

TEST REPORT

Applicant Name: Shenzhen VTU Systems Co., Ltd.
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Report Number: 2401S24086-RF-00B
FCC ID: 2AY3C-VT988

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type: 4G Body Worn Camera
Model No.: VT988
Multiple Model(s) No.: VT980, VT990, iTALK-BC8
Trade Mark: VtuRola
Date Received: 2024/04/10
Issue Date: 2024/06/26

Test Result:

Pass▲

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

Prepared and Checked By:

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Jojo Guo
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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TABLE OF CONTENTS

DOCUMENT REVISION HISTORY	4
GENERAL INFORMATION.....	5
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	5
OBJECTIVE	5
TEST METHODOLOGY	5
MEASUREMENT UNCERTAINTY	6
TEST FACILITY	6
SYSTEM TEST CONFIGURATION	7
DESCRIPTION OF TEST CONFIGURATION	7
EQUIPMENT MODIFICATIONS	8
EUT EXERCISE SOFTWARE	8
DUTY CYCLE	8
SUPPORT EQUIPMENT LIST AND DETAILS	11
EXTERNAL I/O CABLE.....	11
BLOCK DIAGRAM OF TEST SETUP	11
SUMMARY OF TEST RESULTS	14
TEST EQUIPMENT LIST	15
FCC§15.247 (I), §1.1307 (B) (1) & §2.1093 - RF EXPOSURE.....	17
APPLICABLE STANDARD	17
MEASUREMENT RESULT	17
FCC §15.203 - ANTENNA REQUIREMENT.....	18
APPLICABLE STANDARD	18
ANTENNA CONNECTOR CONSTRUCTION	18
FCC §15.207 (A) - AC LINE CONDUCTED EMISSIONS	19
APPLICABLE STANDARD	19
EUT SETUP	19
EMI TEST RECEIVER SETUP.....	19
TEST PROCEDURE	19
FACTOR & OVER LIMIT CALCULATION.....	20
TEST DATA	20
FCC §15.209, §15.205 & §15.247(D) - SPURIOUS EMISSIONS	32
APPLICABLE STANDARD	32
EUT SETUP	32
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	33
TEST PROCEDURE	34
FACTOR & OVER LIMIT/MARGIN CALCULATION	34
TEST DATA	34
FCC §15.247(A) (2) - 6 DB EMISSION BANDWIDTH.....	58
APPLICABLE STANDARD	58
TEST PROCEDURE	58
TEST DATA	58

FCC §15.247(B) (3) - MAXIMUM CONDUCTED OUTPUT POWER	68
APPLICABLE STANDARD	68
TEST PROCEDURE	68
TEST DATA	69
FCC §15.247(D) - 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE.....	70
APPLICABLE STANDARD	70
TEST PROCEDURE	70
TEST DATA	71
FCC §15.247(E) - POWER SPECTRAL DENSITY.....	76
APPLICABLE STANDARD	76
TEST PROCEDURE	76
TEST DATA	77
EUT PHOTOGRAPHS.....	82
TEST SETUP PHOTOGRAPHS	83
APPENDIX- BLE	84
APPENDIX A: DTS BANDWIDTH	84
APPENDIX B: OCCUPIED CHANNEL BANDWIDTH	86
APPENDIX C: MAXIMUM CONDUCTED OUTPUT POWER.....	88
APPENDIX D: MAXIMUM POWER SPECTRAL DENSITY	90
APPENDIX E: BAND EDGE MEASUREMENTS.....	92
APPENDIX F: DUTY CYCLE	93

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	2401S24086-RF-00B	Original Report	2024/06/26

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	4G Body Worn Camera
Tested Model	VT988
Multiple Model(s)	VT980, VT990, iTALK-BC8
Frequency Range	BLE 1M: 2402-2480MHz Wi-Fi: 2412-2472 MHz
Maximum Conducted Output Peak Power	BLE: -1.15dBm Wi-Fi: 17.97dBm(802.11b), 12.52dBm(802.11g), 12.99dBm(802.11n20) 18.44dBm(802.11n40)
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM
Antenna Specification [#]	-2.42dBi (provided by the applicant)
Voltage Range	DC 3.8V from Battery or DC 5V from Adapter or DC 5V from Charger
Sample serial number	2JMV-3 for Conducted and Radiated Emissions Test 2JMV-1 for RF Conducted Test (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Adapter Information	Model: J121L-0502000IU Input: AC 100-240V~50/60Hz 0.6A Output: DC 5.0V, 2.0A 10.0W
Note: The Multiple models are electrically identical with the test model except for model number and sales channel. Please refer to the declaration letter [#] for more detail, which was provided by manufacturer.	

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 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.

802.11n-HT40 mode was tested with Channel 3, 7 and 11.

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

“QRCT3; cmd.exe”[#] software was used and power level as below. The software and power level was provided by the applicant. 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	17	17	17
802.11g	6Mbps	7	7	7
802.11n20	MCS0	7	7	7
802.11n40	MCS0	12	12	12
BLE	1Mbps	Default	Default	Default

Duty cycle

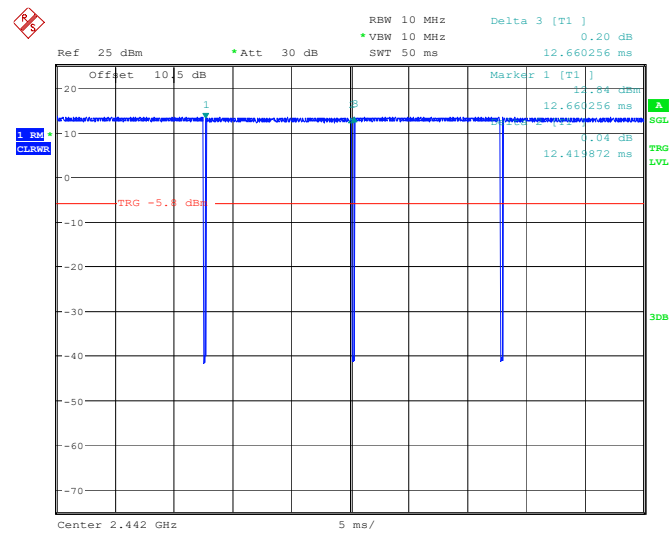
2.4G Wi-Fi:

Test Modes	Ton (ms)	Ton+off (ms)	Duty Cycle (%)	1/T (Hz)	VBW Setting (Hz)
802.11b	12.420	12.660	98.10	/	10
802.11g	2.061	2.104	97.96	485	500
802.11n-HT20	1.728	1.779	97.13	579	1000
802.11n-HT40	0.849	0.905	93.81	1178	3000

BLE: Please refer to the Appendix.

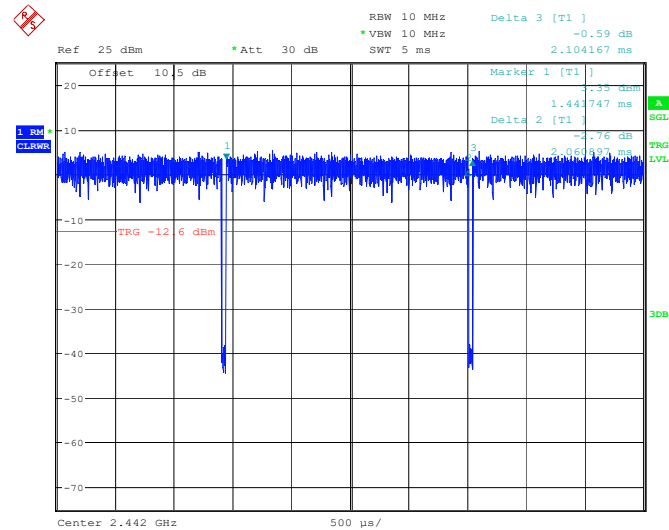
2.4G Wi-Fi:

802.11b



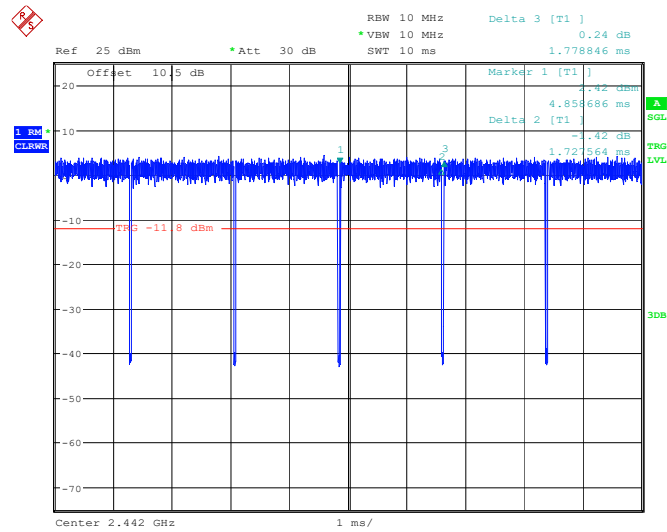
ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:06:49

802.11g



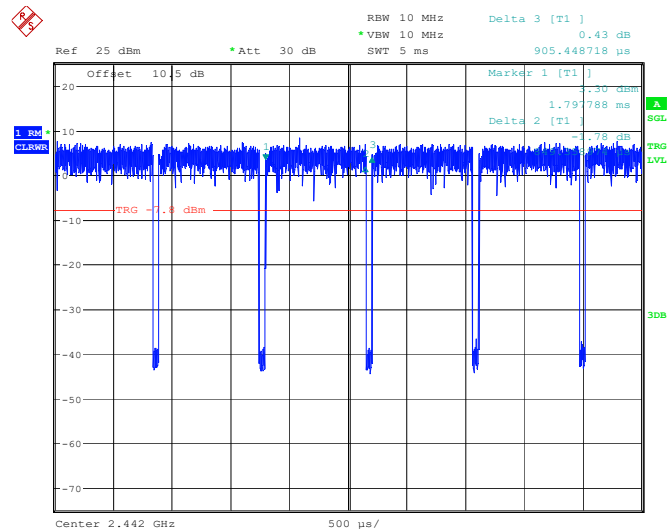
ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:31:32

802.11n20



ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:45:33

802.11n40



ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:57:09

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Bull	Receptacle	Unknown	Unknown
VTU	Battery	VTBP-980A	898224010309

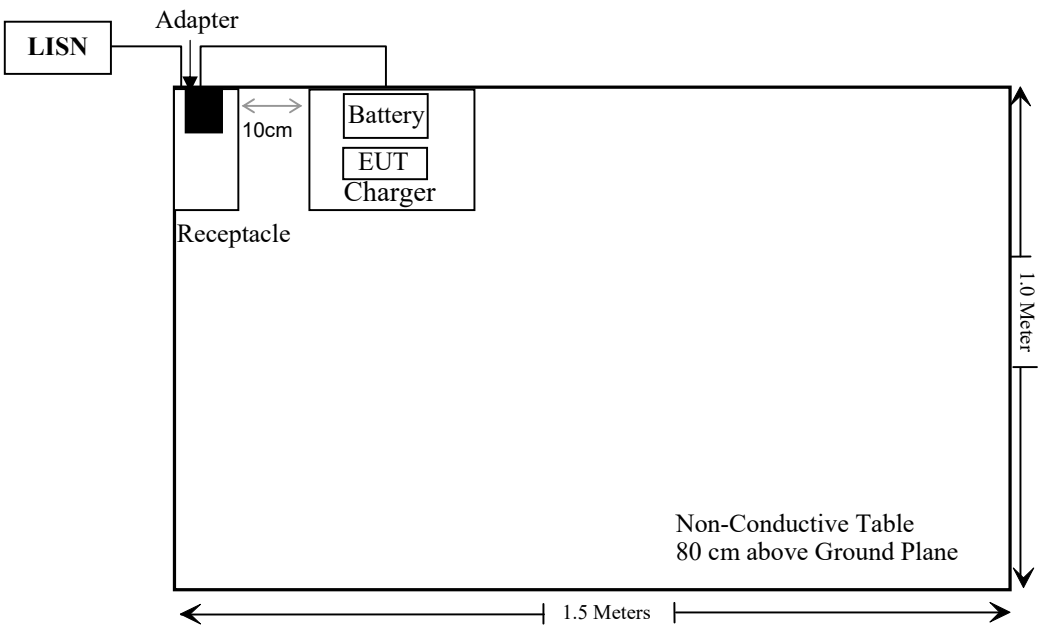
External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter
Shielding Detachable USB Cable	1.0	Charger	Adapter
Un-shielding Un-Detachable AC Cable	1.5	Receptacle	LISN
Shielding Un-Detachable AC Cable	1.5	Receptacle	AC Mains

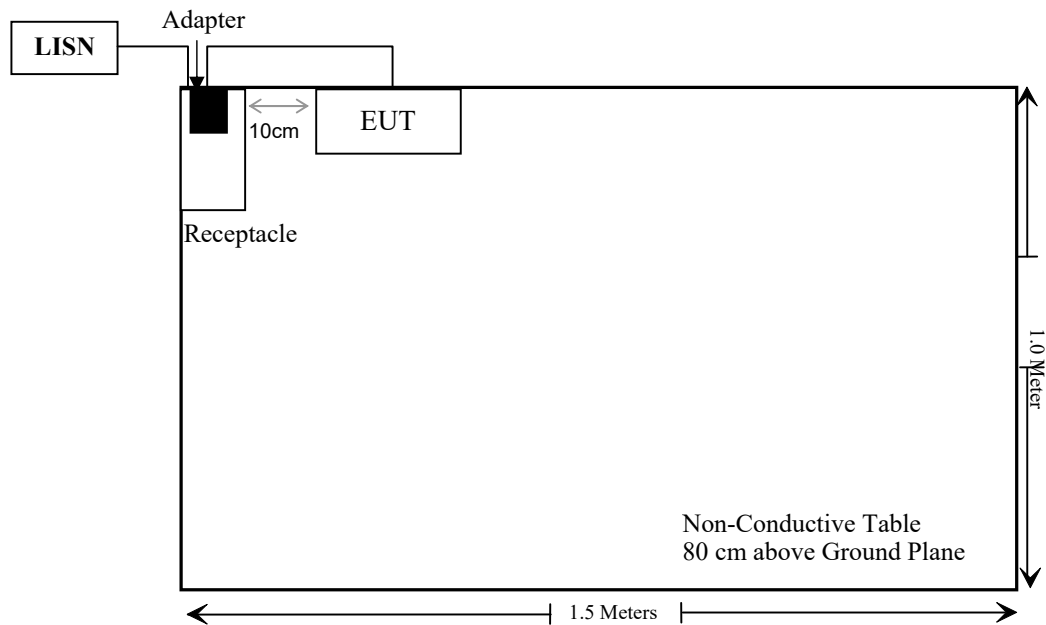
Block Diagram of Test Setup

For Conducted Emissions:

Charger:

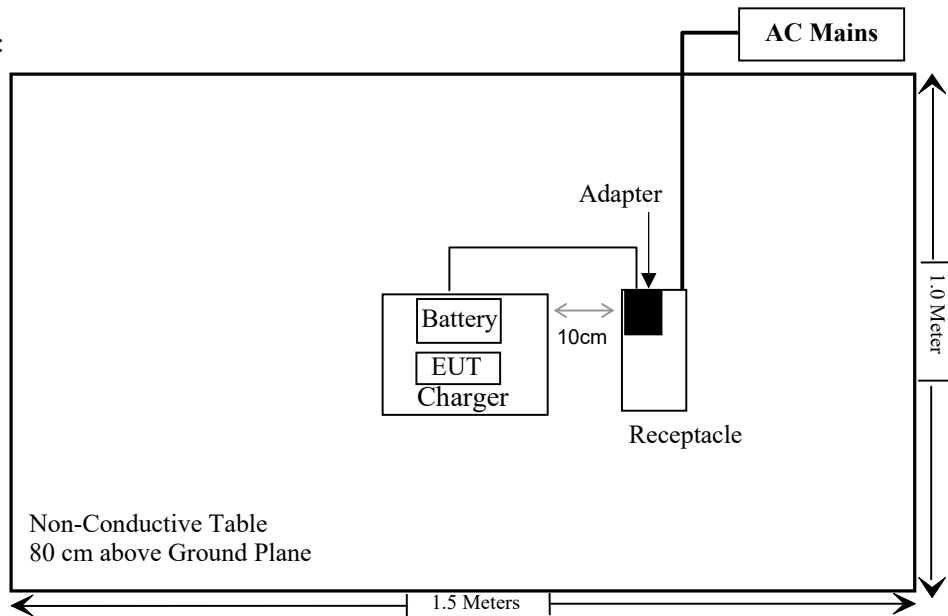


USB:

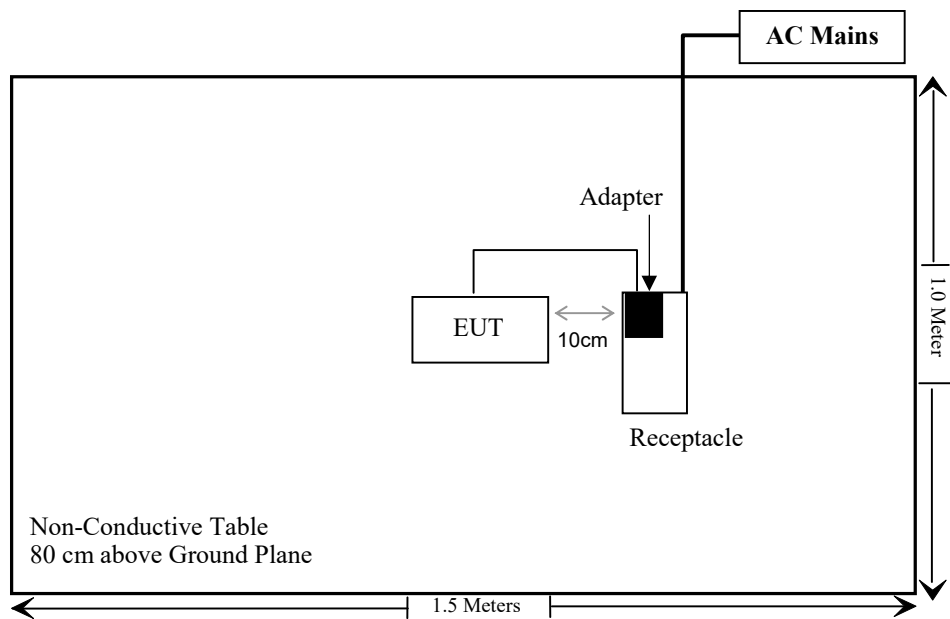


For Radiated Emissions below 1GHz:

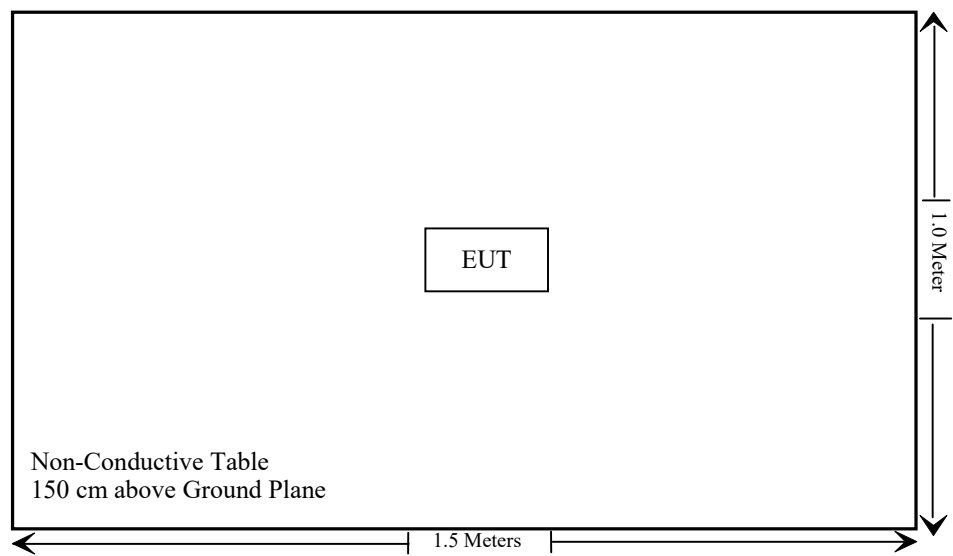
Charger:



USB:



For Radiated Emissions above 1GHz:



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	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	2023/08/03	2024/08/02
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2023/08/03	2024/08/02
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310 N	186238	2023/06/08	2024/06/07
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2026/07/19
BACL	Active Loop Antenna	1313-1A	4031911	2024/03/21	2025/03/20
Unknown	Cable	Chamber Cable 1	F-03-EM236	2023/08/03	2024/08/02
Unknown	Cable	Chamber Cable 4	EC-007	2023/08/03	2024/08/02
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2024/03/27	2025/03/26
COM-POWER	Pre-amplifier	PA-122	181919	2023/06/29	2024/06/28
Schwarzbeck	Horn Antenna	BBHA9120D(1201)	1143	2023/07/26	2026/07/25
Unknown	RF Cable	KMSE	0735	2023/10/08	2024/10/07
Unknown	RF Cable	UFA147	219661	2023/10/08	2024/10/07
SNSD	2.4G Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2023/08/03	2024/08/02
A.H.System	Pre-amplifier	PAM-1840VH	190	2023/08/02	2024/08/01
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					
R&S	SPECTRUM ANALYZER	FSU26	200120	2024/01/08	2025/01/07
Tonscend	RF control Unit	JS0806-2	19D8060154	2023/09/06	2024/09/05
ANRITSU	Microwave peak power sensor	MA24418A	12622	2023/08/08	2024/08/07
Rohde & Schwarz	Signal and Spectrum Analyzer	FSV40	101473	2024/01/16	2025/01/15
MARCONI	10dB Attenuator	6534/3	2942	2023/07/04	2024/07/03

* **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.

- a) 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:

For BLE:

Frequency (MHz)	Maximum Tune-up power [#]		Calculated Distance (mm)	Calculated Value	Threshold (1-g SAR)	SAR Test Exclusion
	(dBm)	(mW)				
2402-2480	-1.0	0.79	5	0.3	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: 2401S24086-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[#] is - 2.42dBi, fulfill the requirement of this section. Please refer to the EUT photos.

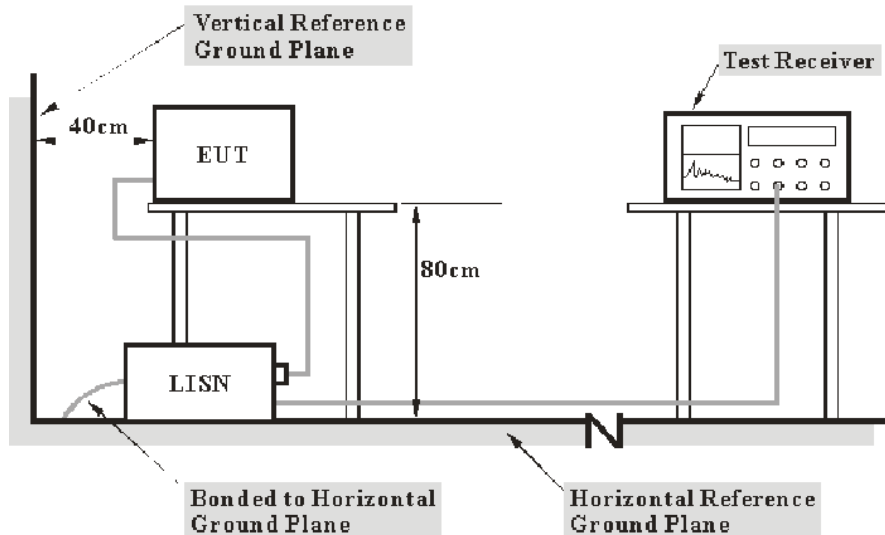
Result: Compliant

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).

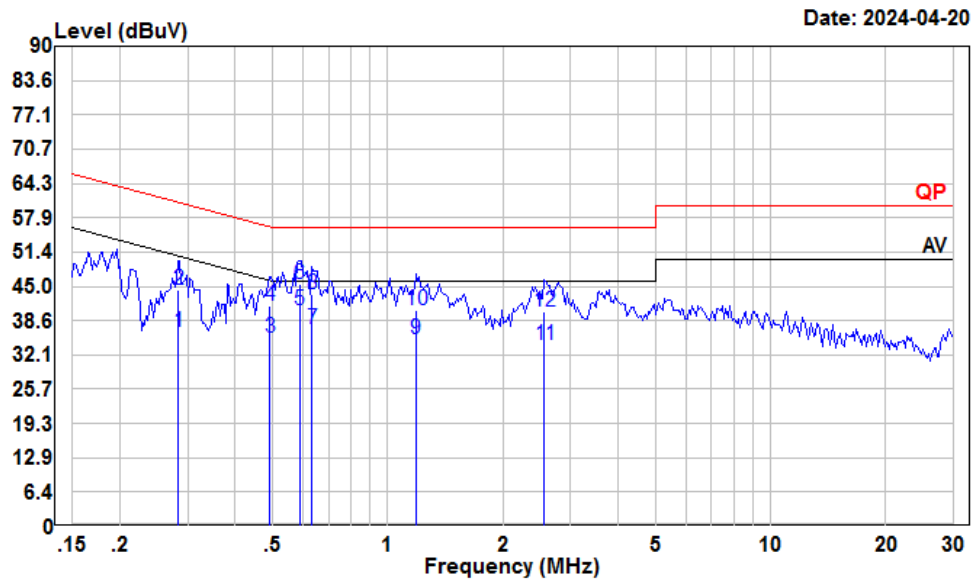
Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	61~70 %
ATM Pressure:	101 kPa

The testing was performed by Macy Shi on 2024-04-20 and 2024-06-06.

EUT operation mode: Transmitting

For Charger**BLE:** Maximum output power mode, Middle Channel**AC 120V/60 Hz, Line**

Condition: Line

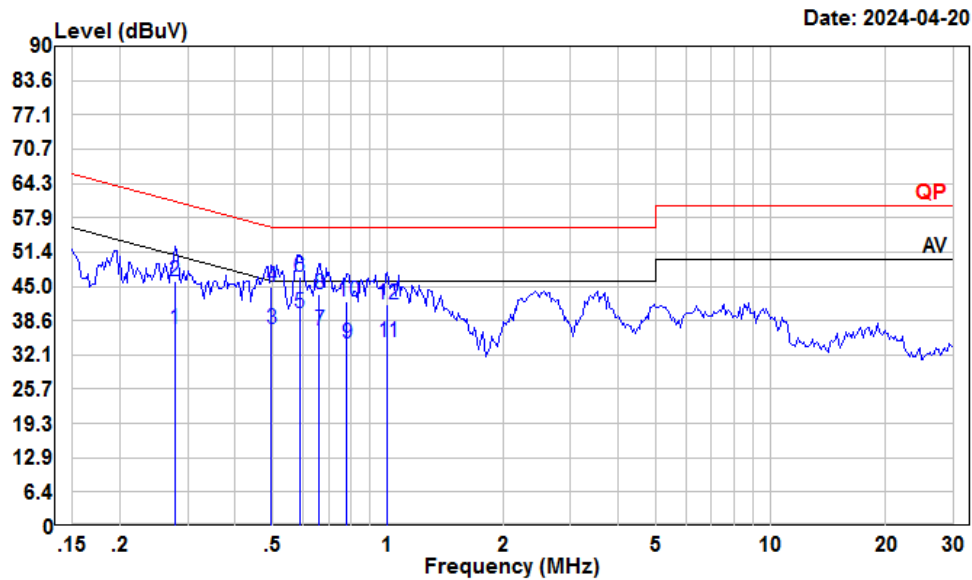
Project : 2401S24086-RF

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	0.28	15.51	36.35	10.69	10.15	50.72	-14.37 Average
2	0.28	23.55	44.39	10.69	10.15	60.72	-16.33 QP
3	0.49	14.69	35.36	10.51	10.16	46.14	-10.78 Average
4	0.49	20.67	41.34	10.51	10.16	56.14	-14.80 QP
5	0.59	19.69	40.40	10.50	10.21	46.00	-5.60 Average
6	0.59	24.76	45.47	10.50	10.21	56.00	-10.53 QP
7	0.63	16.20	36.92	10.50	10.22	46.00	-9.08 Average
8	0.63	22.70	43.42	10.50	10.22	56.00	-12.58 QP
9	1.18	14.60	35.11	10.45	10.06	46.00	-10.89 Average
10	1.18	20.10	40.61	10.45	10.06	56.00	-15.39 QP
11	2.57	13.37	34.08	10.49	10.22	46.00	-11.92 Average
12	2.57	19.68	40.39	10.49	10.22	56.00	-15.61 QP

AC 120V/60 Hz, Neutral



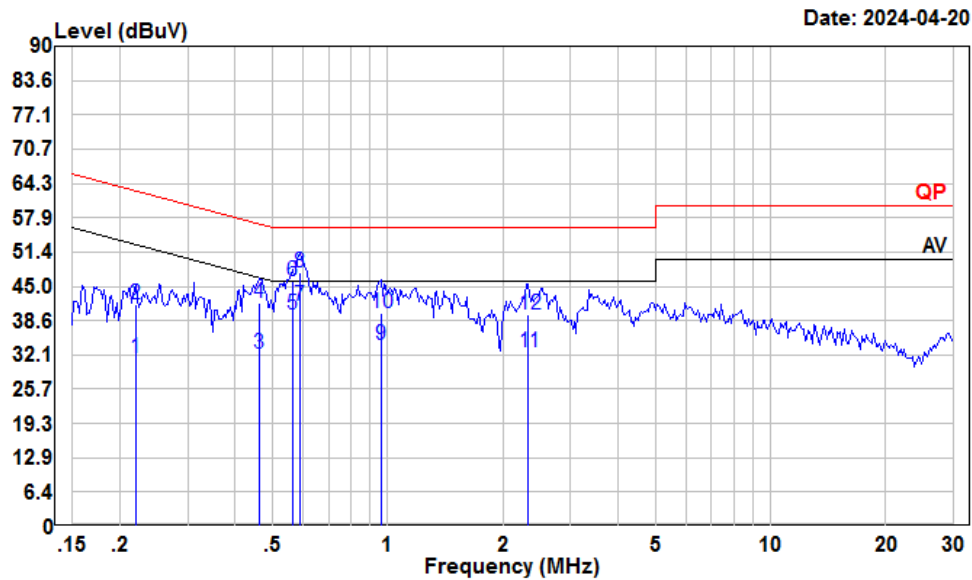
Condition: Neutral

Project : 2401S24086-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	0.28	16.27	36.94	10.51	10.16	50.90	-13.96	Average
2	0.28	25.20	45.87	10.51	10.16	60.90	-15.03	QP
3	0.50	16.20	37.05	10.70	10.15	46.05	-9.00	Average
4	0.50	24.09	44.94	10.70	10.15	56.05	-11.11	QP
5	0.59	18.97	39.88	10.70	10.21	46.00	-6.12	Average
6	0.59	25.87	46.78	10.70	10.21	56.00	-9.22	QP
7	0.66	15.70	36.61	10.70	10.21	46.00	-9.39	Average
8	0.66	22.50	43.41	10.70	10.21	56.00	-12.59	QP
9	0.78	13.30	34.24	10.76	10.18	46.00	-11.76	Average
10	0.78	21.20	42.14	10.76	10.18	56.00	-13.86	QP
11	1.00	13.30	34.41	10.90	10.21	46.00	-11.59	Average
12	1.00	20.50	41.61	10.90	10.21	56.00	-14.39	QP

2.4G Wi-Fi: Maximum output power mode, 802.11n40 Middle Channel**AC 120V/60 Hz, Line**

Condition: Line

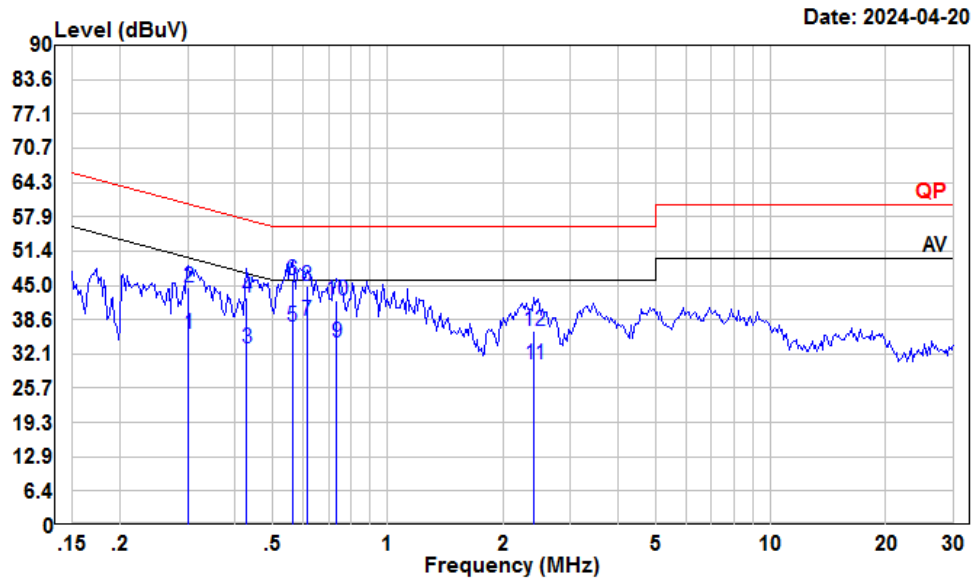
Project : 2401S24086-RF

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	0.22	10.74	31.65	10.77	10.14	52.83	-21.18	Average
2	0.22	20.71	41.62	10.77	10.14	62.83	-21.21	QP
3	0.46	11.58	32.29	10.53	10.18	46.67	-14.38	Average
4	0.46	21.17	41.88	10.53	10.18	56.67	-14.79	QP
5	0.56	19.10	39.79	10.50	10.19	46.00	-6.21	Average
6	0.56	25.40	46.09	10.50	10.19	56.00	-9.91	QP
7	0.59	20.75	41.46	10.50	10.21	46.00	-4.54	Average
8	0.59	26.90	47.61	10.50	10.21	56.00	-8.39	QP
9	0.96	13.51	34.11	10.41	10.19	46.00	-11.89	Average
10	0.96	19.41	40.01	10.41	10.19	56.00	-15.99	QP
11	2.33	11.96	32.69	10.53	10.20	46.00	-13.31	Average
12	2.33	18.97	39.70	10.53	10.20	56.00	-16.30	QP

AC 120V/60 Hz, Neutral



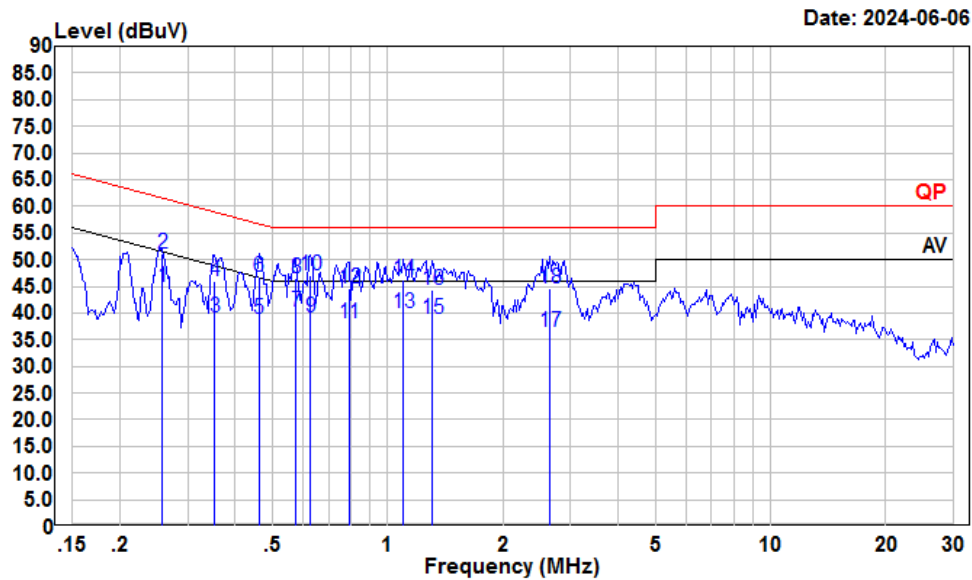
Condition: Neutral

Project : 2401S24086-RF

Tester : Macy shi

Note : 2.4G WIFI

	Freq	Read Level	Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.30	15.14	35.79	10.53	10.12	50.19	-14.40	Average
2	0.30	23.95	44.60	10.53	10.12	60.19	-15.59	QP
3	0.43	12.40	33.25	10.65	10.20	47.29	-14.04	Average
4	0.43	21.90	42.75	10.65	10.20	57.29	-14.54	QP
5	0.56	16.31	37.20	10.70	10.19	46.00	-8.80	Average
6	0.56	25.13	46.02	10.70	10.19	56.00	-9.98	QP
7	0.61	17.40	38.32	10.70	10.22	46.00	-7.68	Average
8	0.61	24.00	44.92	10.70	10.22	56.00	-11.08	QP
9	0.74	13.39	34.32	10.73	10.20	46.00	-11.68	Average
10	0.74	21.29	42.22	10.73	10.20	56.00	-13.78	QP
11	2.41	9.58	30.19	10.40	10.21	46.00	-15.81	Average
12	2.41	15.78	36.39	10.40	10.21	56.00	-19.61	QP

For USB**BLE:** Maximum output power mode, Middle Channel**AC 120V/60 Hz, Line**

Condition: Line

Project : 2401S24086-RF

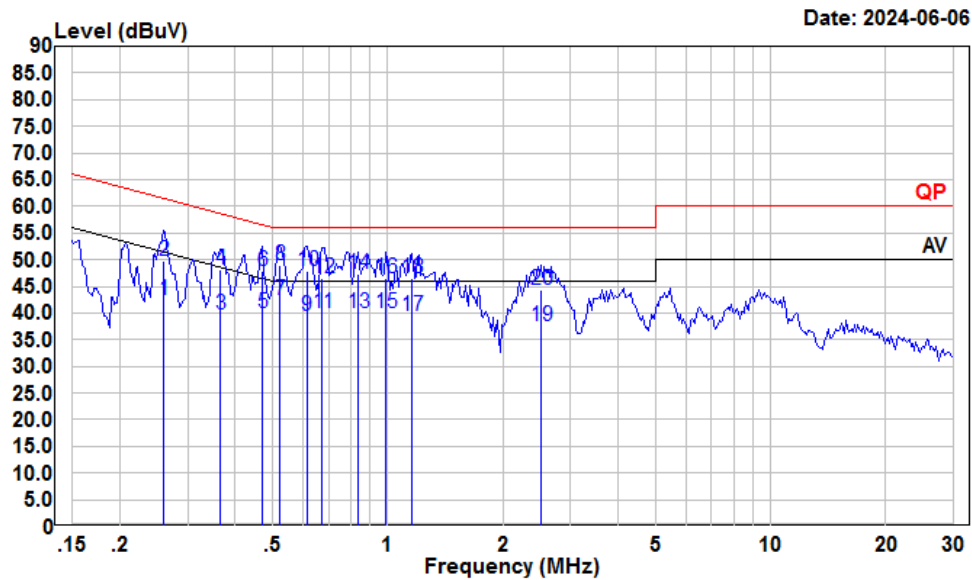
tester : Macy.shi

Note : BLE

	Freq	Read Level	LISN Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.26	24.01	44.81	10.72	10.08	51.51	-6.70	Average
2	0.26	30.40	51.20	10.72	10.08	61.51	-10.31	QP
3	0.35	18.50	39.23	10.61	10.12	48.87	-9.64	Average
4	0.35	25.20	45.93	10.61	10.12	58.87	-12.94	QP
5	0.46	18.23	38.88	10.53	10.12	46.67	-7.79	Average
6	0.46	26.20	46.85	10.53	10.12	56.67	-9.82	QP
7	0.58	19.70	40.32	10.50	10.12	46.00	-5.68	Average
8	0.58	25.90	46.52	10.50	10.12	56.00	-9.48	QP
9	0.63	18.55	39.18	10.50	10.13	46.00	-6.82	Average
10	0.63	26.55	47.18	10.50	10.13	56.00	-8.82	QP
11	0.79	17.50	38.09	10.47	10.12	46.00	-7.91	Average
12	0.79	24.10	44.69	10.47	10.12	56.00	-11.31	QP
13	1.10	19.30	39.85	10.43	10.12	46.00	-6.15	Average
14	1.10	25.60	46.15	10.43	10.12	56.00	-9.85	QP
15	1.30	18.29	38.92	10.48	10.15	46.00	-7.08	Average
16	1.30	23.79	44.42	10.48	10.15	56.00	-11.58	QP

	Freq	Read Level	Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
17	2.65	15.90	36.55	10.48	10.17	46.00	-9.45	Average
18	2.65	23.88	44.53	10.48	10.17	56.00	-11.47	QP

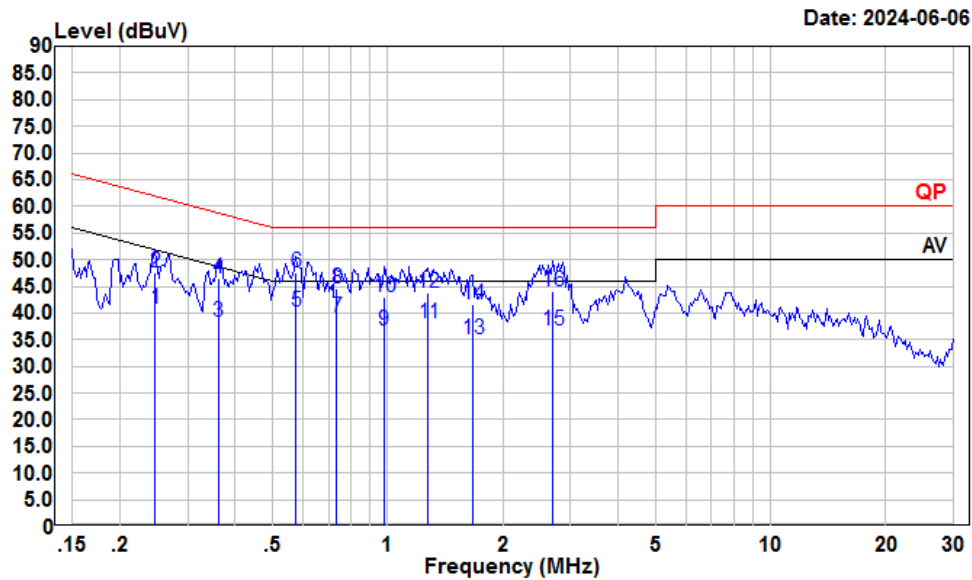
AC 120V/60 Hz, Neutral



Condition: Neutral
Project : 2401S24086-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	0.26	21.92	42.50	10.49	10.09	51.42	-8.92	Average
2	0.26	29.21	49.79	10.49	10.09	61.42	-11.63	QP
3	0.37	19.00	39.71	10.60	10.11	48.61	-8.90	Average
4	0.37	27.50	48.21	10.60	10.11	58.61	-10.40	QP
5	0.47	19.04	39.85	10.68	10.13	46.49	-6.64	Average
6	0.47	27.16	47.97	10.68	10.13	56.49	-8.52	QP
7	0.52	21.54	42.38	10.70	10.14	46.00	-3.62	Average
8	0.52	28.11	48.95	10.70	10.14	56.00	-7.05	QP
9	0.61	18.70	39.52	10.70	10.12	46.00	-6.48	Average
10	0.61	27.00	47.82	10.70	10.12	56.00	-8.18	QP
11	0.68	19.10	39.94	10.70	10.14	46.00	-6.06	Average
12	0.68	25.60	46.44	10.70	10.14	56.00	-9.56	QP
13	0.83	19.20	40.11	10.80	10.11	46.00	-5.89	Average
14	0.83	26.30	47.21	10.80	10.11	56.00	-8.79	QP
15	0.99	19.00	40.00	10.89	10.11	46.00	-6.00	Average
16	0.99	25.60	46.60	10.89	10.11	56.00	-9.40	QP

	Freq	Read Level	Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
17	1.16	18.51	39.43	10.79	10.13	46.00	-6.57	Average
18	1.16	25.51	46.43	10.79	10.13	56.00	-9.57	QP
19	2.51	16.99	37.56	10.40	10.17	46.00	-8.44	Average
20	2.51	23.72	44.29	10.40	10.17	56.00	-11.71	QP

2.4G Wi-Fi: Maximum output power mode, 802.11n40 Middle Channel**AC 120V/60 Hz, Line**

Condition: Line

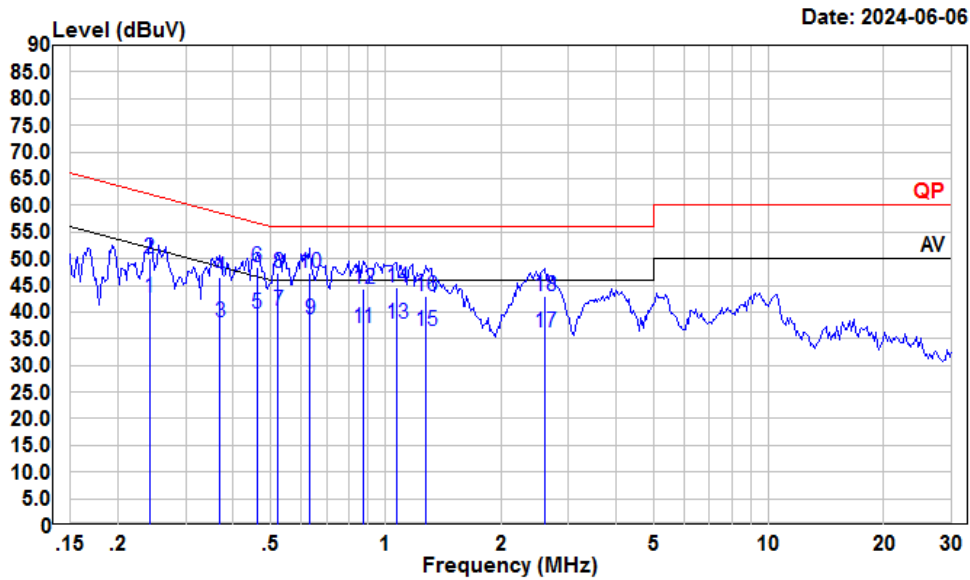
Project : 2401S24086-RF

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	0.25	20.09	40.90	10.73	10.08	51.86	-10.96	Average
2	0.25	26.83	47.64	10.73	10.08	61.86	-14.22	QP
3	0.36	17.70	38.43	10.61	10.12	48.69	-10.26	Average
4	0.36	25.65	46.38	10.61	10.12	58.69	-12.31	QP
5	0.58	19.69	40.31	10.50	10.12	46.00	-5.69	Average
6	0.58	26.91	47.53	10.50	10.12	56.00	-8.47	QP
7	0.74	18.50	39.13	10.49	10.14	46.00	-6.87	Average
8	0.74	24.10	44.73	10.49	10.14	56.00	-11.27	QP
9	0.98	16.29	36.81	10.41	10.11	46.00	-9.19	Average
10	0.98	22.49	43.01	10.41	10.11	56.00	-12.99	QP
11	1.28	17.50	38.12	10.47	10.15	46.00	-7.88	Average
12	1.28	23.30	43.92	10.47	10.15	56.00	-12.08	QP
13	1.66	14.40	35.12	10.55	10.17	46.00	-10.88	Average
14	1.66	20.80	41.52	10.55	10.17	56.00	-14.48	QP
15	2.71	16.05	36.69	10.47	10.17	46.00	-9.31	Average
16	2.71	23.53	44.17	10.47	10.17	56.00	-11.83	QP

AC 120V/60 Hz, Neutral



Condition: Neutral

Project : 2401S24086-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	0.24	22.19	42.73	10.46	10.08	52.04	-9.31	Average
2	0.24	29.44	49.98	10.46	10.08	62.04	-12.06	QP
3	0.37	17.40	38.11	10.60	10.11	48.52	-10.41	Average
4	0.37	25.80	46.51	10.60	10.11	58.52	-12.01	QP
5	0.46	18.81	39.60	10.67	10.12	46.67	-7.07	Average
6	0.46	27.59	48.38	10.67	10.12	56.67	-8.29	QP
7	0.52	19.50	40.34	10.70	10.14	46.00	-5.66	Average
8	0.52	26.60	47.44	10.70	10.14	56.00	-8.56	QP
9	0.63	17.70	38.53	10.70	10.13	46.00	-7.47	Average
10	0.63	26.46	47.29	10.70	10.13	56.00	-8.71	QP
11	0.87	16.00	36.93	10.82	10.11	46.00	-9.07	Average
12	0.87	23.40	44.33	10.82	10.11	56.00	-11.67	QP
13	1.07	16.80	37.77	10.85	10.12	46.00	-8.23	Average
14	1.07	23.60	44.57	10.85	10.12	56.00	-11.43	QP
15	1.28	15.50	36.37	10.72	10.15	46.00	-9.63	Average
16	1.28	22.20	43.07	10.72	10.15	56.00	-12.93	QP

	Freq	Read Level	Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
17	2.59	15.71	36.28	10.40	10.17	46.00	-9.72	Average
18	2.59	22.35	42.92	10.40	10.17	56.00	-13.08	QP

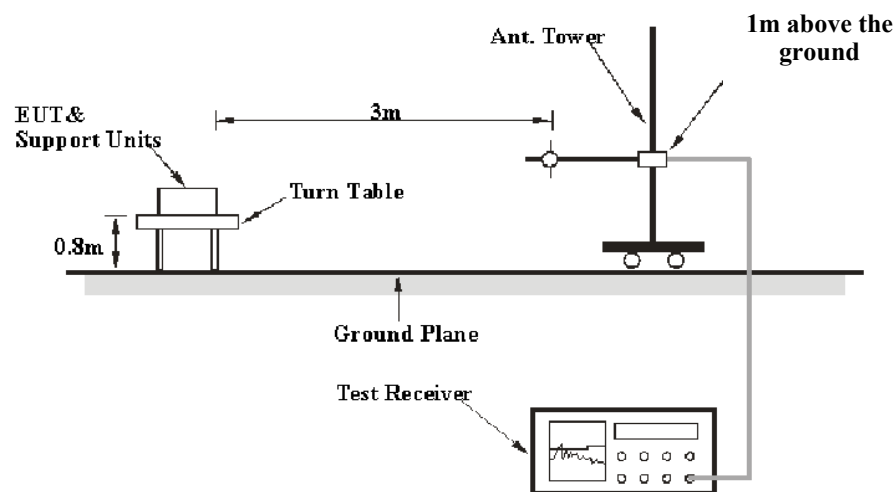
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

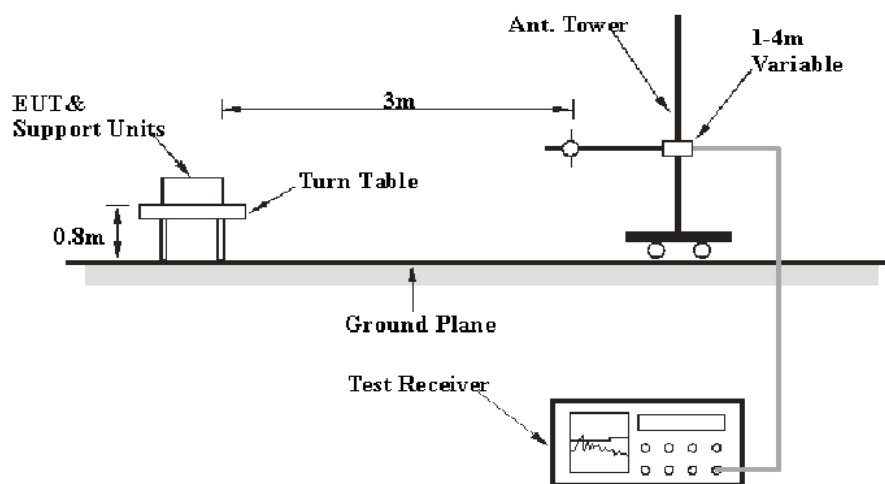
FCC §15.247 (d); §15.209; §15.205;

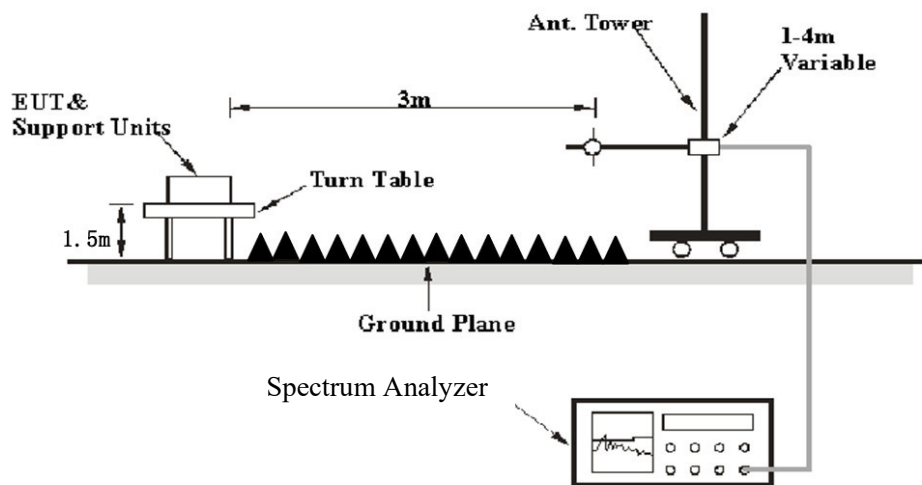
EUT Setup

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:	25~25.4 °C
Relative Humidity:	50~54 %
ATM Pressure:	101 kPa

The testing was performed by Warren Huang on 2024-05-10 and Anson Su on 2024-06-05 for below 1GHz, Zenos Qiao and Tyler Wu on 2024-04-30 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.

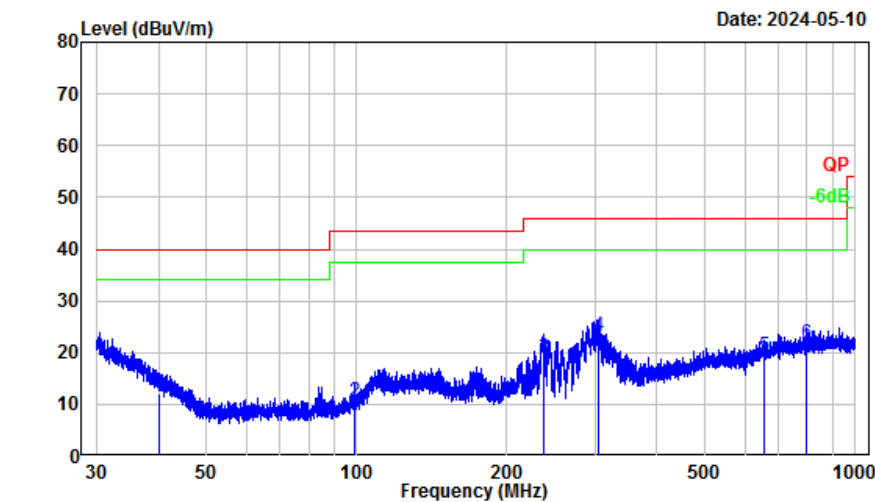
For Charger

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

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

30MHz-1GHz:

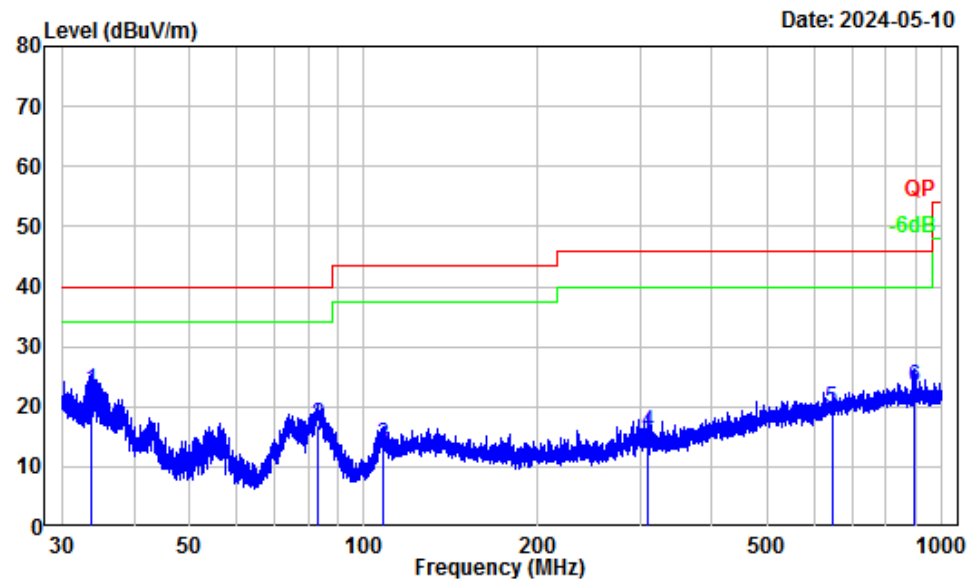
BLE (Maximum output power mode, Middle Channel)
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401S24086-RF
Note : BLE
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.06	-11.56	23.49	11.93	40.00	-28.07	QP
2	99.18	-15.68	26.18	10.50	43.50	-33.00	QP
3	237.79	-14.28	33.21	18.93	46.00	-27.07	QP
4	305.55	-12.69	35.95	23.26	46.00	-22.74	QP
5	658.55	-6.58	26.02	19.44	46.00	-26.56	QP
6	800.03	-5.30	26.89	21.59	46.00	-24.41	QP

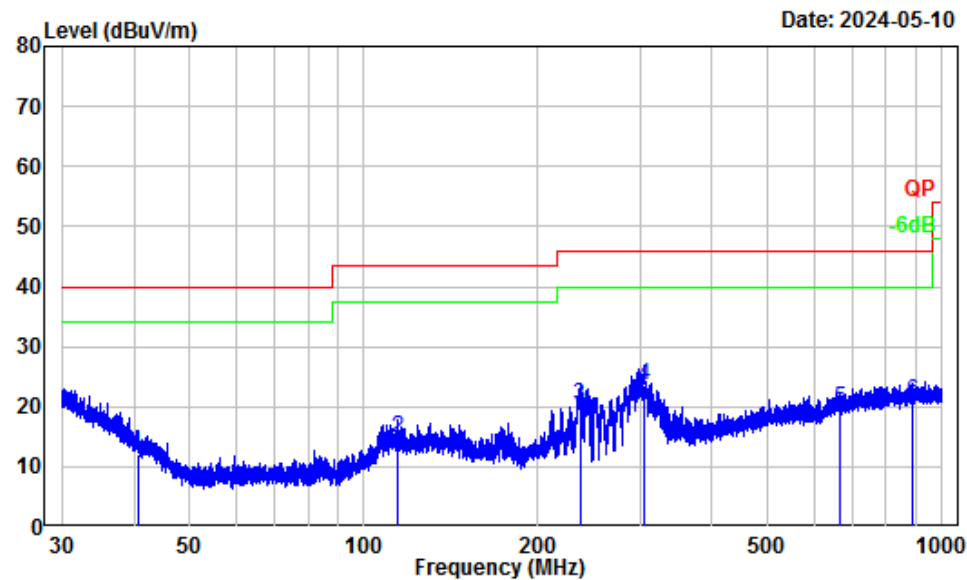
Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401S24086-RF
Note : BLE
Tester : Warren Huang

	Freq Factor		Read Level	Limit Level	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	33.67	-8.94	31.50	22.56	40.00	-17.44 QP
2	83.45	-18.79	35.65	16.86	40.00	-23.14 QP
3	107.94	-14.83	28.38	13.55	43.50	-29.95 QP
4	308.91	-13.02	28.59	15.57	46.00	-30.43 QP
5	644.84	-7.18	26.66	19.48	46.00	-26.52 QP
6	895.82	-4.86	28.09	23.23	46.00	-22.77 QP

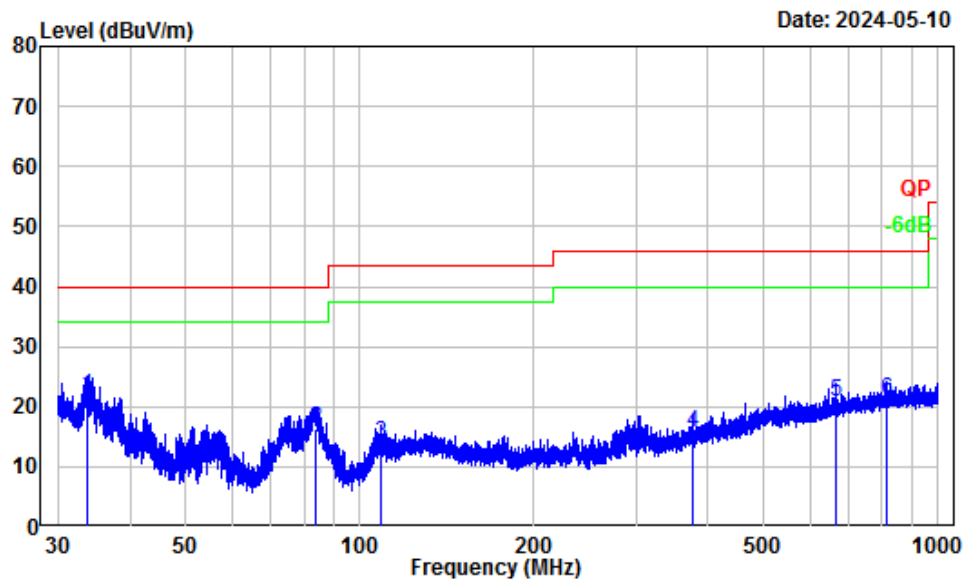
2.4G Wi-Fi (Maximum output power mode, 802.11n40 Middle Channel)
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401S24086-RF
Note : 2.4G WIFI
Tester : Warren Huang

Freq Factor			Read Level	Level	Limit Line	Over Limit	Remark
MHz	dB/m		dBuV	dBuV/m	dBuV/m	dB	
1	40.58	-11.88	23.95	12.07	40.00	-27.93	QP
2	114.62	-12.75	27.60	14.85	43.50	-28.65	QP
3	236.33	-14.24	34.50	20.26	46.00	-25.74	QP
4	305.95	-12.69	36.36	23.67	46.00	-22.33	QP
5	665.51	-6.52	26.10	19.58	46.00	-26.42	QP
6	887.22	-4.54	25.34	20.80	46.00	-25.20	QP

Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401S24086-RF
Note : 2.4G WIFI
Tester : Warren Huang

	Freq Factor		Read Level	Limit Level	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	33.84	-9.06	30.81	21.75	40.00	-18.25 QP
2	84.00	-18.80	35.11	16.31	40.00	-23.69 QP
3	108.65	-14.64	28.50	13.86	43.50	-29.64 QP
4	377.26	-11.48	27.13	15.65	46.00	-30.35 QP
5	664.35	-6.93	27.82	20.89	46.00	-25.11 QP
6	815.61	-5.32	26.31	20.99	46.00	-25.01 QP

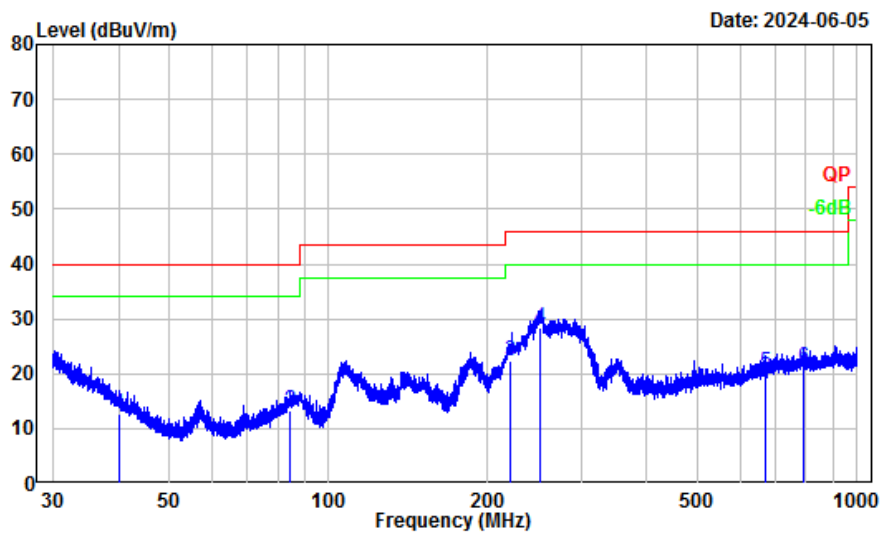
For USB

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

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

30MHz-1GHz:

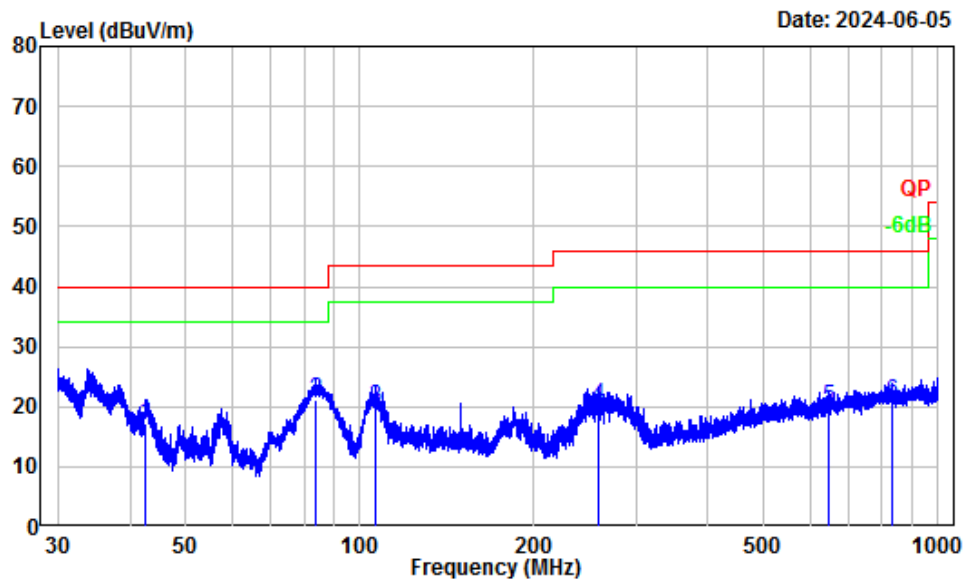
BLE (Maximum output power mode, Middle Channel)
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401S24086-RF
Test Mode : BLE
Tester : Anson Su

	Freq	Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.03	-11.54	24.33	12.79	40.00	-27.21	QP
2	84.55	-18.17	31.55	13.38	40.00	-26.62	QP
3	220.62	-13.92	36.27	22.35	46.00	-23.65	QP
4	251.62	-14.47	42.85	28.38	46.00	-17.62	QP
5	673.14	-6.46	26.78	20.32	46.00	-25.68	QP
6	794.44	-5.33	26.59	21.26	46.00	-24.74	QP

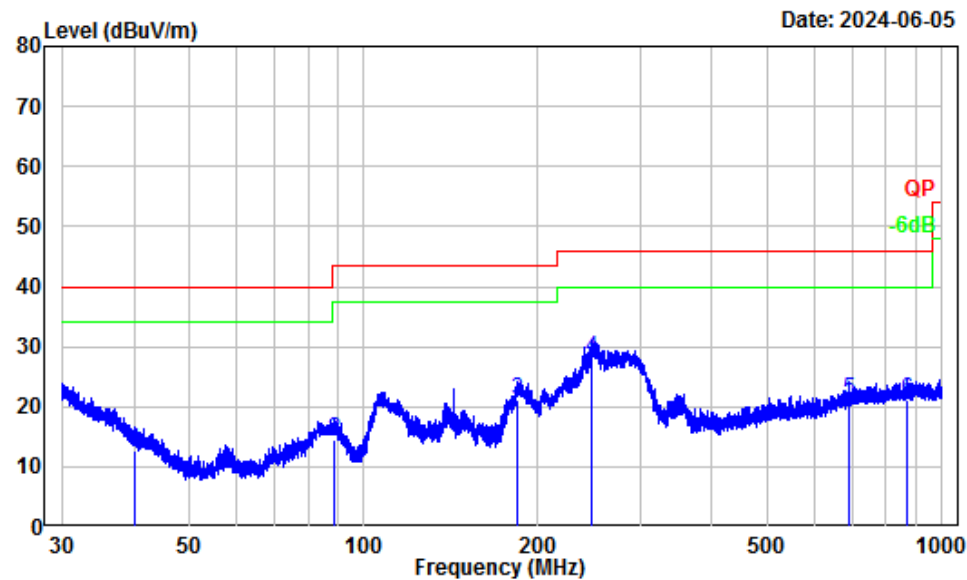
Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401S24086-RF
Test Mode : BLE
Tester : Anson Su

	Freq Factor		Read Level	Limit Level	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	42.66	-14.53	31.68	17.15	40.00	-22.85 QP
2	84.00	-18.79	39.83	21.04	40.00	-18.96 QP
3	106.25	-15.26	35.26	20.00	43.50	-23.50 QP
4	259.12	-14.61	34.90	20.29	46.00	-25.71 QP
5	647.39	-7.19	27.03	19.84	46.00	-26.16 QP
6	831.86	-5.23	25.91	20.68	46.00	-25.32 QP

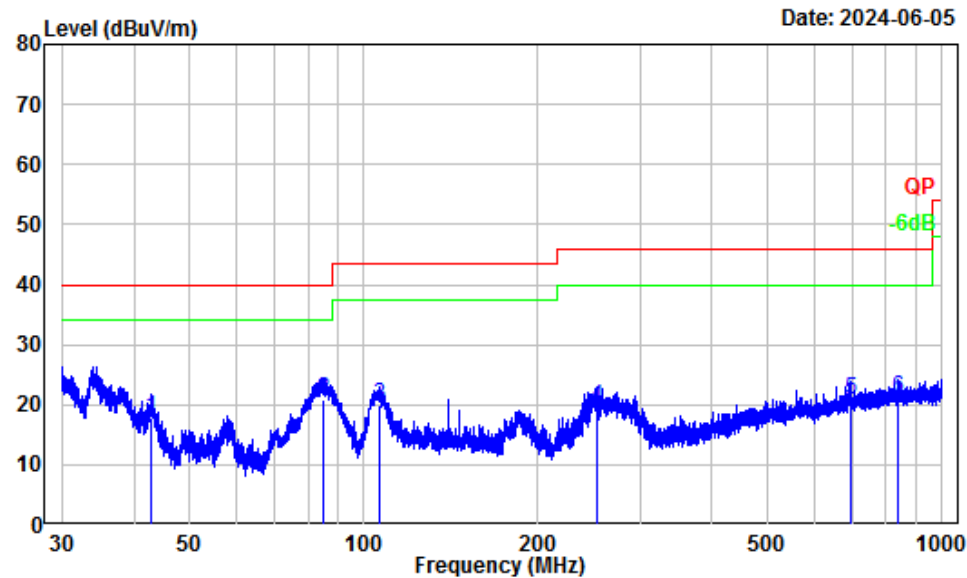
2.4G Wi-Fi (Maximum output power mode, 802.11n40 Middle Channel)
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401S24086-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	40.24 -11.67	24.20	12.53	40.00	-27.47	QP
2	88.61 -18.12	32.51	14.39	43.50	-29.11	QP
3	184.25 -14.73	35.75	21.02	43.50	-22.48	QP
4	247.36 -14.48	42.64	28.16	46.00	-17.84	QP
5	690.77 -6.26	27.50	21.24	46.00	-24.76	QP
6	869.89 -4.66	25.93	21.27	46.00	-24.73	QP

Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401S24086-RF
Test Mode : 2.4G WIFI
Tester : Anson Su

	Freq Factor		Read Level	Limit Level	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	42.82	-14.62	32.42	17.80	40.00	-22.20 QP
2	84.96	-18.81	39.55	20.74	40.00	-19.26 QP
3	106.06	-15.31	35.09	19.78	43.50	-23.72 QP
4	252.84	-14.83	34.57	19.74	46.00	-26.26 QP
5	693.20	-6.63	27.58	20.95	46.00	-25.05 QP
6	839.92	-5.18	26.27	21.09	46.00	-24.91 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							
2387.69	54.76	PK	H	-2.93	51.83	74	-22.17
2387.69	41.87	AV	H	-2.93	38.94	54	-15.06
2386.94	54.98	PK	V	-2.93	52.05	74	-21.95
2386.94	42.09	AV	V	-2.93	39.16	54	-14.84
4804.00	47.29	PK	H	2.42	49.71	74	-24.29
4804.00	32.87	AV	H	2.42	35.29	54	-18.71
4804.00	47.51	PK	V	2.42	49.93	74	-24.07
4804.00	33.06	AV	V	2.42	35.48	54	-18.52
Middle Channel 2440MHz							
4880.00	47.05	PK	H	2.58	49.63	74	-24.37
4880.00	32.73	AV	H	2.58	35.31	54	-18.69
4880.00	47.22	PK	V	2.58	49.80	74	-24.20
4880.00	32.91	AV	V	2.58	35.49	54	-18.51
High Channel 2480MHz							
2483.81	55.09	PK	H	-3.17	51.92	74	-22.08
2483.81	42.34	AV	H	-3.17	39.17	54	-14.83
2483.58	55.36	PK	V	-3.17	52.19	74	-21.81
2483.58	42.53	AV	V	-3.17	39.36	54	-14.64
4960.00	46.84	PK	H	2.68	49.52	74	-24.48
4960.00	32.56	AV	H	2.68	35.24	54	-18.76
4960.00	47.03	PK	V	2.68	49.71	74	-24.29
4960.00	31.74	AV	V	2.68	34.42	54	-19.58

Note:

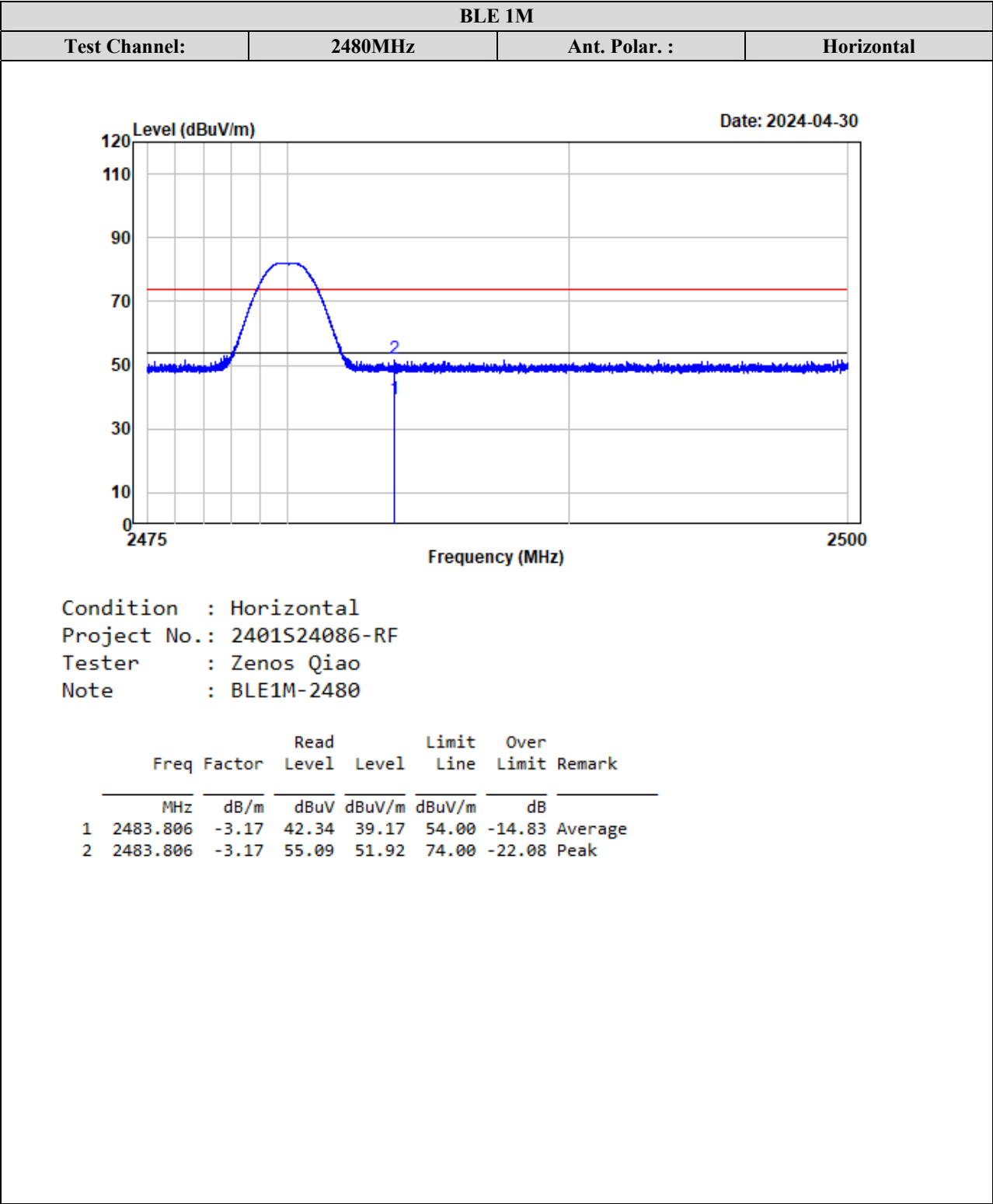
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

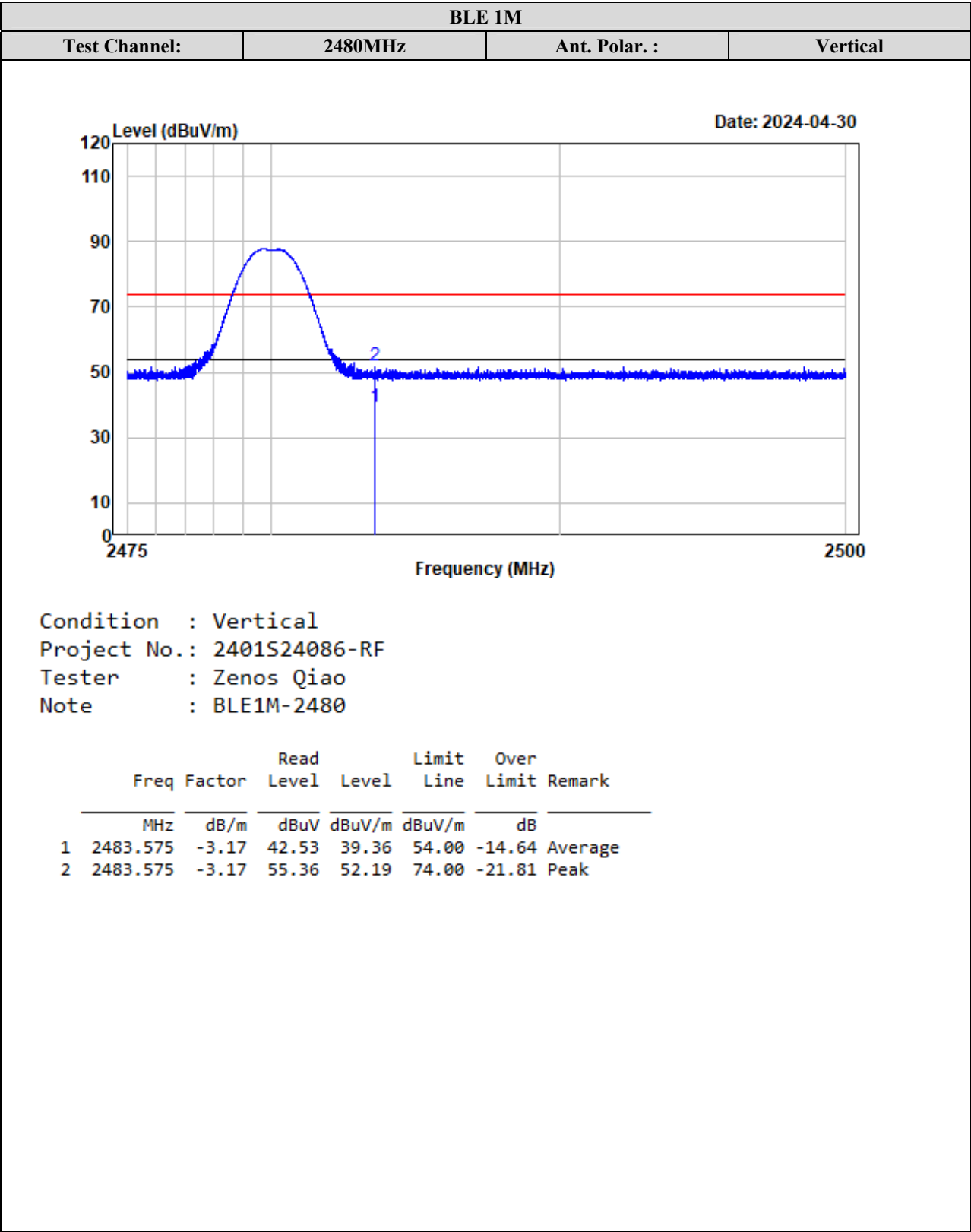
Corrected Amplitude = Corrected Factor + Reading

Margin = Corrected. Amplitude - Limit

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

Test plots 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							
2389.02	55.13	PK	H	-2.93	52.20	74	-21.80
2389.02	40.06	AV	H	-2.93	37.13	54	-16.87
2361.69	55.49	PK	V	-2.93	52.56	74	-21.44
2361.69	40.58	AV	V	-2.93	37.65	54	-16.35
4824.00	47.58	PK	H	2.45	50.03	74	-23.97
4824.00	39.23	AV	H	2.45	41.68	54	-12.32
4824.00	48.19	PK	V	2.45	50.64	74	-23.36
4824.00	39.72	AV	V	2.45	42.17	54	-11.83
Middle Channel 2442MHz							
4884.00	46.15	PK	H	2.60	48.75	74	-25.25
4884.00	40.09	AV	H	2.60	42.69	54	-11.31
4884.00	46.64	PK	V	2.60	49.24	74	-24.76
4884.00	40.27	AV	V	2.60	42.87	54	-11.13
High Channel 2472MHz							
4944.00	47.15	PK	H	2.61	49.76	74	-24.24
4944.00	38.62	AV	H	2.61	41.23	54	-12.77
4944.00	47.67	PK	V	2.61	50.28	74	-23.72
4944.00	39.19	AV	V	2.61	41.80	54	-12.20

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							
2383.01	55.02	PK	H	-2.93	52.09	74	-21.91
2383.01	40.16	AV	H	-2.93	37.23	54	-16.77
2376.98	55.37	PK	V	-2.93	52.44	74	-21.56
2376.98	40.35	AV	V	-2.93	37.42	54	-16.58
4824.00	46.02	PK	H	2.45	48.47	74	-25.53
4824.00	31.23	AV	H	2.45	33.68	54	-20.32
4824.00	46.34	PK	V	2.45	48.79	74	-25.21
4824.00	31.67	AV	V	2.45	34.12	54	-19.88
Middle Channel 2442MHz							
4884.00	46.07	PK	H	2.60	48.67	74	-25.33
4884.00	31.28	AV	H	2.60	33.88	54	-20.12
4884.00	46.19	PK	V	2.60	48.79	74	-25.21
4884.00	31.54	AV	V	2.60	34.14	54	-19.86
High Channel 2472MHz							
2483.65	69.15	PK	H	-3.10	66.05	74	-7.95
2483.65	52.36	AV	H	-3.10	49.26	54	-4.74
2483.51	70.21	PK	V	-3.10	67.11	74	-6.89
2483.51	53.73	AV	V	-3.10	50.63	54	-3.37
4944.00	46.13	PK	H	2.61	48.74	74	-25.26
4944.00	31.34	AV	H	2.61	33.95	54	-20.05
4944.00	46.05	PK	V	2.61	48.66	74	-25.34
4944.00	31.12	AV	V	2.61	33.73	54	-20.27

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							
2383.69	55.13	PK	H	-2.93	52.20	74	-21.80
2383.69	40.04	AV	H	-2.93	37.11	54	-16.89
2318.74	55.37	PK	V	-3.03	52.34	74	-21.66
2318.74	40.28	AV	V	-3.03	37.25	54	-16.75
4824.00	45.31	PK	H	2.45	47.76	74	-26.24
4824.00	31.67	AV	H	2.45	34.12	54	-19.88
4824.00	45.95	PK	V	2.45	48.40	74	-25.60
4824.00	31.83	AV	V	2.45	34.28	54	-19.72
Middle Channel 2442MHz							
4884.00	45.83	PK	H	2.60	48.43	74	-25.57
4884.00	31.45	AV	H	2.60	34.05	54	-19.95
4884.00	46.17	PK	V	2.60	48.77	74	-25.23
4884.00	31.56	AV	V	2.60	34.16	54	-19.84
High Channel 2472MHz							
2483.67	70.34	PK	H	-3.10	67.24	74	-6.76
2483.67	53.26	AV	H	-3.10	50.16	54	-3.84
2483.58	71.88	PK	V	-3.10	68.78	74	-5.22
2483.58	54.09	AV	V	-3.10	50.99	54	-3.01
4944.00	46.07	PK	H	2.61	48.68	74	-25.32
4944.00	31.32	AV	H	2.61	33.93	54	-20.07
4944.00	46.34	PK	V	2.61	48.95	74	-25.05
4944.00	31.45	AV	V	2.61	34.06	54	-19.94

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							
2388.32	55.03	PK	H	-2.93	52.10	74	-21.90
2388.32	41.25	AV	H	-2.93	38.32	54	-15.68
2371.19	55.46	PK	V	-2.93	52.53	74	-21.47
2371.19	41.49	AV	V	-2.93	38.56	54	-15.44
4844.00	45.32	PK	H	2.45	47.77	74	-26.23
4844.00	32.25	AV	H	2.45	34.70	54	-19.30
4844.00	45.86	PK	V	2.45	48.31	74	-25.69
4844.00	32.37	AV	V	2.45	34.82	54	-19.18
Middle Channel 2442MHz							
4884.00	45.37	PK	H	2.60	47.97	74	-26.03
4884.00	32.19	AV	H	2.60	34.79	54	-19.21
4884.00	45.91	PK	V	2.60	48.51	74	-25.49
4884.00	32.46	AV	V	2.60	35.06	54	-18.94
High Channel 2462MHz							
2483.56	66.45	PK	H	-3.10	63.35	74	-10.65
2483.56	53.27	AV	H	-3.10	50.17	54	-3.83
2483.51	67.71	PK	V	-3.10	64.61	74	-9.39
2483.51	54.08	AV	V	-3.10	50.98	54	-3.02
4924.00	45.36	PK	H	2.63	47.99	74	-26.01
4924.00	32.12	AV	H	2.63	34.75	54	-19.25
4924.00	45.95	PK	V	2.63	48.58	74	-25.42
4924.00	32.54	AV	V	2.63	35.17	54	-18.83

Note:

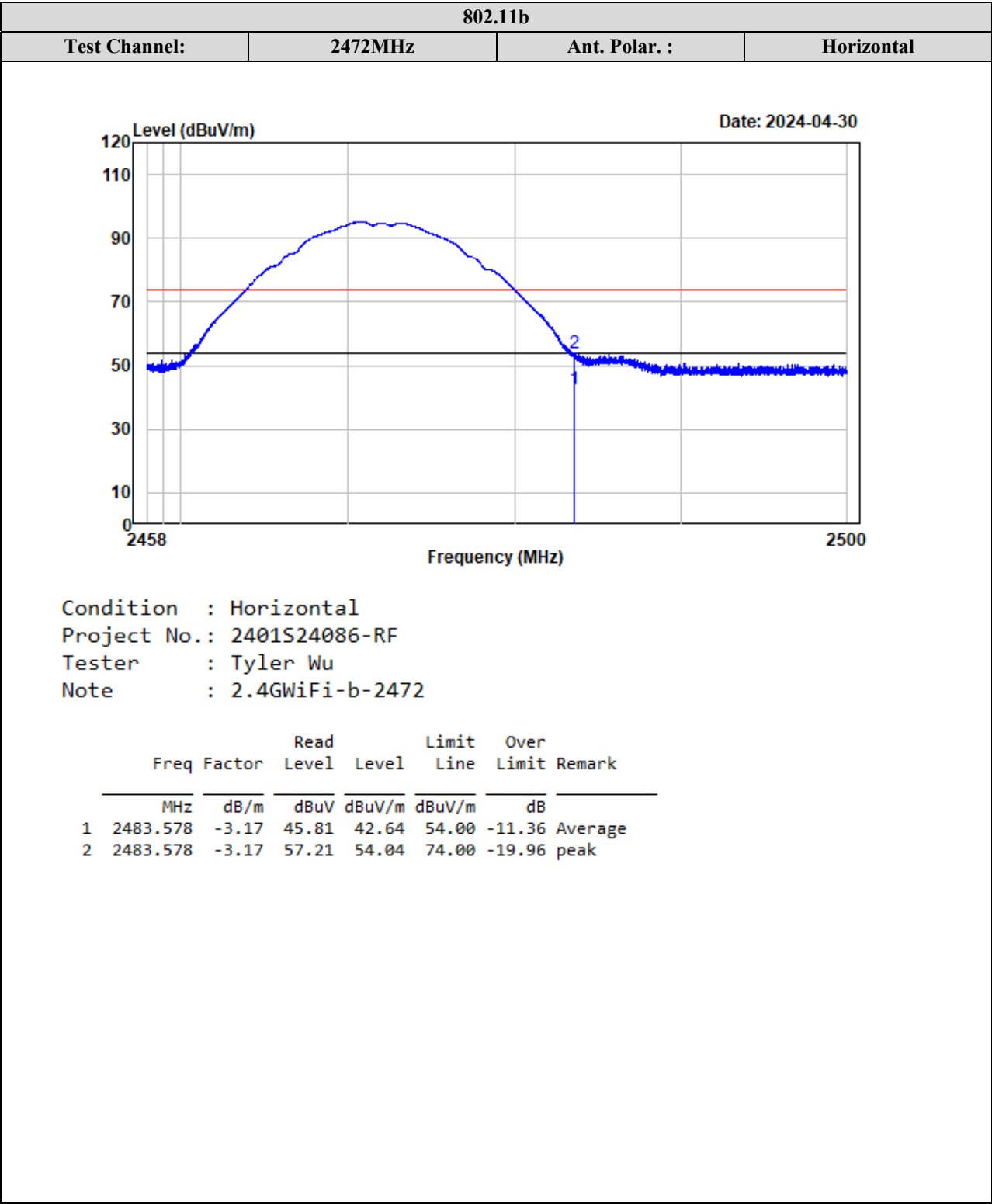
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Factor + Reading

Margin = Corrected. Amplitude - Limit

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

Test plots for Band Edge Measurements (Radiated):



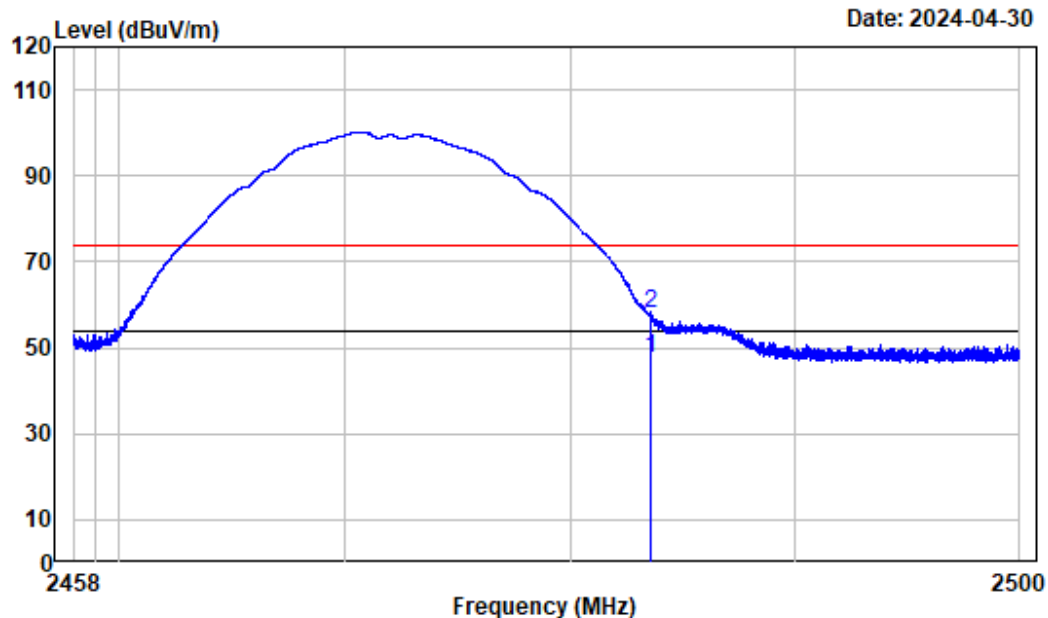
802.11b

Test Channel:

2472MHz

Ant. Polar. :

Vertical



Condition : Vertical

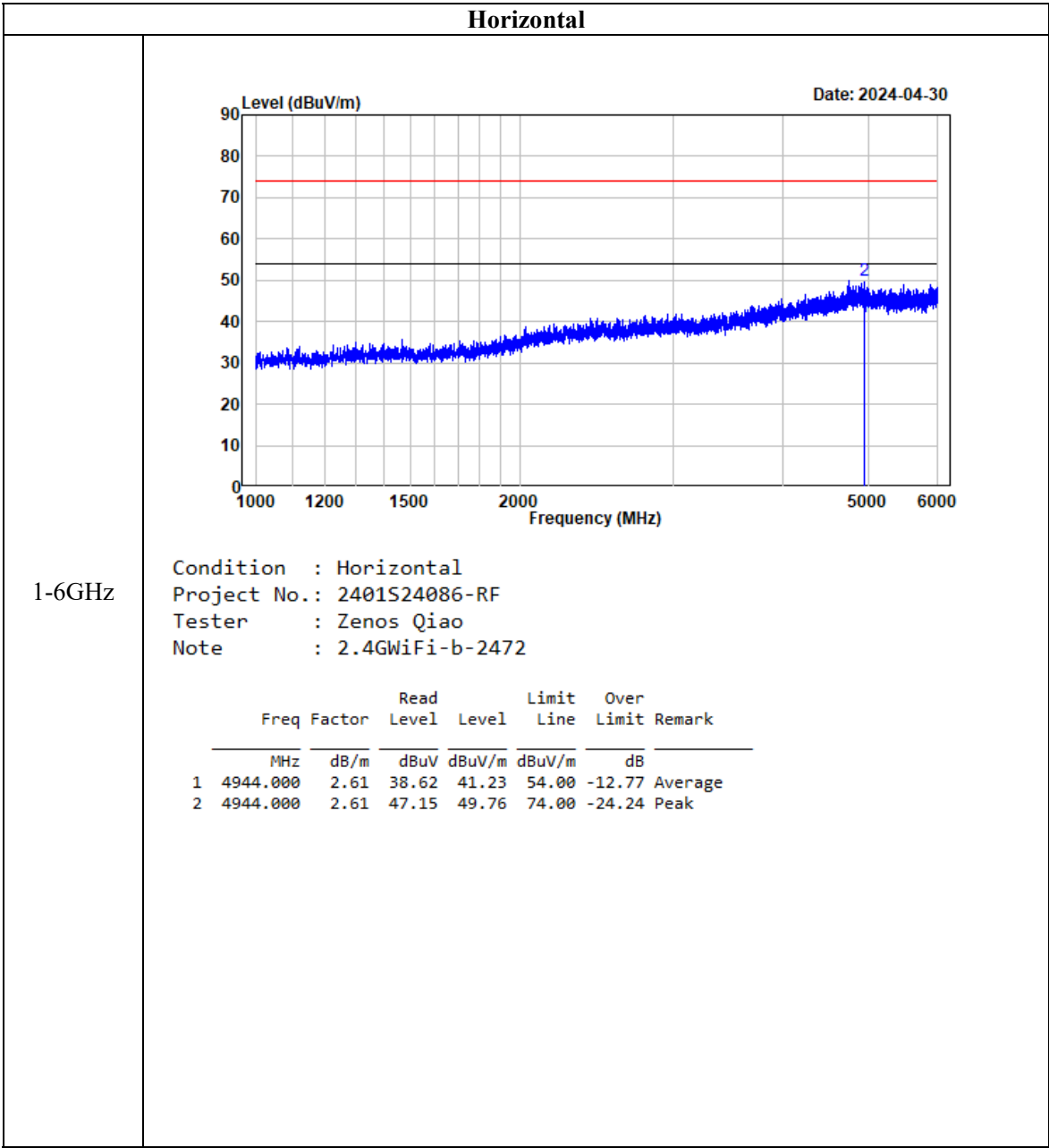
Project No.: 2401S24086-RF

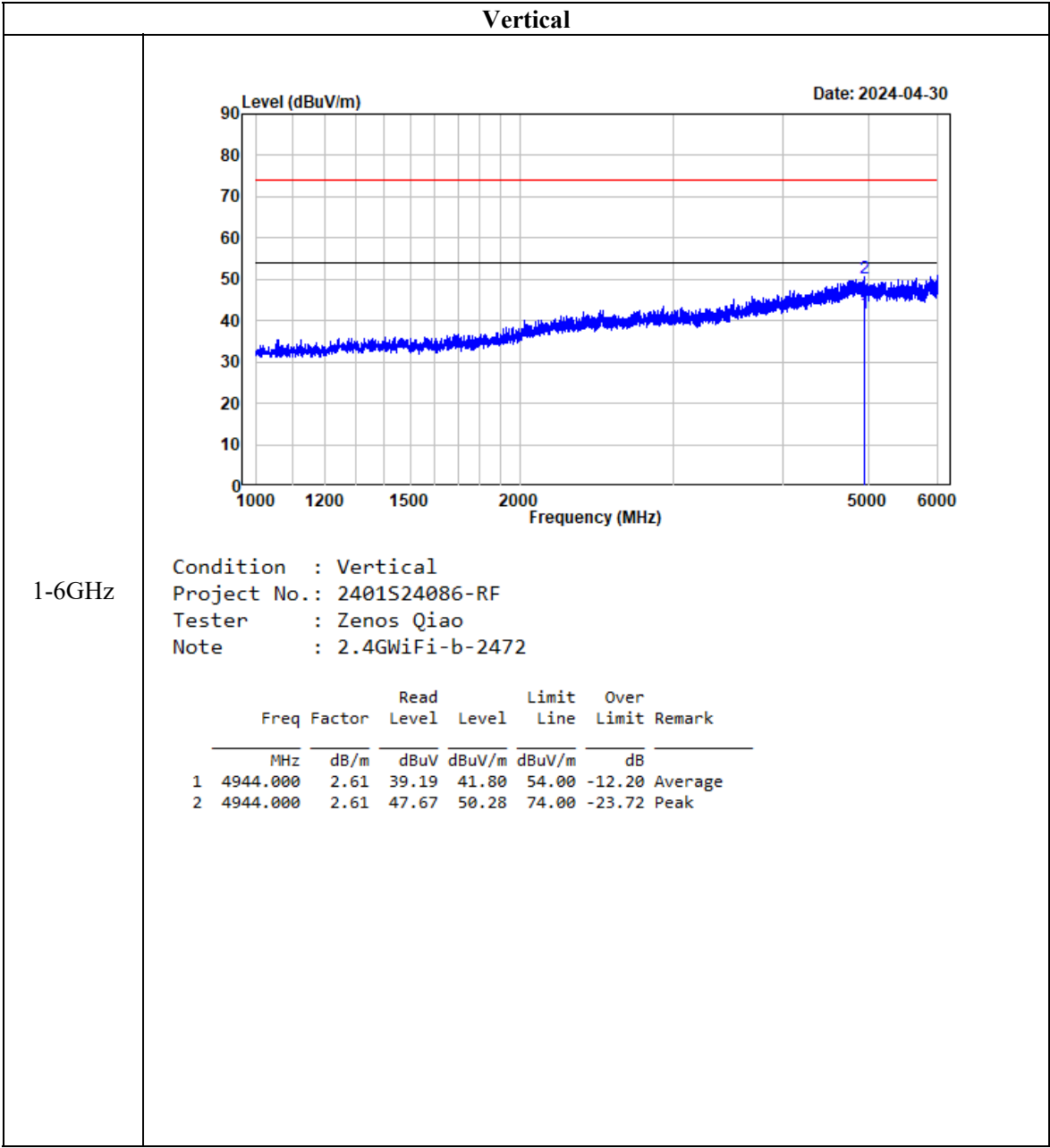
Tester : Tyler Wu

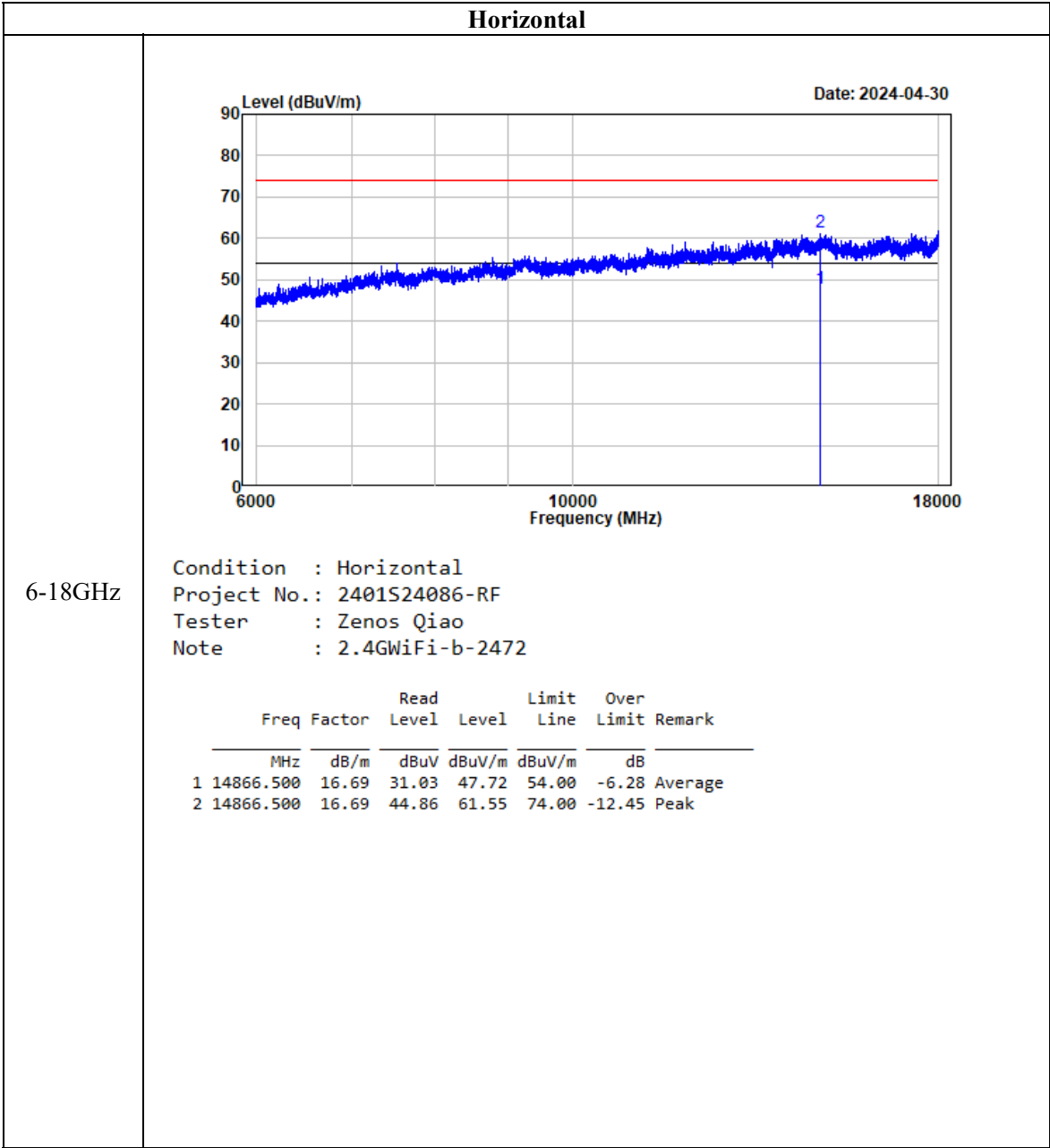
Note : 2.4GWiFi-b-2472

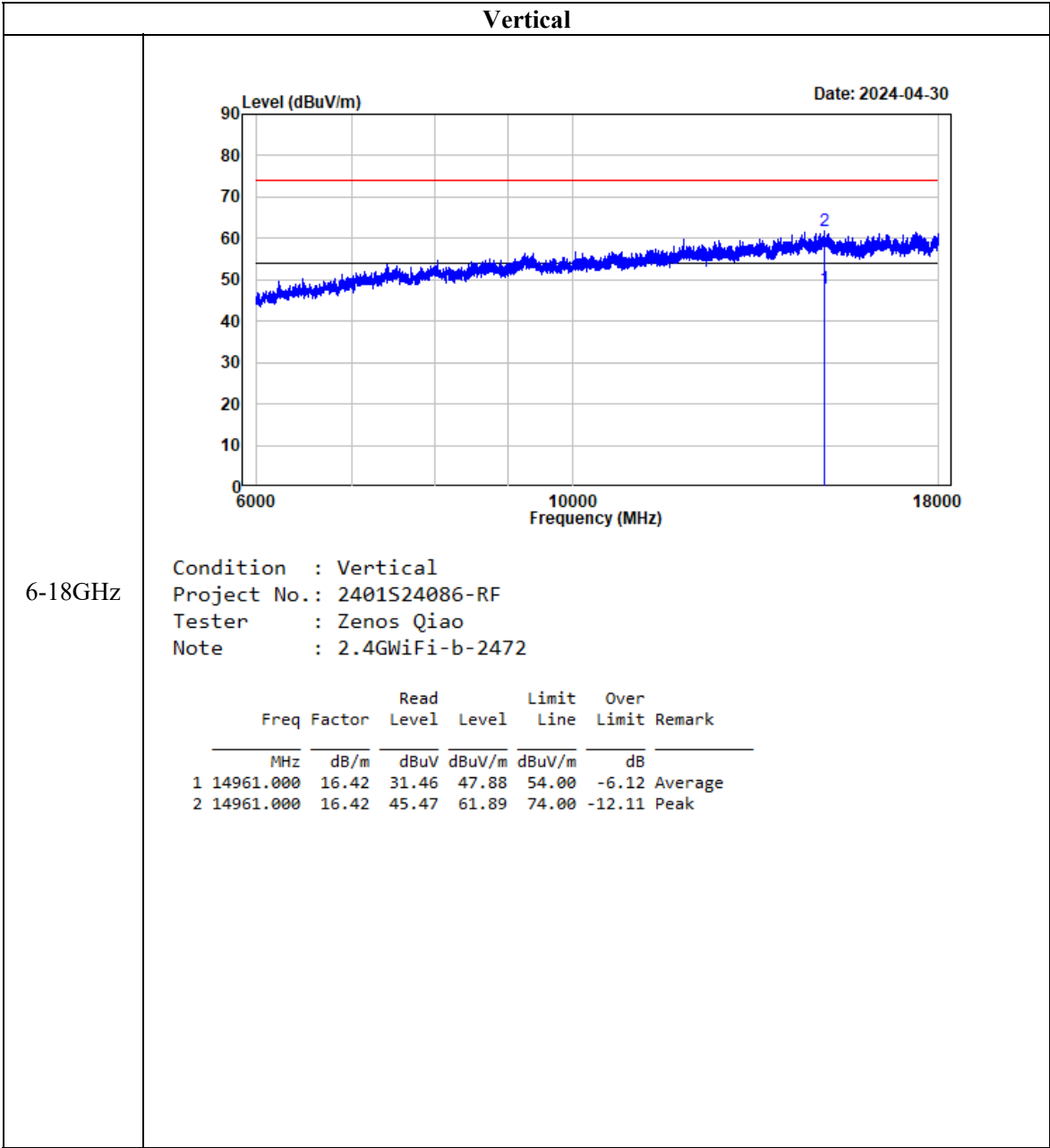
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.524	-3.17	50.75	47.58	54.00	-6.42	Average
2	2483.524	-3.17	61.09	57.92	74.00	-16.08	peak

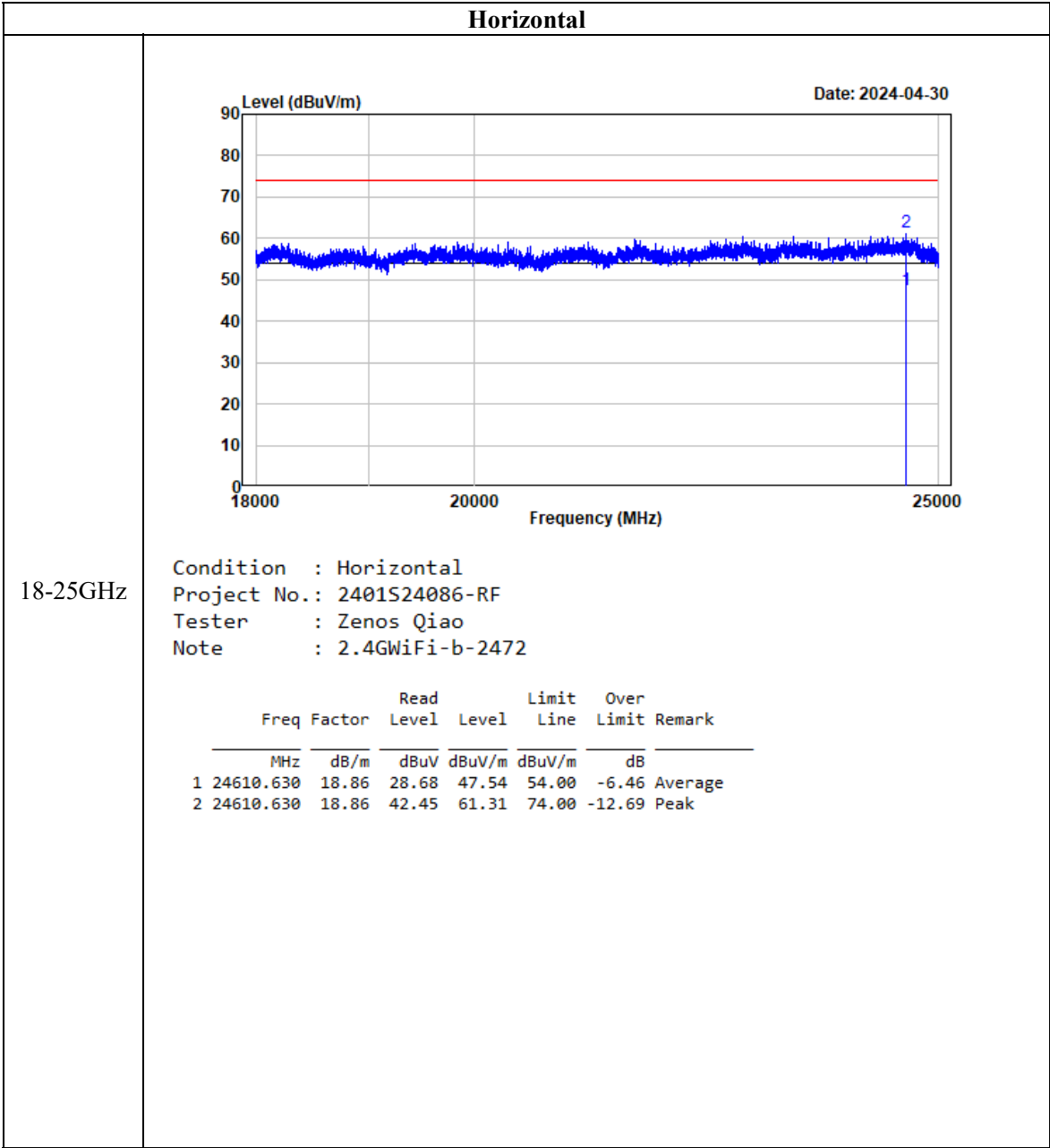
Test plots for Harmonic Measurements:

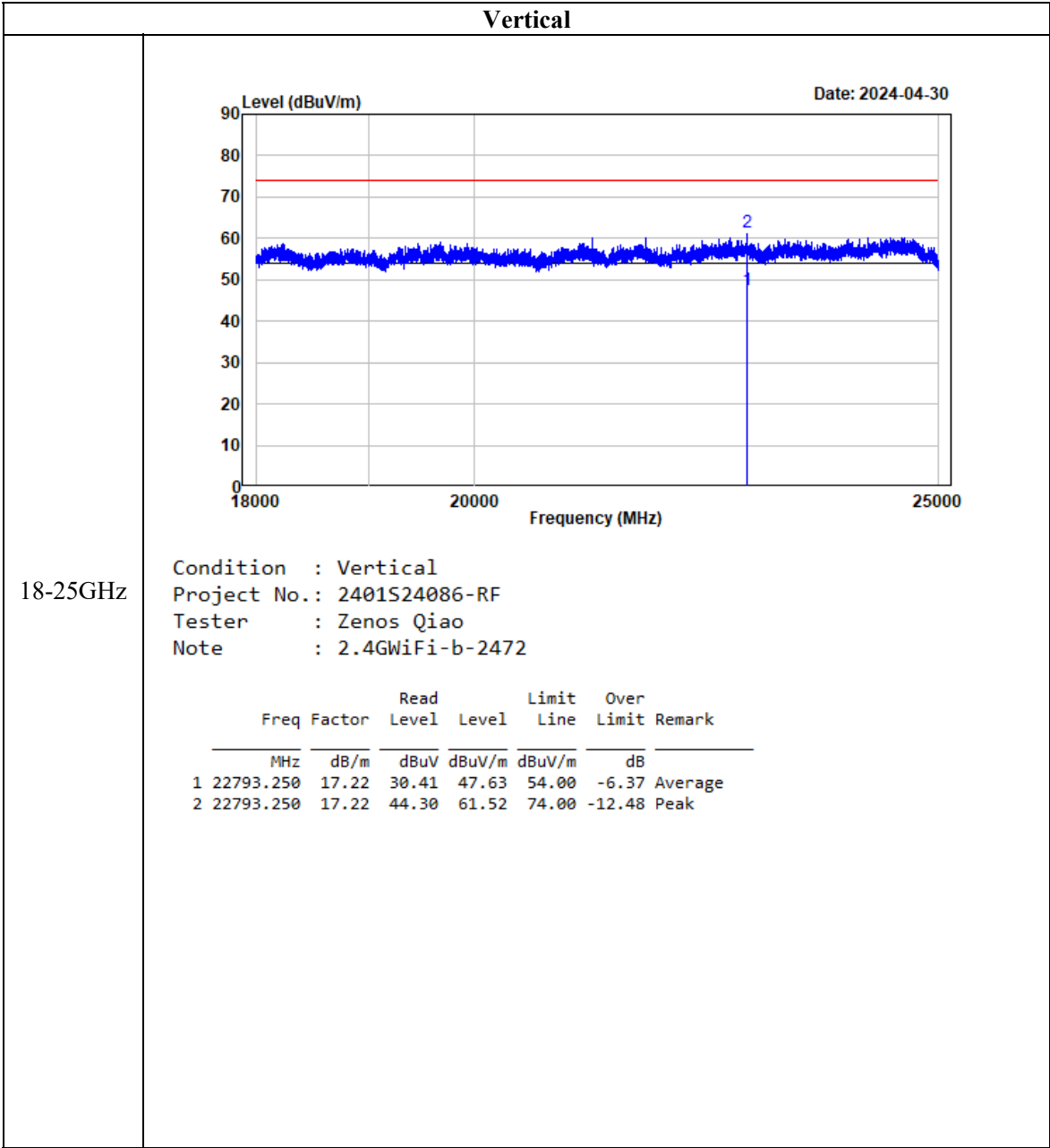












FCC §15.247(a) (2) - 6 dB EMISSION BANDWIDTH

Applicable Standard

According to FCC §15.247(a) (2)

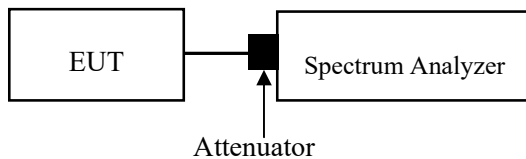
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

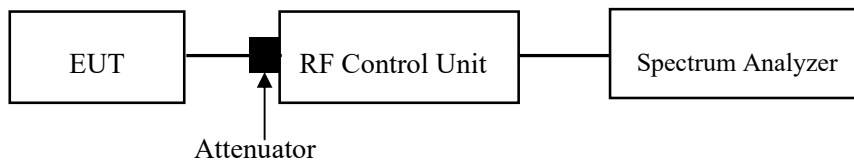
Test Method: ANSI C63.10-2013 Clause 11.8.1 & Clause 6.9.3

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.

For Wi-Fi mode:



For BLE mode:



Test Data

Environmental Conditions

Temperature:	24~25 °C
Relative Humidity:	45~50 %
ATM Pressure:	100~101kPa

The testing was performed by Tom Tan and Allen Bai from 2024-05-21 to 2024-05-27.

EUT operation mode: Transmitting

Test Result: Compliant.

BLE: Please refer to the Appendix.

2.4G Wi-Fi:

Test Modes	Test Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
802.11b	2412	7.62	13.56	0.5
	2442	8.13	13.68	0.5
	2472	8.13	13.48	0.5
802.11g	2412	15.18	16.60	0.5
	2442	15.18	16.68	0.5
	2472	15.18	16.64	0.5
802.11n20	2412	15.84	17.84	0.5
	2442	15.81	17.88	0.5
	2472	15.18	17.72	0.5
802.11n40	2422	35.76	36.24	0.5
	2442	35.28	36.16	0.5
	2462	35.64	36.16	0.5

6 dB Bandwidth

Low Channel	802.11b Ref 25 dBm Att 30 dB *RBW 100 kHz *VBW 300 kHz *SMT 1 s Delta 2 [T1] 0.64 dB 7.620000000 MHz Offset 10.5 dB 1.75 MAX D1 5.16 dBm D2 -1.84 dBm Marker 1 [T1] -1.84 dBm 2.408400000 GHz A LVL 30B Center 2.412 GHz 3 MHz/ Span 30 MHz ProjectNo.:2401S24086-RF Tester:Allen Bai Date: 27.MAY.2024 22:18:00
Middle Channel	Ref 25 dBm Att 30 dB *RBW 100 kHz *VBW 300 kHz *SMT 1 s Delta 2 [T1] -0.46 dB 8.130000000 MHz Offset 10.5 dB 1.95 MAX D1 5.74 dBm D2 -1.26 dBm Marker 1 [T1] -1.26 dBm 2.437920000 GHz A LVL 30B Center 2.442 GHz 3 MHz/ Span 30 MHz ProjectNo.:2401S24086-RF Tester:Allen Bai Date: 27.MAY.2024 22:10:51
High Channel	Ref 25 dBm Att 30 dB *RBW 100 kHz *VBW 300 kHz *SMT 1 s Delta 2 [T1] 0.11 dB 8.130000000 MHz Offset 10.5 dB 1.75 MAX D1 3.57 dBm D2 -3.43 dBm Marker 1 [T1] -3.43 dBm 2.467440000 GHz A LVL 30B Center 2.472 GHz 3 MHz/ Span 30 MHz ProjectNo.:2401S24086-RF Tester:Allen Bai Date: 27.MAY.2024 22:25:40

Version 1.0 (2023/10/07)

Version 1.0 (2023/10/07)

OBW

Low Channel	802.11b Ref 25 dBm Offset 10.5 dB Att 30 dB RBW 300 kHz VBW 1 MHz SMT 1 s Marker 1 [T1] 6.69 dBm 2.412480000 GHz OSW 15.560000000 MHz Temp 1 [T1] OSW -1.88 dBm 2.405440000 GHz Temp 2 [T1] OSW -4.36 dBm 2.418000000 GHz Center 2.412 GHz 4 MHz/ Span 40 MHz ProjectNo.:2401S24086-RF Tester:Allen Bai Date: 27.MAY.2024 21:59:09
Middle Channel	Ref 25 dBm Offset 10.5 dB Att 30 dB RBW 300 kHz VBW 1 MHz SMT 1 s Marker 1 [T1] 6.80 dBm 2.442520000 GHz OSW 15.680000000 MHz Temp 1 [T1] OSW -1.57 dBm 2.435240000 GHz Temp 2 [T1] OSW -3.92 dBm 2.448920000 GHz Center 2.442 GHz 4 MHz/ Span 40 MHz ProjectNo.:2401S24086-RF Tester:Allen Bai Date: 27.MAY.2024 22:08:08
High Channel	Ref 25 dBm Offset 10.5 dB Att 30 dB RBW 300 kHz VBW 1 MHz SMT 1 s Marker 1 [T1] 5.87 dBm 2.471480000 GHz OSW 15.480000000 MHz Temp 1 [T1] OSW -11.82 dBm 2.465160000 GHz Temp 2 [T1] OSW -4.67 dBm 2.478640000 GHz Center 2.472 GHz 4 MHz/ Span 40 MHz ProjectNo.:2401S24086-RF Tester:Allen Bai Date: 27.MAY.2024 22:22:28

Low Channel



Ref 25 dBm Att 30 dB BW 300 KHz VM 1 MHz SWT 1 s Marker 1 [F1] -3.27 dBm 2.442520000 GHz

Offset 10 5 dB CRW 0.880000000 MHz Temp 1 [F2] dBm -11.01 dBm 2.433120000 GHz Temp 2 [F3] dBm -1.00 dBm 2.451000000 GHz

Center 2.442 GHz 4 MHz / Span 40 MHz

ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:46:52

Ref 25 dBm Att 30 dB BW 300 kHz VM 1 MHz SWT 1 s Marker 1 [71] -3.82 dBm 2.470760000 GHz

Offset 10.5 dB

SP MAX

SPAN

Center 2.472 GHz 4 MHz/ Span 40 MHz

ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:50:03

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

Applicable Standard

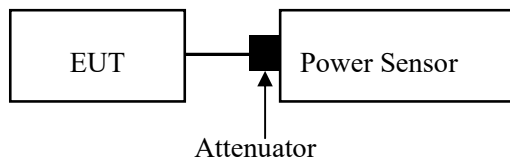
According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted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

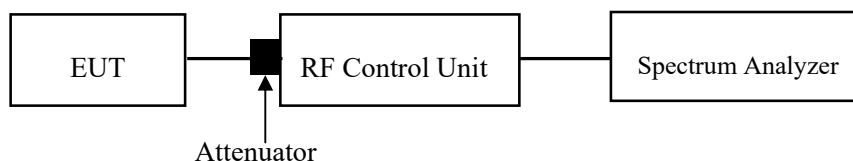
Test Method: ANSI C63.10-2013 Clause 11.9.1.1 for BLE & Clause 11.9.1.3 & 11.9.2.3.2 for Wi-Fi

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:	24~25 °C
Relative Humidity:	45~50 %
ATM Pressure:	100~101kPa

The testing was performed by Tom Tan and Allen Bai from 2024-05-21 to 2024-05-27.

EUT operation mode: Transmitting

Test Result: Compliant.

BLE: Please refer to the Appendix.

2.4G Wi-Fi:

Test Modes	Test Frequency (MHz)	Maximum Conducted Peak Output Power (dBm)	Maximum Conducted Average Output Power (dBm)	Limit (dBm)
802.11b	2412	17.73	13.19	30
	2442	17.97	14.14	30
	2472	16.94	13.13	30
802.11g	2412	12.15	3.57	30
	2442	12.52	3.94	30
	2472	11.51	2.97	30
802.11n20	2412	12.65	3.54	30
	2442	12.99	3.99	30
	2472	12.00	2.99	30
802.11n40	2422	17.71	8.53	30
	2442	18.44	9.41	30
	2462	17.76	8.74	30

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

Applicable Standard

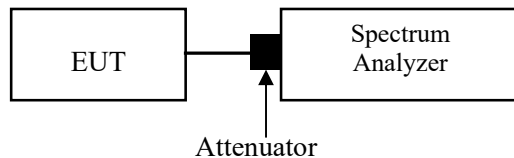
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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

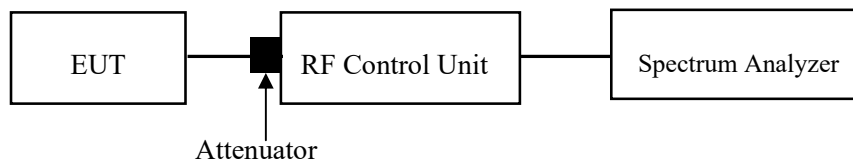
Test Method: ANSI C63.10-2013 Clause 11.11

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.

For Wi-Fi mode:



For BLE mode:



Test Data**Environmental Conditions**

Temperature:	24~25 °C
Relative Humidity:	45~50 %
ATM Pressure:	100~101kPa

The testing was performed by Tom Tan and Allen Bai from 2024-05-21 to 2024-05-27.

EUT operation mode: Transmitting

Test Result: Compliant.

BLE: Please refer to the Appendix.

Band Edge

**802.11b,
Left Side**

Ref 25 dBm *Att 30 dB RBW 100 kHz Marker 3 [Ti]
VBW 300 kHz -46.12 dBm
SWT 1 s 2.40000000 GHz

Marker 1 [Ti] -2.27 dBm 2.41260000 GHz
Marker 2 [Ti] -4.98 dBm 2.39707000 GHz
Marker 3 [Ti] -46.12 dBm 2.40000000 GHz

Start 2.31 GHz 13.5 MHz/ Stop 2.445 GHz

ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:18:43

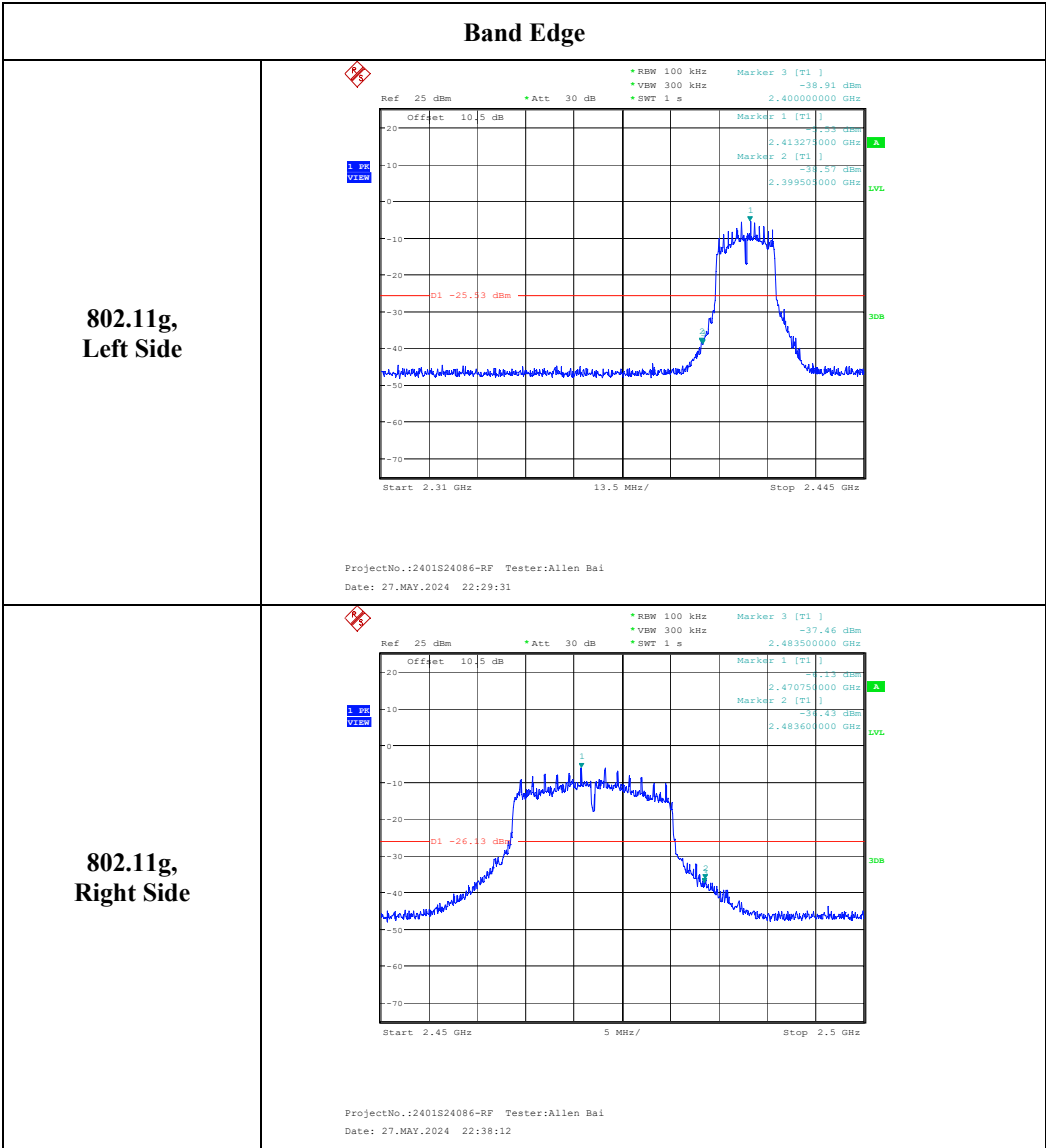
**802.11b,
Right Side**

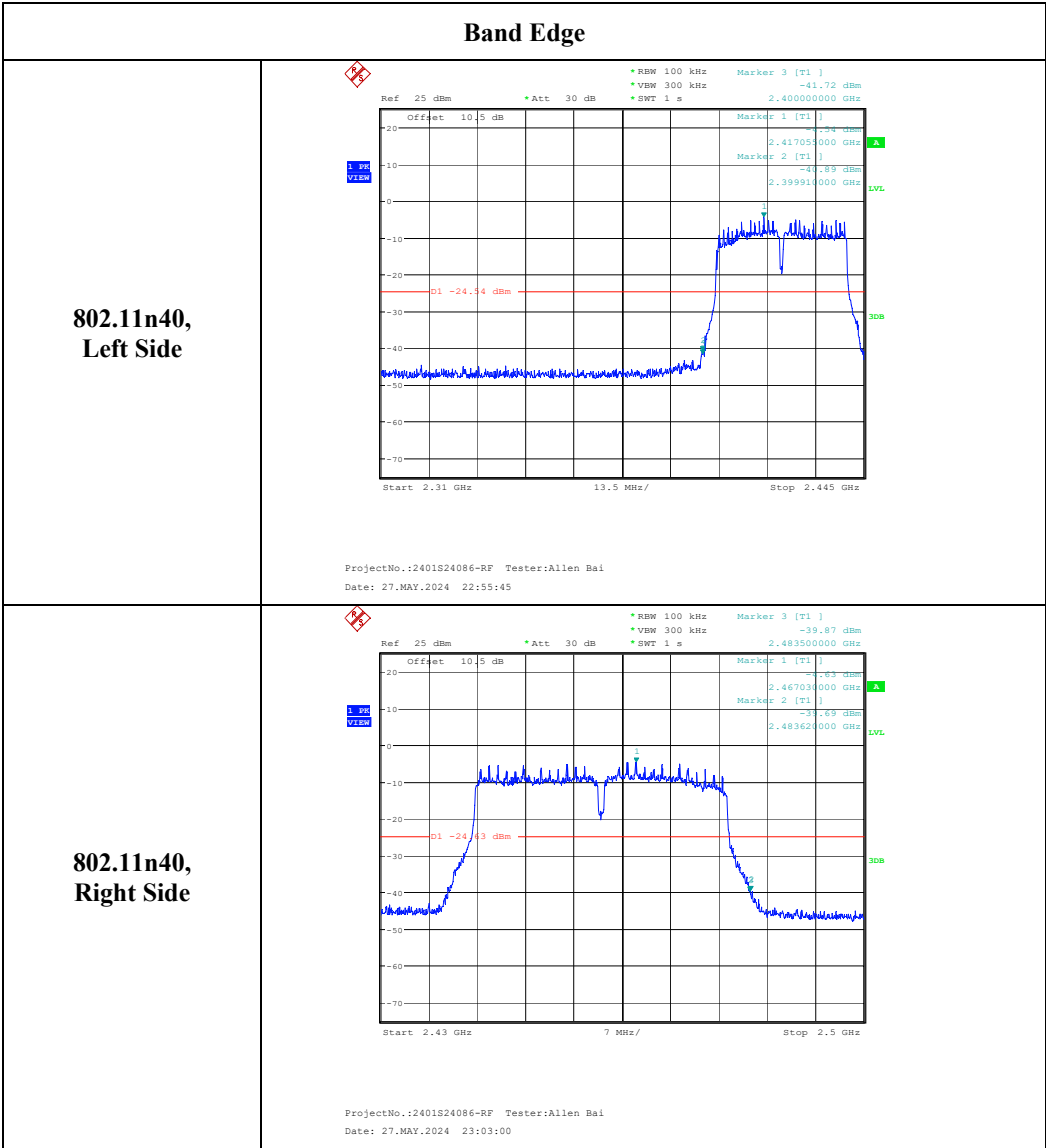
Ref 25 dBm *Att 30 dB RBW 100 kHz Marker 3 [Ti]
VBW 300 kHz -39.87 dBm
SWT 1 s 2.48500000 GHz

Marker 1 [Ti] -3.74 dBm 2.47045000 GHz
Marker 2 [Ti] -3.74 dBm 2.48550000 GHz
Marker 3 [Ti] -39.87 dBm 2.48500000 GHz

Start 2.45 GHz 5 MHz/ Stop 2.5 GHz

ProjectNo.:2401S24086-RF Tester:Allen Bai
Date: 27.MAY.2024 22:23:45





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.

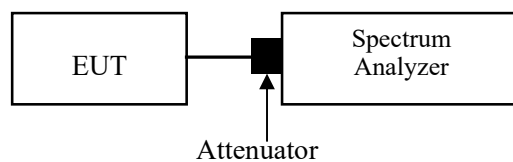
Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.10.2

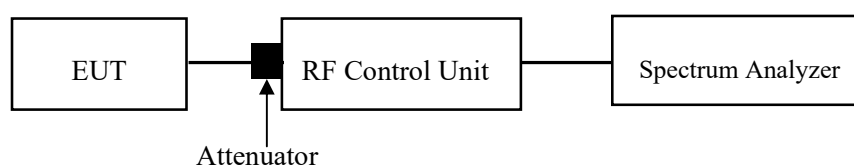
Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.

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.

For Wi-Fi mode:



For BLE mode:



Test Data

Environmental Conditions

Temperature:	24~25 °C
Relative Humidity:	45~50 %
ATM Pressure:	100~101kPa

The testing was performed by Tom Tan and Allen Bai from 2024-05-21 to 2024-05-27.

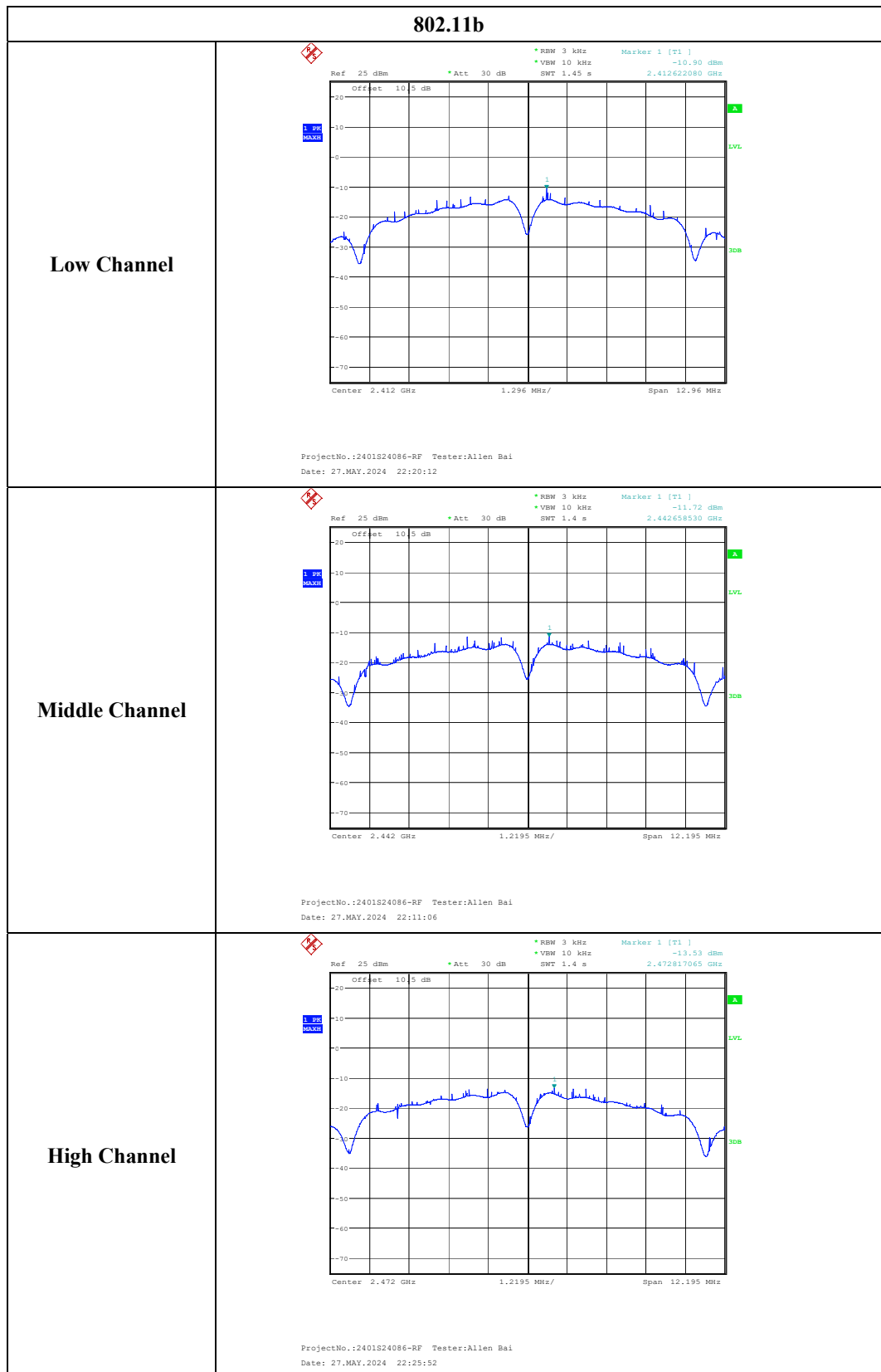
EUT operation mode: Transmitting

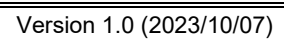
Test Result: Compliant.

BLE: Please refer to the Appendix.

2.4G Wi-Fi:

Test Modes	Test Frequency (MHz)	Reading (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	2412	-10.90	8.00
	2442	-11.72	8.00
	2472	-13.53	8.00
802.11g	2412	-22.25	8.00
	2442	-22.03	8.00
	2472	-23.19	8.00
802.11n20	2412	-22.76	8.00
	2442	-23.35	8.00
	2472	-22.92	8.00
802.11n40	2422	-20.73	8.00
	2442	-20.17	8.00
	2462	-20.78	8.00





Version 1.0 (2023/10/07)

[illegible]

EUT PHOTOGRAPHS

Please refer to the attachment 2401S24086-RF External photo and 2401S24086-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2401S24086-RFA Test Setup photo.

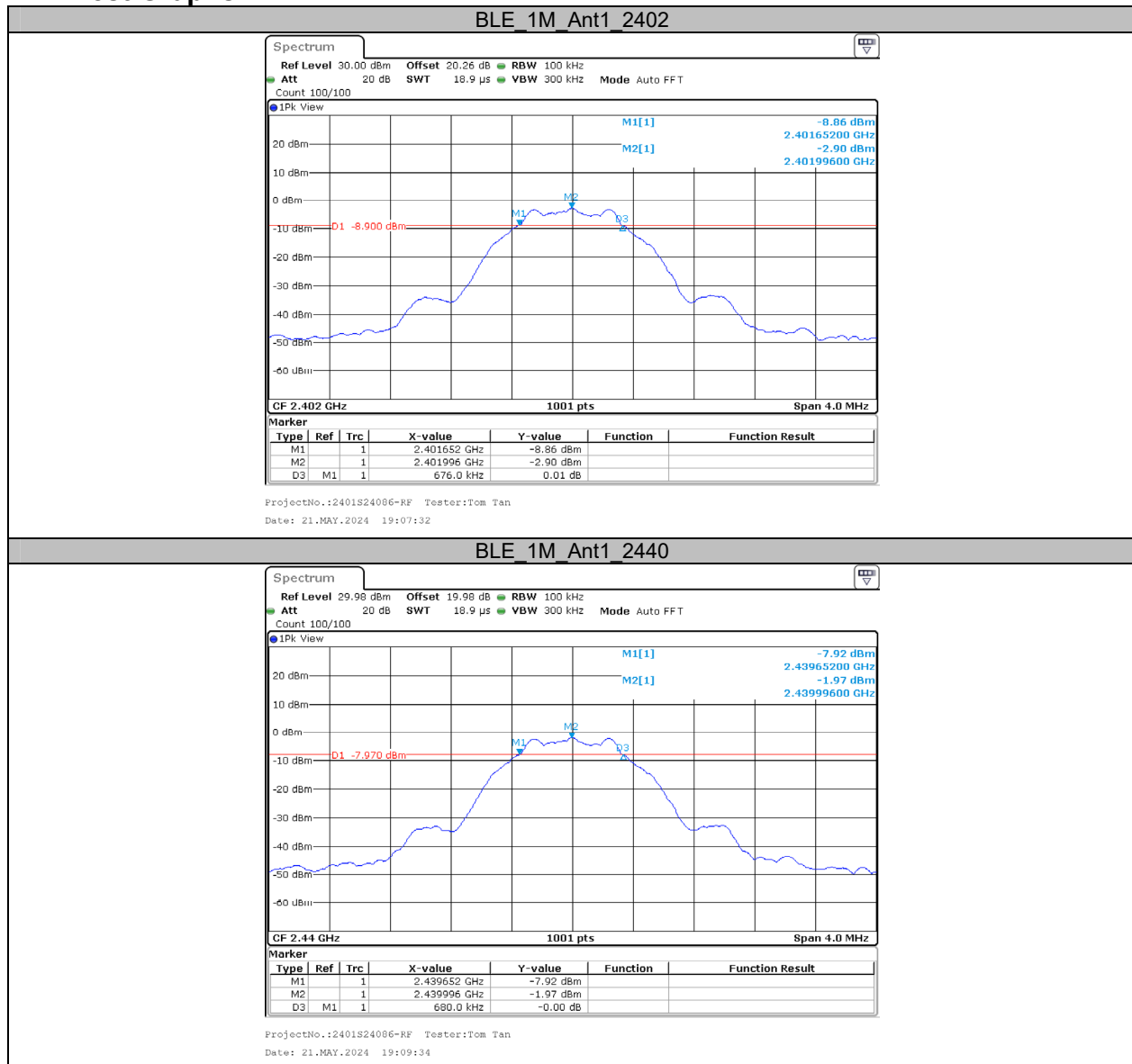
APPENDIX- BLE

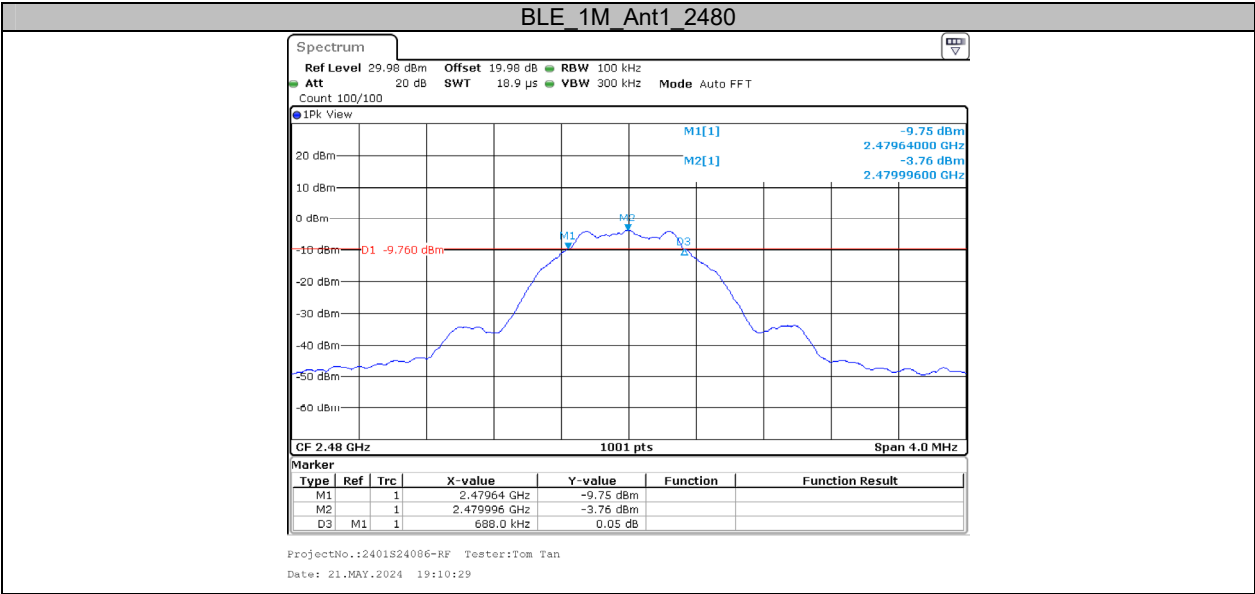
Appendix A: DTS Bandwidth

Test Result

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.68	2401.65	2402.33	0.5	PASS
		2440	0.68	2439.65	2440.33	0.5	PASS
		2480	0.69	2479.64	2480.33	0.5	PASS

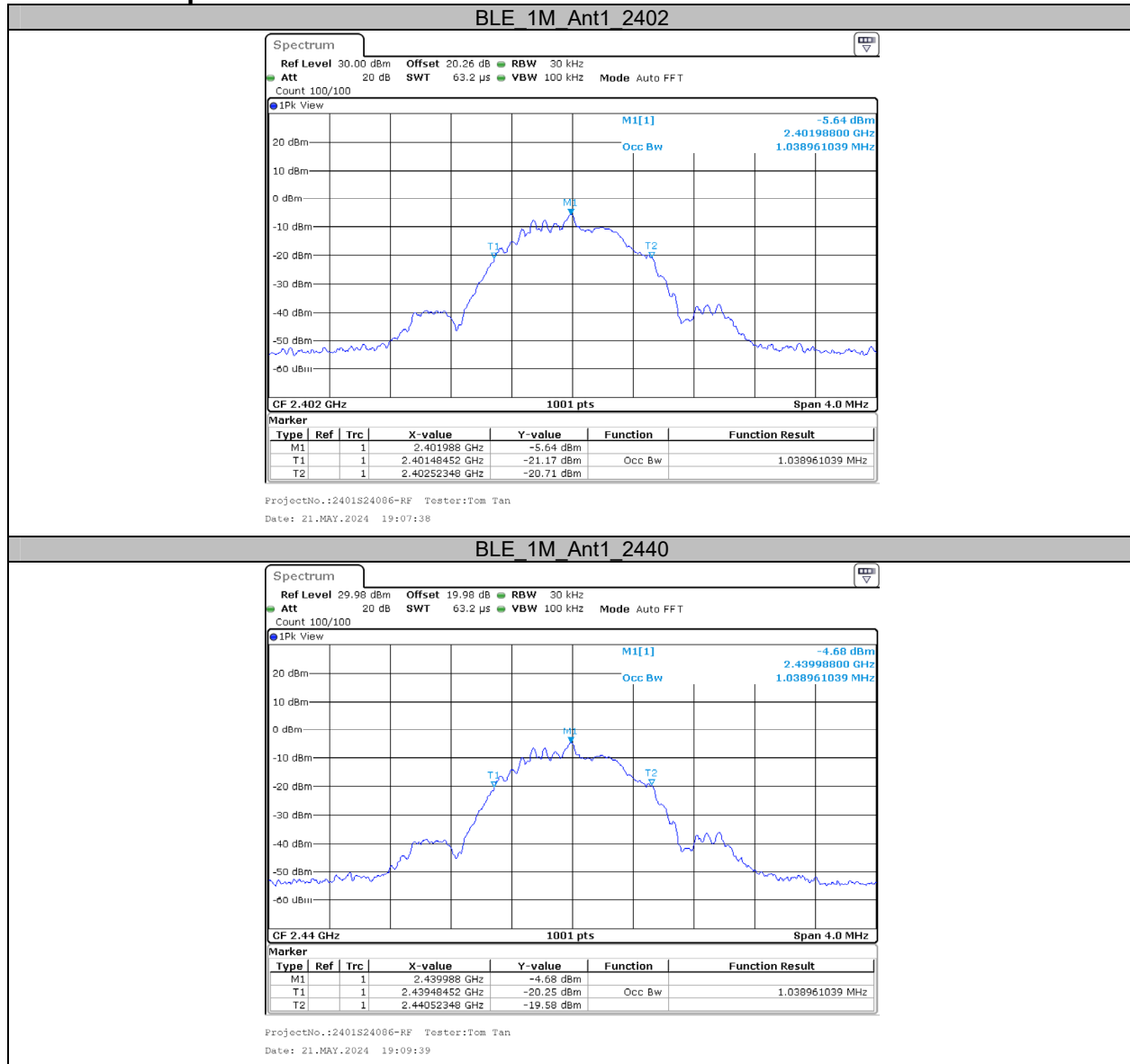
Test Graphs

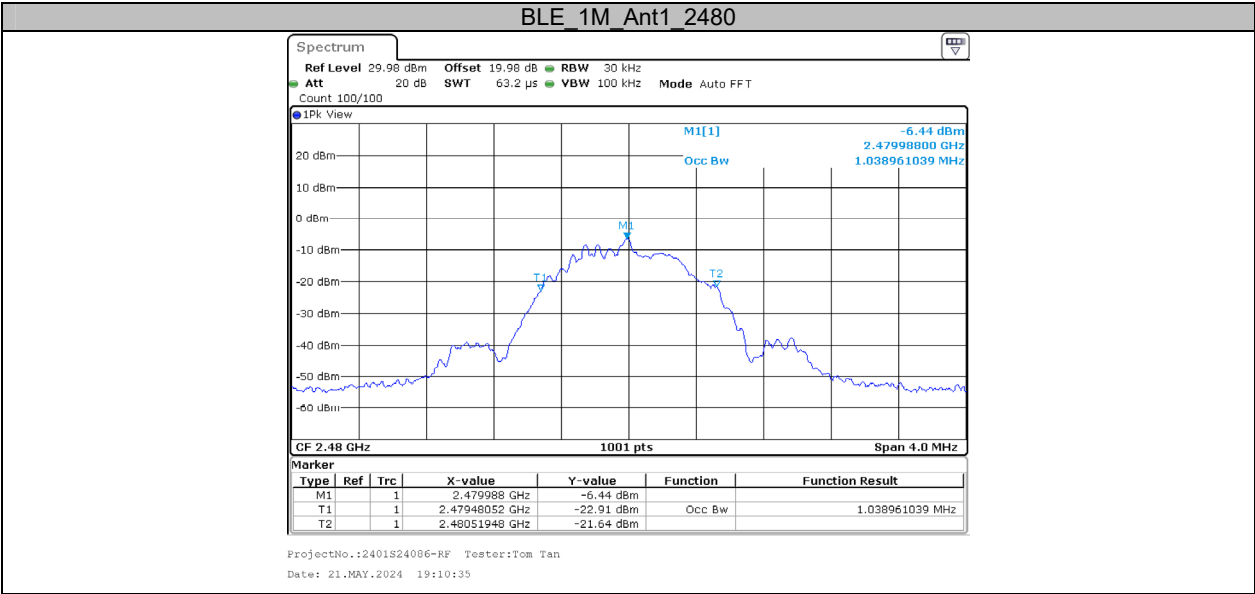




Appendix B: Occupied Channel Bandwidth**Test Result**

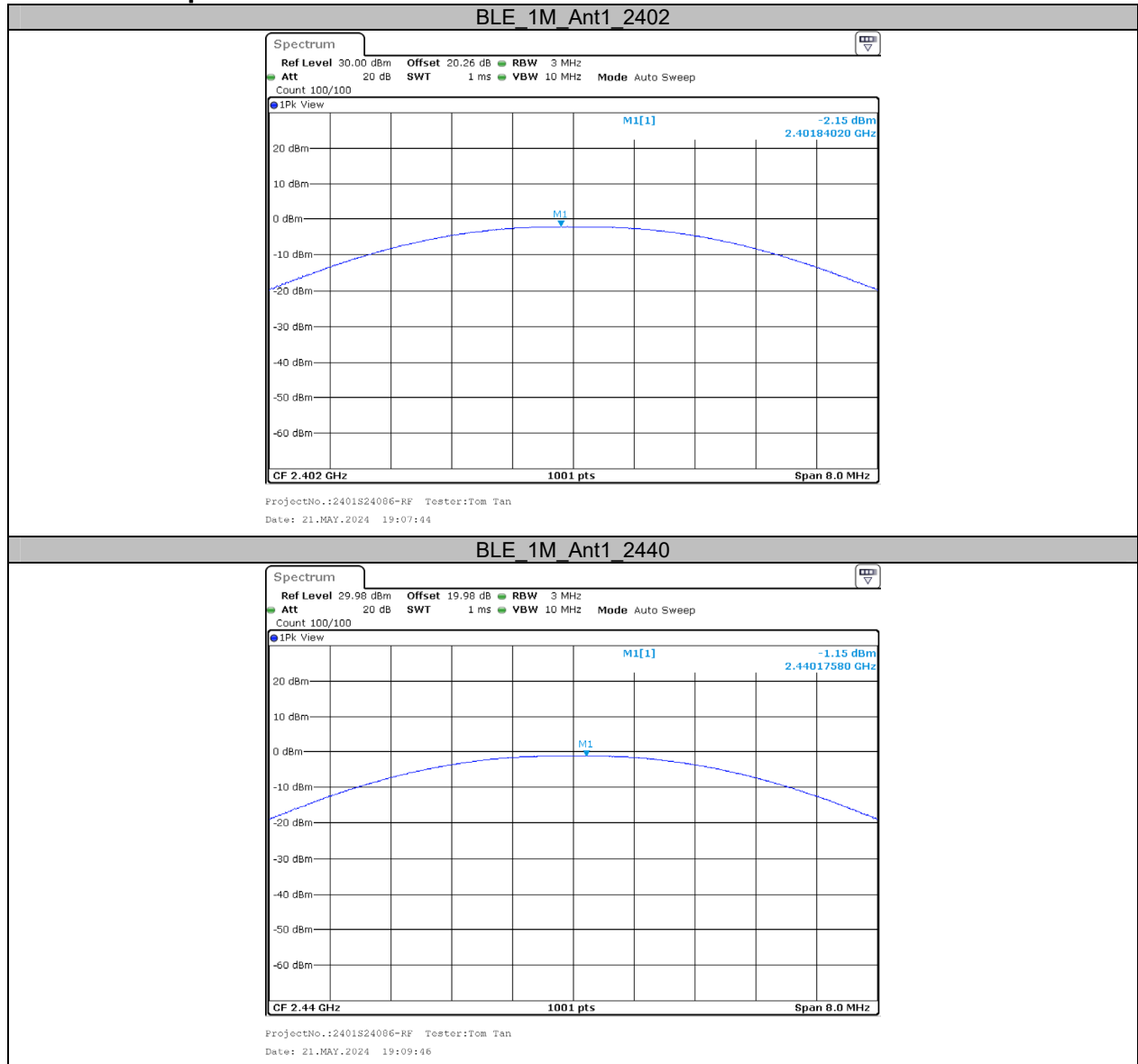
Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.039	2401.4845	2402.5235	---	---
		2440	1.039	2439.4845	2440.5235	---	---
		2480	1.039	2479.4805	2480.5195	---	---

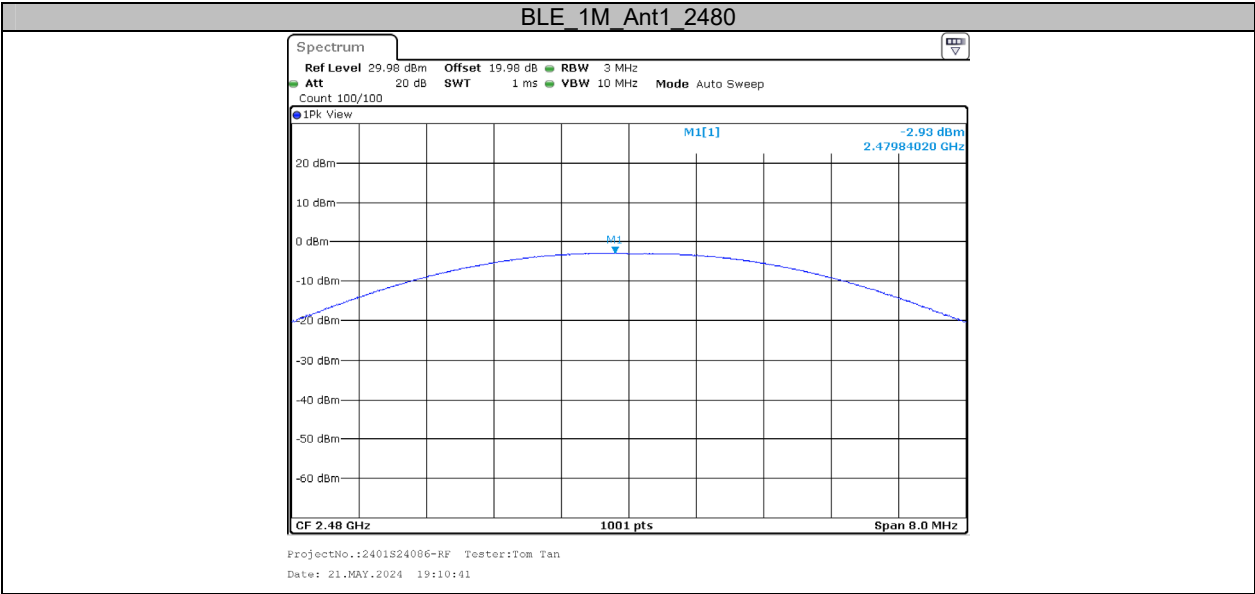
Test Graphs



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	-2.15	≤30	PASS
		2440	-1.15	≤30	PASS
		2480	-2.93	≤30	PASS

Test Graphs Peak

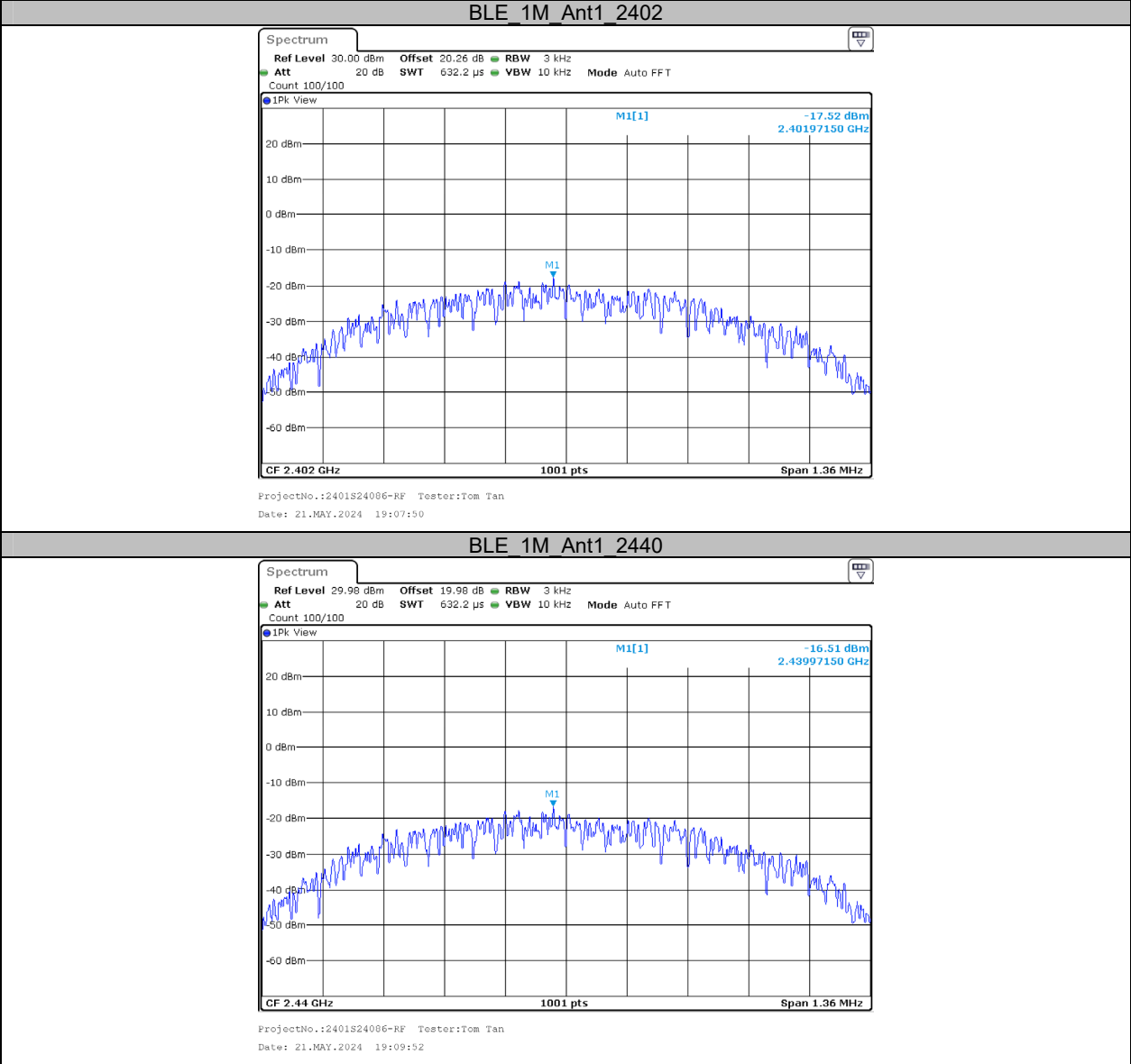


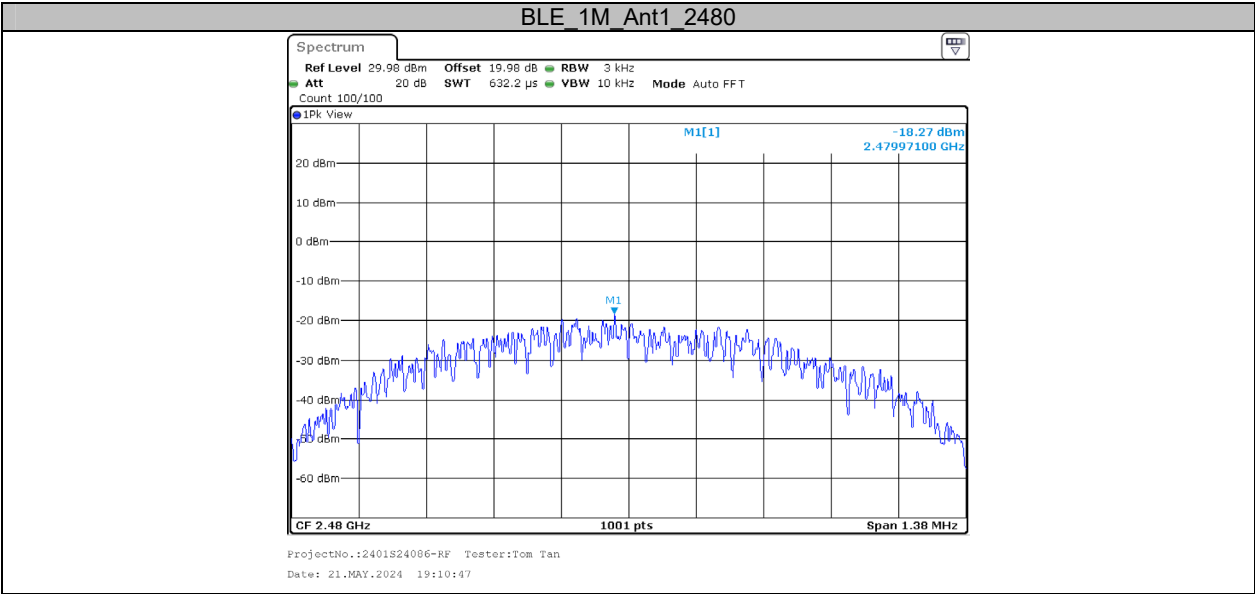
Appendix D: Maximum Power Spectral Density

Test Result

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-17.52	≤8.00	PASS
		2440	-16.51	≤8.00	PASS
		2480	-18.27	≤8.00	PASS

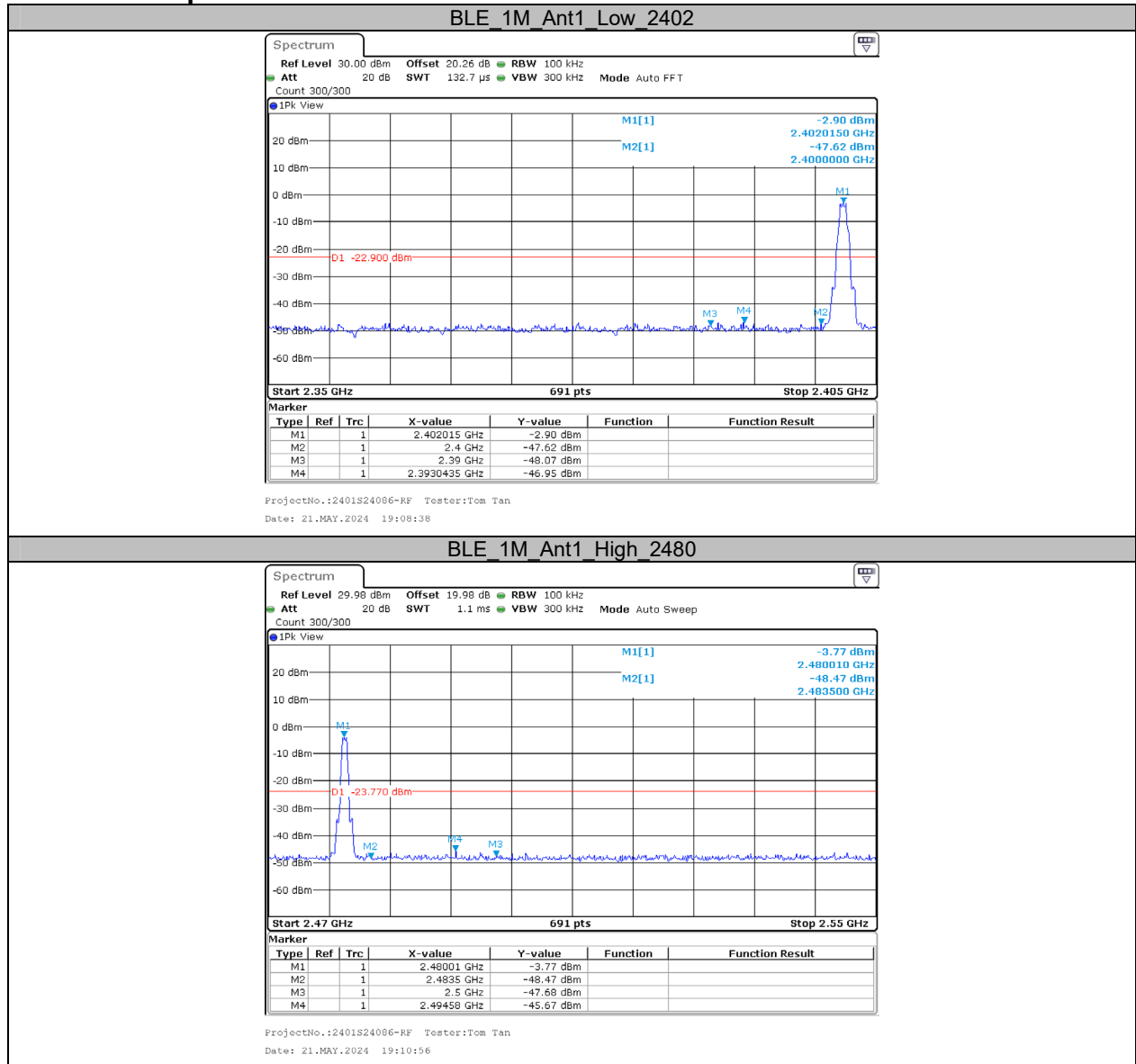
Test Graphs





Appendix E: Band Edge Measurements

Test Graphs

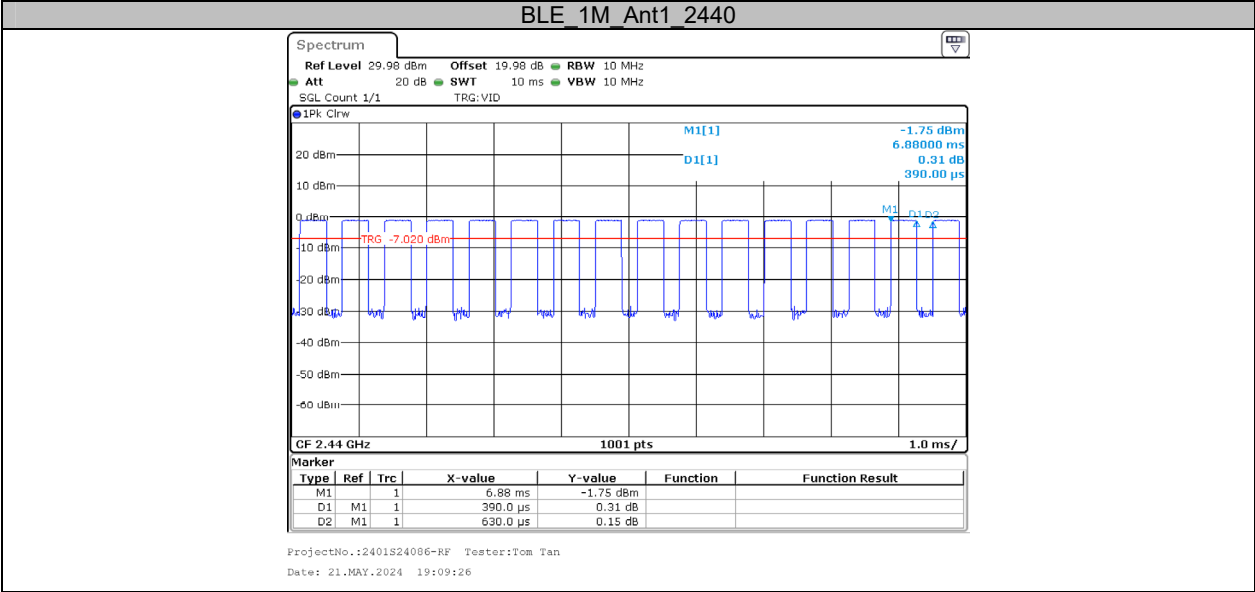


Appendix F: Duty Cycle

Test Result

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	1/T[Hz]	VBW Setting [Hz]
BLE_1M	Ant1	2440	0.39	0.63	61.90	2564	3000

Test Graphs



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