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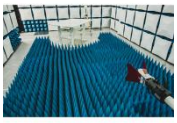

MEASUREMENT REPORT

FCC PART 15.247 / ISED RSS-GEN & RSS-247 Bluetooth (Low Energy)

Applicant Name:
Garmin International Inc.
1200 E. 151st. Street
Olathe, Kansas 66062
United States

Date of Testing:
04/21/2026 - 06/14/2026
Test Report Issue Date:
7/2/2026
Test Site/Location:
Element Materials Technolgy, Morgan Hill, CA, USA
Test Report Serial No.:
1C2604210033-03-R2.IPH

FCC ID:	**IPH-A5231**
IC:	**1792A-A5231**
APPLICANT:	**Garmin International Inc.**

Application Type:	Certification
Model/HVIN:	AA5231
EUT Type:	Portable Digital Transceiver
Max. RF Output Power:	2.075 mW (3.17 dBm) Peak Conducted
Frequency Range:	2402 – 2480MHz
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
ISED Specification:	RSS GEN Issue 5 + A1 +2 RSS-247 Issue 4
Test Procedure(s):	ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024, KDB 558074 D01 v05r02

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 and KDB 558074 D01 v05r02. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez
Executive Vice President

ilac-MRA
ACCREDITED
CERT #2041.02

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Revision Summary

Revision	Date	Comments	Revised By
-	05/07/2026	Initial Release	WKR007077
R1	05/18/2026	Addressed Comments Regarding FCCID, Title Page, and Table Values	WKR016696
R2	07/02/2026	Addressed Comments Regarding Section 1.3	WKR017014

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1 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 Element Materials Technology Test Location

These measurement tests were conducted at the Element Materials Technology facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at Element Materials Technology located in Morgan Hill, CA 95037, U.S.A.

- Element Materials Technology is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- Element Materials Technology facility is a registered test laboratory with the site description on file with ISED (Wireless Test Lab number 22831) and FCC (Designation Number US1163).

- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreements (MRAs).

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2 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Garmin International Inc. Portable Digital Transceiver FCC ID: IPH-A5231 and IC: 1792A-A5231**. The data found in this test report was taken with the EUT operating in Bluetooth low energy mode. While in low energy mode, the Bluetooth transmitter hops pseudo-randomly between 40 channels, three of which are “advertising channels”. When the transmitter is hopping only between the three advertising channels, the EUT does not fall under the category of a “hopper” as defined in 15.247(a)(iii) which states that a “frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.” As operation on only the advertising channels does not qualify the EUT as a hopper, the EUT is certified as a DTS device in this mode. The data found in this report is representative of the device when it transmits on its advertising channels. Typical Bluetooth operation is covered under the DSS report found with this application.

Test Device Serial No.: 3631845957, 3631846089

2.2 Device Capabilities

This device contains the following capabilities:

Bluetooth (1x, EDR, LE) / ANT/ANT+ / 802.11b/g/n WLAN / NFC

LE-1M		LE-2M	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
37	2402	0	2404
:	:	:	:
17	2440	17	2440
:	:	:	:
39	2480	36	2478

Table 2-1. Bluetooth LE Frequency / Channel Operations

This device is capable of operating in hopping and non-hopping mode. The EUT can hop between 40 different channels in the 2400 – 2483.5MHz band.

Mode	Data Rate	Modulation	Bandwidth (MHz)
LE1M	1Mbps	GFSK	1
LE2M	2Mbps	GFSK	2

Table 2-2. Bluetooth LE Configuration

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The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section 6.0 b) of KDB 558074 D01 v05r02 and ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Mode	Duty Cycle [%]	DCCF [dB]
LE1M	100	N/A
LE2M	100	N/A

Table 2-3. Measured Duty Cycles

2.3 Antenna Description

Following antennas gains provided by manufacturer were used for testing. The validity of the calculated results is based on the accuracy of the information provided.

Frequency [GHz]	Antenna Gain (dBi)
2.4	2.53

Table 2-4. Highest Antenna Gain

2.4 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 and KDB 558074 D01 v05r02. ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5, 7.6, and 7.7 for antenna port conducted emissions test setups.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz and above 18GHz were tested with the highest transmitting power and the worst case channel were reported.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

For AC line conducted and radiated test below 1GHz, following configuration were investigated and the worst case was reported.

- EUT powered by AC/DC adaptor via USB-C cable with wire charger

EUT was configured to be operated at a 100% duty cycle using software provided by the customer.

2.5 Software and Firmware

The test was conducted with firmware version 4.07 installed on the EUT.

2.6 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

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3 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024) and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 7m x 3.66m x 2.7m shielded enclosure. The shielded enclosure is manufactured by AP Americas. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-6. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50µH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is EPCOS 2X60A Power Line Filter (100dB Attenuation, 14kHz-18GHz) and the two EPCOs 2X48A filters (100dB Minimum Insertion Loss, 14kHz - 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that the cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.10. Automated test software was used to perform the AC line conducted emissions testing. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 10.50.40.

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3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was rotated about its vertical axis while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

3.4 Environmental Conditions

The temperature is controlled within range of 15ºC to 35ºC. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna(s) of the EUT are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

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5 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	2.00
Line Conducted Disturbance	1.88
Radiated Disturbance (<30MHz)	4.24
Radiated Disturbance (30MHz - 1GHz)	4.96
Radiated Disturbance (1 - 18GHz)	5.18
Radiated Disturbance (>18GHz)	5.18

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6 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance with the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	N9020A	MXA Signal Analyzer	7/7/2025	Biennial	7/7/2027	MY56470202
Anritsu	ML2496A	Power Meter	6/27/2025	Annual	6/27/2026	1840005
Anritsu	MA2411B	Pulse Power Sensor	6/27/2025	Annual	6/27/2026	1911105
Anritsu	MA2411B	Pulse Power Sensor	7/3/2025	Annual	7/3/2026	1726261
ATM	180-442-KF	20dB Nominal Gain Horn Antenna	3/31/2026	Annual	3/31/2027	T058601-02
ETS-Lindgren	3117	Double Ridged Guide Horn (1-18 GHz)	4/21/2026	Annual	4/21/2027	218555
Fairview Microwave/MCL	FMCA1975-36/BW-K10-2W44+	30MHz-40GHz RF Cable/Attenuator *	6/10/2025	Annual	6/10/2026	-
Keysight Technology	N9040B	UXA Signal Analyzer	6/9/2025	Annual	6/9/2026	MY57212015
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	8/6/2025	Annual	8/6/2026	101639
Rohde & Schwarz	FSW43	Spectrum Analyzer 2Hz to 43GHz	8/5/2025	Annual	8/5/2026	104093
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	5/13/2025	Annual	5/13/2026	101867
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	10/14/2025	Annual	10/14/2026	102328
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	6/3/2025	Annual	6/3/2026	100052
Rohde & Schwarz	HFH2-Z2	Loop Antenna	5/12/2025	Annual	5/12/2026	100546
Rohde & Schwarz	ENV216	Two-Line V-Network	8/18/2025	Annual	8/18/2026	101363
Schwarzbeck	VULB 9162	Bilog Antenna (30MHz - 6GHz)	7/17/2025	Annual	7/17/2026	00302

Table 6-1. Test Equipment List

Note:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. * denotes passive equipment that have been internally verified/calibrated.

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7 TEST RESULTS

7.1 Summary

Company Name: Garmin International Inc.

FCC ID: IPH-A5231

IC: 1792A-A5231

FCC Classification: Digital Transmission System (DTS)

Number of Channels: 40

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [6.3.1(a)]	6dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 7.3
2.1049	RSS-Gen [6.7]	Occupied Bandwidth	N/A		N/A	Section 7.2
15.247(b)(3)	RSS-247 [6.3.2]	Transmitter Output Power	< 1 Watt		PASS	Section 7.4
15.247(e)	RSS-247 [6.3.1(b)]	Transmitter Power Spectral Density	< 8dBm / 3kHz Band		PASS	Section 7.5
15.247(d)	RSS-247 [6.6]	Band Edge / Out-of-Band Emissions	≥ 20dBc		PASS	Section 7.6, 7.8
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Section 7.8, 7.9
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen [8.8])	LINE CONDUCTED	PASS	Section 7.10

Table 7-1. Summary of Test Results

Notes:

1. All modes of operation were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3. All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4. For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element "Conducted Automation," Version 1.5.0.
5. For radiated testing, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element "Chamber Automation," Version 3.6.1.

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7.2 99% Occupied Bandwidth

§2.1049; RSS-Gen [6.7]

Test Overview and Limit

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 11.8.2 Option 2
KDB 558074 D01 v05r02 – Section 8.2
RSS-Gen [6.7]

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Span = between 1.5x to 5x the OBW
3. RBW = in the range of 1- 5% of the OBW
4. VBW ≥ 3 x RBW
5. Detector = Peak
6. Trace mode = max hold
7. Sweep = auto couple
8. The trace was allowed to stabilize
9. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

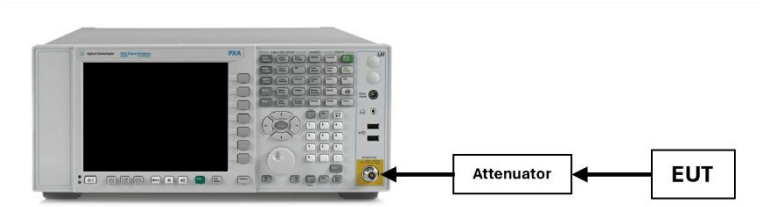

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. All supported modulation have been tested on the unit and only worst case configuration is reported.
2. Low, mid and high channels were tested and tabular data has been reported.

Frequency [MHz]	Data Rate [Mbps]	Channel	Measured 99% Occupied Bandwidth [MHz]
2402	1.0	37	1.524
2440	1.0	17	1.575
2480	1.0	39	1.347
2404	2.0	0	2.586
2440	2.0	17	2.544
2478	2.0	36	2.586

Table 7-2. 99% OBW Measurements

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Plot 7-1. 99% OBW Plot (Bluetooth (LE), 1Mbps – Ch. 37)

Plot 7-2. 99% OBW Plot (Bluetooth (LE), 1Mbps – Ch. 17)

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Plot 7-3. 99% OBW Plot (Bluetooth (LE), 1Mbps – Ch. 39)

Plot 7-4. 99% OBW Plot (Bluetooth (LE), 2Mbps – Ch. 0)

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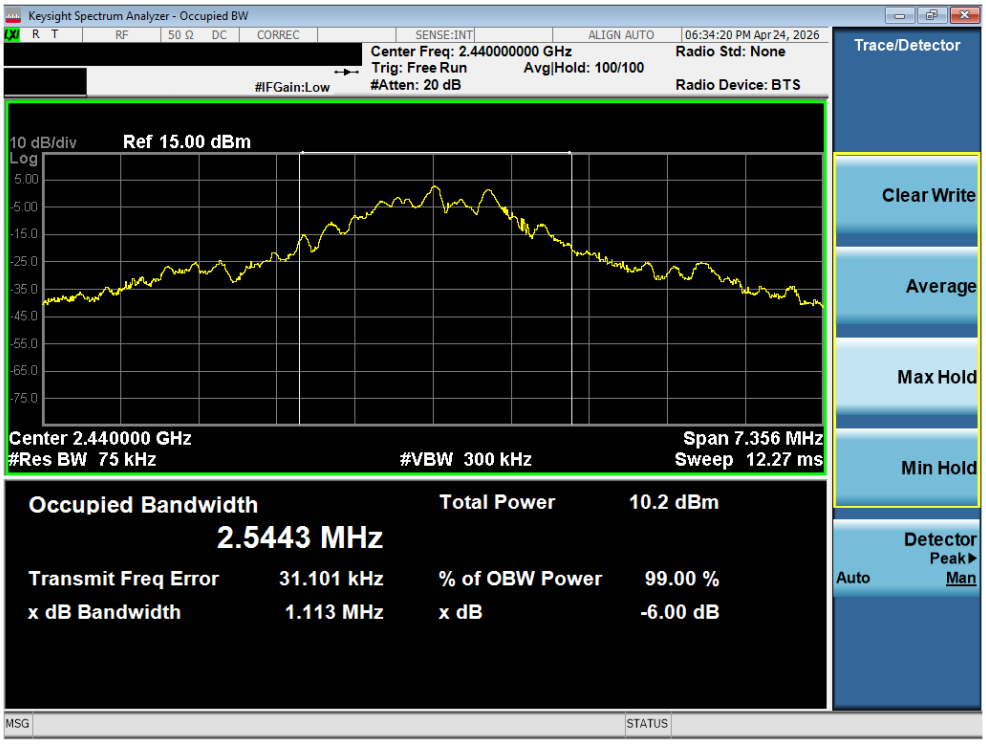

Plot 7-5. 99% OBW Plot (Bluetooth (LE), 2Mbps – Ch. 17)

Plot 7-6. 99% OBW Plot (Bluetooth (LE), 2Mbps – Ch. 36)

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7.3 6 dB Bandwidth

§15.247(a)(2); RSS-247 [6.3.1(a)]

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the transmitter antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible 6dB bandwidth is 500 kHz.

Test Procedure Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 11.8.2 Option 2
KDB 558074 D01 v05r02 – Section 8.2

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 100kHz
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

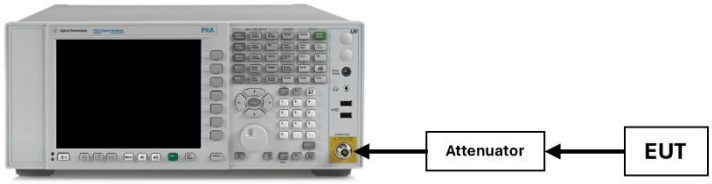

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

None

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Frequency [MHz]	Data Rate [Mbps]	Channel	Measured 6dB Bandwidth [MHz]	Minimum 6dB Bandwidth [MHz]	Pass/Fail
2402	1.0	37	0.683	0.50	Pass
2440	1.0	17	0.744	0.50	Pass
2480	1.0	39	0.701	0.50	Pass
2404	2.0	0	1.246	0.50	Pass
2440	2.0	17	1.232	0.50	Pass
2478	2.0	36	1.129	0.50	Pass

Table 7-3. 6dB BW Measurements

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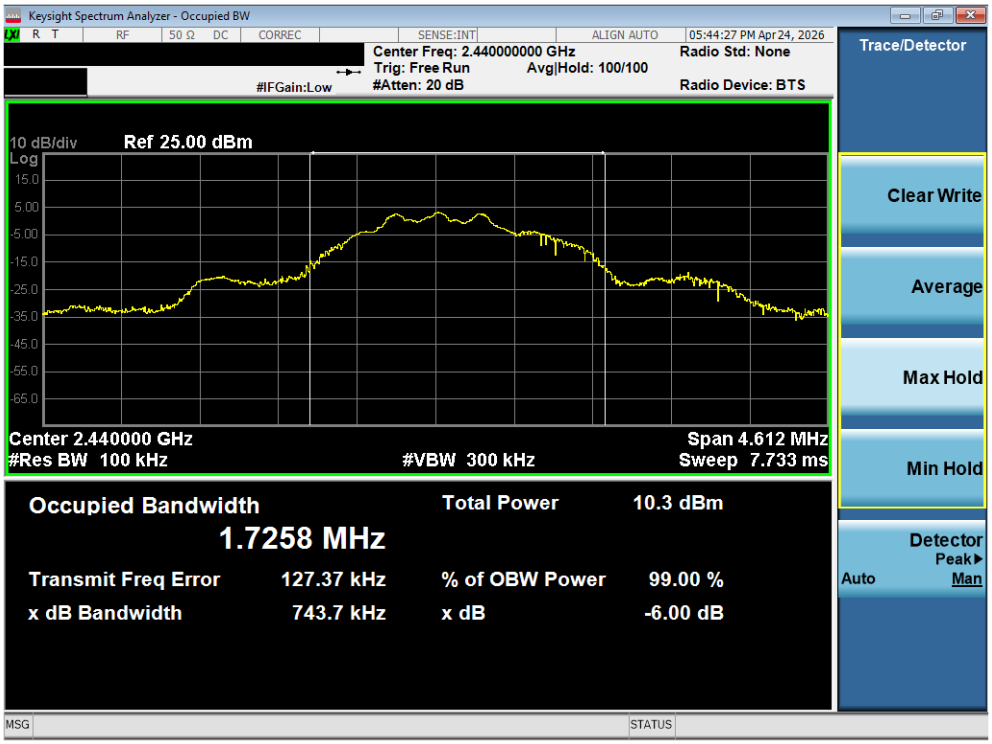
Plot 7-7. 6dB BW Plot (Bluetooth (LE), 1Mbps – Ch. 37)



Plot 7-8. 6dB BW Plot (Bluetooth (LE), 1Mbps – Ch. 17)

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Plot 7-9. 6dB BW Plot (Bluetooth (LE), 1Mbps – Ch. 39)

Plot 7-10. 6dB BW Plot (Bluetooth (LE), 2Mbps – Ch. 0)

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Plot 7-11. 6dB BW Plot (Bluetooth (LE), 2Mbps – Ch. 17)

Plot 7-12. 6dB BW Plot (Bluetooth (LE), 2Mbps – Ch. 36)

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7.4 Transmitter Output Power and Max EIRP

§15.247(b)(3); RSS-247 [6.3.2]

Test Overview and Limits

The transmitter antenna terminal of the EUT is connected to the input of a spectrum analyzer. Measurements are made while the EUT is operating at maximum power and at the appropriate frequencies.

The maximum peak conducted output power of digital modulation systems operating in the 2400-2483.5 MHz band is 1 Watt.

The conducted output power limit on paragraph above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W.

Test Procedure Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 11.9.1.2 PKPM1 Peak Power Method
KDB 558074 D01 v05r02 – Section 8.3.1.3 PKPM1 Peak-reading Power Meter Method
ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 11.9.2.3.2 Method AVGPM-G
KDB 558074 D01 v05r02 – Section 8.3.2.3 Measurement using a Power Meter (PM)

Test Settings

Method PKPM1 (Peak Power Measurement)

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

Method AVGPM-G (Average Power Measurement)

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-3. Test Instrument & Measurement Setup for Peak and Average Power Measurement

Test Notes

None

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7.4.1 Peak Output Power and Max EIRP Measurement – Bluetooth (LE)

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Peak Conducted Power		Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	EIRP Margin [dB]
			[dBm]	[mW]						
2402	1.0	37	-1.62	0.689	30.00	-31.62	2.53	0.91	36.02	-35.11
2404	1.0	0	2.48	1.770	30.00	-27.52	2.53	5.01	36.02	-31.01
2440	1.0	17	2.72	1.871	30.00	-27.28	2.53	5.25	36.02	-30.77
2476	1.0	35	2.82	1.914	30.00	-27.18	2.53	5.35	36.02	-30.67
2478	1.0	36	-1.35	0.733	30.00	-31.35	2.53	1.18	36.02	-34.84
2480	1.0	39	-1.17	0.764	30.00	-31.17	2.53	1.36	36.02	-34.66
2404	2.0	0	2.85	1.928	30.00	-27.15	2.53	5.38	36.02	-30.64
2440	2.0	17	3.05	2.018	30.00	-26.95	2.53	5.58	36.02	-30.44
2476	2.0	35	3.17	2.075	30.00	-26.83	2.53	5.70	36.02	-30.32
2478	2.0	36	-0.71	0.849	30.00	-30.71	2.53	1.82	36.02	-34.20

Table 7-4. Peak Conducted Output Power and Max EIRP Measurements (Bluetooth LE)

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Average Conducted Power		Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	EIRP Margin [dB]
			[dBm]	[mW]						
2402	1.0	37	-2.43	0.571	30.00	-32.43	2.53	0.10	36.02	-35.92
2404	1.0	0	1.90	1.549	30.00	-28.10	2.53	4.43	36.02	-31.59
2440	1.0	17	2.07	1.611	30.00	-27.93	2.53	4.60	36.02	-31.42
2476	1.0	35	2.15	1.641	30.00	-27.85	2.53	4.68	36.02	-31.34
2478	1.0	36	-2.03	0.627	30.00	-32.03	2.53	0.50	36.02	-35.52
2480	1.0	39	-2.02	0.628	30.00	-32.02	2.53	0.51	36.02	-35.51
2404	2.0	0	1.93	1.560	30.00	-28.07	2.53	4.46	36.02	-31.56
2440	2.0	17	2.06	1.607	30.00	-27.94	2.53	4.59	36.02	-31.43
2476	2.0	35	2.14	1.637	30.00	-27.86	2.53	4.67	36.02	-31.35
2478	2.0	36	-1.98	0.634	30.00	-31.98	2.53	0.55	36.02	-35.47

Table 7-5. Average Conducted Output Power and Max EIRP Measurements (Bluetooth LE)

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7.4.2 Sample EIRP Calculation:

At 2402MHz, the peak conducted output power was calculated to be -1.62 dBm with antenna gain of 2.53 dBi.

e.i.r.p. (dBm) = Conducted Power (dBm) + Ant gain (dBi)

-1.62 dBm + 2.53 dBi = 0.91 dBm

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7.5 Power Spectral Density

§15.247(e); RSS-247 [6.3.1(b)]

Test Overview and Limit

The peak power density is measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies.

The maximum permissible power spectral density is 8 dBm in any 3 kHz band.

Test Procedure Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 11.10.2 Method PKPSD
KDB 558074 D01 v05r02 – Section 8.4 DTS Maximum Power Spectral Density level in the fundamental emission

Test Settings

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span > 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW ≥ 3 x RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

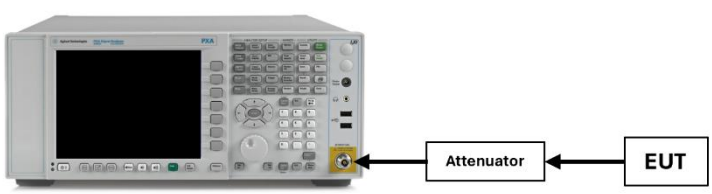

Figure 7-4. Test Instrument & Measurement Setup

Test Notes

None.

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Frequency [MHz]	Data Rate [Mbps]	Channel No.	Measured Power Density [dBm/3kHz]	Max Power Density [dBm/3kHz]	Margin [dB]
2402	1.0	37	-6.73	8.0	-14.73
2404	1.0	0	-3.15	8.0	-11.15
2440	1.0	17	-2.70	8.0	-10.70
2476	1.0	35	-2.63	8.0	-10.63
2478	1.0	36	-7.06	8.0	-15.06
2480	1.0	39	-6.68	8.0	-14.68
2404	2.0	0	-2.47	8.0	-10.47
2440	2.0	17	-2.59	8.0	-10.59
2476	2.0	35	-2.33	8.0	-10.33
2478	2.0	36	-6.52	8.0	-14.52

Table 7-6. Conducted Power Density Measurements

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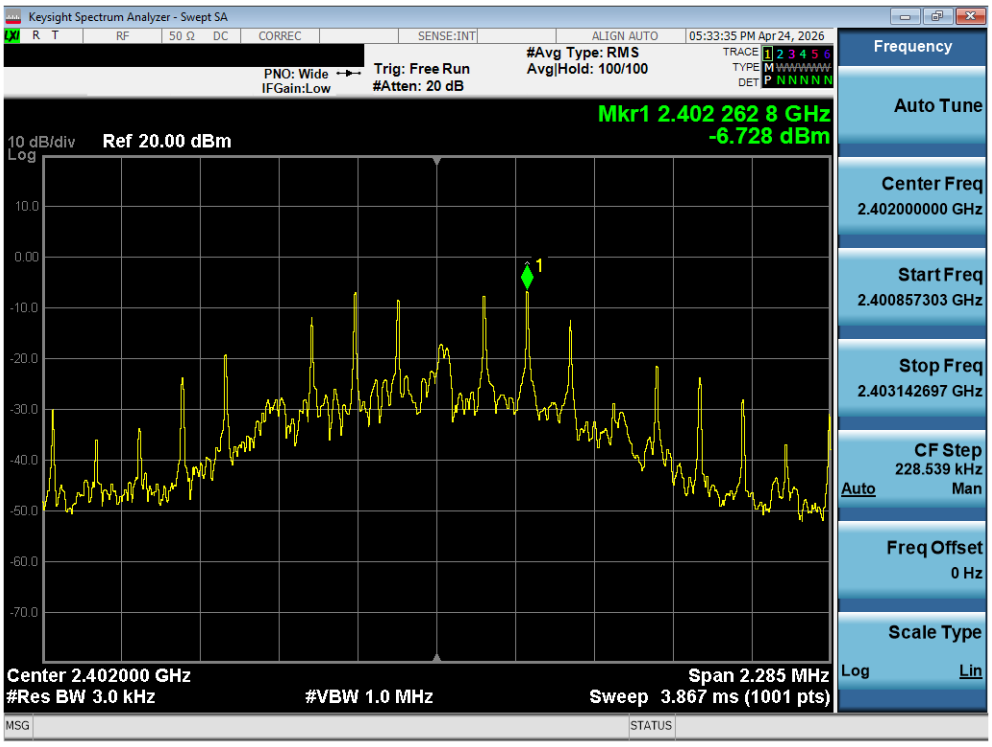
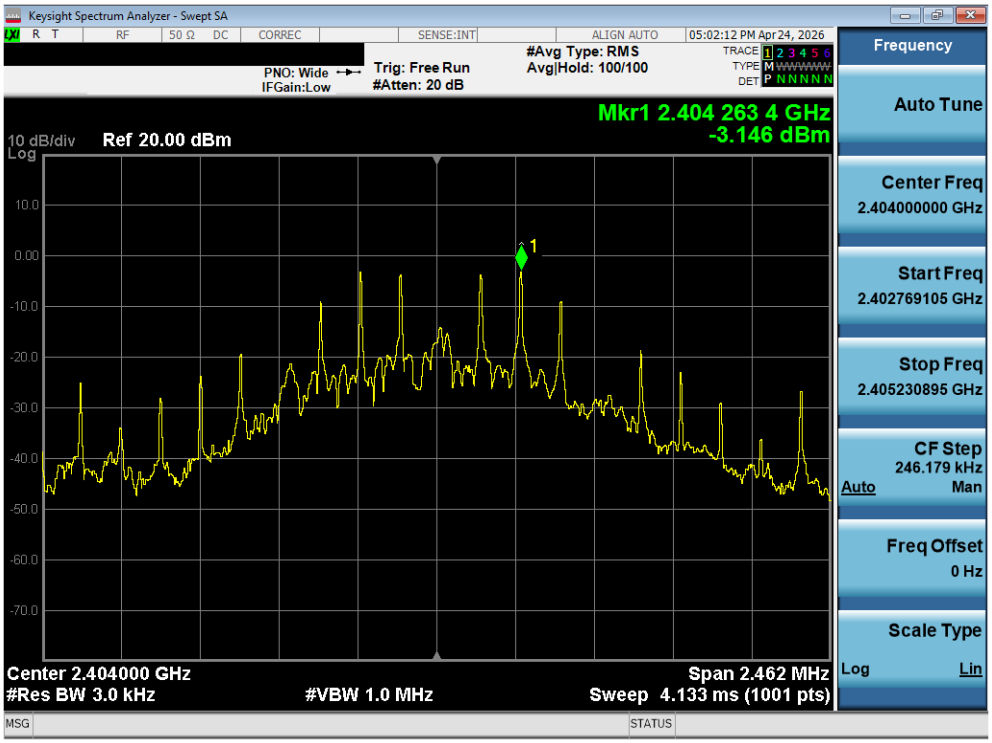


Plot 7-13. Power Spectral Density Plot (Bluetooth (LE), 1Mbps – Ch. 37)



Plot 7-14. Power Spectral Density Plot (Bluetooth (LE), 1Mbps – Ch. 0)

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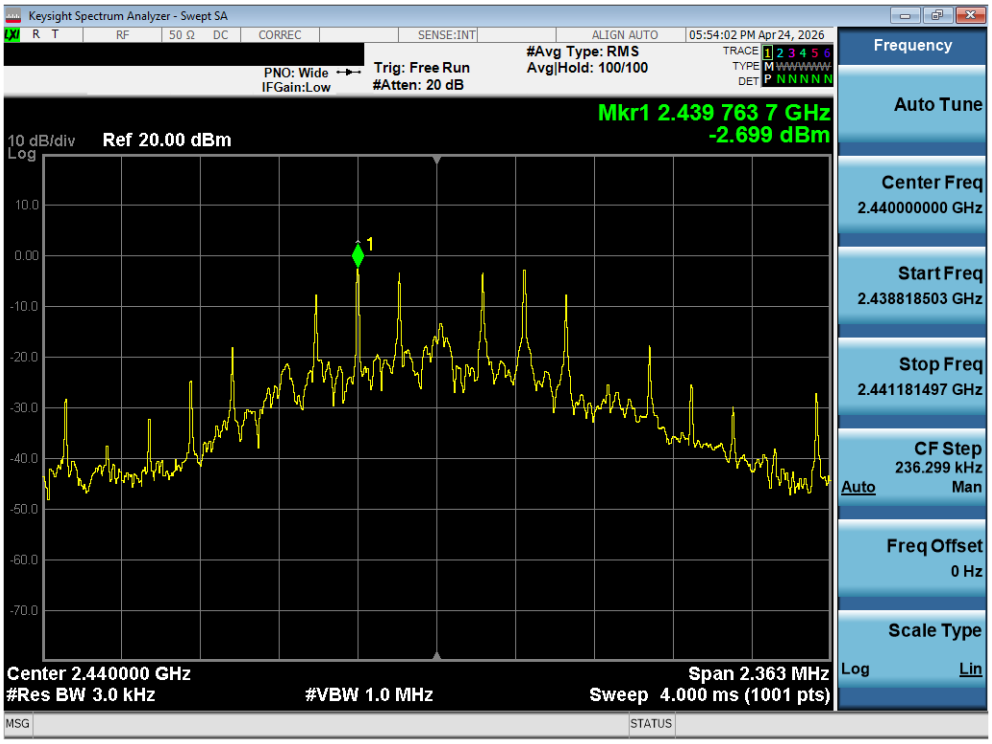
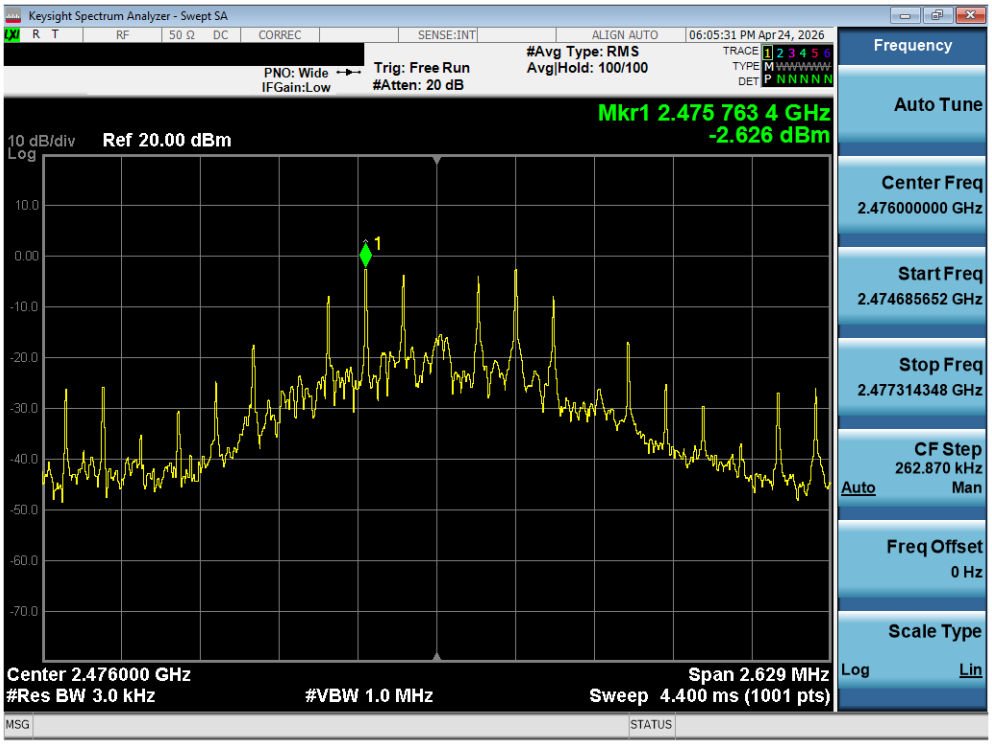


Plot 7-15. Power Spectral Density Plot (Bluetooth (LE), 1Mbps – Ch. 17)



Plot 7-16. Power Spectral Density Plot (Bluetooth (LE), 1Mbps – Ch. 35)

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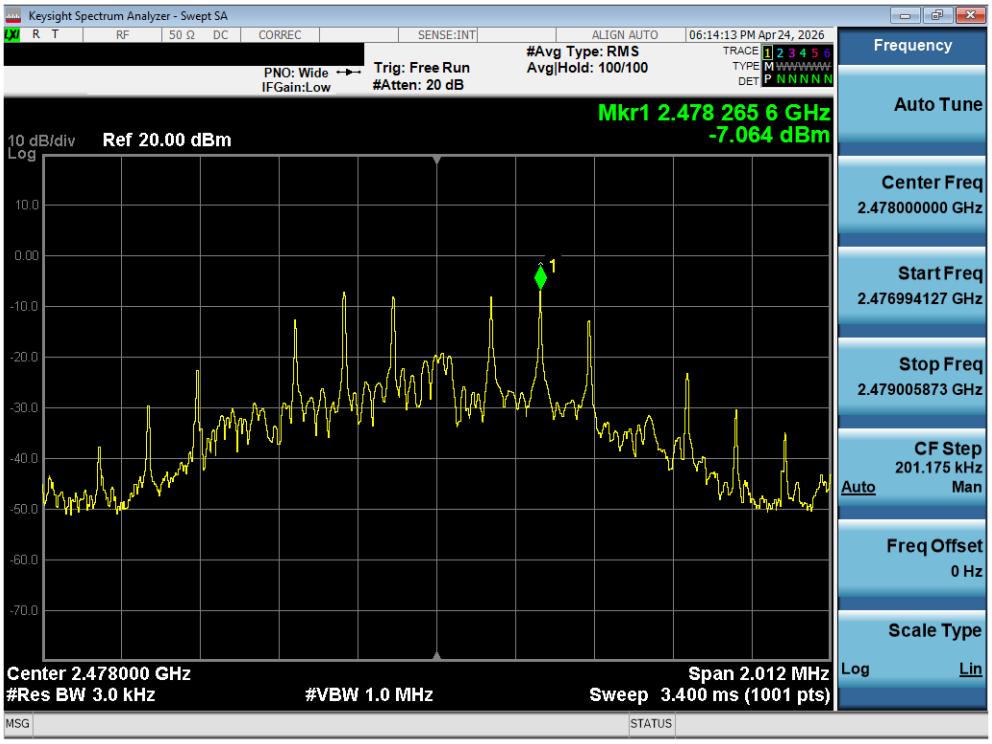
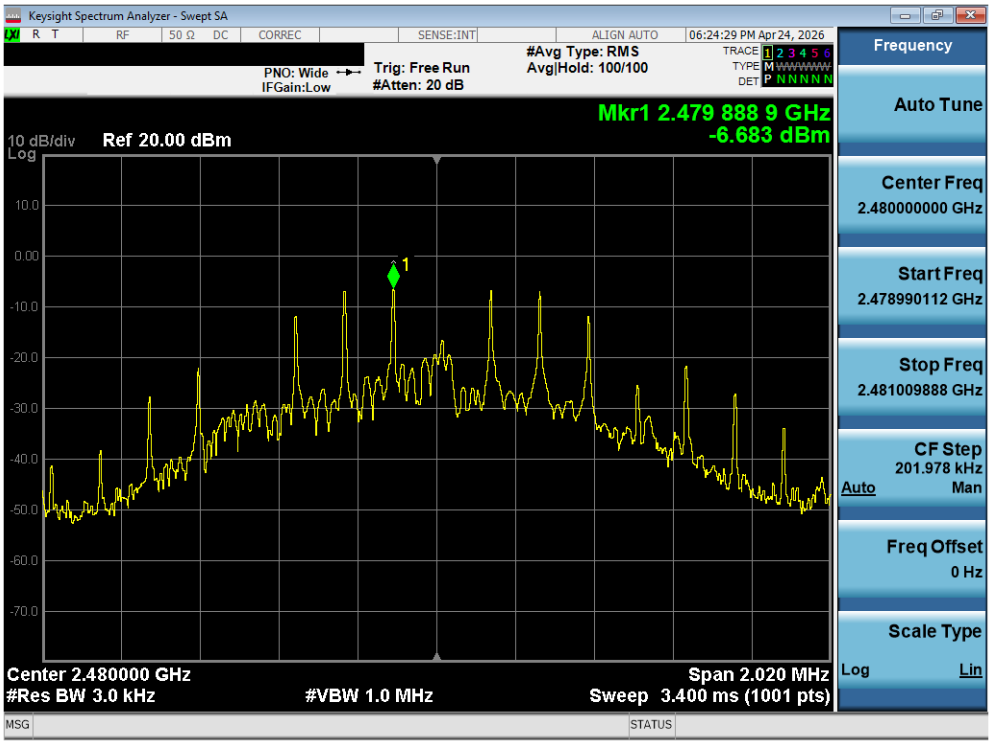


Plot 7-17. Power Spectral Density Plot (Bluetooth (LE), 1Mbps – Ch. 36)



Plot 7-18. Power Spectral Density Plot (Bluetooth (LE), 1Mbps – Ch. 39)

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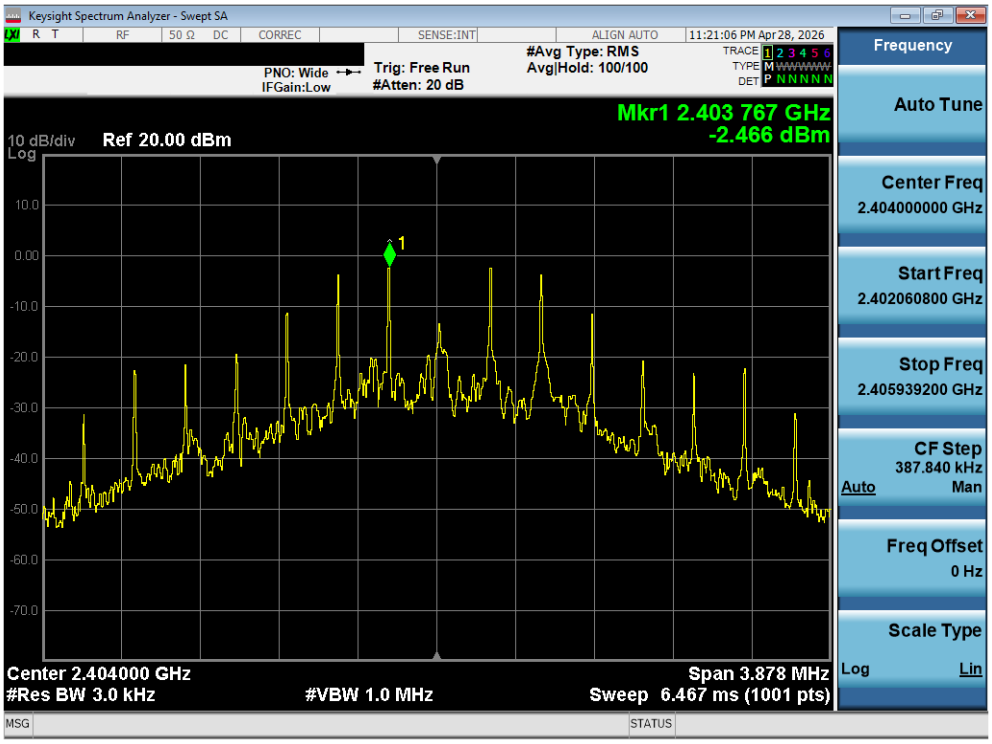
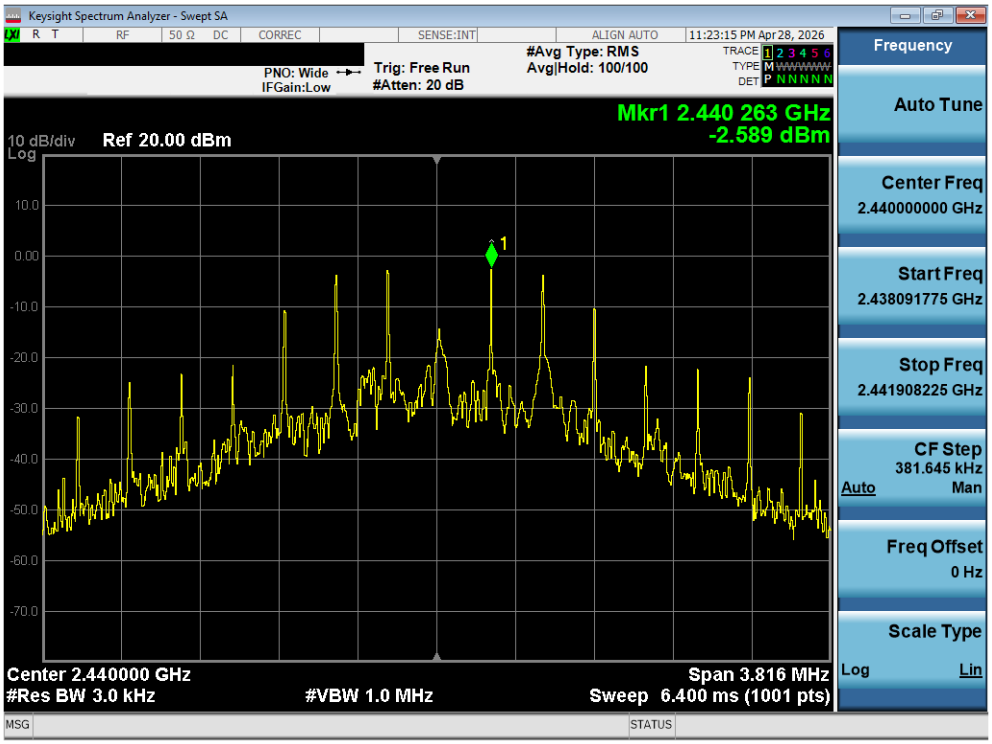


Plot 7-19. Power Spectral Density Plot (Bluetooth (LE), 2Mbps – Ch. 0)



Plot 7-20. Power Spectral Density Plot (Bluetooth (LE), 2Mbps – Ch. 17)

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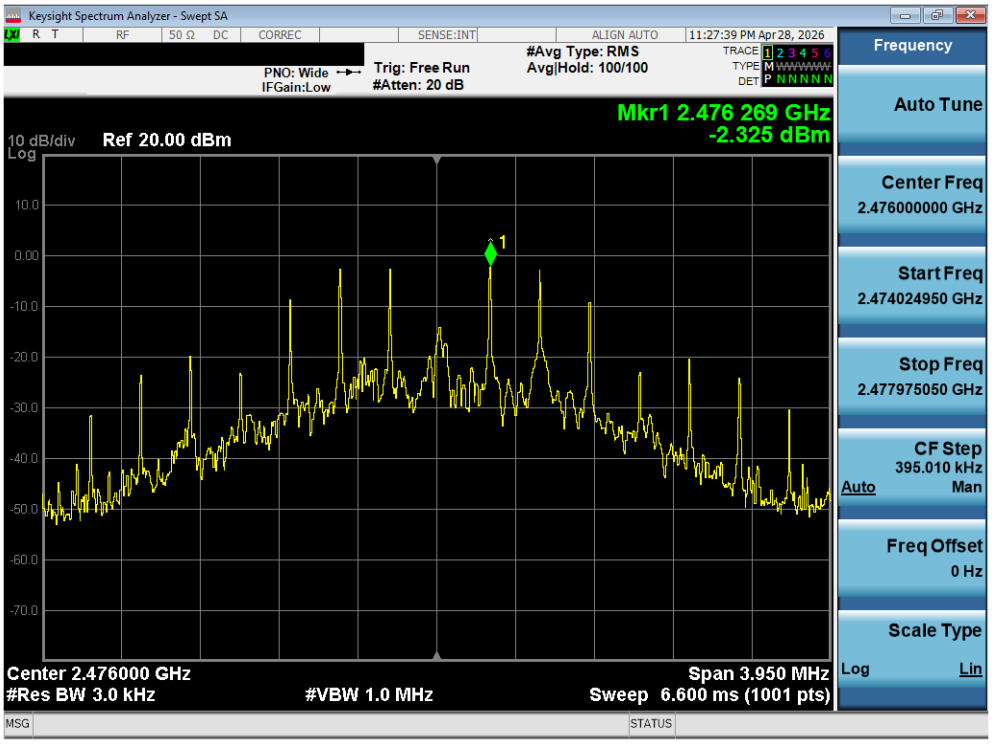
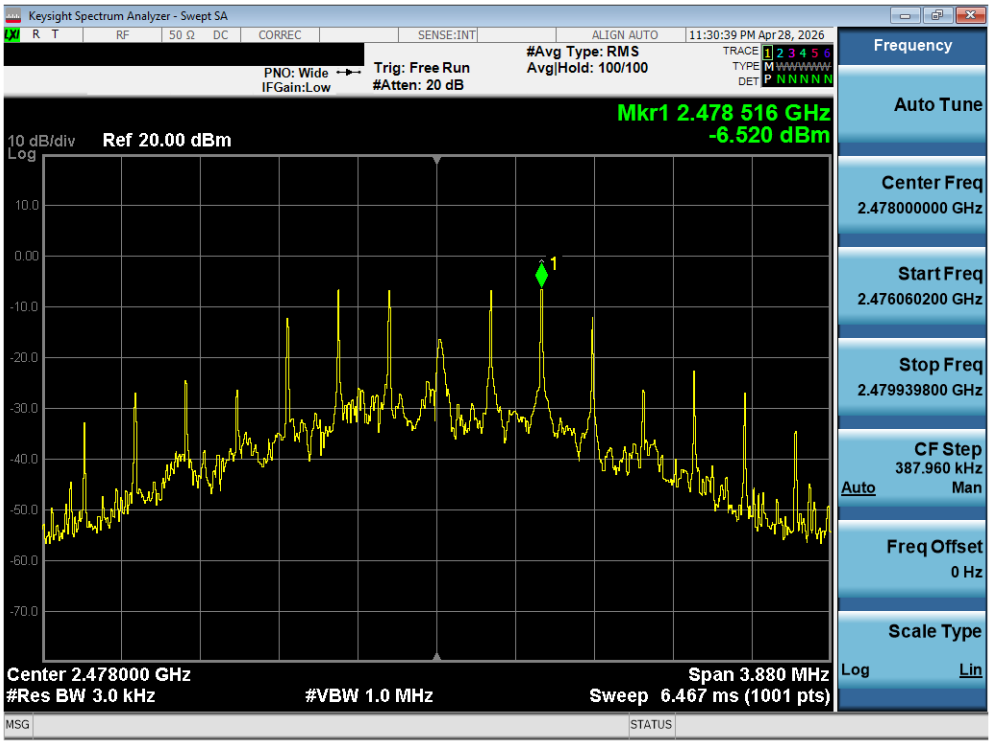


Plot 7-21. Power Spectral Density Plot (Bluetooth (LE), 2Mbps – Ch. 35)



Plot 7-22. Power Spectral Density Plot (Bluetooth (LE), 2Mbps – Ch. 36)

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7.6 Conducted Authorized Band Edge

§15.247(d); RSS-247 [6.6]

Test Overview and Limit

For the following out of band conducted spurious emissions plots at the band edge, the EUT was set to transmit at maximum power with the largest packet size available. These settings produced the worst-case emissions.

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth.

Test Procedure Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 11.11.3
KDB 558074 D01 v05r02 – Section 8.7.2

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100kHz
4. VBW ≥ 3 × RBW
5. Detector = Peak
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

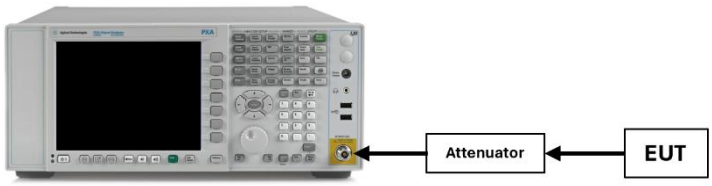

Figure 7-5. Test Instrument & Measurement Setup

Test Notes

None

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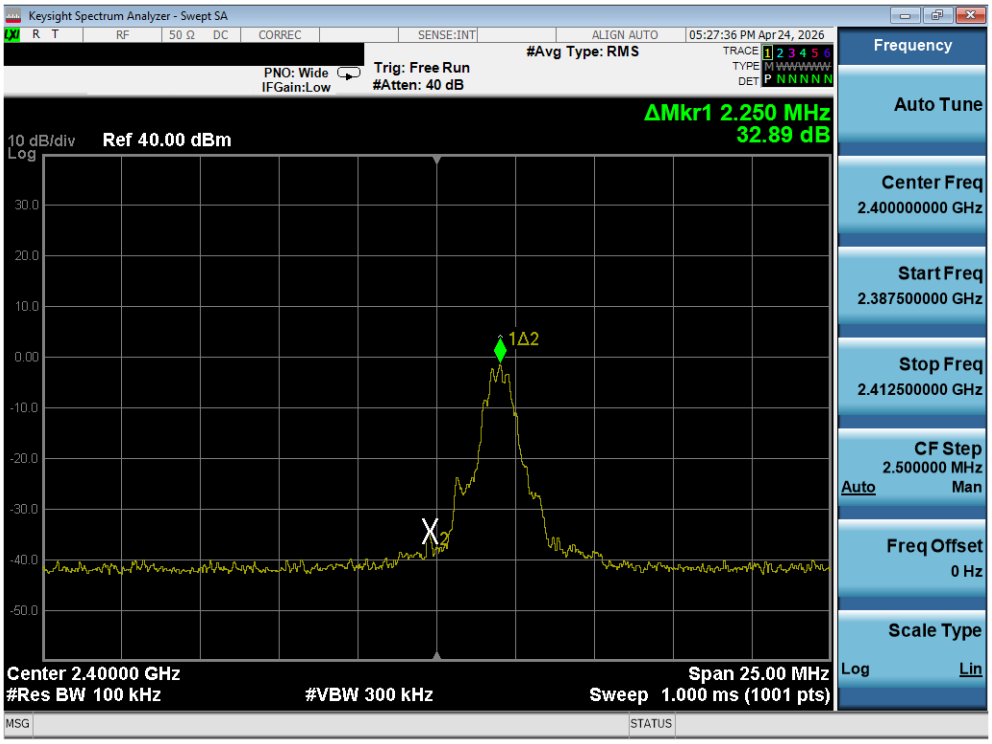
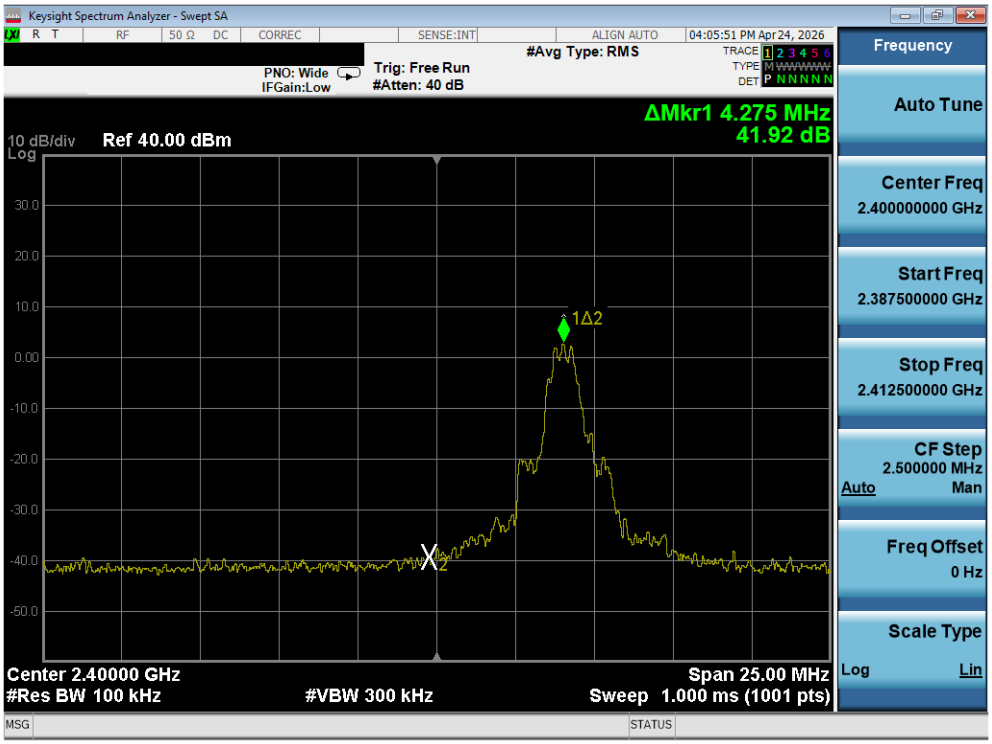


Plot 7-23. Band Edge Plot (Bluetooth (LE), 1Mbps – Ch.37)



Plot 7-24. Band Edge Plot (Bluetooth (LE), 1Mbps – Ch.0)

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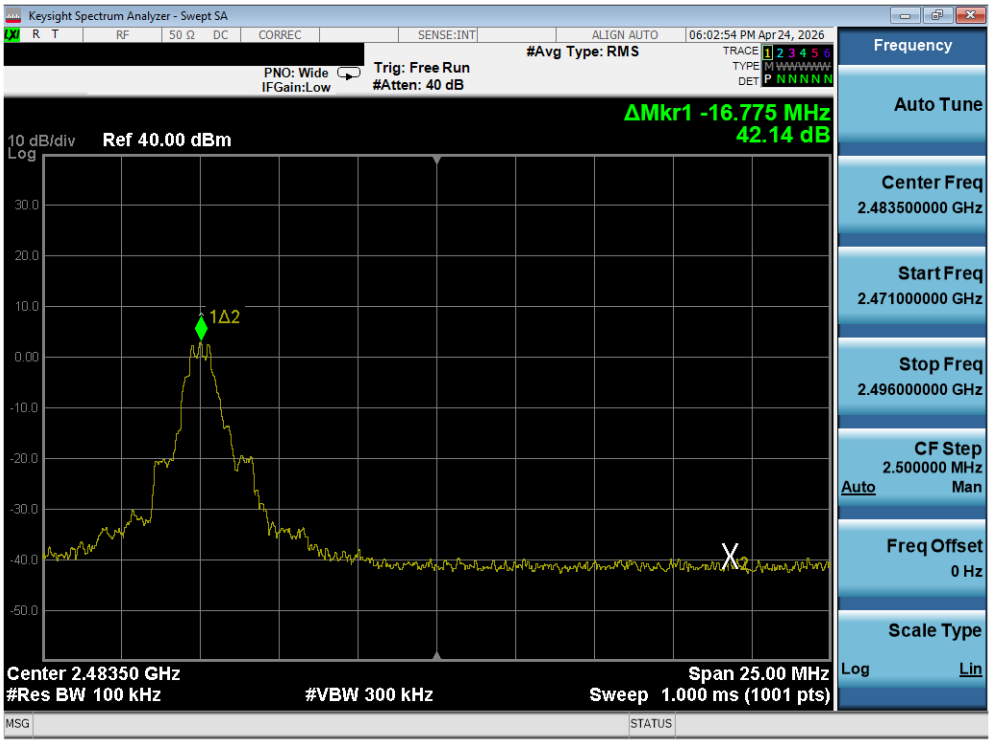
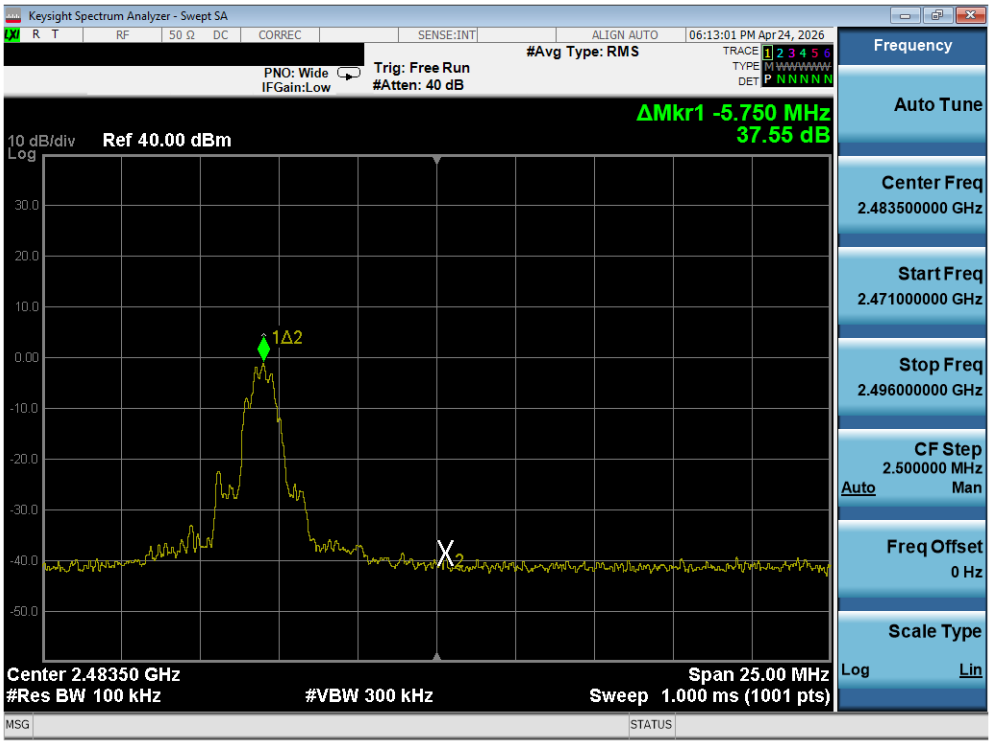


Plot 7-25. Band Edge Plot (Bluetooth (LE), 1Mbps – Ch. 35)



Plot 7-26. Band Edge Plot (Bluetooth (LE), 1Mbps – Ch. 36)

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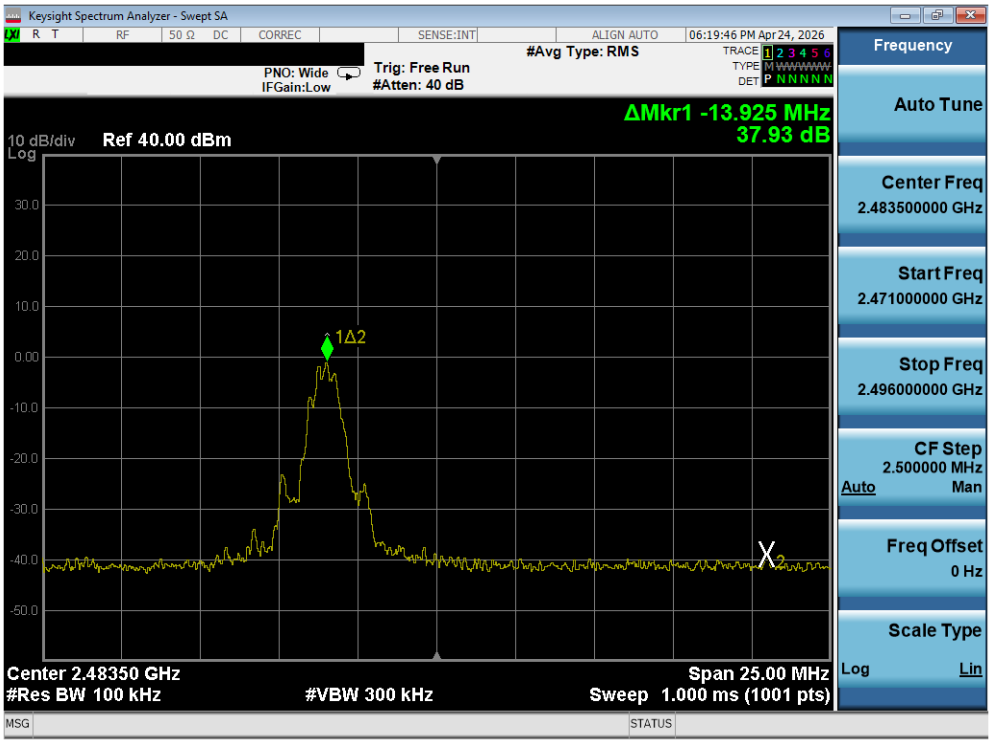
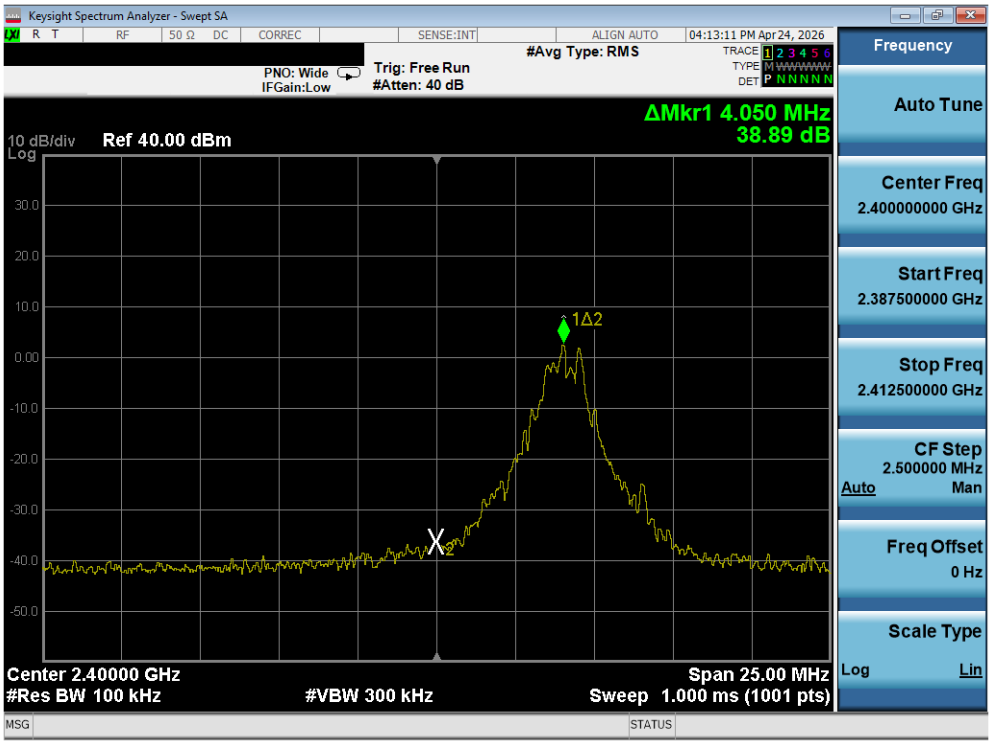


Plot 7-27. Band Edge Plot (Bluetooth (LE), 1Mbps – Ch. 39)



Plot 7-28. Band Edge Plot (Bluetooth (LE), 2Mbps – Ch. 0)

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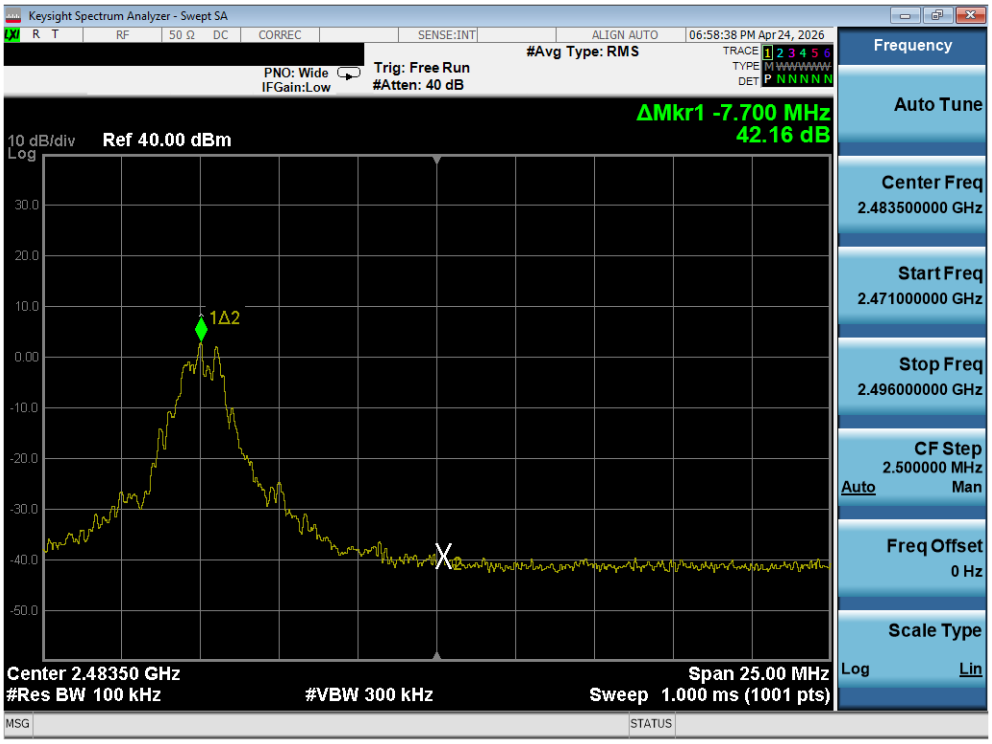
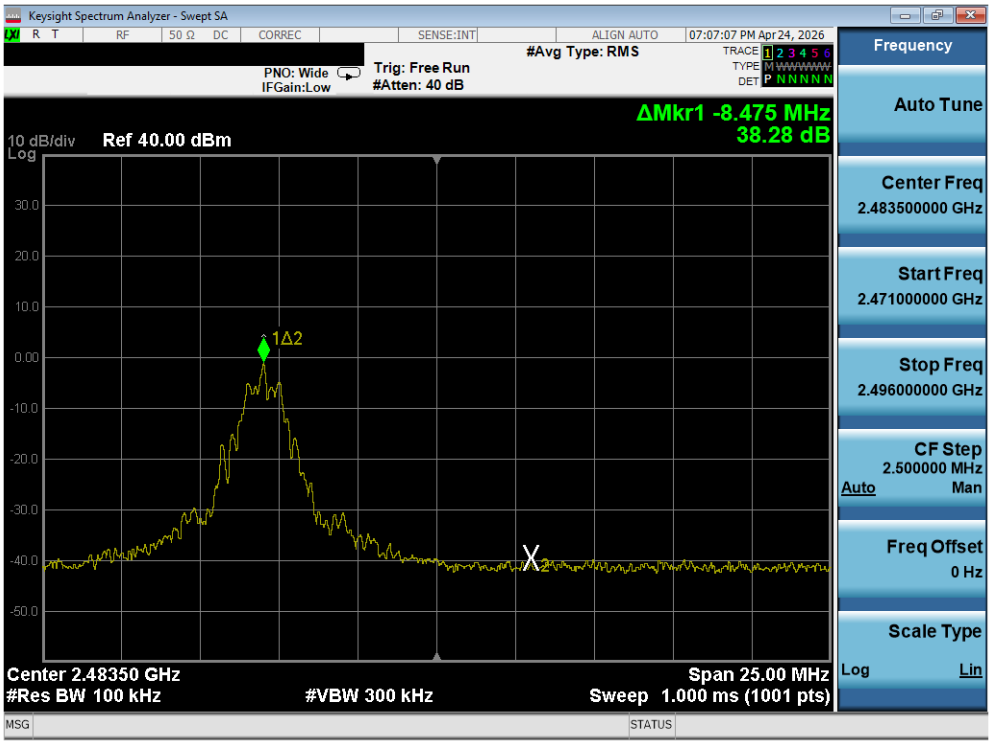


Plot 7-29. Band Edge Plot (Bluetooth (LE), 2Mbps – Ch. 35)



Plot 7-30. Band Edge Plot (Bluetooth (LE), 2Mbps – Ch. 36)

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7.7 Conducted Spurious Emissions

§15.247(d); RSS-247 [6.6]

Test Overview and Limit

For the following out of band conducted spurious emissions plots, the EUT was set to transmit at maximum power with the largest packet size available. The worst case spurious emissions were found in this configuration.

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the procedure in Section 8.5 of KDB 558074 D01 v05r02 and Section 11.11 of ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024.

Test Procedure Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 11.11.3
KDB 558074 D01 v05r02 – Section 8.5
ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 14.5.3
KDB 662911 D01 v02r01 – Section E)3)b)

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 25GHz (separated into two plots per channel)
2. RBW = 100kHz
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

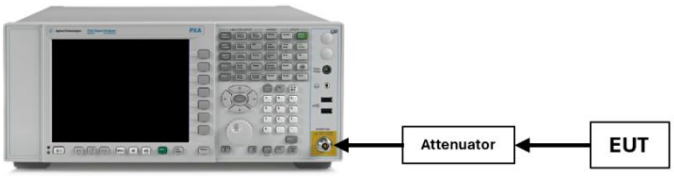

Figure 7-6. Test Instrument & Measurement Setup

Test Notes

None

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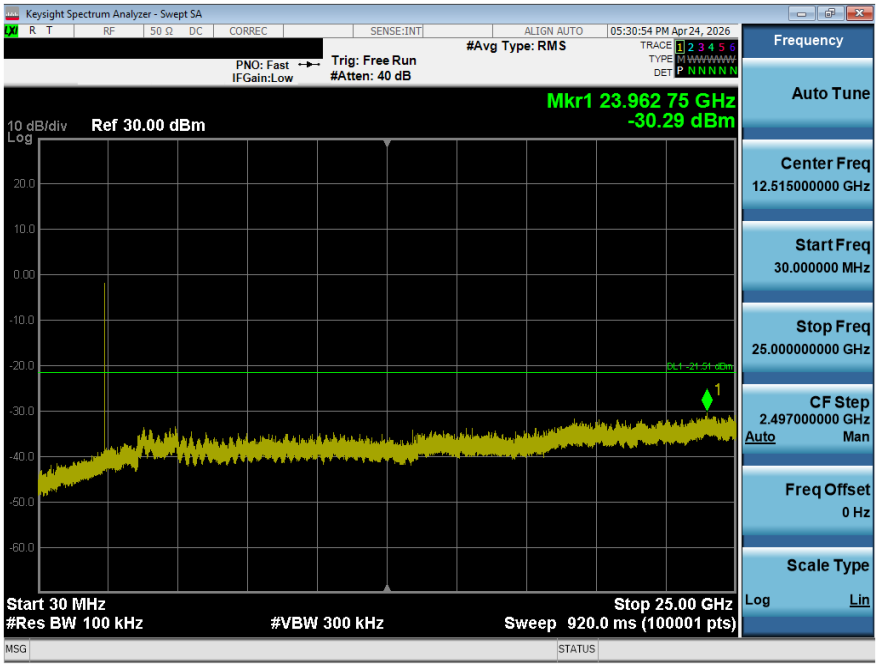
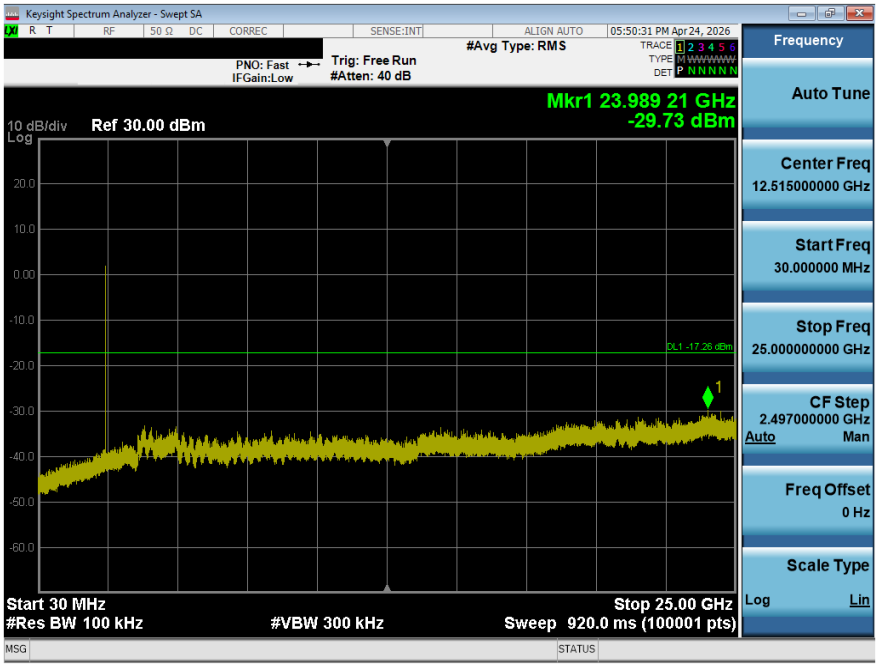


Plot 7-31. Conducted Spurious Plot (Bluetooth (LE), 1Mbps – Ch. 37)



Plot 7-32. Conducted Spurious Plot (Bluetooth (LE), 1Mbps – Ch. 17)

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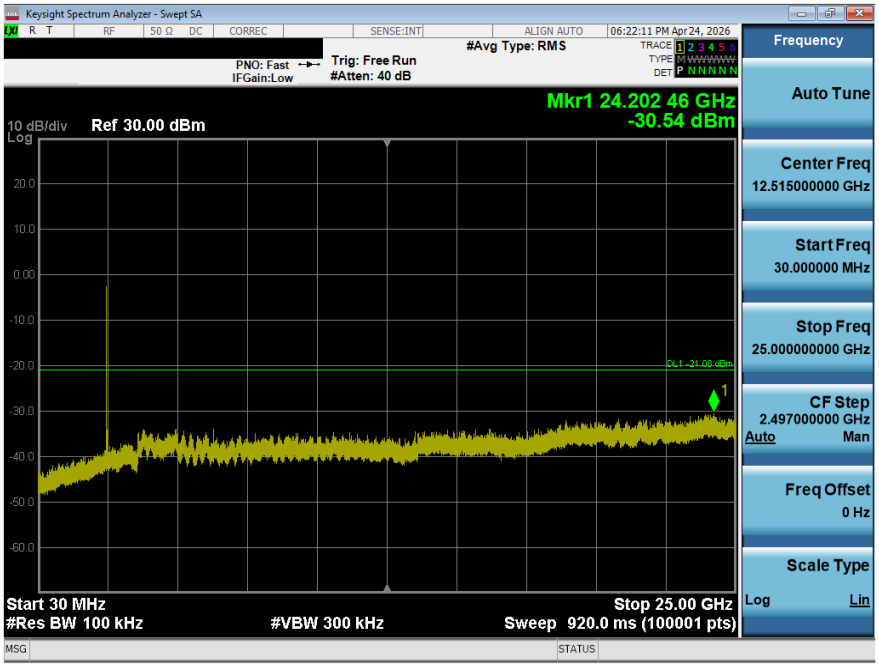
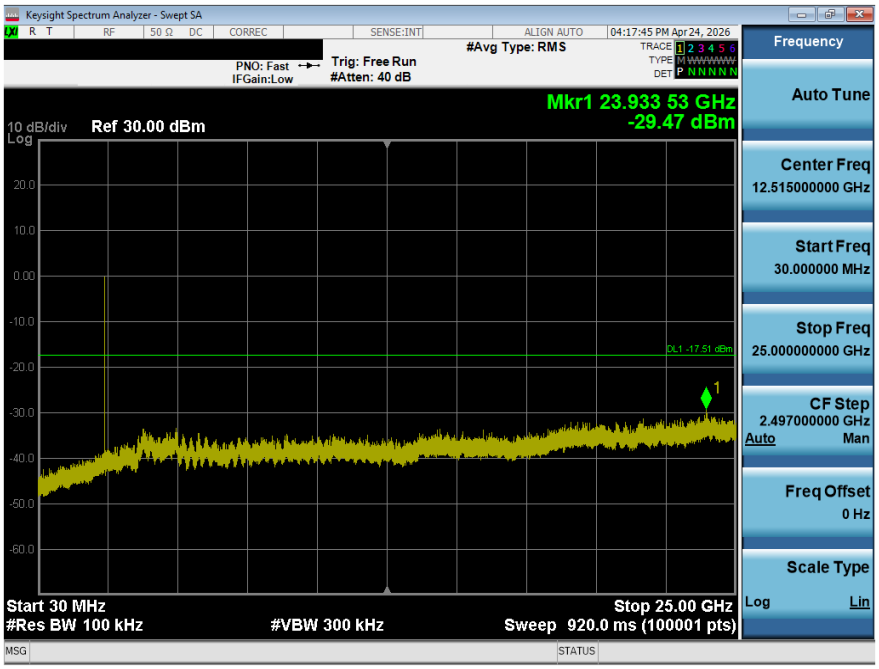


Plot 7-33. Conducted Spurious Plot (Bluetooth (LE), 1Mbps – Ch. 39)



Plot 7-34. Conducted Spurious Plot (Bluetooth (LE), 2Mbps – Ch. 0)

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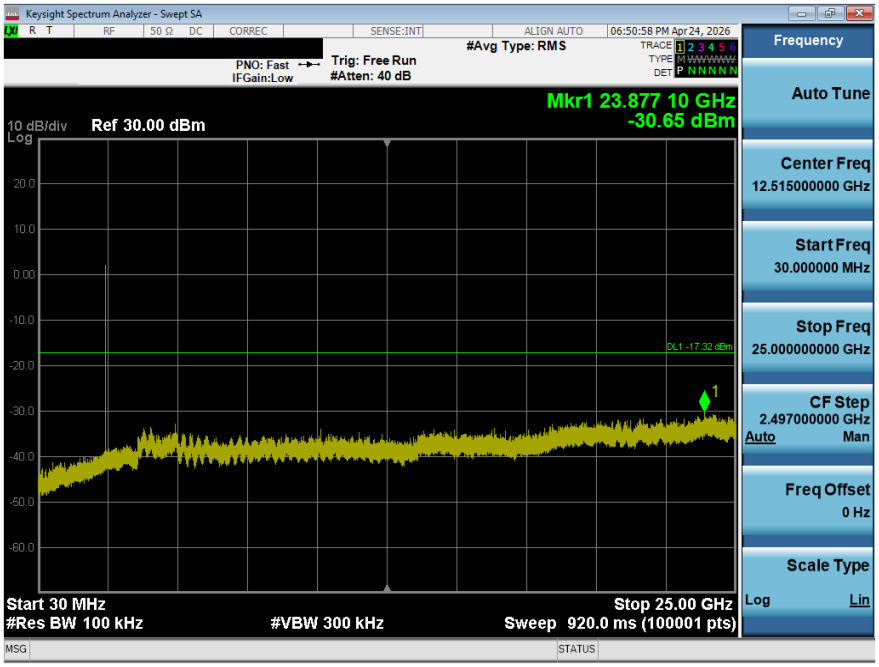
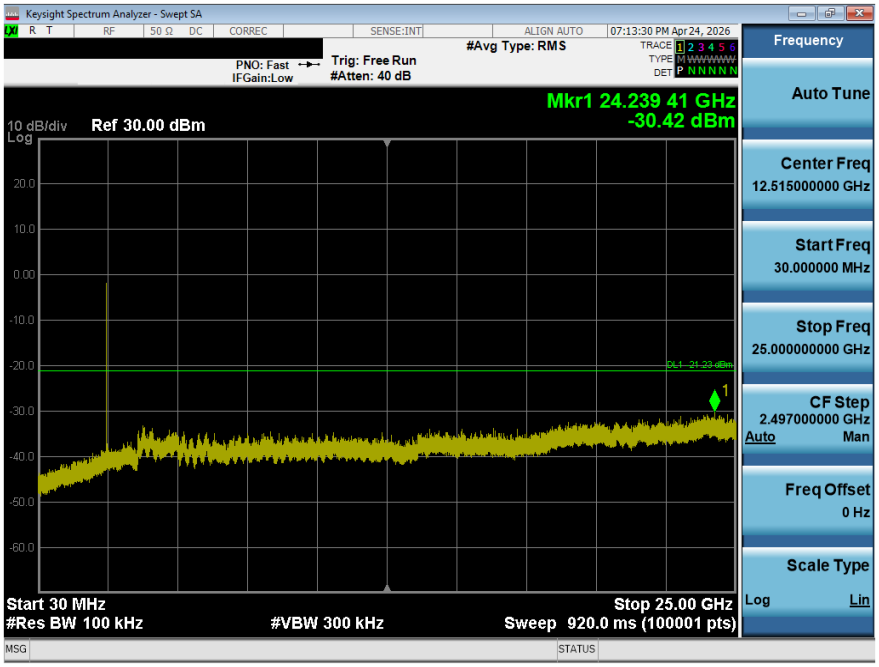


Plot 7-35. Conducted Spurious Plot (Bluetooth (LE), 2Mbps – Ch. 17)



Plot 7-36. Conducted Spurious Plot (Bluetooth (LE), 2Mbps – Ch. 36)

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7.8 Radiated Spurious Emissions – Above 1GHz

§15.205 §15.209 §15.247(d); RSS-Gen [8.9]

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 7 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-7 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
Above 960.0 MHz	500	3

Table 7-7. Radiated Limits

Test Procedures Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 – Subclause 6.6.4.3
KDB 558074 D01 v05r02 – Sections 8.6, 8.7

Test Settings

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be ≥ 2 x span/RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

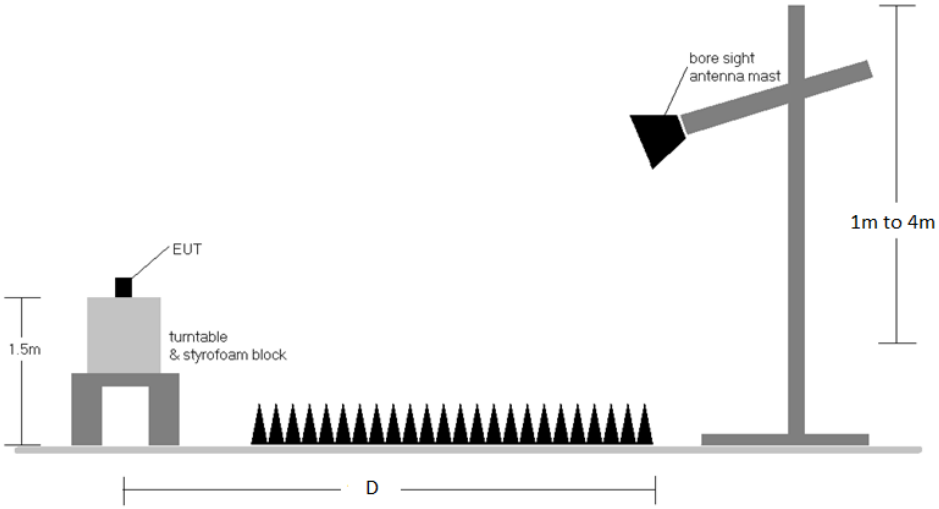

Figure 7-7. Radiated Test Setup >1GHz

Test Notes

1. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 D01 v05r02 were not used to evaluate this device for compliance to radiated limits. All radiated spurious emissions levels were measured in a radiated test setup.
2. All emissions lying in restricted bands specified in §15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 7-7.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas.
6. D is the measurement test distance and emissions 1-18GHz were measured at a 3 meters test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
8. All supported modulation have been tested on the unit and only worst case configuration is reported.

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Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$ – Preamplifier Gain $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 7.8.2 was calculated using the formula:

  Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

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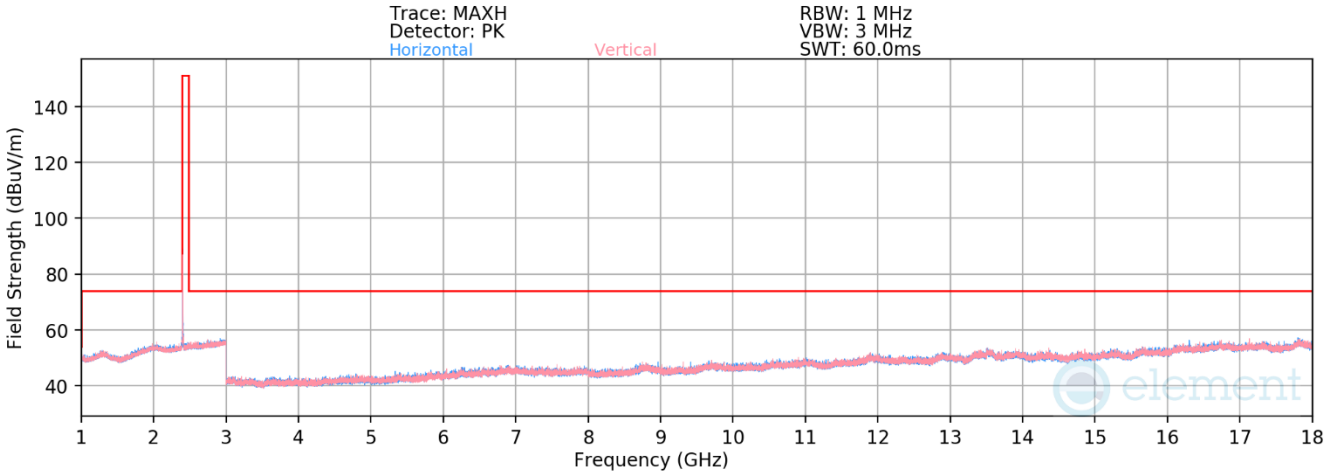
7.8.1 Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247(d); RSS-Gen [8.9]



Plot 7-37. Radiated Spurious Emissions 1-18GHz (1Mbps – Ch. 37)

Bluetooth Mode:	LE
Data Rate:	1Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2402MHz
Channel:	37

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4804.00	Avg	H	-	-	-79.38	4.97	32.59	53.98	-21.39
4804.00	Peak	H	-	-	-68.06	5.17	44.12	73.98	-29.86
12010.00	Avg	H	-	-	-81.98	14.58	39.59	53.98	-14.38
12010.00	Peak	H	-	-	-71.03	14.63	50.60	73.98	-23.38

Table 7-8. Radiated Measurements

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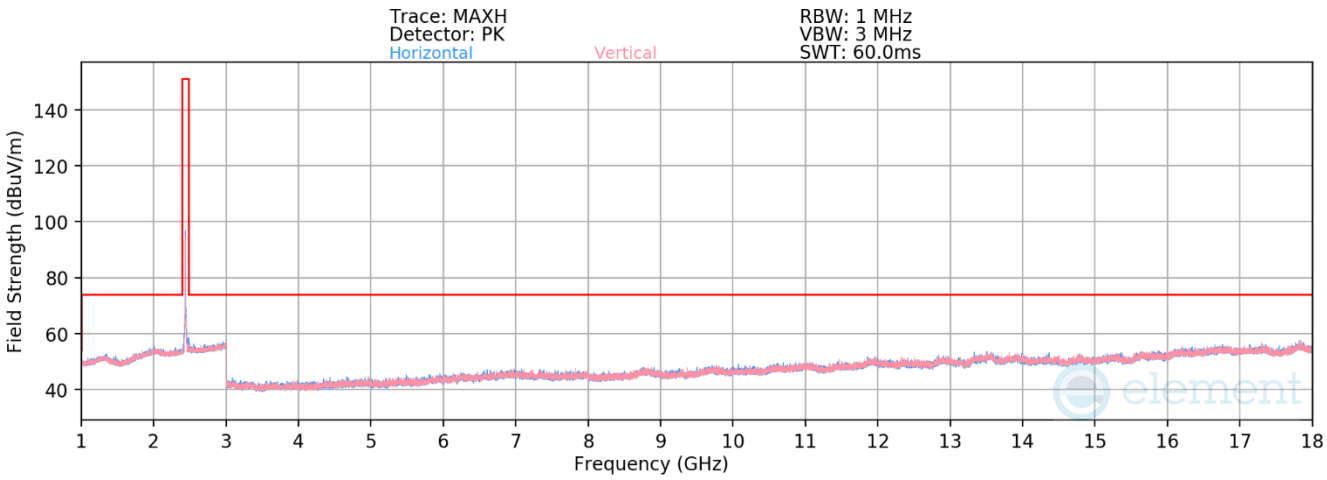
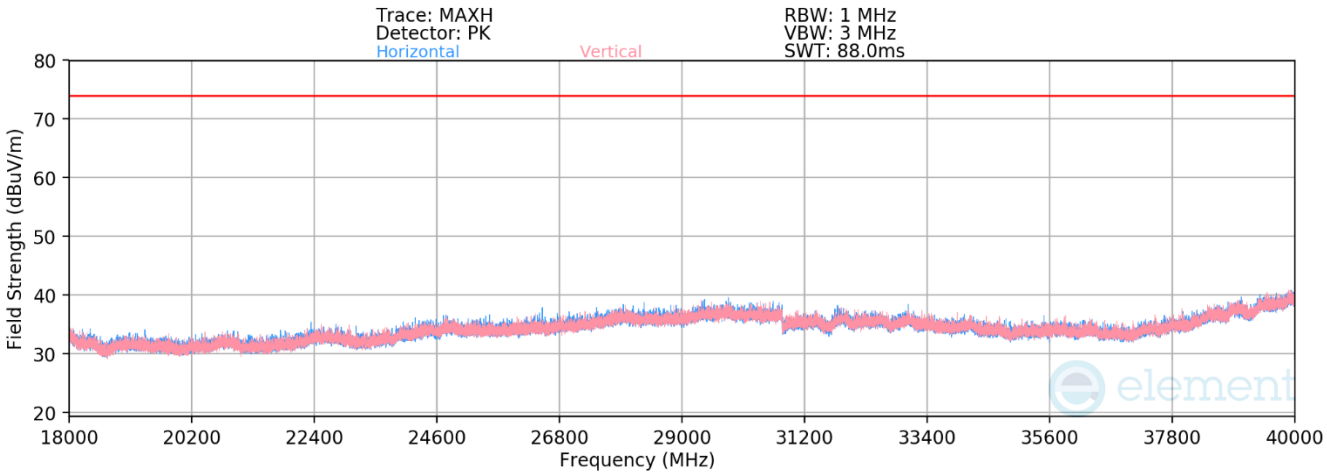


Plot 7-38. Radiated Spurious Emissions 1-18GHz (1Mbps – Ch. 17)



Plot 7-39. Radiated Spurious Emissions Above 18GHz (1Mbps – Ch. 17)

Bluetooth Mode:	LE
Data Rate:	1Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2440MHz
Channel:	17

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Dist. Corr. Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4880.00	Avg	H	-	-	-79.52	5.46	0.00	32.94	53.98	-21.04
4880.00	Peak	H	-	-	-67.70	5.48	0.00	44.78	73.98	-29.20
7320.00	Avg	H	-	-	-82.39	10.38	0.00	34.99	53.98	-18.99
7320.00	Peak	H	-	-	-71.19	10.38	0.00	46.19	73.98	-27.79
12200.00	Avg	H	-	-	-82.33	15.61	0.00	40.27	53.98	-13.71
12200.00	Peak	H	-	-	-70.50	15.41	0.00	51.91	73.98	-22.07
19520.00	Avg	H	-	-	-63.14	-6.07	-9.54	28.25	53.98	-25.73
19520.00	Peak	H	-	-	-50.84	-6.07	-9.54	40.55	73.98	-33.43

Table 7-9. Radiated Measurements

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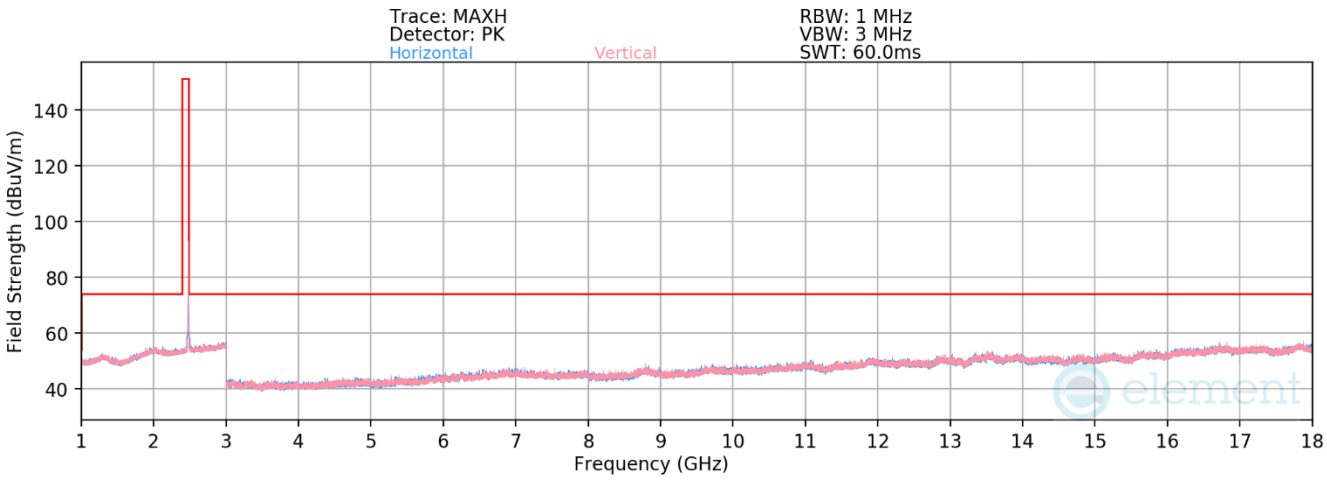

Plot 7-40. Radiated Spurious Emissions 1-18GHz (1Mbps – Ch. 39)

Bluetooth Mode:	LE
Data Rate:	1Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2480MHz
Channel:	39

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4960.00	Avg	H	-	-	-79.54	5.58	33.04	53.98	-20.94
4960.00	Peak	H	-	-	-67.92	5.35	44.43	73.98	-29.55
7440.00	Avg	H	-	-	-82.08	10.25	35.17	53.98	-18.80
7440.00	Peak	H	-	-	-70.77	10.25	46.48	73.98	-27.50
12400.00	Avg	H	-	-	-83.42	15.04	38.61	53.98	-15.36
12400.00	Peak	H	-	-	-71.60	15.08	50.47	73.98	-23.51

Table 7-10. Radiated Measurements

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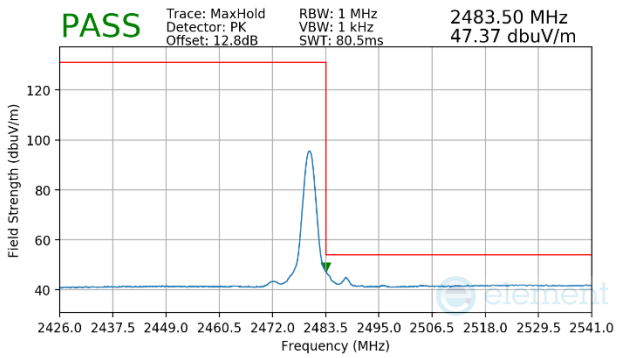
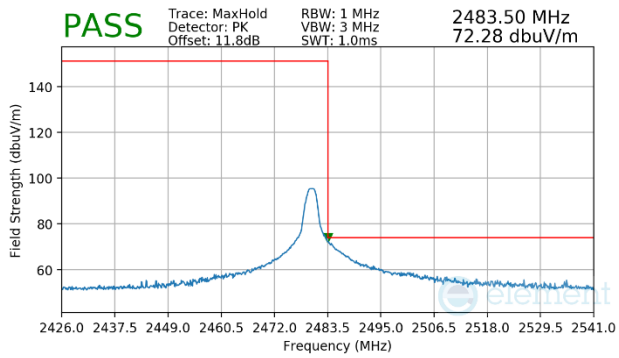
7.8.2 Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

Bluetooth Mode:	LE
Data Rate:	1Mbps
Measurement Distance:	3 Meters
Operating Frequency:	2480MHz
Channel:	39

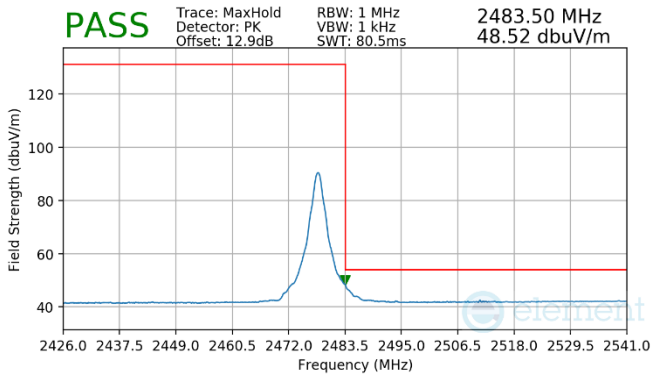


Plot 7-41. Radiated Restricted Upper Band Edge Measurement (Average)

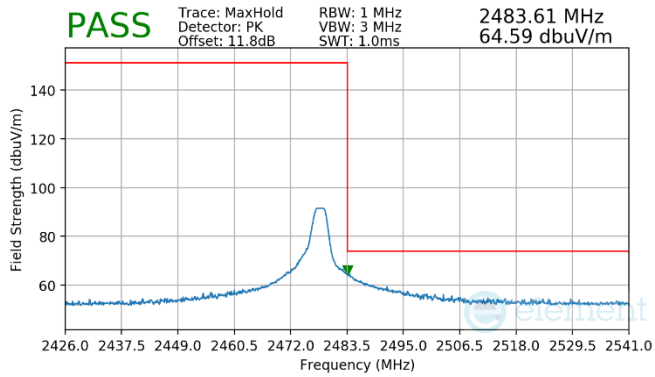


Plot 7-42. Radiated Restricted Upper Band Edge Measurement (Peak)

Bluetooth Mode:	LE
Data Rate:	2Mbps
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	35



Plot 7-43. Radiated Restricted Lower Band Edge Measurement (Average)



Plot 7-44. Radiated Restricted Lower Band Edge Measurement (Peak)

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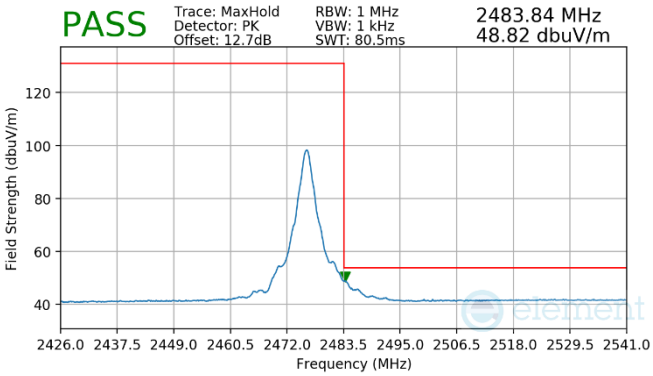
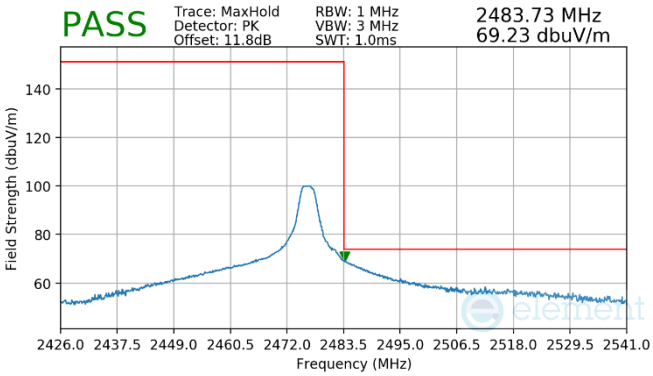
Bluetooth Mode:	LE
Data Rate:	2Mbps
Measurement Distance:	3 Meters
Operating Frequency:	2478MHz
Channel:	36



Plot 7-45. Radiated Restricted Upper Band Edge Measurement (Average)



Plot 7-46. Radiated Restricted Upper Band Edge Measurement (Peak)

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7.9 Radiated Spurious Emissions – Below 1GHz

§15.209; RSS-Gen [8.9]

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 7 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-11 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-11. Radiated Limits

Test Procedures Used

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

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. VBW = 300kHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagrams below.

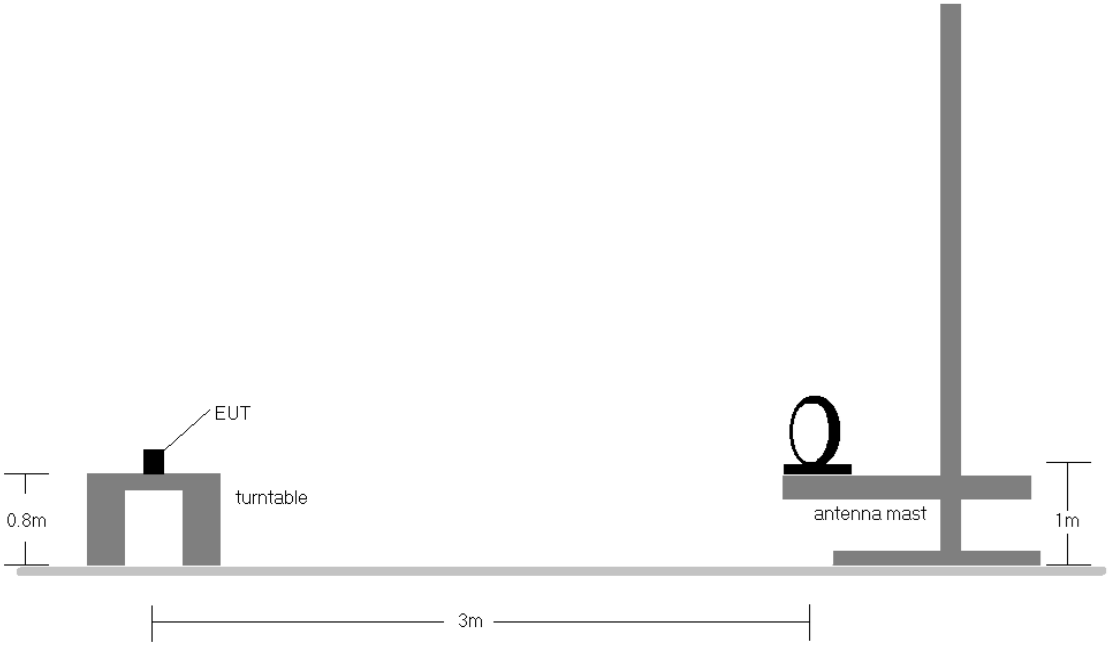

Figure 7-8. Radiated Test Setup < 30MHz

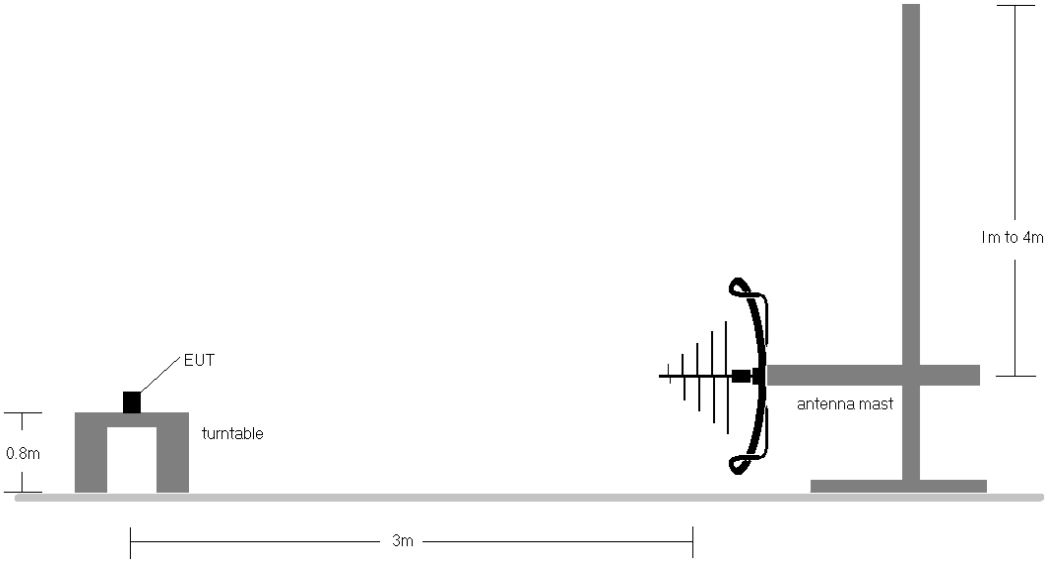

Figure 7-9. Radiated Test Setup < 1GHz

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Test Notes

1. All emissions lying in restricted bands specified in §15.205 and RSS-Gen (8.10) are below the limit shown in Table 7-11.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes. For below 30MHz the loop antenna was positioned in 3 orthogonal planes (X front, Y side, Z top) to determine the orientation resulting in the worst case emissions.
3. This unit was tested with its standard battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector on emissions that were within 6dB of the limit.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
9. All supported modulation have been tested on the unit and only worst case configuration is reported.
10. Both configurations below were investigated, and the worst case has been reported.
    a. EUT powered by AC/DC adaptor via USB-C cable with wire charger

Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$ – Preamplifier Gain $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

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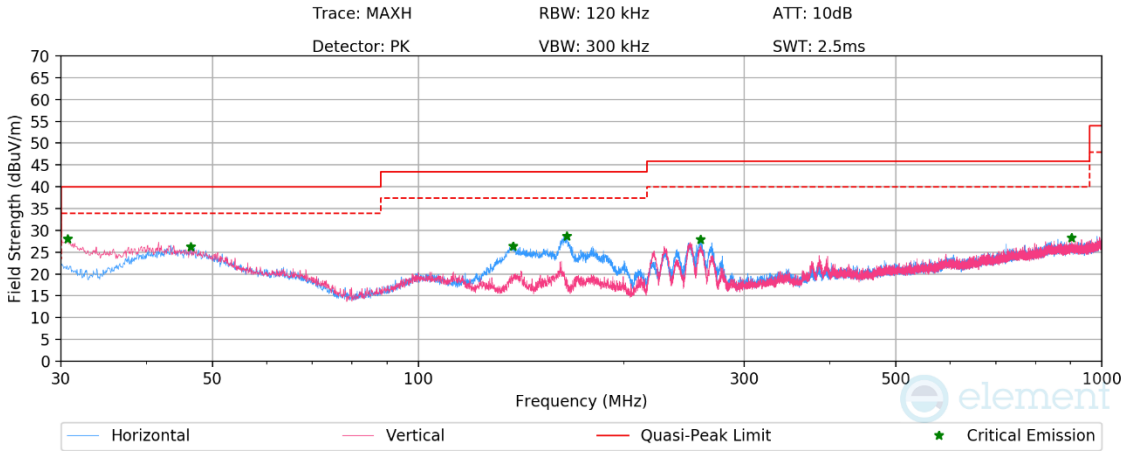
7.9.1 Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209; RSS-Gen [8.9]



Plot 7-47. Radiated Spurious Emissions Below 1GHz (1Mbps – Ch.17, Pol. H & V, with AC/DC Adapter)

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
30.66	Max-Peak	V	100	304	-59.64	-19.30	28.07	40.00	-11.93
46.44	Max-Peak	V	200	20	-65.54	-15.15	26.31	40.00	-13.69
137.64	Max-Peak	H	200	310	-59.34	-21.27	26.40	43.50	-17.10
164.95	Max-Peak	H	100	155	-58.03	-20.24	28.73	43.50	-14.77
258.73	Max-Peak	H	100	290	-62.91	-16.19	27.90	46.00	-18.10
904.06	Max-Peak	V	100	327	-74.37	-4.32	28.31	46.00	-17.69

Table 7-12. Radiated Spurious Emissions Below 1GHz (1Mbps – Ch.17, Pol. H & V, with AC/DC Adapter)

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7.10 AC Line-Conducted Emissions

§15.207; RSS-Gen [8.8]

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for AC Line conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below, per Section 15.207 and RSS-Gen (8.8).

Frequency of emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Table 7-13. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024, Subclause 6.2

Test Settings

Quasi-Peak Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

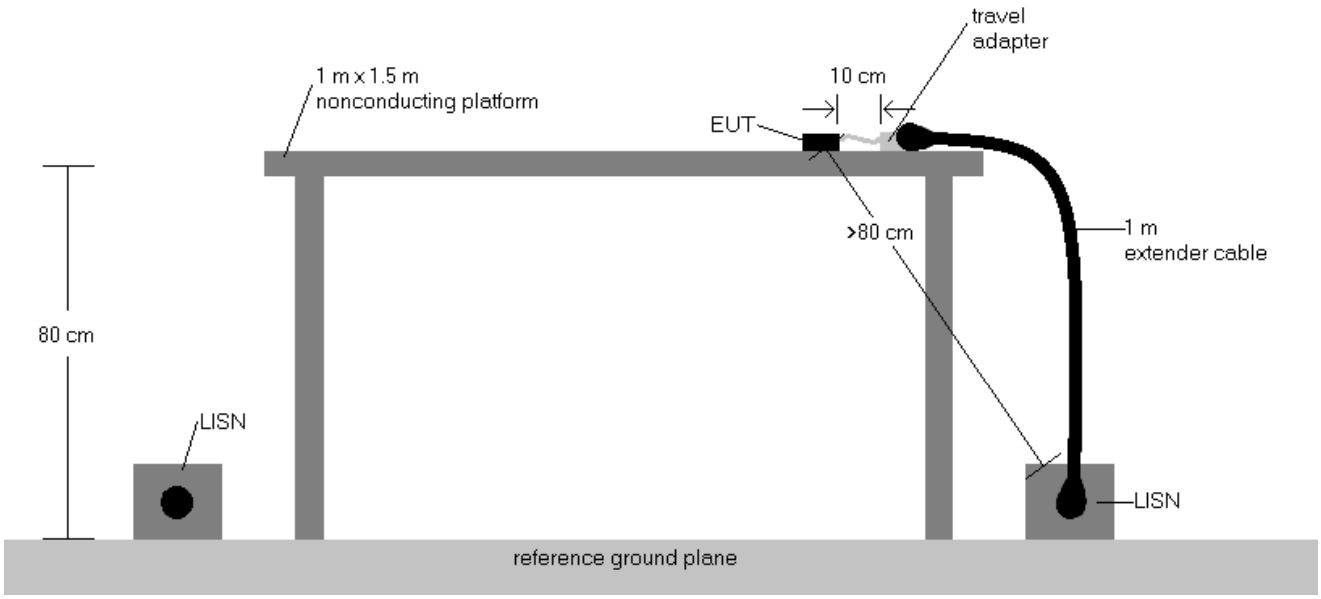

Figure 7-10. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported. The emissions found were not affected by the choice of channel used during testing.
2. Both configurations below were investigated, and the worst case has been reported.
    a. EUT powered by AC/DC adaptor via USB-C cable with wire charger
3. The limit for an intentional radiator from 150kHz to 30MHz are specified in Part 15.207 and RSS-Gen (8.8).
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBμV) = QP/AV Analyzer/Receiver Level (dBμV) + Correction Factor (dB)
6. Margin (dB) = QP/AV Level (dBμV) - QP/AV Limit (dBμV)
7. Traces shown in plot are made using a quasi peak and average detectors.
8. Deviations to the Specifications: None.

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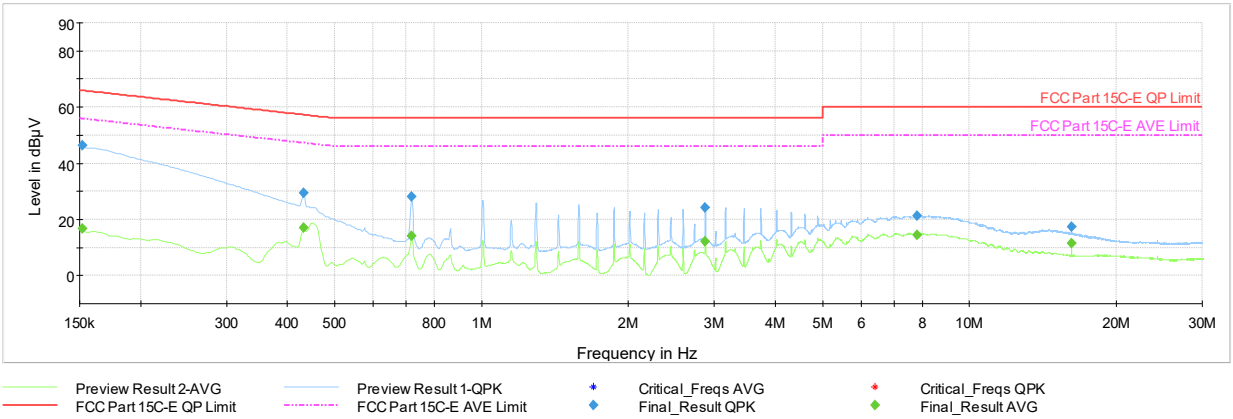

Plot 7-48. AC Line Conducted Plot with Bluetooth LE (L1, 1Mbps– Ch.19 with AC/DC Adapter)

Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.152	FINAL	---	16.62	55.88	-39.26	L1	GND
0.152	FINAL	46.33	---	65.88	-19.55	L1	GND
0.431	FINAL	---	16.93	47.23	-30.30	L1	GND
0.431	FINAL	29.36	---	57.23	-27.87	L1	GND
0.719	FINAL	---	14.18	46.00	-31.82	L1	GND
0.719	FINAL	27.97	---	56.00	-28.03	L1	GND
2.875	FINAL	24.07	---	56.00	-31.93	L1	GND
2.875	FINAL	---	12.11	46.00	-33.89	L1	GND
7.816	FINAL	21.16	---	60.00	-38.84	L1	GND
7.816	FINAL	---	14.57	50.00	-35.43	L1	GND
16.172	FINAL	---	11.57	50.00	-38.43	L1	GND
16.172	FINAL	17.29	---	60.00	-42.71	L1	GND

Table 7-14. AC Line Conducted Data with Bluetooth LE (L1, 1Mbps– Ch.19 with AC/DC Adapter)

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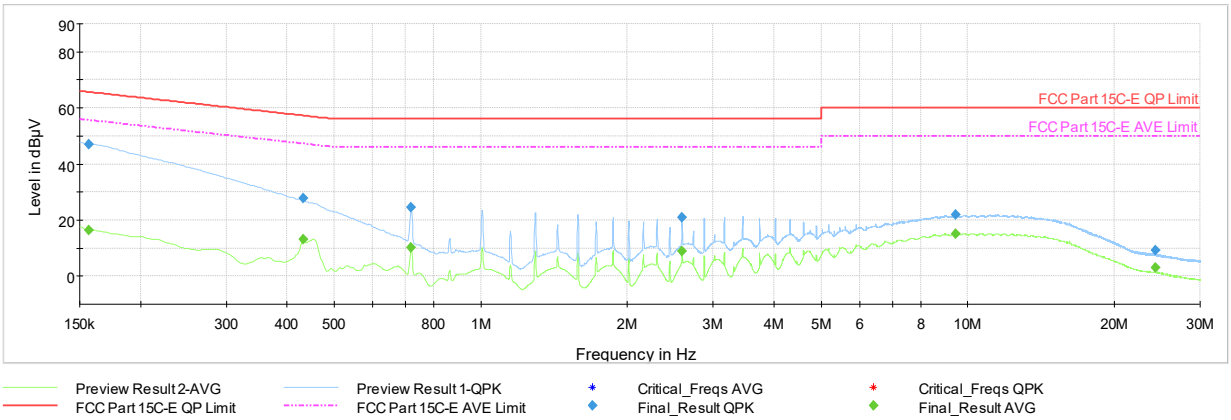

Plot 7-49. AC Line Conducted Plot with Bluetooth LE (N, 1Mbps– Ch.19, with AC/DC Adapter)

Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.157	FINAL	---	16.39	55.63	-39.24	N	GND
0.157	FINAL	46.89	---	65.63	-18.74	N	GND
0.431	FINAL	---	13.27	47.23	-33.96	N	GND
0.431	FINAL	27.90	---	57.23	-29.33	N	GND
0.719	FINAL	---	10.33	46.00	-35.67	N	GND
0.719	FINAL	24.61	---	56.00	-31.39	N	GND
2.589	FINAL	20.83	---	56.00	-35.17	N	GND
2.589	FINAL	---	8.83	46.00	-37.17	N	GND
9.445	FINAL	21.81	---	60.00	-38.19	N	GND
9.445	FINAL	---	15.04	50.00	-34.96	N	GND
24.270	FINAL	---	3.01	50.00	-46.99	N	GND
24.270	FINAL	9.13	---	60.00	-50.87	N	GND

Table 7-15. AC Line Conducted Data with Bluetooth LE (N, 1Mbps– Ch.19 with AC/DC Adapter)

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8 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Garmin International Inc. Portable Digital Transceiver FCC ID: IPH-A5231 and IC: 1792A-A5231** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules and RSS-247 of the Innovation, Science and Economic Development Canada Rules.

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