Certificate #4312.01

TEST REPORT

Product Name:	IP Phone
Trade Mark:	GRANDSTREAM
Model No.:	GRP2602W
HVIN:	GRP2602WV2
Report Number:	2401158930RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-247 Issue 3 RSS-Gen Issue 5
FCC ID:	YZZGRP2602WV2
IC:	11964A-GRP2602WV2
Test Result:	PASS
Date of Issue:	June 24, 2024

Prepared for:

Grandstream Networks, Inc.
126 Brookline Ave., 3rd Floor, Boston, MA 02215, USA

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
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Date: June 24, 2024

UnionTrust Laboratories UnionTrust *Certified*

Version

Version No.	Date	Description
V1.0	June 24, 2024	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Grandstream Networks, Inc.
Address of Applicant:	126 Brookline Ave., 3rd Floor, Boston, MA 02215, USA
Manufacturer:	Grandstream Networks, Inc.
Address of Manufacturer:	126 Brookline Ave., 3rd Floor, Boston, MA 02215, USA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	IP Phone		
Model No.:	GRP2602W		
HVIN:	GRP2602WV2		
Trade Mark:	GRANDSTREAM		
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n/ax	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac/ax
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac/ax
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac/ax
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac/ax
Sample Received Date:	January 15, 2024		
Sample Tested Date:	February 28, 2024 to April 11, 2024		

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 (1)	
Model No.:	GQ06-050060-ZU
Input:	100-240V~50/60Hz 0.3 A Max
Output:	5.0V⎓0.6 A
DC Cable	1.8 Meter, Unshielded without ferrite

Adapter (2)	
Model No.:	DCT06W050060US-D0
Input:	100-240V~50/60Hz 0.2 A Max
Output:	5.0V⎓0.6A 3.0W
DC Cable	1.8 Meter, Unshielded without ferrite

Adapter (3)	
Model No.:	F06US0500060A
Input:	100-240V~50/60Hz 0.2 A Max
Output:	5.0V⎓0.6A
DC Cable	1.8 Meter, Unshielded without ferrite

Cable(1)	
Description:	Ethernet Cable
Cable Type:	Unshielded without ferrite
Length:	1.5 Meter

Cable(2)	
Description:	Phone Cord
Cable Type:	Unshielded without ferrite
Length:	2.5 Meter

Others
1x Handset, 1x Phone Stand

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/g/n-HT20/n-HT40/ax-HE20/ax-HE40
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) IEEE 802.11ax:OFDM/ OFDMA Note 1 (1024QAM, 256QAM, 64QAM, 16QAM, 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 IEEE 802.11n-HT40: Up to MCS7 IEEE 802.11ax-HE20/ HE40: Up to MCS11
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20/ax-HE20: 11 IEEE 802.11n-HT40/ax-HE40: 7
Channel Separation:	5 MHz
Antenna Type:	PCB Antenna
Antenna Gain:	2.0 dBi
Maximum Peak Power:	IEEE 802.11b: 18.00 dBm IEEE 802.11g: 27.16 dBm IEEE 802.11n-HT20: 26.41 dBm IEEE 802.11n-HT40: 26.70 dBm IEEE 802.11ax-HE20: 26.68 dBm IEEE 802.11ax-HE40: 25.61 dBm
Maximum e.i.r.p	IEEE 802.11b: 20.00 dBm IEEE 802.11g: 29.16 dBm IEEE 802.11n-HT20: 28.41 dBm IEEE 802.11n-HT40: 28.70 dBm IEEE 802.11ax-HE20: 28.68 dBm IEEE 802.11ax-HE40: 27.61 dBm
Normal Test Voltage:	5Vdc
Note 1: For IEEE 802.11ax, the customer declaration the product supports only the SU mode.	

1.4 OTHER INFORMATION

Operation Frequency Each of Channel	
IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20 IEEE 802.11ax-HE20	**f = 2407 + 5k MHz, k = 1,…,11**
IEEE 802.11n-HT40 IEEE 802.11ax-HE40	**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	Lenovo	B40-80	MP12NEQ6	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	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
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
7	Radiated emission 26GHz-40GHz	± 4.6 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.68 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	± 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 (b)(4) 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 3, 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 3, 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 3, 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 3, 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 3, Section 5.5	ANSI C63.10-2013 Clause 11.13	PASS
Disclaimer and Explanations: The declared of product specification and data (e.g. antenna gain, RF specification, etc) for EUT presented in the report are provided by the customer, and the customer takes all the responsibilities for the accuracy of product specification.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☑	3m SAC	ETS-LINDGREN	3m	Euroshiedpn-CT001270-1317	11-Nov-2023	10-Nov-2026
☑	Receiver	R&S	ESIB26	100114	27-Oct-2023	26-Oct-2024
☑	Loop Antenna	ETS-LINDGREN	6502	00202525	30-Oct-2023	29-Oct-2024
☑	Broadband Antenna	ETS-LINDGREN	3142E	00201566	30-Oct-2023	29-Oct-2024
☑	6dB Attenuator	Talent	RA6A5-N-18	18103001	30-Oct-2023	29-Oct-2024
☑	Preamplifier	HP	8447F	2805A02960	31-Oct-2023	30-Oct-2024
☑	Band Rejection Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G590	17-Jan-2024	16-Jan-2025
☑	Double-Ridged Waveguide Horn Antenna	ETS-LINDGREN	3117-PA	00201541	16-Apr-2023	15-Apr-2024
					01-Apr-2024	31-Mar-2025
☑	Pre-amplifier	ETS-Lindgren	00118385	00201874	31-Oct-2023	30-Oct-2024
☑	Double-Ridged Waveguide Horn Antenna	ETS-LINDGREN	3116C-PA	00202652	30-Oct-2023	29-Oct-2024
☑	Pre-amplifier	ETS-Lindgren	00118384	00202652	30-Oct-2023	29-Oct-2024
☑	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	1316.3003K07-101181-K3	27-Oct-2023	26-Oct-2024
☑	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	27-Oct-2023	26-Oct-2024
☑	LISN	R&S	ESH2-Z5	860014/024	27-Oct-2023	26-Oct-2024
☑	LISN	ETS-Lindgren	3816/2SH	00201088	27-Oct-2023	26-Oct-2024
☑	Test Software	EZ-EMC	EZ-CON	Software Version: EMC-CON 3A1.1		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☑	EXA Spectrum Analyzer	KEYSIGHT	N9020A	MY51286807	27-Oct-2023	26-Oct-2024
☑	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	27-Oct-2023	26-Oct-2024
☐	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	27-Oct-2023	26-Oct-2024

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	5	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	21.6	55.8	100.2	S202401152625-ZJA02/4	Linson Xie
Conducted Peak Output Power	23.6	49.3	100.5	S202401152625-ZJA04/4	Allen Zhou
6dB Bandwidth & Occupied Bandwidth					
Power Spectral Density					
Conducted Out of Band Emission					
Radiated Spurious Emissions	24.2	55.3	100.2	S202401152625-ZJA03/4	Yana Zeng
Band Edge Measurements (Radiated)					

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
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 IEEE 802.11ax-HE20	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(H)**
IEEE 802.11n-HT40 IEEE 802.11ax-HE40	2422 MHz to 2462 MHz	Channel 3	Channel 7	Channel 9
		2422 MHz	2437 MHz	2452 MHz

4.3 EUT TEST STATUS

Mode	Tx Function	Description
IEEE 802.11b IEEE 802.11g IEEE 802.11n-HT20 IEEE 802.11n-HT40 IEEE 802.11ax-HE20 IEEE 802.11ax-HE40	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

Power Setting			
Mode	**Lowest(L)**	**Middle(M)**	**Highest(H)**
IEEE 802.11b	Default	Default	Default
IEEE 802.11g	Default	Default	Default
IEEE 802.11n-HT20	Default	Default	Default
IEEE 802.11n-HT40	Default	Default	Default
IEEE 802.11ax-HE20	Default	Default	Default
IEEE 802.11ax-HE40	40	40	40

Test Software
Test software name: Putty commands

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
IEEE 802.11ax-HE20	MCS0
IEEE 802.11ax-HE40	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

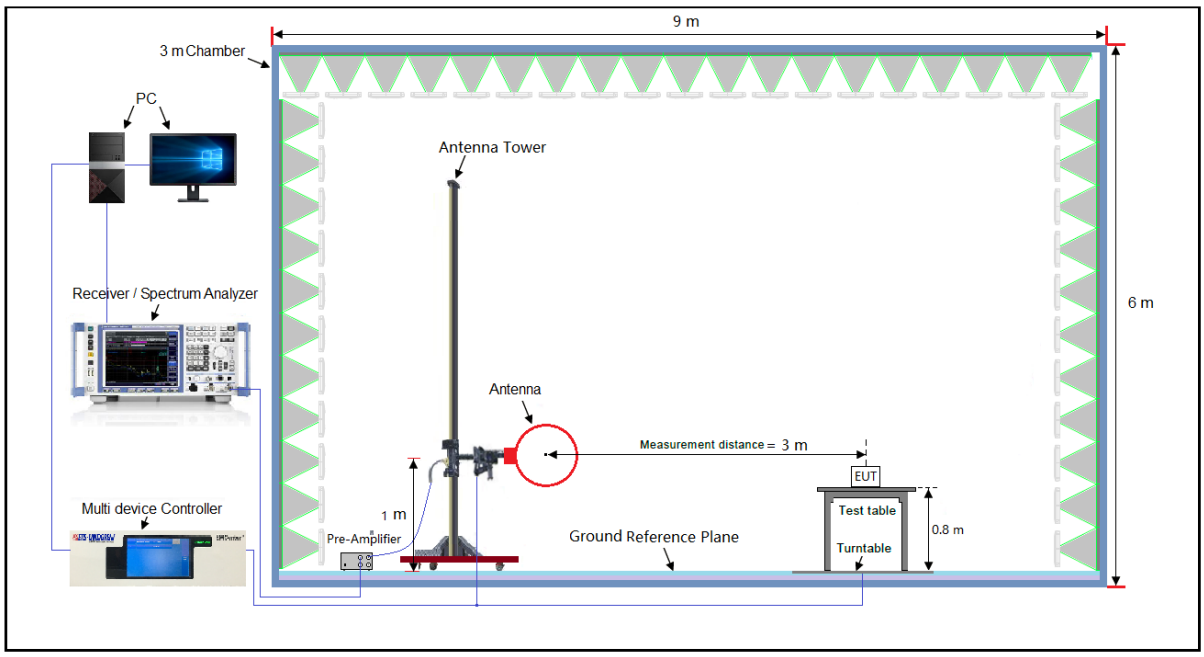


Figure 2. 30MHz to 1GHz

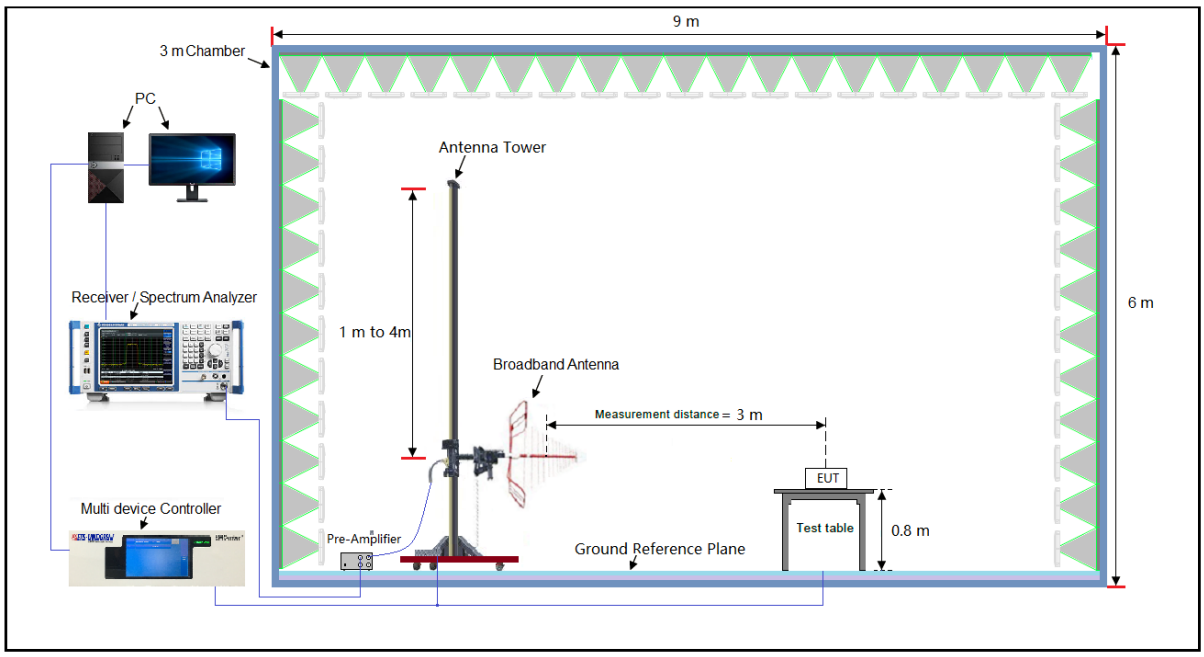
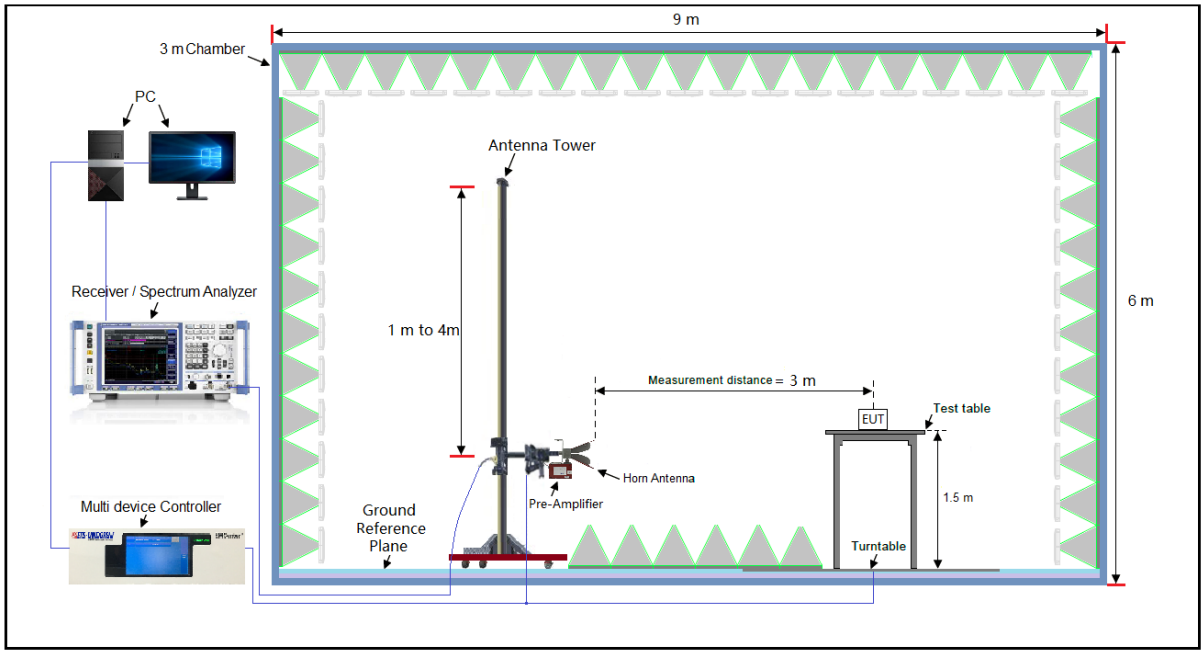
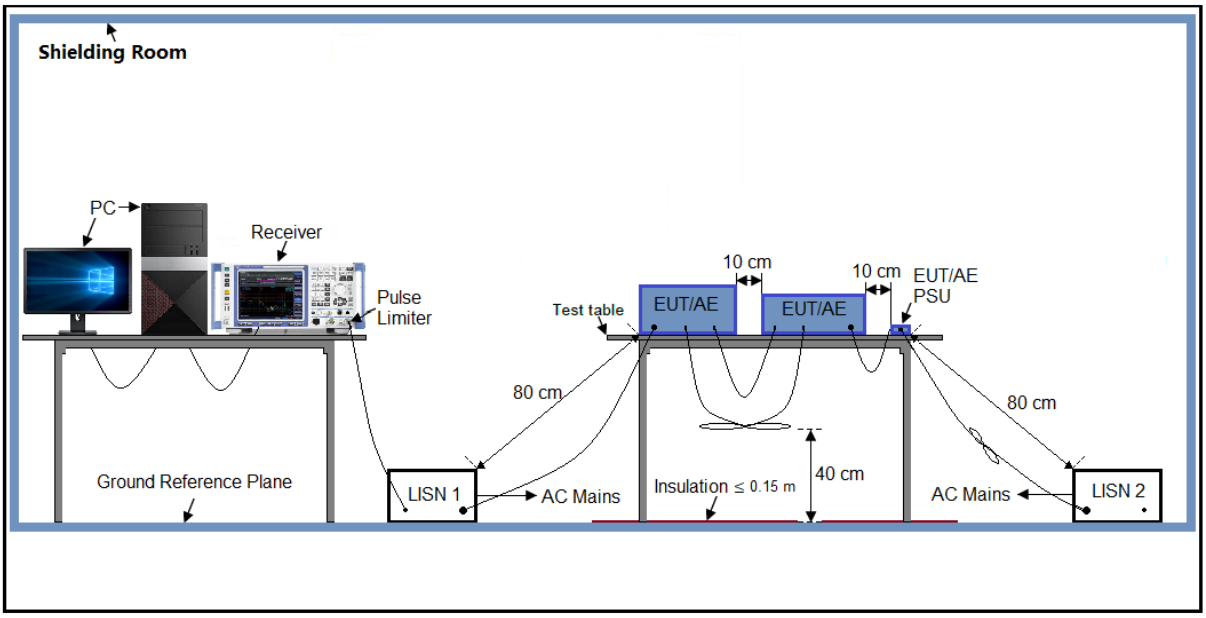


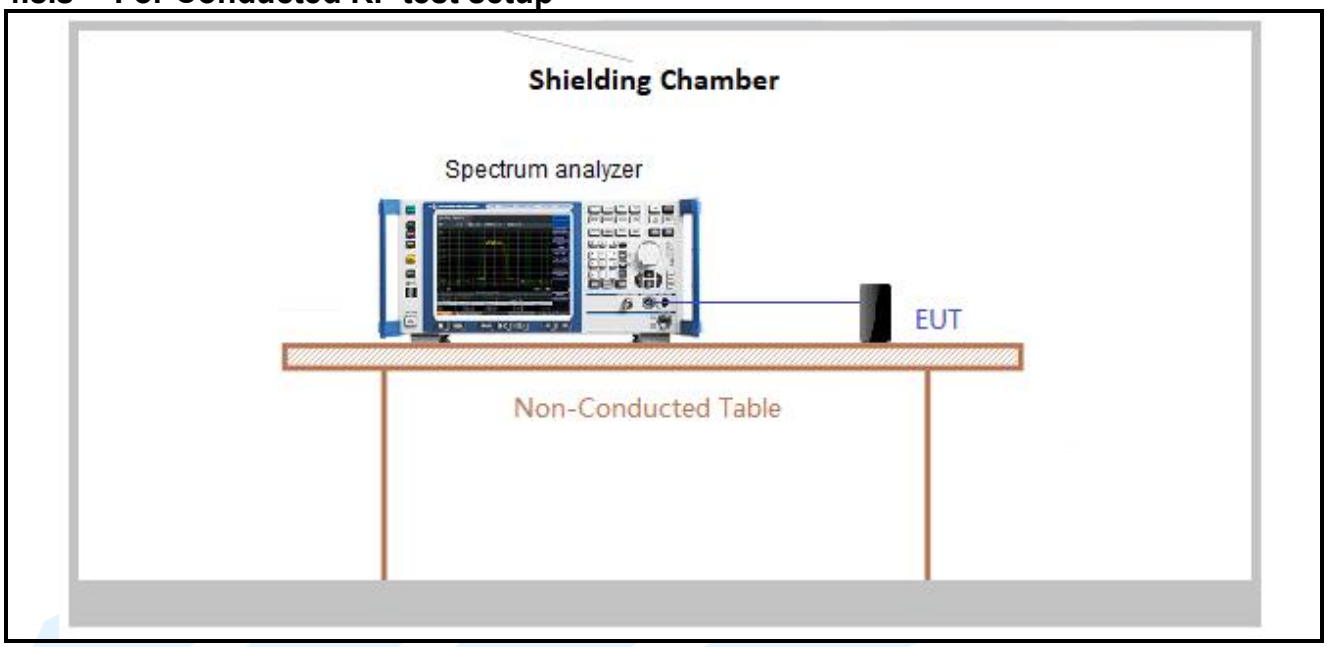
Figure 3. Above 1GHz



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. 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.

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

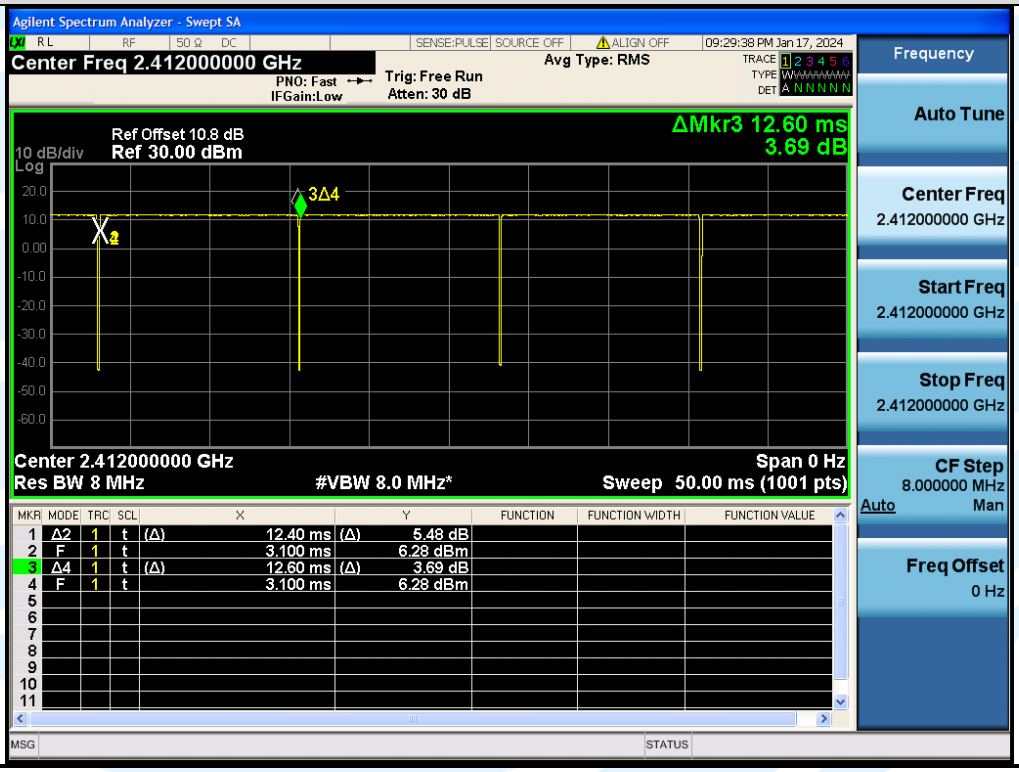
Mode	Data Rates	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/T Minimum VBW (kHz)
IEEE 802.11b	1 Mbps	12.400	12.600	0.98	98.41	0.00	0.01
IEEE 802.11g	6 Mbps	5.490	5.640	0.97	97.34	0.12	0.18
IEEE 802.11n-HT20	MCS 0	5.370	5.520	0.97	97.28	0.12	0.19
IEEE 802.11n-HT40	MCS 0	4.650	4.800	0.97	96.88	0.14	0.22
IEEE 802.11ax-HE20	MCS 0	4.650	4.800	0.97	96.88	0.14	0.22
IEEE 802.11ax-HE40	MCS 0	4.620	4.800	0.96	96.25	0.17	0.22

Remark:

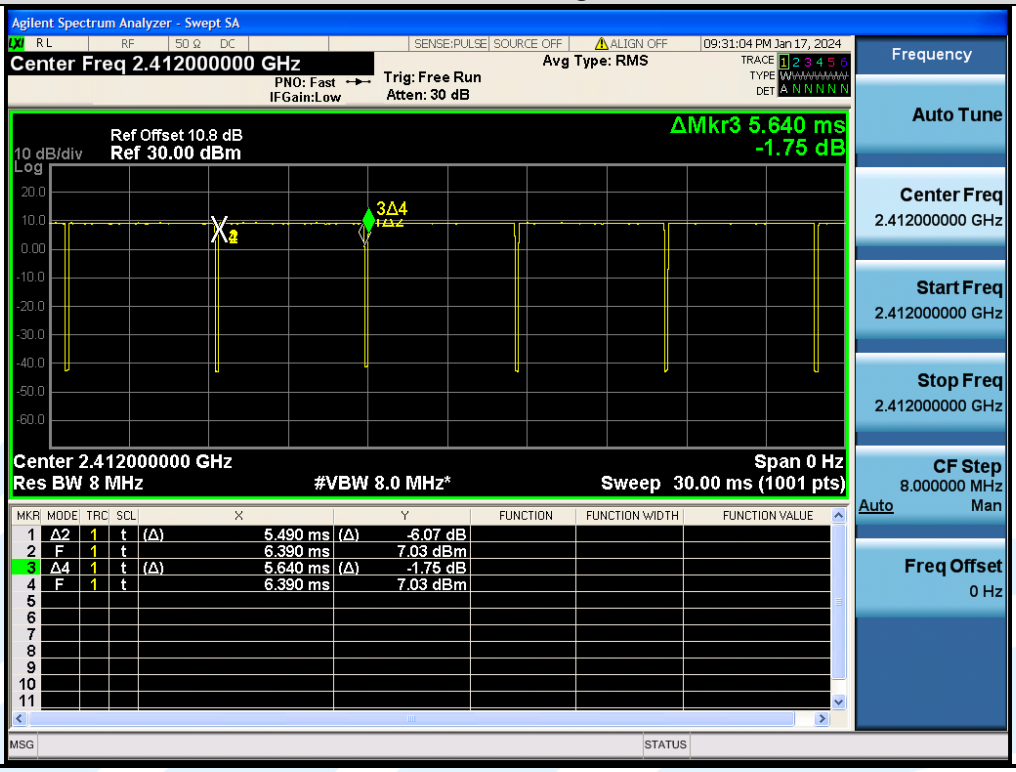
1) Duty cycle= On Time/ Period;
2) Duty Cycle factor = 10 * log(1/ Duty cycle);
3) Average factor = 20 $\log_{10}$ Duty Cycle.

The test plots as follows

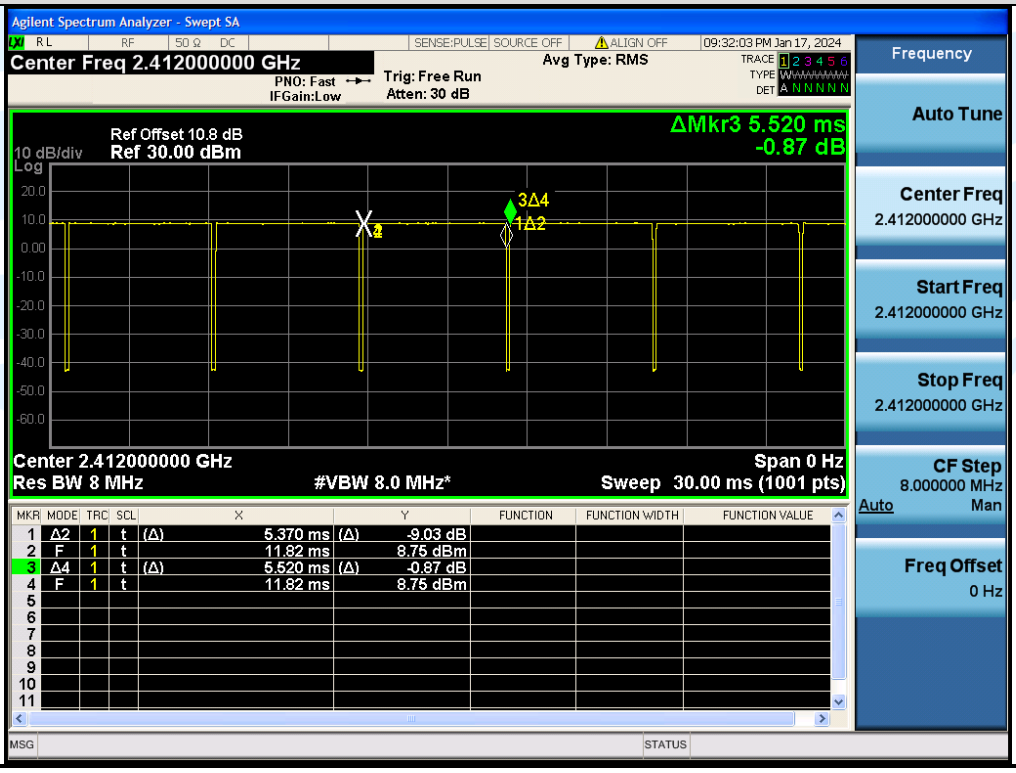
IEEE 802.11b



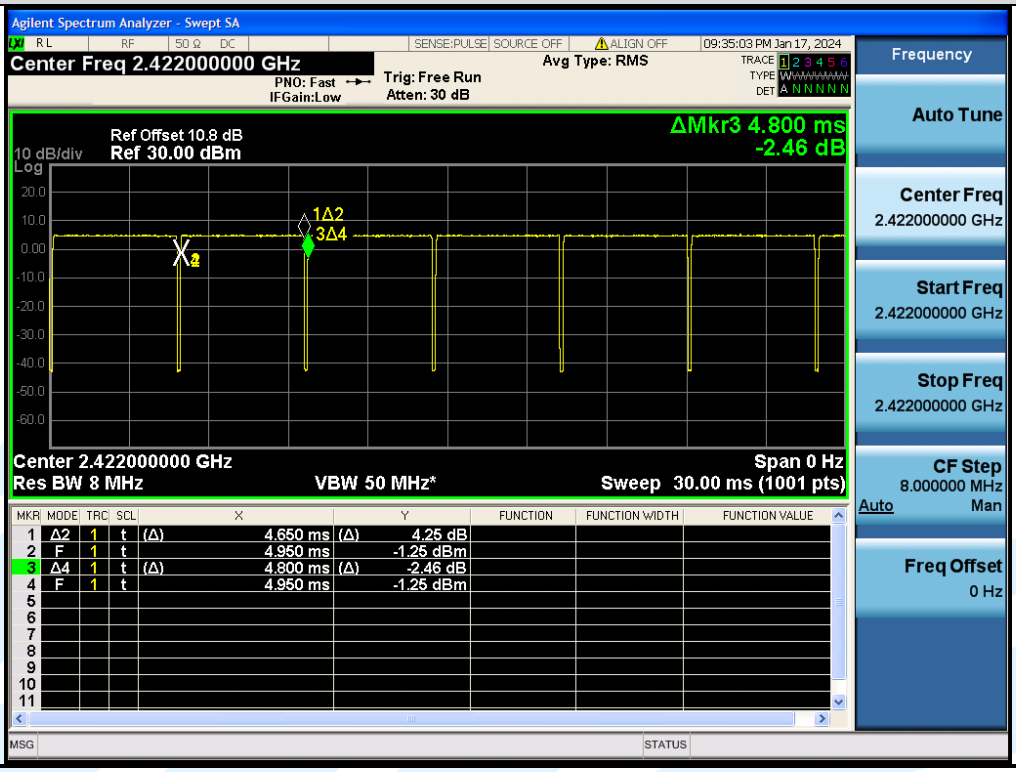
IEEE 802.11g



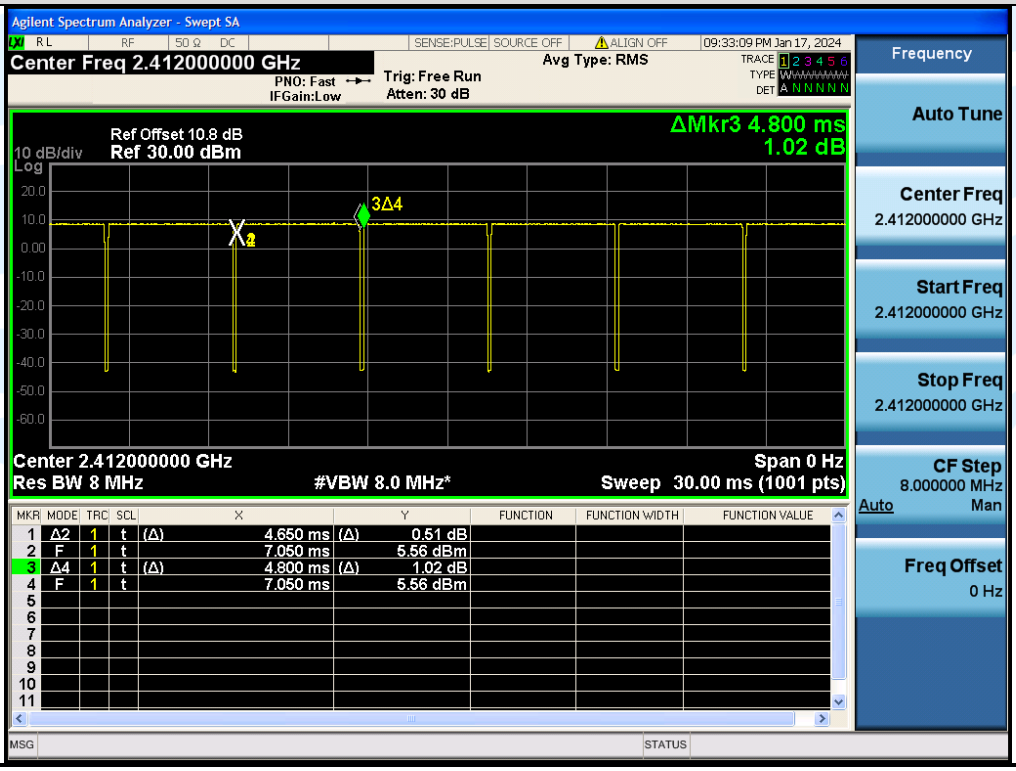
IEEE 802.11n-HT20



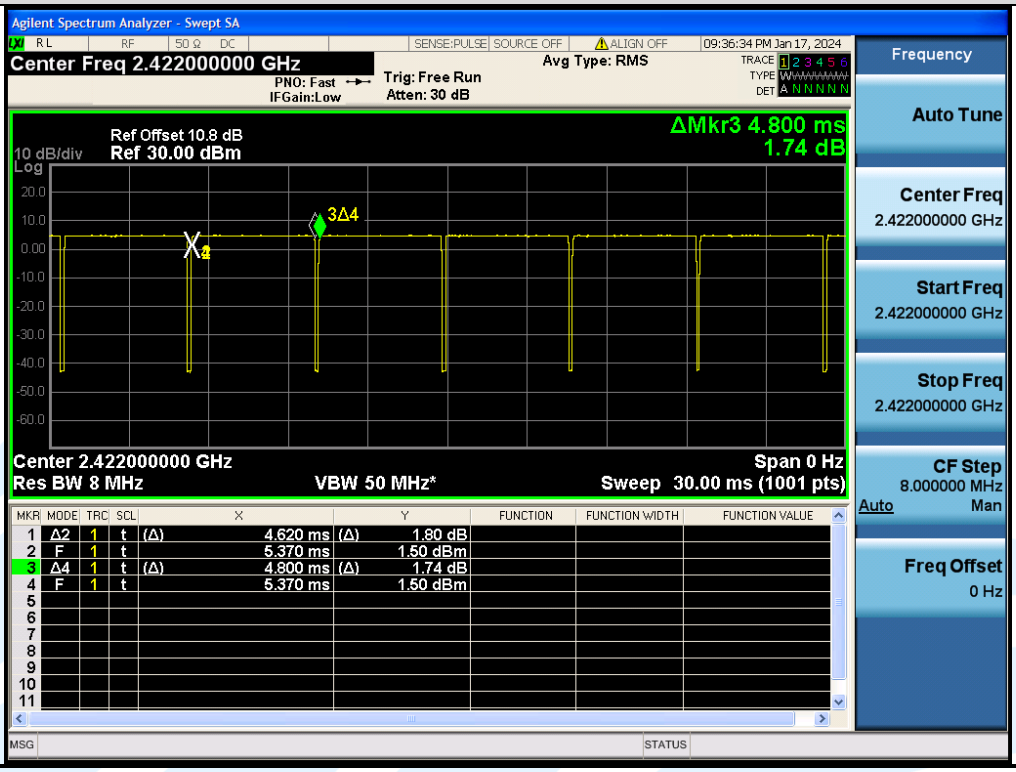
IEEE 802.11n-HT40



IEEE 802.11ax-HE20



IEEE 802.11ax-HE40



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 3	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 2.0 dBi.

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section15.247 (b)(3)
RSS-247 Issue 3, 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	Frequency (MHz)	RU&Index	Max. Peak Power(dBm)	Limit (dBm)	ISED EIRP (dBm)	Limit (dBm)	Result
IEEE 802.11b	2412	N/A	18.00	30.00	20.00	36.02	Pass
	2437	N/A	17.55	30.00	19.55	36.02	Pass
	2462	N/A	17.11	30.00	19.11	36.02	Pass
IEEE 802.11g	2412	N/A	26.93	30.00	28.93	36.02	Pass
	2437	N/A	26.56	30.00	28.56	36.02	Pass
	2462	N/A	***27.16***	30.00	29.16	36.02	Pass
IEEE 802.11n-HT20	2412	N/A	25.64	30.00	27.64	36.02	Pass
	2437	N/A	25.77	30.00	27.77	36.02	Pass
	2462	N/A	26.41	30.00	28.41	36.02	Pass
IEEE 802.11n-HT40	2422	N/A	25.52	30.00	27.52	36.02	Pass
	2437	N/A	26.70	30.00	28.70	36.02	Pass
	2452	N/A	25.37	30.00	27.37	36.02	Pass
IEEE 802.11ax-HE20	2412	SU	26.03	30.00	28.03	36.02	Pass
	2437	SU	26.68	30.00	28.68	36.02	Pass
	2462	SU	26.68	30.00	28.68	36.02	Pass
IEEE 802.11ax-HE40	2422	SU	23.83	30.00	25.83	36.02	Pass
	2437	SU	25.61	30.00	27.61	36.02	Pass
	2452	SU	24.27	30.00	26.27	36.02	Pass

Note:
1. The antenna gain of 2.0 dBi less than 6dBi maximum permission antenna gain value based on 1 watt (30dBm) peak output power limit.
2. The maximum EIRP is calculated from max output power and antenna gain, the antenna gain provided by the customer, and the customer takes all the responsibilities for the accuracy of antenna gain.

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 3, 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 Mode:	Link mode
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) RSS-247 Issue 3, 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 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)
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 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
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.

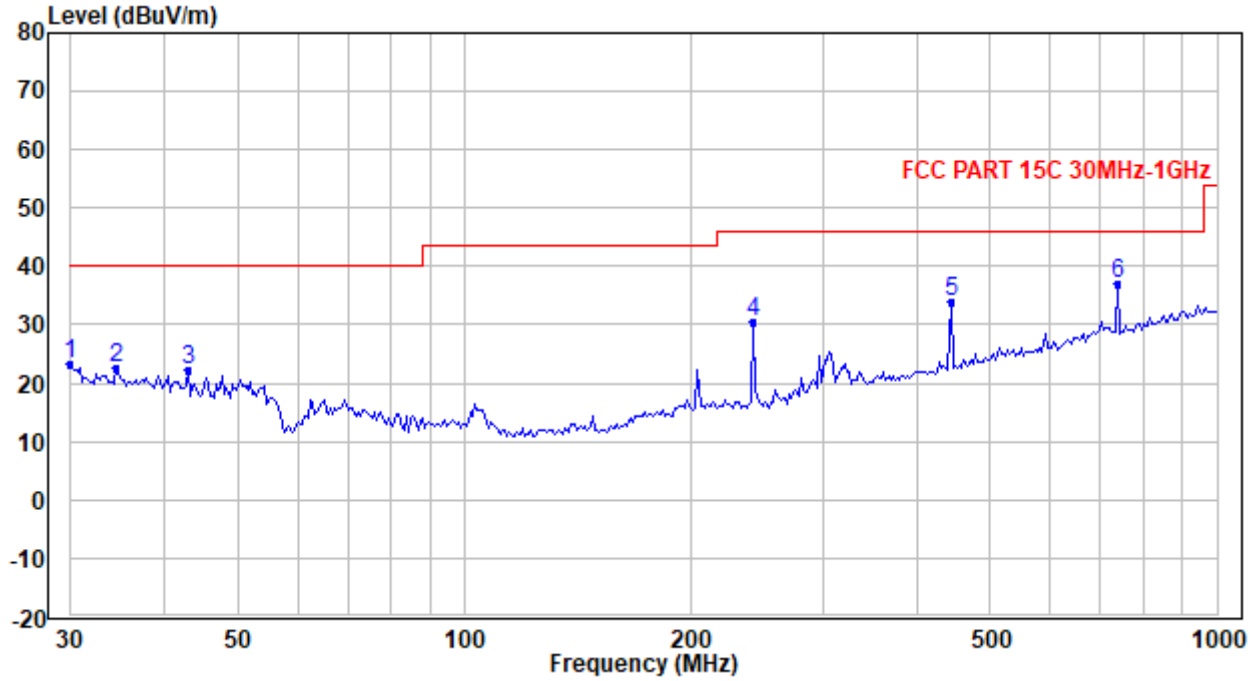
Test Result: Pass

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.

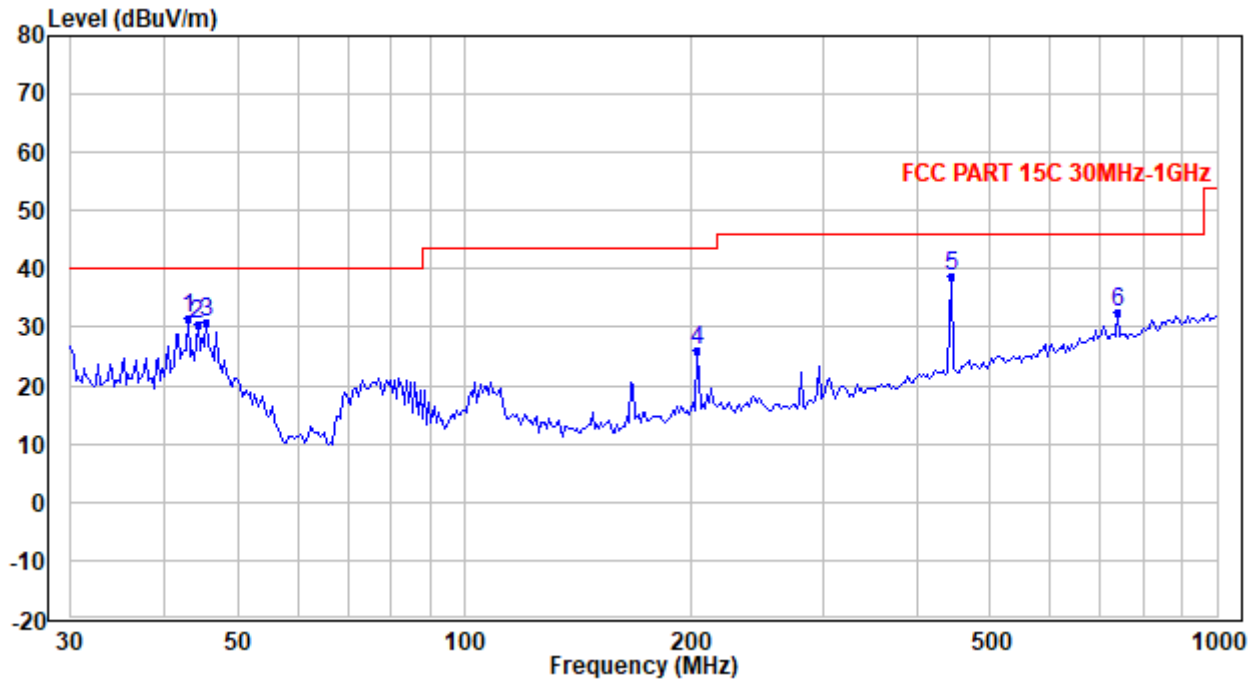
Radiated Emission Test Data (30 MHz ~ 1 GHz):
Worst-Case Configuration (IEEE 802.11g_Channel 11)

Horizontal



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.000	27.42	-4.08	23.34	40.00	-16.66	QP
2	34.527	29.41	-6.67	22.74	40.00	-17.26	QP
3	42.931	32.50	-10.29	22.21	40.00	-17.79	QP
4	241.838	41.20	-10.62	30.58	46.00	-15.42	QP
5	442.572	37.98	-3.99	33.99	46.00	-12.01	QP
6	739.214	35.19	1.99	37.18	46.00	-8.82	QP

Vertical



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	42.931	41.95	-10.29	31.66	40.00	-8.34	QP
2	44.154	43.08	-12.43	30.65	40.00	-9.35	QP
3	45.413	43.21	-12.39	30.82	40.00	-9.18	QP
4	204.305	37.06	-11.05	26.01	43.50	-17.49	QP
5	442.572	42.70	-3.99	38.71	46.00	-7.29	QP
6	739.214	30.71	1.99	32.70	46.00	-13.30	QP

Radiated Emission Test Data (Above 1GHz):								
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	30.26	-0.84	29.42	54.00	-24.58	Average	Horizontal
2	4824	46.73	-0.84	45.89	74.00	-28.11	Peak	Horizontal
3	7236	27.91	2.88	30.79	54.00	-23.21	Average	Horizontal
4	7236	39.49	2.88	42.37	74.00	-31.63	Peak	Horizontal
5	4824	25.96	-0.84	25.12	54.00	-28.88	Average	Vertical
6	4824	39.27	-0.84	38.43	74.00	-35.57	Peak	Vertical
7	7236	28.03	2.88	30.91	54.00	-23.09	Average	Vertical
8	7236	40.33	2.88	43.21	74.00	-30.79	Peak	Vertical
IEEE 802.11b_ Channel 6:								
1	4874	34.10	-0.77	33.33	54.00	-20.67	Average	Horizontal
2	4874	52.26	-0.77	51.49	74.00	-22.51	Peak	Horizontal
3	7311	27.21	2.95	30.16	54.00	-23.84	Average	Horizontal
4	7311	39.03	2.95	41.98	74.00	-32.02	Peak	Horizontal
5	4874	30.04	-0.77	29.27	54.00	-24.73	Average	Vertical
6	4874	44.98	-0.77	44.21	74.00	-29.79	Peak	Vertical
7	7311	24.15	2.95	27.10	54.00	-26.90	Average	Vertical
8	7311	35.73	2.95	38.68	74.00	-35.32	Peak	Vertical
IEEE 802.11b_ Channel 11:								
1	4924	26.01	-0.71	25.30	54.00	-28.70	Average	Horizontal
2	4924	43.14	-0.71	42.43	74.00	-31.57	Peak	Horizontal
3	7386	26.22	3.01	29.23	54.00	-24.77	Average	Horizontal
4	7386	38.81	3.01	41.82	74.00	-32.18	Peak	Horizontal
5	4924	22.91	-0.71	22.20	54.00	-31.80	Average	Vertical
6	4924	35.74	-0.71	35.03	74.00	-38.97	Peak	Vertical
7	7386	25.64	3.01	28.65	54.00	-25.35	Average	Vertical
8	7386	36.85	3.01	39.86	74.00	-34.14	Peak	Vertical

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	30.94	-0.84	30.10	54.00	-23.90	Average	Horizontal
2	4824	44.96	-0.84	44.12	74.00	-29.88	Peak	Horizontal
3	7236	27.91	2.88	30.79	54.00	-23.21	Average	Horizontal
4	7236	39.63	2.88	42.51	74.00	-31.49	Peak	Horizontal
5	4824	26.18	-0.84	25.34	54.00	-28.66	Average	Vertical
6	4824	39.94	-0.84	39.10	74.00	-34.90	Peak	Vertical
7	7236	27.91	2.88	30.79	54.00	-23.21	Average	Vertical
8	7236	39.63	2.88	42.51	74.00	-31.49	Peak	Vertical
IEEE 802.11g_ Channel 6:								
1	4874	35.90	-0.77	35.13	54.00	-18.87	Average	Horizontal
2	4874	50.13	-0.77	49.36	74.00	-24.64	Peak	Horizontal
3	7311	27.21	2.95	30.16	54.00	-23.84	Average	Horizontal
4	7311	39.46	2.95	42.41	74.00	-31.59	Peak	Horizontal
5	4874	30.44	-0.77	29.67	54.00	-24.33	Average	Vertical
6	4874	44.25	-0.77	43.48	74.00	-30.52	Peak	Vertical
7	7311	27.27	2.95	30.22	54.00	-23.78	Average	Vertical
8	7311	39.35	2.95	42.30	74.00	-31.70	Peak	Vertical
IEEE 802.11g_ Channel 11:								
1	4924	28.51	-0.71	27.80	54.00	-26.20	Average	Horizontal
2	4924	42.10	-0.71	41.39	74.00	-32.61	Peak	Horizontal
3	7386	26.15	3.01	29.16	54.00	-24.84	Average	Horizontal
4	7386	37.88	3.01	40.89	74.00	-33.11	Peak	Horizontal
5	4924	23.11	-0.71	22.40	54.00	-31.60	Average	Vertical
6	4924	36.02	-0.71	35.31	74.00	-38.69	Peak	Vertical
7	7386	25.93	3.01	28.94	54.00	-25.06	Average	Vertical
8	7386	37.60	3.01	40.61	74.00	-33.39	Peak	Vertical

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	27.62	-0.84	26.78	54.00	-27.22	Average	Horizontal
2	4824	41.46	-0.84	40.62	74.00	-33.38	Peak	Horizontal
3	7236	27.91	2.88	30.79	54.00	-23.21	Average	Horizontal
4	7236	39.98	2.88	42.86	74.00	-31.14	Peak	Horizontal
5	4824	26.03	-0.84	25.19	54.00	-28.81	Average	Vertical
6	4824	39.30	-0.84	38.46	74.00	-35.54	Peak	Vertical
7	7236	27.91	2.88	30.79	54.00	-23.21	Average	Vertical
8	7236	40.30	2.88	43.18	74.00	-30.82	Peak	Vertical
IEEE 802.11n-HT20_ Channel 6:								
1	4874	35.85	-0.77	35.08	54.00	-18.92	Average	Horizontal
2	4874	49.45	-0.77	48.68	74.00	-25.32	Peak	Horizontal
3	7311	27.21	2.95	30.16	54.00	-23.84	Average	Horizontal
4	7311	40.82	2.95	43.77	74.00	-30.23	Peak	Horizontal
5	4874	30.35	-0.77	29.58	54.00	-24.42	Average	Vertical
6	4874	43.79	-0.77	43.02	74.00	-30.98	Peak	Vertical
7	7311	27.21	2.95	30.16	54.00	-23.84	Average	Vertical
8	7311	38.93	2.95	41.88	74.00	-32.12	Peak	Vertical
IEEE 802.11n-HT20_ Channel 11:								
1	4924	28.00	-0.71	27.29	54.00	-26.71	Average	Horizontal
2	4924	41.39	-0.71	40.68	74.00	-33.32	Peak	Horizontal
3	7386	26.08	3.01	29.09	54.00	-24.91	Average	Horizontal
4	7386	37.81	3.01	40.82	74.00	-33.18	Peak	Horizontal
5	4924	22.91	-0.71	22.20	54.00	-31.80	Average	Vertical
6	4924	35.33	-0.71	34.62	74.00	-39.38	Peak	Vertical
7	7386	26.08	3.01	29.09	54.00	-24.91	Average	Vertical
8	7386	37.33	3.01	40.34	74.00	-33.66	Peak	Vertical

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	30.82	-0.81	30.01	54.00	-23.99	Average	Horizontal
2	4844	45.58	-0.81	44.77	74.00	-29.23	Peak	Horizontal
3	7266	27.82	2.91	30.73	54.00	-23.27	Average	Horizontal
4	7266	40.35	2.91	43.26	74.00	-30.74	Peak	Horizontal
5	4844	26.29	-0.81	25.48	54.00	-28.52	Average	Vertical
6	4844	39.57	-0.81	38.76	74.00	-35.24	Peak	Vertical
7	7266	27.88	2.91	30.79	54.00	-23.21	Average	Vertical
8	7266	41.26	2.91	44.17	74.00	-29.83	Peak	Vertical
IEEE 802.11n-HT40_ Channel 6:								
1	4874	34.73	-0.77	33.96	54.00	-20.04	Average	Horizontal
2	4874	49.06	-0.77	48.29	74.00	-25.71	Peak	Horizontal
3	7311	27.21	2.95	30.16	54.00	-23.84	Average	Horizontal
4	7311	39.55	2.95	42.50	74.00	-31.50	Peak	Horizontal
5	4874	29.94	-0.77	29.17	54.00	-24.83	Average	Vertical
6	4874	42.11	-0.77	41.34	74.00	-32.66	Peak	Vertical
7	7311	27.40	2.95	30.35	54.00	-23.65	Average	Vertical
8	7311	39.68	2.95	42.63	74.00	-31.37	Peak	Vertical
IEEE 802.11n-HT40_ Channel 9:								
1	4904	32.20	-0.74	31.46	54.00	-22.54	Average	Horizontal
2	4904	45.37	-0.74	44.63	74.00	-29.37	Peak	Horizontal
3	7356	26.11	2.98	29.09	54.00	-24.91	Average	Horizontal
4	7356	37.82	2.98	40.80	74.00	-33.20	Peak	Horizontal
5	4904	22.62	-0.74	21.88	54.00	-32.12	Average	Vertical
6	4904	35.87	-0.74	35.13	74.00	-38.87	Peak	Vertical
7	7356	26.18	2.98	29.16	54.00	-24.84	Average	Vertical
8	7356	38.79	2.98	41.77	74.00	-32.23	Peak	Vertical

IEEE 802.11ax-HE20_ Channel 1:								
No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824	27.86	-0.84	27.02	54.00	-26.98	Average	Horizontal
2	4824	42.87	-0.84	42.03	74.00	-31.97	Peak	Horizontal
3	7236	27.91	2.88	30.79	54.00	-23.21	Average	Horizontal
4	7236	40.31	2.88	43.19	74.00	-30.81	Peak	Horizontal
5	4824	26.25	-0.84	25.41	54.00	-28.59	Average	Vertical
6	4824	39.73	-0.84	38.89	74.00	-35.11	Peak	Vertical
7	7236	28.03	2.88	30.91	54.00	-23.09	Average	Vertical
8	7236	40.30	2.88	43.18	74.00	-30.82	Peak	Vertical
IEEE 802.11ax-HE20_ Channel 6:								
1	4874	35.87	-0.77	35.10	54.00	-18.90	Average	Horizontal
2	4874	51.39	-0.77	50.62	74.00	-23.38	Peak	Horizontal
3	7311	27.52	2.95	30.47	54.00	-23.53	Average	Horizontal
4	7311	39.62	2.95	42.57	74.00	-31.43	Peak	Horizontal
5	4874	30.52	-0.77	29.75	54.00	-24.25	Average	Vertical
6	4874	42.28	-0.77	41.51	74.00	-32.49	Peak	Vertical
7	7311	27.34	2.95	30.29	54.00	-23.71	Average	Vertical
8	7311	39.38	2.95	42.33	74.00	-31.67	Peak	Vertical
IEEE 802.11ax-HE20_ Channel 11:								
1	4924	27.95	-0.71	27.24	54.00	-26.76	Average	Horizontal
2	4924	40.59	-0.71	39.88	74.00	-34.12	Peak	Horizontal
3	7386	26.08	3.01	29.09	54.00	-24.91	Average	Horizontal
4	7386	37.90	3.01	40.91	74.00	-33.09	Peak	Horizontal
5	4924	23.11	-0.71	22.40	54.00	-31.60	Average	Vertical
6	4924	35.16	-0.71	34.45	74.00	-39.55	Peak	Vertical
7	7386	26.22	3.01	29.23	54.00	-24.77	Average	Vertical
8	7386	38.23	3.01	41.24	74.00	-32.76	Peak	Vertical

IEEE 802.11ax-HE40_ Channel 3:								
No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4844	31.03	-0.81	30.22	54.00	-23.78	Average	Horizontal
2	4844	45.03	-0.81	44.22	74.00	-29.78	Peak	Horizontal
3	7266	27.82	2.91	30.73	54.00	-23.27	Average	Horizontal
4	7266	39.98	2.91	42.89	74.00	-31.11	Peak	Horizontal
5	4844	26.43	-0.81	25.62	54.00	-28.38	Average	Vertical
6	4844	40.01	-0.81	39.20	74.00	-34.80	Peak	Vertical
7	7266	27.94	2.91	30.85	54.00	-23.15	Average	Vertical
8	7266	39.69	2.91	42.60	74.00	-31.40	Peak	Vertical
IEEE 802.11ax-HE40_ Channel 6:								
1	4874	33.30	-0.77	32.53	54.00	-21.47	Average	Horizontal
2	4874	46.71	-0.77	45.94	74.00	-28.06	Peak	Horizontal
3	7311	27.27	2.95	30.22	54.00	-23.78	Average	Horizontal
4	7311	39.30	2.95	42.25	74.00	-31.75	Peak	Horizontal
5	4874	31.13	-0.77	30.36	54.00	-23.64	Average	Vertical
6	4874	43.27	-0.77	42.50	74.00	-31.50	Peak	Vertical
7	7311	27.27	2.95	30.22	54.00	-23.78	Average	Vertical
8	7311	38.75	2.95	41.70	74.00	-32.30	Peak	Vertical
IEEE 802.11ax-HE40_ Channel 9:								
1	4904	32.10	-0.74	31.36	54.00	-22.64	Average	Horizontal
2	4904	45.34	-0.74	44.60	74.00	-29.40	Peak	Horizontal
3	7356	26.25	2.98	29.23	54.00	-24.77	Average	Horizontal
4	7356	37.63	2.98	40.61	74.00	-33.39	Peak	Horizontal
5	4904	29.52	-0.74	28.78	54.00	-25.22	Average	Vertical
6	4904	41.90	-0.74	41.16	74.00	-32.84	Peak	Vertical
7	7356	26.04	2.98	29.02	54.00	-24.98	Average	Vertical
8	7356	38.59	2.98	41.57	74.00	-32.43	Peak	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 3, 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.

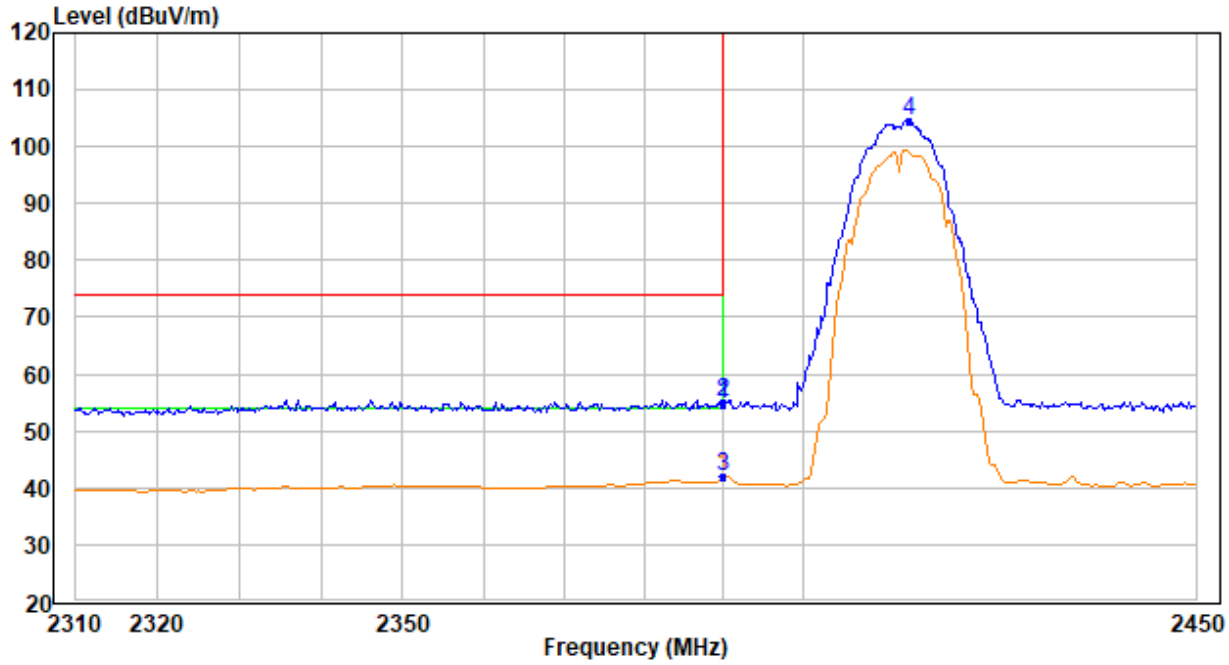
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

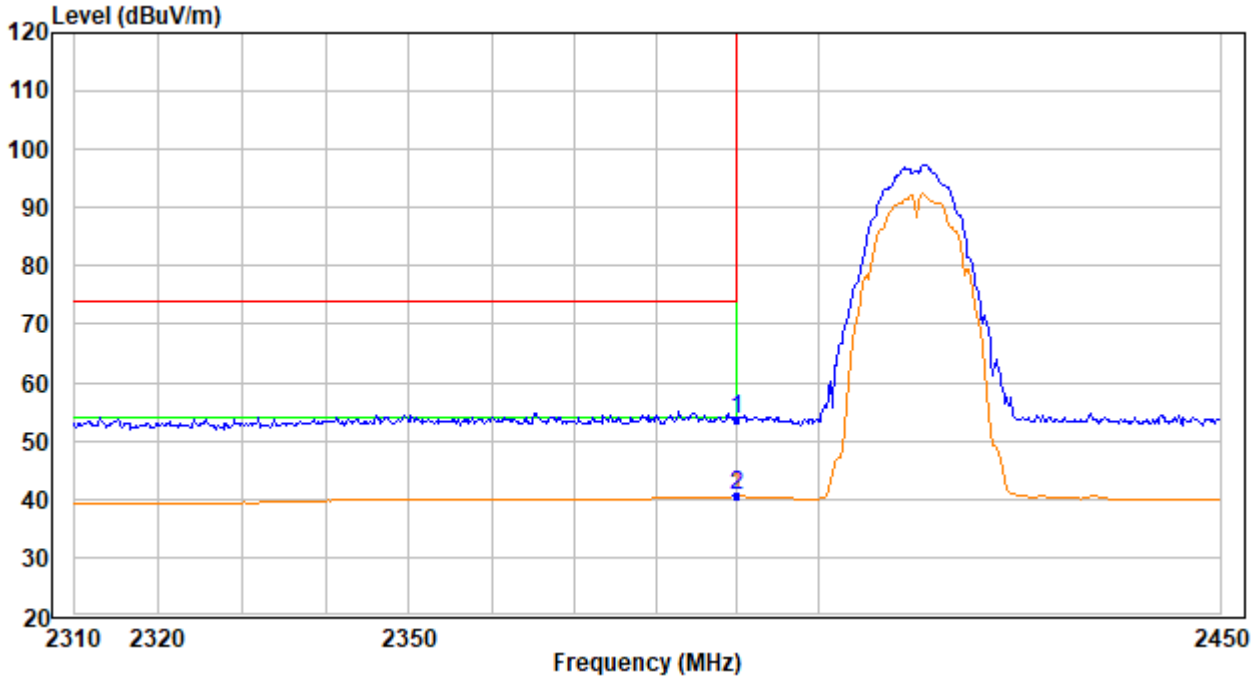
IEEE 802.11b

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



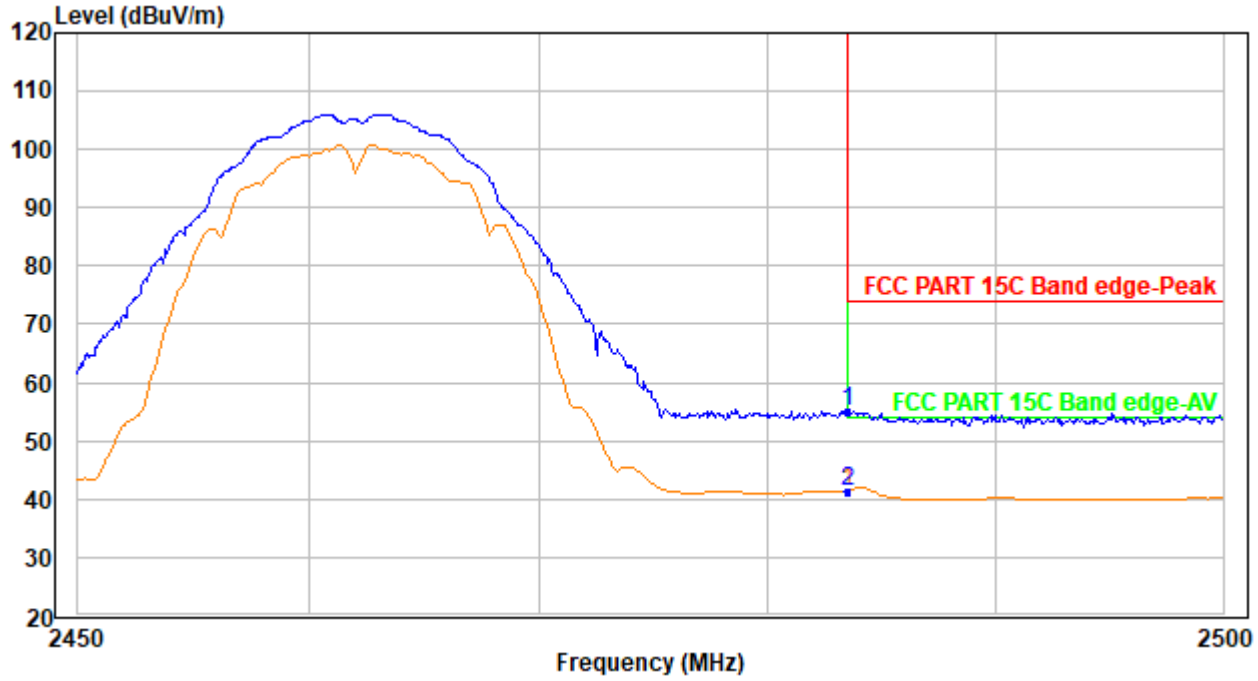
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	54.71	74.00	42.09	54.00	Pass
2390.000	54.98	74.00	--	--	Pass
2413.247	104.59	137.00	--	--	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



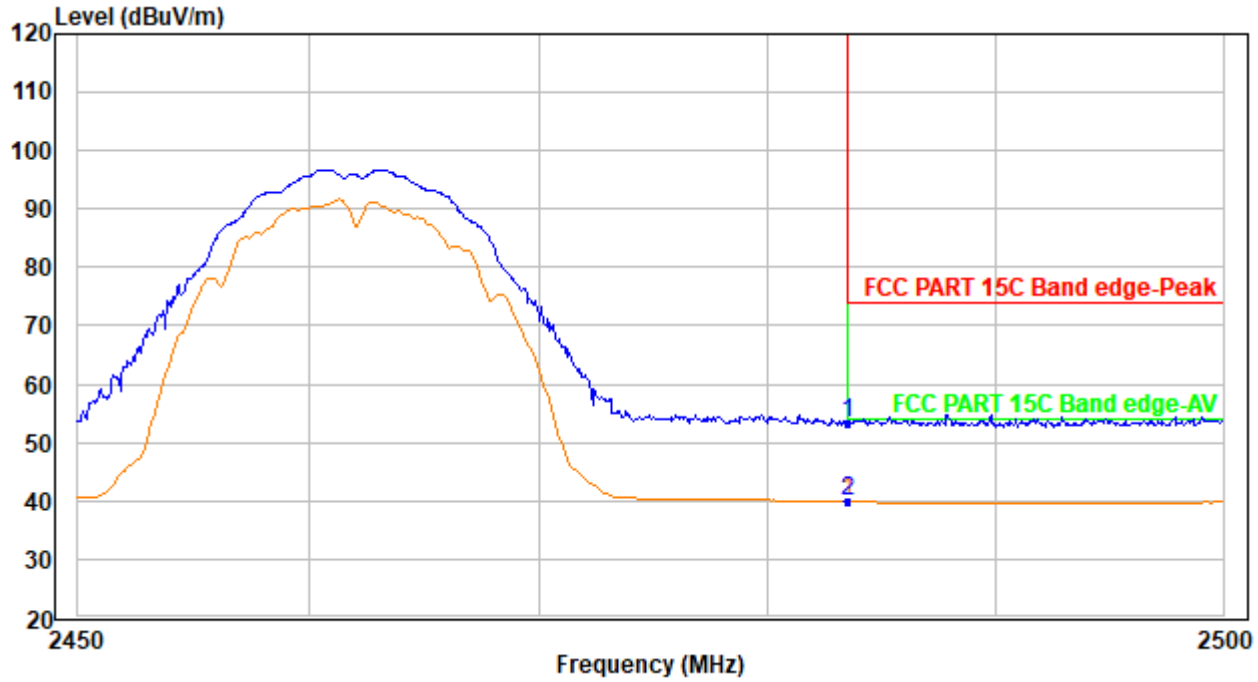
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	53.51	74.00	40.64	54.00	Pass

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
2483.500	54.95	74.00	41.40	54.00	Pass

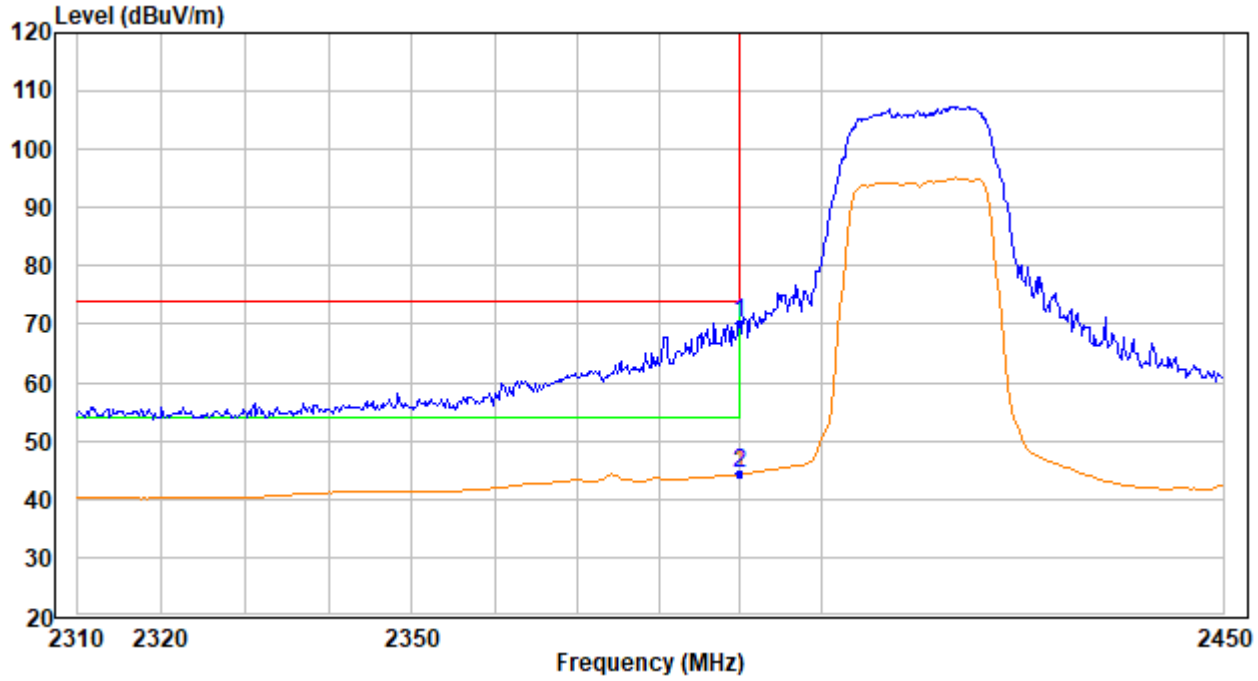
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	53.31	74.00	39.86	54.00	Pass

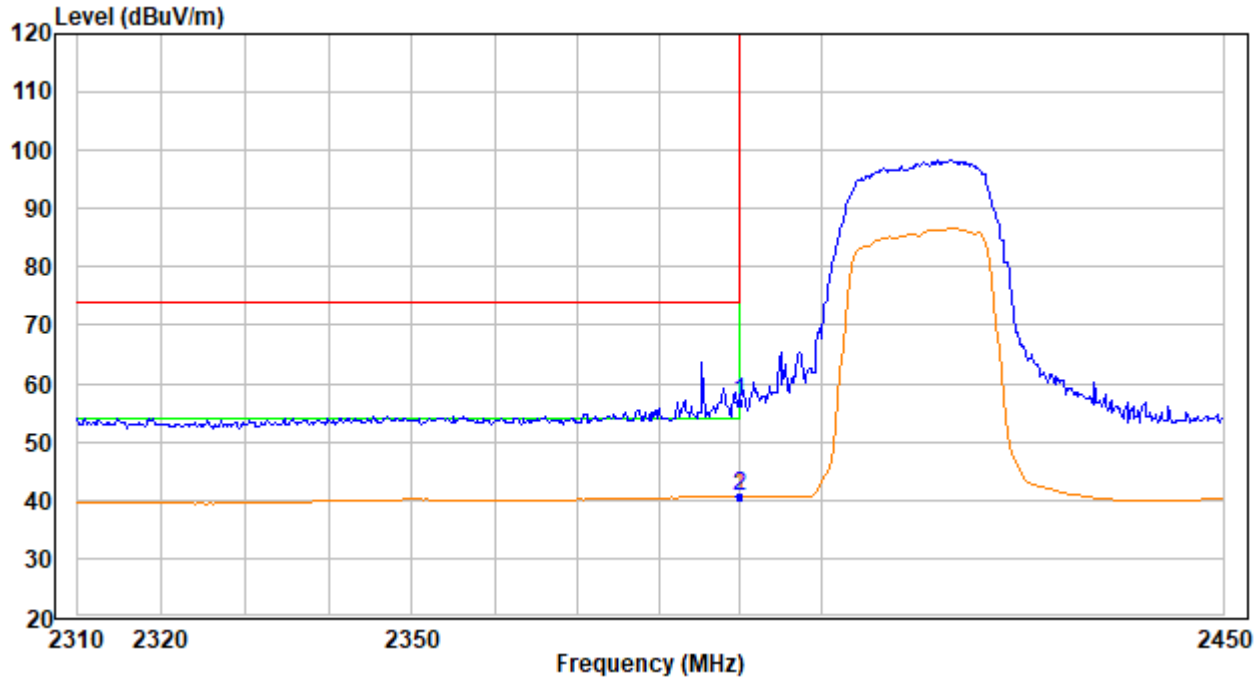
IEEE 802.11g

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



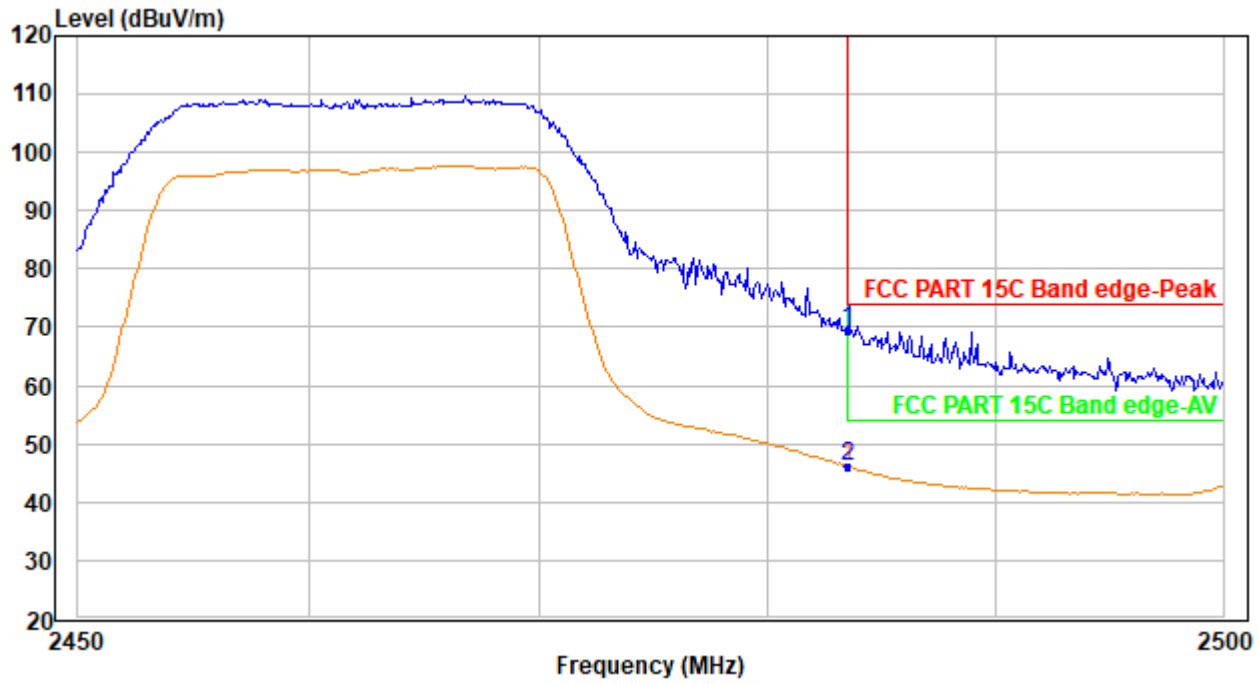
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	70.33	74.00	44.27	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



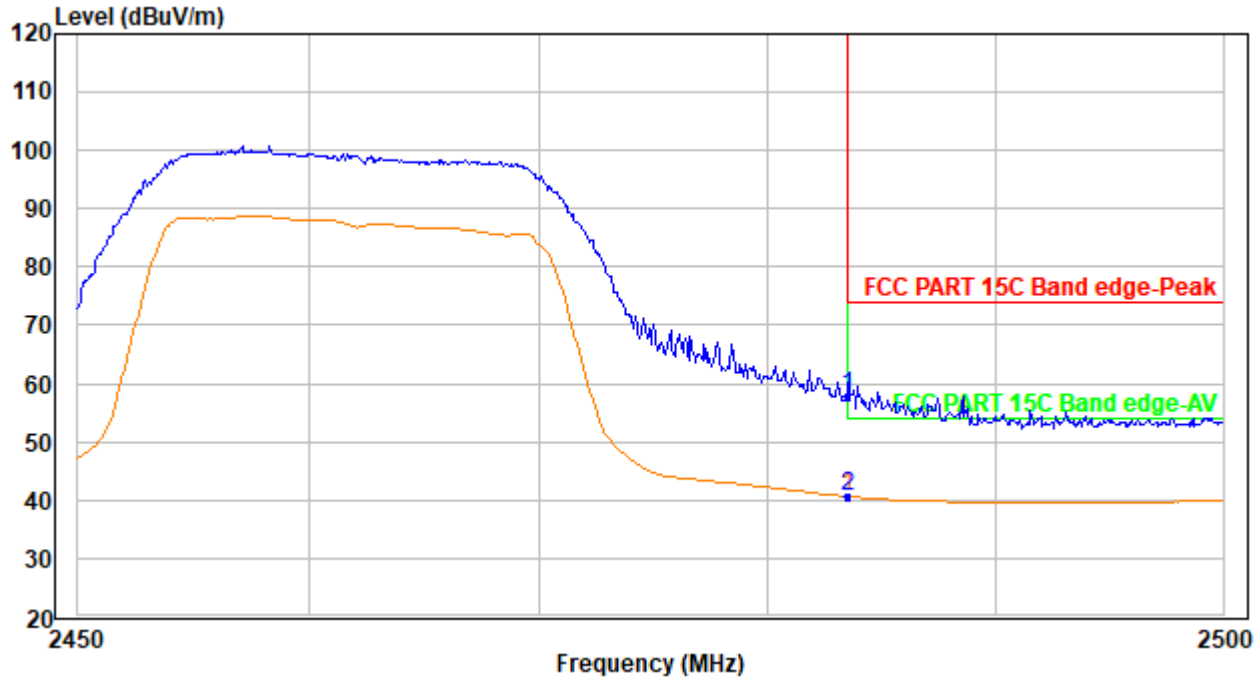
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	56.62	74.00	40.58	54.00	Pass

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
2483.500	69.41	74.00	46.09	54.00	Pass

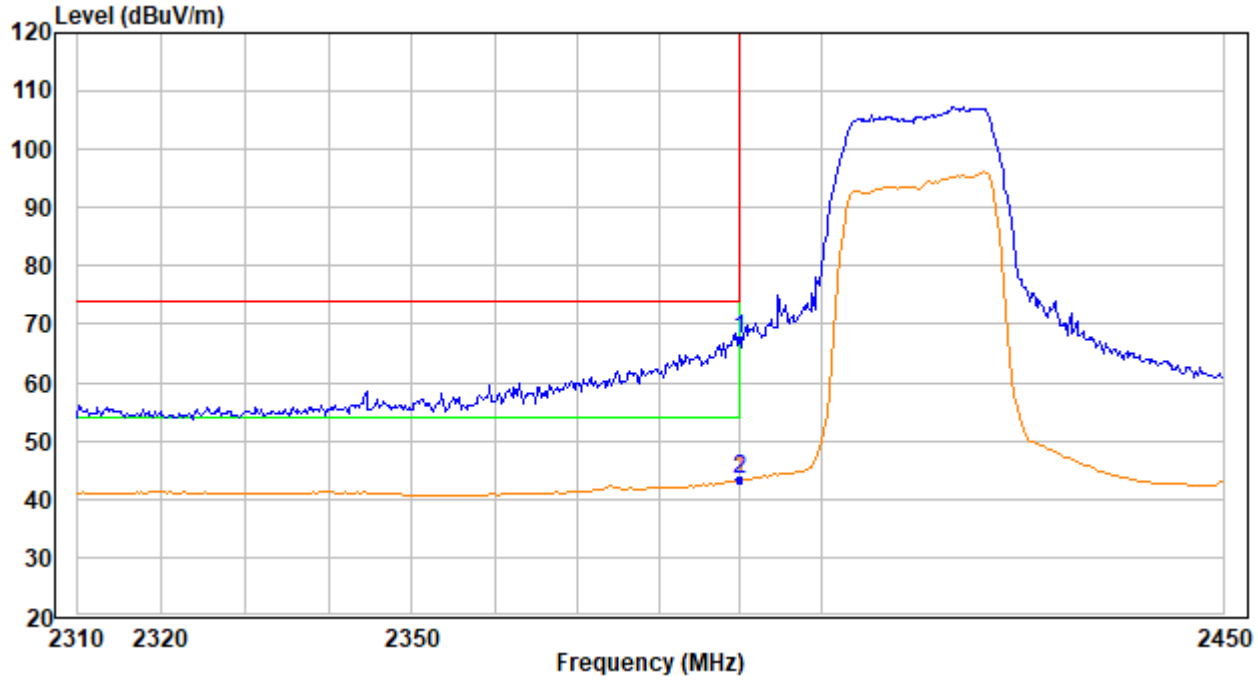
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	57.77	74.00	40.67	54.00	Pass

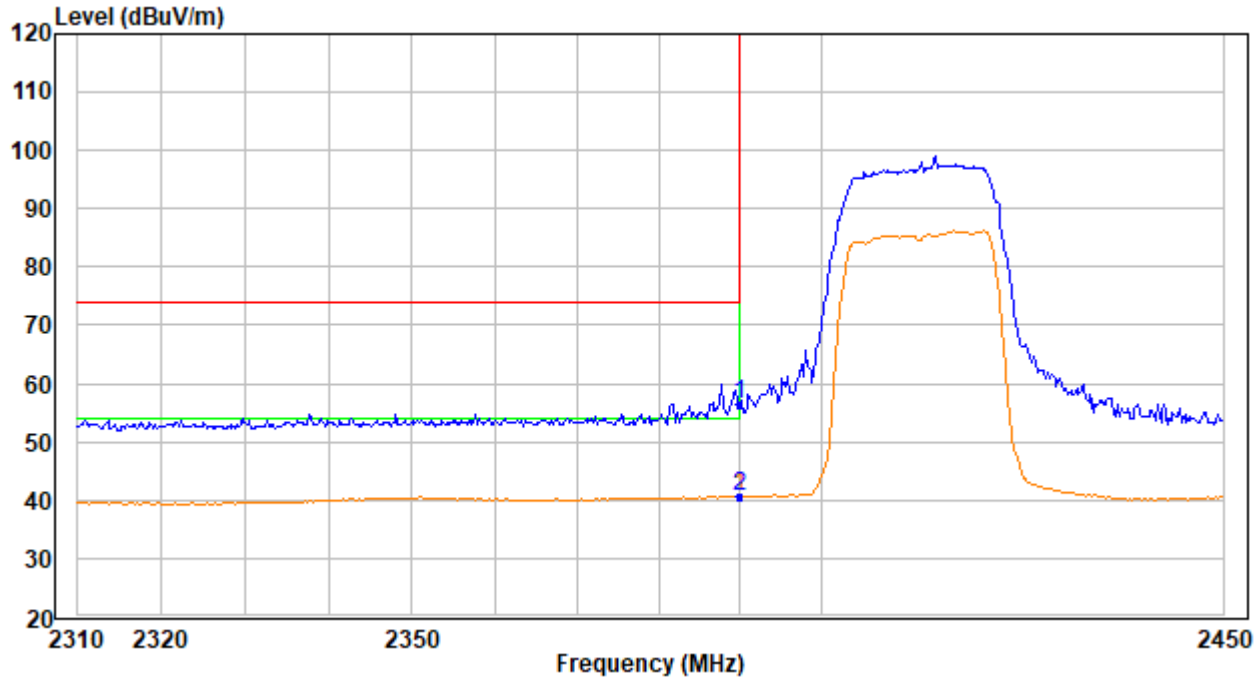
IEEE 802.11n-HT20

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



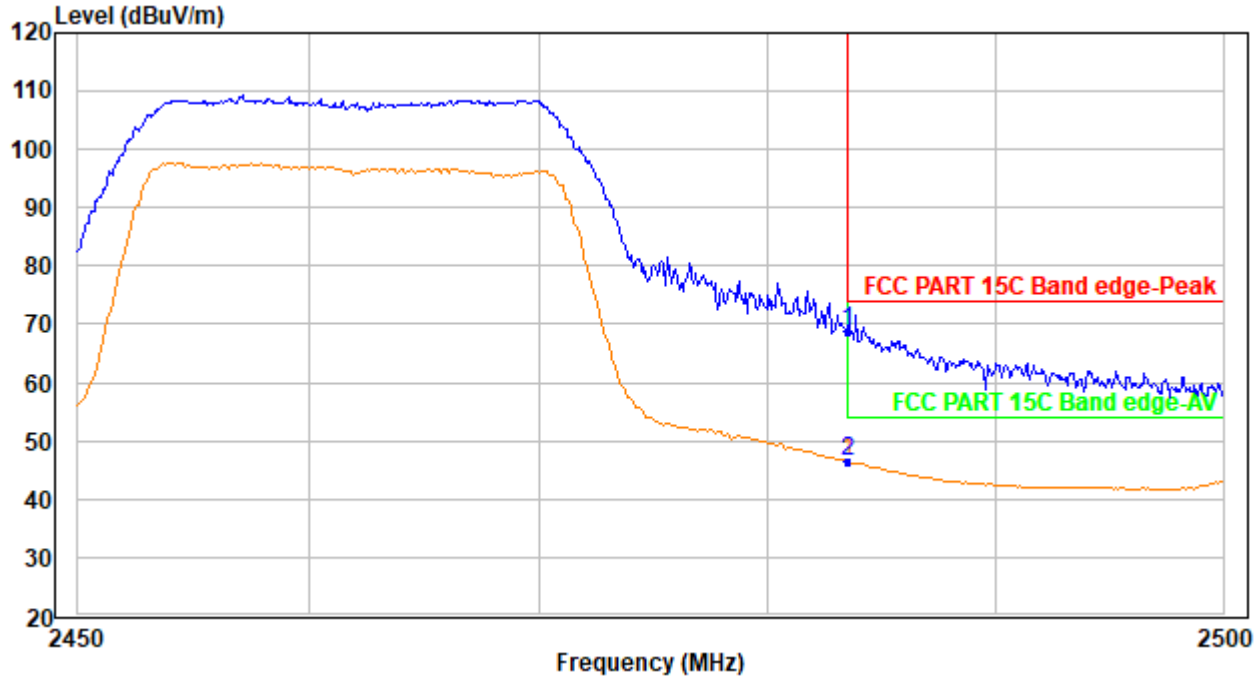
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	67.55	74.00	43.37	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



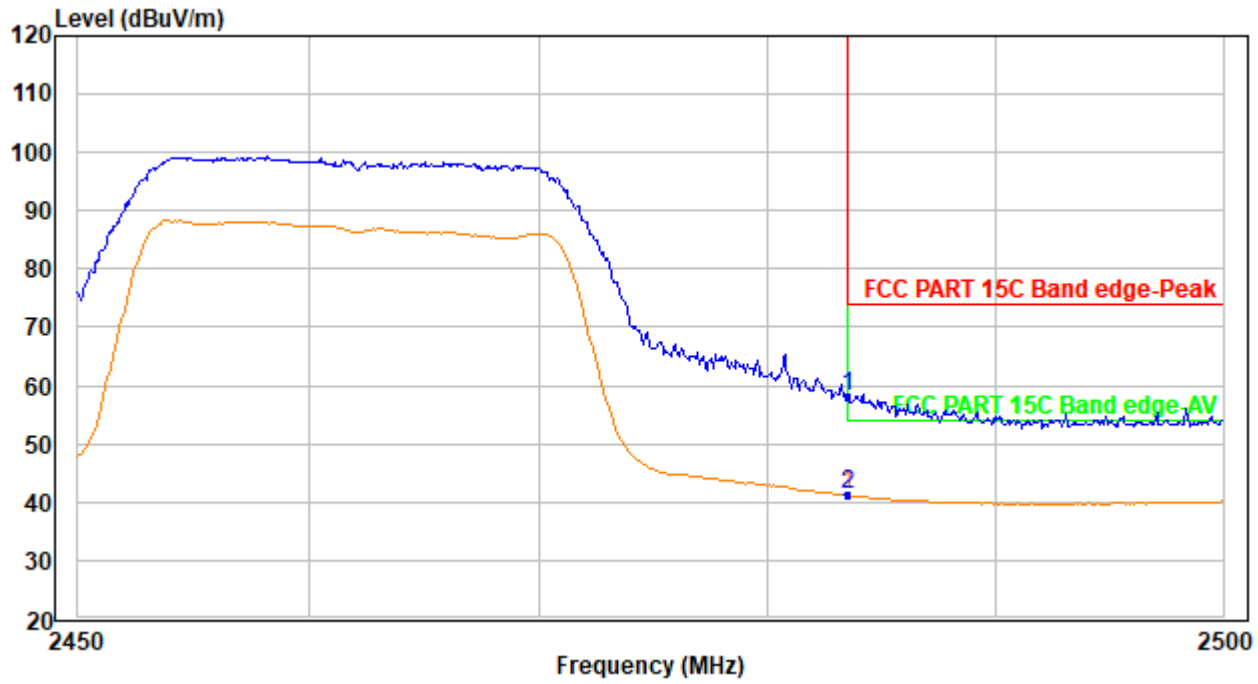
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	56.36	74.00	40.66	54.00	Pass

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
2483.500	68.63	74.00	46.38	54.00	Pass

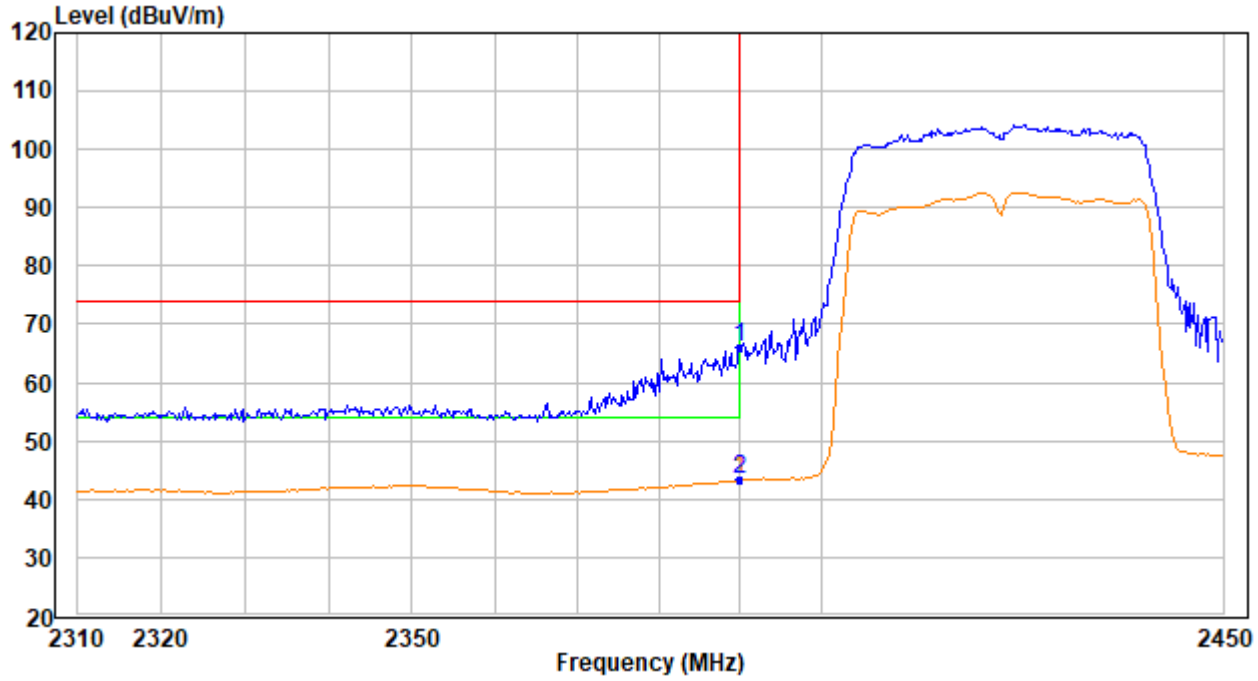
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	58.26	74.00	41.18	54.00	Pass

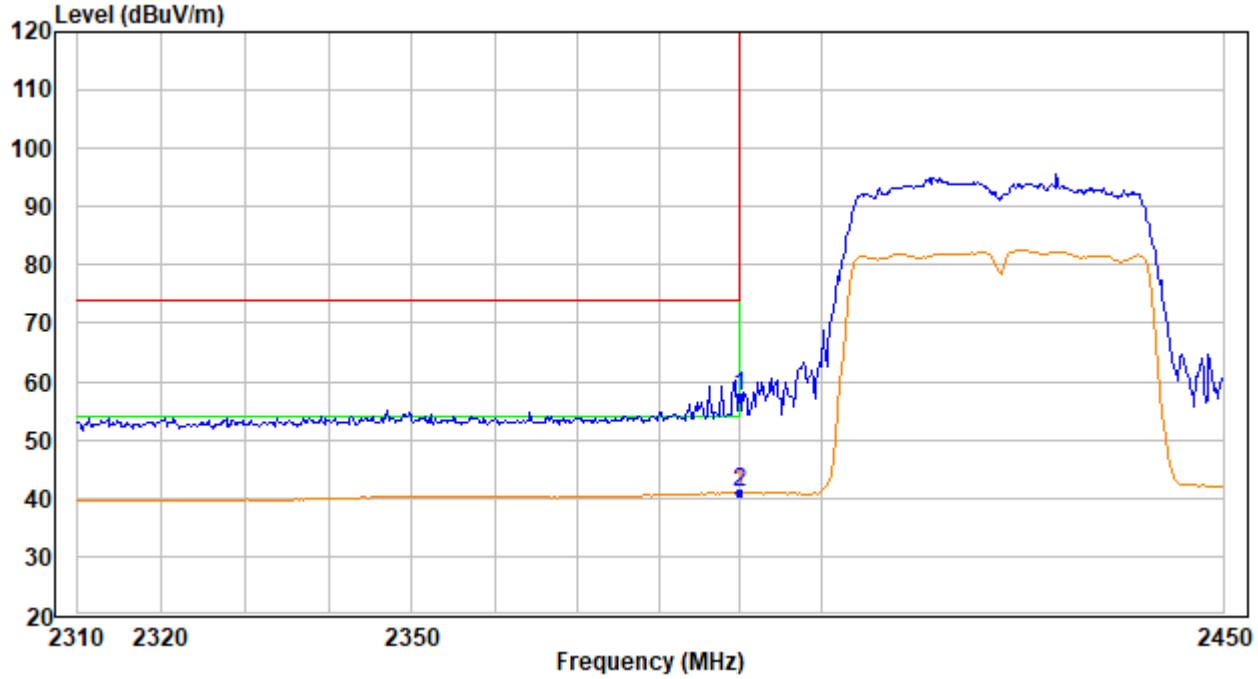
IEEE 802.11n-HT40

Test Channel:	Channel 3	Ant. Polar. :	Horizontal



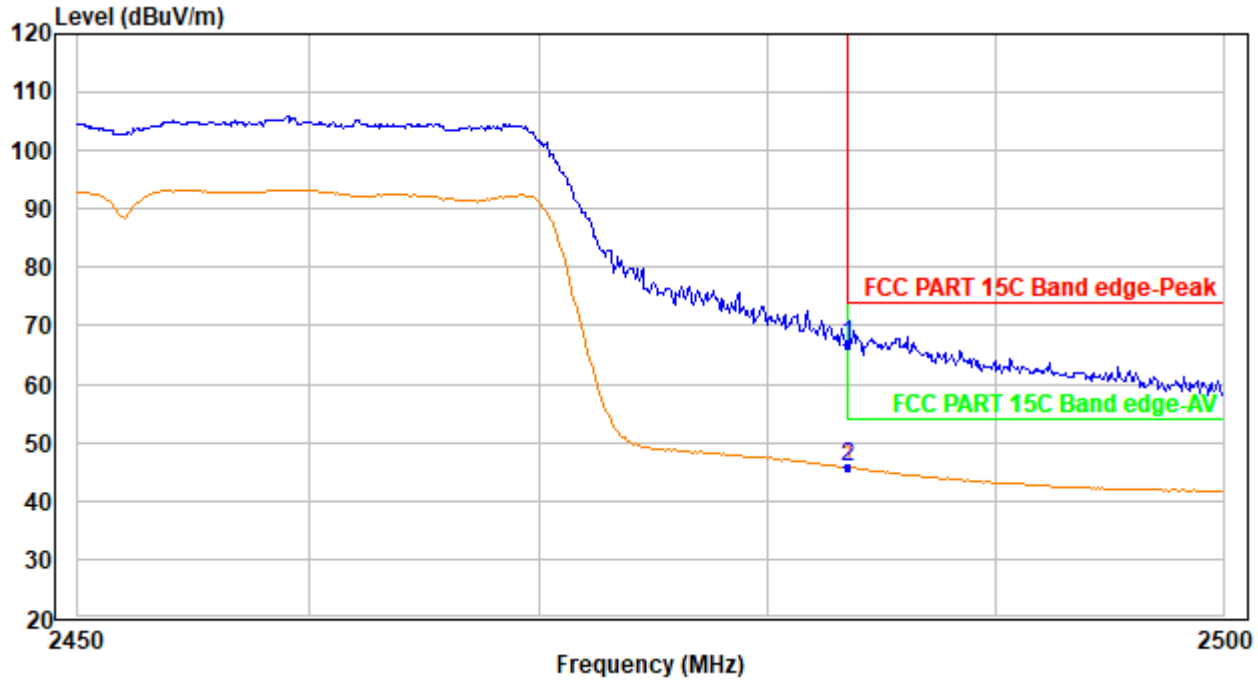
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	65.89	74.00	43.25	54.00	Pass

Test Channel:	Channel 3	Ant. Polar. :	Vertical



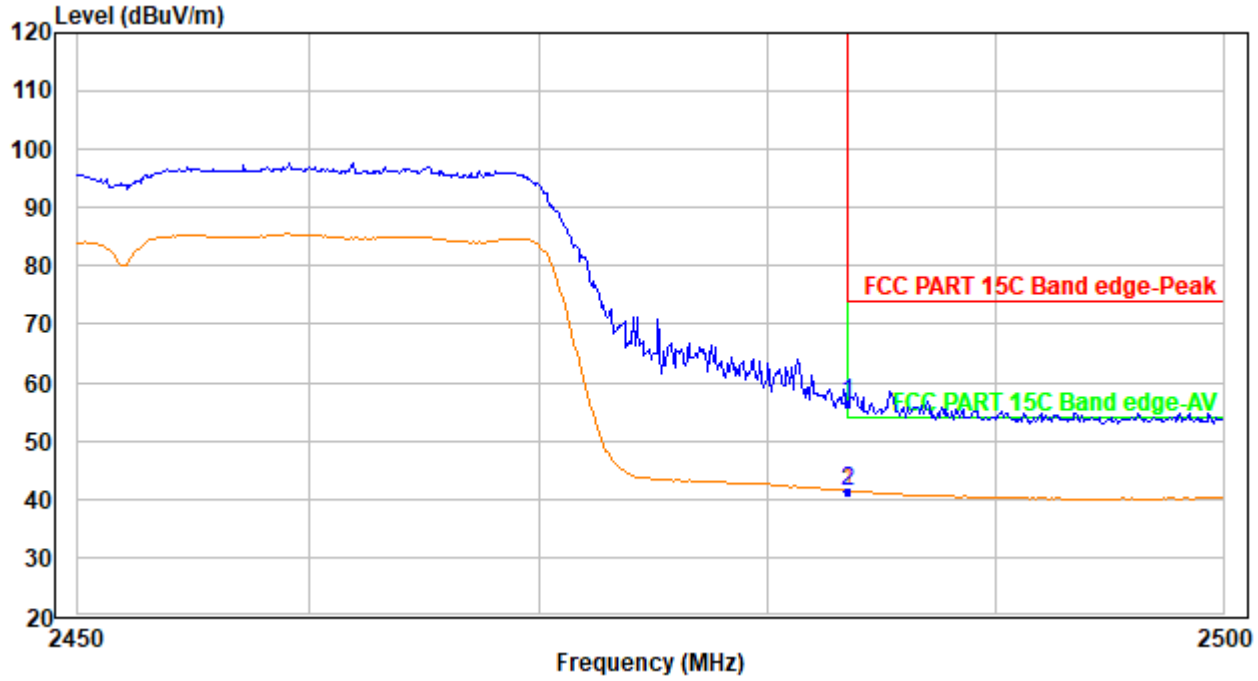
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	57.57	74.00	40.87	54.00	Pass

Test Channel:	Channel 9	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	66.85	74.00	45.78	54.00	Pass

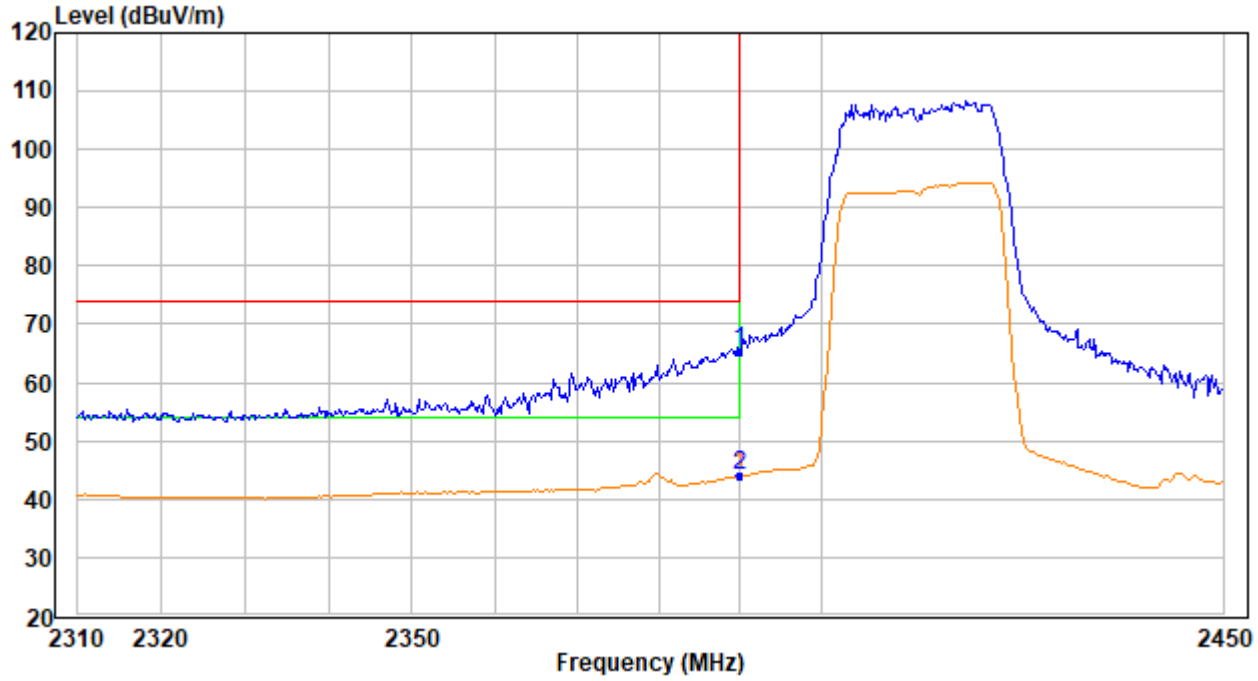
Test Channel:	Channel 9	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	56.34	74.00	41.47	54.00	Pass

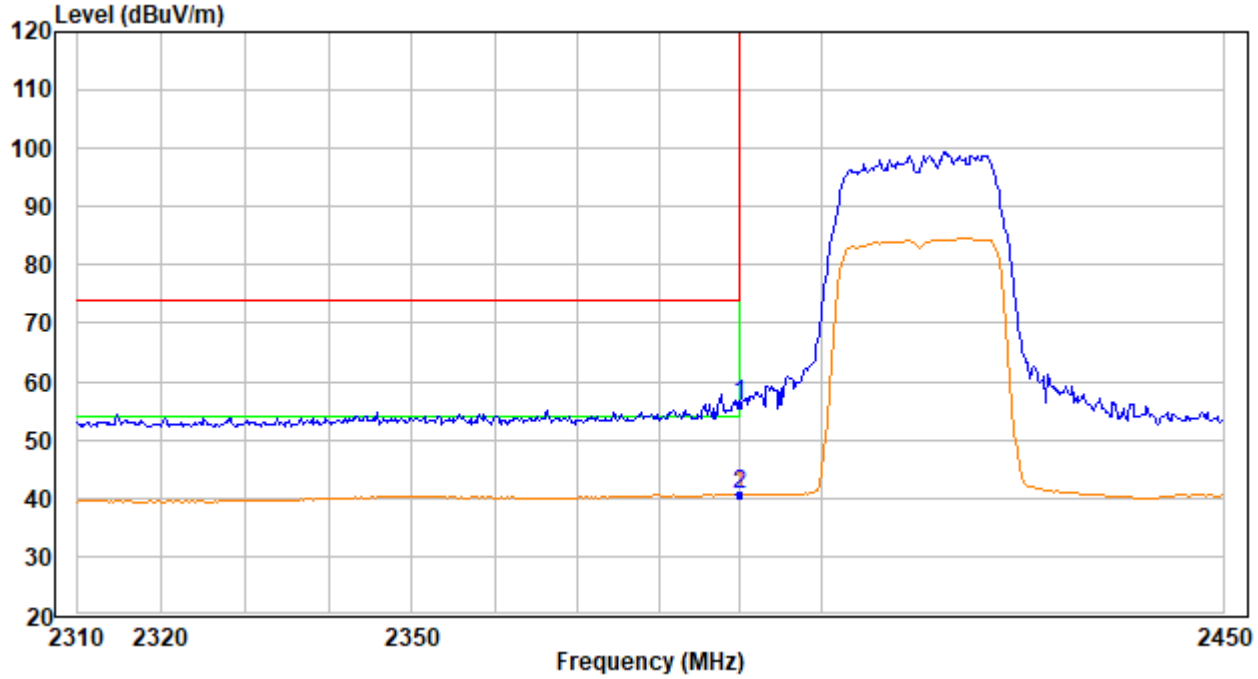
IEEE 802.11ax-HE20

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



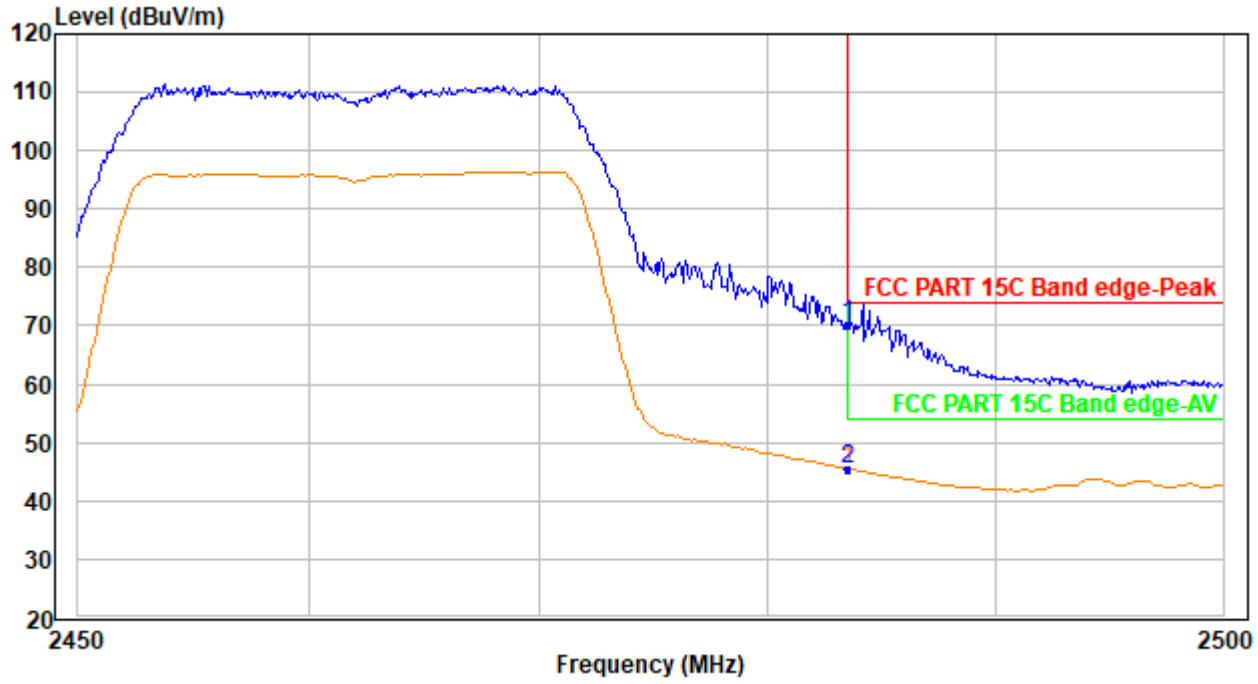
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	65.29	74.00	43.94	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



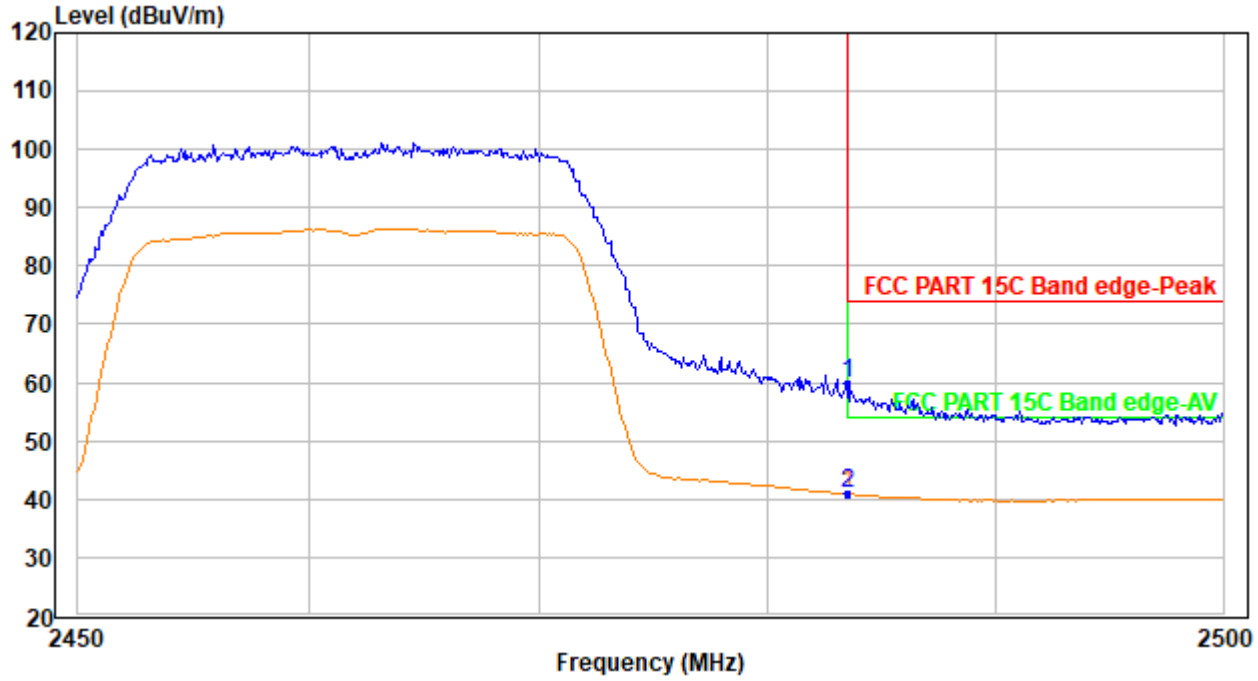
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	56.02	74.00	40.50	54.00	Pass

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
2483.500	70.13	74.00	45.48	54.00	Pass

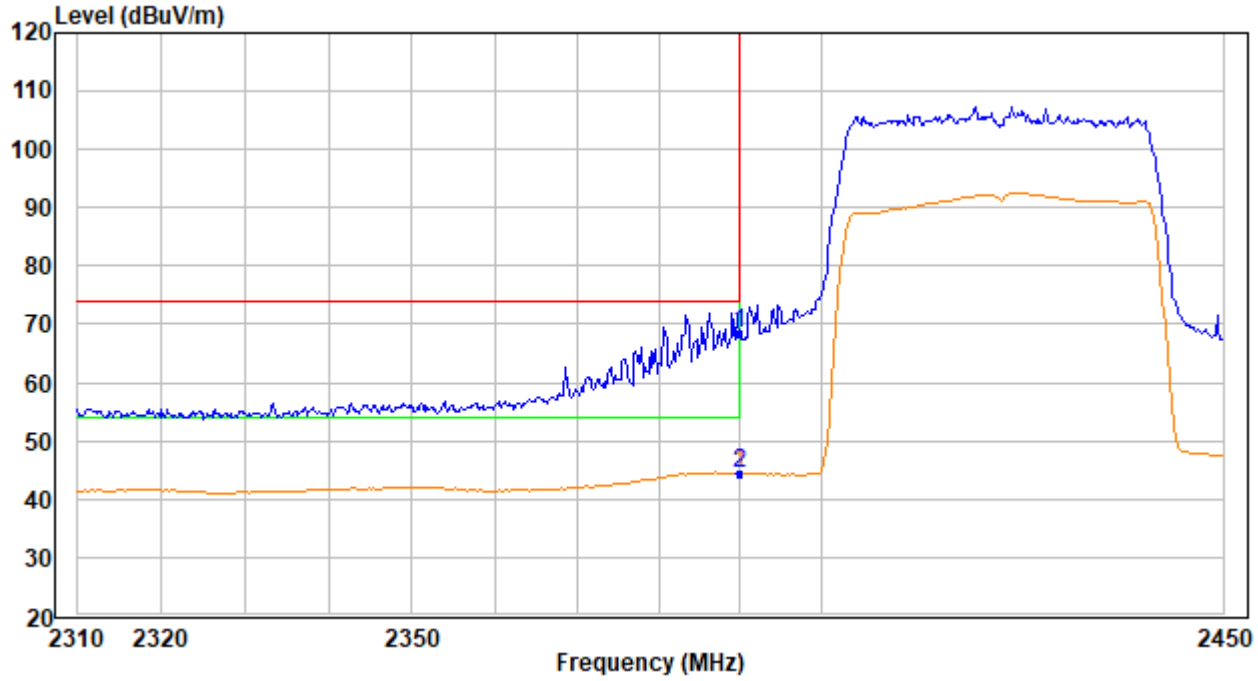
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	59.74	74.00	40.79	54.00	Pass

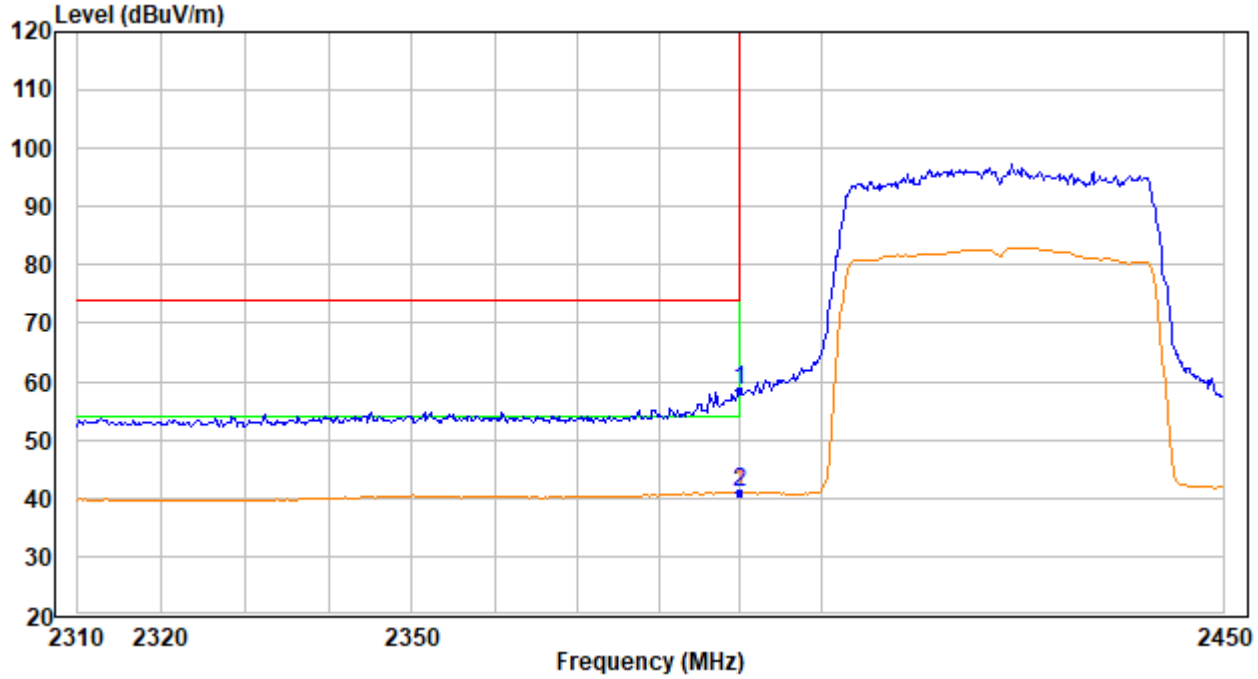
IEEE 802.11ax-HE40

Test Channel:	Channel 3	Ant. Polar. :	Horizontal



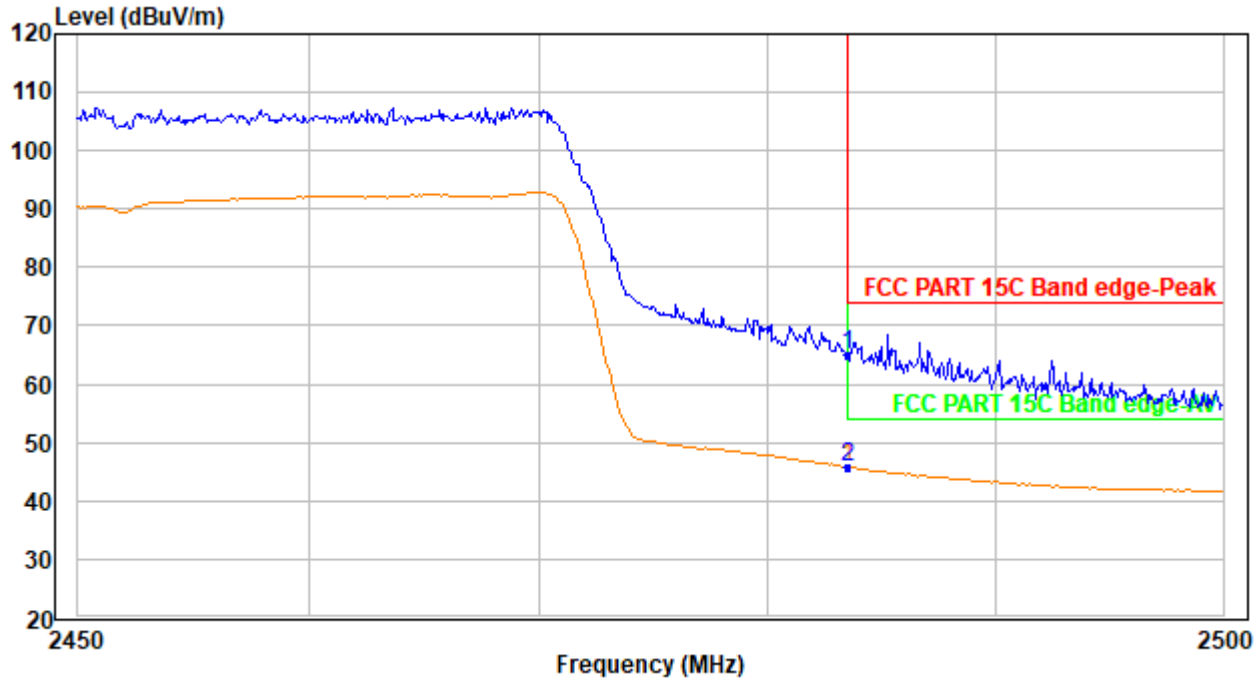
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	68.57	74.00	44.38	54.00	Pass

Test Channel:	Channel 3	Ant. Polar. :	Vertical



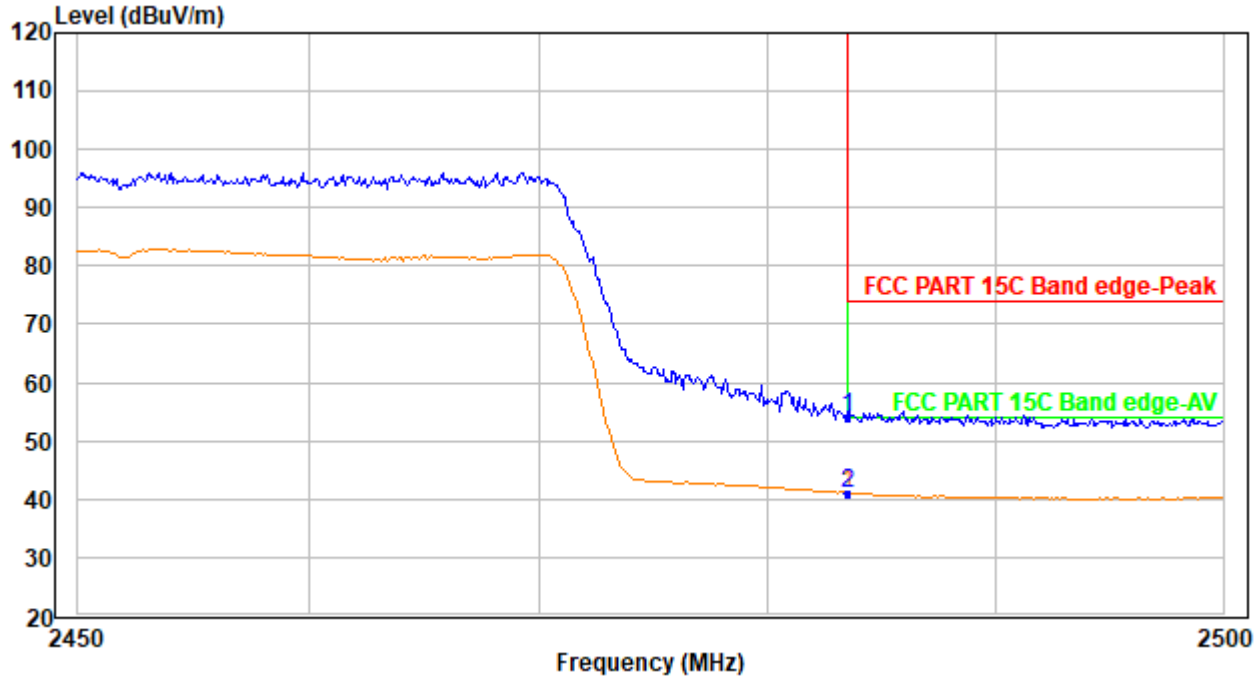
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	58.58	74.00	40.88	54.00	Pass

Test Channel:	Channel 9	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	65.04	74.00	45.72	54.00	Pass

Test Channel:	Channel 9	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	54.14	74.00	40.94	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

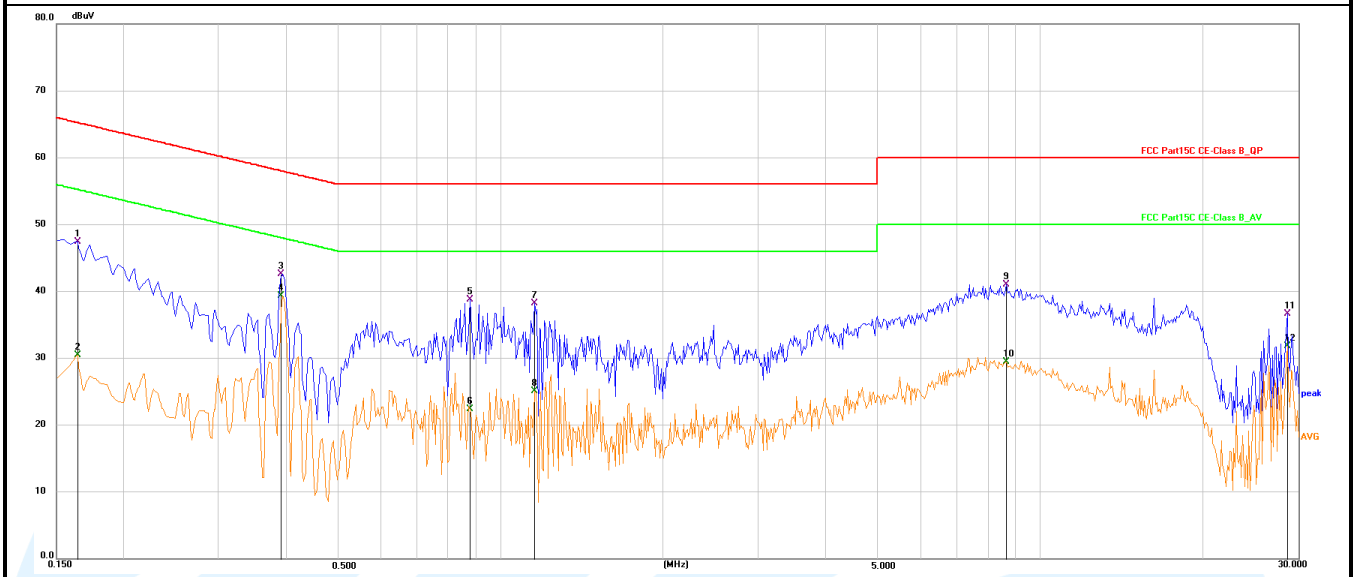
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second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

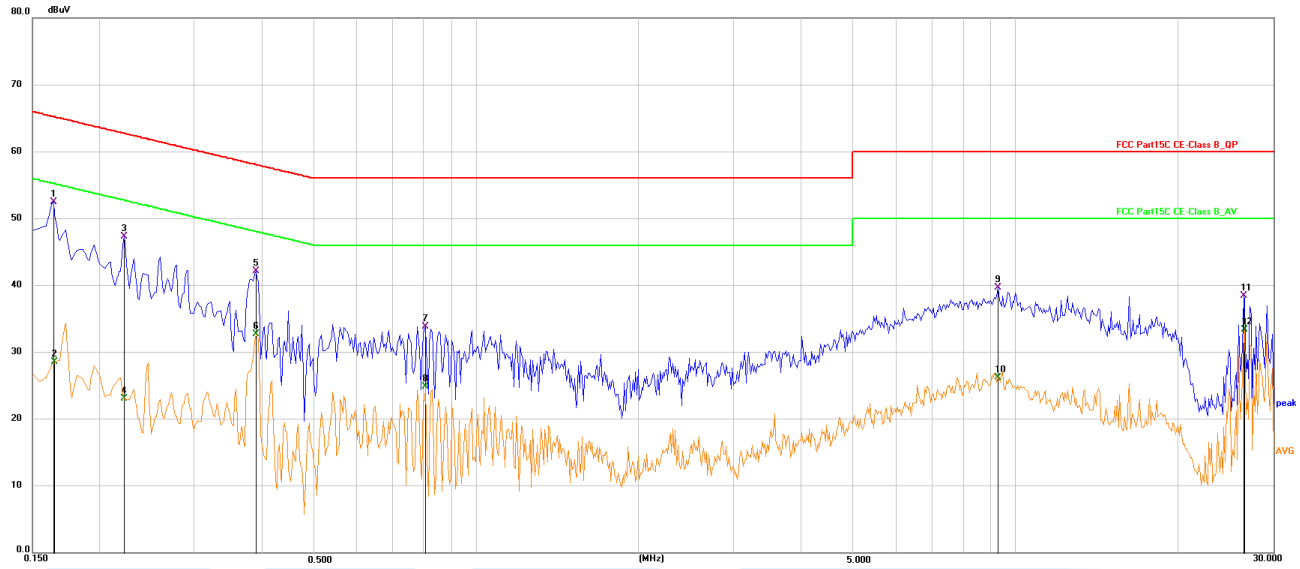
The worst measurement data as follows:
Quasi Peak and Average:
Mode: WIFI Link

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1641	37.27	10.19	47.46	65.25	-17.79	QP
2	0.1641	20.28	10.19	30.47	55.25	-24.78	AVG
3	0.3933	32.45	10.13	42.58	57.99	-15.41	QP
4	0.3933	29.18	10.13	39.31	47.99	-8.68	AVG
5	0.8757	28.48	10.28	38.76	56.00	-17.24	QP
6	0.8757	12.16	10.28	22.44	46.00	-23.56	AVG
7	1.1534	27.91	10.33	38.24	56.00	-17.76	QP
8	1.1534	14.74	10.33	25.07	46.00	-20.93	AVG
9	8.6373	30.52	10.48	41.00	60.00	-19.00	QP
10	8.6373	18.95	10.48	29.43	50.00	-20.57	AVG
11	28.6030	25.75	10.90	36.65	60.00	-23.35	QP
12	28.6030	20.89	10.90	31.79	50.00	-18.21	AVG

Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1635	42.34	10.16	52.50	65.28	-12.78	QP
2	0.1650	18.36	10.15	28.51	55.21	-26.70	AVG
3	0.2220	37.19	10.06	47.25	62.74	-15.49	QP
4	0.2220	12.99	10.06	23.05	52.74	-29.69	AVG
5	0.3885	31.90	10.18	42.08	58.10	-16.02	QP
6	0.3885	22.49	10.18	32.67	48.10	-15.43	AVG
7	0.8070	23.62	10.22	33.84	56.00	-22.16	QP
8	0.8070	14.62	10.22	24.84	46.00	-21.16	AVG
9	9.2985	29.27	10.38	39.65	60.00	-20.35	QP
10	9.2985	15.77	10.38	26.15	50.00	-23.85	AVG
11	26.4884	27.60	10.82	38.42	60.00	-21.58	QP
12	26.6100	22.53	10.82	33.35	50.00	-16.65	AVG

Remark:

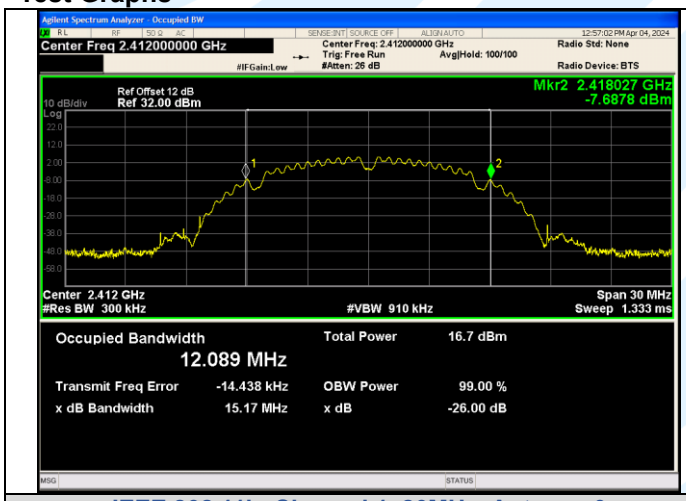
1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result - Limit
4. An initial pre-scan was performed on the Phase and neutral lines with peak detector.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

APPENDIX A RF TEST DATA

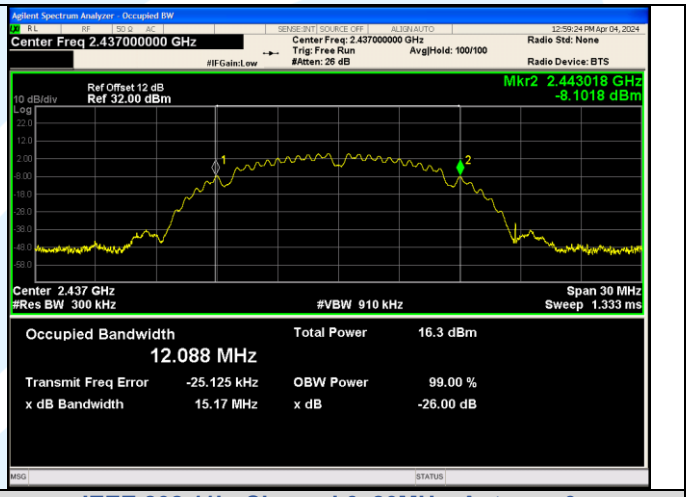
A.1 99% BANDWIDTH

Mode	Channel	RU & Index	Ant.	99% BW (MHz)
IEEE 802.11b	1	N/A	0	12.089
	6			12.088
	11			12.091
IEEE 802.11g	1			17.060
	6			17.102
	11			17.082
IEEE 802.11n_20	1			18.108
	6			18.121
	11			18.097
IEEE 802.11n_40	3			36.457
	6			36.478
	9			36.485
IEEE 802.11ax_20	1	SU		19.183
	6			19.158
	11			19.183
IEEE 802.11ax_40	3			37.866
	6			37.887
	9			37.914

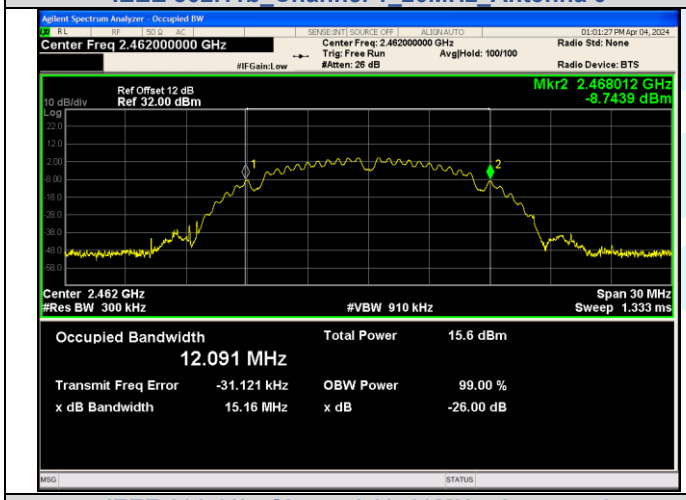
Test Graphs



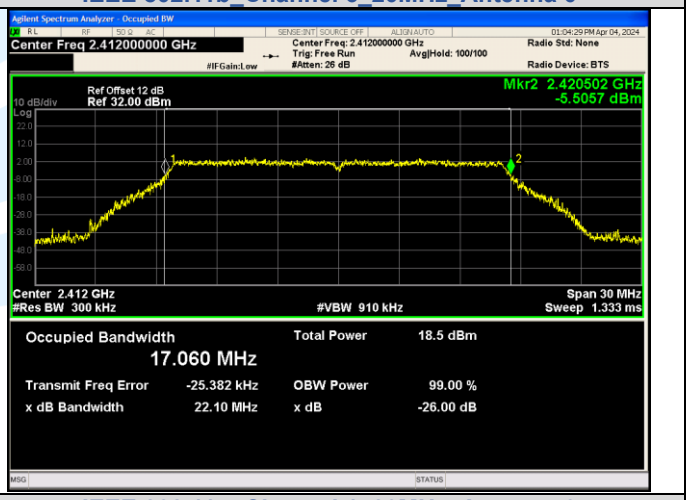
IEEE 802.11b_Channel 1_20MHz_Antenna 0



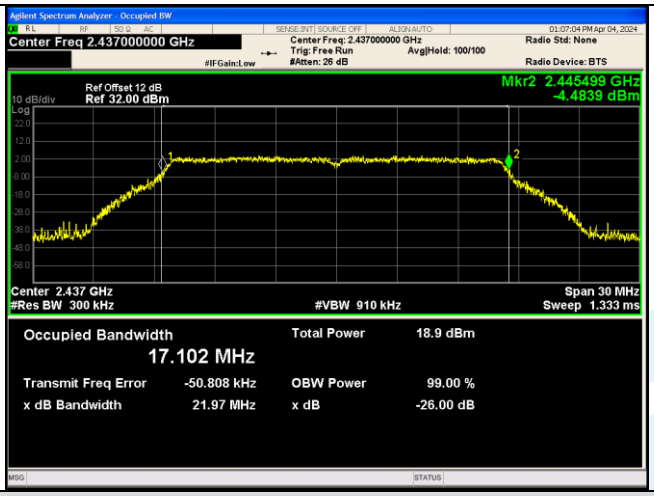
IEEE 802.11b_Channel 6_20MHz_Antenna 0



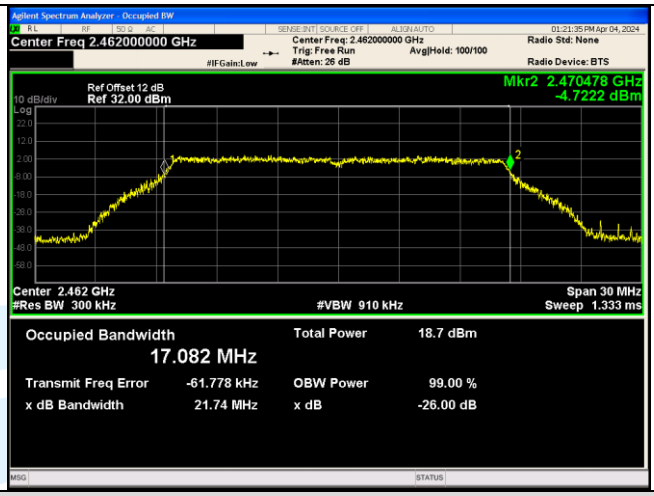
IEEE 802.11b_Channel 11_20MHz_Antenna 0



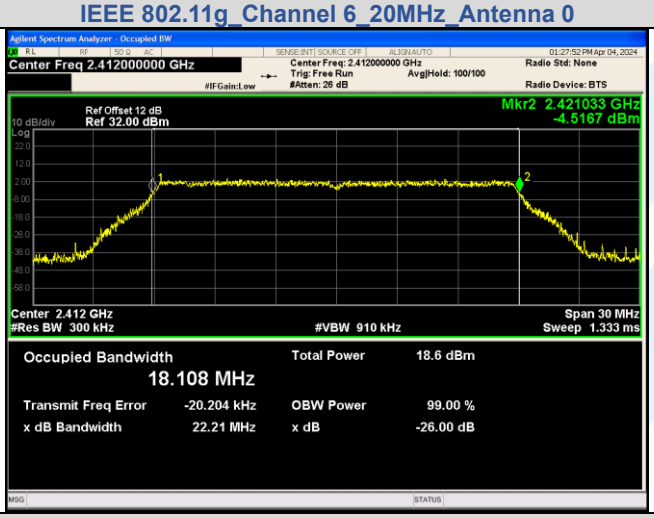
IEEE 802.11g_Channel 1_20MHz_Antenna 0



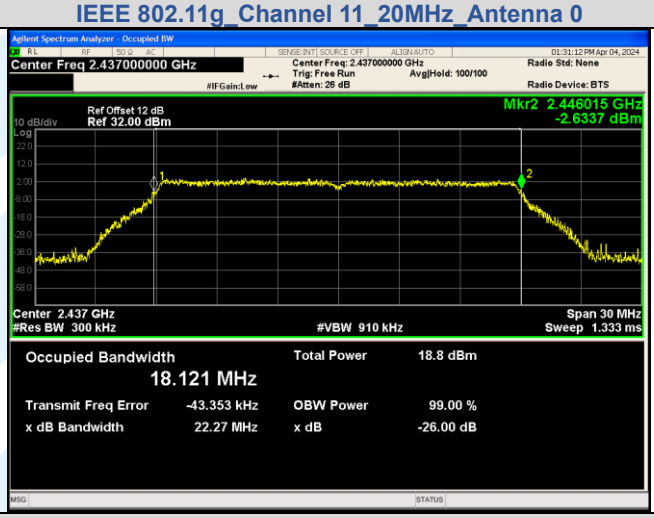
IEEE 802.11g_Channel 6_20MHz_Antenna 0



IEEE 802.11g_Channel 11_20MHz_Antenna 0



IEEE 802.11n_Channel 1_20MHz_Antenna 0



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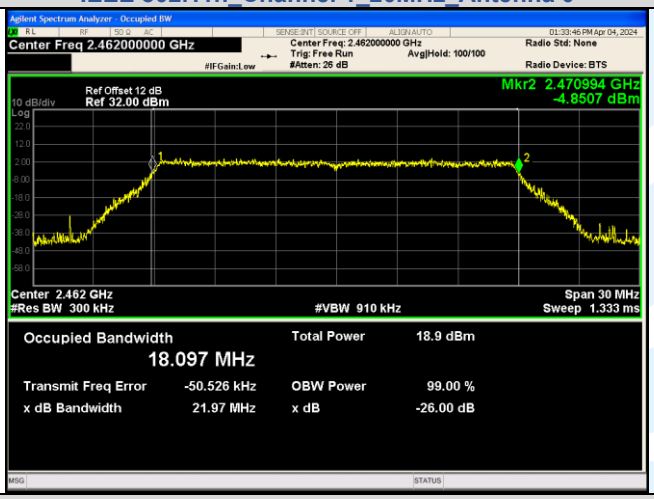
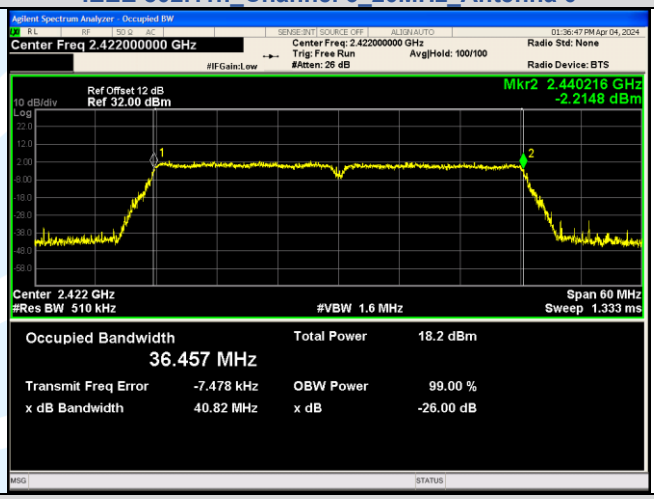
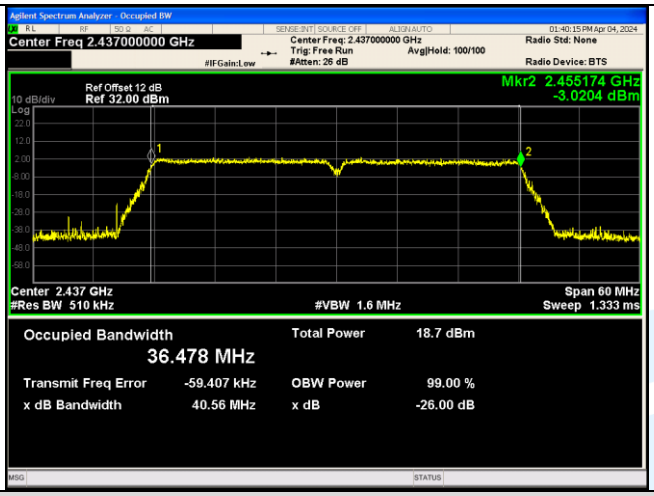


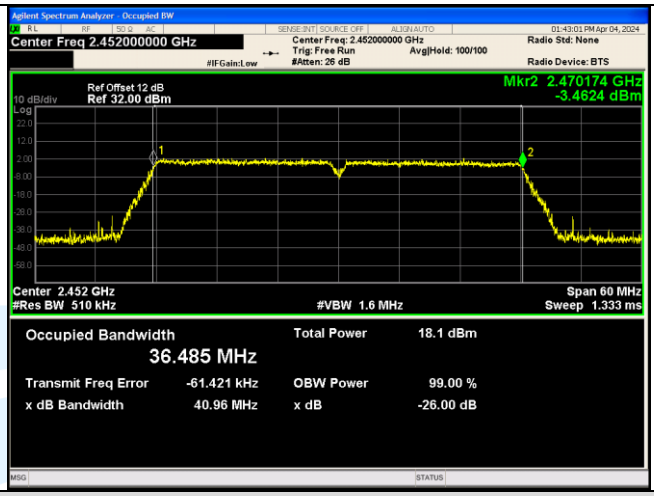
IEEE 802.11n_Channel 11_20MHz_Antenna 0



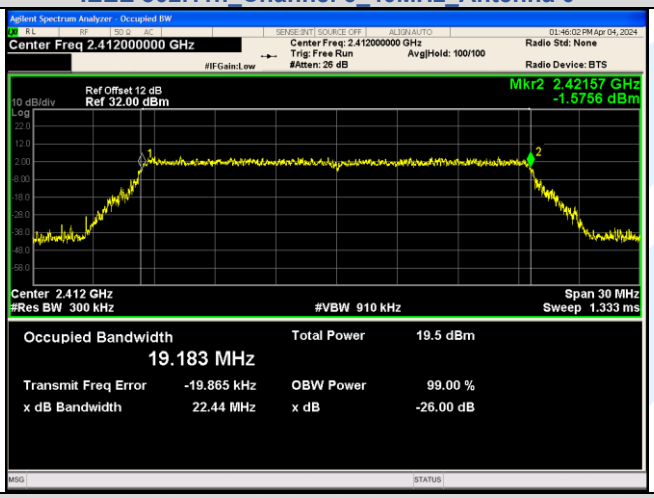
IEEE 802.11n_Channel 3_40MHz_Antenna 0



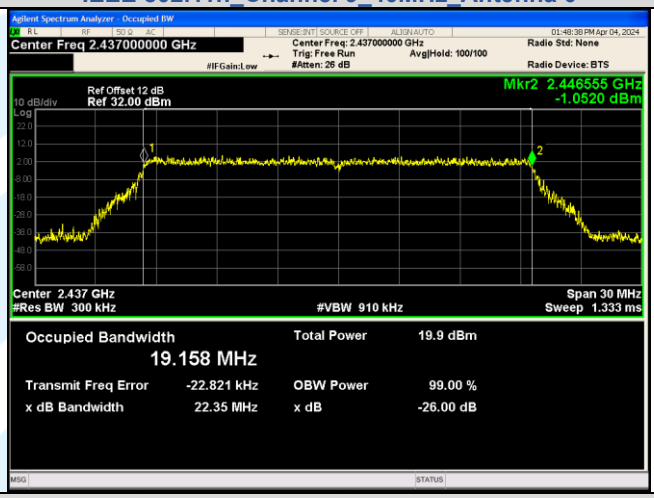
IEEE 802.11n_Channel 6_40MHz_Antenna 0



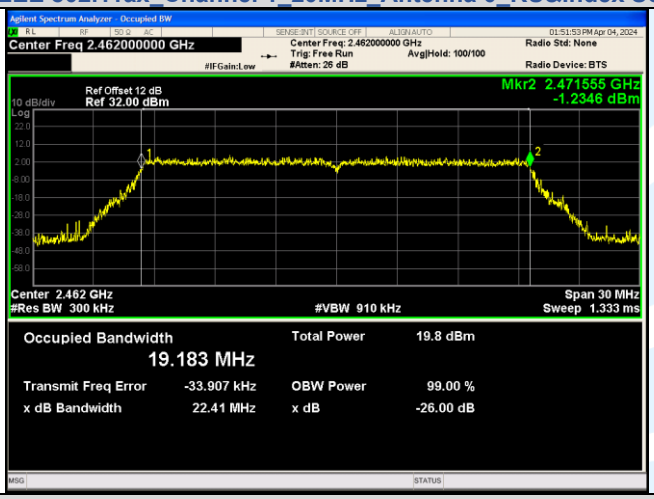
IEEE 802.11n_Channel 9_40MHz_Antenna 0



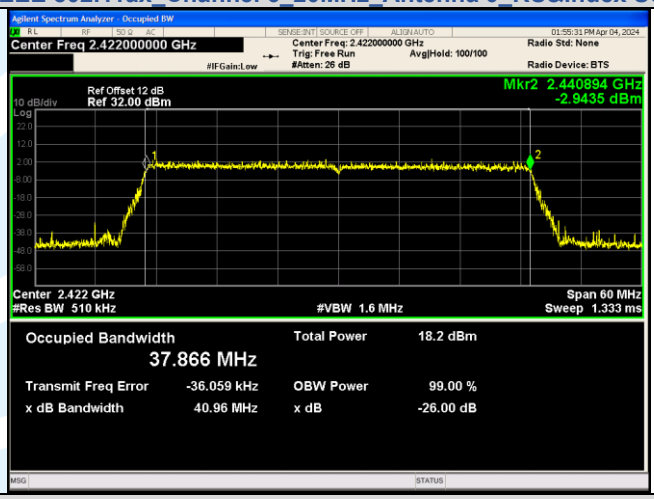
IEEE 802.11ax_Channel 1_20MHz_Antenna 0_RU&Index SU



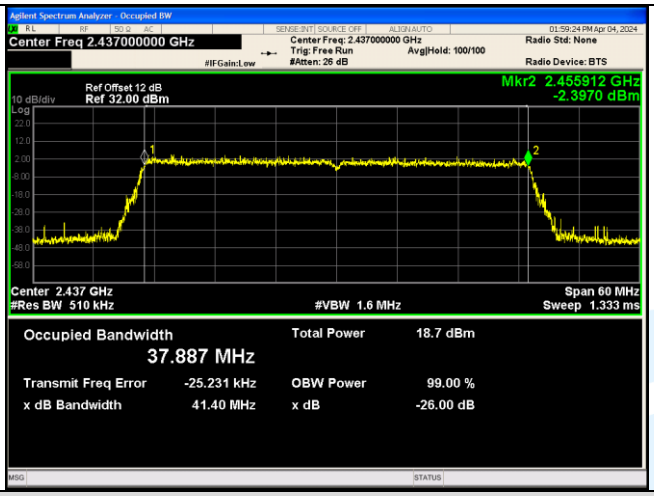
IEEE 802.11ax_Channel 6_20MHz_Antenna 0_RU&Index SU



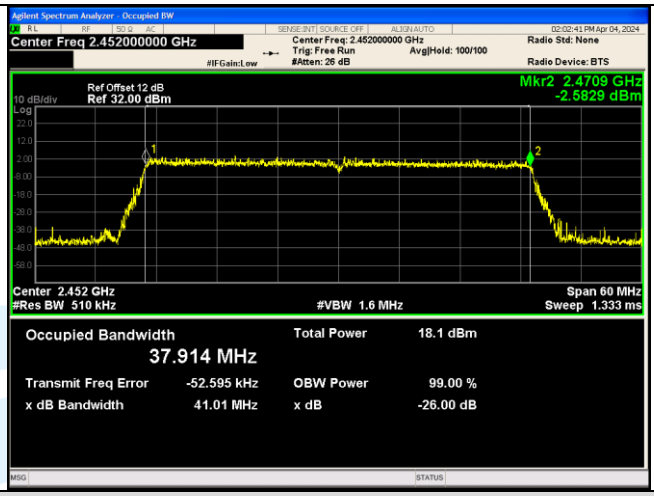
IEEE 802.11ax_Channel 11_20MHz_Antenna 0_RU&Index SU



IEEE 802.11ax_Channel 3_40MHz_Antenna 0_RU&Index SU



IEEE 802.11ax_Channel 6_40MHz_Antenna 0_RU&Index SU

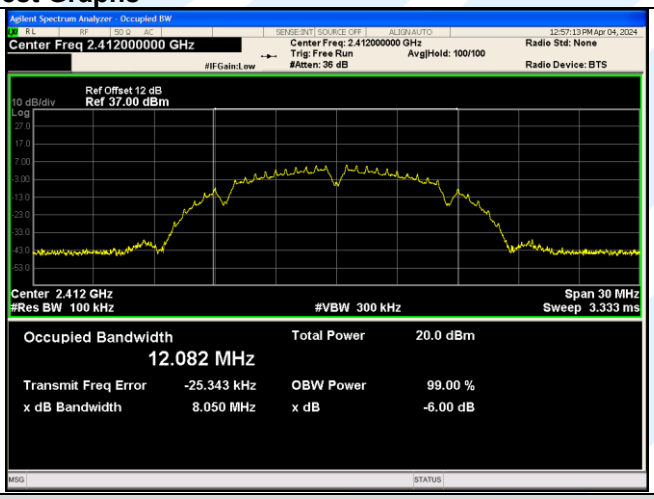


IEEE 802.11ax_Channel 9_40MHz_Antenna 0_RU&Index SU

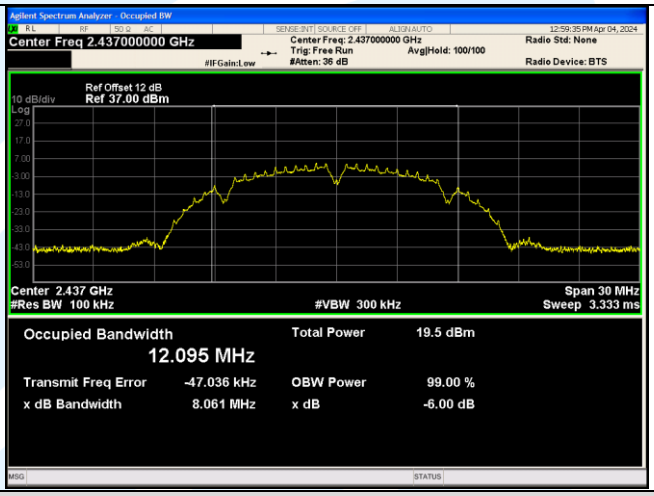
A.2 6DB BANDWIDTH

Mode	Channel	RU & Index	Ant.	Center Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
IEEE 802.11b	1	N/A	0	2412	8.050	0.5	PASS
	6			2437	8.061		PASS
	11			2462	8.072		PASS
IEEE 802.11g	1			2412	16.48		PASS
	6			2437	16.40		PASS
	11			2462	16.39		PASS
IEEE 802.11n_20	1			2412	17.64		PASS
	6			2437	17.66		PASS
	11			2462	17.66		PASS
IEEE 802.11n_40	3			2422	36.33		PASS
	6			2437	36.35		PASS
	9			2452	36.33		PASS
IEEE 802.11ax_20	1	SU		2412	19.08		PASS
	6			2437	19.02		PASS
	11			2462	19.06		PASS
IEEE 802.11ax_40	3			2422	38.06		PASS
	6			2437	38.13		PASS
	9			2452	37.93		PASS

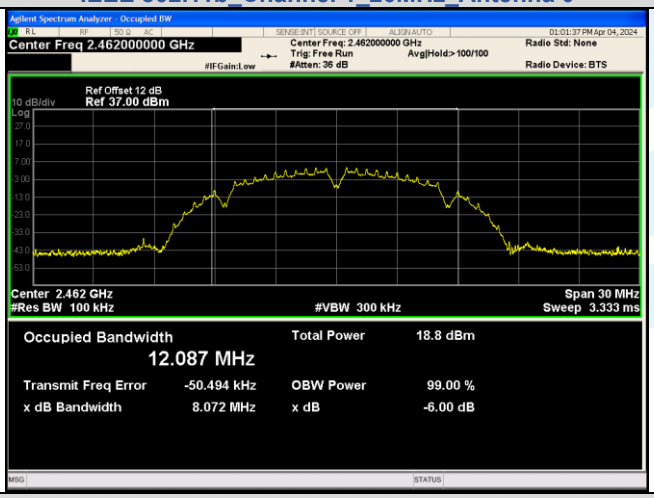
Test Graphs



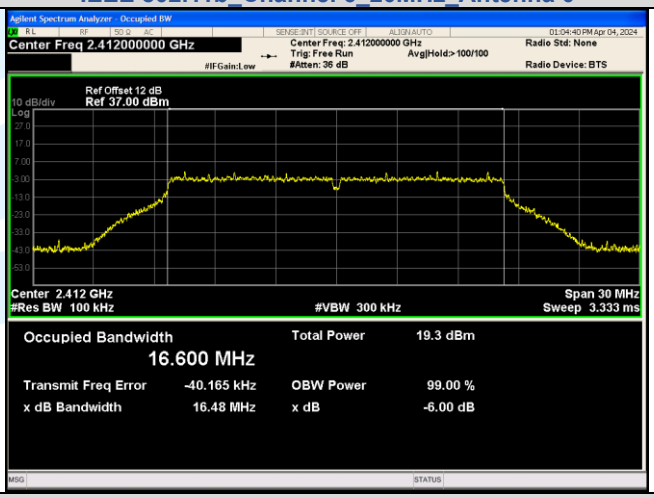
IEEE 802.11b_Channel 1_20MHz_Antenna 0



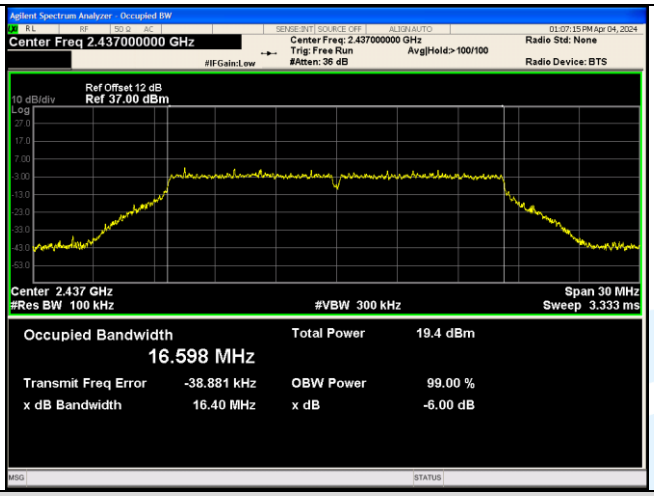
IEEE 802.11b_Channel 6_20MHz_Antenna 0



IEEE 802.11b_Channel 11_20MHz_Antenna 0



IEEE 802.11g_Channel 1_20MHz_Antenna 0



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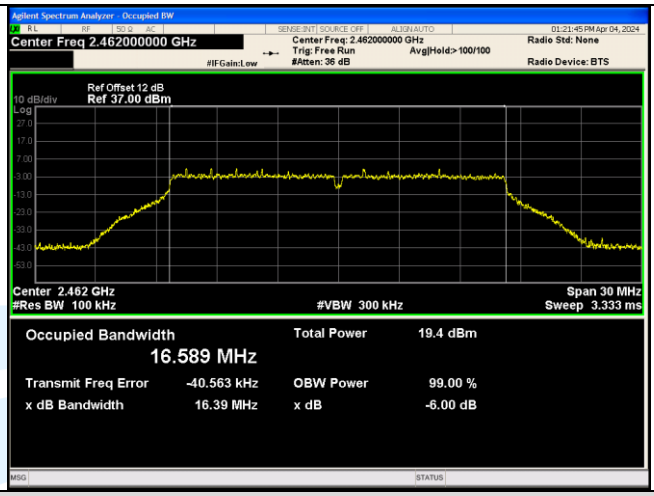

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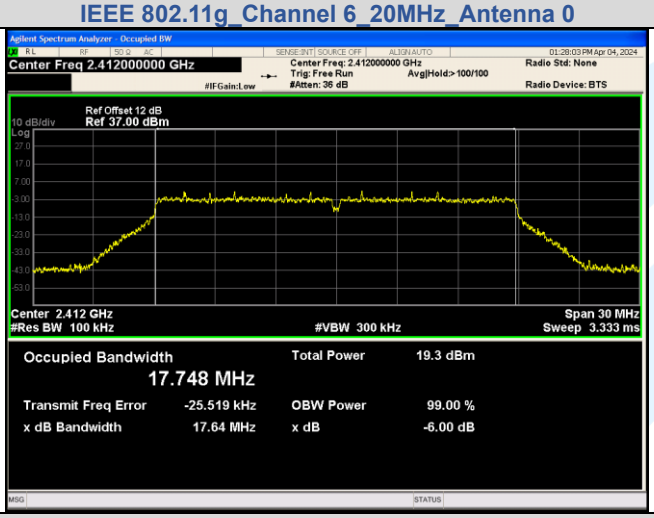
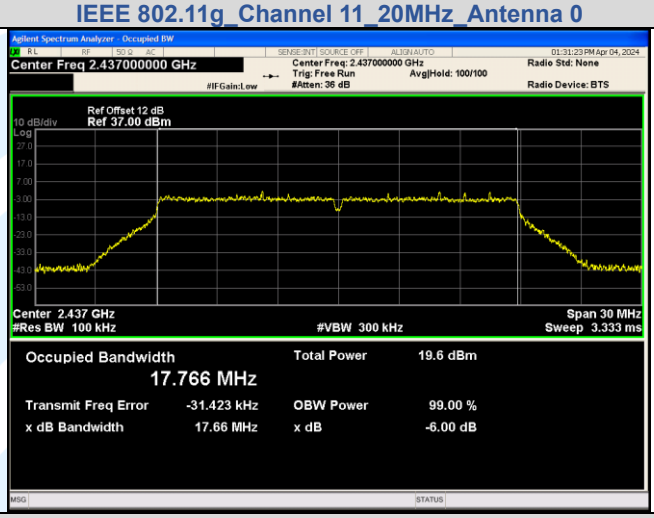
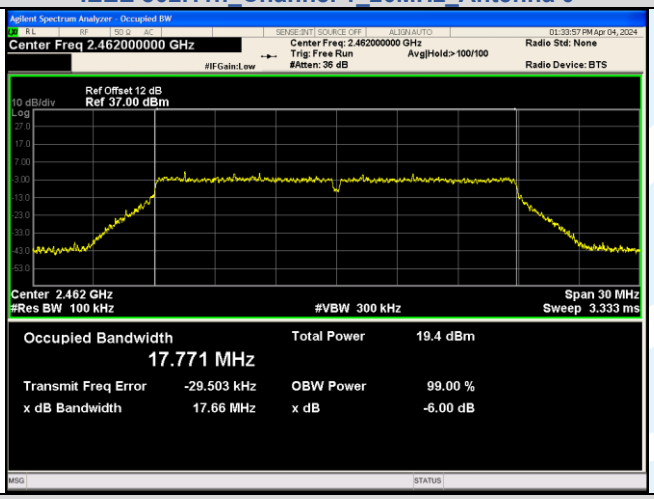


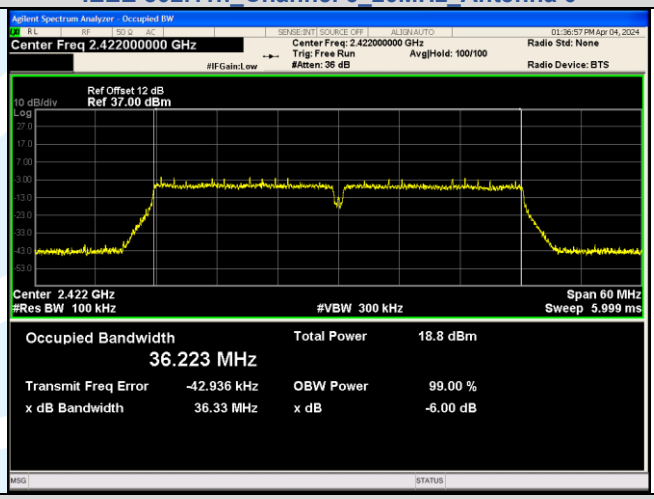
IEEE 802.11n_Channel 1_20MHz_Antenna 0



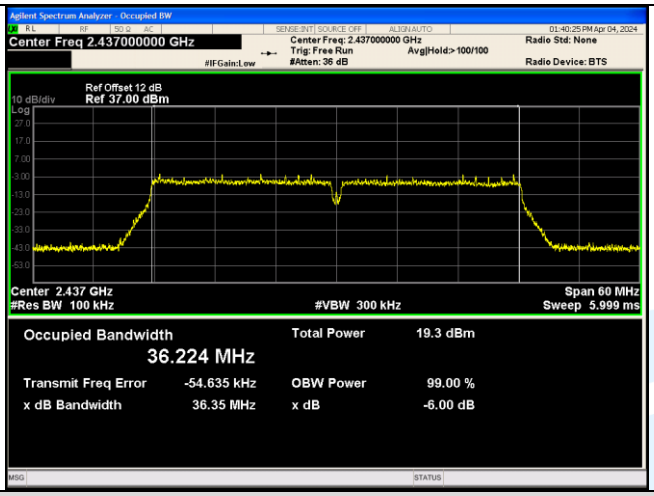
IEEE 802.11n_Channel 6_20MHz_Antenna 0



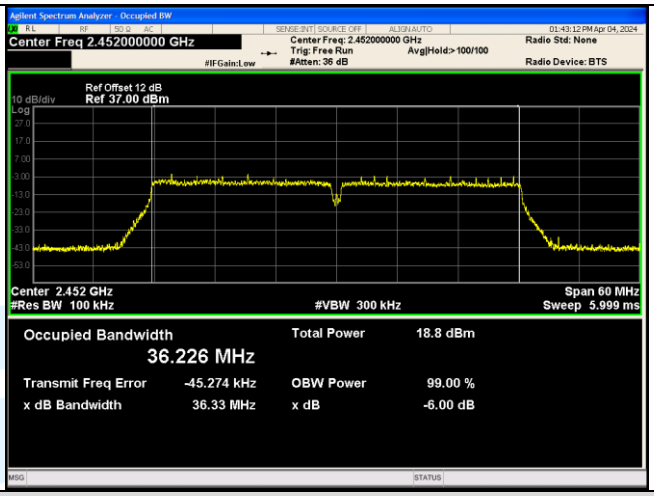
IEEE 802.11n_Channel 11_20MHz_Antenna 0



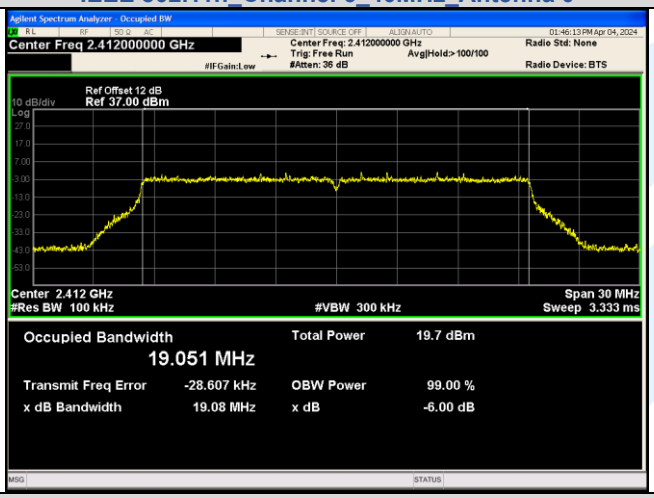
IEEE 802.11n_Channel 3_40MHz_Antenna 0



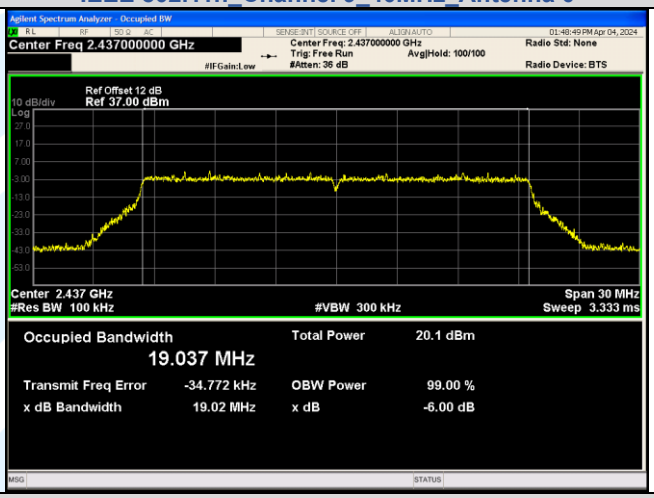
IEEE 802.11n_Channel 6_40MHz_Antenna 0



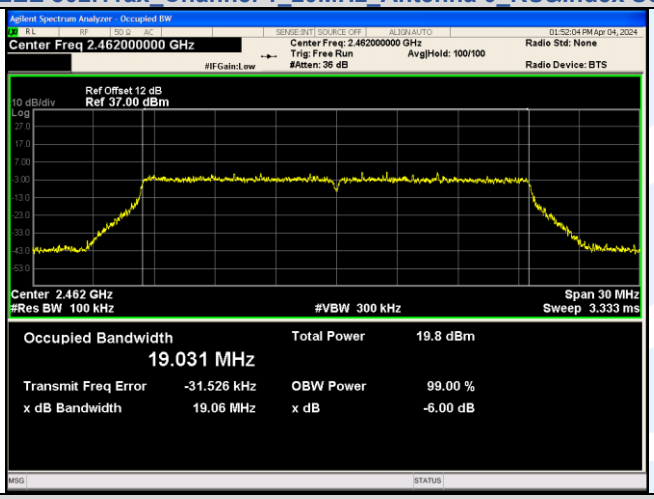
IEEE 802.11n_Channel 9_40MHz_Antenna 0



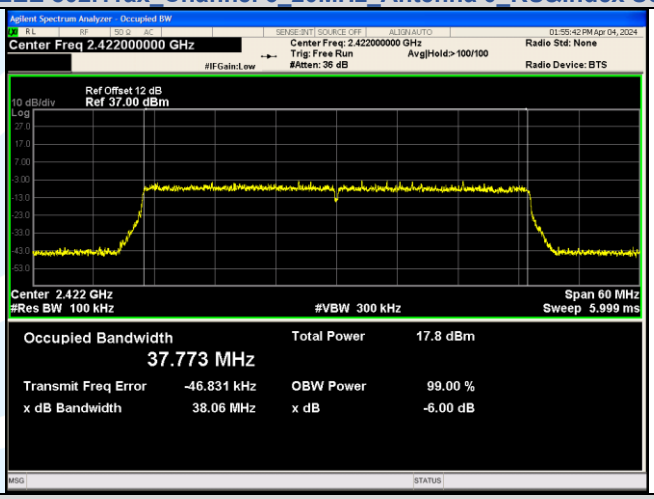
IEEE 802.11ax_Channel 1_20MHz_Antenna 0_RU&Index SU



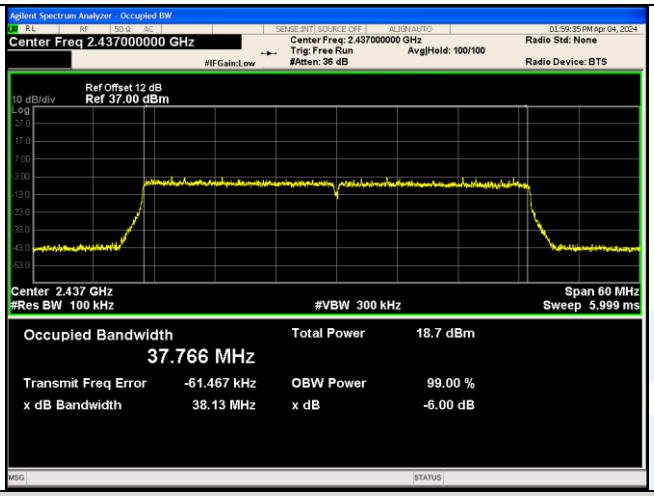
IEEE 802.11ax_Channel 6_20MHz_Antenna 0_RU&Index SU



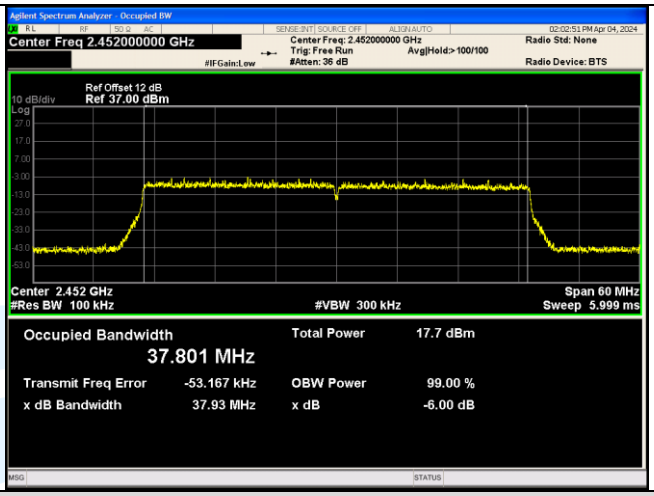
IEEE 802.11ax_Channel 11_20MHz_Antenna 0_RU&Index SU



IEEE 802.11ax_Channel 3_40MHz_Antenna 0_RU&Index SU



IEEE 802.11ax_Channel 6_40MHz_Antenna 0_RU&Index SU



IEEE 802.11ax_Channel 9_40MHz_Antenna 0_RU&Index SU