FCC TEST REPORT

Product Name:	Hyebrid Full-Touch Handheld Computer
Trade Mark:	BLUEBIRD
Model No.:	HF550X
Add. Model No.:	N/A
Report Number:	2304244979RFC-3
Test Standards:	FCC 47 CFR Part 15 Subpart C
FCC ID:	SS4HF550XR
Test Result:	PASS
Date of Issue:	October 7, 2023

Prepared for:

Bluebird Inc.
3F, 115, Irwon-ro, Gangnam-gu, Seoul, Republic of Korea

Prepared by:

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	Assistant Manager		

Version

Version No.	Date	Description
V1.0	October 7, 2023	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Bluebird Inc.
Address of Applicant:	3F, 115, Irwon-ro, Gangnam-gu, Seoul, Republic of Korea
Manufacturer:	Bluebird Inc.
Address of Manufacturer:	3F, 115, Irwon-ro, Gangnam-gu, Seoul, Republic of Korea

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Hyebrid Full-Touch Handheld Computer		
Model No.:	HF550X		
Add. Model No.:	N/A		
Trade Mark:	BLUEBIRD		
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
		Bluetooth 5.0	
	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
	NFC:	13.553 MHz to 13.567 MHz	
	RFID:	902 MHz to 928 MHz	
Software Version:	R1.0 (Provided by the customer)		
Hardware Version:	REV0.8 (Provided by the customer)		
Sample Received Date:	April 13, 2023		
Sample Tested Date:	April 27, 2023 to May 31, 2023		
Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.			

1.2.2 Description of Accessories

Adapter	
Model No.:	KSA29B0500200D5
Input:	100-240 V~50/60 Hz 0.5A
Output:	5.0 V ⎓ 2.0A
AC Cable:	N/A
DC Cable:	N/A

Battery	
Model No.:	BAT-400001
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.85 Vdc
Limited Charge Voltage:	4.4 Vdc
Rated Capacity:	4000 mAh

Cable	
Description:	USB Type-C Plug Cable
Connector:	USB Type-C / USB 3.0 Type A
Cable Type:	Shielded without ferrite
Length:	1 Meter

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, IEEE 802.11n-HT40	
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) IEEE 802.11n-HT40: 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 MCS 15 IEEE 802.11n-HT40: Up to MCS 15	
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11 IEEE 802.11n-HT40: 7	
Channel Separation:	5 MHz	
Antenna Type: (Provided by the customer)	Ant. 0	PIFA Antenna
	Ant. 1	PIFA Antenna
Antenna Gain: (Provided by the customer)	Ant. 0	1.137 dBi
	Ant. 1	0.654 dBi
Maximum Peak Power:	SISO_ Ant. 0	IEEE 802.11b: 20.43 dBm IEEE 802.11g: 21.35 dBm IEEE 802.11n-HT20: 20.25 dBm IEEE 802.11n-HT40: 21.89 dBm
	SISO_ Ant. 1	IEEE 802.11b: 19.24 dBm IEEE 802.11g: 20.32 dBm IEEE 802.11n-HT20: 18.88 dBm IEEE 802.11n-HT40: 20.65 dBm
	MIMO_ Ant. 0+1	IEEE 802.11n-HT20: 22.63 dBm IEEE 802.11n-HT40: 24.30 dBm
Normal Test Voltage:	3.85Vdc and/or 120 Vac	

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**
IEEE 802.11n-HT40	**f = 2407 + 5k MHz, k = 3,…,9**
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	DELL	Inspiron 5409	N/A	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable x 2	SMA	0.3 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, China 518109
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 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 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	±4.6 dB
5	Radiated emission 1GHz-18GHz	±4.4 dB
6	Radiated emission 18GHz-26GHz	±4.6 dB

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 (b)	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013 Clause 6.2	PASS
Conducted Peak Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3)	ANSI C63.10-2013 Clause 11.9.1.3	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)	ANSI C63.10-2013 Clause 11.8.1	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e)	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)	ANSI C63.10-2013 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209	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	ANSI C63.10-2013 Clause 11.13	PASS

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☒	Receiver	R&S	ESIB26	100114	3-Nov-2022	2-Nov-2023
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	21-Nov-2022	20-Nov-2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	13-Dec-2022	12-Dec-2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	13-Dec-2022	12-Dec-2023
☒	Preamplifier	HP	8447F	2805A02960	1-Nov-2022	31-Oct-2023
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	17-Apr-2022	16-Apr-2024
☒	Pre-amplifier	ETS-LINDGREN	00118385	00201874	1-Nov-2022	31-Oct-2023
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	21-Nov-2022	20-Nov-2023
☒	Pre-amplifier	ETS-LINDGREN	00118384	00202652	21-Nov-2022	20-Nov-2023
☒	Band Reject Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G248	2-Nov-2022	1-Nov-2023
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	Receiver	R&S	ESR7	101181	1-Nov-2022	31-Oct-2023
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	1-Nov-2022	31-Oct-2023
☒	LISN	R&S	ESH2-Z5	860014/024	1-Nov-2022	31-Oct-2023
☐	LISN	ETS-Lindgren	3816/2SH	00201088	1-Nov-2022	31-Oct-2023
☒	Test Software	Audix	e3	Software Version: 9 20151119i		

RF Conducted Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	14-Apr-2023	13-Apr-2024
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	3-Nov-2022	2-Nov-2023

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	Relative Humidity (%)
NT/NV	+15 to +35	3.85Vdc and/or 120 Vac	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temp. (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
AC Power Line Conducted Emission	25.3	57	100.6	S20234131355-ZJA03/5	Lucas Ouyang
Conducted Peak Output Power	25.1	53	99.9	S20234131355-ZJA05/5	Allen Zhou
6dB Bandwidth					
Power Spectral Density					
Conducted Out of Band Emission					
Radiated Spurious Emissions	24.1	61.3	99.8	S20234131355-ZJA03/5	Fire Huo
Band Edge Measurements (Radiated)					

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H11)
IEEE 802.11b	2412 MHz to 2472 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2472 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2472 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
Mode	**Tx/Rx Frequency**	**Test RF Channel Lists**		
		Lowest(L)	**Middle(M)**	**Highest(H9)**
IEEE 802.11n-HT40	2422 MHz to 2462 MHz	Channel 3	Channel 7	Channel 9
		2422 MHz	2437 MHz	2452 MHz

4.3 EUT TEST STATUS

Mode	Tx/Rx Function	Description
IEEE 802.11b IEEE 802.11g IEEE 802.11n-HT20 IEEE 802.11n-HT40	1Tx/1Rx	1. Keep the EUT in continuously transmitting or receiving with modulation test single.
IEEE 802.11n-HT20 IEEE 802.11n-HT40	2Tx/2Rx	2. Keep the EUT in continuously transmitting or receiving with modulation test single.

Power Setting (Provided by the customer)						
Mode	Channel 1		Channel 6		Channel 11	
	Antenna 0	Antenna 1	Antenna 0	Antenna 1	Antenna 0	Antenna 1
IEEE 802.11b	16	16	16	16	16	16
IEEE 802.11g	15	15	15	15	15	15
IEEE 802.11n-HT20	14	14	14	14	14	14
Mode	Channel 3		Channel 6		Channel 9	
	Antenna 0	Antenna 1	Antenna 0	Antenna 1	Antenna 0	Antenna 1
IEEE 802.11n-HT40	14	14	14	14	14	14

Test Software (Provided by the customer)
Test software name: QRCT V4.0

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
IEEE 802.11n-HT40	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

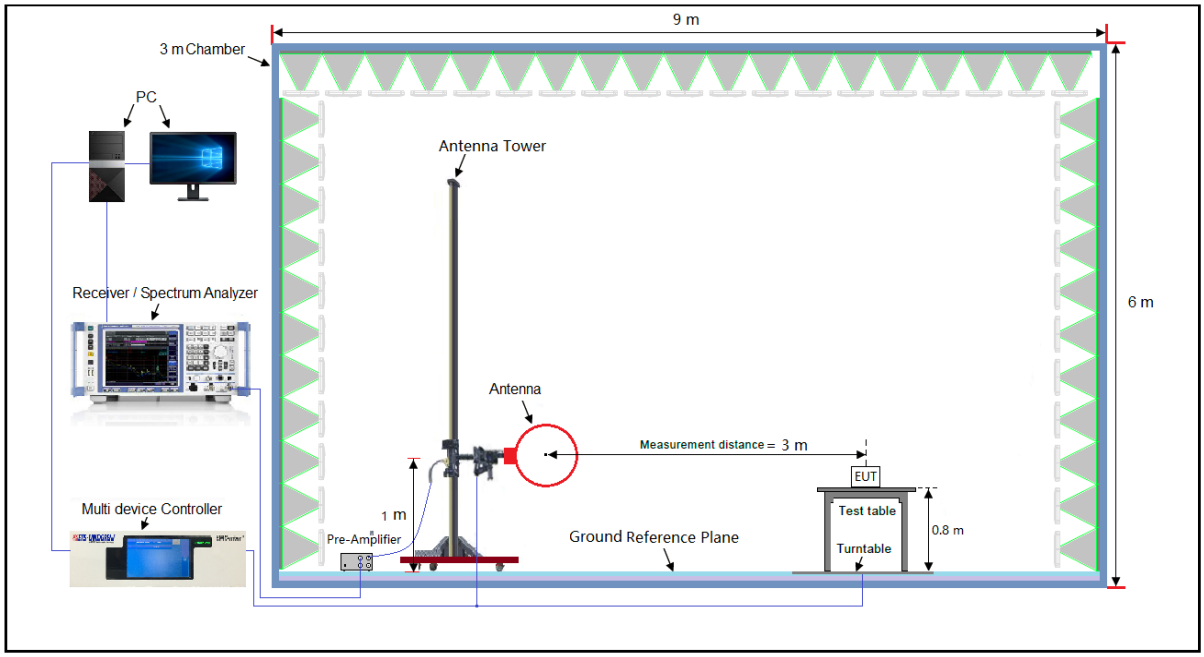


Figure 2. 30MHz to 1GHz

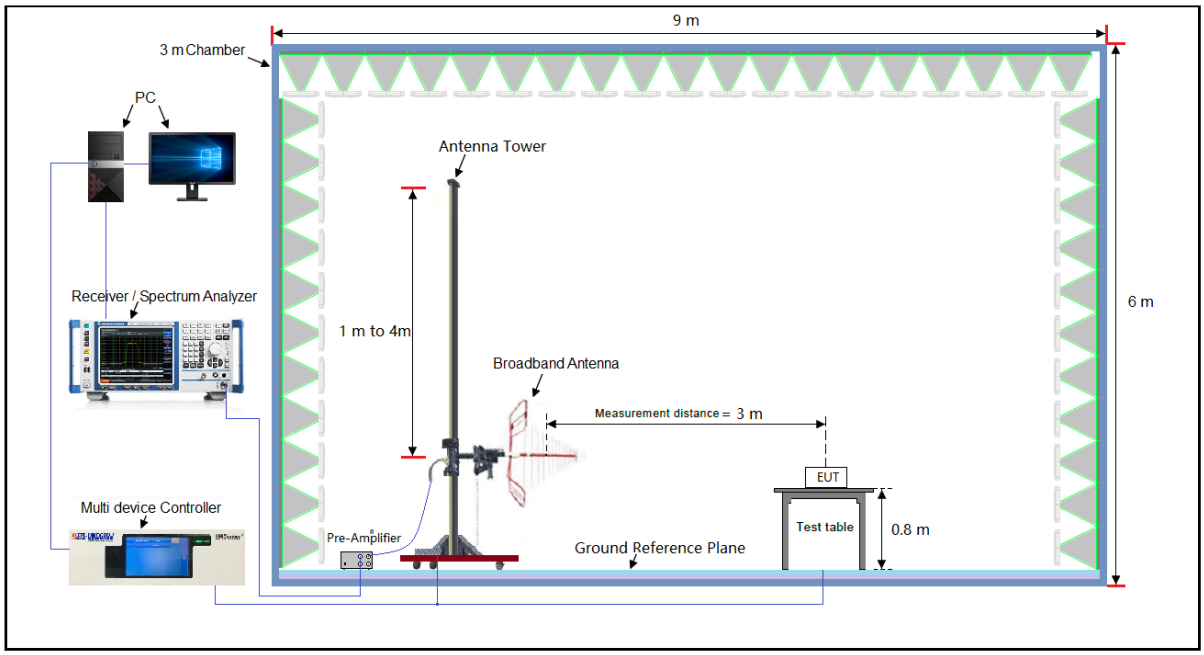
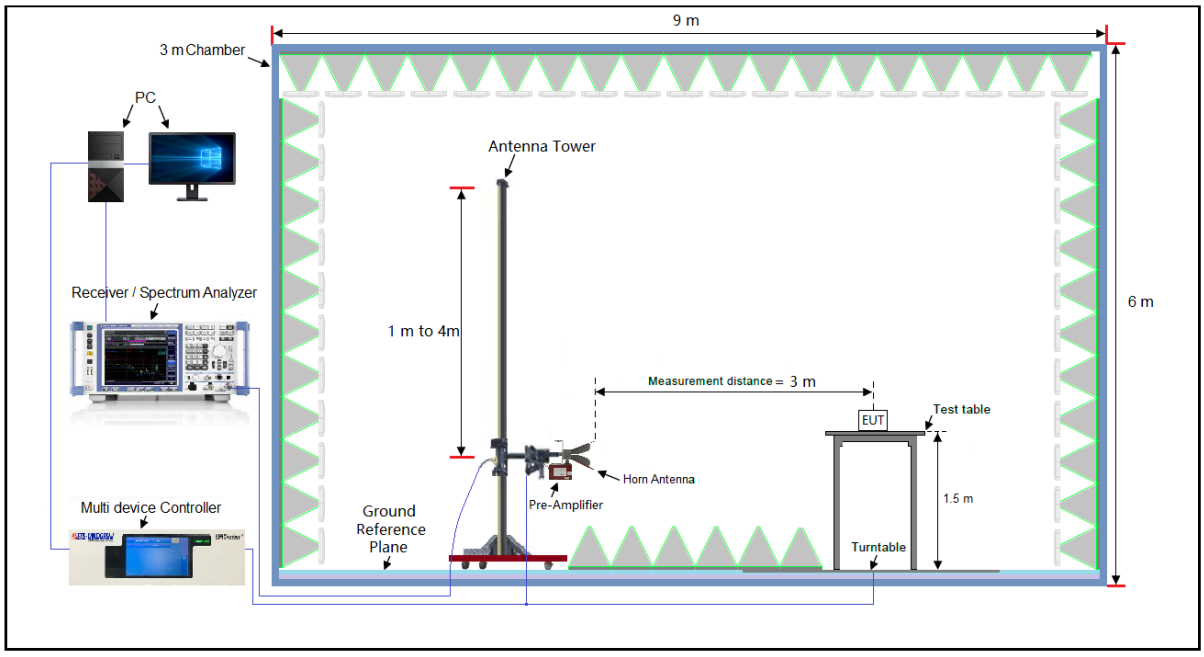
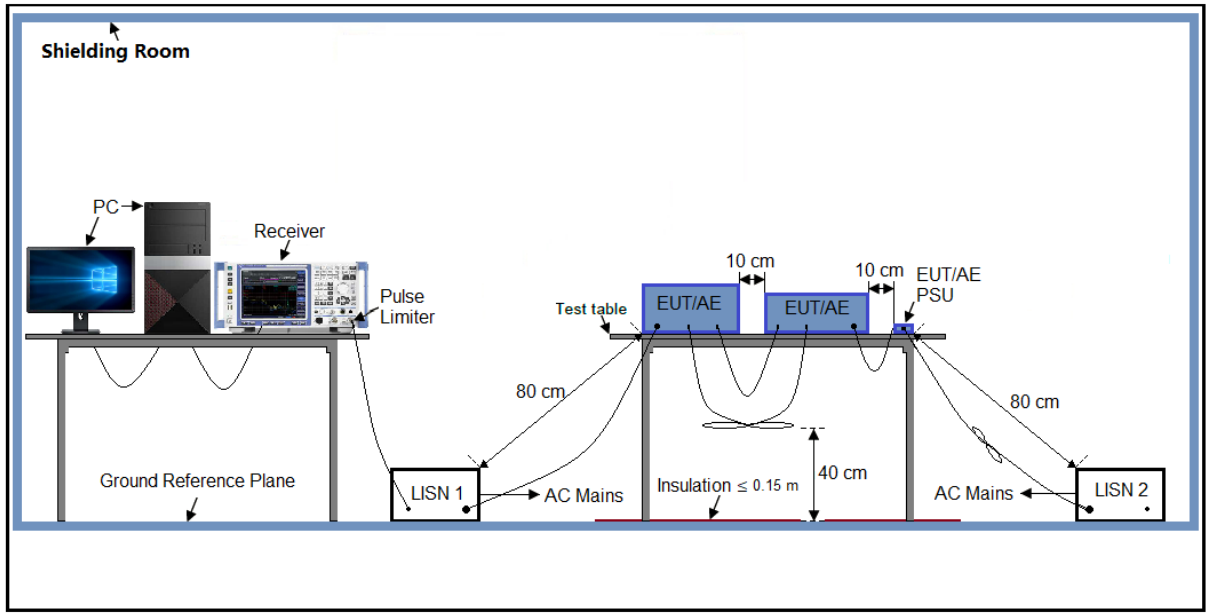


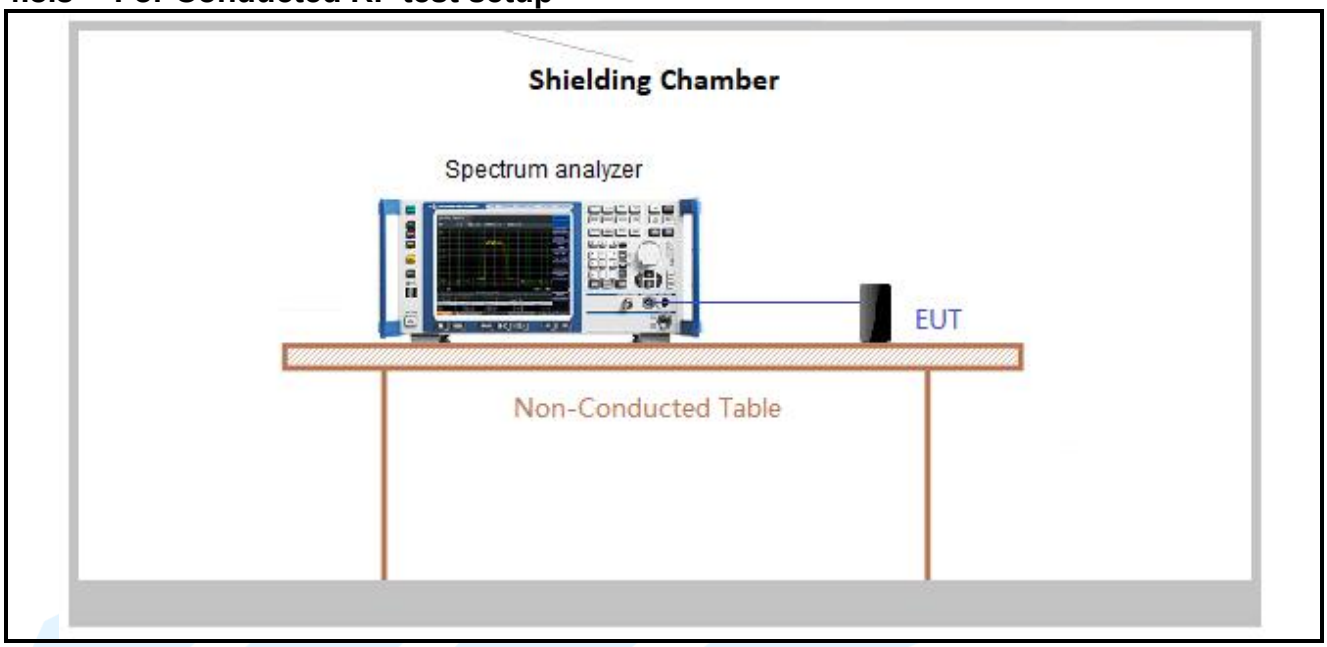
Figure 3. Above 1GHz



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 3.85V 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 orientation.

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

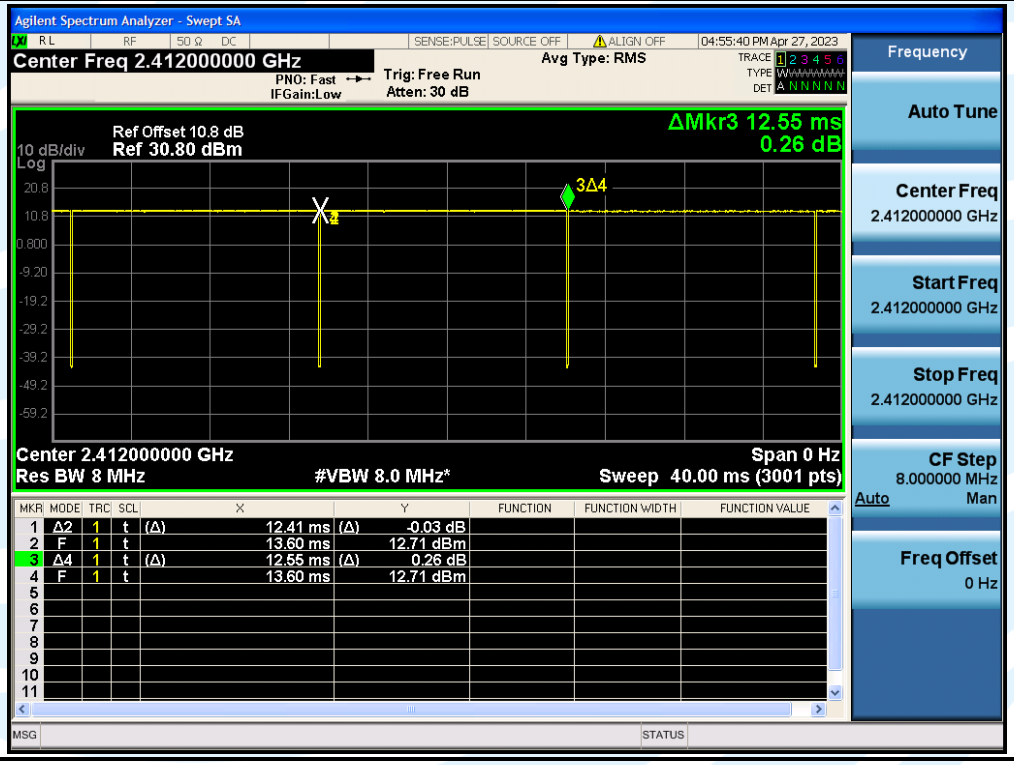
Mode	Data Rates	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/T Minimum VBW (kHz)
IEEE 802.11b	1 Mbps	12.410	12.550	0.99	98.88	0.00	0.01
IEEE 802.11g	6 Mbps	2.060	2.103	0.98	97.96	0.09	0.49
IEEE 802.11n-HT20	MCS 0	1.920	1.963	0.98	97.81	0.10	0.52
IEEE 802.11n-HT40	MCS 0	0.947	0.998	0.95	94.83	0.23	1.06

Remark:

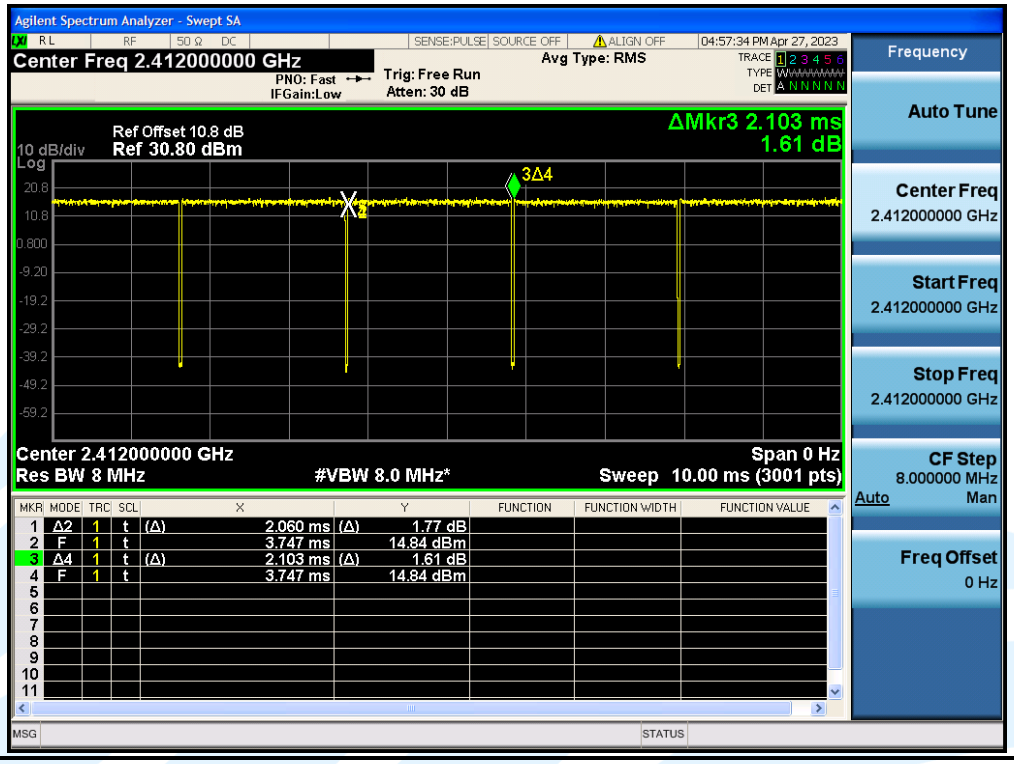
1) Duty cycle= On Time/ Period;
2) Duty Cycle factor = 10 * log(1/ Duty cycle)

The test plots as follows

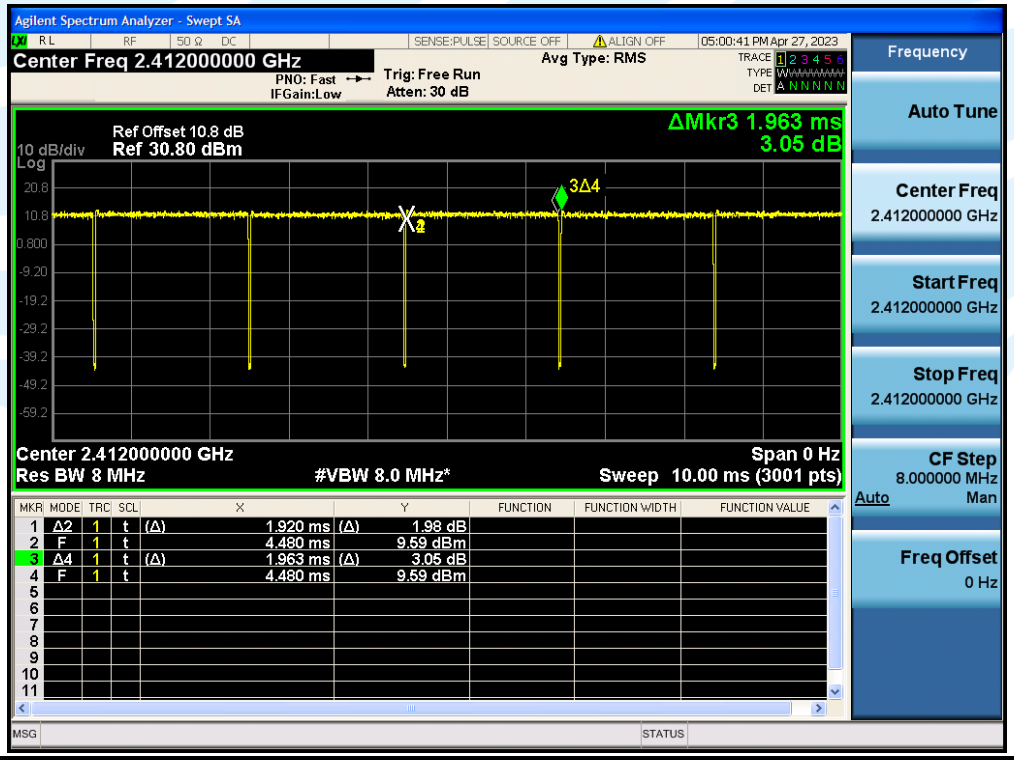
IEEE 802.11b



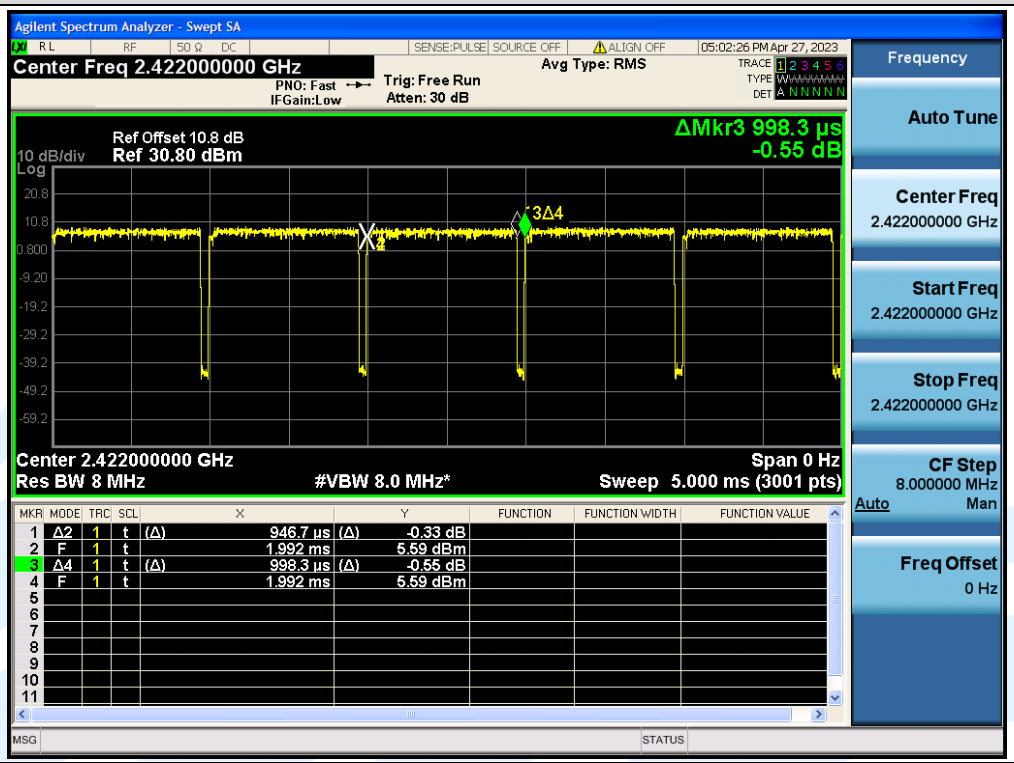
IEEE 802.11g



IEEE 802.11n-HT20



IEEE 802.11n-HT40



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	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
4	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	KDB 662911 D01 Multiple Transmitter Output v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

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.
EUT Antenna:
Both antenna in the interior of the equipment and no consideration of replacement. The transmit signals are correlated with each other and the antenna gain of both chains is completely consistent, the best case directional gain of the antenna is 0.9 dBi (See section 5.3).

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section15.247 (b)(3)

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	Frequency	Max. Peak Power (dBm)				Result
	(MHz)	Ant. 0	Ant. 1	Total	Limit dBm)	
IEEE 802.11b	2412	20.05	***19.24***	N/A	30.00	Pass
	2437	***20.43***	19.10	N/A	30.00	Pass
	2462	20.07	19.13	N/A	30.00	Pass
IEEE 802.11g	2412	20.93	20.26	N/A	30.00	Pass
	2437	***21.35***	20.08	N/A	30.00	Pass
	2462	21.05	***20.32***	N/A	30.00	Pass
IEEE 802.11n-HT20	2412	19.77	18.69	22.27	30.00	Pass
	2437	***20.25***	***18.88***	***22.63***	30.00	Pass
	2462	20.02	18.81	22.47	30.00	Pass
IEEE 802.11n-HT40	2422	21.76	20.56	24.21	30.00	Pass
	2437	***21.89***	20.58	24.29	30.00	Pass
	2452	21.84	***20.65***	***24.30***	30.00	Pass

Mode	Frequency	Max. Avg. Power (dBm)				
	(MHz)	Meas Value Ant. 0	Meas Value Ant. 1	Corr'd Value Ant. 0	Corr'd Value Ant. 1	Total Ant.0+1
IEEE 802.11b	2412	17.68	***16.68***	17.68	***16.68***	N/A
	2437	***17.91***	16.58	***17.91***	16.58	N/A
	2462	17.59	16.49	17.59	16.49	N/A
IEEE 802.11g	2412	16.16	***15.29***	16.25	***15.38***	N/A
	2437	***16.63***	15.10	***16.72***	15.19	N/A
	2462	16.18	15.23	16.27	15.32	N/A
IEEE 802.11n-HT20	2412	14.79	13.56	14.89	13.66	17.32
	2437	***15.19***	***13.69***	***15.29***	***13.79***	***17.61***
	2462	14.78	13.45	14.88	13.55	17.27
IEEE 802.11n-HT40	2422	15.35	13.96	15.58	14.19	17.95
	2437	***15.57***	***14.02***	***15.80***	***14.25***	***18.10***
	2452	15.32	13.82	15.55	14.05	17.88

Remark:
1. Total (Ant 0+1) = $10*\log[(10^{Ant.\ 0/10})+(10^{Ant.\ 0/10})]$
2. Directional gain and the maximum conducted output power limit see table below:

Frequency (MHz)	Antenna Gain (dBi)		Uncorrelated Directional gain (dBi)	Correlated Directional gain (dBi)	Limit	
	Ant .0	Ant .1	Power	PSD	Power (dBm)	PSD (dBm/3kHz)
2400 - 2483.5	1.137	0.654	0.90	3.91	30	8

For CDD transmissions, directional gain is calculated as follows. In all formulas,

N_{ANT} = number of transmit antennas and
N_{SS} = number of spatial streams. (Assume N_{SS} = 1 unless you have specific information to the contrary.)

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

For power measurements on IEEE 802.11 devices, 1,2

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths $\geq$ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

For Uncorrelated transmissions, directional gain is calculated as follows. In all formulas:

Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2$ /NANT] dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

5.46 DB BANDWIDTH

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)
Test Method:	ANSI C63.10-2013 Clause 11.8.1
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: 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. 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:	**Please refer to Appendix A**

5.5 POWER SPECTRAL DENSITY

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (e)

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 Mode: Link mode

Test Results: **Please refer to Appendix A**

5.6 CONDUCTED OUT OF BAND EMISSION

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247(d)

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 Mode: Link mode

Test Results: **Please refer to Appendix A**

5.7 RADIATED SPURIOUS EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209

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 4.5.1 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 X 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

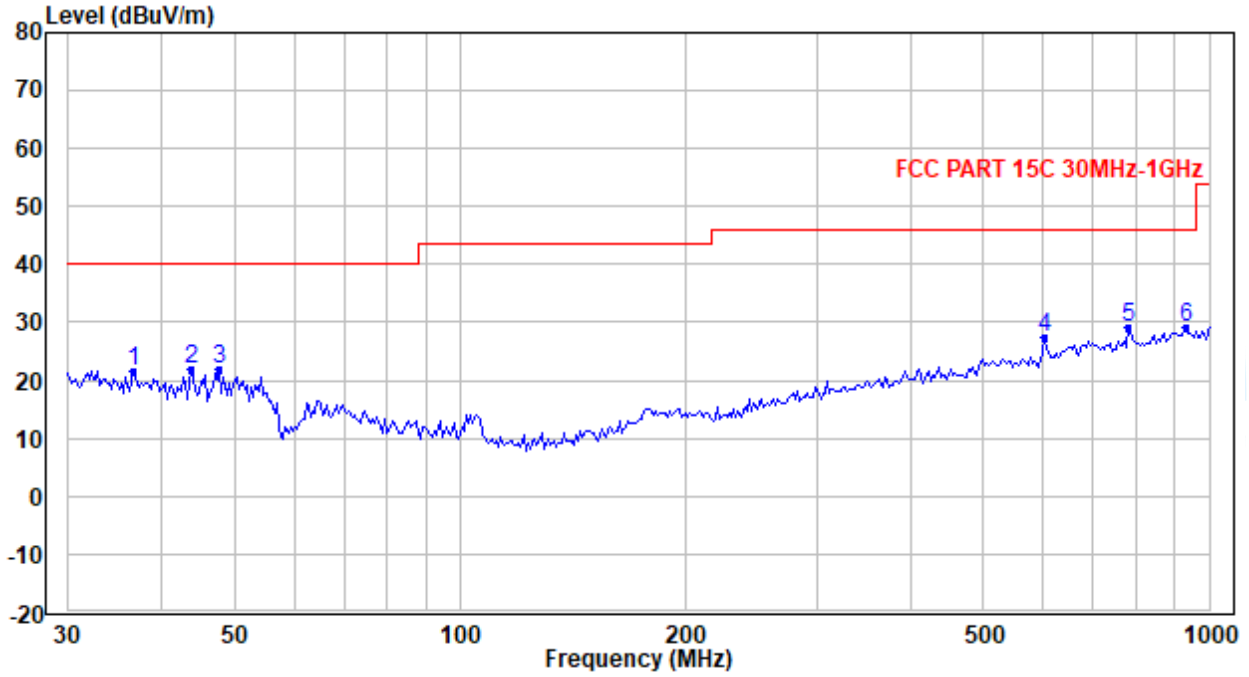
The measurement data as follows:

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):

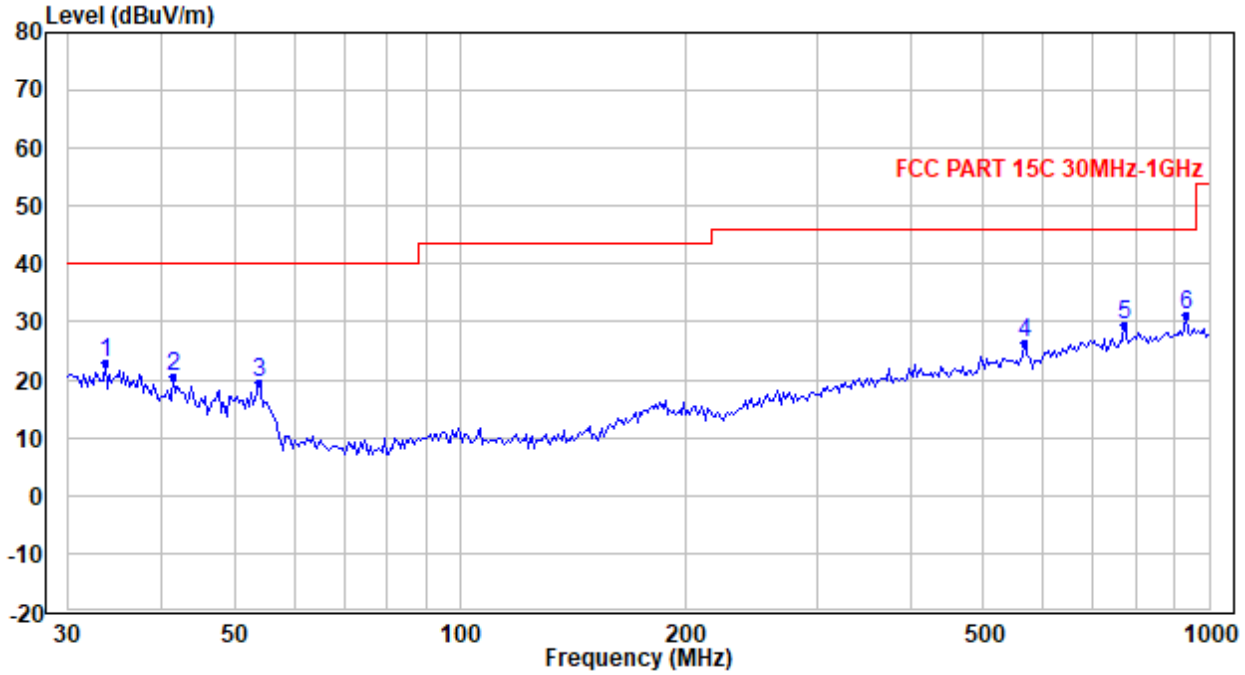
Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	36.524	27.45	-5.97	21.48	40.00	-18.52	QP
2	43.845	32.40	-10.54	21.86	40.00	-18.14	QP
3	47.703	35.19	-13.31	21.88	40.00	-18.12	QP
4	602.929	27.46	-0.16	27.30	46.00	-18.70	QP
5	781.961	26.23	2.75	28.98	46.00	-17.02	QP
6	932.141	24.25	4.93	29.18	46.00	-16.82	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	33.570	28.41	-5.36	23.05	40.00	-16.95	QP
2	41.448	29.31	-8.60	20.71	40.00	-19.29	QP
3	53.756	35.80	-16.24	19.56	40.00	-20.44	QP
4	565.978	27.89	-1.46	26.43	46.00	-19.57	QP
5	771.047	27.05	2.51	29.56	46.00	-16.44	QP
6	932.141	26.17	4.93	31.10	46.00	-14.90	QP

Radiated Emission Test Data (Above 1GHz): SISO_ Ant. 0_IEEE 802.11b_ Channel 1:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	4824	41.7	-2.4	39.3	74	-34.7	Peak	Horizontal
2	4824	29.8	-2.4	27.4	54	-26.6	Average	Horizontal
3	7236	39.9	1.6	41.5	74	-32.5	Peak	Horizontal
4	7236	27.1	1.6	28.8	54	-25.3	Average	Horizontal
5	4824	41.5	-2.4	39.1	74	-34.9	Peak	Vertical
6	4824	28.9	-2.4	26.5	54	-27.5	Average	Vertical
7	7236	40.4	1.6	42.0	74	-32.0	Peak	Vertical
8	7236	27.1	1.6	28.8	54	-25.3	Average	Vertical
SISO_ Ant. 0_ IEEE 802.11b_ Channel 6:								
1	4874	40.7	-2.3	38.4	74	-35.6	Peak	Horizontal
2	4874	27.1	-2.3	24.7	54	-29.3	Average	Horizontal
3	7311	38.3	1.7	40.0	74	-34.0	Peak	Horizontal
4	7311	26.9	1.7	28.6	54	-25.4	Average	Horizontal
5	4874	40.0	-2.3	37.6	74	-36.4	Peak	Vertical
6	4874	27.3	-2.3	24.9	54	-29.1	Average	Vertical
7	7311	40.3	1.7	42.0	74	-32.0	Peak	Vertical
8	7311	26.9	1.7	28.6	54	-25.4	Average	Vertical
SISO_ Ant. 0_ IEEE 802.11b_ Channel 11:								
1	4924	40.0	-2.3	37.8	74	-36.2	Peak	Horizontal
2	4924	29.1	-2.3	26.8	54	-27.2	Average	Horizontal
3	7386	40.7	1.7	42.4	74	-31.6	Peak	Horizontal
4	7386	28.5	1.7	30.2	54	-23.8	Average	Horizontal
5	4924	40.2	-2.3	37.9	74	-36.1	Peak	Vertical
6	4924	29.1	-2.3	26.8	54	-27.2	Average	Vertical
7	7386	40.5	1.7	42.2	74	-31.8	Peak	Vertical
8	7386	28.6	1.7	30.3	54	-23.7	Average	Vertical

SISO_ Ant. 1_IEEE 802.11b_ Channel 1:								
No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824	41.4	-2.4	39.0	74	-35.0	Peak	Horizontal
2	4824	28.9	-2.4	26.5	54	-27.5	Average	Horizontal
3	7236	39.9	1.6	41.5	74	-32.5	Peak	Horizontal
4	7236	26.8	1.6	28.4	54	-25.6	Average	Horizontal
5	4824	40.5	-2.4	38.1	74	-35.9	Peak	Vertical
6	4824	28.8	-2.4	26.4	54	-27.6	Average	Vertical
7	7236	38.5	1.6	40.1	74	-33.9	Peak	Vertical
8	7236	26.9	1.6	28.6	54	-25.4	Average	Vertical
SISO_ Ant. 1_ IEEE 802.11b_ Channel 6:								
1	4874	39.7	-2.3	37.3	74	-36.7	Peak	Horizontal
2	4874	27.2	-2.3	24.8	54	-29.2	Average	Horizontal
3	7311	40.5	1.7	42.1	74	-31.9	Peak	Horizontal
4	7311	26.9	1.7	28.6	54	-25.4	Average	Horizontal
5	4874	40.2	-2.3	37.9	74	-36.1	Peak	Vertical
6	4874	27.1	-2.3	24.7	54	-29.3	Average	Vertical
7	7311	38.8	1.7	40.4	74	-33.6	Peak	Vertical
8	7311	27.0	1.7	28.7	54	-25.4	Average	Vertical
SISO_ Ant. 1_ IEEE 802.11b_ Channel 11:								
1	4924	40.3	-2.3	38.0	74	-36.0	Peak	Horizontal
2	4924	28.2	-2.3	25.9	54	-28.1	Average	Horizontal
3	7386	40.3	1.7	42.0	74	-32.0	Peak	Horizontal
4	7386	28.6	1.7	30.3	54	-23.7	Average	Horizontal
5	4924	40.6	-2.3	38.3	74	-35.7	Peak	Vertical
6	4924	28.1	-2.3	25.8	54	-28.2	Average	Vertical
7	7386	40.1	1.7	41.9	74	-32.1	Peak	Vertical
8	7386	28.6	1.7	30.3	54	-23.7	Average	Vertical

SISO_ Ant. 0_IEEE 802.11g_ Channel 1:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	4824	40.7	-2.4	38.3	74	-35.7	Peak	Horizontal
2	4824	30.6	-2.4	28.2	54	-25.8	Average	Horizontal
3	7236	39.8	1.6	41.4	74	-32.6	Peak	Horizontal
4	7236	28.4	1.6	30.1	54	-23.9	Average	Horizontal
5	4824	41.2	-2.4	38.8	74	-35.2	Peak	Vertical
6	4824	29.8	-2.4	27.4	54	-26.6	Average	Vertical
7	7236	40.1	1.6	41.8	74	-32.2	Peak	Vertical
8	7236	29.7	1.6	31.4	54	-22.6	Average	Vertical
SISO_ Ant. 0_ IEEE 802.11g_ Channel 6:								
1	4874	40.9	-2.3	38.5	74	-35.5	Peak	Horizontal
2	4874	30.1	-2.3	27.7	54	-26.3	Average	Horizontal
3	7311	38.8	1.7	40.5	74	-33.5	Peak	Horizontal
4	7311	27.6	1.7	29.3	54	-24.7	Average	Horizontal
5	4874	41.0	-2.3	38.6	74	-35.4	Peak	Vertical
6	4874	29.4	-2.3	27.1	54	-27.0	Average	Vertical
7	7311	39.6	1.7	41.3	74	-32.7	Peak	Vertical
8	7311	28.7	1.7	30.4	54	-23.6	Average	Vertical
SISO_ Ant. 0_ IEEE 802.11g_ Channel 11:								
1	4924	40.9	-2.3	38.6	74	-35.4	Peak	Horizontal
2	4924	28.8	-2.3	26.6	54	-27.5	Average	Horizontal
3	7386	39.9	1.7	41.6	74	-32.4	Peak	Horizontal
4	7386	27.9	1.7	29.6	54	-24.4	Average	Horizontal
5	4924	40.5	-2.3	38.2	74	-35.8	Peak	Vertical
6	4924	30.3	-2.3	28.0	54	-26.0	Average	Vertical
7	7386	38.9	1.7	40.6	74	-33.4	Peak	Vertical
8	7386	29.2	1.7	30.9	54	-23.1	Average	Vertical

SISO_ Ant. 1_IEEE 802.11g_ Channel 1:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	4824	40.3	-2.4	37.9	74	-36.1	Peak	Horizontal
2	4824	28.8	-2.4	26.4	54	-27.6	Average	Horizontal
3	7236	39.8	1.6	41.5	74	-32.5	Peak	Horizontal
4	7236	26.9	1.6	28.6	54	-25.4	Average	Horizontal
5	4824	40.5	-2.4	38.1	74	-35.9	Peak	Vertical
6	4824	28.9	-2.4	26.5	54	-27.5	Average	Vertical
7	7236	40.2	1.6	41.8	74	-32.2	Peak	Vertical
8	7236	26.9	1.6	28.6	54	-25.4	Average	Vertical
SISO_ Ant. 1_ IEEE 802.11g_ Channel 6:								
1	4874	42.3	-2.3	39.9	74	-34.1	Peak	Horizontal
2	4874	28.4	-2.3	26.1	54	-28.0	Average	Horizontal
3	7311	41.1	1.7	42.7	74	-31.3	Peak	Horizontal
4	7311	27.8	1.7	29.5	54	-24.5	Average	Horizontal
5	4874	42.0	-2.3	39.7	74	-34.3	Peak	Vertical
6	4874	29.4	-2.3	27.1	54	-26.9	Average	Vertical
7	7311	41.3	1.7	43.0	74	-31.0	Peak	Vertical
8	7311	28.0	1.7	29.7	54	-24.3	Average	Vertical
SISO_ Ant. 1_ IEEE 802.11g_ Channel 11:								
1	4924	42.2	-2.3	40.0	74	-34.0	Peak	Horizontal
2	4924	30.1	-2.3	27.8	54	-26.2	Average	Horizontal
3	7386	40.8	1.7	42.5	74	-31.5	Peak	Horizontal
4	7386	29.2	1.7	31.0	54	-23.0	Average	Horizontal
5	4924	41.8	-2.3	39.5	74	-34.5	Peak	Vertical
6	4924	30.3	-2.3	28.0	54	-26.0	Average	Vertical
7	7386	40.3	1.7	42.1	74	-31.9	Peak	Vertical
8	7386	29.2	1.7	30.9	54	-23.1	Average	Vertical

MIMO_ Ant. 0+1_ IEEE 802.11n-HT20_ Channel 1:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	4824	41.2	-2.4	38.8	74	-35.2	Peak	Horizontal
2	4824	30.5	-2.4	28.1	54	-25.9	Average	Horizontal
3	7236	40.3	1.6	41.9	74	-32.1	Peak	Horizontal
4	7236	29.4	1.6	31.0	54	-23.0	Average	Horizontal
5	4824	40.0	-2.4	37.6	74	-36.4	Peak	Vertical
6	4824	29.9	-2.4	27.5	54	-26.5	Average	Vertical
7	7236	40.2	1.6	41.8	74	-32.2	Peak	Vertical
8	7236	27.8	1.6	29.4	54	-24.6	Average	Vertical
MIMO_ Ant. 0+1_ IEEE 802.11n-HT20_ Channel 6:								
1	4874	40.0	-2.3	37.6	74	-36.4	Peak	Horizontal
2	4874	29.1	-2.3	26.8	54	-27.2	Average	Horizontal
3	7311	40.4	1.7	42.1	74	-31.9	Peak	Horizontal
4	7311	27.7	1.7	29.4	54	-24.6	Average	Horizontal
5	4874	40.7	-2.3	38.3	74	-35.7	Peak	Vertical
6	4874	29.4	-2.3	27.1	54	-26.9	Average	Vertical
7	7311	39.4	1.7	41.1	74	-32.9	Peak	Vertical
8	7311	28.8	1.7	30.5	54	-23.5	Average	Vertical
MIMO_ Ant. 0+1_ IEEE 802.11n-HT20_ Channel 11:								
1	4924	41.5	-2.3	39.2	74	-34.8	Peak	Horizontal
2	4924	29.8	-2.3	27.6	54	-26.5	Average	Horizontal
3	7386	40.8	1.7	42.6	74	-31.4	Peak	Horizontal
4	7386	28.9	1.7	30.6	54	-23.4	Average	Horizontal
5	4924	40.4	-2.3	38.1	74	-35.9	Peak	Vertical
6	4924	30.3	-2.3	28.0	54	-26.0	Average	Vertical
7	7386	40.7	1.7	42.5	74	-31.5	Peak	Vertical
8	7386	29.8	1.7	30.8	54	-23.2	Average	Vertical

MIMO_ Ant. 0+1_ IEEE 802.11n-HT40_ Channel 3:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	4844	41.5	-2.4	39.1	74	-34.9	Peak	Horizontal
2	4844	29.4	-2.4	27.0	54	-27.0	Average	Horizontal
3	7266	38.8	1.7	40.4	74	-33.6	Peak	Horizontal
4	7266	27.5	1.7	29.1	54	-24.9	Average	Horizontal
5	4844	41.5	-2.4	39.1	74	-34.9	Peak	Vertical
6	4844	29.8	-2.4	27.4	54	-26.6	Average	Vertical
7	7266	40.6	1.7	42.2	74	-31.8	Peak	Vertical
8	7266	29.7	1.7	31.4	54	-22.6	Average	Vertical
MIMO_ Ant. 0+1_ IEEE 802.11n-HT40_ Channel 6:								
1	4874	40.1	-2.3	37.8	74	-36.2	Peak	Horizontal
2	4874	29.2	-2.3	26.9	54	-27.1	Average	Horizontal
3	7311	40.4	1.7	42.1	74	-31.9	Peak	Horizontal
4	7311	27.9	1.7	29.6	54	-24.4	Average	Horizontal
5	4874	40.4	-2.3	38.0	74	-36.0	Peak	Vertical
6	4874	30.4	-2.3	28.1	54	-25.9	Average	Vertical
7	7311	40.2	1.7	41.9	74	-32.1	Peak	Vertical
8	7311	29.7	1.7	31.3	54	-22.7	Average	Vertical
MIMO_ Ant. 0+1_ IEEE 802.11n-HT40_ Channel 9:								
1	4904	40.9	-2.3	38.6	74	-35.4	Peak	Horizontal
2	4904	30.0	-2.3	27.6	54	-26.4	Average	Horizontal
3	7356	39.8	1.7	41.5	74	-32.5	Peak	Horizontal
4	7356	29.0	1.7	30.7	54	-23.3	Average	Horizontal
5	4904	41.4	-2.3	39.1	74	-34.9	Peak	Vertical
6	4904	30.4	-2.3	28.1	54	-25.9	Average	Vertical
7	7356	40.3	1.7	42.0	74	-32.0	Peak	Vertical
8	7356	29.3	1.7	31.0	54	-23.0	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

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 4.5.1 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 5.7. 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.

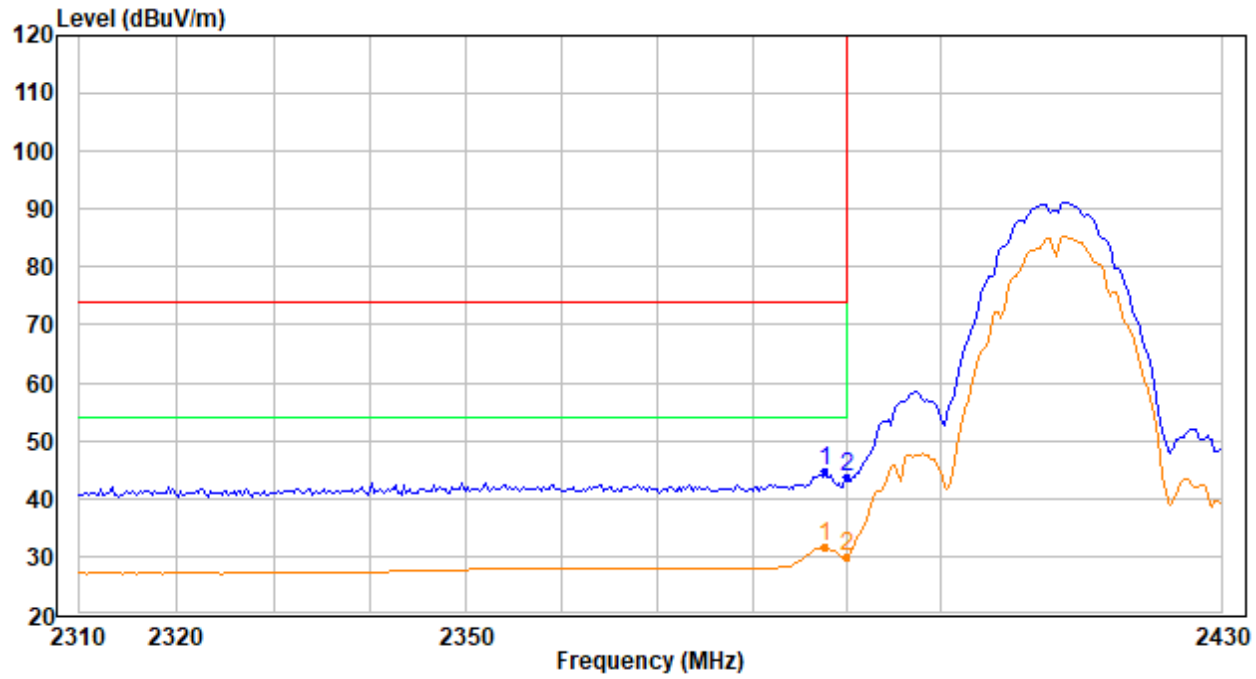
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

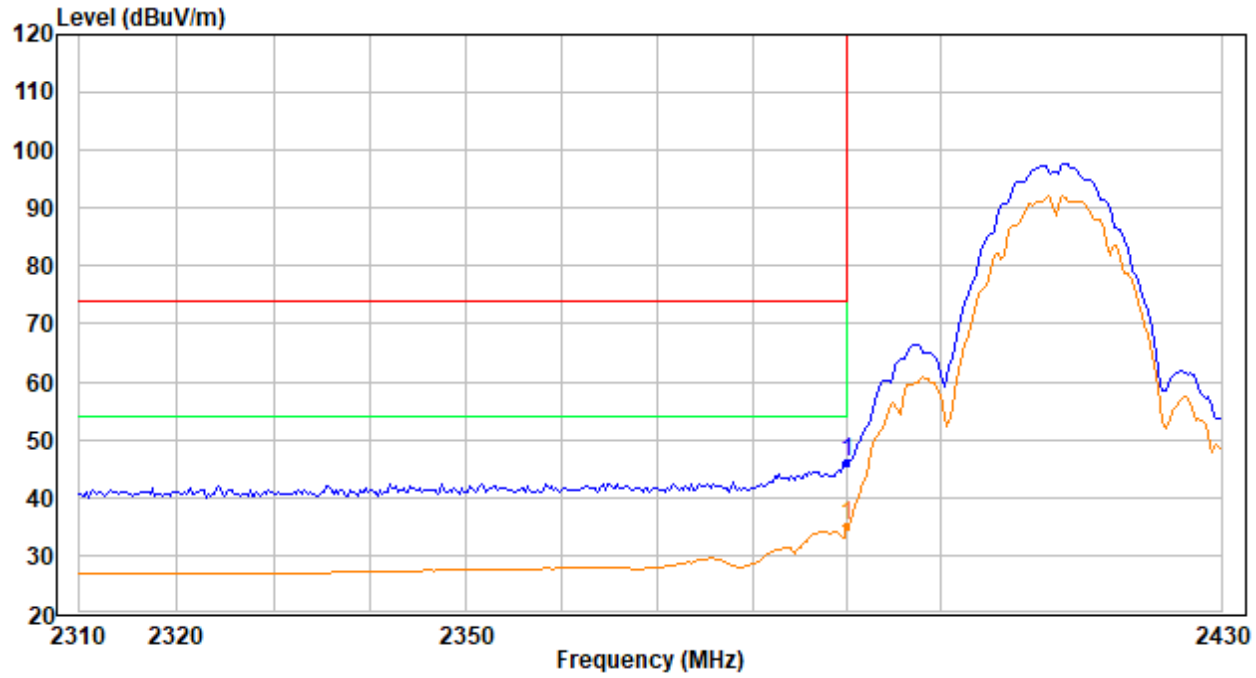
SISO_ Ant. 0_IEEE 802.11b

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



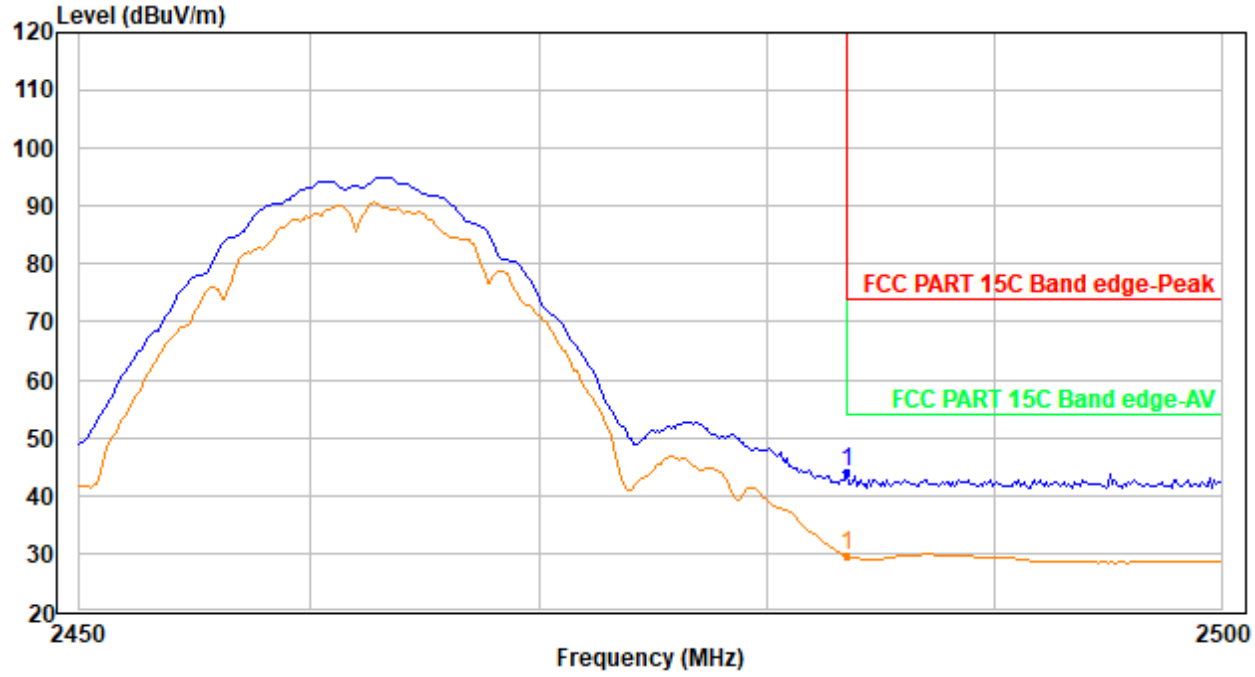
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2387.675	44.62	74.00	31.60	54.00	Pass
2390.000	43.77	74.00	29.96	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



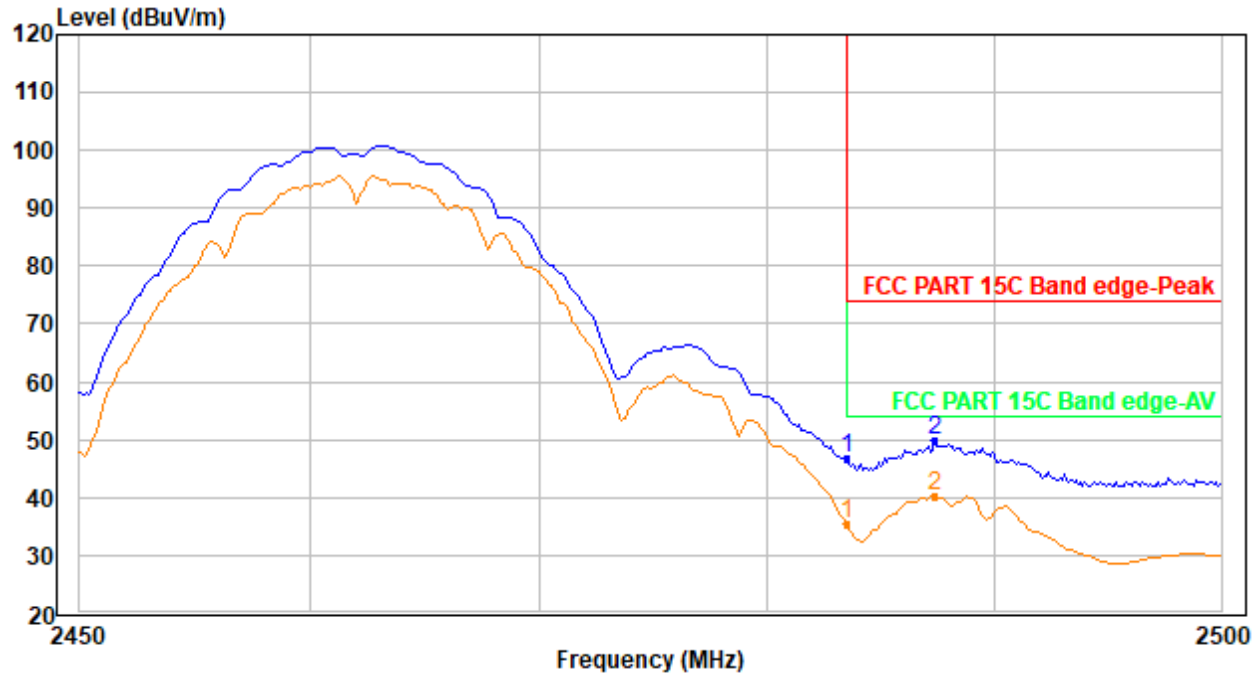
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.000	46.03	74.00	35.23	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	43.94	74.00	29.64	54.00	Pass

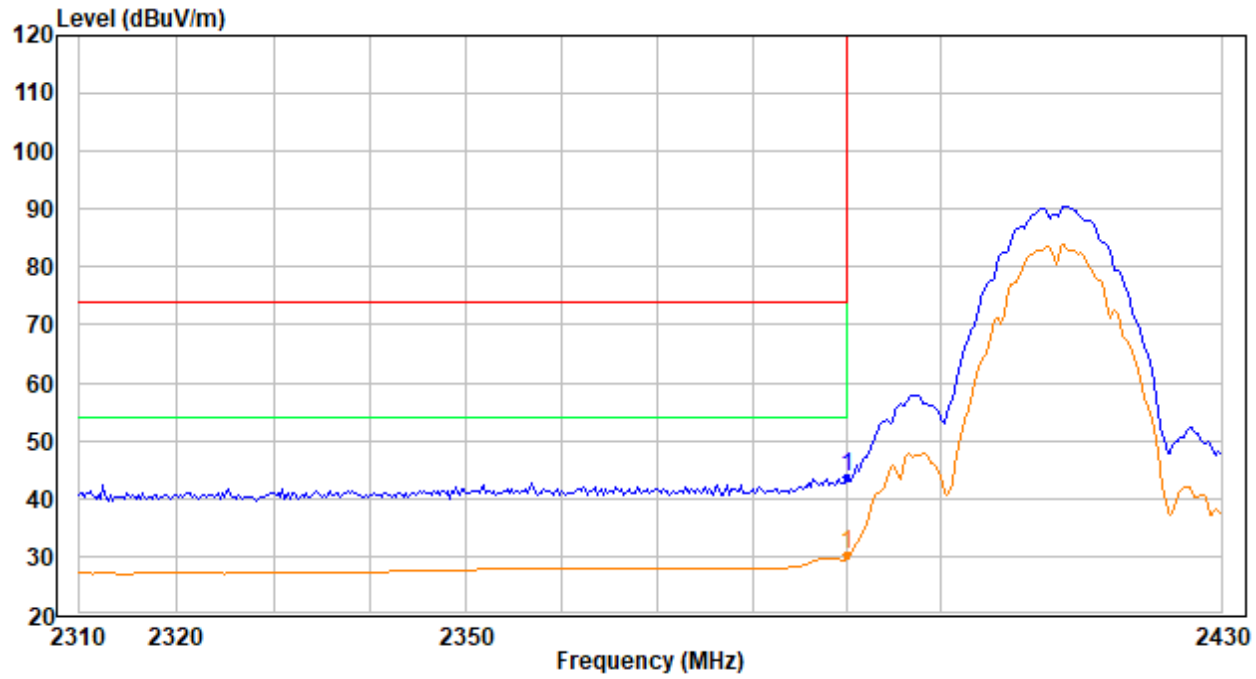
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	46.69	74.00	35.55	54.00	Pass
2487.375	49.84	74.00	40.34	54.00	Pass

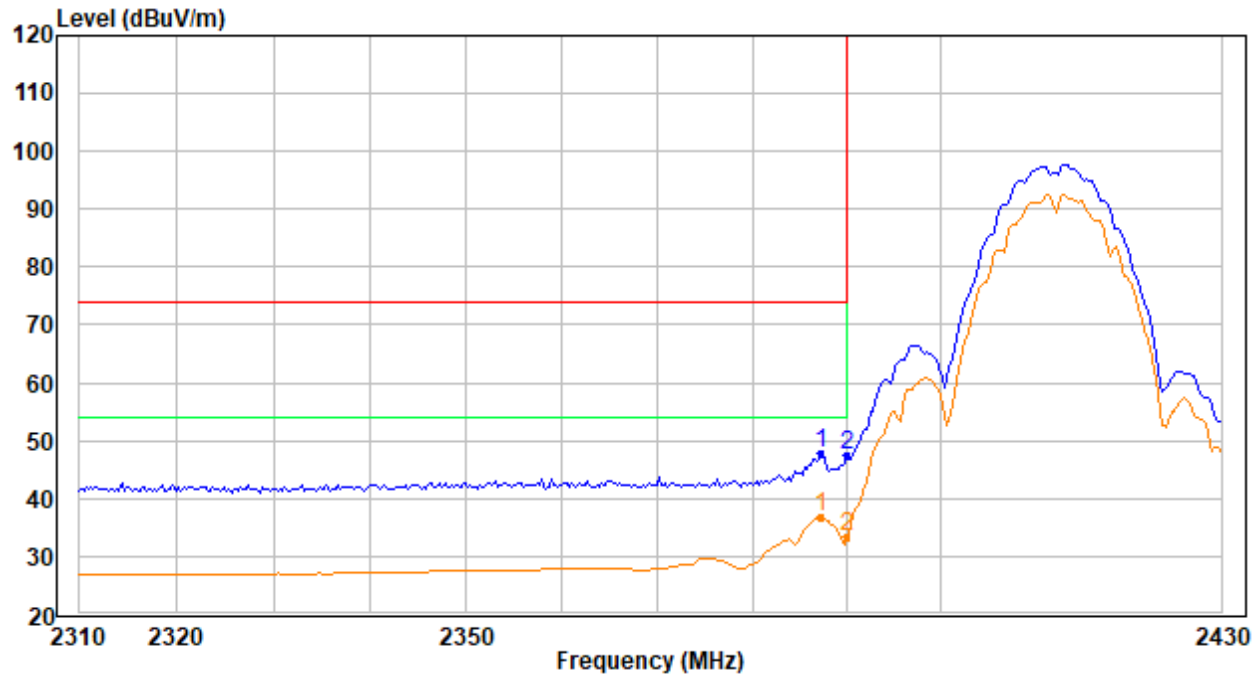
SISO_ Ant. 1_IEEE 802.11b

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



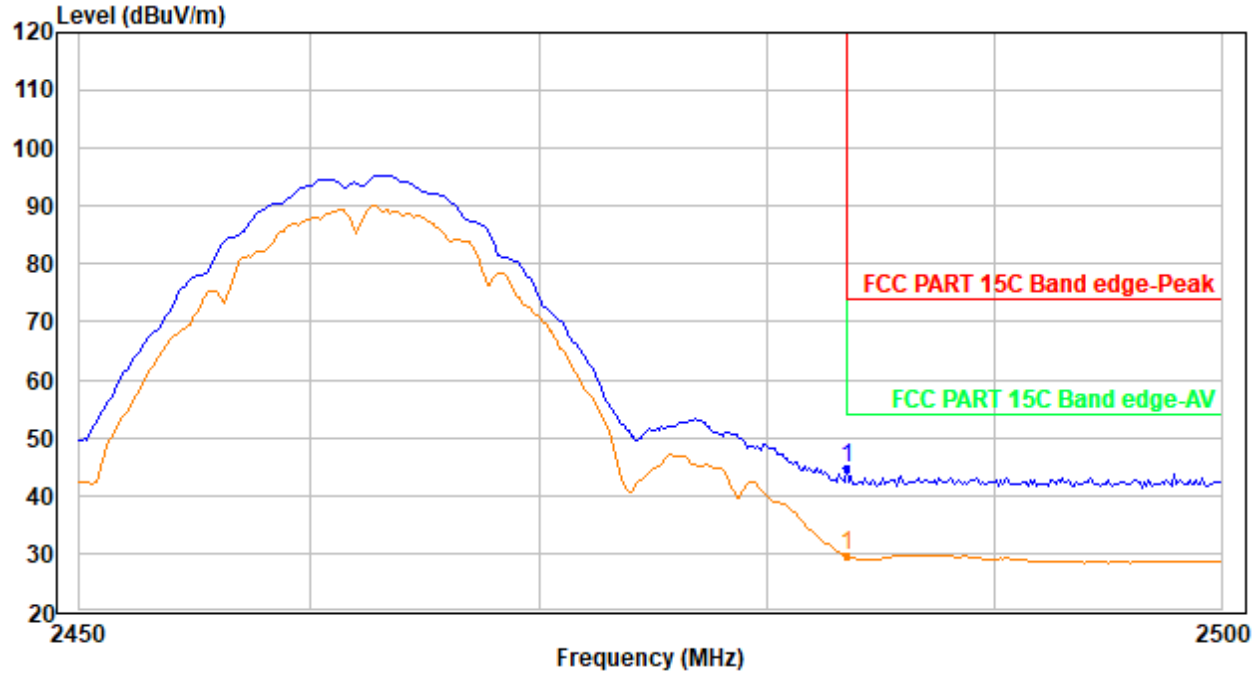
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	43.65	74.00	30.41	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



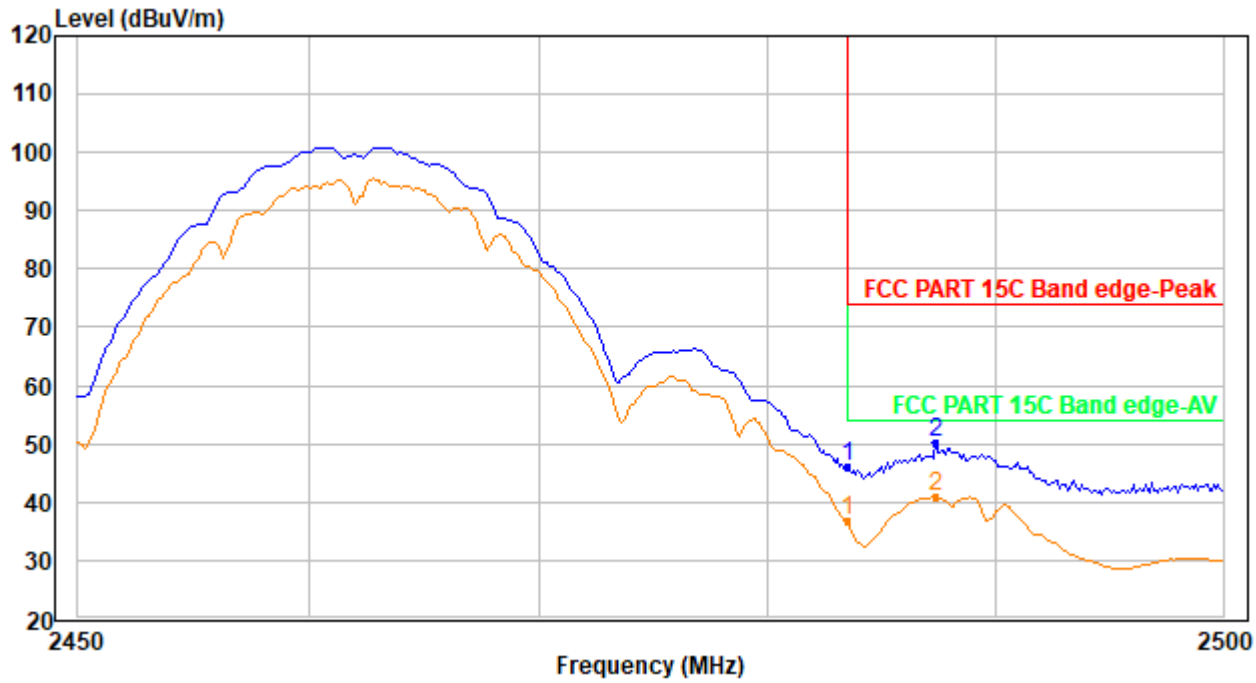
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2387.194	47.87	74.00	36.93	54.00	Pass
2390.0000	47.37	74.00	33.39	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	44.81	74.00	29.56	54.00	Pass

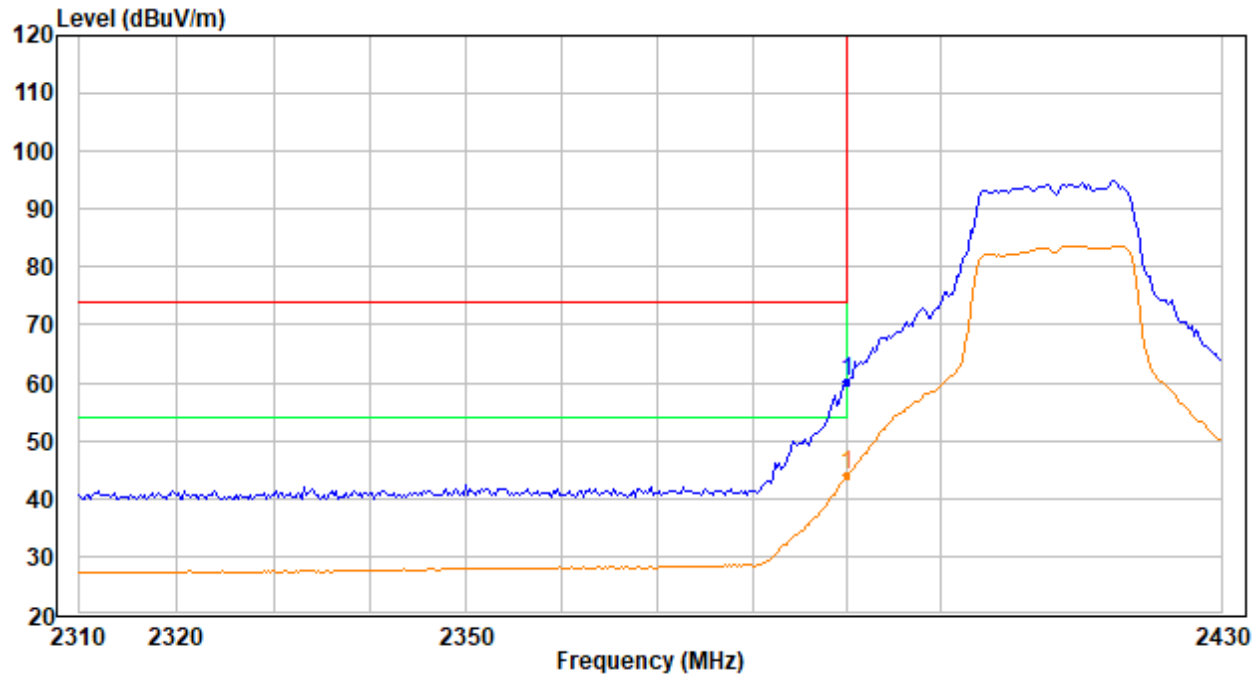
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	46.01	74.00	36.69	54.00	Pass
2487.375	50.10	74.00	40.91	54.00	Pass

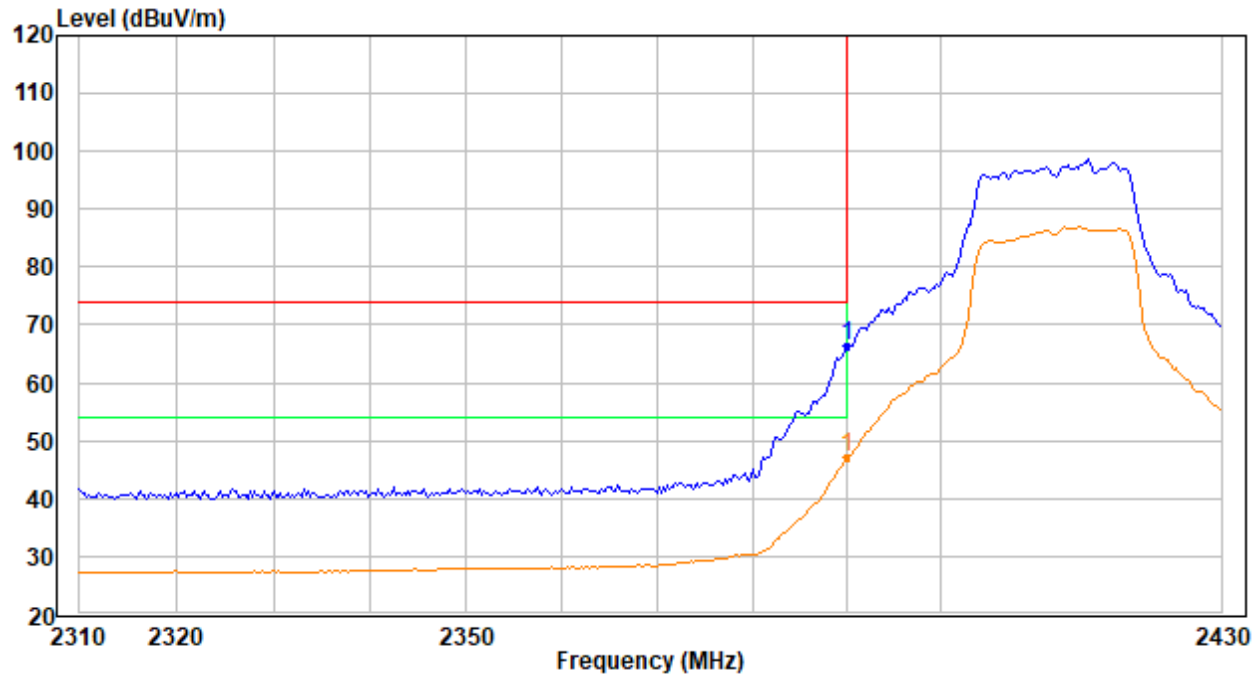
SISO_ Ant. 0_IEEE 802.11g

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



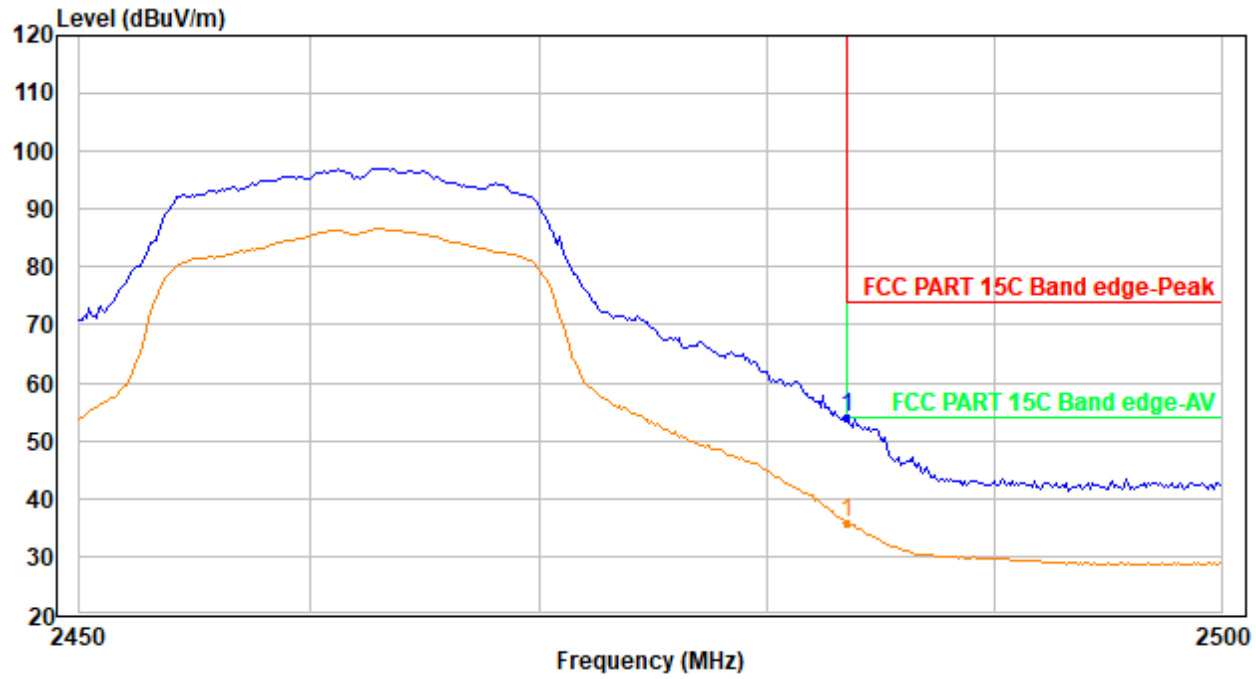
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	60.25	74.00	43.93	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



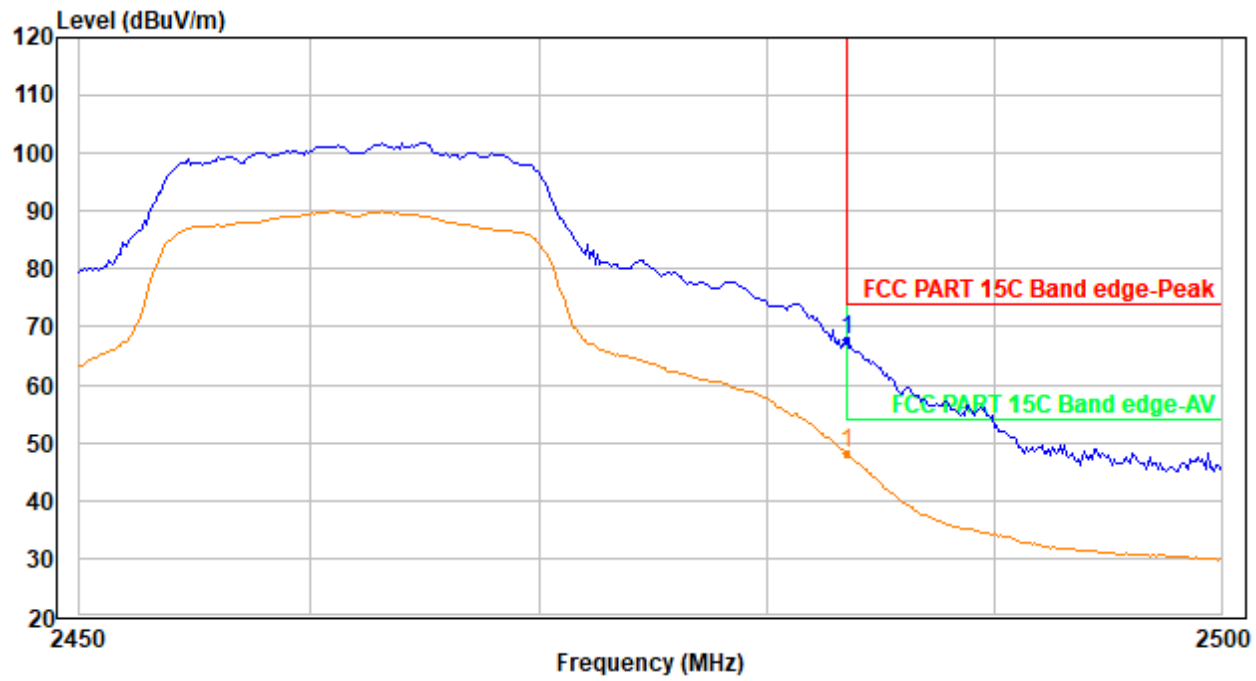
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	66.35	74.00	47.03	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	53.91	74.00	35.91	54.00	Pass

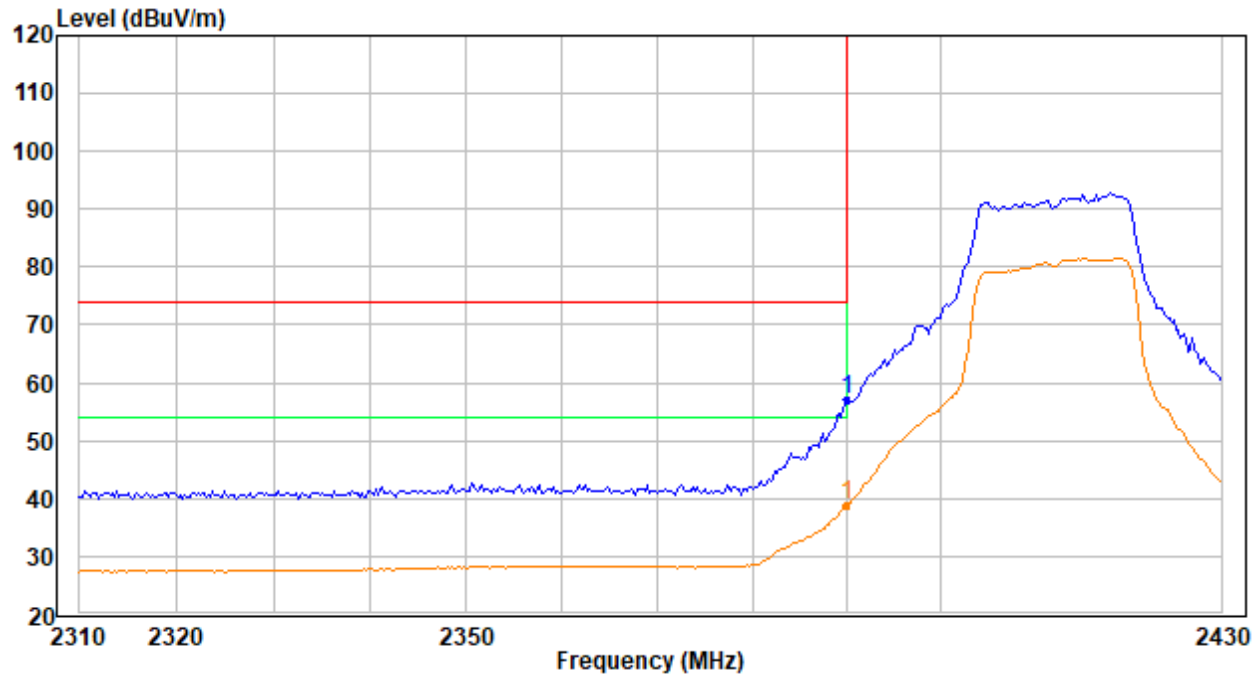
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	67.85	74.00	48.26	54.00	Pass

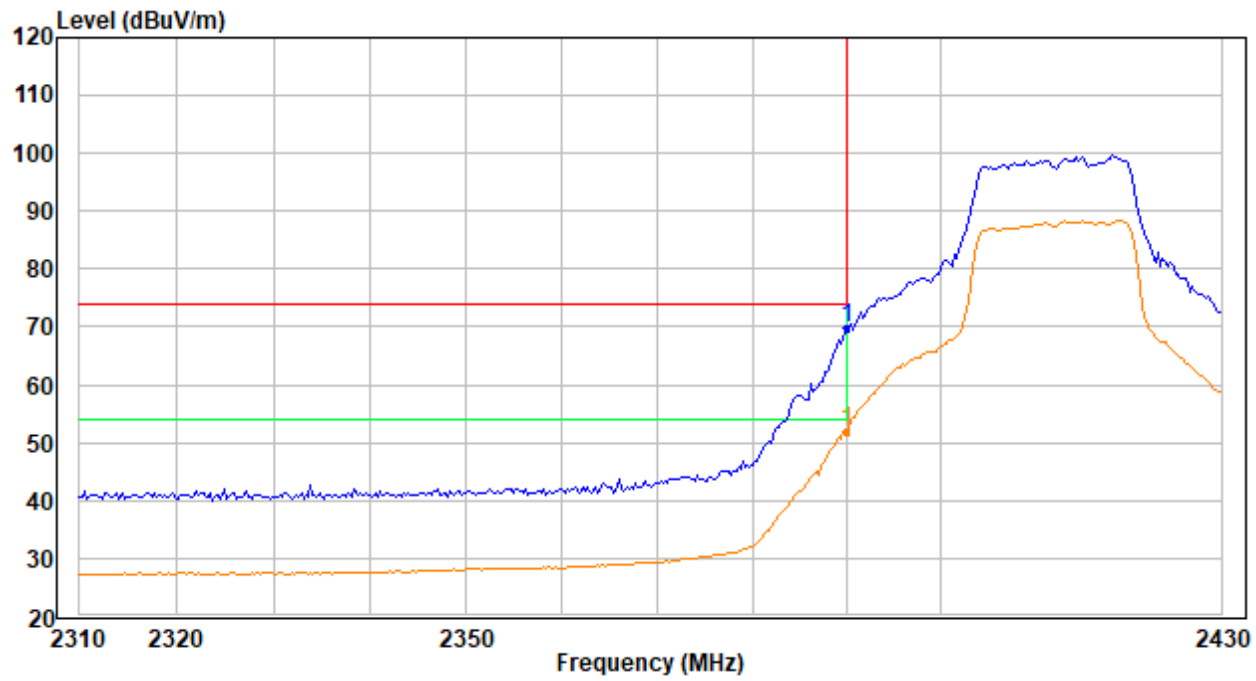
SISO_ Ant. 1_IEEE 802.11g

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



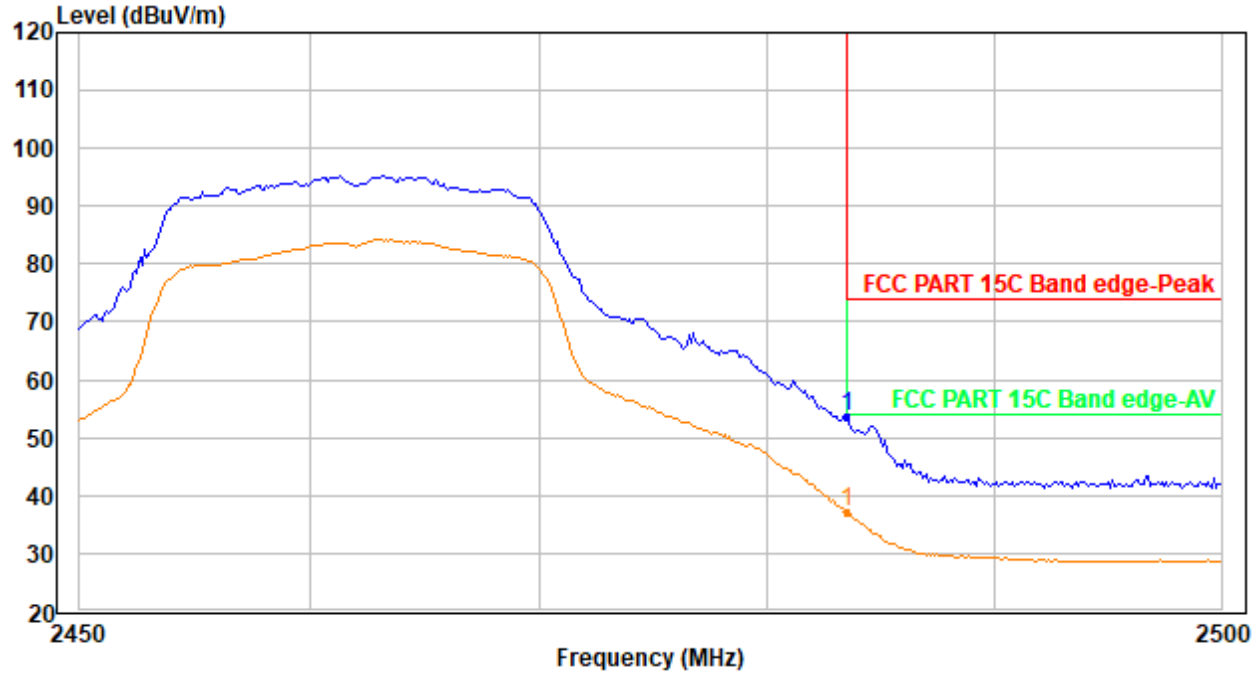
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	57.13	74.00	39.00	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



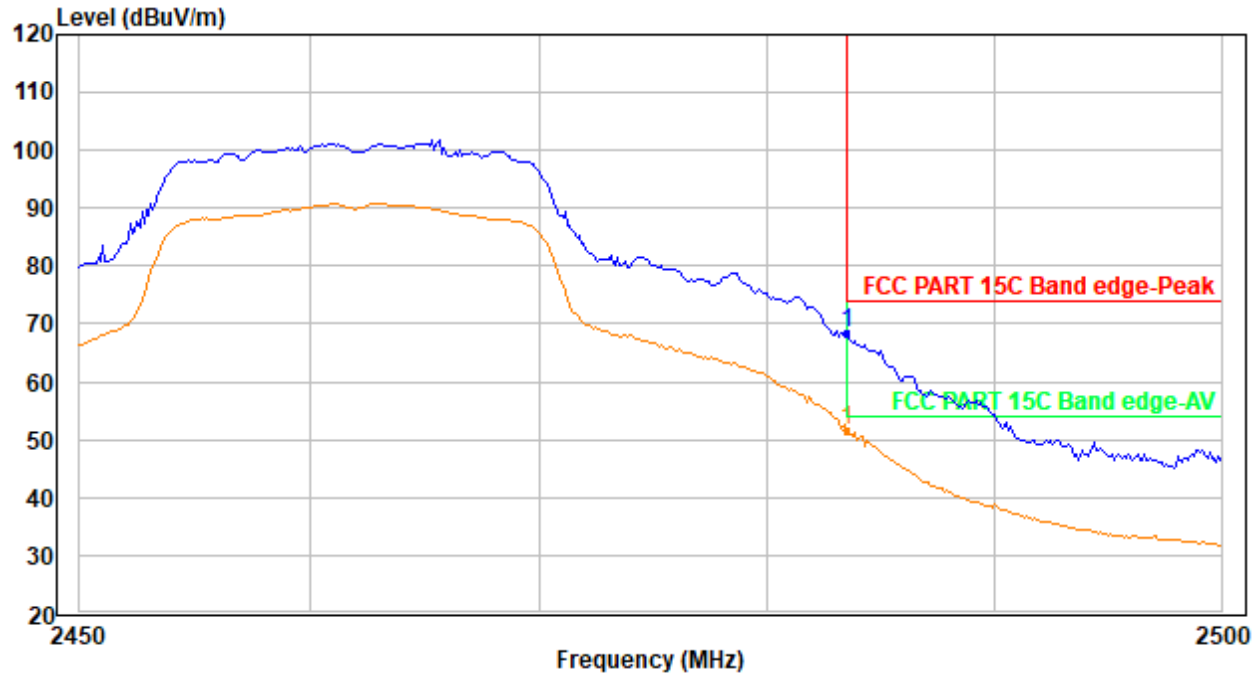
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	69.85	74.00	52.09	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	53.53	74.00	37.09	54.00	Pass

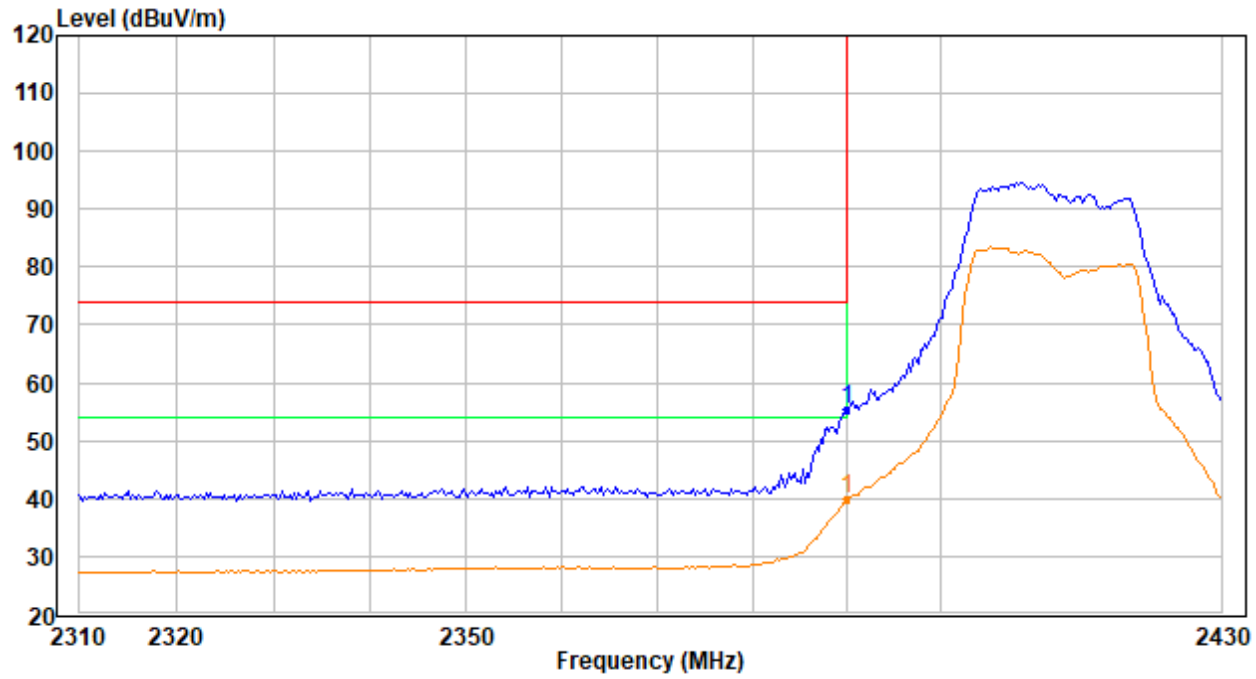
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	68.50	74.00	51.70	54.00	Pass

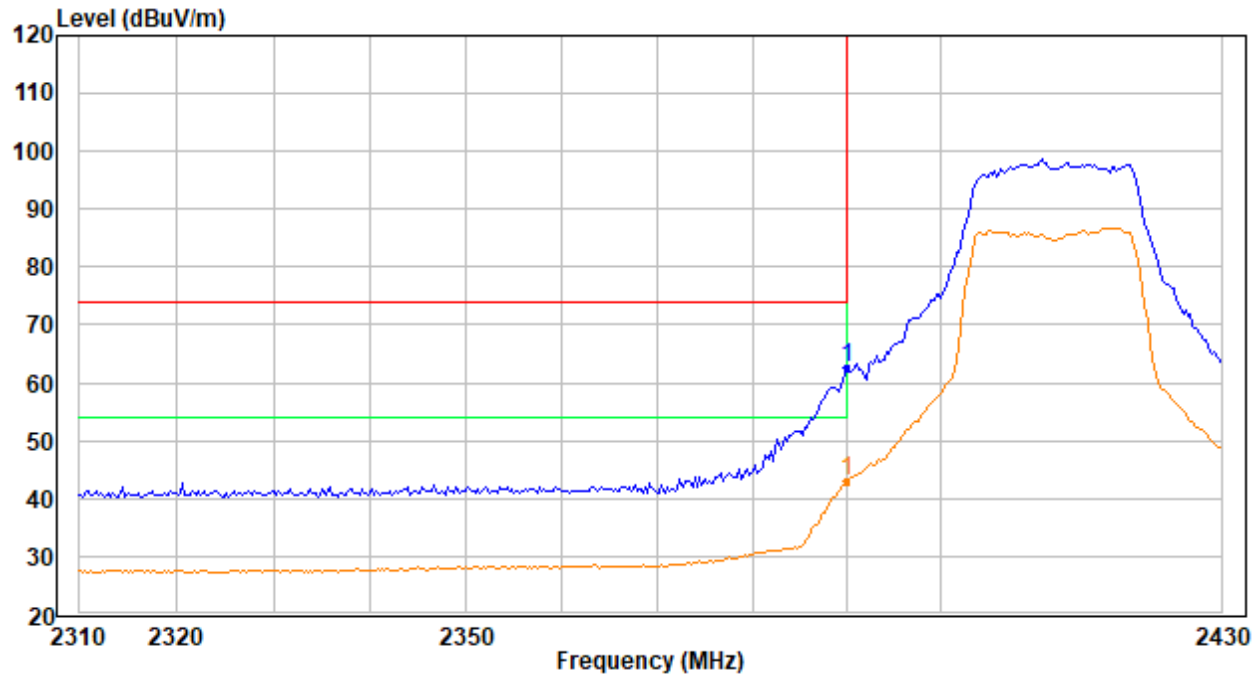
MIMO_ Ant. 0+1_IEEE 802.11n-HT20

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



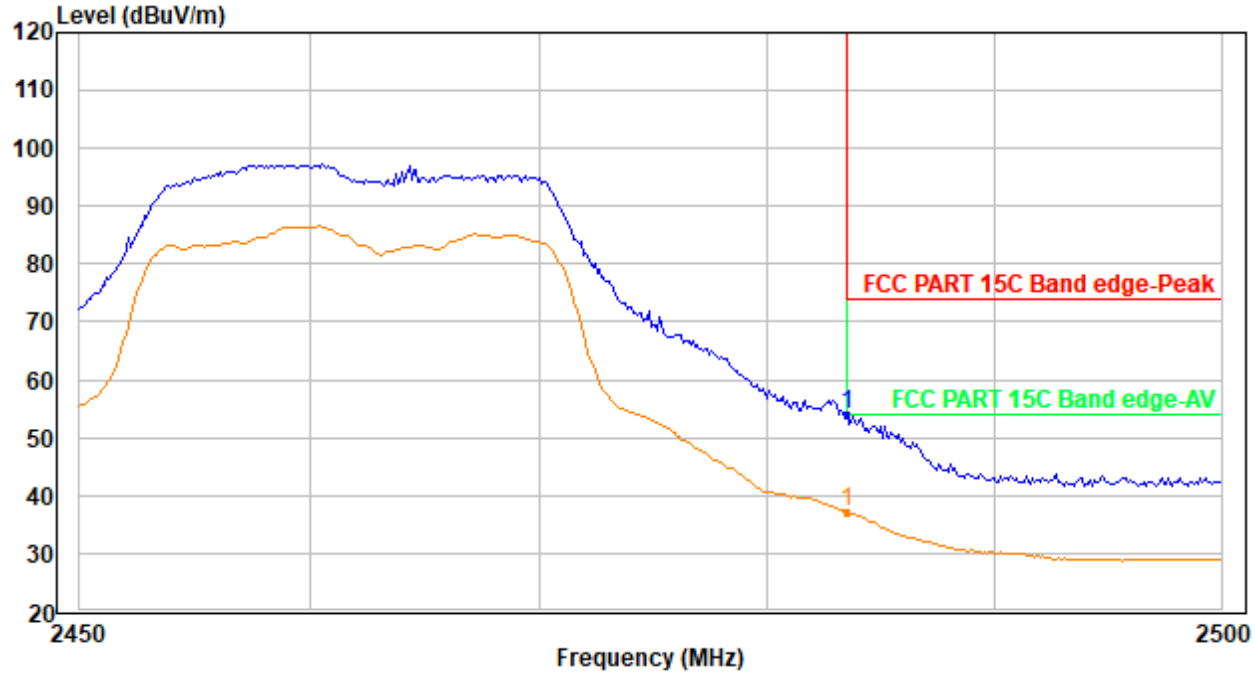
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	55.46	74.00	39.96	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



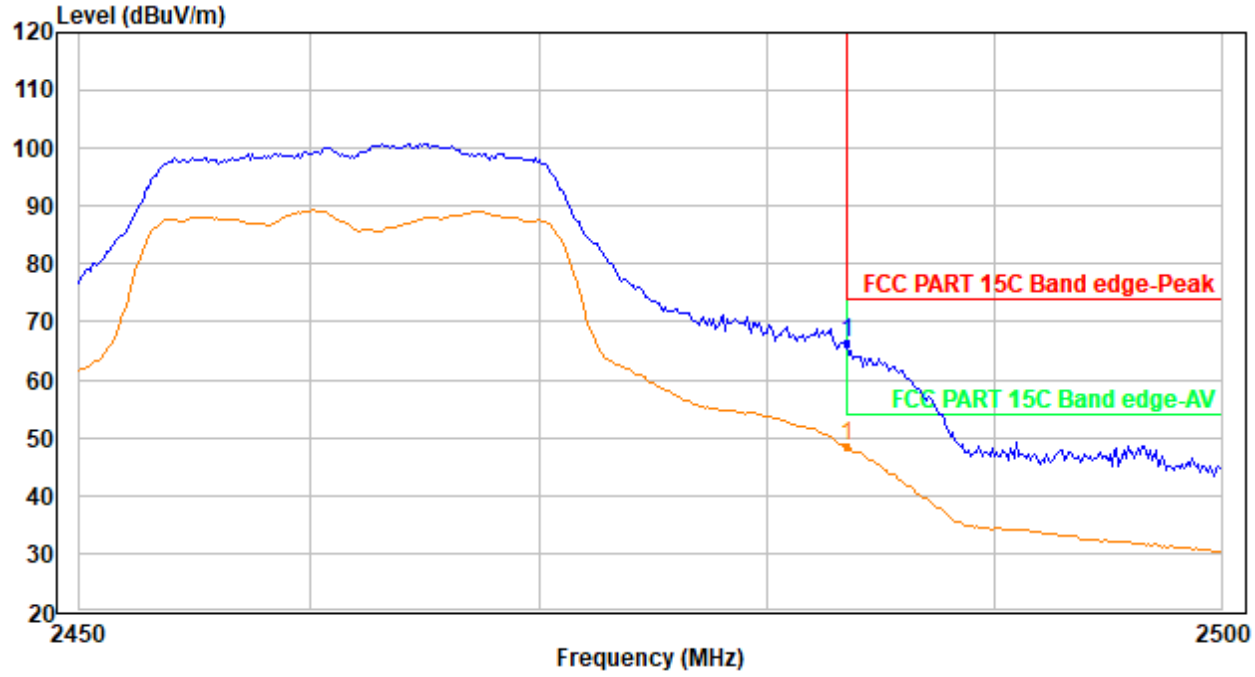
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	62.72	74.00	42.98	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	54.07	74.00	37.13	54.00	Pass

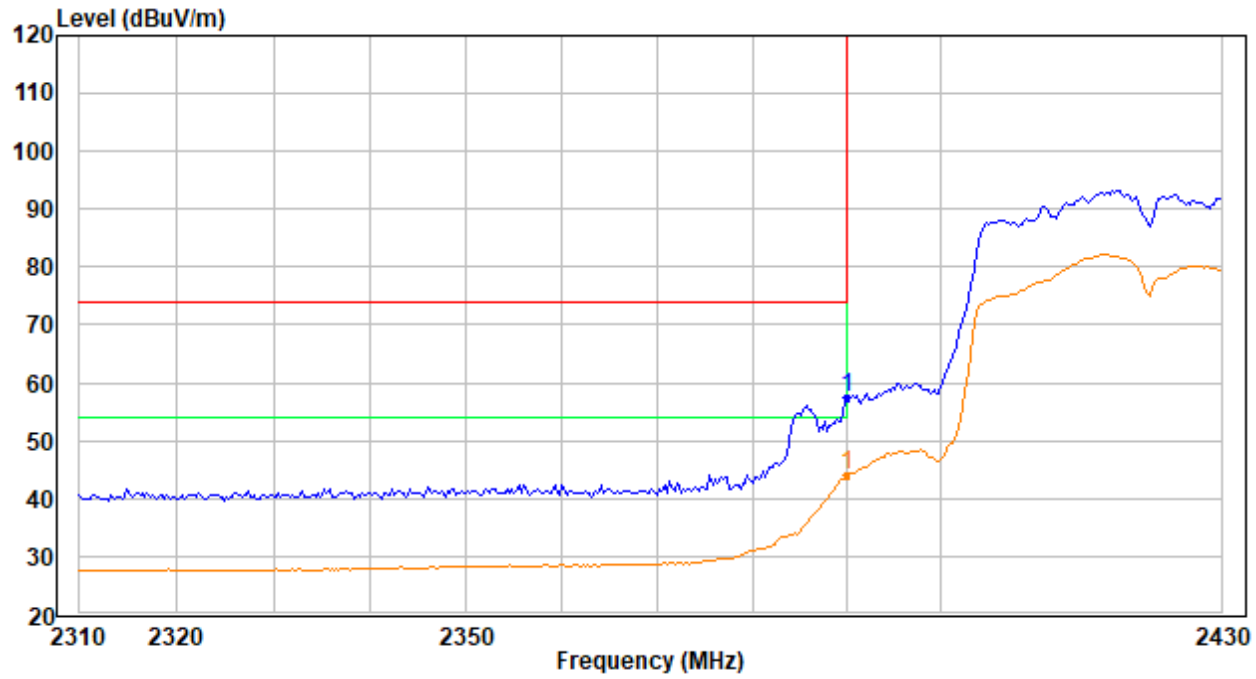
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	66.35	74.00	48.53	54.00	Pass

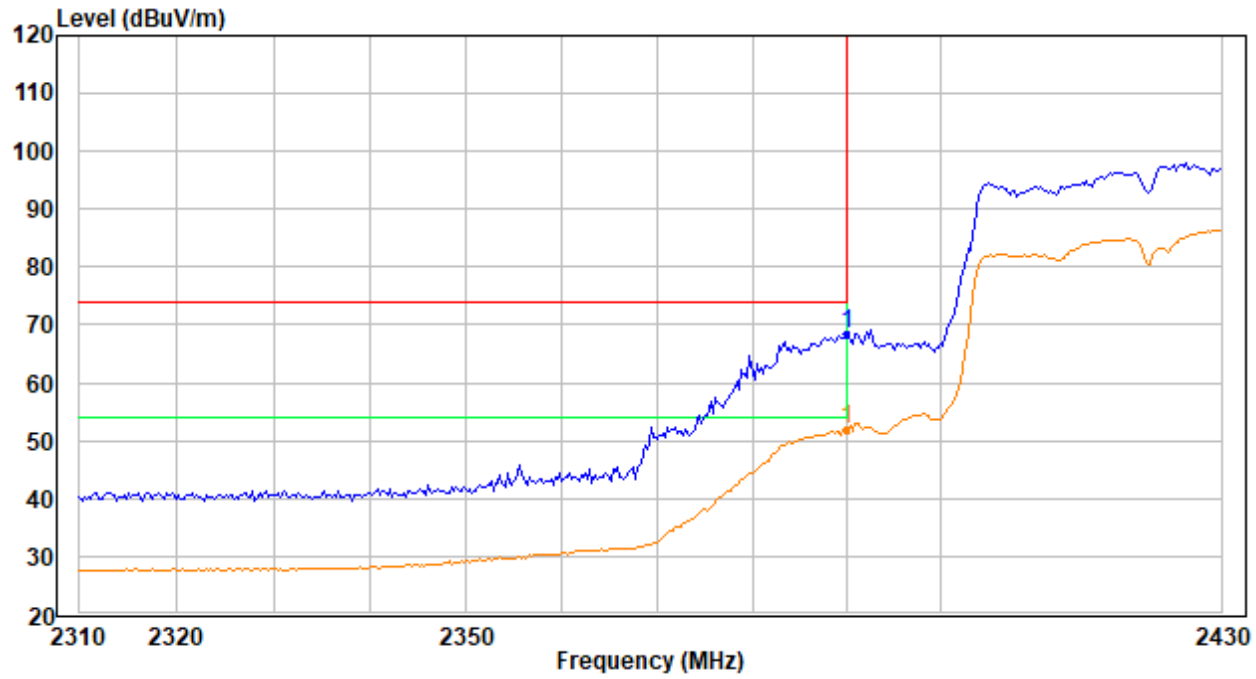
MIMO_ Ant. 0+1_IEEE 802.11n-HT40

Test Channel:	Channel 3	Ant. Polar. :	Horizontal



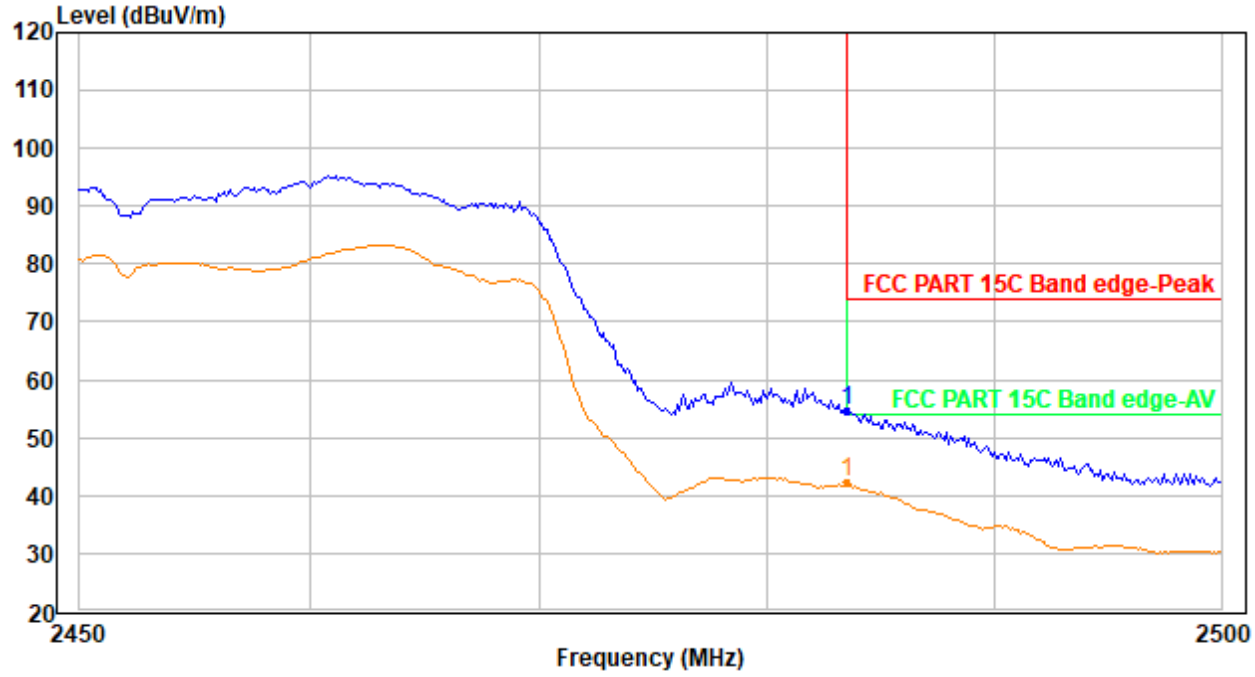
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	57.32	74.00	43.96	54.00	Pass

Test Channel:	Channel 3	Ant. Polar. :	Vertical



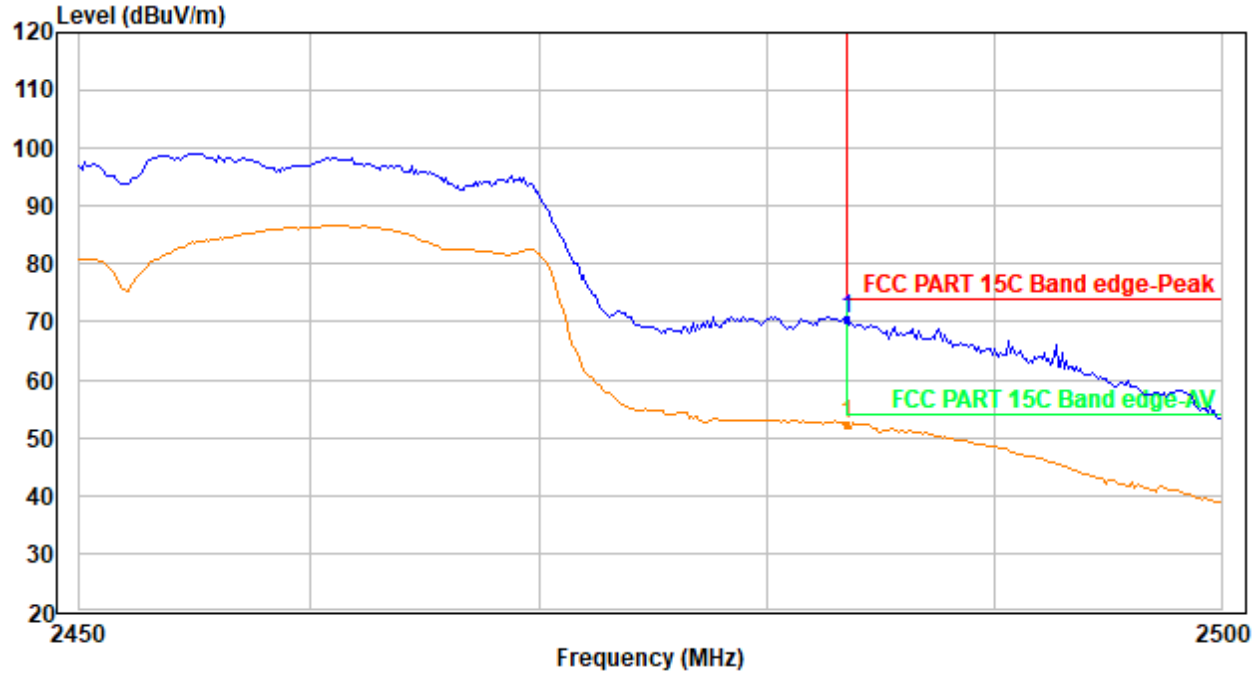
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	68.30	74.00	51.88	54.00	Pass

Test Channel:	Channel 9	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	54.84	74.00	42.50	54.00	Pass

Test Channel:	Channel 9	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	70.52	74.00	52.40	54.00	Pass

5.9 CONDUCTED EMISSION

Test Requirement: 47 CFR Part 15C Section 15.207

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 4.5.2 for details.

Test Procedures:

Test frequency range :150KHz-30MHz

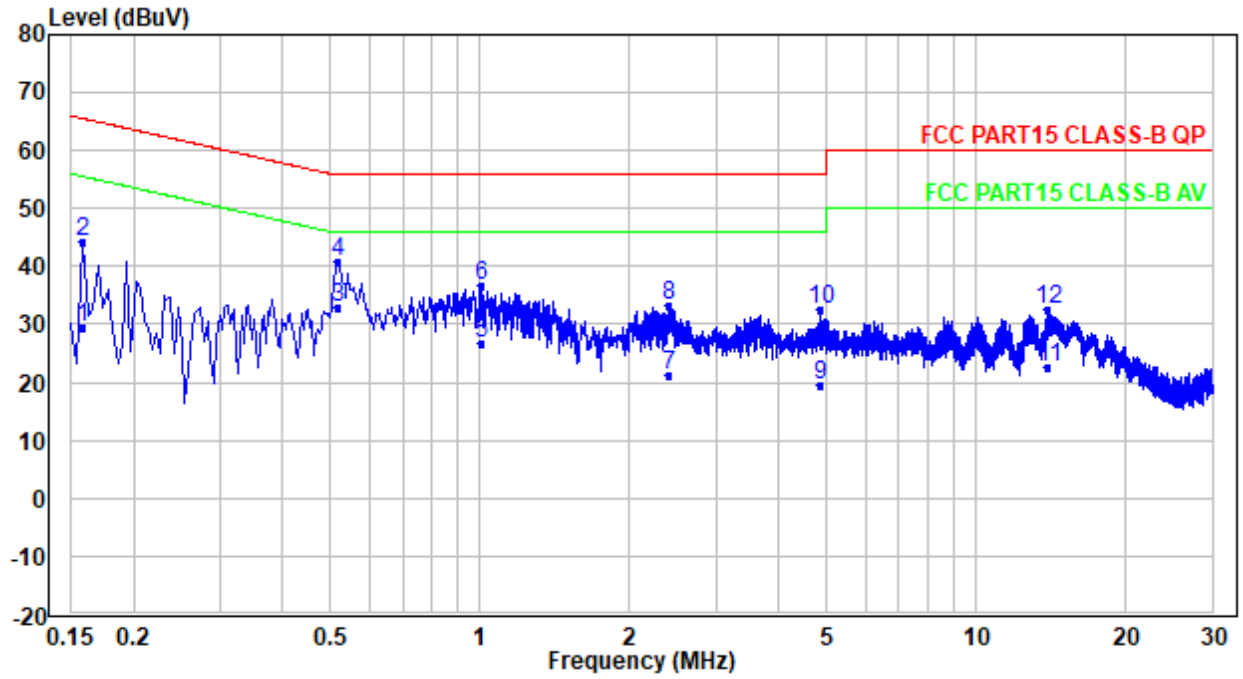
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second 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

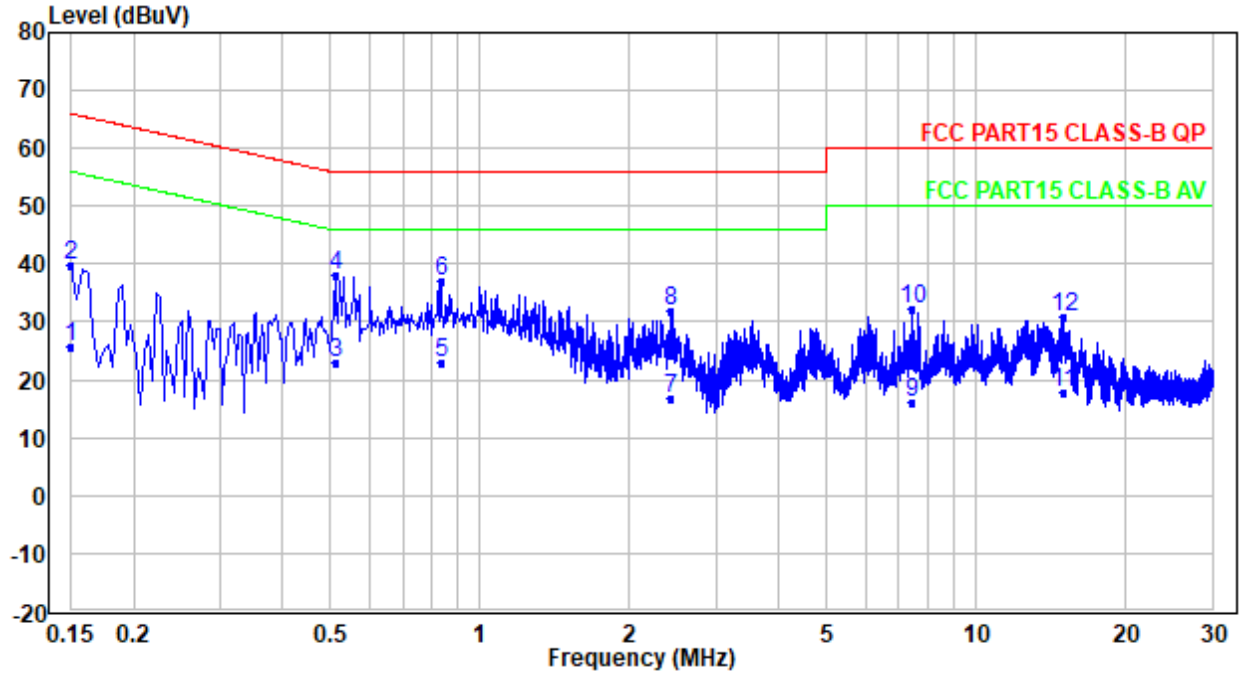
The measurement data as follows:
Quasi Peak and Average:
Mode: WIFI Link

Live Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.158	19.38	10.03	29.41	55.57	-26.16	Average
2	0.158	34.38	10.03	44.41	65.57	-21.16	QP
3	0.518	22.81	10.04	32.85	46.00	-13.15	Average
4	0.518	30.81	10.04	40.85	56.00	-15.15	QP
5	1.010	16.60	10.06	26.66	46.00	-19.34	Average
6	1.010	26.60	10.06	36.66	56.00	-19.34	QP
7	2.398	11.04	10.16	21.20	46.00	-24.80	Average
8	2.398	23.04	10.16	33.20	56.00	-22.80	QP
9	4.862	9.10	10.32	19.42	46.00	-26.58	Average
10	4.862	22.10	10.32	32.42	56.00	-23.58	QP
11	14.029	11.86	10.76	22.62	50.00	-27.38	Average
12	14.029	21.86	10.76	32.62	60.00	-27.38	QP

Neutral Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.150	15.69	10.02	25.71	56.00	-30.29	Average
2	0.150	29.69	10.02	39.71	66.00	-26.29	QP
3	0.510	13.04	10.03	23.07	46.00	-22.93	Average
4	0.510	28.04	10.03	38.07	56.00	-17.93	QP
5	0.834	13.01	10.04	23.05	46.00	-22.95	Average
6	0.834	27.01	10.04	37.05	56.00	-18.95	QP
7	2.418	6.76	10.14	16.90	46.00	-29.10	Average
8	2.418	21.76	10.14	31.90	56.00	-24.10	QP
9	7.462	5.66	10.41	16.07	50.00	-33.93	Average
10	7.462	21.66	10.41	32.07	60.00	-27.93	QP
11	14.989	7.06	10.84	17.90	50.00	-32.10	Average
12	14.989	20.06	10.84	30.90	60.00	-29.10	QP

Remark:

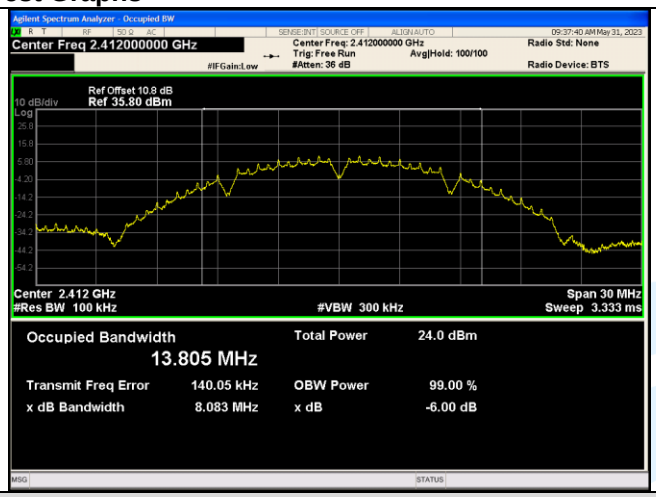
1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result - Limit
4. An initial pre-scan was performed on the Phase and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.
5. All possible modes of operation were investigated, and testing at two nominal voltages of 240V/50Hz and 120V/60Hz, only the worst case emissions reported.

APPENDIX A RF TEST DATA

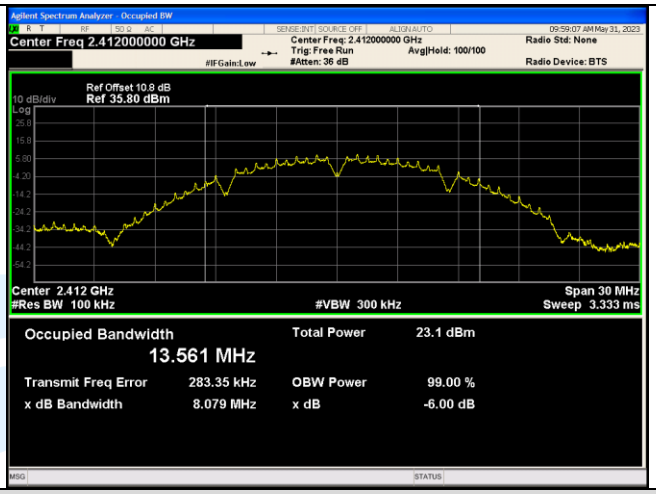
A.1 6DB BANDWIDTH

Mode	Channel	Ant.	Center Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
IEEE 802.11b	1	0	2412	8.083	0.5	PASS
		1	2412	8.079		PASS
	6	0	2437	8.078		PASS
		1	2437	8.074		PASS
	11	0	2462	8.084		PASS
		1	2462	8.076		PASS
IEEE 802.11g	1	0	2412	15.47		PASS
		1	2412	15.70		PASS
	6	0	2437	15.35		PASS
		1	2437	15.08		PASS
	11	0	2462	15.66		PASS
		1	2462	14.99		PASS
IEEE 802.11n_20	1	0	2412	15.67		PASS
		1	2412	16.35		PASS
	6	0	2437	16.08		PASS
		1	2437	15.93		PASS
	11	0	2462	15.10		PASS
		1	2462	15.12		PASS
IEEE 802.11n_40	3	0	2422	35.10		PASS
		1	2422	35.06		PASS
	6	0	2437	35.08		PASS
		1	2437	35.08		PASS
	9	0	2452	35.74		PASS
		1	2452	35.67		PASS

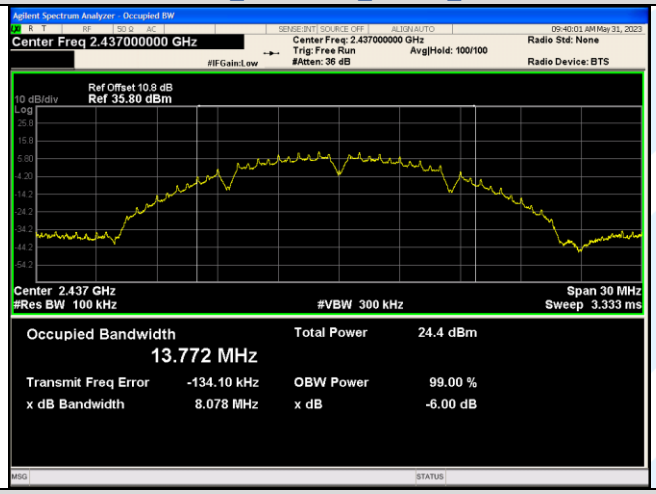
Test Graphs



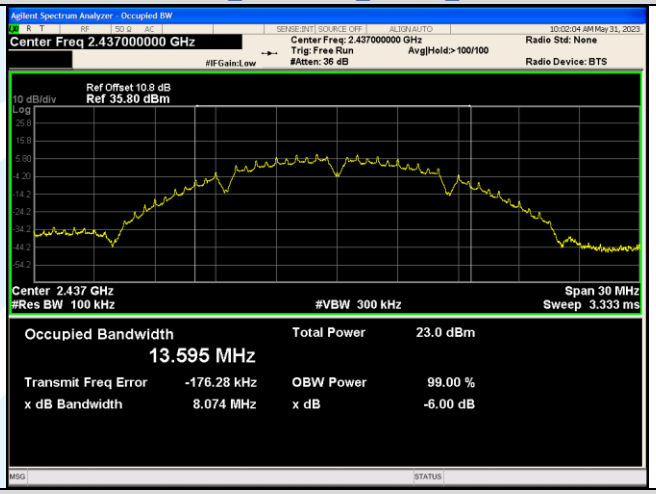
IEEE 802.11b_Channel 1_20MHz_Antenna 0



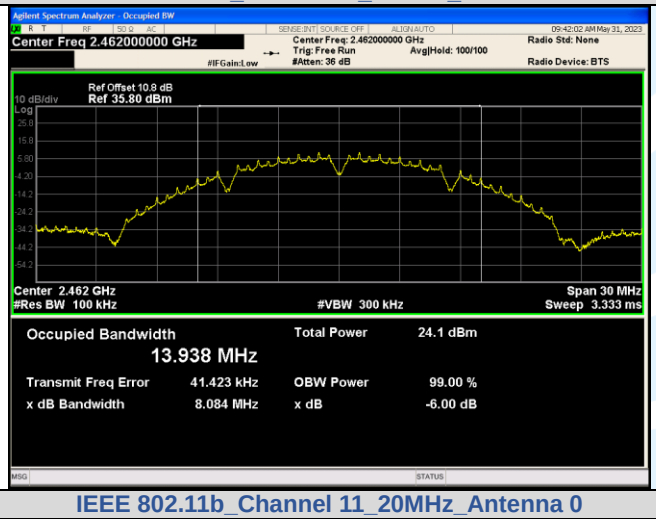
IEEE 802.11b_Channel 1_20MHz_Antenna 1



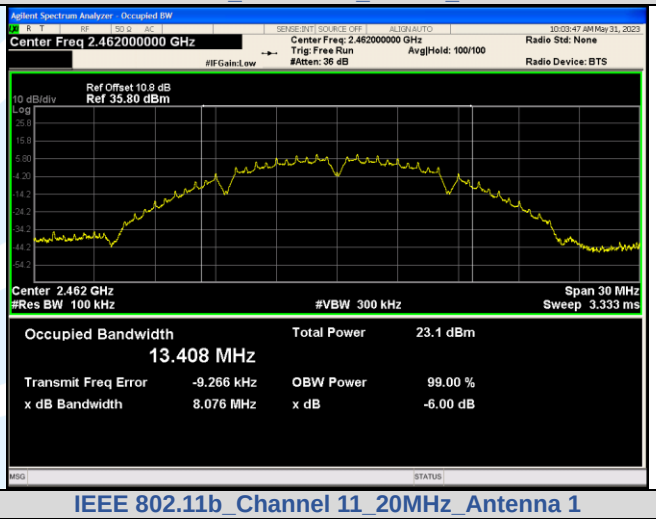
IEEE 802.11b_Channel 6_20MHz_Antenna 0



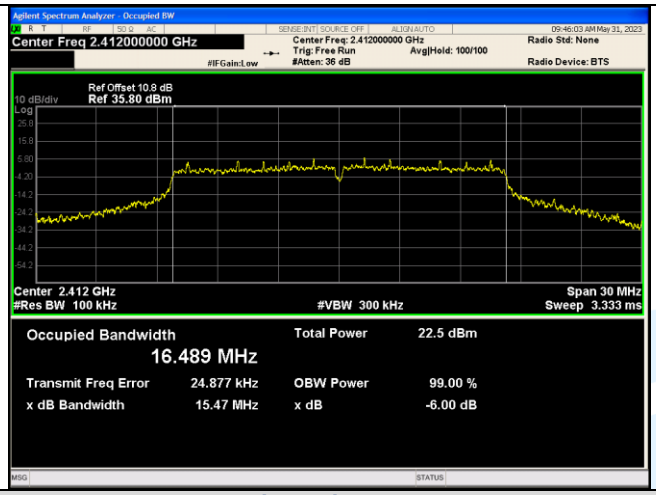
IEEE 802.11b_Channel 6_20MHz_Antenna 1



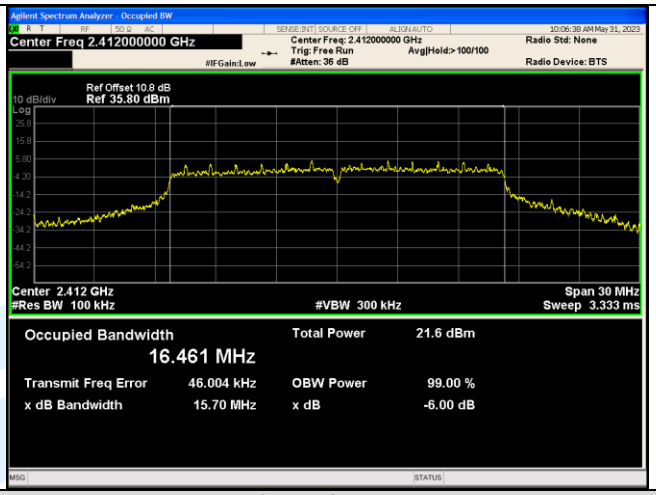
IEEE 802.11b_Channel 11_20MHz_Antenna 0



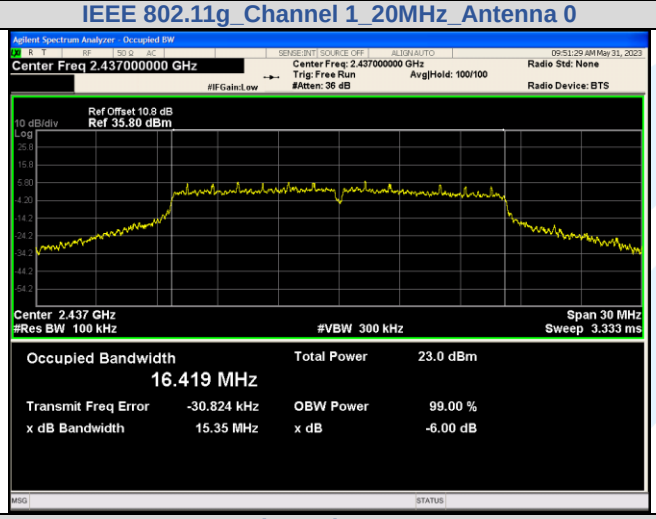
IEEE 802.11b_Channel 11_20MHz_Antenna 1



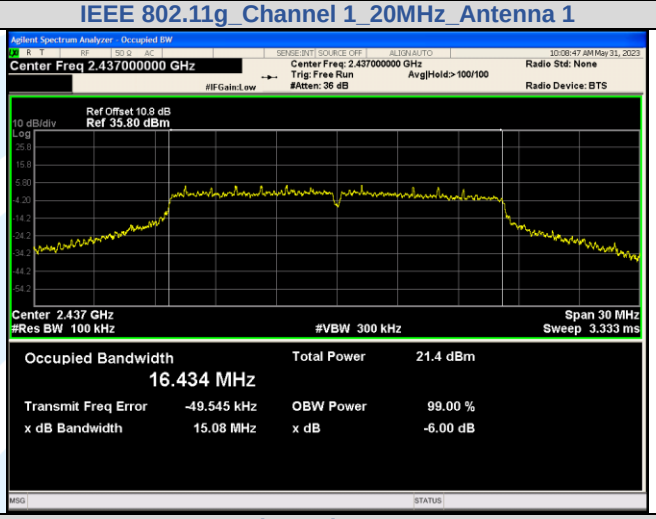
IEEE 802.11g_Channel 1_20MHz_Antenna 0



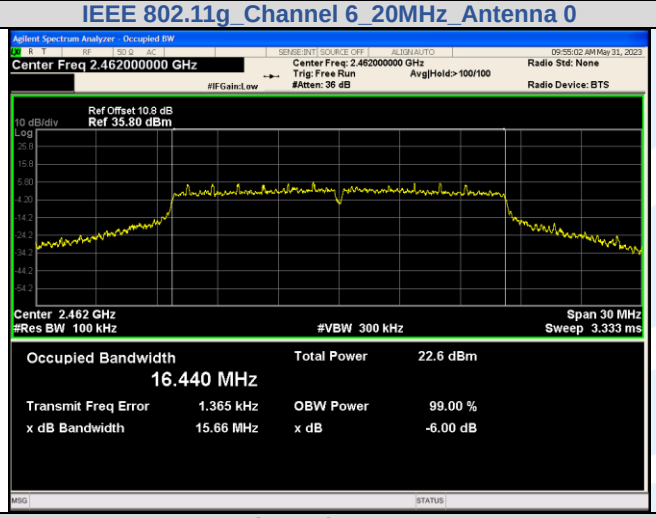
IEEE 802.11g_Channel 1_20MHz_Antenna 1



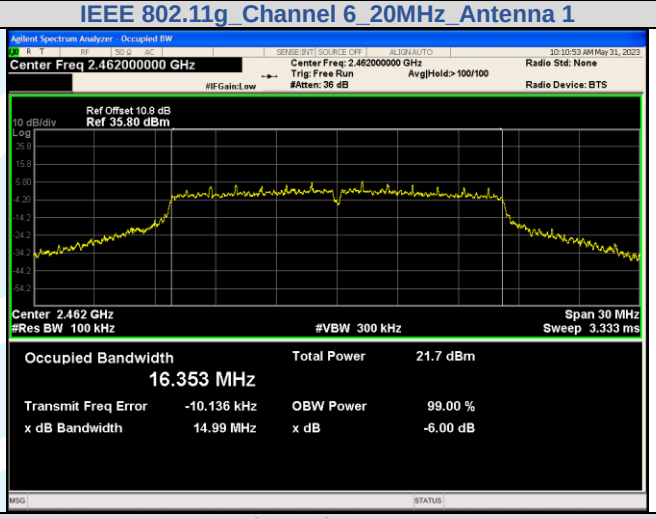
IEEE 802.11g_Channel 6_20MHz_Antenna 0



IEEE 802.11g_Channel 6_20MHz_Antenna 1



IEEE 802.11g_Channel 11_20MHz_Antenna 0



IEEE 802.11g_Channel 11_20MHz_Antenna 1