TEST REPORT

Applicant Name :	Thundercomm Technology Co., Ltd □
Address :	No. 107, Middle Datagu Road, Xiantao Street, Yubei District, Chongqing, China, 401122
Report Number :	SZNS220928-44462E-RF-00B
FCC ID:	2AOHHTURBOX-C6490

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	C6490
Model No.:	C6490-U4A
Multiple Model(s) No.:	C6490-U46,C6490-U4AS,C6490-U46S
Trade Mark:	TurboX
Date Received:	2022/09/28
Report Date:	2023/04/21

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	SZNS220928-44462E-RF-00B	Original Report	2023-03-15
1	SZNS220928-44462E-RF-00B	Add 802.11AX mode	2023-04-21

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	C6490
Tested Model	C6490-U4A
Multiple Models	C6490-U46,C6490-U4AS,C6490-U46S (model difference see product declaration letter of similarity)
Frequency Range	BLE: 2402-2480MHz Wi-Fi: 2412-2462MHz/2422-2452MHz
Maximum Conducted Output Power	BLE_Peak Power: 10.71dBm Wi-Fi_Average Power: 20.19dBm(802.11b), 17.55dBm(802.11g),17.45dBm(802.11n20), 17.61dBm(802.11n40) , 19.54dBm(802.11ax20) ,19.54dBm(802.11ax40)
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM, OFDMA
Antenna Specification*	2.5dBi (provided by the applicant)
Voltage Range	DC 3.8V
Sample serial number	SZNS220928-44462E-RF-S1 for Conducted and Radiated Emissions SZNS220928-44462E-RF-S2 RF conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Note: Pre-scan all models, the worst case model C6490-U4A was selected to test.	

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance 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 Compliance Testing of Unlicensed Wireless Devices.

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

Test Location 1:

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 Location 2:

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.71dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.92dB
Emissions, Radiated	9kHz - 30MHz	2.06dB
	30MHz - 1GHz	5.08dB
	1GHz - 18GHz	4.96dB
	18GHz - 26.5GHz	5.16dB
	26.5GHz - 40GHz	4.64dB
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:

☒Test Location 1:
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.

☒Test Location 2:
the Floor 1, KuMaKe Building, Dongzhou Community, Guangming Street, Guangming District, Shenzhen, Guangdong, 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 30241.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

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

802.11b, 802.11g, 802.11n-HT20, 802.11ax20 mode was tested with Channel 1, 6 and 11.
802.11n-HT40, 802.11ax40 mode was tested with Channel 3, 6 and 9.

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"QRCT *" exercise software was used. The software and power level was provided by the manufacturer.

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

Mode	Data rate	Power Level*		
		Low Channel	Middle Channel	High Channel
802.11b	1Mbps	17	17	17
802.11g	6Mbps	15	15	15
802.11n-HT20	MCS0	15	15	15
802.11n-HT40	MCS0	15	15	15
BLE	1Mbps/2Mbps	Default	Default	Default

Mode	RU Size	RU Index	Power Level*		
			Low channel	Middle channel	High channel
802.11 ax20	26	0	4	4	4
	52	37	8	8	8
	106	53	12	12	12
	242	61	16	16	16
802.11 ax40	26	0	0	0	0
	52	37	4	4	4
	106	53	8	8	8
	242	61	12	12	12
	484	65	16	16	16

The worst-case data rates are determined to be as follows for each mode based upon inverstigation by measuring the average power, peak power and PSD across all data rates, bandwidths and modulations.

The device support SISO and MIMO, for 802.11n/ax mode, the MIMO mode support beamforming, the SISO/MIMO and beamforming/nonbeamforming modes have same parameter, which was declared by applicant. The MIMO/beamforming was the worst mode which was selected to test.

For 802.11ax mode, the all different tone and RU index configurations was performed for output power, the maximum result is in Full RU configuration, so the other test was only performed at full RU configuration

All the antenna ports have the same power level.

Duty cycle

Test result Please refer to the Appendix Wi-Fi and Appendix BLE.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
LIANYUNDA	Adapter	LYD120200B	Unkown
Thundercomm Technology Co., Ltd	Test jig	I/O board	Unkown

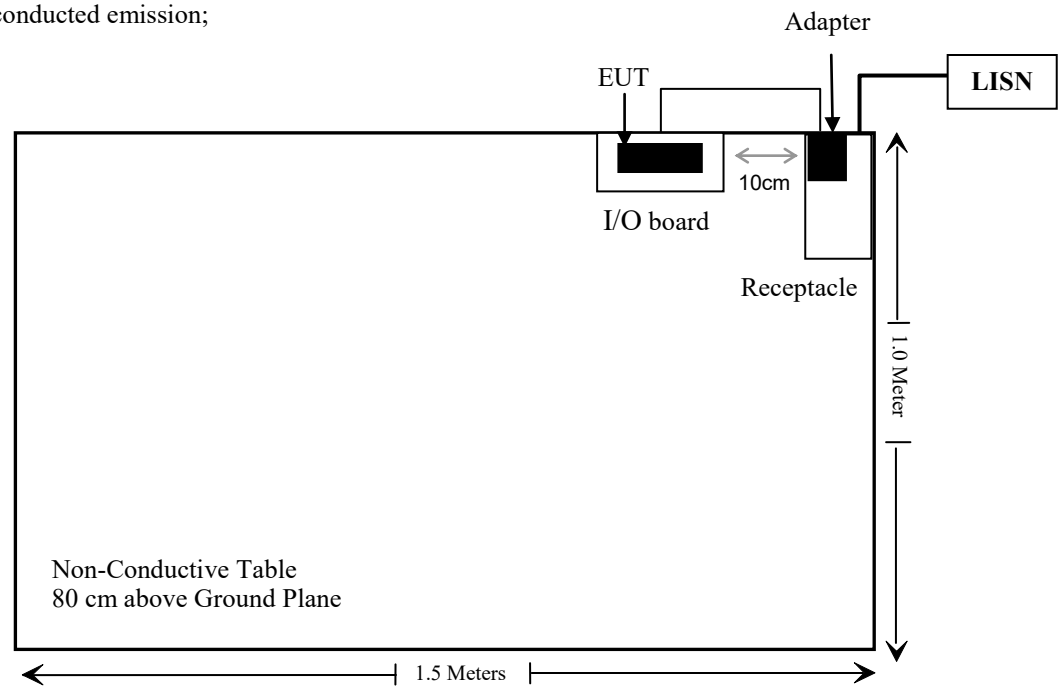
External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Un-Detachable DC Cable	1.0	EUT	Adapter

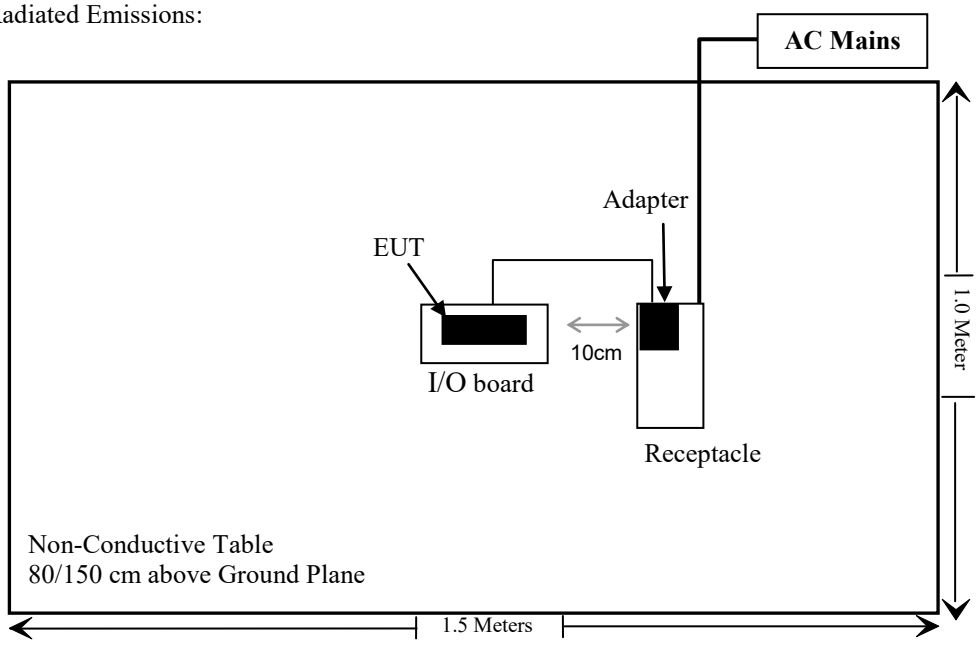
Block Diagram of Test Setup

Test Location 1:

For conducted emission;

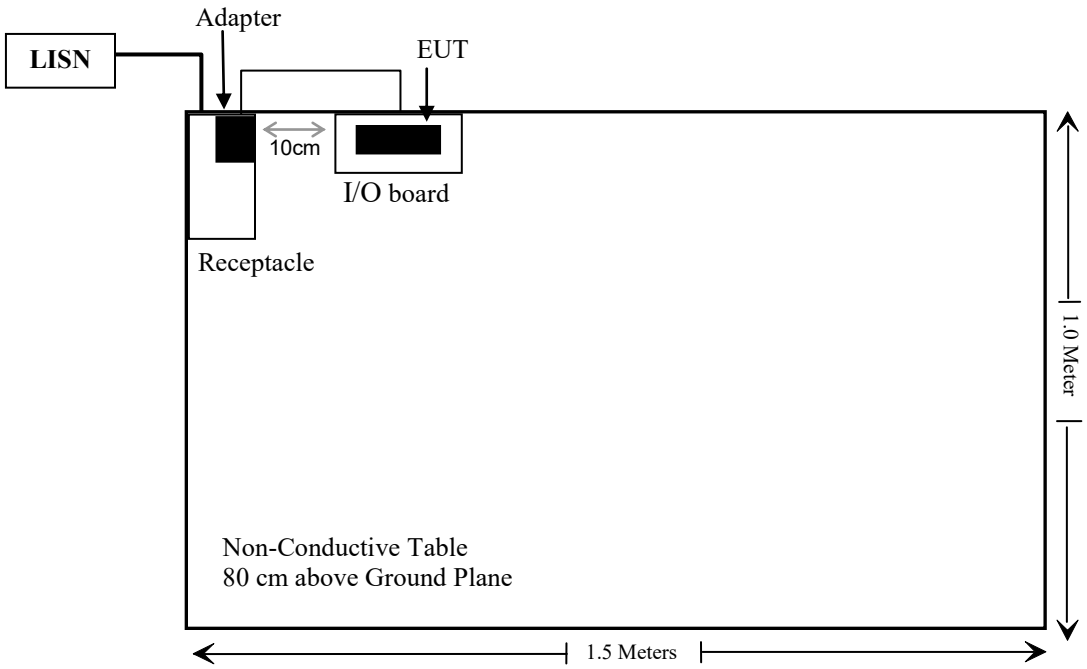


For Radiated Emissions:



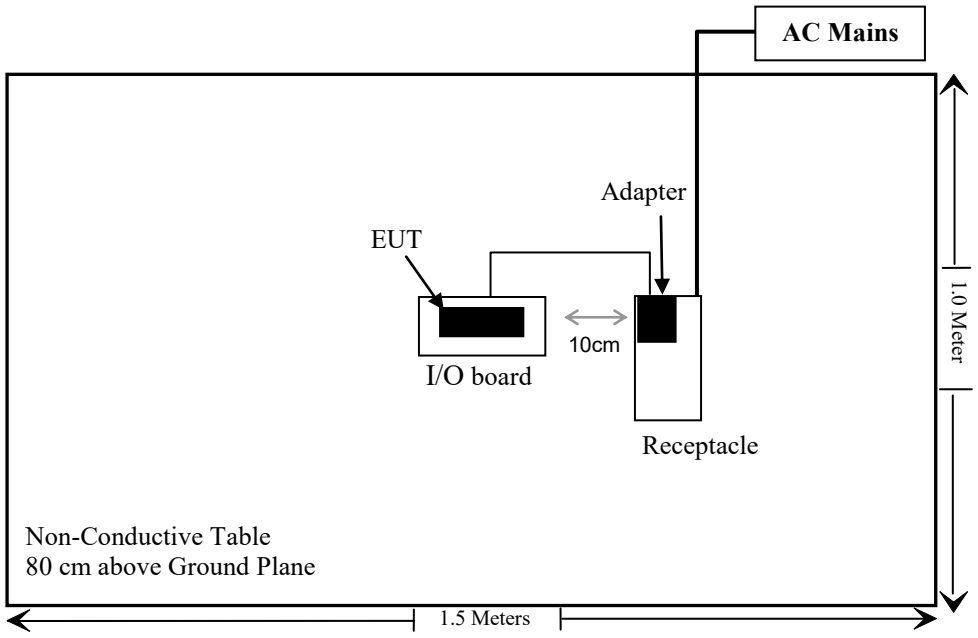
Test Location 2:

For conducted emission;

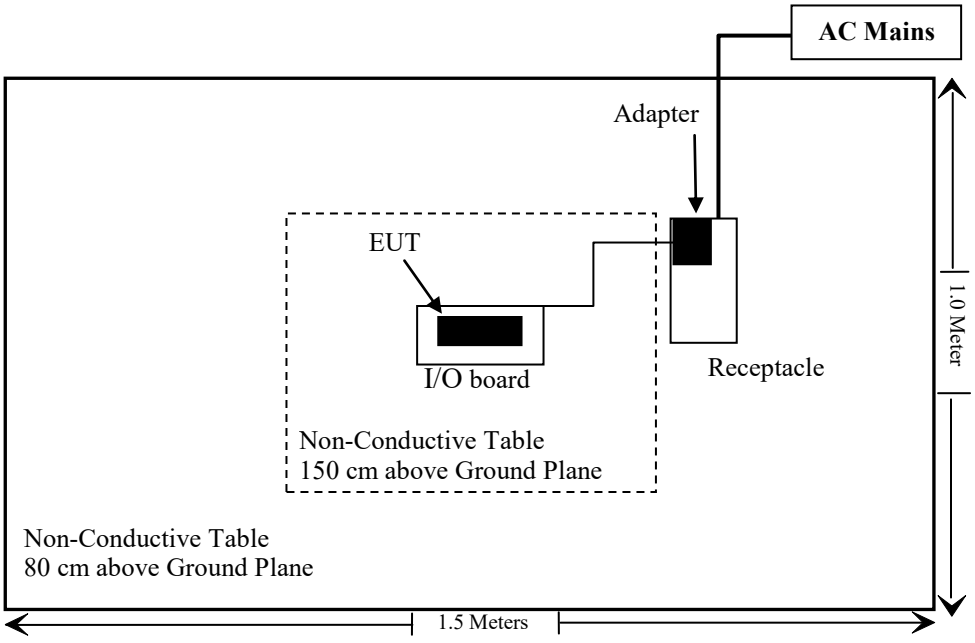


For Radiated Emissions:

Below 1GHz:



Above 1GHz:


AC Mains
Adapter
EUT
I/O board
Receptacle
1.0 Meter
Non-Conductive Table
150 cm above Ground Plane
Non-Conductive Table
80 cm above Ground Plane
1.5 Meters

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i) & §1.1307 (b) (3) & §2.1091	MPE-Based Exemption	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

Note: The 802.11AX mode was test on Test Location 2, the other modes was test on Test Location 1.

TEST EQUIPMENT LIST

Test Location 1:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Conducted Emission Test Software: e3 19821b (V9)					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2021/11/11	2022/11/10
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N650	2021/12/14	2022/12/13
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2021/12/14	2022/12/13

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF conducted test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101590	2022/01/19	2023/01/18
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101590	2022/11/25	2023/11/24
Tonscend	RF Control Unit	JS0806-2	19G8060182	2021/10/26	2022/10/25
Tonscend	RF Control Unit	JS0806-2	19G8060182	2022/10/24	2023/10/23
Agilent	USB wideband power sensor	U2021XA	MY54250003	2022/06/27	2023/06/26
HP	20dB Attenuator	8491A	53857	2021/12/14	2022/12/13
HP	20dB Attenuator	8491A	53857	2022/11/25	2023/11/24
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	Each time

Test Location 2:

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	2023/02/22	2026/02/21
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
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	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	101948	2022/11/25	2023/11/24
Agilent	USB wideband power sensor	U2021XA	MY54250003	2022/06/27	2023/06/26
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.34	RF-04	Each time	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- MPE-Based Exemption

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemptionfrom further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

Ris the minimum separation distance in meters
f = frequency in MHz

Result

For worst case:

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	ERP Limit (W)
		(dBm)	(dBi)	(dBd)	(dBm)	(W)		
BT	2402-2480	2.5	2.5	0.35	2.85	0.002	0.2	0.768
BLE	2402-2480	11.0	2.5	0.35	11.35	0.014	0.2	0.768
2.4G Wi-Fi	2412-2462	20.5	5.5	3.35	23.85	0.243	0.2	0.768
5G Wi-Fi	5150-5250	18.5	5.6	3.45	21.95	0.157	0.2	0.768
	5250-5350	19.0	5.6	3.45	22.45	0.176	0.2	0.768
	5470-5725	18.5	5.6	3.45	21.95	0.157	0.2	0.768
	5725-5850	16.0	5.6	3.45	19.45	0.088	0.2	0.768
	5850-5895	18.0	5.6	3.45	21.45	0.140	0.2	0.768
6G Wi-Fi	5925-6425	11.0	5.6	3.45	14.45	0.028	0.2	0.768
	6425-6525	9.5	5.6	3.45	12.95	0.020	0.2	0.768
	6525-6875	10.0	5.6	3.45	13.45	0.022	0.2	0.768
	6875-7125	9.5	5.6	3.45	12.95	0.020	0.2	0.768

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The BT, 2.4G Wi-Fi, 5G Wi-Fi and 6G Wi-Fi cannot Simultaneous transmitting.
3. For the 2.4G Wi-Fi, as it can support the beam-forming function, so the directional antenna gain should add the 10lg2, 2.5dBi+10lg2=5.5dBi.
4. For the 5G Wi-Fi & 6G Wi-Fi, as it can support the beam-forming function, so the directional antenna gain should add the 10lg2, 2.6dBi+10lg2=5.6dBi.
5. 0dBd=2.15dBi

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

Result: Compliant.

FCC §15.203 - 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 compliance 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.

Antenna Connector Construction

No standard antenna connect port with this module,The EUT tested with one FPC antenna arrangement for BLE and two FPC antennas arrangement for Wi-Fi which were integrated on the tested board use the MHF-Type connector and no consideration of replacement, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Type	Antenna Type	Antenna Gain	Impedance	Frequency Range
BLE ANT & Wi-Fi ANT1	FPC	2.5dBi	50Ω	2.4~2.5GHz
Wi-Fi ANT2	FPC	2.5dBi	50Ω	2.4~2.5GHz

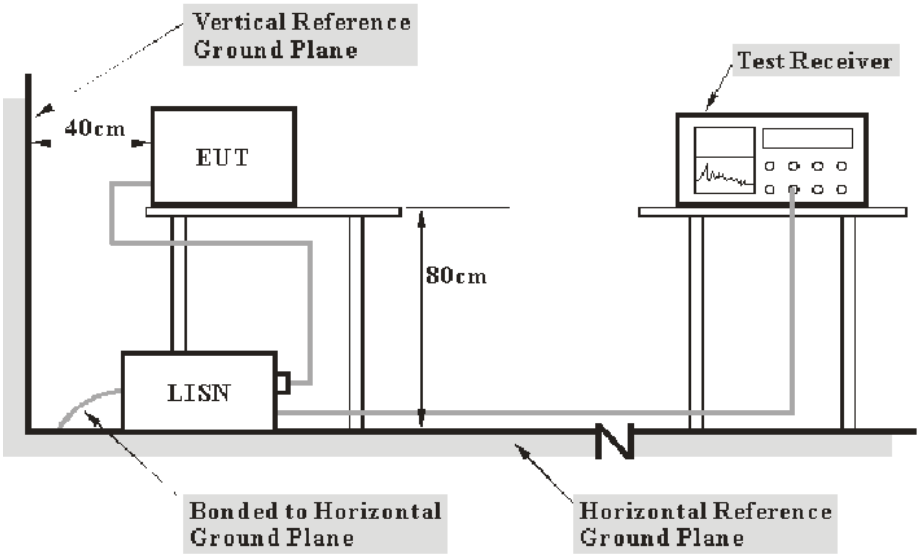
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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 limits.

The spacing between the peripherals was 10 cm.

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

During the conducted emission test, the adapter was connected to the outlet of the LISN.

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.

Transd 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 compliance 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

For modes except 802.11ax mode:

Temperature:	23 ℃
Relative Humidity:	41%
ATM Pressure:	101.0 kPa

The testing was performed by Jason Liu on 2022-11-01.

Test 802.11ax mode:

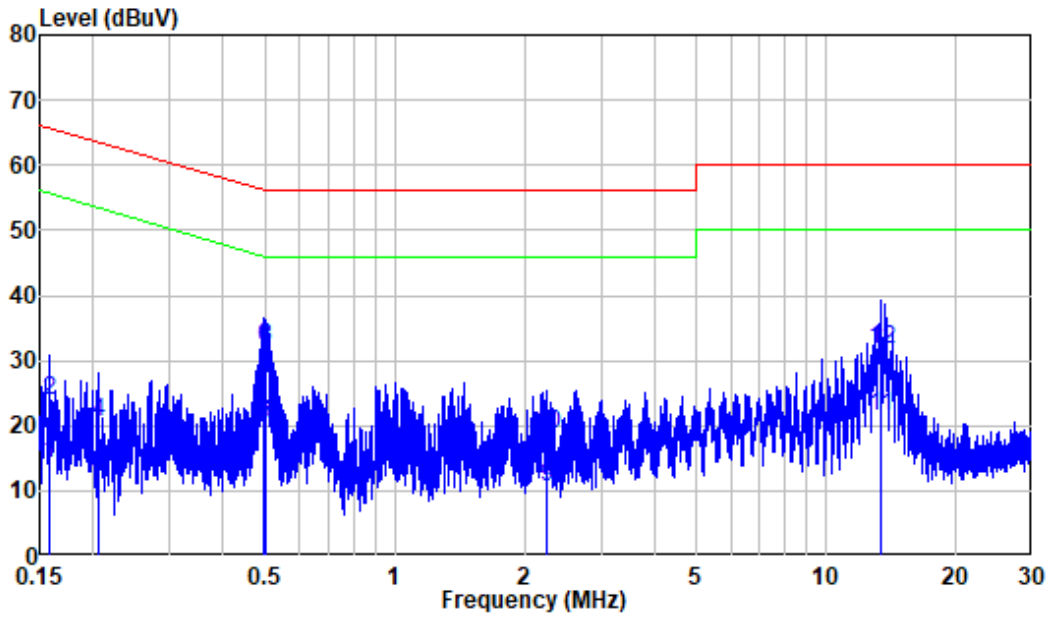
Temperature:	26℃
Relative Humidity:	45%
ATM Pressure:	101.0 kPa

The testing was performed by Jerry Wu on 2023-04-20.

EUT operation mode: Transmitting

For modes except 802.11ax mode: *(Worst case is 802.11g, low channel)*

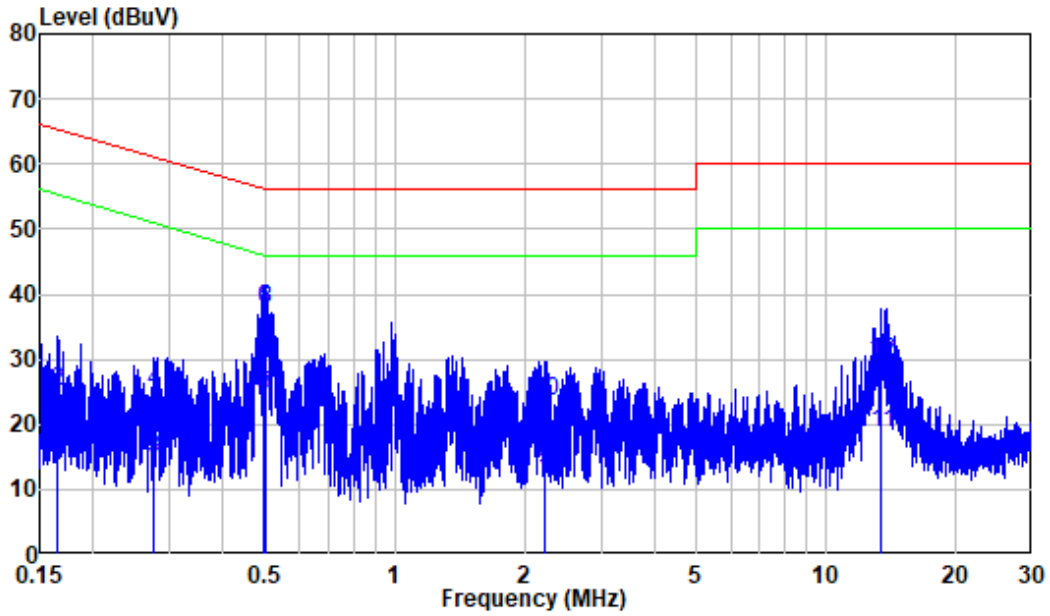
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : SZNS220928-44462E-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	4.38	14.18	55.56	-41.38	Average
2	0.158	9.80	13.93	23.73	65.56	-41.83	QP
3	0.205	9.80	2.50	12.30	53.41	-41.11	Average
4	0.205	9.80	10.87	20.67	63.41	-42.74	QP
5	0.498	9.80	10.51	20.31	46.03	-25.72	Average
6	0.498	9.80	22.31	32.11	56.03	-23.92	QP
7	0.500	9.80	9.98	19.78	46.00	-26.22	Average
8	0.500	9.80	22.18	31.98	56.00	-24.02	QP
9	2.255	9.82	0.80	10.62	46.00	-35.38	Average
10	2.255	9.82	8.94	18.76	56.00	-37.24	QP
11	13.328	9.93	11.64	21.57	50.00	-28.43	Average
12	13.328	9.93	21.87	31.80	60.00	-28.20	QP

AC 120V/60 Hz, Neutral

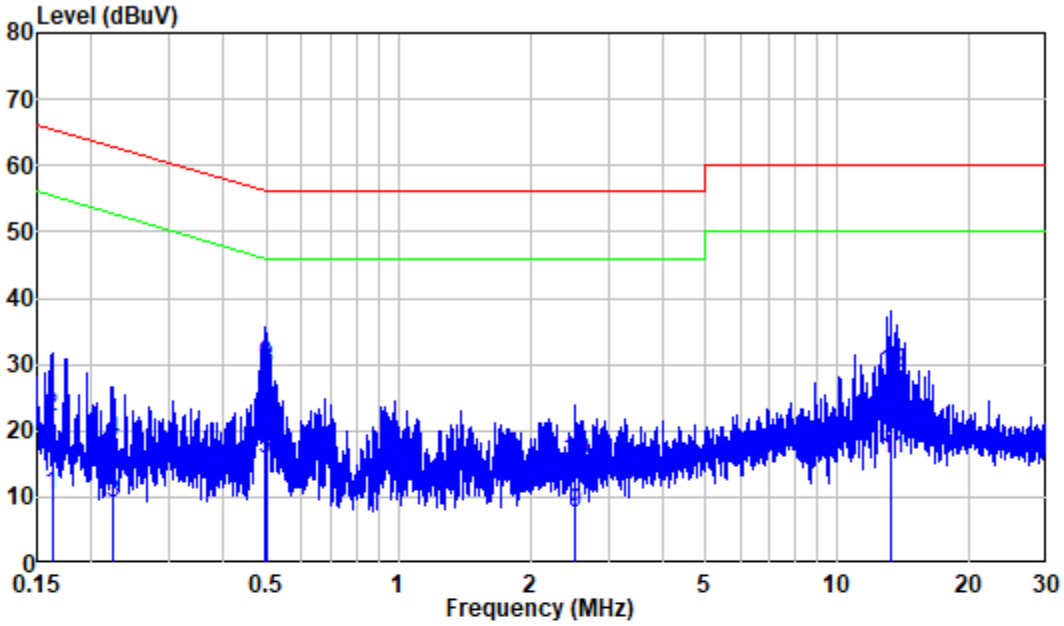


Site : Shielding Room
Condition: Neutral
Job No. : SZNS220928-44462E-RF
Mode : 2.4G WIFI
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.166	9.80	5.08	14.88	55.18	-40.30	Average
2	0.166	9.80	15.39	25.19	65.18	-39.99	QP
3	0.276	9.80	5.12	14.92	50.92	-36.00	Average
4	0.276	9.80	15.33	25.13	60.92	-35.79	QP
5	0.495	9.80	14.55	24.35	46.08	-21.73	Average
6	0.495	9.80	28.02	37.82	56.08	-18.26	QP
7	0.501	9.80	14.70	24.50	46.00	-21.50	Average
8	0.501	9.80	28.02	37.82	56.00	-18.18	QP
9	2.228	9.82	3.17	12.99	46.00	-33.01	Average
10	2.228	9.82	13.85	23.67	56.00	-32.33	QP
11	13.426	10.03	8.79	18.82	50.00	-31.18	Average
12	13.426	10.03	19.70	29.73	60.00	-30.27	QP

Test 802.11ax mode: *(worst case is 802.11ax20, middle channel)*

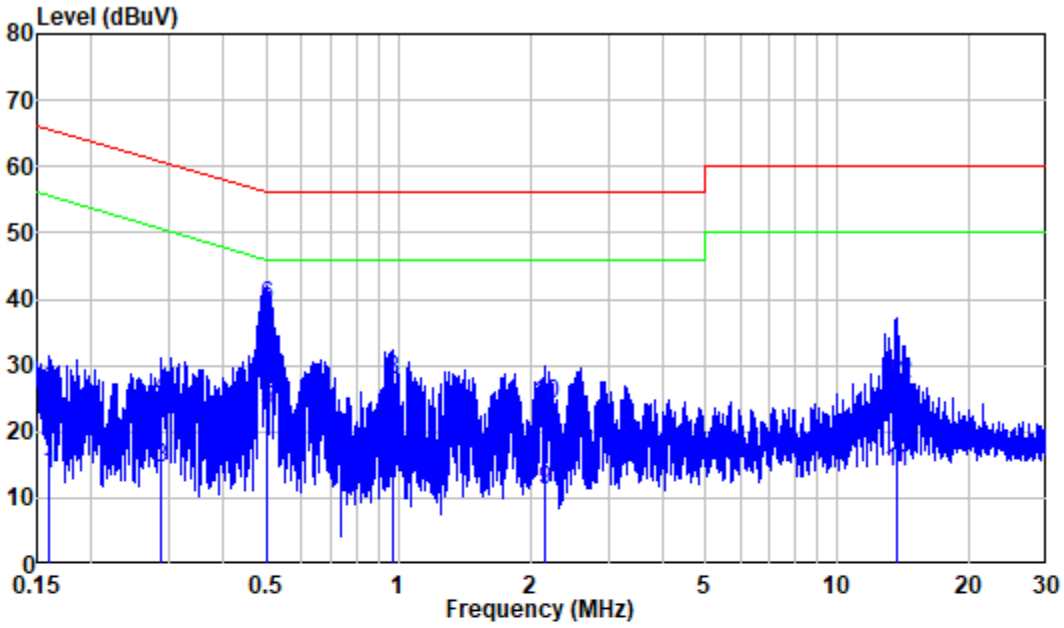
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : SZNS220928-44462E-RF
Mode : WIFI transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.162	9.98	0.32	10.30	55.35	-45.05	Average
2	0.162	9.98	12.20	22.18	65.35	-43.17	QP
3	0.222	9.99	-1.01	8.98	52.73	-43.75	Average
4	0.222	9.99	8.51	18.50	62.73	-44.23	QP
5	0.495	10.07	5.53	15.60	46.08	-30.48	Average
6	0.495	10.07	19.87	29.94	56.08	-26.14	QP
7	0.503	10.07	5.07	15.14	46.00	-30.86	Average
8	0.503	10.07	19.27	29.34	56.00	-26.66	QP
9	2.525	10.38	-2.90	7.48	46.00	-38.52	Average
10	2.525	10.38	5.02	15.40	56.00	-40.60	QP
11	13.275	13.79	1.82	15.61	50.00	-34.39	Average
12	13.275	13.79	14.85	28.64	60.00	-31.36	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : SZNS220928-44462E-RF
Mode : WIFI transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.160	10.18	3.51	13.69	55.44	-41.75	Average
2	0.160	10.18	15.70	25.88	65.44	-39.56	QP
3	0.287	10.25	4.23	14.48	50.62	-36.14	Average
4	0.287	10.25	14.76	25.01	60.62	-35.61	QP
5	0.500	10.37	12.87	23.24	46.00	-22.76	Average
6	0.500	10.37	28.61	38.98	56.00	-17.02	QP
7	0.971	9.86	5.17	15.03	46.00	-30.97	Average
8	0.971	9.86	17.87	27.73	56.00	-28.27	QP
9	2.157	10.03	1.17	11.20	46.00	-34.80	Average
10	2.157	10.03	14.10	24.13	56.00	-31.87	QP
11	13.614	13.88	0.00	13.88	50.00	-36.12	Average
12	13.614	13.88	13.44	27.32	60.00	-32.68	QP

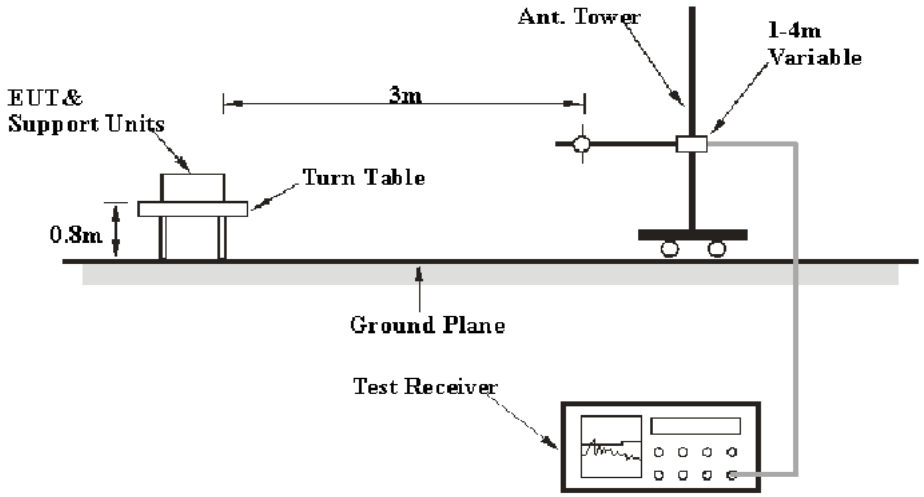
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

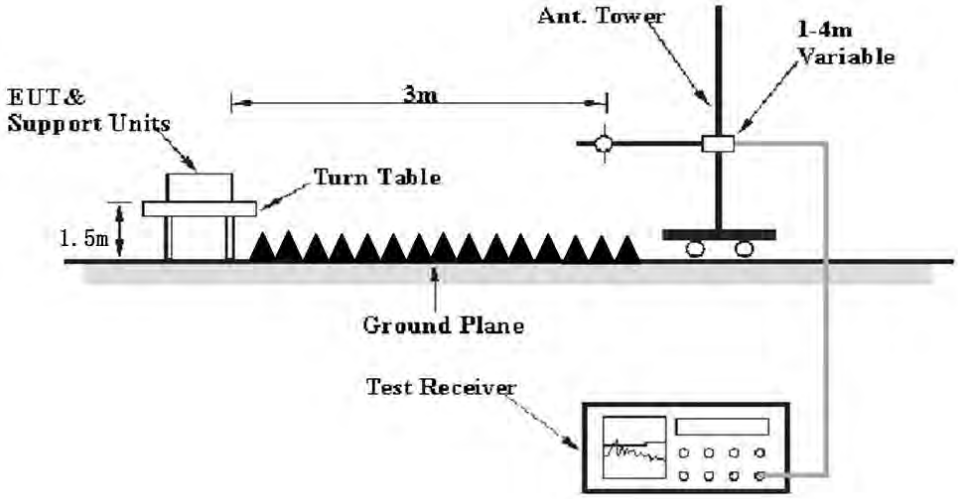
FCC §15.247 (d); §15.209; §15.205;

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. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

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.

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 compliance 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

For modes except 802.11ax mode:

Temperature:	24~25.6℃
Relative Humidity:	50~57%
ATM Pressure:	101.0 kPa

The testing was performed by Level Li on 2022-10-31 for below 1GHz, Jimi Zheng on 2022-10-18 for above 1GHz

For 802.11ax mode:

Temperature:	24~25.6℃
Relative Humidity:	50~54%
ATM Pressure:	101.0 kPa

The testing was performed by Jimi Zheng on 2023-04-20 for below 1GHz and on 2023-04-19 for above 1GHz.

EUT operation mode: Transmitting

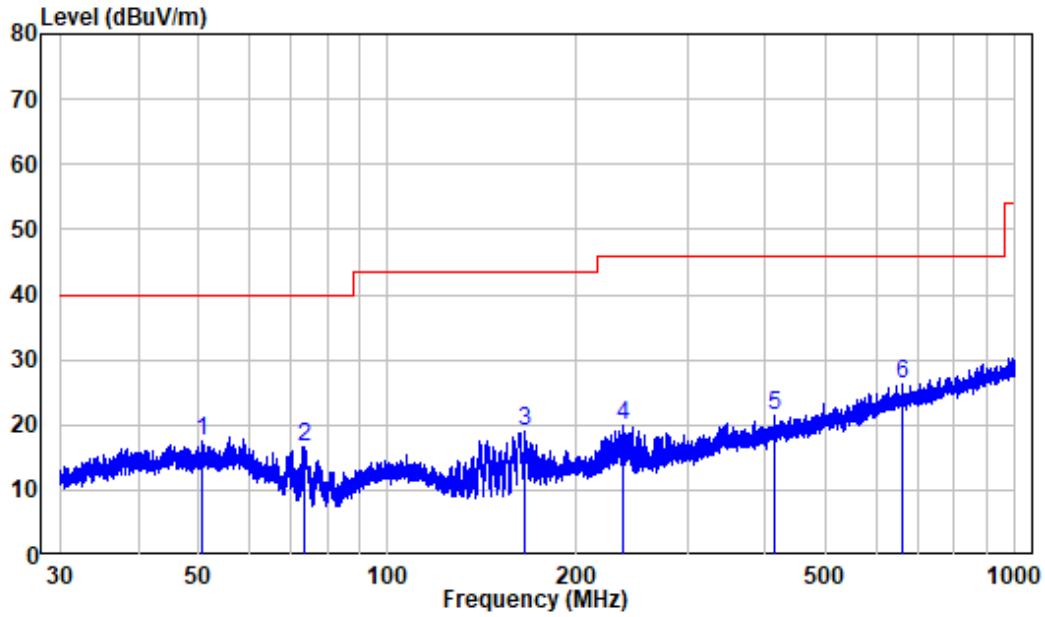
Note: Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded

30MHz-1GHz:

Note: When the test result of peak was less than the limit of QP more than 6dB, just peak value were recorded.

For modes except 802.11ax mode: *(Worst case is 802.11g, low channel)*

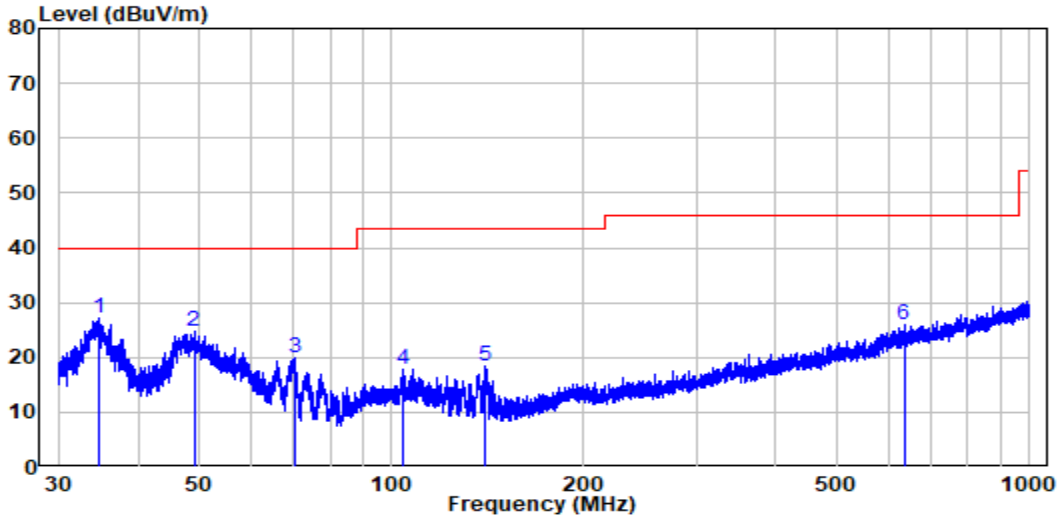
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS220928-44462E-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	50.409	-9.92	27.53	17.61	40.00	-22.39	Peak
2	73.488	-15.95	32.59	16.64	40.00	-23.36	Peak
3	165.487	-14.07	32.95	18.88	43.50	-24.62	Peak
4	237.893	-10.93	30.71	19.78	46.00	-26.22	Peak
5	412.366	-6.28	27.81	21.53	46.00	-24.47	Peak
6	660.282	-1.64	27.89	26.25	46.00	-19.75	Peak

Vertical

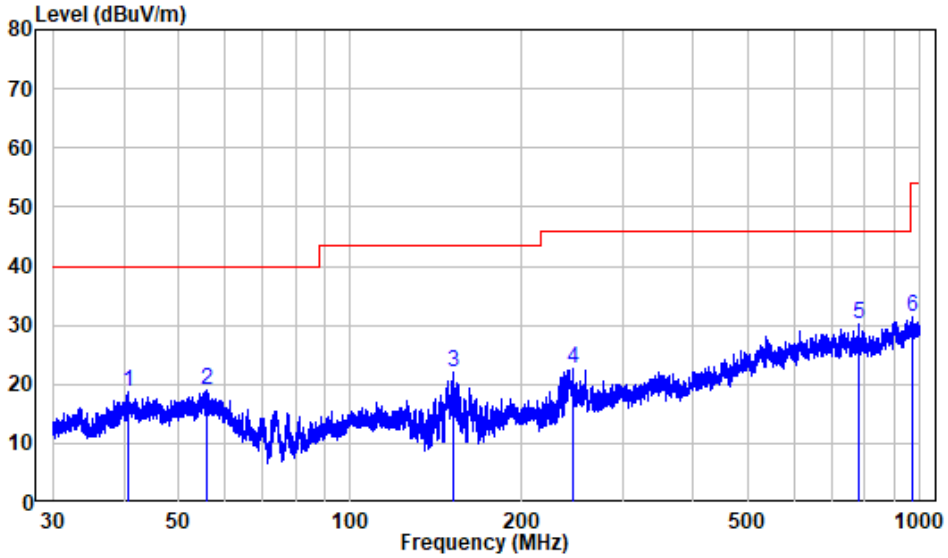


Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS220928-44462E-RF
Test Mode: 2.4G WIFI

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.654	-11.65	38.68	27.03	40.00	-12.97	Peak
2	48.950	-9.96	34.61	24.65	40.00	-15.35	Peak
3	70.398	-14.95	34.93	19.98	40.00	-20.02	Peak
4	104.307	-11.77	29.73	17.96	43.50	-25.54	Peak
5	140.158	-15.46	33.79	18.33	43.50	-25.17	Peak
6	635.577	-1.99	27.87	25.88	46.00	-20.12	Peak

For 802.11ax mode: *(Worst case is 802.11ax20, middle channel)*

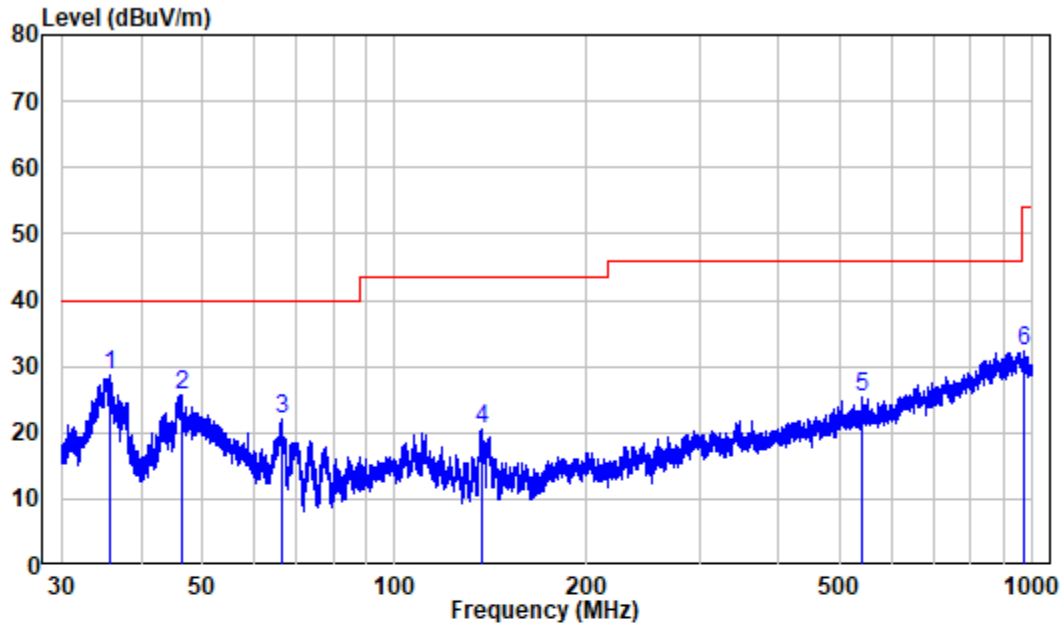
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS220928-44462E-RF
Test Mode: WIFI transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.719	-10.35	29.15	18.80	40.00	-21.20	Peak
2	55.903	-10.27	29.35	19.08	40.00	-20.92	Peak
3	151.730	-15.14	37.24	22.10	43.50	-21.40	Peak
4	245.413	-10.53	33.23	22.70	46.00	-23.30	Peak
5	780.291	0.23	29.90	30.13	46.00	-15.87	Peak
6	968.509	2.74	28.59	31.33	54.00	-22.67	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS220928-44462E-RF
Test Mode: WIFI transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	35.765	-11.33	39.91	28.58	40.00	-11.42	Peak
2	46.279	-10.08	35.84	25.76	40.00	-14.24	Peak
3	66.470	-13.16	35.15	21.99	40.00	-18.01	Peak
4	137.059	-15.23	35.71	20.48	43.50	-23.02	Peak
5	540.898	-3.58	28.94	25.36	46.00	-20.64	Peak
6	970.209	2.77	29.47	32.24	54.00	-21.76	Peak

1-25 GHz:

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)				
BLE 1M									
Low Channel 2402MHz									
2310	68.68	PK	270	1.5	H	-7.24	61.44	74	-12.56
2310	54.68	AV	270	1.5	H	-7.24	47.44	54	-6.56
2310	68.15	PK	73	2.4	V	-7.24	60.91	74	-13.09
2310	54.41	AV	73	2.4	V	-7.24	47.17	54	-6.83
2390	69.74	PK	340	1.2	H	-7.22	62.52	74	-11.48
2390	55.63	AV	340	1.2	H	-7.22	48.41	54	-5.59
2390	70.07	PK	277	1.1	V	-7.22	62.85	74	-11.15
2390	55.79	AV	277	1.1	V	-7.22	48.57	54	-5.43
4804	53.95	PK	266	1.7	H	-3.51	50.44	74	-23.56
4804	53.99	PK	104	1.5	V	-3.51	50.48	74	-23.52
Middle Channel 2440MHz									
4880	54.17	PK	61	2.2	H	-3.37	50.8	74	-23.20
4880	54.44	PK	100	1.8	V	-3.37	51.07	74	-22.93
High Channel 2480MHz									
2483.5	70.64	PK	210	1.7	H	-7.2	63.44	74	-10.56
2483.5	56.52	AV	210	1.7	H	-7.2	49.32	54	-4.68
2483.5	70.86	PK	330	2.4	V	-7.2	63.66	74	-10.34
2483.5	56.50	AV	330	2.4	V	-7.2	49.3	54	-4.7
2500	69.27	PK	271	1.2	H	-7.18	62.09	74	-11.91
2500	55.39	AV	271	1.2	H	-7.18	48.21	54	-5.79
2500	68.47	PK	174	1	V	-7.18	61.29	74	-12.71
2500	55.49	AV	174	1	V	-7.18	48.31	54	-5.69
4960	54.40	PK	168	2.4	H	-3.01	51.39	74	-22.61
4960	54.22	PK	44	1.3	V	-3.01	51.21	74	-22.79

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)				
BLE 2M									
Low Channel 2402MHz									
2310	68.16	PK	54	2.2	H	-7.24	60.92	74	-13.08
2310	54.58	AV	54	2.2	H	-7.24	47.34	54	-6.66
2310	68.36	PK	302	1.7	V	-7.24	61.12	74	-12.88
2310	54.42	AV	302	1.7	V	-7.24	47.18	54	-6.82
2390	70.08	PK	125	1.4	H	-7.22	62.86	74	-11.14
2390	55.62	AV	125	1.4	H	-7.22	48.40	54	-5.60
2390	69.79	PK	179	2.4	V	-7.22	62.57	74	-11.43
2390	55.62	AV	179	2.4	V	-7.22	48.40	54	-5.60
4804	54.78	PK	304	2.5	H	-3.51	51.27	74	-22.73
4804	54.55	PK	250	2.3	V	-3.51	51.04	74	-22.96
Middle Channel 2440MHz									
4880	54.96	PK	265	2.3	H	-3.37	51.59	74	-22.41
4880	54.48	PK	273	2.2	V	-3.37	51.11	74	-22.89
High Channel 2480MHz									
2483.5	70.44	PK	251	2.1	H	-7.2	63.24	74	-10.76
2483.5	56.55	AV	251	2.1	H	-7.2	49.35	54	-4.65
2483.5	71.14	PK	103	2	V	-7.2	63.94	74	-10.06
2483.5	56.46	AV	103	2	V	-7.2	49.26	54	-4.74
2500	69.22	PK	238	1.9	H	-7.18	62.04	74	-11.96
2500	55.35	AV	238	1.9	H	-7.18	48.17	54	-5.83
2500	69.16	PK	233	2	V	-7.18	61.98	74	-12.02
2500	55.40	AV	233	2	V	-7.18	48.22	54	-5.78
4960	54.04	PK	238	1.6	H	-3.01	51.03	74	-22.97
4960	53.83	PK	346	1.5	V	-3.01	50.82	74	-23.18

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									
Low Channel 2412MHz									
2310	67.90	PK	277	1.9	H	-7.24	60.66	74	-13.34
2310	53.65	AV	277	1.9	H	-7.24	46.41	54	-7.59
2310	67.87	PK	319	2.1	V	-7.24	60.63	74	-13.37
2310	53.82	AV	319	2.1	V	-7.24	46.58	54	-7.42
2390	69.30	PK	13	1.3	H	-7.22	62.08	74	-11.92
2390	54.45	AV	13	1.3	H	-7.22	47.23	54	-6.77
2390	69.86	PK	1	1.9	V	-7.22	62.64	74	-11.36
2390	54.56	AV	1	1.9	V	-7.22	47.34	54	-6.66
4824	54.18	PK	219	2.1	H	-3.53	50.65	74	-23.35
4824	54.50	PK	157	2	V	-3.53	50.97	74	-23.03
Middle Channel 2437MHz									
4874	54.84	PK	282	1.4	H	-3.41	51.43	74	-22.57
4874	54.88	PK	220	1.6	V	-3.41	51.47	74	-22.53
High Channel 2462MHz									
2483.5	70.37	PK	296	1.9	H	-7.2	63.17	74	-10.83
2483.5	54.91	AV	296	1.9	H	-7.2	47.71	54	-6.29
2483.5	70.42	PK	35	2.5	V	-7.2	63.22	74	-10.78
2483.5	55.09	AV	35	2.5	V	-7.2	47.89	54	-6.11
2500	68.41	PK	351	1.3	H	-7.18	61.23	74	-12.77
2500	54.58	AV	351	1.3	H	-7.18	47.4	54	-6.6
2500	68.97	PK	265	2	V	-7.18	61.79	74	-12.21
2500	54.60	AV	265	2	V	-7.18	47.42	54	-6.58
4924	55.04	PK	229	1.8	H	-3.16	51.88	74	-22.12
4924	54.87	PK	262	1.5	V	-3.16	51.71	74	-22.29

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									
Low Channel 2412MHz									
2310	68.58	PK	33	1.7	H	-7.24	61.34	74	-12.66
2310	53.62	AV	33	1.7	H	-7.24	46.38	54	-7.62
2310	68.67	PK	245	2	V	-7.24	61.43	74	-12.57
2310	53.86	AV	245	2	V	-7.24	46.62	54	-7.38
2390	69.82	PK	92	2.3	H	-7.22	62.60	74	-11.40
2390	54.58	AV	92	2.3	H	-7.22	47.36	54	-6.64
2390	70.01	PK	168	1.3	V	-7.22	62.79	74	-11.21
2390	54.44	AV	168	1.3	V	-7.22	47.22	54	-6.78
4824	54.79	PK	233	1.5	H	-3.53	51.26	74	-22.74
4824	54.26	PK	171	1.3	V	-3.53	50.73	74	-23.27
Middle Channel 2437MHz									
4874	54.34	PK	229	1.5	H	-3.41	50.93	74	-23.07
4874	54.45	PK	278	2.1	V	-3.41	51.04	74	-22.96
High Channel 2462MHz									
2483.5	70.64	PK	237	2.2	H	-7.2	63.44	74	-10.56
2483.5	54.96	AV	237	2.2	H	-7.2	47.76	54	-6.24
2483.5	71.02	PK	298	1.5	V	-7.2	63.82	74	-10.18
2483.5	54.96	AV	298	1.5	V	-7.2	47.76	54	-6.24
2500	68.48	PK	108	1.1	H	-7.18	61.3	74	-12.7
2500	54.42	AV	108	1.1	H	-7.18	47.24	54	-6.76
2500	68.98	PK	204	1.4	V	-7.18	61.8	74	-12.2
2500	54.51	AV	204	1.4	V	-7.18	47.33	54	-6.67
4924	54.38	PK	132	2.2	H	-3.16	51.22	74	-22.78
4924	54.73	PK	354	1.1	V	-3.16	51.57	74	-22.43

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									
2310	68.16	PK	324	1.1	H	-7.24	60.92	74	-13.08
2310	53.76	AV	324	1.1	H	-7.24	46.52	54	-7.48
2310	68.44	PK	236	1.4	V	-7.24	61.20	74	-12.80
2310	53.66	AV	236	1.4	V	-7.24	46.42	54	-7.58
2390	69.89	PK	83	1.9	H	-7.22	62.67	74	-11.33
2390	54.69	AV	83	1.9	H	-7.22	47.47	54	-6.53
2390	69.75	PK	162	2.4	V	-7.22	62.53	74	-11.47
2390	54.56	AV	162	2.4	V	-7.22	47.34	54	-6.66
4824	54.03	PK	111	1.6	H	-3.53	50.50	74	-23.50
4824	54.60	PK	75	1.6	V	-3.53	51.07	74	-22.93
Middle Channel 2437MHz									
4874	54.48	PK	213	2.4	H	-3.41	51.07	74	-22.93
4874	54.38	PK	321	1.7	V	-3.41	50.97	74	-23.03
High Channel 2462MHz									
2483.5	70.62	PK	106	1.3	H	-7.2	63.42	74	-10.58
2483.5	54.97	AV	106	1.3	H	-7.2	47.77	54	-6.23
2483.5	71.00	PK	149	2	V	-7.2	63.8	74	-10.2
2483.5	54.85	AV	149	2	V	-7.2	47.65	54	-6.35
2500	68.51	PK	190	2.4	H	-7.18	61.33	74	-12.67
2500	54.37	AV	190	2.4	H	-7.18	47.19	54	-6.81
2500	68.47	PK	282	2.1	V	-7.18	61.29	74	-12.71
2500	54.40	AV	282	2.1	V	-7.18	47.22	54	-6.78
4924	54.54	PK	324	1.5	H	-3.16	51.38	74	-22.62
4924	54.46	PK	176	1.1	V	-3.16	51.30	74	-22.70

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									
2310	67.93	PK	113	1.1	H	-7.24	60.69	74	-13.31
2310	53.85	AV	113	1.1	H	-7.24	46.61	54	-7.39
2310	67.78	PK	24	2.3	V	-7.24	60.54	74	-13.46
2310	53.74	AV	24	2.3	V	-7.24	46.50	54	-7.50
2390	70.25	PK	243	1	H	-7.22	63.03	74	-10.97
2390	55.19	AV	243	1	H	-7.22	47.97	54	-6.03
2390	70.83	PK	210	2	V	-7.22	63.61	74	-10.39
2390	55.23	AV	210	2	V	-7.22	48.01	54	-5.99
4844	54.65	PK	234	1.6	H	-3.54	51.11	74	-22.89
4844	54.67	PK	69	1.7	V	-3.54	51.13	74	-22.87
Middle Channel 2437MHz									
4874	54.18	PK	187	1.2	H	-3.41	50.77	74	-23.23
4874	54.7	PK	25	1.8	V	-3.41	51.29	74	-22.71
High Channel 2452MHz									
2483.5	74.02	PK	238	2.4	H	-7.2	66.82	74	-7.18
2483.5	58.82	AV	238	2.4	H	-7.2	51.62	54	-2.38
2483.5	71.66	PK	136	1.4	V	-7.2	64.46	74	-9.54
2483.5	55.53	AV	136	1.4	V	-7.2	48.33	54	-5.67
2500	69.30	PK	345	1.4	H	-7.18	62.12	74	-11.88
2500	54.45	AV	345	1.4	H	-7.18	47.27	54	-6.73
2500	69.13	PK	73	1.1	V	-7.18	61.95	74	-12.05
2500	54.43	AV	73	1.1	V	-7.18	47.25	54	-6.75
4904	54.83	PK	79	1.1	H	-3.26	51.57	74	-22.43
4904	54.55	PK	166	1.7	V	-3.26	51.29	74	-22.71

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)				
802.11AX20(worst case 242Tone)									
Low Channel 2412MHz									
2310	64.66	PK	45	1.3	H	-10.37	54.29	74	-19.71
2310	49.86	AV	45	1.3	H	-10.37	39.49	54	-14.51
2310	64.59	PK	49	2.3	V	-10.37	54.22	74	-19.78
2310	49.87	AV	49	2.3	V	-10.37	39.50	54	-14.50
2390	76.18	PK	351	1.9	H	-10.70	65.48	74	-8.52
2390	57.59	AV	351	1.9	H	-10.70	46.89	54	-7.11
2390	67.08	PK	46	1.3	V	-10.70	56.38	74	-17.62
2390	52.28	AV	46	1.3	V	-10.70	41.58	54	-12.42
4824	59.16	PK	252	1.8	H	-6.10	53.06	74	-20.94
4824	59.75	PK	141	1.8	V	-6.10	53.65	74	-20.35
Middle Channel 2437MHz									
4874	59.87	PK	230	2.5	H	-5.95	53.92	74	-20.08
4874	59.65	PK	284	1.2	V	-5.95	53.7	74	-20.3
High Channel 2462MHz									
2483.5	74.93	PK	34	1.8	H	-10.55	64.38	74	-9.62
2483.5	56.20	AV	34	1.8	H	-10.55	45.65	54	-8.35
2483.5	68.32	PK	126	1.8	V	-10.55	57.77	74	-16.23
2483.5	53.51	AV	126	1.8	V	-10.55	42.96	54	-11.04
2500	66.39	PK	265	1.3	H	-10.42	55.97	74	-18.03
2500	51.90	AV	265	1.3	H	-10.42	41.48	54	-12.52
2500	66.68	PK	190	1.2	V	-10.42	56.26	74	-17.74
2500	51.93	AV	190	1.2	V	-10.42	41.51	54	-12.49
4924	59.32	PK	277	1.6	H	-5.67	53.65	74	-20.35
4924	59.37	PK	334	2.1	V	-5.67	53.7	74	-20.30

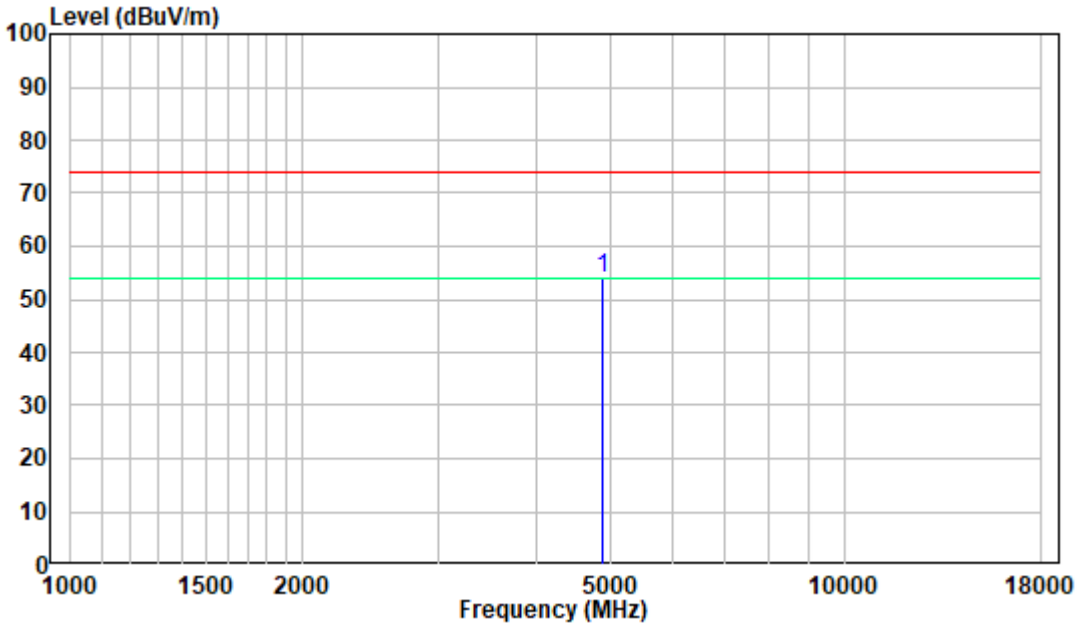
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11AX40(worst case 484Tone)									
Low Channel 2422MHz									
2310	64.99	PK	260	2.3	H	-10.37	54.62	74	-19.38
2310	50.84	AV	260	2.3	H	-10.37	40.47	54	-13.53
2310	64.74	PK	341	1.4	V	-10.37	54.37	74	-19.63
2310	50.00	AV	341	1.4	V	-10.37	39.63	54	-14.37
2390	76.12	PK	46	2.4	H	-10.70	65.42	74	-8.58
2390	58.00	AV	46	2.4	H	-10.70	47.30	54	-6.70
2390	67.00	PK	212	2	V	-10.70	56.30	74	-17.70
2390	52.81	AV	212	2	V	-10.70	42.11	54	-11.89
4824	59.44	PK	189	1.5	H	-6.09	53.35	74	-20.65
4824	59.98	PK	150	1.1	V	-6.09	53.89	74	-20.11
Middle Channel 2437MHz									
4874	59.64	PK	45	2.1	H	-5.95	53.69	74	-20.31
4874	59.59	PK	68	2.4	V	-5.95	53.64	74	-20.36
High Channel 2452MHz									
2483.5	74.44	PK	1	2	H	-10.55	63.89	74	-10.11
2483.5	57.25	AV	1	2	H	-10.55	46.7	54	-7.3
2483.5	70.54	PK	312	1.8	V	-10.55	59.99	74	-14.01
2483.5	55.48	AV	312	1.8	V	-10.55	44.93	54	-9.07
2500	66.49	PK	220	1.9	H	-10.42	56.07	74	-17.93
2500	51.94	AV	220	1.9	H	-10.42	41.52	54	-12.48
2500	66.45	PK	176	1	V	-10.42	56.03	74	-17.97
2500	51.93	AV	176	1	V	-10.42	41.51	54	-12.49
4924	59.50	PK	337	2.4	H	-5.77	53.73	74	-20.27
4924	59.54	PK	350	1.1	V	-5.77	53.77	74	-20.23

Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude (Absolute Level) = Factor + Reading
Margin = Corrected. Amplitude (Absolute Level) - Limit
The other spurious emission which is in the noise floor level was not recorded.
The test result of peak was less than the limit of average, so just peak value were recorded.

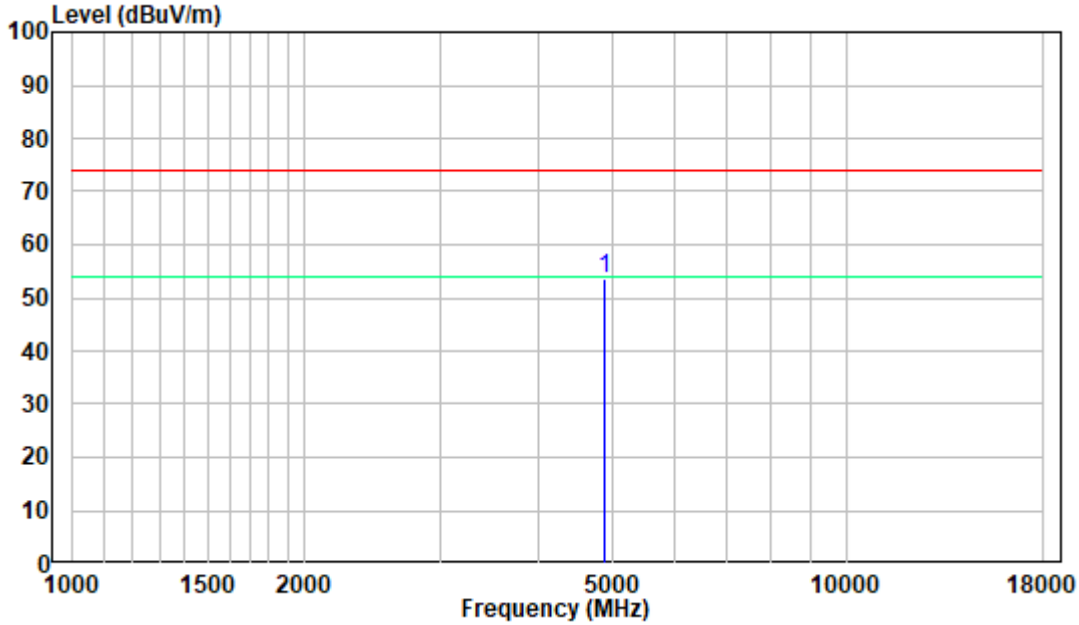
1-18 GHz:

Pre-scan for 802.11ax20, middle channel

Horizontal



Vertical

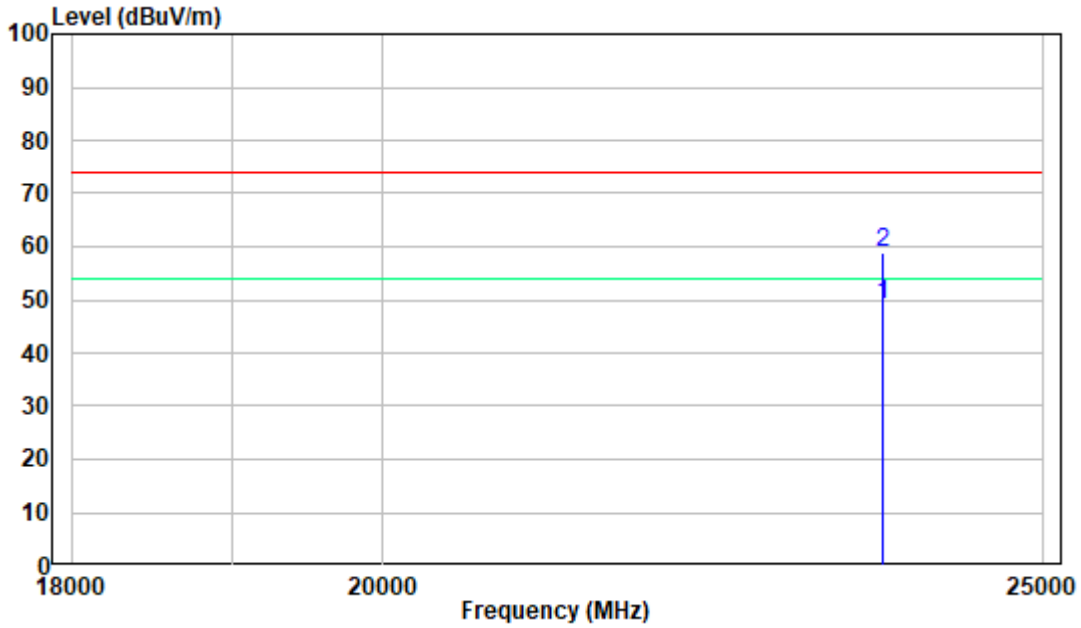


18 -25GHz:

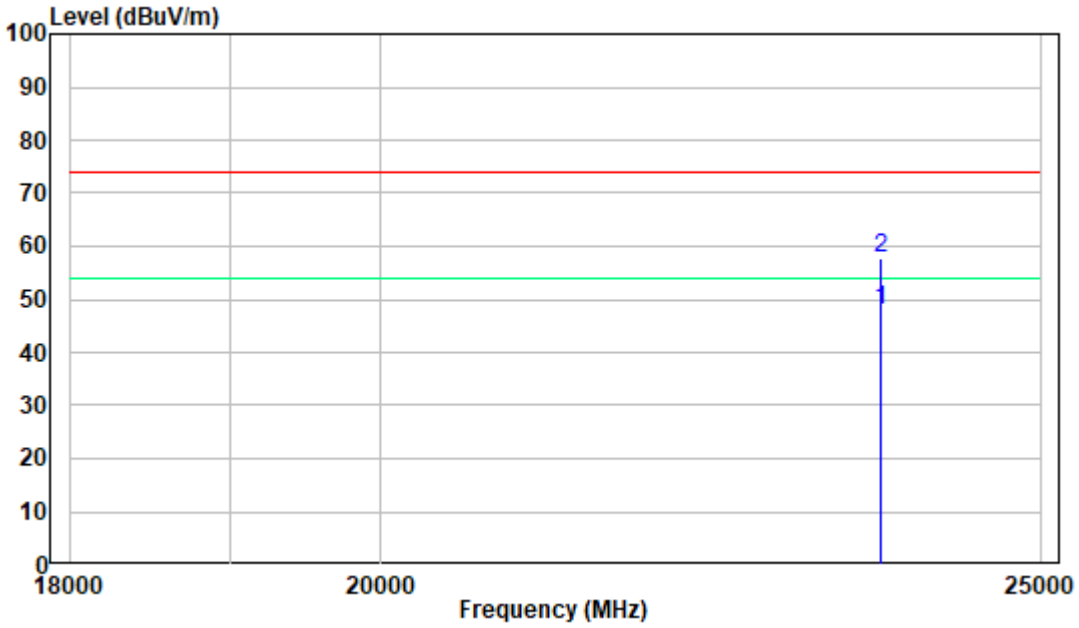
Pre-scan Plots:

Pre-scan for 802.11ax20, middle channel

Horizontal



Vertical



FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH

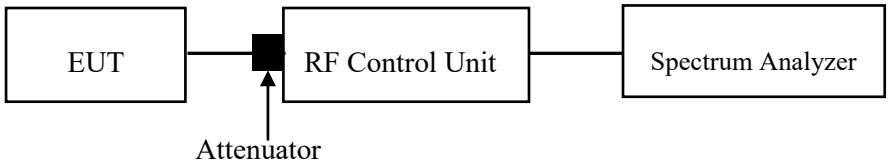
Applicable Standard

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.

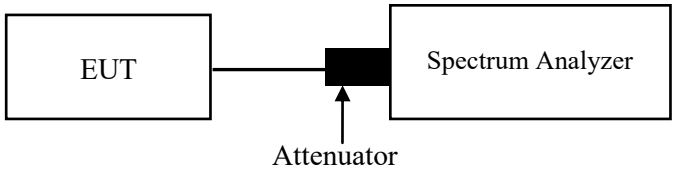
Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.8.1 & Clause 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.



Or



Test Data

Environmental Conditions

For modes except 802.11ax mode:

Temperature:	25~26℃
Relative Humidity:	43~55%
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang from 2022-10-19 to2022-11-04.

For 802.11ax mode:

Temperature:	26℃
Relative Humidity:	43 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling on 2023-04-10.

EUT operation mode: Transmitting

Test Result: Compliant.

Please refer to the Appendix Wi-Fi and Appendix BLE.

FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

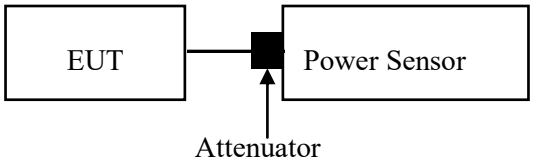
\According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted 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.

Test Procedure

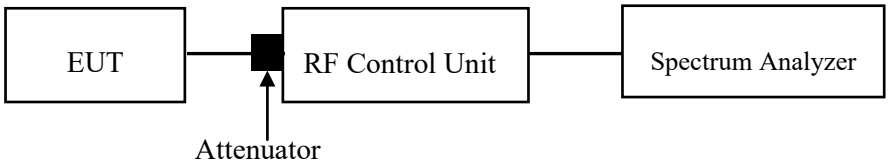
Test Method: ANSI C63.10-2013 Clause 11.9.1.1 for BLE & Clause 11.9.2.3 for Wi-Fi

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

For Wi-Fi mode:



For BLE mode:



Test Data

Environmental Conditions

For modes except 802.11ax mode:

Temperature:	25~26℃
Relative Humidity:	50~55%
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang from 2022-10-19 to2022-11-04.

For 802.11ax mode:

Temperature:	26~27.1℃
Relative Humidity:	43 ~51%
ATM Pressure:	101.0 kPa

The testing was performed by Roger Lin gfrom 2023-04-10 to 2023-04-13.

EUT operation mode: Transmitting

Test Result: Compliant.

Please refer to the Appendix Wi-Fi and Appendix BLE.

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

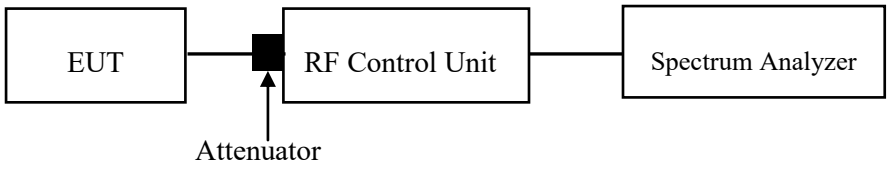
Applicable Standard

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 compliance 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)).

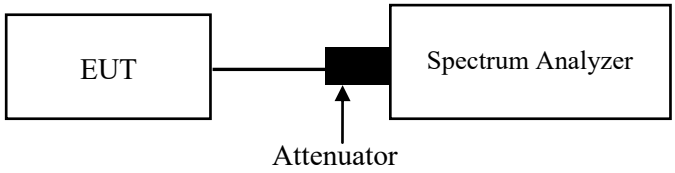
Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.11

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 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.
3. 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.
4. 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.
5. Repeat above procedures until all measured frequencies were complete.



Or



Test Data

Environmental Conditions

For modes except 802.11ax mode:

Temperature:	25~26℃
Relative Humidity:	50~55%
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang from 2022-10-19 to2022-11-04.

For 802.11ax mode:

Temperature:	26℃
Relative Humidity:	43 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling on 2023-04-10.

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

Please refer to the Appendix Wi-Fi and Appendix BLE.

FCC §15.247(e) - 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.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.10.2

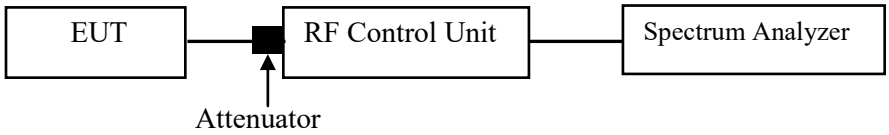
Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.

1. Set the RBW to: 3kHz≤ RBW≤100 kHz.
2. Set the VBW ≥ 3×RBW.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

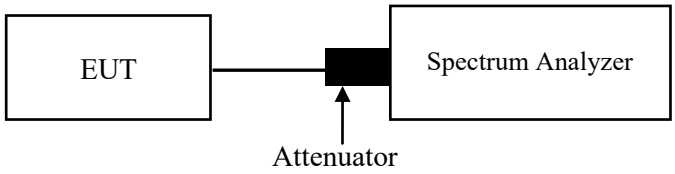
Test Method: ANSI C63.10-2013 Clause 11.10.3 &11.10.5

Use this procedure when the maximum average conducted output power in the fundamental emission is used to demonstrate compliance.

1. Measure the duty cycle (*D*) of the transmitter output signal as described in ANSI C63.10-2013 11.6.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = Power Averaging (rms).
6. Ensure that the number of measurement points in the sweep ≥ [2 × span / RBW].
7. Sweep time = auto couple.
8. Trace mode = trace averaging (rms) mode over a minimum of 100 traces.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.
11. 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%), add [10 log (1 / D)], where D is the duty cycle measured in step 1), to the measured PSD to compute the average PSD during the actual transmission time.
12. When the EUT transmits continuously (or with a $D \geqslant 98\%$), step 11 is not required.
13. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Or



Test Data

Environmental Conditions

For modes except 802.11ax mode:

Temperature:	25~26℃
Relative Humidity:	50~55%
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang from 2022-10-19 to2023-03-10.

For 802.11ax mode:

Temperature:	26℃
Relative Humidity:	43 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling on 2023-04-10.

EUT operation mode: Transmitting

Test Result: Compliant.

Please refer to the Appendix Wi-Fi and Appendix BLE.

APPENDIX Wi-Fi

Appendix A: DTS Bandwidth

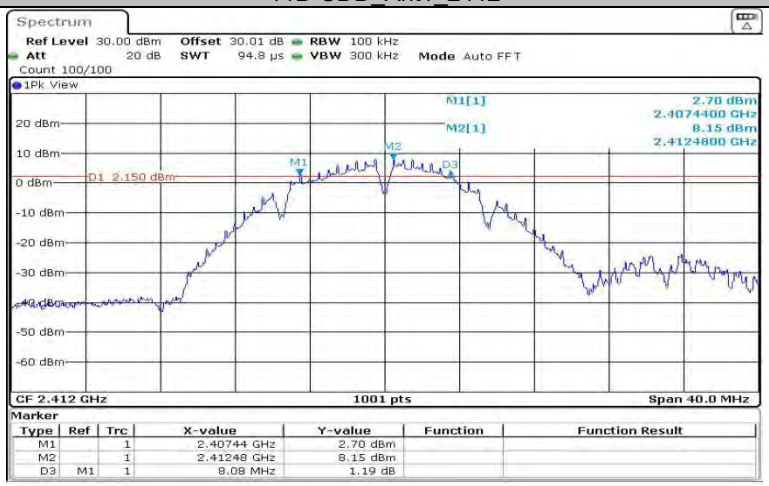
Test Result

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	8.08	2407.44	2415.52	0.5	PASS
	Ant1	2437	7.08	2433.48	2440.56	0.5	PASS
	Ant1	2462	8.56	2457.44	2466.00	0.5	PASS
11G-CDD	Ant1	2412	15.72	2403.84	2419.56	0.5	PASS
	Ant1	2437	15.92	2429.20	2445.12	0.5	PASS
	Ant1	2462	16.32	2453.80	2470.12	0.5	PASS
11N20MIMO	Ant1	2412	17.60	2403.16	2420.76	0.5	PASS
	Ant1	2437	16.68	2429.08	2445.76	0.5	PASS
	Ant1	2462	17.56	2453.20	2470.76	0.5	PASS
11N40MIMO	Ant1	2422	36.32	2403.84	2440.16	0.5	PASS
	Ant1	2437	35.20	2419.40	2454.60	0.5	PASS
	Ant1	2452	35.52	2434.08	2469.60	0.5	PASS

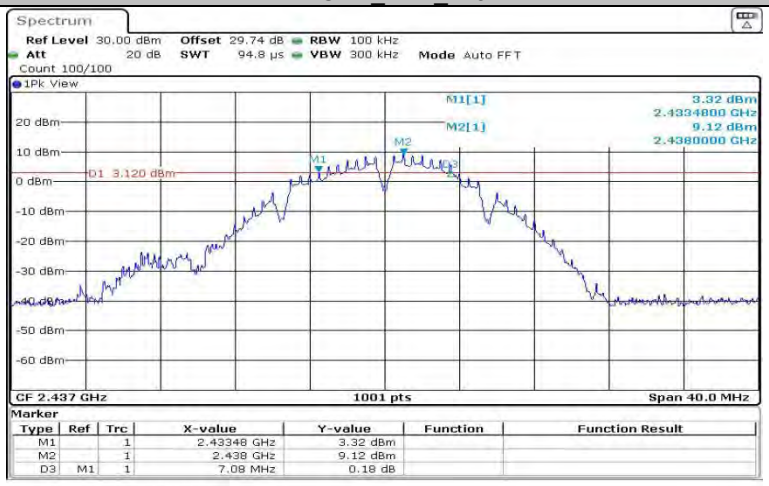
Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11AX20MIMO	Ant1	2412	18.96	2402.52	2421.48	0.5	PASS
	Ant1	2437	18.84	2427.58	2446.42	0.5	PASS
	Ant1	2462	18.90	2452.52	2471.42	0.5	PASS
11AX40MIMO	Ant1	2422	38.10	2402.98	2441.08	0.5	PASS
	Ant1	2437	37.62	2418.10	2455.72	0.5	PASS
	Ant1	2452	37.98	2432.98	2470.96	0.5	PASS

Test Graphs

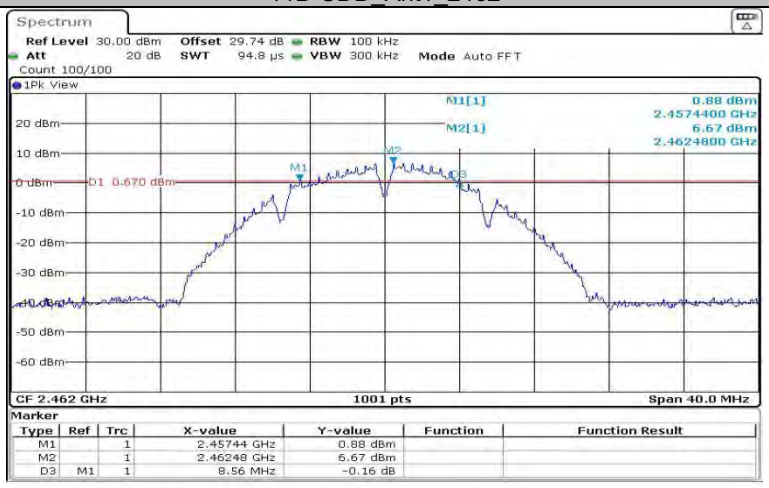
11B-CDD_Ant1_2412



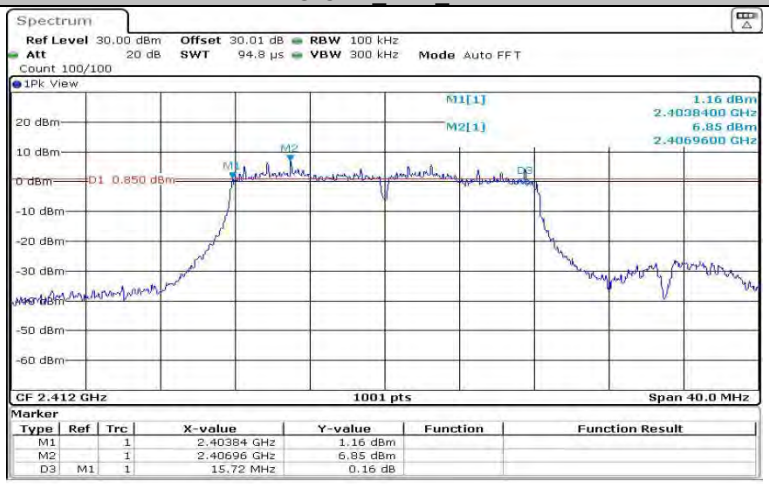
11B-CDD_Ant1_2437



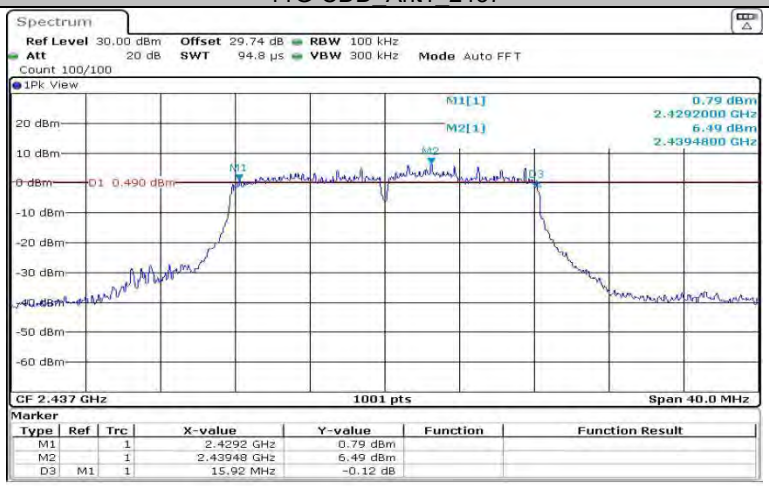
11B-CDD_Ant1_2462



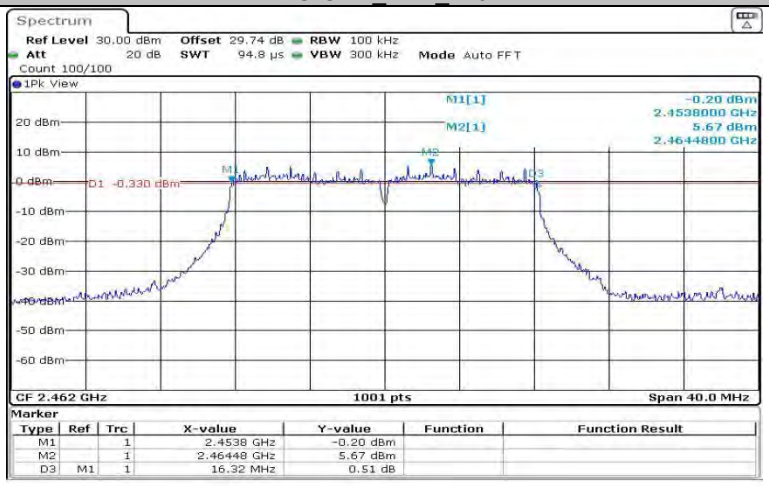
11G-CDD_Ant1_2412



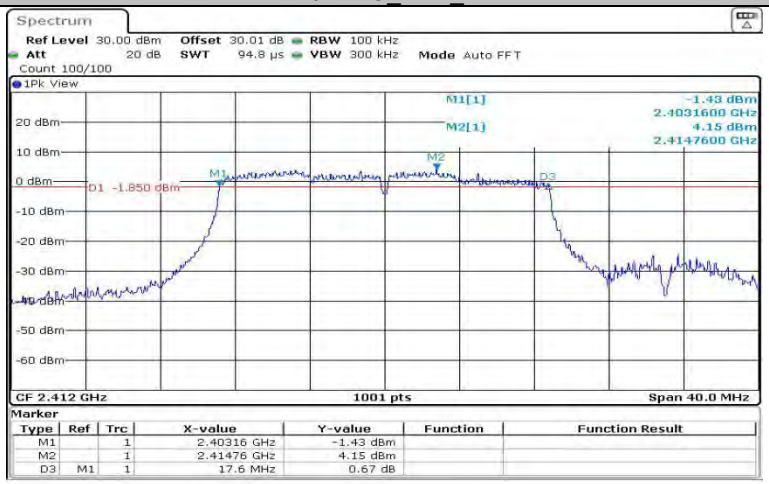
11G-CDD_Ant1_2437



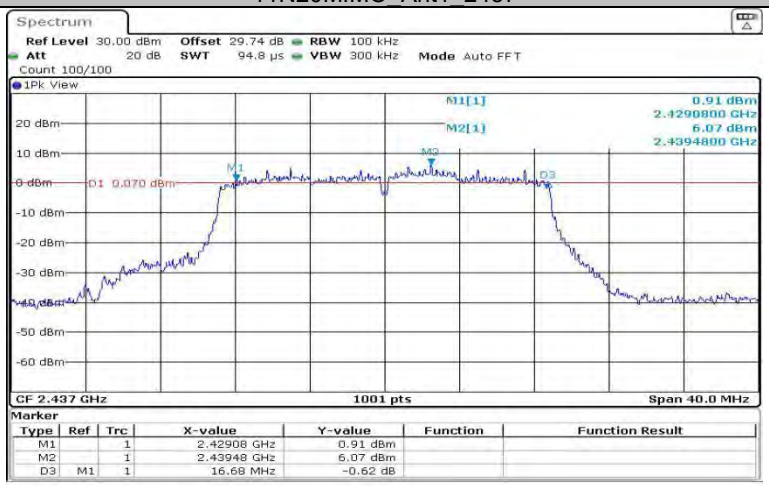
11G-CDD_Ant1_2462



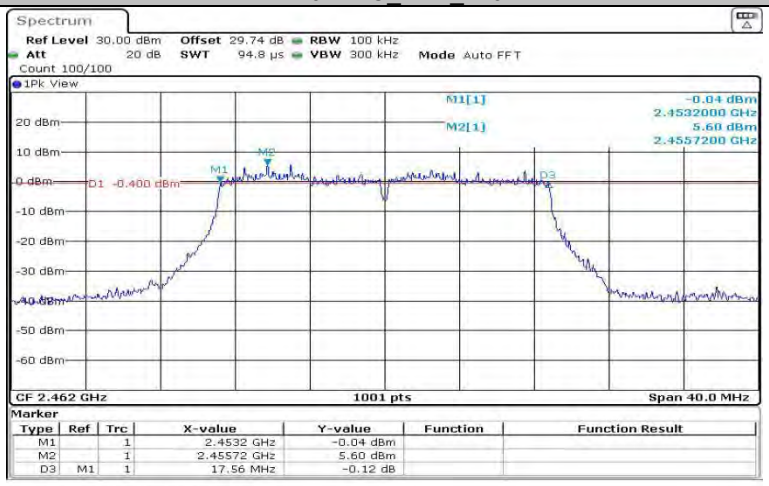
11N20MIMO_Ant1_2412



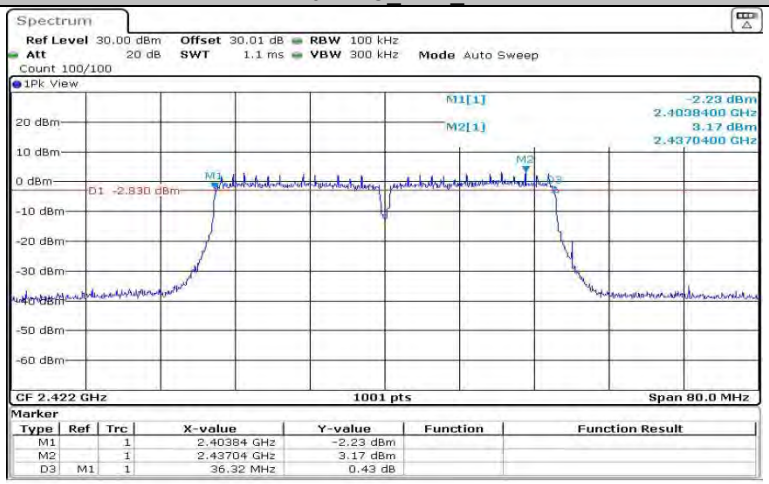
11N20MIMO_Ant1_2437



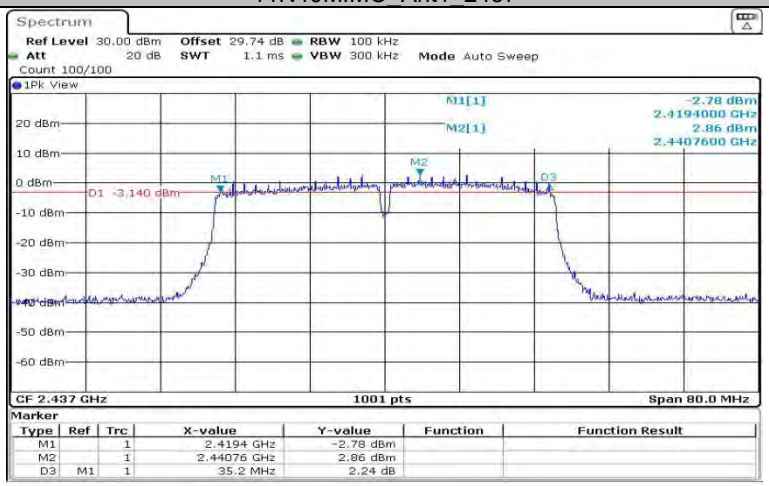
11N20MIMO_Ant1_2462



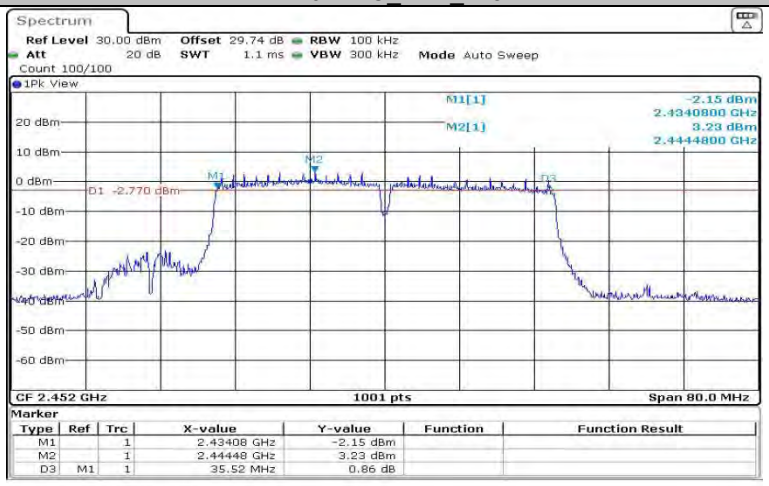
11N40MIMO_Ant1_2422



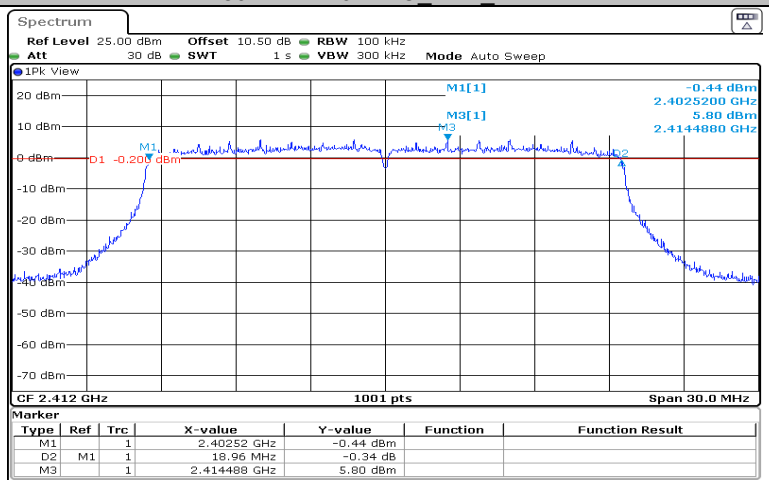
11N40MIMO_Ant1_2437



11N40MIMO_Ant1_2452

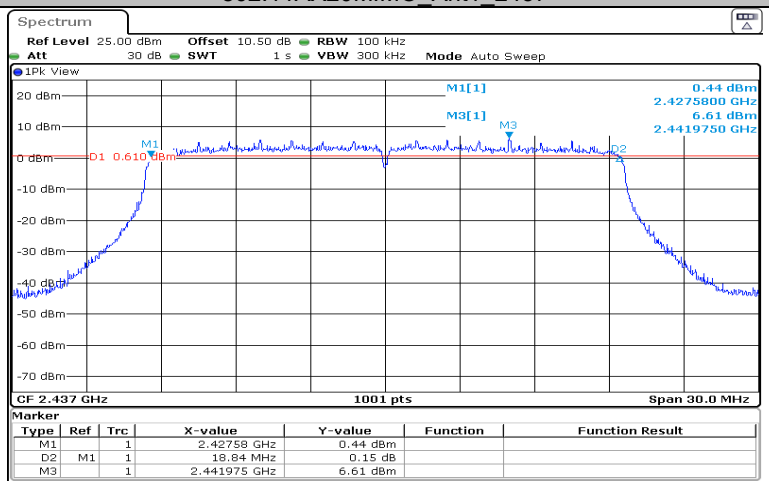


802.11AX20MIMO_Ant1_2412



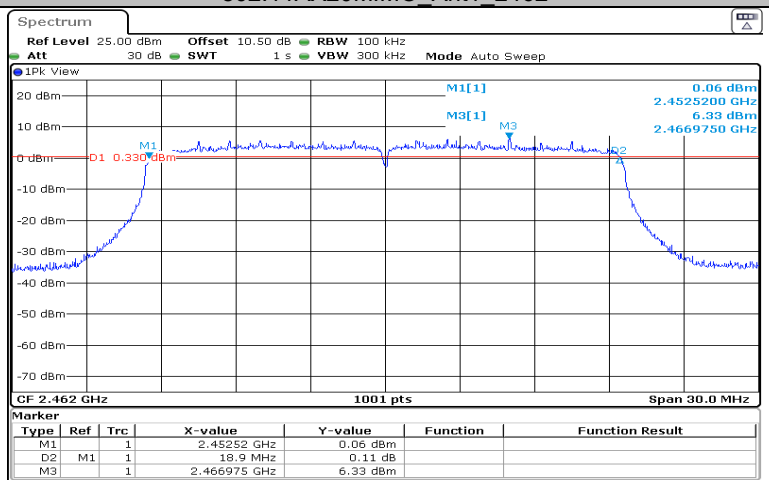
Date: 10.APR.2023 21:56:32

802.11AX20MIMO_Ant1_2437



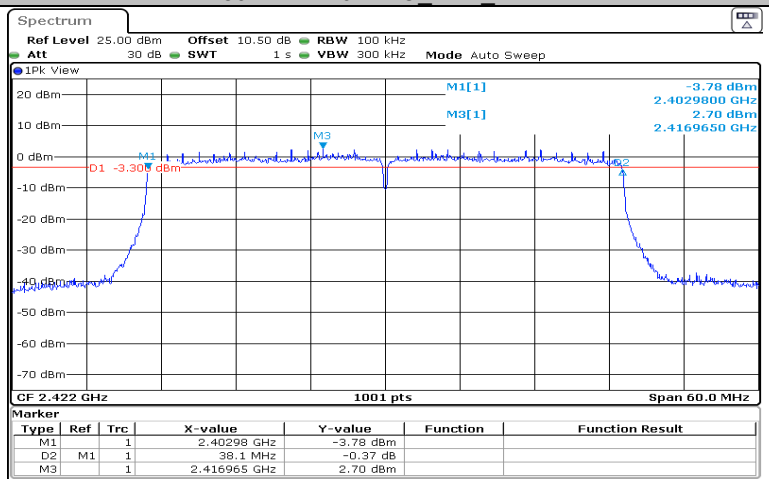
Date: 10.APR.2023 21:59:55

802.11AX20MIMO_Ant1_2462



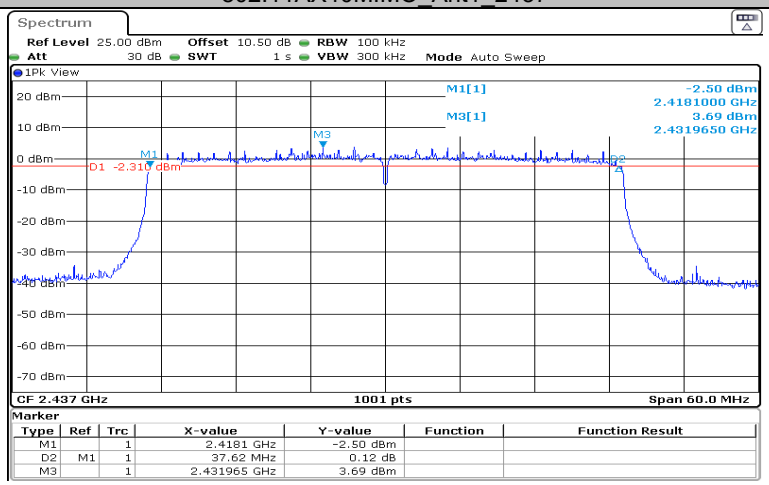
Date: 10.APR.2023 22:06:26

802.11AX40MIMO_Ant1_2422



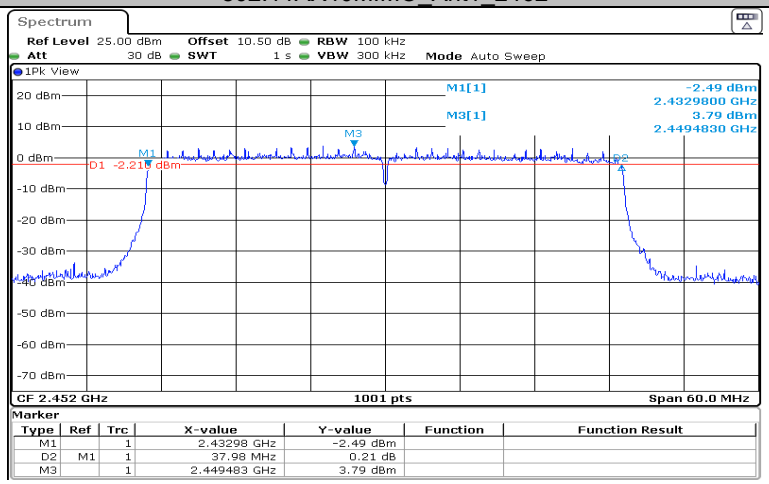
Date: 10.APR.2023 22:09:34

802.11AX40MIMO_Ant1_2437



Date: 10.APR.2023 22:12:50

802.11AX40MIMO_Ant1_2462



Date: 10.APR.2023 22:15:15

Appendix B: Occupied Channel Bandwidth

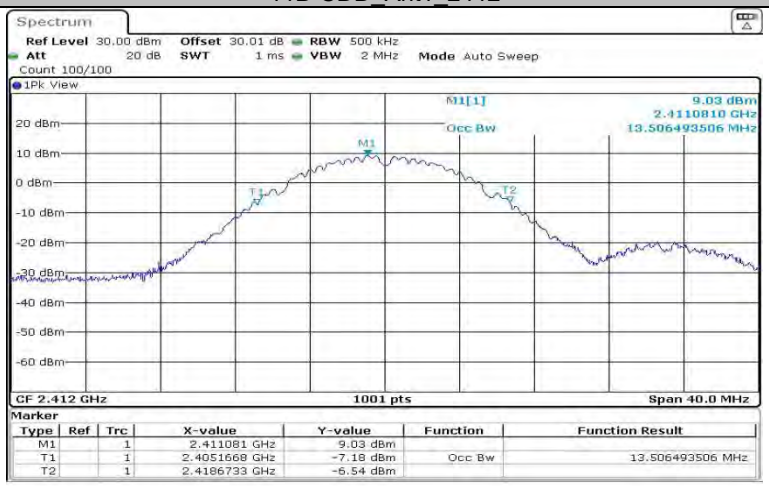
Test Result

Test Mode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	13.506	2405.167	2418.673	---	---
	Ant1	2437	13.347	2430.327	2443.673	---	---
	Ant1	2462	13.506	2455.207	2468.713	---	---
11G-CDD	Ant1	2412	16.743	2403.528	2420.272	---	---
	Ant1	2437	16.663	2428.688	2445.352	---	---
	Ant1	2462	16.863	2453.489	2470.352	---	---
11N20MIMO	Ant1	2412	17.822	2403.049	2420.871	---	---
	Ant1	2437	17.742	2428.169	2445.911	---	---
	Ant1	2462	17.902	2453.009	2470.911	---	---
11N40MIMO	Ant1	2422	36.603	2403.778	2440.382	---	---
	Ant1	2437	36.124	2419.018	2455.142	---	---
	Ant1	2452	36.204	2433.858	2470.062	---	---

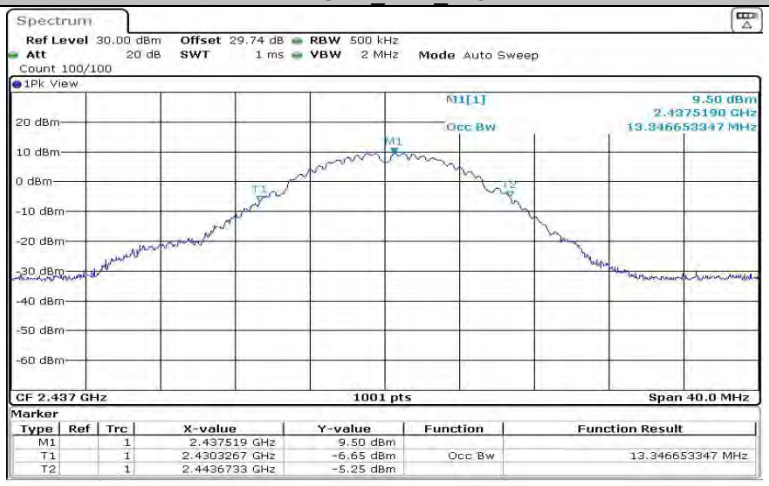
Test Mode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11AX20MIMO	Ant1	2412	18.901	2402.530	2421.431	---	---
	Ant1	2437	18.941	2427.530	2446.471	---	---
	Ant1	2462	18.941	2452.530	2474.471	---	---
11AX40MIMO	Ant1	2422	37.802	2403.139	2440.941	---	---
	Ant1	2437	37.642	2418.219	2455.861	---	---
	Ant1	2452	37.722	2433.139	2470.861	---	---

Test Graphs

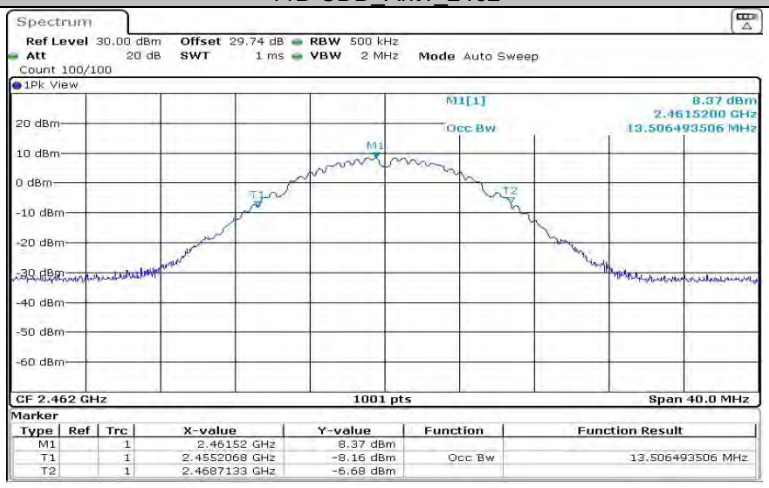
11B-CDD_Ant1_2412



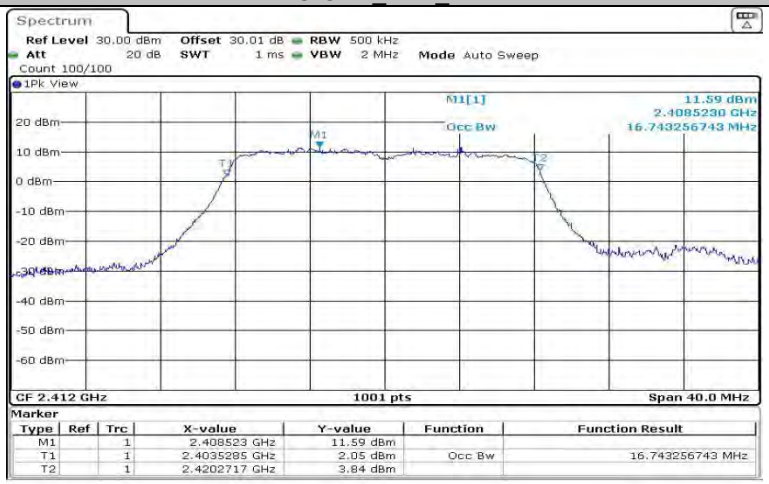
11B-CDD_Ant1_2437



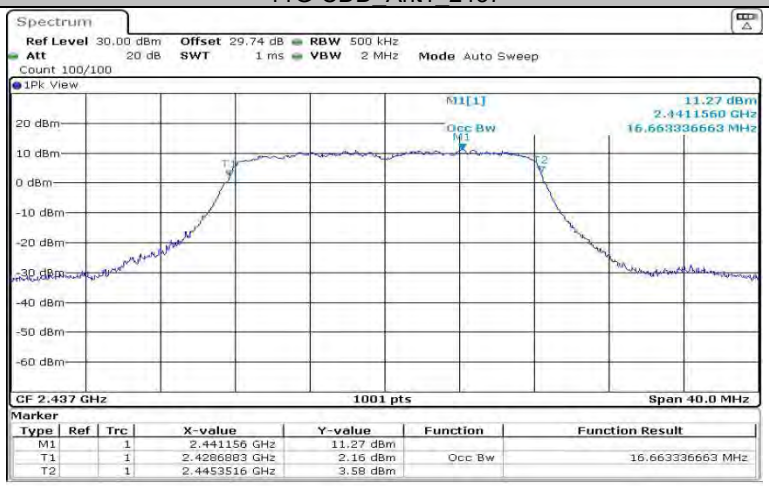
11B-CDD_Ant1_2462



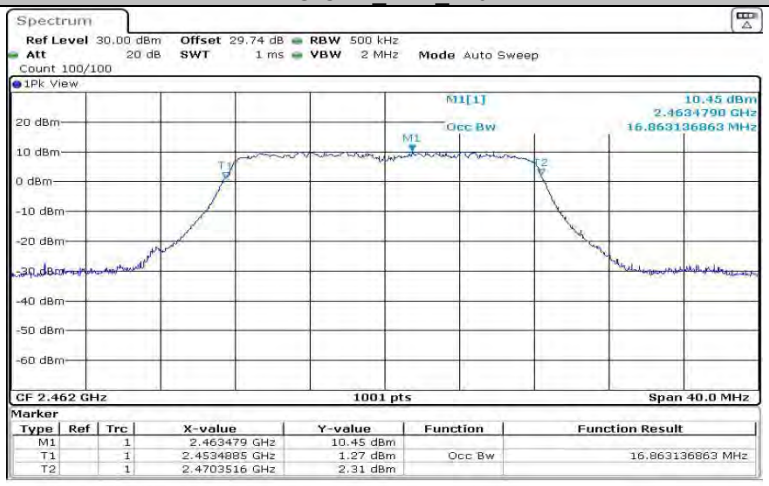
11G-CDD_Ant1_2412



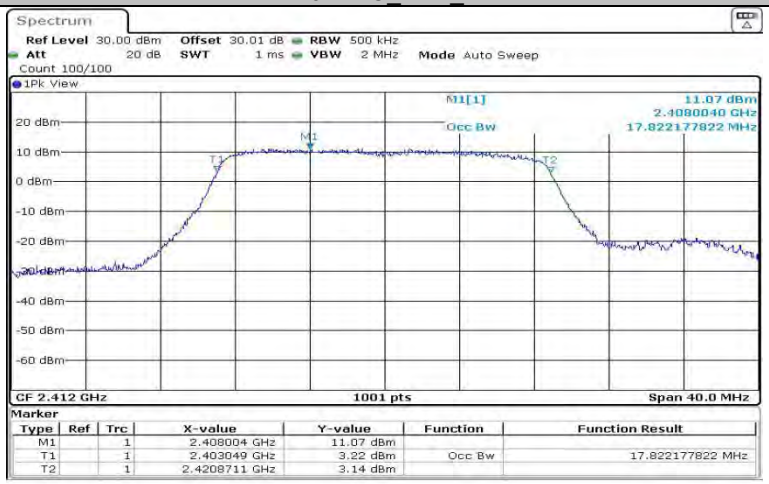
11G-CDD_Ant1_2437



11G-CDD_Ant1_2462

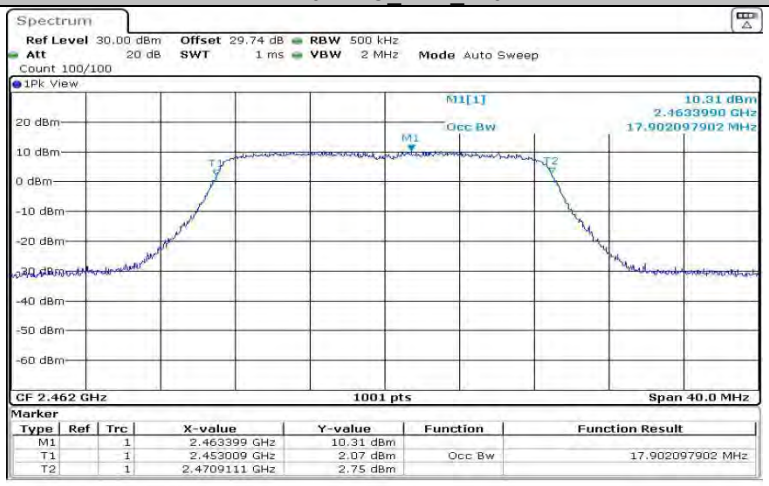


11N20MIMO_Ant1_2412



11N20MIMO_Ant1_2437

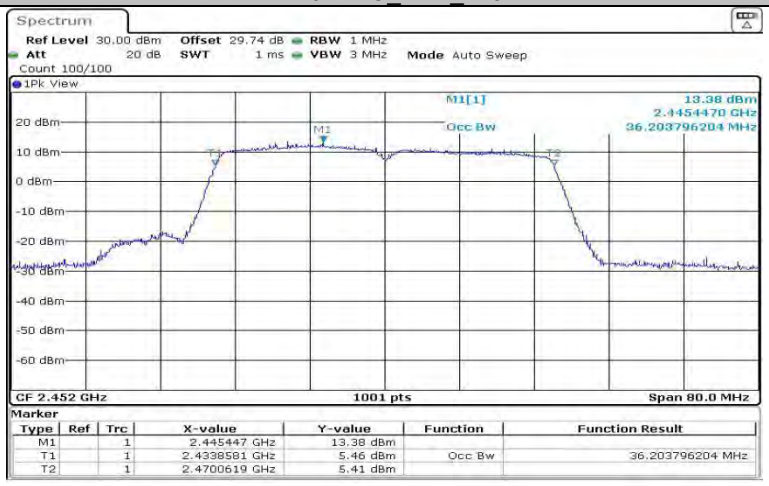
11N20MIMO_Ant1_2462



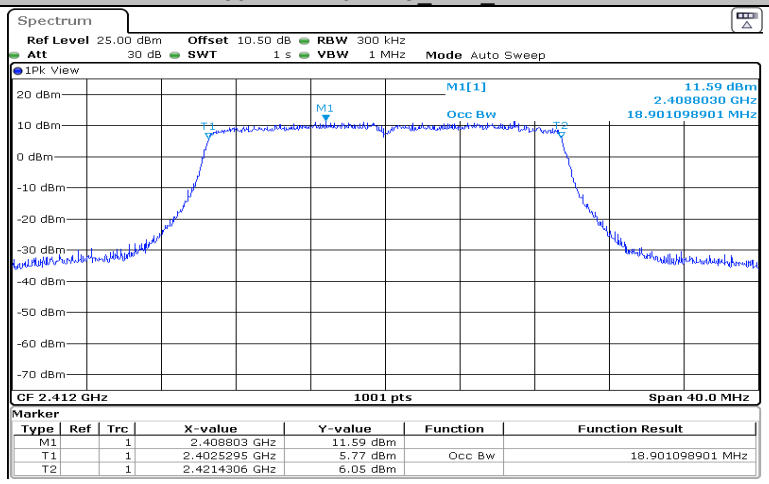
11N40MIMO_Ant1_2422

11N40MIMO_Ant1_2437

11N40MIMO_Ant1_2452



802.11AX20MIMO_Ant1_2412



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.408803 GHz	11.59 dBm		
T1		1	2.4025295 GHz	5.77 dBm	Occ Bw	18.901098901 MHz
T2		1	2.4214306 GHz	6.05 dBm		

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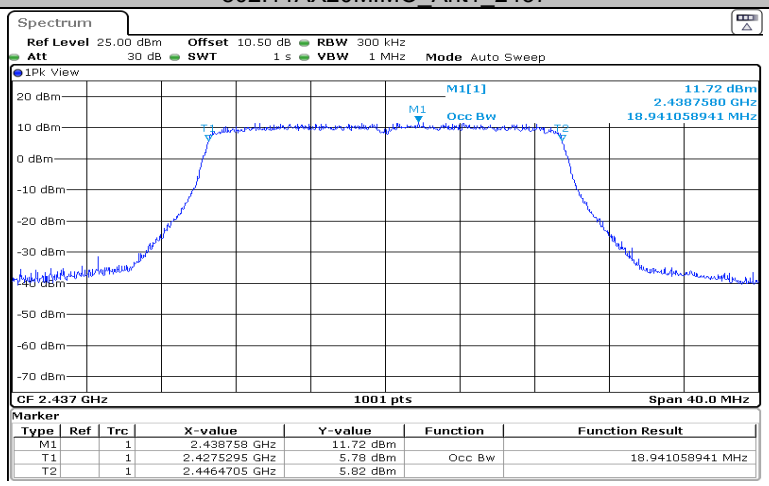
802.11AX20MIMO_Ant1_2437



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.438758 GHz	11.72 dBm		
T1		1	2.4275295 GHz	5.78 dBm	Occ Bw	18.941058941 MHz
T2		1	2.4464705 GHz	5.82 dBm		

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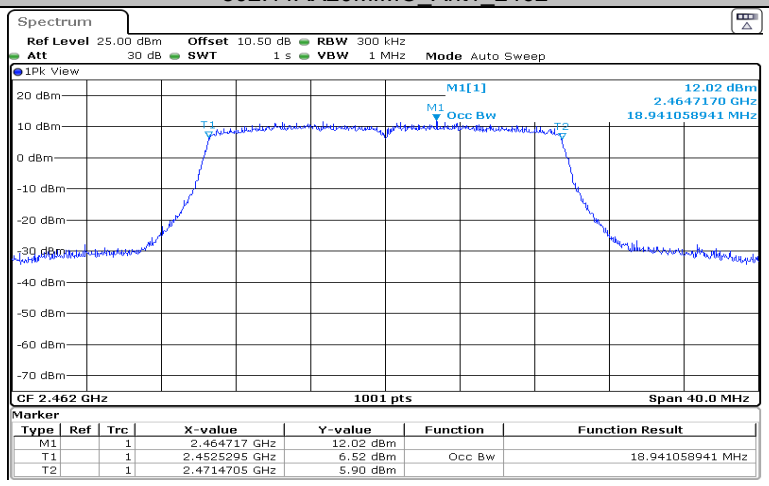
802.11AX20MIMO_Ant1_2462



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.464717 GHz	12.02 dBm		
T1		1	2.4525295 GHz	6.52 dBm	Occ Bw	18.941058941 MHz
T2		1	2.4714705 GHz	5.90 dBm		

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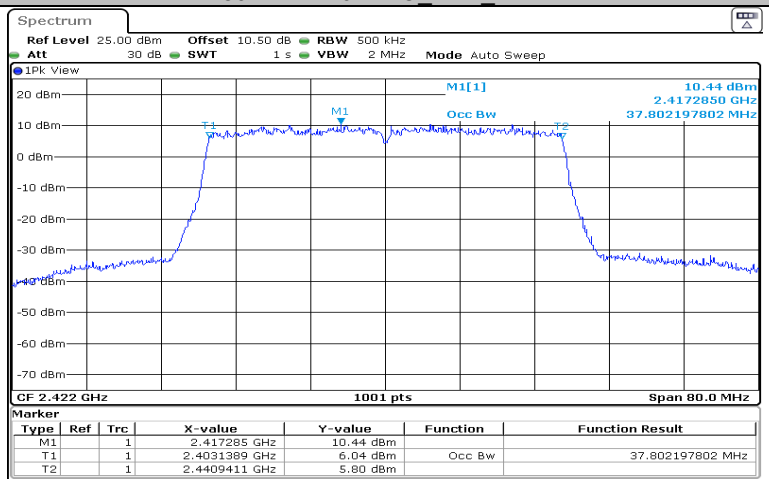
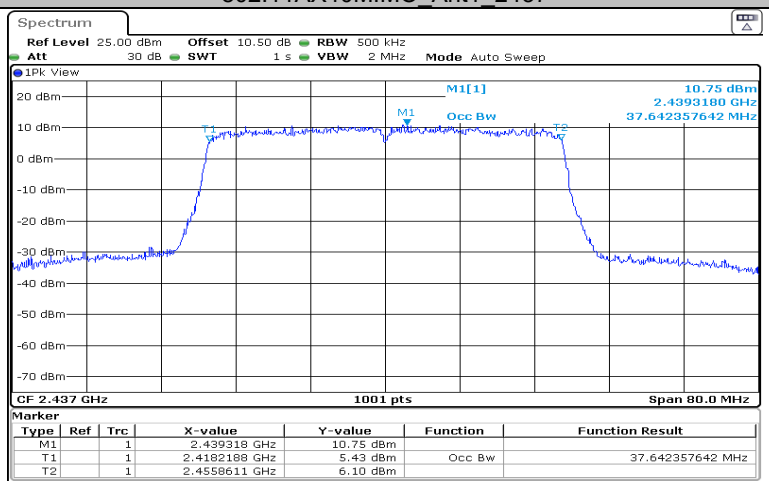
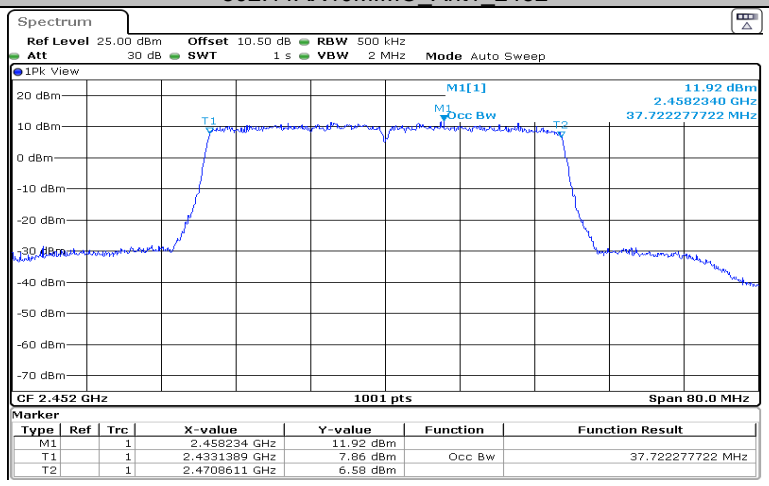
802.11AX40MIMO_Ant1_2422



802.11AX40MIMO_Ant1_2437



802.11AX40MIMO_Ant1_2452



Appendix C: Maximum conducted output power

Test Result

Test Mode	Antenna	Frequency[MHz]	Average Power[dBm]	Conducted Limit [dBm]	Verdict
11B-CDD	Ant1	2412	16.85	≤30.00	PASS
	Ant2	2412	16.27	≤30.00	PASS
	total	2412	19.58	≤30.00	PASS
	Ant1	2437	17.16	≤30.00	PASS
	Ant2	2437	17.20	≤30.00	PASS
	total	2437	20.19	≤30.00	PASS
	Ant1	2462	16.10	≤30.00	PASS
	Ant2	2462	16.39	≤30.00	PASS
	total	2462	19.26	≤30.00	PASS
11G-CDD	Ant1	2412	14.34	≤30.00	PASS
	Ant2	2412	14.44	≤30.00	PASS
	total	2412	17.40	≤30.00	PASS
	Ant1	2437	14.42	≤30.00	PASS
	Ant2	2437	14.66	≤30.00	PASS
	total	2437	17.55	≤30.00	PASS
	Ant1	2462	13.66	≤30.00	PASS
	Ant2	2462	14.41	≤30.00	PASS
	total	2462	17.06	≤30.00	PASS
11N20MIMO	Ant1	2412	14.40	≤30.00	PASS
	Ant2	2412	14.39	≤30.00	PASS
	total	2412	17.41	≤30.00	PASS
	Ant1	2437	14.34	≤30.00	PASS
	Ant2	2437	14.53	≤30.00	PASS
	total	2437	17.45	≤30.00	PASS
	Ant1	2462	13.57	≤30.00	PASS
	Ant2	2462	14.31	≤30.00	PASS
	total	2462	16.97	≤30.00	PASS
11N40MIMO	Ant1	2422	14.31	≤30.00	PASS
	Ant2	2422	14.75	≤30.00	PASS
	total	2422	17.55	≤30.00	PASS
	Ant1	2437	14.49	≤30.00	PASS
	Ant2	2437	14.38	≤30.00	PASS
	total	2437	17.45	≤30.00	PASS
	Ant1	2452	14.25	≤30.00	PASS
	Ant2	2452	14.92	≤30.00	PASS
	total	2452	17.61	≤30.00	PASS

Note1:

The EUT employ CDD for MIMO

Directional Gain = G_{ANT} + *Array Gain*, G_{ANT} = 2.5dBi

For Output Power Measurement,

For 802.11b/g mode, *Array Gain* = 0dB for $N_{ANT} \leqslant 4$

Directional Gain =2.5dBi + 0dB = 2.5dBi < 6dBi

For 802.11n mode, the device support beam-forming function.

Directional Gain = G_{ANT} + 10*log(2/1) =5.5dBi < 6dBi

Note 2: Non-Beam Forming mode share the same power with the Beam Forming mode.

Test Mode	Antenna	Frequency[MHz]	Ru Size	Ru Index	Result [dBm]	Limit [dBm]	Verdict
11AX20MIMO	Ant1	2412	26Tone	RU0	7.75	≤30.00	PASS
			52Tone	RU37	10.88	≤30.00	PASS
			106Tone	RU53	14.02	≤30.00	PASS
			242Tone	RU61	17.27	≤30.00	PASS
	Ant2	2412	26Tone	RU0	5.41	≤30.00	PASS
			52Tone	RU37	8.70	≤30.00	PASS
			106Tone	RU53	11.90	≤30.00	PASS
			242Tone	RU61	15.01	≤30.00	PASS
	total	2412	26Tone	RU0	9.75	≤30.00	PASS
			52Tone	RU37	12.94	≤30.00	PASS
			106Tone	RU53	16.10	≤30.00	PASS
			242Tone	RU61	19.30	≤30.00	PASS
	Ant1	2437	26Tone	RU0	7.98	≤30.00	PASS
			52Tone	RU37	11.28	≤30.00	PASS
			106Tone	RU53	14.42	≤30.00	PASS
			242Tone	RU61	17.62	≤30.00	PASS
	Ant2	2437	26Tone	RU0	5.42	≤30.00	PASS
			52Tone	RU37	8.57	≤30.00	PASS
			106Tone	RU53	11.80	≤30.00	PASS
			242Tone	RU61	15.08	≤30.00	PASS
	total	2437	26Tone	RU0	9.90	≤30.00	PASS
			52Tone	RU37	13.14	≤30.00	PASS
			106Tone	RU53	16.31	≤30.00	PASS
			242Tone	RU61	19.54	≤30.00	PASS
	Ant1	2462	26Tone	RU0	7.91	≤30.00	PASS
			52Tone	RU37	11.18	≤30.00	PASS
			106Tone	RU53	14.33	≤30.00	PASS
			242Tone	RU61	17.52	≤30.00	PASS
	Ant2	2462	26Tone	RU0	5.48	≤30.00	PASS
			52Tone	RU37	8.64	≤30.00	PASS
			106Tone	RU53	11.91	≤30.00	PASS
			242Tone	RU61	15.06	≤30.00	PASS
	total	2462	26Tone	RU0	9.87	≤30.00	PASS
			52Tone	RU37	13.10	≤30.00	PASS
			106Tone	RU53	16.30	≤30.00	PASS
			242Tone	RU61	19.47	≤30.00	PASS
11AX40MIMO	Ant1	2422	26Tone	RU0	3.81	≤30.00	PASS
			52Tone	RU37	7.05	≤30.00	PASS
			106Tone	RU53	10.28	≤30.00	PASS
			242Tone	RU61	13.55	≤30.00	PASS
			484Tone	RU65	16.83	≤30.00	PASS
	Ant2	2422	26Tone	RU0	1.68	≤30.00	PASS
			52Tone	RU37	4.91	≤30.00	PASS
			106Tone	RU53	8.18	≤30.00	PASS
			242Tone	RU61	11.46	≤30.00	PASS
			484Tone	RU65	14.61	≤30.00	PASS
	total	2422	26Tone	RU0	5.88	≤30.00	PASS
			52Tone	RU37	9.12	≤30.00	PASS
			106Tone	RU53	12.37	≤30.00	PASS
			242Tone	RU61	15.64	≤30.00	PASS
			484Tone	RU65	18.87	≤30.00	PASS
	Ant1	2437	26Tone	RU0	4.63	≤30.00	PASS
			52Tone	RU37	7.92	≤30.00	PASS
			106Tone	RU53	11.19	≤30.00	PASS
			242Tone	RU61	14.40	≤30.00	PASS

			484Tone	RU65	17.54	≤30.00	PASS
	Ant2	2437	26Tone	RU0	2.55	≤30.00	PASS
			52Tone	RU37	5.71	≤30.00	PASS
			106Tone	RU53	8.84	≤30.00	PASS
			242Tone	RU61	11.94	≤30.00	PASS
			484Tone	RU65	15.17	≤30.00	PASS
	total	2437	26Tone	RU0	6.72	≤30.00	PASS
			52Tone	RU37	9.96	≤30.00	PASS
			106Tone	RU53	13.18	≤30.00	PASS
			242Tone	RU61	16.35	≤30.00	PASS
			484Tone	RU65	19.53	≤30.00	PASS
	Ant1	2452	26Tone	RU0	4.96	≤30.00	PASS
			52Tone	RU37	8.08	≤30.00	PASS
			106Tone	RU53	11.32	≤30.00	PASS
			242Tone	RU61	14.59	≤30.00	PASS
			484Tone	RU65	17.82	≤30.00	PASS
	Ant2	2452	26Tone	RU0	1.62	≤30.00	PASS
			52Tone	RU37	4.87	≤30.00	PASS
			106Tone	RU53	8.17	≤30.00	PASS
			242Tone	RU61	11.44	≤30.00	PASS
			484Tone	RU65	14.69	≤30.00	PASS
	total	2452	26Tone	RU0	6.61	≤30.00	PASS
			52Tone	RU37	9.78	≤30.00	PASS
			106Tone	RU53	13.03	≤30.00	PASS
			242Tone	RU61	16.30	≤30.00	PASS
			484Tone	RU65	19.54	≤30.00	PASS

Note1:

For 802.11ax mode, the device support beam-forming function.
Directional Gain = G_{ANT} + 10*log(2/1) =5.5dBi < 6dBi

Note 2: Non-Beam Forming mode share the same power with the Beam Forming mode.

Appendix D: Maximum power spectral density

Test Result

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B-CDD	Ant1	2412	-10.51	≤8.00	PASS
	Ant2	2412	-11.41	≤8.00	PASS
	total	2412	-7.93	≤8.00	PASS
	Ant1	2437	-9.89	≤8.00	PASS
	Ant2	2437	-9.66	≤8.00	PASS
	total	2437	-6.76	≤8.00	PASS
	Ant1	2462	-10.76	≤8.00	PASS
	Ant2	2462	-10.86	≤8.00	PASS
	total	2462	-7.80	≤8.00	PASS
11G-CDD	Ant1	2412	-17.67	≤8.00	PASS
	Ant2	2412	-17.15	≤8.00	PASS
	total	2412	-14.39	≤8.00	PASS
	Ant1	2437	-17.53	≤8.00	PASS
	Ant2	2437	-17.4	≤8.00	PASS
	total	2437	-14.45	≤8.00	PASS
	Ant1	2462	-18.83	≤8.00	PASS
	Ant2	2462	-18.13	≤8.00	PASS
	total	2462	-15.46	≤8.00	PASS
11N20MIMO	Ant1	2412	-19.63	≤8.00	PASS
	Ant2	2412	-19.93	≤8.00	PASS
	total	2412	-16.77	≤8.00	PASS
	Ant1	2437	-19.59	≤8.00	PASS
	Ant2	2437	-19.56	≤8.00	PASS
	total	2437	-16.56	≤8.00	PASS
	Ant1	2462	-20.51	≤8.00	PASS
	Ant2	2462	-20.14	≤8.00	PASS
	total	2462	-17.31	≤8.00	PASS
11N40MIMO	Ant1	2422	-17.60	≤8.00	PASS
	Ant2	2422	-16.99	≤8.00	PASS
	total	2422	-14.27	≤8.00	PASS
	Ant1	2437	-17.58	≤8.00	PASS
	Ant2	2437	-17.03	≤8.00	PASS
	total	2437	-14.29	≤8.00	PASS
	Ant1	2452	-17.28	≤8.00	PASS
	Ant2	2452	-16.99	≤8.00	PASS
	total	2452	-14.12	≤8.00	PASS

Note1:

The EUT employ CDD for MIMO

Directional Gain = G_{ANT} + *Array Gain*, G_{ANT} = 2.5dBi

For PSD Measurement,

For 802.11b/g mode, *Array Gain* = $10*\log N_{ANT}=10*\log 2=3dB$

Directional Gain =2.5dBi + 3dB = 5.5dBi < 6dBi

For 802.11n mode, the device support beam-forming function.

Directional gain = G_{ANT} + 10*log(2/1) =5.5dBi< 6dBi

Note 2: Non-Beam Forming mode share the same power with the Beam Forming mode.

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11AX20MIMO_242Tone_RU61	Ant1	2412	-13.41	≤8.00	PASS
	Ant2	2412	-15.40	≤8.00	PASS
	total	2412	-11.28	≤8.00	PASS
	Ant1	2437	-13.18	≤8.00	PASS
	Ant2	2437	-15.18	≤8.00	PASS
	total	2437	-11.06	≤8.00	PASS
	Ant1	2462	-13.03	≤8.00	PASS
	Ant2	2462	-15.31	≤8.00	PASS
	total	2462	-11.01	≤8.00	PASS
11AX40MIMO_484Tone_RU65	Ant1	2422	-16.57	≤8.00	PASS
	Ant2	2422	-18.51	≤8.00	PASS
	total	2422	-14.42	≤8.00	PASS
	Ant1	2437	-15.64	≤8.00	PASS
	Ant2	2437	-18.12	≤8.00	PASS
	total	2437	-13.70	≤8.00	PASS
	Ant1	2452	-15.32	≤8.00	PASS
	Ant2	2452	-18.55	≤8.00	PASS
	total	2452	-13.63	≤8.00	PASS

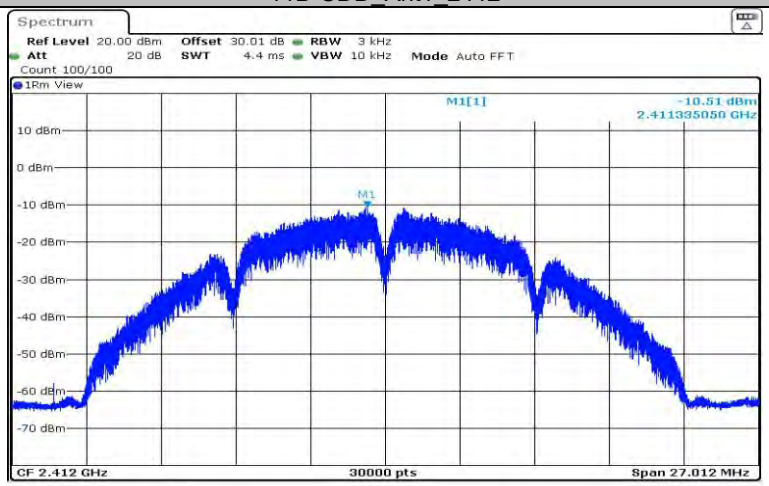
Note1:

For 802.11ax mode, the device support beam-forming function.
Directional gain = G_{ANT} + 10*log(2/1) =5.5dBi< 6dBi

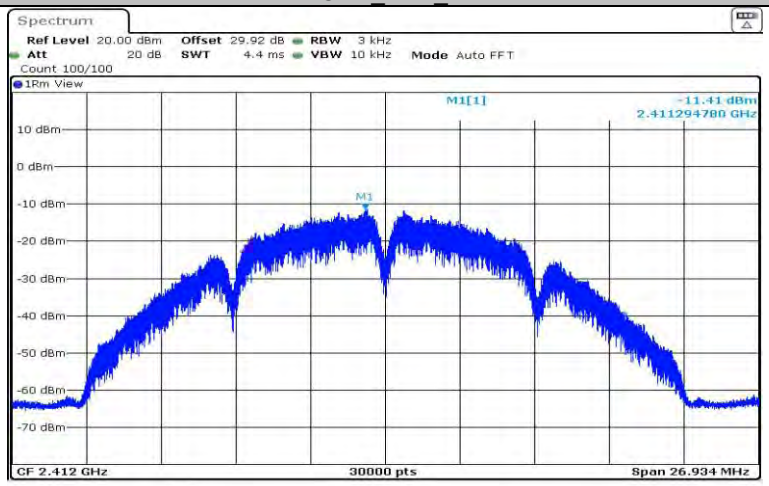
Note 2: Non-Beam Forming mode share the same power with the Beam Forming mode.

Test Graphs

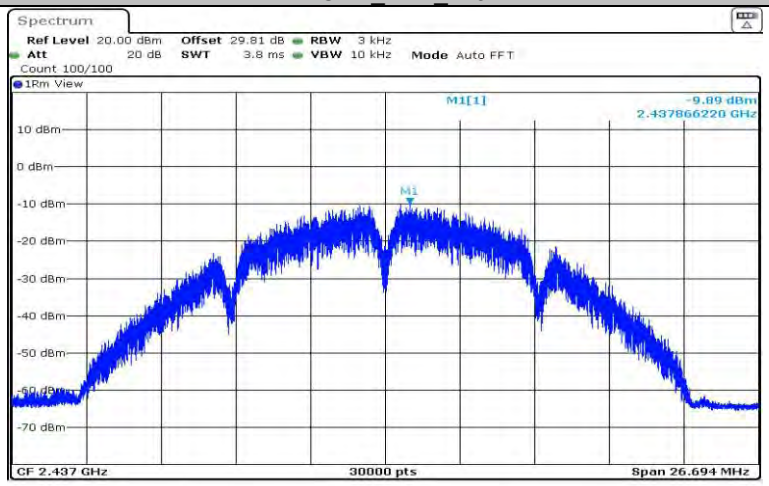
11B-CDD_Ant1_2412



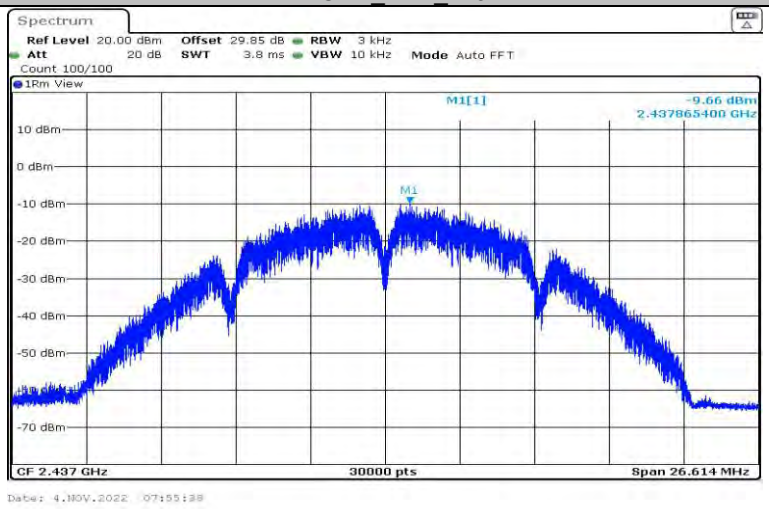
11B-CDD_Ant2_2412



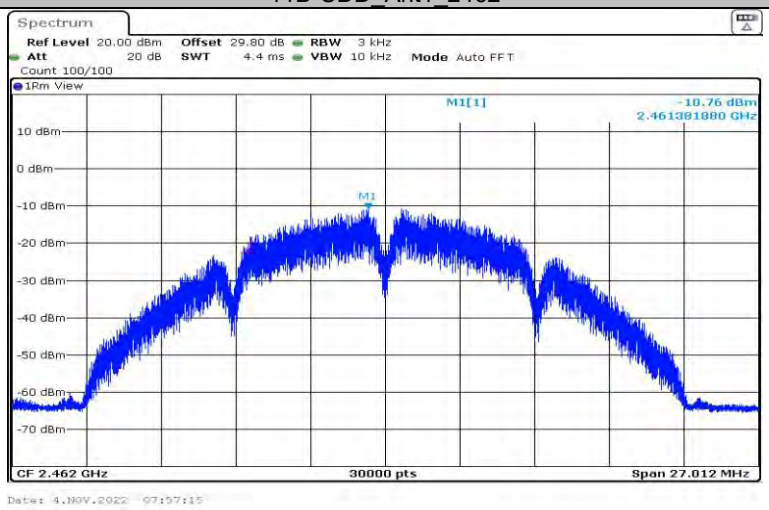
11B-CDD_Ant1_2437



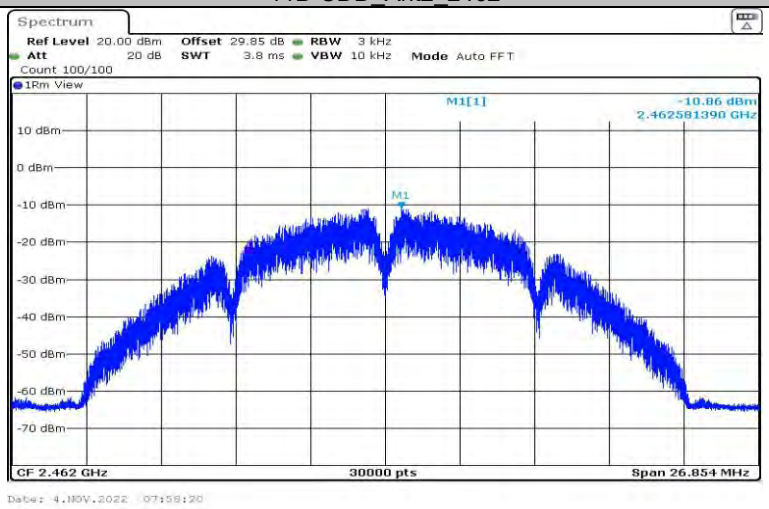
11B-CDD_Ant2_2437



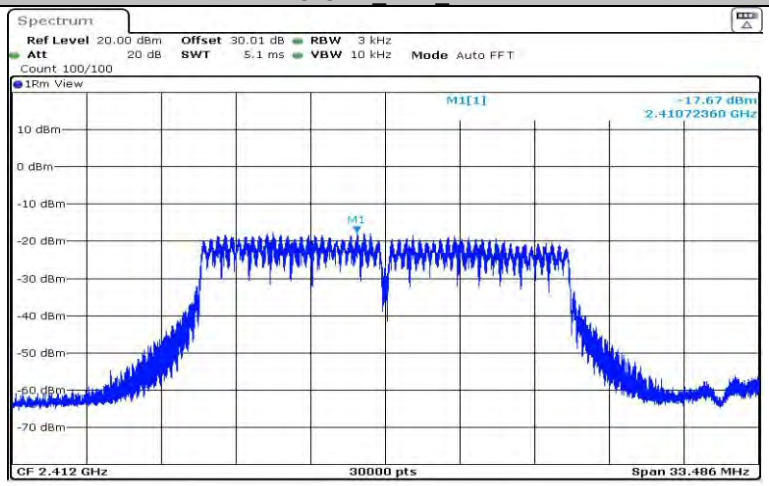
11B-CDD_Ant1_2462



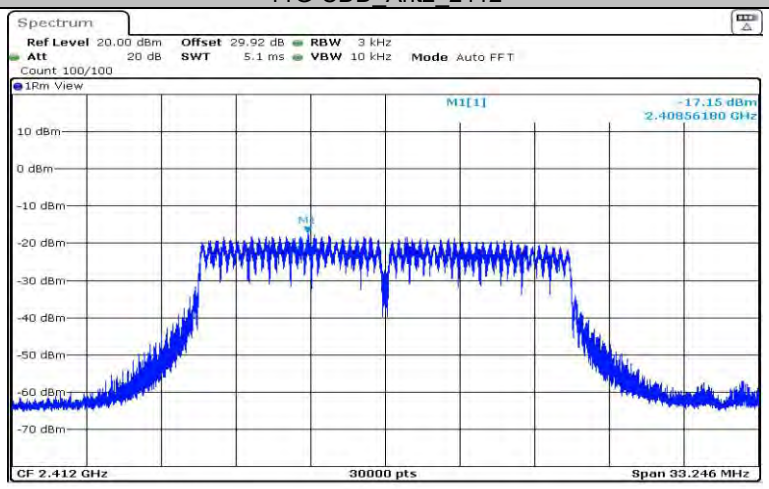
11B-CDD_Ant2_2462



11G-CDD_Ant1_2412



11G-CDD_Ant2_2412



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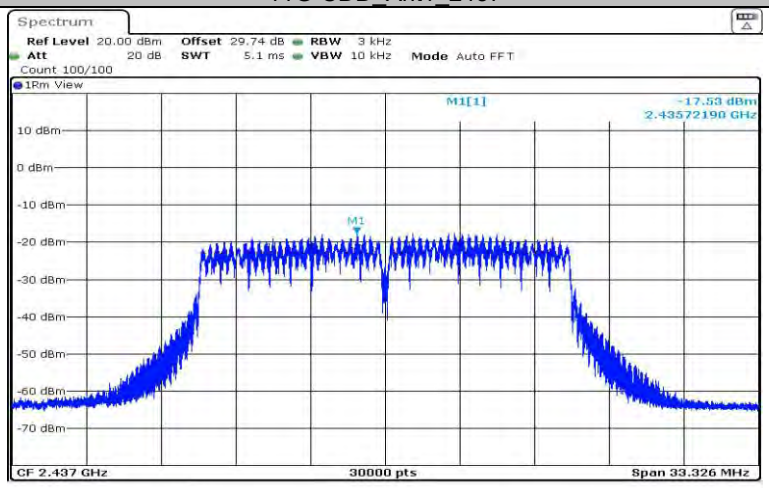

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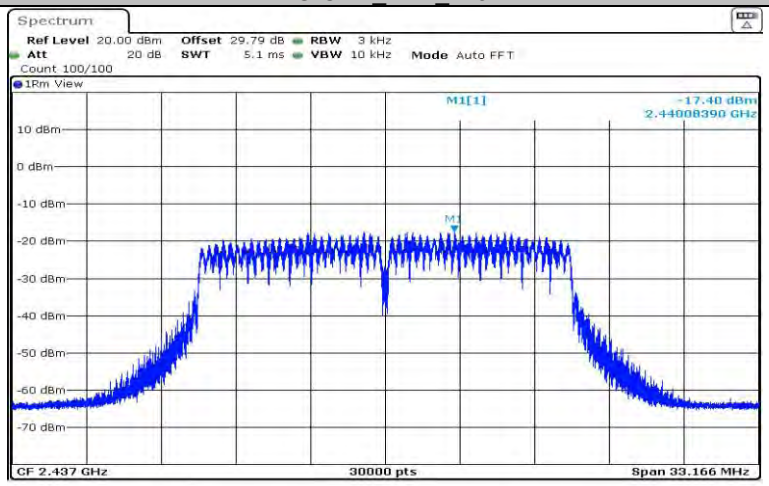
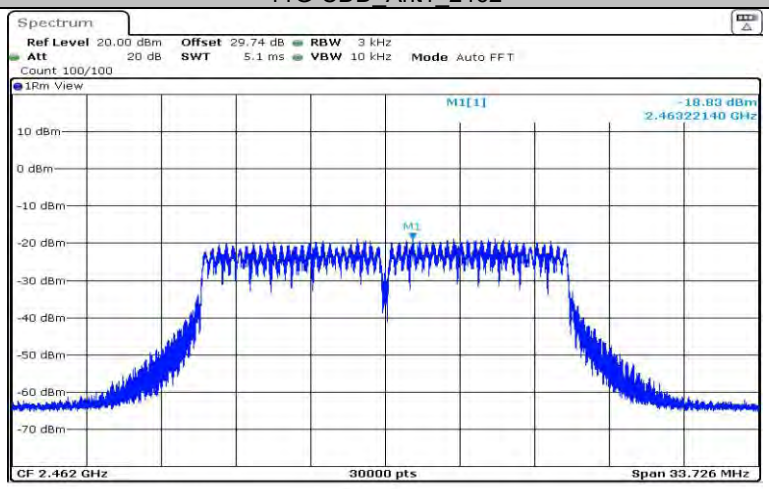


11G-CDD_Ant1_2462



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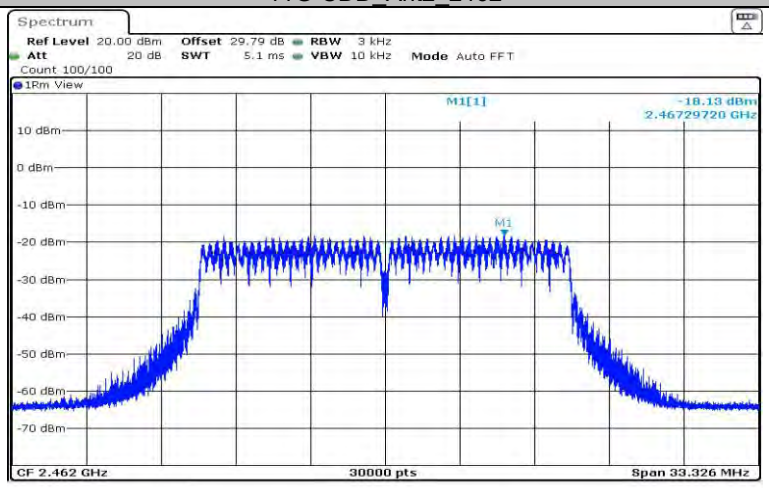
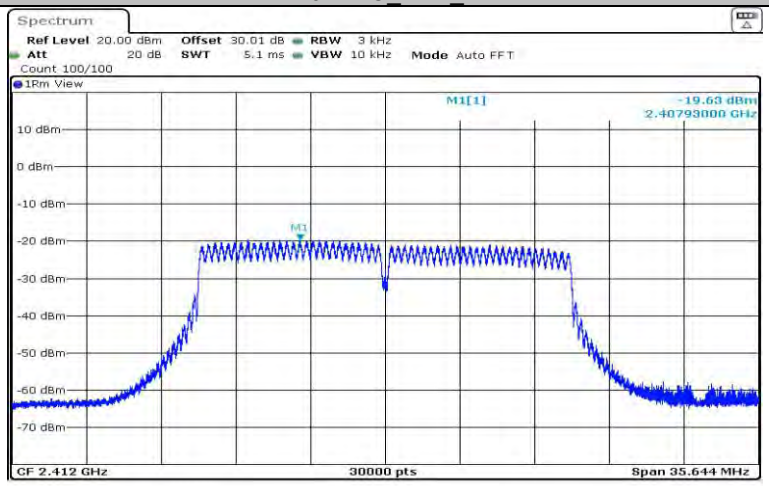


11N20MIMO_Ant1_2412



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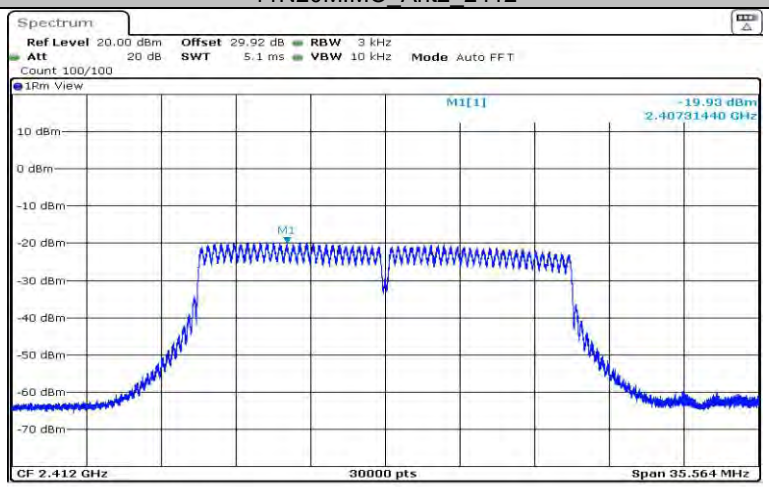
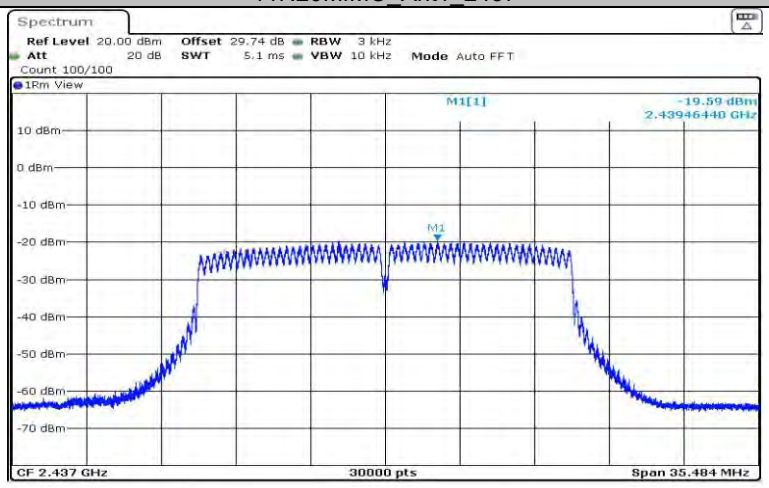
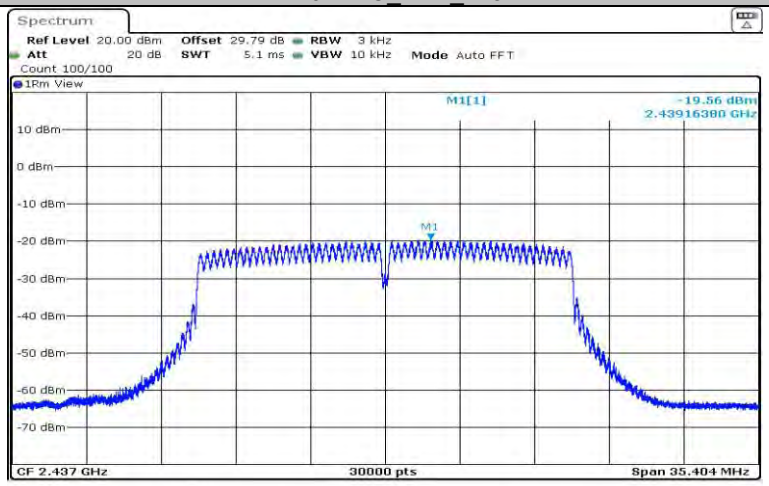


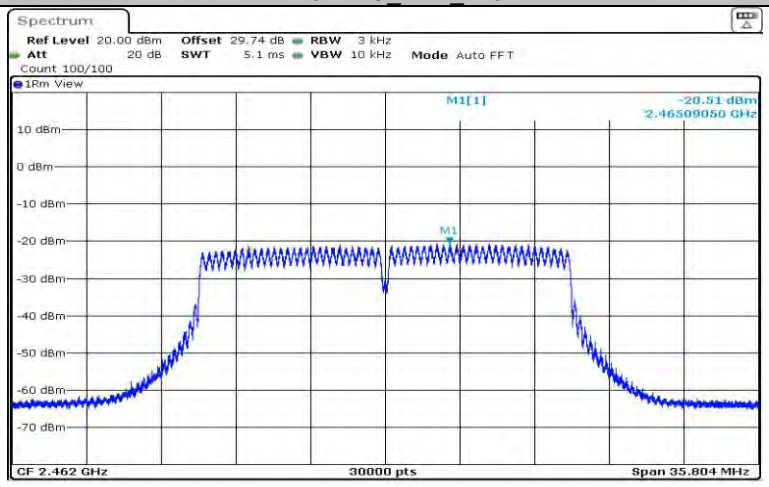
11N20MIMO_Ant1_2437



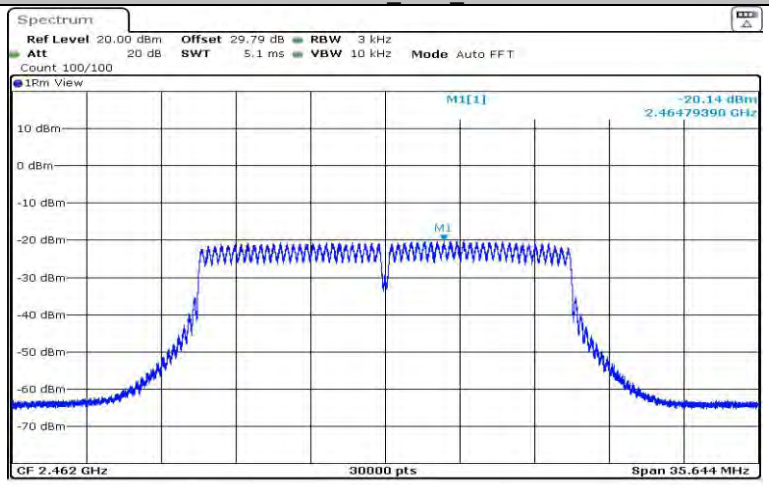
11N20MIMO_Ant2_2437



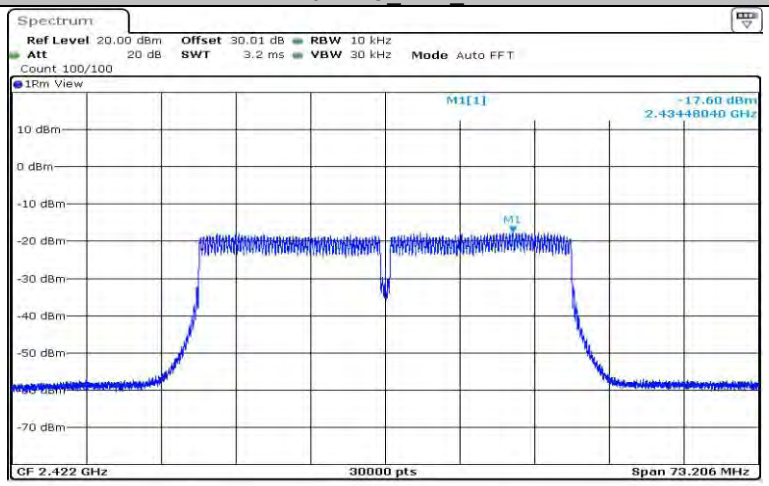
11N20MIMO_Ant1_2462



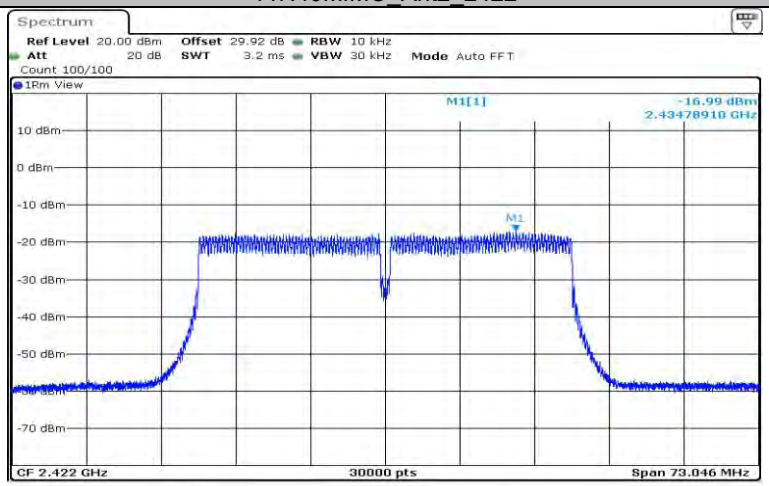
11N20MIMO_Ant2_2462



11N40MIMO_Ant1_2422



11N40MIMO_Ant2_2422



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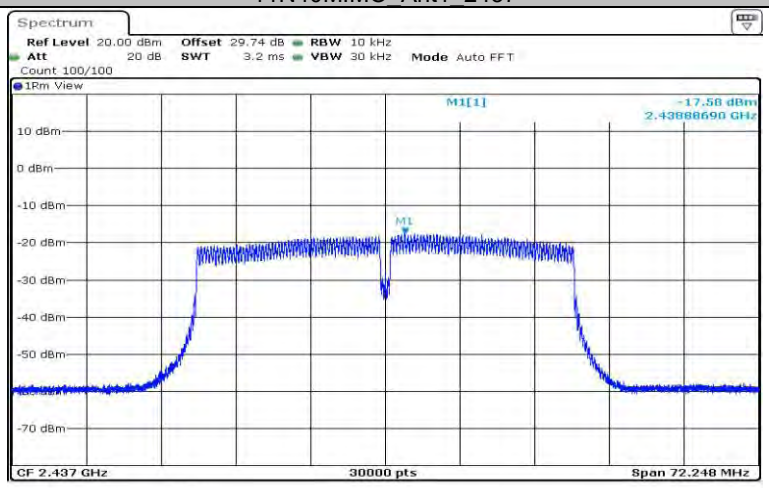
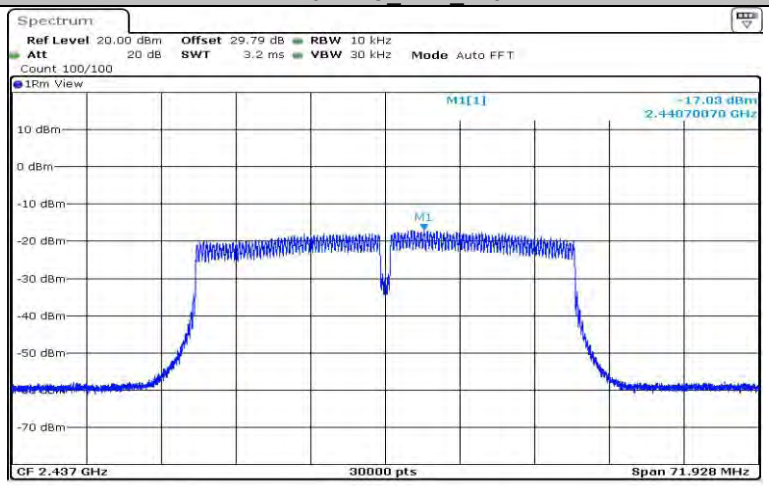
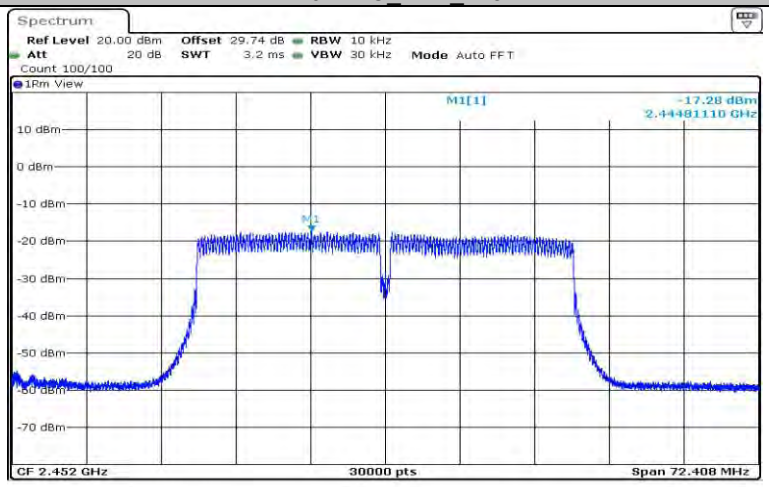


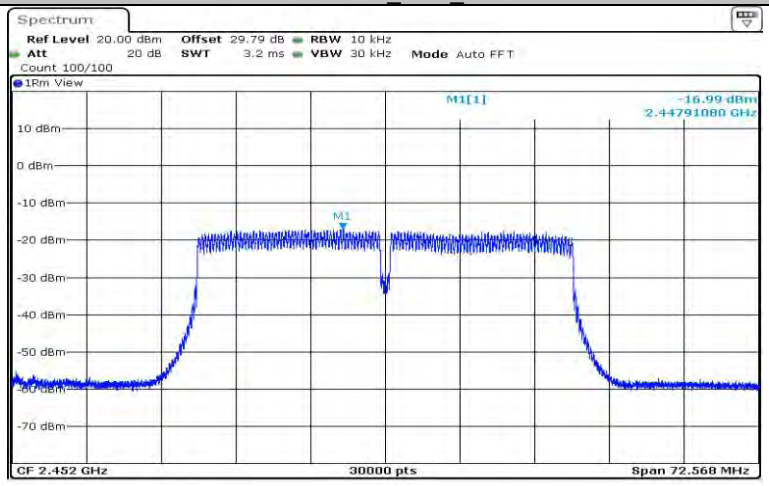
11N40MIMO_Ant2_2437



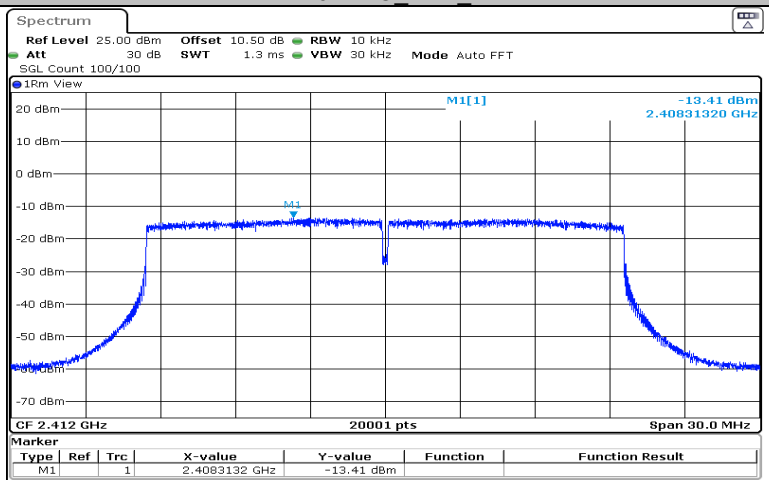
11N40MIMO_Ant1_2452



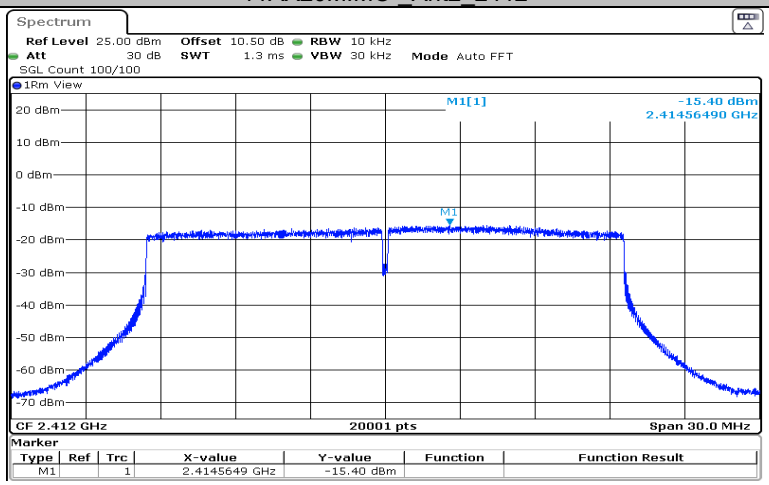
11N40MIMO_Ant2_2452



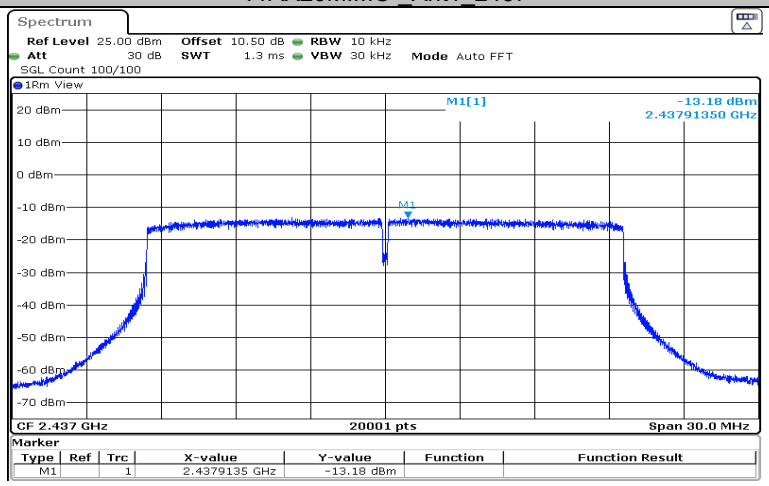
11AX20MIMO_Ant1_2412



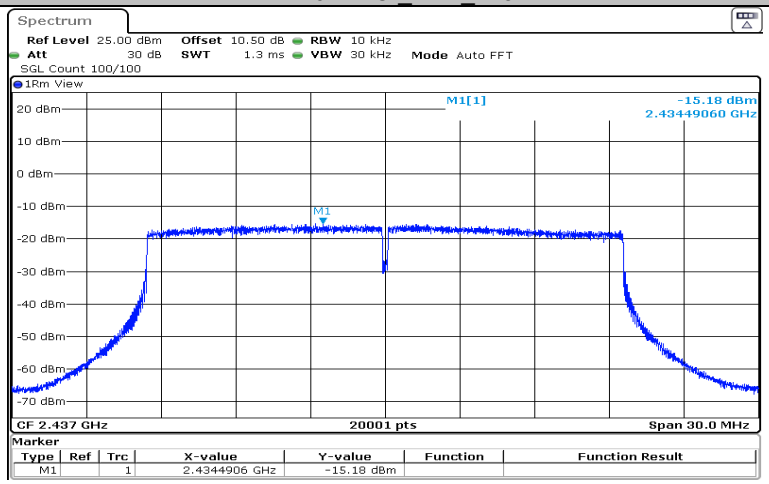
11AX20MIMO _Ant2_2412



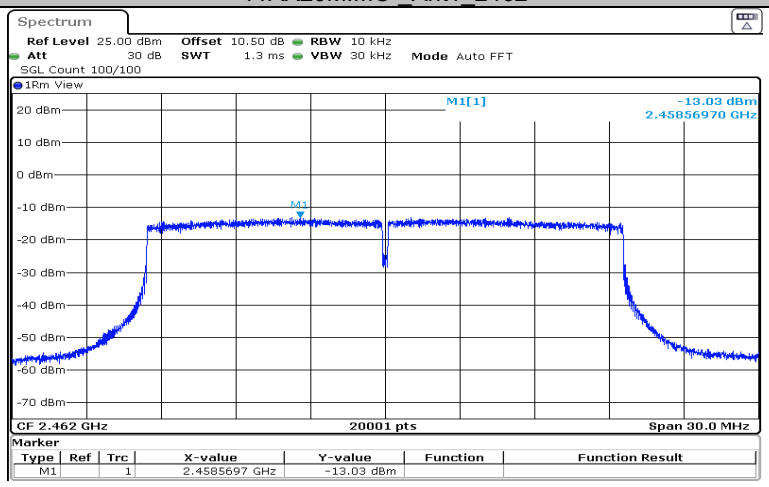
11AX20MIMO _Ant1_2437



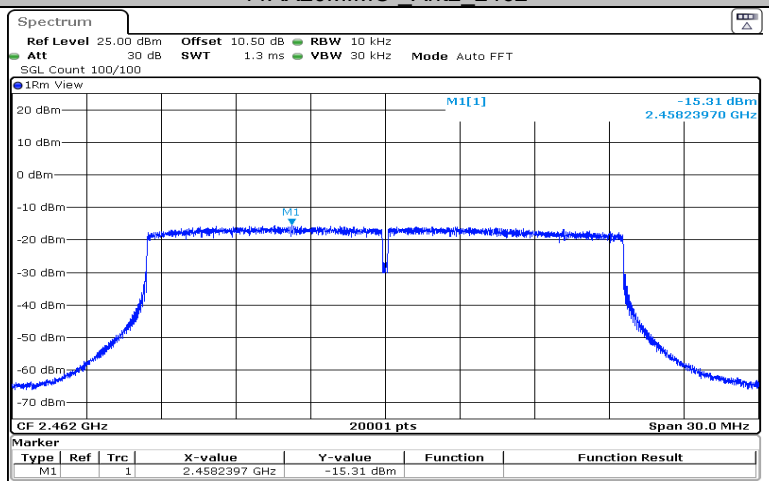
11AX20MIMO _Ant2_2437



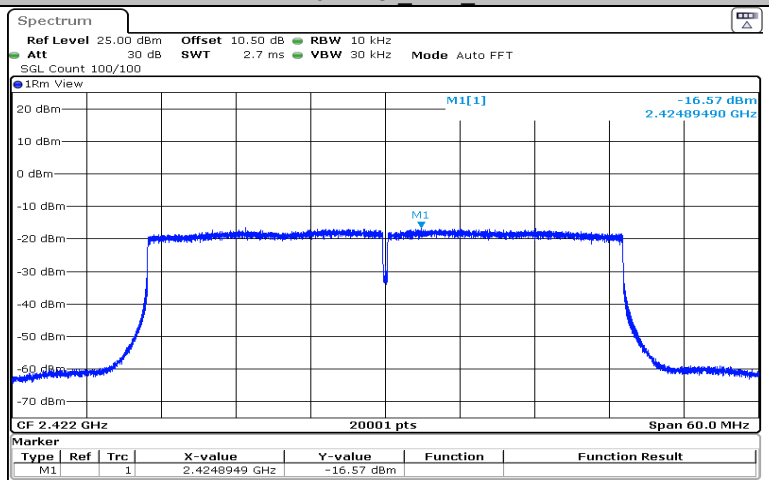
11AX20MIMO _Ant1_2462



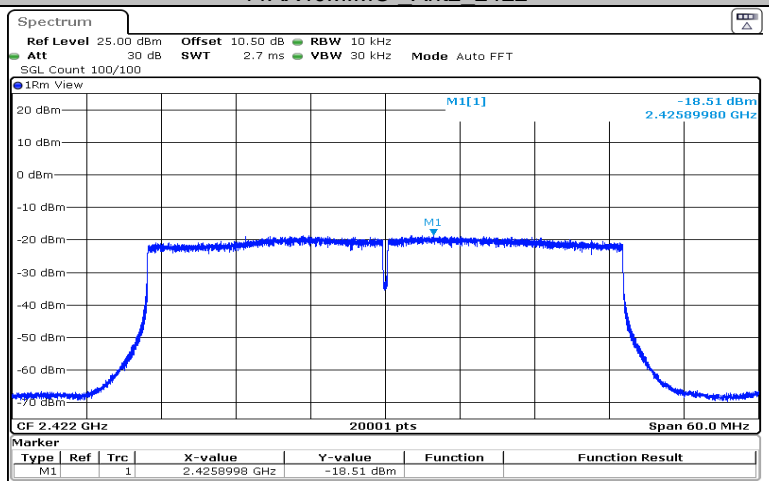
11AX20MIMO _Ant2_2462



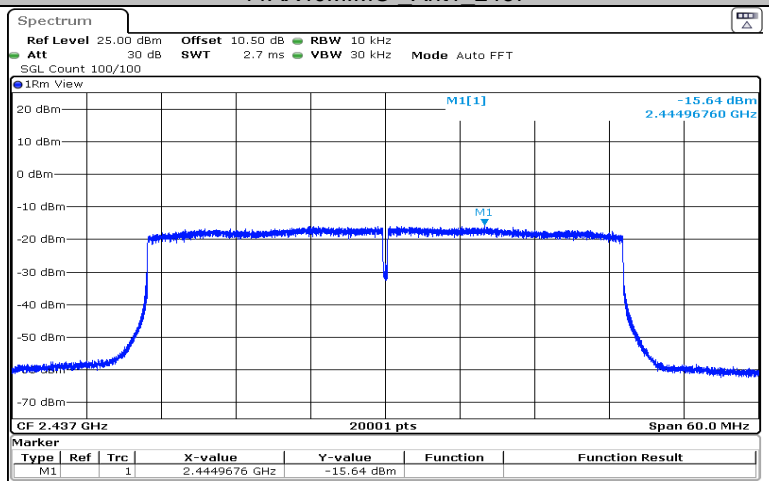
11AX40MIMO _Ant1_2422



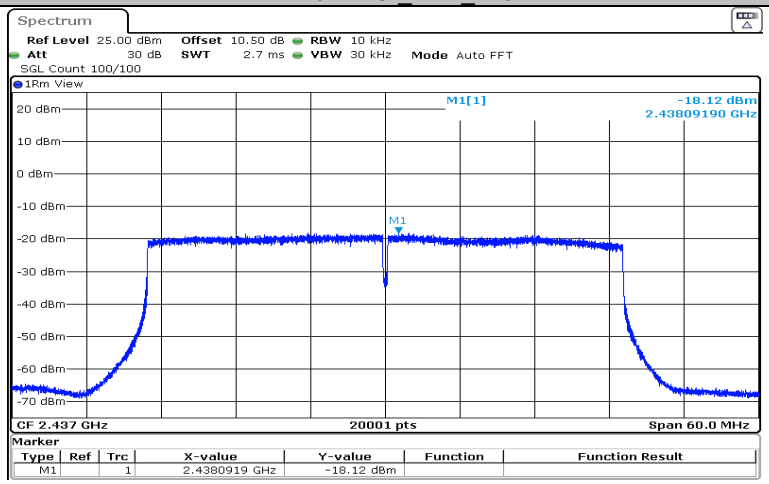
11AX40MIMO _Ant2_2422



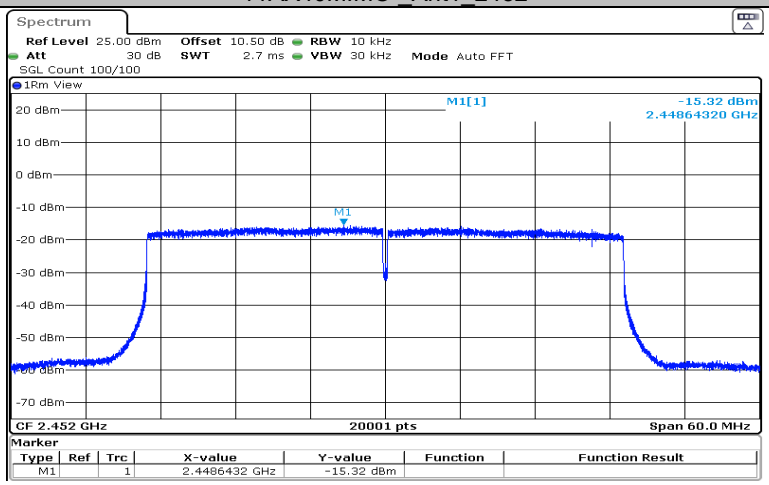
11AX40MIMO _Ant1_2437



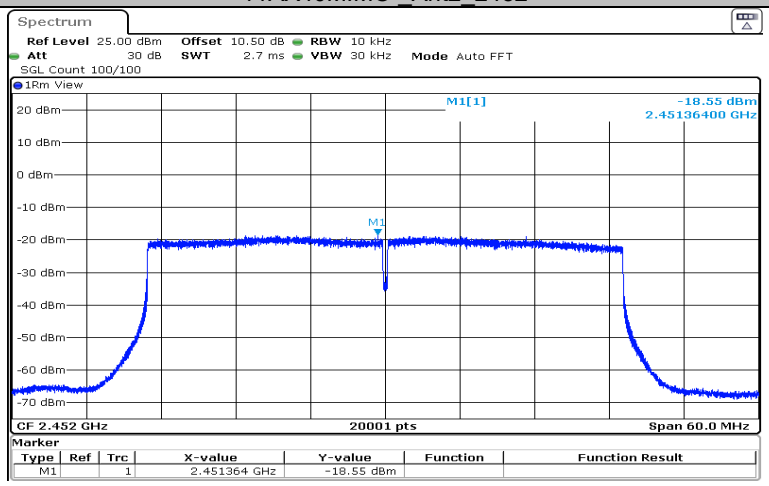
11AX40MIMO _Ant2_2437



11AX40MIMO _Ant1_2452



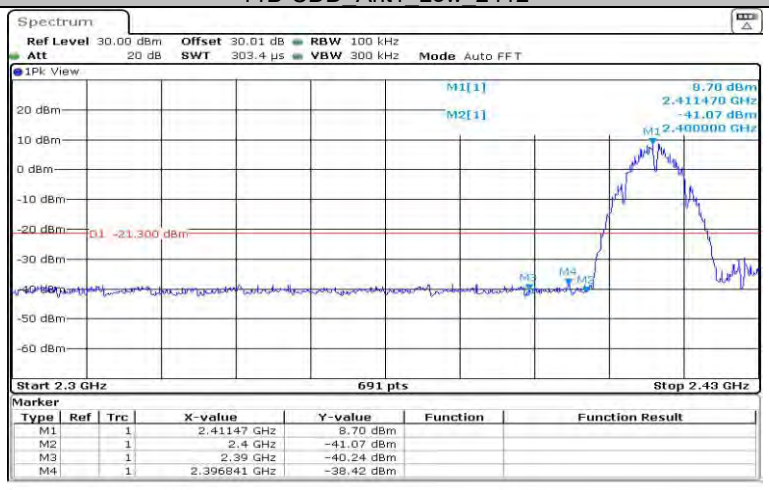
11AX40MIMO _Ant2_2452



Appendix E: Band edge measurements

Test Graphs

11B-CDD_Ant1_Low_2412

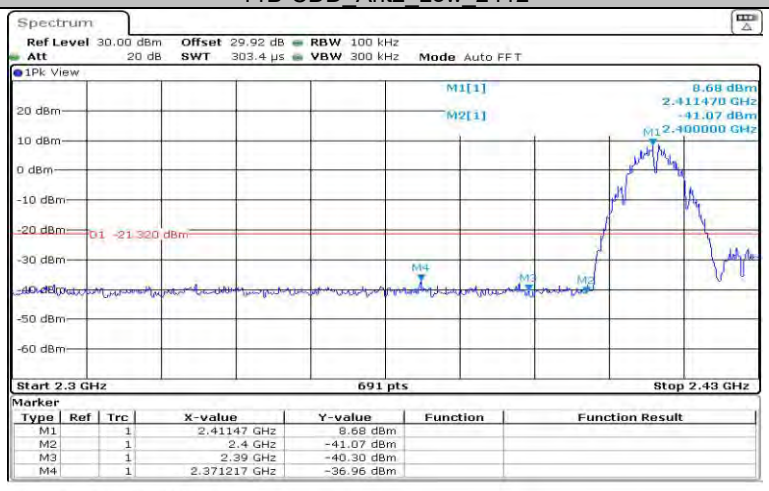


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41147 GHz	8.70 dBm		
M2		1	2.4 GHz	-41.07 dBm		
M3		1	2.39 GHz	-40.24 dBm		
M4		1	2.396841 GHz	-38.42 dBm		

Date: 4.NOV.2022 07:51:58

11B-CDD_Ant2_Low_2412

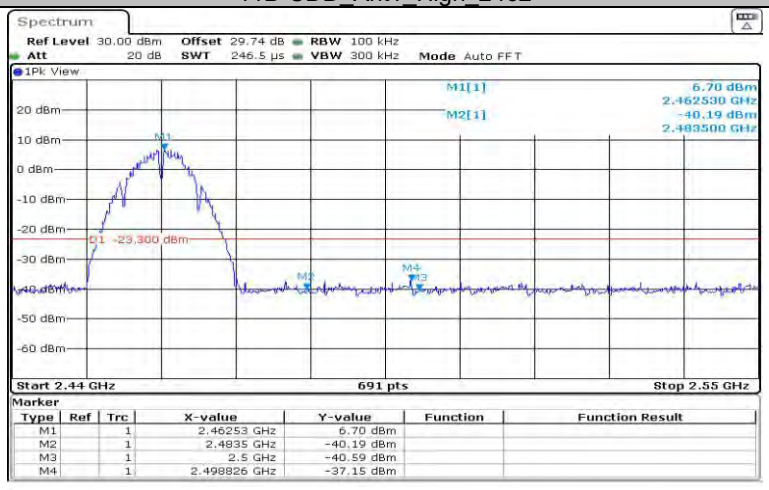


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41147 GHz	8.68 dBm		
M2		1	2.4 GHz	-41.07 dBm		
M3		1	2.39 GHz	-40.30 dBm		
M4		1	2.371217 GHz	-36.96 dBm		

Date: 4.NOV.2022 07:53:03

11B-CDD_Ant1_High_2462

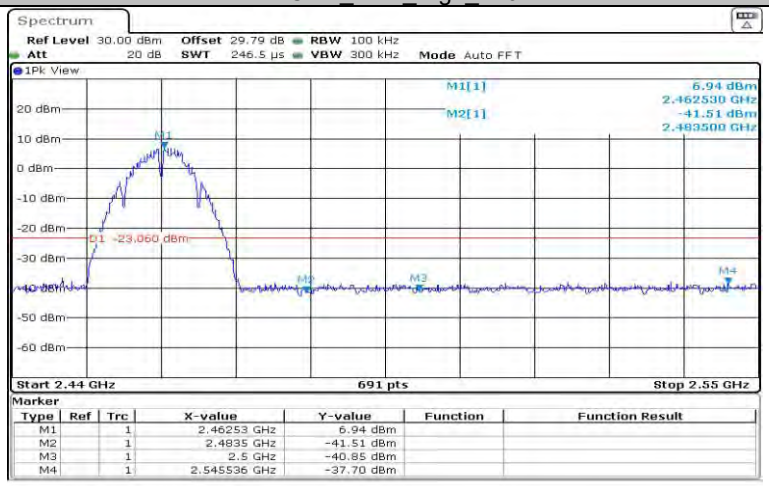


Marker

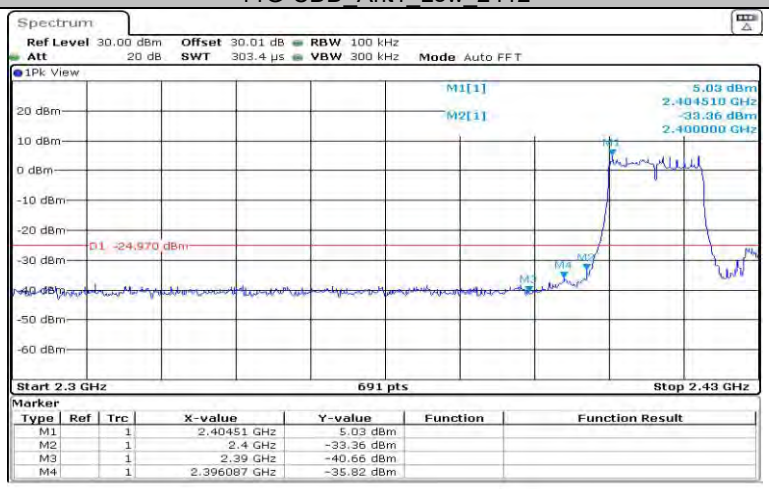
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46253 GHz	6.70 dBm		
M2		1	2.4835 GHz	-40.19 dBm		
M3		1	2.5 GHz	-40.59 dBm		
M4		1	2.498826 GHz	-37.15 dBm		

Date: 4.NOV.2022 07:57:25

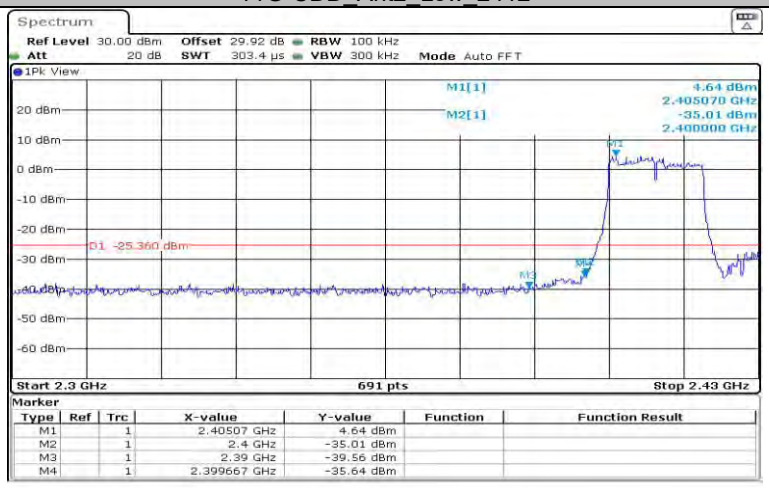
11B-CDD_Ant2_High_2462



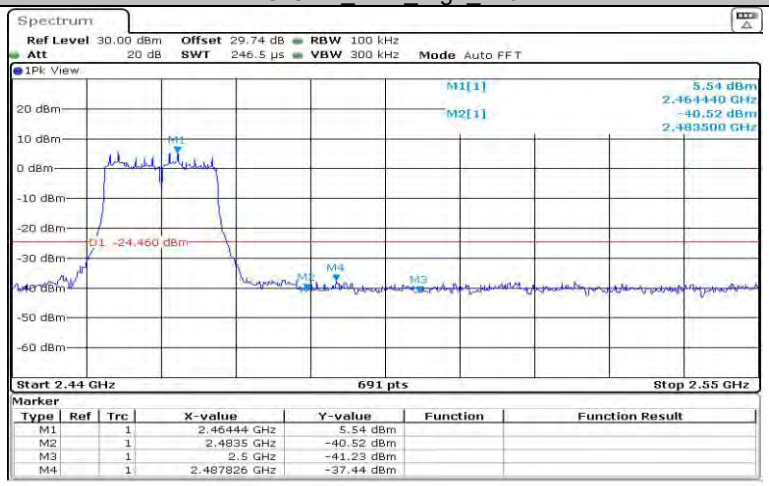
11G-CDD_Ant1_Low_2412



11G-CDD_Ant2_Low_2412



11G-CDD_Ant1_High_2462

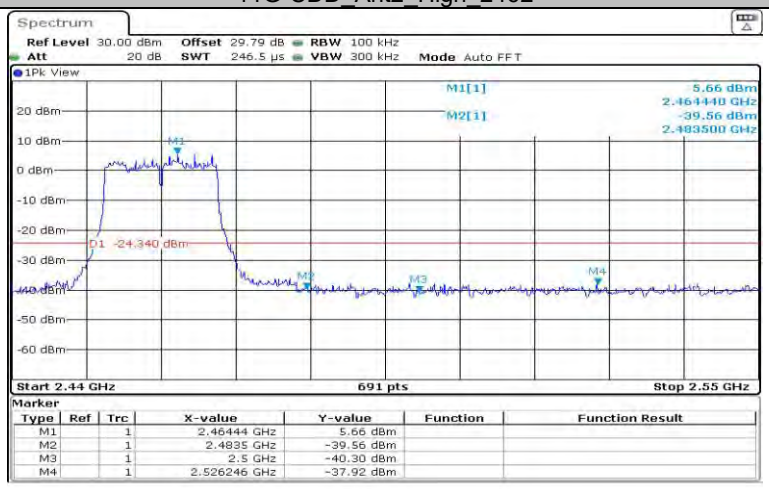


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46444 GHz	5.54 dBm		
M2		1	2.4835 GHz	-40.52 dBm		
M3		1	2.5 GHz	-41.23 dBm		
M4		1	2.487826 GHz	-37.44 dBm		

Date: 4.NOV.2022 08:09:20

11G-CDD_Ant2_High_2462

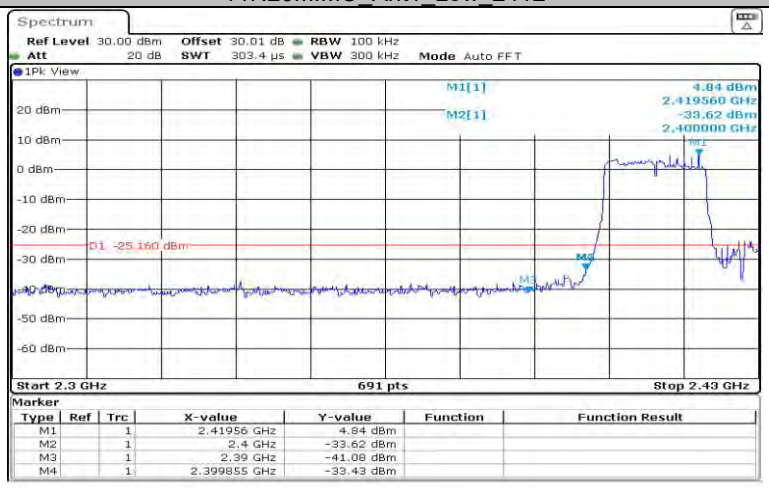


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46444 GHz	5.66 dBm		
M2		1	2.4835 GHz	-39.56 dBm		
M3		1	2.5 GHz	-40.30 dBm		
M4		1	2.526246 GHz	-37.92 dBm		

Date: 4.NOV.2022 08:10:36

11N20MIMO_Ant1_Low_2412

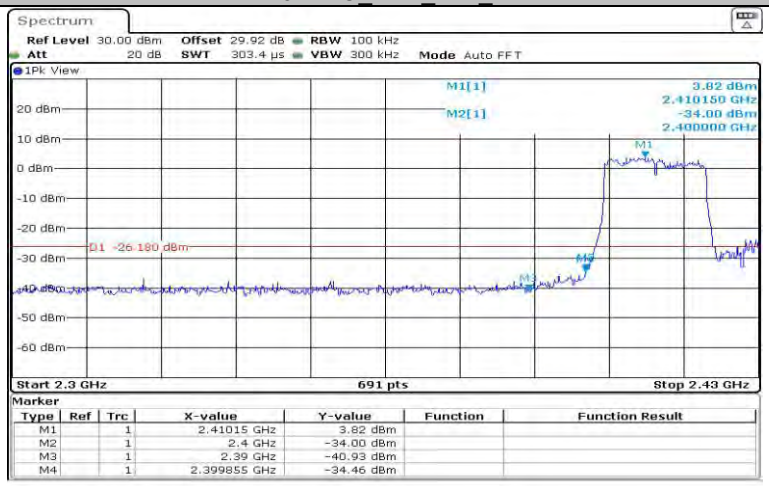


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41956 GHz	4.84 dBm		
M2		1	2.4 GHz	-33.62 dBm		
M3		1	2.39 GHz	-41.08 dBm		
M4		1	2.399855 GHz	-33.43 dBm		

Date: 4.NOV.2022 08:12:59

11N20MIMO_Ant2_Low_2412

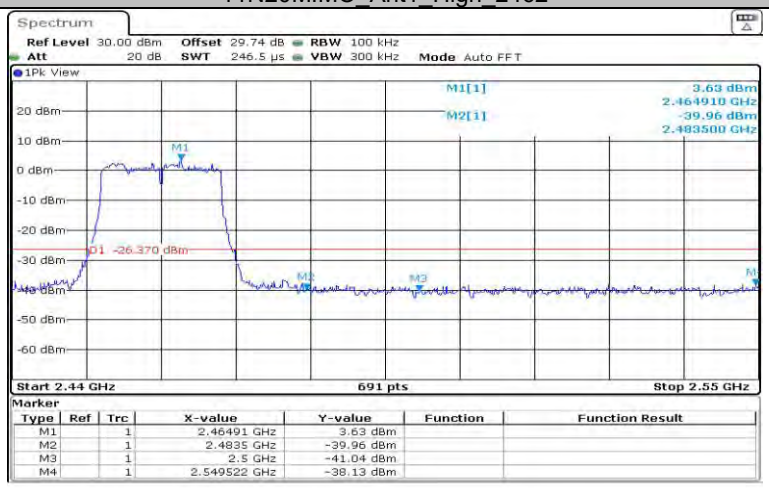


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41015 GHz	3.82 dBm		
M2		1	2.4 GHz	-34.00 dBm		
M3		1	2.39 GHz	-40.93 dBm		
M4		1	2.399855 GHz	-34.46 dBm		

Date: 4.NOV.2022 08:14:10

11N20MIMO_Ant1_High_2462

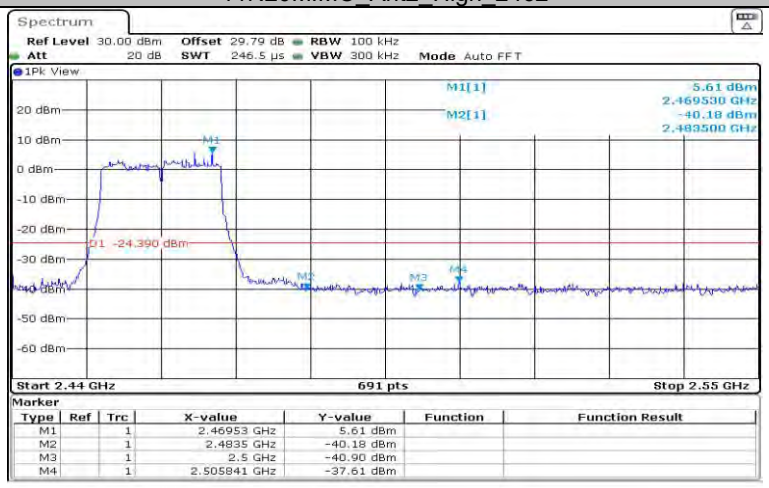


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46491 GHz	3.63 dBm		
M2		1	2.4835 GHz	-39.96 dBm		
M3		1	2.5 GHz	-41.04 dBm		
M4		1	2.549522 GHz	-38.13 dBm		

Date: 4.NOV.2022 08:18:38

11N20MIMO_Ant2_High_2462

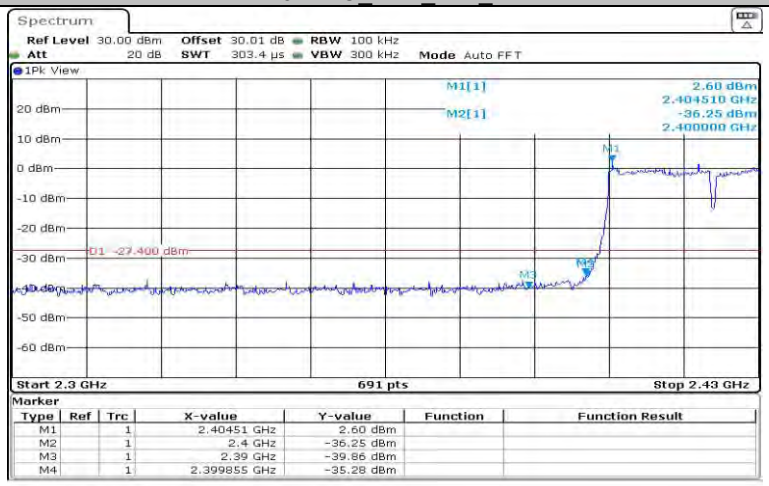


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46953 GHz	5.61 dBm		
M2		1	2.4835 GHz	-40.18 dBm		
M3		1	2.5 GHz	-40.90 dBm		
M4		1	2.505841 GHz	-37.61 dBm		

Date: 4.NOV.2022 08:20:05

11N40MIMO_Ant1_Low_2422

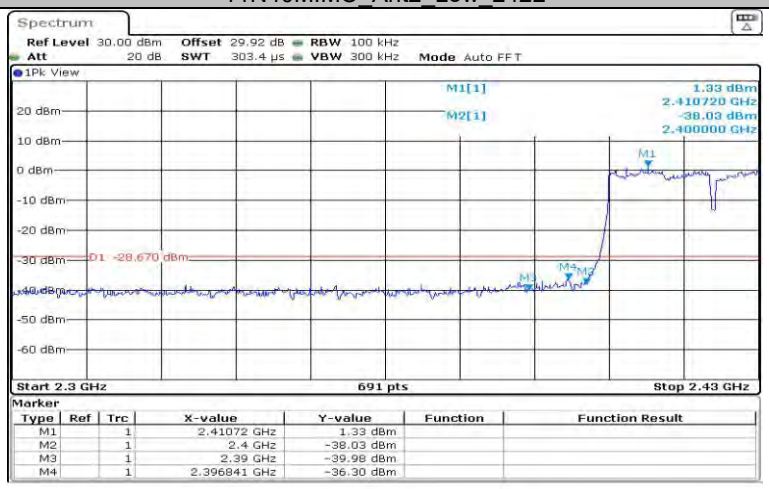


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40451 GHz	2.60 dBm		
M2		1	2.4 GHz	-36.25 dBm		
M3		1	2.39 GHz	-39.86 dBm		
M4		1	2.399855 GHz	-35.28 dBm		

Date: 4.NOV.2022 08:22:16

11N40MIMO_Ant2_Low_2422

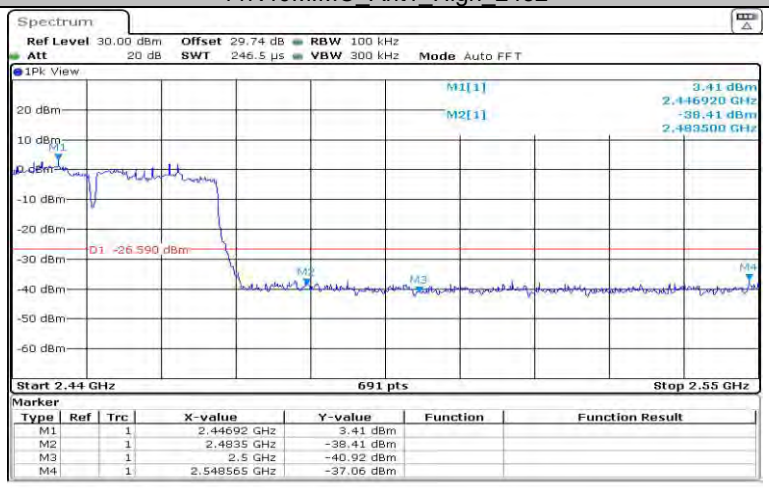


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41072 GHz	1.33 dBm		
M2		1	2.4 GHz	-38.03 dBm		
M3		1	2.39 GHz	-39.98 dBm		
M4		1	2.396841 GHz	-36.30 dBm		

Date: 4.NOV.2022 08:20:19

11N40MIMO_Ant1_High_2452

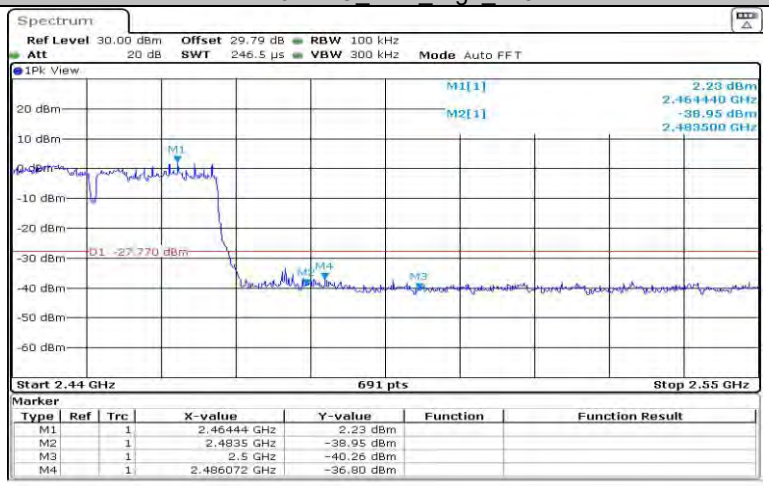


Marker

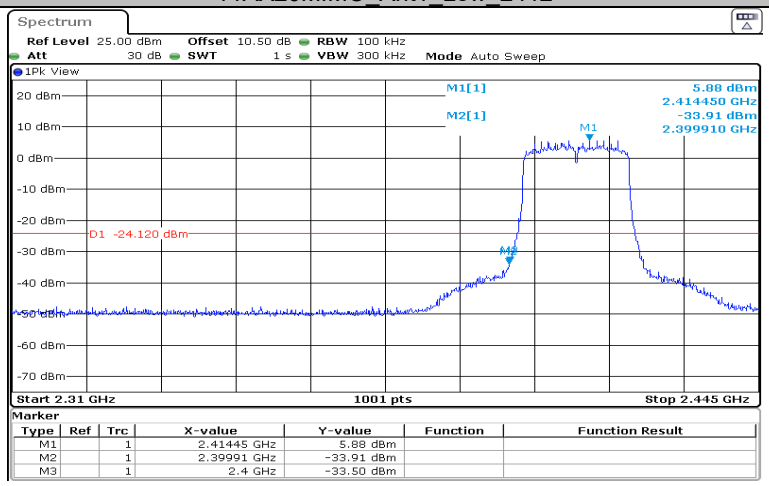
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44692 GHz	3.41 dBm		
M2		1	2.4835 GHz	-38.41 dBm		
M3		1	2.5 GHz	-40.92 dBm		
M4		1	2.548565 GHz	-37.06 dBm		

Date: 4.NOV.2022 08:28:04

11N40MIMO_Ant2_High_2452

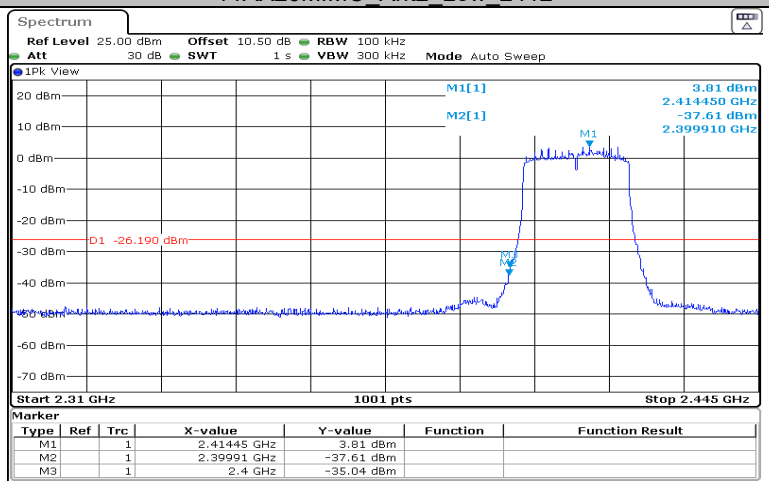


11AX20MIMO_Ant1_Low_2412



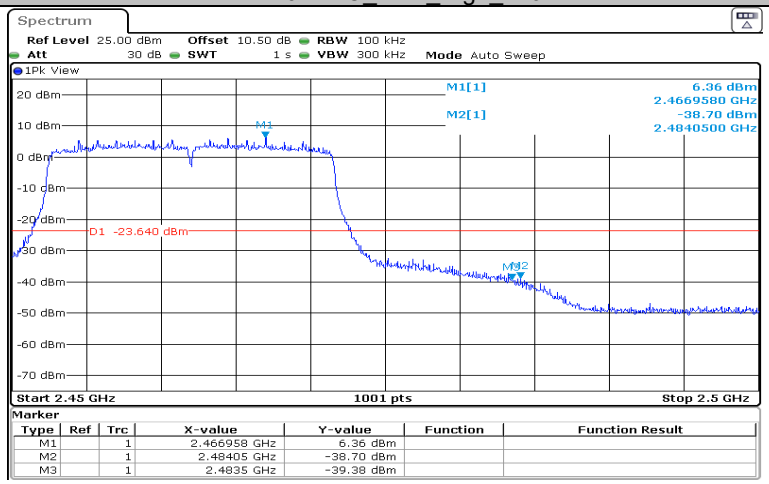
Date: 10.APR.2023 21:57:22

11AX20MIMO_Ant2_Low_2412



Date: 10.APR.2023 21:25:22

11AX20MIMO_Ant1_High_2462

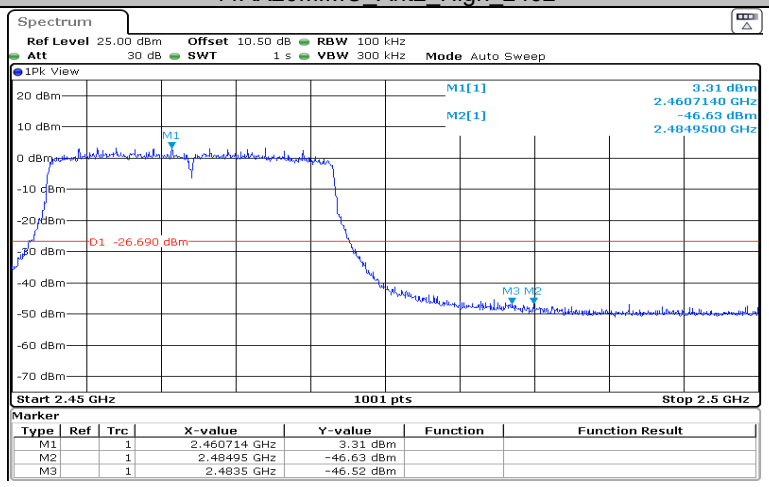


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.466958 GHz	6.36 dBm		
M2		1	2.48405 GHz	-38.70 dBm		
M3		1	2.4835 GHz	-39.38 dBm		

Date: 10.APR.2023 22:07:17

11AX20MIMO_Ant2_High_2462

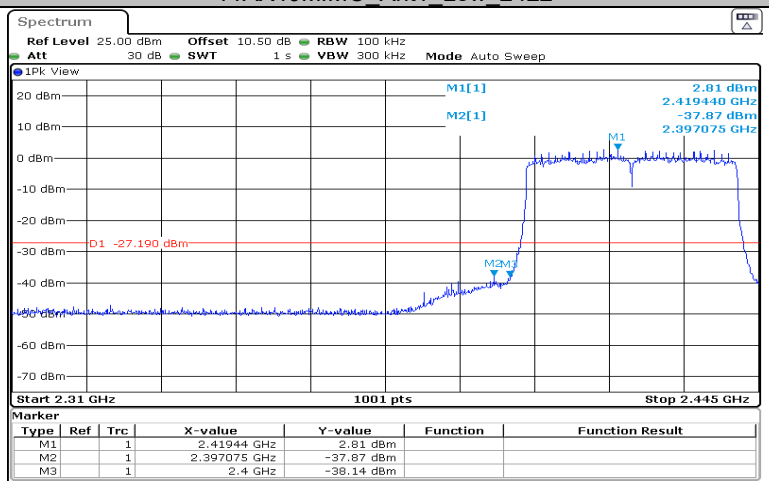


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.460714 GHz	3.31 dBm		
M2		1	2.48495 GHz	-46.63 dBm		
M3		1	2.4835 GHz	-46.52 dBm		

Date: 10.APR.2023 21:31:17

11AX40MIMO_Ant1_Low_2422

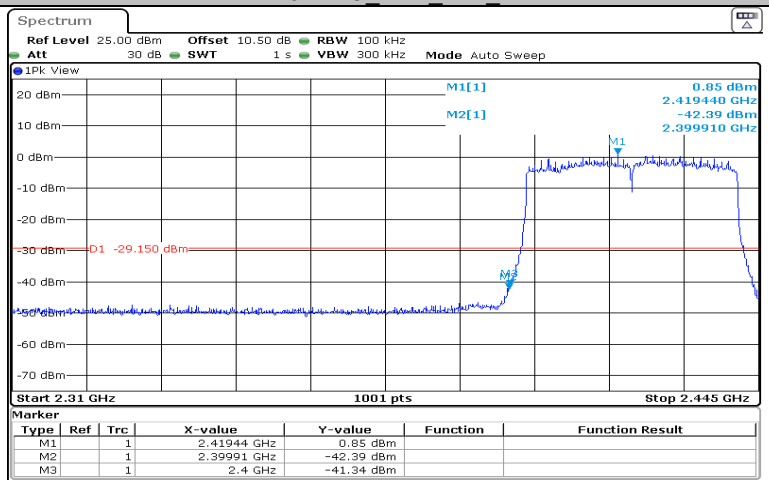


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41944 GHz	2.81 dBm		
M2		1	2.397075 GHz	-37.87 dBm		
M3		1	2.4 GHz	-38.14 dBm		

Date: 10.APR.2023 22:10:27

11AX40MIMO_Ant2_Low_2422

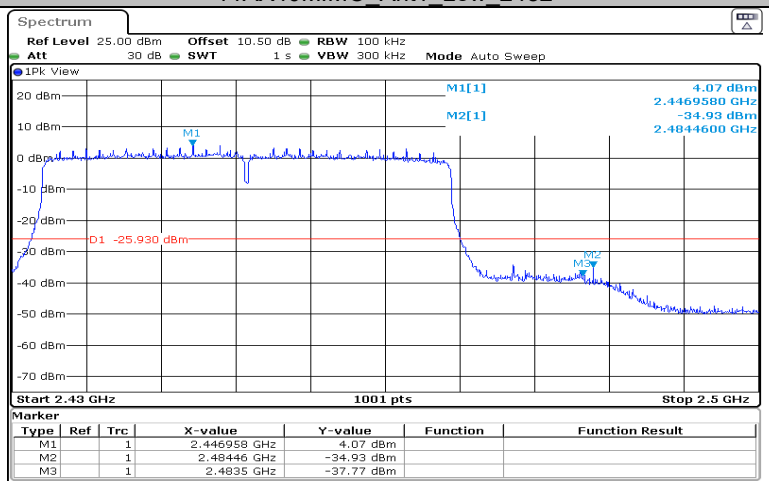


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41944 GHz	0.85 dBm		
M2		1	2.39991 GHz	-42.39 dBm		
M3		1	2.4 GHz	-41.34 dBm		

Date: 10.APR.2023 21:34:35

11AX40MIMO_Ant1_Low_2452

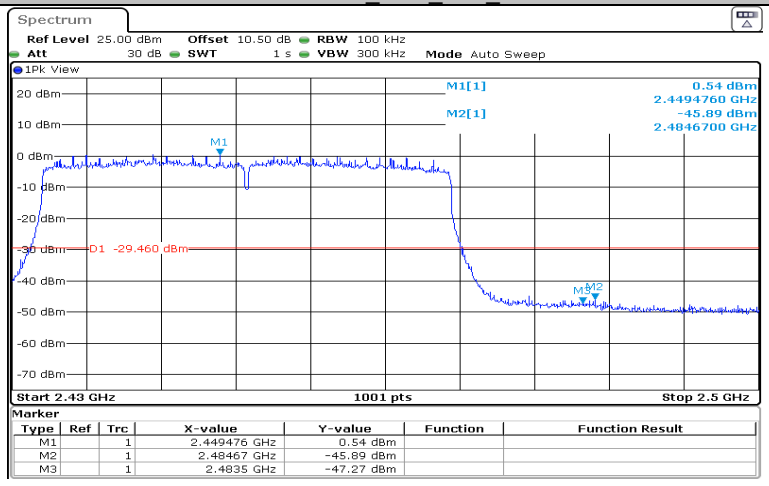


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.446958 GHz	4.07 dBm		
M2		1	2.48446 GHz	-34.93 dBm		
M3		1	2.4835 GHz	-37.77 dBm		

Date: 10.APR.2023 22:16:21

11AX40MIMO_Ant1_Low_2452



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.449476 GHz	0.54 dBm		
M2		1	2.48467 GHz	-45.89 dBm		
M3		1	2.4835 GHz	-47.27 dBm		

Date: 10.APR.2023 21:39:57

Appendix F: Duty Cycle

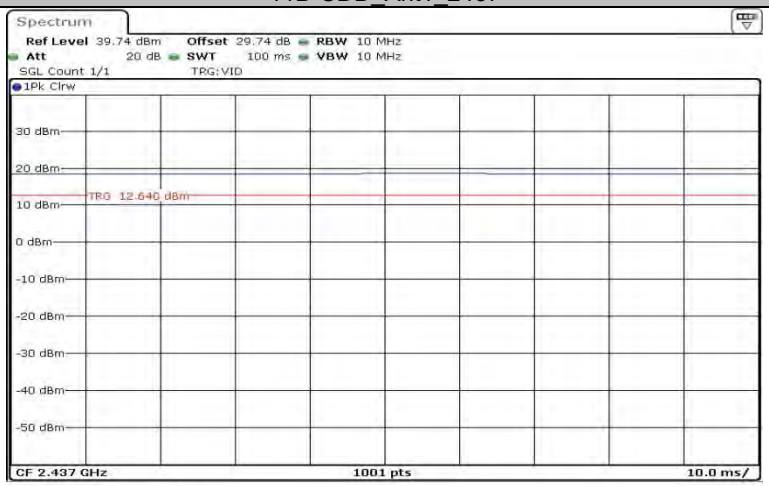
Test Result

Test Mode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B-CDD	Ant1	2437	100.00	100.00	100.00
11G-CDD	Ant1	2437	100.00	100.00	100.00
11N20MIMO	Ant1	2437	100.00	100.00	100.00
11N40MIMO	Ant1	2437	100.00	100.00	100.00

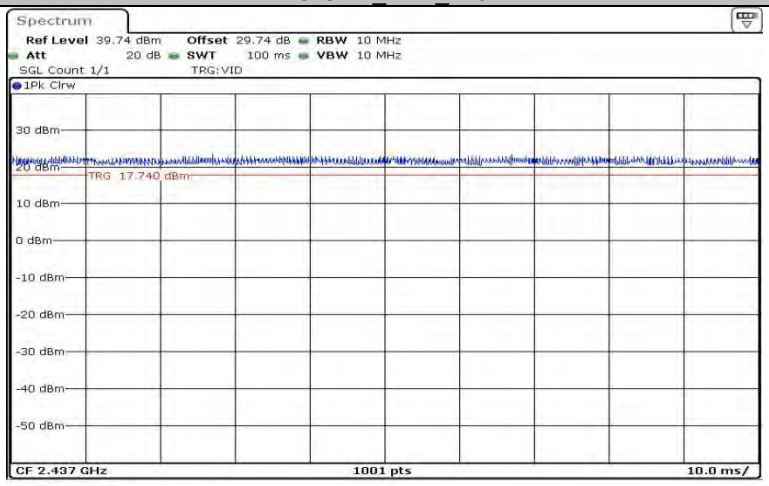
Test Mode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11AX20MIMO	Ant1	2437	5.42	5.44	99.63
11AX40MIMO	Ant1	2437	4.11	4.12	99.76

Test Graphs

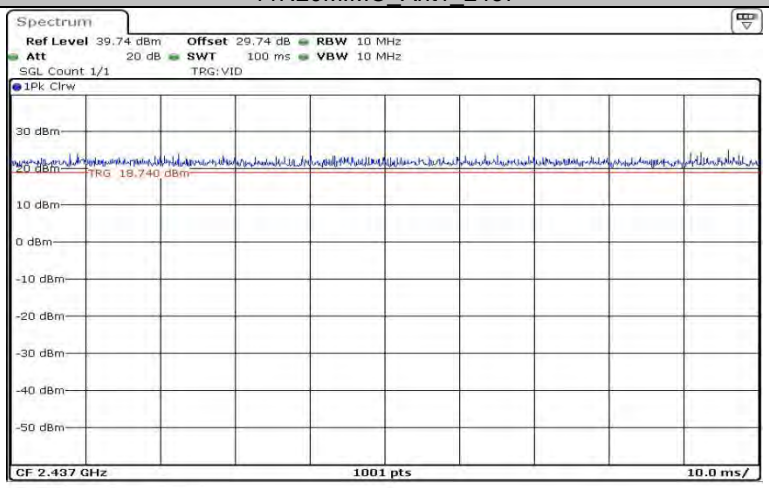
11B-CDD_Ant1_2437



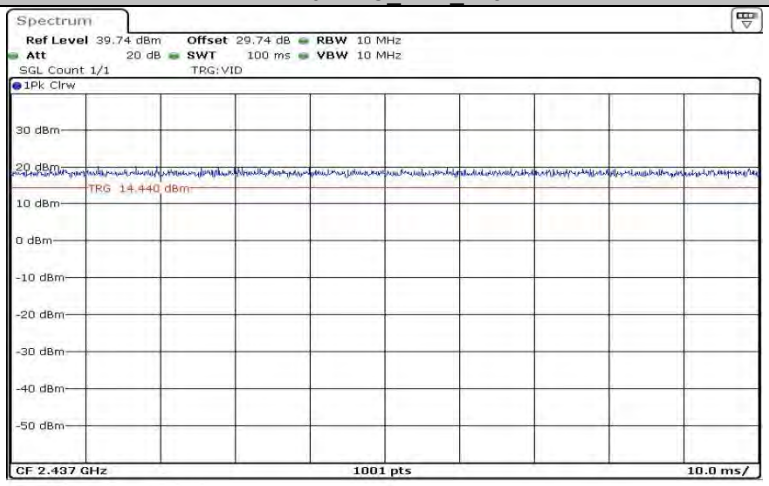
11G-CDD_Ant1_2437



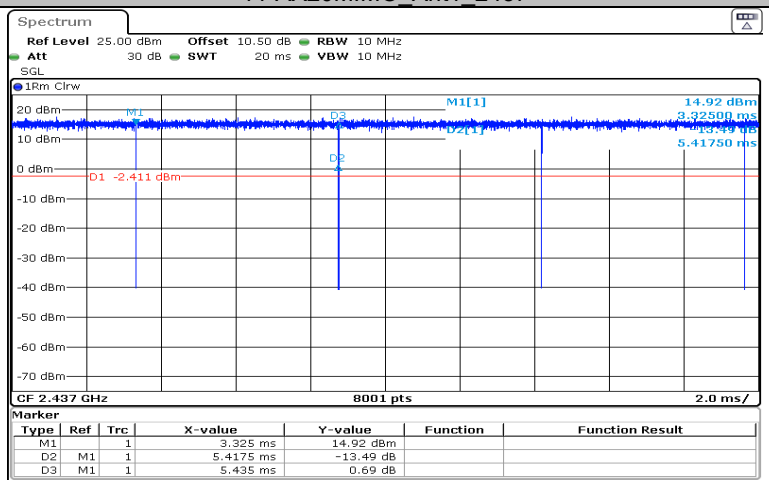
11N20MIMO_Ant1_2437



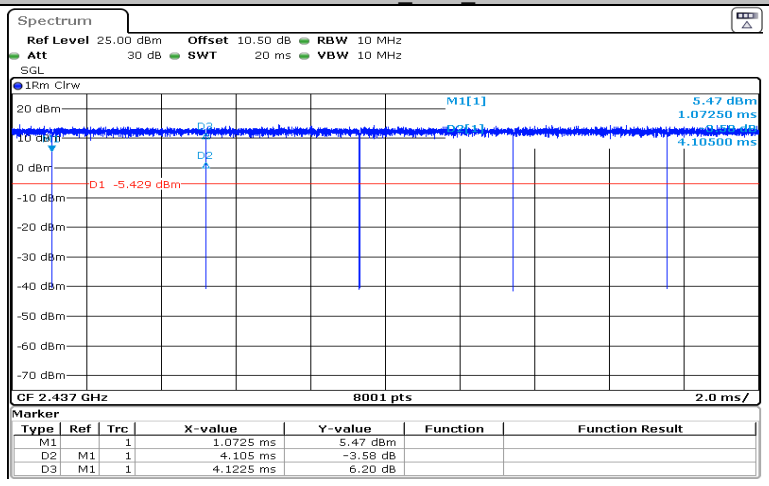
11N40MIMO_Ant1_2437



11 AX20MIMO_Ant1_2437



11 AX40MIMO_Ant1_2437



APPENDIX BLE

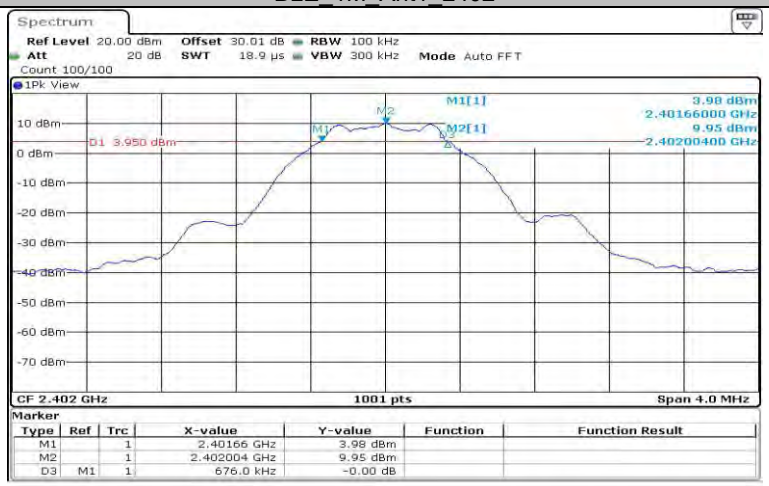
Appendix A: DTS Bandwidth

Test Result

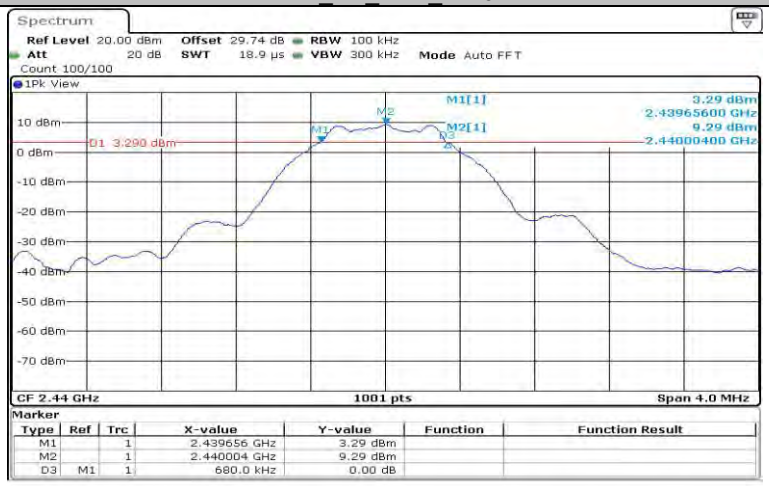
Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.68	2401.66	2402.34	0.5	PASS
		2440	0.68	2439.66	2440.34	0.5	PASS
		2480	0.68	2479.66	2480.34	0.5	PASS
BLE_2M	Ant1	2402	1.13	2401.44	2402.57	0.5	PASS
		2440	1.14	2439.43	2440.57	0.5	PASS
		2480	1.14	2479.44	2480.58	0.5	PASS

Test Graphs

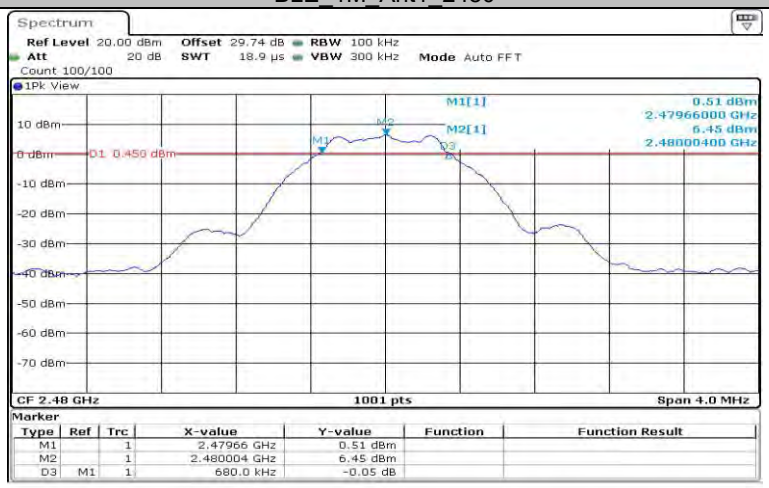
BLE_1M_Ant1_2402



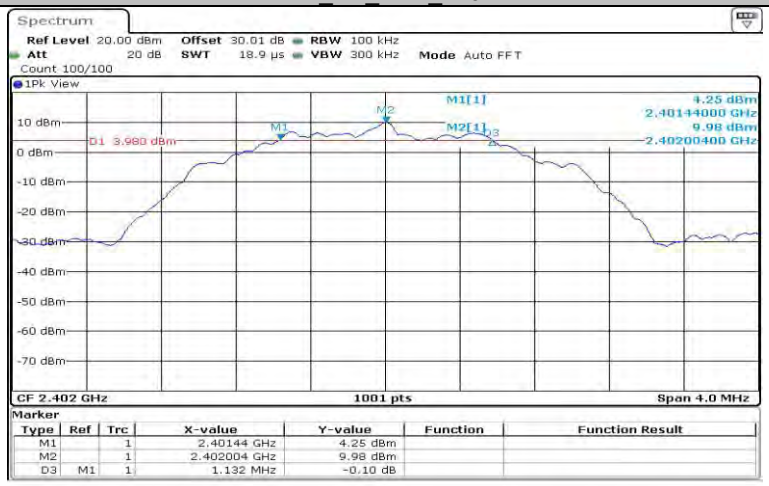
BLE_1M_Ant1_2440



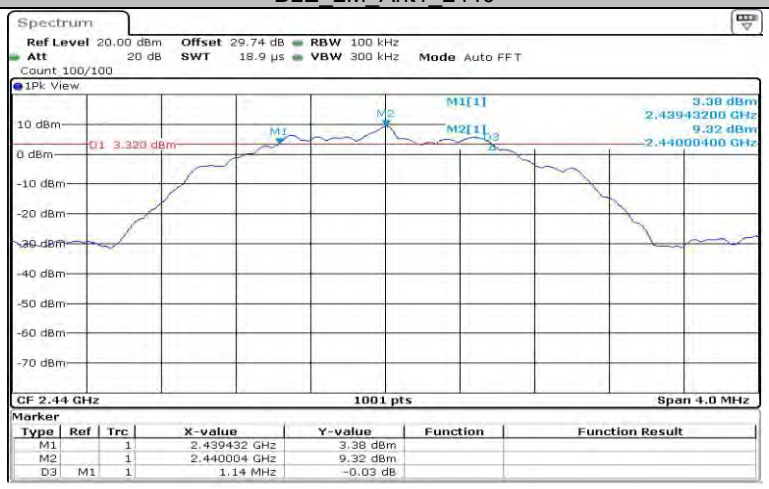
BLE_1M_Ant1_2480



BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480

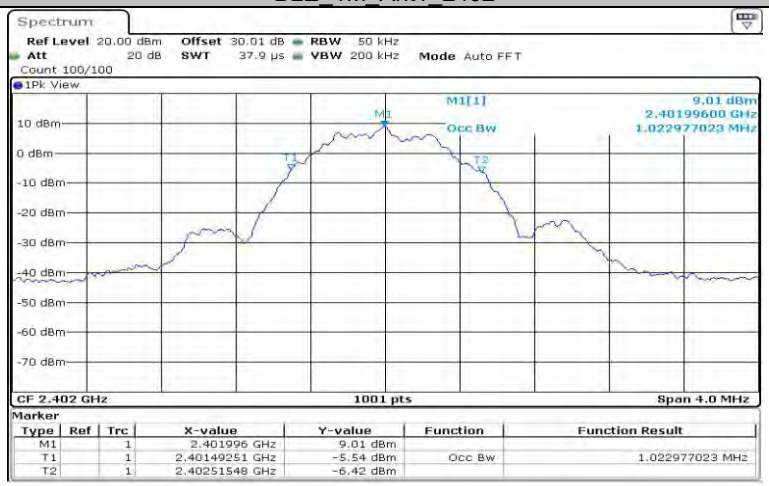
Appendix B: Occupied Channel Bandwidth

Test Result

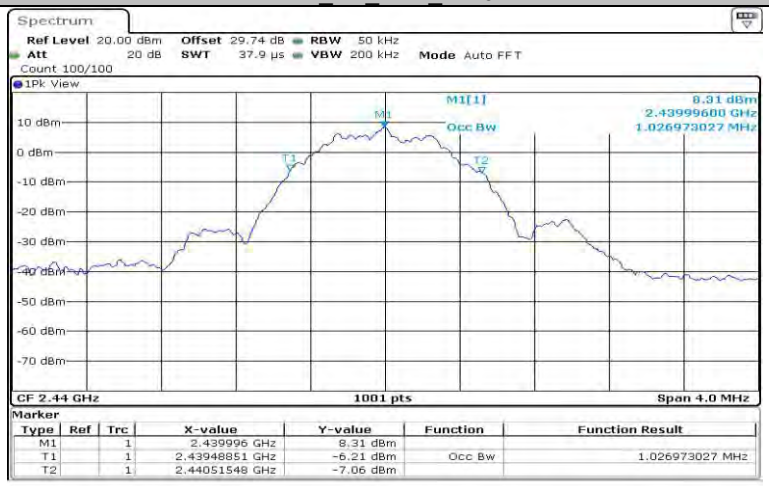
Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.023	2401.493	2402.515	---	---
		2440	1.027	2439.489	2440.515	---	---
		2480	1.027	2479.493	2480.519	---	---
BLE_2M	Ant1	2402	2.014	2401.009	2403.023	---	---
		2440	2.018	2439.005	2441.023	---	---
		2480	2.022	2479.009	2481.031	---	---

Test Graphs

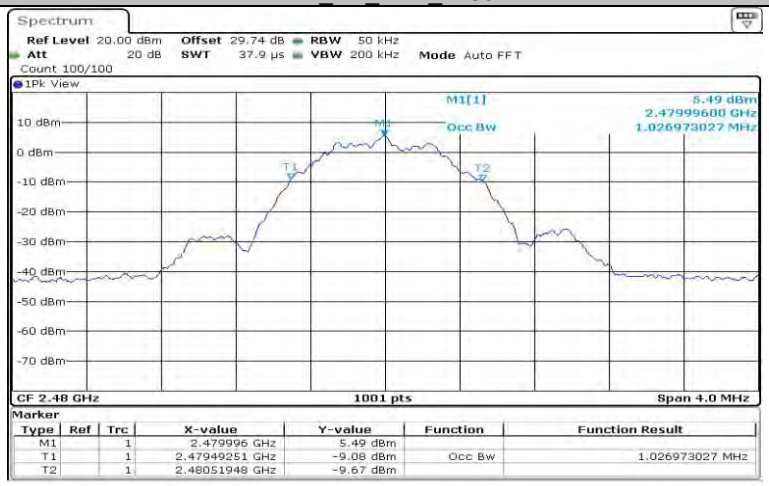
BLE_1M_Ant1_2402



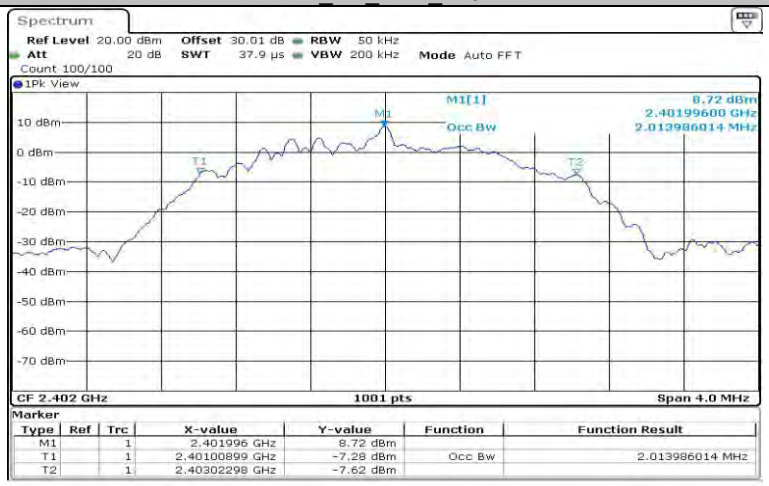
BLE_1M_Ant1_2440



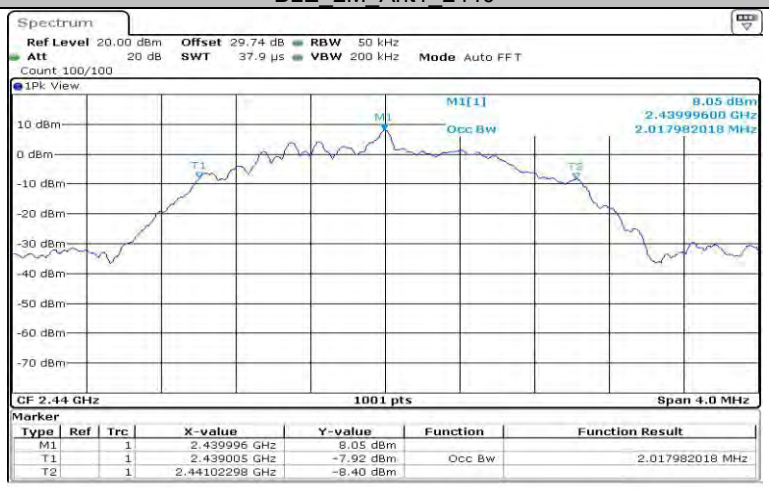
BLE_1M_Ant1_2480



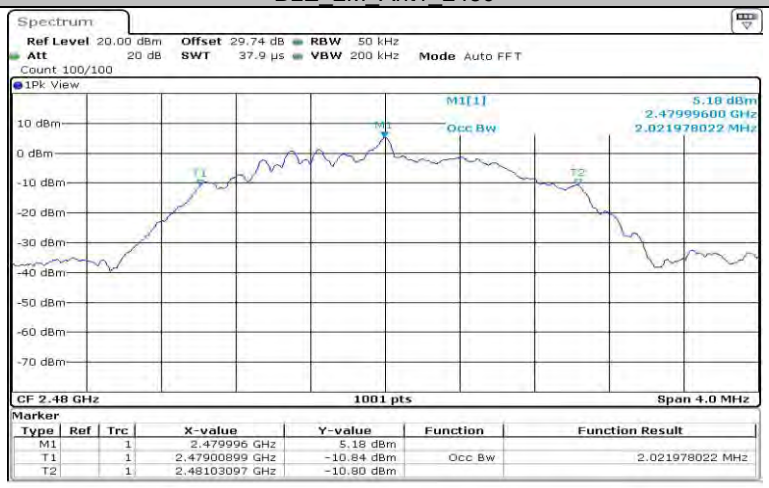
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



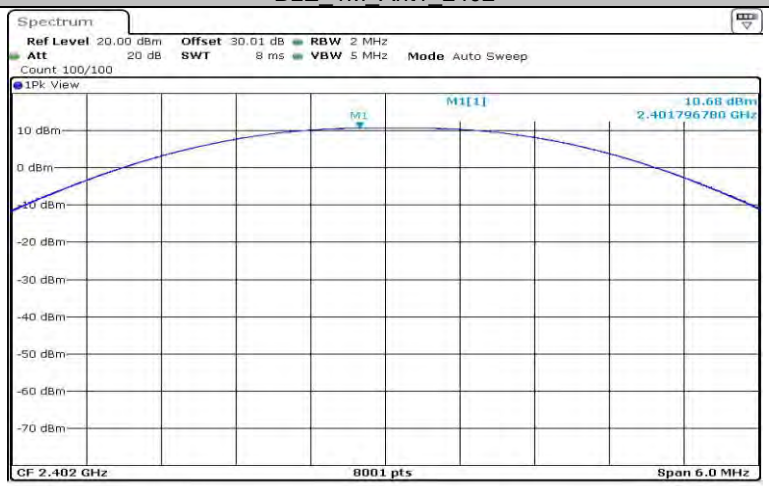
Appendix C: Maximum conducted output power

Test Result

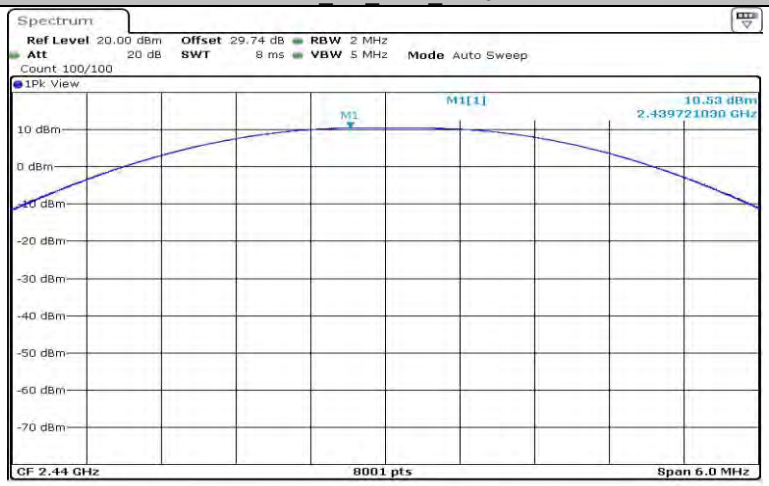
Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power [dBm]	Conducted Limit[dBm]	Verdict
BLE_1M	Ant1	2402	10.68	≤30	PASS
		2440	10.53	≤30	PASS
		2480	7.65	≤30	PASS
BLE_2M	Ant1	2402	10.71	≤30	PASS
		2440	10.59	≤30	PASS
		2480	7.77	≤30	PASS

Test Graphs Peak

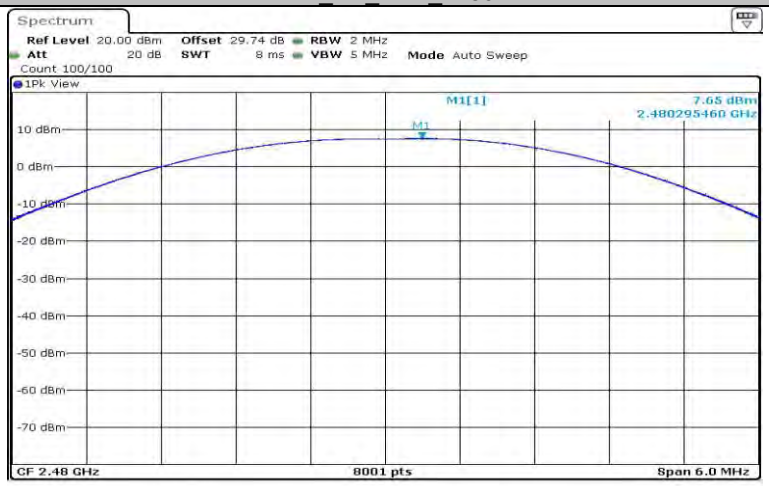
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



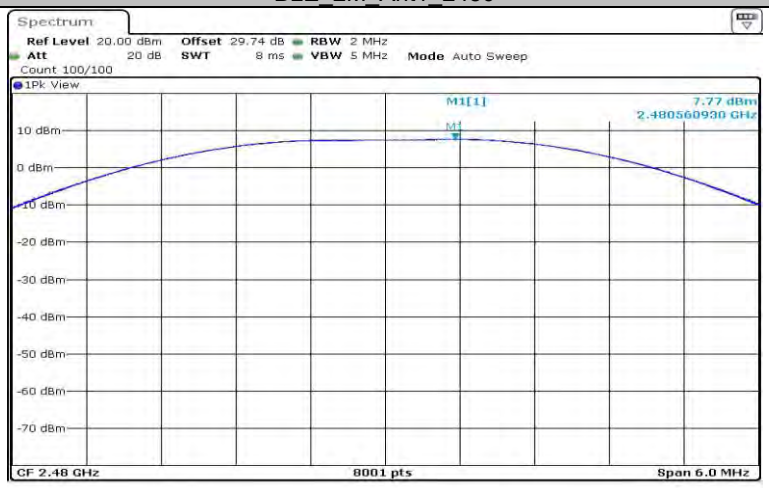
BLE_1M_Ant1_2480



BLE_2M_Ant1_2402

BLE_2M_Ant1_2440

BLE_2M_Ant1_2480



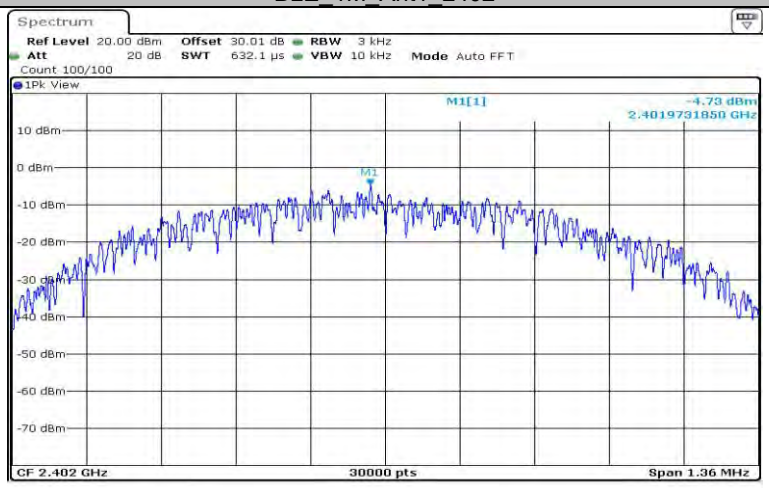
Appendix D: Maximum power spectral density

Test Result

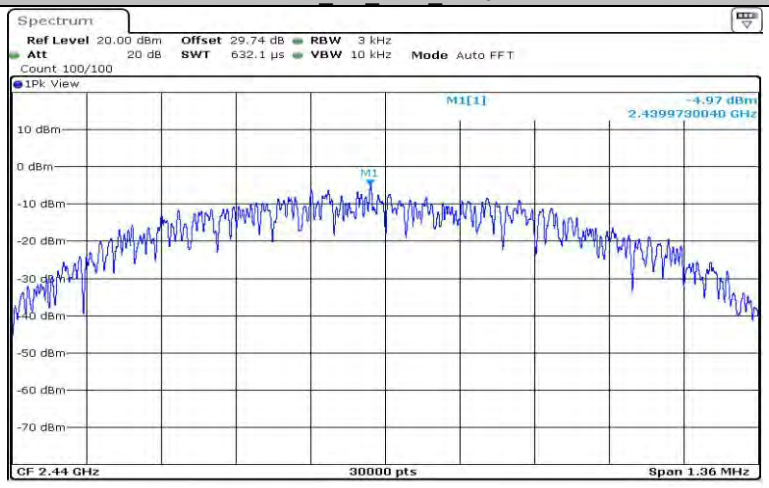
Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-4.73	≤8.00	PASS
		2440	-4.97	≤8.00	PASS
		2480	-7.85	≤8.00	PASS
BLE_2M	Ant1	2402	-7.6	≤8.00	PASS
		2440	-7.83	≤8.00	PASS
		2480	-10.8	≤8.00	PASS

Test Graphs

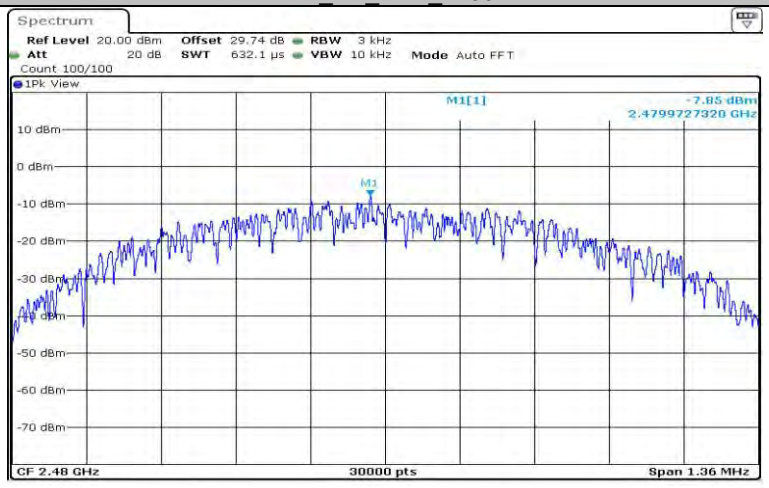
BLE_1M_Ant1_2402



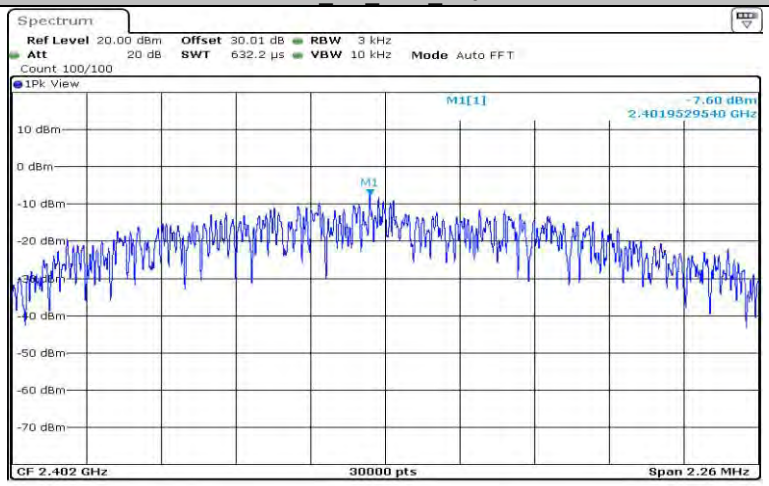
BLE_1M_Ant1_2440



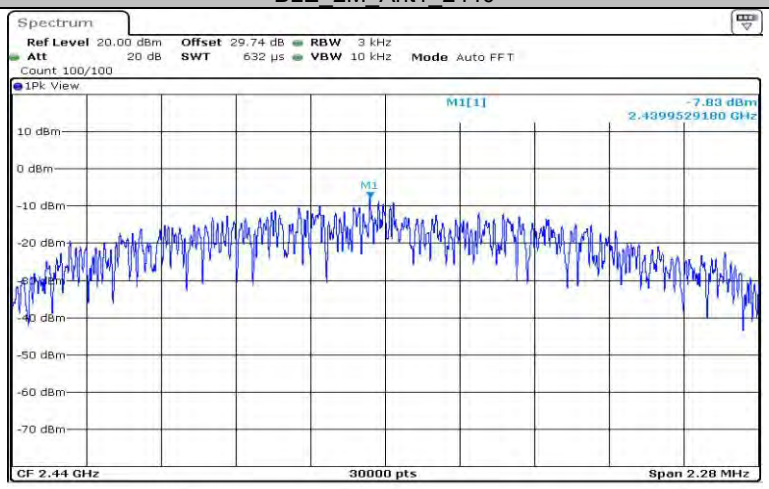
BLE_1M_Ant1_2480



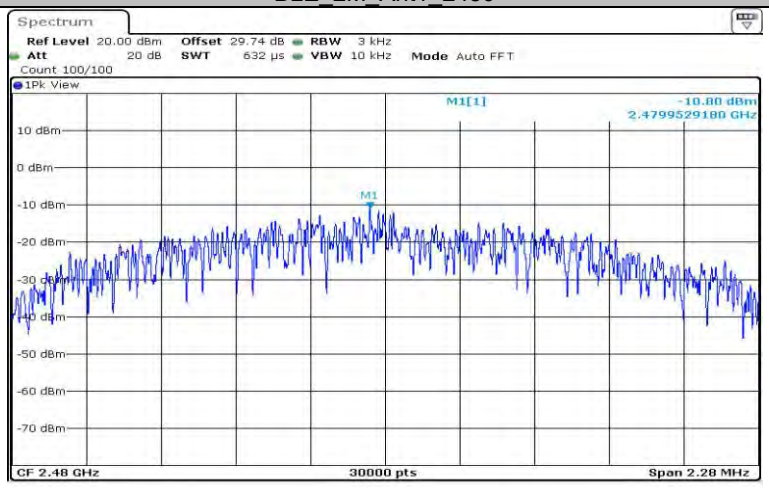
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



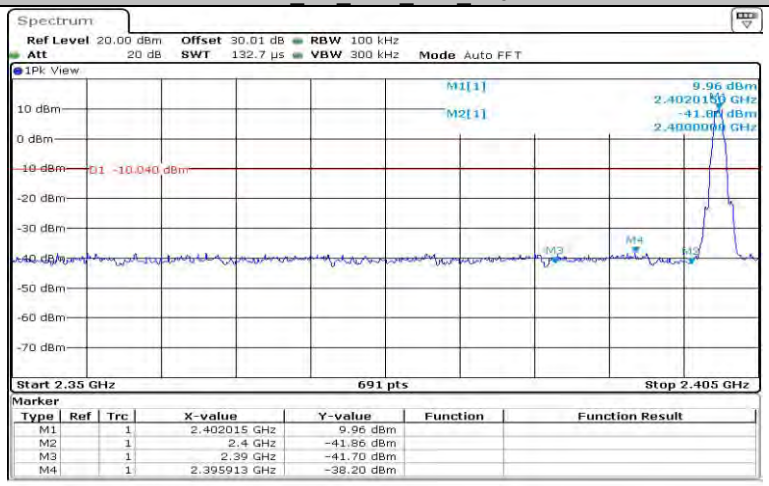
BLE_2M_Ant1_2480



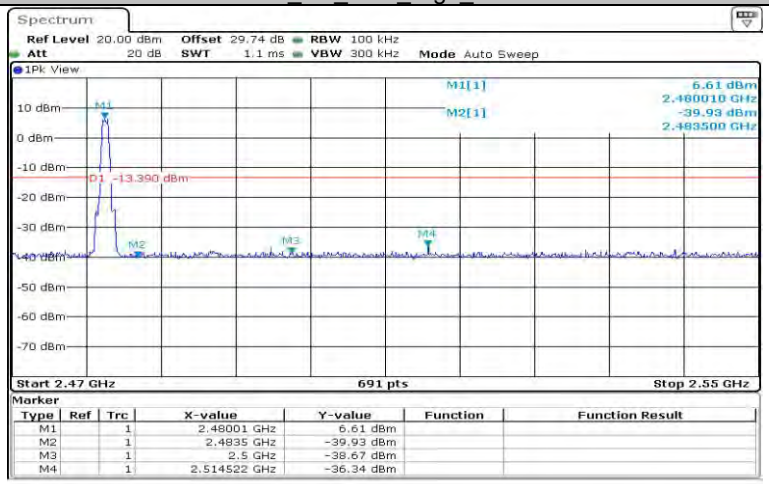
Appendix E: Band edge measurements

Test Graphs

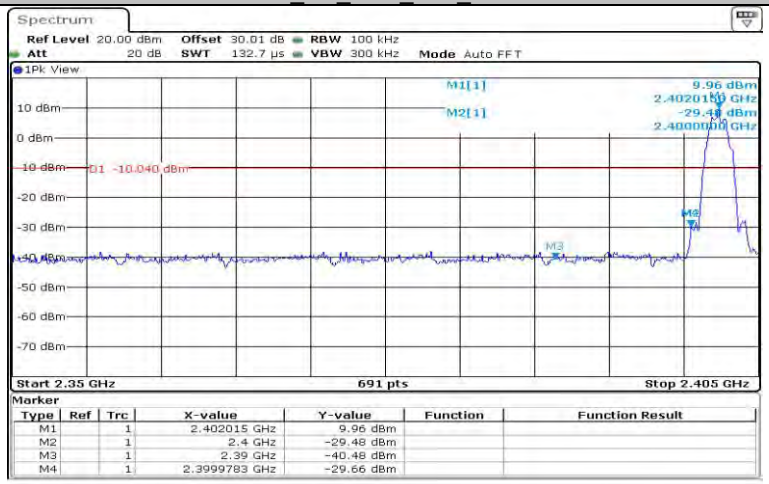
BLE_1M_Ant1_Low_2402



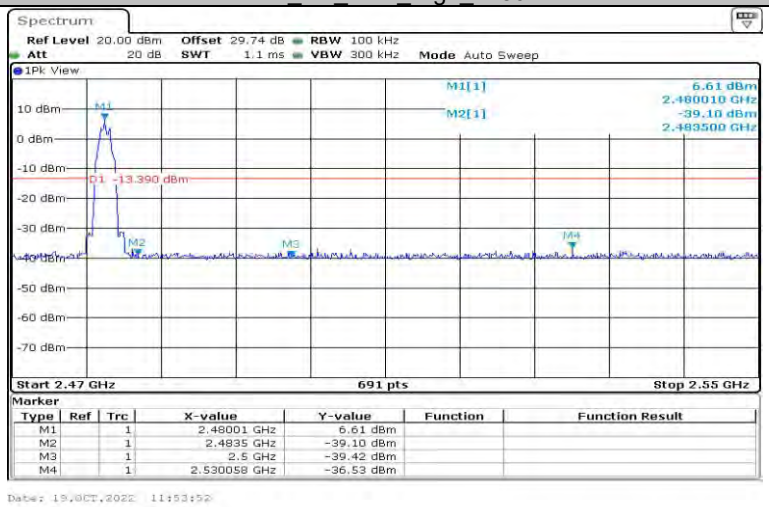
BLE_1M_Ant1_High_2480



BLE_2M_Ant1_Low_2402



BLE_2M_Ant1_High_2480



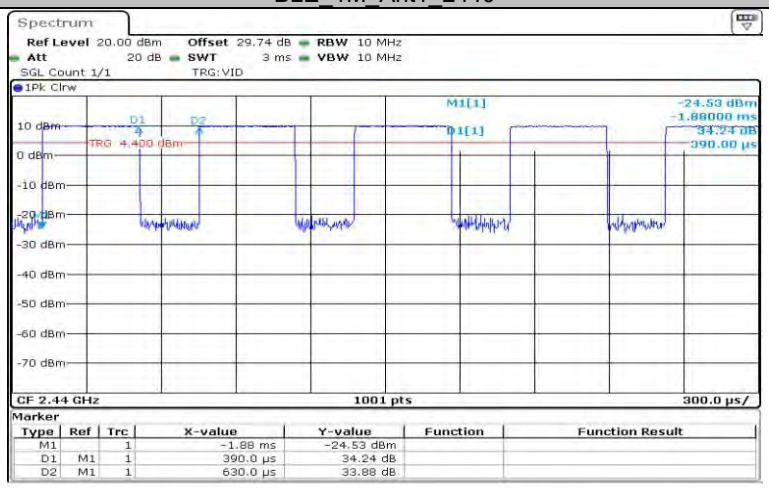
Appendix F: Duty Cycle

Test Result

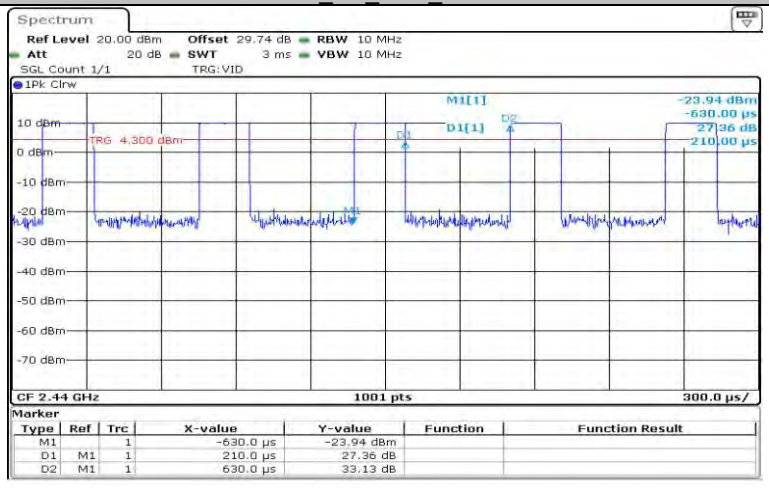
Test Mode	Antenna	Channel	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
BLE_1M	Ant1	2440	0.39	0.63	61.90	2.08	2.56
BLE_2M	Ant1	2440	0.21	0.63	33.33	4.77	4.76

Test Graphs

BLE_1M_Ant1_2440



BLE_2M_Ant1_2440



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