

TEST REPORT

Applicant Name: Shenzhen Topwise Communication Co.,Ltd
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Report Number: 2401V30787E-RF-00A
FCC ID: 2BBKD-T1

Test Standard (s)
FCC PART 15.247

Sample Description

Product Type: Point of Sale Terminal
Model No.: T1
Multiple Model(s) No.: N/A
Trade Mark: TOPWISE
Date Received: 2024/07/15
Issue Date: 2024/09/05

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

Prepared and Checked By:

Gala Liu

Gala Liu
RF Engineer

Approved By:

Nancy Wang

Nancy Wang
RF Supervisor

Note: The information marked * is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report. Customer model name, addresses, names, trademarks etc. are included.
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	2401V30787E-RF-00A	Original Report	2024/09/05

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Point of Sale Terminal
Tested Model	T1
Multiple Model(s)	N/A
Frequency Range	BLE: 2402-2480MHz Wi-Fi: 2412-2462MHz
Maximum Conducted Output Peak Power	BLE: 6.69dBm Wi-Fi: 21.85dBm
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM
Antenna Specification [#]	2.50dBi (provided by the applicant)
Voltage Range	DC3.8V from Li-ion Battery or DC 5V from Adapter
Sample serial number	2OC1-1for Conducted and Radiated Emissions Test 2OC1-2 for RF Conducted Test (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Adapter Information	Adapter 1 Model: PS10UA050K2000UU Input: AC 100-240V, 50/60Hz, 0.35A, Max. Output: DC 5.0V, 2.0A Adapter 2 Model: TPA-141A050200UU01 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 Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF output power, conducted		0.72 dB(k=2, 95% level of confidence)
AC Power Lines Conducted Emissions	9kHz~150 kHz	3.94dB(k=2, 95% level of confidence)
	150 kHz ~30MHz	3.84dB(k=2, 95% level of confidence)
Radiated Emissions	9kHz - 30MHz	3.30dB(k=2, 95% level of confidence)
	30MHz~200MHz (Horizontal)	4.48dB(k=2, 95% level of confidence)
	30MHz~200MHz (Vertical)	4.55dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Horizontal)	4.85dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Vertical)	5.05dB(k=2, 95% level of confidence)
	1GHz - 6GHz	5.35dB(k=2, 95% level of confidence)
	6GHz - 18GHz	5.44dB(k=2, 95% level of confidence)
18GHz - 40GHz		5.16dB(k=2, 95% level of confidence)
Temperature		±1°C
Humidity		±1%
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 Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 715558, the FCC Designation No. : CN5045.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 2.4GHz Wi-Fi 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.

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	15	15	15
802.11g	6Mbps	17	17	17
802.11n20	MCS0	16.5	16.5	16.5
802.11n40	MCS0	16	16	16
BLE	1Mbps	Default	Default	Default

Note: the power level was provided by applicant.

Duty cycle

Please refer to the Appendix.

Support Equipment List and Details

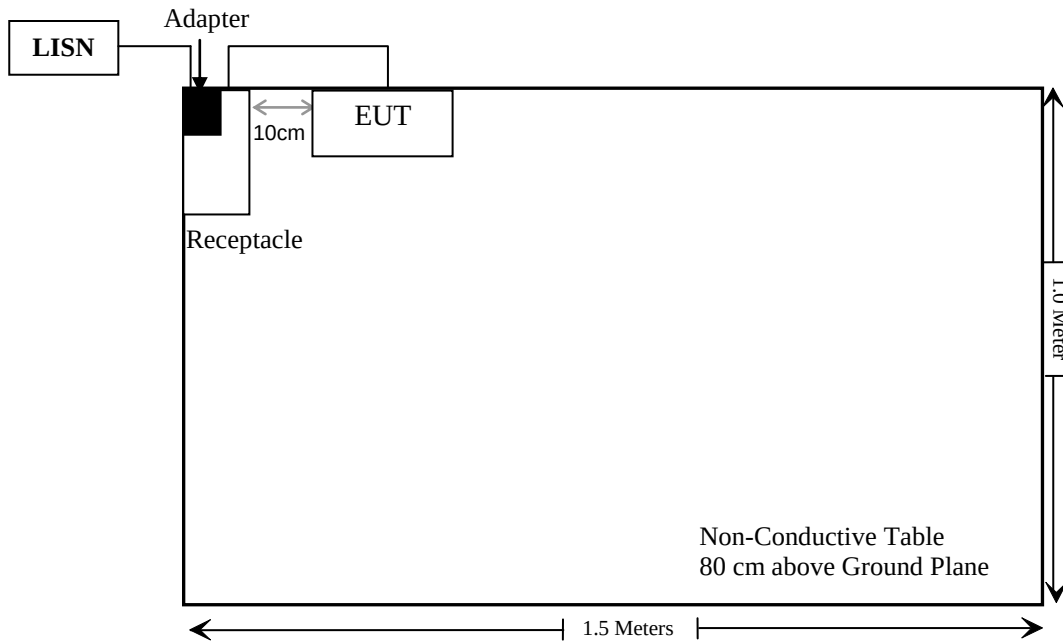
Manufacturer	Description	Model	Serial Number
Unknown	Receptacle	Unknown	Unknown

External I/O Cable

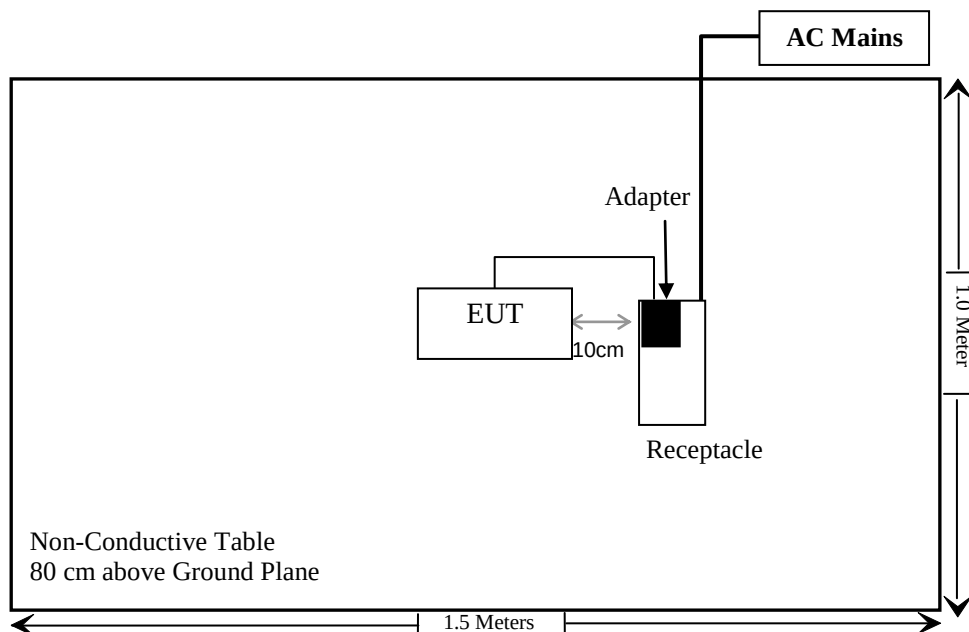
Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter
Unshielded Un-Detachable AC Cable	1.5	Socket	LISN/AC Mains

Block Diagram of Test Setup

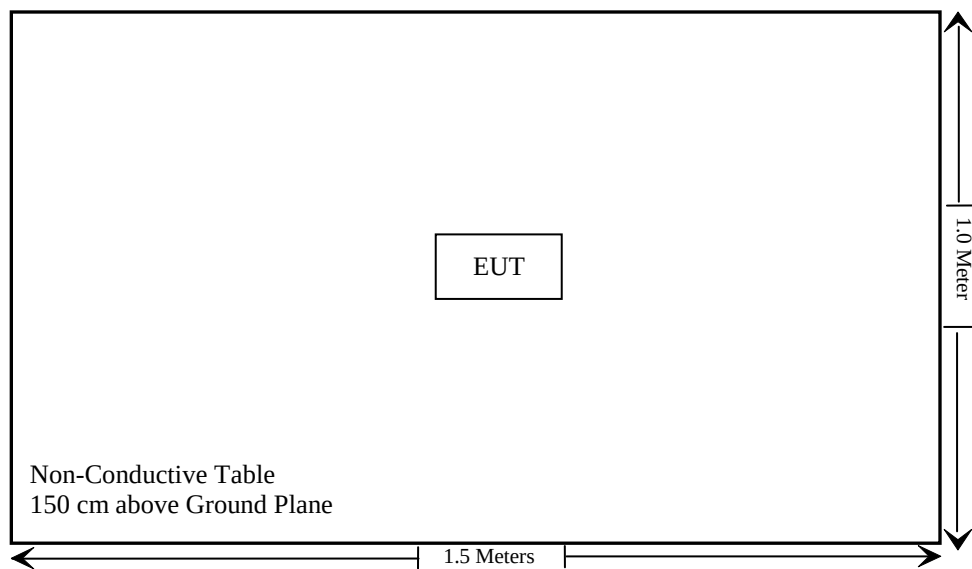
For Conducted Emissions:



For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC 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	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2024/01/16	2025/01/15
Rohde & Schwarz	LISN	ENV216	101613	2024/01/16	2025/01/15
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2024/05/21	2025/05/20
Unknown	CE Cable	Unknown	UF A210B-1-0720-504504	2024/05/21	2025/05/20
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
Radiated Emission Test_ Below 1GHz					
Rohde & Schwarz	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310 N	186238	2024/05/21	2025/05/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2026/07/19
Unknown	Cable	Chamber A Cable 1	N/A	2024/06/18	2025/06/17
Unknown	Cable	XH500C	J-10M-A	2024/06/18	2025/06/17
BACL	Active Loop Antenna	1313-1A	4031911	2024/05/14	2027/05/13
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
Radiated Emission Test_ Above 1GHz					
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2024/03/27	2025/03/26
COM-POWER	Pre-amplifier	PA-122	181919	2024/06/18	2025/06/17
Schwarzbeck	Horn Antenna	BBHA9120D(1201)	1143	2023/07/26	2026/07/25
Unknown	RF Cable	KMSE	735	2024/06/18	2025/06/17
Unknown	RF Cable	UFA147	219661	2024/06/18	2025/06/17
JD	Multiplex Switch Test Control Set	DT7220FSU	DQ77926	2024/06/18	2025/06/17
A.H.System	Pre-amplifier	PAM-1840VH	190	2024/06/18	2025/06/17
Electro-Mechanics Co	Horn Antenna	3116	9510-2270	2023/09/18	2026/09/17
UTIFLEX	RF Cable	NO. 13	232308-001	2023/08/03	2024/08/02
Audix	EMI Test software	E3	191218(V9)	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Tonscend	RF control Unit	JS0806-2	19D8060154	2023/09/06	2024/09/05
Rohde &Schwarz	Spectrum Analyzer	FSV40	101473	2024/01/16	2025/01/15
ANRITSU	Microwave peak power sensor	MA24418A	12622	2024/05/21	2025/05/20
Unknown	10dB Attenuator	Unknown	F-03-EM190	2024/06/27	2025/06/26

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 (i), §1.1307 (b) (1) & §2.1093 - RF EXPOSURE

Applicable Standard

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

According to KDB 447498 D01 General RF Exposure Guidance

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

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ 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 worst case:

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

Result: No Standalone SAR test is required

For Wi-Fi mode, please refer to SAR report: Please refer to SAR test report: 2403V30787E-20.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Antenna Connector Construction

The EUT has one internal antenna arrangement, which was permanently attached, the antenna gain[#] is 2.50dBi, fulfill the requirement of this section. Please refer to the EUT photos.

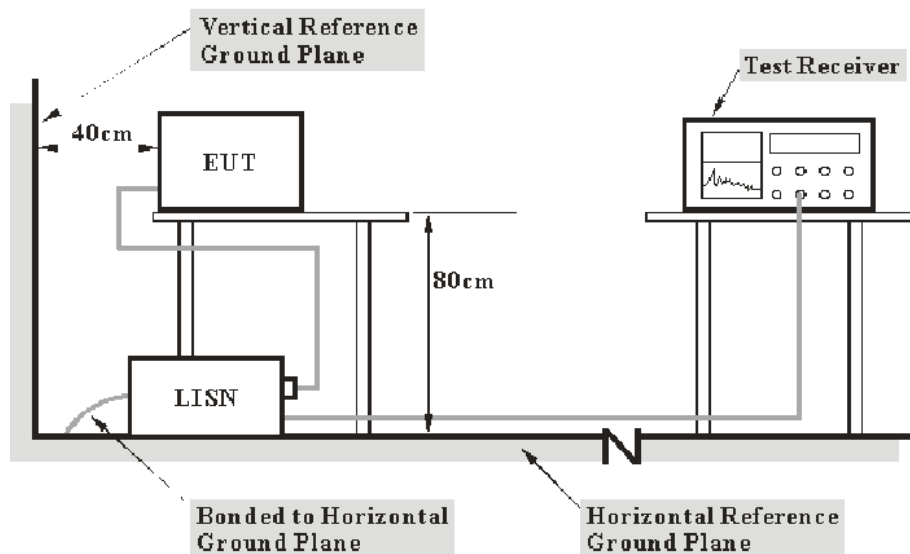
Result: Compliant

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.

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:

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

Note: The term "cable loss" refers to the combination of a cable and a 10dB transient limiter (attenuator).

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	62~70 %
ATM Pressure:	101 kPa

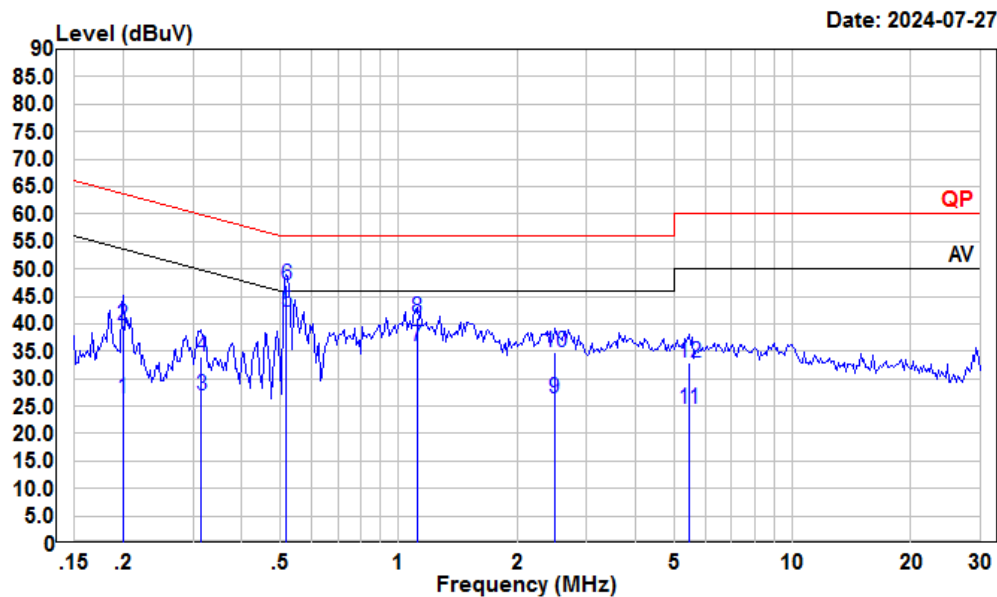
The testing was performed by Macy Shi from 2024-07-27 to 2024-08-13.

EUT operation mode: Transmitting

2.4G Wi-Fi: (Maximum output power mode, 802.11n40 High Channel)

For Adapter 1

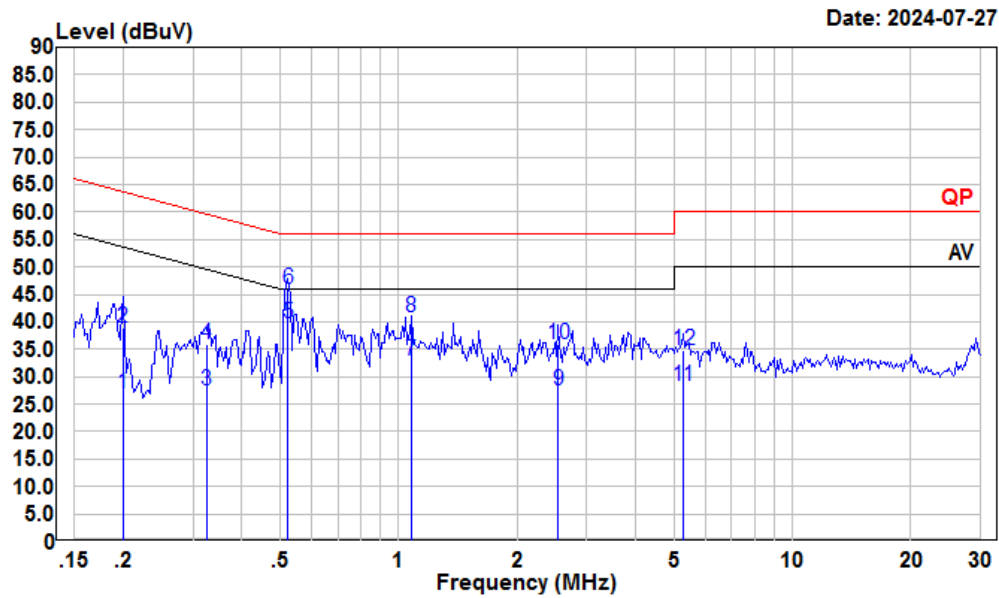
AC 120V/60 Hz, Line



Condition: Line
 Project : 2401V30787E-RF
 tester : Macy.shi
 Note : 2.4G WIFI

	Read Freq	Read Level	LISN Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.20	5.57	26.46	10.80	10.09	53.62	-27.16	Average
2	0.20	18.80	39.69	10.80	10.09	63.62	-23.93	QP
3	0.31	6.06	26.82	10.65	10.11	49.84	-23.02	Average
4	0.31	13.27	34.03	10.65	10.11	59.84	-25.81	QP
5	0.52	21.43	42.07	10.50	10.14	46.00	-3.93	Average
6	0.52	26.46	47.10	10.50	10.14	56.00	-8.90	QP
7	1.11	15.28	35.84	10.43	10.13	46.00	-10.16	Average
8	1.11	20.41	40.97	10.43	10.13	56.00	-15.03	QP
9	2.49	5.70	26.38	10.51	10.17	46.00	-19.62	Average
10	2.49	14.06	34.74	10.51	10.17	56.00	-21.26	QP
11	5.45	3.94	24.53	10.41	10.18	50.00	-25.47	Average
12	5.45	12.40	32.99	10.41	10.18	60.00	-27.01	QP

AC 120V/60 Hz, Neutral



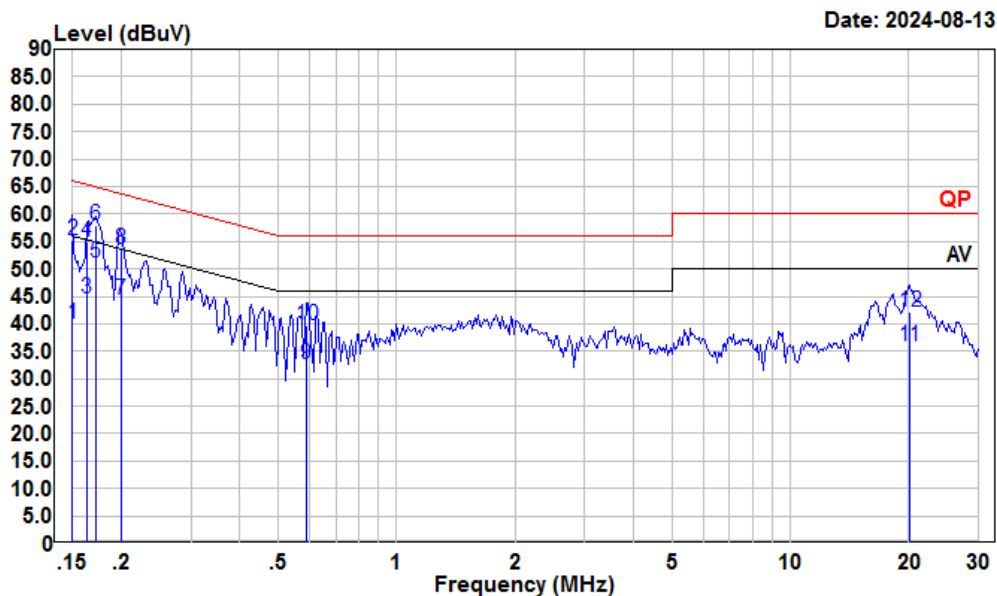
Condition: Neutral

Project : 2401V30787E-RF

tester : Macy.shi

Note : 2.4G WIFI

	Freq	Read Level	LISN Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.20	6.36	26.85	10.40	10.09	53.62	-26.77	Average
2	0.20	18.52	39.01	10.40	10.09	63.62	-24.61	QP
3	0.33	6.69	27.37	10.56	10.12	49.57	-22.20	Average
4	0.33	15.13	35.81	10.56	10.12	59.57	-23.76	QP
5	0.52	18.99	39.83	10.70	10.14	46.00	-6.17	Average
6	0.52	25.11	45.95	10.70	10.14	56.00	-10.05	QP
7	1.08	12.07	33.04	10.85	10.12	46.00	-12.96	Average
8	1.08	19.70	40.67	10.85	10.12	56.00	-15.33	QP
9	2.54	6.80	27.37	10.40	10.17	46.00	-18.63	Average
10	2.54	15.36	35.93	10.40	10.17	56.00	-20.07	QP
11	5.28	7.56	28.29	10.55	10.18	50.00	-21.71	Average
12	5.28	14.07	34.80	10.55	10.18	60.00	-25.20	QP

For Adapter 2**AC 120V/60 Hz, Line**

Condition: Line

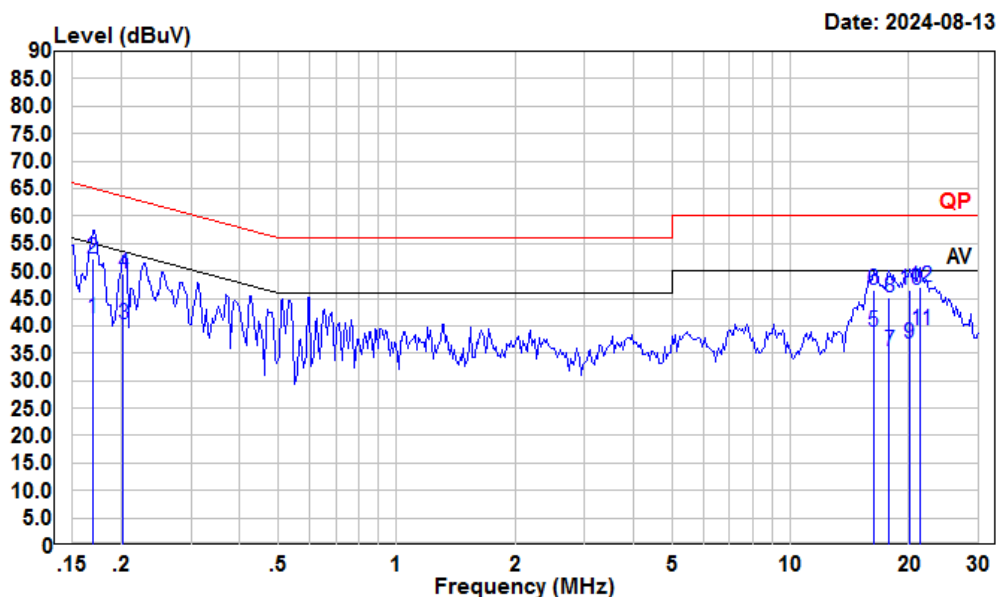
Project : 2401V30787E-RF

tester : Macy.shi

Note : 2.4G WIFI

		Read		LISN	Cable	Limit	Over	
	Freq	Level	Level	Factor	Loss	Line	Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.15	19.00	40.03	10.90	10.13	56.00	-15.97	Average
2	0.15	34.30	55.33	10.90	10.13	66.00	-10.67	QP
3	0.16	23.60	44.58	10.87	10.11	55.30	-10.72	Average
4	0.16	33.90	54.88	10.87	10.11	65.30	-10.42	QP
5	0.17	30.19	51.14	10.85	10.10	54.86	-3.72	Average
6	0.17	36.88	57.83	10.85	10.10	64.86	-7.03	QP
7	0.20	23.47	44.36	10.80	10.09	53.62	-9.26	Average
8	0.20	32.66	53.55	10.80	10.09	63.62	-10.07	QP
9	0.59	12.03	32.65	10.50	10.12	46.00	-13.35	Average
10	0.59	18.98	39.60	10.50	10.12	56.00	-16.40	QP
11	20.06	14.72	35.79	10.90	10.17	50.00	-14.21	Average
12	20.06	21.13	42.20	10.90	10.17	60.00	-17.80	QP

AC 120V/60 Hz, Neutral



Condition: Neutral

Project : 2401V30787E-RF

tester : Macy.shi

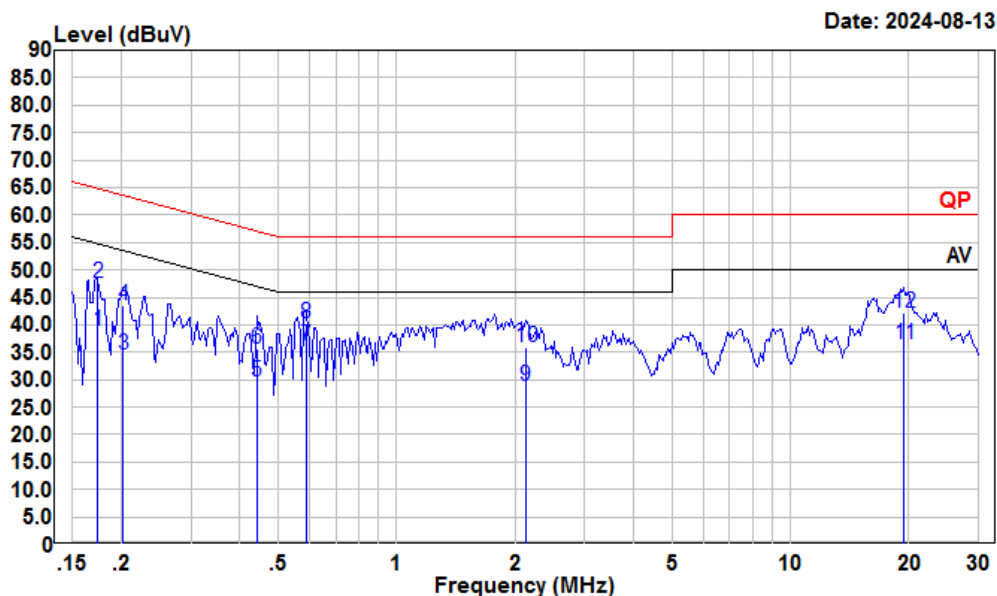
Note : 2.4G WIFI

	Freq	Read Level	LISN Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.17	20.81	41.43	10.52	10.10	55.03	-13.60	Average
2	0.17	31.57	52.19	10.52	10.10	65.03	-12.84	QP
3	0.20	19.80	40.29	10.40	10.09	53.54	-13.25	Average
4	0.20	29.03	49.52	10.40	10.09	63.54	-14.02	QP
5	16.23	17.80	38.78	10.77	10.21	50.00	-11.22	Average
6	16.23	25.50	46.48	10.77	10.21	60.00	-13.52	QP
7	17.85	14.40	35.33	10.74	10.19	50.00	-14.67	Average
8	17.85	24.20	45.13	10.74	10.19	60.00	-14.87	QP
9	20.06	15.90	36.77	10.70	10.17	50.00	-13.23	Average
10	20.06	25.60	46.47	10.70	10.17	60.00	-13.53	QP
11	21.37	18.45	39.30	10.67	10.18	50.00	-10.70	Average
12	21.37	26.27	47.12	10.67	10.18	60.00	-12.88	QP

BLE: (Maximum output power mode, Low Channel)

Worst case is adapter 2:

AC 120V/60 Hz, Line



Condition: Line

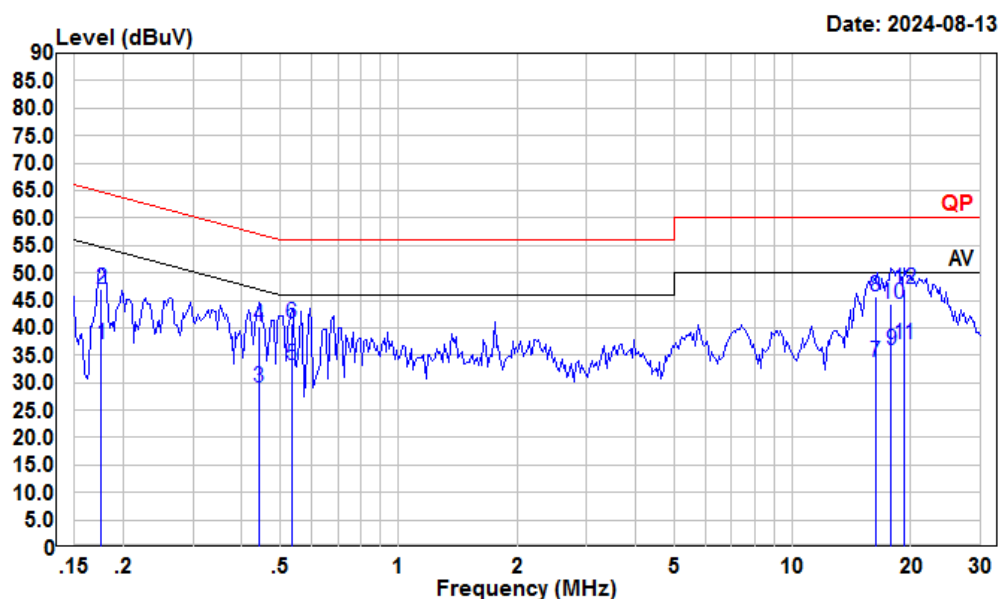
Project : 2401V30787E-RF

tester : Macy.shi

Note : BLE

		Read		LISN	Cable	Limit	Over	
	Freq	Level	Level	Factor	Loss	Line	Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.17	17.85	38.80	10.85	10.10	54.77	-15.97	Average
2	0.17	26.58	47.53	10.85	10.10	64.77	-17.24	QP
3	0.20	13.55	34.44	10.80	10.09	53.54	-19.10	Average
4	0.20	22.72	43.61	10.80	10.09	63.54	-19.93	QP
5	0.44	9.11	29.77	10.54	10.12	47.02	-17.25	Average
6	0.44	14.98	35.64	10.54	10.12	57.02	-21.38	QP
7	0.59	15.62	36.24	10.50	10.12	46.00	-9.76	Average
8	0.59	19.76	40.38	10.50	10.12	56.00	-15.62	QP
9	2.12	8.08	28.84	10.57	10.19	46.00	-17.16	Average
10	2.12	15.21	35.97	10.57	10.19	56.00	-20.03	QP
11	19.43	15.51	36.56	10.87	10.18	50.00	-13.44	Average
12	19.43	20.99	42.04	10.87	10.18	60.00	-17.96	QP

AC 120V/60 Hz, Neutral



Condition: Neutral

Project : 2401V30787E-RF

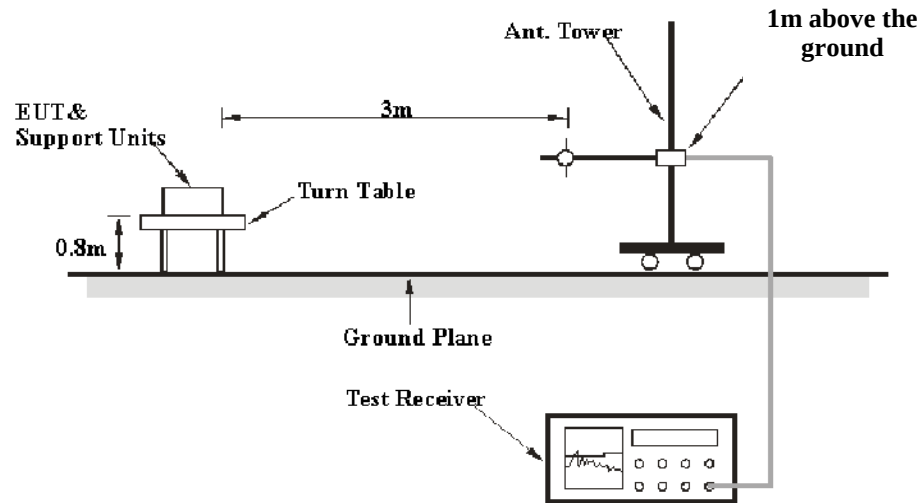
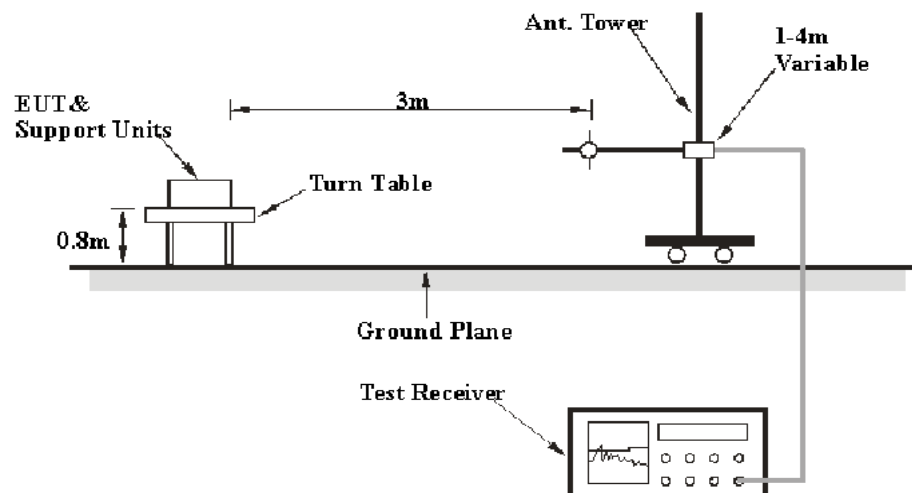
tester : Macy.shi

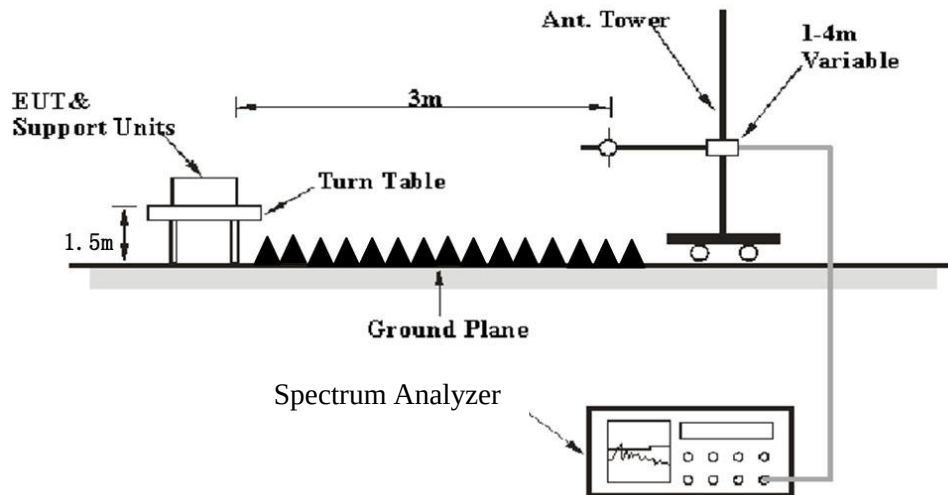
Note : BLE

	Freq	Read Level	LISN Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.18	16.45	37.04	10.49	10.10	54.68	-17.64	Average
2	0.18	26.51	47.10	10.49	10.10	64.68	-17.58	QP
3	0.44	8.23	29.01	10.66	10.12	47.02	-18.01	Average
4	0.44	19.46	40.24	10.66	10.12	57.02	-16.78	QP
5	0.53	12.33	33.16	10.70	10.13	46.00	-12.84	Average
6	0.53	20.02	40.85	10.70	10.13	56.00	-15.15	QP
7	16.26	12.80	33.78	10.77	10.21	50.00	-16.22	Average
8	16.26	24.70	45.68	10.77	10.21	60.00	-14.32	QP
9	17.86	14.90	35.83	10.74	10.19	50.00	-14.17	Average
10	17.86	23.30	44.23	10.74	10.19	60.00	-15.77	QP
11	19.22	15.99	36.88	10.71	10.18	50.00	-13.12	Average
12	19.22	26.09	46.98	10.71	10.18	60.00	-13.02	QP

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

FCC §15.247 (d); §15.209; §15.205;

EUT Setup**9 kHz-30MHz:****30MHz-1GHz:**

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 system was investigated from 9 kHz to 25 GHz.

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

9 kHz-1GHz:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
9 kHz – 150 kHz	/	/	200 Hz	QP
	300 Hz	1 kHz	/	PK
150 kHz – 30 MHz	/	/	9 kHz	QP
	10 kHz	30 kHz	/	PK
30 MHz – 1000 MHz	/	/	120 kHz	QP
	100 kHz	300 kHz	/	PK

1-25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	10 Hz
	<98%	1MHz	≥1/Ton

Note: Ton is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

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 except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz, average detection modes for frequency bands 9–90 kHz and 110–490 kHz, peak and average detection modes for frequencies above 1 GHz.

For 9 kHz-30MHz, the report shall list the six emissions with the smallest margin relative to the limit, for each of the three antenna orientations (parallel, perpendicular, and ground-parallel) unless the margin is greater than 20 dB.

All emissions under the average limit and under the noise floor have not recorded in the report.

Factor & Over Limit/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:

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

Test Data

Environmental Conditions

Temperature:	22 ~25.5°C
Relative Humidity:	50~54 %
ATM Pressure:	101 kPa

The testing was performed by Shy Jiang and Anson Su from 2024-07-26 to 2024-08-13 for below 1GHz and Zenos Qiao from 2024-07-27 to 2024-07-28 for above 1GHz.

EUT operation mode: Transmitting

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

9 kHz-30MHz: *(Maximum output power mode, 802.11n40 High Channel)*

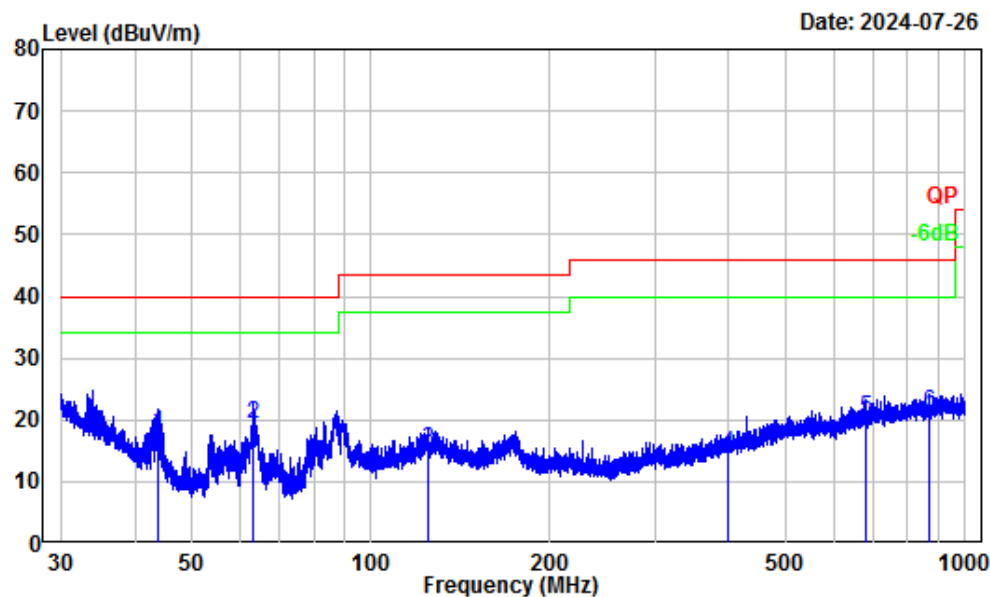
The amplitude of spurious emissions attenuated more than 20 dB below the limit was not recorded.

30MHz-1GHz:

2.4G Wi-Fi (Maximum output power mode, 802.11n40 High Channel)

For Adapter 1

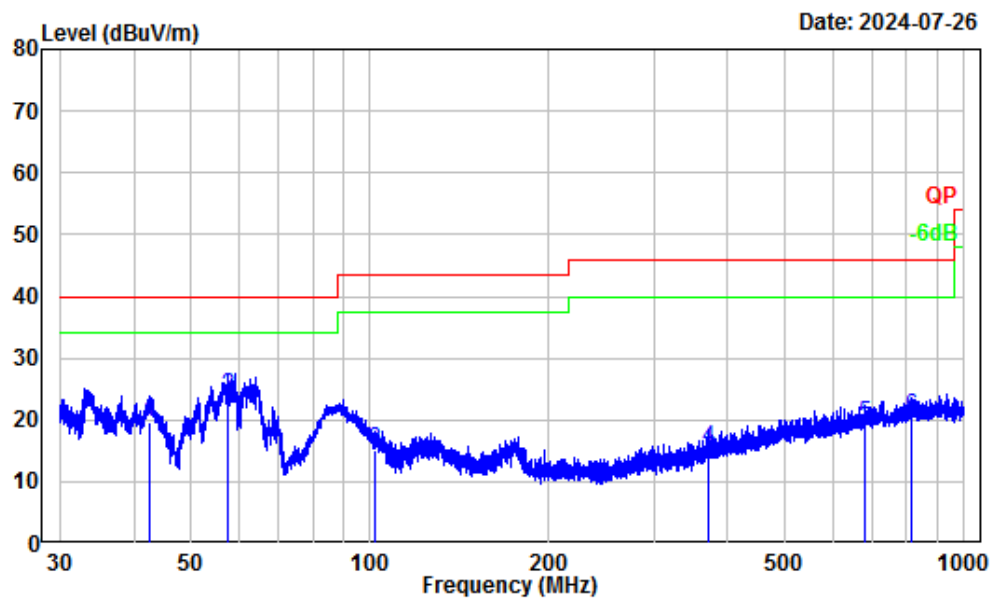
Horizontal



Site : Chamber A
 Condition : 3m Horizontal
 Project Number: 2401V30787E-RF
 Test Mode : 2.4G WIFI
 Tester : Shy Jiang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	43.66	-13.84	31.53	17.69	40.00	-22.31	QP
2	63.26	-17.69	37.10	19.41	40.00	-20.59	QP
3	125.06	-12.21	27.41	15.20	43.50	-28.30	QP
4	398.68	-10.62	25.06	14.44	46.00	-31.56	QP
5	680.26	-6.39	26.67	20.28	46.00	-25.72	QP
6	870.27	-4.66	25.74	21.08	46.00	-24.92	QP

Vertical

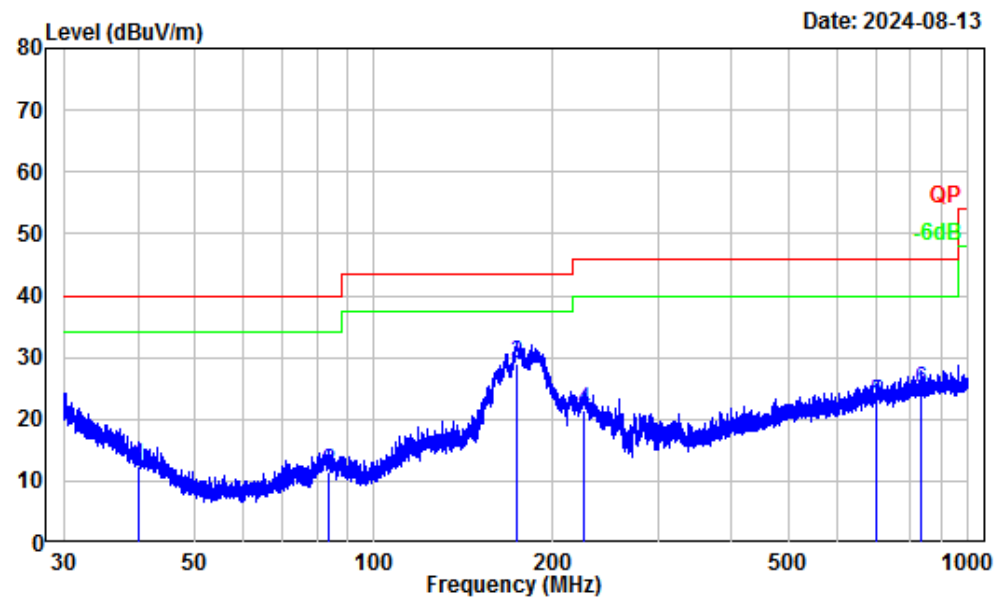


Site : Chamber A
Condition : 3m Vertical
Project Number: 2401V30787E-RF
Test Mode : 2.4G WIFI
Tester : Shy Jiang

	Freq		Read		Limit	Over	Remark
	Factor	Level	Level	Line	Limit	Limit	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	42.43	-14.39	34.07	19.68	40.00	-20.32	QP
2	57.59	-18.80	42.68	23.88	40.00	-16.12	QP
3	101.60	-16.51	31.54	15.03	43.50	-28.47	QP
4	372.17	-11.63	27.09	15.46	46.00	-30.54	QP
5	681.15	-6.77	26.23	19.46	46.00	-26.54	QP
6	817.04	-5.31	25.78	20.47	46.00	-25.53	QP

For Adapter 2

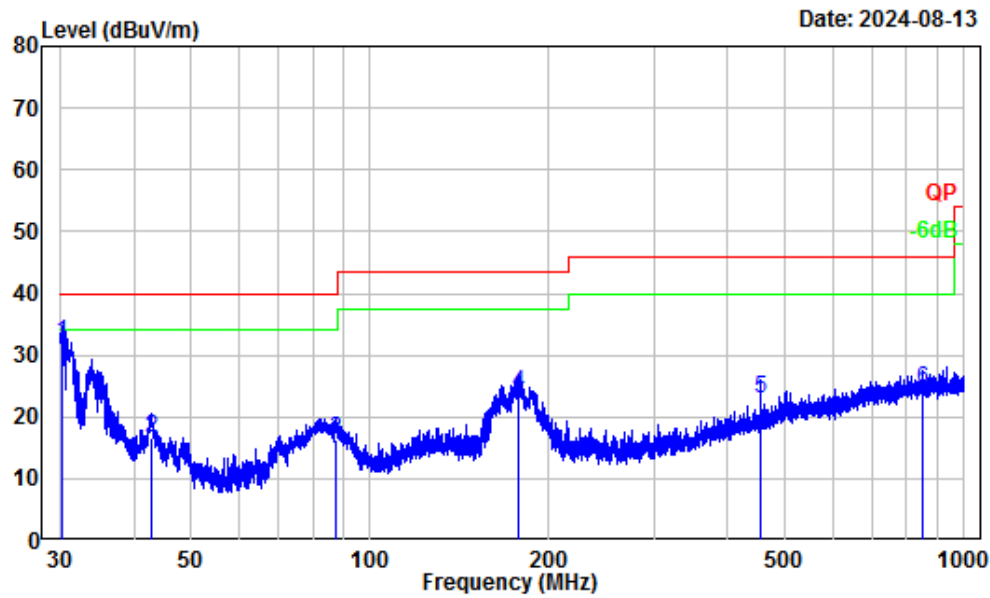
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401V30787E-RF
Test Mode : 2.4G WIFI
Tester : Anson Su

	Freq Factor		Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.13	-12.45	24.69	12.24	40.00	-27.76	QP
2	83.78	-17.93	29.36	11.43	40.00	-28.57	QP
3	173.74	-13.30	42.36	29.06	43.50	-14.44	QP
4	226.10	-13.07	34.44	21.37	46.00	-24.63	QP
5	699.92	-3.52	26.22	22.70	46.00	-23.30	QP
6	831.86	-1.88	26.74	24.86	46.00	-21.14	QP

Vertical

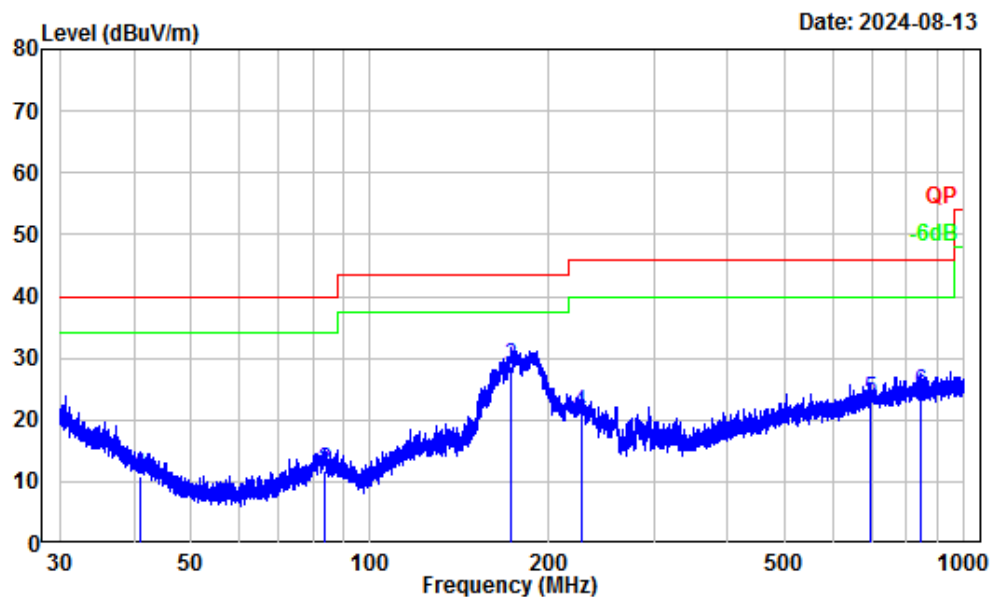


Site : Chamber A
Condition : 3m Vertical
Project Number: 2401V30787E-RF
Test Mode : 2.4G WIFI
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	30.26	-6.13	37.99	31.86	40.00	-8.14	QP
2	42.69	-13.89	30.50	16.61	40.00	-23.39	QP
3	87.30	-17.95	34.33	16.38	40.00	-23.62	QP
4	178.13	-13.55	37.40	23.85	43.50	-19.65	QP
5	455.11	-7.37	30.43	23.06	46.00	-22.94	QP
6	854.40	-1.68	26.16	24.48	46.00	-21.52	QP

BLE (Maximum output power mode, Low Channel)

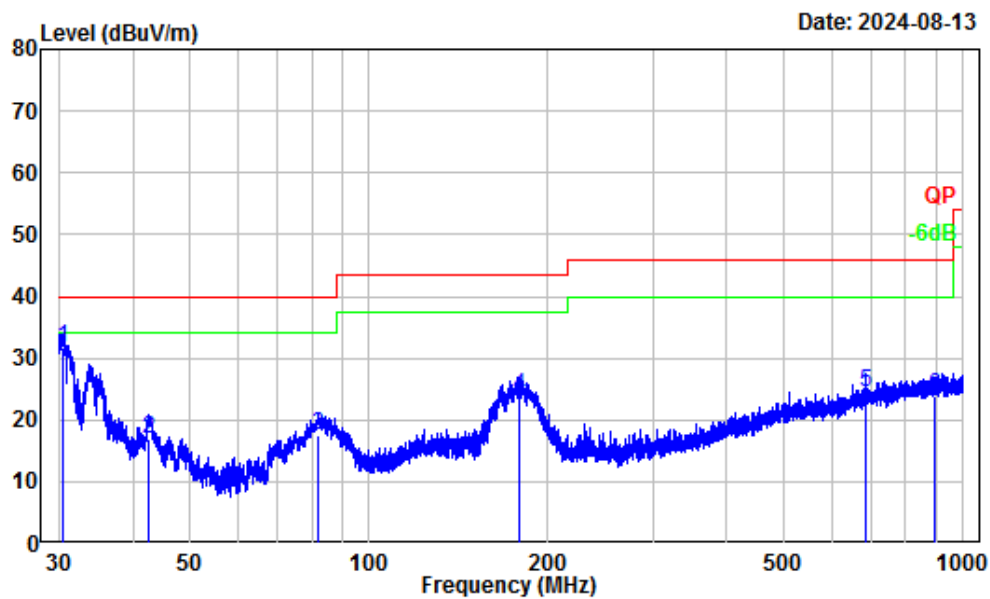
Worst case is adapter 2:

Horizontal

Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401V30787E-RF
Test Mode : BLE
Tester : Anson Su

	Freq		Read		Limit	Over	Remark
	MHz	Factor	Level	Level	Line	Limit	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.93	-12.90	23.81	10.91	40.00	-29.09	QP
2	83.67	-17.93	29.71	11.78	40.00	-28.22	QP
3	173.05	-13.27	41.88	28.61	43.50	-14.89	QP
4	226.30	-13.08	34.12	21.04	46.00	-24.96	QP
5	696.86	-3.56	26.76	23.20	46.00	-22.80	QP
6	847.31	-1.74	26.15	24.41	46.00	-21.59	QP

Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401V30787E-RF
Test Mode : BLE
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	30.41	-6.22	37.89	31.67	40.00	-8.33	QP
2	42.51	-13.78	30.60	16.82	40.00	-23.18	QP
3	82.21	-17.92	35.35	17.43	40.00	-22.57	QP
4	179.47	-13.62	37.41	23.79	43.50	-19.71	QP
5	684.75	-3.70	28.19	24.49	46.00	-21.51	QP
6	893.47	-1.37	25.21	23.84	46.00	-22.16	QP

1-25 GHz:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/AV					
BLE 1M							
Low Channel 2402MHz							
2378.94	55.29	PK	H	-2.93	52.36	74	-21.64
2378.94	41.92	AV	H	-2.93	38.99	54	-15.01
2380.66	55.08	PK	V	-2.93	52.15	74	-21.85
2380.66	41.74	AV	V	-2.93	38.81	54	-15.19
4804.00	49.47	PK	H	2.42	51.89	74	-22.11
4804.00	41.09	AV	H	2.42	43.51	54	-10.49
4804.00	48.98	PK	V	2.42	51.40	74	-22.60
4804.00	40.56	AV	V	2.42	42.98	54	-11.02
Middle Channel 2440MHz							
4880.00	49.91	PK	H	2.58	52.49	74	-21.51
4880.00	42.03	AV	H	2.58	44.61	54	-9.39
4880.00	49.40	PK	V	2.58	51.98	74	-22.02
4880.00	41.25	AV	V	2.58	43.83	54	-10.17
High Channel 2480MHz							
2483.69	55.57	PK	H	-3.17	52.40	74	-21.60
2483.69	42.28	AV	H	-3.17	39.11	54	-14.89
2483.56	55.36	PK	V	-3.17	52.19	74	-21.81
2483.56	42.10	AV	V	-3.17	38.93	54	-15.07
4960.00	49.05	PK	H	2.68	51.73	74	-22.27
4960.00	40.42	AV	H	2.68	43.10	54	-10.90
4960.00	48.49	PK	V	2.68	51.17	74	-22.83
4960.00	39.87	AV	V	2.68	42.55	54	-11.45

Note:

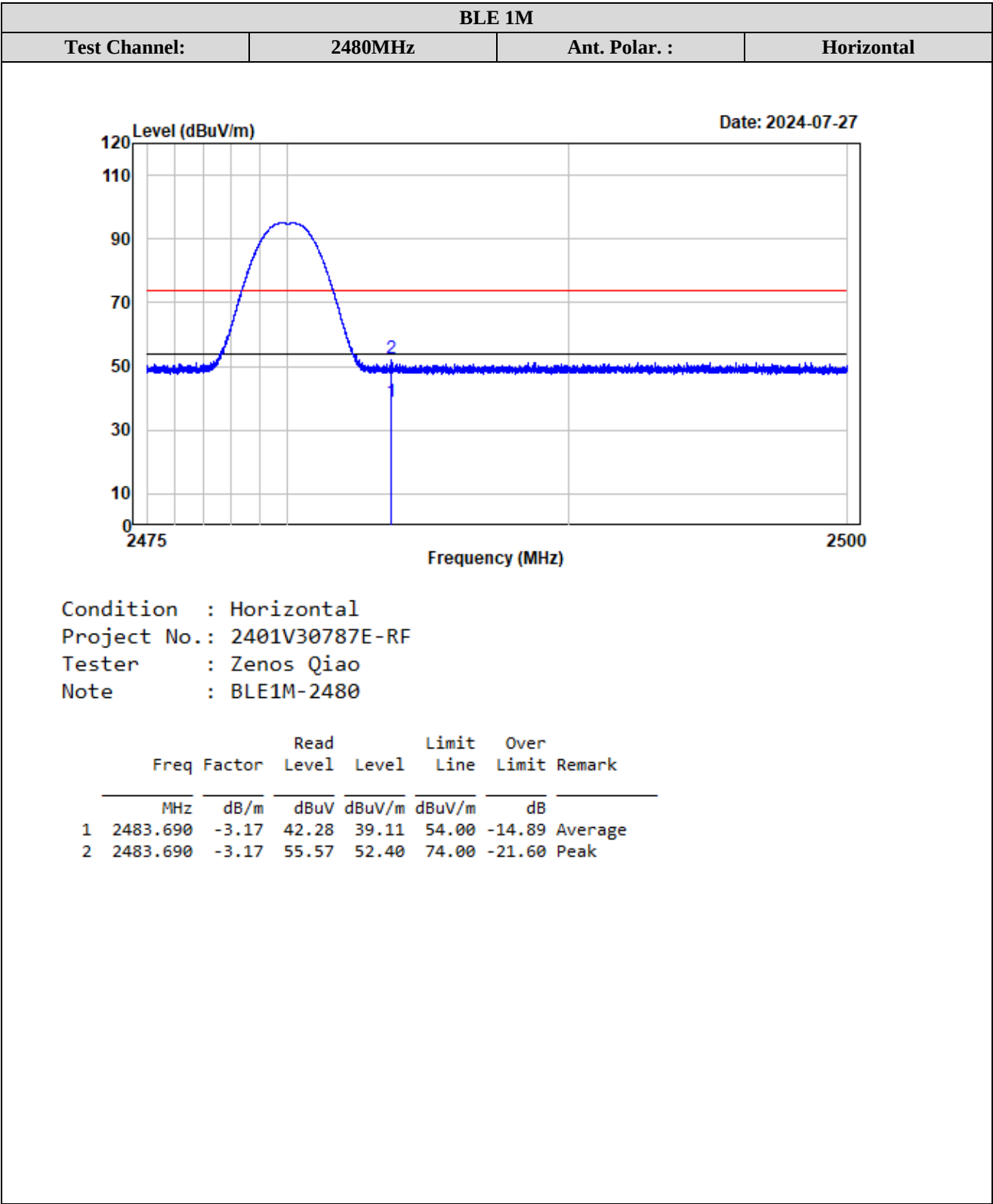
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

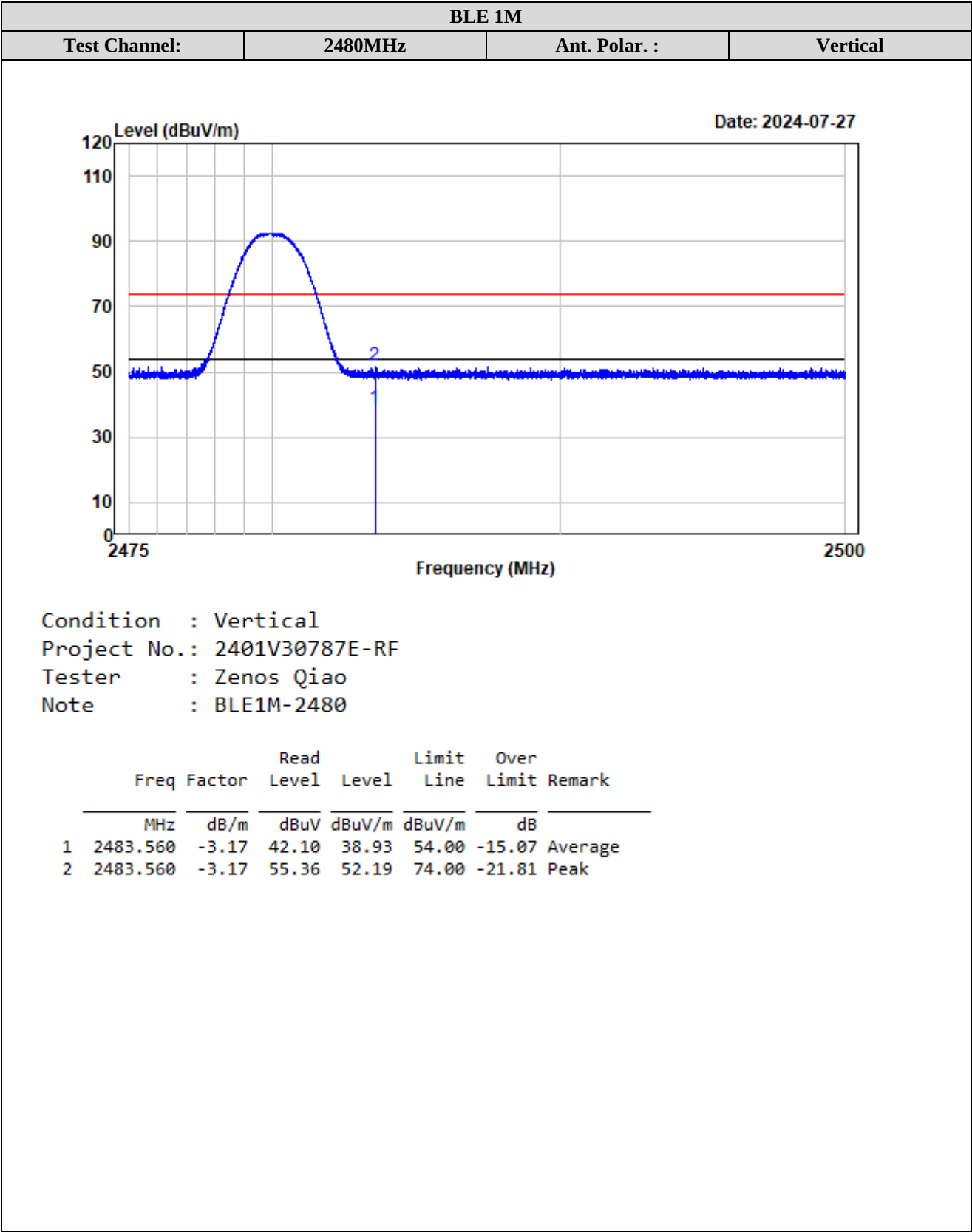
Corrected Amplitude = Corrected Factor + Reading

Margin = Corrected. Amplitude - Limit

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

Test plots example for Band Edge Measurements (Radiated):





2.4G Wi-Fi

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/AV					
802.11b							
Low Channel 2412MHz							
2388.67	55.48	PK	H	-2.93	52.55	74	-21.45
2388.67	41.06	AV	H	-2.93	38.13	54	-15.87
2387.84	55.25	PK	V	-2.93	52.32	74	-21.68
2387.84	40.87	AV	V	-2.93	37.94	54	-16.06
4824.00	47.42	PK	H	2.45	49.87	74	-24.13
4824.00	34.95	AV	H	2.45	37.40	54	-16.60
4824.00	47.06	PK	V	2.45	49.51	74	-24.49
4824.00	34.54	AV	V	2.45	36.99	54	-17.01
Middle Channel 2437MHz							
4874.00	50.68	PK	H	2.56	53.24	74	-20.76
4874.00	45.51	AV	H	2.56	48.07	54	-5.93
4874.00	49.96	PK	V	2.56	52.52	74	-21.48
4874.00	44.87	AV	V	2.56	47.43	54	-6.57
High Channel 2462MHz							
2483.58	55.75	PK	H	-3.17	52.58	74	-21.42
2483.58	41.64	AV	H	-3.17	38.47	54	-15.53
2483.65	55.38	PK	V	-3.17	52.21	74	-21.79
2483.65	41.47	AV	V	-3.17	38.30	54	-15.70
4924.00	48.14	PK	H	2.63	50.77	74	-23.23
4924.00	35.66	AV	H	2.63	38.29	54	-15.71
4924.00	47.78	PK	V	2.63	50.41	74	-23.59
4924.00	35.43	AV	V	2.63	38.06	54	-15.94

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/AV					
802.11g							
Low Channel 2412MHz							
2389.94	57.55	PK	H	-2.93	54.62	74	-19.38
2389.94	42.60	AV	H	-2.93	39.67	54	-14.33
2389.71	56.97	PK	V	-2.93	54.04	74	-19.96
2389.71	42.39	AV	V	-2.93	39.46	54	-14.54
4824.00	46.58	PK	H	2.45	49.03	74	-24.97
4824.00	32.45	AV	H	2.45	34.90	54	-19.10
4824.00	46.36	PK	V	2.45	48.81	74	-25.19
4824.00	32.27	AV	V	2.45	34.72	54	-19.28
Middle Channel 2437MHz							
4874.00	49.49	PK	H	2.56	52.05	74	-21.95
4874.00	36.27	AV	H	2.56	38.83	54	-15.17
4874.00	49.05	PK	V	2.56	51.61	74	-22.39
4874.00	35.54	AV	V	2.56	38.10	54	-15.90
High Channel 2462MHz							
2483.65	65.32	PK	H	-3.17	62.15	74	-11.85
2483.65	45.89	AV	H	-3.17	42.72	54	-11.28
2483.54	63.78	PK	V	-3.17	60.61	74	-13.39
2483.54	44.94	AV	V	-3.17	41.77	54	-12.23
4924.00	47.37	PK	H	2.63	50.00	74	-24.00
4924.00	33.23	AV	H	2.63	35.86	54	-18.14
4924.00	47.11	PK	V	2.63	49.74	74	-24.26
4924.00	33.02	AV	V	2.63	35.65	54	-18.35

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/AV					
802.11n20							
Low Channel 2412MHz							
2389.48	57.72	PK	H	-2.93	54.79	74	-19.21
2389.48	42.57	AV	H	-2.93	39.64	54	-14.36
2389.59	56.89	PK	V	-2.93	53.96	74	-20.04
2389.59	42.14	AV	V	-2.93	39.21	54	-14.79
4824.00	46.74	PK	H	2.45	49.19	74	-24.81
4824.00	32.52	AV	H	2.45	34.97	54	-19.03
4824.00	46.61	PK	V	2.45	49.06	74	-24.94
4824.00	32.36	AV	V	2.45	34.81	54	-19.19
Middle Channel 2437MHz							
4874.00	50.05	PK	H	2.56	52.61	74	-21.39
4874.00	36.13	AV	H	2.56	38.69	54	-15.31
4874.00	49.58	PK	V	2.56	52.14	74	-21.86
4874.00	35.46	AV	V	2.56	38.02	54	-15.98
High Channel 2462MHz							
2483.56	69.14	PK	H	-3.17	65.97	74	-8.03
2483.56	47.66	AV	H	-3.17	44.49	54	-9.51
2483.60	67.57	PK	V	-3.17	64.40	74	-9.60
2483.60	46.73	AV	V	-3.17	43.56	54	-10.44
4924.00	47.89	PK	H	2.63	50.52	74	-23.48
4924.00	33.14	AV	H	2.63	35.77	54	-18.23
4924.00	47.72	PK	V	2.63	50.35	74	-23.65
4924.00	32.96	AV	V	2.63	35.59	54	-18.41

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/AV					
802.11n40							
Low Channel 2422MHz							
2389.83	72.37	PK	H	-2.93	69.44	74	-4.56
2389.83	53.82	AV	H	-2.93	50.89	54	-3.11
2389.36	71.04	PK	V	-2.93	68.11	74	-5.89
2389.36	53.35	AV	V	-2.93	50.42	54	-3.58
4844.00	46.92	PK	H	2.45	49.37	74	-24.63
4844.00	33.21	AV	H	2.45	35.66	54	-18.34
4844.00	46.67	PK	V	2.45	49.12	74	-24.88
4844.00	33.04	AV	V	2.45	35.49	54	-18.51
Middle Channel 2437MHz							
4874.00	48.08	PK	H	2.56	50.64	74	-23.36
4874.00	34.63	AV	H	2.56	37.19	54	-16.81
4874.00	47.75	PK	V	2.56	50.31	74	-23.69
4874.00	34.36	AV	V	2.56	36.92	54	-17.08
High Channel 2452MHz							
2483.89	74.09	PK	H	-3.17	70.92	74	-3.08
2483.89	54.17	AV	H	-3.17	51.00	54	-3.00
2483.75	72.56	PK	V	-3.17	69.39	74	-4.61
2483.75	53.25	AV	V	-3.17	50.08	54	-3.92
4904.00	47.52	PK	H	2.64	50.16	74	-23.84
4904.00	34.01	AV	H	2.64	36.65	54	-17.35
4904.00	47.27	PK	V	2.64	49.91	74	-24.09
4904.00	33.86	AV	V	2.64	36.50	54	-17.50

Note:

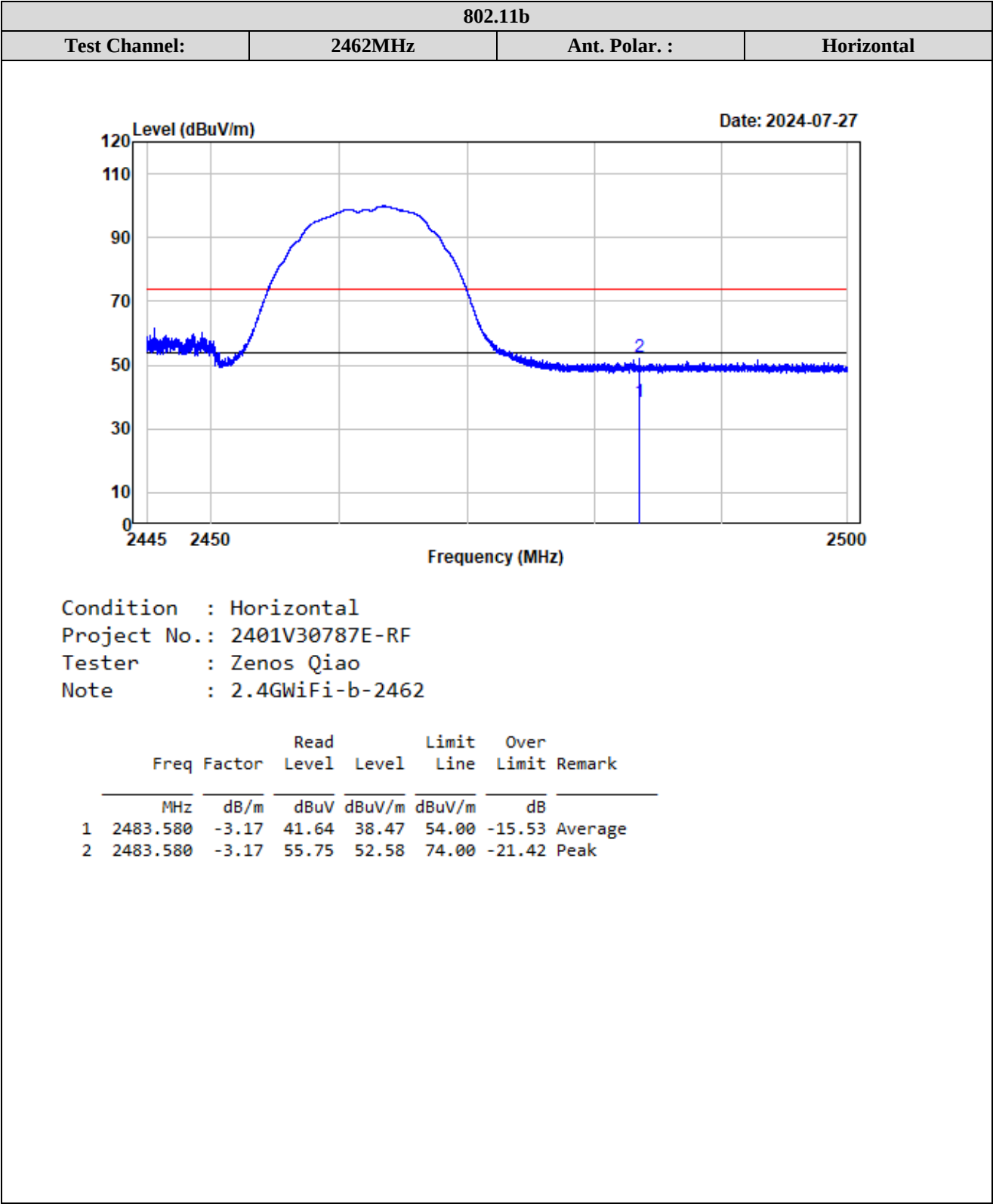
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

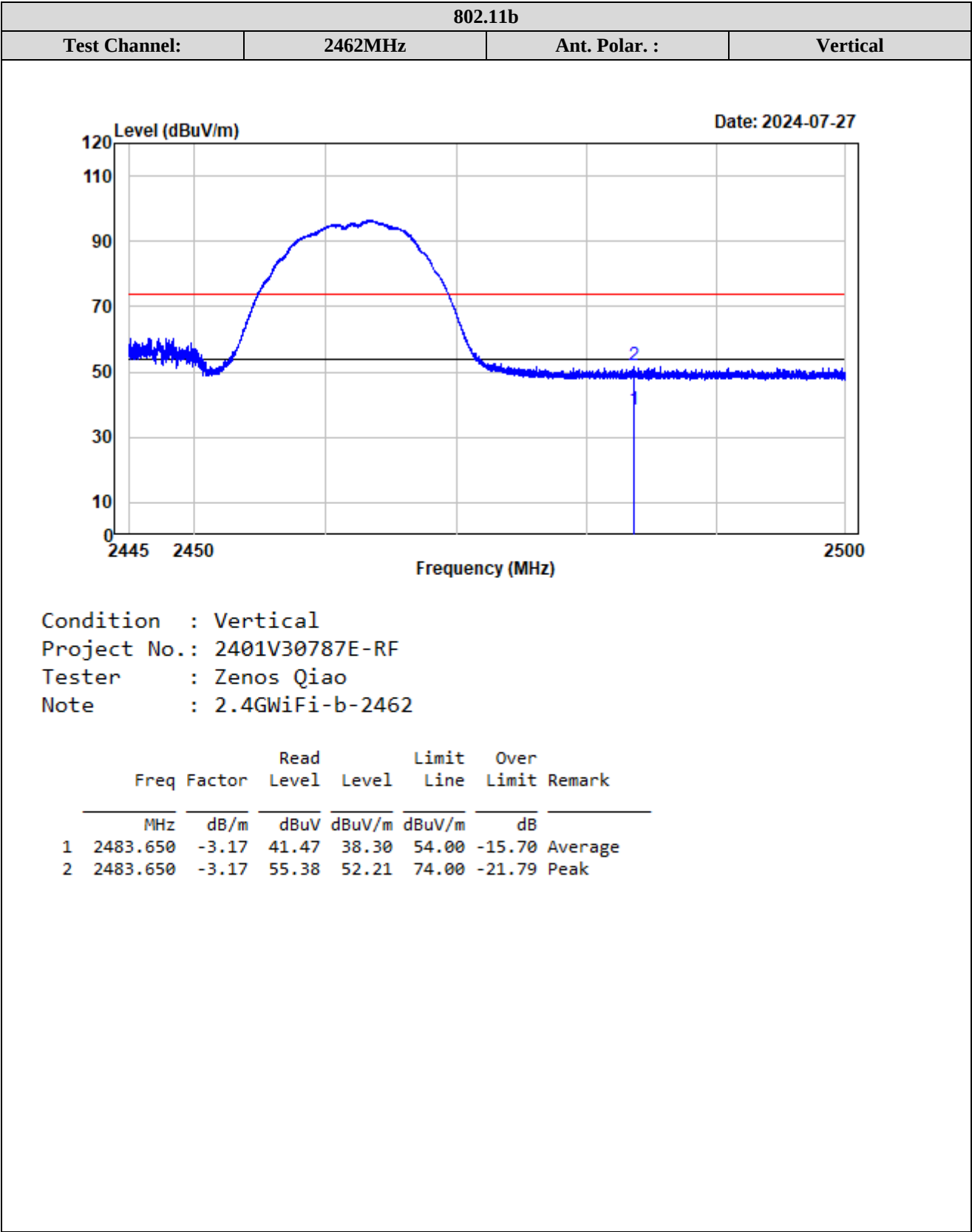
Corrected Amplitude = Factor + Reading

Margin = Corrected. Amplitude - Limit

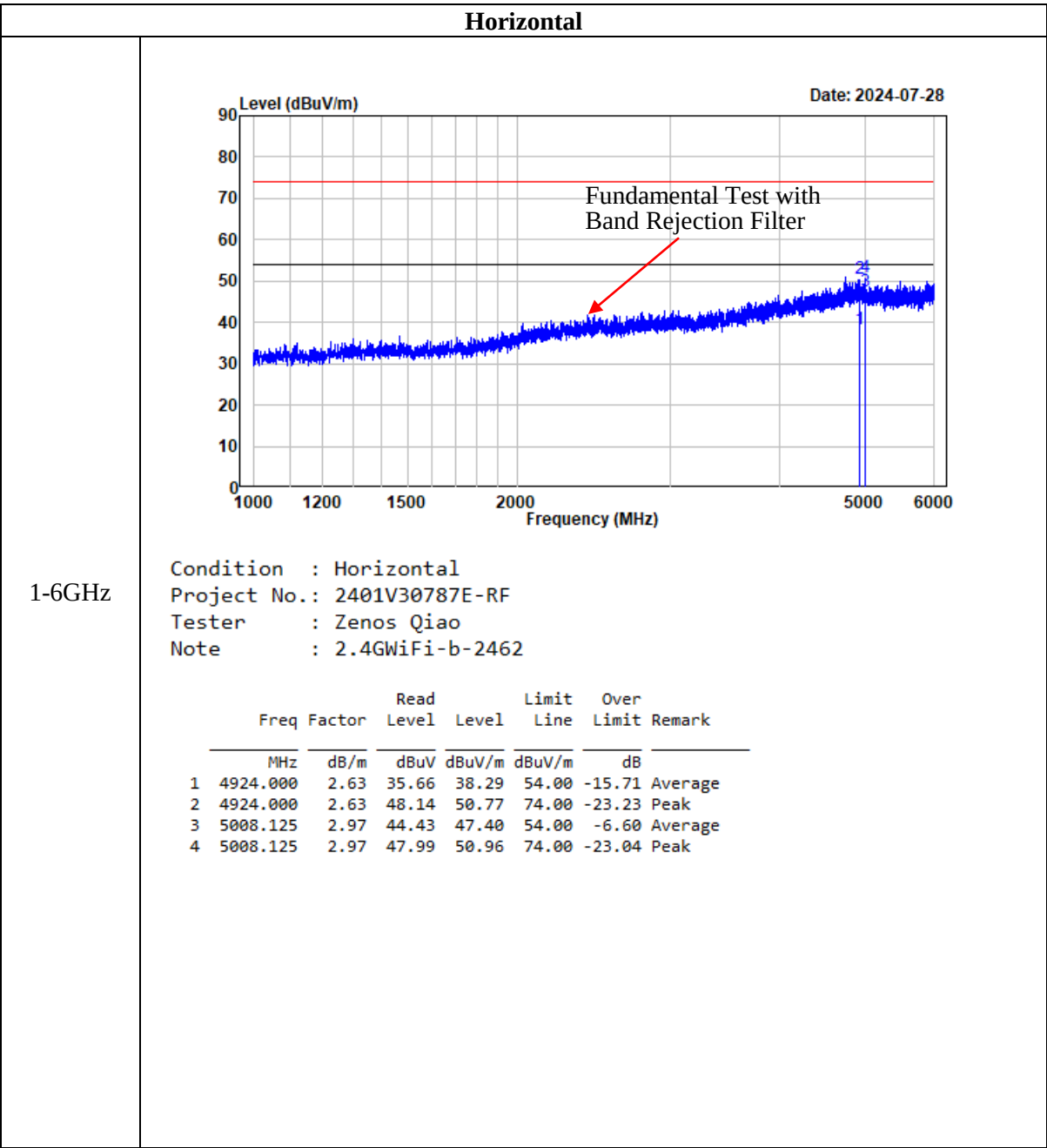
The other spurious emission which is in the noise floor level was not recorded.

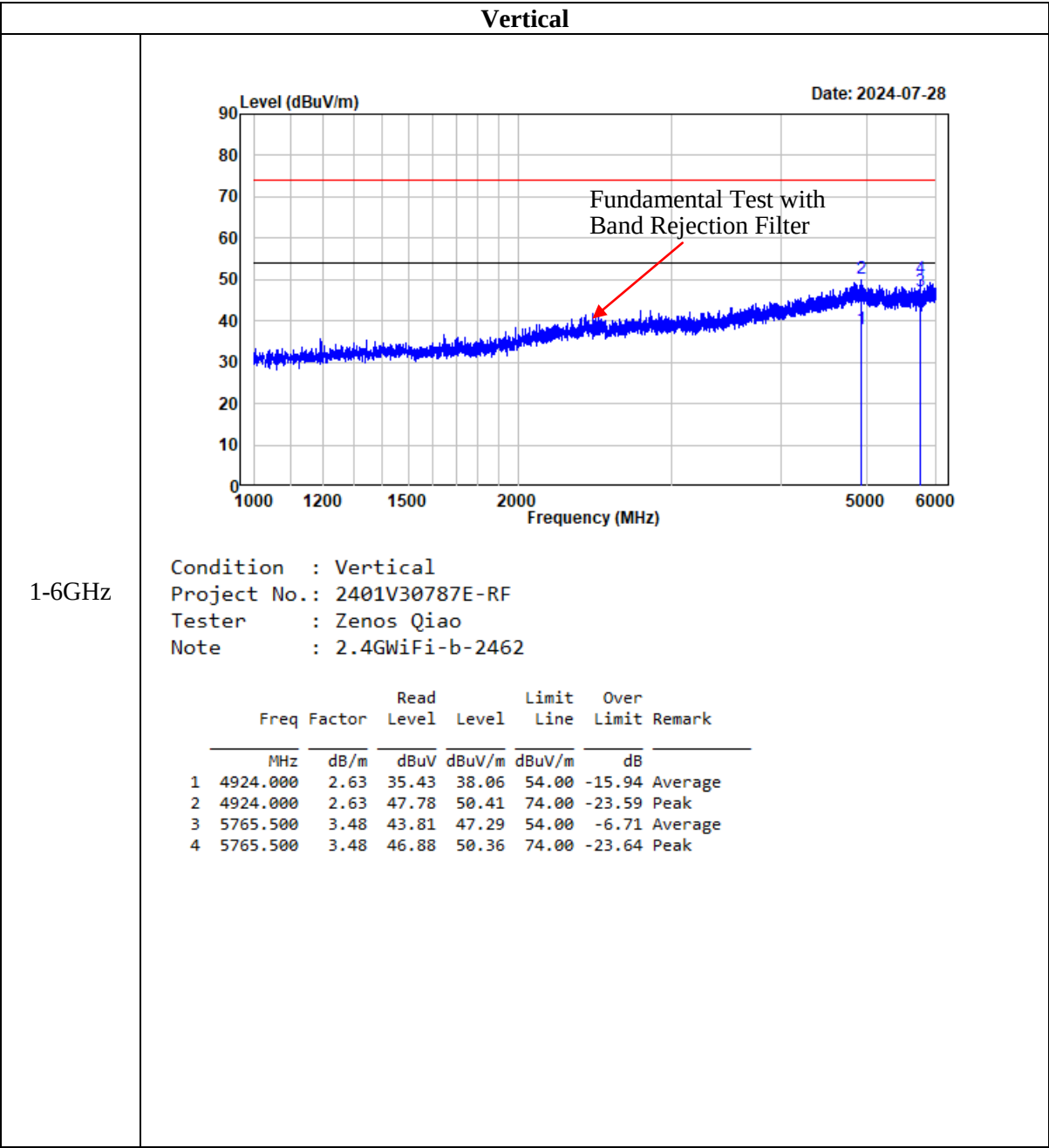
Test plots example for Band Edge Measurements (Radiated):

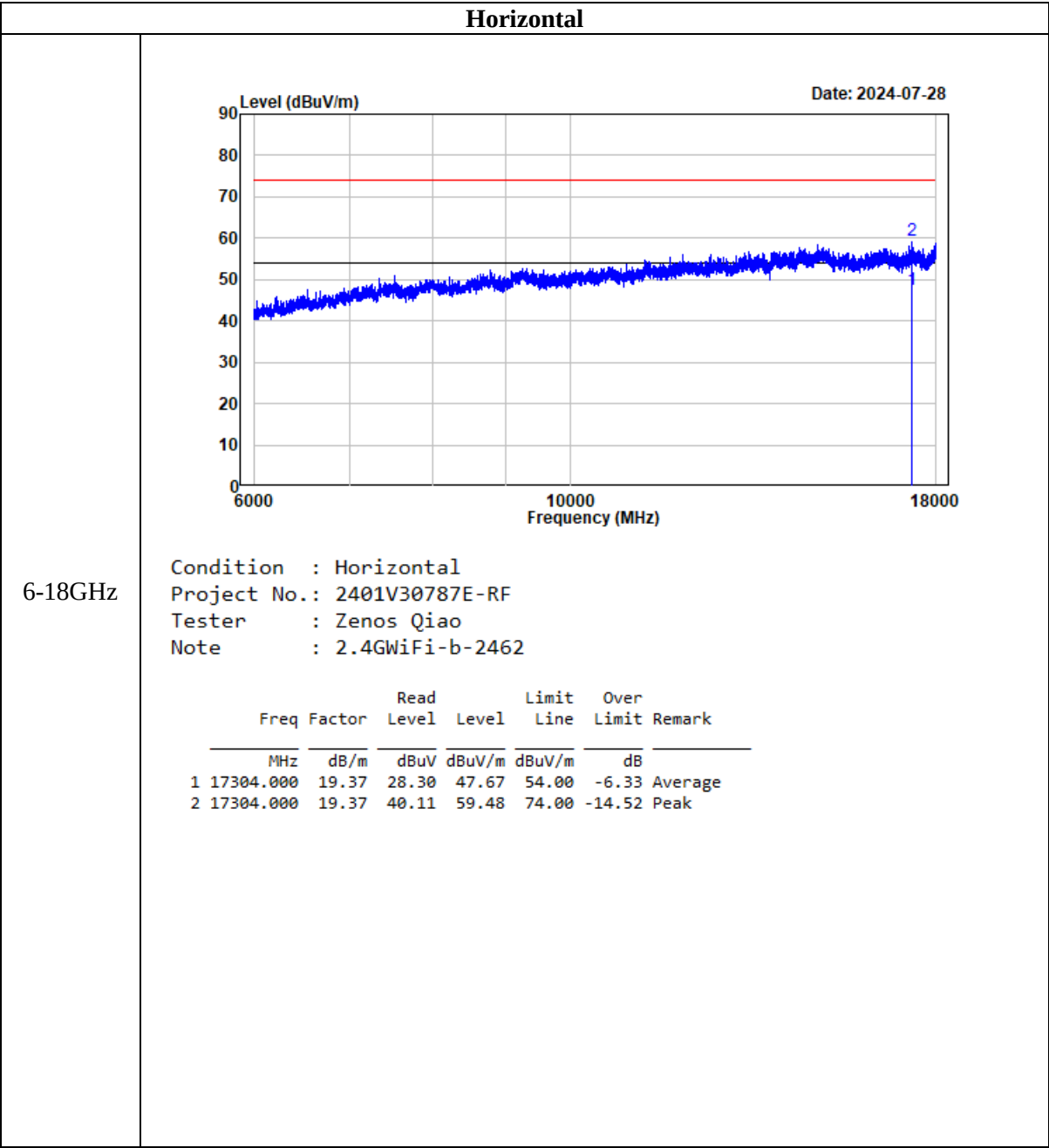


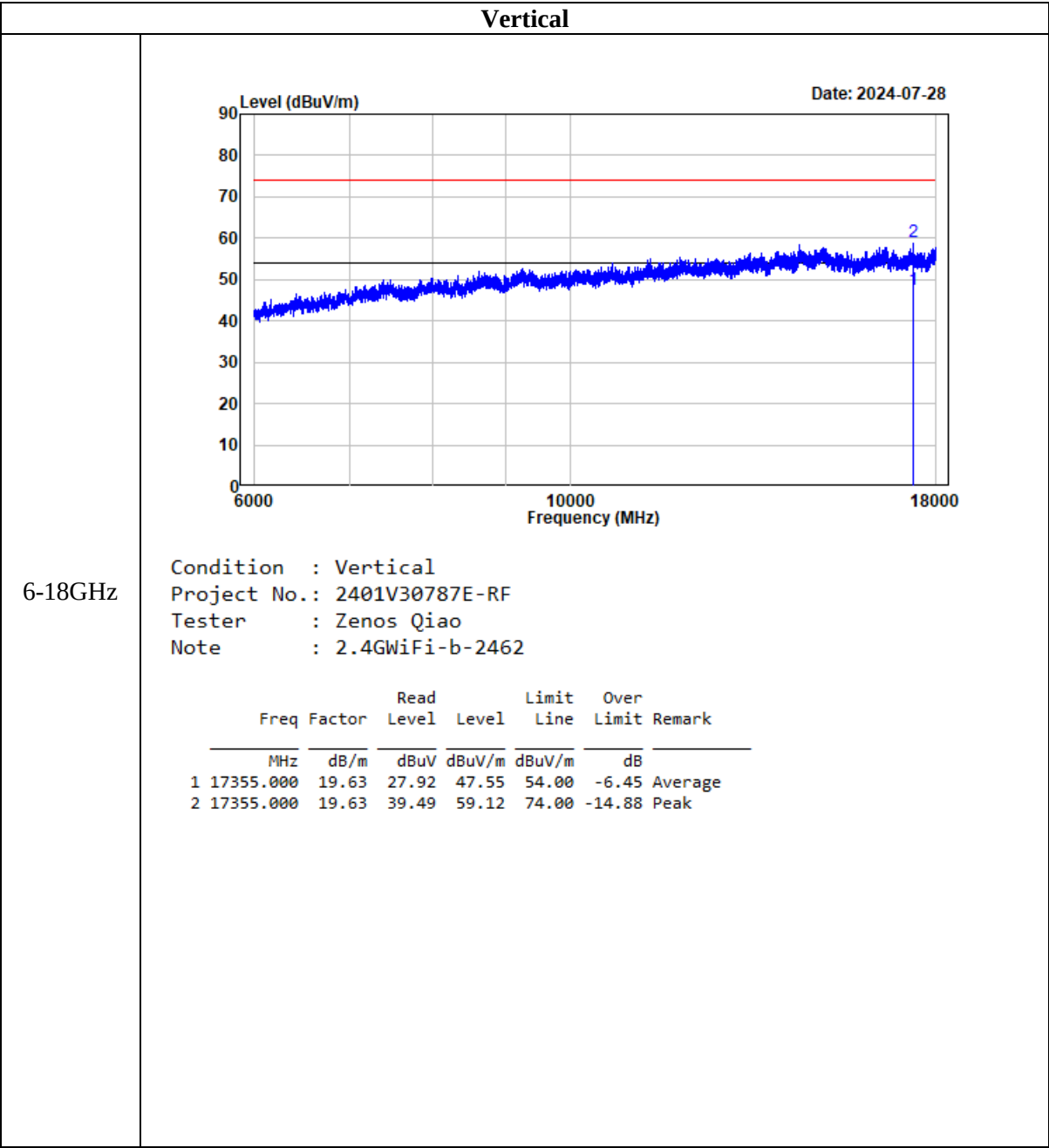


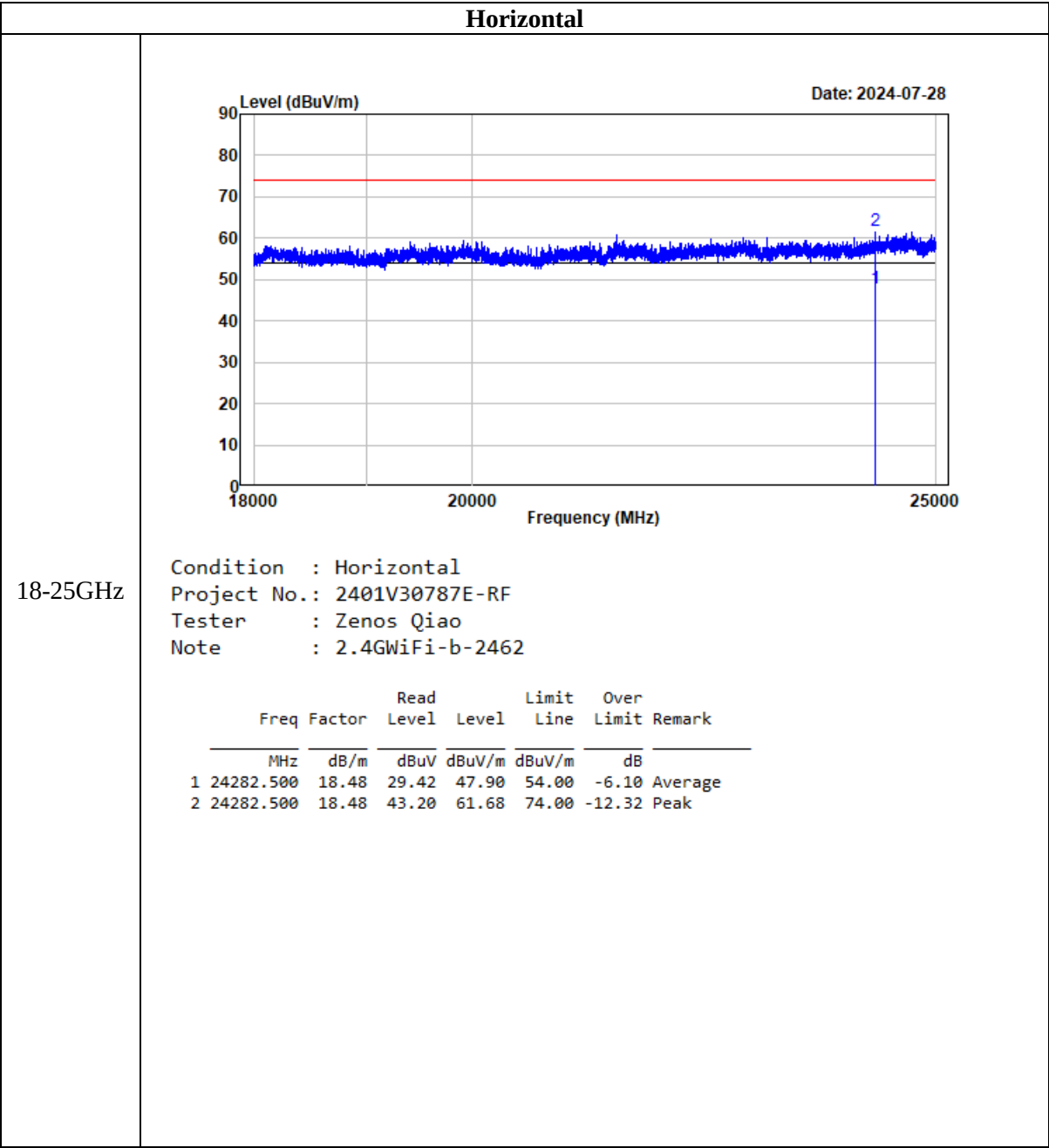
Test plots example for Emissions Measurements:

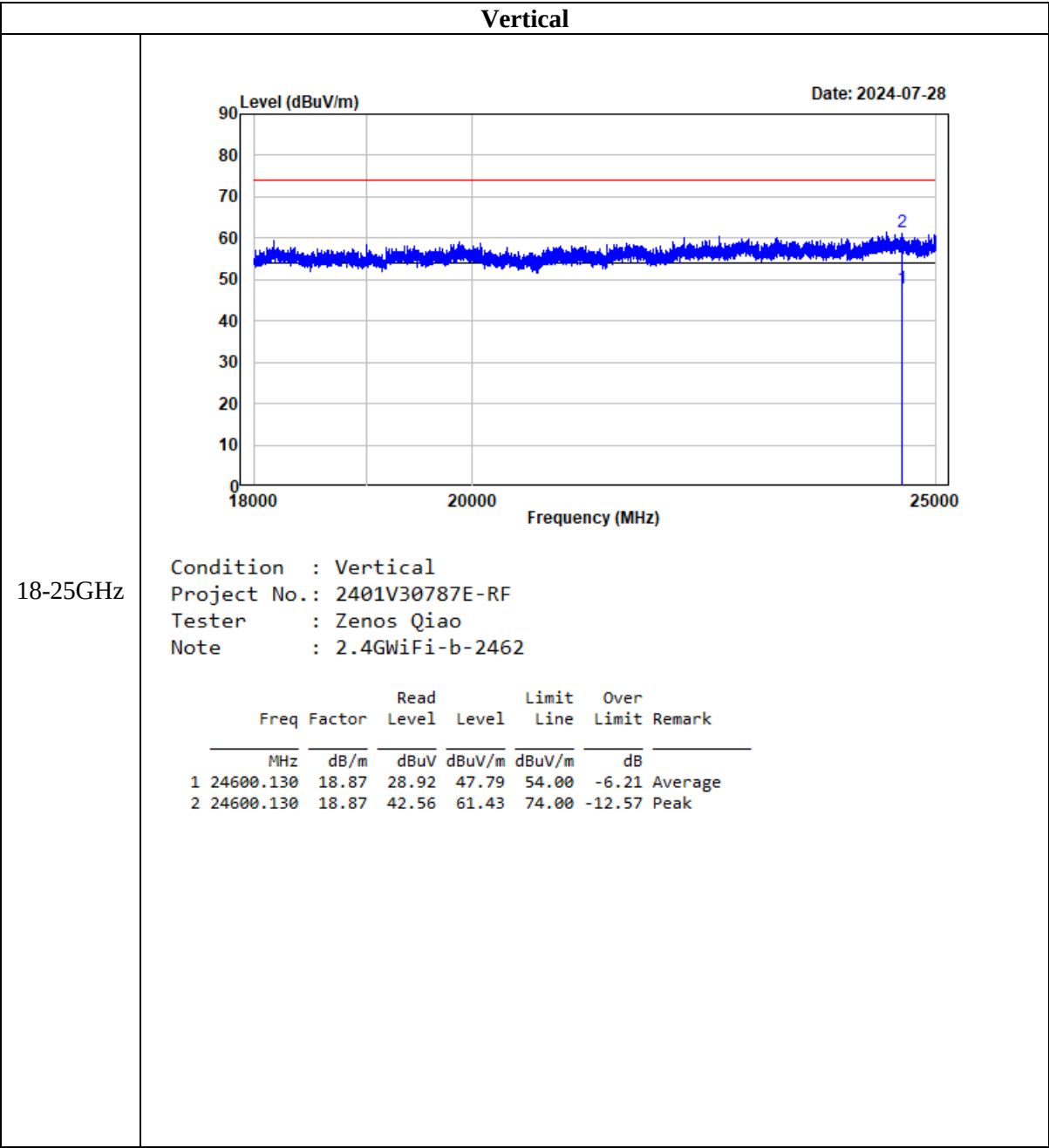












FCC §15.247(a) (2) - 6 dB EMISSION BANDWIDTH

Applicable Standard

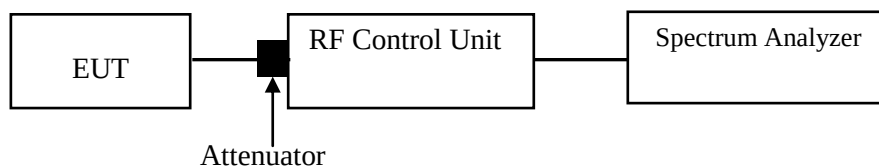
According to FCC §15.247(a) (2)

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:	24 °C
Relative Humidity:	51 %
ATM Pressure:	101 kPa

The testing was performed by Tom Tan on 2024-07-19.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

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

Applicable Standard

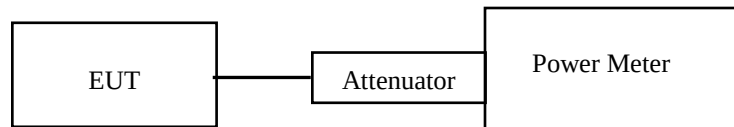
According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted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

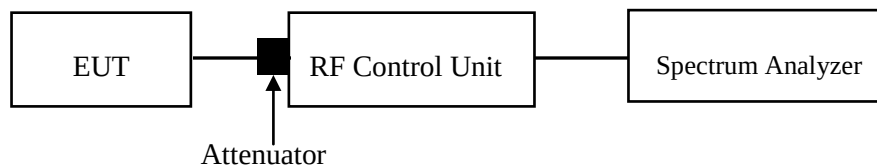
Test Method: ANSI C63.10-2013 Clause 11.9.1.1 for BLE & Clause 11.9.1.3 & 11.9.2.3.2 for Wi-Fi

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:	24 °C
Relative Humidity:	51 %
ATM Pressure:	101 kPa

The testing was performed by Tom Tan on 2024-07-19.

EUT operation mode: Transmitting

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

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

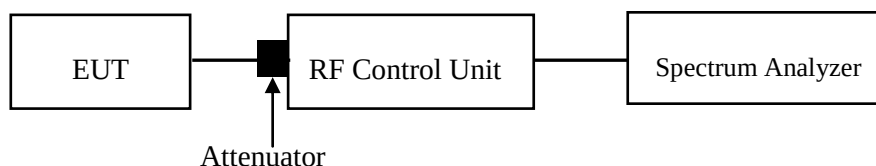
Applicable Standard

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

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:	24 °C
Relative Humidity:	51 %
ATM Pressure:	101 kPa

The testing was performed by Tom Tan on 2024-07-19.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

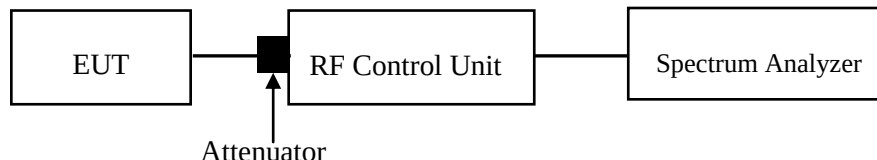
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of 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 Data

Environmental Conditions

Temperature:	24~26 °C
Relative Humidity:	51~53 %
ATM Pressure:	101 kPa

The testing was performed by Tom Tan from 2024-07-19 to 2024-08-14.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

EUT PHOTOGRAPHS

Please refer to the attachment 2401V30787E-RF External photo and 2401V30787E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2401V30787E-RFA Test Setup photo.

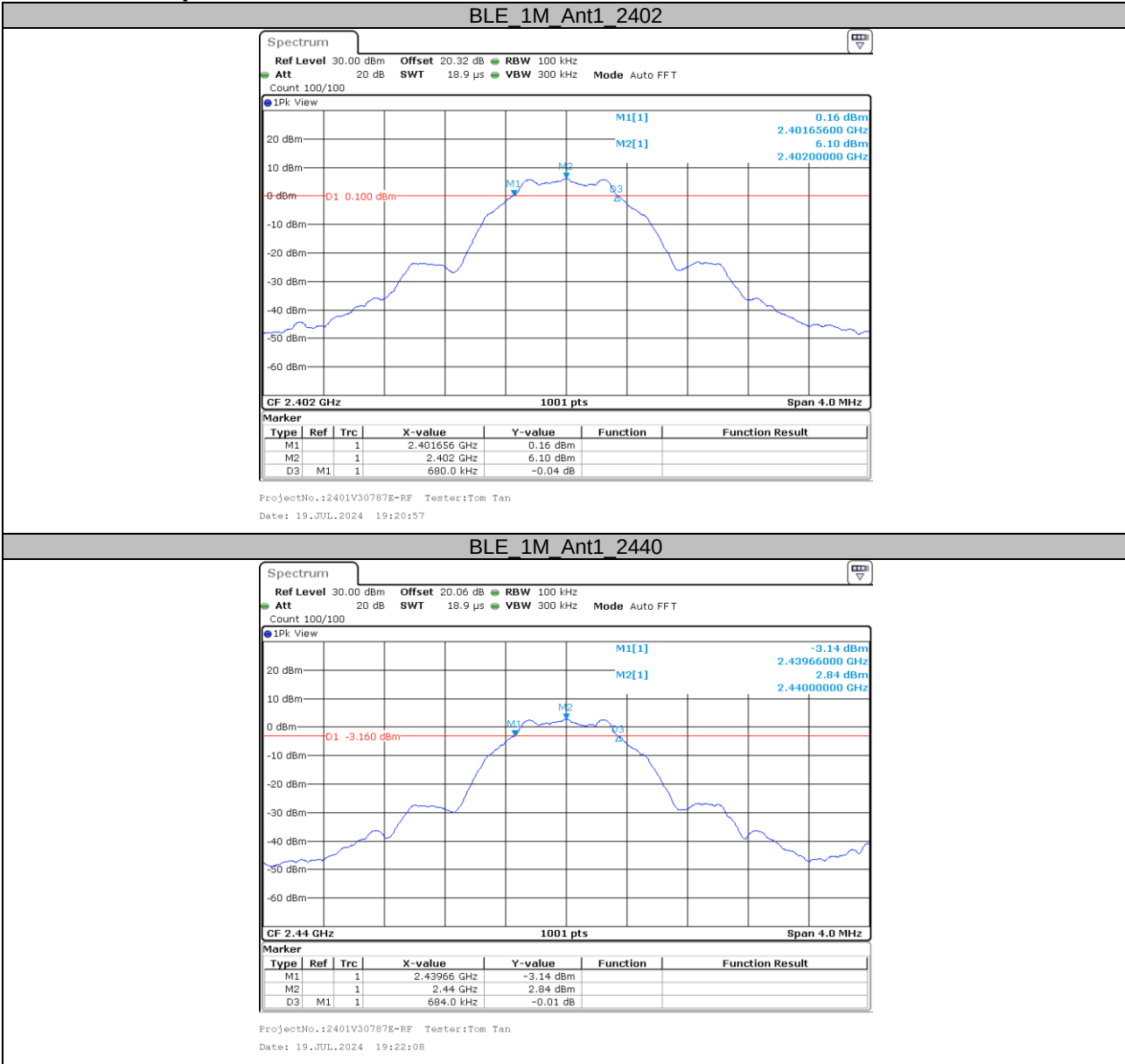
APPENDIX - BLE

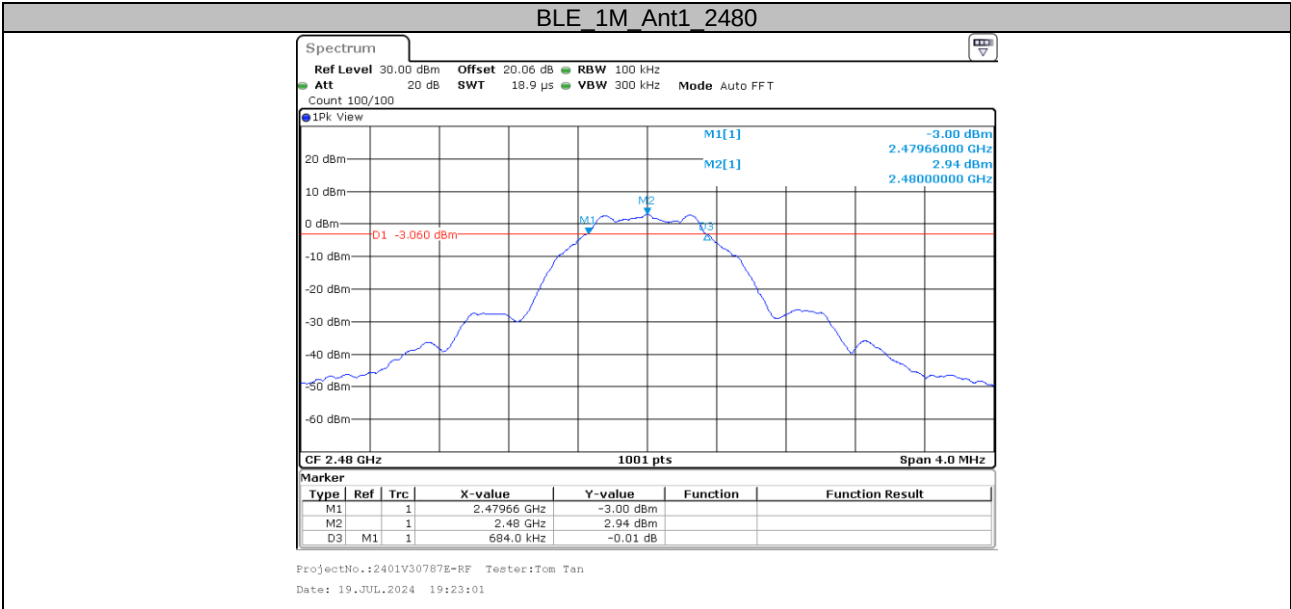
Appendix A: DTS Bandwidth

Test Result

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.68	2401.66	2402.34	0.5	PASS
		2440	0.68	2439.66	2440.34	0.5	PASS
		2480	0.68	2479.66	2480.34	0.5	PASS

Test Graphs



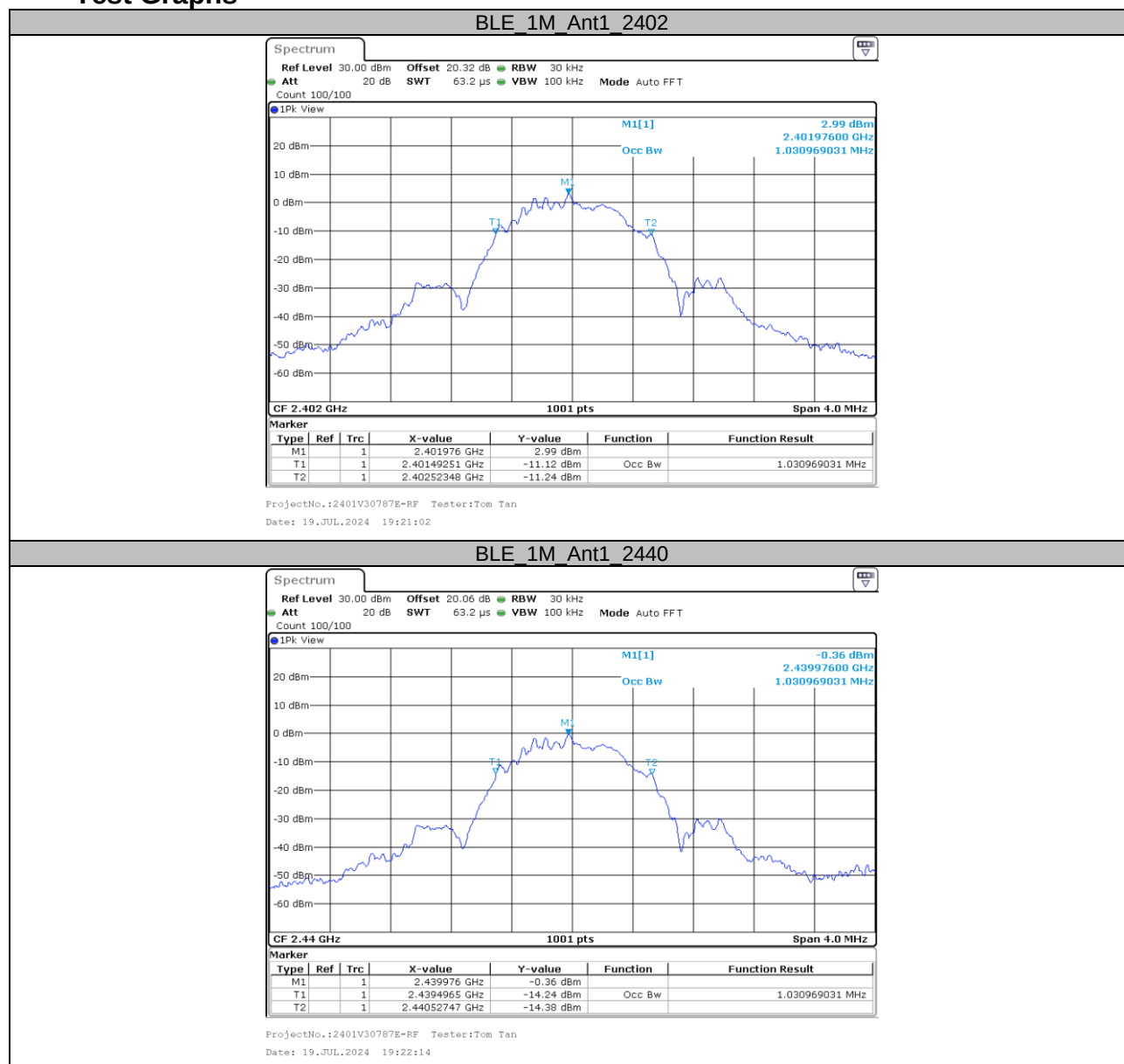


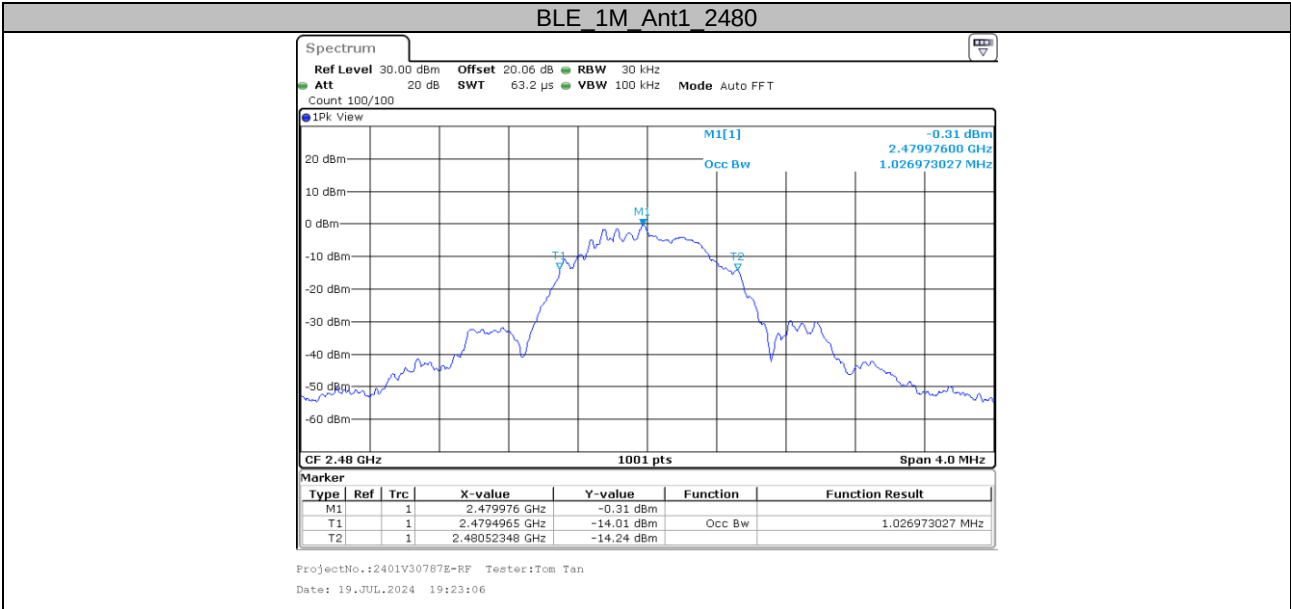
Appendix B: Occupied Channel Bandwidth

Test Result

Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.031	2401.4925	2402.5235	---	---
		2440	1.031	2439.4965	2440.5275	---	---
		2480	1.027	2479.4965	2480.5235	---	---

Test Graphs



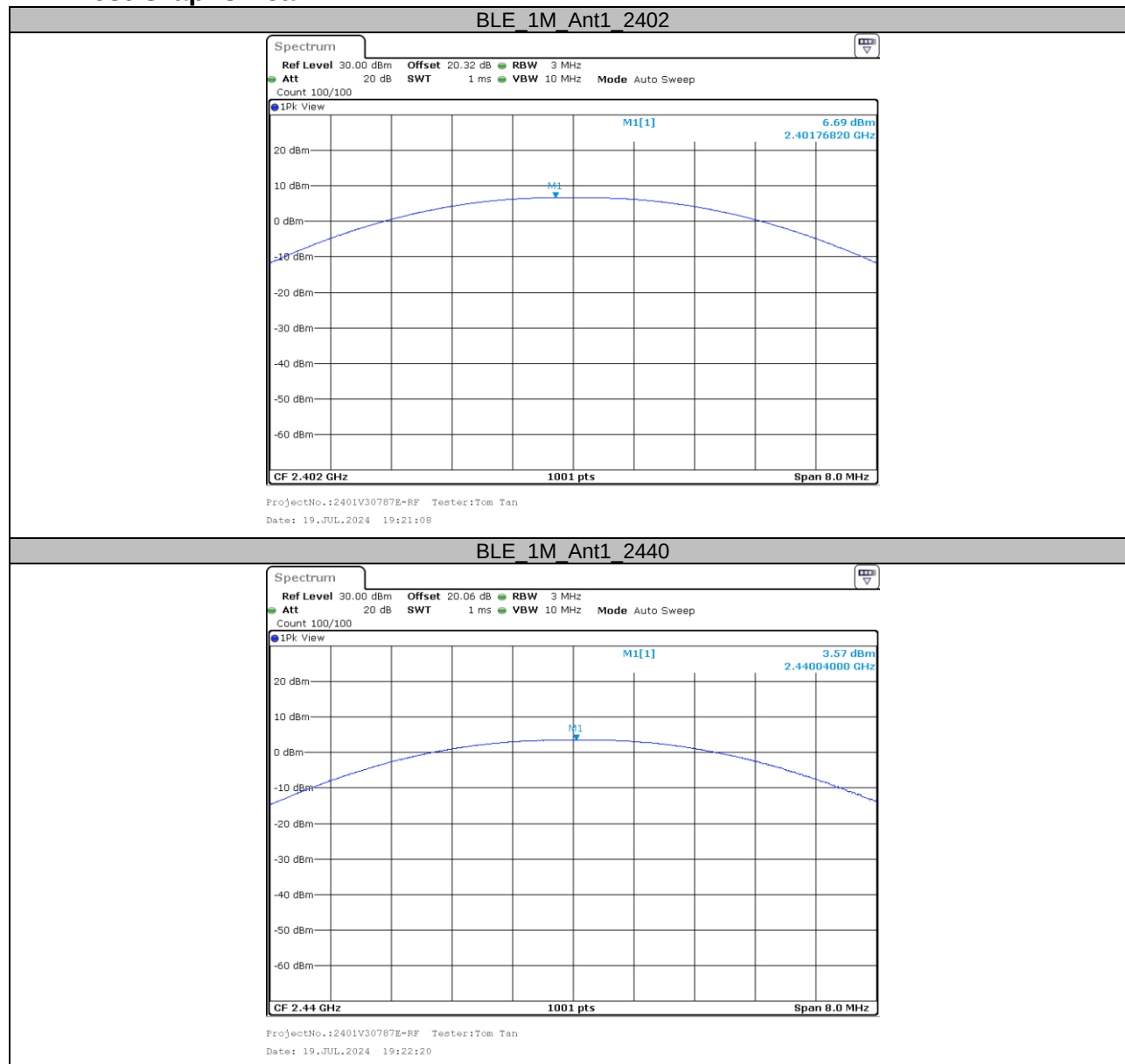


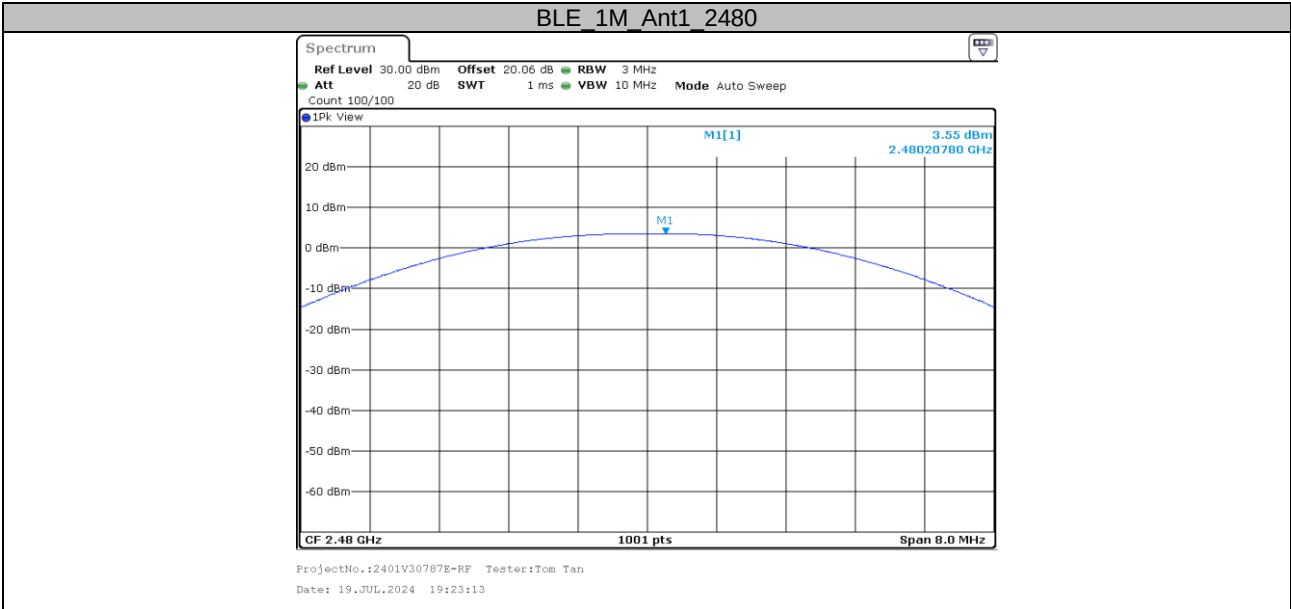
Appendix C: Maximum Conducted Output Power

Test Result Peak

Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	Verdict
BLE_1M	Ant1	2402	6.69	≤30	PASS
		2440	3.57	≤30	PASS
		2480	3.55	≤30	PASS

Test Graphs Peak



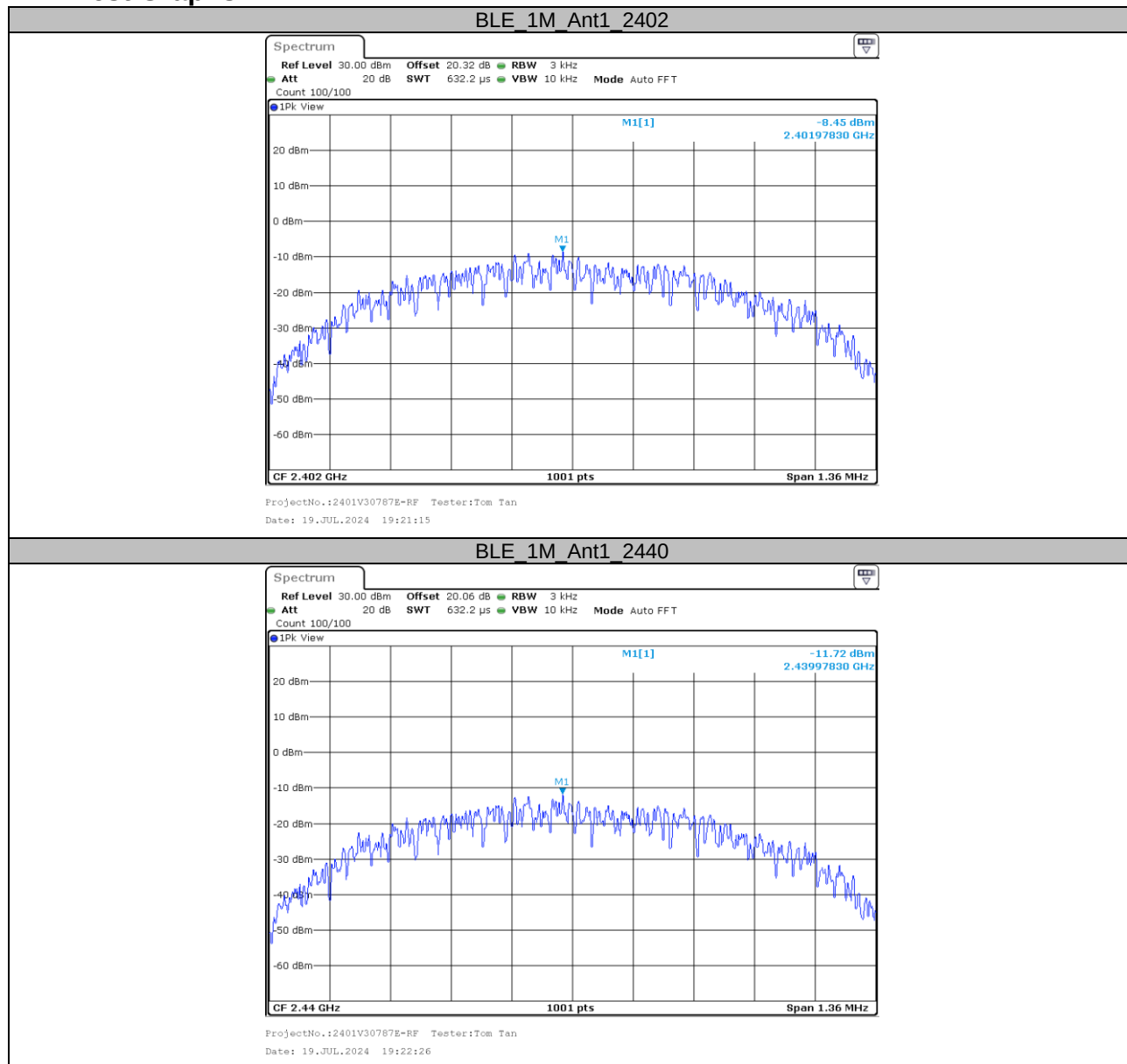


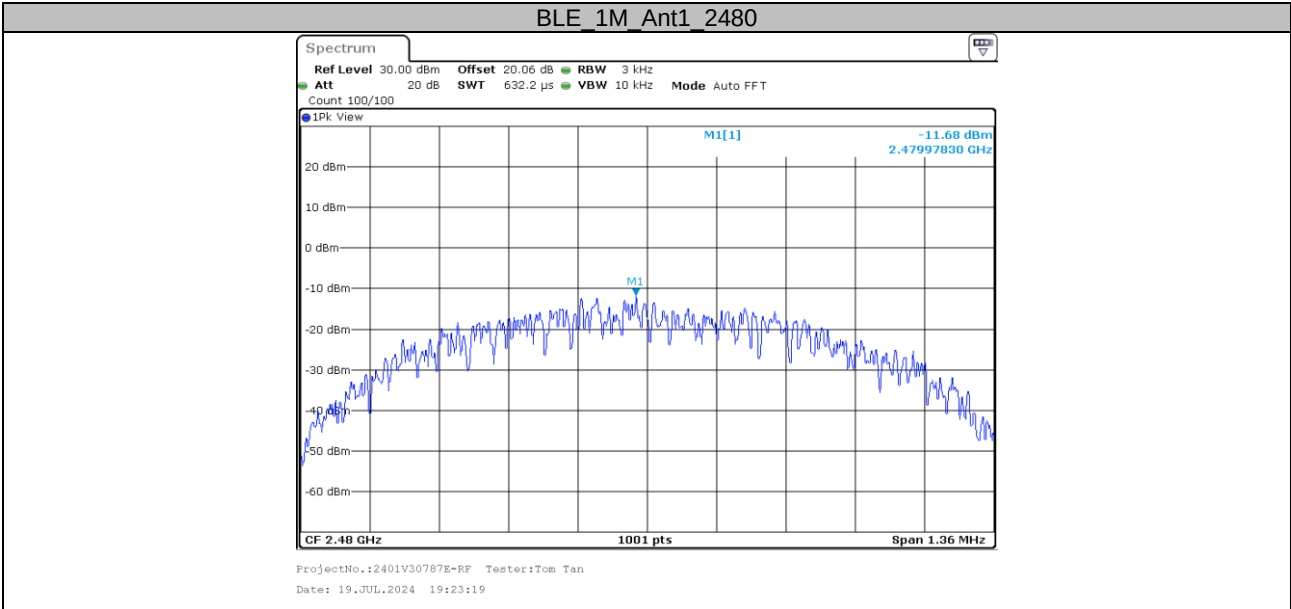
Appendix D: Maximum Power Spectral Density

Test Result

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-8.45	≤8.00	PASS
		2440	-11.72	≤8.00	PASS
		2480	-11.68	≤8.00	PASS

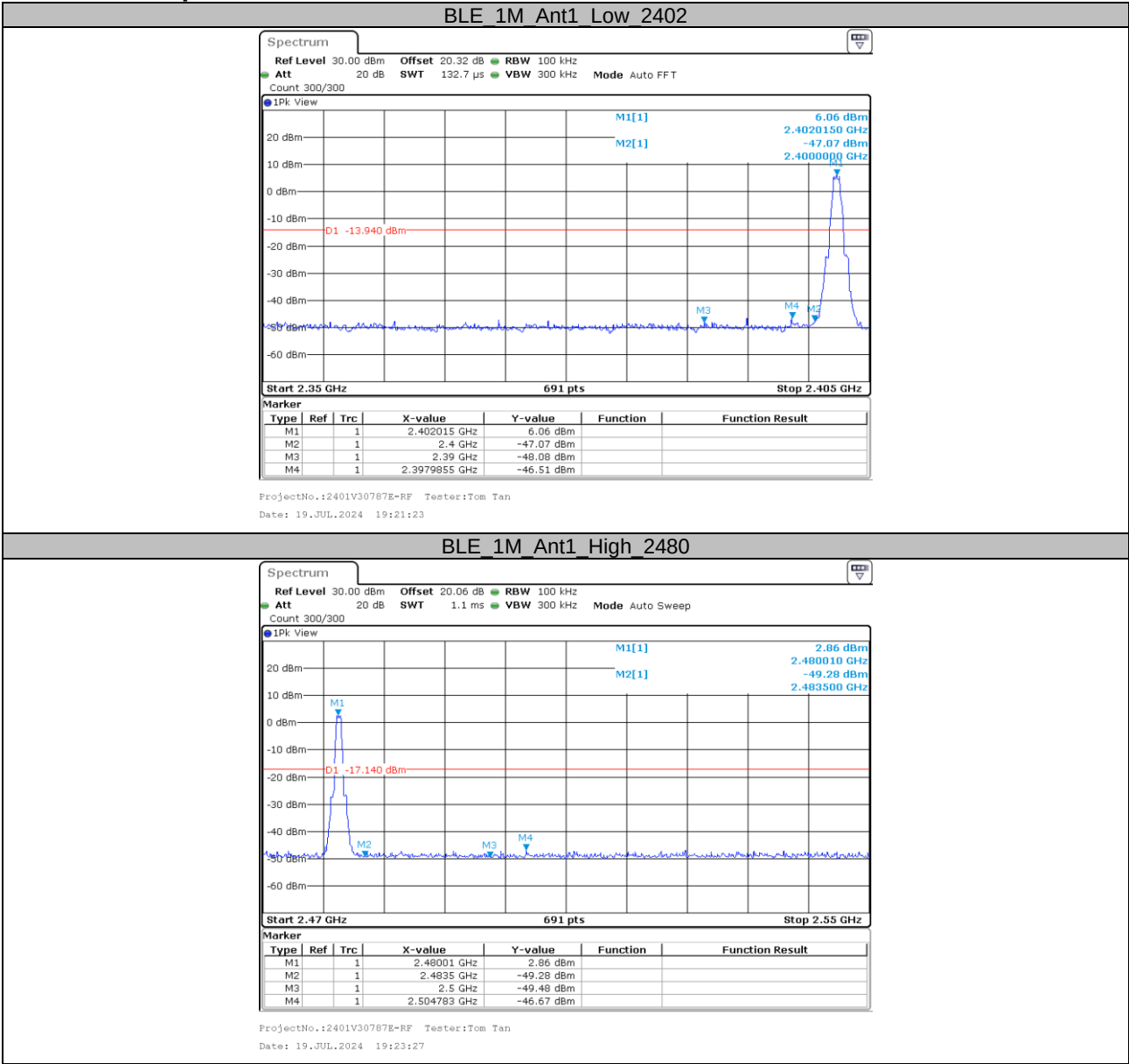
Test Graphs





Appendix E: Band Edge Measurements

Test Graphs

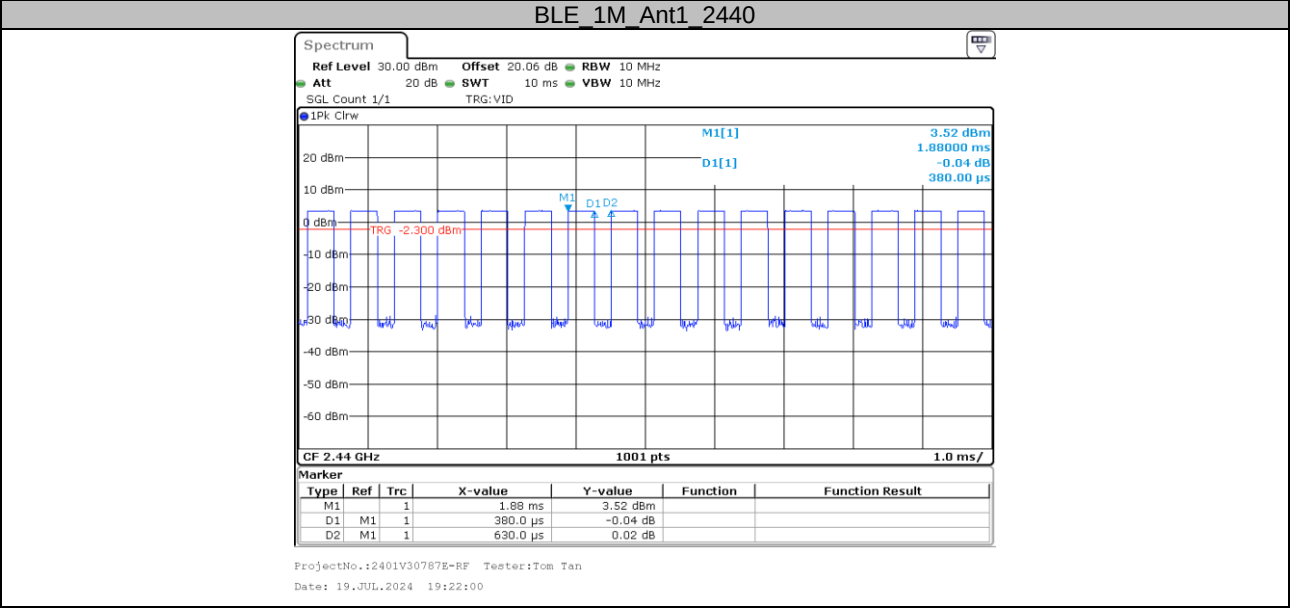


Appendix F: Duty Cycle

Test Result

Test Mode	Antenna	Frequency[MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]	1/T[Hz]	VBW Setting [Hz]
BLE_1M	Ant1	2440	0.38	0.63	60.32	2.20	2632	3000

Test Graphs



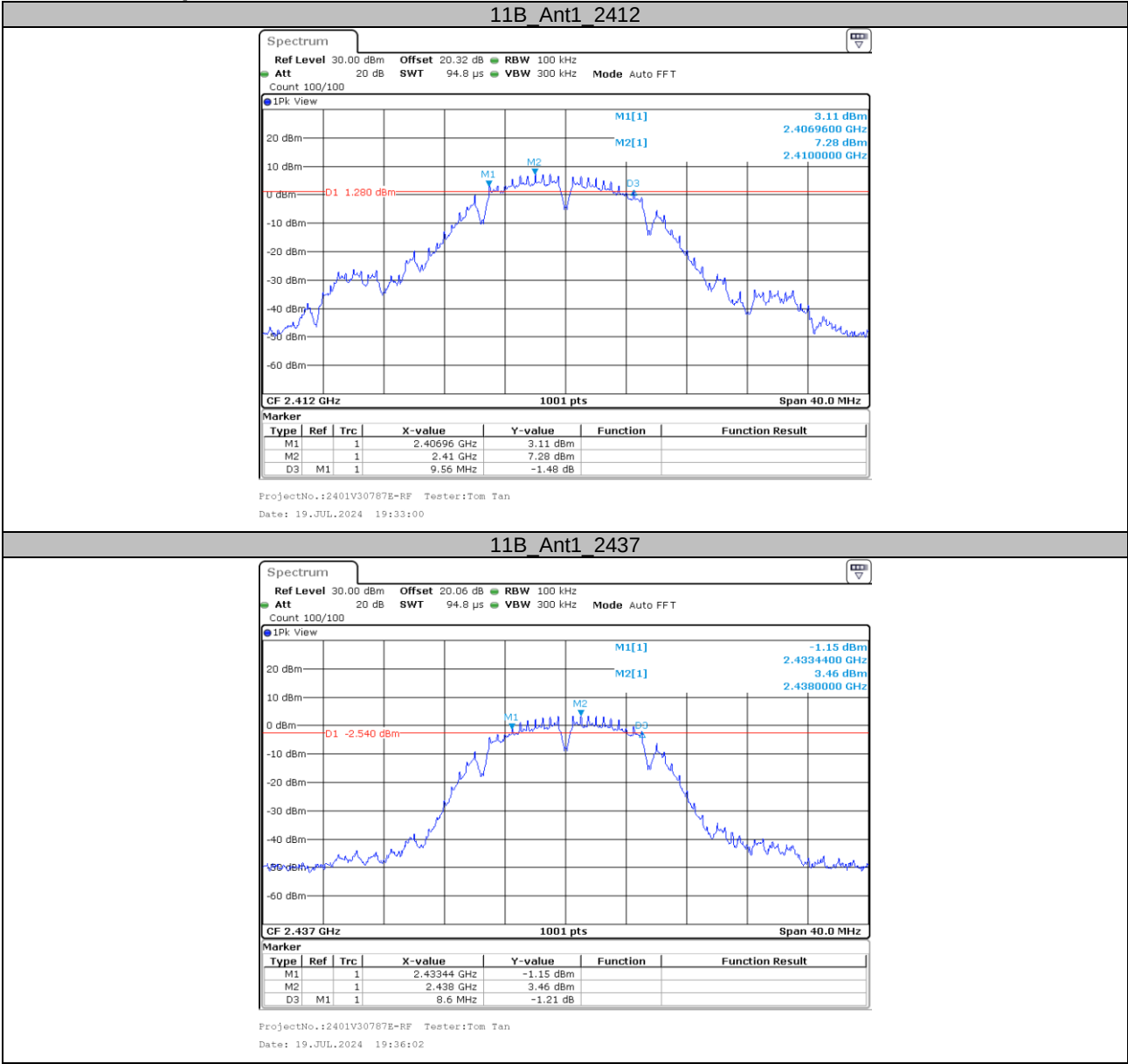
APPENDIX – 2.4G Wi-Fi

Appendix A: DTS Bandwidth

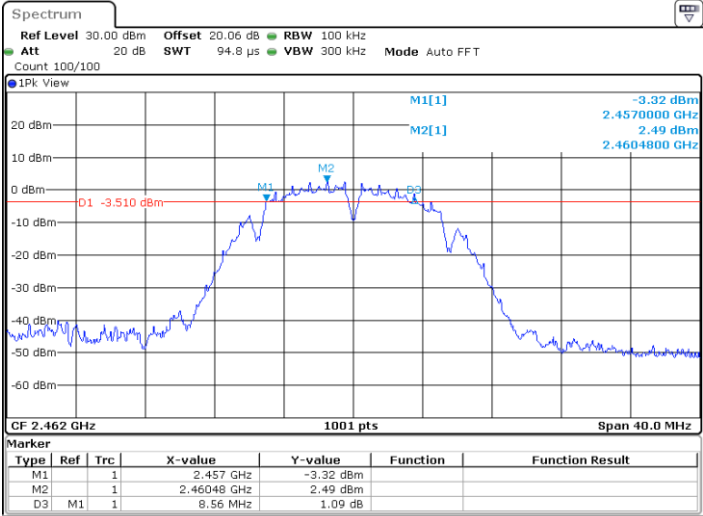
Test Result

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	9.56	2406.96	2416.52	0.5	PASS
		2437	8.60	2433.44	2442.04	0.5	PASS
		2462	8.56	2457.00	2465.56	0.5	PASS
11G	Ant1	2412	15.72	2403.80	2419.52	0.5	PASS
		2437	15.68	2429.48	2445.16	0.5	PASS
		2462	15.68	2453.84	2469.52	0.5	PASS
11N20SISO	Ant1	2412	16.36	2403.20	2419.56	0.5	PASS
		2437	16.36	2429.44	2445.80	0.5	PASS
		2462	16.36	2453.20	2469.56	0.5	PASS
11N40SISO	Ant1	2422	35.76	2403.84	2439.60	0.5	PASS
		2437	34.16	2420.76	2454.92	0.5	PASS
		2452	33.84	2435.76	2469.60	0.5	PASS

Test Graphs

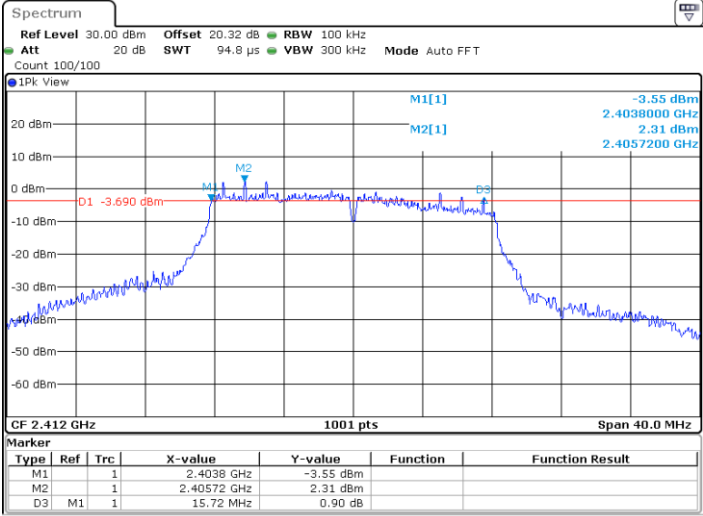


11B_Ant1_2462



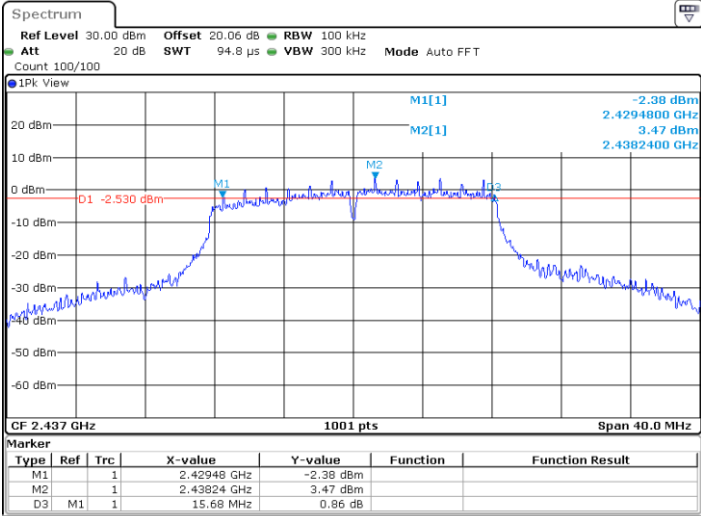
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:37:48

11G_Ant1_2412



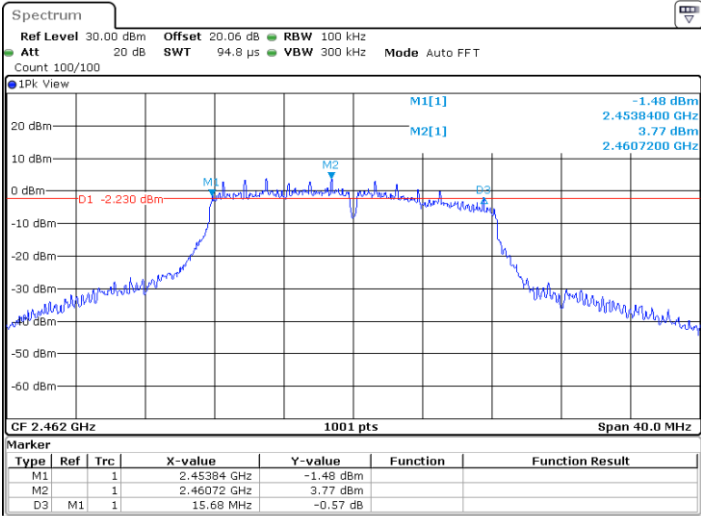
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Date: 19.JUL.2024 19:47:40

11G_Ant1_2437



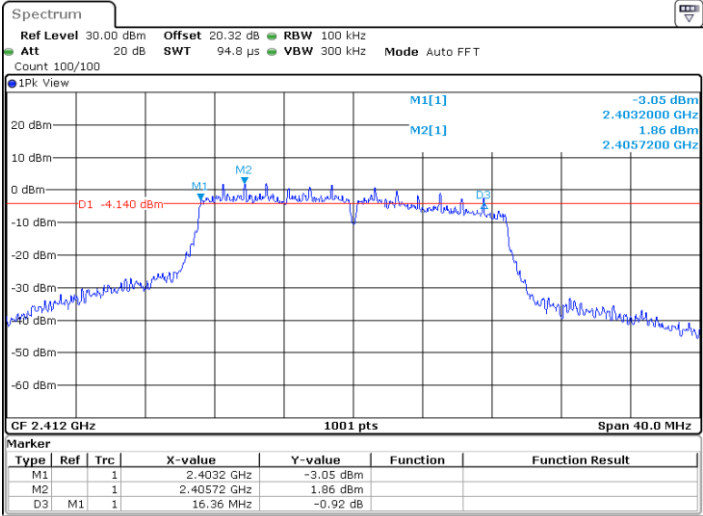
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Date: 19.JUL.2024 19:48:54

11G_Ant1_2462



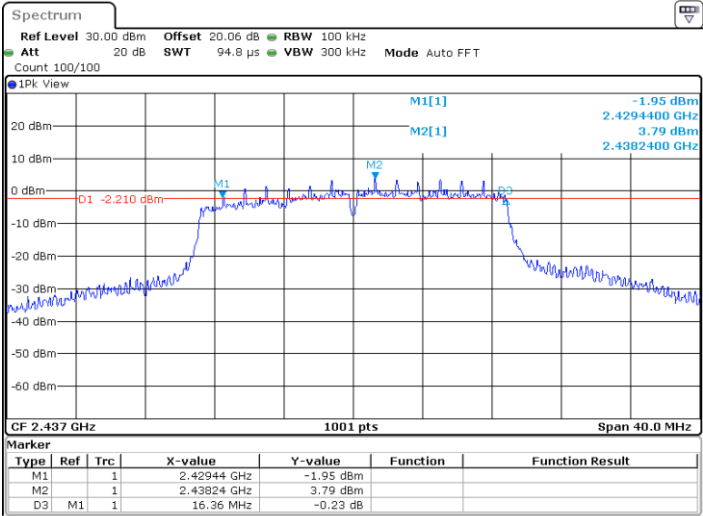
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Date: 19.JUL.2024 19:49:52

11N20SISO Ant1 2412



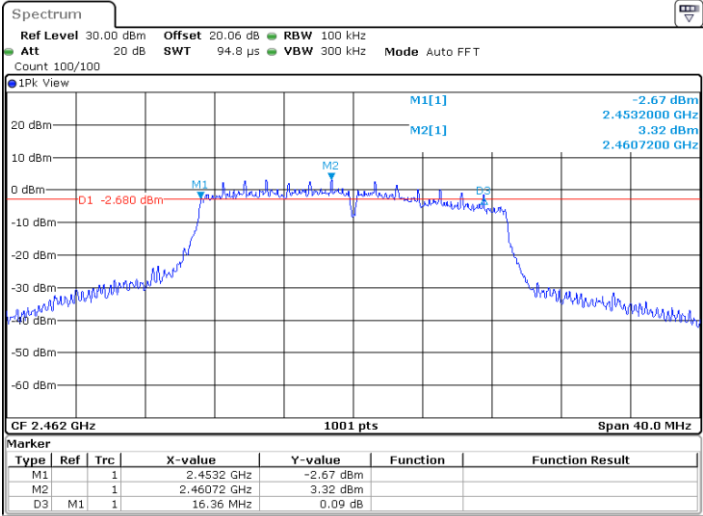
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:51:05

11N20SISO Ant1 2437



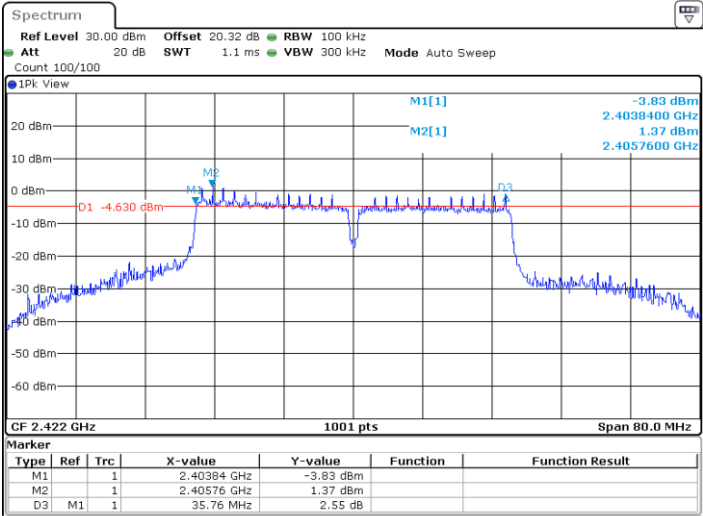
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Date: 19.JUL.2024 19:52:36

11N20SISO_Ant1_2462



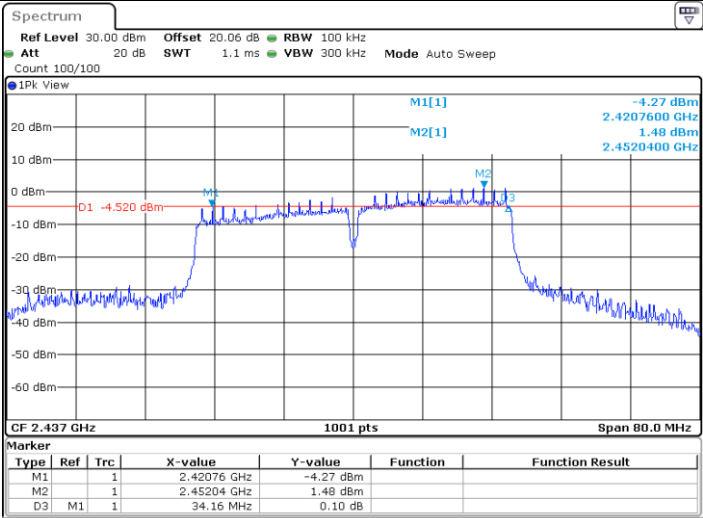
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:53:28

11N40SISO_Ant1_2422



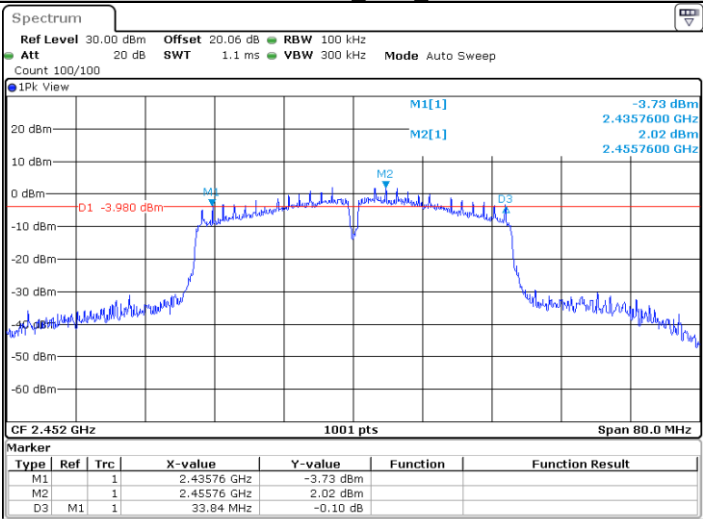
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:54:37

11N40SISO_Ant1_2437



ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:55:48

11N40SISO_Ant1_2452

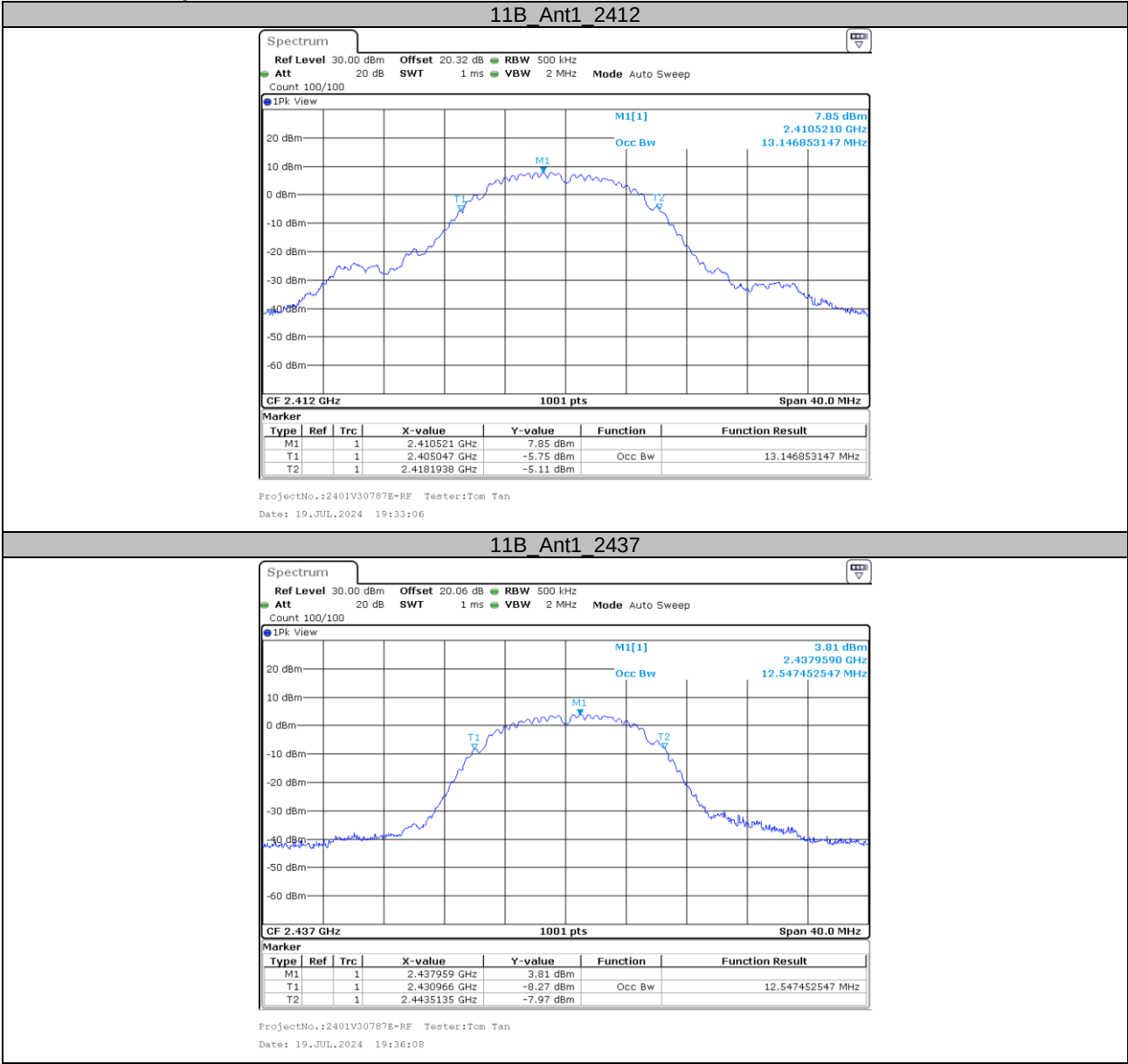


ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:56:47

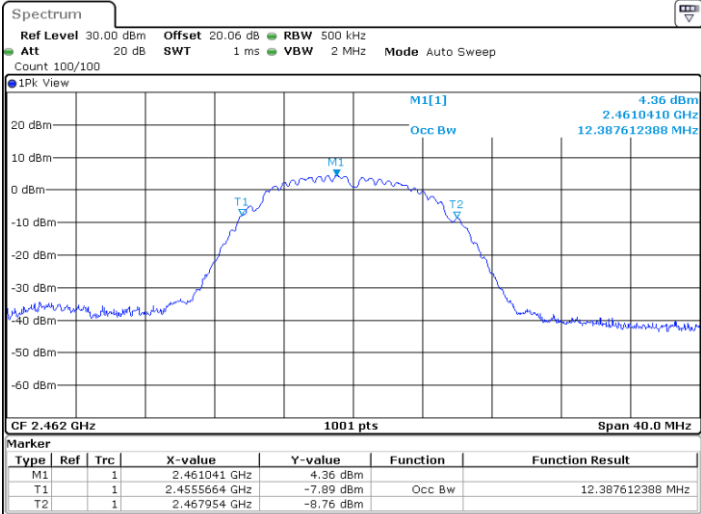
Appendix B: Occupied Channel Bandwidth**Test Result**

Test Mode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.147	2405.0470	2418.1938	---	---
		2437	12.547	2430.9660	2443.5135	---	---
		2462	12.388	2455.5664	2467.9540	---	---
11G	Ant1	2412	17.423	2402.9291	2420.3516	---	---
		2437	17.582	2428.5285	2446.1109	---	---
		2462	17.263	2453.1289	2470.3916	---	---
11N20SISO	Ant1	2412	18.102	2402.6893	2420.7912	---	---
		2437	18.302	2428.1289	2446.4306	---	---
		2462	18.022	2452.8092	2470.8312	---	---
11N40SISO	Ant1	2422	38.042	2402.7393	2440.7812	---	---
		2437	36.683	2419.0180	2455.7013	---	---
		2452	35.564	2434.3377	2469.9021	---	---

Test Graphs

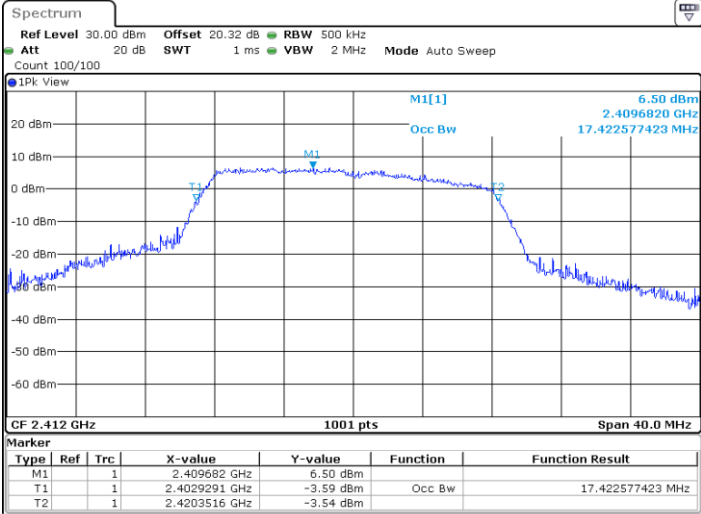


11B_Ant1_2462



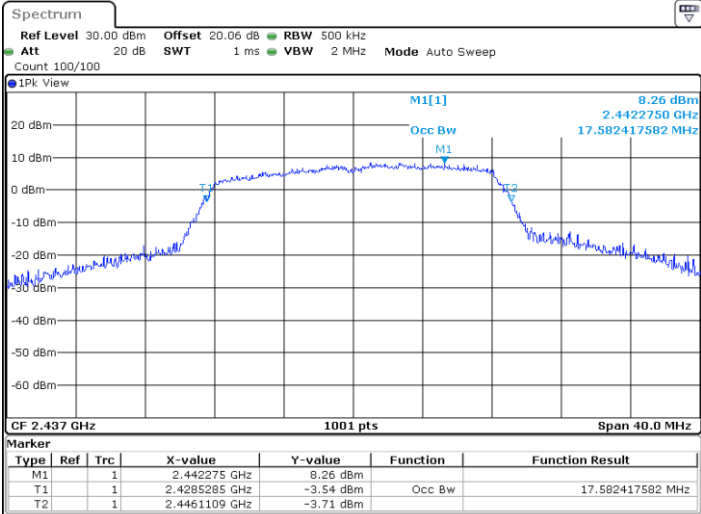
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Date: 19.JUL.2024 19:37:54

11G_Ant1_2412



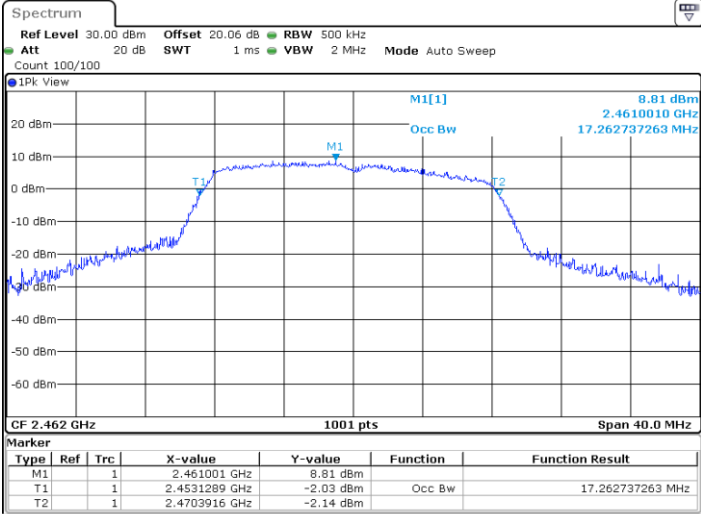
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Date: 19.JUL.2024 19:47:46

11G_Ant1_2437



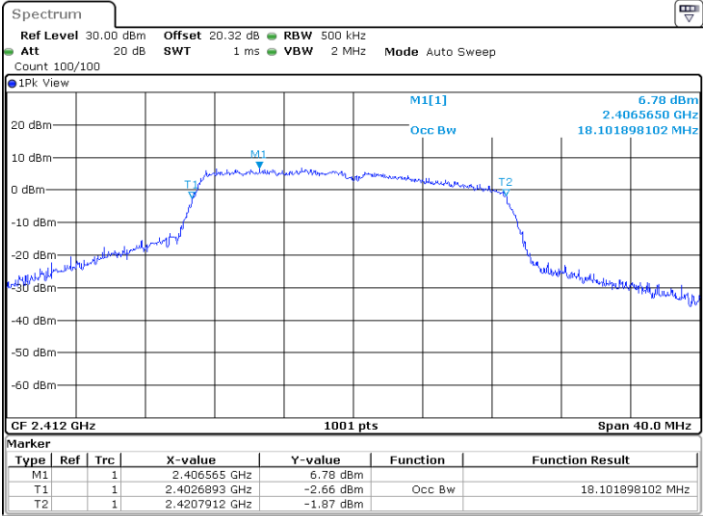
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11G_Ant1_2462



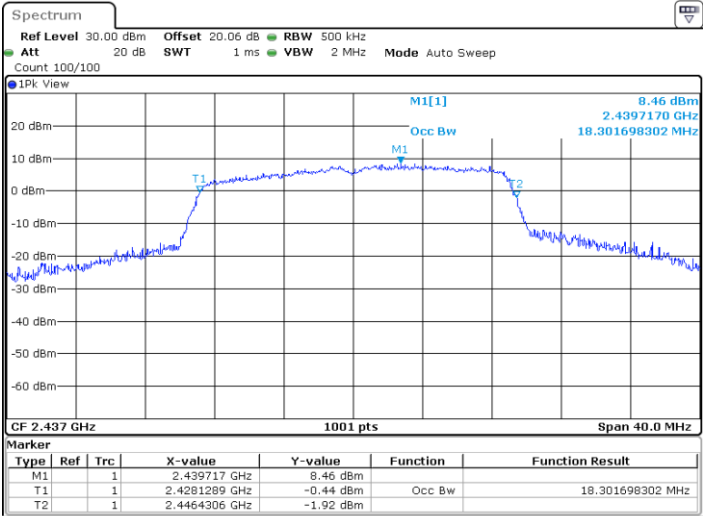
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:49:58

11N20SISO Ant1 2412



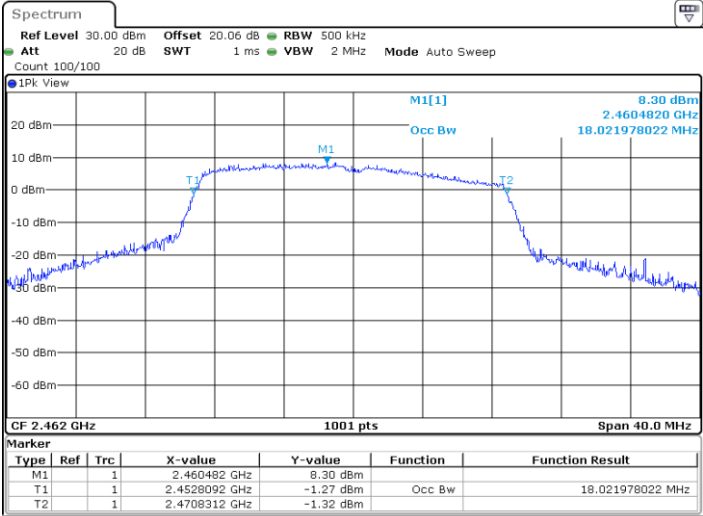
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:51:11

11N20SISO Ant1 2437



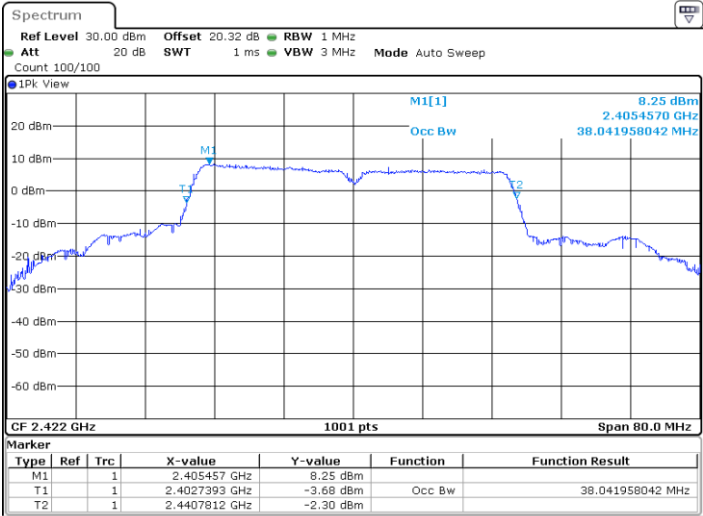
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:52:42

11N20SISO Ant1 2462



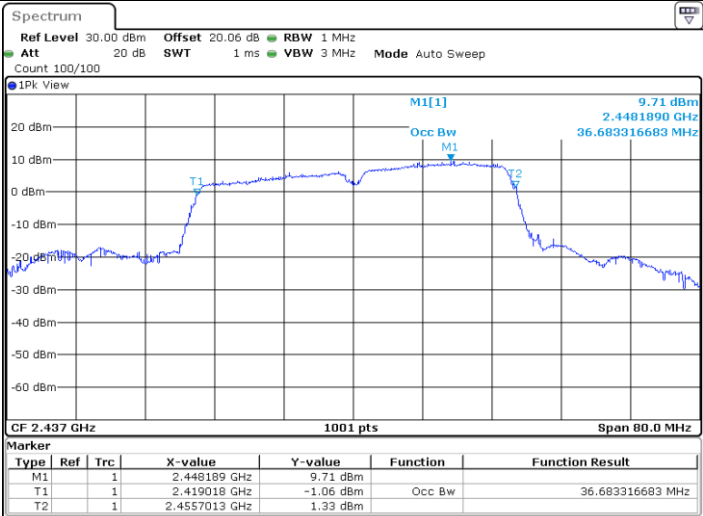
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:53:33

11N40SISO Ant1 2422



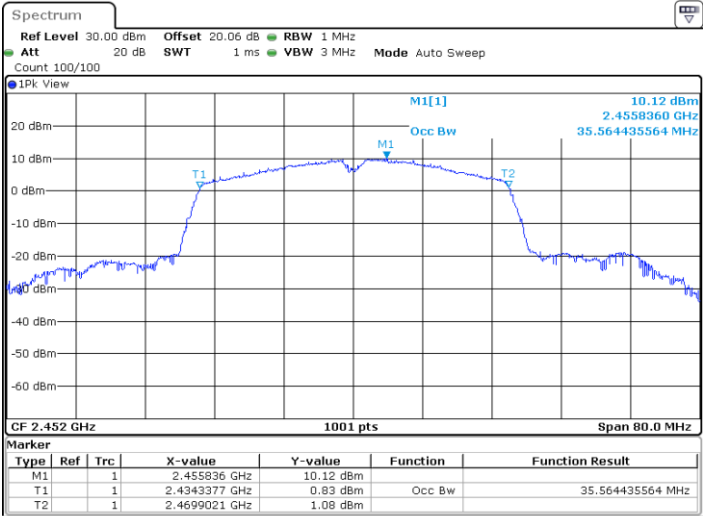
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:54:42

11N40SISO Ant1 2437



ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:55:53

11N40SISO Ant1 2452



ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:56:53

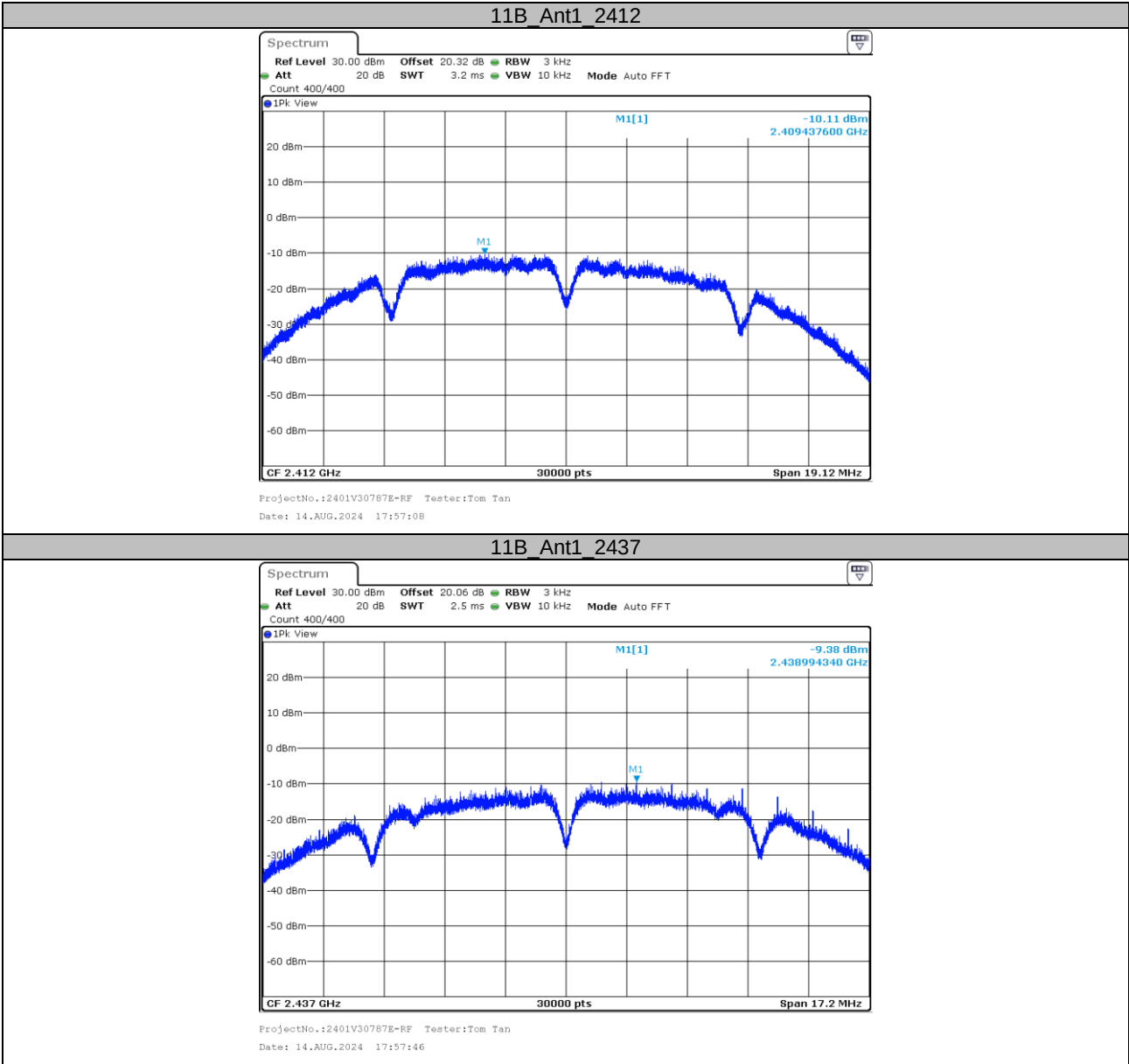
Appendix C: Maximum Conducted Output Power**Test Result**

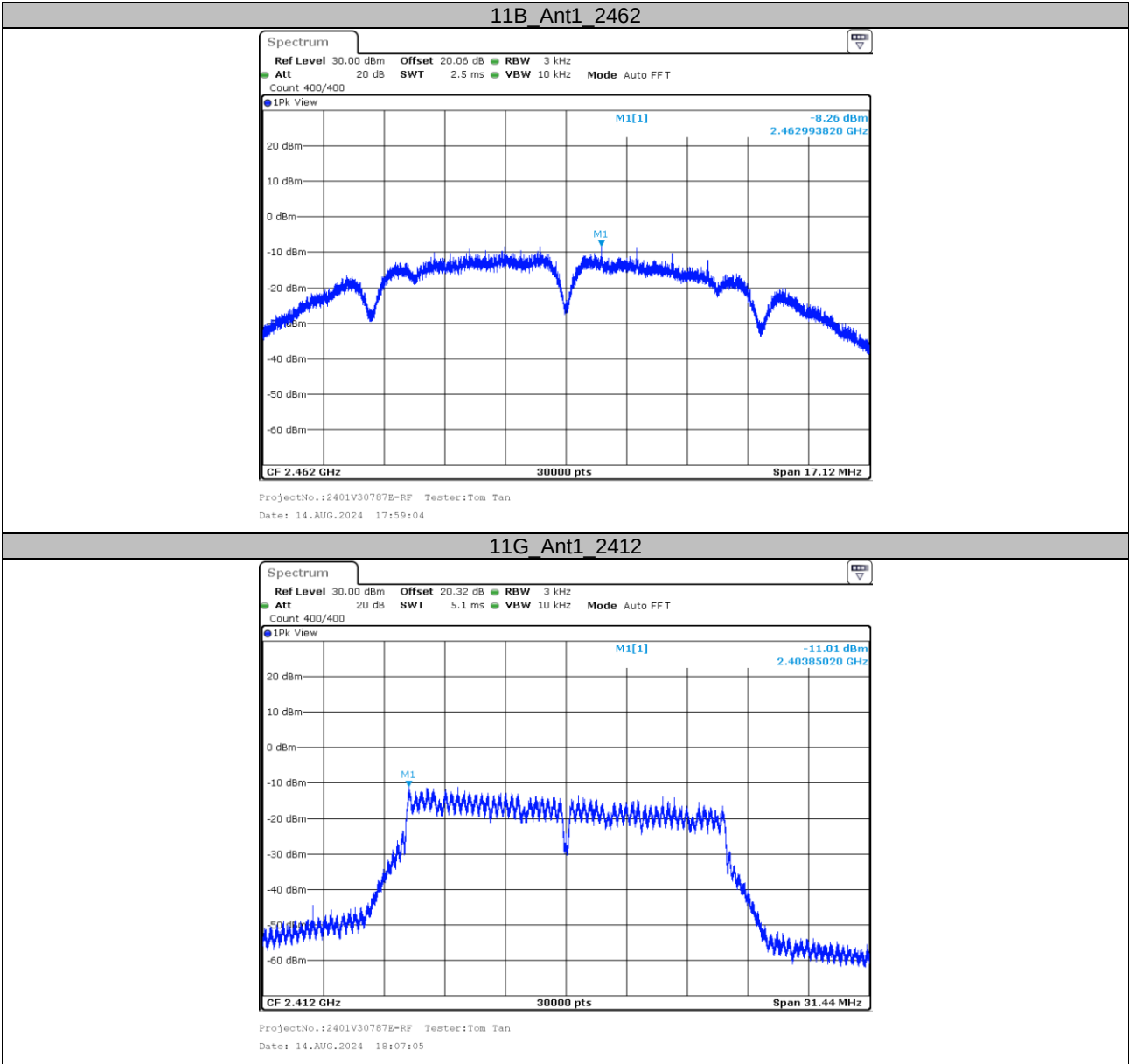
Test Mode	Antenna	Frequency [MHz]	Average Power [dBm]	Peak Power [dBm]	Conducted Limit [dBm]	Verdict
11B	Ant1	2412	12.56	15.16	≤30.00	PASS
		2437	12.57	15.18	≤30.00	PASS
		2462	12.90	15.47	≤30.00	PASS
11G	Ant1	2412	12.43	19.72	≤30.00	PASS
		2437	14.22	21.36	≤30.00	PASS
		2462	14.23	21.49	≤30.00	PASS
11N20SISO	Ant1	2412	12.53	19.71	≤30.00	PASS
		2437	14.42	21.57	≤30.00	PASS
		2462	14.26	21.41	≤30.00	PASS
11N40SISO	Ant1	2422	13.50	21.20	≤30.00	PASS
		2437	14.01	21.07	≤30.00	PASS
		2452	14.62	21.85	≤30.00	PASS

Appendix D: Maximum Power Spectral Density**Test Result**

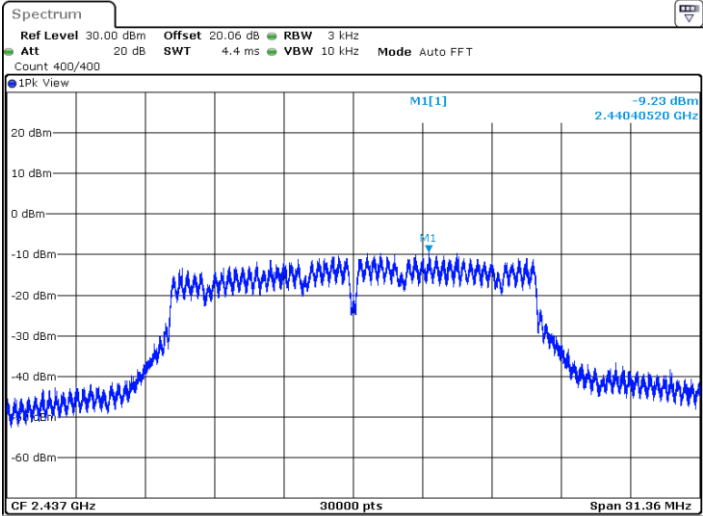
Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-10.11	≤8.00	PASS
		2437	-9.38	≤8.00	PASS
		2462	-8.26	≤8.00	PASS
11G	Ant1	2412	-11.01	≤8.00	PASS
		2437	-9.23	≤8.00	PASS
		2462	-8.88	≤8.00	PASS
11N20SISO	Ant1	2412	-9.49	≤8.00	PASS
		2437	-9.45	≤8.00	PASS
		2462	-8.62	≤8.00	PASS
11N40SISO	Ant1	2422	-10.71	≤8.00	PASS
		2437	-11.48	≤8.00	PASS
		2452	-11.36	≤8.00	PASS

Test Graphs



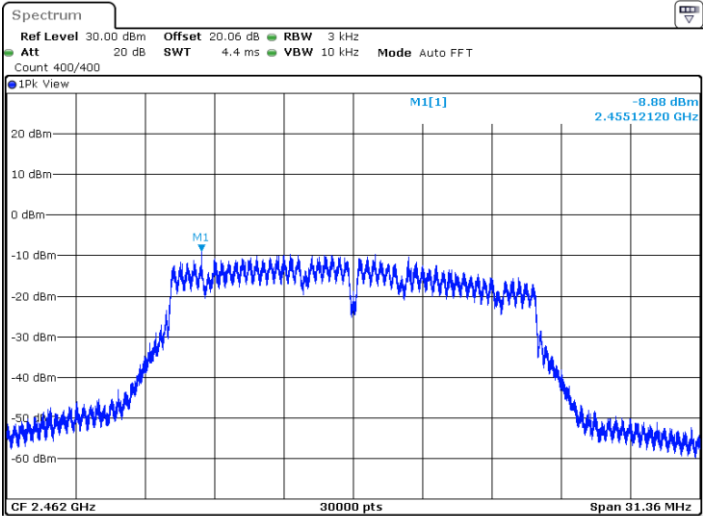


11G_Ant1_2437



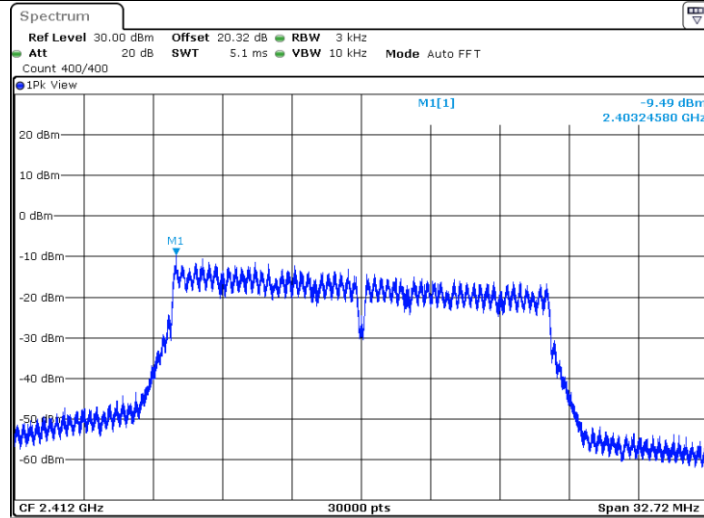
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:08:16

11G_Ant1_2462



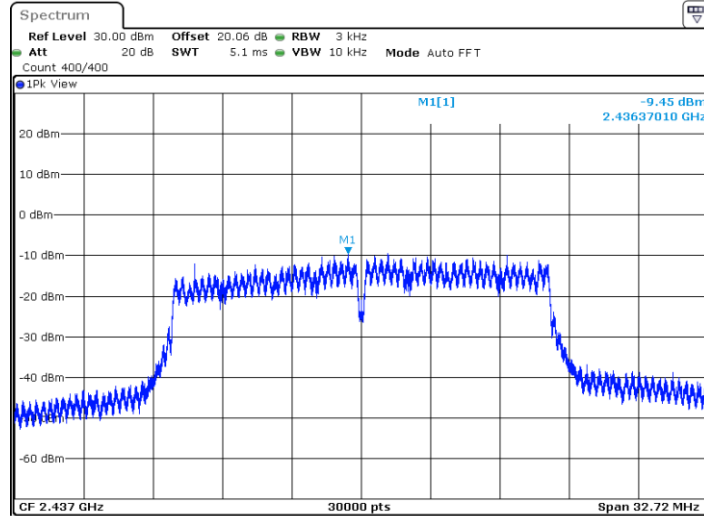
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:09:21

11N20SISO_Ant1_2412



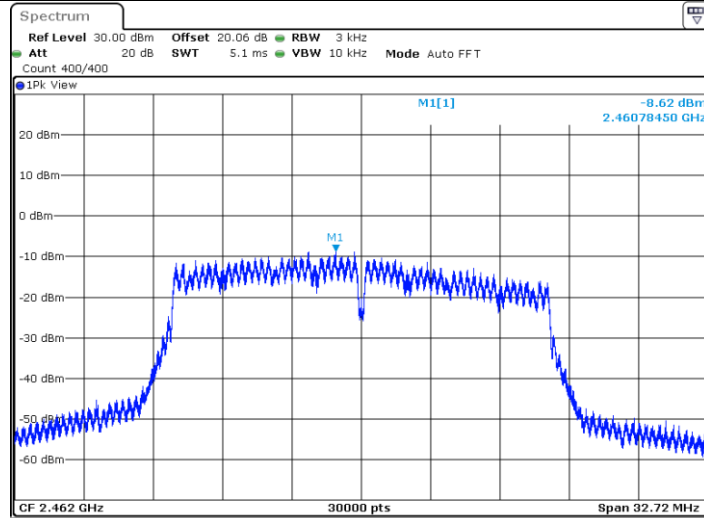
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:10:33

11N20SISO_Ant1_2437



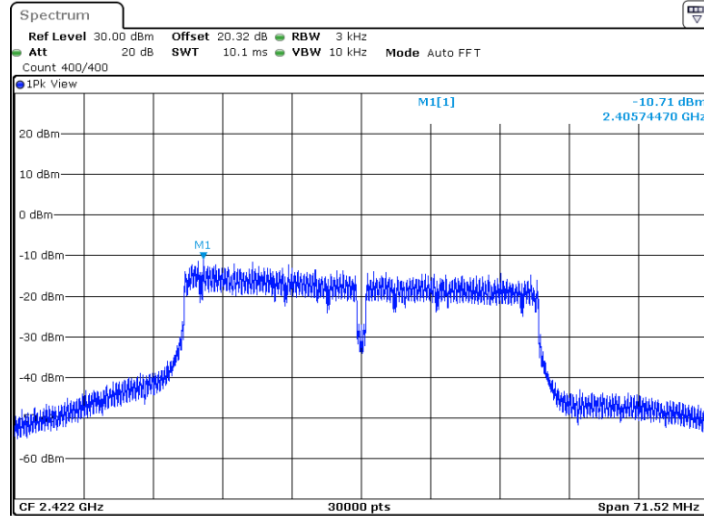
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:11:41

11N20SISO Ant1 2462



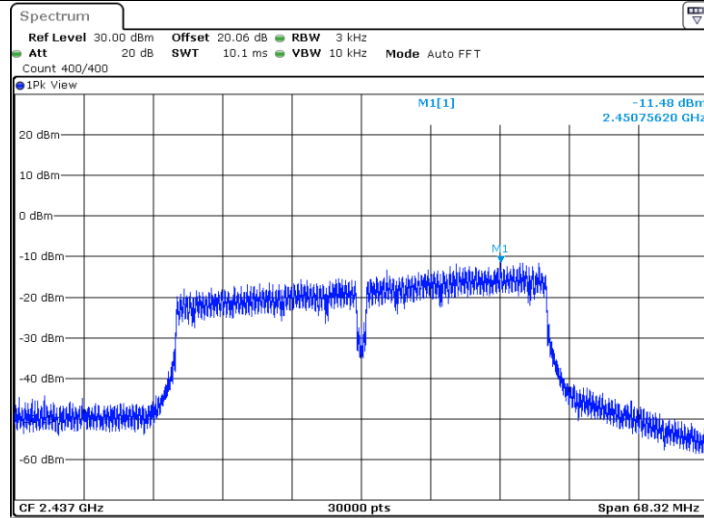
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:13:34

11N40SISO Ant1 2422



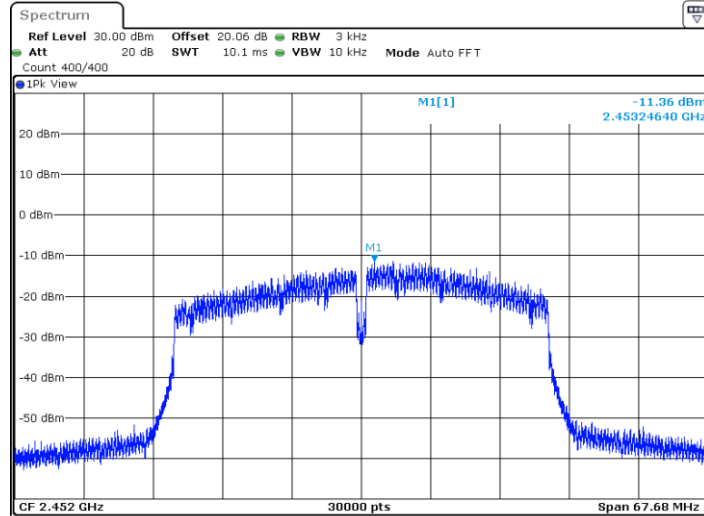
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:23:04

11N40SISO_Ant1_2437



ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:24:11

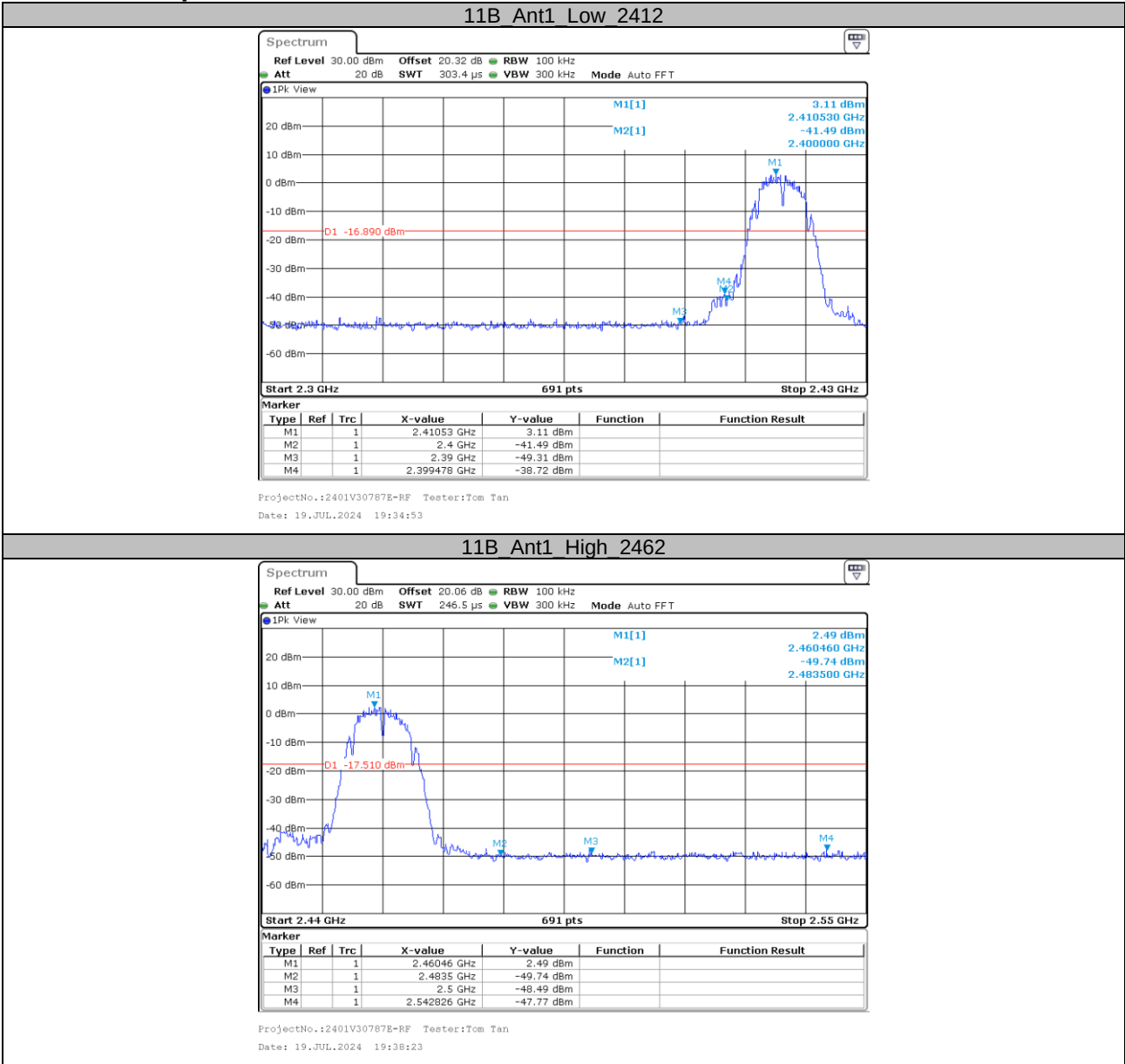
11N40SISO_Ant1_2452



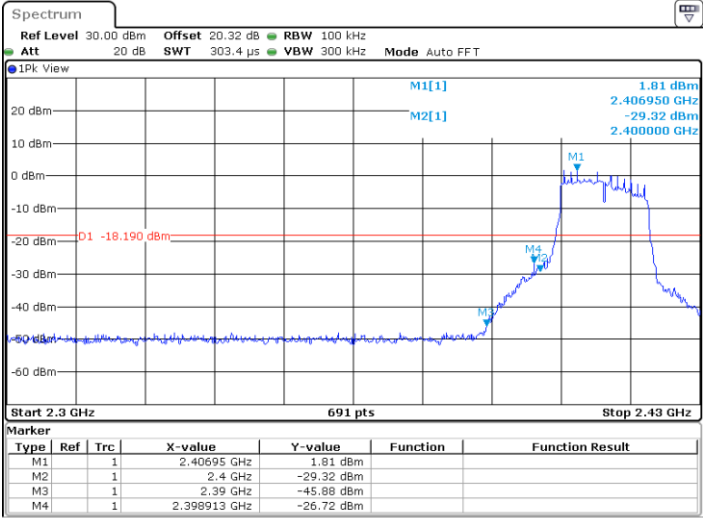
ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 14.AUG.2024 18:25:52

Appendix E: Band Edge Measurements

Test Graphs

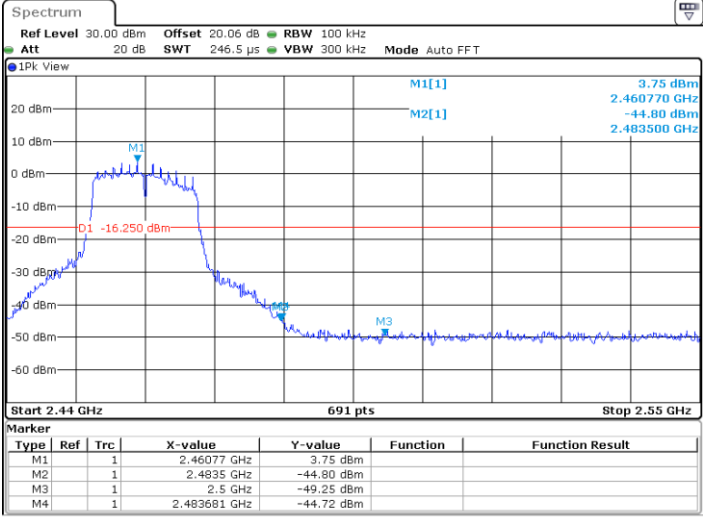


11G Ant1 Low 2412

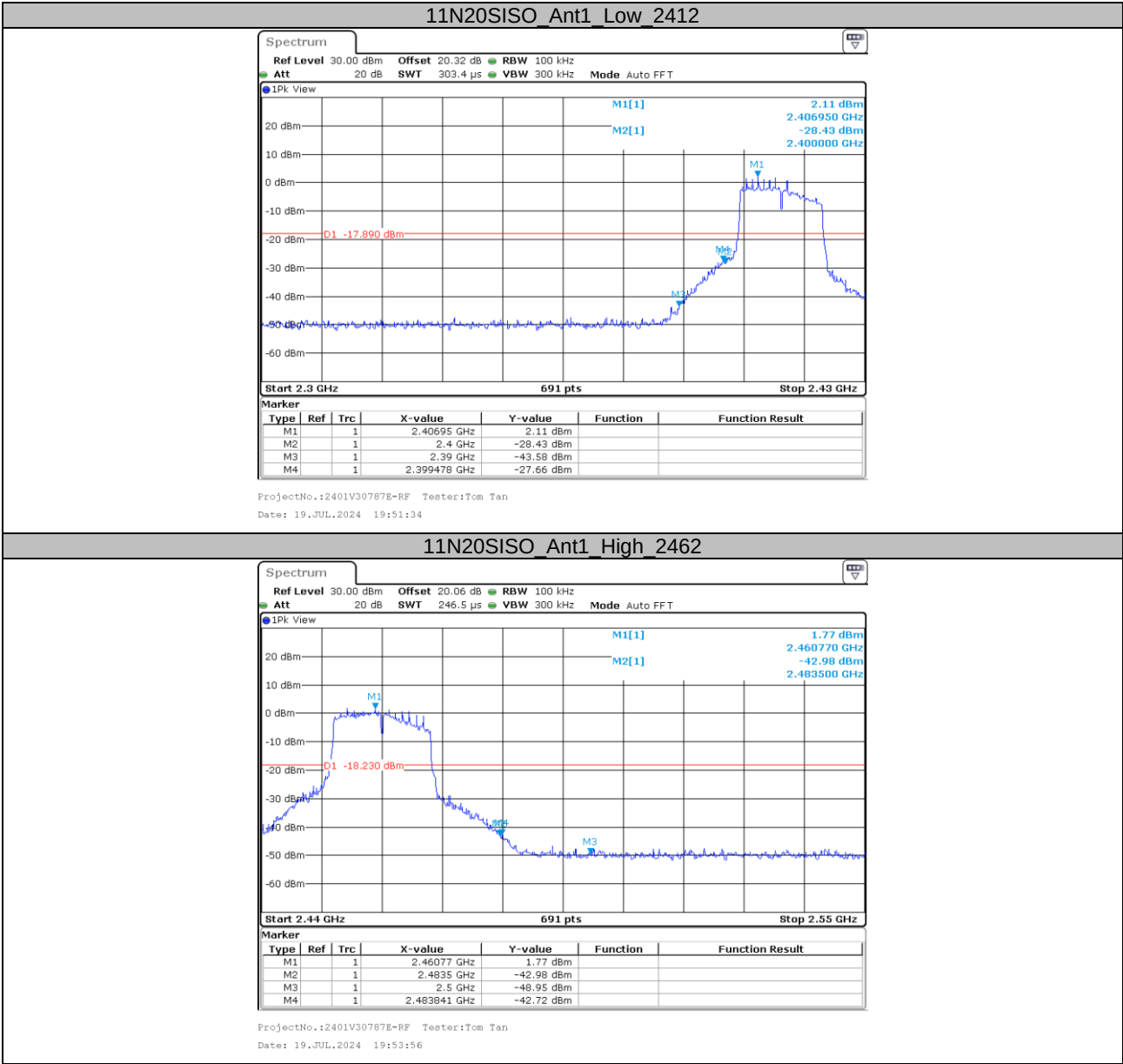


ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:48:09

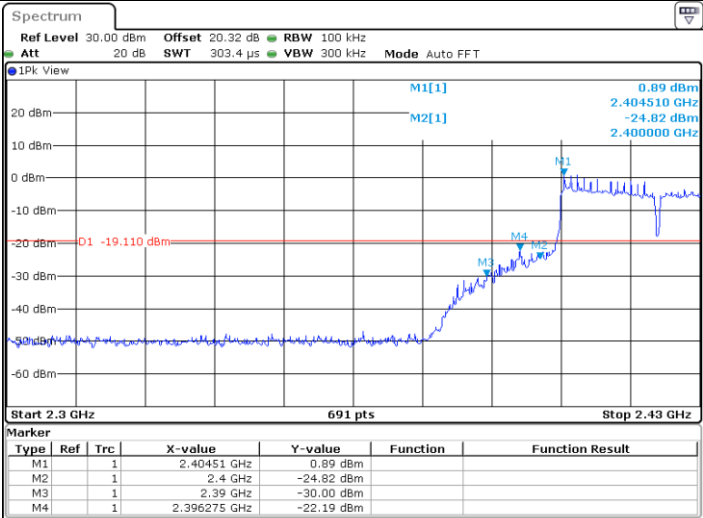
11G Ant1 High 2462



ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:50:21

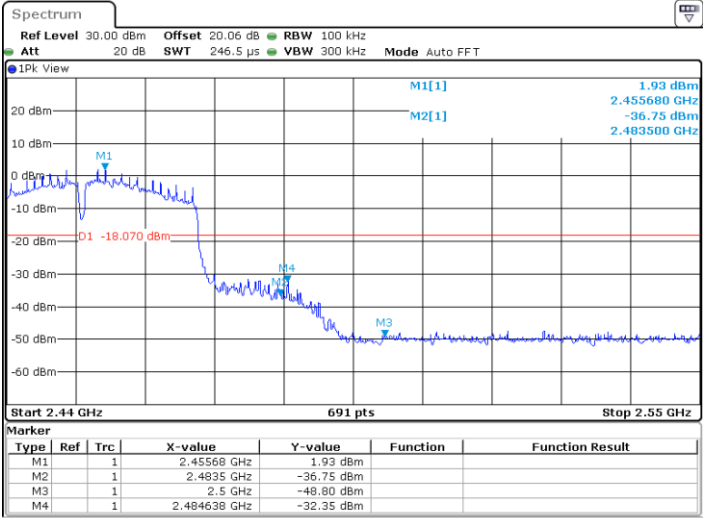


11N40SISO_Ant1_Low_2422



ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:55:08

11N40SISO_Ant1_High_2452



ProjectNo.:2401V30787E-RF Tester:Tom Tan
Date: 19.JUL.2024 19:57:19

Appendix F: Duty Cycle

Test Result

Test Mode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T[Hz]	VBW Setting [Hz]
11B	Ant1	2437	8.38	8.41	99.64	/	10
11G	Ant1	2437	1.39	1.43	97.20	719	1000
11N20SISO	Ant1	2437	1.29	1.33	96.99	775	1000
11N40SISO	Ant1	2437	0.65	0.68	95.59	1538	2000

Test Graphs

