TEST REPORT

Applicant Name :	Grandstream Networks, Inc.
Address :	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA
Report Number :	RA221230-64612E-RFA
FCC ID:	YZZGWN7661
IC:	11964A-GWN7661

Test Standard (s)

FCC PART 15.247; RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2; RSS-247, ISSUE 2, FEBRUARY 2017

Sample Description

Product Type:	In-Wall Wi-Fi 6 Access Point
Model No.:	GWN7661
Multiple Model(s) No.:	N/A
Trade Mark:	GRANDSTREAM
Date Received:	2022/12/30
Report Date:	2023/03/23

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Andy Yu
EMC Engineer

Approved By:

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA221230-64612E-RFA	Original Report	2023/03/23

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	GWN7661
FVIN	0.12.28.2
Frequency Range	Wi-Fi: 2412-2462MHz
Maximum Conducted Average Output Power	Wi-Fi: 22.51dBm(802.11b), 21.88dBm(802.11g) 23.89dBm(802.11n-HT20), 22.62dBm(802.11n-HT40) 23.72dBm(802.11ax20), 21.97dBm(802.11ax40)
Modulation Technique	Wi-Fi: DSSS, OFDM, OFDMA
Antenna Specification*	ANT1 :3.3dBi, ANT2 :3.51dBi (It is provided by the applicant)
Beam-forming	Support (for 802.11n/ax mode)
Voltage Range	DC48V from POE
Sample serial number	1X4N-1 for Conducted and Radiated Emissions 1X4R-2 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition

Objective

This report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules and RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247, Issue 2, February 2017 of the Innovation, Science and Economic Development Canada rules.

The tests were performed in order to determine Compliant with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliant Testing of Unlicensed Wireless Devices and RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247, Issue 2, February 2017.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 2.4GHz Wi-Fi mode, total 11channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

For 802.11b, 802.11g, 802.11n-HT20, 802.11ax-HEW20, EUT was tested with Channel 1, 6 and 11.
For 802.11n-HT40, 802.11ax-HEW40, EUT was tested with Channel 3, 6, 8 and 9.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"QRCT *" exercise software was used

The device was tested with the worst case was performed as below:

Test Mode	Data rate	RuSize	RuIndex	Power Level*		
				Low Channel	Middle Channel	High Channel
802.11b	1 Mbps	N/A	N/A	21	21	21
802.11g	6 Mbps	N/A	N/A	21	21	19
802.11n20	MCS0	N/A	N/A	21	21	18.5
11AX20	MCS0	26Tone	RU0	10	10	10
		52Tone	RU37	9	9	9
		106Tone	RU53	8	8	8
		242Tone	RU61	21	21	18

Test Mode	Data rate	RuSize	RuIndex	Power Level*			
				Low Channel	Middle Channel	High Channel	
						2447MHz	2452MHz
802.11n40	MCS0	N/A	N/A	19	18.5	16	15
11AX40	MCS0	26Tone	RU0	12	12	12	12
		52Tone	RU37	11	11	11	11
		106Tone	RU53	9	9	9	9
		242Tone	RU61	8	8	8	8
		484Tone	RU65	19	18.5	16	15

The software and power level was provided by the applicant.

The EUT support SISO for all mode, MIMO for 802.11n/ax mode, for MIMO, EUT support beamforming and non-beamforming, according to prescan, the worst case MIMO with beamforming was selected to test for 802.11n/ax mode.

For 802.11ax mode, it's support difference RU configuration, the output power was test with difference RU configuration, other item was only test the full RU mode which was the worst case.

Duty cycle

Test Result: Pass. Please refer to the Appendix.

Support Equipment List and Details

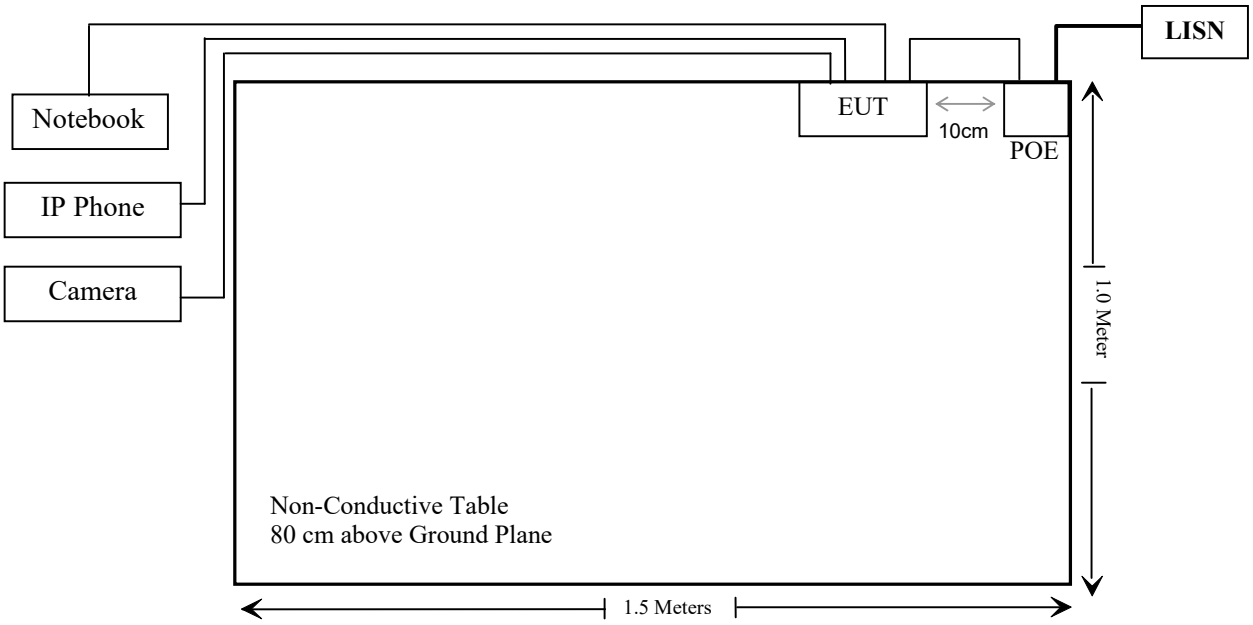
Manufacturer	Description	Model	Serial Number
DELL	NoteBook	Latitude E4710	PC201911252059
Grandstream	IP Phone	GXV3450	Unknown
YEALINK	Camera	UVC84	Unknown
Yealink	POE	Unknown	Unknown

External I/O Cable

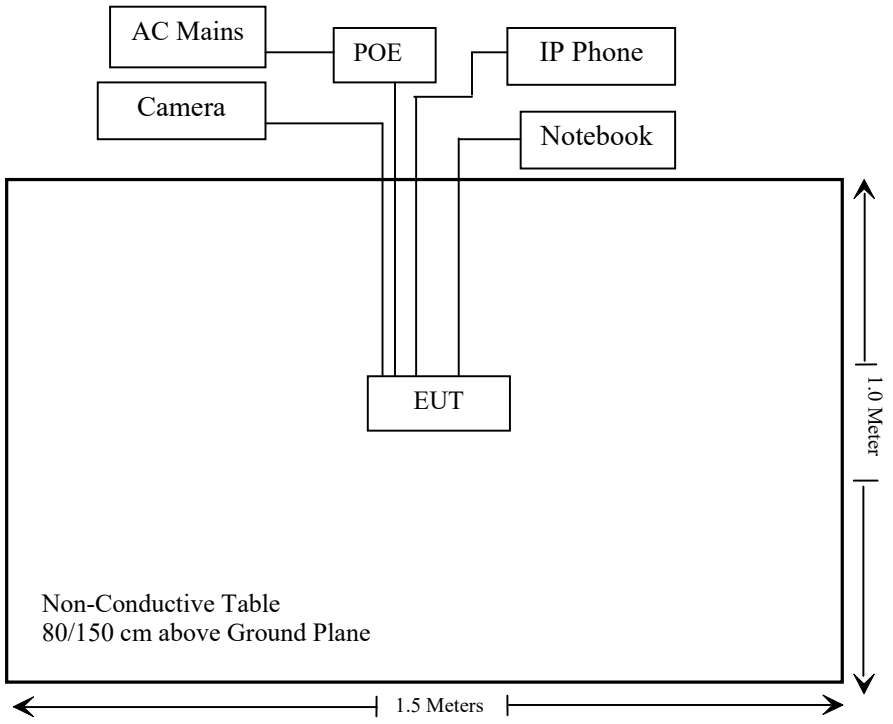
Cable Description	Length (m)	From Port	To
Unshielded detachable AC cable	1.5	POE	LISN
Un-shielded detachable RJ45 cable	1.5	POE	EUT
Un-shielded detachable RJ45 cable	8.0	EUT	NoteBook
Un-shielded detachable RJ45 cable	8.0	EUT	IP Phone
Un-shielded detachable RJ45 cable	8.0	EUT	Camera

Block Diagram of Test Setup

For conducted emission:



For radiated emission:



SUMMARY OF TEST RESULTS

FCC Rules	RSS-247 & RSS-Gen Rules	Description of Test	Result
§15.247 (i), §1.1307 & §2.1091	RSS-102 § 4	RF EXPOSURE	Compliant
§15.203	RSS-Gen §6.8	Antenna Requirement	Compliant
§15.207 (a)	RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	RSS-GEN § 8.10 & RSS-247 § 5.5	Spurious Emissions	Compliant
§15.247 (a)(2)	RSS- Gen§6.7 RSS-247 § 5.2 (a)	99% Occupied Bandwidth & 6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	RSS-247 § 5.4(d)	Maximum Conducted Output Power	Compliant
§15.247(d)	RSS-247 § 5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	RSS-247 § 5.2 (b)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2022/11/25	2023/11/24
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2022/11/25	2023/11/24
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2022/12/07	2023/12/06
Unknown	RF Coaxial Cable	No.17	N0350	2022/11/25	2023/11/24
Conducted Emission Test Software: e3 19821b (V9)					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2022/11/08	2023/11/07
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2022/11/30	2025/11/29
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2022/12/26	2025/12/25
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.16	N650	2022/11/25	2023/11/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF conducted test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101495	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
Tonscend	RF Control Unit	JS0806-2	19G8060182	2022/10/24	2023/10/23
Agilent	USB wideband power sensor	U2021XA	MY54250003	2022/6/27	2023/6/26
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1307 (b) (3) &§2.1091 – RF EXPOSURE

Applicable Standard

According to FCC §2.1091 and §1.1307(b) (3), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D04 Interim General RF Exposure Guidance

SAR-Based Exemption:

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum timeaveraged power or maximum time-averaged ERP, whichever is greater.

Per § 1.1307(b)(3)(i)(B), for single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^x & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^{a}\frac{P_i}{P_{th,i}} + \sum_{j=1}^{b}\frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c}\frac{Evaluated_k}{Exposure\ Limit_k} \le 1$$

Result

For worst case:

Mode	Frequency (MHz)	Tune up conducted power		Antenna Gain		ERP		Evaluation Distance (m)	Pth (mW)
		(dBm)	(mW)	(dBi)	(dBd)	(dBm)	(mW)		
2.4G Wi-Fi	2412-2462	24.0	251.19	6.51	4.36	28.36	685.49	0.2	3060
5G Wi-Fi	5180-5240	25.0	316.23	8.37	6.22	31.22	1324.34	0.2	3060
	5260-5280	19.0	79.43	8.37	6.22	25.22	332.66	0.2	3060
	5500-5700	19.0	79.43	8.37	6.22	25.22	332.66	0.2	3060
	5745-5825	25.5	354.81	8.37	6.22	31.72	1485.94	0.2	3060

Note 1: The tune-up power and antenna gain was declared by the applicant.
Note 2: 0dBd=2.15dBi.
Note 3: the 2.4G Wi-Fi and 5G Wi-Fi can transmit at same time
Note 4. The device employ beamforming for 802.11n/ac/ax mode.
Direction Gain = G_{ANT} + 10*log(N_{ANT}/N_{SS})
For EUT, N_{ANT}=2, for the worst case, N_{SS}=1
For 5G Wi-Fi, G_{ANT1}=4.79dBi, G_{ANT2}=5.37dBi, use the higher gain 5.37dBi for the calculate
So, the direction Gain=5.37dBi+10*log(2/1)=8.37dBi
For 2.4G Wi-Fi, *GANT1=3.3dBi, GANT2=3.51dBi, use the higher gain 3.51dBi for the calculate*
*So, the direction Gain=3.51dBi+10*log(2/1)=6.51dBi*

Simultaneous transmitting consideration (worst case):

The ratio=$P_{2.4G}$/Pth+P_{5G}/Pth=685.49/3060+1485.94/3060=0.71＜1.0, so simultaneous exposure is compliant.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

RSS-102 § 4 –EXPOSURE LIMITS

Applicable Standard

According to RSS-102 §4:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	0.73/ ƒ	-	6**
1.1-10	87/ $ƒ^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $ƒ^{0.25}$	0.1540/ $ƒ^{0.25}$	8.944/ $ƒ^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $ƒ^{0.3417}$	0.008335 $ƒ^{0.3417}$	0.02619 $ƒ^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $ƒ^{1.2}$
150000-300000	0.158 $ƒ^{0.5}$	4.21×10^{-4} $ƒ^{0.5}$	6.67×10^{-5} ƒ	616000/$ƒ^{1.2}$

Note: ƒ is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \le 1$$

Frequency (MHz)	Antenna Gain		Turn up Power		Evaluation Distance (m)	Power Density (W/m^2)	MPE Limit (W/m^2)
	(dBi)	(numeric)	(dBm)	(W)			
2412-2462	6.51	4.48	24.0	0.251	0.20	2.238	5.37
5180-5240	8.37	6.87	14.5	0.028	0.20	0.383	9.01
5260-5280 (Non-BF)	5.37	3.44	17.5	0.056	0.20	0.383	9.13
5260-5280 (BF)	8.37	6.87	14.0	0.025	0.20	0.342	9.13
5500-5700	8.37	6.87	19.0	0.079	0.20	1.080	9.39
5745-5825	8.37	6.87	25.5	0.355	0.20	4.854	9.69

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The 2.4G Wi-Fi and 5G Wi-Fi can transmit at same time
3. The 2.4G Wi-Fi and 5G Wi-Fi can transmit at same time
4. Non-BF means Non-beamforming mode, BF means beamforming mode.
Direction Gain = G_{ANT} + *Array Gain, where Array Gain* = 10*log(N_{ANT}/N_{SS})
For EUT, N_{ANT}=2, for the worst case, N_{SS}=1
For 5G Wi-Fi, G_{ANT1}=4.79dBi, G_{ANT2}=5.37dBi, use the higher gain 5.37dBi for the calculate
So, the direction Gain=5.37dBi+10*log(2/1)=8.37dBi
For 2.4G Wi-Fi, *GANT1=3.3dBi, GANT2=3.51dBi, use the higher gain 3.51dBi for the calculate*
*So, the direction Gain=3.51dBi+10*log(2/1)=6.51dBi*

Simultaneous transmitting consideration (worst case):

The ratio=$MPE_{2.4G}$/limit+MPE_{5G}/limit=2.238/5.37+4.854/9.69=0.918＜1.0, so simultaneous exposure is compliant.

To maintain compliance with the ISEDC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

§15.203 & RSS-Gen §6.8 ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine Compliant with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the Compliant of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device’s antenna shall be stated, based on a measurement or on data from the antenna’s manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device’s ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has two internal antenna arrangement which was permanently attached for 2.4GHz Wi-Fi, fulfill the requirement of this section. Please refer to the EUT photos.

ANT	Type	Antenna Gain	Impedance
ANT 1	Dipole	3.3dBi	50 Ω
ANT 2	Dipole	3.51dBi	50 Ω

Result: Pass

§ 15.207 (a) & RSS-GEN §8.8 AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC § 15.207 (a) & RSS-GEN §8.8

Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 μH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for Compliant with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Table 4 - AC Power Lines Conducted Emission Limits		
Frequency range (MHz)	Conducted limit (dBμV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56[1]	56 to 46[1]
0.5 – 5	56	46
5 – 30	60	50

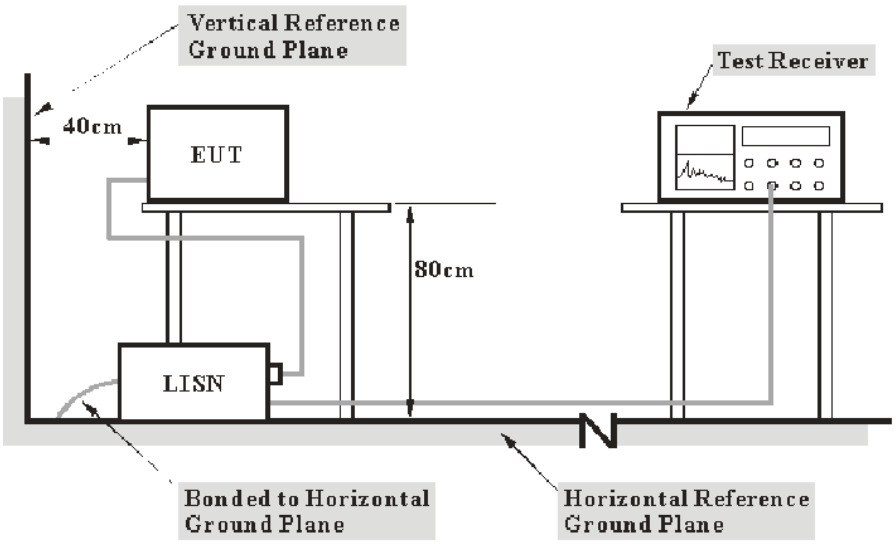
Note 1: The level decreases linearly with the logarithm of the frequency.

For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:

(a) Perform the AC power-line conducted emissions test with the antenna connected to determine Compliant with the limits of table 4 outside the transmitter's fundamental emission band.

(b) Retest with a dummy load instead of the antenna to determine Compliant with the limits of table 4 within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network that simulates the antenna in the fundamental frequency band.

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 & RSS-247/RSS-Gen limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

Transd Factor = LISN VDF + Cable Loss

The "**Over limit**" column of the following data tables indicates the degree of Compliant with the applicable limit. For example, an Over limit of -7 dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

Over Limit = Level – Limit
Level = Read Level + Factor

Test Data

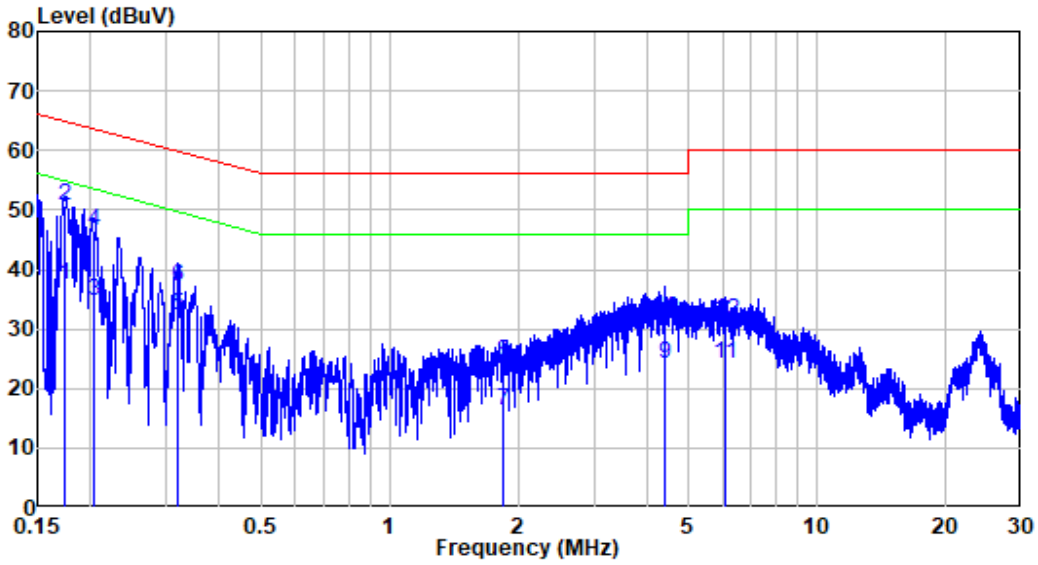
Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Lipa Wu on 2023-02-08.

EUT operation mode: Transmitting (worst case is 802.11N20 mode, low channel)

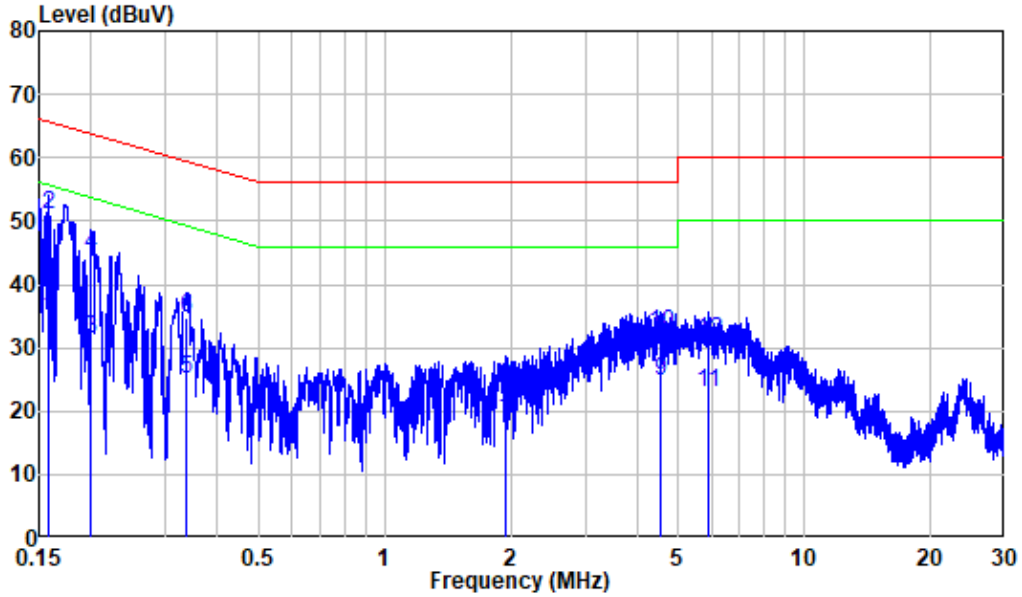
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : RA221230-64612E-RF
Mode : 2.4G WIFi
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.174	9.90	27.63	37.53	54.75	-17.22	Average
2	0.174	9.90	40.94	50.84	64.75	-13.91	QP
3	0.203	9.90	24.69	34.59	53.49	-18.90	Average
4	0.203	9.90	36.58	46.48	63.49	-17.01	QP
5	0.321	9.85	22.40	32.25	49.69	-17.44	Average
6	0.321	9.85	27.29	37.14	59.69	-22.55	QP
7	1.839	9.91	6.27	16.18	46.00	-29.82	Average
8	1.839	9.91	14.56	24.47	56.00	-31.53	QP
9	4.416	9.94	14.19	24.13	46.00	-21.87	Average
10	4.416	9.94	21.71	31.65	56.00	-24.35	QP
11	6.080	9.96	14.08	24.04	50.00	-25.96	Average
12	6.080	9.96	21.51	31.47	60.00	-28.53	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : RA221230-64612E-RF
Mode : 2.4G WIFi
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.158	9.80	24.83	34.63	55.54	-20.91	Average
2	0.158	9.80	41.24	51.04	65.54	-14.50	QP
3	0.200	9.80	21.48	31.28	53.61	-22.33	Average
4	0.200	9.80	34.77	44.57	63.61	-19.04	QP
5	0.336	9.86	15.27	25.13	49.31	-24.18	Average
6	0.336	9.86	24.90	34.76	59.31	-24.55	QP
7	1.942	9.82	8.41	18.23	46.00	-27.77	Average
8	1.942	9.82	14.06	23.88	56.00	-32.12	QP
9	4.528	9.89	14.96	24.85	46.00	-21.15	Average
10	4.528	9.89	22.52	32.41	56.00	-23.59	QP
11	5.902	10.00	12.89	22.89	50.00	-27.11	Average
12	5.902	10.00	21.14	31.14	60.00	-28.86	QP

§15.205, §15.209, §15.247(d) & RSS-GEN § 8.10 & RSS-247 § 5.5 SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

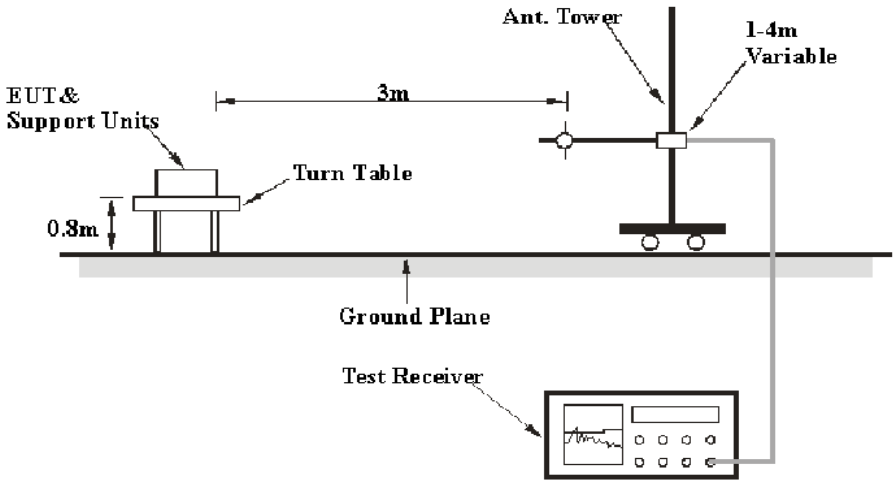
According to RSS-GEN § 8.10 & RSS-247 § 5.5

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

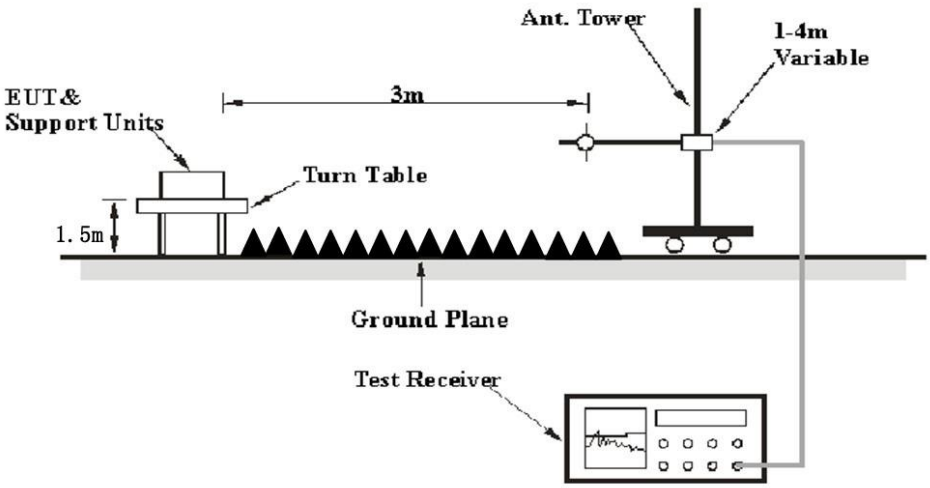
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates Compliant with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013 & RSS-Gen. The specification used was the FCC 15.209, and FCC 15.247 & RSS-Gen limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz [Note 1]	/	Average
	1MHz	＞1/T [Note 2]	/	Average

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

Repeat above procedures until all measured frequencies were complete.

Factor & Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Over Limit/Margin**" column of the following data tables indicates the degree of Compliant with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

Over Limit/Margin = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	24~25.5 ℃
Relative Humidity:	52~50~55 %
ATM Pressure:	101.0 kPa

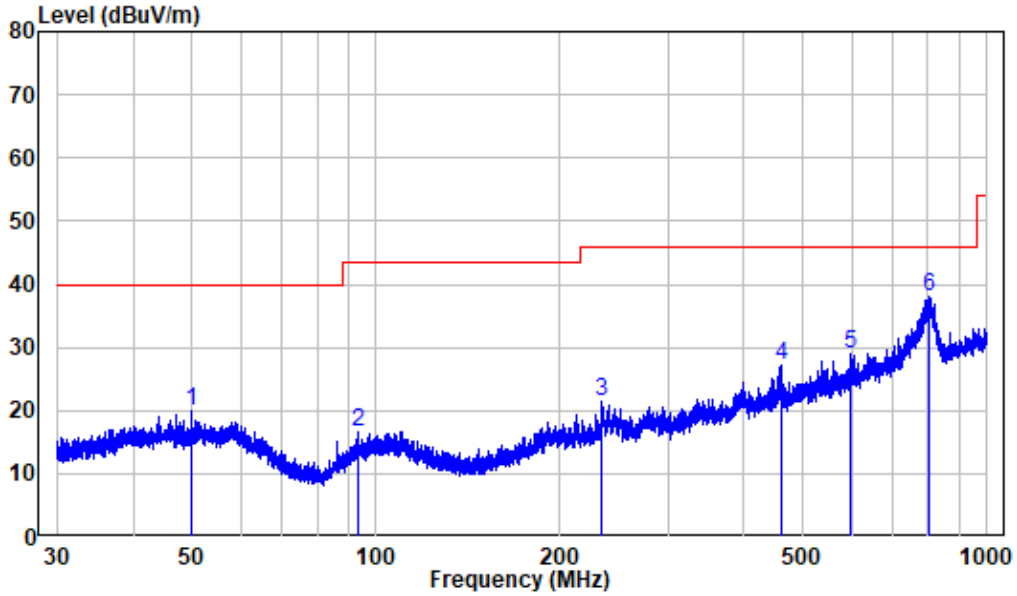
The testing was performed by Jimi Zheng on 2023-02-07 for below 1GHz and Jimi Zheng on 2023-02-14 for above 1GHz.

EUT operation mode: Transmitting

30 MHz~1 GHz: *(worst case is 802.11n20 mode, low channel)*

Note: When the test result of Peak was more than 6dB below the limit of QP, just the Peak value was recorded.

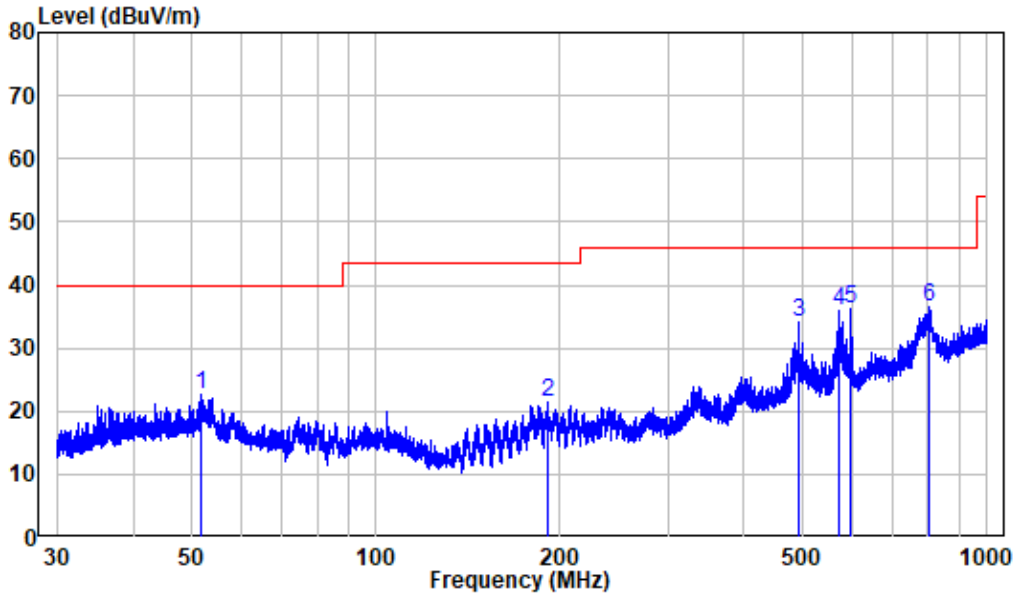
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA221230-64612E-RF
Test Mode: 2.4G WIFI

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	49.729	-9.92	29.79	19.87	40.00	-20.13	Peak
2	93.440	-12.87	29.43	16.56	43.50	-26.94	Peak
3	234.066	-10.99	32.30	21.31	46.00	-24.69	Peak
4	459.316	-5.42	32.51	27.09	46.00	-18.91	Peak
5	598.796	-2.50	31.48	28.98	46.00	-17.02	Peak
6	802.490	-0.40	38.49	38.09	46.00	-7.91	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA221230-64612E-RF
Test Mode: 2.4G WIFI

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	51.526	-9.96	32.70	22.74	40.00	-17.26	Peak
2	190.990	-11.41	32.90	21.49	43.50	-22.01	Peak
3	490.745	-4.64	38.82	34.18	46.00	-11.82	Peak
4	572.614	-3.83	39.70	35.87	46.00	-10.13	Peak
5	599.321	-2.47	38.55	36.08	46.00	-9.92	Peak
6	804.603	-0.43	36.87	36.44	46.00	-9.56	Peak

1 GHz-25 GHz:

Wi-Fi:

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11b(worst case ANT1)									
Low Channel(2412MHz)									
2385.54	65.63	PK	155	1.9	H	-7.22	58.41	74	-15.59
2385.54	53.71	AV	155	1.9	H	-7.22	46.49	54	-7.51
2386.01	66.44	PK	34	1.2	V	-7.22	59.22	74	-14.78
2386.01	54.25	AV	34	1.2	V	-7.22	47.03	54	-6.97
2390	62.89	PK	161	2.1	H	-7.22	55.67	74	-18.33
2390	51.30	AV	161	2.1	H	-7.22	44.08	54	-9.92
2390	63.11	PK	139	2.2	V	-7.22	55.89	74	-18.11
2390	51.52	AV	139	2.2	V	-7.22	44.30	54	-9.70
4824	60.51	PK	358	2	H	-3.52	56.99	74	-17.01
4824	50.10	AV	358	2	H	-3.52	46.58	54	-7.42
4824	59.09	PK	131	2	V	-3.52	55.57	74	-18.43
4824	46.04	AV	131	2	V	-3.52	42.52	54	-11.48
Middle Channel(2437MHz)									
4874	60.16	PK	246	2	H	-3.42	56.74	74	-17.26
4874	49.35	AV	246	2	H	-3.42	45.93	54	-8.07
4874	59.00	PK	341	1.8	V	-3.42	55.58	74	-18.42
4874	45.83	AV	341	1.8	V	-3.42	42.41	54	-11.59
High Channel(2462MHz)									
2483.5	66.83	PK	356	1.2	H	-7.20	59.63	74	-14.37
2483.5	56.89	AV	356	1.2	H	-7.20	49.69	54	-4.31
2483.5	65.30	PK	144	2.1	V	-7.20	58.1	74	-15.90
2483.5	53.06	AV	144	2.1	V	-7.20	45.86	54	-8.14
2487.86	68.81	PK	350	2.2	H	-7.19	61.62	74	-12.38
2487.86	60.09	AV	350	2.2	H	-7.19	52.9	54	-1.10
2488.69	67.23	PK	285	1.4	V	-7.19	60.04	74	-13.96
2488.69	54.90	AV	285	1.4	V	-7.19	47.71	54	-6.29
4924	59.46	PK	94	2.5	H	-3.16	56.30	74	-17.70
4924	48.60	AV	94	2.5	H	-3.16	45.44	54	-8.56
4924	58.37	PK	192	1.4	V	-3.16	55.21	74	-18.79
4924	45.45	AV	192	1.4	V	-3.16	42.29	54	-11.71

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11g (worst case ANT1)									
Low Channel(2412MHz)									
2389.83	69.71	PK	118	2.1	H	-7.22	62.49	74	-11.51
2389.83	55.08	AV	118	2.1	H	-7.22	47.86	54	-6.14
2388.21	67.49	PK	127	1.6	V	-7.22	60.27	74	-13.73
2388.21	54.14	AV	127	1.6	V	-7.22	46.92	54	-7.08
2390	68.80	PK	83	1.2	H	-7.22	61.58	74	-12.42
2390	54.65	AV	83	1.2	H	-7.22	47.43	54	-6.57
2390	65.57	PK	340	1.5	V	-7.22	58.35	74	-15.65
2390	53.68	AV	340	1.5	V	-7.22	46.46	54	-7.54
4824	59.03	PK	270	1.2	H	-3.52	55.51	74	-18.49
4824	43.46	AV	270	1.2	H	-3.52	39.94	54	-14.06
4824	58.21	PK	297	1.5	V	-3.52	54.69	74	-19.31
4824	42.80	AV	297	1.5	V	-3.52	39.28	54	-14.72
Middle Channel(2437MHz)									
4874	58.26	PK	75	1.5	H	-3.42	54.84	74	-19.16
4874	43.17	AV	75	1.5	H	-3.42	39.75	54	-14.25
4874	58.02	PK	143	1.2	V	-3.42	54.6	74	-19.40
4874	42.65	AV	143	1.2	V	-3.42	39.23	54	-14.77
High Channel(2462MHz)									
2483.5	73.26	PK	266	1.8	H	-7.20	66.06	74	-7.94
2483.5	57.73	AV	266	1.8	H	-7.20	50.53	54	-3.47
2483.5	65.29	PK	289	2	V	-7.20	58.09	74	-15.91
2483.5	54.18	AV	289	2	V	-7.20	46.98	54	-7.02
2483.75	75.02	PK	88	2.5	H	-7.20	67.82	74	-6.18
2483.75	59.50	AV	88	2.5	H	-7.20	52.3	54	-1.70
2484.56	67.84	PK	293	2	V	-7.20	60.64	74	-13.36
2484.56	55.27	AV	293	2	V	-7.20	48.07	54	-5.93
4924	59.34	PK	224	1.6	H	-3.16	56.18	74	-17.82
4924	43.65	AV	224	1.6	H	-3.16	40.49	54	-13.51
4924	58.68	PK	76	1.8	V	-3.16	55.52	74	-18.48
4924	43.07	AV	76	1.8	V	-3.16	39.91	54	-14.09

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11n20									
Low Channel(2412MHz)									
2384.73	67.23	PK	327	2.5	H	-7.21	60.02	74	-13.98
2384.73	54.70	AV	327	2.5	H	-7.21	47.49	54	-6.51
2385.68	66.62	PK	121	1.9	V	-7.22	59.40	74	-14.60
2385.68	54.39	AV	121	1.9	V	-7.22	47.17	54	-6.83
2390	64.95	PK	84	2.5	H	-7.22	57.73	74	-16.27
2390	54.07	AV	84	2.5	H	-7.22	46.85	54	-7.15
2390	64.58	PK	221	2.2	V	-7.22	57.36	74	-16.64
2390	53.70	AV	221	2.2	V	-7.22	46.48	54	-7.52
4824	58.95	PK	176	1.9	H	-3.52	55.43	74	-18.57
4824	43.58	AV	176	1.9	H	-3.52	40.06	54	-13.94
4824	58.24	PK	279	2	V	-3.52	54.72	74	-19.28
4824	43.00	AV	279	2	V	-3.52	39.48	54	-14.52
Middle Channel(2437MHz)									
4874	58.75	PK	38	1.2	H	-3.42	55.33	74	-18.67
4874	43.29	AV	38	1.2	H	-3.42	39.87	54	-14.13
4874	58.13	PK	139	1.7	V	-3.42	54.71	74	-19.29
4874	42.92	AV	139	1.7	V	-3.42	39.5	54	-14.50
High Channel(2462MHz)									
2483.5	73.68	PK	218	2.2	H	-7.20	66.48	74	-7.52
2483.5	57.82	AV	218	2.2	H	-7.20	50.62	54	-3.38
2483.5	64.87	PK	342	1.9	V	-7.20	57.67	74	-16.33
2483.5	54.09	AV	342	1.9	V	-7.20	46.89	54	-7.11
2484.01	75.11	PK	3	1.8	H	-7.20	67.91	74	-6.09
2484.01	59.24	AV	3	1.8	H	-7.20	52.04	54	-1.96
2483.65	66.93	PK	347	1	V	-7.20	59.73	74	-14.27
2483.65	55.00	AV	347	1	V	-7.20	47.8	54	-6.20
4924	58.26	PK	300	1.5	H	-3.16	55.10	74	-18.90
4924	43.00	AV	300	1.5	H	-3.16	39.84	54	-14.16
4924	57.77	PK	237	2.3	V	-3.16	54.61	74	-19.39
4924	42.71	AV	237	2.3	V	-3.16	39.55	54	-14.45

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11n40									
Low Channel (2422MHz)									
2389.94	68.57	PK	293	1	H	-7.22	61.35	74	-12.65
2389.94	55.35	AV	293	1	H	-7.22	48.13	54	-5.87
2389.71	67.58	PK	48	1.1	V	-7.22	60.36	74	-13.64
2389.71	54.94	AV	48	1.1	V	-7.22	47.72	54	-6.28
2390	67.38	PK	247	2.3	H	-7.22	60.16	74	-13.84
2390	54.79	AV	247	2.3	H	-7.22	47.57	54	-6.43
2390	65.90	PK	308	1.7	V	-7.22	58.68	74	-15.32
2390	53.71	AV	308	1.7	V	-7.22	46.49	54	-7.51
4844	59.49	PK	113	1.9	H	-3.54	55.95	74	-18.05
4844	43.83	AV	113	1.9	H	-3.54	40.29	54	-13.71
4844	58.76	PK	131	1.7	V	-3.54	55.22	74	-18.78
4844	43.41	AV	131	1.7	V	-3.54	39.87	54	-14.13
Middle Channel (2437MHz)									
4874	59.20	PK	311	1.1	H	-3.42	55.78	74	-18.22
4874	43.69	AV	311	1.1	H	-3.42	40.27	54	-13.73
4874	58.67	PK	194	1.4	V	-3.42	55.25	74	-18.75
4874	43.35	AV	194	1.4	V	-3.42	39.93	54	-14.07
High Channel (2447MHz)									
2483.5	73.42	PK	254	2.2	H	-7.20	66.22	74	-7.78
2483.5	58.09	AV	254	2.2	H	-7.20	50.89	54	-3.11
2483.5	67.36	PK	342	1.4	V	-7.20	60.16	74	-13.84
2483.5	55.84	AV	342	1.4	V	-7.20	48.64	54	-5.36
2484.97	75.48	PK	85	2	H	-7.20	68.28	74	-5.72
2484.97	59.90	AV	85	2	H	-7.20	52.7	54	-1.30
2483.84	69.11	PK	105	1.6	V	-7.20	61.91	74	-12.09
2483.84	56.97	AV	105	1.6	V	-7.20	49.77	54	-4.23
High Channel (2452MHz)									
2483.5	72.54	PK	18	1.5	H	-7.20	65.34	74	-8.66
2483.5	57.92	AV	18	1.5	H	-7.20	50.72	54	-3.28
2483.5	67.50	PK	319	1.9	V	-7.20	60.3	74	-13.70
2483.5	55.31	AV	319	1.9	V	-7.20	48.11	54	-5.89
2485.06	75.83	PK	158	1.4	H	-7.20	68.63	74	-5.37
2485.06	60.08	AV	158	1.4	H	-7.20	52.88	54	-1.12

2484.23	68.87	PK	21	2	V	-7.20	61.67	74	-12.33
2484.23	56.49	AV	21	2	V	-7.20	49.29	54	-4.71
4904	58.95	PK	244	1.5	H	-3.26	55.69	74	-18.31
4904	43.44	AV	244	1.5	H	-3.26	40.18	54	-13.82
4904	58.56	PK	338	1.2	V	-3.26	55.30	74	-18.70
4904	43.20	AV	338	1.2	V	-3.26	39.94	54	-14.06

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11ax20									
Low Channel 2412MHz									
2388.09	68.01	PK	7	1.6	H	-7.22	60.79	74	-13.21
2388.09	55.10	AV	7	1.6	H	-7.22	47.88	54	-6.12
2389.64	66.74	PK	83	1.2	V	-7.22	59.52	74	-14.48
2389.64	54.77	AV	83	1.2	V	-7.22	47.55	54	-6.45
2390	65.38	PK	25	1.3	H	-7.22	58.16	74	-15.84
2390	54.59	AV	25	1.3	H	-7.22	47.37	54	-6.63
2390	64.95	PK	21	2.2	V	-7.22	57.73	74	-16.27
2390	54.22	AV	21	2.2	V	-7.22	47.00	54	-7.00
4824	59.47	PK	246	2	H	-3.52	55.95	74	-18.05
4824	43.58	AV	246	2	H	-3.52	40.06	54	-13.94
4824	58.94	PK	228	1.3	V	-3.52	55.42	74	-18.58
4824	43.20	AV	228	1.3	V	-3.52	39.68	54	-14.32
Middle Channel 2437MHz									
4874	59.11	PK	188	1.7	H	-3.42	55.69	74	-18.31
4874	43.46	AV	188	1.7	H	-3.42	40.04	54	-13.96
4874	58.72	PK	137	1.2	V	-3.42	55.3	74	-18.70
4874	43.23	AV	137	1.2	V	-3.42	39.81	54	-14.19
High Channel 2462MHz									
2483.5	74.30	PK	351	2.2	H	-7.20	67.1	74	-6.90
2483.5	58.12	AV	351	2.2	H	-7.20	50.92	54	-3.08
2483.5	66.49	PK	233	2	V	-7.20	59.29	74	-14.71
2483.5	55.23	AV	233	2	V	-7.20	48.03	54	-5.97
2483.78	76.41	PK	334	2.1	H	-7.20	69.21	74	-4.79
2483.78	60.10	AV	334	2.1	H	-7.20	52.9	54	-1.10
2485.85	67.94	PK	48	2.4	V	-7.20	60.74	74	-13.26
2485.85	55.76	AV	48	2.4	V	-7.20	48.56	54	-5.44
4924	58.74	PK	267	1.1	H	-3.16	55.58	74	-18.42
4924	43.29	AV	267	1.1	H	-3.16	40.13	54	-13.87
4924	58.46	PK	142	2	V	-3.16	55.30	74	-18.70
4924	42.97	AV	142	2	V	-3.16	39.81	54	-14.19

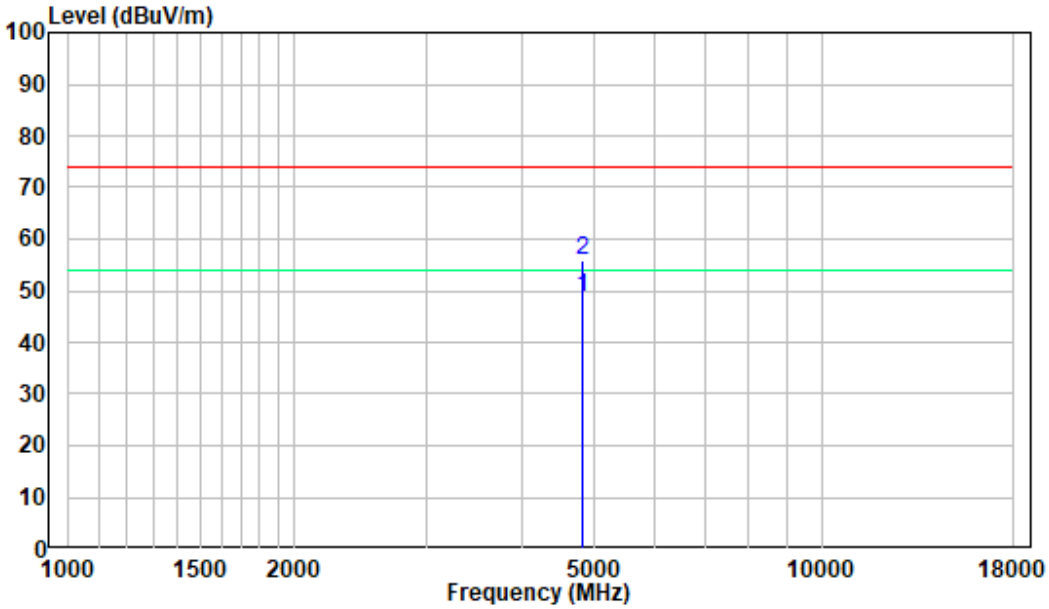
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11ax40									
Low Channel 2422MHz									
2387.96	69.71	PK	307	2.2	H	-7.22	62.49	74	-11.51
2387.96	55.90	AV	307	2.2	H	-7.22	48.68	54	-5.32
2389.55	68.04	PK	28	2.2	V	-7.22	60.82	74	-13.18
2389.55	55.19	AV	28	2.2	V	-7.22	47.97	54	-6.03
2390	67.83	PK	76	2.2	H	-7.22	60.61	74	-13.39
2390	54.95	AV	76	2.2	H	-7.22	47.73	54	-6.27
2390	66.38	PK	48	1.6	V	-7.22	59.16	74	-14.84
2390	54.57	AV	48	1.6	V	-7.22	47.35	54	-6.65
4844	59.77	PK	323	1.4	H	-3.54	56.23	74	-17.77
4844	43.92	AV	323	1.4	H	-3.54	40.38	54	-13.62
4844	59.06	PK	153	1.8	V	-3.54	55.52	74	-18.48
4844	43.61	AV	153	1.8	V	-3.54	40.07	54	-13.93
Middle Channel 2437MHz									
4874	59.35	PK	153	1.9	H	-3.42	55.93	74	-18.07
4874	43.80	AV	153	1.9	H	-3.42	40.38	54	-13.62
4874	58.73	PK	61	1	V	-3.42	55.31	74	-18.69
4874	43.51	AV	61	1	V	-3.42	40.09	54	-13.91
High Channel 2447MHz									
2483.5	74.23	PK	308	2.2	H	-7.20	67.03	74	-6.97
2483.5	58.14	AV	308	2.2	H	-7.20	50.94	54	-3.06
2483.5	68.00	PK	333	1.4	V	-7.20	60.8	74	-13.20
2483.5	56.22	AV	333	1.4	V	-7.20	49.02	54	-4.98
2483.69	76.91	PK	37	1.9	H	-7.20	69.71	74	-4.29
2483.69	60.06	AV	37	1.9	H	-7.20	52.86	54	-1.14
2484.12	69.59	PK	21	2.2	V	-7.20	62.39	74	-11.61
2484.12	57.15	AV	21	2.2	V	-7.20	49.95	54	-4.05
High Channel 2452MHz									
2483.5	73.44	PK	248	2.1	H	-7.20	66.24	74	-7.76
2483.5	58.19	AV	248	2.1	H	-7.20	50.99	54	-3.01
2483.5	68.36	PK	278	1	V	-7.20	61.16	74	-12.84
2483.5	55.32	AV	278	1	V	-7.20	48.12	54	-5.88
2484.58	77.47	PK	36	1.4	H	-7.20	70.27	74	-3.73
2484.58	60.13	AV	36	1.4	H	-7.20	52.93	54	-1.07
2483.77	71.51	PK	285	2	V	-7.20	64.31	74	-9.69
2483.77	56.24	AV	285	2	V	-7.20	49.04	54	-4.96

4904	58.87	PK	51	1.8	H	-3.26	55.61	74	-18.39
4904	43.56	AV	51	1.8	H	-3.26	40.30	54	-13.70
4904	58.39	PK	229	1.5	V	-3.26	55.13	74	-18.87
4904	43.28	AV	229	1.5	V	-3.26	40.02	54	-13.98

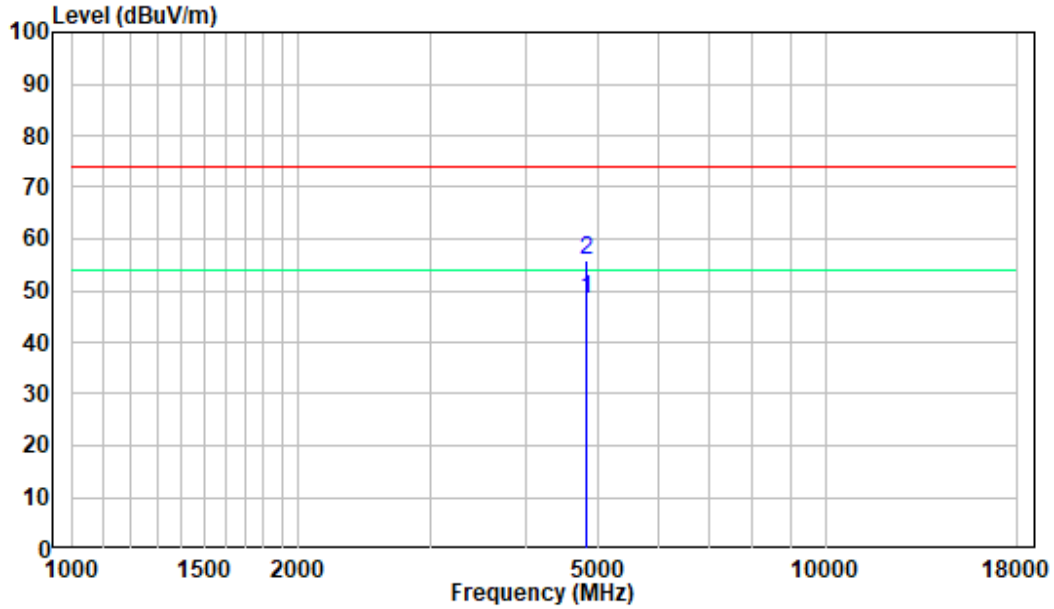
1-18 GHz:

Pre-scan for 802.11b, Low Channel, ANT 1

Horizontal



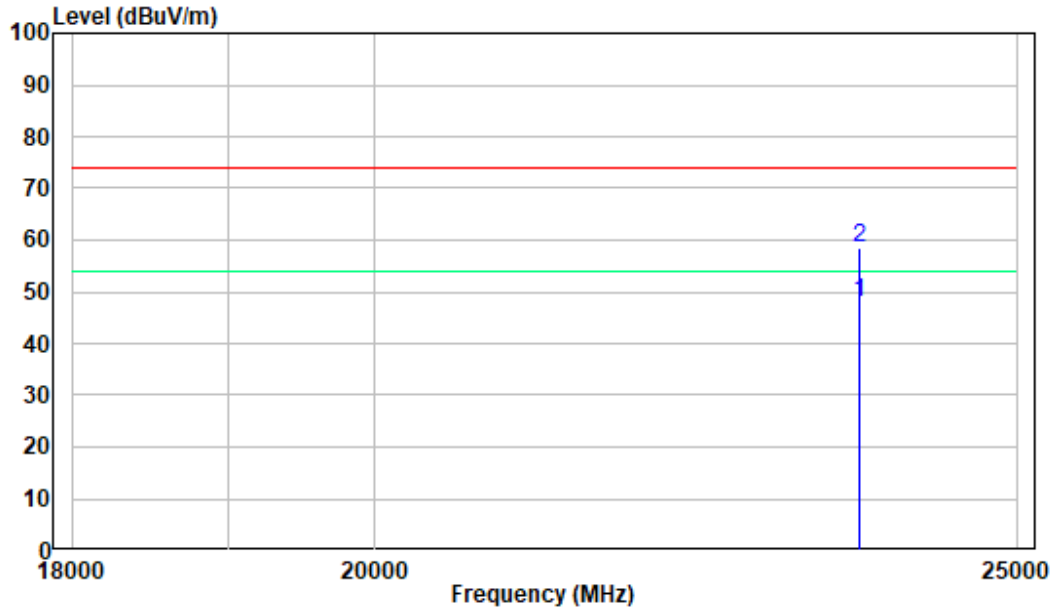
Vertical



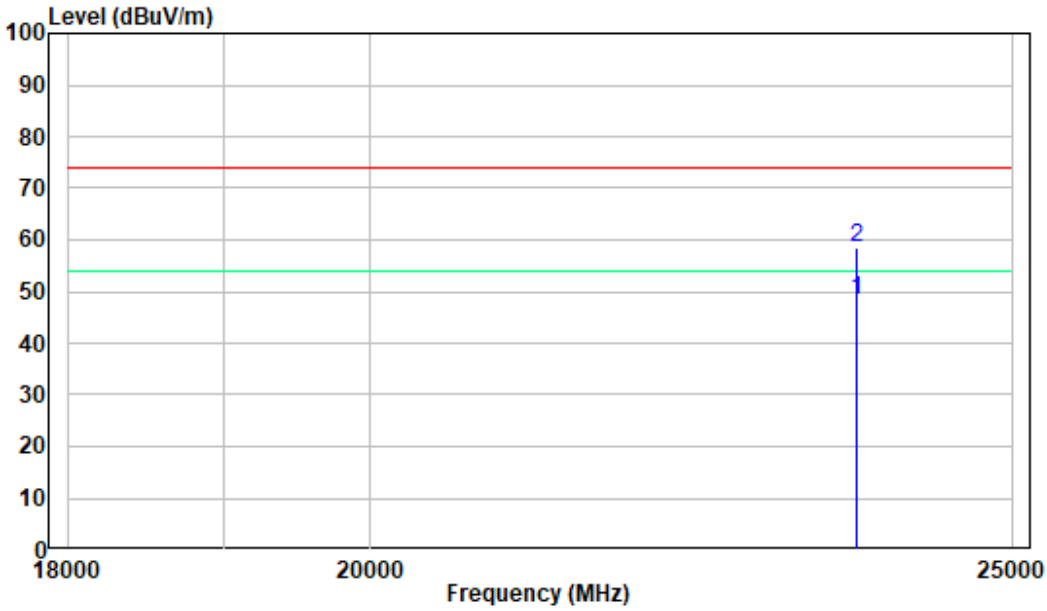
18 -25GHz:

Pre-scan for 802.11b, Low Channel, ANT 1

Horizontal



Vertical



§15.247 (a)(2) & RSS-Gen§6.7 RSS-247 § 5.2 (a) 99% OCCUPIED BANDWIDTH & 6 dB EMISSION BANDWIDTH

Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "6 dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated 6 dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

Test Procedure

Test Method: ANSI C63.10-2013 section 11.8 and section 6.9.3

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

The following conditions shall be observed for measuring the occupied bandwidth and 6 dB bandwidth:
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

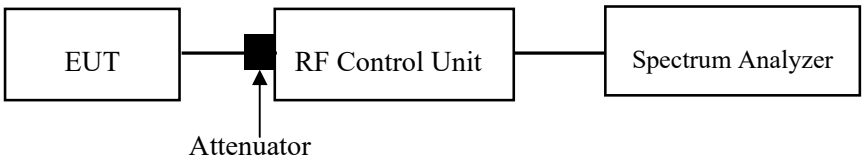
• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / 6 dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 6 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in Compliant with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed

in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).



Test Data

Environmental Conditions

Temperature:	24~25.5 ℃
Relative Humidity:	50~55 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling from 2023-02-11 to 2023-03-16.

EUT operation mode: Transmitting

Test Result Compliant. Please refer to the Appendix.

§15.247(b)(3) & RSS-247 § 5.4(d) MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, Compliant with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

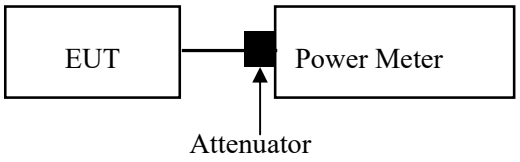
For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak power measurement, Compliant can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

Test Method: ANSI C63.10-2013 section 11.9.2.3.2

a. Place the EUT on a bench and set it in transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
c. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	24~25.5 ℃
Relative Humidity:	50~55 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling from 2023-02-11 to 2023-03-16.

EUT operation mode: Transmitting

Test Result Compliant. Please refer to the Appendix.

§ 15.247(d) & RSS-247 § 5.5 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

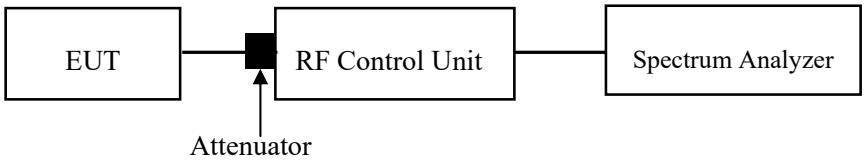
Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates Compliant with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

Test Method: ANSI C63.10-2013 section 11.11.2

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
c. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
d. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
e. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	24~25.5 ℃
Relative Humidity:	50~55 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling from 2023-02-11 to 2023-03-16.

EUT operation mode: Transmitting

Test Result Compliant. Please refer to the Appendix.

§15.247(e) & RSS-247 § 5.2 (b) POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

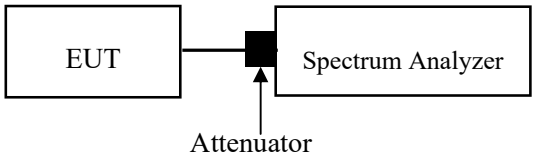
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

Test Procedure

Test Method: ANSI C63.10-2013 section 11.10.5

The following procedure is applicable when the EUT cannot be configured to transmit continuously (i.e., $D < 98\%$), when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e., duty cycle variations are less than ±2%):

a) Measure the duty cycle (*D*) of the transmitter output signal as described in 11.6.
b) Set instrument center frequency to DTS channel center frequency.
c) Set span to at least 1.5 times the OBW.
d) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
e) Set VBW ≥ [3 · RBW].
f) Detector = power averaging (rms) or sample detector (when rms not available).
g) Ensure that the number of measurement points in the sweep ≥ [2 · span / RBW].
h) Sweep time = auto couple.
i) Do not use sweep triggering; allow sweep to “free run.”
j) Employ trace averaging (rms) mode over a minimum of 100 traces.
k) Use the peak marker function to determine the maximum amplitude level.
l) Add [10 log (1 / *D*)], where *D* is the duty cycle measured in step a), to the measured PSD to compute the average PSD during the actual transmission time.
m) If measured value exceeds requirement specified by regulatory agency, 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 Data

Environmental Conditions

Temperature:	24~25.5 ℃
Relative Humidity:	50~55 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling from 2023-03-02 to 2023-03-22.

EUT operation mode: Transmitting

Test Result Compliant. Please refer to the Appendix.

APPENDIX

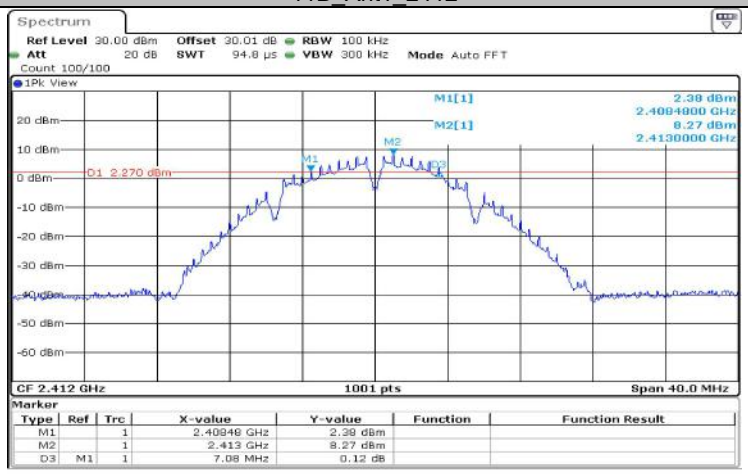
Appendix A: DTS Bandwidth

Test Result

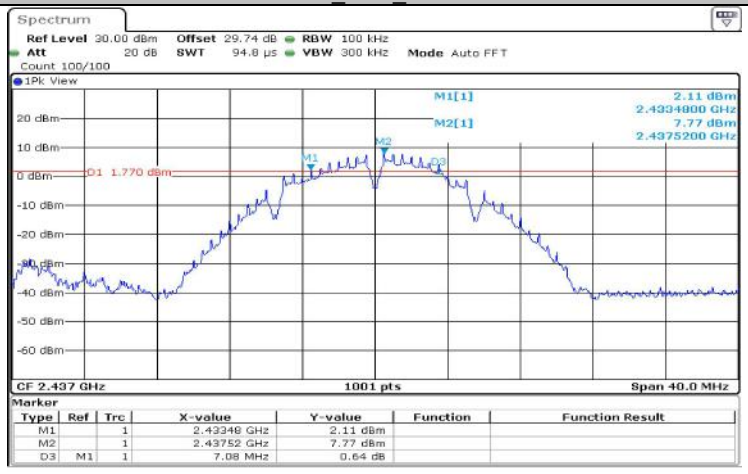
Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	7.08	2408.48	2415.56	0.5	PASS
	Ant1	2437	7.08	2433.48	2440.56	0.5	PASS
	Ant1	2462	7.08	2458.48	2465.56	0.5	PASS
11G	Ant1	2412	15.12	2404.44	2419.56	0.5	PASS
	Ant1	2437	15.12	2429.44	2444.56	0.5	PASS
	Ant1	2462	15.92	2453.84	2469.76	0.5	PASS
11N20MIMO	Ant1	2412	15.28	2404.24	2419.52	0.5	PASS
	Ant1	2437	15.68	2429.44	2445.12	0.5	PASS
	Ant1	2462	16.32	2453.84	2470.16	0.5	PASS
11N40MIMO	Ant1	2422	35.92	2404.24	2440.16	0.5	PASS
	Ant1	2437	35.68	2419.48	2455.16	0.5	PASS
	Ant1	2447	35.44	2429.48	2464.92	0.5	PASS
	Ant1	2452	35.44	2434.48	2469.92	0.5	PASS
11AX20MIMO_242Tone_RU61	Ant1	2412	17.92	2403.20	2421.12	0.5	PASS
	Ant1	2437	14.16	2429.52	2443.68	0.5	PASS
	Ant1	2462	18.32	2452.92	2471.24	0.5	PASS
11AX40MIMO_484Tone_RU65	Ant1	2422	37.04	2403.84	2440.88	0.5	PASS
	Ant1	2437	37.76	2418.20	2455.96	0.5	PASS
	Ant1	2447	37.68	2428.20	2465.88	0.5	PASS
	Ant1	2452	37.68	2433.20	2470.88	0.5	PASS

Test Graphs

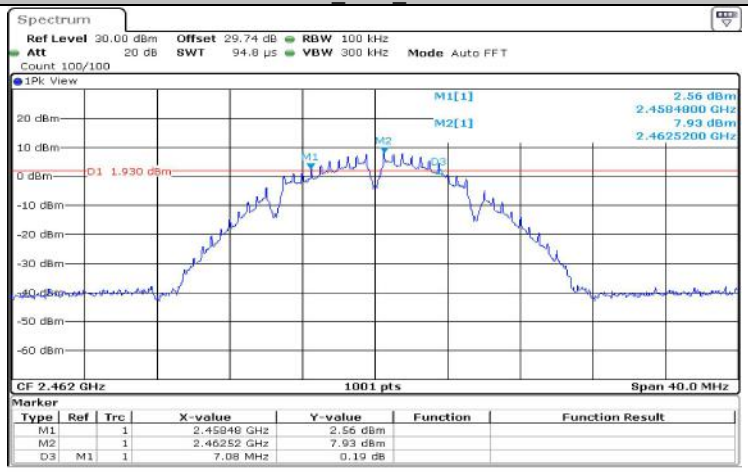
11B_Ant1_2412



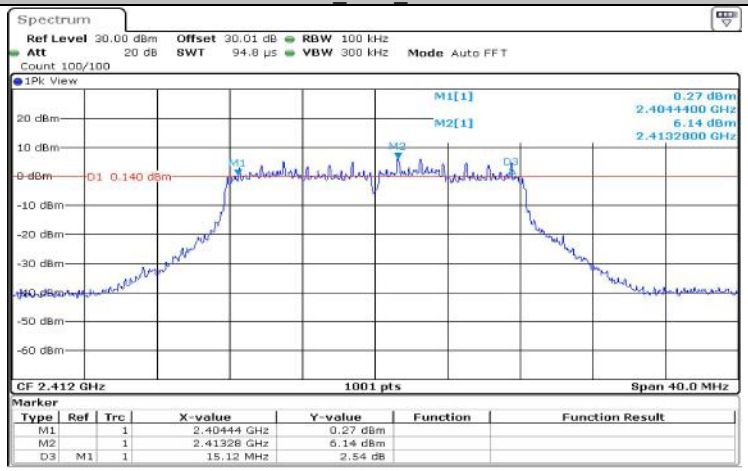
11B_Ant1_2437



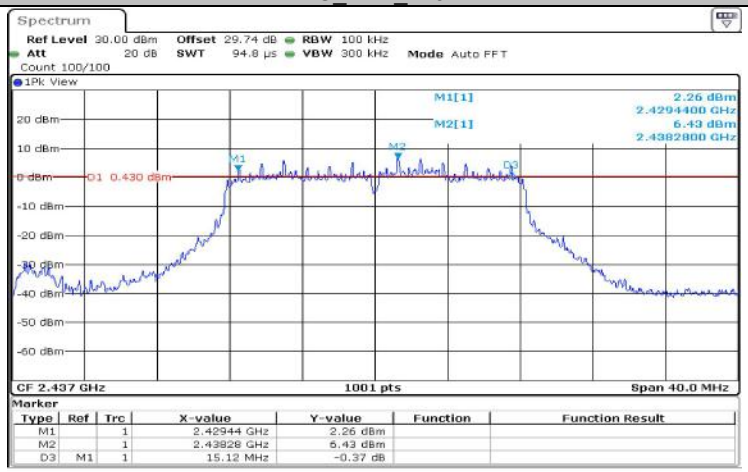
11B_Ant1_2462



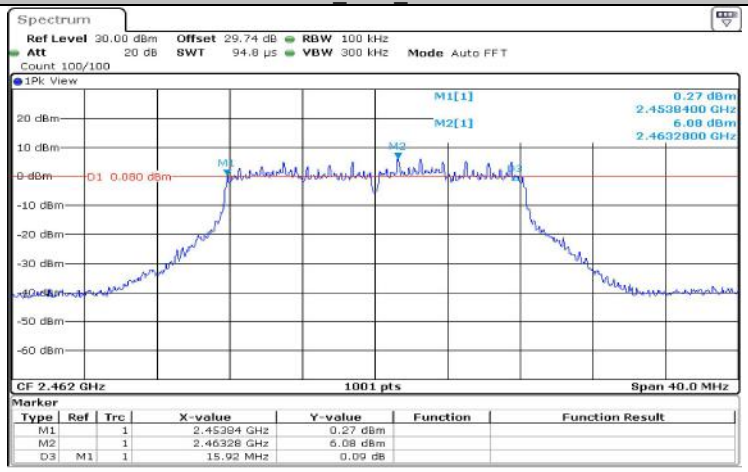
11G_Ant1_2412



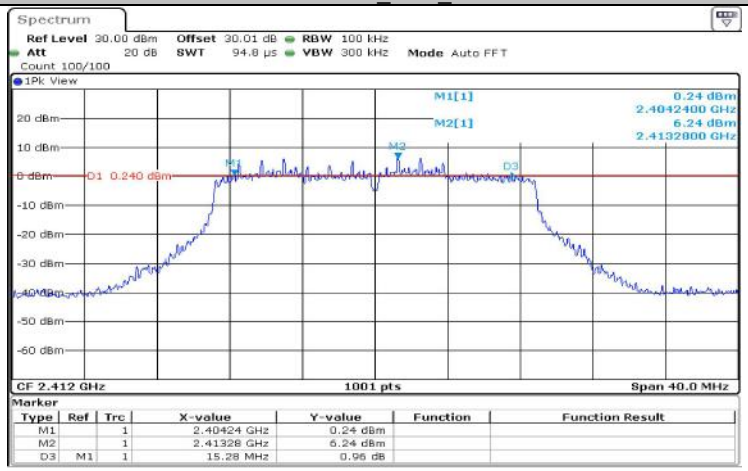
11G_Ant1_2437



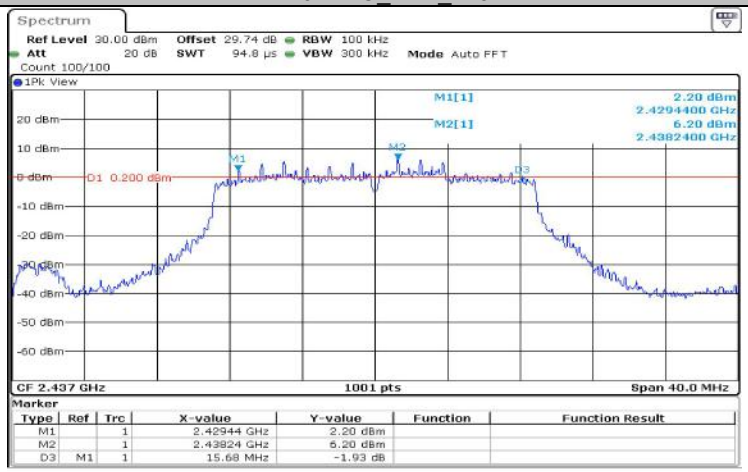
11G_Ant1_2462



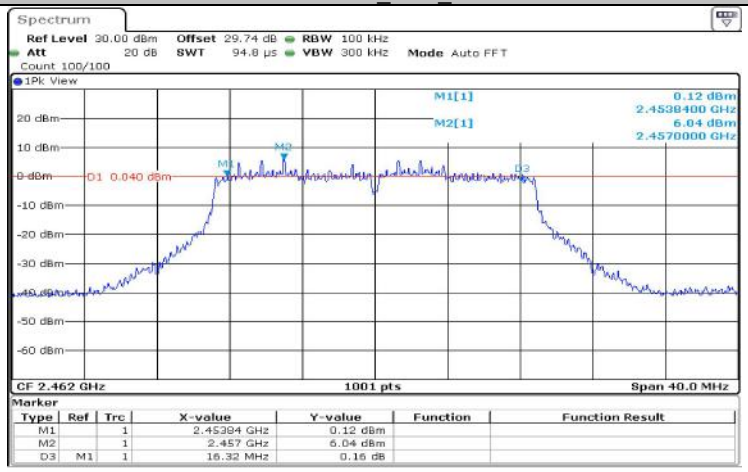
11N20MIMO_Ant1_2412



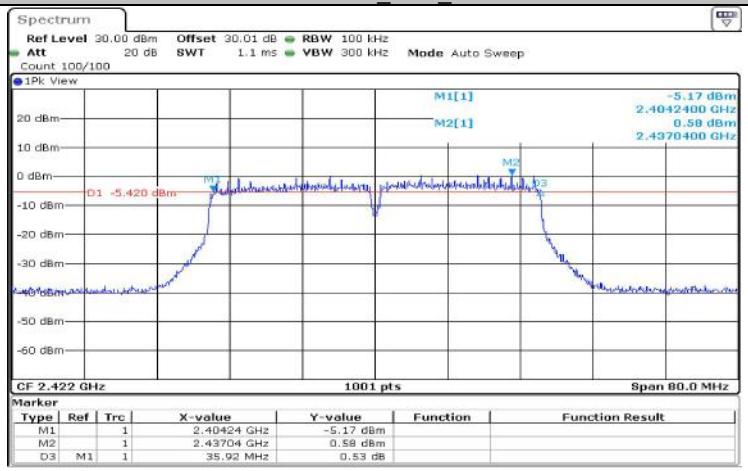
11N20MIMO_Ant1_2437



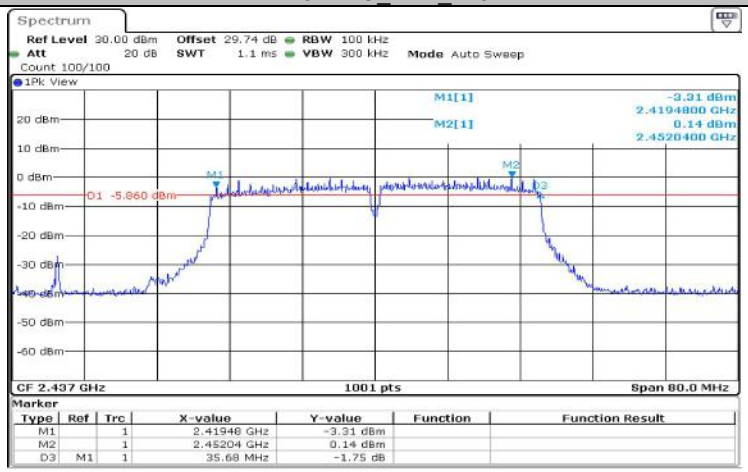
11N20MIMO_Ant1_2462



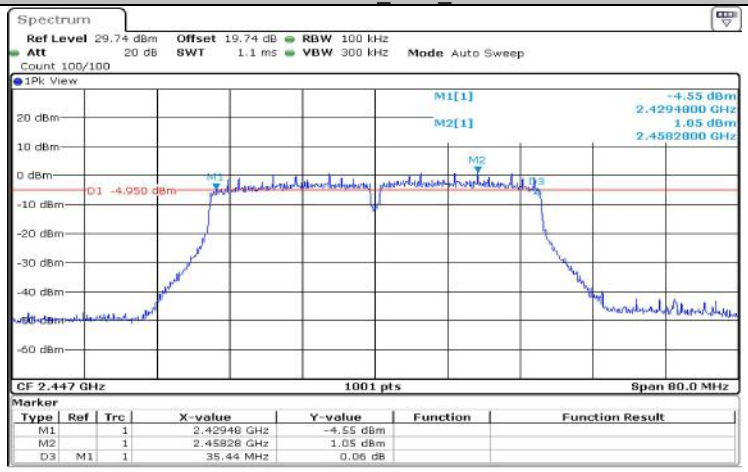
11N40MIMO_Ant1_2422



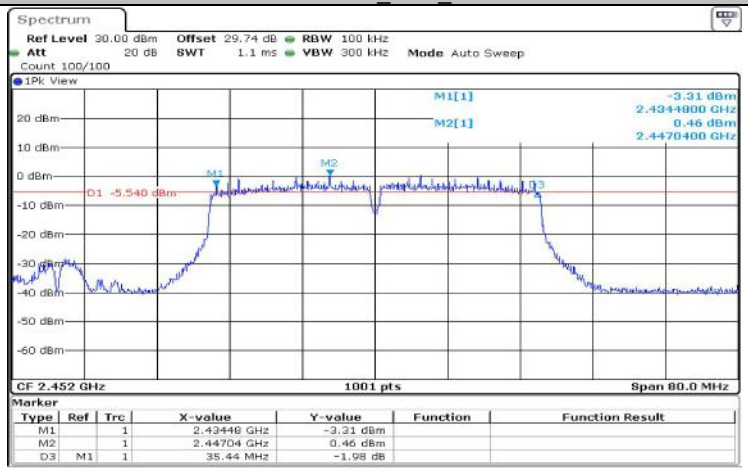
11N40MIMO_Ant1_2437



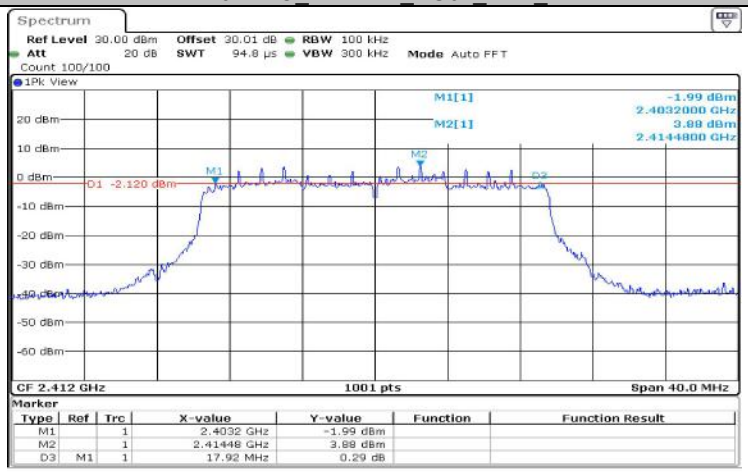
11N40MIMO_Ant1_2447



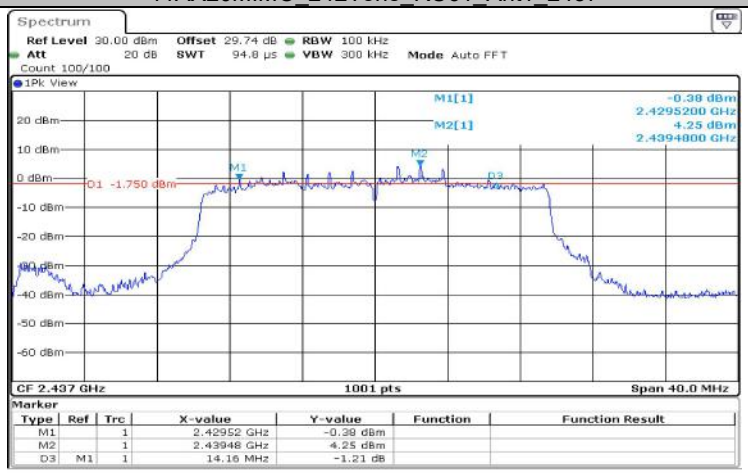
11N40MIMO_Ant1_2452



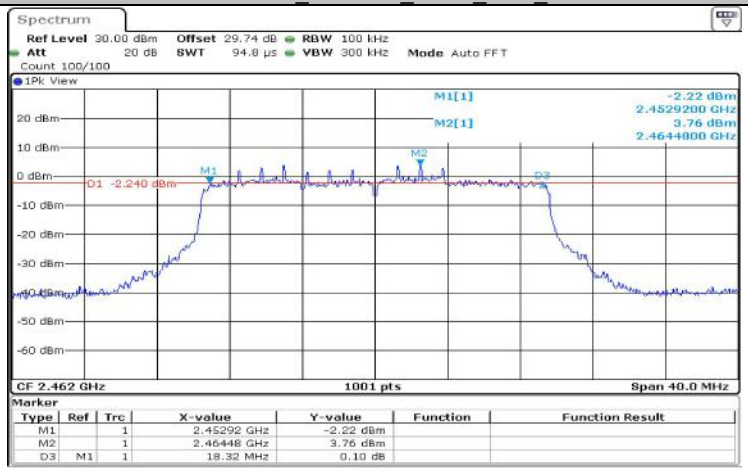
11AX20MIMO_242Tone_RU61_Ant1_2412



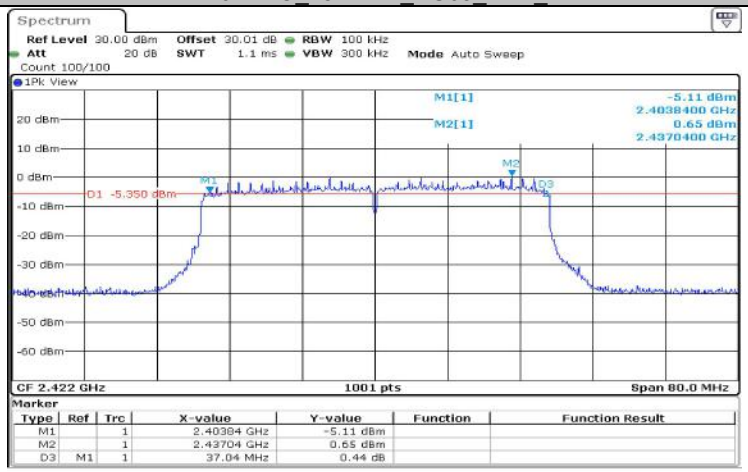
11AX20MIMO_242Tone_RU61_Ant1_2437



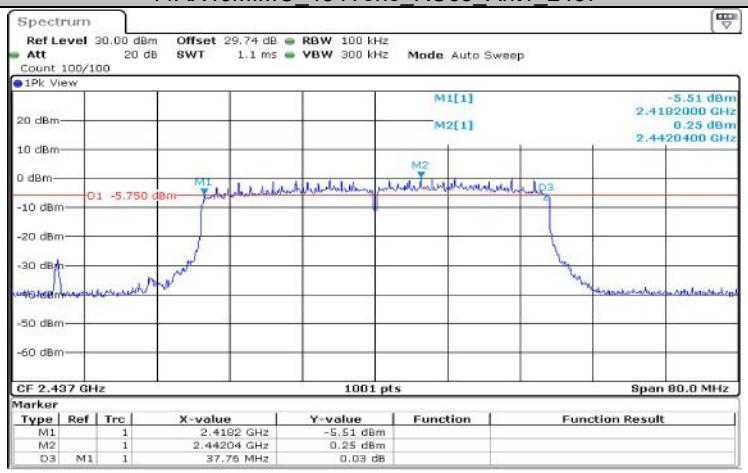
11AX20MIMO_242Tone_RU61_Ant1_2462



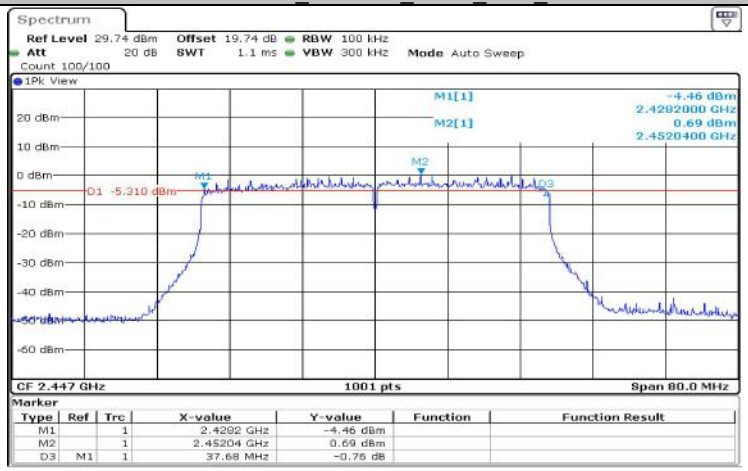
11AX40MIMO_484Tone_RU65_Ant1_2422



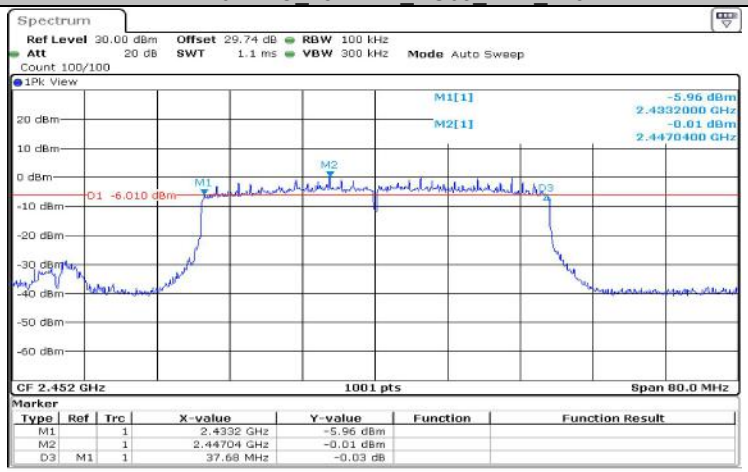
11AX40MIMO_484Tone_RU65_Ant1_2437



11AX40MIMO_484Tone_RU65_Ant1_2447



11AX40MIMO_484Tone_RU65_Ant1_2452



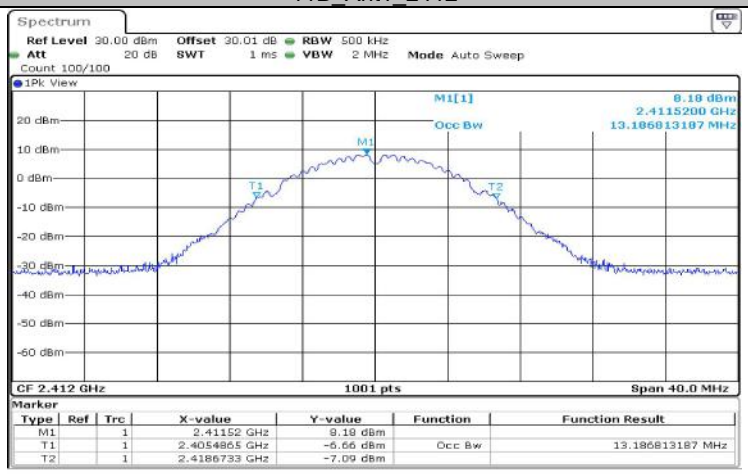
Appendix B: Occupied Channel Bandwidth

Test Result

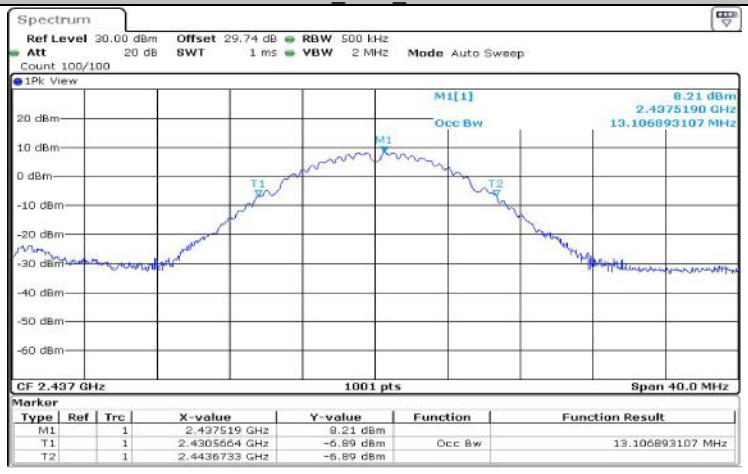
Test Mode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.187	2405.487	2418.673	---	---
	Ant1	2437	13.107	2430.566	2443.673	---	---
	Ant1	2462	13.147	2455.487	2468.633	---	---
11G	Ant1	2412	16.663	2403.688	2420.352	---	---
	Ant1	2437	16.623	2428.728	2445.352	---	---
	Ant1	2462	16.623	2453.728	2470.352	---	---
11N20MIMO	Ant1	2412	17.782	2403.129	2420.911	---	---
	Ant1	2437	17.782	2428.169	2445.951	---	---
	Ant1	2462	17.822	2453.129	2470.951	---	---
11N40MIMO	Ant1	2422	36.444	2403.938	2440.382	---	---
	Ant1	2437	36.284	2419.018	2455.302	---	---
	Ant1	2447	36.204	2429.018	2465.222	---	---
	Ant1	2452	36.284	2434.018	2470.302	---	---
11AX20MIMO_242Tone_RU61	Ant1	2412	19.021	2402.529	2421.550	---	---
	Ant1	2437	18.981	2427.569	2446.550	---	---
	Ant1	2462	18.981	2452.529	2471.510	---	---
11AX40MIMO_484Tone_RU65	Ant1	2422	37.962	2403.219	2441.181	---	---
	Ant1	2437	37.882	2418.219	2456.101	---	---
	Ant1	2447	37.802	2428.219	2466.021	---	---
	Ant1	2452	37.882	2433.139	2471.021	---	---

Test Graphs

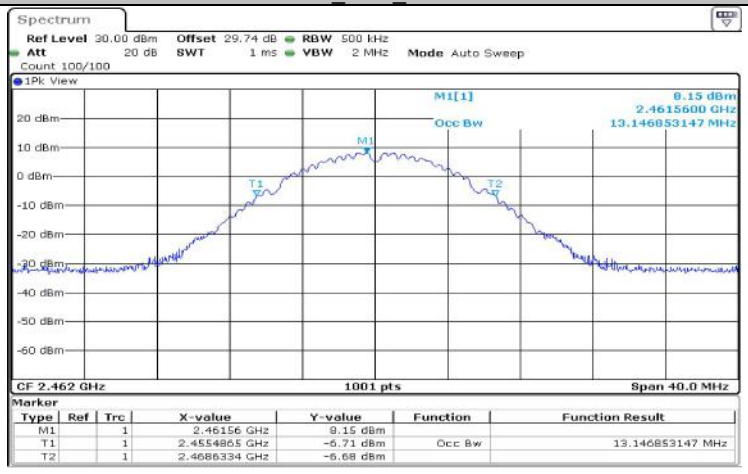
11B_Ant1_2412



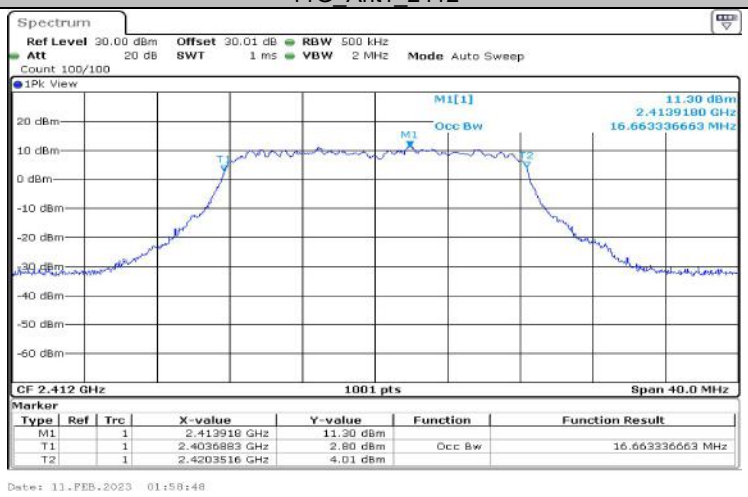
11B_Ant1_2437



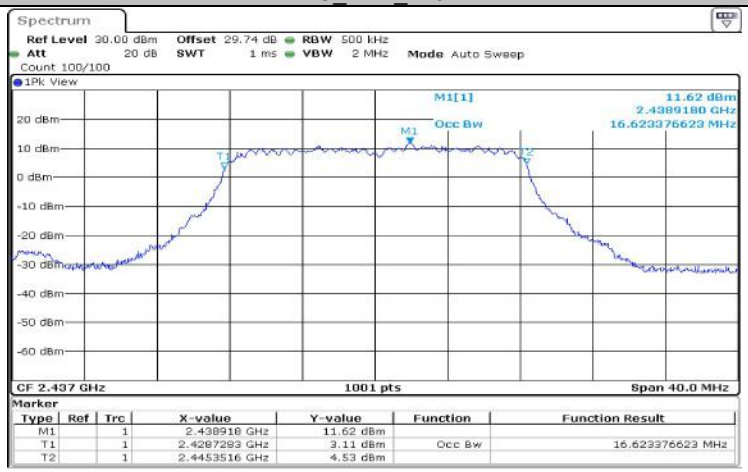
11B_Ant1_2462



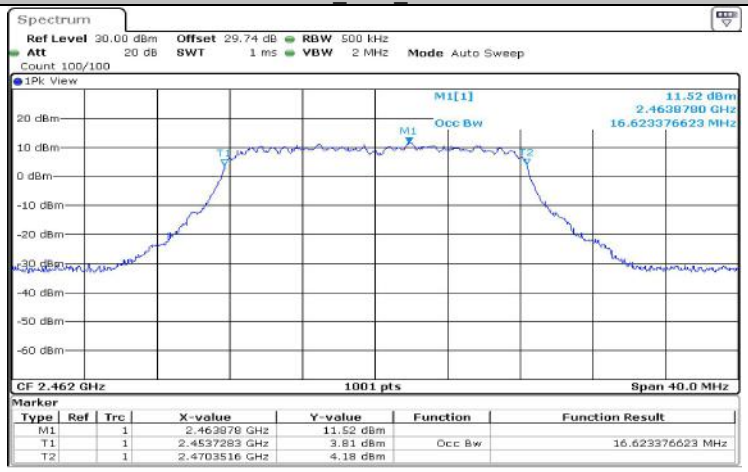
11G_Ant1_2412



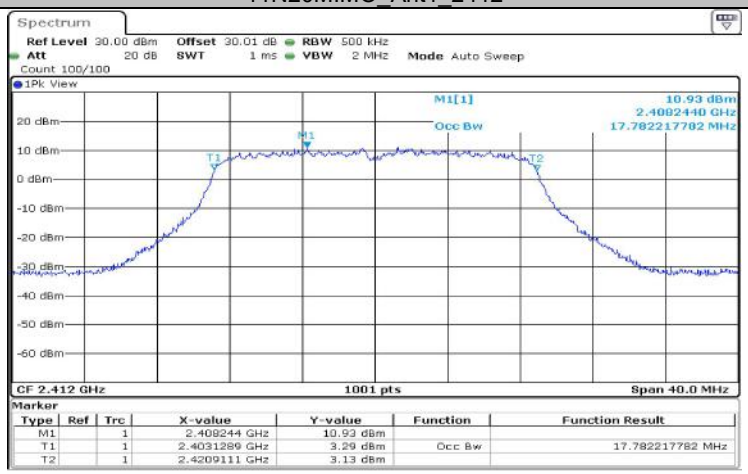
11G_Ant1_2437



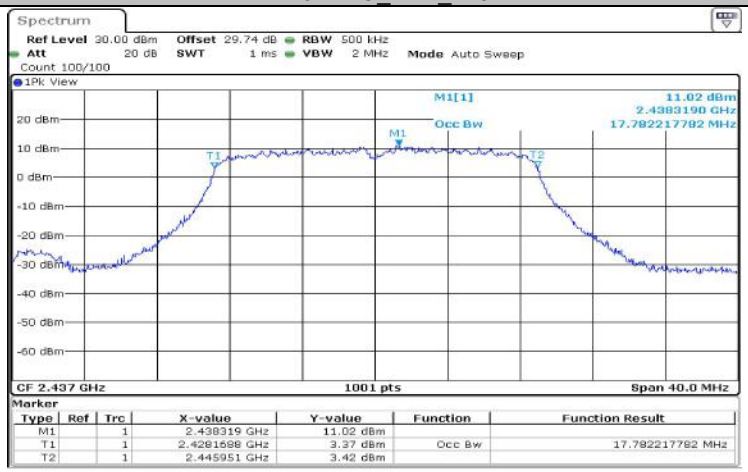
11G_Ant1_2462



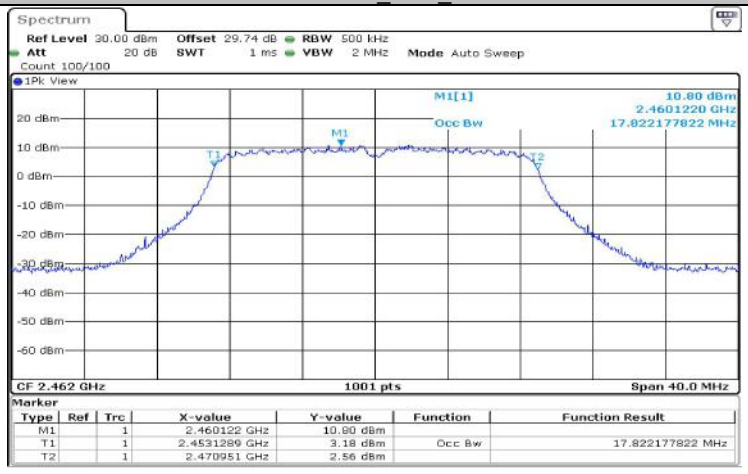
11N20MIMO_Ant1_2412



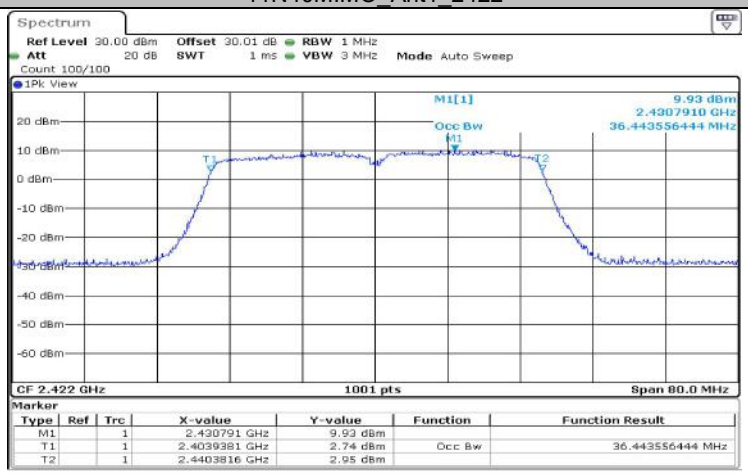
11N20MIMO_Ant1_2437



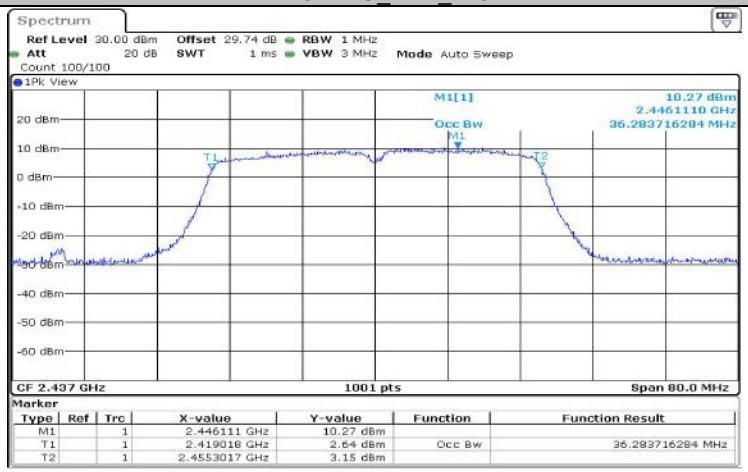
11N20MIMO_Ant1_2462



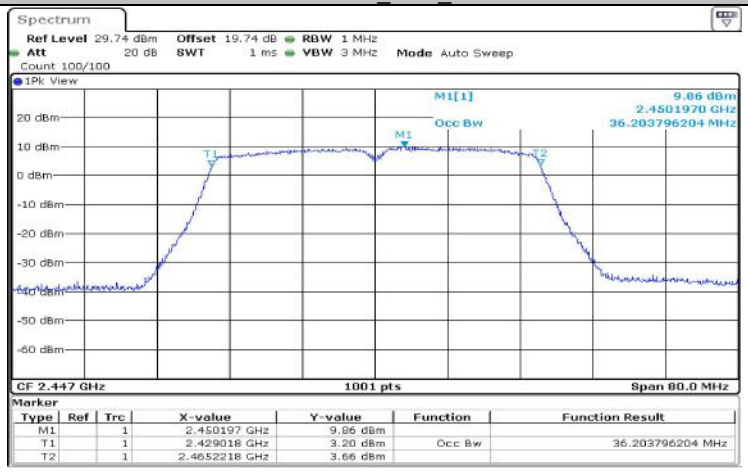
11N40MIMO_Ant1_2422



11N40MIMO_Ant1_2437

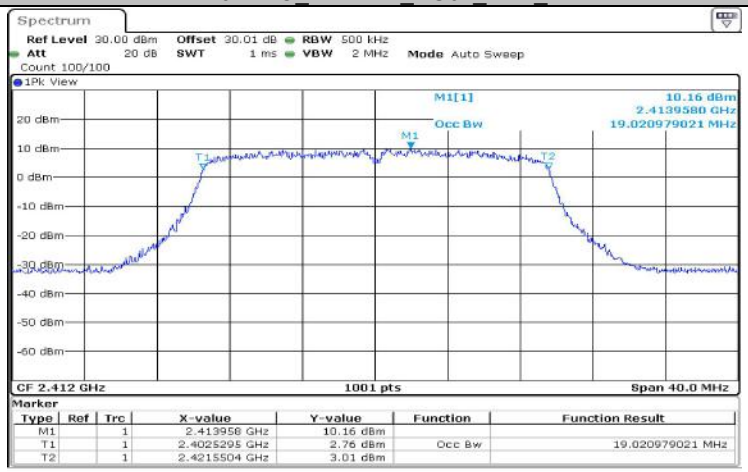


11N40MIMO_Ant1_2447

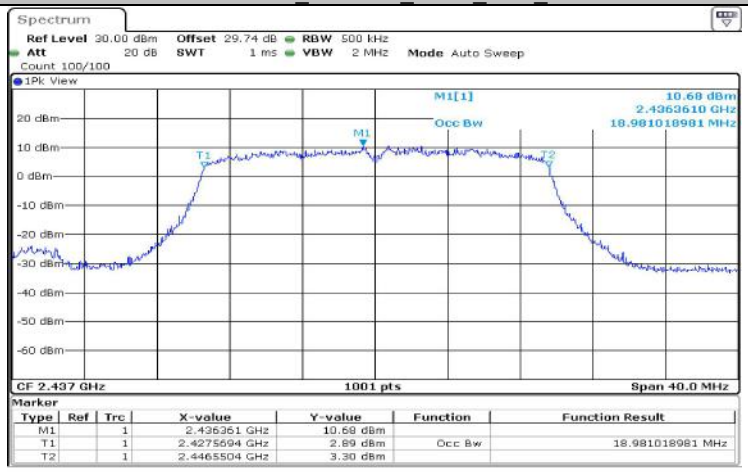


11N40MIMO_Ant1_2452

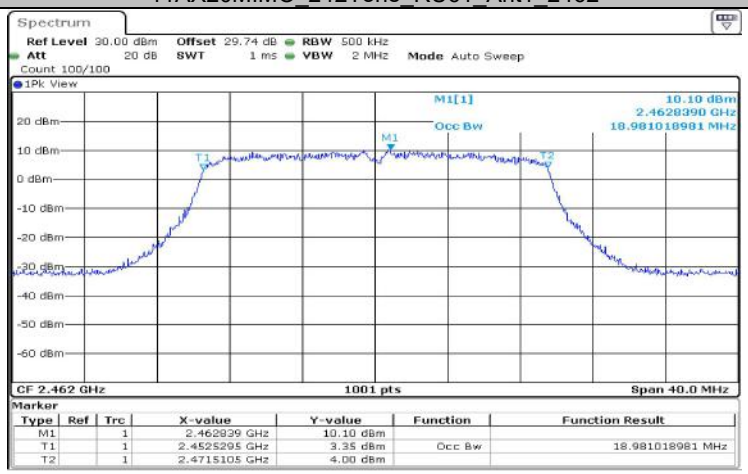
11AX20MIMO_242Tone_RU61_Ant1_2412



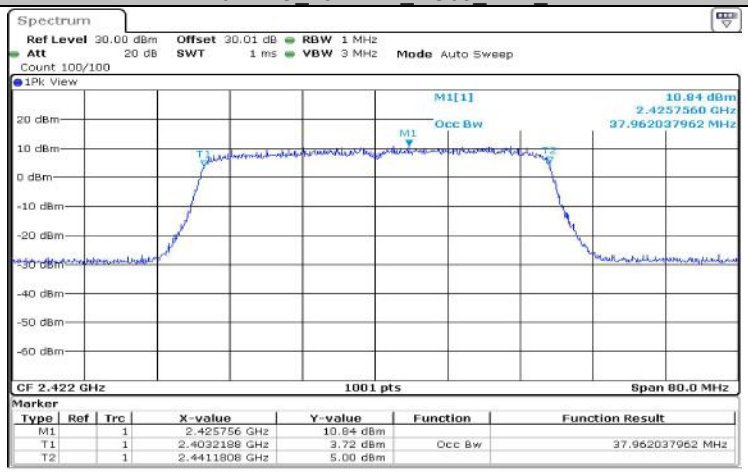
11AX20MIMO_242Tone_RU61_Ant1_2437



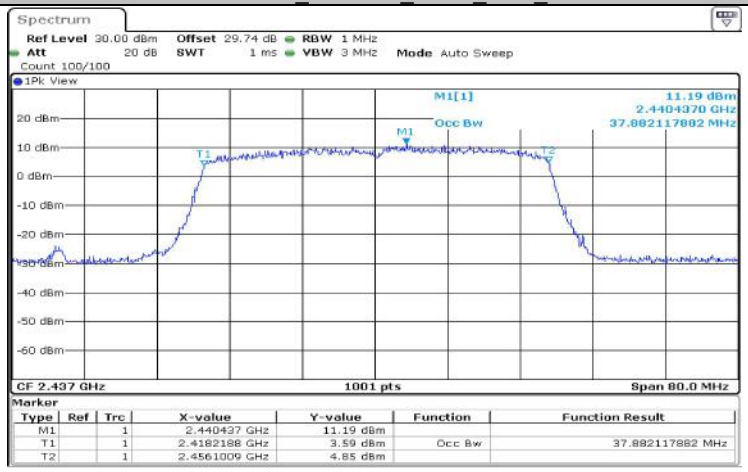
11AX20MIMO_242Tone_RU61_Ant1_2462



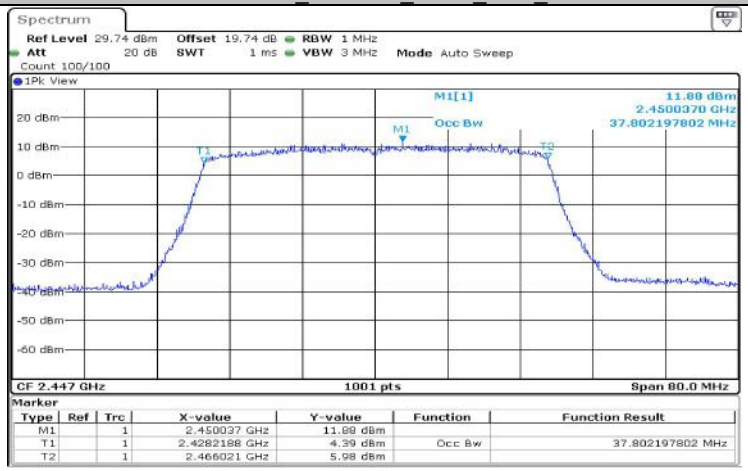
11AX40MIMO_484Tone_RU65_Ant1_2422



11AX40MIMO_484Tone_RU65_Ant1_2437



11AX40MIMO_484Tone_RU65_Ant1_2447



11AX40MIMO_484Tone_RU65_Ant1_2452

Appendix C: Maximum conducted output power

Test Result AV

Test Mode	Antenna	Frequency[MHz]	AV Power[dBm]	Conducted Limit[dBm]	Verdict
11B	Ant1	2412	22.51	≤30.00	PASS
	Ant2	2412	21.21	≤30.00	PASS
	Ant1	2437	21.59	≤30.00	PASS
	Ant2	2437	20.70	≤30.00	PASS
	Ant1	2462	21.41	≤30.00	PASS
	Ant2	2462	20.98	≤30.00	PASS
11G	Ant1	2412	21.88	≤30.00	PASS
	Ant2	2412	20.64	≤30.00	PASS
	Ant1	2437	20.98	≤30.00	PASS
	Ant2	2437	20.23	≤30.00	PASS
	Ant1	2462	18.77	≤30.00	PASS
	Ant2	2462	18.54	≤30.00	PASS
11N20MIMO	Ant1	2412	21.45	≤29.49	PASS
	Ant2	2412	20.22	≤29.49	PASS
	total	2412	23.89	≤29.49	PASS
	Ant1	2437	20.45	≤29.49	PASS
	Ant2	2437	19.82	≤29.49	PASS
	total	2437	23.16	≤29.49	PASS
	Ant1	2462	18.35	≤29.49	PASS
	Ant2	2462	18.05	≤29.49	PASS
	total	2462	21.21	≤29.49	PASS
11N40MIMO	Ant1	2422	20.12	≤29.49	PASS
	Ant2	2422	19.03	≤29.49	PASS
	total	2422	22.62	≤29.49	PASS
	Ant1	2437	18.65	≤29.49	PASS
	Ant2	2437	17.92	≤29.49	PASS
	total	2437	21.31	≤29.49	PASS
	Ant1	2447	16.66	≤29.49	PASS
	Ant2	2447	16.01	≤29.49	PASS
	total	2447	19.36	≤29.49	PASS
	Ant1	2452	14.96	≤29.49	PASS
	Ant2	2452	14.58	≤29.49	PASS
	total	2452	17.78	≤29.49	PASS
11AX20MIMO_242Tone_RU61	Ant1	2412	21.34	≤29.49	PASS
	Ant2	2412	19.97	≤29.49	PASS
	total	2412	23.72	≤29.49	PASS
	Ant1	2437	20.37	≤29.49	PASS
	Ant2	2437	19.65	≤29.49	PASS
	total	2437	23.04	≤29.49	PASS
	Ant1	2462	17.22	≤29.49	PASS
	Ant2	2462	16.97	≤29.49	PASS
	total	2462	20.11	≤29.49	PASS
11AX40MIMO_484Tone_RU65	Ant1	2422	19.30	≤29.49	PASS
	Ant2	2422	18.59	≤29.49	PASS
	total	2422	21.97	≤29.49	PASS
	Ant1	2437	18.11	≤29.49	PASS
	Ant2	2437	17.48	≤29.49	PASS
	total	2437	20.82	≤29.49	PASS
	Ant1	2447	16.15	≤29.49	PASS
	Ant2	2447	15.66	≤29.49	PASS
	total	2447	18.92	≤29.49	PASS
	Ant1	2452	14.57	≤29.49	PASS
	Ant2	2452	14.12	≤29.49	PASS
	total	2452	17.36	≤29.49	PASS

802.11AX Partial RU:

Test Mode	Antenna	Frequency[MHz]	Ru Size	Ru Index	AV Power[dBm]	Conducted Limit[dBm]	Verdict
11AX20MIMO	Ant1	2412	26Tone	RU0	6.73	≤29.49	PASS
			52Tone	RU37	6.98	≤29.49	PASS
			106Tone	RU53	6.73	≤29.49	PASS
	Ant2	2412	26Tone	RU0	6.75	≤29.49	PASS
			52Tone	RU37	7.03	≤29.49	PASS
			106Tone	RU53	6.70	≤29.49	PASS
	total	2412	26Tone	RU0	9.75	≤29.49	PASS
			52Tone	RU37	10.02	≤29.49	PASS
			106Tone	RU53	9.73	≤29.49	PASS
	Ant1	2437	26Tone	RU0	5.97	≤29.49	PASS
			52Tone	RU37	6.52	≤29.49	PASS
			106Tone	RU53	6.00	≤29.49	PASS
	Ant2	2437	26Tone	RU0	6.23	≤29.49	PASS
			52Tone	RU37	6.62	≤29.49	PASS
			106Tone	RU53	6.36	≤29.49	PASS
	total	2437	26Tone	RU0	9.11	≤29.49	PASS
			52Tone	RU37	9.58	≤29.49	PASS
			106Tone	RU53	9.19	≤29.49	PASS
	Ant1	2462	26Tone	RU0	5.74	≤29.49	PASS
			52Tone	RU37	5.85	≤29.49	PASS
			106Tone	RU53	5.82	≤29.49	PASS
	Ant2	2462	26Tone	RU0	6.11	≤29.49	PASS
			52Tone	RU37	6.41	≤29.49	PASS
			106Tone	RU53	6.24	≤29.49	PASS
	total	2462	26Tone	RU0	8.94	≤29.49	PASS
			52Tone	RU37	9.15	≤29.49	PASS
			106Tone	RU53	9.05	≤29.49	PASS
11AX40MIMO	Ant1	2422	26Tone	RU0	7.72	≤29.49	PASS
			52Tone	RU37	7.98	≤29.49	PASS
			106Tone	RU53	7.36	≤29.49	PASS
			242Tone	RU61	7.72	≤29.49	PASS
	Ant2	2422	26Tone	RU0	8.14	≤29.49	PASS
			52Tone	RU37	7.81	≤29.49	PASS
			106Tone	RU53	8.22	≤29.49	PASS
			242Tone	RU61	8.61	≤29.49	PASS
	total	2422	26Tone	RU0	10.95	≤29.49	PASS
			52Tone	RU37	10.91	≤29.49	PASS
			106Tone	RU53	10.82	≤29.49	PASS
			242Tone	RU61	11.20	≤29.49	PASS
	Ant1	2437	26Tone	RU0	7.71	≤29.49	PASS
			52Tone	RU37	7.67	≤29.49	PASS
			106Tone	RU53	6.98	≤29.49	PASS
			242Tone	RU61	7.79	≤29.49	PASS
	Ant2	2437	26Tone	RU0	7.54	≤29.49	PASS
			52Tone	RU37	8.03	≤29.49	PASS
			106Tone	RU53	7.50	≤29.49	PASS
			242Tone	RU61	7.78	≤29.49	PASS
	total	2437	26Tone	RU0	10.64	≤29.49	PASS
			52Tone	RU37	10.86	≤29.49	PASS
			106Tone	RU53	10.26	≤29.49	PASS
			242Tone	RU61	10.80	≤29.49	PASS
	Ant1	2447	26Tone	RU0	7.69	≤29.49	PASS
			52Tone	RU37	7.53	≤29.49	PASS
			106Tone	RU53	6.92	≤29.49	PASS
			242Tone	RU61	7.70	≤29.49	PASS
	Ant2	2447	26Tone	RU0	7.49	≤29.49	PASS
			52Tone	RU37	7.96	≤29.49	PASS

			106Tone	RU53	7.54	≤29.49	PASS
			242Tone	RU61	7.70	≤29.49	PASS
	total	2447	26Tone	RU0	10.60	≤29.49	PASS
			52Tone	RU37	10.76	≤29.49	PASS
			106Tone	RU53	10.25	≤29.49	PASS
			242Tone	RU61	10.71	≤29.49	PASS
	Ant1	2452	26Tone	RU0	6.56	≤29.49	PASS
			52Tone	RU37	6.94	≤29.49	PASS
			106Tone	RU53	6.73	≤29.49	PASS
			242Tone	RU61	6.87	≤29.49	PASS
	Ant2	2452	26Tone	RU0	7.19	≤29.49	PASS
			52Tone	RU37	7.77	≤29.49	PASS
			106Tone	RU53	6.93	≤29.49	PASS
			242Tone	RU61	7.28	≤29.49	PASS
	total	2452	26Tone	RU0	9.90	≤29.49	PASS
			52Tone	RU37	10.39	≤29.49	PASS
			106Tone	RU53	9.84	≤29.49	PASS
			242Tone	RU61	10.09	≤29.49	PASS

Note:

1. The device employ beamforming for 802.11n/ax mode.

Direction Gain = G_{ANT} + 10*log(N_{ANT}/N_{SS})
For EUT, N_{ANT}=2, for the worst case, N_{SS}=1
G_{ANT1}=3.3dBi, G_{ANT2}=3.51dBi, use the higher gain 3.51dBi for the calculate
So, the direction Gain=3.51dBi+10*log(2/1)=6.51dBi>6dBi

For 802.11 n/ax mode, the limit should reduced 0.51dB.

2. The maximum EIRP= 23.89dBm+6.51dBi=30.4dBm<36dBm, it's meet the ISED EIRP limit.

Appendix D: Maximum power spectral density
Test Result

Test Mode	Antenna	Frequency[MHz]	Reading Value [dBm/10kHz]	Duty Cycle Factor[dB]	PSD [dBm/10kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-5.09	2.73	-2.36	≤8.00	PASS
	Ant2	2412	-6.32	2.73	-3.59	≤8.00	PASS
	Ant1	2437	-5.83	2.73	-3.1	≤8.00	PASS
	Ant2	2437	-5.14	2.73	-2.41	≤8.00	PASS
	Ant1	2462	-5.52	2.73	-2.79	≤8.00	PASS
	Ant2	2462	-5.71	2.73	-2.98	≤8.00	PASS
11G	Ant1	2412	-6.92	0.36	-6.56	≤8.00	PASS
	Ant2	2412	-7.41	0.36	-7.05	≤8.00	PASS
	Ant1	2437	-7.33	0.36	-6.97	≤8.00	PASS
	Ant2	2437	-7.72	0.36	-7.36	≤8.00	PASS
	Ant1	2462	-9.35	0.36	-8.99	≤8.00	PASS
	Ant2	2462	-9.45	0.36	-9.09	≤8.00	PASS
11N20MIMO	Ant1	2412	-7.60	0.19	-7.41	≤7.49	PASS
	Ant2	2412	-8.03	0.19	-7.84	≤7.49	PASS
	total	2412	-4.80	0.19	-4.61	≤7.49	PASS
	Ant1	2437	-7.86	0.19	-7.67	≤7.49	PASS
	Ant2	2437	-8.37	0.19	-8.18	≤7.49	PASS
	total	2437	-5.10	0.19	-4.91	≤7.49	PASS
	Ant1	2462	-10.65	0.19	-10.46	≤7.49	PASS
	Ant2	2462	-10.81	0.19	-10.62	≤7.49	PASS
	total	2462	-7.72	0.19	-7.53	≤7.49	PASS
11N40MIMO	Ant1	2422	-11.51	0.29	-11.22	≤7.49	PASS
	Ant2	2422	-12.39	0.29	-12.1	≤7.49	PASS
	total	2422	-8.92	0.29	-8.63	≤7.49	PASS
	Ant1	2437	-12.10	0.29	-11.81	≤7.49	PASS
	Ant2	2437	-12.75	0.29	-12.46	≤7.49	PASS
	total	2437	-9.40	0.29	-9.11	≤7.49	PASS
	Ant1	2447	-15.54	0.29	-15.25	≤7.49	PASS
	Ant2	2447	-15.89	0.29	-15.6	≤7.49	PASS
	total	2447	-12.70	0.29	-12.41	≤7.49	PASS
	Ant1	2452	-16.71	0.29	-16.42	≤7.49	PASS
	Ant2	2452	-16.95	0.29	-16.66	≤7.49	PASS
	total	2452	-13.82	0.29	-13.53	≤7.49	PASS
11AX20MIMO_242Tone_RU61	Ant1	2412	-9.06	0.23	-8.83	≤7.49	PASS
	Ant2	2412	-9.01	0.23	-8.78	≤7.49	PASS
	total	2412	-6.02	0.23	-5.79	≤7.49	PASS
	Ant1	2437	-9.47	0.23	-9.24	≤7.49	PASS
	Ant2	2437	-9.30	0.23	-9.07	≤7.49	PASS
	total	2437	-6.37	0.23	-6.14	≤7.49	PASS
	Ant1	2462	-12.67	0.23	-12.44	≤7.49	PASS
	Ant2	2462	-13.04	0.23	-12.81	≤7.49	PASS
	total	2462	-9.84	0.23	-9.61	≤7.49	PASS
11AX40MIMO_484Tone_RU65	Ant1	2422	-13.59	0.23	-13.36	≤7.49	PASS
	Ant2	2422	-13.58	0.23	-13.35	≤7.49	PASS
	total	2422	-10.57	0.23	-10.34	≤7.49	PASS
	Ant1	2437	-13.58	0.23	-13.35	≤7.49	PASS
	Ant2	2437	-14.21	0.23	-13.98	≤7.49	PASS
	total	2437	-10.87	0.23	-10.64	≤7.49	PASS
	Ant1	2447	-17.32	0.23	-17.09	≤7.49	PASS
	Ant2	2447	-17.32	0.23	-17.09	≤7.49	PASS
	total	2447	-14.31	0.23	-14.08	≤7.49	PASS

	Ant1	2452	-18.50	0.23	-18.27	≤7.49	PASS
	Ant2	2452	-18.71	0.23	-18.48	≤7.49	PASS
	total	2452	-15.59	0.23	-15.36	≤7.49	PASS

Note:
1. PSD = reading value +duty cycle factor, where duty cycle factor please refer Appendix F.

2. The device employ beamforming for 802.11n/ax mode.

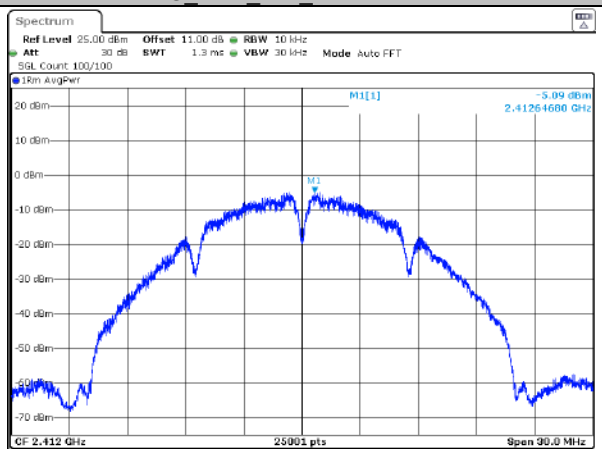
Direction Gain = G_{ANT} + 10*log(N_{ANT}/N_{SS})
For EUT, N_{ANT}=2, for the worst case, N_{SS}=1
G_{ANT1}=3.3dBi, G_{ANT2}=3.51dBi, use the higher gain 3.51dBi for the calculate
So, the direction Gain=3.51dBi+10*log(2/1)=6.51dBi>6dBi

For 802.11 n/ax mode, the limit should reduced 0.51dB.

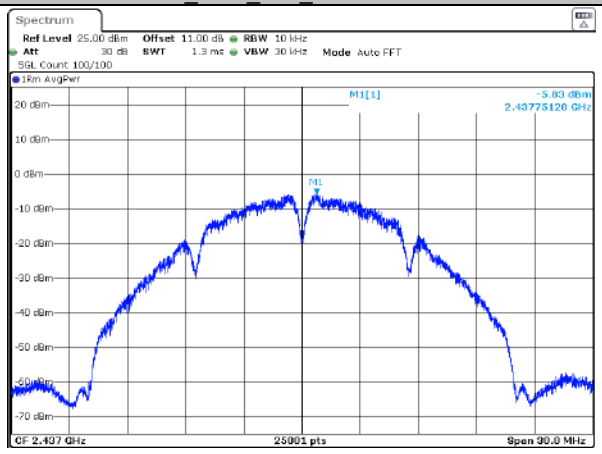
Test Graphs

ANT 1

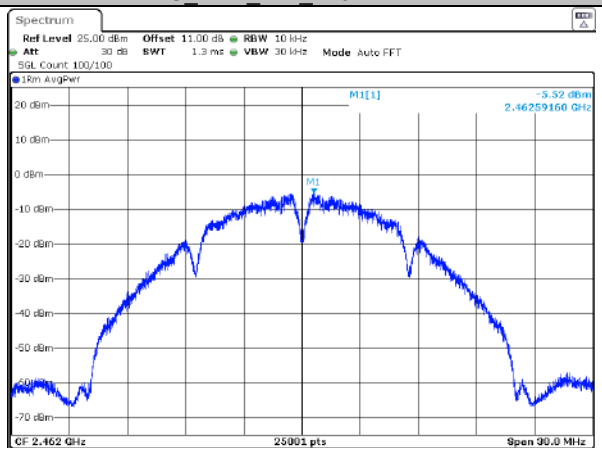
2.4G_WIFI_11B_2412MHz-PSD



2.4G_WIFI_11B_2437MHz-PSD



2.4G_WIFI_11B_2462MHz-PSD



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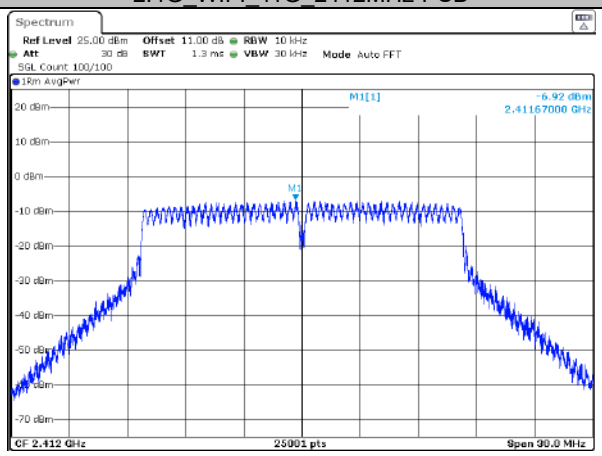

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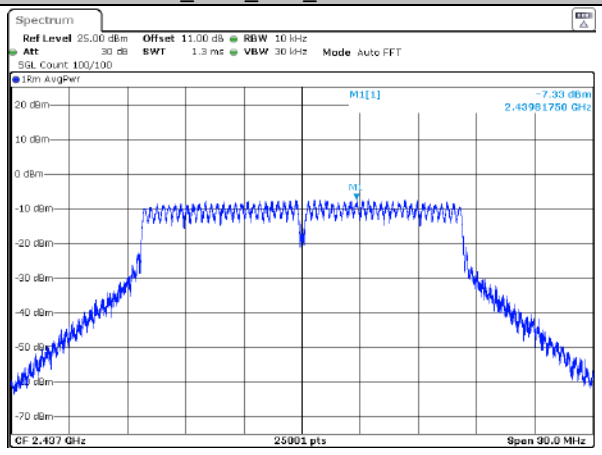

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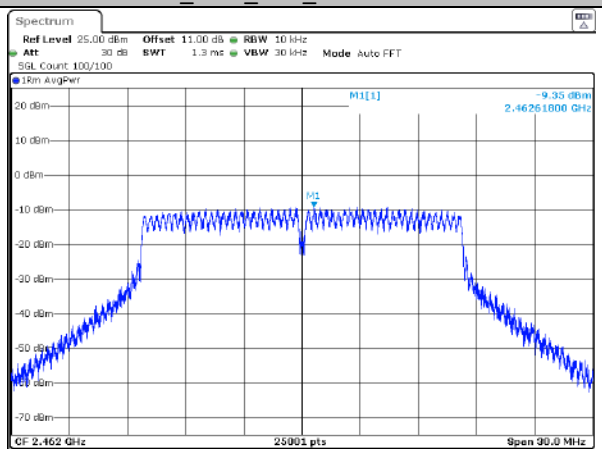

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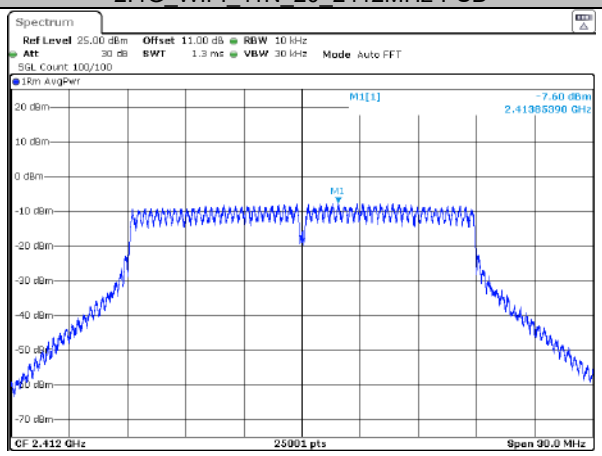

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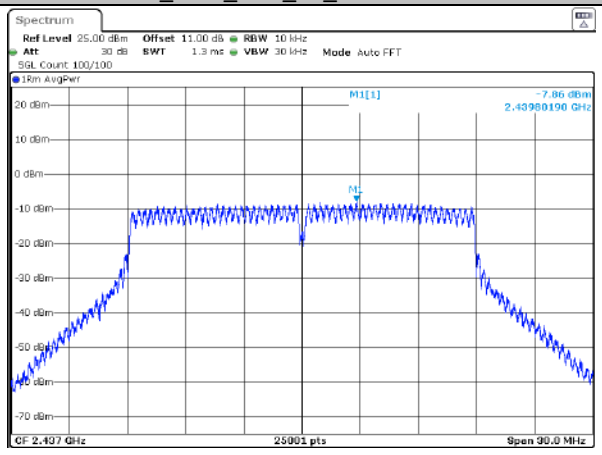

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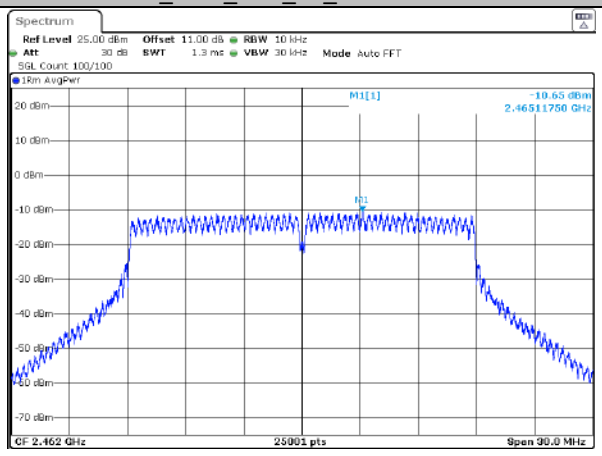
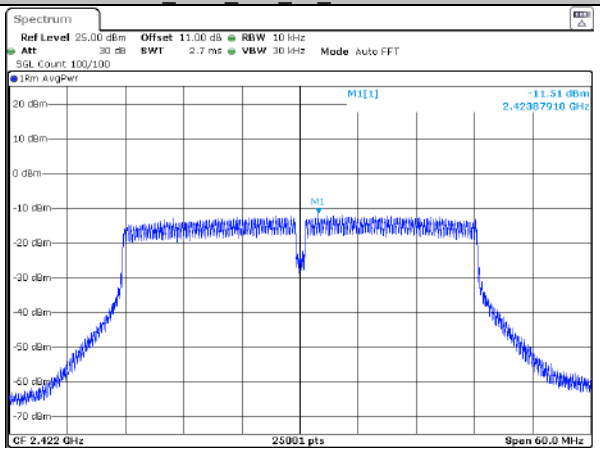


2.4G_WIFI_11N_40_2422MHz-PSD



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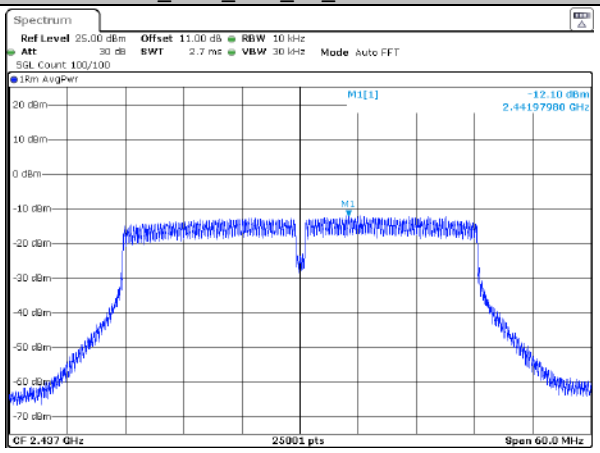

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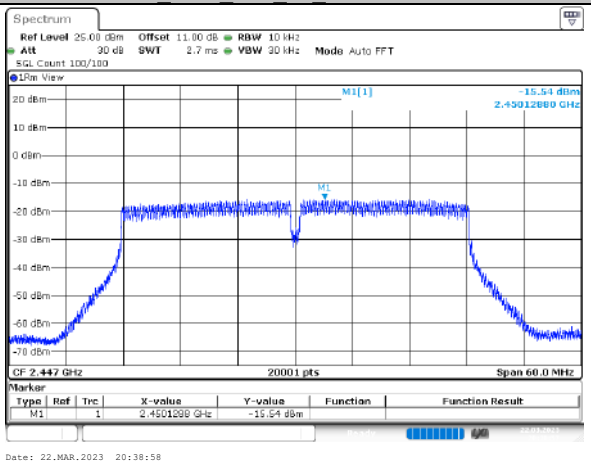

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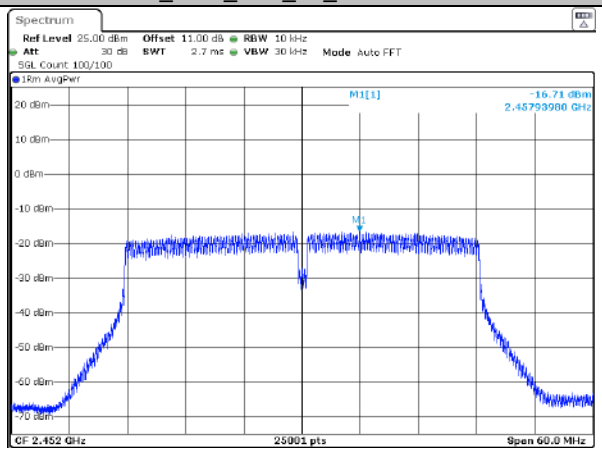

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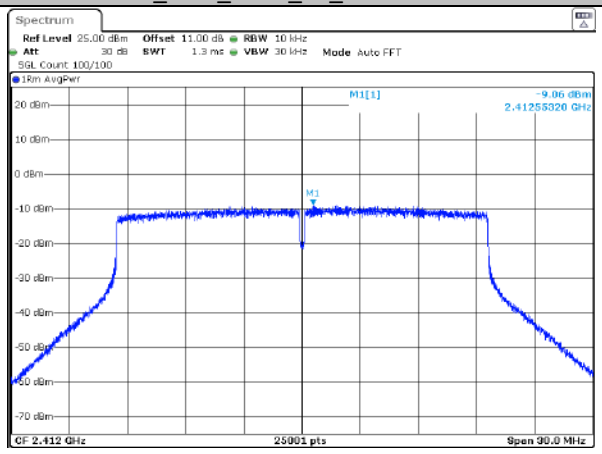

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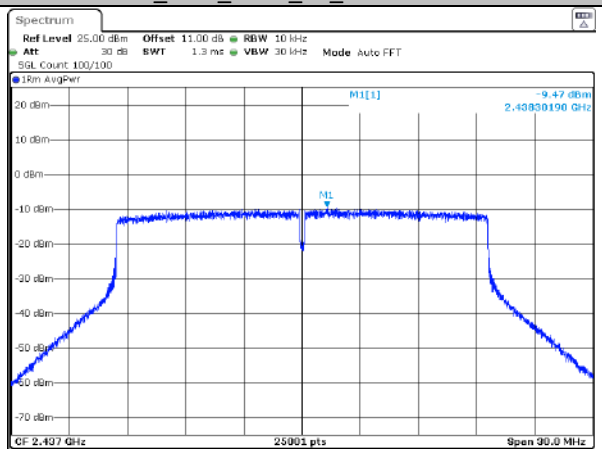

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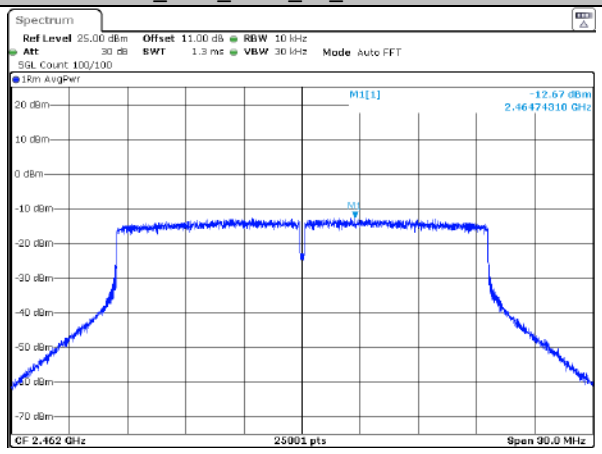
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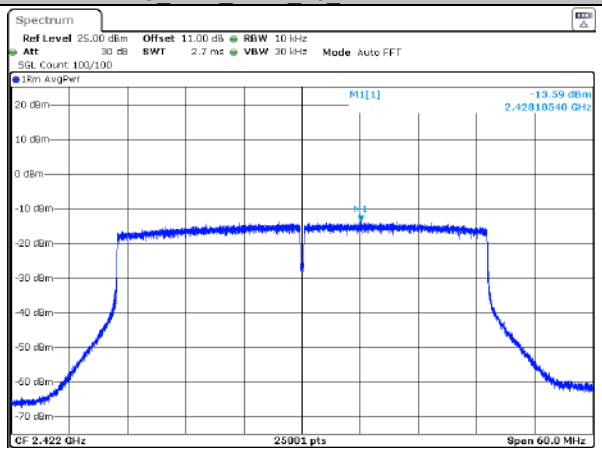
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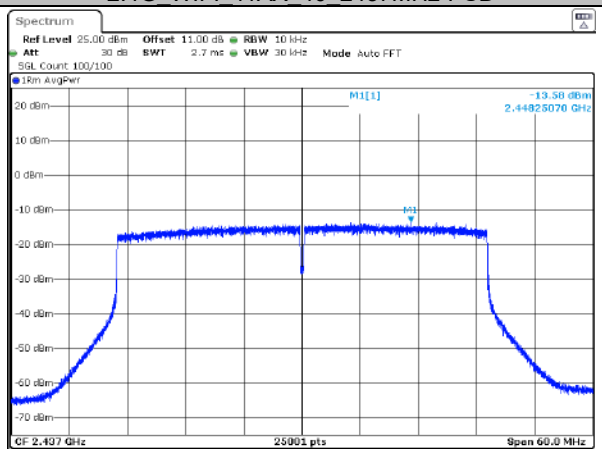

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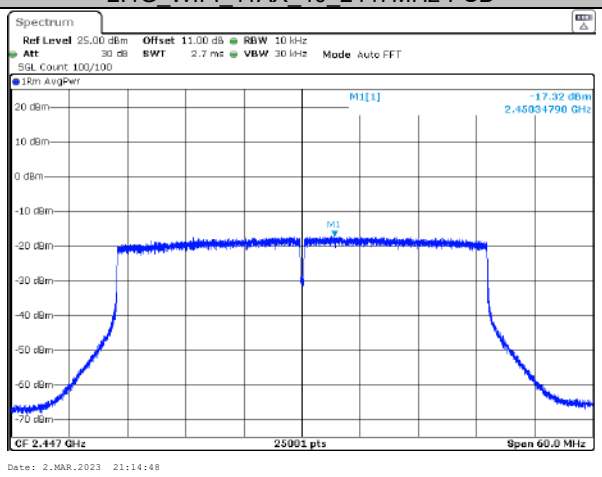
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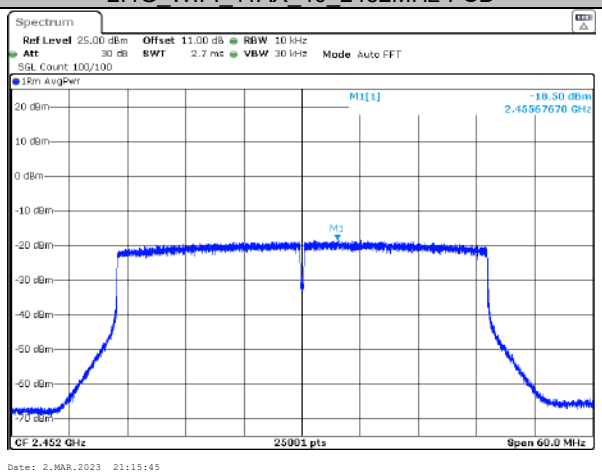
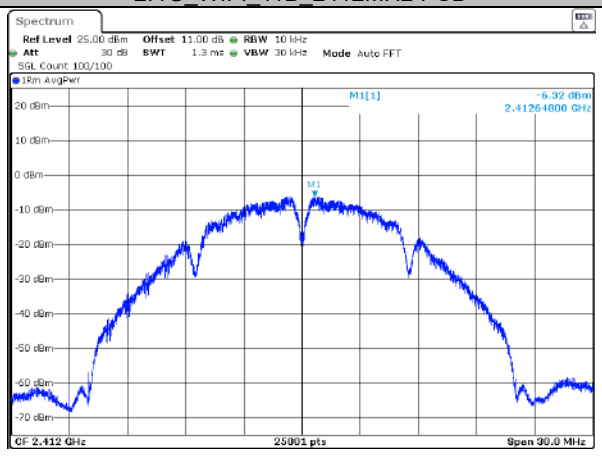


ANT 2

2.4G_WIFI_11B_2412MHz-PSD



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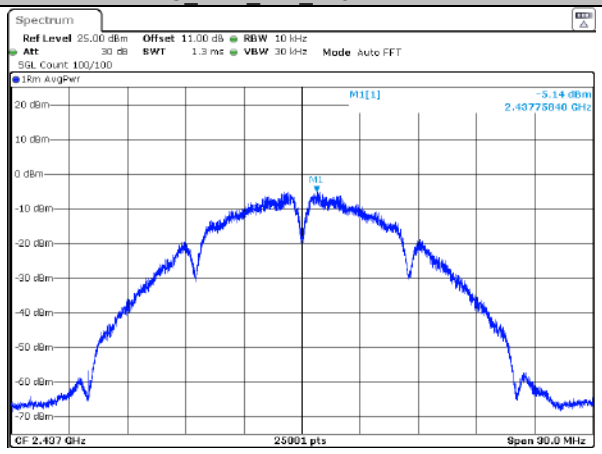

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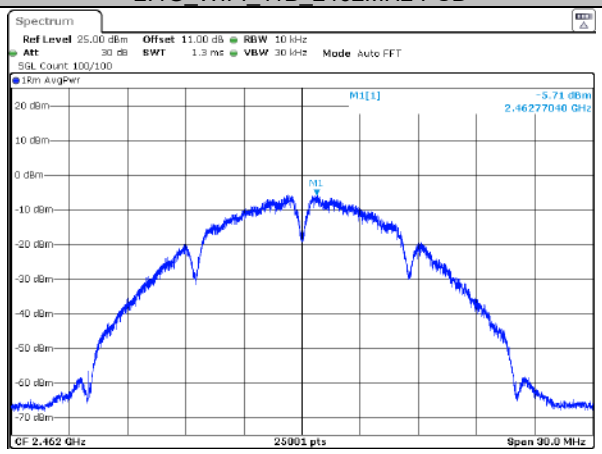

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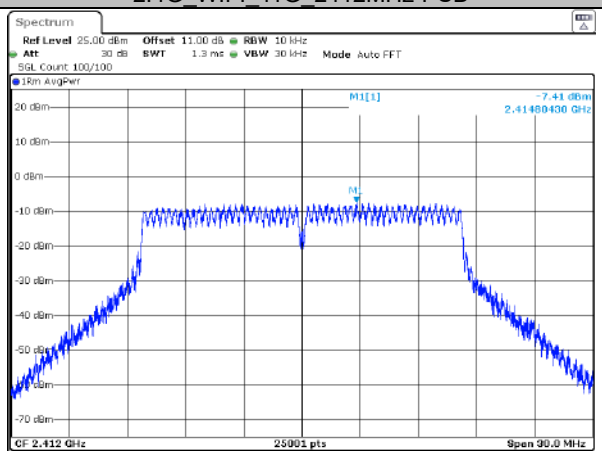

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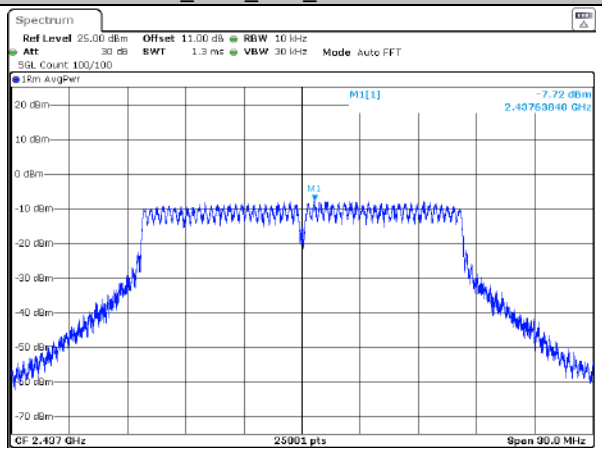

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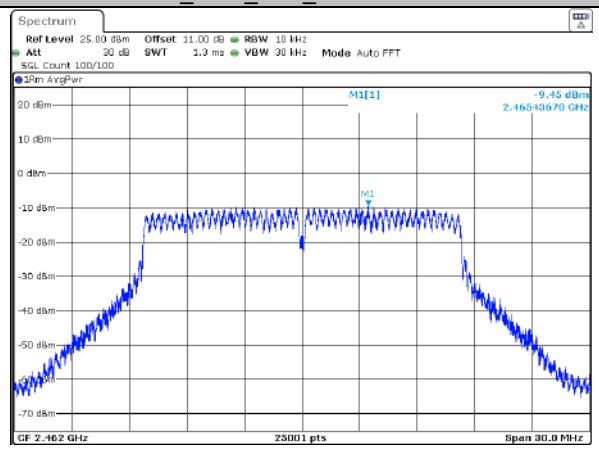

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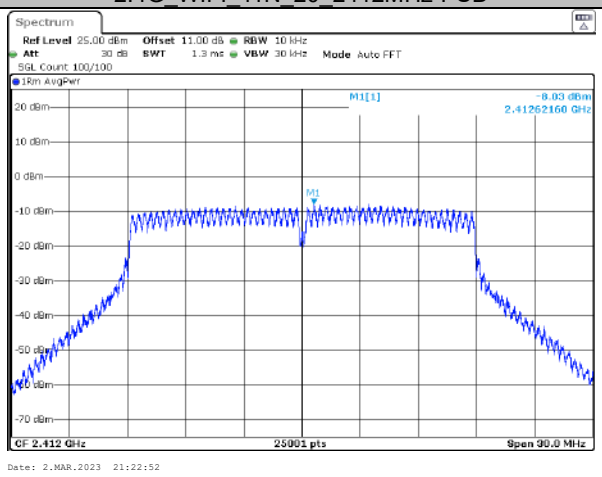

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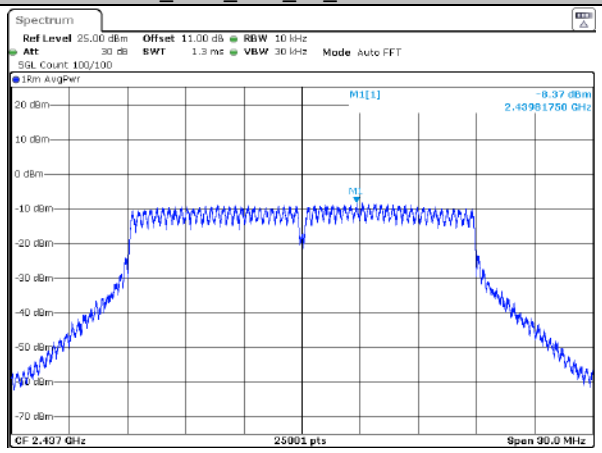

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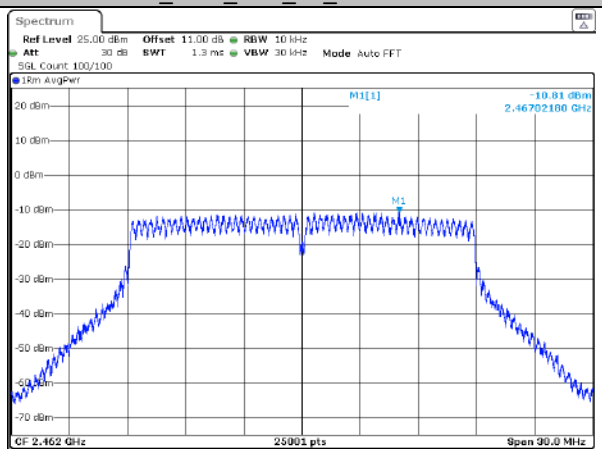
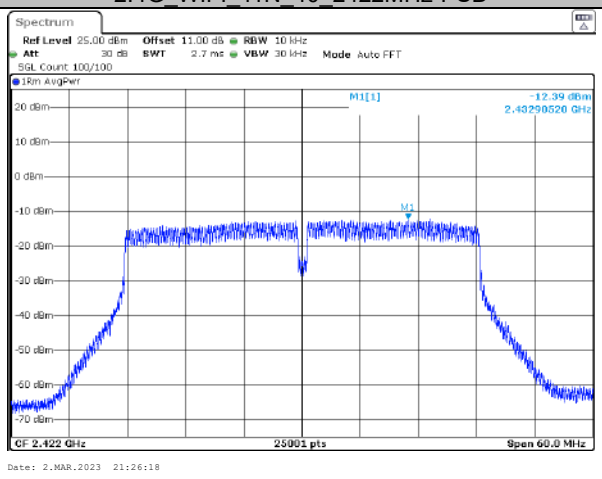


2.4G_WIFI_11N_40_2422MHz-PSD



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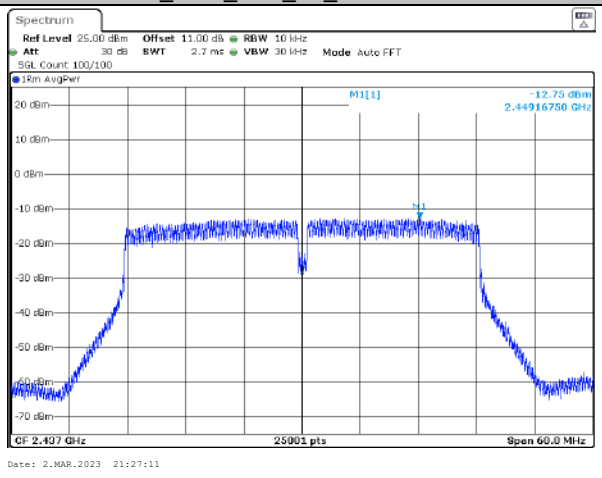

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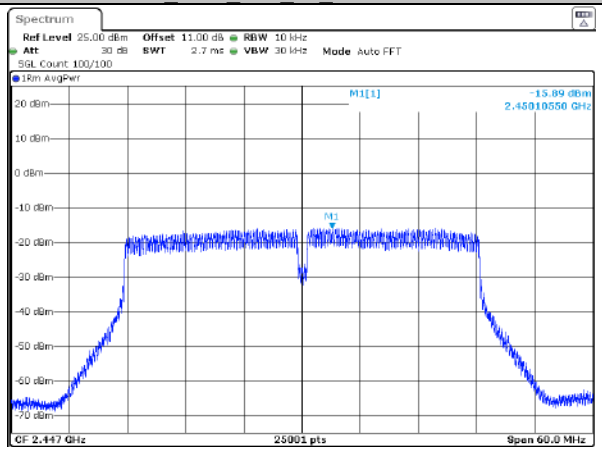

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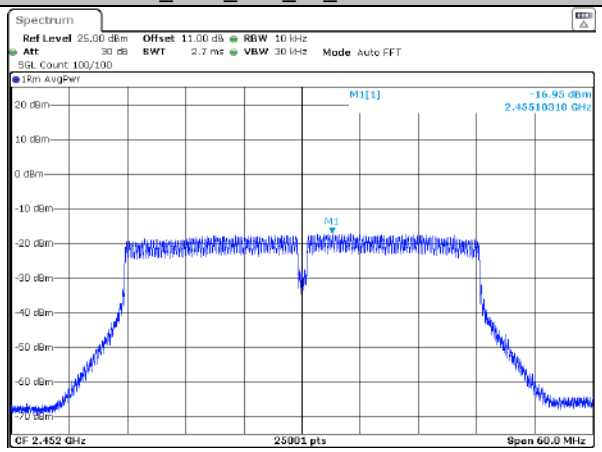

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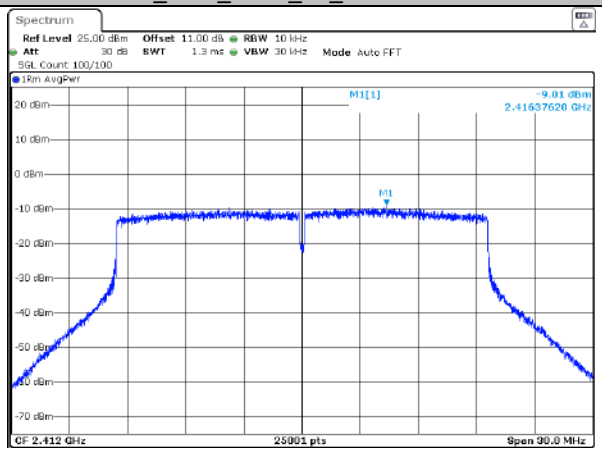

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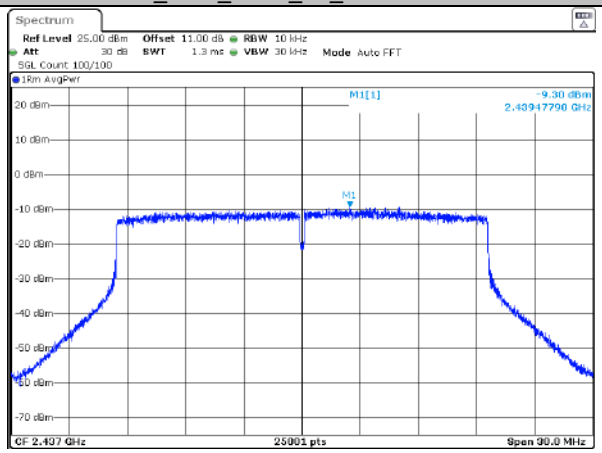

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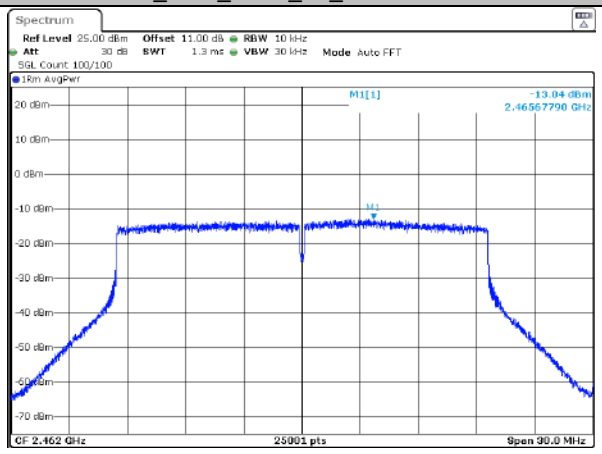
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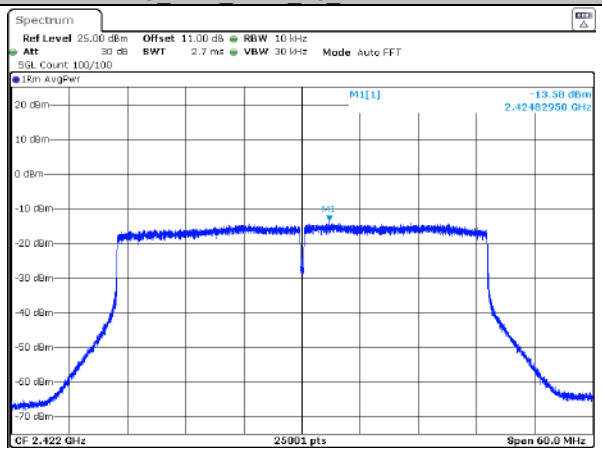
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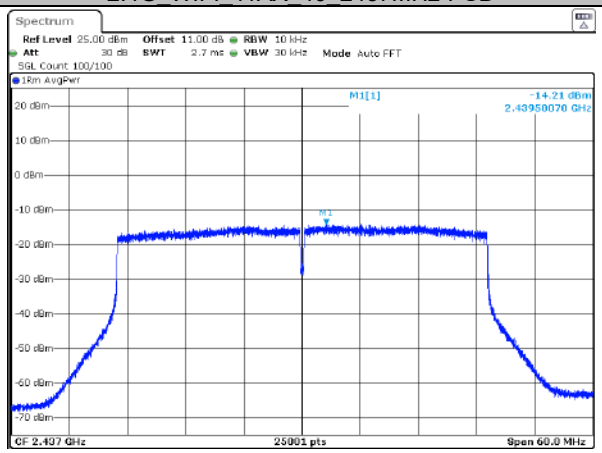

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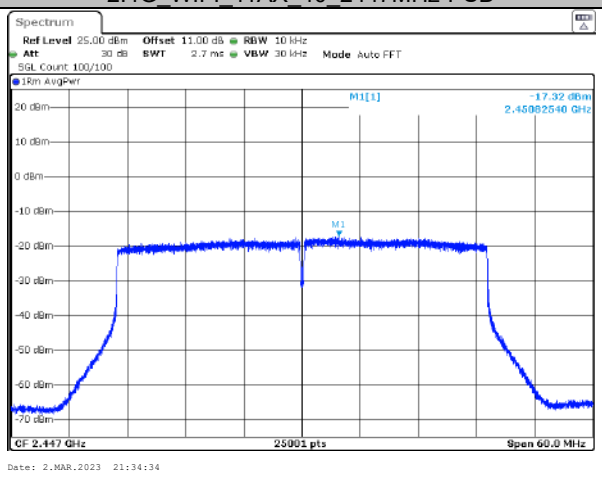
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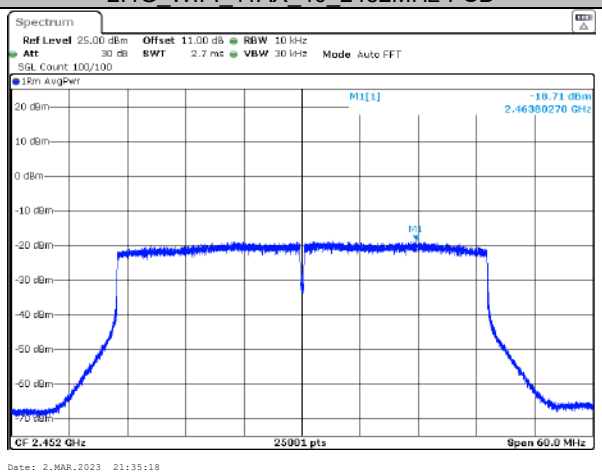
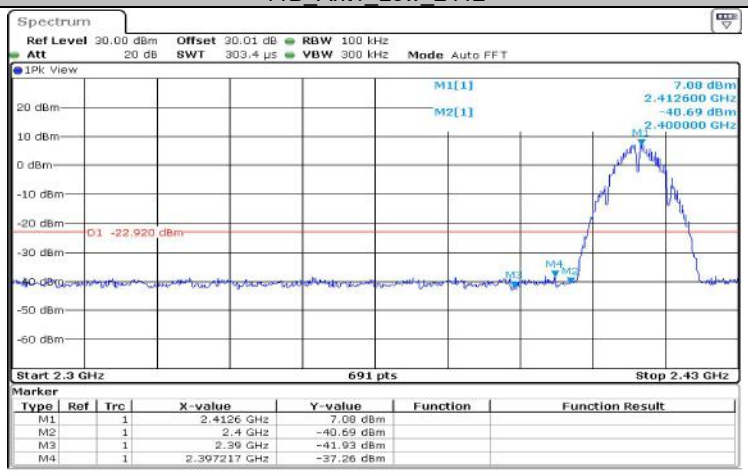


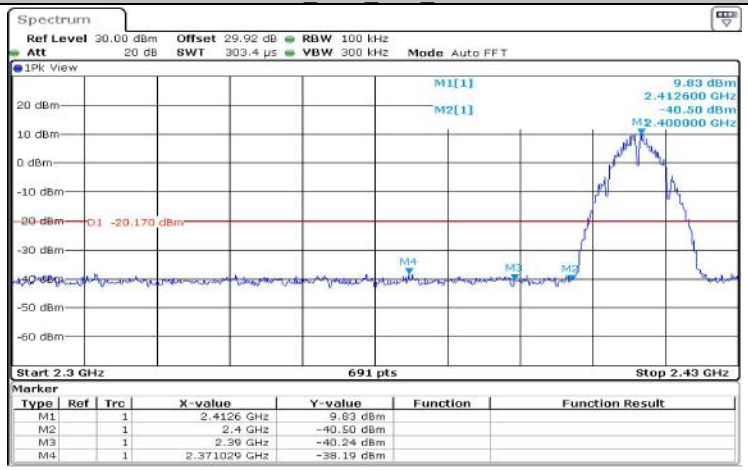
Appendix E: Band edge measurements

Test Graphs

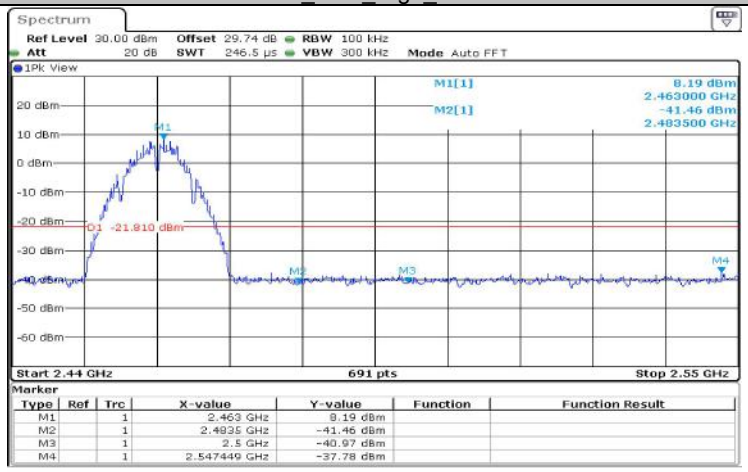
11B_Ant1_Low_2412



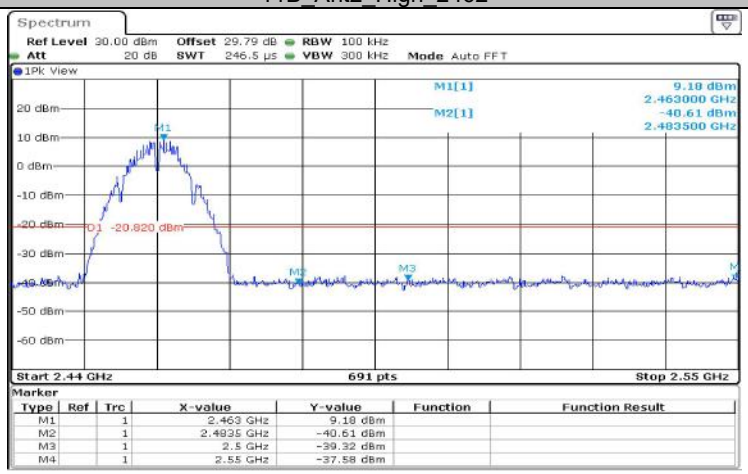
11B_Ant2_Low_2412



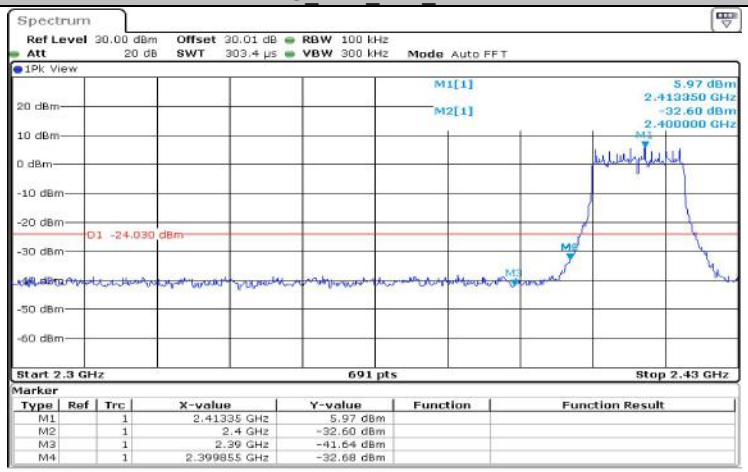
11B_Ant1_High_2462



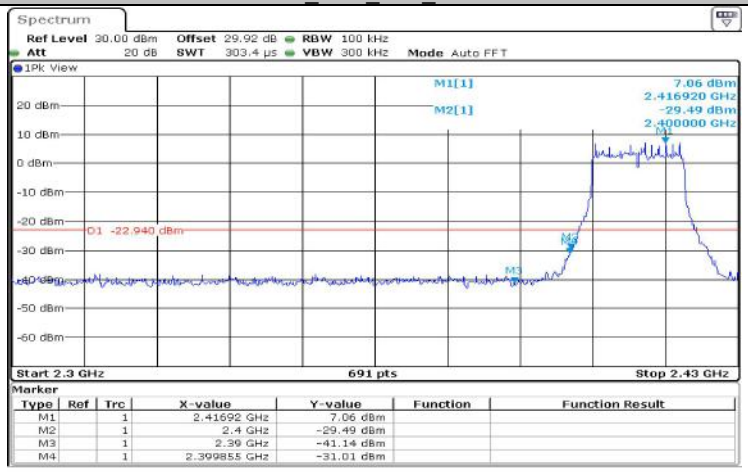
11B_Ant2_High_2462



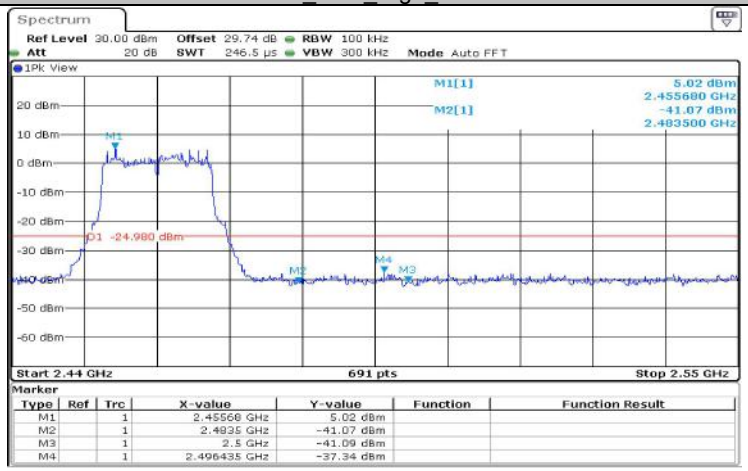
11G_Ant1_Low_2412



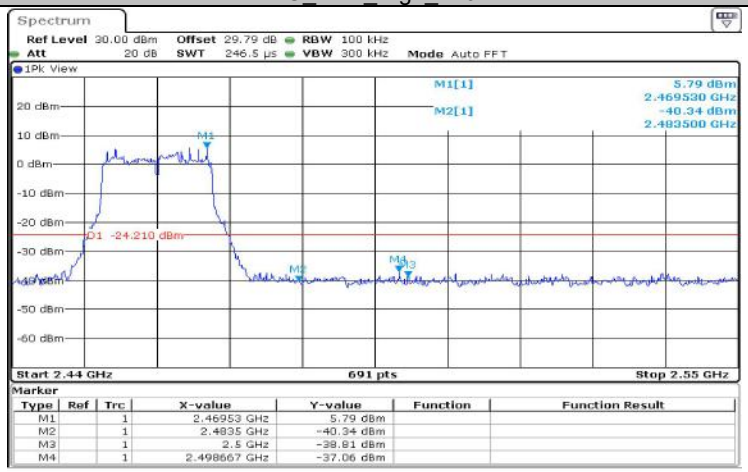
11G_Ant2_Low_2412



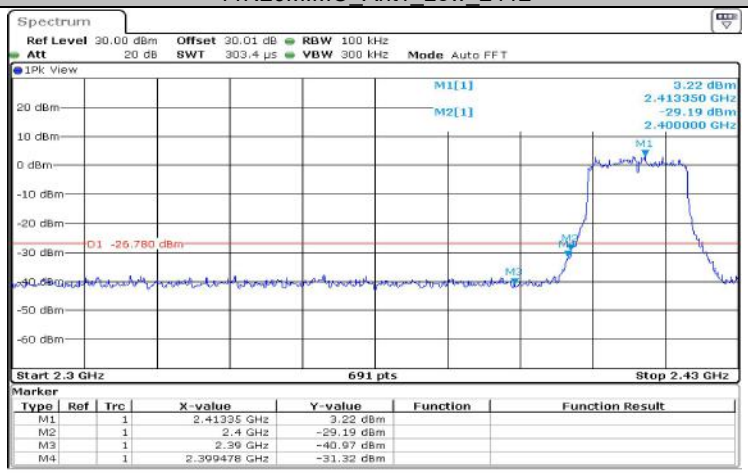
11G_Ant1_High_2462



11G_Ant2_High_2462



11N20MIMO_Ant1_Low_2412



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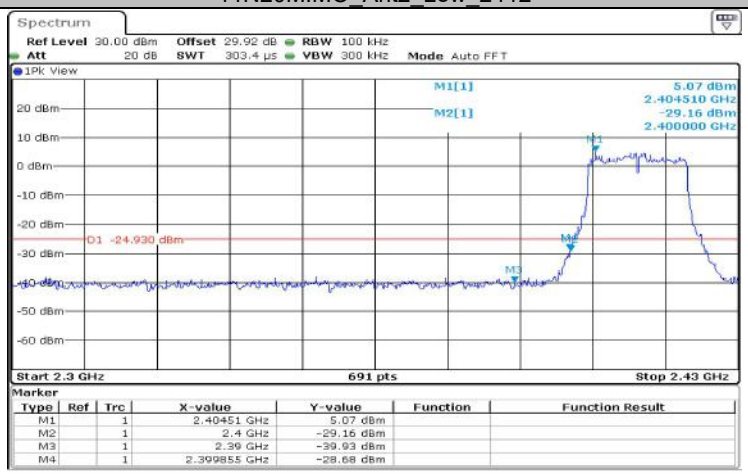

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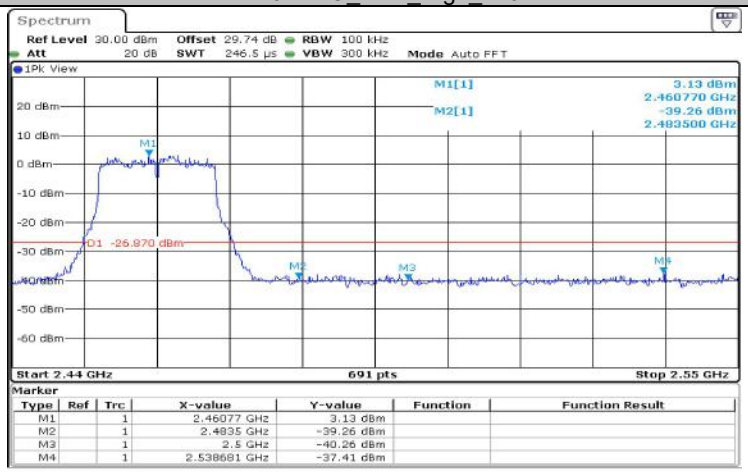

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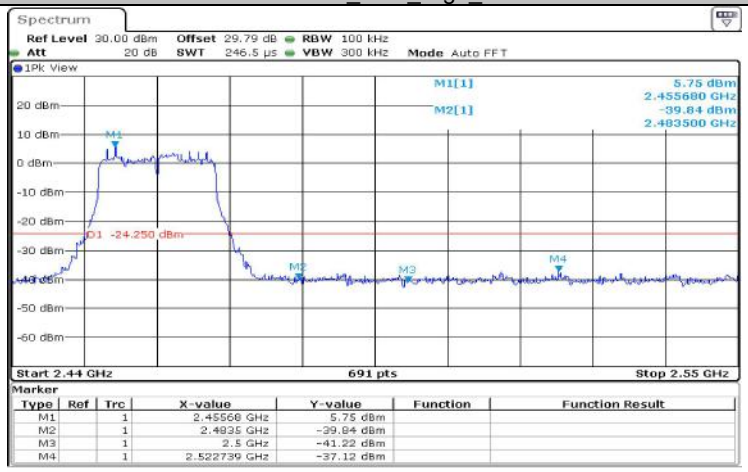
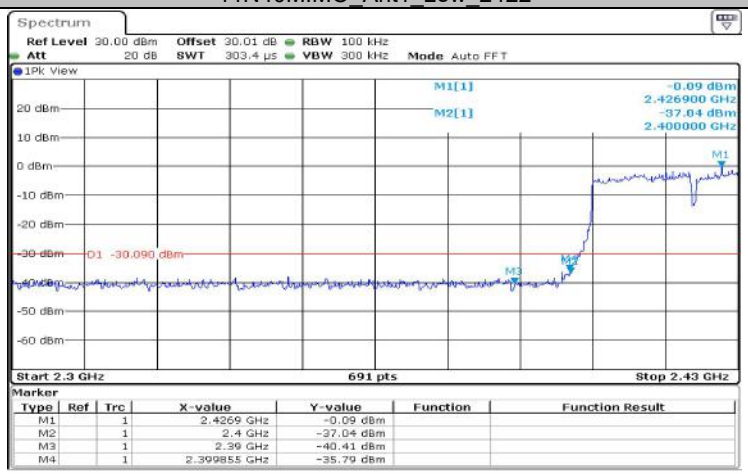


11N40MIMO_Ant1_Low_2422



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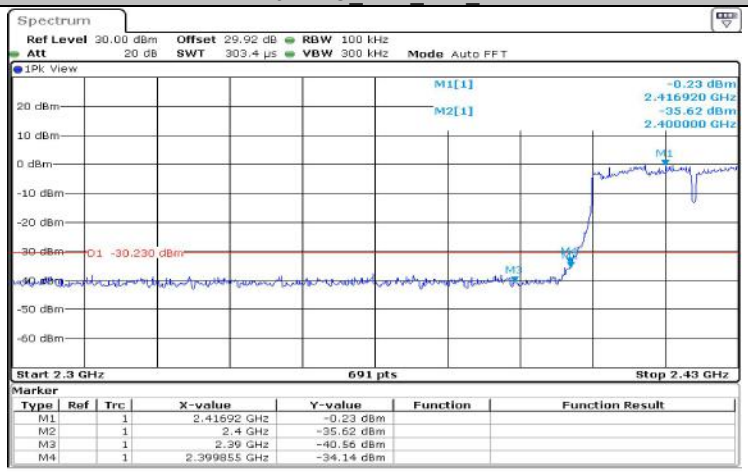
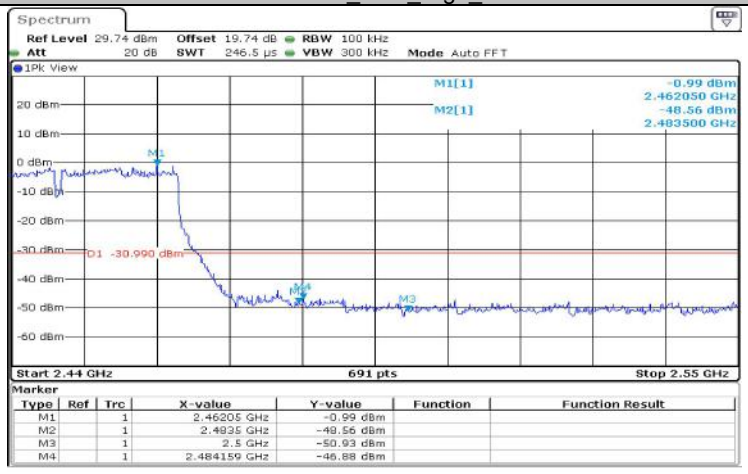
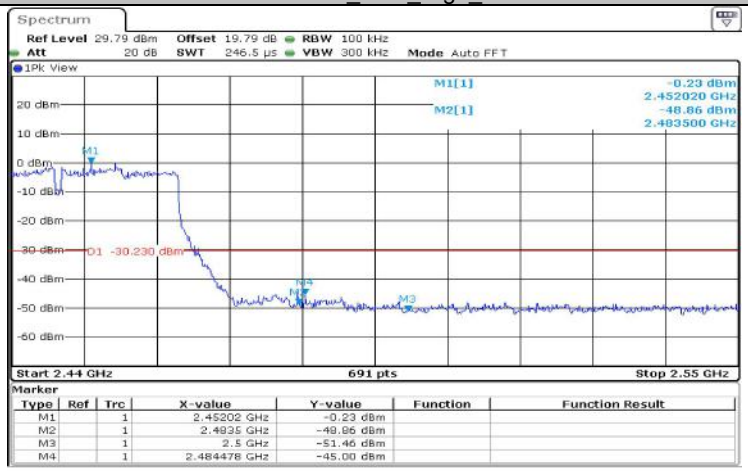


11N40MIMO_Ant1_High_2447



11N40MIMO_Ant2_High_2447



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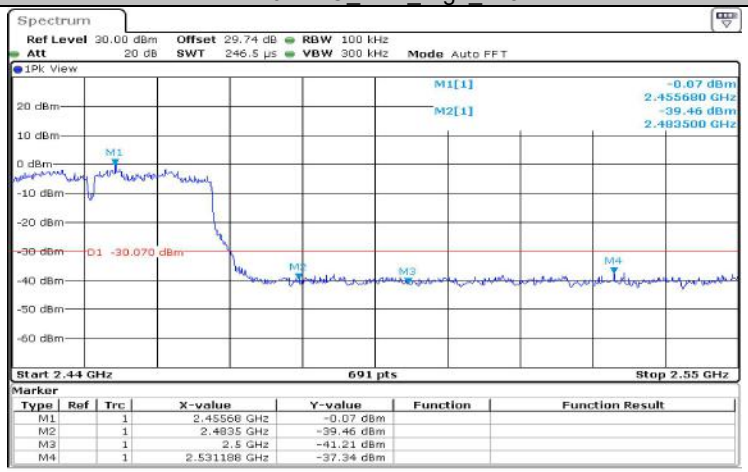
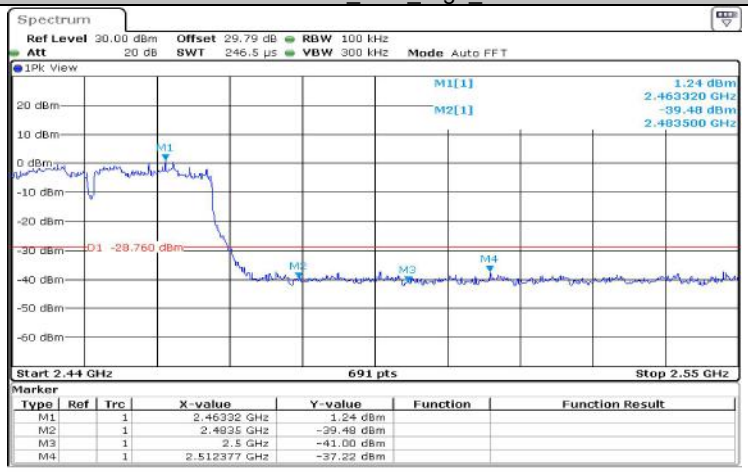
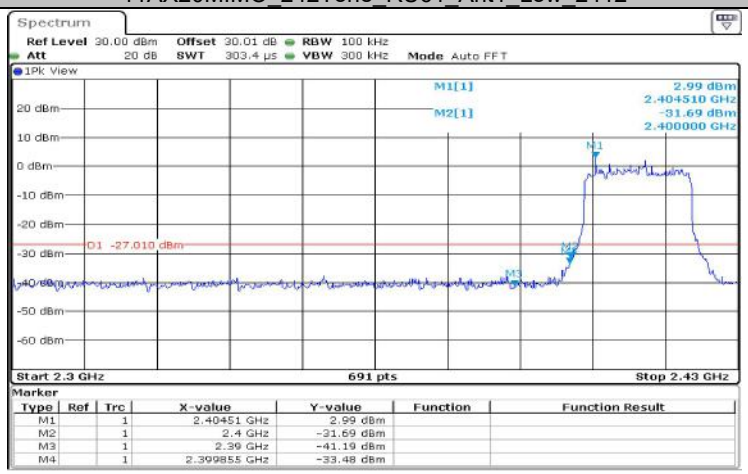


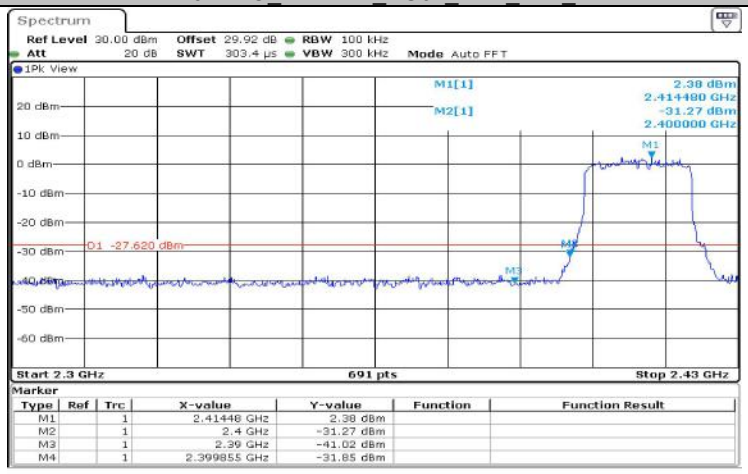
11N40MIMO_Ant2_High_2452



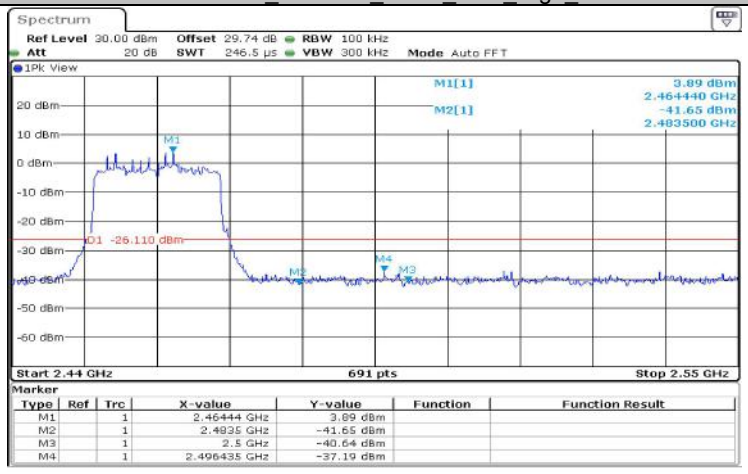
11AX20MIMO_242Tone_RU61_Ant1_Low_2412



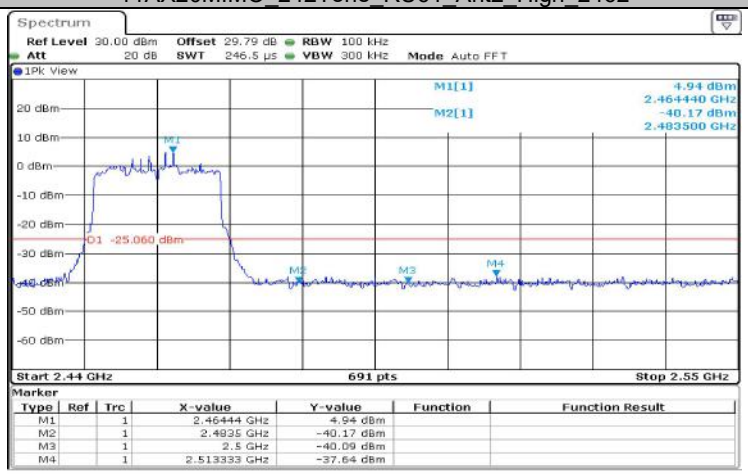
11AX20MIMO_242Tone_RU61_Ant2_Low_2412



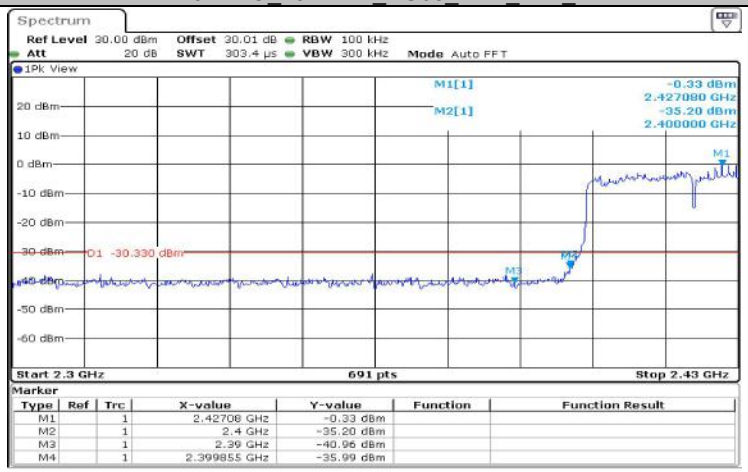
11AX20MIMO_242Tone_RU61_Ant1_High_2462



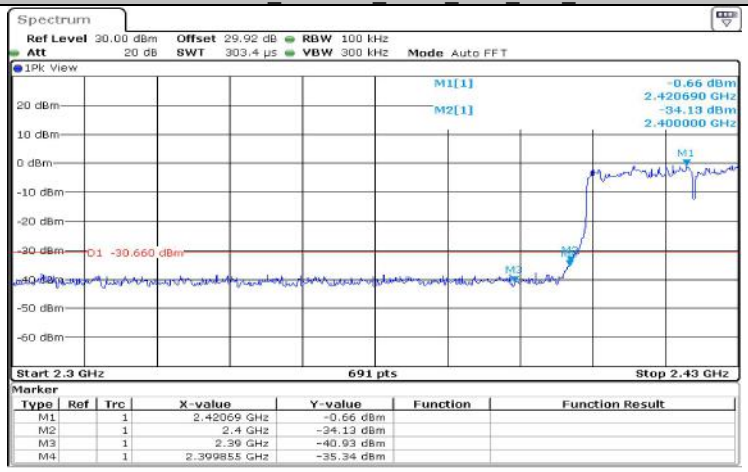
11AX20MIMO_242Tone_RU61_Ant2_High_2462



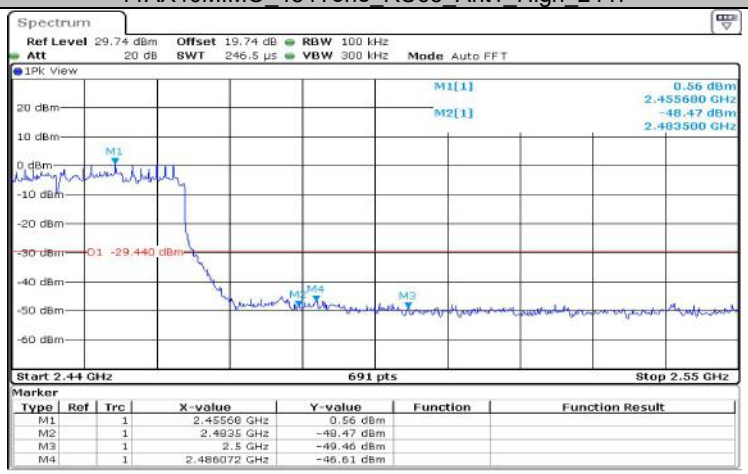
11AX40MIMO_484Tone_RU65_Ant1_Low_2422



11AX40MIMO_484Tone_RU65_Ant2_Low_2422



11AX40MIMO_484Tone_RU65_Ant1_High_2447



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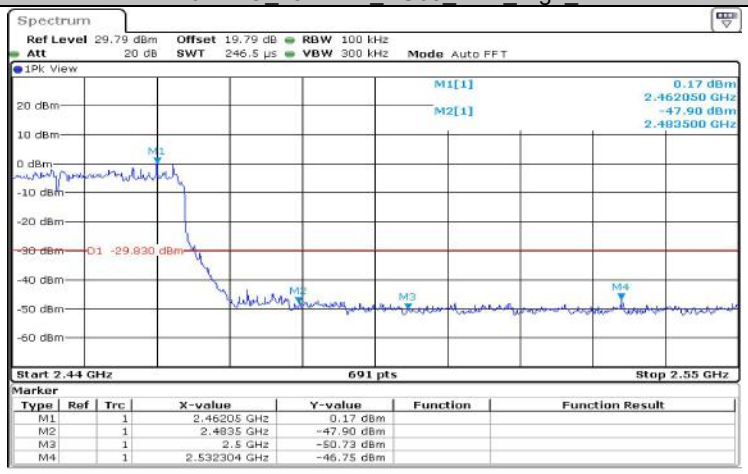
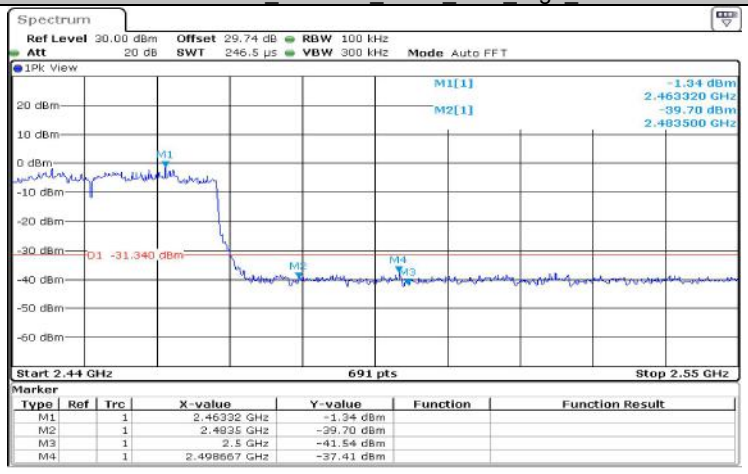


11AX40MIMO_484Tone_RU65_Ant1_High_2452



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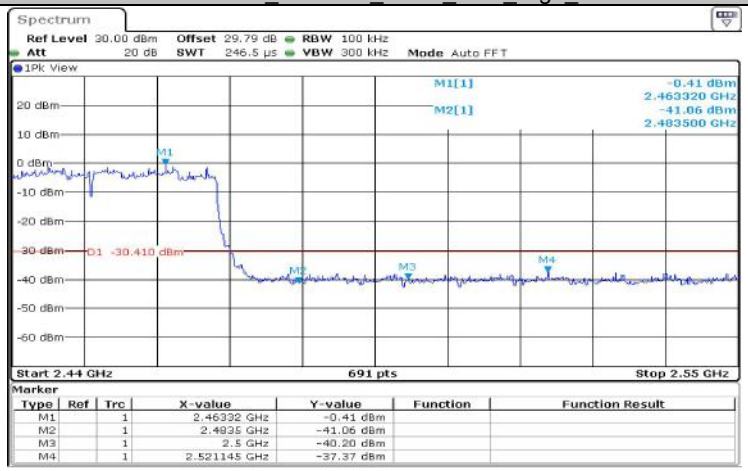


Appendix F: Duty Cycle

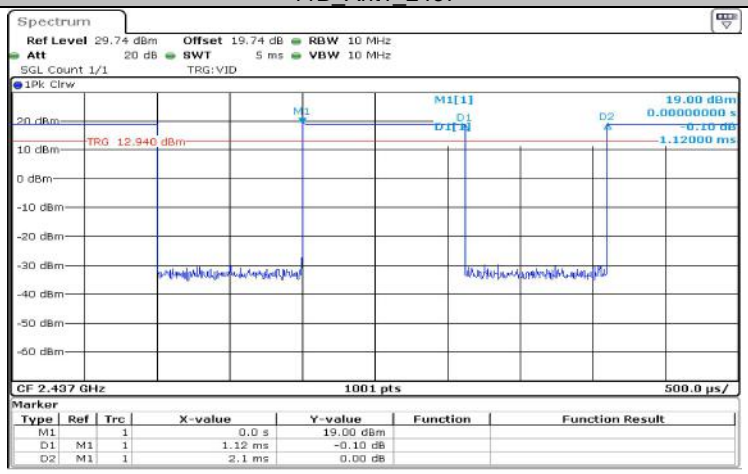
Test Result

Test Mode	Antenna	Frequency [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Duty cycle factor [dB]	1/T Mini VBW setting [kHz]
11B	Ant1	2437	1.12	2.10	53.33	2.73	0.89
11G	Ant1	2437	1.98	2.15	92.09	0.36	0.51
11N20MIMO	Ant1	2437	5.44	5.68	95.77	0.19	0.18
11N40MIMO	Ant1	2437	5.42	5.80	93.45	0.29	0.18
11AX20MIMO_242Tone_RU61	Ant1	2437	5.44	5.74	94.77	0.23	0.18
11AX40MIMO_484Tone_RU65	Ant1	2437	5.45	5.75	94.78	0.23	0.18

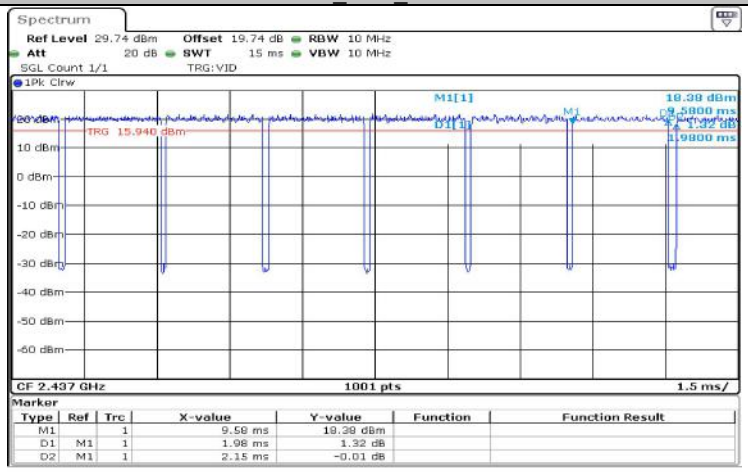
Note: duty cycle factor=10*log (1/duty cycle)

Test Graphs

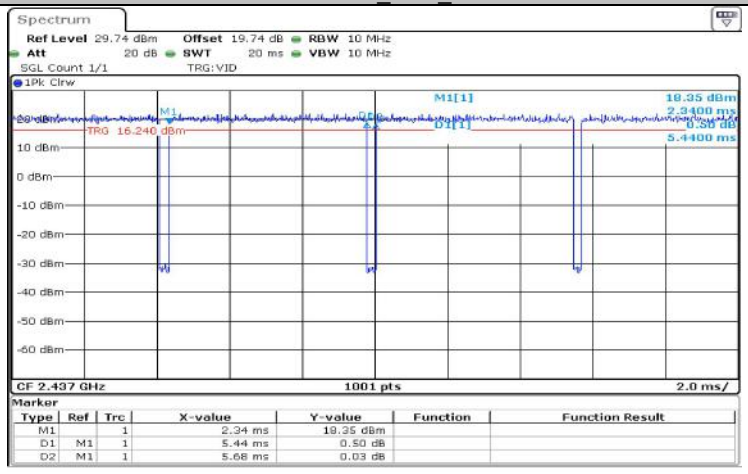
11B_Ant1_2437



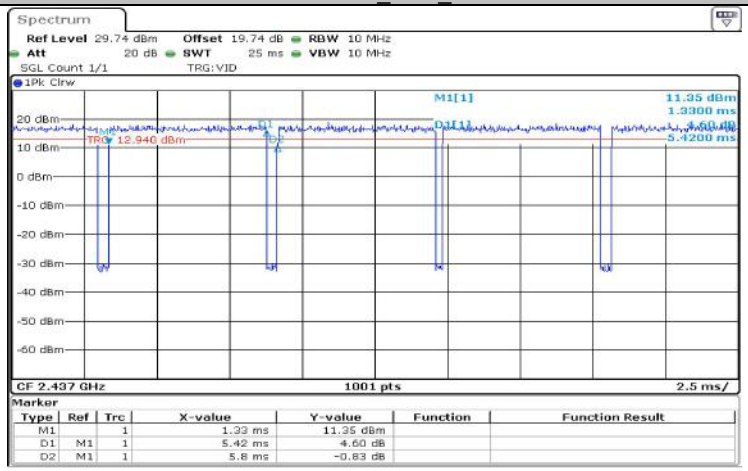
11G_Ant1_2437



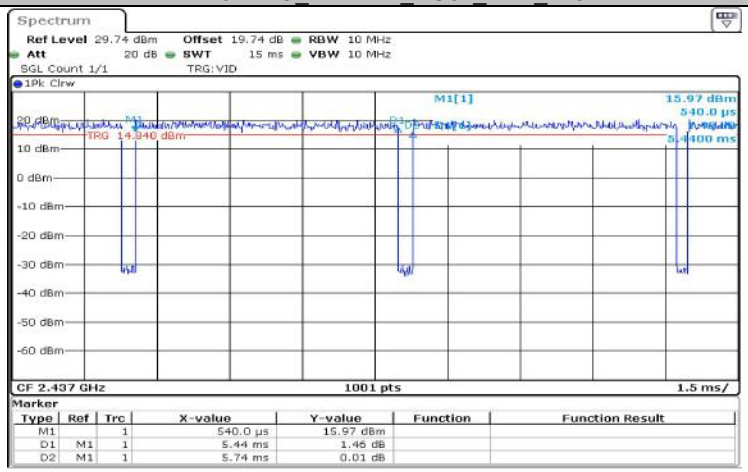
11N20MIMO_Ant1_2437



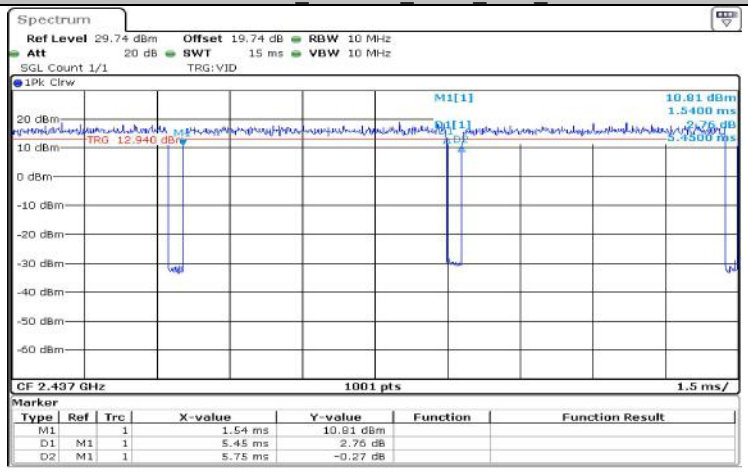
11N40MIMO_Ant1_2437



11AX20MIMO_242Tone_RU61_Ant1_2437



11AX40MIMO_484Tone_RU65_Ant1_2437



******* END OF REPORT *******