TEST REPORT

Applicant Name :	SHENZHEN ACTTO ELECTRONICS TECHNOLOGY CO., LTD.
Address :	1206I,Bld4,HuanggangCenter,Century of Excellence Center, Fushan Community, Futian, Shenzhen, China
Report Number :	RA230424-21931E-RF
FCC ID:	2BA6I-B309

Test Standard (s)
FCC PART 15.247

Sample Description

Product Type:	Retro 2 Mini Bluetooth Keyboard
Model No.:	B307, B309
Trade Mark:	ACTTO
Date Received:	2023-04-24
Date of Test:	2023-05-05 to 2023-06-02
Report Date:	2023-06-02

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.

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230424-21931E-RF	Original Report	2023-06-02

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Retro 2 Mini Bluetooth Keyboard
Tested Model	B307
Multiple Model	B309
Model Difference	Please refer to DOS Letter
Frequency Range	BLE 1M: 2402-2480MHz
Maximum conducted Peak output power	1.95 dBm
Modulation Technique	GFSK
Antenna Specification*	Internal Antenna: 2.34 dBi(provided by the applicant)
Voltage Range	DC 3.7V from battery or DC 5V from USB port
Sample number	RA230424-21931E-RF-S1 (CE&RE) RA230424-21931E-RF-S2 (RF Conducted Test) (Assigned by ATC, Shenzhen)
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 rules.

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

Test Methodology

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

And KDB 558074 D01 15.247 Meas Guidance v05r02.

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

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.71dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.74dB
Emissions, Radiated	30MHz - 1GHz	5.08dB
	1GHz - 18GHz	4.96dB
	18GHz - 26.5GHz	5.16dB
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 4297.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), 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
…	…	…	…
…	…	…	…
…	…	…	…
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

EUT Exercise Software

Software “PXI BLE Tool v1.1.6”* was used during testing and the power level was 4*.

Special Accessories

N/A

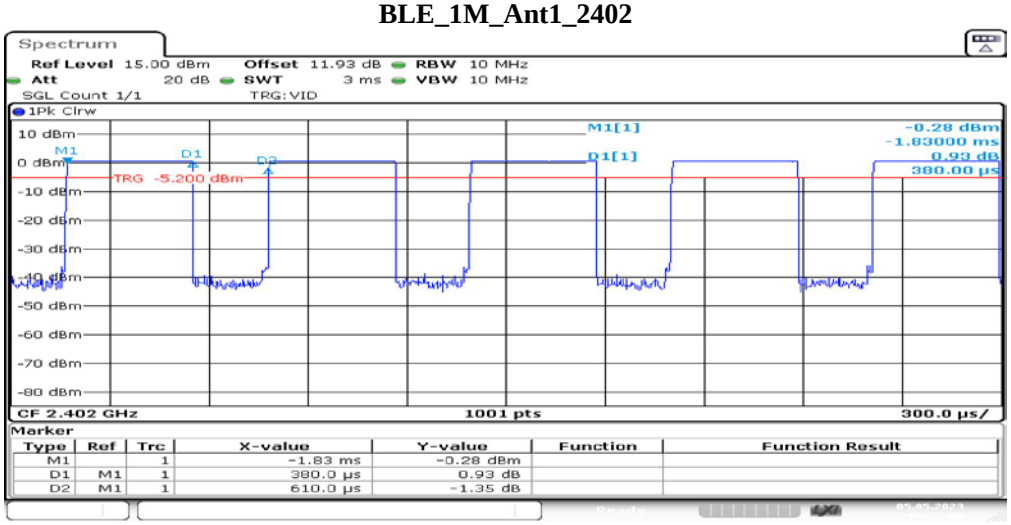
Equipment Modifications

No modification was made to the EUT tested.

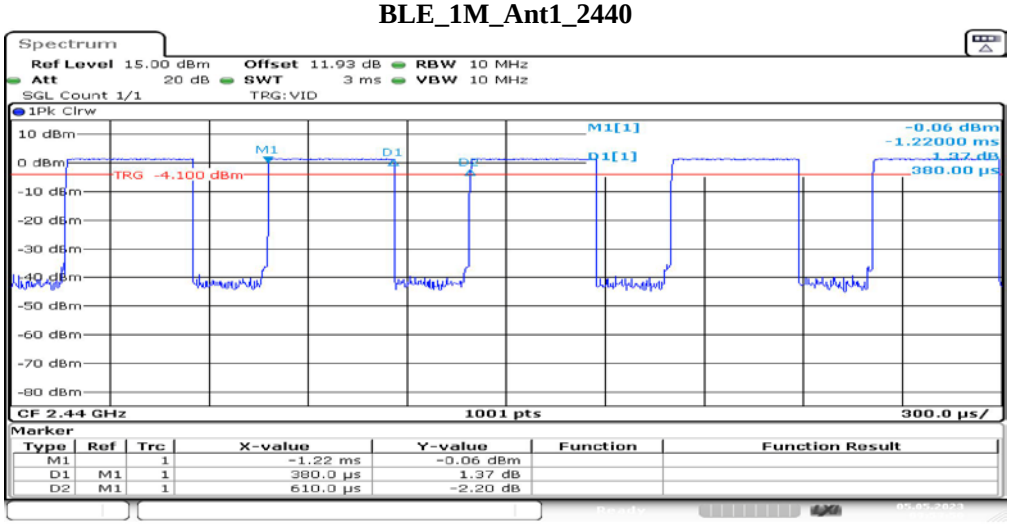
Duty Cycle

Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW[kHz]
BLE_1M	Ant1	2402	0.38	0.61	62.30	2.63
		2440	0.38	0.61	62.30	2.63
		2480	0.38	0.61	62.30	2.63

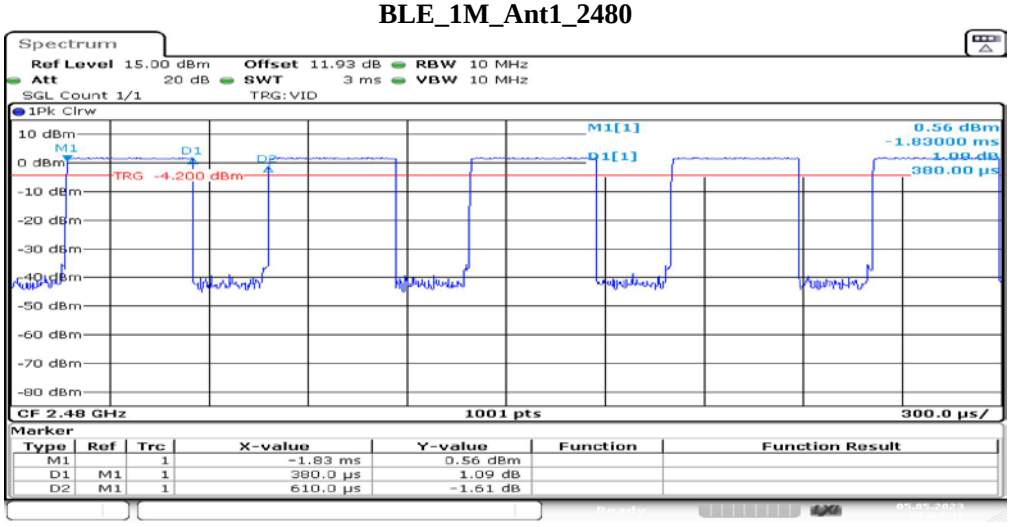
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



Support Equipment List and Details

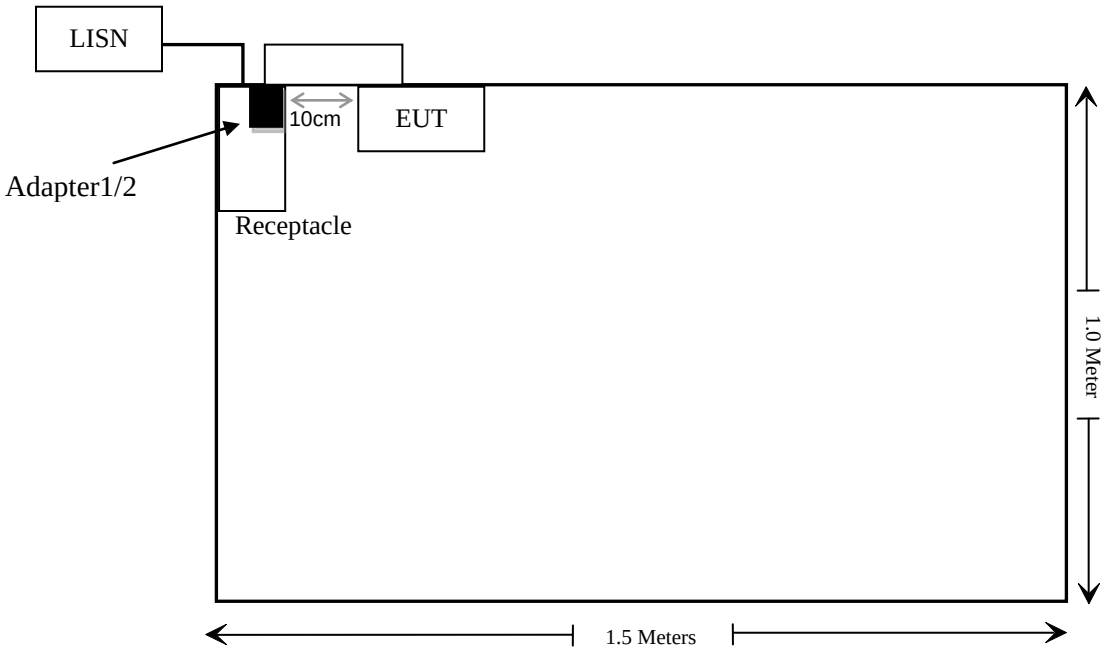
Manufacturer	Description	Model	Serial Number
Xiaomi	Adapter1	MDY-11-EX	Unknown
Sparx	Adapter2	SX-200	Unknown

External I/O Cable

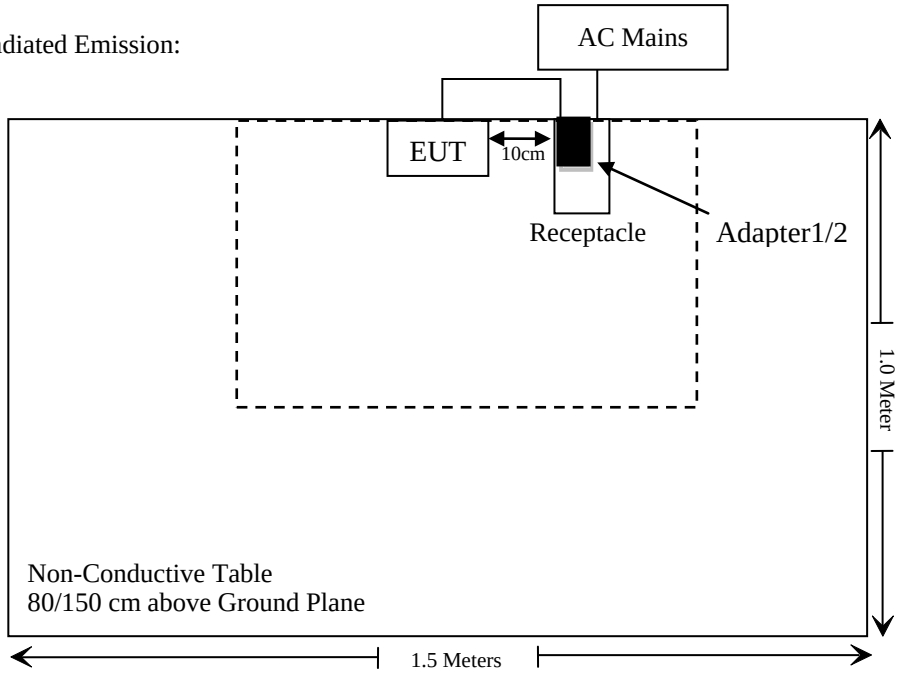
Cable Description	Length (m)	From/Port	To
USB Cable	1.5M	Adapter1/2	EUT

Block Diagram of Test Setup

For conducted emission:



For Radiated Emission:



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

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2022/11/25	2023/11/24
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2022/11/25	2023/11/24
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2022/12/07	2023/12/06
Unknown	RF Coaxial Cable	No.17	N0350	2022/11/25	2023/11/24
Conducted Emission Test Software: e3 191218 (V9)					
Radiated Emissions Test					
Rohde & Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde & Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-184055 36-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
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2022/11/25	2023/11/24
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
Radiated Emission Test Software: e3191218 (V9)					
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2022/11/25	2023/11/24
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2022/11/25	2023/11/24
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.33	RF-03	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§1.1307 (b) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b), 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 D04 Interim General RF Exposure Guidance v01, clause 2.1.3.1-SAR-Based Exemption:

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions.

Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

Test Result

For worst case:

Mode	Frequency	Maximum Tune-up Conducted Power	Antenna Gain		ERP	Distance	SAR-Based Exclusion Threshold		SAR-Based Exclusion
	(MHz)	(dBm)	(dBi)	(dBd)	(dBm)	(mm)	(mW)	(dBm)	
BLE	2402-2480	2.0	2.34	0.19	2.19	5	2.717	4.34	Yes

Note 1: The tune-up power was declared by the applicant.
Note 2: 0dBd=2.15dBi.

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.
c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

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

Antenna Connector Construction

The EUT has one internal antenna arrangement, which was permanently attached and the antenna gain is 2.34 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

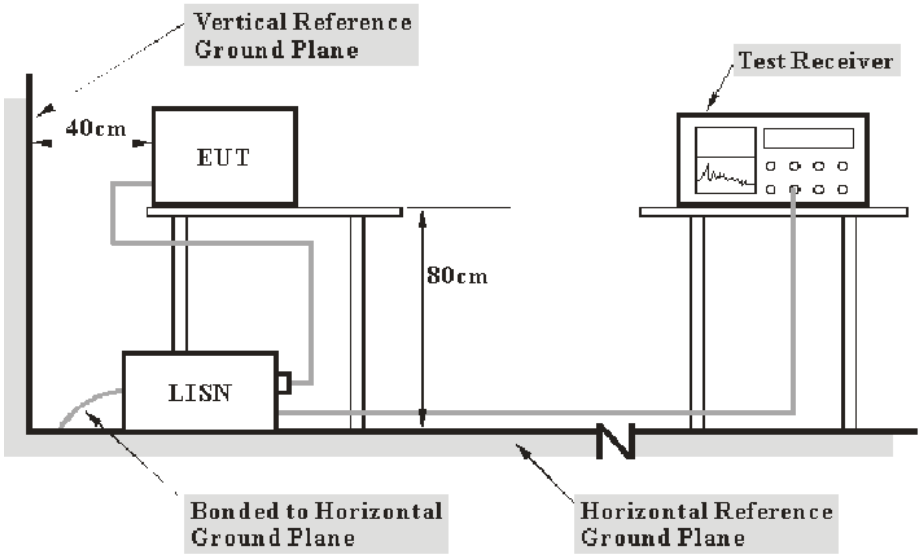
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

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

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

Test Procedure

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

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

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

Factor & Margin Calculation

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

Factor = LISN VDF + 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:

Over Limit = Level – Limit
Level = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	47-49 %
ATM Pressure:	101.0 kPa

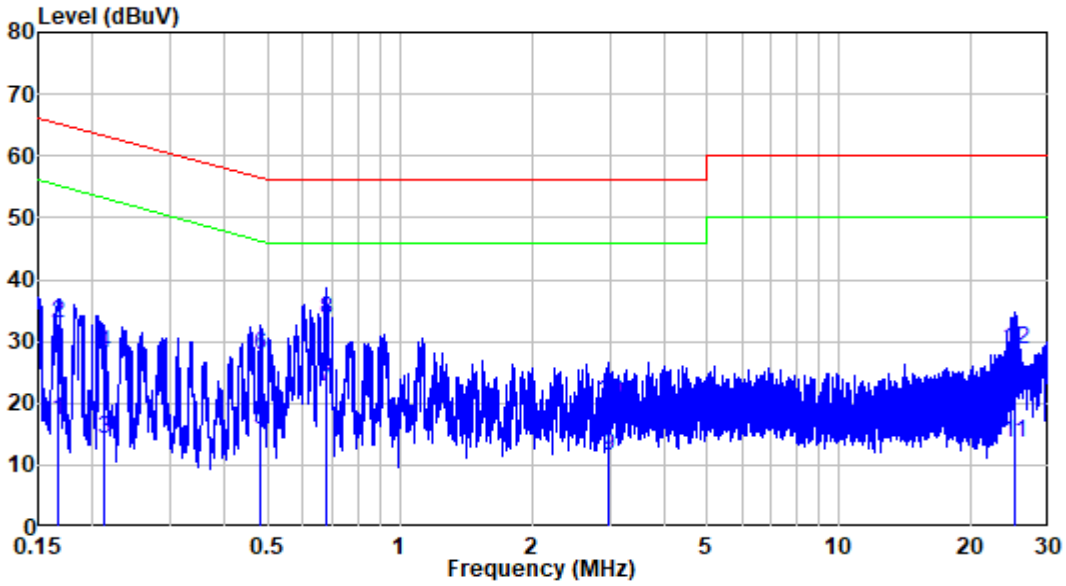
The testing was performed by Jerry Wu on 2023-05-22 for model B307 and on 2023-06-02 for model B309.

EUT operation mode: Charging + BLE Transmitting

Test Result: Please refer to the below plots:

For Model B307:

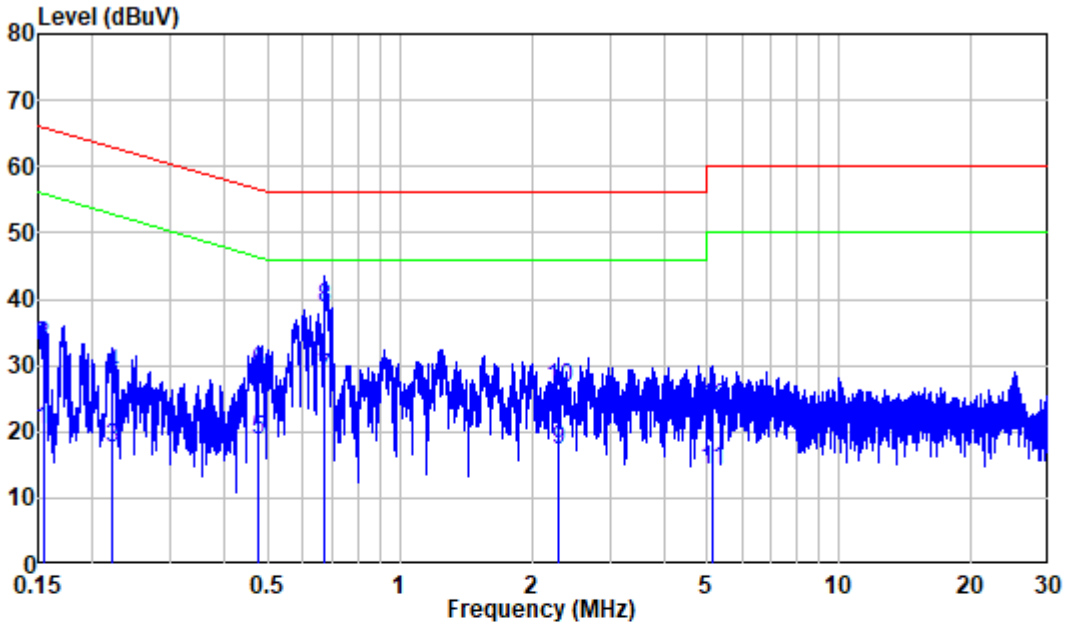
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : RA230424-21931E-RF
Mode : Charging+BLE Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.167	10.34	6.87	17.21	55.11	-37.90	Average
2	0.167	10.34	22.66	33.00	65.11	-32.11	QP
3	0.213	10.30	4.01	14.31	53.11	-38.80	Average
4	0.213	10.30	17.76	28.06	63.11	-35.05	QP
5	0.482	10.56	5.10	15.66	46.31	-30.65	Average
6	0.482	10.56	17.20	27.76	56.31	-28.55	QP
7	0.679	10.66	12.13	22.79	46.00	-23.21	Average
8	0.679	10.66	22.77	33.43	56.00	-22.57	QP
9	2.989	10.49	0.95	11.44	46.00	-34.56	Average
10	2.989	10.49	9.68	20.17	56.00	-35.83	QP
11	25.088	10.24	3.48	13.72	50.00	-36.28	Average
12	25.088	10.24	18.35	28.59	60.00	-31.41	QP

AC 120V/60 Hz, Neutral

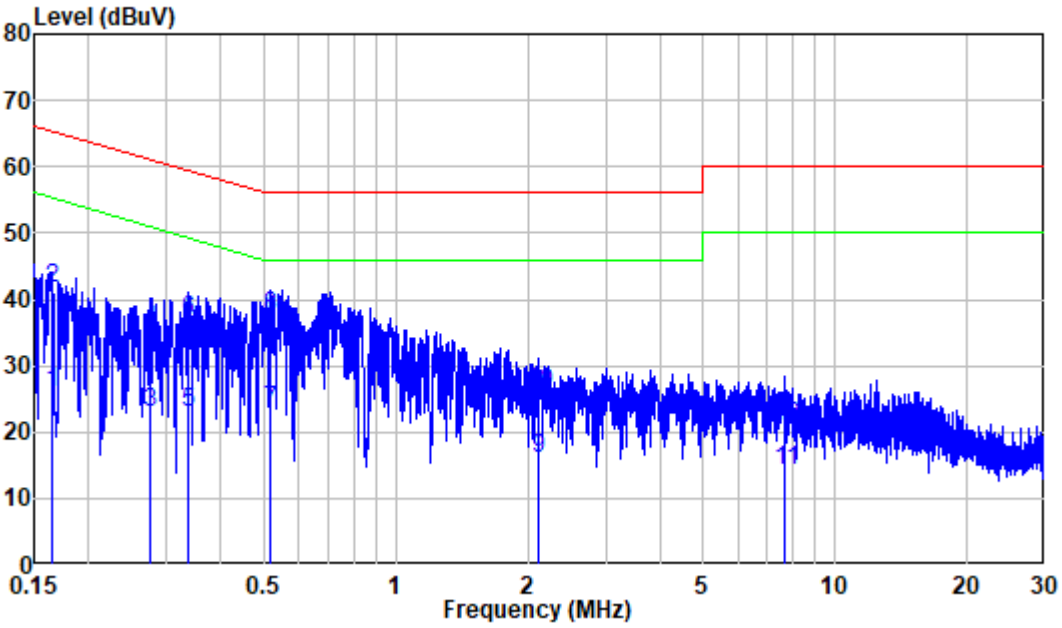


Site : Shielding Room
Condition: Neutral
Job No. : RA230424-21931E-RF
Mode : Charging+BLE Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.154	10.27	9.87	20.14	55.78	-35.64	Average
2	0.154	10.27	22.52	32.79	65.78	-32.99	QP
3	0.221	10.30	7.26	17.56	52.77	-35.21	Average
4	0.221	10.30	18.36	28.66	62.77	-34.11	QP
5	0.477	10.45	8.27	18.72	46.38	-27.66	Average
6	0.477	10.45	18.62	29.07	56.38	-27.31	QP
7	0.675	10.47	17.74	28.21	46.00	-17.79	Average
8	0.675	10.47	28.30	38.77	56.00	-17.23	QP
9	2.297	10.51	6.56	17.07	46.00	-28.93	Average
10	2.297	10.51	15.91	26.42	56.00	-29.58	QP
11	5.129	10.51	3.60	14.11	50.00	-35.89	Average
12	5.129	10.51	12.99	23.50	60.00	-36.50	QP

For Model B309:

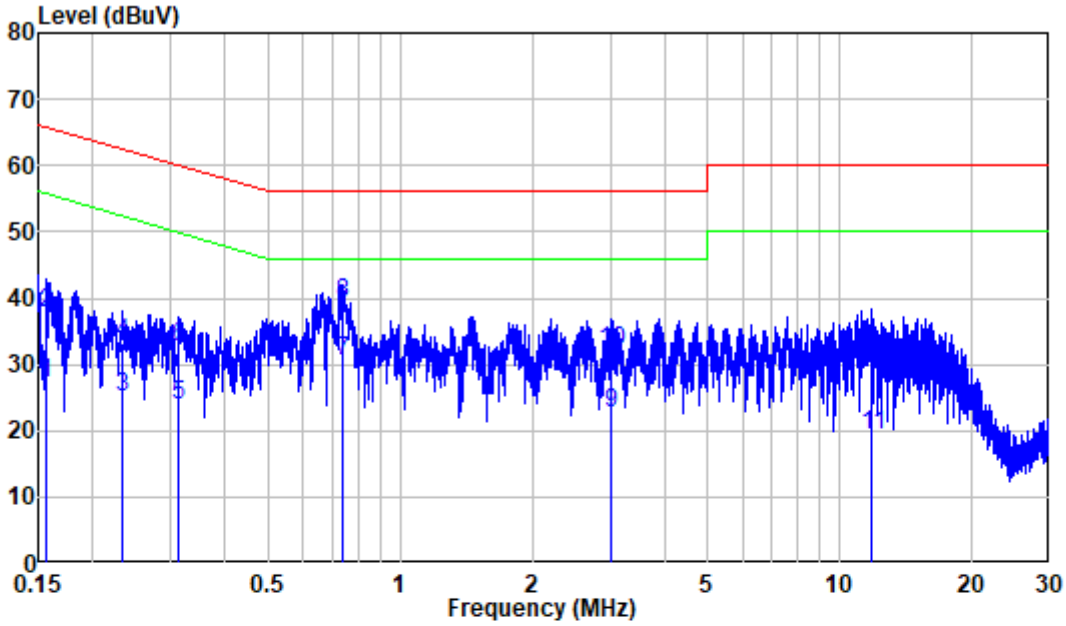
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : RA230424-21931E-RF
Mode : Charging+BLE Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.165	10.35	15.54	25.89	55.22	-29.33	Average
2	0.165	10.35	31.33	41.68	65.22	-23.54	QP
3	0.277	10.38	12.51	22.89	50.91	-28.02	Average
4	0.277	10.38	25.03	35.41	60.91	-25.50	QP
5	0.337	10.44	12.53	22.97	49.27	-26.30	Average
6	0.337	10.44	26.48	36.92	59.27	-22.35	QP
7	0.516	10.58	12.69	23.27	46.00	-22.73	Average
8	0.516	10.58	26.78	37.36	56.00	-18.64	QP
9	2.107	10.41	5.55	15.96	46.00	-30.04	Average
10	2.107	10.41	15.42	25.83	56.00	-30.17	QP
11	7.702	10.61	3.56	14.17	50.00	-35.83	Average
12	7.702	10.61	10.13	20.74	60.00	-39.26	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : RA230424-21931E-RF
Mode : Charging+BLE Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.157	10.28	16.88	27.16	55.61	-28.45	Average
2	0.157	10.28	27.45	37.73	65.61	-27.88	QP
3	0.233	10.32	14.66	24.98	52.34	-27.36	Average
4	0.233	10.32	22.86	33.18	62.34	-29.16	QP
5	0.313	10.37	13.62	23.99	49.89	-25.90	Average
6	0.313	10.37	22.24	32.61	59.89	-27.28	QP
7	0.736	10.46	20.00	30.46	46.00	-15.54	Average
8	0.736	10.46	28.64	39.10	56.00	-16.90	QP
9	3.017	10.53	12.05	22.58	46.00	-23.42	Average
10	3.017	10.53	21.49	32.02	56.00	-23.98	QP
11	11.854	10.49	8.70	19.19	50.00	-30.81	Average
12	11.854	10.49	20.34	30.83	60.00	-29.17	QP

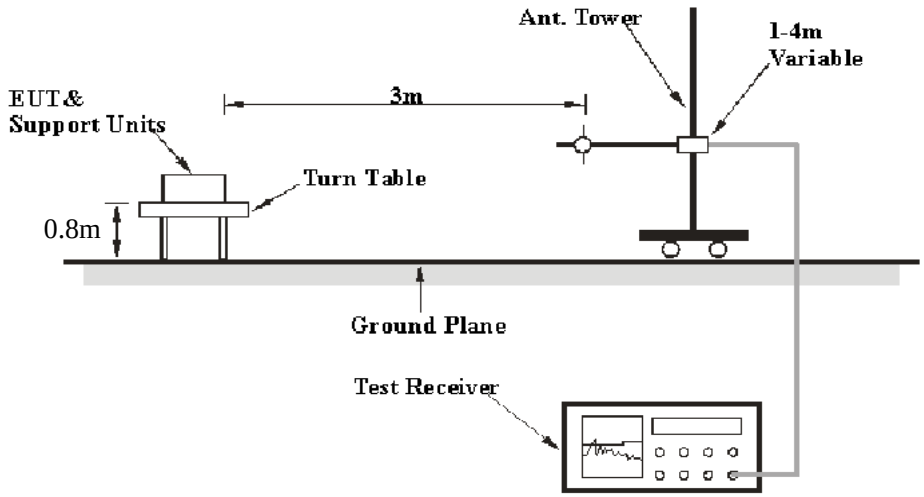
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

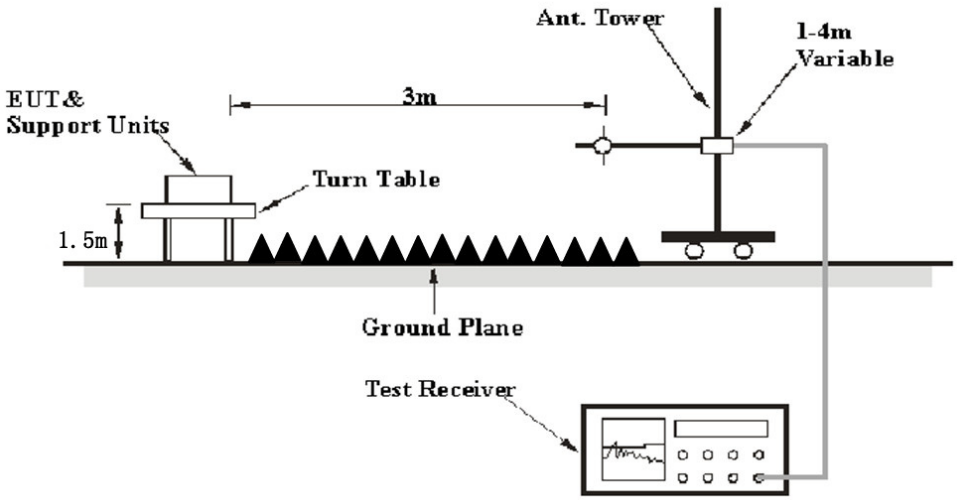
FCC §15.205; §15.209; §15.247(d)

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, 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%

If the maximized peak measured value complies with the limit, 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.

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 = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	22-23 ℃
Relative Humidity:	54-55 %
ATM Pressure:	101.0 kPa

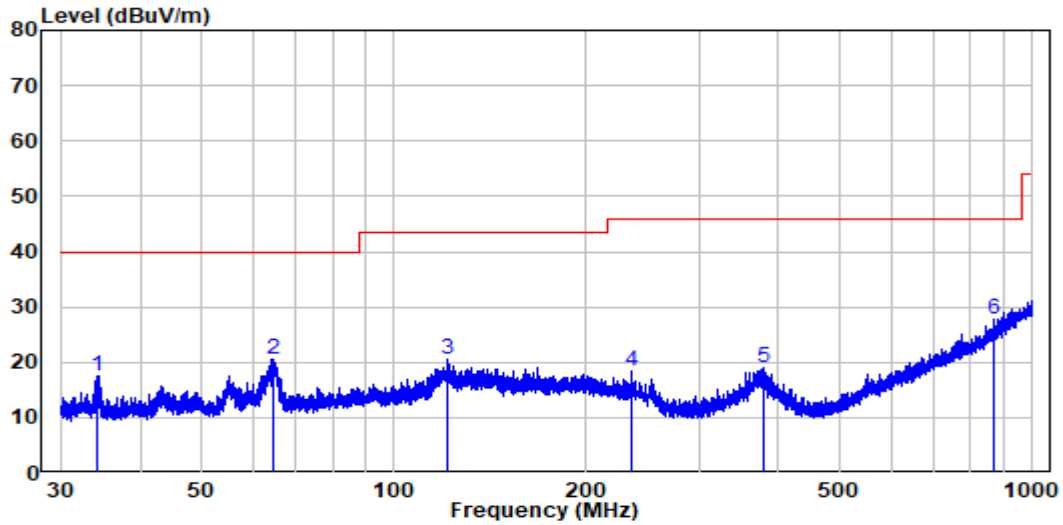
The Below 1G testing was performed by Jason Liu on 2023-05-23 for model B307 and on 2023-06-01 for model B309.
The Above 1G testing was performed by Jeef Hang on 2023-05-23 for model B307.

EUT operation mode: Charging+BLE Transmitting

For Model B307:

Below 1GHz: (worst case is High channel)

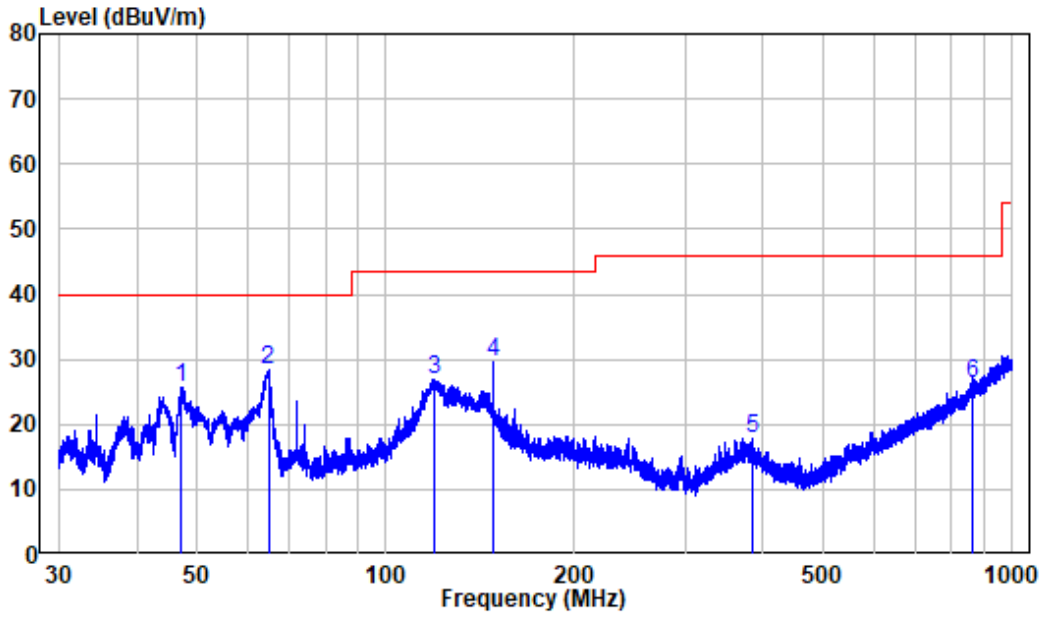
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230424-21931E-RF
Test Mode: Charging+BLE Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.186	-14.45	32.06	17.61	40.00	-22.39	Peak
2	64.603	-13.76	34.41	20.65	40.00	-19.35	Peak
3	121.123	-10.93	31.35	20.42	43.50	-23.08	Peak
4	234.888	-11.76	30.25	18.49	46.00	-27.51	Peak
5	378.916	-11.15	30.29	19.14	46.00	-26.86	Peak
6	869.511	-1.71	29.36	27.65	46.00	-18.35	Peak

Vertical



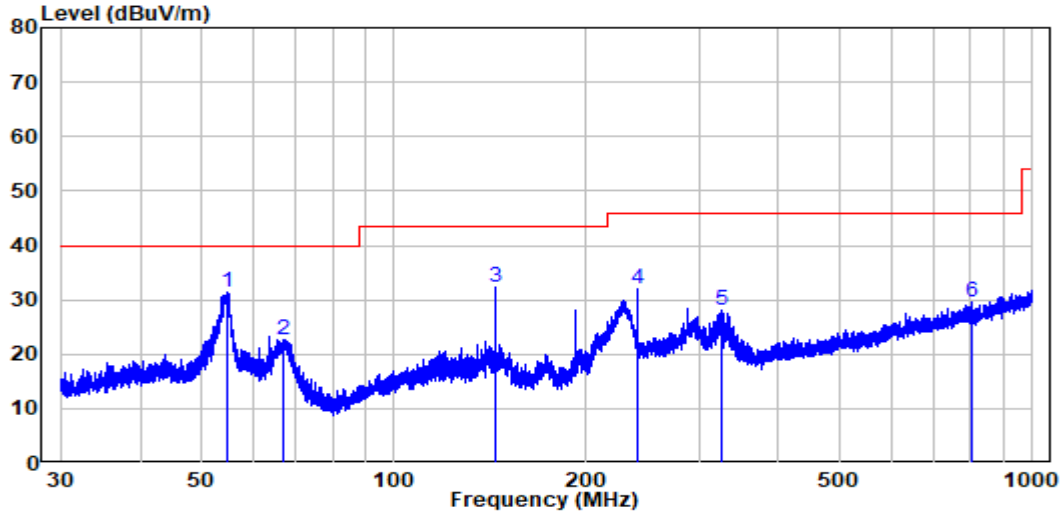
Site : chamber
Condition: 3m VERTICAL
Job No. : RA230424-21931E-RF
Test Mode: Charging+BLE Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	47.139	-14.30	40.05	25.75	40.00	-14.25	Peak
2	64.887	-13.76	42.25	28.49	40.00	-11.51	Peak
3	119.803	-11.03	37.98	26.95	43.50	-16.55	Peak
4	148.376	-10.38	40.02	29.64	43.50	-13.86	Peak
5	384.269	-11.25	29.03	17.78	46.00	-28.22	Peak
6	862.678	-1.95	28.13	26.18	46.00	-19.82	Peak

For Model B309:

Below 1GHz: (worst case is High channel)

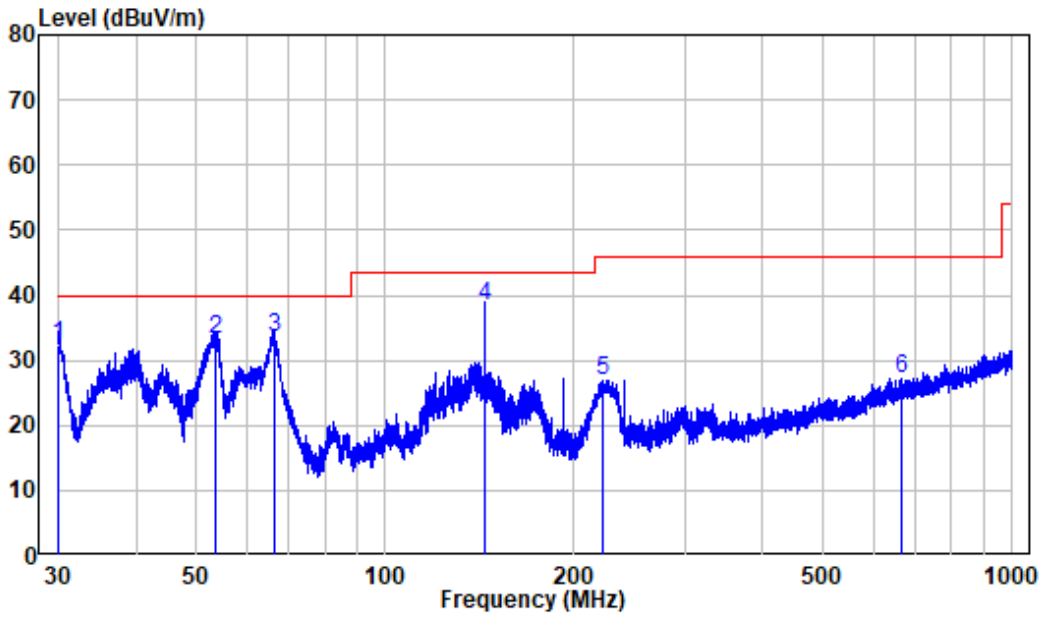
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230424-21931E-RF
Test Mode: Charging+BLE Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	54.571	-10.31	41.59	31.28	40.00	-8.72	Peak
2	67.055	-13.38	35.96	22.58	40.00	-17.42	Peak
3	144.145	-15.52	47.94	32.42	43.50	-11.08	Peak
4	240.198	-10.90	42.82	31.92	46.00	-14.08	Peak
5	325.311	-8.25	36.20	27.95	46.00	-18.05	Peak
6	802.490	-0.40	29.97	29.57	46.00	-16.43	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA230424-21931E-RF
Test Mode: Charging+BLE Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	30.092	-12.39	44.69	32.30	40.00	-7.70	QP
2	53.412	-10.24	43.48	33.24	40.00	-6.76	QP
3	66.470	-13.11	46.76	33.65	40.00	-6.35	QP
4	144.145	-15.52	54.00	38.48	43.50	-5.02	QP
5	221.878	-11.35	38.25	26.90	46.00	-19.10	Peak
6	666.387	-1.66	28.91	27.25	46.00	-18.75	Peak

Above 1GHz: (model B307)

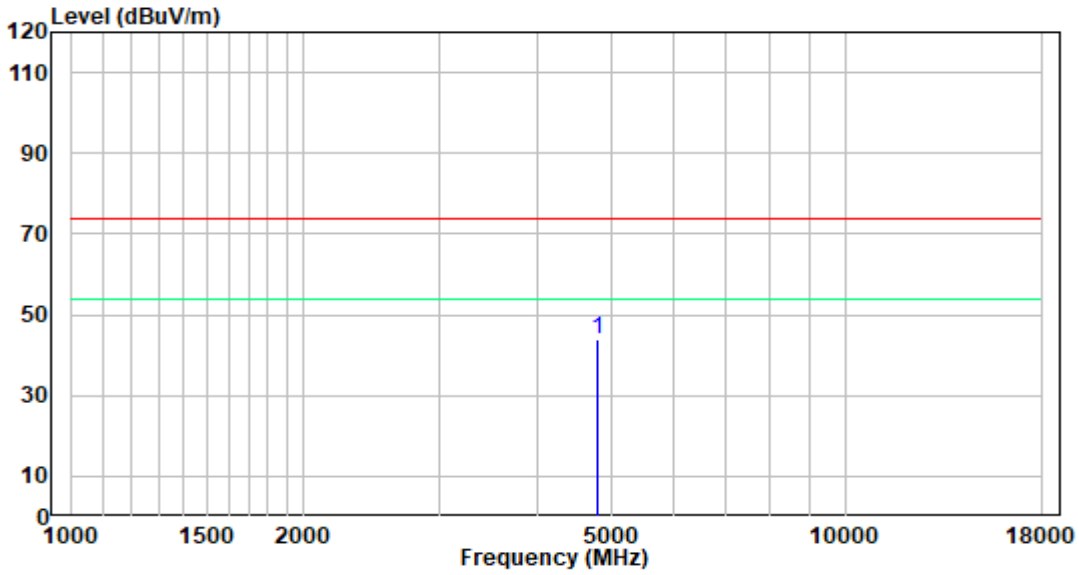
Frequency (MHz)	Receiver		Turntable Angle	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/AV	Degree	Height (m)	Polar (H/V)				
BLE 1M, Low Channel									
2310	49.64	PK	169	1.6	H	-10.36	39.28	74	-34.72
2310	47.15	PK	295	1.2	V	-10.36	36.79	74	-37.21
2390	46.97	PK	87	1.5	H	-10.71	36.26	74	-37.74
2390	56.33	PK	18	1.3	V	-10.71	45.62	74	-28.38
4804	51.97	PK	293	1.9	H	-6.11	45.86	74	-28.14
4804	49.91	PK	101	2.1	V	-6.11	43.8	74	-30.2
BLE 1M, Middle Channel									
4880	50.36	PK	309	1.8	H	-5.9	44.46	74	-29.54
4880	49.62	PK	88	1.6	V	-5.9	43.72	74	-30.28
BLE 1M, High Channel									
2483.5	59.01	PK	35	1.6	H	-10.55	48.46	74	-25.54
2483.5	58.91	PK	102	1.3	V	-10.55	48.36	74	-25.64
2500	45.9	PK	168	1.3	H	-10.42	35.48	74	-38.52
2500	47.84	PK	172	1.4	V	-10.42	37.42	74	-36.58
4960	49.65	PK	297	1.7	H	-5.47	44.18	74	-29.82
4960	49.02	PK	349	2.1	V	-5.47	43.55	74	-30.45

Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Absolute Level (Corrected Amplitude) = Factor + Reading
Margin = Absolute Level - Limit
The other spurious emission which is in the noise floor level was not recorded.
For above 1GHz, when the test result of peak was 20dB below to the limit of peak, which can be compliant to the average limit, just peak value was recorded.

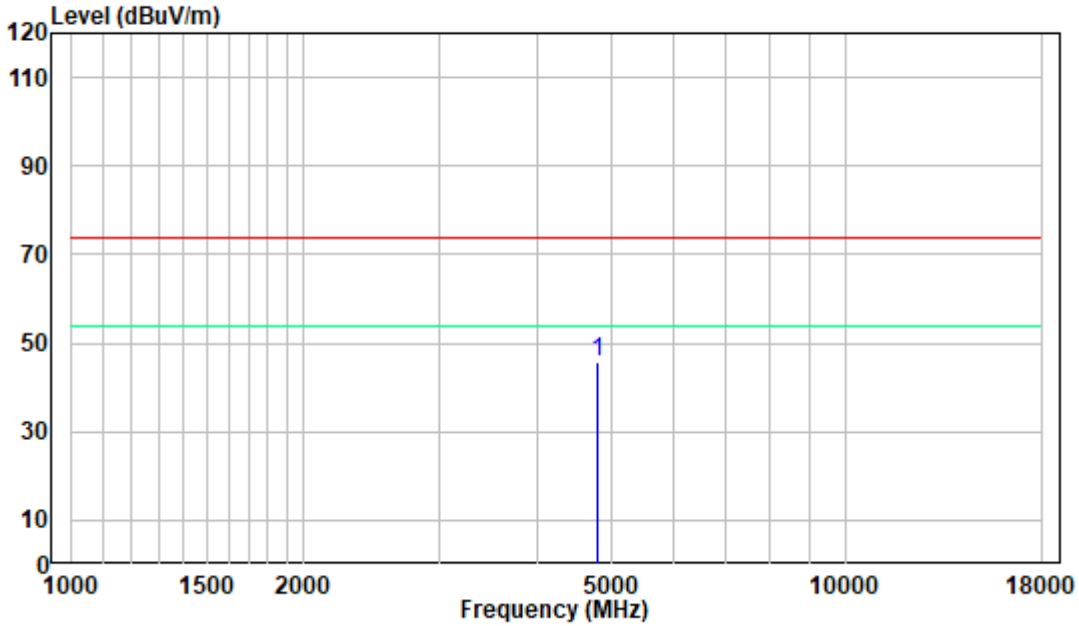
1 GHz - 18 GHz: (Pre-Scan plots)

Low Channel (worst case)

Horizontal



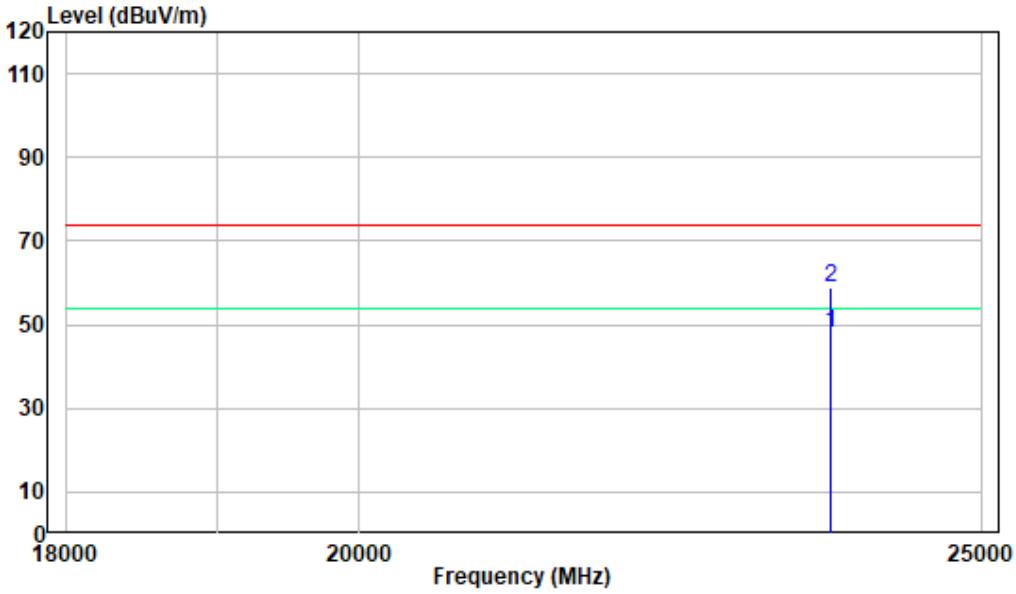
Vertical



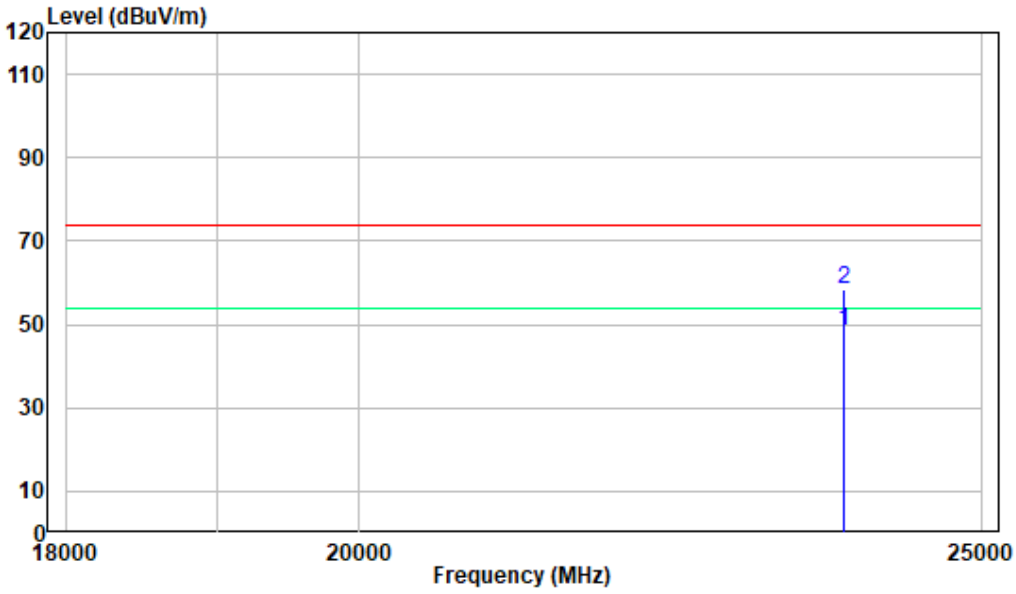
18-25GHz: (Pre-Scan plots)

Low Channel (worst case)

Horizontal



Vertical



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

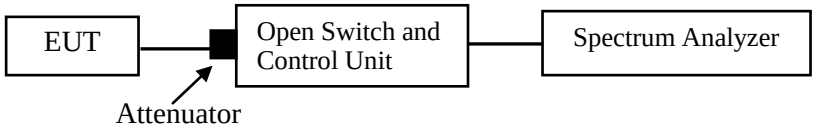
Applicable Standard

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

According to ANSI C63.10-2013, section 11.8 and section 6.9

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



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang on 2023-05-05.

EUT operation mode: Transmitting

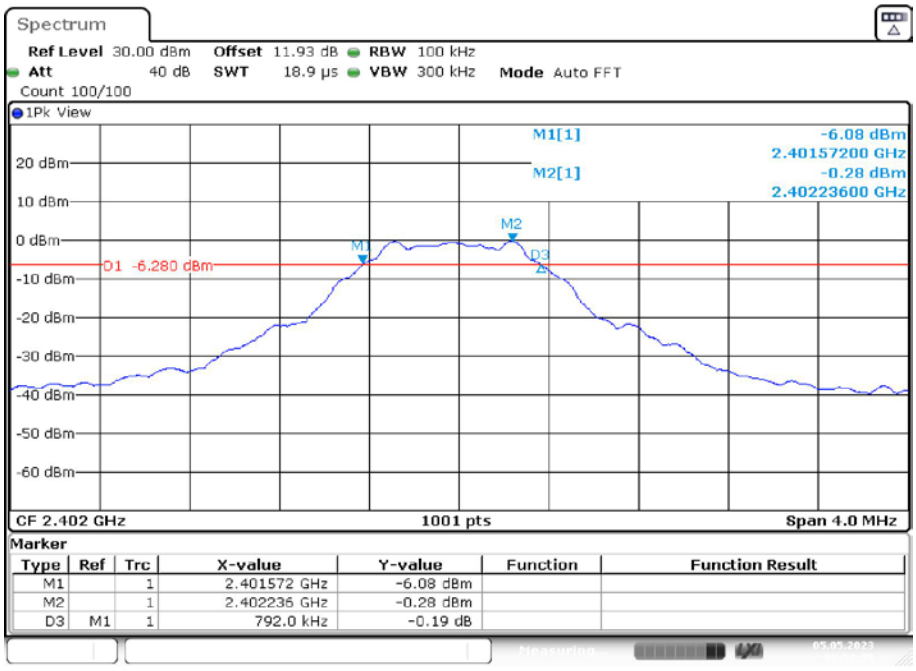
Test Result: Compliant. Please refer to the below plots.

Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.792	0.5	PASS
		2440	0.792	0.5	PASS
		2480	0.792	0.5	PASS

Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
BLE_1M	Ant1	2402	1.139	2401.4046	2402.5435	PASS
		2440	1.175	2439.3886	2440.5634	PASS
		2480	1.171	2479.3886	2480.5594	PASS

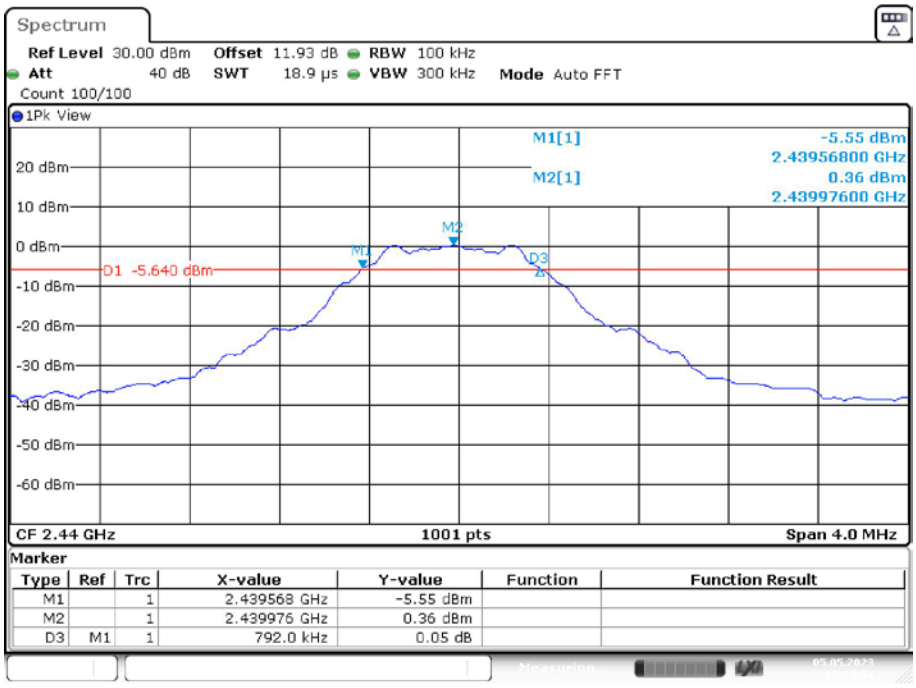
6 dB EMISSION BANDWIDTH

BLE_1M_Ant1_2402



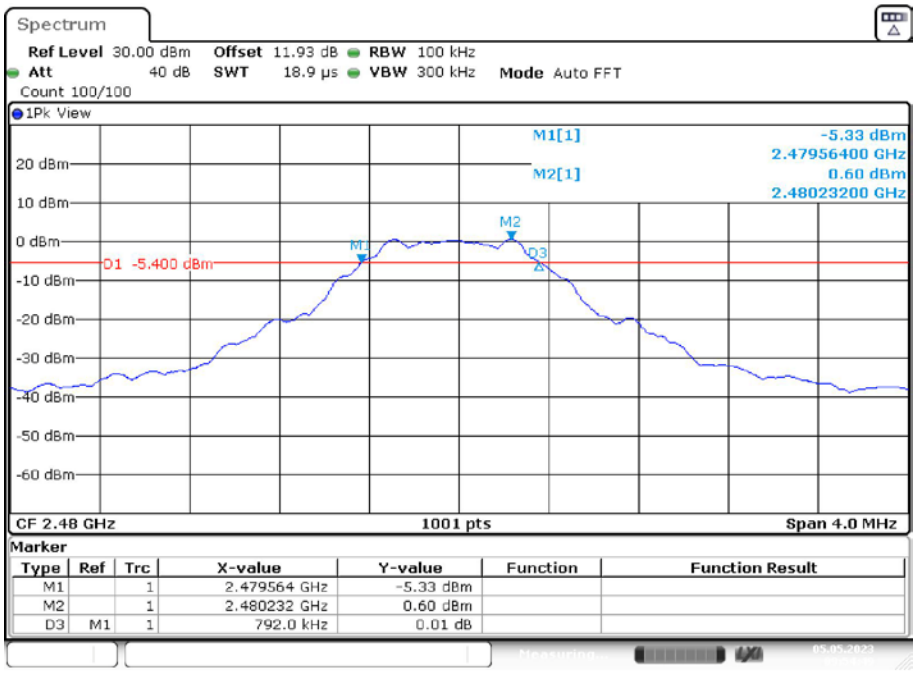
Date: 5.MAY.2023 09:52:58

BLE_1M_Ant1_2440



Date: 5.MAY.2023 09:53:58

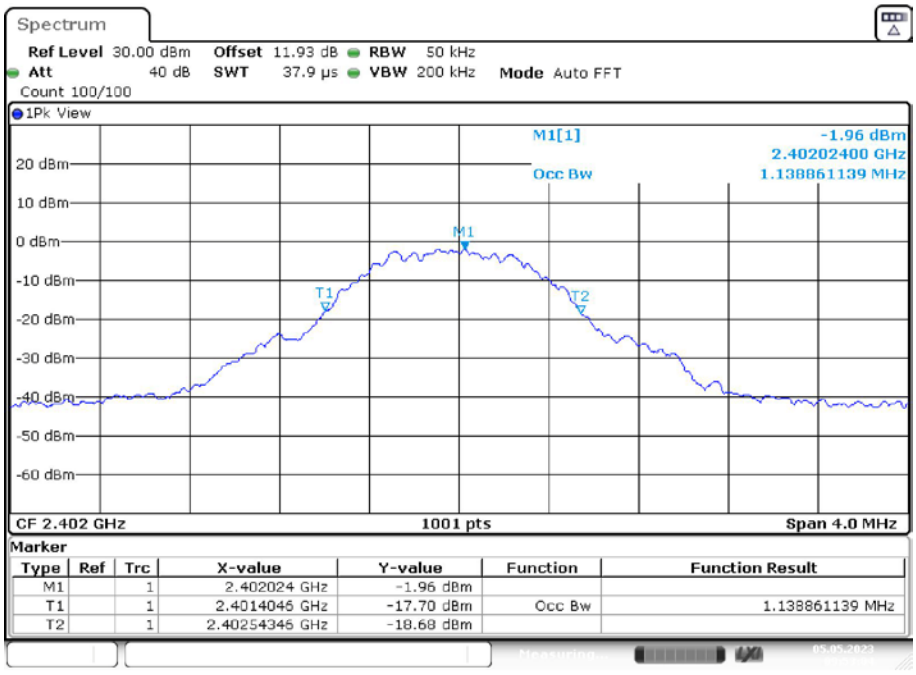
BLE_1M_Ant1_2480



Date: 5.MAY.2023 09:54:49

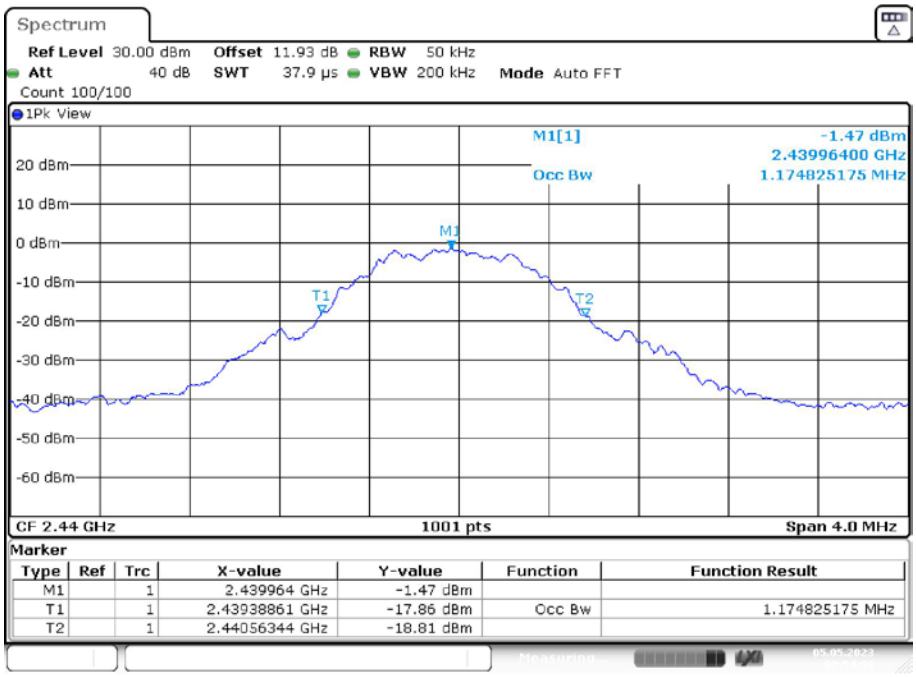
OCCUPIED BANDWIDTH

BLE_1M_Ant1_2402



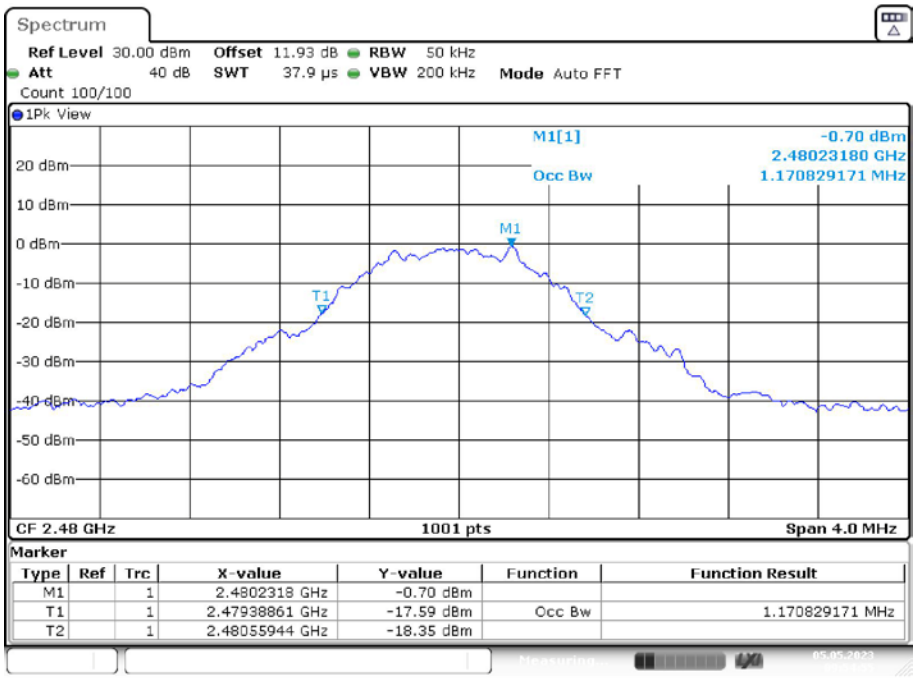
Date: 5.MAY.2023 09:53:04

BLE_1M_Ant1_2440



Date: 5.MAY.2023 09:54:03

BLE_1M_Ant1_2480



Date: 5.MAY.2023 09:54:55

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

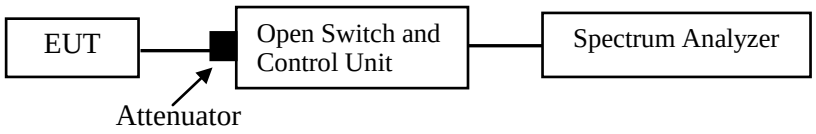
Applicable Standard

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

According to ANSI C63.10-2013, section 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:	24 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

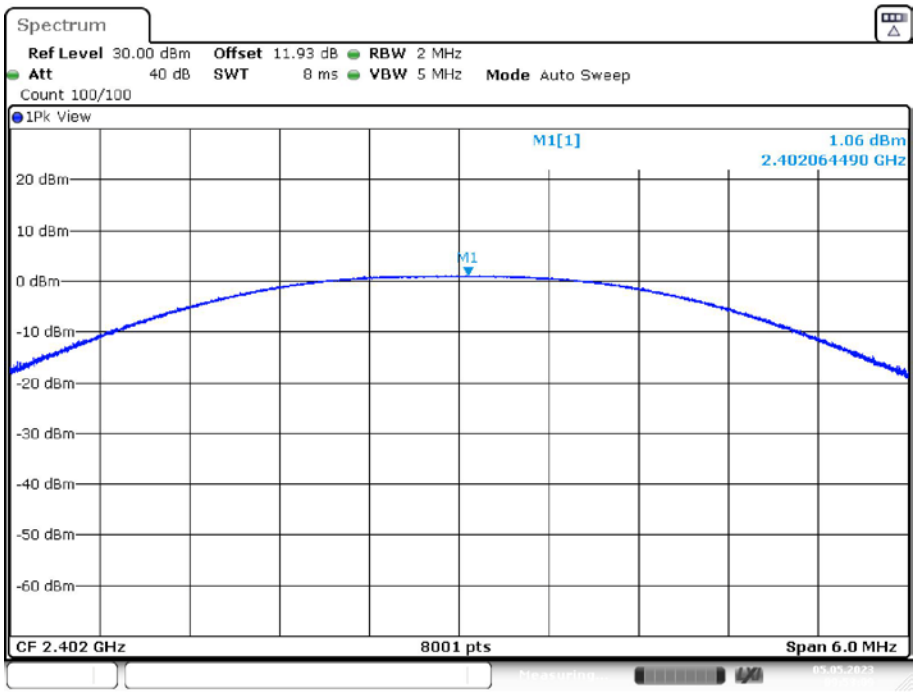
The testing was performed by Matt Liang on 2023-05-05.

EUT operation mode: Transmitting

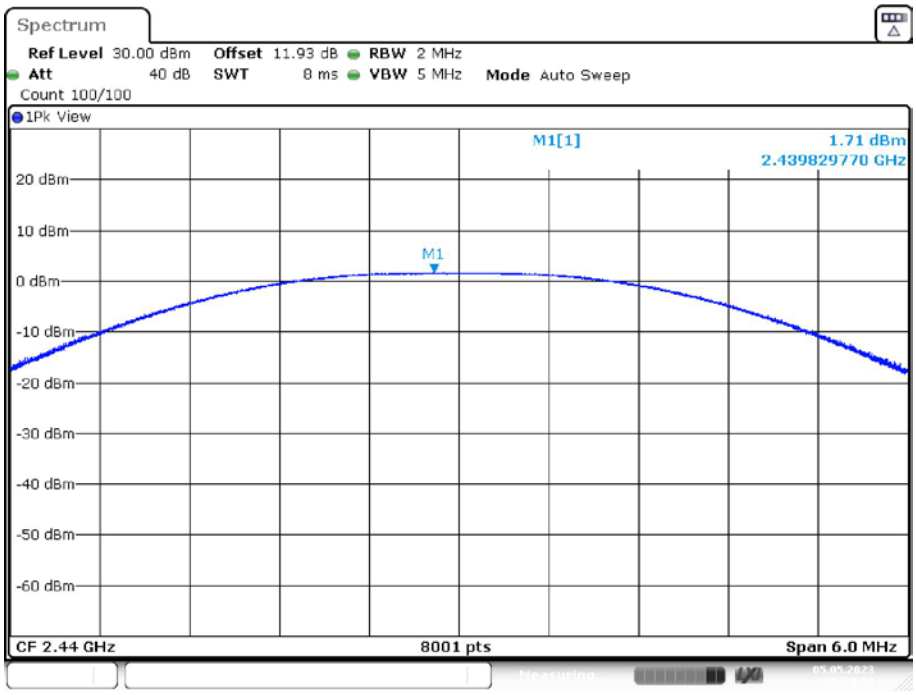
Test Result: Compliant. Please refer to the below plots.

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	1.06	<=30	PASS
		2440	1.71	<=30	PASS
		2480	**1.95**	<=30	PASS

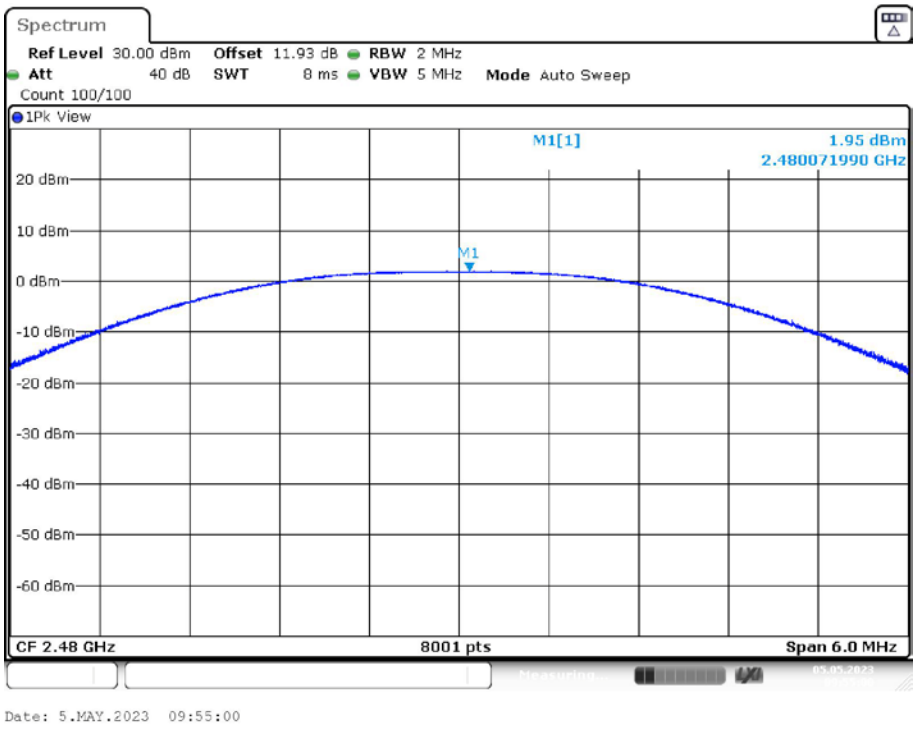
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



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

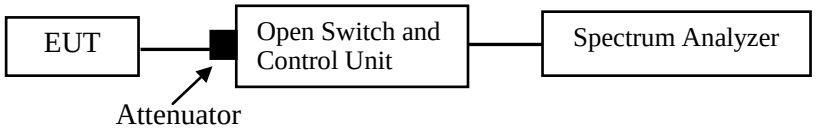
Applicable Standard

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

According to ANSI C63.10-2013, section 11.11

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



Test Data

Environmental Conditions

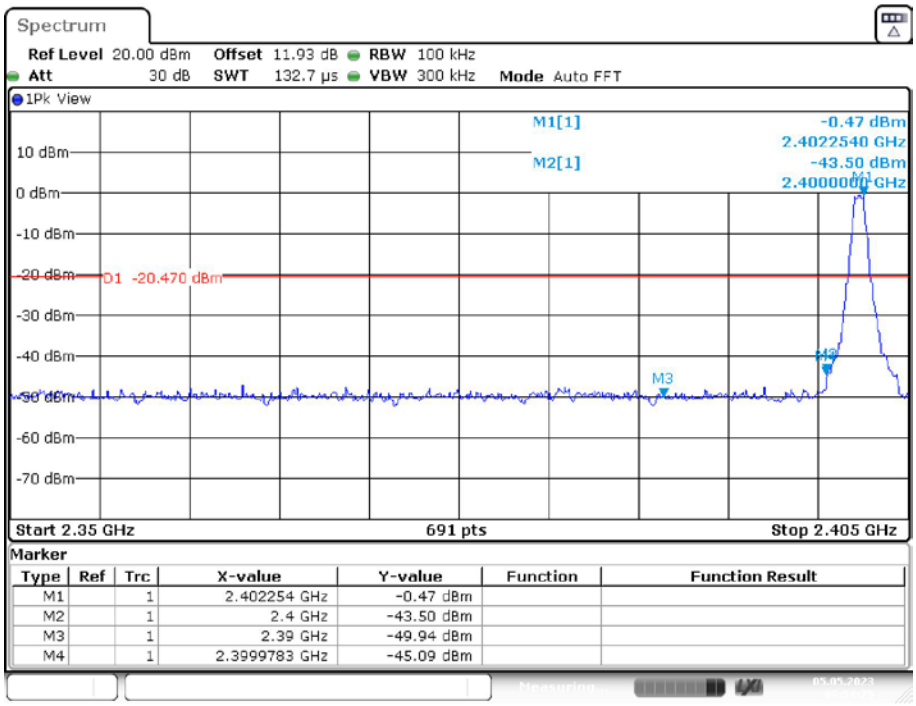
Temperature:	24 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang on 2023-05-05.

EUT operation mode: Transmitting

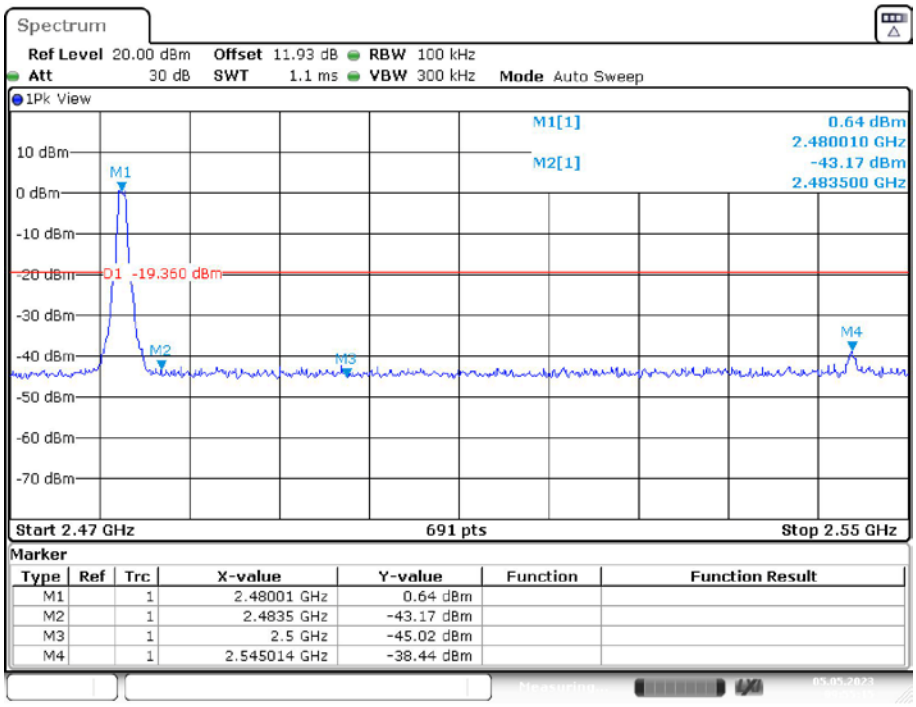
Test Result: Compliant. Please refer to the below plots.

BLE_1M_Ant1_Low_2402



Date: 5.MAY.2023 09:53:25

BLE_1M_Ant1_High_2480



Date: 5.MAY.2023 09:55:15

FCC §15.247(e) – POWER SPECTRAL DENSITY

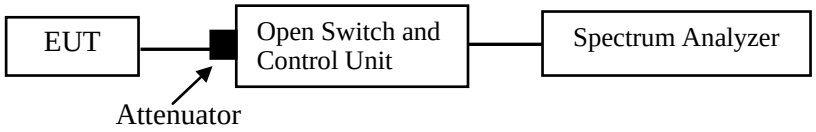
Applicable Standard

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

According to ANSI C63.10-2013, section 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:	24 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

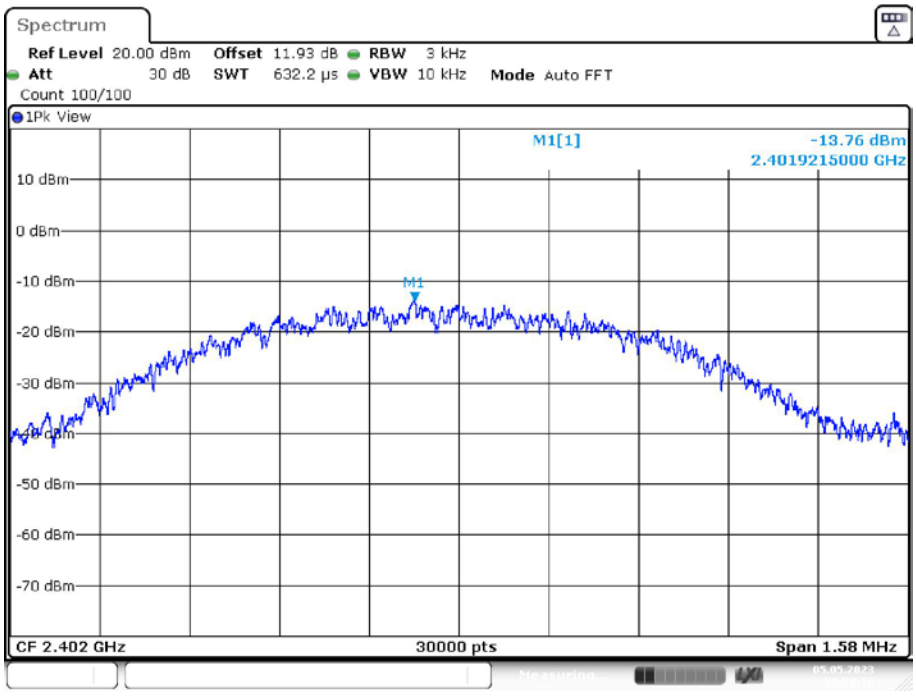
The testing was performed by Matt Liang on 2023-05-05.

EUT operation mode: Transmitting

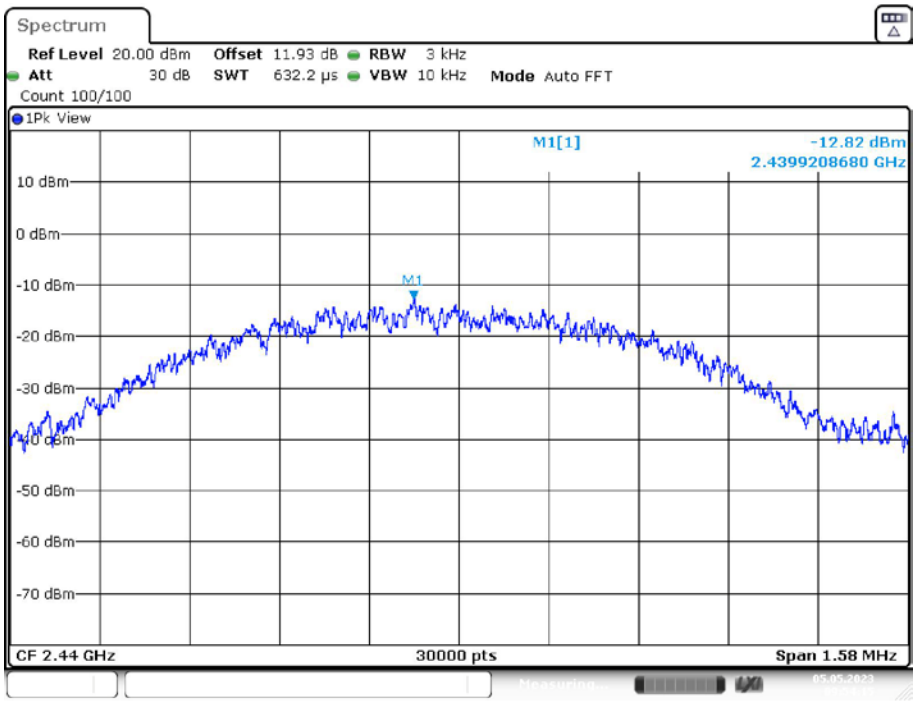
Test Result: Compliant. Please refer to the below table and plots.

Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-13.76	<=8	PASS
		2440	-12.82	<=8	PASS
		2480	-13.08	<=8	PASS

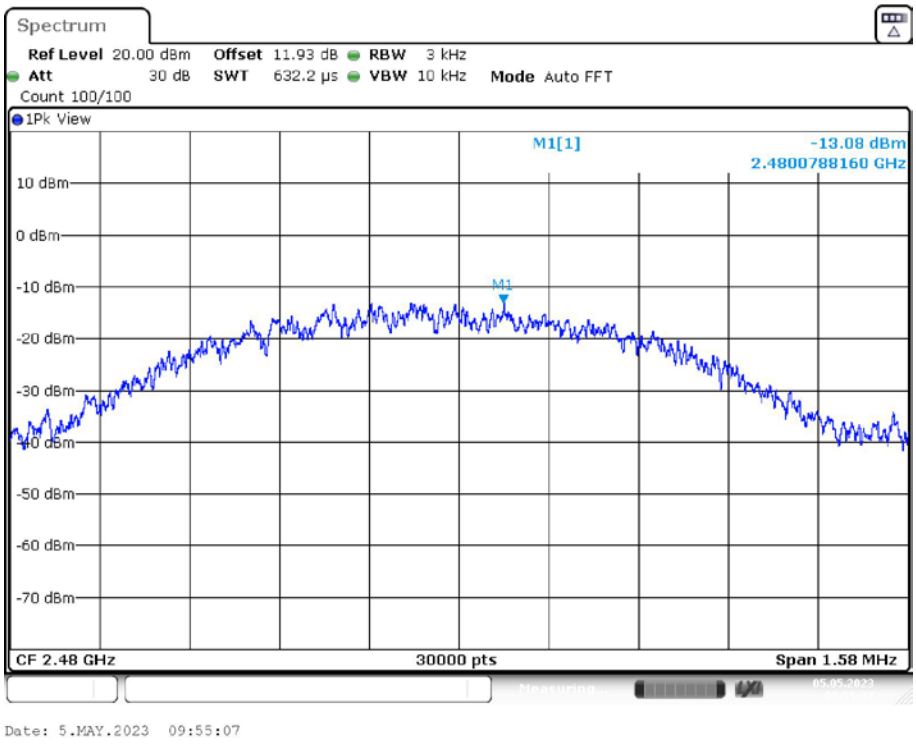
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



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