TEST REPORT

Applicant Name :	Shanghai ABXY Tech Co., Ltd.
Address :	5F, Building 11, No.6055 Jinhai Highway, Fengxian District, Shanghai
Report Number :	RA230523-28733E-RF-00B
FCC ID:	2BBMD-ABXYLUTE1

Test Standard (s)

FCC Part 15.247

Sample Description

Product:	Handheld Game Console
Tested Model:	abxylute_one
Trade Mark:	abxylute
Date Received:	2023-05-23
Date of Test:	2023-06-03 to 2023-06-15
Report Date:	2023-06-15

Test Result:	Pass*

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

Prepared and Checked By:

Roger.Ling

Roger.Ling
EMC Engineer

Approved By:

Candy. Li

Candy Li
EMC Engineer

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

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230523-28733E-RF-00B	Original Report	2023-06-15

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Handheld Game Console		
Tested Model	abxylute_one		
Frequency Range	BLE 1M/2M: 2402-2480MHz Wi-Fi: 2412-2462MHz		
Maximum Conducted Peak Output Power	BLE:4.62dBm		
Maximum Conducted Average Output Power	Wi-Fi		
	17.64dBm(802.11b)	16.23dBm(802.11n20)	
	17.28dBm(802.11g)	16.25dBm(802.11n40)	
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM		
Antenna Specification*	Internal Antenna (provided by the applicant)		
	BLE: 1.69dBi	WIFI ANT1: 1.17dBi	WIFI ANT2: 1.05dBi
Voltage Range	DC 3.87V from battery or DC 5V from USB port		
Sample serial number	264K-5 (CE&RE), 264K-1 (RF Conducted Test) (assigned by ATC, Shenzhen)		
Sample/EUT Status	Good condition		

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.

Measurement Uncertainty

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		2.74dB
Emissions, Radiated	30MHz - 1GHz	5.08dB
	1GHz - 18GHz	4.96dB
	18GHz - 26.5GHz	5.16dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

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

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 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 4297.01.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 30241.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

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

802.11b, 802.11g and 802.11n-HT20 mode was tested with Channel 1, 6 and 11.
802.11n-HT40 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
…	…	…	…
…	…	…	…
…	…	…	…
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

Special Accessories

N/A

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"adb command*" was used during testing and power level as below, which provided by manufacturer.

Mode	Data Rate (Mbps)	Power Level*
802.11 b	1	17
802.11 g	6	17
802.11 n20	MCS0	17
802.11 n40	MCS0	17
BLE	1M/2M	Default

The worse-case data rates are determined to be as above for each mode based upon investigations by measuring the output power and PSD across all data rates, bandwidths and modulations.

EUT have two antennas and support MIMO transmit for Wi-Fi mode, the SISO/MIMO have same parameter setting, the worst case MIMO was recorded in report.

The two antenna ports have same power level setting.

Duty cycle

Test Result: Compliant. Please refer to the Appendix Wi-Fi and Appendix BLE.

Support Equipment List and Details

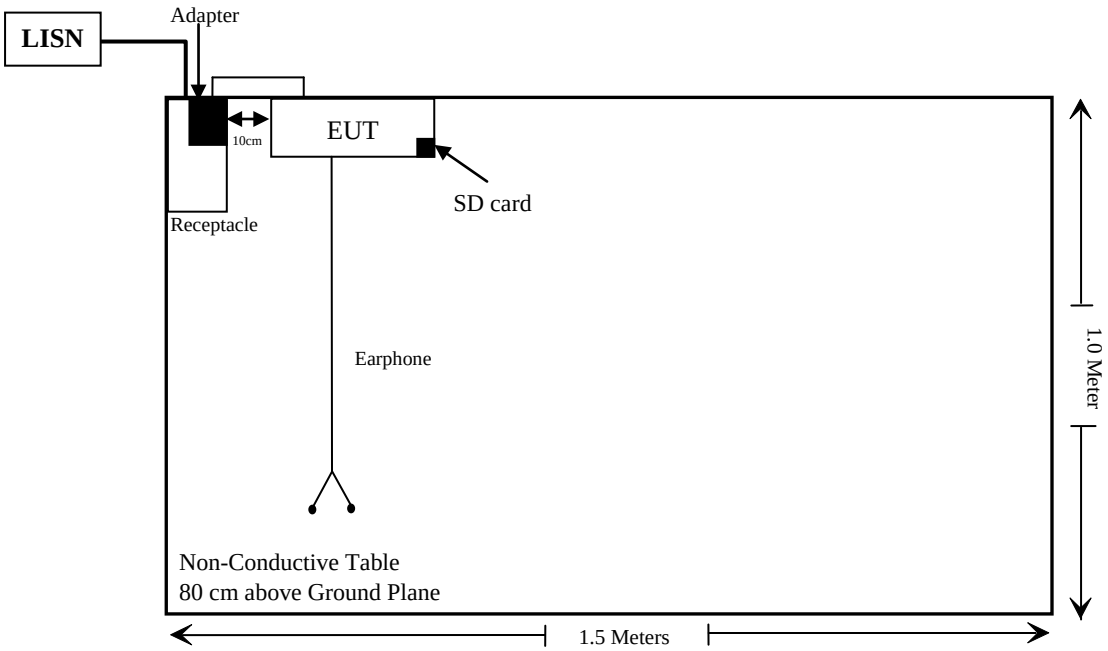
Manufacturer	Description	Model	Serial Number
Hisense	Adapter	E010-1D050200VCU	Unknown
SCI	Earphone	SCRC-130A	Unknown
Kingston	SD card	32GB	Unknown

External I/O Cable

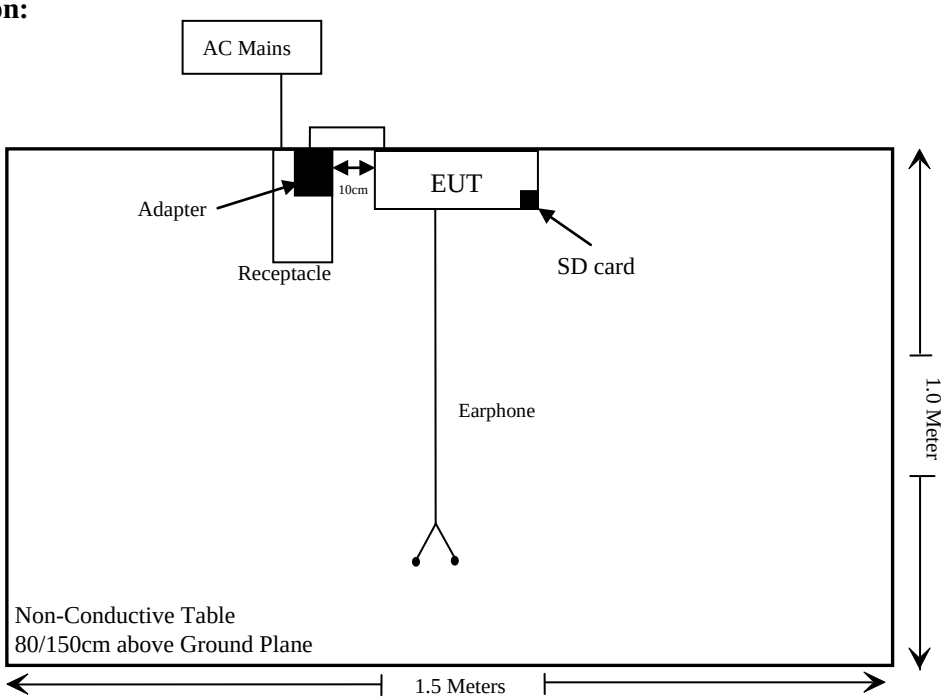
Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	0.8	EUT	Adapter
Un-shielding Detachable Earphone Cable	0.8	EUT	Earphone

Block Diagram of Test Setup

For Conducted Emission:



For Radiated Emission:



Note: the support table edge was flush with the center of turntable.

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 & §2.1093	RF Exposure	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

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission 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 191218 (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	9163-194	2023/02/14	2026/02/13
Schwarzbeck	Horn Antenna	BBHA9120D	837	2023/02/22	2026/02/21
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2022/12/26	2025/12/25
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
Radiated Emission Test Software: e3 191218 (V9)					
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2022/11/25	2023/11/24
Agilent	Power Sensor	U2021XA	MY5425003	2023/02/25	2024/02/24
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	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	

*** 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) (1) &§2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Test Result:

For worst case:

Mode	Frequency (MHz)	Maximum Tune-up power		Calculated Distance (mm)	Calculated Value	Threshold (1-g SAR)	SAR Test Exclusion
		(dBm)	(mW)				
BLE	2402-2480	5.0	3.16	5	1.0	3.0	Yes

Result: No Standalone SAR test is required

For Wi-Fi mode, please refer to the SAR report: RA230523-28733E-SA.

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.
c. 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

The EUT has one antenna arrangement for BLE and two antennas arrangement for 2.4G Wi-Fi, which were permanently attached to the EUT, fulfill the requirement of this section. Please refer to the EUT photos.

Mode	Antenna gain
BLE	1.69dBi
2.4G WIFI	1.17dBi (Ant1) & 1.05dBi (Ant2)

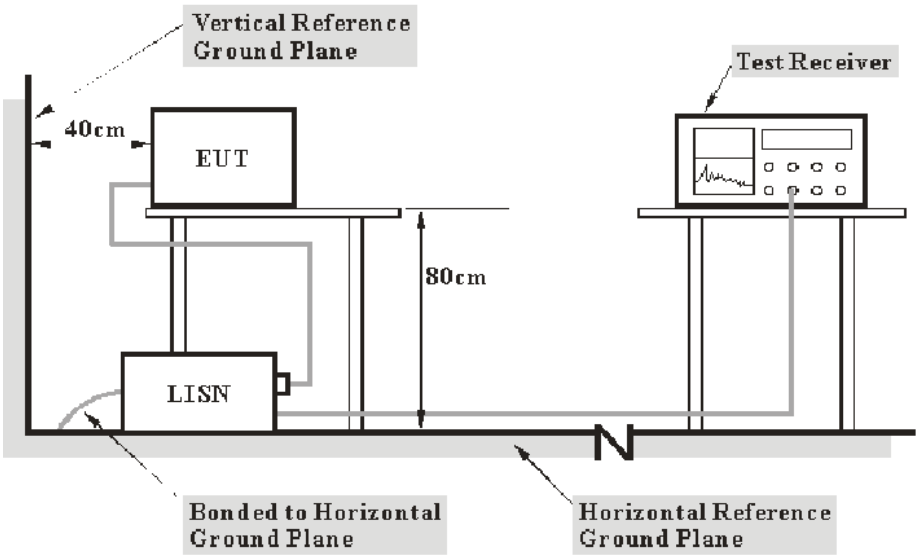
Result: Compliant.

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.

Calculation

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

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

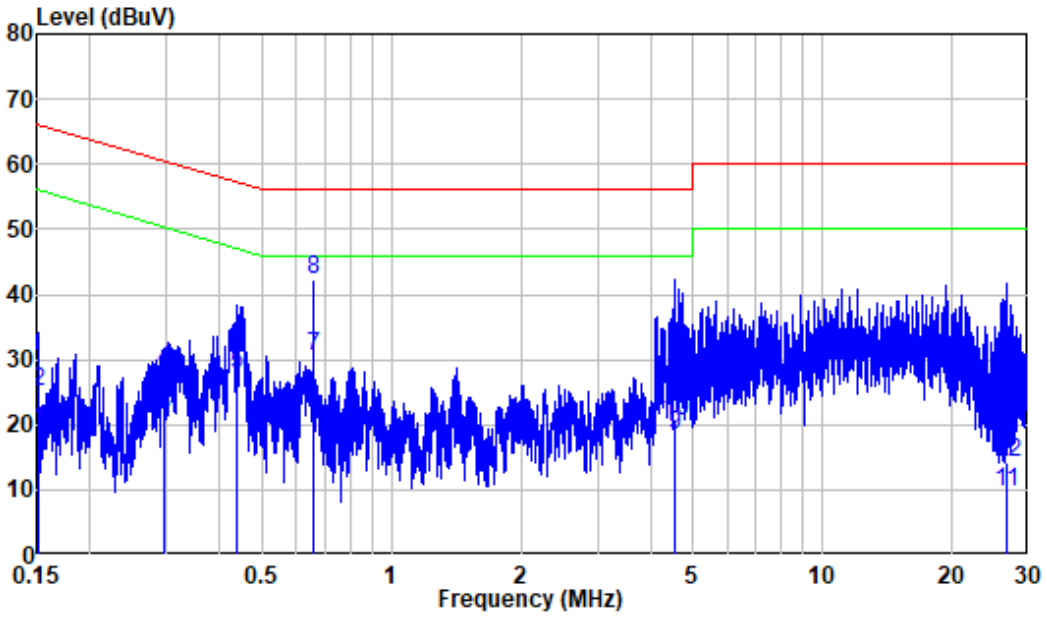
Environmental Conditions

Temperature:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Jerry Wu on 2023-05-31.

EUT operation mode: Transmitting (Pre-scan plots all modes, worst case 2.4G WIFI 802.11g, low channel)

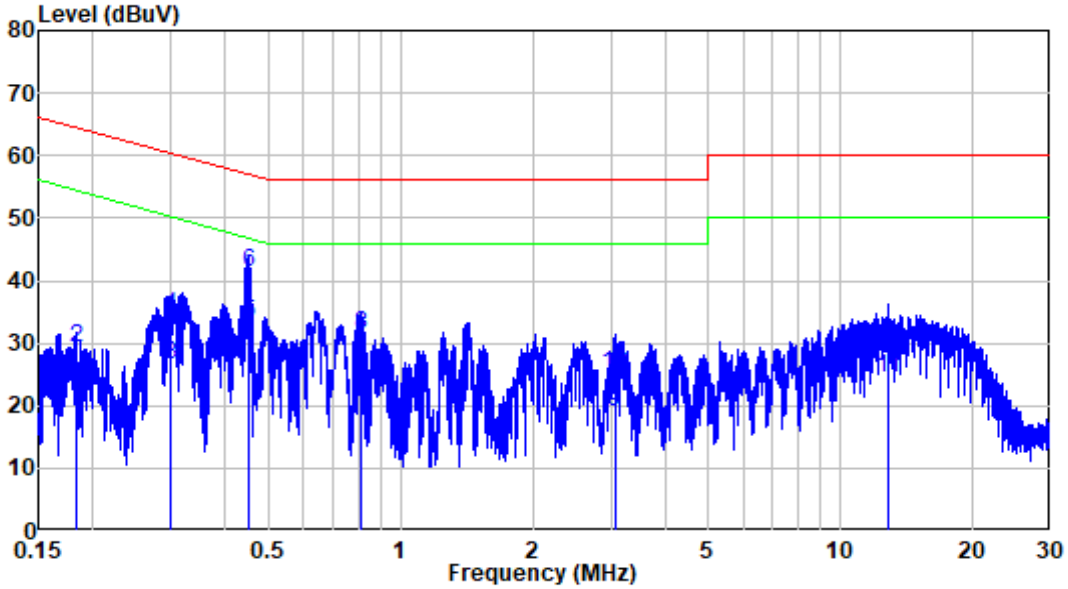
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : RA230523-28733E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.151	10.37	8.64	19.01	55.92	-36.91	Average
2	0.151	10.37	14.76	25.13	65.92	-40.79	QP
3	0.298	10.40	11.11	21.51	50.31	-28.80	Average
4	0.298	10.40	17.99	28.39	60.31	-31.92	QP
5	0.438	10.52	17.31	27.83	47.09	-19.26	Average
6	0.438	10.52	20.21	30.73	57.09	-26.36	QP
7	0.656	10.65	19.98	30.63	46.00	-15.37	Average
8	0.656	10.65	31.50	42.15	56.00	-13.85	QP
9	4.525	10.55	7.86	18.41	46.00	-27.59	Average
10	4.525	10.55	10.01	20.56	56.00	-35.44	QP
11	26.770	10.19	-0.55	9.64	50.00	-40.36	Average
12	26.770	10.19	4.04	14.23	60.00	-45.77	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : RA230523-28733E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.183	10.28	11.07	21.35	54.34	-32.99	Average
2	0.183	10.28	18.90	29.18	64.34	-35.16	QP
3	0.300	10.35	16.30	26.65	50.25	-23.60	Average
4	0.300	10.35	24.04	34.39	60.25	-25.86	QP
5	0.450	10.45	22.65	33.10	46.88	-13.78	Average
6	0.450	10.45	30.82	41.27	56.88	-15.61	QP
7	0.813	10.42	12.59	23.01	46.00	-22.99	Average
8	0.813	10.42	20.90	31.32	56.00	-24.68	QP
9	3.064	10.53	8.60	19.13	46.00	-26.87	Average
10	3.064	10.53	14.53	25.06	56.00	-30.94	QP
11	12.843	10.38	14.02	24.40	50.00	-25.60	Average
12	12.843	10.38	18.07	28.45	60.00	-31.55	QP

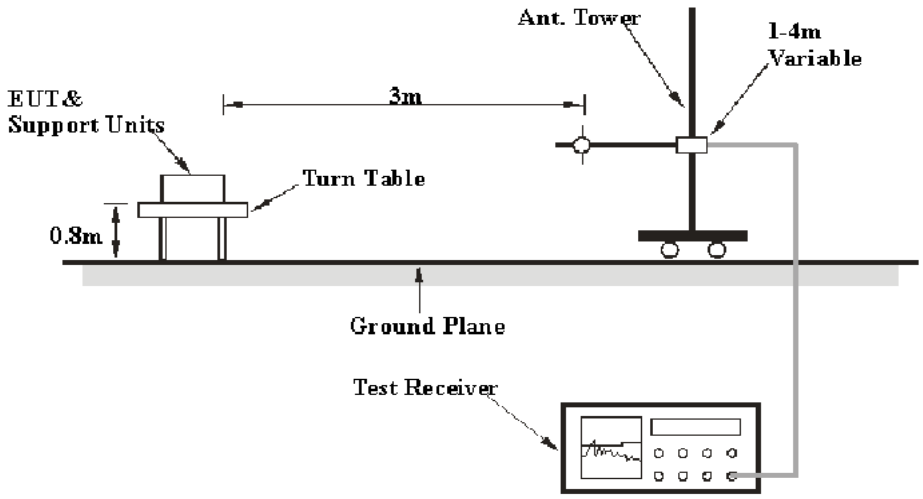
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

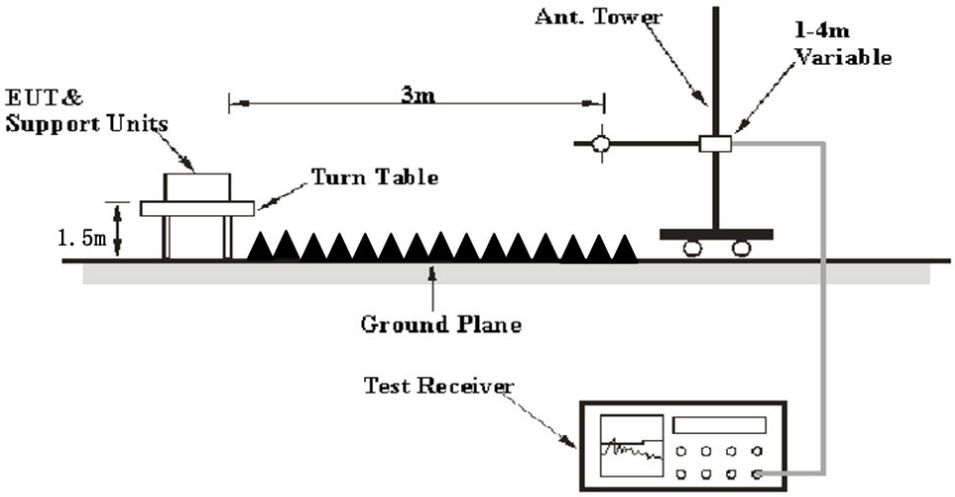
FCC §15.247 (d); §15.209; §15.205;

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%

If the maximized peak measured value complies with the limit, then it is unnecessary to perform QP/Average measurement.

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

Temperature:	23-24 ℃
Relative Humidity:	52-56 %
ATM Pressure:	101.0 kPa

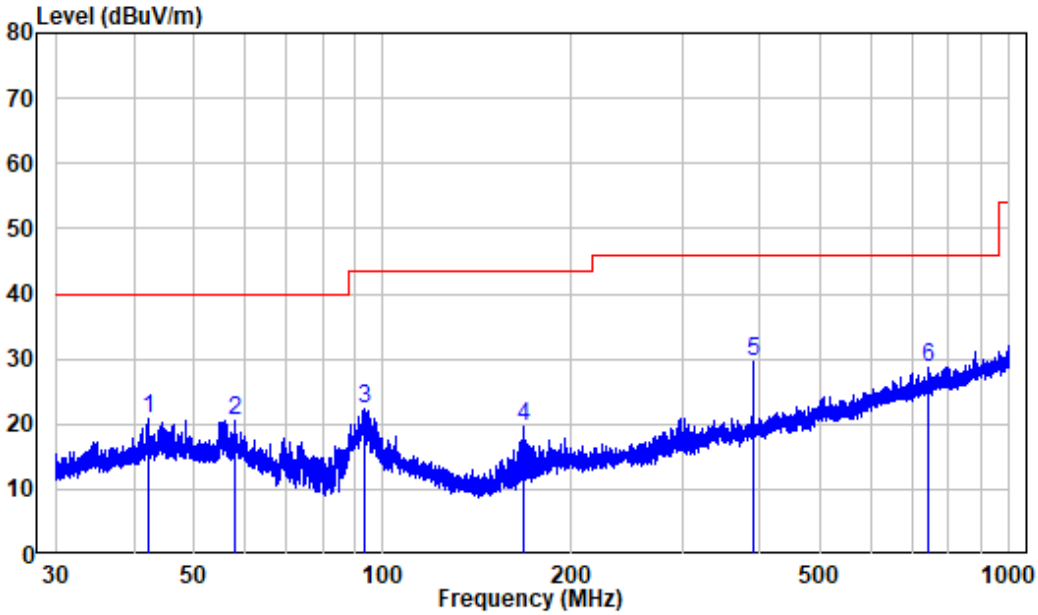
The Below 1G testing was performed by Jason Liu on 2023-06-12.
The Above 1G testing was performed by Jimi Zheng on 2023-06-01 for 2.4G WIFI.
The Above 1G testing was performed by Jeef Huang on 2023-06-03 for BLE.

EUT operation mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

30MHz-1GHz:

Worst case 2.4G WIFI 802.11g, low channel

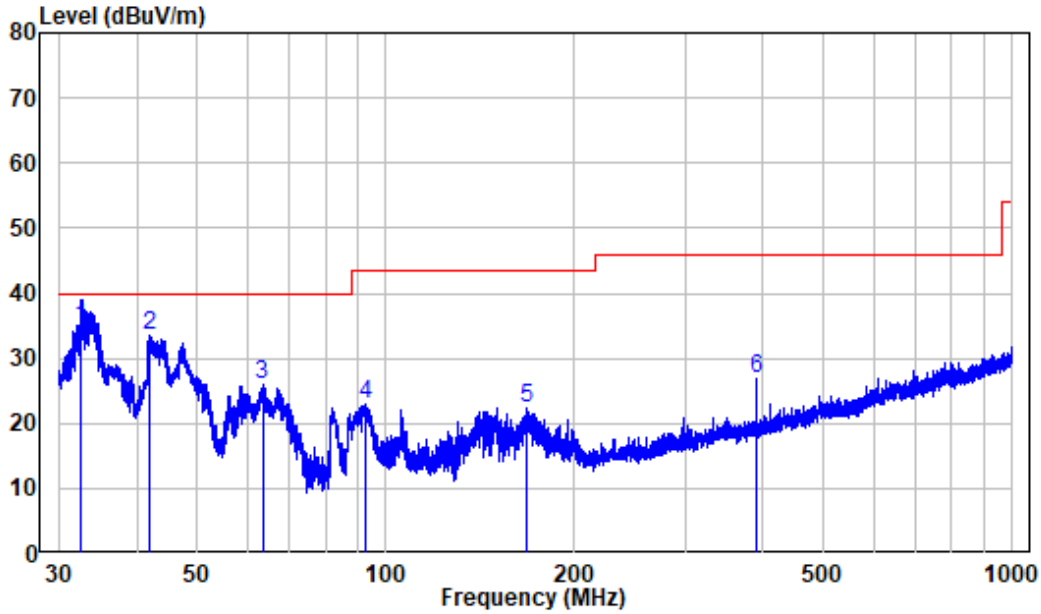
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230523-28733E-RF
Test Mode: 2.4G WIFI Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	42.358	-10.00	30.82	20.82	40.00	-19.18	Peak
2	58.050	-9.92	30.58	20.66	40.00	-19.34	Peak
3	93.481	-12.86	35.16	22.30	43.50	-21.20	Peak
4	167.530	-13.84	33.60	19.76	43.50	-23.74	Peak
5	390.038	-6.89	36.60	29.71	46.00	-16.29	Peak
6	740.634	-0.80	29.56	28.76	46.00	-17.24	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA230523-28733E-RF
Test Mode: 2.4G WIFI Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	32.648	-12.07	46.80	34.73	40.00	-5.27	QP
2	41.786	-10.06	43.44	33.38	40.00	-6.62	Peak
3	63.480	-11.96	37.78	25.82	40.00	-14.18	Peak
4	92.625	-13.11	36.11	23.00	43.50	-20.50	Peak
5	167.971	-13.78	36.22	22.44	43.50	-21.06	Peak
6	390.038	-6.89	33.65	26.76	46.00	-19.24	Peak

1-25 GHz:

BLE:

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
1M, Low Channel									
2310	46.89	PK	211	1.4	H	-10.32	36.57	74	-37.43
2310	46.31	PK	46	1.4	V	-10.32	35.99	74	-38.01
2390	47.25	PK	270	1.0	H	-10.62	36.63	74	-37.37
2390	46.61	PK	177	1.9	V	-10.62	35.99	74	-38.01
4804	49.61	PK	111	2.2	H	-5.58	44.03	74	-29.97
4804	47.73	PK	98	1.9	V	-5.58	42.15	74	-31.85
1M, Middle Channel									
4880	47.9	PK	284	2.0	H	-5.23	42.67	74	-31.33
4880	47.88	PK	59	1.4	V	-5.23	42.65	74	-31.35
1M, High Channel									
2483.5	47.53	PK	331	2.1	H	-10.46	37.07	74	-36.93
2483.5	47.24	PK	16	1.1	V	-10.46	36.78	74	-37.22
2500	46.14	PK	60	1.2	H	-10.32	35.82	74	-38.18
2500	47.02	PK	202	2.2	V	-10.32	36.7	74	-37.3
4960	47.79	PK	183	1.1	H	-4.90	42.89	74	-31.11
4960	47.92	PK	64	1.0	V	-4.90	43.02	74	-30.98
2M, Low Channel									
2310	46.7	PK	211	1.4	H	-10.32	36.38	74	-37.62
2310	46.27	PK	46	1.4	V	-10.32	35.95	74	-38.05
2390	46.14	PK	270	1.0	H	-10.62	35.52	74	-38.48
2390	46.35	PK	177	1.9	V	-10.62	35.73	74	-38.27
4804	47.41	PK	111	2.2	H	-5.58	41.83	74	-32.17
4804	47.39	PK	98	1.9	V	-5.58	41.81	74	-32.19
2M, Middle Channel									
4880	47.82	PK	284	2.0	H	-5.23	42.59	74	-31.41
4880	47.18	PK	59	1.4	V	-5.23	41.95	74	-32.05
2M, High Channel									
2483.5	46.1	PK	331	2.1	H	-10.46	35.64	74	-38.36
2483.5	47.35	PK	16	1.1	V	-10.46	36.89	74	-37.11
2500	46.98	PK	60	1.2	H	-10.32	36.66	74	-37.34
2500	46.88	PK	202	2.2	V	-10.32	36.56	74	-37.44
4960	46.99	PK	183	1.1	H	-4.90	42.09	74	-31.91
4960	46.73	PK	64	1.0	V	-4.90	41.83	74	-32.17

Wi-Fi:

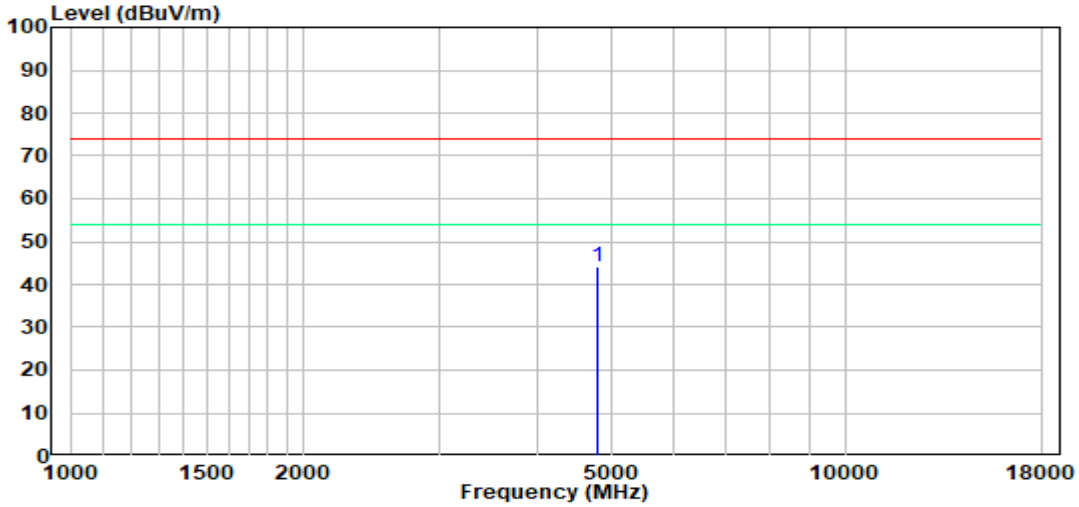
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	55.86	PK	211	1.4	H	-10.32	45.54	74	-28.46
2310	56.48	PK	46	1.4	V	-10.32	46.16	74	-27.84
2390	56.61	PK	270	1.0	H	-10.62	45.99	74	-28.01
2390	56.46	PK	111	2.2	V	-10.62	45.84	74	-28.16
4824	47.56	PK	85	1.8	H	-5.55	42.01	74	-31.99
4824	49.47	PK	59	1.4	V	-5.55	43.92	74	-30.08
802.11B, Middle Channel									
4874	47.21	PK	16	1.1	H	-5.29	41.92	74	-32.08
4874	46	PK	202	2.2	V	-5.29	40.71	74	-33.29
802.11B, High Channel									
2483.5	55.78	PK	64	1.0	H	-10.46	45.32	74	-28.68
2483.5	56.33	PK	327	1.1	V	-10.46	45.87	74	-28.13
2500	55.72	PK	121	2.0	H	-10.32	45.40	74	-28.6
2500	56.4	PK	6	2.0	V	-10.32	46.08	74	-27.92
4924	46.74	PK	266	1.9	H	-5.03	41.71	74	-32.29
4924	46.52	PK	240	1.9	V	-5.03	41.49	74	-32.51
802.11G, Low Channel									
2310	55.43	PK	332	1.3	H	-10.32	45.11	74	-28.89
2310	56.27	PK	340	1.1	V	-10.32	45.95	74	-28.05
2390	55.62	PK	313	2.1	H	-10.62	45.00	74	-29
2390	56.32	PK	112	1.7	V	-10.62	45.70	74	-28.3
4824	47.05	PK	353	1.3	H	-5.55	41.50	74	-32.5
4824	47.67	PK	322	1.4	V	-5.55	42.12	74	-31.88
802.11G, Middle Channel									
4874	47.88	PK	157	1.6	H	-5.29	42.59	74	-31.41
4874	47.34	PK	198	1.4	V	-5.29	42.05	74	-31.95
802.11G, High Channel									
2483.5	56.96	PK	198	1.4	H	-10.46	46.50	74	-27.5
2483.5	55.7	PK	237	1.7	V	-10.46	45.24	74	-28.76
2500	55.55	PK	357	1.3	H	-10.32	45.23	74	-28.77
2500	56.22	PK	357	1.3	V	-10.32	45.90	74	-28.1
4924	46.56	PK	162	1.6	H	-5.03	41.53	74	-32.47
4924	47.28	PK	246	2.0	V	-5.03	42.25	74	-31.75
802.11N20, Low Channel									
2310	56.91	PK	112	1.7	H	-10.32	46.59	74	-27.41
2310	56.23	PK	5	2.2	V	-10.32	45.91	74	-28.09
2390	56.04	PK	353	1.3	H	-10.62	45.42	74	-28.58
2390	55.75	PK	110	1.8	V	-10.62	45.13	74	-28.87
4824	47.04	PK	157	1.6	H	-5.55	41.49	74	-32.51
4824	47.82	PK	128	2.1	V	-5.55	42.27	74	-31.73

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
802.11N20, Middle Channel									
4874	46.97	PK	55	1.1	H	-5.29	41.68	74	-32.32
4874	46.32	PK	237	1.7	V	-5.29	41.03	74	-32.97
802.11N20, High Channel									
2483.5	55.83	PK	237	1.7	H	-10.46	45.37	74	-28.63
2483.5	55.77	PK	162	1.6	V	-10.46	45.31	74	-28.69
2500	55.68	PK	246	2.0	H	-10.32	45.36	74	-28.64
2500	55.52	PK	246	2.0	V	-10.32	45.20	74	-28.8
4924	46.07	PK	109	1.5	H	-5.03	41.04	74	-32.96
4924	47.93	PK	61	2.2	V	-5.03	42.90	74	-31.1
802.11N40, Low Channel									
2310	56.31	PK	263	2.1	H	-10.32	45.99	74	-28.01
2310	54.93	PK	171	1.1	V	-10.32	44.61	74	-29.39
2390	55.35	PK	263	2.1	H	-10.62	44.73	74	-29.27
2390	55.59	PK	268	1.9	V	-10.62	44.97	74	-29.03
4844	46.95	PK	225	1.8	H	-5.52	41.43	74	-32.57
4844	46.99	PK	298	1.1	V	-5.52	41.47	74	-32.53
802.11N40, Middle Channel									
4874	45.97	PK	69	1.9	H	-5.29	40.68	74	-33.32
4874	46.78	PK	22	1.8	V	-5.29	41.49	74	-32.51
802.11N40, High Channel									
2483.5	55.6	PK	71	1.8	H	-10.46	45.14	74	-28.86
2483.5	55.87	PK	171	1.4	V	-10.46	45.41	74	-28.59
2500	55.61	PK	13	1.8	H	-10.32	45.29	74	-28.71
2500	56.21	PK	223	2.0	V	-10.32	45.89	74	-28.11
4904	46.26	PK	64	1.7	H	-5.05	41.21	74	-32.79
4904	46.6	PK	46	1.8	V	-5.05	41.55	74	-32.45

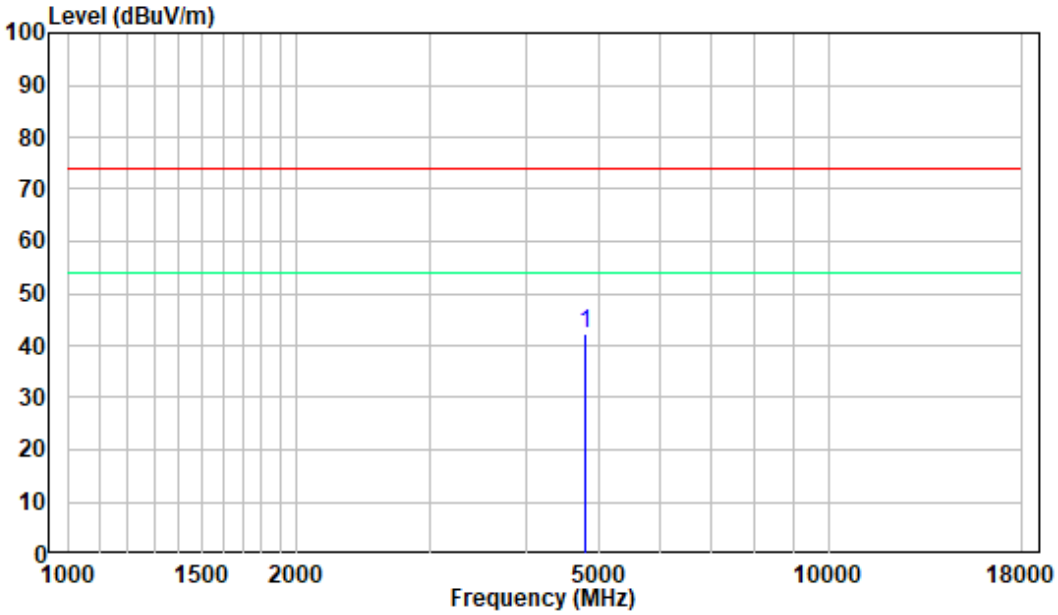
Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Factor + Reading
Margin = Corrected Amplitude – Limit
The other spurious emission which is in the noise floor level was not recorded.
For above 1GHz, the test result of peak was 20dB below to the limit of peak, which can be compliant to the average limit, so just peak value was recorded.

1-18 GHz: (Pre-scan plots)

BLE 1M Low channel (Worst case)
Horizontal

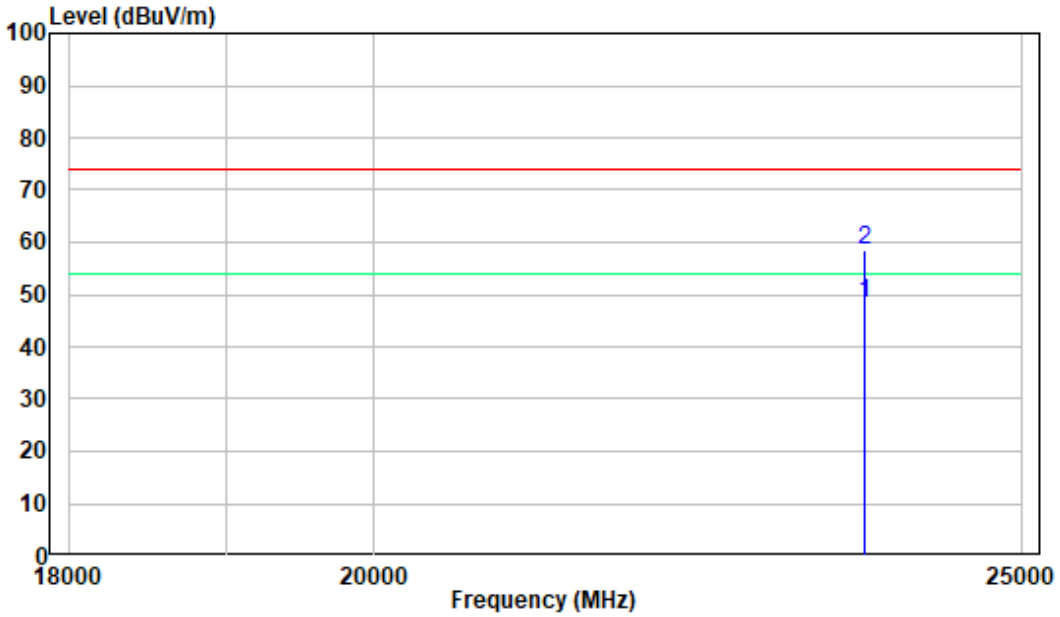


Vertical

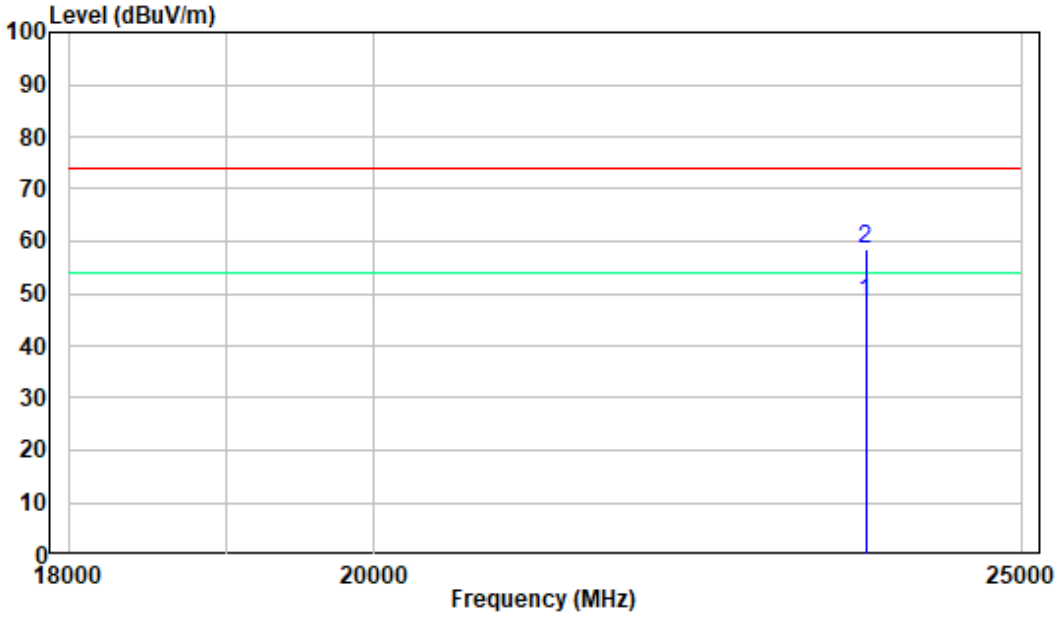


18 -25GHz: (Pre-scan plots)

BLE 1M Low channel (Worst case)
Horizontal



Vertical



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

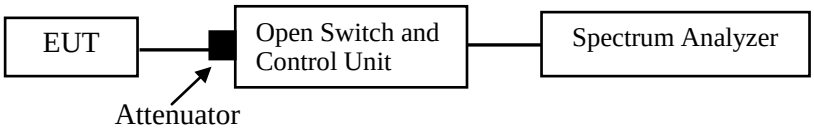
Applicable Standard

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

According to ANSI C63.10-2013, section 11.8 and section 6.9

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.



Test Data

Environmental Conditions

Temperature:	23-25℃
Relative Humidity:	46-49%
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang from 2023-06-03 to2023-06-09.

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

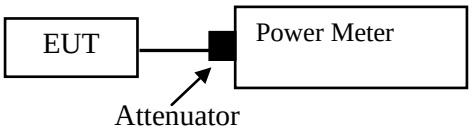
According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted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

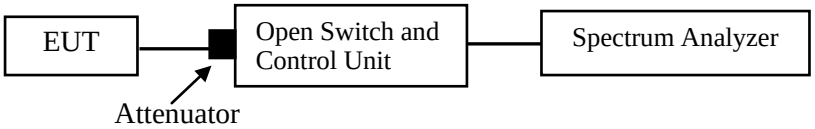
According to ANSI C63.10-2013, section 11.9.1.1 for BLE mode
According to ANSI C63.10-2013, section 11.9.2.3.2 for Wi-Fi mode

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

Temperature:	23-25°C
Relative Humidity:	46-49%
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang from 2023-06-03 to2023-06-09.

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

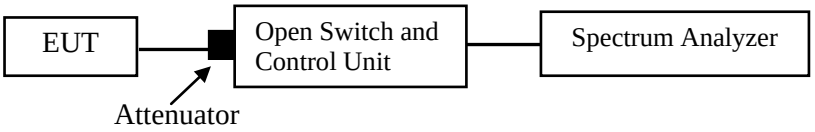
Applicable Standard

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

According to ANSI C63.10-2013, section 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.



Test Data

Environmental Conditions

Temperature:	23-25℃
Relative Humidity:	46-49%
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang from 2023-06-03 to2023-06-09.

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

According to ANSI C63.10-2013, section 11.10.2

Method PKPSD (peak PSD)

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ [3 × RBW].
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

According to ANSI C63.10-2013, section 11.10.3

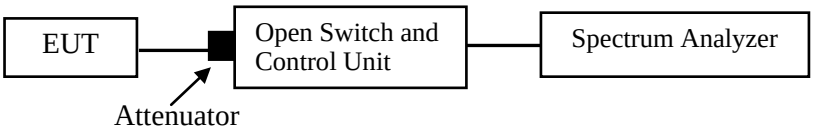
Method AVGPSD-1: (for duty cycle ≥ 98%)

1. Use this procedure when the maximum conducted average output power in the fundamental emission is used to demonstrate compliance and with continuous transmission (or at least 98% duty cycle).
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to at least 1.5 times the OBW.
5. Detector = power averaging (rms) or sample detector (when rms not available).
6. Sweep time = auto couple.
7. Ensure that the number of measurement points in the sweep ≥ [2 · span / RBW].
8. Employ trace averaging (rms) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds requirement specified by regulatory agency, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

According to ANSI C63.10-2013, section 11.10.5

Method AVGPSD-2: (for duty cycle < 98% and constant duty cycle)

1. Use this procedure when the maximum conducted average output power in the fundamental emission is used to demonstrate compliance and the continuous transmission (or at least 98% duty cycle) cannot be achieved but exhibit a constant duty cycle during the measurement duration.
2. Measure the duty cycle (D) of the transmitter output signal as described in C63.10-2013 Clause 11.6.
3. Set the RBW to: 3kHz≤ RBW≤100 kHz.
4. Set the VBW ≥ 3×RBW.
5. Set the span to at least 1.5 times the OBW.
6. Detector = power averaging (rms) or sample detector (when rms not available).
7. Sweep time = auto couple.
8. Ensure that the number of measurement points in the sweep ≥ [2 *span / RBW].
9. Do not use sweep triggering; allow sweep to “free run.”
10. Employ trace averaging (rms) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. Add [10 log (1 / D)], where D is the duty cycle measured in step 2), to the measured PSD to compute the average PSD during the actual transmission time.
13. If measured value exceeds requirement specified by regulatory agency, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).



Test Data

Environmental Conditions

Temperature:	23-25℃
Relative Humidity:	46-49%
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang from 2023-06-03 to2023-06-09.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi and Appendix BLE.

APPENDIX Wi-Fi

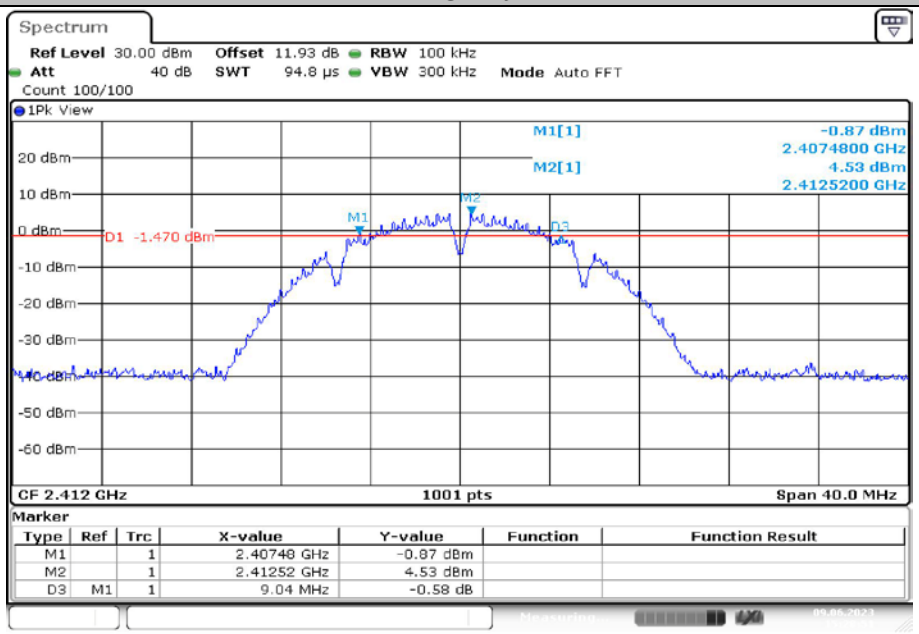
Appendix A: 6dB Emission Bandwidth

Test Result

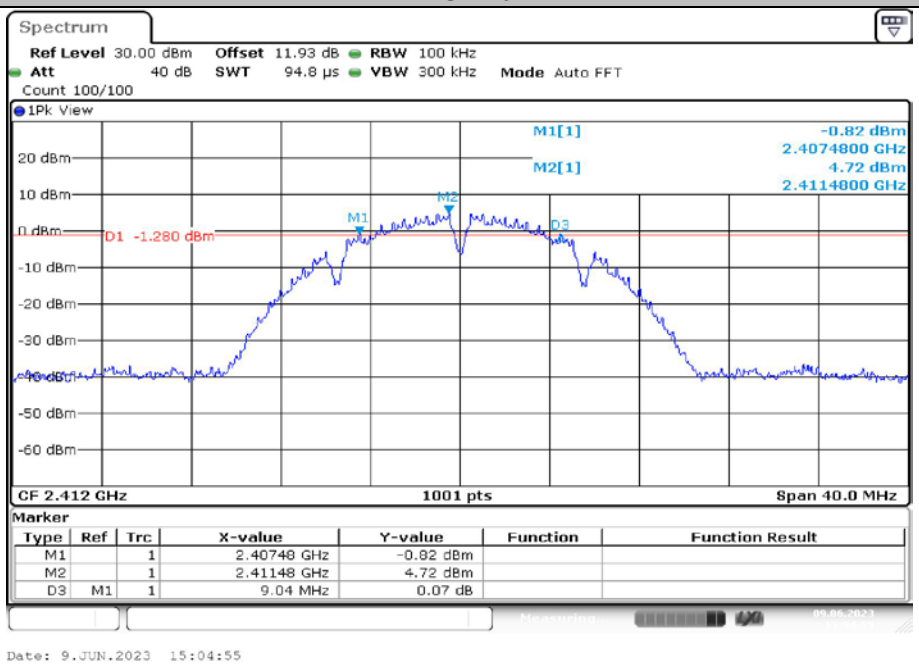
Test Mode	Channel	Antenna	DTS BW [MHz]	Limit[MHz]	Verdict
11B MIMO	2412	Ant1	9.04	0.5	PASS
		Ant2	9.04	0.5	PASS
	2437	Ant1	9.04	0.5	PASS
		Ant2	9.04	0.5	PASS
	2462	Ant1	9.04	0.5	PASS
		Ant2	9.04	0.5	PASS
11G MIMO	2412	Ant1	16.32	0.5	PASS
		Ant2	15.08	0.5	PASS
	2437	Ant1	15.08	0.5	PASS
		Ant2	15.12	0.5	PASS
	2462	Ant1	15.12	0.5	PASS
		Ant2	15.12	0.5	PASS
11N20 MIMO	2412	Ant1	15.72	0.5	PASS
		Ant2	15.12	0.5	PASS
	2437	Ant1	17.16	0.5	PASS
		Ant2	15.08	0.5	PASS
	2462	Ant1	16.32	0.5	PASS
		Ant2	14.20	0.5	PASS
11N40 MIMO	2422	Ant1	35.12	0.5	PASS
		Ant2	35.12	0.5	PASS
	2437	Ant1	35.12	0.5	PASS
		Ant2	35.12	0.5	PASS
	2452	Ant1	35.12	0.5	PASS
		Ant2	35.12	0.5	PASS

Test Graphs

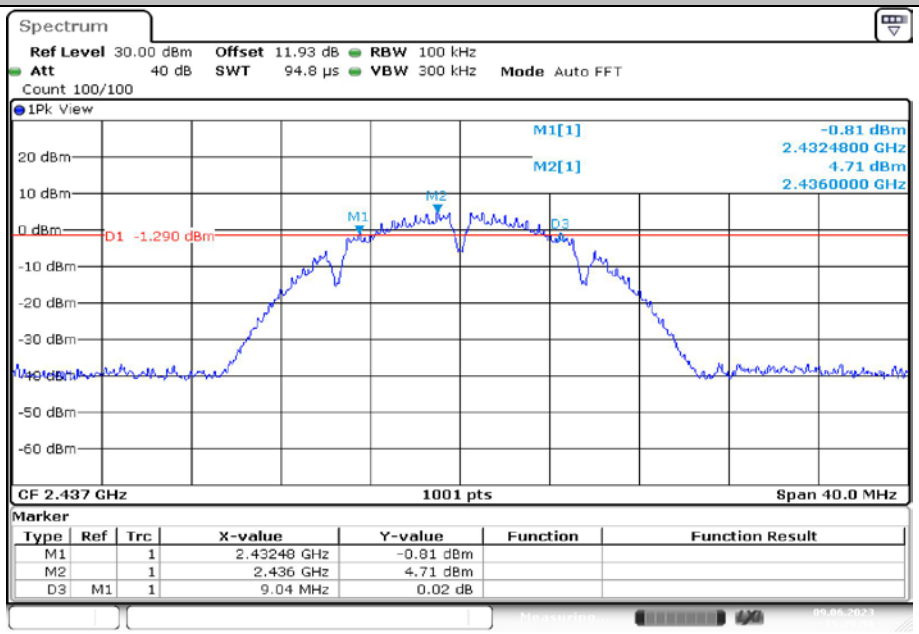
11B MIMO-Ant1-2412



11B MIMO-Ant2-2412



11B MIMO-Ant1-2437



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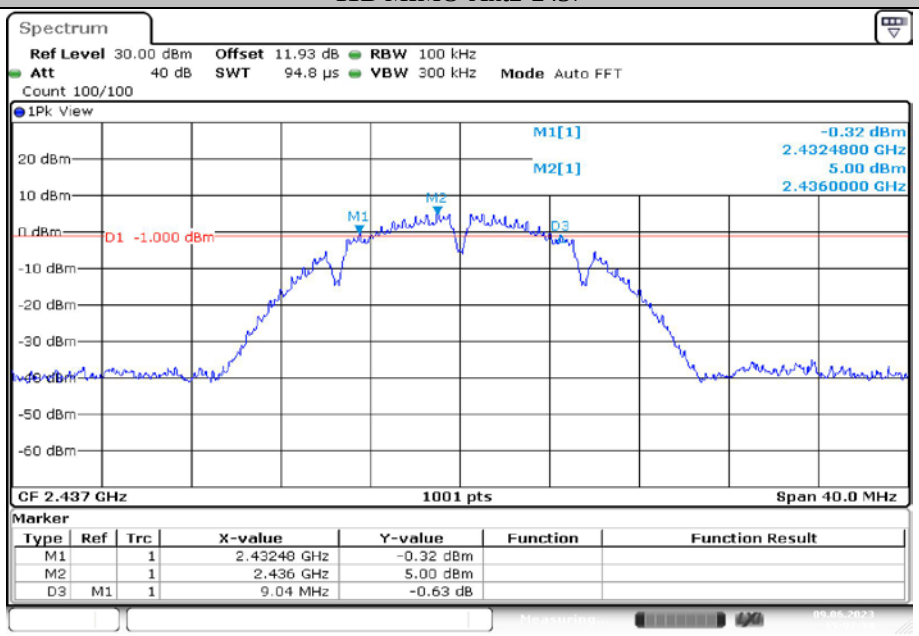
11B MIMO-Ant2-2437



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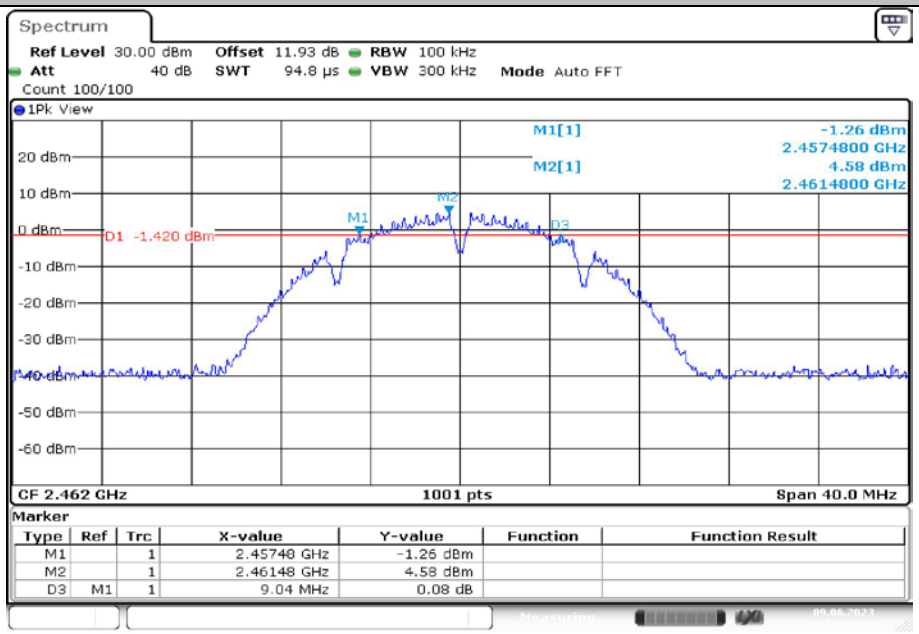
11B MIMO-Ant1-2462



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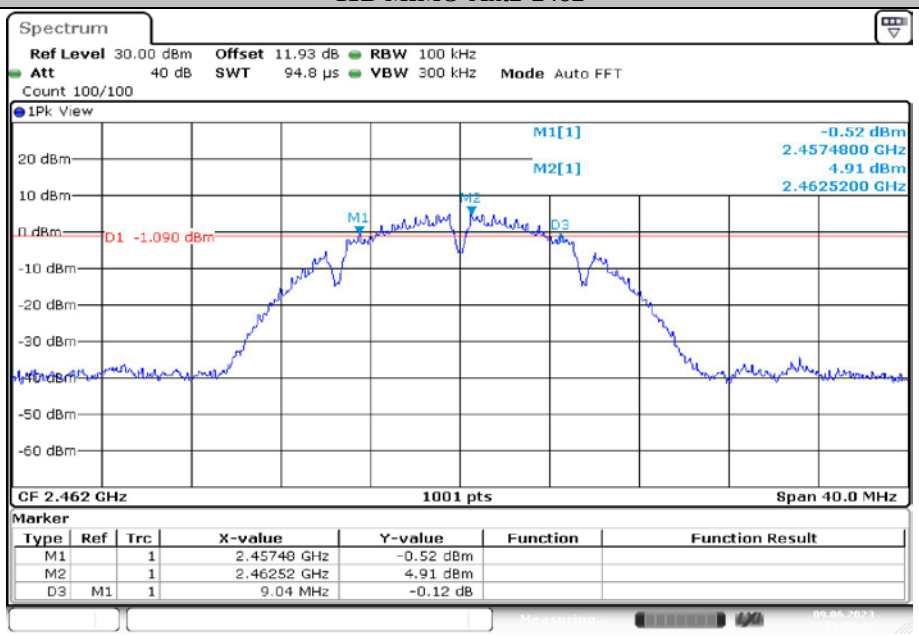

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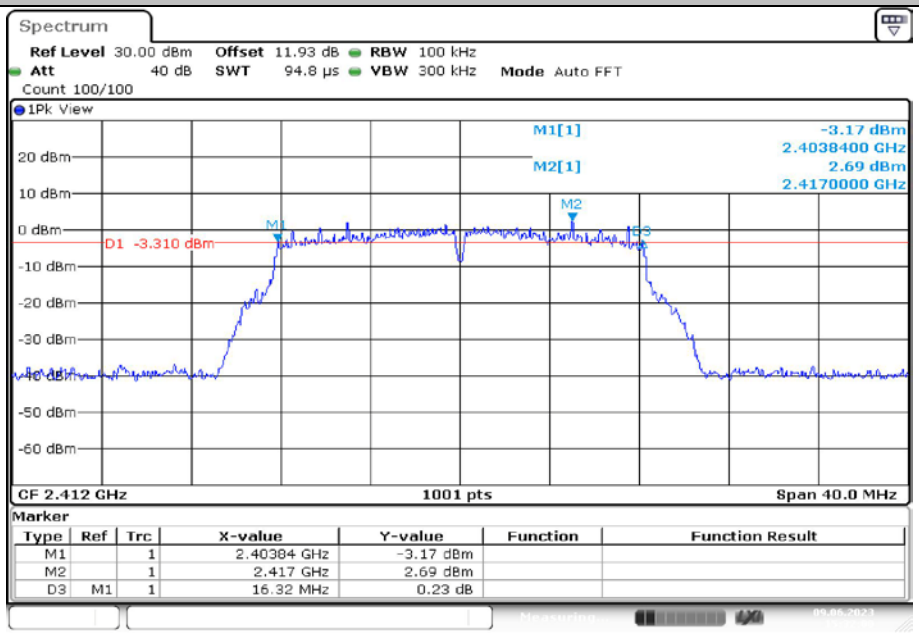
11G MIMO-Ant1-2412



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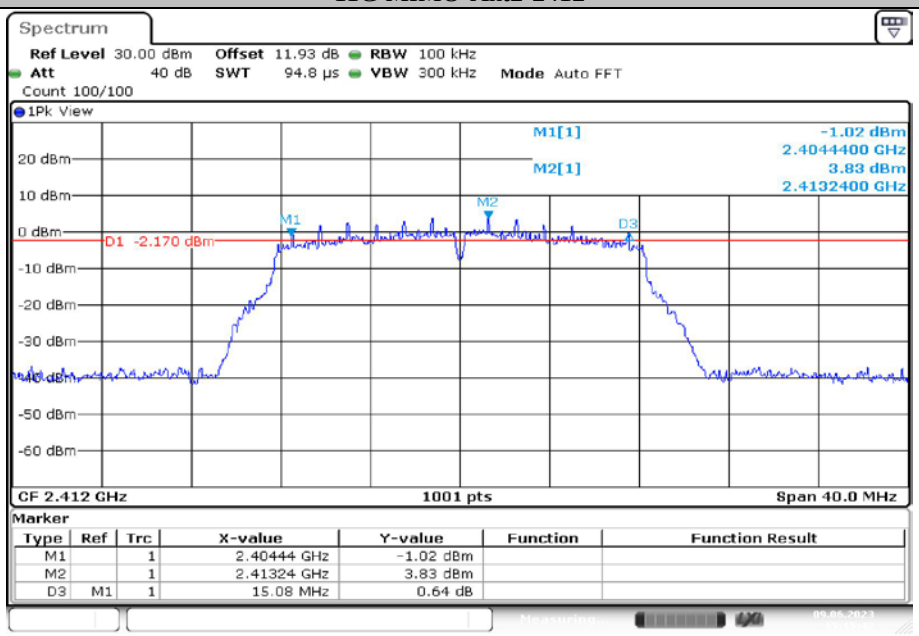

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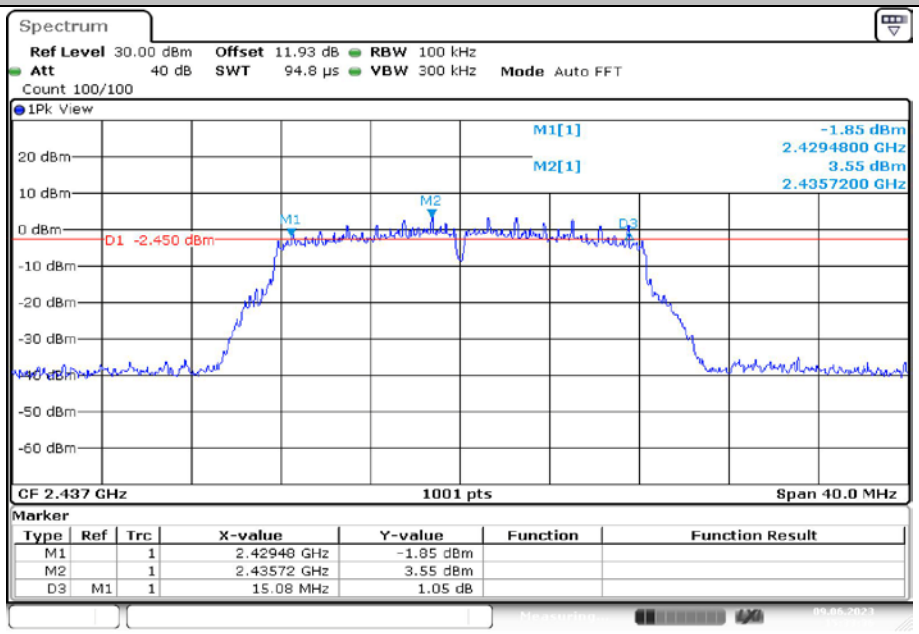

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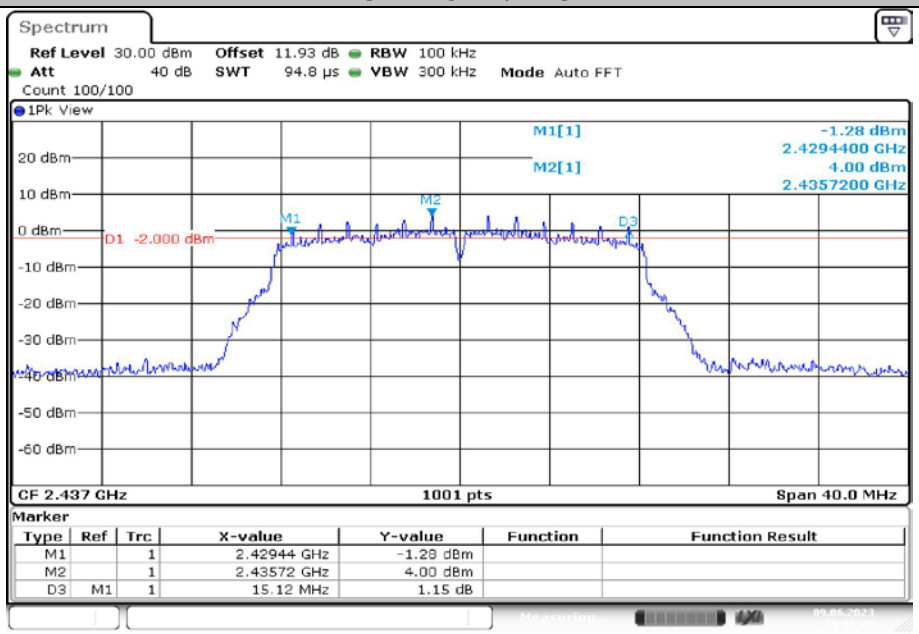

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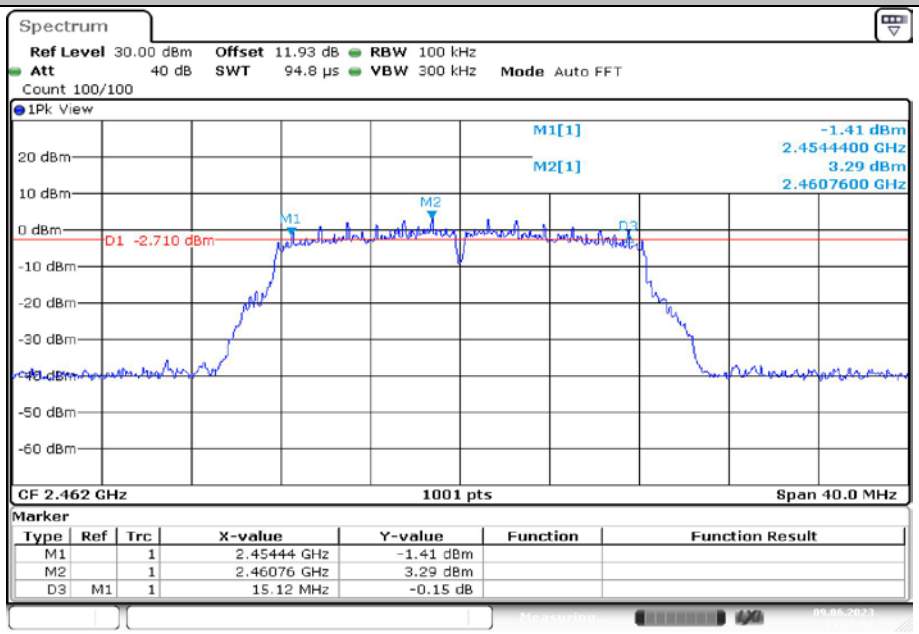
11G MIMO-Ant1-2462



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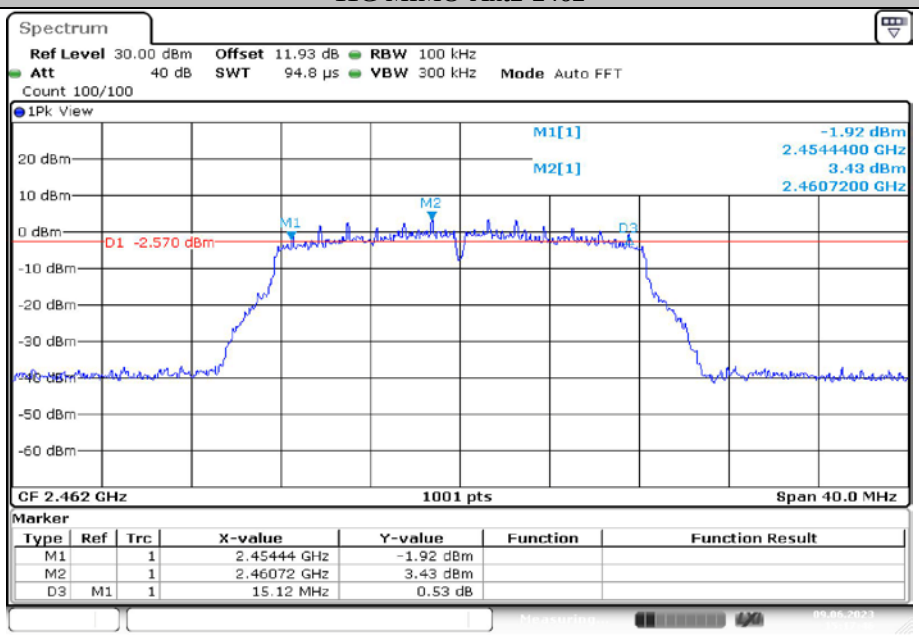
11G MIMO-Ant2-2462



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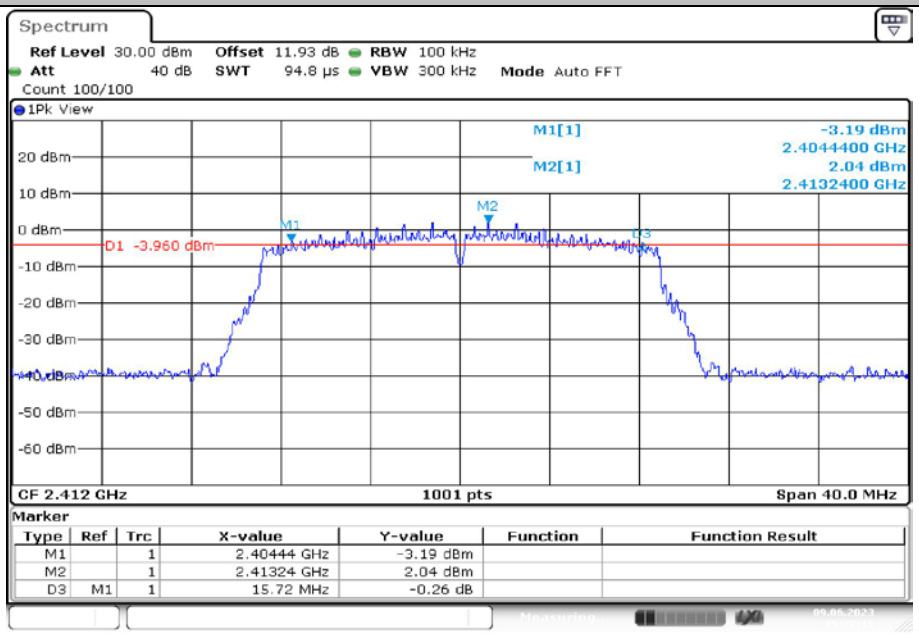
11N20MIMO-Ant1-2412



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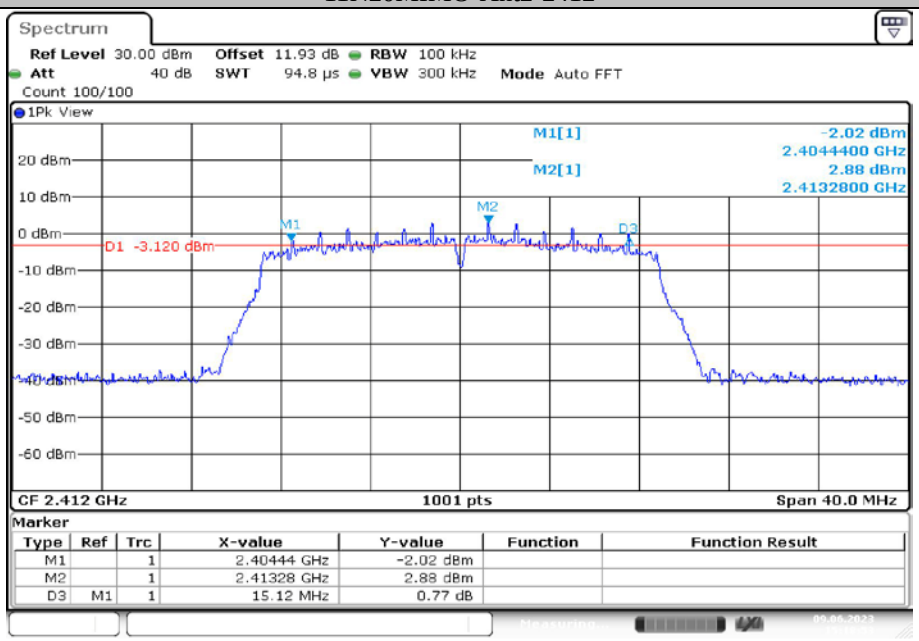
11N20MIMO-Ant2-2412



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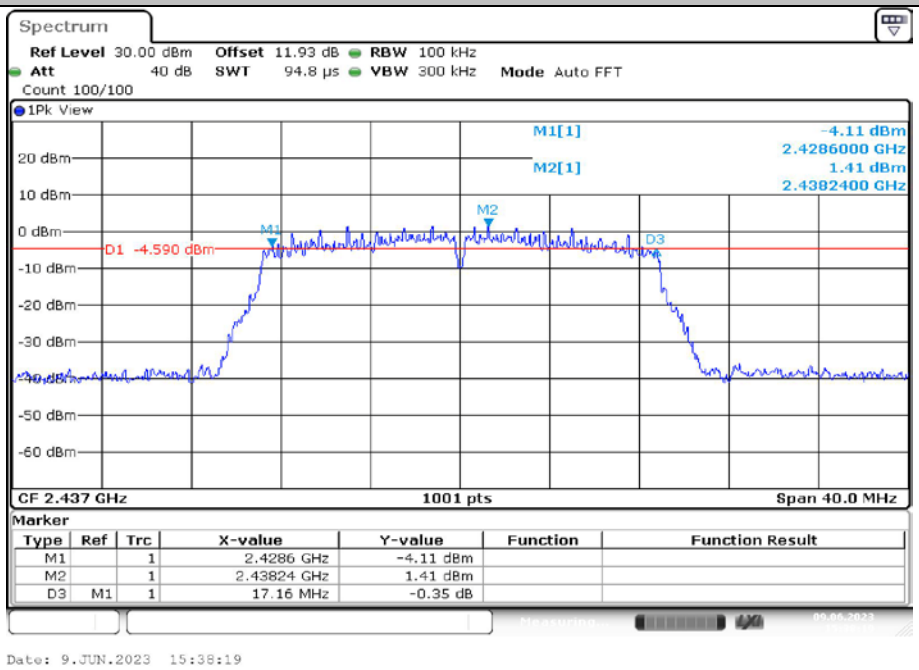

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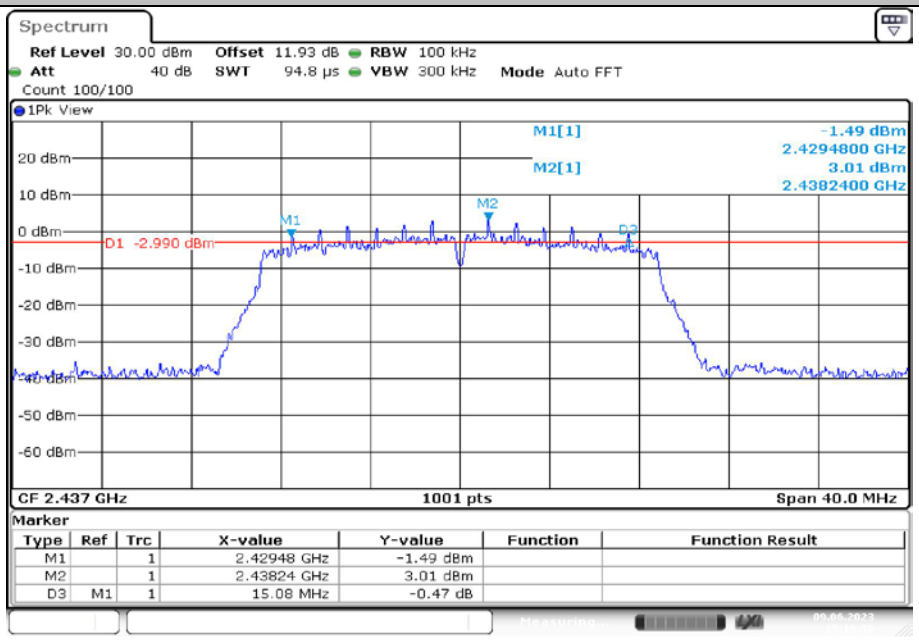

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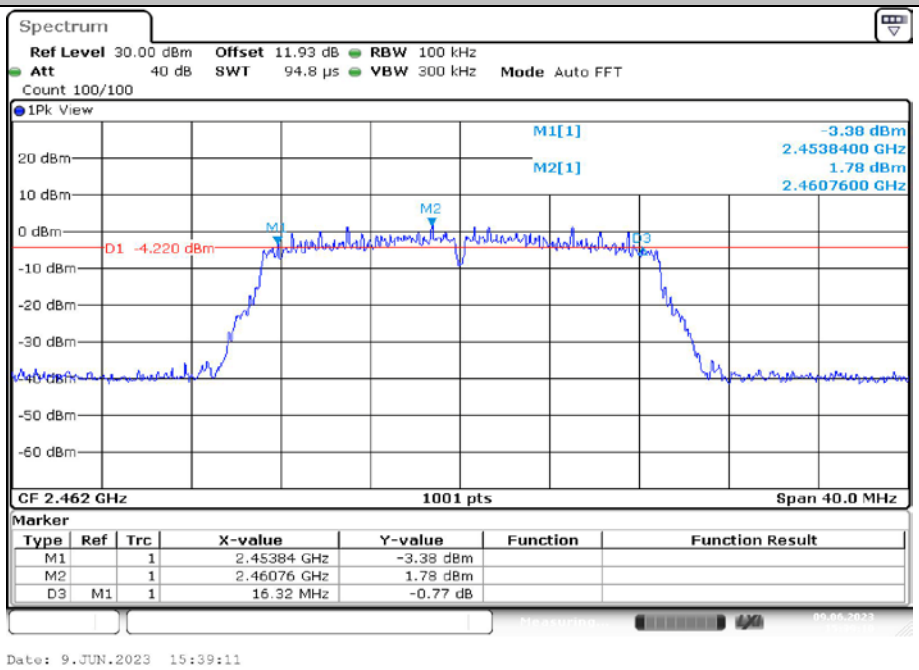

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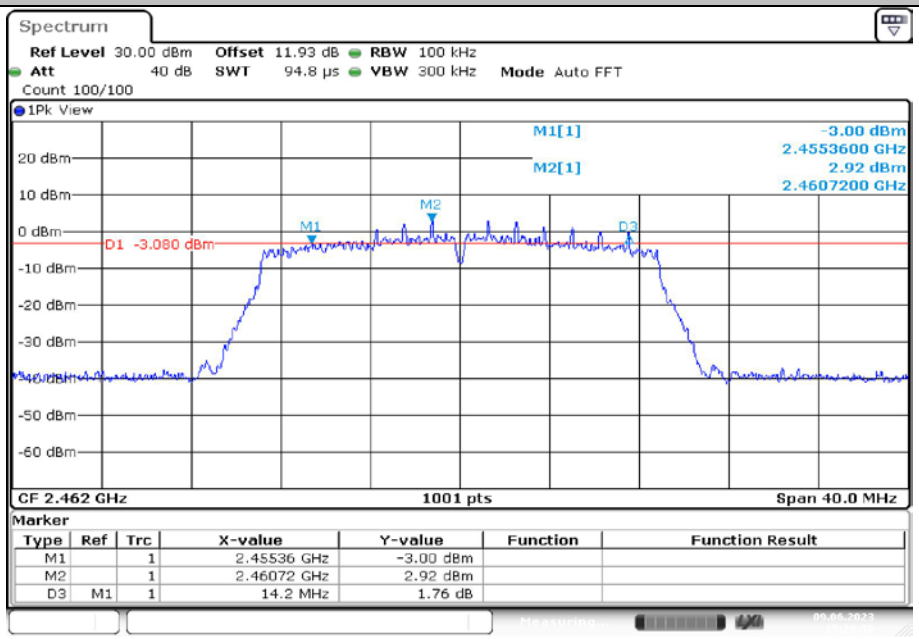

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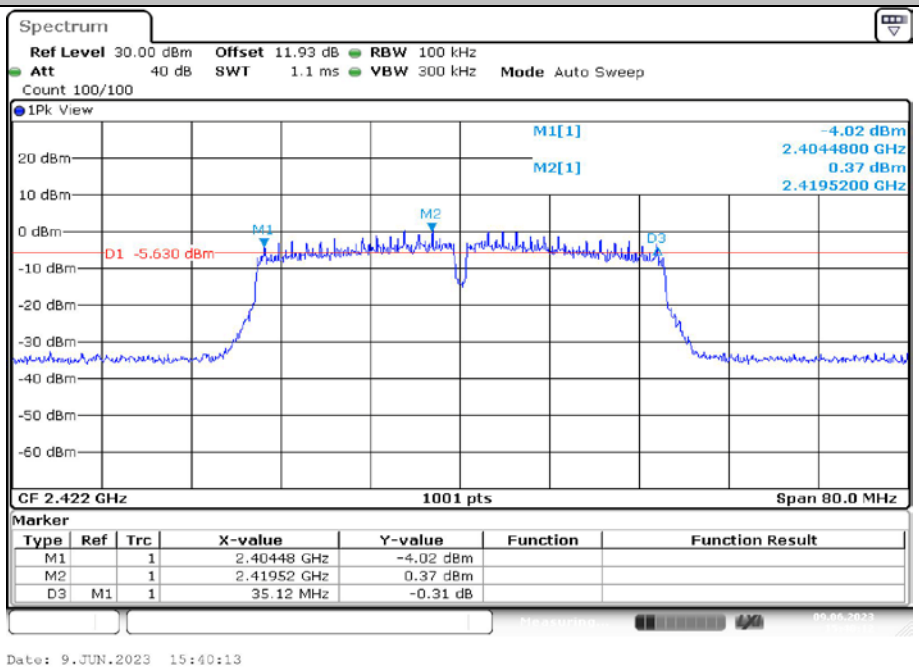
11N40MIMO-Ant1-2422



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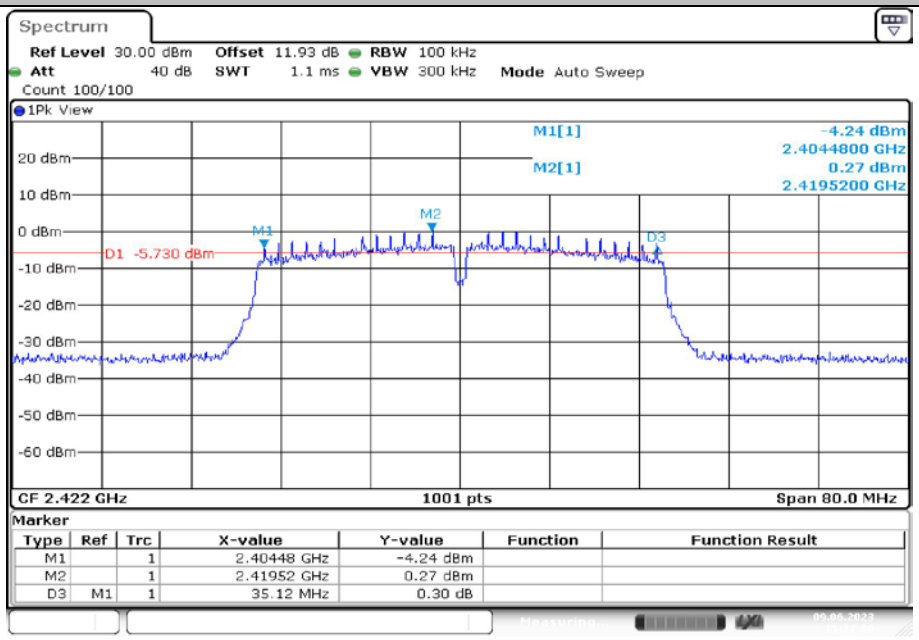

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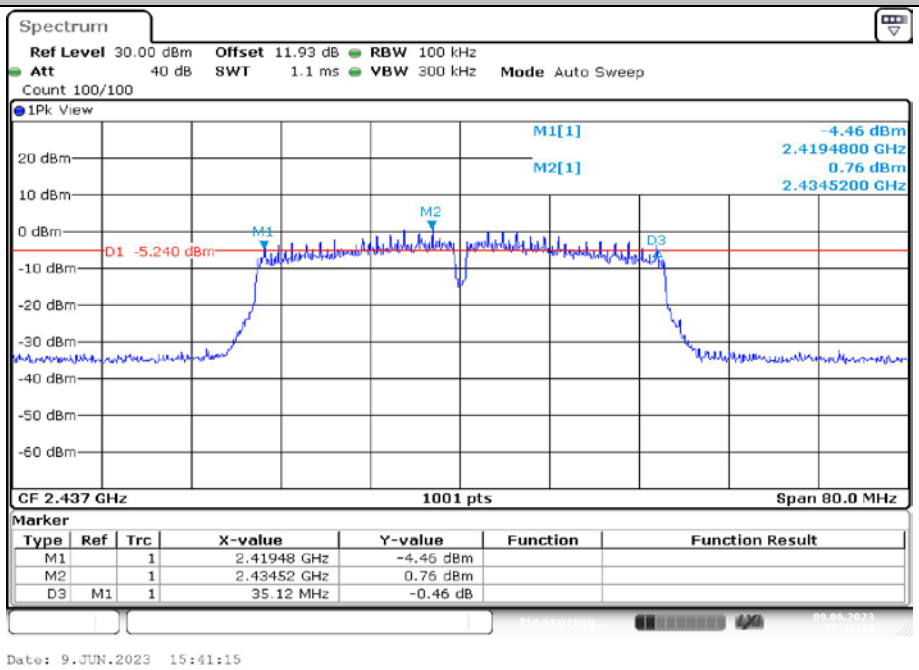

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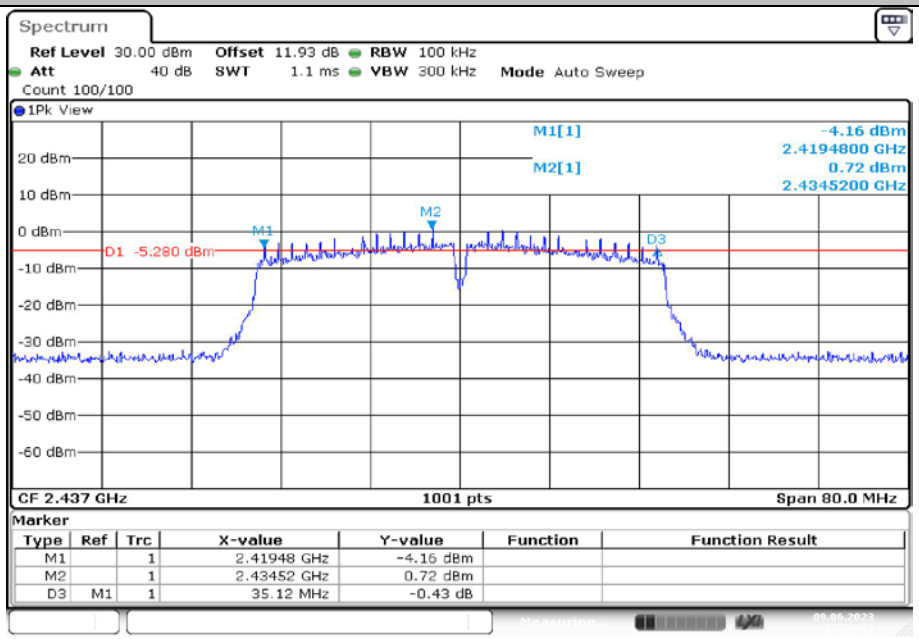

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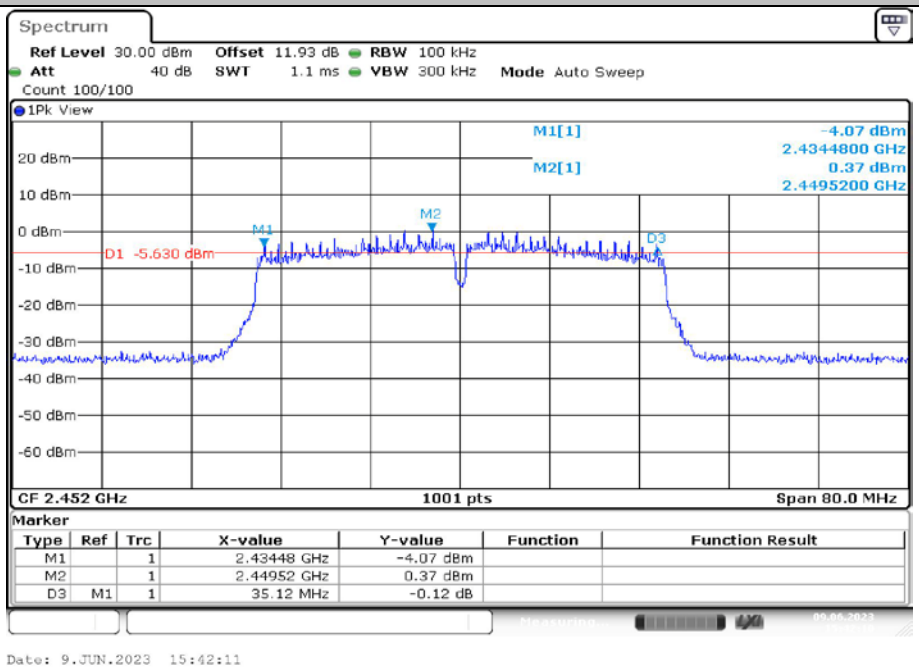
11N40MIMO-Ant1-2452



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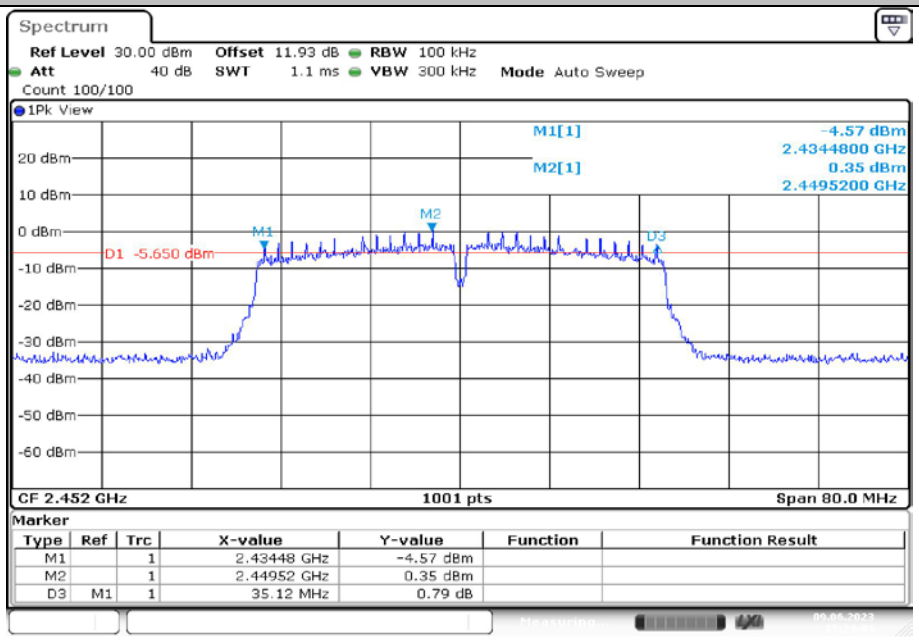


Date: 9.JUN.2023 15:24:05

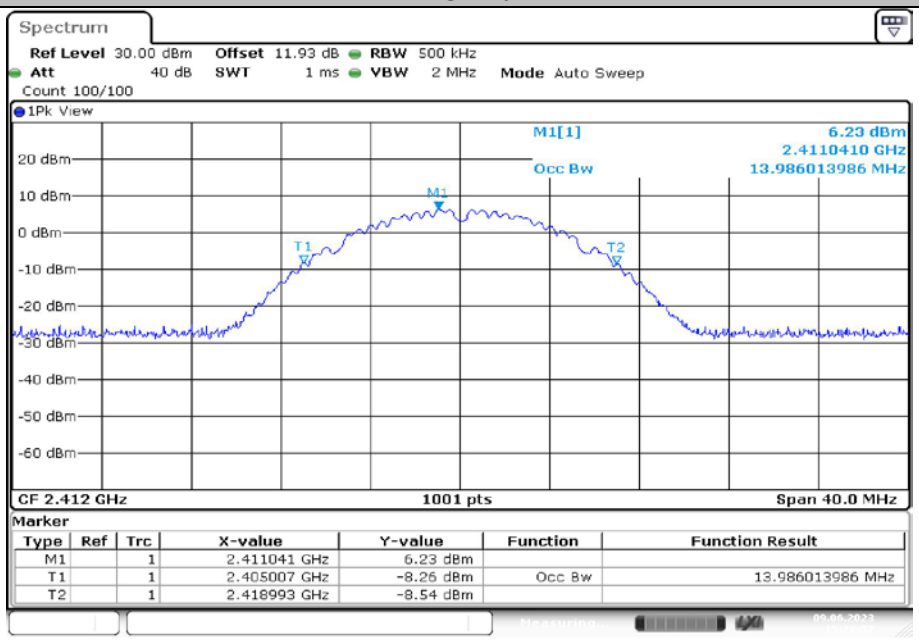
Appendix B: Occupied Channel Bandwidth

Test Result

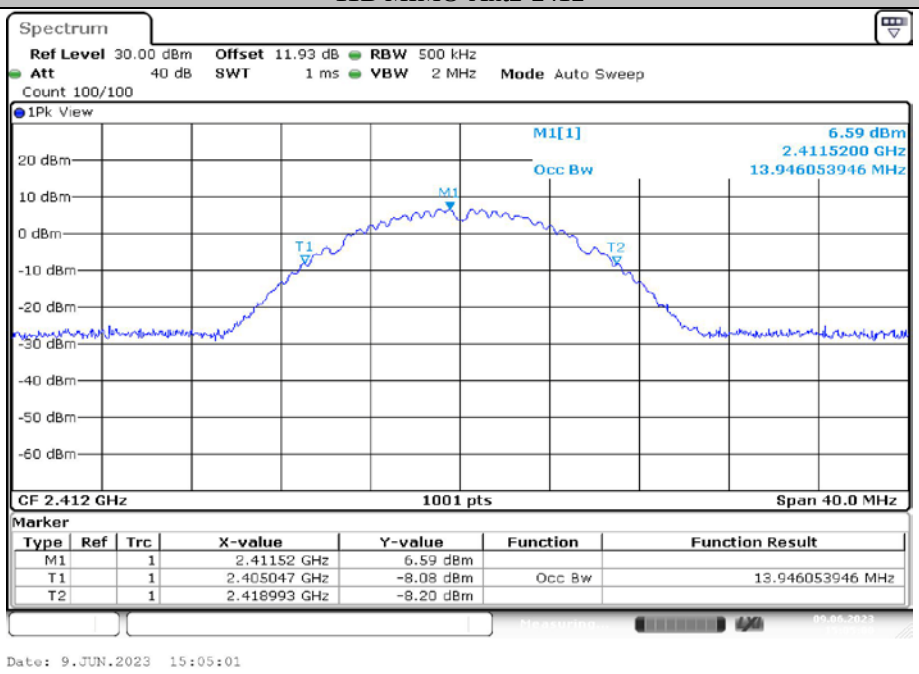
Test Mode	Channel	Antenna	OCB [MHz]	Limit[MHz]	Verdict
11B MIMO	2412	Ant1	13.986	---	PASS
		Ant2	13.946	---	PASS
	2437	Ant1	13.946	---	PASS
		Ant2	13.986	---	PASS
	2462	Ant1	13.946	---	PASS
		Ant2	14.026	---	PASS
11G MIMO	2412	Ant1	16.903	---	PASS
		Ant2	17.223	---	PASS
	2437	Ant1	16.863	---	PASS
		Ant2	17.263	---	PASS
	2462	Ant1	16.903	---	PASS
		Ant2	17.223	---	PASS
11N20 MIMO	2412	Ant1	17.742	---	PASS
		Ant2	17.982	---	PASS
	2437	Ant1	17.742	---	PASS
		Ant2	18.022	---	PASS
	2462	Ant1	17.702	---	PASS
		Ant2	17.982	---	PASS
11N40 MIMO	2422	Ant1	36.603	---	PASS
		Ant2	36.364	---	PASS
	2437	Ant1	36.523	---	PASS
		Ant2	36.124	---	PASS
	2452	Ant1	36.603	---	PASS
		Ant2	36.364	---	PASS

Test Graphs

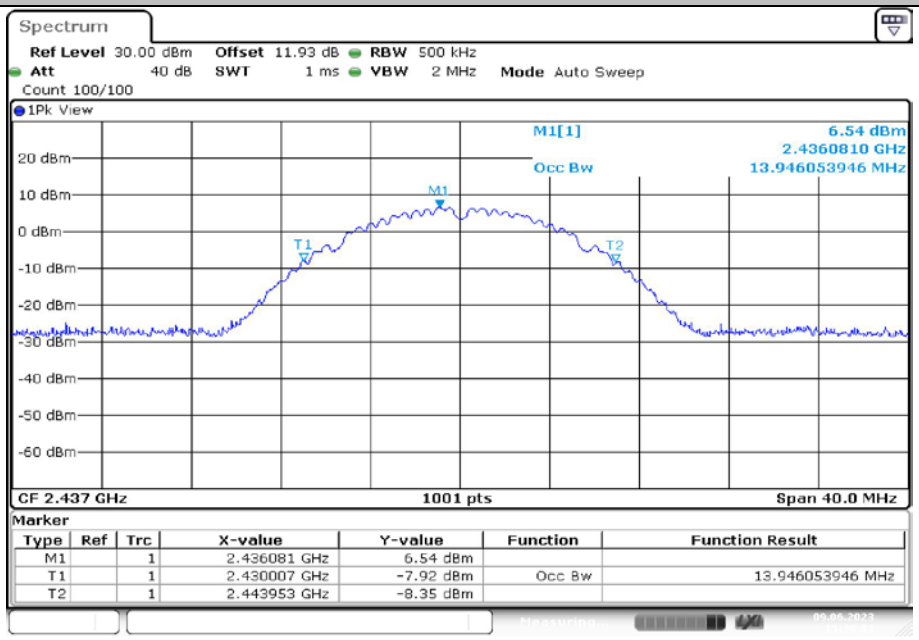
11B MIMO-Ant1-2412



11B MIMO-Ant2-2412



11B MIMO-Ant1-2437



Date: 9.JUN.2023 15:30:04

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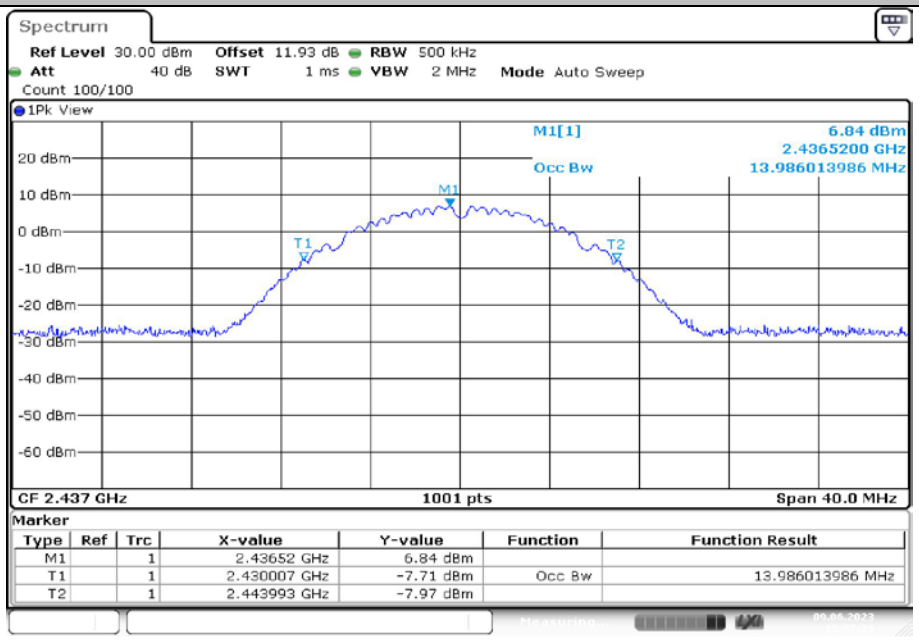
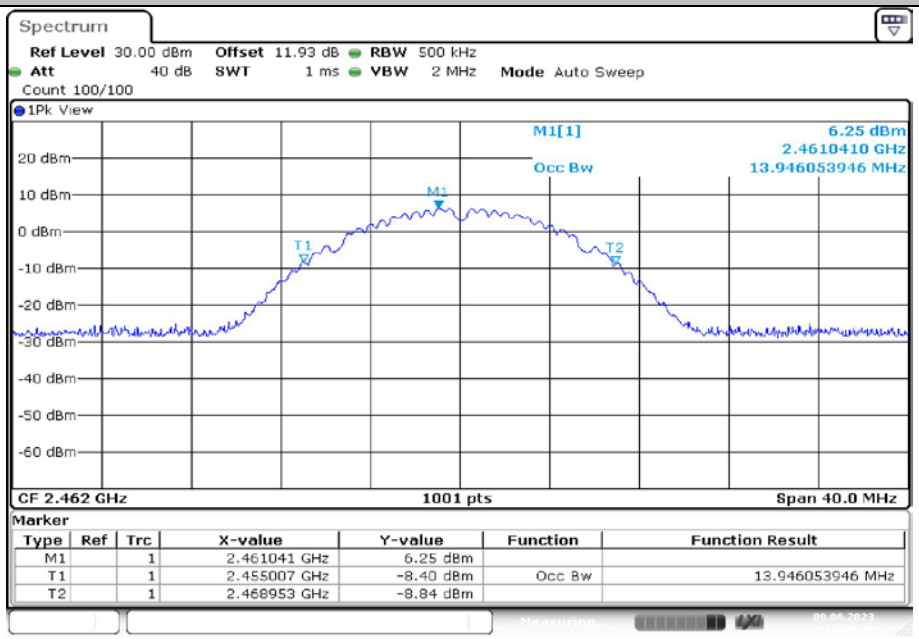


Date: 9.JUN.2023 15:07:40

11B MIMO-Ant1-2462



Date: 9.JUN.2023 15:30:57

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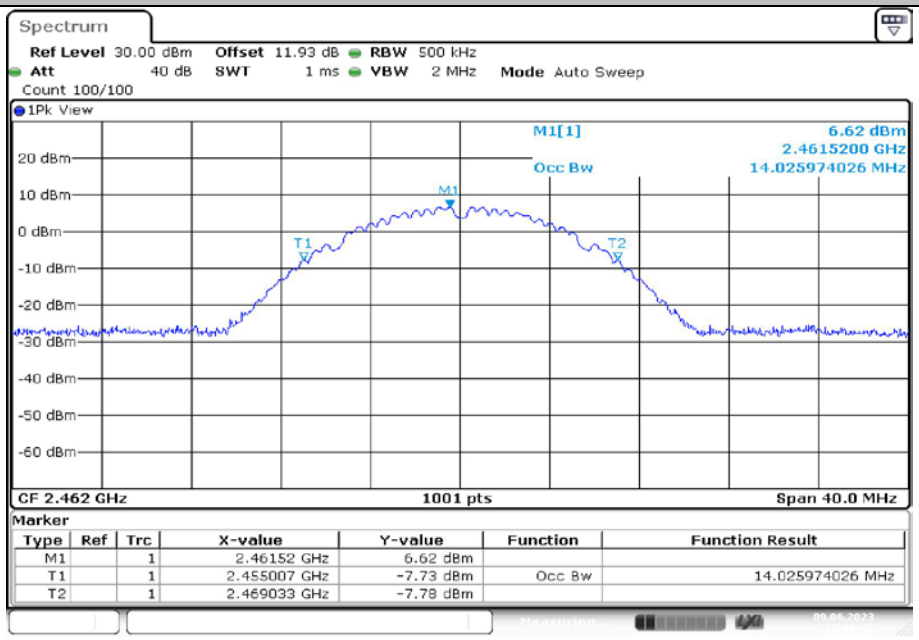

Date: 9.JUN.2023 15:08:48

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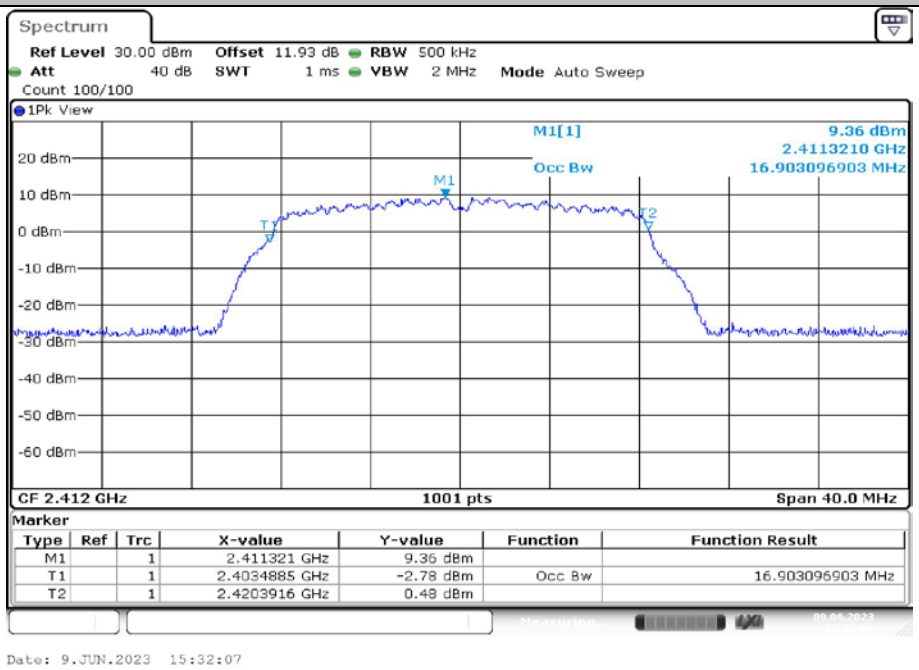

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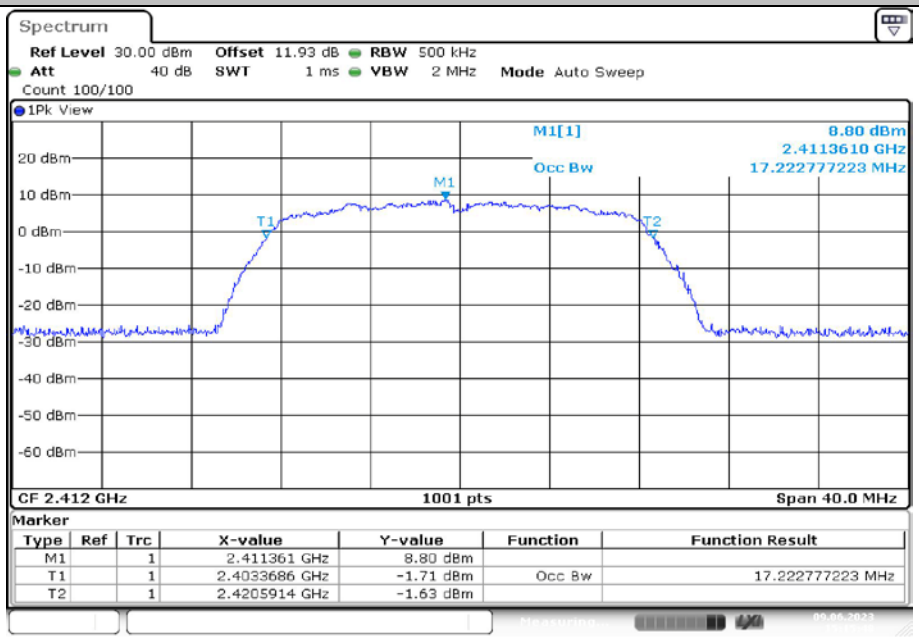

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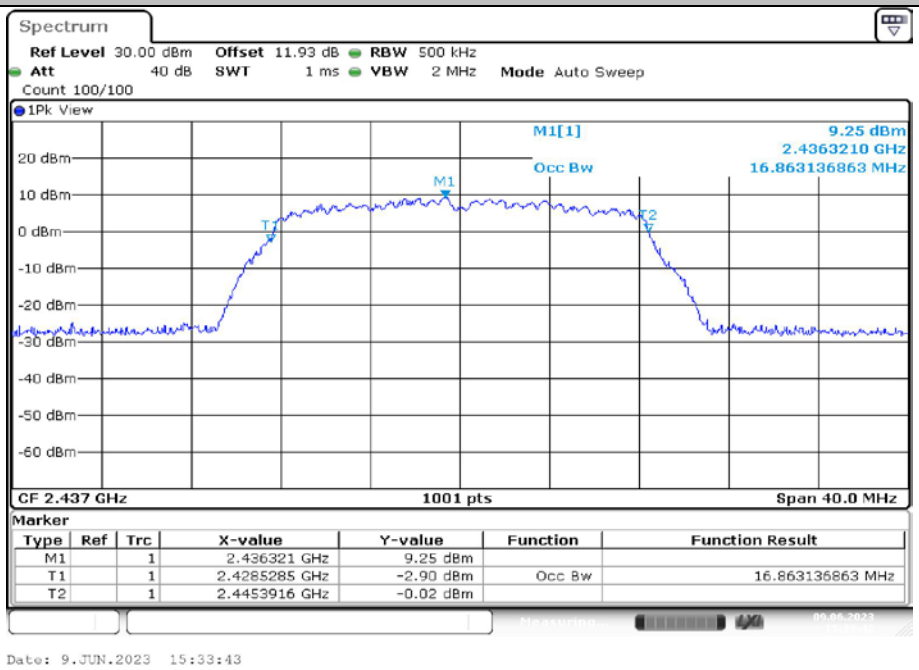

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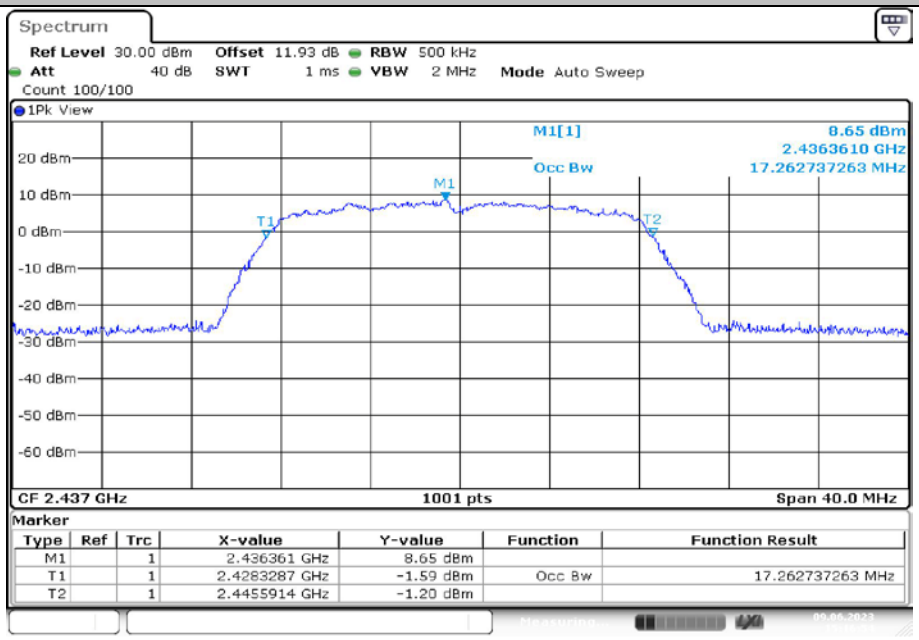

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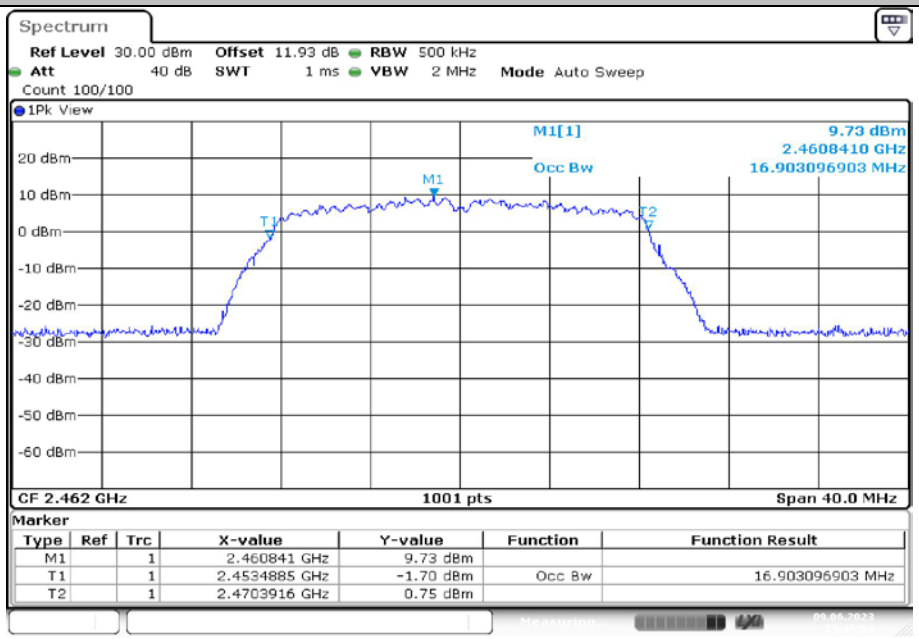

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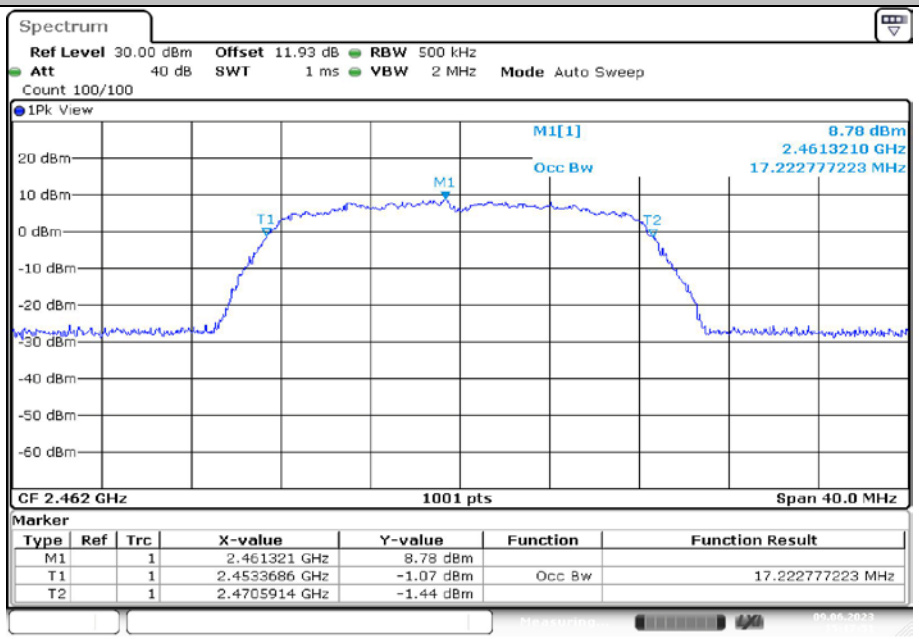

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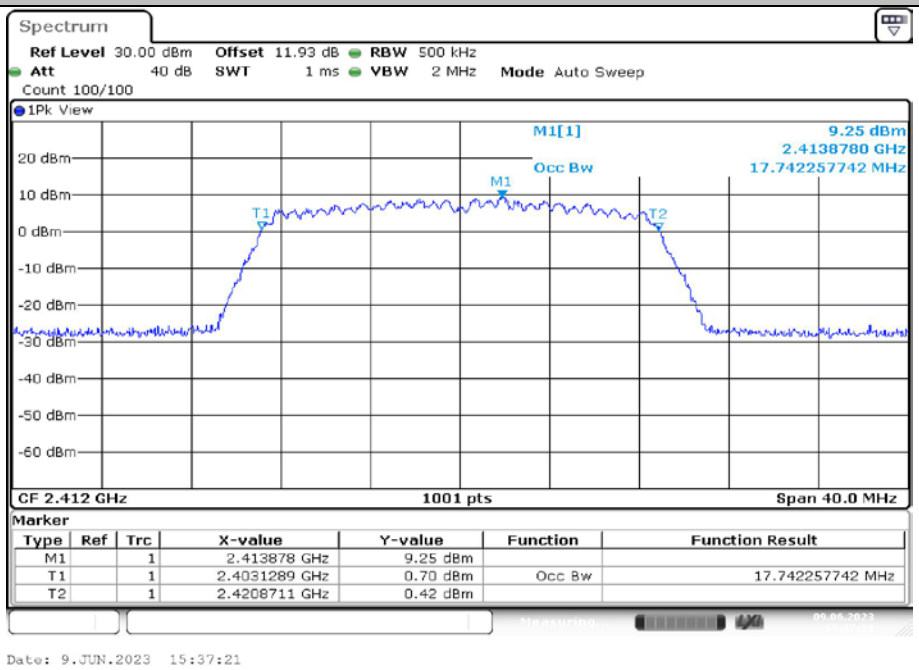
11N20MIMO-Ant1-2412



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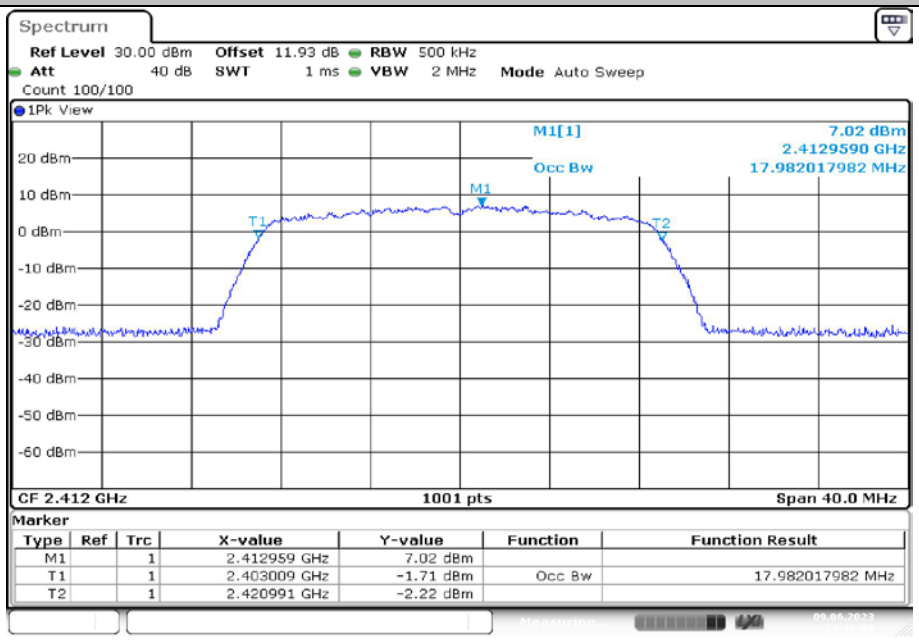

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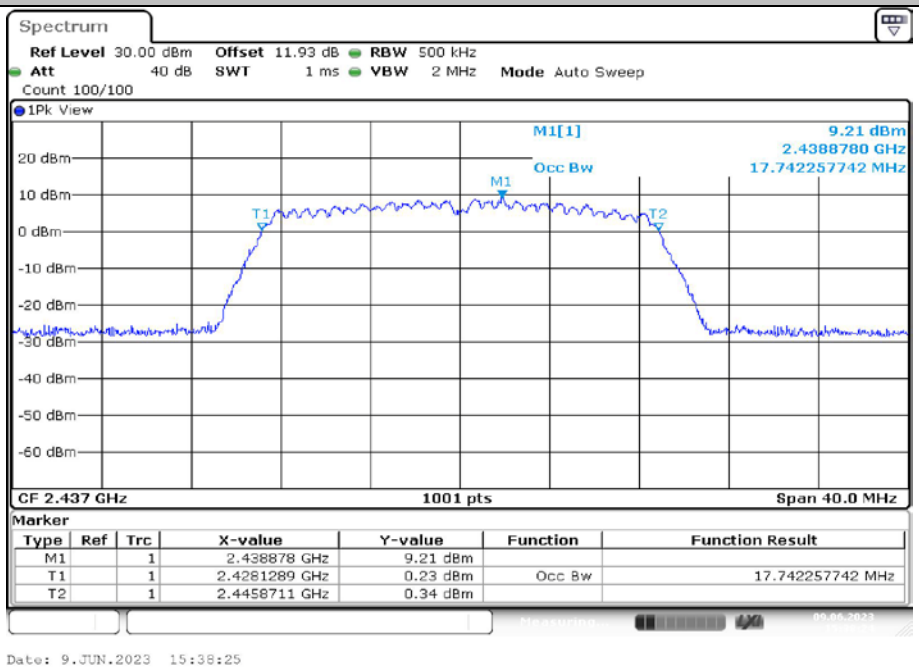

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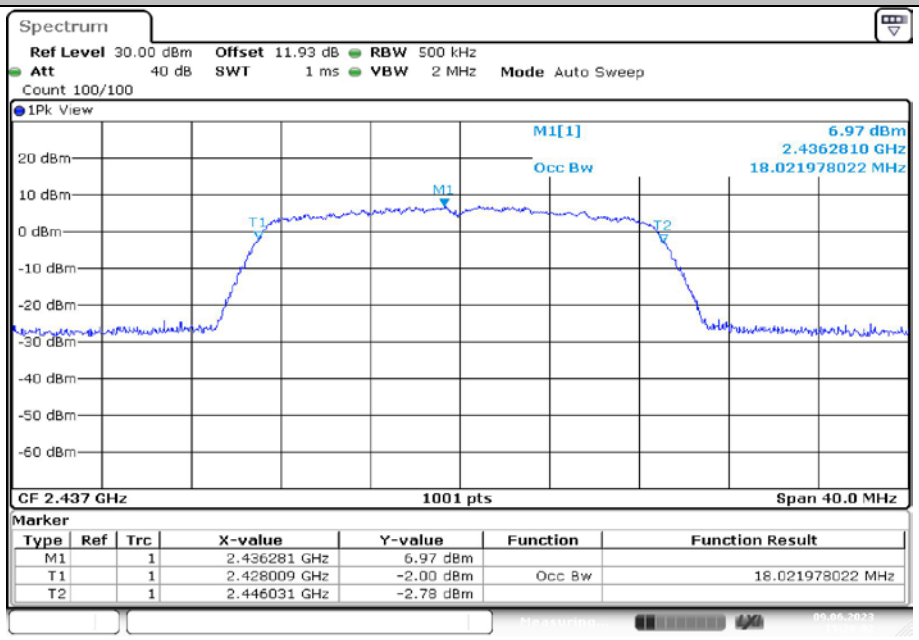

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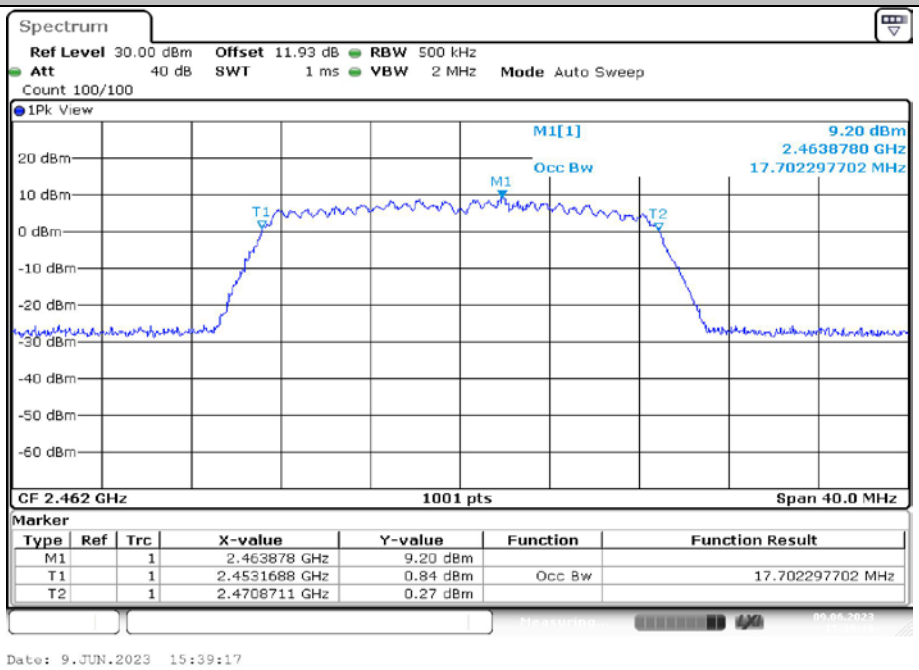

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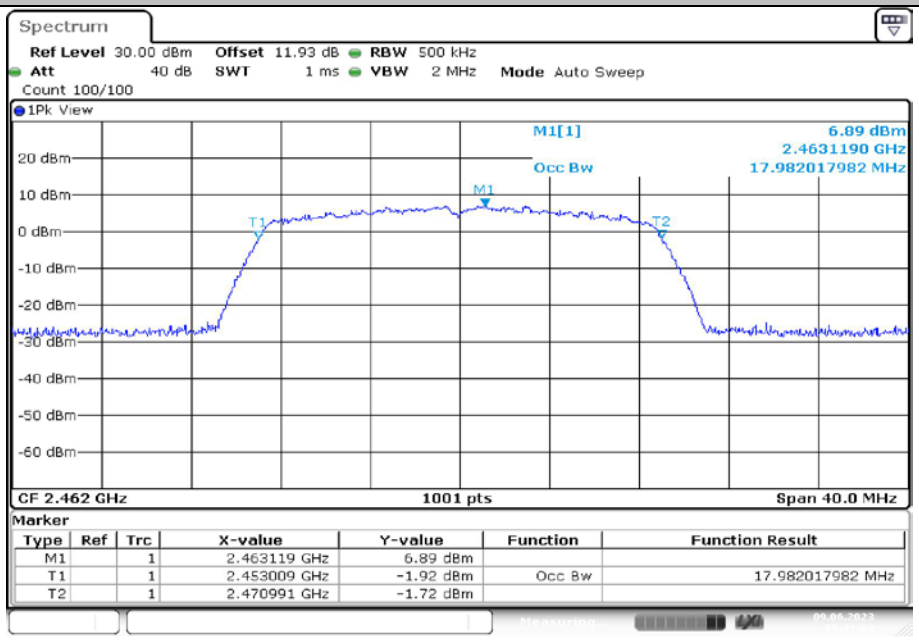

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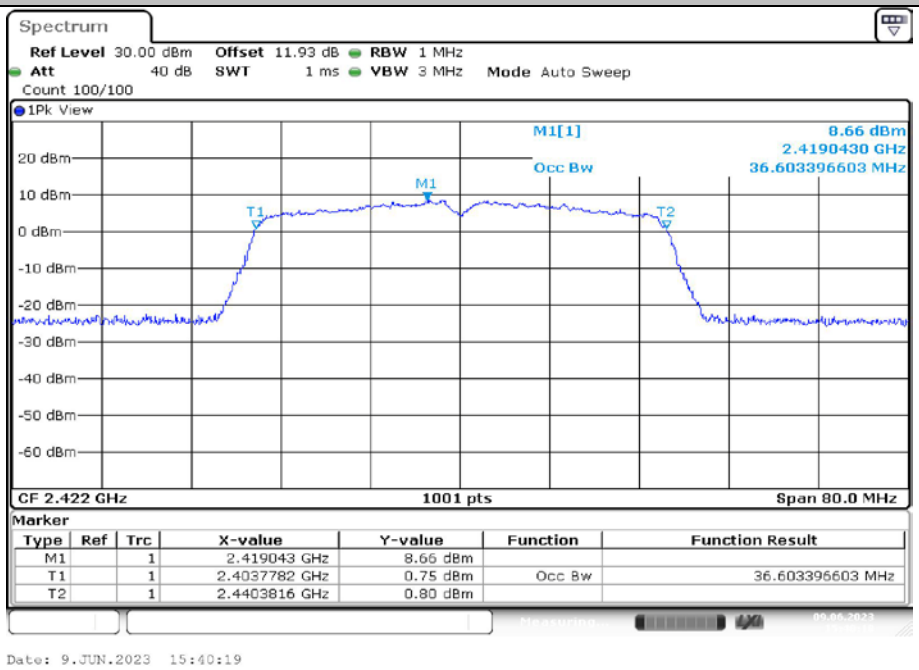
11N40MIMO-Ant1-2422



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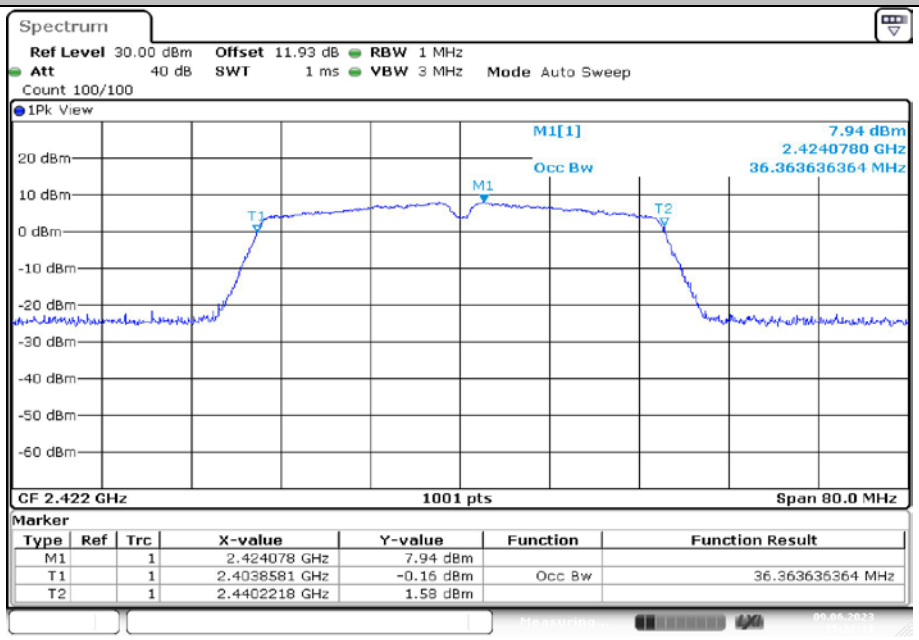

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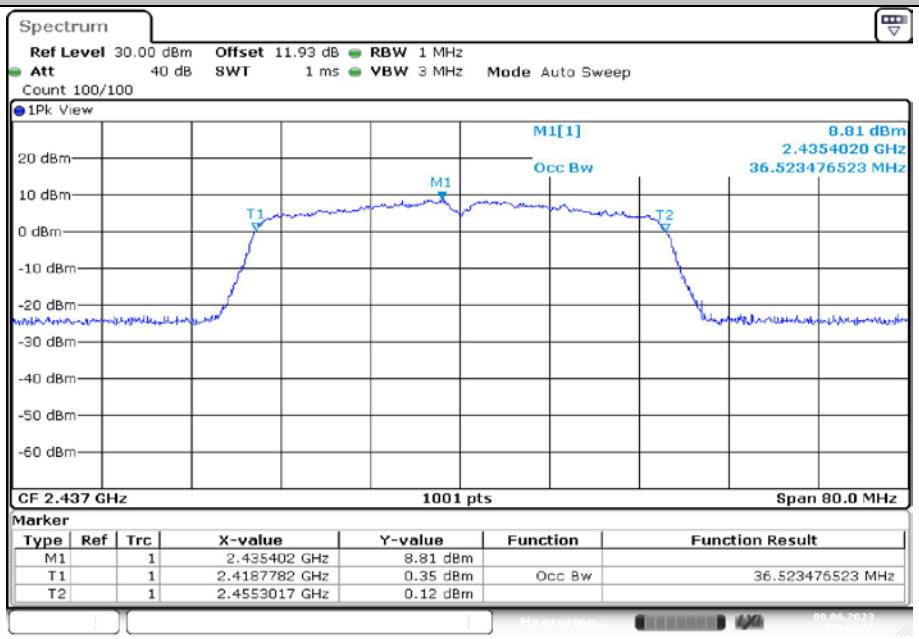
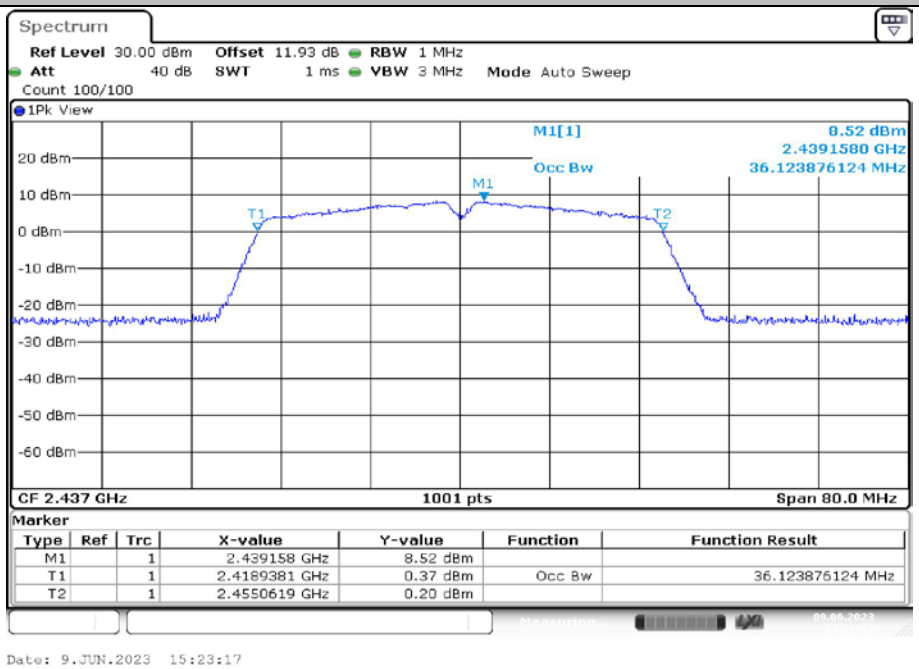


11N40MIMO-Ant2-2437



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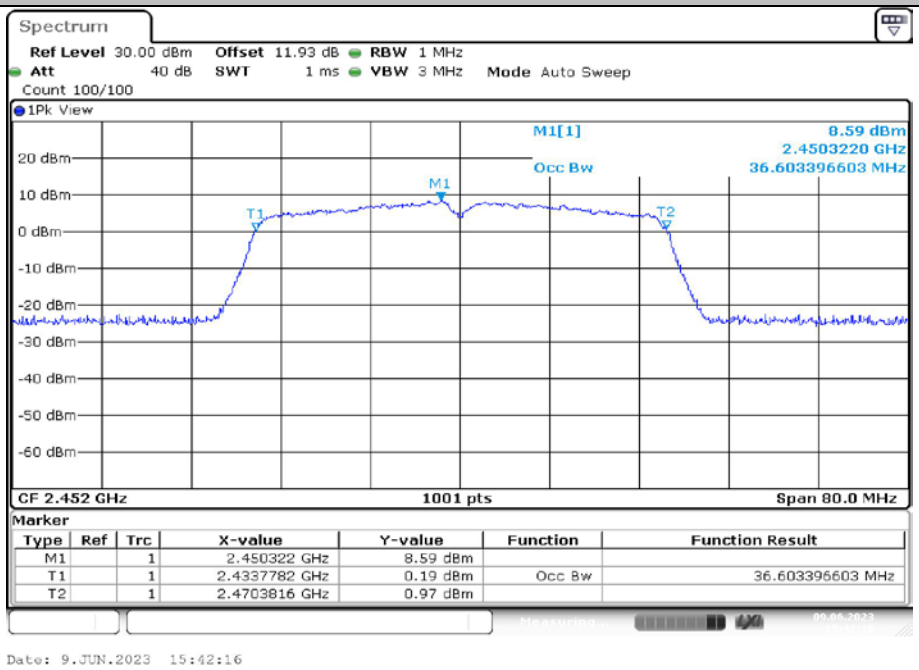

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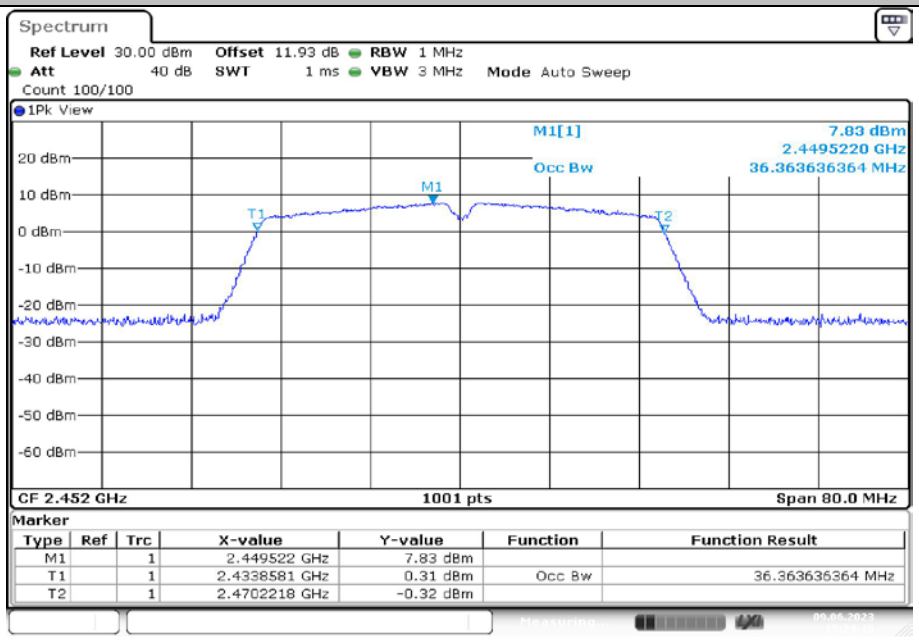

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