TEST REPORT

Applicant Name :	Anhui Huami Information Technology Co.,Ltd.
Address(FCC) :	7/F,Building B2,Huami Global Innovation Center,No. 900, Wang jiang West Road, High-tech Zone,Hefei City Anhui Pilot Free Trade Zone, China
Address(IC) :	7/F,Building B2,Huami Global Innovation Center, No. 900, Wang jiang West Road, High-tech Zone, Pilot Free Trade Zone, Hefei Anhui China (Peoples Republic Of)
Factory1 Name	Cosonic Electroacoustic Technology Co., Ltd.
Factory1 Address:	No.151, Shipai Section, Dongyuan Avenue, Shipai Town Dongguan, Guangdong, China
Factory2 Name	COSONIC VIETNAM COMPANY LIMITED
Factory2 Address:	Lot C5-1, Ba Thien ll Industrial Park,Thien Ke Ward,Binh Xuyen District,Vinh Phuc Province,Vietnam
Report Number :	RA230529-30064E-RFA
FCC ID:	2AC8UA2211
IC:	21806-A2211

Test Standard (s)

FCC PART 15.247, RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2; RSS-247, ISSUE 2, FEBRUARY 2017

Sample Description

Product Type:	Smart watch
Model No.:	A2211
Trade Mark:	AMAZFIT
Date Received:	2023-05-29
Date of Test:	2023-06-01 to 2023-06-05
Report Date:	2023-06-09

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	RA230529-30064E-RFA	Original Report	2023-06-09

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Smart watch
Tested Model	A2211
HVIN	A2211
Frequency Range	BLE 1M/2M: 2402-2480MHz
Maximum Conducted Peak Output Power	BLE: -1.7dBm
Modulation Technique	GFSK
Antenna Specification*	-3.46dBi (It is provided by the applicant)
Voltage Range	DC 3.87V from battery or DC 5V from adapter
Sample serial number	RA230529-30064E-RF-S1 (CE&RE) RA230529-30064E-RF-S2 (RF Conducted Test) (Assigned by ATC, Shenzhen)
Sample/EUT Status	Good condition

Objective

This report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules and RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247, Issue 2, February 2017 of the Innovation, Science and Economic Development Canada rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliant Testing of Unlicensed Wireless Devices and RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247, Issue 2, February 2017.

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.

Each test item follows test standards and with no deviation.

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	4.98dB
	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.

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

The system was configured for testing in an engineering 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.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

Software “RTLBTAPP”* was used during testing and the Power level is Default *

Duty cycle

Test Mode	Antenna	Channel	TransmissionDuration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW[kHz]
BLE_1M	Ant1	2402	0.39	0.62	62.90	2.56
		2440	0.39	0.62	62.90	2.56
		2480	0.39	0.62	62.90	2.56
BLE_2M	Ant1	2402	0.21	0.62	33.87	4.76
		2440	0.21	0.62	33.87	4.76
		2480	0.21	0.62	33.87	4.76

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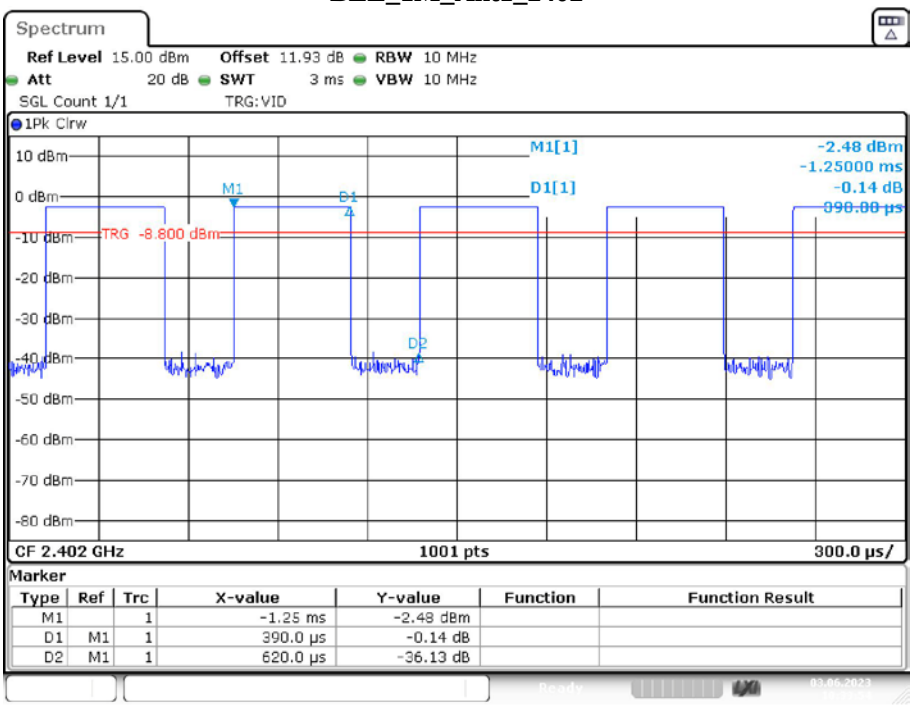

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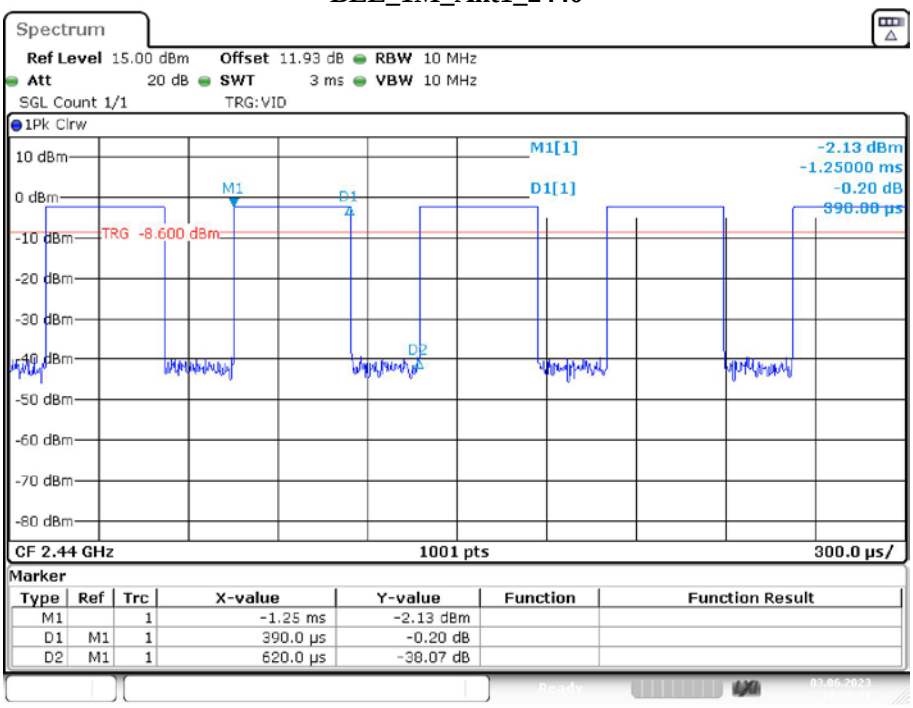

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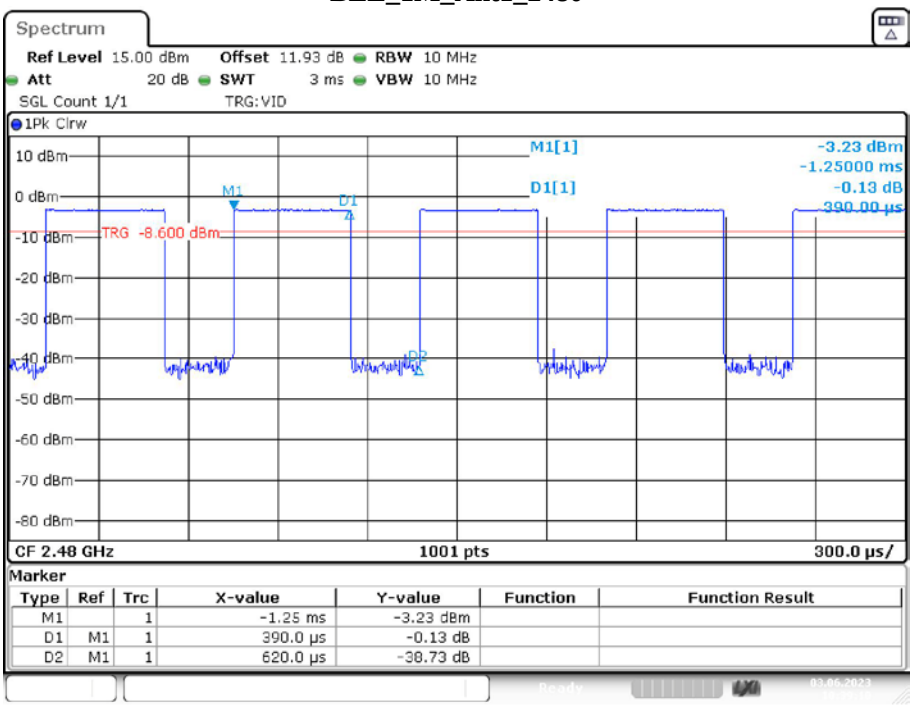

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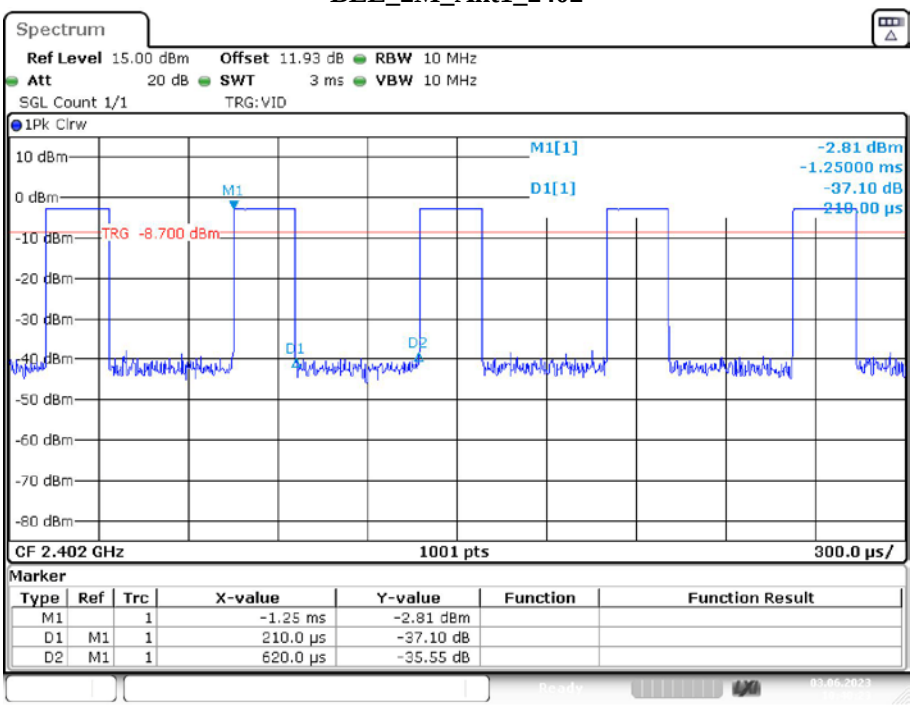

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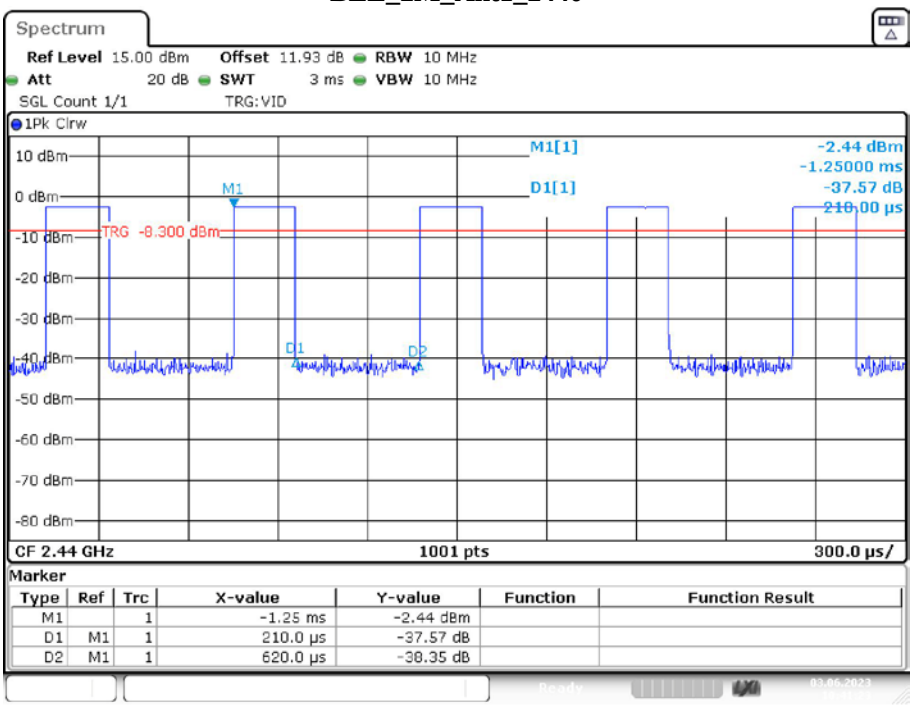

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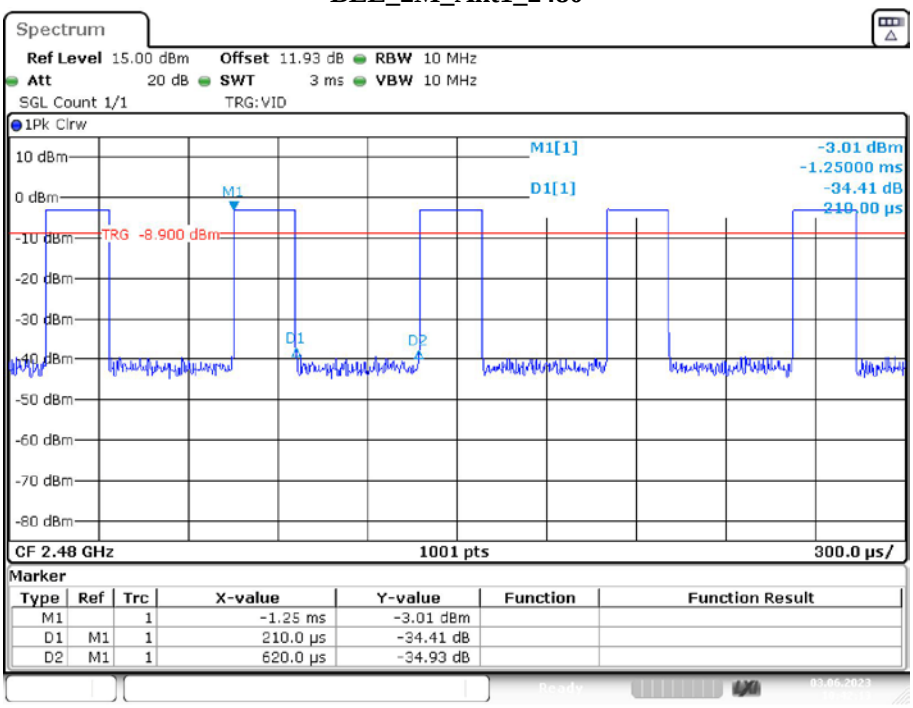

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Support Equipment List and Details

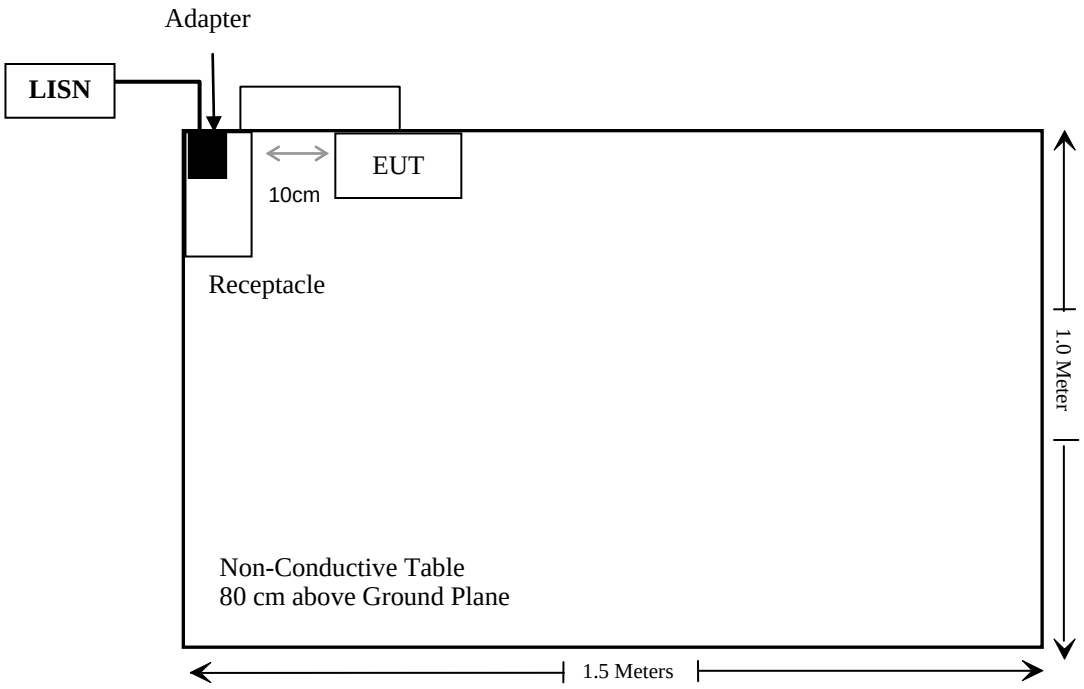
Manufacturer	Description	Model	Serial Number
Unknown	Adapter	Unknown	Unknown

External I/O Cable

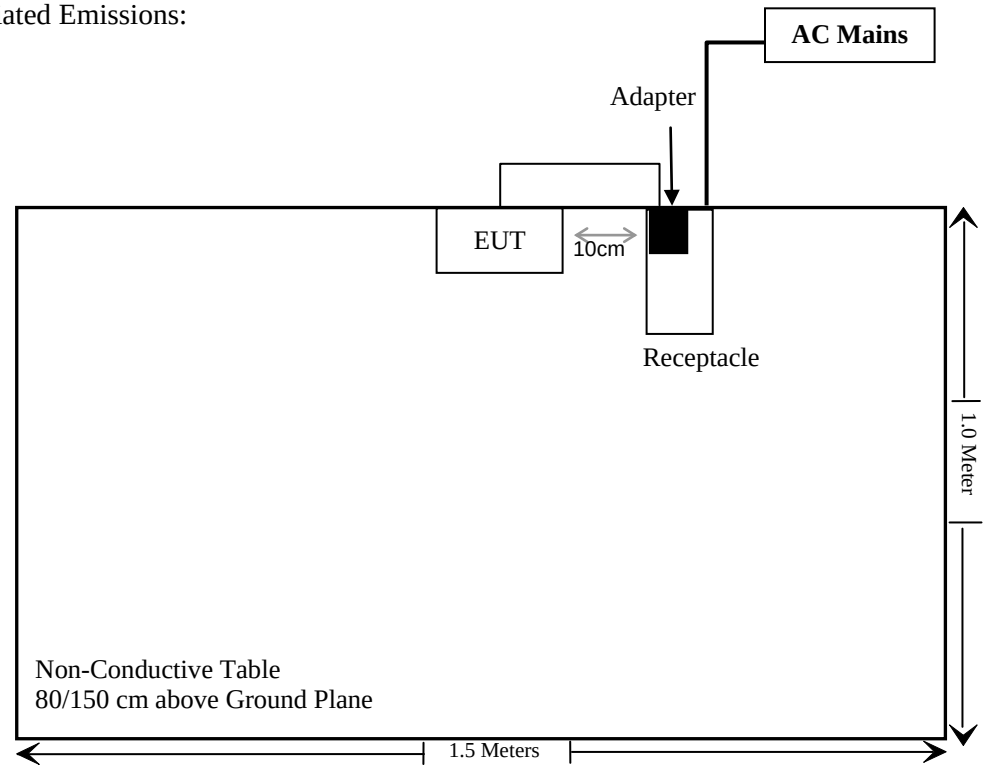
Cable Description	Length (m)	From Port	To
USB power cord	0.45	Adapter	EUT

Block Diagram of Test Setup

For Conducted Emission:



For Radiated Emissions:



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

SUMMARY OF TEST RESULTS

FCC Rules	ISEDC Rules	Description of Test	Result
§1.1307 (b), 2.1093	RSS-102 § 2.5.1	RF EXPOSURE & Exemption Limits for Routine Evaluation – SAR Evaluation	Compliant
§15.203	RSS-Gen §6.8	Antenna Requirement	Compliant
§15.207 (a)	RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	RSS-GEN § 8.10 & RSS-247 § 5.5	Spurious Emissions	Compliant
§15.247 (a)(2)	RSS- Gen§6.7 RSS-247 § 5.2 (a)	99% Occupied Bandwidth & 6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	RSS-247 § 5.4(d)	Maximum Conducted Output Power	Compliant
§15.247(d)	RSS-247 § 5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	RSS-247 § 5.2 (b)	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-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
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2022/11/25	2023/11/24
Wainwright	Band Reject Filter	WRCG2400/2485-2375/2510-60/11SS	10	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§15.247 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

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

a) According to KDB 447498 D01 General RF Exposure Guidance

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

Frequency (MHz)	Maximum Tune-up power		Calculated Distance (mm)	Calculated Value	Threshold (1-g SAR)	SAR Test Exclusion
	(dBm)	(mW)				
2402-2480	-1.0	0.79	5	0.2	3.0	**Yes**

Result: No Standalone SAR test is required

RSS-102 § 2.5.1 - EXEMPTION LIMITS FOR ROUTINE EVALUATION-SAR EVALUATION

Applicable Standard

According to RSS-102 Issue 5 § (2.5.1), SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance4,5

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

Test Result:

The higher of the conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power:

(2480-2450)/(3500-2450)= (4-P)/(4-2)

The exemption limit of 2480MHz is P= 3.94mW

Ant gain: -3.46dBi

Tune up conducted power= -1dBm=0.794mW<3.94mW

So the stand-alone SAR evaluation is compliant.

§15.203 & RSS-Gen §6.8-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.

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device’s antenna shall be stated, based on a measurement or on data from the antenna’s manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device’s ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has an internal antenna arrangement which was permanently attached and the antenna gain is -3.46 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna	Type	Antenna Gain	Impedance
	Integral	-3.46dBi	50Ω

Result: Compliant

§15.207 (a) & RSS-GEN §8.8-AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC § 15.207 (a) & RSS-GEN §8.8

Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 μH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Table 4 - AC Power Lines Conducted Emission Limits

Frequency range (MHz)	Conducted limit (dBμV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56[1]	56 to 46[1]
0.5 – 5	56	46
5 – 30	60	50

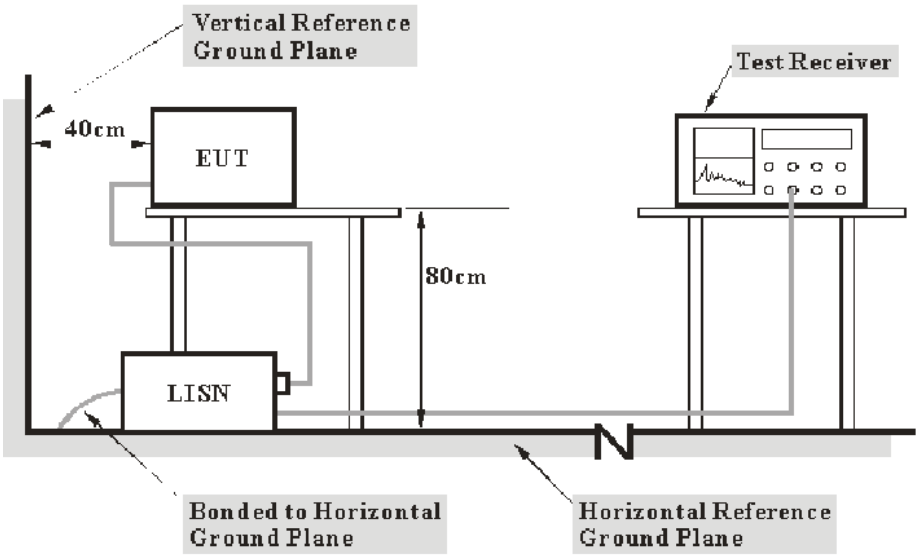
Note 1: The level decreases linearly with the logarithm of the frequency.

For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:

(a) Perform the AC power-line conducted emissions test with the antenna connected to determine compliance with the limits of table 4 outside the transmitter's fundamental emission band.

(b) Retest with a dummy load instead of the antenna to determine compliance with the limits of table 4 within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network that simulates the antenna in the fundamental frequency band.

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 & RSS-247/RSS-Gen limits.

The spacing between the peripherals was 10 cm.

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 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.

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

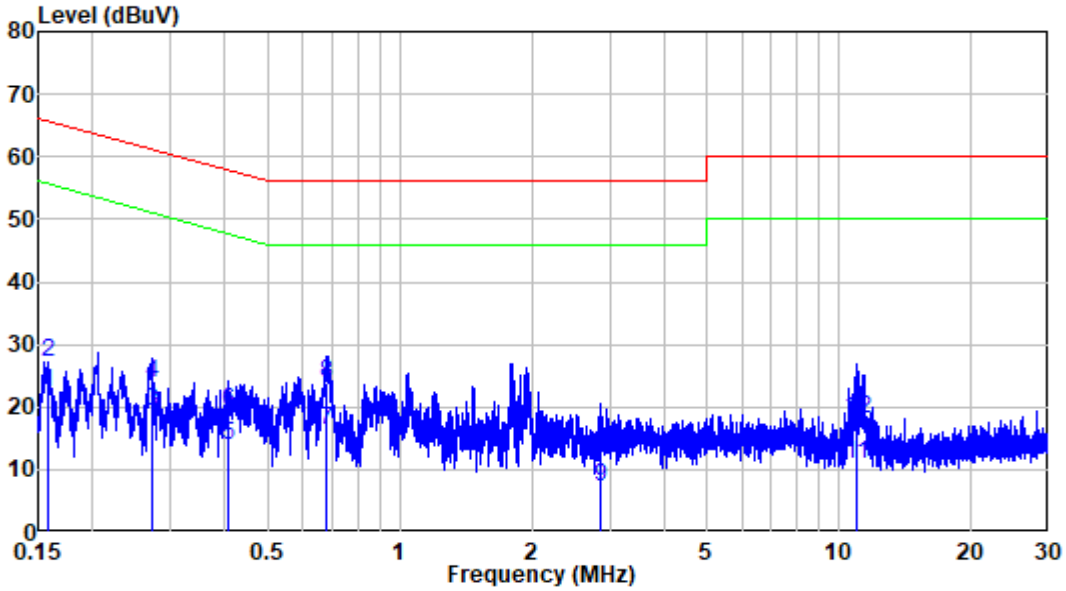
Environmental Conditions

Temperature:	25℃
Relative Humidity:	49%
ATM Pressure:	101.0 kPa

The testing was performed by Jerry Wu on 2023-06-02.

EUT operation mode: Transmitting (*BLE 2M High Channel)*

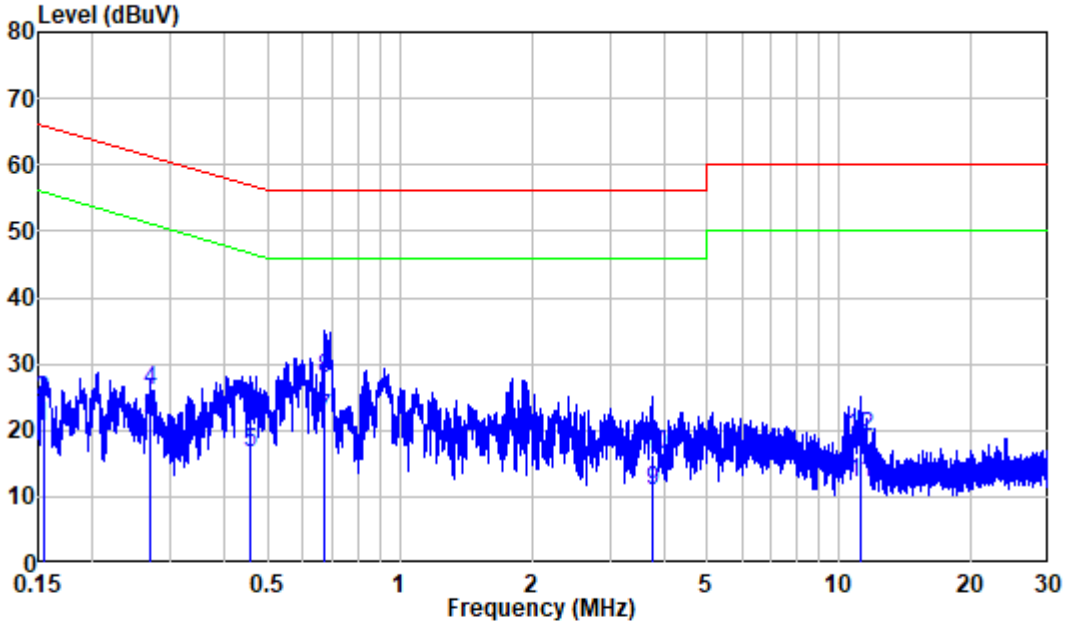
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : RA230529-30064E-RF
Mode : BLE Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.159	10.36	12.05	22.41	55.53	-33.12	Average
2	0.159	10.36	16.76	27.12	65.53	-38.41	QP
3	0.273	10.38	9.01	19.39	51.03	-31.64	Average
4	0.273	10.38	13.49	23.87	61.03	-37.16	QP
5	0.405	10.49	3.31	13.80	47.75	-33.95	Average
6	0.405	10.49	8.97	19.46	57.75	-38.29	QP
7	0.680	10.66	5.68	16.34	46.00	-29.66	Average
8	0.680	10.66	13.19	23.85	56.00	-32.15	QP
9	2.856	10.47	-3.27	7.20	46.00	-38.80	Average
10	2.856	10.47	2.02	12.49	56.00	-43.51	QP
11	10.927	10.52	0.30	10.82	50.00	-39.18	Average
12	10.927	10.52	7.62	18.14	60.00	-41.86	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : RA230529-30064E-RF
Mode : 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	10.23	20.50	55.78	-35.28	Average
2	0.154	10.27	14.28	24.55	65.78	-41.23	QP
3	0.270	10.34	11.01	21.35	51.11	-29.76	Average
4	0.270	10.34	15.72	26.06	61.11	-35.05	QP
5	0.455	10.45	6.08	16.53	46.79	-30.26	Average
6	0.455	10.45	12.20	22.65	56.79	-34.14	QP
7	0.676	10.47	11.15	21.62	46.00	-24.38	Average
8	0.676	10.47	17.16	27.63	56.00	-28.37	QP
9	3.749	10.54	0.33	10.87	46.00	-35.13	Average
10	3.749	10.54	5.84	16.38	56.00	-39.62	QP
11	11.131	10.57	1.37	11.94	50.00	-38.06	Average
12	11.131	10.57	8.38	18.95	60.00	-41.05	QP

§15.205, §15.209, §15.247(d) & RSS-GEN § 8.10 & RSS-247 § 5.5-SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

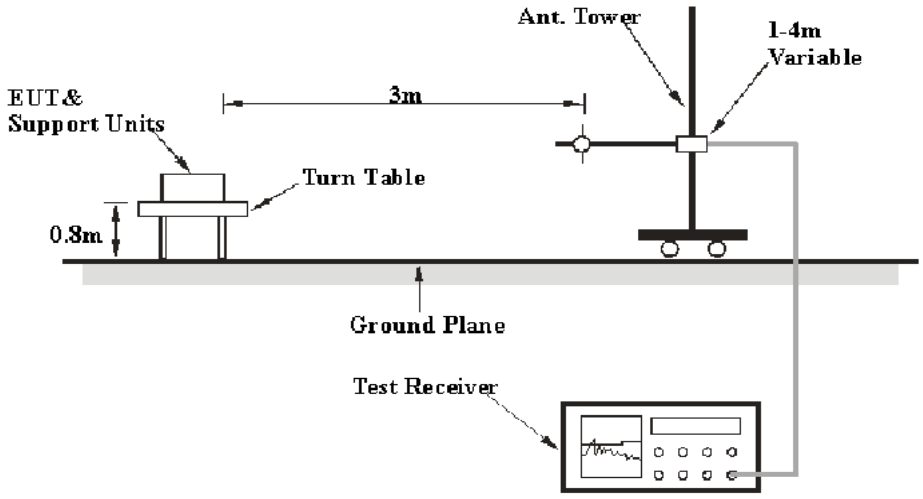
According to RSS-247 § 5.5

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

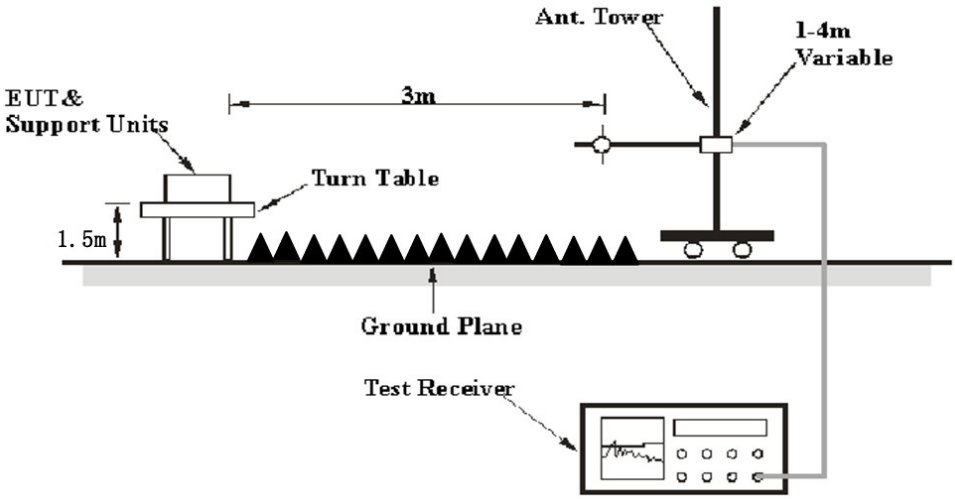
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either 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.

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.

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 30 MHz to 25 GHz.

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.

Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

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.

Repeat above procedures until all measured frequencies were complete.

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

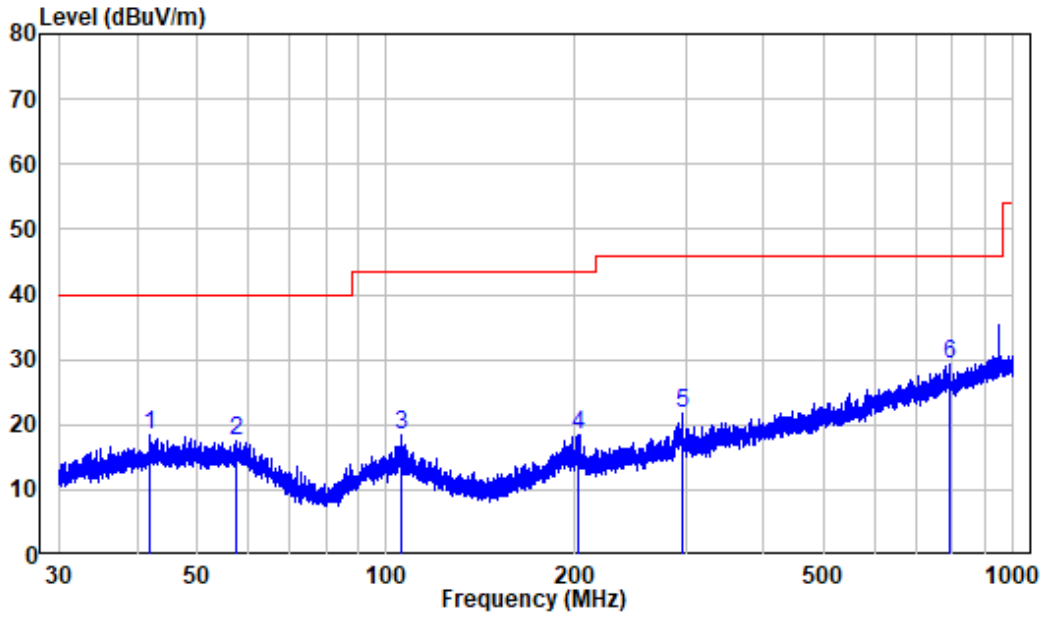
Temperature:	24 ℃
Relative Humidity:	52-56 %
ATM Pressure:	101.0 kPa

The Below 1G testing was performed by Jason Liu on 2023-06-05.
The Above 1G testing was performed by Jeef Hang on 2023-06-01.

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

Below 1GHz: (worst case, BLE 2M High Channel)

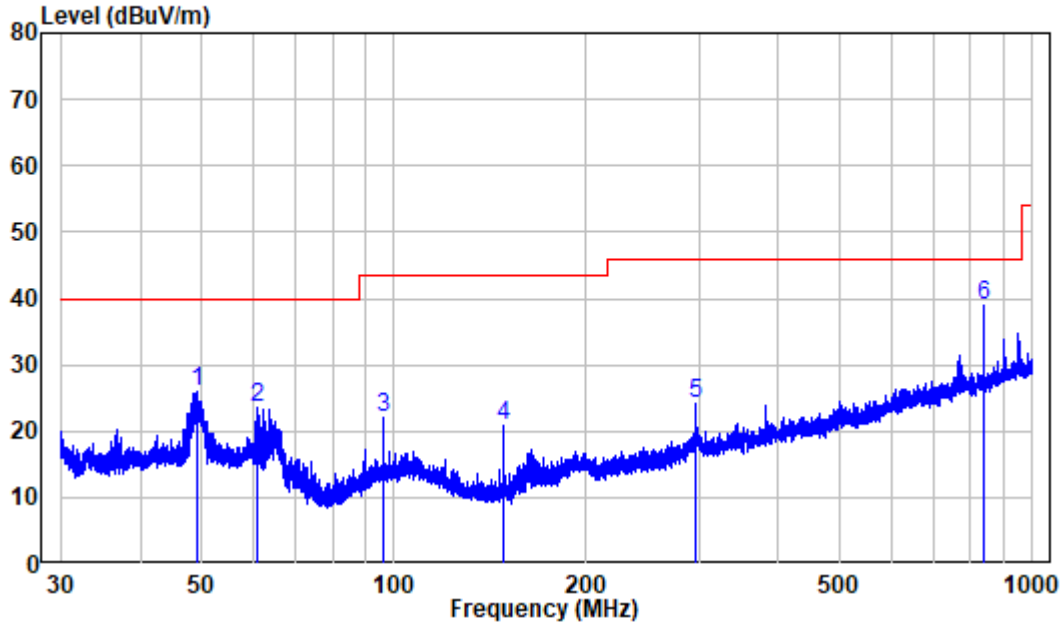
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230529-30064E-RF
Test Mode: BLE Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	41.878	-10.04	28.38	18.34	40.00	-21.66	Peak
2	57.543	-9.97	27.62	17.65	40.00	-22.35	Peak
3	105.688	-11.90	30.43	18.53	43.50	-24.97	Peak
4	202.189	-11.59	30.06	18.47	43.50	-25.03	Peak
5	296.703	-9.25	31.04	21.79	46.00	-24.21	Peak
6	794.092	-0.22	29.54	29.32	46.00	-16.68	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA230529-30064E-RF
Test Mode: BLE Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	49.057	-9.96	35.88	25.92	40.00	-14.08	Peak
2	61.132	-11.08	34.52	23.44	40.00	-16.56	Peak
3	95.930	-12.31	34.43	22.12	43.50	-21.38	Peak
4	148.571	-15.35	36.07	20.72	43.50	-22.78	Peak
5	297.094	-9.25	33.54	24.29	46.00	-21.71	Peak
6	836.611	0.22	38.84	39.06	46.00	-6.94	Peak

Above 1GHz:

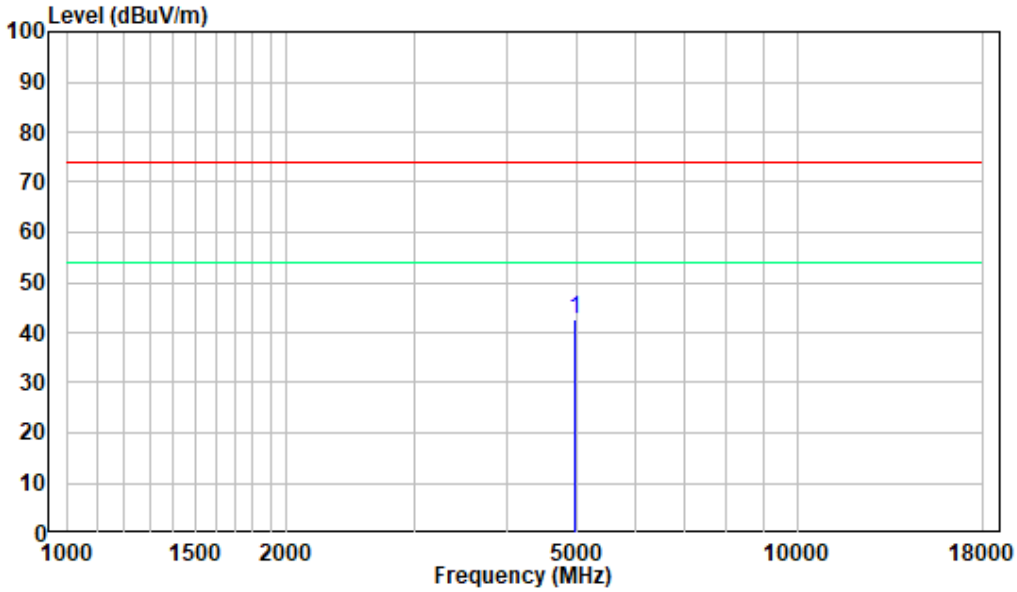
Frequency (MHz)	Receiver		Turntable Angle	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/AV	Degree	Height (m)	Polar (H/V)				
BLE 1M, Low Channel									
2310	51.25	PK	295	2.0	H	-10.36	40.89	74	-33.11
2310	50.73	PK	237	1.1	V	-10.36	40.37	74	-33.63
2390	51.51	PK	216	1.7	H	-10.71	40.8	74	-33.2
2390	53.95	PK	289	1.0	V	-10.71	43.24	74	-30.76
4804	49.07	PK	214	1.8	H	-6.11	42.96	74	-31.04
4804	48.43	PK	27	1.2	V	-6.11	42.32	74	-31.68
BLE 1M, Middle Channel									
4880	48.85	PK	220	1.8	H	-5.9	42.95	74	-31.05
4880	45.52	PK	34	1.5	V	-5.9	39.62	74	-34.38
BLE 1M, High Channel									
2483.5	46.66	PK	105	1.2	H	-10.55	36.11	74	-37.89
2483.5	47.06	PK	140	2.2	V	-10.55	36.51	74	-37.49
2500	46.09	PK	249	1.9	H	-10.42	35.67	74	-38.33
2500	48.76	PK	272	1.0	V	-10.42	38.34	74	-35.66
4960	49.37	PK	207	1.7	H	-5.47	43.9	74	-30.1
4960	49.4	PK	337	2.2	V	-5.47	43.93	74	-30.07
BLE 2M, Low Channel									
2310	48.38	PK	295	2.0	H	-10.36	38.02	74	-35.98
2310	48.85	PK	237	1.1	V	-10.36	38.49	74	-35.51
2390	51.06	PK	216	1.7	H	-10.71	40.35	74	-33.65
2390	115.34	PK	289	1.0	V	-10.71	104.63	74	30.63
4804	48.34	PK	214	1.8	H	-6.11	42.23	74	-31.77
4804	49.52	PK	27	1.2	V	-6.11	43.41	74	-30.59
BLE 2M, Middle Channel									
4880	48.9	PK	220	1.8	H	-5.9	43	74	-31
4880	48.47	PK	34	1.5	V	-5.9	42.57	74	-31.43
BLE 2M, High Channel									
2483.5	48.13	PK	105	1.2	H	-10.55	37.58	74	-36.42
2483.5	48.42	PK	140	2.2	V	-10.55	37.87	74	-36.13
2500	48	PK	249	1.9	H	-10.42	37.58	74	-36.42
2500	48.29	PK	272	1.0	V	-10.42	37.87	74	-36.13
4960	48.29	PK	207	1.7	H	-5.47	42.82	74	-31.18
4960	49.73	PK	337	2.2	V	-5.47	44.26	74	-29.74

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.

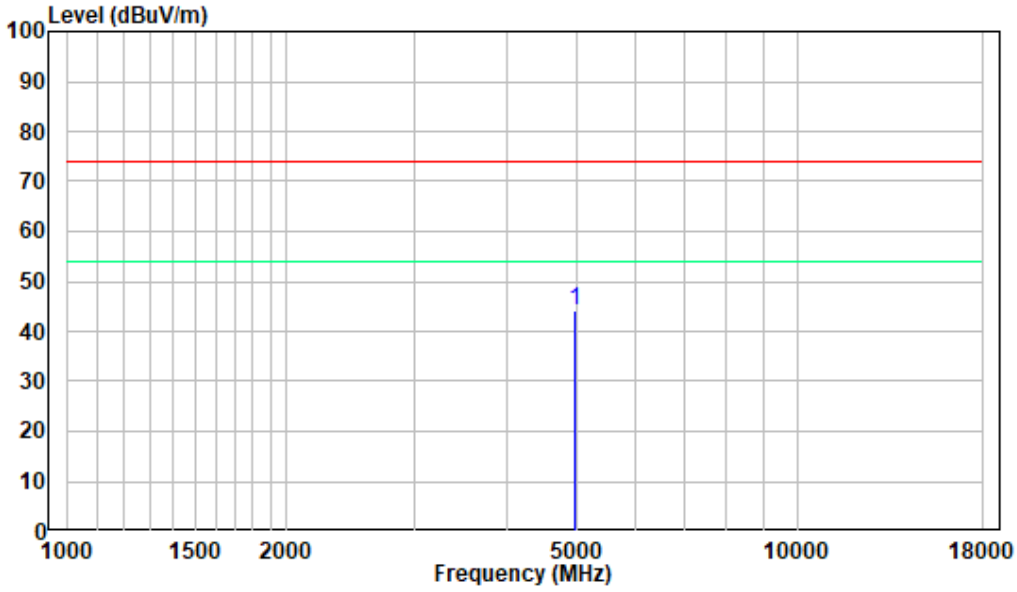
1 GHz - 18 GHz: (Pre-Scan plots)

(worst case, BLE 2M High Channel)

Horizontal



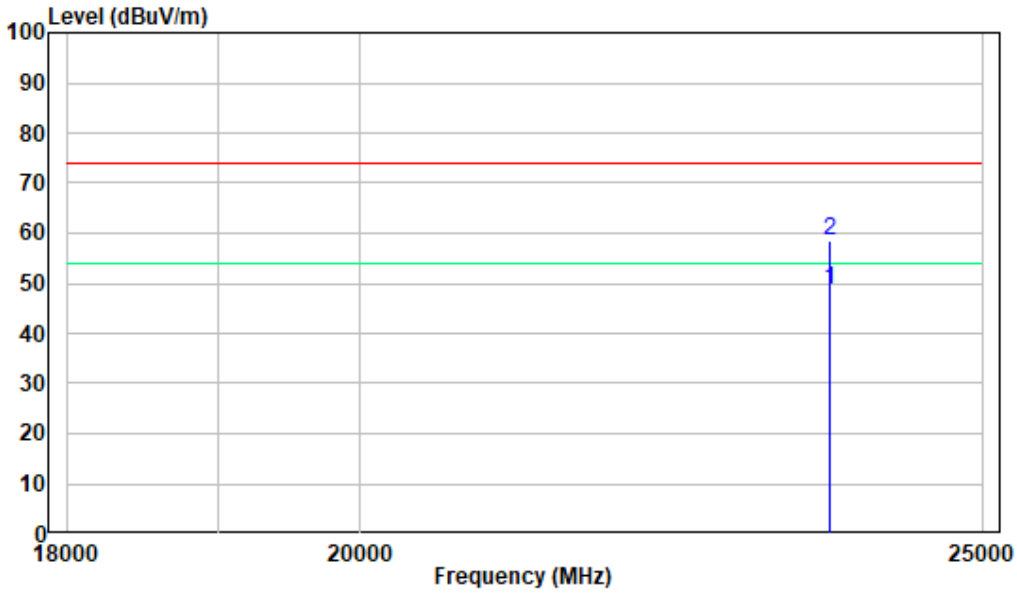
Vertical



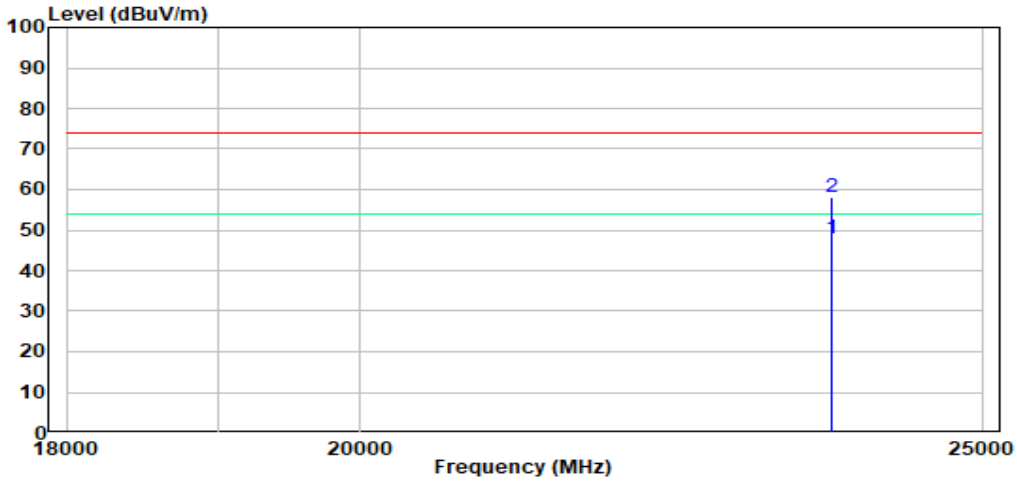
18-25GHz: (Pre-Scan plots)

(worst case, BLE 2M High Channel)

Horizontal



Vertical



§15.247 (a)(2) & RSS-Gen§6.7 RSS-247 § 5.2 (a)- 99% OCCUPIED BANDWIDTH & 6 dB EMISSION 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.

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "6 dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated 6 dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

Test Procedure

According to ANSI C63.10-2013, section 11.8 and section 6.9 & RSS-GEN § 6.7.

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.

The following conditions shall be observed for measuring the occupied bandwidth and 6 dB bandwidth:
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

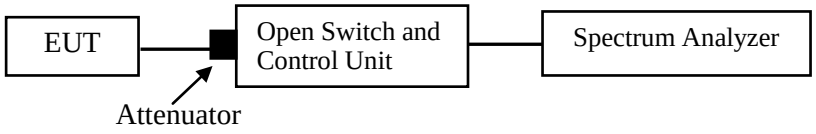
• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / 6 dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 6 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level 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, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).



Test Data

Environmental Conditions

Temperature:	25℃
Relative Humidity:	45%
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang on 2023-06-03..

EUT operation mode: Transmitting

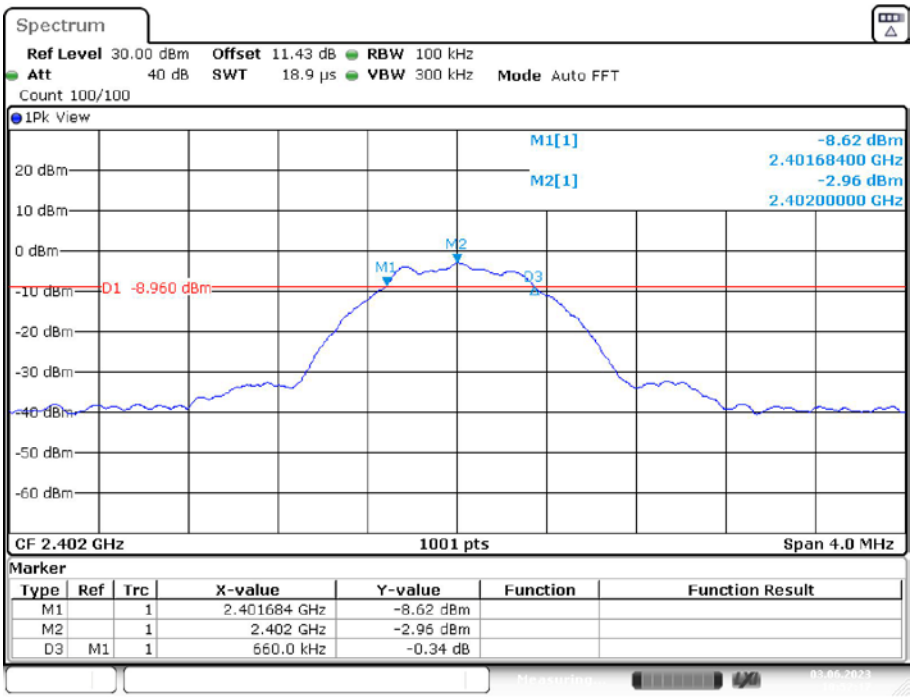
Test Result: Compliant. Please refer to the below plots.

Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.66	0.5	PASS
		2440	0.65	0.5	PASS
		2480	0.66	0.5	PASS
BLE_2M	Ant1	2402	1.10	0.5	PASS
		2440	1.11	0.5	PASS
		2480	1.11	0.5	PASS

Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
BLE_1M	Ant1	2402	1.047	2401.4965	2402.5435	PASS
		2440	1.191	2439.4446	2440.6354	PASS
		2480	1.059	2479.4845	2480.5435	PASS
BLE_2M	Ant1	2402	2.09	2400.9930	2403.0829	PASS
		2440	2.086	2438.9970	2441.0829	PASS
		2480	2.078	2479.0090	2481.0869	PASS

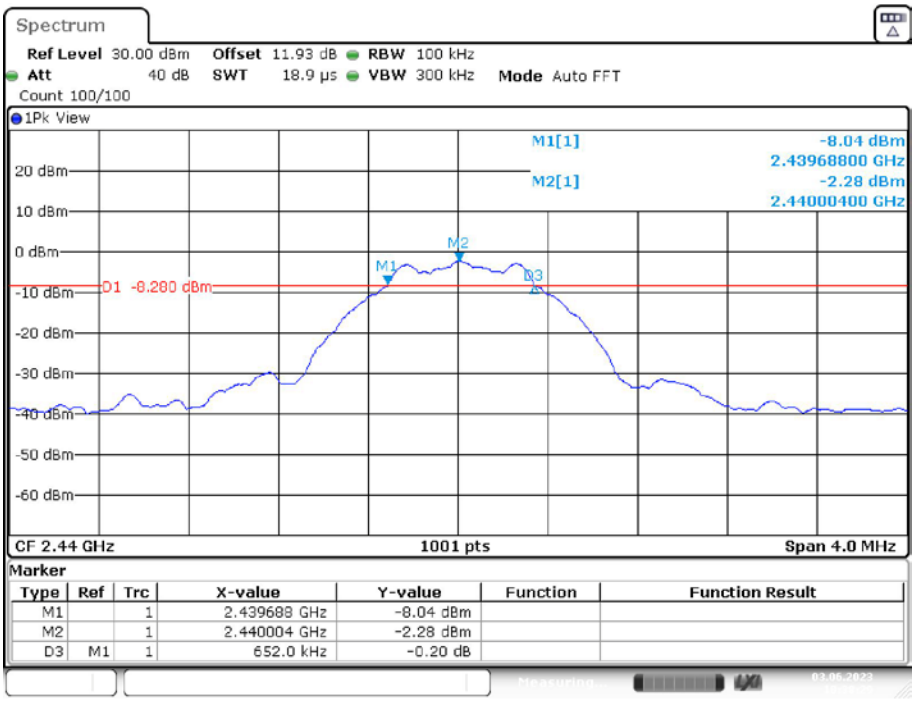
6 dB EMISSION BANDWIDTH

BLE_1M_Ant1_2402



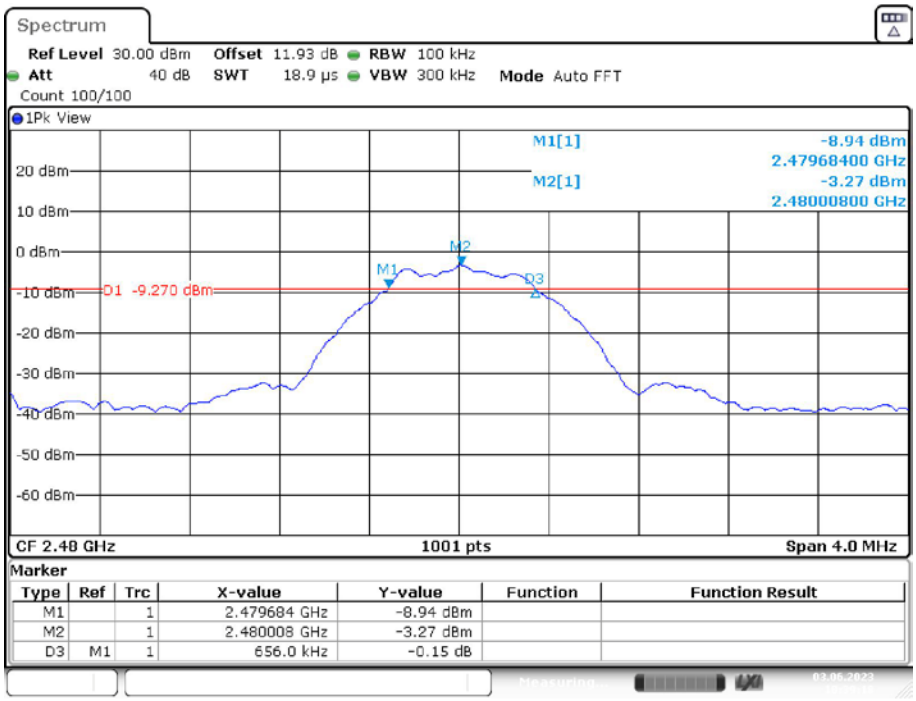
Date: 3.JUN.2023 10:52:17

BLE_1M_Ant1_2440



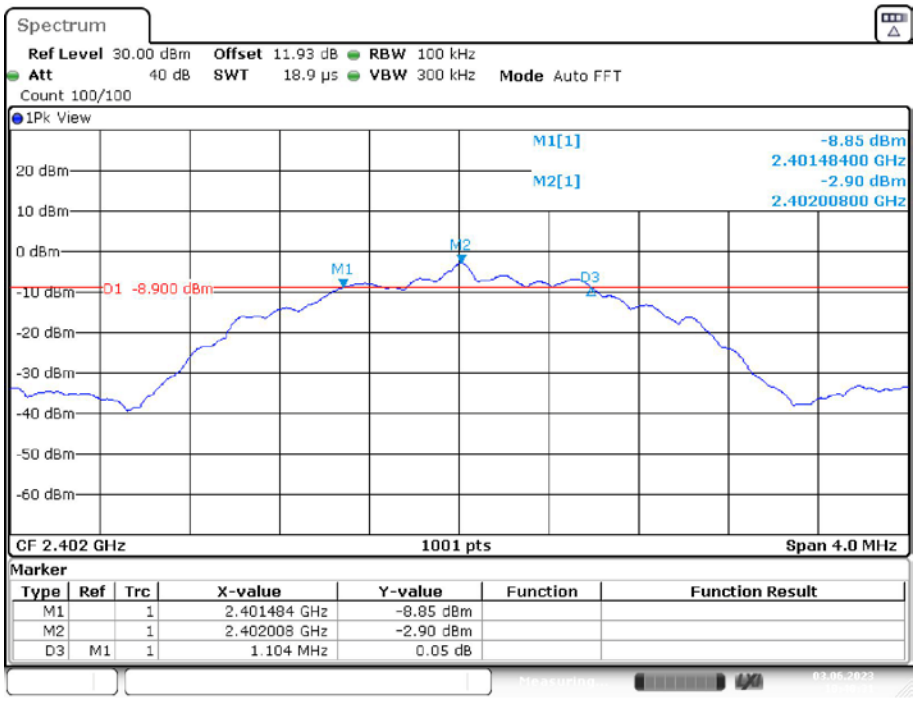
Date: 3.JUN.2023 10:38:28

BLE_1M_Ant1_2480



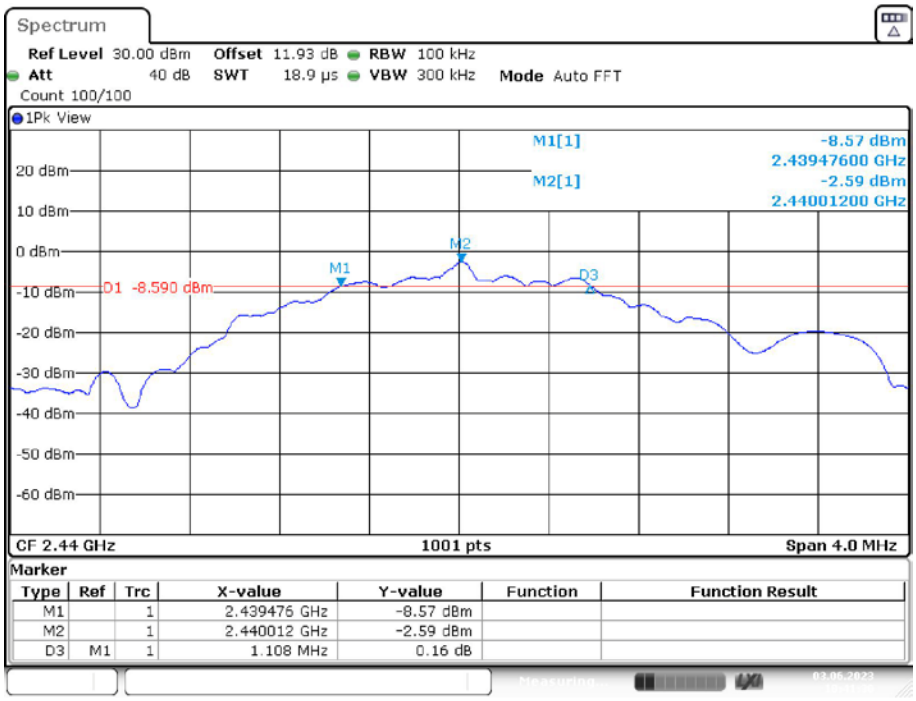
Date: 3.JUN.2023 10:39:18

BLE_2M_Ant1_2402



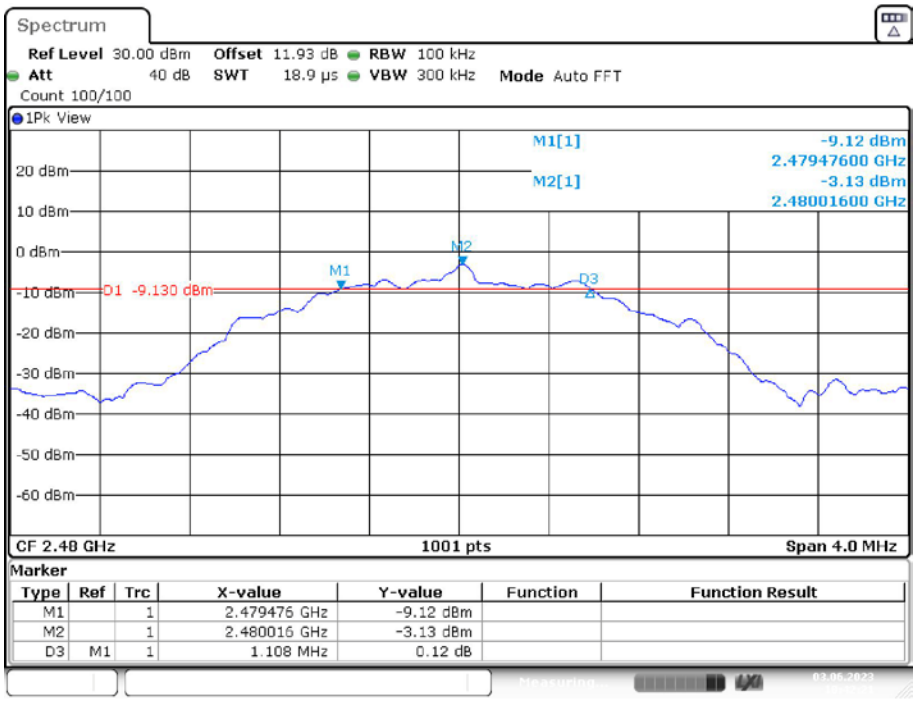
Date: 3.JUN.2023 10:40:31

BLE_2M_Ant1_2440



Date: 3.JUN.2023 10:41:30

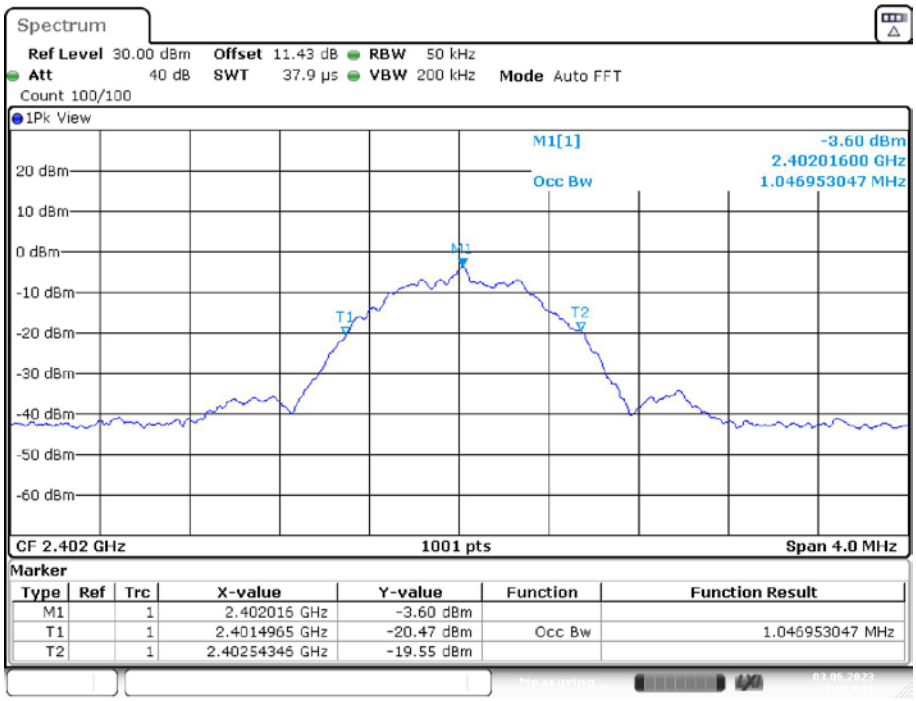
BLE_2M_Ant1_2480



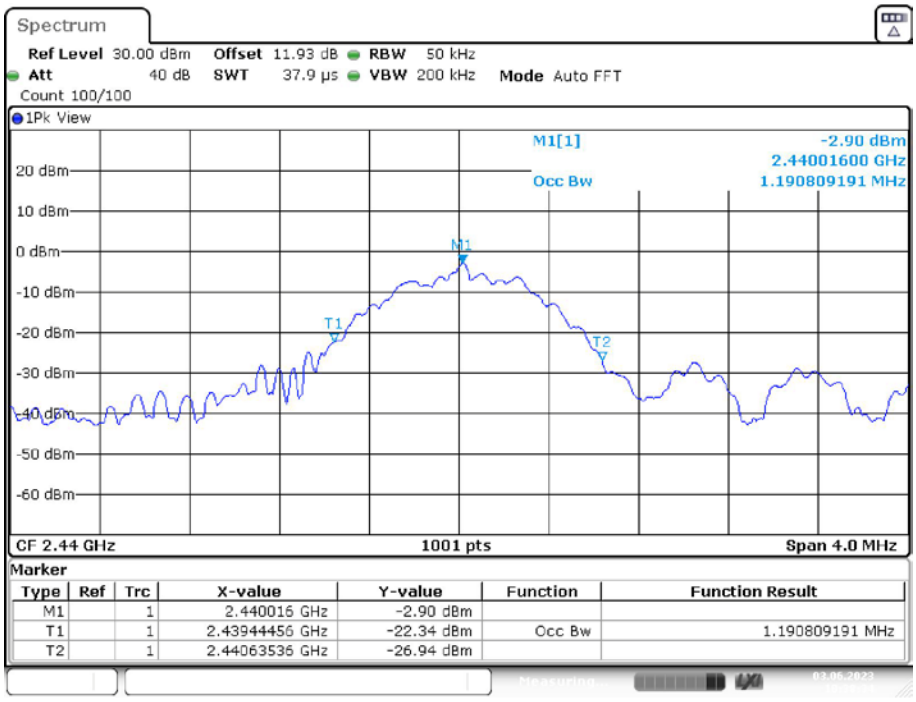
Date: 3.JUN.2023 10:42:20

OCCUPIED BANDWIDTH

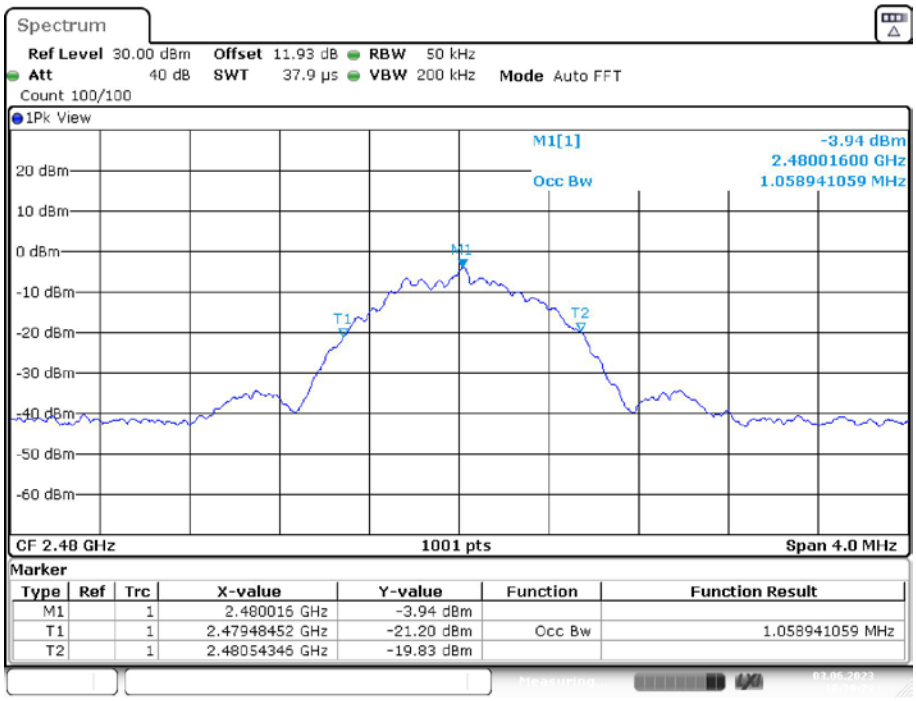
BLE_1M_Ant1_2402



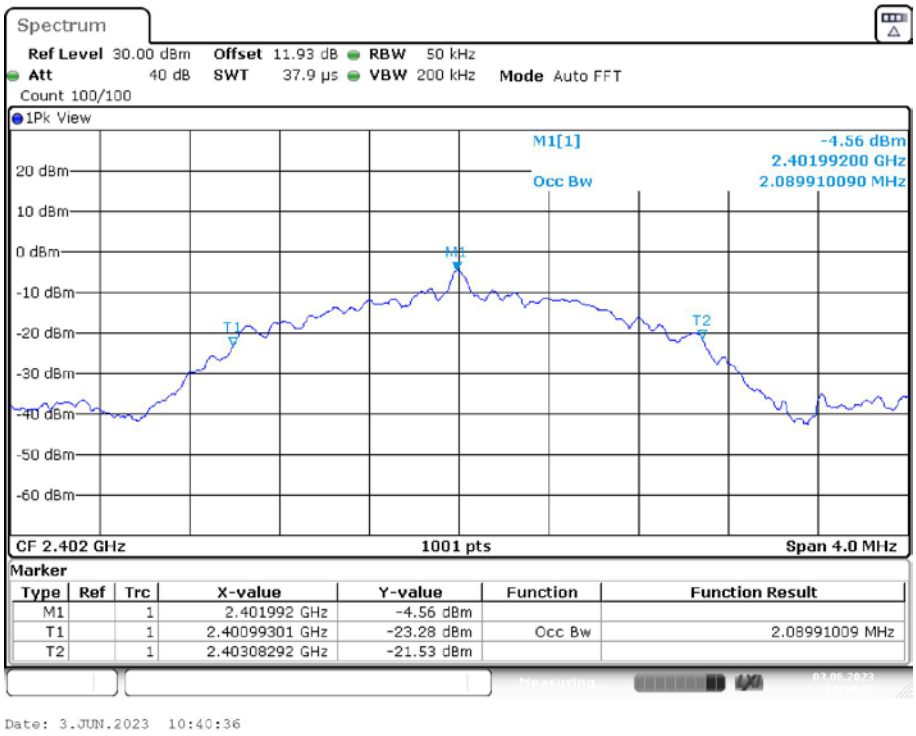
BLE_1M_Ant1_2440



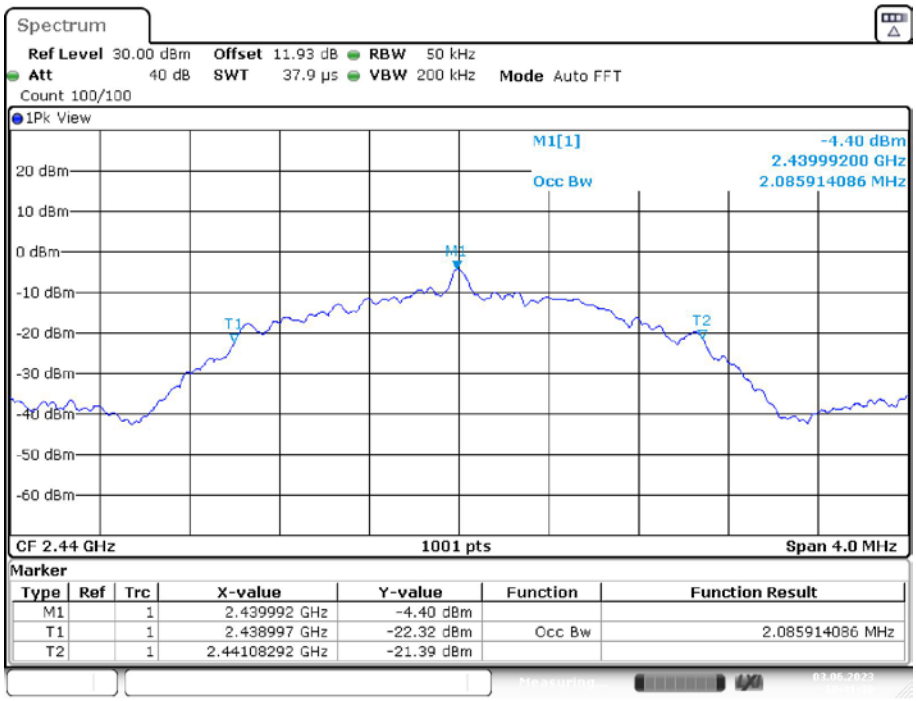
BLE_1M_Ant1_2480



BLE_2M_Ant1_2402

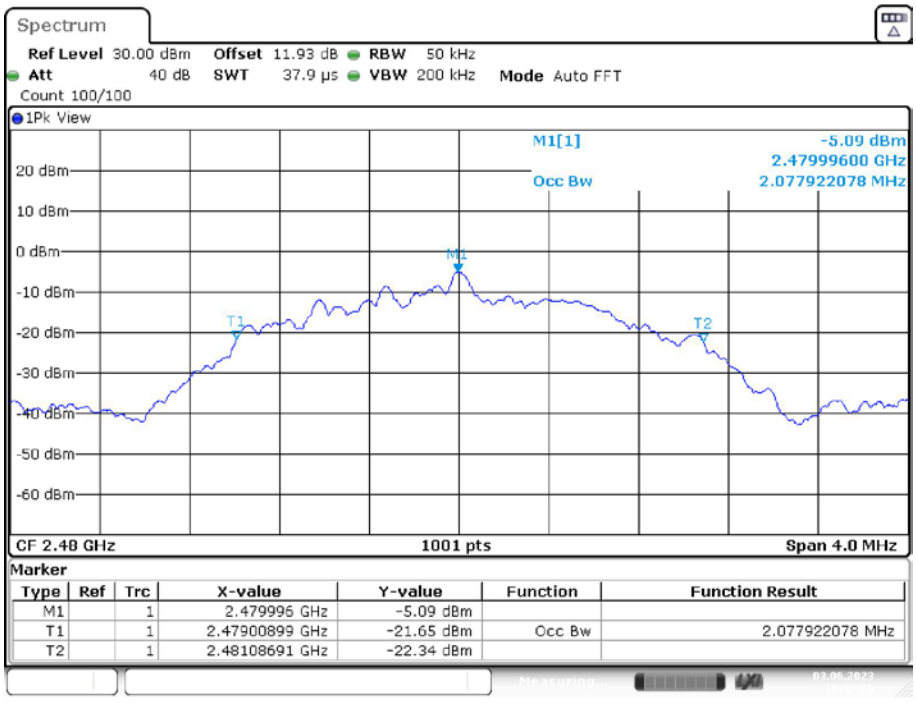


BLE_2M_Ant1_2440



Date: 3.JUN.2023 10:41:36

BLE_2M_Ant1_2480



Date: 3.JUN.2023 10:42:26

§ 15.247(b)(3) & RSS-247 § 5.4(d)-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.

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

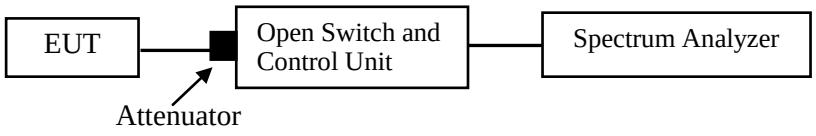
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the 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 transmitting at a reduced power level. If multiple modes of operation are implemented, 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.

Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	25℃
Relative Humidity:	45%
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang on 2023-06-03.

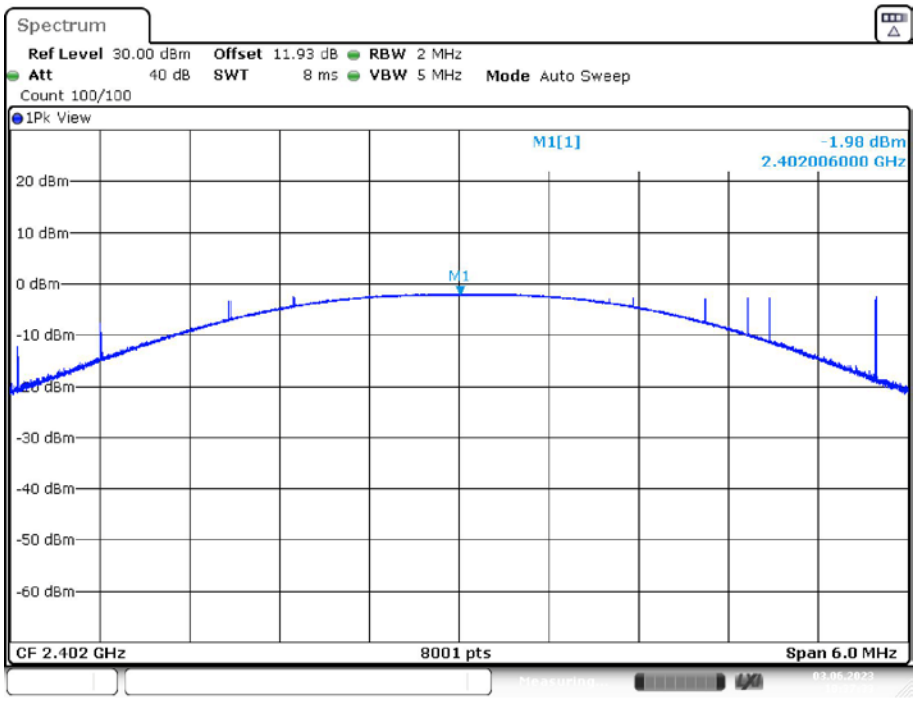
EUT operation mode: Transmitting

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

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-1.98	<=30	PASS
		2440	**-1.7**	<=30	PASS
		2480	-2.7	<=30	PASS
BLE_2M	Ant1	2402	-2.26	<=30	PASS
		2440	-1.96	<=30	PASS
		2480	-2.49	<=30	PASS

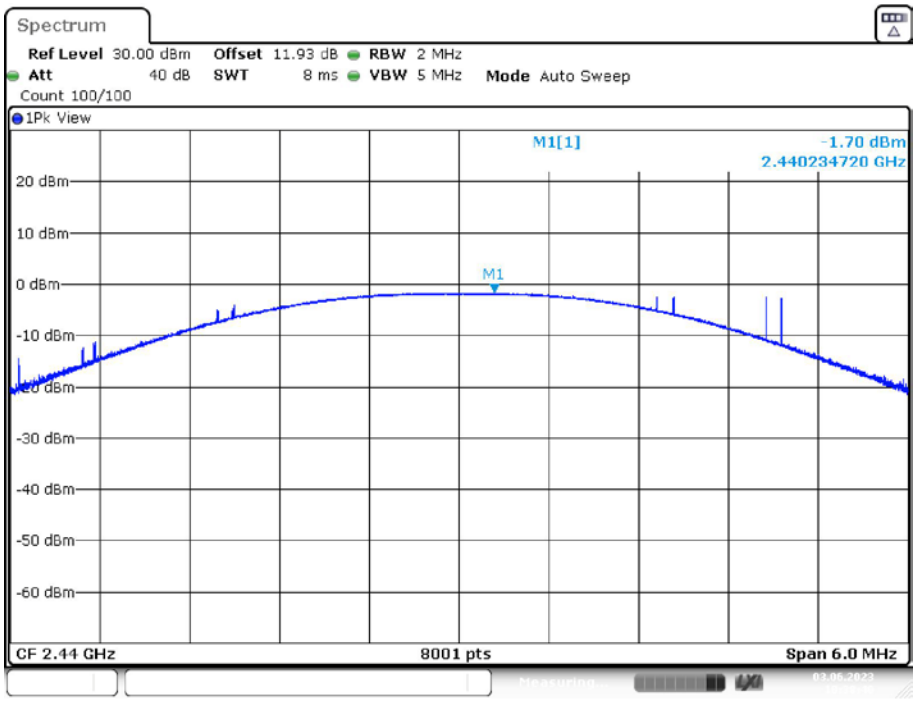
Note: The maximum antenna gain is -3.46dBi, so the EIRP is compliant to the ISED limit.

BLE_1M_Ant1_2402



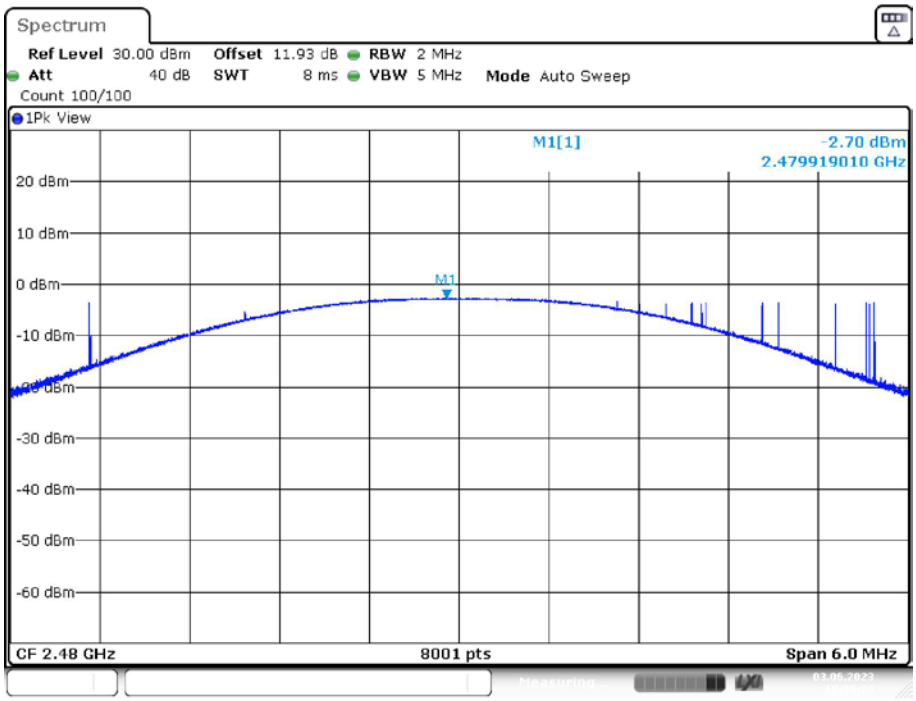
Date: 3.JUN.2023 10:37:33

BLE_1M_Ant1_2440



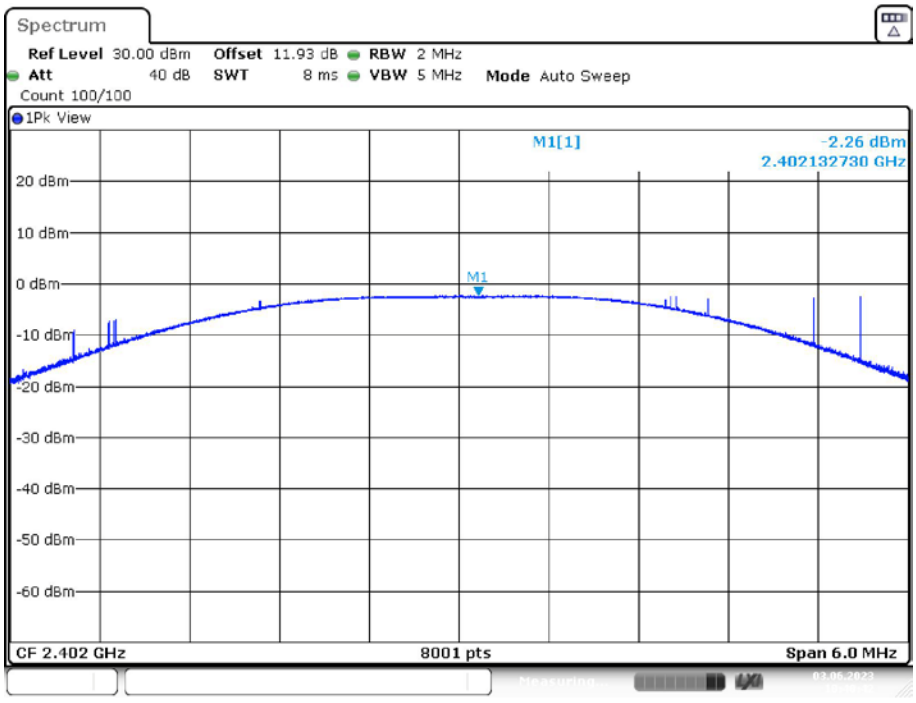
Date: 3.JUN.2023 10:38:40

BLE_1M_Ant1_2480



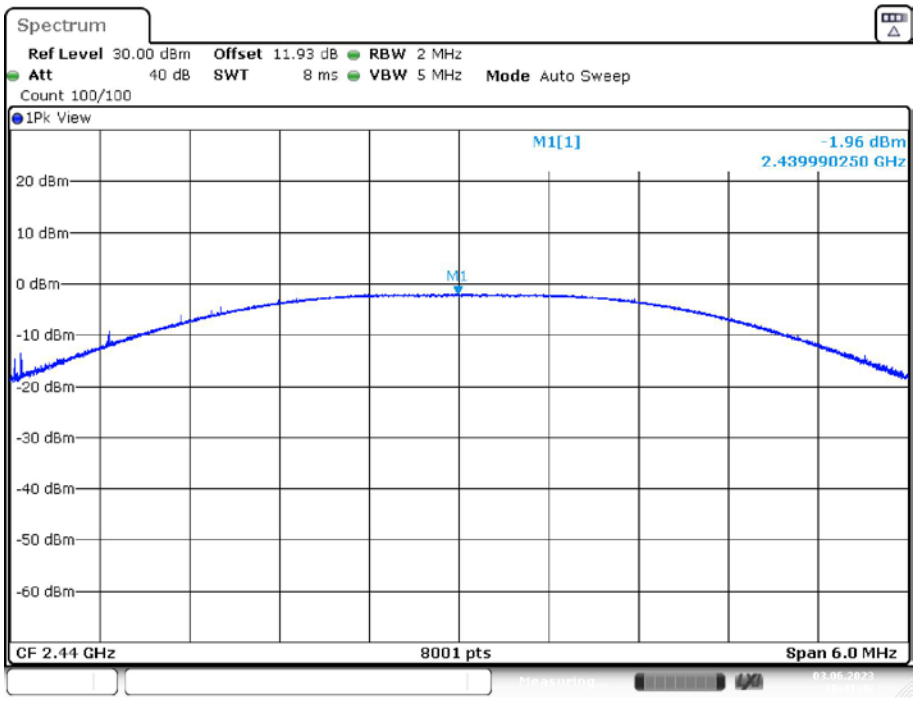
Date: 3.JUN.2023 10:39:29

BLE_2M_Ant1_2402



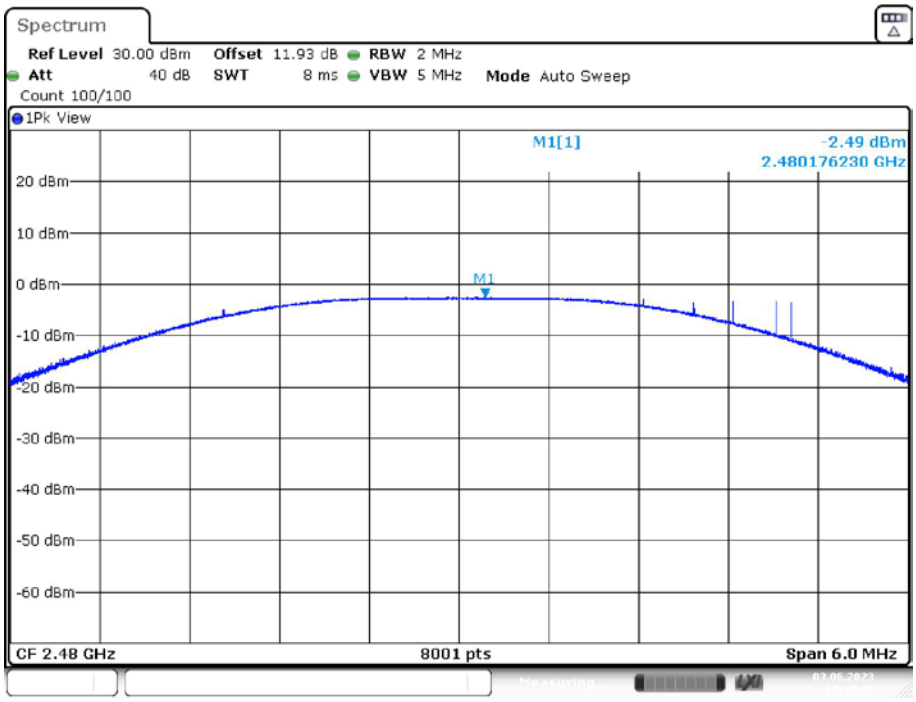
Date: 3.JUN.2023 10:40:42

BLE_2M_Ant1_2440



Date: 3.JUN.2023 10:41:42

BLE_2M_Ant1_2480



Date: 3.JUN.2023 10:42:32

§ 15.247(d) & RSS-247 § 5.5-100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

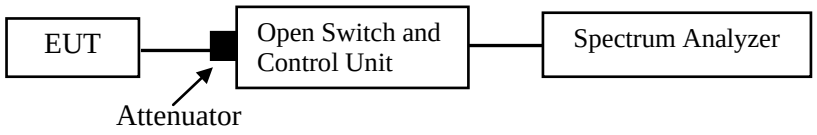
Applicable Standard

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 11.11.2

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

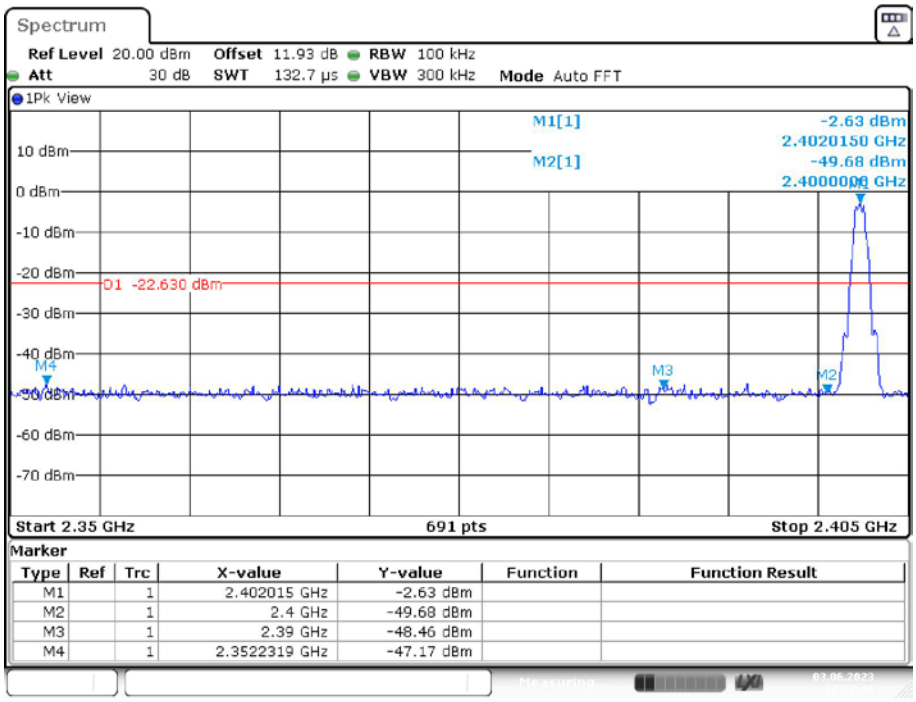
Temperature:	24-25℃
Relative Humidity:	43-45%
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang from 2023-06-03 to 2023-06-05.

EUT operation mode: Transmitting

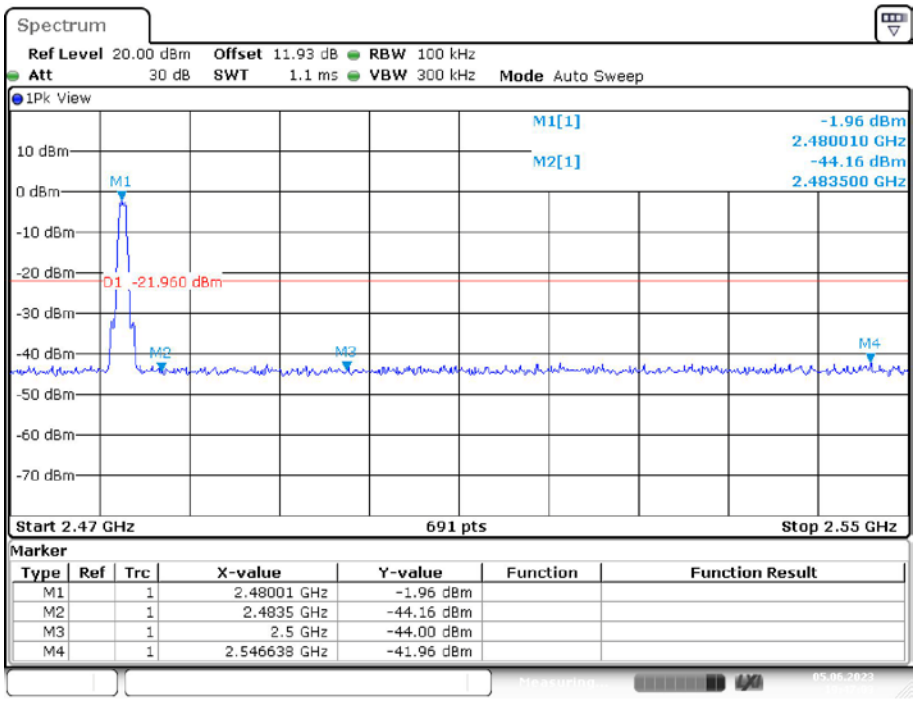
Test Result: Compliant. Please refer to the below plots.

BLE_1M_Ant1_Low_2402



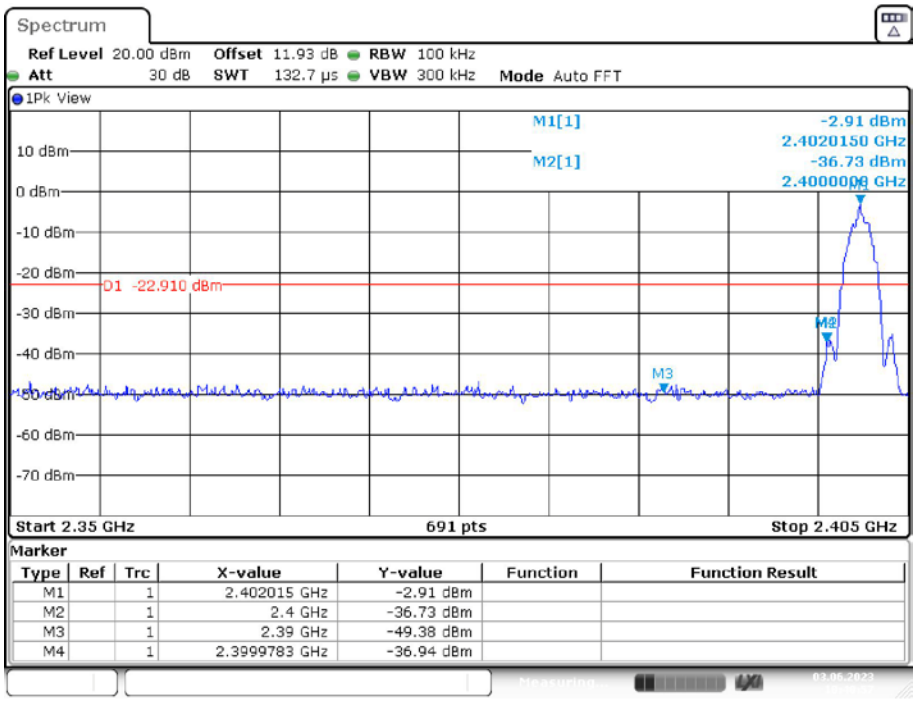
Date: 3.JUN.2023 10:37:48

BLE_1M_Ant1_High_2480



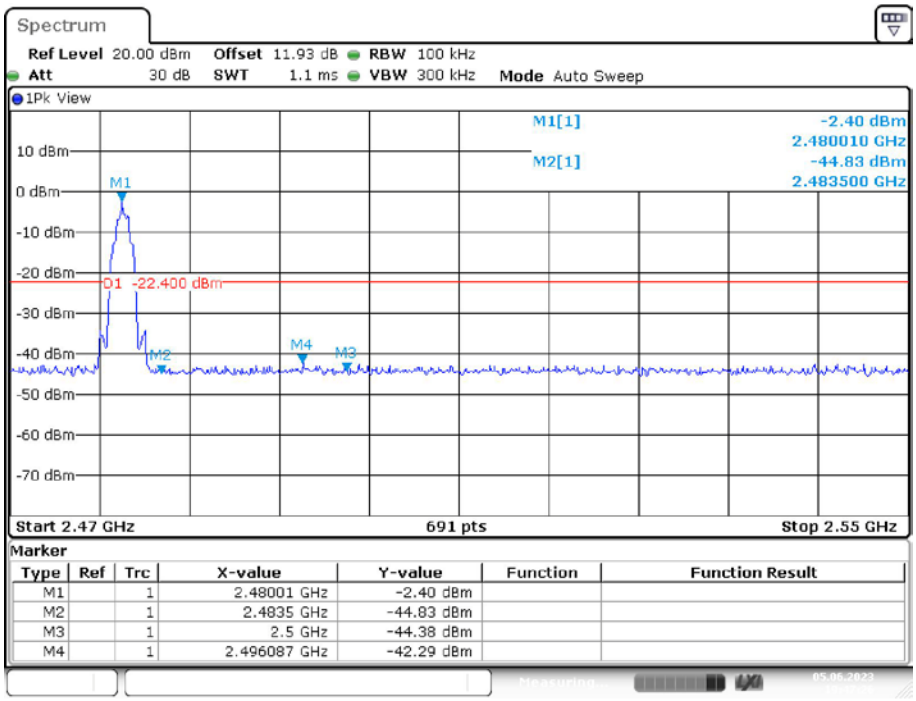
Date: 5.JUN.2023 19:47:03

BLE_2M_Ant1_Low_2402



Date: 3.JUN.2023 10:40:57

BLE_2M_Ant1_High_2480



Date: 5.JUN.2023 19:47:26

§ 15.247(e) & RSS-247 § 5.2 (b)-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.

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than8 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 section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

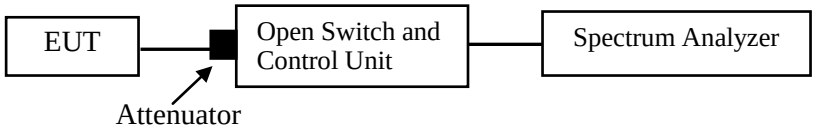
Test Procedure

According to ANSI C63.10-2013, section 11.10.2

Method PKPSD (peak PSD)

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ [3 × RBW].
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	25℃
Relative Humidity:	45%
ATM Pressure:	101.0 kPa

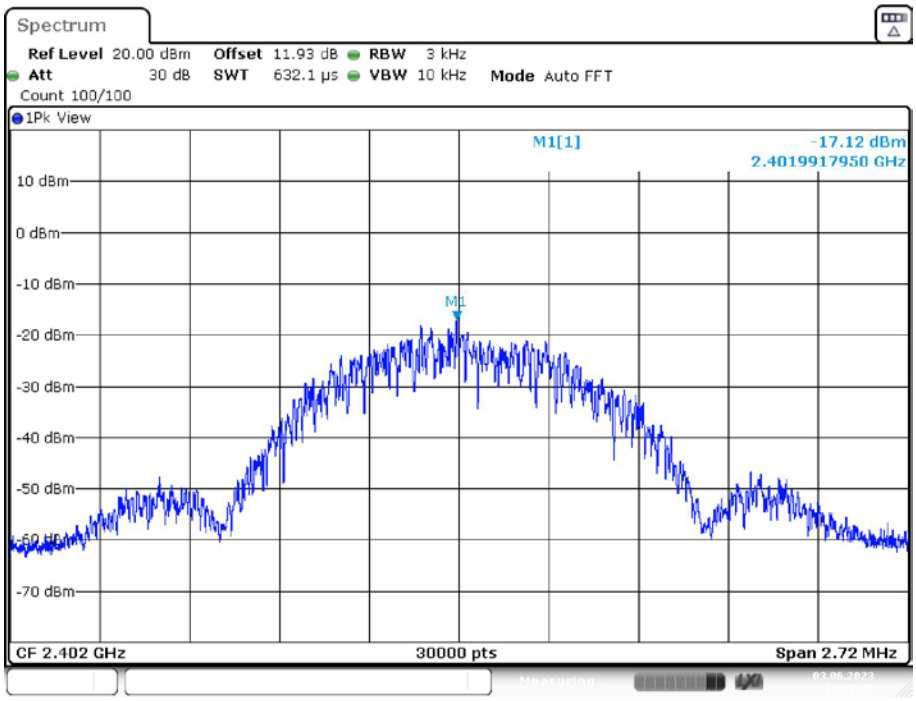
The testing was performed by Matt Liang on 2023-06-03.

EUT operation mode: Transmitting

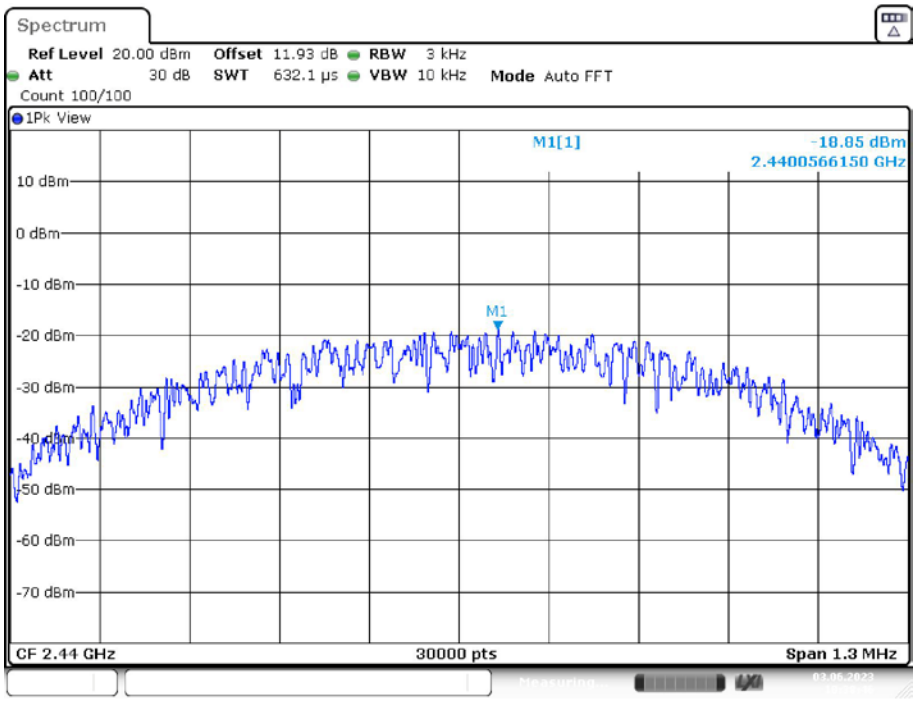
Test Result: Compliant. Please refer to the below table and plots.

Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-17.12	<=8	PASS
		2440	-18.85	<=8	PASS
		2480	-17.55	<=8	PASS
BLE_2M	Ant1	2402	-20.51	<=8	PASS
		2440	-18.8	<=8	PASS
		2480	-20.11	<=8	PASS

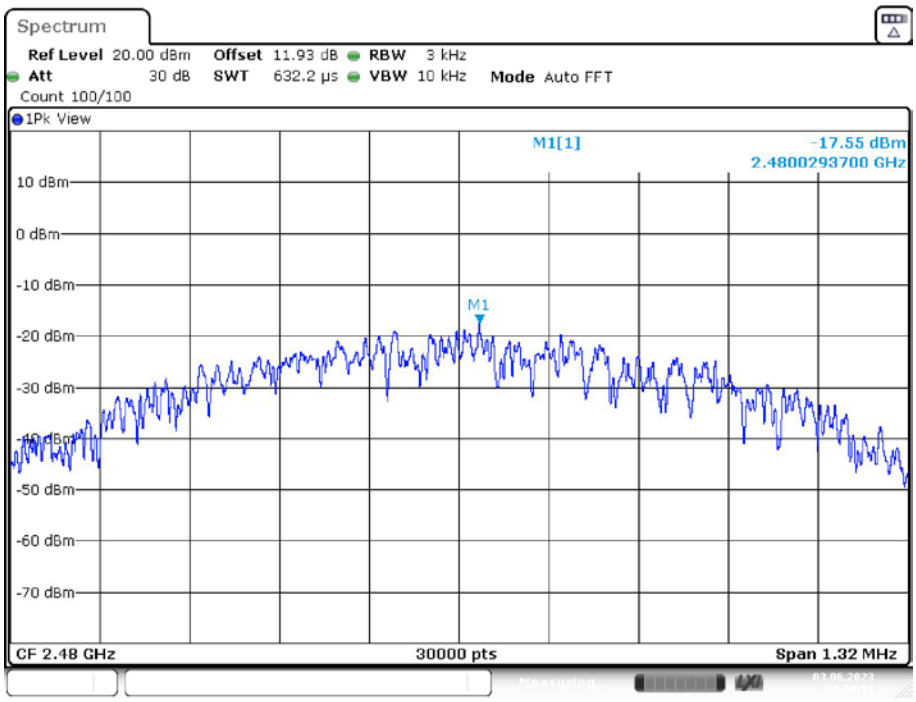
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440

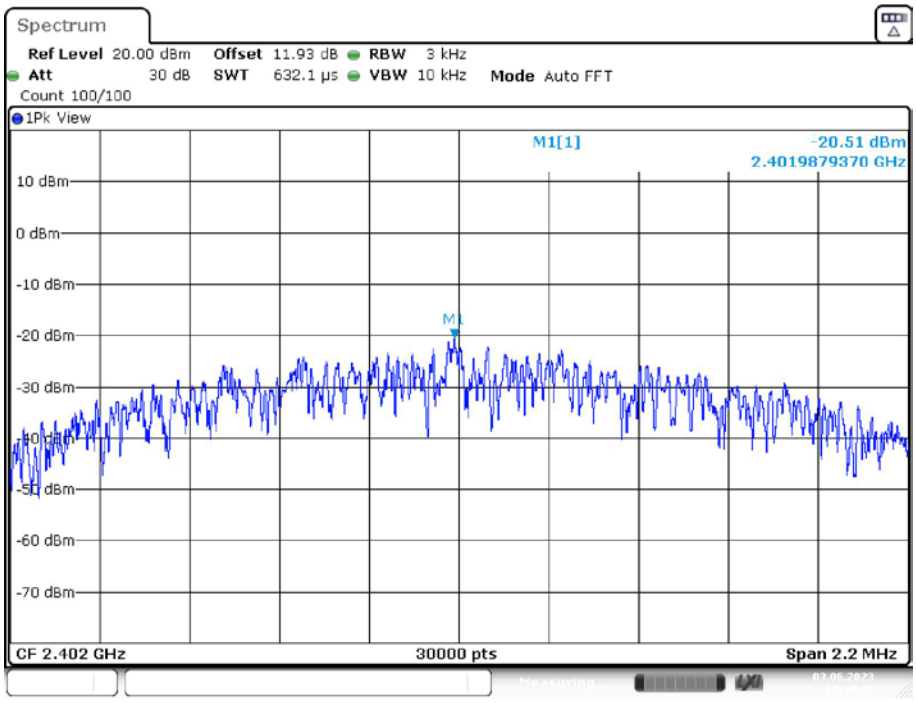


BLE_1M_Ant1_2480



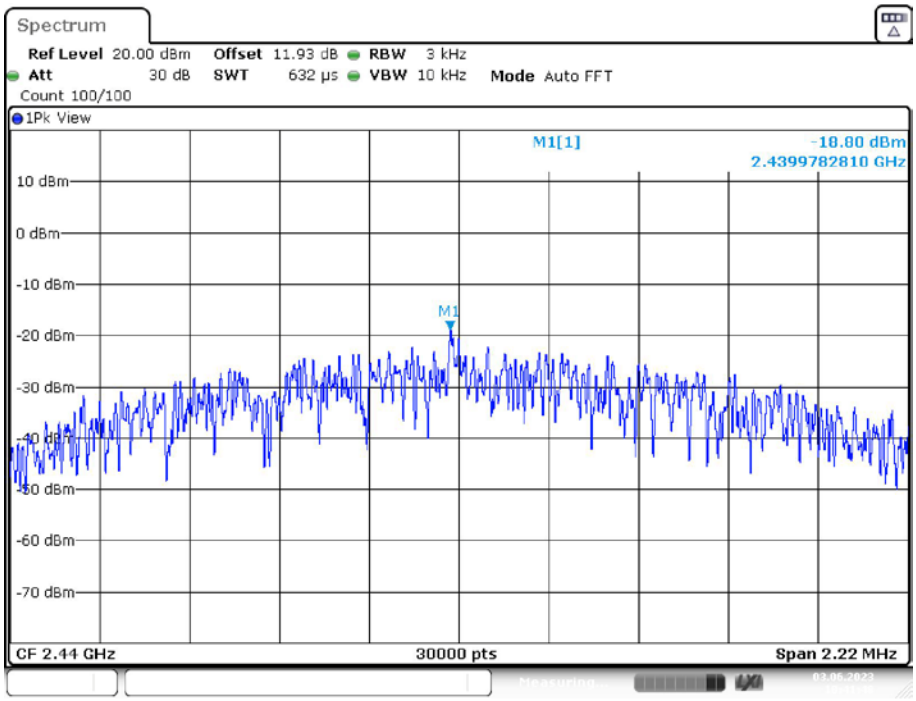
Date: 3.JUN.2023 10:39:35

BLE_2M_Ant1_2402

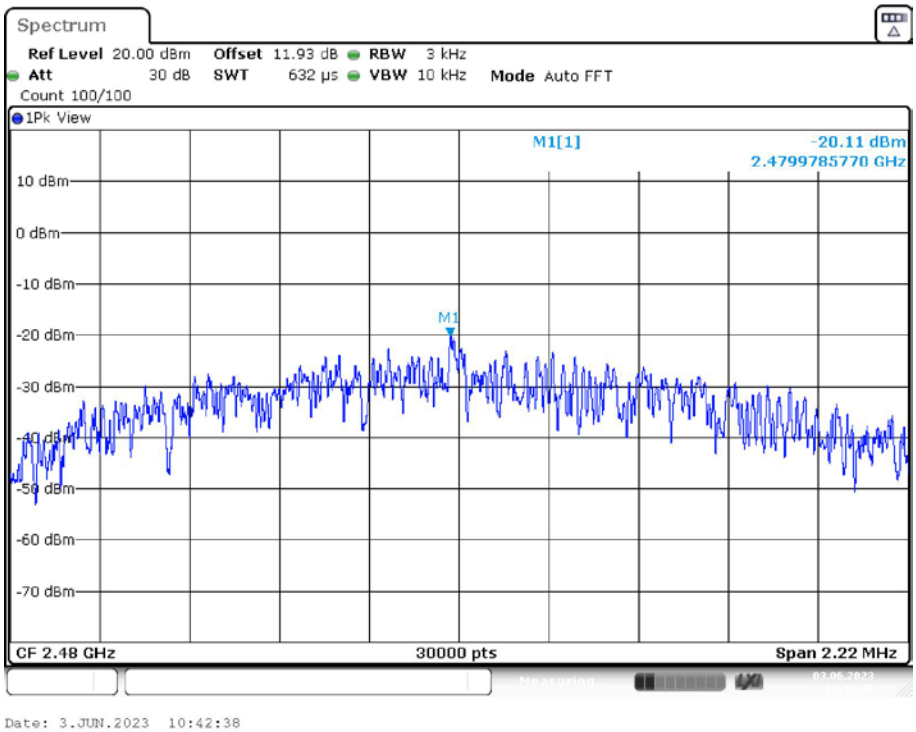


Date: 3.JUN.2023 10:40:48

BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



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