



TESTREPORT

Applicant Name : South Surveying & Mapping Technology Co., Ltd.
Address : No.39, Sicheng Road, Tianhe District, Guangzhou, China
Report Number: RA230407-17721E-RF-00B
FCC ID: 2AJTU-INSIGHTV2

Test Standard (s)

FCC Part 15.247

Sample Description

Product: GNSS RECEIVER
Insight V2, K58plus, G6pro, T5, C7, C8, C9, G3, G5, G9, RT300, J1, T12, ROVA 1S, ROVA 2S, ROVA 3S, ROVA 4S, ROVA 5S, Insight V1, Insight V3, Insight V4, Insight V5, S1, S2, S3, S4, S5, S6, S7, Rova1, Rova2, Rova3, Rova4, Rova5, INNO7, INNO8, INNO9, GalaxyG7, GalaxyG8, GalaxyG9, K6, K6S, K6X, K7, K7S, K7X, K8, K8S, K8X, K9, K9S, K9X, K30, K30Pro, K30X, K40, K40Pro, K40X, K50, K50Pro, K50X, RENO1, RENO2, RENO3, RENO4, RENO5, T12, T13, T14, T15, V2
Model No.:
Trade Name: SOUTH, KOLIDA, SANDING, RUIDE, TIANYU
Date Received: 2023-04-10
Date of Test: 2023-04-14 to 2023-06-15
Report Date: 2023-06-15

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

Prepared and Checked By:

Bob. Liao

Bob.Liao
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 "★".

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TABLE OF CONTENTS

DOCUMENT REVISION HISTORY	4
GENERAL INFORMATION.....	5
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	5
OBJECTIVE	5
TEST METHODOLOGY	6
MEASUREMENT UNCERTAINTY	6
SYSTEM TEST CONFIGURATION.....	7
DESCRIPTION OF TEST CONFIGURATION	7
EQUIPMENT MODIFICATIONS	7
EUT EXERCISE SOFTWARE	7
DUTY CYCLE	7
SUPPORT EQUIPMENT LIST AND DETAILS	7
EXTERNAL I/O CABLE.....	7
SUMMARY OF TEST RESULTS	9
TEST EQUIPMENT LIST	10
§2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)	11
FCC §15.203 - ANTENNA REQUIREMENT.....	13
APPLICABLE STANDARD	13
ANTENNA CONNECTOR CONSTRUCTION	13
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	14
APPLICABLE STANDARD	14
EUT SETUP.....	14
EMI TEST RECEIVER SETUP.....	14
TEST PROCEDURE	14
CALCULATION	15
TEST DATA	15
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....	18
APPLICABLE STANDARD	18
EUT SETUP.....	18
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	19
TEST PROCEDURE	19
CALCULATION	19
TEST DATA	19
FCC §15.247(a) (2) - 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH.....	26
APPLICABLE STANDARD	26
TEST PROCEDURE	26
TEST DATA	26
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER.....	27
APPLICABLE STANDARD	27
TEST PROCEDURE	27
TEST DATA	27
FCC §15.247(d) - 100KHZ BANDWIDTH OF FREQUENCY BAND EDGE	28
APPLICABLE STANDARD	28
TEST PROCEDURE	28
TEST DATA	28
FCC §15.247(e) - POWER SPECTRAL DENSITY	29
APPLICABLE STANDARD	29

TEST PROCEDURE	29
TEST DATA	29
APPENDIX A: 6dB Emission Bandwidth	30
APPENDIX B: Occupied Channel Bandwidth	34
APPENDIX C: Maximum Conducted Output Power	38
APPENDIX D: Band Edge Measurements.....	39
APPENDIX E: Maximum Power Spectral Density	42
APPENDIX F: Duty Cycle.....	46
TEST DATA	46

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230407-17721E-RF-00B	Original Report	2023-06-15

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product Type	GNSS RECEIVER		
Tested Model	Insight V2		
Multiple Model	K58plus, G6pro, T5, C7, C8, C9, G3, G5, G9, RT300, J1, T12, ROVA 1S, ROVA 2S, ROVA 3S, ROVA 4S, ROVA 5S, Insight V1, Insight V3, Insight V4, Insight V5, S1, S2, S3, S4, S5, S6, S7, Rova1, Rova2, Rova3, Rova4, Rova5, INNO7, INNO8, INNO9, GalaxyG7, GalaxyG8, GalaxyG9, K6, K6S, K6X, K7, K7S, K7X, K8, K8S, K8X, K9, K9S, K9X, K30, K30Pro, K30X, K40, K40Pro, K40X, K50, K50Pro, K50X, RENO1, RENO2, RENO3, RENO4, RENO5, T12, T13, T14, T15, V2		
Model Difference	Please refer to DOS letter		
Frequency Range	Wi-Fi: 2412-2462MHz (802.11b/g/n20)		
Maximum Conducted Peak Power	Wi-Fi:		
	18.78dBm(802.11b)	22.68dBm(802.11g)	21.67dBm(802.11n20)
Modulation Technique	Wi-Fi: DSSS, OFDM		
Antenna Specification*	Internal Antenna: 2.43dBi(provided by the applicant)		
Voltage Range	DC 7.2V from battery DC 5V/9V/15V/20V from adapter(PD) DC 3.3-11V from adapter(PPS) DC 5V/9V/12V from adapter(QC)		
Sample serial number	24CH-11(CE&RE), 24CH-12 (RF Conducted Test)		
Sample/EUT Status	Good condition		
Adapter Information	Model No.: S045SU2000225 Input: 100-240V~50/60Hz 1.4A MAX Output: PD3.0: 5V ---3A/9V ---3A/15V ---3A/20V ---2.25A PSS: 3.3-11V ---3A QC: 5V ---3A/9V ---3A/12V ---3A		

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
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, and 802.11n-HT20, total 11 channels 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.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

Software “Esp RFTTestTool-v2.8-Manual.exe”* was used during testing and power level as below:

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

Duty cycle

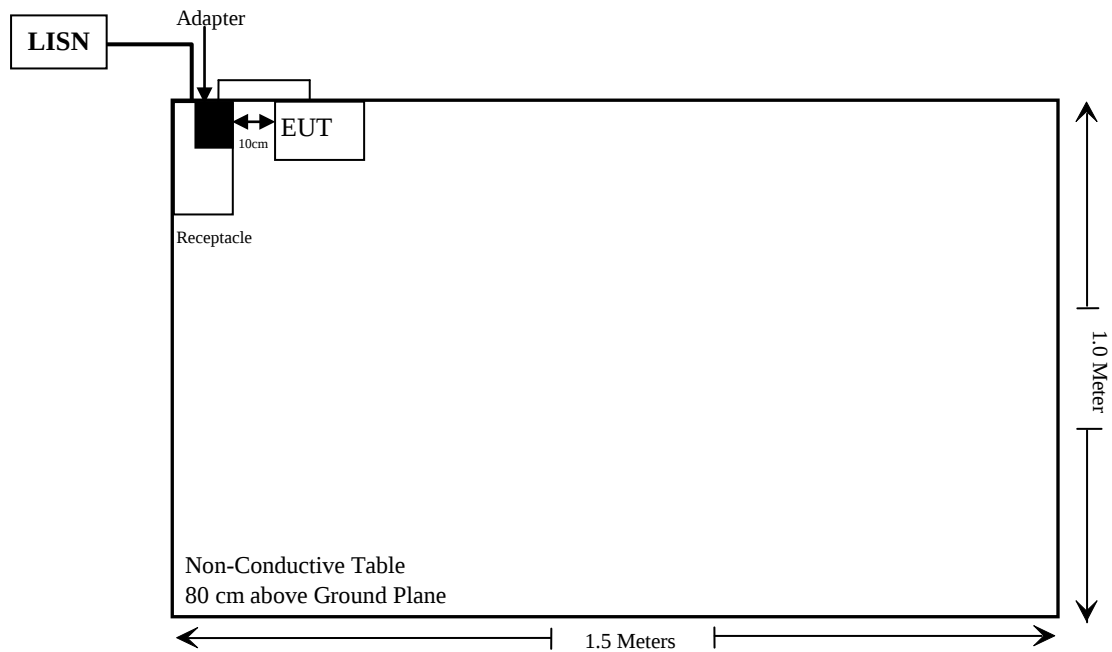
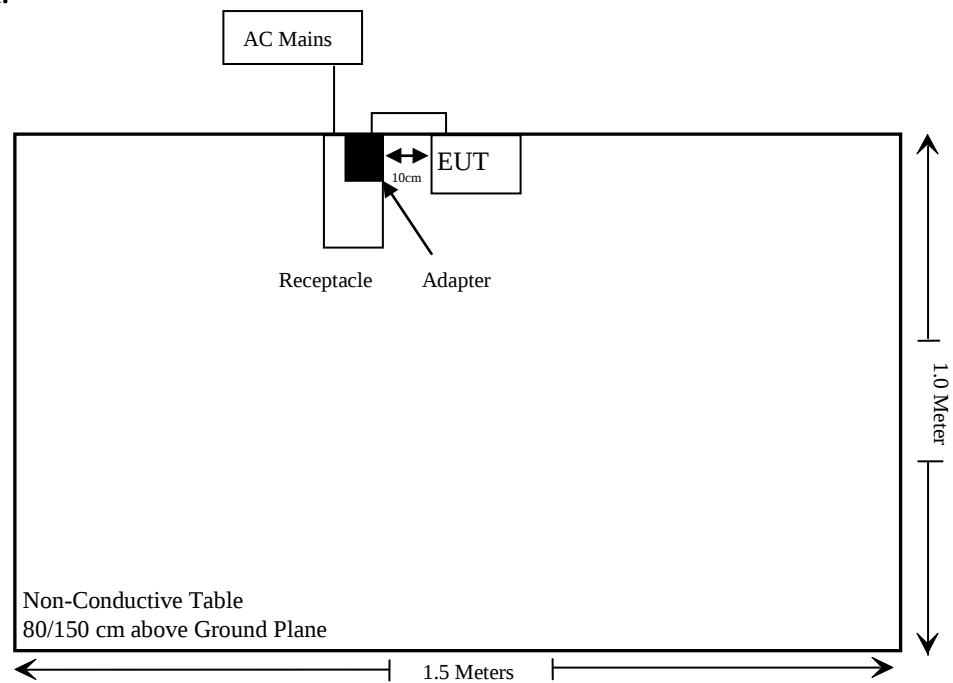
Test Result: Compliant. Please refer to the Appendix F

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
listed	Adapter	S045SU2000225	UNKNOW

External I/O Cable

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

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
§2.1091	MPE	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)	100kHz 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 Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2022/11/25	2023/11/24
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2022/11/25	2023/11/24
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2022/12/07	2023/12/06
Unknown	RF Coaxial Cable	No.17	N0350	2022/11/25	2023/11/24
Conducted Emission Test Software: e3 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-184055 36-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	WHKX3.6/18 G-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.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
Radiated Emission Test Software: e3 191218 (V9)					
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2022/11/25	2023/11/24
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2022/11/25	2023/11/24
Agilent	Power Sensor	U2021XA	MY5425003	2023/02/25	2024/02/24
WEINSCHL	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).

§2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

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

Limits for Maximum Permissible Exposure (MPE)

Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3 - 3.0	614	1.63	(100)*	6
3.0 - 30	1842/f	4.89/f	(900/f ²)*	6
30 - 300	61.4	0.163	1.0	6
300 - 1500	/	/	f/300	6
1500 - 100000	/	/	5	6
Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3 - 1.34	614	1.63	(100)*	30
1.34 - 30	842/f	2.19/f	(180/f ²)*	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	/	/	f/1500	30
1500 - 100000	/	/	1.0	30

f = frequency in MHz;

* = Plane-wave equivalent power density;

Result

Calculated Formulary:

Predication of MPE limit at a given distance

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

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For worst case

Frequency (MHz)	Antenna Gain		Tune up conducted power		Distance (cm)	Power density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
2402-2480	2.43	1.75	7	5.0119	40	0.0004	1
2412-2462	2.43	1.75	23	199.5262	40	0.0174	1
410-470	2.14	1.64	34.2	2630.2680	40	0.2142	0.2733

Note1: The BT function can't transmit at the same time with the Wi-Fi function.

Note2: The BT/Wi-Fi function can transmit at the same time with the DMR function.

Simultaneous transmitting consideration:

The ratio= $MPE_{2.4G\ Wi-Fi}/limit + MPE_{DMR}/limit = 0.0174/1 + 0.2142/0.2733 = 0.80 < 1.0$

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 40cm from nearby persons.

Result: Compliant.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- 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 antenna arrangement for 2.4G Wi-Fi, which was permanently attached and the antenna gain is 2.43 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

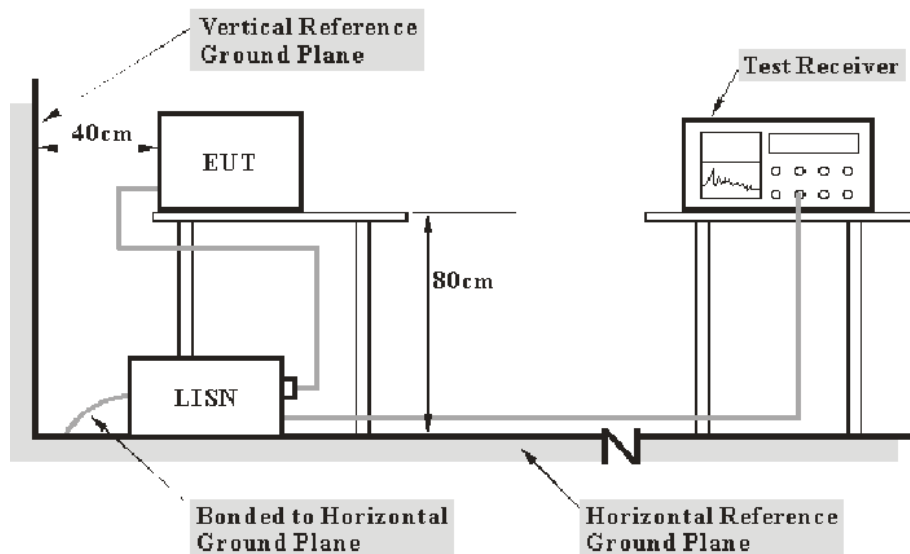
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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 30MHz.

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

FrequencyRange	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:

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

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

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

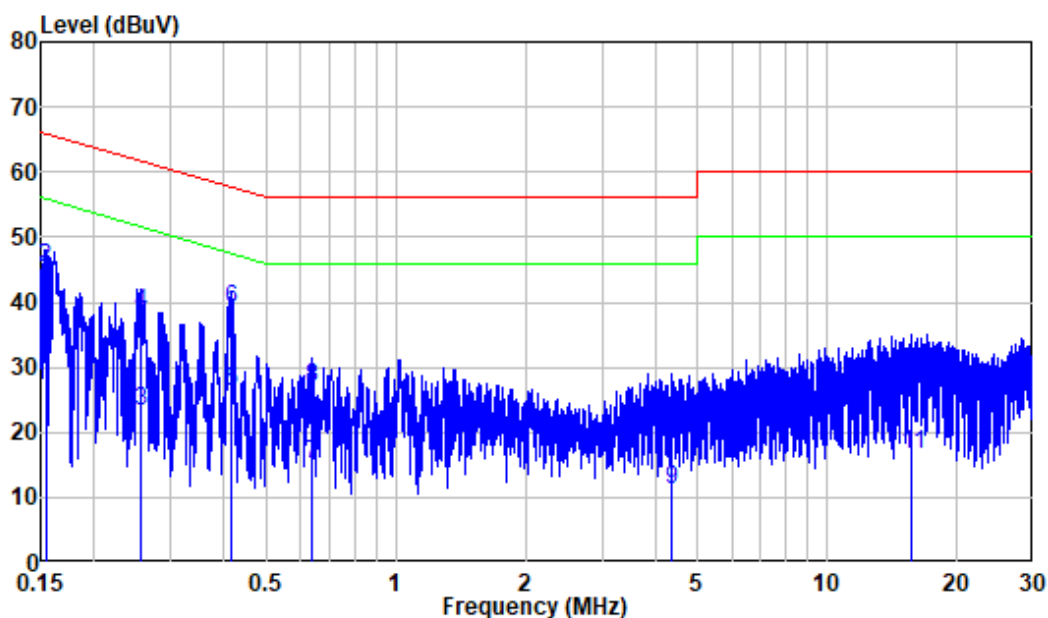
Test Data

Environmental Conditions

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

The testing was performed by Jerry Wu on 2023-06-05.

EUT operation mode: Charging + 2.4G Wi-Fi Transmitting (The worst case of 802.11b low channel is as follows)

AC 120V/60 Hz, Line

Site : Shielding Room

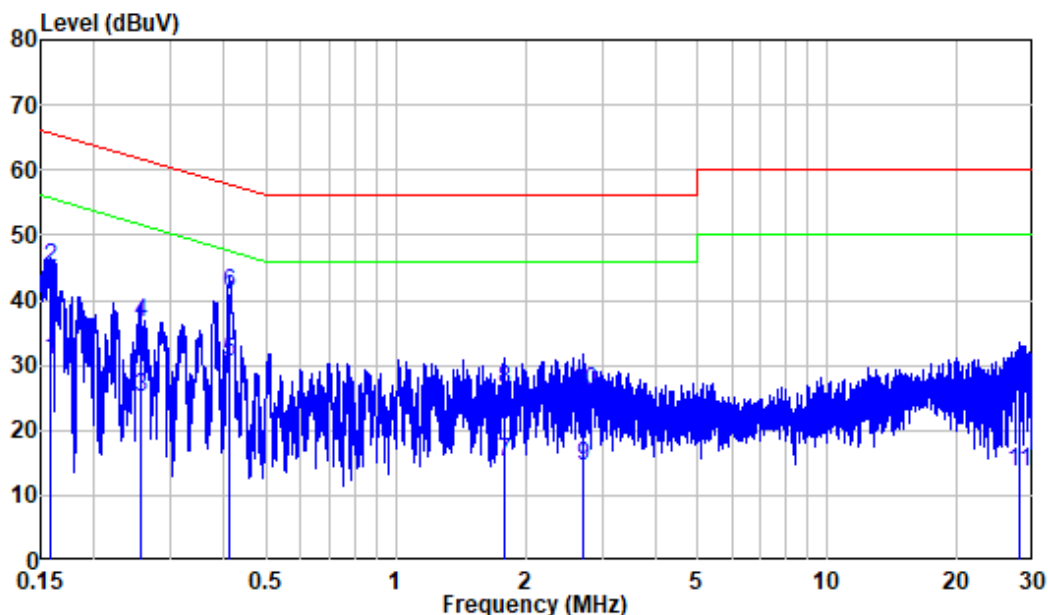
Condition: Line

Job No. : RA230407-17721E-RF

Mode : Charging+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	0.154	10.36	20.11	30.47	55.78	-25.31	Average
2	0.154	10.36	34.89	45.25	65.78	-20.53	QP
3	0.256	10.35	13.04	23.39	51.57	-28.18	Average
4	0.256	10.35	28.05	38.40	61.57	-23.17	QP
5	0.416	10.51	15.63	26.14	47.52	-21.38	Average
6	0.416	10.51	28.44	38.95	57.52	-18.57	QP
7	0.638	10.64	4.36	15.00	46.00	-31.00	Average
8	0.638	10.64	16.29	26.93	56.00	-29.07	QP
9	4.338	10.54	0.58	11.12	46.00	-34.88	Average
10	4.338	10.54	11.27	21.81	56.00	-34.19	QP
11	15.708	10.21	6.53	16.74	50.00	-33.26	Average
12	15.708	10.21	18.39	28.60	60.00	-31.40	QP

AC 120V/60 Hz, Neutral

Site : Shielding Room

Condition: Neutral

Job No. : RA230407-17721E-RF

Mode : Charging+2.4G WIFI Transmitting

Power : AC 120V 60Hz

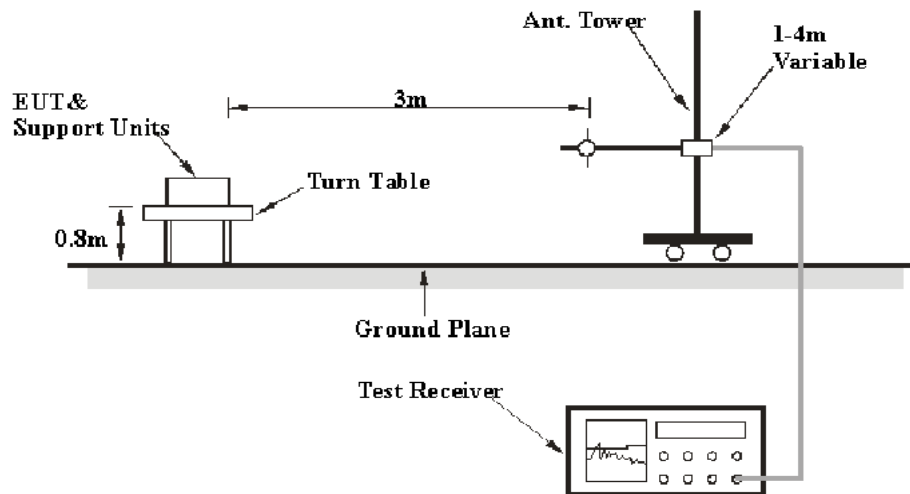
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.159	10.28	20.48	30.76	55.53	-24.77	Average
2	0.159	10.28	34.73	45.01	65.53	-20.52	QP
3	0.255	10.33	14.79	25.12	51.58	-26.46	Average
4	0.255	10.33	26.14	36.47	61.58	-25.11	QP
5	0.410	10.43	20.15	30.58	47.65	-17.07	Average
6	0.410	10.43	30.64	41.07	57.65	-16.58	QP
7	1.776	10.47	4.56	15.03	46.00	-30.97	Average
8	1.776	10.47	15.73	26.20	56.00	-29.80	QP
9	2.709	10.52	4.10	14.62	46.00	-31.38	Average
10	2.709	10.52	15.34	25.86	56.00	-30.14	QP
11	27.874	10.24	3.24	13.48	50.00	-36.52	Average
12	27.874	10.24	17.02	27.26	60.00	-32.74	QP

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

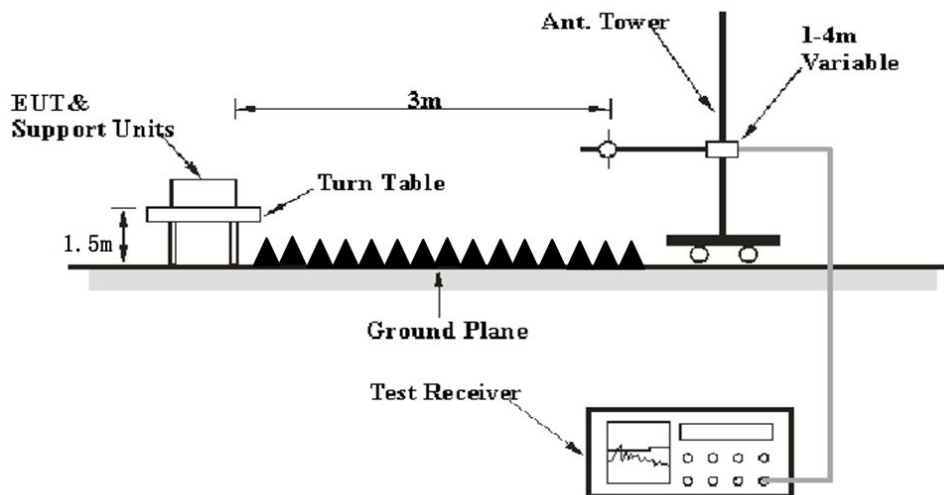
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3meters 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
30MHz – 1000 MHz	100 kHz	300 kHz	120kHz	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 under the QP/Average limit more than 6dB, 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.

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 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

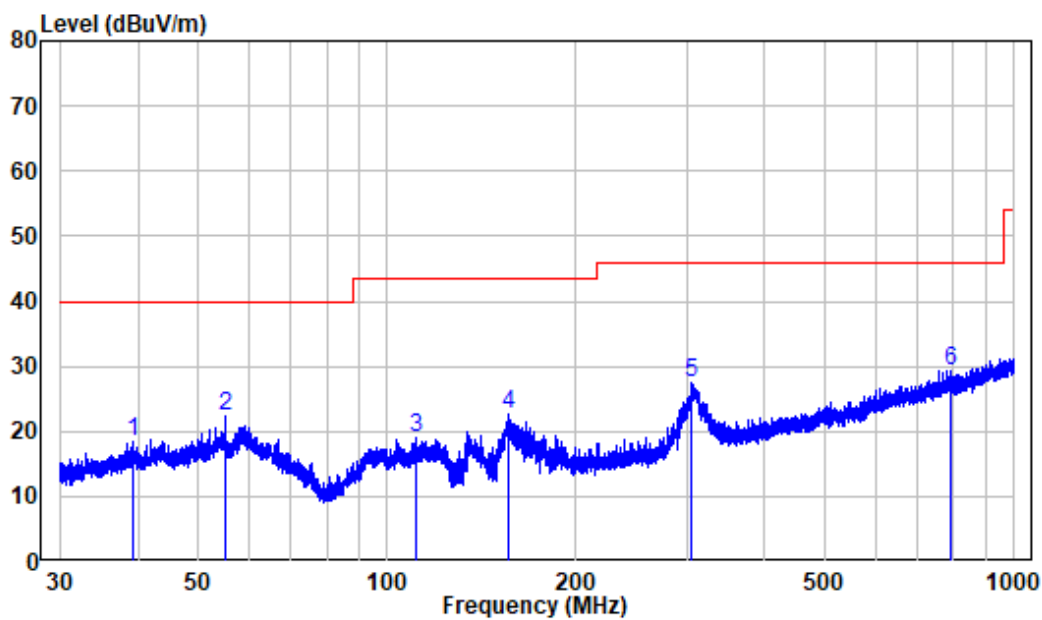
Environmental Conditions

Temperature:	23-24°C
Relative Humidity:	53-57%
ATM Pressure:	101.0kPa

The Below 1GHz testing was performed by Jason Liu on 2023-06-05.

The Above 1GHz testing was performed by Jimi Zheng on 2023-04-14.

EUT operation mode: Charging + 2.4G Wi-Fi Transmitting (Pre-scanned in X, Y, and Z axis directions, and the worst-case in X axis direction is recorded)

30MHz-1GHz:**802.11 b Low Channel (Worst case)****Horizontal**

Site : chamber

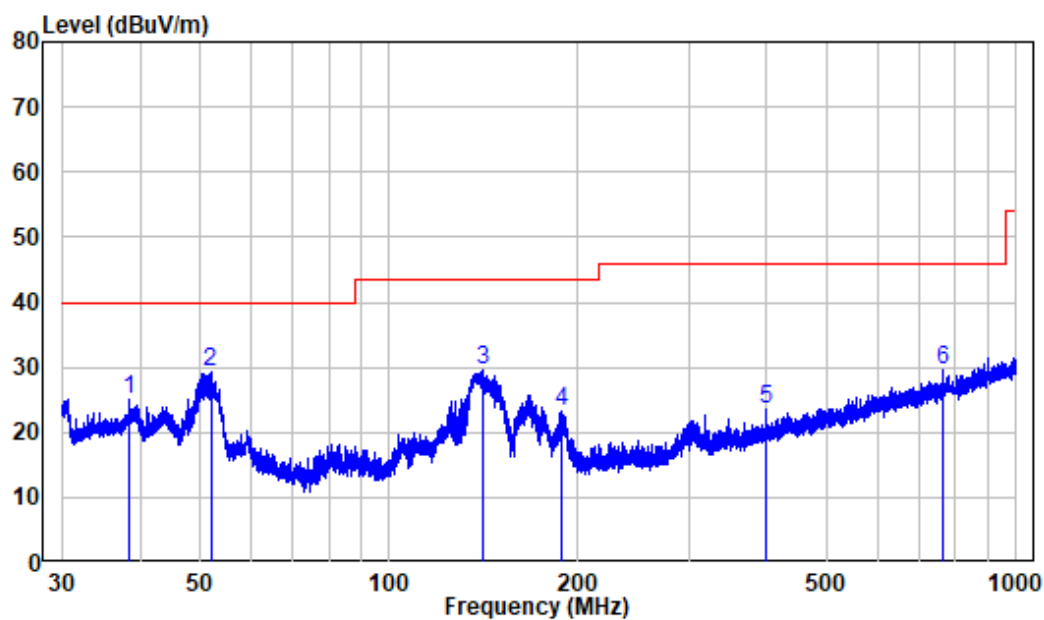
Condition: 3m HORIZONTAL

Job No. : RA230407-17721E-RF

Test Mode: Charging+2.4G WIFI Transmitting

	Freq	Factor	Read Level	Read Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	39.368	-10.49	28.79	18.30	40.00	-21.70	Peak
2	55.052	-10.28	32.60	22.32	40.00	-17.68	Peak
3	110.860	-12.08	31.00	18.92	43.50	-24.58	Peak
4	156.252	-14.78	37.42	22.64	43.50	-20.86	Peak
5	306.351	-9.01	36.49	27.48	46.00	-18.52	Peak
6	792.353	-0.19	29.61	29.42	46.00	-16.58	Peak

Vertical



Site : chamber

Condition: 3m VERTICAL

Job No. : RA230407-17721E-RF

Test Mode: Charging+2.4G WIFI Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	38.414	-10.72	35.85	25.13	40.00	-14.87	Peak
2	51.866	-9.97	39.14	29.17	40.00	-10.83	Peak
3	140.773	-15.49	44.94	29.45	43.50	-14.05	Peak
4	188.495	-11.76	35.05	23.29	43.50	-20.21	Peak
5	400.081	-6.73	30.30	23.57	46.00	-22.43	Peak
6	766.393	-0.35	30.02	29.67	46.00	-16.33	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	57.23	PK	139	1.1	H	-10.32	46.91	74	-27.09
2310	56.06	PK	64	1.7	V	-10.32	45.74	74	-28.26
2390	55.84	PK	312	1.6	H	-10.62	45.22	74	-28.78
2390	58.09	PK	327	2.1	V	-10.62	47.47	74	-26.53
4824	47.33	PK	206	1.5	H	-5.55	41.78	74	-32.22
4824	46.97	PK	158	1.4	V	-5.55	41.42	74	-32.58
802.11B, Middle Channel									
4874	47.74	PK	152	1.9	H	-5.29	42.45	74	-31.55
4874	46.85	PK	226	2.0	V	-5.29	41.56	74	-32.44
11B, High Channel									
2483.5	56.09	PK	91	1.3	H	-10.46	45.63	74	-28.37
2483.5	56.3	PK	45	1.2	V	-10.46	45.84	74	-28.16
2500	56.8	PK	220	2.0	H	-10.32	46.48	74	-27.52
2500	56.97	PK	248	2.2	V	-10.32	46.65	74	-27.35
4924	47.27	PK	155	1.4	H	-5.03	42.24	74	-31.76
4924	47.13	PK	350	2.1	V	-5.03	42.10	74	-31.9
802.11G, Low Channel									
2310	56.14	PK	252	1.1	H	-10.32	45.82	74	-28.18
2310	55.63	PK	256	1.1	V	-10.32	45.31	74	-28.69
2390	55.66	PK	294	1.4	H	-10.62	45.04	74	-28.96
2390	56.73	PK	349	1.8	V	-10.62	46.11	74	-27.89
4824	47.41	PK	145	1.3	H	-5.55	41.86	74	-32.14
4824	47.35	PK	294	1.4	V	-5.55	41.80	74	-32.2
802.11G, Middle Channel									
4874	46.75	PK	113	2.2	H	-5.29	41.46	74	-32.54
4874	48.3	PK	286	1.1	V	-5.29	43.01	74	-30.99
802.11G, High Channel									
2483.5	55.81	PK	286	1.1	H	-10.46	45.35	74	-28.65
2483.5	55.84	PK	142	1.7	V	-10.46	45.38	74	-28.62
2500	56.37	PK	148	1.3	H	-10.32	46.05	74	-27.95
2500	57.39	PK	148	1.3	V	-10.32	47.07	74	-26.93
4924	47.37	PK	92	2.0	H	-5.03	42.34	74	-31.66
4924	45.86	PK	60	1.4	V	-5.03	40.83	74	-33.17
802.11N20, Low Channel									
2310	56.03	PK	256	1.7	H	-10.32	45.71	74	-28.29
2310	56.15	PK	53	2.1	V	-10.32	45.83	74	-28.17
2390	56.27	PK	121	1.9	H	-10.62	45.65	74	-28.35
2390	58.5	PK	306	1.1	V	-10.62	47.88	74	-26.12
4824	46.65	PK	113	2.2	H	-5.55	41.10	74	-32.9

4824	47.63	PK	88	2.2	V	-5.55	42.08	74	-31.92
802.11N20, Middle Channel									
4874	47.07	PK	314	2.1	H	-5.29	41.78	74	-32.22
4874	47.72	PK	142	1.7	V	-5.29	42.43	74	-31.57
802.11N20, High Channel									
2483.5	56.13	PK	142	1.7	H	-10.46	45.67	74	-28.33
2483.5	56.72	PK	92	2.0	V	-10.46	46.26	74	-27.74
2500	56.87	PK	60	1.4	H	-10.32	46.55	74	-27.45
2500	56.42	PK	60	1.4	V	-10.32	46.10	74	-27.9
4924	47.84	PK	7	1.2	H	-5.03	42.81	74	-31.19
4924	48.12	PK	268	2.1	V	-5.03	43.09	74	-30.91

Note:

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

Absolute Level (Corrected Amplitude) = Factor + Reading

Margin = Absolute Level (Corrected Amplitude) – Limit

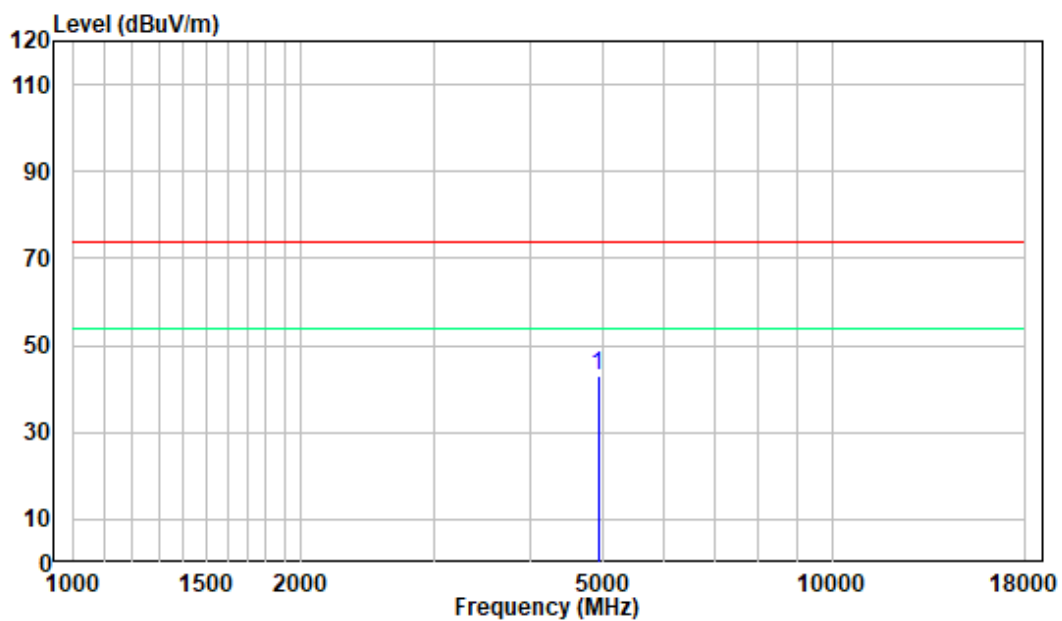
The other spurious emission which is in the noise floor level was not recorded.

For above 1GHz, 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.

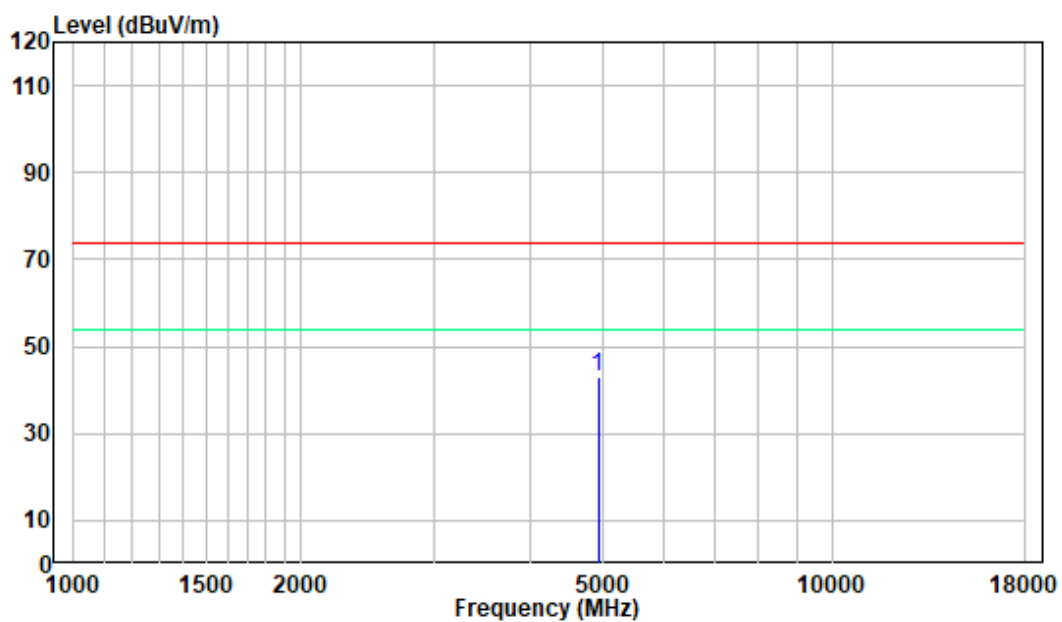
1-18 GHz (Pre-scan plots):

802.11 n20 High Channel (Worst case)

Horizontal



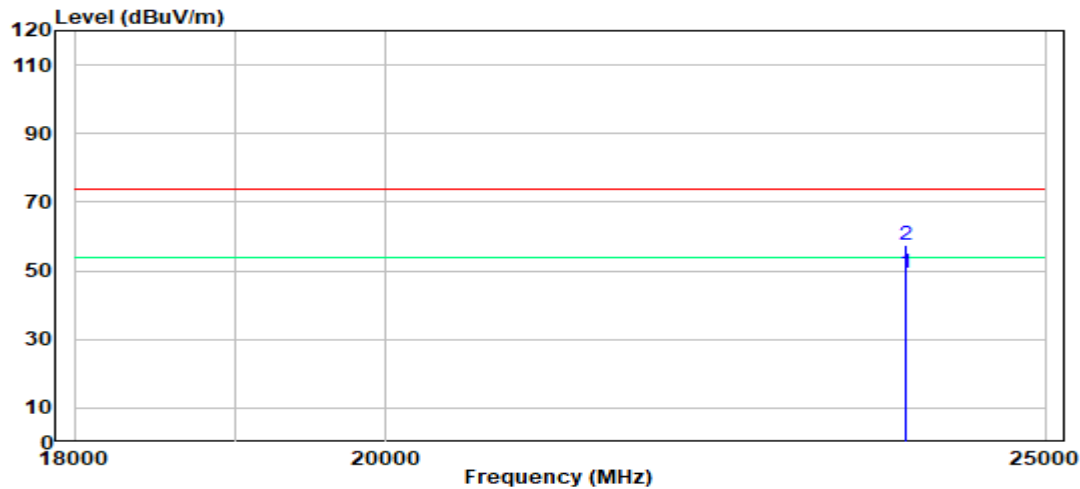
Vertical



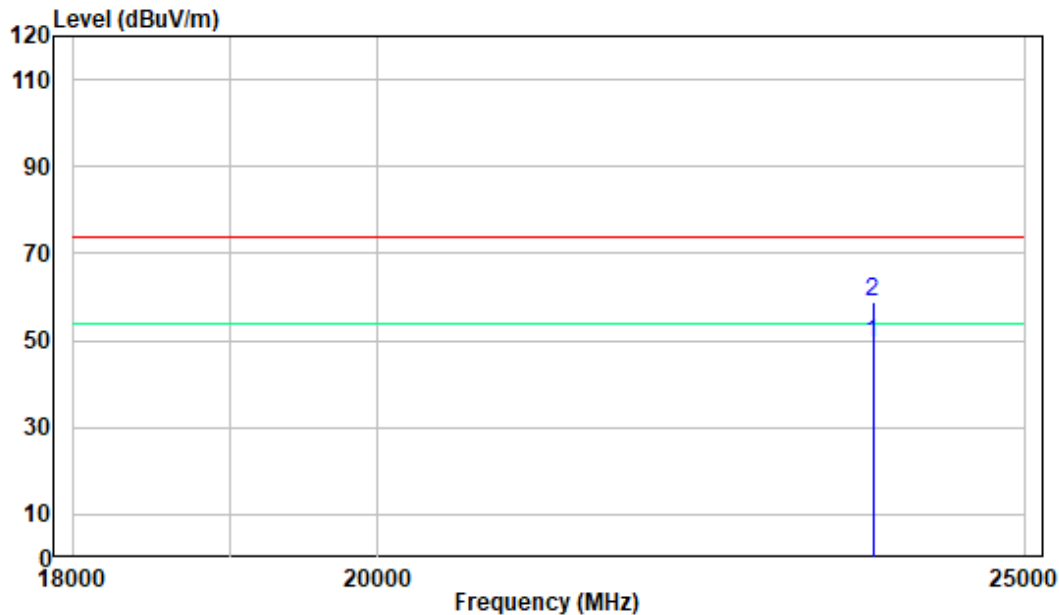
18 -25GHz (Pre-scan plots):

802.11 b Low Channel (Worst case)

Horizontal



Vertical



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

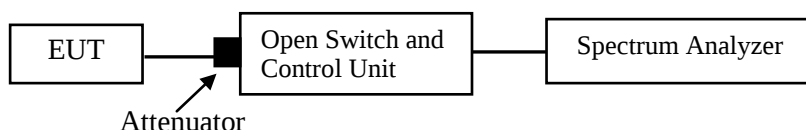
Applicable Standard

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:	24 °C
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang on 2023-04-19.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix A and Appendix B.

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

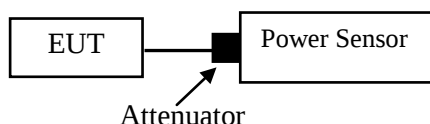
Applicable Standard

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 11.9.1.3

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

Temperature:	24 °C
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang on 2023-04-19.

EUT operation mode: Transmitting

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

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

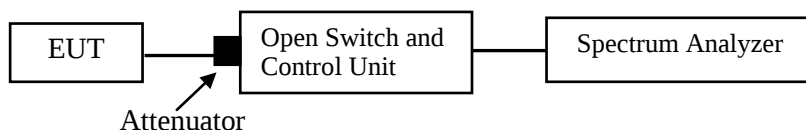
Applicable Standard

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:	24 °C
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang on 2023-04-19.

EUT operation mode: Transmitting

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

FCC §15.247(e) - POWER SPECTRAL DENSITY

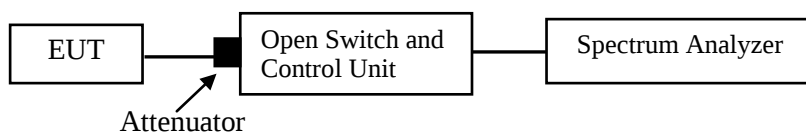
Applicable Standard

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

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
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 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	23-24 °C
Relative Humidity:	48-49 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang on 2023-04-19 and 2023-06-05.

EUT operation mode: Transmitting

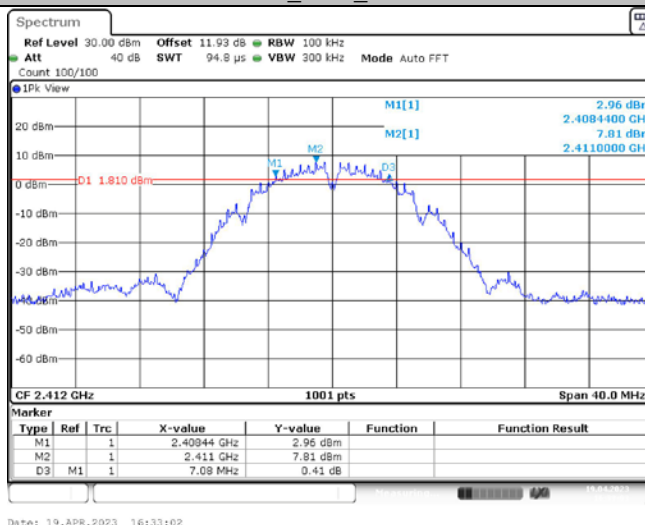
Test Result: Compliant. Please refer to the Appendix E.

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

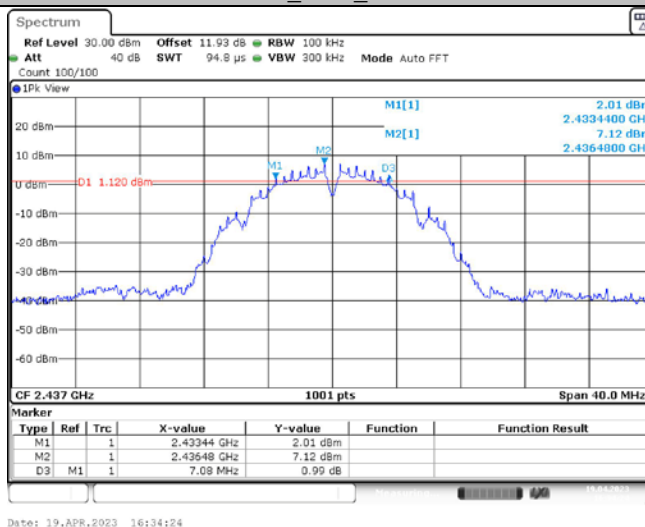
Test Mode	Antenna	Channel[MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	7.08	0.5	PASS
		2437	7.08	0.5	PASS
		2462	7.08	0.5	PASS
11G	Ant1	2412	16.36	0.5	PASS
		2437	16.44	0.5	PASS
		2462	16.32	0.5	PASS
11N20 SISO	Ant1	2412	17.20	0.5	PASS
		2437	17.32	0.5	PASS
		2462	17.60	0.5	PASS

Test Graphs

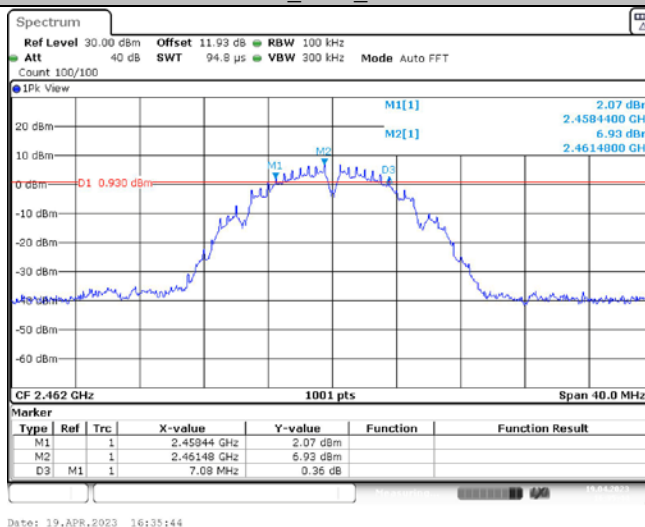
11B_Ant1_2412



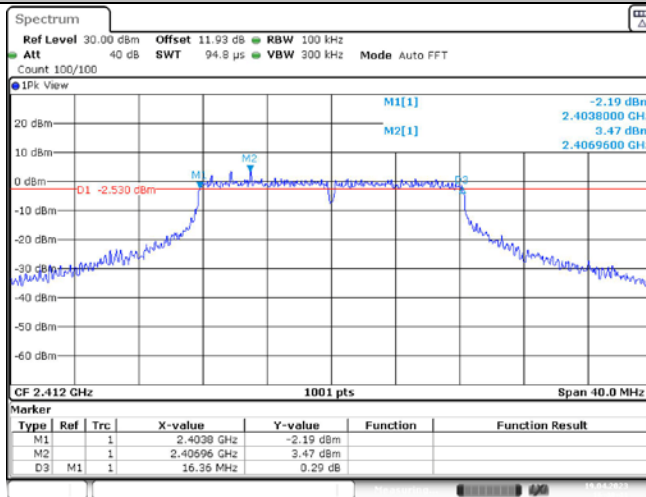
11B_Ant1_2437



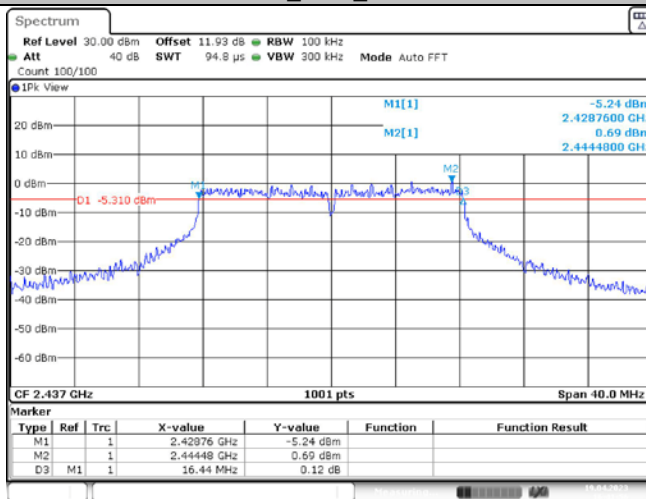
11B_Ant1_2462



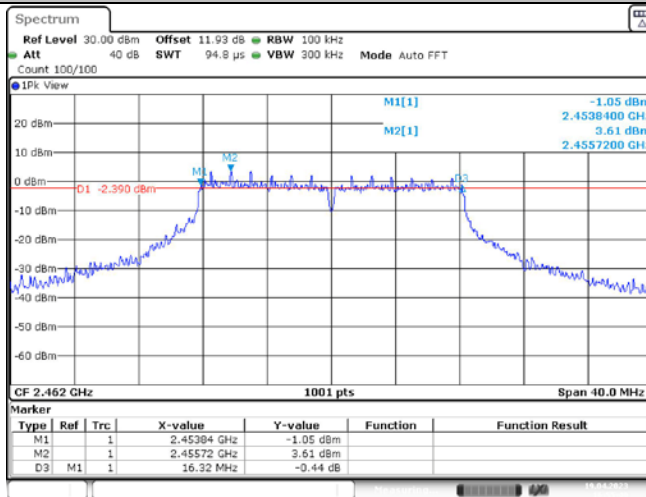
11G_Ant1_2412



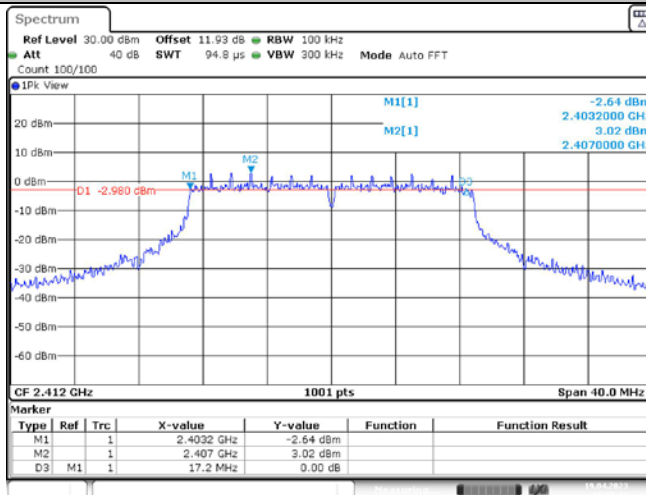
11G_Ant1_2437



11G_Ant1_2462

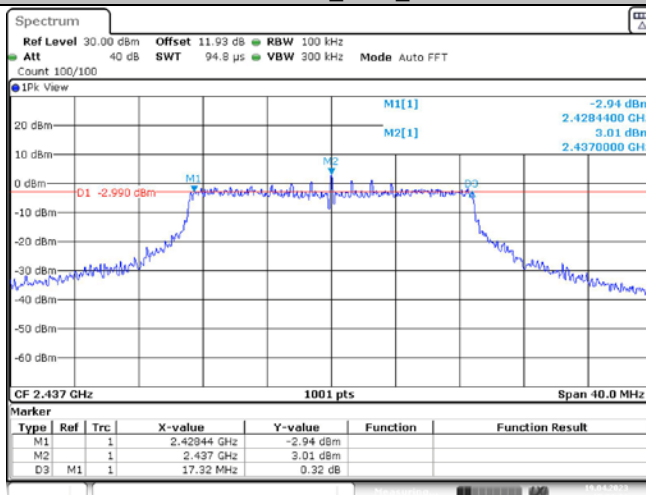


11N20SISO_Ant1_2412



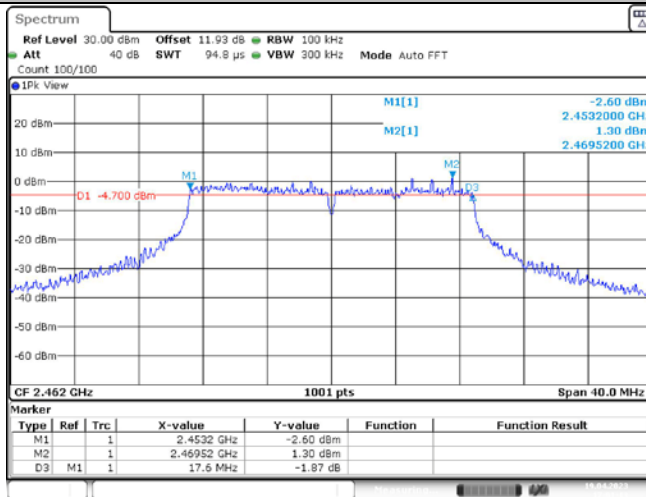
Date: 19.APR.2023 16:57:13

11N20SISO_Ant1_2437



Date: 19.APR.2023 17:00:01

11N20SISO_Ant1_2462



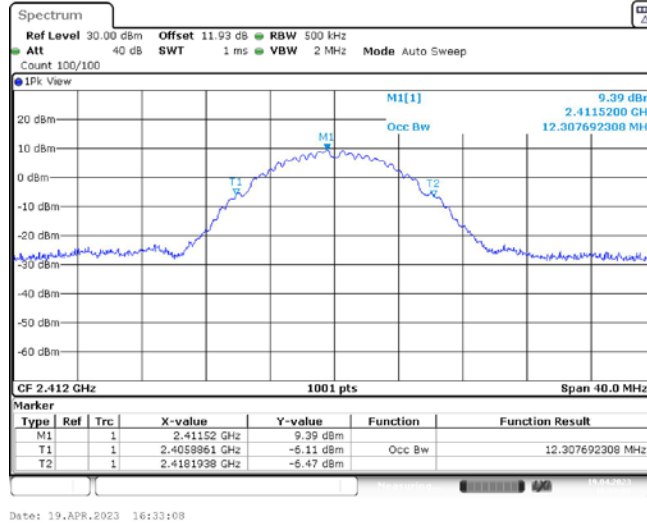
Date: 19.APR.2023 17:01:13

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

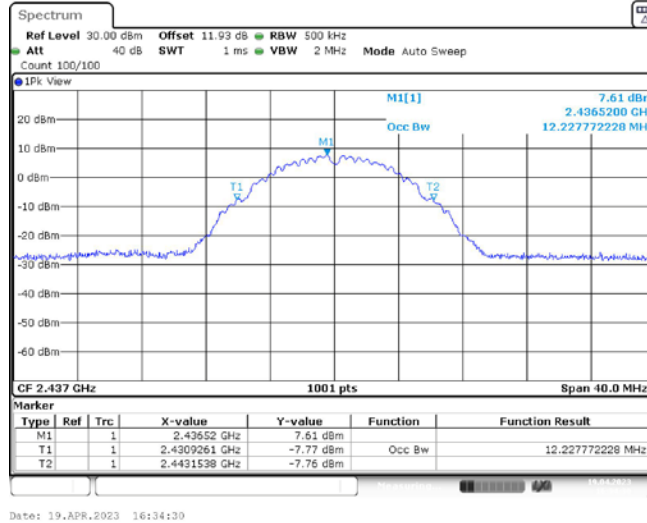
Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	12.308	---	PASS
		2437	12.228	---	PASS
		2462	12.268	---	PASS
11G	Ant1	2412	18.342	---	PASS
		2437	18.621	---	PASS
		2462	18.422	---	PASS
11N20 SISO	Ant1	2412	18.861	---	PASS
		2437	19.221	---	PASS
		2462	19.021	---	PASS

Test Graphs:

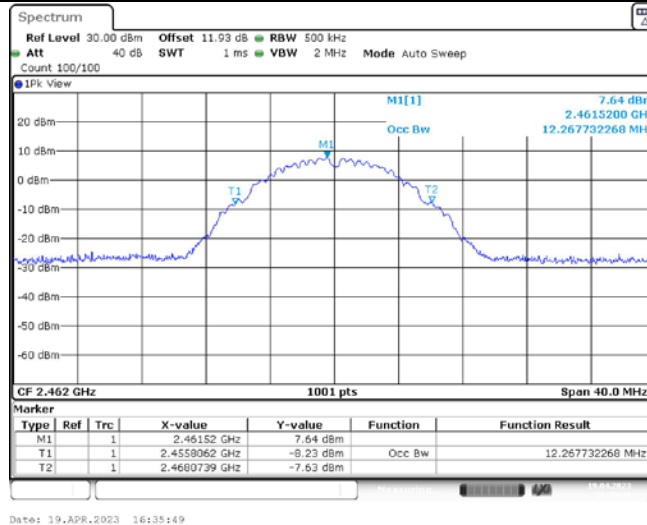
11B_Ant1_2412



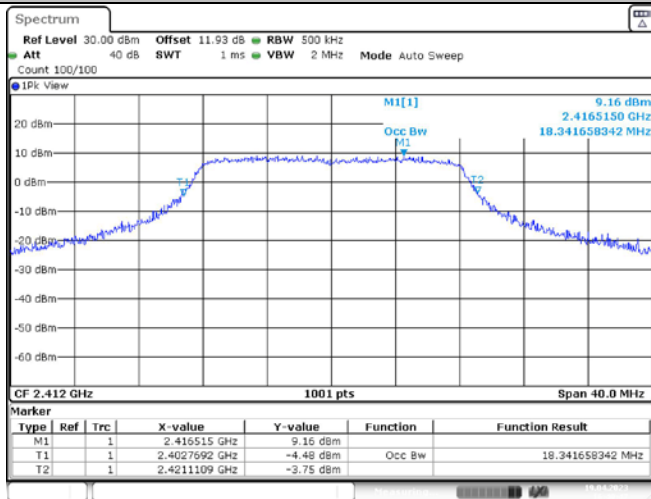
11B_Ant1_2437



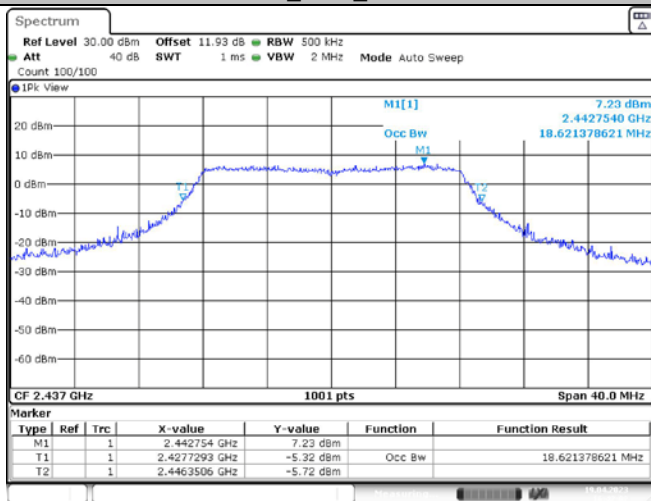
11B_Ant1_2462



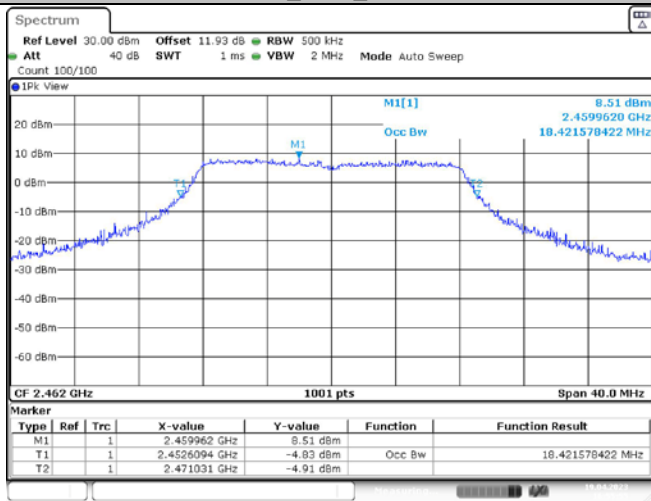
11G_Ant1_2412



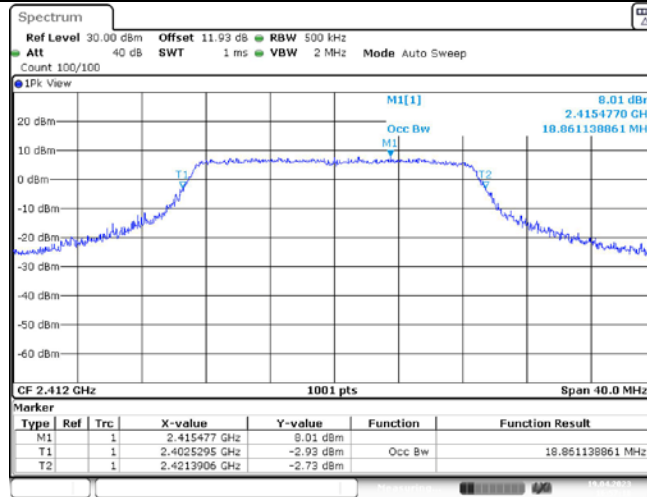
11G_Ant1_2437



11G_Ant1_2462

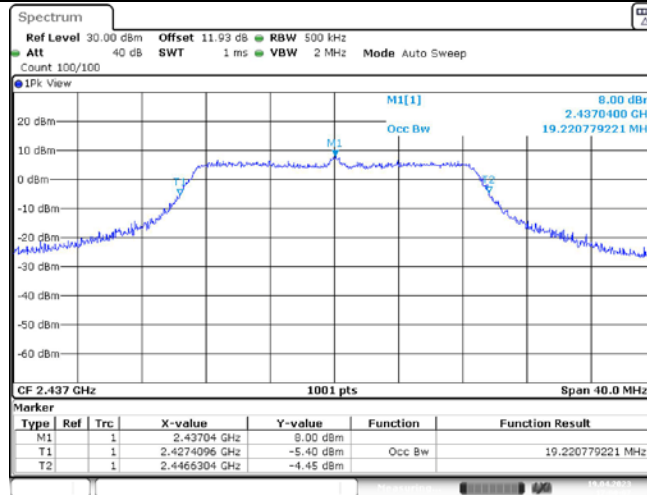


11N20SISO_Ant1_2412



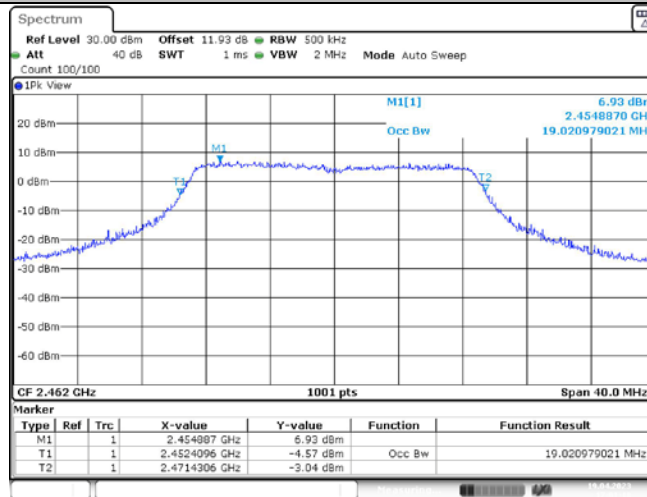
Date: 19.APR.2023 16:57:19

11N20SISO_Ant1_2437



Date: 19.APR.2023 17:00:07

11N20SISO_Ant1_2462



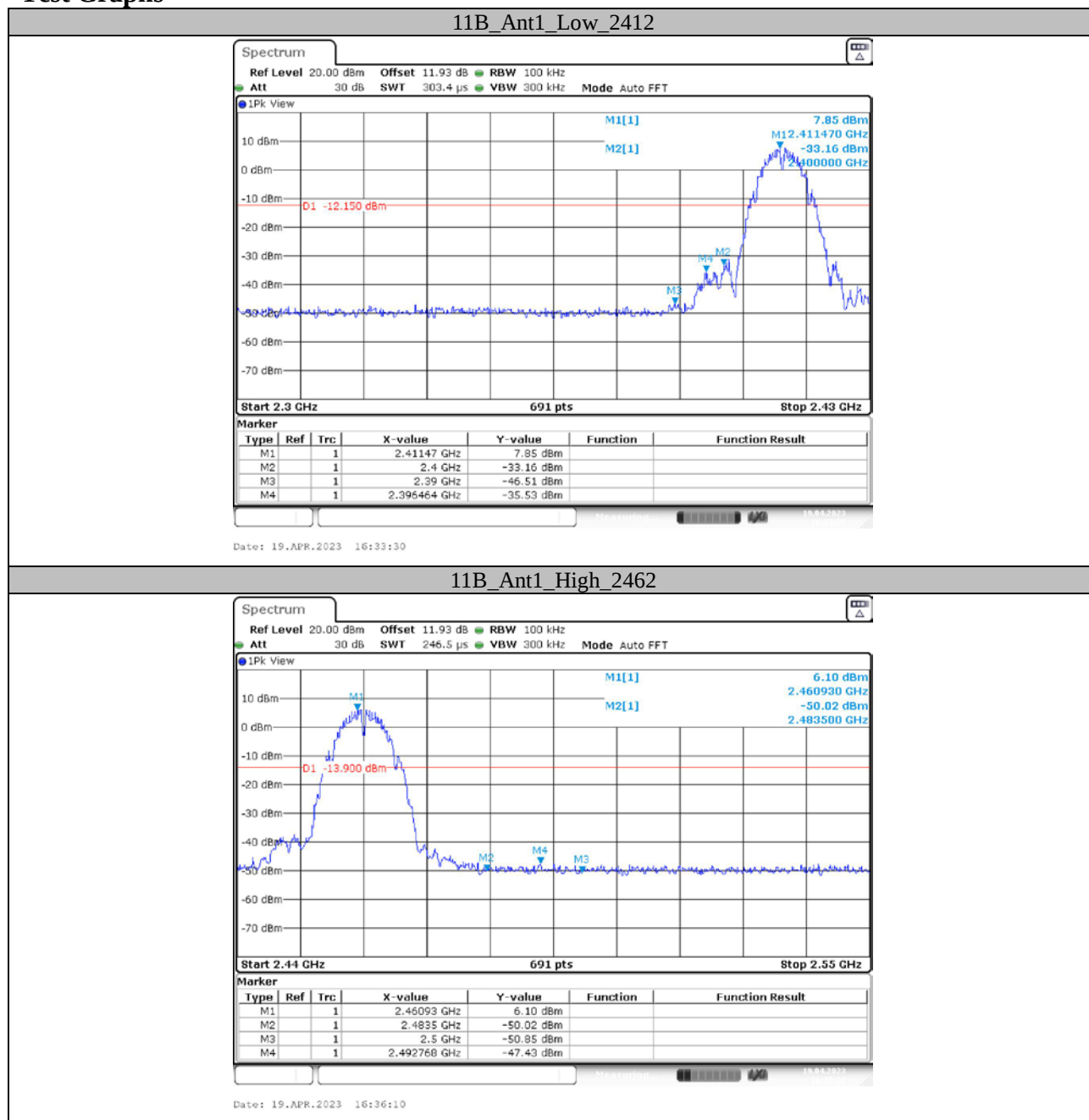
Date: 19.APR.2023 17:01:19

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

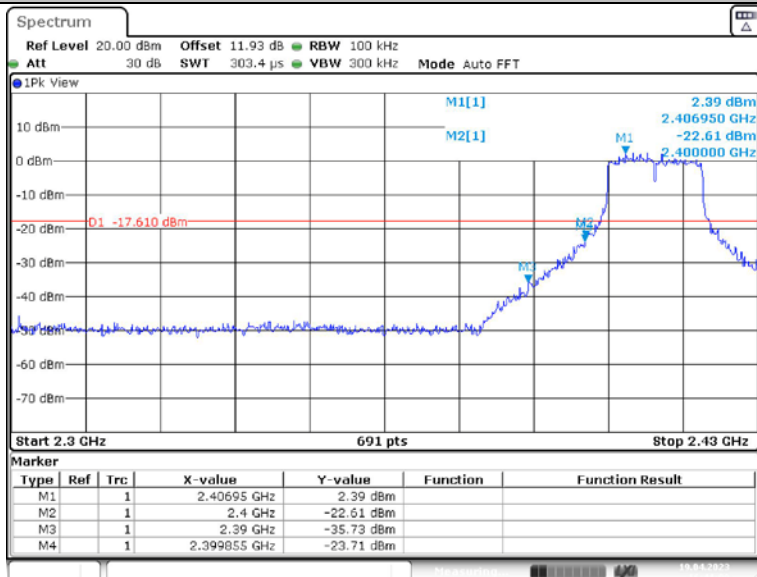
Test Mode	Antenna	Channel	Peak power [dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	18.78	<=30	PASS
		2437	17.28	<=30	PASS
		2462	17.35	<=30	PASS
11G	Ant1	2412	22.68	<=30	PASS
		2437	20.39	<=30	PASS
		2462	21.66	<=30	PASS
11N20 SISO	Ant1	2412	21.67	<=30	PASS
		2437	20.69	<=30	PASS
		2462	20.59	<=30	PASS

APPENDIX D: Band Edge Measurements

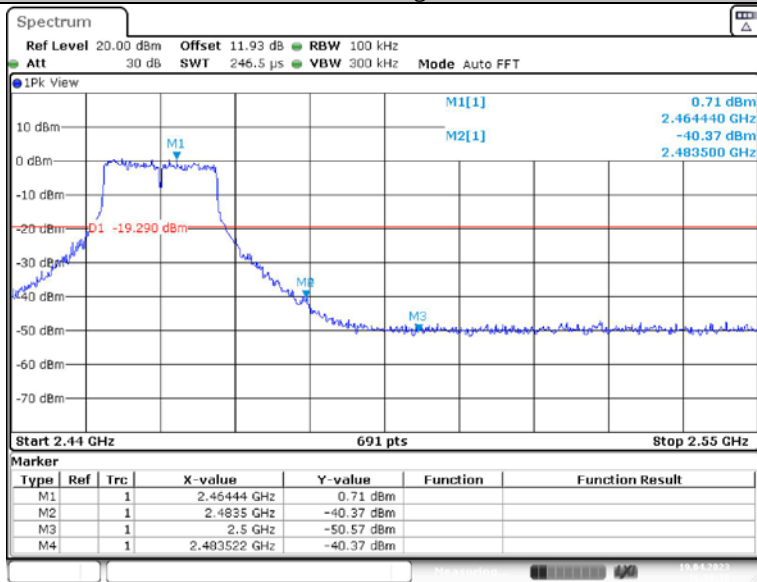
Test Graphs



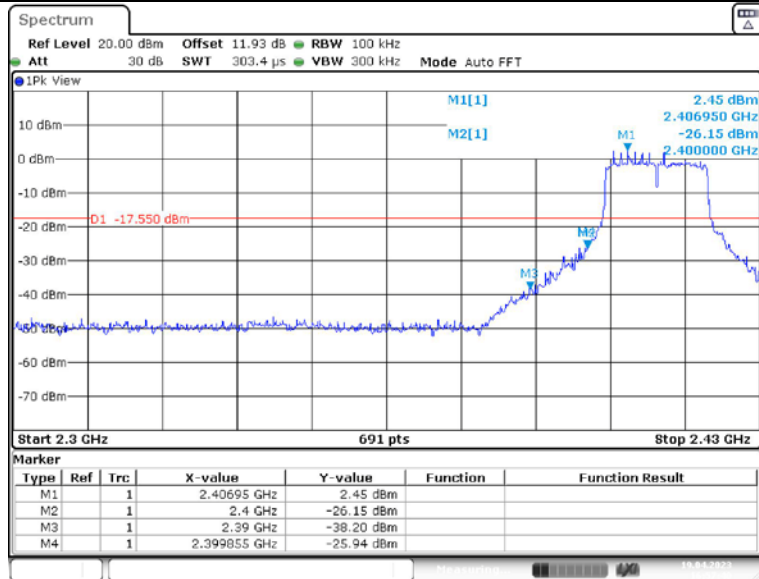
11G_Ant1_Low_2412



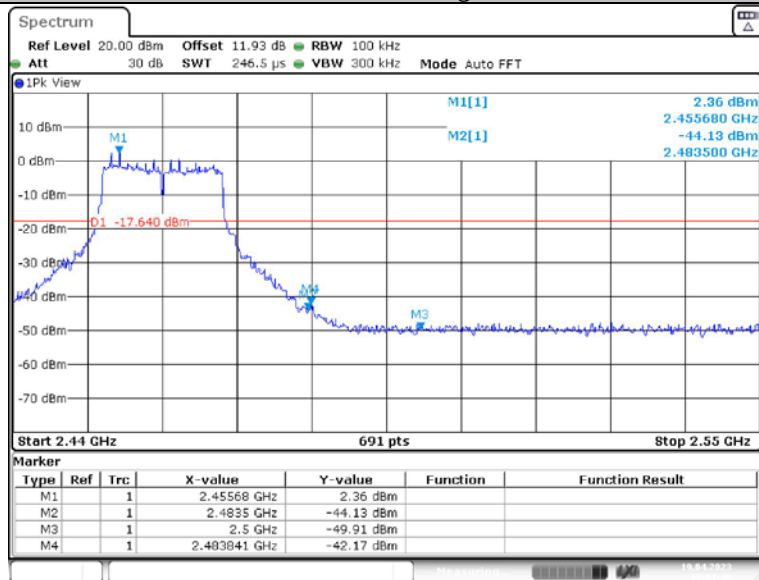
11G_Ant1_High_2462



11N20SISO_Ant1_Low_2412



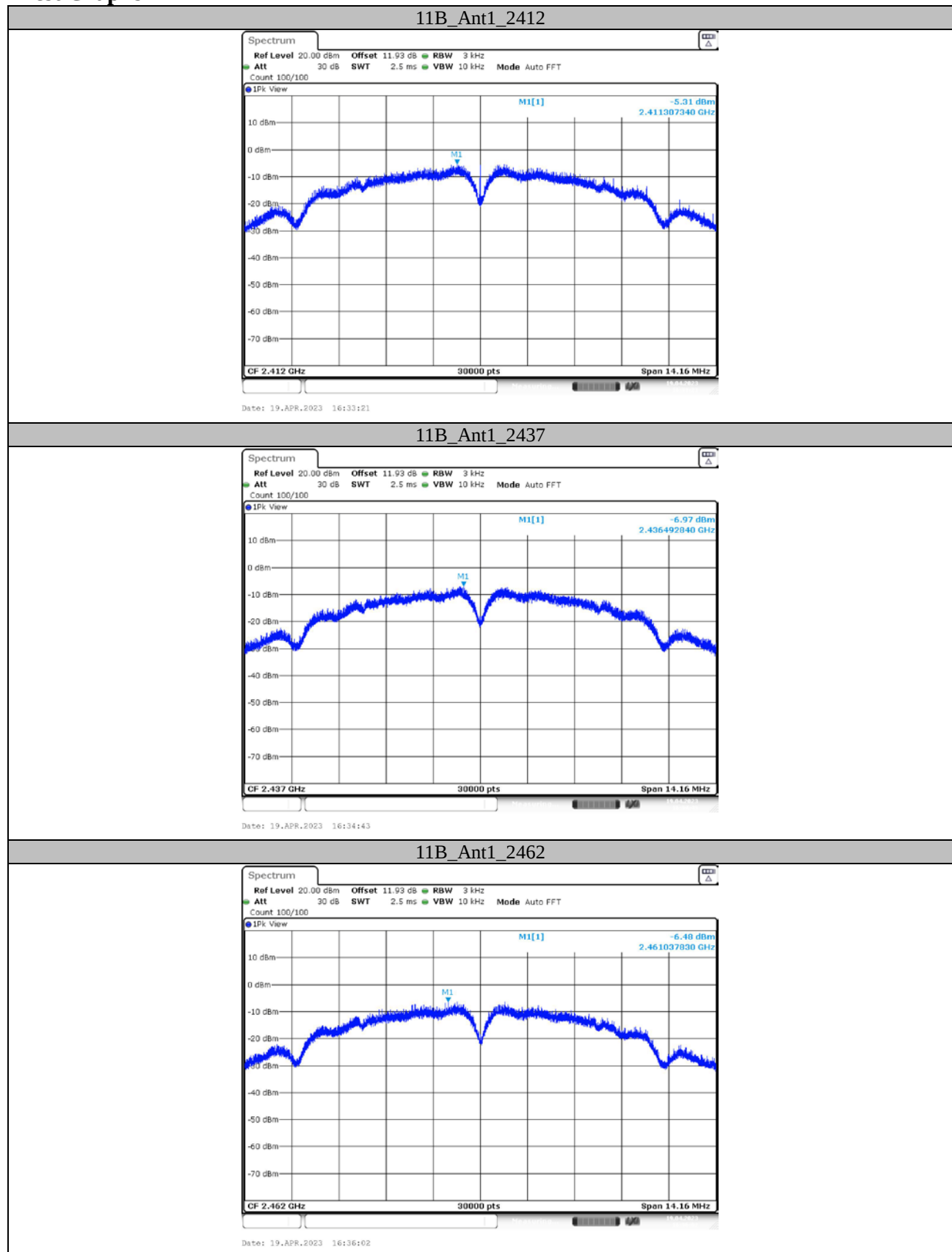
11N20SISO_Ant1_High_2462



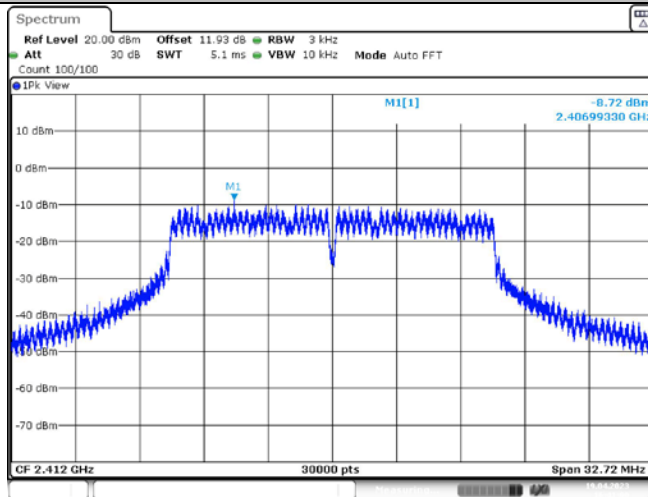
APPENDIX E: Maximum Power Spectral Density**Test Result**

Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-5.31	<=8	PASS
		2437	-6.97	<=8	PASS
		2462	-6.48	<=8	PASS
11G	Ant1	2412	-8.72	<=8	PASS
		2437	-11.77	<=8	PASS
		2462	-9.44	<=8	PASS
11N20 SISO	Ant1	2412	-10.74	<=8	PASS
		2437	-11.21	<=8	PASS
		2462	-11.06	<=8	PASS

Test Graphs

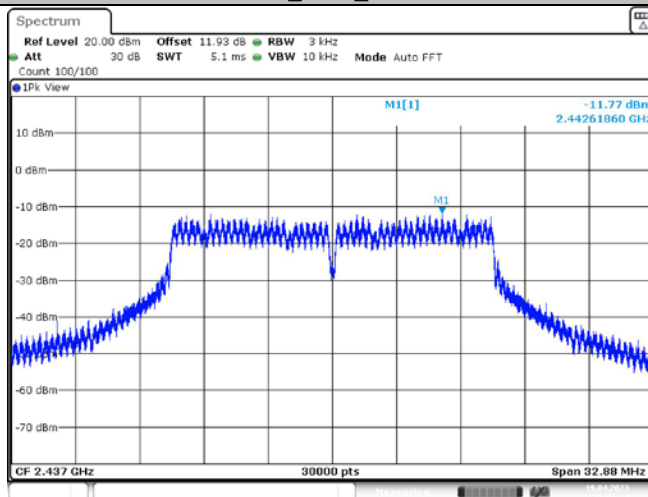


11G_Ant1_2412



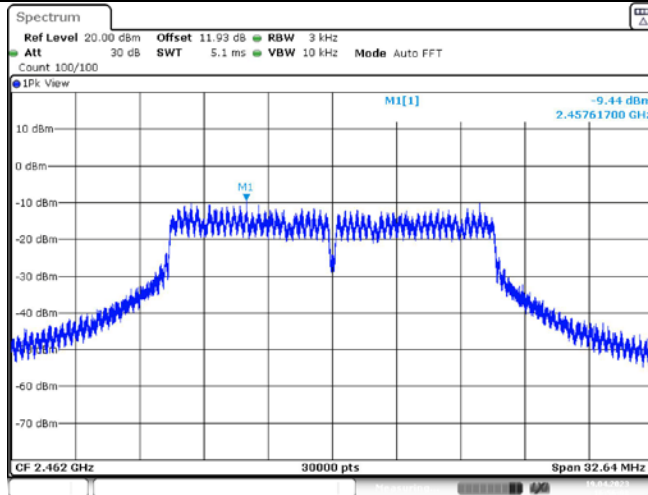
Date: 19.APR.2023 16:41:09

11G_Ant1_2437



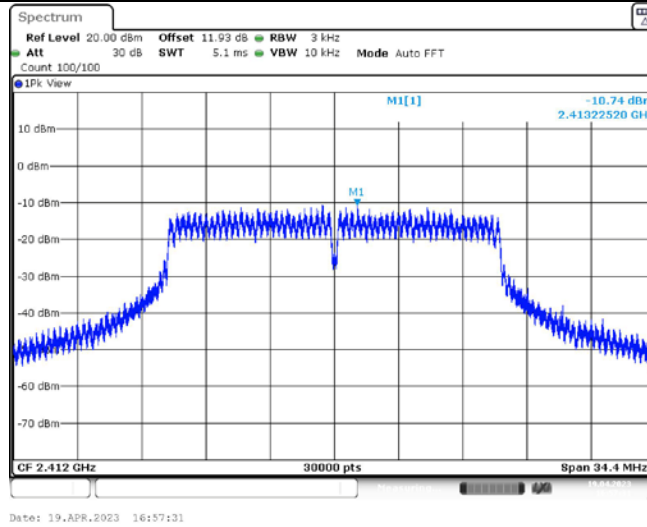
Date: 19.APR.2023 16:42:14

11G_Ant1_2462

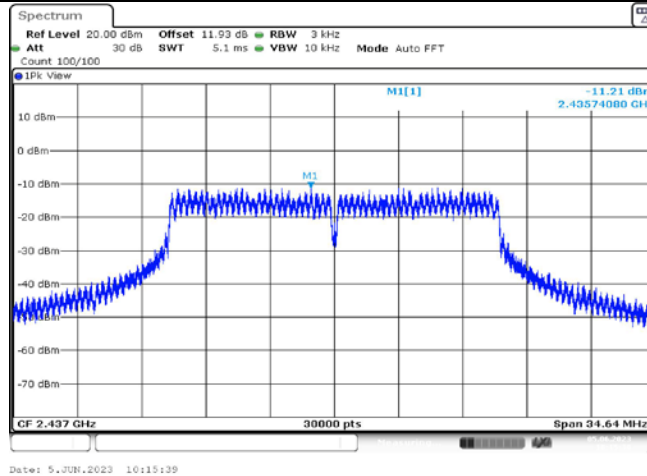


Date: 19.APR.2023 16:56:09

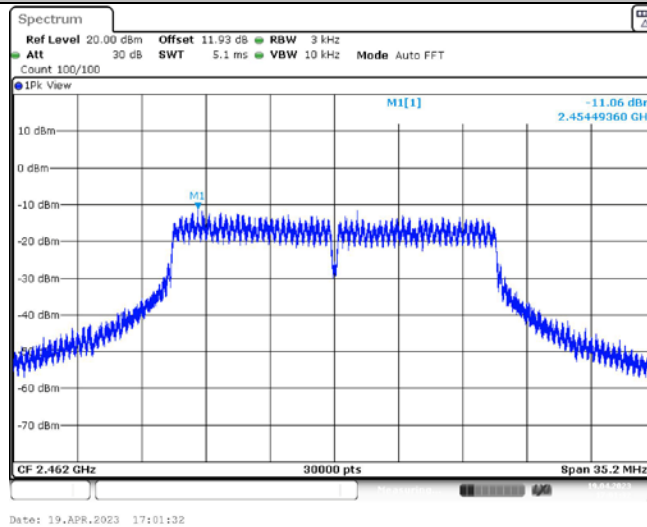
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462



APPENDIX F: Duty Cycle

Test Data

Environmental Conditions

Temperature:	23-24 °C
Relative Humidity:	47-49 %
ATM Pressure:	101.0 kPa

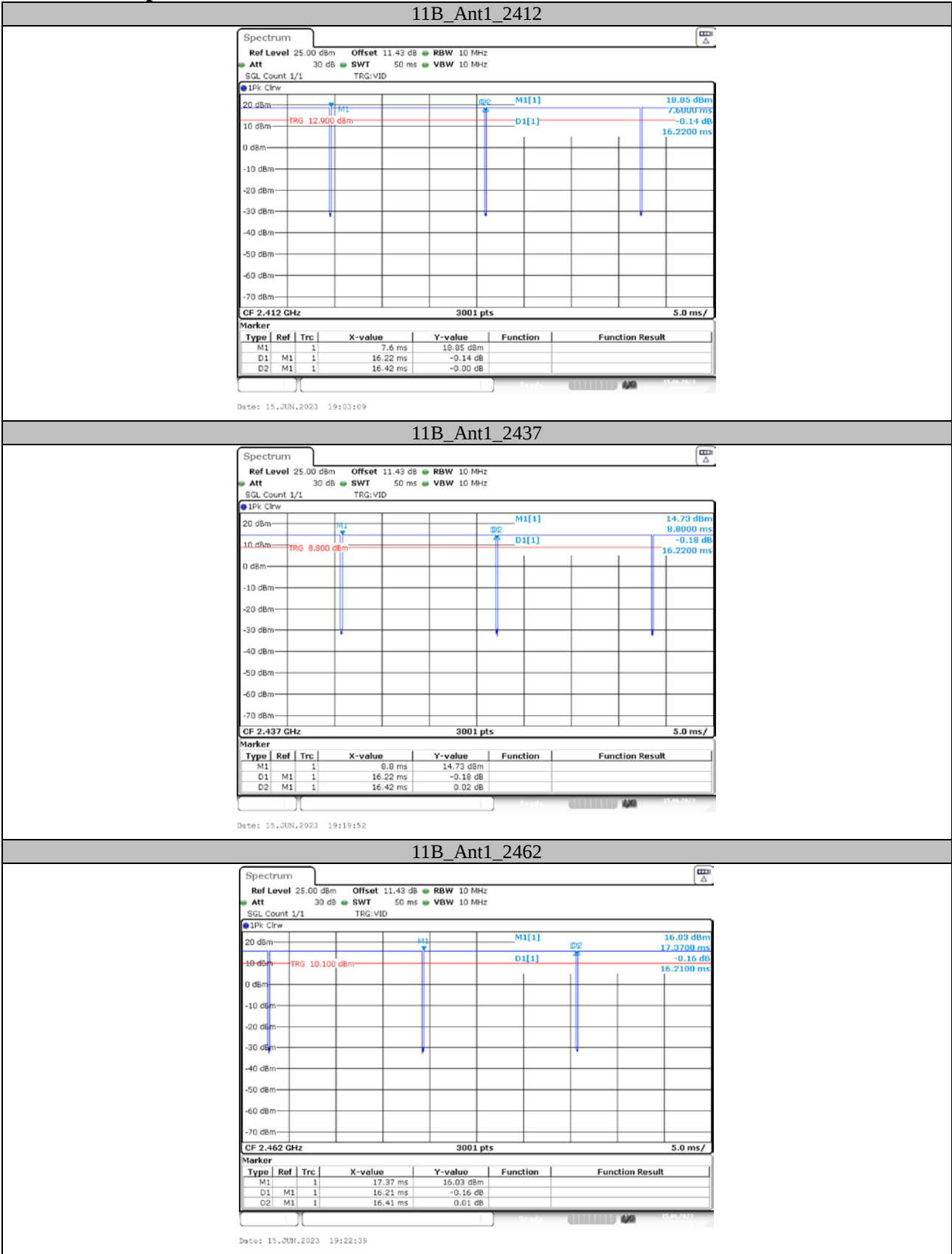
The testing was performed by Jacob Huang on 2023-04-19 and 2023-06-15.

EUT operation mode: Transmitting

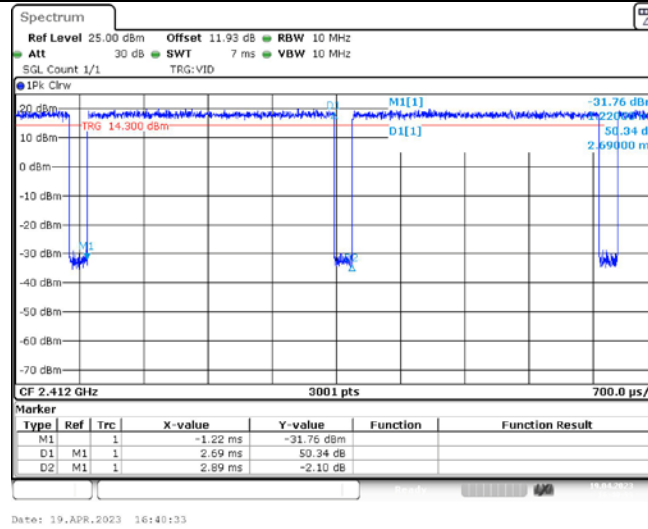
Test Result

Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW[kHz]
11B	Ant1	2412	16.22	16.42	98.78	0.06
		2437	16.22	16.42	98.78	0.06
		2462	16.21	16.41	98.78	0.06
11G	Ant1	2412	2.69	2.89	93.08	0.37
		2437	2.69	2.89	93.08	0.37
		2462	2.69	2.89	93.08	0.37
11N20 SISO	Ant1	2412	2.5	2.70	92.59	0.40
		2437	2.5	2.70	92.59	0.40
		2462	2.5	2.70	92.59	0.40

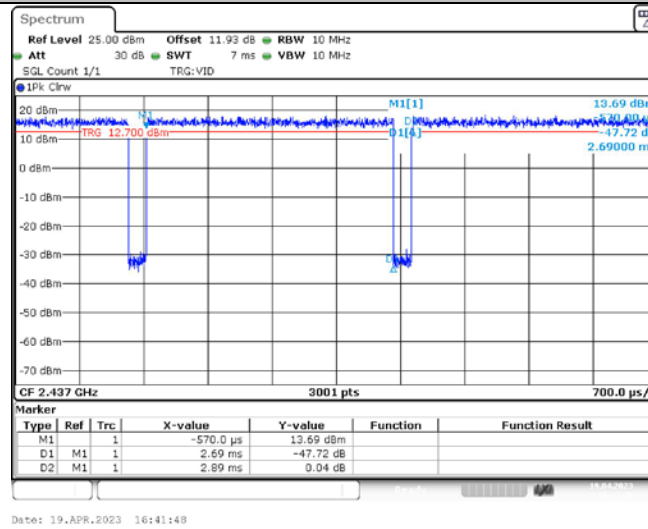
Test Graphs



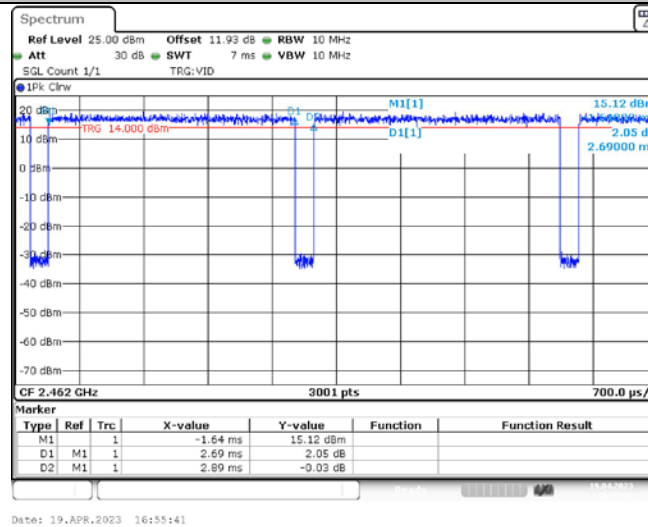
11G_Ant1_2412



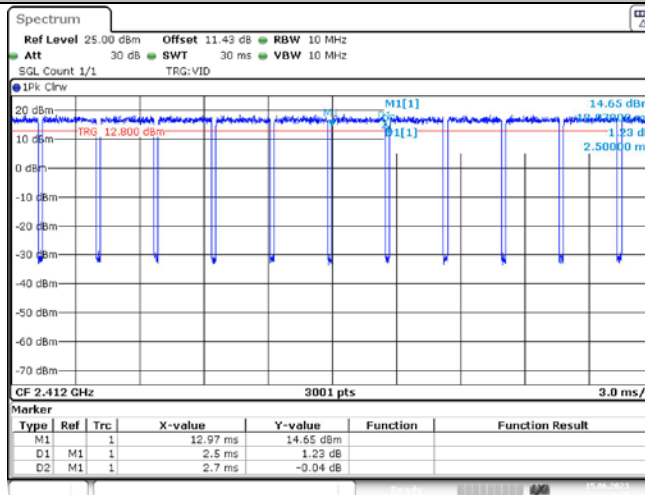
11G_Ant1_2437



11G_Ant1_2462

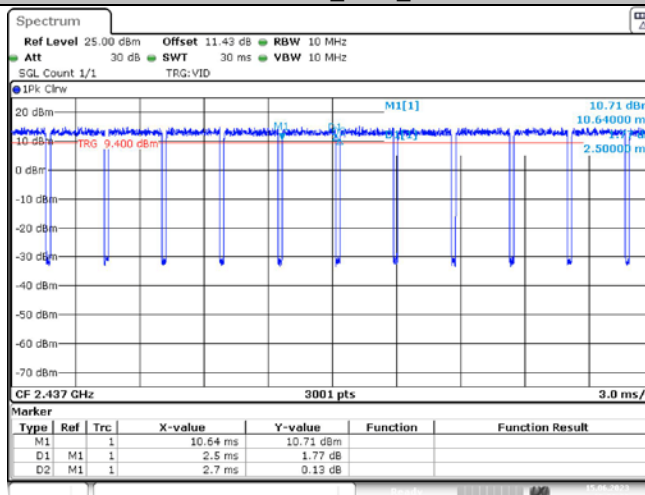


11N20SISO_Ant1_2412



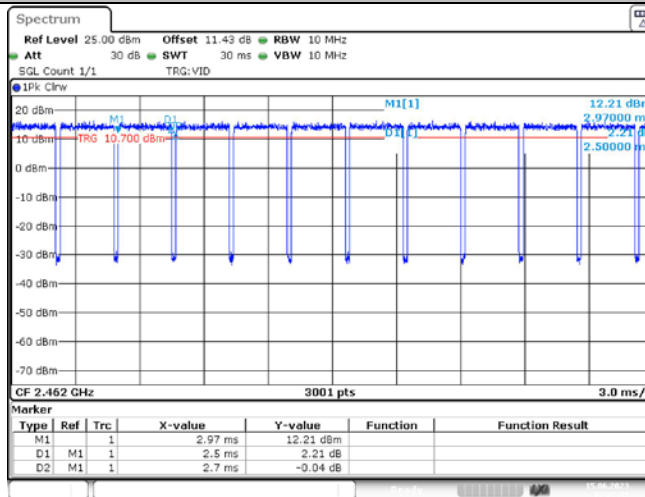
Date: 15 JUN 2023 19:20:57

11N20SISO_Ant1_2437



Date: 15 JUN 2023 19:21:29

11N20SISO_Ant1_2462



Date: 15 JUN 2023 19:21:57

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