FCC RF Test Report

(BLE)

Report No.:	JYTSZ-R12-2401349
Applicant:	LG Electronics USA, Inc.
Address of Applicant:	111 Sylvan Avenue North Building, Englewood Cliffs, New Jersey, United States 07632

Equipment Under Test (EUT)

Product Name:	Bluetooth Module
Model No.:	MB2710
Trade Mark:	LG
FCC ID:	BEJ-MB2710
Applicable Standards:	FCC CFR Title 47 Part 15C (§15.247)
Date of Sample Receipt:	07 Nov., 2024
Date of Test:	08 Nov., to 19 Nov., 2024
Date of Report Issued:	02 Jan., 2025
Test Result:	PASS

Project by:	Project Engineer	***Date:***	*02 Jan., 2025*
Reviewed by:	Senior Engineer	***Date:***	*02 Jan., 2025*
Approved by:	Manager	***Date:***	*02 Jan., 2025*

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 above the application standard version. Test results reported herein relate only to the item(s) tested.

1 Version

Version No.	Date	Description
00	*20 Nov., 2024*	*Original*
01	*02 Jan., 2025*	*Update Page 21.*

2 Contents

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3 General Information

3.1 Client Information

Applicant:	LG Electronics USA, Inc.
Address:	111 Sylvan Avenue North Building, Englewood Cliffs, New Jersey, United States 07632
Manufacturer:	LG Electronics USA, Inc.
Address:	111 Sylvan Avenue North Building, Englewood Cliffs, New Jersey, United States 07632
Factory:	Shenzhen Jingxun Technology Co., Ltd
Address:	3/F, A5 Building Zhiyuan Community No.1001, Xueyuan Road Nanshan District, Shenzhen City

3.2 General Description of E.U.T.

Product Name:	Bluetooth Module
Model No.:	MB2710
Operation Frequency:	2402 MHz - 2480 MHz
Channel Numbers:	40
Channel Separation:	2MHz
Modulation Technology:	GFSK
Data Speed:	1 Mbps (LE 1M PHY)
Antenna Type:	Internal Antenna
Antenna Gain:	1.73 dBi (declare by applicant)
Antenna transmit mode:	SISO (1TX, 1RX)
Power Supply:	DC 3.3~4.2V
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

3.3 Test Mode and Test Environment

Test Mode:	
Transmitting mode	Keep the EUT in continuous transmitting with modulation

Remark:

1. *For AC power line conducted emission and radiated spurious emission (below 1GHz), pre-scan all data speed, found 1 Mbps (LE 1M PHY) was worse case mode. The report only reflects the test data of worst mode.*
2. *Channel Low, Mid and High for each type band with rated data rate were chosen for full testing. The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for these modes. Just the worst case position (H mode) shown in report.*

Operating Environment:	
Temperature:	15℃ ~ 35℃
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar
Voltage:	DC 3.3V
Test Engineer:	Logan Li (Conducted measurement) Real Chen (Radiated measurement)

3.4 Description of Test Auxiliary Equipment

The EUT has been tested as an independent unit.

3.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 150kHz)	3.57 dB
Conducted Emission for LISN (150kHz ~ 30MHz)	3.14 dB
Radiated Emission (30MHz ~ 200MHz) (3m SAC)	4.6 dB
Radiated Emission (200MHz ~ 1000MHz) (3m SAC)	5.8 dB
Radiated Emission (1GHz ~ 6GHz) (3m FAR)	4.95 dB
Radiated Emission (6GHz ~ 18GHz) (3m FAR)	5.23 dB
Radiated Emission (18GHz ~ 40GHz) (3m FAR)	5.32 dB

Note: *All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.*

3.6 Additions to, Deviations, or Exclusions from the Method

No

3.7 Laboratory Facility

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

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

3.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info-JYTee@lets.com, Website: http://jyt.lets.com

3.9 Test Instruments List

Radiated Emission(3m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2026
Loop Antenna	Schwarzbeck	FMZB 1519 B	WXJ002-4	01-05-2024	01-04-2025
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	01-09-2024	01-08-2025
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	01-05-2024	01-04-2025
Horn Antenna	Schwarzbeck	BBHA9170	WXJ002-5	12-28-2023	12-27-2024
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	12-27-2023	12-26-2024
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	12-27-2023	12-26-2024
Pre-amplifier (18GHz ~ 40GHz)	RF System	TRLA-180400G45B	WXJ002-7	12-28-2023	12-27-2024
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	12-27-2023	12-26-2024
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	12-27-2023	12-26-2024
Spectrum Analyzer	KEYSIGHT	N9010B	WXJ004-2	09-09-2024	09-08-2025
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-17-2024	01-16-2025
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-17-2024	01-16-2025
Coaxial Cable (18GHz ~ 40GHz)	JYTSZ	JYT3M-40G-SS-8M	WXG001-7	01-17-2024	01-16-2025
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

Radiated Emission(3m FAR):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m FAR	YUNYI	9m*6m*6m	WXJ097	06-15-2023	06-14-2028
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ097-2	07-01-2024	06-30-2025
Biconical Antenna	Schwarzbeck	VUBA9117	WXJ002-1	07-01-2024	06-30-2027
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ097-3	06-16-2024	06-15-2025
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-3	12-28-2023	12-27-2024
Horn Antenna	Schwarzbeck	BBHA9170	WXJ002-5	12-28-2023	12-27-2024
Horn Antenna	Schwarzbeck	BBHA9170	WXJ002-6	12-28-2023	12-27-2024
Pre-amplifier (30MHz ~ 1GHz)	YUNYI	PAM-310N	WXJ097-5	04-24-2024	04-23-2025
Pre-amplifier (1GHz ~ 18GHz)	YUNYI	PAM-118N	WXJ097-6	04-24-2024	04-23-2025
Pre-amplifier (18GHz ~ 40GHz)	RF System	TRLA-180400G45B	WXJ002-7	12-28-2023	12-27-2024
EMI Test Receiver	Rohde & Schwarz	ESCI3	WXJ003	12-27-2023	12-26-2024
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	12-27-2023	12-26-2024
Spectrum Analyzer	KEYSIGHT	N9020B	WXJ081-1	06-11-2024	06-10-2025
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-13M	WXG097-1	07-30-2024	07-29-2025
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG097-2	07-30-2024	07-29-2025
Coaxial Cable (18GHz ~ 40GHz)	JYTSZ	JYT3M-40G-SS-8M	WXG097-3	07-30-2024	07-29-2025
High Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Low Band Reject Filter Group	Tonscend	JS0806-F	WXJ097-4	N/A	
Test Software	Tonscend	TS+	Version: 5.0.0		

Conducted Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
EMI Test Receiver	Rohde & Schwarz	ESR3	WXJ003-2	06-11-2024	06-10-2025
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	12-27-2023	12-26-2024
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	12-27-2023	12-26-2024
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	01-17-2024	01-16-2025
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

Conducted Method:					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
Spectrum Analyzer	Keysight	N9010B	WXJ004-3	09-10-2024	09-09-2025
Temperature Humidity Chamber	ZHONG ZHI	CZ-A-80D	WXJ032-3	01-09-2023	01-08-2025
Power Detector Box	MWRFTEST	MW100-PSB	WXJ007-4	09-10-2024	09-09-2025
DC Power Supply	Keysight	E3642A	WXJ025-2	N/A	
RF Control Unit	MWRFTEST	MW100-RFCB	WXG006	N/A	
Test Software	MWRFTEST	MTS 8310	Version: 2.0.0.0		

4 Measurement Setup and Procedure

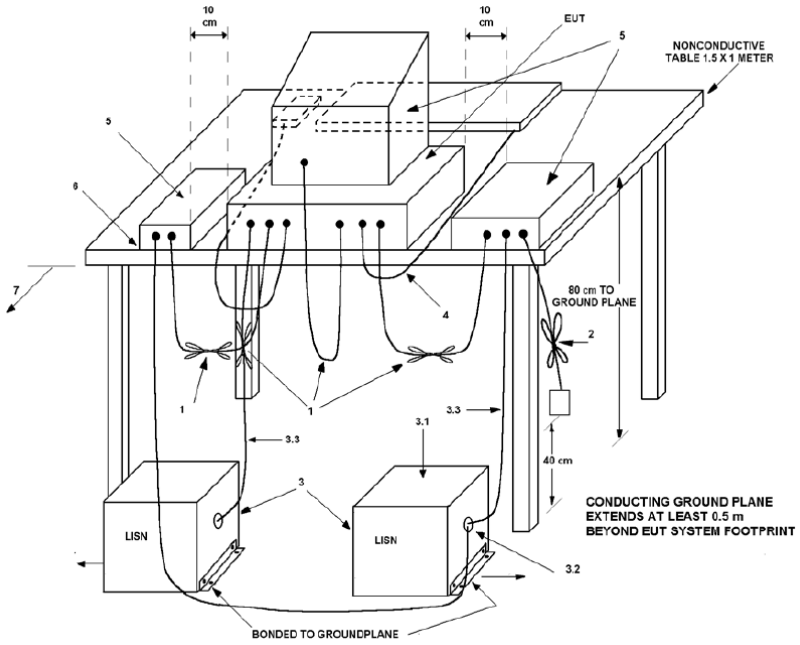
4.1 Test Channel

According to ANSI C63.10-2013 chapter 5.6.1 Table 4 requirement, select lowest channel, middle channel, and highest channel in the frequency range in which device operates for testing. The detailed frequency points are as follows:

Lowest channel		Middle channel		Highest channel	
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	20	2442	39	2480

4.2 Test Setup

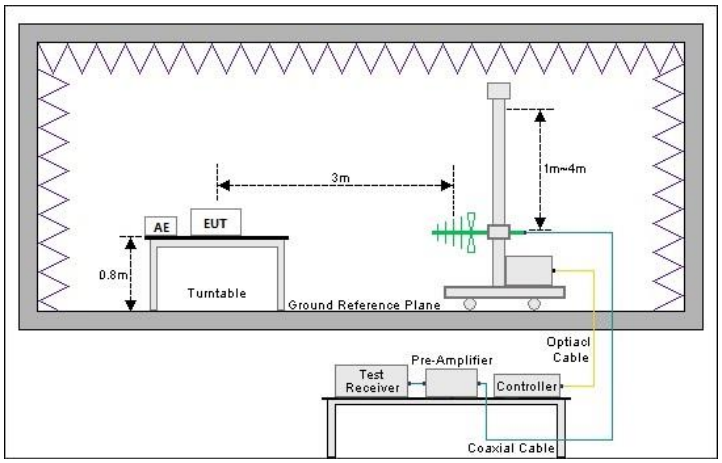
1) Conducted emission measurement:



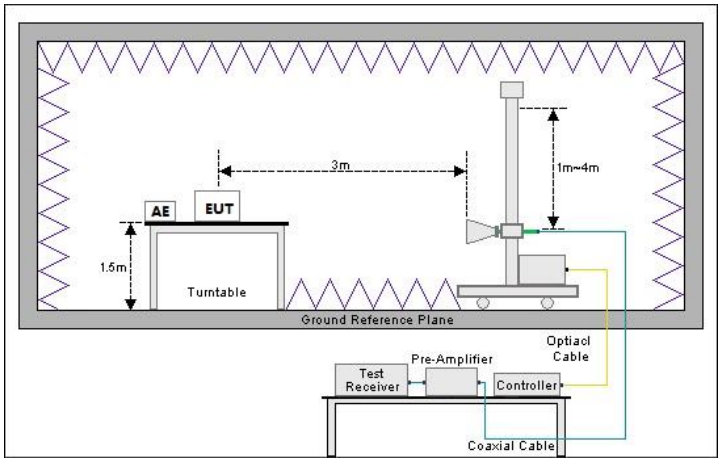
Note: The detailed descriptions please refer to Figure 8 of ANSI C63.4:2014.

2) Radiated emission measurement:

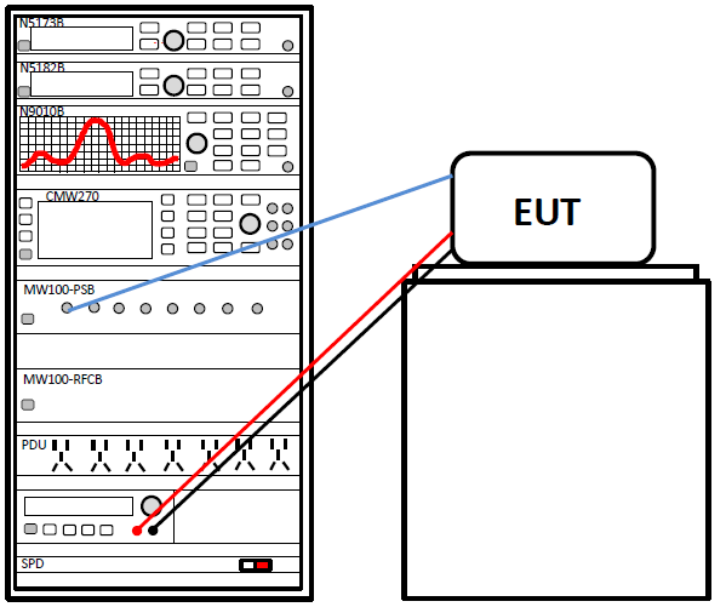
Below 1GHz (3m SAC)



Above 1GHz (3m FAR)



3) Conducted test method



4.3 Test Procedure

Test method	Test step
Conducted emission	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. 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.
Radiated emission	**For below 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data. **For above 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method	1. The BLE antenna port of EUT was connected to the test port of the test system through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. Open the test software, prepare a test plan, and control the system through the software. After the test is completed, the test report is exported through the test software.

5 Test Results

5.1 Summary

5.1.1 Clause and Data Summary

Test items	Standard clause	Test data	Result
Antenna Requirement	15.203 15.247 (b)(4)	See Section 5.2	Pass
AC Power Line Conducted Emission	15.207	See Section 5.3	Pass
Conducted Output Power	15.247 (b)(3)	Appendix A – BLE 1M PHY	Pass
6dB Emission Bandwidth 99% Occupied Bandwidth	15.247 (a)(2)	Appendix A – BLE 1M PHY	Pass
Power Spectral Density	15.247 (e)	Appendix A – BLE 1M PHY	Pass
Band-edge Emission Conduction Spurious Emission	15.247 (d)	Appendix A – BLE 1M PHY	Pass
Emissions in Restricted Frequency Bands	15.205 15.247 (d)	See Section 5.4	Pass
Emissions in Non-restricted Frequency Bands	15.209 15.247(d)	See Section 5.5	Pass

Remark:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *N/A: Not Applicable.*
3. *The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer).*

Test Method:	*ANSI C63.10-2013* *KDB 558074 D01 15.247 Meas Guidance v05r02*

5.1.2 Test Limit

<table>
<tr><th>Test items</th><th>Limit</th></tr>
<tr><td>AC Power Line Conducted Emission</td><td>
<table>
<tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBµV)</th></tr>
<tr><th>Quasi-Peak</th><th>Average</th></tr>
<tr><td>0.15 – 0.5</td><td>66 to 56 Note 1</td><td>56 to 46 Note 1</td></tr>
<tr><td>0.5 – 5</td><td>56</td><td>46</td></tr>
<tr><td>5 – 30</td><td>60</td><td>50</td></tr>
<tr><td colspan="3">Note 1: The limit level in dBµV decreases linearly with the logarithm of frequency.
Note 2: The more stringent limit applies at transition frequencies.</td></tr>
</table>
</td></tr>
<tr><td>Conducted Output Power</td><td>For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.</td></tr>
<tr><td>6dB Emission Bandwidth</td><td>The minimum 6 dB bandwidth shall be at least 500 kHz.</td></tr>
<tr><td>99% Occupied Bandwidth</td><td>N/A</td></tr>
<tr><td>Power Spectral Density</td><td>For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.</td></tr>
<tr><td>Band-edge Emission

Conduction Spurious Emission</td><td>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).</td></tr>
<tr><td>Emissions in Restricted Frequency Bands

Emissions in Non-restricted Frequency Bands</td><td>
<table>
<tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBµV/m)</th><th rowspan="2">Detector</th></tr>
<tr><th>@ 3m</th><th>@ 10m</th></tr>
<tr><td>30 – 88</td><td>40.0</td><td>30.0</td><td>Quasi-peak</td></tr>
<tr><td>88 – 216</td><td>43.5</td><td>33.5</td><td>Quasi-peak</td></tr>
<tr><td>216 – 960</td><td>46.0</td><td>36.0</td><td>Quasi-peak</td></tr>
<tr><td>960 – 1000</td><td>54.0</td><td>44.0</td><td>Quasi-peak</td></tr>
<tr><td colspan="4">Note: The more stringent limit applies at transition frequencies.</td></tr>
<tr><th rowspan="2">Frequency</th><th colspan="3">Limit (dBµV/m) @ 3m</th></tr>
<tr><th colspan="2">Average</th><th>Peake</th></tr>
<tr><td>Above 1 GHz</td><td colspan="2">54.0</td><td>74.0</td></tr>
<tr><td colspan="4">Note: The measurement bandwidth shall be 1 MHz or greater.</td></tr>
</table>
</td></tr>
</table>

5.2 Antenna requirement

Standard requirement:	FCC Part 15 C Section 15.203 /247(b)(4)

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.

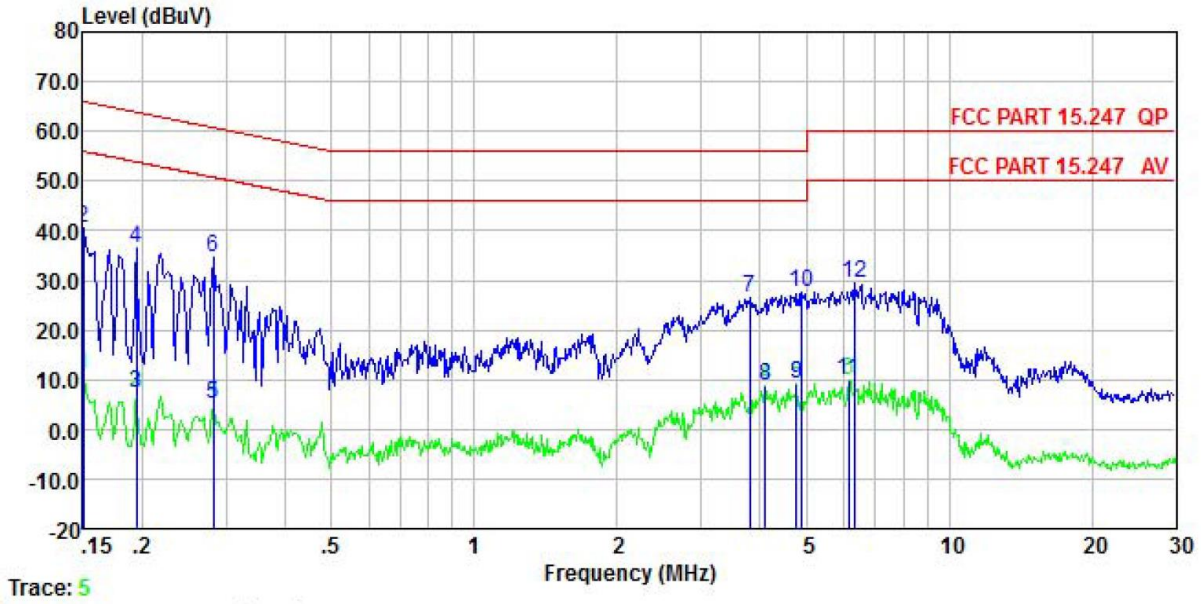
15.247(b) (4) requirement:
(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi 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.

E.U.T Antenna:

The BLE antenna is an Internal antenna which cannot replace by end-user, the best case gain of the antenna is 1.73 dBi. See product internal photos for details.

5.3 AC Power Line Conducted Emission

Product name:	Bluetooth Module	**Product model:**	MB2710
Test by:	Kiran Zeng	**Test mode:**	BLE Tx (LE 1M PHY)
Test frequency:	150 kHz ~ 30 MHz	**Phase:**	Line
Test voltage:	DC 5V		

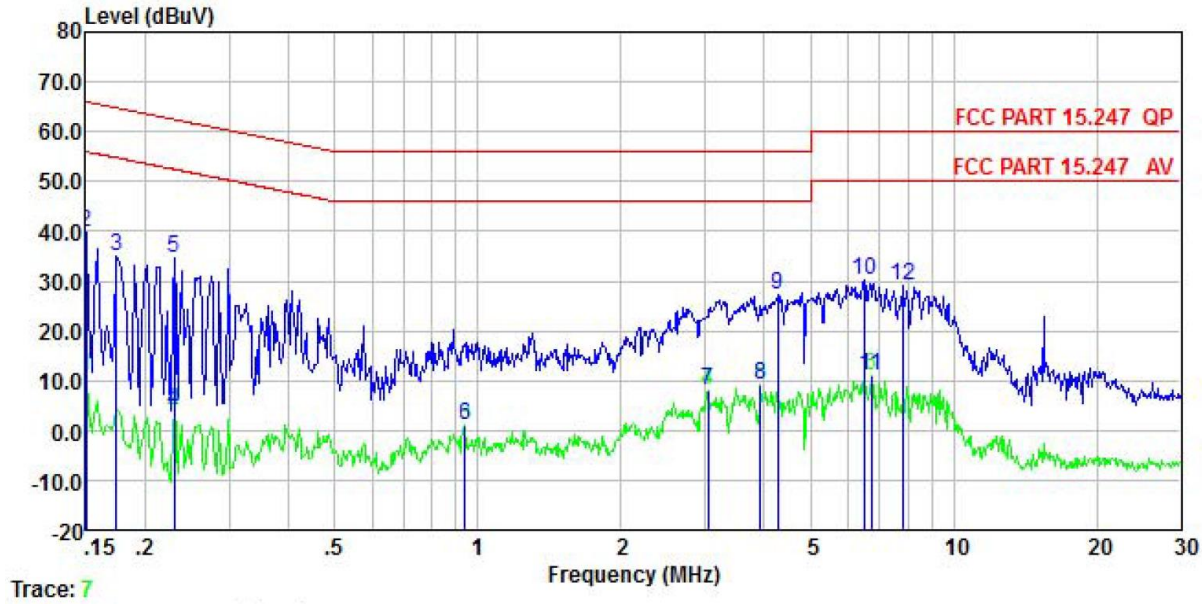


	Freq	Read Level	LISN Factor	Aux Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB	
1	0.150	1.09	0.20	0.00	9.88	0.01	11.18	56.00	-44.82	Average
2	0.150	30.50	0.20	0.00	9.88	0.01	40.59	66.00	-25.41	QP
3	0.194	-2.98	0.20	0.00	9.88	0.03	7.13	53.84	-46.71	Average
4	0.194	26.30	0.20	0.00	9.88	0.03	36.41	63.84	-27.43	QP
5	0.282	-4.92	0.20	0.00	9.88	0.02	5.18	50.76	-45.58	Average
6	0.282	24.58	0.20	0.00	9.88	0.02	34.68	60.76	-26.08	QP
7	3.799	16.15	0.20	0.00	9.89	0.08	26.32	56.00	-29.68	QP
8	4.092	-1.49	0.20	0.00	9.89	0.08	8.68	46.00	-37.32	Average
9	4.772	-0.93	0.20	0.00	9.89	0.09	9.25	46.00	-36.75	Average
10	4.900	17.37	0.20	0.00	9.89	0.09	27.55	56.00	-28.45	QP
11	6.153	-0.18	0.20	0.00	9.90	0.09	10.01	50.00	-39.99	Average
12	6.319	19.11	0.20	0.00	9.90	0.09	29.30	60.00	-30.70	QP

Remark:

1. Level = Read level + LISN Factor + Cable Loss.

Product name:	Bluetooth Module	Product model:	MB2710
Test by:	Kiran Zeng	Test mode:	BLE Tx (LE 1M PHY)
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	DC 5V		



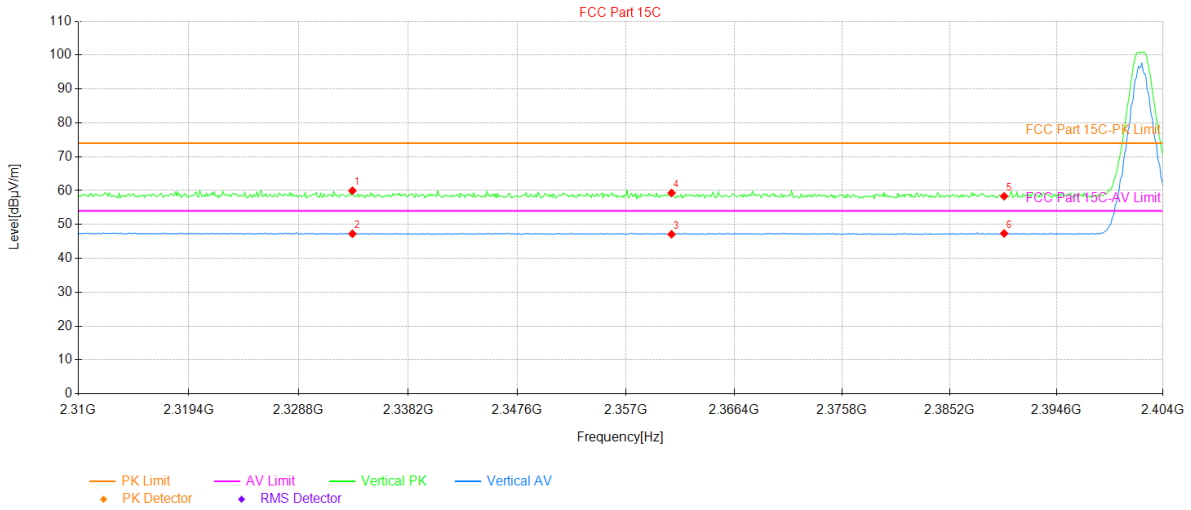
	Freq	Read Level	LISN Factor	Aux Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB	
1	0.150	0.90	0.20	0.00	9.88	0.01	10.99	56.00	-45.01	Average
2	0.150	29.80	0.20	0.00	9.88	0.01	39.89	66.00	-26.11	QP
3	0.174	24.95	0.20	0.00	9.88	0.01	35.04	64.77	-29.73	QP
4	0.230	-5.95	0.20	0.00	9.88	0.02	4.15	52.44	-48.29	Average
5	0.230	24.46	0.20	0.00	9.88	0.02	34.56	62.44	-27.88	QP
6	0.938	-9.20	0.20	0.00	9.88	0.04	0.92	46.00	-45.08	Average
7	3.041	-2.27	0.30	0.00	9.89	0.07	7.99	46.00	-38.01	Average
8	3.922	-1.19	0.30	0.00	9.89	0.08	9.08	46.00	-36.92	Average
9	4.269	16.94	0.30	0.00	9.89	0.08	27.21	56.00	-28.79	QP
10	6.488	19.83	0.30	0.00	9.90	0.09	30.12	60.00	-29.88	QP
11	6.698	0.85	0.30	0.00	9.90	0.10	11.15	50.00	-38.85	Average
12	7.810	18.66	0.33	0.00	9.90	0.10	28.99	60.00	-31.01	QP

Remark:

1. Level = Read level + LISN Factor + Cable Loss.

5.4 Emissions in Restricted Frequency Bands

Product Name:	Bluetooth Module	Product Model:	MB2710
Test By:	Real Chen	Test mode:	BLE Tx (LE 1M PHY)
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 5V		



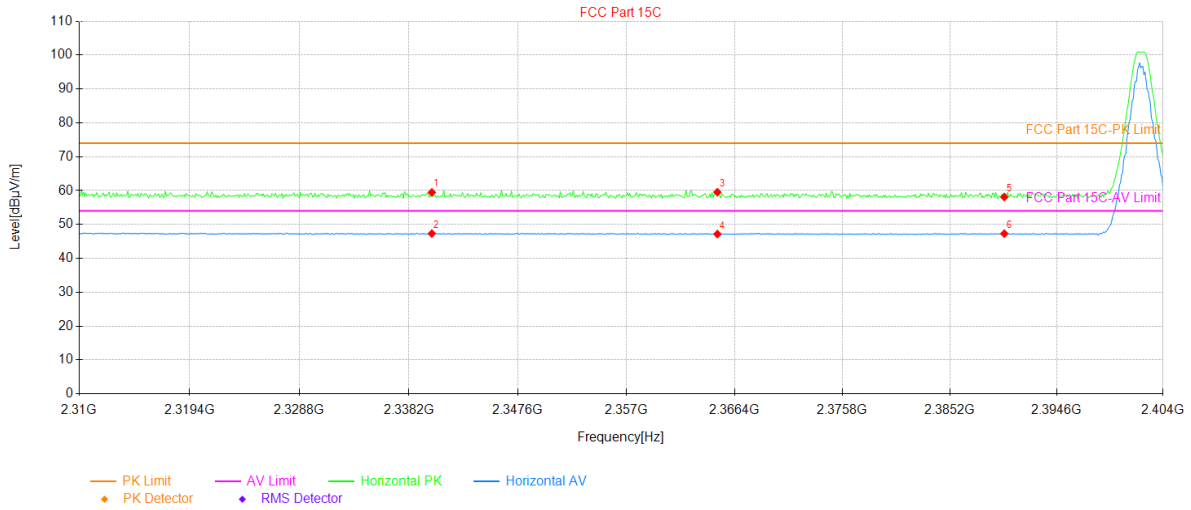
Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Angle [°]	Detector	Verdict	Polarity
1	2333.41	23.81	36.15	59.96	74.00	14.04	136	PK	PASS	Vertical
2	2333.41	11.10	36.15	47.25	54.00	6.75	147	AV	PASS	Vertical
3	2360.95	10.80	36.32	47.12	54.00	6.88	238	AV	PASS	Vertical
4	2360.95	22.98	36.32	59.30	74.00	14.70	73	PK	PASS	Vertical
5	2390.00	21.87	36.47	58.34	74.00	15.66	128	PK	PASS	Vertical
6	2390.00	10.89	36.47	47.36	54.00	6.64	330	AV	PASS	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Bluetooth Module	Product Model:	MB2710
Test By:	Real Chen	Test mode:	BLE Tx (LE 1M PHY)
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 5V		



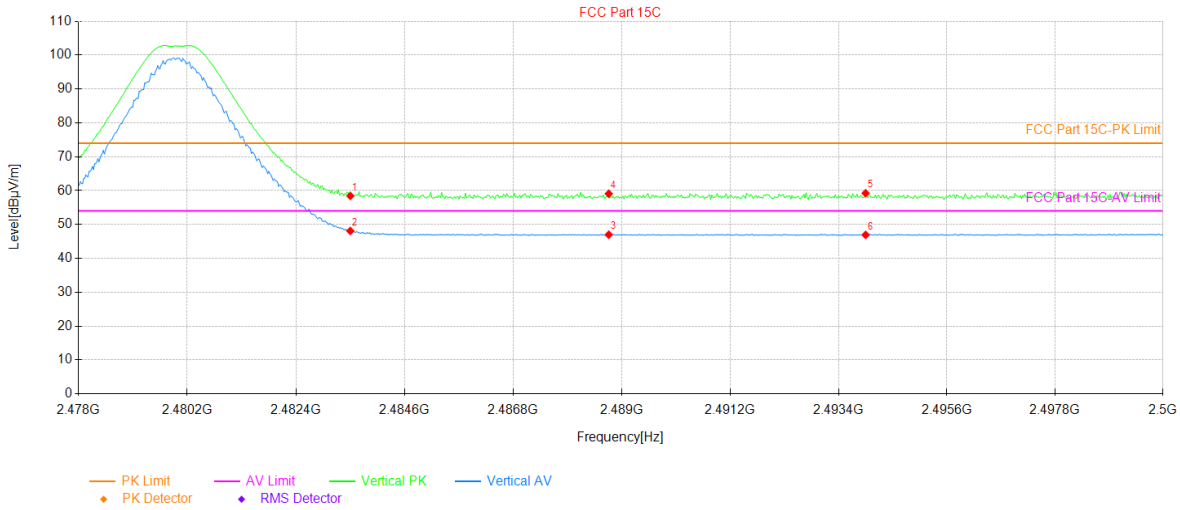
Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Angle [°]	Detector	Verdict	Polarity
1	2340.17	23.27	36.20	59.47	74.00	14.53	2	PK	PASS	Horizontal
2	2340.17	11.13	36.20	47.33	54.00	6.67	148	AV	PASS	Horizontal
3	2364.90	23.20	36.34	59.54	74.00	14.46	230	PK	PASS	Horizontal
4	2364.90	10.83	36.34	47.17	54.00	6.83	226	AV	PASS	Horizontal
5	2390.00	21.64	36.47	58.11	74.00	15.89	202	PK	PASS	Horizontal
6	2390.00	10.82	36.47	47.29	54.00	6.71	340	AV	PASS	Horizontal

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Bluetooth Module	Product Model:	MB2710
Test By:	Real Chen	Test mode:	BLE Tx (LE 1M PHY)
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC 5V		



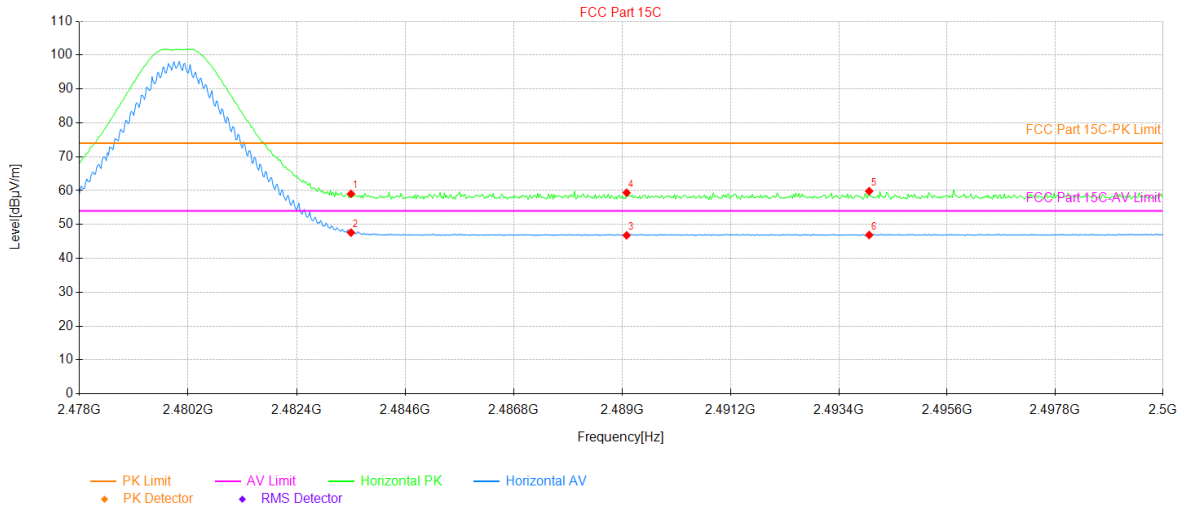
Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Angle [°]	Detector	Verdict	Polarity
1	2483.50	22.32	36.11	58.43	74.00	15.57	174	PK	PASS	Vertical
2	2483.50	11.98	36.11	48.09	54.00	5.91	102	AV	PASS	Vertical
3	2488.74	10.86	36.13	46.99	54.00	7.01	264	AV	PASS	Vertical
4	2488.74	22.95	36.13	59.08	74.00	14.92	309	PK	PASS	Vertical
5	2493.95	23.08	36.15	59.23	74.00	14.77	106	PK	PASS	Vertical
6	2493.95	10.77	36.15	46.92	54.00	7.08	343	AV	PASS	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Bluetooth Module	Product Model:	MB2710
Test By:	Real Chen	Test mode:	BLE Tx (LE 1M PHY)
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 5V		



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Angle [°]	Detector	Verdict	Polarity
1	2483.50	22.93	36.11	59.04	74.00	14.96	81	PK	PASS	Horizontal
2	2483.50	11.49	36.11	47.60	54.00	6.40	165	AV	PASS	Horizontal
3	2489.09	10.66	36.13	46.79	54.00	7.21	255	AV	PASS	Horizontal
4	2489.09	23.24	36.13	59.37	74.00	14.63	277	PK	PASS	Horizontal
5	2494.02	23.68	36.15	59.83	74.00	14.17	123	PK	PASS	Horizontal
6	2494.02	10.74	36.15	46.89	54.00	7.11	97	AV	PASS	Horizontal

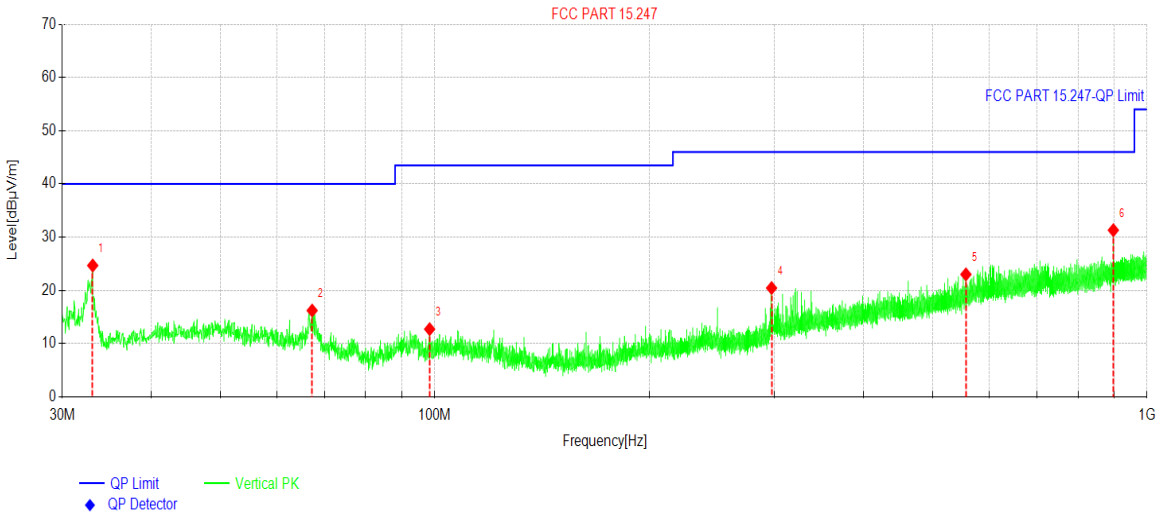
Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

5.5 Emissions in Non-restricted Frequency Bands

Below 1GHz:

Product Name:	Bluetooth Module	**Product Model:**	MB2710
Test By:	Alan Chen	**Test mode:**	BLE Tx (LE 1M PHY)
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	DC 5V		

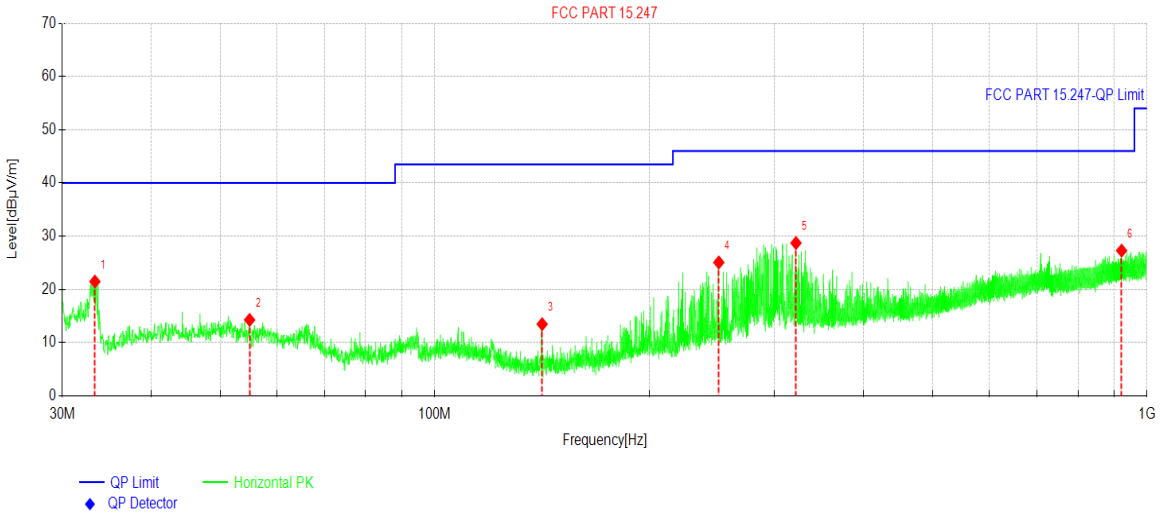


Suspected Data List								
NO.	Freq. [MHz]	Reading[dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	33.1042	40.49	-15.81	24.68	40.00	15.32	PK	Vertical
2	67.2984	31.97	-15.75	16.22	40.00	23.78	PK	Vertical
3	98.3884	27.66	-14.94	12.72	43.50	30.78	PK	Vertical
4	297.1514	33.51	-13.06	20.45	46.00	25.55	PK	Vertical
5	556.9303	30.97	-7.96	23.01	46.00	22.99	PK	Vertical
6	896.9323	33.99	-2.68	31.31	46.00	14.69	PK	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Bluetooth Module	Product Model:	MB2710
Test By:	Alan Chen	Test mode:	BLE Tx (LE 1M PHY)
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC 5V		



Suspected Data List

NO.	Freq. [MHz]	Reading[dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	33.3467	37.24	-15.76	21.48	40.00	18.52	PK	Horizontal
2	54.9787	27.48	-13.21	14.27	40.00	25.73	PK	Horizontal
3	141.5556	31.76	-18.29	13.47	43.50	30.03	PK	Horizontal
4	250.5405	38.96	-13.89	25.07	46.00	20.93	PK	Horizontal
5	321.4996	41.38	-12.66	28.72	46.00	17.28	PK	Horizontal
6	921.2806	29.67	-2.38	27.29	46.00	18.71	PK	Horizontal

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Above 1GHz:

BLE Tx (LE 1M PHY)						
Test channel: Lowest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
4804.00	48.53	-8.00	40.53	74.00	33.47	Vertical
4804.00	48.27	-8.00	40.27	74.00	33.73	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
4804.00	39.45	-8.00	31.45	54.00	22.55	Vertical
4804.00	39.79	-8.00	31.79	54.00	22.21	Horizontal
Test channel: Middle channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
4884.00	48.64	-7.45	41.19	74.00	32.81	Vertical
4884.00	48.67	-7.45	41.22	74.00	32.78	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
4884.00	39.01	-7.45	31.56	54.00	22.44	Vertical
4884.00	39.42	-7.45	31.97	54.00	22.03	Horizontal
Test channel: Highest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
4960.00	48.22	-7.08	41.14	74.00	32.86	Vertical
4960.00	48.44	-7.08	41.36	74.00	32.64	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
4960.00	39.22	-7.08	32.14	54.00	21.86	Vertical
4960.00	40.28	-7.08	33.20	54.00	20.80	Horizontal

Remark:

1. Level = Reading + Factor.

2. *Test Frequency up to 25GHz, and the emission levels of other frequencies are lower than the limit 20dB, not show in test report.*

Appendix A – BLE 1M PHY

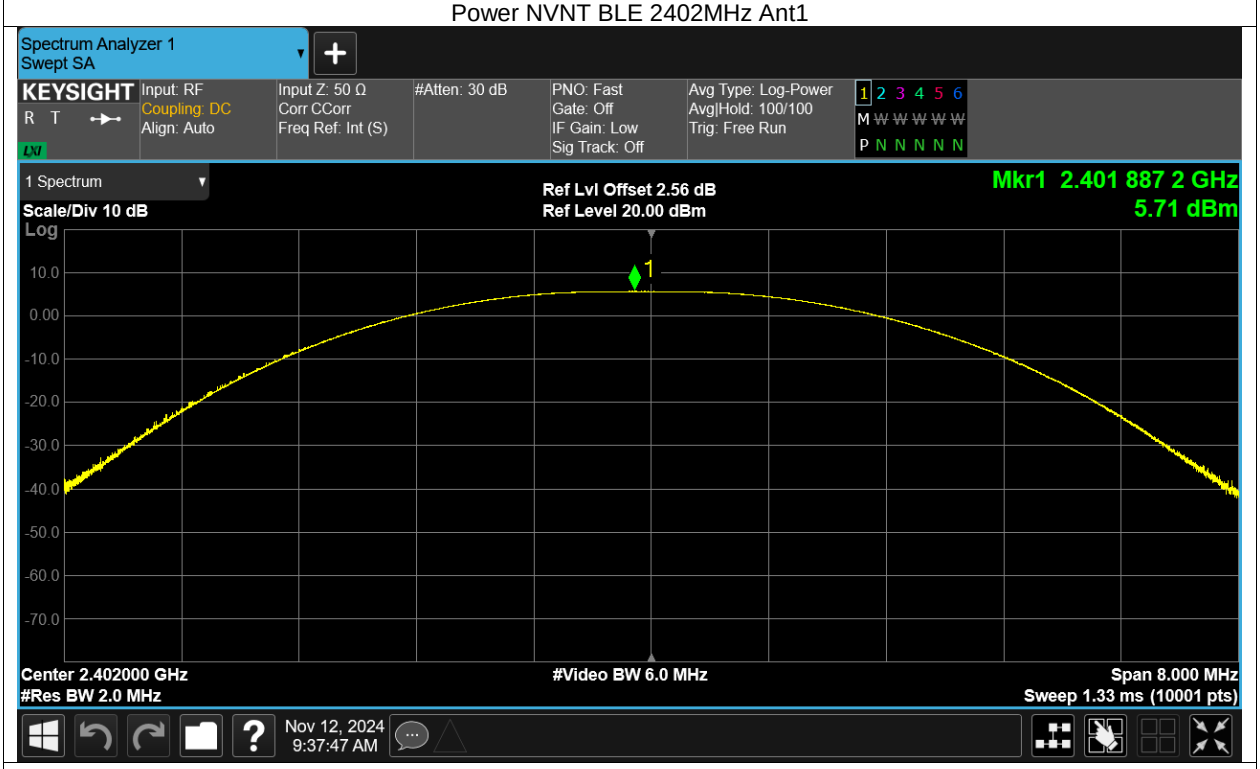
Test Data

Maximum Conducted Output Power

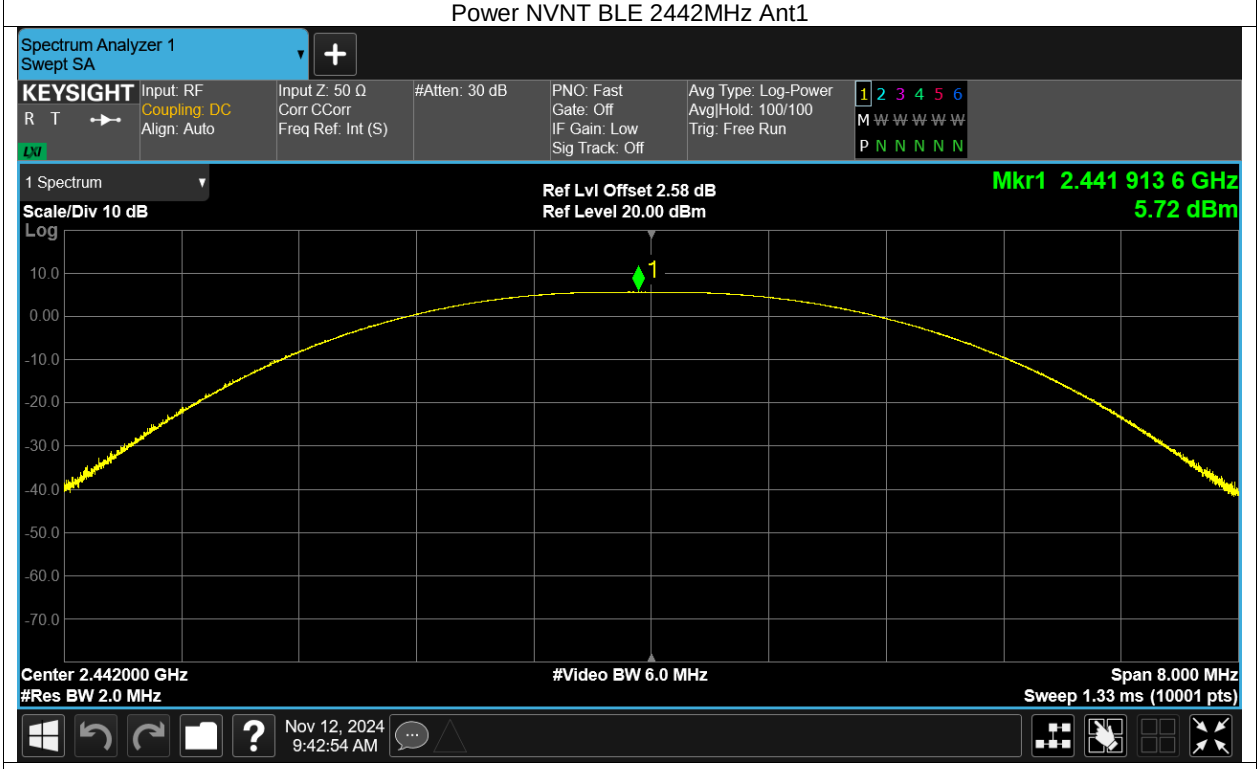
Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE	2402	Ant1	5.713	30	Pass
NVNT	BLE	2442	Ant1	5.719	30	Pass
NVNT	BLE	2480	Ant1	5.62	30	Pass

Test Graphs

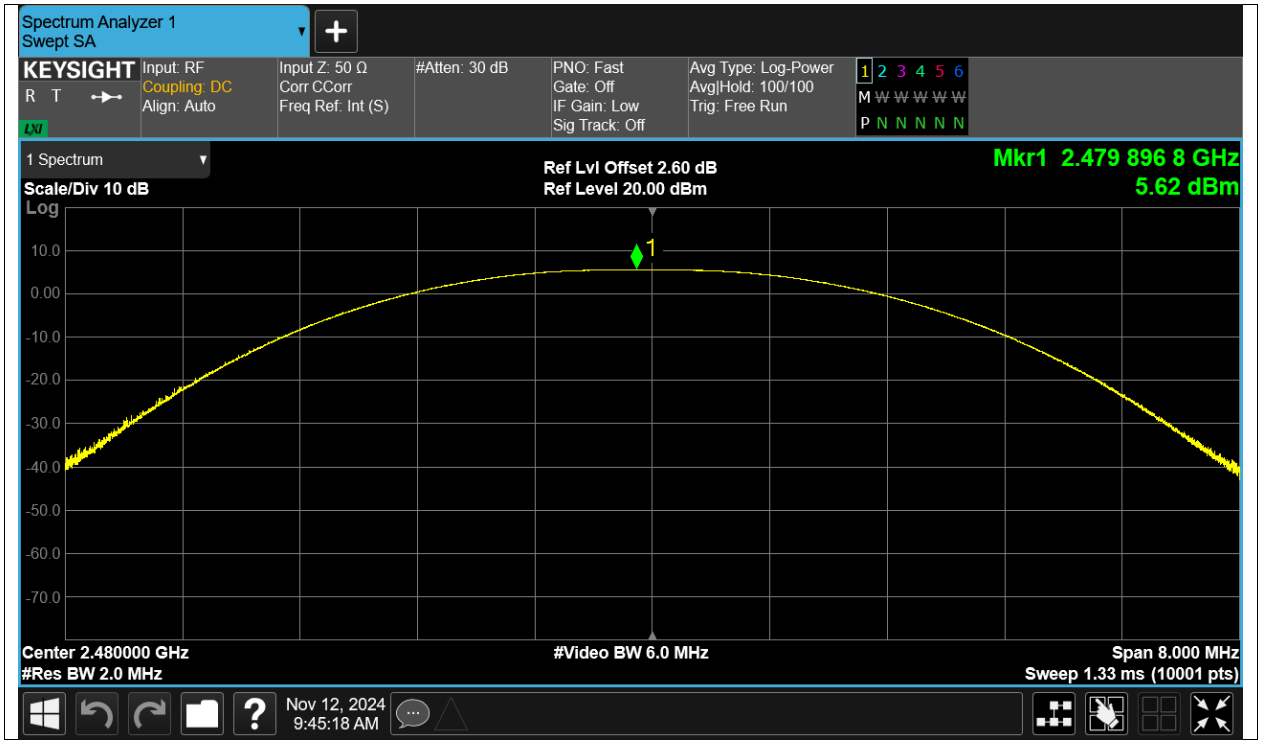
Power NVNT BLE 2402MHz Ant1



Power NVNT BLE 2442MHz Ant1



Power NVNT BLE 2480MHz Ant1

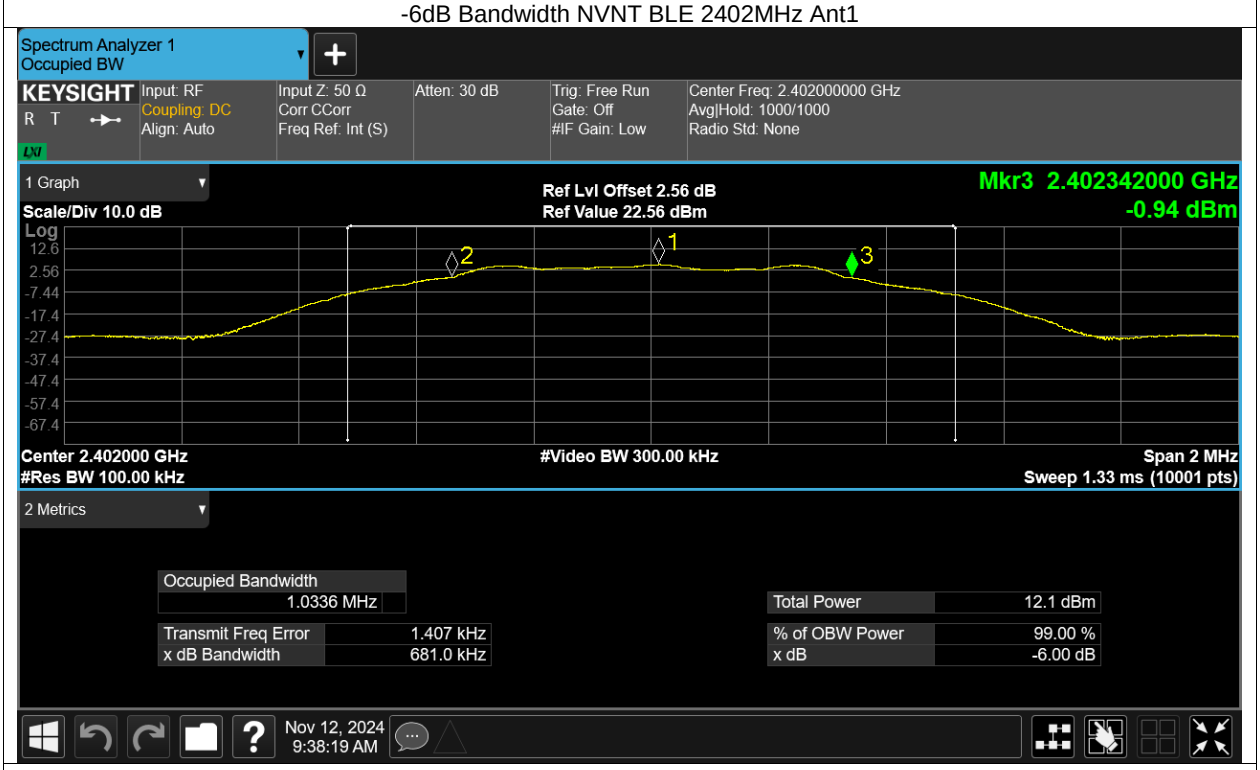

Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corr CCorr
Freq Ref: Int (S)
#Atten: 30 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold: 100/100
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 2.60 dB
Ref Level 20.00 dBm
Mkr1 2.479 896 8 GHz
5.62 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.480000 GHz
#Res BW 2.0 MHz
#Video BW 6.0 MHz
Span 8.000 MHz
Sweep 1.33 ms (10001 pts)
Nov 12, 2024
9:45:18 AM

-6dB Bandwidth

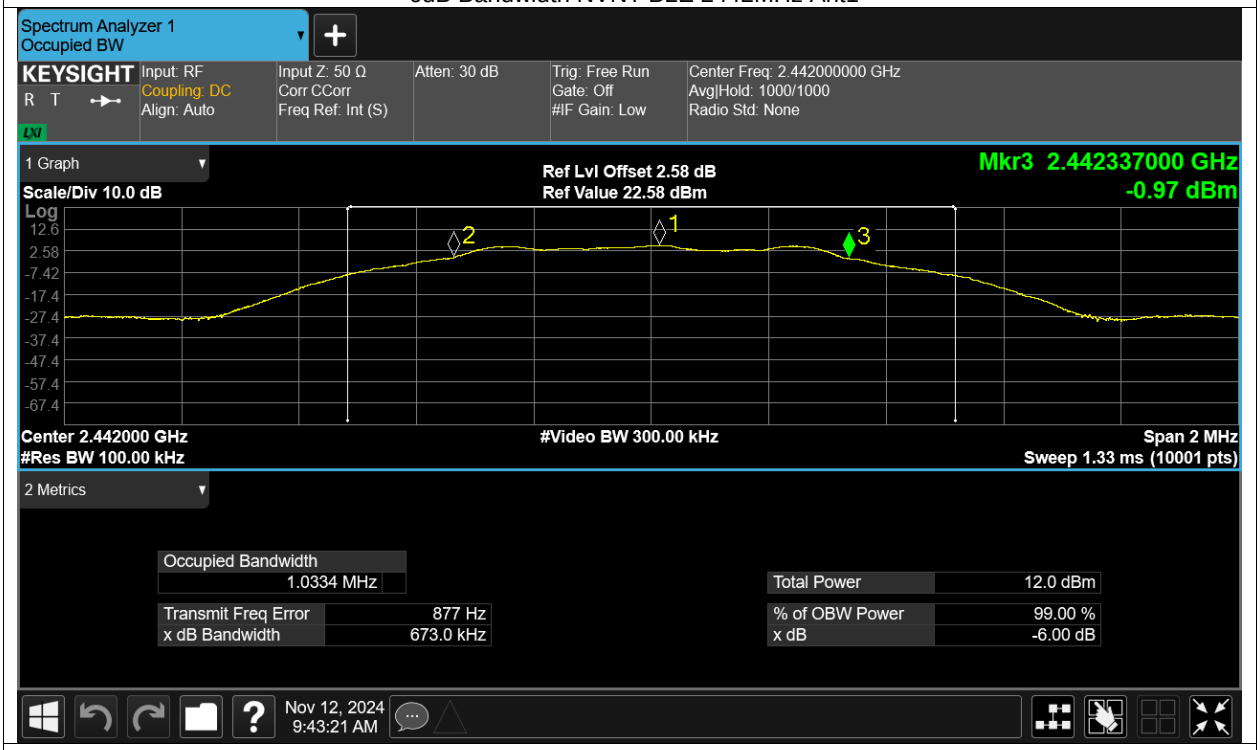
Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	limit	Verdic
NVNT	BLE	2402	Ant1	0.681	0.5	Pass
NVNT	BLE	2442	Ant1	0.673	0.5	Pass
NVNT	BLE	2480	Ant1	0.679	0.5	Pass

Test Graphs

-6dB Bandwidth NVNT BLE 2402MHz Ant1



-6dB Bandwidth NVNT BLE 2442MHz Ant1



-6dB Bandwidth NVNT BLE 2480MHz Ant1

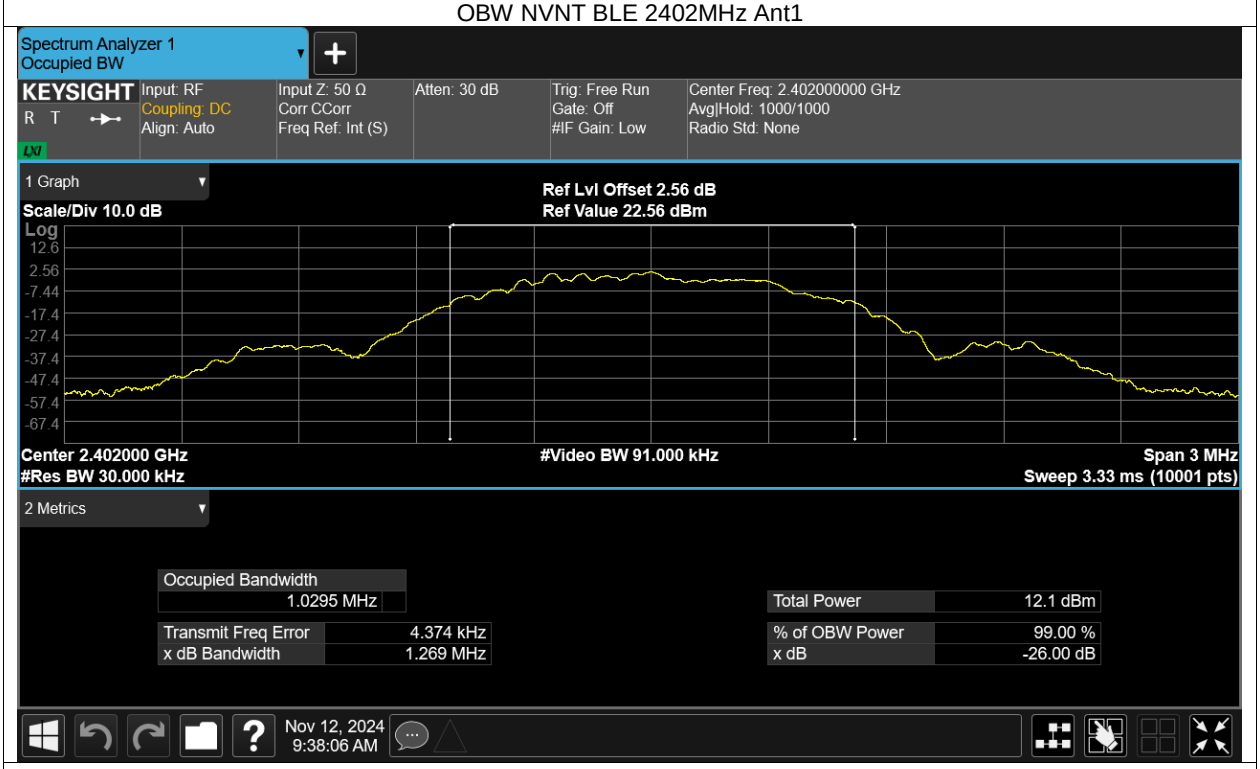

Spectrum Analyzer 1
Occupied BW
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corr CCorr
Freq Ref: Int (S)
Atten: 30 dB
Trig: Free Run
Gate: Off
#IF Gain: Low
Center Freq: 2.480000000 GHz
Avg|Hold: 1000/1000
Radio Std: None
1 Graph
Ref Lvl Offset 2.60 dB
Ref Value 22.60 dBm
Mkr3 2.480340000 GHz
-1.12 dBm
Scale/Div 10.0 dB
Log
12.6
2.60
-7.40
-17.4
-27.4
-37.4
-47.4
-57.4
-67.4
Center 2.480000 GHz
#Res BW 100.00 kHz
#Video BW 300.00 kHz
Span 2 MHz
Sweep 1.33 ms (10001 pts)
2 Metrics
Occupied Bandwidth
1.0336 MHz
Transmit Freq Error 94 Hz
x dB Bandwidth 679.0 kHz
Total Power 12.0 dBm
% of OBW Power 99.00 %
x dB -6.00 dB
Nov 12, 2024
9:45:47 AM

Occupied Channel Bandwidth

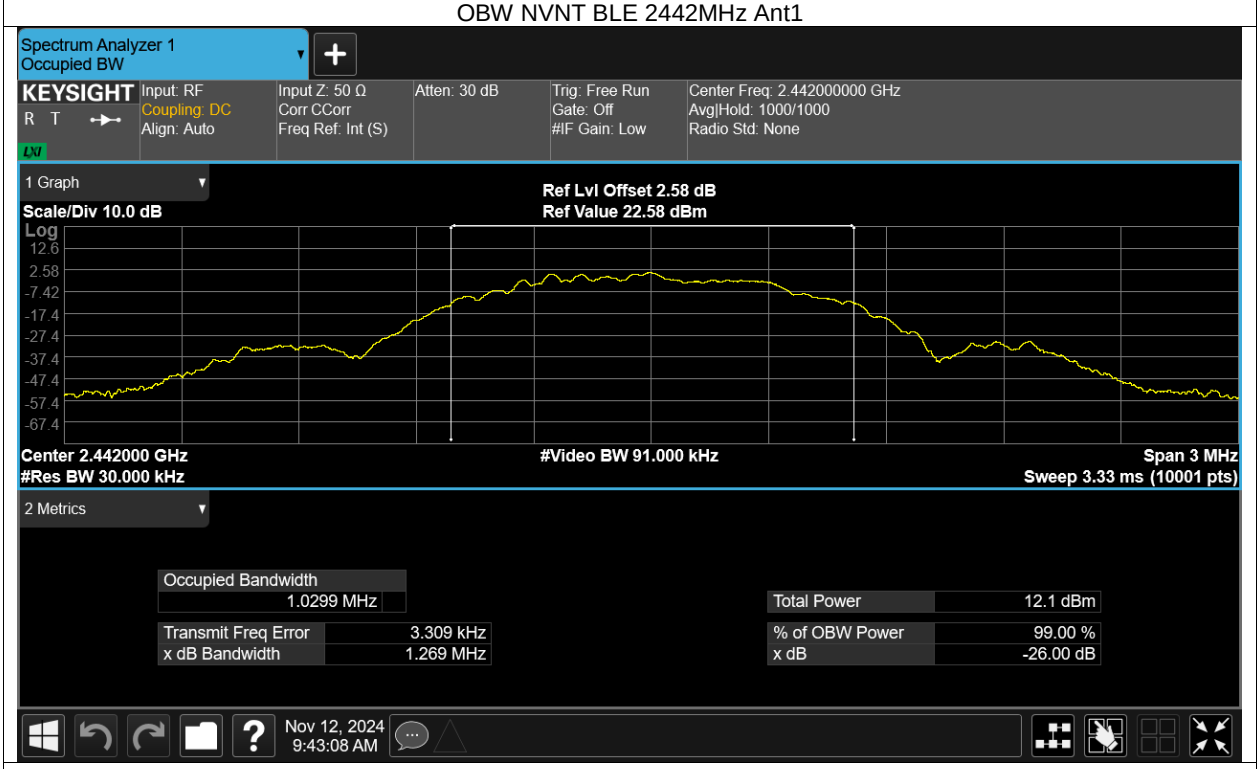
Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	BLE	2402	Ant1	1.03
NVNT	BLE	2442	Ant1	1.03
NVNT	BLE	2480	Ant1	1.03

Test Graphs

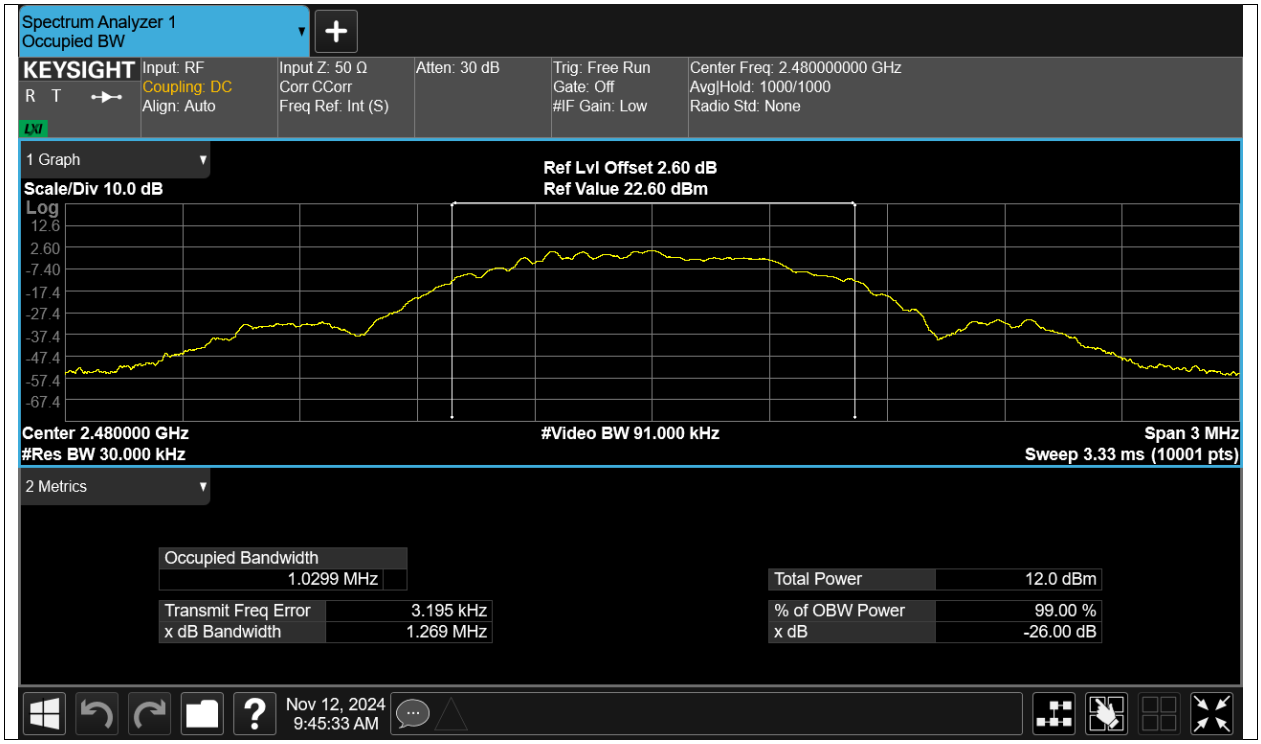
OBW NVNT BLE 2402MHz Ant1



OBW NVNT BLE 2442MHz Ant1



OBW NVNT BLE 2480MHz Ant1

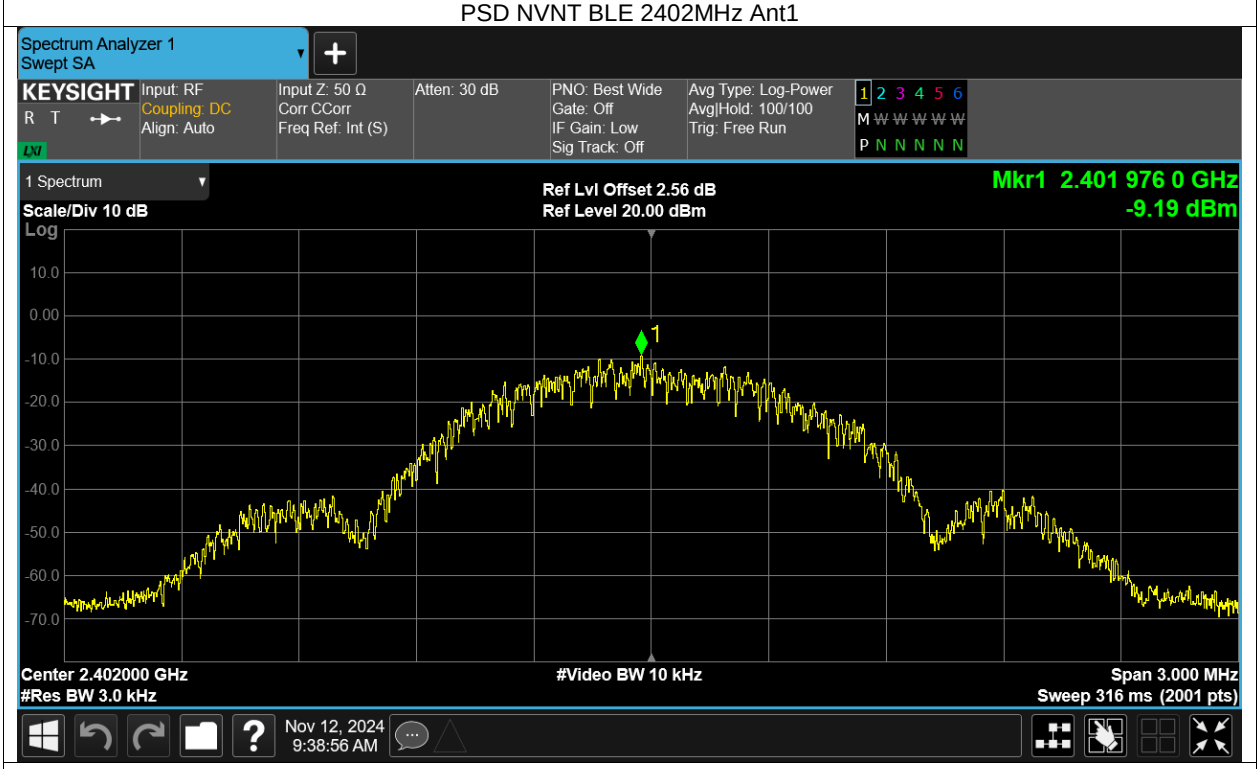

Spectrum Analyzer 1
Occupied BW
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corr CCorr
Freq Ref: Int (S)
Atten: 30 dB
Trig: Free Run
Gate: Off
#IF Gain: Low
Center Freq: 2.480000000 GHz
Avg|Hold: 1000/1000
Radio Std: None
1 Graph
Ref Lvl Offset 2.60 dB
Ref Value 22.60 dBm
Scale/Div 10.0 dB
Log
12.6
2.60
-7.40
-17.4
-27.4
-37.4
-47.4
-57.4
-67.4
Center 2.480000 GHz
#Res BW 30.000 kHz
#Video BW 91.000 kHz
Span 3 MHz
Sweep 3.33 ms (10001 pts)
2 Metrics
Occupied Bandwidth
1.0299 MHz
Transmit Freq Error 3.195 kHz
x dB Bandwidth 1.269 MHz
Total Power 12.0 dBm
% of OBW Power 99.00 %
x dB -26.00 dB
Nov 12, 2024
9:45:33 AM

Maximum Power Spectral Density Level

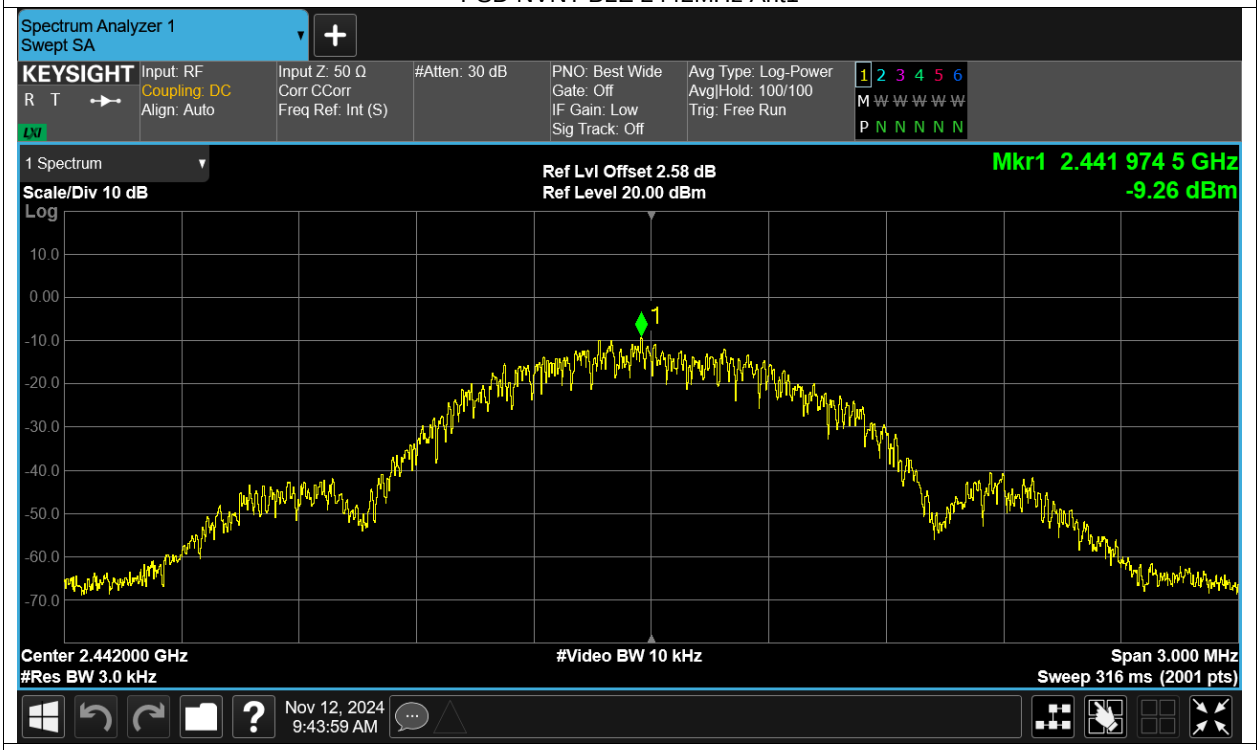
Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm)	Limit (dBm)	Verdict
NVNT	BLE	2402	Ant1	-9.187	8	Pass
NVNT	BLE	2442	Ant1	-9.256	8	Pass
NVNT	BLE	2480	Ant1	-9.409	8	Pass

Test Graphs

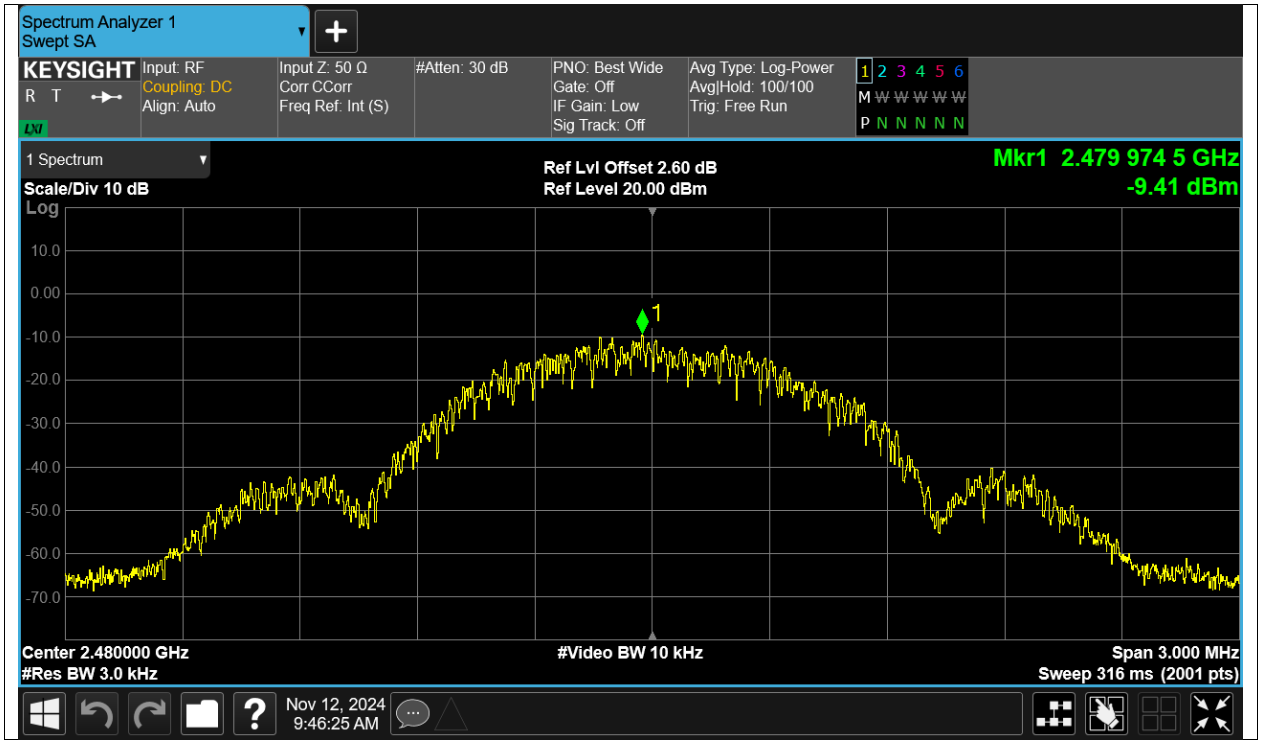
PSD NVNT BLE 2402MHz Ant1



PSD NVNT BLE 2442MHz Ant1



PSD NVNT BLE 2480MHz Ant1

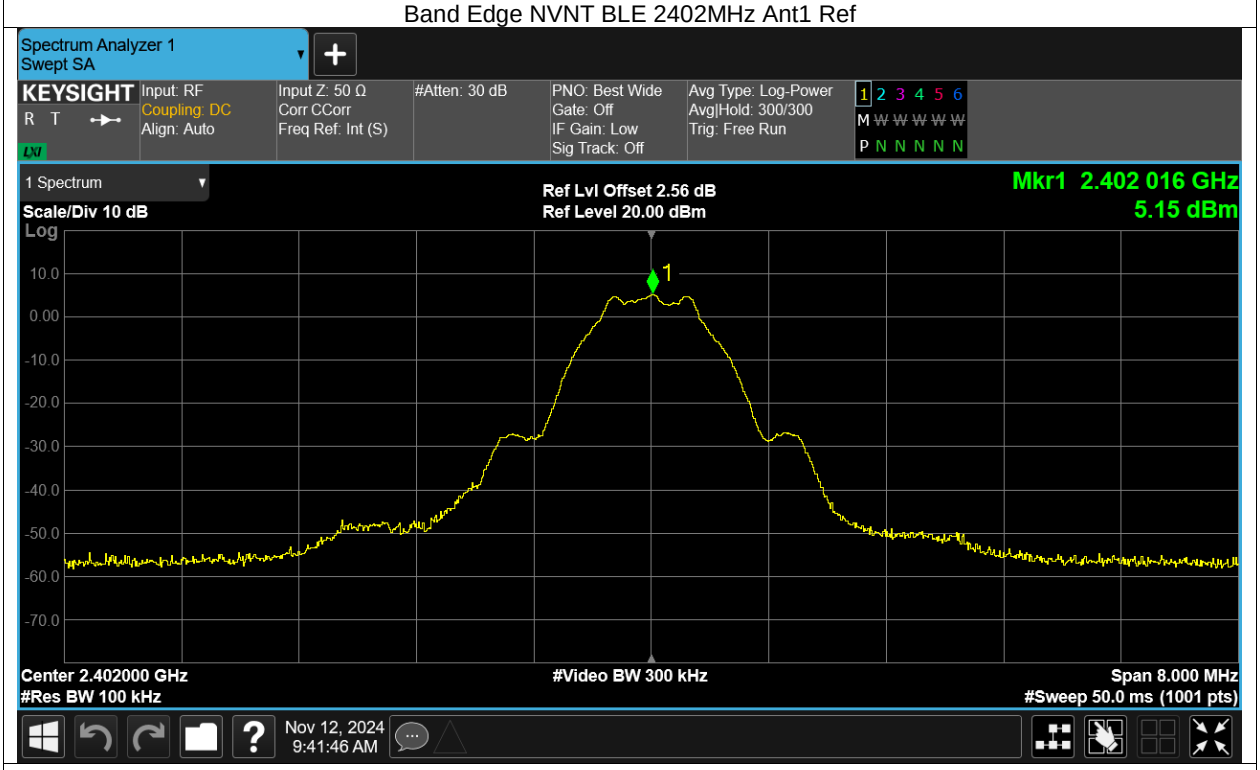

Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corr CCorr
Freq Ref: Int (S)
#Atten: 30 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold: 100/100
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 2.60 dB
Ref Level 20.00 dBm
Mkr1 2.479 974 5 GHz
-9.41 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.480000 GHz
#Res BW 3.0 kHz
#Video BW 10 kHz
Span 3.000 MHz
Sweep 316 ms (2001 pts)
Nov 12, 2024
9:46:25 AM

Band Edge

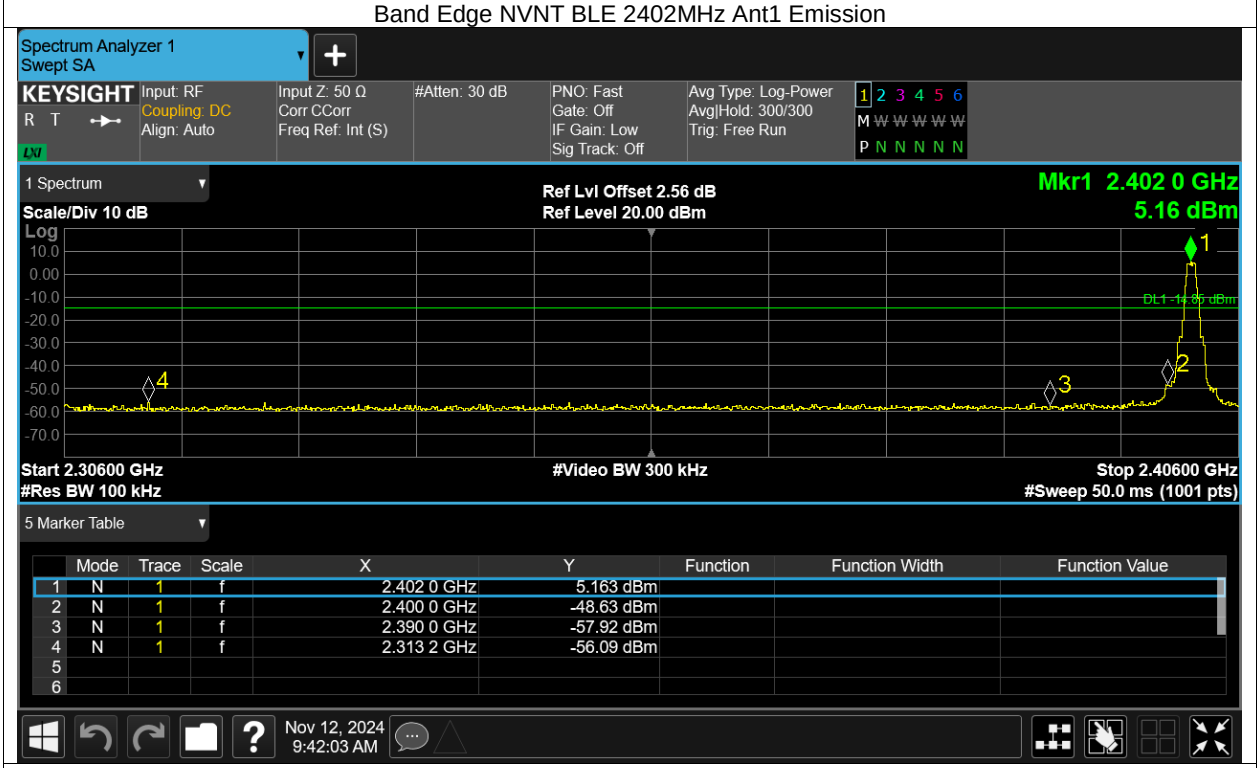
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE	2402	Ant1	-61.24	-20	Pass
NVNT	BLE	2480	Ant1	-60.54	-20	Pass

Test Graphs

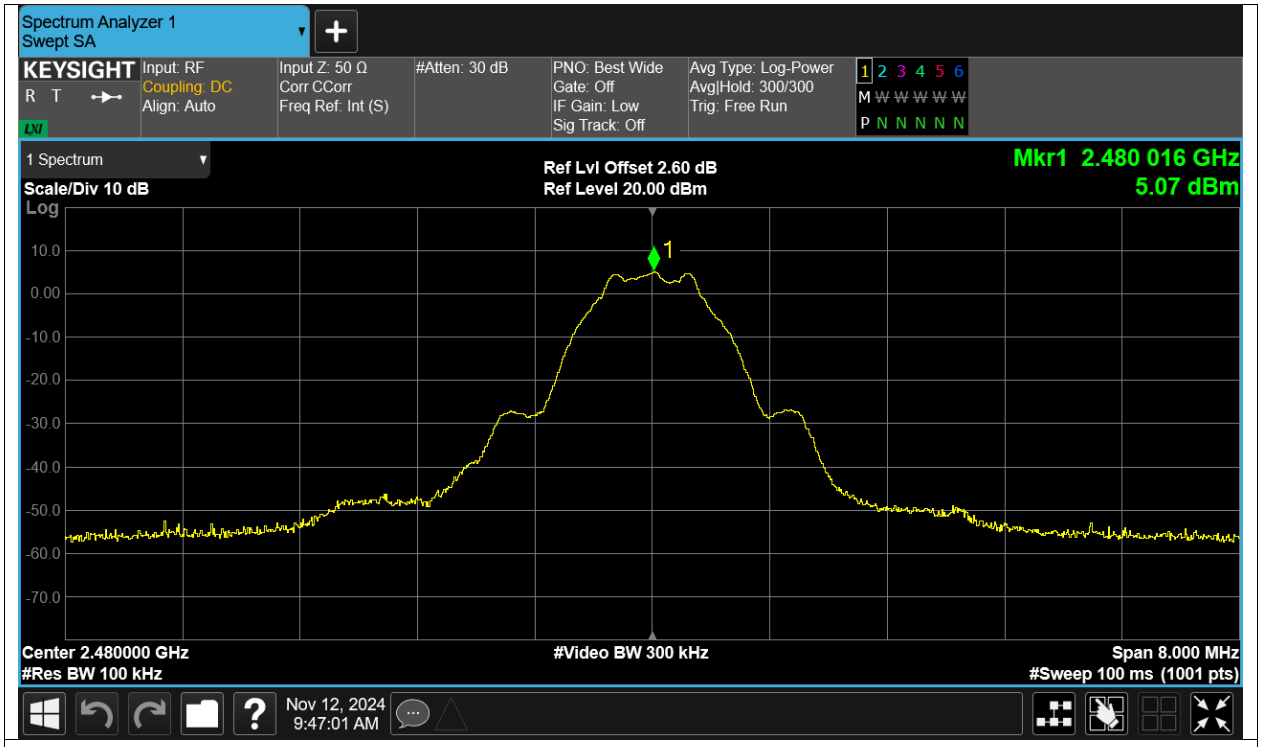
Band Edge NVNT BLE 2402MHz Ant1 Ref



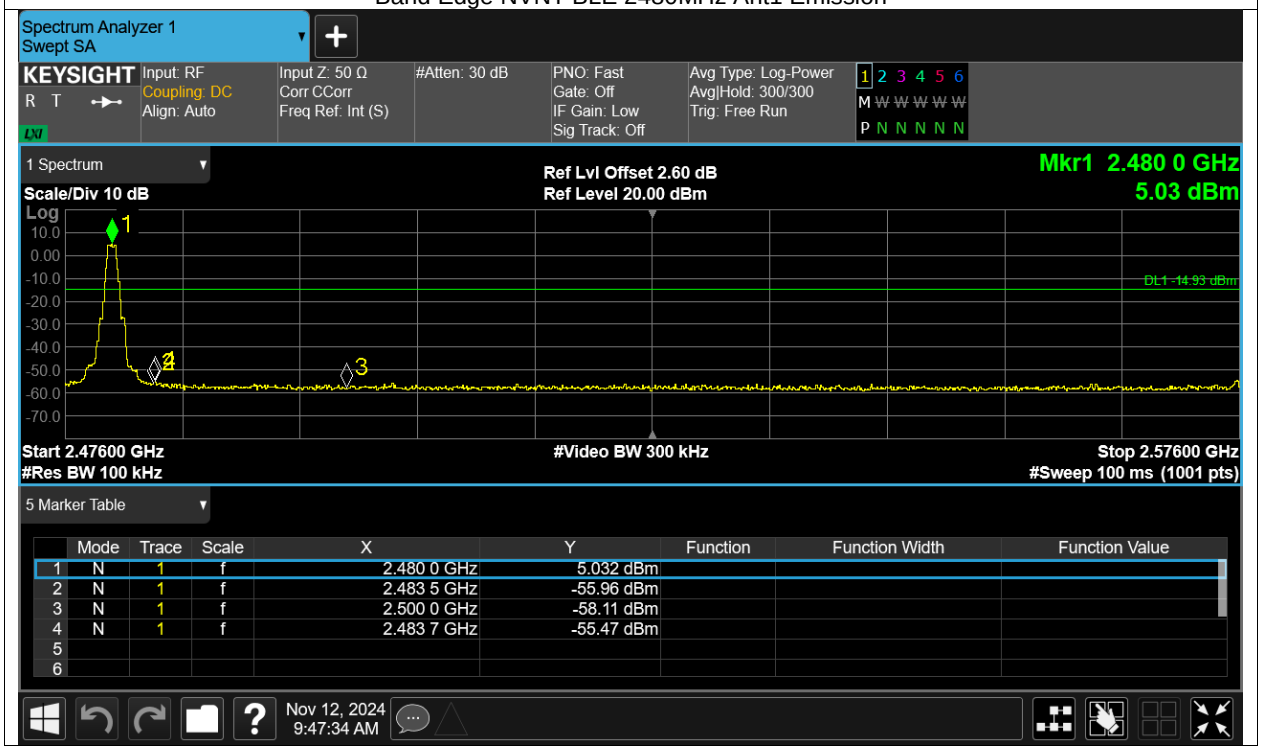
Band Edge NVNT BLE 2402MHz Ant1 Emission



Band Edge NVNT BLE 2480MHz Ant1 Ref



Band Edge NVNT BLE 2480MHz Ant1 Emission

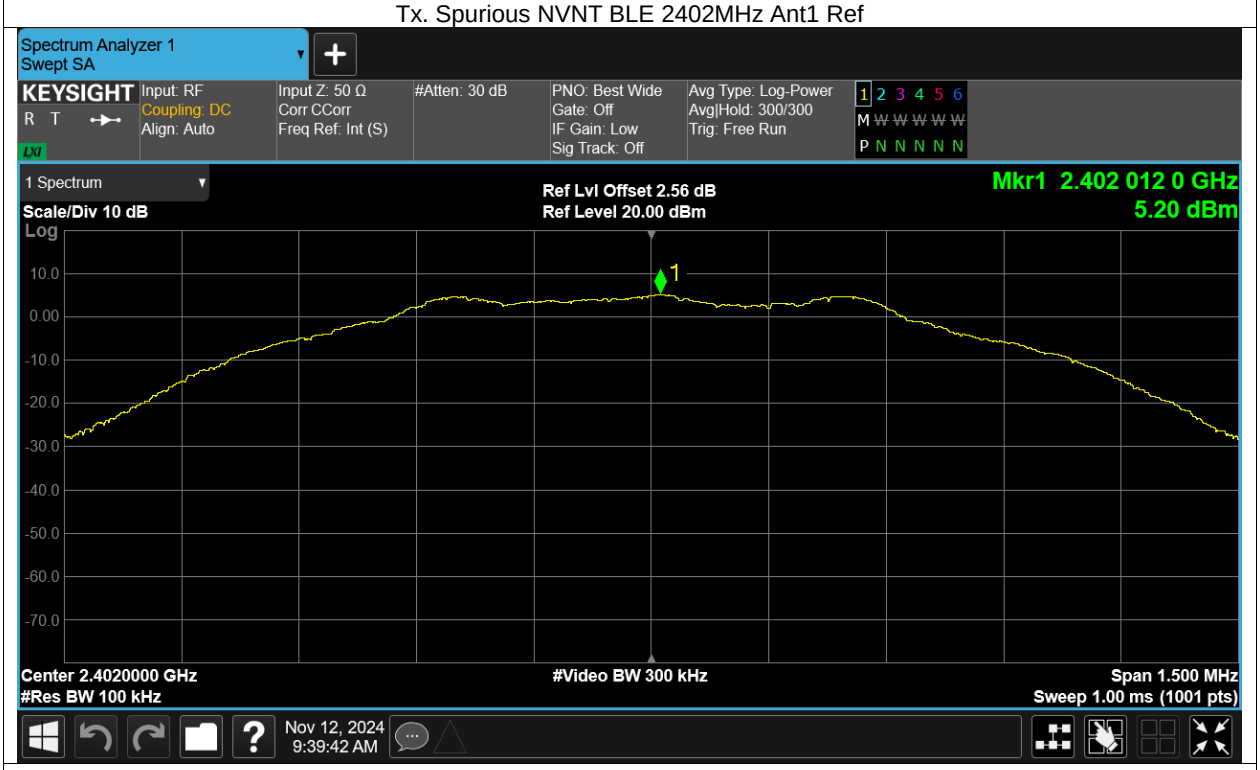


Conducted RF Spurious Emission

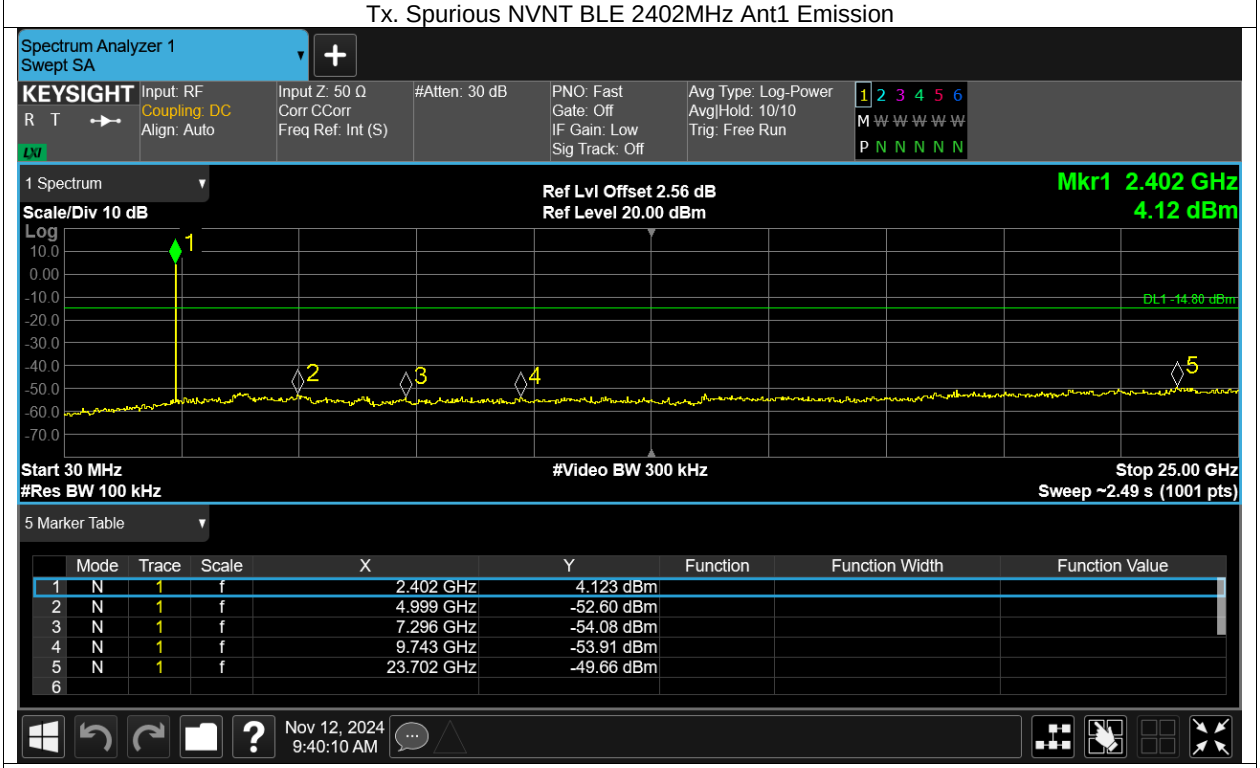
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE	2402	Ant1	-54.86	-20	Pass
NVNT	BLE	2442	Ant1	-54.34	-20	Pass
NVNT	BLE	2480	Ant1	-53.21	-20	Pass

Test Graphs

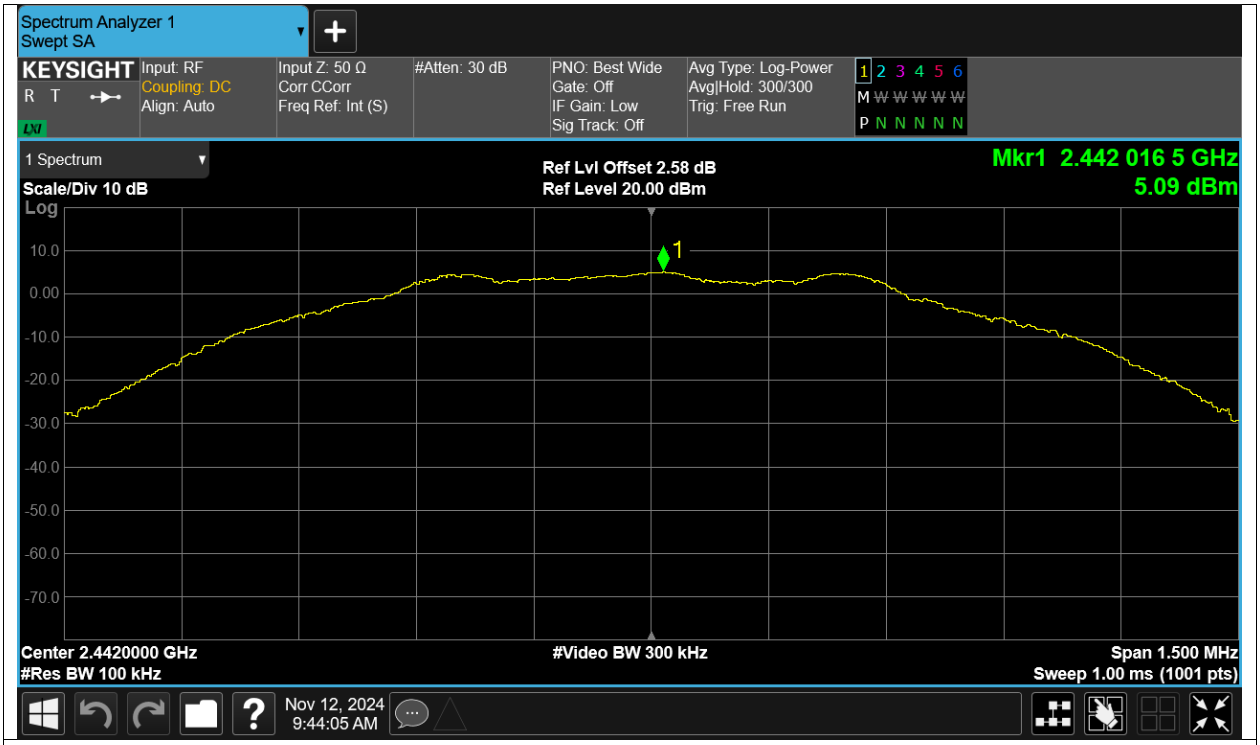
Tx. Spurious NVNT BLE 2402MHz Ant1 Ref



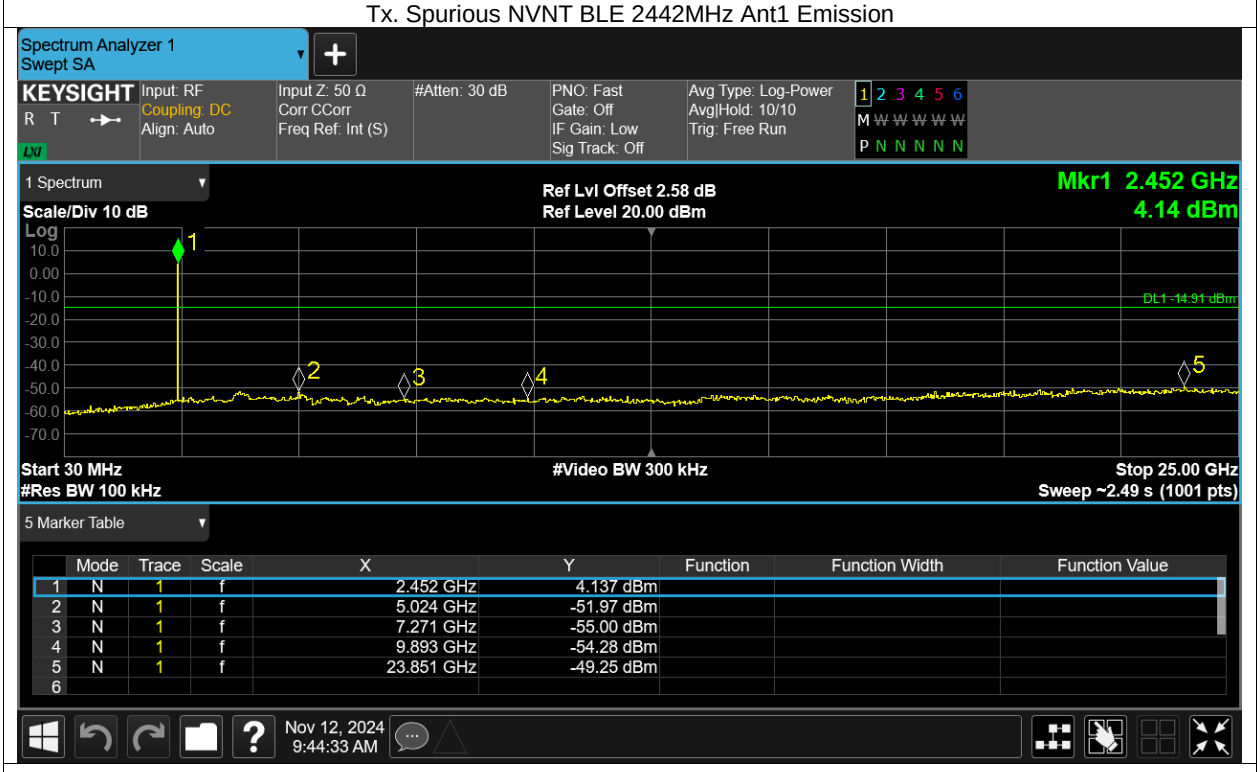
Tx. Spurious NVNT BLE 2402MHz Ant1 Emission



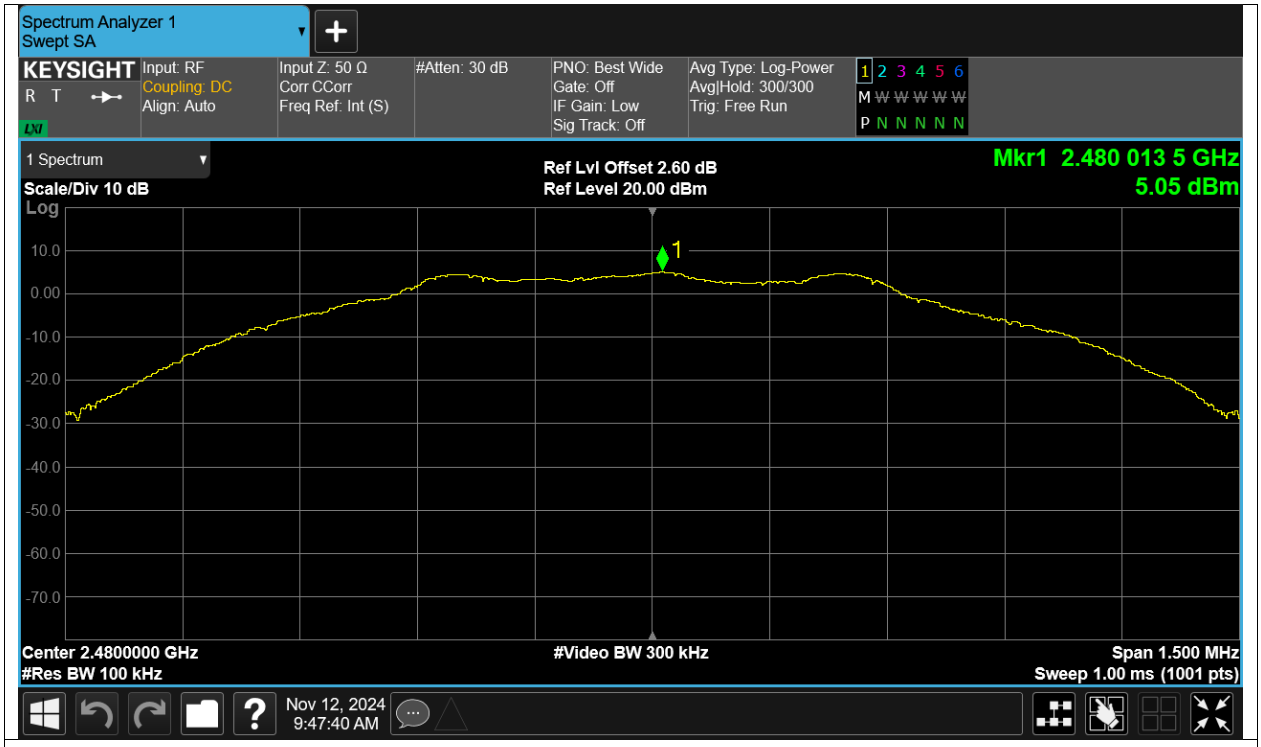
Tx. Spurious NVNT BLE 2442MHz Ant1 Ref



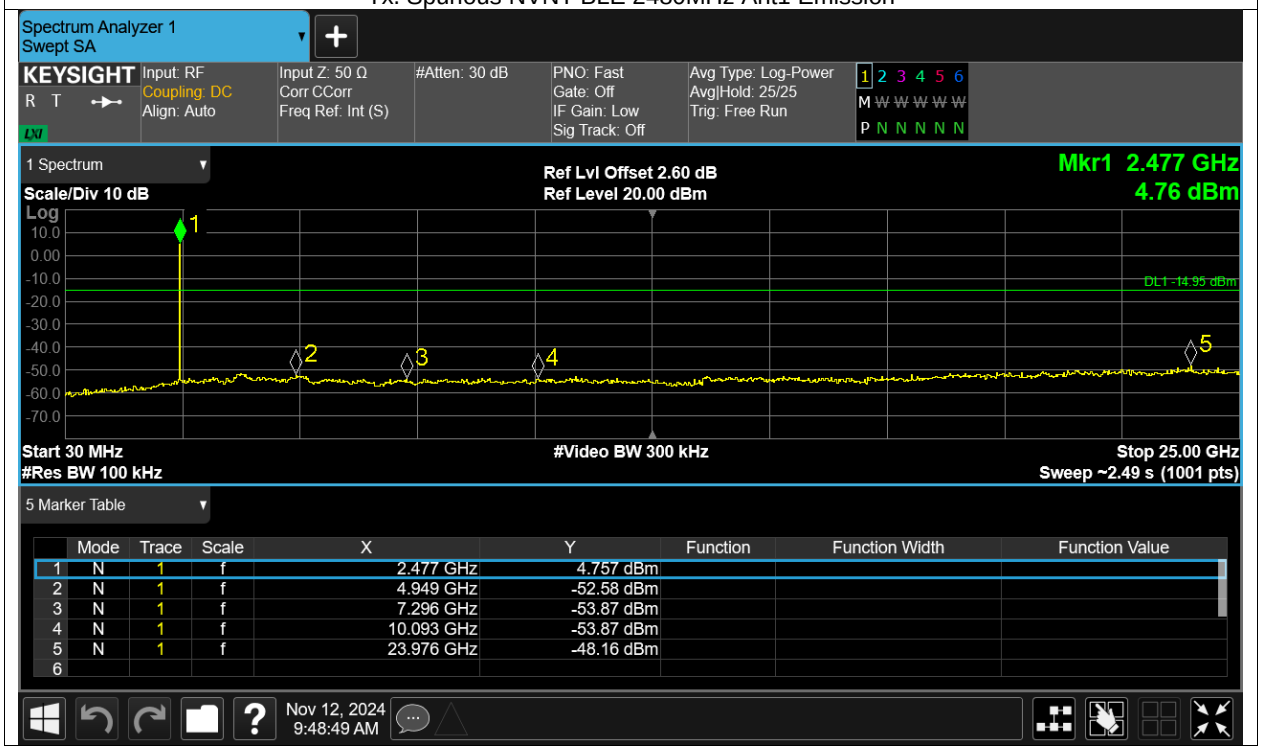
Tx. Spurious NVNT BLE 2442MHz Ant1 Emission



Tx. Spurious NVNT BLE 2480MHz Ant1 Ref



Tx. Spurious NVNT BLE 2480MHz Ant1 Emission



------End of report------