FCC PART 15.247
TEST REPORT

On Behalf of

Shenzhen NEWTEK Technology Co.,Ltd

101, Building A, No. 121, Shapu 2nd Road, Songgang Street, Baoan District, Shenzhen

FCC ID: 2BDWR-5518D
Model: 5518D, 5519D, 5520D, 5518W

December 14, 2023

This Report Concerns:	**Equipment Type:**
☒ Original Report	Wireless keyboard

Test Engineer:	Fan Yang / Fan Yang
Report Number:	**QCT23LR-2236E-01**
Test Date:	December 4~5, 2023
Reviewed By:	Gordon Tan/ Gordon.Tan
Approved By:	Kendy Wang / Kendy Wang
Prepared By:	**Shenzhen QC Testing Laboratory Co., Ltd.** East of 1/F., Building E, Xinghong Science Park, No.111, Shuiku Road, Fenghuanggang, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China **Tel: 0755-23008269** **Fax: 0755-23726780**

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Revision History of This Test Report

Report Number	Description	Issued Date
QCT23LR-2236E-01	Initial Issue	2023-12-14

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1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Description	Wireless keyboard
Model No.	5518D, 5519D, 5520D, 5518W
Tested Model	5518D
Sample(s) Status	Engineer sample
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	40
Channel separation:	2MHz
Modulation type:	GFSK
Antenna Type:	Multilayer chip Antenna
Antenna gain:	2.67dBi*1
Power supply:	DC 3V (Powered by battery 1.5V AAA*2)
Trade Mark:	N/A
Applicant	Shenzhen NEWTEK Technology Co.,Ltd
Address	101, Building A, No. 121, Shapu 2nd Road, Songgang Street, Baoan District, Shenzhen
Manufacturer	Shenzhen NEWTEK Technology Co.,Ltd
Address	101, Building A, No. 121, Shapu 2nd Road, Songgang Street, Baoan District, Shenzhen
Sample No.	Y23L2235E01YN

Note: *1This information provided by Manufacturer, SZ QC Lab is not responsible for the accuracy of this information.

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1.2 System Test Configuration

1.2.1 Channel List

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402 MHz	11	2422 MHz	21	2442 MHz	31	2462 MHz
2	2404 MHz	12	2424 MHz	22	2444 MHz	32	2464 MHz
3	2406 MHz	13	2426 MHz	23	2446 MHz	33	2466 MHz
4	2408 MHz	14	2428 MHz	24	2448 MHz	34	2468 MHz
5	2410 MHz	15	2430 MHz	25	2450 MHz	35	2470 MHz
6	2412 MHz	16	2432 MHz	26	2452 MHz	36	2472 MHz
7	2414 MHz	17	2434 MHz	27	2454 MHz	37	2474 MHz
8	2416 MHz	18	2436 MHz	28	2456 MHz	38	2476 MHz
9	2418 MHz	19	2438 MHz	29	2458 MHz	39	2478 MHz
10	2420 MHz	20	2440 MHz	30	2460 MHz	40	2480 MHz

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2440MHz
The Highest channel	2480MHz

1.2.2 EUT Exercise Software

" BK32xx RF Test_V1.9.1 " software was used to test, The power level is 3. The software and power level was provided by the applicant.

1.2.3 Support Equipment

Manufacturer	Description	Model	Serial Number
Notebook	DELL	Inspiron 15 3511	/

1.2.4 Test mode

Transmitting mode: Keep the EUT in continuously transmitting.

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1.3 Test Facility

Test Firm : Shenzhen QC Testing Laboratory Co., Ltd.

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19. The testing quality system of our laboratory meets with ISO/IEC-17025 requirements. This approval result is accepted by MRA of APLAC.

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

CNAS – Registration No.: L8464

The EMC Laboratory has been accredited by CNAS, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

A2LA Certificate Number: 6759.01

The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 561109

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 29628

CAB identifier: CN0141

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

1.4 Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±1.42 x10^{-4}%
RF output power, conducted	±1.06dB
Power Spectral Density, conducted	±1.06dB
Unwanted Emissions, conducted	±2.51dB
AC Power Line Conducted Emission	±1.80dB
Radiated Spurious Emission test (9kHz-30MHz)	±2.66dB
Radiated Spurious Emission test (30MHz-1000MHz)	±4.04dB
Radiated Spurious Emission test (1000MHz-18000MHz)	±4.70 dB
Radiated Spurious Emission test (18GHz-40GHz)	±4.80dB
Temperature	±0.8℃
Humidity	±3.2%
DC and low frequency voltages	±0.1%
Time	±5%
Duty cycle	±5%

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

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2. Summary of Test Results

Test Item	Section	Result
Antenna Requirement	FCC part 15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	FCC part 15.207	Pass
Conducted Peak Output Power	FCC part 15.247 (b)(3)	Pass
Channel Bandwidth & 99% Occupied Bandwidth	FCC part 15.247 (a)(2)	Pass
Power Spectral Density	FCC part 15.247 (e)	Pass
Band Edge	FCC part 15.247(d)	Pass
Spurious Emissions	FCC part 15.205/15.209	Pass

Note: 1. Pass: The EUT complies with the essential requirements in the standard.

2.Test according to ANSI C63.10:2013

3.. All indications of Pass/Fail in this report are opinions expressed by Shenzhen QC Testing Laboratory Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.

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3. List of Test and Measurement Instruments

3.1 Conducted Emission Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	EMI Test Receiver	R&S	ESIB 7	2277573376	2023.03.21	2024.03.20
2	Artificial Mains Network	SCHWARZBECK	NSLK8126	8126200	2023.03.21	2024.03.20
3	PULSE LIMITER	R&S	ESH3-Z2	100058	2023.03.21	2024.03.20
4	EMITEST RECEIVER	ROHDE & SCHWARZ	ESCS30	834115/014	2023.03.21	2024.03.20
Conducted Emission Measurement Software: TS						

3.2 Radiated Emission Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1.	Spectrum Analyzer	ROHDE&SCHWARZ	FSV 40	101458	2023.04.12	2024.04.11
2.	Loop Antenna	EMCO	6502	2133	2022.07.23	2024.07.22
3.	Logarithmic compound broadband Antenna	SCKWARZBECK	VULB9168	VULB9168-1-588	2023.04.01	2025.03.31
4.	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB 7	2277573376	2023.04.12	2024.04.11
5.	EMI Test Receiver	R&S	ESPI	101131	2023.03.21	2024.03.20
6.	Horn Antenna	SCHWARZBECK	BBHA9120D	02069	2023.04.01	2025.03.31
7.	Horn Antenna	COM-MW	ZLB7-18-40G -950	12221225	2023.01.12	2025.01.09
8.	Amplifier	R&S	BBV9721	9721-031	2023.03.21	2024.03.20
9.	Amplifier	HPX	BP-01G-18G	210902	2023.03.21	2024.03.20
10.	Pre-amplifier	COM-MW	DLAN-18000 -40000-02	10229104	2023.01.11	2024.01.10
11.	966 Chamber	ZhongYu Electron	9*6*6	/	2022.07.25	2025.07.24
Radiated Emission Measurement Software: EZ_EMC						

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3.3 RF Conducted test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1.	Wideband Radio Communication Tester	Rohde & Schwarz	CW500	151583	2023.03.21	2024.03.20
2.	Spectrum Analyzer	ROHDE& SCHWARZ	FSV 40	101458	2023.04.12	2024.04.11
3.	Signal Generator	Agilent	N5182A	MY50141563	2023.03.21	2024.03.20
4.	RF Automatic Test System	MW	MW100-RFCB/ MW100-PSB	MW2007004	2023.03.21	2024.03.20
RF Conducted Measurement Software: MTS 8310						

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4. Antenna requirement

Standard requirement: FCC Part15 C Section 15.203 /247(c)

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(c) (1)(i) requirement:
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

EUT Antenna: The Ant is Multilayer chip Antenna, the best case gain of the antenna is 2.67dBi, reference to the Internal photo for details.

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5. Conducted Emissions

5.1 Applicable Standard

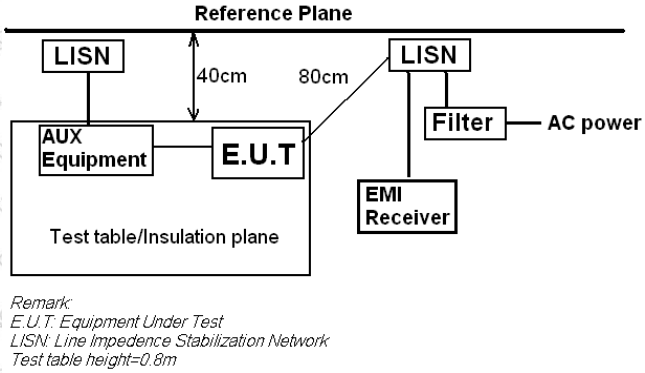
FCC Part15 C Section 15.207

5.2 Limit

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

Note *: The level decreases linearly with the logarithm of the frequency.

5.3 Test setup



5.4 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.
RBW=9 kHz, VBW=30 kHz, Sweep time=auto

5.5 Test procedure

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.

5.6 Test Data

Temperature	27.1℃	Humidity	45%
ATM Pressure	101.1kPa	Antenna Gain	2.67dBi
Test by	Fan Yang	Test result	PASS

Test voltage: AC 120V/60Hz

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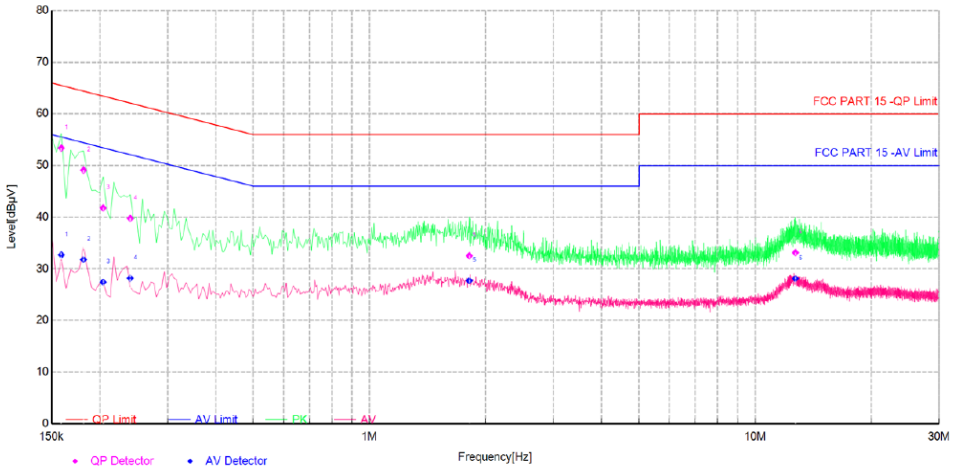
Measurement data:

Pre-scan all test modes, found worst case at BLE 1M 2402MHz, and so only show the test result of BLE 1M 2402MHz.

Line:



Final Data List										
NO.	Freq. [MHz]	Factor[dB]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Phase	Verdict
1	0.159	10.05	53.40	65.52	12.12	32.70	55.52	22.82	L	PASS
2	0.1815	10.17	49.13	64.42	15.29	31.79	54.42	22.63	L	PASS
3	0.2040	10.28	41.78	63.45	21.67	27.40	53.45	26.05	L	PASS
4	0.2400	10.38	39.75	62.10	22.35	28.18	52.10	23.92	L	PASS
5	1.8150	10.13	32.53	56.00	23.47	27.70	46.00	18.30	L	PASS
6	12.7145	10.32	33.13	60.00	26.87	28.09	50.00	21.91	L	PASS

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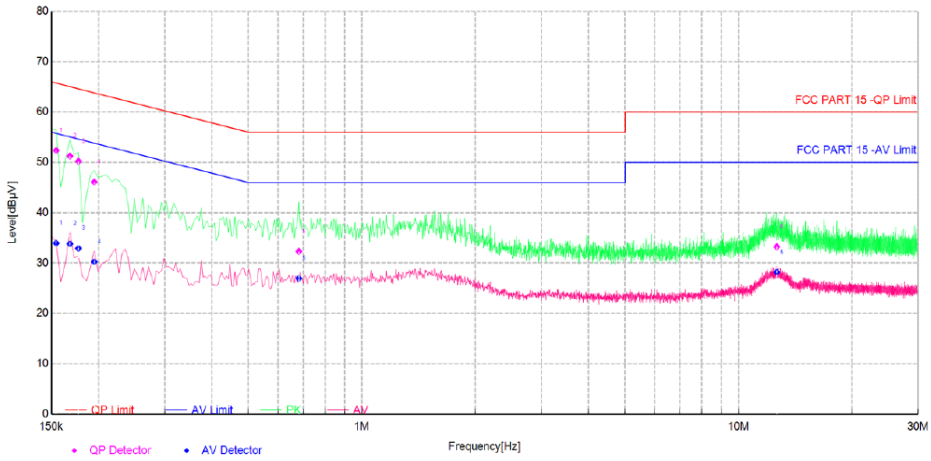
Neutral:



Final Data List										
NO.	Freq. [MHz]	Factor[dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Phase	Verdict
1	0.1545	10.01	52.36	65.75	13.39	33.93	55.75	21.82	N	PASS
2	0.1680	10.11	51.25	65.06	13.81	33.81	55.06	21.25	N	PASS
3	0.1770	10.16	50.22	64.63	14.41	32.93	54.63	21.70	N	PASS
4	0.1950	10.29	46.10	63.82	17.72	30.25	53.82	23.57	N	PASS
5	0.6810	10.20	32.31	56.00	23.69	26.95	46.00	19.05	N	PASS
6	12.6380	10.35	33.22	60.00	26.78	28.19	50.00	21.81	N	PASS

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.

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6. Conducted Peak Output Power

6.1 Applicable Standard

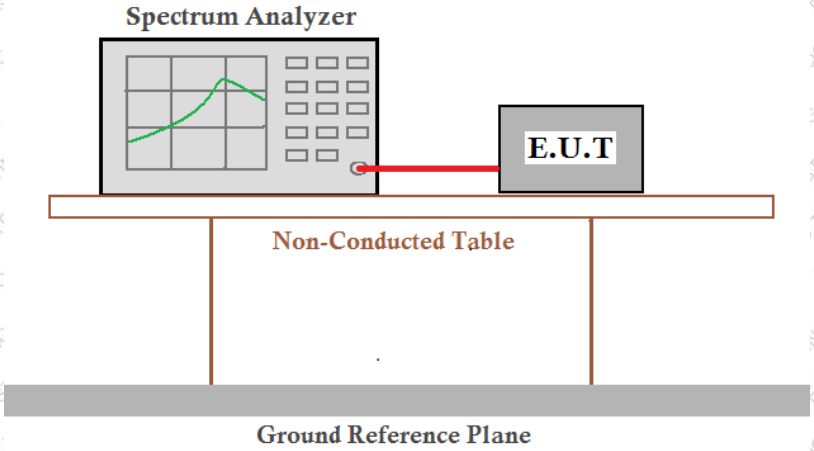
FCC Part15 C Section 15.247 (b)(3)

6.2 Limit

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

6.3 Test setup



6.4 Test Data

Temperature	25.9 ℃	Humidity	48%
ATM Pressure	101.1kPa	Antenna Gain	2.67dBi
Test by	Fan Yang	Test result	PASS

Please refer to following table and plots.

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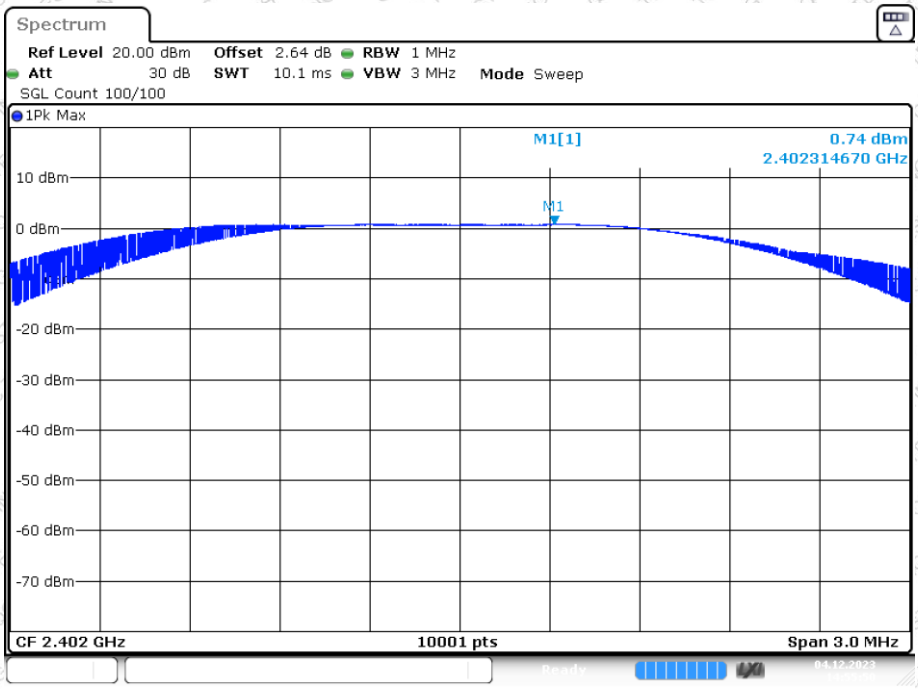
Output Power:

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
BLE 1M	Lowest	0.74	30	Pass
	Middle	-0.16		
	Highest	0.32		
BLE 2M	Lowest	0.87	30	Pass
	Middle	-0.09		
	Highest	0.38		

Power NVNT BLE 1M 2402MHz Ant1



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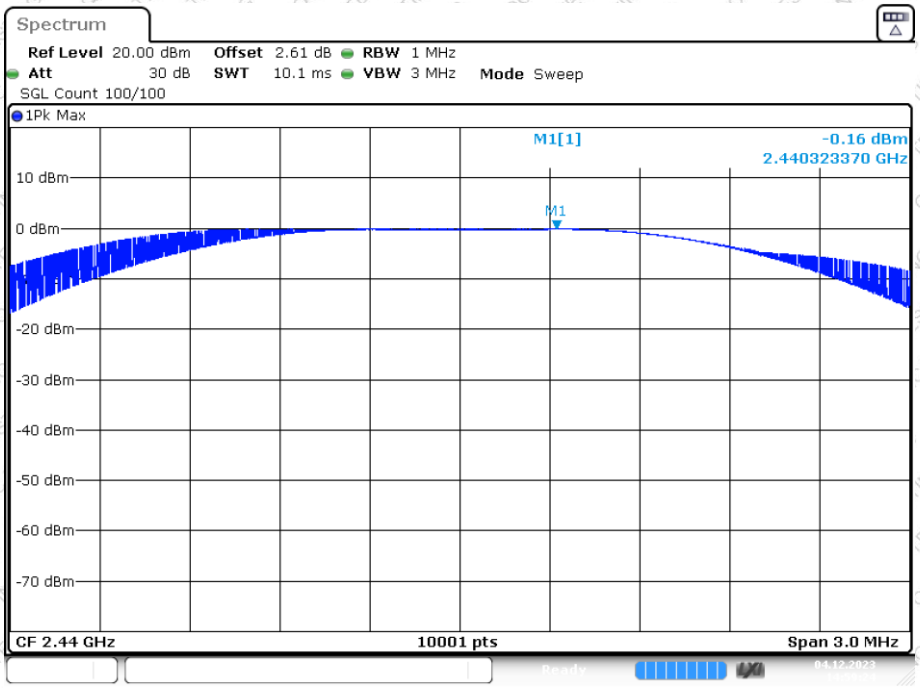
Power NVNT BLE 1M 2440MHz Ant1



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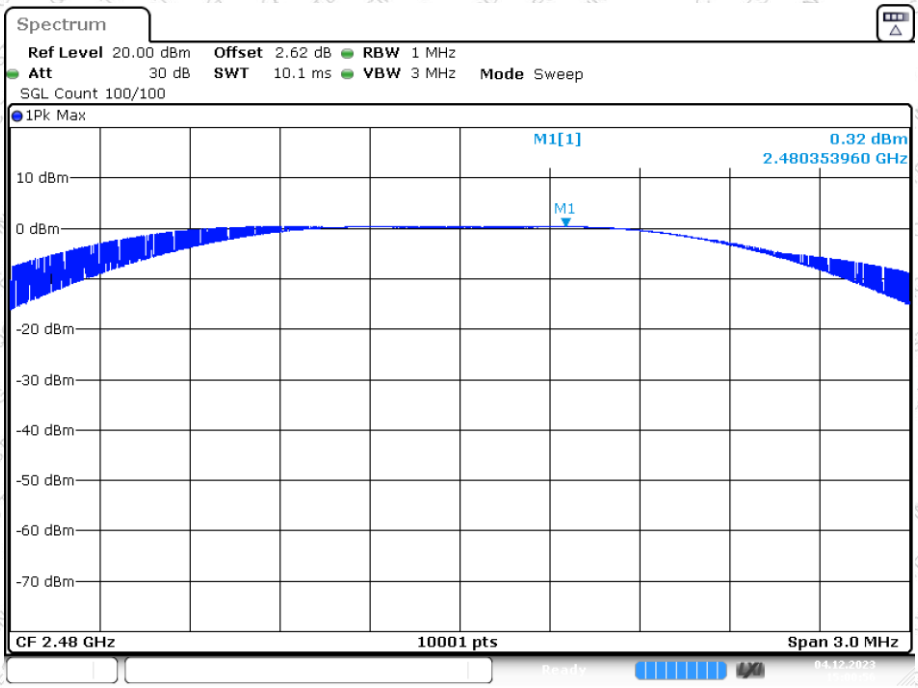
Power NVNT BLE 1M 2480MHz Ant1



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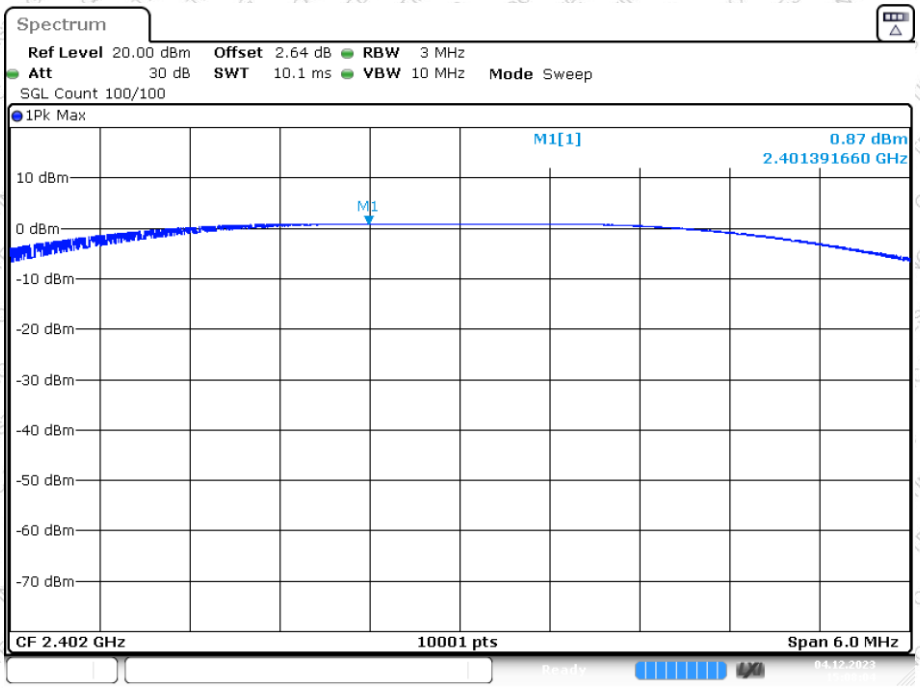
Power NVNT BLE 2M 2402MHz Ant1



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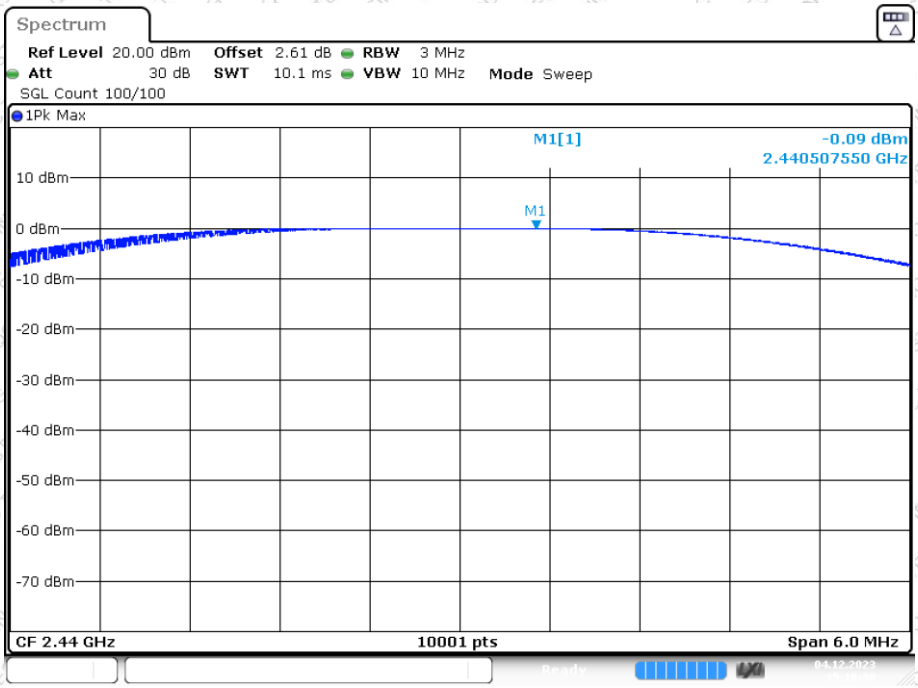
Power NVNT BLE 2M 2440MHz Ant1



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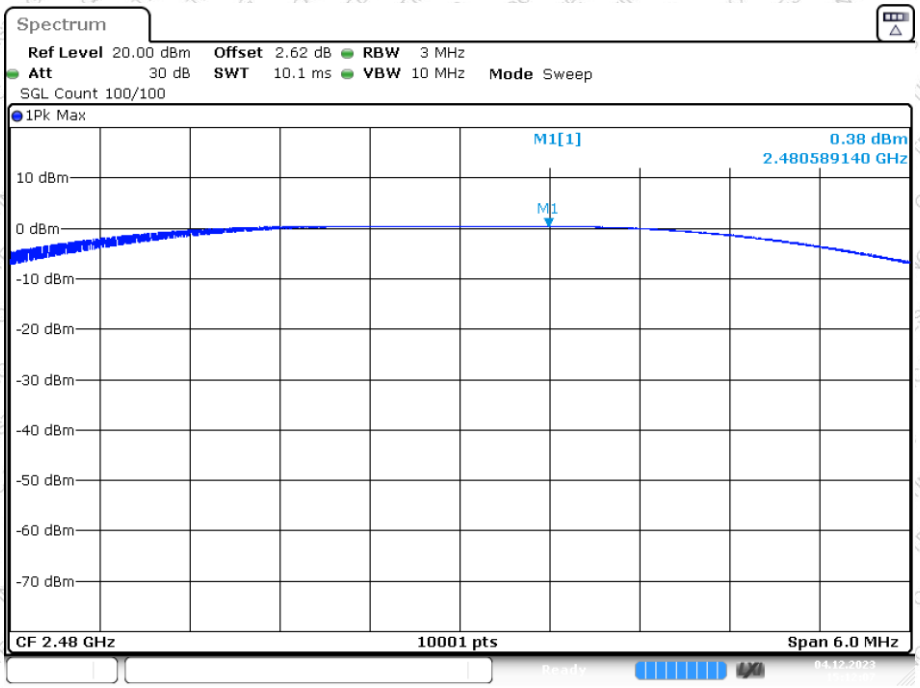
Power NVNT BLE 2M 2480MHz Ant1



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7. Channel Bandwidth & 99% Occupied Bandwidth

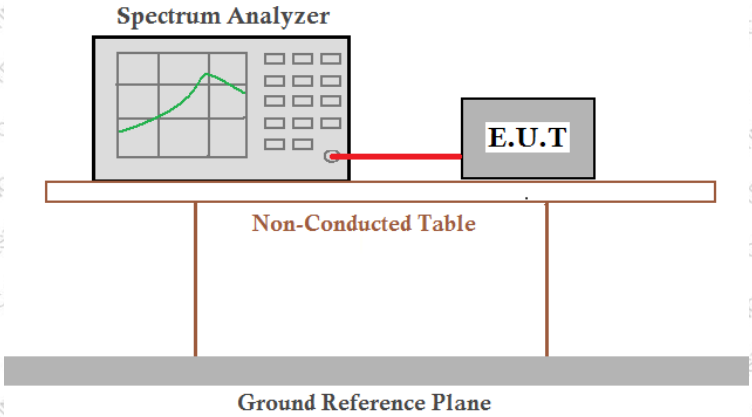
7.1 Applicable Standard

FCC Part15 C Section 15.247 (a)(2)

7.2 Limit

The minimum 6 dB bandwidth shall be 500 kHz.

7.3 Test setup



7.4 Test Procedure

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

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

7.5 Test Data

Temperature	25.9 ℃	Humidity	48%
ATM Pressure	101.1kPa	Antenna Gain	2.67dBi
Test by	Fan Yang	Test result	PASS

Please refer to following table and plots.

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DTS Bandwidth:

Mode	Test channel	DTS Bandwidth (MHz)	Limit (MHz)	Verdict
BLE 1M	Lowest	0.914	0.5	PASS
	Middle	0.91	0.5	PASS
	Highest	0.908	0.5	PASS
BLE 2M	Lowest	1.697	0.5	PASS
	Middle	1.674	0.5	PASS
	Highest	1.682	0.5	PASS

99% Occupied Bandwidth:

Mode	Test channel	99% Occupied Bandwidth (MHz)	Verdict
BLE 1M	Lowest	1.389	PASS
	Middle	1.498	PASS
	Highest	1.387	PASS
BLE 2M	Lowest	2.464	PASS
	Middle	2.478	PASS
	Highest	2.438	PASS

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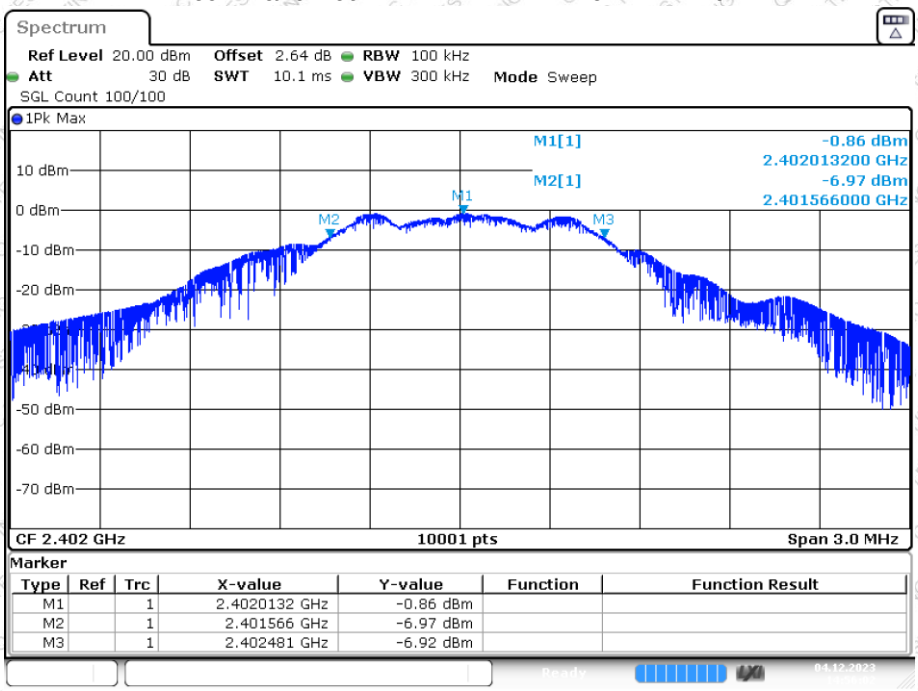
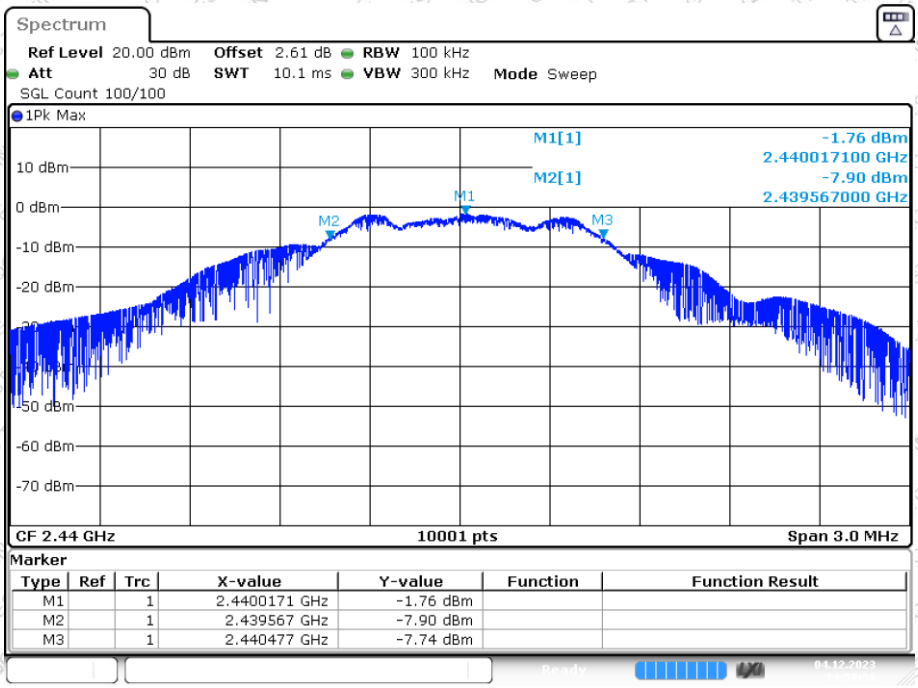
DTS Bandwidth:

-6dB Bandwidth NVNT BLE 1M 2402MHz Ant1



Date: 4.DEC.2023 14:56:02

-6dB Bandwidth NVNT BLE 1M 2440MHz Ant1



Date: 4.DEC.2023 14:59:36

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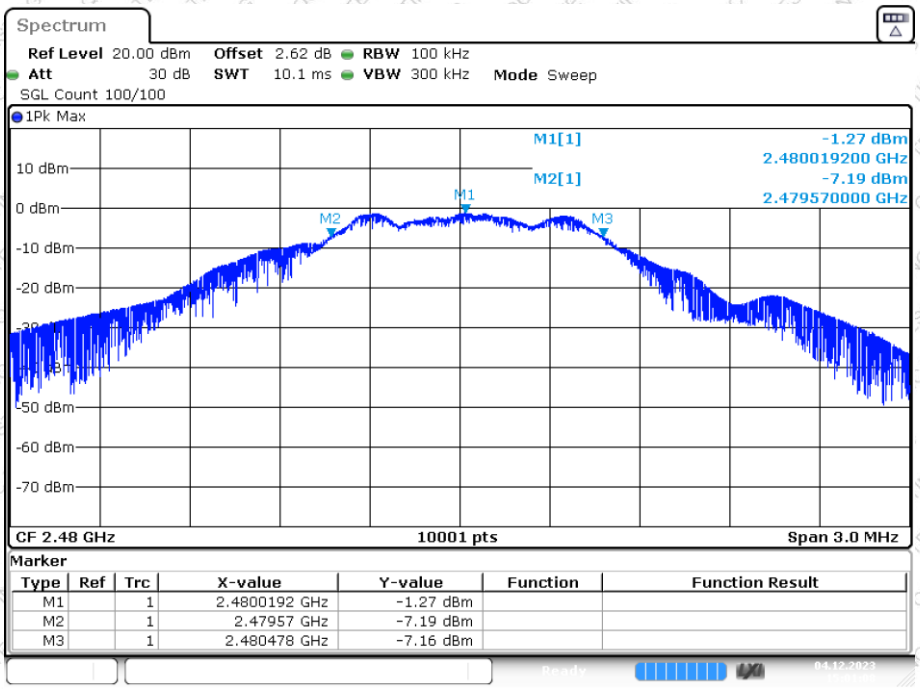
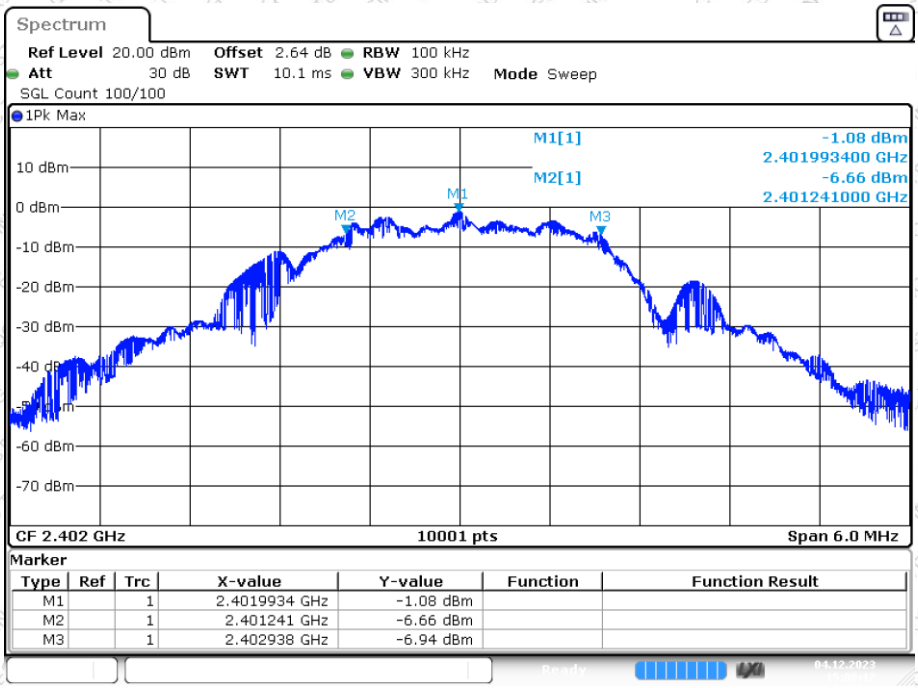
-6dB Bandwidth NVNT BLE 1M 2480MHz Ant1



Date: 4.DEC.2023 15:01:08

-6dB Bandwidth NVNT BLE 2M 2402MHz Ant1



Date: 4.DEC.2023 15:08:17

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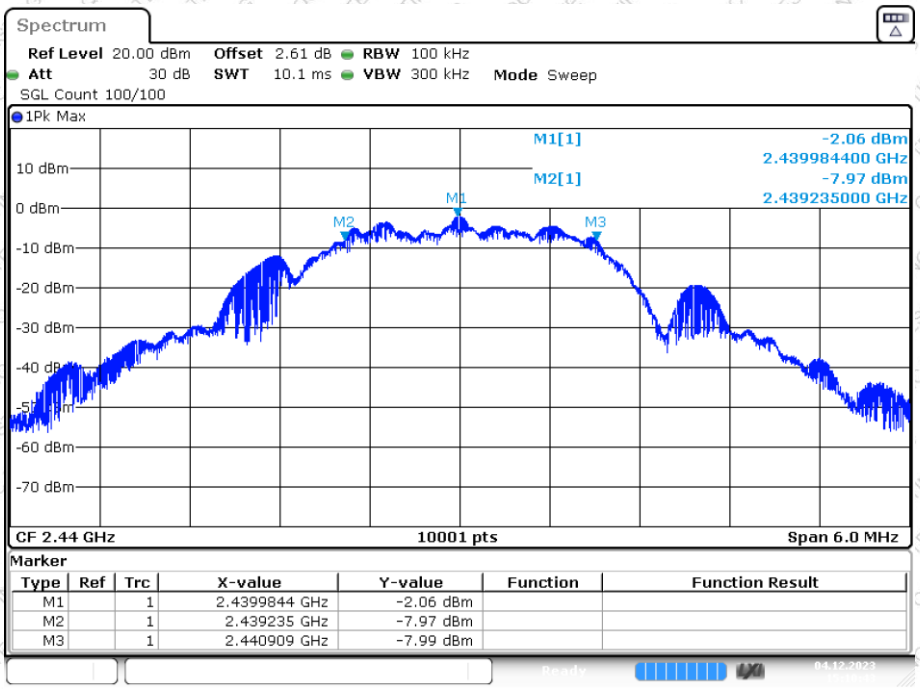
-6dB Bandwidth NVNT BLE 2M 2440MHz Ant1



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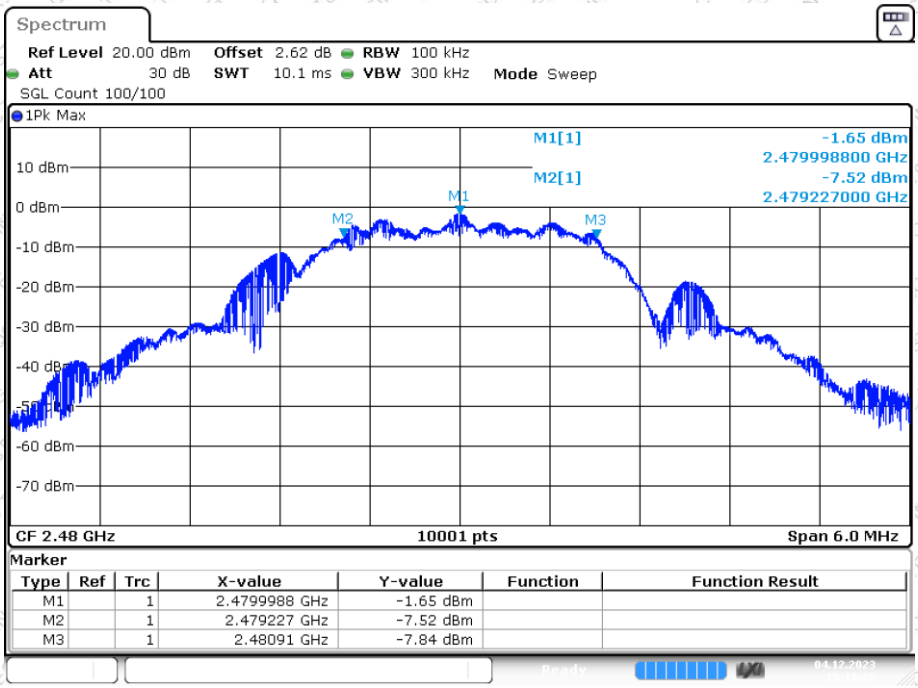
-6dB Bandwidth NVNT BLE 2M 2480MHz Ant1



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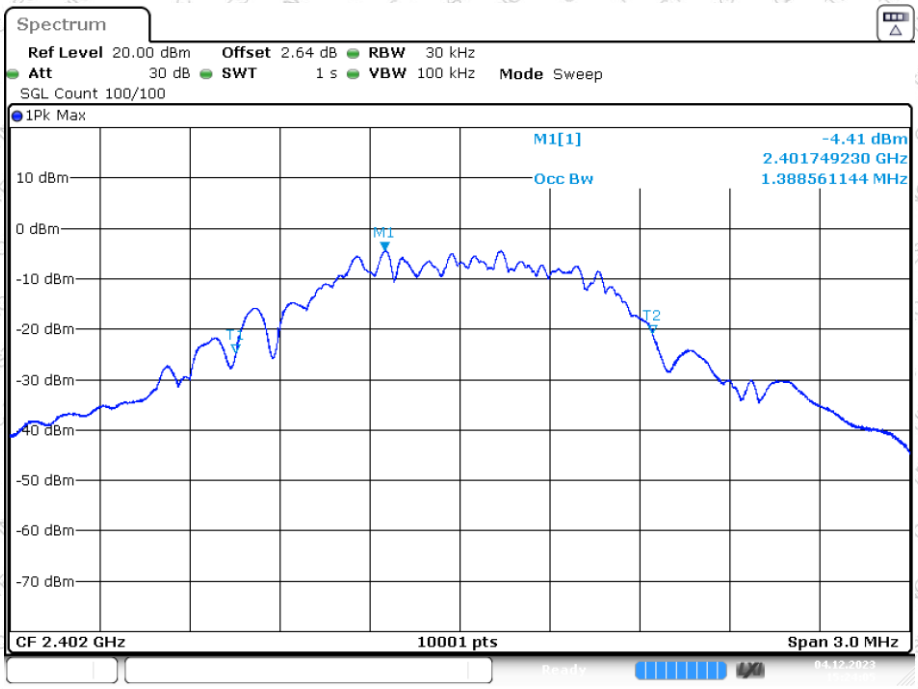
99% Occupied Bandwidth:

OBW NVNT BLE 1M 2402MHz Ant1



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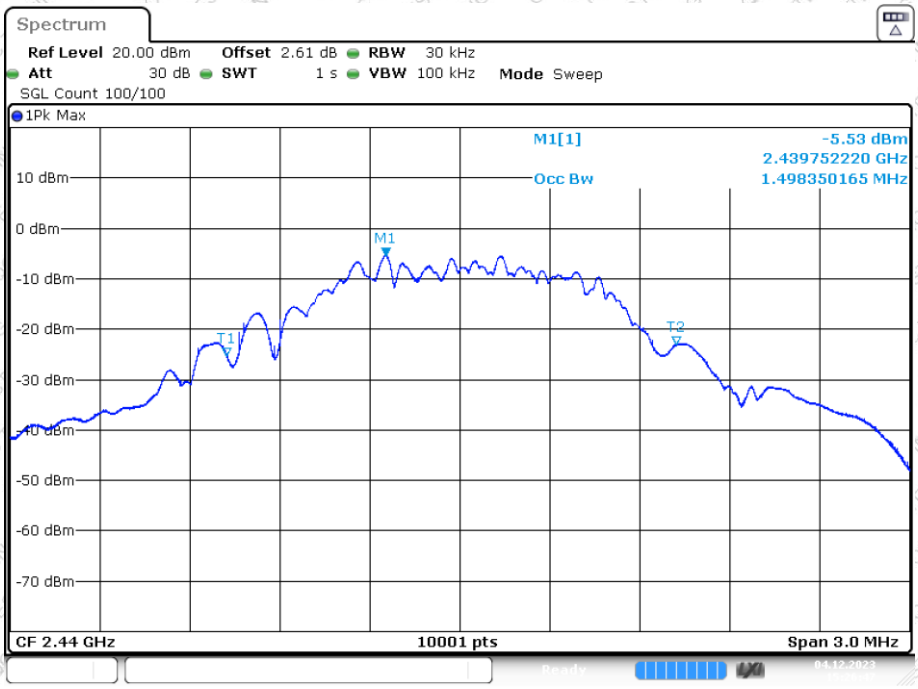
OBW NVNT BLE 1M 2440MHz Ant1



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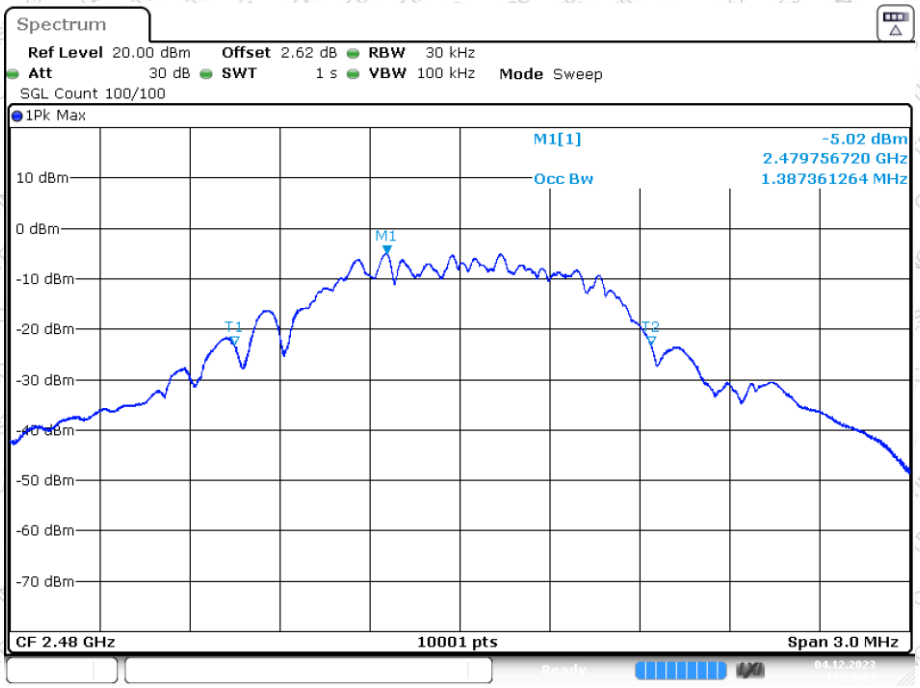
OBW NVNT BLE 1M 2480MHz Ant1



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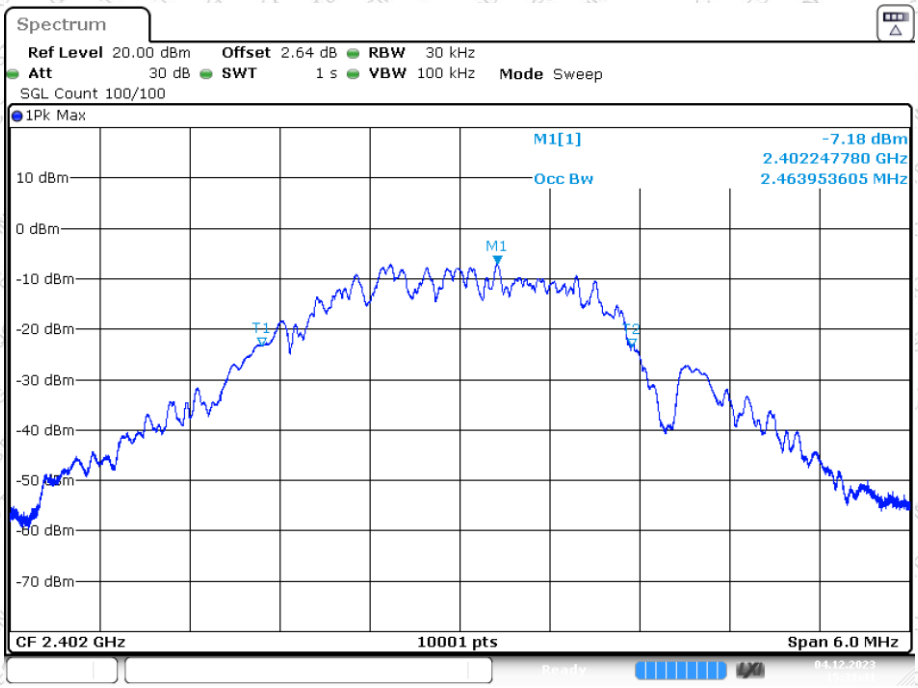
OBW NVNT BLE 2M 2402MHz Ant1



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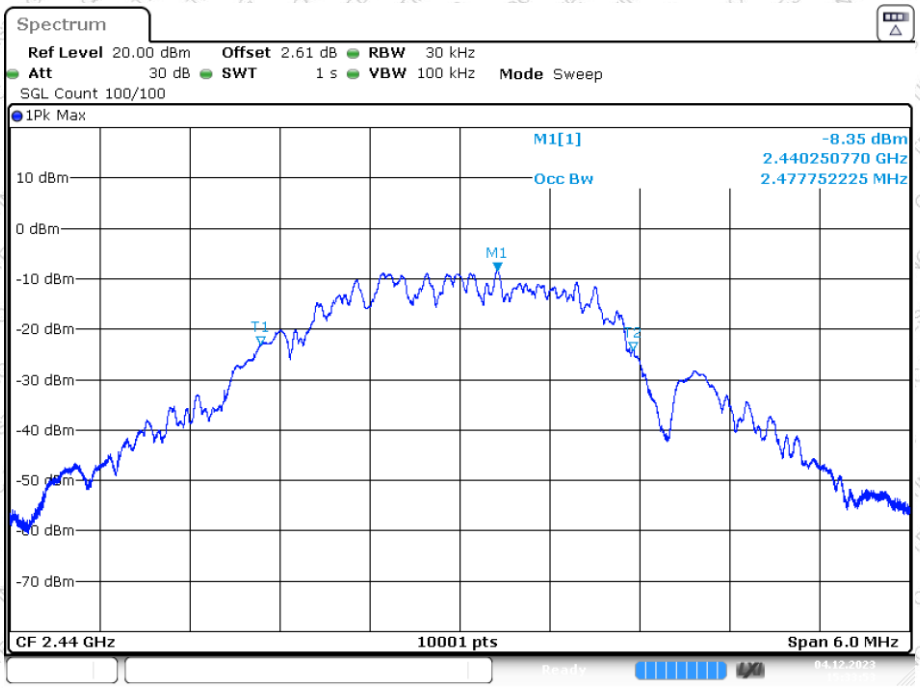
OBW NVNT BLE 2M 2440MHz Ant1



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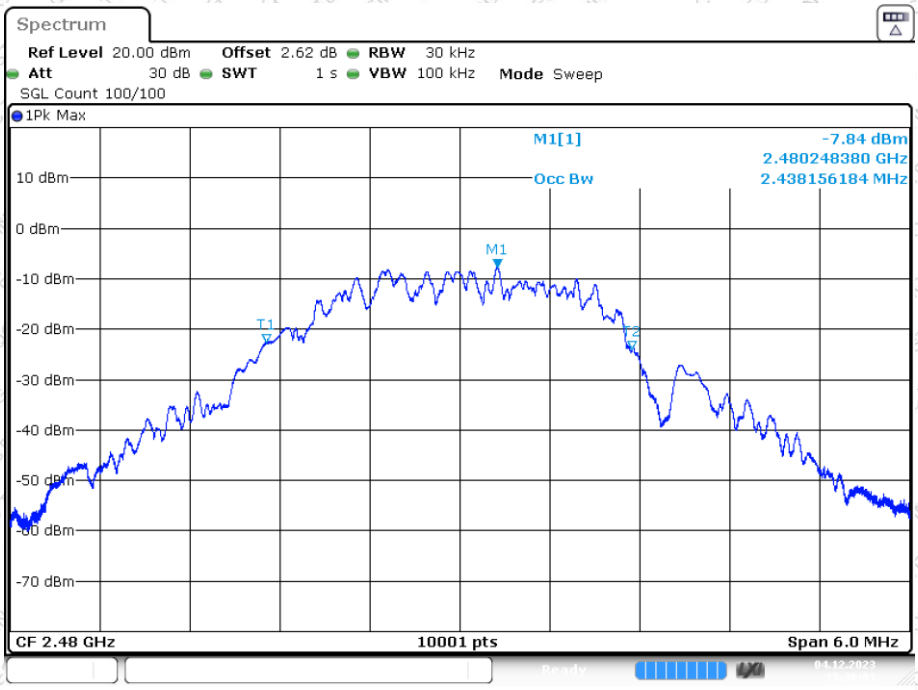

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8. Power Spectral Density

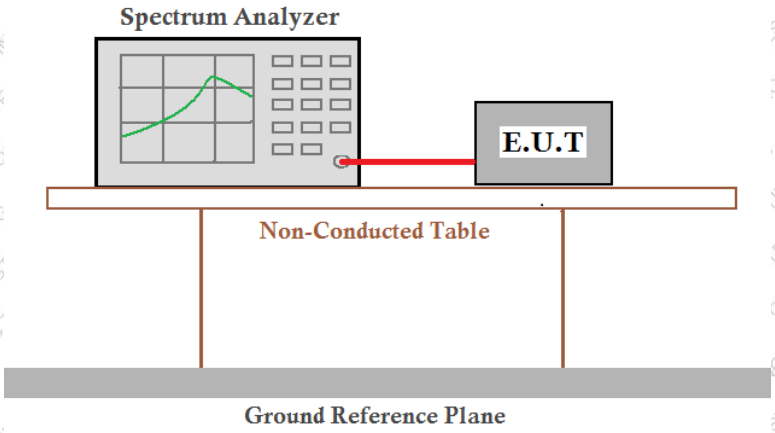
8.1 Applicable Standard

FCC Part15 C Section 15.247 (e)

8.2 Limit

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

8.3 Test setup



8.4 Test Procedure

Refer to KDB558074 D01 15.247 Meas Guidance v05r02

8.5 Test Data

Temperature	25.9 ℃	Humidity	48%
ATM Pressure	101.1kPa	Antenna Gain	2.67dBi
Test by	Fan Yang	Test result	PASS

Please refer to following table and plots.

Mode	Test channel	Power Spectral Density (dBm/3kHz)	Limit(dBm/3kHz)	Result
BLE 1M	Lowest	-13.45	8.00	Pass
	Middle	-14.26		
	Highest	-13.83		
BLE 2M	Lowest	-16.29		
	Middle	-17.2		
	Highest	-16.48		

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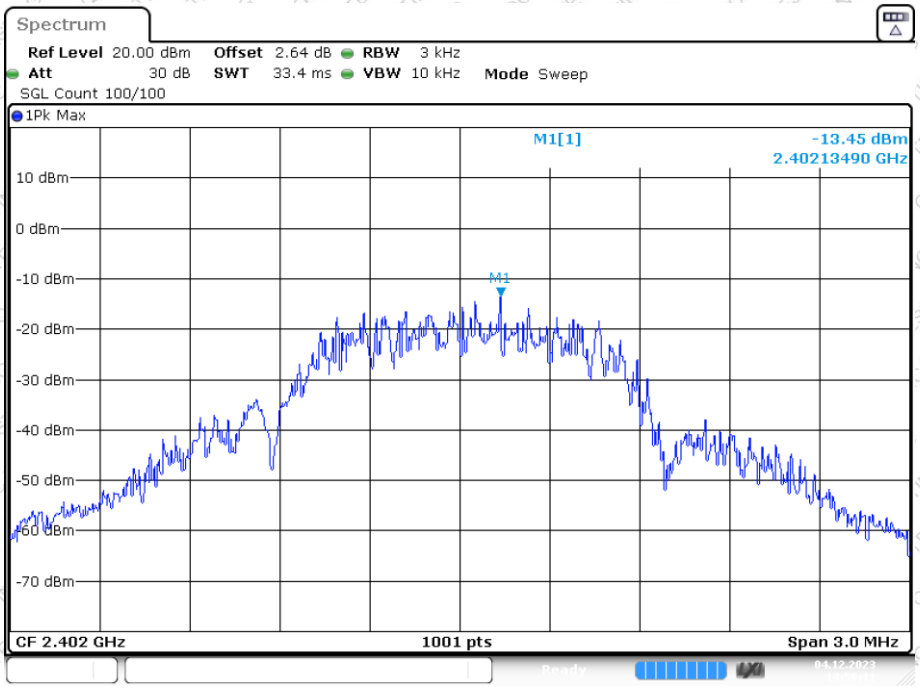
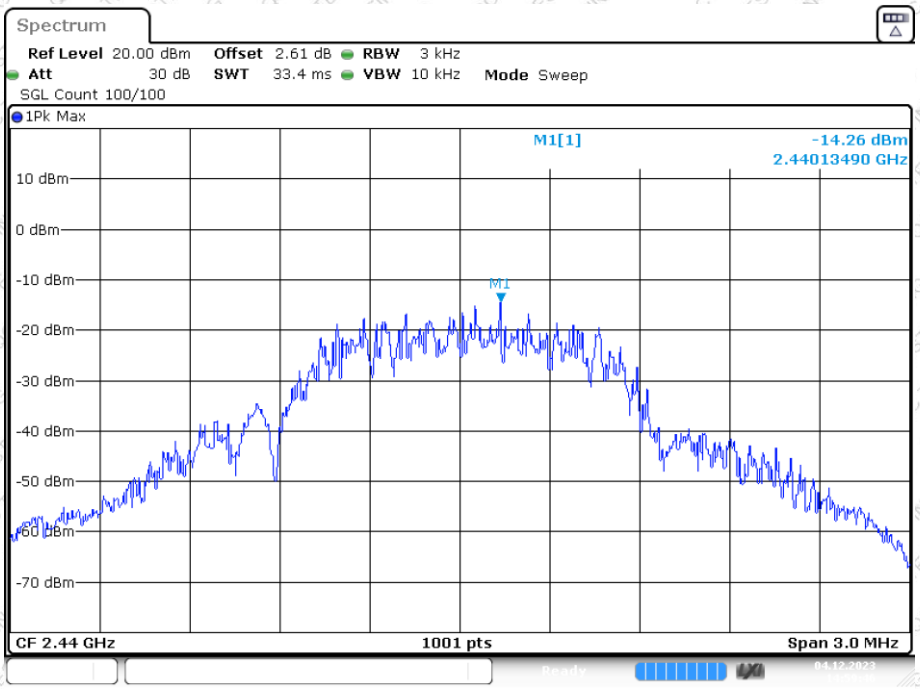
PSD NVNT BLE 1M 2402MHz Ant1



Date: 4.DEC.2023 14:56:11

PSD NVNT BLE 1M 2440MHz Ant1



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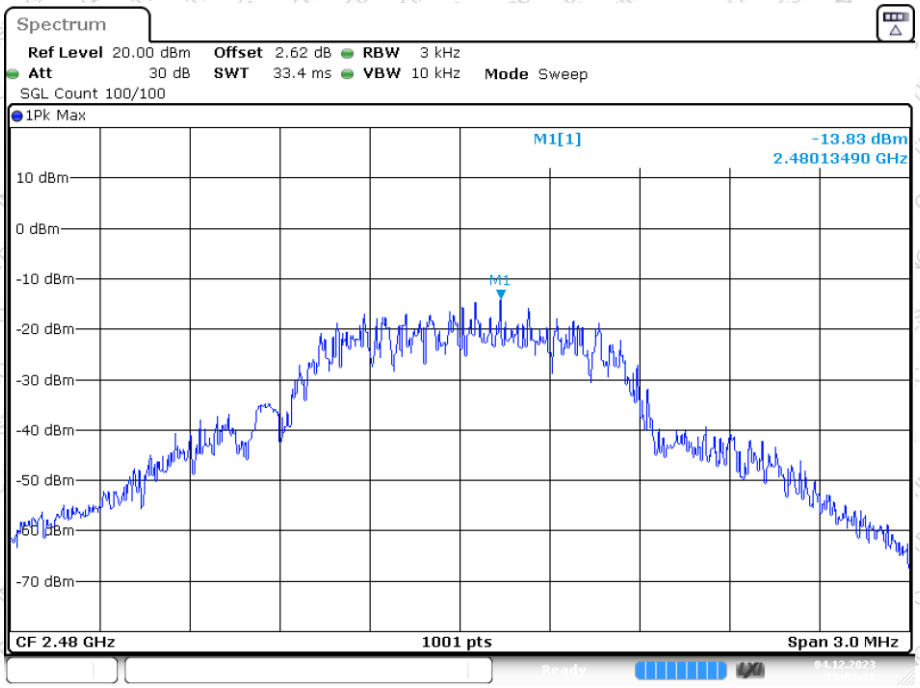
PSD NVNT BLE 1M 2480MHz Ant1



Date: 4.DEC.2023 15:01:18

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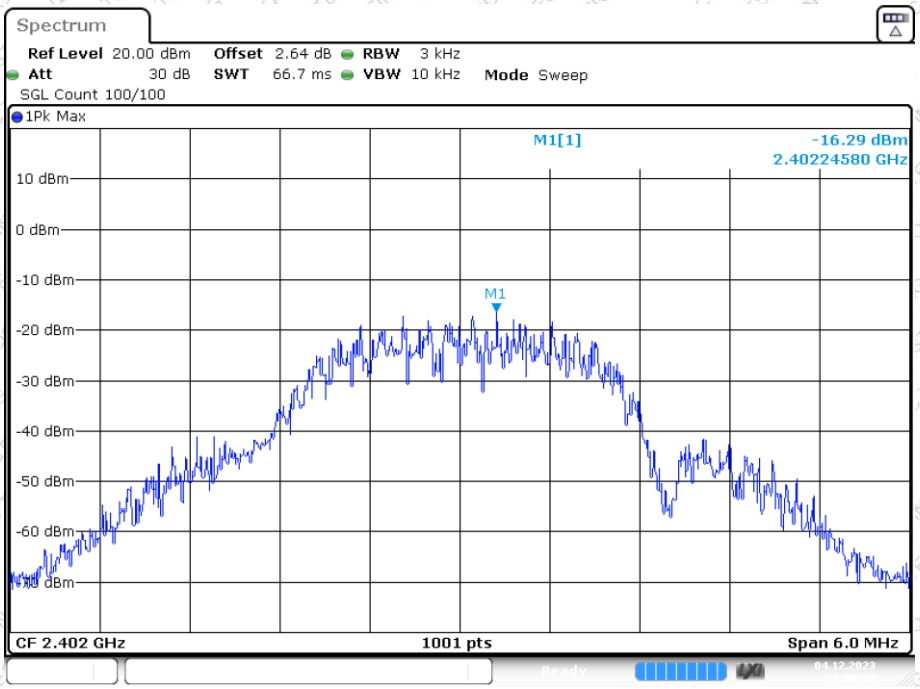

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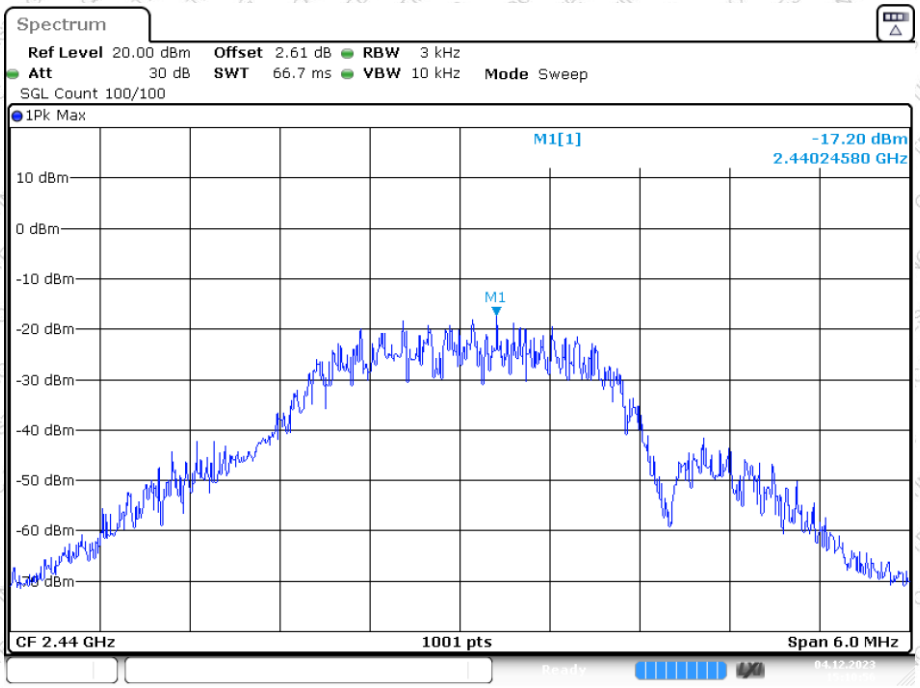
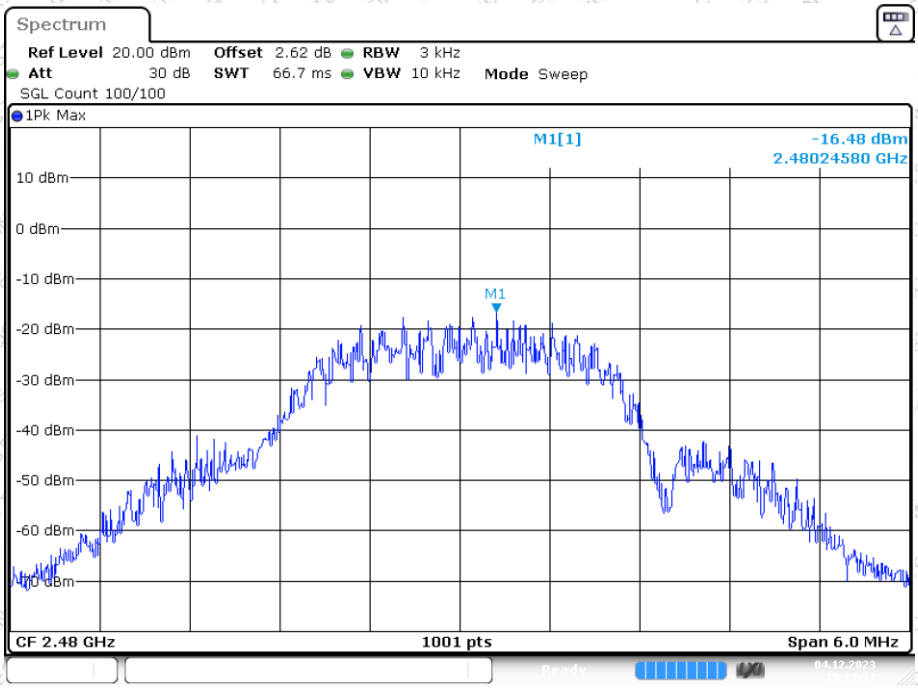
PSD NVNT BLE 2M 2440MHz Ant1



Date: 4.DEC.2023 15:10:56

PSD NVNT BLE 2M 2480MHz Ant1



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9. Spurious Emission in Non-restricted & restricted Bands

9.1 Conducted Emission Method

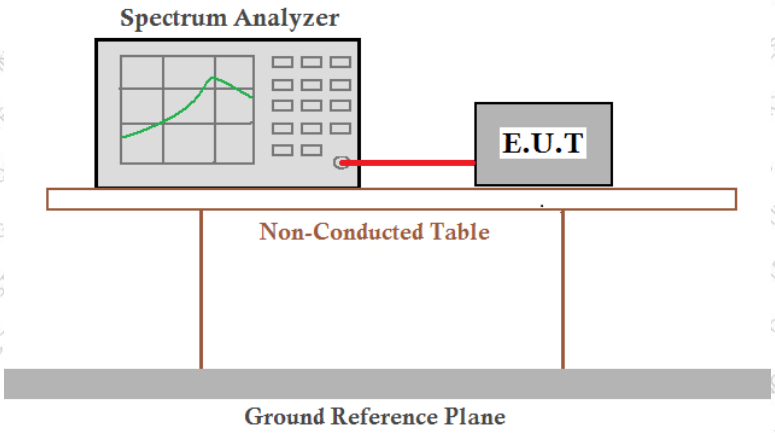
9.1.1 Applicable Standard

FCC Part15 C Section 15.247 (d)

9.1.2 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

9.1.3 Test setup



9.1.4 Test Procedure

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- Repeat above procedures until all measured frequencies were complete.

9.1.5 Test Data

Temperature	25.9 ℃	Humidity	48%
ATM Pressure	101.1kPa	Antenna Gain	2.67dBi
Test by	Fan Yang	Test result	PASS

Please refer to following plots.

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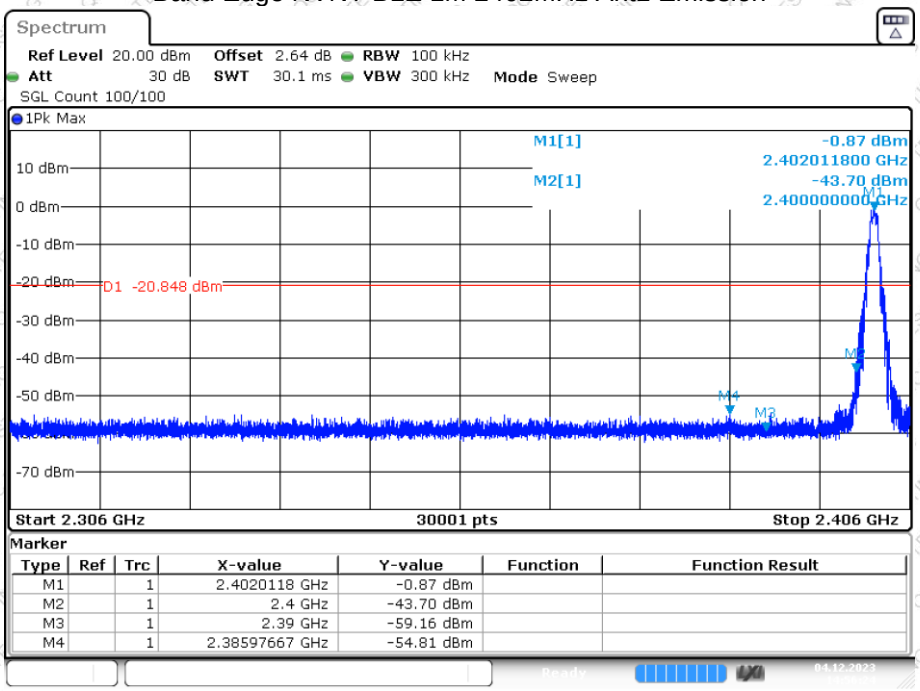
Band Edge NVNT BLE 1M 2402MHz Ant1 Emission



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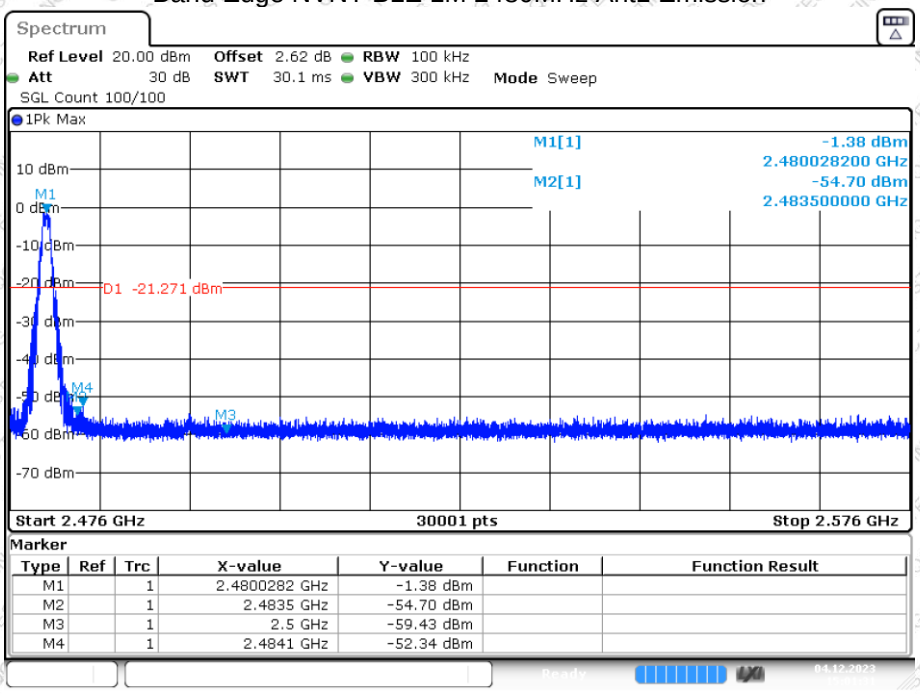
Band Edge NVNT BLE 1M 2480MHz Ant1 Emission



Date: 4.DEC.2023 15:01:31

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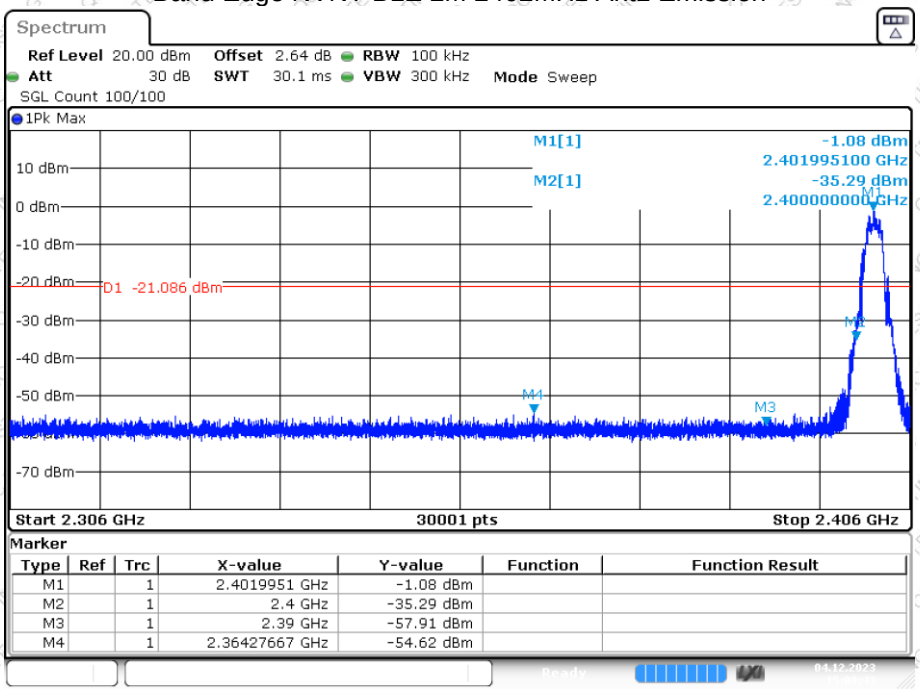
Band Edge NVNT BLE 2M 2402MHz Ant1 Emission

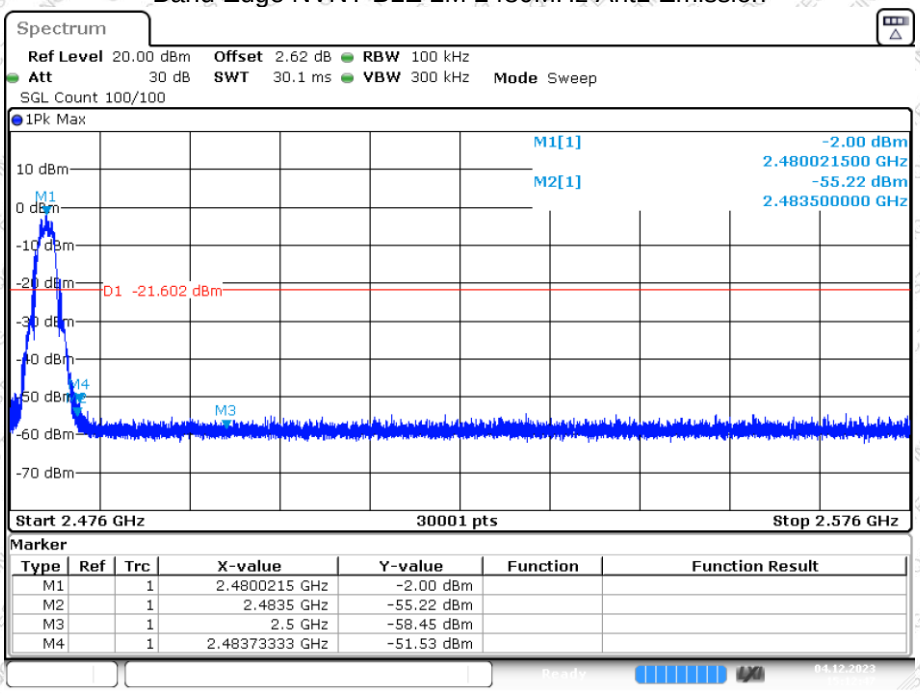


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4019951 GHz	-1.08 dBm		
M2		1	2.4 GHz	-35.29 dBm		
M3		1	2.39 GHz	-57.91 dBm		
M4		1	2.36427667 GHz	-54.62 dBm		

Date: 4.DEC.2023 15:08:44

Band Edge NVNT BLE 2M 2480MHz Ant1 Emission



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4800215 GHz	-2.00 dBm		
M2		1	2.4835 GHz	-55.22 dBm		
M3		1	2.5 GHz	-58.45 dBm		
M4		1	2.48373333 GHz	-51.53 dBm		

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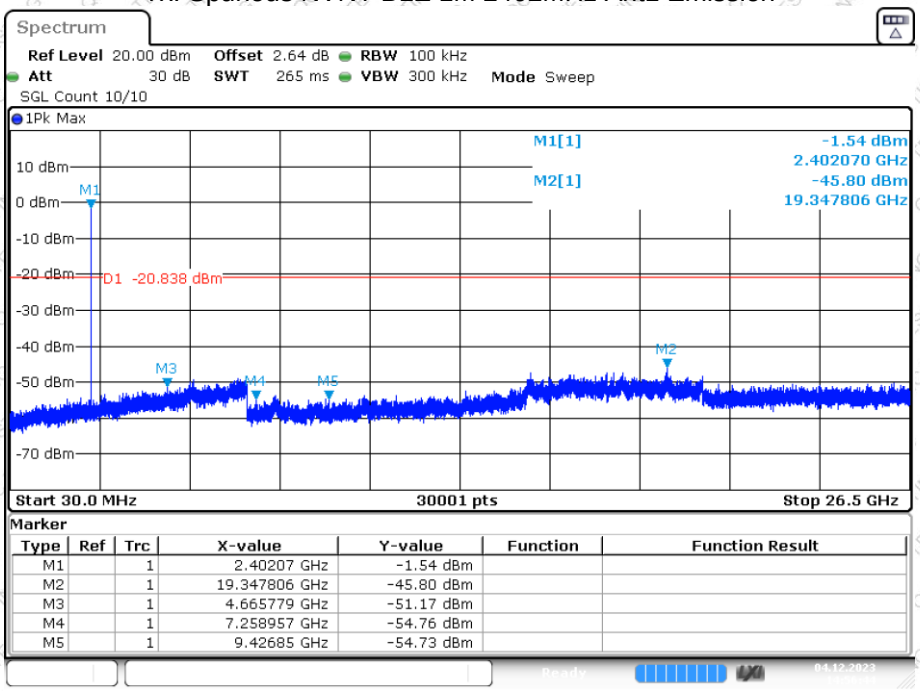
Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Emission



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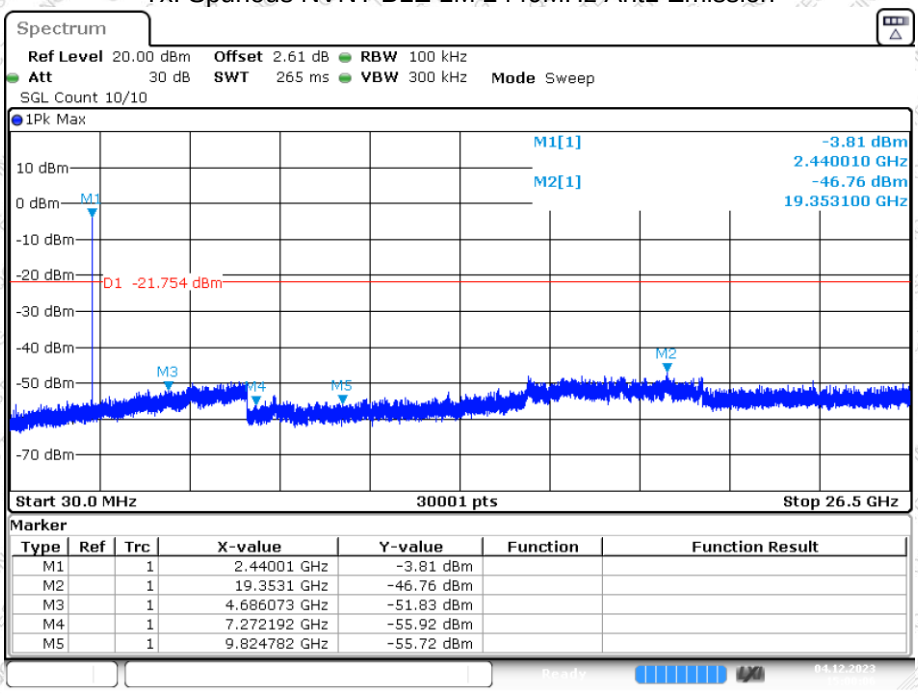
Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Emission



Date: 4.DEC.2023 15:00:06

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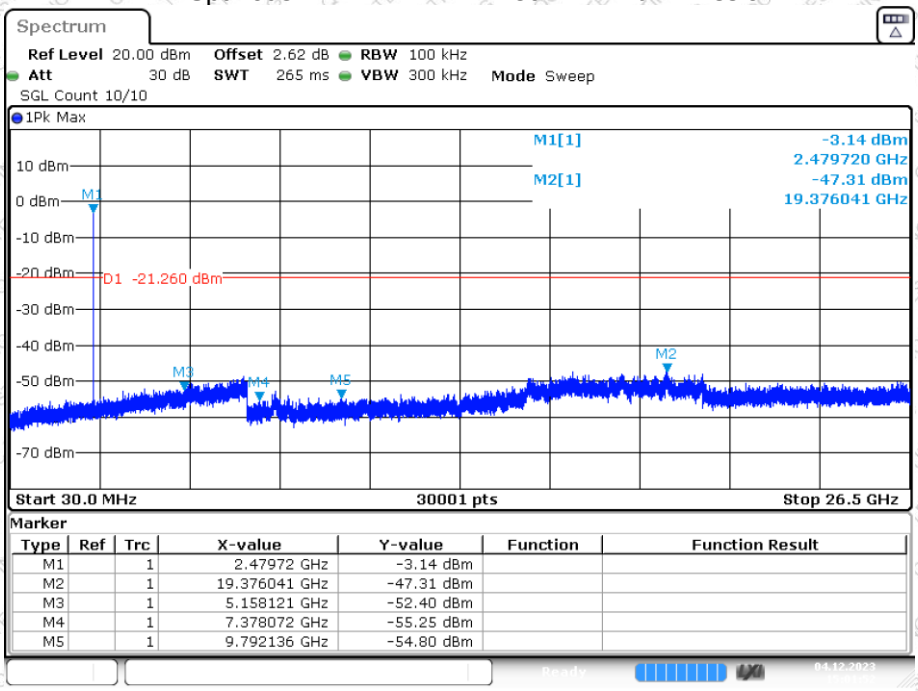
Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Emission

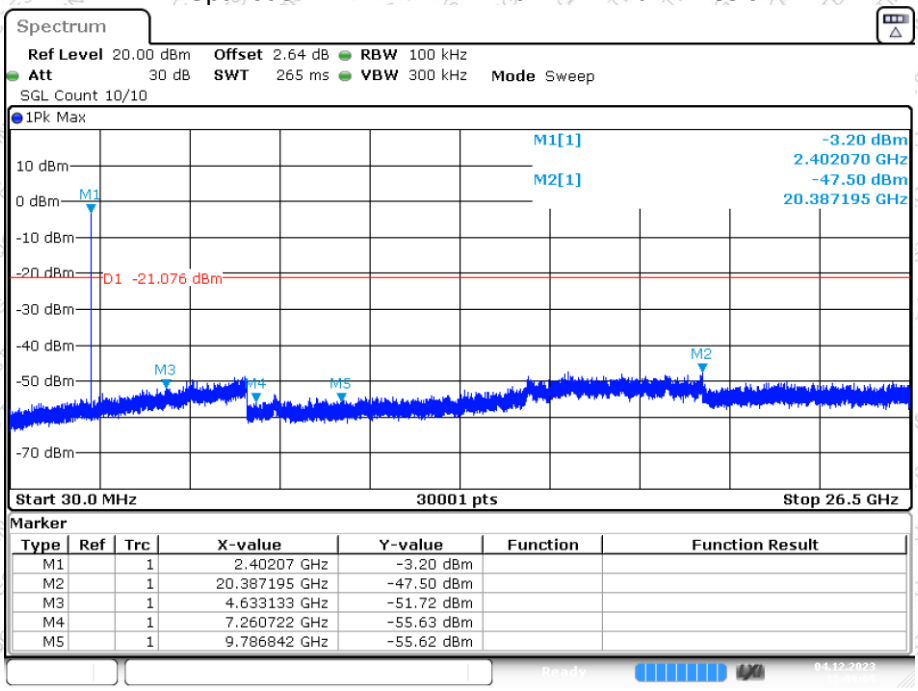


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47972 GHz	-3.14 dBm		
M2		1	19.376041 GHz	-47.31 dBm		
M3		1	5.158121 GHz	-52.40 dBm		
M4		1	7.378072 GHz	-55.25 dBm		
M5		1	9.792136 GHz	-54.80 dBm		

Date: 4.DEC.2023 15:01:52

Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Emission



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40207 GHz	-3.20 dBm		
M2		1	20.387195 GHz	-47.50 dBm		
M3		1	4.633133 GHz	-51.72 dBm		
M4		1	7.260722 GHz	-55.63 dBm		
M5		1	9.786842 GHz	-55.62 dBm		

Date: 4.DEC.2023 15:09:05

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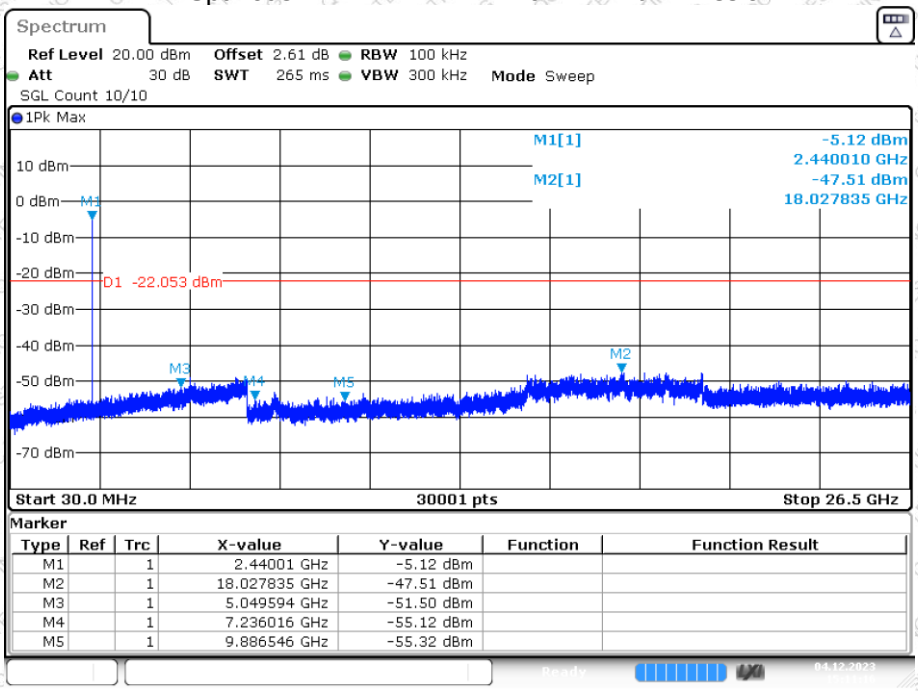
Tx. Spurious NVNT BLE 2M 2440MHz Ant1 Emission

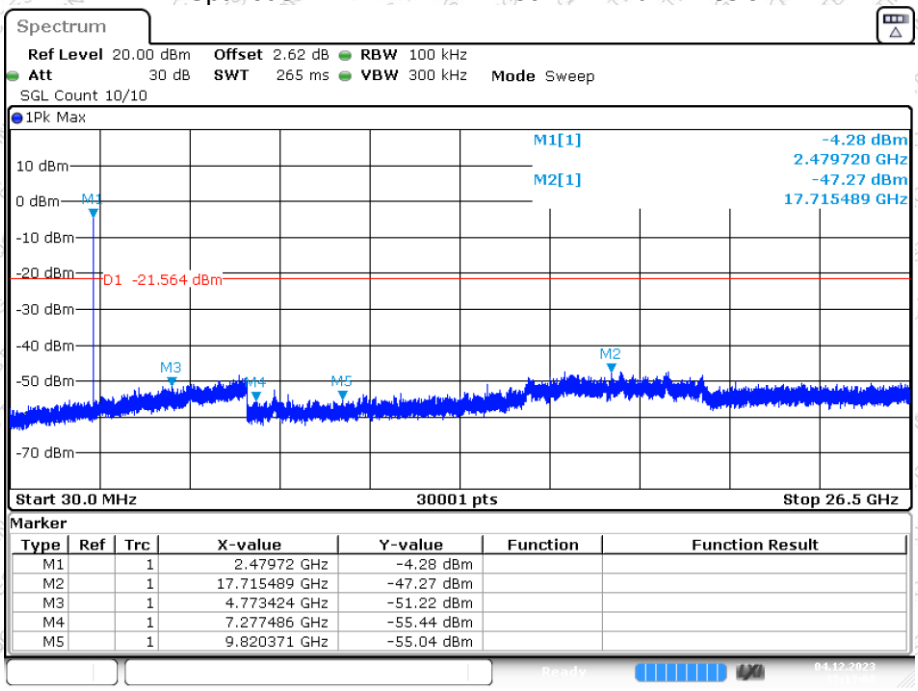


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44001 GHz	-5.12 dBm		
M2		1	18.027835 GHz	-47.51 dBm		
M3		1	5.049594 GHz	-51.50 dBm		
M4		1	7.236016 GHz	-55.12 dBm		
M5		1	9.886546 GHz	-55.32 dBm		

Date: 4.DEC.2023 15:11:17

Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Emission



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47972 GHz	-4.28 dBm		
M2		1	17.715489 GHz	-47.27 dBm		
M3		1	4.773424 GHz	-51.22 dBm		
M4		1	7.277486 GHz	-55.44 dBm		
M5		1	9.820371 GHz	-55.04 dBm		

Date: 4.DEC.2023 15:13:09

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9.2 Radiated Emission Method

9.2.1 Applicable Standard

FCC Part15 C Section 15.209 and 15.205

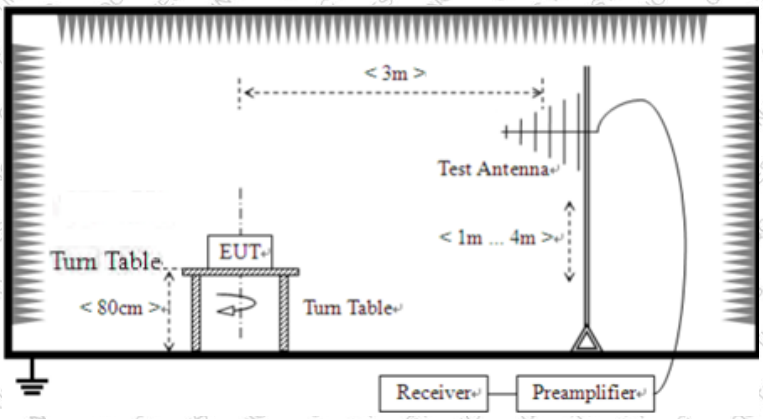
9.2.2 Limit

Frequency	Field Strengths Limits (μV/m at 3 m)	Field Strengths Limits (dBμV/m at 3 m)	Remark
30 – 88	100	40.0	Quasi-peak
88 – 216	150	43.5	Quasi-peak
216 – 960	200	46.0	Quasi-peak
Above 960	500	54.0	Quasi-peak
Above 1GHz	/	54.0	Peak
		74.0	Average

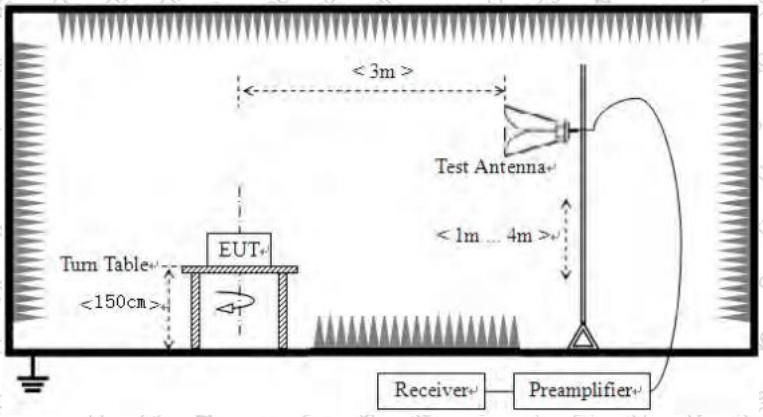
Note: dBμV/m =20log(μV/m)

9.2.3 Test setup

For radiated emissions from 30MHz to1GHz



For radiated emissions above 1GHz



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9.2.4 EMI Test Receiver Setup

Frequency	RBW	VBW	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	Peak
	1 MHz	10 Hz	/	Average

9.2.5 Test procedure

- The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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 and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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.

9.2.6 Test Data

Temperature	25.9 ℃	Humidity	48%
ATM Pressure	101.1kPa	Antenna Gain	2.67dBi
Test by	Charlie He	Test result	PASS

Test voltage: DC 3V

Remarks:

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.
2. The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

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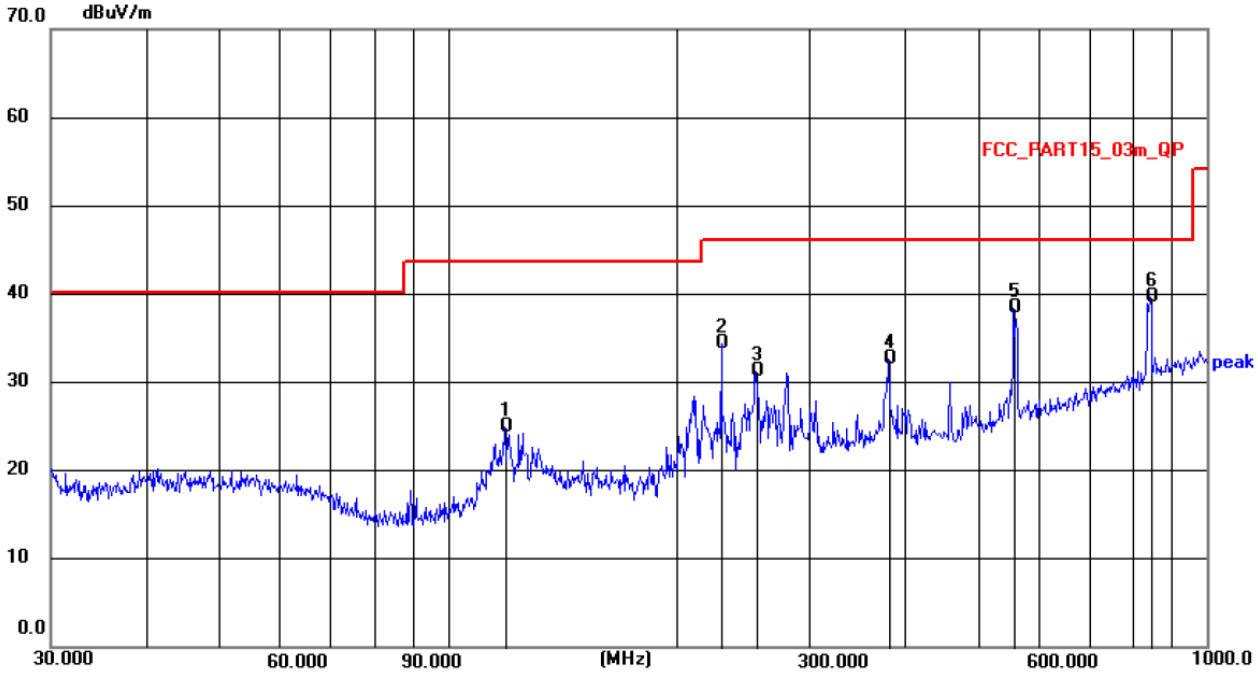
Below 1GHz

Pre-scan all test modes, found worst case at BLE 1M 2402MHz, and so only show the test result of BLE 1M 2402MHz.

Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	119.0180	11.53	13.39	24.92	43.50	18.58	QP
2	229.2931	21.55	12.76	34.31	46.00	11.69	QP
3	254.7284	17.84	13.47	31.31	46.00	14.69	QP
4	381.2487	15.40	17.20	32.60	46.00	13.40	QP
5	556.7744	17.72	20.71	38.43	46.00	7.57	QP
6 *	842.1296	14.24	25.33	39.57	46.00	6.43	QP

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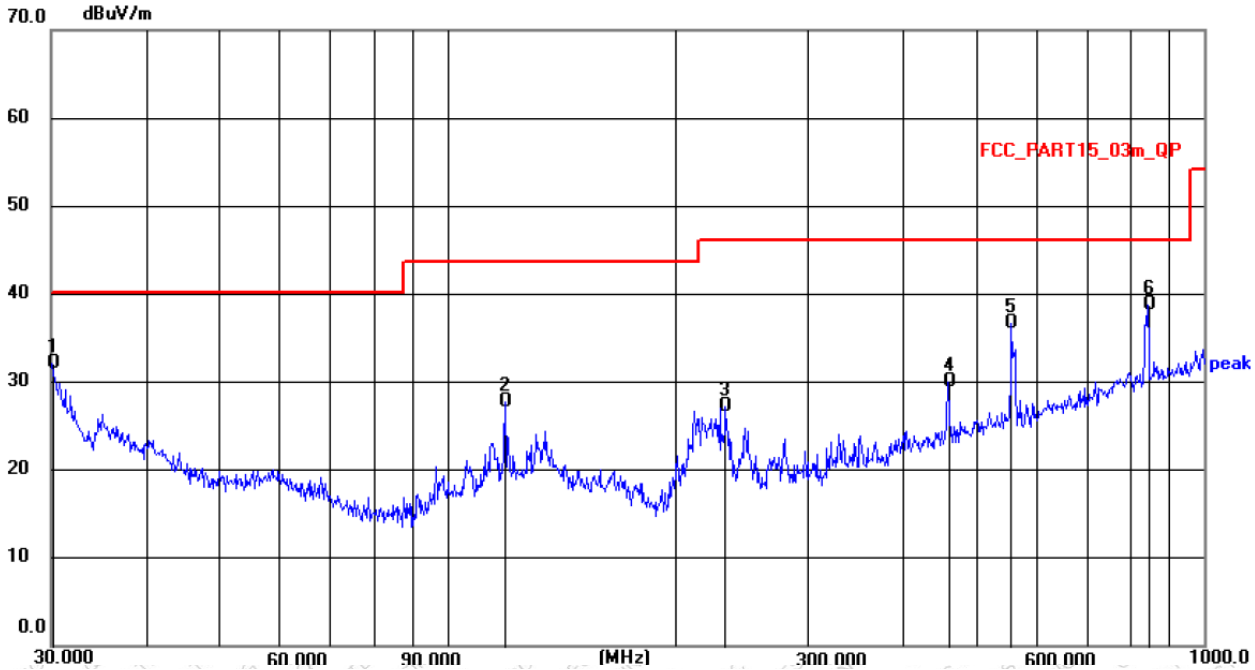
Vertical:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.1053	19.68	12.46	32.14	40.00	7.86	QP
2	119.4360	14.76	13.06	27.82	43.50	15.68	QP
3	233.3486	14.16	13.01	27.17	46.00	18.83	QP
4	459.1144	11.20	18.75	29.95	46.00	16.05	QP
5	556.7743	16.17	20.56	36.73	46.00	9.27	QP
6 *	842.1296	13.35	25.34	38.69	46.00	7.31	QP

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Above 1GHz

Pre-scan all test modes, found worst case at BLE 1M Mode, and so only show the test result of BLE 1M Mode.

Test channel: Lowest channel

Frequency (MHz)	Read Level (dBμV)	polarization	Factor (dB/m)	Level (dBμV/m)	Limit Line (dBμV/m)	Margin (dB)	Detector
2310	50.65	H	-11.14	39.51	74	34.49	peak
2310	51.31	V	-11.16	40.15	74	33.85	peak
2325.153	57.68	H	-11.13	46.55	74	27.45	peak
2333.037	60.63	V	-11.11	49.52	74	24.48	peak
2390	50.53	H	-10.9	39.63	74	34.37	peak
2390	51.73	V	-10.96	40.77	74	33.23	peak
4804	42.98	H	-4.37	38.61	74	35.39	peak
4804	44.93	V	-4.51	40.42	74	33.58	peak

Test channel: Middle channel

Frequency (MHz)	Read Level (dBμV)	polarization	Factor (dB/m)	Level (dBμV/m)	Limit Line (dBμV/m)	Margin (dB)	Detector
4880	44.48	H	-4.1	40.38	74	33.62	peak
4880	45.55	V	-4.23	41.32	74	32.68	peak

Test channel: Highest channel

Frequency (MHz)	Read Level (dBμV)	polarization	Factor (dB/m)	Level (dBμV/m)	Limit Line (dBμV/m)	Margin (dB)	Detector
2483.5	63.46	H	-10.61	52.85	74	21.15	peak
2483.5	51.09	V	-10.71	40.38	74	33.62	peak
2497.853	55.17	H	-10.57	44.6	74	29.4	peak
2494.987	54.57	V	-10.68	43.89	74	30.11	peak
2500	52.08	H	-10.57	41.51	74	32.49	peak
2500	49.89	V	-10.67	39.22	74	34.78	peak
4960	45.95	H	-3.82	42.13	74	31.87	peak
4960	46.56	V	-3.93	42.63	74	31.37	peak

Remarks:

1. Level =Receiver Read level + Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

---------- THE END OF TEST REPORT ----------

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