

# RF TEST REPORT



Report No.: 15070860-FCC-R3

Supersede Report No.: N/A

Applicant	Verykool USA Inc	
Product Name	Mobile Phone	
Model No.	s5020	
Serial No.	N/A	
Test Standard	FCC Part 15.247: 2014, ANSI C63.10: 2013	
Test Date	September 24 to October 10, 2015	
Issue Date	October 15, 2015	
Test Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
Equipment complied with the specification <input checked="" type="checkbox"/>		
Equipment did not comply with the specification <input type="checkbox"/>		
<i>Winnie Zhang</i>	<i>David Huang</i>	
Winnie Zhang 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**

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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.



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### 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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## 1. Report Revision History

Report No.	Report Version	Description	Issue Date
15070860-FCC-R3	NONE	Original	October 15, 2015

## 2. Customer information

Applicant Name	Verykool USA Inc
Applicant Add	3636 Nobel Drive, Suite 325, San Diego, CA 92122 USA
Manufacturer	HUIZHOU QIAOXING ELECTRONICS TECHNOLOGY CO.,LTD
Manufacturer Add	Room -611, TianAn High-Tech Plaza II , Futian District, Shenzhen, China, 518040

## 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: Mobile Phone

Main Model: s5020

Serial Model: N/A

Date EUT received: September 23, 2015

Test Date(s): September 24 to October 10, 2015

Equipment Category : DTS

Antenna Gain:

- GSM850: 2.7dBi
- PCS1900: 2.5dBi
- UMTS-FDD Band V: 2.7 dBi
- UMTS-FDD Band IV: 2.5 dBi
- UMTS-FDD Band II: 1.97 dBi
- Bluetooth/BLE/WIFI: 2.9dBi
- GPS: 1.86dBi

Type of Modulation:

- GSM / GPRS: GMSK
- EGPRS: GMSK
- UMTS-FDD: QPSK, 16QAM
- 802.11b/g/n: DSSS, OFDM
- Bluetooth: GFSK,  $\pi/4$ DQPSK, 8DPSK
- BLE: GFSK
- GPS: BPSK

RF Operating Frequency (ies):

- GSM850 TX: 824.2 ~ 848.8 MHz; RX: 869.2 ~ 893.8 MHz
- PCS1900 TX: 1850.2 ~ 1909.8 MHz; RX: 1930.2 ~ 1989.8 MHz
- UMTS-FDD Band V TX: 826.4 ~ 846.6 MHz; RX: 871.4 ~ 891.6 MHz
- UMTS-FDD Band IV TX: 1712.4 ~ 1752.6 MHz;
- RX : 2112.4 ~ 2152.6 MHz
- UMTS-FDD Band II TX: 1852.4 ~ 1907.6 MHz;
- RX: 1932.4 ~ 1987.6 MHz
- WIFI: 802.11b/g/n(20M): 2412-2462 MHz
- WIFI: 802.11n(40M): 2422-2452 MHz

	Bluetooth& BLE: 2402-2480 MHz
	GPS RX:1575.42 MHz
Max. Output Power:	802.11b:8.74dBm 802.11g:9.06dBm 802.11n(20M):8.97dBm 802.11n(40M):9.17dBm
Number of Channels:	GSM 850: 124CH PCS1900: 299CH UMTS-FDD Band V : 102CH UMTS-FDD Band IV: 202CH UMTS-FDD Band II : 277CH WIFI :802.11b/g/n(20M): 11CH WIFI :802.11n(40M): 7CH Bluetooth: 79CH BLE: 40CH GPS:1CH
Port:	Power Port, Earphone Port, USB Port
Input Power:	Adapter: Model:Q500 Input: AC 100-240V; 50/60Hz;0.2A Output: DC5.0V;1000mA Battery: Model:Q506 Spec:DC3.8V,3000mAh,11.4Wh Limited charger voltage:4.35V
Trade Name :	verykool
GPRS/EGPRS Multi-slot class	8/10/12
FCC ID:	WA6S5020

## 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 Non-Restricted Frequency Bands	Compliance
§15.207 (a),	AC Power Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands	Compliance

### Measurement Uncertainty

Emissions		
Test Item	Description	Uncertainty
Band Edge and Radiated Spurious Emissions	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 3 antennas:

A permanently attached PIFA antenna for Bluetooth/BLE/WIFI, the gain is 2.9dBi.

A permanently attached PIFA antenna for GSM and UMTS, the gain is 2.7dBi for GSM850, 2.5dBi for PCS1900, 2.7dBi for UMTS-FDD Band V, 2.5dBi for UMTS-FDD Band IV, 1.97dBi for UMTS-FDD Band II.

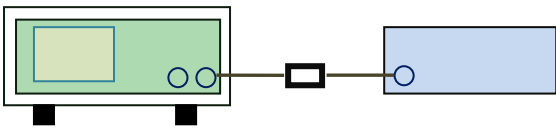
A permanently attached PIFA antenna for GPS, the gain is 1.86dBi.

**The antenna meets up with the ANTENNA REQUIREMENT.**

**Result:** Compliance.

## 6.2 DTS (6 dB&20 dB) Channel Bandwidth

Temperature	25°C
Relative Humidity	52%
Atmospheric Pressure	1028mbar
Test date :	September 28, 2015
Tested By :	Winnie Zhang

Spec	Item	Requirement	Applicable
§ 15.247(a)(2)	a)	6dB BW ≥ 500kHz; 20dB BW ≥ 500kHz;	<input checked="" type="checkbox"/>
	b)	99% BW: For FCC reference only; required by IC.	<input checked="" type="checkbox"/>
Test Setup	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>		
Test Procedure	<p>558074 D01 DTS MEAS Guidance v03r02, 8.1 DTS bandwidth</p> <p><u>6dB bandwidth</u></p> <ol style="list-style-type: none"> <li>Set RBW = 100 kHz.</li> <li>Set the video bandwidth (VBW) ≥ 3 × RBW.</li> <li>Detector = Peak.</li> <li>Trace mode = max hold.</li> <li>Sweep = auto couple.</li> <li>Allow the trace to stabilize.</li> <li>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.</li> </ol> <p><u>20dB bandwidth</u></p> <p>C63.10 Occupied Bandwidth (OBW=20dB bandwidth)</p> <ol style="list-style-type: none"> <li>Set RBW = 1%-5% OBW.</li> <li>Set the video bandwidth (VBW) ≥ 3 x RBW.</li> <li>Set the span range between 2 times and 5 times of the OBW.</li> <li>Sweep time=Auto, Detector=PK, Trace=Max hold.</li> <li>Once the reference level is established, the equipment is conditioned with typical modulating signals to produce the worst-</li> </ol>		

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	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	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data ☒ Yes ☐ N/A

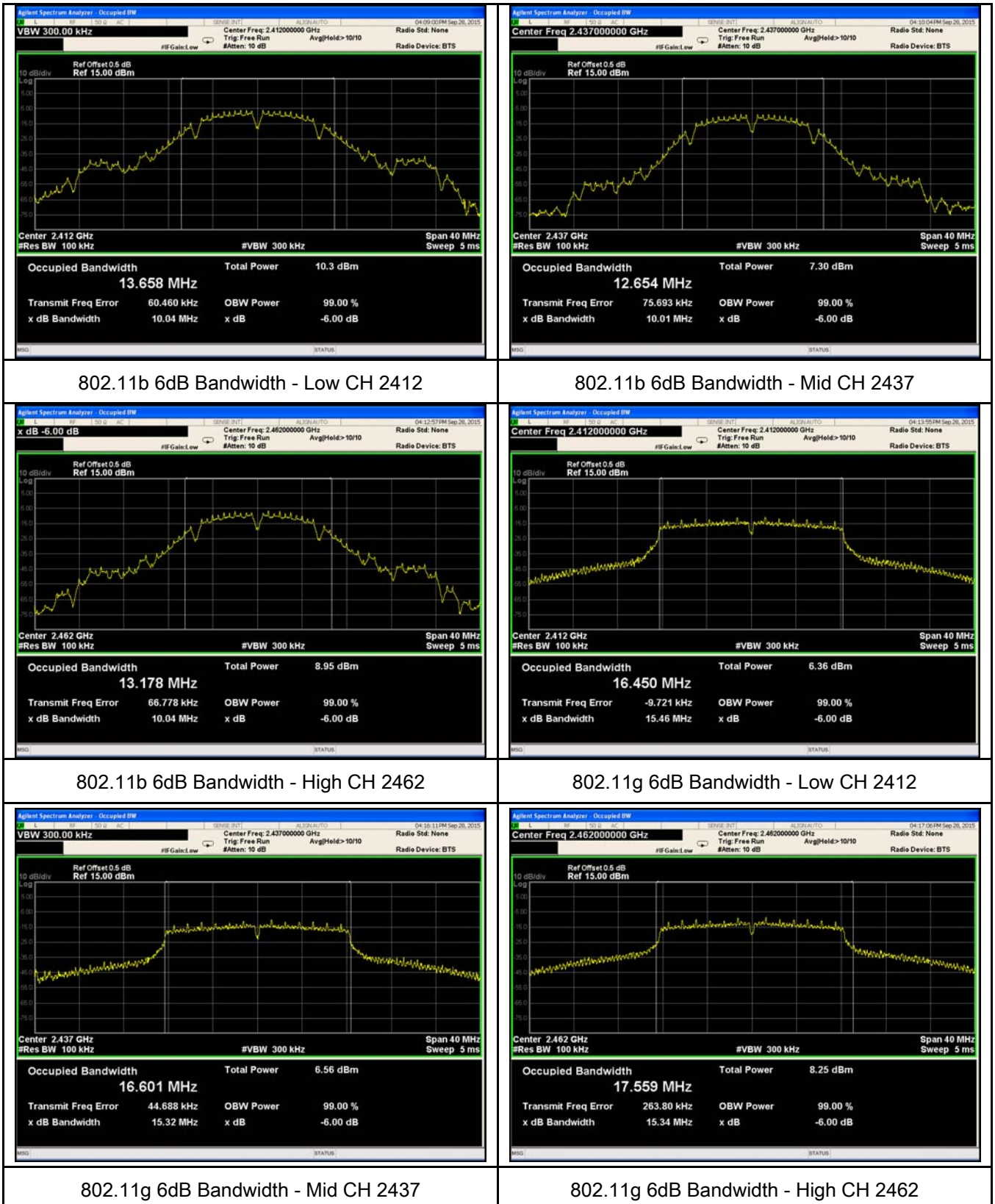
Test Plot ☒ Yes (See below) ☐ N/A

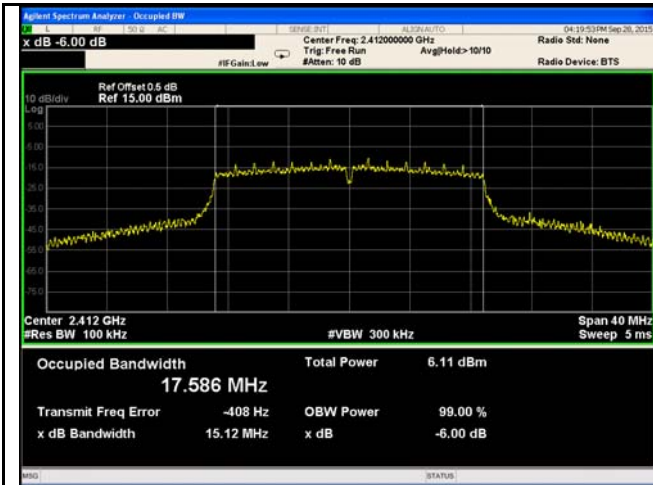
### Measurement result

Test mode	CH	Freq (MHz)	6dB Bandwidth (MHz)	20dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	10.04	14.28	$\geq 0.5$
	Mid	2437	10.01	14.32	$\geq 0.5$
	High	2462	10.04	15.24	$\geq 0.5$
802.11g	Low	2412	15.46	18.93	$\geq 0.5$
	Mid	2437	15.32	18.84	$\geq 0.5$
	High	2462	15.34	21.72	$\geq 0.5$
802.11n (20M)	Low	2412	15.12	19.24	$\geq 0.5$
	Mid	2437	15.97	20.68	$\geq 0.5$
	High	2462	15.70	22.23	$\geq 0.5$
802.11n (40M)	Low	2422	35.16	38.21	$\geq 0.5$
	Mid	2437	35.14	54.63	$\geq 0.5$
	High	2452	35.14	38.00	$\geq 0.5$

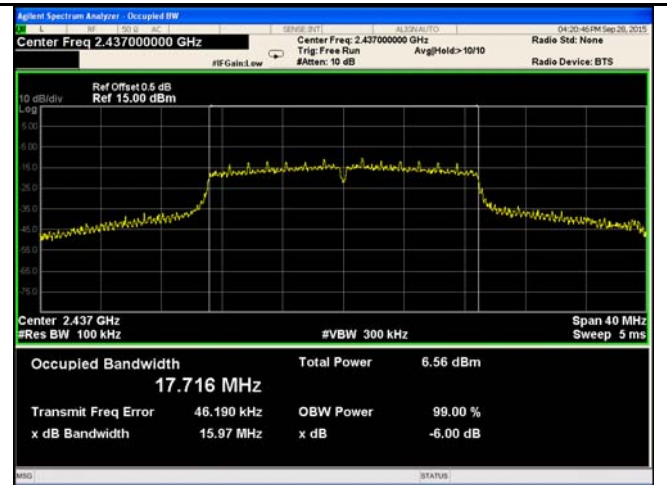
## Test Plots

### 6dB Bandwidth measurement result

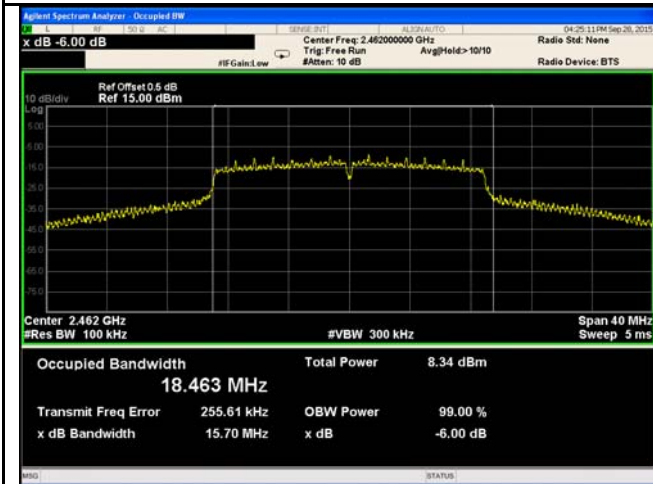




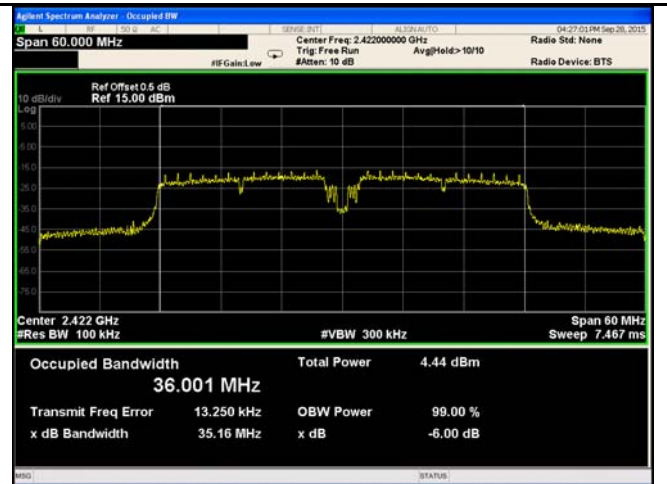
802.11n20 6dB Bandwidth - Low CH 2412



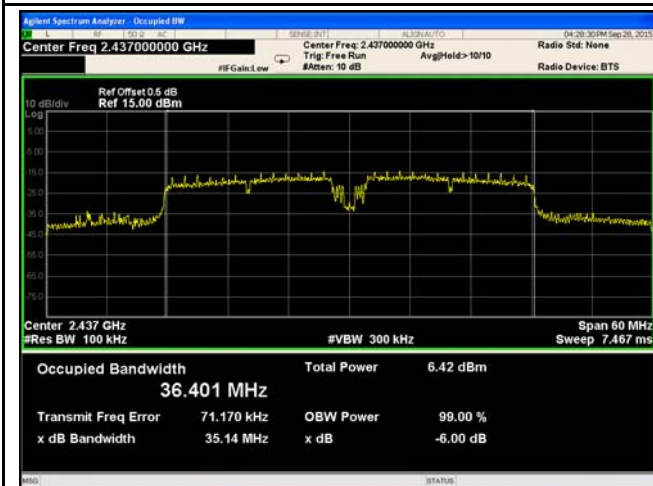
802.11n20 6dB Bandwidth - Mid CH 2437



802.11n20 6dB Bandwidth - High CH 2462



802.11n40 6dB Bandwidth - Low CH 2422

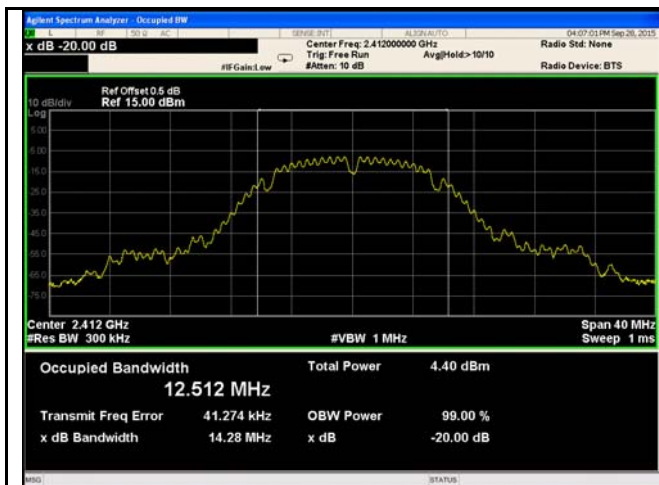


802.11n40 6dB Bandwidth - Mid CH 2437



802.11n40 6dB Bandwidth - High CH 2452

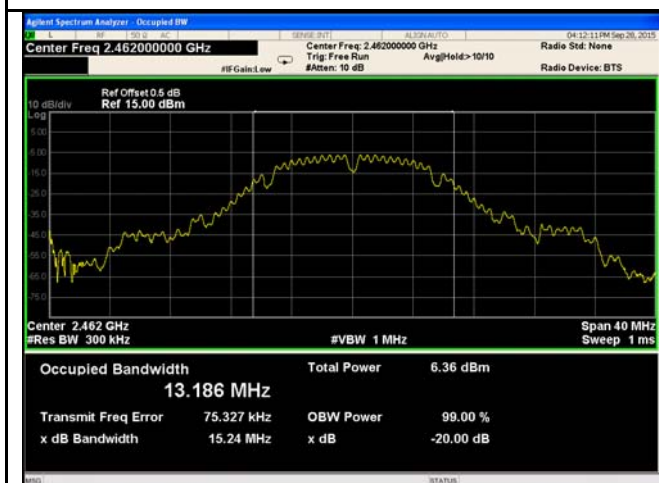
## 20 dB Bandwidth measurement result



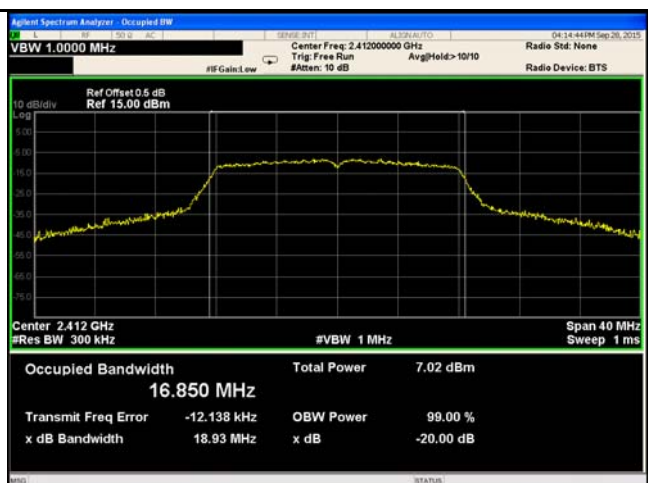
802.11b 20dB Bandwidth - Low CH 2412



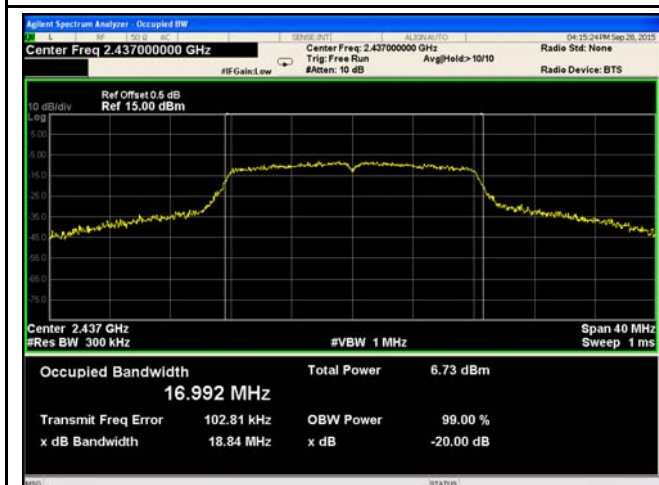
802.11b 20dB Bandwidth - Mid CH 2437



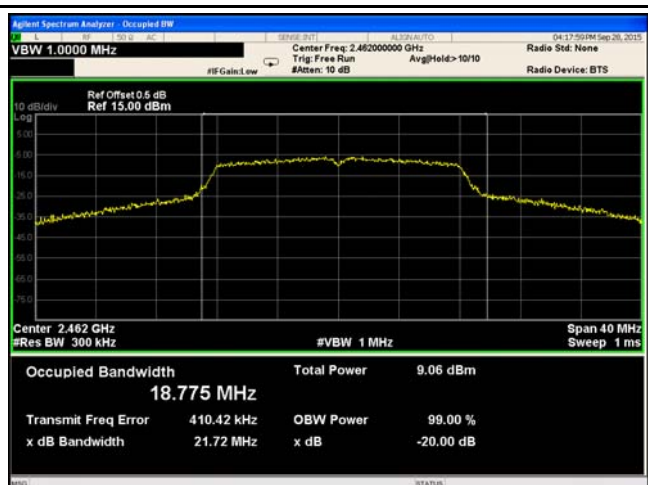
802.11b 20dB Bandwidth - High CH 2462



802.11g 20dB Bandwidth - Low CH 2412

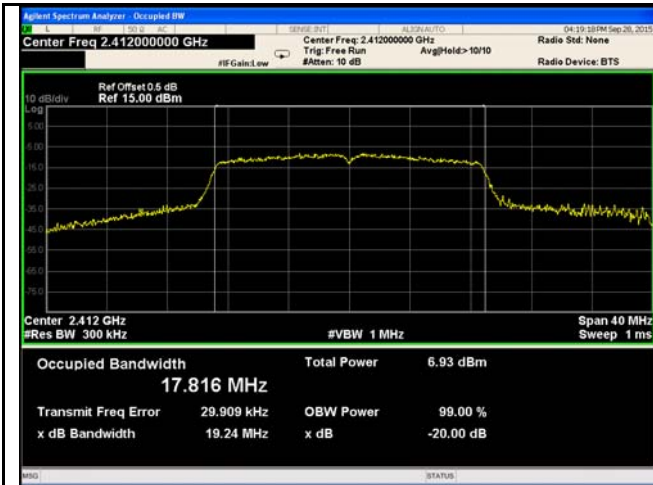


802.11g 20dB Bandwidth - Mid CH 2437



802.11g 20dB Bandwidth - High CH 2462

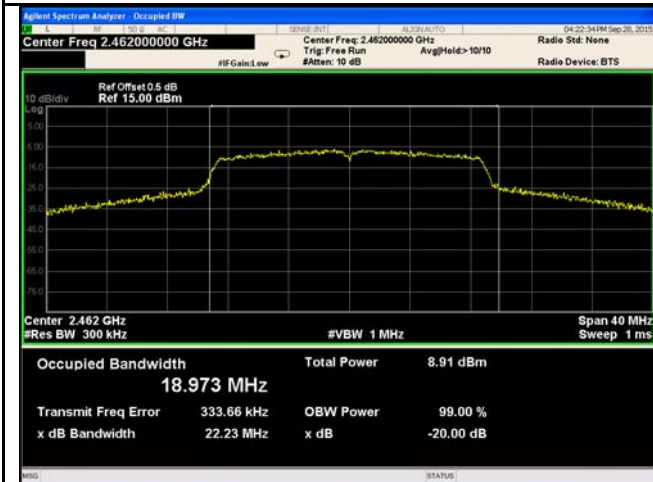




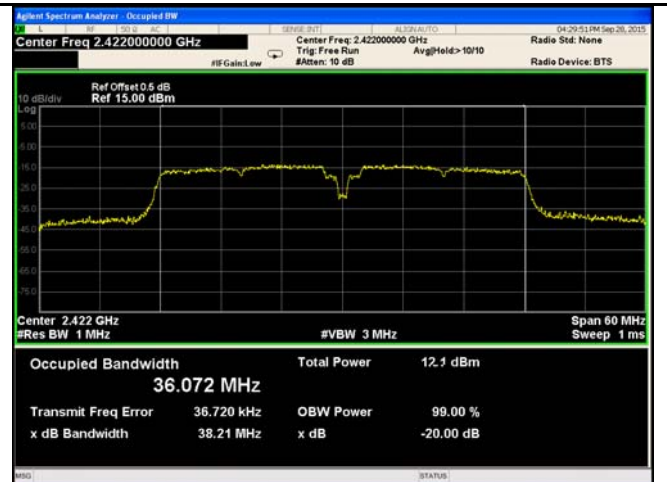
802.11n20 20dB Bandwidth - Low CH 2412



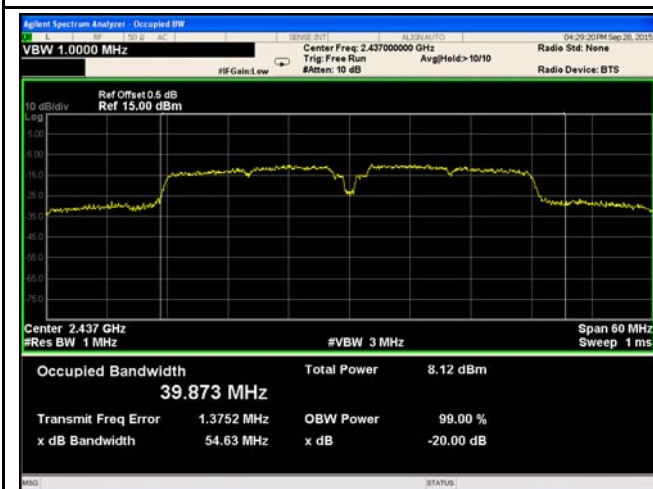
802.11n20 20dB Bandwidth - Mid CH 2437



802.11n20 20dB Bandwidth - High CH 2462



802.11n40 20dB Bandwidth - Low CH 2422



802.11n40 20dB Bandwidth - Mid CH 2437

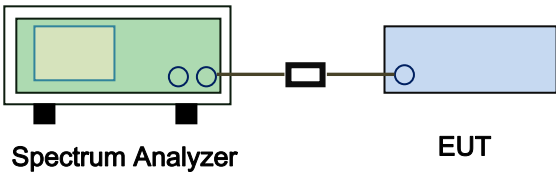


802.11n40 20dB Bandwidth - High CH 2452

### 6.3 Maximum Output Power

Temperature	22°C
Relative Humidity	53%
Atmospheric Pressure	1029mbar
Test date :	September 29, 2015
Tested By :	Winnie Zhang

#### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(b) (2)	a)	FHSS in 2400-2483.5MHz with $\geq 75$ channels: $\leq 1$ Watt	<input type="checkbox"/>
	b)	FHSS in 5725-5850MHz: $\leq 1$ Watt	<input type="checkbox"/>
	c)	For all other FHSS in the 2400-2483.5MHz band: $\leq 0.125$ Watt.	<input type="checkbox"/>
	d)	FHSS in 902-928MHz with $\geq 50$ channels: $\leq 1$ Watt	<input type="checkbox"/>
	e)	FHSS in 902-928MHz with $\geq 25$ & $< 50$ channels: $\leq 0.25$ Watt	<input type="checkbox"/>
	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: $\leq 1$ Watt	<input checked="" type="checkbox"/>
Test Setup	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>		
Test Procedure	<p>558074 D01 DTS MEAS Guidance v03r02, 9.1.2 Integrated band power method Maximum output power measurement procedure</p> <ul style="list-style-type: none"> <li>- a) Set span to at least 1.5 times the OBW.</li> <li>- b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.</li> <li>- c) Set VBW <math>\geq 3 \times</math> RBW.</li> <li>- d) Number of points in sweep <math>\geq 2 \times</math> span / RBW. (This gives bin-to-bin spacing <math>\leq</math> RBW/2, so that narrowband signals are not lost between frequency bins.)</li> <li>- e) Sweep time = auto.</li> <li>- f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.</li> <li>- g) If transmit duty cycle <math>&lt; 98\%</math>, use a sweep trigger with the level set to enable</li> </ul>		



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	<p>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 <math>\geq 98\%</math>, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".</p> <ul style="list-style-type: none"> <li>- h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.</li> <li>- 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.</li> </ul>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data ☒ Yes ☐ N/A

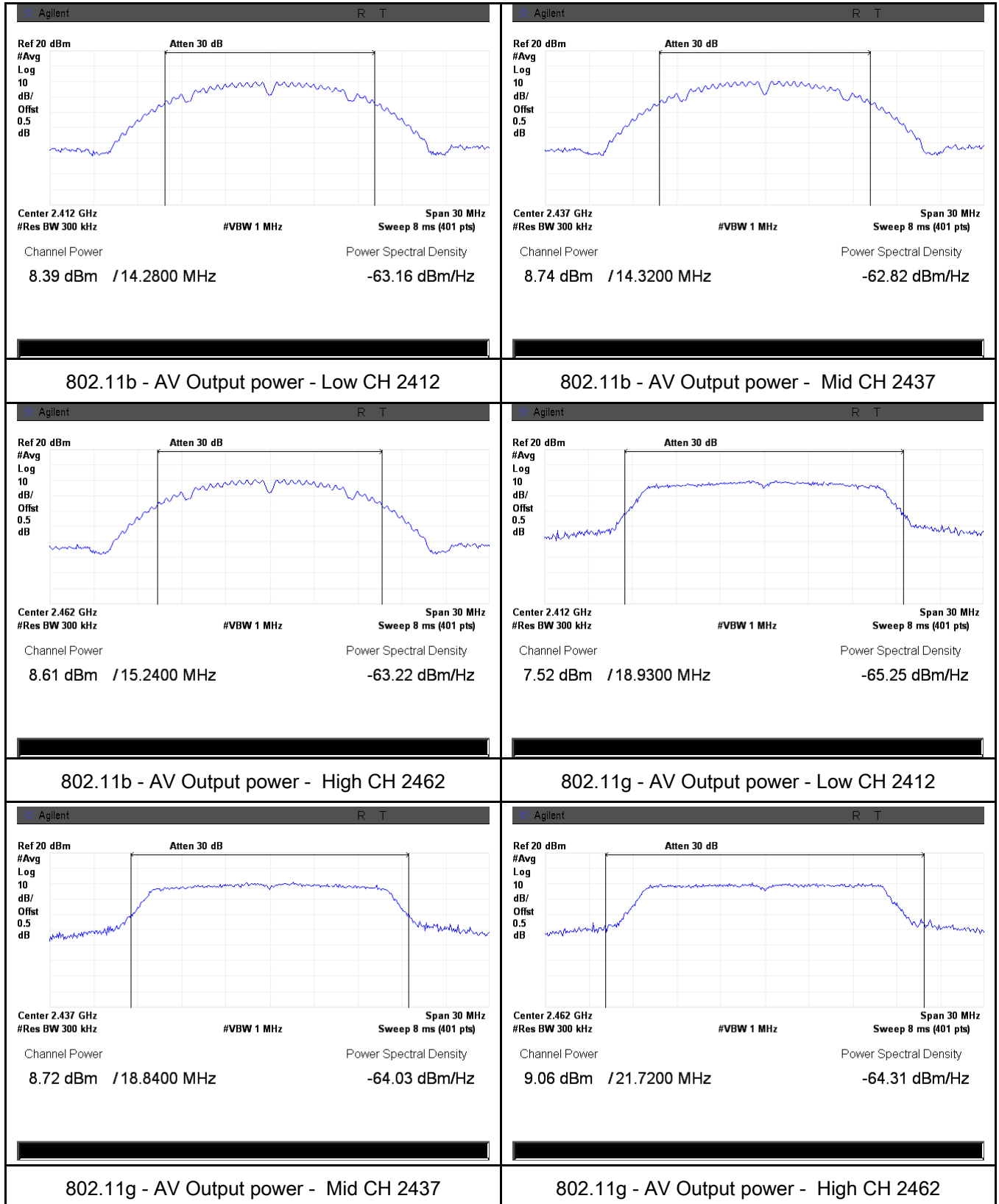
Test Plot ☒ Yes (See below) ☐ N/A

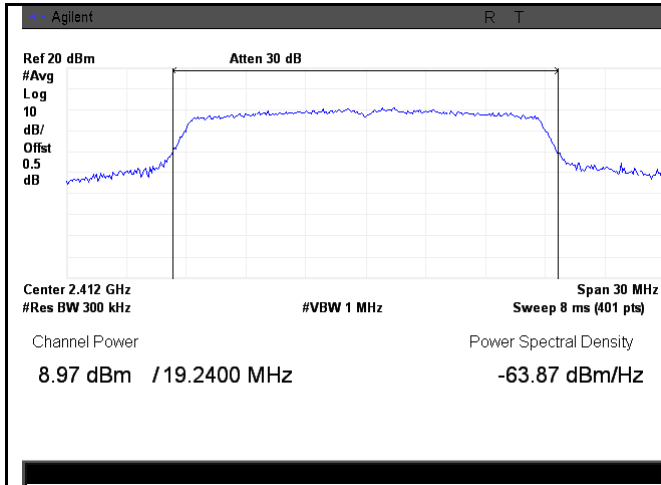
#### Output Power measurement result

Type	Test mode	CH	Freq (MHz)	Conducted Power (dBm)	Limit (dBm)	Result
Output power	802.11b	Low	2412	8.39	30	Pass
		Mid	2437	<b>8.74</b>	30	Pass
		High	2462	8.61	30	Pass
	802.11g	Low	2412	7.52	30	Pass
		Mid	2437	8.72	30	Pass
		High	2462	<b>9.06</b>	30	Pass
	802.11n (20M)	Low	2412	<b>8.97</b>	30	Pass
		Mid	2437	8.58	30	Pass
		High	2462	8.57	30	Pass
	802.11n (40M)	Low	2422	7.81	30	Pass
		Mid	2437	<b>9.17</b>	30	Pass
		High	2452	8.62	30	Pass

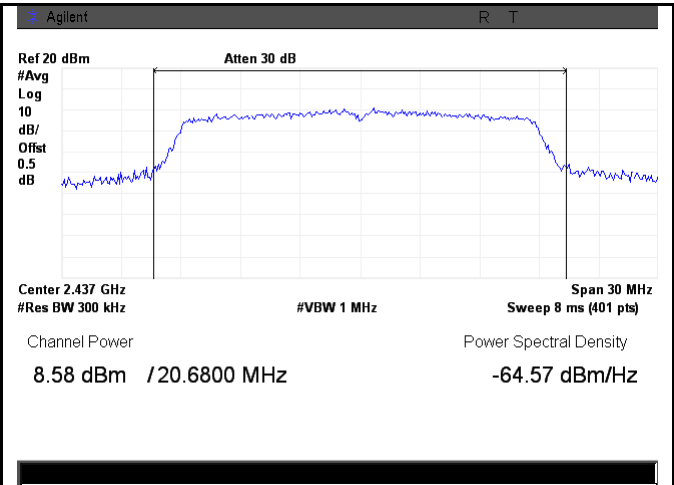
## Test Plots

### The Average Power

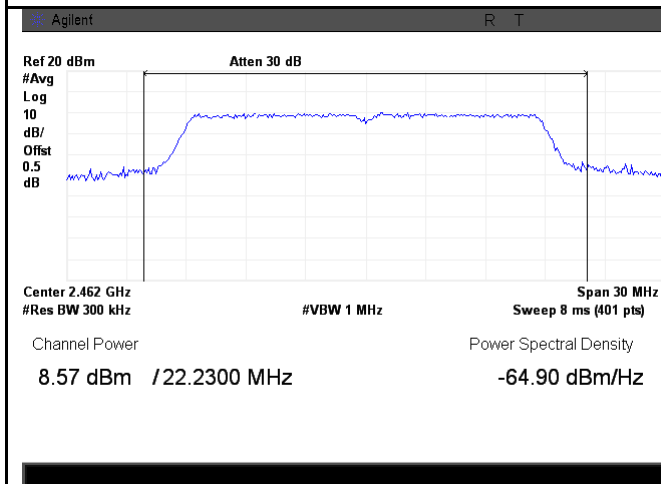




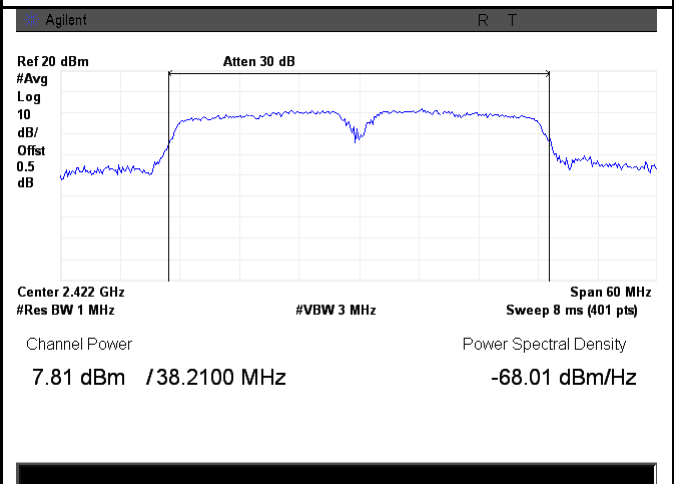
802.11n20 - AV Output power - Low CH 2412



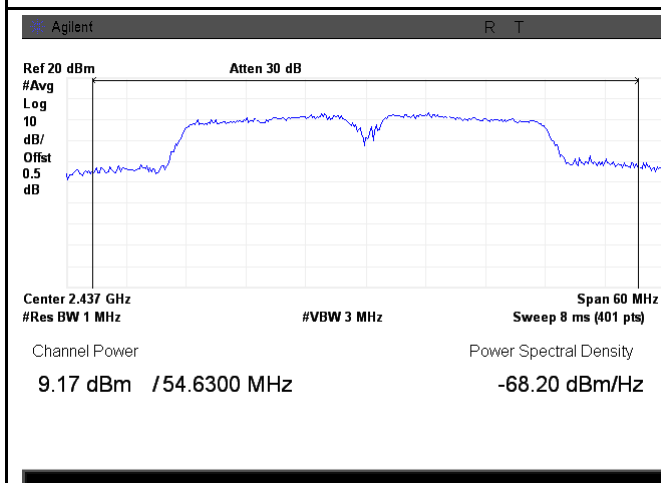
802.11n20 - AV Output power - Mid CH 2437



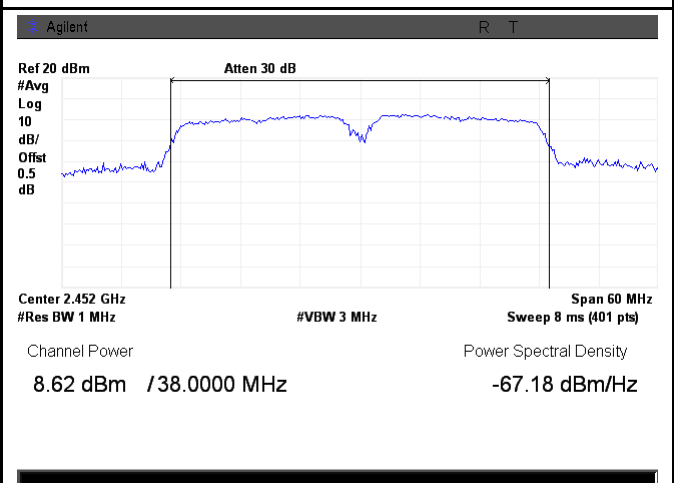
802.11n20 - AV Output power - High CH 2462



802.11n40 - AV Output power - Low CH 2422



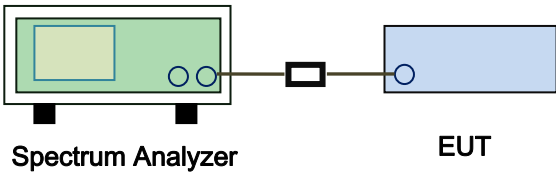
802.11n40 - AV Output power - Mid CH 2437



802.11n40 - AV Output power - High CH 2452

## 6.4 Power Spectral Density

Temperature	22°C
Relative Humidity	53%
Atmospheric Pressure	1029mbar
Test date :	September 29, 2015
Tested By :	Winnie Zhang

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.	<input checked="" type="checkbox"/>
Test Setup	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>		
Test Procedure	<p>558074 D01 DTS MEAS Guidance v03r02, 10.2 power spectral density method power spectral density measurement procedure</p> <ul style="list-style-type: none"> <li>- a) Set analyzer center frequency to DTS channel center frequency.</li> <li>- b) Set the span to 1.5 times the DTS bandwidth.</li> <li>- c) Set the RBW to: <math>3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}</math>.</li> <li>- d) Set the VBW <math>\geq 3 \times \text{RBW}</math>.</li> <li>- e) Detector = peak.</li> <li>- f) Sweep time = auto couple.</li> <li>- g) Trace mode = max hold.</li> <li>- h) Allow trace to fully stabilize.</li> <li>- i) Use the peak marker function to determine the maximum amplitude level within the RBW.</li> <li>- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.</li> </ul>		
Remark			
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

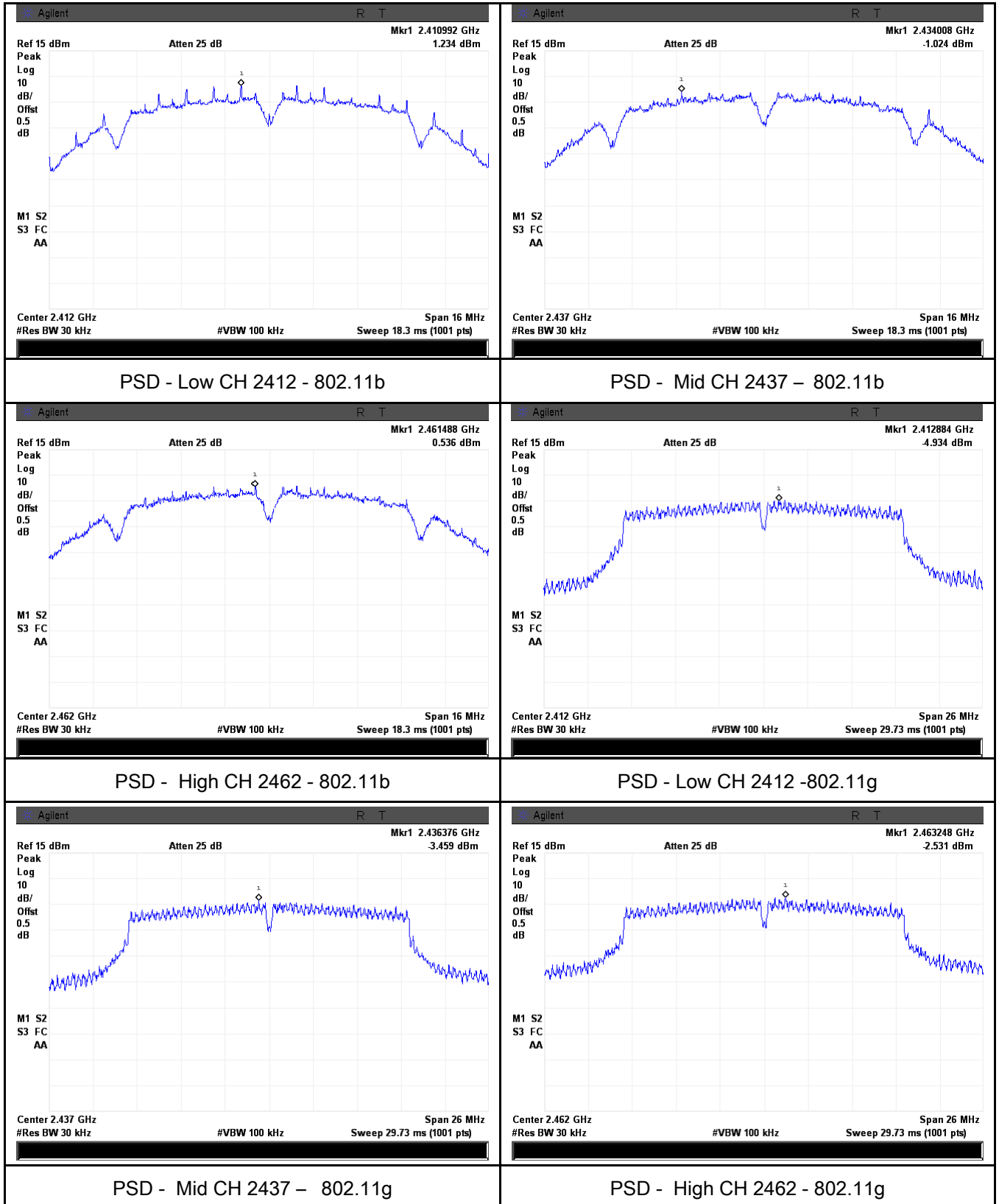
Test Data ☒ Yes ☐ N/A  
Test Plot ☒ Yes (See below) ☐ N/A

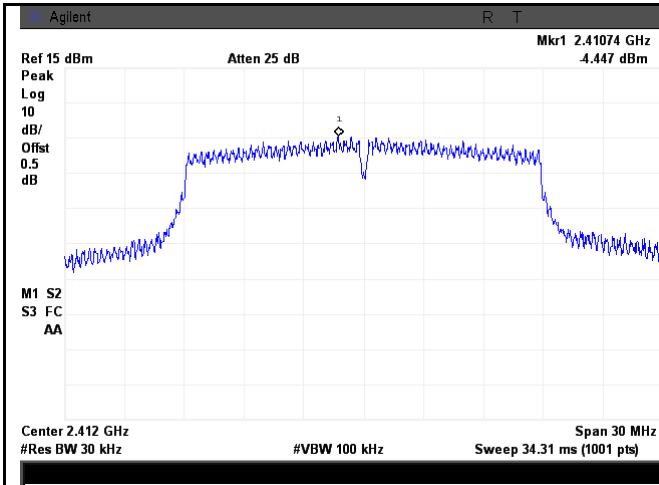
**Power Spectral Density measurement result**

Type	Test mode	CH	Freq (MHz)	PSD (dBm)	Limit (dBm)	Result
PSD	802.11b	Low	2412	1.234	8	Pass
		Mid	2437	-1.024	8	Pass
		High	2462	0.536	8	Pass
	802.11g	Low	2412	-4.934	8	Pass
		Mid	2437	-3.459	8	Pass
		High	2462	-2.531	8	Pass
	802.11n (20M)	Low	2412	-4.447	8	Pass
		Mid	2437	-3.782	8	Pass
		High	2462	-2.185	8	Pass
	802.11n (40M)	Low	2422	-4.720	8	Pass
		Mid	2437	-2.197	8	Pass
		High	2452	-3.400	8	Pass

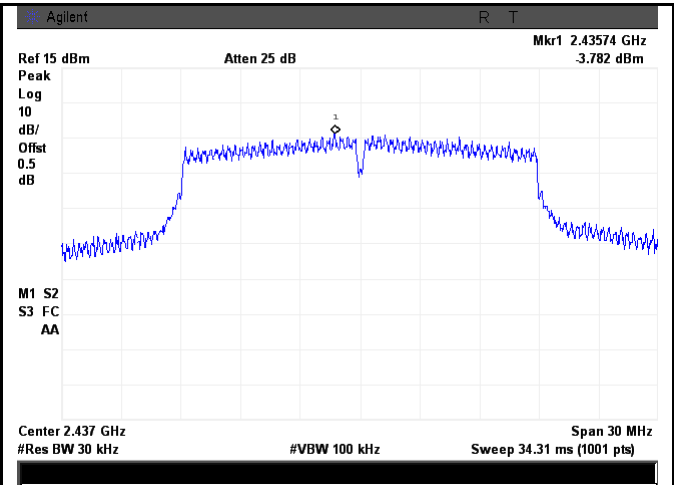
## Test Plots

### Power Spectral Density measurement result

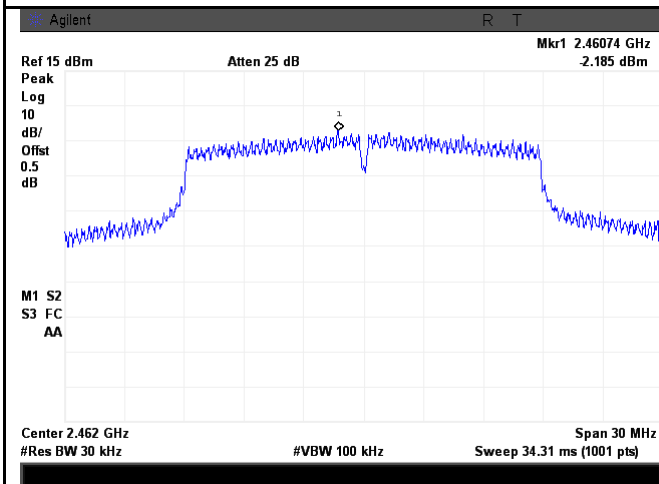




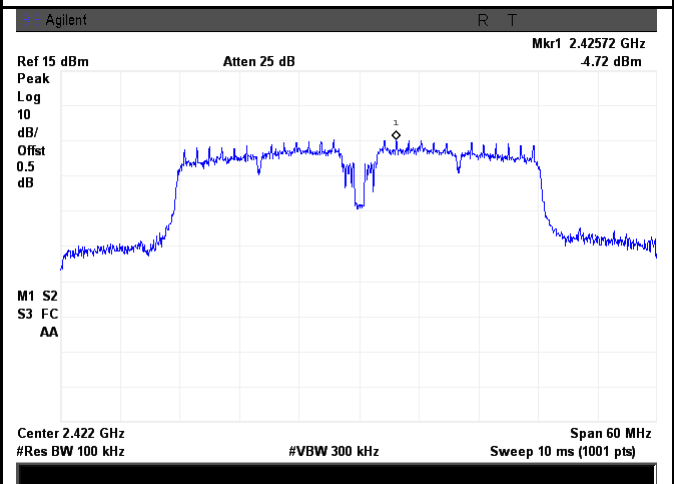
PSD - Low CH 2412 - 802.11n20



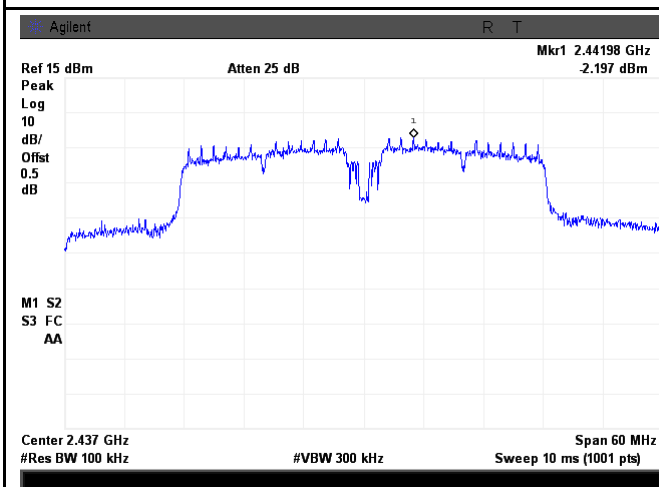
PSD - Mid CH 2437 - 802.11n20



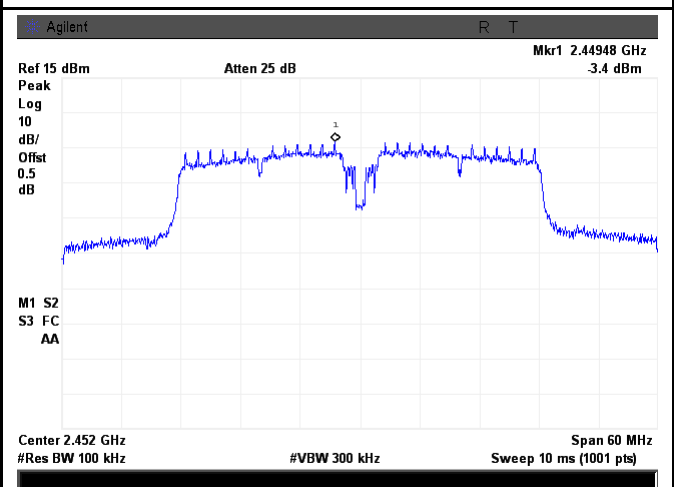
PSD - High CH 2462 - 802.11n20



PSD - Low CH 2422 - 802.11n40



PSD - Mid CH 2437 - 802.11n40



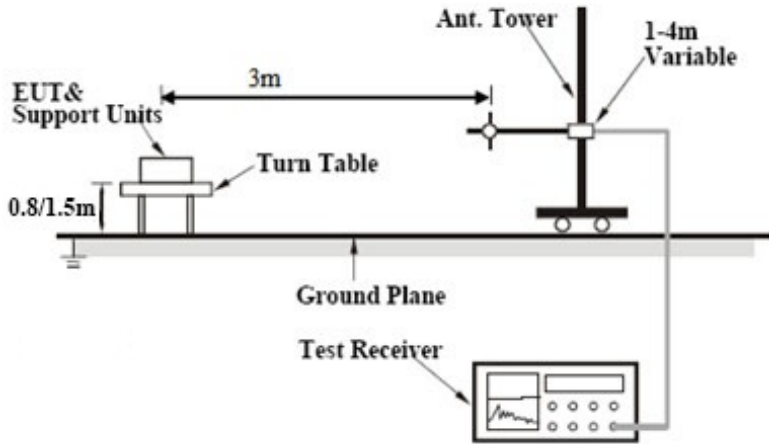
PSD - High CH 2452 - 802.11n40

## 6.5 Band-Edge & Unwanted Emissions into Non-Restricted Frequency Bands

Temperature	22°C
Relative Humidity	51%
Atmospheric Pressure	1009mbar
Test date :	October 09, 2015
Tested By :	Winnie Zhang

### 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.	<input checked="" type="checkbox"/>

Test Setup	
------------	--

Test Procedure	<p>Radiated Method Only</p> <ul style="list-style-type: none"> <li>1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.</li> <li>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.</li> <li>3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge,</li> </ul>
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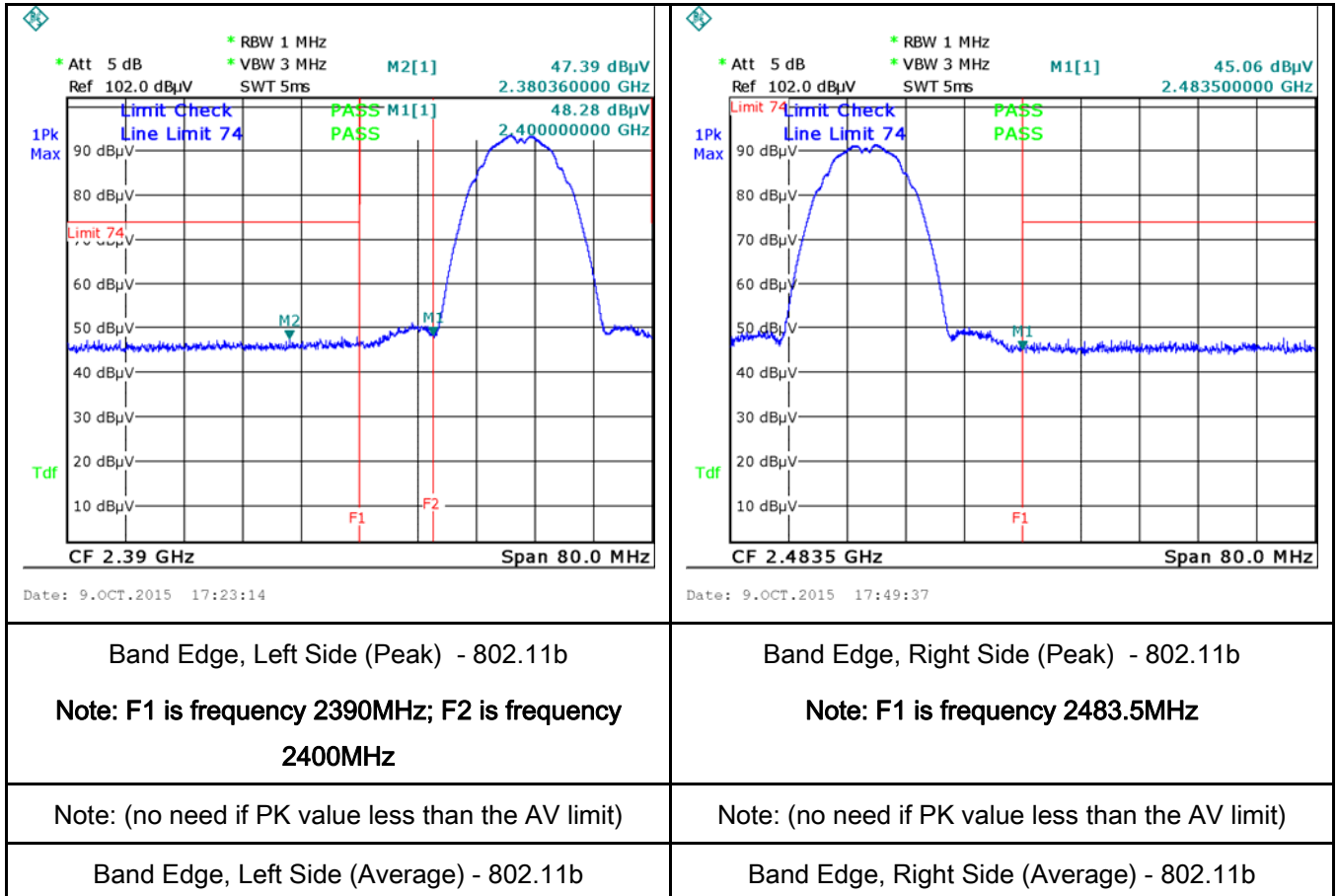
	<p>check the emission of EUT, if pass then set Spectrum Analyzer as below:</p> <p>a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.</p> <p>b. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz.</p> <p>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.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- 5. Repeat above procedures until all measured frequencies were complete.</li> </ul>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

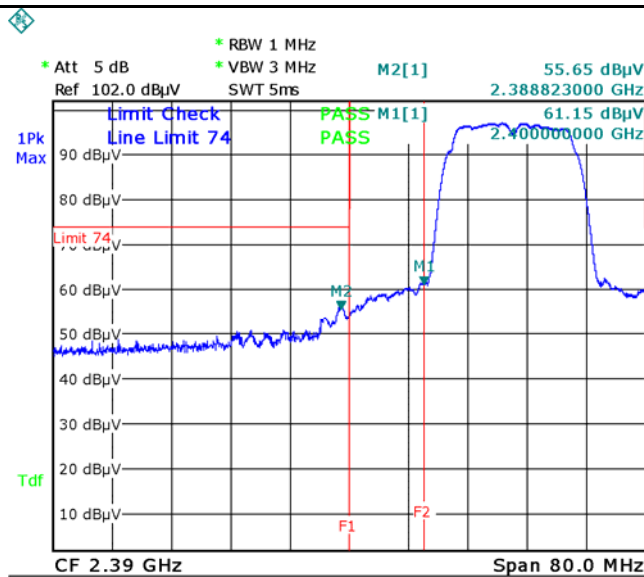
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

## Test Plots

### Band Edge measurement result

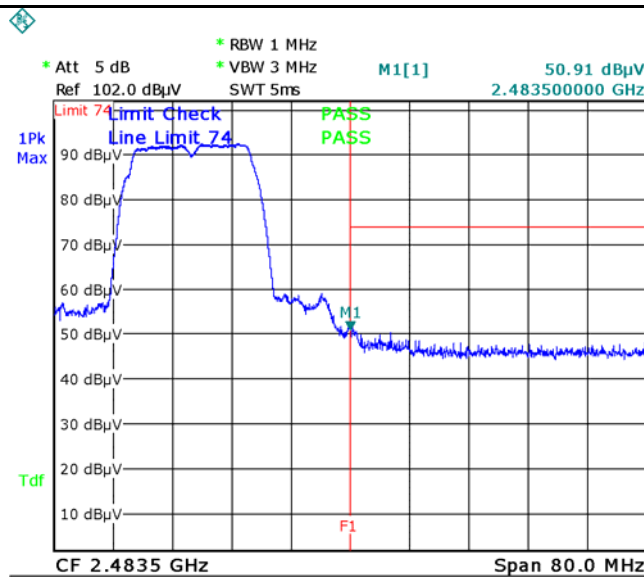




Date: 9.OCT.2015 17:25:32

Band Edge, Left Side (Peak) - 802.11g

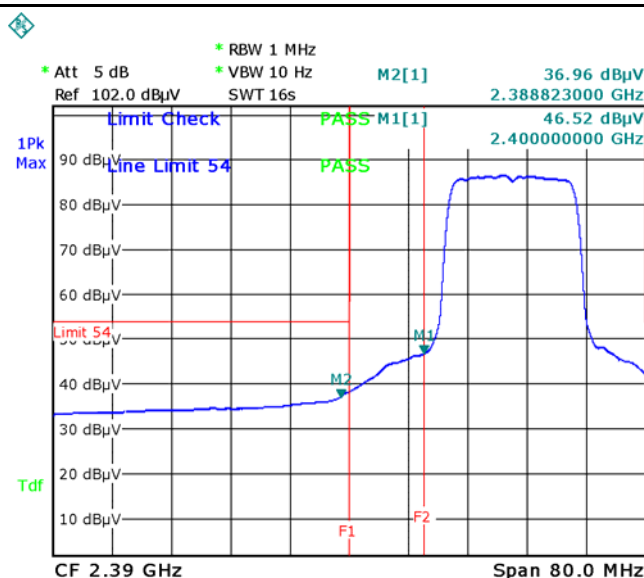
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 9.OCT.2015 17:50:58

Band Edge, Right Side (Peak) - 802.11g

Note: F1 is frequency 2483.5MHz



Date: 9.OCT.2015 17:26:48

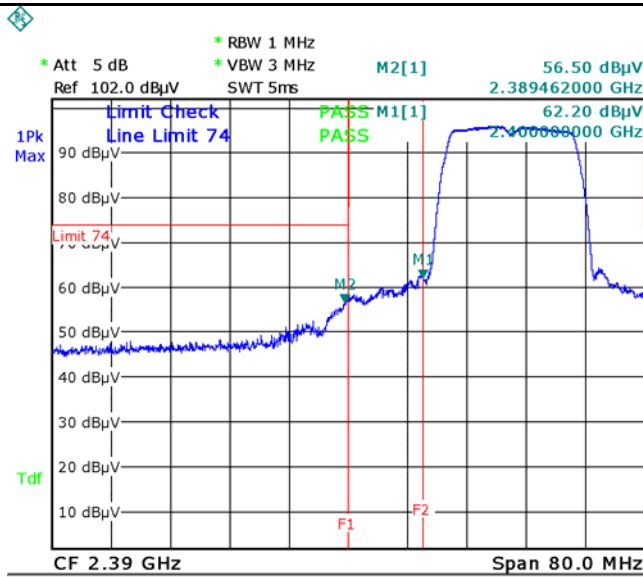
Band Edge, Left Side (Average) - 802.11g

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

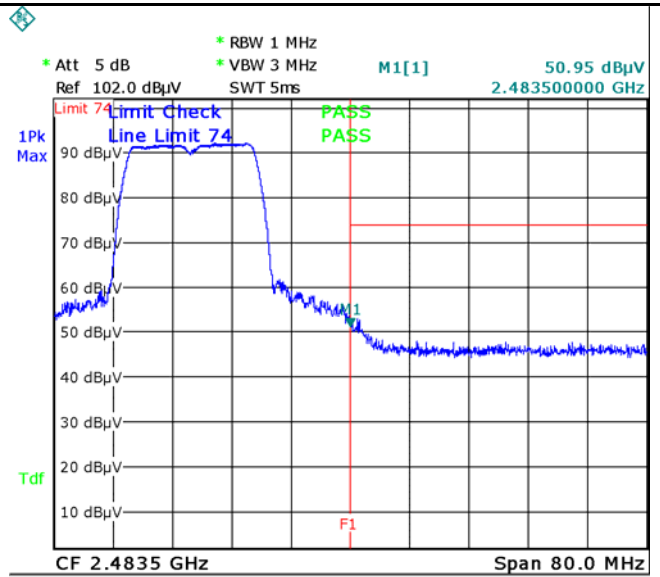
Note: (no need if PK value less than the AV limit)

Band Edge, Right Side (Average) - 802.11g

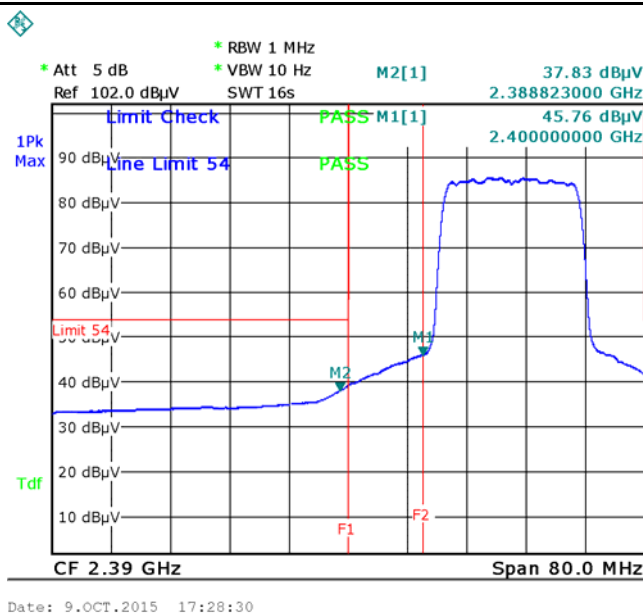
Note: F1 is frequency 2483.5MHz



Band Edge, Left Side (Peak) - 802.11n20  
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



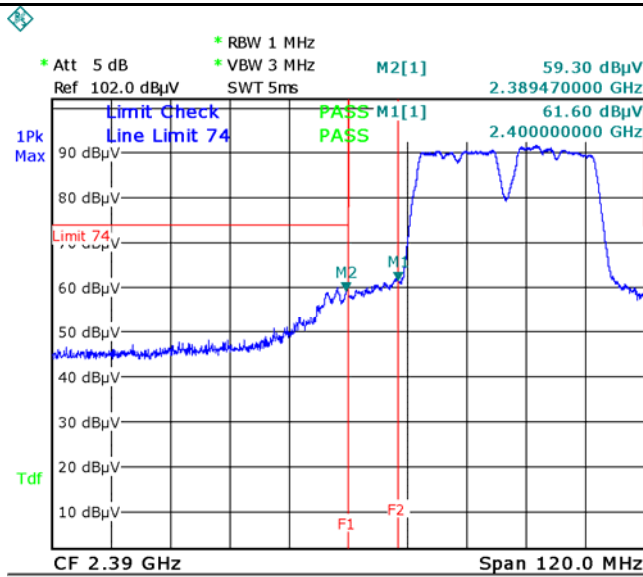
Band Edge, Right Side (Peak) - 802.11n20  
Note: F1 is frequency 2483.5MHz



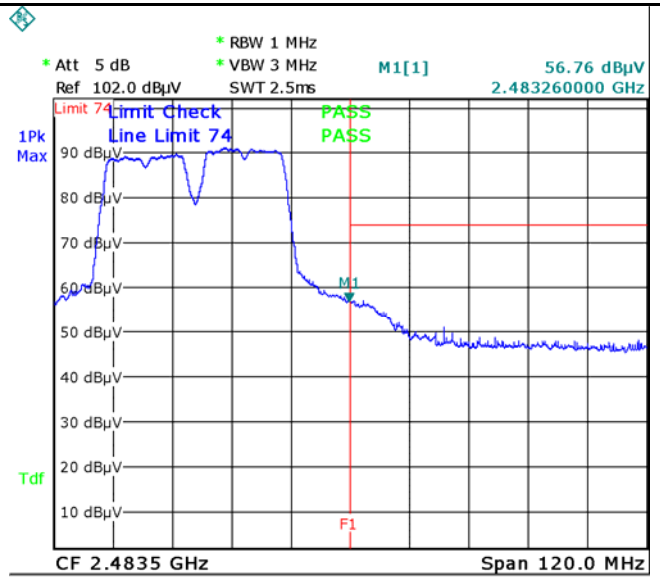
Band Edge, Left Side (Average) - 802.11n20  
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz

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

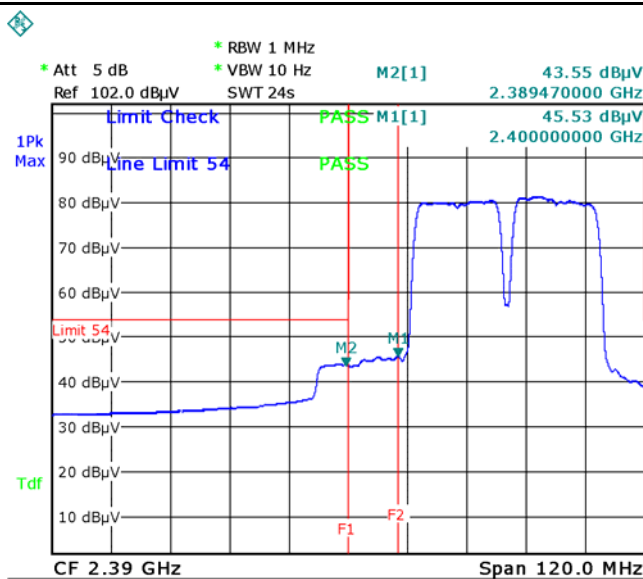
Band Edge, Right Side (Average) - 802.11n20  
Note: F1 is frequency 2483.5MHz



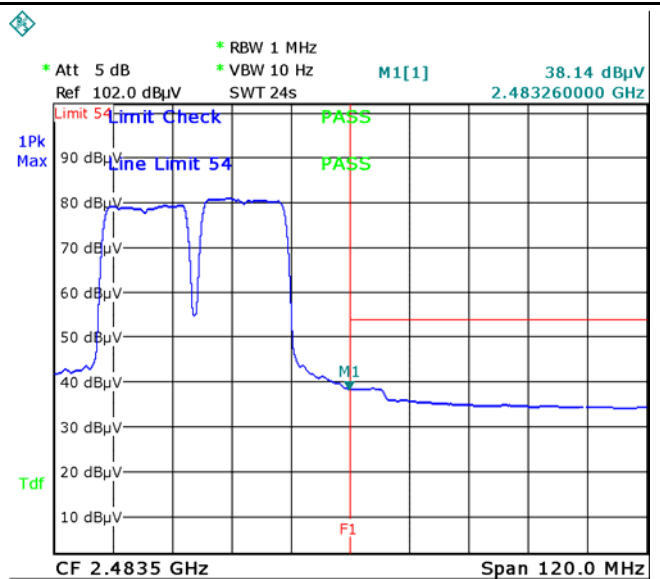
Band Edge, Left Side (Peak) - 802.11n40  
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Band Edge, Right Side (Peak) - 802.11n40  
Note: F1 is frequency 2483.5MHz



Band Edge, Left Side (Average) - 802.11n40  
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



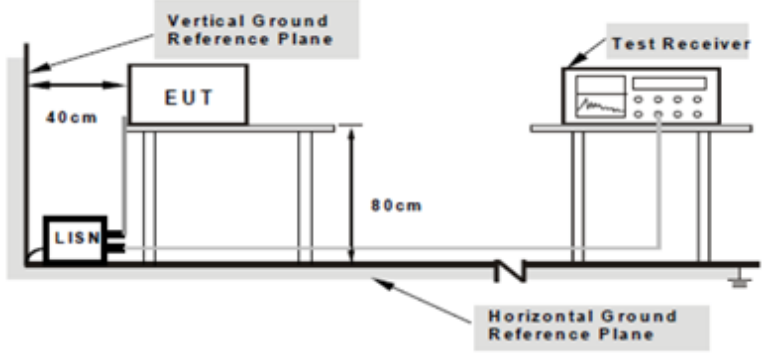
Band Edge, Right Side (Average) - 802.11n40  
Note: F1 is frequency 2483.5MHz

## 6.6 AC Power Line Conducted Emissions

Temperature	22°C
Relative Humidity	51%
Atmospheric Pressure	1009mbar
Test date :	October 09, 2015
Tested By :	Winnie Zhang

### Requirement(s):

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

Test Setup	 <p>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.</p>
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Procedure	<ol style="list-style-type: none"> <li>The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.</li> <li>The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.</li> <li>The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.</li> <li>All other supporting equipment were powered separately from another main supply.</li> </ol>
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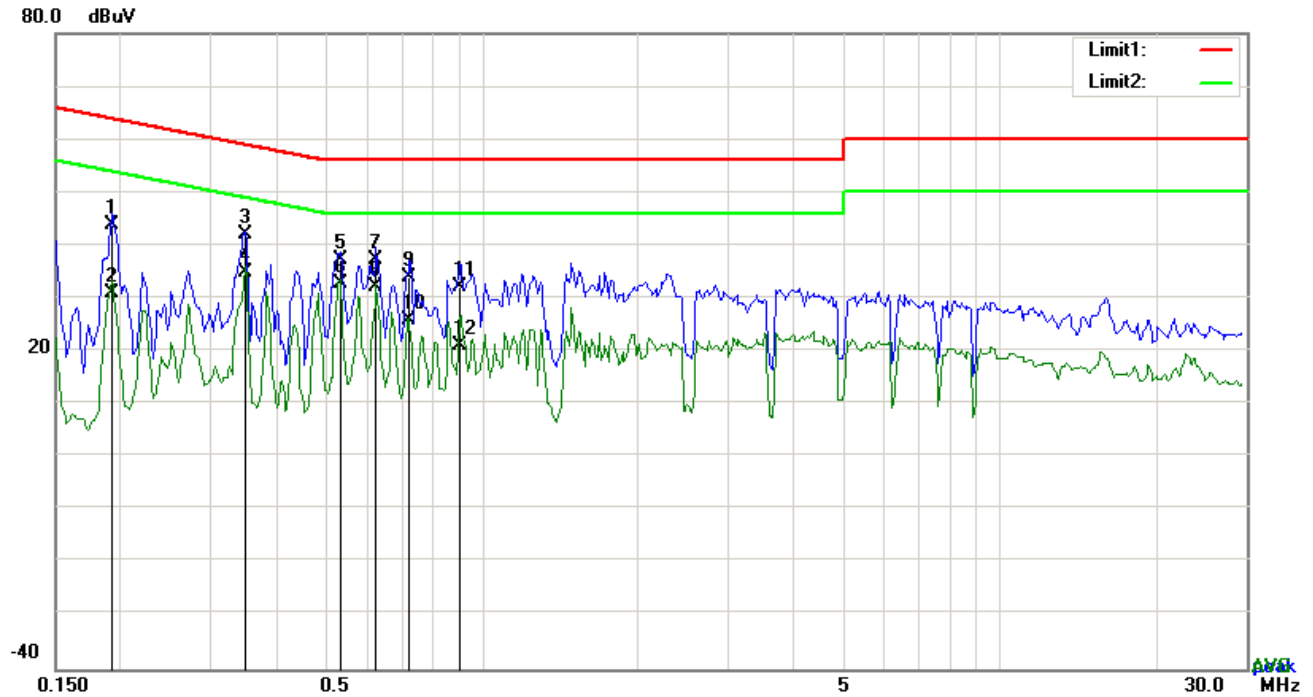
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	<p>5. The EUT was switched on and allowed to warm up to its normal operating condition.</p> <p>6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.</p> <p>7. 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.</p> <p>8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).</p>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

**Test Mode:** Transmitting Mode



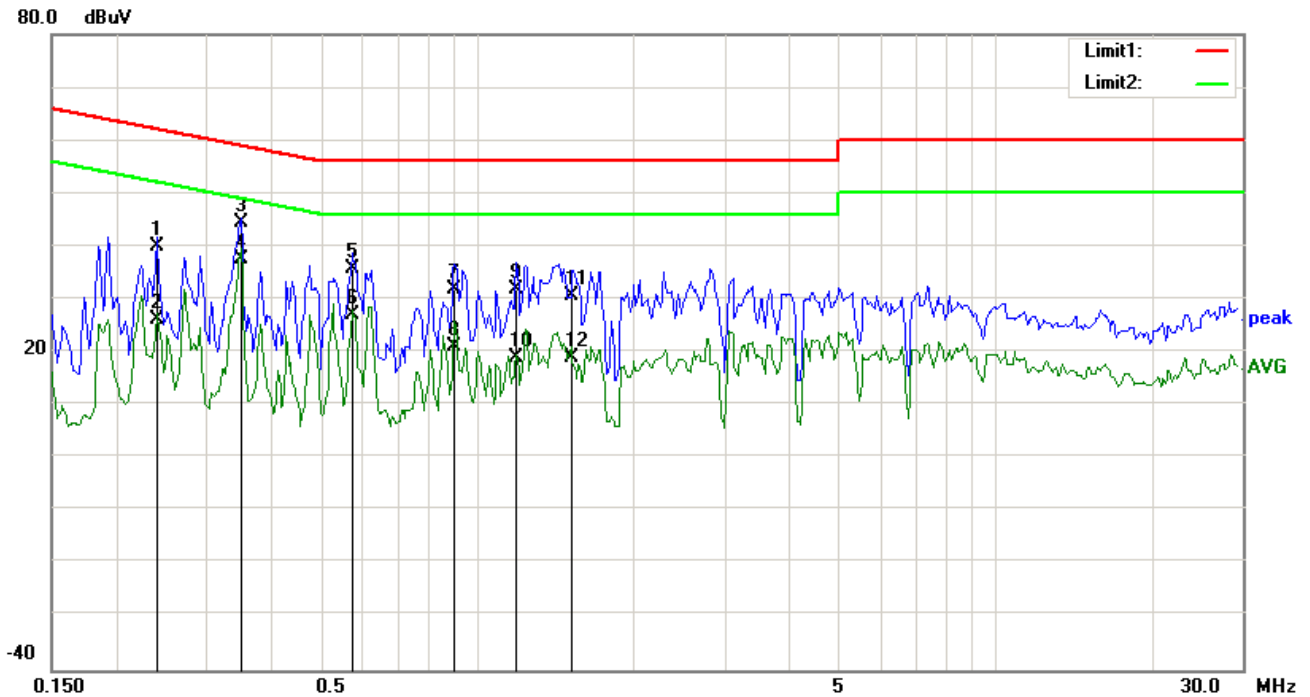
### Test Data

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

No.	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)
1	L1	0.1929	33.95	QP	10.03	43.98	63.91	-19.93
2	L1	0.1929	20.89	AVG	10.03	30.92	53.91	-22.99
3	L1	0.3489	32.01	QP	10.03	42.04	58.99	-16.95
4	L1	0.3489	24.87	AVG	10.03	34.90	48.99	-14.09
5	L1	0.5322	27.16	QP	10.03	37.19	56.00	-18.81
6	L1	0.5322	22.87	AVG	10.03	32.90	46.00	-13.10
7	L1	0.6258	27.11	QP	10.03	37.14	56.00	-18.86
8	L1	0.6258	22.12	AVG	10.03	32.15	46.00	-13.85
9	L1	0.7272	24.05	QP	10.03	34.08	56.00	-21.92
10	L1	0.7272	15.76	AVG	10.03	25.79	46.00	-20.21
11	L1	0.9066	22.06	QP	10.03	32.09	56.00	-23.91
12	L1	0.9066	10.95	AVG	10.03	20.98	46.00	-25.02



**Test Mode:** Transmitting Mode

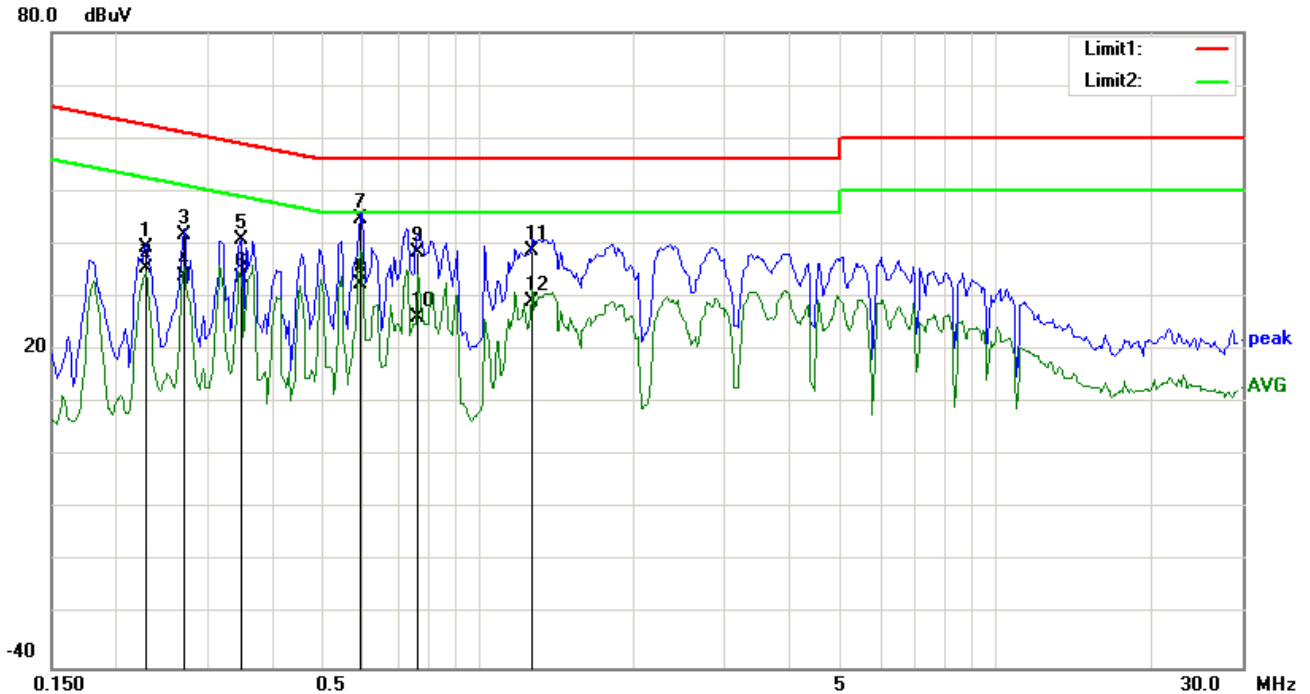


### Test Data

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

No.	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)
1	N	0.2397	29.93	QP	10.02	39.95	62.11	-22.16
2	N	0.2397	16.16	AVG	10.02	26.18	52.11	-25.93
3	N	0.3489	34.52	QP	10.02	44.54	58.99	-14.45
4	N	0.3489	27.52	AVG	10.02	37.54	48.99	-11.45
5	N	0.5712	25.60	QP	10.02	35.62	56.00	-20.38
6	N	0.5712	17.12	AVG	10.02	27.14	46.00	-18.86
7	N	0.9027	21.82	QP	10.03	31.85	56.00	-24.15
8	N	0.9027	10.90	AVG	10.03	20.93	46.00	-25.07
9	N	1.1874	21.88	QP	10.03	31.91	56.00	-24.09
10	N	1.1874	9.00	AVG	10.03	19.03	46.00	-26.97
11	N	1.5267	20.66	QP	10.04	30.70	56.00	-25.30
12	N	1.5267	9.01	AVG	10.04	19.05	46.00	-26.95

**Test Mode:** Transmitting Mode

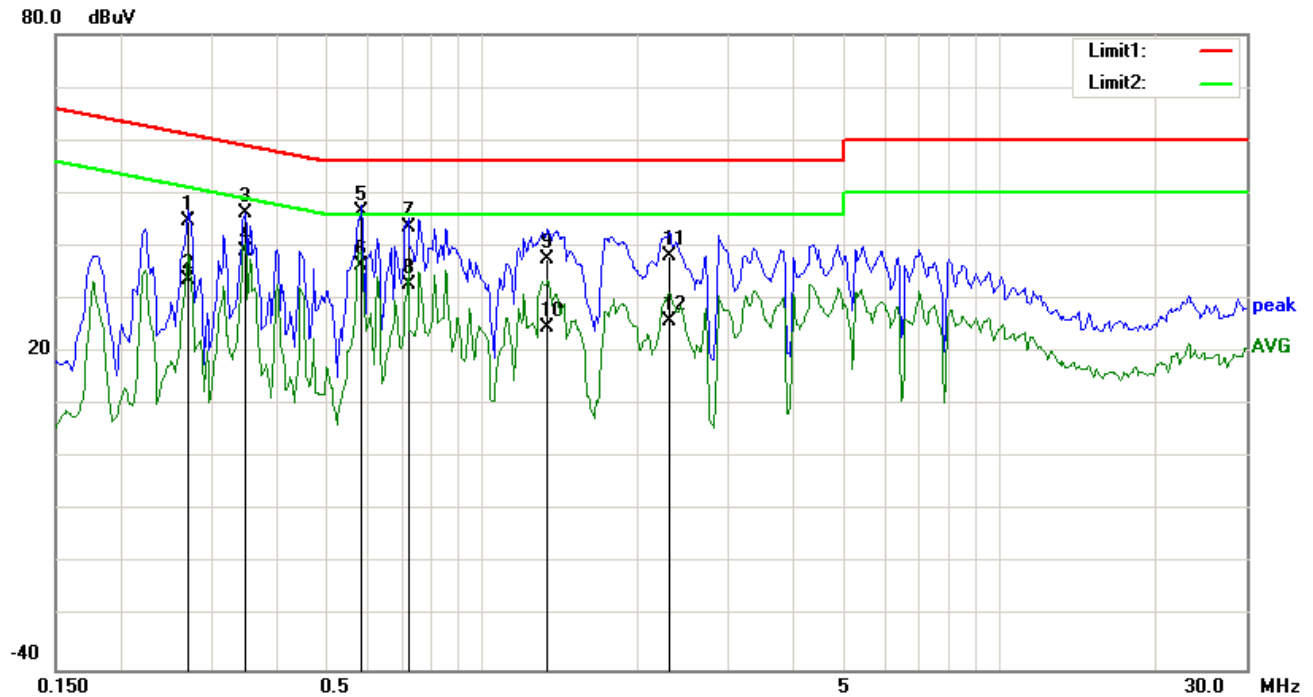


### Test Data

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

No.	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)
1	L1	0.2280	29.42	QP	10.03	39.45	62.52	-23.07
2	L1	0.2280	25.30	AVG	10.03	35.33	52.52	-17.19
3	L1	0.2709	31.65	QP	10.03	41.68	61.09	-19.41
4	L1	0.2709	23.99	AVG	10.03	34.02	51.09	-17.07
5	L1	0.3489	30.94	QP	10.03	40.97	58.99	-18.02
6	L1	0.3489	23.74	AVG	10.03	33.77	48.99	-15.22
7	L1	0.5946	34.62	QP	10.03	44.65	56.00	-11.35
8	L1	0.5946	22.52	AVG	10.03	32.55	46.00	-13.45
9	L1	0.7662	28.55	QP	10.03	38.58	56.00	-17.42
10	L1	0.7662	16.10	AVG	10.03	26.13	46.00	-19.87
11	L1	1.2732	28.61	QP	10.03	38.64	56.00	-17.36
12	L1	1.2732	19.11	AVG	10.03	29.14	46.00	-16.86

**Test Mode:** Transmitting Mode



### Test Data

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

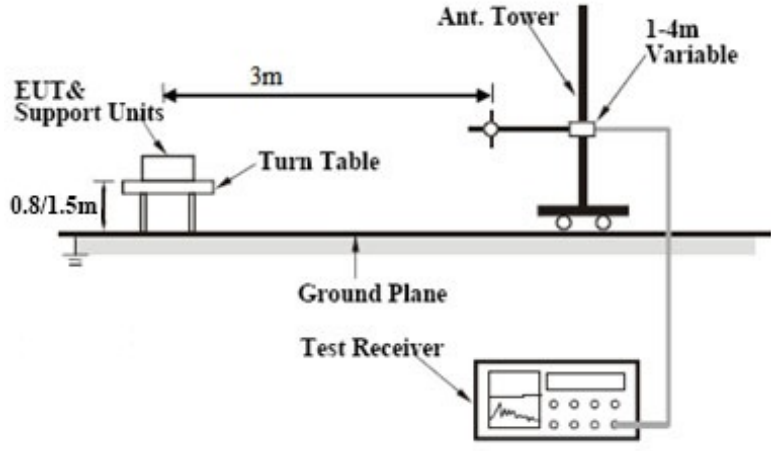
No.	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)
1	N	0.2709	34.84	QP	10.02	44.86	61.09	-16.23
2	N	0.2709	23.56	AVG	10.02	33.58	51.09	-17.51
3	N	0.3489	36.30	QP	10.02	46.32	58.99	-12.67
4	N	0.3489	29.05	AVG	10.02	39.07	48.99	-9.92
5	N	0.5868	36.53	QP	10.02	46.55	56.00	-9.45
6	N	0.5868	26.23	AVG	10.02	36.25	46.00	-9.75
7	N	0.7233	33.42	QP	10.02	43.44	56.00	-12.56
8	N	0.7233	22.58	AVG	10.02	32.60	46.00	-13.40
9	N	1.3434	27.60	QP	10.03	37.63	56.00	-18.37
10	N	1.3434	14.67	AVG	10.03	24.70	46.00	-21.30
11	N	2.3067	28.14	QP	10.04	38.18	56.00	-17.82
12	N	2.3067	15.92	AVG	10.04	25.96	46.00	-20.04

## 6.7 Radiated Emissions

Temperature	22°C
Relative Humidity	51%
Atmospheric Pressure	1009mbar
Test date :	October 09, 2015
Tested By :	Winnie Zhang

### Requirement(s):

Spec	Item	Requirement	Applicable										
47CFR§15.247(d),	a)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges	<input checked="" type="checkbox"/>										
		<table><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>		Frequency range (MHz)	Field Strength (µV/m)	30 – 88	100	88 – 216	150	216 960	200	Above 960	500
		Frequency range (MHz)		Field Strength (µV/m)									
		30 – 88		100									
		88 – 216		150									
216 960	200												
Above 960	500												
	b)	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 <input checked="" type="checkbox"/> 20 dB down <input type="checkbox"/> 30 dB down	<input checked="" type="checkbox"/>										
	c)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	<input checked="" type="checkbox"/>										

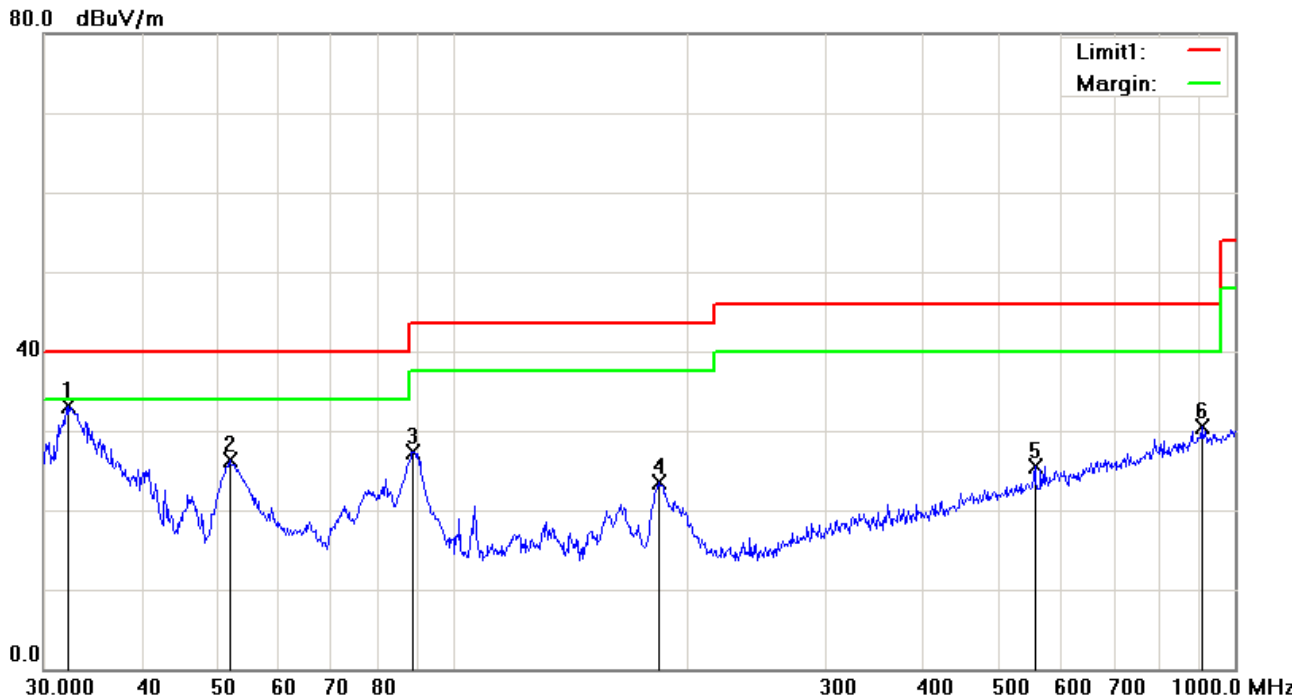
Test Setup	
Procedure	<ol style="list-style-type: none"> <li>The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating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

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

**Test Mode:** Transmitting Mode

(Below 1GHz)

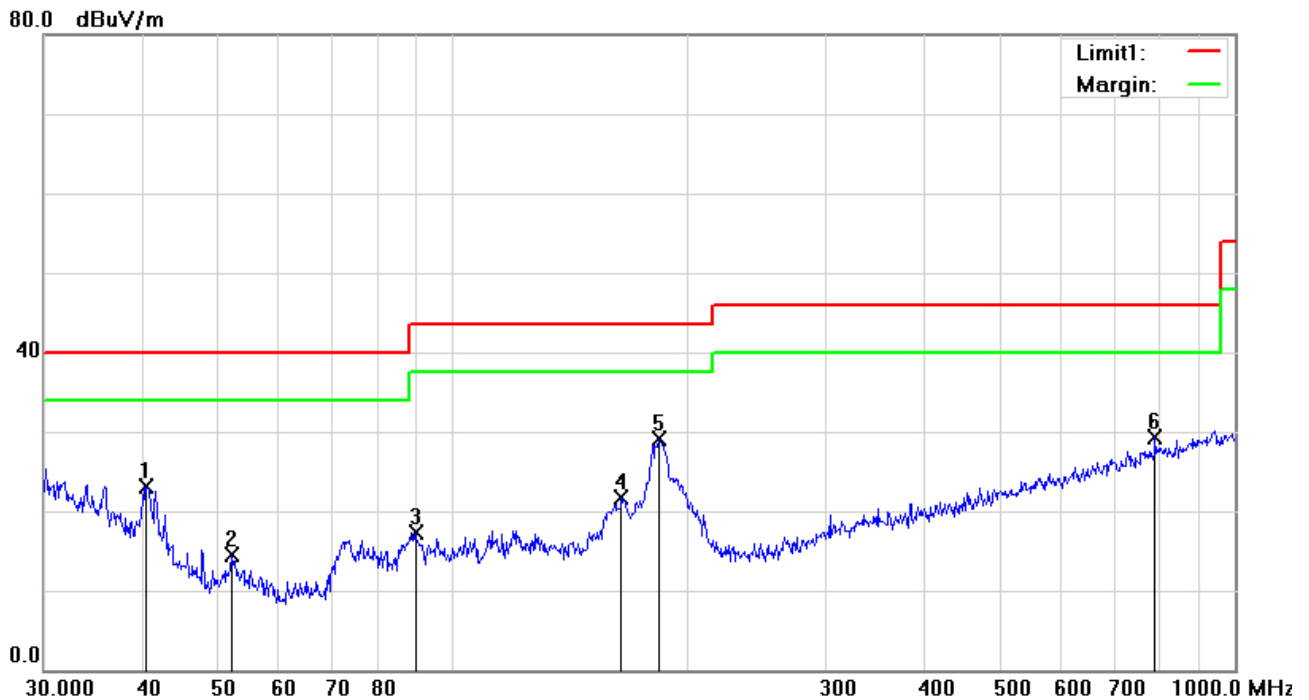


### Test Data

#### Vertical Polarity Plot @3m

No	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Height	Degree
1	V	32.1795	35.02	peak	-1.87	33.15	40.00	-6.85	100	194
2	V	51.8430	39.78	peak	-13.40	26.38	40.00	-13.62	100	242
3	V	88.9639	40.80	peak	-13.40	27.40	43.50	-16.10	100	167
4	V	183.2005	33.17	peak	-9.67	23.50	43.50	-20.00	100	179
5	V	554.8254	26.29	peak	-0.73	25.56	46.00	-20.44	100	220
6	V	906.4824	25.69	peak	4.74	30.43	46.00	-15.57	100	0

**(Below 1GHz)**



**Test Data**

**Horizontal Polarity Plot @3m**

No	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Height	Degree
1	H	40.5591	31.05	peak	-7.96	23.09	40.00	-16.91	100	229
2	H	52.2079	27.93	peak	-13.44	14.49	40.00	-25.51	100	192
3	H	89.5900	30.71	peak	-13.38	17.33	43.50	-26.17	100	188
4	H	164.3302	30.43	peak	-8.64	21.79	43.50	-21.71	100	274
5	H	183.2005	38.83	peak	-9.67	29.16	43.50	-14.34	100	109
6	H	790.6188	26.30	peak	3.06	29.36	46.00	-16.64	100	241

<b>Test Mode:</b>	<b>Transmitting Mode</b>
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#### Low Channel (2412 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)
4824	38.19	AV	V	34	6.86	31.72	47.33	54	-6.67
4824	37.52	AV	H	33.8	6.86	31.72	46.46	54	-7.54
4824	47.38	PK	V	34	6.86	31.72	56.52	74	-17.48
4824	46.83	PK	H	33.8	6.86	31.72	55.77	74	-18.23

#### Middle Channel (2437 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)
4874	38.25	AV	V	33.6	6.82	31.82	46.85	54	-7.15
4874	37.61	AV	H	33.8	6.82	31.82	46.41	54	-7.59
4874	47.48	PK	V	33.6	6.82	31.82	56.08	74	-17.92
4874	46.77	PK	H	33.8	6.82	31.82	55.57	74	-18.43

#### High Channel (2462 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)
4924	38.21	AV	V	34.6	6.76	31.92	47.65	54	-6.35
4924	37.75	AV	H	34.7	6.76	31.92	47.29	54	-6.71
4924	47.53	PK	V	34.6	6.76	31.92	56.97	74	-17.03
4924	46.86	PK	H	34.7	6.76	31.92	56.4	74	-17.6



## Annex A. TEST INSTRUMENT

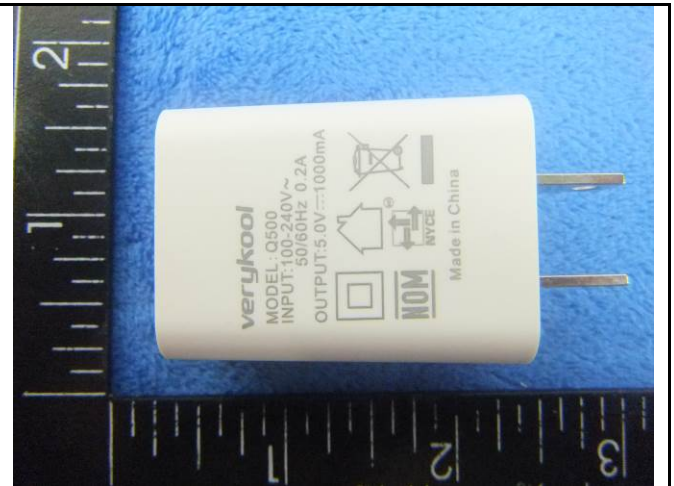
Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191106	09/25/2015	09/24/2016	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191107	09/25/2015	09/24/2016	<input checked="" type="checkbox"/>
LISN	ISN T800	34373	09/25/2015	09/24/2016	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/24/2015	09/23/2016	<input checked="" type="checkbox"/>
Transient Limiter	LIT-153	531118	09/01/2015	08/31/2016	<input checked="" type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	09/01/2015	08/31/2016	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/20/2014	11/19/2015	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	09/01/2015	08/31/2016	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/25/2015	03/24/2016	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/21/2015	09/20/2016	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/24/2015	09/23/2016	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/25/2015	09/23/2016	<input checked="" type="checkbox"/>

## Annex B. EUT and Test Setup Photographs

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



Whole Package - Top View



Adapter - Front View



EUT - Front View



EUT - Rear View

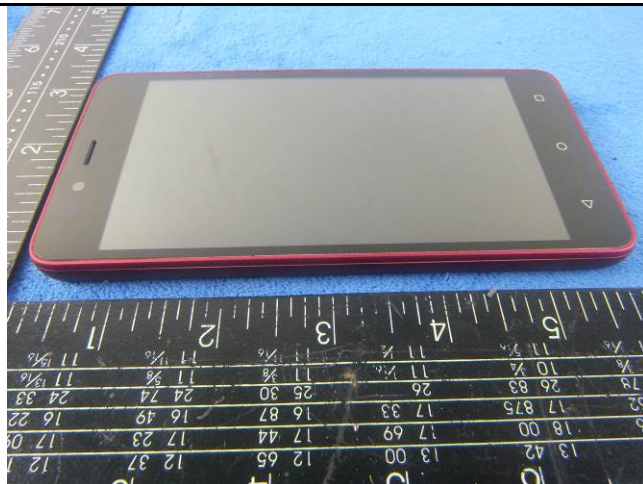
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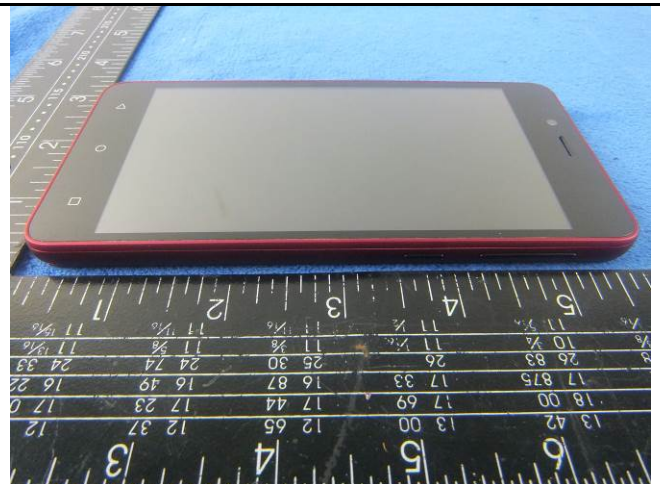
EUT - Top View



EUT - Bottom View



EUT - Left View



EUT - Right View



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



Cover Off - Top View 1



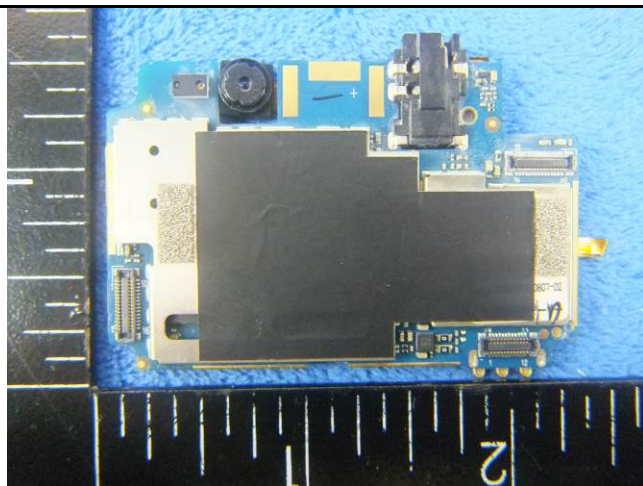
Cover Off - Top View 2



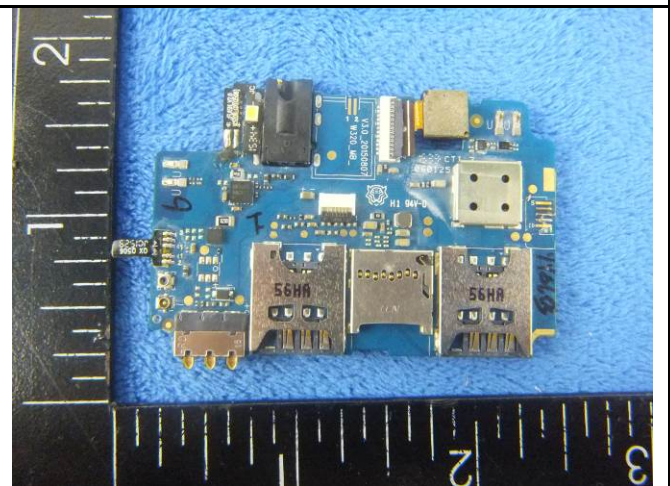
Battery - Top View



Battery - Bottom View

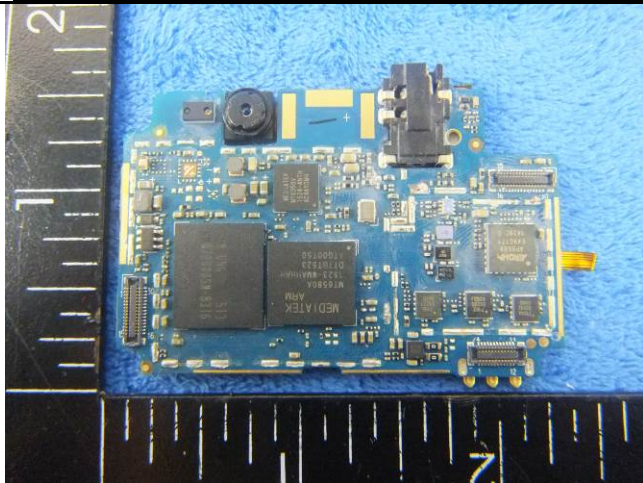


Mainboard With Shielding - Front View

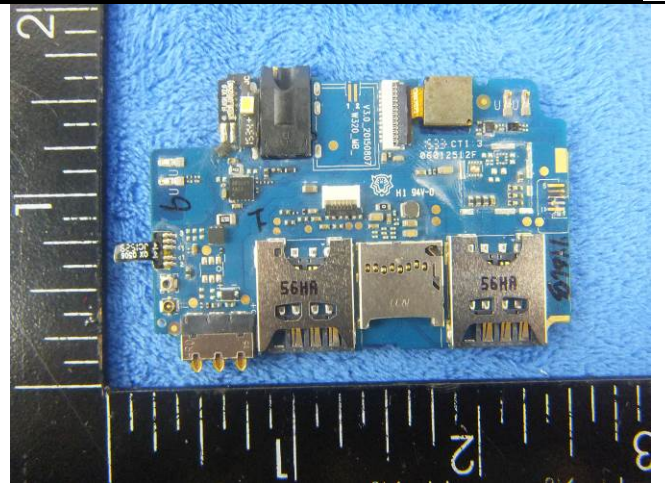


Mainboard With Shielding - Rear View

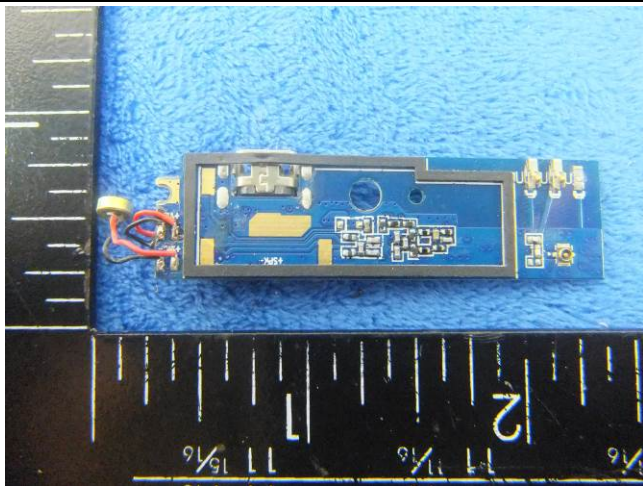




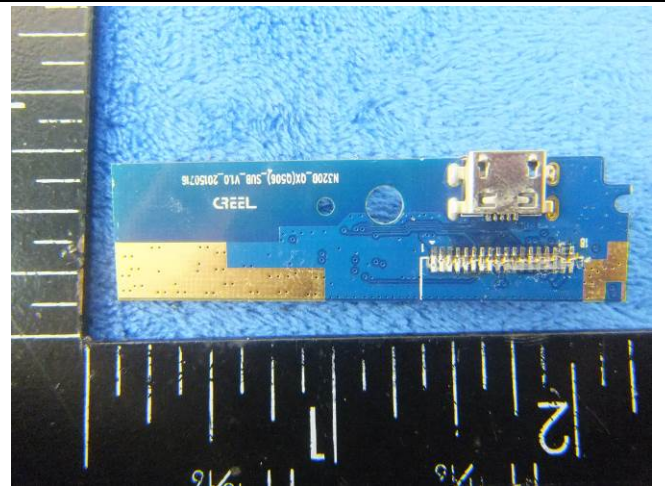
Mainboard Without Shielding - Front View



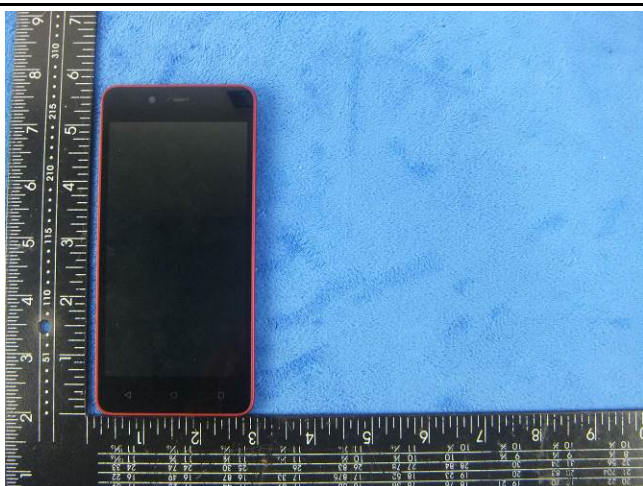
Mainboard Without Shielding - Rear View



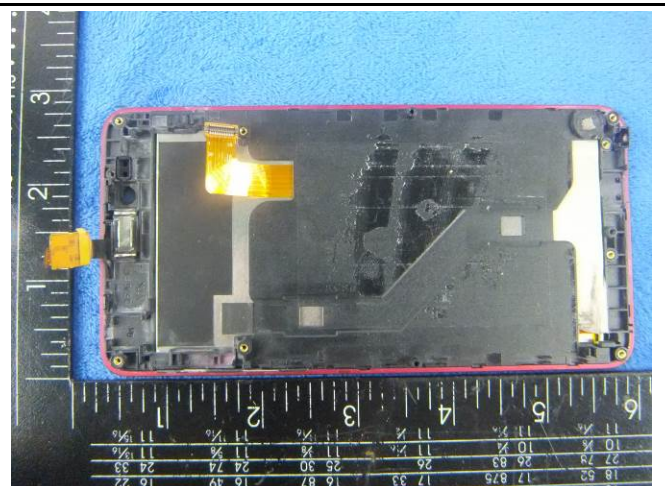
Small board - Front View



Small board - Rear View



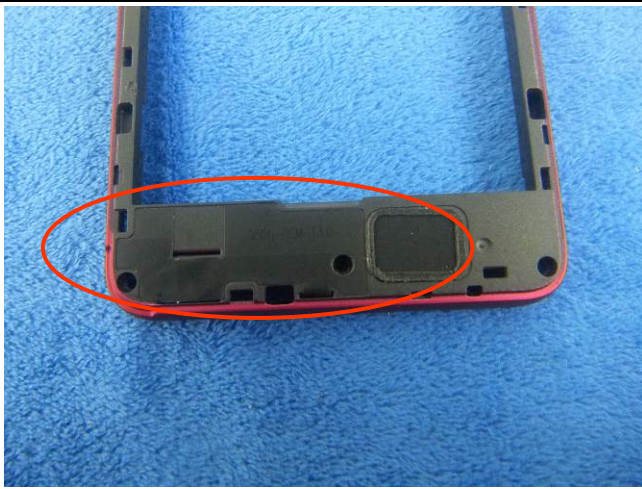
LCD - Front View



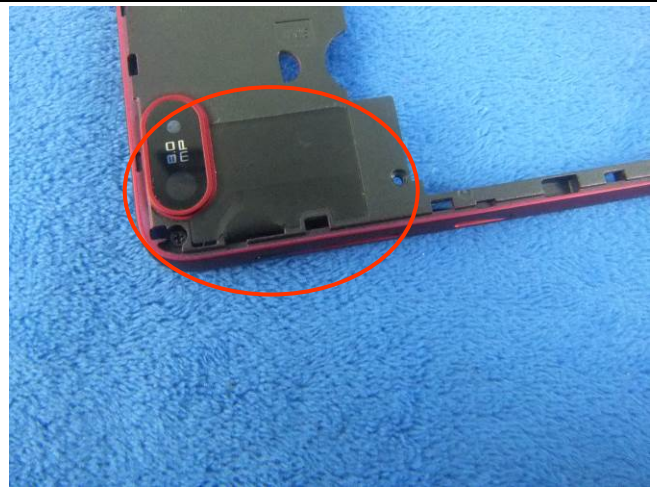
LCD - Rear View



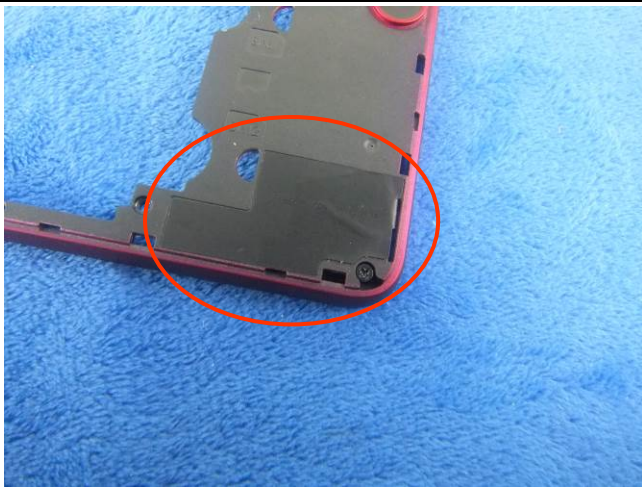
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GSM/PCS/UMTS-FDD Antenna View



WIFI/BT/BLE - Antenna View



GPS - Antenna View

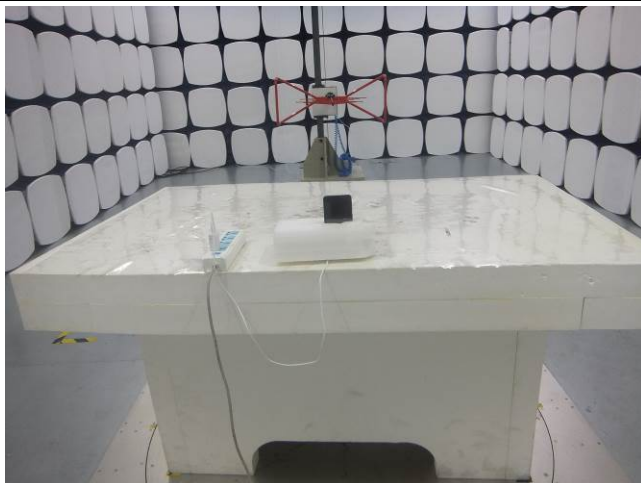
**Annex B.iii. Photograph: Test Setup Photo**



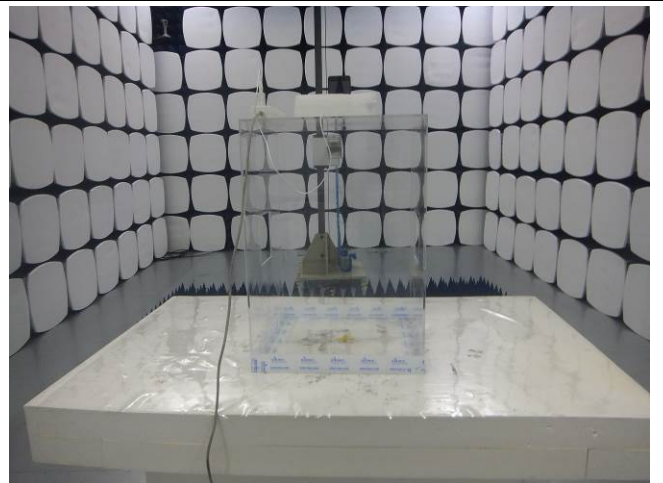
Conducted Emissions Test Setup Front View



Conducted Emissions Test Setup Side View



Radiated Spurious Emissions Test Setup Below 1GHz

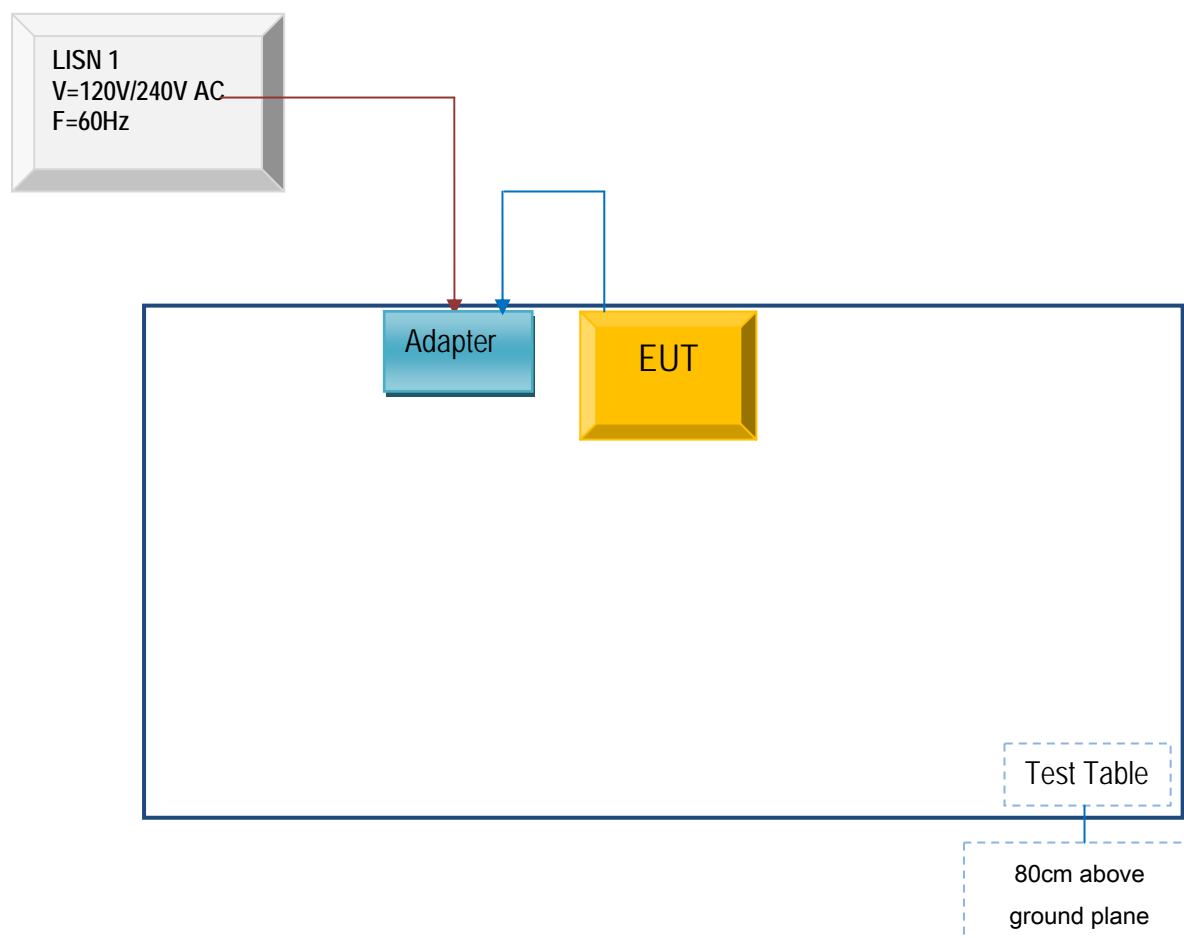


Radiated Spurious Emissions Test Setup Above  
1GHz

## Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

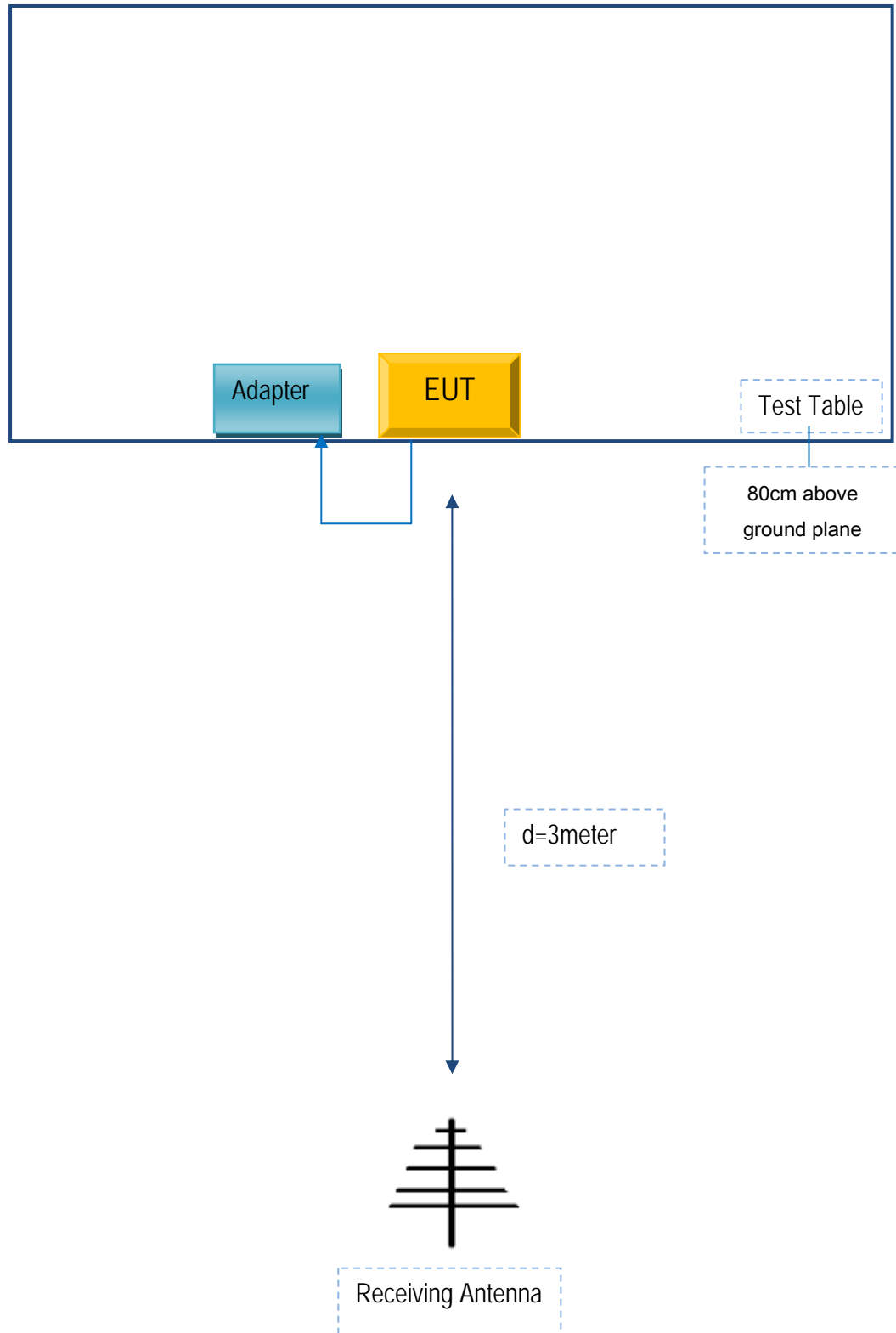
### Annex C.ii. TEST SET UP BLOCK

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

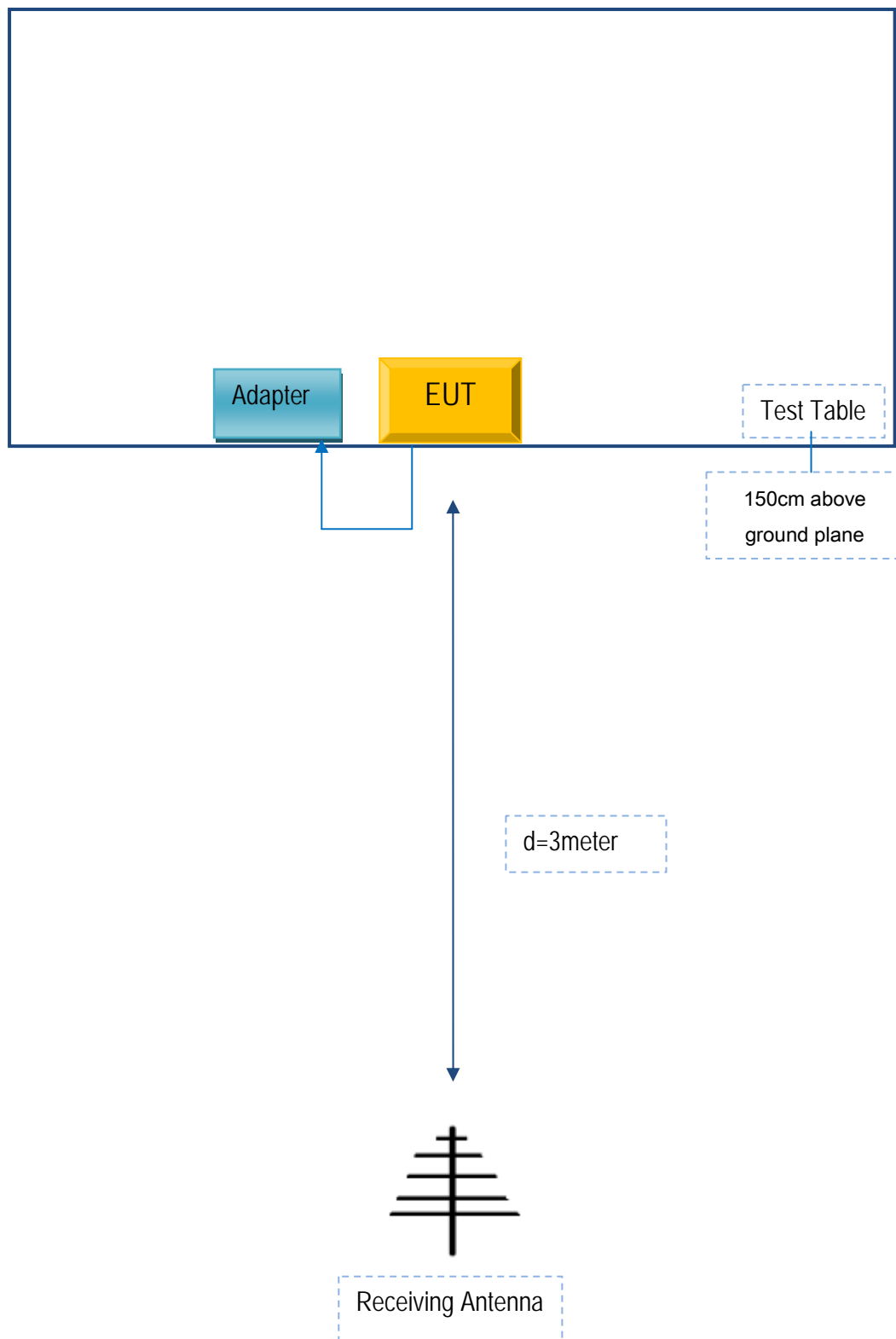




**Block Configuration Diagram for Radiated Emissions ( Below 1GHz ) .**



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



## **Annex C. ii. SUPPORTING EQUIPMENT DESCRIPTION**

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

Manufacturer	Equipment Description	Model	Calibration Date	Calibration Due Date
N/A	N/A	N/A	N/A	N/A

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

Please see attachment

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## Annex E. DECLARATION OF SIMILARITY

N/A