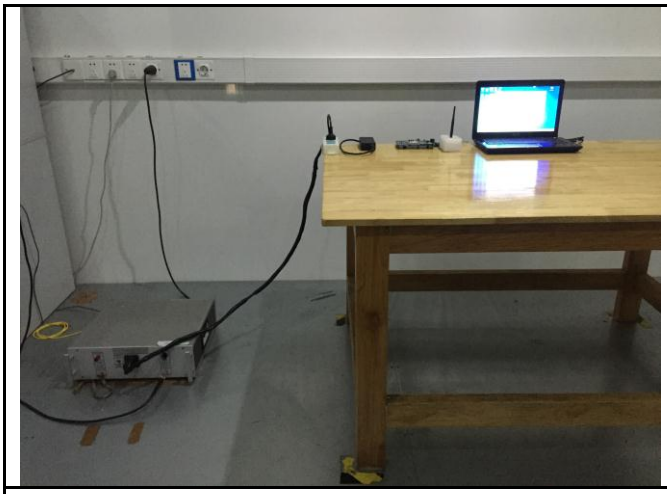
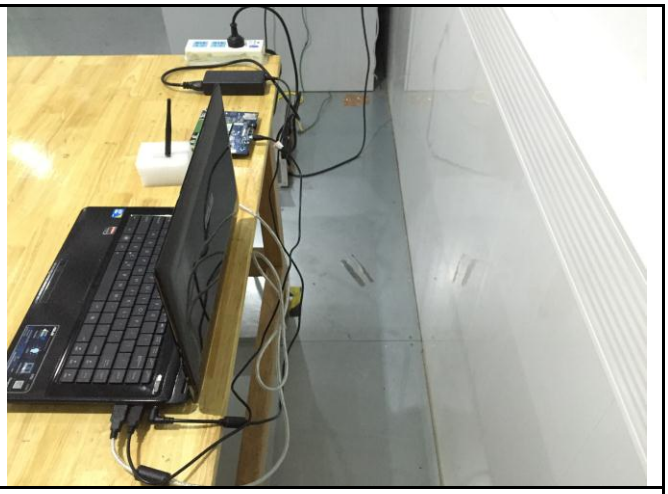
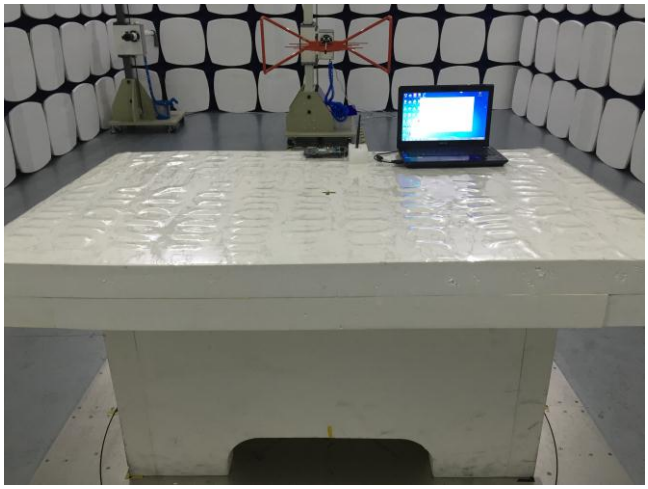
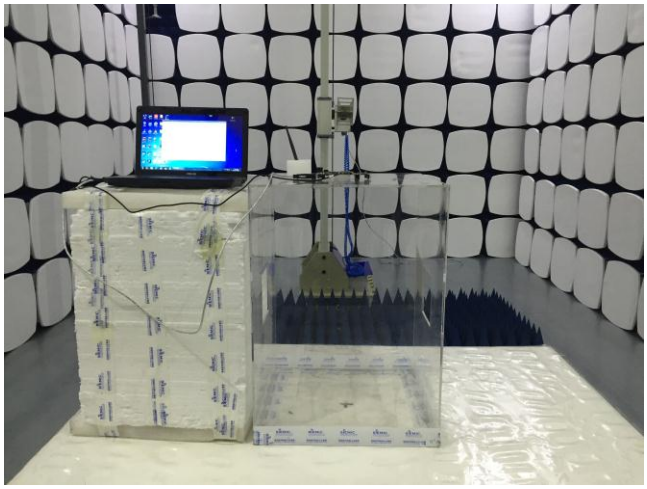
EUT- without Shielding – Front View



EUT - Rear View



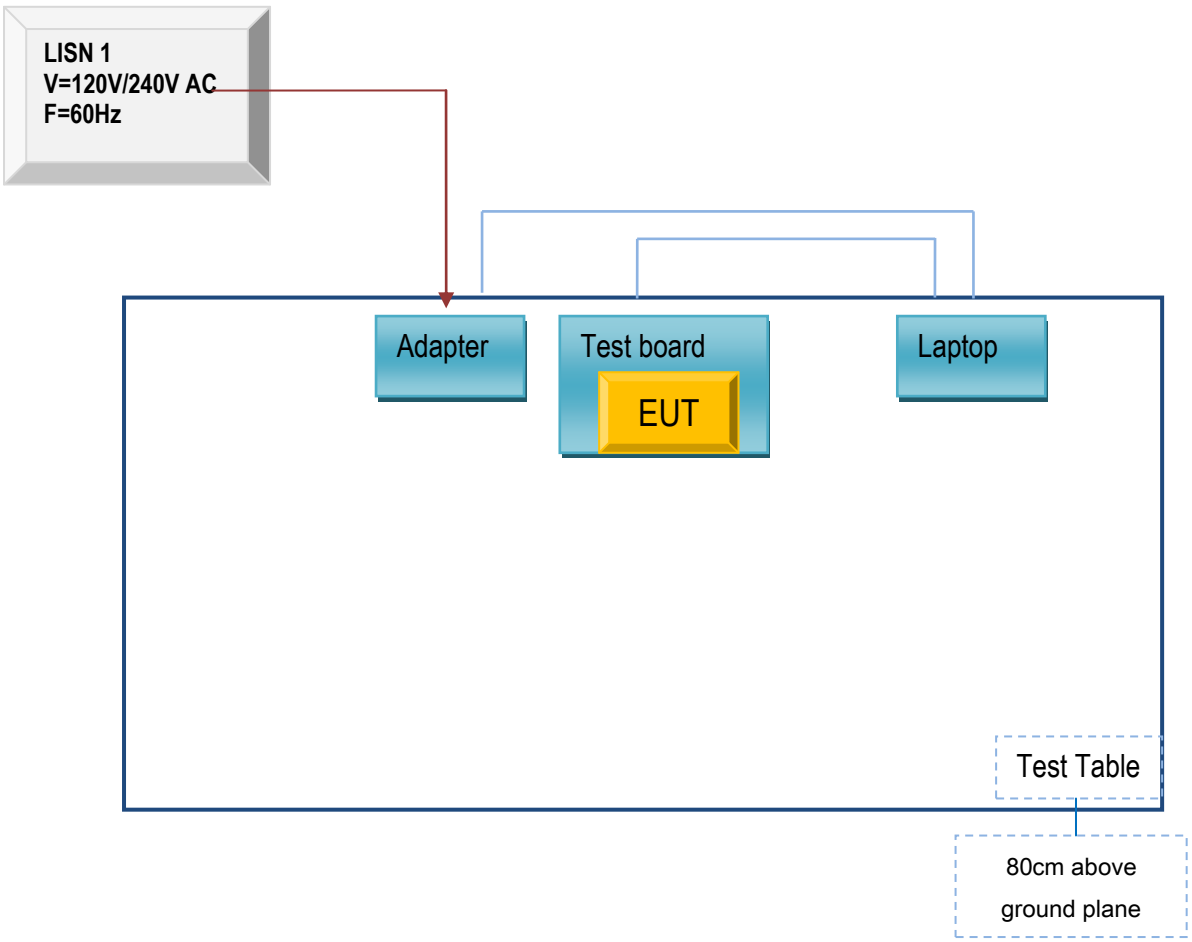
Annex B.iii. Photograph: Test Setup Photo

	
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

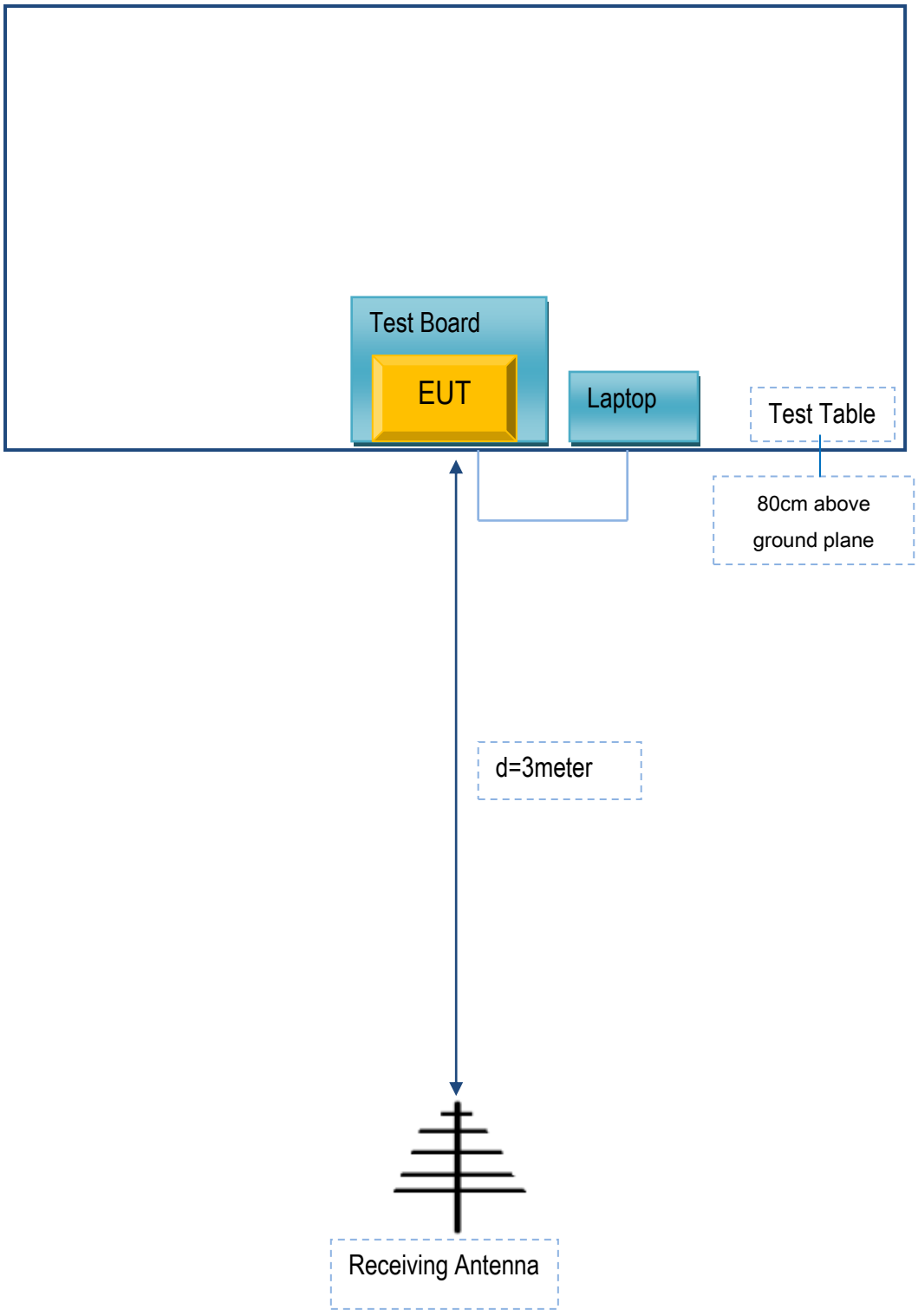
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

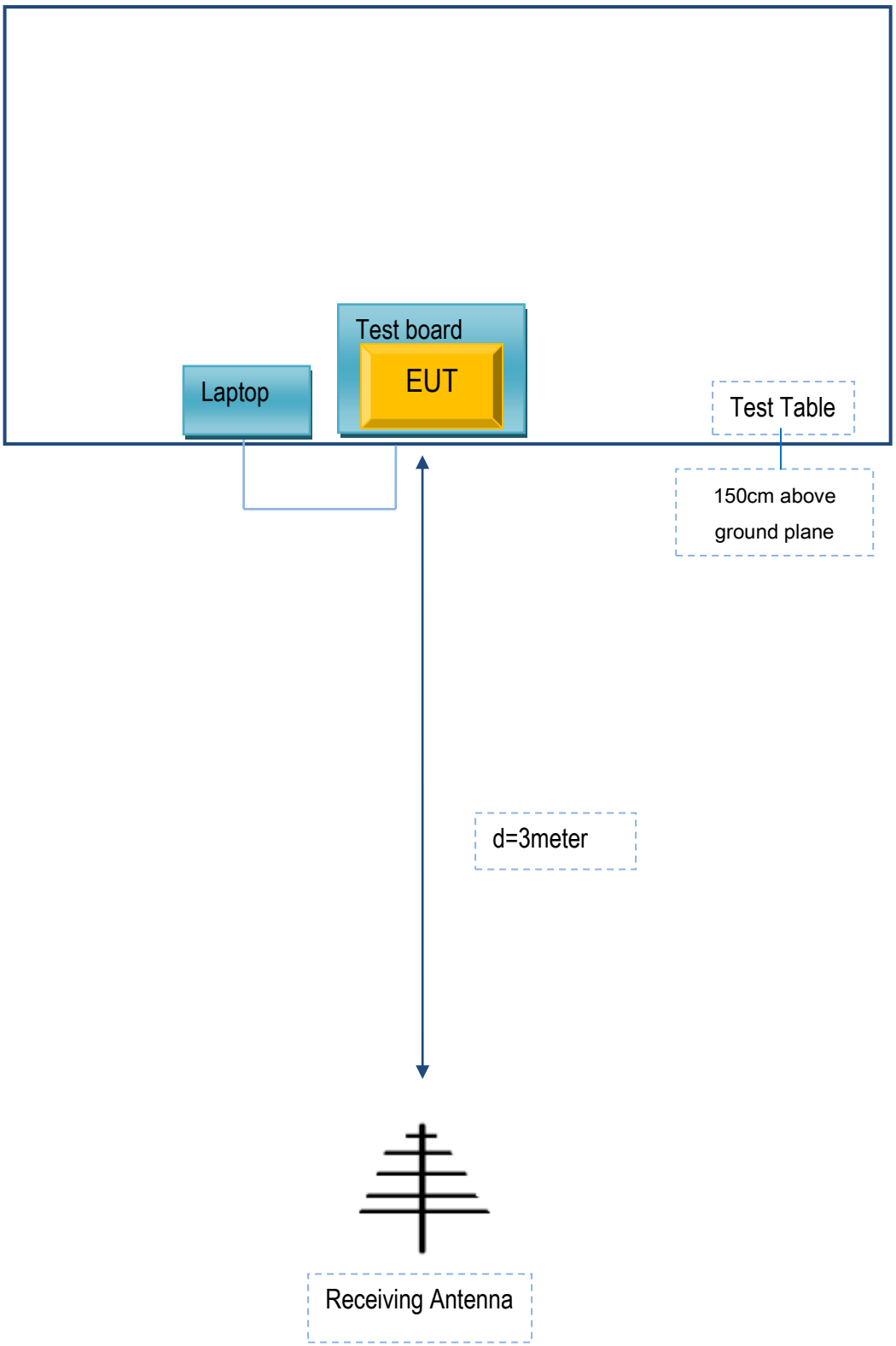
Block Configuration Diagram for AC Line Conducted Emissions



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
Lenovo	Laptop	E40	LR-1EHRX
Quectel Wireless Solutions Co., Ltd.	Test Board	Q1-A0770	MP87108N1000974

Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
Power Cable	Un-shielding	No	0.8m	GT211032
USB Cable	Un-shielding	No	1m	MP87108N1000974

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

Please see the attachment

Annex E. DECLARATION OF SIMILARITY

N/A