

# TEST REPORT

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Guangdong, China  
Report Number: 2401Z54419E-RF-00B  
FCC ID: 2ASYE-T3-S3

## Test Standard (s)

FCC PART 15.247

## Sample Description

Product Type: T3-S3  
Model No.: T3-S3  
Multiple Model(s) No.: N/A  
Trade Mark: LILYGO  
Date Received: 2024-11-12  
Issue Date: 2025-05-13

Test Result:

Pass▲

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

Prepared and Checked By:

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Ekko Wu  
RF Engineer

Approved By:

Michelle Zeng

Michelle Zeng  
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	2401Z54419E-RF-00B	Original Report	2025-05-13

## GENERAL INFORMATION

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

<b>Frequency Range</b>	2402~2480MHz
<b>Maximum Conducted Output Peak Power</b>	6.5dBm
<b>Modulation Technique</b>	GFSK
<b>Antenna Specification<sup>#</sup></b>	4.9dBi (provided by the applicant)
<b>Voltage Range</b>	DC 5V from USB Port
<b>Sample serial number</b>	2UD0-1 for Conducted and Radiated Emissions Test 2UD0-2 for RF Conducted Test (Assigned by BACL, Shenzhen)
<b>Sample/EUT Status</b>	Good condition
<b>Adapter Information</b>	N/A

### Objective

This report is in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209, 15.247 rules.

### Test Methodology

All tests and measurements indicated in this document were performed in accordance ANSI C63.10-2013.

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		109.2kHz(k=2, 95% level of confidence)
RF output power, conducted		0.86dB(k=2, 95% level of confidence)
AC Power Lines Conducted Emissions	9kHz~150 kHz	3.63dB(k=2, 95% level of confidence)
	150 kHz ~30MHz	3.66dB(k=2, 95% level of confidence)
Radiated Emissions	0.009MHz~30MHz	3.60dB(k=2, 95% level of confidence)
	30MHz~200MHz (Horizontal)	5.32dB(k=2, 95% level of confidence)
	30MHz~200MHz (Vertical)	5.43dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Horizontal)	5.77dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Vertical)	5.73dB(k=2, 95% level of confidence)
	1GHz - 6GHz	5.34dB(k=2, 95% level of confidence)
	6GHz - 18GHz	5.40dB(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 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.

### EUT Exercise Software

Exercise Software <sup>#</sup>	EspRFTTestTool_v3.6_manual.exe		
Power Level <sup>#</sup>			
Mode	Low Channel	Middle Channel	High Channel
BLE 1M	10	10	10
BLE 2M	10	10	10

### Special Accessories

No special accessory.

### Equipment Modifications

No modification was made to the EUT tested.

**Support Equipment List and Details**

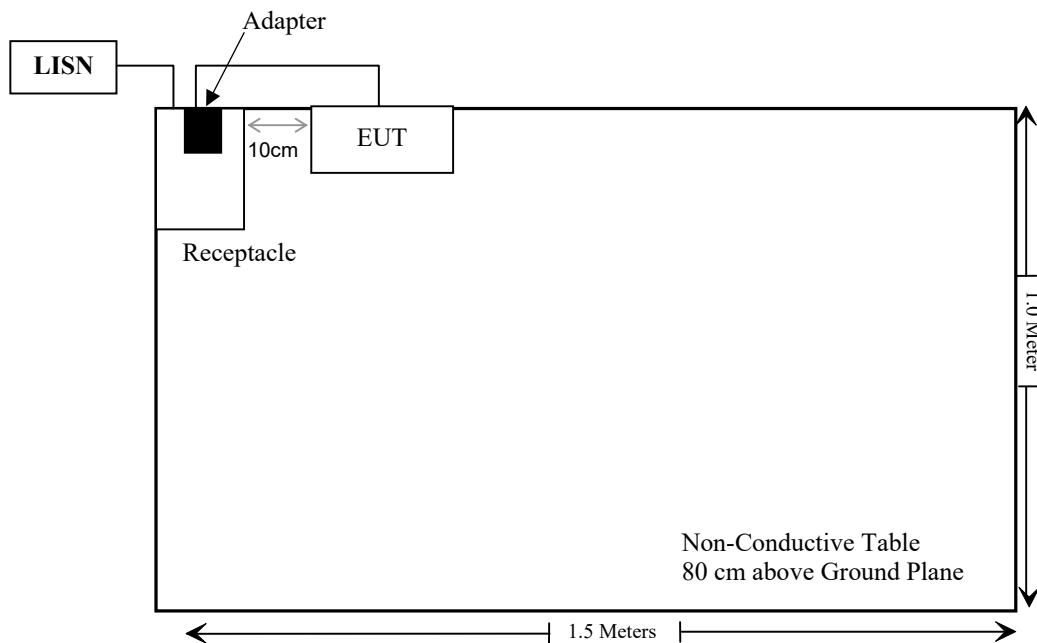
Manufacturer	Description	Model	Serial Number
BLU	Adapter	US-CR-2000	Unknown
Huajin	Adapter	HJ-0502000W2-US	Unknown
Oupu	Receptacle	Unknown	Unknown

**External I/O Cable**

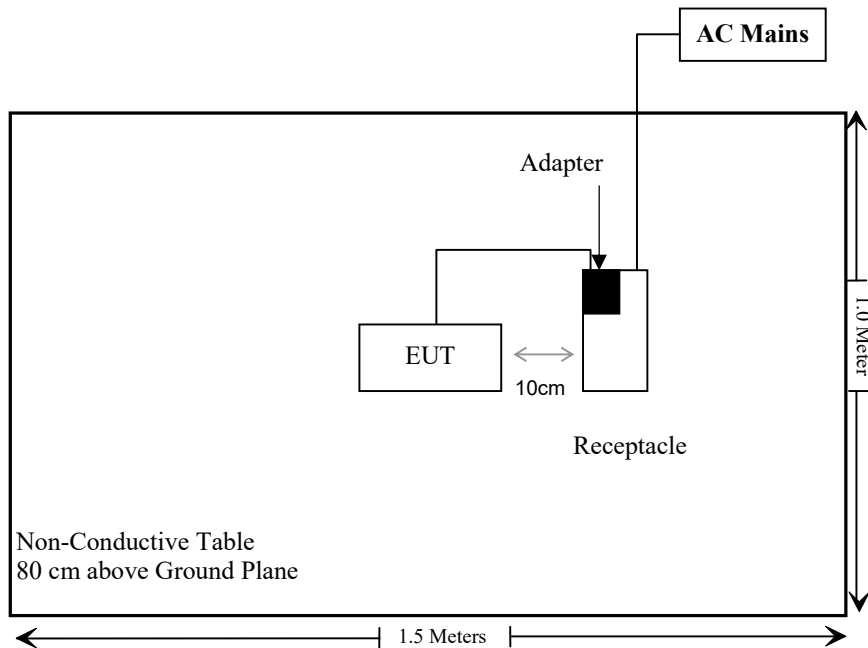
Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	0.5	EUT	Adapter
Unshielded detachable AC cable	1.0	Receptacle	LISN/AC Mains

**Block Diagram of Test Setup**

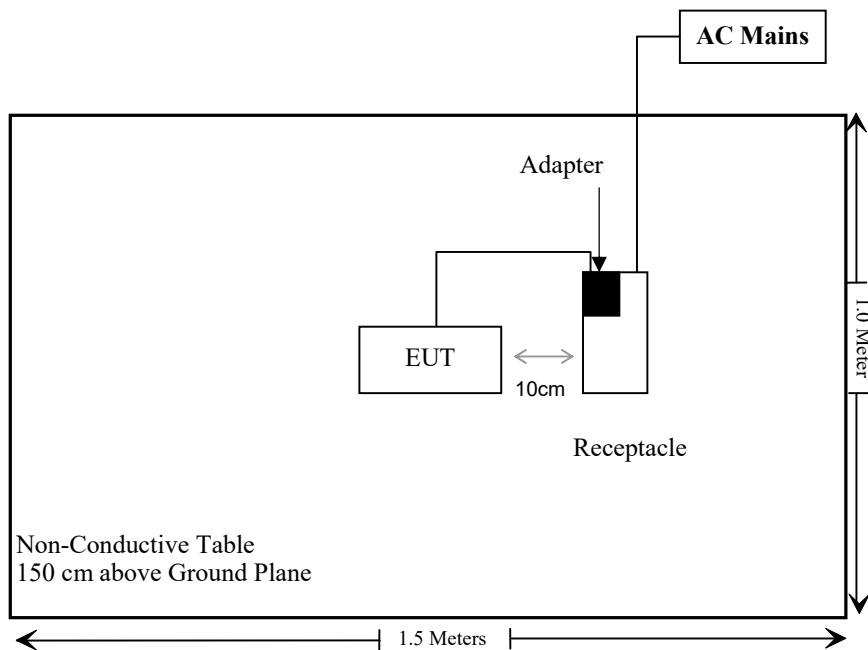
For Conducted Emissions:



For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:





**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§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
C63.10 §11.6	Duty Cycle	/
§15.247 (i) & §1.1307(b)(3)(i)(C)& §2.1091	MPE-based Exemption	Compliant

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Conducted Emission Test</b>					
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2024/01/16	2025/01/15
Rohde & Schwarz	LISN	ENV216	101613	2024/01/16	2025/01/15
Unknown	CE Cable	Unknown	UF A210B-1-0720-504504	2024/05/21	2025/05/20
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2024/05/21	2025/05/20
<b>Radiated Emission Test</b>					
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
Rohde & Schwarz	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310N	186238	2024/05/21	2025/05/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2026/07/19
Unknown	Cable	XH500C	J-10M-A	2024/06/18	2025/06/17
Unknown	Cable	Chamber Cable 1	F-03-EM236	2024/06/18	2025/06/17
BACL	Active Loop Antenna	1313-1A	4031911	2024/05/14	2027/05/13
Unknown	Cable	PNG214	1354	2024/05/21	2025/05/20
Unknown	Cable	2Y194	0735	2024/05/21	2025/05/20
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	0735	2024/06/18	2025/06/17
Unknown	RF Cable	UFA147	219661	2024/06/18	2025/06/17
Unknown	RF Cable	XH750A-N	J-10M	2024/06/18	2025/06/17
JD	Filter Switch Unit	DT7220FSU	DS79906	2024/09/09	2025/09/08
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	2024/06/18	2025/06/17

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyze	FSU26	200982	2024/09/20	2025/09/19
Rohde&Schwarz	Spectrum Analyzer	FSV40-N	102259	2024/01/16	2025/01/15
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).

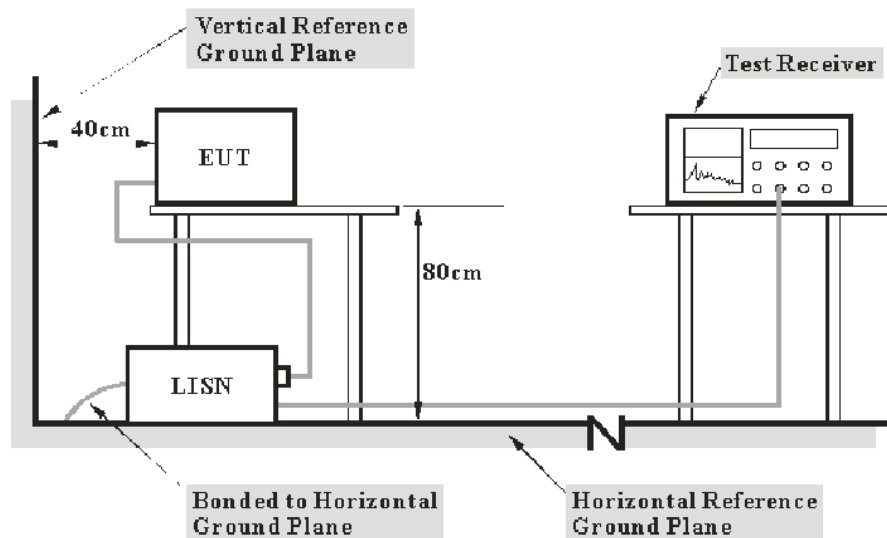
## REQUIREMENTS AND TEST PROCEDURES

### 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**

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).

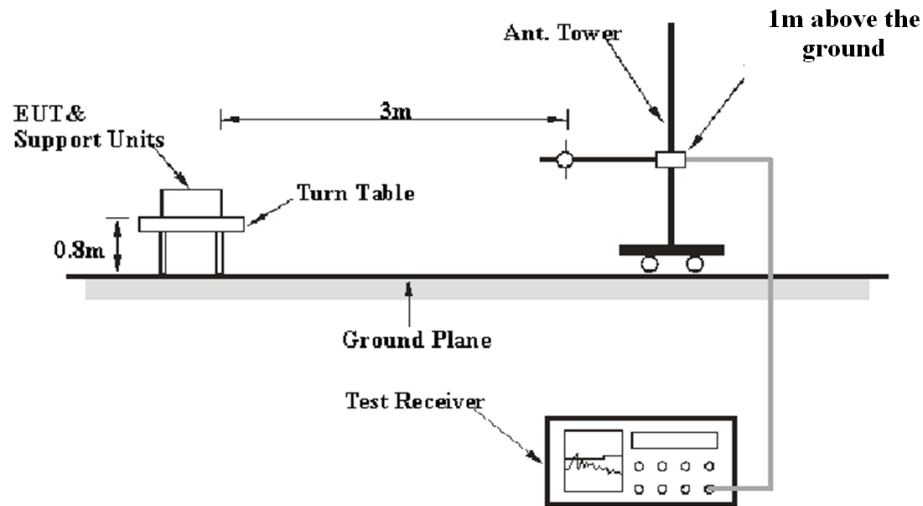
## Unwanted Emission Frequencies and Restricted Bands

### Applicable Standard

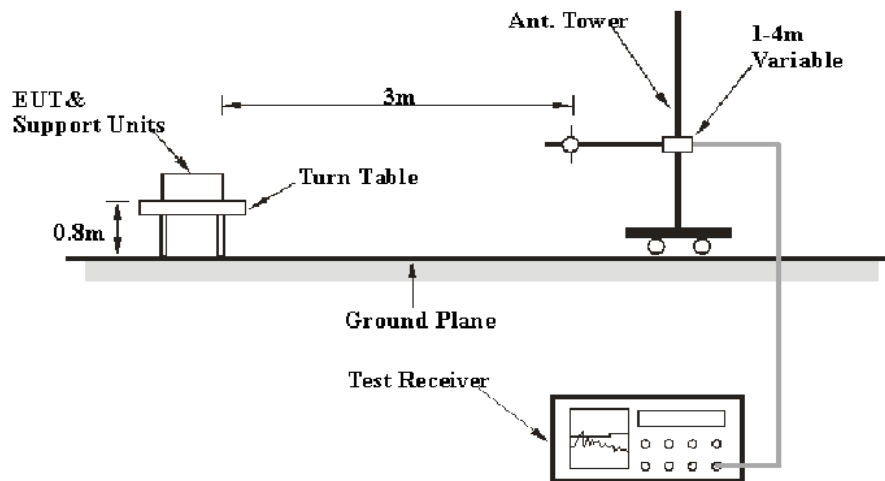
FCC §15.247 (d); §15.209; §15.205;

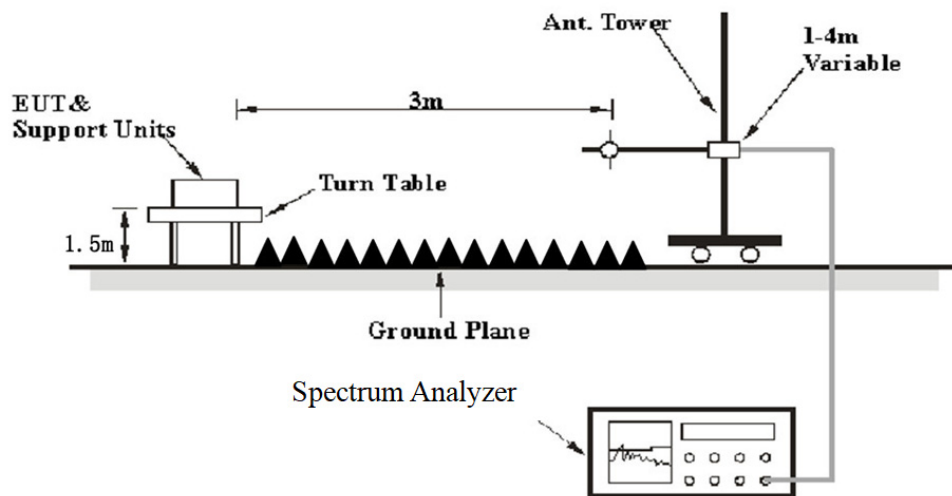
### EUT Setup

9 kHz-30MHz:



30MHz-1GHz:



**Above 1GHz:**

The radiated emission tests were performed in the 3meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.205, FCC 15.209, FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

**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	Detector
9 kHz – 150 kHz	/	/	200 Hz	QP	QP
	300 Hz	1 kHz	/	PK	PK
150 kHz – 30 MHz	/	/	9 kHz	QP	QP
	10 kHz	30 kHz	/	PK	PK
30 MHz – 1000 MHz	/	/	120 kHz	QP	QP
	100 kHz	300 kHz	/	PK	PK

1-25GHz:

Pre-scan

Measurement	Duty cycle	RBW	Video B/W	Detector
PK	Any	1MHz	3 MHz	PK
AV	>98%	1MHz	1 kHz	PK
	<98%	1MHz	$\geq 1/\text{Ton}$	PK

Final measurement for emission identified during pre-scan

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

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:

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



## 6 dB Emission Bandwidth

### Standard Applicable

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.

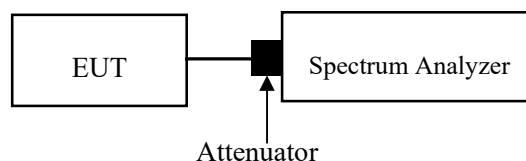
### Test Procedure

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

- Set RBW = 100 kHz.
- Set the VBW  $\geq [3 \times \text{RBW}]$ .
- Detector = peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. Procedure as below

- The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (\text{OBW}/\text{RBW})]$  below the reference level.
- Step a) through step c) might require iteration to adjust within the specified range.
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
- If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).



## Peak Output Power Measurement

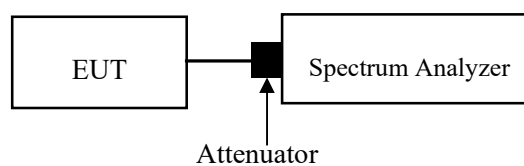
### Applicable Standard

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

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.
4. Set the RBW  $\geq$  DTS bandwidth.
5. Set the VBW  $\geq [3 \times \text{RBW}]$ .
6. Set span  $\geq [3 \times \text{RBW}]$ .
7. Sweep time = auto couple.
8. Detector = peak.
9. Trace mode = max hold.
10. Allow the trace to stabilize.
11. Use peak marker function to determine the peak amplitude level.



Note: A short RF cable with low cable loss connected to the EUT antenna port, which was provided by client or lab, the cable loss was add with offset into test equipment, the total offset consists of attenuator and/or RF cable loss

## 100 kHz Bandwidth of Frequency Band Edge

### Applicable Standard

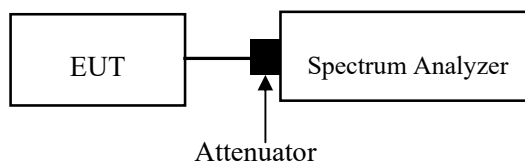
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required

### Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.11

1. Set the RBW =100 kHz.
2. Set the VBW  $\geq 3 \times$  RBW.
3. Detector = peak
4. Sweep time = auto couple.
5. Trace mode=max hold
6. All trace to fully stabilize
7. Use the peak marker function to determine the maximum amplitude level.  
Ensure that amplitude of all unwanted emissions outside of the authorized frequency band(excluding restricted frequency bands) is attenuated by at least the minimum requirement specified in 11.11.  
Report the three highest emissions relative to the limit.



## Power Spectral Density

### Applicable Standard

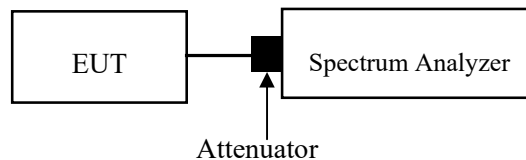
According to FCC §15.247(e):

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

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set analyzer center frequency to DTS channel center frequency
3. Set the span to 1.5 times the DTS bandwidth.
4. Set the RBW to:  $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$ .
5. Set the VBW  $\geq 3 \times \text{RBW}$ .
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level within the RBW.
11. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Note: A short RF cable with low cable loss connected to the EUT antenna port, which was provided by client or lab, the cable loss was add with offset into test equipment, the total offset consists of attenuator and/or RF cable loss

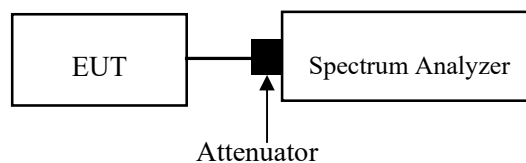
## Duty Cycle

### Test Procedure

According to ANSI C63.10-2013 Section 11.6

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:

- 1) Set the center frequency of the instrument to the center frequency of the transmission.
- 2) Set  $RBW \geq OBW$  if possible; otherwise, set RBW to the largest available value.
- 3) Set  $VBW \geq RBW$ . Set detector = peak or average.
- 4) The zero-span measurement method shall not be used unless both RBW and VBW are  $> 50/T$  and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if  $T \leq 16.7 \mu s$ .)



## **ANTENNA REQUIREMENT**

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### **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 an internal antenna arrangement, which was permanently attached, the antenna gain<sup>#</sup> is 4.9dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result: Compliant**

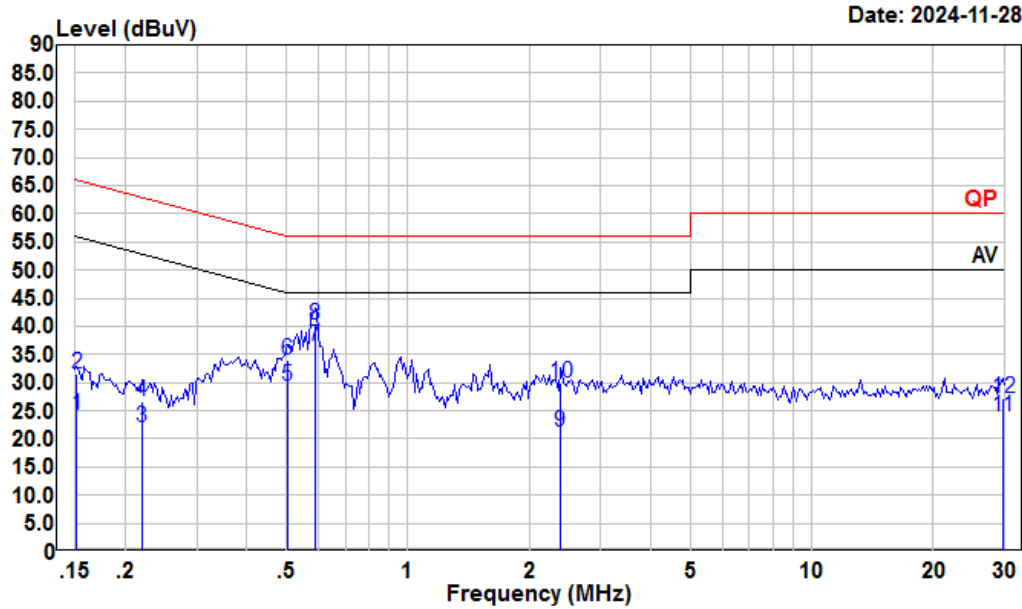
TEST DATA AND RESULTS

AC Line Conducted Emissions

Environmental Conditions

Temperature (°C)	24	Relative Humidity (%)	45
ATM Pressure (kPa)	101	Test engineer	Macy.shi
Test date	2024.11.28		
EUT operation mode	Transmitting(Maximum output power mode, BLE 1M, high channel)		

## AC 120V 60 Hz, Line



Condition: Line

Project : 2401Z54419E-RF

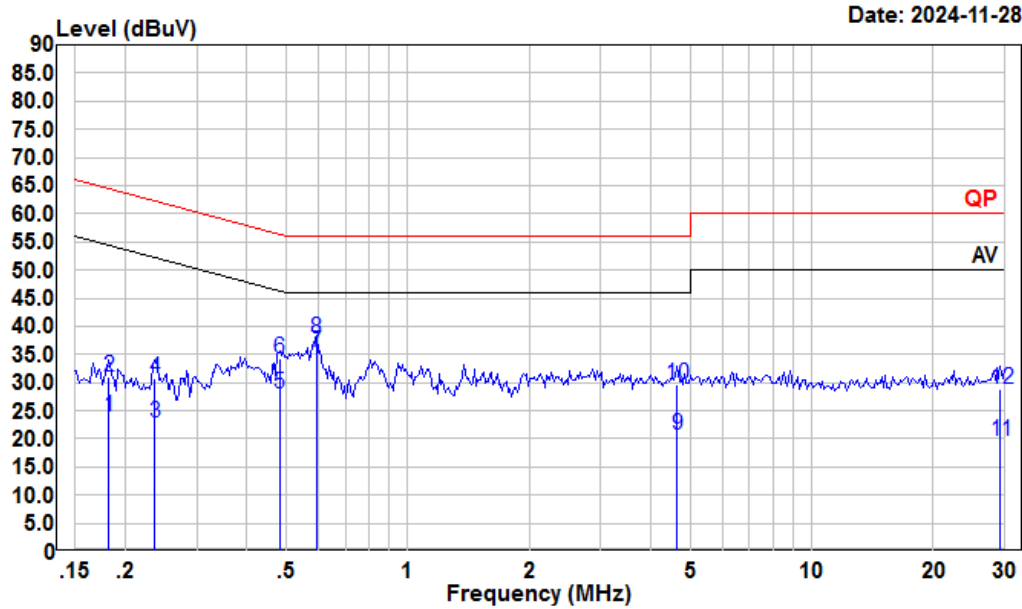
tester : Macy.shi Note: Transmitting

Setting : RBW:9KHz

	Freq	Read Level	LISN Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.152	3.25	24.28	10.90	10.13	55.91	-31.63	Average
2	0.152	10.43	31.46	10.90	10.13	65.91	-34.45	QP
3	0.220	1.26	22.12	10.77	10.09	52.83	-30.71	Average
4	0.220	5.80	26.66	10.77	10.09	62.83	-36.17	QP
5	0.502	8.86	29.50	10.50	10.14	46.00	-16.50	Average
6	0.502	13.25	33.89	10.50	10.14	56.00	-22.11	QP
7	0.589	15.79	36.41	10.50	10.12	46.00	-9.59	Average
8	0.589	19.70	40.32	10.50	10.12	56.00	-15.68	QP
9	2.384	0.65	21.34	10.52	10.17	46.00	-24.66	Average
10	2.384	9.17	29.86	10.52	10.17	56.00	-26.14	QP
11	29.684	3.13	23.86	10.51	10.22	50.00	-26.14	Average
12	29.684	6.57	27.30	10.51	10.22	60.00	-32.70	QP



## AC 120V 60 Hz, Neutral



Condition: Neutral

Project : 2401Z54419E-RF

tester : Macy.shi Note: Transmitting

Setting : RBW:9KHz

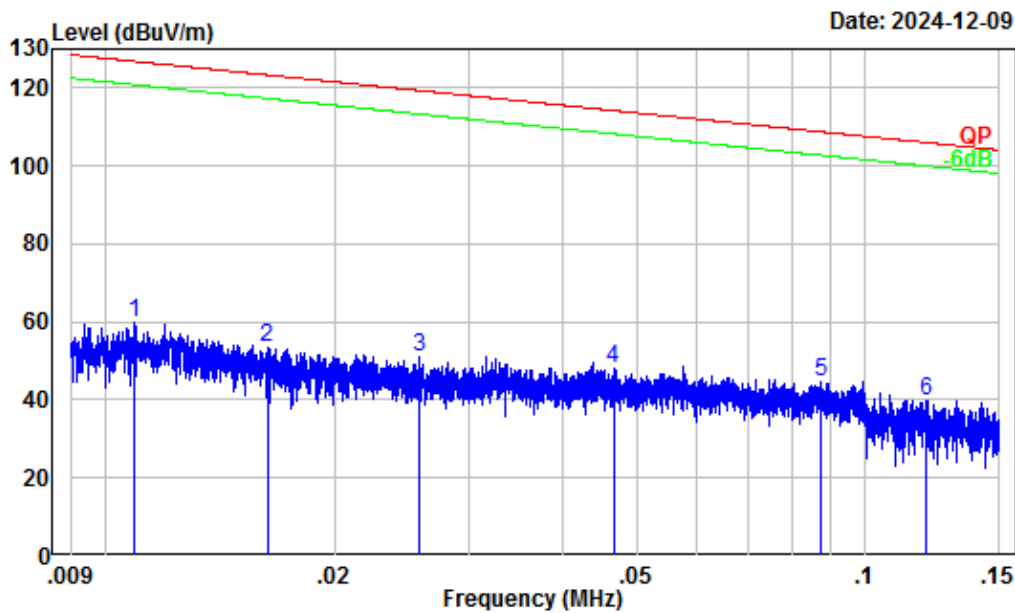
	Freq	Read Level	LISN Level	Cable Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.182	3.29	23.86	10.47	10.10	54.42	-30.56	Average
2	0.182	10.47	31.04	10.47	10.10	64.42	-33.38	QP
3	0.237	2.42	22.95	10.45	10.08	52.22	-29.27	Average
4	0.237	10.11	30.64	10.45	10.08	62.22	-31.58	QP
5	0.481	7.18	28.00	10.69	10.13	46.32	-18.32	Average
6	0.481	13.38	34.20	10.69	10.13	56.32	-22.12	QP
7	0.595	14.64	35.46	10.70	10.12	46.00	-10.54	Average
8	0.595	17.03	37.85	10.70	10.12	56.00	-18.15	QP
9	4.647	0.09	20.76	10.48	10.19	46.00	-25.24	Average
10	4.647	8.97	29.64	10.48	10.19	56.00	-26.36	QP
11	29.371	-1.25	19.48	10.51	10.22	50.00	-30.52	Average
12	29.371	8.18	28.91	10.51	10.22	60.00	-31.09	QP

**Unwanted Emission Frequencies and Restricted Bands****Environmental Conditions**

<b>Temperature (°C)</b>	18.6&24.1	<b>Relative Humidity (%)</b>	48&50
<b>ATM Pressure (kPa):</b>	102.2&101	<b>Test engineer:</b>	Carl Zhu & Dylan Yang
<b>Test date:</b>	2024-12-09&2024-12-03		
<b>EUT operation mode:</b>	Below 1GHz: Transmitting(Maximum output power mode, BLE 1M, high channel) Above 1GHz: Transmitting		
<b>Note:</b>	1. After pre-scan in the X, Y and Z axes of orientation, the worst case z-axis of orientation were recorded. 2. For 9 kHz~30 MHz test, Pre-scan in the parallel, perpendicular and ground parallel, just the worst case parallel was recorded in the report		

Below 1GHz:

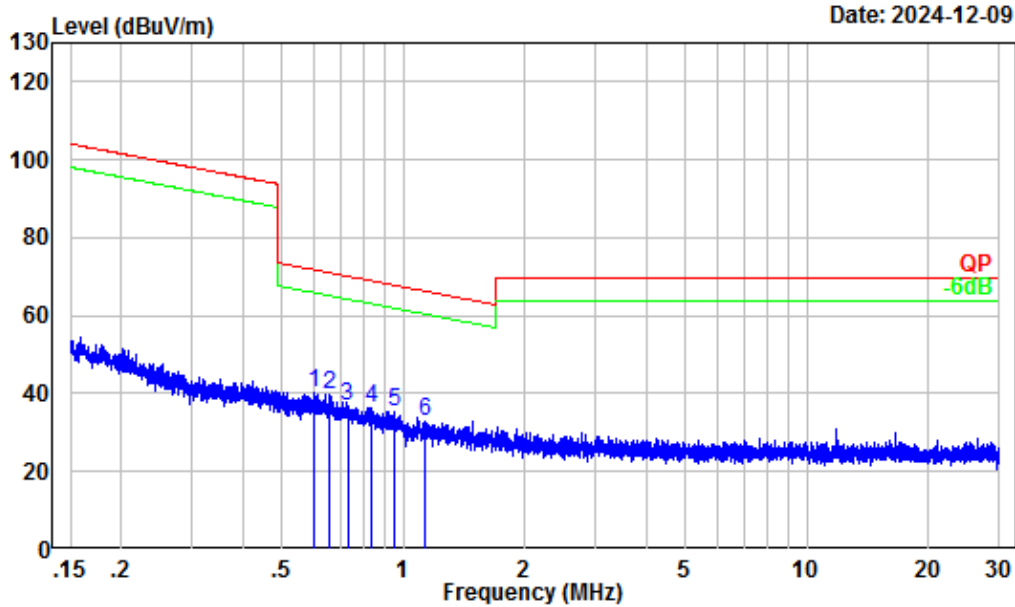
9kHz-150kHz



Site : Chamber A  
Condition : 3m  
Project Number : 2401Z54419E-RF  
Test Mode : BLE Transmitting  
Detector: Peak RBW/VBW: 0.3/1kHz  
Tester : Carl Zhu

	Freq	Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB/m	dBUV	dBUV/m	dBUV/m	dB	
1	0.01	32.12	27.77	59.89	126.83	-66.94	Peak
2	0.02	31.10	22.21	53.31	123.35	-70.04	Peak
3	0.03	29.29	21.59	50.88	119.35	-68.47	Peak
4	0.05	26.76	21.30	48.06	114.24	-66.18	Peak
5	0.09	22.87	21.91	44.78	108.75	-63.97	Peak
6	0.12	20.79	19.00	39.79	105.99	-66.20	Peak

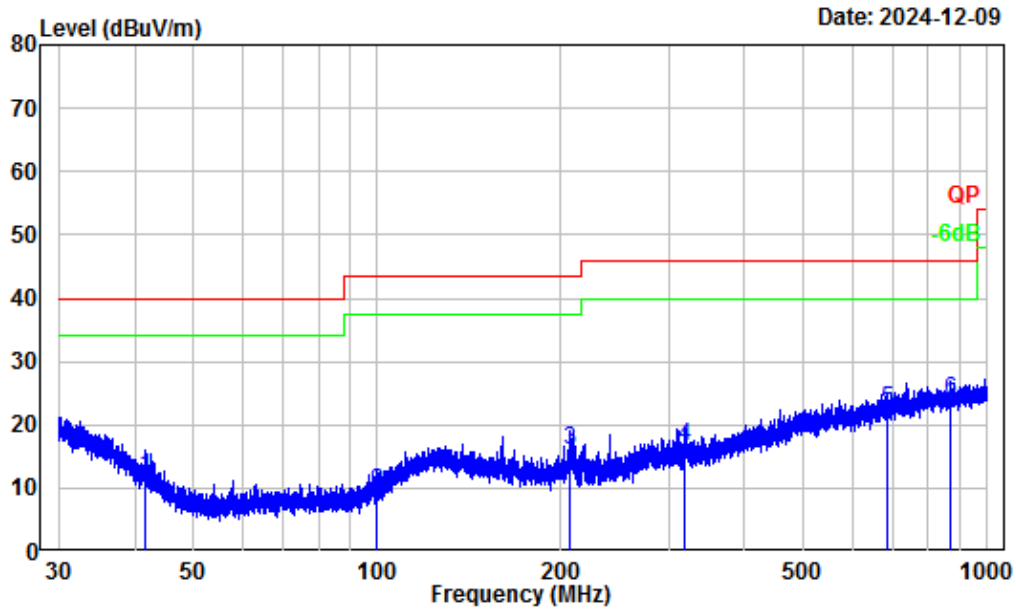
## 150kHz-30MHz



Site : Chamber A  
Condition : 3m  
Project Number : 2401Z54419E-RF  
Test Mode : BLE Transmitting  
Detector: Peak RBW/VBW: 10/30kHz  
Tester : Carl Zhu

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.60	5.16	35.20	40.36	72.00	-31.64	Peak
2	0.66	4.48	35.26	39.74	71.22	-31.48	Peak
3	0.73	3.58	33.40	36.98	70.28	-33.30	Peak
4	0.83	2.46	34.01	36.47	69.10	-32.63	Peak
5	0.95	1.59	33.66	35.25	67.95	-32.70	Peak
6	1.13	0.82	31.87	32.69	66.35	-33.66	Peak

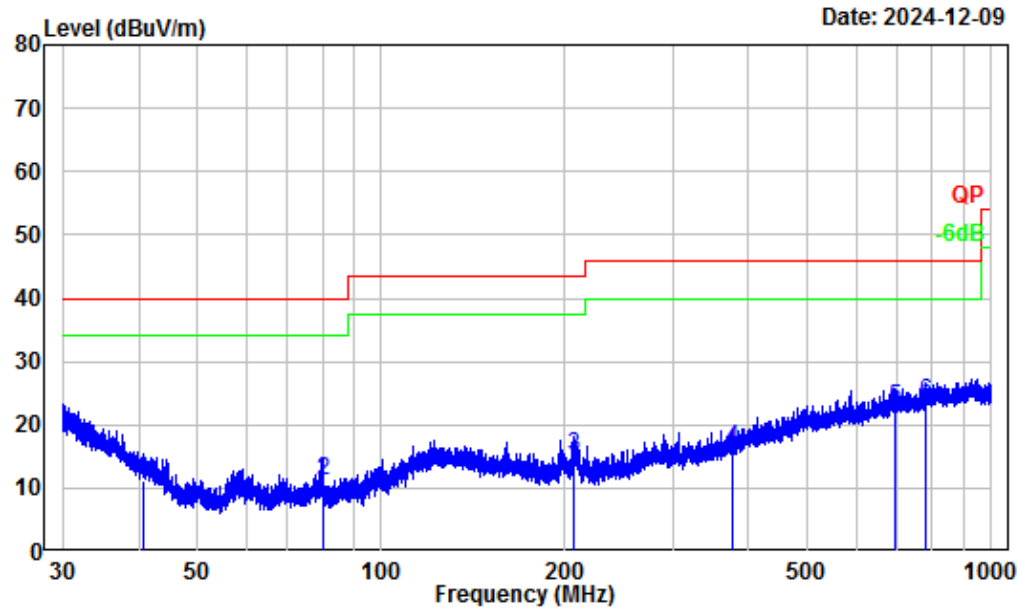
## 30MHz-1GHz\_Horizontal



Site : Chamber A  
Condition : 3m Horizontal  
Project Number : 2401Z54419E-RF  
Test Mode : BLE Transmitting  
Detector: Peak RBW/VBW: 100/300kHz  
Tester : Carl Zhu

	Freq Factor		Read	Limit	Over	Remark
	MHz	dB/m	Level	Line	Limit	
			dBuV	dBuV/m	dBuV/m	dB
1	41.62	-13.57	25.47	11.90	40.00	-28.10 QP
2	99.92	-15.91	25.13	9.22	43.50	-34.28 QP
3	206.94	-13.67	29.54	15.87	43.50	-27.63 QP
4	318.40	-10.84	27.38	16.54	46.00	-29.46 QP
5	683.55	-3.69	25.96	22.27	46.00	-23.73 QP
6	869.89	-1.62	25.39	23.77	46.00	-22.23 QP

30MHz-1GHz\_Vertical



Site : Chamber A  
Condition : 3m Vertical  
Project Number : 2401Z54419E-RF  
Test Mode : BLE Transmitting  
Detector: Peak RBW/VBW: 100/300kHz  
Tester : Carl Zhu

	Freq Factor		Read	Limit	Over	Remark
	MHz	dB/m	Level	Line	Limit	
			dBuV	dBuV/m	dBuV/m	dB
1	40.83	-12.95	24.21	11.26	40.00	-28.74 QP
2	80.01	-17.90	29.18	11.28	40.00	-28.72 QP
3	206.94	-13.67	28.72	15.05	43.50	-28.45 QP
4	376.27	-9.25	25.65	16.40	46.00	-29.60 QP
5	693.81	-3.56	26.32	22.76	46.00	-23.24 QP
6	782.35	-2.36	25.99	23.63	46.00	-22.37 QP

**Above 1GHz:**

Frequency (MHz)	Reading (dBμV)	Detector (PK/AV)	Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
<b>BLE 1M</b>							
Low Channel							
4804	55.07	PK	H	2.42	57.49	74	-16.51
4804	48.53	AV	H	2.42	50.95	54	-3.05
4804	50.32	PK	V	2.42	52.74	74	-21.26
4804	43.42	AV	V	2.42	45.84	54	-8.16
Middle Channel							
4880	53.65	PK	H	2.58	56.23	74	-17.77
4880	47.68	AV	H	2.58	50.26	54	-3.74
4880	49.71	PK	V	2.58	52.29	74	-21.71
4880	43.21	AV	V	2.58	45.79	54	-8.21
High Channel							
4960	52.32	PK	H	2.69	55.01	74	-18.99
4960	46.39	AV	H	2.69	49.08	54	-4.92
4960	48.32	PK	V	2.69	51.01	74	-22.99
4960	42.25	AV	V	2.69	44.94	54	-9.06
<b>BLE 2M</b>							
Low Channel							
4804	54.13	PK	H	2.42	56.55	74	-17.45
4804	45.82	AV	H	2.42	48.24	54	-5.76
4804	49.45	PK	V	2.42	51.87	74	-22.13
4804	40.28	AV	V	2.42	42.7	54	-11.3
Middle Channel							
4880	55.67	PK	H	2.58	58.25	74	-15.75
4880	46.52	AV	H	2.58	49.1	54	-4.9
4880	50.36	PK	V	2.58	52.94	74	-21.06
4880	41.71	AV	V	2.58	44.29	54	-9.71
High Channel							
4960	56.83	PK	H	2.69	59.52	74	-14.48
4960	47.43	AV	H	2.69	50.12	54	-3.88
4960	51.05	PK	V	2.69	53.74	74	-20.26
4960	42.16	AV	V	2.69	44.85	54	-9.15

Note:

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

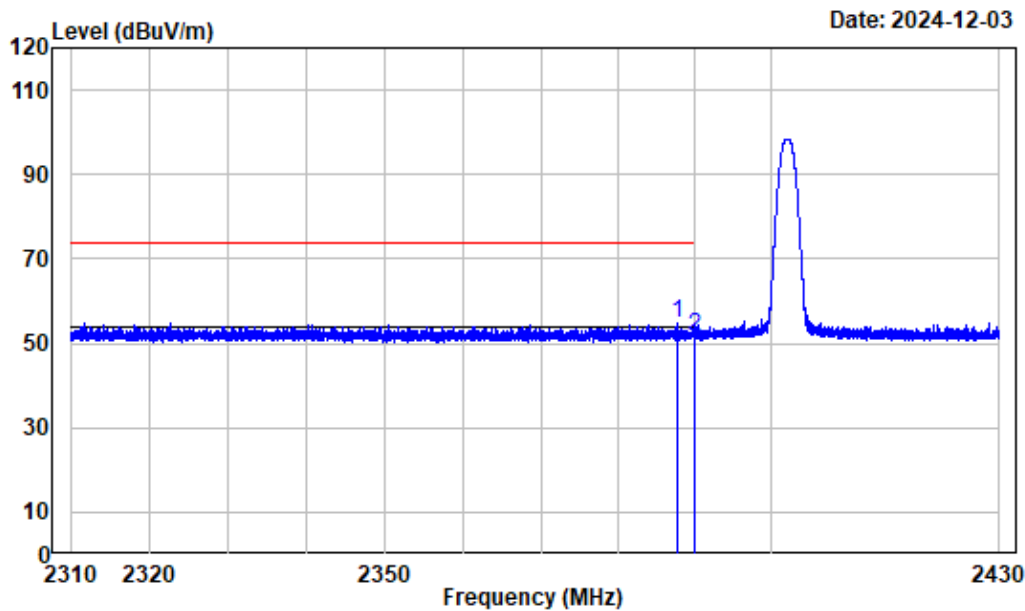
Corrected Amplitude/Level = Corrected Factor + Reading

Margin = Corrected Amplitude/Level - Limit

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

Test plots

Left Band edge\_Horizontal\_Peak\_BLE 1M

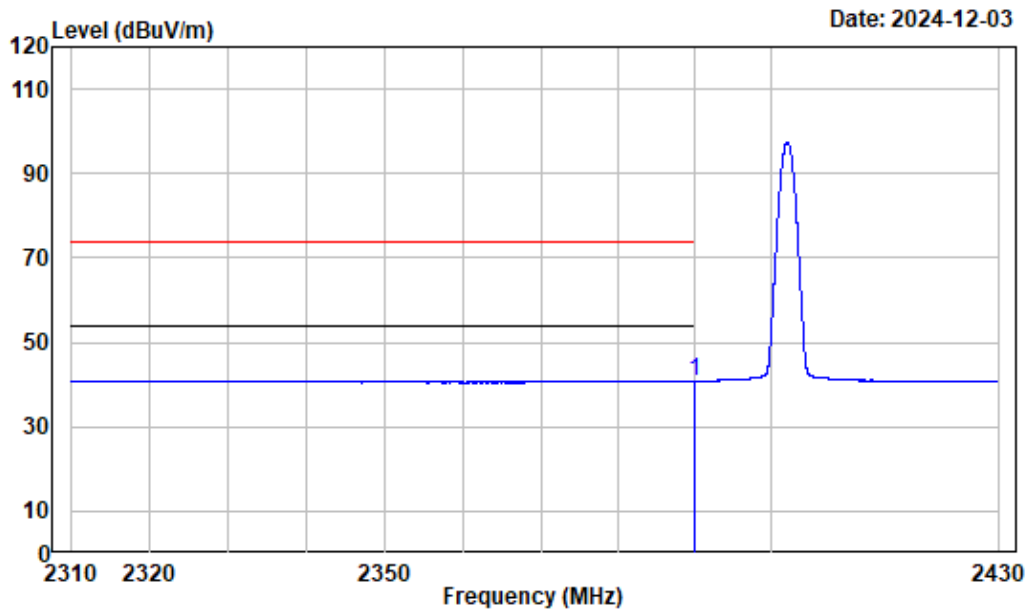


Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

Freq Factor		Read	Limit	Over	Remark	
MHz	dB/m	Level	Level	Line		
		dBuV	dBuV/m	dBuV/m	dB	
1	2387.695	-3.20	58.13	54.93	74.00	-19.07 peak
2	2390.000	-3.20	55.03	51.83	74.00	-22.17 Peak



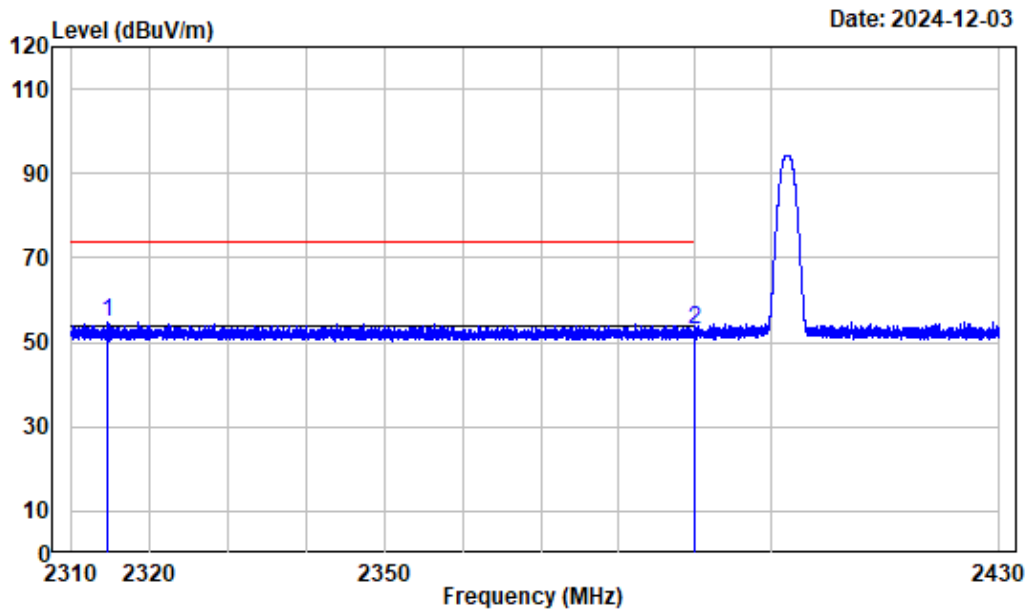
Left Band edge\_Horizontal\_Average\_BLE 1M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE1M\_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	-3.20	44.04	40.84	54.00	-13.16	Average

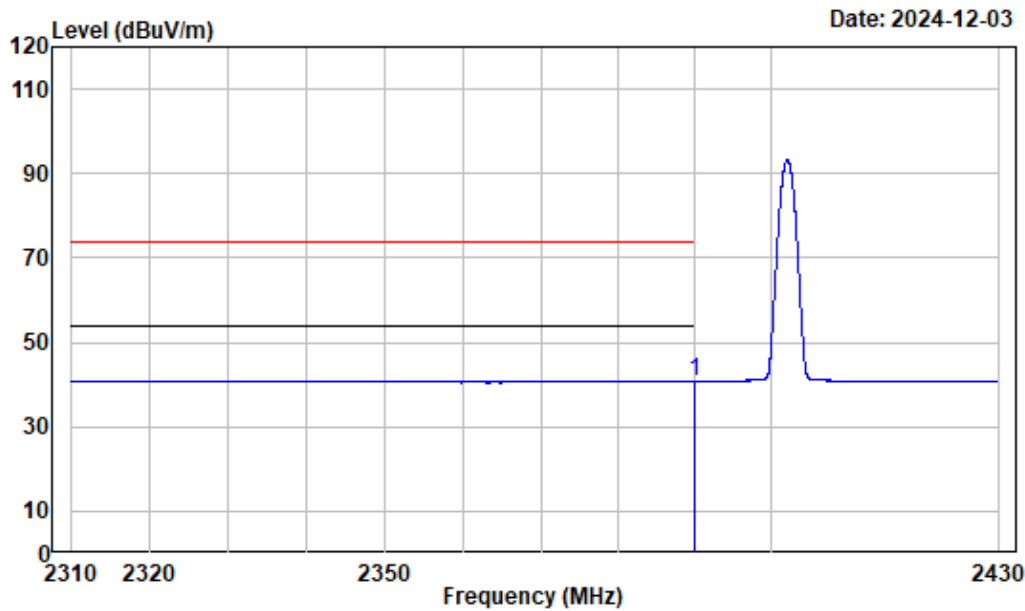
Left Band edge\_Vertical\_Peak\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

	Freq Factor		Read	Limit	Over	Remark
	MHz	dB/m	Level	Level	Line	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	2314.605	-3.11	57.95	54.84	74.00	-19.16 peak
2	2390.000	-3.20	56.23	53.03	74.00	-20.97 Peak

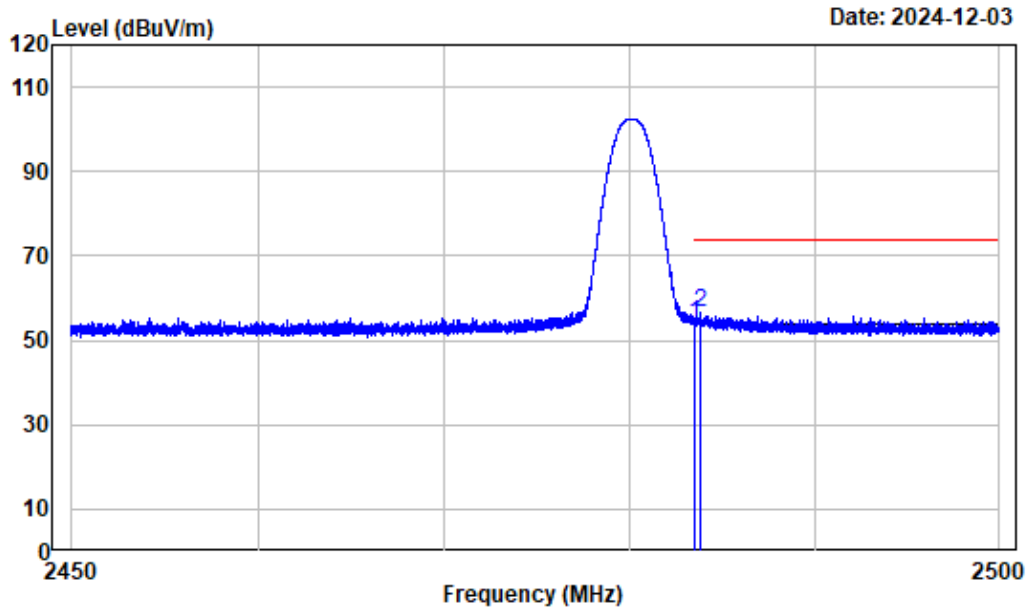
Left Band edge\_Vertical\_Average\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE1M\_2402

Freq Factor		Read	Limit	Over	Remark	
MHz	dB/m	Level	Level	Line		
		dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	-3.20	43.99	40.79	54.00	-13.21 Average

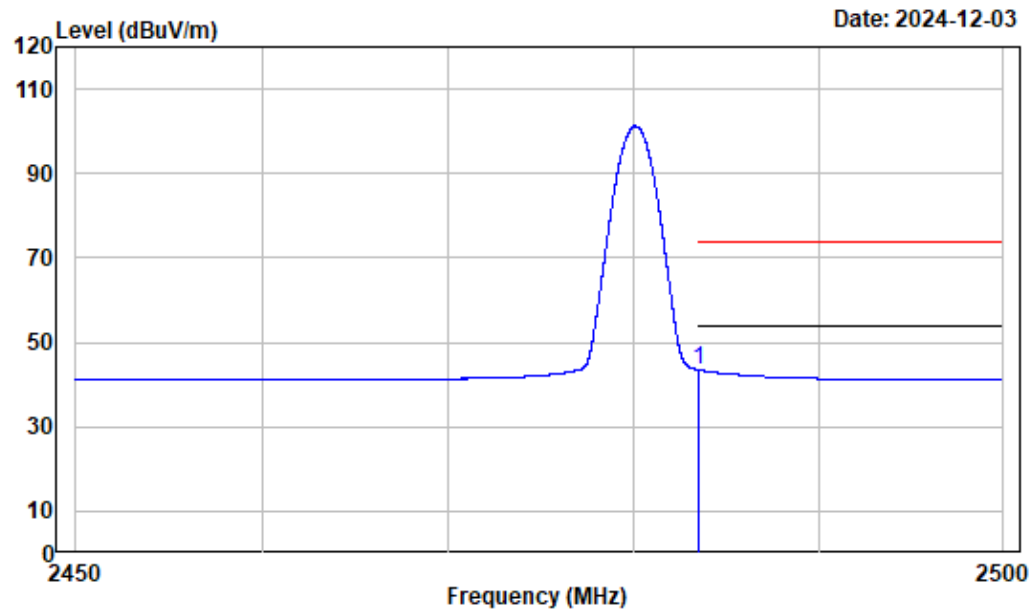
## Right Band edge\_Horizontal\_Peak\_BLE 1M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2480

	Freq Factor		Read Level		Limit	Over	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	57.03	53.86	74.00	-20.14	Peak
2	2483.779	-3.17	59.86	56.69	74.00	-17.31	peak

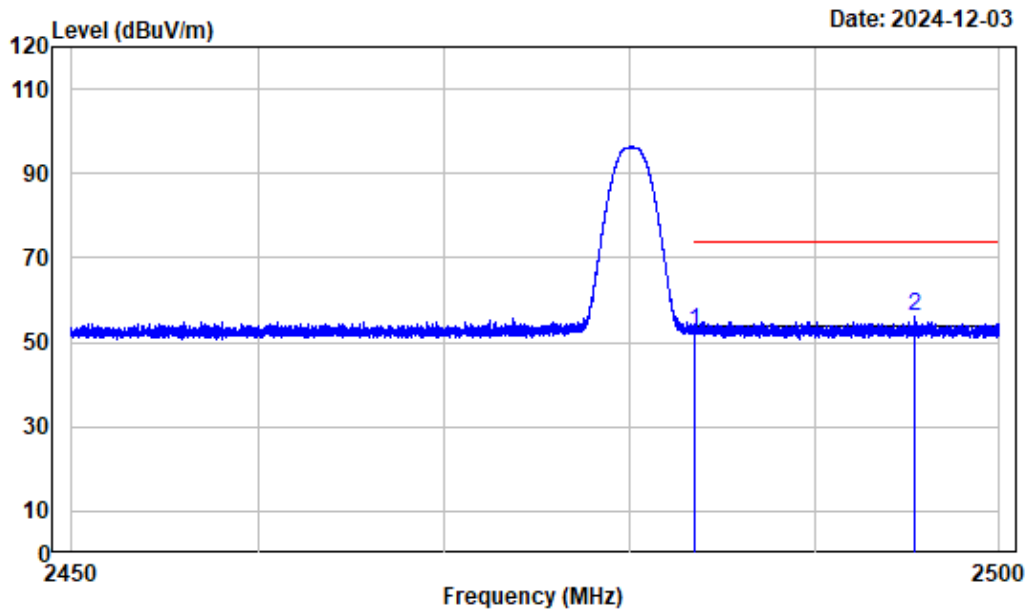
Right Band edge\_Horizontal\_Average\_BLE 1M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE1M\_2480

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	46.61	43.44	54.00	-10.56 Average

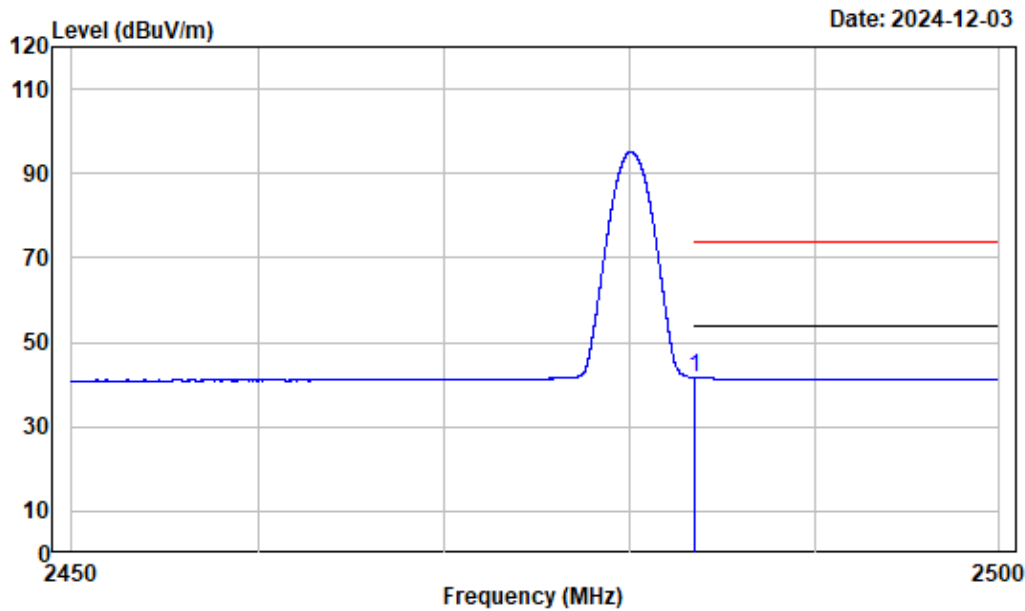
Right Band edge\_Vertical\_Peak\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2480

	Freq Factor		Read		Limit	Over	Remark
	MHz	dB/m	Level	Level	Line	Limit	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	55.78	52.61	74.00	-21.39	Peak
2	2495.431	-3.19	59.19	56.00	74.00	-18.00	peak

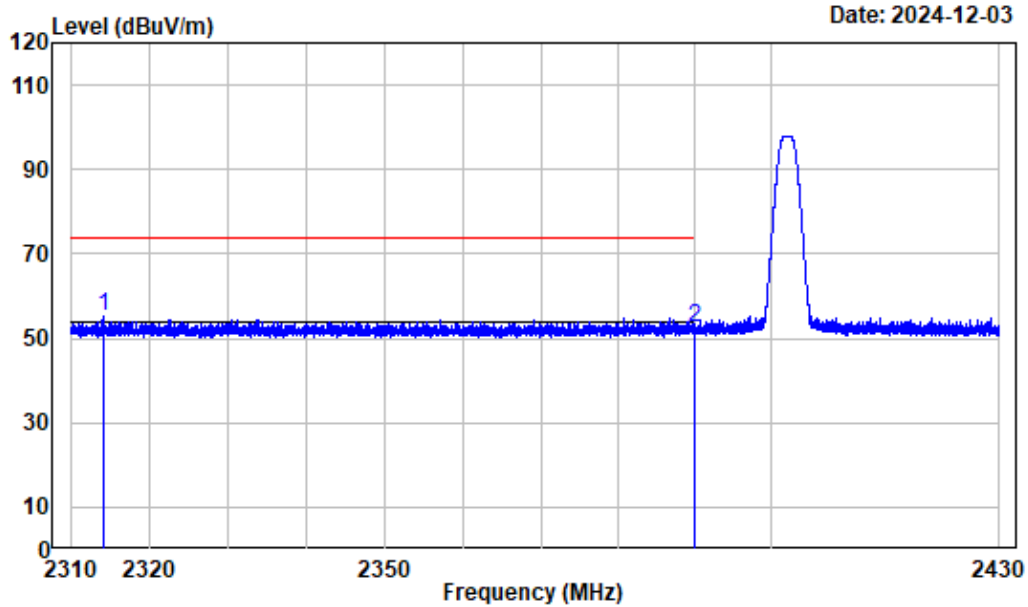
Right Band edge\_Vertical\_Average\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE1M\_2480

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 2483.500	-3.17	44.84	41.67	54.00	-12.33	Average

## Left Band edge\_Horizontal\_Peak\_BLE 2M

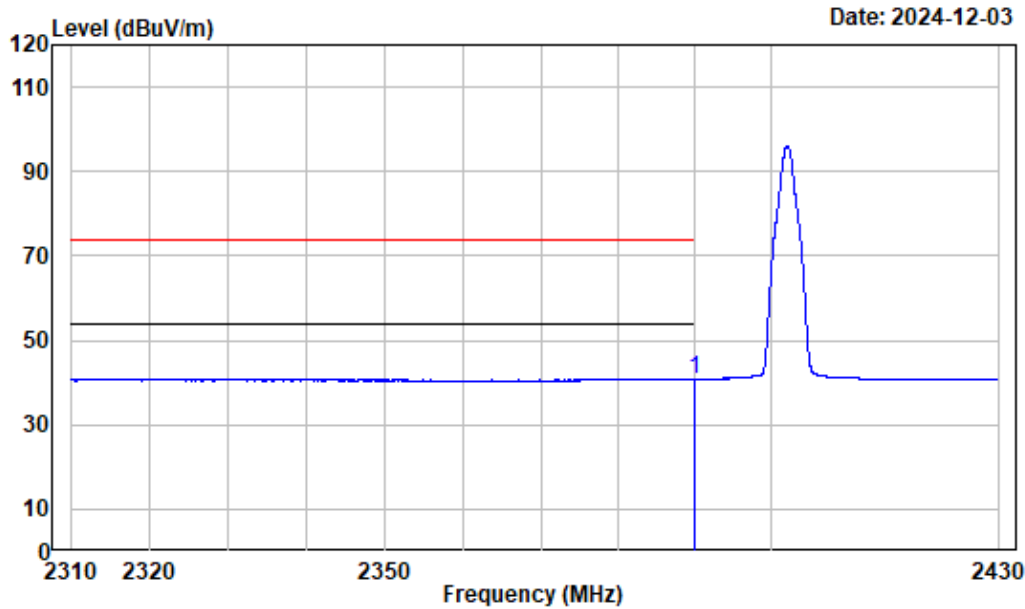


Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2402

	Freq Factor		Read Level		Limit	Over	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2314.246	-3.11	58.27	55.16	74.00	-18.84	peak
2	2390.000	-3.20	55.64	52.44	74.00	-21.56	Peak



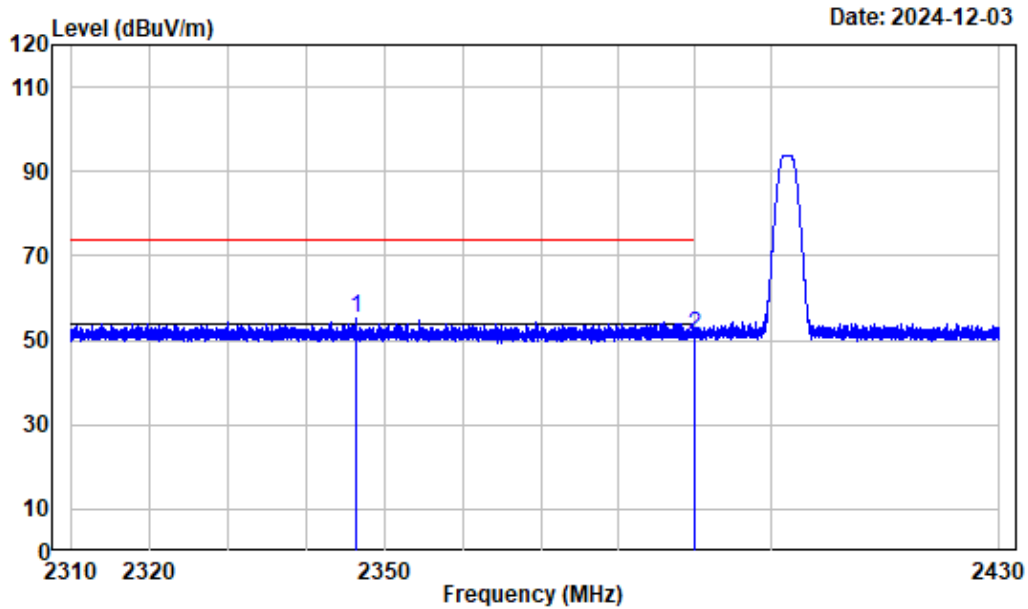
Left Band edge\_Horizontal\_Average\_BLE 2M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE2M\_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	-3.20	44.01	40.81	54.00	-13.19	Average

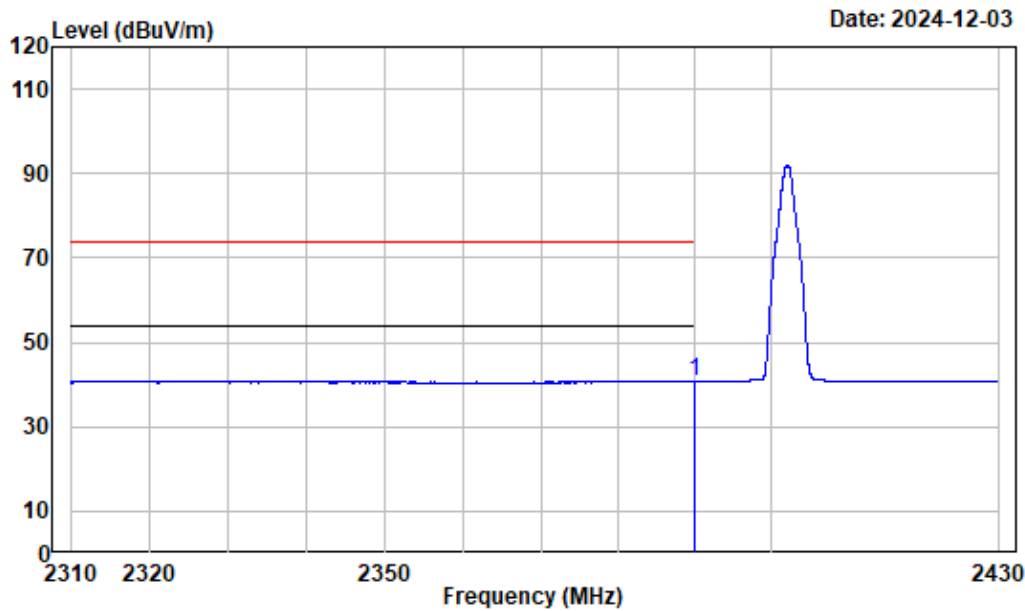
## Left Band edge\_Vertical\_Peak\_BLE 2M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2402

	Freq Factor		Read		Limit	Over	Remark
	MHz	dB/m	Level	Level	Line	Limit	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2346.199	-3.14	58.50	55.36	74.00	-18.64	peak
2	2390.000	-3.20	54.51	51.31	74.00	-22.69	Peak

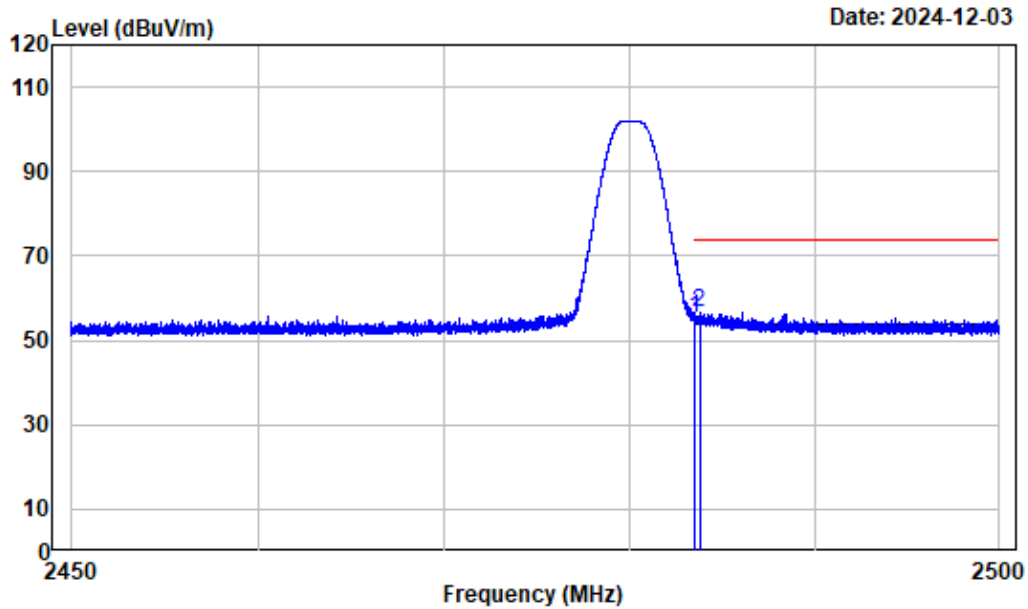
Left Band edge\_Vertical\_Average\_BLE 2M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE2M\_2402

Freq Factor		Read	Limit	Over	Remark	
MHz	dB/m	Level	Level	Line		
		dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	-3.20	43.91	40.71	54.00	-13.29 Average

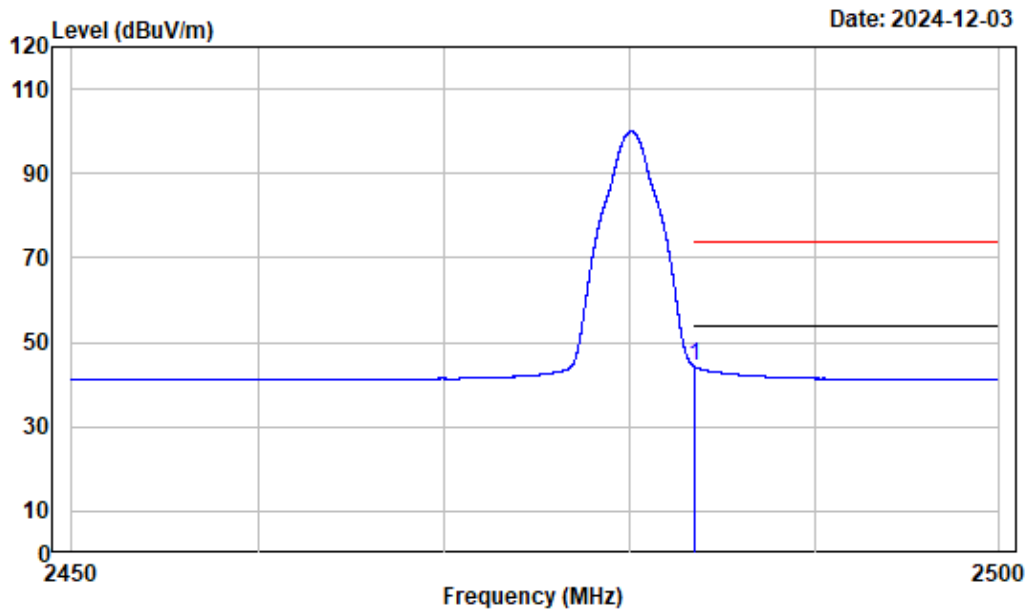
## Right Band edge\_Horizontal\_Peak\_BLE 2M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2480

	Freq Factor		Read		Limit	Over	Remark
	MHz	dB/m	Level	Level	Line	Limit	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	58.61	55.44	74.00	-18.56	Peak
2	2483.748	-3.17	59.59	56.42	74.00	-17.58	peak

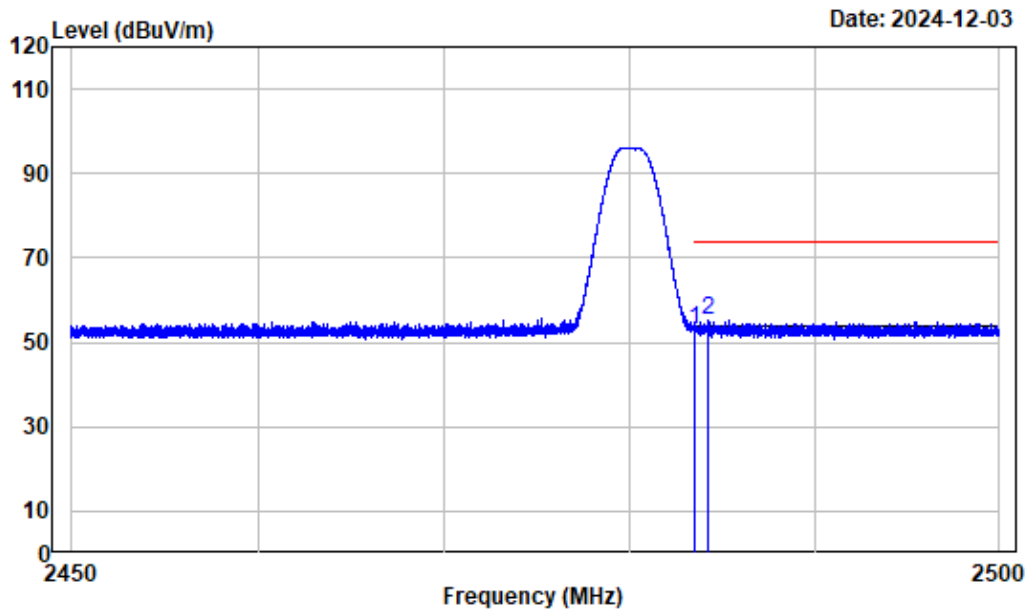
Right Band edge\_Horizontal\_Average\_BLE 2M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE2M\_2480

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	47.35	44.18	54.00	-9.82 Average

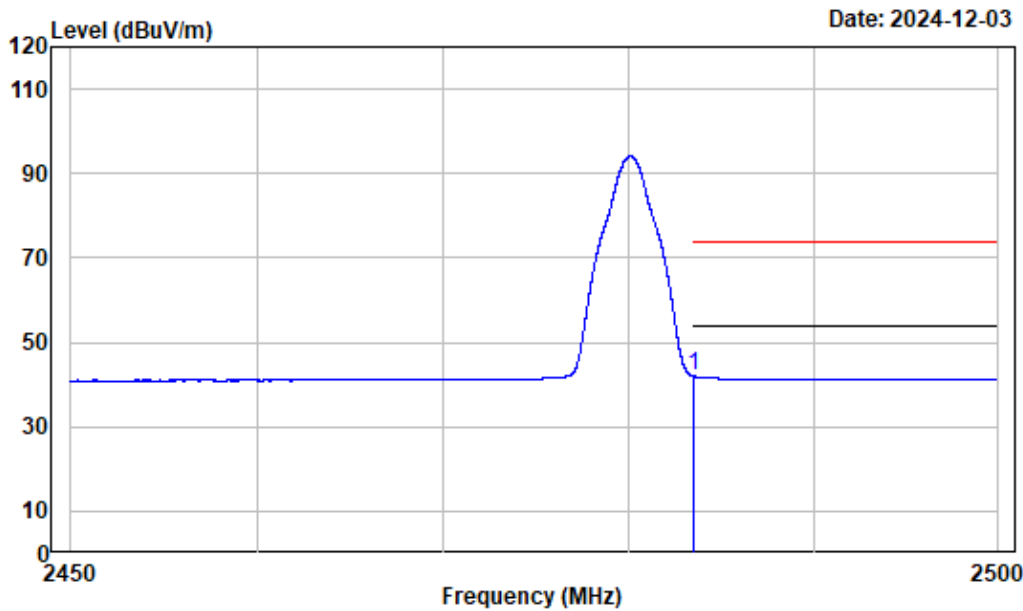
Right Band edge\_Vertical\_Peak\_BLE 2M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2480

Freq Factor		Read		Limit	Over	Remark
MHz	dB/m	Level	Level	Line	Limit	
		dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	56.15	52.98	74.00	-21.02 Peak
2	2484.198	-3.17	58.38	55.21	74.00	-18.79 peak

Right Band edge\_Vertical\_Average\_BLE 2M

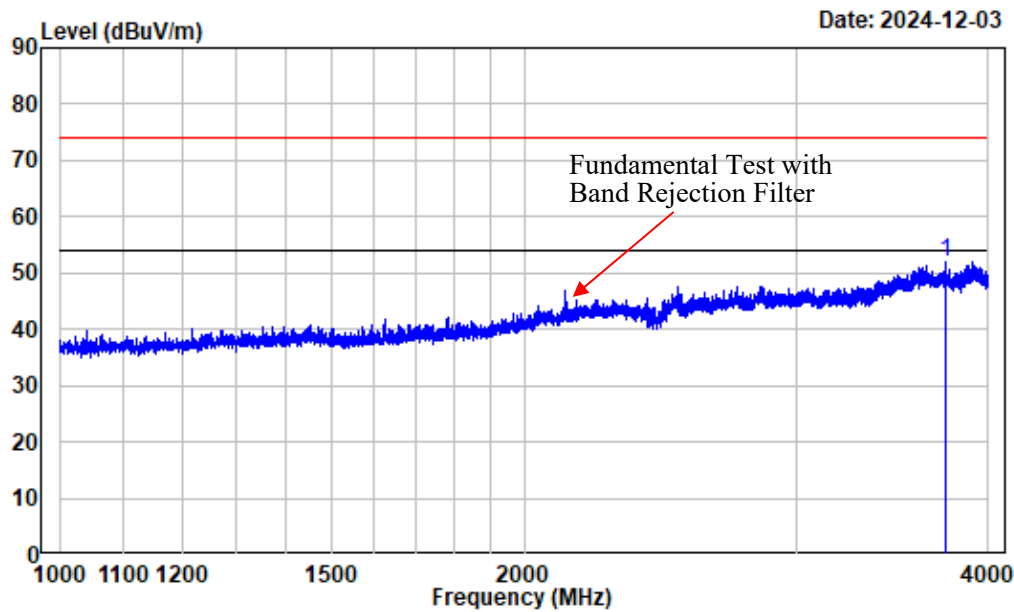


Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE2M\_2480

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	45.17	42.00	54.00	-12.00 Average

Listed with the worst harmonic margin test plot:

1-4GHz\_Horizontal\_BLE 1M

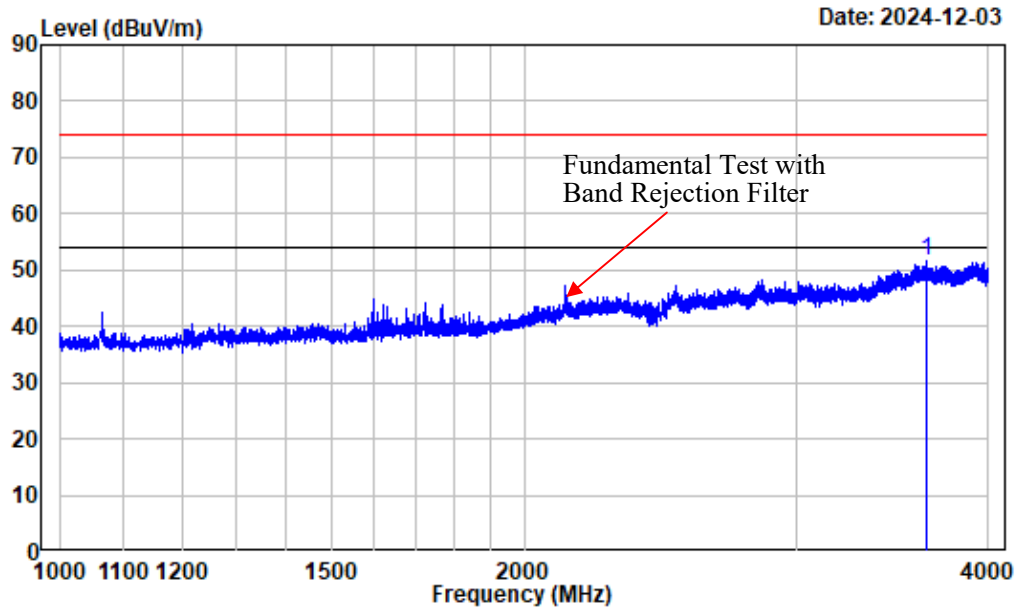


Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

Freq Factor		Read Level		Limit Line	Over Limit	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3750.594	-0.89	53.00	52.11	74.00	-21.89 Peak



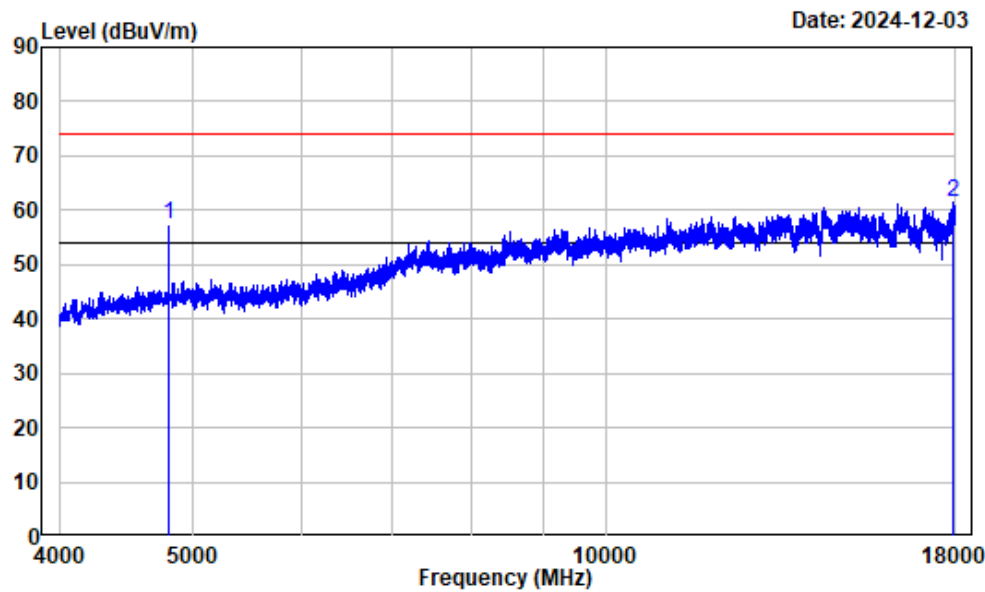
## 1-4GHz\_Vertical\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

	Freq Factor		Read		Limit	Over	Remark
	MHz	dB/m	Level	Level	Line	Limit	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3646.706	-1.44	52.92	51.48	74.00	-22.52	Peak

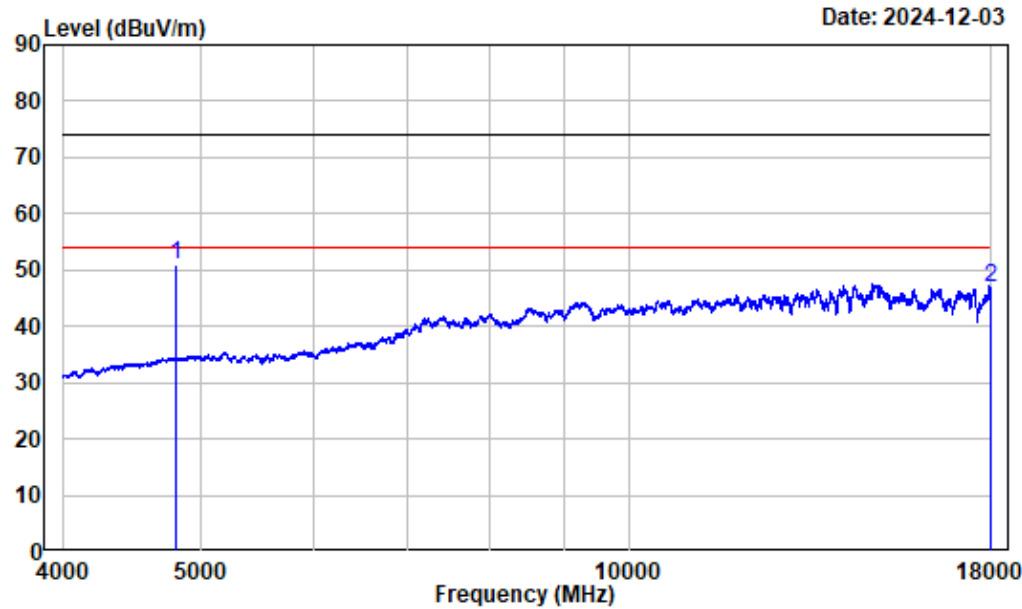
4-18GHz\_Horizontal\_Peak\_BLE 1M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

		Read		Limit	Over	Remark
Freq Factor		Level	Level	Line	Limit	
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 4804.000	2.42	55.07	57.49	74.00	-16.51	Peak
2 17935.240	24.16	37.47	61.63	74.00	-12.37	Peak

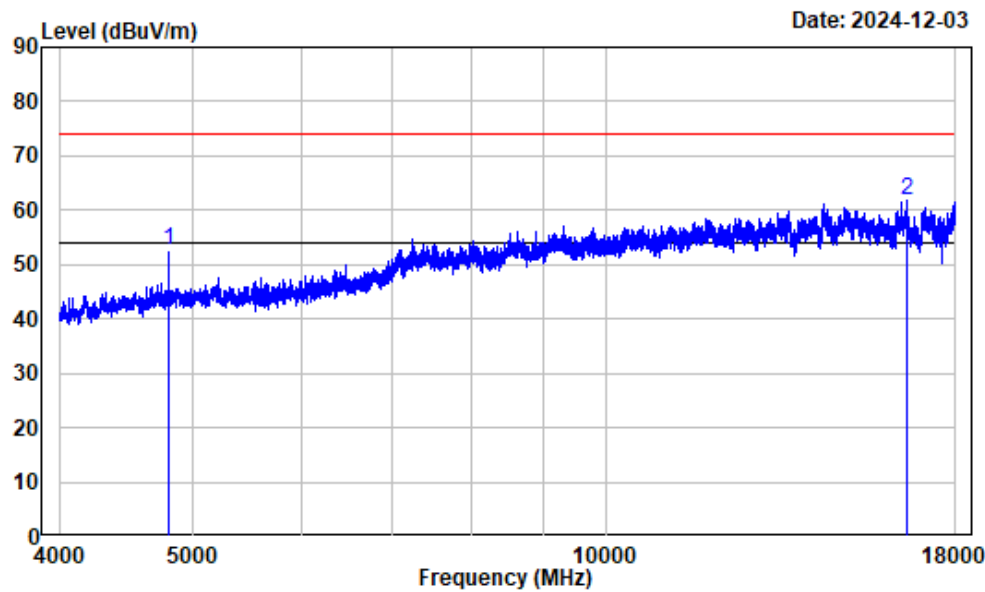
4-18GHz\_Horizontal\_Average\_BLE 1M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE1M\_2402

Freq Factor		Read Level	Level	Limit Line	Over Limit	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 4804.000	2.42	48.53	50.95	54.00	-3.05	Average
2 17993.000	24.57	22.37	46.94	54.00	-7.06	Average

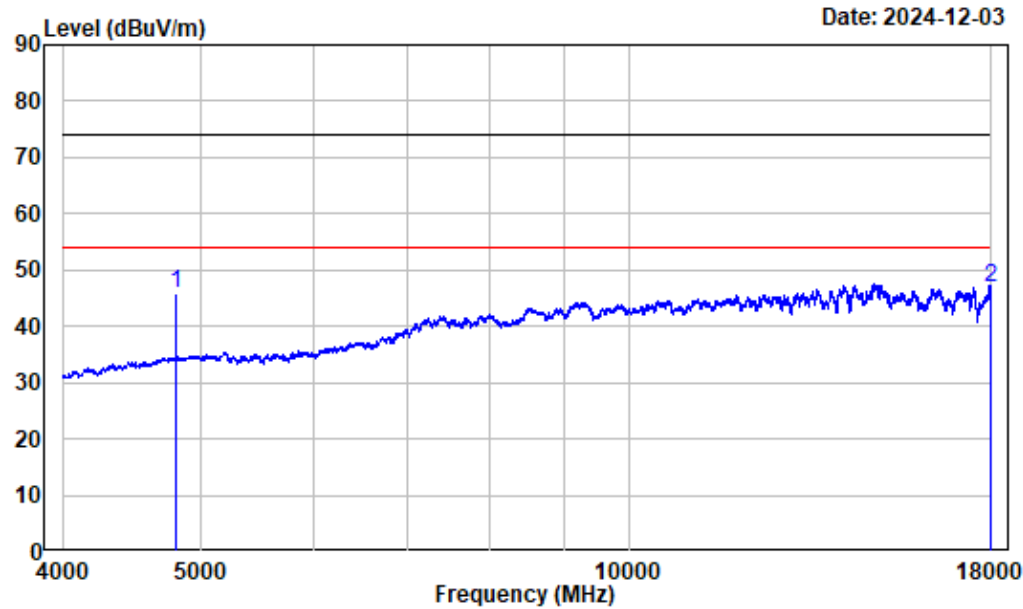
4-18GHz\_Veritical\_Peak\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

Freq		Factor	Read Level	Level	Limit Line	Over Limit	Remark
MHz		dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4804.000	2.42	50.32	52.74	74.00	-21.26	Peak
2	16592.820	15.98	45.76	61.74	74.00	-12.26	Peak

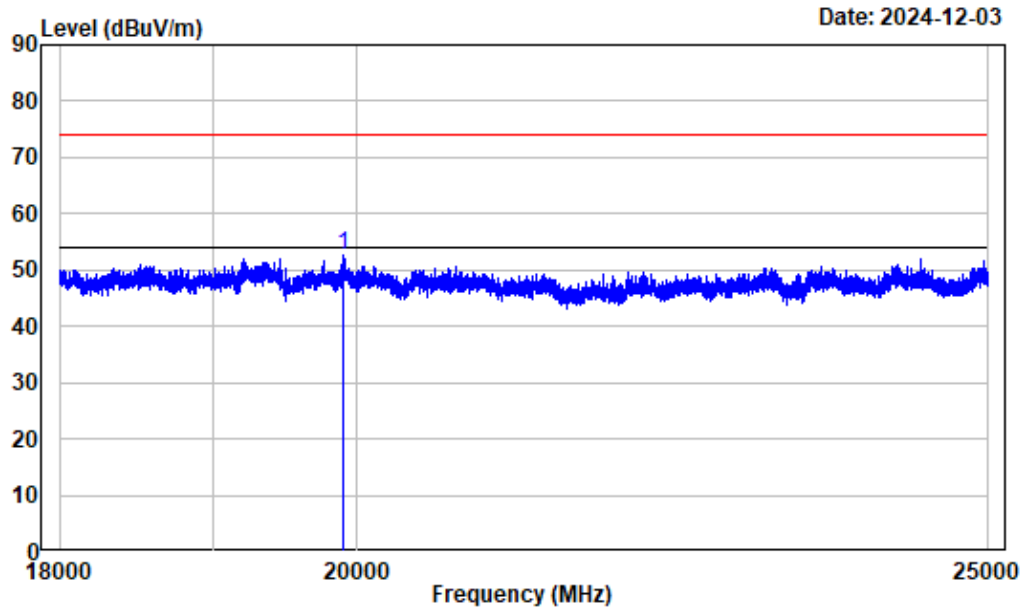
4-18GHz\_Vertical\_Average\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE1M\_2402

Freq Factor		Read Level	Level	Limit Line	Over Limit	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 4804.000	2.42	43.42	45.84	54.00	-8.16	Average
2 18000.000	24.62	22.34	46.96	54.00	-7.04	Average

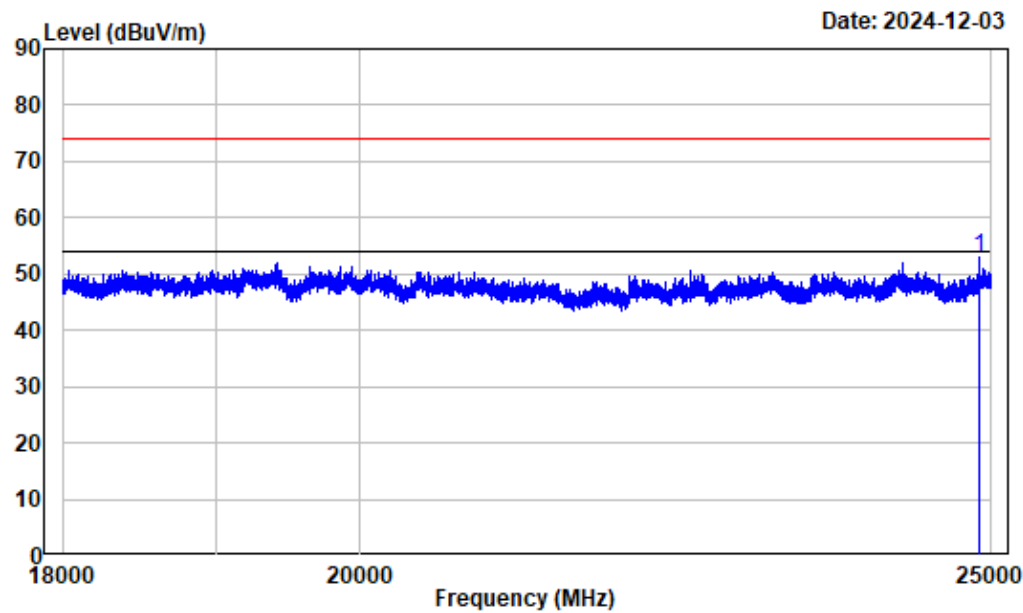
## 18-25GHz\_Horizontal\_BLE 1M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

	Freq Factor		Read Level		Limit	Over	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	19903.360	15.42	37.29	52.71	74.00	-21.29	Peak

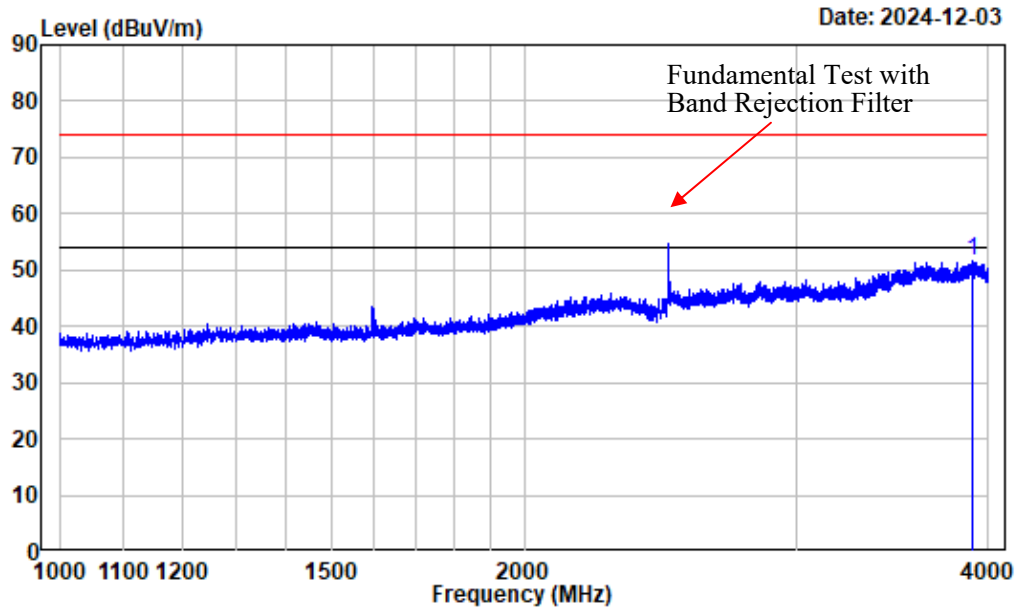
18-25GHz\_Vertical\_BLE 1M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE1M\_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	24901.110	16.90	36.16	53.06	74.00	-20.94	Peak

1-4GHz\_Horizontal\_BLE 2M

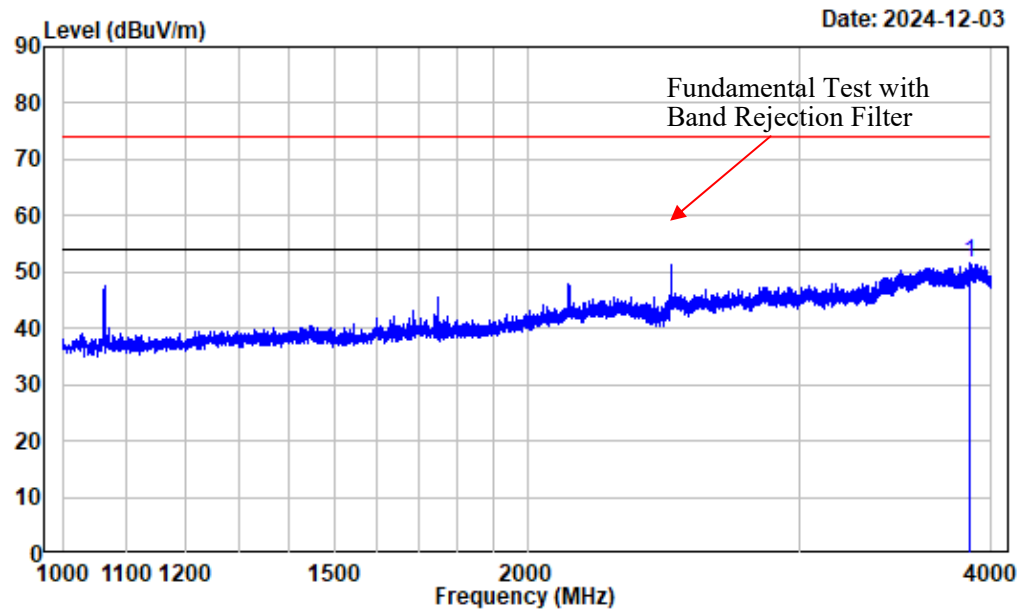


Condition : Horizontal  
 Project No. : 2401Z54419E-RF  
 Tester : Dylan.Yang  
 Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
 Note : BLE2M\_2480

	Freq Factor		Read Level		Limit	Over	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3906.238	-0.48	52.18	51.70	74.00	-22.30	Peak



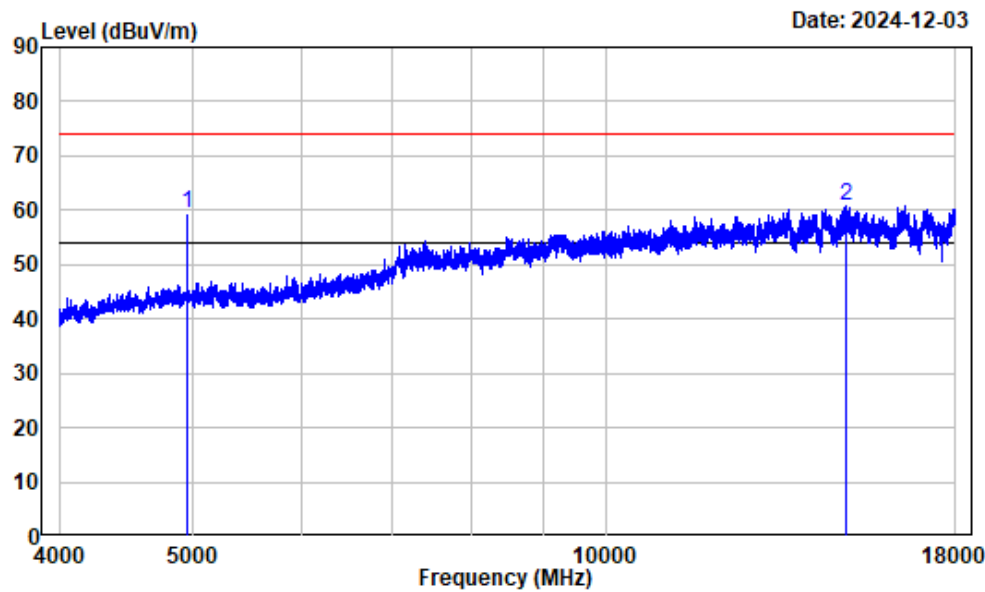
1-4GHz\_Vertical\_BLE 2M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2480

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3874.359	-0.66	52.17	51.51	74.00	-22.49 Peak

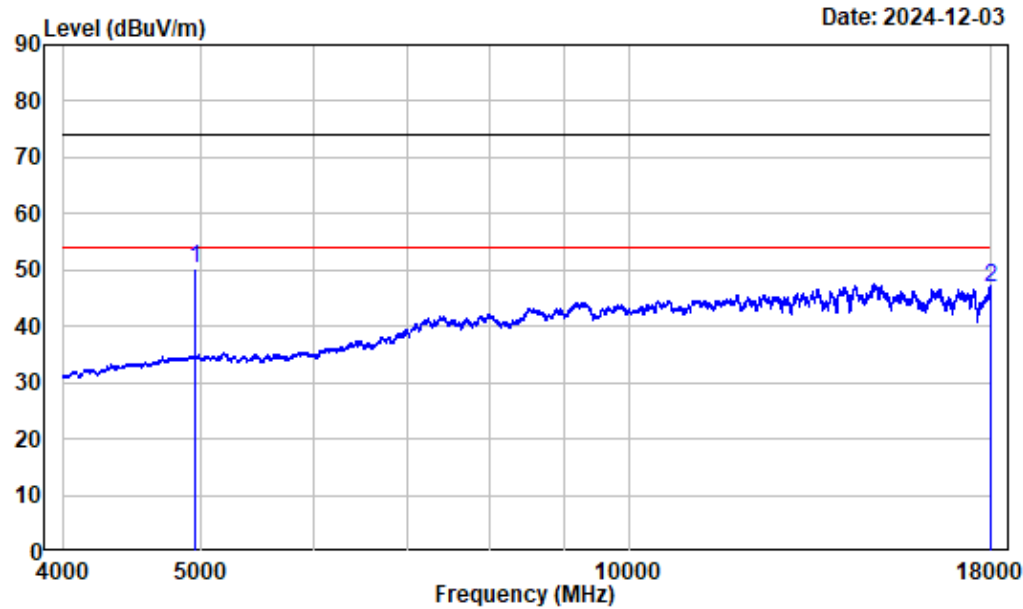
4-18GHz\_Horizontal\_Peak\_BLE 2M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2480

		Read		Limit	Over	Remark
Freq Factor		Level	Level	Line	Limit	
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 4960.000	2.69	56.83	59.52	74.00	-14.48	Peak
2 14975.620	16.39	44.39	60.78	74.00	-13.22	Peak

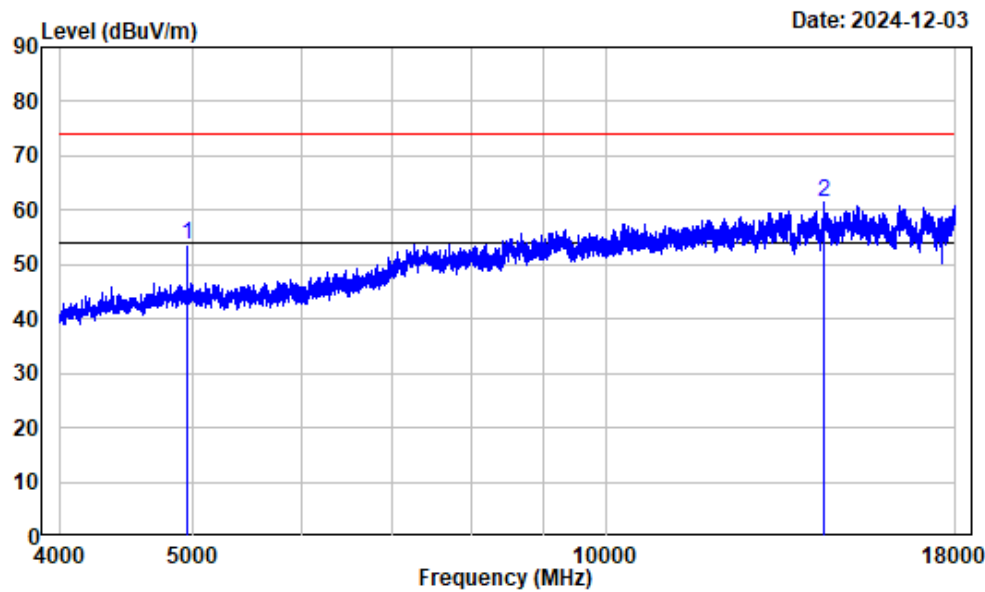
4-18GHz\_Horizontal\_Average\_BLE 2M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE2M\_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4960.000	2.69	47.43	50.12	54.00	-3.88	Average
2	17993.000	24.57	22.38	46.95	54.00	-7.05	Average

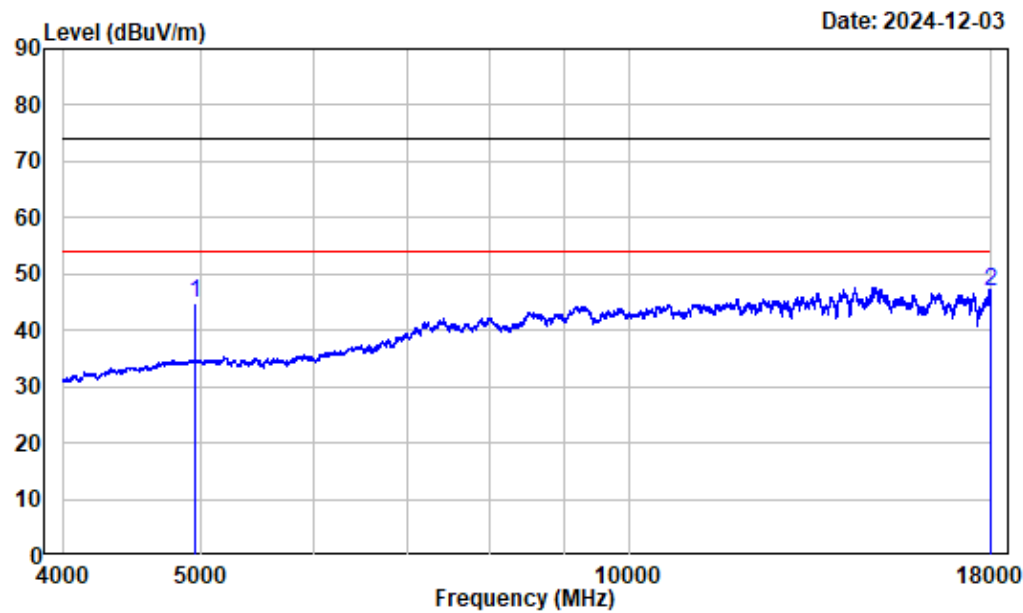
4-18GHz\_Veritical\_Peak\_BLE 2M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2480

Freq		Factor	Read Level	Level	Limit Line	Over Limit	Remark
MHz		dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4960.000	2.69	51.05	53.74	74.00	-20.26	Peak
2	14443.560	17.34	44.23	61.57	74.00	-12.43	Peak

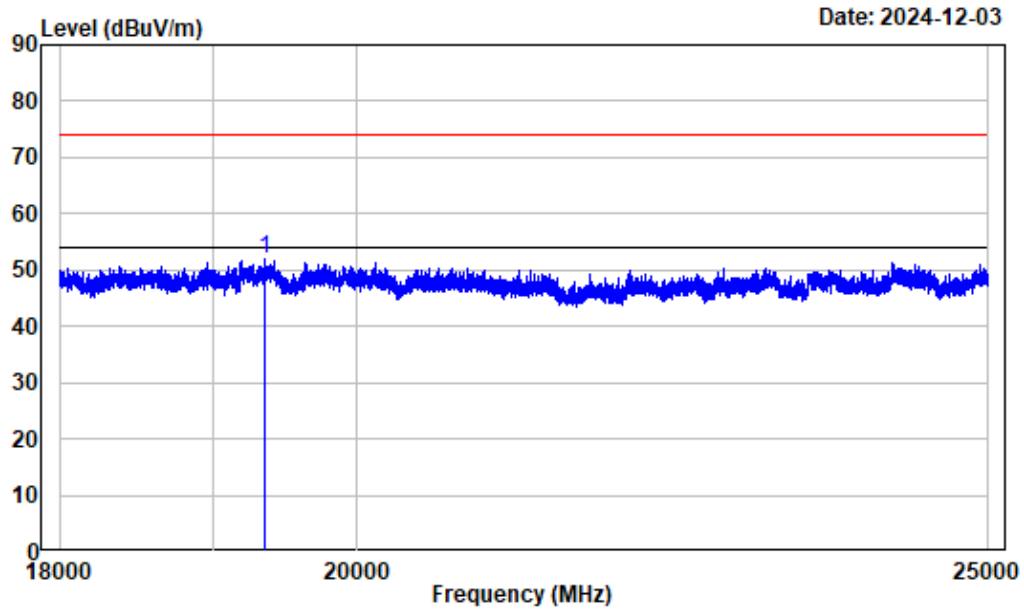
4-18GHz\_Vertical\_Average\_BLE 2M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Average reading: RBW:1MHz VBW:1KHz Detector:Peak  
Note : BLE2M\_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4960.000	2.69	42.16	44.85	54.00	-9.15	Average
2	17998.250	24.61	22.37	46.98	54.00	-7.02	Average

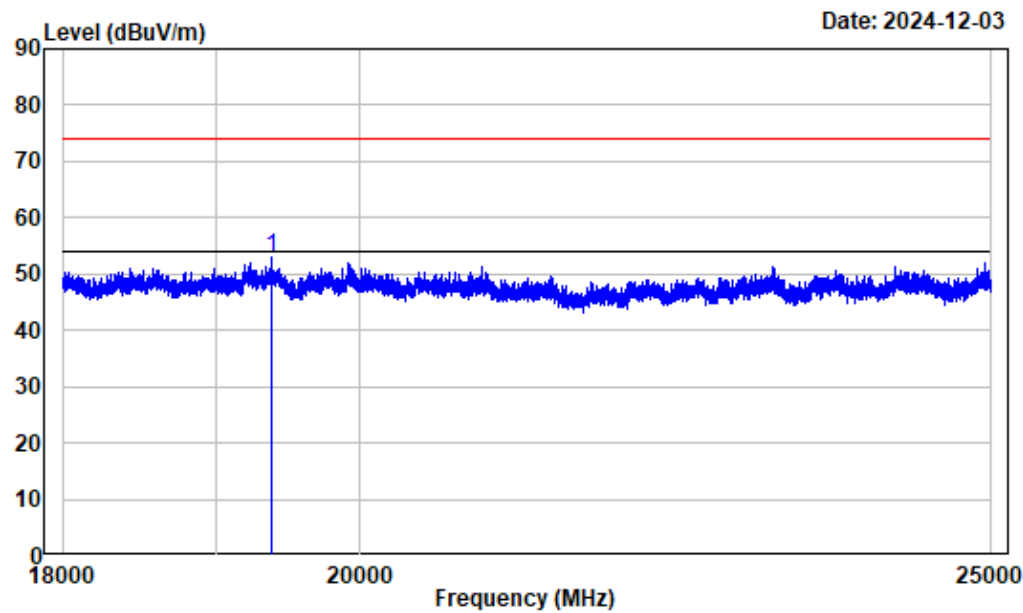
## 18-25GHz\_Horizontal\_BLE 2M



Condition : Horizontal  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	19350.290	15.14	36.89	52.03	74.00	-21.97	Peak

18-25GHz\_Vertical\_BLE 2M



Condition : Vertical  
Project No. : 2401Z54419E-RF  
Tester : Dylan.Yang  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : BLE2M\_2480

Freq Factor		Read	Limit	Over	Remark
MHz	dB/m	Level	Level	Line	
		dBuV	dBuV/m	dBuV/m	dB
1 19384.420	15.11	37.84	52.95	74.00	-21.05 Peak

6dB Emission Bandwidth

Test Information:

Sample No.:	2UD0-2	Test Date:	2024/12/24
Test Site:	RF	Test Mode:	Transmitting
Tester:	Cheeb Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C):	22.3	Relative Humidity: (%)	35	ATM Pressure: (kPa)	101.5
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Test Data:

BLE 1M

Channel	Result (MHz)	Limit (MHz)	Verdict
Low Channel	0.650	≥0.5	Pass
Middle Channel	0.645	≥0.5	Pass
High Channel	0.650	≥0.5	Pass

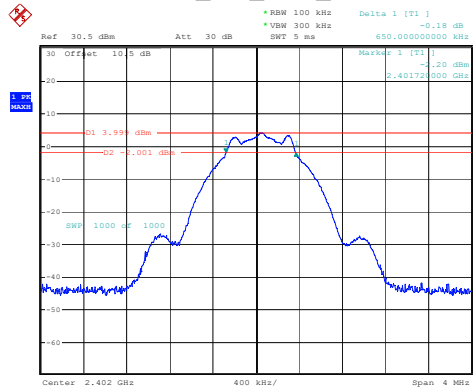
BLE 2M

Channel	Result (MHz)	Limit (MHz)	Verdict
Low Channel	1.133	≥0.5	Pass
Middle Channel	1.125	≥0.5	Pass
High Channel	1.118	≥0.5	Pass



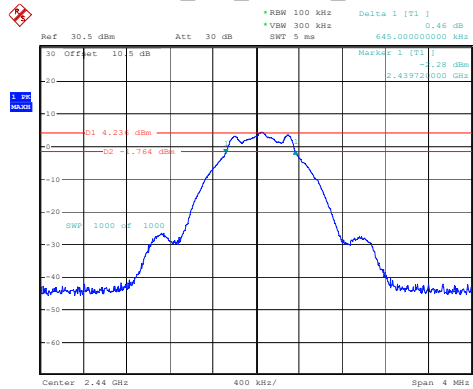
BLE 1M

BLE\_1M\_Low\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 11:57:12

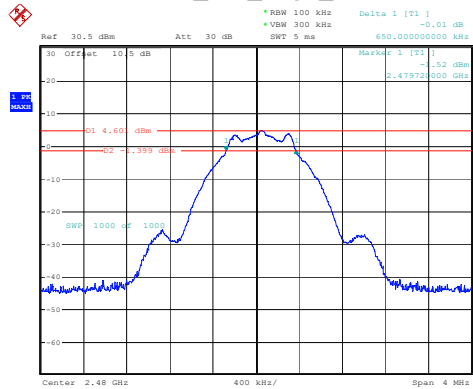
BLE\_1M\_Middle\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 11:58:19

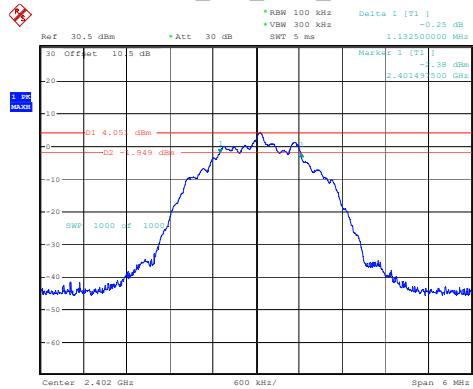
BLE 2M

BLE\_1M\_High\_Channel



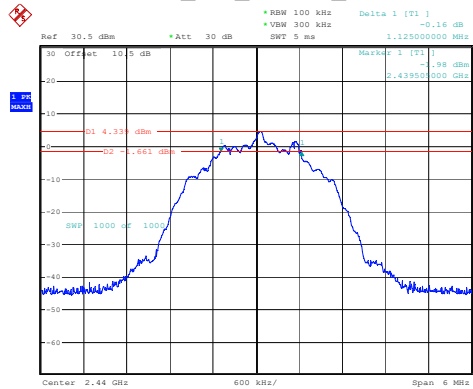
ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 11:59:35

BLE\_2M\_Low\_Channel



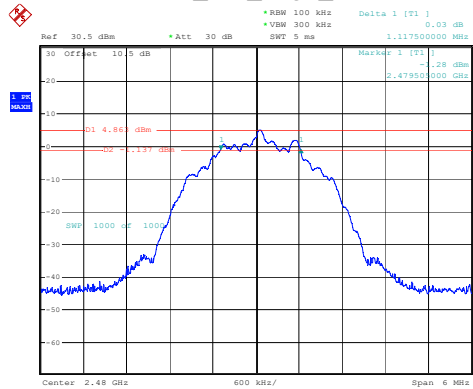
ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 13:03:31

BLE\_2M\_Middle\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 13:04:27

BLE\_2M\_High\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 13:05:38

99% Occupied Bandwidth

Test Information:

Sample No.:	2UD0-2	Test Date:	2024/12/24
Test Site:	RF	Test Mode:	Transmitting
Tester:	Cheeb Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C):	22.3	Relative Humidity: (%)	35	ATM Pressure: (kPa)	101.5
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Test Data:

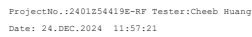
BLE 1M

Channel	99% OBW (MHz)
Low Channel	1.025
Middle Channel	1.025
High Channel	1.020

BLE 2M

Channel	99% OBW (MHz)
Low Channel	2.018
Middle Channel	2.025
High Channel	2.025

## BLE\_1M\_Low\_Channel



ProjectNo.:2401z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 11:58:28

ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 11:59:45

ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 13:03:40

ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 13:04:35

ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 24.DEC.2024 13:05:48

Maximum Conducted Output Power

Test Information:

Sample No.:	2UD0-2	Test Date:	2024/11/21
Test Site:	RF	Test Mode:	Transmitting
Tester:	Cheeb Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C):	25	Relative Humidity: (%)	52	ATM Pressure: (kPa)	101
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Test Data:

BLE 1M

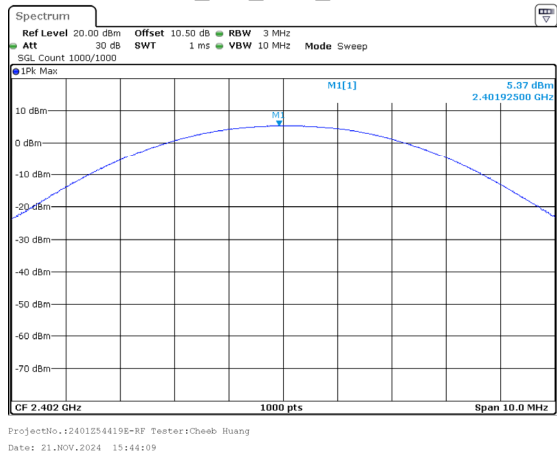
Channel	Result (dBm)	Limit (dBm)	Verdict
Low Channel	5.37	30.00	Pass
Middle Channel	6.35	30.00	Pass
High Channel	6.50	30.00	Pass

BLE 2M

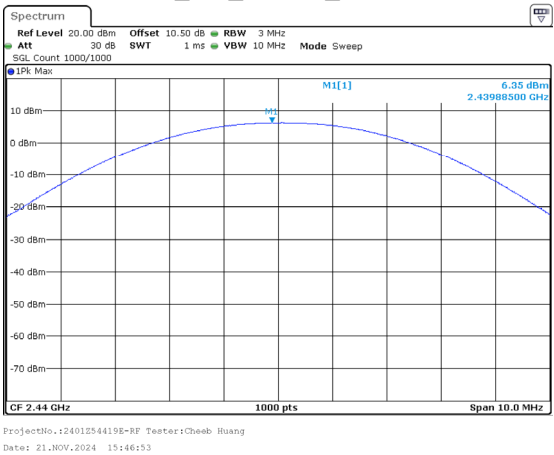
Channel	Result (dBm)	Limit (dBm)	Verdict
Low Channel	5.30	30.00	Pass
Middle Channel	6.19	30.00	Pass
High Channel	6.26	30.00	Pass

BLE 1M

BLE\_1M\_Low\_Channel

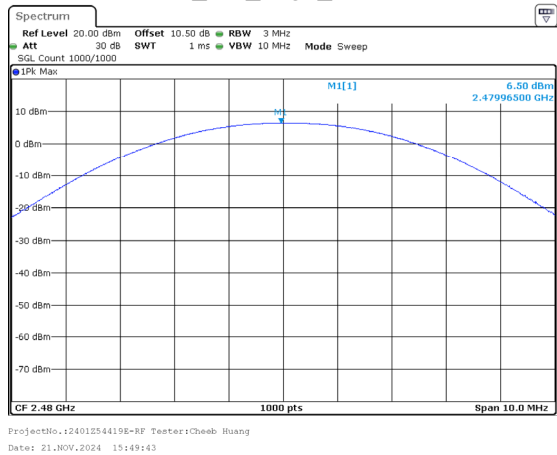


BLE\_1M\_Middle\_Channel

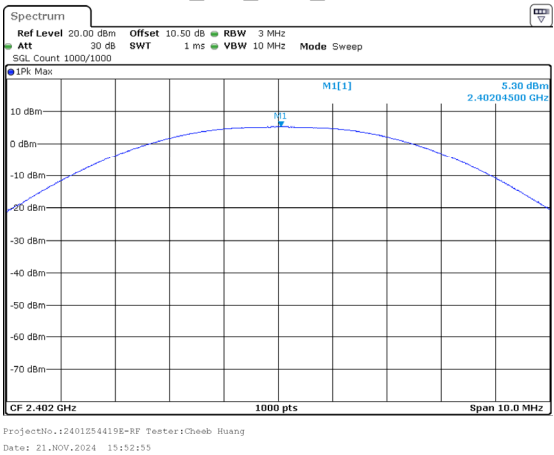


BLE 2M

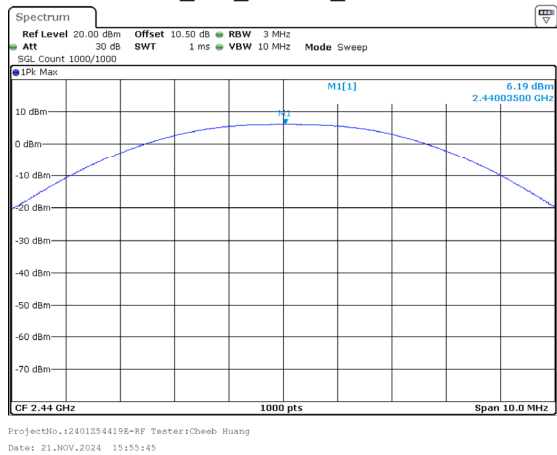
BLE\_1M\_High\_Channel



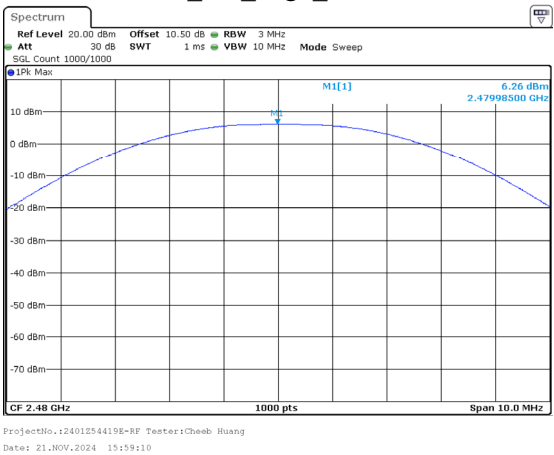
BLE\_2M\_Low\_Channel



BLE\_2M\_Middle\_Channel



BLE\_2M\_High\_Channel



100 kHz Bandwidth of Frequency Band Edge

Test Information:

Sample No.:	2UD0-2	Test Date:	2024/11/21
Test Site:	RF	Test Mode:	Transmitting
Tester:	Cheeb Huang	Test Result:	Pass

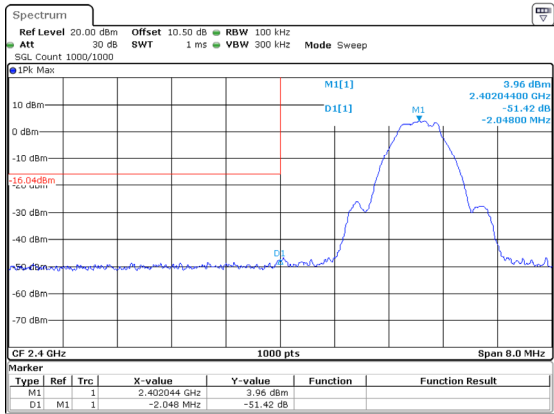
Environmental Conditions:

Temperature: (°C):	25	Relative Humidity: (%)	52	ATM Pressure: (kPa)	101
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Test Data:

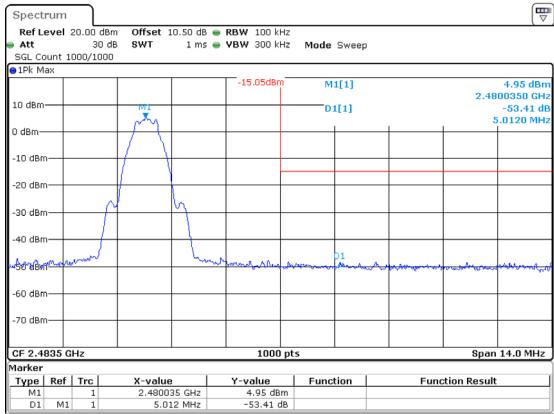
BLE 1M

BLE\_1M\_Low\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:43:10

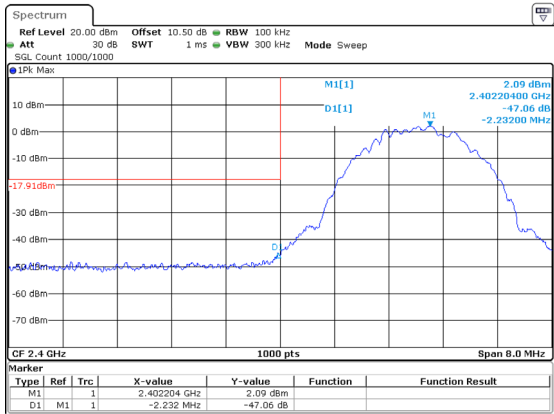
BLE\_1M\_High\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:48:42

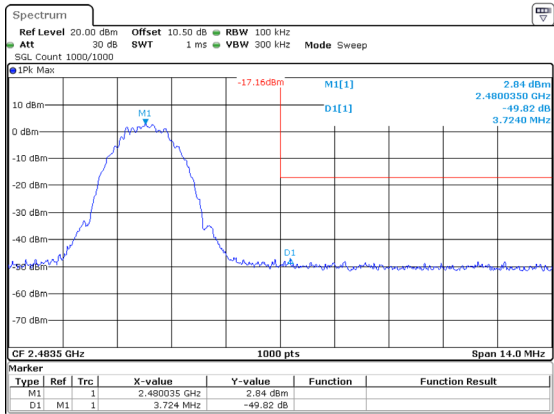
BLE 2M

BLE\_2M\_Low\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:51:41

BLE\_2M\_High\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:58:00

Power Spectral Density

Test Information:

Sample No.:	2UD0-2	Test Date:	2024/11/21
Test Site:	RF	Test Mode:	Transmitting
Tester:	Cheeb Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C):	25	Relative Humidity: (%)	52	ATM Pressure: (kPa)	101
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Test Data:

BLE 1M

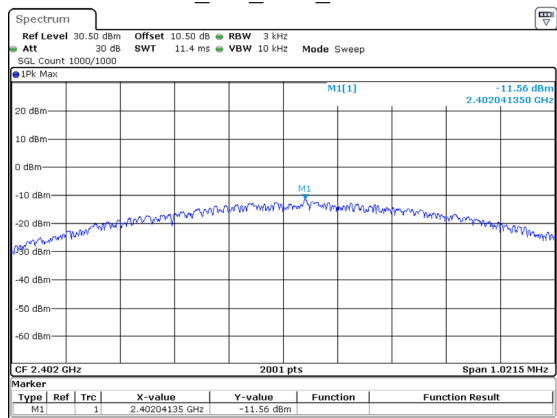
Channel	Result (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-11.56	8	Pass
Middle Channel	-10.38	8	Pass
High Channel	-10.01	8	Pass

BLE 2M

Channel	Result (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-15.68	8	Pass
Middle Channel	-14.79	8	Pass
High Channel	-14.73	8	Pass

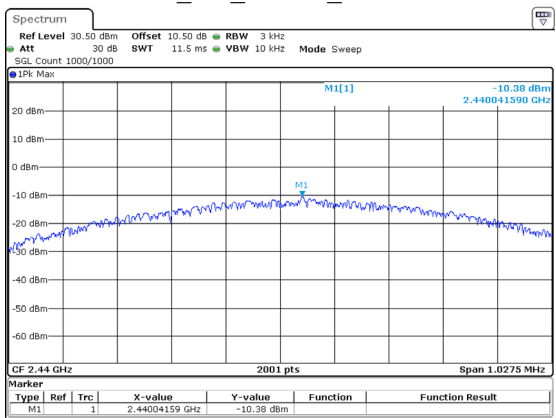
BLE 1M

BLE\_1M\_Low\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:45:03

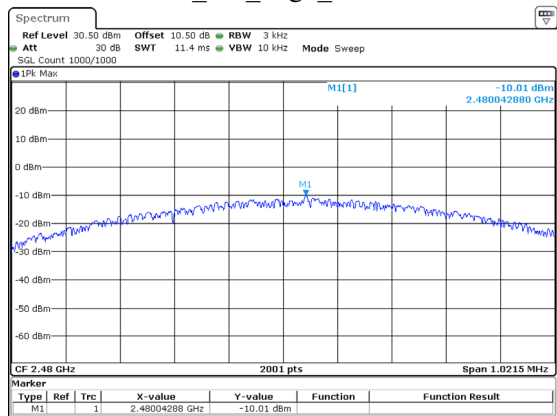
BLE\_1M\_Middle\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:47:48

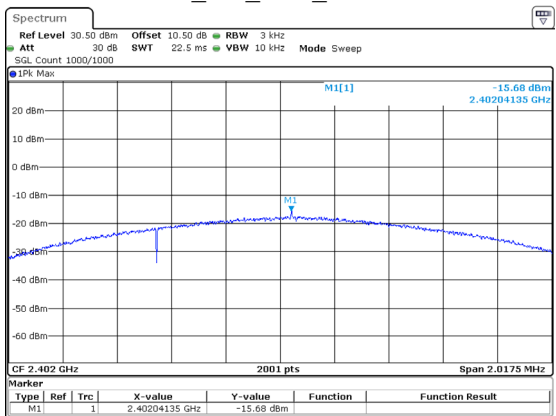
BLE 2M

BLE\_1M\_High\_Channel



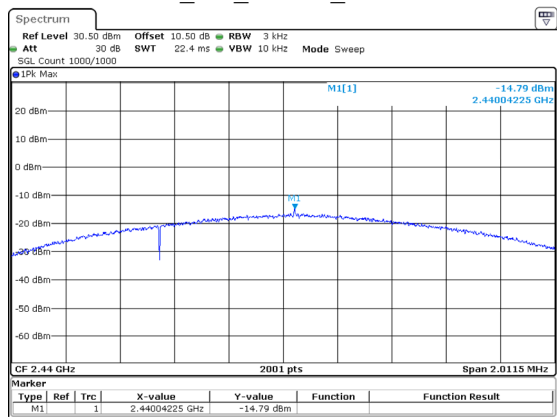
ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:50:38

BLE\_2M\_Low\_Channel



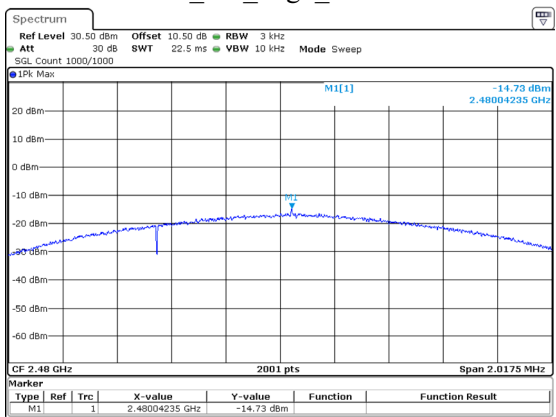
ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:54:14

BLE\_2M\_Middle\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:57:04

BLE\_2M\_High\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 16:00:30



Duty Cycle

Test Information:

Sample No.:	2UD0-2	Test Date:	2024/11/21
Test Site:	RF	Test Mode:	Transmitting
Tester:	Cheeb Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C):	25	Relative Humidity: (%)	52	ATM Pressure: (kPa)	101
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Test Data:

BLE 1M

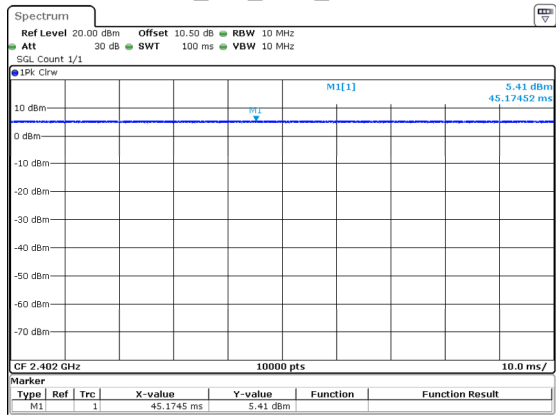
Channel	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)	Duty Cycle Factor(dB)	1/Ton (Hz)	VBW Setting (kHz)
Low Channel	100	100	100	0	10	0.010
Middle Channel	100	100	100	0	10	0.010
High Channel	100	100	100	0	10	0.010

BLE 2M

Channel	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)	Duty Cycle Factor(dB)	1/Ton (Hz)	VBW Setting (kHz)
Low Channel	100	100	100	0	10	0.010
Middle Channel	100	100	100	0	10	0.010
High Channel	100	100	100	0	10	0.010

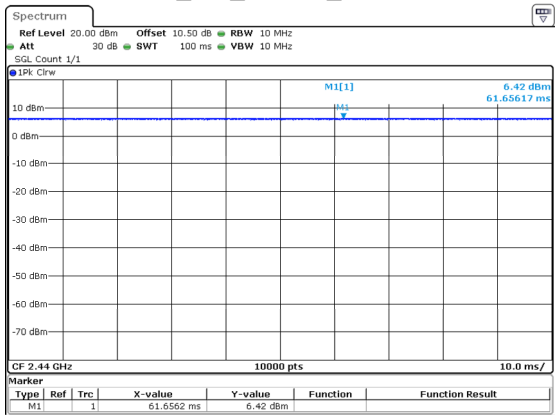
BLE 1M

BLE\_1M\_Low\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:43:51

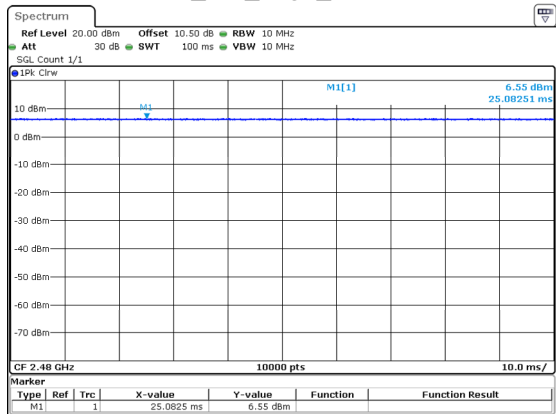
BLE\_1M\_Middle\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:46:36

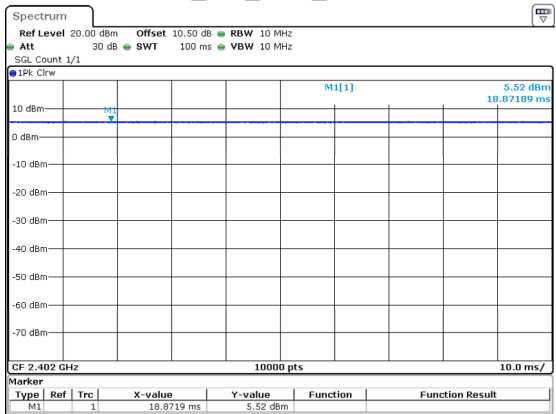
BLE 2M

BLE\_1M\_High\_Channel



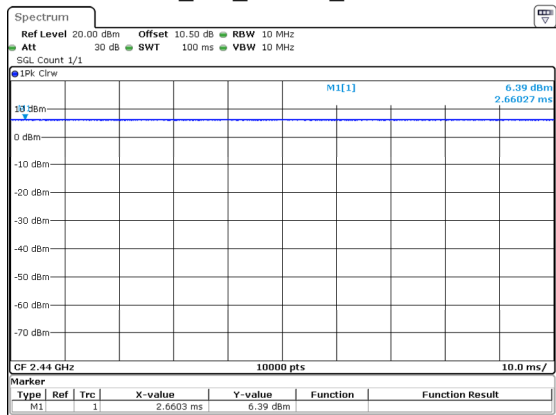
ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:49:24

BLE\_2M\_Low\_Channel



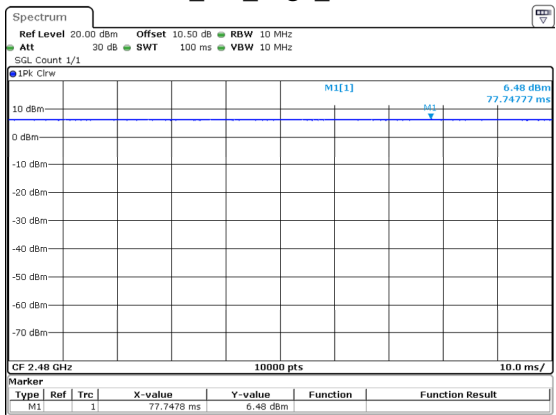
ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:52:24

BLE\_2M\_Middle\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:55:28

BLE\_2M\_High\_Channel



ProjectNo.:2401Z54419E-RF Tester:Cheeb Huang  
Date: 21.NOV.2024 15:58:53

## RF EXPOSURE EVALUATION

### MPE-BASED EXEMPTION

#### Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance V01

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(3)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$ .
1.34-30	$3,450 R^2/f^2$ .
30-300	$3.83 R^2$ .
300-1,500	$0.0128 R^2f$ .
1,500-100,000	$19.2R^2$ .

R is the minimum separation distance in meters

f = frequency in MHz

#### Result

Mode	Frequency (MHz)	Tune up conducted power <sup>#</sup> (dBm)	Antenna Gain <sup>#</sup>		ERP		Evaluation Distance (m)	ERP Limit (W)
			(dBi)	(dBd)	(dBm)	(W)		
BLE	2402-2480	7.0	4.9	2.75	9.75	0.009	0.2	0.768
2.4G Wi-Fi	2412-2462	16.50	4.9	2.75	19.25	0.084	0.2	0.768
Lora	915	8.00	-3.33	-5.48	2.52	0.002	0.2	0.462

Note: The tune up conducted power<sup>#</sup> and antenna gain<sup>#</sup> were declared and provided by the applicant.

The BLE, 2.4G Wi-Fi and Lora can't transmit at the same time

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

#### Result: Compliant

## **EUT PHOTOGRAPHS**

Please refer to the attachment 2401Z54419E-RF External photo and 2401Z54419E-RF Internal photo.

## **TEST SETUP PHOTOGRAPHS**

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Please refer to the attachment 2401Z54419E-RFA Test Setup photo.

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