FCC Part 15.247

TEST REPORT

For

CC&C Technologies, Inc

8F, 150, Jian Yi Road, Zhonghe District, New Taipei City, Taiwan 235, R. O. C.

FCC ID: PANBA25T

Report Type:	**Product Type:**
Original Report	BT5.4 APTX LE Audio Dongle

Report Producer : Coco Lin

Report Number : RXZ240719063RF01

Report Date : 2024-12-02

Reviewed By: Andy Shih Andy. Shih

Prepared By: Bay Area Compliance Laboratories Corp.
(New Taipei Laboratory)
70, Lane 169, Sec. 2, Datong Road, Xizhi Dist.,
New Taipei City 221, Taiwan, R.O.C.
Tel: +886 (2) 2647 6898
Fax: +886 (2) 2647 6895
www.bacl.com.tw

Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ240719063	RXZ240719063RF01	2024-12-02	Original Report	Coco Lin

TABLE OF CONTENTS

1 General Information 5

1.1 Product Description for Equipment under Test (EUT) 5
1.2 Objective 6
1.3 Test Methodology 6
1.4 Statement 6
1.5 Measurement Uncertainty 7
1.6 Environmental Conditions 7
1.7 Test Facility 7

2 System Test Configuration 8

2.1 Description of Test Configuration 8
2.2 Equipment Modifications 8
2.3 EUT Exercise Software 8
2.4 Support Equipment List and Details 8
2.5 External Cable List and Details 8
2.6 Test Mode 9
2.7 Block Diagram of Test Setup 9
2.8 Duty Cycle 10

3 Summary of Test Results 12

4 Test Equipment List and Details 13

5 FCC §15.247(i), §1.1307(b)(3) – RF Exposure 14

5.1 Applicable Standard 14
5.2 RF Exposure Evaluation Result 15

6 FCC §15.203 – Antenna Requirements 16

6.1 Applicable Standard 16
6.2 Antenna Information 16

7 FCC §15.207(a) – AC Line Conducted Emissions 17

7.1 Applicable Standard 17
7.2 EUT Setup 17
7.3 EMI Test Receiver Setup 18
7.4 Test Procedure 18
7.5 Corrected Factor & Over Limit Calculation 18
7.6 Test Results 19

8 FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions 20

8.1 Applicable Standard 20
8.2 EUT Setup 21
8.3 EMI Test Receiver & Spectrum Analyzer Setup 22
8.4 Test Procedure 23
8.5 Corrected Factor & Margin Calculation 23
8.6 Test Results 24

9 FCC §15.247(a)(2) – 6 dB Emission Bandwidth 35

9.1 Applicable Standard 35
9.2 Test Procedure 35
9.3 Test Results 35

10 FCC §15.247(b)(3) – Maximum Output Power 39

10.1 Applicable Standard 39
10.2 Test Procedure 39

10.3 Test Results 39
11 FCC§15.247(d) – 100 kHz Bandwidth of Frequency Band Edge 41
11.1 Applicable Standard 41
11.2 Test Procedure 41
11.3 Test Results 41
12 FCC §15.247(e) – Power Spectral Density 44
12.1 Applicable Standard 44
12.2 Test Procedure 44
12.3 Test Results 44

1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	CC&C Technologies, Inc
	8F, 150, Jian Yi Road, Zhonghe District, New Taipei City, Taiwan 235, R. O. C.
Brand(Trade) Name	CC&C
Product (Equipment)	BT5.4 APTX LE Audio Dongle
Main Model Name	BA-25T
Series Model Name	N/A
Frequency Range	BLE(1M) / BLE(2M) : 2402 ~ 2480 MHz
Maximum Conducted Peak Output Power	BLE(1M) Mode : 4.95 dBm BLE(2M) Mode : 5.20 dBm
Modulation Technique	BLE(1M) / BLE(2M) : GFSK
Transmit Data Rate	BLE(1M) Mode : 1 Mbps BLE(2M) Mode : 2 Mbps
Power Operation (Voltage Range)	External USB port: 5Vdc
Received Date	2024/08/20
Date of Test	2024/08/29 ~ 2024/10/22

*All measurement and test data in this report was gathered from production sample serial number: RXZ240719063-1 (Assigned by BACL, New Taipei Laboratory).

1.2 Objective

This report is prepared on behalf of *CC&C Technologies, Inc* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

1.3 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.
KDB 558074 D01 Meas Guidance v05

1.4 Statement

Decision Rule: No, (The test results do not include MU judgment)

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.
Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

1.5 Measurement Uncertainty

Parameter		Uncertainty
AC Mains		+/- 3.02 dB
RF output power, conducted		+/- 0.57 dB
Power Spectral Density, conducted		+/- 0.60 dB
Occupied Bandwidth		+/- 0.09 %
Unwanted Emissions, conducted		+/- 1.09 dB
Emissions, radiated	9 kHz~30 MHz	+/- 3.20 dB
	30 MHz~1 GHz	+/- 3.30 dB
	1 GHz~18 GHz	+/- 5.14 dB
	18 GHz~40 GHz	+/- 4.75 dB
Temperature		+/- 0.76 °C
Humidity		+/- 0.41 %

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.

1.6 Environmental Conditions

Test Site	Test Date	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2024/10/22	24.9	60	1012.7	Wayne Pan
Radiation Spurious Emissions	2024/9/2~2024/10/17	23.9~27.7	46~67	1005.6~1012.3	Nick Hsieh
Duty Cycle	2024/8/30	26.4	44	1006	Wayne Pan
Conducted Spurious Emissions	2024/8/29	25.8	48	1004.4	Wayne Pan
6 dB Emission Bandwidth	2024/8/29	25.8	48	1004.4	Wayne Pan
Maximum Output Power	2024/8/29~2024/8/30	25.8~26.4	44~48	1004.4~1006	Wayne Pan
100 kHz Bandwidth of Frequency Band Edge	2024/8/29	25.8	48	1004.4	Wayne Pan
Power Spectral Density	2024/8/29	25.8	48	1004.4	Wayne Pan

1.7 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp.(New Taipei Laboratory) to collect test data is located on

☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 221, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3732) and the FCC designation No.TW3732 under the Mutual Recognition Agreement (MRA) in FCC Test.

2 System Test Configuration

2.1 Description of Test Configuration

For BLE mode, there are totally 40 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	--	--
2	2406	--	--
3	2408	37	2476
--	--	38	2478
19	2440	39	2480

For BLE Modes were tested with channel 0, 19 and 39.

2.2 Equipment Modifications

No modification was made to the EUT.

2.3 EUT Exercise Software

The test software was used "BlueSuite v3.3

The system was configured for testing in engineering mode, which was provided by Applicant.

Test Frequency		Low	Middle	High
Power Level Setting	BLE 1M	Default	Default	Default
	BLE 2M	Default	Default	Default

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number
NB	DELL	E6410
Adapter	DELL	DA90PE3-00

2.5 External Cable List and Details

N/A

2.6 Test Mode

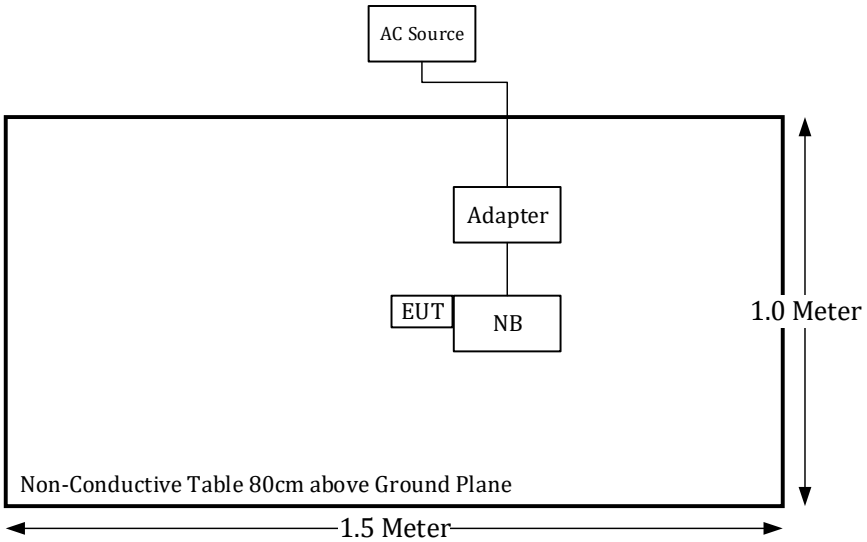
Full System (model: BA-25T) for all test item.

2.7 Block Diagram of Test Setup

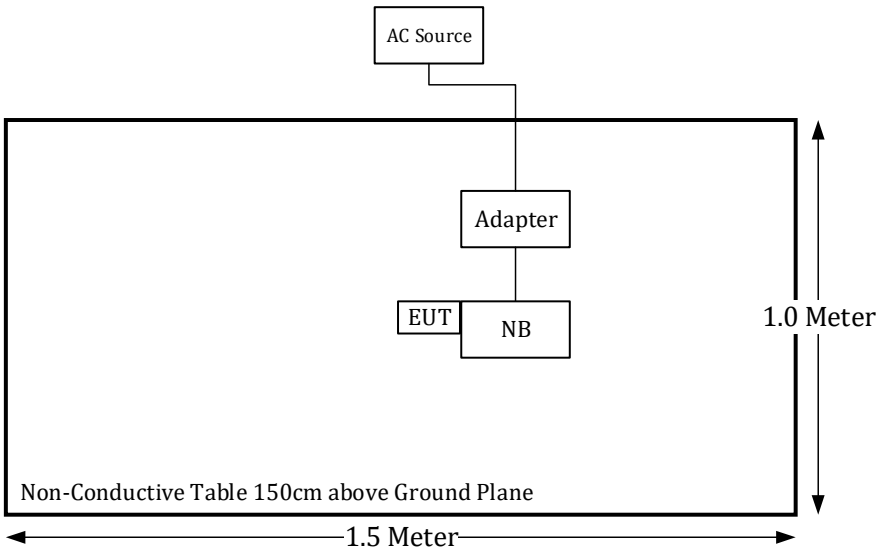
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation:

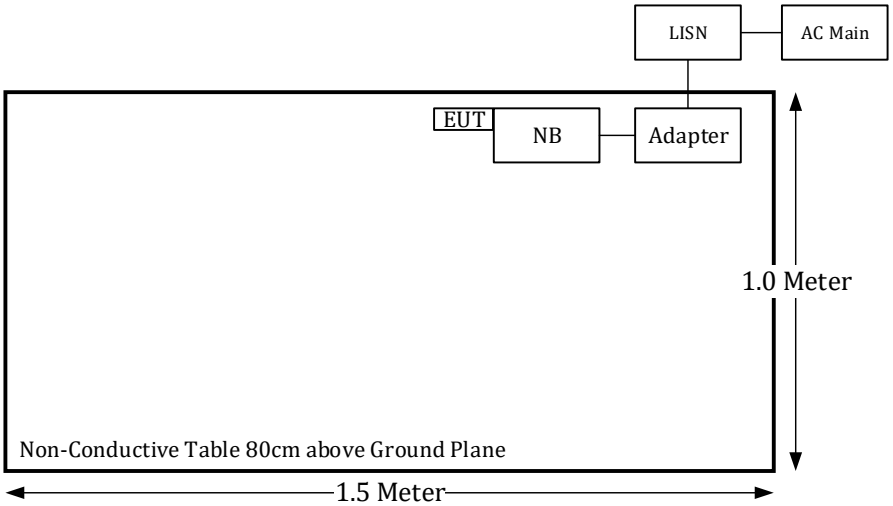
Below 1GHz:



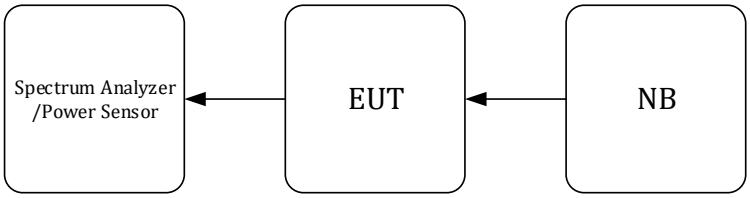
Above 1GHz:



Conduction:



Conducted:



2.8 Duty Cycle

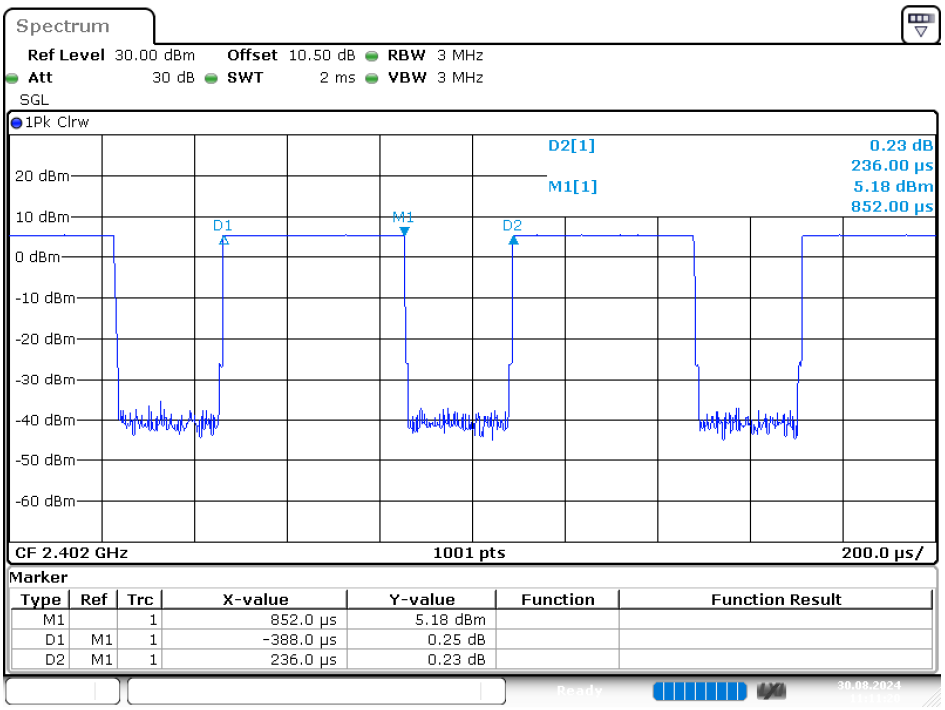
The duty cycle as below:

Radio Mode	T_{on} (ms)	T_{off} (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T (kHz)	1/T VBW setting (kHz)
BLE 1M	0.388	0.236	62	2.08	2.58	3
BLE 2M	1.063	0.796	57	2.44	0.94	1

Note: Duty Cycle Correction Factor = 10*log(1/duty cycle)

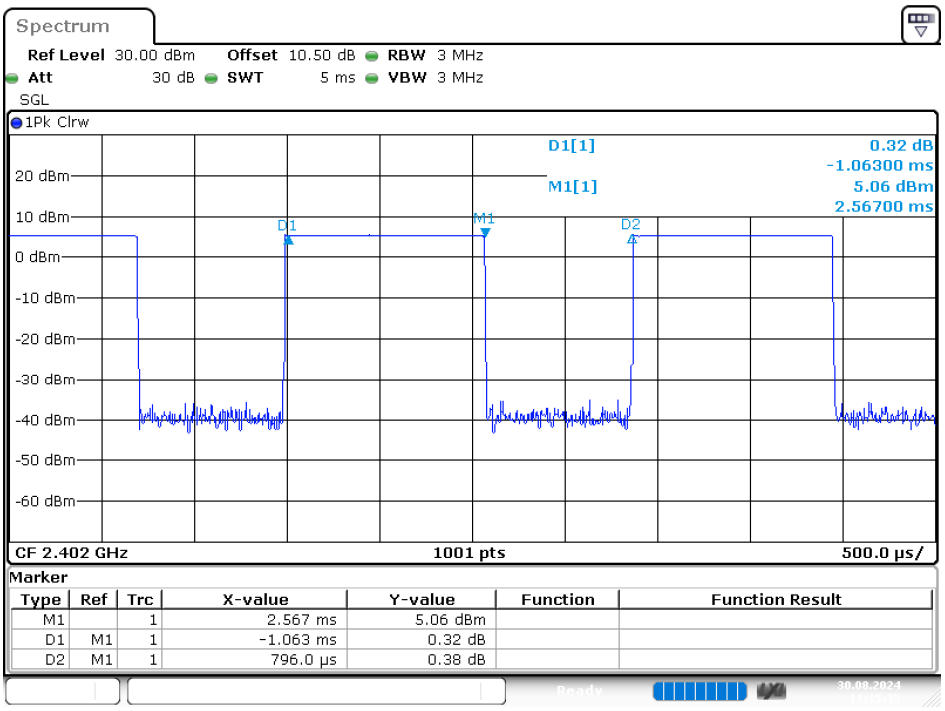
Please refer to the following plots.

BLE(1M) Mode



Date: 30.AUG.2024 11:11:20

BLE(2M) Mode



Date: 30.AUG.2024 11:15:35

3 Summary of Test Results

FCC Rules	Description of Test	Results
§15.247(i), §1.1307(b)(3)(i)	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

4 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101612	2024/2/16	2025/2/15
EMI Test Receiver	Rohde & Schwarz	ESW8	100947	2024/5/24	2025/5/23
RF Cable	EMEC	EM-CB5D	1	2024/6/5	2025/6/4
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiation 3M Room (966-A)					
Active Loop Antenna	ETS-Lindgren	6502	35796	2024/3/27	2025/3/26
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2024/1/19	2025/1/18
Double Ridged Guide Horn Antenna	A.H. system	SAS-571	1020	2024/5/21	2025/5/20
Horn Antenna	ETS-Lindgren	3116	62638	2024/8/30	2025/8/29
Preamplifier	Sonoma	310N	130601	2024/1/29	2025/1/28
Preamplifier	Channel	ERA-100M-18G-01D1748	EC2300051	2024/3/29	2025/3/28
Microware Preamplifier	EM Electronics Corporation	EM18G40G	60656	2024/1/8	2025/1/7
Spectrum Analyzer	Rohde & Schwarz	FSV40	101939	2024/3/27	2025/3/26
EMI Test Receiver	Rohde & Schwarz(R&S)	ESR3	102099	2024/6/24	2025/6/23
Microflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2024/1/23	2025/1/22
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2024/1/23	2025/1/22
Coaxial Cable	COMMATE	PEWC	8Dr	2023/12/23	2024/12/22
Cable	EMC	EMC105-SM-SM-10000	201003	2024/1/23	2025/1/22
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2023/12/23	2024/12/22
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2024/1/23	2025/1/22
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2024/1/23	2025/1/22
Band-stop filter	Woken	STI15-9831	STI15-9831-1	2023/10/20	2024/10/19
High-pass filter	XINGBOKEJI	XBLBQ-GTA54	200108-3-2	2023/10/20	2024/10/19
Software	AUDIX	E3	18621a	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz(R&S)	FSV40	101204	2024/5/30	2025/5/29
Cable	UTIFLEX	UFA210A	9435	2023/10/2	2024/10/1
Power Sensor	Boonton	RTP5006	11037	2024/5/21	2025/5/20
Attenuator	MCL	BW-S10W5+	1419	2024/2/23	2025/2/22

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements.

5 FCC §15.247(i), §1.1307(b)(3) – RF Exposure

5.1 Applicable Standard

According to subpart 15.247(i) and subpart §1.1307(b)(3)(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

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

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

5.2 RF Exposure Evaluation Result

Project info

Band	Freq (MHz)	Tune-up Average Power (dBm)	Ant Gain (dBi)	Distances (mm)	Tune-up Average Power (mW)	ERP (dBm)	ERP (mW)
BLE	2480	4.1	0.6	5	2.57	2.55	1.80

§ 1.1307(b)(3)(i)(A) and (C) method is not applicable.

§ 1.1307(b)(3)(i)(B)

Band	Freq (MHz)	Pth (mW)	X	ERP 20cm (mW)	Result Option B
BLE	2480	2.72	1.905	3060	exempt

The available maximum time-averaged power or effective radiated power (ERP), whichever is greater. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive).

Note: The Tune-up output power was declared by the Applicant.

Result: The device compliant the SAR-Based Exemption.

6 FCC §15.203 – Antenna Requirements

6.1 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.

6.2 Antenna Information

Manufacturer	Type	Antenna Gain
VSO	IFA Antenna	0.6 dBi

The antenna is permanently attached to the device.

Result: Compliance

7 FCC §15.207(a) – AC Line Conducted Emissions

7.1 Applicable Standard

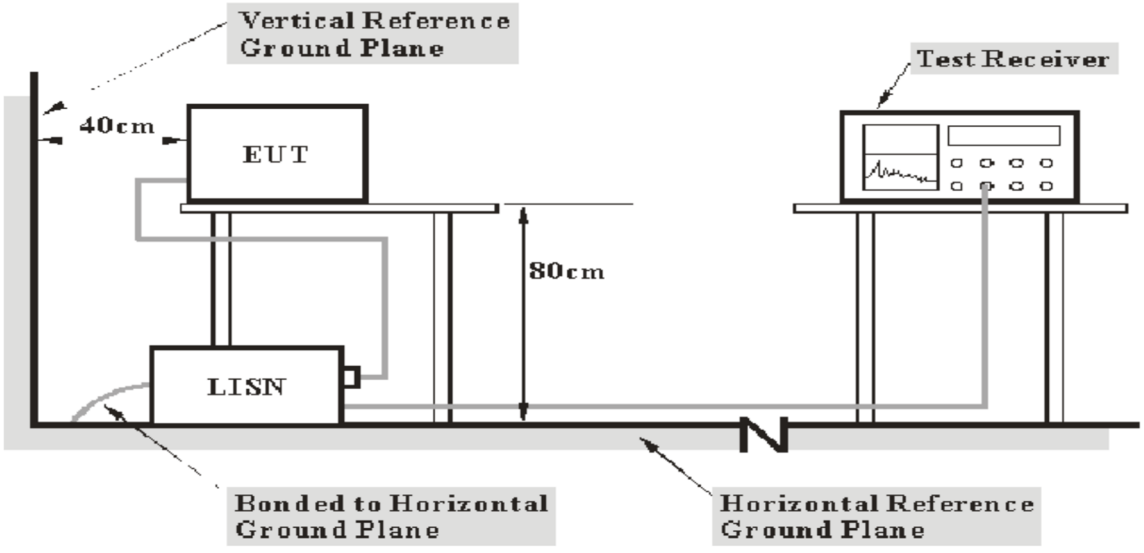
According to §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

7.2 EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

7.3 EMI Test Receiver Setup

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

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

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

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

7.5 Corrected Factor & Over Limit Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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 Over Limit calculation is as follows:

Over Limit = Result – Limit Line

7.6 Test Results

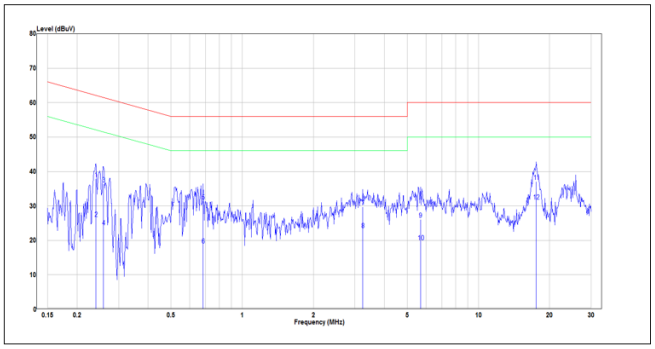
Test Mode: Transmitting

Main: AC120 V, 60 Hz

Worst case is BLE(2M) mode, High channel

Line

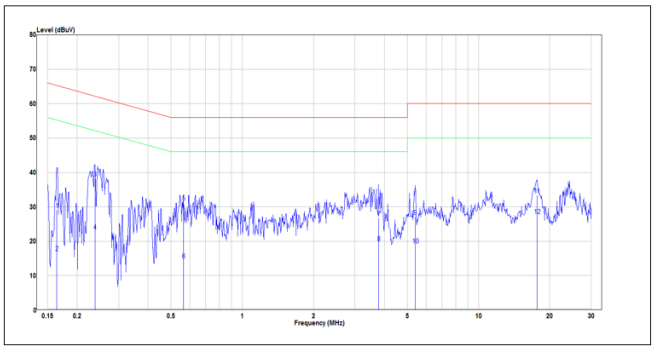
2024-10-22 19:43:56



No.	Frequency (MHz)	Reading dBuV	Correct Factor(dB)	Result dBuV	Limit dBuV	Over limit (dB)	Remark	Phase
1	0.240	27.91	10.06	37.97	62.08	-24.12	QP	Line
2	0.240	16.24	10.06	26.31	52.08	-25.78	Average	Line
3	0.259	26.38	10.08	36.46	61.47	-25.01	QP	Line
4	0.259	13.78	10.08	23.85	51.47	-27.62	Average	Line
5	0.683	21.08	10.29	31.37	56.00	-24.63	QP	Line
6	0.683	8.30	10.29	18.59	46.00	-27.41	Average	Line
7	3.241	19.44	10.37	29.81	56.00	-26.19	QP	Line
8	3.241	12.75	10.37	23.12	46.00	-22.88	Average	Line
9	5.683	15.68	10.41	26.10	60.00	-33.90	QP	Line
10	5.683	9.20	10.41	19.62	50.00	-30.38	Average	Line
11	17.568	26.48	10.59	37.07	60.00	-22.93	QP	Line
12	17.568	20.80	10.59	31.39	50.00	-18.61	Average	Line

Neutral

2024-10-22 19:51:31



No.	Frequency (MHz)	Reading dBuV	Correct Factor(dB)	Result dBuV	Limit dBuV	Over limit (dB)	Remark	Phase
1	0.164	19.28	9.89	29.17	65.25	-36.08	QP	Neutral
2	0.164	6.78	9.89	16.67	55.25	-38.58	Average	Neutral
3	0.238	28.19	10.07	38.26	62.17	-23.91	QP	Neutral
4	0.238	12.82	10.07	22.89	52.17	-29.28	Average	Neutral
5	0.564	21.06	10.28	31.34	56.00	-24.66	QP	Neutral
6	0.564	4.22	10.28	14.50	46.00	-31.50	Average	Neutral
7	3.779	16.42	10.38	26.80	56.00	-29.20	QP	Neutral
8	3.779	9.18	10.38	19.56	46.00	-26.44	Average	Neutral
9	5.390	16.79	10.41	27.20	60.00	-32.80	QP	Neutral
10	5.390	8.42	10.41	18.83	50.00	-31.17	Average	Neutral
11	17.661	22.74	10.65	33.39	60.00	-26.61	QP	Neutral
12	17.661	16.76	10.65	27.41	50.00	-22.59	Average	Neutral

Note:

Result = Reading + Factor

Over Limit = Result – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

8 FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions

8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	608 – 614	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	960 – 1240	5. 35 – 5. 46
2.1735 – 2.1905	16.80425 – 16.80475	1300 – 1427	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1435 – 1626.5	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1645.5 – 1646.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1660 – 1710	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1718.8 – 1722.2	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	2200 – 2300	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2310 – 2390	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2483.5 – 2500	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2690 – 2900	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	3260 – 3267	22.01 – 23.12
8.41425 – 8.41475	162.0125 –167.17	3.332 – 3.339	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3 3458 – 3 358	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3.600 – 4.400	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4		Above 38.6
13.36 – 13.41	399.9 – 410		

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

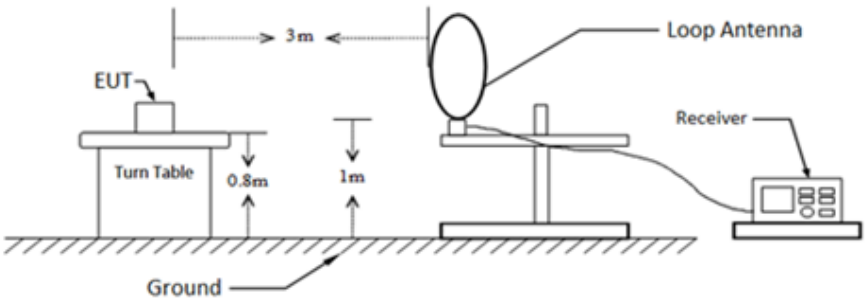
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

According to ANSI C63.10-2013, section 5.3.3
Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field, and the emissions to be measured can be detected by the measurement equipment (see 4.3.4). Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. Measurements from 18 GHz to 40 GHz are typically made at distances significantly less than 3 m from the EUT. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade of distance (inverse of linear distance for field-strength measurements or inverse of linear distance-squared for power-density measurements).

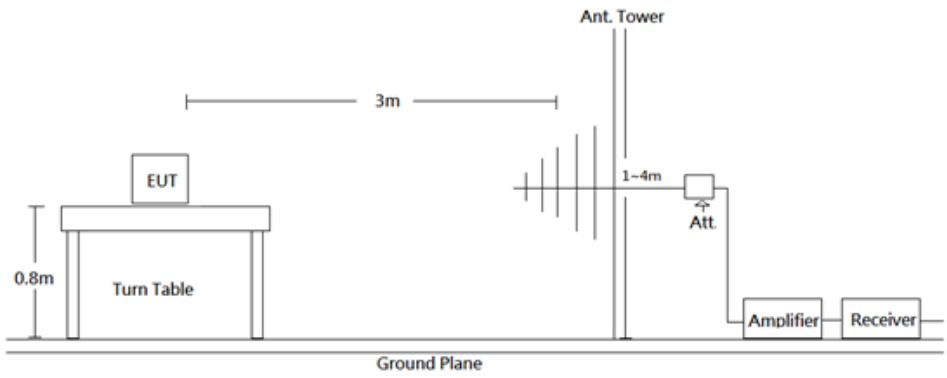
As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the 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).

8.2 EUT Setup

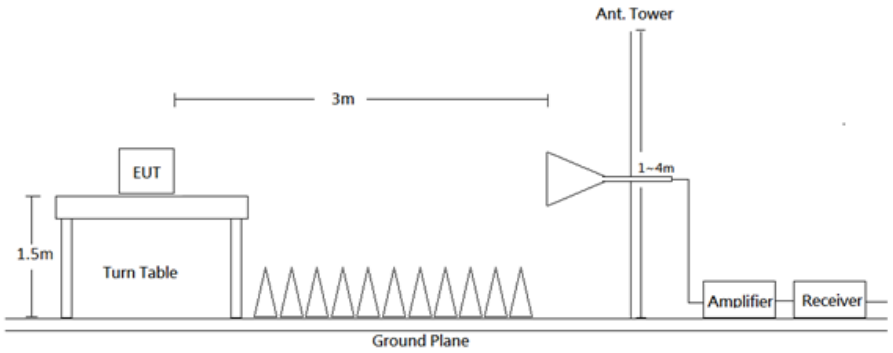
9kHz-30MHz:



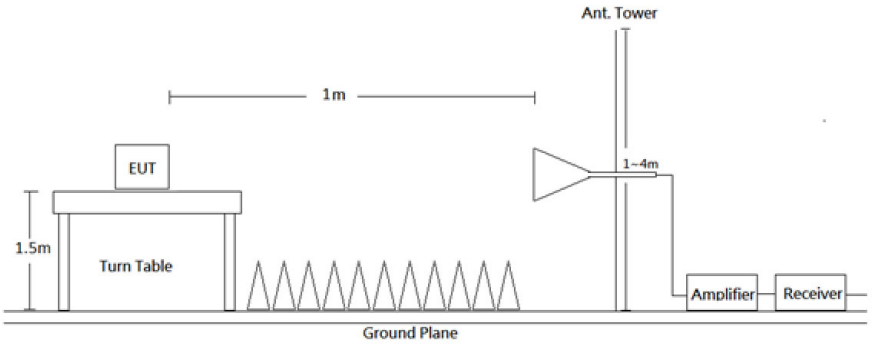
30MHz-1GHz:



1-18 GHz:



18-26.5 GHz:



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

8.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 9 kHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Duty cycle	Measurement method	Detector
9 kHz - 150 kHz	300 Hz	1 kHz	/	QP/AV	QP/AV
150 kHz - 30 MHz	10 kHz	30 kHz	/	QP/AV	QP/AV
30-1000 MHz	120 kHz	300 kHz	/	QP	QP
Above 1 GHz	Pre-scan :				
	1 MHz	3 MHz	/	PK	PK
	1 MHz	3 kHz	>98%	Ave	PK
	1 MHz	≥ 1/Ton, not less than 3 kHz	<98%	Ave	PK
	Final measurement for emission identified during pre-scan :				
	1 MHz	3 MHz	/	PK	PK
	1 MHz	10 Hz	>98%	Ave	PK
	1 MHz	≥ 1/Ton	<98%	Ave	PK

Note: Ton is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

8.4 Test Procedure

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

All data was recorded in Quasi-peak and average detector mode from 9 kHz to 30 MHz, Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

8.5 Corrected Factor & Margin Calculation

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

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

Margin = Level – Limit

8.6 Test Results

Test Mode: Transmitting

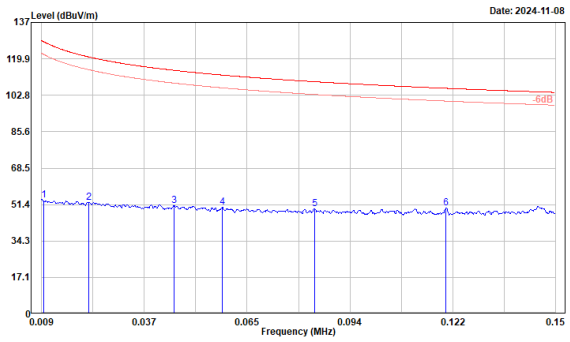
(Pre-scan with three orthogonal axis, and worse case as Z axis.)

9kHz-30MHz:

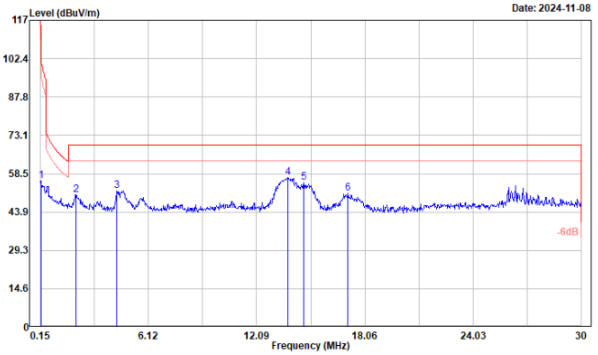
(worst case is BLE 2M mode High channel)

(Pre-scan using three directional polarities, worst case as parallel.)

9kHz-150kHz	150kHz-30MHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.010	36.37	16.91	53.28	128.00	-74.72	100	360	Average
0.022	37.70	14.83	52.53	120.77	-68.24	100	360	Average
0.045	38.25	12.75	51.00	114.47	-63.47	100	360	Average
0.059	38.39	11.90	50.29	112.24	-61.95	100	360	Average
0.084	38.12	11.32	49.44	109.13	-59.69	100	360	Average
0.120	38.43	11.22	49.65	106.02	-56.37	100	360	Average

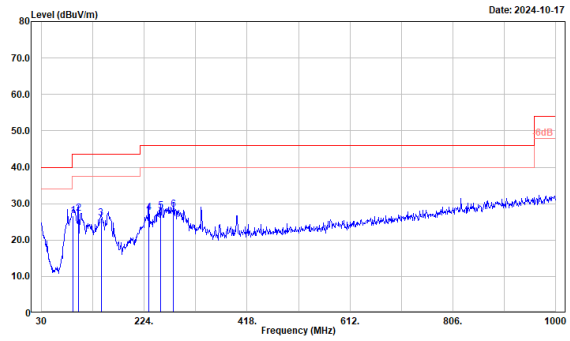


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.180	44.14	11.53	55.67	102.51	-46.84	100	0	Average
2.120	39.82	10.70	50.52	69.54	-19.02	100	0	Average
4.389	41.26	10.63	51.89	69.54	-17.65	100	0	Average
13.821	45.54	11.57	57.11	69.54	-12.43	100	0	Average
14.687	43.54	11.58	55.12	69.54	-14.42	100	0	Average
17.135	39.46	11.63	51.09	69.54	-18.45	100	0	Average

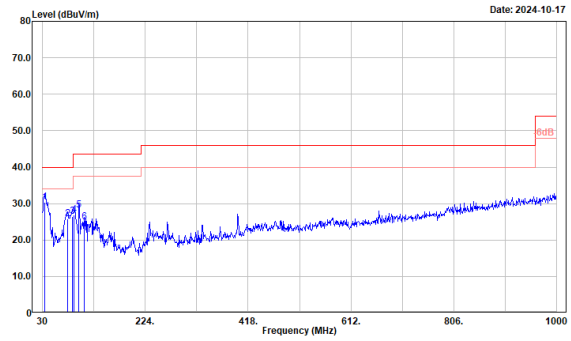
30MHz-1GHz:

(Worst case is BLE(2M) mode)

Low channel	
Horizontal	**Vertical**



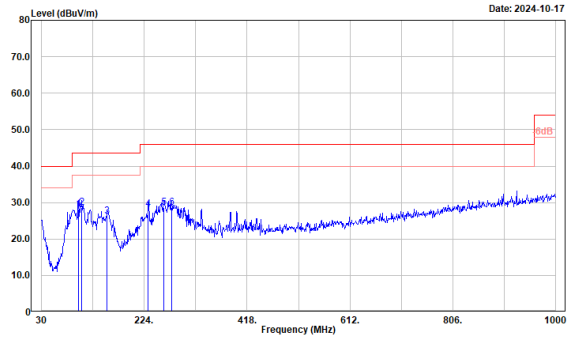
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
89.170	42.12	-15.56	26.56	43.50	-16.94	100	256	QP
99.840	40.54	-13.16	27.38	43.50	-16.12	100	279	QP
142.520	35.68	-9.75	25.93	43.50	-17.57	100	252	QP
232.730	38.95	-11.37	27.58	46.00	-18.42	100	99	QP
255.040	39.00	-11.01	27.99	46.00	-18.01	100	7	QP
279.290	37.50	-9.16	28.34	46.00	-17.66	100	360	QP



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
34.850	36.52	-6.06	30.46	40.00	-9.54	100	278	QP
77.530	41.32	-15.50	25.82	40.00	-14.18	100	274	QP
86.260	42.36	-15.98	26.38	40.00	-13.62	100	286	QP
90.140	42.28	-15.46	26.82	43.50	-16.68	100	58	QP
98.870	41.51	-13.36	28.15	43.50	-15.35	100	77	QP
108.570	36.02	-11.06	24.96	43.50	-18.54	100	309	QP

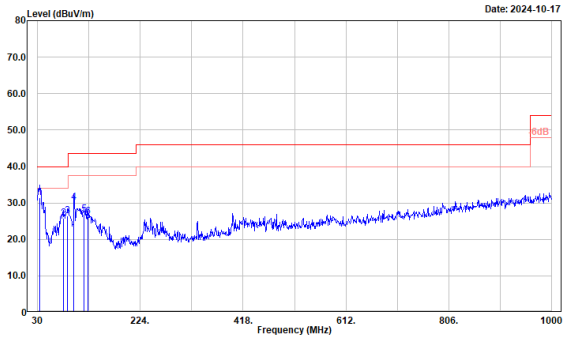
Middle channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
99.840	41.27	-13.16	28.11	43.50	-15.39	100	258	QP
106.630	39.93	-11.41	28.52	43.50	-14.98	100	273	QP
154.160	36.23	-9.93	26.30	43.50	-17.20	100	281	QP
231.760	39.61	-11.42	28.19	46.00	-17.81	100	105	QP
260.860	39.08	-10.37	28.71	46.00	-17.29	100	0	QP
275.410	37.80	-9.17	28.63	46.00	-17.37	100	3	QP

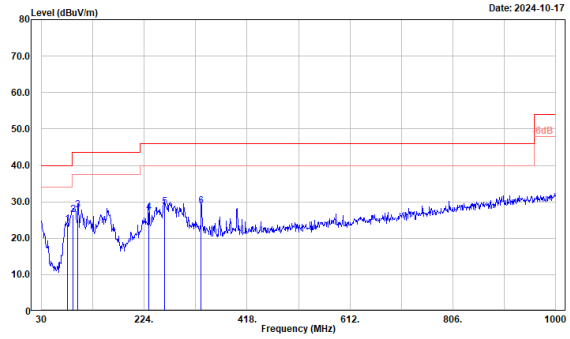
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
33.880	36.86	-5.34	31.52	40.00	-8.48	100	202	QP
78.500	41.40	-15.58	25.82	40.00	-14.18	100	271	QP
87.230	42.40	-15.85	26.55	40.00	-13.45	100	75	QP
98.870	43.54	-13.36	30.18	43.50	-13.32	100	351	QP
118.270	36.41	-9.60	26.81	43.50	-16.69	100	340	QP
126.030	35.35	-9.03	26.32	43.50	-17.18	100	313	QP

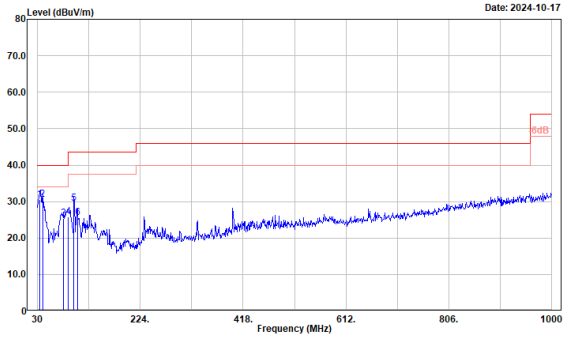
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
79.470	39.37	-15.63	23.74	40.00	-16.26	100	192	QP
90.140	41.84	-15.46	26.38	43.50	-17.12	100	227	QP
98.870	41.21	-13.36	27.85	43.50	-15.65	100	245	QP
232.730	38.47	-11.37	27.10	46.00	-18.90	100	93	QP
261.830	38.80	-10.21	28.59	46.00	-17.41	100	356	QP
331.670	37.05	-8.23	28.82	46.00	-17.18	100	277	QP

Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
34.850	36.61	-6.06	30.55	40.00	-9.45	100	210	QP
39.700	40.11	-9.59	30.52	40.00	-9.48	100	210	QP
79.470	40.90	-15.63	25.27	40.00	-14.73	100	339	QP
88.200	41.41	-15.67	25.74	43.50	-17.76	100	268	QP
98.870	42.74	-13.36	29.38	43.50	-14.12	100	313	QP
105.660	37.28	-11.60	25.68	43.50	-17.82	100	309	QP

Level = Reading + Factor.

Margin = Level – Limit.

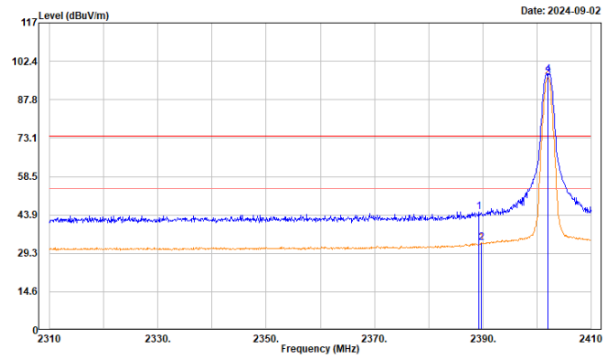
Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Band-Edge:

BLE(1M) Mode

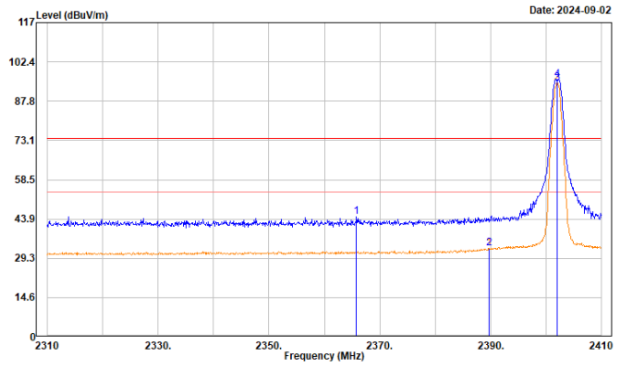
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2389.200	56.23	-11.09	45.14	74.00	-28.86	166	204	Peak
2389.700	44.42	-11.09	33.33	54.00	-20.67	166	204	Average
2402.000	107.28	-11.02	96.26			166	204	Average
2402.000	108.28	-11.02	97.26			166	204	Peak

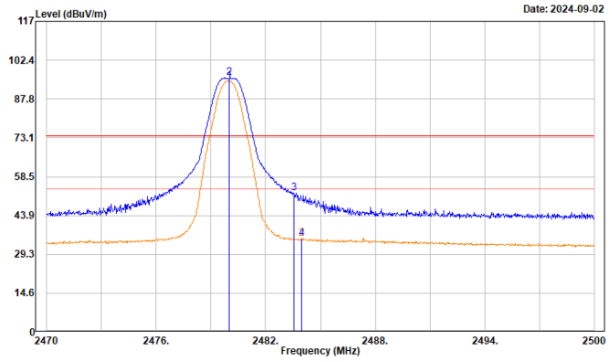
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2365.800	56.04	-11.28	44.76	74.00	-29.24	101	114	Peak
2389.800	44.07	-11.09	32.98	54.00	-21.02	101	114	Average
2402.000	105.47	-11.02	94.45			101	114	Average
2402.000	106.68	-11.02	95.66			101	114	Peak

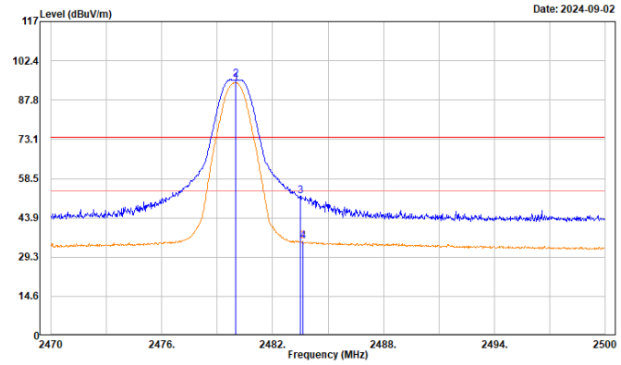
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	105.28	-10.66	94.62			174	198	Average
2480.000	106.27	-10.66	95.61			174	198	Peak
2483.530	62.84	-10.61	52.23	74.00	-21.77	174	198	Peak
2483.950	45.84	-10.60	35.24	54.00	-18.76	174	198	Average

Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	104.91	-10.66	94.25			206	112	Average
2480.000	105.96	-10.66	95.30			206	112	Peak
2483.500	62.57	-10.61	51.96	74.00	-22.04	206	112	Peak
2483.620	45.75	-10.61	35.14	54.00	-18.86	206	112	Average

Level = Reading + Factor.

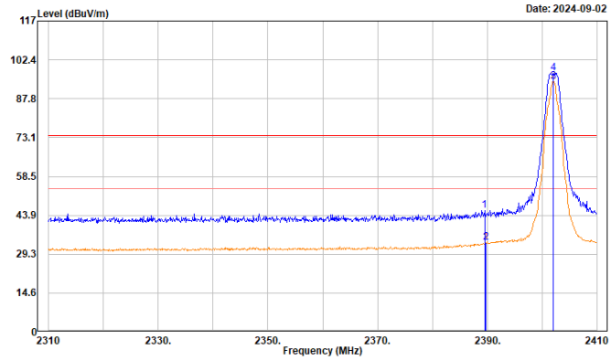
Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

BLE(2M) Mode

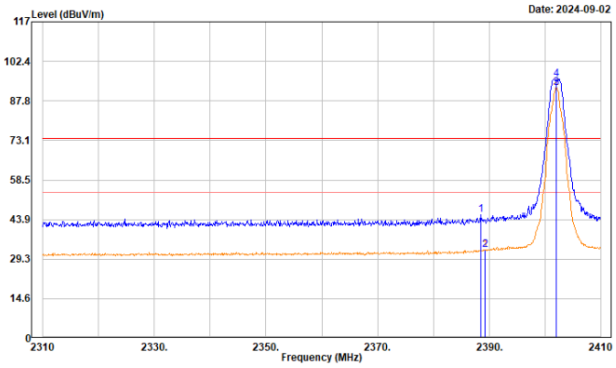
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2389.500	56.64	-11.09	45.55	74.00	-28.45	167	201	Peak
2389.700	44.67	-11.09	33.58	54.00	-20.42	167	201	Average
2402.000	105.27	-11.02	94.25			167	201	Average
2402.000	108.30	-11.02	97.28			167	201	Peak

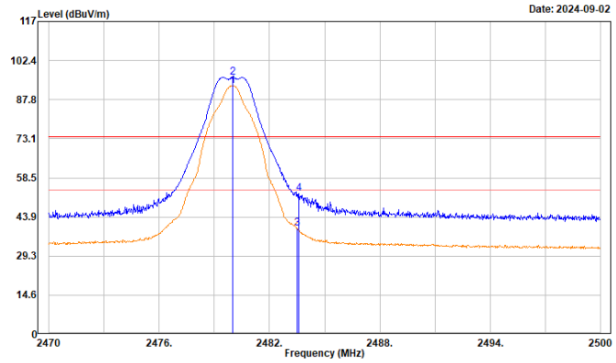
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2388.500	56.70	-11.10	45.60	74.00	-28.40	103	112	Peak
2389.200	43.88	-11.09	32.79	54.00	-21.21	103	112	Average
2402.000	103.68	-11.02	92.66			103	112	Average
2402.000	106.78	-11.02	95.76			103	112	Peak

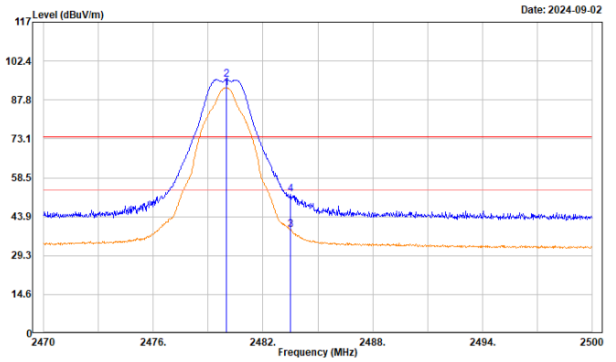
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	103.60	-10.66	92.94			180	203	Average
2480.000	106.68	-10.66	96.02			180	203	Peak
2483.500	50.15	-10.61	39.54	54.00	-14.46	180	203	Average
2483.590	63.20	-10.61	52.59	74.00	-21.41	180	203	Peak

Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	102.99	-10.66	92.33			211	109	Average
2480.000	105.97	-10.66	95.31			211	109	Peak
2483.500	49.76	-10.61	39.15	54.00	-14.85	211	109	Average
2483.500	62.91	-10.61	52.30	74.00	-21.70	211	109	Peak

Level = Reading + Factor.

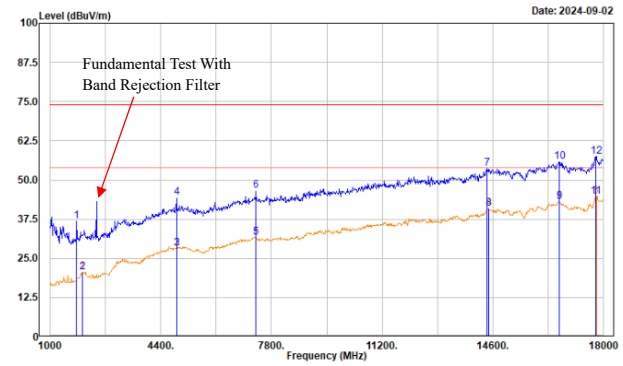
Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

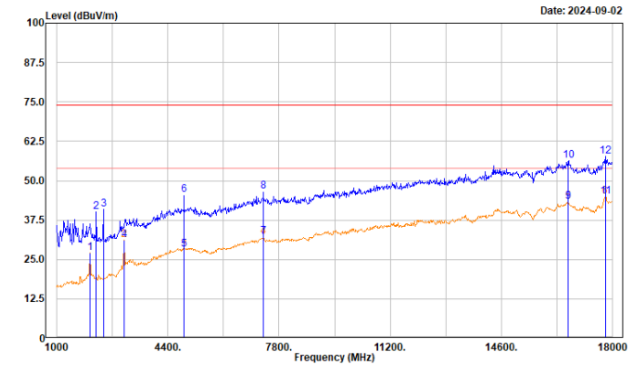
1GHz-18GHz:

(worst case is BLE(1M) Mode Middle channel)

Horizontal	Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1816.000	50.57	-13.70	36.87	74.00	-37.13	150	119	Peak
1986.000	32.52	-11.84	20.68	54.00	-33.32	150	122	Average
4880.000	31.79	-3.54	28.25	54.00	-25.75	150	275	Average
4880.000	47.94	-3.54	44.40	74.00	-29.60	135	275	Peak
7320.000	31.08	0.53	31.61	54.00	-22.39	135	275	Average
7320.000	46.05	0.53	46.58	74.00	-27.42	138	351	Peak
14413.000	42.36	11.21	53.57	74.00	-20.43	150	2	Peak
14481.000	29.49	11.41	40.90	54.00	-13.10	150	2	Average
16640.000	31.09	12.04	43.13	54.00	-10.87	150	317	Average
16640.000	43.74	12.04	55.78	74.00	-18.22	150	317	Peak
17762.000	32.02	12.83	44.85	54.00	-9.15	150	32	Average
17762.000	44.54	12.83	57.37	74.00	-16.63	150	32	Peak

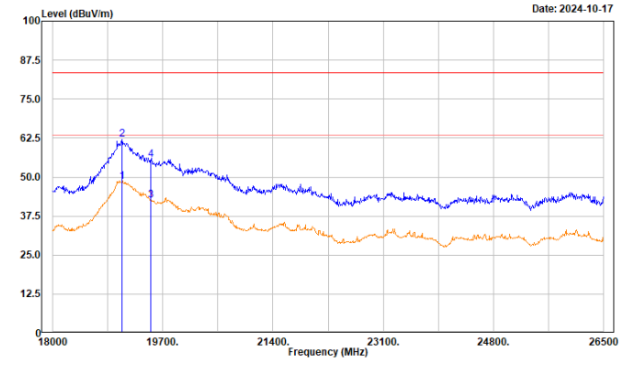


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2020.000	38.64	-11.64	27.00	54.00	-27.00	150	115	Average
2207.000	52.37	-12.36	40.01	74.00	-33.99	150	85	Peak
2428.000	51.91	-11.02	40.89	74.00	-33.11	150	88	Peak
3074.000	39.46	-8.27	31.19	54.00	-22.81	150	211	Average
4880.000	31.83	-3.54	28.29	54.00	-25.71	294	164	Average
4880.000	49.14	-3.54	45.60	74.00	-28.40	294	164	Peak
7320.000	31.66	0.53	32.19	54.00	-21.81	136	139	Average
7320.000	46.08	0.53	46.61	74.00	-27.39	136	139	Peak
16640.000	31.41	12.04	43.45	54.00	-10.55	150	279	Average
16640.000	44.40	12.04	56.44	74.00	-17.56	150	279	Peak
17779.000	32.01	12.85	44.86	54.00	-9.14	150	213	Average
17779.000	44.97	12.85	57.82	74.00	-16.18	150	213	Peak

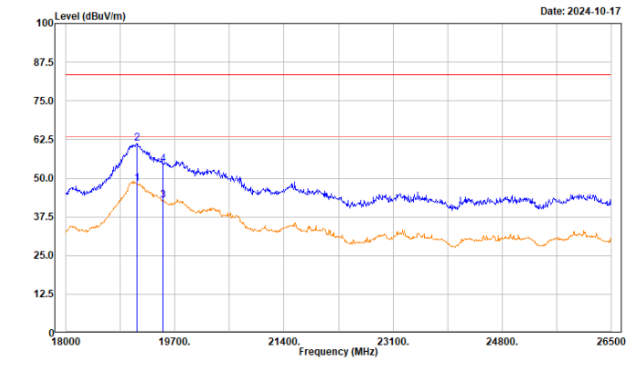
18GHz-26.5GHz:

(worst case is BLE(1M) Mode Middle channel)

Horizontal	Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19071.000	30.54	17.92	48.46	63.50	-15.04	150	71	Average
19071.000	44.08	17.92	62.00	83.50	-21.50	150	71	Peak
19520.000	29.35	13.09	42.44	63.50	-21.06	150	316	Average
19520.000	42.38	13.09	55.47	83.50	-28.03	150	316	Peak



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19105.000	30.57	17.65	48.22	63.50	-15.28	150	28	Average
19105.000	43.53	17.65	61.18	83.50	-22.32	150	28	Peak
19520.000	29.63	13.09	42.72	63.50	-20.78	150	60	Average
19520.000	41.50	13.09	54.59	83.50	-28.91	150	60	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

For 18-26.5GHz Convert the test distance limit of 3 meters to a limit of 1 meter:

Conversion factor = 20 log (1m/3m) = 9.5 dB,

Average Limit = 54+9.5 = 63.50 dBuV/m , Peak Limit = 63.50+20 = 83.50 dBuV/m @ 1m

Above 1GHz

BLE(1M) Mode

Low channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.02	-4.09	28.93	54.00	-25.07	155	15	Average
4804.000	47.26	-4.09	43.17	74.00	-30.83	155	15	Peak
7206.000	33.25	0.43	33.68	54.00	-20.32	128	305	Average
7206.000	46.59	0.43	47.02	74.00	-26.98	128	305	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.59	-4.09	29.50	54.00	-24.50	357	154	Average
4804.000	47.81	-4.09	43.72	74.00	-30.28	357	154	Peak
7206.000	31.97	0.43	32.40	54.00	-21.60	211	90	Average
7206.000	45.05	0.43	45.48	74.00	-28.52	211	90	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1816.000	50.57	-13.70	36.87	74.00	-37.13	150	119	Peak
1986.000	32.52	-11.84	20.68	54.00	-33.32	150	122	Average
4880.000	31.79	-3.54	28.25	54.00	-25.75	150	275	Average
4880.000	47.94	-3.54	44.40	74.00	-29.60	135	275	Peak
7320.000	31.08	0.53	31.61	54.00	-22.39	135	275	Average
7320.000	46.05	0.53	46.58	74.00	-27.42	138	351	Peak
14413.000	42.36	11.21	53.57	74.00	-20.43	150	2	Peak
14481.000	29.49	11.41	40.90	54.00	-13.10	150	2	Average
16640.000	31.09	12.04	43.13	54.00	-10.87	150	317	Average
16640.000	43.74	12.04	55.78	74.00	-18.22	150	317	Peak
17762.000	32.02	12.83	44.85	54.00	-9.15	150	32	Average
17762.000	44.54	12.83	57.37	74.00	-16.63	150	32	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2020.000	38.64	-11.64	27.00	54.00	-27.00	150	115	Average
2207.000	52.37	-12.36	40.01	74.00	-33.99	150	85	Peak
2428.000	51.91	-11.02	40.89	74.00	-33.11	150	88	Peak
3074.000	39.46	-8.27	31.19	54.00	-22.81	150	211	Average
4880.000	31.83	-3.54	28.29	54.00	-25.71	294	164	Average
4880.000	49.14	-3.54	45.60	74.00	-28.40	294	164	Peak
7320.000	31.66	0.53	32.19	54.00	-21.81	136	139	Average
7320.000	46.08	0.53	46.61	74.00	-27.39	136	139	Peak
16640.000	31.41	12.04	43.45	54.00	-10.55	150	279	Average
16640.000	44.40	12.04	56.44	74.00	-17.56	150	279	Peak
17779.000	32.01	12.85	44.86	54.00	-9.14	150	213	Average
17779.000	44.97	12.85	57.82	74.00	-16.18	150	213	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	36.88	-3.67	33.21	54.00	-20.79	152	190	Average
4960.000	47.64	-3.67	43.97	74.00	-30.03	152	190	Peak
7440.000	35.05	0.28	35.33	54.00	-18.67	125	309	Average
7440.000	46.71	0.28	46.99	74.00	-27.01	125	309	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	37.30	-3.67	33.63	54.00	-20.37	309	257	Average
4960.000	48.03	-3.67	44.36	74.00	-29.64	309	257	Peak
7440.000	33.16	0.28	33.44	54.00	-20.56	133	140	Average
7440.000	45.56	0.28	45.84	74.00	-28.16	133	140	Peak

Note:

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

BLE(2M) Mode

Low channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	32.96	-4.09	28.87	54.00	-25.13	151	278	Average
4804.000	46.39	-4.09	42.30	74.00	-31.70	151	278	Peak
7206.000	34.41	0.43	34.84	54.00	-19.16	104	356	Average
7206.000	47.23	0.43	47.66	74.00	-26.34	104	356	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	34.95	-4.09	30.86	54.00	-23.14	308	170	Average
4804.000	47.47	-4.09	43.38	74.00	-30.62	308	170	Peak
7206.000	31.64	0.43	32.07	54.00	-21.93	150	143	Average
7206.000	45.31	0.43	45.74	74.00	-28.26	150	143	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	34.42	-3.54	30.88	54.00	-23.12	122	276	Average
4880.000	47.00	-3.54	43.46	74.00	-30.54	122	276	Peak
7320.000	33.72	0.53	34.25	54.00	-19.75	102	13	Average
7320.000	46.56	0.53	47.09	74.00	-26.91	102	13	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	37.12	-3.54	33.58	54.00	-20.42	291	164	Average
4880.000	48.68	-3.54	45.14	74.00	-28.86	291	164	Peak
7320.000	31.41	0.53	31.94	54.00	-22.06	155	294	Average
7320.000	45.31	0.53	45.84	74.00	-28.16	155	294	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	34.70	-3.67	31.03	54.00	-22.97	145	192	Average
4960.000	48.18	-3.67	44.51	74.00	-29.49	145	192	Peak
7440.000	34.29	0.28	34.57	54.00	-19.43	103	306	Average
7440.000	46.93	0.28	47.21	74.00	-26.79	103	306	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	34.94	-3.67	31.27	54.00	-22.73	307	265	Average
4960.000	48.17	-3.67	44.50	74.00	-29.50	307	265	Peak
7440.000	31.96	0.28	32.24	54.00	-21.76	115	294	Average
7440.000	45.45	0.28	45.73	74.00	-28.27	115	294	Peak

Note:

Level = Reading + Factor.

Margin = Level – Limit.

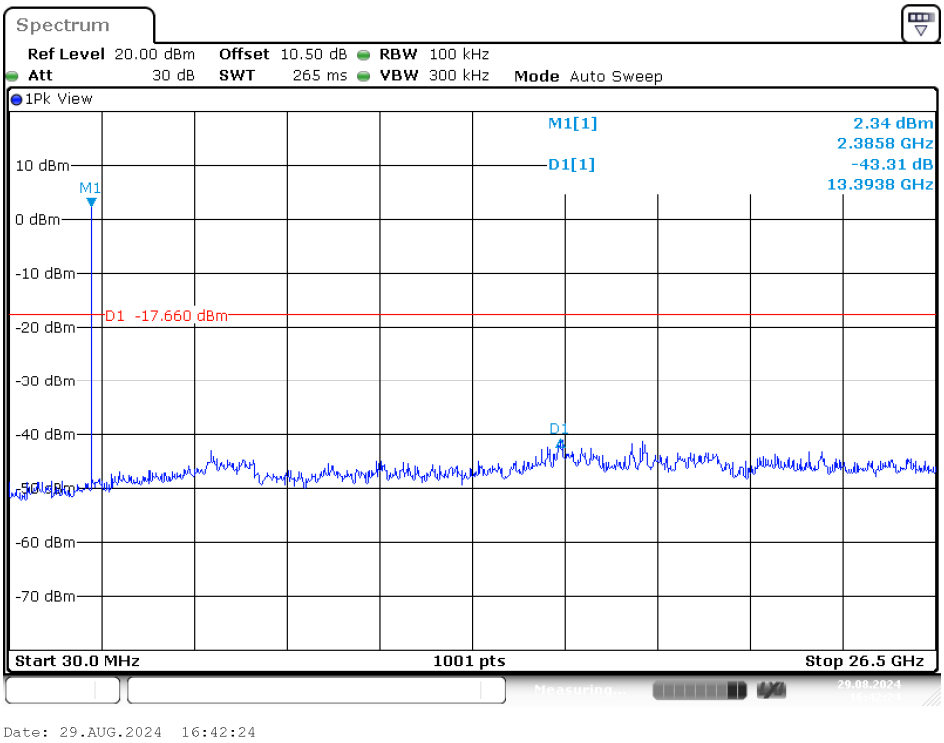
Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Conducted Spurious Emissions:

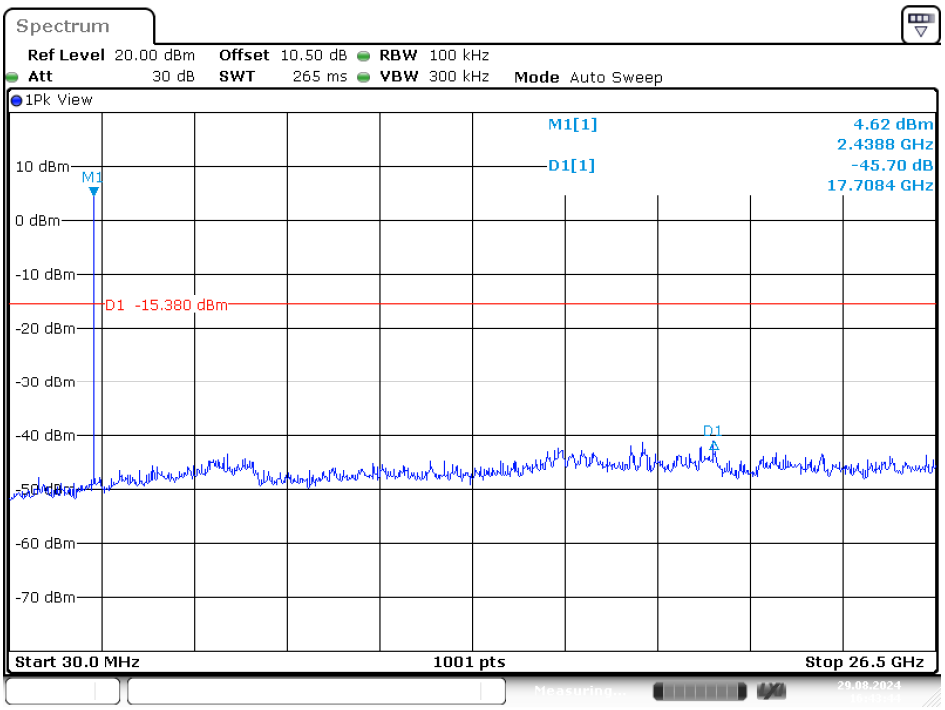
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE(1M) Mode				
Low	2402	43.31	≥ 20	PASS
Mid	2441	45.70	≥ 20	PASS
High	2480	45.95	≥ 20	PASS
BLE(2M) Mode				
Low	2402	41.65	≥ 20	PASS
Mid	2441	42.23	≥ 20	PASS
High	2480	44.19	≥ 20	PASS

Please refer to the following plots

BLE(1M) Mode
Low Channel

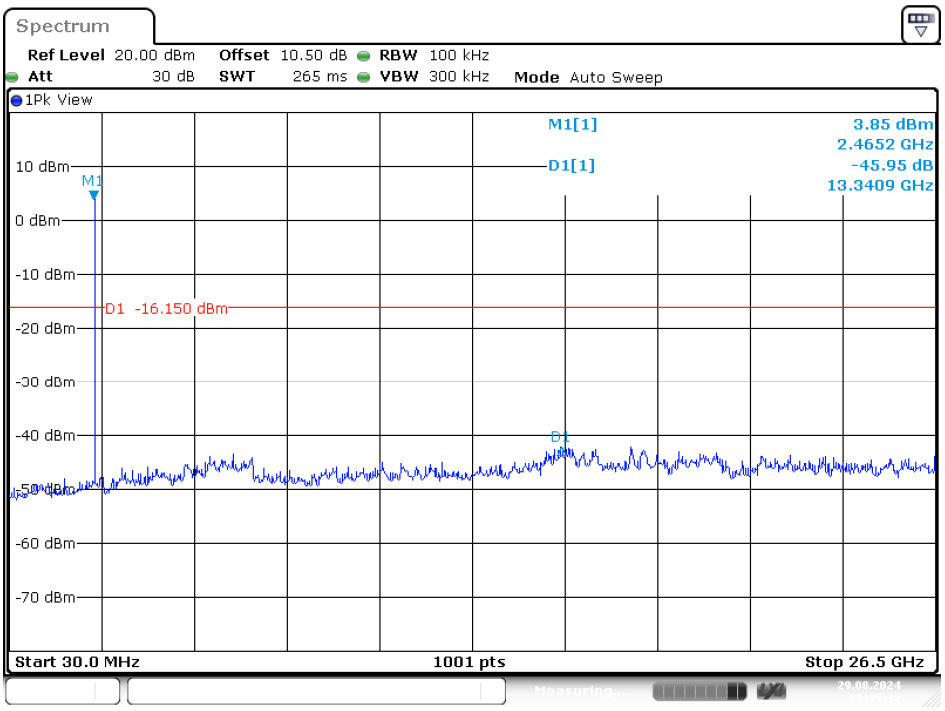


Middle Channel



Date: 29.AUG.2024 16:43:44

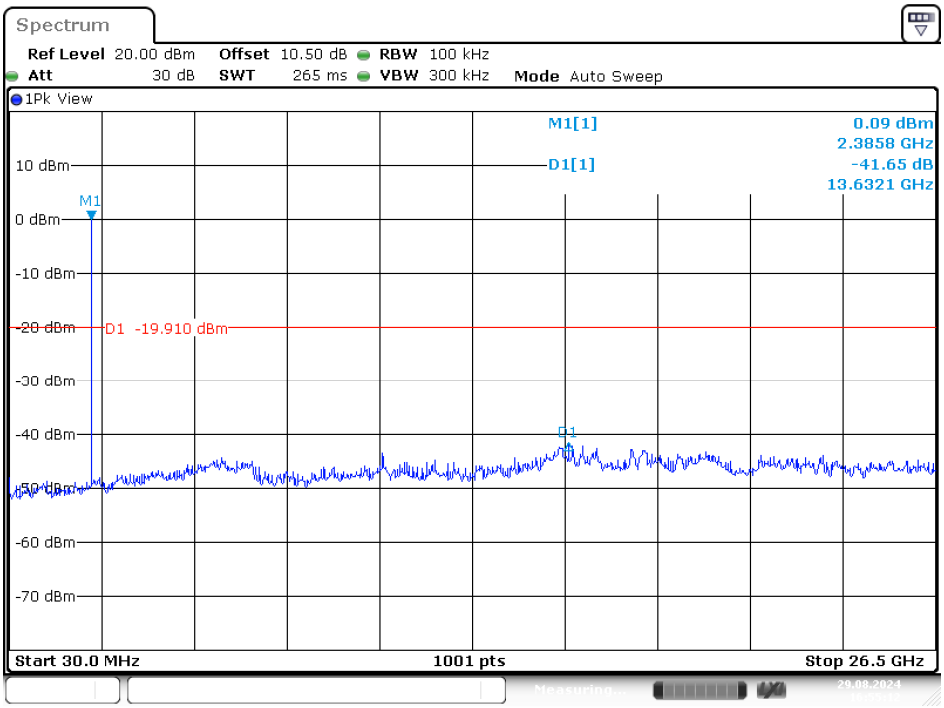
High Channel



Date: 29.AUG.2024 16:45:33

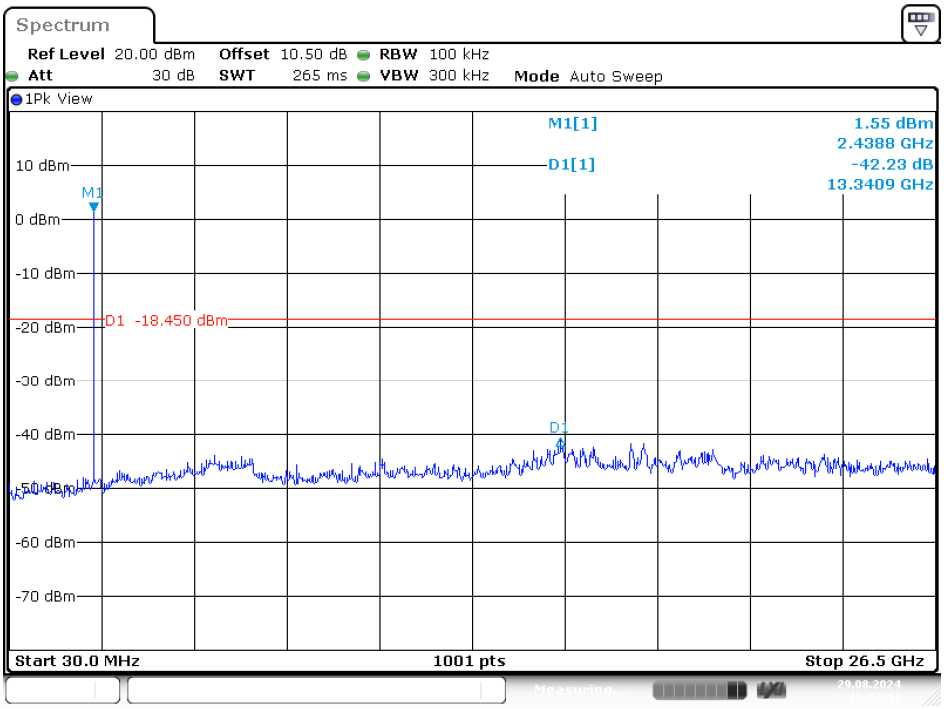
BLE(2M) Mode

Low Channel



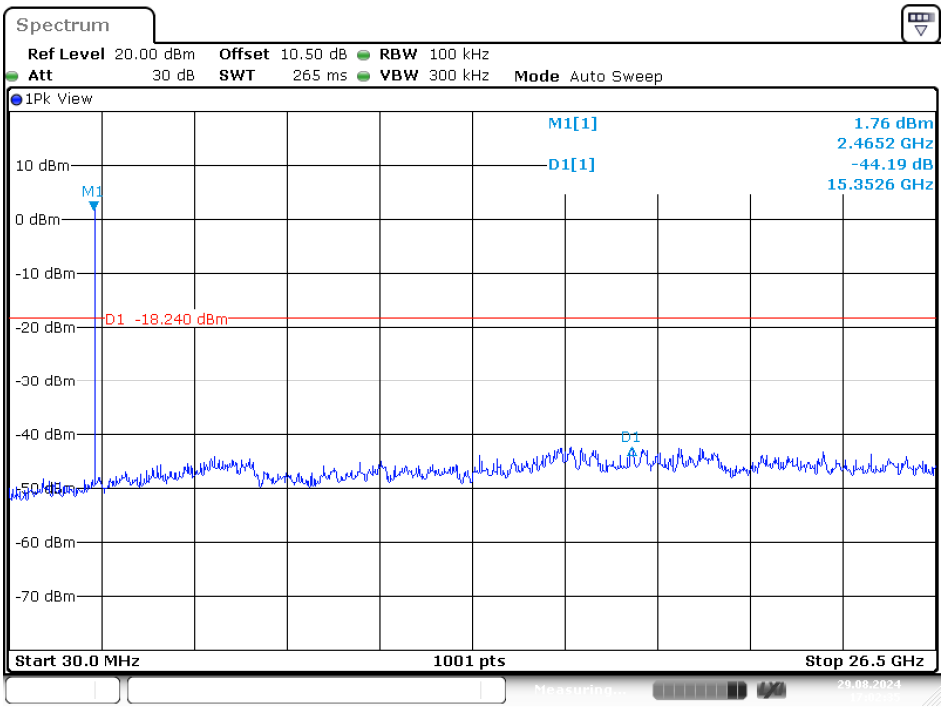
Date: 29.AUG.2024 16:55:13

Middle Channel



Date: 29.AUG.2024 16:57:41

High Channel



Date: 29.AUG.2024 17:02:36

9 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2).

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

9.2 Test Procedure

According to ANSI C63.10-2013, section 11.8

The steps for the first option are as follows:

a) Set RBW = 100 kHz.

b) Set the VBW ≥ [3 × RBW].

c) Detector = peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

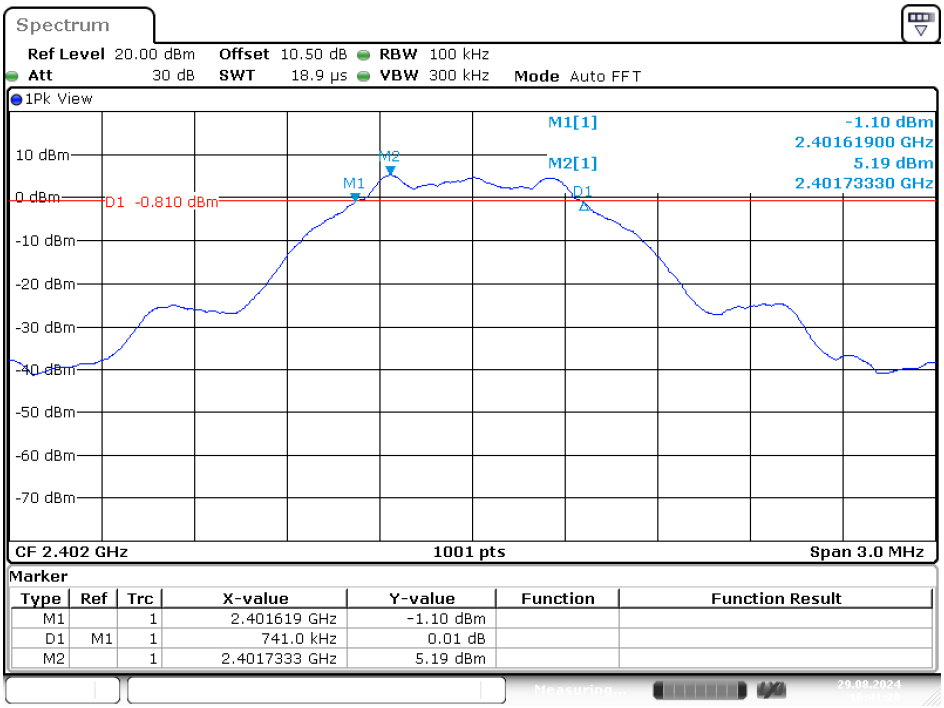
9.3 Test Results

Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	Limit (kHz)	Result
BLE(1M) Mode				
Low	2402	741	> 500	Compliance
Middle	2440	744	> 500	Compliance
High	2480	741	> 500	Compliance
BLE(2M) Mode				
Low	2402	1284	> 500	Compliance
Middle	2440	1284	> 500	Compliance
High	2480	1284	> 500	Compliance

Please refer to the following plots

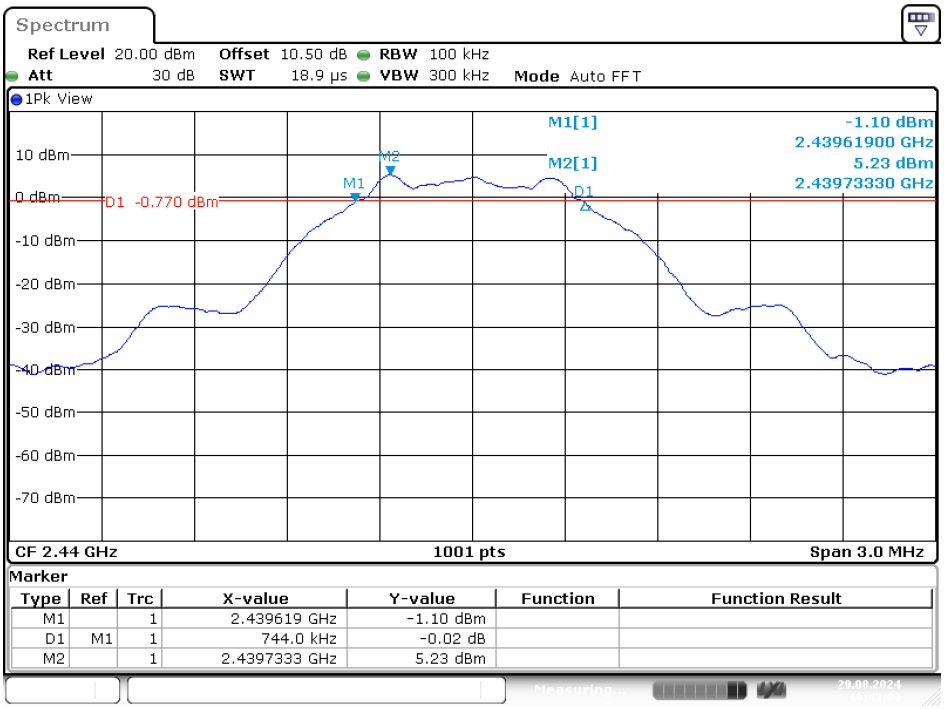
BLE(1M) Mode

Low Channel



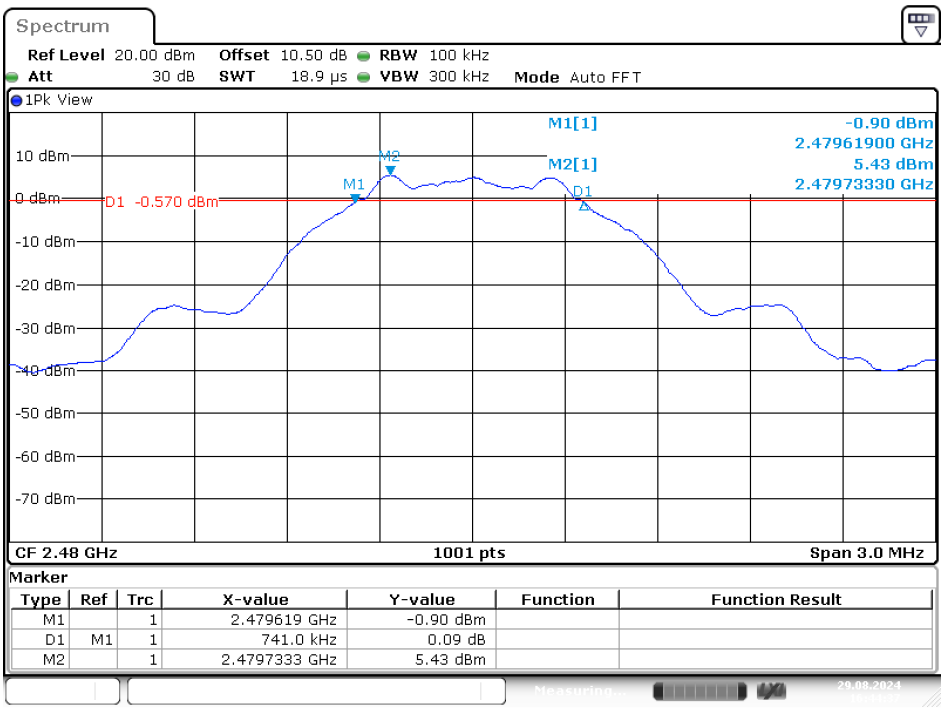
Date: 29.AUG.2024 16:41:28

Middle Channel



Date: 29.AUG.2024 16:43:04

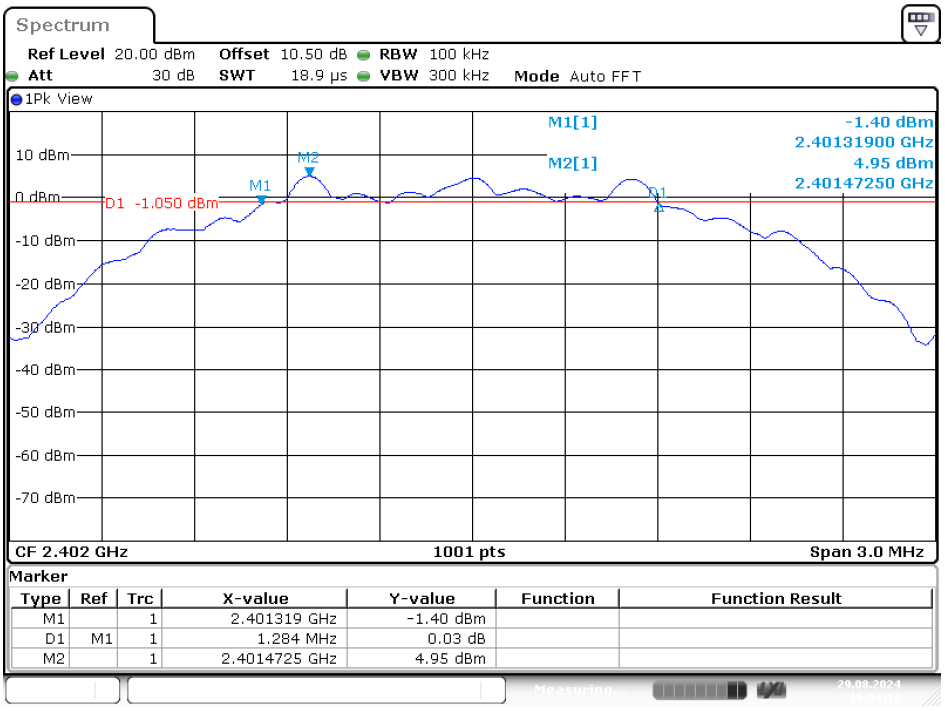
High Channel



Date: 29.AUG.2024 16:44:37

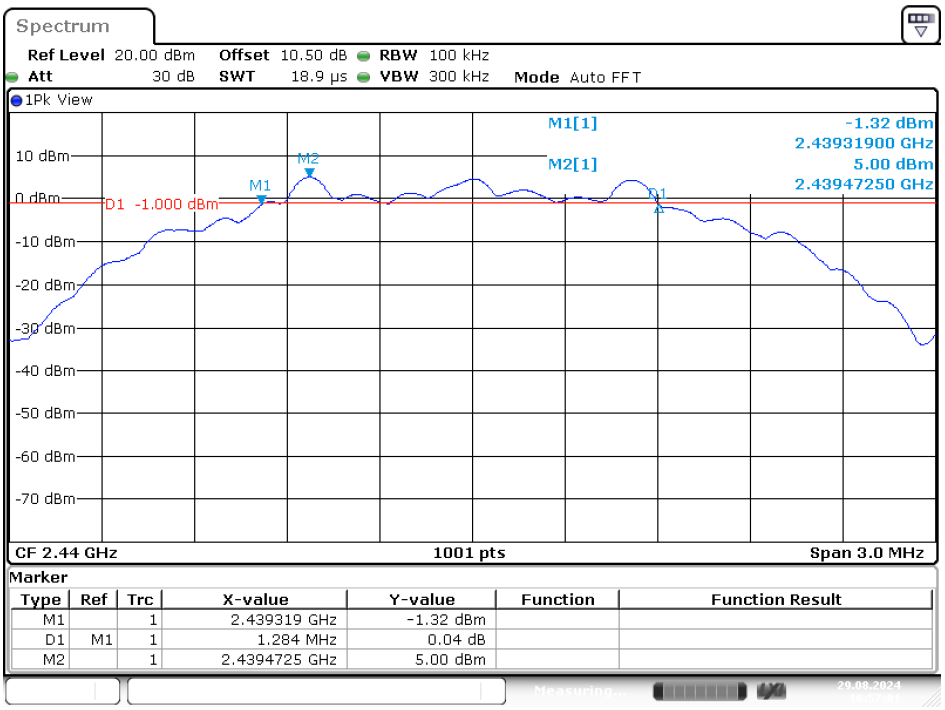
BLE(2M) Mode

Low Channel



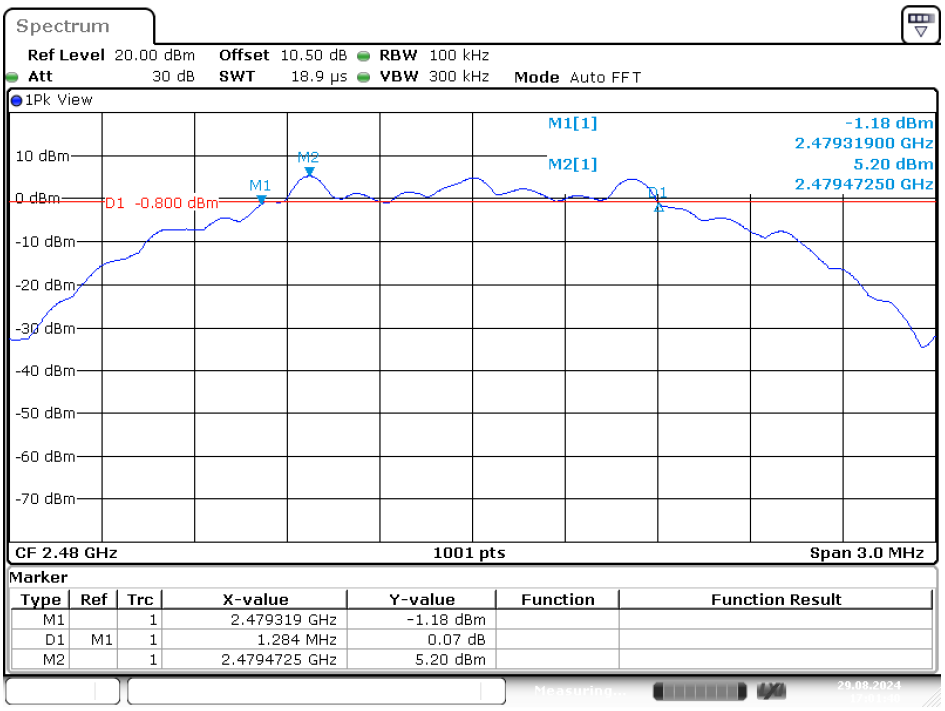
Date: 29.AUG.2024 16:54:17

Middle Channel



Date: 29.AUG.2024 16:57:01

High Channel



Date: 29.AUG.2024 17:01:40

10 FCC §15.247(b)(3) – Maximum Output Power

10.1 Applicable Standard

According to FCC §15.247(b) (3).

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.

10.2 Test Procedure

According to ANSI C63.10-2013, section 11.9.1.3

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 measuring equipment.

10.3 Test Results

Conducted Peak Output Power

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Result
BLE(1M) Mode				
Low	2402	4.93	30	PASS
Middle	2440	4.91	30	PASS
High	2480	4.95	30	PASS
BLE(2M) Mode				
Low	2402	5.15	30	PASS
Middle	2440	5.11	30	PASS
High	2480	5.20	30	PASS

Conducted Average Output Power

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)	Duty Factor (dB)	Conducted Average Output Power With Duty Factor (dBm)	Limit (dBm)	Result
BLE(1M) Mode						
Low	2402	1.89	2.08	3.97	30	PASS
Middle	2440	1.86	2.08	3.94	30	PASS
High	2480	1.91	2.08	3.99	30	PASS
BLE(2M) Mode						
Low	2402	1.53	2.44	3.97	30	PASS
Middle	2440	1.51	2.44	3.95	30	PASS
High	2480	1.56	2.44	4.00	30	PASS

11 FCC§15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

11.1 Applicable Standard

According to FCC §15.247(d).

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)).

11.2 Test Procedure

According to ANSI C63.10-2013 Section 11.11

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ [3 × RBW].
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

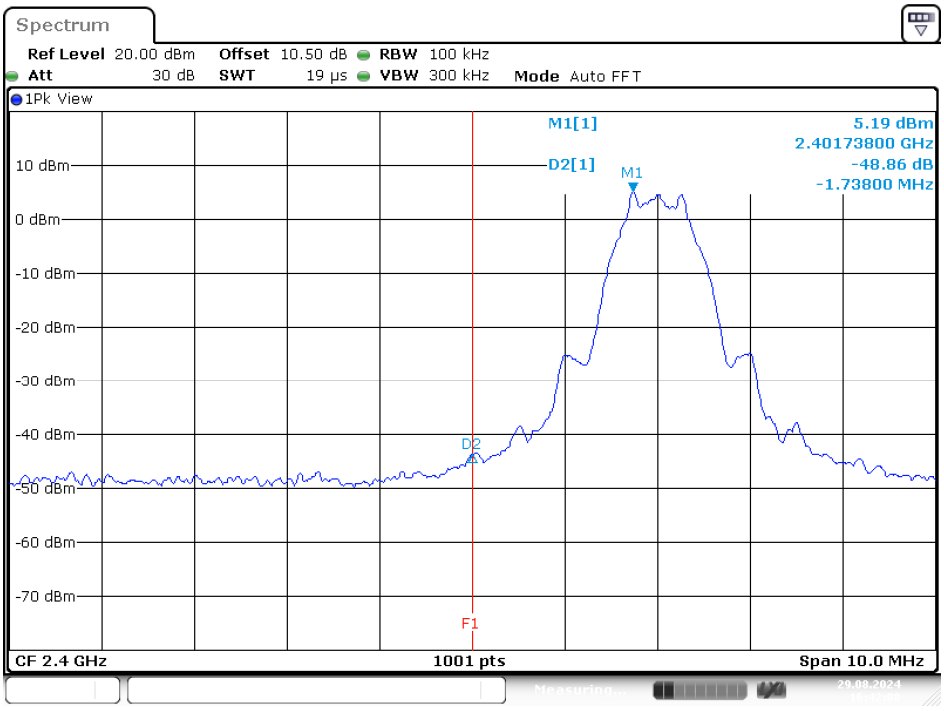
11.3 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE(1M) Mode				
Low	2402	48.86	≥ 20	PASS
High	2480	52.23	≥ 20	PASS
BLE(2M) Mode				
Low	2402	31.02	≥ 20	PASS
High	2480	51.42	≥ 20	PASS

Please refer to the following plots

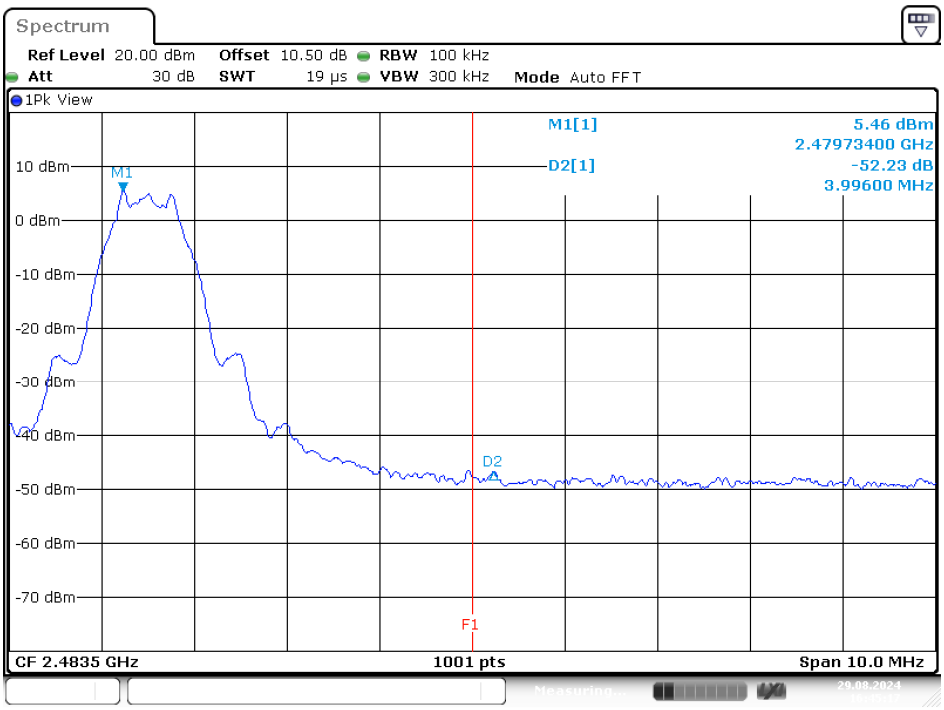
BLE(1M) Mode

Band Edge, Left Side



Date: 29.AUG.2024 16:42:09

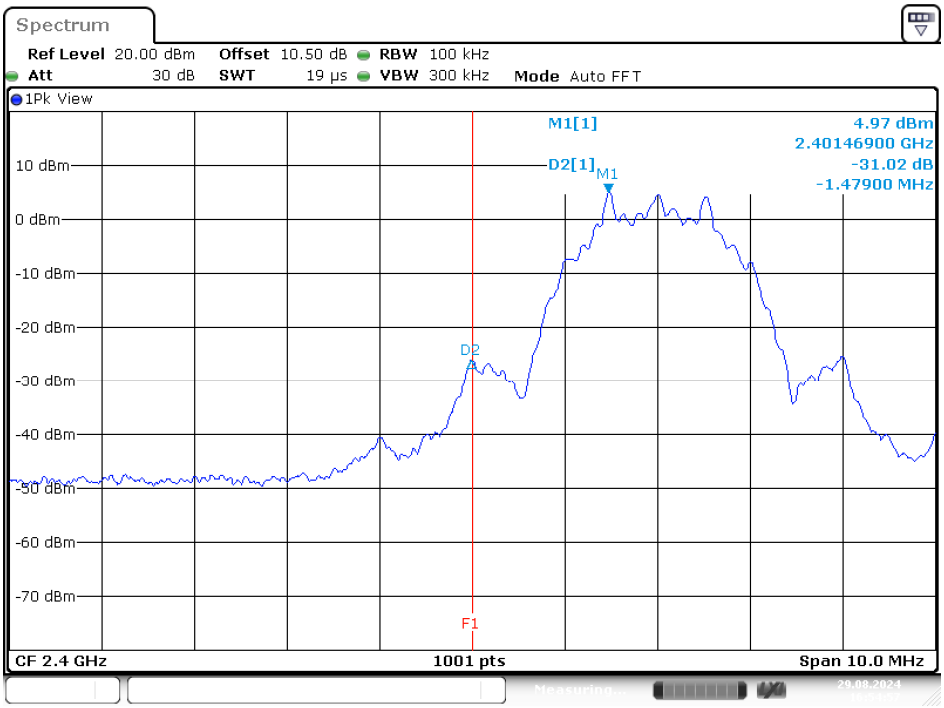
Band Edge, Right Side



Date: 29.AUG.2024 16:45:17

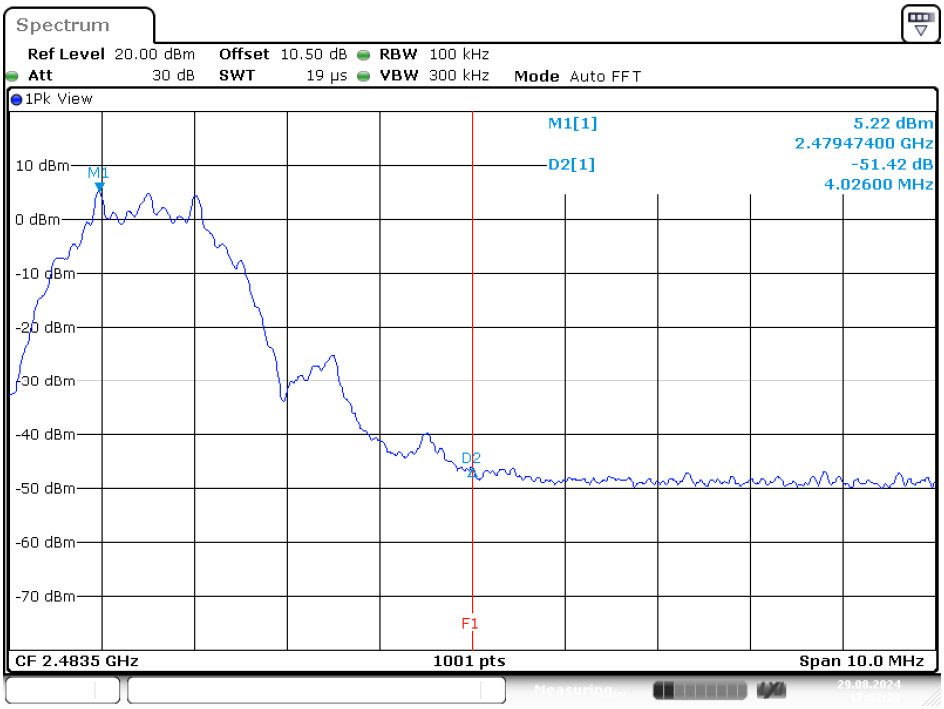
BLE(2M) Mode

Band Edge, Left Side



Date: 29.AUG.2024 16:54:57

Band Edge, Right Side



Date: 29.AUG.2024 17:02:20

12 FCC §15.247(e) – Power Spectral Density

12.1 Applicable Standard

According to FCC §15.247(e).

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

12.2 Test Procedure

According to ANSI C63.10-2013, section 11.10.2

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

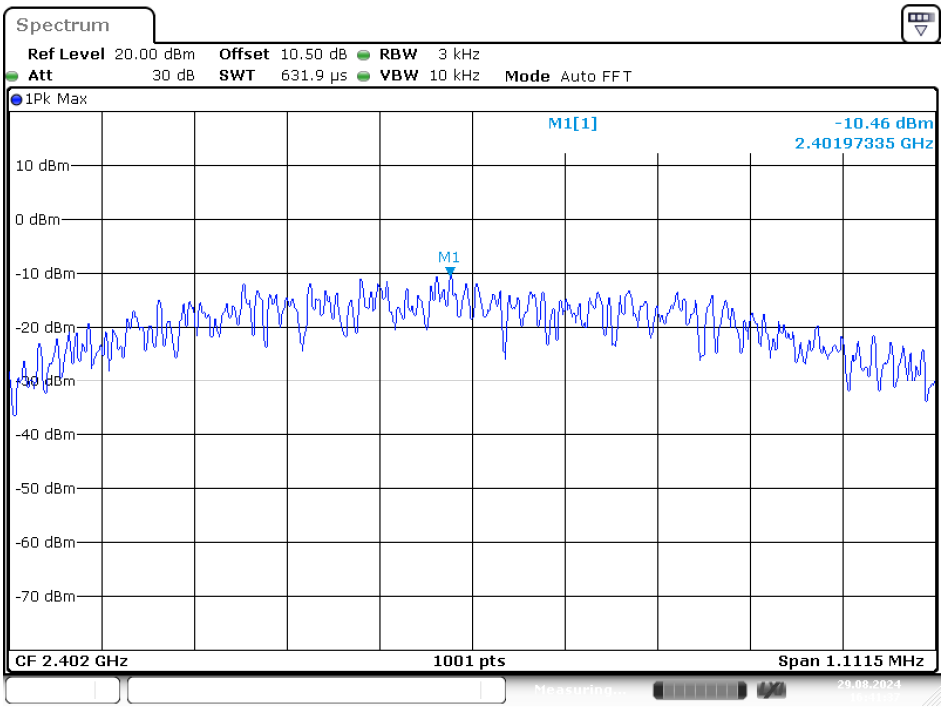
12.3 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
BLE(1M) Mode				
Low	2402	-10.46	8	Compliance
Middle	2440	-10.34	8	Compliance
High	2480	-10.16	8	Compliance
BLE(2M) Mode				
Low	2402	-13.96	8	Compliance
Middle	2440	-13.87	8	Compliance
High	2480	-13.61	8	Compliance

Please refer to the following plots

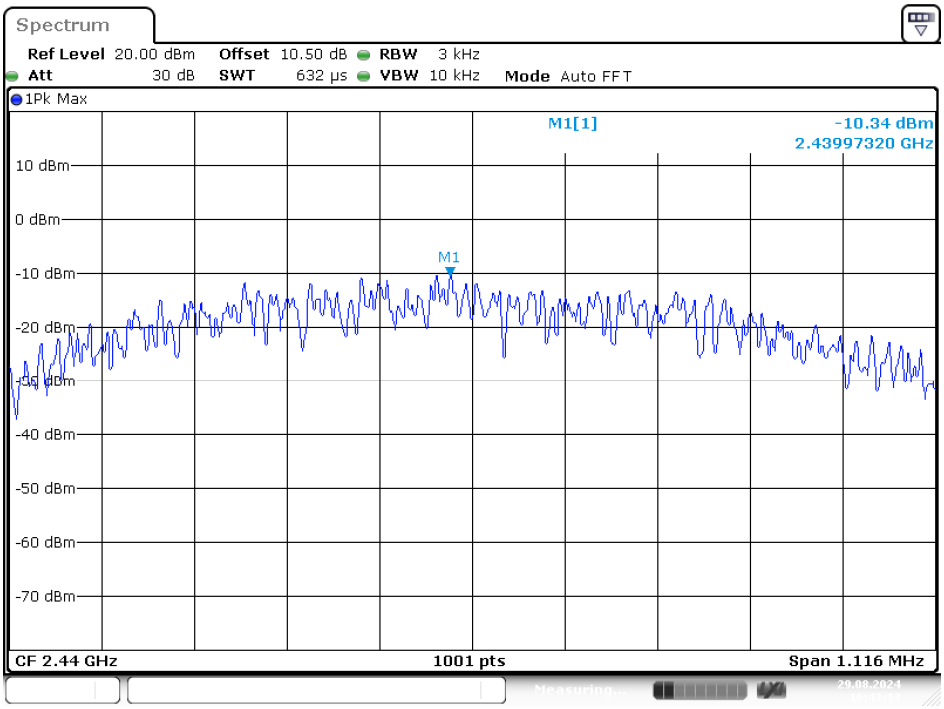
BLE(1M) Mode

Low Channel



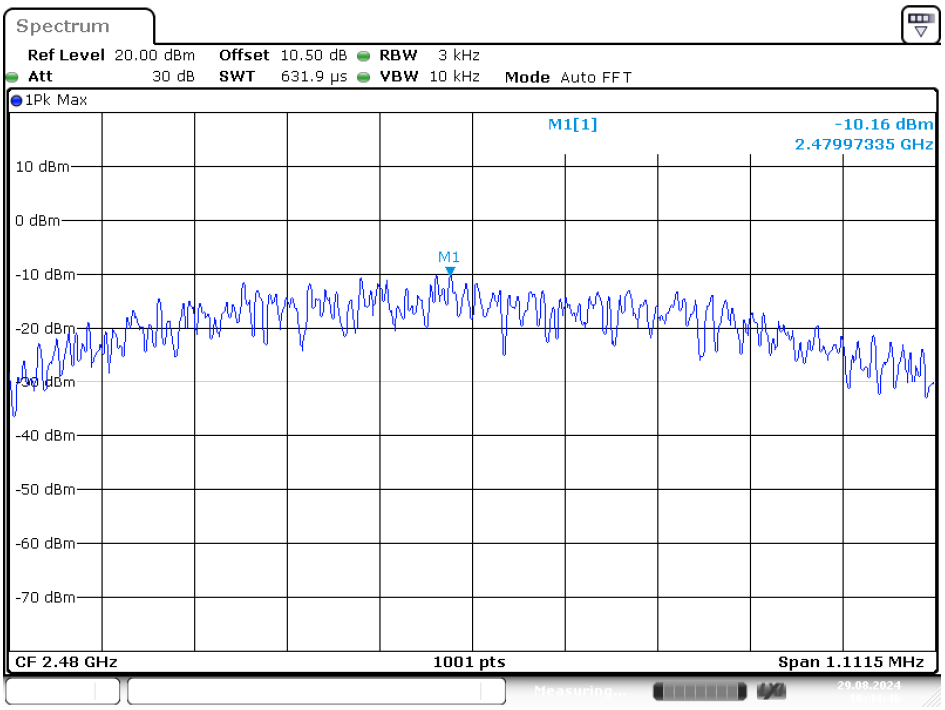
Date: 29.AUG.2024 16:41:37

Middle Channel



Date: 29.AUG.2024 16:43:13

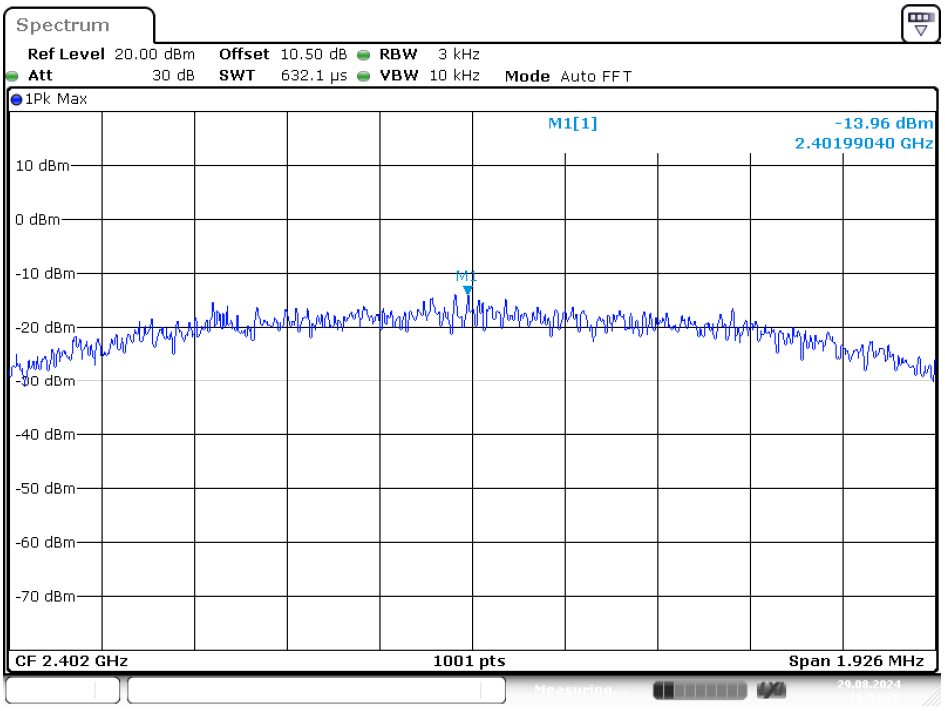
High Channel



Date: 29.AUG.2024 16:44:46

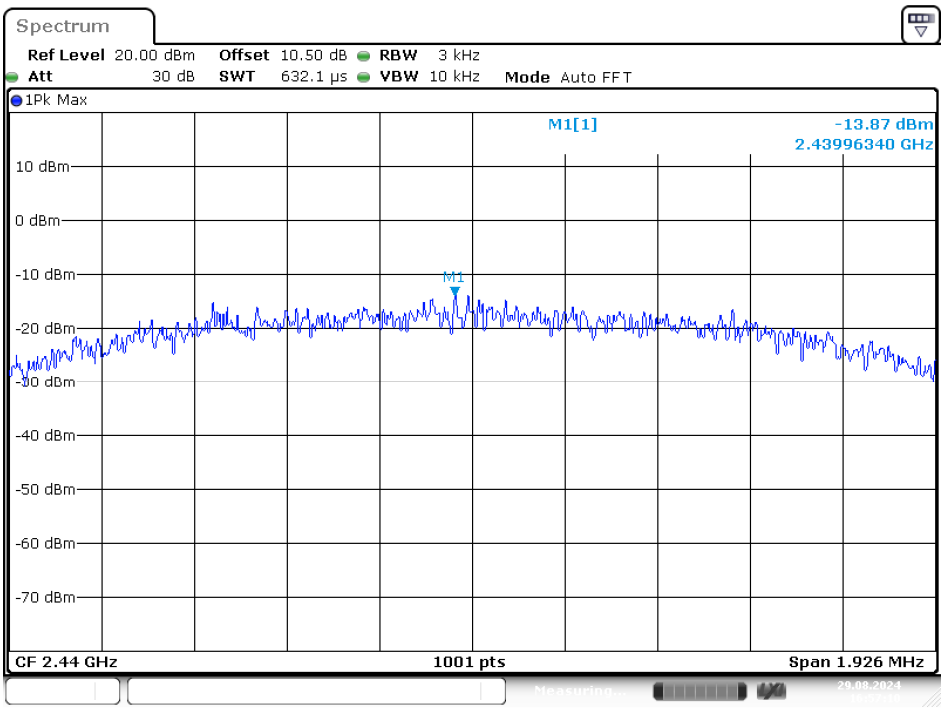
BLE(2M) Mode

Low Channel



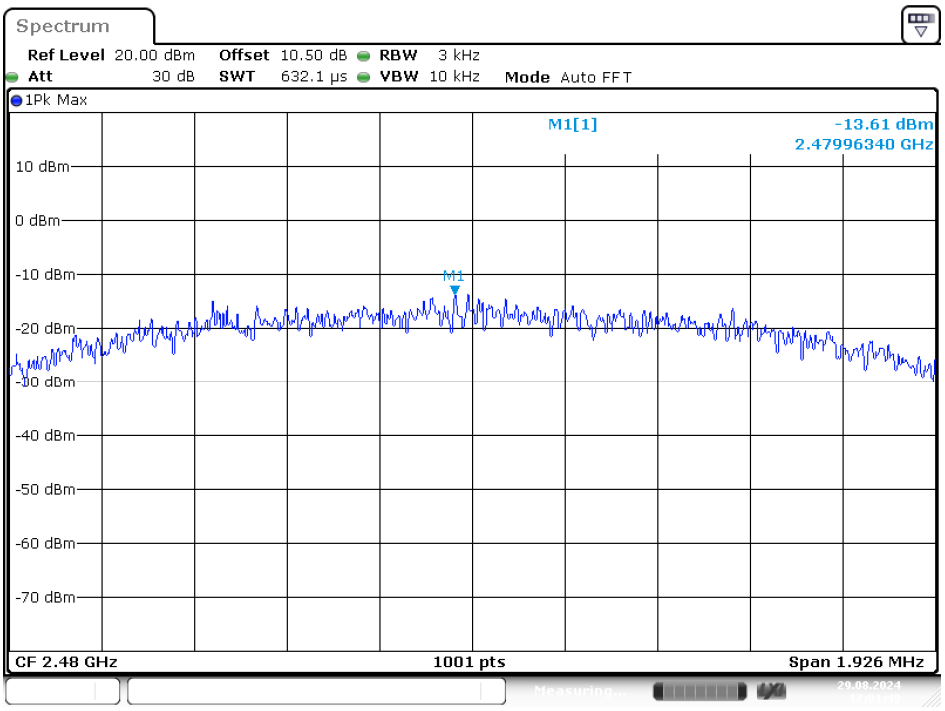
Date: 29.AUG.2024 16:54:26

Middle Channel



Date: 29.AUG.2024 16:57:10

High Channel



Date: 29.AUG.2024 17:01:49

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