



TEST REPORT

Applicant Name : ITEL MOBILE LIMITED
Address : FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25
SHAN MEI STREET FOTAN NT Hong Kong
Report Number : RA230523-28698E-RF-00B
FCC ID: 2AJMN-A663L

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type: Mobile Phone
Model No.: A663L
Multiple Model(s) No.: N/A
Trade Mark: itel
Date Received: 2023/05/23
Report Date: 2023/06/03

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

Prepared and Checked By:

Nick Fang
EMC Engineer

Approved By:

Candy Li
EMC Engineer

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

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230523-28698E-RF-00B	Original Report	2023/06/03

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	BLE: 2402-2480MHz Wi-Fi: 2412-2472MHz
Maximum Conducted Output Power	BLE: 6.49dBm (Peak) Wi-Fi: 15.09dBm(Average)
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM
Antenna Specification*	-1.0dBi (provided by the applicant)
Voltage Range	DC 3.85V from battery or DC 5V from adapter
Test Sample serial number	2647-5for Conducted and Radiated Emissions Test 2647-1for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter information	Model: U100ISA Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 5.0V, 2.0A

Objective

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

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

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

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

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		0.082×10^{-7}
RF output power, conducted		0.71dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.06dB
	30MHz - 1GHz	5.08dB
	1GHz - 18GHz	4.96dB
	18GHz - 26.5GHz	5.16dB
	26.5GHz - 40GHz	4.64dB
Temperature		1°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 429 7.01.

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 Wi-Fi mode, total 13 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	12	2467
6	2437	13	2472
7	2442	/	/

802.11b, 802.11g and 802.11n-HT20 mode was tested with Channel 1, 7 and 13.

For BLE mode, 40 channels are provided to testing:

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

EUT was tested with Channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

EUT was testing in engineering mode.

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

Mode	Data rate	Power Level*		
		Low Channel	Middle Channel	High Channel
802.11b	1Mbps	13	13	13
802.11g	6Mbps	5	5	5
802.11n-HT20	MCS0	5	5	5
BLE	1Mbps	Default	Default	Default

Note: the power level was provided by applicant.

Duty cycle

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

Support Equipment List and Details

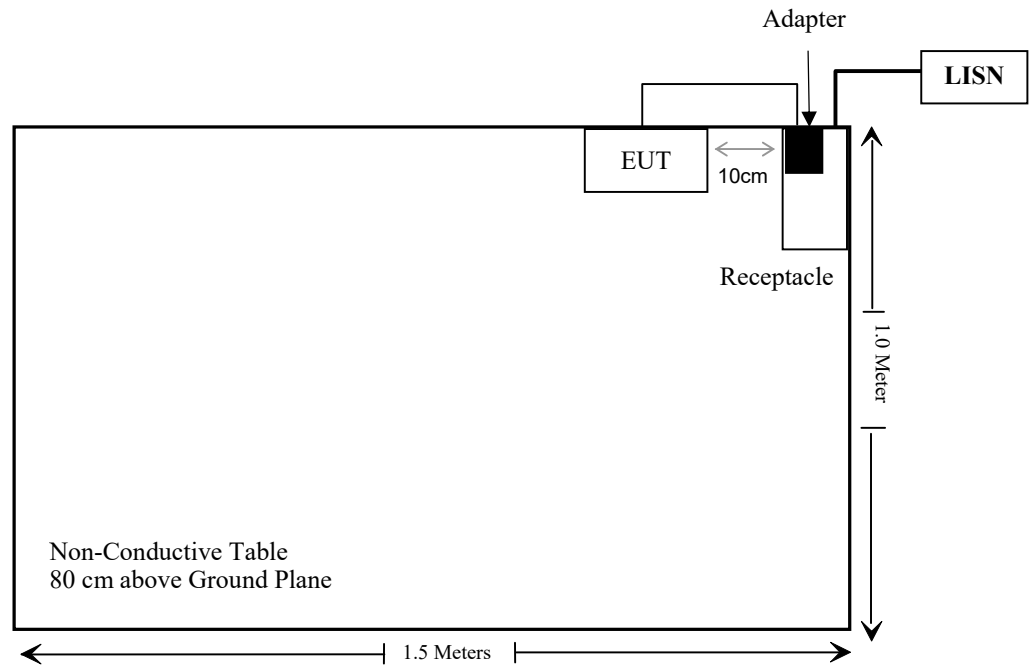
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

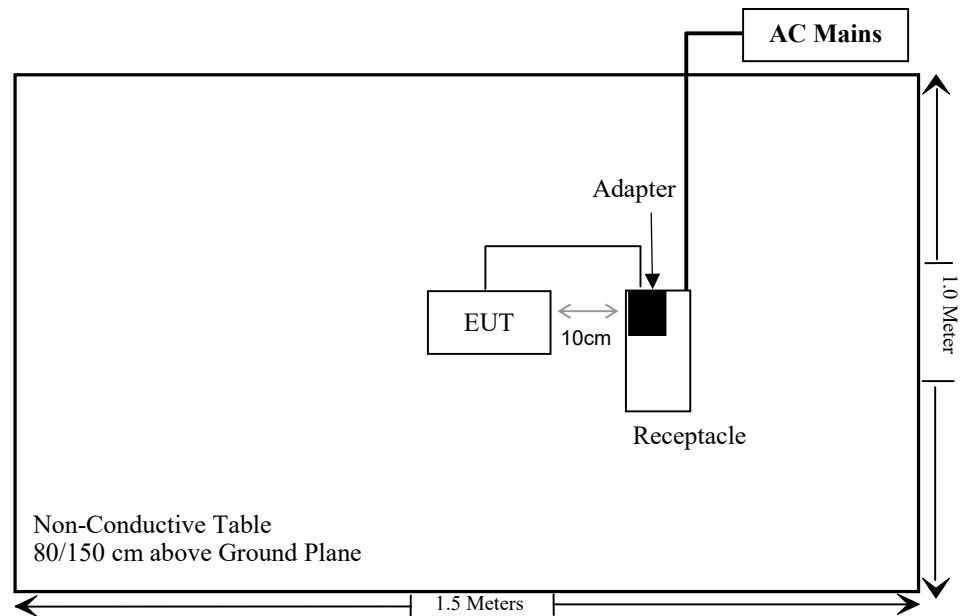
Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter

Block Diagram of Test Setup

For conducted emission:



For Radiated Emissions:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1) & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted 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
Unknown	RF Coaxial Cable	No.17	N0350	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.18	N0850	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
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	837	2023/02/22	2026/02/21
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2022/12/26	2025/12/25
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101590	2022/11/25	2023/11/24
Tonscend	RF Control Unit	JS0806-2	19G8060182	2022/10/24	2023/10/23
Agilent	Power Sensor	U2021XA	MY5425003	2023/02/25	2024/02/24
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	

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

FCC§15.247 (i), §1.1307 (b) & §2.1093 – RF EXPOSURE

Applicable Standard

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

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Measurement Result

For BLE:

Mode	Frequency (MHz)	Max tune-up conducted power* (dBm)	Max tune-up conducted power* (mW)	Distance (mm)	Calculated value	Threshold (1-g SAR)	SAR Test Exclusion
BLE	2402-2480	7.0	5.01	5	1.6	3.0	Yes

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

Result: No Standalone SAR test is required

For Wi-Fi mode, please refer to SAR report: Please refer to SAR test report: RA230523-28698E-SA.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has one internal antenna arrangement, which was permanently attached, the antenna gain for is -1.0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

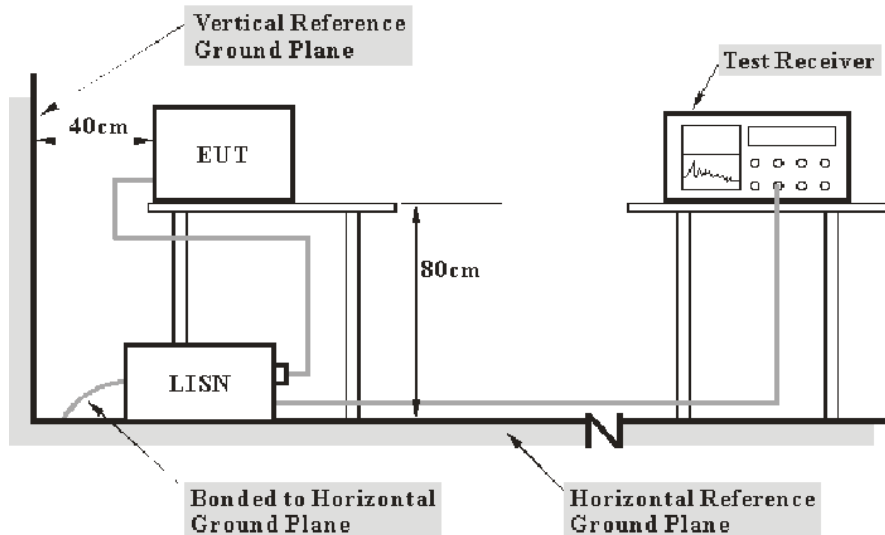
Result: Compliant.

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 30 MHz.

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

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

Test Procedure

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

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

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

Transd Factor & Margin Calculation

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

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

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:

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

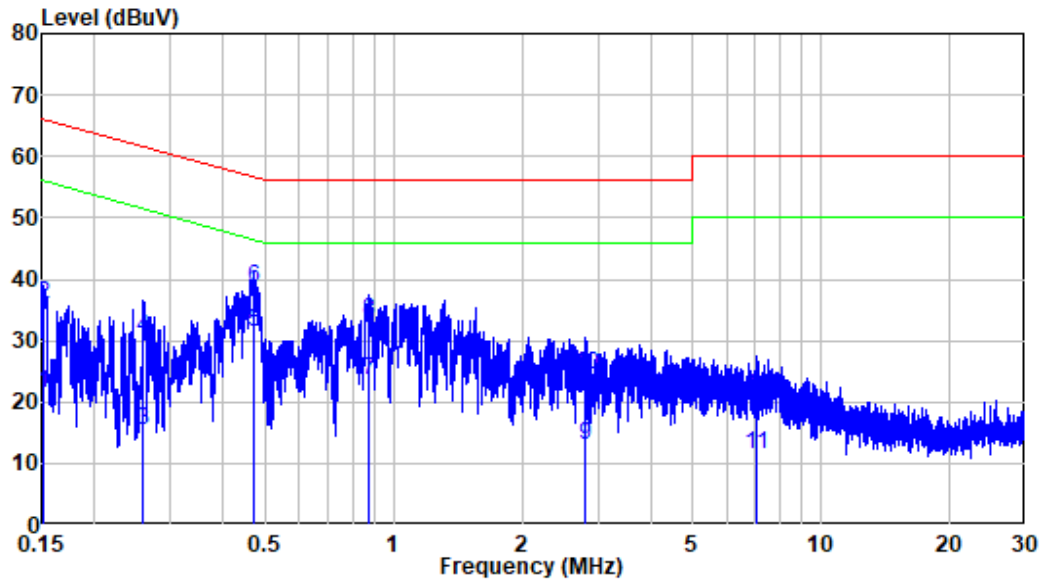
Test Data

Environmental Conditions

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

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

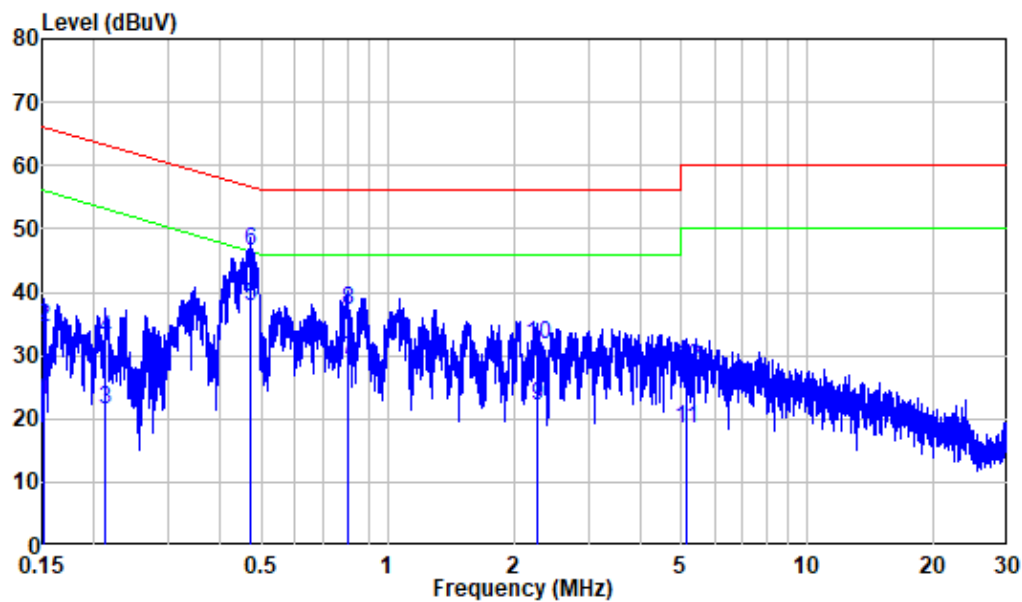
EUT operation mode: Transmitting (Worst case is 802.11g, middle channel)

AC 120V/60 Hz, Line

Site : Shielding Room
 Condition: Line
 Job No. : RA230523-28698E-RF
 Mode : 2.4G WIFI Transmitting
 Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.151	10.37	11.20	21.57	55.94	-34.37	Average
2	0.151	10.37	25.56	35.93	65.94	-30.01	QP
3	0.260	10.36	4.99	15.35	51.43	-36.08	Average
4	0.260	10.36	20.20	30.56	61.43	-30.87	QP
5	0.471	10.55	20.72	31.27	46.49	-15.22	Average
6	0.471	10.55	28.18	38.73	56.49	-17.76	QP
7	0.871	10.54	12.99	23.53	46.00	-22.47	Average
8	0.871	10.54	22.61	33.15	56.00	-22.85	QP
9	2.815	10.47	2.56	13.03	46.00	-32.97	Average
10	2.815	10.47	14.09	24.56	56.00	-31.44	QP
11	7.039	10.62	0.75	11.37	50.00	-38.63	Average
12	7.039	10.62	10.07	20.69	60.00	-39.31	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
 Condition: Neutral
 Job No. : RA230523-28698E-RF
 Mode : 2.4G WIFI Transmitting
 Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.152	10.27	12.62	22.89	55.88	-32.99	Average
2	0.152	10.27	24.17	34.44	65.88	-31.44	QP
3	0.213	10.30	11.14	21.44	53.11	-31.67	Average
4	0.213	10.30	22.19	32.49	63.11	-30.62	QP
5	0.469	10.45	27.31	37.76	46.53	-8.77	Average
6	0.469	10.45	35.90	46.35	56.53	-10.18	QP
7	0.800	10.42	18.74	29.16	46.00	-16.84	Average
8	0.800	10.42	26.65	37.07	56.00	-18.93	QP
9	2.268	10.50	11.62	22.12	46.00	-23.88	Average
10	2.268	10.50	21.12	31.62	56.00	-24.38	QP
11	5.146	10.50	7.85	18.35	50.00	-31.65	Average
12	5.146	10.50	17.55	28.05	60.00	-31.95	QP

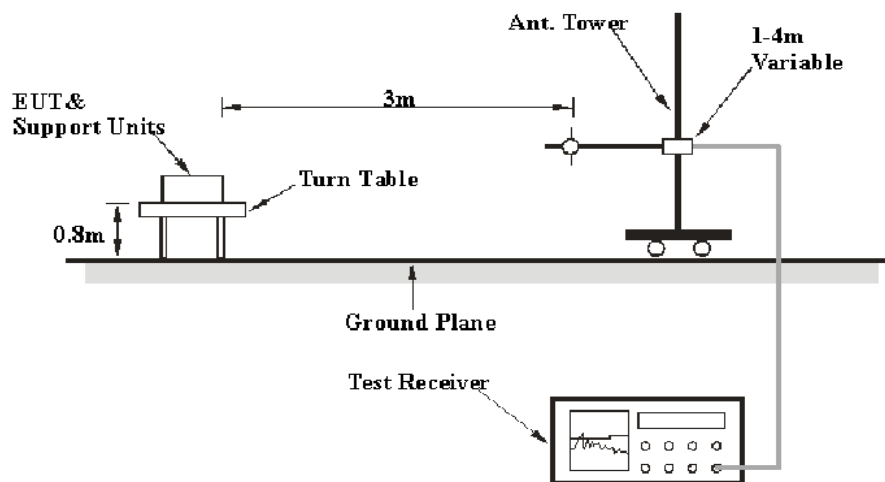
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

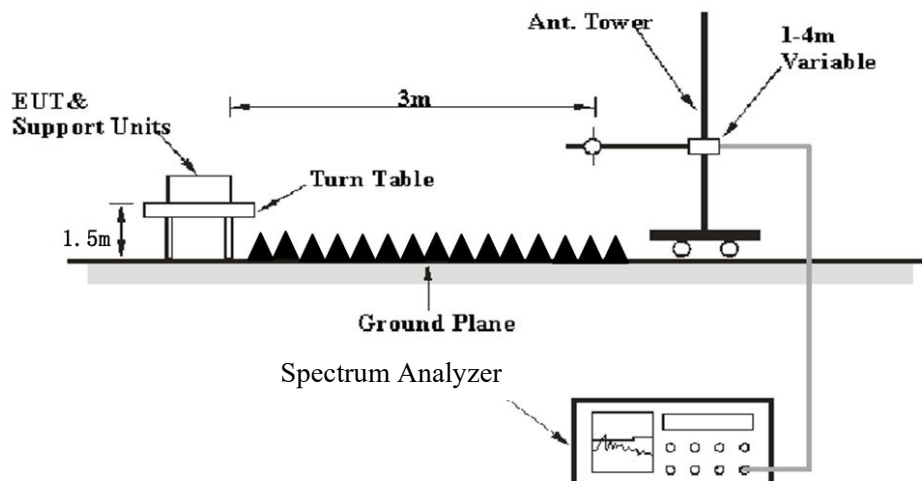
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



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

EMI Test Receiver & Spectrum Analyzer Setup

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

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

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

Note 2: when duty cycle is less than 98%

Test Procedure

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

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

Factor & Margin Calculation

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

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

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

Temperature:	23~25.5 °C
Relative Humidity:	52~54 %
ATM Pressure:	101 kPa

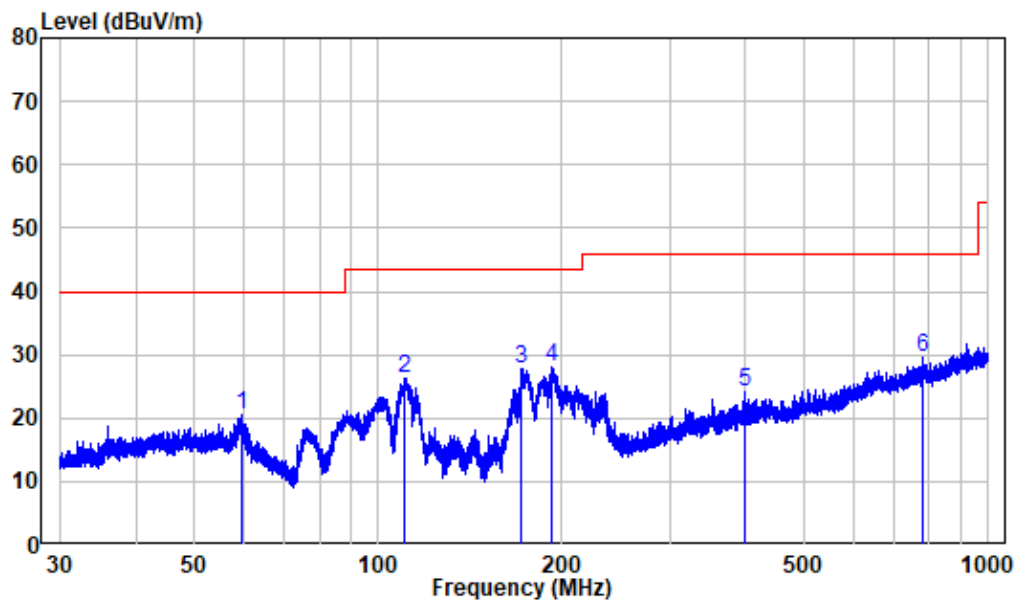
The testing was performed by Jason Liu on 2023-06-01 for below 1GHz and on 2023-05-28 for above 1GHz.

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

30MHz-1GHz: (Worst case is 802.11g, middle channel)

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

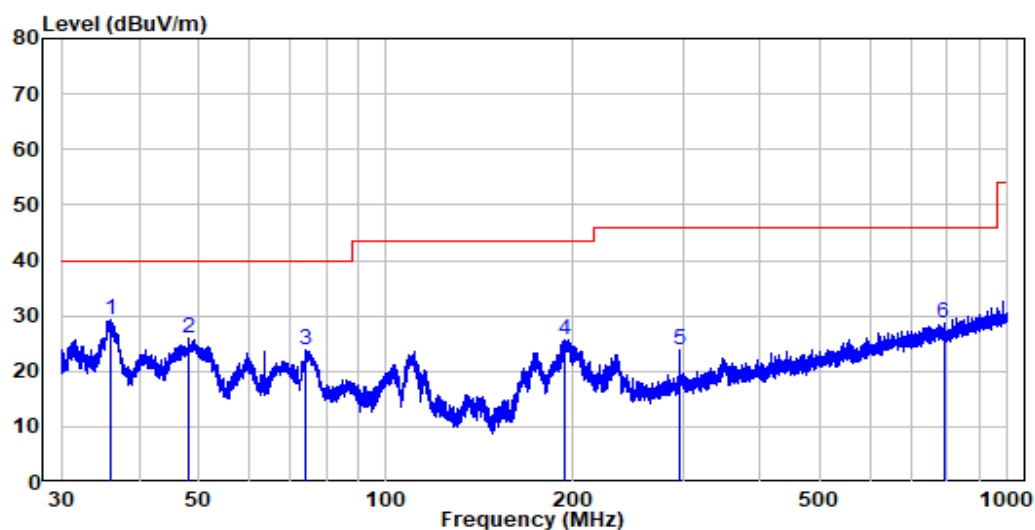
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230523-28698E-RF
Test Mode: 2.4G WIFI Transmitting

	Freq Factor		Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	59.571	-10.47	31.00	20.53	40.00	-19.47	Peak
2	110.037	-11.97	38.32	26.35	43.50	-17.15	Peak
3	171.919	-13.39	41.26	27.87	43.50	-15.63	Peak
4	192.334	-11.26	39.40	28.14	43.50	-15.36	Peak
5	399.555	-6.74	30.92	24.18	46.00	-21.82	Peak
6	779.265	0.08	29.62	29.70	46.00	-16.30	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA230523-28698E-RF
Test Mode: 2.4G WIFI Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	36.016	-11.20	40.45	29.25	40.00	-10.75	Peak
2	48.015	-10.00	35.83	25.83	40.00	-14.17	Peak
3	74.168	-16.09	39.80	23.71	40.00	-16.29	Peak
4	193.858	-11.31	37.09	25.78	43.50	-17.72	Peak
5	296.834	-9.25	33.06	23.81	46.00	-22.19	Peak
6	789.234	-0.12	28.91	28.79	46.00	-17.21	Peak

1-25 GHz:

BLE_1M:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel 2402MHz									
2388.89	67.93	PK	70	2.2	H	-10.62	57.31	74	-16.69
2388.89	53.20	AV	70	2.2	H	-10.62	42.58	54	-11.42
2387.54	67.81	PK	280	2.1	V	-10.62	57.19	74	-16.81
2387.54	53.08	AV	280	2.1	V	-10.62	42.46	54	-11.54
2390	66.04	PK	63	1.1	H	-10.62	55.42	74	-18.58
2390	52.59	AV	63	1.1	H	-10.62	41.97	54	-12.03
2390	65.92	PK	106	2.3	V	-10.62	55.30	74	-18.70
2390	52.47	AV	106	2.3	V	-10.62	41.85	54	-12.15
4804	60.76	PK	235	2	H	-5.57	55.19	74	-18.81
4804	45.33	AV	235	2	H	-5.57	39.76	54	-14.24
4804	60.54	PK	353	2	V	-5.57	54.97	74	-19.03
4804	45.09	AV	353	2	V	-5.57	39.52	54	-14.48
Middle Channel 2440MHz									
4880	60.49	PK	300	1.9	H	-5.24	55.25	74	-18.75
4880	45.05	AV	300	1.9	H	-5.24	39.81	54	-14.19
4880	60.26	PK	198	1.7	V	-5.24	55.02	74	-18.98
4880	44.84	AV	198	1.7	V	-5.24	39.6	54	-14.40
High Channel 2480MHz									
2483.5	66.54	PK	325	1.4	H	-10.46	56.08	74	-17.92
2483.5	53.17	AV	325	1.4	H	-10.46	42.71	54	-11.29
2483.5	66.42	PK	280	1.6	V	-10.46	55.96	74	-18.04
2483.5	53.06	AV	280	1.6	V	-10.46	42.6	54	-11.40
2484.15	68.68	PK	204	1.4	H	-10.46	58.22	74	-15.78
2484.15	53.79	AV	204	1.4	H	-10.46	43.33	54	-10.67
2483.78	68.53	PK	68	1.1	V	-10.46	58.07	74	-15.93
2483.78	53.65	AV	68	1.1	V	-10.46	43.19	54	-10.81
4960	59.82	PK	321	1.4	H	-4.90	54.92	74	-19.08
4960	44.46	AV	321	1.4	H	-4.90	39.56	54	-14.44
4960	59.58	PK	153	1.8	V	-4.90	54.68	74	-19.32
4960	44.25	AV	153	1.8	V	-4.90	39.35	54	-14.65

Wi-Fi:

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11b									
Low Channel 2412MHz									
2387.68	68.30	PK	235	1.8	H	-10.62	57.68	74	-16.32
2387.68	52.53	AV	235	1.8	H	-10.62	41.91	54	-12.09
2388.75	68.18	PK	318	2.4	V	-10.62	57.56	74	-16.44
2388.75	52.41	AV	318	2.4	V	-10.62	41.79	54	-12.21
2390	66.09	PK	17	1.7	H	-10.62	55.47	74	-18.53
2390	52.02	AV	17	1.7	H	-10.62	41.40	54	-12.60
2390	65.97	PK	73	2.4	V	-10.62	55.35	74	-18.65
2390	51.90	AV	73	2.4	V	-10.62	41.28	54	-12.72
4824	59.74	PK	208	1.5	H	-5.55	54.19	74	-19.81
4824	45.83	AV	208	1.5	H	-5.55	40.28	54	-13.72
4824	59.22	PK	95	1.8	V	-5.55	53.67	74	-20.33
4824	45.31	AV	95	1.8	V	-5.55	39.76	54	-14.24
Middle Channel 2442MHz									
4884	60.13	PK	40	1.5	H	-5.20	54.93	74	-19.07
4884	47.01	AV	40	1.5	H	-5.20	41.81	54	-12.19
4884	59.65	PK	191	1.8	V	-5.20	54.45	74	-19.55
4884	46.50	AV	191	1.8	V	-5.20	41.3	54	-12.70
High Channel 2472MHz									
2483.5	70.70	PK	99	1.7	H	-10.46	60.24	74	-13.76
2483.5	60.34	AV	99	1.7	H	-10.46	49.88	54	-4.12
2483.5	70.26	PK	246	2.1	V	-10.46	59.8	74	-14.20
2483.5	60.12	AV	246	2.1	V	-10.46	49.66	54	-4.34
2483.65	71.98	PK	231	2.2	H	-10.46	61.52	74	-12.48
2483.65	60.87	AV	231	2.2	H	-10.46	50.41	54	-3.59
2483.78	71.49	PK	184	1.1	V	-10.46	61.03	74	-12.97
2483.78	60.65	AV	184	1.1	V	-10.46	50.19	54	-3.81
4944	60.48	PK	265	2.5	H	-5.01	55.47	74	-18.53
4944	47.96	AV	265	2.5	H	-5.01	42.95	54	-11.05
4944	59.99	PK	347	1.2	V	-5.01	54.98	74	-19.02
4944	47.42	AV	347	1.2	V	-5.01	42.41	54	-11.59

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11g									
Low Channel 2412MHz									
2385.89	67.92	PK	171	1.9	H	-10.63	57.29	74	-16.71
2385.89	53.23	AV	171	1.9	H	-10.63	42.60	54	-11.40
2387.64	67.79	PK	204	1.1	V	-10.62	57.17	74	-16.83
2387.64	53.10	AV	204	1.1	V	-10.62	42.48	54	-11.52
2390	66.14	PK	306	1.5	H	-10.62	55.52	74	-18.48
2390	52.70	AV	306	1.5	H	-10.62	42.08	54	-11.92
2390	66.03	PK	330	1.2	V	-10.62	55.41	74	-18.59
2390	52.58	AV	330	1.2	V	-10.62	41.96	54	-12.04
4824	60.67	PK	311	1.6	H	-5.55	55.12	74	-18.88
4824	45.72	AV	311	1.6	H	-5.55	40.17	54	-13.83
4824	60.44	PK	275	1.5	V	-5.55	54.89	74	-19.11
4824	45.50	AV	275	1.5	V	-5.55	39.95	54	-14.05
Middle Channel 2442MHz									
4884	60.44	PK	220	1.6	H	-5.20	55.24	74	-18.76
4884	45.28	AV	220	1.6	H	-5.20	40.08	54	-13.92
4884	60.20	PK	187	1.8	V	-5.20	55.00	74	-19.00
4884	45.06	AV	187	1.8	V	-5.20	39.86	54	-14.14
High Channel 2472MHz									
2483.5	80.09	PK	101	1.8	H	-10.46	69.63	74	-4.37
2483.5	60.73	AV	101	1.8	H	-10.46	50.27	54	-3.73
2483.5	79.85	PK	13	2.3	V	-10.46	69.39	74	-4.61
2483.5	60.52	AV	13	2.3	V	-10.46	50.06	54	-3.94
2483.86	81.20	PK	26	2.1	H	-10.46	70.74	74	-3.26
2483.86	61.26	AV	26	2.1	H	-10.46	50.8	54	-3.20
2483.99	80.97	PK	258	2.1	V	-10.46	70.51	74	-3.49
2483.99	61.04	AV	258	2.1	V	-10.46	50.58	54	-3.42
4944	59.86	PK	176	2.4	H	-5.01	54.85	74	-19.15
4944	44.95	AV	176	2.4	H	-5.01	39.94	54	-14.06
4944	59.64	PK	143	2.2	V	-5.01	54.63	74	-19.37
4944	44.72	AV	143	2.2	V	-5.01	39.71	54	-14.29

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
802.11n20									
Low Channel 2412MHz									
2384.25	68.22	PK	218	1.6	H	-10.64	57.58	74	-16.42
2384.25	53.37	AV	218	1.6	H	-10.64	42.73	54	-11.27
2385.48	68.10	PK	84	1.6	V	-10.63	57.47	74	-16.53
2385.48	53.25	AV	84	1.6	V	-10.63	42.62	54	-11.38
2390	66.53	PK	47	2.1	H	-10.62	55.91	74	-18.09
2390	52.84	AV	47	2.1	H	-10.62	42.22	54	-11.78
2390	66.41	PK	297	1.3	V	-10.62	55.79	74	-18.21
2390	52.72	AV	297	1.3	V	-10.62	42.10	54	-11.90
4824	60.83	PK	120	2.5	H	-5.55	55.28	74	-18.72
4824	45.68	AV	120	2.5	H	-5.55	40.13	54	-13.87
4824	60.61	PK	177	1.5	V	-5.55	55.06	74	-18.94
4824	45.45	AV	177	1.5	V	-5.55	39.90	54	-14.10
Middle Channel 2442MHz									
4884	60.53	PK	55	1.4	H	-5.20	55.33	74	-18.67
4884	45.24	AV	55	1.4	H	-5.20	40.04	54	-13.96
4884	60.31	PK	117	2.0	V	-5.20	55.11	74	-18.89
4884	45.02	AV	117	2.0	V	-5.20	39.82	54	-14.18
High Channel 2472MHz									
2483.5	80.19	PK	7	2.1	H	-10.46	69.73	74	-4.27
2483.5	60.93	AV	7	2.1	H	-10.46	50.47	54	-3.53
2483.5	79.98	PK	170	1.4	V	-10.46	69.52	74	-4.48
2483.5	60.71	AV	170	1.4	V	-10.46	50.25	54	-3.75
2483.69	81.35	PK	194	1.5	H	-10.46	70.89	74	-3.11
2483.69	61.44	AV	194	1.5	H	-10.46	50.98	54	-3.02
2483.84	81.10	PK	191	2.2	V	-10.46	70.64	74	-3.36
2483.84	61.22	AV	191	2.2	V	-10.46	50.76	54	-3.24
4944	59.91	PK	355	2	H	-5.01	54.90	74	-19.10
4944	44.84	AV	355	2	H	-5.01	39.83	54	-14.17
4944	59.72	PK	174	1.2	V	-5.01	54.71	74	-19.29
4944	44.55	AV	174	1.2	V	-5.01	39.54	54	-14.46

Note:

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

Corrected Amplitude = Factor + Reading

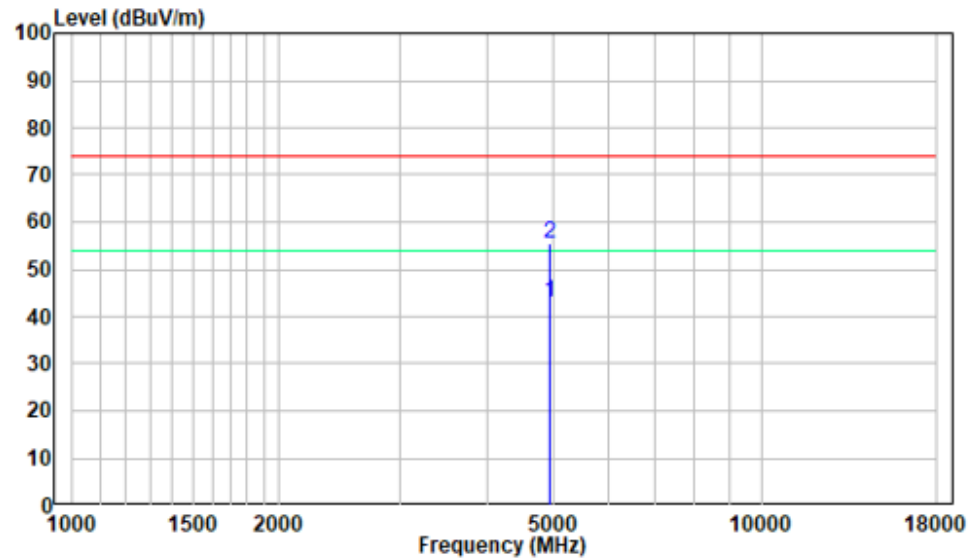
Margin = Corrected. Amplitude - Limit

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

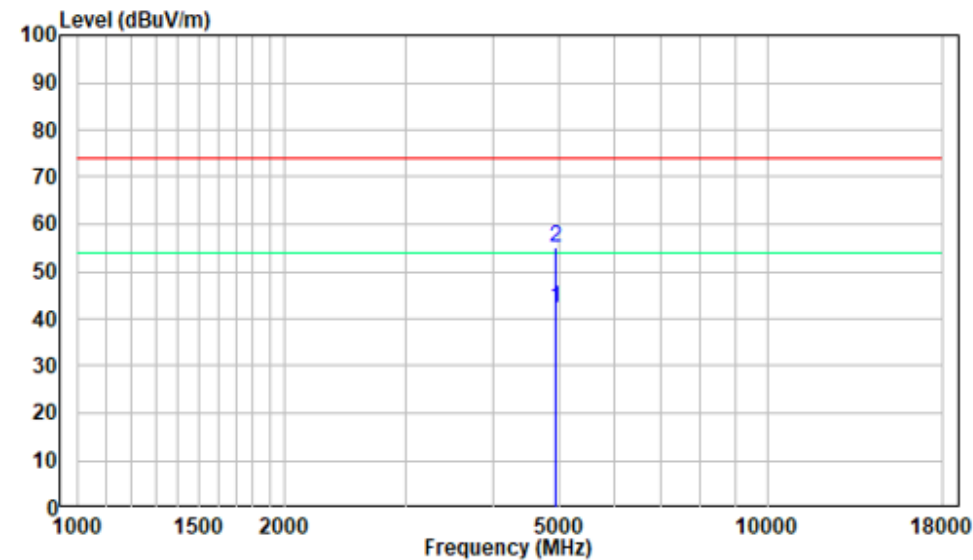
1-18 GHz:

Pre-scan for 802.11b, High Channel

Horizontal



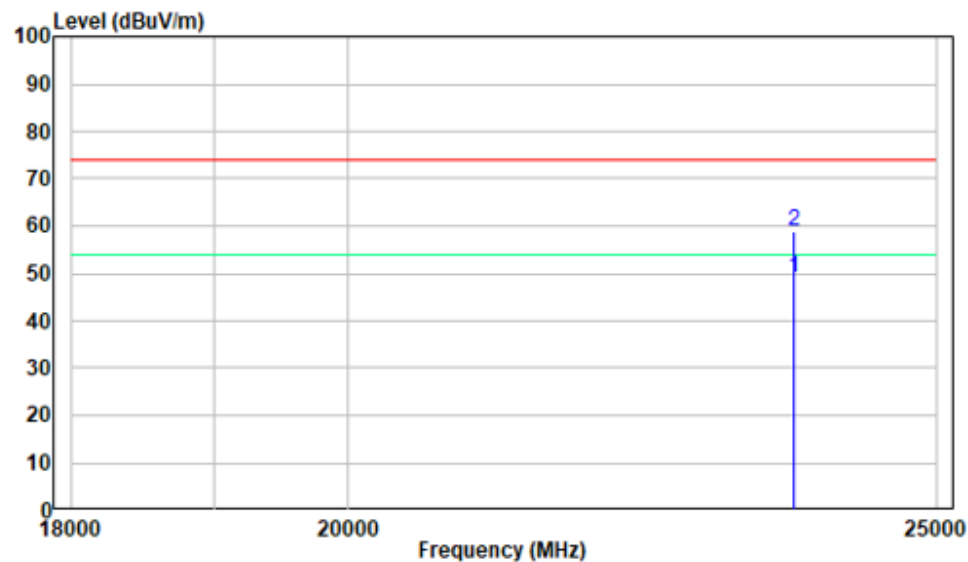
Vertical



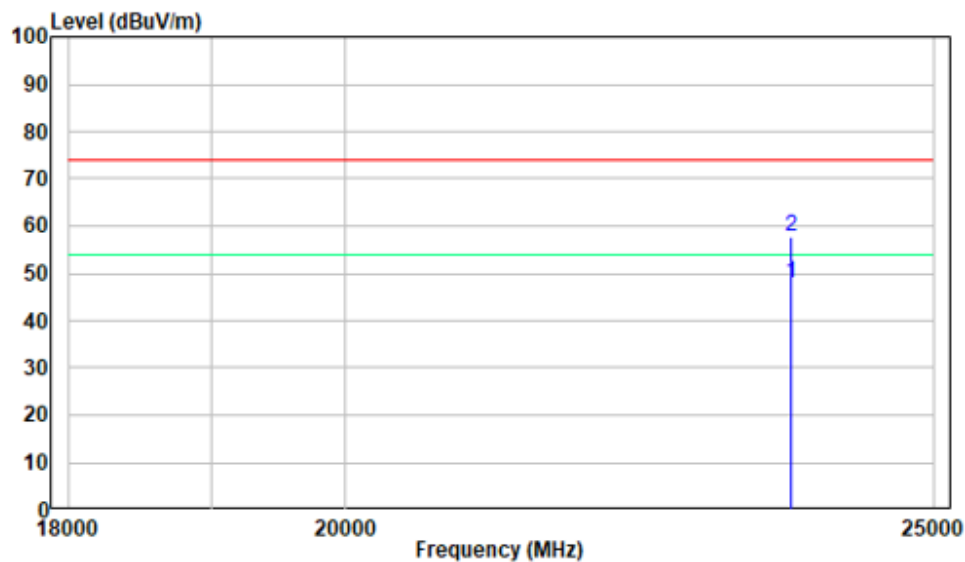
18 -25GHz:

Pre-scan for 802.11b, High Channel

Horizontal



Vertical



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

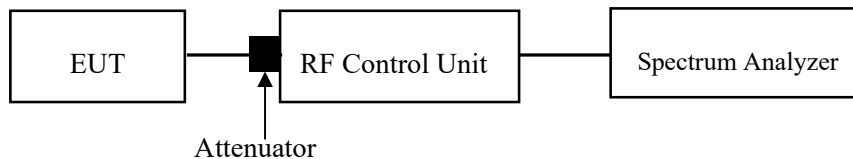
Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.8.1 & Clause 6.9.3

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



Test Data

Environmental Conditions

Temperature:	25.7~27.7 °C
Relative Humidity:	55~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-27 to 2023-06-02.

EUT operation mode: Transmitting

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

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

Applicable Standard

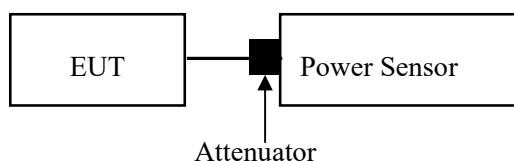
According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted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

Test Procedure

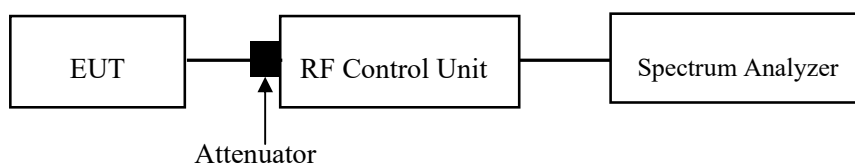
Test Method: ANSI C63.10-2013 Clause 11.9.1.1 for BLE & Clause 11.9.2.3.2 for Wi-Fi

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

For Wi-Fi mode:



For BLE mode:



Test Data

Environmental Conditions

Temperature:	25.7~27.7 °C
Relative Humidity:	55~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-27 to 2023-06-02.

EUT operation mode: Transmitting

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

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

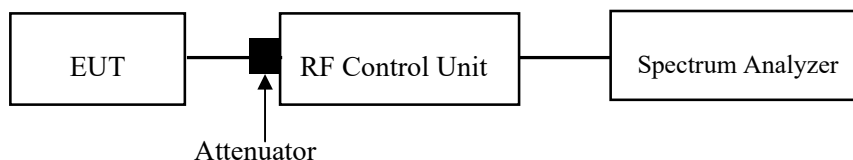
Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.11

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



Test Data

Environmental Conditions

Temperature:	25.7~27.7 °C
Relative Humidity:	55~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-27 to 2023-06-02.

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

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

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.10.2

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

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

Test Method: ANSI C63.10-2013 Clause 11.10.3 Method Ave.GPSD-1

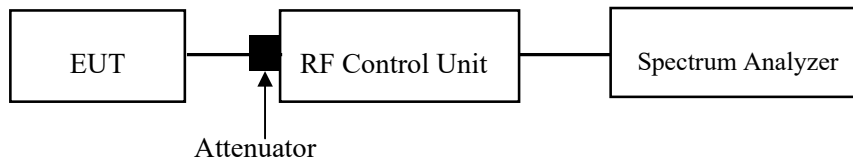
The following procedure may be used when the maximum (average) conducted output power was used to determine compliance to the fundamental output power limit. This is the baseline method for determining the maximum (average) conducted PSD level. If the instrument has a power averaging (rms) detector, then it must be used; otherwise, use the sample detector. The EUT must be configured to transmit continuously ($D \geq 98\%$), or else sweep triggering/signal gating must be implemented to ensure that measurements are made only when the EUT is transmitting at its maximum power control level (no transmitter OFF time to be considered):

1. Set instrument center frequency to DTS channel center frequency.
2. Set span to at least 1.5 times the OBW.
3. Set the RBW to: $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{BW}$.
5. Detector = power averaging (rms) or sample detector (when rms not available)
6. Ensure that the number of measurement points in the sweep $\geq [2 \times \text{span} / \text{RBW}]$.
7. Sweep time = auto couple.
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 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 Method: ANSI C63.10-2013 Clause 11.10.5 Method Ave.GPSD-2

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

1. Measure the duty cycle (D) of the transmitter output signal as described in 11.6.
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. Set the RBW to: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
5. Set the VBW $\geq 3 \times \text{BW}$.
6. Detector = power averaging (rms) or sample detector (when rms not available)
7. Ensure that the number of measurement points in the sweep $\geq [2 \times \text{span} / \text{RBW}]$.
8. Sweep time = auto couple.
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. 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

Temperature:	25.7~27.7 °C
Relative Humidity:	55~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-27 to 2023-06-02.

EUT operation mode: Transmitting

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

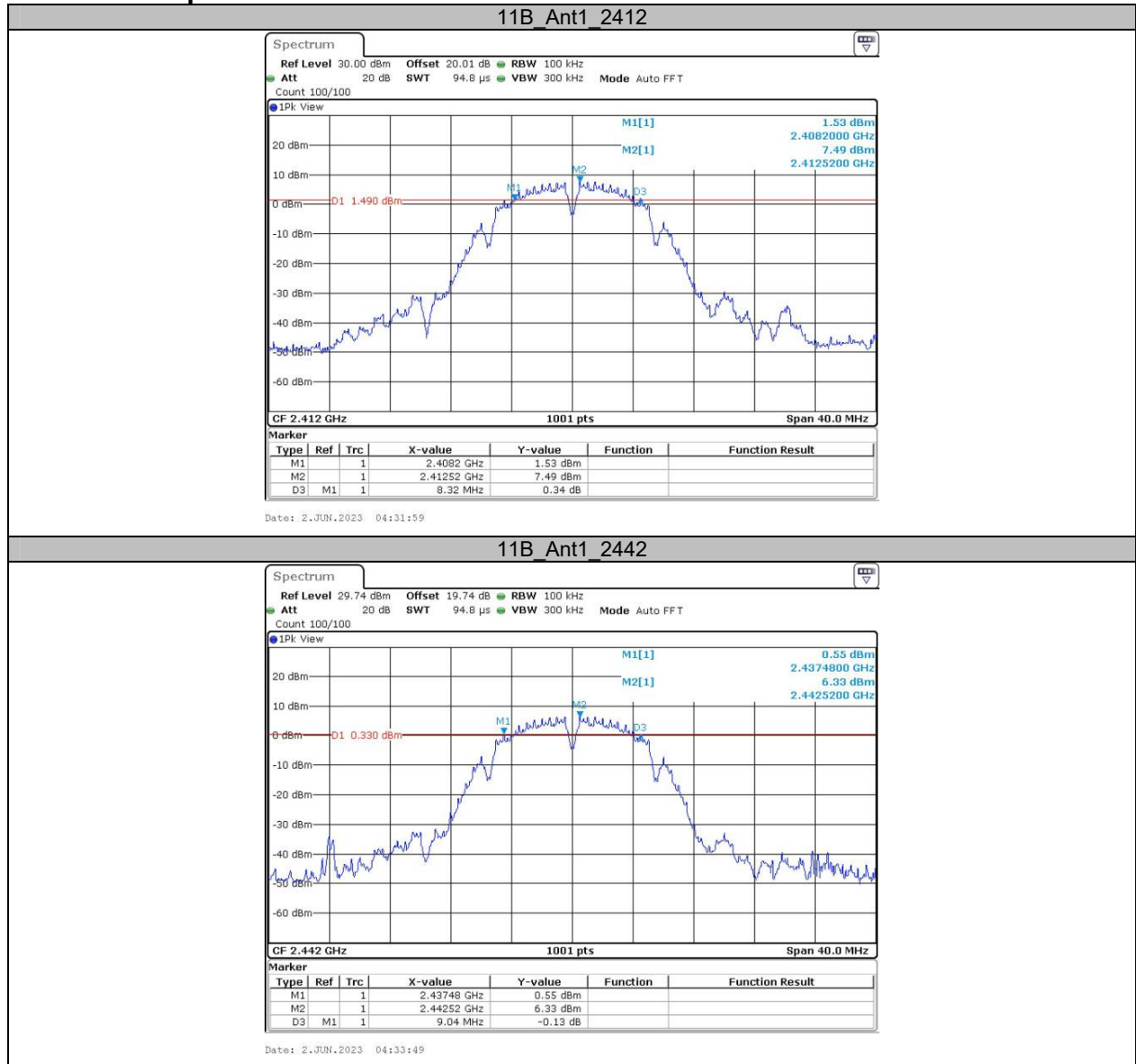
APPENDIX Wi-Fi

Appendix A: DTS Bandwidth

Test Result

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.32	2408.20	2416.52	0.5	PASS
		2442	9.04	2437.48	2446.52	0.5	PASS
		2472	8.56	2467.48	2476.04	0.5	PASS
11G	Ant1	2412	16.32	2403.84	2420.16	0.5	PASS
		2442	16.32	2433.84	2450.16	0.5	PASS
		2472	16.32	2463.84	2480.16	0.5	PASS
11N20SISO	Ant1	2412	16.68	2404.08	2420.76	0.5	PASS
		2442	17.56	2433.20	2450.76	0.5	PASS
		2472	17.32	2463.20	2480.52	0.5	PASS

Test Graphs

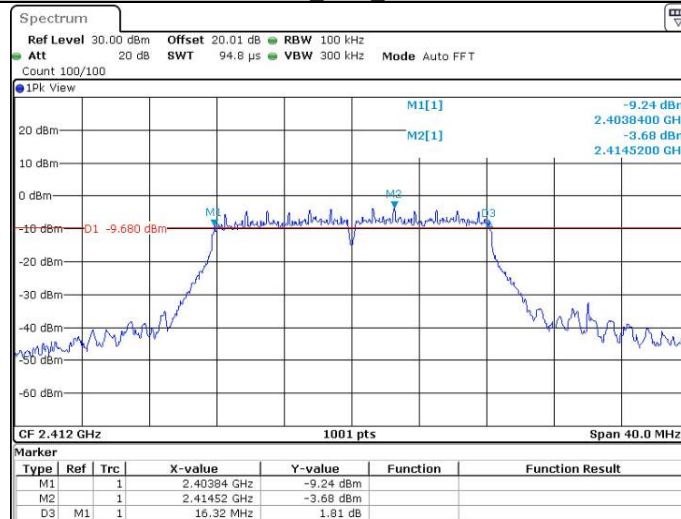


11B_Ant1_2472

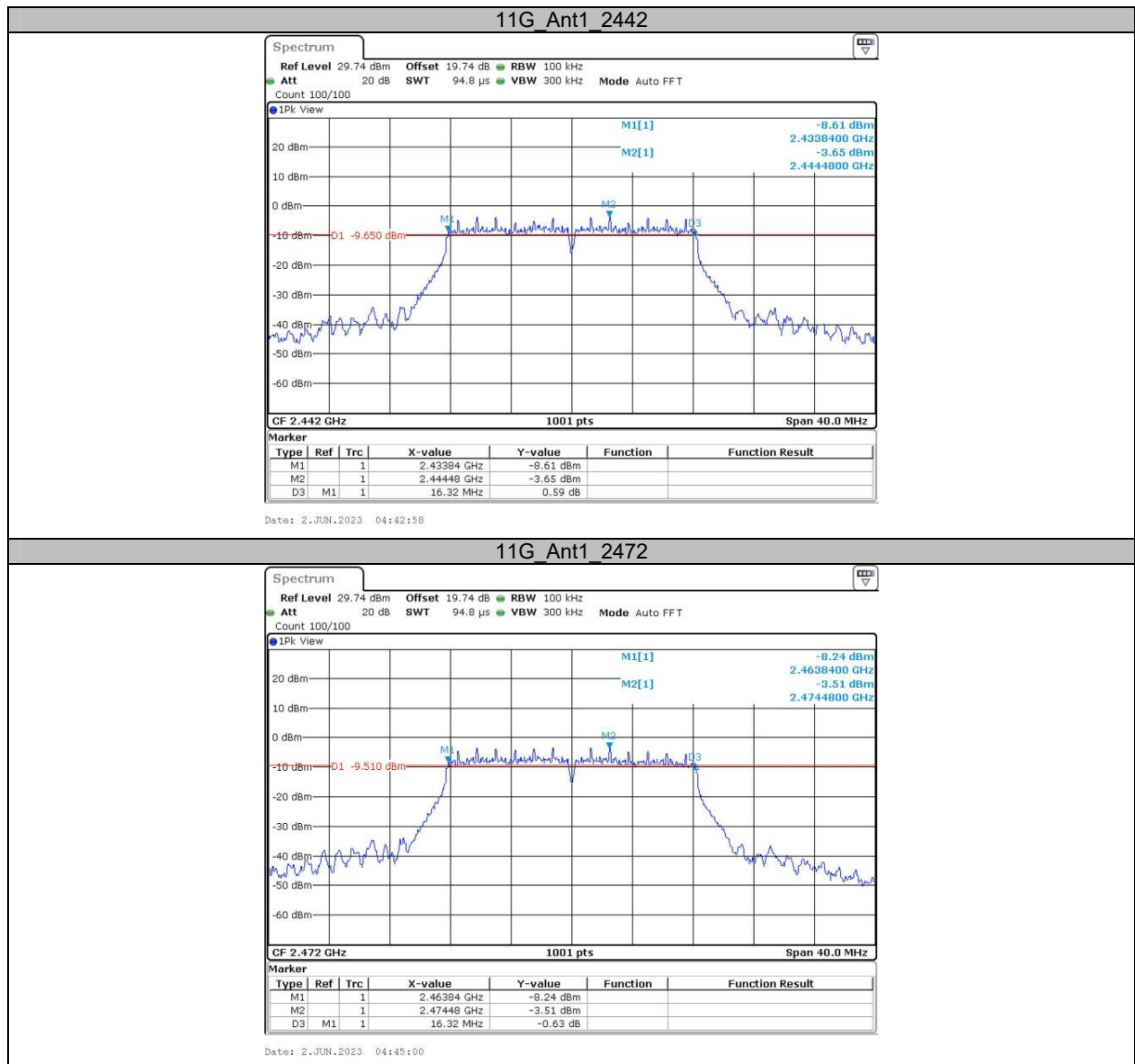


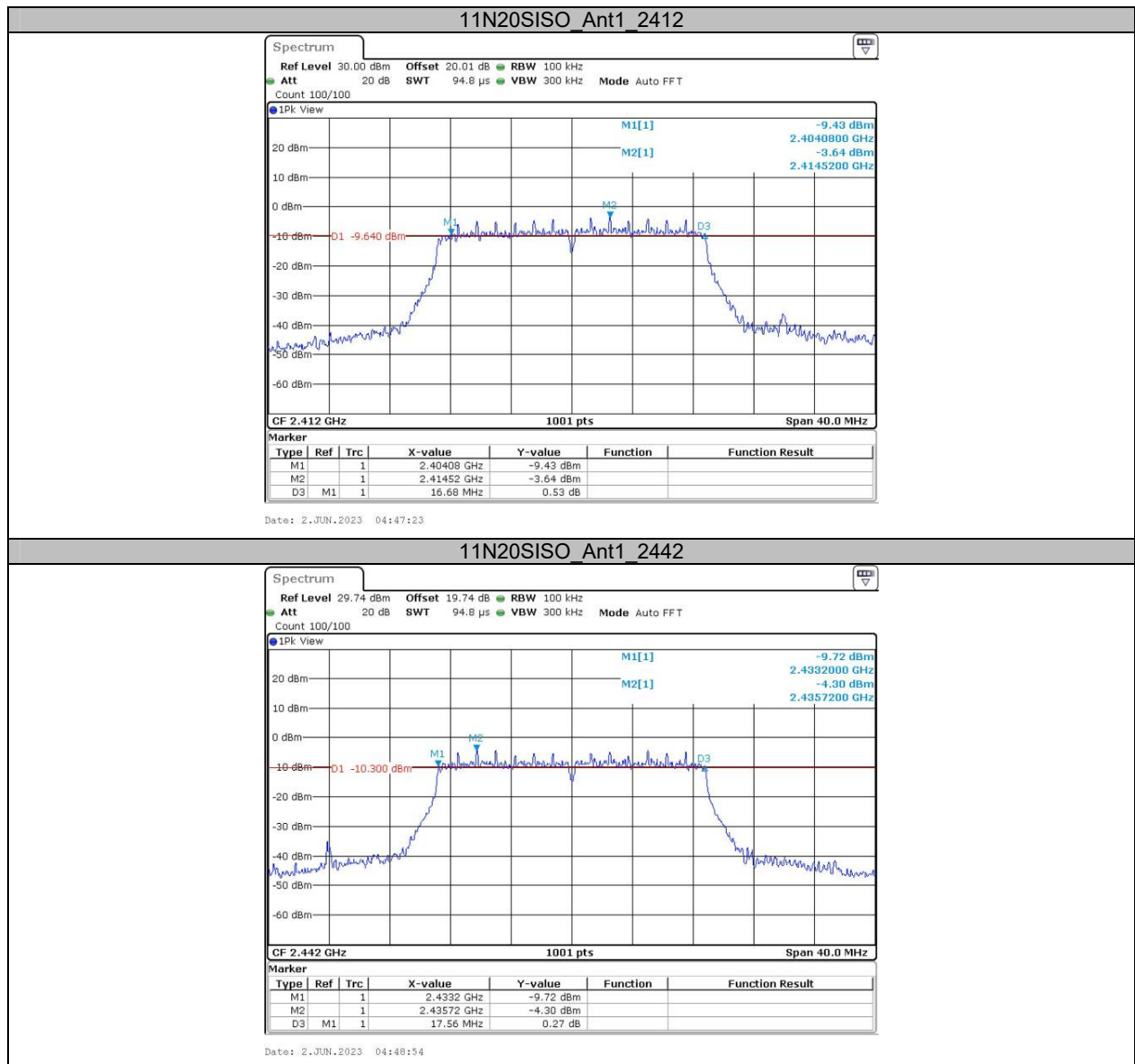
Date: 2.JUN.2023 04:35:03

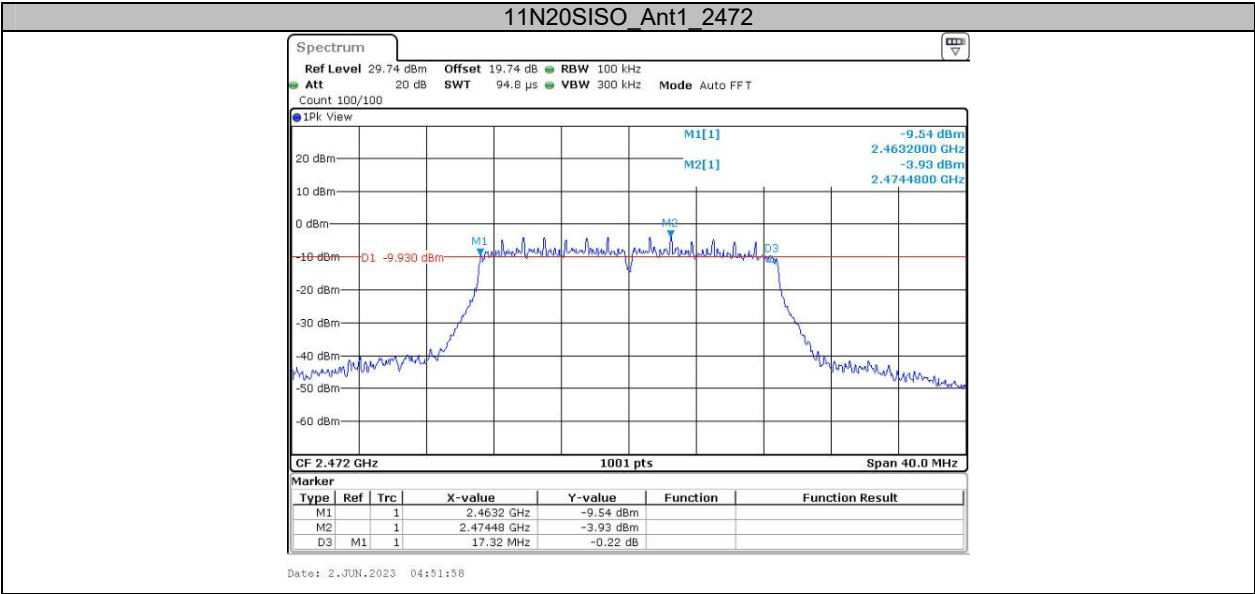
11G_Ant1_2412



Date: 2.JUN.2023 04:38:59



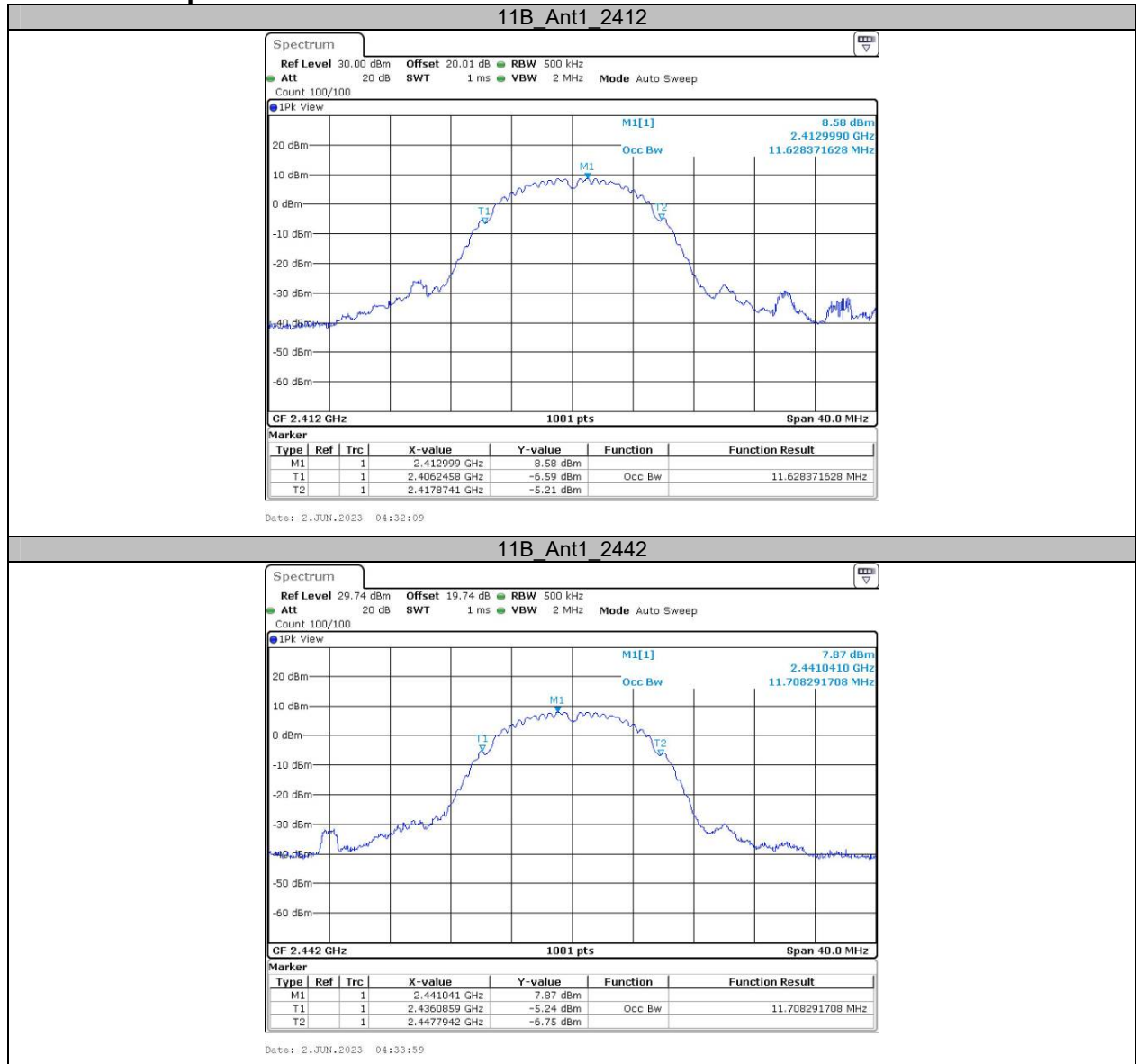




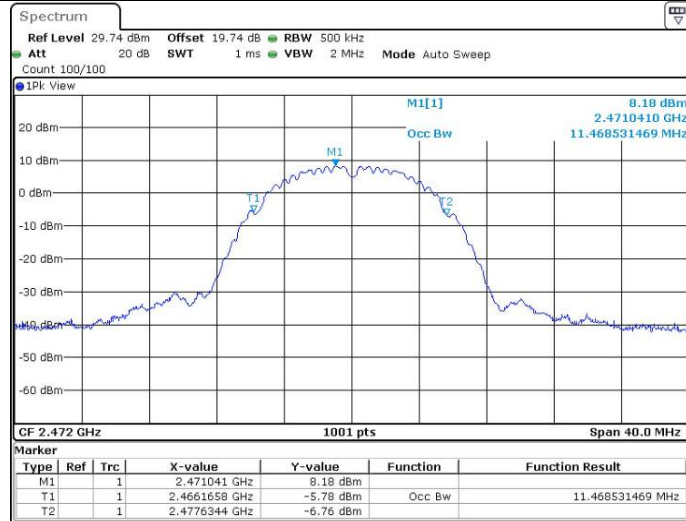
Appendix B: Occupied Channel Bandwidth**Test Result**

Test Mode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]
11B	Ant1	2412	11.628	2406.246	2417.874
		2442	11.708	2436.086	2447.794
		2472	11.469	2466.166	2477.634
11G	Ant1	2412	17.662	2403.249	2420.911
		2442	17.822	2433.049	2450.871
		2472	17.662	2463.049	2480.711
11N20SISO	Ant1	2412	18.342	2402.929	2421.271
		2442	18.422	2432.809	2451.231
		2472	18.342	2462.769	2481.111

Test Graphs

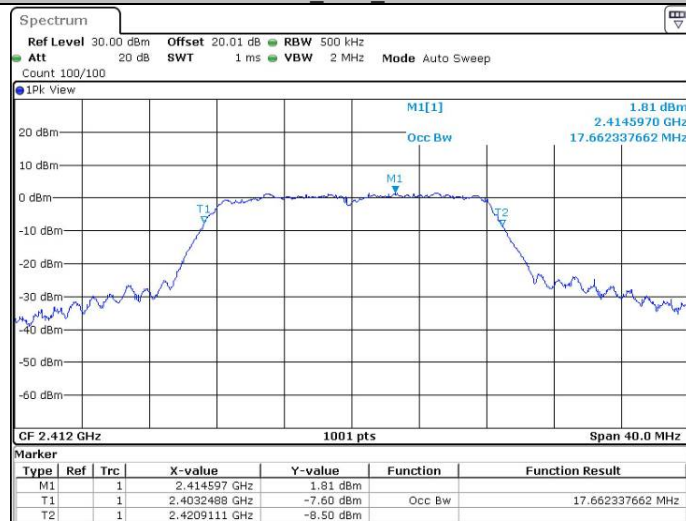


11B_Ant1_2472



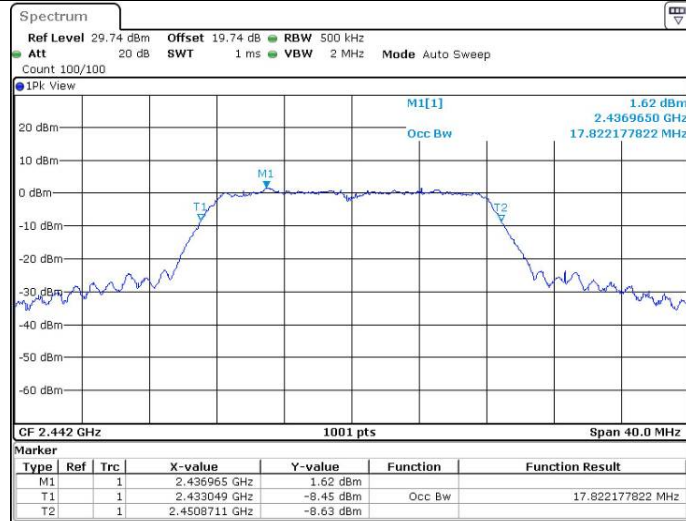
Date: 2.JUN.2023 04:35:14

11G_Ant1_2412



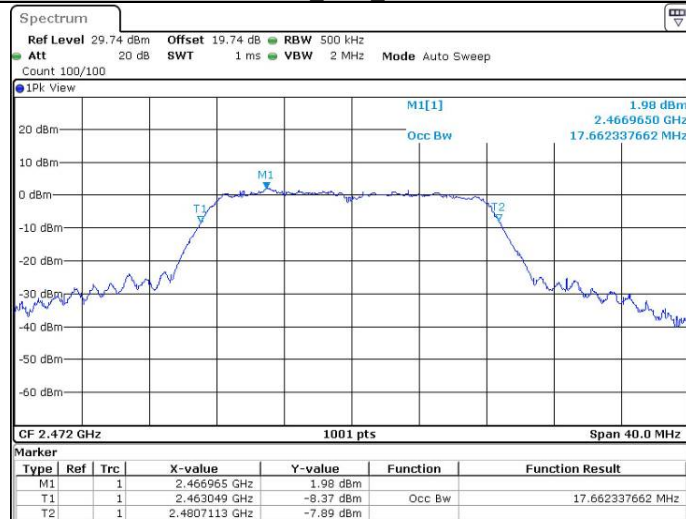
Date: 2.JUN.2023 04:39:11

11G_Ant1_2442

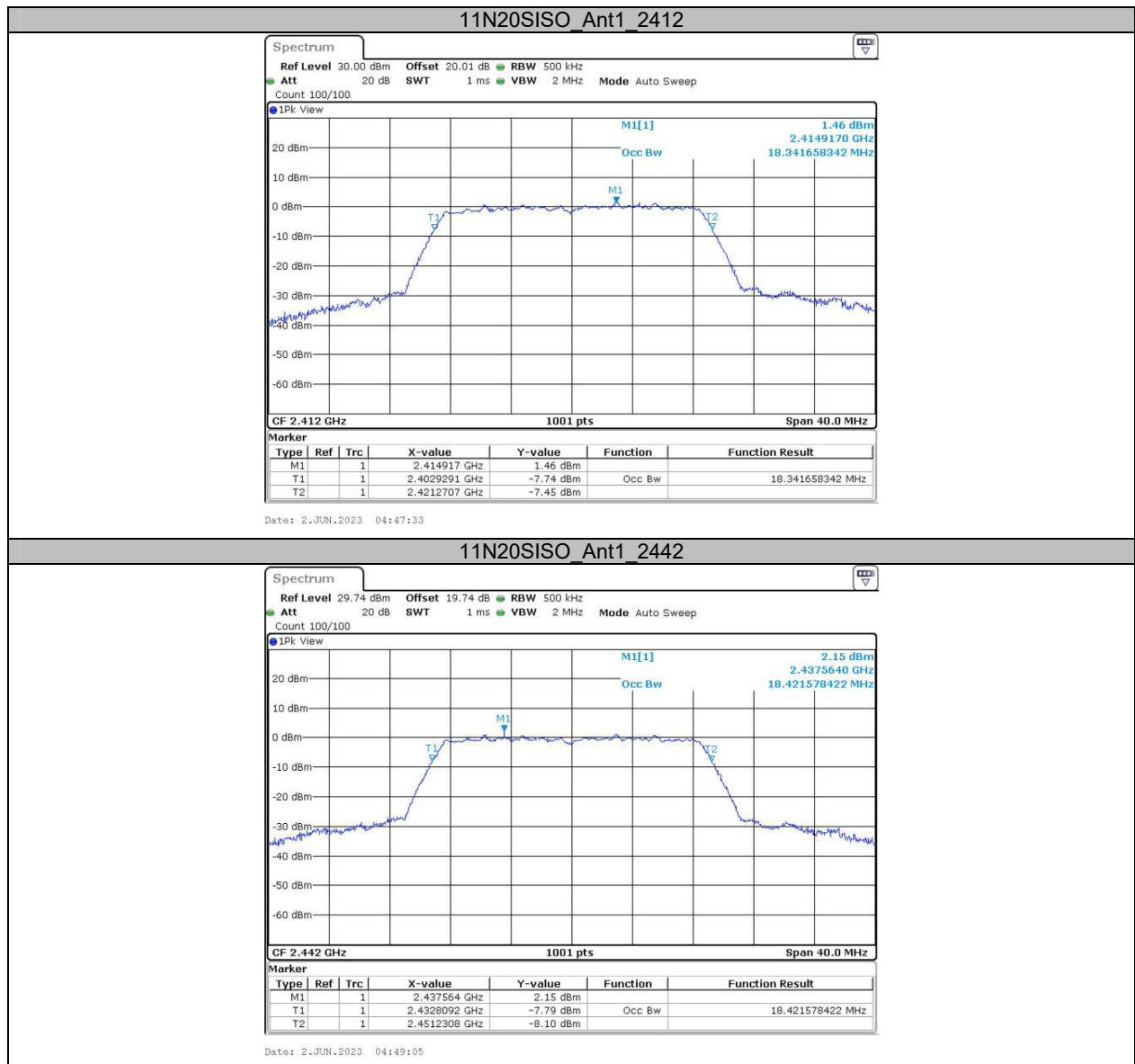


Date: 2.JUN.2023 04:43:09

11G_Ant1_2472



Date: 2.JUN.2023 04:45:11





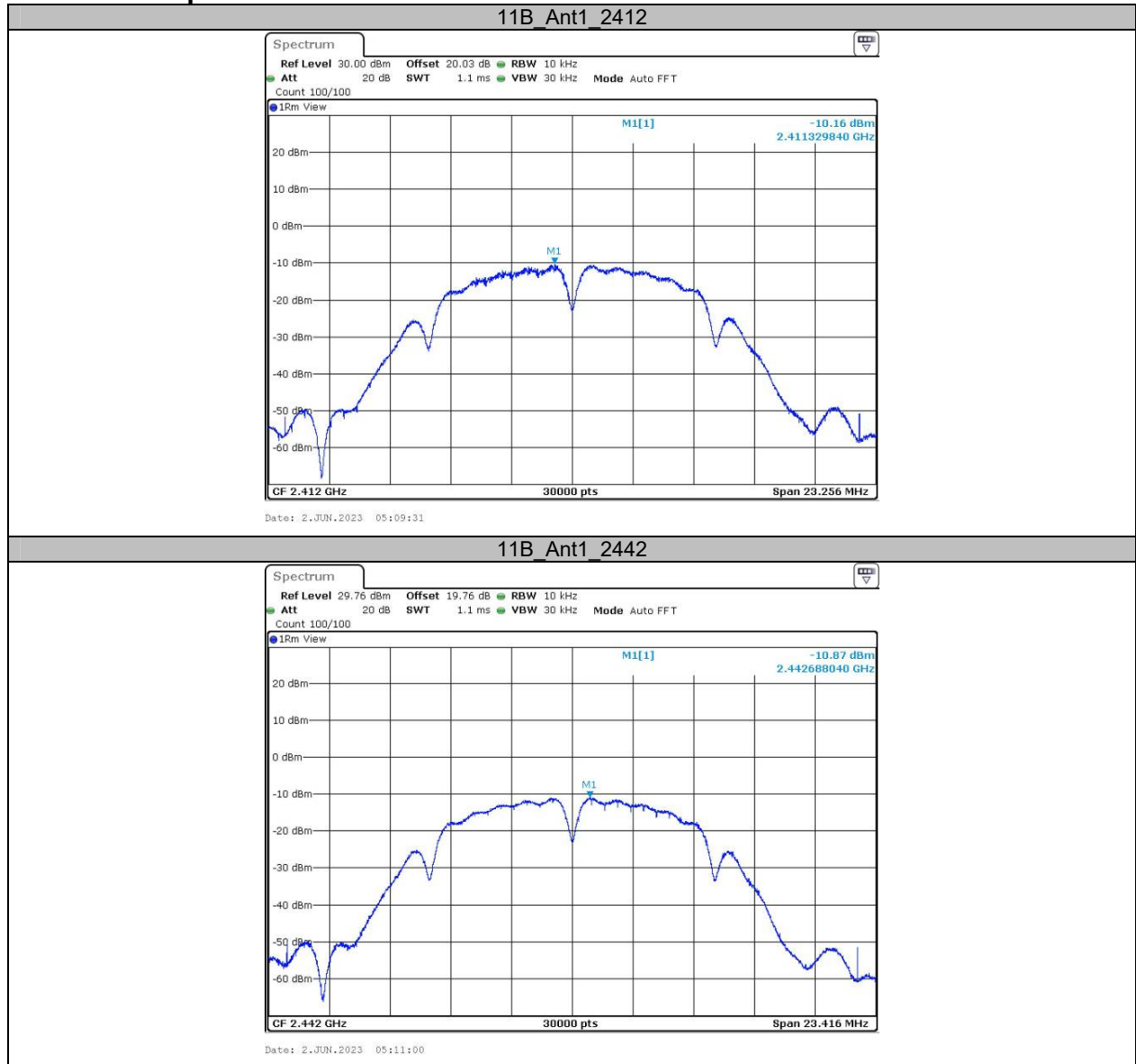
Appendix C: Maximum conducted output power**Test Result**

Test Mode	Antenna	Frequency [MHz]	Average Power [dBm]	Conducted Limit [dBm]	Verdict
11B	Ant1	2412	14.90	≤30.00	PASS
		2442	15.09	≤30.00	PASS
		2472	15.08	≤30.00	PASS
11G	Ant1	2412	6.75	≤30.00	PASS
		2442	6.99	≤30.00	PASS
		2472	6.93	≤30.00	PASS
11N20SISO	Ant1	2412	6.13	≤30.00	PASS
		2442	6.42	≤30.00	PASS
		2472	6.35	≤30.00	PASS

Appendix D: Maximum power spectral density**Test Result**

Test Mode	Antenna	Frequency [MHz]	Reading [dBm/10kHz]	Limit [dBm/3kHz]	Verdict
11B	Ant1	2412	-10.16	≤8.00	PASS
		2442	-10.87	≤8.00	PASS
		2472	-10.67	≤8.00	PASS
11G	Ant1	2412	-20.44	≤8.00	PASS
		2442	-21.08	≤8.00	PASS
		2472	-20.89	≤8.00	PASS
11N20SISO	Ant1	2412	-21.22	≤8.00	PASS
		2442	-20.85	≤8.00	PASS
		2472	-21.49	≤8.00	PASS

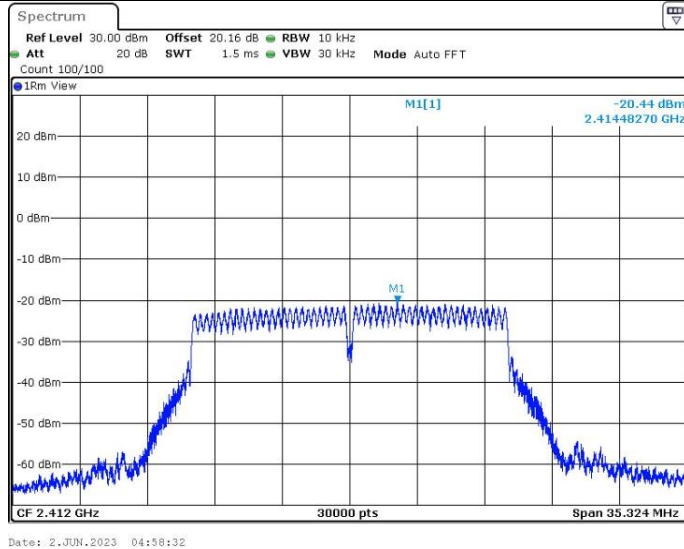
Note: the duty cycle factor was added into the final result.

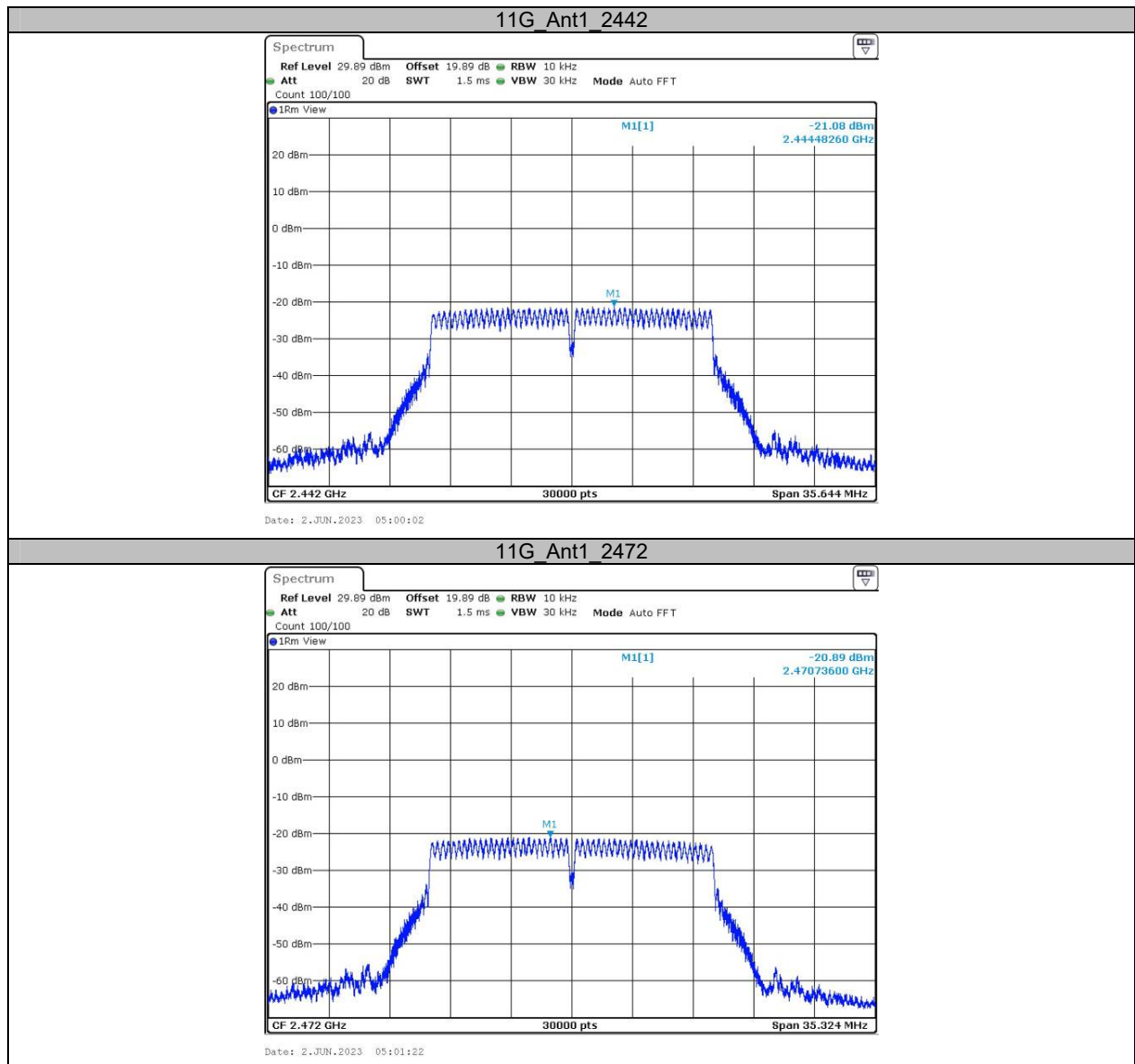
Test Graphs

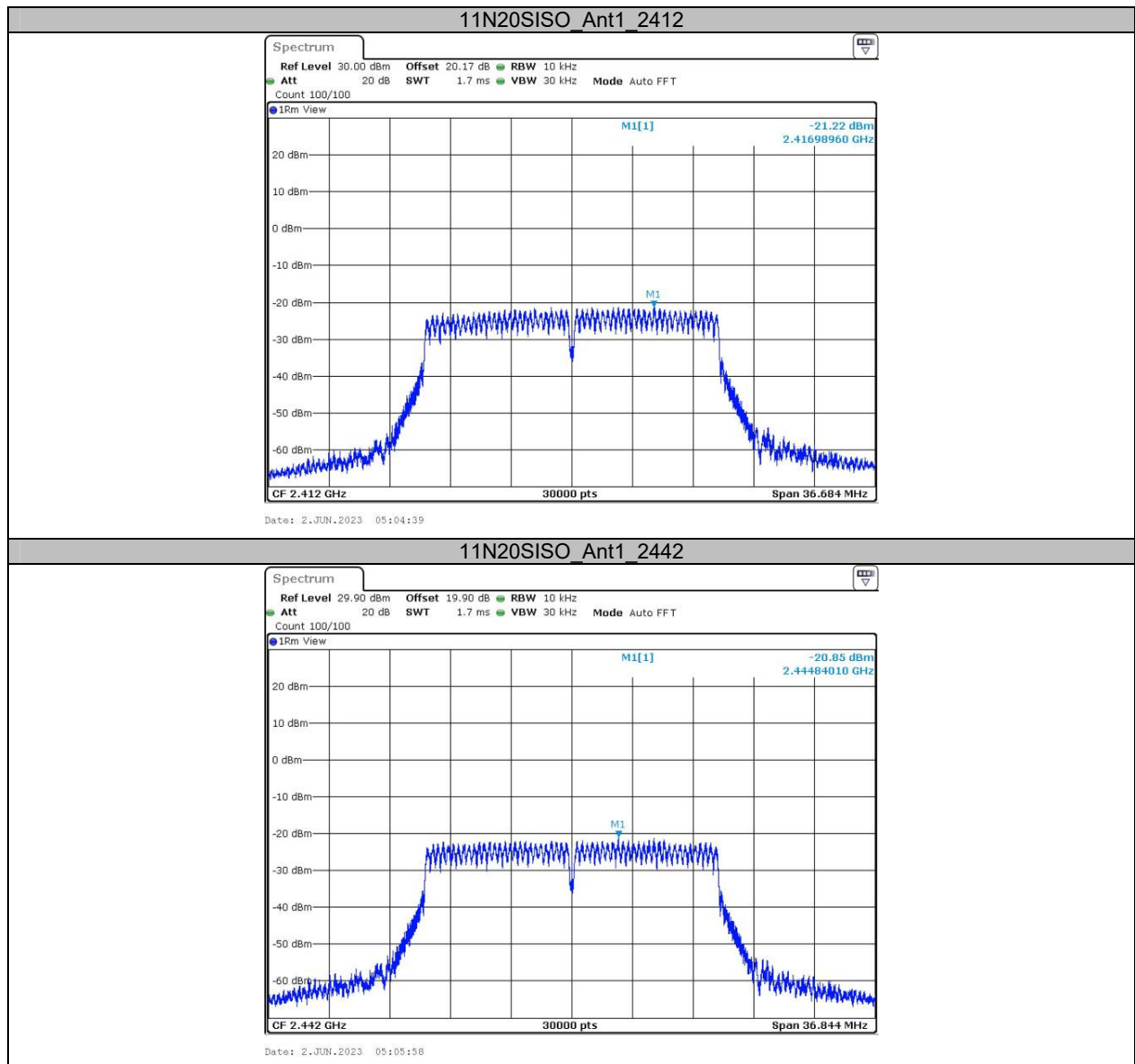
11B_Ant1_2472

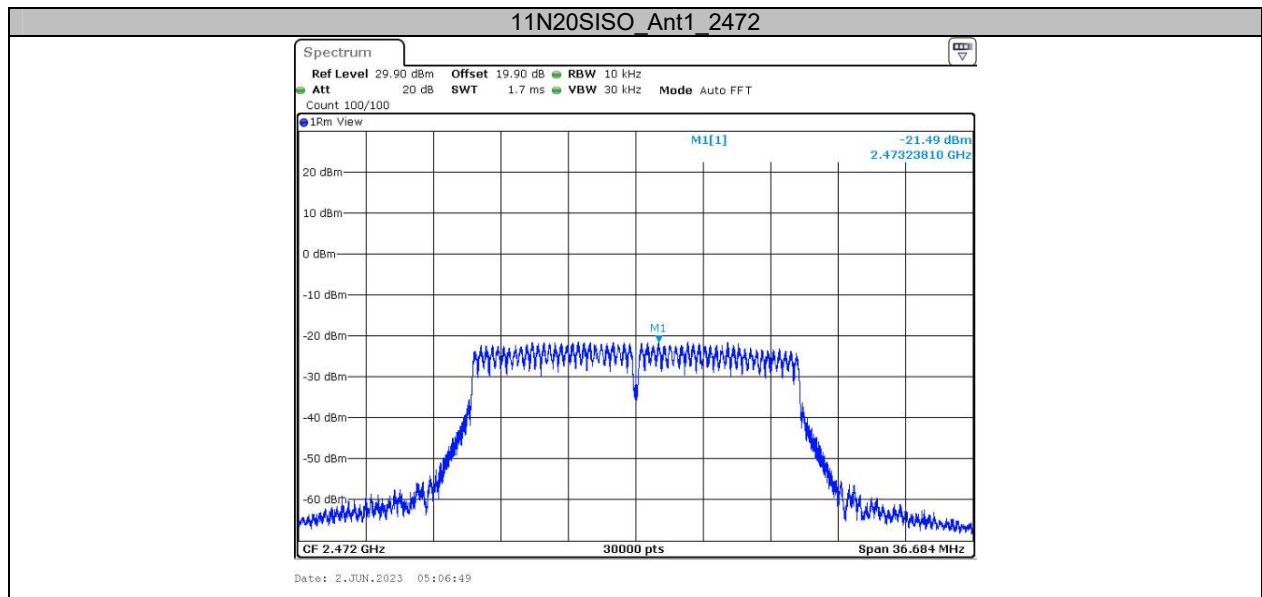


11G_Ant1_2412



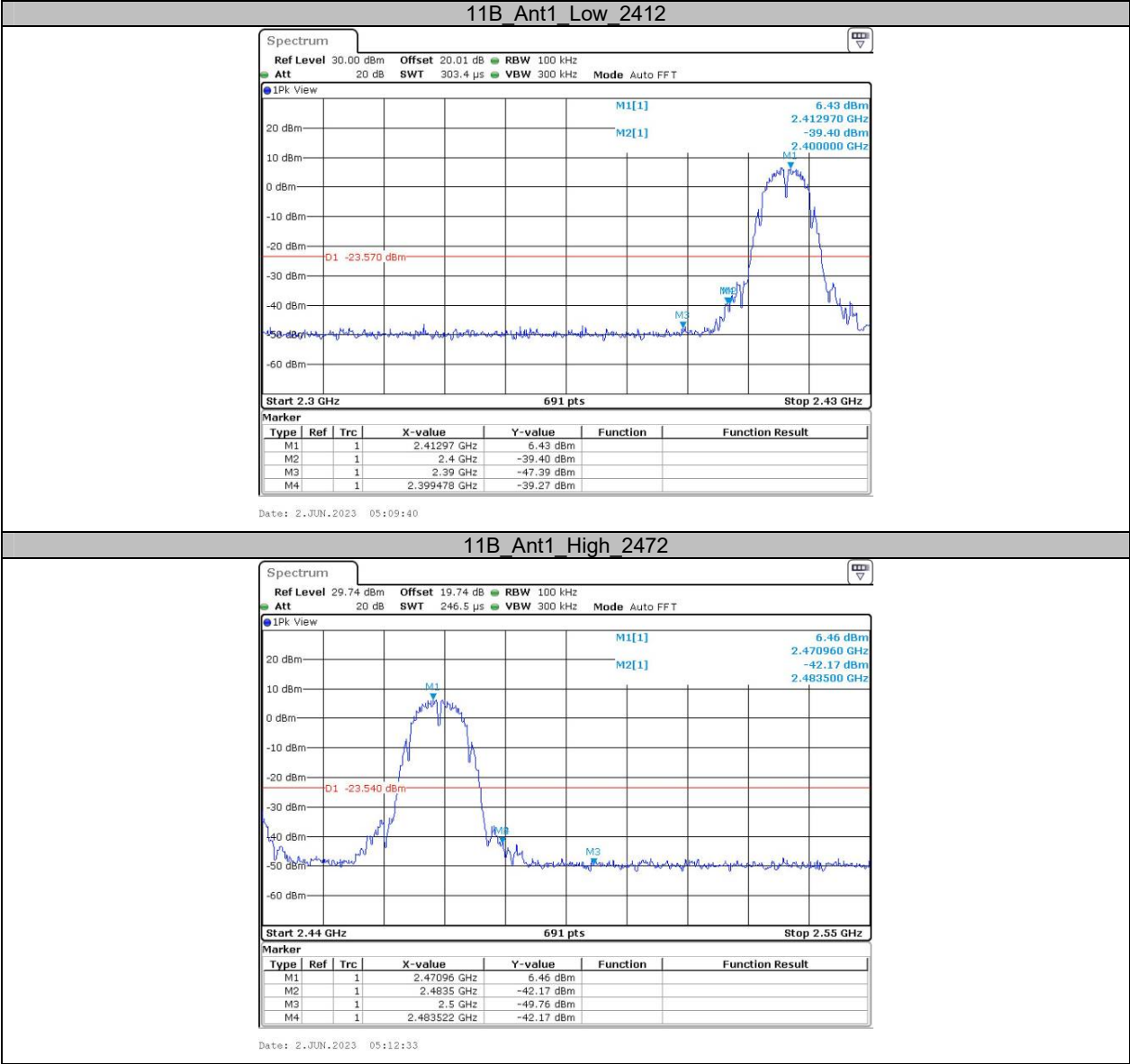


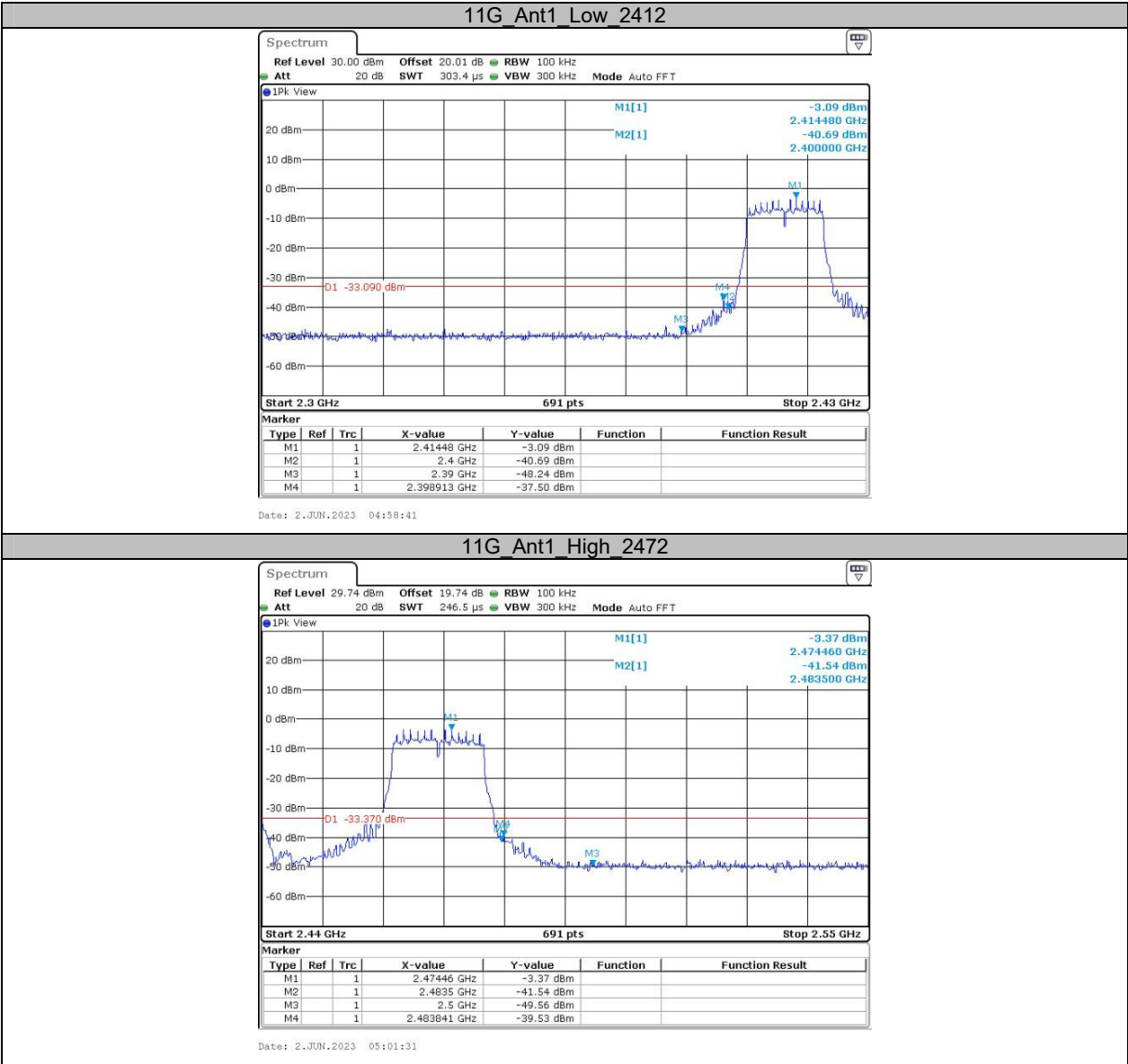


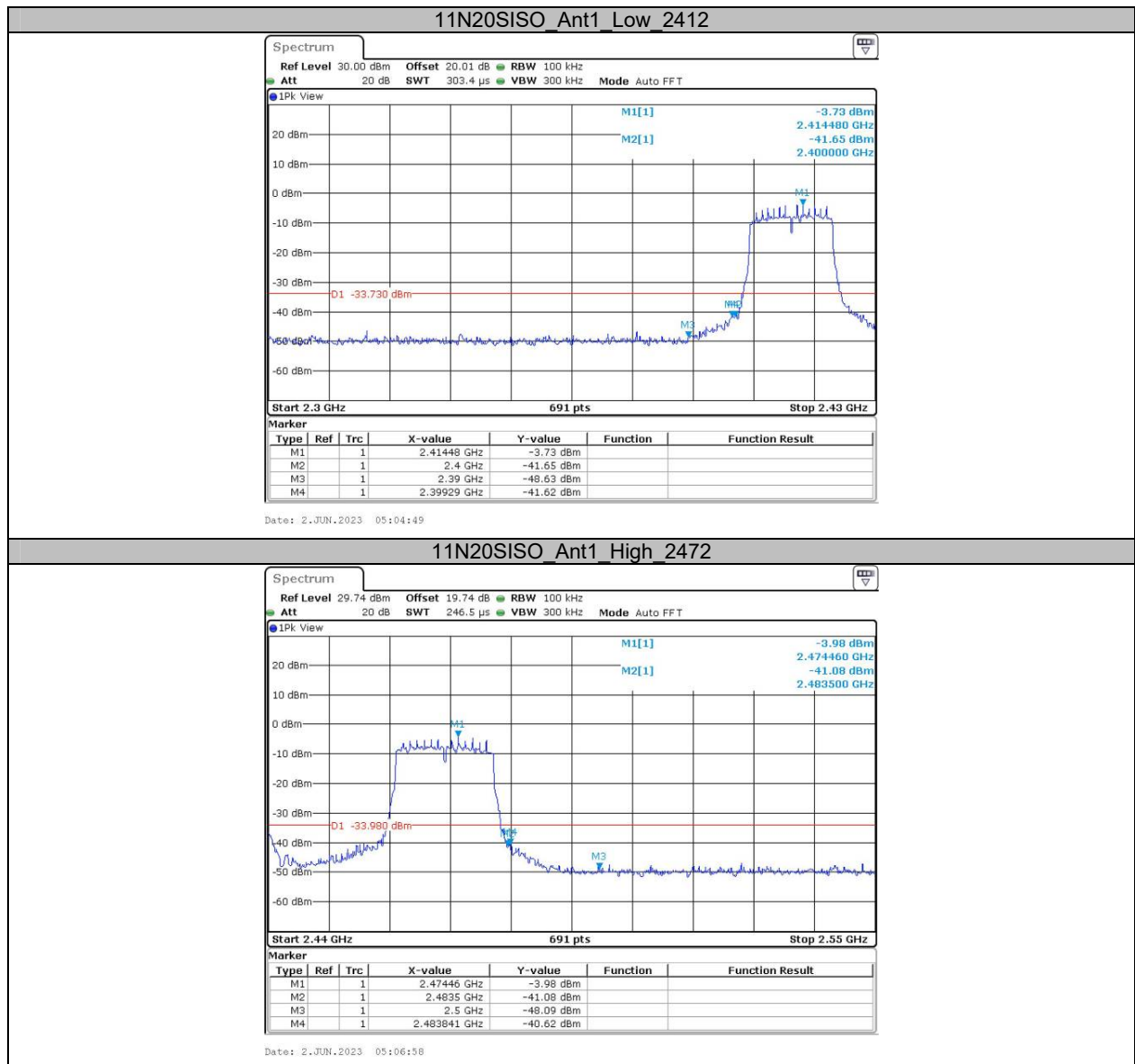


Appendix E: Band edge measurements

Test Graphs





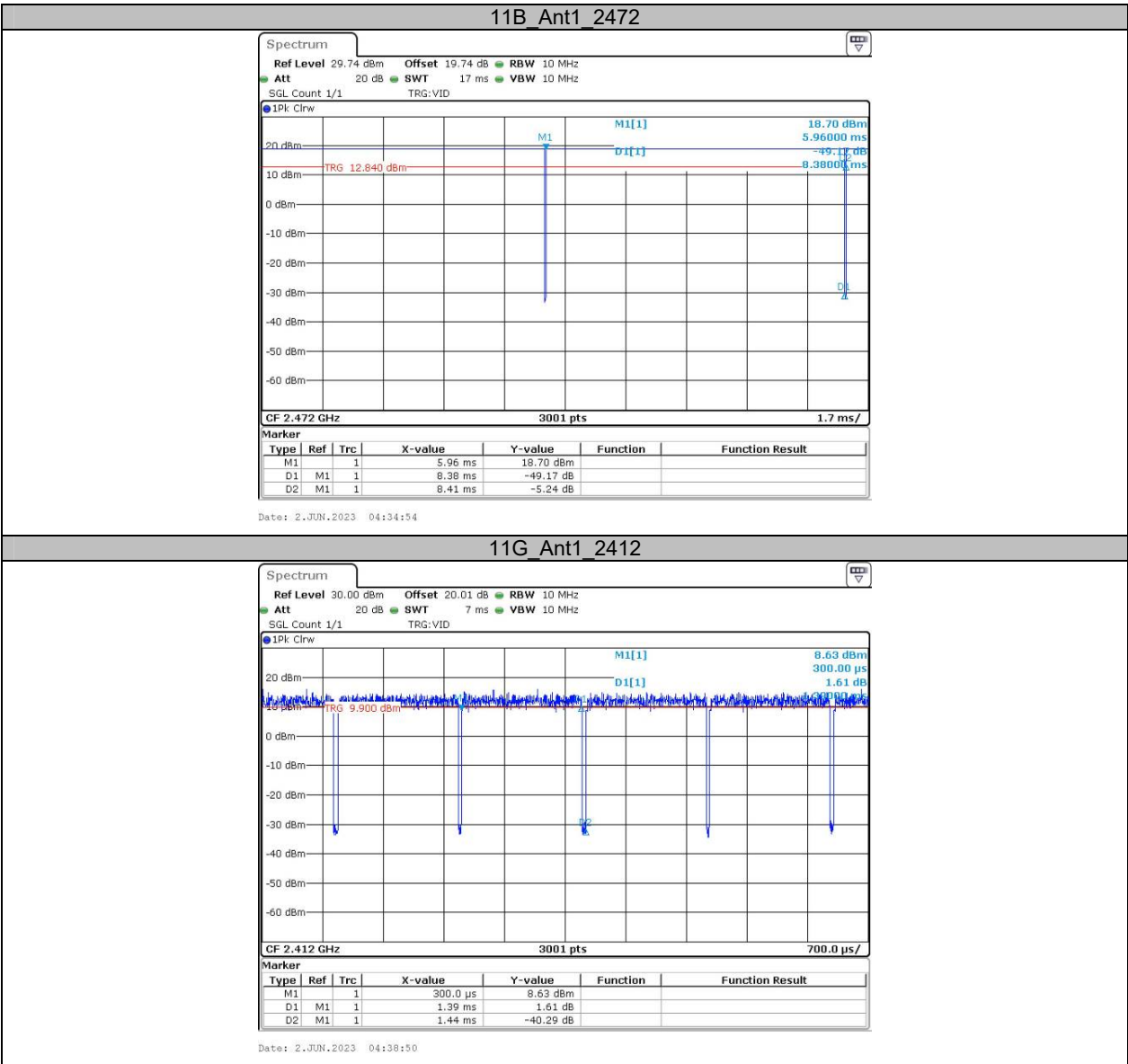


Appendix F: Duty Cycle**Test Result**

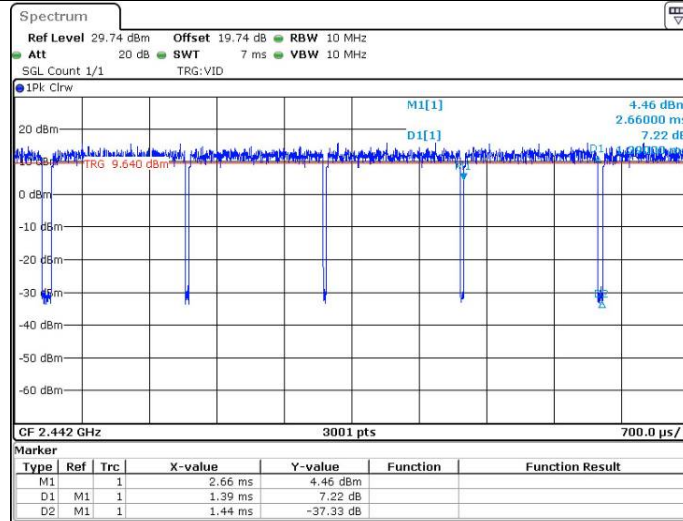
Test Mode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Duty cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
11B	Ant1	2412	8.38	8.41	99.64	/	/
		2442	8.38	8.42	99.52	/	/
		2472	8.38	8.41	99.64	/	/
11G	Ant1	2412	1.39	1.44	96.53	0.15	0.72
		2442	1.39	1.44	96.53	0.15	0.72
		2472	1.39	1.44	96.53	0.15	0.72
11N20SISO	Ant1	2412	1.30	1.35	96.30	0.16	0.77
		2442	1.30	1.35	96.30	0.16	0.77
		2472	1.30	1.35	96.30	0.16	0.77

Test Graphs



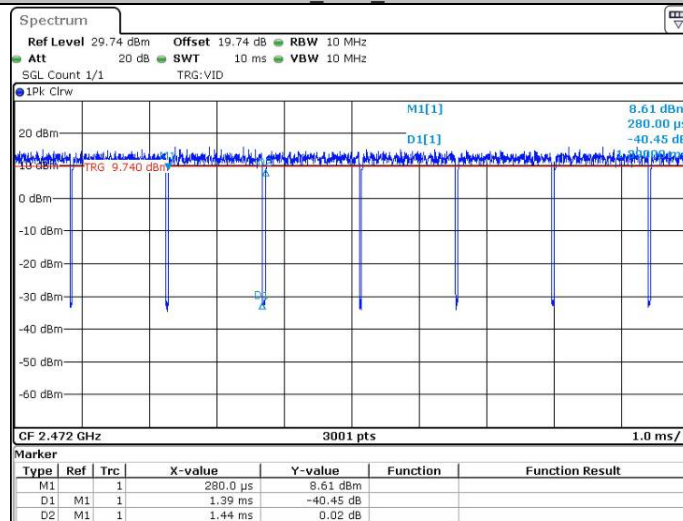


11G_Ant1_2442

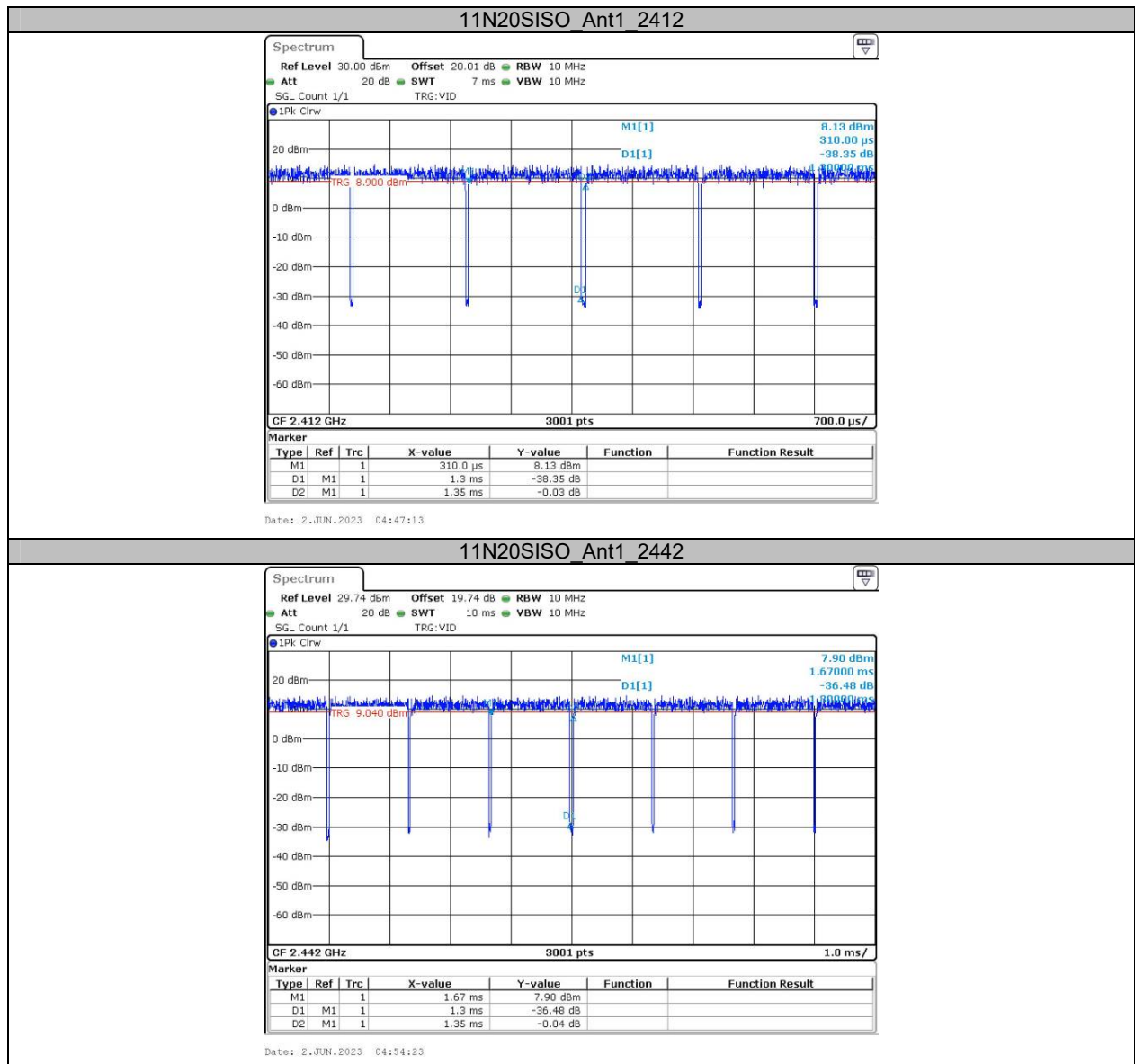


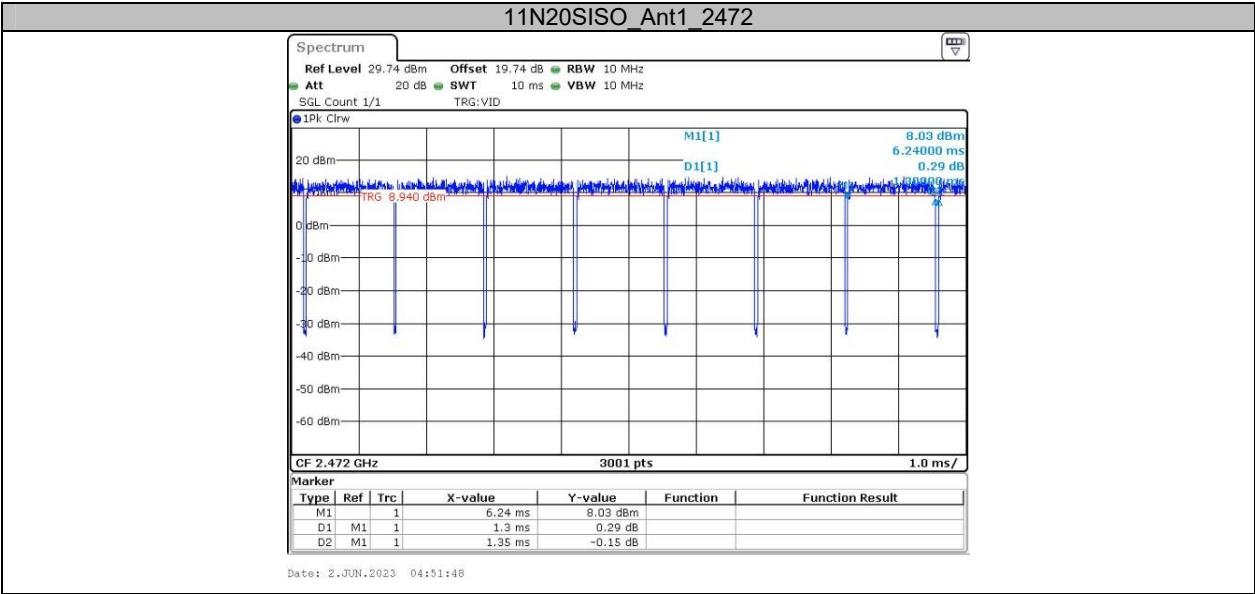
Date: 2.JUN.2023 04:42:49

11G_Ant1_2472



Date: 2.JUN.2023 04:55:40





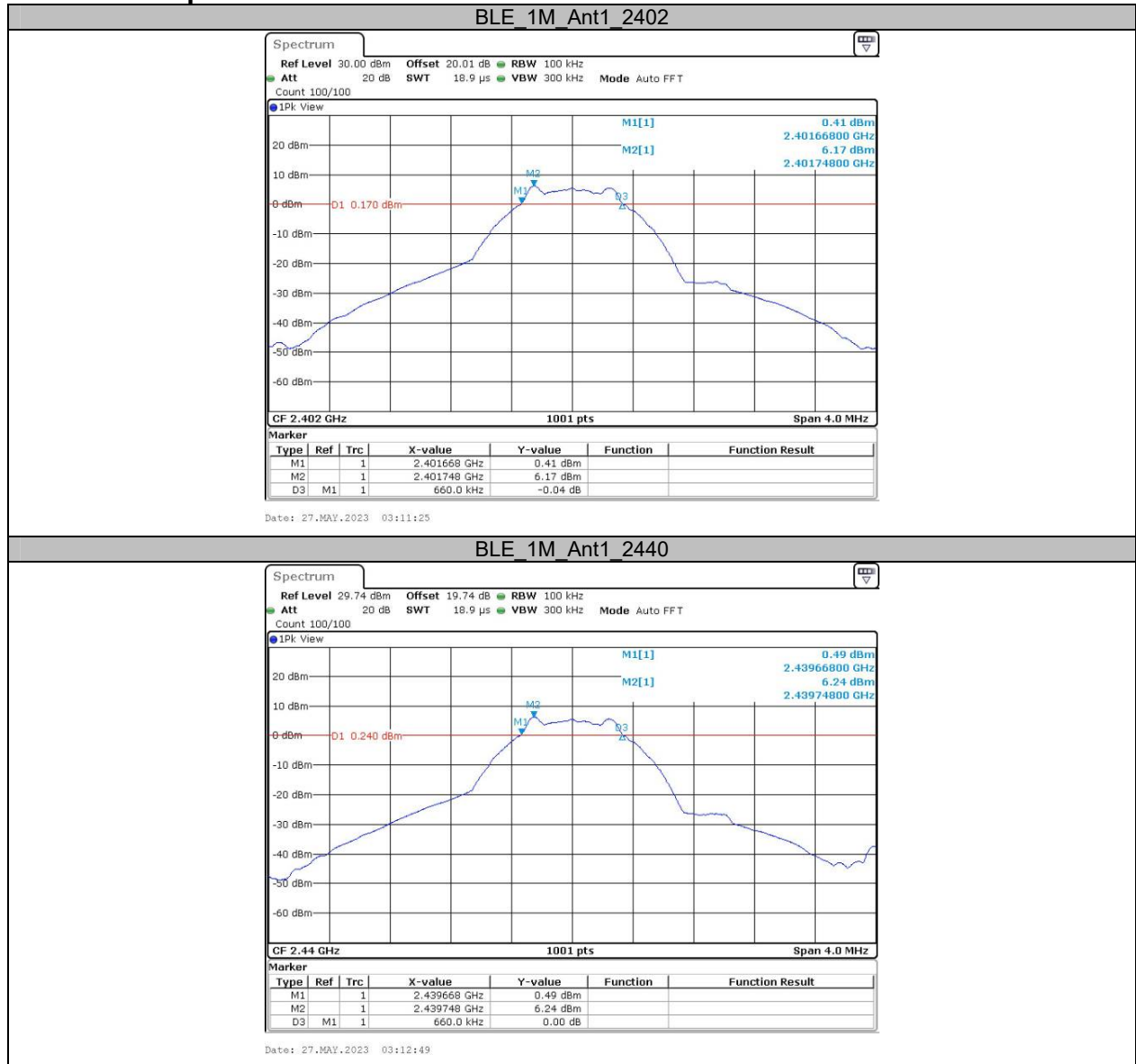
APPENDIX BLE

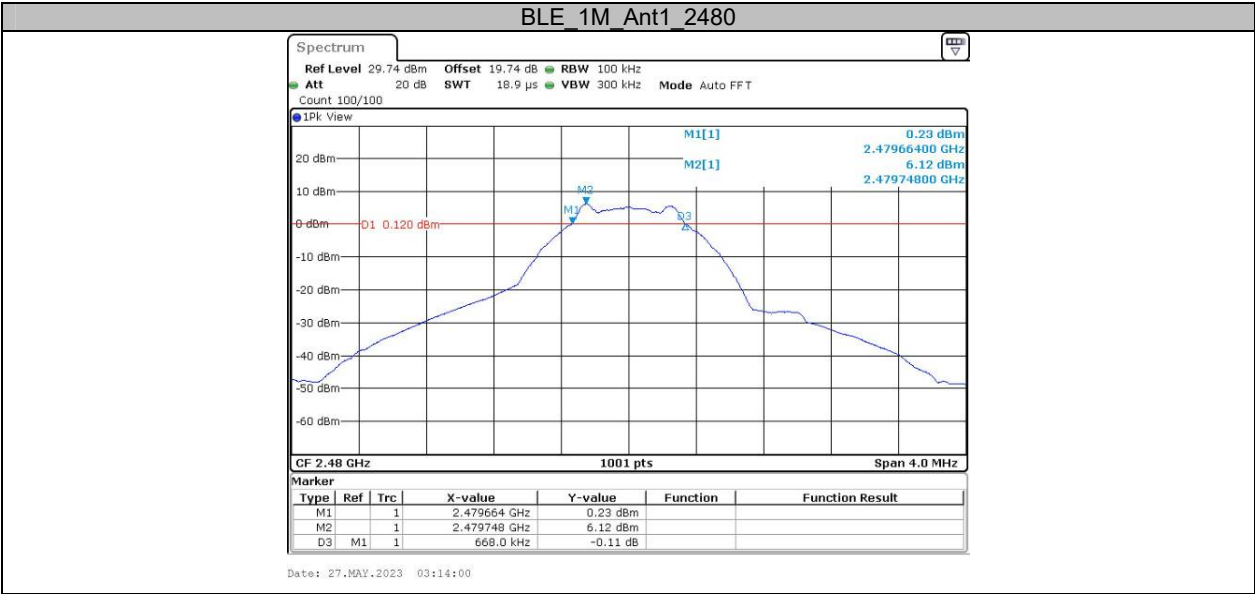
Appendix A: DTS Bandwidth

Test Result

Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.66	2401.67	2402.33	0.5	PASS
		2440	0.66	2439.67	2440.33	0.5	PASS
		2480	0.67	2479.66	2480.33	0.5	PASS

Test Graphs

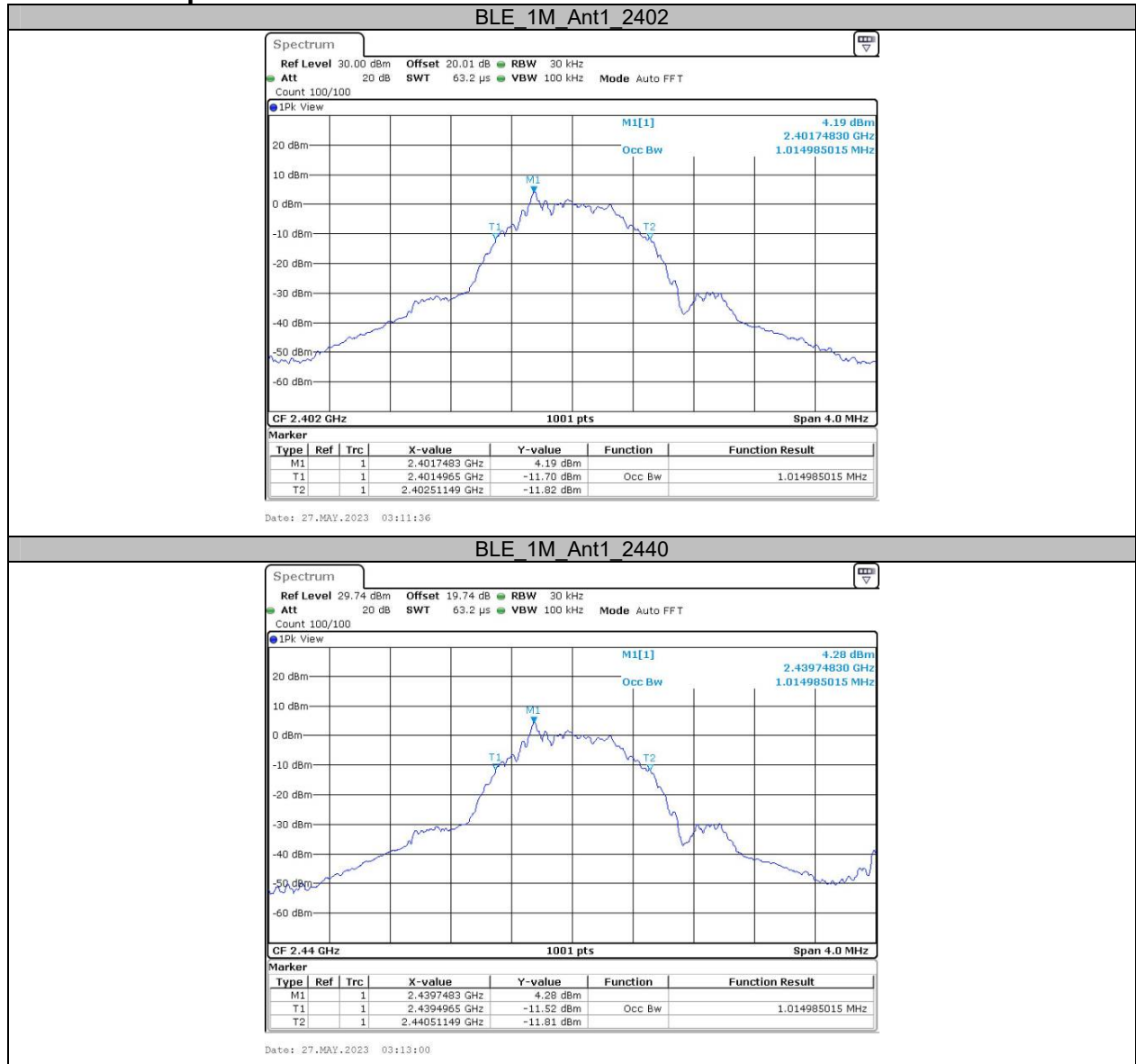




Appendix B: Occupied Channel Bandwidth**Test Result**

Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.015	2401.497	2402.511	---	---
		2440	1.015	2439.497	2440.511	---	---
		2480	1.015	2479.497	2480.511	---	---

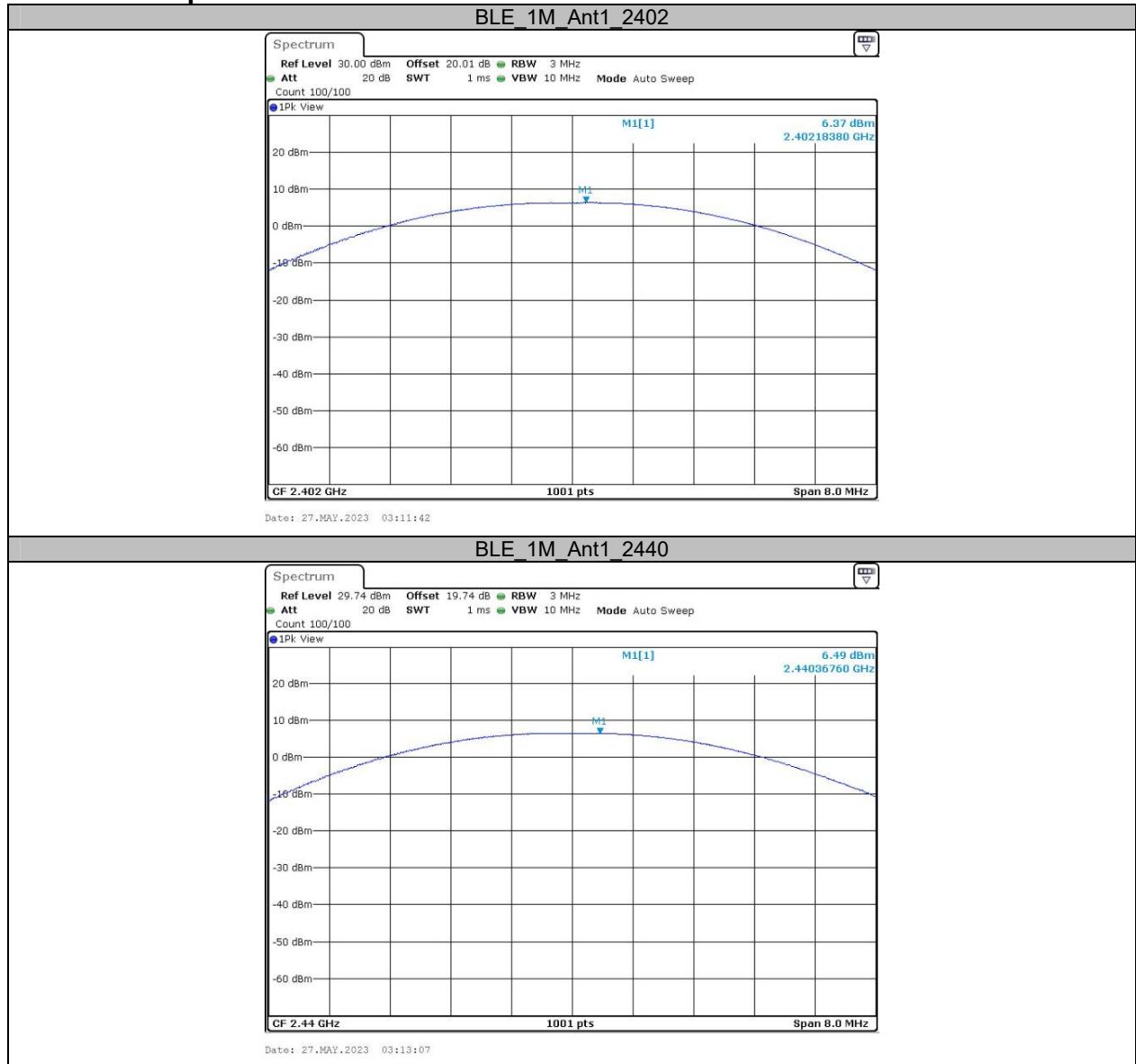
Test Graphs

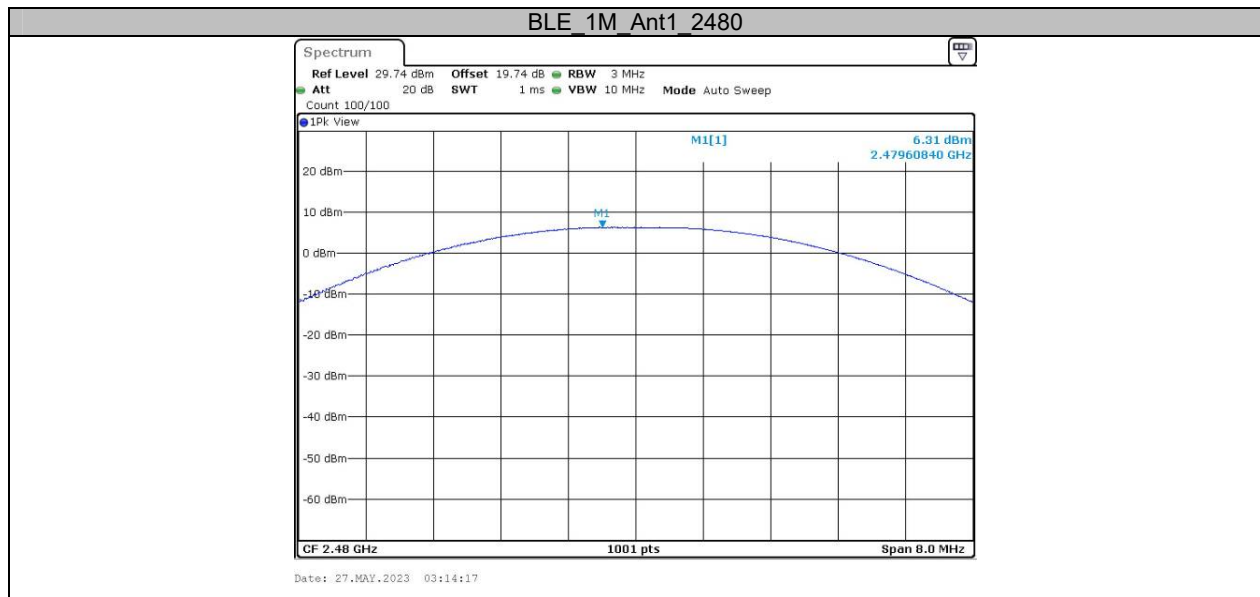




Appendix C: Maximum conducted output power**Test Result**

Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power [dBm]	Limit [dBm]	Verdict
BLE_1M	Ant1	2402	6.37	≤30	PASS
		2440	6.49	≤30	PASS
		2480	6.31	≤30	PASS

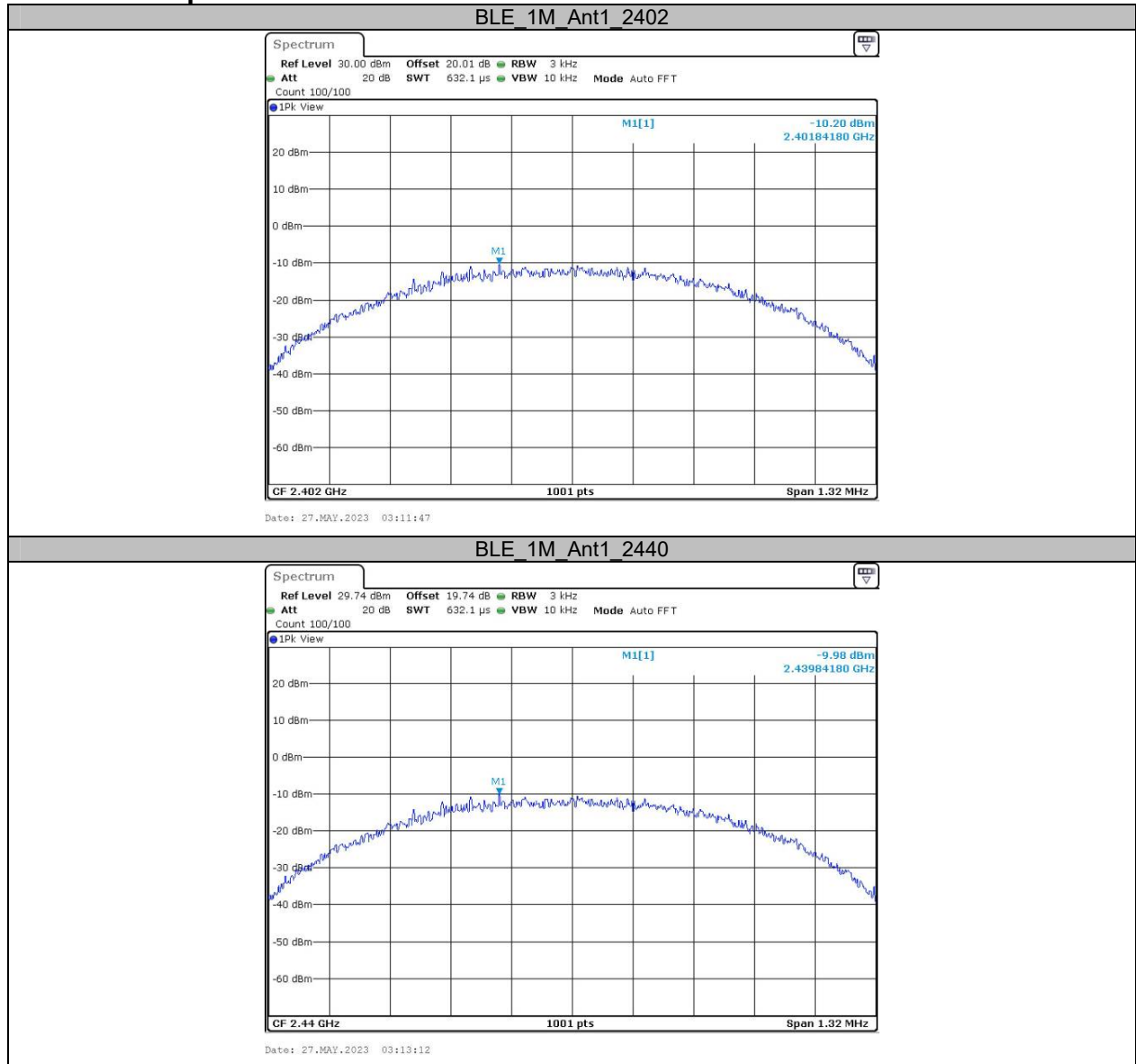
Test Graphs Peak

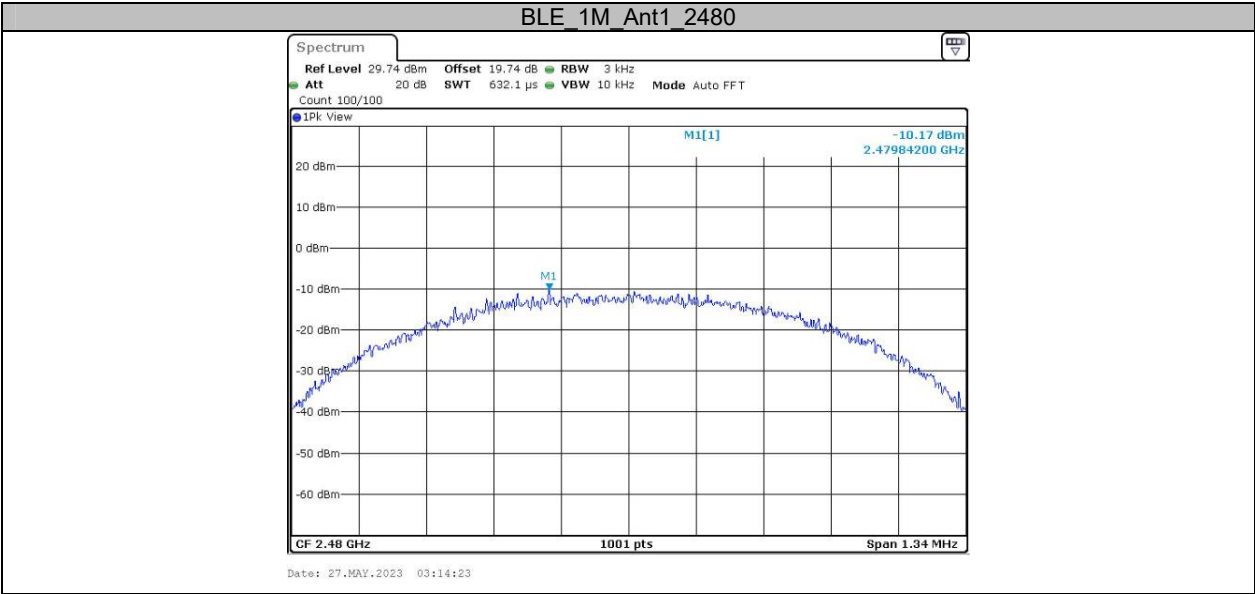


Appendix D: Maximum power spectral density**Test Result**

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-10.2	≤8.00	PASS
		2440	-9.98	≤8.00	PASS
		2480	-10.17	≤8.00	PASS

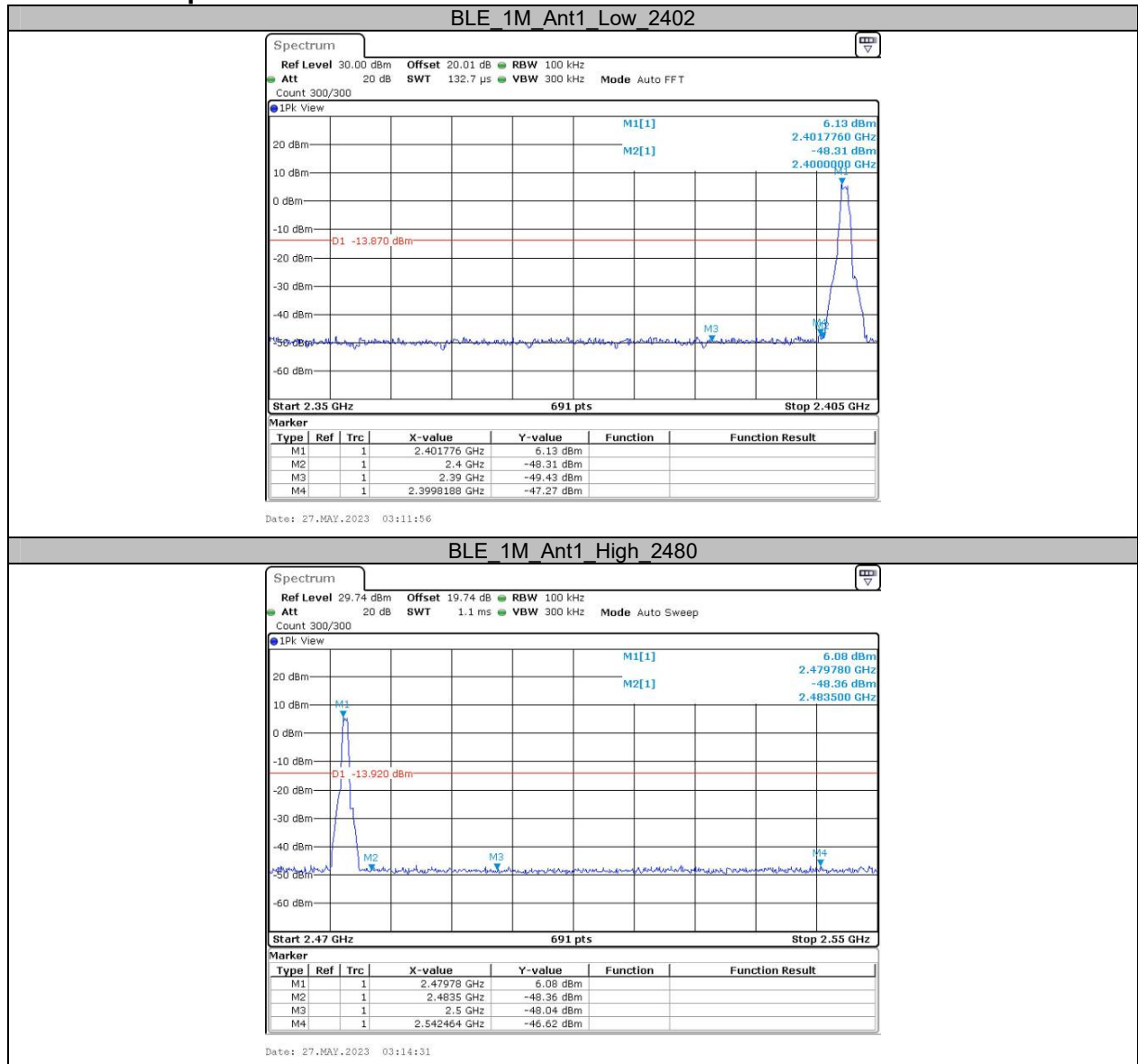
Test Graphs





Appendix E: Band edge measurements

Test Graphs

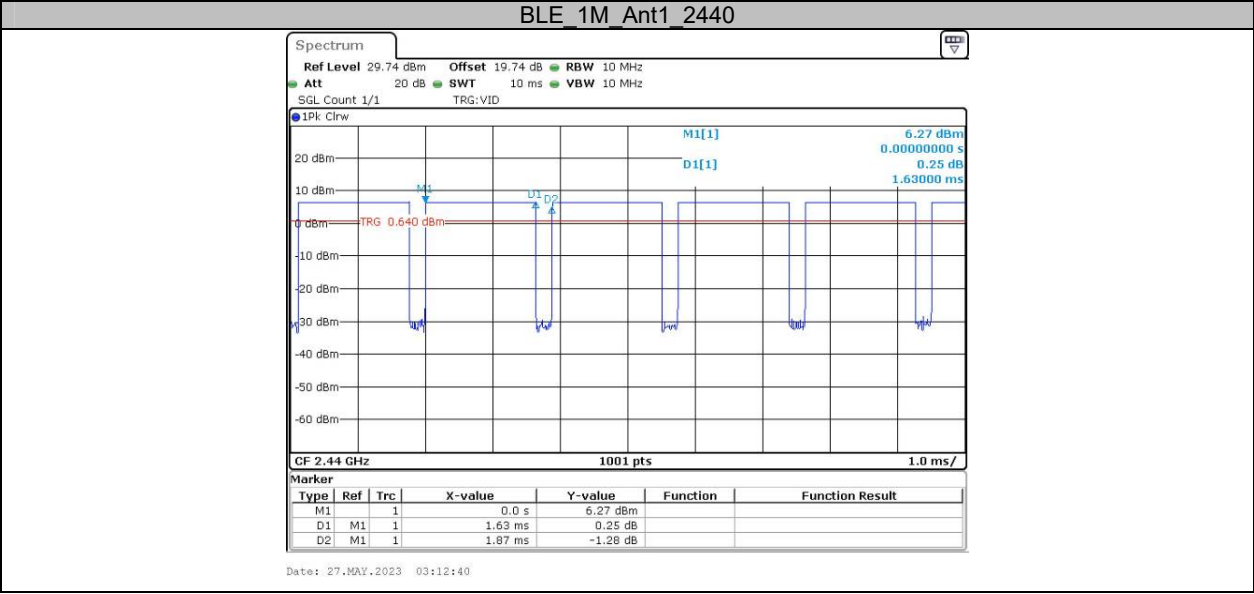


Appendix F: Duty Cycle

Test Result

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	1/T (kHz)
BLE_1M	Ant1	2440	1.63	1.87	87.17	0.613

Test Graphs



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