



# TEST REPORT

Applicant Name : Shenzhen Junge Yunchuang Technology Co., Ltd.  
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 Report Number : RA230324-14579E-RF-00B  
 FCC ID: 2A3FP-P11

**Test Standard (s)**  
 FCC Part 15.247

### Sample Description

Product: Projector  
 Tested Model: PJ-SK500W, F501, F502, F503, F504, F505, F506  
 Trade Name: N/A  
 Date Received: 2023-03-24  
 Date of Test: 2023-04-10 to 2023-05-31  
 Report Date: 2023-05-31

Test Result:	Pass*
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\* In the configuration tested, the EUT complied with the standards above.

**Prepared and Checked By:**

*Bob. Liao*

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**Approved By:**

*Candy. Li*

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 Candy Li  
 EMC Engineer

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## TABLE OF CONTENTS

<b>DOCUMENT REVISION HISTORY .....</b>	<b>4</b>
<b>GENERAL INFORMATION.....</b>	<b>5</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	5
OBJECTIVE .....	5
TEST METHODOLOGY .....	5
MEASUREMENT UNCERTAINTY .....	6
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>7</b>
DESCRIPTION OF TEST CONFIGURATION .....	7
SPECIAL ACCESSORIES .....	7
EQUIPMENT MODIFICATIONS .....	7
EUT EXERCISE SOFTWARE .....	7
DUTY CYCLE .....	7
SUPPORT EQUIPMENT LIST AND DETAILS .....	8
EXTERNAL I/O CABLE.....	8
BLOCK DIAGRAM OF TEST SETUP .....	8
<b>SUMMARY OF TEST RESULTS.....</b>	<b>10</b>
<b>TEST EQUIPMENT LIST .....</b>	<b>11</b>
<b>FCC §1.1307 (b) – RF EXPOSURE .....</b>	<b>12</b>
<b>FCC §15.203 - ANTENNA REQUIREMENT.....</b>	<b>14</b>
APPLICABLE STANDARD .....	14
ANTENNA CONNECTOR CONSTRUCTION .....	14
<b>FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS .....</b>	<b>15</b>
APPLICABLE STANDARD .....	15
EUT SETUP .....	15
EMI TEST RECEIVER SETUP.....	15
TEST PROCEDURE .....	16
FACTOR & OVER LIMIT CALCULATION.....	16
TEST DATA .....	16
<b>FCC §15.209, §15.205 &amp; §15.247(d) - SPURIOUS EMISSIONS.....</b>	<b>19</b>
APPLICABLE STANDARD .....	19
EUT SETUP .....	19
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP .....	20
TEST PROCEDURE .....	20
FACTOR & MARGIN CALCULATION .....	20
TEST DATA .....	20
<b>FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH &amp; OCCUPIED BANDWIDTH.....</b>	<b>28</b>
APPLICABLE STANDARD .....	28
TEST PROCEDURE .....	28
TEST DATA .....	28
<b>FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER.....</b>	<b>29</b>
APPLICABLE STANDARD .....	29
TEST PROCEDURE .....	29
TEST DATA .....	29
<b>FCC §15.247(d) – 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE.....</b>	<b>30</b>
APPLICABLE STANDARD .....	30
TEST PROCEDURE .....	30
TEST DATA .....	30

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<b>FCC §15.247(e) - POWER SPECTRAL DENSITY .....</b>	<b>31</b>
APPLICABLE STANDARD .....	31
TEST PROCEDURE .....	31
TEST DATA .....	32
<b>APPENDIX A: 6dB Emission Bandwidth .....</b>	<b>33</b>
<b>APPENDIX B: Occupied Channel Bandwidth .....</b>	<b>38</b>
<b>APPENDIX C: Maximum Conducted Output Power .....</b>	<b>43</b>
<b>APPENDIX D: Band Edge Measurements.....</b>	<b>44</b>
<b>APPENDIX E: Maximum Power Spectral Density .....</b>	<b>48</b>
<b>APPENDIX F: Duty Cycle.....</b>	<b>53</b>

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## DOCUMENT REVISION HISTORY

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Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230324-14579E-RF-00B	Original Report	2023-05-31

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Product	Projector	
Tested Model	PJ-SK500W	
Multiple Model	F501, F502, F503, F504, F505, F506	
Model Difference	Please refer to DOS Letter	
Frequency Range	Wi-Fi: 2412-2462MHz(802.11b/g/n20/n40)	
Maximum Conducted Average Output Power	Wi-Fi	
	18.24dBm(802.11b),	18.62dBm(802.11g),
	17.34dBm(802.11n20),	14.13dBm(802.11n40)
Modulation Technique	Wi-Fi: DSSS, OFDM	
Antenna Specification*	Internal Antenna: 3.35dBi (provided by the applicant)	
Voltage Range	AC 100-240V	
Sample serial number	RA230324-14579E-RF-S1(CE&RE) RA230324-14579E-RF-S2(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 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
	26.5GHz - 40GHz	4.64dB
Temperature		1°C
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 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 mode, 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 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.

### Special Accessories

The AC power cable and HD Cable with ferrite cord.

### Equipment Modifications

No modification was made to the EUT tested.

### EUT Exercise Software

Software “Serial”\* was used during testing and power level as below, which provided by manufacturer.

Mode	Data Rate (Mbps)	Power Level*
802.11 b	1	Default
802.11 g	6	Default
802.11 n20	MCS0	Default
802.11 n40	MCS0	15

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.

### Duty cycle

Test Result: Compliant. Please refer to the Appendix

## Support Equipment List and Details

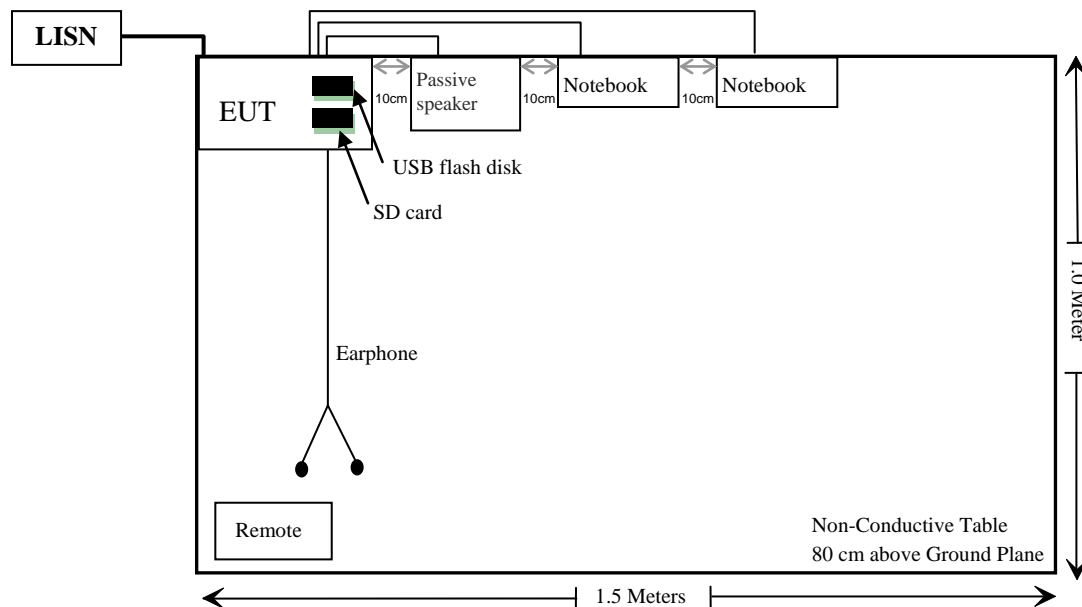
Manufacturer	Description	Model	Serial Number
LENOVO	Notebook	ThinkPad x240	SL10F31638JS
Hasee	Notebook	CV15S01	K6406H01120953
Unknown	Earphone	Unknown	Unknown
Unknown	Passive speaker	Unknown	Unknown
Kingston	USB flash disk	DTKN	Unknown
Unknown	SD Card	Unknown	Unknown

## External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable AC Cable	1.4	EUT	L.I.S.N
Shielding Detachable HDMI Cable	1.2	EUT	Notebook
Un-shielding Detachable VAG Cable	1.0	EUT	Notebook
Un-shielding Detachable Earphone Cable	1	EUT	Earphone
Un-shielding Detachable Cable	0.9	EUT	Passive speaker

## Block Diagram of Test Setup

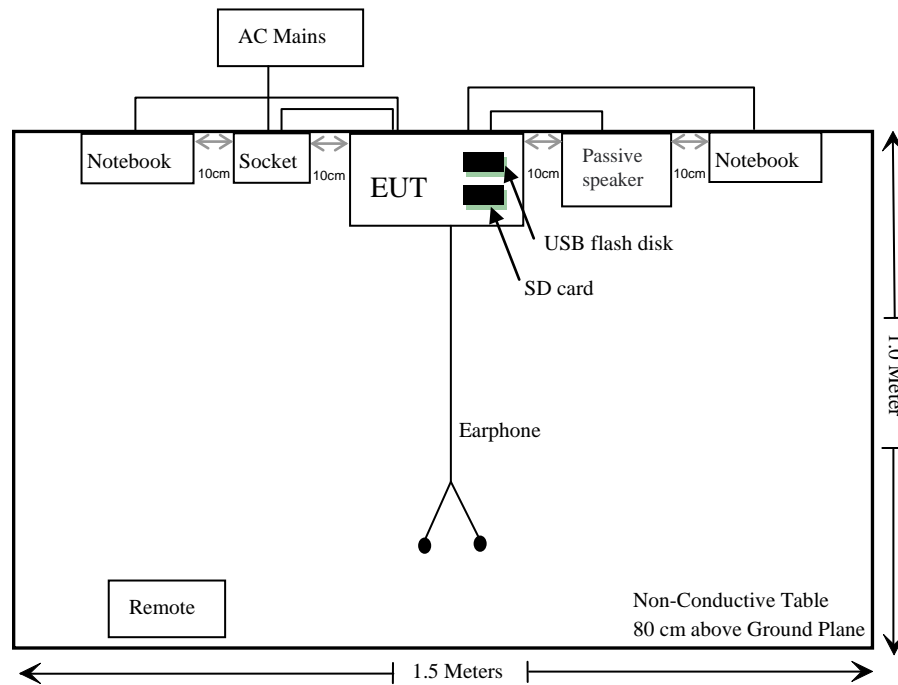
### For Conducted Emission:





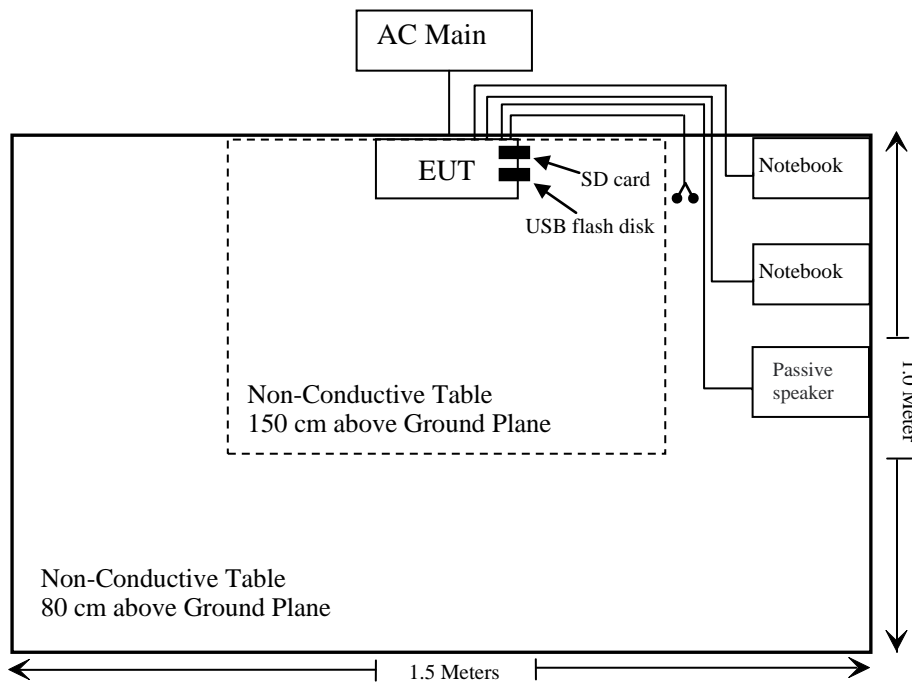
**For Radiated Emission:**

Below 1G



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

Above 1G



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

**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§1.1307(b)	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
<b>Conducted Emissions Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	100784	2022/11/25	2023/11/24
R & S	L.I.S.N.	ENV216	101314	2022/11/25	2023/11/24
Anritsu Corp	50Ω 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)					
<b>Radiated Emissions Test</b>					
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
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.10	N050	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
Radiated Emission Test Software:e3 191218 (V9)					
<b>RF Conducted Test</b>					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2022/11/25	2023/11/24
Agilent	Power Sensor	U2021XA	MY5425003	2023/02/25	2024/02/24
WEINSCHTEL	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 §1.1307 (b) – RF EXPOSURE

### Applicable Standard

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

According to KDB 447498 D04 Interim General RF Exposure Guidance v01, clause 2.1.4 –MPE-Based Exemption:

An alternative to the SAR-based exemption is provided in § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power. For this case, a RF source is an RF exempt device if its ERP (watts) is no more than a frequency-dependent value, as detailed tabular form in Appendix B. These limits have been derived based on the basic specifications on Maximum Permissible Exposure (MPE) considered for the FCC rules in § 1.1310(e)(1).

Table 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	$19.2R^2$ .

f = frequency in MHz;

R = minimum separation distance from the body of a nearby person (appropriate units, e.g., m);

**Test result**

For worst case:

Mode	Frequency Range (MHz)	Tune-up Output Power		Antenna Gain		ERP		Evaluation Distance (cm)	MPE-Based Exemption Threshold (W)
		(dBm)	(mW)	(dBi)	(dBd)	(dBm)	(W)		
BT	2402-2480	-1	0.79	-0.68	-2.83	-3.83	0.0004	20	0.768
2.4G Wi-Fi	2412-2462	19	79.43	3.35	1.2	20.2	0.1047	20	0.768
5G Wi-Fi	5150-5250	14.5	28.18	1.88	-0.27	14.23	0.0265	20	0.768

Note 1: The tune-up power was declared by the applicant.

Note 2: 0dBd=2.15dBi.

Note 3: The BT function can transmit at the same time with the Wi-Fi function.

Simultaneous transmitting consideration:

The ratio=  $MPE_{BT}/limit + MPE_{2.4G\ Wi-Fi}/limit = 0.0004/0.768 + 0.1047/0.768 = 0.137 < 1.0$

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

**Result:** Compliant.

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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **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 internal antennas arrangement for 2.4G Wi-Fi, which were permanently attached to the EUT and the antenna gain is 3.35dBi, fulfill the requirement of this section. Please refer to the EUT photos.

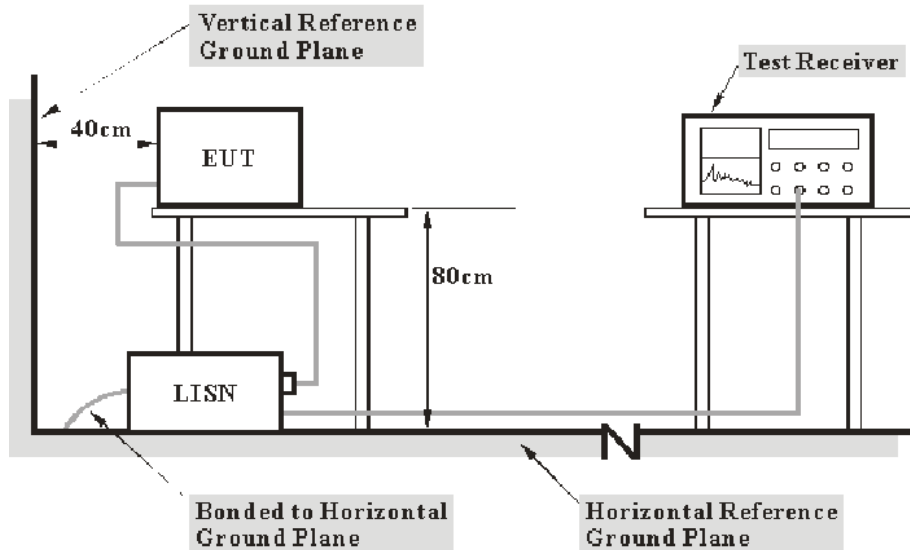
**Result:** Compliant.

## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC §15.207(a)

### 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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

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.

## Factor & Over Limit Calculation

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

$$\text{Factor} = \text{LISN VDF} + \text{Cable Loss}$$

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:

$$\begin{aligned} \text{Over Limit} &= \text{Level} - \text{Limit} \\ \text{Level} &= \text{Read Level} + \text{Factor} \end{aligned}$$

## Test Data

### Environmental Conditions

<b>Temperature:</b>	22°C
<b>Relative Humidity:</b>	59 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Jerry Wu on 2023-04-26.*

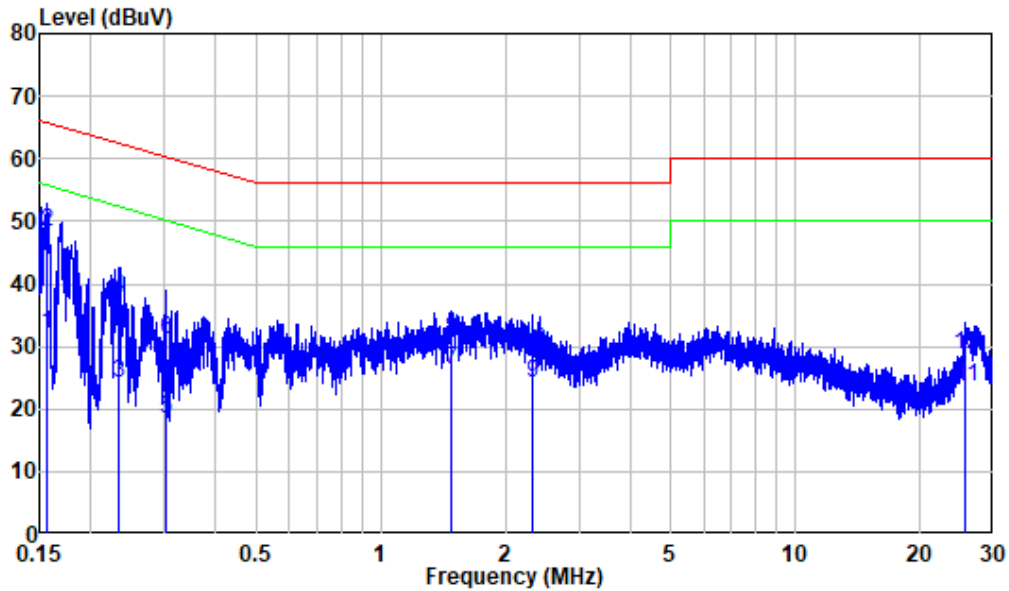
*EUT operation mode: Full load+2.4G WIFI Transmite (worst case 802.11b, high channel)*

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

**Test Result:** Please refer the below plots.



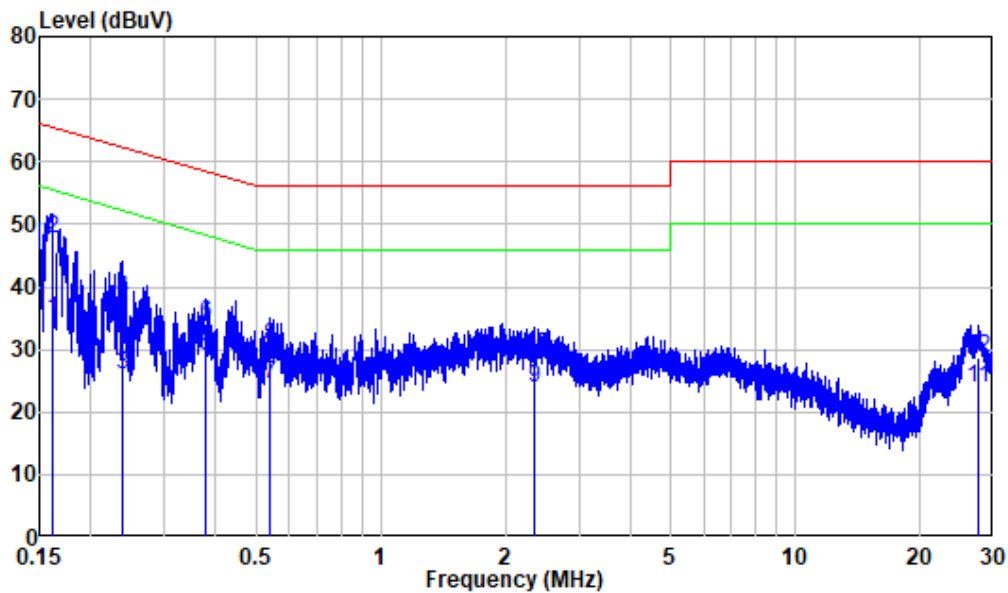
**AC 120V/60 Hz, Line**



Site : Shielding Room  
 Condition: Line  
 Job No. : RA230324-14579-RF  
 Mode : Full load+2.4Gwifi Transmite  
 Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.156	10.09	22.01	32.10	55.65	-23.55	Average
2	0.156	10.09	38.13	48.22	65.65	-17.43	QP
3	0.234	10.20	13.84	24.04	52.30	-28.26	Average
4	0.234	10.20	27.65	37.85	62.30	-24.45	QP
5	0.302	10.22	8.28	18.50	50.17	-31.67	Average
6	0.302	10.22	20.78	31.00	60.17	-29.17	QP
7	1.479	10.38	15.97	26.35	46.00	-19.65	Average
8	1.479	10.38	20.86	31.24	56.00	-24.76	QP
9	2.324	10.41	13.67	24.08	46.00	-21.92	Average
10	2.324	10.41	18.75	29.16	56.00	-26.84	QP
11	25.727	10.06	13.62	23.68	50.00	-26.32	Average
12	25.727	10.06	18.77	28.83	60.00	-31.17	QP

AC 120V/60 Hz, Neutral

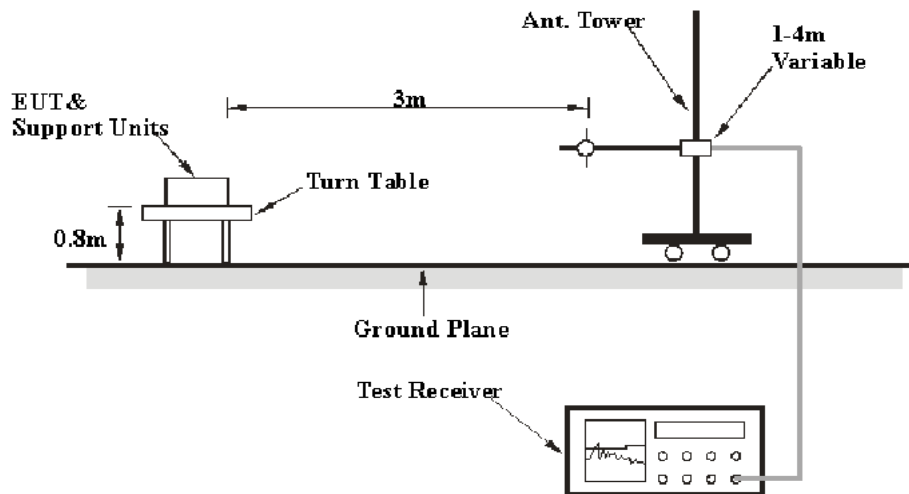
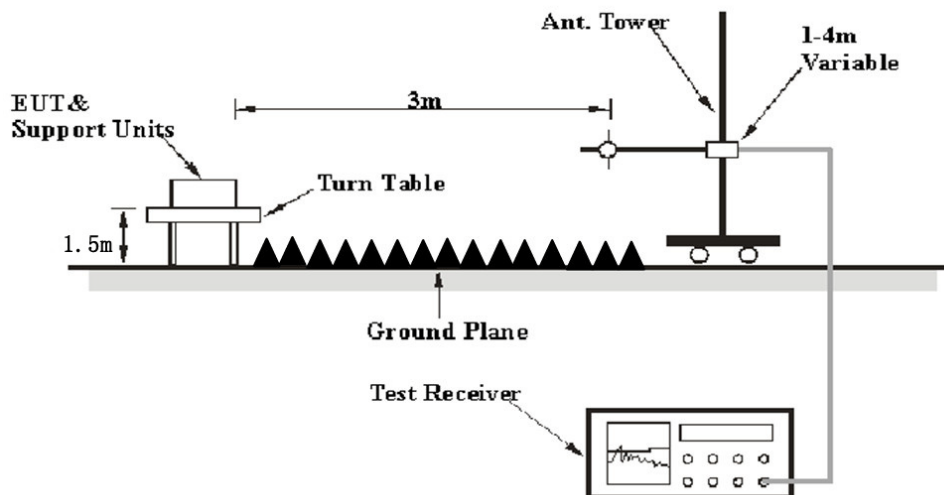


Site : Shielding Room  
 Condition: Neutral  
 Job No. : RA230324-14579-RF  
 Mode : Full load+2.4Gwifi Transmite  
 Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.161	9.68	24.94	34.62	55.41	-20.79	Average
2	0.161	9.68	38.00	47.68	65.41	-17.73	QP
3	0.239	9.70	16.22	25.92	52.14	-26.22	Average
4	0.239	9.70	28.19	37.89	62.14	-24.25	QP
5	0.378	9.74	19.17	28.91	48.32	-19.41	Average
6	0.378	9.74	24.52	34.26	58.32	-24.06	QP
7	0.537	9.77	14.53	24.30	46.00	-21.70	Average
8	0.537	9.77	20.57	30.34	56.00	-25.66	QP
9	2.341	9.81	14.11	23.92	46.00	-22.08	Average
10	2.341	9.81	19.20	29.01	56.00	-26.99	QP
11	27.452	10.05	13.76	23.81	50.00	-26.19	Average
12	27.452	10.05	18.67	28.72	60.00	-31.28	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

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	1 MHz	3 MHz	/	PK
	1 MHz	10Hz*	/	Ave.
	1 MHz	1/T**	/	Ave.

Note: \* for duty cycle  $\geq 98\%$

\*\*for duty cycle  $< 98\%$ , and T is maximum transmission duration.

## Test Procedure

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

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

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

## 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:

$$\text{Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\begin{aligned} \text{Over Limit/Margin} &= \text{Level} / \text{Corrected Amplitude} - \text{Limit} \\ \text{Level} / \text{Corrected Amplitude} &= \text{Read Level} + \text{Factor} \end{aligned}$$

## Test Data

### Environmental Conditions

<b>Temperature:</b>	23-24°C
<b>Relative Humidity:</b>	57-58%
<b>ATM Pressure:</b>	101.0kPa

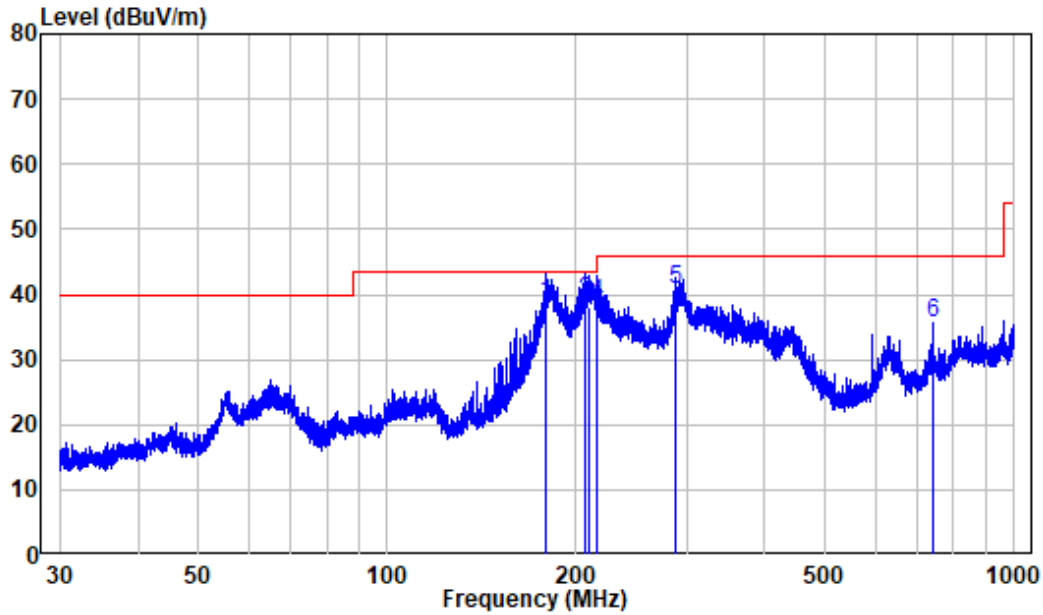
The testing was performed by Jason Liu on 2023-05-12 for below 1G and on 2023-04-10 for above 1G.

EUT operation mode: Full load+2.4G WIFI Transmite or 2.4G WIFI Transmitting

**Test Result:** Please refer the below tables and plots.

**30MHz-1GHz: (Worst case 802.11b mode, High Channel)**

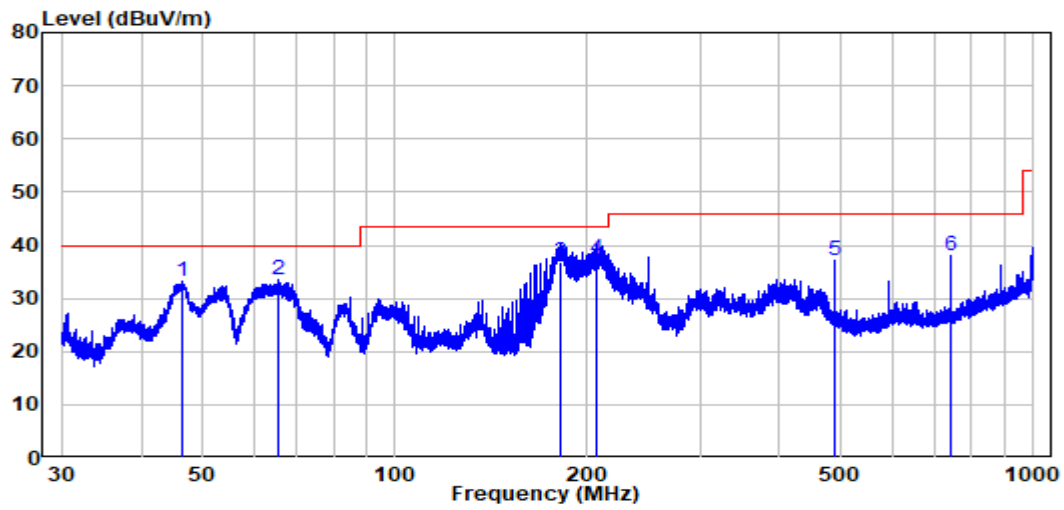
**Horizontal**



Site : chamber  
 Condition: 3m HORIZONTAL  
 Job No. : RA230324-14579E-RF  
 Test Mode: Full load+2.4Gwifi Transmite

	Freq	Factor	Read Level	Level	Limit	Over	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	179.386	-12.73	51.30	38.57	43.50	-4.93	QP
2	206.579	-12.01	51.00	38.99	43.50	-4.51	QP
3	210.140	-12.04	49.99	37.95	43.50	-5.55	QP
4	215.835	-11.88	50.60	38.72	43.50	-4.78	QP
5	287.990	-9.31	50.20	40.89	46.00	-5.11	QP
6	741.934	-0.71	36.34	35.63	46.00	-10.37	Peak

Vertical



Site : chamber  
 Condition: 3m VERTICAL  
 Job No. : RA230324-14579E-RF  
 Test Mode: Full load+2.4Gwifi Transmite

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	46.422	-10.08	43.14	33.06	40.00	-6.94	Peak
2	65.630	-12.81	46.26	33.45	40.00	-6.55	Peak
3	181.602	-12.50	49.20	36.70	43.50	-6.80	QP
4	206.850	-12.02	49.31	37.29	43.50	-6.21	QP
5	489.241	-4.51	41.67	37.16	46.00	-8.84	Peak
6	741.934	-0.71	38.76	38.05	46.00	-7.95	Peak

**1-25 GHz:**

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	56.22	PK	274	1.5	H	-10.36	45.86	74	-28.14
2310	57.58	PK	265	1.2	V	-10.36	47.22	74	-26.78
2390	58.73	PK	253	1.8	H	-10.71	48.02	74	-25.98
2390	56.73	PK	73	2.2	V	-10.71	46.02	74	-27.98
4824	49.37	PK	158	1.3	H	-6.11	43.26	74	-30.74
4824	48.48	PK	135	1.4	V	-6.11	42.37	74	-31.63
802.11B, Middle Channel									
4874	48.63	PK	304	1.1	H	-5.94	42.69	74	-31.31
4874	49.2	PK	84	1.9	V	-5.94	43.26	74	-30.74
802.11B, High Channel									
2483.5	63.59	PK	79	1.5	H	-10.55	53.04	74	-20.96
2483.5	58.06	PK	360	2.0	V	-10.55	47.51	74	-26.49
2500	58.68	PK	340	1.7	H	-10.42	48.26	74	-25.74
2500	57.11	PK	212	1.3	V	-10.42	46.69	74	-27.31
4924	47.93	PK	1	2.0	H	-5.67	42.26	74	-31.74
4924	47.65	PK	295	2.1	V	-5.67	41.98	74	-32.02
802.11G, Low Channel									
2310	55.64	PK	258	1.6	H	-10.36	45.28	74	-28.72
2310	62.61	PK	115	1.1	V	-10.36	52.25	74	-21.75
2390	79.22	PK	127	1.2	H	-10.71	68.51	74	-5.49
2390	54.28	AVG	73	1.5	H	-10.71	43.57	54	-10.43
2390	74.79	PK	73	1.5	V	-10.71	64.08	74	-9.92
2390	49.21	AVG	197	1.3	V	-10.71	38.50	54	-15.50
4824	48.4	PK	327	1.5	H	-6.11	42.29	74	-31.71
4824	48.83	PK	200	1.2	V	-6.11	42.72	74	-31.28
802.11G, Middle Channel									
4874	47.38	PK	222	1.1	H	-5.94	41.44	74	-32.56
4874	48.87	PK	197	1.6	V	-5.94	42.93	74	-31.07
802.11G, High Channel									
2483.5	78.23	PK	201	1.1	H	-10.55	67.68	74	-6.32
2483.5	51.4	AV	43	2.0	H	-10.55	40.85	54	-13.15
2483.5	74.39	PK	187	1.8	V	-10.55	63.84	74	-10.16
2483.5	49.1	AV	60	2.0	V	-10.55	38.55	54	-15.45
2500	60.13	PK	97	1.1	H	-10.42	49.71	74	-24.29
2500	57.82	PK	97	1.1	V	-10.42	47.40	74	-26.60
4924	48.71	PK	342	1.5	H	-5.67	43.04	74	-30.96
4924	48.04	PK	53	2.1	V	-5.67	42.37	74	-31.63

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
802.11N20, Low Channel									
2310	56.46	PK	212	1.6	H	-10.36	46.10	74	-27.90
2310	56.61	PK	51	2.2	V	-10.36	46.25	74	-27.75
2390	81.72	PK	343	1.2	H	-10.71	71.01	74	-2.99
2390	50.81	AV	273	1.9	H	-10.71	40.10	54	-13.90
2390	76.04	PK	71	1.1	V	-10.71	65.33	74	-8.67
2390	50.01	AV	156	1.1	V	-10.71	39.30	54	-14.70
4824	47.31	PK	21	1.0	H	-6.11	41.20	74	-32.80
4824	48.55	PK	251	1.9	V	-6.11	42.44	74	-31.56
802.11N20, Middle Channel									
4874	48.85	PK	76	1.2	H	-5.94	42.91	74	-31.09
4874	48.8	PK	65	1.7	V	-5.94	42.86	74	-31.14
802.11N20, High Channel									
2483.5	78.59	PK	179	1.8	H	-10.55	68.04	74	-5.96
2483.5	47	AV	223	1.0	H	-10.55	36.45	54	-17.55
2483.5	72.74	PK	358	1.6	V	-10.55	62.19	74	-11.81
2483.5	46.3	AV	179	1.3	V	-10.55	35.75	54	-18.25
2500	60.47	PK	175	2.0	H	-10.42	50.05	74	-23.95
2500	61.67	PK	175	2.0	V	-10.42	51.25	74	-22.75
4924	48.58	PK	209	1.1	H	-5.67	42.91	74	-31.09
4924	48.25	PK	87	1.7	V	-5.67	42.58	74	-31.42
802.11N40, Low Channel									
2310	56.86	PK	98	1.8	H	-10.36	46.50	74	-27.50
2310	55.98	PK	274	1.1	V	-10.36	45.62	74	-28.38
2390	79.48	PK	274	1.1	H	-10.71	68.77	74	-5.23
2390	51.81	AV	303	1.3	H	-10.71	41.10	54	-12.90
2390	67.61	PK	249	2.2	V	-10.71	56.90	74	-17.10
2390	47.21	AV	44	1.2	V	-10.71	36.50	54	-17.50
4844	48.55	PK	206	1.9	H	-6.09	42.46	74	-31.54
4844	48.02	PK	187	1.4	V	-6.09	41.93	74	-32.07
802.11N40, Middle Channel									
4874	50.31	PK	195	1.1	H	-5.94	44.37	74	-29.63
4874	48.98	PK	160	1.7	V	-5.94	43.04	74	-30.96



Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
802.11N40, High Channel									
2483.5	83.9	PK	165	1.2	H	-10.55	73.35	74	-0.65
2483.5	55.8	AV	36	2.2	H	-10.55	45.25	54	-8.75
2483.5	82.07	PK	343	1.7	V	-10.55	71.52	74	-2.48
2483.5	50	AV	212	1.3	V	-10.55	39.45	54	-14.55
2500	71.77	PK	203	2.0	H	-10.42	61.35	74	-12.65
2500	53.9	AV	322	1.8	H	-10.42	43.48	54	-10.52
2500	68.77	PK	322	1.8	V	-10.42	58.35	74	-15.65
2500	42.2	AV	90	1.2	V	-10.42	31.78	54	-22.22
4904	49.28	PK	90	1.2	H	-5.77	43.51	74	-30.49
4904	48.74	PK	0	1.0	V	-5.77	42.97	74	-31.03

**Note:**

Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Absolute Level (Corrected Amplitude) = Factor + Reading

Margin = Absolute Level (Corrected Amplitude) – Limit

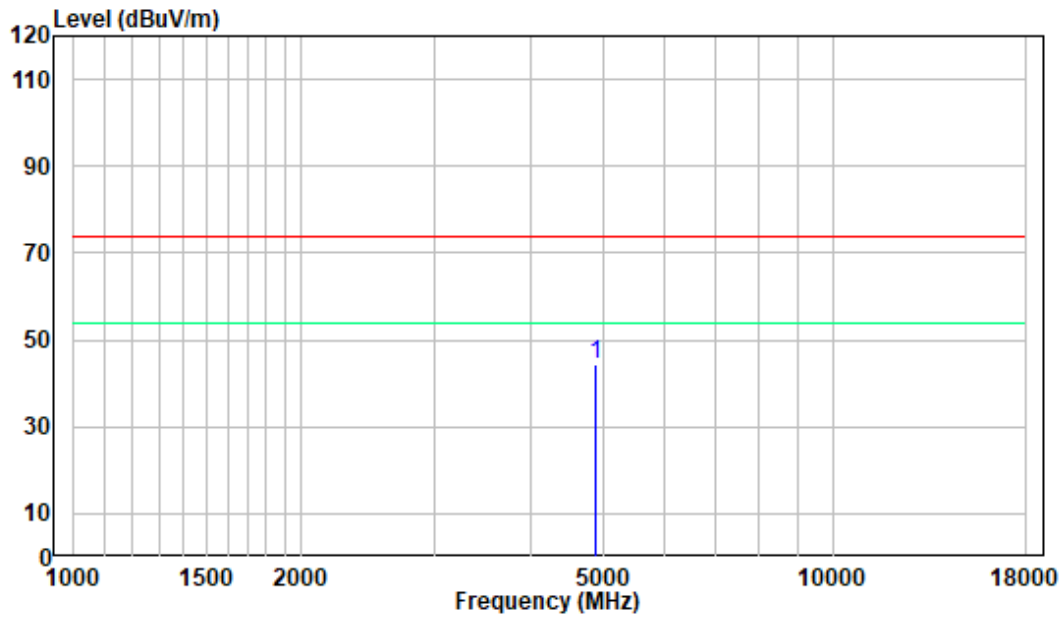
The other spurious emission which is in the noise floor level was not recorded.

For above 1GHz, when the test result of peak was 20dB below to the limit of peak, which can be compliant to the average limit, just peak value was recorded.

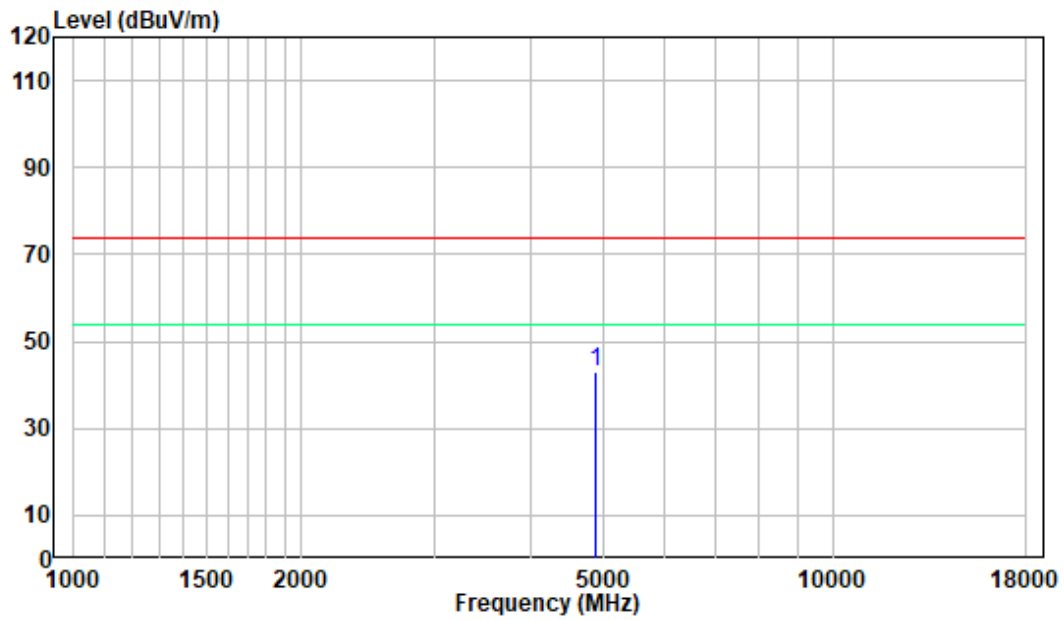
1-18 GHz: (Pre-scan plots)

802.11 n40 Middle Channel (Worst case)

Horizontal



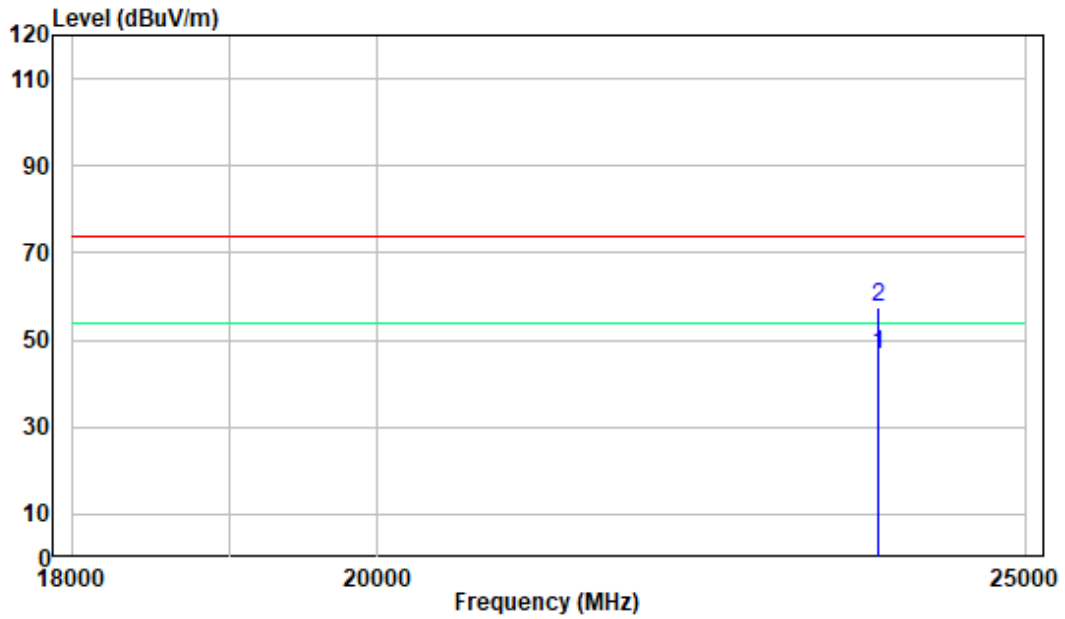
Vertical



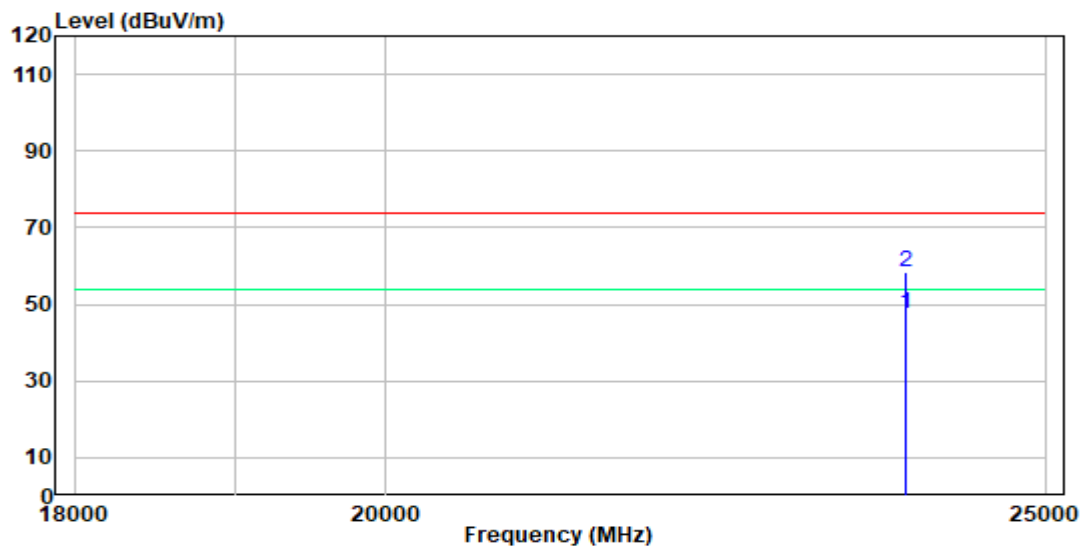
18 -25GHz: (Pre-scan plots)

802.11 n40 Middle Channel (Worst case)

Horizontal



Vertical



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

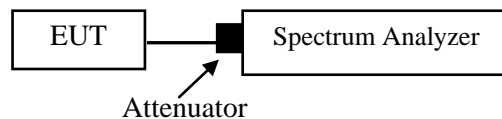
### Applicable Standard

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

<b>Temperature:</b>	24°C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Bob Liao on 2023-04-13.*

*EUT operation mode: Transmitting*

**Test Result:** Compliant. Please refer to the Appendix.

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

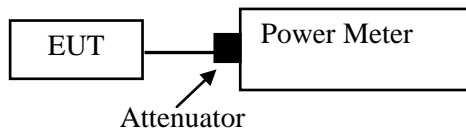
### Applicable Standard

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 11.9.2.3.2

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.



### Test Data

#### Environmental Conditions

<b>Temperature:</b>	24°C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Bob Liao on 2023-04-13.*

*EUT operation mode: Transmitting*

**Test Result:** Compliant. Please refer to the Appendix.

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

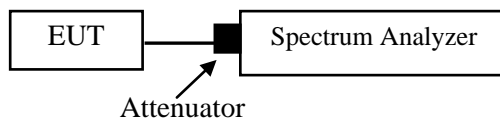
### Applicable Standard

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

<b>Temperature:</b>	24°C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Bob Liao on 2023-04-13.*

*EUT operation mode: Transmitting*

**Test Result:** Compliant. Please refer to the Appendix.

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## FCC §15.247(e) - POWER SPECTRAL DENSITY

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### 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 11.10.3

Method AVGPSD-1: (for duty cycle  $\geq 98\%$ )

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:  $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$ .
3. Set the VBW  $\geq 3 \times \text{RBW}$ .
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  $\geq [2 \cdot \text{span} / \text{RBW}]$ .
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 duty cycle is constant)

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:  $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$ .
4. Set the VBW  $\geq 3 \times \text{RBW}$ .
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  $\geq [2 \cdot \text{span} / \text{RBW}]$ .
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.

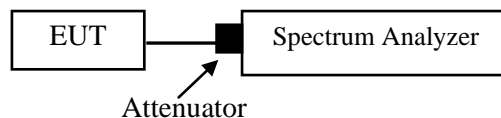
13. If measured value exceeds requirement specified by regulatory agency, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

According to ANSI C63.10-2013, section 11.10.7

Method AVGPSD-3: (for duty cycle < 98% and duty cycle not constant)

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

- a) Set the instrument span to a minimum of 1.5 times the OBW.
- b) Set sweep trigger to "free run."
- c) Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set VBW  $\geq [3 \times \text{RBW}]$ .
- e) Number of points in sweep  $\geq [2 \times \text{span} / \text{RBW}]$ . (This ensures that bin-to-bin spacing is  $\leq \text{RBW} / 2$ , so that narrowband signals are not lost between frequency bins.)
- f) Sweep time  $\leq (\text{number of points in sweep}) \times T$ , where T is defined in 11.6.  
NOTE—If this results in a sweep time less than the auto sweep time of the instrument, then this method shall not be used (use AVGPSD-2A instead). The purpose of this step is to ensure that averaging time in each bin is less than or equal to the minimum time of a transmission.
- g) Detector = RMS (power averaging).
- h) Trace mode = max hold.
- i) Allow max hold to run for at least 60 s or longer as needed to allow the trace to stabilize.
- j) Use the peak marker function to determine the maximum PSD level.
- k) If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).



## Test Data

### Environmental Conditions

<b>Temperature:</b>	24°C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Bob Liao on 2023-06-04.*

*EUT operation mode: Transmitting*

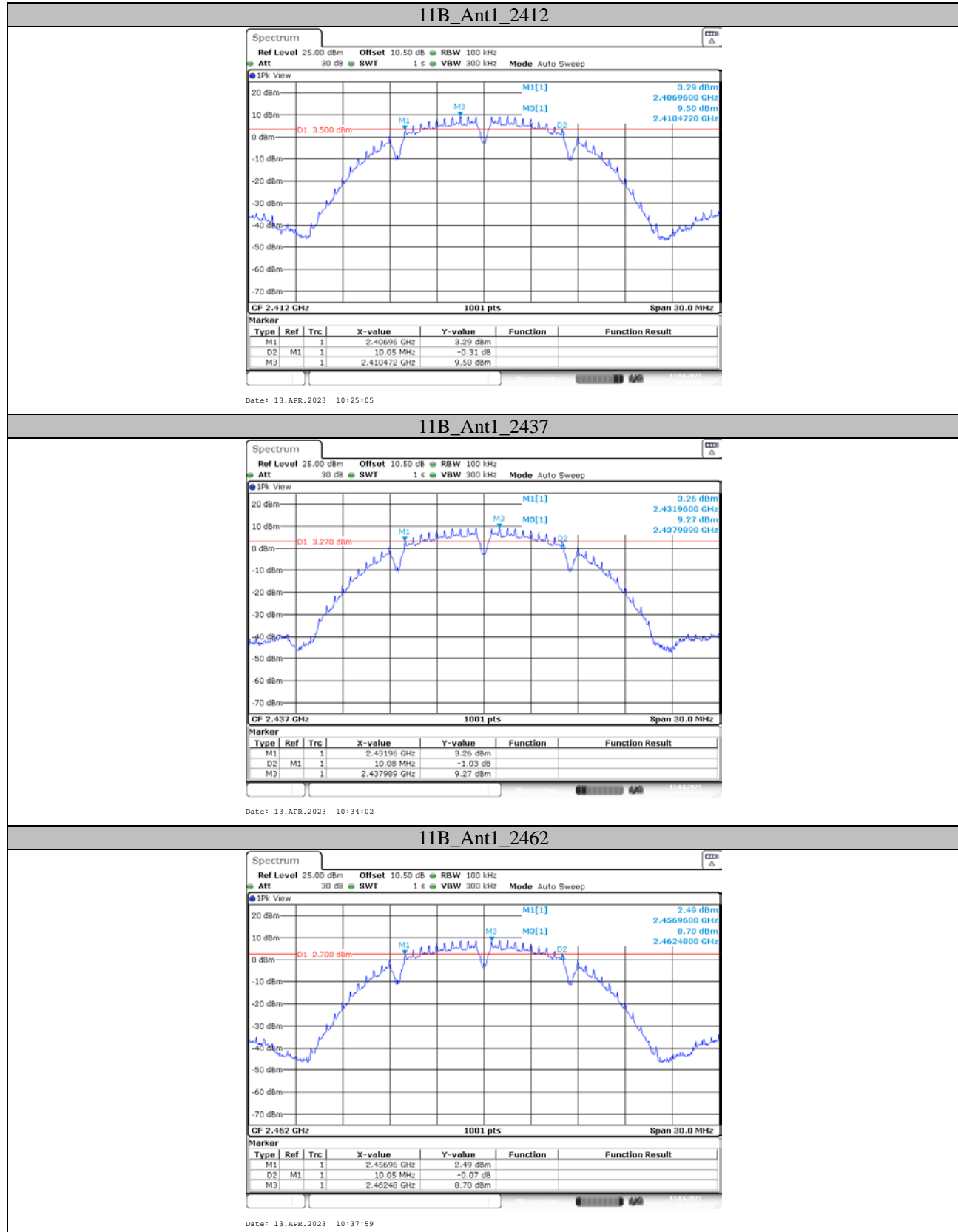
**Test Result:** Compliant. Please refer to the Appendix.



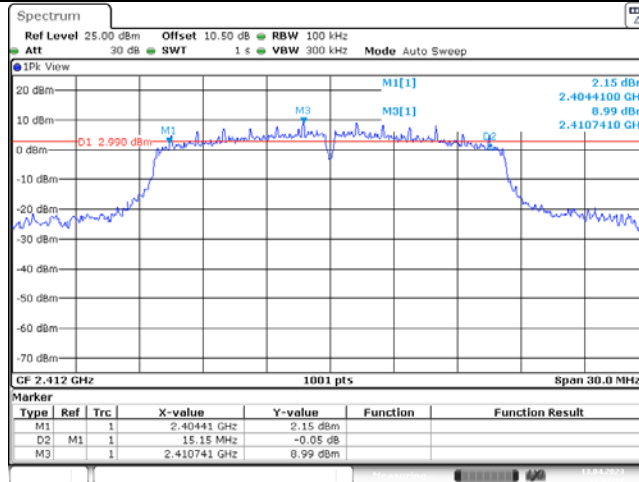
**APPENDIX A: 6dB Emission Bandwidth****Test Result**

Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	10.05	0.5	PASS
		2437	10.08	0.5	PASS
		2462	10.05	0.5	PASS
11G	Ant1	2412	15.15	0.5	PASS
		2437	15.15	0.5	PASS
		2462	15.15	0.5	PASS
11N20 SISO	Ant1	2412	15.15	0.5	PASS
		2437	15.15	0.5	PASS
		2462	15.15	0.5	PASS
11N40 SISO	Ant1	2422	31.44	0.5	PASS
		2437	31.44	0.5	PASS
		2452	31.44	0.5	PASS

Test Graphs

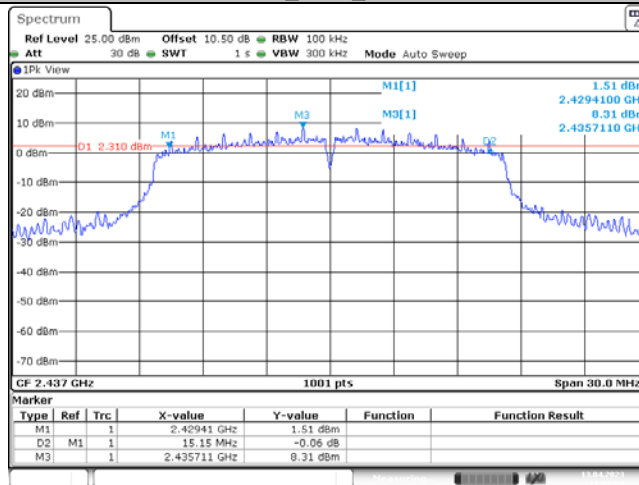


11G\_Ant1\_2412



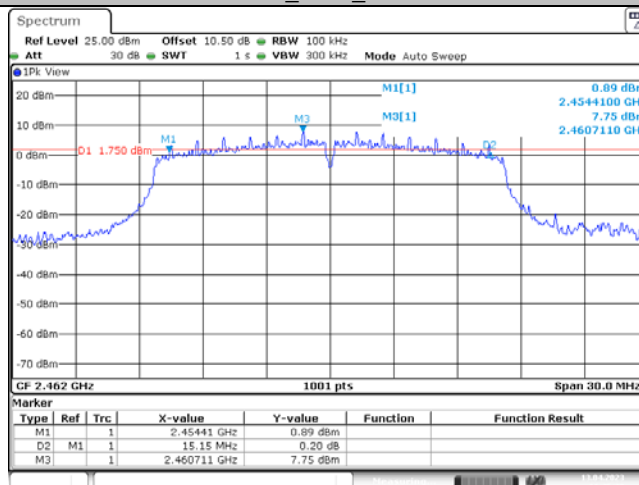
Date: 13.APR.2023 11:07:13

11G\_Ant1\_2437



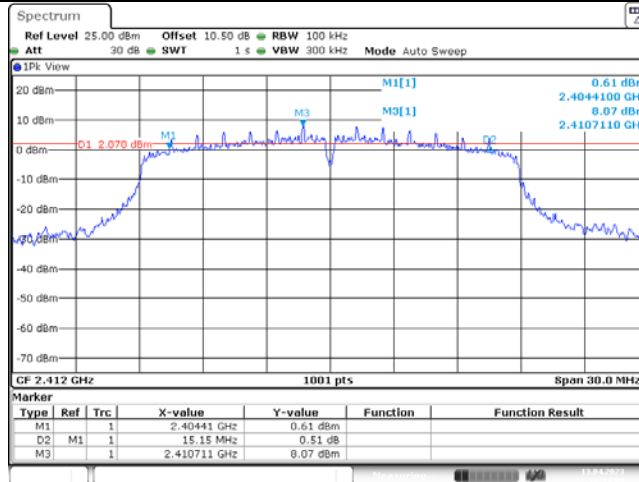
Date: 13.APR.2023 11:22:08

11G\_Ant1\_2462



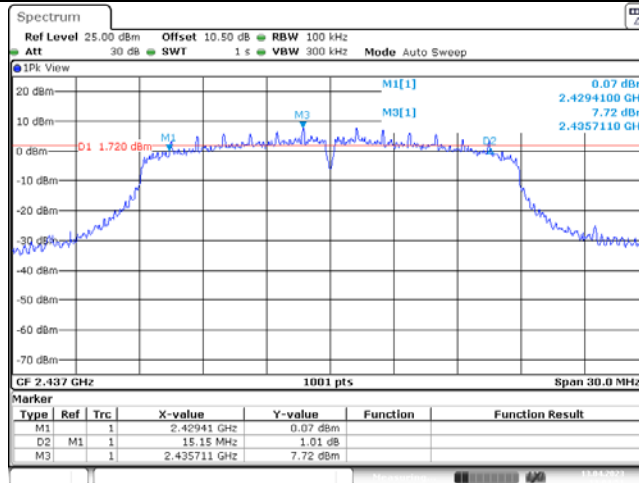
Date: 13.APR.2023 11:25:39

11N20SISO\_Ant1\_2412



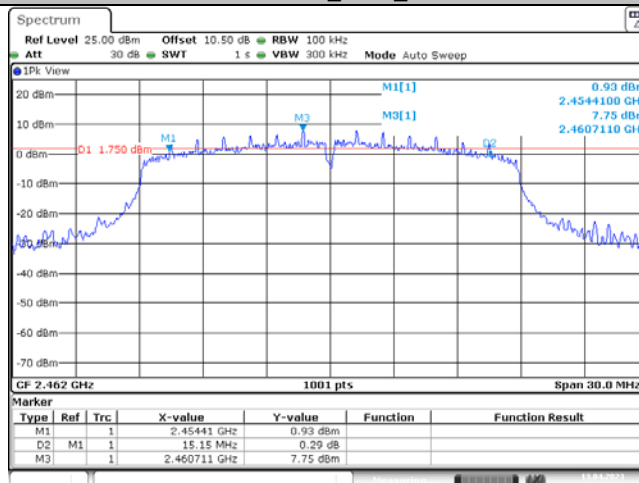
Date: 13.APR.2023 12:39:01

11N20SISO\_Ant1\_2437



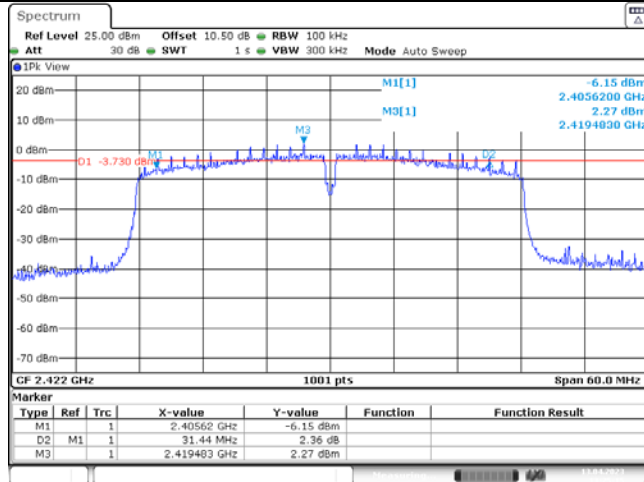
Date: 13.APR.2023 13:04:52

11N20SISO\_Ant1\_2462



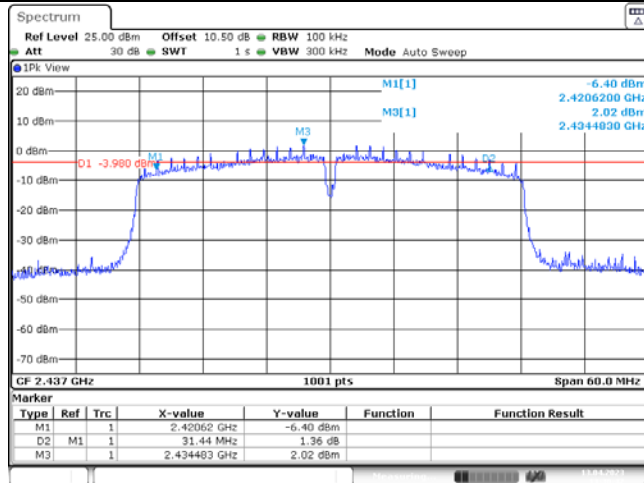
Date: 13.APR.2023 13:09:56

11N40SISO\_Ant1\_2422



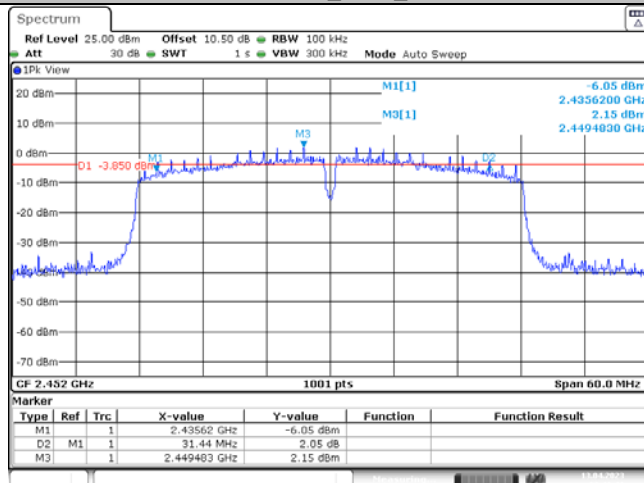
Date: 13.APR.2023 13:25:16

11N40SISO\_Ant1\_2437



Date: 13.APR.2023 13:30:48

11N40SISO\_Ant1\_2452

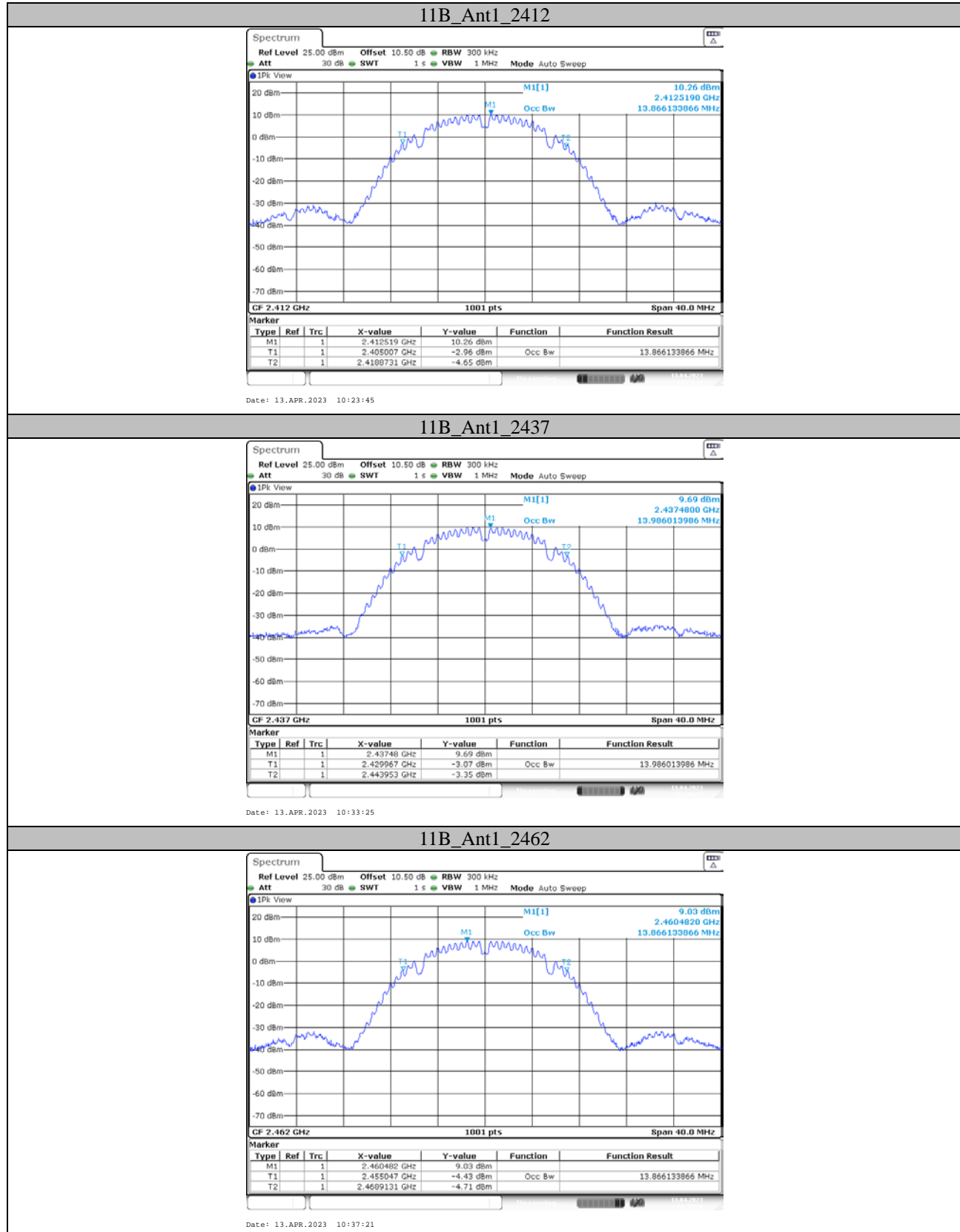


Date: 13.APR.2023 13:41:41

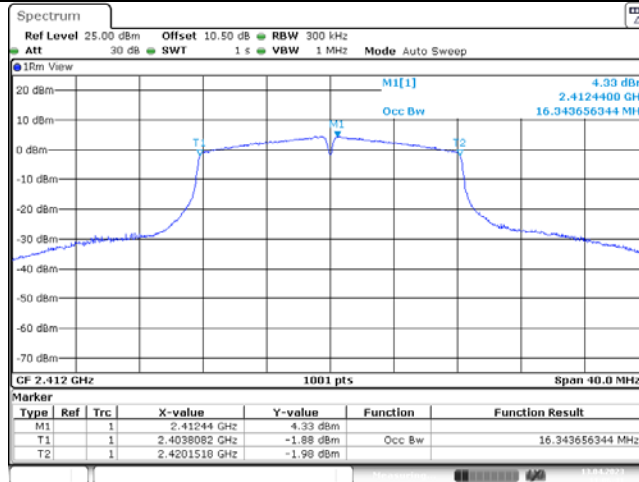
**APPENDIX B: Occupied Channel Bandwidth****Test Result:**

Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.866	---	PASS
		2437	13.986	---	PASS
		2462	13.866	---	PASS
11G	Ant1	2412	16.344	---	PASS
		2437	16.583	---	PASS
		2462	16.623	---	PASS
11N20 SISO	Ant1	2412	17.542	---	PASS
		2437	17.463	---	PASS
		2462	17.582	---	PASS
11N40 MIMO	Ant1	2422	35.245	---	PASS
		2437	35.325	---	PASS
		2452	35.405	---	PASS

Test Graphs:

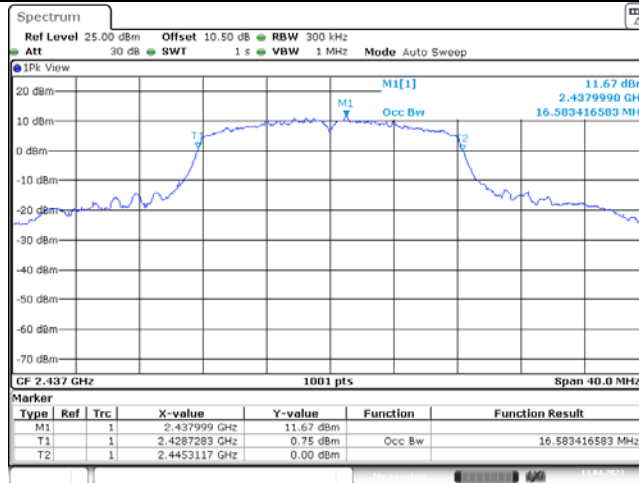


11G\_Ant1\_2412



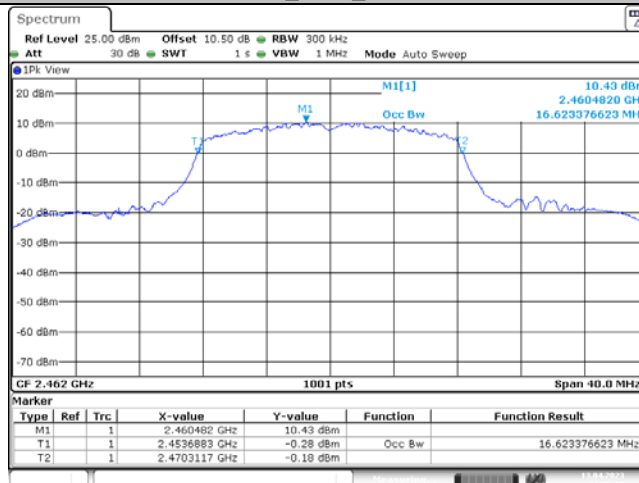
Date: 13.APR.2023 11:06:42

11G\_Ant1\_2437



Date: 13.APR.2023 11:21:42

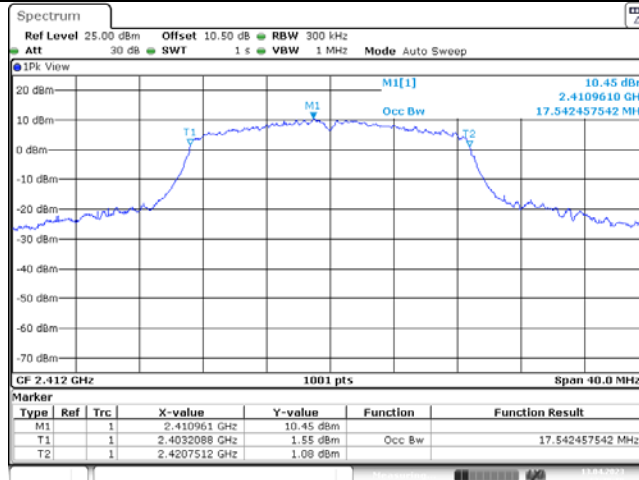
11G\_Ant1\_2462



Date: 13.APR.2023 11:25:00

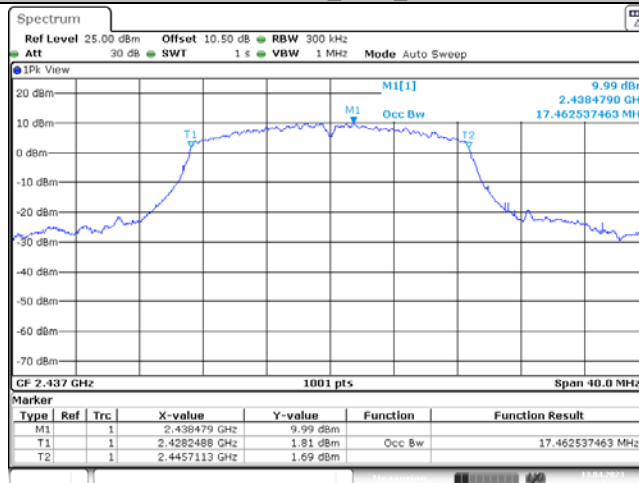


11N20SISO\_Ant1\_2412SO\_Ant1\_2412



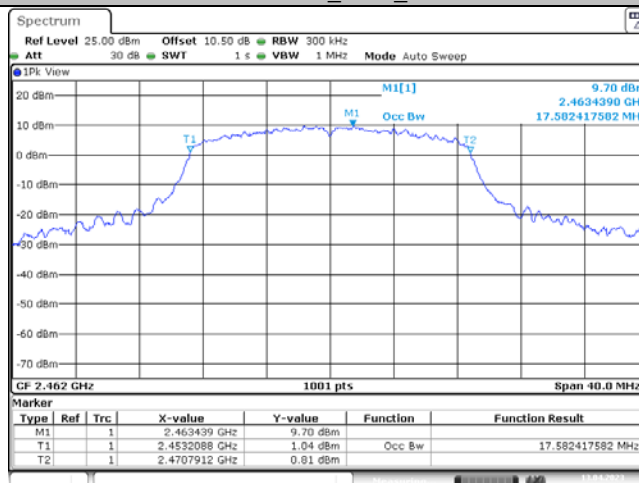
Date: 13.APR.2023 12:38:20

11N20SISO\_Ant1\_2437



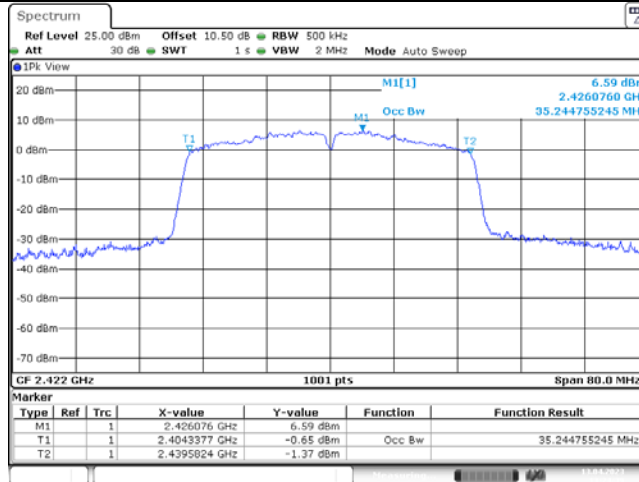
Date: 13.APR.2023 13:04:24

11N20SISO\_Ant1\_2462



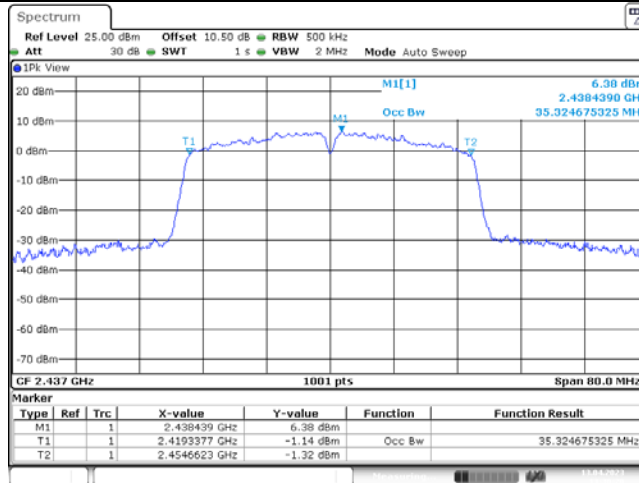
Date: 13.APR.2023 13:09:15

11N40SISO\_Ant1\_2422



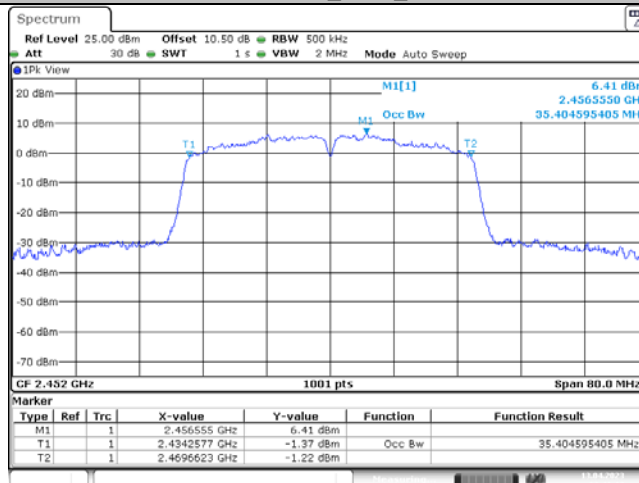
Date: 13.APR.2023 13:24:39

11N40SISO\_Ant1\_2437



Date: 13.APR.2023 13:30:21

11N40SISO\_Ant1\_2452



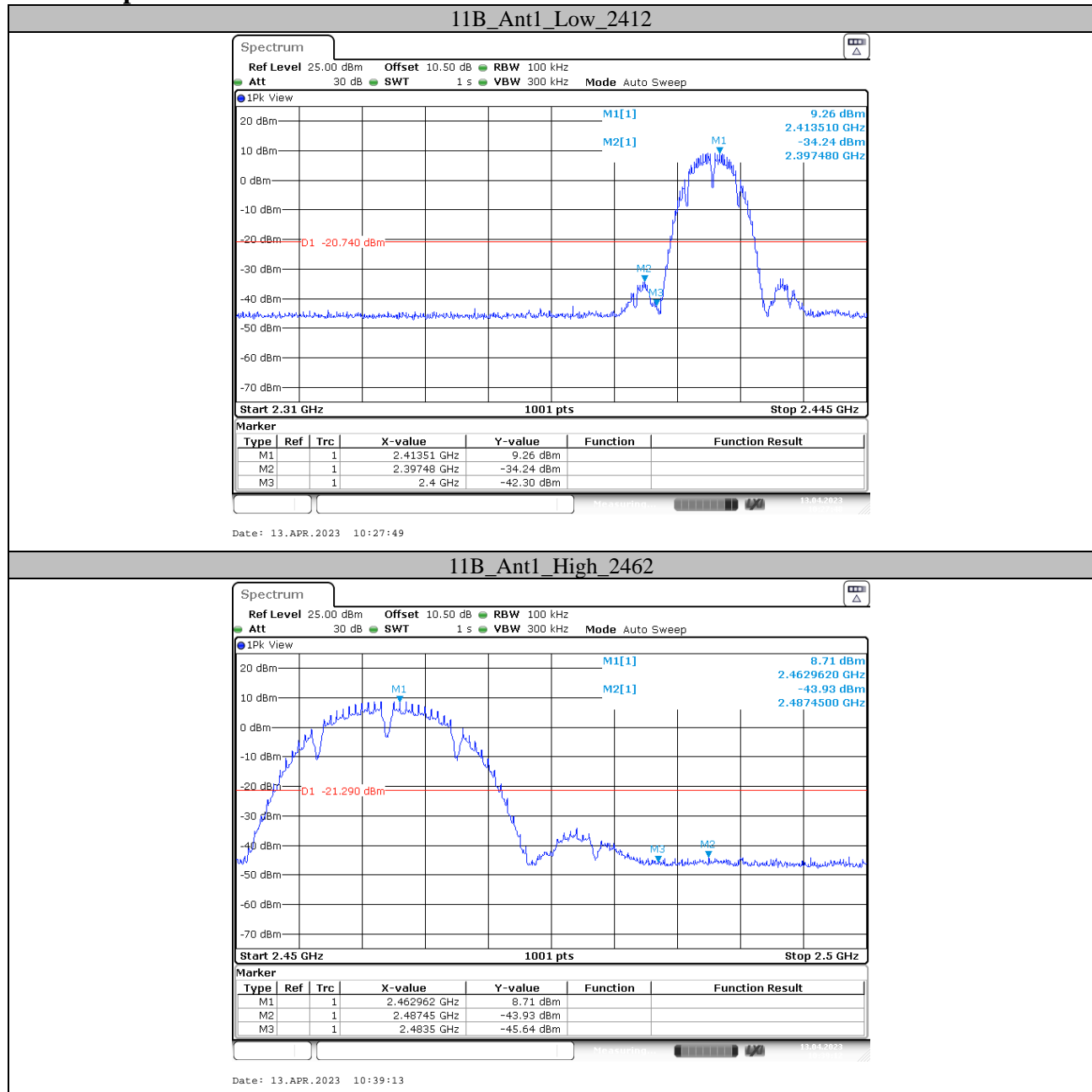
Date: 13.APR.2023 13:41:14

**APPENDIX C: Maximum Conducted Output Power****Test Result**

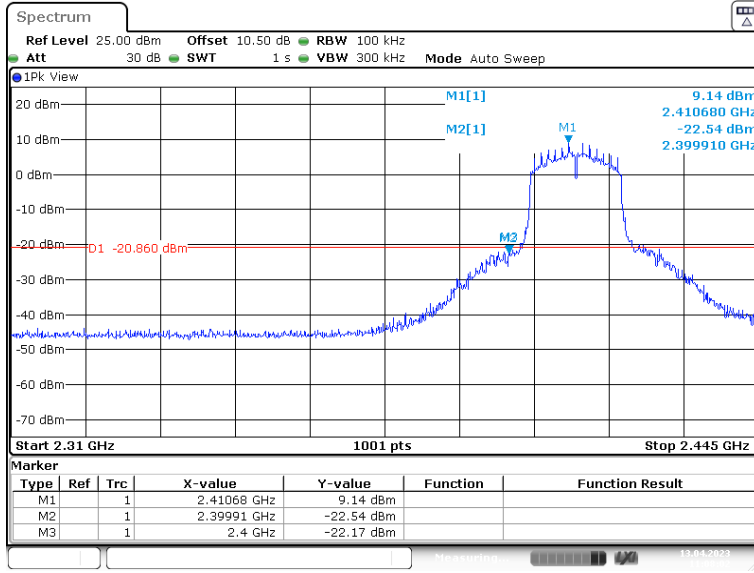
Test Mode	Antenna	Channel	Average Power[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	18.11	<=30	PASS
		2437	<b>18.24</b>	<=30	PASS
		2462	17.53	<=30	PASS
11G	Ant1	2412	<b>18.62</b>	<=30	PASS
		2437	18.24	<=30	PASS
		2462	17.69	<=30	PASS
11N20 SISO	Ant1	2412	17.32	<=30	PASS
		2437	<b>17.34</b>	<=30	PASS
		2462	17.29	<=30	PASS
11N40 SISO	Ant1	2422	14.09	<=30	PASS
		2437	14.03	<=30	PASS
		2452	<b>14.13</b>	<=30	PASS

## APPENDIX D: Band Edge Measurements

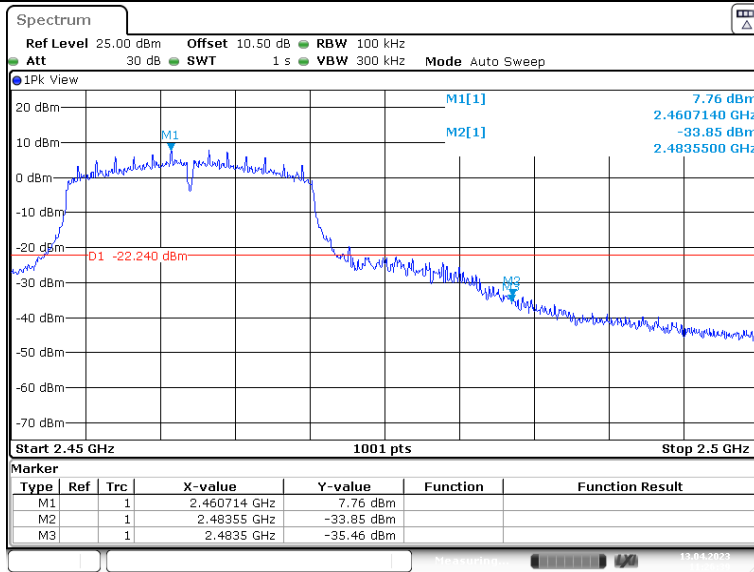
### Test Graphs

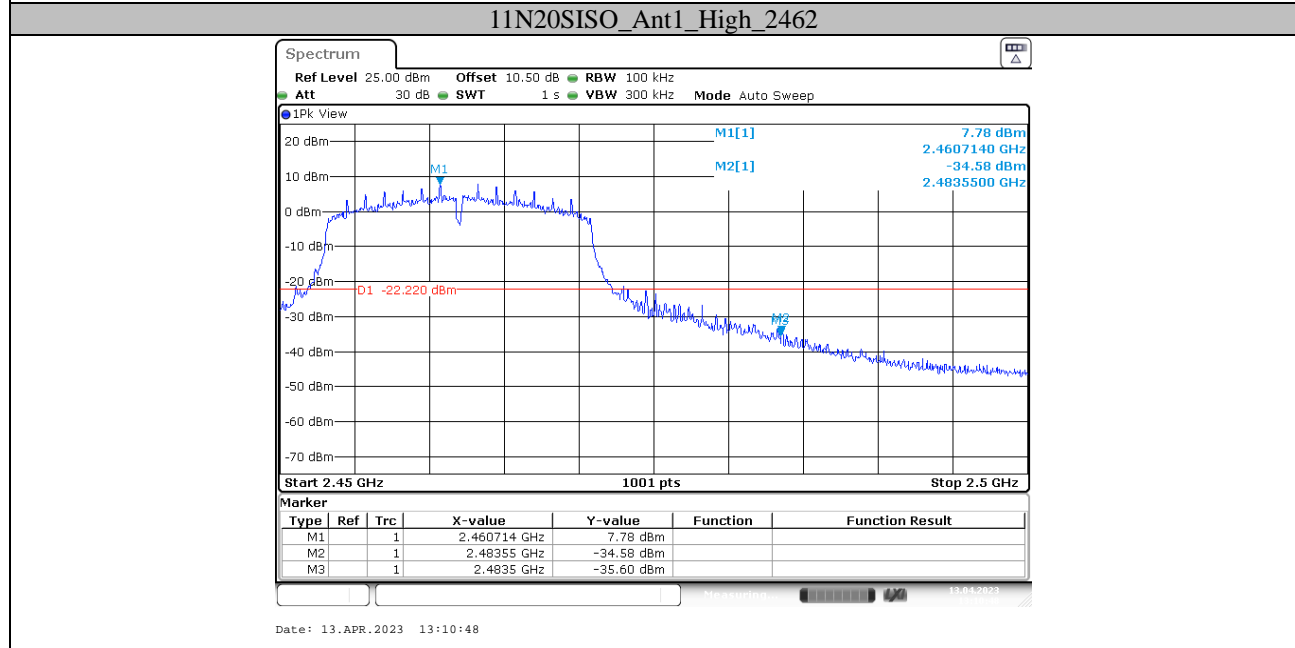
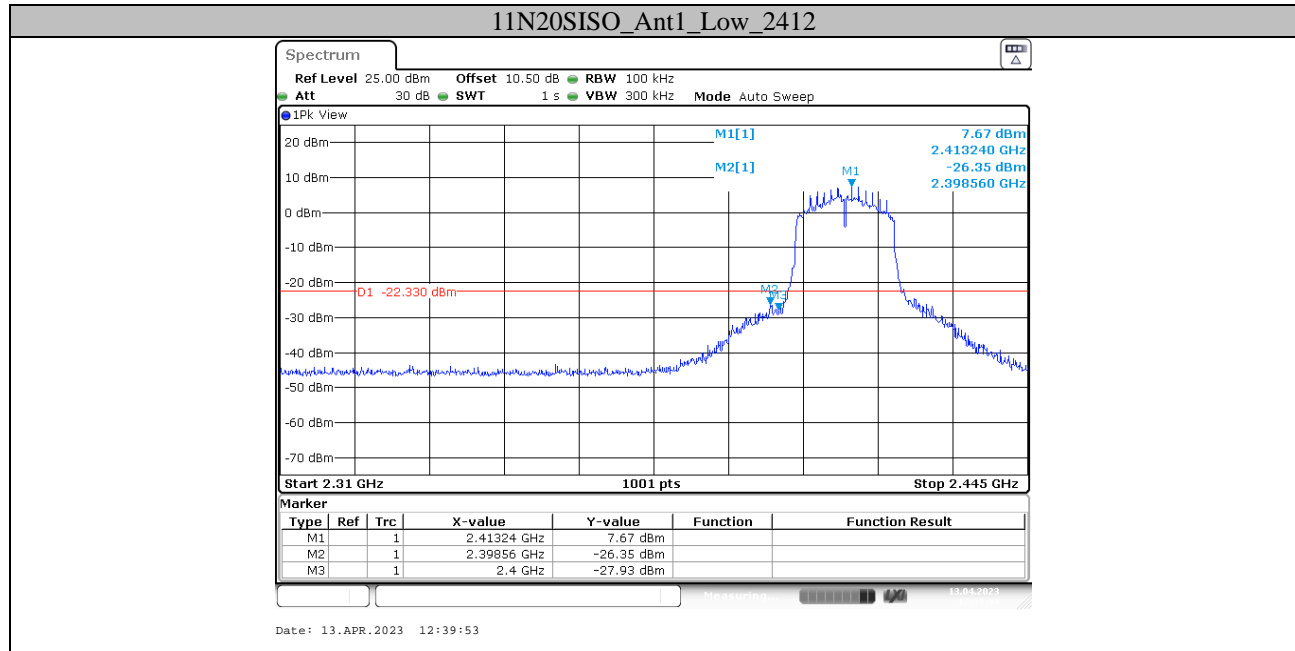


11G\_Ant1\_Low\_2412

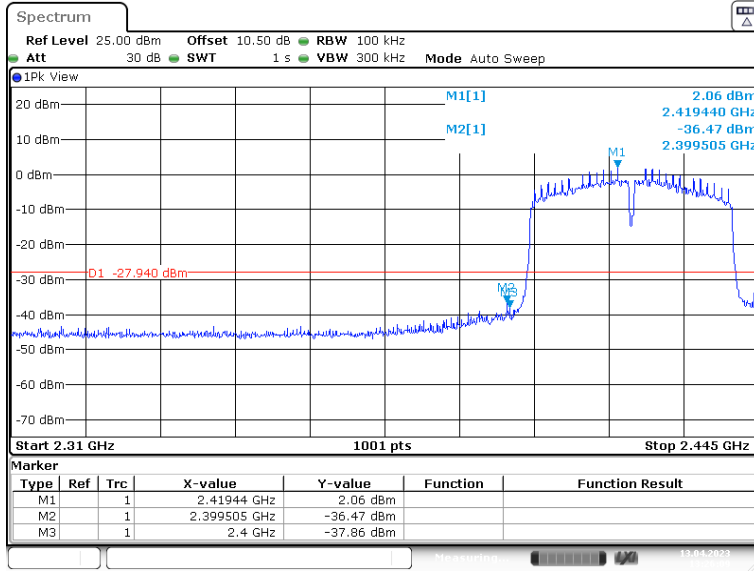


11G\_Ant1\_High\_2462

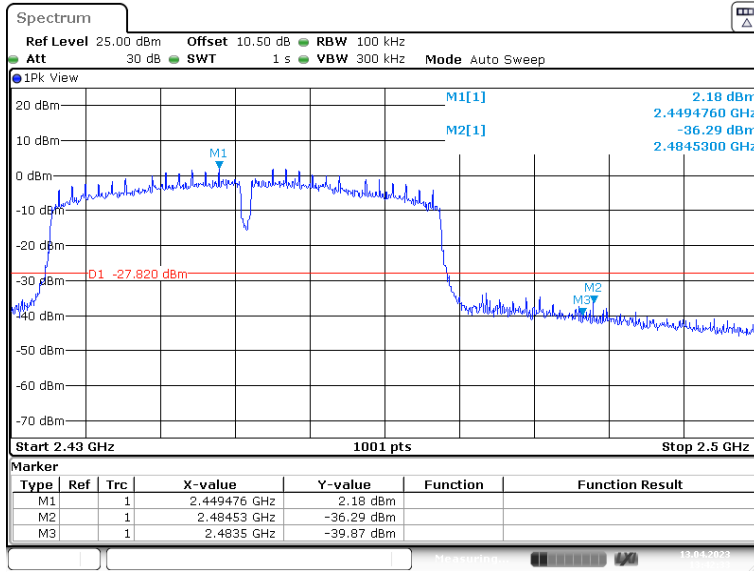




11N40SISO\_Ant1\_Low\_2422



11N40SISO\_Ant1\_High\_2452



## APPENDIX E: Maximum Power Spectral Density

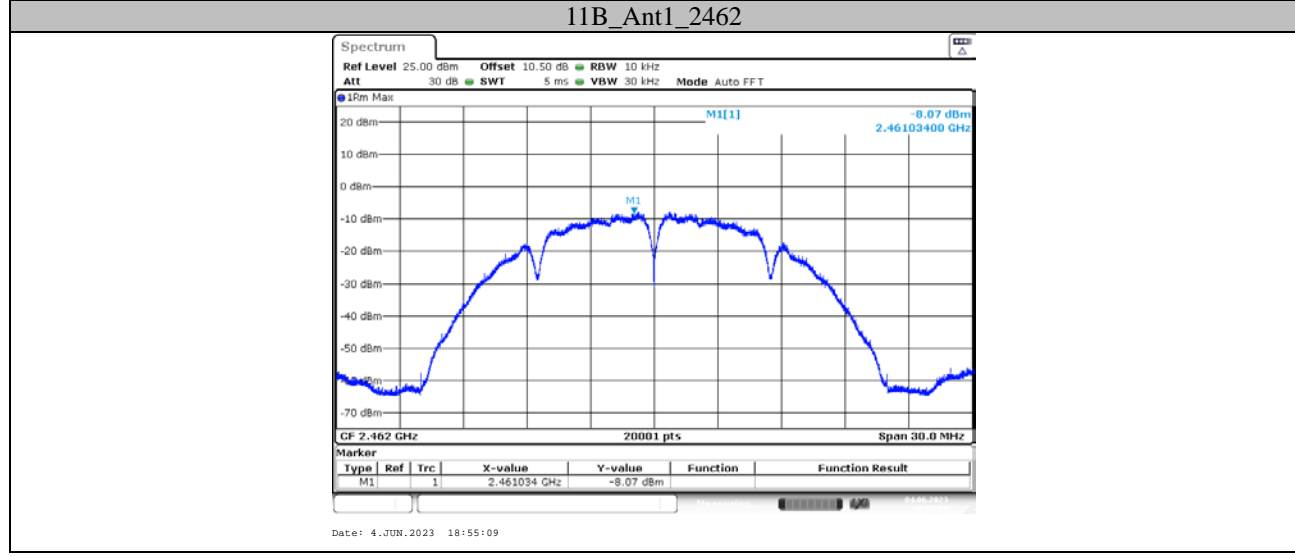
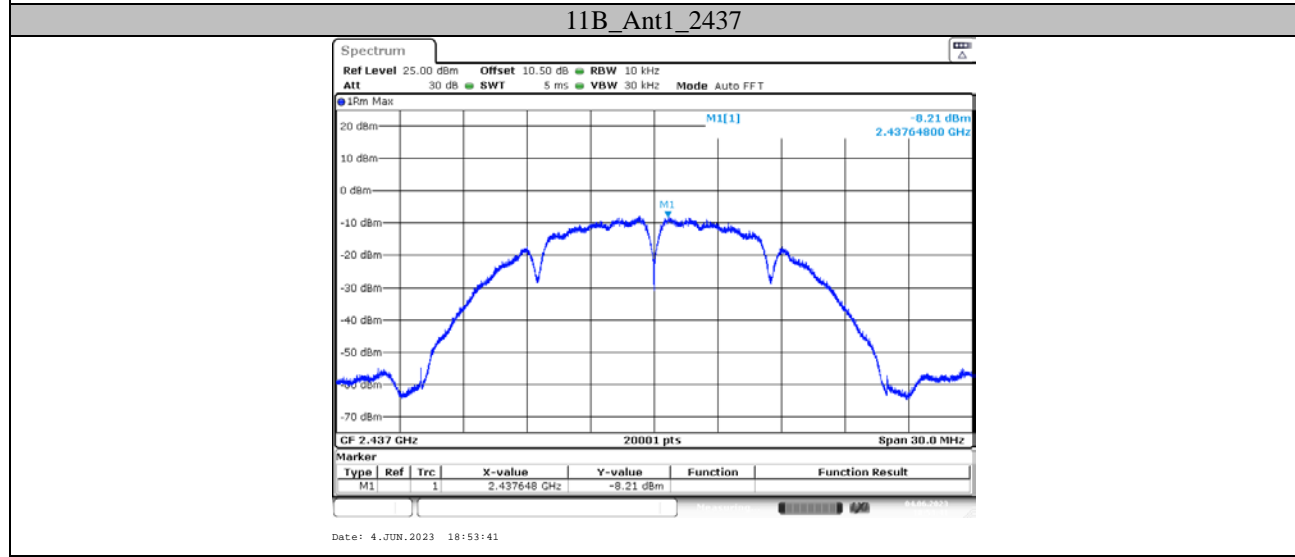
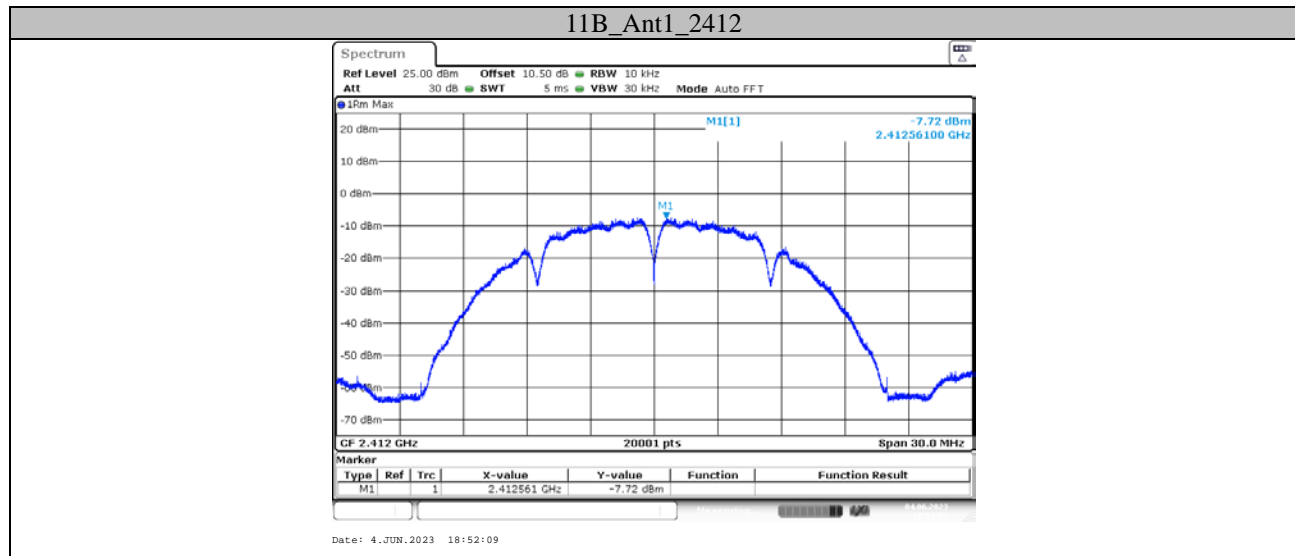
### Test Result

Test Mode	Antenna	Channel	PSD [dBm/10kHz]	Limit [dBm/3kHz]	Verdict
11B	Ant1	2412	-7.72	<=8	PASS
		2437	-8.21	<=8	PASS
		2462	-8.07	<=8	PASS
11G	Ant1	2412	-7.51	<=8	PASS
		2437	-7.16	<=8	PASS
		2462	-8.27	<=8	PASS
11N20 SISO	Ant1	2412	-8.75	<=8	PASS
		2437	-9.13	<=8	PASS
		2462	-8.63	<=8	PASS
11N40 SISO	Ant1	2422	-13.67	<=8	PASS
		2437	-14.22	<=8	PASS
		2452	-14.12	<=8	PASS

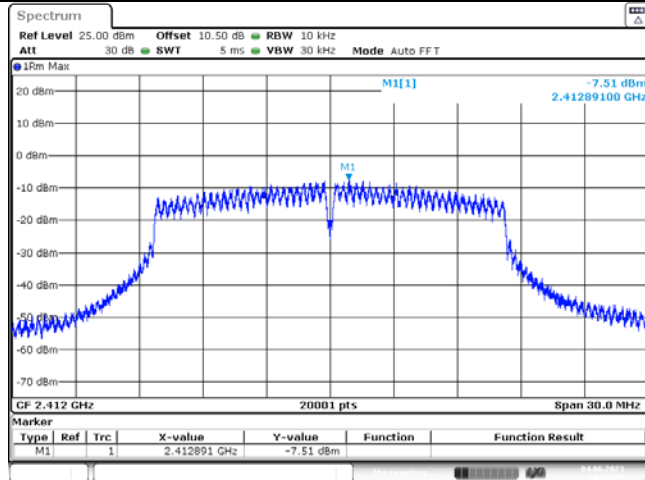
Note: the duty cycle not constant, method AVPSD-3 was used



### Test Graphs

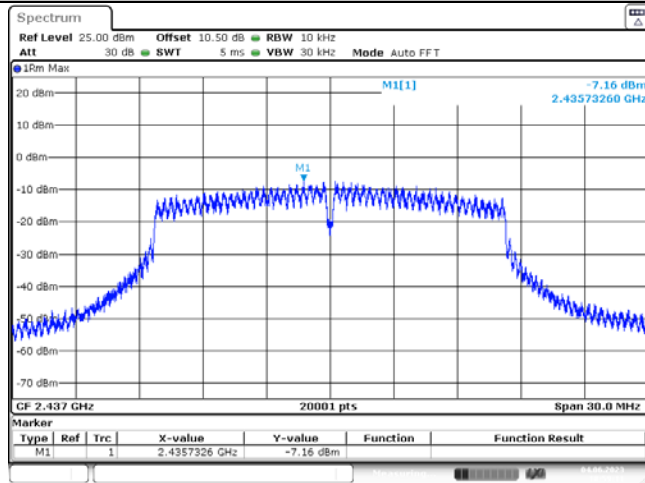


11G\_Ant1\_2412



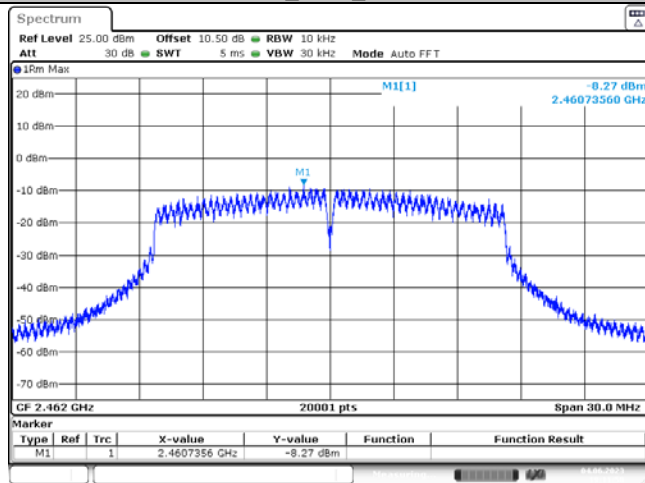
Date: 4 JUN.2023 18:56:55

11G\_Ant1\_2437



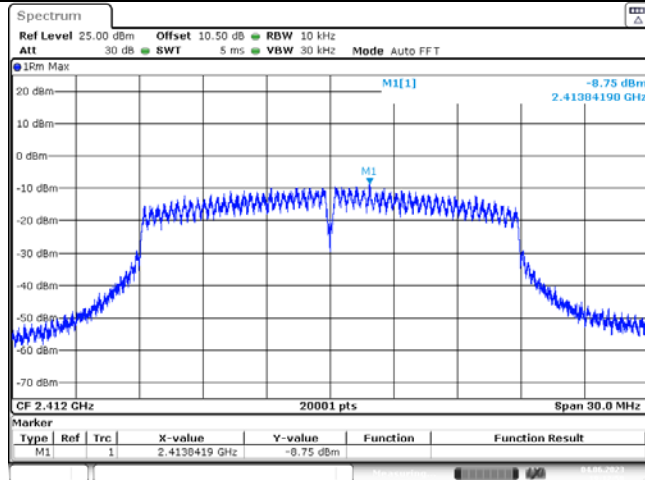
Date: 4 JUN.2023 18:59:11

11G\_Ant1\_2462



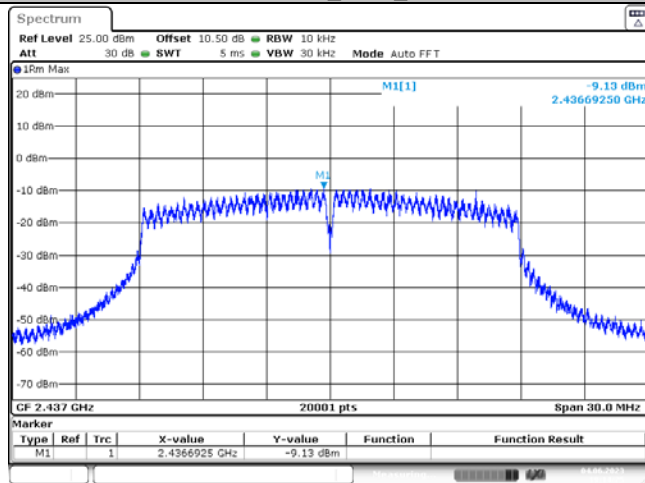
Date: 4 JUN.2023 19:11:50

11N20SISO\_Ant1\_2412



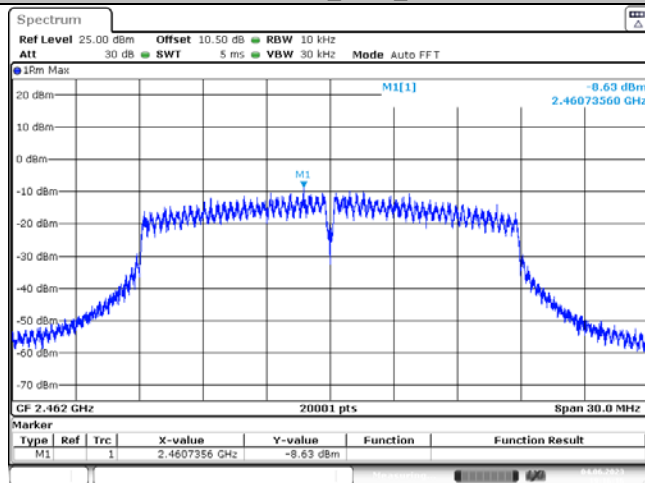
Date: 4 JUN.2023 19:12:57

11N20SISO\_Ant1\_2437



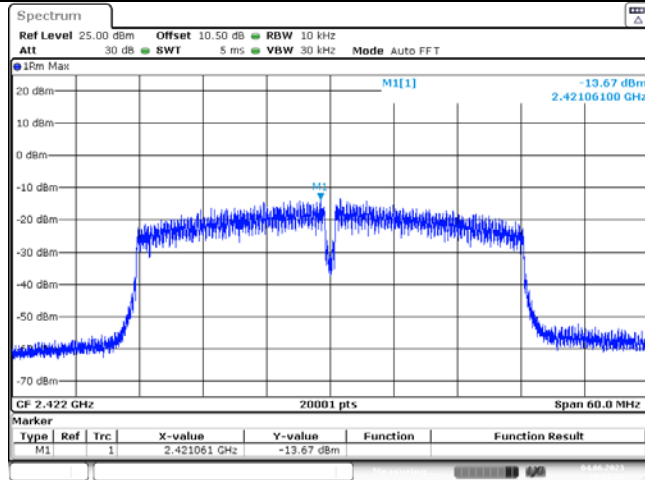
Date: 4 JUN.2023 19:14:25

11N20SISO\_Ant1\_2462



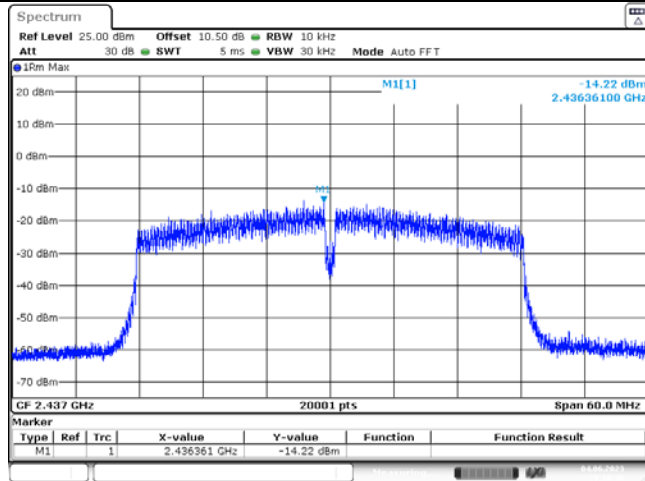
Date: 4 JUN.2023 19:16:15

11N40SISO\_Ant1\_2422



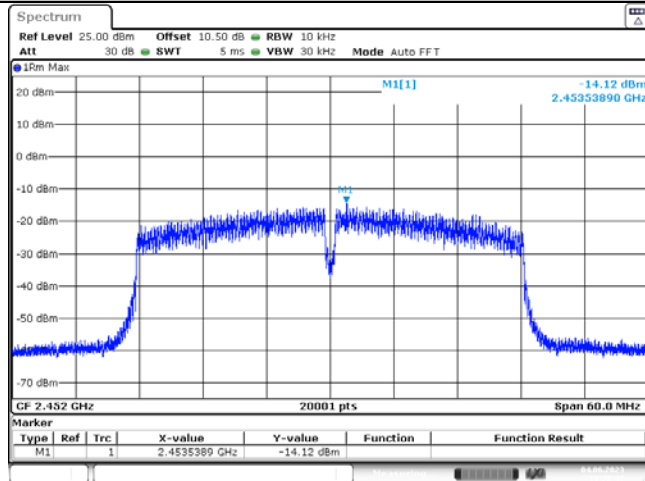
Date: 4 JUN.2023 19:17:36

11N40SISO\_Ant1\_2437



Date: 4 JUN.2023 19:18:46

11N40SISO\_Ant1\_2452



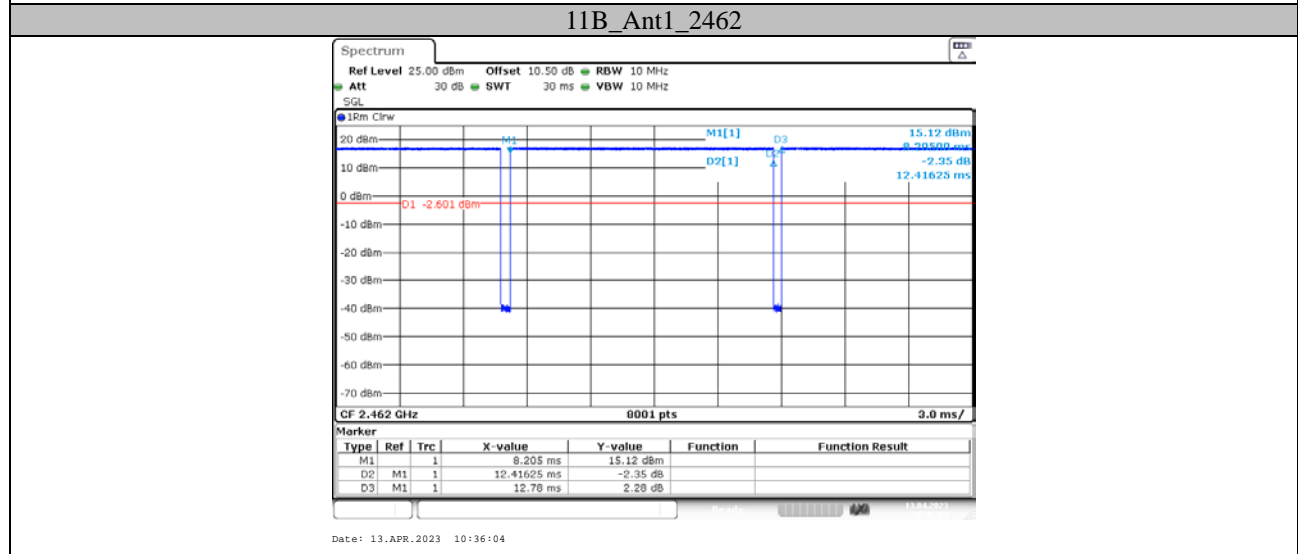
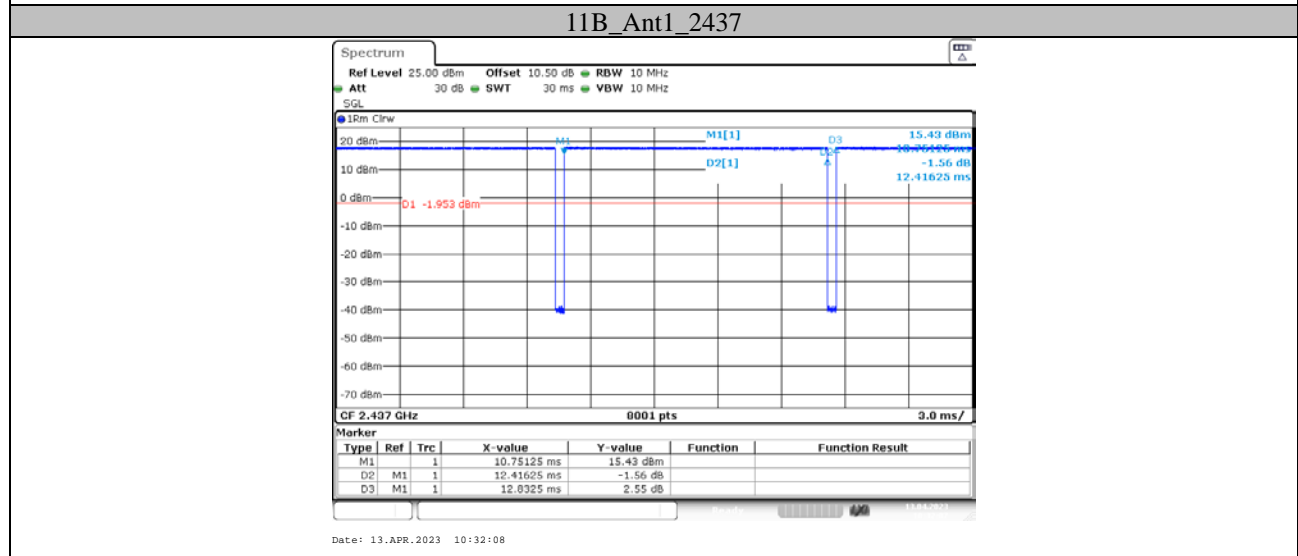
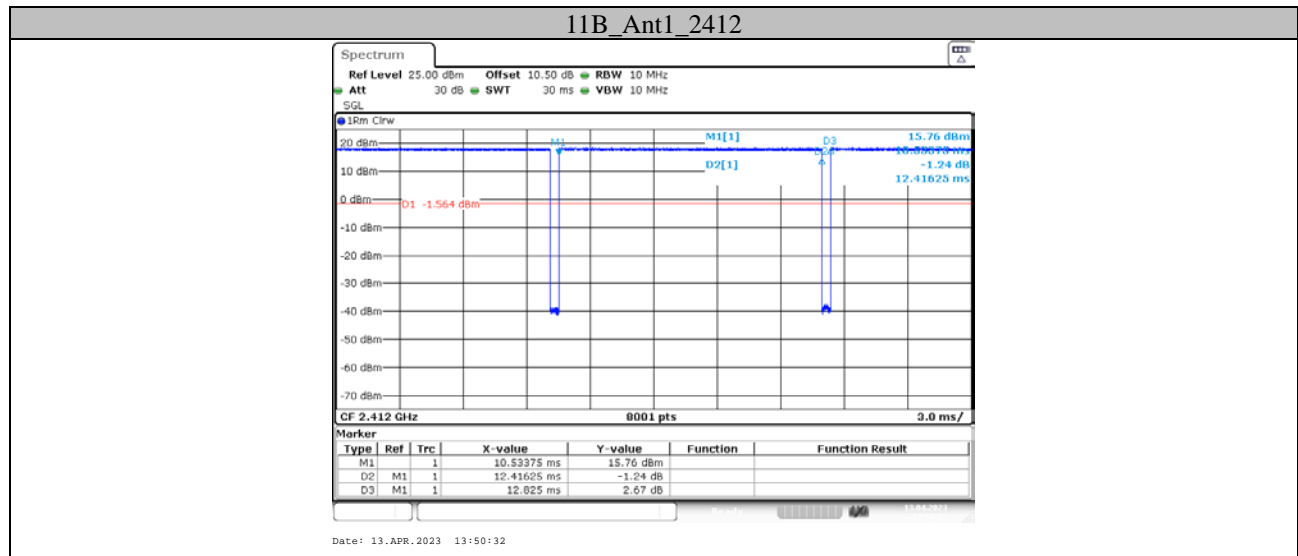
Date: 4 JUN.2023 19:20:36

## APPENDIX F: Duty Cycle

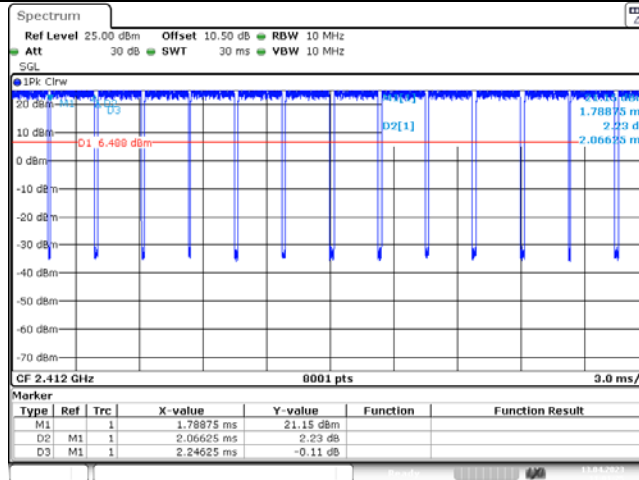
### Test Result

Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW[kHz]
11B	Ant1	2412	12.416	12.825	Not Constant	0.08
		2437	12.416	12.833	Not Constant	0.08
		2462	12.416	12.780	Not Constant	0.08
11G	Ant1	2412	2.066	2.246	Not Constant	0.48
		2437	2.066	2.273	Not Constant	0.48
		2462	2.063	2.235	Not Constant	0.48
11N20SISO	Ant1	2412	1.920	2.145	Not Constant	0.52
		2437	1.920	2.126	Not Constant	0.52
		2462	1.920	2.089	Not Constant	0.52
11N40SISO	Ant1	2422	0.941	1.069	Not Constant	1.06
		2437	0.945	1.073	Not Constant	1.06
		2452	0.945	1.163	Not Constant	1.06

### Test Graphs

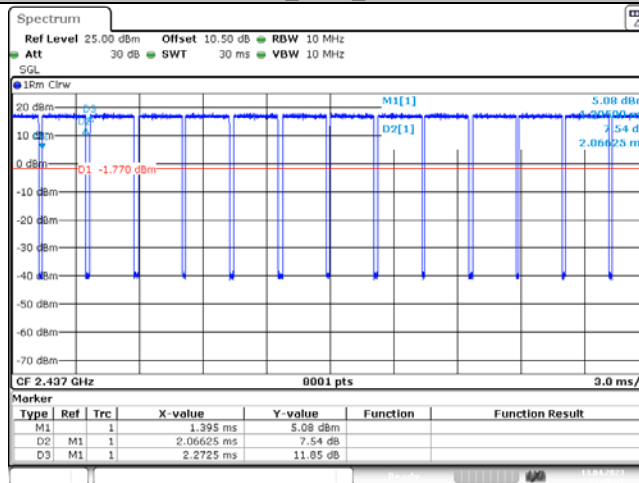


11G\_Ant1\_2412



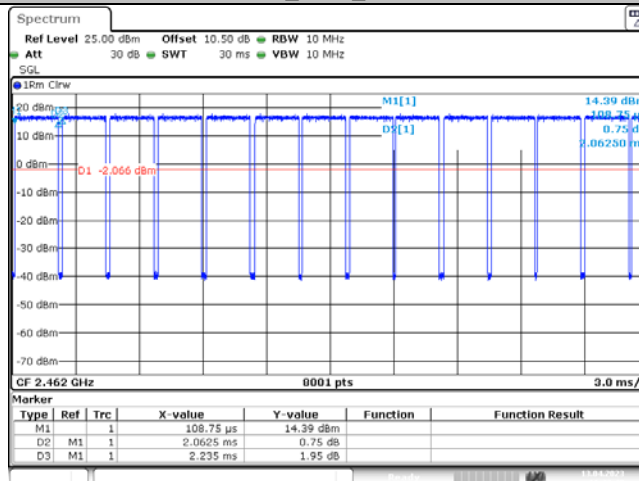
Date: 13.APR.2023 11:01:26

11G\_Ant1\_2437

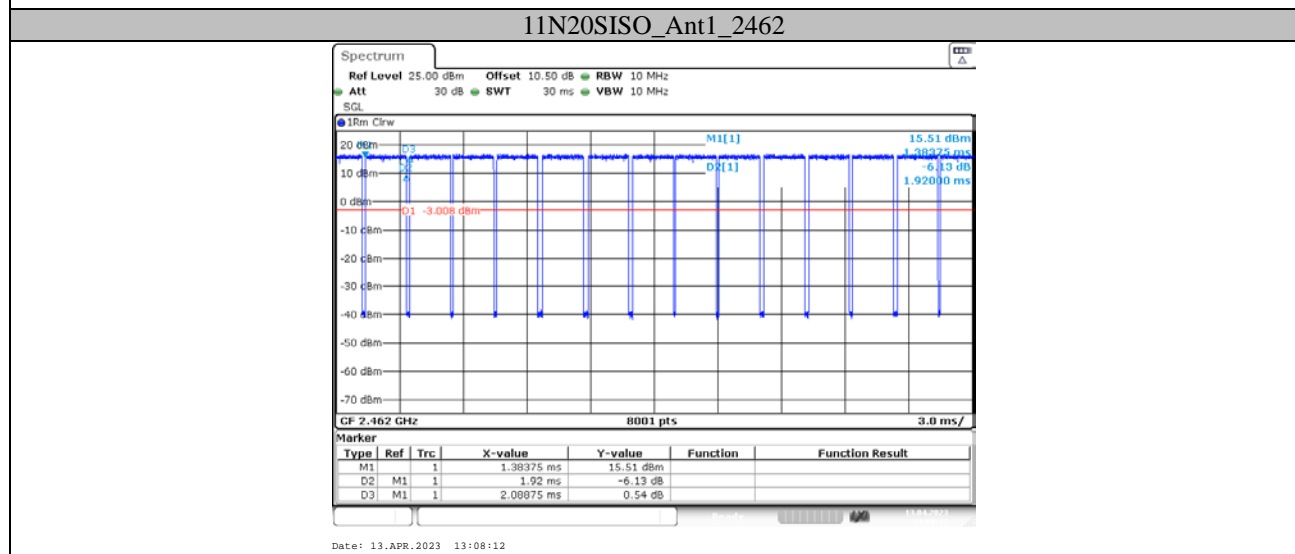
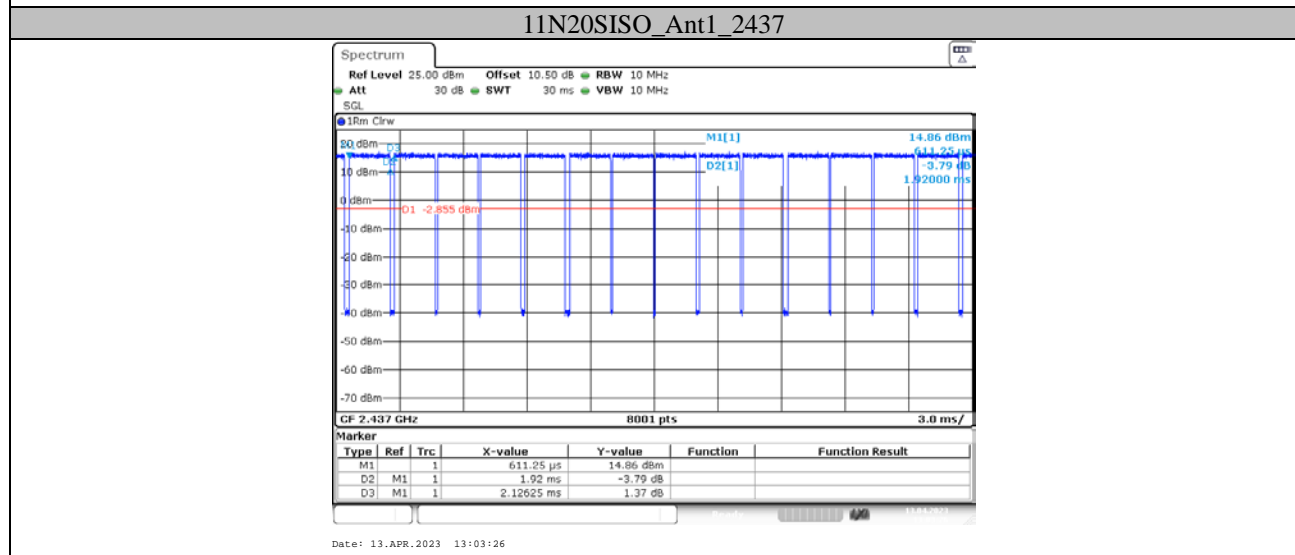
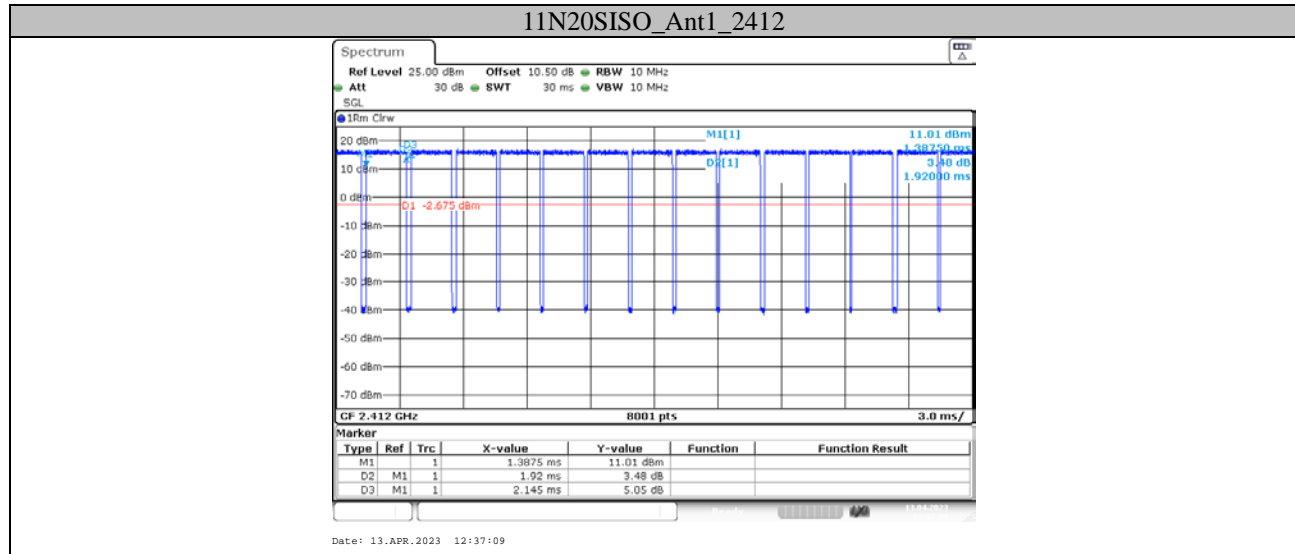


Date: 13.APR.2023 11:20:38

11G\_Ant1\_2462

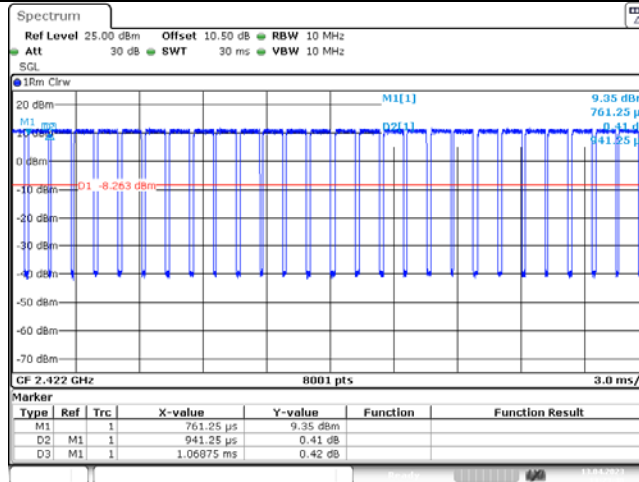


Date: 13.APR.2023 11:23:48



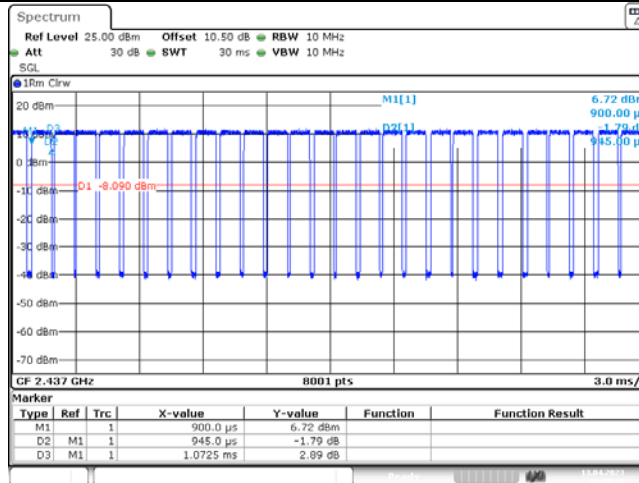


11N40SISO\_Ant1\_2422



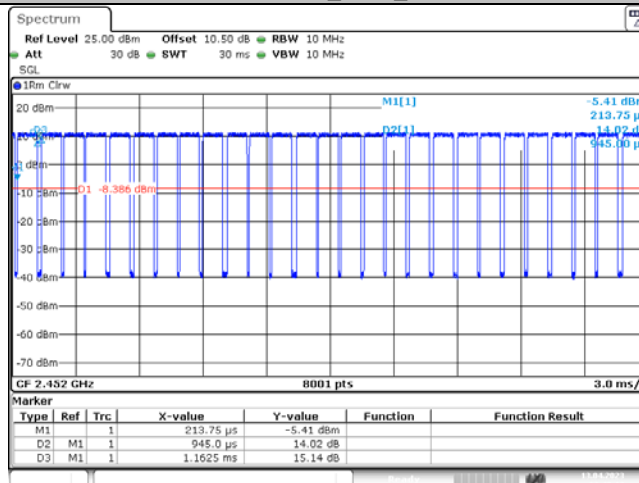
Date: 13.APR.2023 13:23:41

11N40SISO\_Ant1\_2437



Date: 13.APR.2023 13:29:25

11N40SISO\_Ant1\_2452



Date: 13.APR.2023 13:40:14

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