Certificate #4312.01

TEST REPORT

Product Name:	Wireless Speaker
Trade Mark:	PHILIPS or
Model No. /HVIN:	TAS2000
Add. Model No.:	TAS2000B/00, TAS2000W/00, TAS2000B/37, TAS2000W/37, TAS2000B/61, TAS2000W/61, TAS2000B/10, TAS2000W/10, TAS2000B/12, TAS2000W/12, TAS2000x/yy(x=A-Z or Nil ,for the production or package color, yy-00-99 or Nil ,for the country code)
Report Number:	25103020558RFC-2
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-247 Issue 4 RSS-Gen Issue 5
FCC ID:	2AR2STAS2000
IC:	24589-TAS2000
Test Result:	PASS
Date of Issue:	December 3, 2025

Prepared for:

MMD Hong Kong Holding Limited
Units 1208-11, 12th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

Prepared by:

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UnionTrust Laboratories UnionTrust

Version

Version No.	Date	Description
V1.0	December 3, 2025	Original

CONTENTS

1. GENERAL INFORMATION 4
   1.1 CLIENT INFORMATION 4
   1.2 EUT INFORMATION 4
      1.2.1 GENERAL DESCRIPTION OF EUT 4
      1.2.2 DESCRIPTION OF ACCESSORIES 4
   1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD 4
   1.4 OTHER INFORMATION 5
   1.5 DESCRIPTION OF SUPPORT UNITS 5
   1.6 TEST LOCATION 5
   1.7 TEST FACILITY 5
   1.8 DEVIATION FROM STANDARDS 6
   1.9 ABNORMALITIES FROM STANDARD CONDITIONS 6
   1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER 6
   1.11 MEASUREMENT UNCERTAINTY 6
2. TEST SUMMARY 7
3. EQUIPMENT LIST 8
4. TEST CONFIGURATION 9
   4.1 ENVIRONMENTAL CONDITIONS FOR TESTING 9
      4.1.1 NORMAL OR EXTREME TEST CONDITIONS 9
      4.1.2 RECORD OF NORMAL ENVIRONMENT AND TEST SAMPLE 9
   4.2 TEST CHANNELS 9
   4.3 EUT TEST STATUS 9
   4.4 TEST SETUP 10
      4.4.1 FOR RADIATED EMISSIONS TEST SETUP 10
      4.4.2 FOR CONDUCTED EMISSIONS TEST SETUP 11
      4.4.3 FOR CONDUCTED RF TEST SETUP 12
   4.5 SYSTEM TEST CONFIGURATION 12
   4.6 DUTY CYCLE 13
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION 14
   5.1 REFERENCE DOCUMENTS FOR TESTING 14
   5.2 ANTENNA REQUIREMENT 14
   5.3 CONDUCTED OUTPUT POWER AND E.I.R.P. 15
   5.4 6 DB BANDWIDTH & OCCUPIED BANDWIDTH 16
   5.5 POWER SPECTRAL DENSITY 17
   5.6 CONDUCTED OUT OF BAND EMISSION 18
   5.7 RADIATED SPURIOUS EMISSIONS 19
   5.8 BAND EDGE MEASUREMENTS (RADIATED) 23
   5.9 CONDUCTED EMISSION 26

APPENDIX A RF TEST DATA 29
   A.1 MAXIMUM CONDUCTED OUTPUT POWER AND E.I.R.P 29
   A.2 6DB BANDWIDTH 31
   A.3 OCCUPIED CHANNEL BANDWIDTH 33
   A.4 MAXIMUM POWER SPECTRAL DENSITY 35
   A.5 BAND EDGE MEASUREMENTS 37
   A.6 CONDUCTED SPURIOUS EMISSION 38

APPENDIX 1 PHOTOS OF TEST SETUP 43
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS 43

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	MMD Hong Kong Holding Limited
Address of Applicant:	Units 1208-11, 12th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong
Manufacturer:	MMD Hong Kong Holding Limited
Address of Manufacturer:	Units 1208-11, 12th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Wireless Speaker	
Model No./ HVIN:	TAS2000	
Add. Model No.:	TAS2000B/00, TAS2000W/00, TAS2000B/37, TAS2000W/37, TAS2000B/61, TAS2000W/61, TAS2000B/10, TAS2000W/10, TAS2000B/12, TAS2000W/12, TAS2000x/yy(x=A-Z or Nil ,for the production or package color, yy-00-99 or Nil ,for the country code)	
Trade Mark:	PHILIPS or	
DUT Stage:	Identical Prototype	
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	Bluetooth V5.4
Sample Received Date:	October 29, 2025	
Sample Tested Date:	October 30, 2025 to November 8, 2025	

Note:
1. The additional model TAS2000B/00, TAS2000W/00, TAS2000B/37, TAS2000W/37, TAS2000B/61, TAS2000W/61, TAS2000B/10, TAS2000W/10, TAS2000B/12, TAS2000W/12, TAS2000x/yy(x=A-Z or Nil ,for the production or package color, yy-00-99 or Nil ,for the country code) is identical with the test model TAS2000 except the product color and model number for marketing purpose.
2. The ISED certification is only for the main model.

Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.

1.2.2 Description of Accessories

Refer to Report 25103020558EMC-1 for accessories.

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	2400 MHz to 2483.5 MHz
Frequency Range:	2402 MHz to 2480 MHz
Bluetooth Version:	Bluetooth LE
Type of Modulation:	GFSK
Number of Channels:	40
Channel Separation:	2 MHz
Antenna Type:	PCB Antenna
Antenna Gain: (Provided by the customer)	1.81 dBi
Maximum Peak Power:	1.52 dBm
Normal Test Voltage:	120 Vac

1.4 OTHER INFORMATION

Operation Frequency Each of Channel	
f = 2402 + 2k MHz, k = 0,…,39	
Note:	
f	is the operating frequency (MHz);
k	is the operating channel.

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	DELL	Latitude 3400	16238087894	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust
ADAPTER	BULL	GNV-AU1652	G88869421070025	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.1 Meter	Applicant

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6th, Baoneng Science and Technology Park, Longhua Street, Longhua District, Shenzhen, China
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.9 dB
5	Radiated emission 1GHz-18GHz	± 4.8 dB
6	Radiated emission 18GHz-26GHz	± 5.1 dB
7	Radiated emission 26GHz-40GHz	± 5.1 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.68 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	2.4 GHz: ± 6.5 x 10^{-8}
12	Transmission Time	± 0.19 %

2. TEST SUMMARY

Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (b)(4) RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 6.2	PASS
Conducted Output Power and E.I.R.P	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 4, Section 6.3.2	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.9.1.2	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 4, Section 6.3.1	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.8.1	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, Section 6.7	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 4, Section 6.3.1	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.10.2	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 4, Section 6.6	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-Gen Issue 5, Section 6.13/8.9/8.10	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.11 & Clause 11.12	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 Issue 4, Section 5.5	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.13	PASS
Disclaimer and Explanations: The declared of product specification and data (e.g. antenna gain, RF specification, etc) for EUT presented in the report are provided by the customer, and the customer takes all the responsibilities for the accuracy of product specification.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	3m SAC	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	11-Nov-2023	10-Nov-2026
☒	Receiver	R&S	ESIB26	100114	24-Oct-2025	23-Oct-2026
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	28-Mar-2025	27-Mar-2026
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	26-Oct-2025	25-Oct-2026
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	27-Mar-2025	28-Mar-2026
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	24-Oct-2025	23-Oct-2026
☒	Preamplifier	HP	8447F	2805A02960	24-Oct-2025	23-Oct-2026
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	24-Oct-2025	23-Oct-2026
☒	Pre-amplifier	ETS-Lindgren	00118384	00202652	24-Oct-2025	23-Oct-2026
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	29-Mar-2025	28-Mar-2026
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	28-Mar-2025	27-Mar-2026
☒	Band Reject Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G590	21-Feb-2025	20-Feb-2026
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	Receiver	R&S	ESCI3	1166.5950.03	24-Oct-2025	23-Oct-2026
☒	LISN	R&S	EVN216	3560.6550.12	26-Sep-2025	25-Sep-2026
☐	LISN	ETS-Lindgren	3816/2SH	00201088	24-Oct-2025	23-Oct-2026
☒	Test Software	EZ-EMC	EZ-CON	Software Version: EMC-CON 3A1.1		

Conducted RF test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	Spectrum Analyzer	KEYSIGHT	N9020A	MY51286807	24-Oct-2025	23-Oct-2026
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	24-Oct-2025	23-Oct-2026
☐	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	24-Oct-2025	23-Oct-2026

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	3.7	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
AC Power Line Conducted Emission	26.1	61.1	100.4	S202510297102-ZJA04/9	Fire Huo
Conducted Output Power and E.I.R.P	23.3	52.5	100.6	S202510297102-ZJA06/9	David Du
6dB Bandwidth & Occupied Bandwidth					
Power Spectral Density					
Conducted Out of Band Emission					
Radiated Spurious Emissions	25.2	50.1	100.5	S202510297102-ZJA05/9	Leo Li
Band Edge Measurements (Radiated)					

4.2 TEST CHANNELS

Type of Modulation	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
GFSK	2402 MHz to 2480 MHz	Channel 0	Channel 19	Channel 39
		2402 MHz	2440 MHz	2480 MHz

4.3 EUT TEST STATUS

Type of Modulation	Tx Function	Description
GFSK	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

Power Setting(Provided by the customer)
Power Setting: 4

Test Software(Provided by the customer)
Test software name: BT_tool, 1.1.4

4.4 TEST SETUP

4.4.1 For Radiated Emissions test setup

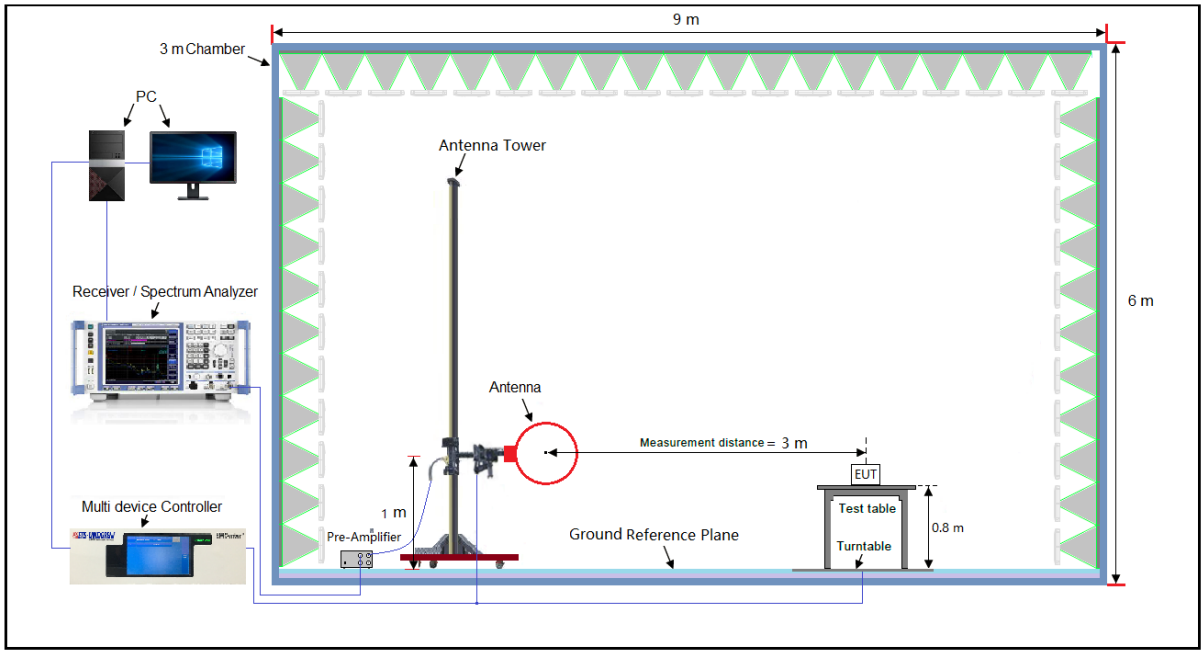


Figure 1. Below 30MHz

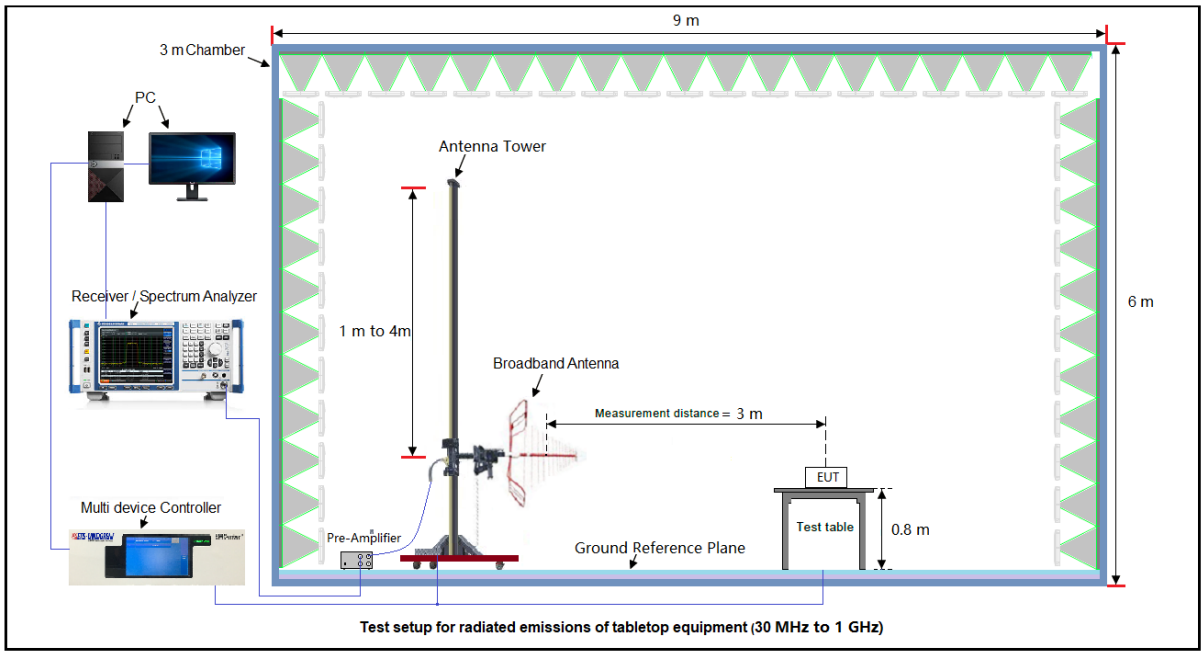


Figure 2. 30MHz to 1GHz

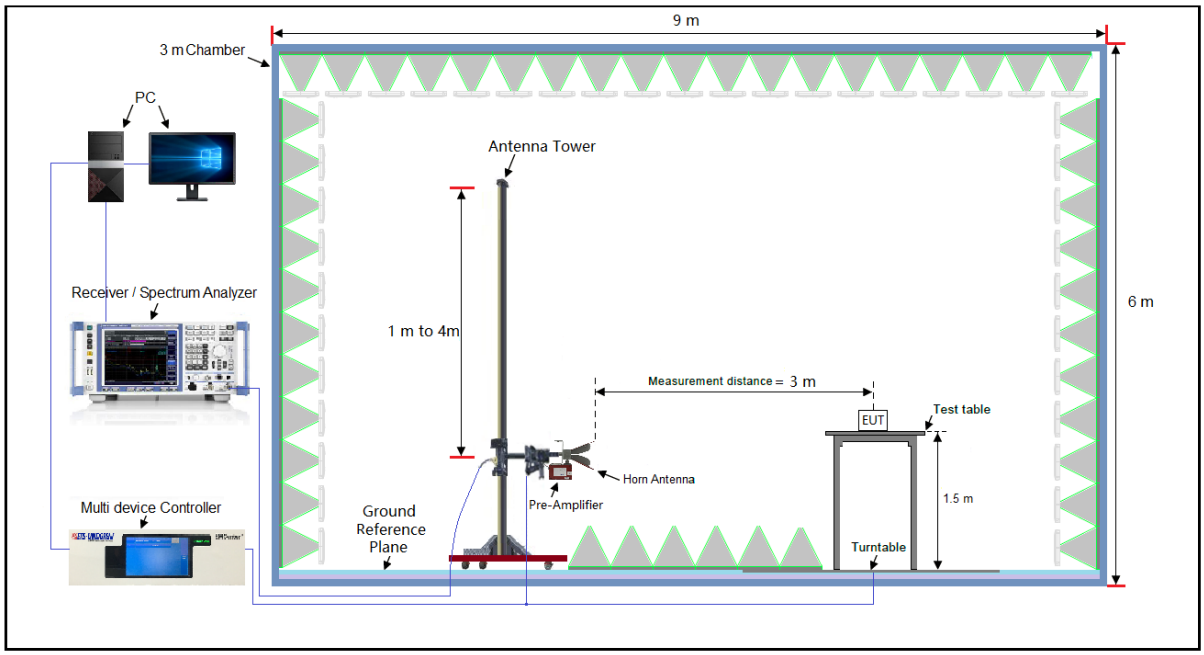
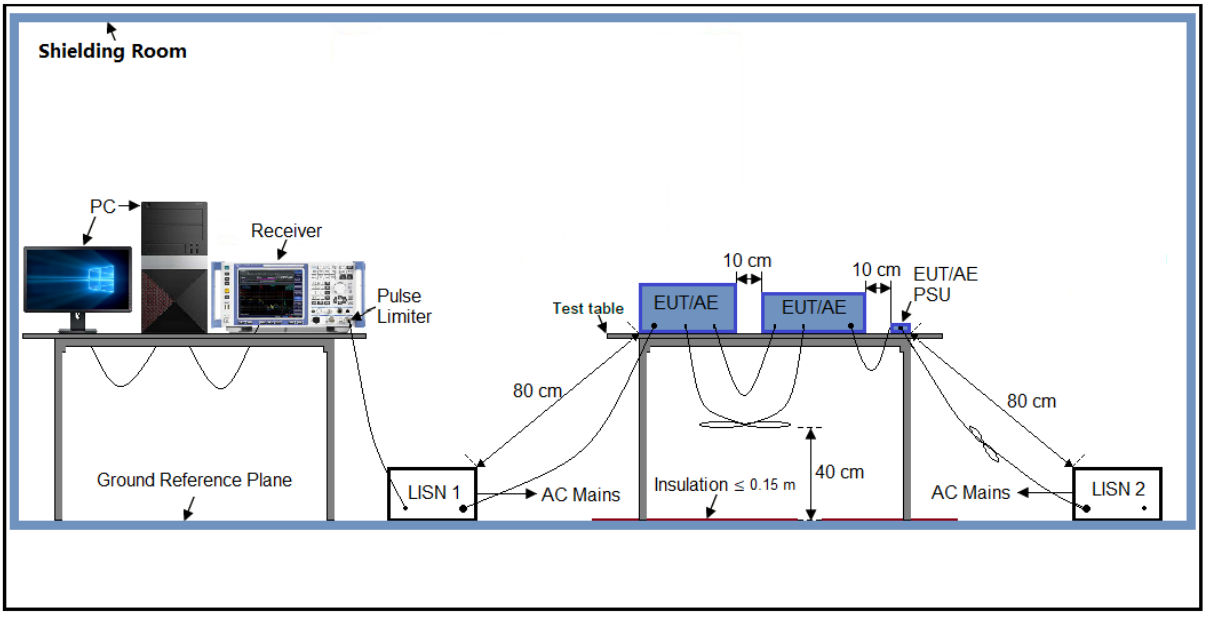
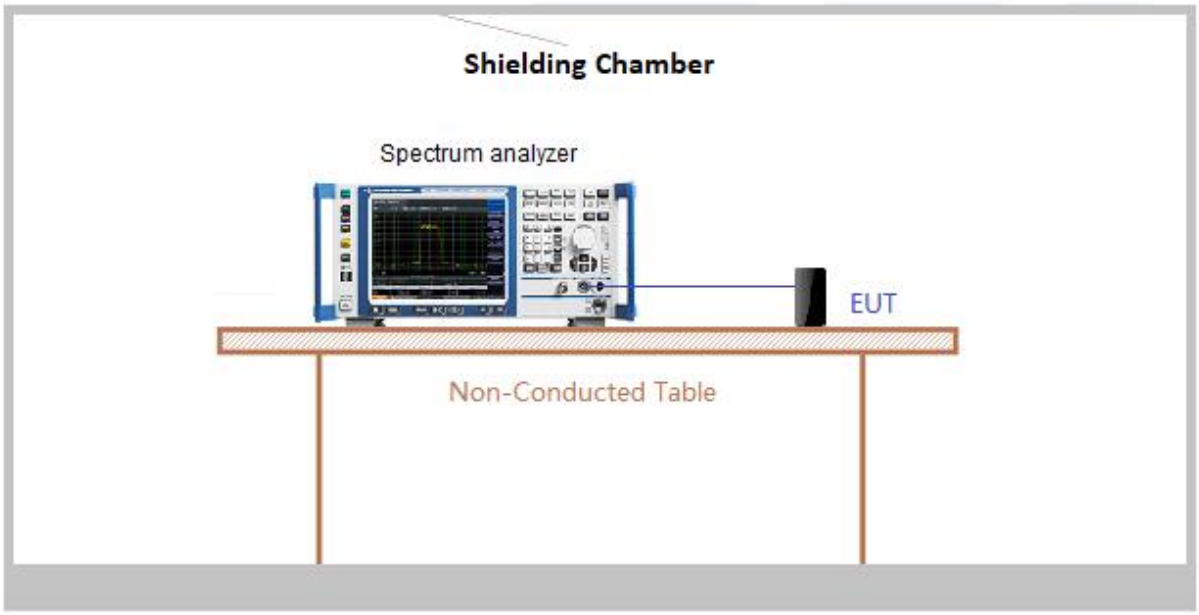


Figure 3. Above 1GHz

4.4.2 For Conducted Emissions test setup



4.4.3 For Conducted RF test setup



4.5 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

Frequency	Mode	Antenna Port	Worst-case axis positioning
Above 1GHz	1TX	Chain 0	Z axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.6 DUTY CYCLE

Test Procedure: ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.6.

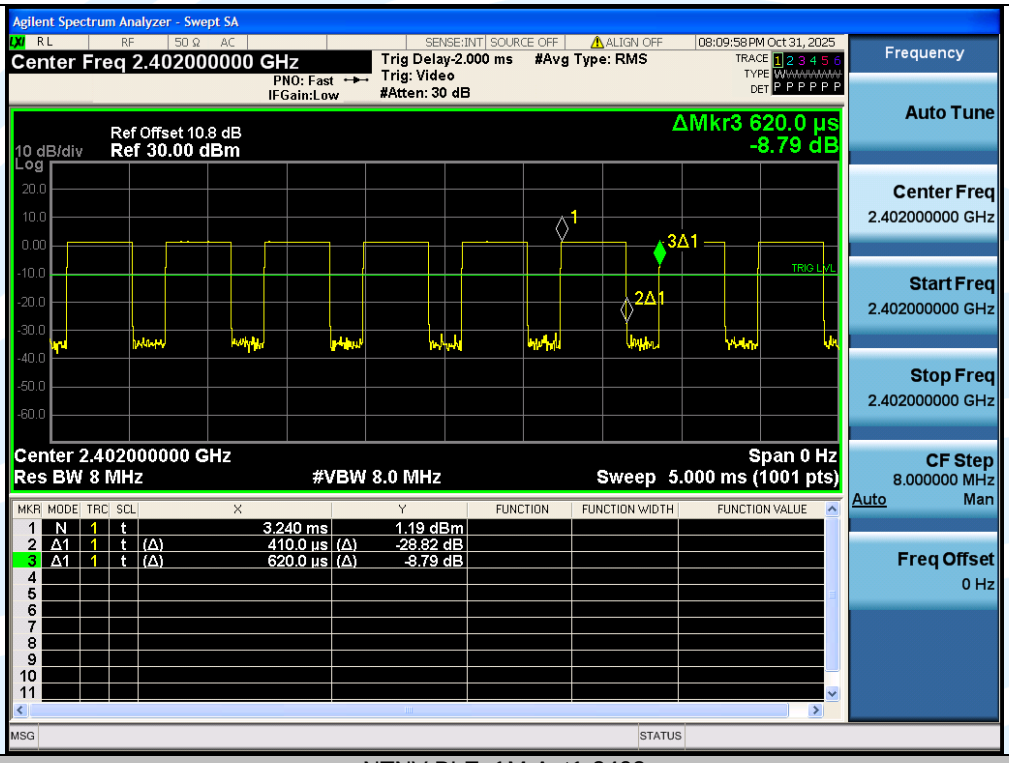
Test Results

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor [dB]
BLE_1M	Ant1	2402	0.41	0.62	66.13	1.80

Remark:

1) Duty cycle= On Time/ Period;
2) Duty Cycle factor = 10 * log(1/ Duty cycle);
3) Average factor = 20 $\log_{10}$ Duty Cycle.

The test plot as follows



NTNV-BLE_1M-Ant1-2402

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	RSS-247 Issue 4	Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands
4	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
5	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024	American National Standard for Testing Unlicesed Wireless Devices
6	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum system, and Hybrid system devices operating under Section 15.247 of the FCC rules

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(b) (4) requirement:** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. **RSS-Gen Issue 5, Section 6.8 requirement:** According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
EUT Antenna:
Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 1.81 dBi.

5.3 CONDUCTED OUTPUT POWER AND E.I.R.P

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section15.247 (b)(3) RSS-247 Issue 4, Section 6.3.2
Test Method:	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.9.1.3
Limit:	For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W.
Test Procedure:	1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter. 2. Measure out each test modes' peak or average output power, record the power level. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.3 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	**Please refer to Appendix A**

Note:

1. The antenna gain of 1.81 dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.
2. The maximum EIRP is calculated from max output power and antenna gain, the antenna gain provided by the customer, and the customer takes all the responsibilities for the accuracy of antenna gain.

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 4, Section 6.3.1 RSS-Gen Issue 5, Section 6.7
Test Method:	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.8.1 RSS-Gen Issue 5, Section 6.7
Limit:	For digital transmission systems, the minimum 6 dB bandwidth shall be 500 kHz.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: **6dB Bandwidth** a) Set RBW = 100 kHz. b) Set the video bandwidth (VBW) ≥ 3 x 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. **Occupied Bandwidth** a) Set RBW = 1% to 5% of the occupied bandwidth b) Set the video bandwidth (VBW) ≥ 3 x RBW. c) Detector = Peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.3 for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	**Please refer to Appendix A**

5.5 POWER SPECTRAL DENSITY

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 4, Section 6.3.1
Test Method:	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.10.2
Limit:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: a) Set analyzer center frequency to DTS channel center frequency. b) Set the span to 1.5 times the DTS bandwidth. c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. d) Set the VBW ≥ 3 x RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum amplitude level within the RBW. j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.3 for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	**Please refer to Appendix A**

5.6 CONDUCTED OUT OF BAND EMISSION

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 6.6
Test Method:	ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.11
Limit:	In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: **Step 1: Reference level measurement** a) Set instrument center frequency to DTS channel center frequency. b) Set the span to ≥ 1.5 times the DTS bandwidth. c) Set the RBW = 100 kHz. d) Set the VBW ≥ 3 x RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. Note that the channel found to contain the maximum PSD level can be used to establish the reference level. **Step 2: Emission level measurement** a) Set RBW = 100 kHz. b) Set VBW ≥ 300 kHz. c) Detector = peak. d) Sweep = auto couple. e) Trace Mode = max hold. f) Allow trace to fully stabilize. g) Use the peak marker function to determine the maximum amplitude level. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.3 for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	**Please refer to Appendix A**

5.7 RADIATED SPURIOUS EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209
RSS-Gen Issue 5, Section 6.13/8.9/8.10

Test Method: ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.11 & Clause 11.12

Receiver Setup:

Frequency	RBW
0.009 MHz-0.150 MHz	200/300 kHz
0.150 MHz -30 MHz	9/10 kHz
30 MHz-1 GHz	100/120 kHz
Above 1 GHz	1 MHz

Limits:

Spurious Emissions

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009 MHz-0.490 MHz	2400/F(kHz)	--	--	300
0.490 MHz-1.705 MHz	24000/F(kHz)	--	--	30
1.705 MHz-30 MHz	30	--	--	30
30 MHz-88 MHz	100	40.0	Quasi-peak	3
88 MHz-216 MHz	150	43.5	Quasi-peak	3
216 MHz-960 MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1 GHz	500	54.0	Average	3

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2. Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table

is 1.5 meter).

2) Test the EUT in the lowest channel ,middle channel, the Highest channel
3) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the Z axis positioning which it is worse case.
4) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

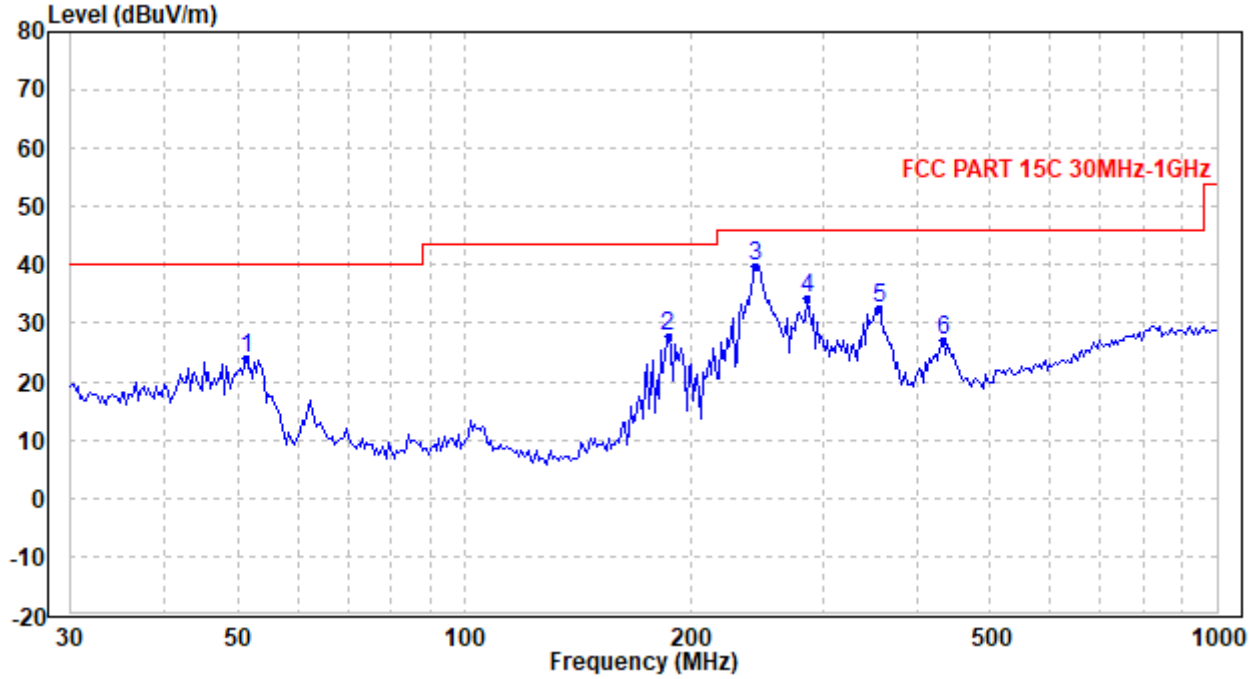
Test Result: Pass

The measurement data as follows:

Radiated Emission Test Data (9 KHz ~ 30 MHz):
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

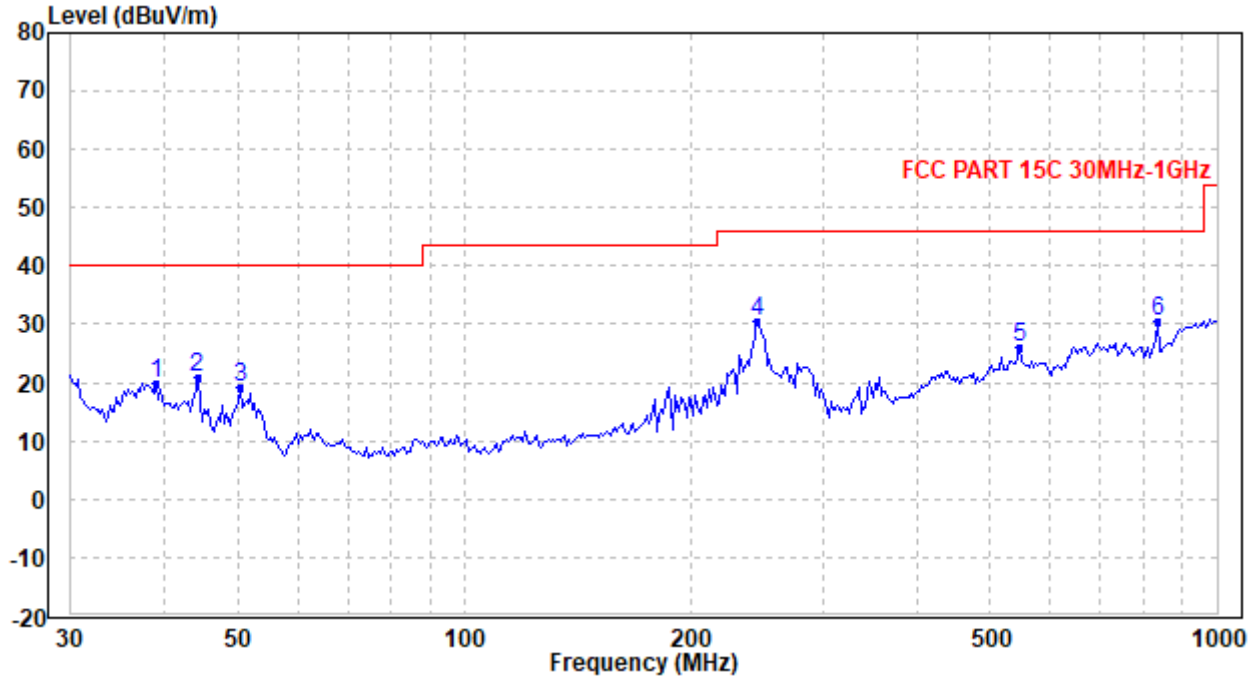
Radiated Emission Test Data (30 MHz ~ 1 GHz):
Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	51.176	37.83	-14.01	23.82	40.00	-16.18	QP
2	186.468	39.65	-11.91	27.74	43.50	-15.76	QP
3	243.543	50.46	-10.61	39.85	46.00	-6.15	QP
4	286.265	43.75	-9.42	34.33	46.00	-11.67	QP
5	355.940	39.01	-6.55	32.46	46.00	-13.54	QP
6	433.340	31.10	-3.90	27.20	46.00	-18.80	QP

Vertical



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	38.908	27.82	-7.89	19.93	40.00	-20.07	QP
2	44.154	33.18	-12.43	20.75	40.00	-19.25	QP
3	50.461	32.87	-13.75	19.12	40.00	-20.88	QP
4	245.261	41.25	-10.62	30.63	46.00	-15.37	QP
5	546.437	27.70	-1.66	26.04	46.00	-19.96	QP
6	833.013	27.01	3.65	30.66	46.00	-15.34	QP

Radiated Emission Test Data (Above 1GHz):								
LE_ Lowest Channel:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	4804	38.65	-2.08	36.57	54.00	-17.43	Average	Horizontal
2	4804	60.93	-2.08	58.85	74.00	-15.15	Peak	Horizontal
3	7206	34.90	1.30	36.20	54.00	-17.80	Average	Horizontal
4	7206	48.26	1.30	49.56	74.00	-24.44	Peak	Horizontal
5	4804	37.12	-2.08	35.04	54.00	-18.96	Average	Vertical
6	4804	55.99	-2.08	53.91	74.00	-20.09	Peak	Vertical
7	7206	34.72	1.30	36.02	54.00	-17.98	Average	Vertical
8	7206	46.81	1.30	48.11	74.00	-25.89	Peak	Vertical
LE_ Middle Channel:								
1	4880	38.35	-2.05	36.30	54.00	-17.70	Average	Horizontal
2	4880	59.41	-2.05	57.36	74.00	-16.64	Peak	Horizontal
3	7320	33.16	1.31	34.47	54.00	-19.53	Average	Horizontal
4	7320	45.74	1.31	47.05	74.00	-26.95	Peak	Horizontal
5	4880	36.29	-2.05	34.24	54.00	-19.76	Average	Vertical
6	4880	56.54	-2.05	54.49	74.00	-19.51	Peak	Vertical
7	7320	32.46	1.31	33.77	54.00	-20.23	Average	Vertical
8	7320	44.30	1.31	45.61	74.00	-28.39	Peak	Vertical
LE_ Highest Channel:								
1	4960	38.15	-2.02	36.13	54.00	-17.87	Average	Horizontal
2	4960	58.26	-2.02	56.24	74.00	-17.76	Peak	Horizontal
3	7440	33.74	1.32	35.06	54.00	-18.94	Average	Horizontal
4	7440	46.93	1.32	48.25	74.00	-25.75	Peak	Horizontal
5	4960	36.23	-2.02	34.21	54.00	-19.79	Average	Vertical
6	4960	53.78	-2.02	51.76	74.00	-22.24	Peak	Vertical
7	7440	33.41	1.32	34.73	54.00	-19.27	Average	Vertical
8	7440	48.47	1.32	49.79	74.00	-24.21	Peak	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

5.8 BAND EDGE MEASUREMENTS (RADIATED)

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209
RSS-247 Issue 4, Section 6.6

Test Method: ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Clause 11.12

Limits:

Radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

Frequency	Limit (dBμV/m @3m)	Remark
30 MHz-88 MHz	40.0	Quasi-peak Value
88 MHz-216 MHz	43.5	Quasi-peak Value
216 MHz-960 MHz	46.0	Quasi-peak Value
960 MHz-1 GHz	54.0	Quasi-peak Value
Above 1 GHz	54.0	Average Value
	74.0	Peak Value

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

Radiated band edge measurements at 2390 MHz and 2483.5 MHz were made with the unit transmitting in the low end of the channel range and the high end closest to the restricted bands respectively. The emissions were made on the 966 Semi-Chamber. Use (resolution bandwidth (RBW) = 1 MHz, video bandwidth (VBW) = 3 MHz for peak levels and RBW = 1 MHz and VBW = 10 Hz or 1/T for average levels).

1. Use radiated spurious emission test procedure described in clause 5.10. The transmitter output (antenna port) was connected to the test receiver.
2. Set the PK and AV limit line.
3. Record the fundamental emission and emissions out of the band-edge.
4. Determine band-edge compliance as required.

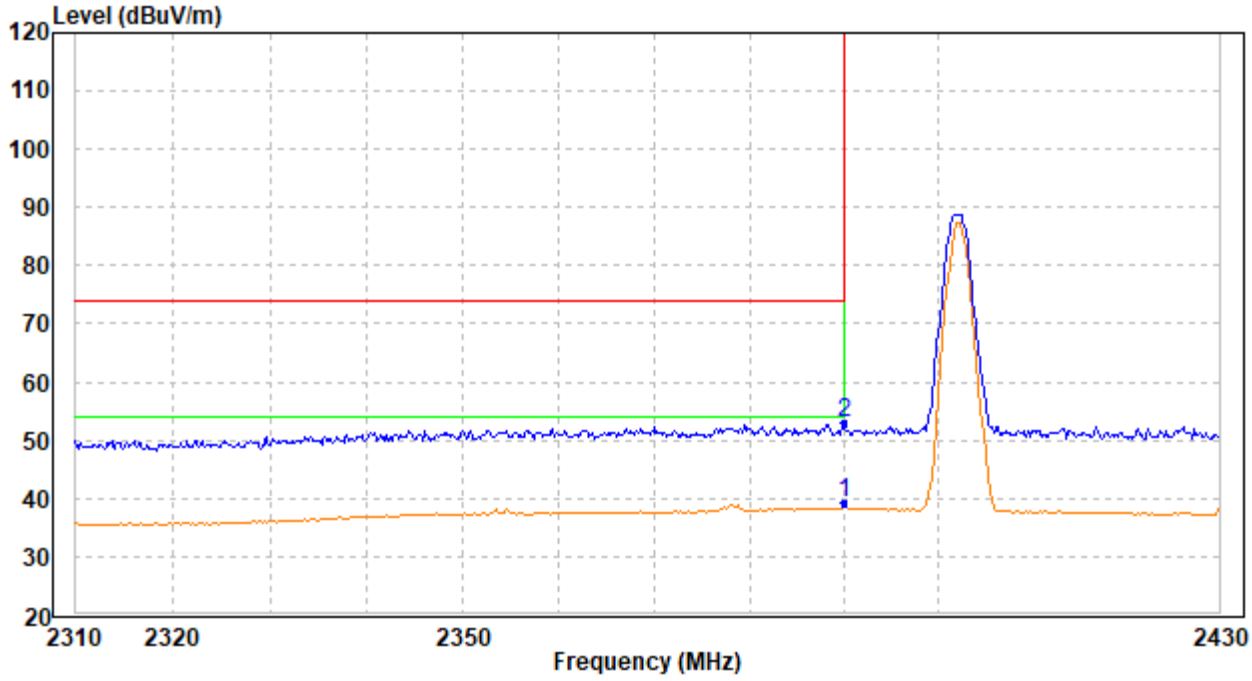
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

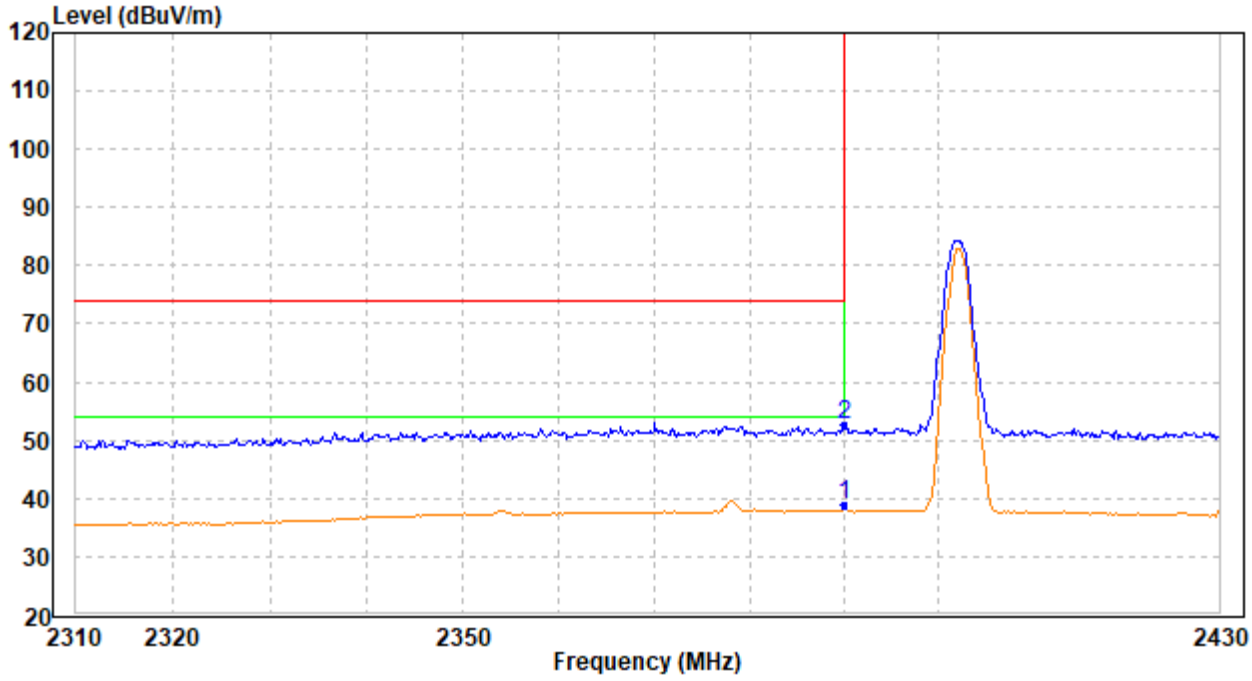
LE Mode:

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



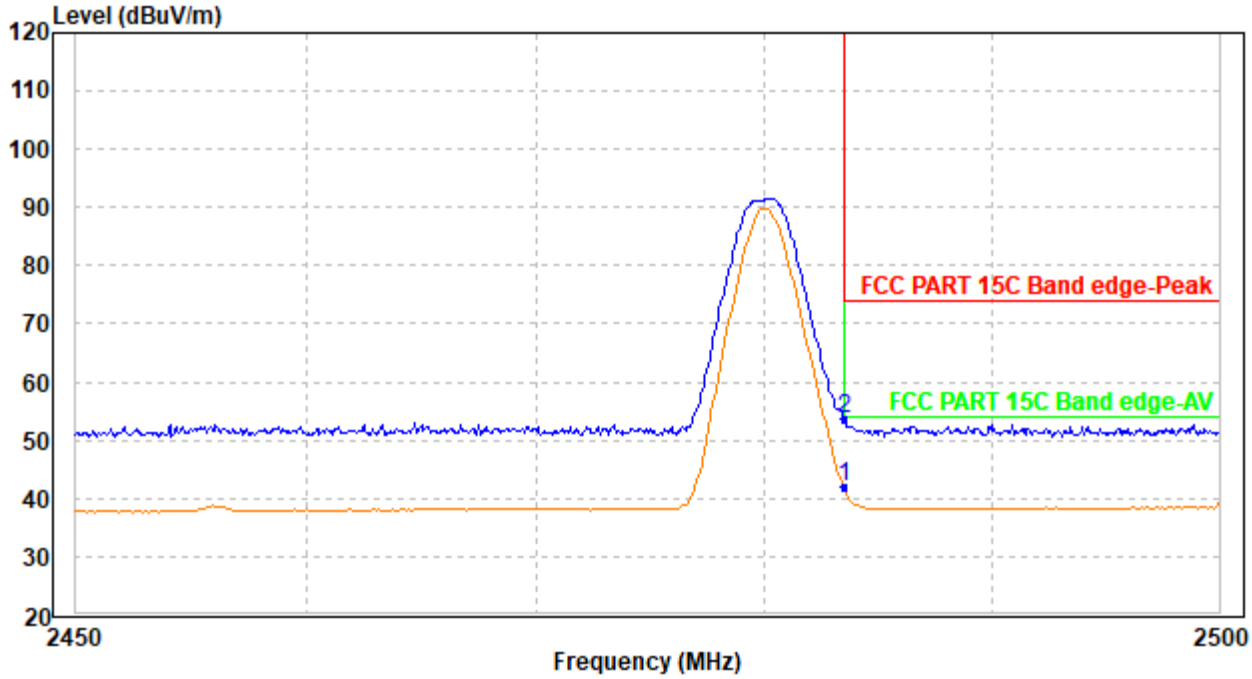
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	52.89	74.00	39.19	54.00	PASS

Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



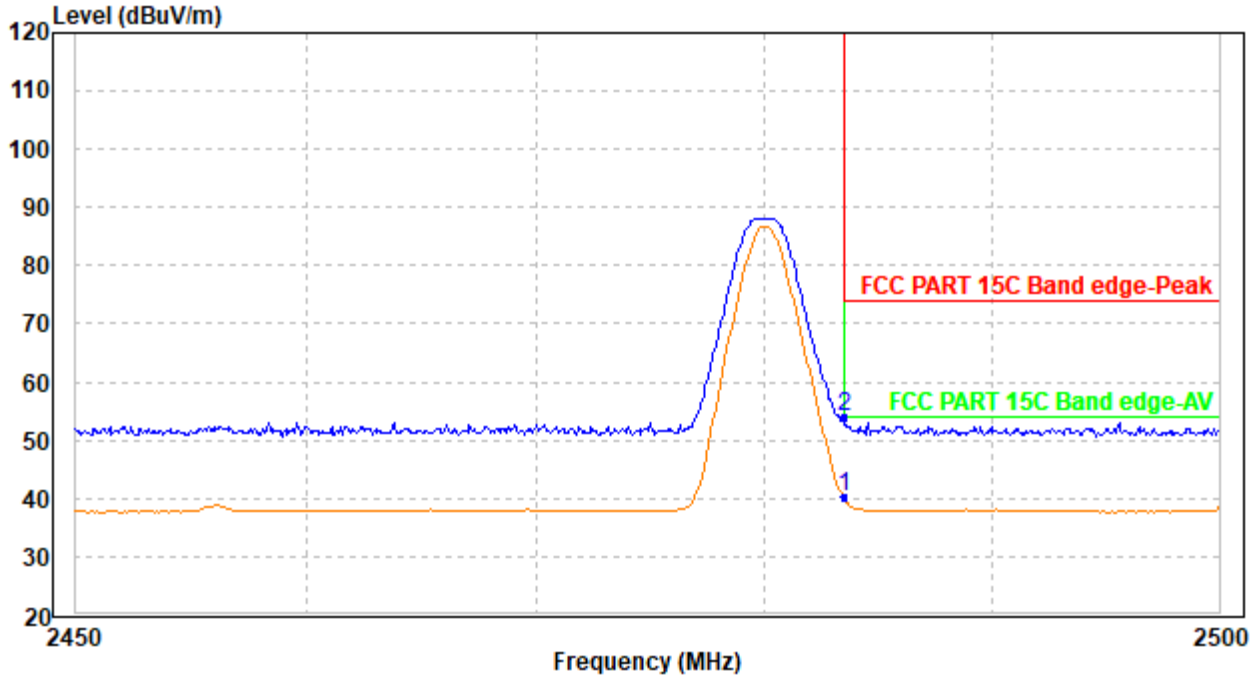
Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2390.000	52.70	74.00	38.89	54.00	PASS

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	53.65	74.00	41.86	54.00	PASS

Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBμV/m)	Peak Limit (dBμV/m)	AV level (dBμV/m)	AV Limit (dBμV/m)	Conclusion
2483.500	53.93	74.00	40.16	54.00	PASS

5.9 CONDUCTED EMISSION

Test Requirement: 47 CFR Part 15C Section 15.207
RSS-Gen Issue 5, Section 8.8

Test Method: ANSI C63.10-2020+COR. 1-2023+C63.10A-2024 + ERRATA TO C63.10A-2024 Section 6.2

Limits:

Frequency range (MHz)	Limits (dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.4.2 for details.

Test Procedures:

Test frequency range :150KHz-30MHz

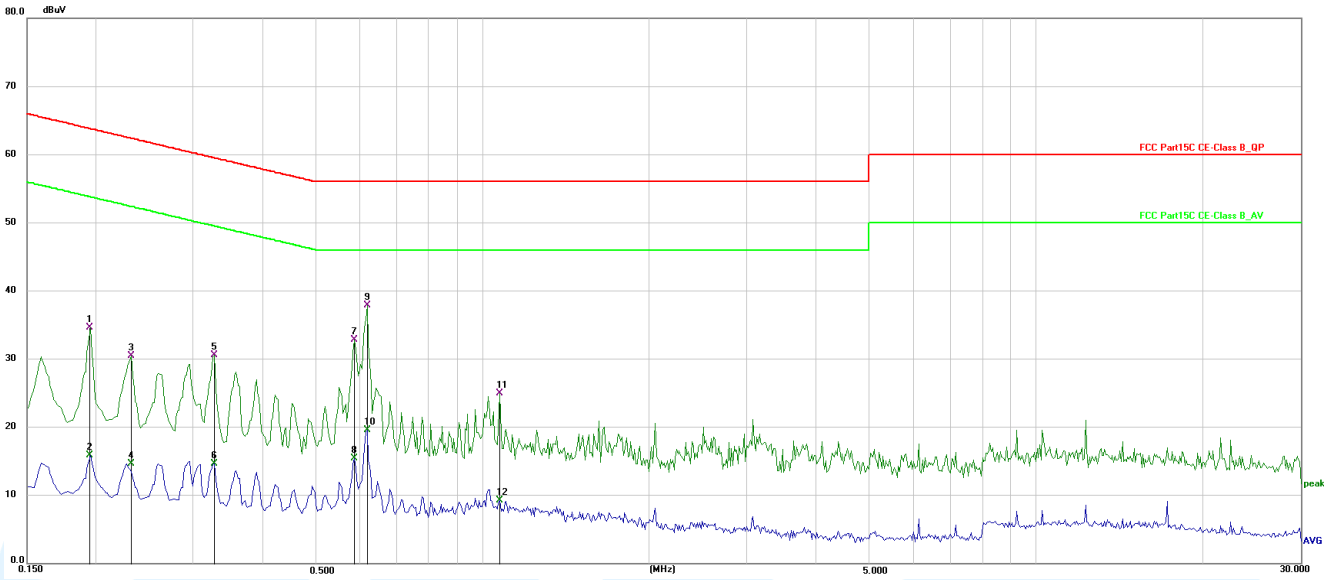
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

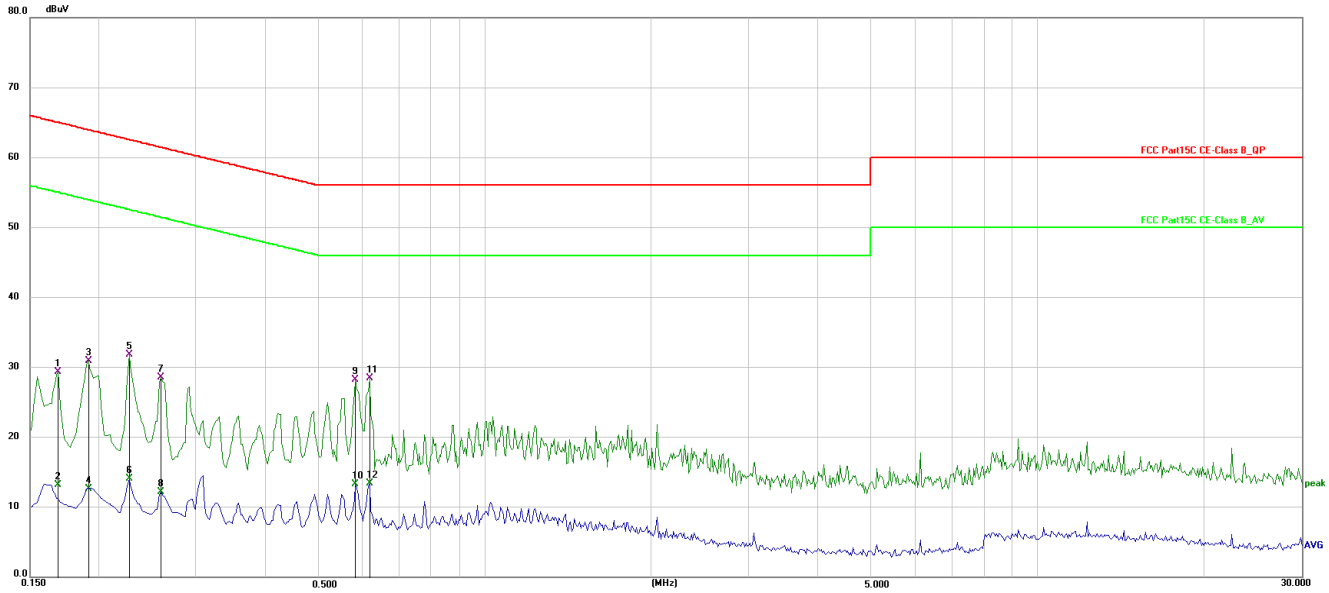
The worst measurement data as follows:
Quasi Peak and Average:
Mode: BT Link

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1949	24.78	9.80	34.58	63.83	-29.25	QP
2	0.1949	6.08	9.80	15.88	53.83	-37.95	AVG
3	0.2310	20.65	9.78	30.43	62.41	-31.98	QP
4	0.2310	4.82	9.78	14.60	52.41	-37.81	AVG
5	0.3255	20.88	9.75	30.63	59.57	-28.94	QP
6	0.3255	4.88	9.75	14.63	49.57	-34.94	AVG
7	0.5865	23.01	9.79	32.80	56.00	-23.20	QP
8	0.5865	5.61	9.79	15.40	46.00	-30.60	AVG
9	0.6180	28.08	9.79	37.87	56.00	-18.13	QP
10	0.6180	9.83	9.79	19.62	46.00	-26.38	AVG
11	1.0725	15.26	9.71	24.97	56.00	-31.03	QP
12	1.0725	-0.49	9.71	9.22	46.00	-36.78	AVG

Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1680	19.52	9.80	29.32	65.06	-35.74	QP
2	0.1680	3.33	9.80	13.13	55.06	-41.93	AVG
3	0.1905	21.15	9.77	30.92	64.01	-33.09	QP
4	0.1905	2.86	9.77	12.63	54.01	-41.38	AVG
5	0.2265	22.07	9.78	31.85	62.58	-30.73	QP
6	0.2265	4.26	9.78	14.04	52.58	-38.54	AVG
7	0.2580	18.78	9.79	28.57	61.50	-32.93	QP
8	0.2580	2.34	9.79	12.13	51.50	-39.37	AVG
9	0.5820	18.46	9.74	28.20	56.00	-27.80	QP
10	0.5820	3.54	9.74	13.28	46.00	-32.72	AVG
11	0.6180	18.68	9.74	28.42	56.00	-27.58	QP
12	0.6180	3.70	9.74	13.44	46.00	-32.56	AVG

Remark:

1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result - Limit
4. An initial pre-scan was performed on the Phase and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

APPENDIX A RF TEST DATA

A.1 MAXIMUM CONDUCTED OUTPUT POWER AND E.I.R.P

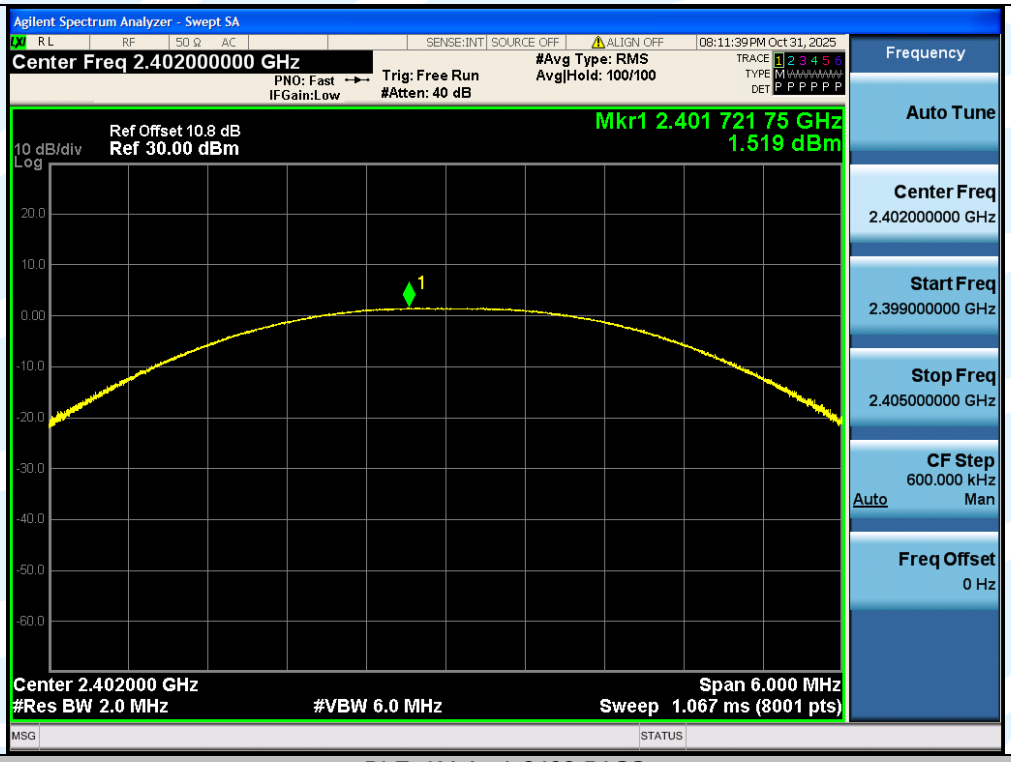
Test Result Peak.

Test Mode	Antenna	Frequency [MHz]	Conducted Peak Powert [dBm]	Conducted Limit [dBm]	Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Verdict
BLE_1M	Ant1	2402	1.52	≤30	1.81	3.33	≤36	PASS
BLE_1M	Ant1	2440	0.53	≤30	1.81	2.34	≤36	PASS
BLE_1M	Ant1	2480	-0.33	≤30	1.81	1.48	≤36	PASS

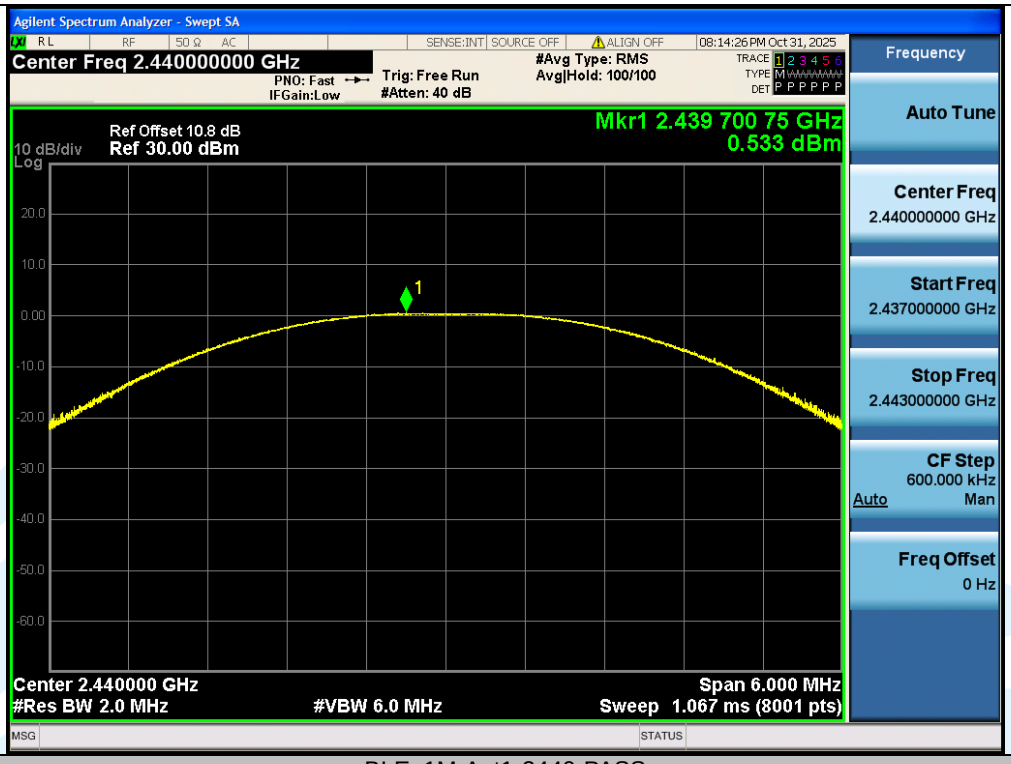
Test Result Average.

Test Mode	Ant	Freq [MHz]	Result [dBm]	Limit [dBm]	Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Verdict
BLE_1M	Ant1	2402	1.48	≤30.00	1.81	3.29	≤36.00	PASS
BLE_1M	Ant1	2440	0.31	≤30.00	1.81	2.12	≤36.00	PASS
BLE_1M	Ant1	2480	-0.72	≤30.00	1.81	1.09	≤36.00	PASS

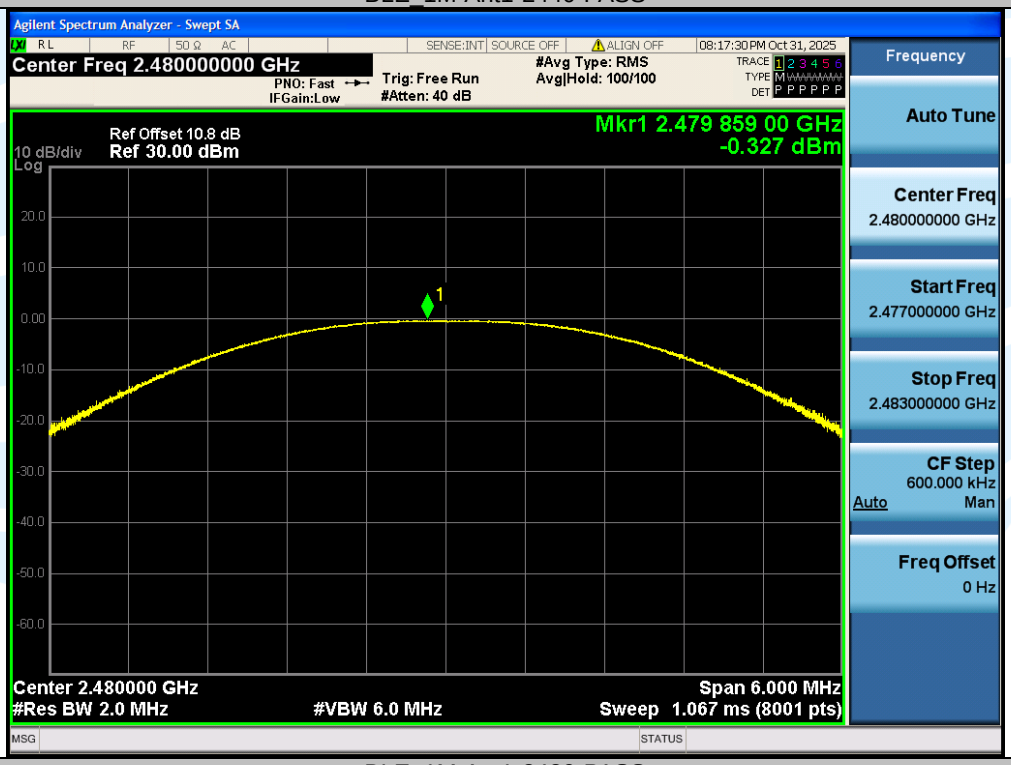
Test Graphs



BLE_1M-Ant1-2402-PASS



BLE_1M-Ant1-2440-PASS

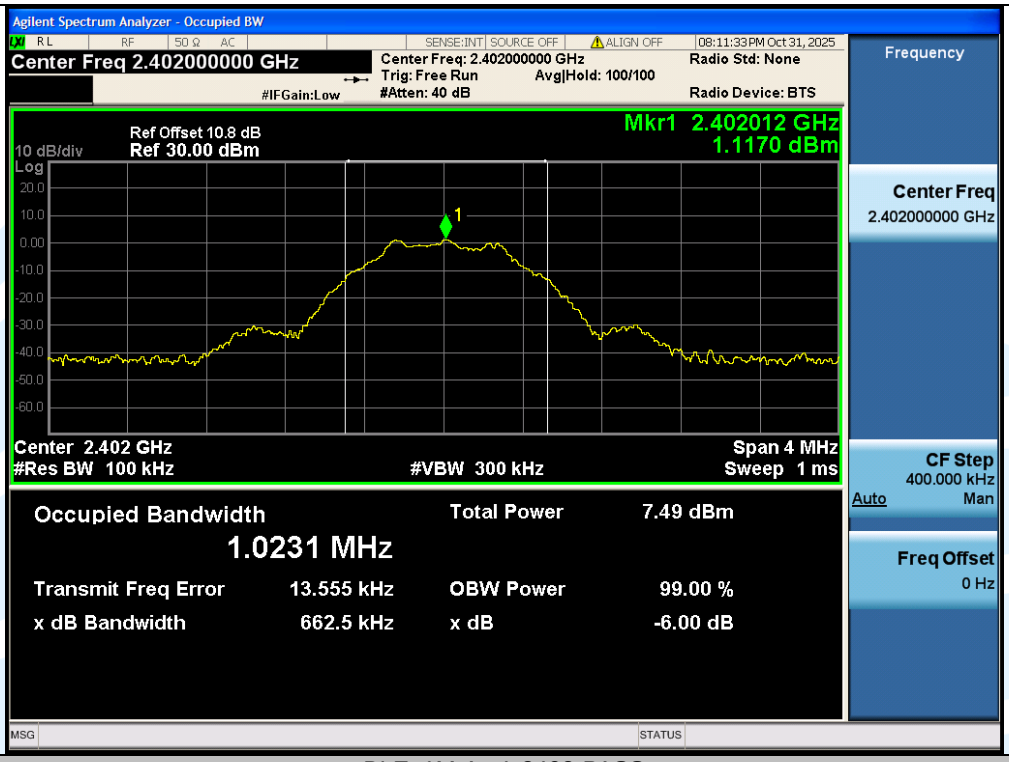


BLE_1M-Ant1-2480-PASS

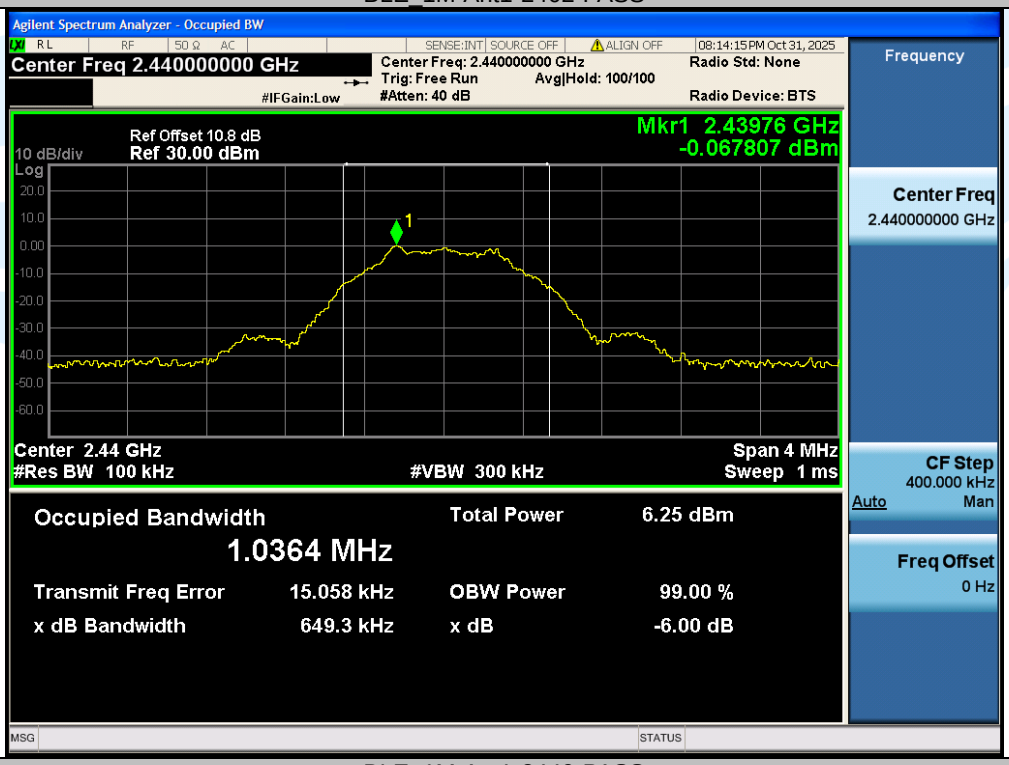
A.2 6DB BANDWIDTH

Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	Limit [MHz]	Verdict
BLE_1M	Ant1	2402	0.6625	0.5	PASS
BLE_1M	Ant1	2440	0.6493	0.5	PASS
BLE_1M	Ant1	2480	0.6467	0.5	PASS

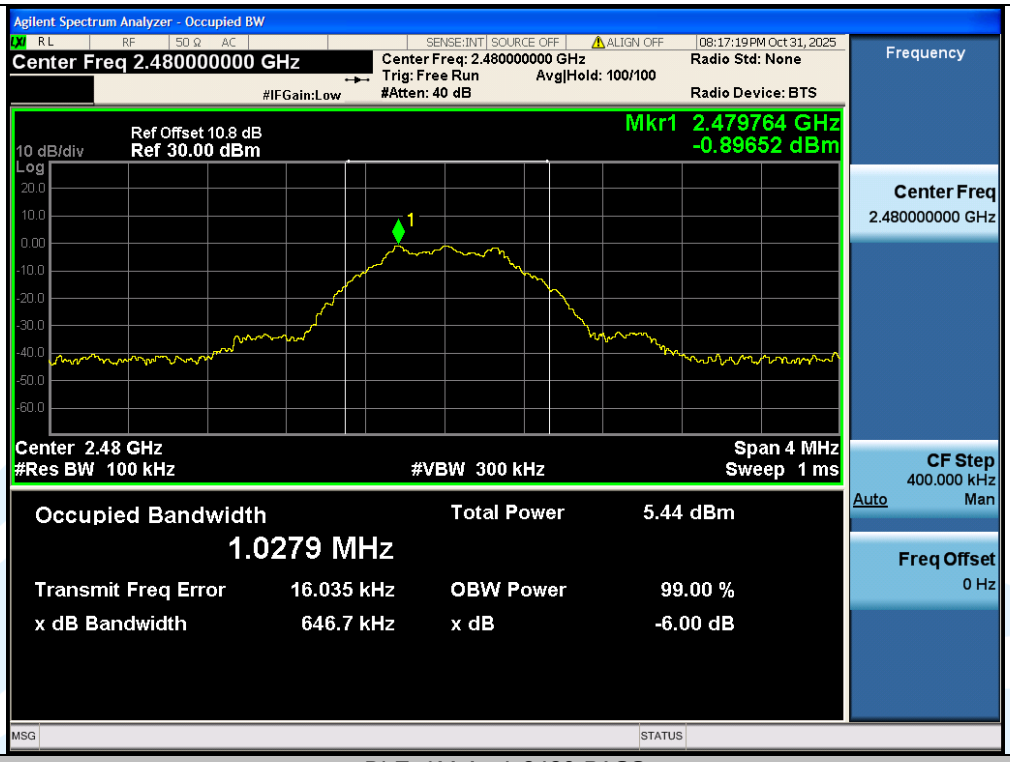
Test Graphs



BLE_1M-Ant1-2402-PASS



BLE_1M-Ant1-2440-PASS

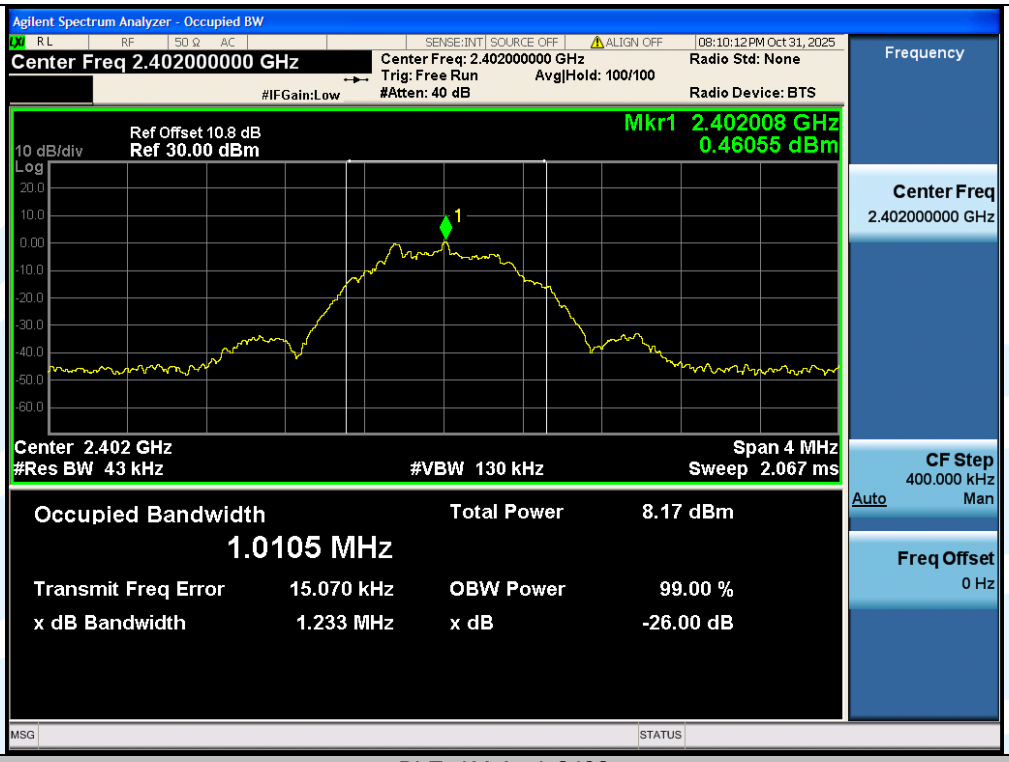


BLE_1M-Ant1-2480-PASS

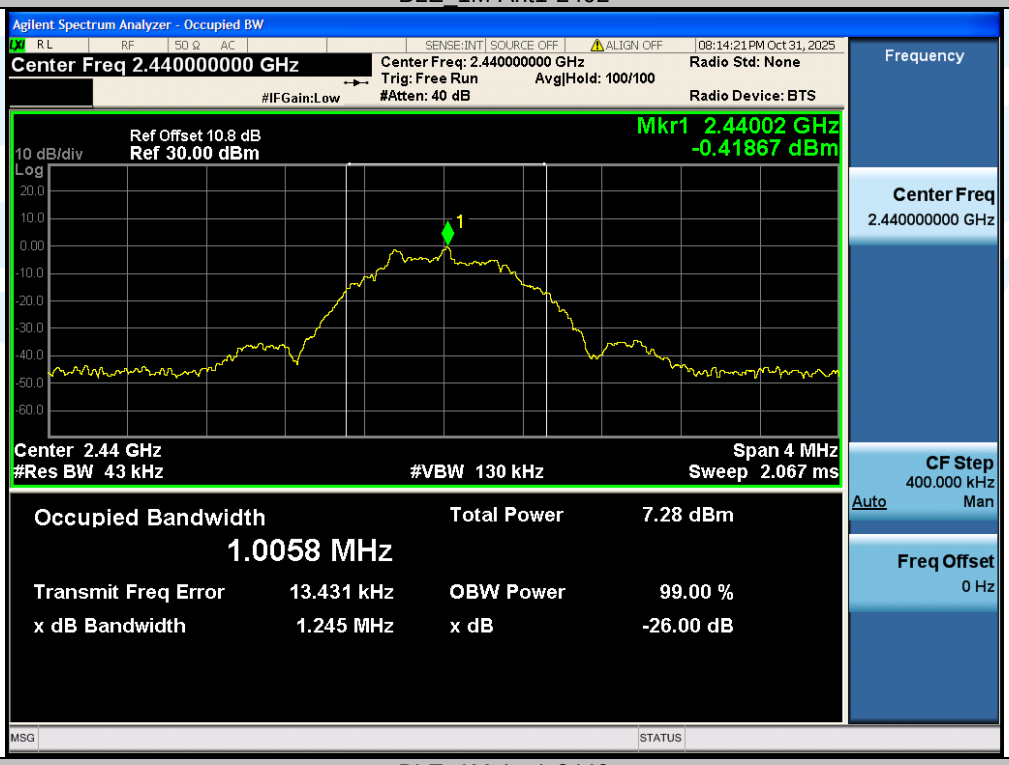
A.3 Occupied Channel Bandwidth

Test Mode	Antenna	Frequency [MHz]	OCB [MHz]	FL [MHz]	FH [MHz]
BLE_1M	Ant1	2402	1.0105	2401.5098	2402.5203
BLE_1M	Ant1	2440	1.0058	2439.5105	2440.5163
BLE_1M	Ant1	2480	1.0152	2479.5087	2480.5239

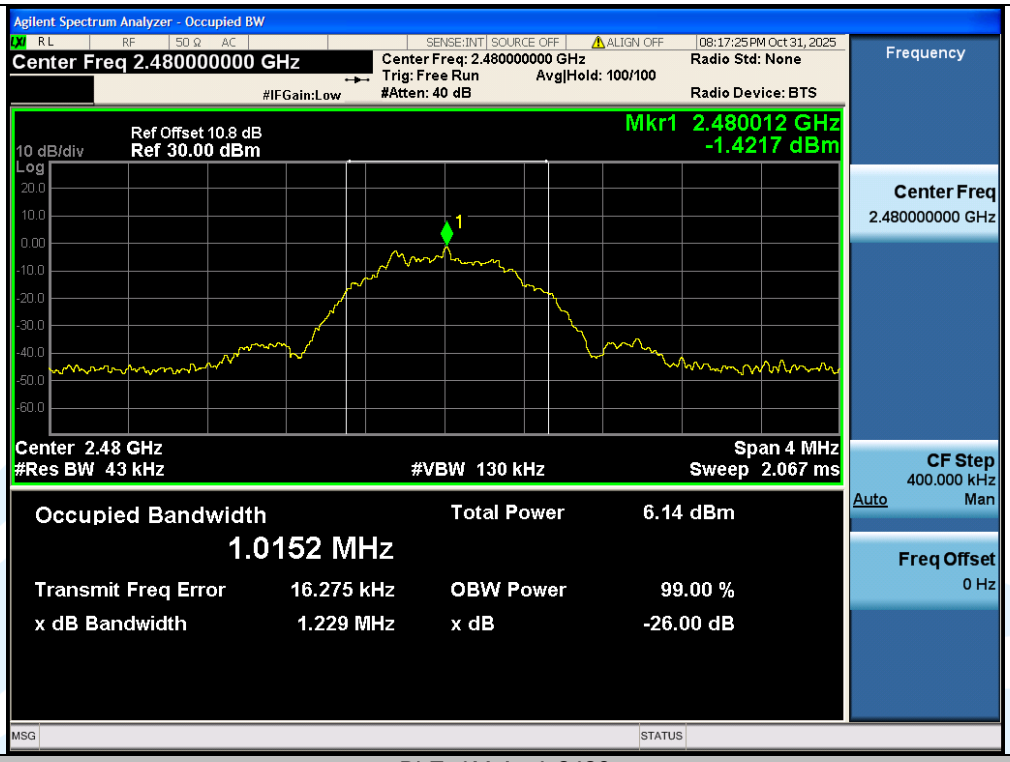
Test Graphs



BLE_1M-Ant1-2402



BLE_1M-Ant1-2440

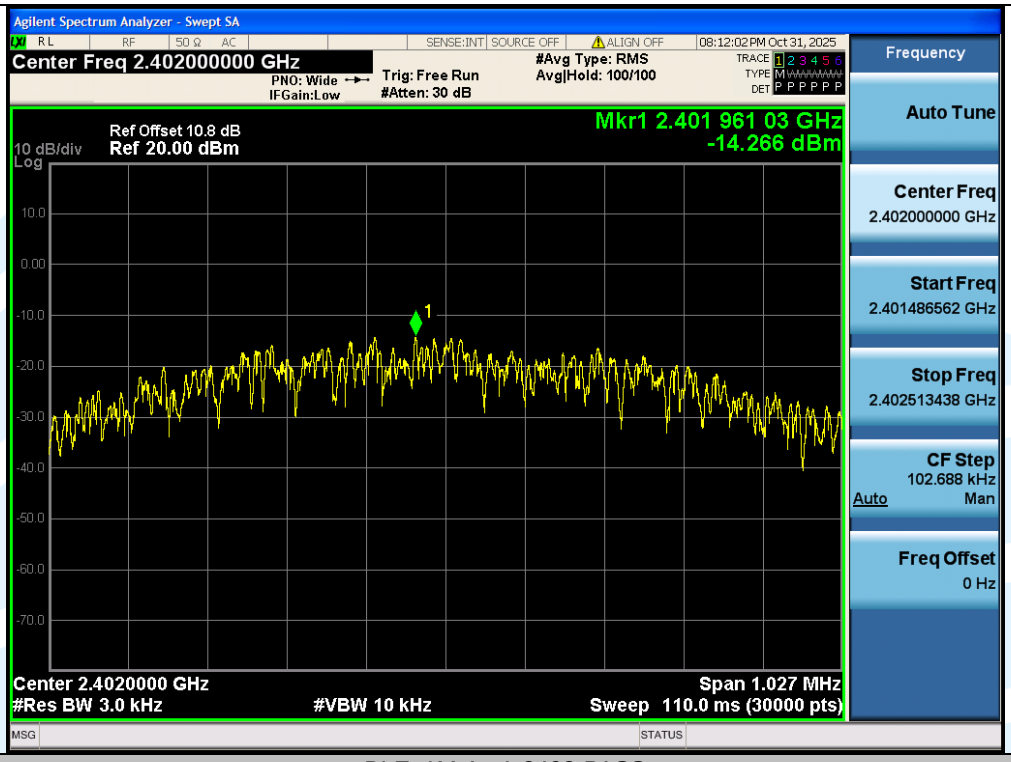


BLE_1M-Ant1-2480

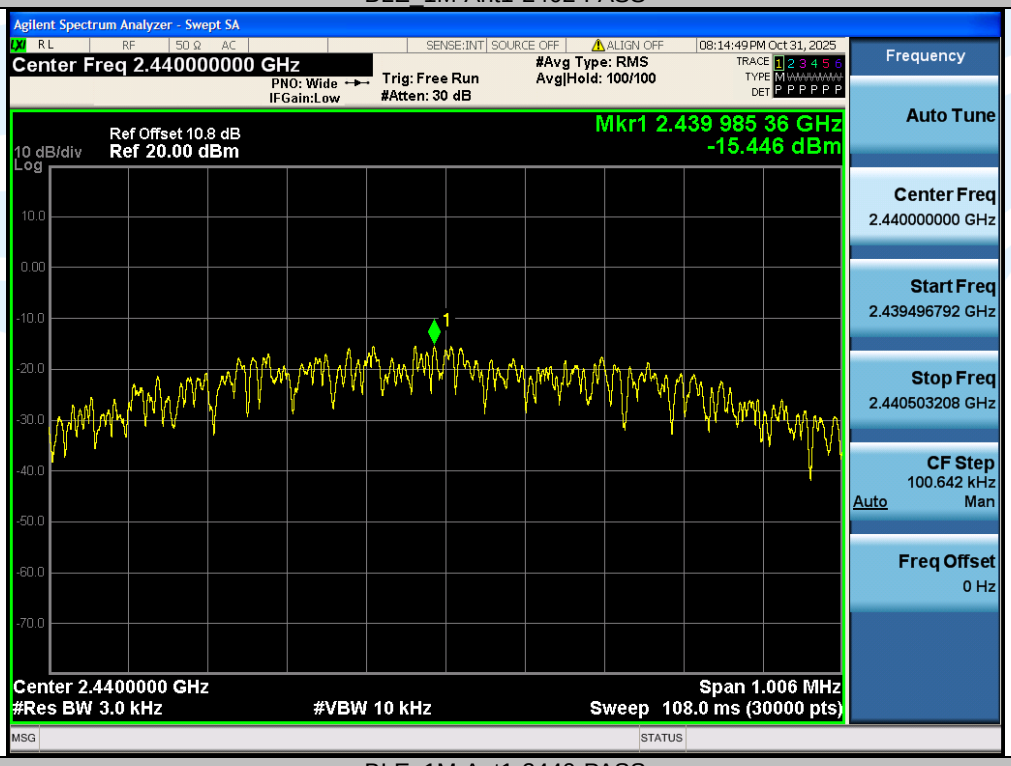
A.4 Maximum power spectral density

Test Mode	Antenna	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.27	≤8.00	PASS
BLE_1M	Ant1	2440	-15.45	≤8.00	PASS
BLE_1M	Ant1	2480	-16.13	≤8.00	PASS

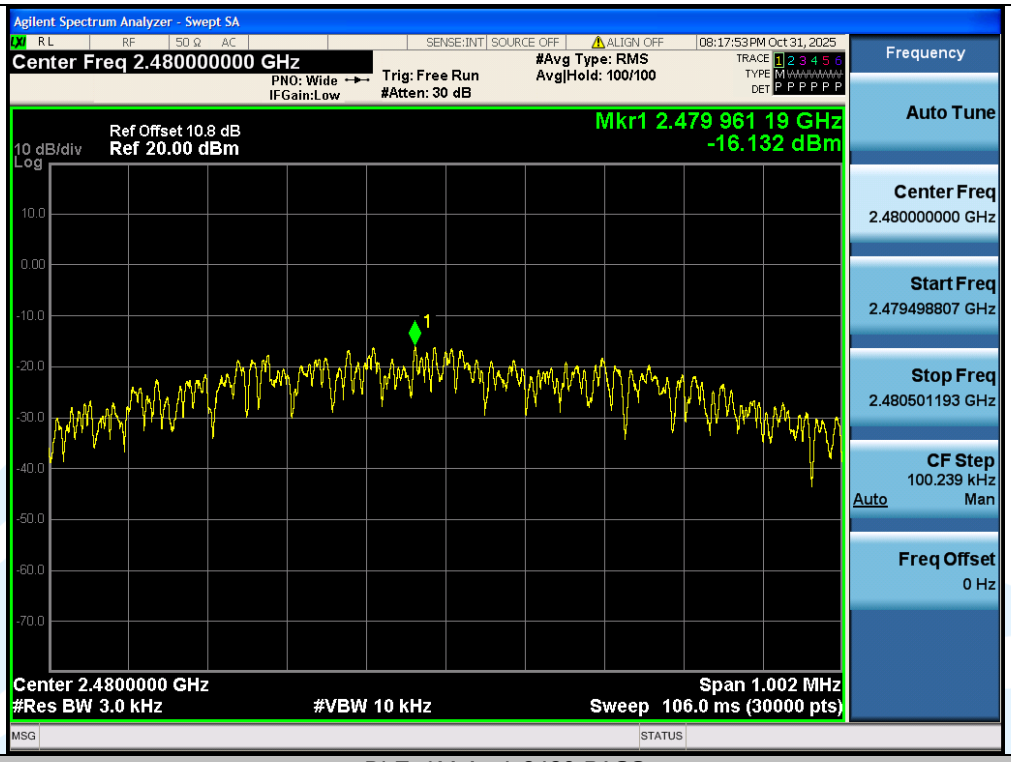
Test Graphs



BLE_1M-Ant1-2402-PASS



BLE_1M-Ant1-2440-PASS

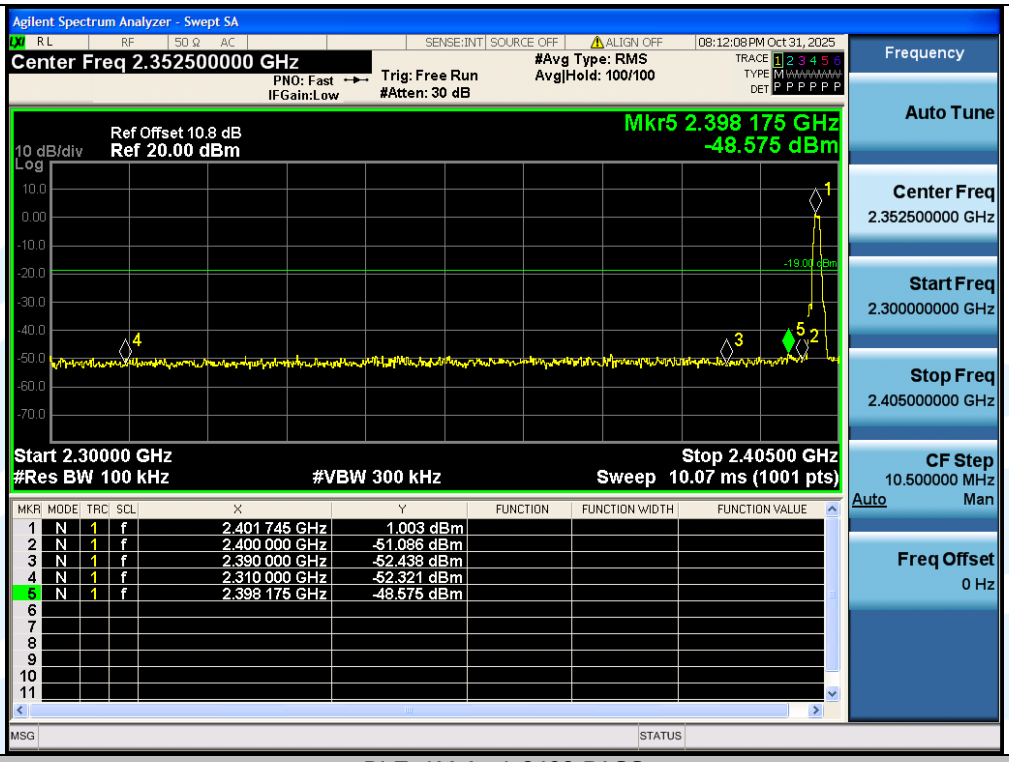


BLE_1M-Ant1-2480-PASS

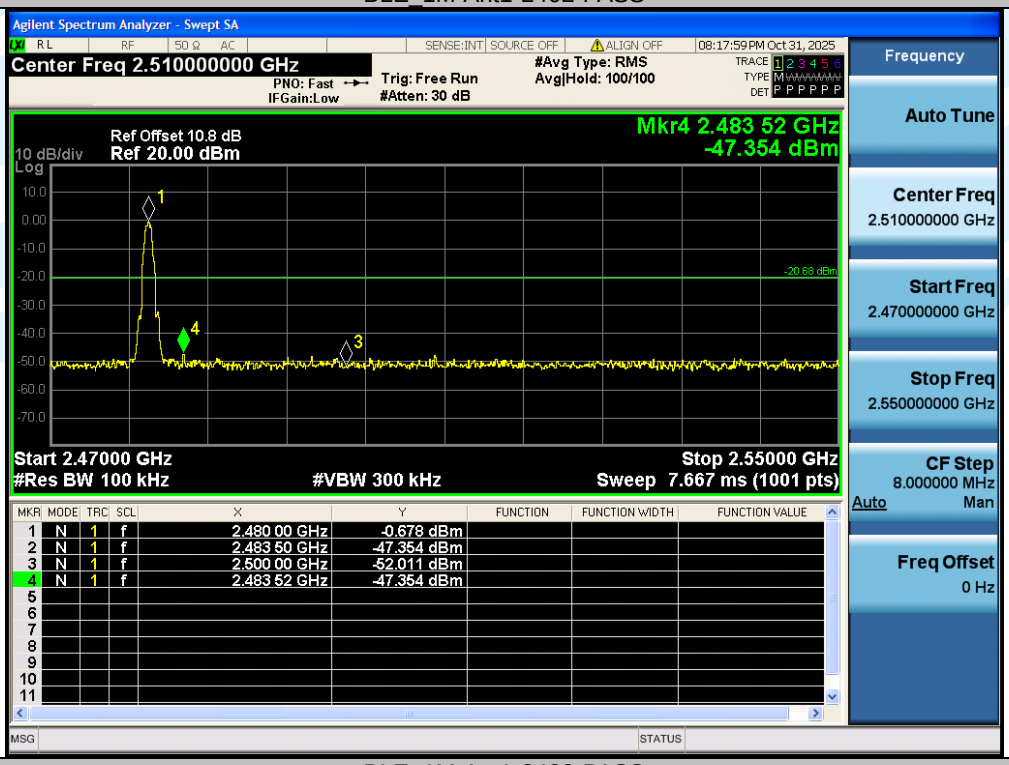
A.5 BAND EDGE MEASUREMENTS

Test Mode	Antenna	Ch Name	Frequency [MHz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
BLE_1M	Ant1	Low	2402	1.00	-48.58	≤-19	PASS
BLE_1M	Ant1	High	2480	-0.68	-47.35	≤-20.68	PASS

Test Graphs



BLE_1M-Ant1-2402-PASS



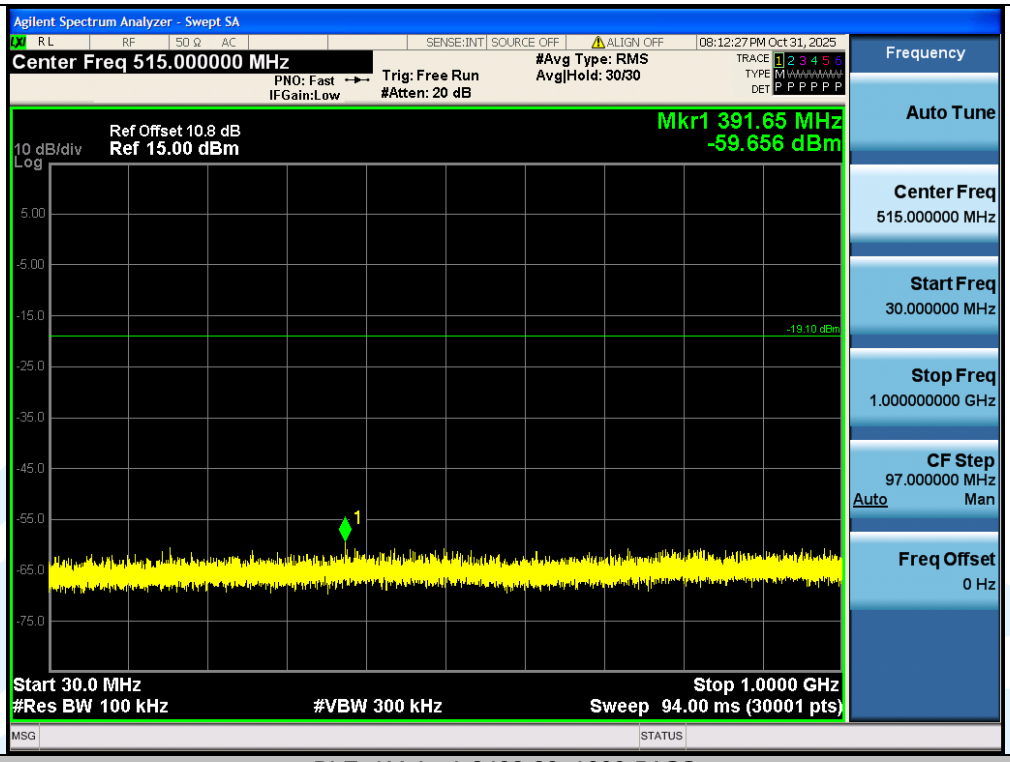
BLE_1M-Ant1-2480-PASS

A.6 CONDUCTED SPURIOUS EMISSION

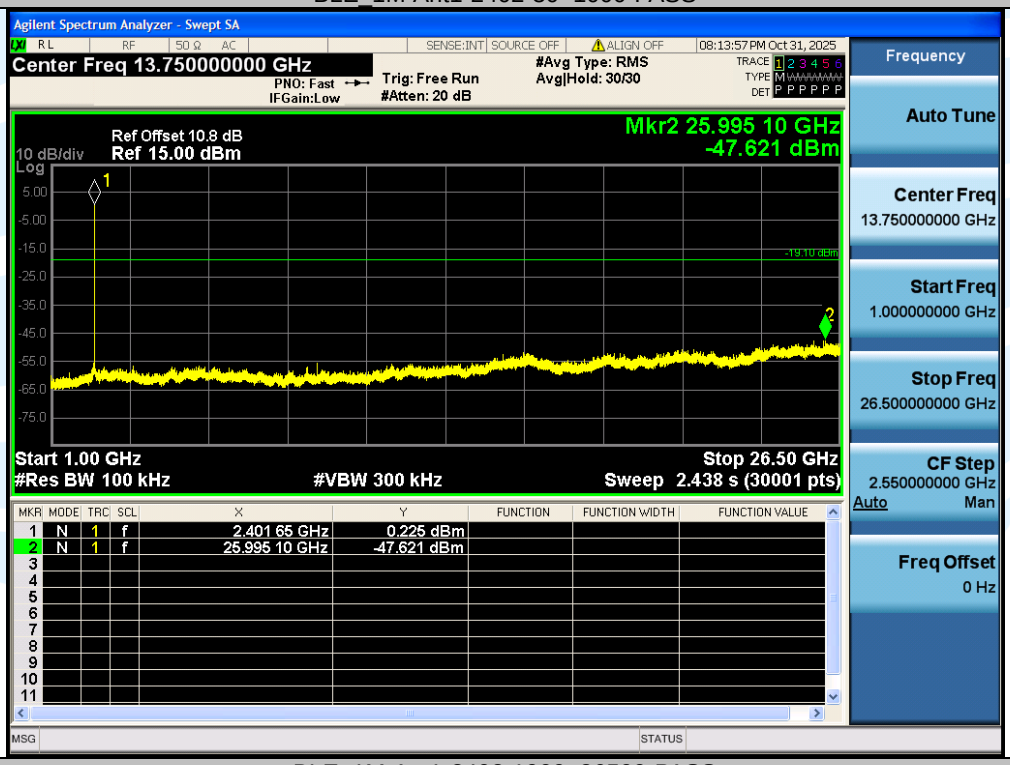
Test Mode	Antenna	Frequency [MHz]	Freq Range [MHz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
BLE_1M	Ant1	2402	0~Reference	0.90	0.90	---	PASS
BLE_1M	Ant1	2402	30~1000	0.90	-59.66	≤-19.1	PASS
BLE_1M	Ant1	2402	1000~26500	0.90	-47.62	≤-19.1	PASS
BLE_1M	Ant1	2440	0~Reference	-0.73	-0.73	---	PASS
BLE_1M	Ant1	2440	30~1000	-0.73	-59.81	≤-20.73	PASS
BLE_1M	Ant1	2440	1000~26500	-0.73	-47.92	≤-20.73	PASS
BLE_1M	Ant1	2480	0~Reference	-0.84	-0.84	---	PASS
BLE_1M	Ant1	2480	30~1000	-0.84	-59.87	≤-20.84	PASS
BLE_1M	Ant1	2480	1000~26500	-0.84	-48.02	≤-20.84	PASS

Test Graphs

BLE_1M-Ant1-2402-0~Reference-PASS

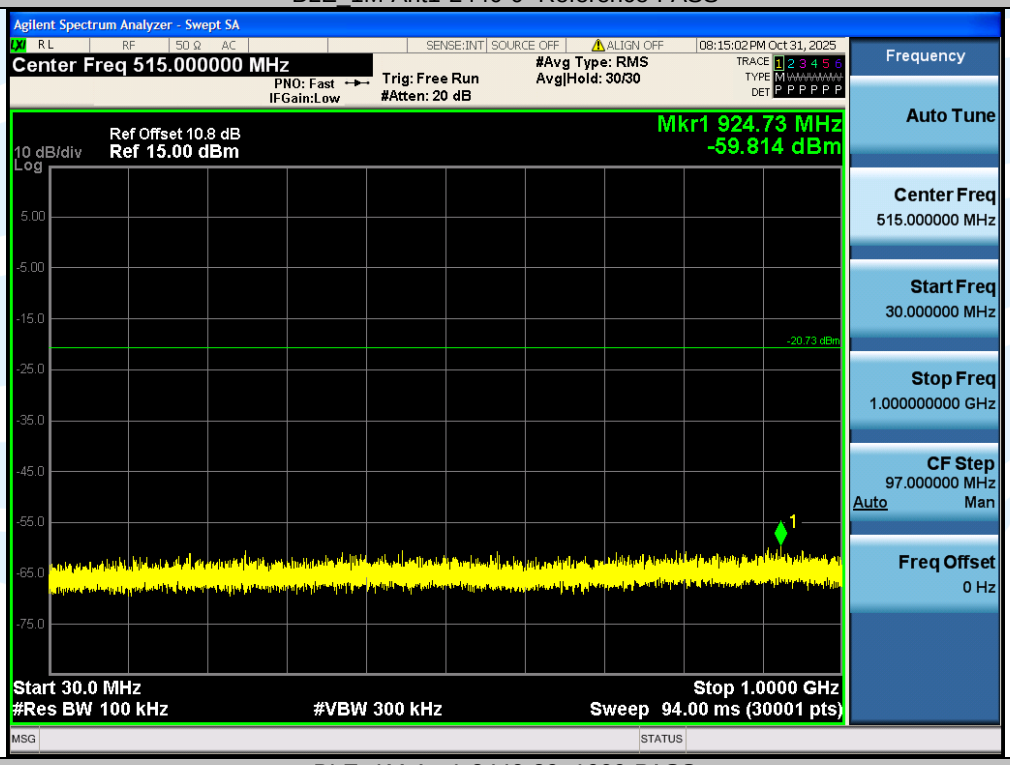


BLE_1M-Ant1-2402-30~1000-PASS

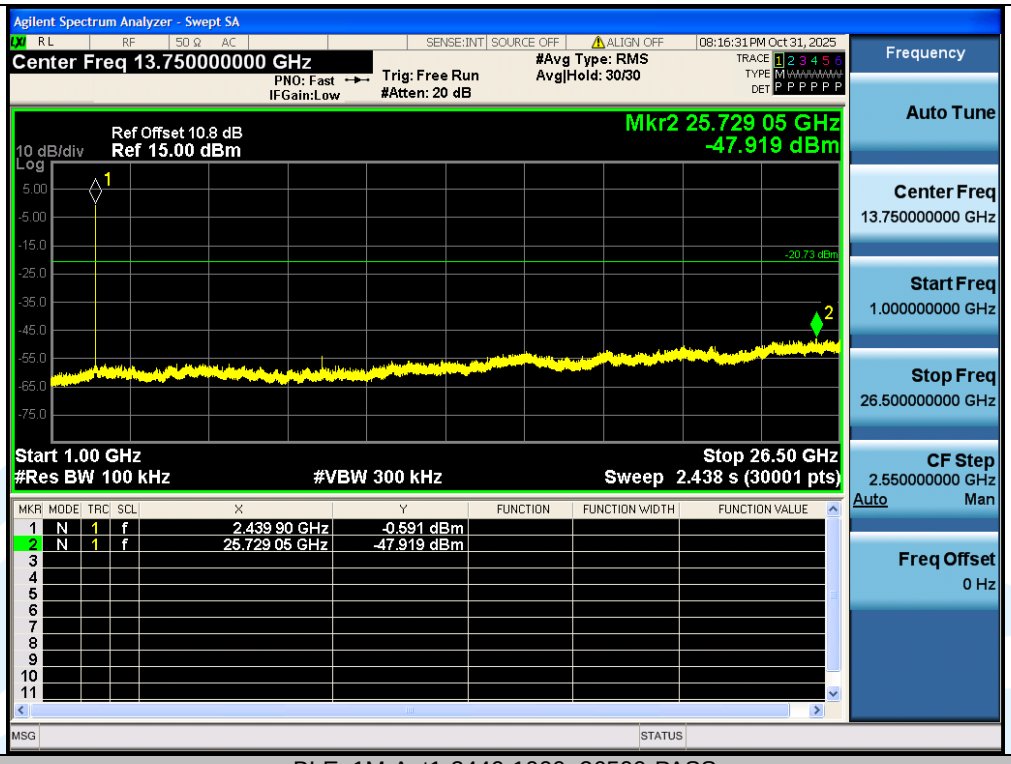


BLE_1M-Ant1-2402-1000~26500-PASS

BLE_1M-Ant1-2440-0~Reference-PASS

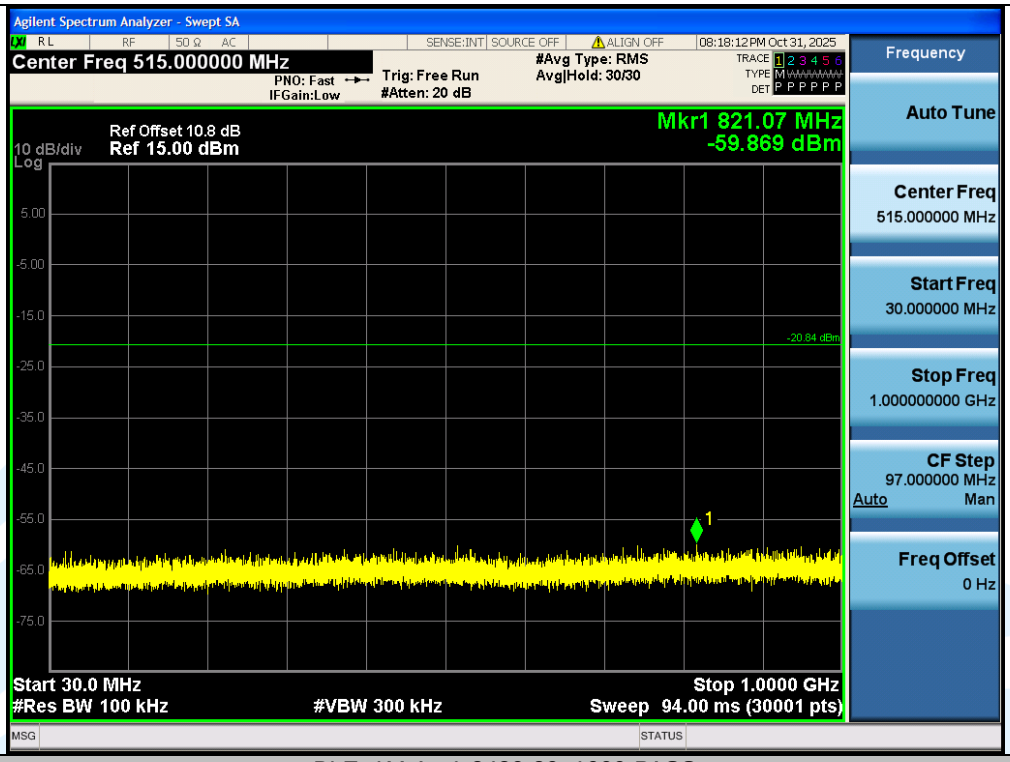


BLE_1M-Ant1-2440-30~1000-PASS

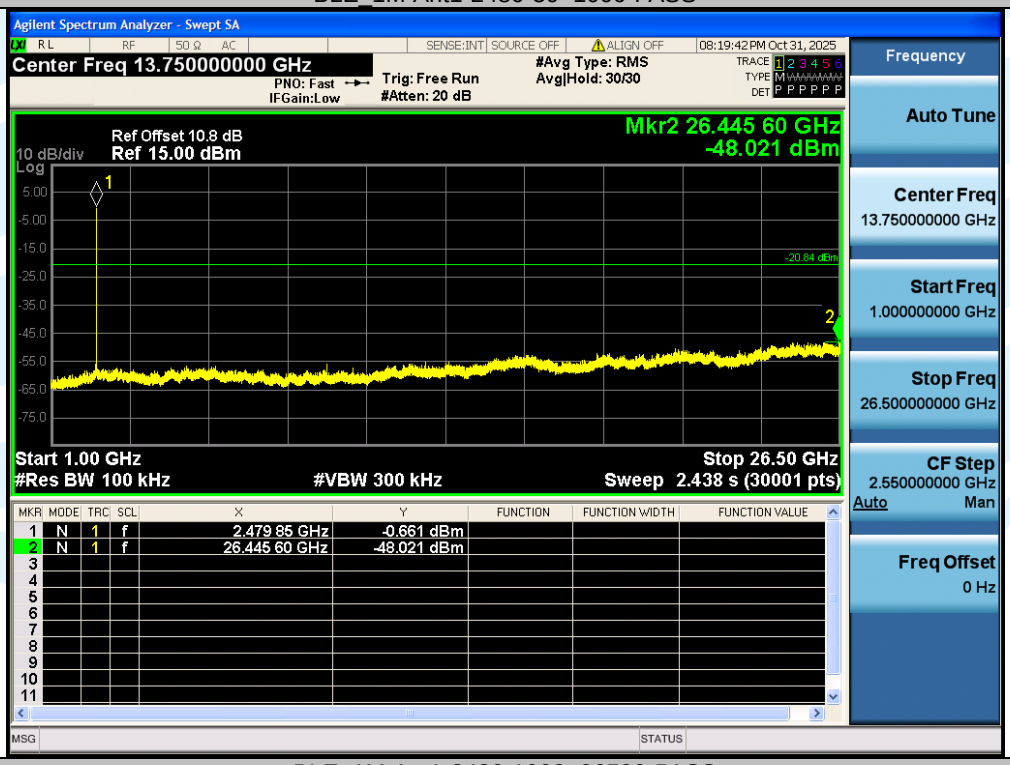


BLE_1M-Ant1-2440-1000~26500-PASS

BLE_1M-Ant1-2480-0~Reference-PASS



BLE_1M-Ant1-2480-30~1000-PASS



BLE_1M-Ant1-2480-1000~26500-PASS

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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