ACCREDITED
Certificate #4312.01

TEST REPORT

Product Name:	IP Phone
Trade Mark:	GRANDSTREAM
Model No.:	GRP2614
HVIN:	GRP2614V2CW
Report Number:	220105006RFC-3
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-247 Issue 2 RSS-Gen Issue 5
FCC ID:	YZZGRP2614V2CW
IC:	11964A-GRP2614V2CW
Test Result:	PASS
Date of Issue:	March 29, 2022

Prepared for:

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

Prepared by:

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UnionTrust Laboratories UnionTrust *Certified*

Date: March 29, 2022

Version

Version No.	Date	Description
V1.0	March 29, 2022	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.:	GRP2614		
HVIN:	GRP2614V2CW		
Trade Mark:	GRANDSTREAM		
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
Sample Received Date:	January 6, 2022		
Sample Tested Date:	January 6, 2022 to March 9, 2022		

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.:	GQ12-120100-AU
Input:	100-240 V~50/60 Hz 0.4A Max
Output:	12 V⎓1.0 A
DC Cable:	2.5 Meter, Unshielded without ferrite

Adapter(2)	
Model No.:	DSA-12PFU-12 FUS 120100
Input:	100-240 V~50/60 Hz 0.5A
Output:	12 V⎓1.0 A 12.0W
DC Cable:	2.5 Meter, Unshielded without ferrite

Adapter(3)	
Model No.:	F12US1200100A
Input:	100-240 V~50/60 Hz 0.5A max
Output:	12 V⎓1.0 A
DC Cable:	2.5 Meter, Unshielded without ferrite

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

Cable(2)	
Connector:	Phone Cord
Cable Type:	Unshielded without ferrite
Length:	3.5 Meter

Others
1x Handset, 1x Phone Stand

Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.

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 MCS7 IEEE 802.11n-HT40: Up to MCS7
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:	Dipole Antenna
Antenna Gain: (Provided by the customer)	3.5 dBi
Maximum e.i.r.p	IEEE 802.11b: 19.92 dBm IEEE 802.11g: 17.22 dBm IEEE 802.11n-HT20: 15.99 dBm IEEE 802.11n-HT40: 15.52 dBm
Maximum conducted output power:	IEEE 802.11b: 16.24 dBm IEEE 802.11g: 13.72 dBm IEEE 802.11n-HT20: 12.49 dBm IEEE 802.11n-HT40: 12.02 dBm
Normal Test Voltage:	120V~60Hz

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	Latitude 3400	16238087894	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust
Headset	YEY	VE120-MV	N/A	UnionTrust
IP Phone	GRANDSTREAM	GRP2615	N/A	Applicant

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Ethernet Cable	RJ45	1.5 Unshielded without ferrite	UnionTrust
2	Ethernet Cable	RJ45	2.0 Unshielded without ferrite	UnionTrust
3	Ethernet Cable	RJ45	5.0 Unshielded without ferrite	UnionTrust
4	Antenna Cable	SMA	0.5 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	± 4.9 dB
5	Radiated emission 1GHz-18GHz	± 4.8 dB
6	Radiated emission 18GHz-26GHz	± 5.1 dB
7	Radiated emission 26GHz-40GHz	± 5.1 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.68 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	2.4 GHz: ± 6.5 x 10^{-8}
12	Transmission Time	± 0.19 %

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart C Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c) RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013 Clause 6.2	PASS
Conducted Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 2, Section 5.4(d)	ANSI C63.10-2013 Clause 11.9.2.2.2	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 2, Section 5.2(a)	ANSI C63.10-2013 Clause 11.8.1	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, Section 6.7	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 2, Section 5.2(b)	ANSI C63.10-2013 Clause 11.10.3	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-Gen Issue 5, Section 6.13/8.9/8.10	ANSI C63.10-2013 Clause 11.11 & Clause 11.12	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.13	PASS
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 (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	3m SAC	ETS-LINDGREN	3m	Euroshiedpn-CT001270-1317	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 05, 2021	Nov. 04, 2022
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Apr. 22, 2021	Apr. 21, 2022
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 11, 2021	Nov. 10, 2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 11, 2021	Nov. 10, 2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 11, 2021	Nov. 10, 2023
☒	Preamplifier	HP	8447F	2805A02960	Nov. 05, 2021	Nov. 04, 2022
☒	Band Rejection Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G248	Nov. 06, 2021	Nov. 05, 2022
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	Apr. 30, 2021	Apr. 29, 2023
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	Nov. 06, 2021	Nov. 05, 2022
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 14, 2020	Nov. 13, 2023
☒	Pre-amplifier	ETS-Lindgren	00118384	00202652	Nov. 17, 2020	Nov. 16, 2022
☒	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 (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Nov. 05, 2021	Nov. 04, 2022
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 05, 2021	Nov. 04, 2022
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 05, 2021	Nov. 04, 2022
☒	LISN	ETS-Lindgren	3816/2SH	00201088	Nov. 05, 2021	Nov. 04, 2022
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Apr. 22, 2021	Apr. 21, 2022
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 05, 2021	Nov. 04, 2022
☐	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Nov. 05, 2021	Nov. 04, 2022
☐	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	Nov. 05, 2021	Nov. 04, 2022

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 (%)
NV/NT	+15 to +35	120V~60Hz	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
AC Power Line Conducted Emission	25.6	50	100.55	220105006-A02/4	David Zhang
Conducted Peak Output Power	25.5	49	100.55	220105006-A01/4	Hank Wu
6dB Bandwidth & Occupied Bandwidth					
Power Spectral Density					
Conducted Out of Band Emission					
Radiated Spurious Emissions	24.6	51	100.14	220105006-A02/4	Asia Yan
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 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40	2422 MHz to 2452 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	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

Power Setting(Provided by the customer)			
Mode	**Channel 1**	**Channel 6**	**Channel 11**
IEEE 802.11b	15	15	15
IEEE 802.11g	10	10	10
IEEE 802.11n-HT20	11	11	11
IEEE 802.11n-HT40	11	11	11

Test Software(Provided by the customer)
Test software name: QRCT4;

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

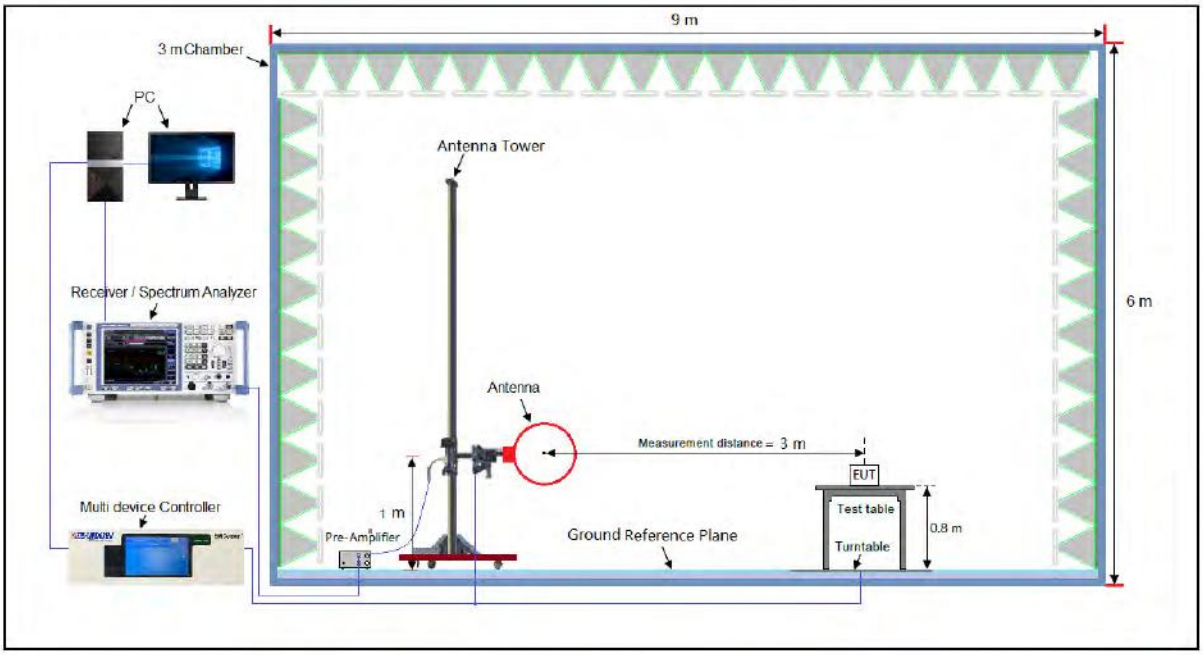


Figure 2. 30MHz to 1GHz

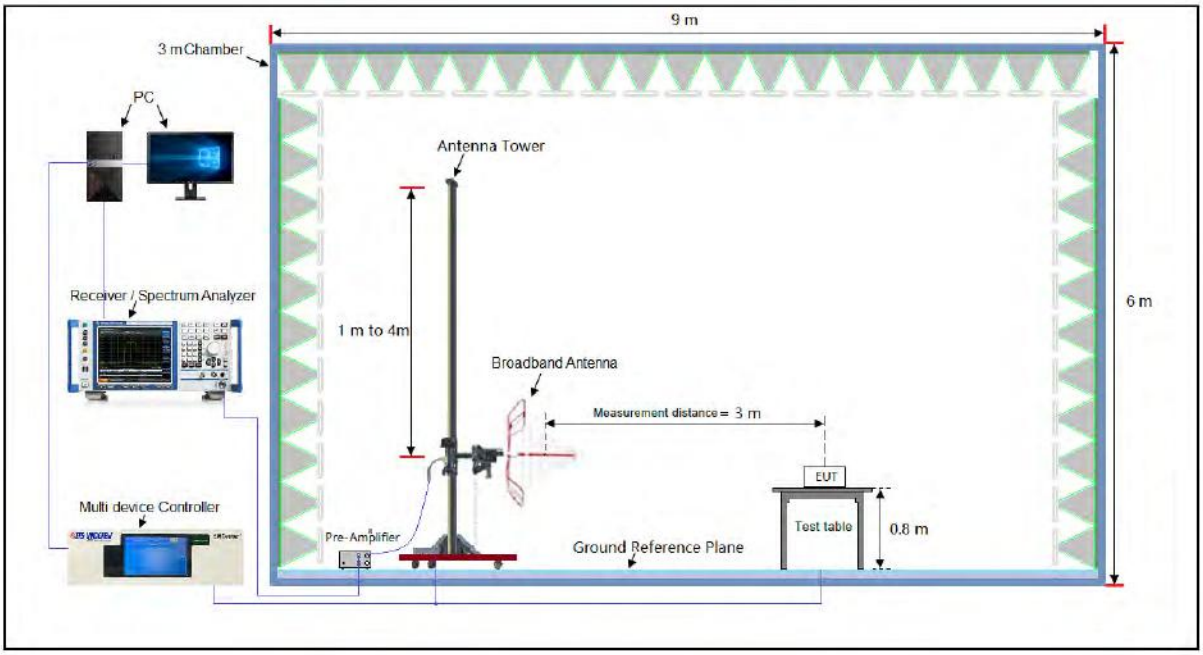
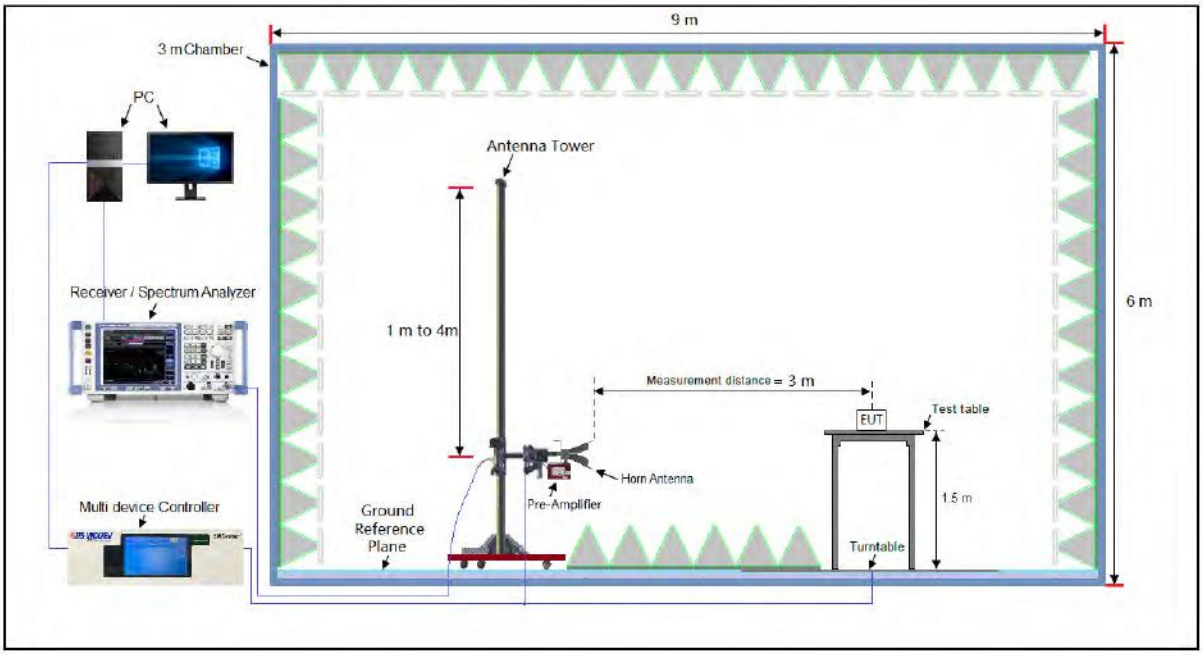
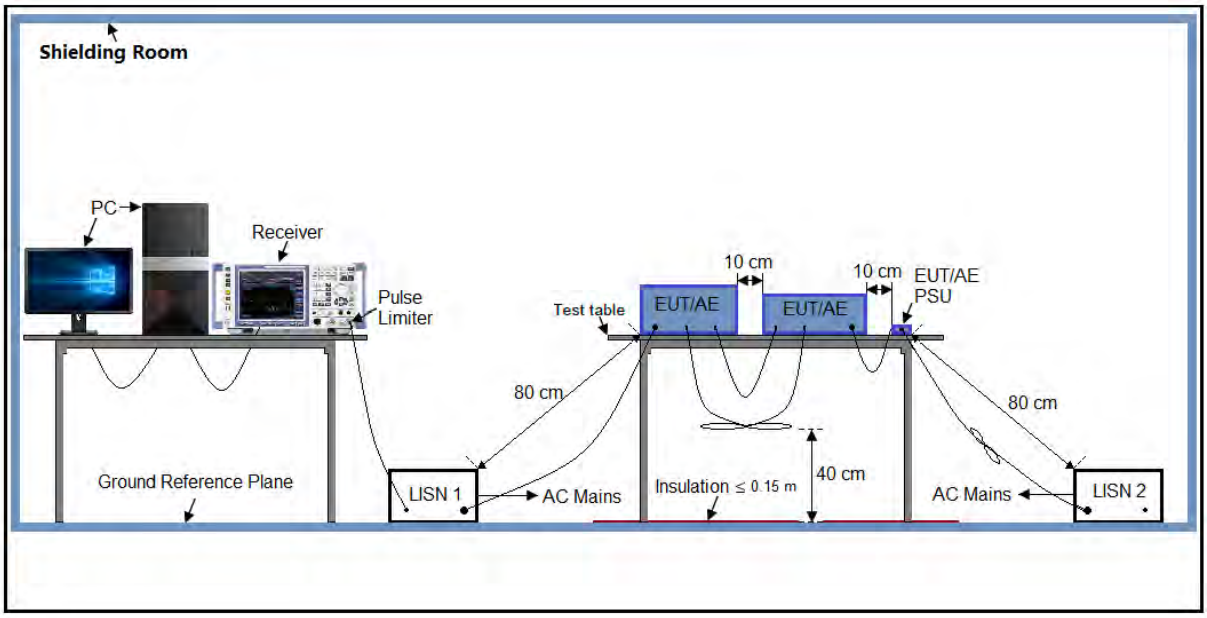


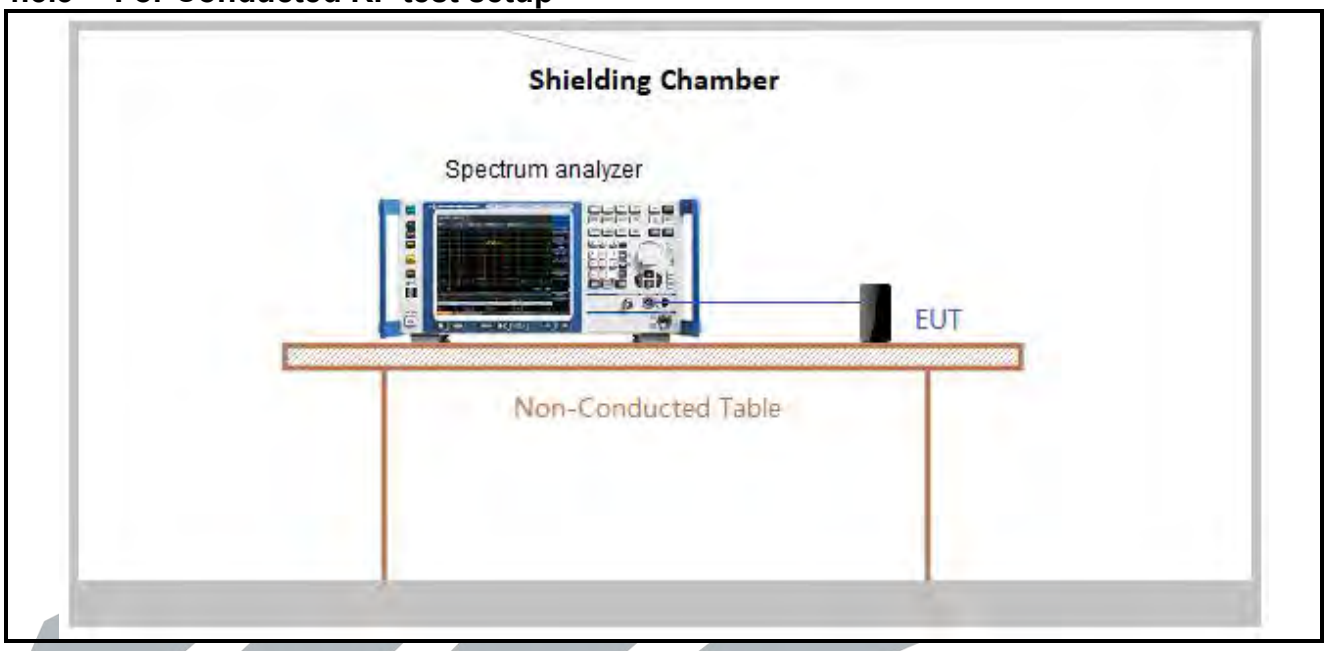
Figure 3. Above 1GHz



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. 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

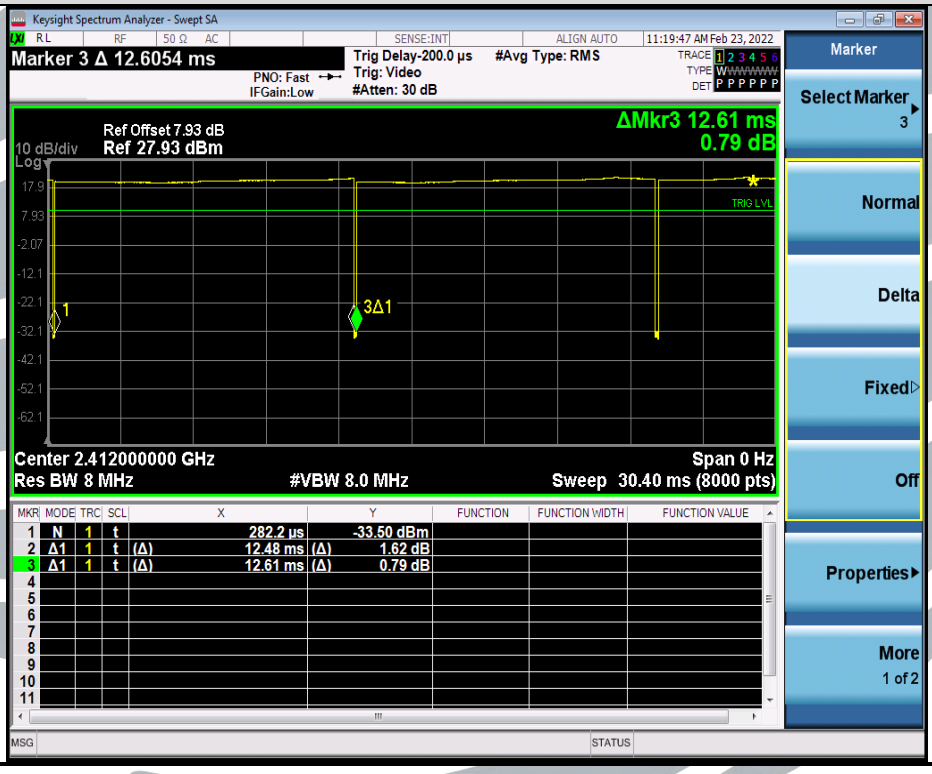
Mode	Data rates (Mbps)	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
IEEE 802.11b	1	12.48	12.61	0.99	98.97	0.00	0.01	-0.09
IEEE 802.11g	6	2.081	2.245	0.93	92.69	0.33	0.48	-0.66
IEEE 802.11n-HT20	MCS0	1.927	2.094	0.92	92.02	0.36	0.52	-0.72
IEEE 802.11n-HT40	MCS0	0.951	1.126	0.84	84.48	0.73	1.05	-1.46

Remark:

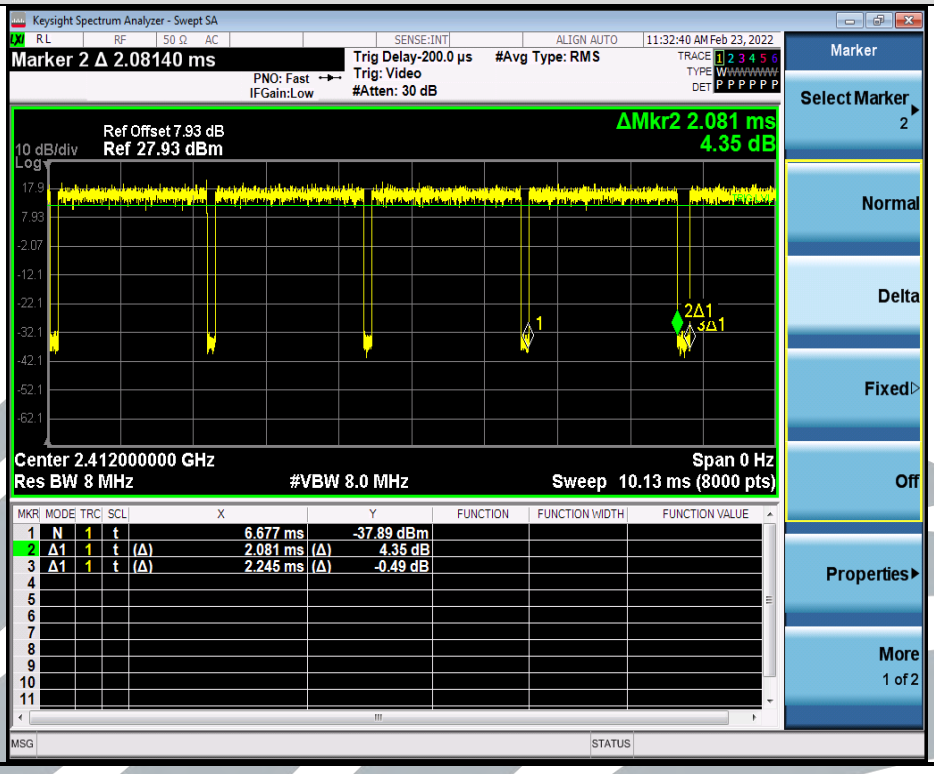
1) Duty cycle= On Time/ Period;
2) Duty Cycle factor = 10 * log(1/ Duty cycle);
3) Average factor = 20 $\log_{10}$ Duty Cycle.

The test plots as follows

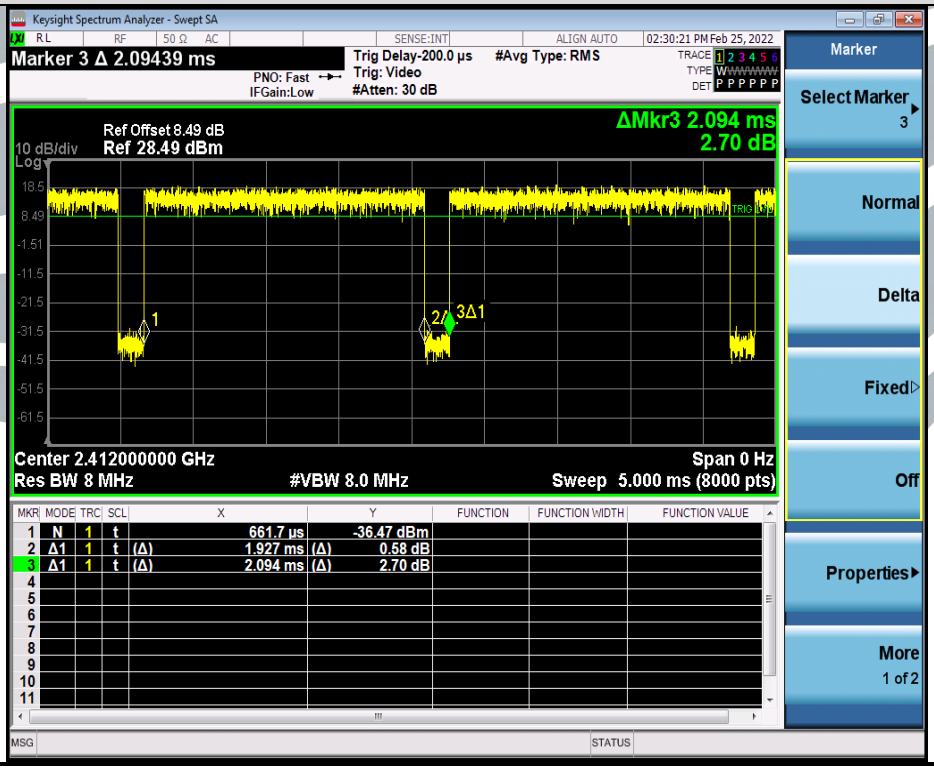
IEEE 802.11b



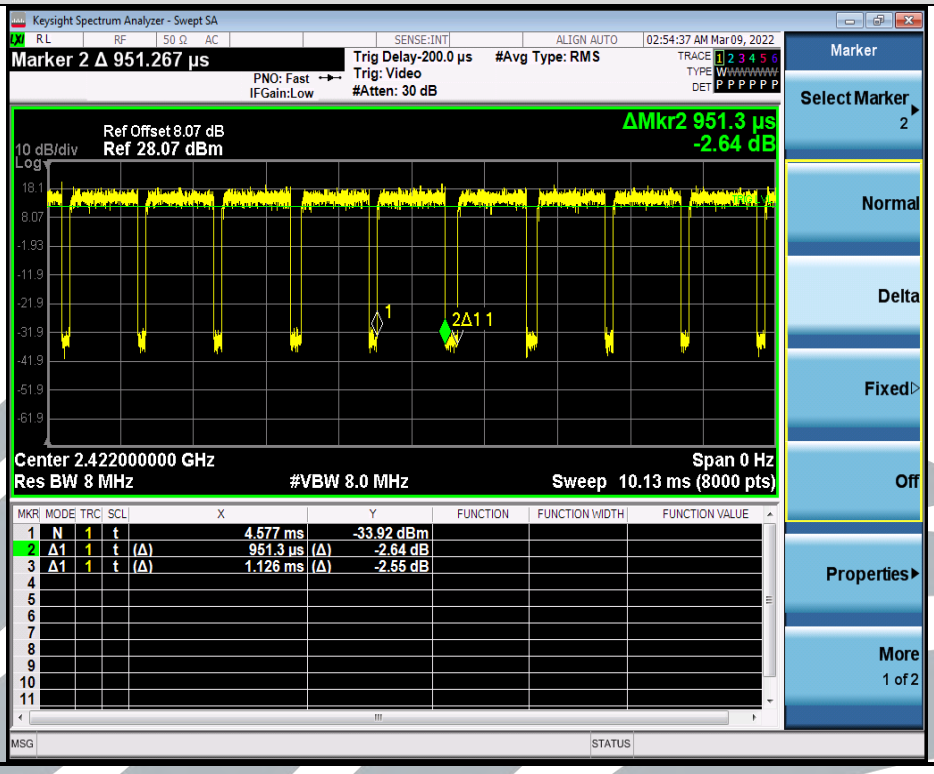
IEEE 802.11g



IEEE 802.11n-HT20



IEEE 802.11n-HT40



5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

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

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(b) (4) requirement:** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. **RSS-Gen Issue 5, Section 6.8 requirement:** According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
EUT Antenna:
Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 3.5 dBi.

5.3 CONDUCTED OUTPUT POWER

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

Test Method: ANSI C63.10-2013 Clause 11.9.2.2.2

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

Test Procedure: Method AVGSA-1 uses trace averaging with the EUT transmitting at full power throughout each sweep. The procedure for this method is as follows:

a) Set span to at least 1.5 times the OBW.

b) Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz

c) Set VBW ≥ [3 × RBW].

d) Number of points in sweep ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)

e) Sweep time = auto.

f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

g) If transmit duty cycle < 98%, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at the maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no OFF intervals) or at duty cycle ≥ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."

h) Trace average at least 100 traces in power averaging (rms) mode.

i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

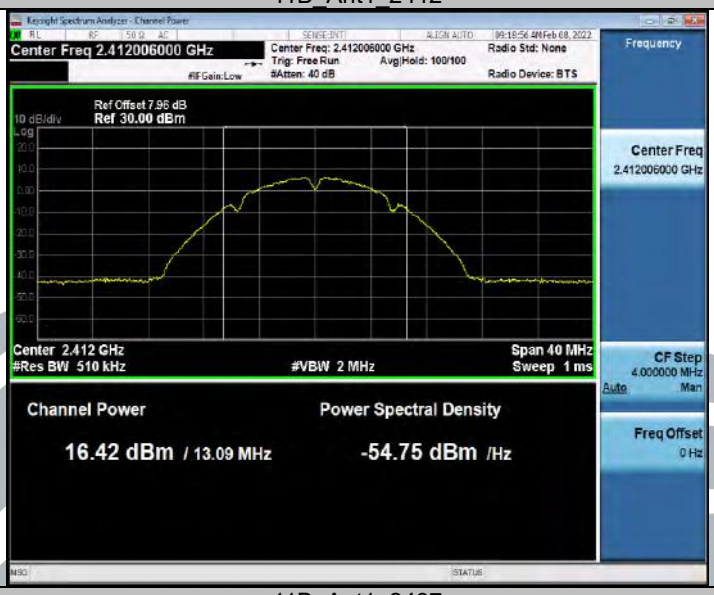
Test Results:

Test Mode	Antenna	Channel	Result[dBm]	EIRP[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	16.42	19.92	≤30	PASS
		2437	16.10	19.60	≤30	PASS
		2462	15.79	19.29	≤30	PASS
11G	Ant1	2412	13.72	17.22	≤30	PASS
		2437	13.51	17.01	≤30	PASS
		2462	13.14	16.64	≤30	PASS
11N20SISO	Ant1	2412	12.49	15.99	≤30	PASS
		2437	12.22	15.72	≤30	PASS
		2462	11.94	15.44	≤30	PASS
11N40SISO	Ant1	2422	12.02	15.52	≤30	PASS
		2437	11.74	15.24	≤30	PASS
		2452	11.43	14.93	≤30	PASS

Note: The antenna gain of 3.5 dBi less than 6dBi maximum permission antenna gain value based on 1 watt (30dBm) peak output power limit.

Test Graphs:

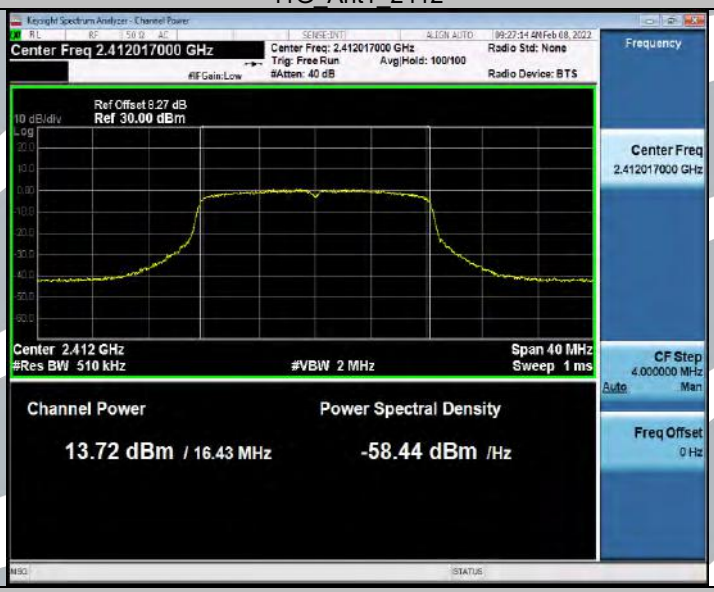
11B_Ant1_2412



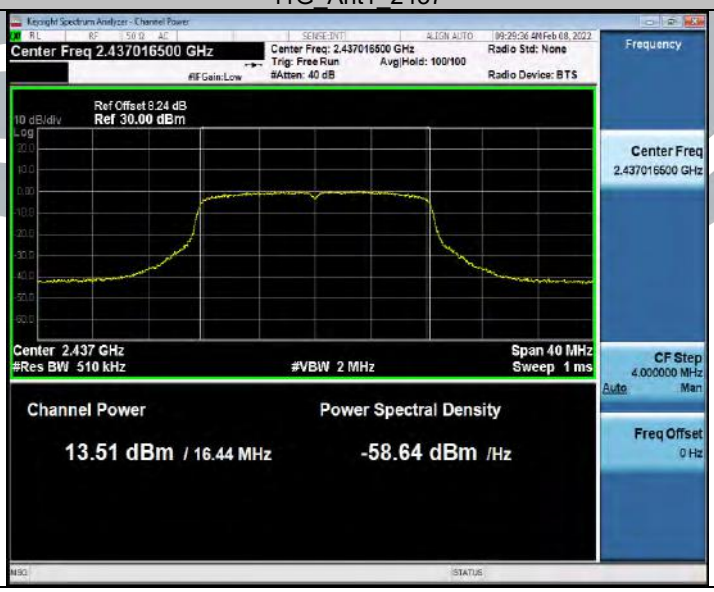
11B_Ant1_2437

11B_Ant1_2462

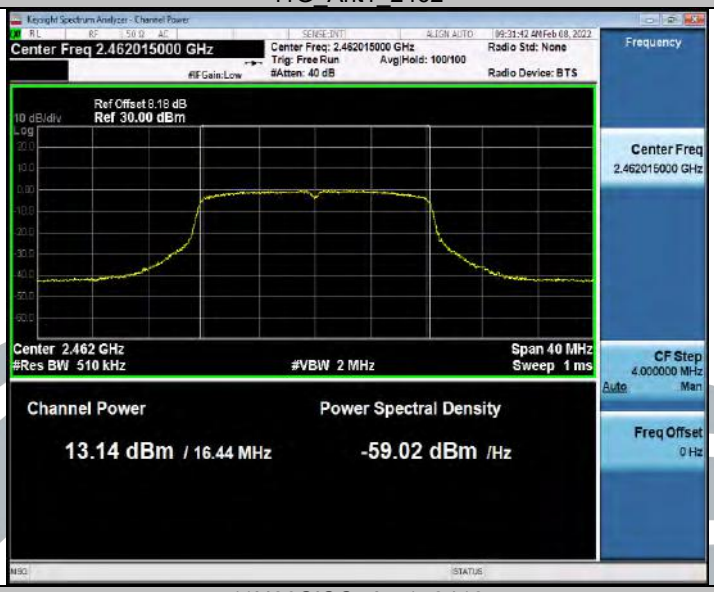
11G_Ant1_2412



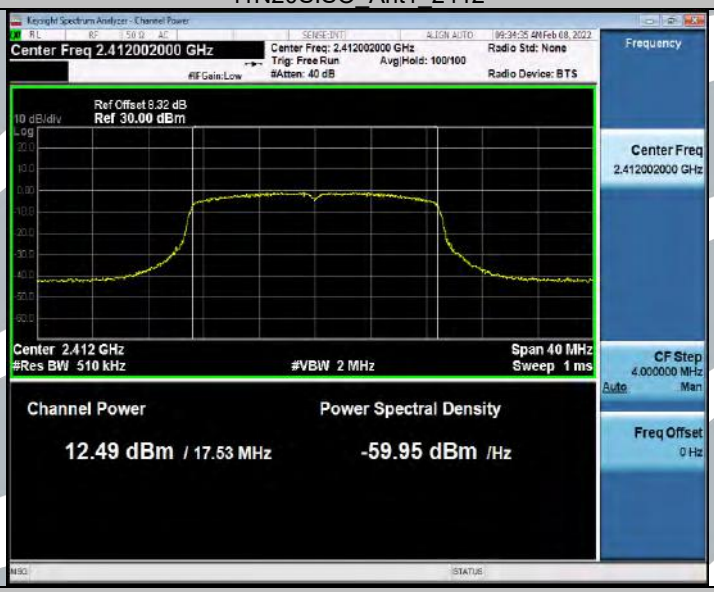
11G_Ant1_2437



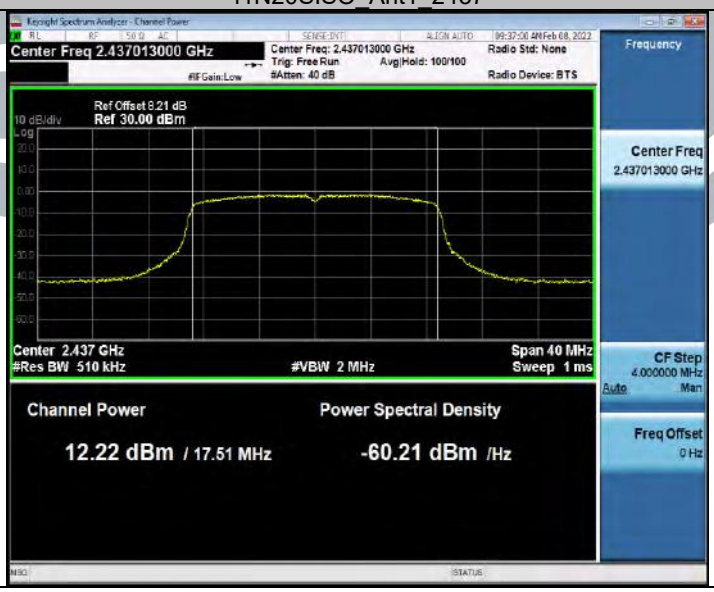
11G_Ant1_2462



11N20SISO_Ant1_2412



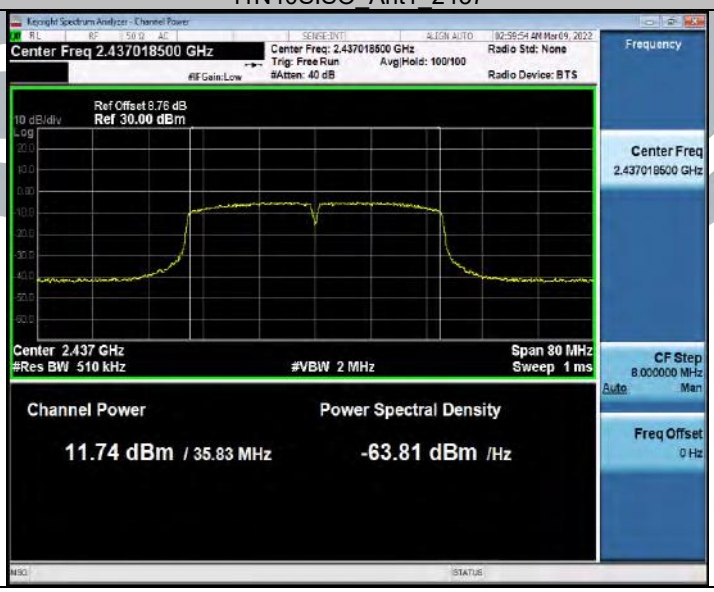
11N20SISO_Ant1_2437



11N20SISO_Ant1_2462

11N40SISO_Ant1_2422

11N40SISO_Ant1_2437



11N40SISO_Ant1_2452

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

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

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

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

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

6dB Bandwidth
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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

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

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Results: Pass

DTS Bandwidth

Test Mode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	7.120	2408.440	2415.560	≥0.5	PASS
		2437	7.120	2433.440	2440.560	≥0.5	PASS
		2462	7.120	2458.440	2465.560	≥0.5	PASS
11G	Ant1	2412	13.800	2405.120	2418.920	≥0.5	PASS
		2437	14.160	2430.360	2444.520	≥0.5	PASS
		2462	14.840	2454.720	2469.560	≥0.5	PASS
11N20SISO	Ant1	2412	14.200	2405.360	2419.560	≥0.5	PASS
		2437	13.400	2430.280	2443.680	≥0.5	PASS
		2462	14.160	2454.480	2468.640	≥0.5	PASS
11N40SISO	Ant1	2422	32.960	2406.560	2439.520	≥0.5	PASS
		2437	33.840	2419.480	2453.320	≥0.5	PASS
		2452	33.840	2435.680	2469.520	≥0.5	PASS

Occupied Channel Bandwidth

Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.090	2405.461	2418.551	---	PASS
		2437	13.117	2430.450	2443.567	---	PASS
		2462	13.127	2455.427	2468.554	---	PASS
11G	Ant1	2412	16.428	2403.803	2420.231	---	PASS
		2437	16.437	2428.798	2445.235	---	PASS
		2462	16.438	2453.796	2470.234	---	PASS
11N20SISO	Ant1	2412	17.528	2403.238	2420.766	---	PASS
		2437	17.508	2428.259	2445.767	---	PASS
		2462	17.526	2453.235	2470.761	---	PASS
11N40SISO	Ant1	2422	35.864	2404.111	2439.975	---	PASS
		2437	35.831	2419.103	2454.934	---	PASS
		2452	35.894	2434.099	2469.993	---	PASS

Test Graphs:

11B_Ant1_2412

11B_Ant1_2437

11B_Ant1_2462

11G_Ant1_2412

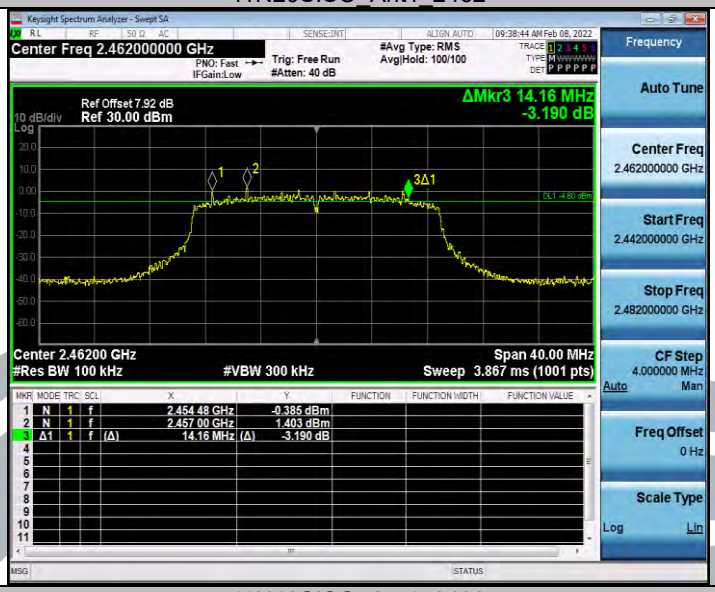
11G_Ant1_2437

11G_Ant1_2462

11N20SISO_Ant1_2412

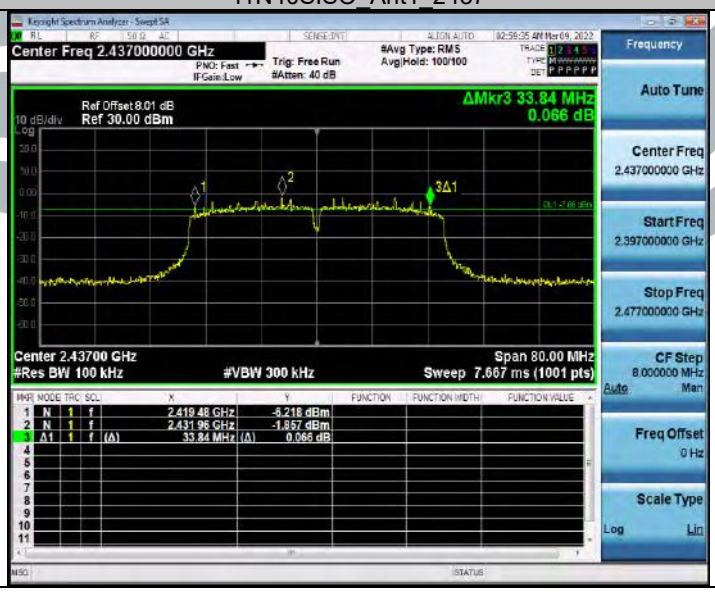
11N20SISO_Ant1_2437

11N20SISO_Ant1_2462



11N40SISO_Ant1_2422

11N40SISO_Ant1_2437



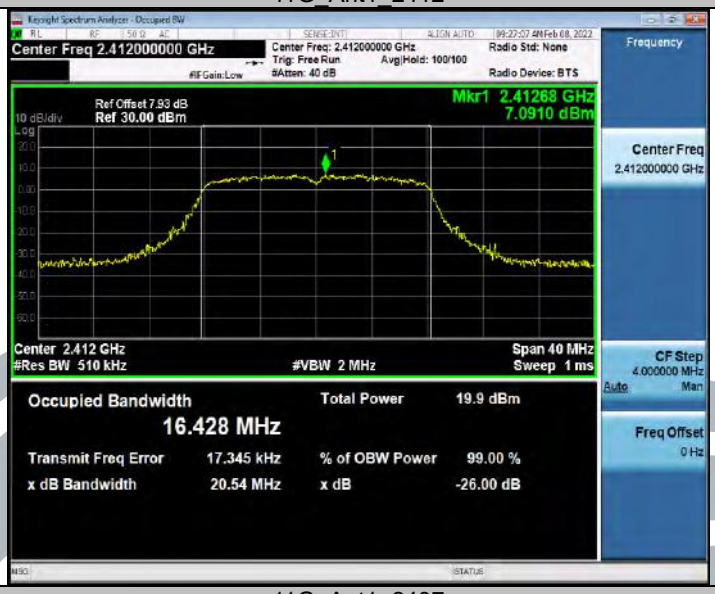
11N40SISO_Ant1_2452

11B_Ant1_2412

11B_Ant1_2437

11B_Ant1_2462

11G_Ant1_2412



11G_Ant1_2437

11G_Ant1_2462

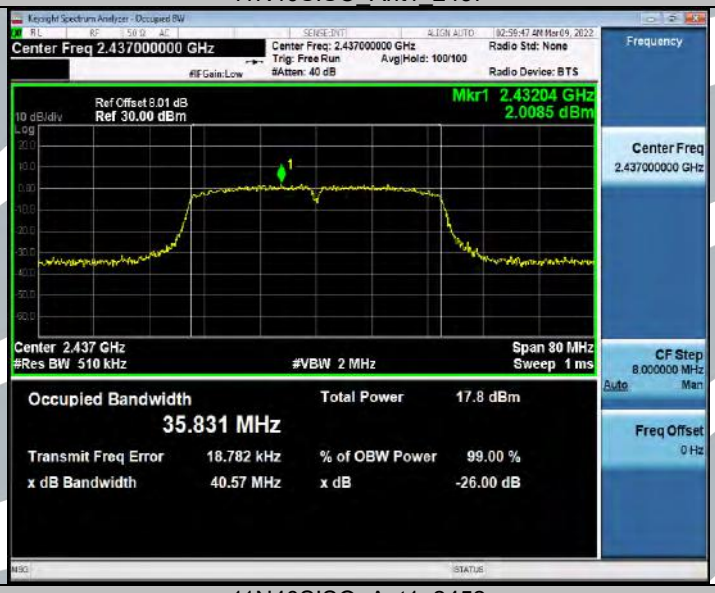
11N20SISO_Ant1_2412

11N20SISO_Ant1_2437

11N20SISO_Ant1_2462

11N40SISO_Ant1_2422

11N40SISO_Ant1_2437



11N40SISO_Ant1_2452

5.5 POWER SPECTRAL DENSITY

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

Test Method: ANSI C63.10-2013 Clause 11.10.3

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: Method AVGPSD-1 uses trace averaging with EUT transmitting at full power throughout each sweep.

The following procedure may be used when the maximum (average) conducted output power was used to determine compliance to the fundamental output power limit. This is the baseline method for determining the maximum (average) conducted PSD level. If the instrument has a power averaging (rms) detector, then it must be used; otherwise, use the sample detector. The EUT must be configured to transmit continuously (D ≥ 98%), or else sweep triggering/signal gating must be implemented to ensure that measurements are made only when the EUT is transmitting at its maximum power control level (no transmitter OFF time to be considered):

a) Set instrument center frequency to DTS channel center frequency.
b) Set span to at least 1.5 times the OBW.
c) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set VBW ≥ [3 × RBW].
e) Detector = power averaging (rms) or sample detector (when rms not available).
f) Ensure that the number of measurement points in the sweep ≥ [2 × span / RBW].
g) Sweep time = auto couple.
h) Employ trace averaging (rms) mode over a minimum of 100 traces.
i) Use the peak marker function to determine the maximum amplitude level.
j) If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Results: Pass

Test Mode	Antenna	Channel	Result [dBm/30kHz]	Result [dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-4.4	-14.4	≤8	PASS
		2437	-5.09	-15.09	≤8	PASS
		2462	-5.3	-15.3	≤8	PASS
11G	Ant1	2412	-10.13	-20.13	≤8	PASS
		2437	-10.52	-20.52	≤8	PASS
		2462	-10.72	-20.72	≤8	PASS
11N20SISO	Ant1	2412	-11.64	-21.64	≤8	PASS
		2437	-11.59	-21.59	≤8	PASS
		2462	-11.97	-21.97	≤8	PASS
11N40SISO	Ant1	2422	-14.64	-24.64	≤8	PASS
		2437	-15.21	-25.21	≤8	PASS
		2452	-15.25	-25.25	≤8	PASS

Note: Result [dBm/3kHz]= Result[dBm/30kHz]-10*log10(30/3)

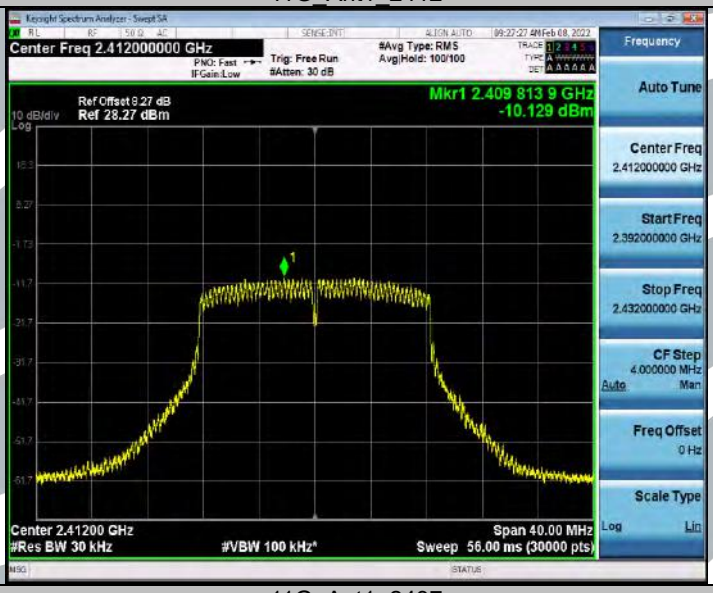
Test Graphs:

11B_Ant1_2412

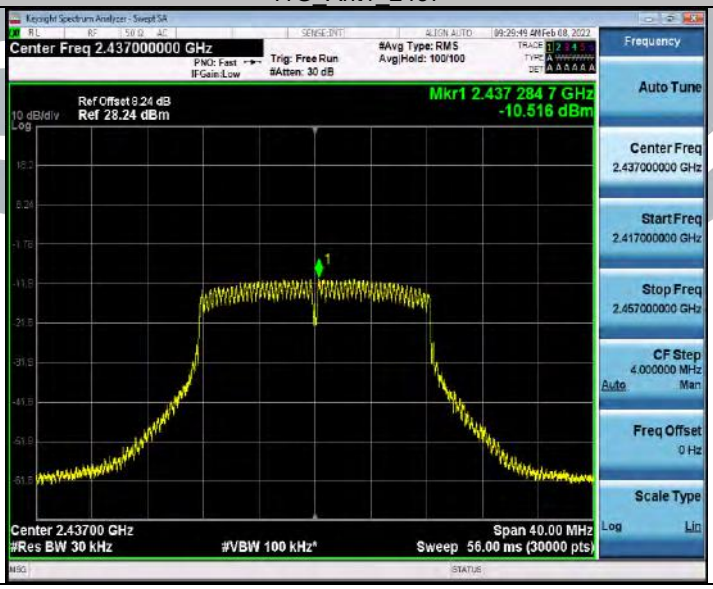
11B_Ant1_2437

11B_Ant1_2462

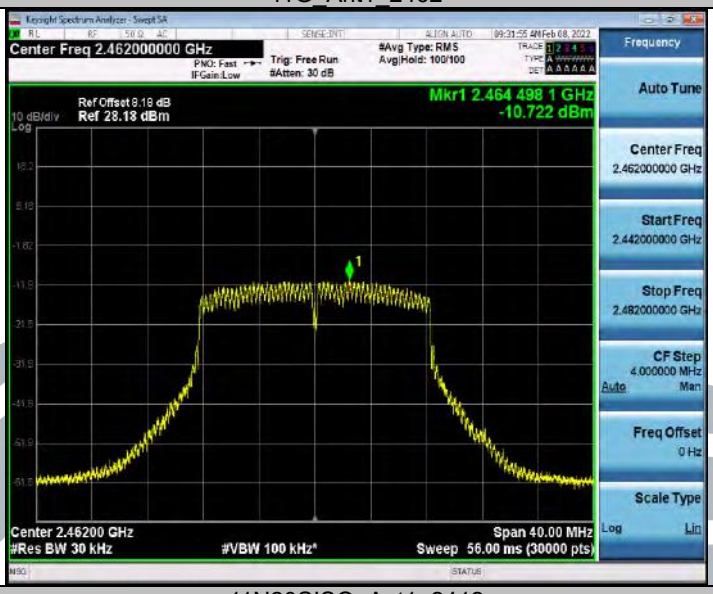
11G_Ant1_2412



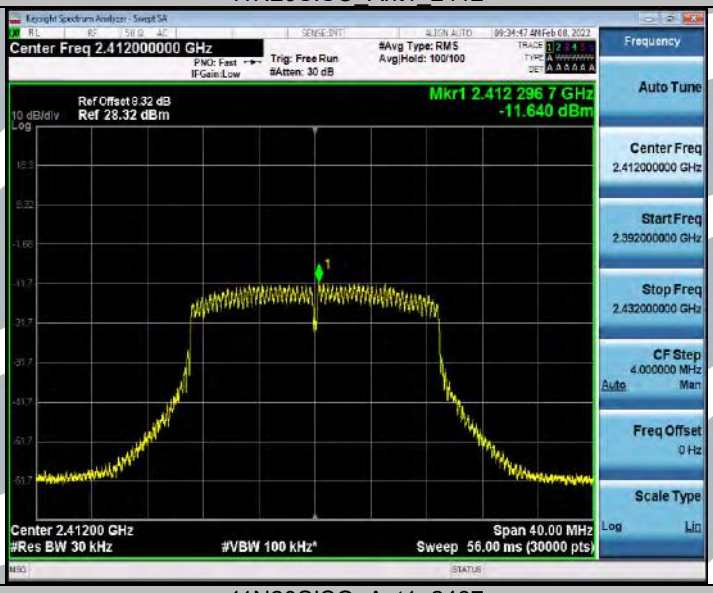
11G_Ant1_2437



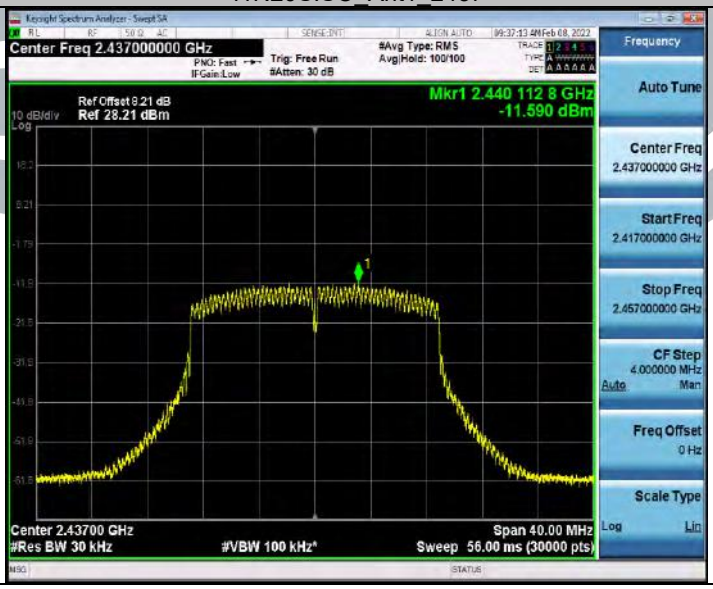
11G_Ant1_2462



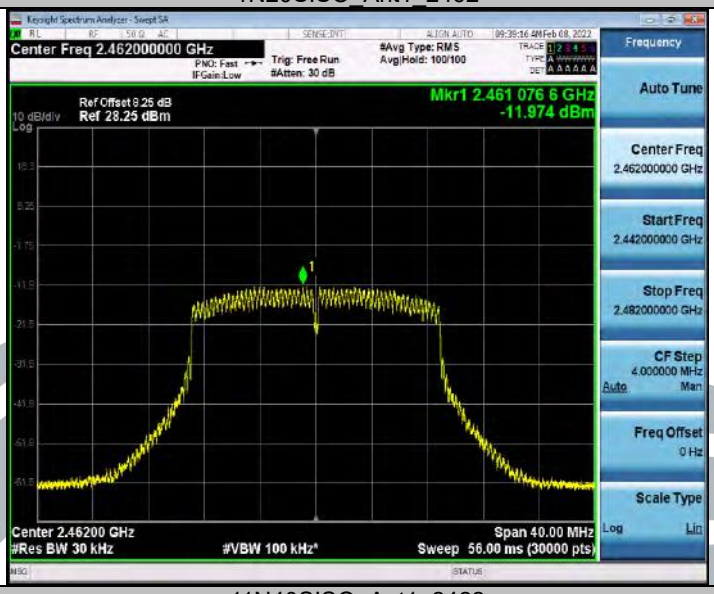
11N20SISO_Ant1_2412



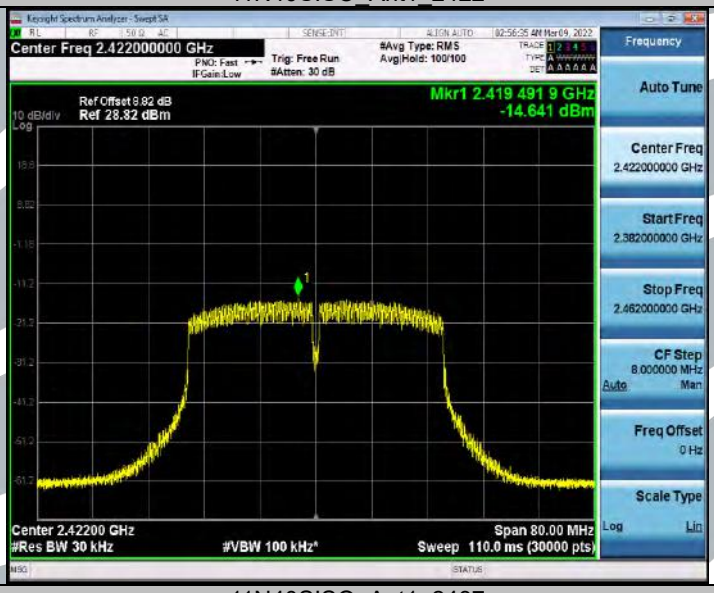
11N20SISO_Ant1_2437



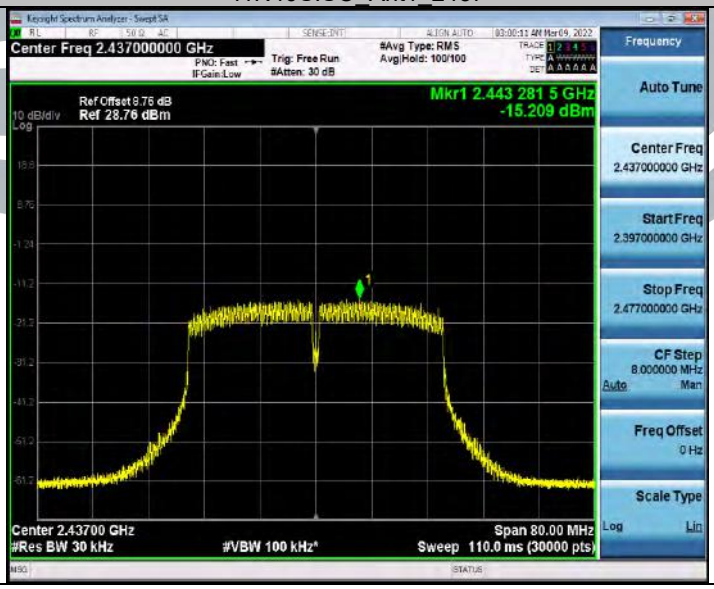
1N20SISO_Ant1_2462

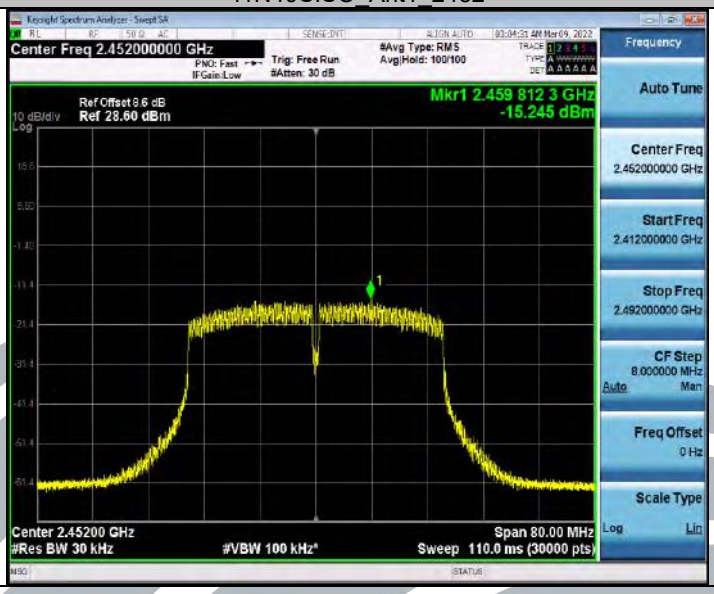


11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452


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 30dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

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

Step 1:Measurement Procedure REF

a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the DTS bandwidth.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.
j) Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Step 2:Measurement Procedure OOBE

a) Set RBW = 100 kHz.
b) Set VBW ≥ 300 kHz.
c) Detector = peak.
d) Sweep = auto couple.
e) Trace Mode = max hold.
f) Allow trace to fully stabilize.
g) Use the peak marker function to determine the maximum amplitude level.

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

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Results: Pass

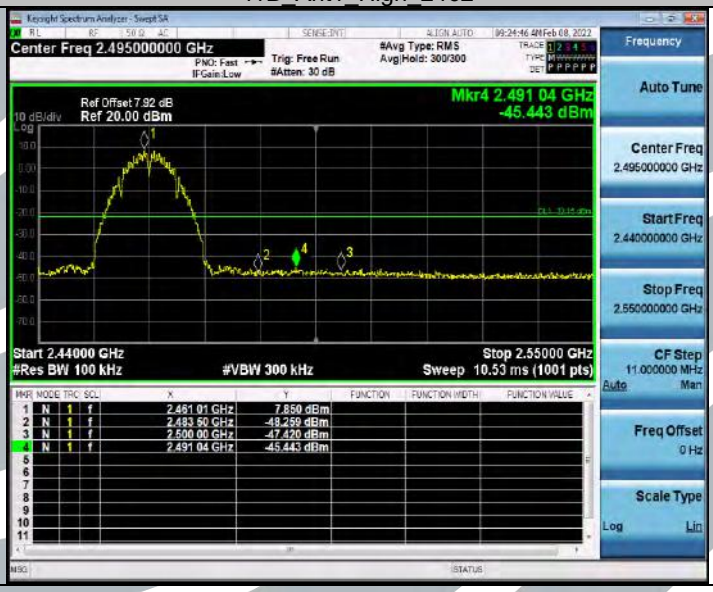
Test Mode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	8.32	-42.34	≤-21.68	PASS
		High	2462	7.85	-45.44	≤-22.15	PASS
11G	Ant1	Low	2412	3.90	-35.04	≤-26.1	PASS
		High	2462	2.51	-45.78	≤-27.49	PASS
11N20SISO	Ant1	Low	2412	2.80	-34.98	≤-27.2	PASS
		High	2462	1.64	-46.08	≤-28.36	PASS
11N40SISO	Ant1	Low	2422	-1.62	-34.4	≤-31.62	PASS
		High	2452	-2.12	-46.06	≤-32.12	PASS

Test Mode	Antenna	Channel	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	Reference	7.07	7.07	---	PASS
			30~1000	7.07	-57.91	≤-22.93	PASS
			1000~26500	7.07	-39.89	≤-22.93	PASS
		2437	Reference	5.61	5.61	---	PASS
			30~1000	5.61	-57.49	≤-24.39	PASS
			1000~26500	5.61	-39.75	≤-24.39	PASS
		2462	Reference	6.33	6.33	---	PASS
			30~1000	6.33	-57.64	≤-23.67	PASS
			1000~26500	6.33	-39.66	≤-23.67	PASS
11G	Ant1	2412	Reference	2.91	2.91	---	PASS
			30~1000	2.91	-57.92	≤-27.09	PASS
			1000~26500	2.91	-39.61	≤-27.09	PASS
		2437	Reference	0.32	0.32	---	PASS
			30~1000	0.32	-57.58	≤-29.68	PASS
			1000~26500	0.32	-39.73	≤-29.68	PASS
		2462	Reference	-0.72	-0.72	---	PASS
			30~1000	-0.72	-56.29	≤-30.72	PASS
			1000~26500	-0.72	-39.79	≤-30.72	PASS
11N20SISO	Ant1	2412	Reference	-1.08	-1.08	---	PASS
			30~1000	-1.08	-57.61	≤-31.08	PASS
			1000~26500	-1.08	-39.67	≤-31.08	PASS
		2437	Reference	2.41	2.41	---	PASS
			30~1000	2.41	-56.78	≤-27.59	PASS
			1000~26500	2.41	-39.79	≤-27.59	PASS
		2462	Reference	-2.06	-2.06	---	PASS
			30~1000	-2.06	-57.32	≤-32.06	PASS
			1000~26500	-2.06	-38.42	≤-32.06	PASS
11N40SISO	Ant1	2422	Reference	-3.92	-3.92	---	PASS
			30~1000	-3.92	-56.58	≤-33.92	PASS
			1000~26500	-3.92	-38.97	≤-33.92	PASS
		2437	Reference	-2.32	-2.32	---	PASS
			30~1000	-2.32	-57.12	≤-32.32	PASS
			1000~26500	-2.32	-38.95	≤-32.32	PASS
		2452	Reference	-4.29	-4.29	---	PASS
			30~1000	-4.29	-57.37	≤-34.29	PASS
			1000~26500	-4.29	-37.8	≤-34.29	PASS

Test Graphs:

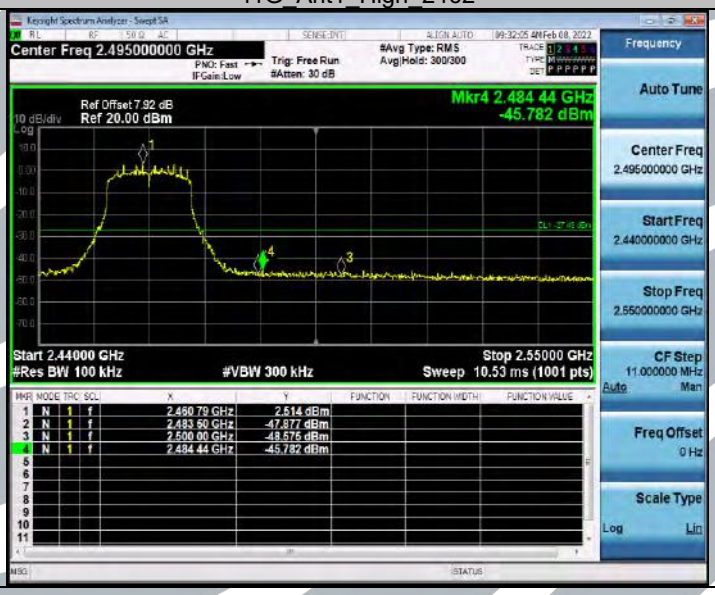
11B_Ant1_Low_2412

11B_Ant1_High_2462



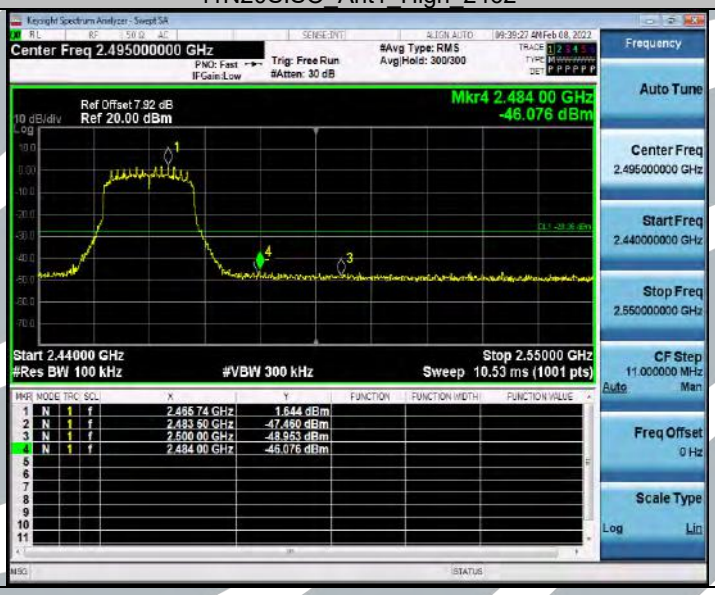
11G_Ant1_Low_2412

11G_Ant1_High_2462



11N20SISO_Ant1_Low_2412

11N20SISO_Ant1_High_2462

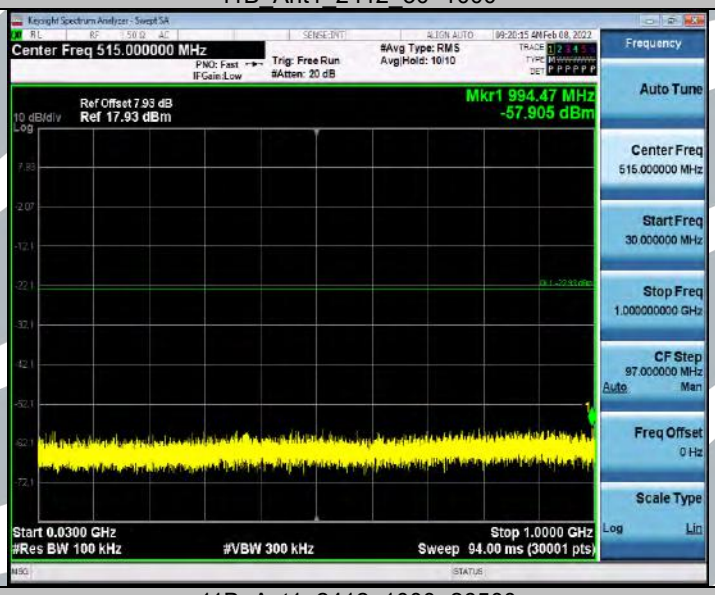


11N40SISO_Ant1_Low_2422

11N40SISO_Ant1_High_2452

11B_Ant1_2412_0~Reference

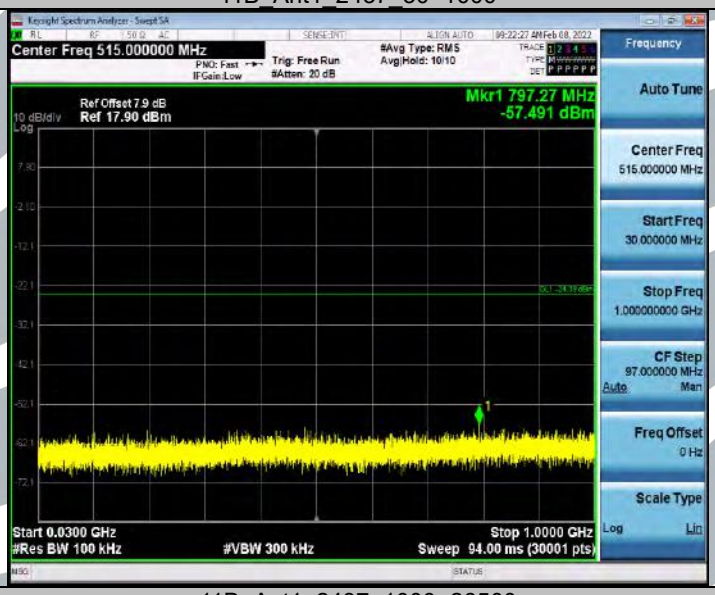
11B_Ant1_2412_30~1000



11B_Ant1_2412_1000~26500

11B_Ant1_2437_0~Reference

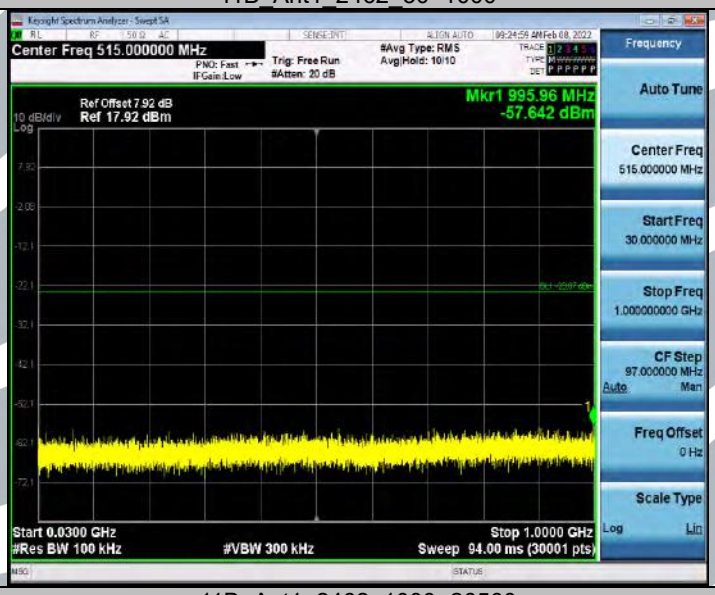
11B_Ant1_2437_30~1000



11B_Ant1_2437_1000~26500

11B_Ant1_2462_0~Reference

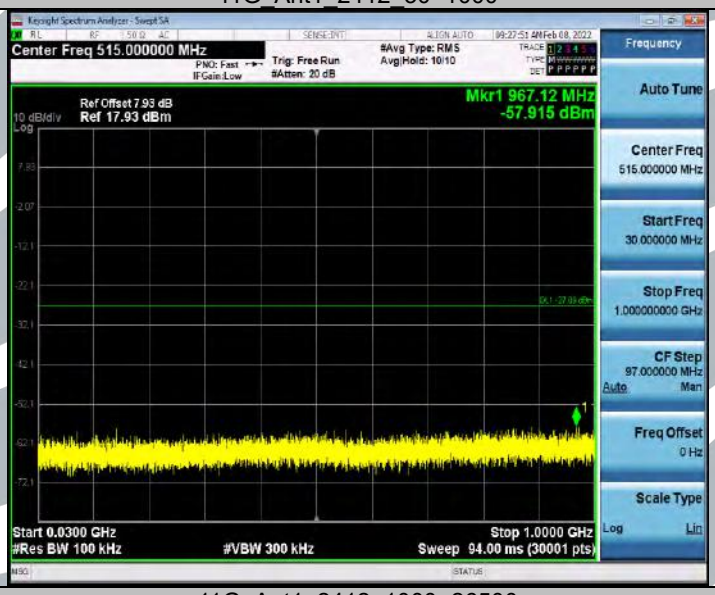
11B_Ant1_2462_30~1000



11B_Ant1_2462_1000~26500

11G_Ant1_2412_0~Reference

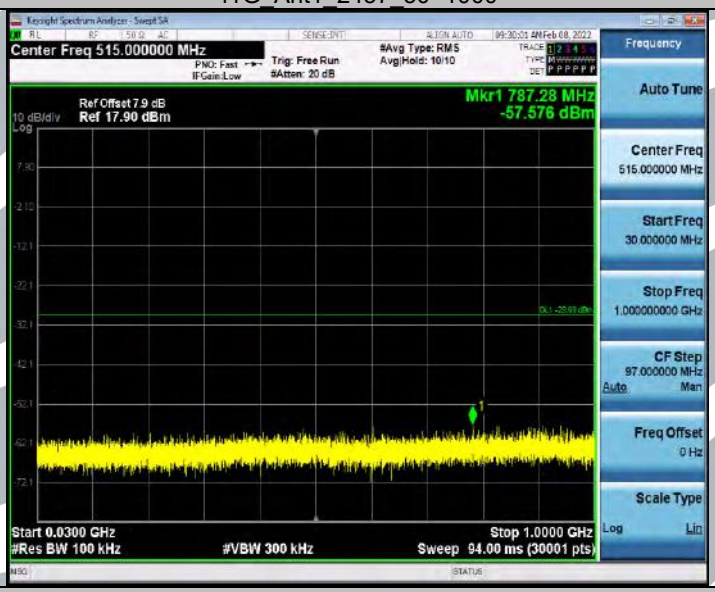
11G_Ant1_2412_30~1000



11G_Ant1_2412_1000~26500

11G_Ant1_2437_0~Reference

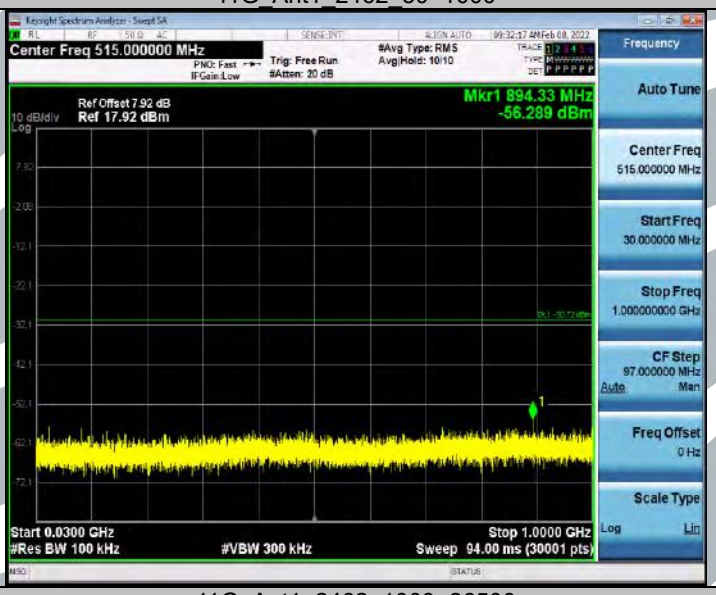
11G_Ant1_2437_30~1000



11G_Ant1_2437_1000~26500

11G_Ant1_2462_0~Reference

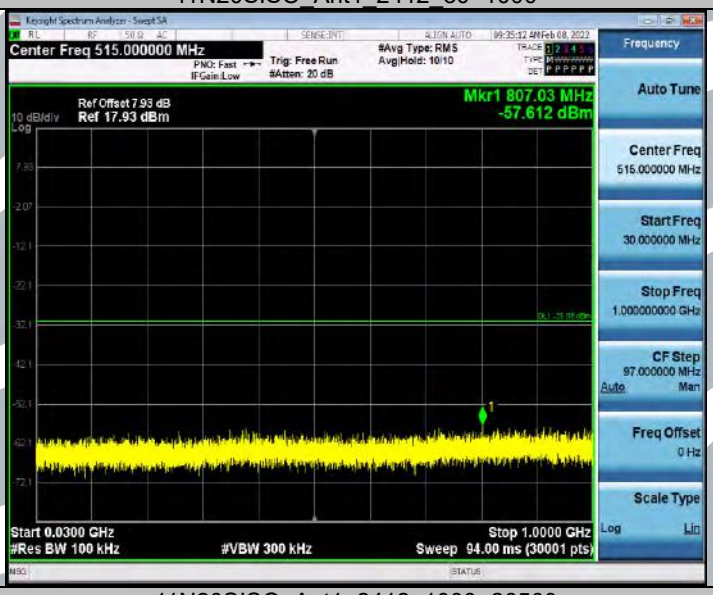
11G_Ant1_2462_30~1000



11G_Ant1_2462_1000~26500

11N20SISO_Ant1_2412_0~Reference

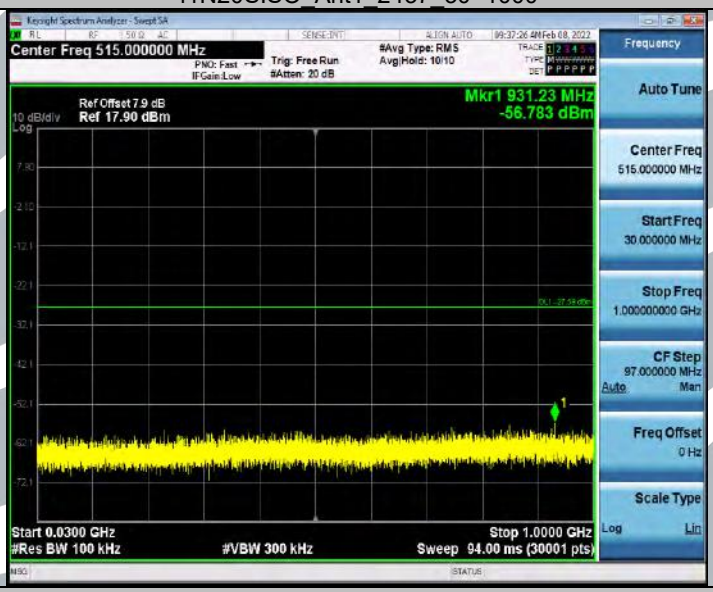
11N20SISO_Ant1_2412_30~1000



11N20SISO_Ant1_2412_1000~26500

11N20SISO_Ant1_2437_0~Reference

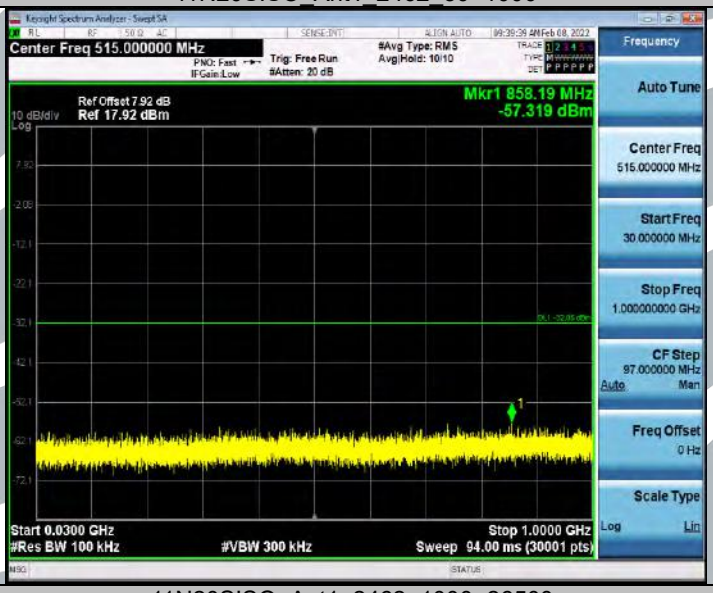
11N20SISO_Ant1_2437_30~1000



11N20SISO_Ant1_2437_1000~26500

11N20SISO_Ant1_2462_0~Reference

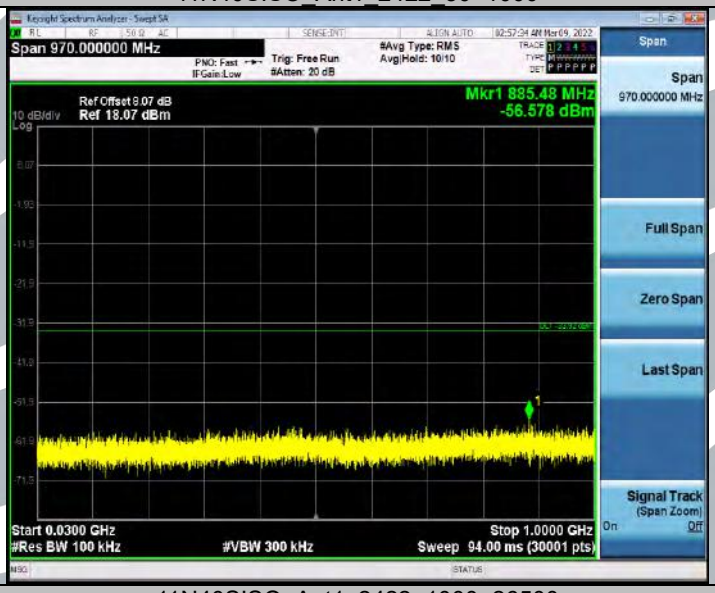
11N20SISO_Ant1_2462_30~1000



11N20SISO_Ant1_2462_1000~26500

11N40SISO_Ant1_2422_0~Reference

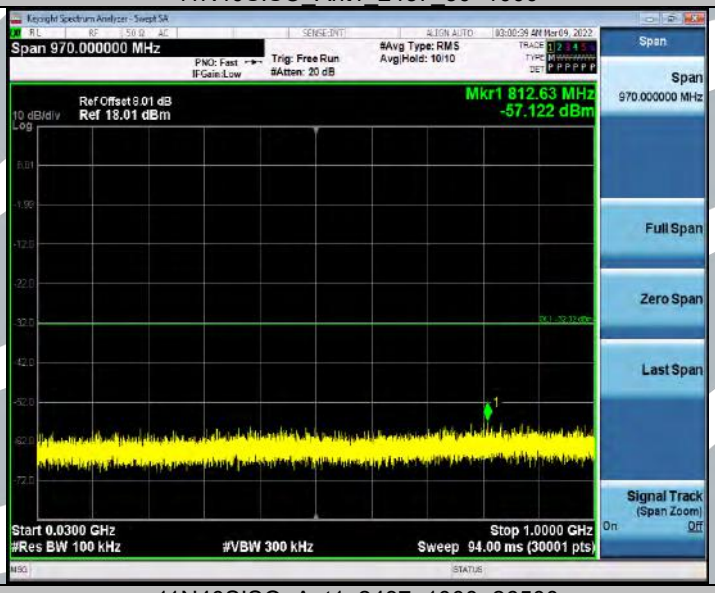
11N40SISO_Ant1_2422_30~1000



11N40SISO_Ant1_2422_1000~26500

11N40SISO_Ant1_2437_0~Reference

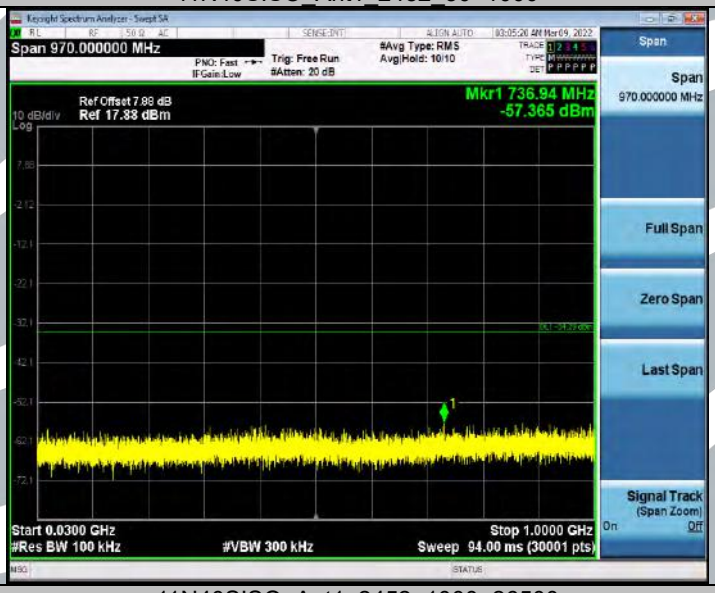
11N40SISO_Ant1_2437_30~1000



11N40SISO_Ant1_2437_1000~26500

11N40SISO_Ant1_2452_0~Reference

11N40SISO_Ant1_2452_30~1000



11N40SISO_Ant1_2452_1000~26500

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 Y axis positioning which it is worse case.
4) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

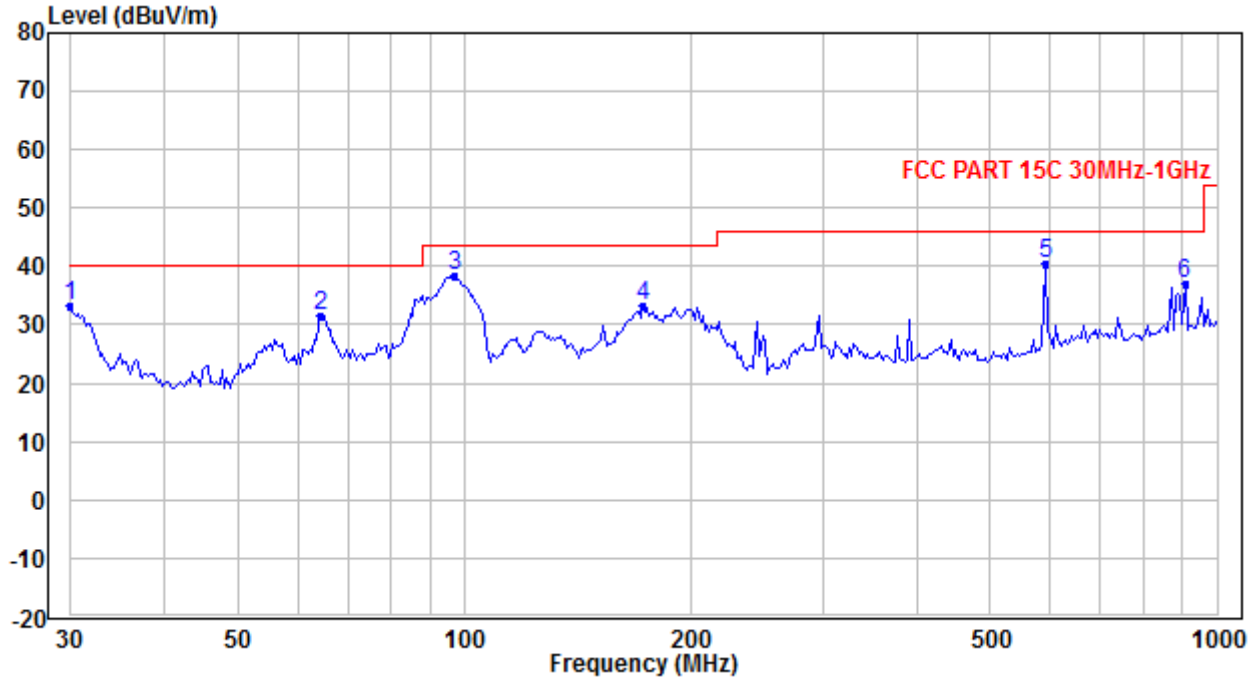
Radiated Emission Test Data (9 KHz ~ 30 MHz):

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

Radiated Emission Test Data (30 MHz ~ 1 GHz):

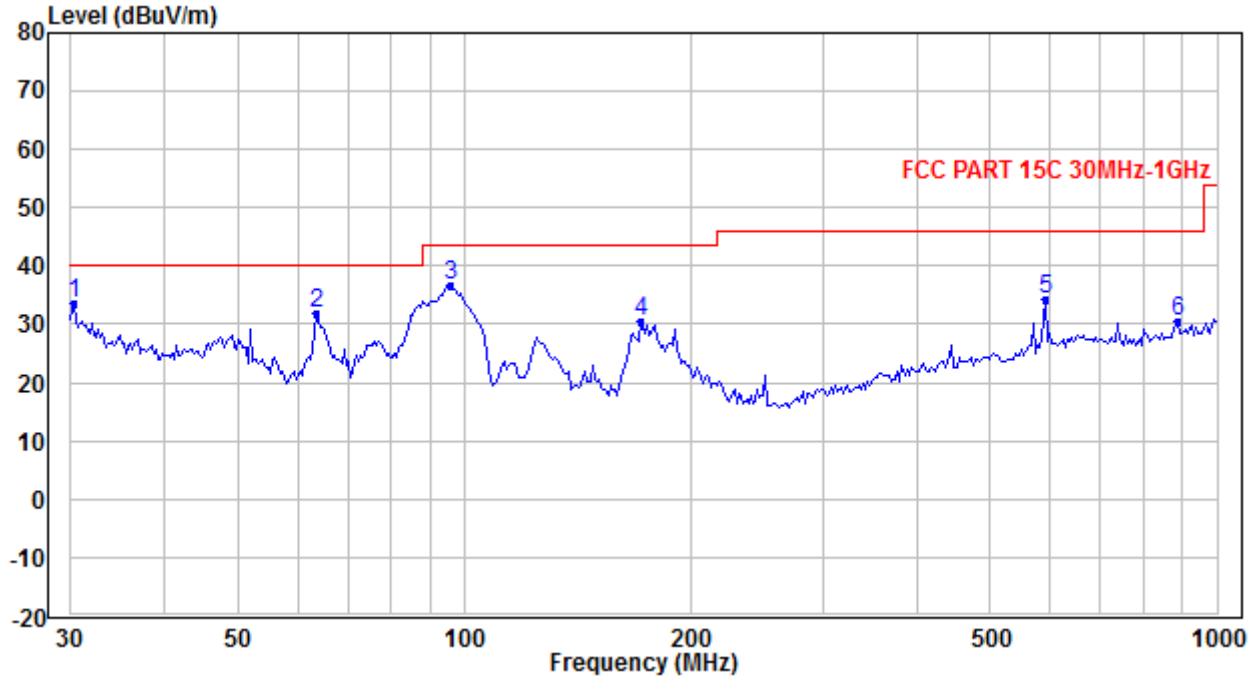
Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.000	37.84	-4.63	33.21	40.00	-6.79	QP
2	64.532	48.90	-17.22	31.68	40.00	-8.32	QP
3	97.002	54.39	-15.98	38.41	43.50	-5.09	QP
4	172.598	44.64	-11.54	33.10	43.50	-10.40	QP
5	590.351	41.51	-1.11	40.40	46.00	-5.60	QP
6	906.304	32.91	4.08	36.99	46.00	-9.01	QP

Vertical



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.212	38.16	-4.66	33.50	40.00	-6.50	QP
2	63.631	49.19	-17.34	31.85	40.00	-8.15	QP
3	95.649	52.48	-15.95	36.53	43.50	-6.97	QP
4	171.389	41.89	-11.37	30.52	43.50	-12.98	QP
5	590.351	35.52	-1.11	34.41	46.00	-11.59	QP
6	887.398	26.68	3.87	30.55	46.00	-15.45	QP

Radiated Emission Test Data (Above 1GHz):

IEEE 802.11b_ Channel 1:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	48.32	-2.33	45.99	74.00	-28.01	Peak	Horizontal
2	4824.00	32.25	-2.33	29.92	54.00	-24.08	Average	Horizontal
3	7236.00	41.79	1.47	43.26	74.00	-30.74	Peak	Horizontal
4	7236.00	27.51	1.47	28.98	54.00	-25.02	Average	Horizontal
5	4824.00	44.81	-2.33	42.48	74.00	-31.52	Peak	Vertical
6	4824.00	28.08	-2.33	25.75	54.00	-28.25	Average	Vertical
7	7236.00	39.36	1.47	40.83	74.00	-33.17	Peak	Vertical
8	7236.00	27.26	1.47	28.73	54.00	-25.27	Average	Vertical

IEEE 802.11b_ Channel 6:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	47.34	-2.29	45.05	74.00	-28.95	Peak	Horizontal
2	4874.00	30.70	-2.29	28.41	54.00	-25.59	Average	Horizontal
3	7311.00	44.92	1.60	46.52	74.00	-27.48	Peak	Horizontal
4	7311.00	30.33	1.60	31.93	54.00	-22.07	Average	Horizontal
5	4874.00	44.87	-2.29	42.58	74.00	-31.42	Peak	Vertical
6	4874.00	28.93	-2.29	26.64	54.00	-27.36	Average	Vertical
7	7311.00	42.93	1.60	44.53	74.00	-29.47	Peak	Vertical
8	7311.00	29.26	1.60	30.86	54.00	-23.14	Average	Vertical

IEEE 802.11b_ Channel 11:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	48.36	-2.26	46.10	74.00	-27.90	Peak	Horizontal
2	4924.00	31.47	-2.26	29.21	54.00	-24.79	Average	Horizontal
3	7386.00	47.30	1.72	49.02	74.00	-24.98	Peak	Horizontal
4	7386.00	32.78	1.72	34.50	54.00	-19.50	Average	Horizontal
5	4924.00	44.18	-2.26	41.92	74.00	-32.08	Peak	Vertical
6	4924.00	28.40	-2.26	26.14	54.00	-27.86	Average	Vertical
7	7386.00	45.01	1.72	46.73	74.00	-27.27	Peak	Vertical
8	7386.00	31.34	1.72	33.06	54.00	-20.94	Average	Vertical

IEEE 802.11g_ Channel 1:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	40.90	-2.33	38.57	74.00	-35.43	Peak	Horizontal
2	4824.00	28.36	-2.33	26.03	54.00	-27.97	Average	Horizontal
3	7236.00	39.99	1.47	41.46	74.00	-32.54	Peak	Horizontal
4	7236.00	27.00	1.47	28.47	54.00	-25.53	Average	Horizontal
5	4824.00	39.50	-2.33	37.17	74.00	-36.83	Peak	Vertical
6	4824.00	28.02	-2.33	25.69	54.00	-28.31	Average	Vertical
7	7236.00	40.12	1.47	41.59	74.00	-32.41	Peak	Vertical
8	7236.00	27.07	1.47	28.54	54.00	-25.46	Average	Vertical

IEEE 802.11g_ Channel 6:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	41.38	-2.29	39.09	74.00	-34.91	Peak	Horizontal
2	4874.00	28.66	-2.29	26.37	54.00	-27.63	Average	Horizontal
3	7311.00	40.41	1.60	42.01	74.00	-31.99	Peak	Horizontal
4	7311.00	28.48	1.60	30.08	54.00	-23.92	Average	Horizontal
5	4874.00	38.54	-2.29	36.25	74.00	-37.75	Peak	Vertical
6	4874.00	27.22	-2.29	24.93	54.00	-29.07	Average	Vertical
7	7311.00	40.47	1.60	42.07	74.00	-31.93	Peak	Vertical
8	7311.00	28.32	1.60	29.92	54.00	-24.08	Average	Vertical

IEEE 802.11g_ Channel 11:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	41.94	-2.26	39.68	74.00	-34.32	Peak	Horizontal
2	4924.00	29.48	-2.26	27.22	54.00	-26.78	Average	Horizontal
3	7386.00	40.70	1.72	42.42	74.00	-31.58	Peak	Horizontal
4	7386.00	29.37	1.72	31.09	54.00	-22.91	Average	Horizontal
5	4924.00	38.03	-2.26	35.77	74.00	-38.23	Peak	Vertical
6	4924.00	26.90	-2.26	24.64	54.00	-29.36	Average	Vertical
7	7386.00	40.79	1.72	42.51	74.00	-31.49	Peak	Vertical
8	7386.00	29.13	1.72	30.85	54.00	-23.15	Average	Vertical

IEEE 802.11n-HT20_ Channel 1:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	38.99	-2.33	36.66	74.00	-37.34	Peak	Horizontal
2	4824.00	27.73	-2.33	25.40	54.00	-28.60	Average	Horizontal
3	7236.00	39.65	1.47	41.12	74.00	-32.88	Peak	Horizontal
4	7236.00	26.94	1.47	28.41	54.00	-25.59	Average	Horizontal
5	4824.00	39.45	-2.33	37.12	74.00	-36.88	Peak	Vertical
6	4824.00	27.85	-2.33	25.52	54.00	-28.48	Average	Vertical
7	7236.00	39.50	1.47	40.97	74.00	-33.03	Peak	Vertical
8	7236.00	26.94	1.47	28.41	54.00	-25.59	Average	Vertical

IEEE 802.11n-HT20_ Channel 6:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	38.89	-2.29	36.60	74.00	-37.40	Peak	Horizontal
2	4874.00	26.70	-2.29	24.41	54.00	-29.59	Average	Horizontal
3	7311.00	40.55	1.60	42.15	74.00	-31.85	Peak	Horizontal
4	7311.00	28.15	1.60	29.75	54.00	-24.25	Average	Horizontal
5	4874.00	38.74	-2.29	36.45	74.00	-37.55	Peak	Vertical
6	4874.00	26.22	-2.29	23.93	54.00	-30.07	Average	Vertical
7	7311.00	40.80	1.60	42.40	74.00	-31.60	Peak	Vertical
8	7311.00	28.20	1.60	29.80	54.00	-24.20	Average	Vertical

IEEE 802.11n-HT20_ Channel 11:

No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	37.81	-2.26	35.55	74.00	-38.45	Peak	Horizontal
2	4924.00	26.70	-2.26	24.44	54.00	-29.56	Average	Horizontal
3	7386.00	41.39	1.72	43.11	74.00	-30.89	Peak	Horizontal
4	7386.00	28.92	1.72	30.64	54.00	-23.36	Average	Horizontal
5	4924.00	38.16	-2.26	35.90	74.00	-38.10	Peak	Vertical
6	4924.00	26.29	-2.26	24.03	54.00	-29.97	Average	Vertical
7	7386.00	40.74	1.72	42.46	74.00	-31.54	Peak	Vertical
8	7386.00	28.82	1.72	30.54	54.00	-23.46	Average	Vertical

IEEE 802.11n-HT40_ Channel 3:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4844.00	40.18	-2.32	37.86	74.00	-36.14	Peak	Horizontal
2	4844.00	29.04	-2.32	26.72	54.00	-27.28	Average	Horizontal
3	7266.00	40.03	1.52	41.55	74.00	-32.45	Peak	Horizontal
4	7266.00	26.95	1.52	28.47	54.00	-25.53	Average	Horizontal
5	4844.00	39.98	-2.32	37.66	74.00	-36.34	Peak	Vertical
6	4844.00	28.29	-2.32	25.97	54.00	-28.03	Average	Vertical
7	7266.00	40.31	1.52	41.83	74.00	-32.17	Peak	Vertical
8	7266.00	26.89	1.52	28.41	54.00	-25.59	Average	Vertical

IEEE 802.11n-HT40_ Channel 6:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	39.52	-2.29	37.23	74.00	-36.77	Peak	Horizontal
2	4874.00	27.22	-2.29	24.93	54.00	-29.07	Average	Horizontal
3	7311.00	39.96	1.60	41.56	74.00	-32.44	Peak	Horizontal
4	7311.00	27.50	1.60	29.10	54.00	-24.90	Average	Horizontal
5	4874.00	38.57	-2.29	36.28	74.00	-37.72	Peak	Vertical
6	4874.00	26.96	-2.29	24.67	54.00	-29.33	Average	Vertical
7	7311.00	38.02	1.60	39.62	74.00	-34.38	Peak	Vertical
8	7311.00	25.76	1.60	27.36	54.00	-26.64	Average	Vertical

IEEE 802.11n-HT40_ Channel 9:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4904.00	35.85	-2.28	33.57	74.00	-40.43	Peak	Horizontal
2	4904.00	25.11	-2.28	22.83	54.00	-31.17	Average	Horizontal
3	7356.00	41.24	1.67	42.91	74.00	-31.09	Peak	Horizontal
4	7356.00	28.87	1.67	30.54	54.00	-23.46	Average	Horizontal
5	4904.00	35.57	-2.28	33.29	74.00	-40.71	Peak	Vertical
6	4904.00	24.27	-2.28	21.99	54.00	-32.01	Average	Vertical
7	7356.00	40.67	1.67	42.34	74.00	-31.66	Peak	Vertical
8	7356.00	29.07	1.67	30.74	54.00	-23.26	Average	Vertical

Remark:

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

5.8 BAND EDGE MEASUREMENTS (RADIATED)

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

Test Method: ANSI C63.10-2013 Clause 11.13

Limits:

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

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

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

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

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

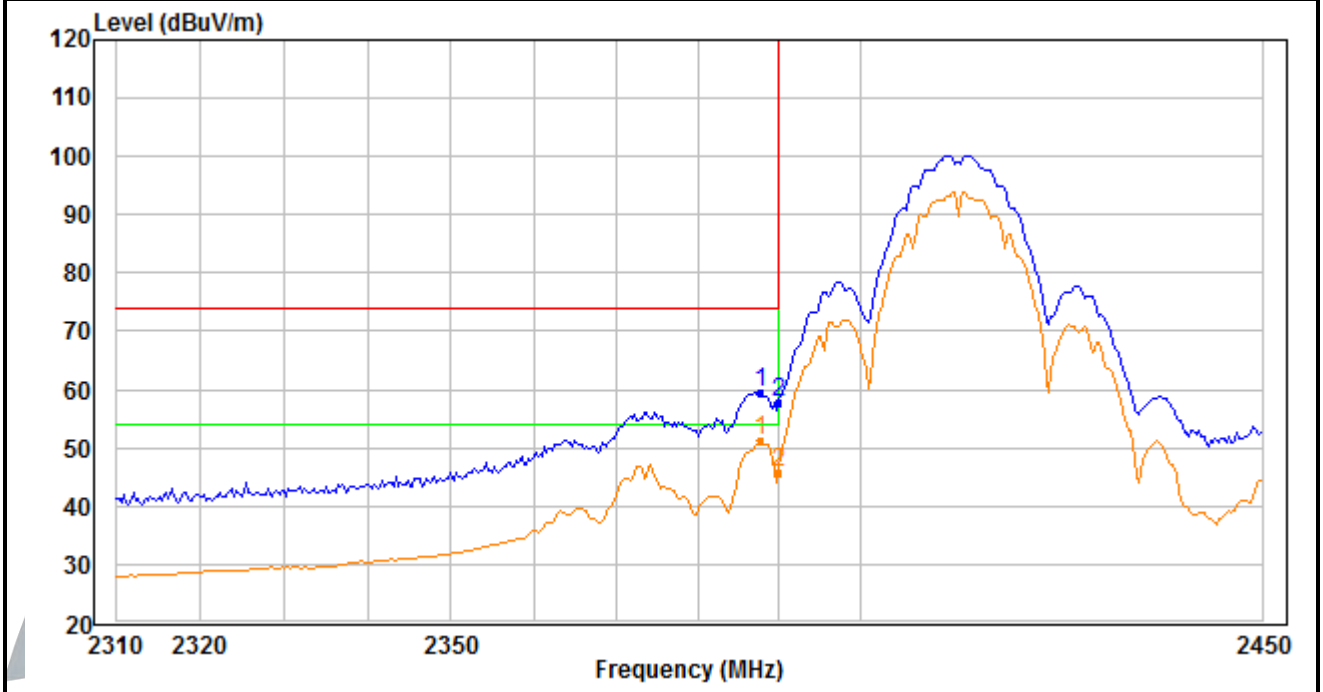
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

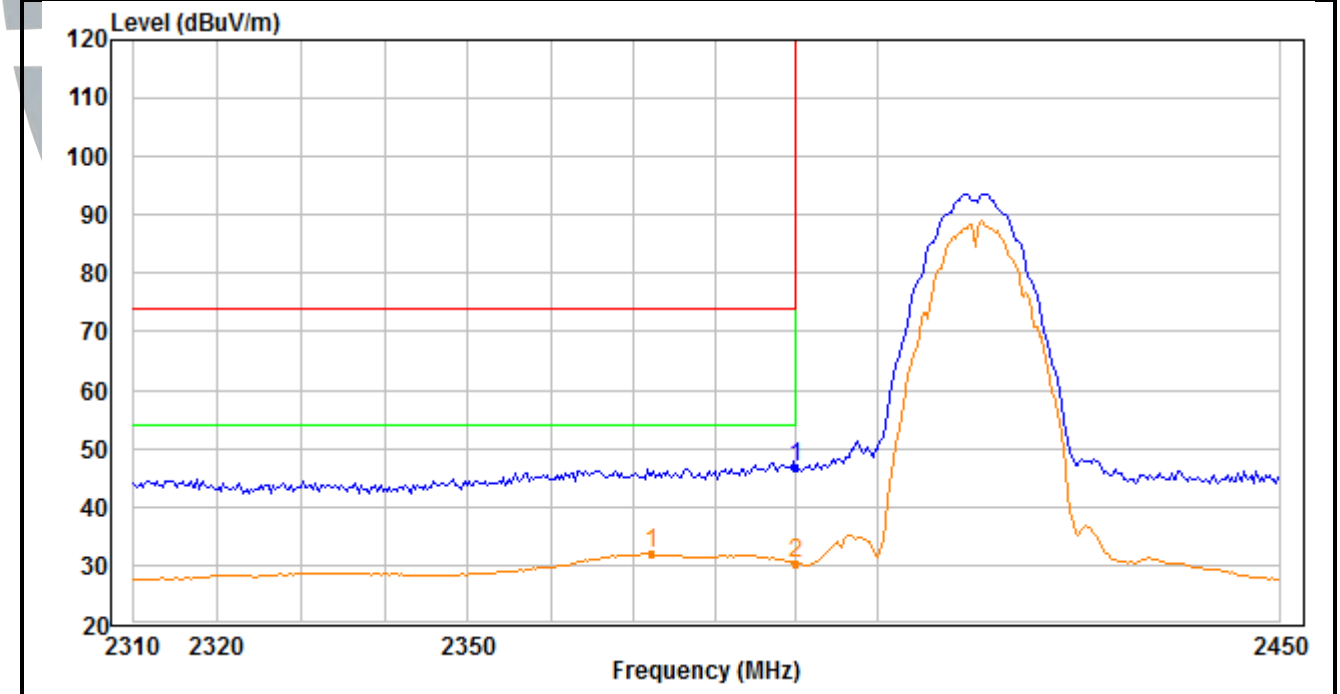
IEEE 802.11b

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



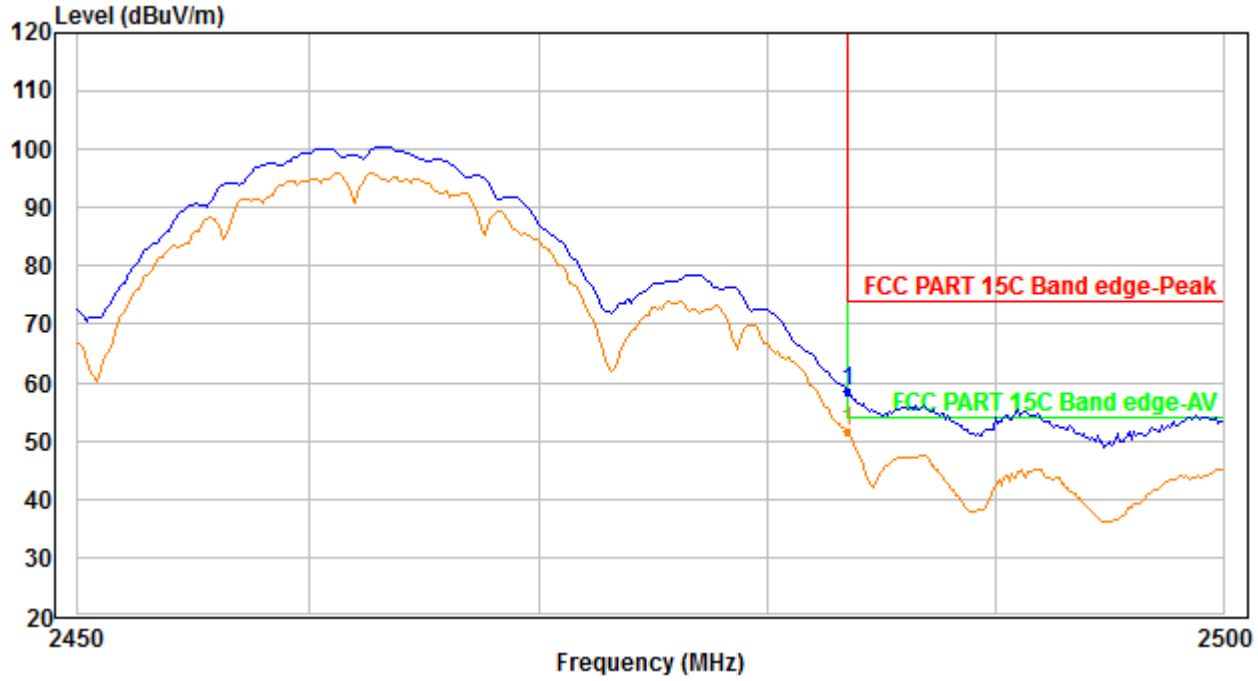
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2387.715	59.62	74.00	51.24	54.00	Pass
2390.000	57.79	74.00	45.92	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



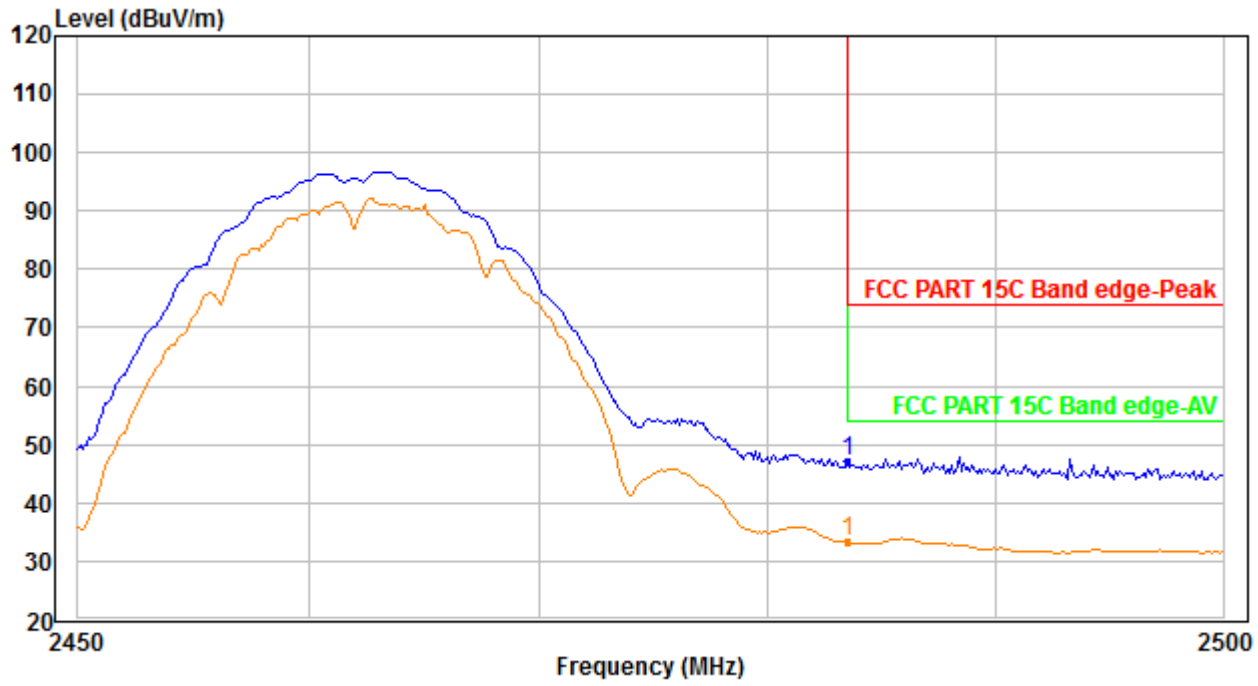
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2372.285	/	74.00	31.95	54.00	Pass
2390.000	46.78	74.00	30.33	54.00	Pass

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	58.43	74.00	51.54	54.00	Pass

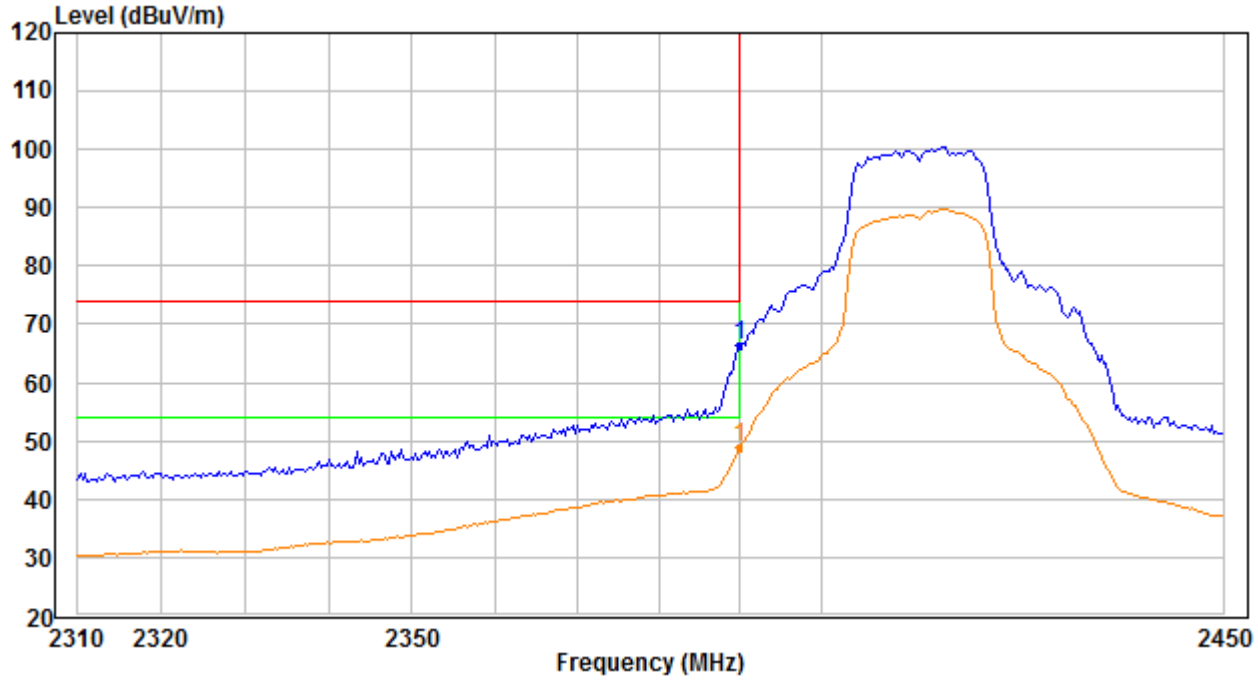
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	47.17	74.00	33.27	54.00	Pass

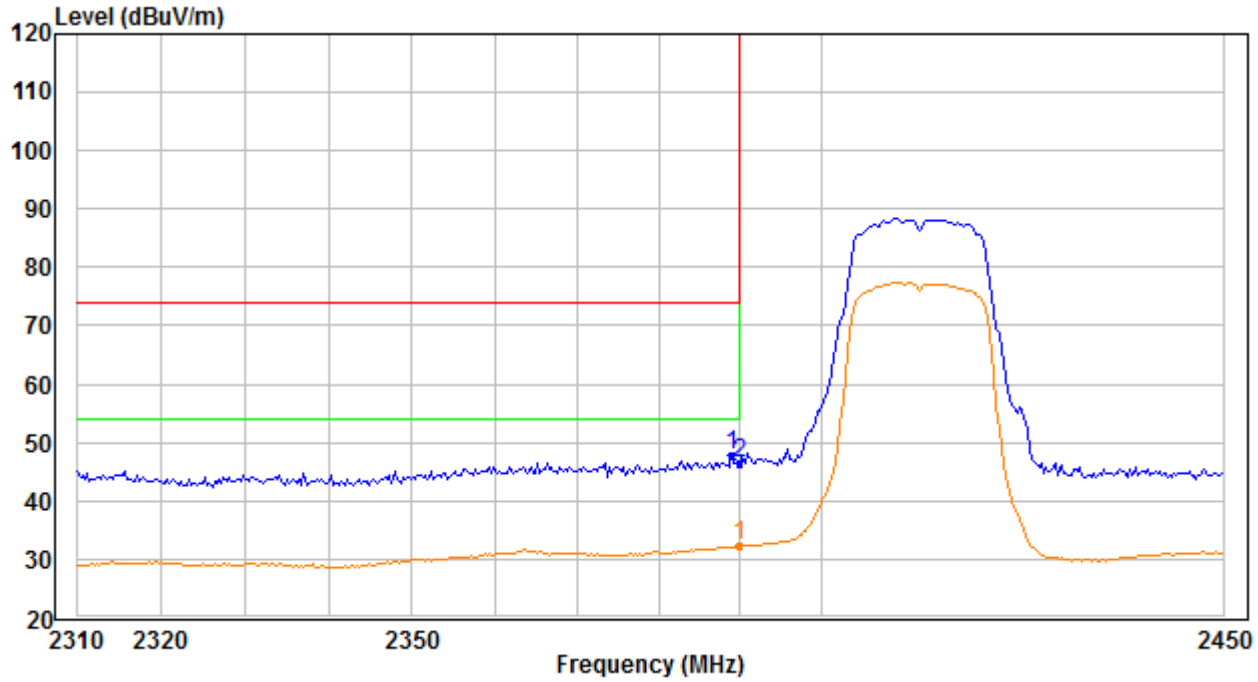
IEEE 802.11g

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



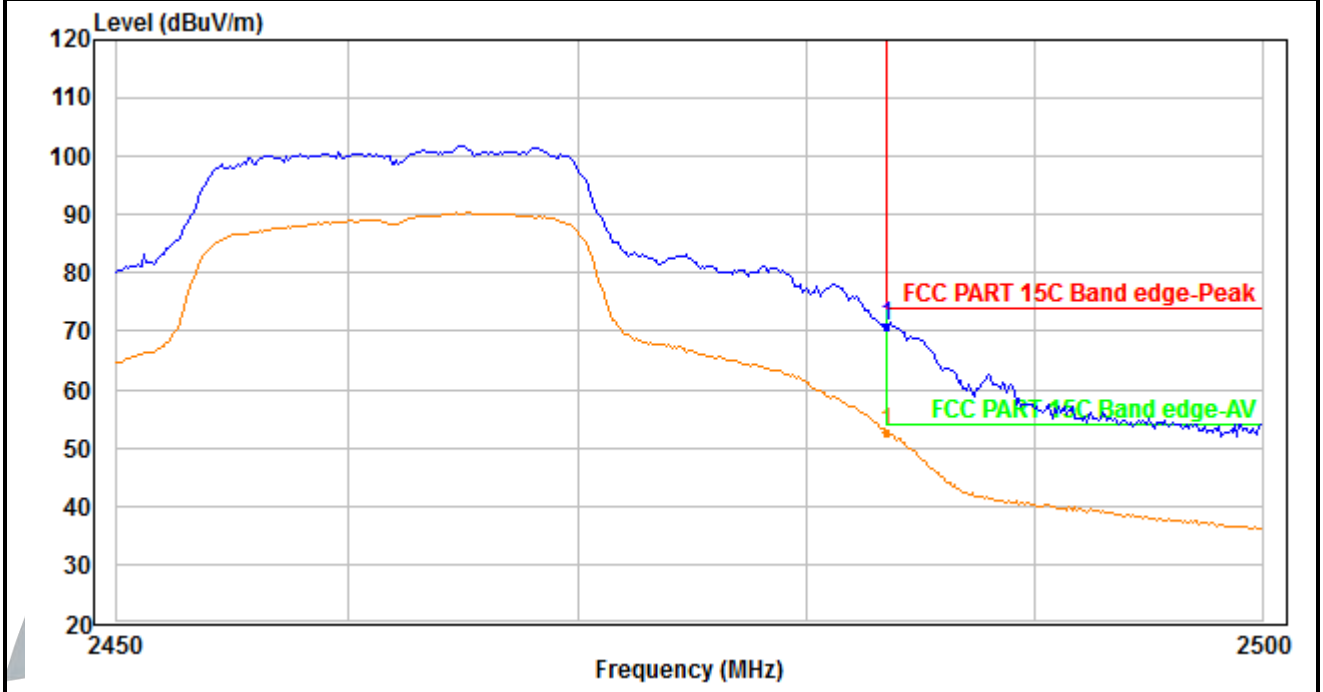
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	66.40	74.00	48.94	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



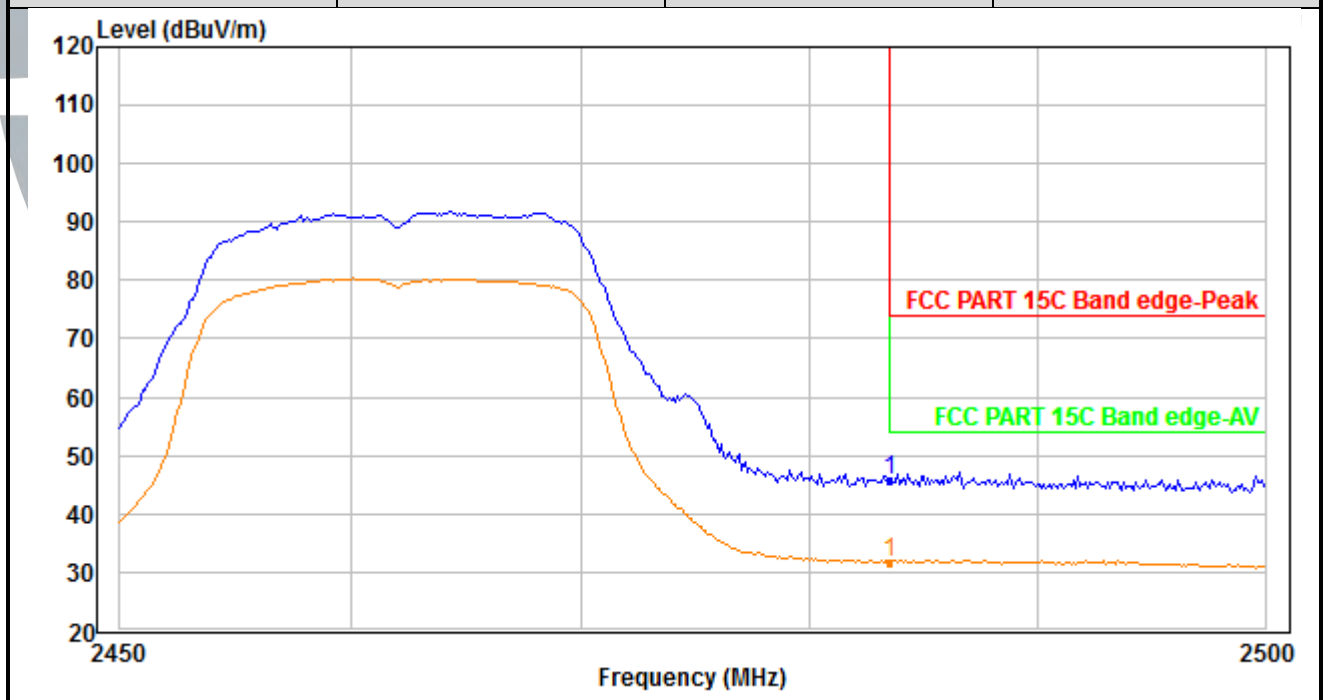
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2388.838	47.88	74.00	/	54.00	Pass
2390.000	46.39	74.00	32.46	54.00	Pass

Test Channel:	Channel 11	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	70.96	74.00	52.56	54.00	Pass

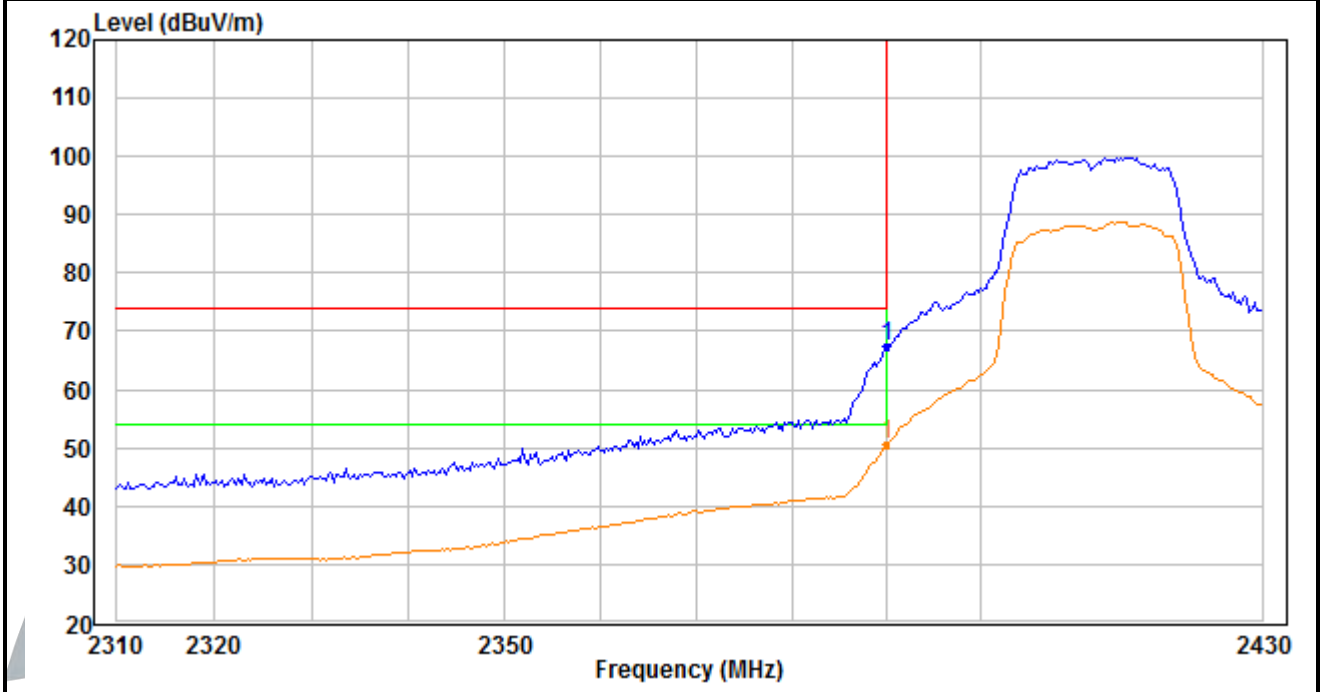
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	45.63	74.00	31.81	54.00	Pass

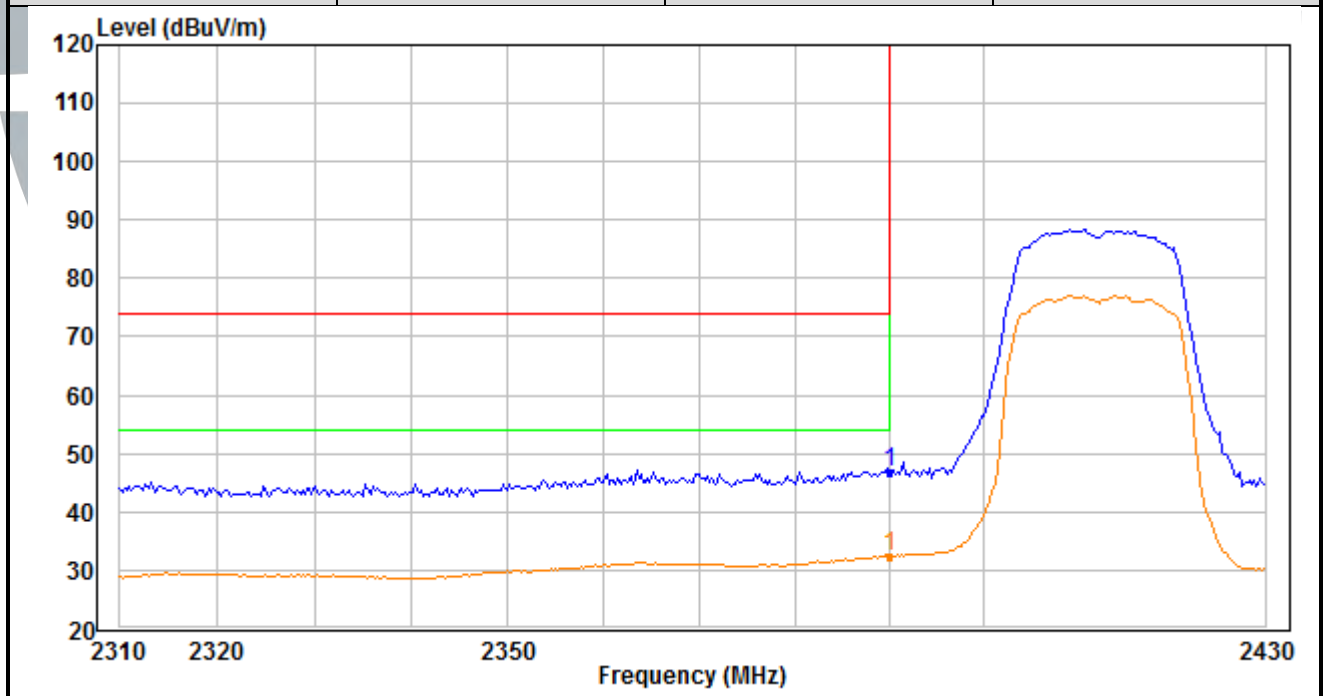
IEEE 802.11n-HT20

Test Channel:	Channel 1	Ant. Polar. :	Horizontal



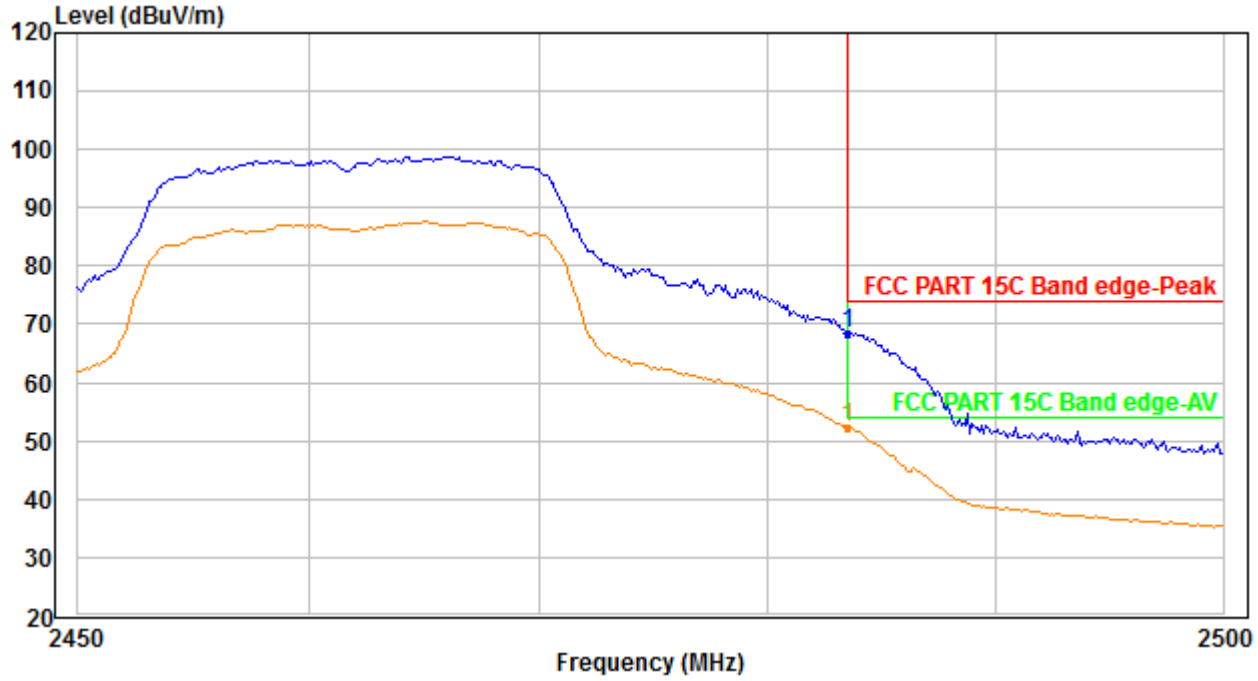
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	67.26	74.00	50.73	54.00	Pass

Test Channel:	Channel 1	Ant. Polar. :	Vertical



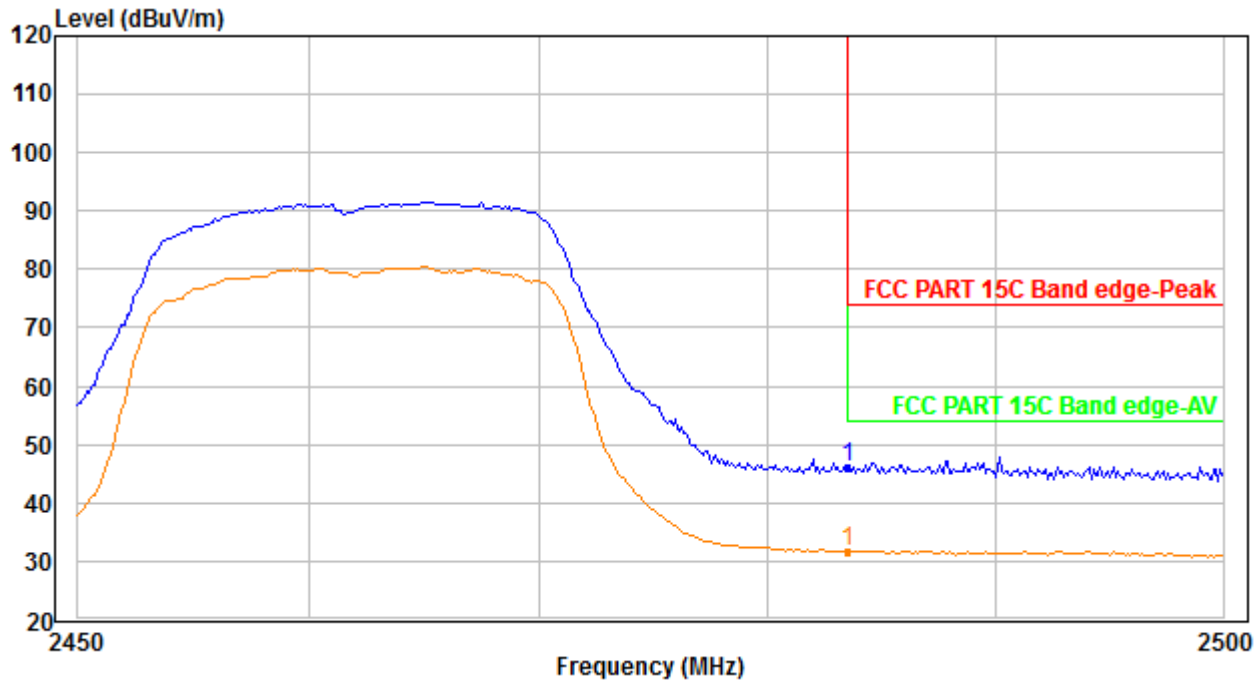
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	46.67	74.00	32.41	54.00	Pass

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	68.55	74.00	52.47	54.00	Pass

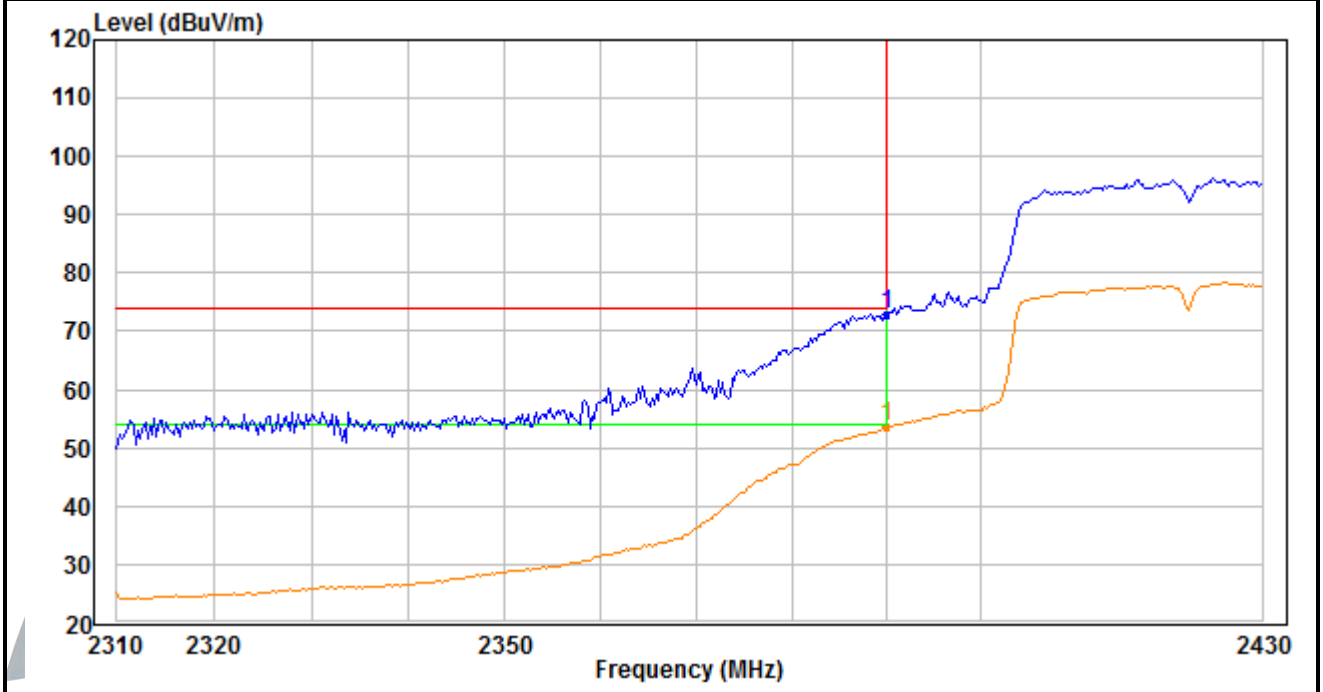
Test Channel:	Channel 11	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	46.04	74.00	31.69	54.00	Pass

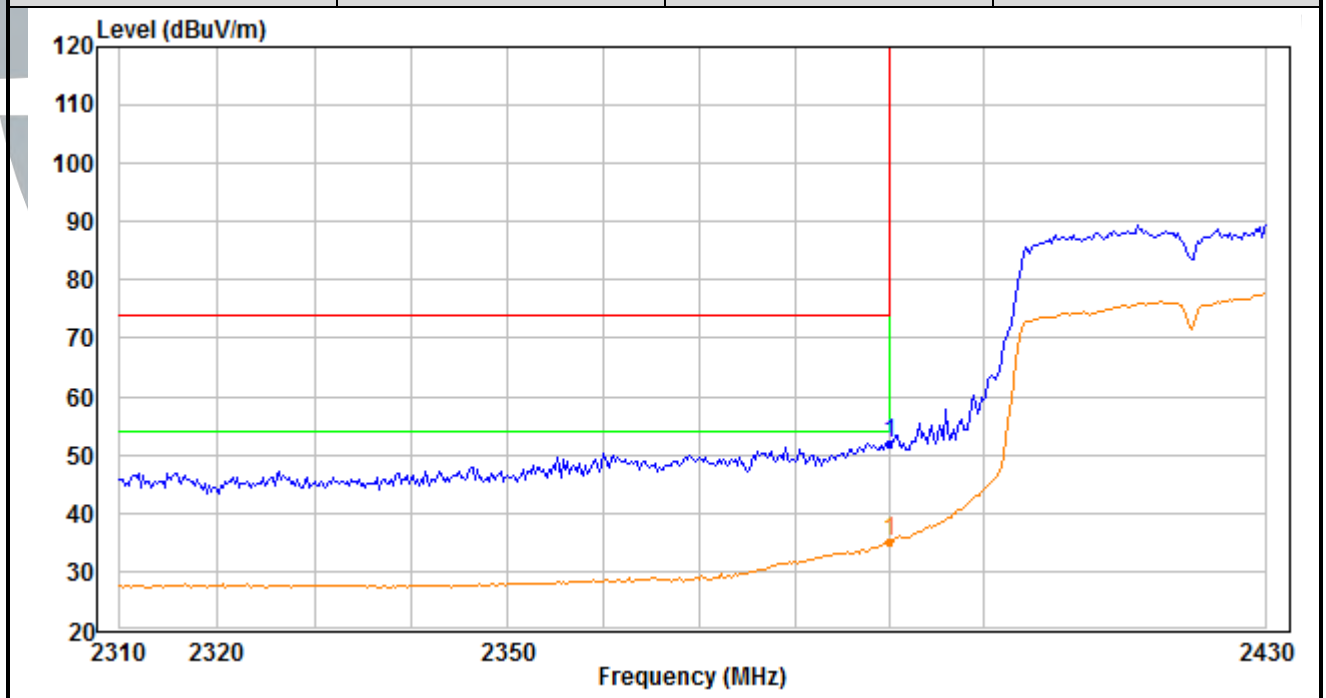
IEEE 802.11n-HT40

Test Channel:	Channel 3	Ant. Polar. :	Horizontal



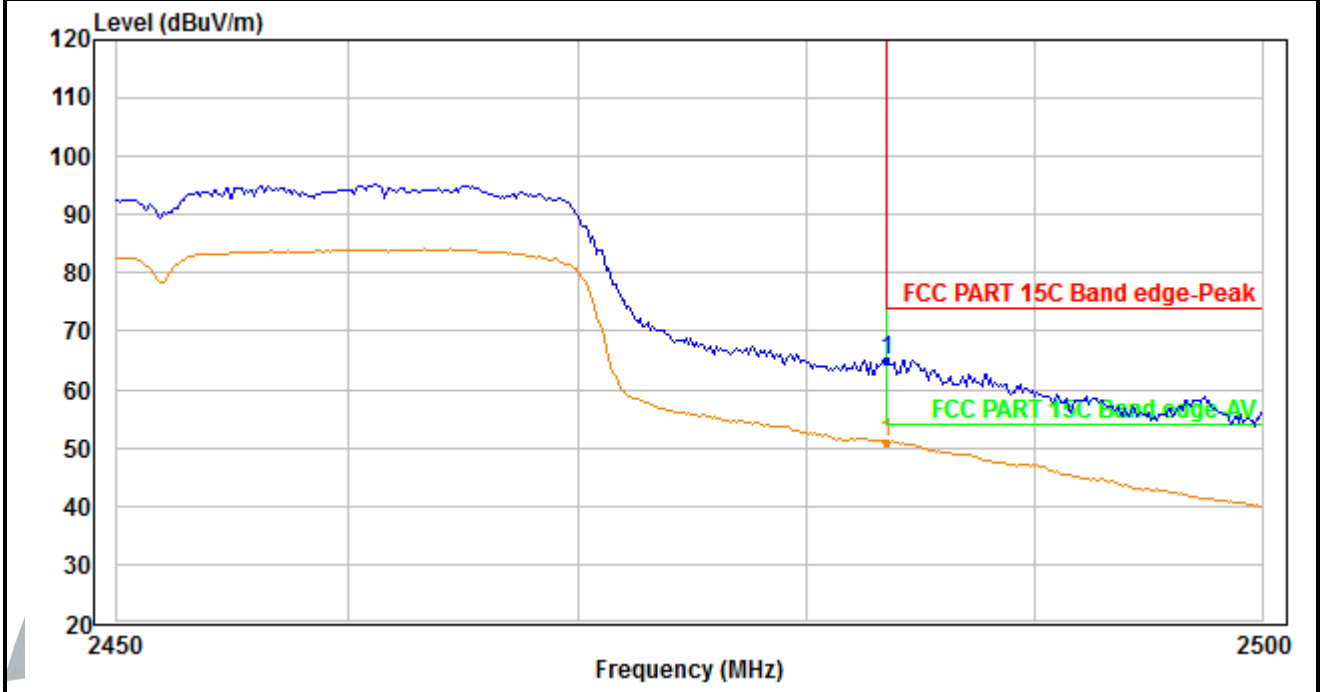
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	72.98	74.00	53.83	54.00	Pass

Test Channel:	Channel 3	Ant. Polar. :	Vertical



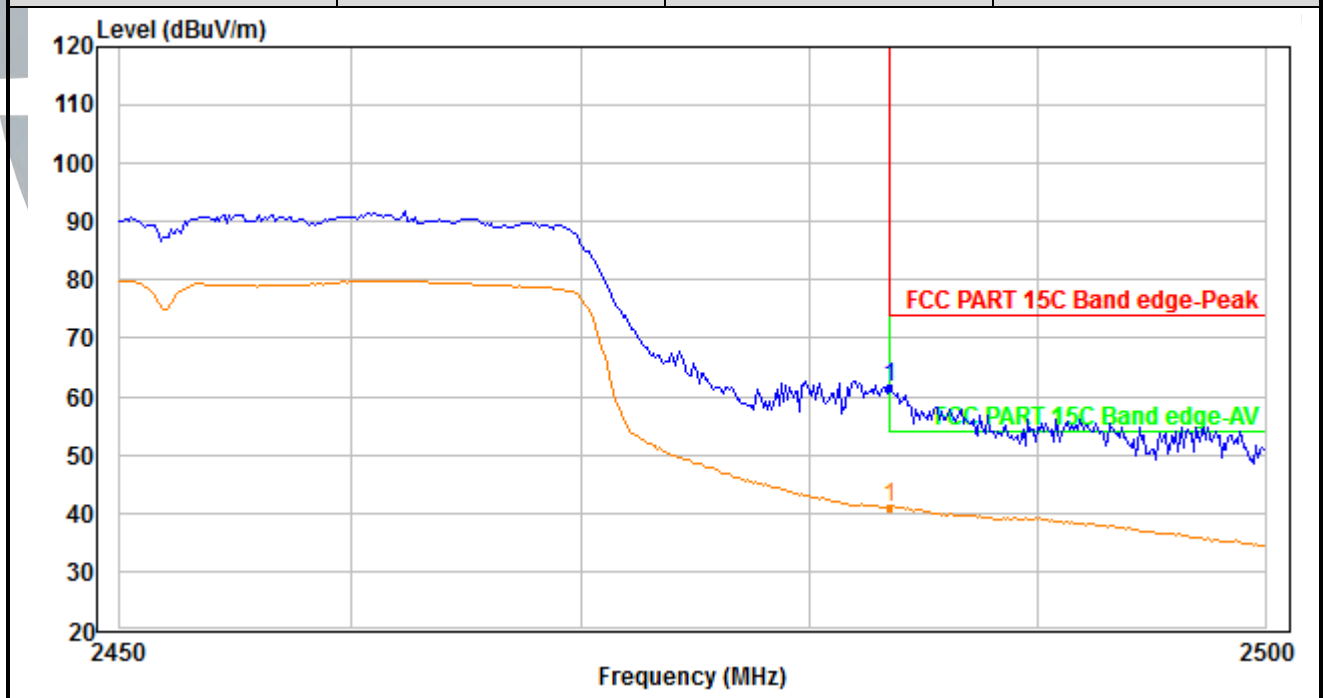
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	51.88	74.00	35.22	54.00	Pass

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	65.12	74.00	50.97	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	61.68	74.00	40.98	54.00	Pass

5.9 CONDUCTED EMISSION

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

Test Method: ANSI C63.10-2013 Section 6.2

Limits:

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

Remark:

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

Test Setup: Refer to section 4.4.2 for details.

Test Procedures:

Test frequency range :150KHz-30MHz

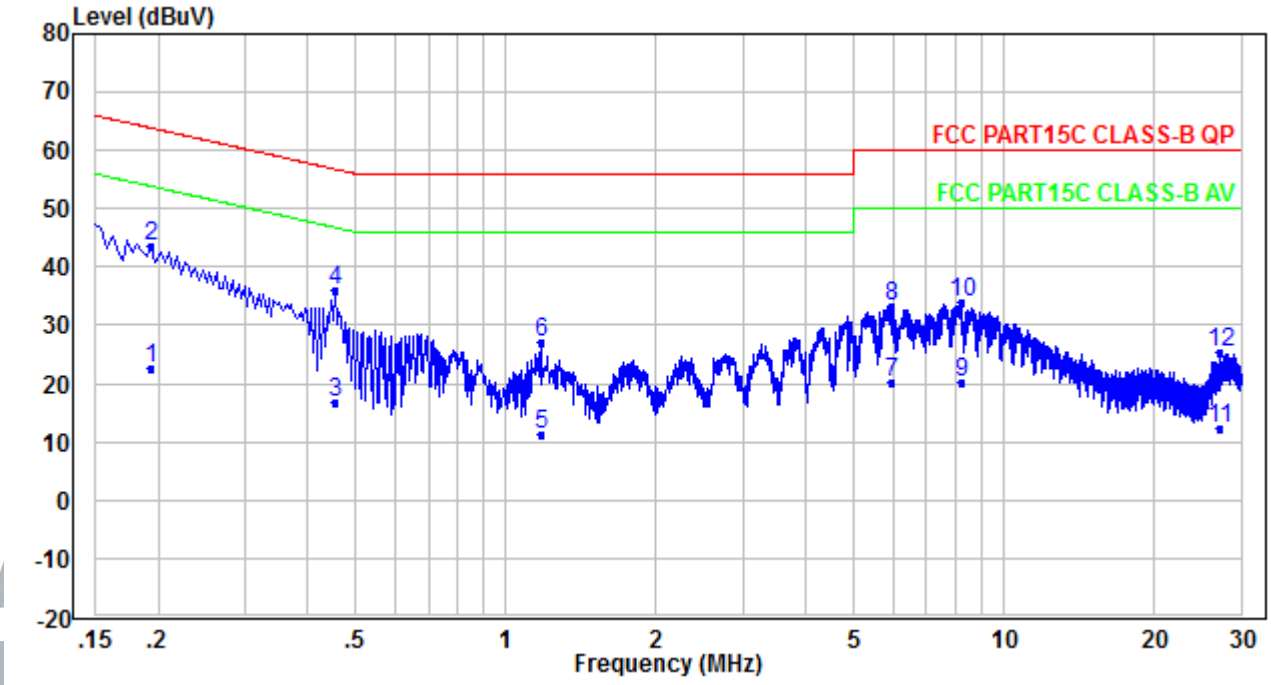
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second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

Equipment Used: Refer to section 3 for details.

Test Result: Pass

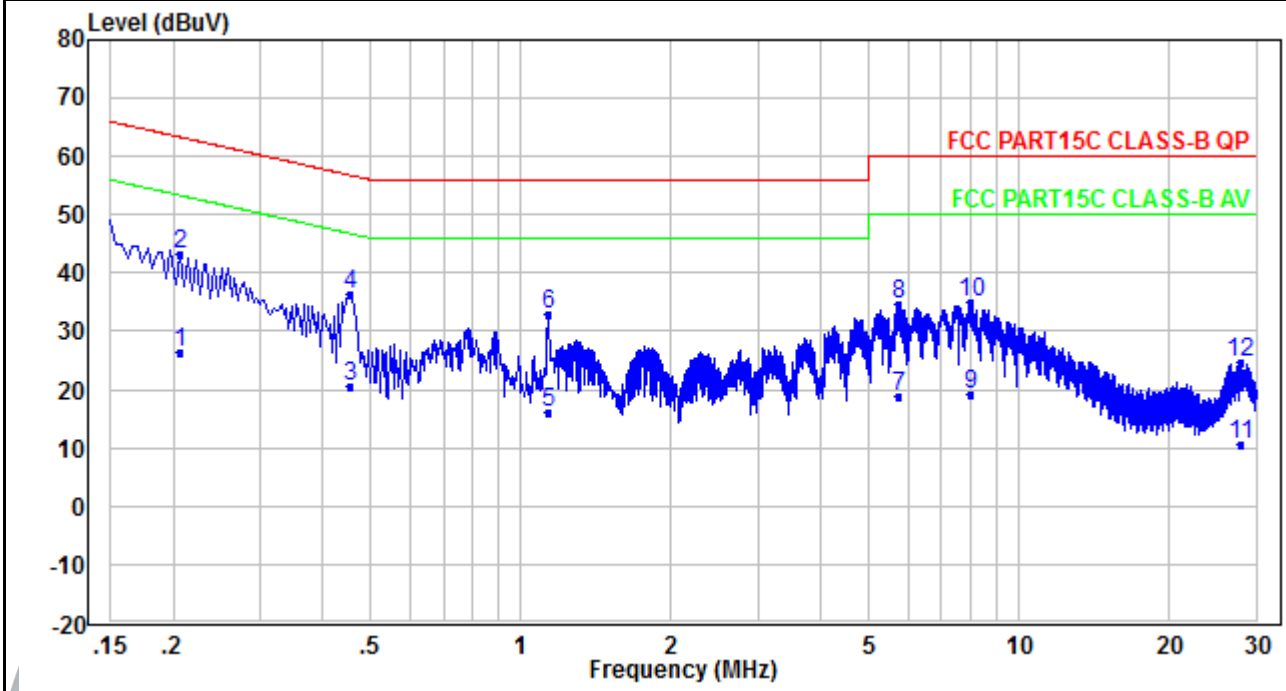
The measurement data as follows:
Quasi Peak and Average:
Mode: WIFI Link

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.194	13.30	9.39	22.69	53.86	-31.17	Average
2	0.194	34.30	9.39	43.69	63.86	-20.17	QP
3	0.454	7.47	9.40	16.87	46.80	-29.93	Average
4	0.454	26.47	9.40	35.87	56.80	-20.93	QP
5	1.174	1.88	9.36	11.24	46.00	-34.76	Average
6	1.174	17.88	9.36	27.24	56.00	-28.76	QP
7	5.950	10.70	9.57	20.27	50.00	-29.73	Average
8	5.950	23.70	9.57	33.27	60.00	-26.73	QP
9	8.261	10.61	9.48	20.09	50.00	-29.91	Average
10	8.261	24.61	9.48	34.09	60.00	-25.91	QP
11	27.220	3.05	9.40	12.45	50.00	-37.55	Average
12	27.220	16.05	9.40	25.45	60.00	-34.55	QP

Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.206	16.84	9.40	26.24	53.37	-27.13	Average
2	0.206	33.84	9.40	43.24	63.37	-20.13	QP
3	0.454	11.02	9.41	20.43	46.80	-26.37	Average
4	0.454	27.02	9.41	36.43	56.80	-20.37	QP
5	1.134	6.51	9.42	15.93	46.00	-30.07	Average
6	1.134	23.51	9.42	32.93	56.00	-23.07	QP
7	5.750	9.24	9.56	18.80	50.00	-31.20	Average
8	5.750	25.24	9.56	34.80	60.00	-25.20	QP
9	7.985	9.60	9.46	19.06	50.00	-30.94	Average
10	7.985	25.60	9.46	35.06	60.00	-24.94	QP
11	27.864	1.15	9.42	10.57	50.00	-39.43	Average
12	27.864	15.15	9.42	24.57	60.00	-35.43	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 1 PHOTOS OF TEST SETUP

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

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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