RF TEST REPORT

Report No.: 18070600-FCC-R

Supersede Report No.: N/A

Applicant	Polygroup Trading Limited
Product Name	Controller
Model No.	TBC001-24V
Serial No.	N/A
Test Standard	FCC Part 15.247, ANSI C63.10: 2013
Test Date	June 12 to 14, 2018
Issue Date	June 15, 2018
Test Result	☑ Pass ☐ Fail
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Aaron Liang	David Huang	
Aaron Liang Test Engineer	David Huang Checked By	

This test report may be reproduced in full only

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

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

Zone A, Floor 1, Building 2 Wan Ye Long Technology Park

South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108

Phone: +86 0755 2601 4629801 Email: China@siemic.com.cn

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

This page has been left blank intentionally.

CONTENTS

1. Report Revision History

Report No.	Report Version	Description	Issue Date
18070600-FCC-R	NONE	Original	June 15, 2018

2. Customer information

Applicant Name	Polygroup Trading Limited
Applicant Add	Unit 606, Fairmont House, 8 Cotton Tree Drive, Central, Hong Kong
Manufacturer	Polygroup Trading Limited
Manufacturer Add	Unit 606, Fairmont House, 8 Cotton Tree Drive, Central, Hong Kong

3. Test site information

Test Lab A:

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.	535293
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

Test Lab B:

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Address	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	694825
IC Test Site No.	4842B-1
Test Software	EZ_EMC(ver.Icp-03A1)

Note: We just perform Radiated Spurious Emission above 18GHz in the test Lab. B.

4. Equipment under Test (EUT) Information

Description of EUT:	Controller
Main Model:	TBC001-24V
Serial Model:	N/A
Date EUT received:	June 11, 2018
Test Date(s):	June 12 to 14, 2018
Equipment Category：	DTS
Antenna Gain:	WIFI: 2.5dBi
Antenna Type:	PCB Antenna
Type of Modulation:	802.11b/g/n: DSSS, OFDM
RF Operating Frequency (ies):	WIFI: 802.11b/g/n(20M): 2412-2462 MHz
Max. AV Output Power:	802.11b: 2.187dBm 802.11g: 1.483dBm 802.11n(20M): 1.141dBm
Max. PK Output Power:	802.11b: 3.69dBm 802.11g: 3.47dBm 802.11n(20M): 3.15dBm
Number of Channels:	WIFI :802.11b/g/n(20M): 11CH
Port:	Please refer to the user manual
Input Power:	Adapter: Model:TS-48W24V Input:120Vac, 0.83A Output:24Vdc, 2000mA

Trade Name : N/A

FCC ID: 2APJZ-TW180427

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&20 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

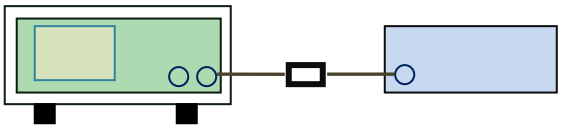
The EUT has 1 antenna:
A permanently attached PCB antenna for WIFI, the gain is 2.5dBi for WIFI.

The antenna meets up with the ANTENNA REQUIREMENT.

Result: Compliance.

6.2 DTS (6 dB&20 dB) Channel Bandwidth

Temperature	24℃
Relative Humidity	54%
Atmospheric Pressure	1017mbar
Test date :	June 14, 2018
Tested By :	Aaron Liang

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 bandwidth a) Set RBW = 100 kHz. b) Set the video bandwidth (VBW) ≥ 3 × RBW. c) Detector = Peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the freq uencies associated with the two outermost amplitude points (upper and lower fr equencies) that are attenuated by 6 dB relative to the maximum level measure d in the fundamental emission. 20dB bandwidth C63.10 Occupied Bandwidth (OBW=20dB bandwidth) 1. Set RBW = 1%-5% OBW. 2. Set the video bandwidth (VBW) ≥ 3 x RBW. 3. Set the span range between 2 times and 5 times of the OBW. 4. Sweep time=Auto, Detector=PK, Trace=Max hold. 5. Once the reference level is established, the equipment is conditioned with t ypical modulating signals to produce the worst-		

	case (i.e., the widest) bandwidth. Unless otherwise specified for an unlicensed wireless device, measure the bandwidth at the 20 dB levels with respect to the reference level.
Remark	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Measurement result

Test mode	CH	Freq (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	9.08	≥ 0.5
	Mid	2437	8.09	≥ 0.5
	High	2462	9.06	≥ 0.5
802.11g	Low	2412	16.36	≥ 0.5
	Mid	2437	16.36	≥ 0.5
	High	2462	16.36	≥ 0.5
802.11n (20M)	Low	2412	17.31	≥ 0.5
	Mid	2437	17.55	≥ 0.5
	High	2462	17.32	≥ 0.5

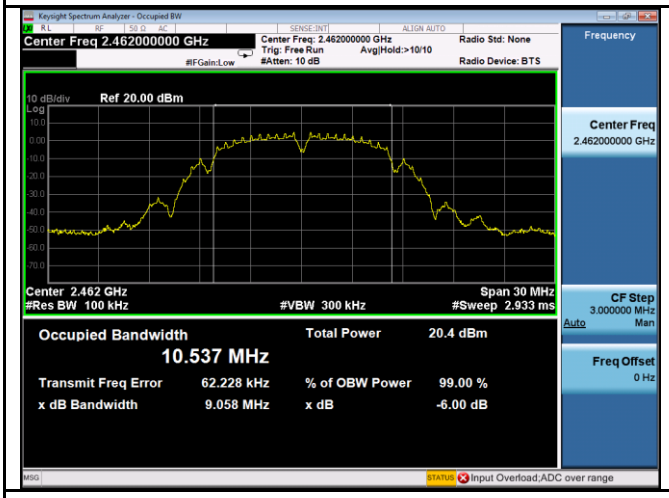
Test mode	CH	Freq (MHz)	20dB Bandwidth (MHz)
802.11b	Low	2412	13.09
	Mid	2437	13.06
	High	2462	13.08
802.11g	Low	2412	17.48
	Mid	2437	17.48
	High	2462	17.46
802.11n (20M)	Low	2412	18.58
	Mid	2437	18.58
	High	2462	18.58

Test Plots

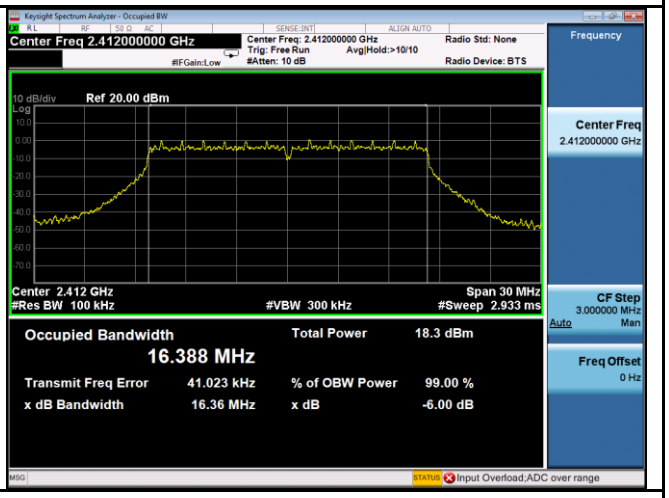
6dB Bandwidth measurement result

802.11b 6dB Bandwidth - Low CH 2412

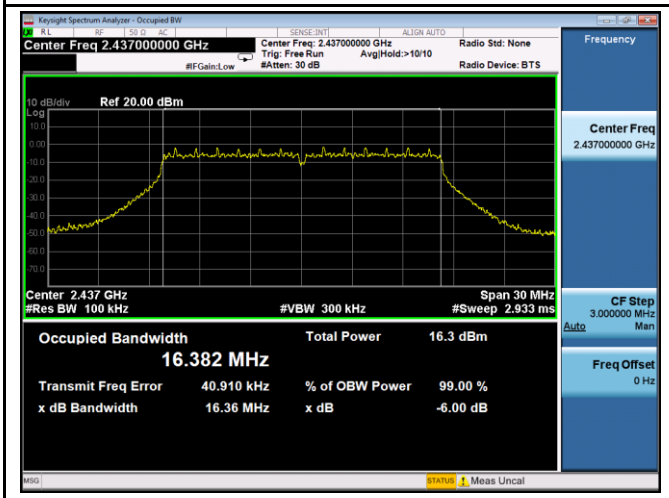
802.11b 6dB Bandwidth - Mid CH 2437



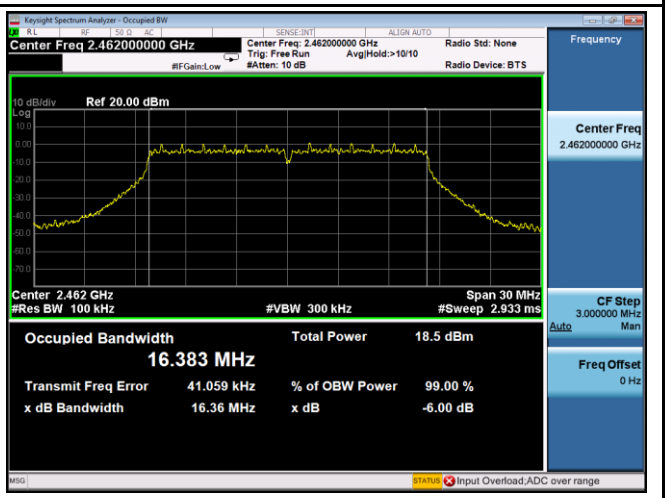
802.11b 6dB Bandwidth - High CH 2462



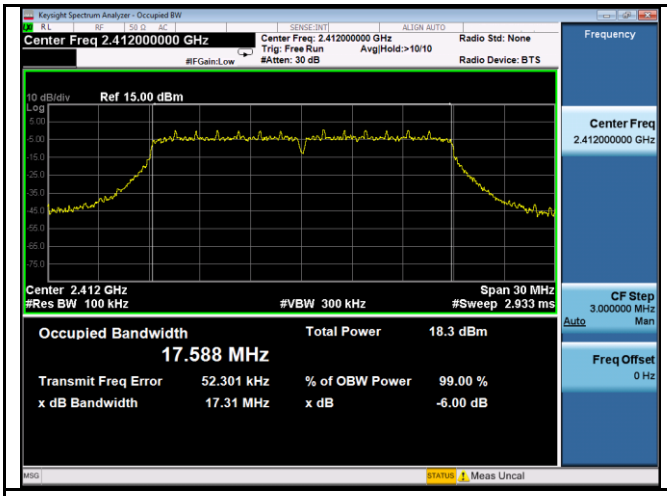
802.11g 6dB Bandwidth - Low CH 2412



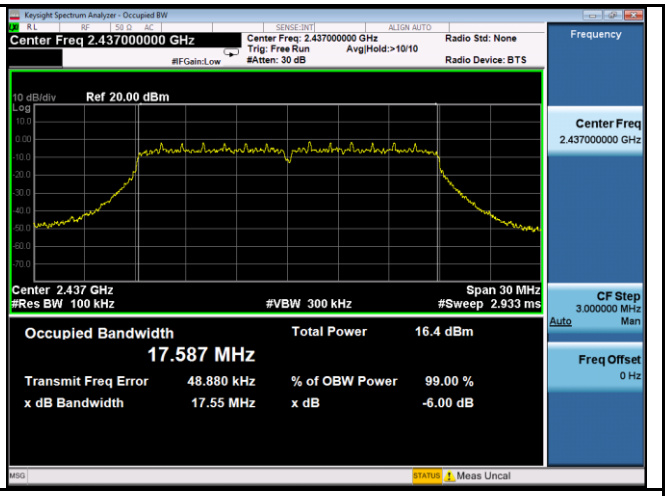
802.11g 6dB Bandwidth - Mid CH 2437



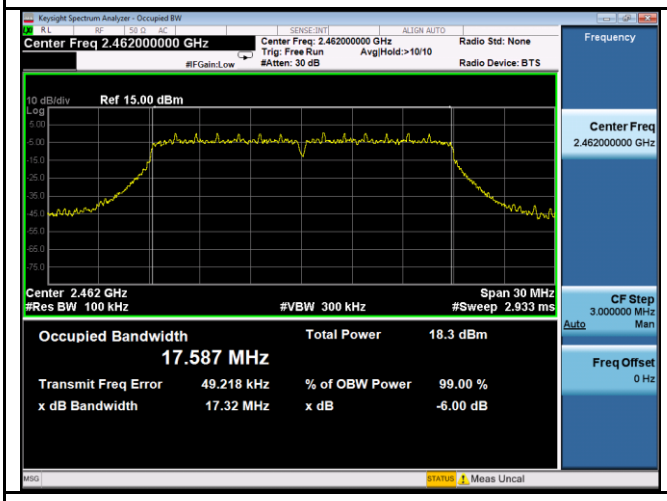
802.11g 6dB Bandwidth - High CH 2462



802.11n20 6dB Bandwidth - Low CH 2412



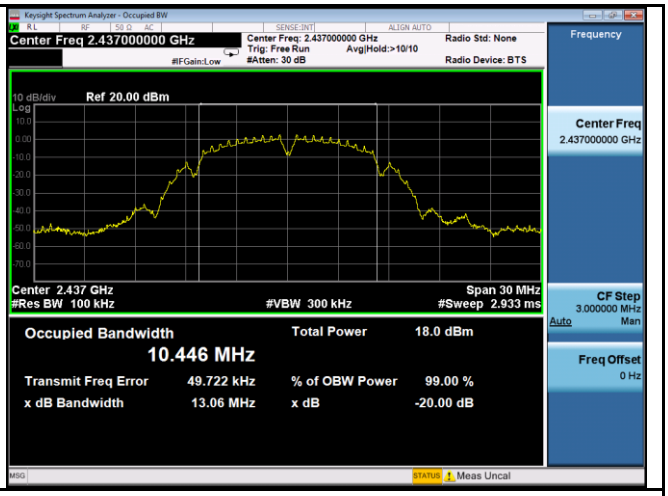
802.11n20 6dB Bandwidth - Mid CH 2437



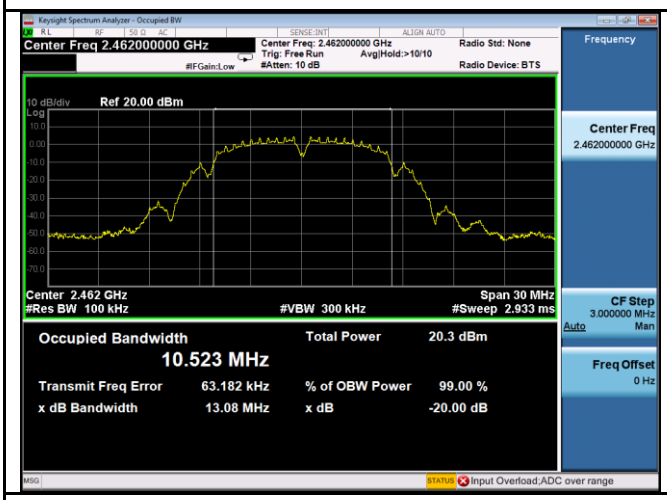
802.11n20 6dB Bandwidth - High CH 2462

20 dB Bandwidth measurement result

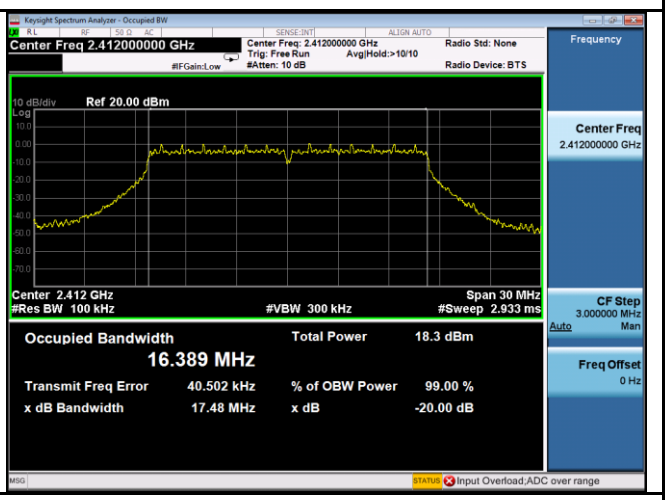
802.11b 20dB Bandwidth - Low CH 2412



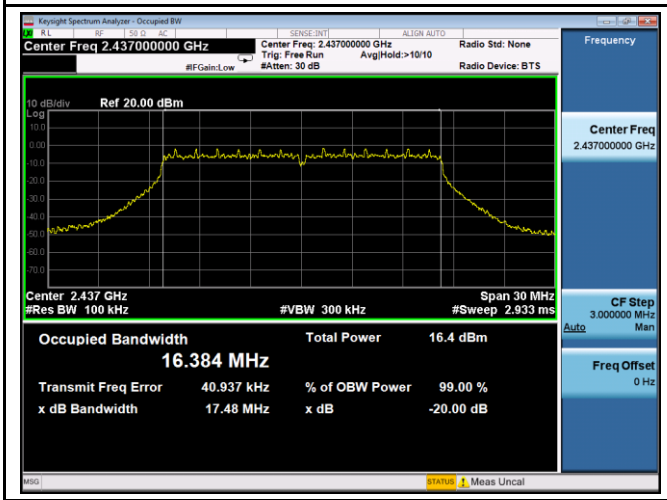
802.11b 20dB Bandwidth - Mid CH 2437



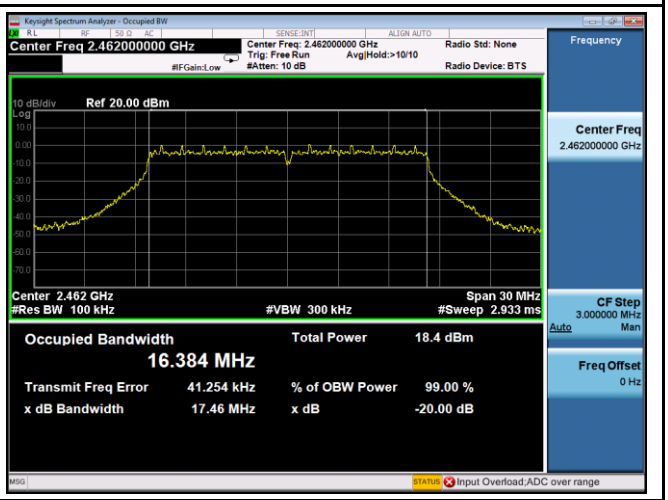
802.11b 20dB Bandwidth - High CH 2462



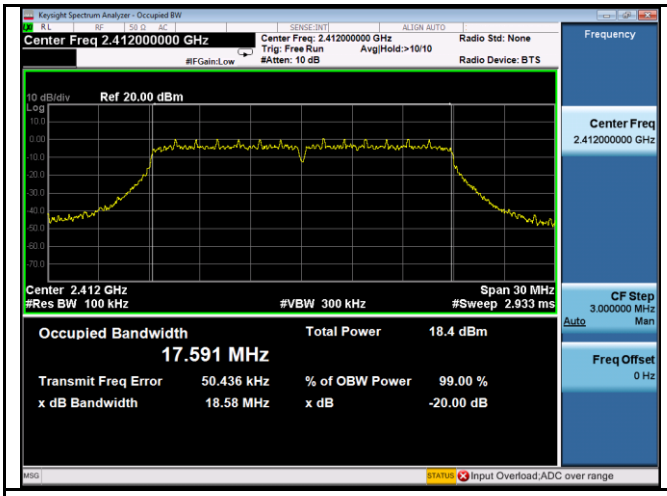
802.11g 20dB Bandwidth - Low CH 2412



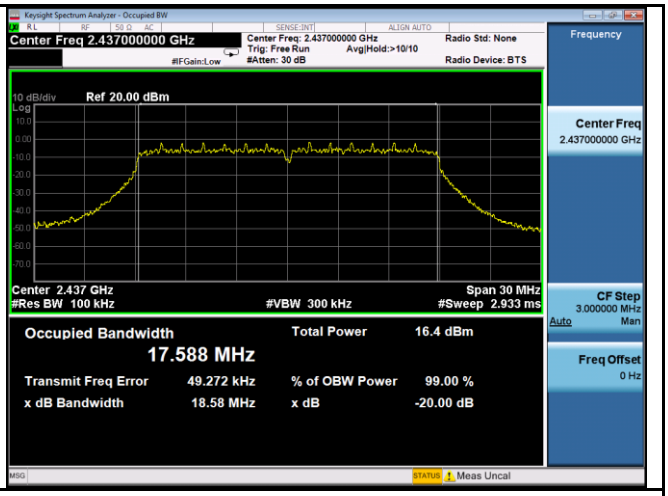
802.11g 20dB Bandwidth - Mid CH 2437



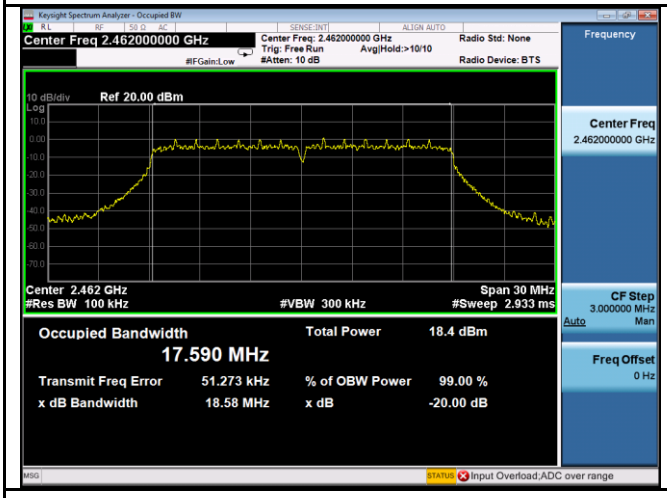
802.11g 20dB Bandwidth - High CH 2462



802.11n20 20dB Bandwidth - Low CH 2412



802.11n20 20dB Bandwidth - Mid CH 2437

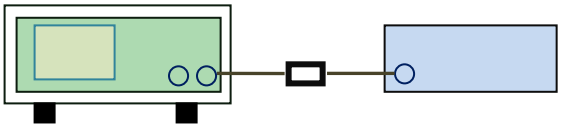


802.11n20 20dB Bandwidth - High CH 2462

6.3 Maximum Output Power

Temperature	24℃
Relative Humidity	54%
Atmospheric Pressure	1017mbar
Test date :	June 14, 2018
Tested By :	Aaron Liang

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 span to at least 1.5 times the OBW. - b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz. - c) Set VBW ≥ 3 x RBW. - d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) - e) Sweep time = auto. - f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode. - g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum		

	power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to " free run" . - h) Trace average at least 100 traces in power averaging (i.e., RMS) mode. - i) Compute power by integrating the spectrum across the OBW of the signal using the instrument' s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
Remark	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

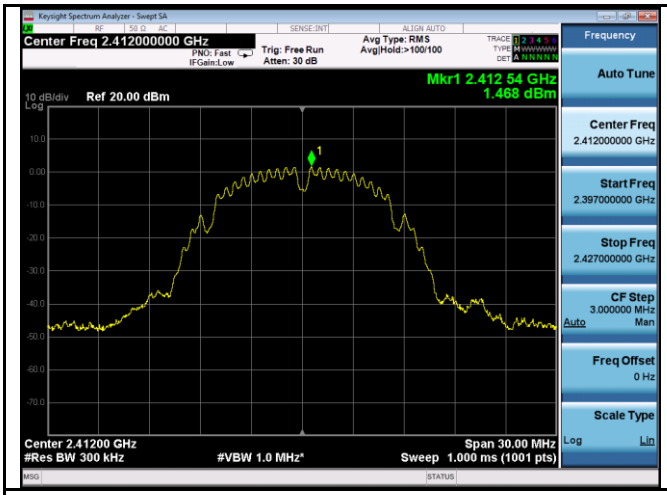
Test Plot ☑ Yes (See below) ☐ N/A

Output Power measurement result

Type	Test mode	CH	Frequency (MHz)	AV Output power (dBm)	PK Output power (dBm)	Limit (dBm)	Result
Output power	802.11b	Low	2412	1.468	3.69	30	Pass
		Mid	2437	1.744	3.34	30	Pass
		High	2462	2.187	3.46	30	Pass
	802.11g	Low	2412	1.147	2.85	30	Pass
		Mid	2437	1.483	2.95	30	Pass
		High	2462	1.064	3.47	30	Pass
	802.11n (20M)	Low	2412	1.141	3.15	30	Pass
		Mid	2437	1.136	2.89	30	Pass
		High	2462	0.895	3.14	30	Pass

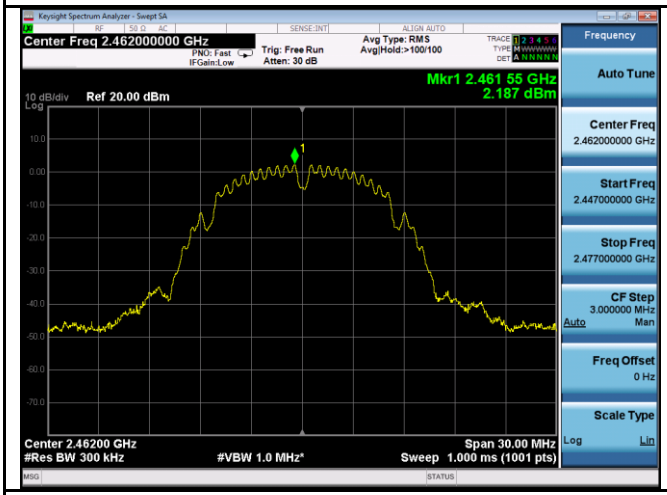
Test Plots

The Average Power

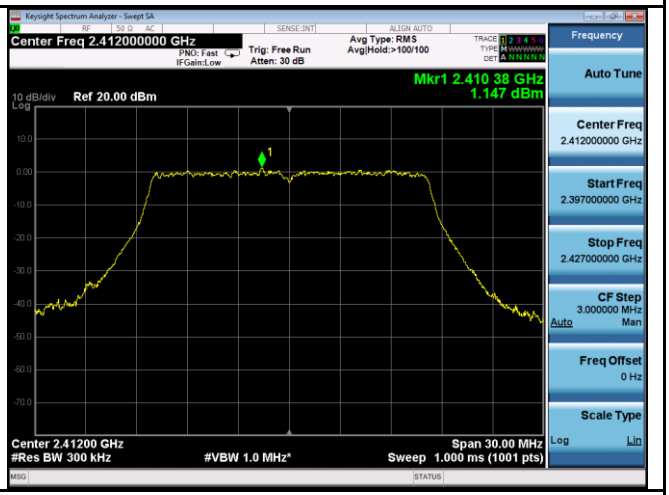


802.11b - AV Output power - Low CH 2412

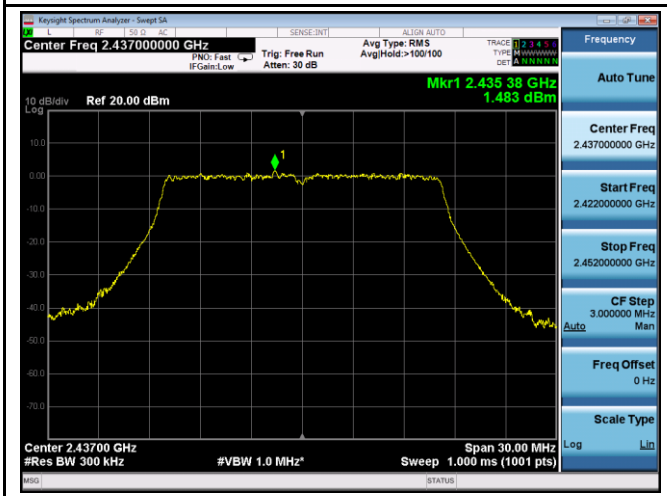
802.11b - AV Output power - Mid CH 2437



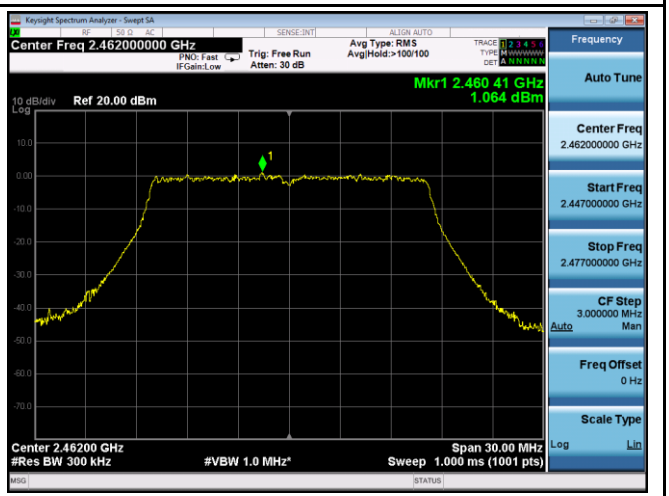
802.11b - AV Output power - High CH 2462



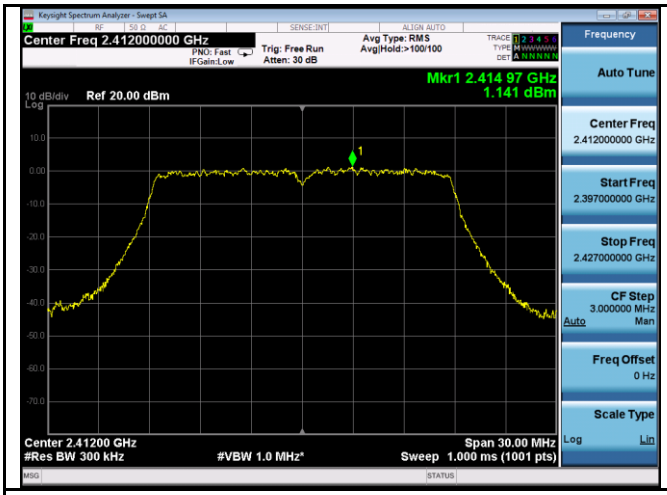
802.11g - AV Output power - Low CH 2412



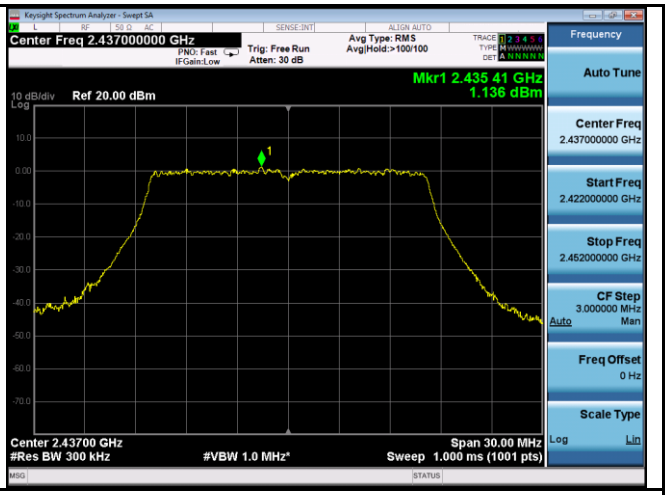
802.11g - AV Output power - Mid CH 2437



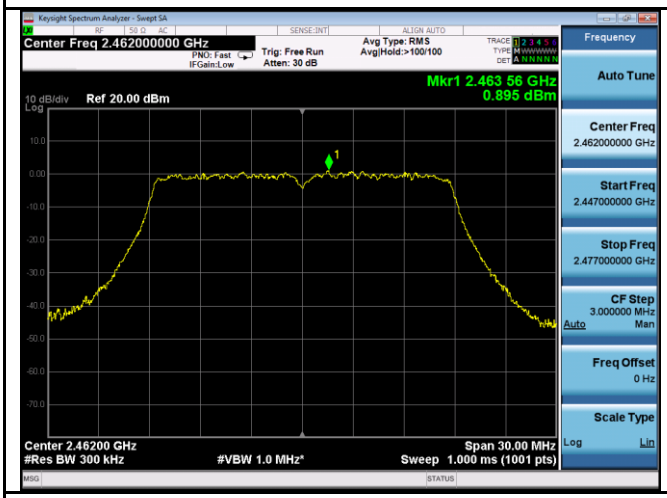
802.11g - AV Output power - High CH 2462



802.11n20 - AV Output power - Low CH 2412

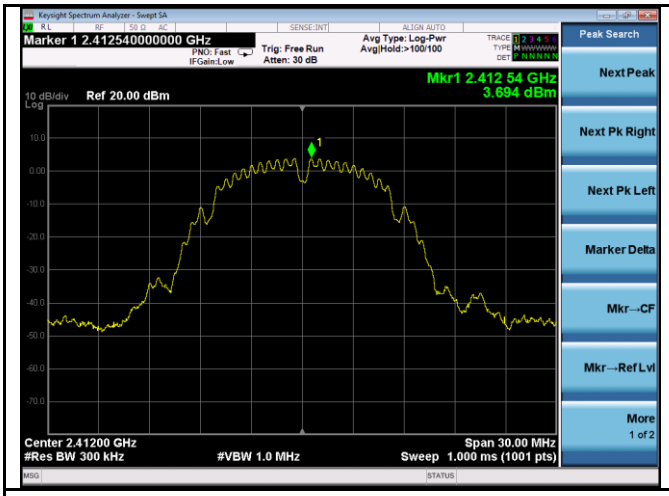


802.11n20 - AV Output power - Mid CH 2437

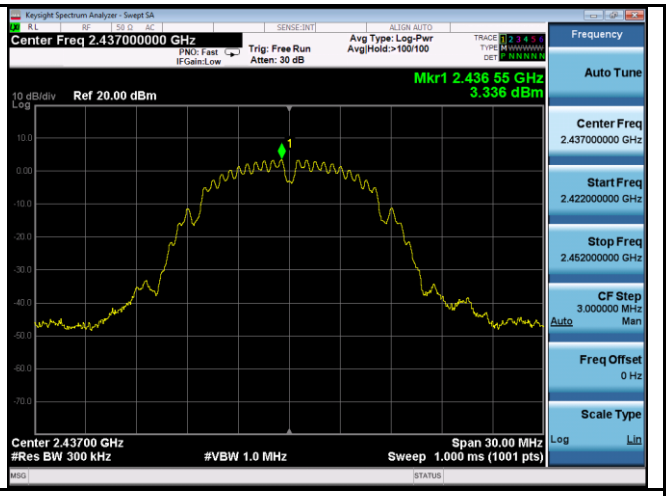


802.11n20 - AV Output power - High CH 2462

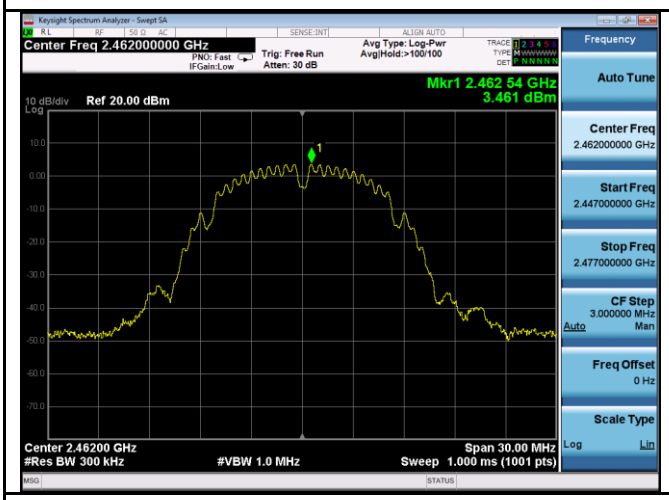
The Peak Power



802.11b - PK Output power - Low CH 2412

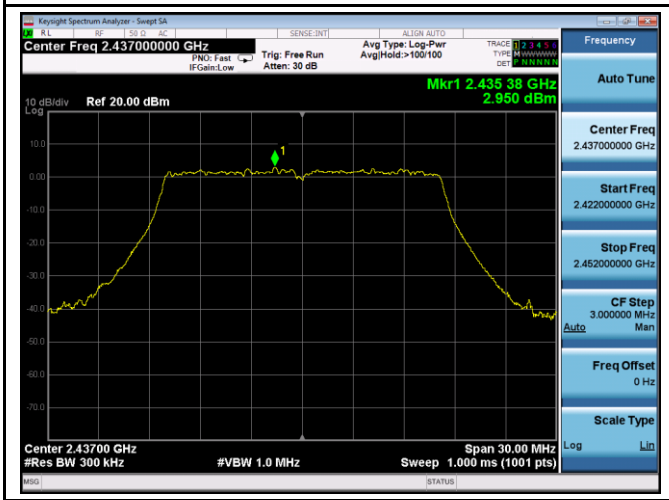


802.11b - PK Output power - Mid CH 2437



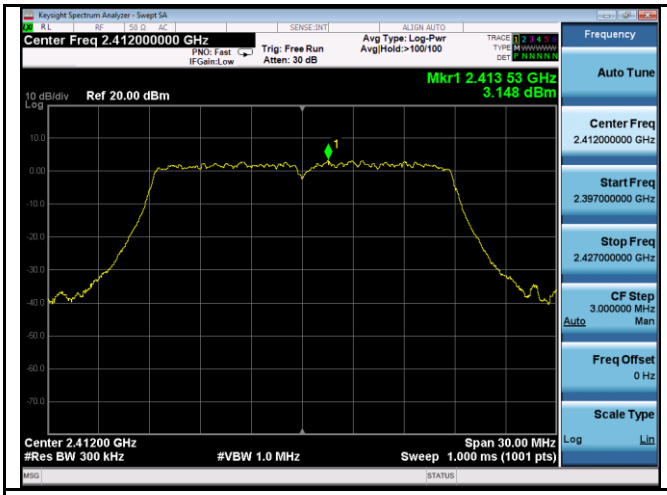
802.11b - PK Output power - High CH 2462

802.11g – PK Output power - Low CH 2412

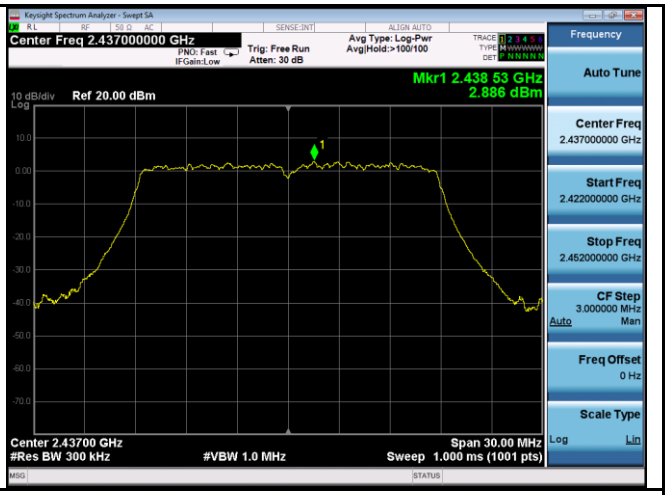


802.11g - PK Output power - Mid CH 2437

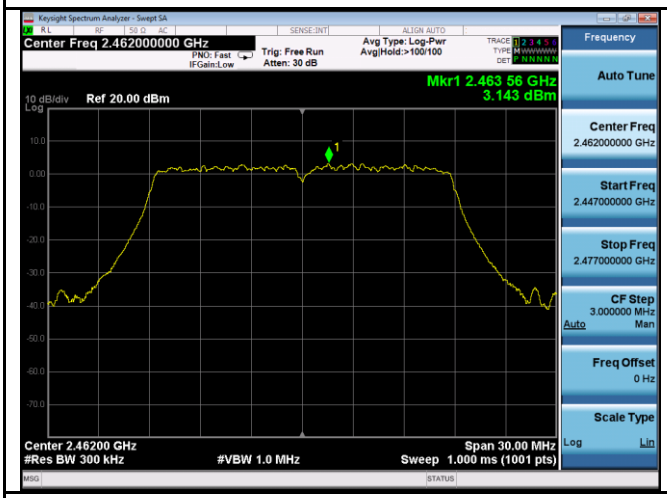
802.11g - PK Output power - High CH 2462



802.11n20 - PK Output power - Low CH 2412



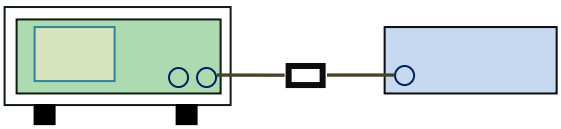
802.11n20 - PK Output power - Mid CH 2437



802.11n20 - PK Output power - High CH 2462

6.4 Power Spectral Density

Temperature	24℃
Relative Humidity	54%
Atmospheric Pressure	1017mbar
Test date :	June 14, 2018
Tested By :	Aaron Liang

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			
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

Type	Test mode	CH	Freq (MHz)	PSD (dBm)	Limit (dBm)	Result
PSD	802.11b	Low	2412	-7.181	8	Pass
		Mid	2437	-11.415	8	Pass
		High	2462	-6.369	8	Pass
	802.11g	Low	2412	-10.107	8	Pass
		Mid	2437	-10.725	8	Pass
		High	2462	-9.231	8	Pass
	802.11n (20M)	Low	2412	-9.697	8	Pass
		Mid	2437	-9.940	8	Pass
		High	2462	-10.024	8	Pass

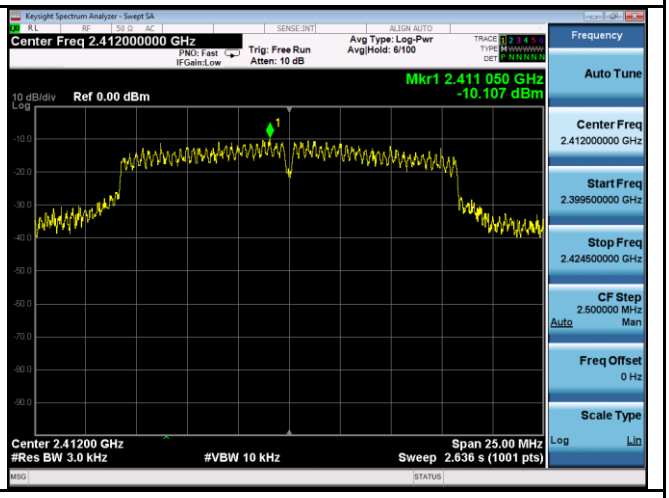
Test Plots

Power Spectral Density measurement result

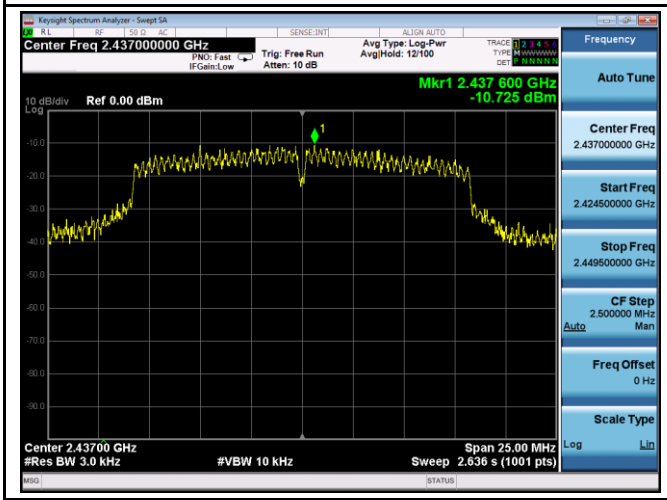
PSD - Low CH 2412 - 802.11b

PSD - Mid CH 2437 – 802.11b

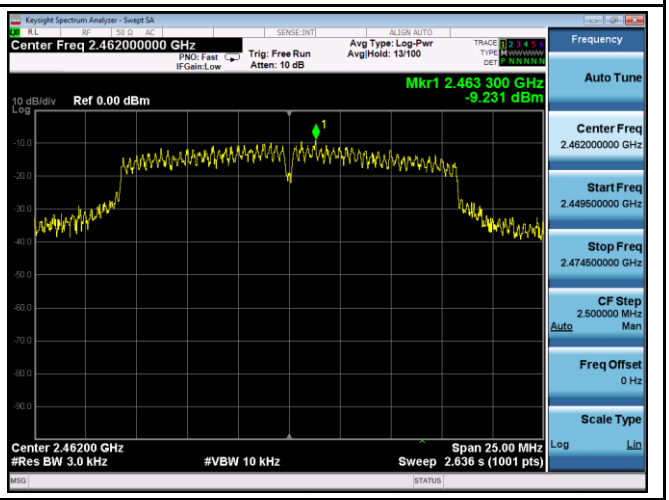
PSD - High CH 2462 - 802.11b



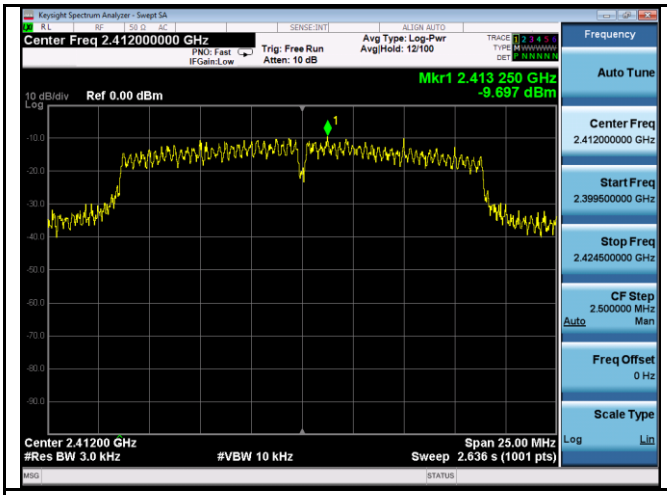
PSD - Low CH 2412 -802.11g



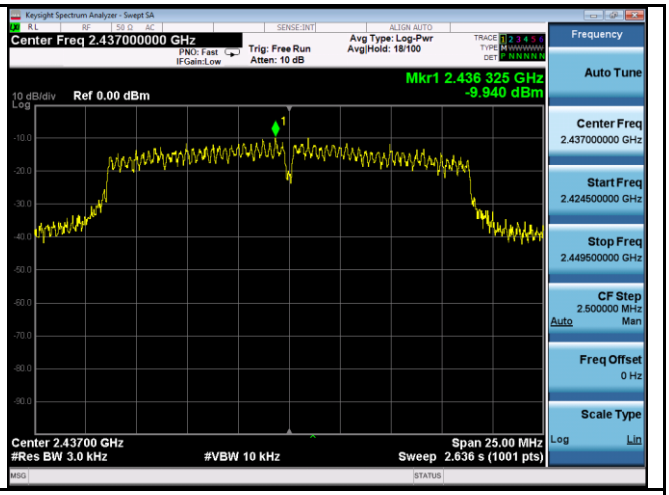
PSD - Mid CH 2437 – 802.11g



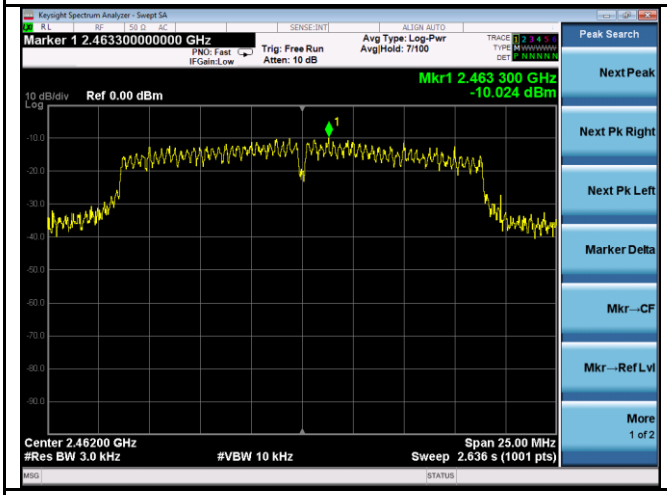
PSD - High CH 2462 - 802.11g



PSD - Low CH 2412 - 802.11n20



PSD - Mid CH 2437 – 802.11n20

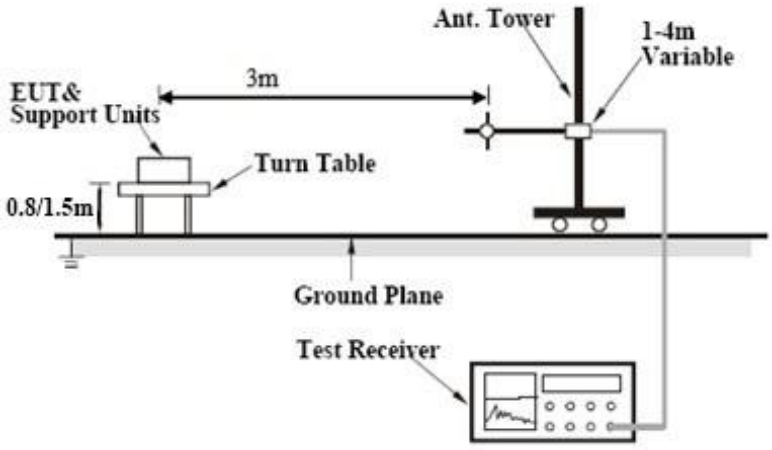


PSD - High CH 2472 - 802.11n20

6.5 Band-Edge & Unwanted Emissions into Restricted Frequency Bands

Temperature	24℃
Relative Humidity	54%
Atmospheric Pressure	1017mbar
Test date :	June 14, 2018
Tested By :	Aaron Liang

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.		

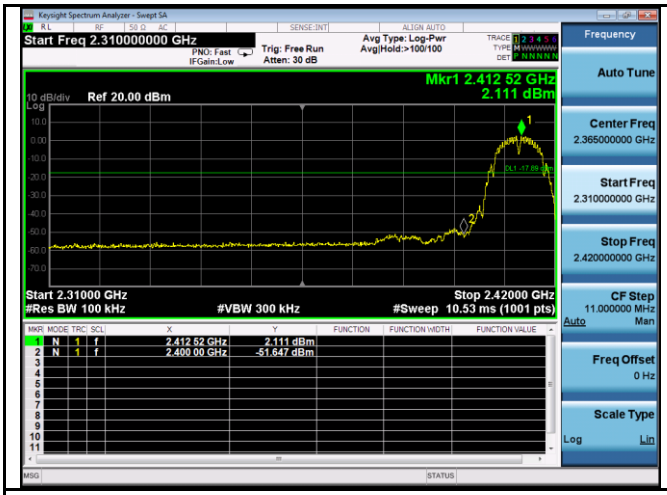
	- 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below: a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 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

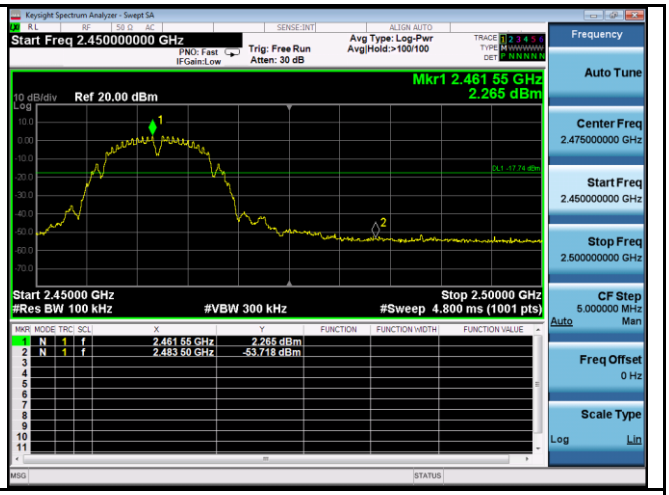
Test Plot ☑ Yes (See below) ☐ N/A

Test Plots

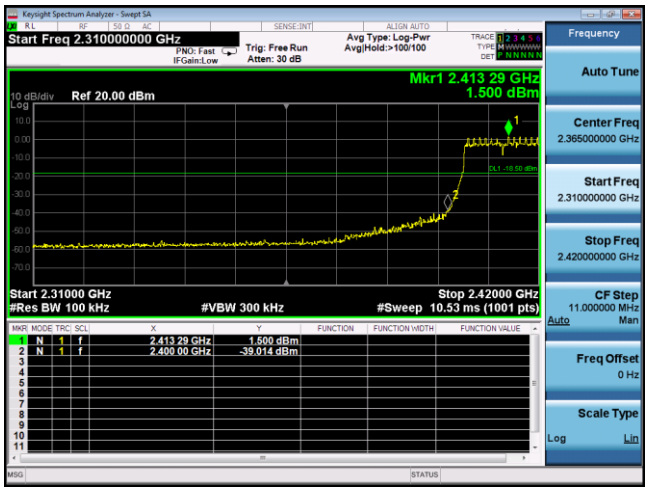
Band Edge measurement result



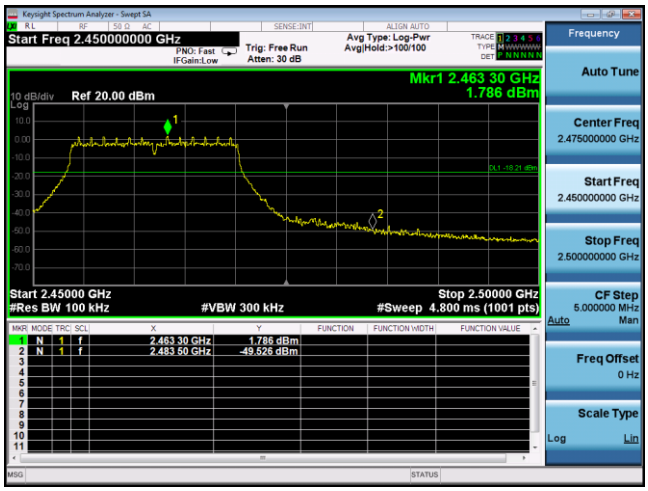
Band Edge, Left Side - 802.11b



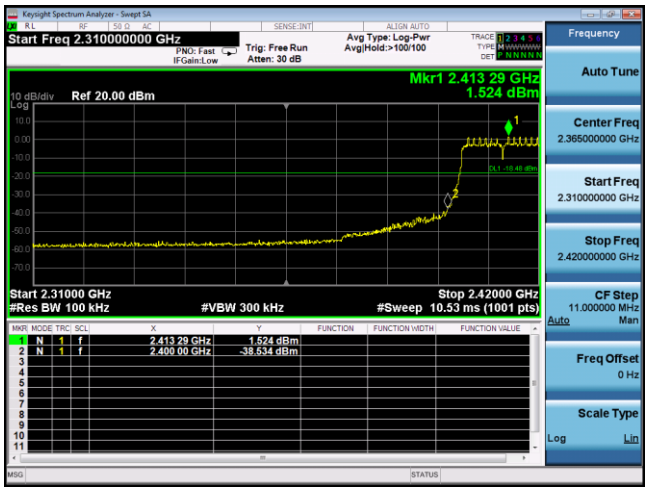
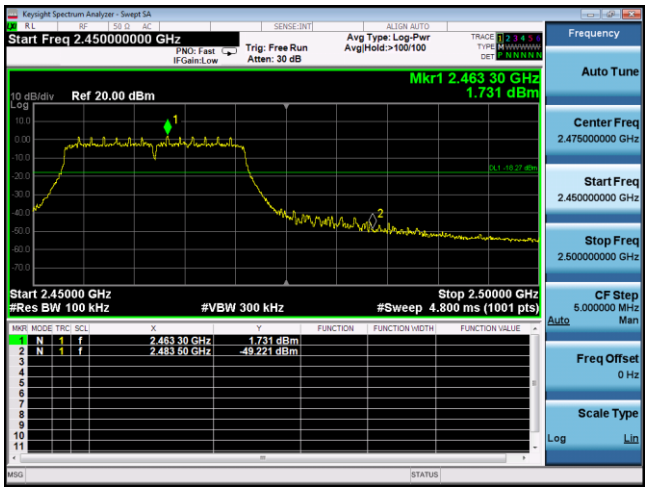
Band Edge, Right Side - 802.11b



Band Edge, Left Side - 802.11g



Band Edge, Right Side - 802.11g

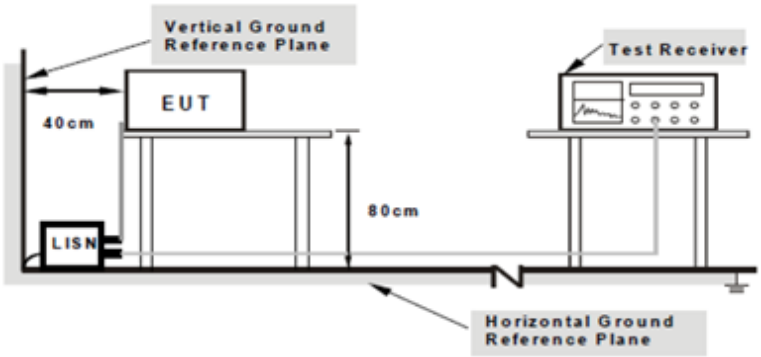
	
Band Edge, Left Side - 802.11n20	Band Edge, Right Side - 802.11n20

Note: Both Horizontal and vertical polarities were investigated

6.6 AC Power Line Conducted Emissions

Temperature	24℃
Relative Humidity	54%
Atmospheric Pressure	1017mbar
Test date :	June 14, 2018
Tested By :	Aaron Liang

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"> 

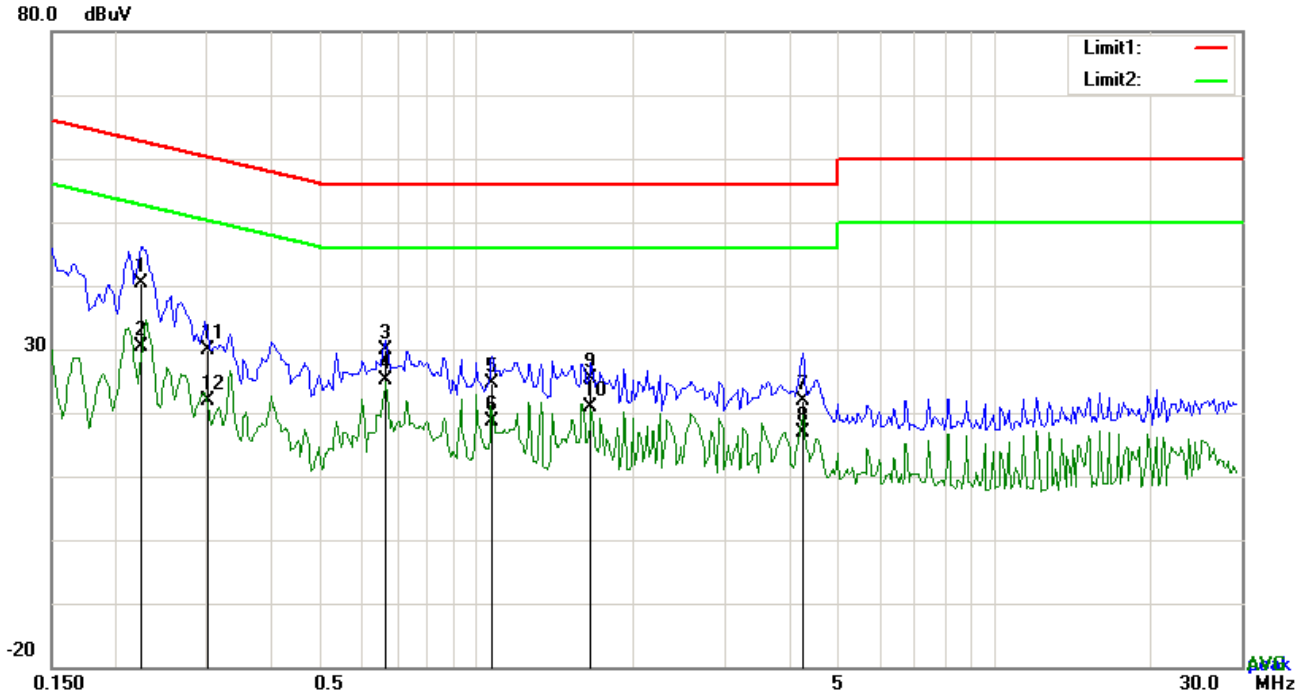
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</td></tr>
<tr><td>Procedure</td><td colspan="3">1. The EUT and supporting equipment were set up in accordance with the requirements of 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

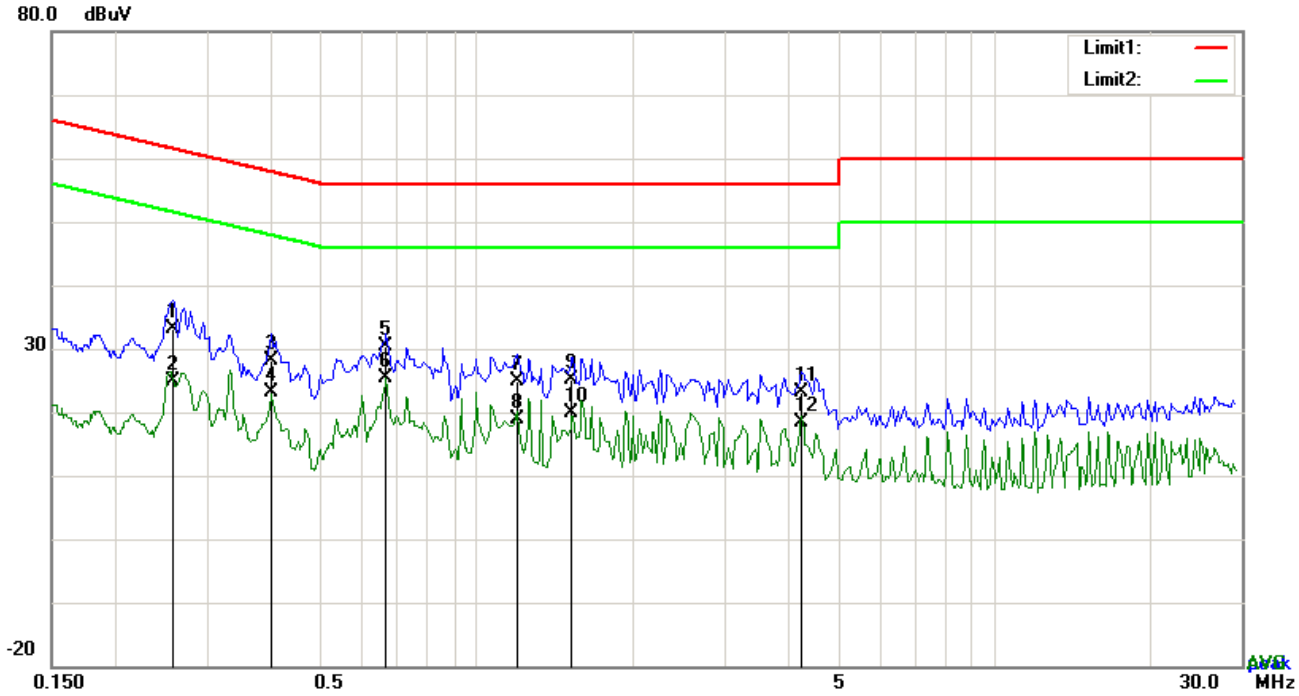


Test Data

Phase Line Plot at 120Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	L1	0.2241	30.34	QP	10.03	40.37	62.67	-22.30
2	L1	0.2241	20.42	AVG	10.03	30.45	52.67	-22.22
3	L1	0.3003	19.92	QP	10.03	29.95	60.23	-30.28
4	L1	0.3003	11.79	AVG	10.03	21.82	50.23	-28.41
5	L1	0.6648	19.97	QP	10.03	30.00	56.00	-26.00
6	L1	0.6648	15.20	AVG	10.03	25.23	46.00	-20.77
7	L1	1.0665	14.64	QP	10.03	24.67	56.00	-31.33
8	L1	1.0665	8.71	AVG	10.03	18.74	46.00	-27.26
9	L1	1.6593	15.39	QP	10.04	25.43	56.00	-30.57
10	L1	1.6593	10.90	AVG	10.04	20.94	46.00	-25.06
11	L1	4.2519	11.92	QP	10.07	21.99	56.00	-34.01
12	L1	4.2519	6.77	AVG	10.07	16.84	46.00	-29.16

Test Mode:	Transmitting Mode



Test Data

Phase Neutral Plot at 120Vac, 60Hz

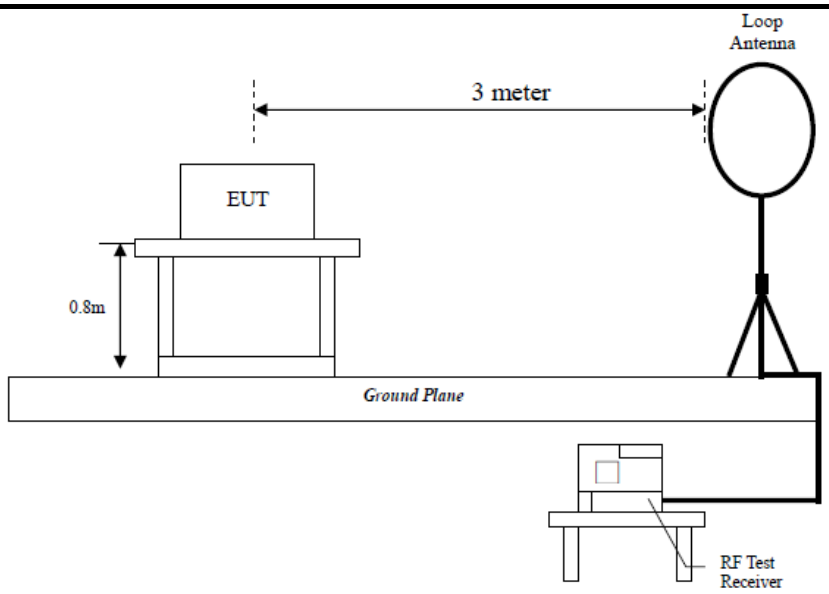
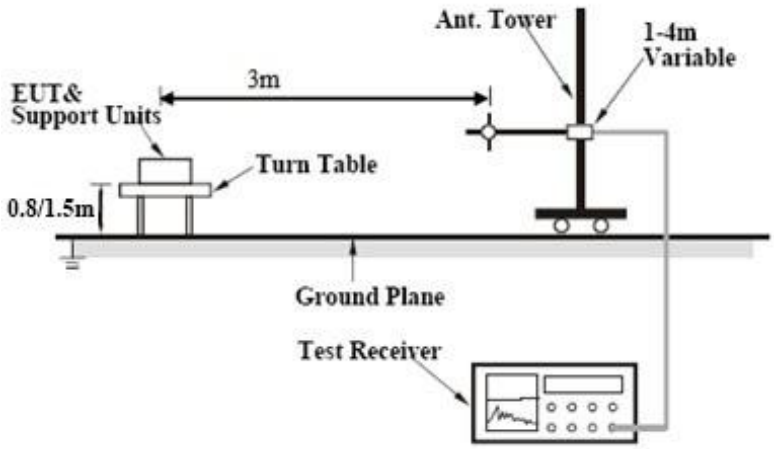
No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	N	0.2575	23.05	QP	10.02	33.07	61.51	-28.44
2	N	0.2575	14.92	AVG	10.02	24.94	51.51	-26.57
3	N	0.3996	18.19	QP	10.02	28.21	57.86	-29.65
4	N	0.3996	13.11	AVG	10.02	23.13	47.86	-24.73
5	N	0.6648	20.43	QP	10.02	30.45	56.00	-25.55
6	N	0.6648	15.33	AVG	10.02	25.35	46.00	-20.65
7	N	1.1913	14.97	QP	10.03	25.00	56.00	-31.00
8	N	1.1913	8.74	AVG	10.03	18.77	46.00	-27.23
9	N	1.5267	15.14	QP	10.04	25.18	56.00	-30.82
10	N	1.5267	9.80	AVG	10.04	19.84	46.00	-26.16
11	N	4.2246	13.14	QP	10.06	23.20	56.00	-32.80
12	N	4.2246	8.33	AVG	10.06	18.39	46.00	-27.61

6.7 Radiated Spurious Emissions & Restricted Band

Temperature	24℃
Relative Humidity	54%
Atmospheric Pressure	1017mbar
Test date :	June 14, 2018
Tested By :	Aaron Liang

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>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>
</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	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Test Result:

Test Mode:	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:

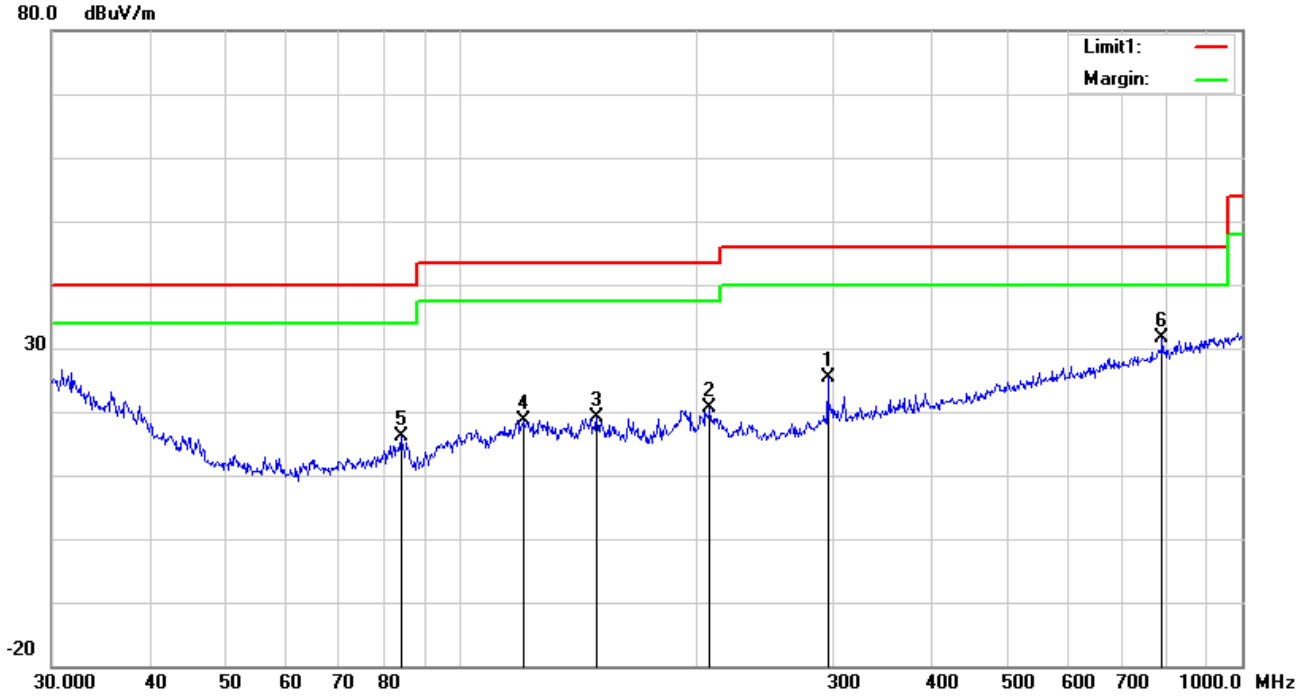
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

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

Test Mode:	Transmitting Mode

30MHz -1GHz

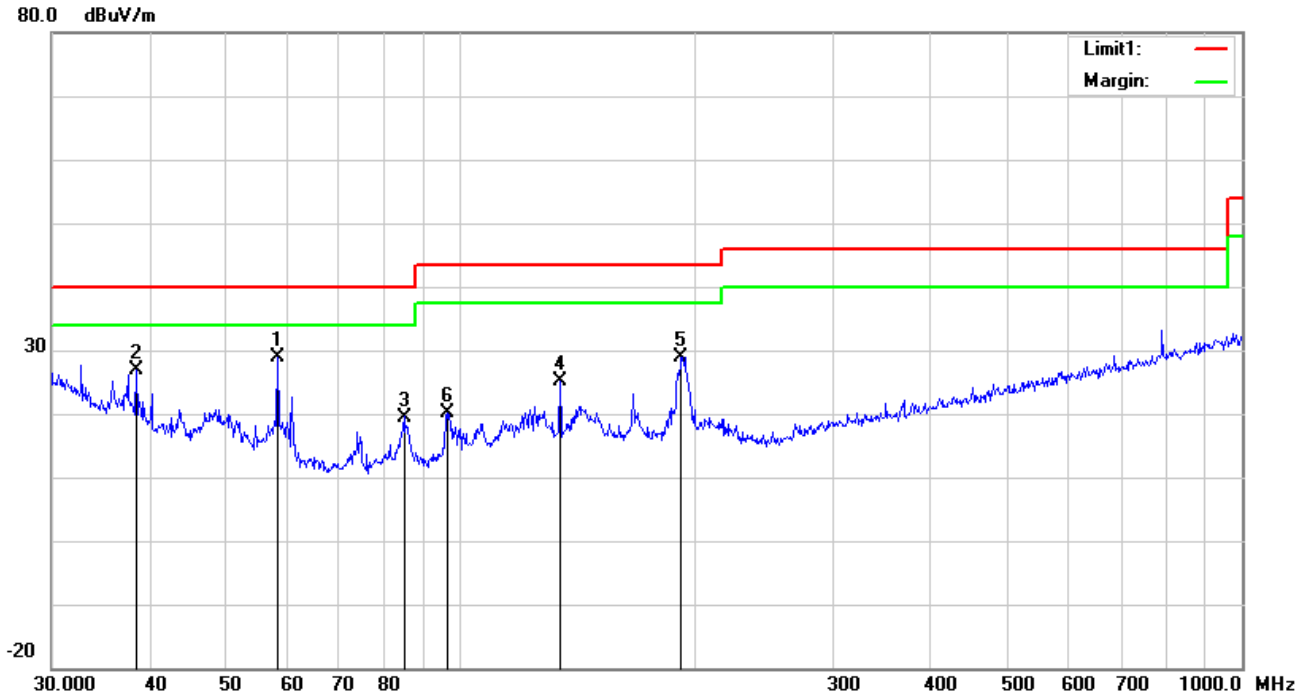


Test Data

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	295.1469	32.51	peak	13.39	22.29	1.78	25.39	46.00	-20.61	100	51
2	H	208.5803	29.51	peak	11.98	22.36	1.57	20.70	43.50	-22.80	200	192
3	H	149.4857	27.43	peak	12.60	22.34	1.34	19.03	43.50	-24.47	100	169
4	H	120.6991	25.96	peak	13.85	22.36	1.16	18.61	43.50	-24.89	100	357
5	H	84.1100	29.60	peak	7.76	22.38	1.07	16.05	40.00	-23.95	100	355
6	H	790.6188	28.60	peak	21.29	21.17	2.94	31.66	46.00	-14.34	100	216

30MHz -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	58.4074	43.03	peak	7.48	22.41	0.76	28.86	40.00	-11.14	100	101
2	V	38.4809	33.47	peak	15.01	22.27	0.78	26.99	40.00	-13.01	100	237
3	V	84.7019	33.01	peak	7.79	22.37	1.07	19.50	40.00	-20.50	100	281
4	V	134.0882	33.27	peak	12.98	22.40	1.23	25.08	43.50	-18.42	100	235
5	V	191.7450	37.96	peak	11.65	22.33	1.54	28.82	43.50	-14.68	100	30
6	V	96.4362	31.95	peak	9.54	22.32	1.03	20.20	43.50	-23.30	100	98

Above 1GHz

Test Mode:	Transmitting Mode

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:802.11b(Worst Case)-2412MHz									
2391.2	43.68	28.72	3.36	26.32	49.44	74.00	-24.56	peak	Vertical
4824	33.02	32.94	3.98	27.49	42.45	54.00	-11.55	Average	Vertical
4824	42.55	32.94	3.98	27.49	51.98	74.00	-22.02	peak	Vertical
7244	33.31	25.28	5.51	27.94	36.16	54.00	-17.84	Average	Vertical
7244	43.09	25.28	5.51	27.94	45.94	74.00	-28.06	peak	Vertical
2391.2	43.58	28.72	3.36	26.32	49.34	74.00	-24.66	peak	Horizontal
4824	33.47	32.94	3.98	27.49	42.90	54.00	-11.10	Average	Horizontal
4824	44.11	32.94	3.98	27.49	53.54	74.00	-20.46	peak	Horizontal
7244	32.32	25.28	5.51	27.94	35.17	54.00	-18.83	Average	Horizontal
7244	42.88	25.28	5.51	27.94	45.73	74.00	-28.27	peak	Horizontal
Middle Channel:802.11b(Worst Case)-2437MHz									
4876	32.14	32.11	4.04	27.53	40.76	54.00	-13.24	Average	Vertical
4876	42.39	32.11	4.04	27.53	51.01	74.00	-22.99	peak	Vertical
7315	33.58	24.33	5.58	27.96	35.53	54.00	-18.47	Average	Vertical
7315	42.66	24.33	5.58	27.96	44.61	74.00	-29.39	peak	Vertical
4876	33.29	32.11	4.04	27.53	41.91	54.00	-12.09	Average	Horizontal
4876	42.99	32.11	4.04	27.53	51.61	74.00	-22.39	peak	Horizontal
7315	32.34	24.33	5.58	27.96	34.29	54.00	-19.71	Average	Horizontal
7315	43.01	24.33	5.58	27.96	44.96	74.00	-29.04	peak	Horizontal
High Channel:802.11b(Worst Case)-2462MHz									
2487	43.58	28.79	3.48	26.34	49.51	74.00	-24.49	peak	Vertical
4920	33.74	31.32	4.12	27.58	41.60	54.00	-12.40	Average	Vertical
4920	42.01	31.32	4.12	27.58	49.87	74.00	-24.13	peak	Vertical
7390	33.49	24.38	5.68	27.99	35.56	54.00	-18.44	Average	Vertical
7390	42.69	24.38	5.68	27.99	44.76	74.00	-29.24	peak	Vertical
2487	42.45	28.79	3.48	26.34	48.38	74.00	-25.62	peak	Horizontal
4920	33.49	31.32	4.12	27.58	41.35	54.00	-12.65	Average	Horizontal
4920	43.72	31.32	4.12	27.58	51.58	74.00	-22.42	peak	Horizontal
7390	33.81	24.38	5.68	27.99	35.88	54.00	-18.12	Average	Horizontal
7390	42.58	24.38	5.68	27.99	44.65	74.00	-29.35	peak	Horizontal

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.

4, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

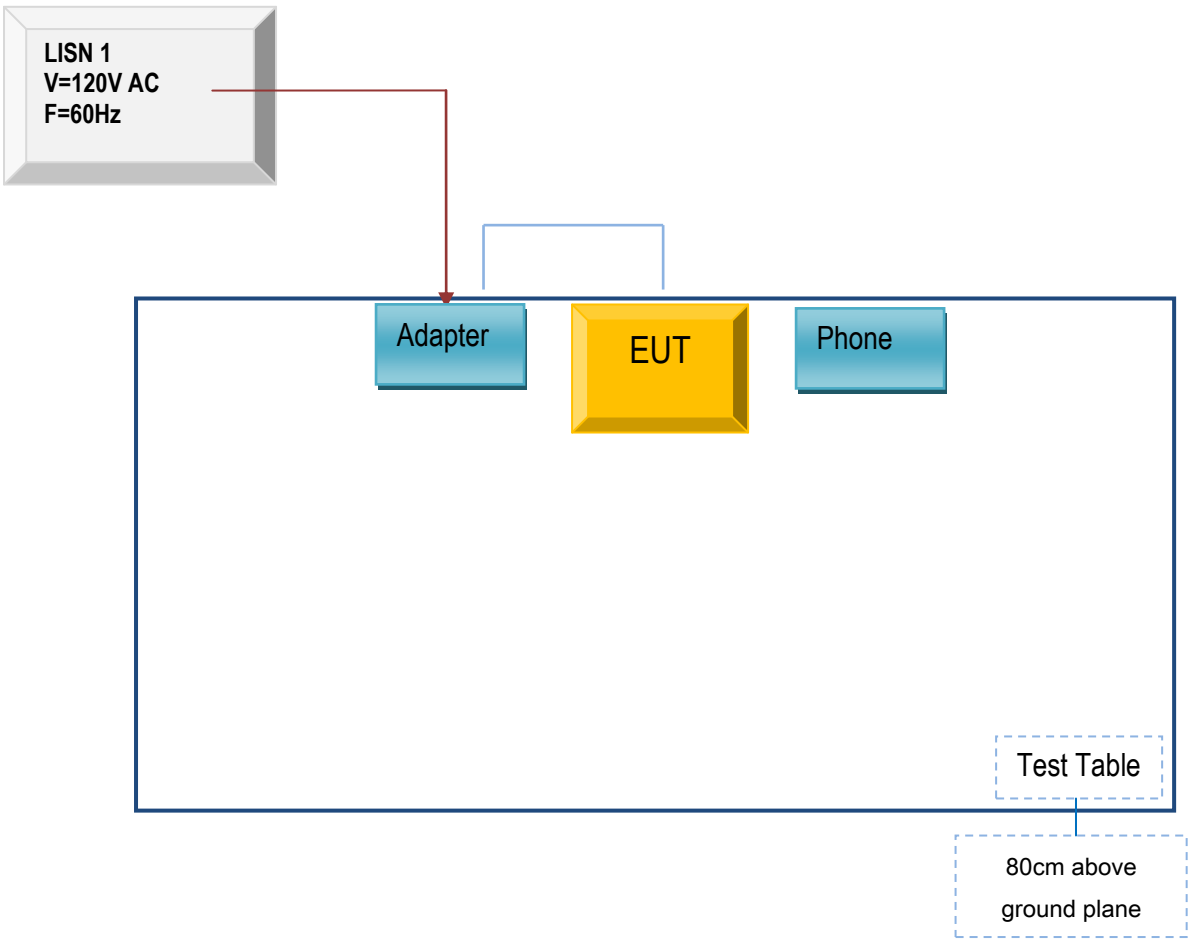
Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	☑
Line Impedance	LI-125A	191106	09/23/2017	09/22/2018	☑
Line Impedance	LI-125A	191107	09/23/2017	09/22/2018	☑
ISN	ISN T800	34373	09/23/2017	09/22/2018	☐
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	☐
RF conducted test					
Agilent ESA-E SERIES	E4407B	MY45108319	09/15/2017	09/14/2018	☑
Power Splitter	1#	1#	08/30/2017	08/29/2018	☑
DC Power Supply	E3640A	MY40004013	09/15/2017	09/14/2018	☑
Radiated Emissions					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	☑
Positioning Controller	UC3000	MF780208282	11/17/2017	11/16/2018	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/22/2018	03/21/2019	☑
Horn Antenna	BBHA9170	3145226D1	09/27/2017	09/26/2018	☑
Active Antenna (9kHz-30MHz)	AL-130	121031	10/12/2017	10/11/2018	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	☑
Universal Radio Communication Tester	CMU200	121393	09/23/2017	09/22/2018	☑

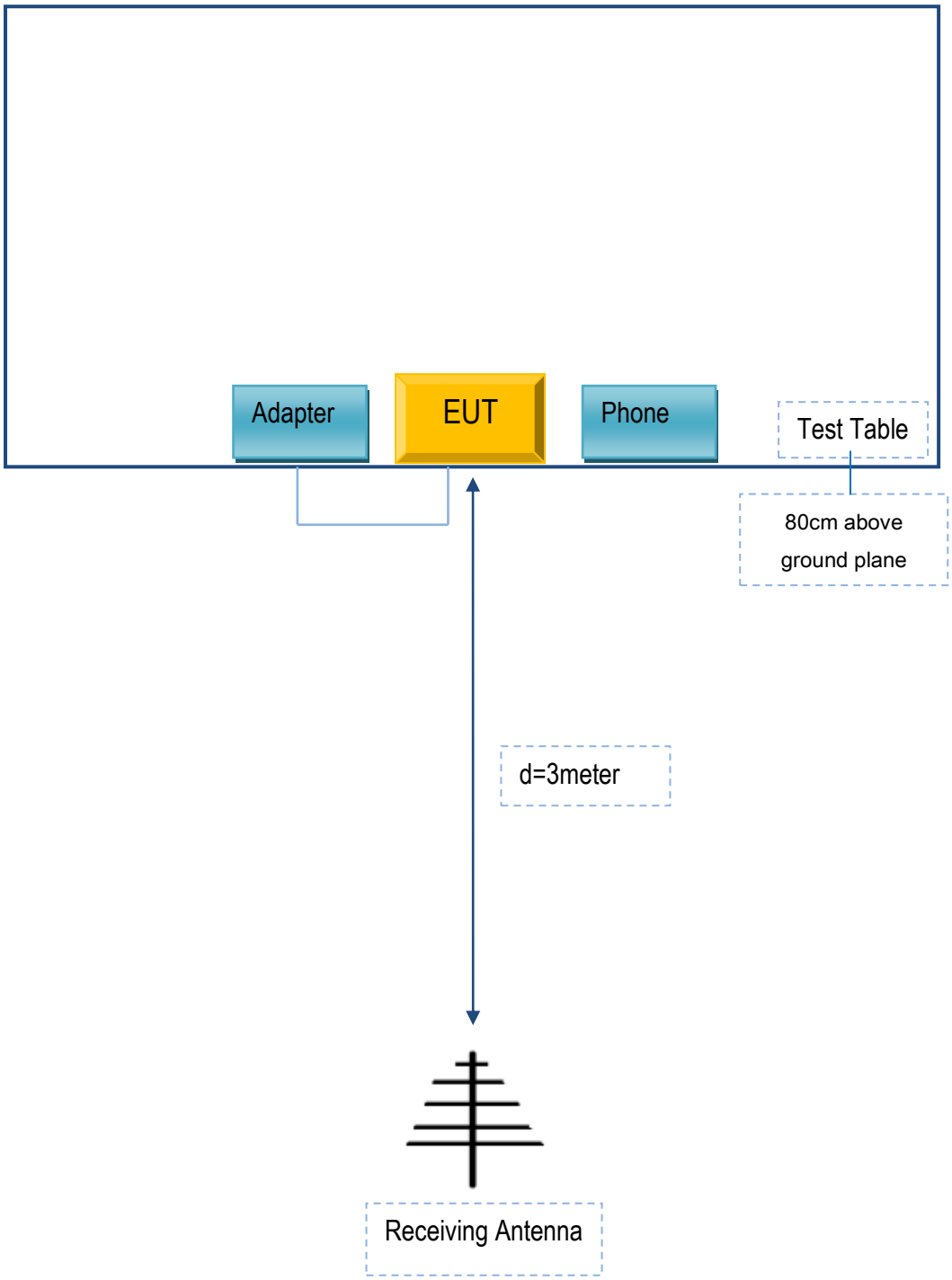
Annex B. TEST SETUP AND SUPPORTING EQUIPMENT

Annex B.i. TEST SET UP BLOCK

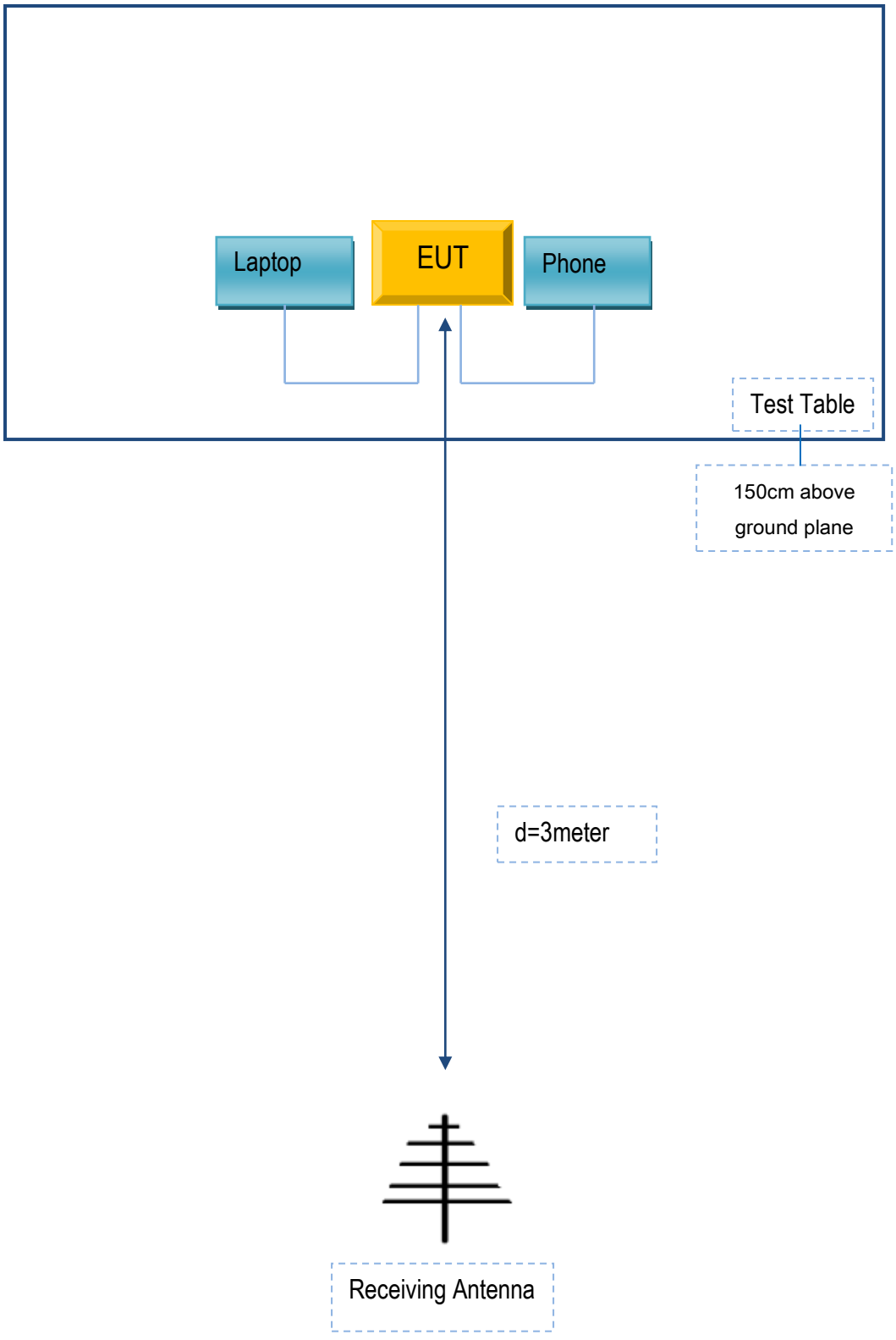
Block Configuration Diagram for AC Line Conducted Emissions



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



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



Annex B. 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
Polygroup Trading Limited	Adapter	TS-48W24V	N/A
Lenovo	Laptop	E40	N/A
Huawei	Phone	Honor 9	N/A

Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
USB Cable	Un-shielding	No	0.8m	N/A
Power Cable	Un-shielding	No	0.8m	N/A

Annex C. User Manual / Block Diagram / Schematics / Partlist/ DECLARATION OF SIMILARITY

Please see the attachment