FCC Part 15.247
RSS-247, ISSUE 4, July 24
RSS-GEN, ISSUE 5, February 2021 Amendment 2
TEST REPORT

For

Technology Solutions (UK) Ltd

Suite A, Loughborough Technology Centre, Epinal Way, Loughborough, Leicestershire, LE11 3GE, United Kingdom

FCC ID: S6J3138
IC: 8948A-3138

Report Type:	**Product Type:**
Original Report	RFID READER

Report Producer : Jojo Lu

Report Number : RXZ241220075RF08

Report Date : 2025-09-11

Reviewed By: Andy Shih

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ241220075	RXZ241220075RF08	2025-09-11	Original Report	Jojo Lu

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	Technology Solutions (UK) Ltd
	Suite A, Loughborough Technology Centre, Epinal Way, Loughborough, Leicestershire, LE11 3GE, United Kingdom
Brand(Trade) Name	TSL
Product (Equipment)	RFID READER
Model Name/HVIN	3138-AS1-US，3138-AS2-US，3138-AX1-US，3138-AX2-US
PMN	3138
Model Discrepancy	Please refer to the difference declaration letter provided by the Applicant.
Frequency Range	BLE(1M): 2402 ~ 2480 MHz
Maximum Conducted Peak Output Power	BLE(1M) Mode : 2.99 dBm
Modulation Technique	BLE(1M) Mode : GFSK
Transmit Data Rate	BLE(1M) Mode: 1 Mbps
Power Operation (Voltage Range)	7.2Vdc from Battery 5.2Vdc from Adapter
Received Date	2025/01/06

*All measurement and test data in this report was gathered from production sample serial number: RXZ241220075-1、RXZ241220075-2、RXZ241220075-3、RXZ241220075-4 (Assigned by BACL, New Taipei Laboratory.)

1.2 Objective

This report is prepared on behalf of *Technology Solutions (UK) Ltd* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules and RSS-247, Issue 4, July 24, RSS-Gen, Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and KDB 558074 D01 15.247 Meas Guidance v05r02. And RSS-247, Issue 4, July 24, RSS-Gen, Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

1.4 Statement

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

1. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory).
2. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.
3. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
4. 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.
5. 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 (%)	Test Engineer
AC Line Conducted Emissions	2025/2/20	19.9	62	Aaron
Radiation Spurious Emissions	2025/1/16~2025/9/9	16.2~25.4	49~64	Nick
Duty Cycle	2025/3/6	23.7	58	Wayne
Conducted Spurious Emissions	2025/3/6	23.7	58	Wayne
Emission Bandwidth	2025/3/6	23.7	58	Wayne
Maximum Output Power	2025/3/6	23.7	58	Wayne
100 kHz Bandwidth of Frequency Band Edge	2025/3/6	23.7	58	Wayne
Power Spectral Density	2025/3/6	23.7	58	Wayne

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) 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.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: TW3732.

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 "RF Test USB v1.8.1"

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

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number
Adapter	HANG	C13
Docking	TSL	3138-CRD-01
Phone	Datalogic	Memor 10

2.5 External Cable List and Details

Description	Manufacturer	Model Number
Micro USB	BACL	1m

2.6 Test Mode

Pre-scan

Mode 1: model (3138-AS1-US), USB Type-C handle

Mode 2: model (3138-AX1-US), USB Type-C handle

Mode 3: model (3138-AS2-US), 8 pad connector handle

Mode 4: model (3138-AX2-US), 8 pad connector handle

Worst case is the Mode 1

Mode 1: model (3138-AS1-US) for all test item, Tx Test status.

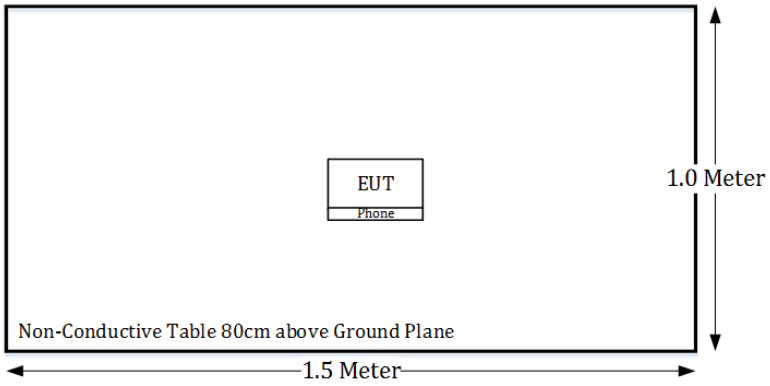
Mode 2: model (3138-AX1-US) test Below 1GHz Radiated Spurious Emissions.

2.7 Block Diagram of Test Setup

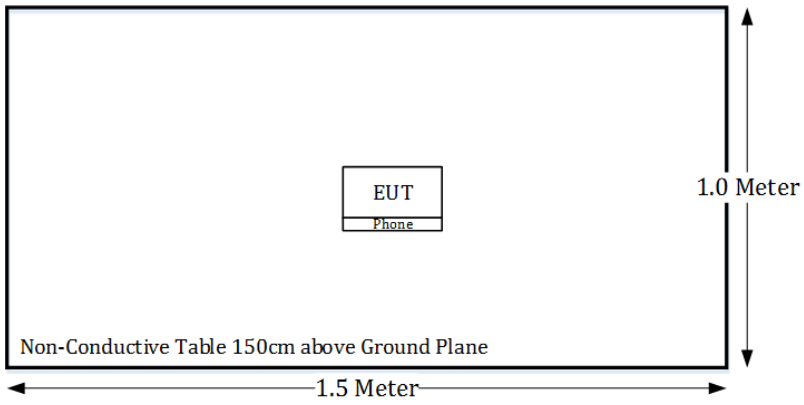
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation:

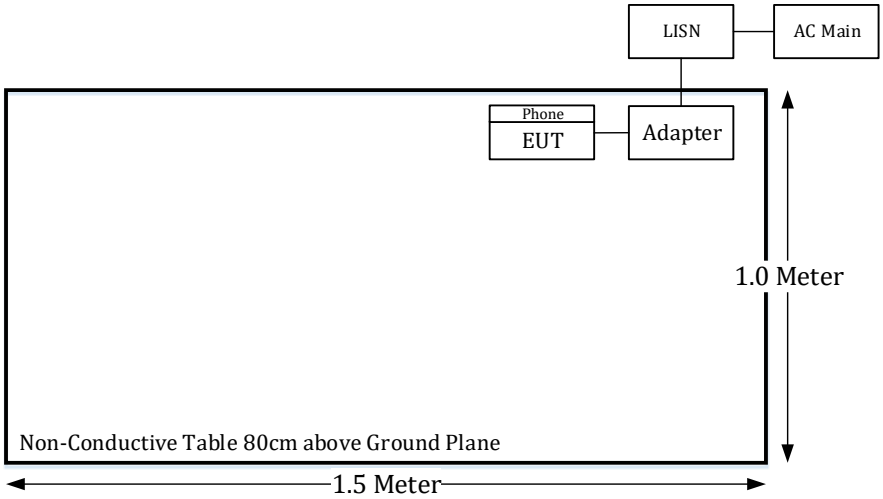
Below 1GHz



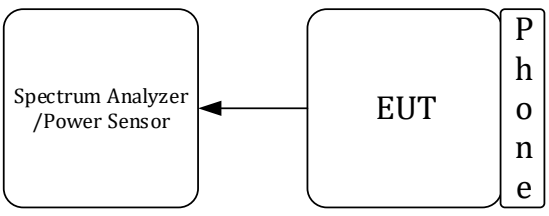
Above 1GHz:



Conduction:



Conducted:



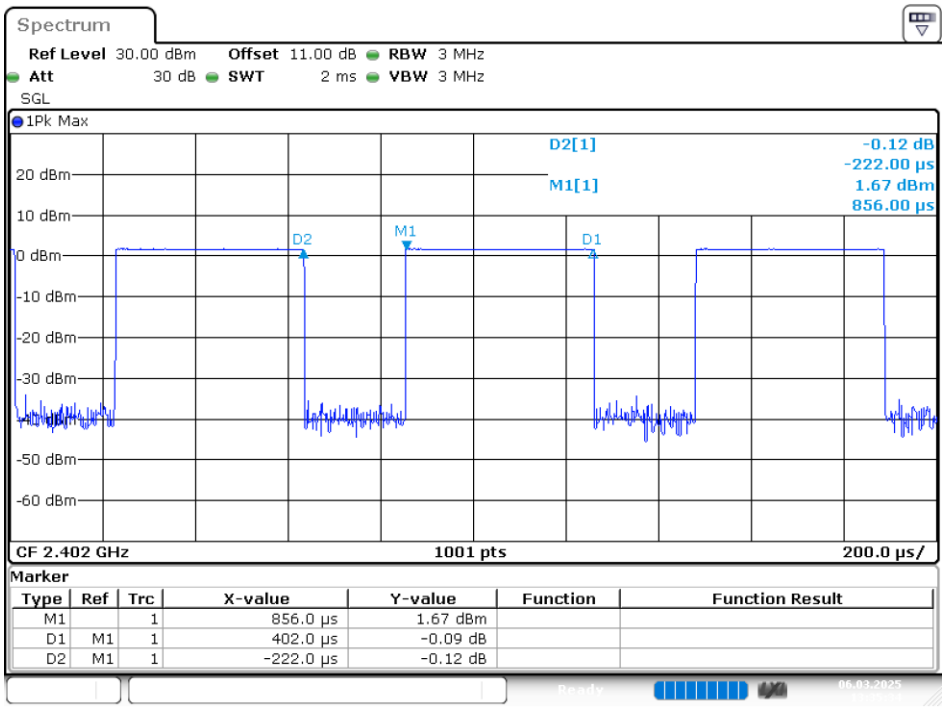
2.8 Duty Cycle

The duty cycle as below:

Radio Mode	On Time (ms)	Off Time (ms)	Duty Cycle (%)	1/T (kHz)	1/T VBW setting (kHz)
BLE(1M)	0.402	0.222	64	2.49	3

Please refer to the following plots.

BLE(1M) Mode



3 Summary of Test Results

Rules	Description of Test	Results
FCC §15.203 RSS-Gen §6.8	Antenna Requirement	Compliance
FCC §15.207(a) RSS-Gen §8.8	AC Line Conducted Emissions	Compliance
FCC §15.205, §15.209, §15.247(d) RSS-247 §6.6 RSS-Gen §8.9 RSS-Gen §8.10	Spurious Emissions	Compliance
FCC §15.247(a)(2) RSS-247 §6.3.1(a) RSS-Gen §6.7	Emission Bandwidth	Compliance
FCC §15.247(b)(3) RSS-247 §6.3.2	Maximum Peak Output Power	Compliance
FCC §15.247(d) RSS-247 §6.6	100 kHz Bandwidth of Frequency Band Edge	Compliance
FCC §15.247(e) RSS-247 §6.3.1(b)	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	2025/2/17	2026/2/17
EMI Test Receiver	Rohde & Schwarz	ESR	102759	2024/9/19	2025/9/19
RF Cable	EMEC	EM-CB5D	1	2024/6/5	2025/6/5
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiation 3M Room - Below 1GHz (966-A)					
Active Loop Antenna	ETS-Lindgren	6502	35796	2024/3/27	2025/3/27
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2025/1/16	2026/1/16
Preamplifier	Sonoma	310N	130602	2024/6/18	2025/6/18
				2025/6/17	2026/6/17
Spectrum Analyzer	Rohde & Schwarz	FSV40	101941	2024/12/25	2025/12/25
EMI Test Receiver	Rohde & Schwarz(R&S)	ESR3	102759	2024/9/19	2025/9/19
Microflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2024/12/20	2025/12/20
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2024/12/20	2025/12/20
Coaxial Cable	COMMATE	PEWC	8Dr	2024/12/20	2025/12/20
Cable	EMC	EMC105-SM-SM-10000	201003	2024/12/20	2025/12/20
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2024/12/20	2025/12/20
Software	AUDIX	E3	18621a	N.C.R	N.C.R
Radiation 3M Room - Above 1GHz (966-A)					
Horn Antenna	A.H. system	SAS-571	1020	2024/5/21	2025/5/21
Horn Antenna	ETS-Lindgren	3116	62638	2024/8/30	2025/8/30
Preamplifier	Channel	ERA-100M-18G-01D1748	EC2300049	2024/12/12	2025/12/12
Preamplifier	BACL	BACL-1313-A1840	4011511	2024/2/1	2025/2/1
Spectrum Analyzer	Rohde & Schwarz	FSV40	101941	2024/12/25	2025/12/25
EMI Test Receiver	Rohde & Schwarz(R&S)	ESR3	102759	2024/9/19	2025/9/19
Microflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2024/12/20	2025/12/20
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2024/12/20	2025/12/20
Coaxial Cable	COMMATE	PEWC	8Dr	2024/12/20	2025/12/20
Cable	EMC	EMC105-SM-SM-10000	201003	2024/12/20	2025/12/20
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2024/12/20	2025/12/20
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2024/1/23	2025/1/23
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2024/1/23	2025/1/23
Band-stop filter	Woken	STI15-9831	STI15-9831-1	2024/10/19	2025/10/19
High-pass filter	XINGBOKEJI	XBLBQ-GTA54	200108-3-2	2024/10/19	2025/10/19
Software	AUDIX	E3	18621a	N.C.R	N.C.R

Conducted Room					
Spectrum Analyzer	Rohde & Schwarz(R&S)	FSV40	101204	2024/5/30	2025/5/30
Cable	UTIFLEX	UFA210A	9435	2024/10/1	2025/10/1
Power Sensor	Boonton	RTP5006	11037	2024/5/21	2025/5/21
Attenuator	MCL	BW-S10W5+	1419	2025/3/6	2026/3/6

***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 §15.203 & RSS-GEN §6.8 – Antenna Requirements

5.1 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.

According to RSS-Gen 6.8:

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

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

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

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

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

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

5.2 Antenna Information

Model	Type	Antenna Gain	Impedance
AMAN301512ST01	Dielectric Chip	2.1 dBi	50Ω

Unit uses a unique coupling to the intentional radiator.

Result: Compliance

6 FCC §15.207(a) & RSS-GEN §8.8 – AC Line Conducted Emissions

6.1 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.

According to RSS-GEN §8.8

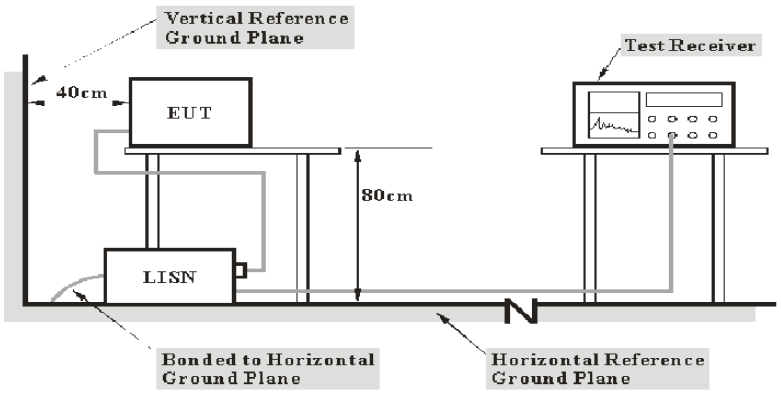
Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the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

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

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.

6.2 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 C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024 measurement procedure. The specification used was with the FCC Part 15.207 and RSS-GEN limits.

6.3 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

6.4 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.

6.5 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

6.6 Test Results

Test Mode: Transmitting

Main: AC120 V, 60 Hz

(Worst case is Adapter mode)

Line

Description: **BLE, RBW:9kHz/VBW:30kHz**

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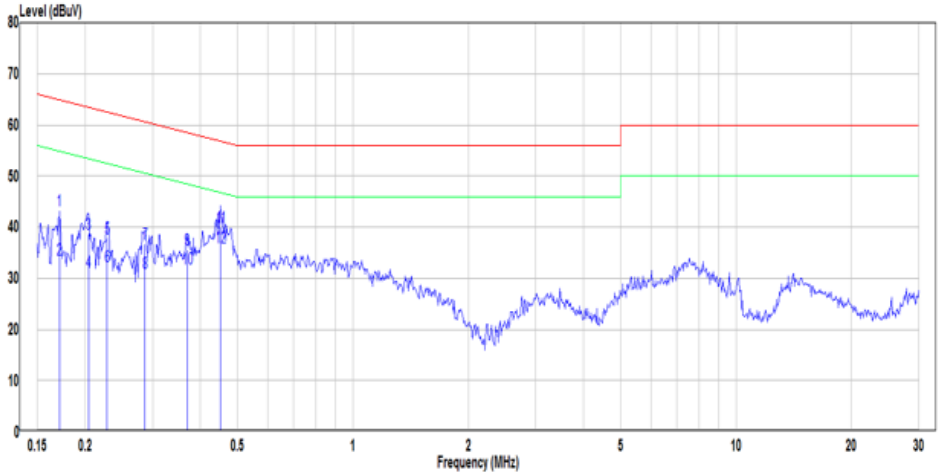

No.	Frequency (MHz)	Reading dBuV	Correct Factor(dB)	Result dBuV	Limit dBuV	Over limit (dB)	Remark	Phase
1	0.171	33.43	9.91	43.34	64.90	-21.56	QP	Line
2	0.171	23.69	9.91	33.60	54.90	-21.30	Average	Line
3	0.204	28.65	10.03	38.68	63.45	-24.76	QP	Line
4	0.204	21.30	10.03	31.33	53.45	-22.12	Average	Line
5	0.228	27.83	10.05	37.88	62.52	-24.63	QP	Line
6	0.228	22.21	10.05	32.26	52.52	-20.26	Average	Line
7	0.286	26.73	10.10	36.83	60.63	-23.80	QP	Line
8	0.286	21.04	10.10	31.14	50.63	-19.49	Average	Line
9	0.369	25.41	10.16	35.57	58.52	-22.95	QP	Line
10	0.369	21.76	10.16	31.92	48.52	-16.60	Average	Line
11	0.452	29.80	10.22	40.02	56.85	-16.83	QP	Line
12	0.452	25.75	10.22	35.97	46.85	-10.88	Average	Line

Neutral

Description: **BLE,RBW:9kHz/VBW:30kHz**

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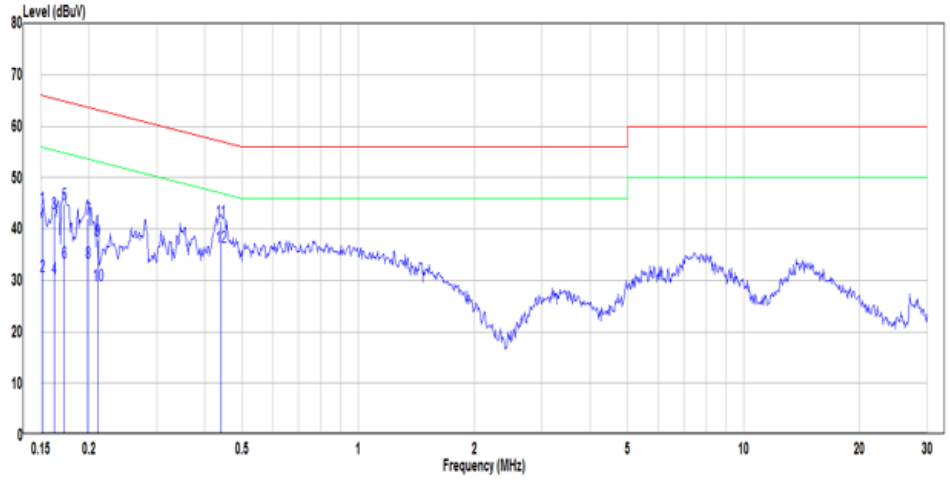


No.	Frequency (MHz)	Reading dBuV	Correct Factor(dB)	Result dBuV	Limit dBuV	Over limit (dB)	Remark	Phase
1	0.152	34.37	9.84	44.21	65.91	-21.70	QP	Neutral
2	0.152	20.98	9.84	30.82	55.91	-25.09	Average	Neutral
3	0.162	33.27	9.88	43.15	65.34	-22.19	QP	Neutral
4	0.162	20.46	9.88	30.34	55.34	-24.99	Average	Neutral
5	0.172	34.79	9.92	44.71	64.86	-20.15	QP	Neutral
6	0.172	23.52	9.92	33.44	54.86	-21.41	Average	Neutral
7	0.199	31.92	10.03	41.95	63.67	-21.72	QP	Neutral
8	0.199	23.46	10.03	33.49	53.67	-20.18	Average	Neutral
9	0.211	27.77	10.05	37.82	63.18	-25.36	QP	Neutral
10	0.211	19.10	10.05	29.15	53.18	-24.03	Average	Neutral
11	0.440	31.37	10.22	41.59	57.07	-15.47	QP	Neutral
12	0.440	26.20	10.22	36.42	47.07	-10.64	Average	Neutral

Note:

Result = Reading + Factor

Over Limit = Result – Limit Line

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

7 FCC §15.209, §15.205, §15.247(d) & RSS-247 §6.6, RSS-GEN §8.9, §8.10 – Spurious Emissions

7.1 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 RSS-Gen 8.10,

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

(a)The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).

(b)Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.

(c)Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

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) and RSS-GEN §8.9: 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.

As per RSS-GEN §8.9: Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General field strength limits at frequencies above 30 MHz	
Frequency (MHz)	**Field Strength (µV/m at 3 m)**
30 - 88	100
88 - 216	150
216 - 960	200
Above 960	500

Table 6 – General field strength limits at frequencies below 30 MHz		
Frequency (MHz)	**Field Strength (H-Field) (µA/m)**	**Measurement distance (m)**
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Note 2: The limit was added 51.5dB to convert the limit from dBuA/m to dBuV/m.

According to ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024, 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

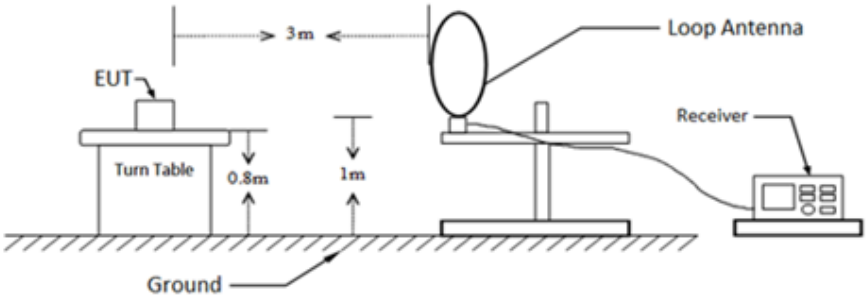
18 GHz to 40 GHz are typically made at distances significantly less than 3 m from the EUT. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade of distance (inverse of linear distance 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).

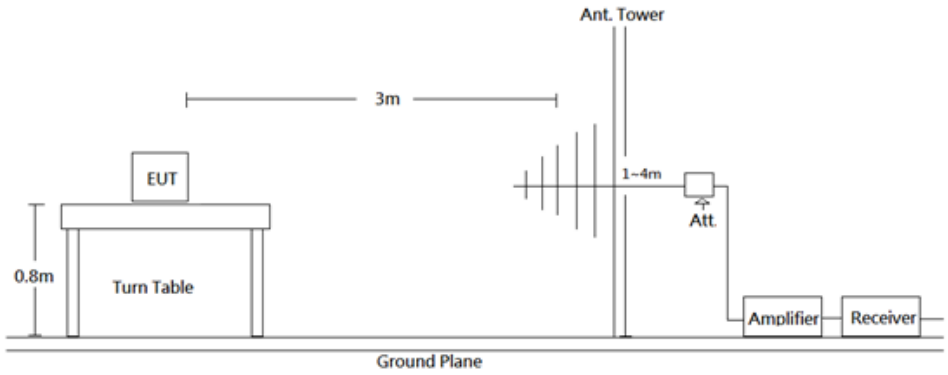
As per RSS-247 6.6,
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum device, digitally modulated device, or hybrid system is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power – based on either an RF conducted or a radiated measurement – provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 6.3.2, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

7.2 EUT Setup

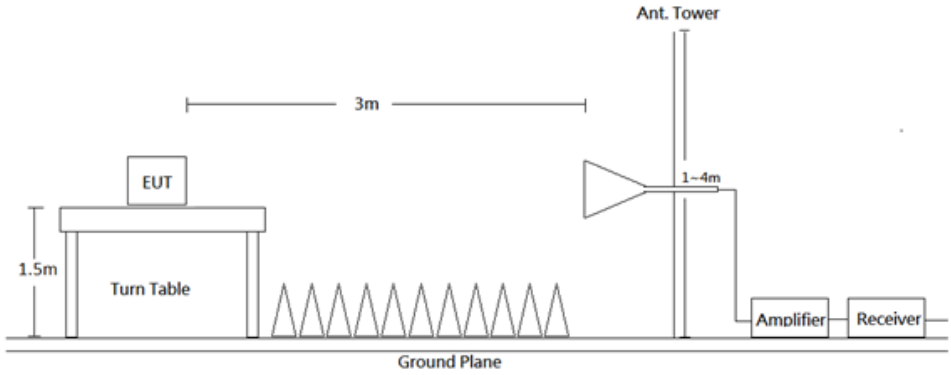
9kHz-30MHz:



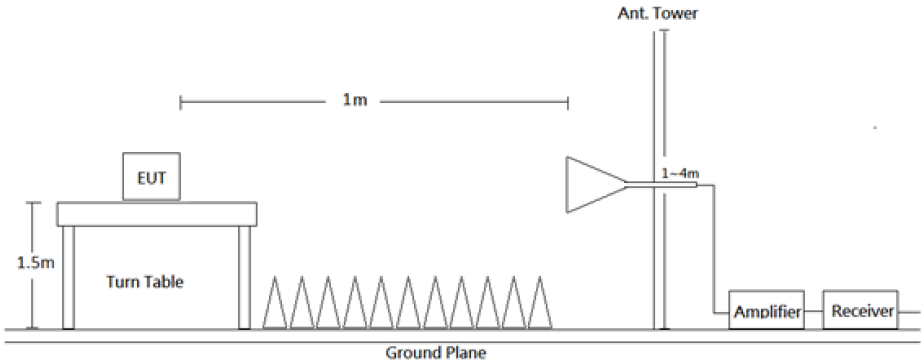
30MHz-1GHz:



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 C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024. The specification used was the FCC Part 15.209, FCC 15.247 and RSS-Gen, RSS-247 Limits.

7.3 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	Video B/W	IF B/W	Duty cycle	Measurement method	Detector
9 kHz - 150 kHz	300 Hz	1 kHz	200 Hz	/	QP/AV	QP/AV
150 kHz - 30 MHz	10 kHz	30 kHz	9 kHz	/	QP/AV	QP/AV
30-1000 MHz	100 kHz	300 kHz	/	/	PK	PK
	/	/	120 kHz	/	QP	QP
Above 1 GHz	Pre-scan :					
	1 MHz	3 MHz	/	/	PK	PK
	1 MHz	1 kHz	/	>98%	Ave	PK
	1 MHz	≥ 1/Ton, not less than 1 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: T 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.

7.4 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.

7.5 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

7.6 Test Results

Test Mode: Transmitting

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

9kHz-30MHz:

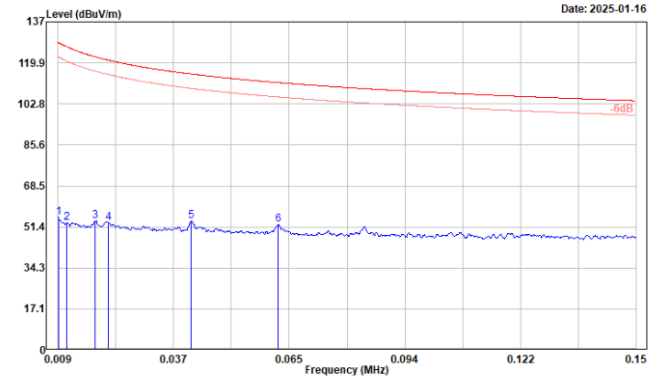
(Worst case is Mode 1)

(Worst case is BLE 1M mode, High channel)

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

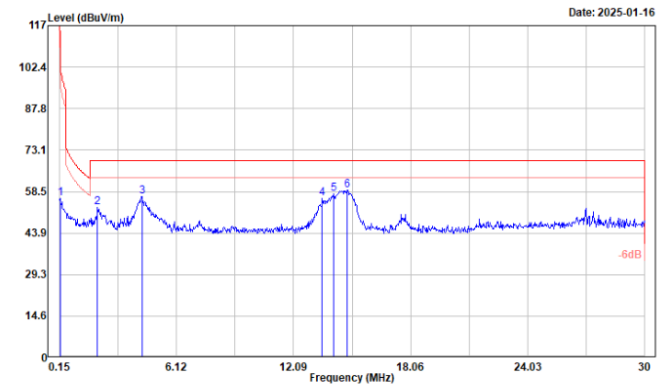
9kHz-150kHz	150kHz-30MHz

Description: RBW:300Hz/VBW:1kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.009	37.60	17.59	55.19	128.39	-73.20	100	0	Average
0.011	37.01	16.07	53.08	126.57	-73.49	100	0	Average
0.018	38.69	15.31	54.00	122.42	-68.42	100	0	Average
0.021	38.23	14.91	53.14	120.99	-67.85	100	0	Average
0.042	41.12	12.87	53.99	115.23	-61.24	100	0	Average
0.063	40.49	11.72	52.21	111.66	-59.45	100	0	Average

Description: RBW:10kHz/VBW:30kHz



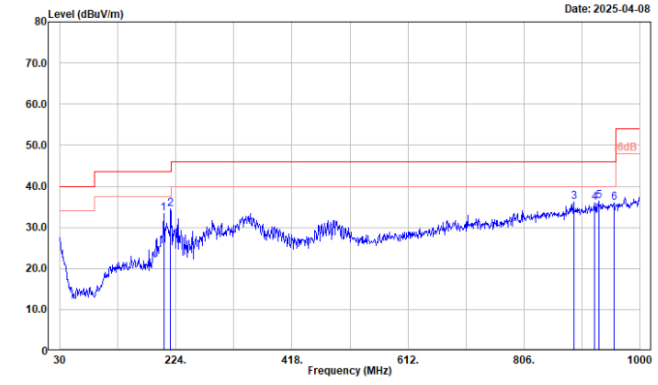
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.180	44.46	11.53	55.99	102.51	-46.52	100	360	Average
2.090	42.11	10.71	52.82	69.54	-16.72	100	360	QP
4.359	46.18	10.63	56.81	69.54	-12.73	100	360	QP
13.553	44.60	11.55	56.15	69.54	-13.39	100	360	QP
14.120	46.22	11.57	57.79	69.54	-11.75	100	360	QP
14.836	47.51	11.59	59.10	69.54	-10.44	100	360	QP

30MHz-1GHz:

Mode 1

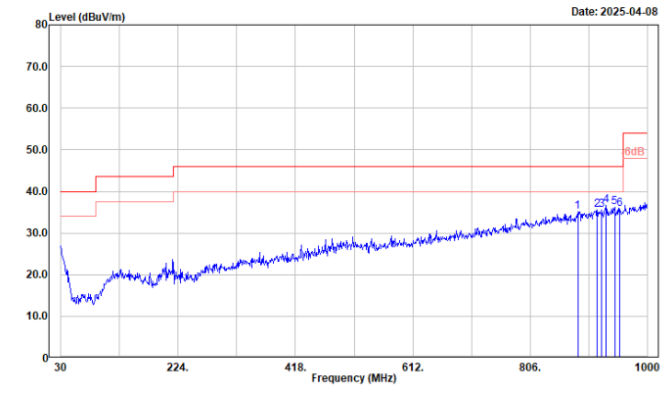
Low channel	
Horizontal	**Vertical**

Description: BLE-LOW,RBW:100kHz/VBW:300kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
203.630	44.01	-10.65	33.36	43.50	-10.14	100	201	QP
215.270	46.02	-11.57	34.45	43.50	-9.05	100	357	QP
889.420	31.46	4.83	36.29	46.00	-9.71	100	208	QP
923.370	30.33	5.56	35.89	46.00	-10.11	100	144	QP
931.130	30.46	5.90	36.36	46.00	-9.64	100	37	QP
956.350	29.96	6.13	36.09	46.00	-9.91	100	360	QP

Description: BLE-LOW,RBW:100kHz/VBW:300kHz

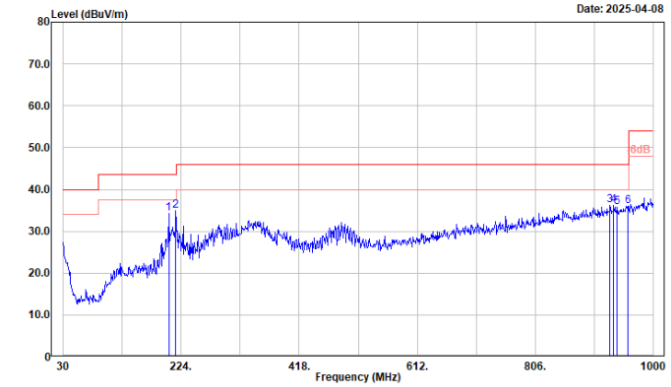


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
884.570	30.45	4.65	35.10	46.00	-10.90	100	305	QP
916.580	30.26	5.33	35.59	46.00	-10.41	100	96	QP
924.340	30.05	5.60	35.65	46.00	-10.35	100	345	QP
932.100	30.66	5.94	36.60	46.00	-9.40	100	352	QP
945.680	30.21	5.94	36.15	46.00	-9.85	100	103	QP
954.410	29.62	6.08	35.70	46.00	-10.30	100	103	QP

Middle channel

Horizontal

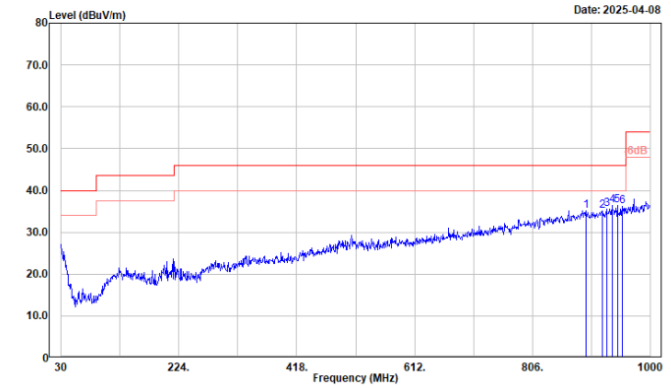
Description: BLE-Middle,RBW:100kHz/VBW:300kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
203.630	44.91	-10.65	34.26	43.50	-9.24	100	171	QP
215.270	46.50	-11.57	34.93	43.50	-8.57	100	2	QP
929.190	30.37	5.83	36.20	46.00	-9.80	100	50	QP
935.010	30.11	6.03	36.14	46.00	-9.86	100	312	QP
940.830	29.99	5.89	35.88	46.00	-10.12	100	335	QP
958.290	29.89	6.16	36.05	46.00	-9.95	100	118	QP

Vertical

Description: BLE-Middle,RBW:100kHz/VBW:300kHz

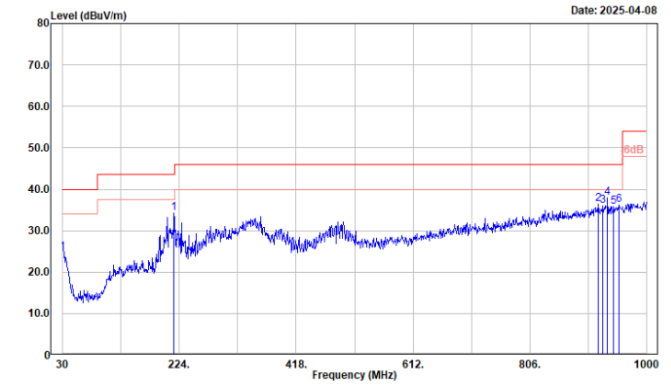


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
894.270	30.24	4.92	35.16	46.00	-10.84	100	45	QP
920.460	29.71	5.46	35.17	46.00	-10.83	100	100	QP
928.220	29.66	5.79	35.45	46.00	-10.55	100	56	QP
936.950	30.35	5.97	36.32	46.00	-9.68	100	360	QP
945.680	30.56	5.94	36.50	46.00	-9.50	100	0	QP
953.440	30.18	6.04	36.22	46.00	-9.78	100	290	QP

High channel

Horizontal

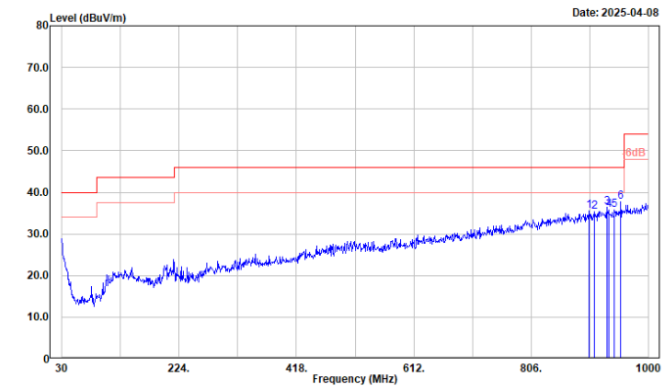
Description: BLE-High,RBW:100kHz/VBW:300kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
215.270	45.81	-11.57	34.24	43.50	-9.26	100	153	QP
919.490	30.88	5.44	36.32	46.00	-9.68	100	287	QP
927.250	30.21	5.73	35.94	46.00	-10.06	100	39	QP
935.010	31.82	6.03	37.85	46.00	-8.15	100	0	QP
944.710	29.88	5.93	35.81	46.00	-10.19	100	284	QP
954.410	30.18	6.08	36.26	46.00	-9.74	100	360	QP

Vertical

Description: BLE-High,RBW:100kHz/VBW:300kHz

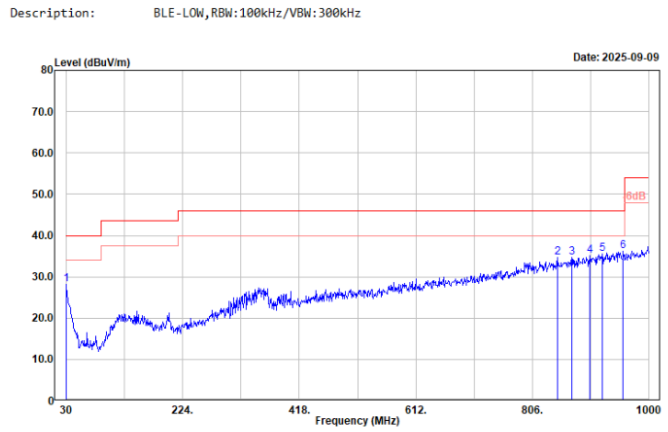


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
901.060	30.55	4.95	35.50	46.00	-10.50	100	148	QP
910.760	30.21	5.15	35.36	46.00	-10.64	100	19	QP
931.130	30.57	5.90	36.47	46.00	-9.53	100	145	QP
934.040	29.85	6.00	35.85	46.00	-10.15	100	107	QP
943.740	29.84	5.92	35.76	46.00	-10.24	100	15	QP
954.410	31.74	6.08	37.82	46.00	-8.18	100	15	QP

Mode 2

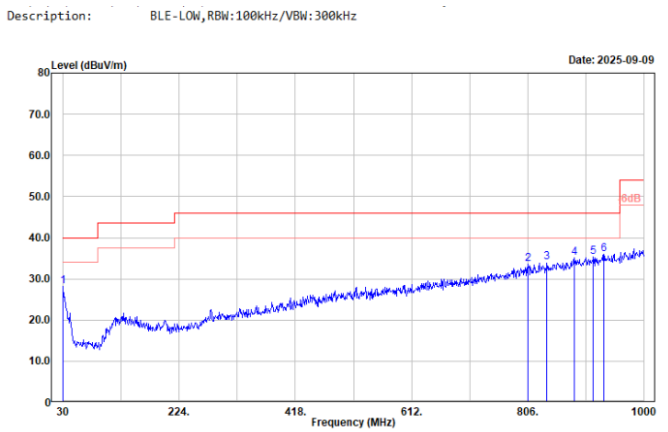
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	30.55	-2.28	28.27	40.00	-11.73	100	360	QP
847.710	30.80	3.89	34.69	46.00	-11.31	100	234	QP
871.960	30.47	4.17	34.64	46.00	-11.36	100	172	QP
902.030	30.08	4.97	35.05	46.00	-10.95	100	175	QP
922.400	30.11	5.54	35.65	46.00	-10.35	100	37	QP
957.320	30.16	6.14	36.30	46.00	-9.70	100	226	QP

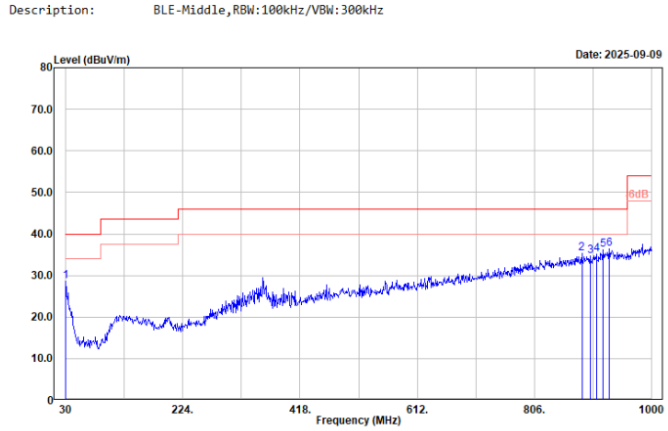
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	30.47	-2.28	28.19	40.00	-11.81	100	304	QP
806.000	30.61	2.90	33.51	46.00	-12.49	100	351	QP
838.010	30.32	3.61	33.93	46.00	-12.07	100	185	QP
883.600	30.55	4.62	35.17	46.00	-10.83	100	227	QP
915.610	29.95	5.30	35.25	46.00	-10.75	100	335	QP
933.070	29.92	5.97	35.89	46.00	-10.11	100	266	QP

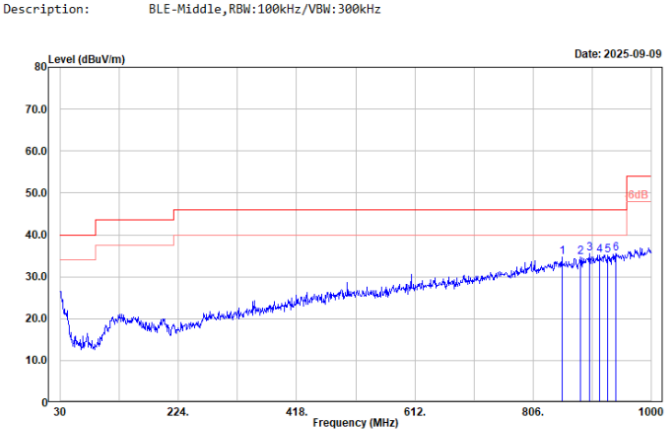
Middle channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	30.93	-2.28	28.65	40.00	-11.35	100	67	QP
884.570	30.72	4.65	35.37	46.00	-10.63	100	232	QP
898.150	29.67	4.92	34.59	46.00	-11.41	100	186	QP
908.820	29.93	5.10	35.03	46.00	-10.97	100	31	QP
919.490	30.82	5.44	36.26	46.00	-9.74	100	317	QP
930.160	30.52	5.88	36.40	46.00	-9.60	100	51	QP

Vertical

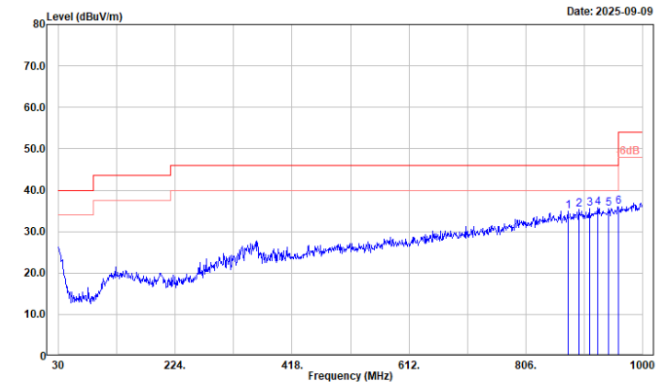


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
853.530	30.69	3.98	34.67	46.00	-11.33	100	130	QP
883.600	30.03	4.62	34.65	46.00	-11.35	100	215	QP
899.120	30.73	4.91	35.64	46.00	-10.36	100	266	QP
915.610	29.84	5.30	35.14	46.00	-10.86	100	316	QP
929.190	29.35	5.83	35.18	46.00	-10.82	100	177	QP
941.800	29.66	5.89	35.55	46.00	-10.45	100	62	QP

High channel

Horizontal

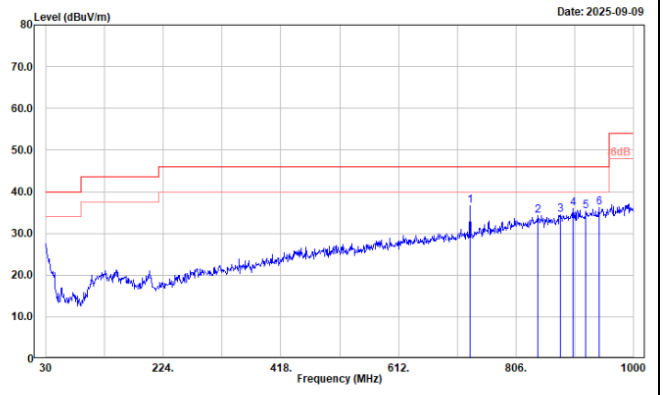
Description: BLE-High,RBW:100kHz/VBW:300kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
875.840	30.73	4.26	34.99	46.00	-11.01	100	104	QP
894.270	30.34	4.92	35.26	46.00	-10.74	100	131	QP
911.730	30.38	5.17	35.55	46.00	-10.45	100	51	QP
925.310	30.20	5.63	35.83	46.00	-10.17	100	139	QP
943.740	29.70	5.92	35.62	46.00	-10.38	100	309	QP
959.260	29.86	6.19	36.05	46.00	-9.95	100	360	QP

Vertical

Description: BLE-High,RBW:100kHz/VBW:300kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
730.340	35.86	0.84	36.70	46.00	-9.30	100	243	QP
841.890	30.48	3.76	34.24	46.00	-11.76	100	196	QP
879.720	30.08	4.48	34.56	46.00	-11.44	100	33	QP
900.090	31.10	4.91	36.01	46.00	-9.99	100	347	QP
921.430	29.88	5.50	35.38	46.00	-10.62	100	138	QP
942.770	30.30	5.91	36.21	46.00	-9.79	100	9	QP

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

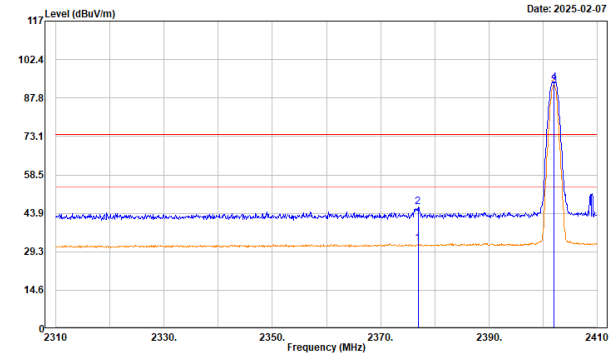
Band-Edge:

BLE 1M

Low channel

Horizontal

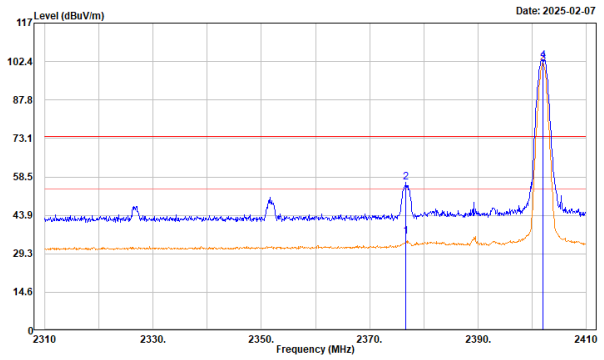
Description: BLE_1M-TX-2402,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2376.900	43.70	-11.20	32.50	54.00	-21.50	379	179	Average
2376.900	57.52	-11.20	46.32	74.00	-27.68	379	179	Peak
2402.000	103.74	-11.02	92.72			379	179	Average
2402.000	104.70	-11.02	93.68			379	179	Peak

Vertical

Description: BLE_1M-TX-2402,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz

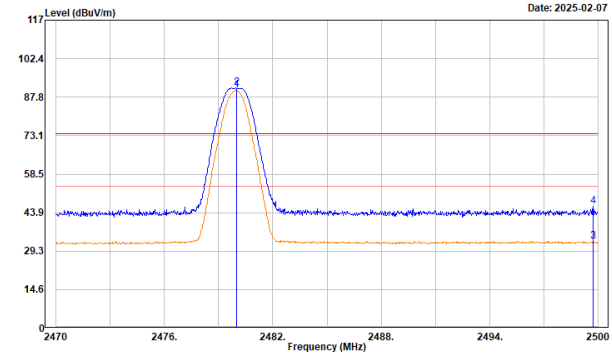


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2376.700	46.94	-11.20	35.74	54.00	-18.26	138	196	Average
2376.700	67.51	-11.20	56.31	74.00	-17.69	138	196	Peak
2402.000	112.91	-11.02	101.89			138	196	Average
2402.000	113.91	-11.02	102.89			138	196	Peak

High channel

Horizontal

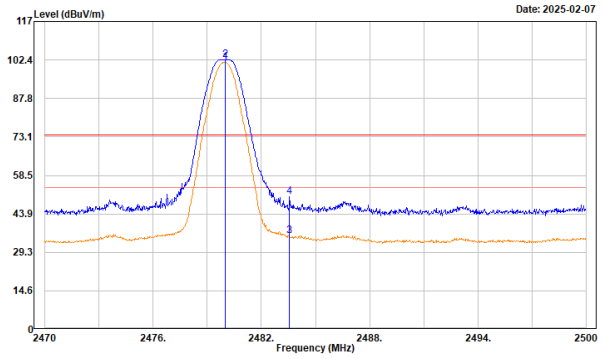
Description: BLE_1M-TX-2480,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	100.91	-10.66	90.25			193	249	Average
2480.000	101.83	-10.66	91.17			193	249	Peak
2499.730	43.55	-10.42	33.13	54.00	-20.87	193	249	Average
2499.730	56.73	-10.42	46.31	74.00	-27.69	193	249	Peak

Vertical

Description: BLE_1M-TX-2480,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz



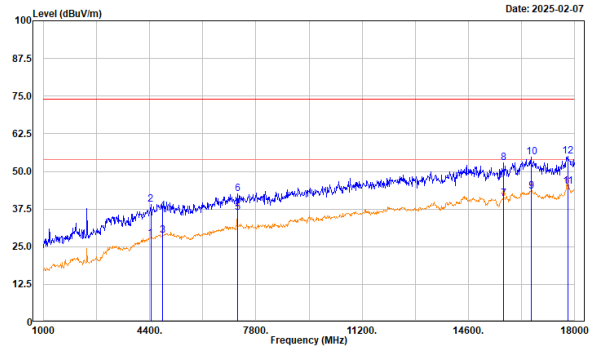
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	112.16	-10.66	101.50			192	209	Average
2480.000	113.06	-10.66	102.40			192	209	Peak
2483.560	46.24	-10.61	35.63	54.00	-18.37	192	209	Average
2483.560	61.03	-10.61	50.42	74.00	-23.58	192	209	Peak

1GHz-18GHz:

(Worst case is BLE 1M mode, Low channel)

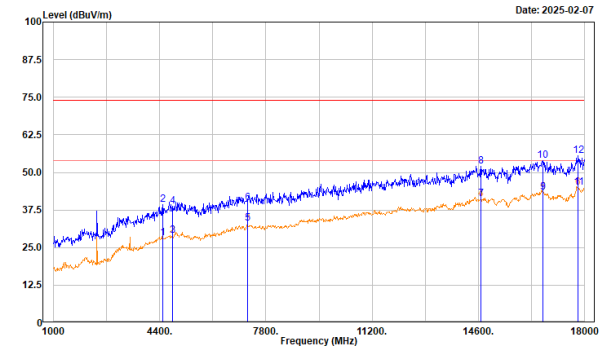
Horizontal	Vertical

Description: BLE_1M-TX-2402,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4434.000	32.44	-4.72	27.72	54.00	-26.28	150	201	Average
4434.000	43.76	-4.72	39.04	74.00	-34.96	150	201	Peak
4804.000	32.69	-4.09	28.60	54.00	-25.40	123	178	Average
4804.000	40.86	-4.09	36.77	74.00	-37.23	123	178	Peak
7206.000	35.88	0.43	36.31	54.00	-17.69	235	156	Average
7206.000	42.09	0.43	42.52	74.00	-31.48	235	156	Peak
15739.000	31.92	8.92	40.84	54.00	-13.16	150	8	Average
15739.000	44.04	8.92	52.96	74.00	-21.04	150	8	Peak
16606.000	31.17	12.12	43.29	54.00	-10.71	150	252	Average
16606.000	42.65	12.12	54.77	74.00	-19.23	150	252	Peak
17779.000	32.17	12.85	45.02	54.00	-8.98	150	321	Average
17779.000	42.26	12.85	55.11	74.00	-18.89	150	321	Peak

Description: BLE_1M-TX-2402,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz



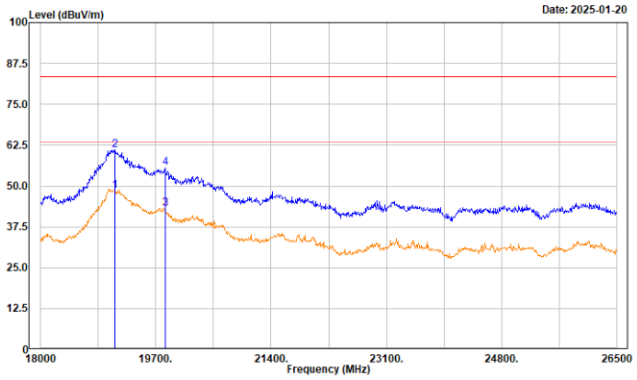
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4502.000	32.76	-4.69	28.07	54.00	-25.93	150	2	Average
4502.000	43.87	-4.69	39.18	74.00	-34.82	150	2	Peak
4804.000	33.05	-4.09	28.96	54.00	-25.04	133	154	Average
4804.000	42.76	-4.09	38.67	74.00	-35.33	133	154	Peak
7206.000	32.63	0.43	33.06	54.00	-20.94	372	224	Average
7206.000	39.52	0.43	39.95	74.00	-34.05	372	224	Peak
14685.000	29.85	11.33	41.18	54.00	-12.82	150	79	Average
14685.000	40.81	11.33	52.14	74.00	-21.86	150	79	Peak
16657.000	31.37	11.99	43.36	54.00	-10.64	150	103	Average
16657.000	42.03	11.99	54.02	74.00	-19.98	150	103	Peak
17796.000	32.18	12.88	45.06	54.00	-8.94	150	309	Average
17796.000	42.67	12.88	55.55	74.00	-18.45	150	309	Peak

18GHz-26.5GHz:

(Worst case is BLE 1M mode, High channel)

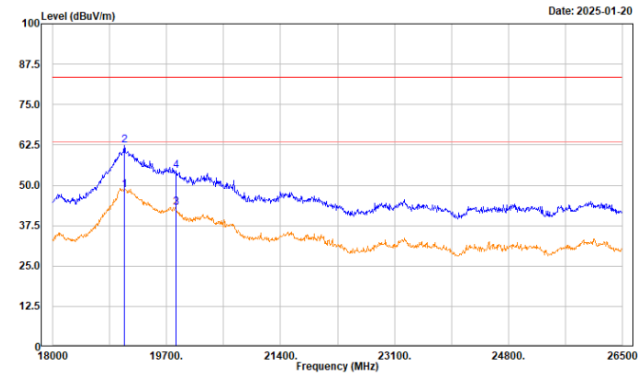
Horizontal	Vertical

Description: BLE_1M-TX-2480,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19096.500	30.81	17.74	48.55	63.50	-14.95	150	334	Average
19096.500	43.32	17.74	61.06	83.50	-22.44	150	334	Peak
19840.000	31.68	11.37	43.05	63.50	-20.45	150	206	Average
19840.000	44.23	11.37	55.60	83.50	-27.90	150	206	Peak

Description: BLE_1M-TX-2480,Peak RBW:1MHz/VBW:3MHz,Avg RBW:1MHz/VBW:3kHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19071.000	30.48	17.92	48.40	63.50	-15.10	150	189	Average
19071.000	44.42	17.92	62.34	83.50	-21.16	150	189	Peak
19840.000	31.68	11.37	43.05	63.50	-20.45	150	360	Average
19840.000	42.97	11.37	54.34	83.50	-29.16	150	360	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@1m , 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)	(°)	
4434.000	32.44	-4.72	27.72	54.00	-26.28	150	201	Average
4434.000	43.76	-4.72	39.04	74.00	-34.96	150	201	Peak
4804.000	32.69	-4.09	28.60	54.00	-25.40	123	178	Average
4804.000	40.86	-4.09	36.77	74.00	-37.23	123	178	Peak
7206.000	35.88	0.43	36.31	54.00	-17.69	235	156	Average
7206.000	42.09	0.43	42.52	74.00	-31.48	235	156	Peak
15739.000	31.92	8.92	40.84	54.00	-13.16	150	8	Average
15739.000	44.04	8.92	52.96	74.00	-21.04	150	8	Peak
16606.000	31.17	12.12	43.29	54.00	-10.71	150	252	Average
16606.000	42.65	12.12	54.77	74.00	-19.23	150	252	Peak
17779.000	32.17	12.85	45.02	54.00	-8.98	150	321	Average
17779.000	42.26	12.85	55.11	74.00	-18.89	150	321	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4502.000	32.76	-4.69	28.07	54.00	-25.93	150	2	Average
4502.000	43.87	-4.69	39.18	74.00	-34.82	150	2	Peak
4804.000	33.05	-4.09	28.96	54.00	-25.04	133	154	Average
4804.000	42.76	-4.09	38.67	74.00	-35.33	133	154	Peak
7206.000	32.63	0.43	33.06	54.00	-20.94	372	224	Average
7206.000	39.52	0.43	39.95	74.00	-34.05	372	224	Peak
14685.000	29.85	11.33	41.18	54.00	-12.82	150	79	Average
14685.000	40.81	11.33	52.14	74.00	-21.86	150	79	Peak
16657.000	31.37	11.99	43.36	54.00	-10.64	150	103	Average
16657.000	42.03	11.99	54.02	74.00	-19.98	150	103	Peak
17796.000	32.18	12.88	45.06	54.00	-8.94	150	309	Average
17796.000	42.67	12.88	55.55	74.00	-18.45	150	309	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
3295.000	32.38	-7.52	24.86	54.00	-29.14	150	336	Average
3295.000	43.72	-7.52	36.20	74.00	-37.80	150	336	Peak
4880.000	33.34	-3.54	29.80	54.00	-24.20	142	189	Average
4880.000	42.58	-3.54	39.04	74.00	-34.96	142	189	Peak
7320.000	35.33	0.53	35.86	54.00	-18.14	103	250	Average
7320.000	45.22	0.53	45.75	74.00	-28.25	103	250	Peak
14804.000	29.77	11.26	41.03	54.00	-12.97	150	4	Average
14804.000	41.78	11.26	53.04	74.00	-20.96	150	4	Peak
16708.000	31.07	11.85	42.92	54.00	-11.08	150	115	Average
16708.000	42.57	11.85	54.42	74.00	-19.58	150	115	Peak
17796.000	31.89	12.88	44.77	54.00	-9.23	150	299	Average
17796.000	42.42	12.88	55.30	74.00	-18.70	150	299	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4230.000	32.90	-5.65	27.25	54.00	-26.75	150	7	Average
4230.000	44.47	-5.65	38.82	74.00	-35.18	150	7	Peak
4880.000	32.86	-3.54	29.32	54.00	-24.68	166	137	Average
4880.000	42.87	-3.54	39.33	74.00	-34.67	166	137	Peak
7320.000	36.33	0.53	36.86	54.00	-17.14	295	204	Average
7320.000	39.84	0.53	40.37	74.00	-33.63	295	204	Peak
14872.000	29.66	10.84	40.50	54.00	-13.50	150	188	Average
14872.000	41.25	10.84	52.09	74.00	-21.91	150	188	Peak
16368.000	31.87	11.15	43.02	54.00	-10.98	150	266	Average
16368.000	44.72	11.15	55.87	74.00	-18.13	150	266	Peak
17745.000	32.10	12.78	44.88	54.00	-9.12	150	55	Average
17745.000	42.13	12.78	54.91	74.00	-19.09	150	55	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
3958.000	32.49	-6.30	26.19	54.00	-27.81	150	56	Average
3958.000	43.39	-6.30	37.09	74.00	-36.91	150	56	Peak
4960.000	32.72	-3.67	29.05	54.00	-24.95	158	166	Average
4960.000	41.83	-3.67	38.16	74.00	-35.84	158	166	Peak
7440.000	33.29	0.28	33.57	54.00	-20.43	112	252	Average
7440.000	40.72	0.28	41.00	74.00	-33.00	112	252	Peak
14498.000	30.67	11.47	42.14	54.00	-11.86	150	304	Average
14498.000	40.24	11.47	51.71	74.00	-22.29	150	304	Peak
16640.000	32.29	12.04	44.33	54.00	-9.67	150	113	Average
16640.000	42.57	12.04	54.61	74.00	-19.39	150	113	Peak
17728.000	31.46	12.76	44.22	54.00	-9.78	150	71	Average
17728.000	41.68	12.76	54.44	74.00	-19.56	150	71	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4366.000	32.73	-5.07	27.66	54.00	-26.34	150	32	Average
4366.000	43.63	-5.07	38.56	74.00	-35.44	150	32	Peak
4960.000	32.49	-3.67	28.82	54.00	-25.18	131	193	Average
4960.000	42.18	-3.67	38.51	74.00	-35.49	131	193	Peak
7440.000	36.39	0.28	36.67	54.00	-17.33	271	226	Average
7440.000	43.53	0.28	43.81	74.00	-30.19	271	226	Peak
15365.000	31.33	9.30	40.63	54.00	-13.37	150	129	Average
15365.000	43.75	9.30	53.05	74.00	-20.95	150	129	Peak
16657.000	31.78	11.99	43.77	54.00	-10.23	150	69	Average
16657.000	42.88	11.99	54.87	74.00	-19.13	150	69	Peak
17762.000	32.18	12.83	45.01	54.00	-8.99	150	310	Average
17762.000	41.37	12.83	54.20	74.00	-19.80	150	310	Peak

Note:

Level = Reading + Factor.

Margin = Level – Limit.

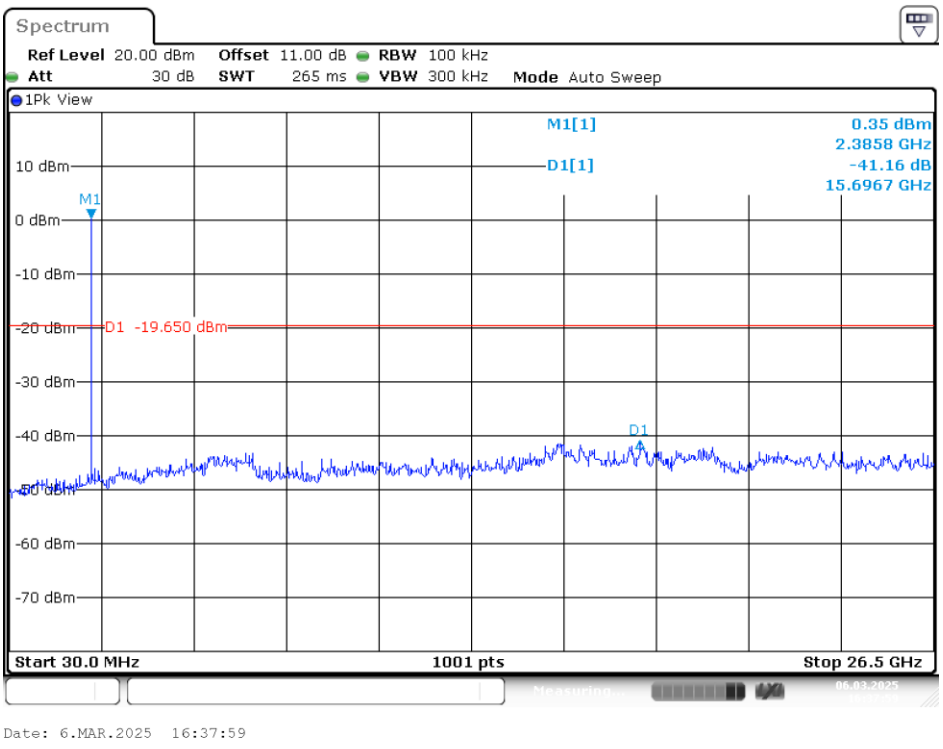
Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE(1M) Mode				
Low	2402	41.16	≥ 20	PASS
Mid	2440	41.58	≥ 20	PASS
High	2480	38.40	≥ 20	PASS

BLE(1M) Mode

Low Channel



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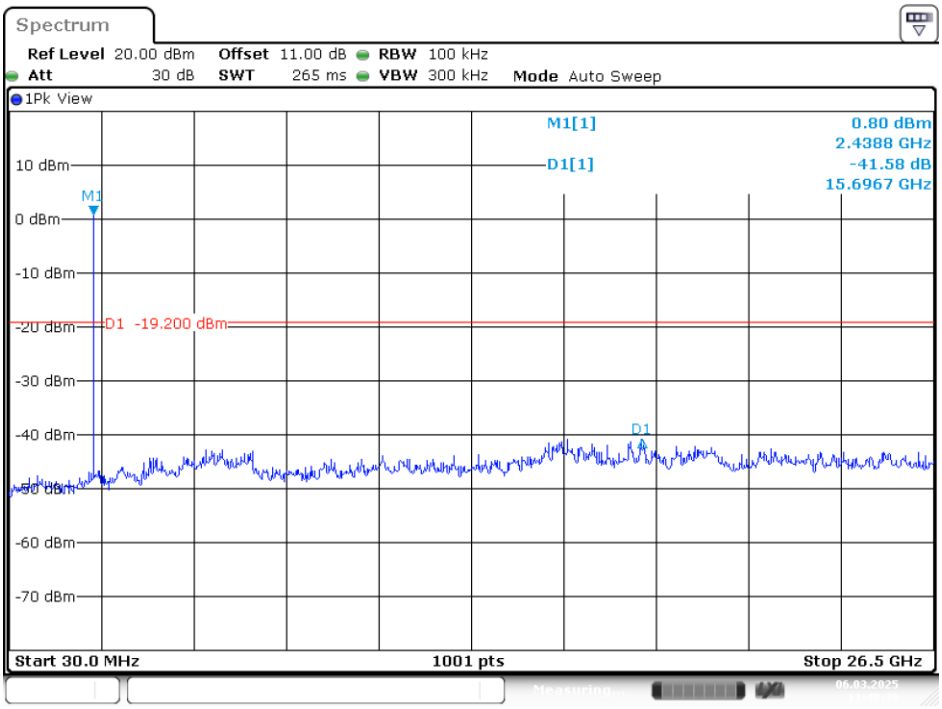
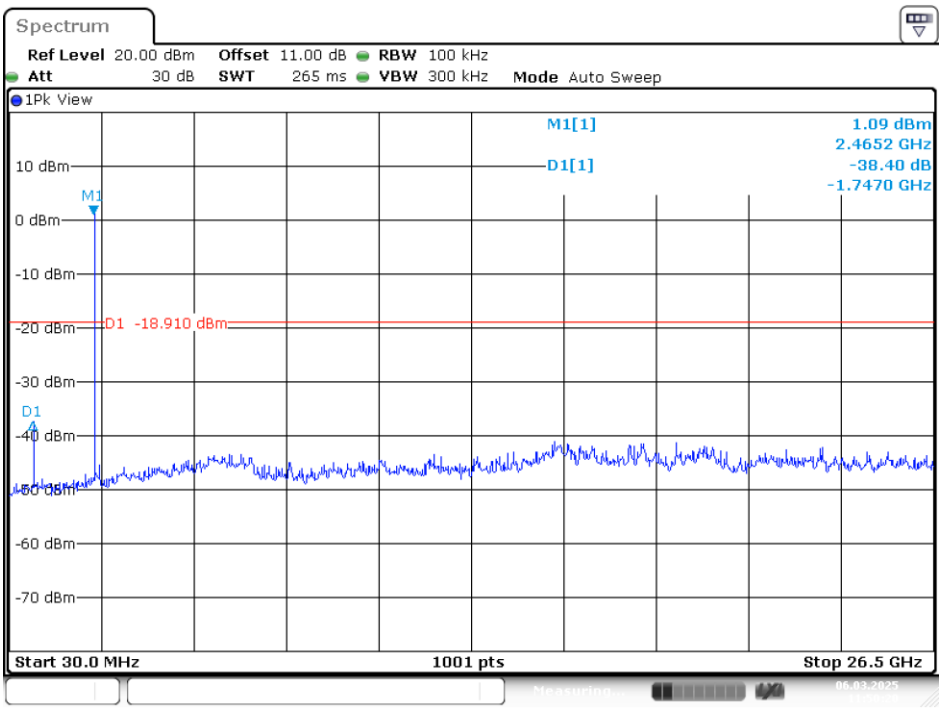
Middle Channel



Date: 6.MAR.2025 11:48:37

High Channel



Date: 6.MAR.2025 11:50:21

8 FCC §15.247(a)(2) & RSS-247 §6.3.1(a), RSS-GEN §6.7 – 6 dB Emission Bandwidth & Occupied Bandwidth

8.1 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.

According to RSS-247 §6.3.1(a)

The minimum 6 dB bandwidth shall be 500 kHz.

According to RSS-GEN §6.7

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

8.2 Test Procedure

According to ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024, 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.

According to ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024, Section 6.9.3

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

8.3 Test Results

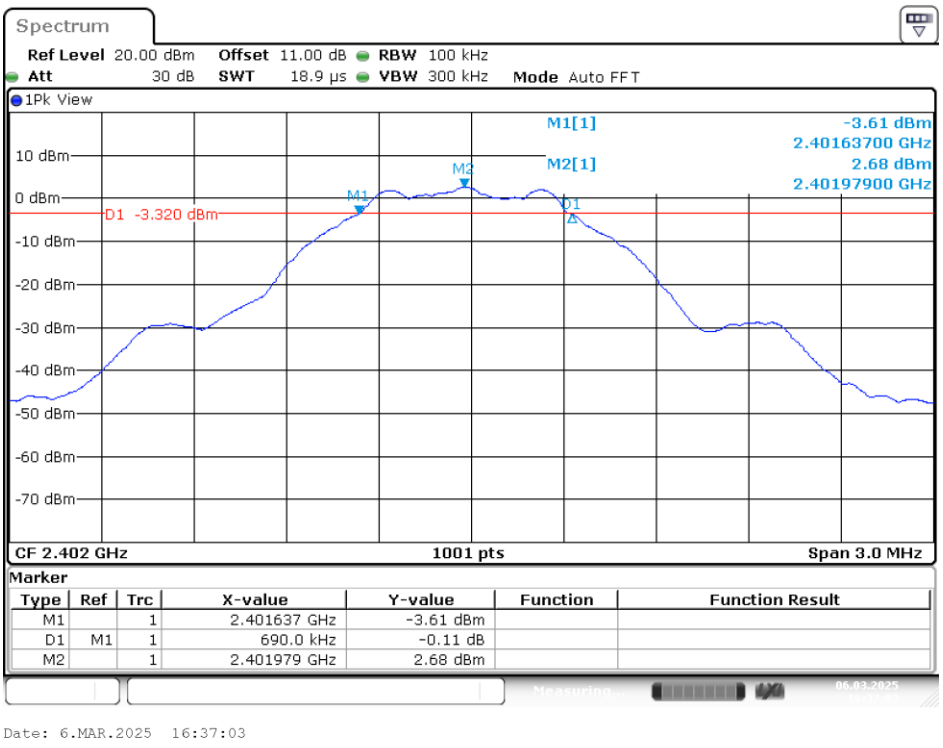
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (kHz)	Result
BLE(1M) Mode					
Low	2402	0.69	1.02	> 500	PASS
Middle	2440	0.68	1.02	> 500	PASS
High	2480	0.69	1.03	> 500	PASS

Please refer to the following plots

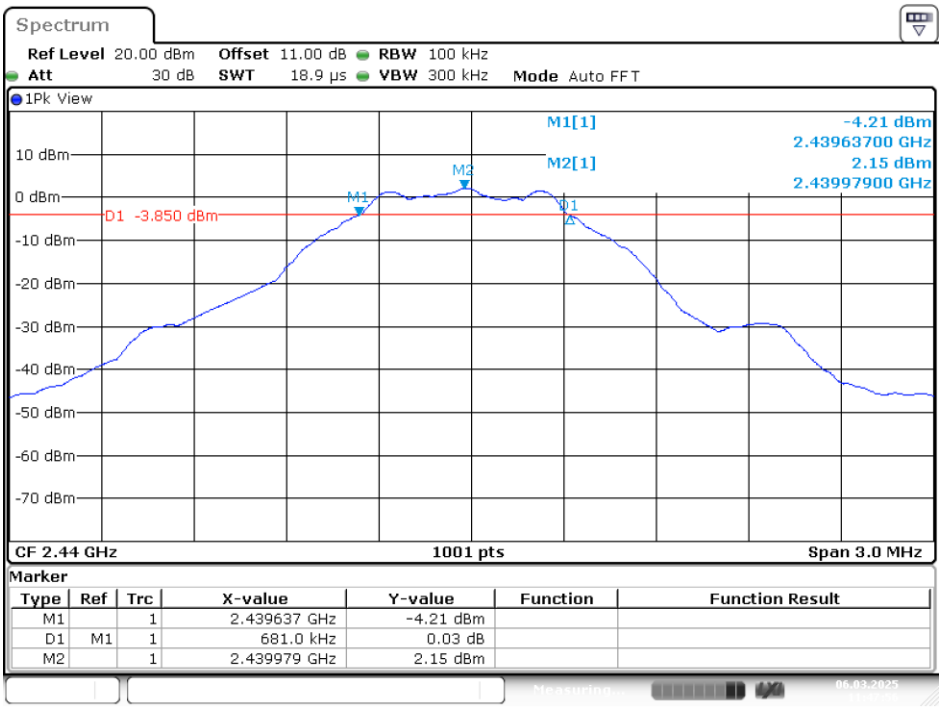
6 dB Emission Bandwidth

BLE(1M) Mode

Low Channel



Middle Channel



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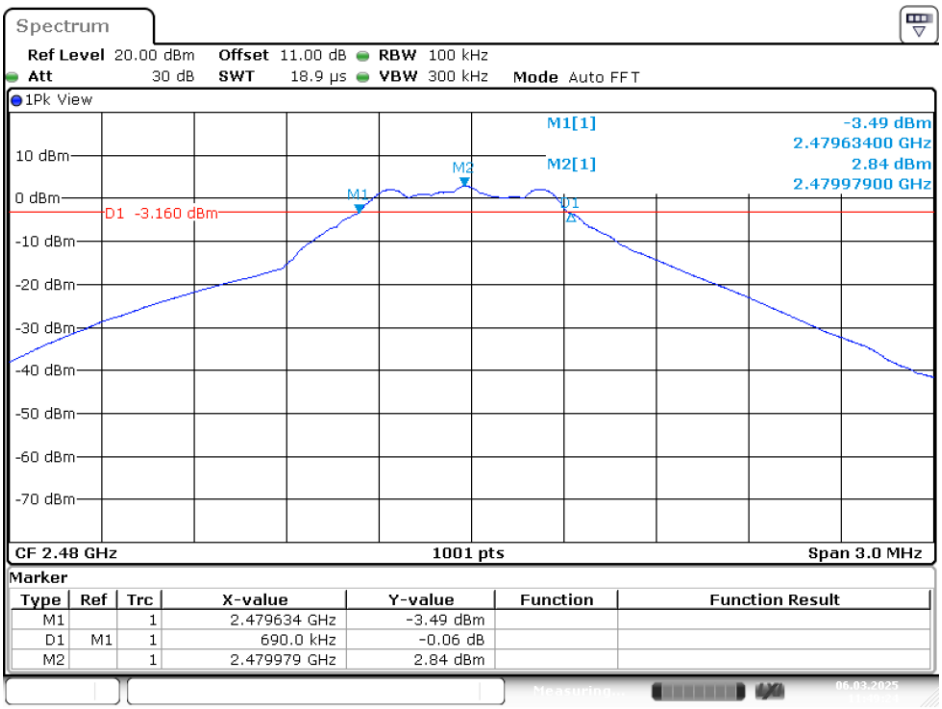
High Channel



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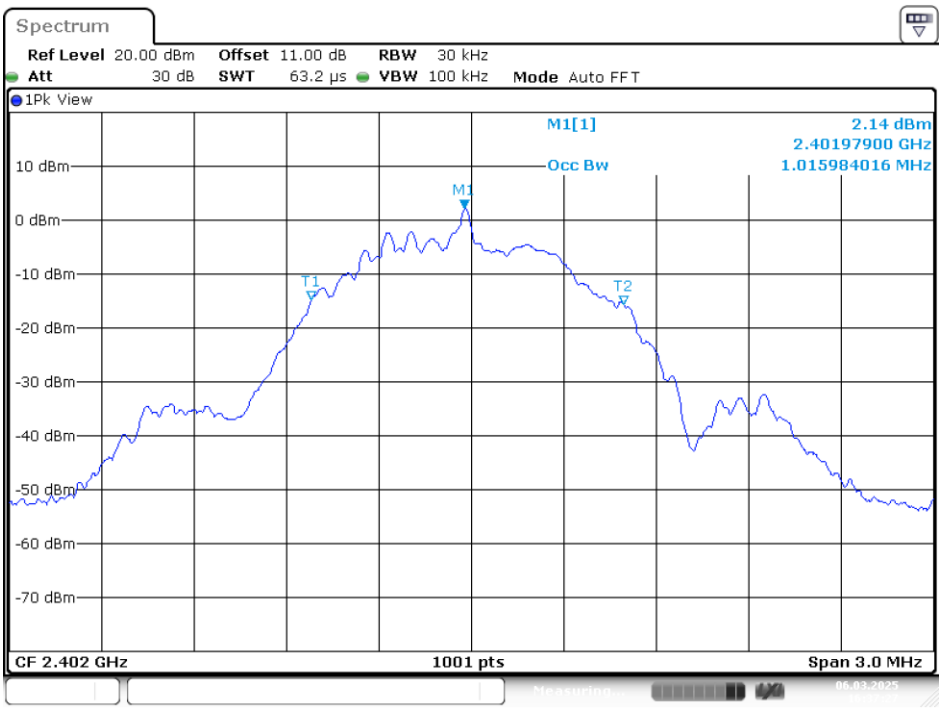
99% Bandwidth

BLE(1M) Mode

Low Channel



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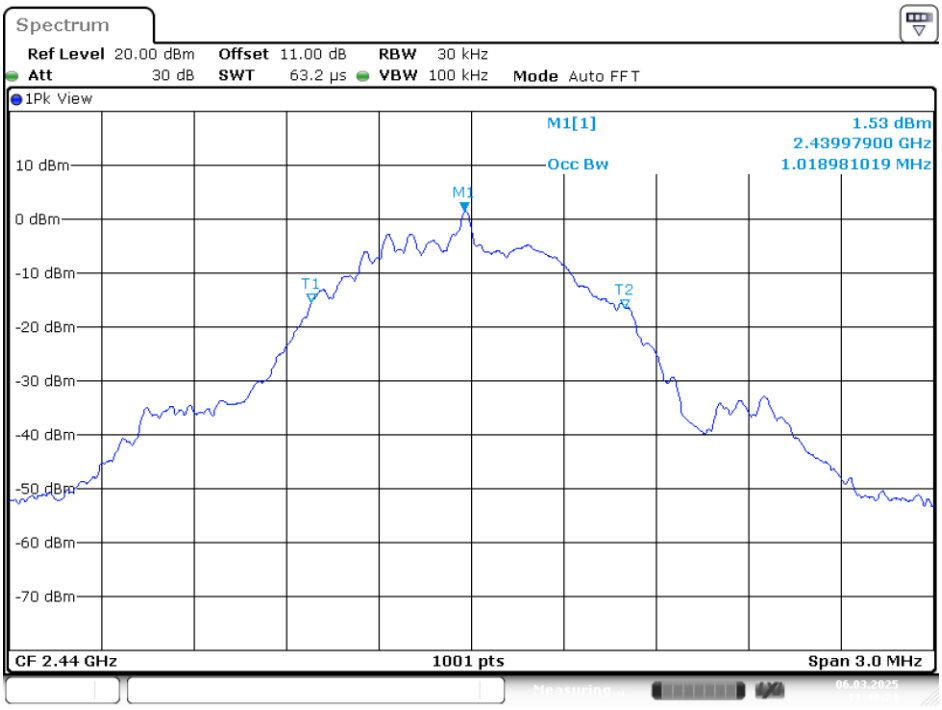
Middle Channel



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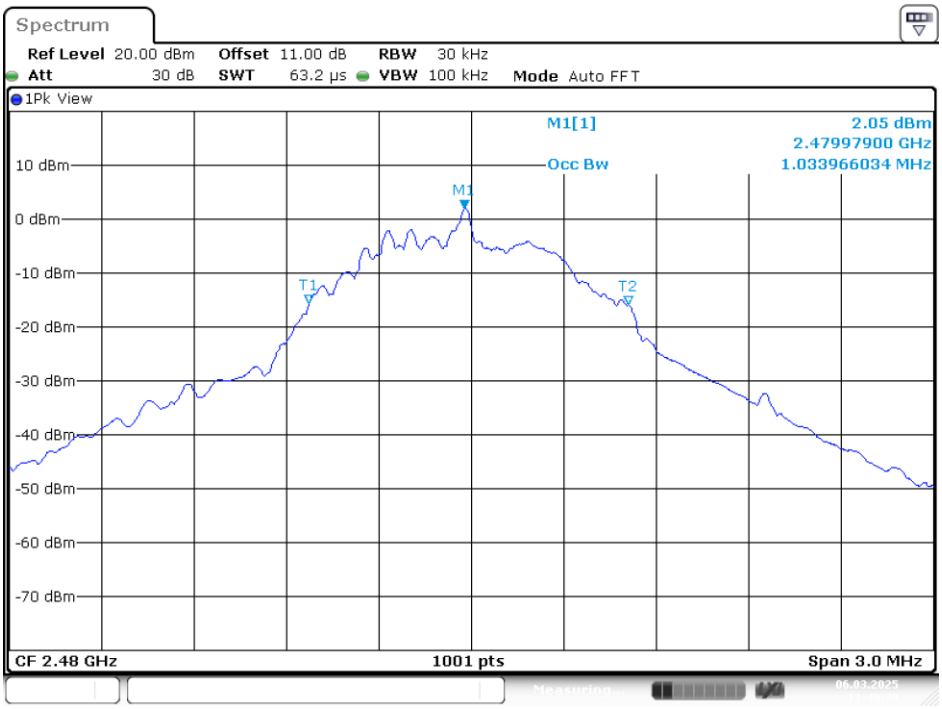
High Channel



9 FCC §15.247(b)(3) & RSS-247 §6.3.2 – Maximum Output Power

9.1 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.

According to RSS-247 §6.3.2.

For DTS operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W, and the e.i.r.p. shall not exceed 4 W, except as provided in section 6.5 a) and b).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.

9.2 Test Procedure

According to ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024, section 11.9.1.2

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.

9.3 Test Results

Conducted Peak Output Power

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Antenna Gain (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)
BLE(1M) Mode						
Low	2402	1.68	30	2.1	3.78	36
Middle	2440	2.22	30	2.1	4.32	36
High	2480	2.99	30	2.1	5.09	36

10 FCC §15.247(d) & RSS-247 §6.6 – 100 kHz Bandwidth of Frequency Band Edge

10.1 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)).

According to RSS-247 §6.6.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum device, digitally modulated device, or hybrid system is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power – based on either an RF conducted or a radiated measurement – provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 6.3.2, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

10.2 Test Procedure

According to ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024, Section 11.11.3

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.

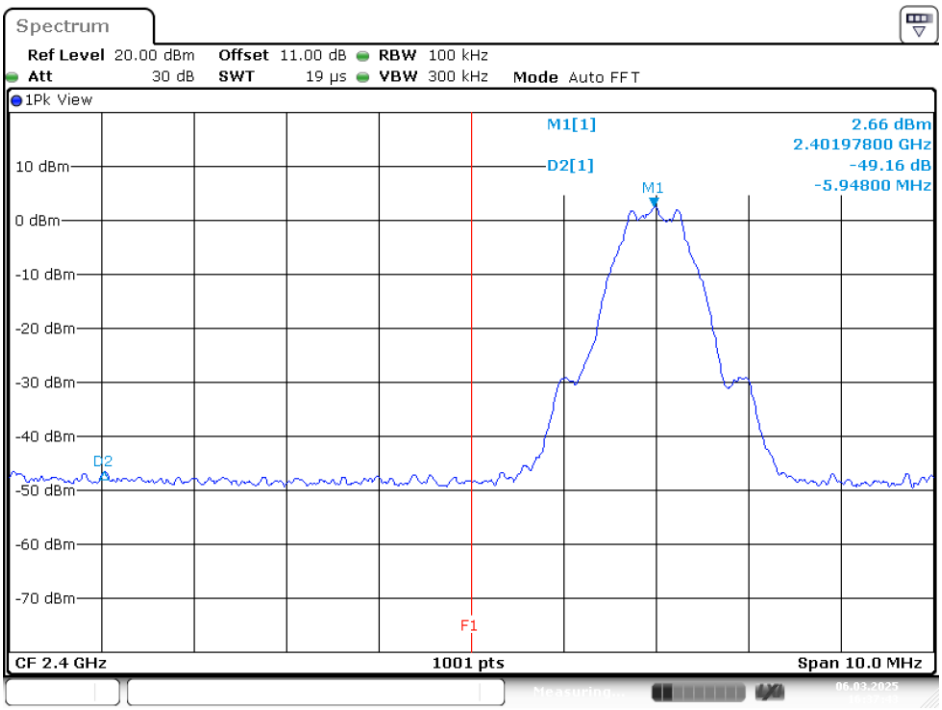
10.3 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE(1M) Mode				
Low	2402	49.16	≥ 20	PASS
High	2480	49.56	≥ 20	PASS

Please refer to the following plots

BLE(1M) Mode

Band Edge, Low Channel



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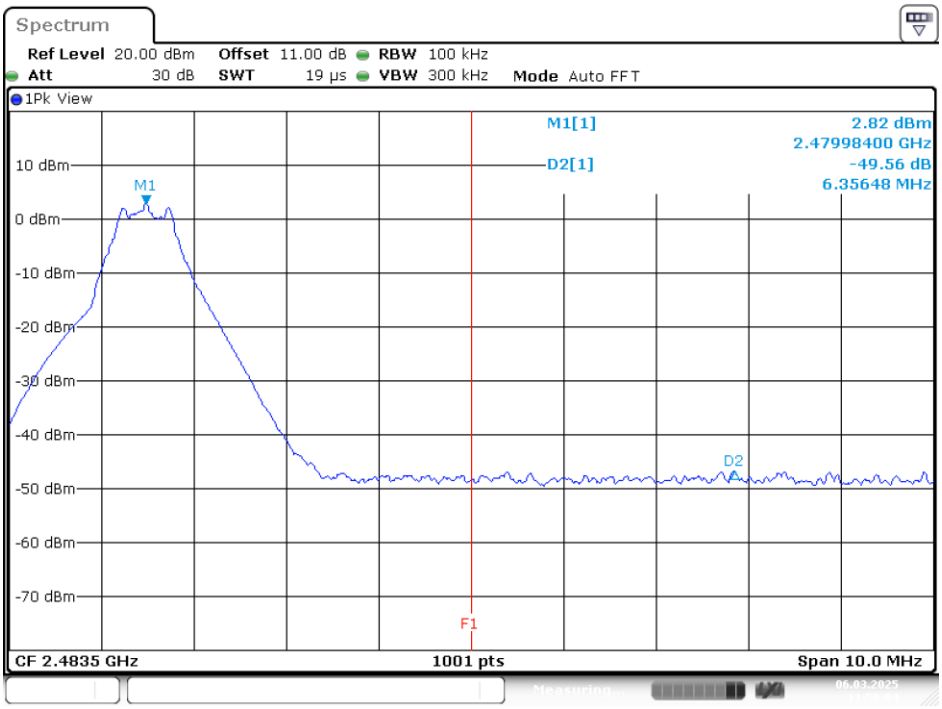
Band Edge, High Channel



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11 FCC §15.247(e) & RSS-247 §6.3.1(b) – Power Spectral Density

11.1 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.

According to RSS-247 §6.3.1(b).

The transmitter power spectral density conducted from the transmitter to the antenna(s) shall not be greater than 8 dBm/3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 6.3.2 The power spectral density shall be determined using the same method as is used to determine the maximum conducted output power.

11.2 Test Procedure

According to ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024+Errata to C63.10a-2024, section 11.10.2

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ [3 × RBW].
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 requirement, then reduce RBW (but no less than 3 kHz) and repeat

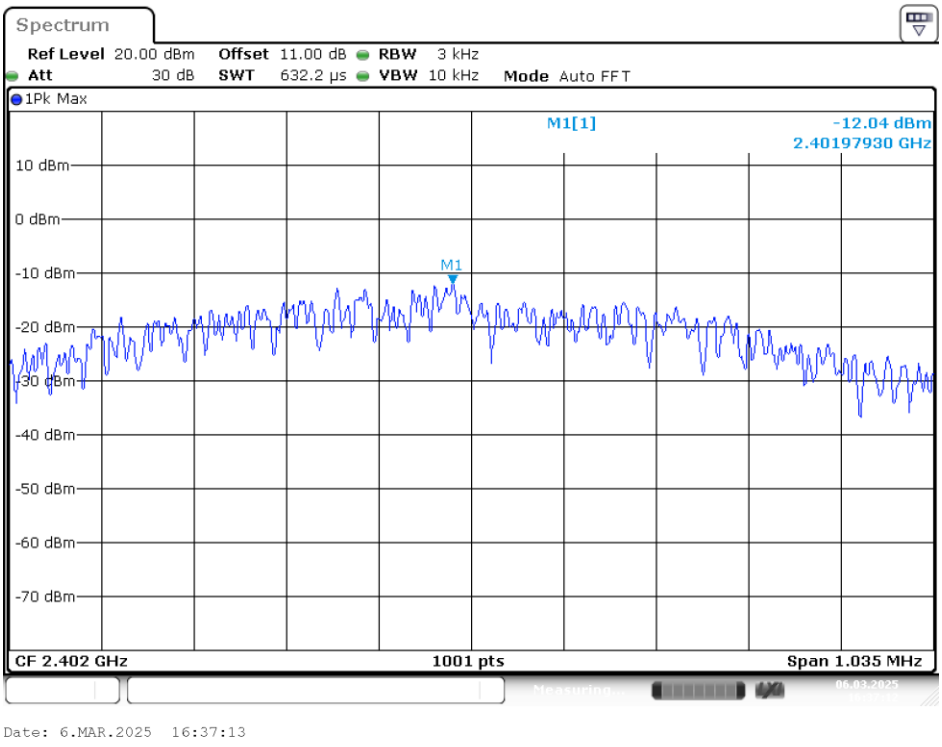
11.3 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
BLE(1M) Mode				
Low	2402	-12.04	8	PASS
Middle	2440	-12.48	8	PASS
High	2480	-11.95	8	PASS

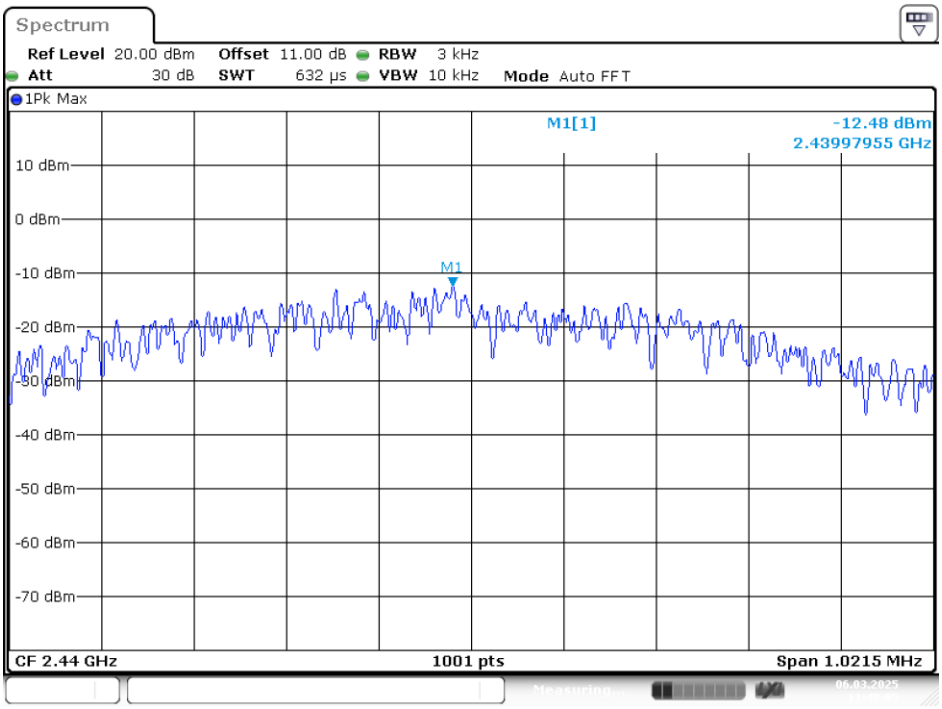
Please refer to the following plots

BLE(1M) Mode

Low Channel



Middle Channel



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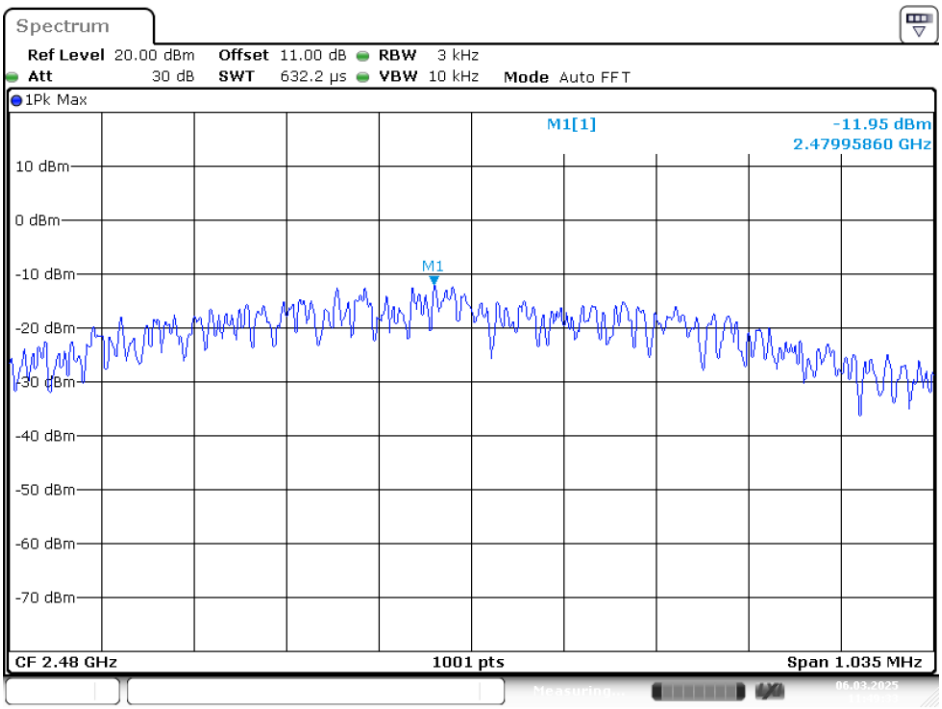
High Channel



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