TEST REPORT

Applicant Name :	ORAIMO TECHNOLOGY LIMITED
Address :	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Report Number :	RA230417-19971E-RF-00B
FCC ID:	2AXYP-OEB-E04D-L

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	True Wireless Earbuds
Model No.:	OEB-E04D
Multiple Model(s) No.:	N/A
Trade Mark:	oraimo
Date Received:	2023/04/17
Report Date:	2023/05/09

Test Result:	Pass*

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

Prepared and Checked By:

Dave Liang

EMC Engineer

Approved By:

Candy Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".
Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230417-19971E-RF-00B	Original Report	2023/05/09

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	BLE: 2402-2480MHz
Maximum Conducted Peak Output Power	BLE: 2.12dBm
Modulation Technique	BLE: GFSK
Antenna Specification*	0.55dBi (provided by the applicant)
Voltage Range	DC 3.7V from battery
Sample serial number	24RF_4 for Radiated Emissions Test 24RF_3 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition

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, 15.209 and 15.247 rules.

Test Methodology

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

And KDB 558074 D01 15.247 Meas Guidance v05r02.

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

Measurement Uncertainty

Parameter		Uncertainty
Harmonic Current		0.512%, k=2
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.71dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions	9k-30MHz	2.74dB, k=2
	150kHz-30MHz	2.92dB, k=2
Audio Frequency Response		0.1dB
Low Pass Filter Response		1.2dB
Modulation Limiting		1%
Emissions, Radiated	9kHz - 30MHz	2.06dB
	30MHz - 1GHz	5.08dB
	1GHz - 18GHz	4.96dB
	18GHz - 26.5GHz	5.16dB
	26.5GHz - 40GHz	4.64dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the Floor 1, KuMaKe Building, Dongzhou Community, Guangming Street, Guangming District, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 30241.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 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

"BT_tool v1.12 *" software was used to test, the software and power level was provided by manufacturer and power level as below:

Mode	Data rate	Power Level*		
		Low Channel	Middle Channel	High Channel
BLE1M	1Mbps	7	7	7
BLE2M	2Mbps	7	7	7

Duty cycle

Test Result: Compliant. Please refer to the Appendix

Support Equipment List and Details

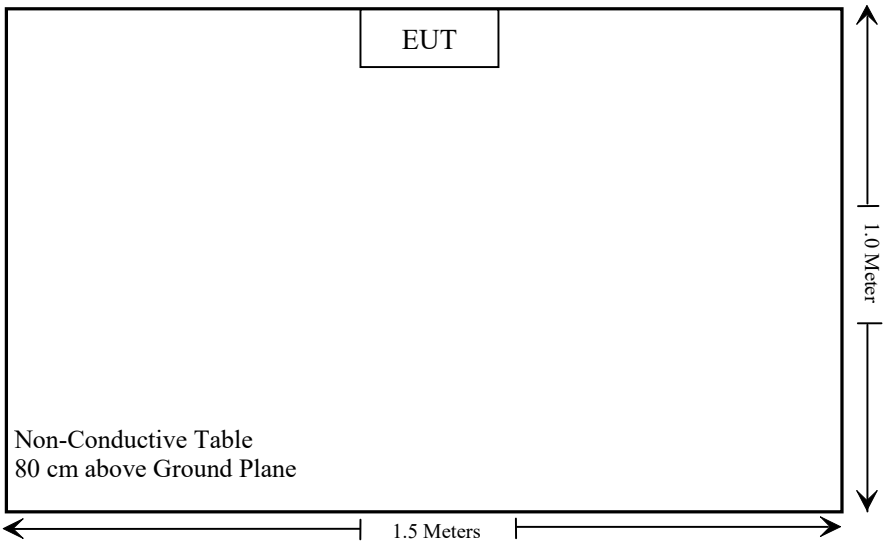
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

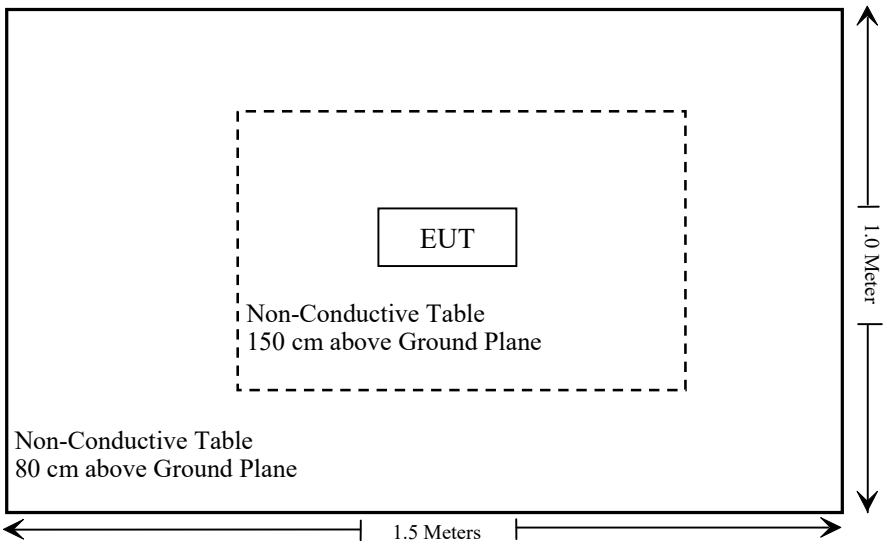
Block Diagram of Test Setup

Below 1GHz:



Note: the support table edge was flush with center of turntable

Above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (3) & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

Not Applicable: Bluetooth cannot work when charging

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated emission test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2022/11/08	2023/11/07
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2022/11/30	2025/11/29
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2022/12/26	2025/12/25
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.16	N650	2022/11/25	2023/11/24
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2022/11/25	2023/11/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF conducted test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
Tonscend	RF Control Unit	JS0806-2	19G8060182	2022/10/24	2023/10/23
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	

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

FCC§15.247 (i), §1.1307 (b) (3) &§2.1093 – RF EXPOSURE

Applicable Standard

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

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Measurement Result

For worst case:

Mode	Frequency (MHz)	Max tune-up conducted power (dBm)	Max tune-up conducted power (mW)	Distance (mm)	Calculated value	Threshold (1-g SAR)	SAR Test Exclusion
BLE	2402-2480	2.5	1.78	5	0.6	3.0	Yes

Result: Compliant.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

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 integral antenna which was permanently attached, and the maximum antenna gain is 0.55dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

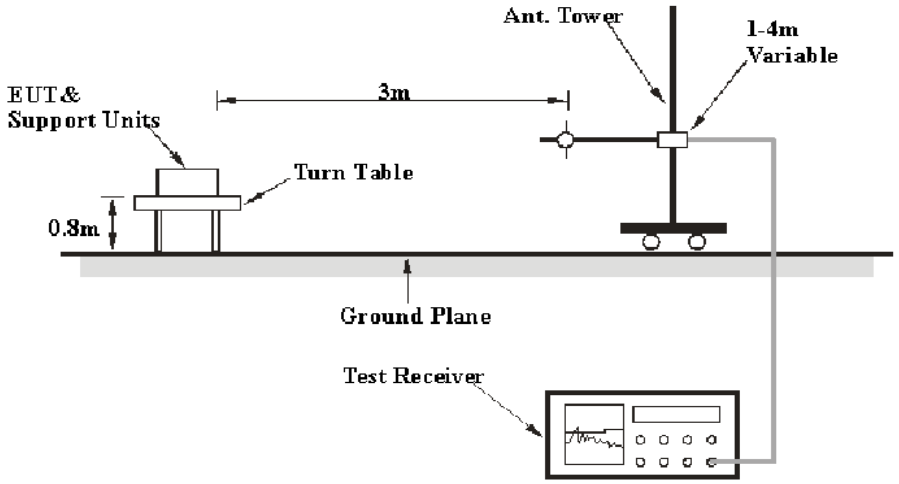
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

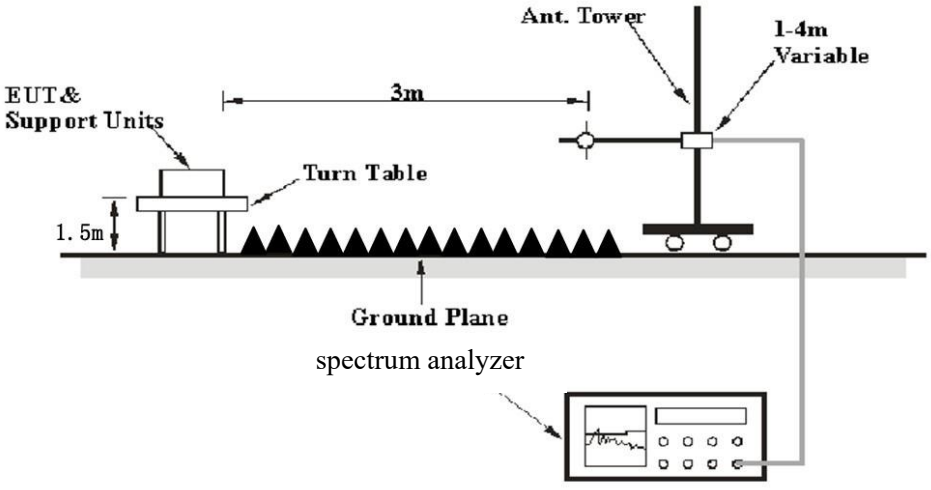
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



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

EMI Test Receiver & Spectrum Analyzer Setup

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

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

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

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

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

Factor & Margin Calculation

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

Factor = Antenna Factor + Cable Loss - 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:

Over Limit/Margin = Corrected Amplitude / Absolute Level – Limit
Absolute Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	24~25.3℃
Relative Humidity:	51~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Jason Liu on 2023-05-04 for below 1GHz and Jimi Zheng on 2023-05-05 for above 1GHz

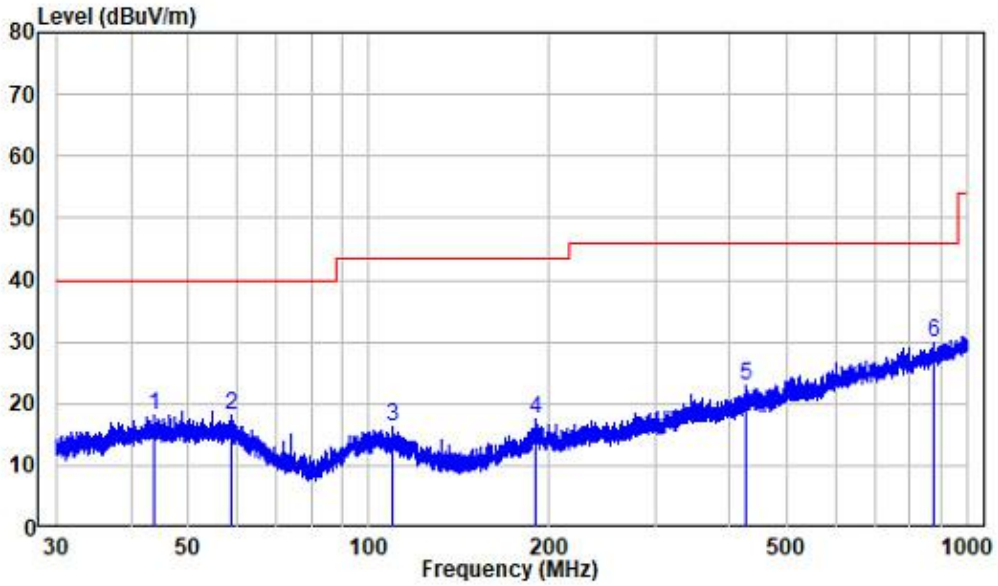
EUT operation mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case X-axes of orientation was recorded)

30MHz-1GHz:

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

BLE 1M: (*Worst case is Low channel*)

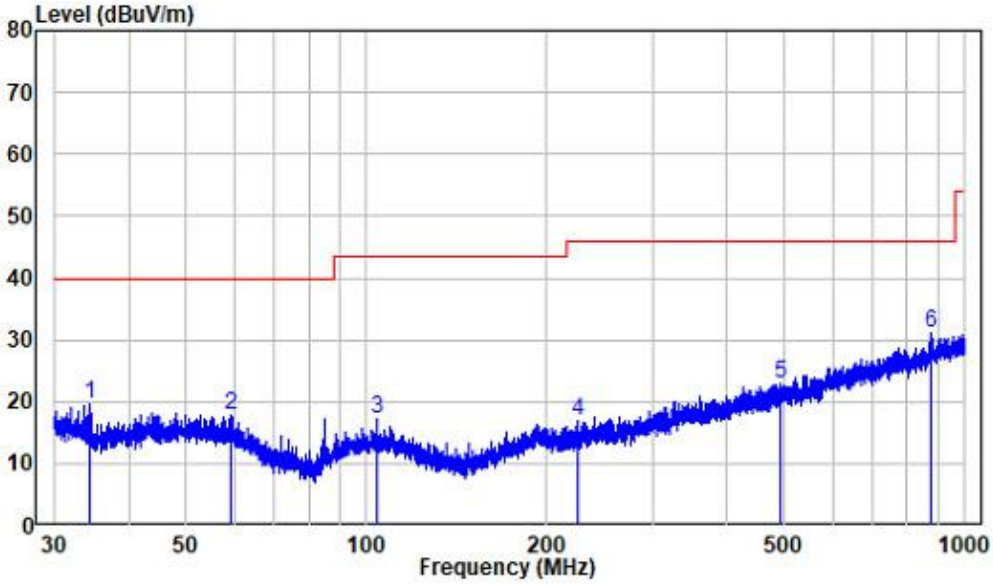
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZ230417-19971E-RF
Test Mode: BLE 1M Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	43.697	-9.92	27.91	17.99	40.00	-22.01	Peak
2	59.025	-10.28	28.35	18.07	40.00	-21.93	Peak
3	109.748	-11.97	28.27	16.30	43.50	-27.20	Peak
4	189.406	-11.66	29.05	17.39	43.50	-26.11	Peak
5	426.334	-5.84	28.77	22.93	46.00	-23.07	Peak
6	874.863	1.17	28.68	29.85	46.00	-16.15	Peak

Vertical

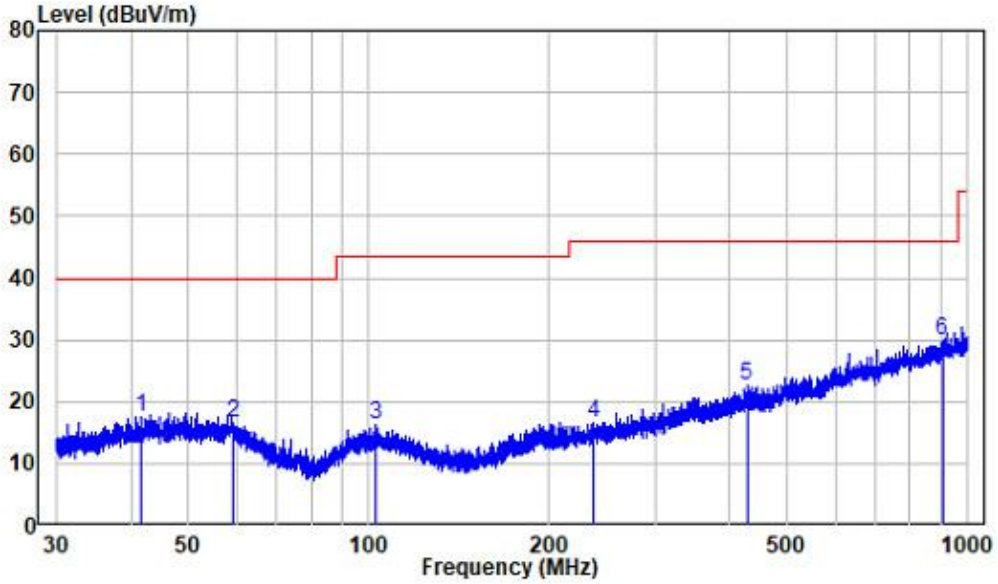


Site : chamber
Condition: 3m VERTICAL
Job No. : SZ230417-19971E-RF
Test Mode: BLE 1M Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.593	-11.67	31.25	19.58	40.00	-20.42	Peak
2	59.284	-10.36	28.31	17.95	40.00	-22.05	Peak
3	104.399	-11.78	28.88	17.10	43.50	-26.40	Peak
4	226.099	-11.23	28.27	17.04	46.00	-28.96	Peak
5	493.333	-4.54	27.49	22.95	46.00	-23.05	Peak
6	877.167	1.20	29.86	31.06	46.00	-14.94	Peak

BLE 2M: (*Worst case is Low channel*)

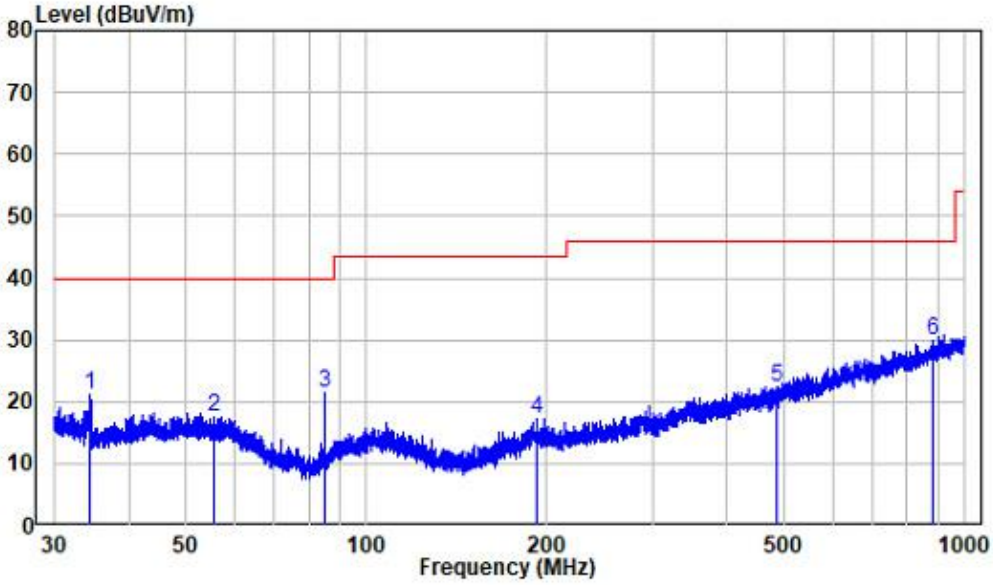
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZ230417-19971E-RF
Test Mode: BLE 2M Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	41.494	-10.11	27.58	17.47	40.00	-22.53	Peak
2	59.441	-10.42	27.03	16.61	40.00	-23.39	Peak
3	102.584	-11.62	27.82	16.20	43.50	-27.30	Peak
4	237.164	-10.94	27.60	16.66	46.00	-29.34	Peak
5	427.270	-5.83	28.53	22.70	46.00	-23.30	Peak
6	905.291	1.69	28.08	29.77	46.00	-16.23	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : SZ230417-19971E-RF
Test Mode: BLE 2M Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.502	-11.70	32.78	21.08	40.00	-18.92	Peak
2	55.439	-10.24	27.77	17.53	40.00	-22.47	Peak
3	84.776	-15.72	37.23	21.51	40.00	-18.49	Peak
4	191.997	-11.25	28.40	17.15	43.50	-26.35	Peak
5	483.697	-4.92	27.37	22.45	46.00	-23.55	Peak
6	880.249	1.23	28.53	29.76	46.00	-16.24	Peak

1-25 GHz:

BLE 1M

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2349.6	66.82	PK	246	1.1	H	-10.79	56.03	74	-17.97
2349.6	53.76	Ave.	246	1.1	H	-10.79	42.97	54	-11.03
2380.8	67.64	PK	149	1.3	V	-10.72	56.92	74	-17.08
2380.8	54.45	Ave.	149	1.3	V	-10.72	43.73	54	-10.27
2390	65.23	PK	161	2.5	H	-10.70	54.53	74	-19.47
2390	54.32	Ave.	161	2.5	H	-10.70	43.62	54	-10.38
2390	67.08	PK	332	1.8	V	-10.70	56.38	74	-17.62
2390	53.79	Ave.	332	1.8	V	-10.70	43.09	54	-10.91
4804	56.99	PK	353	1	H	-6.11	50.88	74	-23.12
4804	46.06	Ave.	353	1	H	-6.11	39.95	54	-14.05
4804	57.47	PK	142	2.1	V	-6.11	51.36	74	-22.64
4804	46.20	Ave.	142	2.1	V	-6.11	40.09	54	-13.91
Middle Channel(2440MHz)									
4880	57.70	PK	272	1.3	H	-5.91	51.79	74	-22.21
4880	46.16	Ave.	272	1.3	H	-5.91	40.25	54	-13.75
4880	58.78	PK	62	1.3	V	-5.91	52.87	74	-21.13
4880	46.43	Ave.	62	1.3	V	-5.91	40.52	54	-13.48
High Channel(2480 MHz)									
2483.5	66.85	PK	63	1.5	H	-10.55	56.3	74	-17.70
2483.5	55.83	Ave.	63	1.5	H	-10.55	45.28	54	-8.72
2483.5	66.32	PK	272	1.3	V	-10.55	55.77	74	-18.23
2483.5	54.67	Ave.	272	1.3	V	-10.55	44.12	54	-9.88
2484.43	68.73	PK	118	1.9	H	-10.54	58.19	74	-15.81
2484.43	56.06	Ave.	118	1.9	H	-10.54	45.52	54	-8.48
2489.08	68.13	PK	84	1.5	V	-10.51	57.62	74	-16.38
2489.08	54.98	Ave.	84	1.5	V	-10.51	44.47	54	-9.53
4960	58.15	PK	252	1.7	H	-5.47	52.68	74	-21.32
4960	45.76	Ave.	252	1.7	H	-5.47	40.29	54	-13.71
4960	58.61	PK	140	2.5	V	-5.47	53.14	74	-20.86
4960	46.17	Ave.	140	2.5	V	-5.47	40.70	54	-13.30

BLE 2M

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2383.4	67.90	PK	126	2	H	-10.72	57.18	74	-16.82
2383.4	54.97	Ave.	126	2	H	-10.72	44.25	54	-9.75
2385.8	68.51	PK	61	1.3	V	-10.71	57.80	74	-16.20
2385.8	54.92	Ave.	61	1.3	V	-10.71	44.21	54	-9.79
2390	66.14	PK	307	2.4	H	-10.70	55.44	74	-18.56
2390	54.67	Ave.	307	2.4	H	-10.70	43.97	54	-10.03
2390	65.18	PK	105	1.7	V	-10.70	54.48	74	-19.52
2390	54.26	Ave.	105	1.7	V	-10.70	43.56	54	-10.44
4804	59.74	PK	238	1.7	H	-6.11	53.63	74	-20.37
4804	47.11	Ave.	238	1.7	H	-6.11	41.00	54	-13.00
4804	59.79	PK	306	2.4	V	-6.11	53.68	74	-20.32
4804	47.22	Ave.	306	2.4	V	-6.11	41.11	54	-12.89
Middle Channel(2440MHz)									
4880	59.50	PK	302	2.1	H	-5.91	53.59	74	-20.41
4880	47.11	Ave.	302	2.1	H	-5.91	41.2	54	-12.80
4880	59.75	PK	106	1.9	V	-5.91	53.84	74	-20.16
4880	47.23	Ave.	106	1.9	V	-5.91	41.32	54	-12.68
High Channel(2480 MHz)									
2483.5	68.19	PK	261	1.1	H	-10.55	57.64	74	-16.36
2483.5	57.08	Ave.	261	1.1	H	-10.55	46.53	54	-7.47
2483.5	65.45	PK	234	1.4	V	-10.55	54.9	74	-19.10
2483.5	55.40	Ave.	234	1.4	V	-10.55	44.85	54	-9.15
2484.22	69.61	PK	111	1	H	-10.54	59.07	74	-14.93
2484.22	56.84	Ave.	111	1	H	-10.54	46.3	54	-7.70
2489.05	67.99	PK	5	1.2	V	-10.51	57.48	74	-16.52
2489.05	55.46	Ave.	5	1.2	V	-10.51	44.95	54	-9.05
4960	58.37	PK	241	1.8	H	-5.47	52.90	74	-21.10
4960	46.11	Ave.	241	1.8	H	-5.47	40.64	54	-13.36
4960	58.59	PK	137	1.1	V	-5.47	53.12	74	-20.88
4960	46.46	Ave.	137	1.1	V	-5.47	40.99	54	-13.01

Note:

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

Absolute Level = Corrected Factor + Reading

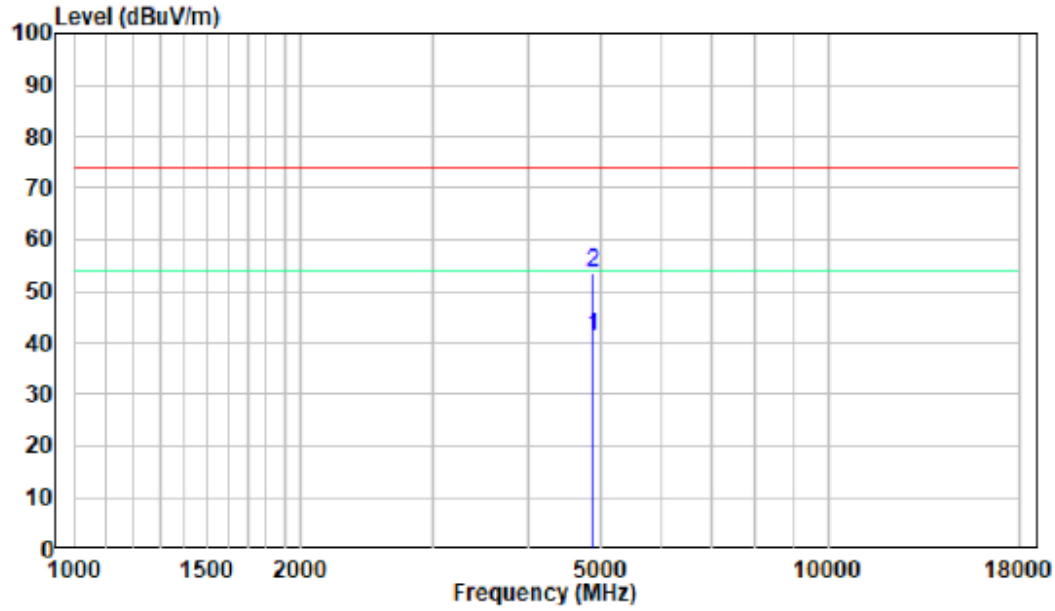
Margin = Absolute Level - Limit

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

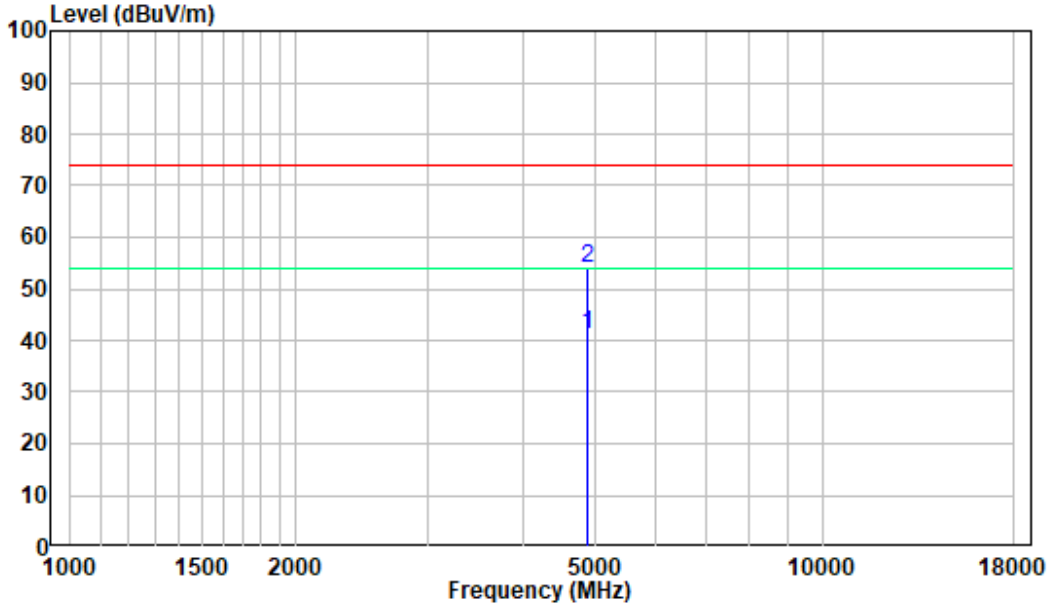
1-18 GHz:

Pre-scan for BLE 2M, Middle Channel

Horizontal



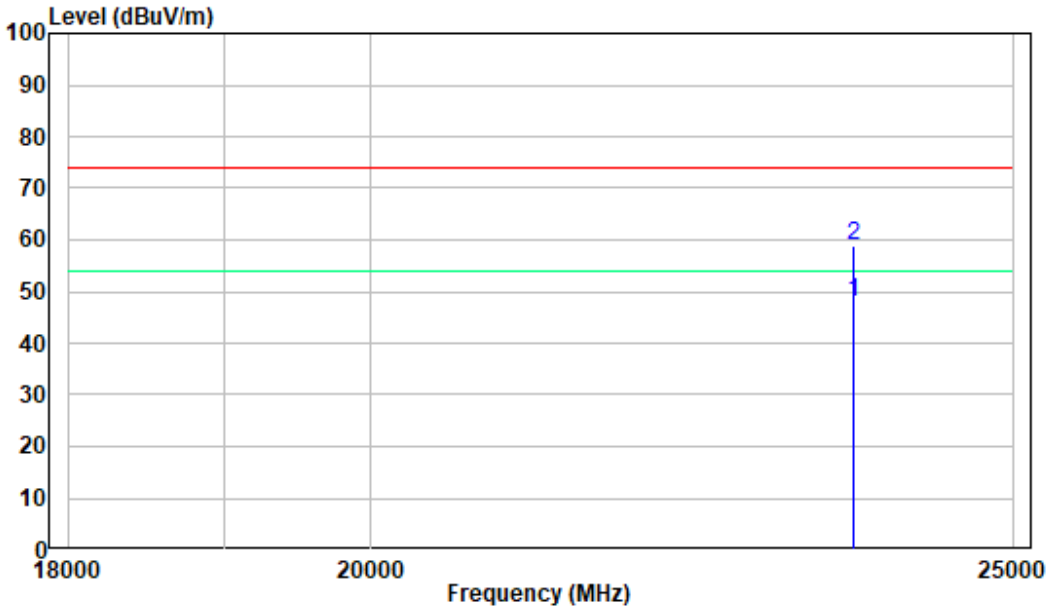
Vertical



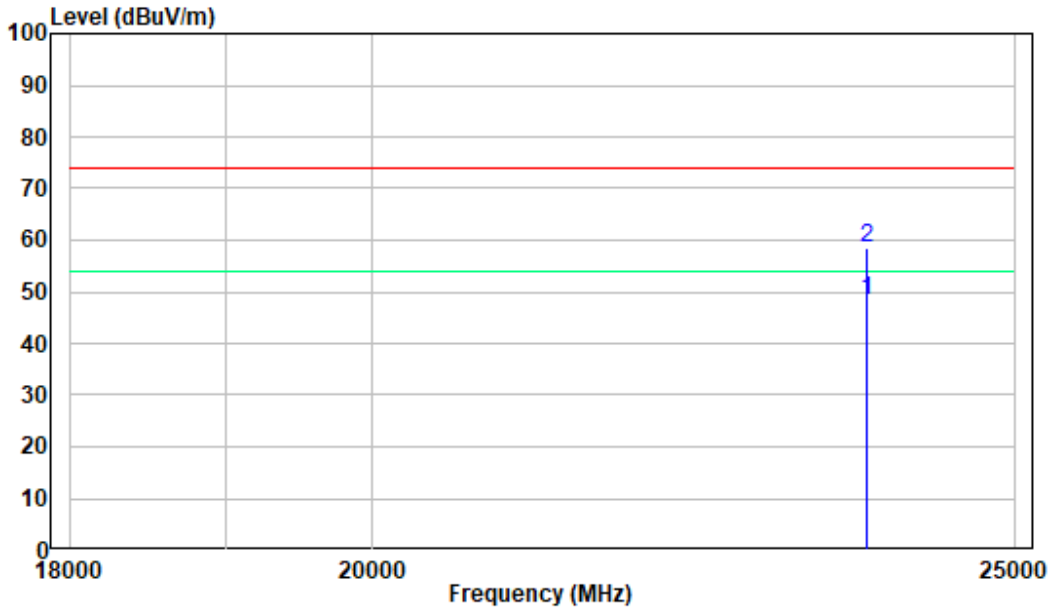
18 -25GHz:

Pre-scan for BLE 2M, Middle Channel

Horizontal



Vertical



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

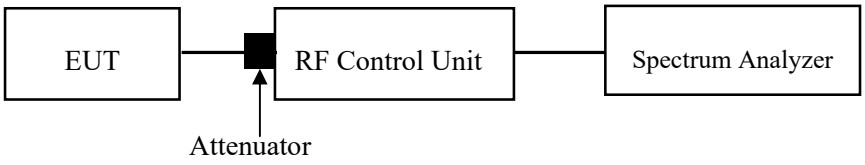
Applicable Standard

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

Test Procedure

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

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



Test Data

Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	60 %
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang on 2023-05-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

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

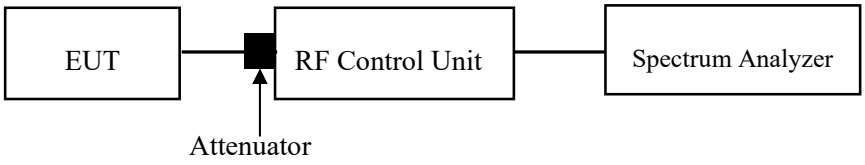
Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.9.1.1

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



Test Data

Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	60 %
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang on 2023-05-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

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

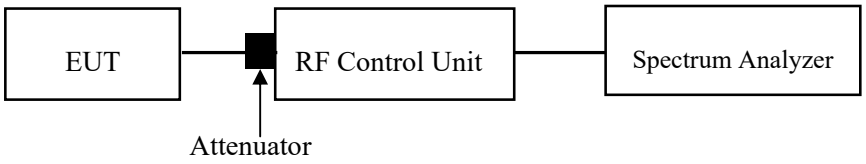
Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.11

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



Test Data

Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	60 %
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang on 2023-05-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

FCC §15.247(e) - POWER SPECTRAL DENSITY

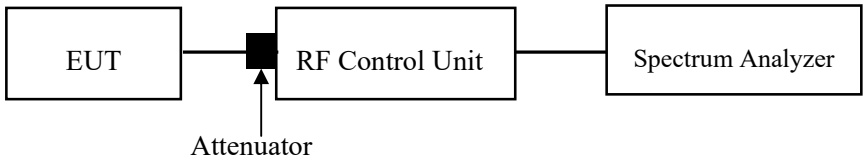
Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.10.2

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



Test Data

Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	60 %
ATM Pressure:	101.0 kPa

The testing was performed by Glenn Jiang on 2023-05-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

APPENDIX

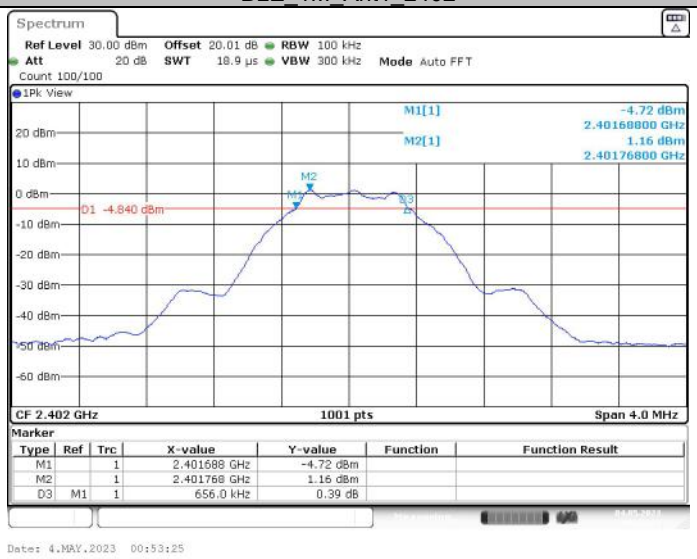
Appendix A: DTS Bandwidth

Test Result

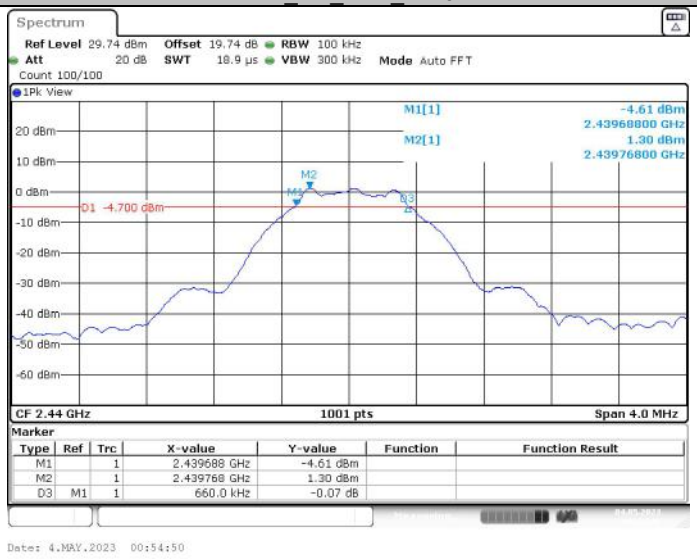
Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.66	0.5	PASS
		2440	0.66	0.5	PASS
		2480	0.66	0.5	PASS
BLE_2M	Ant1	2402	1.14	0.5	PASS
		2440	1.14	0.5	PASS
		2480	1.14	0.5	PASS

Test Graphs

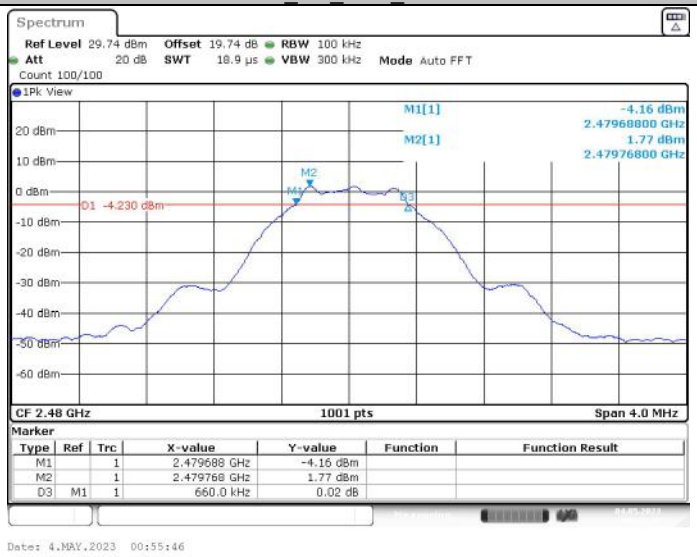
BLE_1M_Ant1_2402



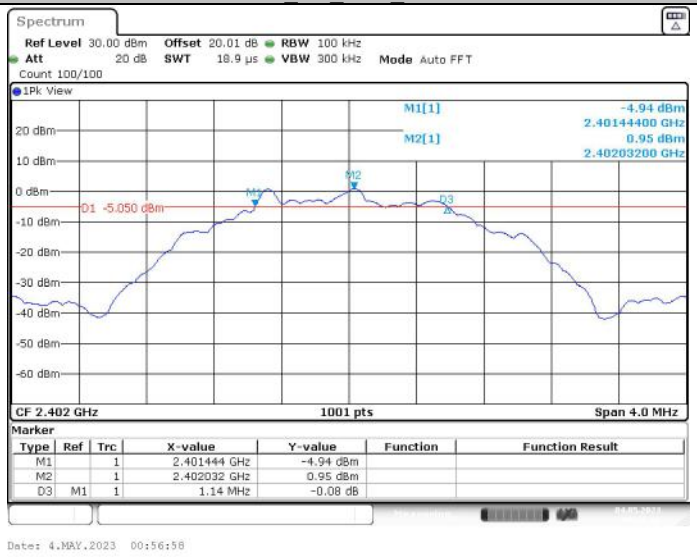
BLE_1M_Ant1_2440



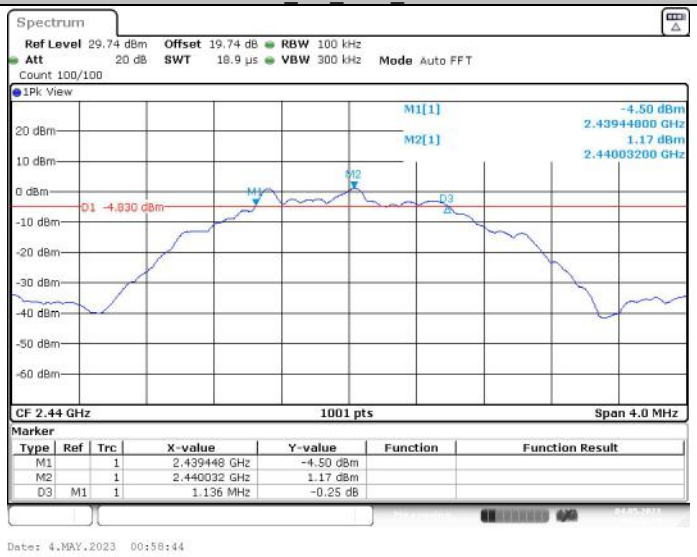
BLE_1M_Ant1_2480



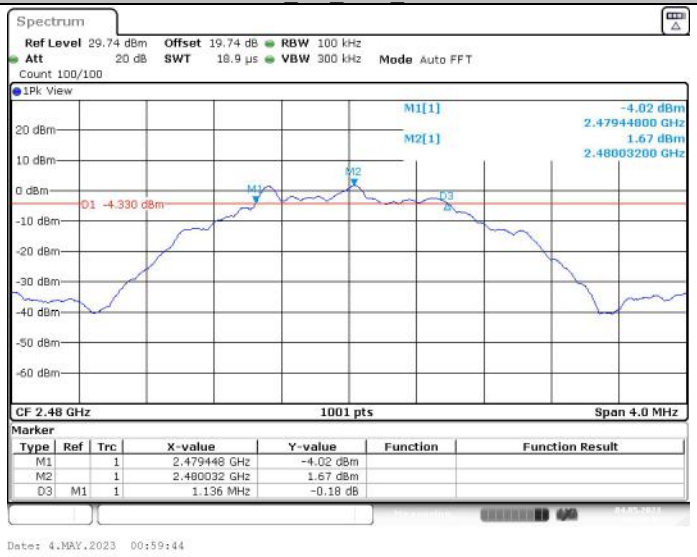
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



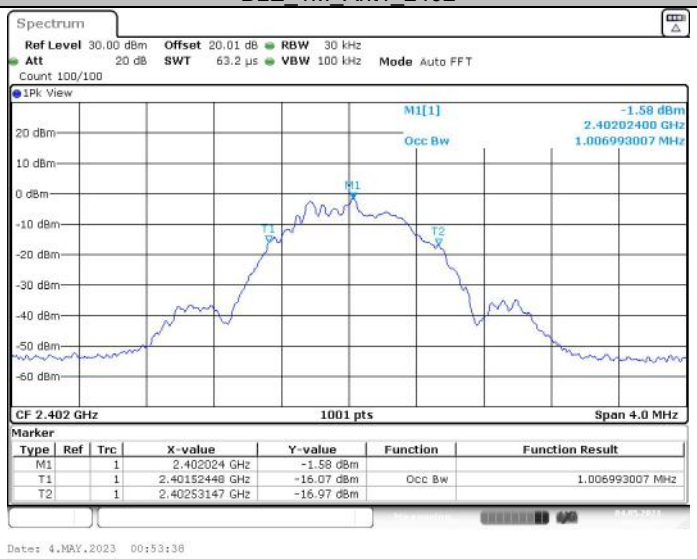
Appendix B: Occupied Channel Bandwidth

Test Result

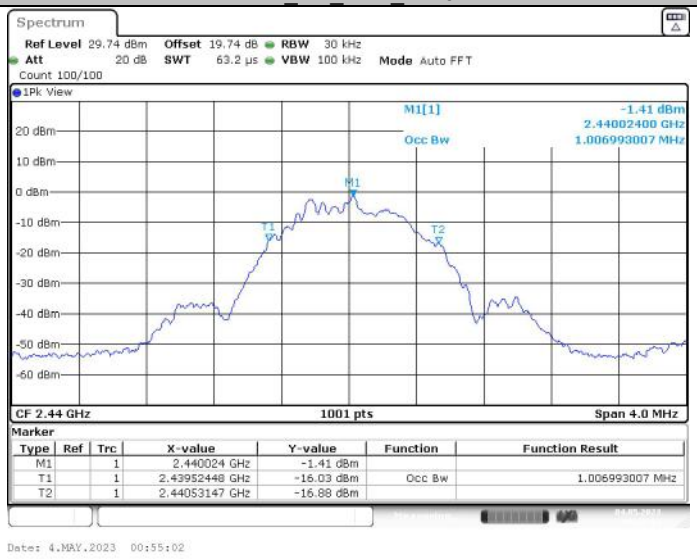
Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.007	2401.524	2402.531	---	---
		2440	1.007	2439.524	2440.531	---	---
		2480	1.007	2479.524	2480.531	---	---
BLE_2M	Ant1	2402	1.958	2401.057	2403.015	---	---
		2440	1.962	2439.057	2441.019	---	---
		2480	1.962	2479.057	2481.019	---	---

Test Graphs

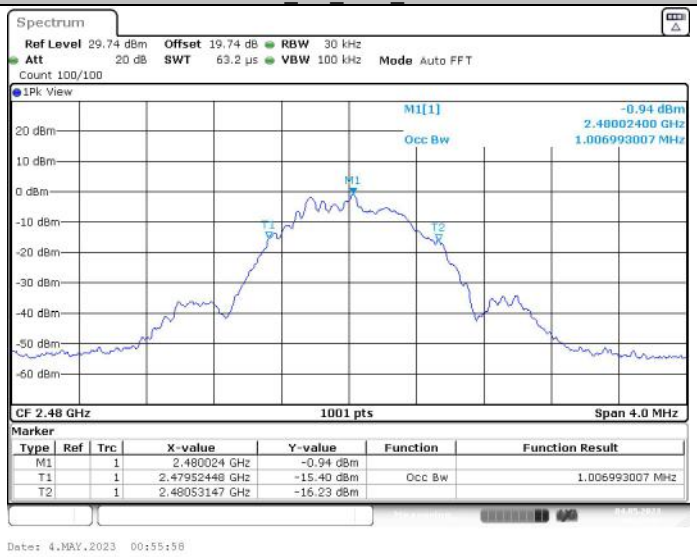
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



BLE_2M_Ant1_2402

BLE_2M_Ant1_2440

BLE_2M_Ant1_2480

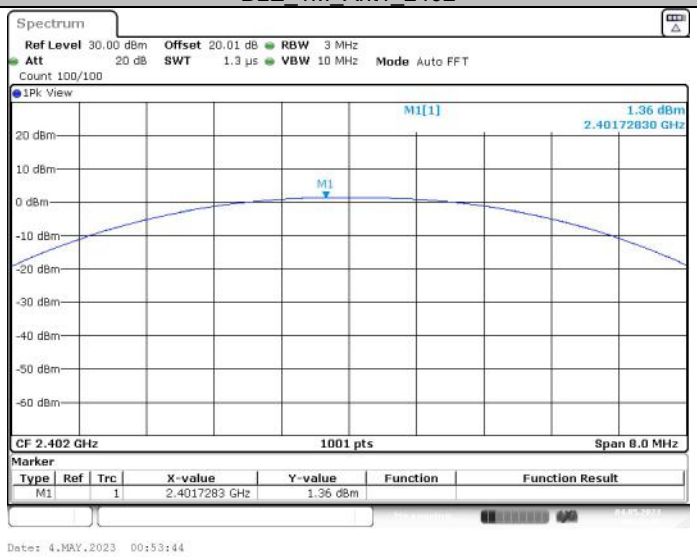
Appendix C: Maximum conducted output power

Test Result Peak

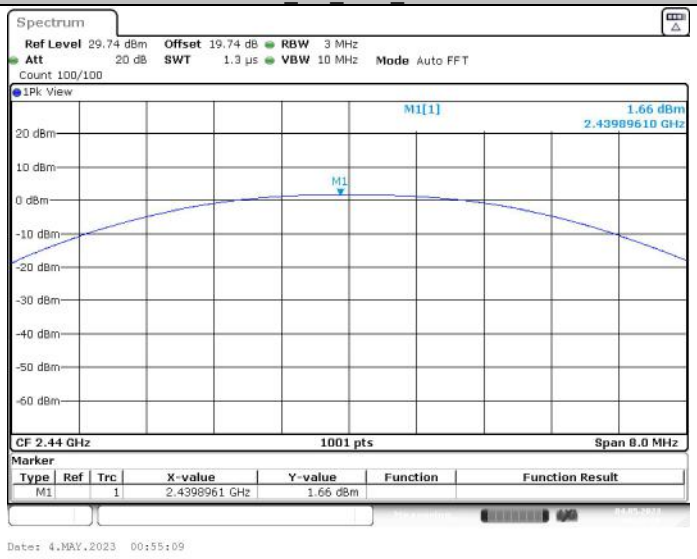
Test Mode	Antenna	Frequency[MHz]	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
BLE_1M	Ant1	2402	1.36	≤30	PASS
		2440	1.66	≤30	PASS
		2480	**2.12**	≤30	PASS
BLE_2M	Ant1	2402	1.34	≤30	PASS
		2440	1.60	≤30	PASS
		2480	2.06	≤30	PASS

Test Graphs Peak

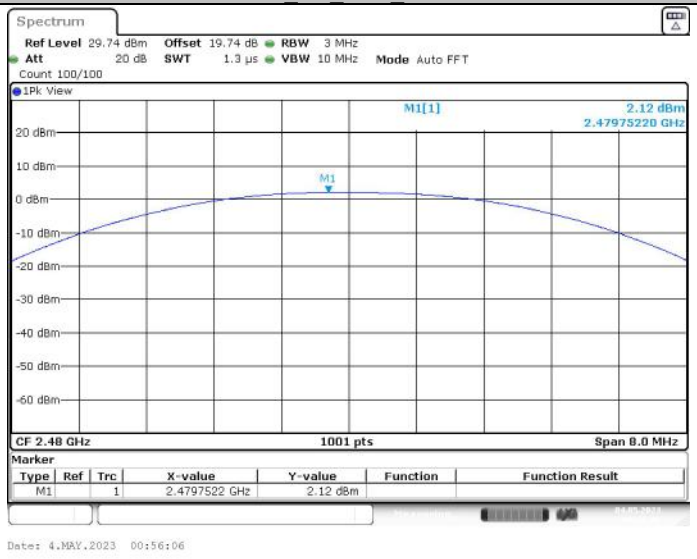
BLE_1M_Ant1_2402



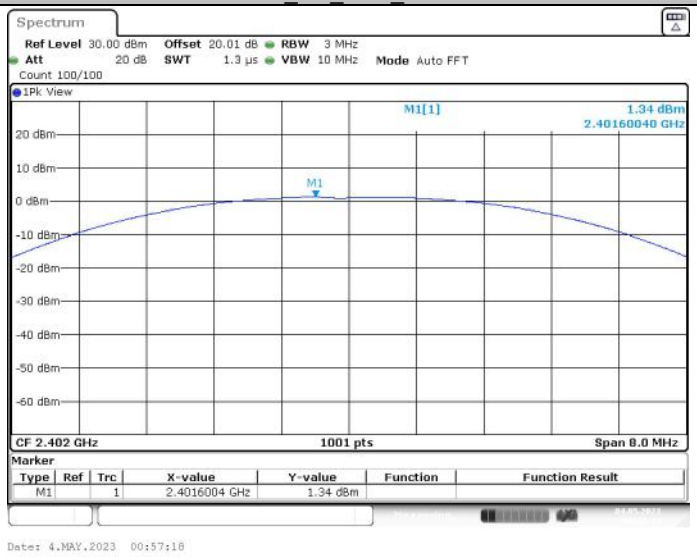
BLE_1M_Ant1_2440



BLE_1M_Ant1_2480

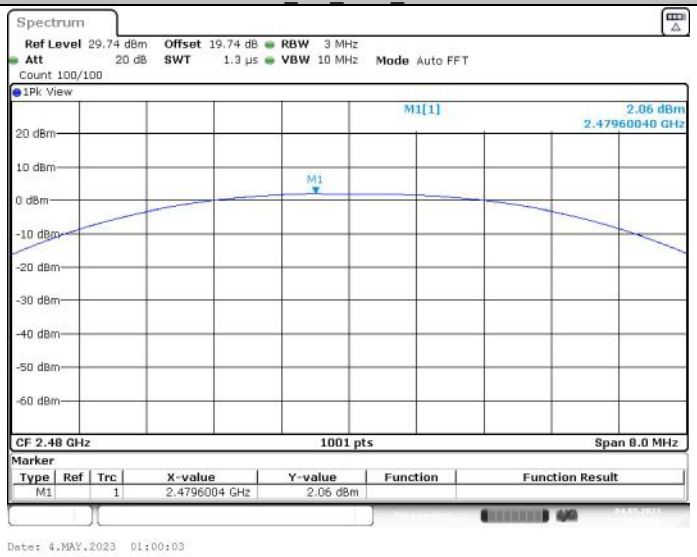


BLE_2M_Ant1_2402



BLE_2M_Ant1_2440

BLE_2M_Ant1_2480



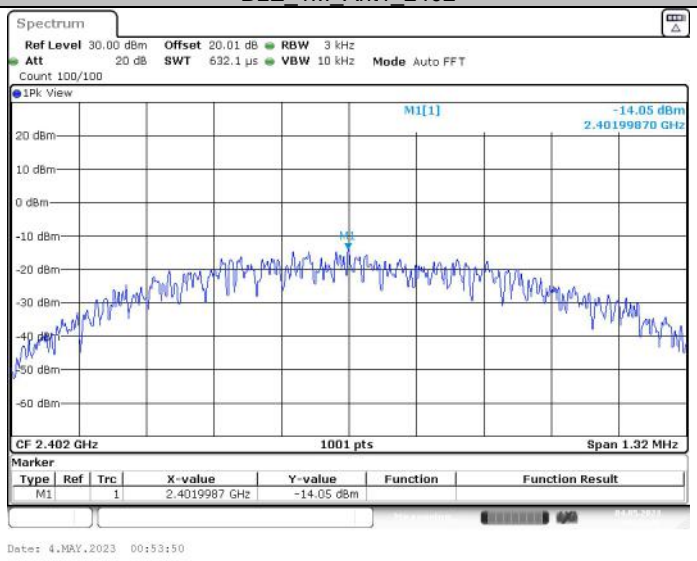
Appendix D: Maximum power spectral density

Test Result

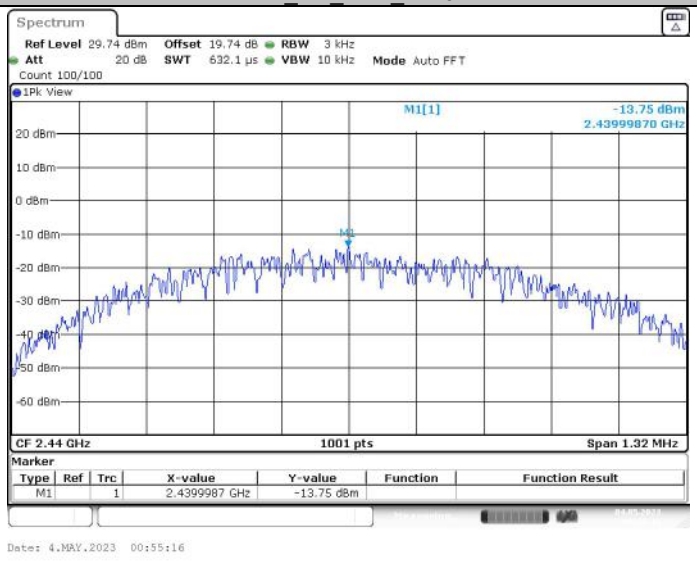
Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.05	≤8.00	PASS
		2440	-13.75	≤8.00	PASS
		2480	-13.31	≤8.00	PASS
BLE_2M	Ant1	2402	-17.41	≤8.00	PASS
		2440	-17.08	≤8.00	PASS
		2480	-16.65	≤8.00	PASS

Test Graphs

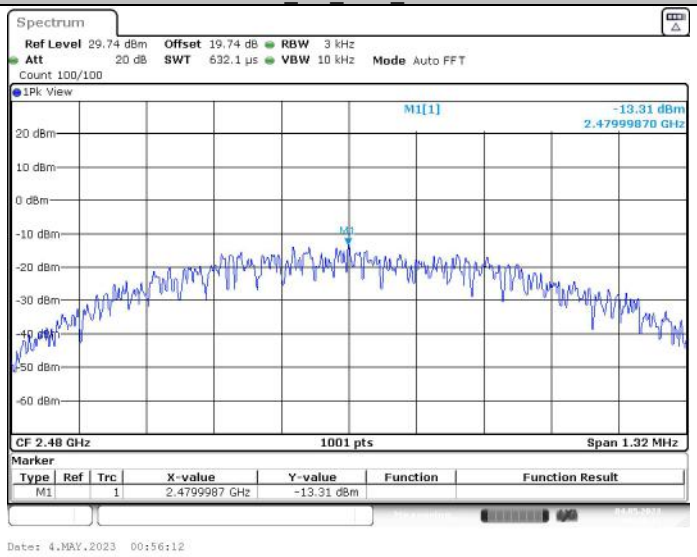
BLE_1M_Ant1_2402



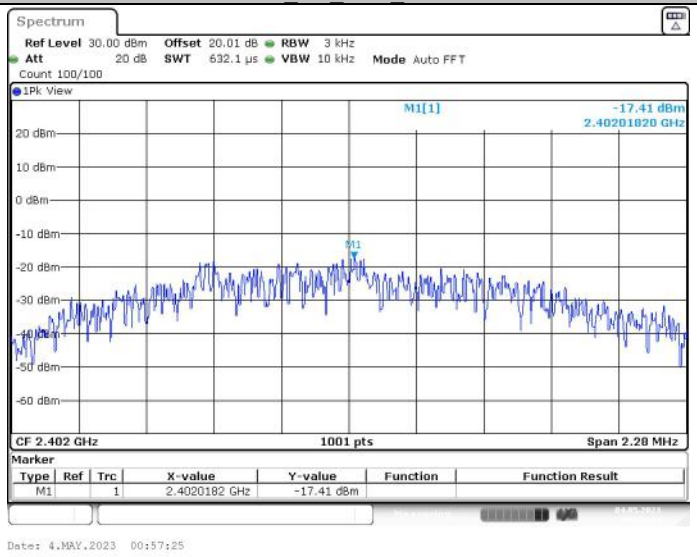
BLE_1M_Ant1_2440



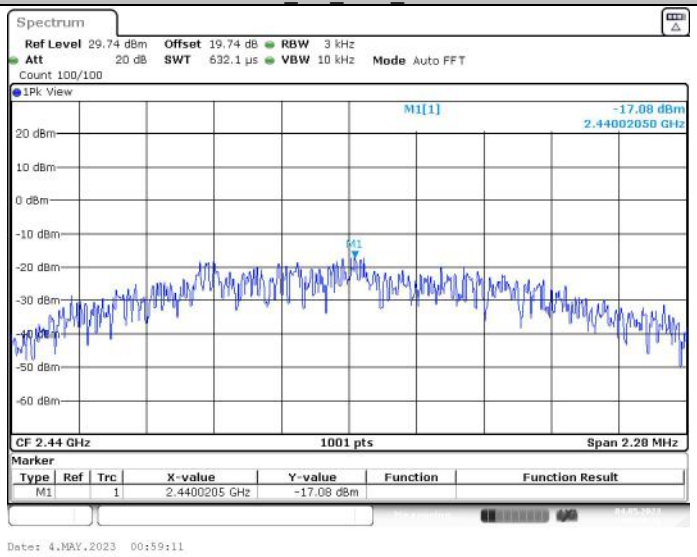
BLE_1M_Ant1_2480



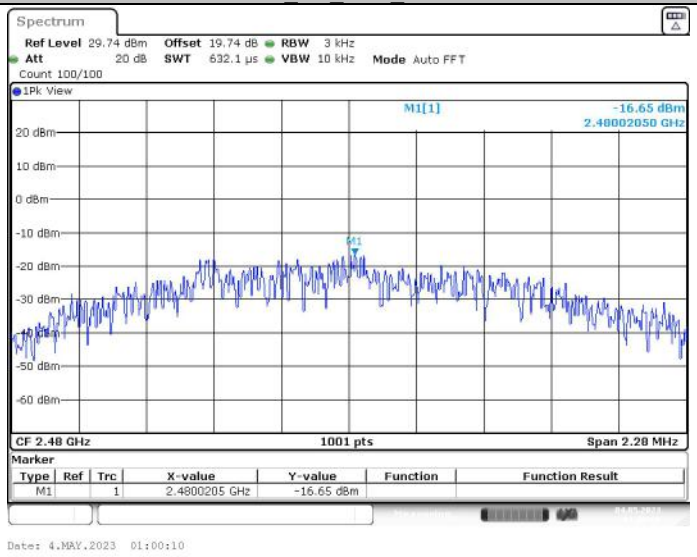
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



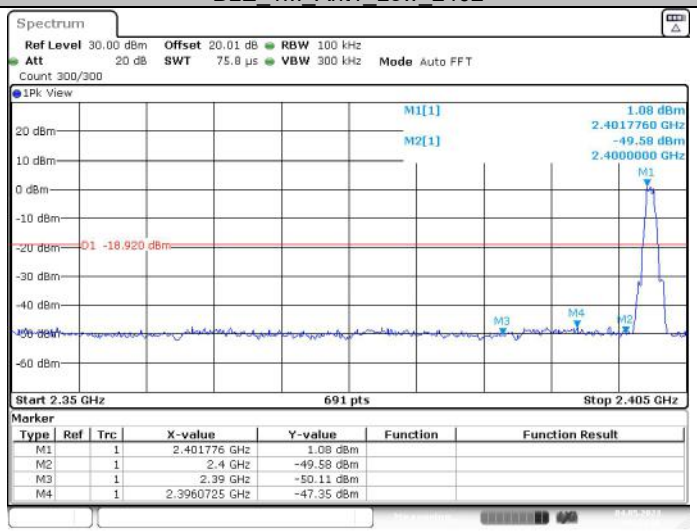
BLE_2M_Ant1_2480



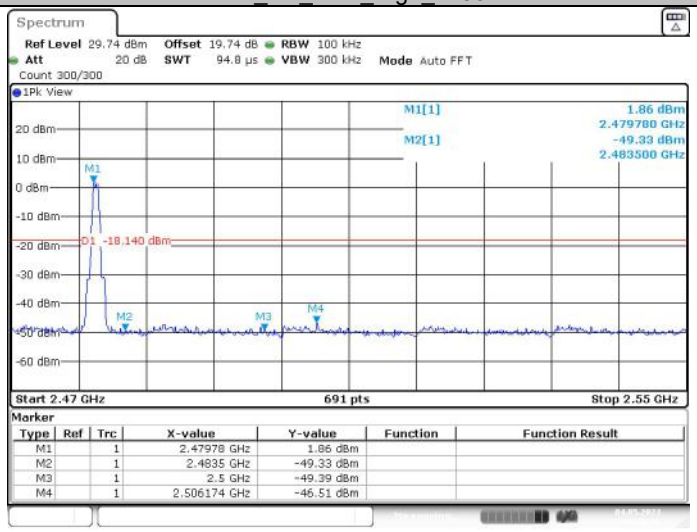
Appendix E: Band edge measurements

Test Graphs

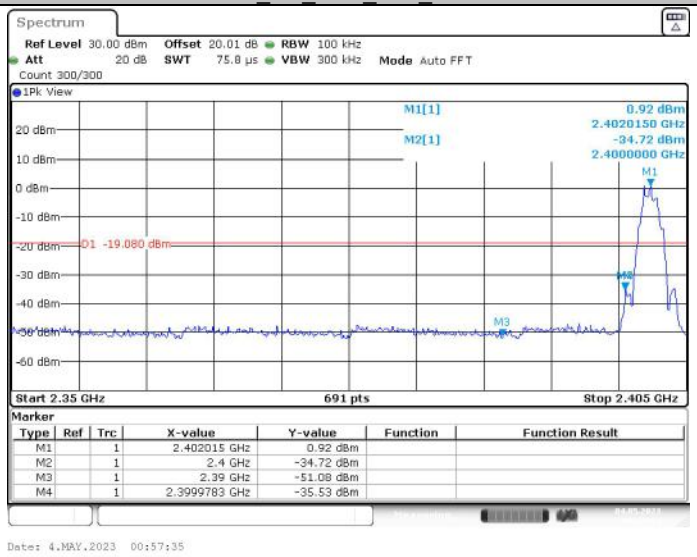
BLE_1M_Ant1_Low_2402



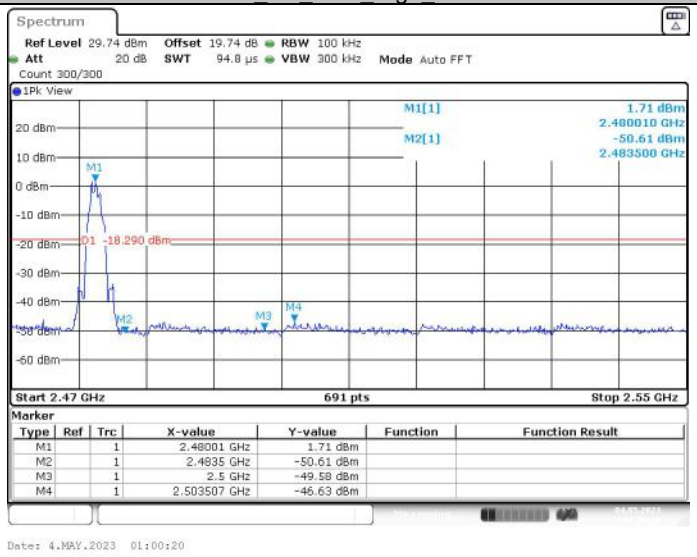
BLE_1M_Ant1_High_2480



BLE_2M_Ant1_Low_2402



BLE_2M_Ant1_High_2480



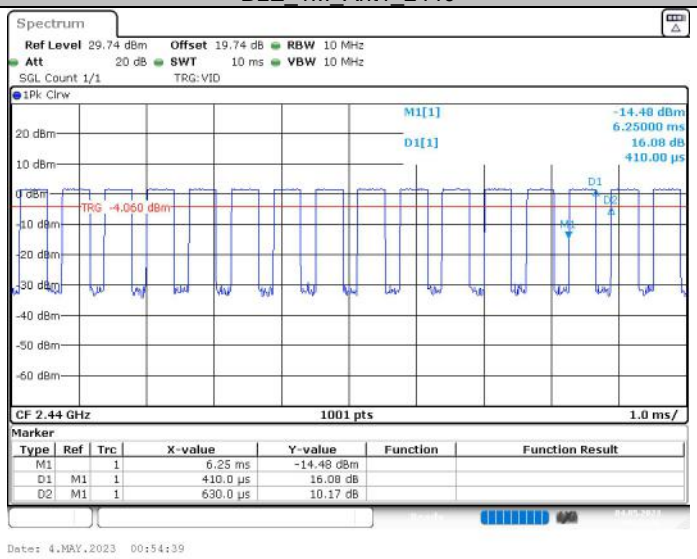
Appendix F: Duty Cycle

Test Result

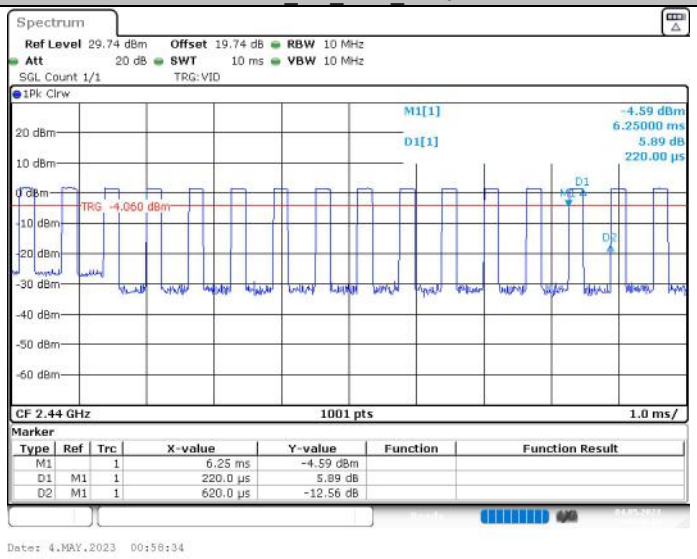
Test Mode	Antenna	Frequency[MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	1/T[kHz]
BLE_1M	Ant1	2440	0.41	0.63	65.08	2.439
BLE_2M	Ant1	2440	0.22	0.62	35.48	4.545

Test Graphs

BLE_1M_Ant1_2440



BLE_2M_Ant1_2440



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