TEST REPORT

Product Name:	Vision MARK-1
Trade Mark:	N/A
Model No. / HVIN:	Vision MARK-1
Report Number:	210125061RFC-2
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-247 Issue 2 RSS-Gen Issue 5
FCC ID:	2AYS7-MARK1
IC:	27077-MARK1
Test Result:	PASS
Date of Issue:	May 7, 2021

Prepared for:

Insituware LLC
107 Gilbreth Pkwy, Suite #202, Mullica Hill, NJ 08062

Prepared by:

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UnionTrust Laboratories UnionTrust *Certified*

Date: May 7, 2021

Version

Version No.	Date	Description
V1.0	May 7, 2021	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Insituware LLC
Address of Applicant:	107 Gilbreth Pkwy, Suite #202, Mullica Hill, NJ 08062
Manufacturer:	Insituware LLC
Address of Manufacturer:	107 Gilbreth Pkwy, Suite #202, Mullica Hill, NJ 08062

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Vision MARK-1		
Model No. / HVIN:	Vision MARK-1		
Trade Mark:	N/A		
DUT Stage:	Production Unit		
	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
		Bluetooth V4.2	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
Sample Received Date:	January 26, 2021		
Sample Tested Date:	January 26, 2021 to April 2, 2021		

1.2.2 Description of Accessories

Adapter	
Model No.:	GTM96180-1807-2.0
Input:	100-240 V~50/60 Hz 0.6 A
Output:	5.0 V ⎓ 3.6 A 18W
DC Cable:	1.20 Meter, Unshielded without ferrite
Manufacturer:	GlobTek Inc

Battery	
Model No.:	PR-CU-R295-V1
Battery Type:	Lithium-ion Polymer Battery
Rated Voltage:	3.7 Vdc
Limited Charge Voltage:	4.2 Vdc
Rated Capacity:	5000 mAh
Manufacturer:	AA Portable Power Corp (Battery Space)

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	2400 MHz to 2483.5 MHz
Frequency Range:	2412 MHz to 2462 MHz
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20
Type of Modulation:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK)
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS7
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11
Channel Separation:	5 MHz
Antenna Type:	PCB Trace Antenna
Antenna Gain:	6.5 dBi
Maximum Peak Power:	IEEE 802.11b: 10.95 dBm IEEE 802.11g: 18.17 dBm IEEE 802.11n-HT20: 18.03 dBm
Maximum e.i.r.p	IEEE 802.11b: 17.45 dBm IEEE 802.11g: 24.67 dBm IEEE 802.11n-HT20: 24.53 dBm
Normal Test Voltage:	3.7 Vdc

1.4 OTHER INFORMATION

Operation Frequency Each of Channel	
IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20	**f = 2407 + 5k MHz, k = 1,…,11**
Note: **f** is the operating frequency (MHz); **k** is the operating channel.	

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	Lenovo	E450	SL10G10780	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.20 Meter	Applicant
2	USB Cable	Type C	0.50 Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district,

Shenzhen, China
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.2 dB
2	Conducted emission 150KHz-30MHz	±2.7 dB
3	Radiated emission 9KHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.9 dB
5	Radiated emission 1GHz-18GHz	± 4.8 dB
6	Radiated emission 18GHz-26GHz	± 5.1 dB
7	Radiated emission 26GHz-40GHz	± 5.1 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.9 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	2.4 GHz: ± 6.5 x 10-8
12	Transmission Time	± 0.19 %

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart C Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c) RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013 Clause 6.2	PASS
Conducted Peak Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 2, Section 5.4(d)	ANSI C63.10-2013 Clause 11.9.1.3	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 2, Section 5.2(a)	ANSI C63.10-2013 Clause 11.8.1	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, Section 6.7	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 2, Section 5.2(b)	ANSI C63.10-2013 Clause 11.10.2	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-Gen Issue 5, Section 6.13/8.9/8.10	ANSI C63.10-2013 Clause 11.11 & Clause 11.12	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.13	PASS
Note: 1) N/A: In this whole report not applicable.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 18, 2020	Nov. 17, 2021
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 14, 2020	Nov. 13, 2021
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 14, 2020	Nov. 13, 2021
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 14, 2020	Nov. 13, 2021
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 10, 2020	Nov. 9, 2021
☒	Preamplifier	HP	8447F	2805A02960	May. 30, 2020	May. 9, 2021
☐	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	Nov. 18, 2020	Nov. 17, 2021
☐	6dB Attenuator	Talent	RA6A5-N-18	18103002	Nov. 14, 2020	Nov. 13, 2021
☐	Horn Antenna	ETS-LINDGREN	3117	00164202	May. 30, 2020	May. 29, 2021
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	Dec. 03, 2018	Dec. 03, 2021
☐	Horn Antenna	ETS-LINDGREN	3116C	00200180	Jun. 19, 2020	Jun. 18, 2021
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 14, 2020	Nov. 13, 2021
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Band Rejection Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G248	Nov. 16, 2020	Nov. 15, 2021
☐	Band Rejection Filter (5150MHz~5880MHz)	Micro-Tronics	BRM50716	G1868	Nov. 16, 2020	Nov. 15, 2021
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	Receiver	R&S	ESR7	1316.3003K07 -101181-K3	Nov. 18, 2020	Nov. 17, 2021
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 18, 2020	Nov. 17, 2021
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 18, 2020	Nov. 17, 2021
☐	LISN	ETS-Lindgren	3816/2SH	00201088	Nov. 18, 2020	Nov. 17, 2021
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 10, 2020	Nov. 09, 2021
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 10, 2020	Nov. 09, 2021
☐	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Nov. 10, 2020	Nov. 09, 2021
☒	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	Nov. 10, 2020	Nov. 09, 2021

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	3.7	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Tested by
AC Power Line Conducted Emission	24.5	51	100.03	Tripp Jiang
Conducted Peak Output Power	24.3	48	99.80	Leo Li
6dB Bandwidth & Occupied Bandwidth	24.3	48	99.80	Leo Li
Power Spectral Density	24.3	48	99.80	Leo Li
Conducted Out of Band Emission	24.3	48	99.80	Leo Li
Radiated Spurious Emissions	25.9	54	100.34	Andy Lin
Band Edge Measurements (Radiated)	25.9	54	100.34	Andy Lin

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz

4.3 EUT TEST STATUS

Mode	Tx Function	Description
IEEE 802.11b IEEE 802.11g IEEE 802.11n-HT20	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

Power Setting	
Mode	**Channel 1 -11**
Power Setting: not applicable, test used software default power level.	

Test Software
Test software name: Testing_Commands_Insituware_Rev1;

4.4 PRE-SCAN

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Following data rate was (were) selected for the final test as listed below

Mode	Worst-case data rates
IEEE 802.11b	1 Mbps
IEEE 802.11g	6 Mbps
IEEE 802.11n-HT20	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

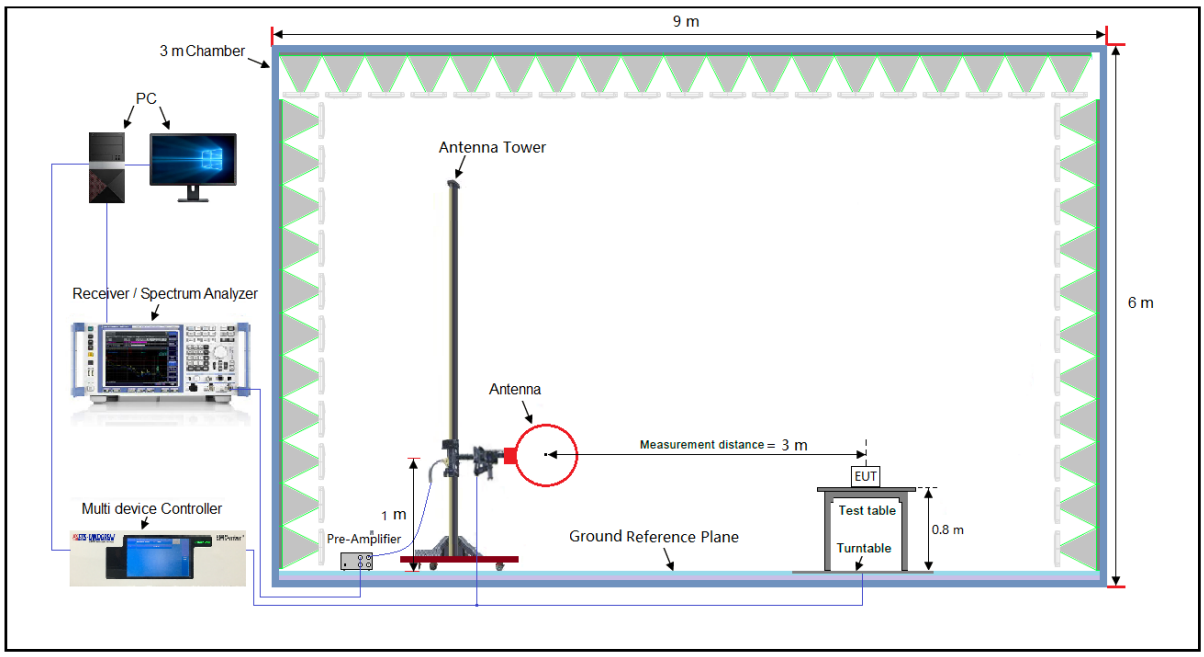


Figure 2. 30MHz to 1GHz

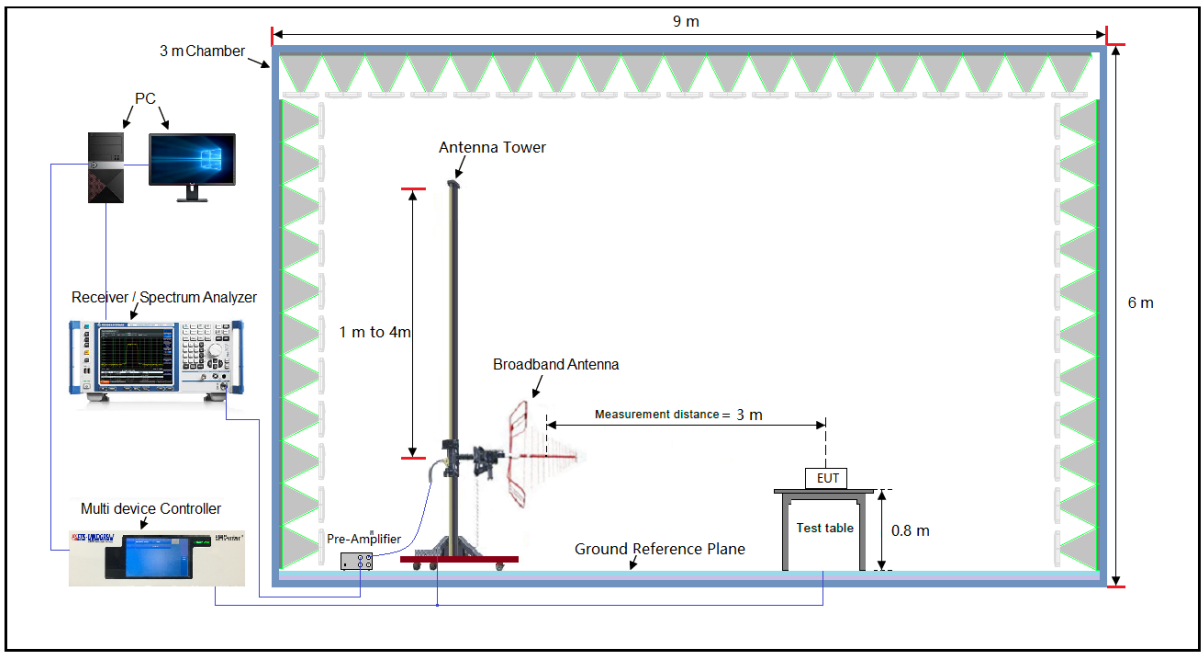
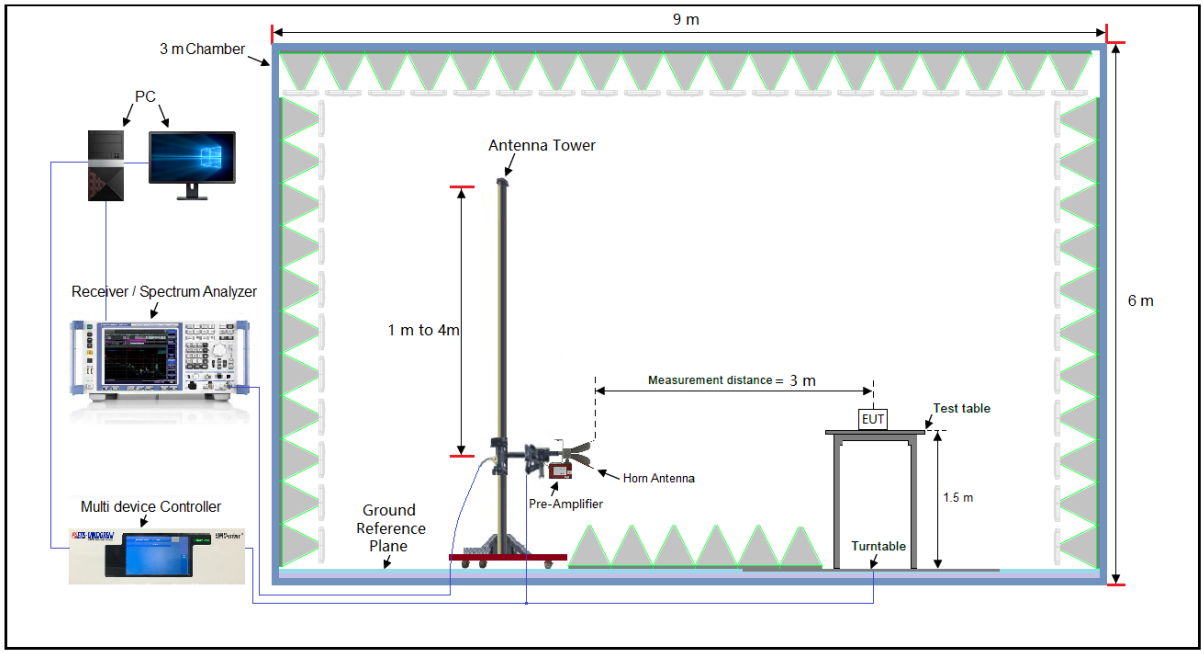
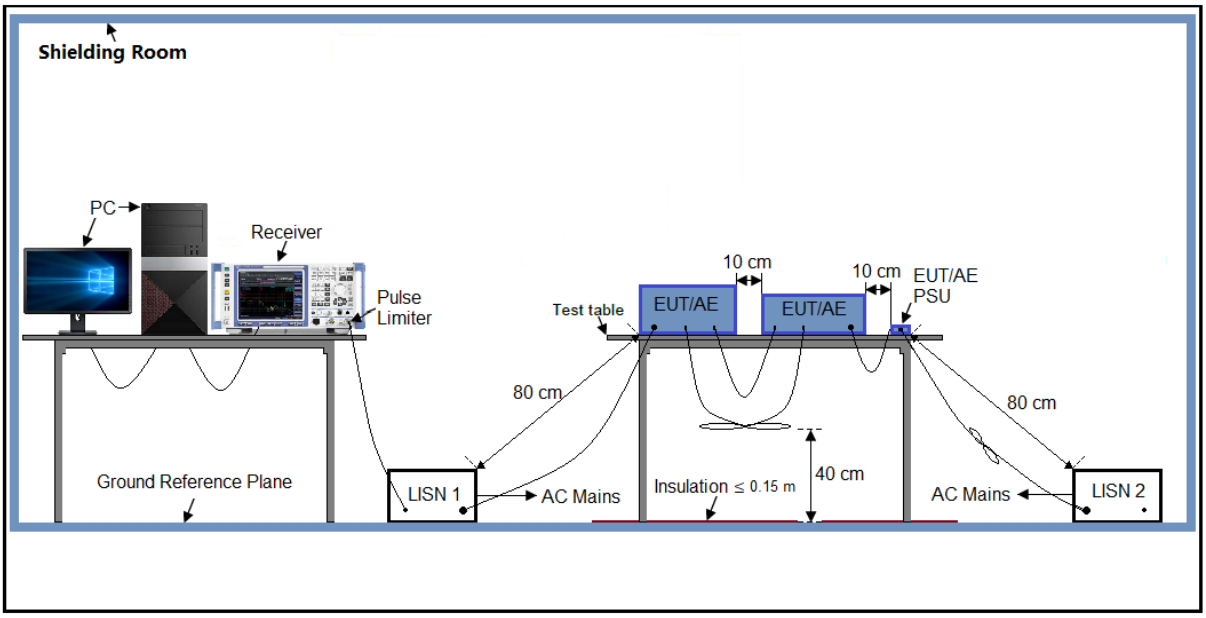


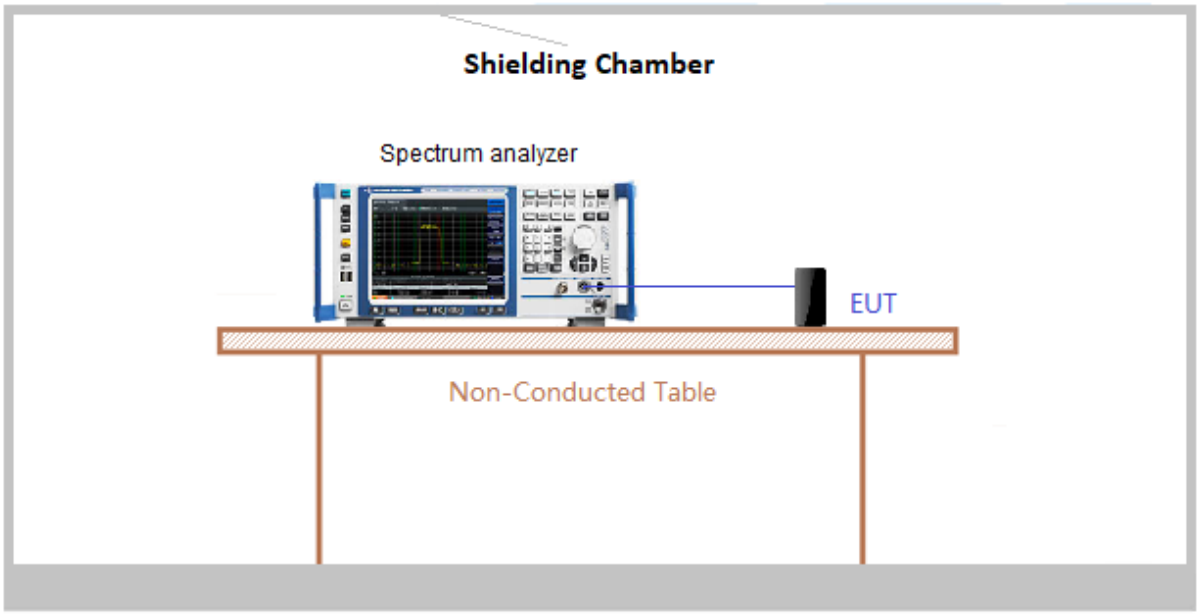
Figure 3. Above 1GHz



4.5.2 For Conducted Emissions test setup



4.5.3 For Conducted RF test setup



4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.7V battery. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

Frequency	Mode	Antenna Port	Worst-case axis positioning
Above 1GHz	1TX	Chain 0	Z axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.7 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 11.6.

Test Results

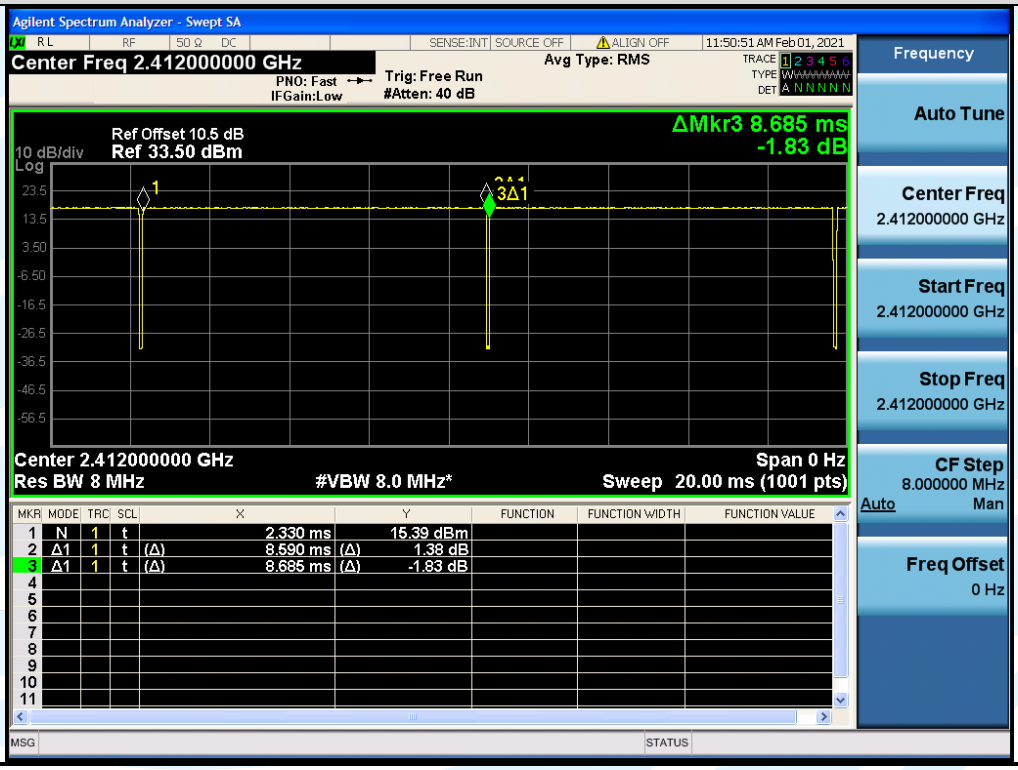
Mode	Data rates (Mbps)	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
IEEE 802.11b	1	8.5900	8.6850	0.99	98.91	0.00	0.01	-0.10
IEEE 802.11g	6	1.4300	1.5350	0.93	93.16	0.31	0.70	-0.62
IEEE 802.11n-HT20	MCS0	1.3350	1.4400	0.93	92.71	0.33	0.75	-0.66

Remark:

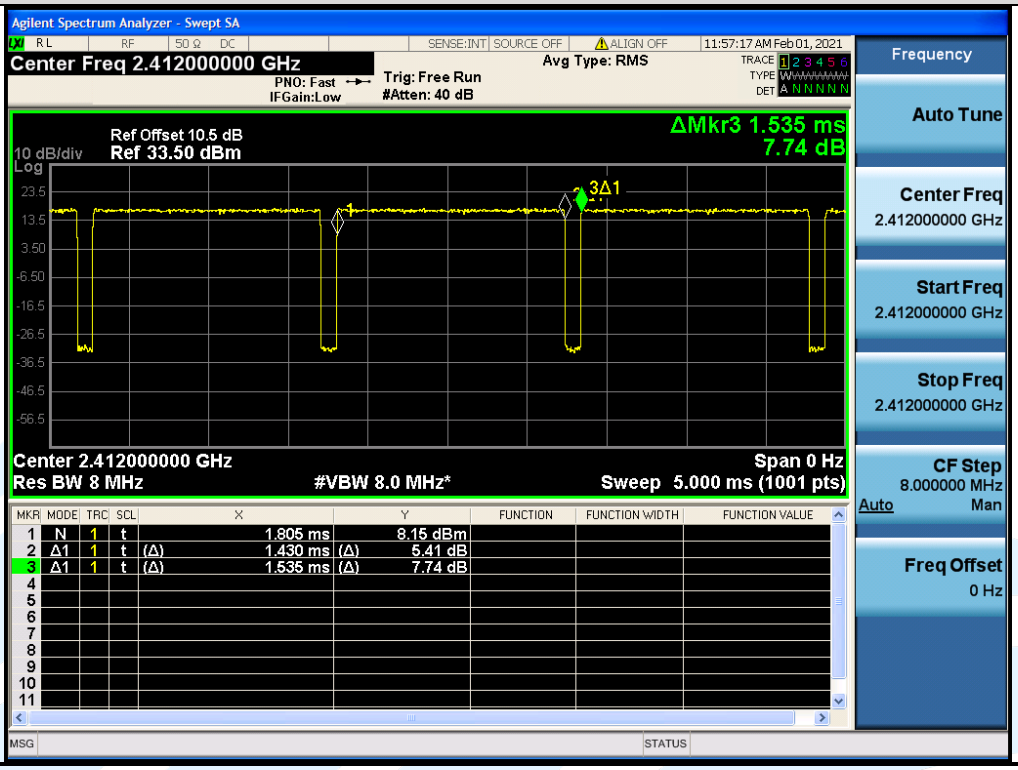
1) Duty cycle= On Time/ Period;
2) Duty Cycle factor = 10 * log(1/ Duty cycle);
3) Average factor = 20 $\log_{10}$ Duty Cycle.

The test plots as follows

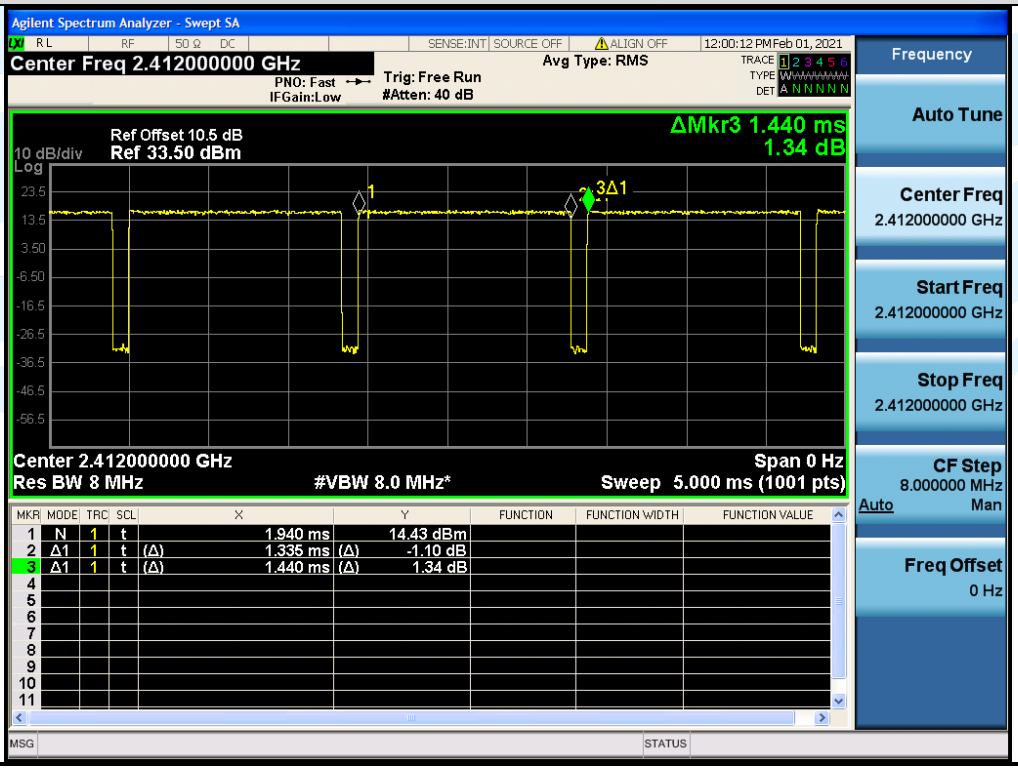
IEEE 802.11b



IEEE 802.11g



IEEE 802.11n-HT20



5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	RSS-247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
4	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
5	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
6	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum system, and Hybrid system devices operating under Section 15.247 of the FCC rules

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(b) (4) requirement:** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. **RSS-Gen Issue 5, Section 6.8 requirement:** According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
EUT Antenna:
Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 6.5 dBi.

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section15.247 (b)(3)
RSS-247 Issue 2, Section 5.4(d)

Test Method: ANSI C63.10-2013 Clause 11.9.1.3

Limit: For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

Test Procedure:
1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes' peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Results:

Mode	Channel/ Frequency (MHz)	Maximum Conducted Peak Power (dBm)	Maximum e.i.r.p (dBm)	Limit (dBm)	Pss / Fail
IEEE 802.11b	1(2412)	10.24	16.74	29.5	Pass
	6(2437)	10.95	17.45	29.5	Pass
	11(2462)	9.96	16.46	29.5	Pass
IEEE 802.11g	1(2412)	17.78	24.28	29.5	Pass
	6(2437)	18.17	24.67	29.5	Pass
	11(2462)	17.58	24.08	29.5	Pass
IEEE 802.11n-HT20	1(2412)	17.34	23.84	29.5	Pass
	6(2437)	18.03	24.53	29.5	Pass
	11(2462)	17.23	23.73	29.5	Pass

Remark:

Directional Gain = 6.5dBi +10log(1)=6.5dBi > 6dBi ,so the power density limit shall be reduced to 30-(6.5 -6) =29.5dBm.

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)
RSS-247 Issue 2, Section 5.2(a)
RSS-Gen Issue 5, Section 6.7

Test Method: ANSI C63.10-2013 Clause 11.8.1
RSS-Gen Issue 5, Section 6.7

Limit: For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

6dB Bandwidth
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x 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 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.

Occupied Bandwidth
a) Set RBW = 1% to 5% of the occupied bandwidth
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

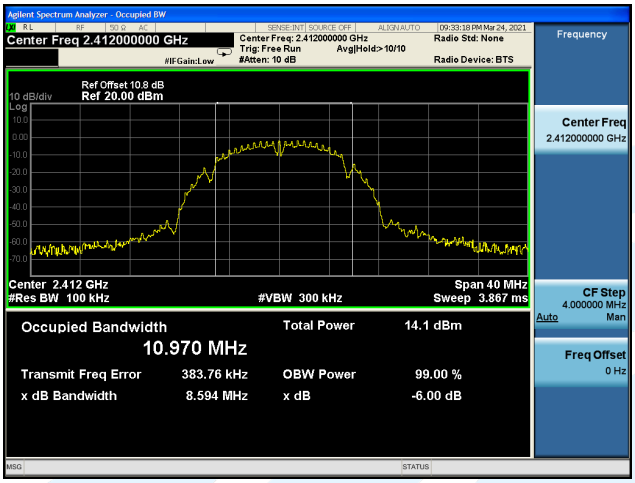
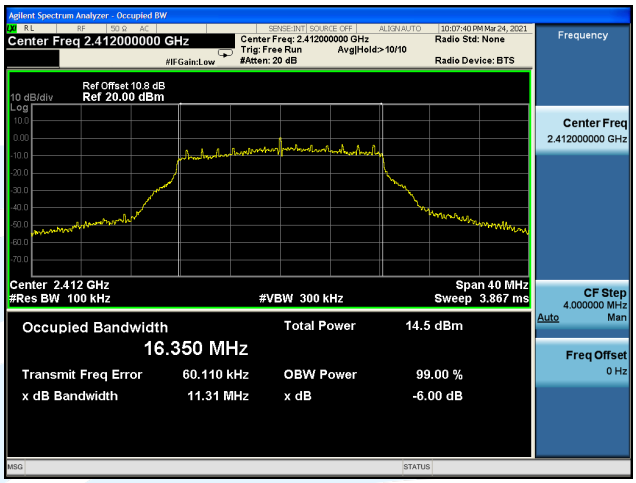
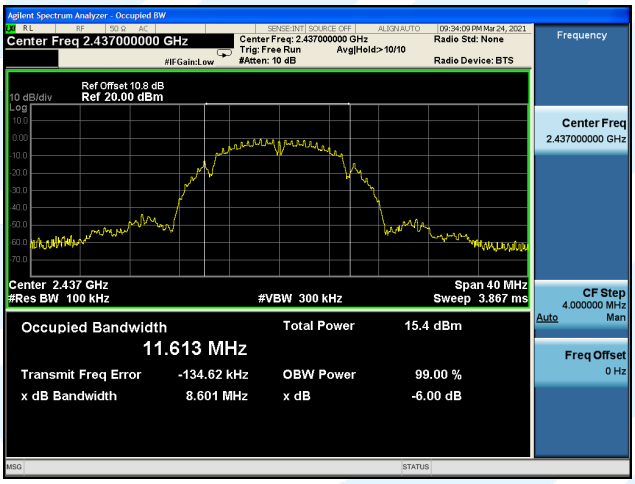
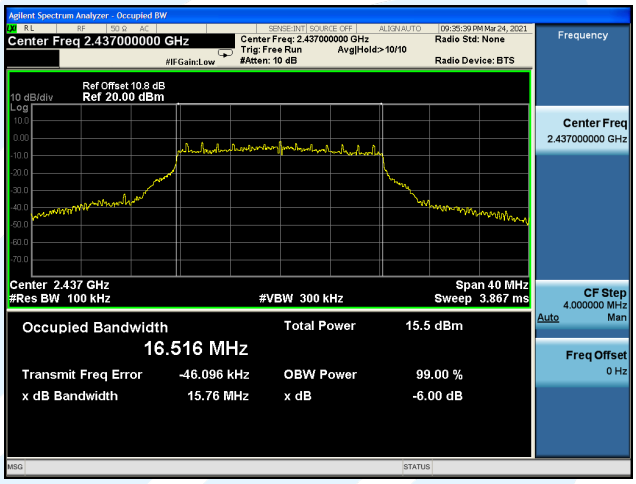
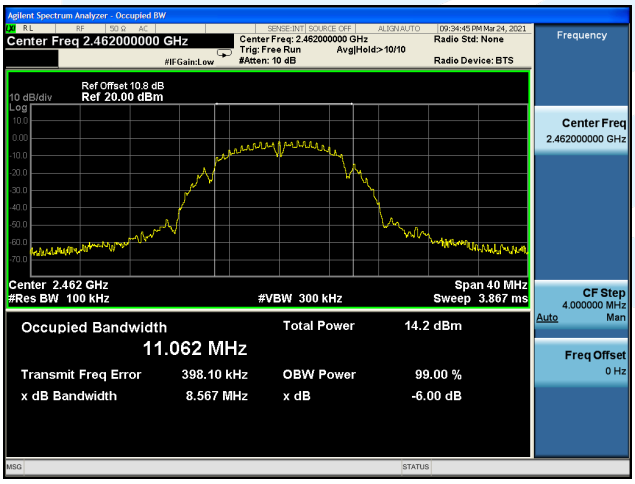
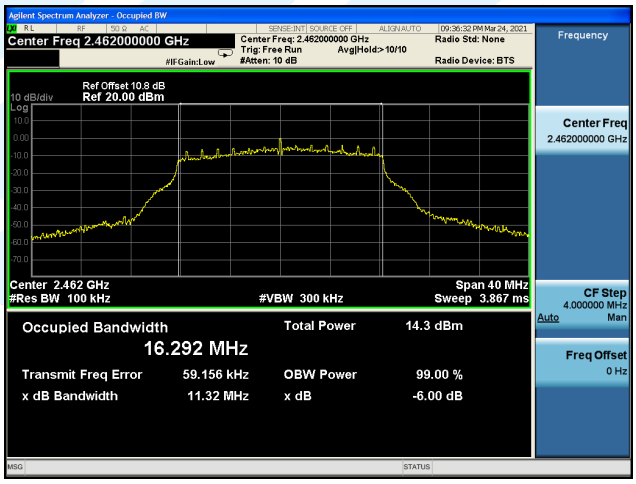
Instruments Used: Refer to section 3 for details

Test Results:

Mode	Channel/ Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit	Pass / Fail
IEEE 802.11b	1(2412)	8.594	11.053	> 500 kHz	Pass
	6(2437)	8.601	11.655	> 500 kHz	Pass
	11(2462)	8.567	11.093	> 500 kHz	Pass
IEEE 802.11g	1(2412)	11.31	16.688	> 500 kHz	Pass
	6(2437)	15.76	17.116	> 500 kHz	Pass
	11(2462)	11.32	16.574	> 500 kHz	Pass
IEEE 802.11n-HT20	1(2412)	8.835	17.742	> 500 kHz	Pass
	6(2437)	16.39	18.126	> 500 kHz	Pass
	11(2462)	8.842	17.622	> 500 kHz	Pass

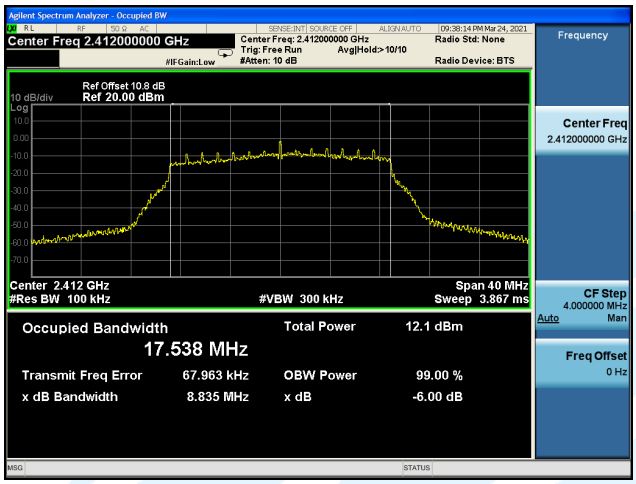
The test plots as follows:

6 dB Bandwidth

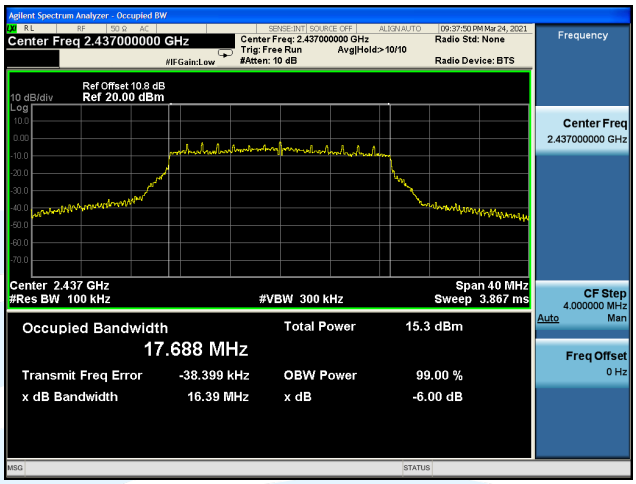
IEEE 802.11b	IEEE 802.11g
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

IEEE 802.11n-HT20

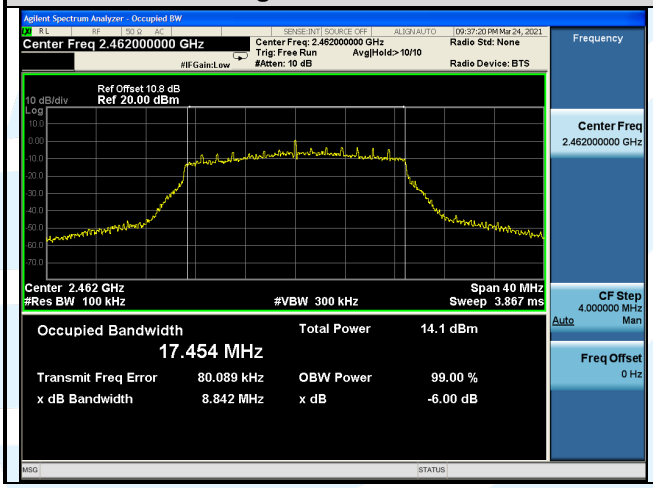
Lowest Channel



Middle Channel

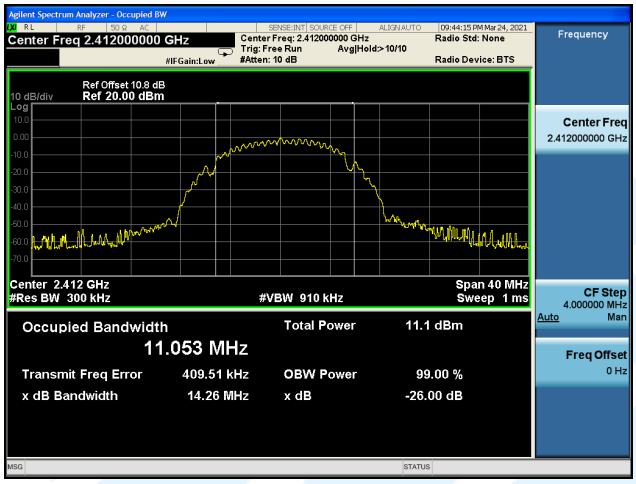
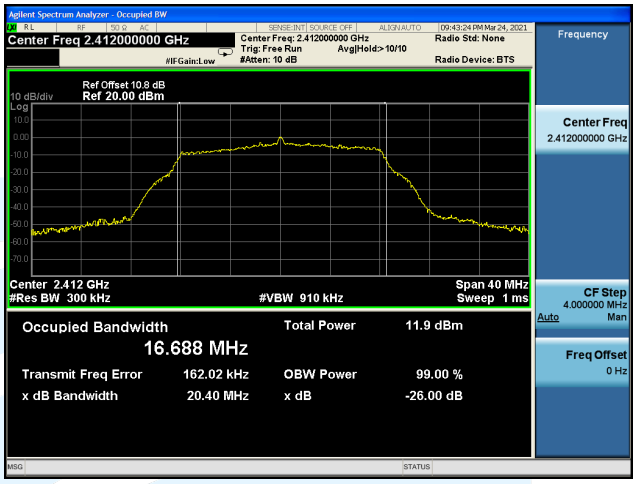
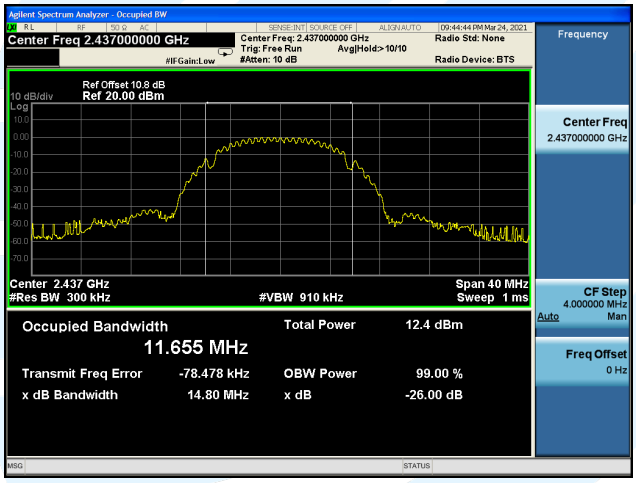
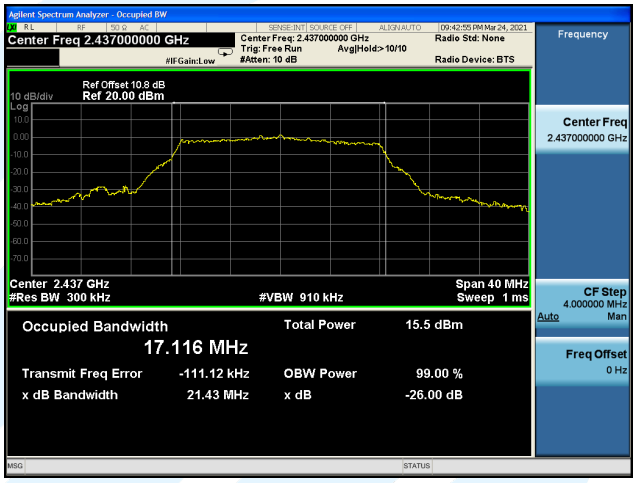
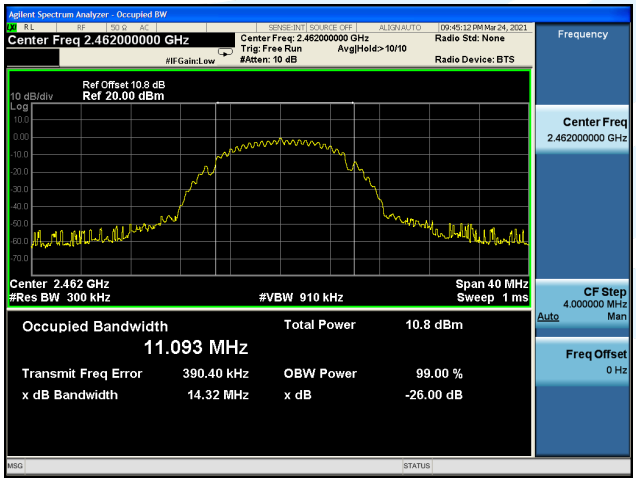
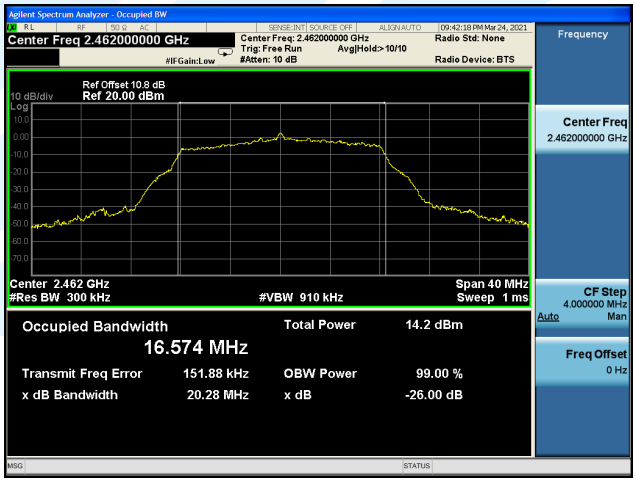


Highest Channel



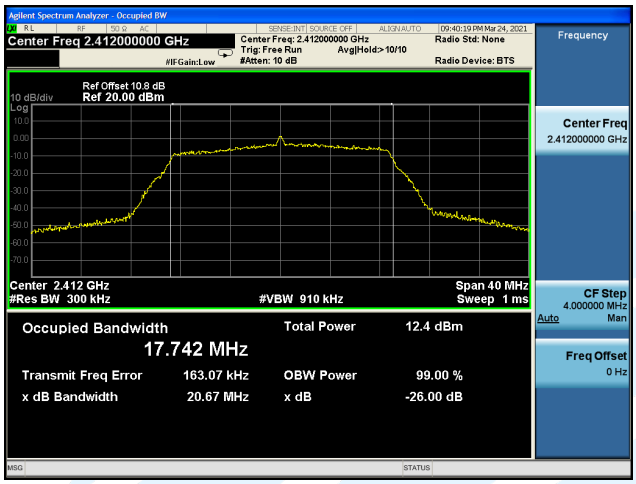
/

Occupied Bandwidth

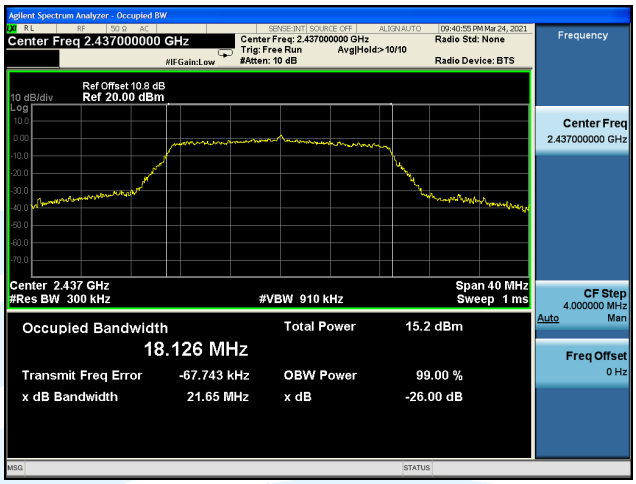
IEEE 802.11b	IEEE 802.11g
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

IEEE 802.11n-HT20

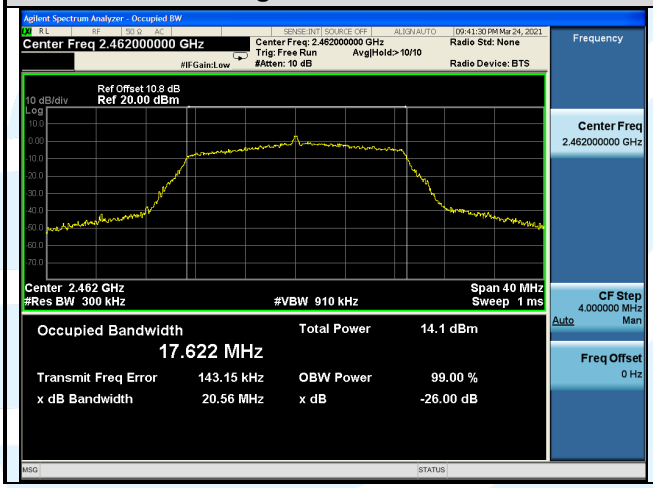
Lowest Channel



Middle Channel



Highest Channel



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5.5 POWER SPECTRAL DENSITY

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (e)
RSS-247 Issue 2, Section 5.2(b)

Test Method: ANSI C63.10-2013 Clause 11.10.2

Limit: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

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 x 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.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

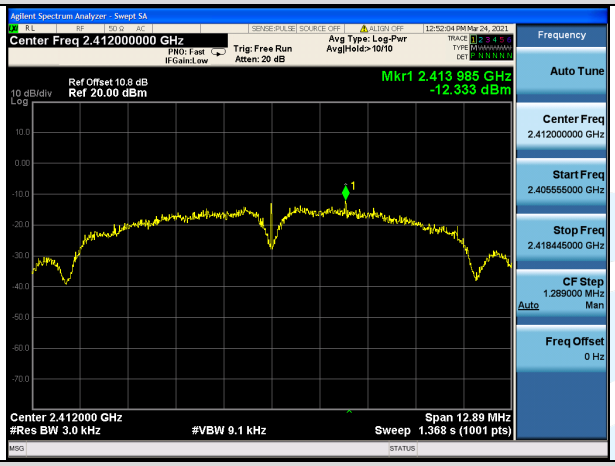
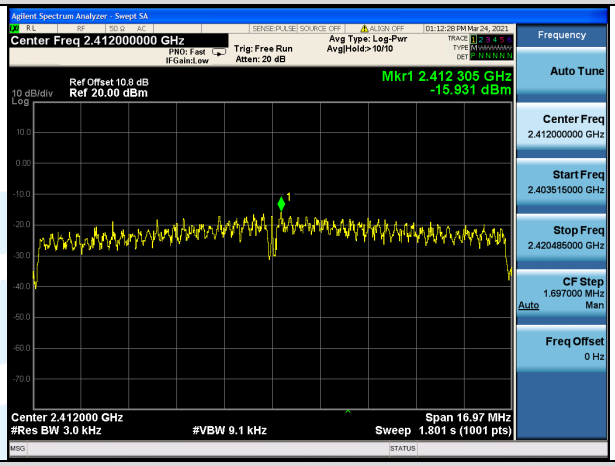
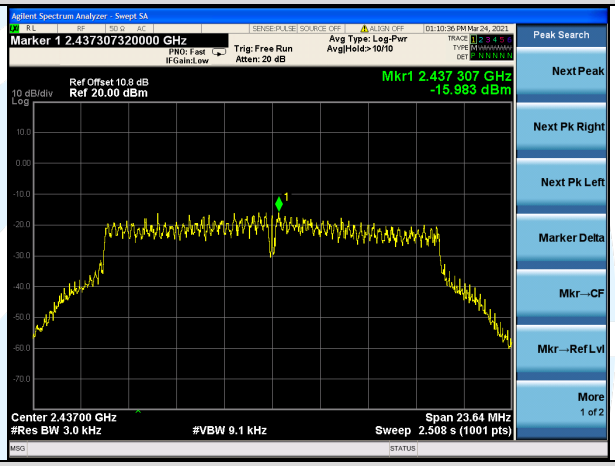
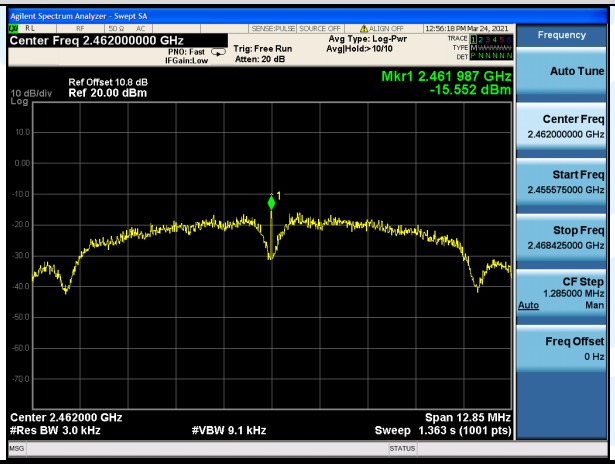
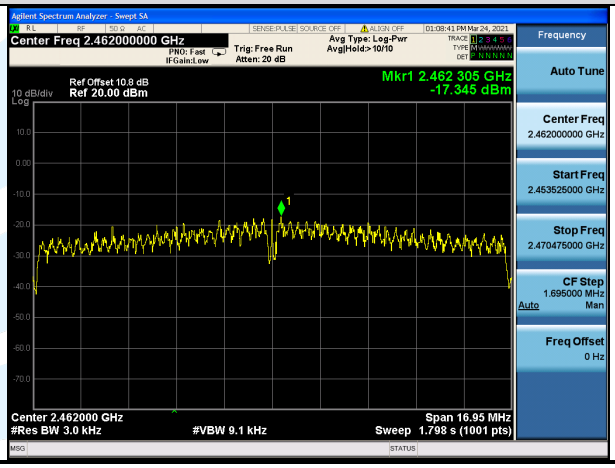
Instruments Used: Refer to section 3 for details

Test Results:

Mode	Channel/ Frequency (MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass / Fail
IEEE 802.11b	1(2412)	-12.333	7.5	Pass
	6(2437)	-13.670	7.5	Pass
	11(2462)	-15.552	7.5	Pass
IEEE 802.11g	1(2412)	-15.931	7.5	Pass
	6(2437)	-15.983	7.5	Pass
	11(2462)	-17.345	7.5	Pass
IEEE 802.11n-HT20	1(2412)	-16.753	7.5	Pass
	6(2437)	-16.341	7.5	Pass
	11(2462)	-17.718	7.5	Pass

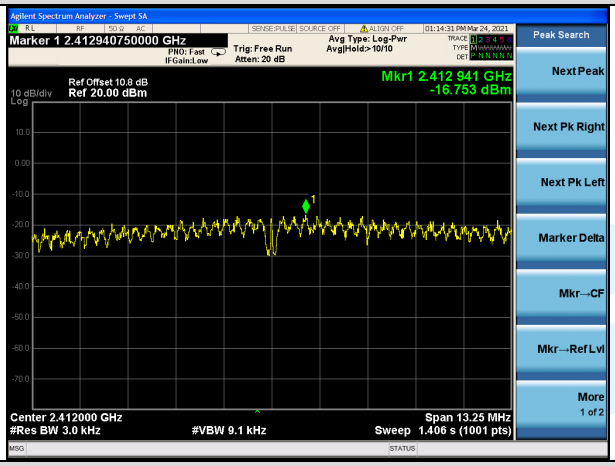
Remark:
Directional Gain = 6.5dBi +10log(1)=6.5dBi > 6dBi ,so the power density limit shall be reduced to 8-(6.5 -6) =7.5dBm.

The test plots as follows:

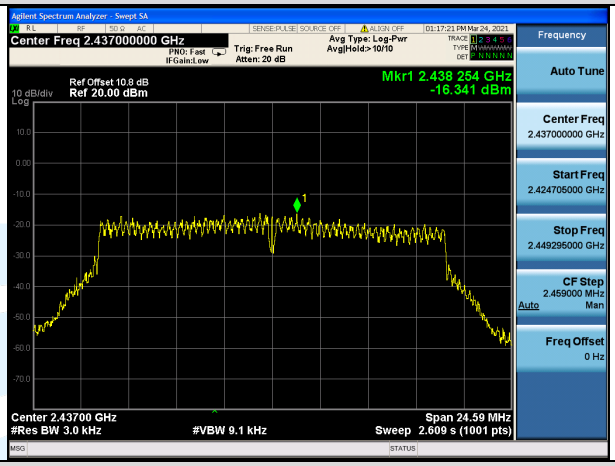
IEEE 802.11b	IEEE 802.11g
Channel 1	
	
Channel 6	
	
Channel 11	
	

IEEE 802.11n-HT20

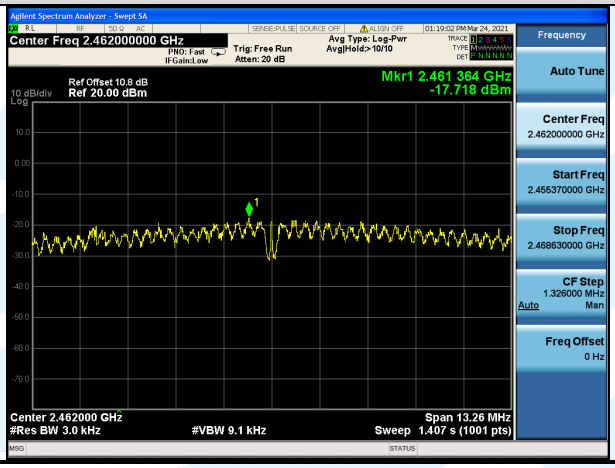
Channel 1



Channel 6



Channel 11



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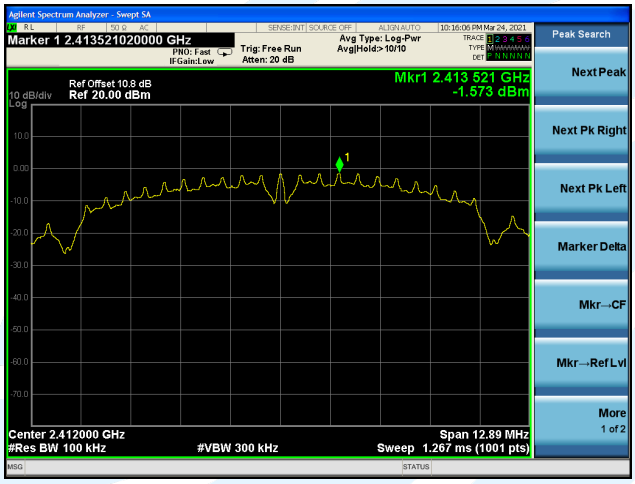
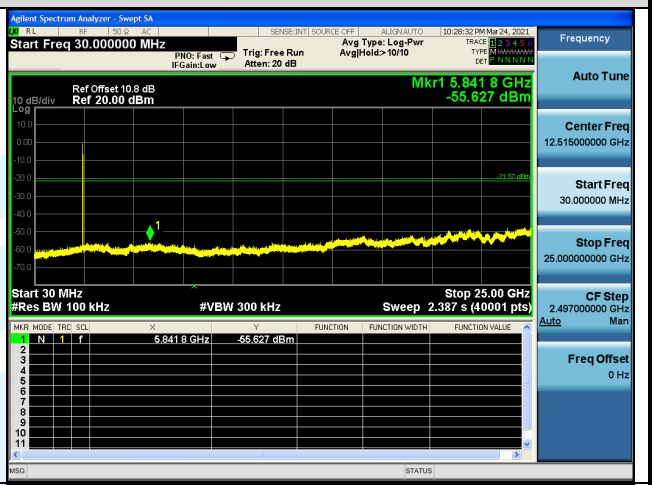
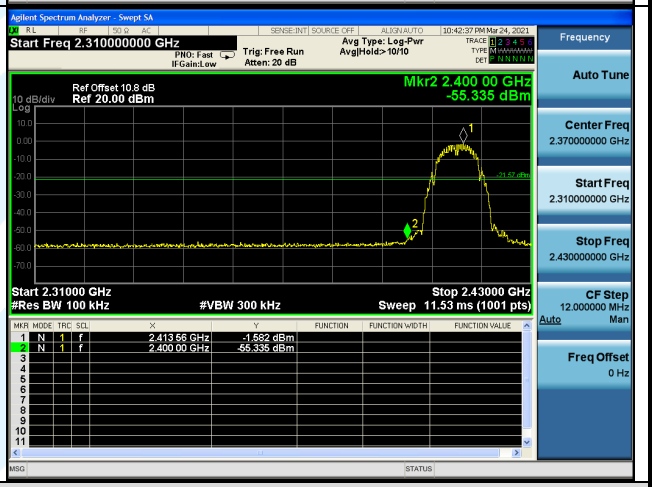
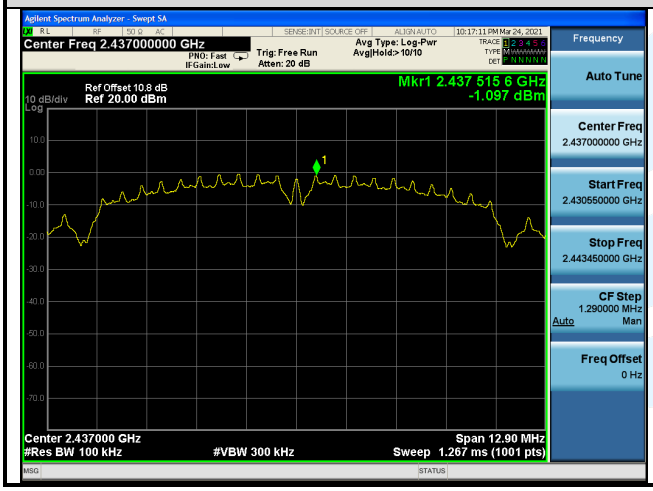
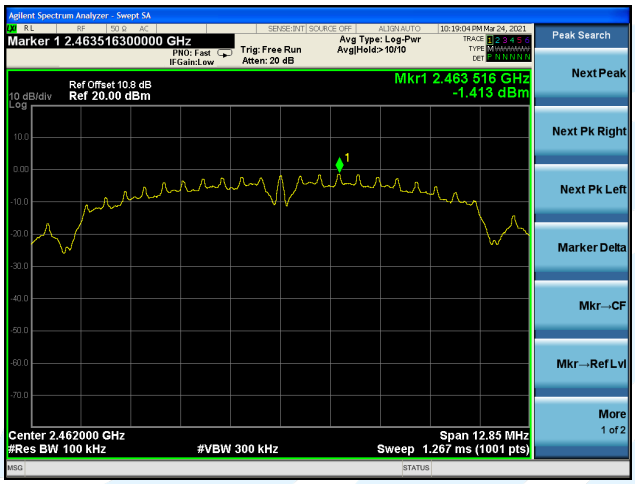
5.6 CONDUCTED OUT OF BAND EMISSION

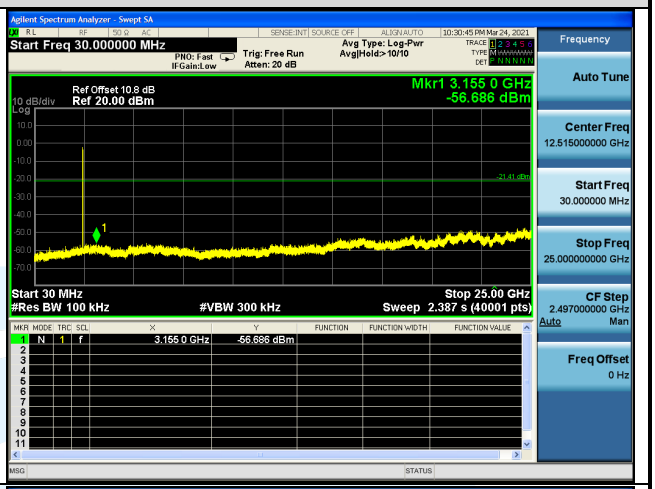
Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5
Test Method:	ANSI C63.10-2013 Clause 11.11
Limit:	In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: **Step 1:Measurement Procedure REF** a) Set instrument center frequency to DTS channel center frequency. b) Set the span to ≥ 1.5 times the DTS bandwidth. c) Set the RBW = 100 kHz. d) Set the VBW ≥ 3 x 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 PSD level. j) Note that the channel found to contain the maximum PSD level can be used to establish the reference level. **Step 2:Measurement Procedure OOBE** a) Set RBW = 100 kHz. b) Set VBW ≥ 300 kHz. c) Detector = peak. d) Sweep = auto couple. e) Trace Mode = max hold. f) Allow trace to fully stabilize. g) Use the peak marker function to determine the maximum amplitude level. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.5.3 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	Pass

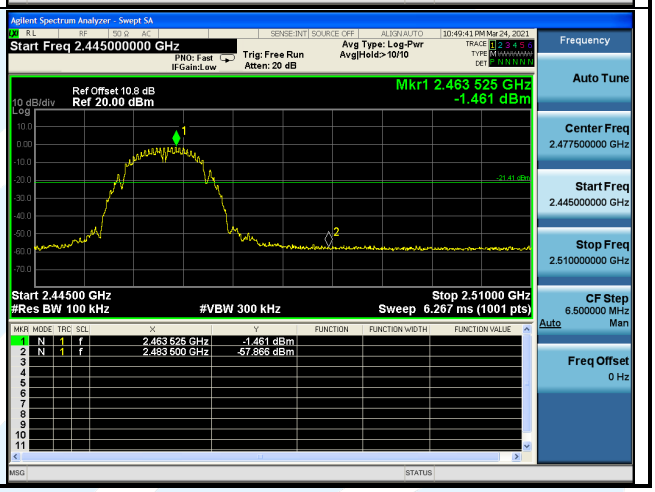
The test plots as follows:

IEEE 802.11b	
In-Band Reference Level	**Out of Band Emission**
Channel 1	
	 
Channel 6	
	

Channel 11


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.463516300000 GHz
Avg Type: Log-Pwr
Avg|Hold:>10/10
Trig: Free Run
Atten: 20 dB
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr1 2.463 516 GHz
-1.413 dBm
Center 2.462000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 12.85 MHz
Sweep 1.267 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

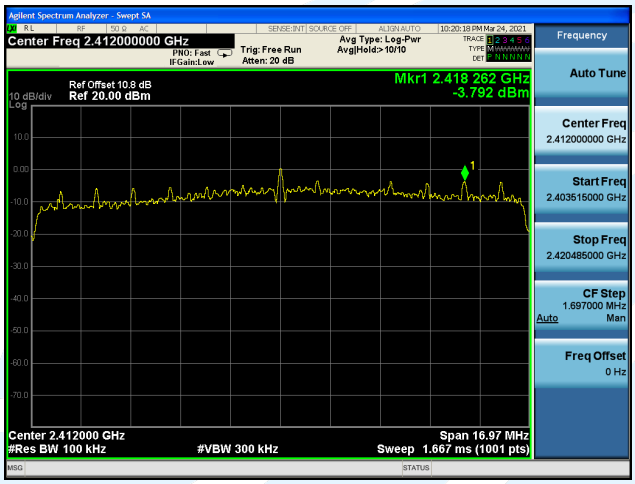

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
Avg Type: Log-Pwr
Avg|Hold:>10/10
Trig: Free Run
Atten: 20 dB
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr1 3.155 0 GHz
-56.686 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto Man
Freq Offset
0 Hz

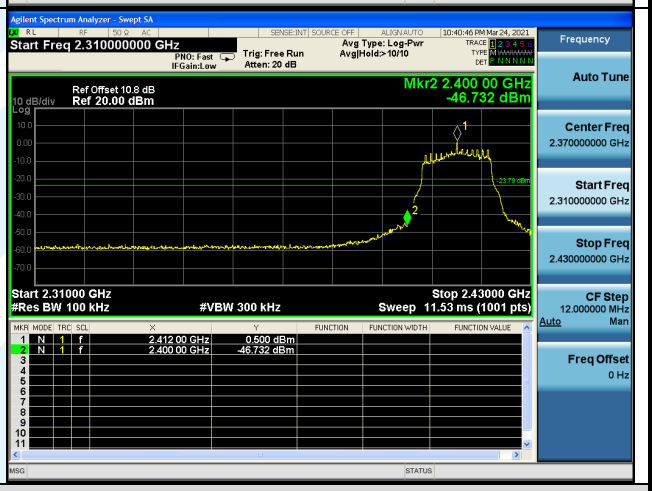

Agilent Spectrum Analyzer - Swept SA
Start Freq 2.445000000 GHz
Avg Type: Log-Pwr
Avg|Hold:>10/10
Trig: Free Run
Atten: 20 dB
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr1 2.463 525 GHz
-1.461 dBm
Start 2.44500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.51000 GHz
Sweep 6.267 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.477500000 GHz
Start Freq
2.445000000 GHz
Stop Freq
2.510000000 GHz
CF Step
6.500000 MHz
Auto Man
Freq Offset
0 Hz

IEEE 802.11g

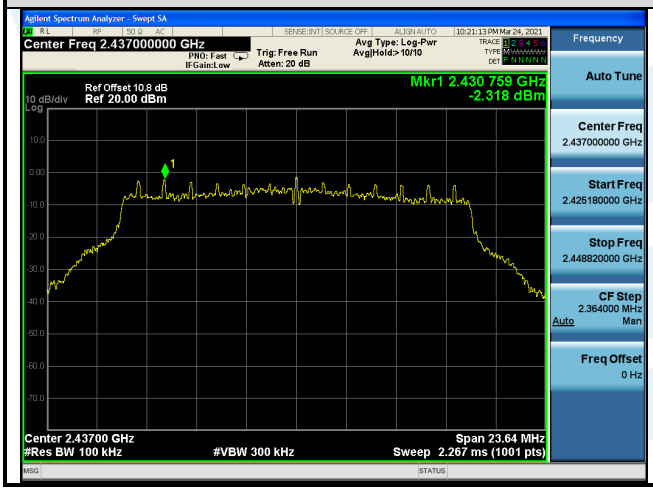
In-Band Reference Level	Out of Band Emission

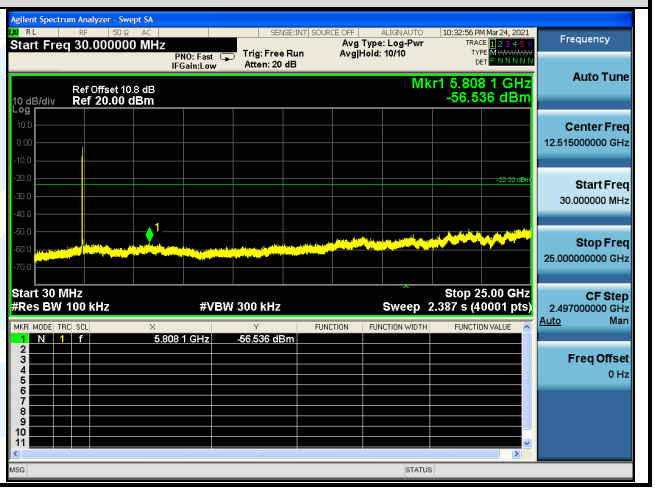
Channel 1



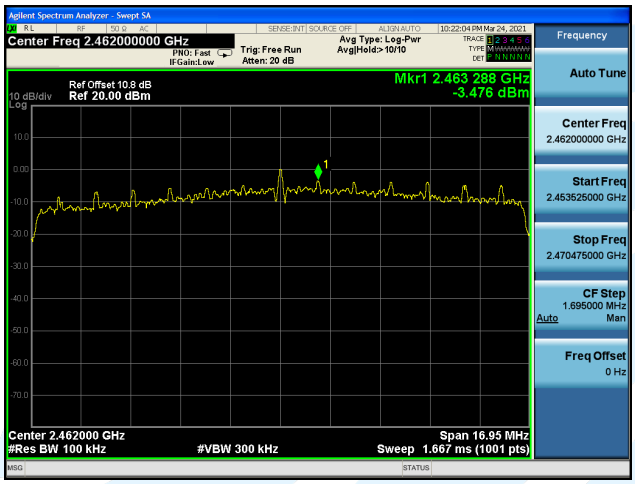


Channel 6





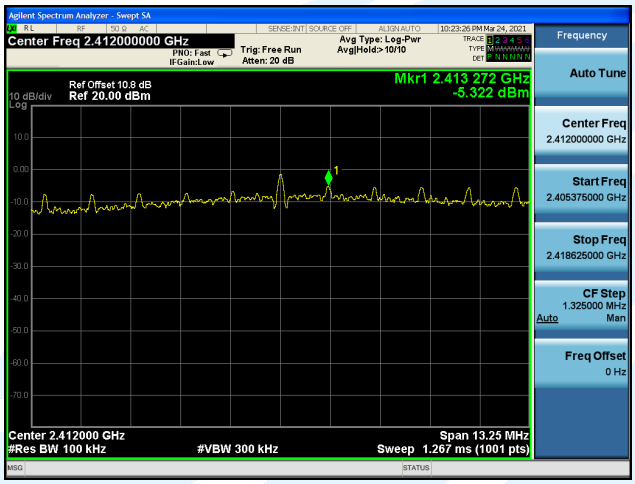
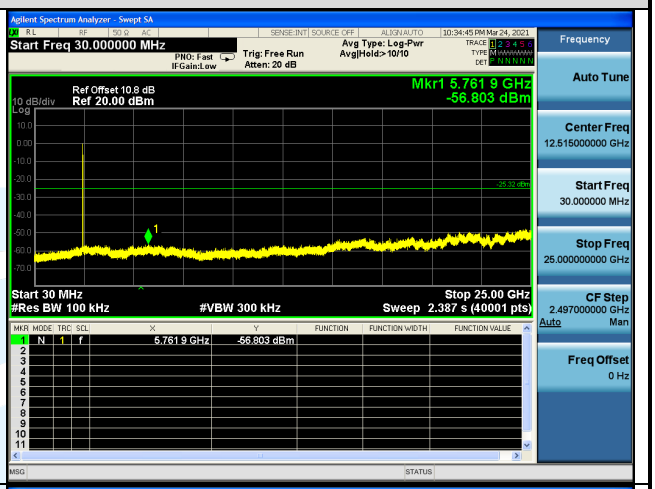
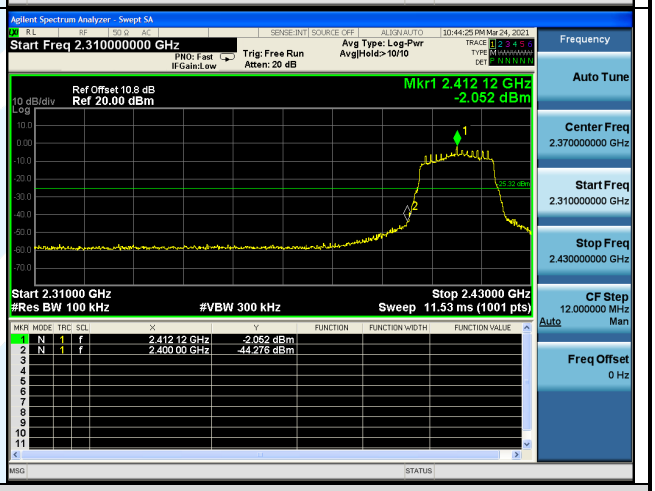
Channel 11


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr1 2.463 288 GHz
-3.476 dBm
Center 2.462000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 16.95 MHz
Sweep 1.667 ms (1001 pts)
Frequency
Auto Tune
Center Freq 2.462000000 GHz
Start Freq 2.453525000 GHz
Stop Freq 2.470475000 GHz
CF Step 1.695000 MHz
Auto Man
Freq Offset 0 Hz

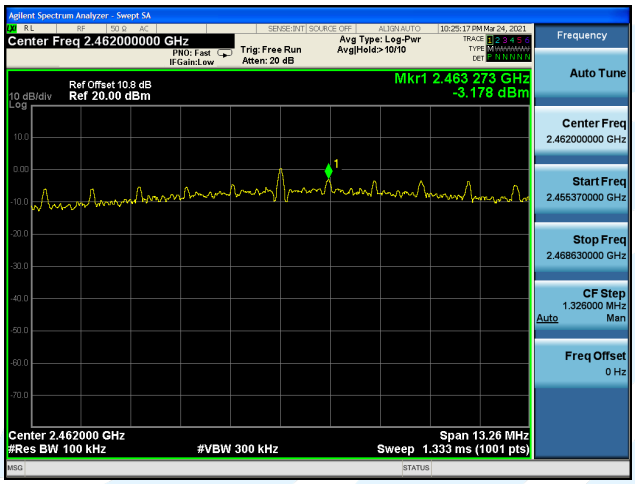
Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr1 5.783 1 GHz
-55.513 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
Frequency
Auto Tune
Center Freq 12.515000000 GHz
Start Freq 30.000000 MHz
Stop Freq 25.000000000 GHz
CF Step 2.497000000 GHz
Auto Man
Freq Offset 0 Hz

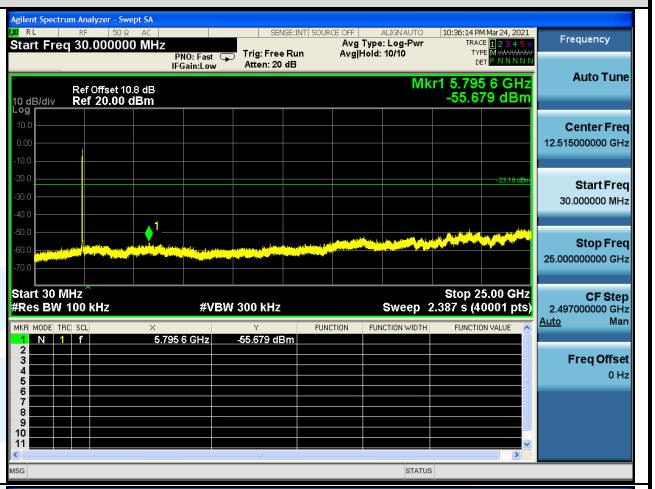
Agilent Spectrum Analyzer - Swept SA
Start Freq 2.445000000 GHz
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr2 2.483 500 GHz
-54.600 dBm
Start 2.44500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.51000 GHz
Sweep 6.267 ms (1001 pts)
Frequency
Auto Tune
Center Freq 2.477500000 GHz
Start Freq 2.445000000 GHz
Stop Freq 2.510000000 GHz
CF Step 6.500000 MHz
Auto Man
Freq Offset 0 Hz

IEEE 802.11n-HT20

In-Band Reference Level	Out of Band Emission
Channel 1	
	
	
Channel 6	

Channel 11


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr1 2.463 273 GHz
-3.178 dBm
Center 2.462000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 13.26 MHz
Sweep 1.333 ms (1001 pts)
Frequency
Auto Tune
Center Freq 2.462000000 GHz
Start Freq 2.455370000 GHz
Stop Freq 2.468630000 GHz
CF Step 1.326000 MHz
Auto Man
Freq Offset 0 Hz


Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr1 5.795 6 GHz
-55.679 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
Frequency
Auto Tune
Center Freq 12.515000000 GHz
Start Freq 30.000000 MHz
Stop Freq 25.000000000 GHz
CF Step 2.497000000 GHz
Auto Man
Freq Offset 0 Hz

Agilent Spectrum Analyzer - Swept SA
Start Freq 2.445000000 GHz
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
Ref Offset 10.8 dB
10 dB/div Ref 20.00 dBm
Mkr2 2.483 500 GHz
-53.718 dBm
Start 2.44500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.51000 GHz
Sweep 6.267 ms (1001 pts)
Frequency
Auto Tune
Center Freq 2.477500000 GHz
Start Freq 2.445000000 GHz
Stop Freq 2.510000000 GHz
CF Step 6.500000 MHz
Auto Man
Freq Offset 0 Hz

5.7 RADIATED SPURIOUS EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209
RSS-Gen Issue 5, Section 6.13/8.9/8.10

Test Method: ANSI C63.10-2013 Clause 11.11 & Clause 11.12

Receiver Setup:

Frequency	RBW
0.009 MHz-0.150 MHz	200/300 kHz
0.150 MHz -30 MHz	9/10 kHz
30 MHz-1 GHz	100/120 kHz
Above 1 GHz	1 MHz

Limits:

Spurious Emissions

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009 MHz-0.490 MHz	2400/F(kHz)	--	--	300
0.490 MHz-1.705 MHz	24000/F(kHz)	--	--	30
1.705 MHz-30 MHz	30	--	--	30
30 MHz-88 MHz	100	40.0	Quasi-peak	3
88 MHz-216 MHz	150	43.5	Quasi-peak	3
216 MHz-960 MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1 GHz	500	54.0	Average	3

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2. Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).

2) Test the EUT in the lowest channel ,middle channel, the Highest channel
3) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the Z axis positioning which it is worse case.
4) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

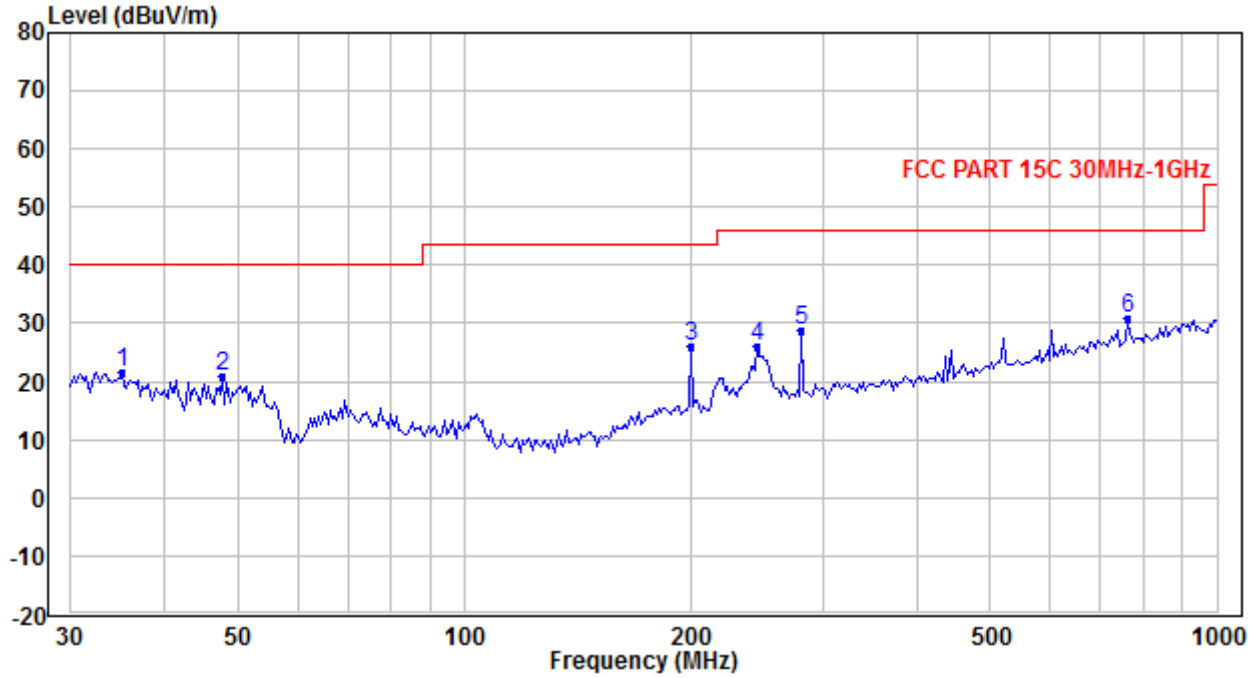
Test Result: Pass

The measurement data as follows:

Radiated Emission Test Data (9 KHz ~ 30 MHz):
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

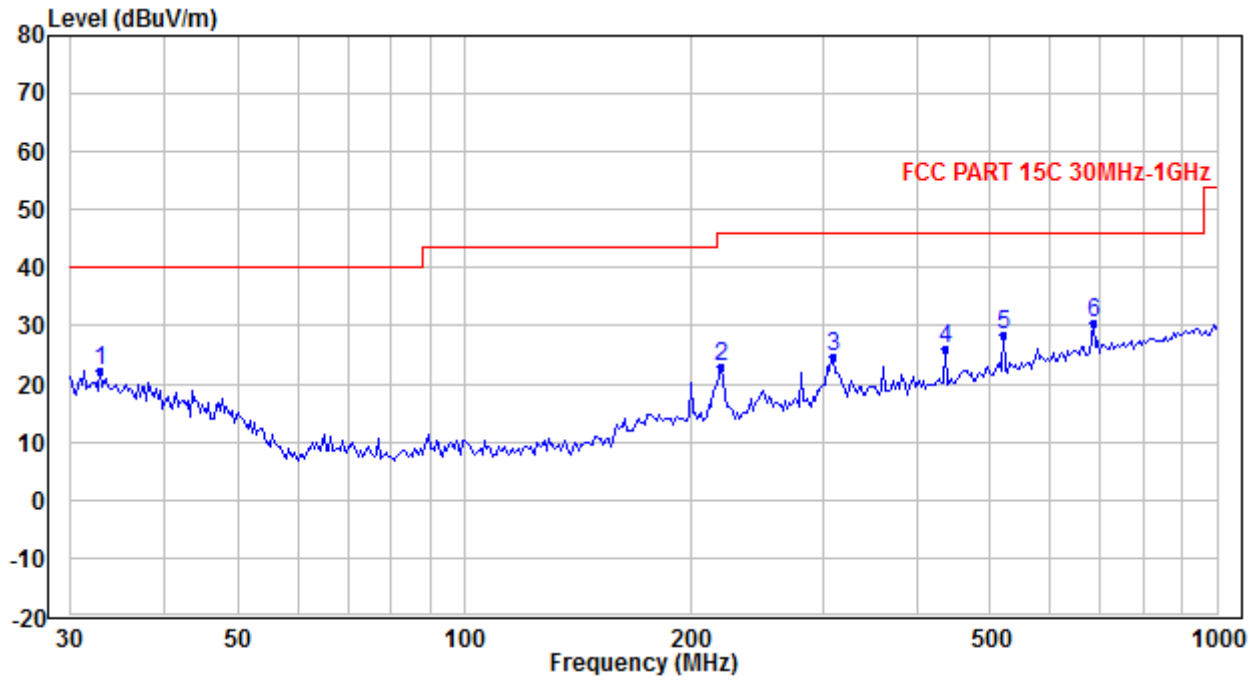
Radiated Emission Test Data (30 MHz ~ 1 GHz):
Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	35.016	26.84	-5.17	21.67	40.00	-18.33	QP
2	47.703	34.12	-13.14	20.98	40.00	-19.02	QP
3	200.043	37.07	-10.99	26.08	43.50	-17.42	QP
4	245.261	35.18	-9.07	26.11	46.00	-19.89	QP
5	280.294	36.15	-7.50	28.65	46.00	-17.35	QP
6	760.287	29.17	1.74	30.91	46.00	-15.09	QP

Vertical



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	32.870	27.09	-4.75	22.34	40.00	-17.66	QP
2	219.179	34.04	-11.07	22.97	46.00	-23.03	QP
3	309.271	30.75	-6.21	24.54	46.00	-21.46	QP
4	436.396	30.47	-4.56	25.91	46.00	-20.09	QP
5	520.208	31.22	-2.63	28.59	46.00	-17.41	QP
6	684.226	29.52	1.03	30.55	46.00	-15.45	QP

Radiated Emission Test Data (Above 1GHz):

IEEE 802.11b_ Channel 1:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	40.30	3.87	44.17	74.00	-29.83	Peak	Horizontal
2	4824.00	26.77	3.87	30.64	54.00	-23.36	Average	Horizontal
3	7236.00	41.87	6.40	48.27	74.00	-25.73	Peak	Horizontal
4	7236.00	30.01	6.40	36.41	54.00	-17.59	Average	Horizontal
5	4824.00	40.23	4.00	44.23	74.00	-29.77	Peak	Vertical
6	4824.00	27.03	4.00	31.03	54.00	-22.97	Average	Vertical
7	7236.00	40.24	6.50	46.74	74.00	-27.26	Peak	Vertical
8	7236.00	29.29	6.50	35.79	54.00	-18.21	Average	Vertical

IEEE 802.11b_ Channel 6:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	41.69	3.79	45.48	74.00	-28.52	Peak	Horizontal
2	4874.00	29.56	3.79	33.35	54.00	-20.65	Average	Horizontal
3	7311.00	42.78	6.37	49.15	74.00	-24.85	Peak	Horizontal
4	7311.00	29.93	6.37	36.30	54.00	-17.70	Average	Horizontal
5	4874.00	41.79	3.97	45.76	74.00	-28.24	Peak	Vertical
6	4874.00	29.25	3.97	33.22	54.00	-20.78	Average	Vertical
7	7311.00	42.40	6.47	48.87	74.00	-25.13	Peak	Vertical
8	7311.00	29.88	6.47	36.35	54.00	-17.65	Average	Vertical

IEEE 802.11b_ Channel 11:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	40.57	-4.07	36.50	74.00	-37.50	Peak	Horizontal
2	4924.00	28.25	-4.07	24.18	54.00	-29.82	Average	Horizontal
3	7386.00	41.10	-1.94	39.16	74.00	-34.84	Peak	Horizontal
4	7386.00	29.89	-1.94	27.95	54.00	-26.05	Average	Horizontal
5	4924.00	40.83	-3.84	36.99	74.00	-37.01	Peak	Vertical
6	4924.00	28.29	-3.84	24.45	54.00	-29.55	Average	Vertical
7	7386.00	41.36	-1.84	39.52	74.00	-34.48	Peak	Vertical
8	7386.00	29.89	-1.84	28.05	54.00	-25.95	Average	Vertical

IEEE 802.11g_ Channel 1:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	42.59	3.87	46.46	74.00	-27.54	Peak	Horizontal
2	4824.00	27.47	3.87	31.34	54.00	-22.66	Average	Horizontal
3	7236.00	42.91	6.40	49.31	74.00	-24.69	Peak	Horizontal
4	7236.00	30.41	6.40	36.81	54.00	-17.19	Average	Horizontal
5	4824.00	42.20	4.00	46.20	74.00	-27.80	Peak	Vertical
6	4824.00	27.41	4.00	31.41	54.00	-22.59	Average	Vertical
7	7236.00	41.90	6.50	48.40	74.00	-25.60	Peak	Vertical
8	7236.00	29.58	6.50	36.08	54.00	-17.92	Average	Vertical

IEEE 802.11g_ Channel 6:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	42.48	3.79	46.27	74.00	-27.73	Peak	Horizontal
2	4874.00	29.61	3.79	33.40	54.00	-20.60	Average	Horizontal
3	7311.00	42.27	6.37	48.64	74.00	-25.36	Peak	Horizontal
4	7311.00	30.89	6.37	37.26	54.00	-16.74	Average	Horizontal
5	4874.00	41.28	3.97	45.25	74.00	-28.75	Peak	Vertical
6	4874.00	29.59	3.97	33.56	54.00	-20.44	Average	Vertical
7	7311.00	41.10	6.47	47.57	74.00	-26.43	Peak	Vertical
8	7311.00	30.47	6.47	36.94	54.00	-17.06	Average	Vertical

IEEE 802.11g_ Channel 11:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	40.39	3.71	44.10	74.00	-29.90	Peak	Horizontal
2	4924.00	28.42	3.71	32.13	54.00	-21.87	Average	Horizontal
3	7386.00	42.60	6.34	48.94	74.00	-25.06	Peak	Horizontal
4	7386.00	29.84	6.34	36.18	54.00	-17.82	Average	Horizontal
5	4924.00	39.55	3.94	43.49	74.00	-30.51	Peak	Vertical
6	4924.00	28.18	3.94	32.12	54.00	-21.88	Average	Vertical
7	7386.00	39.59	6.44	46.03	74.00	-27.97	Peak	Vertical
8	7386.00	28.58	6.44	35.02	54.00	-18.98	Average	Vertical

IEEE 802.11n-HT20_ Channel 1:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	40.16	3.87	44.03	74.00	-29.97	Peak	Horizontal
2	4824.00	27.35	3.87	31.22	54.00	-22.78	Average	Horizontal
3	7236.00	42.93	6.40	49.33	74.00	-24.67	Peak	Horizontal
4	7236.00	30.50	6.40	36.90	54.00	-17.10	Average	Horizontal
5	4824.00	42.37	4.00	46.37	74.00	-27.63	Peak	Vertical
6	4824.00	29.22	4.00	33.22	54.00	-20.78	Average	Vertical
7	7236.00	41.91	6.50	48.41	74.00	-25.59	Peak	Vertical
8	7236.00	30.01	6.50	36.51	54.00	-17.49	Average	Vertical

IEEE 802.11n-HT20_ Channel 6:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	41.27	3.79	45.06	74.00	-28.94	Peak	Horizontal
2	4874.00	29.75	3.79	33.54	54.00	-20.46	Average	Horizontal
3	7311.00	42.67	6.37	49.04	74.00	-24.96	Peak	Horizontal
4	7311.00	30.72	6.37	37.09	54.00	-16.91	Average	Horizontal
5	4874.00	41.11	3.97	45.08	74.00	-28.92	Peak	Vertical
6	4874.00	29.35	3.97	33.32	54.00	-20.68	Average	Vertical
7	7311.00	42.21	6.47	48.68	74.00	-25.32	Peak	Vertical
8	7311.00	30.77	6.47	37.24	54.00	-16.76	Average	Vertical

IEEE 802.11n-HT20_ Channel 11:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	42.25	3.71	45.96	74.00	-28.04	Peak	Horizontal
2	4924.00	28.31	3.71	32.02	54.00	-21.98	Average	Horizontal
3	7386.00	40.68	6.34	47.02	74.00	-26.98	Peak	Horizontal
4	7386.00	29.74	6.34	36.08	54.00	-17.92	Average	Horizontal
5	4924.00	40.28	3.94	44.22	74.00	-29.78	Peak	Vertical
6	4924.00	28.41	3.94	32.35	54.00	-21.65	Average	Vertical
7	7386.00	41.04	6.44	47.48	74.00	-26.52	Peak	Vertical
8	7386.00	29.79	6.44	36.23	54.00	-17.77	Average	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

5.8 BAND EDGE MEASUREMENTS (RADIATED)

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209
RSS-247 Issue 2, Section 5.5

Test Method: ANSI C63.10-2013 Clause 11.13

Limits:

Radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

Frequency	Limit (dBμV/m @3m)	Remark
30 MHz-88 MHz	40.0	Quasi-peak Value
88 MHz-216 MHz	43.5	Quasi-peak Value
216 MHz-960 MHz	46.0	Quasi-peak Value
960 MHz-1 GHz	54.0	Quasi-peak Value
Above 1 GHz	54.0	Average Value
	74.0	Peak Value

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

Radiated band edge measurements at 2390 MHz and 2483.5 MHz were made with the unit transmitting in the low end of the channel range and the high end closest to the restricted bands respectively. The emissions were made on the 966 Semi-Chamber. Use (resolution bandwidth (RBW) = 1 MHz, video bandwidth (VBW) = 3 MHz for peak levels and RBW = 1 MHz and VBW = 10 Hz or 1/T for average levels).

1. Use radiated spurious emission test procedure described in clause 5.10. The transmitter output (antenna port) was connected to the test receiver.
2. Set the PK and AV limit line.
3. Record the fundamental emission and emissions out of the band-edge.
4. Determine band-edge compliance as required.

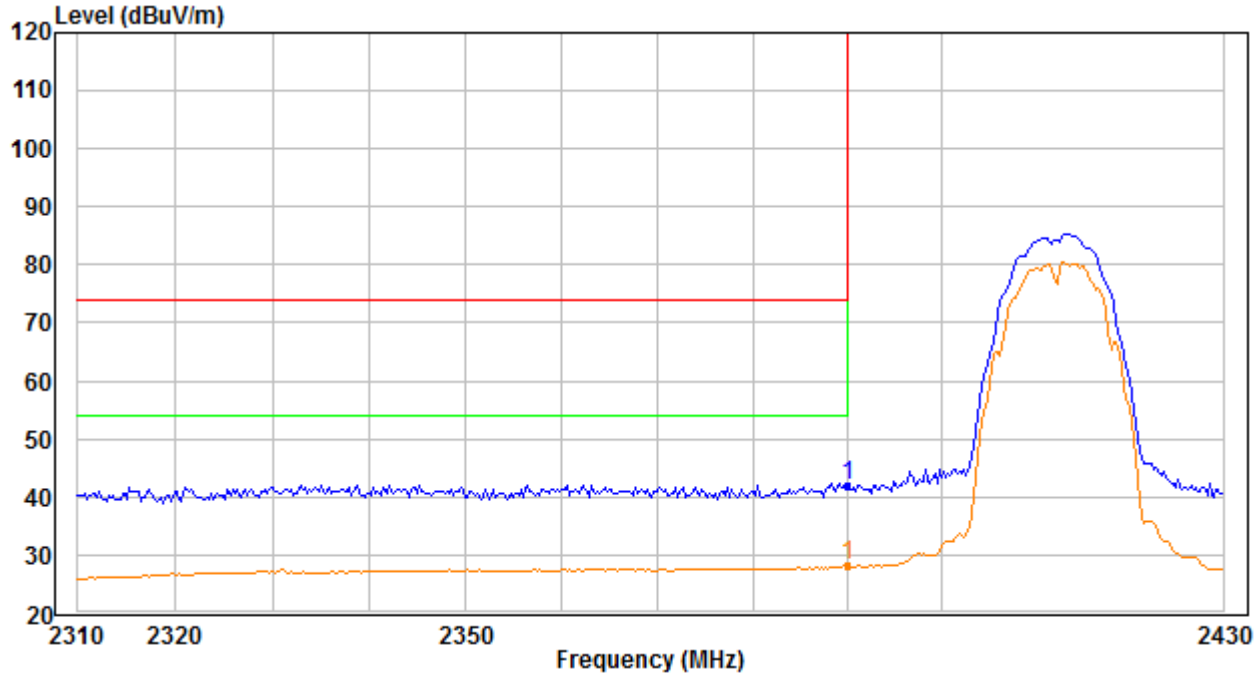
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

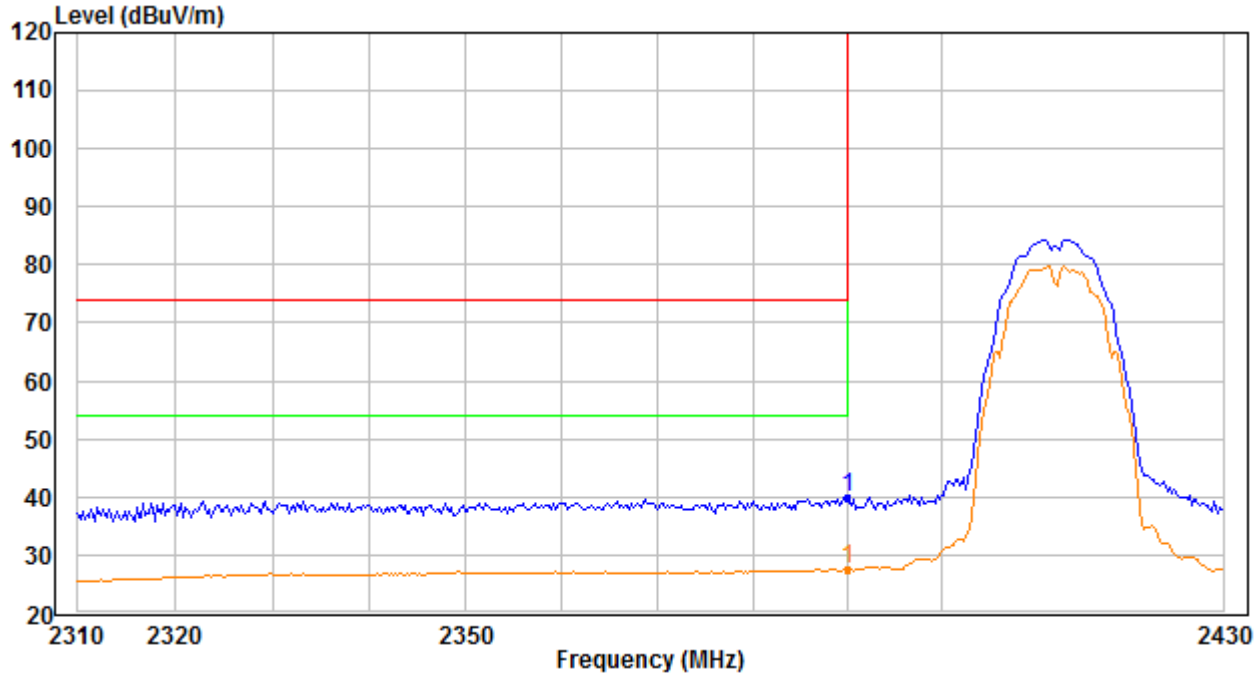
IEEE 802.11b

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



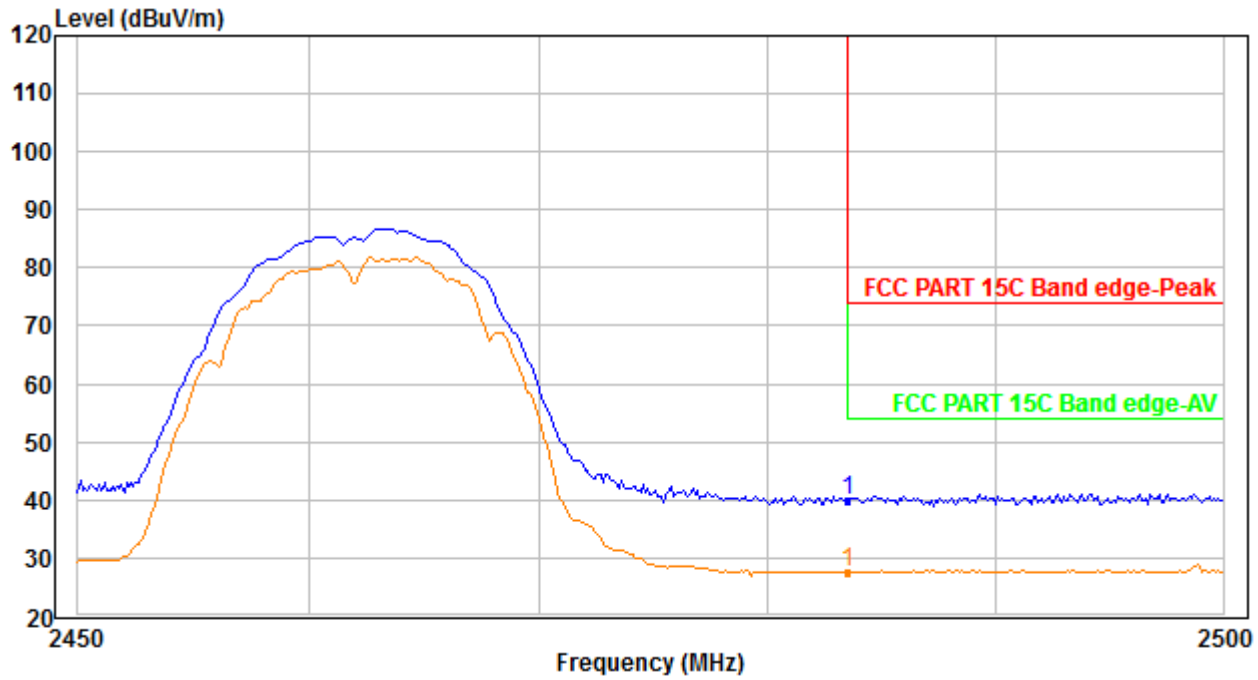
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.0000	42.01	74.00	28.10	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



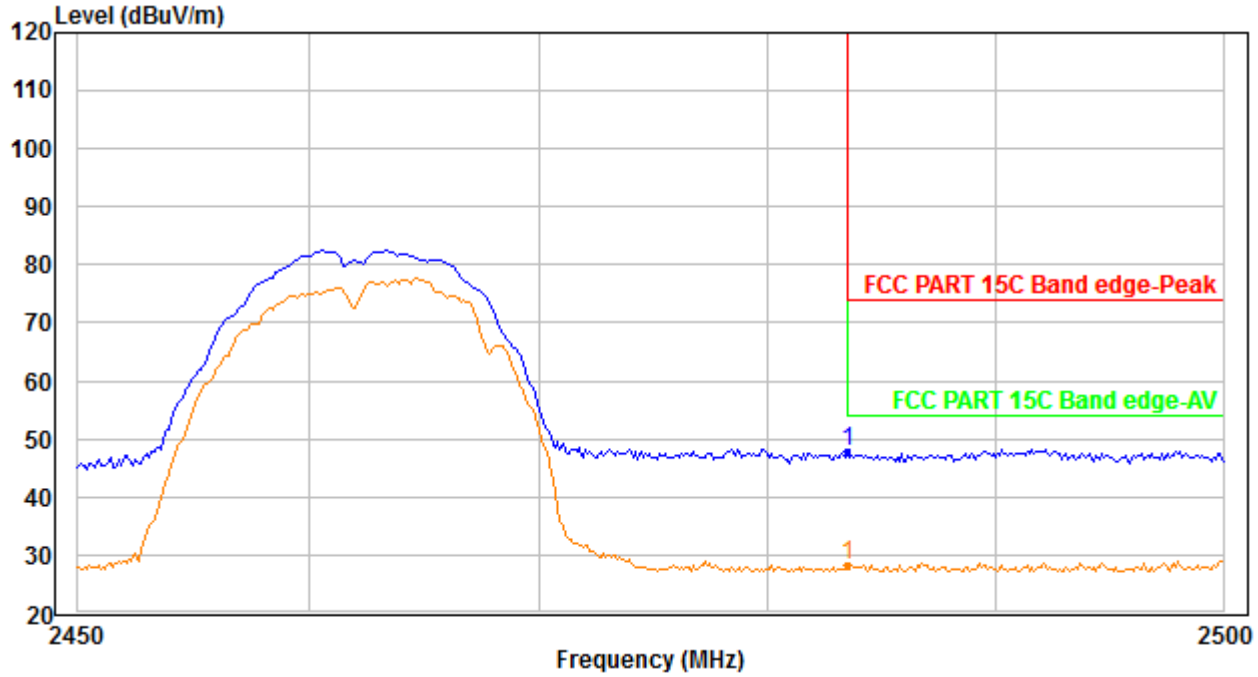
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.0000	39.87	74.00	27.46	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.5000	40.01	74.00	27.59	54.00	Pass

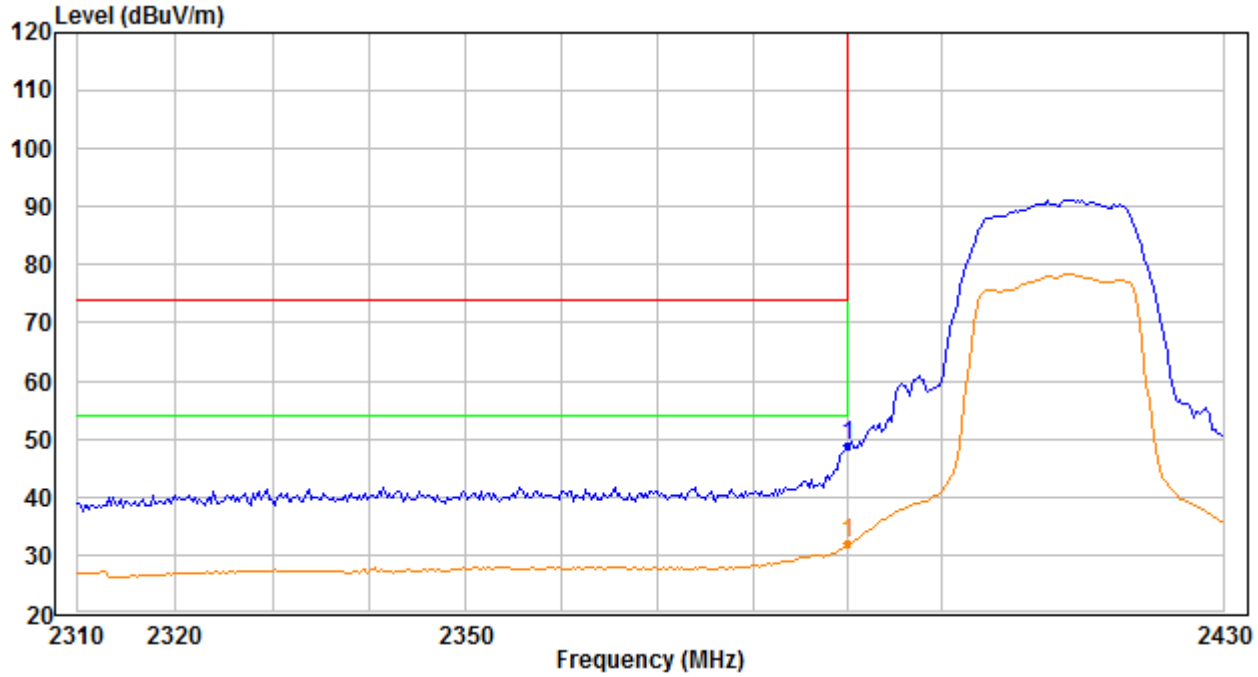
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.5000	47.68	74.00	28.20	54.00	Pass

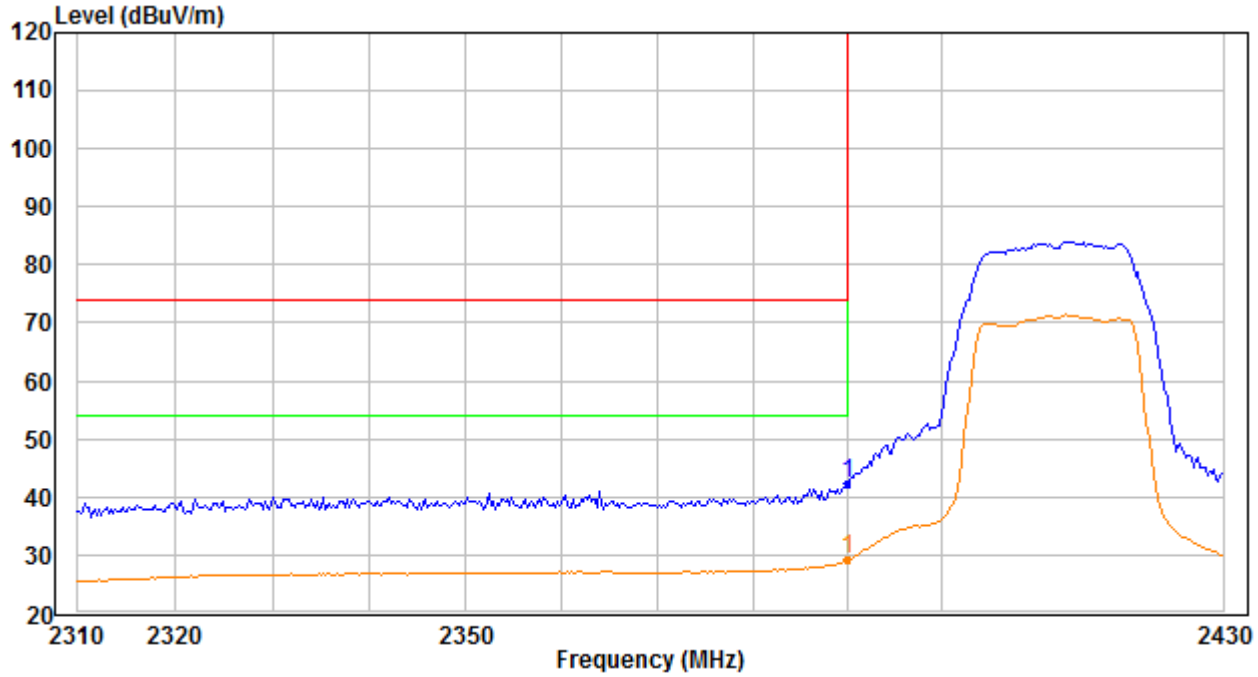
IEEE 802.11g

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



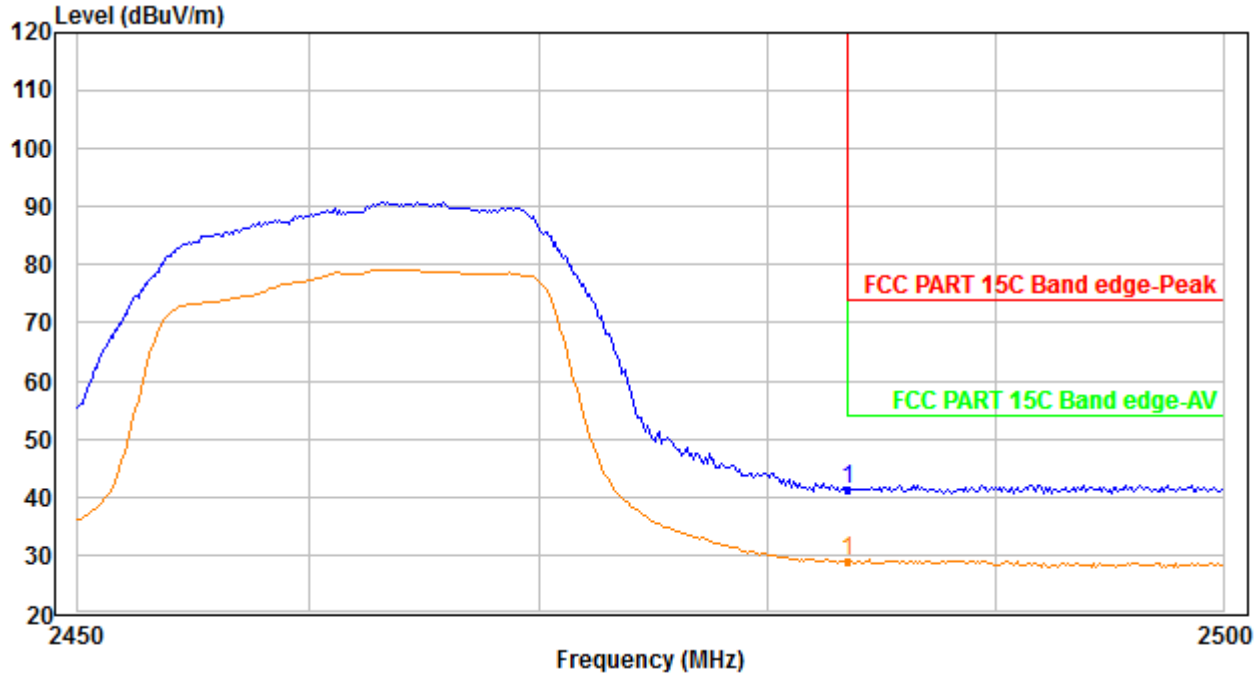
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.0000	48.70	74.00	31.89	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



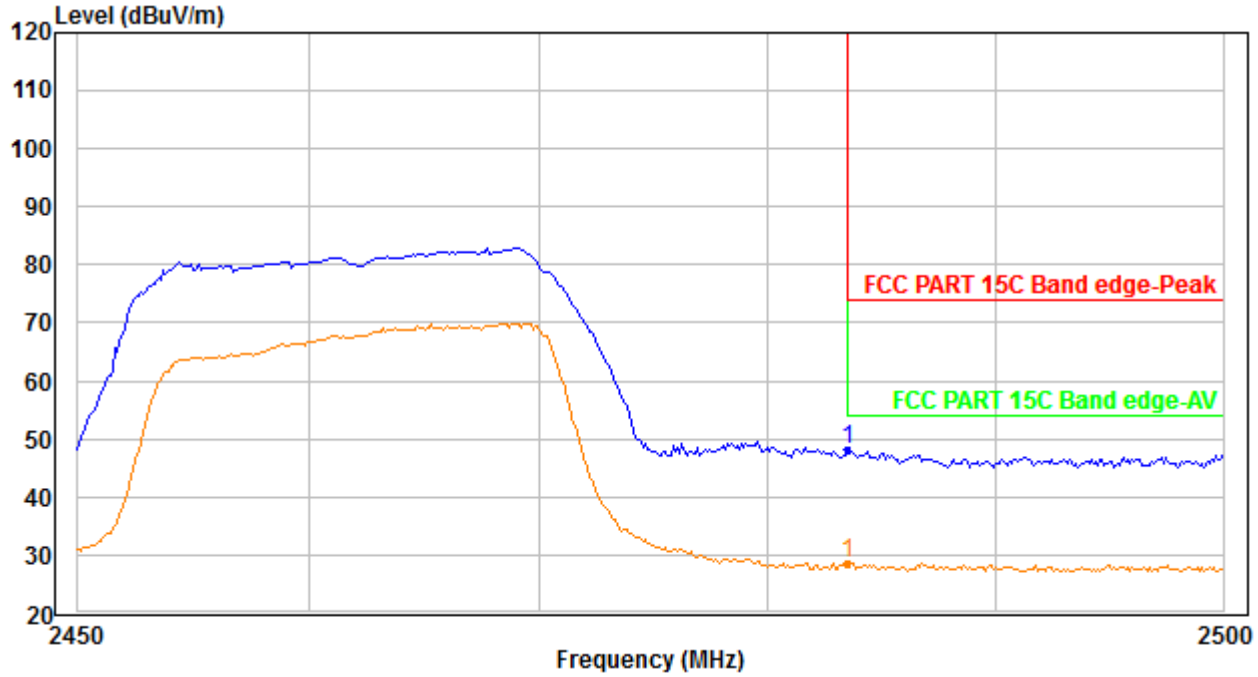
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.0000	42.25	74.00	29.28	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.5000	41.22	74.00	28.84	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.5000	48.01	74.00	28.43	54.00	Pass

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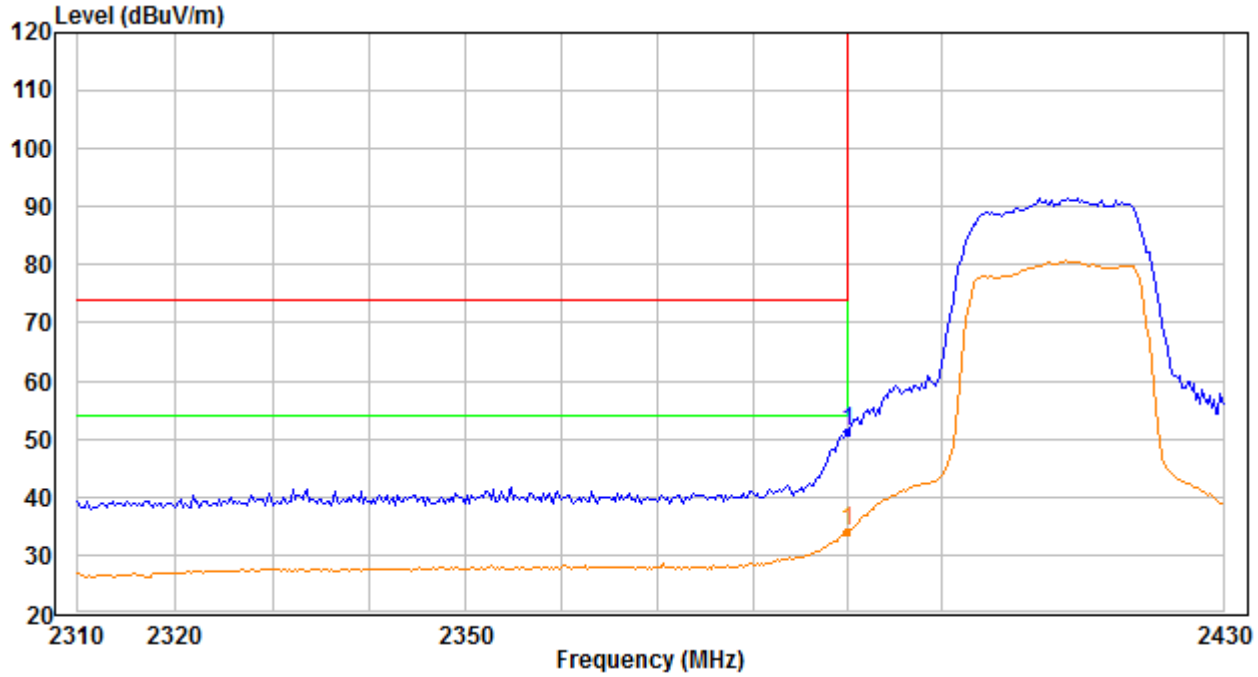
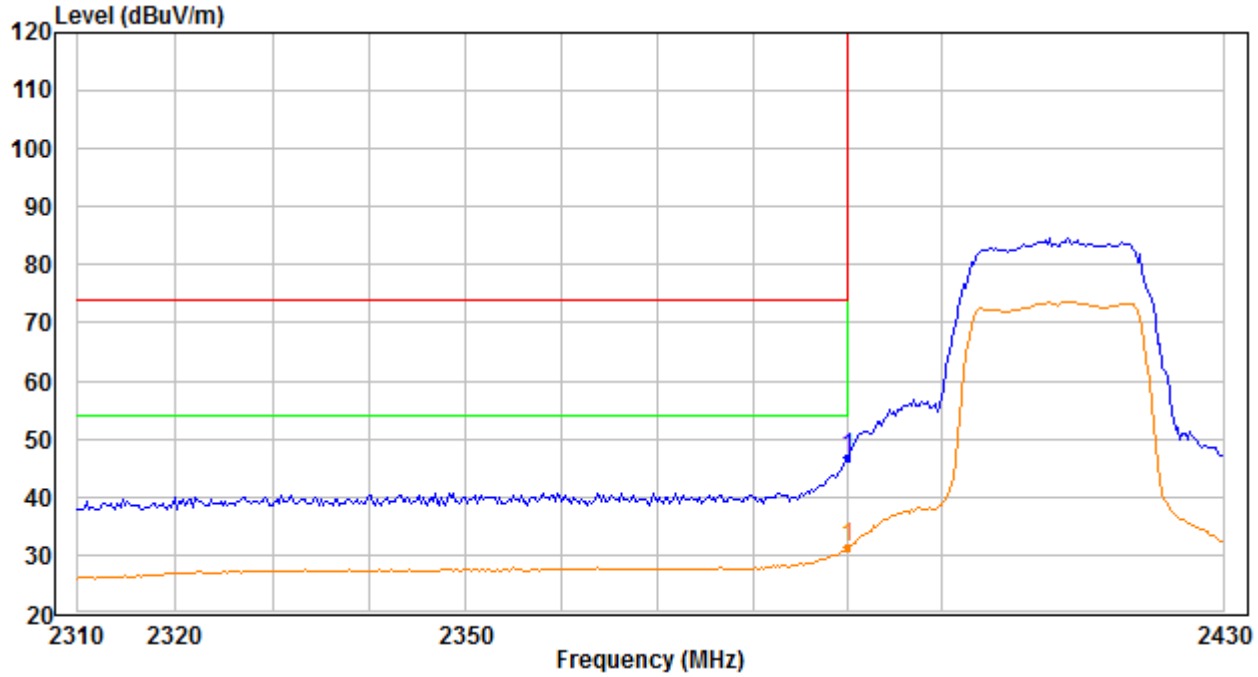
Test Channel:	Channel 1	Ant. Polar. :	Horizontal



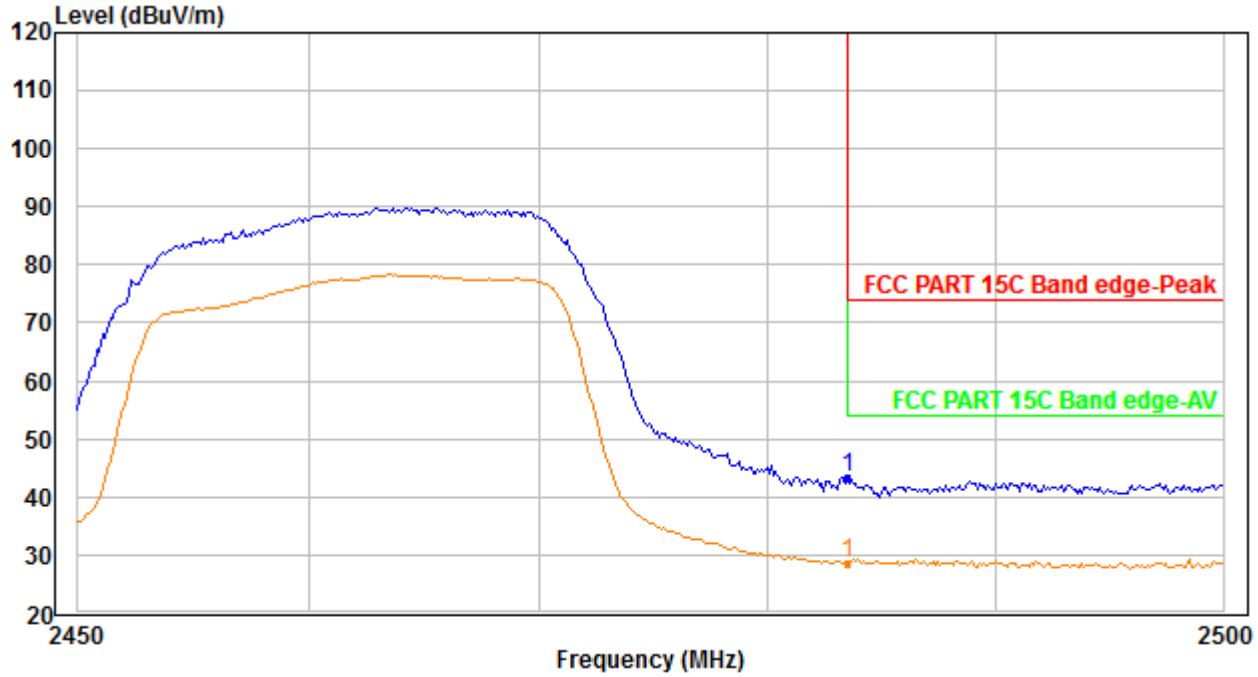
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.0000	51.12	74.00	34.17	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



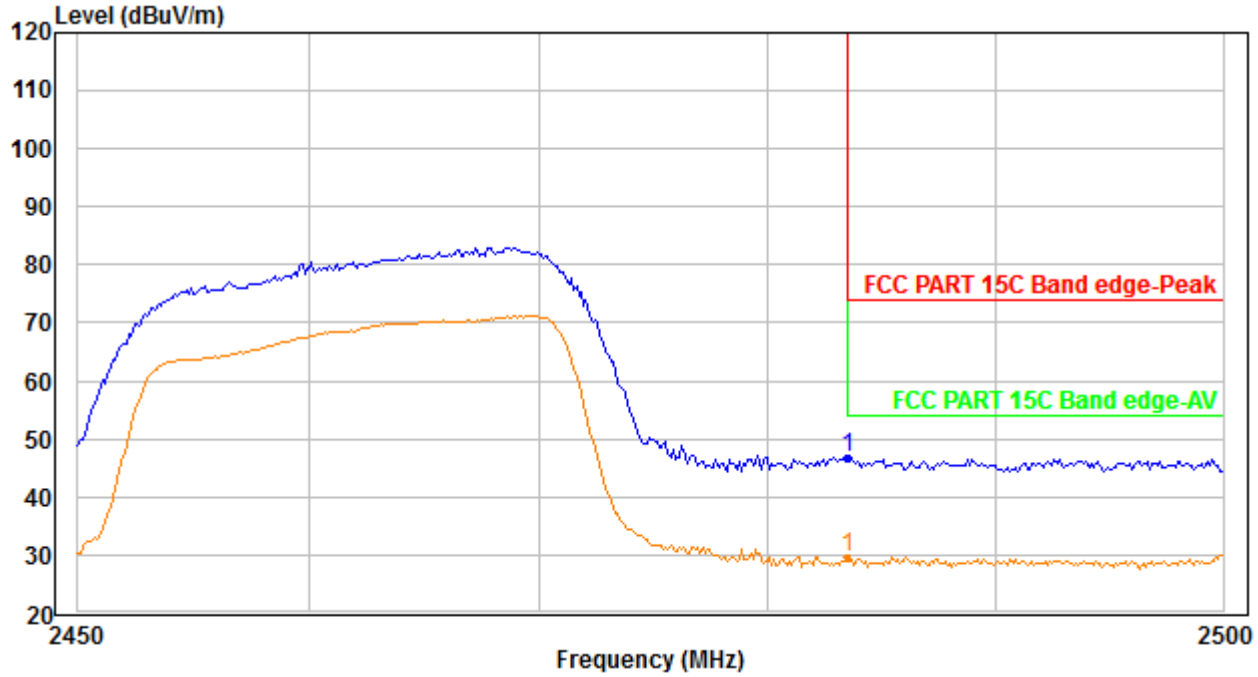
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.0000	46.80	74.00	31.43	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.5000	43.40	74.00	28.61	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.5000	46.88	74.00	29.77	54.00	Pass

5.9 CONDUCTED EMISSION

Test Requirement: 47 CFR Part 15C Section 15.207
RSS-Gen Issue 5, Section 8.8

Test Method: ANSI C63.10-2013 Section 6.2

Limits:

Frequency range (MHz)	Limits (dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.4.2 for details.

Test Procedures:

Test frequency range :150KHz-30MHz

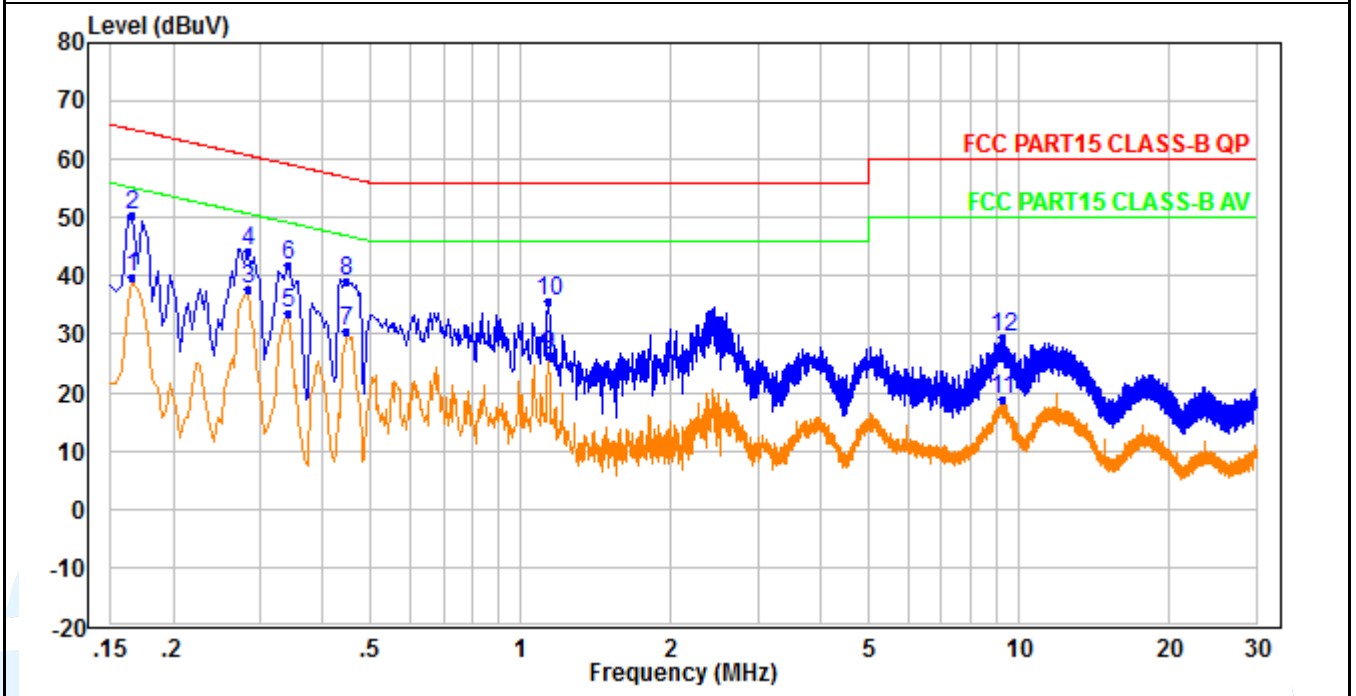
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

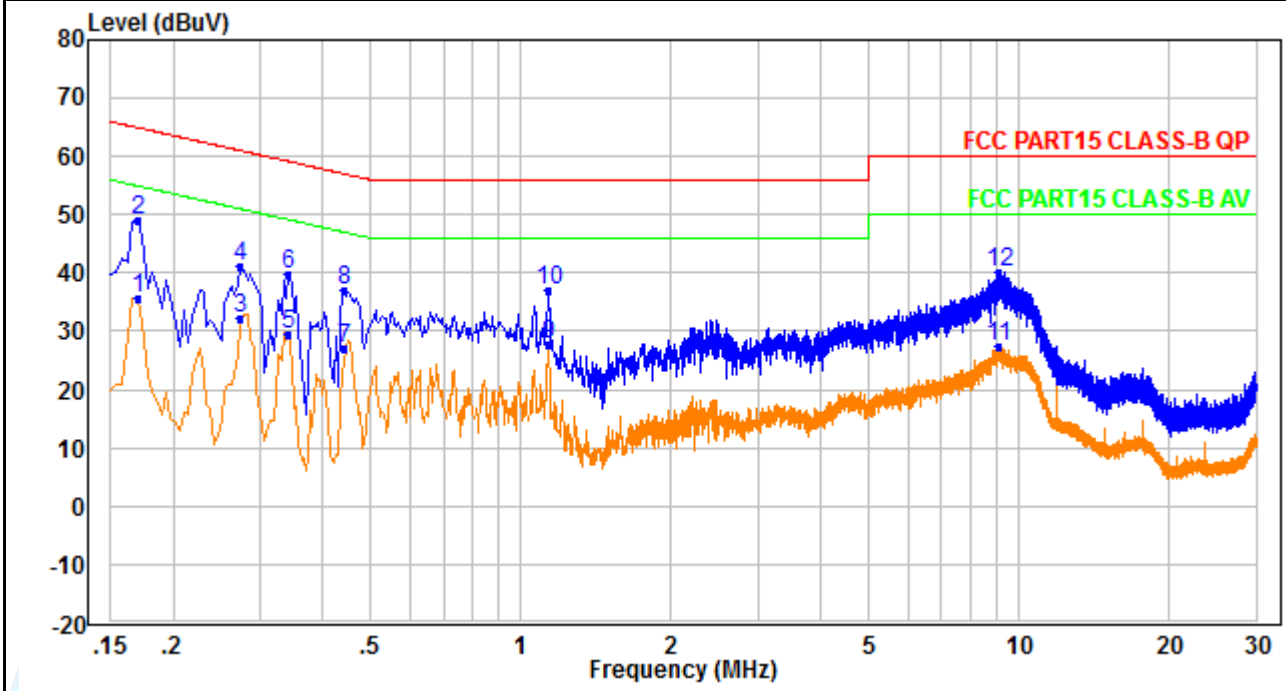
The measurement data as follows:
Quasi Peak and Average:
Mode: WIFI Link

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.166	30.02	9.75	39.77	55.16	-15.39	Average
2	0.166	40.70	9.75	50.45	65.16	-14.71	QP
3	0.282	27.94	9.75	37.69	50.76	-13.07	Average
4	0.282	34.59	9.75	44.34	60.76	-16.42	QP
5	0.342	23.77	9.77	33.54	49.15	-15.61	Average
6	0.342	32.18	9.77	41.95	59.15	-17.20	QP
7	0.446	20.57	9.81	30.38	46.95	-16.57	Average
8	0.446	29.36	9.81	39.17	56.95	-17.78	QP
9	1.138	16.57	9.89	26.46	46.00	-19.54	Average
10	1.138	25.77	9.89	35.66	56.00	-20.34	QP
11	9.281	8.76	10.24	19.00	50.00	-31.00	Average
12	9.281	19.30	10.24	29.54	60.00	-30.46	QP

Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.170	25.81	9.75	35.56	54.96	-19.40	Average
2	0.170	39.47	9.75	49.22	64.96	-15.74	QP
3	0.274	22.39	9.75	32.14	51.00	-18.86	Average
4	0.274	31.44	9.75	41.19	61.00	-19.81	QP
5	0.342	19.67	9.76	29.43	49.15	-19.72	Average
6	0.342	29.87	9.76	39.63	59.15	-19.52	QP
7	0.442	17.42	9.78	27.20	47.02	-19.82	Average
8	0.442	27.14	9.78	36.92	57.02	-20.10	QP
9	1.138	17.84	9.83	27.67	46.00	-18.33	Average
10	1.138	27.09	9.83	36.92	56.00	-19.08	QP
11	9.129	17.19	10.32	27.51	50.00	-22.49	Average
12	9.129	29.71	10.32	40.03	60.00	-19.97	QP

Remark:

1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result - Limit
4. An initial pre-scan was performed on the Phase and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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