

TEST REPORT

Applicant Name : Huayuan Smart Communications Co., Ltd
Address : No.1, Ln 49, Chengdu St., Banqiao Dist., New Taipei City, 220558,
Taiwan
Report Number : XMTN1220706-30454E-RF
FCC ID: 2A7UN-DD7MINI

Test Standard (s)
FCC PART 15.247

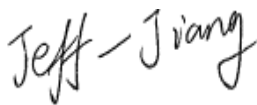
Sample Description

Product Type: Bluetooth Button
Model No.: DD7-MINI
Trade Name: **Chiloki**
Date Received: 2022-07-06
Date of Test: 2022-07-13 to 2022-08-11
Report Date: 2022-08-12

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:



Jeff Jiang
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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TABLE OF CONTENTS

GENERAL INFORMATION	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
SYSTEM TEST CONFIGURATION	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
SPECIAL ACCESSORIES	6
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	8
TEST EQUIPMENT LIST	9
FCC§15.247 (i), §1.1307 (b) – RF EXPOSURE	10
TEST RESULT	10
FCC §15.203 – ANTENNA REQUIREMENT	11
APPLICABLE STANDARD	11
ANTENNA CONNECTOR CONSTRUCTION	11
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	12
APPLICABLE STANDARD	12
EUT SETUP	12
EMI TEST RECEIVER SETUP	12
TEST PROCEDURE	13
FACTOR & MARGIN CALCULATION	13
TEST DATA	13
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS	18
APPLICABLE STANDARD	18
EUT SETUP	18
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	19
TEST PROCEDURE	19
FACTOR & MARGIN CALCULATION	19
TEST DATA	19
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH	26
APPLICABLE STANDARD	26
TEST PROCEDURE	26
TEST DATA	26
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER	34
APPLICABLE STANDARD	34
TEST PROCEDURE	34
TEST DATA	34
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE	38
APPLICABLE STANDARD	38

TEST PROCEDURE	38
TEST DATA	38
FCC §15.247(e) - POWER SPECTRAL DENSITY	41
APPLICABLE STANDARD	41
TEST PROCEDURE	41
TEST DATA	41
FCC §15.247(G) - DUTY CYCLE.....	46
TEST DATA	46

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Bluetooth Button
Tested Model	DD7-MINI
Trade Name	Chiloki
Frequency Range	BLE 1M/2M: 2402~2480MHz
Maximum conducted Peak output power	-1.21dBm
Modulation Technique	GFSK
Antenna Specification*	Internal Antenna: 2.93 dBi(provided by the applicant)
Voltage Range	DC3.7V from battery or DC 5V from USB port
Sample number	XMTN1220706-30454E-RF-S1 (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		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
Temperature		1°C
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 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

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

Listed by Innovation, Science and Economic Development Canada (ISED), the Registration Number is 5077A.

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 “EMI_Test_Tool”* was used during testing and the power level was 3.3*.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

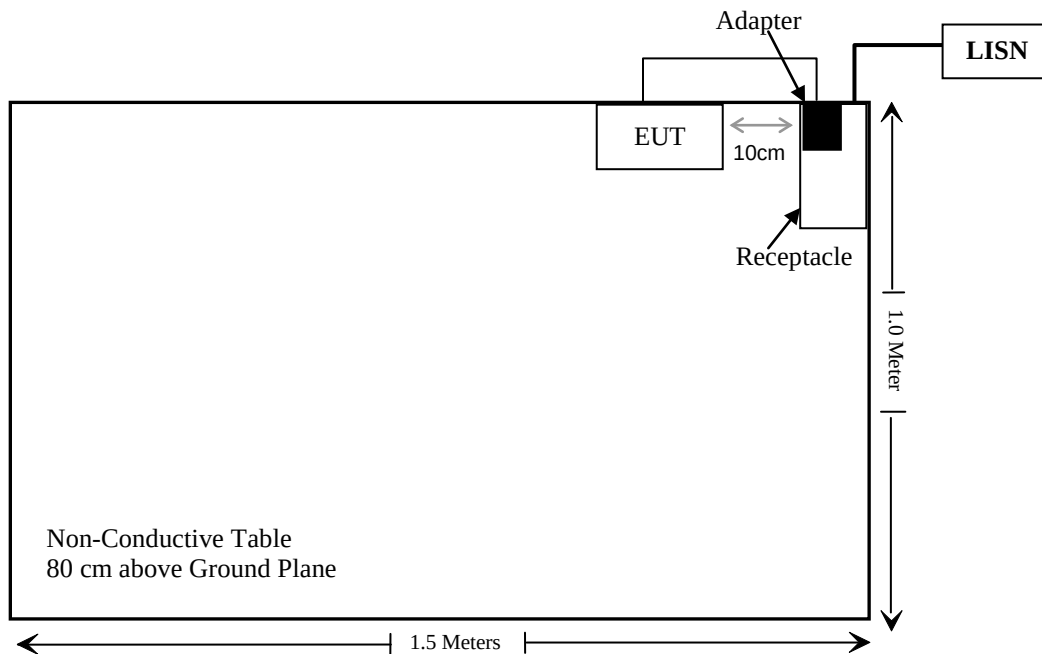
Manufacturer	Description	Model	Serial Number
Hisenes	Adapter	E010	1D050200VCU

External I/O Cable

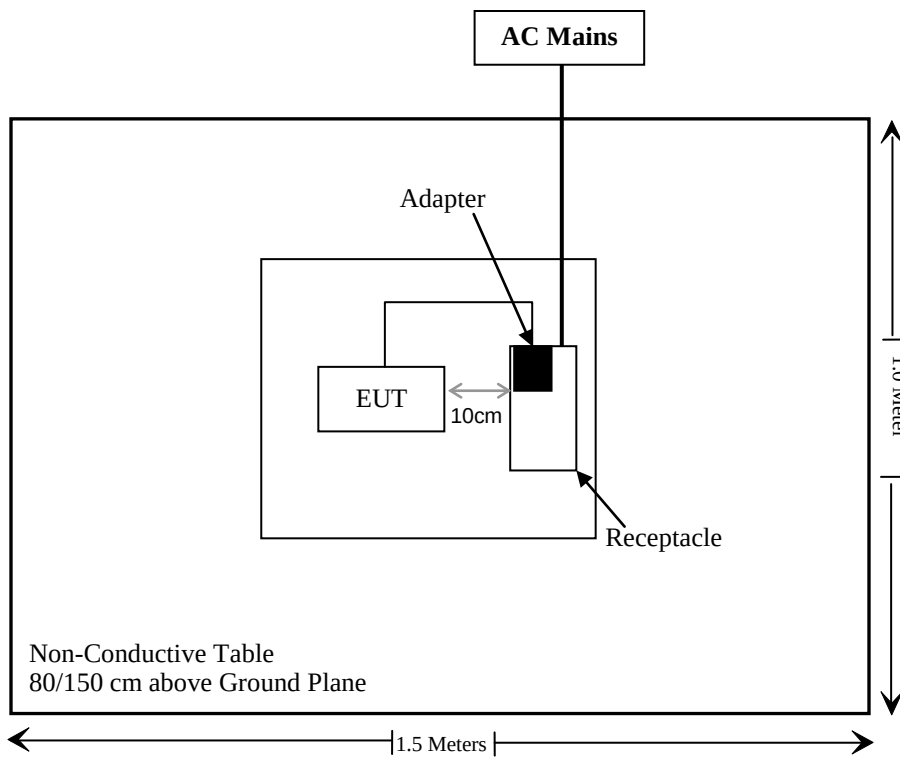
Cable Description	Length (m)	From/Port	To
Un-shielding Detachable Charging Cable	0.3	Adapter	EUT
Unshielded Un-detachable AC cable	1.2	LISN	Receptacle

Block Diagram of Test Setup

For conducted emission:



For Radiated Emissions:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247(i), §1.1307(b)	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	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Conducted Emission Test Software: e3 19821b (V9)					
Radiated Emissions Test					
Rohde & Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde & Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2021/11/11	2022/11/10
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N650	2021/12/14	2022/12/13
Radiated Emission Test Software: e3 19821b (V9)					
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2021/12/13	2022/12/12
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2021/12/13	2022/12/12
WEINSCHL	10dB Attenuator	5324	AU 3842	2021/12/14	2022/12/13
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) – 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 2.1.2 – 1-mW test Exemption:

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

Test Result

For worst case:

Mode	Frequency	Maximum Tune-up Conducted Power		1-mW test Exemption
	(MHz)	(dBm)	(mW)	
BLE	2402-2480	-1.0	0.79	Yes

Note 1: The tune-up power was declared by the applicant.

Result: Compliant.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

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

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

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

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

Antenna Connector Construction

The EUT has one Internal Antenna arrangement, which was permanently attached and the antenna gain is 2dBi, fulfill the requirement of this section. Please refer to the EUT photos.

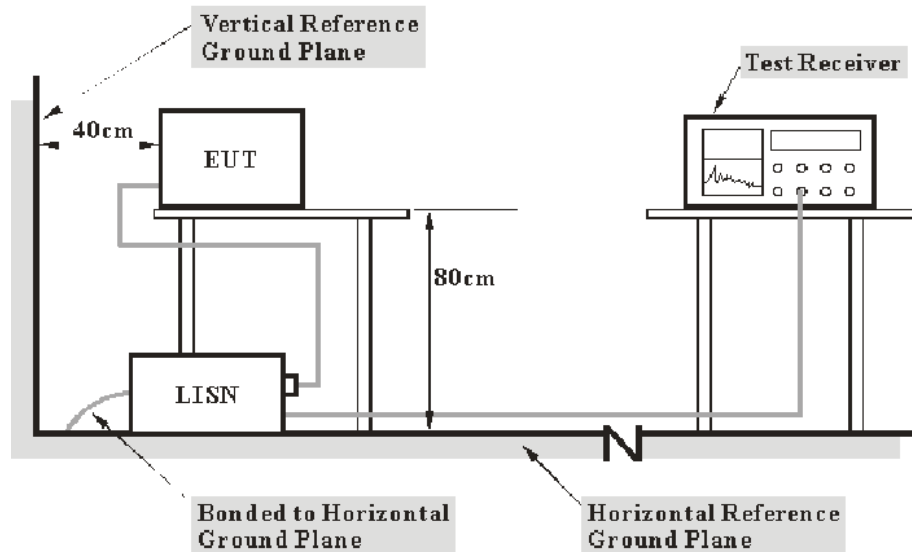
Result: Compliant.

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

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:

$$\text{Factor} = \text{LISN VDF} + \text{Cable Loss}$$

The “**Over limit**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over limit of -7 dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

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

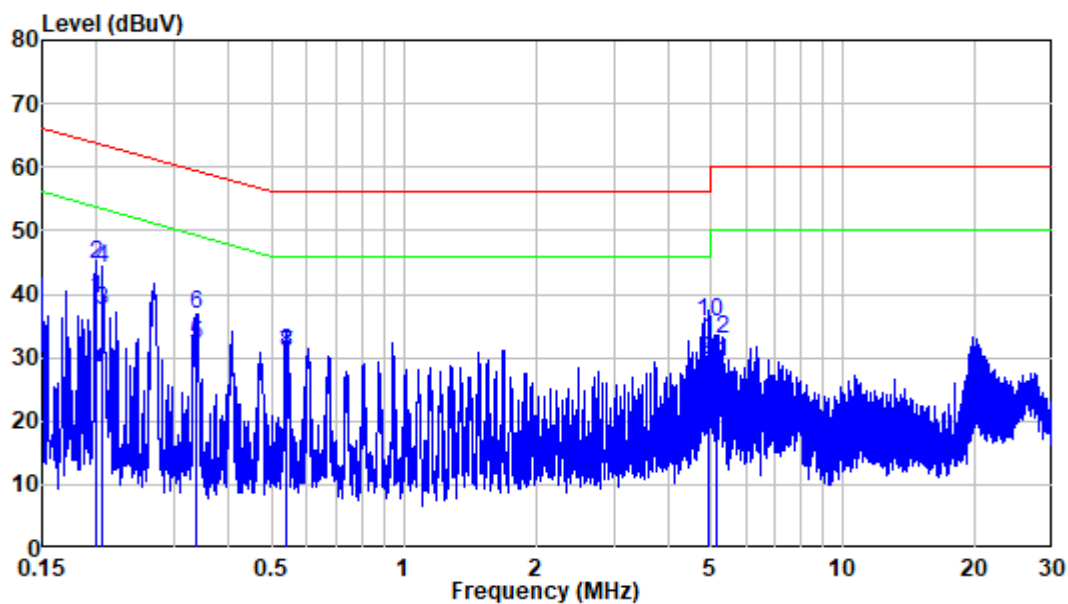
Test Data

Environmental Conditions

Temperature:	24°C
Relative Humidity:	42 %
ATM Pressure:	101.1 kPa

The testing was performed by Jason Liu on 2022-07-13.

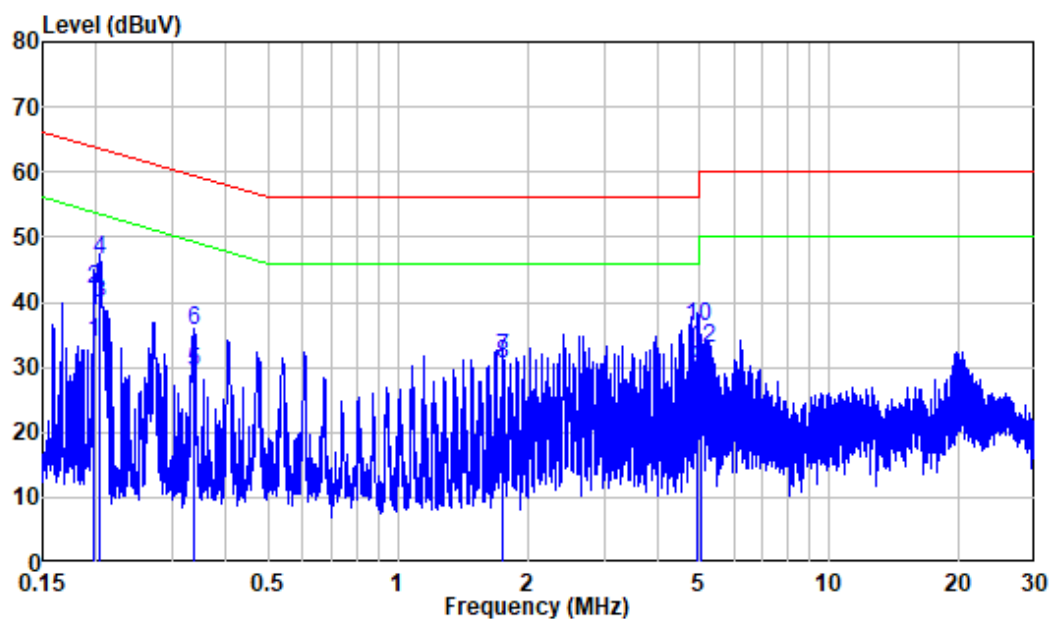
EUT operation mode: BLE Transmitting

BLE 1MHz:**AC 120V/60 Hz, Line**

Site : Shielding Room
 Condition: Line
 Mode : BLE 1MHz
 Model : DD7-MINI
 Power : AC 120V 60Hz

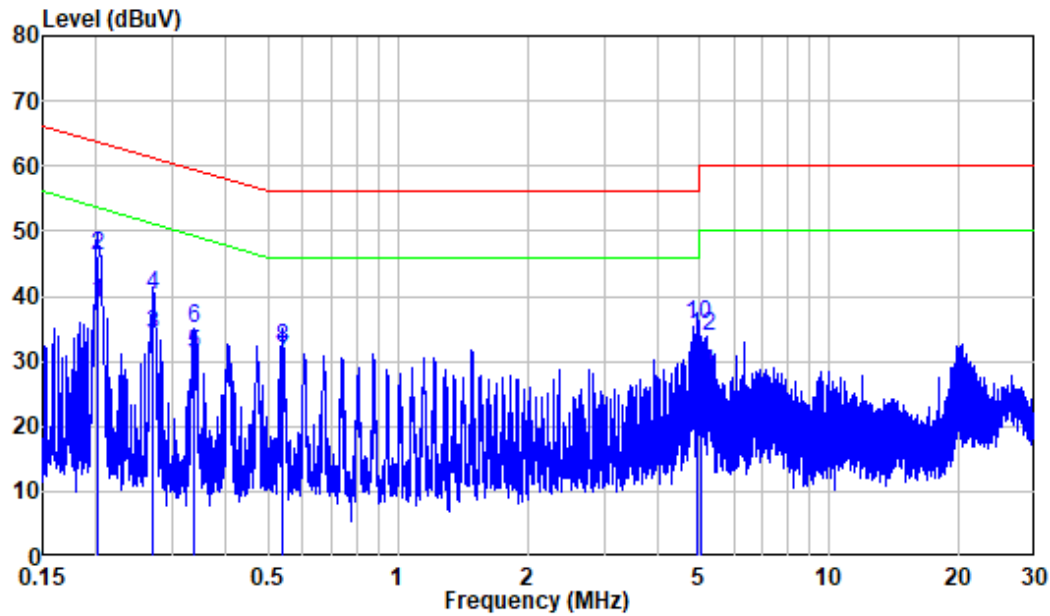
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.199	9.80	29.32	39.12	53.63	-14.51	Average
2	0.199	9.80	34.97	44.77	63.63	-18.86	QP
3	0.205	9.80	27.62	37.42	53.39	-15.97	Average
4	0.205	9.80	34.16	43.96	63.39	-19.43	QP
5	0.337	9.80	22.19	31.99	49.27	-17.28	Average
6	0.337	9.80	27.13	36.93	59.27	-22.34	QP
7	0.542	9.81	20.56	30.37	46.00	-15.63	Average
8	0.542	9.81	20.86	30.67	56.00	-25.33	QP
9	4.919	9.85	19.80	29.65	46.00	-16.35	Average
10	4.919	9.85	25.73	35.58	56.00	-20.42	QP
11	5.122	9.85	19.37	29.22	50.00	-20.78	Average
12	5.122	9.85	23.05	32.90	60.00	-27.10	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
 Condition: Neutral
 Mode : BLE 1MHz
 Model : DD7-MINI
 Power : AC 120V 60Hz

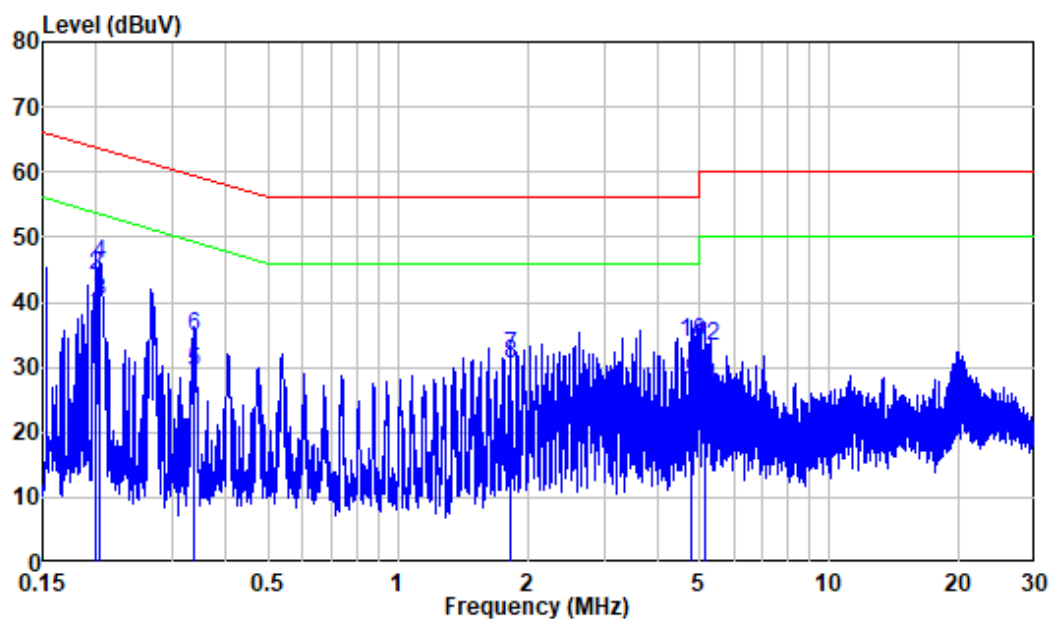
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.198	9.80	24.12	33.92	53.70	-19.78	Average
2	0.198	9.80	32.21	42.01	63.70	-21.69	QP
3	0.203	9.80	29.99	39.79	53.48	-13.69	Average
4	0.203	9.80	36.63	46.43	63.48	-17.05	QP
5	0.336	9.80	19.62	29.42	49.31	-19.89	Average
6	0.336	9.80	25.76	35.56	59.31	-23.75	QP
7	1.753	9.82	21.66	31.48	46.00	-14.52	Average
8	1.753	9.82	20.72	30.54	56.00	-25.46	QP
9	4.922	9.89	19.69	29.58	46.00	-16.42	Average
10	4.922	9.89	26.22	36.11	56.00	-19.89	QP
11	5.058	9.89	17.83	27.72	50.00	-22.28	Average
12	5.058	9.89	23.15	33.04	60.00	-26.96	QP

BLE 2MHz:**AC 120V/60 Hz, Line**

Site : Shielding Room
 Condition: Line
 Mode : BLE 2MHz
 Model : DD7-MINI
 Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBUV	dBUV	dBUV	dB	
1	0.201	9.80	29.22	39.02	53.57	-14.55	Average
2	0.201	9.80	36.45	46.25	63.57	-17.32	QP
3	0.270	9.80	24.21	34.01	51.12	-17.11	Average
4	0.270	9.80	30.46	40.26	61.12	-20.86	QP
5	0.337	9.80	21.36	31.16	49.28	-18.12	Average
6	0.337	9.80	25.31	35.11	59.28	-24.17	QP
7	0.540	9.81	20.51	30.32	46.00	-15.68	Average
8	0.540	9.81	22.32	32.13	56.00	-23.87	QP
9	4.922	9.85	19.60	29.45	46.00	-16.55	Average
10	4.922	9.85	25.77	35.62	56.00	-20.38	QP
11	5.058	9.85	18.34	28.19	50.00	-21.81	Average
12	5.058	9.85	23.83	33.68	60.00	-26.32	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
 Condition: Neutral
 Mode : BLE 2MHz
 Model : DD7-MINI
 Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.199	9.80	28.09	37.89	53.64	-15.75	Average
2	0.199	9.80	34.32	44.12	63.64	-19.52	QP
3	0.204	9.80	30.32	40.12	53.44	-13.32	Average
4	0.204	9.80	36.11	45.91	63.44	-17.53	QP
5	0.338	9.80	19.61	29.41	49.26	-19.85	Average
6	0.338	9.80	24.83	34.63	59.26	-24.63	QP
7	1.820	9.82	21.77	31.59	46.00	-14.41	Average
8	1.820	9.82	20.60	30.42	56.00	-25.58	QP
9	4.791	9.88	17.77	27.65	46.00	-18.35	Average
10	4.791	9.88	24.02	33.90	56.00	-22.10	QP
11	5.129	9.89	16.87	26.76	50.00	-23.24	Average
12	5.129	9.89	23.17	33.06	60.00	-26.94	QP

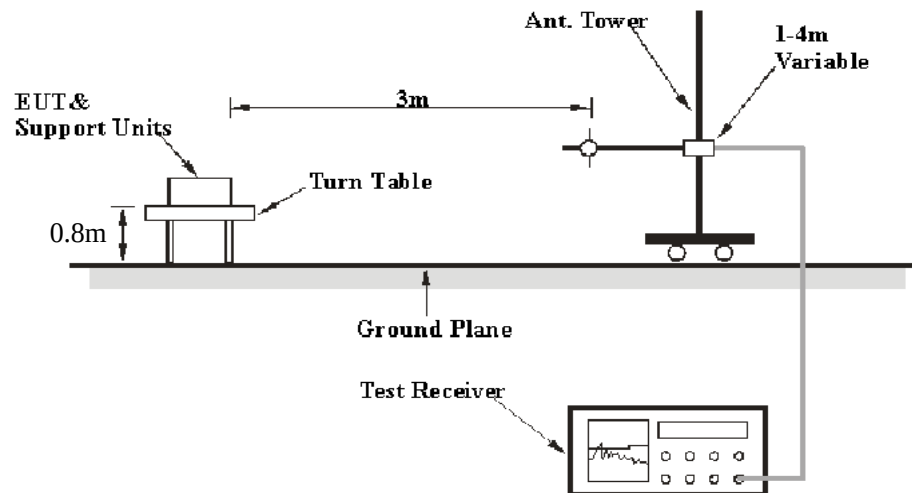
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

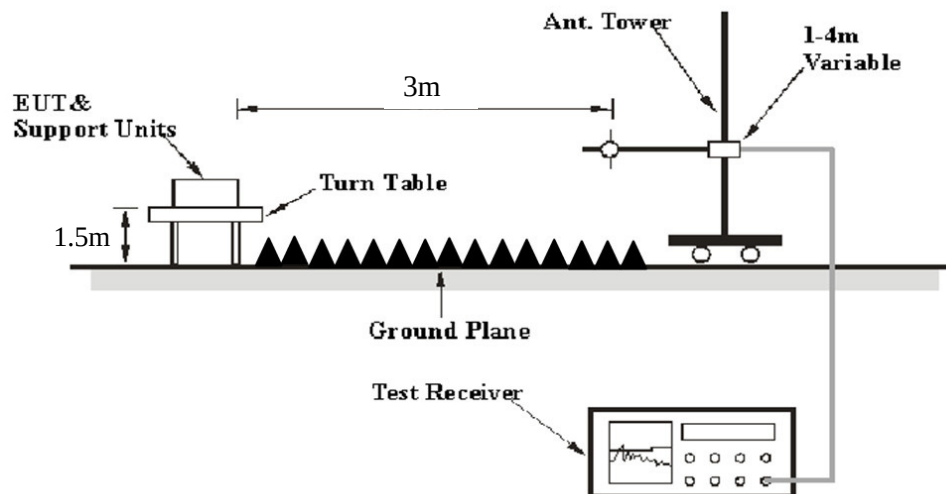
FCC §15.205; §15.209; §15.247(d)

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:

$$\text{Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Over Limit/Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

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

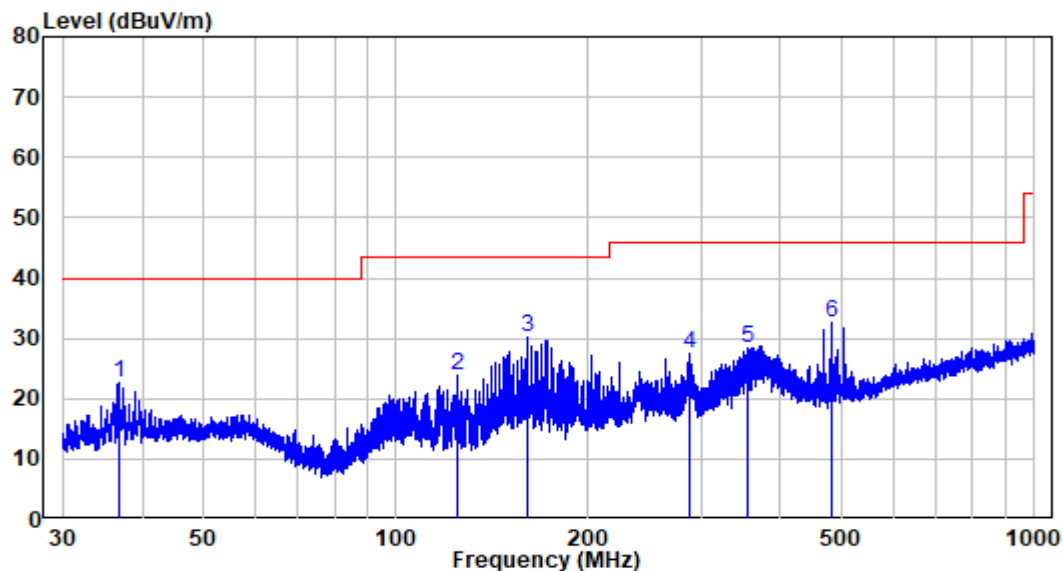
Test Data

Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	58-62 %
ATM Pressure:	101.0-101.2 kPa

The testing was performed by Level Li from 2022-07-15 to 2022-07-26.

EUT operation mode: BLE Transmitting (Scan with BLE 1M/2M mode at X axis, Y axis, Z axis, the worst case is at X axis)

Below 1GHz: BLE 1M High Channel (worst case)**Horizontal**

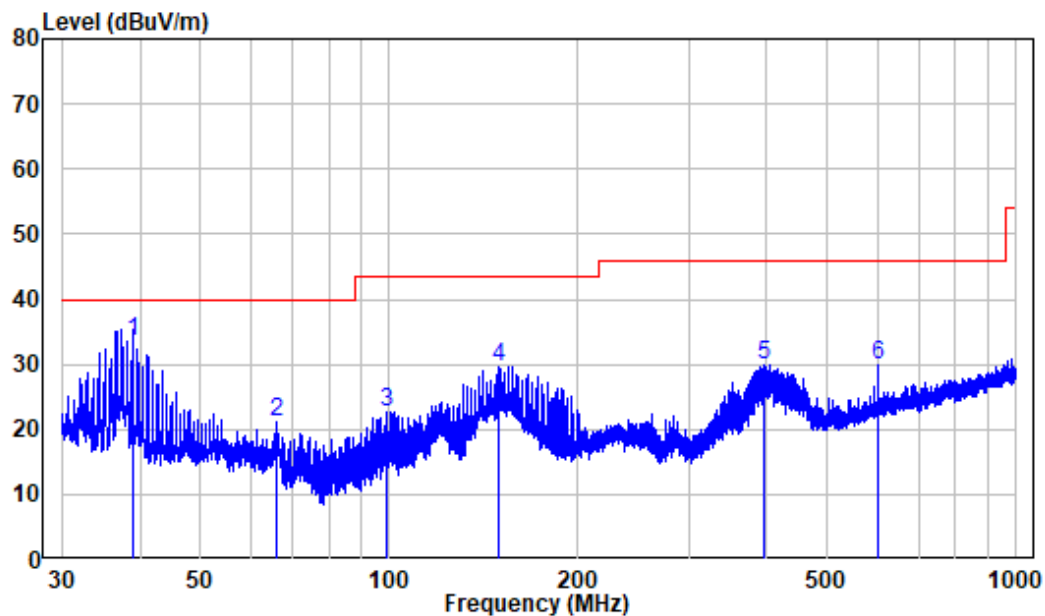
Site : chamber

Condition: 3m HORIZONTAL

Job No. : XMTN1220706-30454E-RF

Test Mode: BLE

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	36.702	-11.06	33.82	22.76	40.00	-17.24	Peak
2	124.351	-14.25	38.01	23.76	43.50	-19.74	Peak
3	160.909	-14.24	44.28	30.04	43.50	-13.46	Peak
4	287.990	-9.36	36.79	27.43	46.00	-18.57	Peak
5	354.805	-7.48	35.98	28.50	46.00	-17.50	Peak
6	480.107	-5.00	37.54	32.54	46.00	-13.46	Peak

Vertical

Site : chamber
Condition: 3m VERTICAL
Job No. : XMTN1220706-30454E-RF
Test Mode: BLE

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	38.922	-10.61	43.99	33.38	40.00	-6.62	QP
2	65.890	-12.85	33.96	21.11	40.00	-18.89	Peak
3	98.789	-12.08	34.84	22.76	43.50	-20.74	Peak
4	148.897	-15.34	44.93	29.59	43.50	-13.91	Peak
5	396.763	-6.78	36.66	29.88	46.00	-16.12	Peak
6	600.110	-2.43	32.25	29.82	46.00	-16.18	Peak

Above 1GHz:

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
BLE 1M, Low Channel									
2310	45.17	PK	65	2.0	H	-7.23	37.94	74	-36.06
2310	49.05	PK	161	1.9	V	-7.23	41.82	74	-32.18
2390	48.53	PK	114	1.6	H	-7.21	41.32	74	-32.68
2390	49.28	PK	44	1.7	V	-7.21	42.07	74	-31.93
4804	50.93	PK	44	1.7	H	-3.52	47.41	74	-26.59
4804	46.46	PK	336	1.5	V	-3.52	42.94	74	-31.06
7206	49.42	PK	114	1.6	H	2.71	52.13	74	-21.87
7206	43.97	PK	336	1.5	V	2.71	46.68	74	-27.32
BLE 1M, Middle Channel									
4880	50.14	PK	44	1.7	H	-3.38	46.76	74	-27.24
4880	46.48	PK	336	1.5	V	-3.38	43.1	74	-30.9
7320	47.64	PK	310	1.6	H	3.31	50.95	74	-23.05
7320	41.84	PK	356	1.5	V	3.31	45.15	74	-28.85
BLE 1M, High Channel									
2483.5	46.83	PK	168	1.7	H	-7.2	39.63	74	-34.37
2483.5	44.89	PK	173	1.9	V	-7.2	37.69	74	-36.31
2500	44.41	PK	42	1.3	H	-7.18	37.23	74	-36.77
2500	44.74	PK	231	2.1	V	-7.18	37.56	74	-36.44
4960	51.02	PK	231	2.1	H	-3.01	48.01	74	-25.99
4960	47.01	PK	103	1.4	V	-3.01	44	74	-30

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
BLE 2M, Low Channel									
2310	46.05	PK	4	1.0	H	-7.23	38.82	74	-35.18
2310	48.1	PK	256	1.8	V	-7.23	40.87	74	-33.13
2390	47.92	PK	85	1.5	H	-7.21	40.71	74	-33.29
2390	47.32	PK	50	1.2	V	-7.21	40.11	74	-33.89
4804	51.45	PK	50	1.2	H	-3.52	47.93	74	-26.07
4804	47.4	PK	69	1.3	V	-3.52	43.88	74	-30.12
7206	48.2	PK	85	1.5	H	2.71	50.91	74	-23.09
7206	45.11	PK	69	1.3	V	2.71	47.82	74	-26.18
BLE 2M, Middle Channel									
4880	50.14	PK	50	1.2	H	-3.38	46.76	74	-27.24
4880	46.5	PK	69	1.3	V	-3.38	43.12	74	-30.88
7320	47.73	PK	210	1.7	H	3.31	51.04	74	-22.96
7320	44	PK	179	1.8	V	3.31	47.31	74	-26.69
BLE 2M, High Channel									
2483.5	47.85	PK	297	1.2	H	-7.2	40.65	74	-33.35
2483.5	45.05	PK	254	1.4	V	-7.2	37.85	74	-36.15
2500	45.1	PK	62	1.3	H	-7.18	37.92	74	-36.08
2500	44.9	PK	189	1.4	V	-7.18	37.72	74	-36.28
4960	50.6	PK	189	1.4	H	-3.01	47.59	74	-26.41
4960	46.36	PK	20	1.8	V	-3.01	43.35	74	-30.65

Note:

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

Absolute Level (Corrected Amplitude) = Factor + Reading

Margin = Absolute Level - Limit

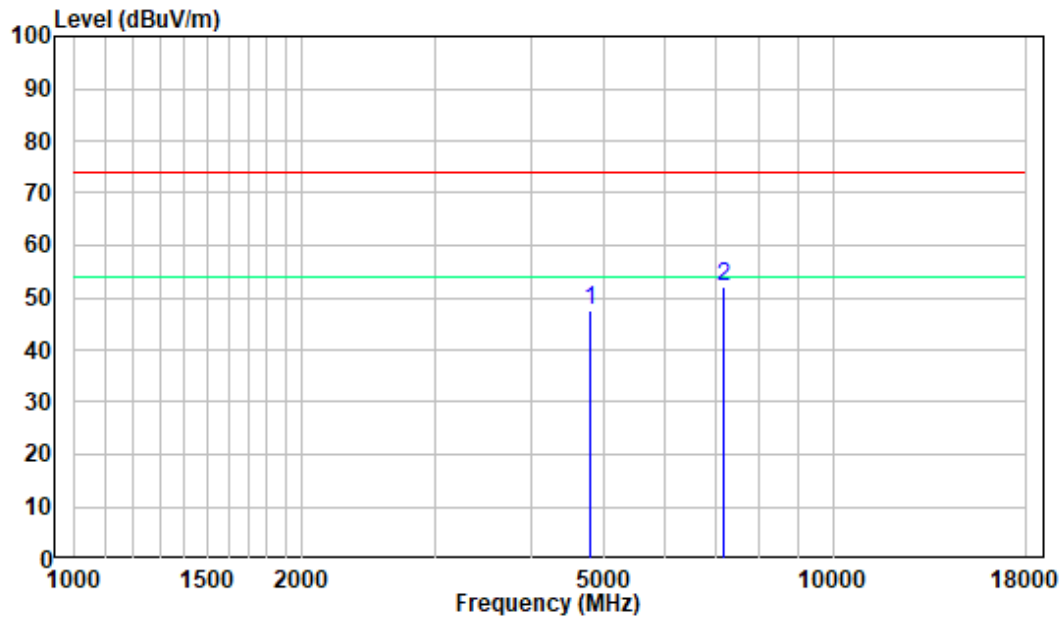
The other spurious emission which is in the noise floor level was not recorded.

For above 1GHz, the test result of peak was 20dB below to the limit of peak, which can be compliant to the average limit, so just peak value was recorded.

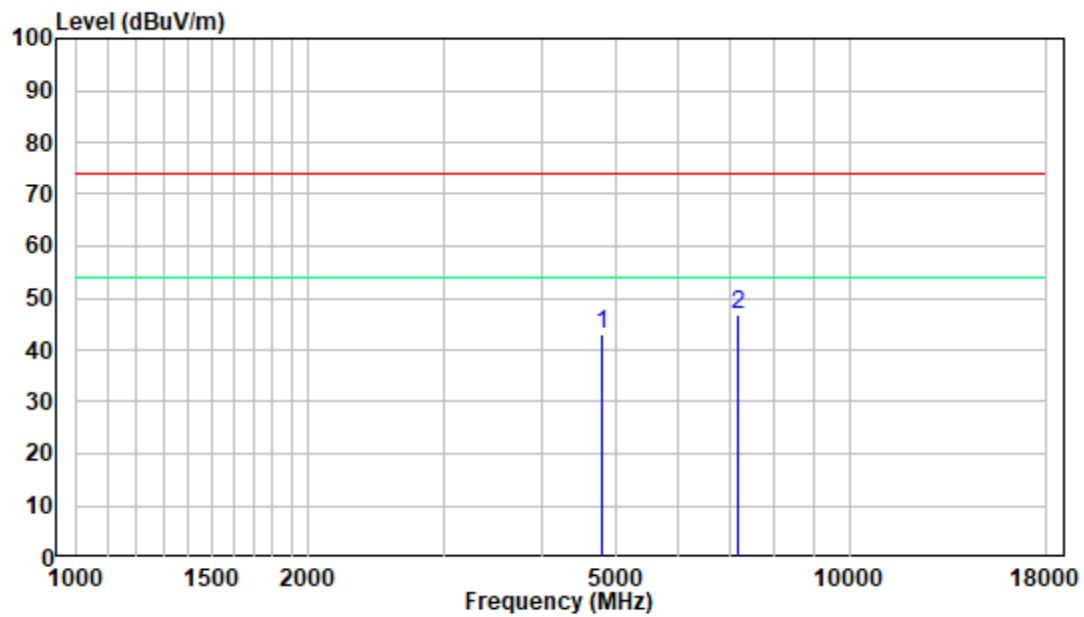
1 GHz - 18 GHz: (Pre-Scan plots)

BLE 1M Low Channel (worst case)

Horizontal



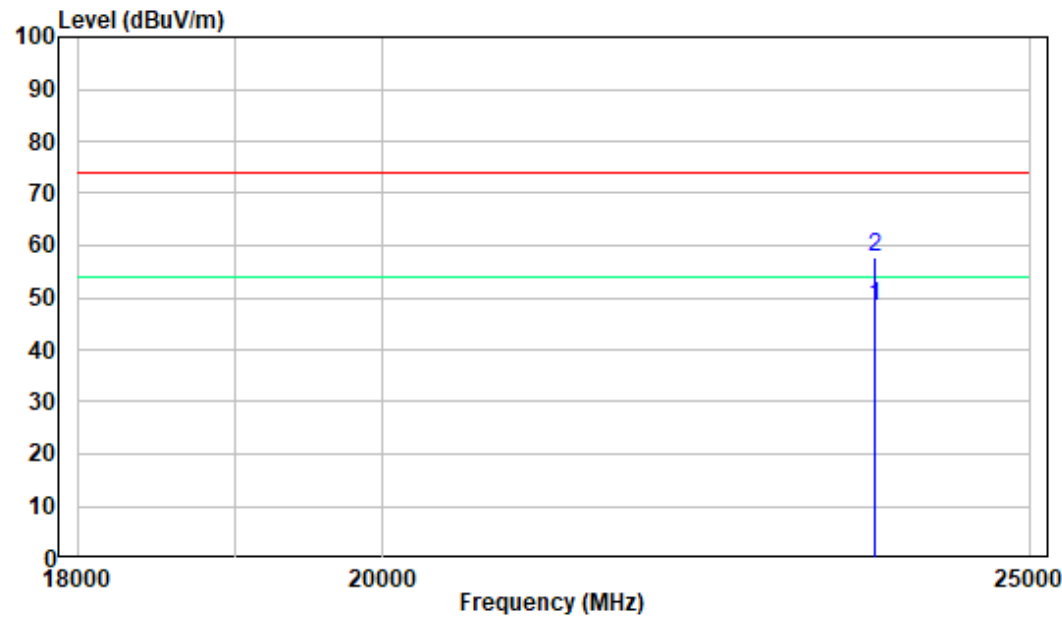
Vertical



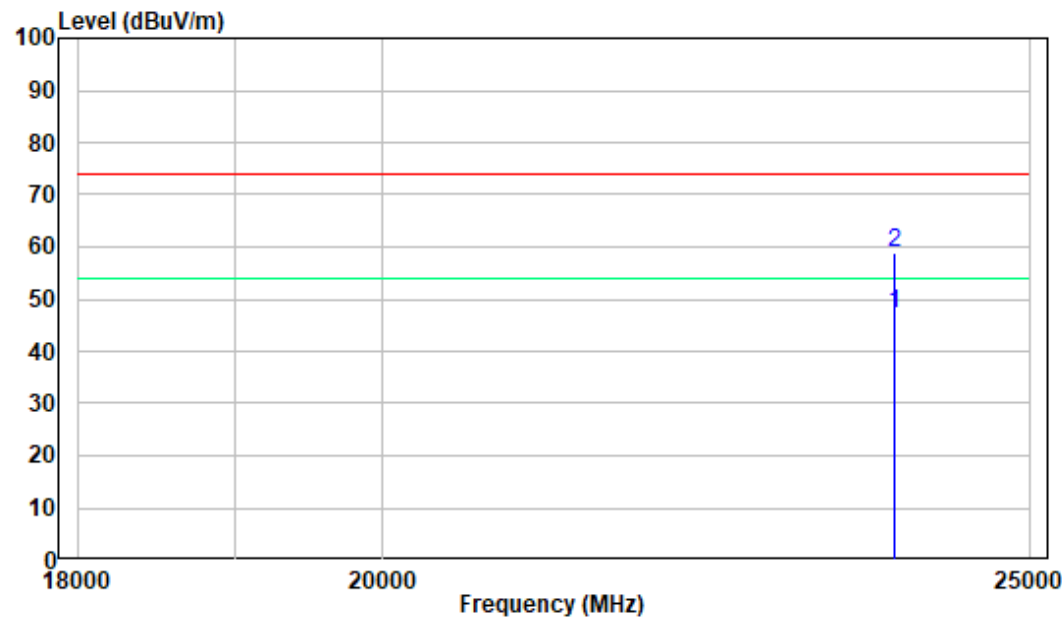
18-25GHz: (Pre-Scan plots)

BLE 1M Low Channel (worst case)

Horizontal



Vertical



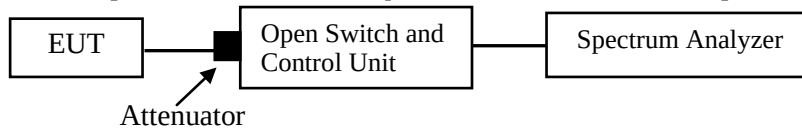
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH

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

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



Test Data

Environmental Conditions

Temperature:	26°C
Relative Humidity:	52%
ATM Pressure:	101.2 kPa

The testing was performed by Glenn.Jiang on 2022-08-11.

EUT operation mode: Transmitting

Test Result

Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.696	0.5	PASS
		2440	0.708	0.5	PASS
		2480	0.700	0.5	PASS
BLE_2M	Ant1	2402	1.396	0.5	PASS
		2440	1.392	0.5	PASS
		2480	1.328	0.5	PASS

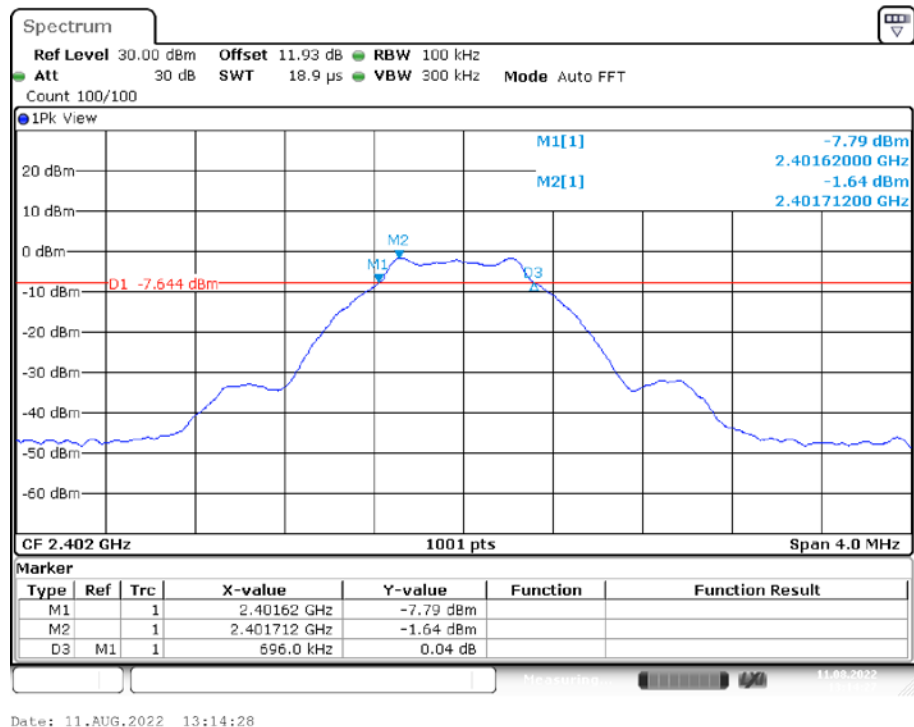
Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.027	2401.449	2402.484	---	PASS
		2440	1.035	2439.225	2440.655	---	PASS
		2480	1.043	2479.433	2480.492	---	PASS
BLE_2M	Ant1	2402	2.082	2400.917	2403.007	---	PASS
		2440	2.082	2438.861	2441.035	---	PASS
		2480	2.102	2478.901	2481.011	---	PASS

Please refer to the below plots:

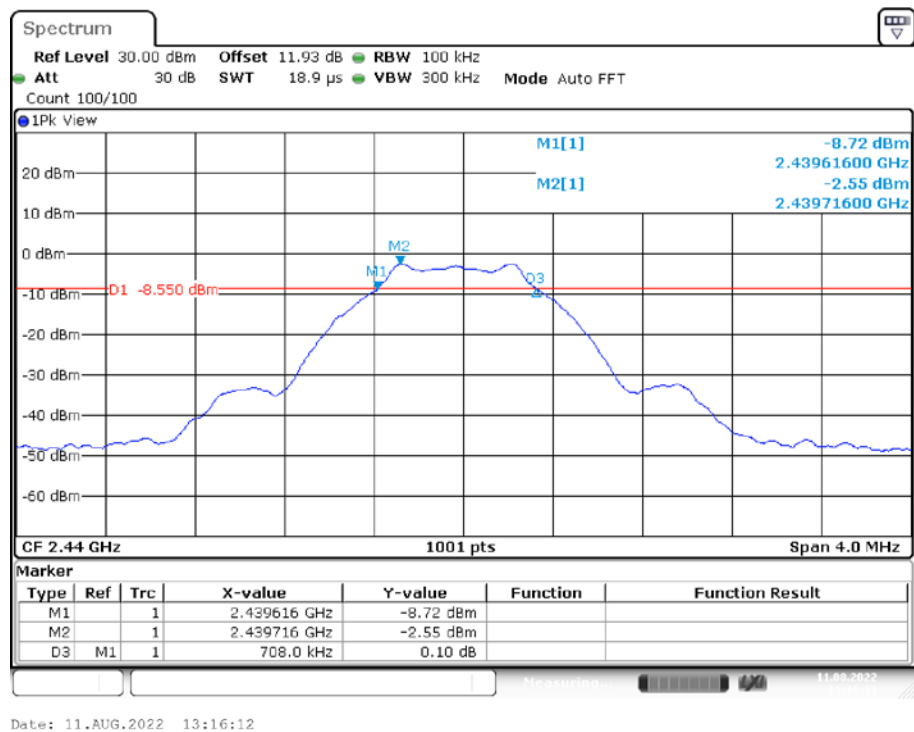
BLE_1M

6 dB EMISSION BANDWIDTH

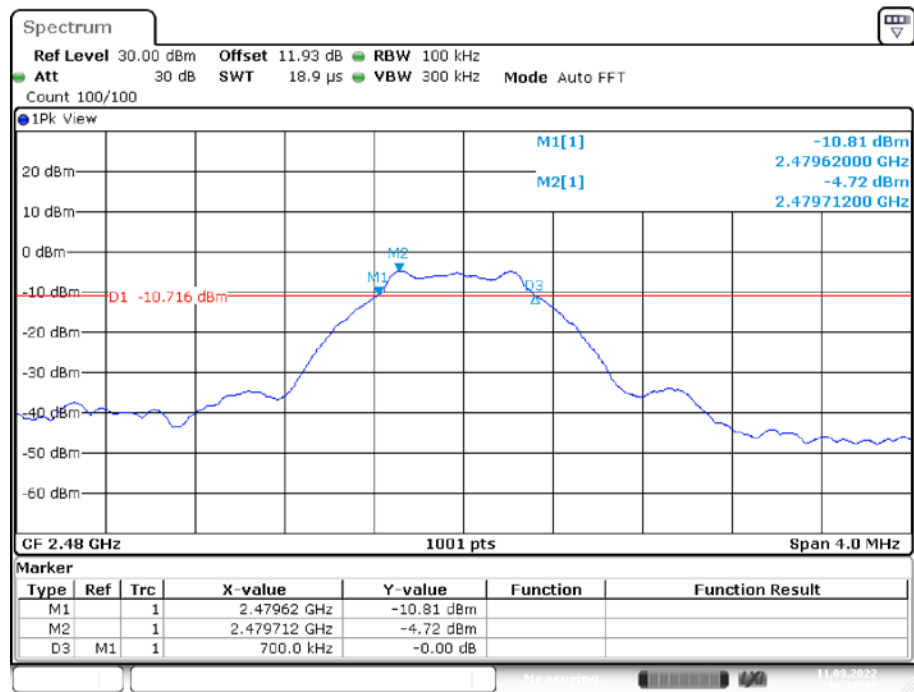
Low Channel



Middle Channel



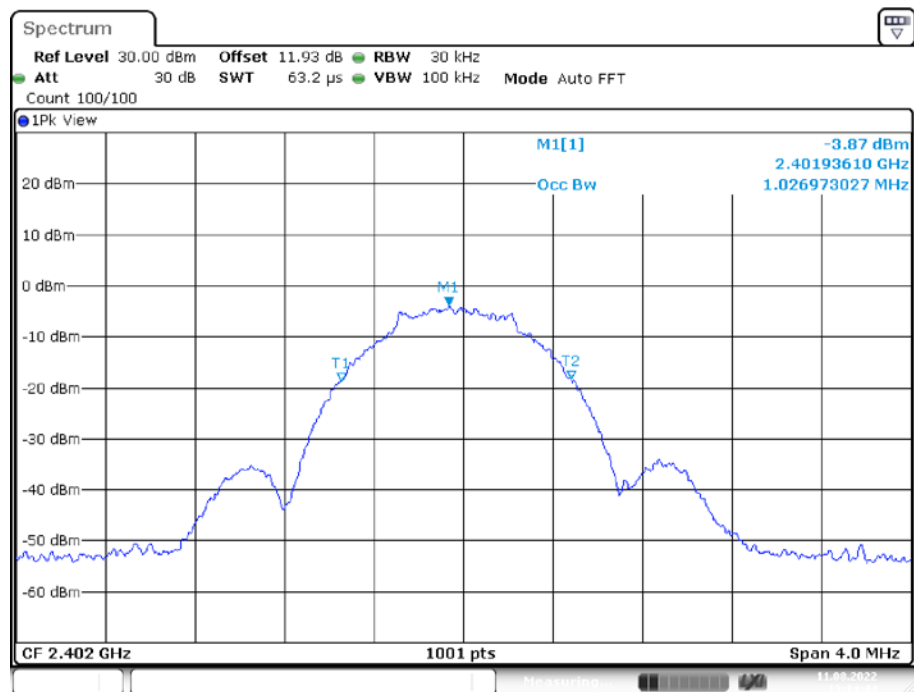
High Channel



Date: 11.AUG.2022 13:17:18

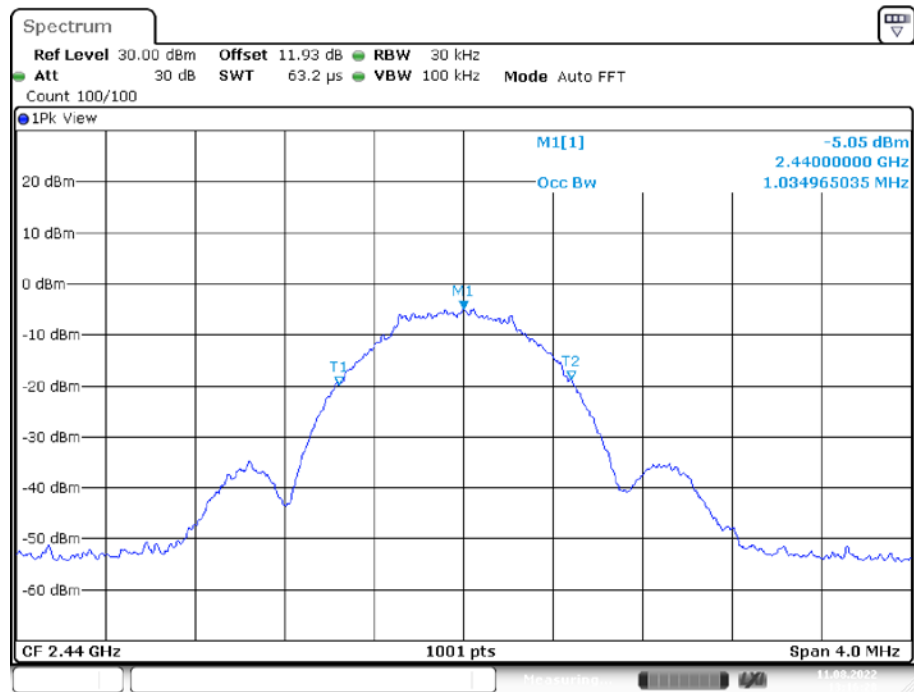
OCCUPIED BANDWIDTH

Low Channel



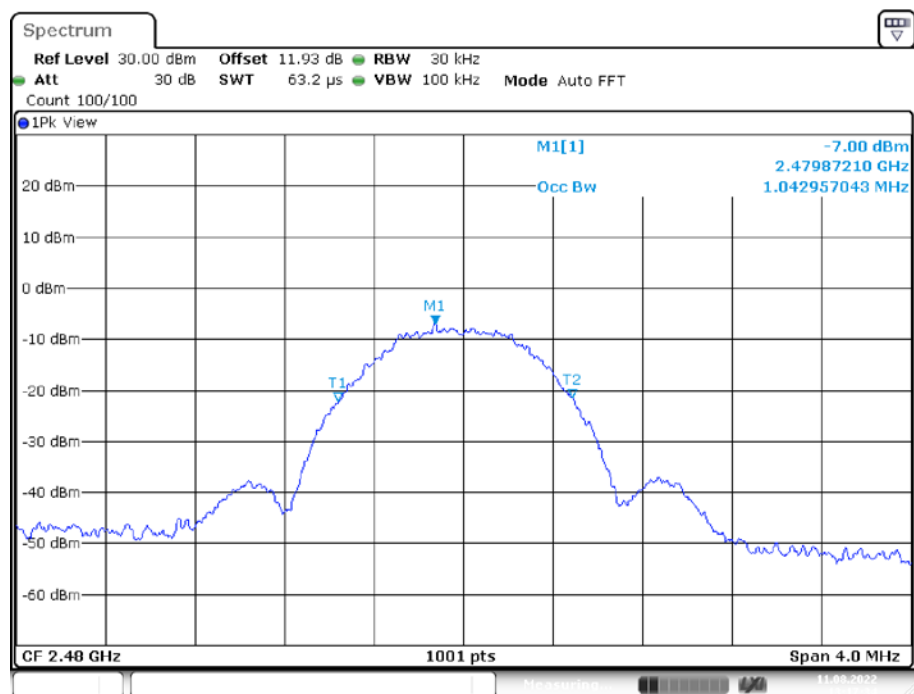
Date: 11.AUG.2022 13:14:45

Middle Channel



Date: 11.AUG.2022 13:16:29

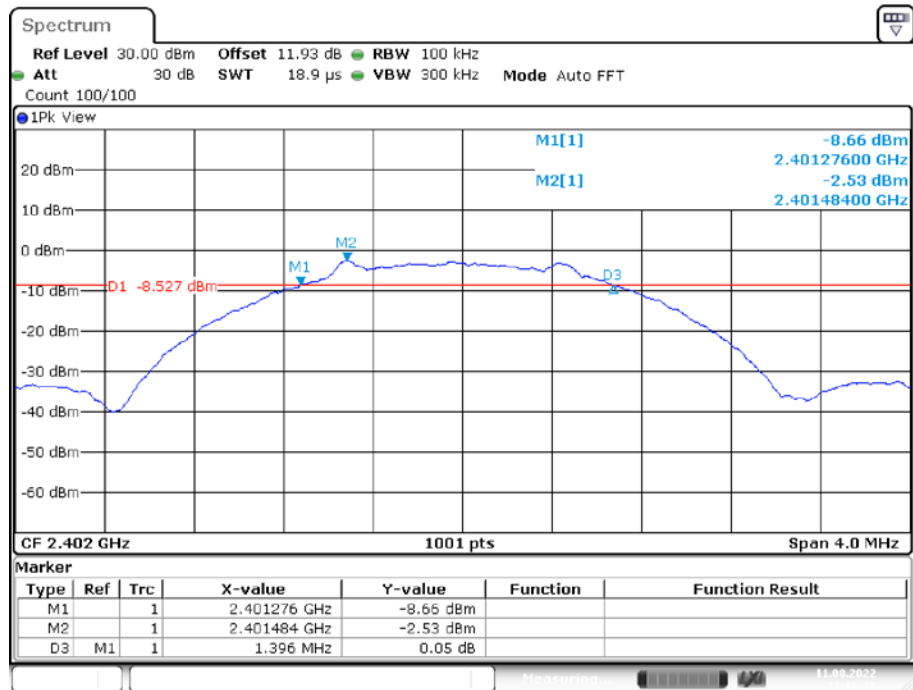
High Channel



Date: 11.AUG.2022 13:17:35

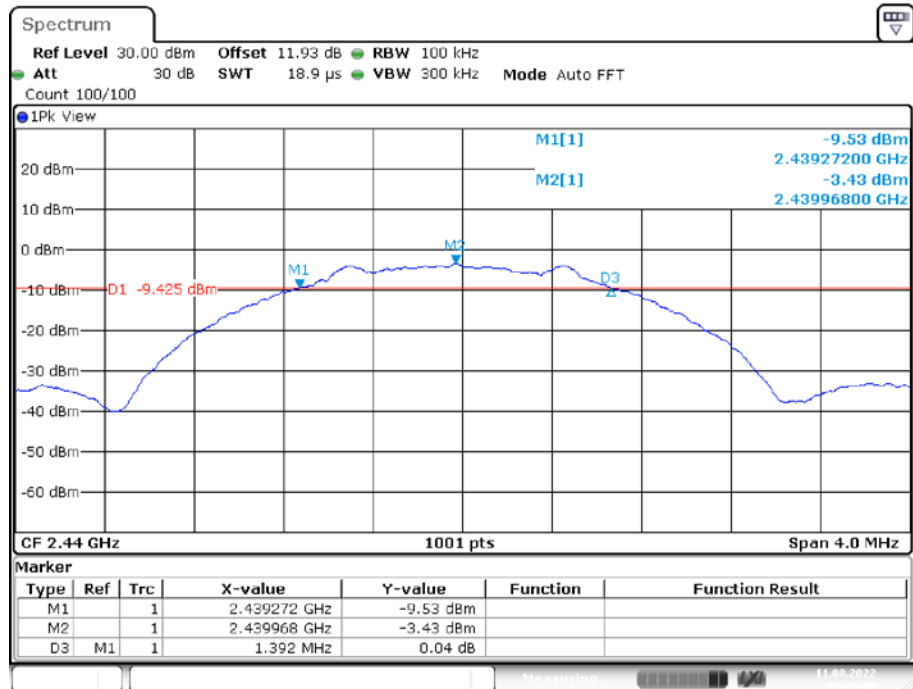
BLE_2M
6 dB EMISSION BANDWIDTH

Low Channel



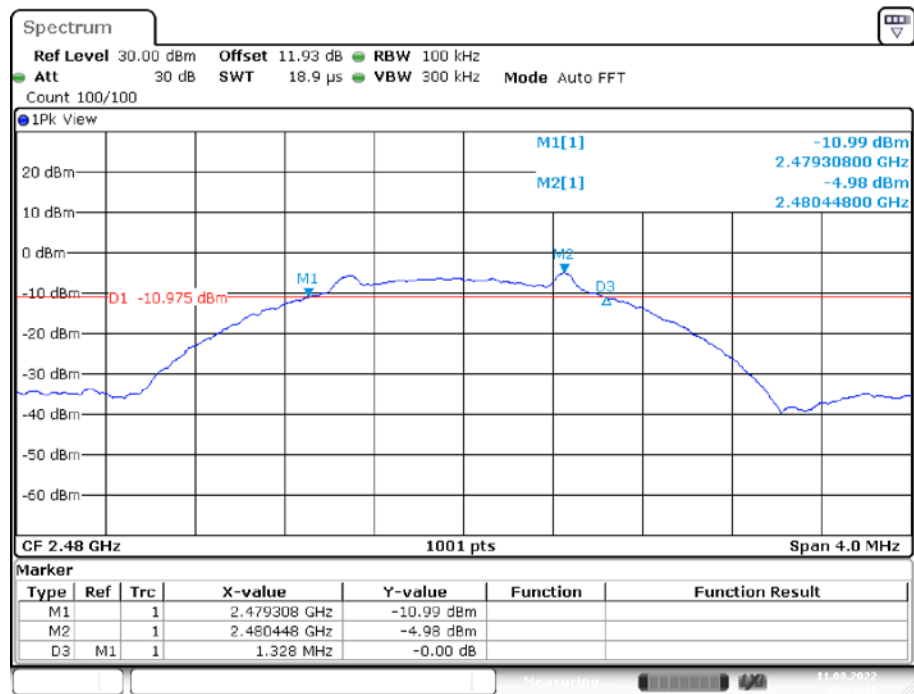
Date: 11.AUG.2022 13:18:39

Middle Channel



Date: 11.AUG.2022 13:20:01

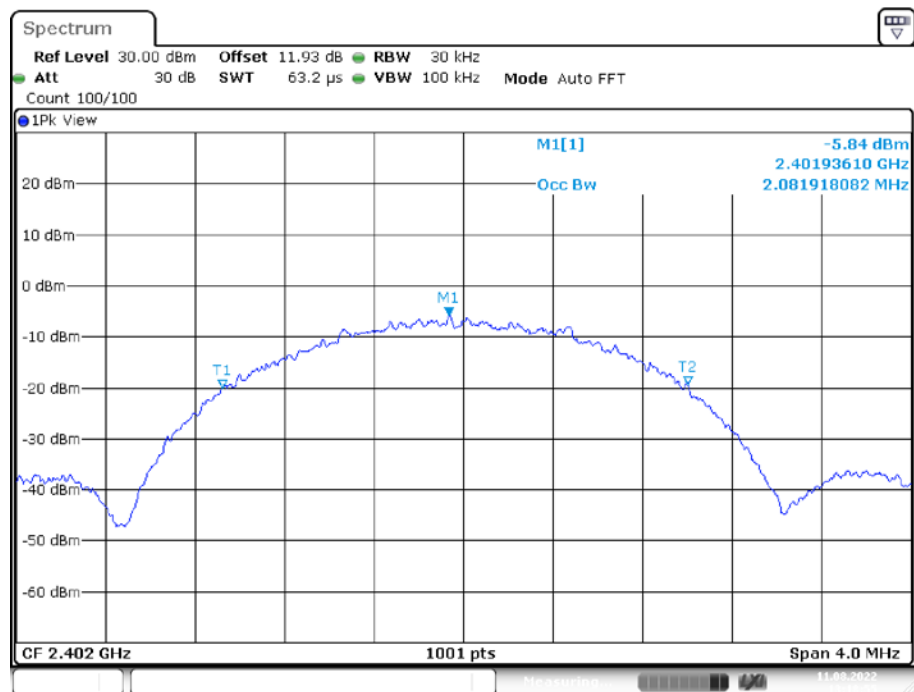
High Channel



Date: 11.AUG.2022 13:21:11

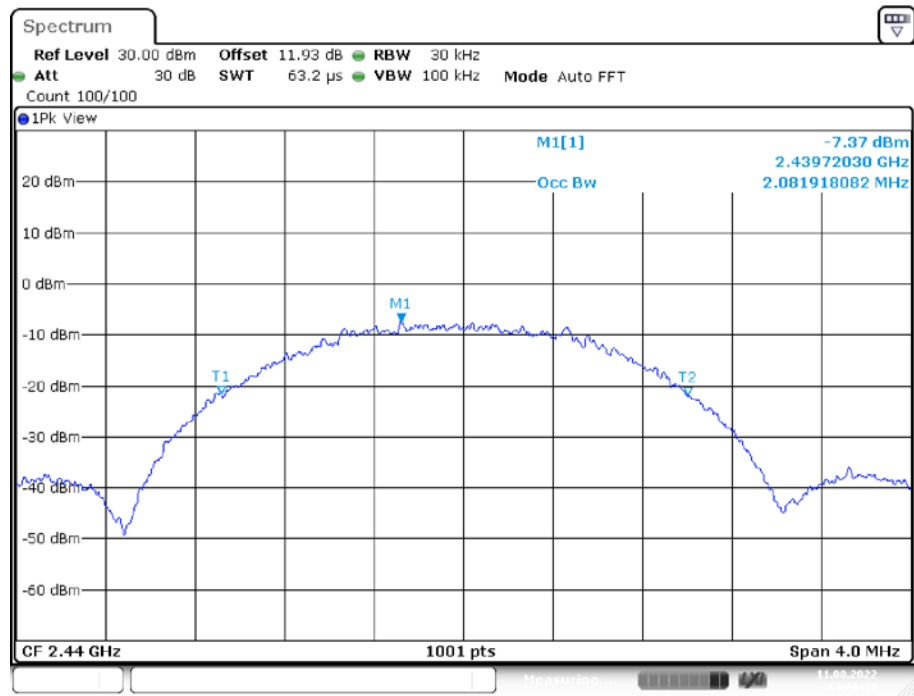
OCCUPIED BANDWIDTH

Low Channel

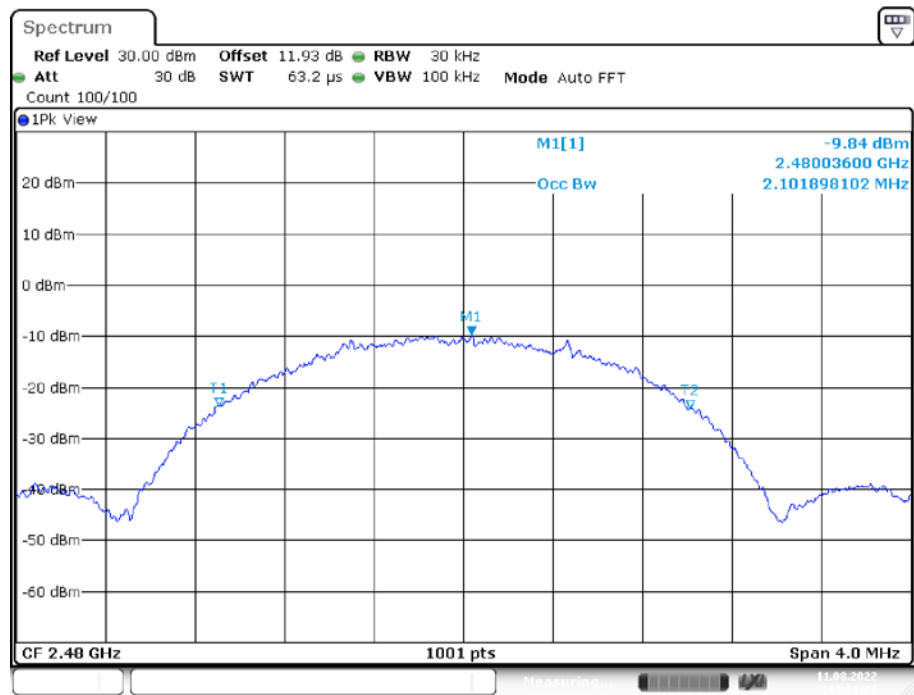


Date: 11.AUG.2022 13:18:56

Middle Channel



High Channel



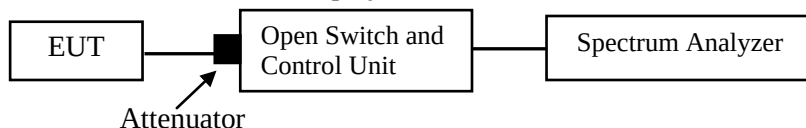
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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

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



Test Data

Environmental Conditions

Temperature:	26°C
Relative Humidity:	52%
ATM Pressure:	101.2 kPa

The testing was performed by Glenn.Jiang on 2022-08-10.

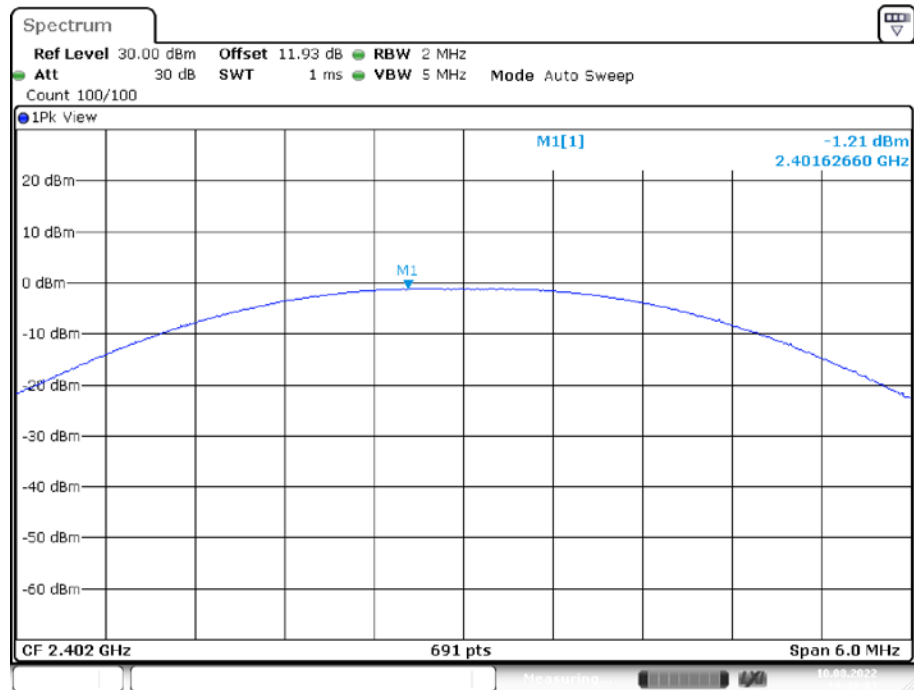
EUT operation mode: Transmitting

Test Result

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-1.21	<=30	PASS
		2440	-1.98	<=30	PASS
		2480	-3.79	<=30	PASS
BLE_2M	Ant1	2402	-1.26	<=30	PASS
		2440	-1.98	<=30	PASS
		2480	-3.5	<=30	PASS

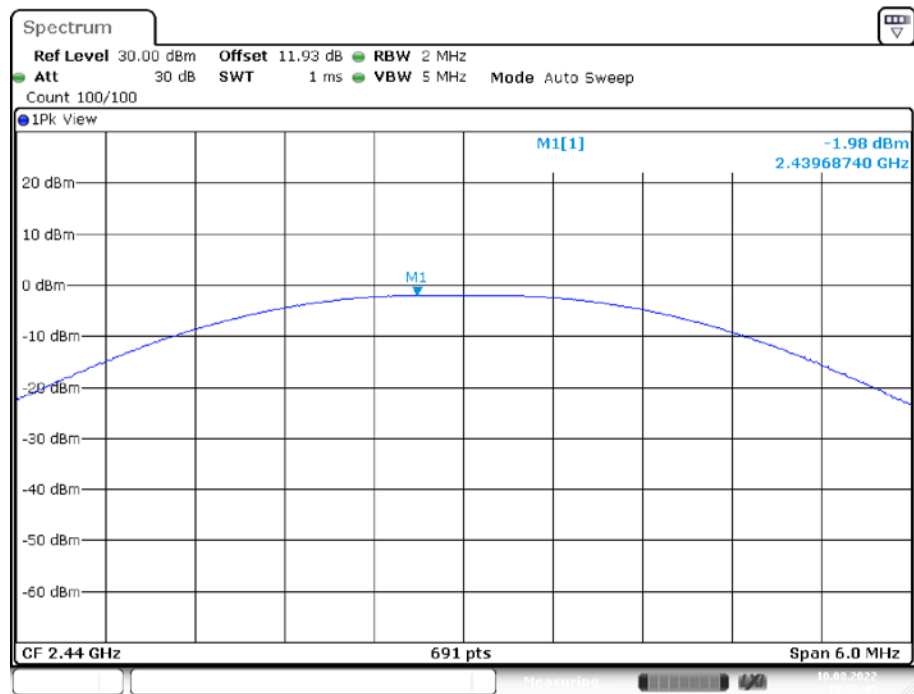
Please refer to the below plots:

BLE_1M_Ant1_2402



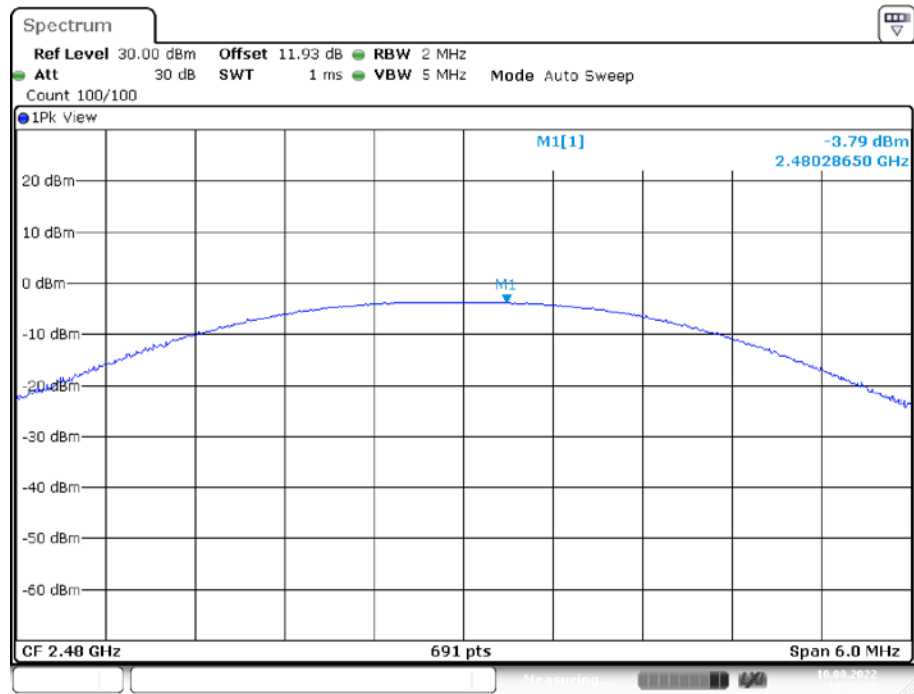
Date: 10.AUG.2022 19:48:03

BLE_1M_Ant1_2440



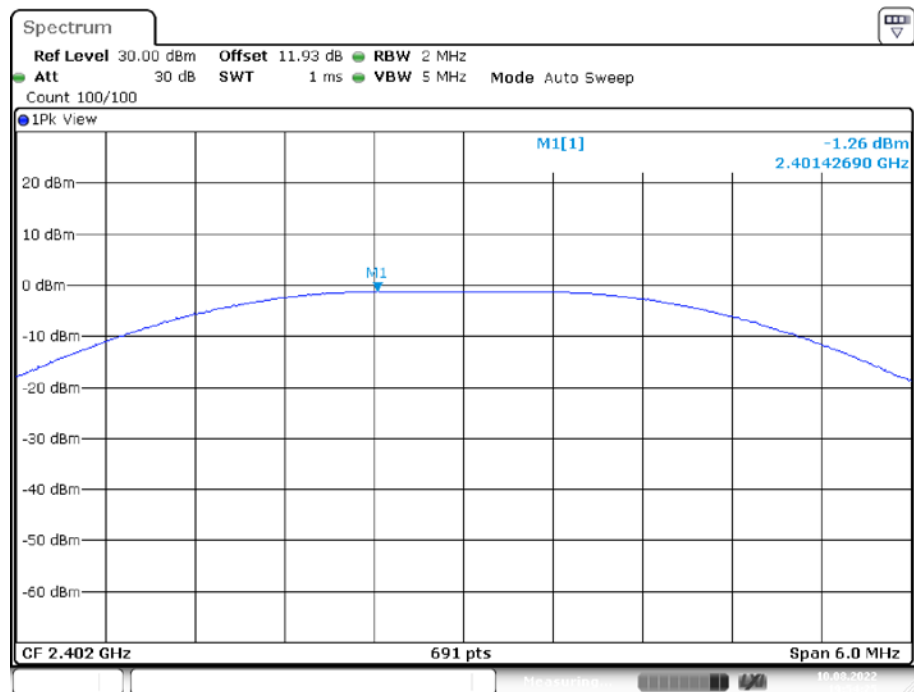
Date: 10.AUG.2022 19:50:45

BLE_1M_Ant1_2480



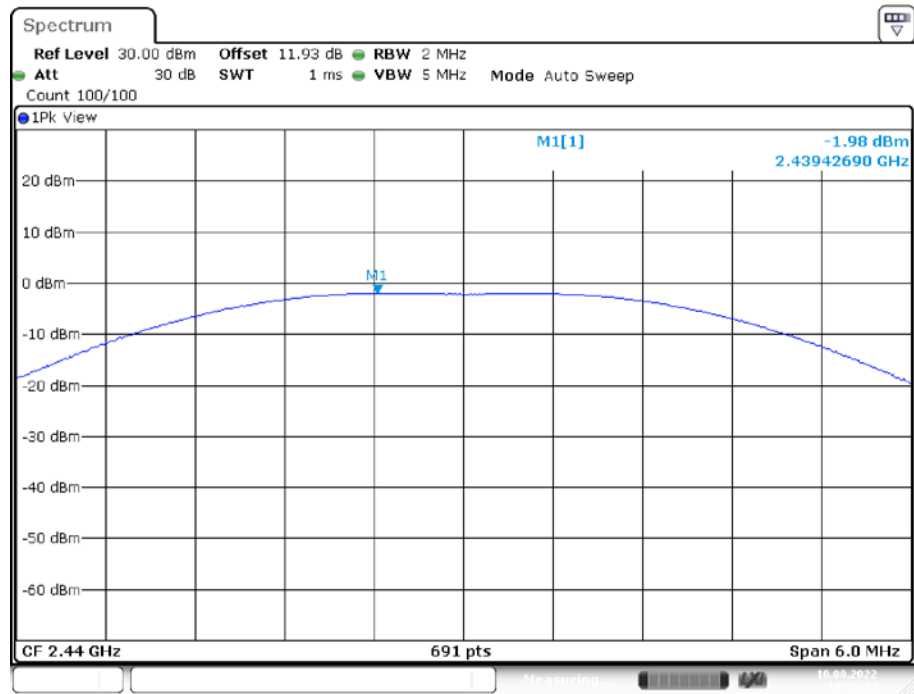
Date: 10.AUG.2022 19:51:59

BLE_2M_Ant1_2402

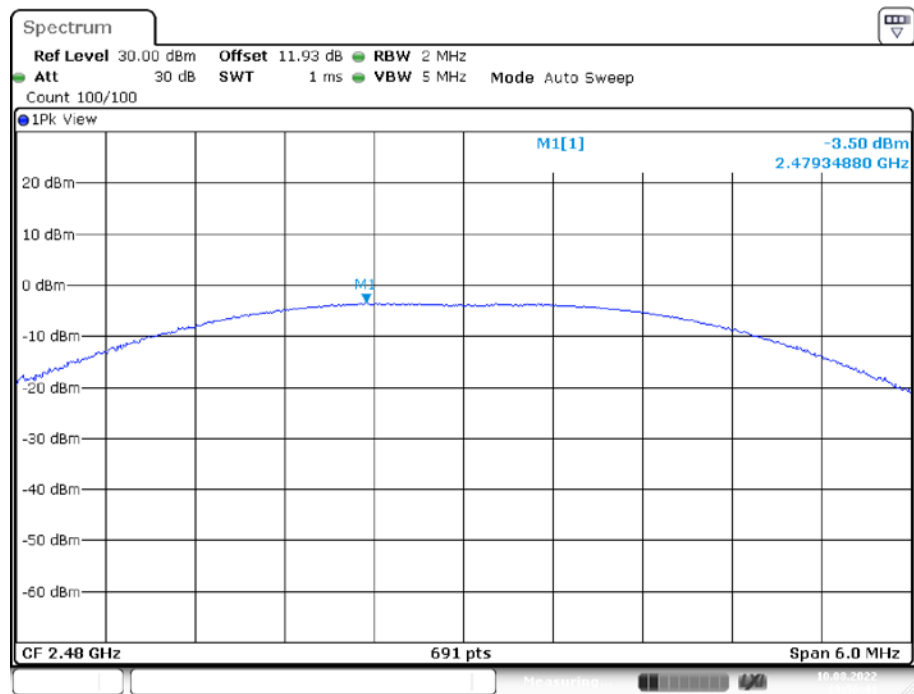


Date: 10.AUG.2022 19:54:25

BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



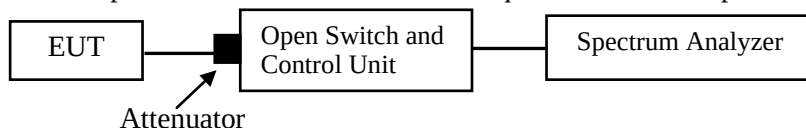
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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

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



Test Data

Environmental Conditions

Temperature:	26°C
Relative Humidity:	52%
ATM Pressure:	101.2 kPa

The testing was performed by Glenn.Jiang on 2022-08-11.

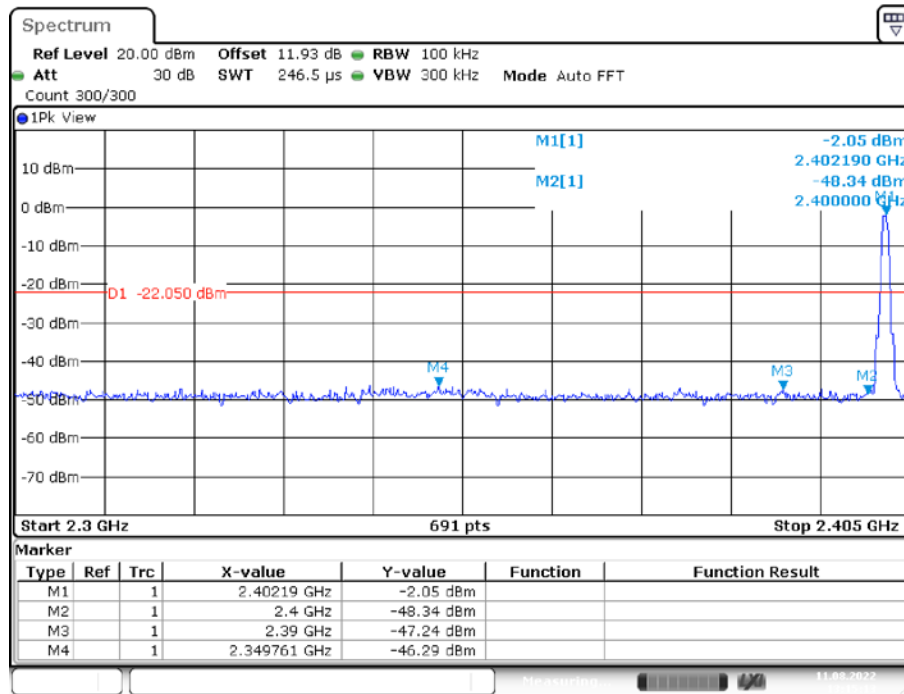
EUT operation mode: Transmitting

Test Result: Compliant.

Please refer to the below plots:

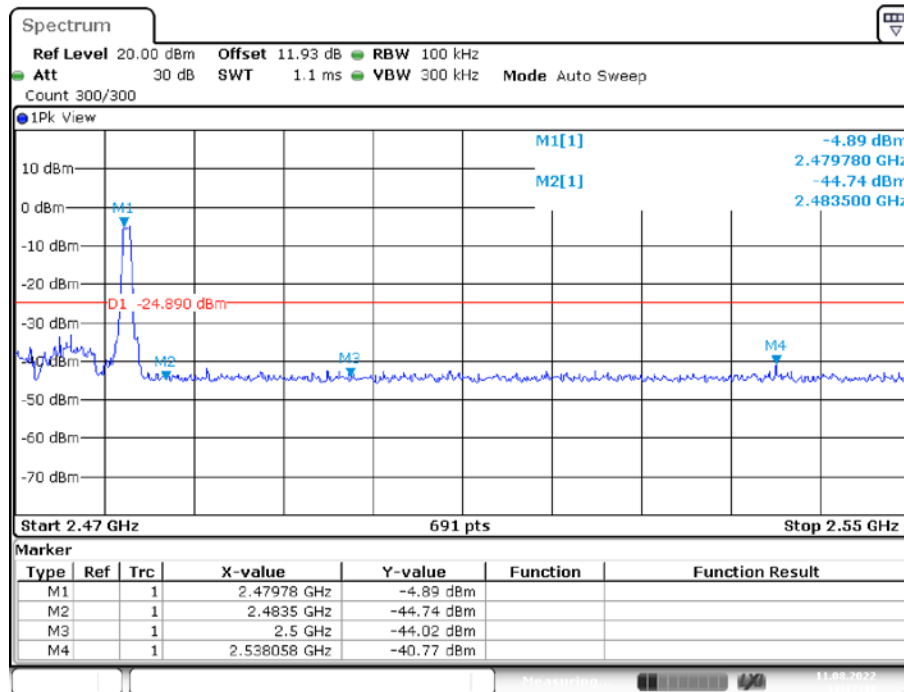
BLE_1M

Low Channel



Date: 11.AUG.2022 13:15:13

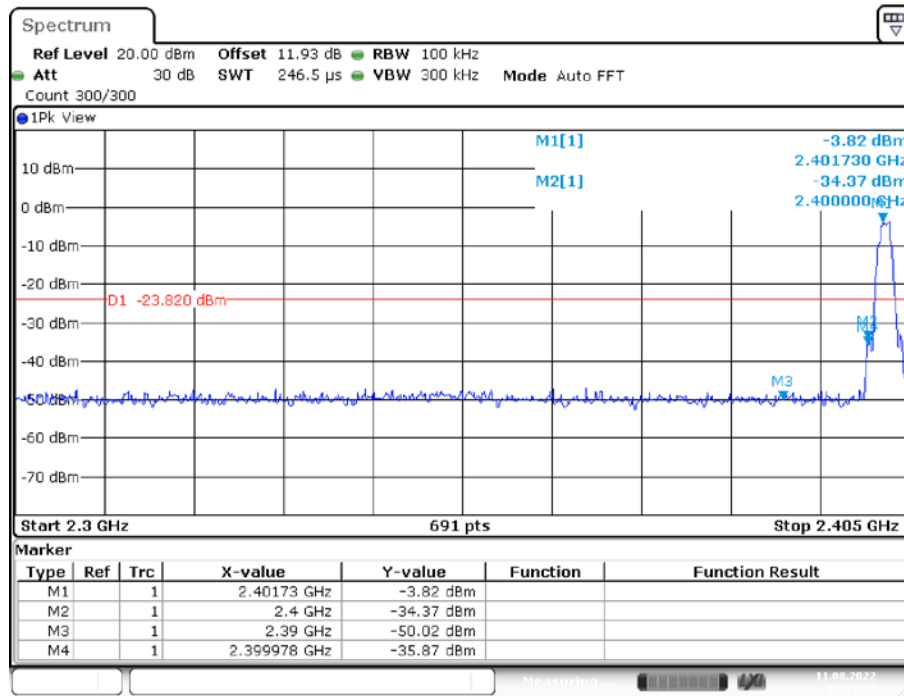
High Channel



Date: 11.AUG.2022 13:17:50

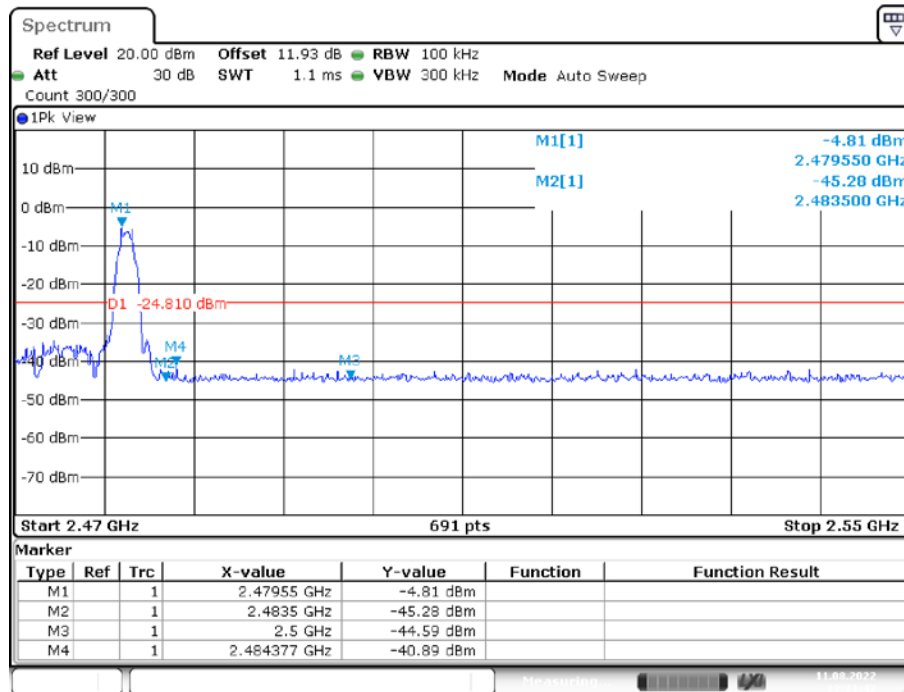
BLE_2M

Low Channel



Date: 11.AUG.2022 13:19:11

High Channel



Date: 11.AUG.2022 13:21:43

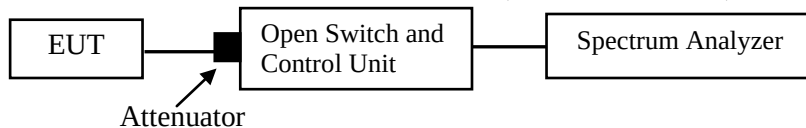
FCC §15.247(e) - POWER SPECTRAL DENSITY

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

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: $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
3. Set the VBW $\geq 3 \times \text{RBW}$.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	26°C
Relative Humidity:	52%
ATM Pressure:	101.2 kPa

The testing was performed by Glenn.Jiang on 2022-08-11.

EUT operation mode: Transmitting

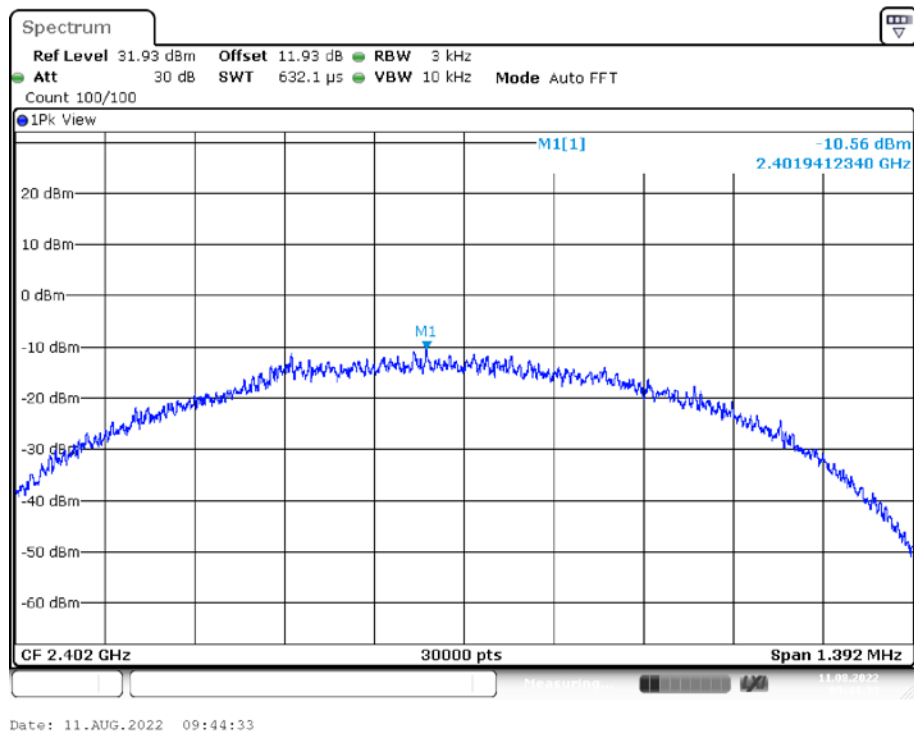
Test Result

Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-10.56	≤ 8	PASS
		2440	-11.75	≤ 8	PASS
		2480	-12.45	≤ 8	PASS
BLE_2M	Ant1	2402	-14.70	≤ 8	PASS
		2440	-15.36	≤ 8	PASS
		2480	-16.99	≤ 8	PASS

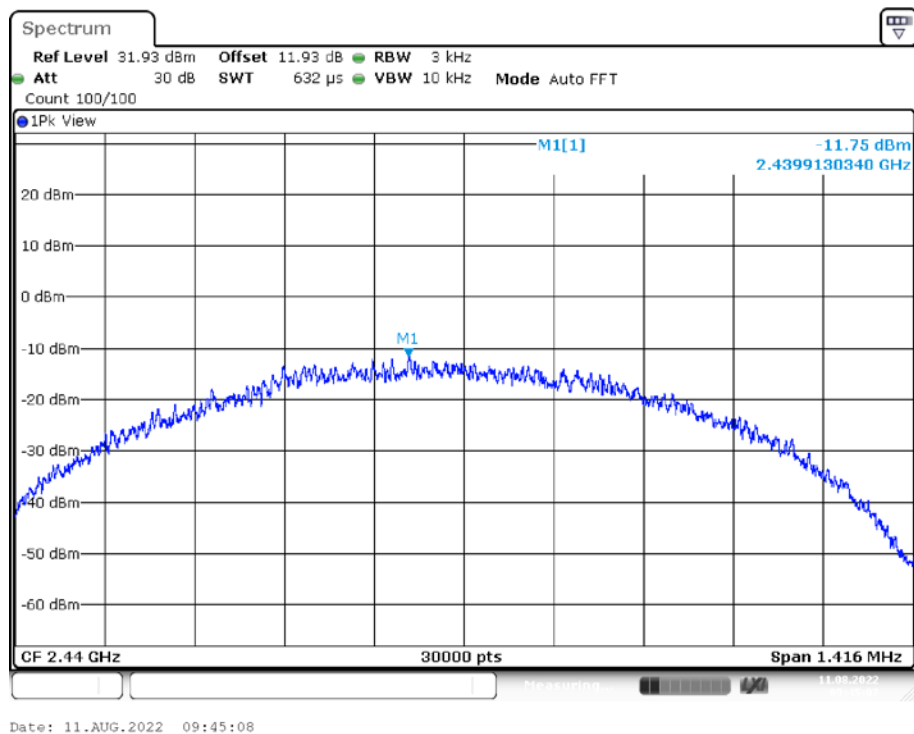
Please refer to the below plots:

BLE_1M

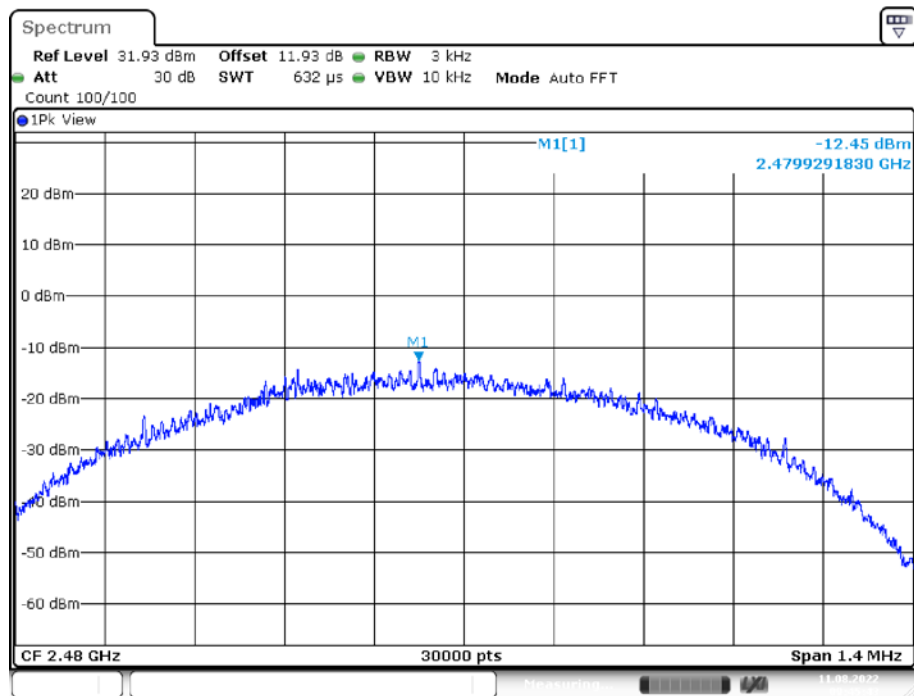
Low Channel



Middle Channel



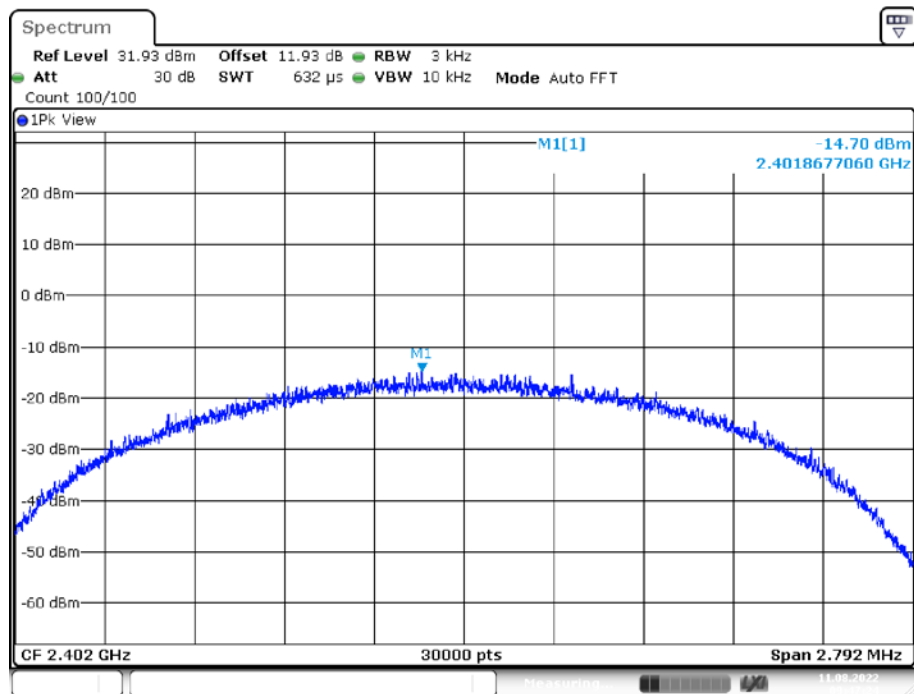
High Channel



Date: 11.AUG.2022 09:45:43

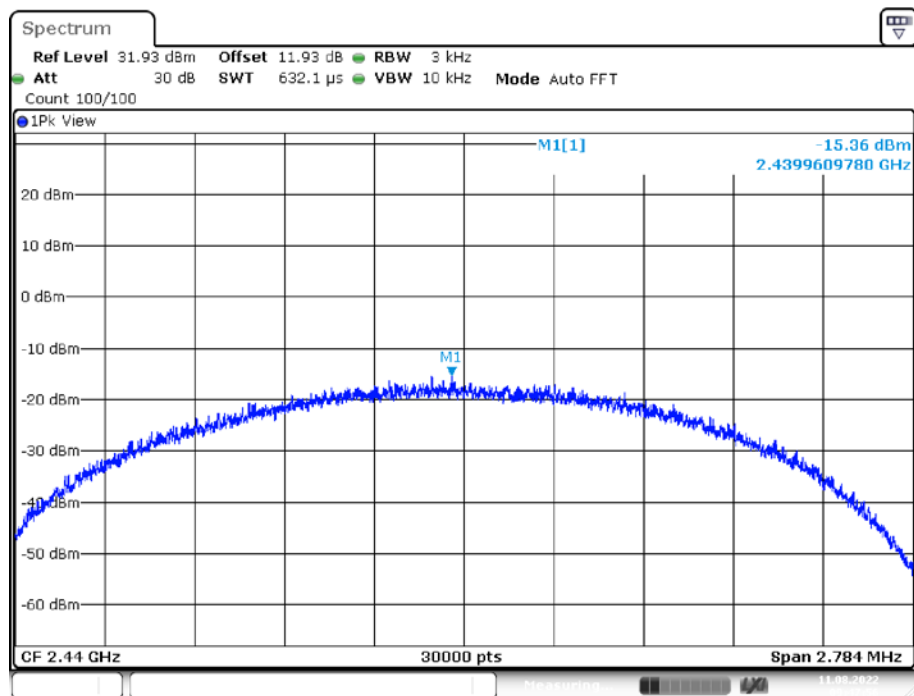
BLE_2M

Low Channel



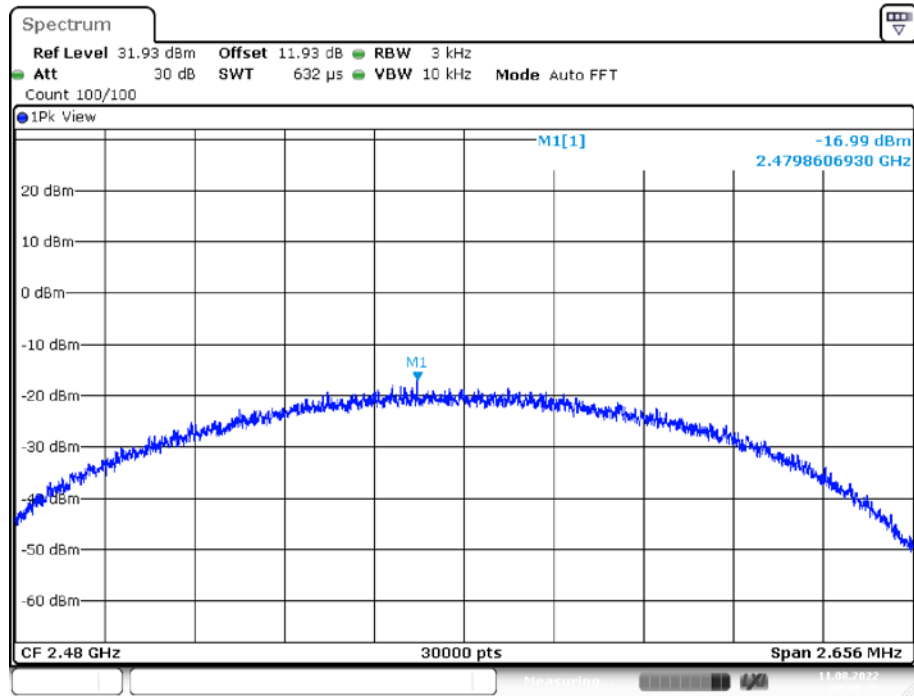
Date: 11.AUG.2022 09:47:25

Middle Channel



Date: 11.AUG.2022 09:47:56

High Channel



FCC §15.247(G) - DUTY CYCLE

Test Data

Environmental Conditions

Temperature:	26°C
Relative Humidity:	52%
ATM Pressure:	101.2 kPa

The testing was performed by Glenn.Jiang on 2022-08-11.

EUT operation mode: Transmitting

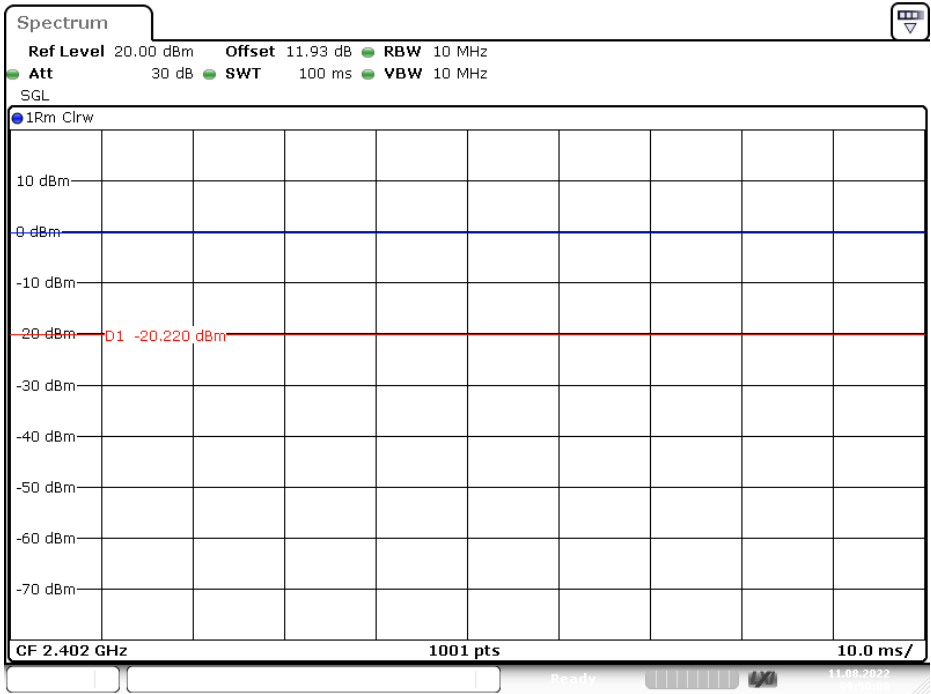
Test Result

Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
BLE_1M	Ant1	2402	100	100	100
		2440	100	100	100
		2480	100	100	100
BLE_2M	Ant1	2402	100	100	100
		2440	100	100	100
		2480	100	100	100

Please refer to the below plots:

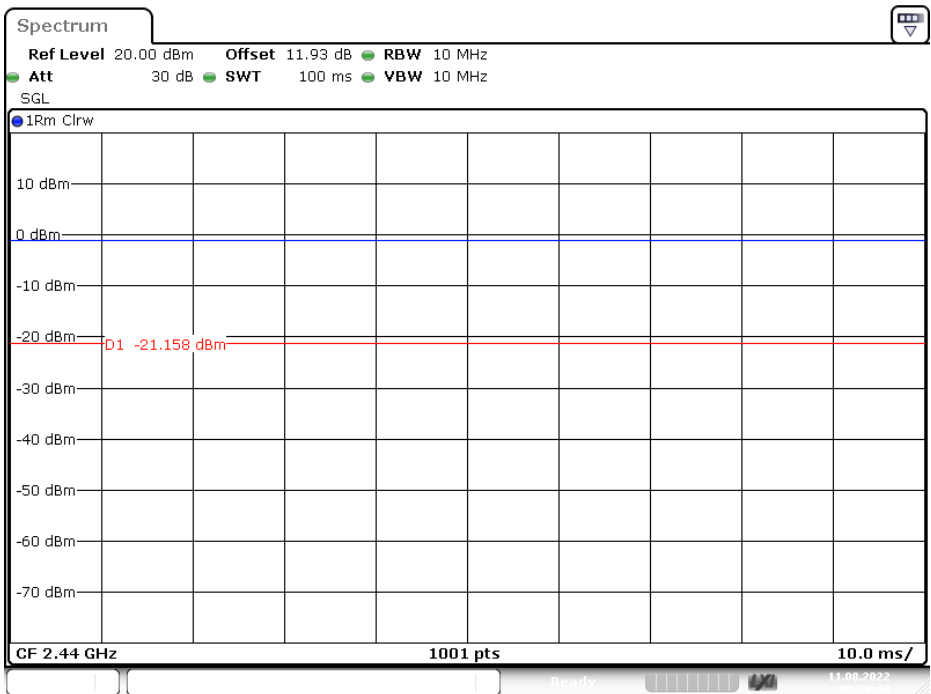
BLE_1M

Low Channel



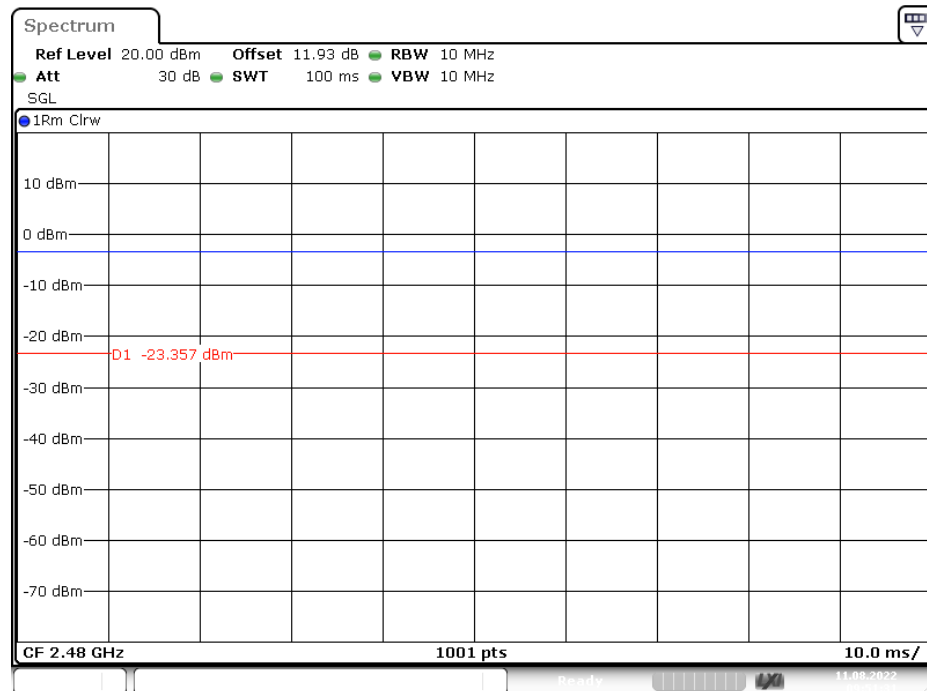
Date: 11.AUG.2022 09:50:00

Middle Channel



Date: 11.AUG.2022 09:50:44

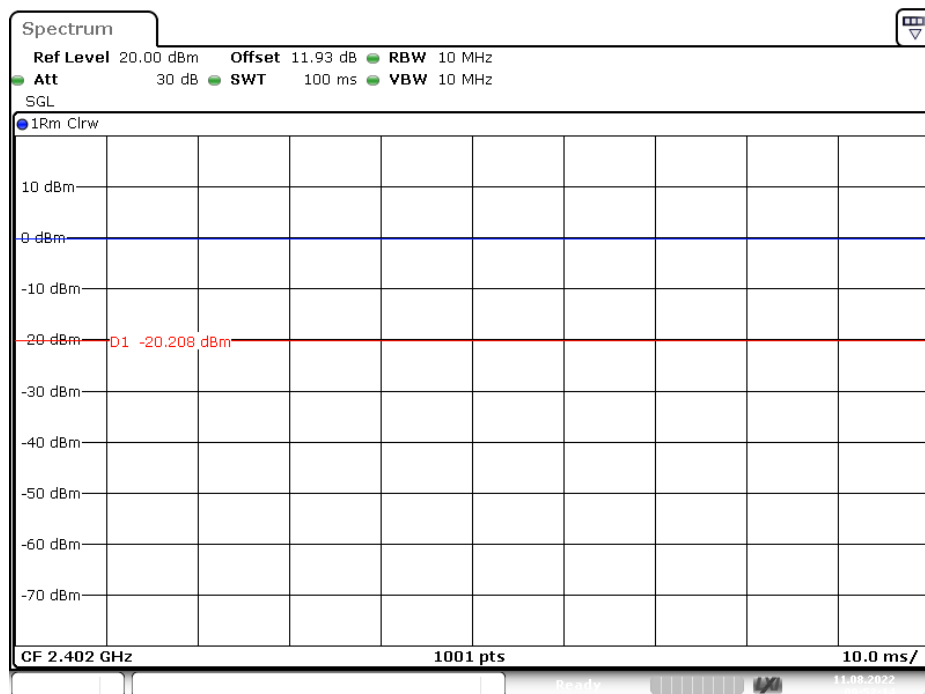
High Channel



Date: 11.AUG.2022 09:51:31

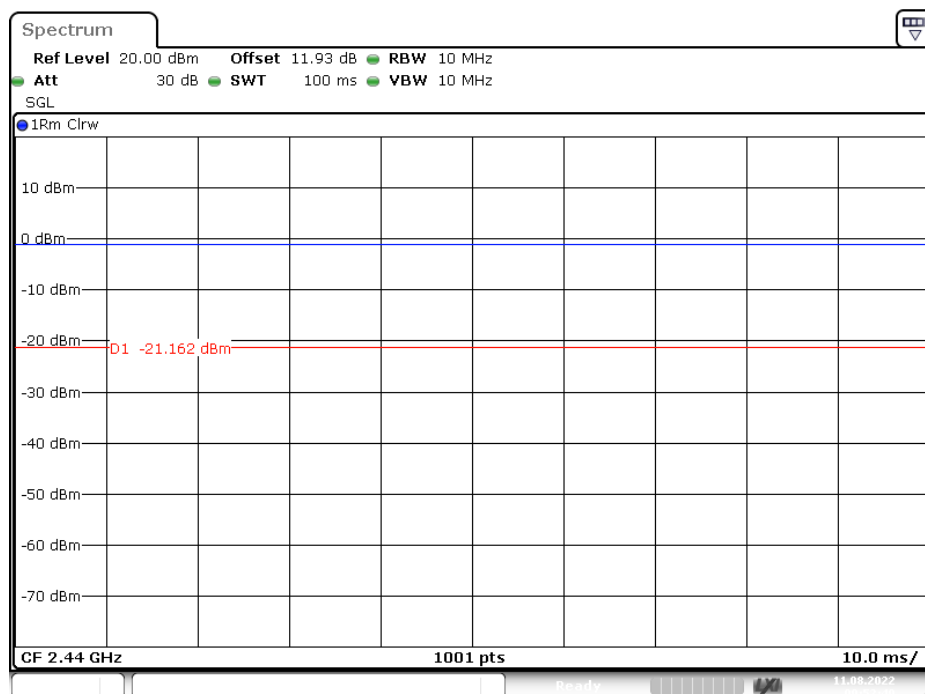
BLE_2M

Low Channel



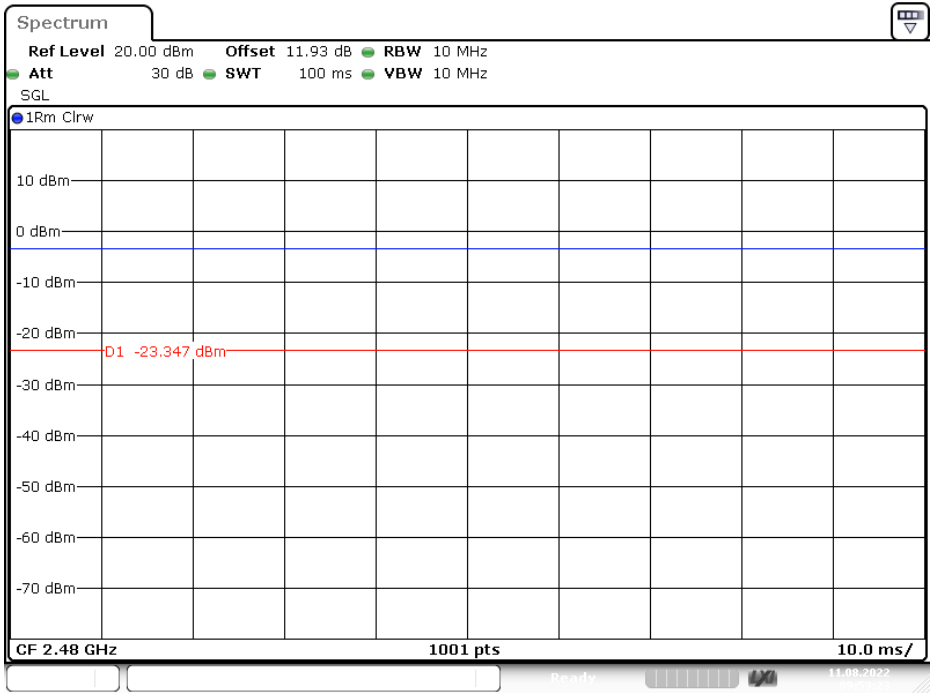
Date: 11.AUG.2022 09:52:14

Middle Channel



Date: 11.AUG.2022 09:52:50

High Channel



Date: 11.AUG.2022 09:53:23

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