



FCC PART 15.247 TEST REPORT

On Behalf of

Shenzhen Jincheng Chaopin Technology Co., Ltd

B1203, Jieshun Technology Center, No.5 Guansheng 2nd Road, Luhuhu Community,
Guanhu Street, Longhua District, Shenzhen, China

FCC ID: 2BF2F-APWZ608
Model: APWZ-608

September 2, 2024

This Report Concerns:

☒ Original Report

Equipment Type:

Starry Sky Series Wireless Earphones

Test Engineer:

LBi Li / LBi Li

Report Number:

QCT24GR-1903E-01

Test Date:

July 31, 2024 ~ September 2, 2024

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Report Number

Description

Issued Date

QCT24GR-1903E-01

Initial Issue

2024-9-2



1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

| | |
|----------------------|--|
| EUT Description: | Starry Sky Series Wireless Earphones |
| Model No.: | APWZ-608 |
| Tested Model: | APWZ-608 |
| Sample(s) Status: | Engineer sample |
| Packet Type: | Bluetooth LE(1Mbps) |
| Operation Frequency: | 2402MHz~2480MHz |
| Channel numbers: | 40 |
| Channel separation: | 2MHz |
| Modulation type: | GFSK |
| Antenna Type: | Chip Antenna |
| Antenna gain*1: | -0.68dBi |
| Power supply: | DC 5V (Powered by adapter) DC 3.7V (Powered by battery) |
| Trade Mark: | N/A |
| Applicant: | Shenzhen Jincheng Chaopin Technology Co., Ltd |
| Address: | B1203, Jieshun Technology Center, No.5 Guansheng 2nd Road,Luhu Community, Guanhu Street, Longhua District, Shenzhen, China |
| Manufacturer: | Shenzhen Jincheng Chaopin Technology Co., Ltd |
| Address: | B1203, Jieshun Technology Center, No.5 Guansheng 2nd Road,Luhu Community, Guanhu Street, Longhua District, Shenzhen, China |
| Sample No.: | Y24G1903E01LY |

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

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

"FCC_assist_1.0.2.2" exercise software was used to test, The power level is default. The software and power level was provided by the applicant.

1.2.3 Support Equipment

| Manufacturer | Description | Model | Remark |
|--------------|-------------|-----------|---|
| Vivo | Adapter | V1820B-CN | Input: AC 100-240V~, 50/60Hz Output: 5V \square , 1A |

1.2.4 Test mode

Transmitting mode: Keep the EUT in continuously transmitting.



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 | $\pm 1.42 \times 10^{-4}\%$ |
| RF output power, conducted | $\pm 1.06\text{dB}$ |
| Power Spectral Density, conducted | $\pm 1.06\text{dB}$ |
| Unwanted Emissions, conducted | $\pm 2.51\text{dB}$ |
| AC Power Line Conducted Emission | $\pm 1.80\text{dB}$ |
| Radiated Spurious Emission test (9kHz-30MHz) | $\pm 2.66\text{dB}$ |
| Radiated Spurious Emission test (30MHz-1000MHz) | $\pm 4.04\text{dB}$ |
| Radiated Spurious Emission test (1000MHz-18000MHz) | $\pm 4.70\text{ dB}$ |
| Radiated Spurious Emission test (18GHz-40GHz) | $\pm 4.80\text{dB}$ |
| Temperature | $\pm 0.8^{\circ}\text{C}$ |
| Humidity | $\pm 3.2\%$ |
| DC and low frequency voltages | $\pm 0.1\%$ |
| Time | $\pm 5\%$ |
| Duty cycle | $\pm 5\%$ |

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



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.



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 | Rohde&Schwarz | ESIB 7 | 2277573376 | 2024.03.14 | 2025.03.13 |
| 2 | EMI Test Receiver | Rohde&Schwarz | ESCI3 | 101820 | 2024.08.06 | 2025.08.05 |
| 3 | Artificial Mains Network | SCHWARZBECK | NSLK8126 | 8126200 | 2024.08.06 | 2025.08.05 |
| 4 | PULSE LIMITER | Rohde&Schwarz | ESH3-Z2 | 100058 | 2024.03.14 | 2025.03.13 |

Conducted Emission Measurement Software: TS+ JS32-CE Ver 5.0.0

3.2 Radiated Emission Test

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal.Due |
|------|-------------------------------|---------------|---------------------|--------------|------------|------------|
| 1. | EMI Test Receiver | R&S | ESIB 7 | 2277573376 | 2024.03.14 | 2025.03.13 |
| 2. | EMI Test Receiver | ESPI3 | ESPI3 | 101131 | 2024.03.14 | 2025.03.13 |
| 3. | Spectrum Analyzer | Rohde&Schwarz | FSV 40 | 101458 | 2024.03.14 | 2025.03.13 |
| 4. | TRILOG Broadband Test-Antenna | SCHWARZBECK | VULB9168 | VULB9168-588 | 2023.04.01 | 2025.03.31 |
| 5. | Loop Antenna | EMCO | 6502 | 2133 | 2023.03.18 | 2025.03.17 |
| 6. | horn antenna | SCHWARZBECK | BBHA9120D | 2069 | 2023.04.01 | 2025.03.31 |
| 7. | Horn Antenna | COM-MW | ZLB7-18-40G-950 | 12221225 | 2023.01.12 | 2025.01.09 |
| 8. | Pre-amplifier | MITEQ | TTA0001-18 | 2063645 | 2024.03.27 | 2025.03.26 |
| 9. | Pre-amplifier | COM-MW | DLAN-18000-40000-02 | 10229104 | 2024.03.14 | 2025.03.13 |
| 10. | 966 Camber | ZhongYU | 9*6*6 | / | 2023.05.08 | 2026.05.07 |

Radiated Emission Measurement Software: EZ EMC Ver QCT03A2 RE+



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 | 2024.03.14 | 2025.03.13 |
| 2. | Spectrum Analyzer | ROHDE & SCHWARZ | FSV 40 | 101458 | 2024.03.14 | 2025.03.13 |
| 3. | Signal Generator | Agilent | N5182A | MY50141563 | 2024.03.14 | 2025.03.13 |
| 4. | RF Automatic Test System | MW | MW100-RFCB/ MW100-PSB | MW2007004 | 2024.03.14 | 2025.03.13 |
| RF Conducted Measurement Software: MTS 8310 Ver 2.0.0.0 | | | | | | |



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 PCB Antenna, the best case gain of the antenna is -0.68dBi, reference to the Internal photo for details.

5. Conducted Emissions

5.1 Applicable Standard

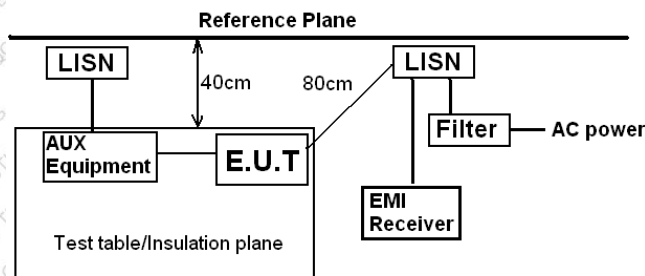
FCC Part15 C Section 15.207

5.2 Limit

| Frequency range (MHz) | Limit (dB μ V) | |
|-----------------------|--------------------|-----------|
| | 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



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedance Stabilization Network
Test table height=0.8m

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 | 24 °C | Humidity | 51% |
| ATM Pressure | 101.1kPa | Antenna Gain | -0.68dBi |
| Test by | LBi Li | Test result | PASS |

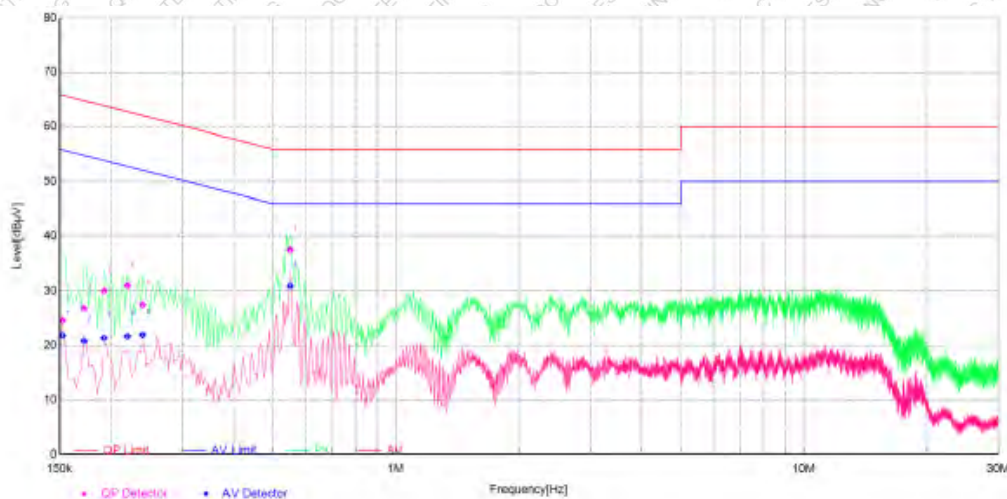
Test voltage: AC 120V/60Hz



Measurement data:

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

Line:

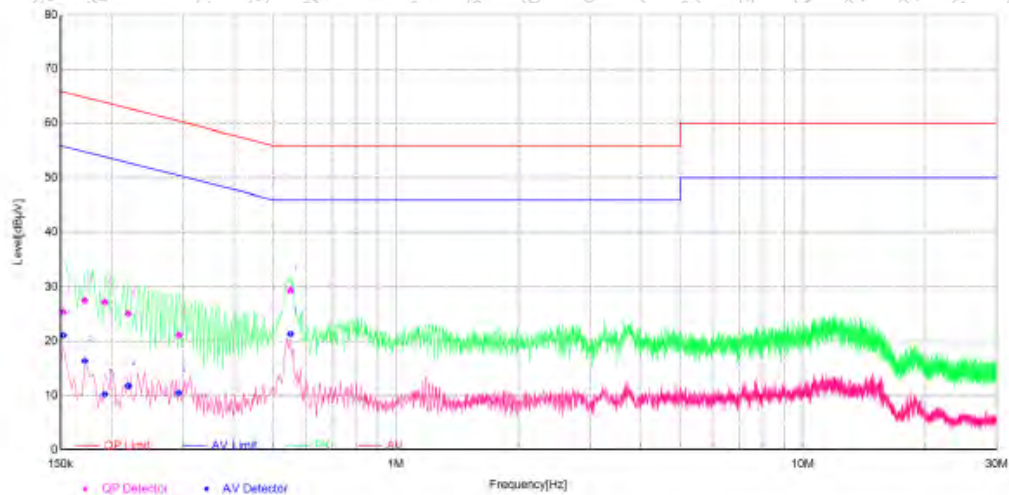


Final Data List

| 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 | 0.1525 | 10.58 | 24.49 | 65.86 | 41.37 | 21.87 | 55.86 | 33.99 | L | PASS |
| 2 | 0.1725 | 10.62 | 26.73 | 64.84 | 38.11 | 20.87 | 54.84 | 33.97 | L | PASS |
| 3 | 0.1925 | 10.66 | 30.02 | 63.93 | 33.91 | 21.43 | 53.93 | 32.50 | L | PASS |
| 4 | 0.2200 | 10.68 | 30.97 | 62.82 | 31.85 | 21.74 | 52.82 | 31.08 | L | PASS |
| 5 | 0.2400 | 10.68 | 27.44 | 62.10 | 34.66 | 22.02 | 52.10 | 30.08 | L | PASS |
| 6 | 0.5625 | 10.75 | 37.48 | 56.00 | 18.52 | 30.90 | 46.00 | 15.10 | L | PASS |



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 | 0.1525 | 10.47 | 25.23 | 65.86 | 40.63 | 21.12 | 55.86 | 34.74 | N | PASS |
| 2 | 0.1725 | 10.48 | 27.43 | 64.84 | 37.41 | 16.35 | 54.84 | 38.49 | N | PASS |
| 3 | 0.1925 | 10.49 | 27.12 | 63.93 | 36.81 | 10.31 | 53.93 | 43.62 | N | PASS |
| 4 | 0.2200 | 10.57 | 24.98 | 62.82 | 37.84 | 11.75 | 52.82 | 41.07 | N | PASS |
| 5 | 0.2925 | 10.82 | 21.13 | 60.45 | 39.32 | 10.53 | 50.45 | 39.92 | N | PASS |
| 6 | 0.5525 | 10.64 | 29.29 | 56.00 | 26.71 | 21.38 | 46.00 | 24.62 | 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.

6. Conducted Peak Output Power

6.1 Applicable Standard

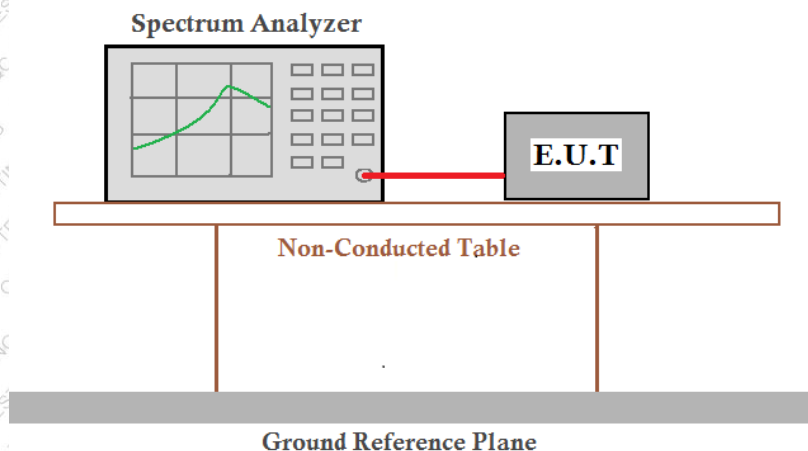
FCC Part15 C Section 15.247 (b)(3)

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 | 24 °C | Humidity | 50 % |
| ATM Pressure | 101.1kPa | Antenna Gain | -0.68dBi |
| Test by | LBi Li | Test result | PASS |

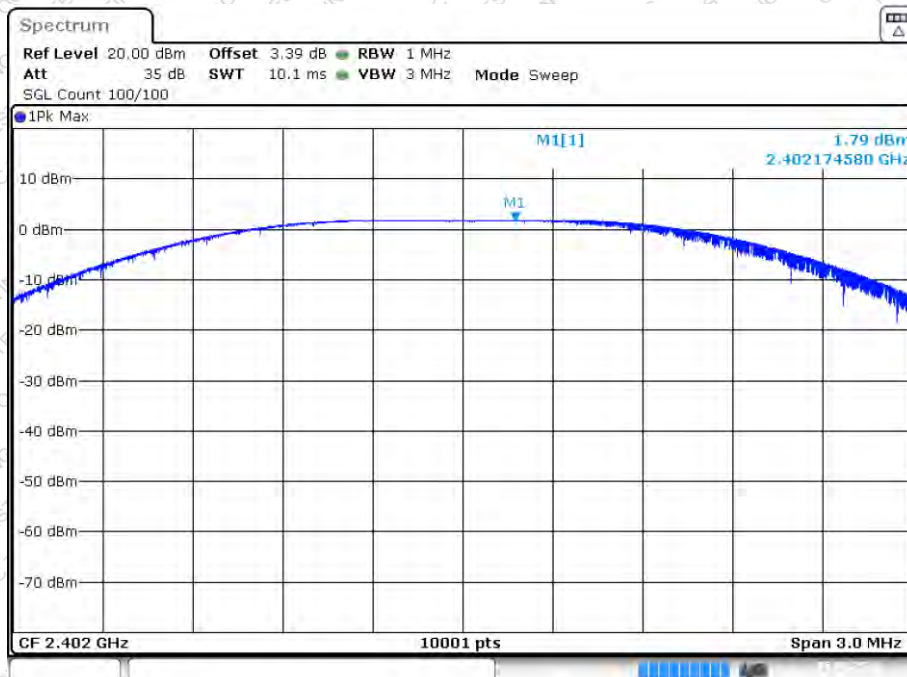
Please refer to following table and plots.



Output Power:

| Modulation | CH No. | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Verdict |
|------------|---------|-----------------|--------------------|-------------|---------|
| BLE | Lowest | 2402 | 1.79 | ≤30 | PASS |
| | Middle | 2440 | 1.88 | ≤30 | PASS |
| | Highest | 2480 | 2.65 | ≤30 | PASS |

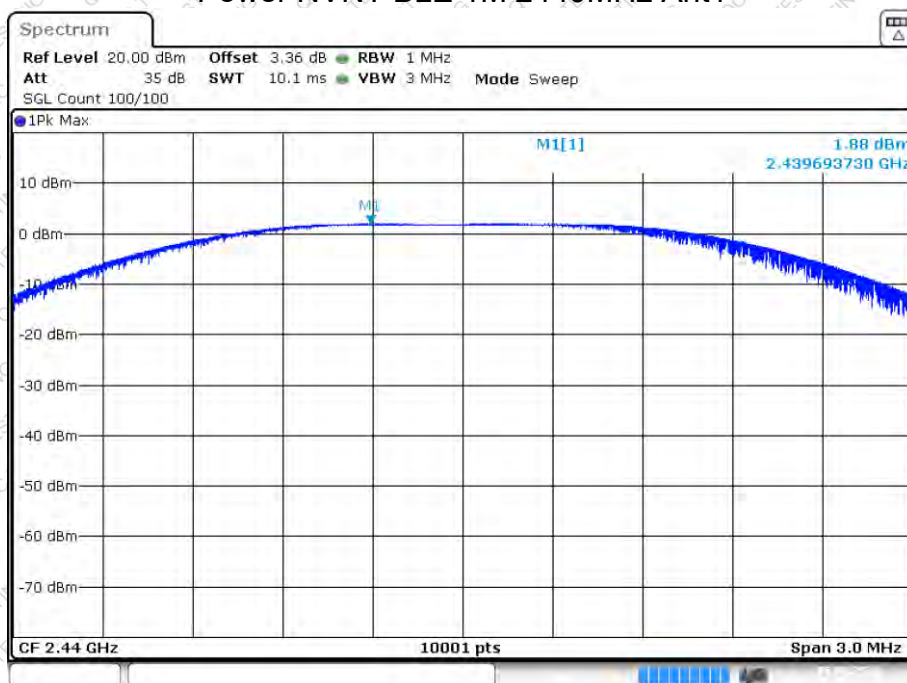
Power NVNT BLE 1M 2402MHz Ant1



Date: 6.AUG.2024 16:05:10

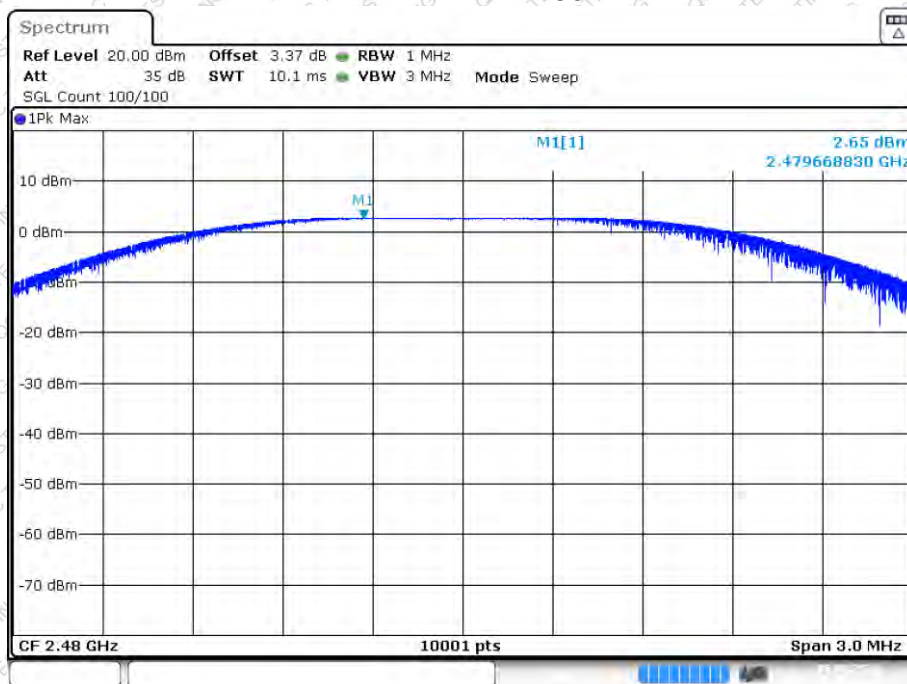


Power NVNT BLE 1M 2440MHz Ant1



Date: 6.AUG 2024 16:07:02

Power NVNT BLE 1M 2480MHz Ant1



Date: 6.AUG 2024 16:07:57

7. Channel Bandwidth & 99% Occupied Bandwidth

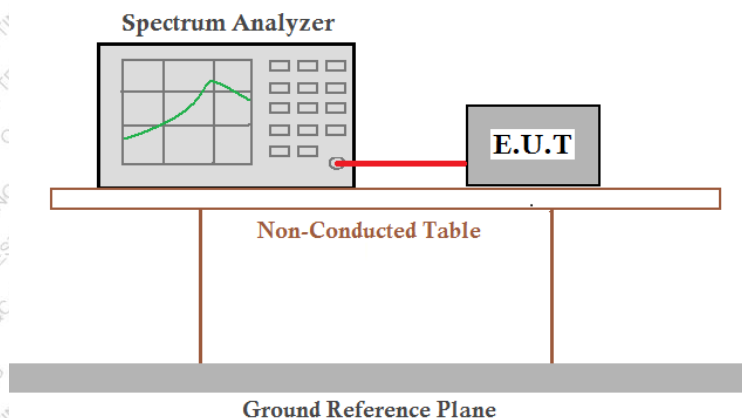
7.1 Applicable Standard

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 | 24 °C | Humidity | 50 % |
| ATM Pressure | 101.1kPa | Antenna Gain | -0.68dBi |
| Test by | LBi Li | Test result | PASS |

Please refer to following table and plots.



DTS Bandwidth:

| Modulation | CH No. | Frequency (MHz) | DTS Bandwidth (MHz) | Limit (MHz) | Verdict |
|------------|---------|-----------------|---------------------|-------------|---------|
| BLE | Lowest | 2402 | 0.505 | 0.5 | PASS |
| | Middle | 2440 | 0.521 | 0.5 | PASS |
| | Highest | 2480 | 0.535 | 0.5 | PASS |

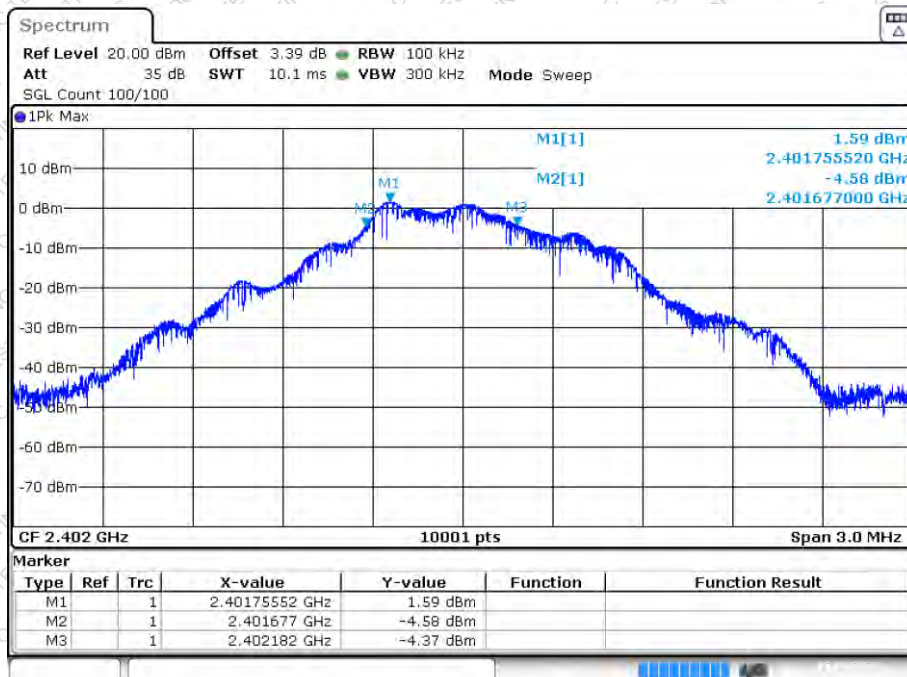
99% Occupied Bandwidth:

| Modulation | CH No. | Frequency (MHz) | 99% Bandwidth (MHz) | Limit (MHz) | Verdict |
|------------|---------|-----------------|---------------------|-------------|---------|
| BLE | Lowest | 2402 | 1.159 | --- | PASS |
| | Middle | 2440 | 1.216 | --- | PASS |
| | Highest | 2480 | 1.266 | --- | PASS |



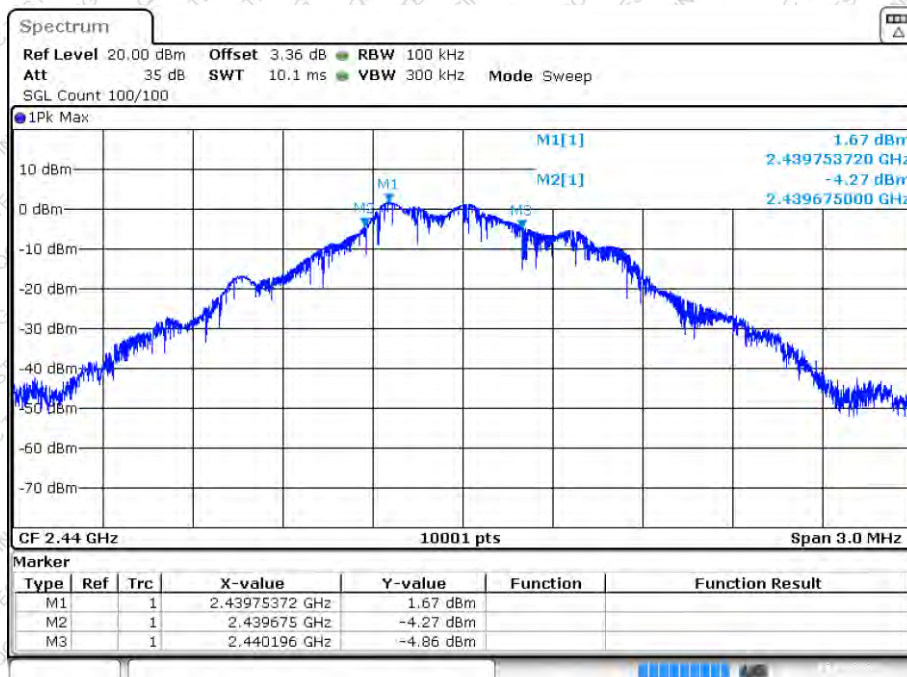
DTS Bandwidth:

-6dB Bandwidth NVNT BLE 1M 2402MHz Ant1



Date: 6 AUG 2024 16:05:29

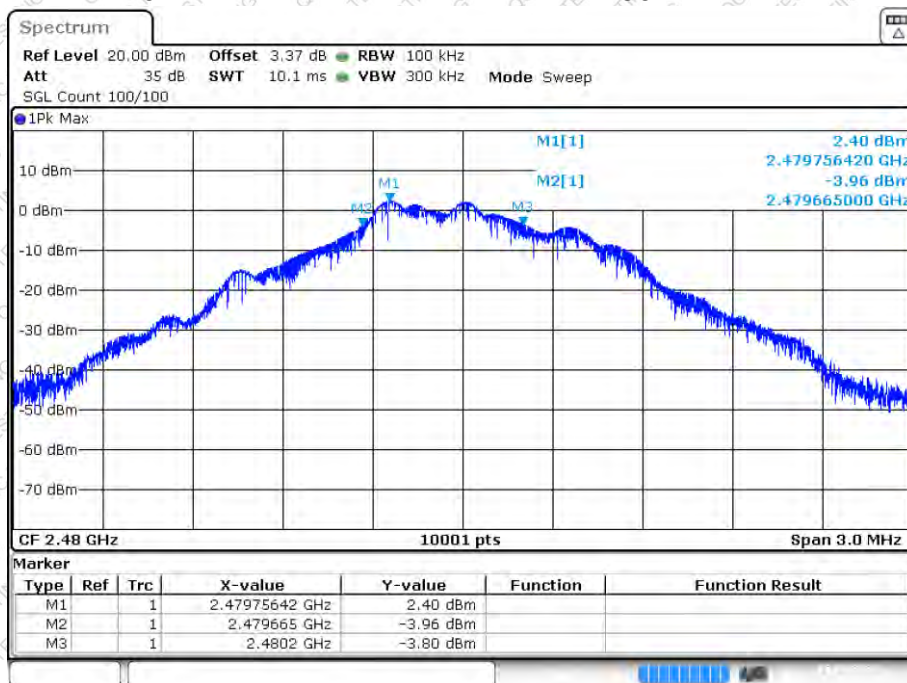
-6dB Bandwidth NVNT BLE 1M 2440MHz Ant1



Date: 6 AUG 2024 16:07:14



-6dB Bandwidth NVNT BLE 1M 2480MHz Ant1



99% Occupied Bandwidth:

OBW NVNT BLE 1M 2402MHz Ant1



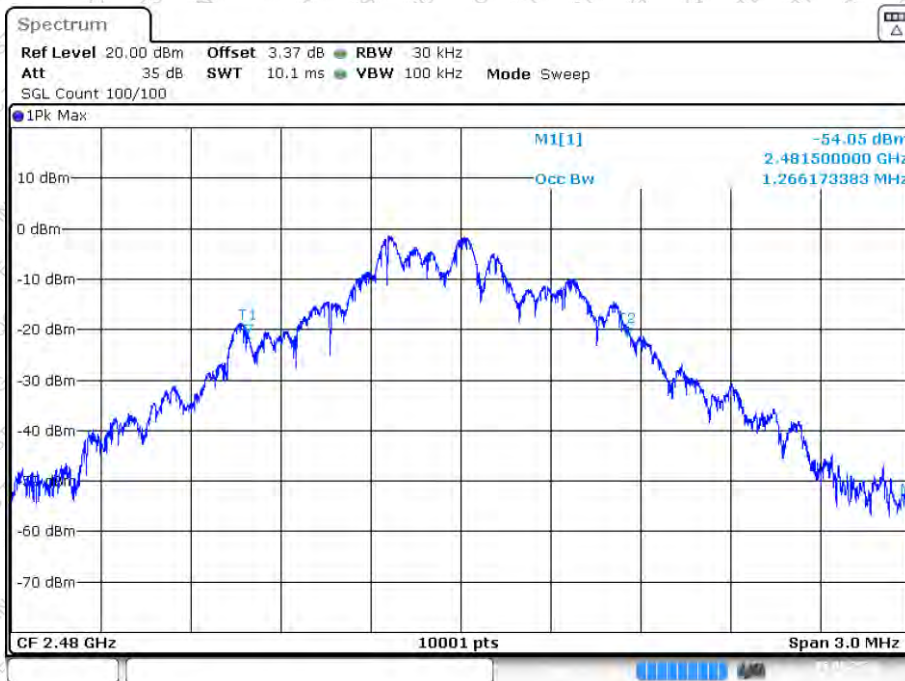


OBW NVNT BLE 1M 2440MHz Ant1



Date: 6.AUG.2024 16:07:08

OBW NVNT BLE 1M 2480MHz Ant1



Date: 6.AUG.2024 16:08:03

8. Power Spectral Density

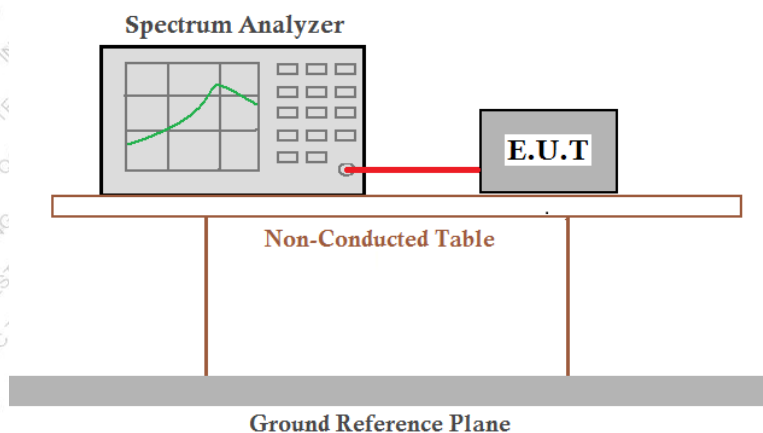
8.1 Applicable Standard

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

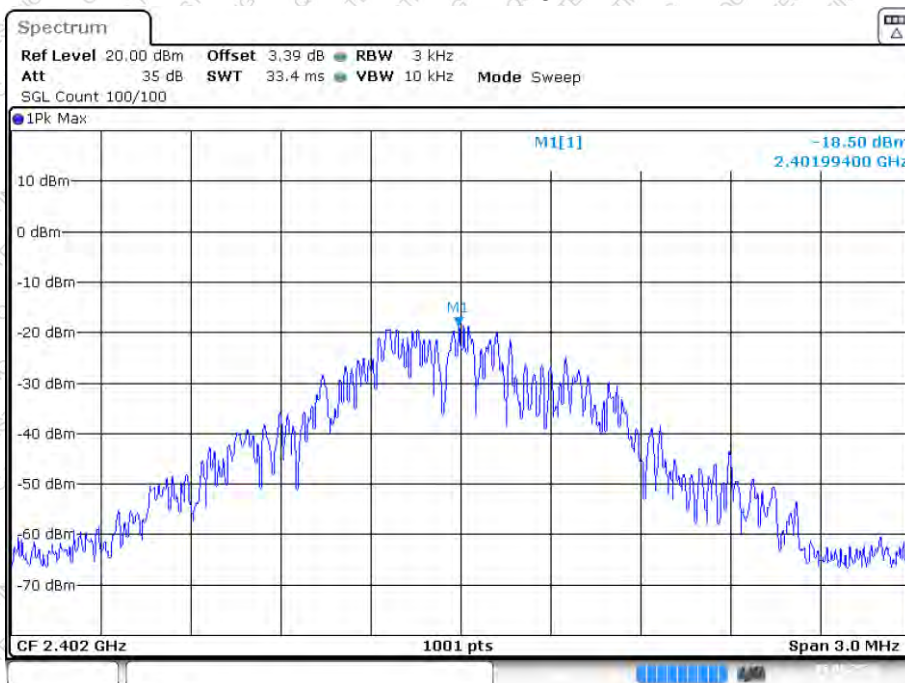
| | | | |
|--------------|----------|--------------|----------|
| Temperature | 24 °C | Humidity | 50 % |
| ATM Pressure | 101.1kPa | Antenna Gain | -0.68dBi |
| Test by | LBi Li | Test result | PASS |

Please refer to following table and plots.

| Modulation | Test channel | Power Spectral Density (dBm/3kHz) | Limit(dBm/3kHz) | Result |
|------------|--------------|-----------------------------------|-----------------|--------|
| BLE | Lowest | -18.5 | 8.00 | Pass |
| | Middle | -18.11 | | |
| | Highest | -17.59 | | |

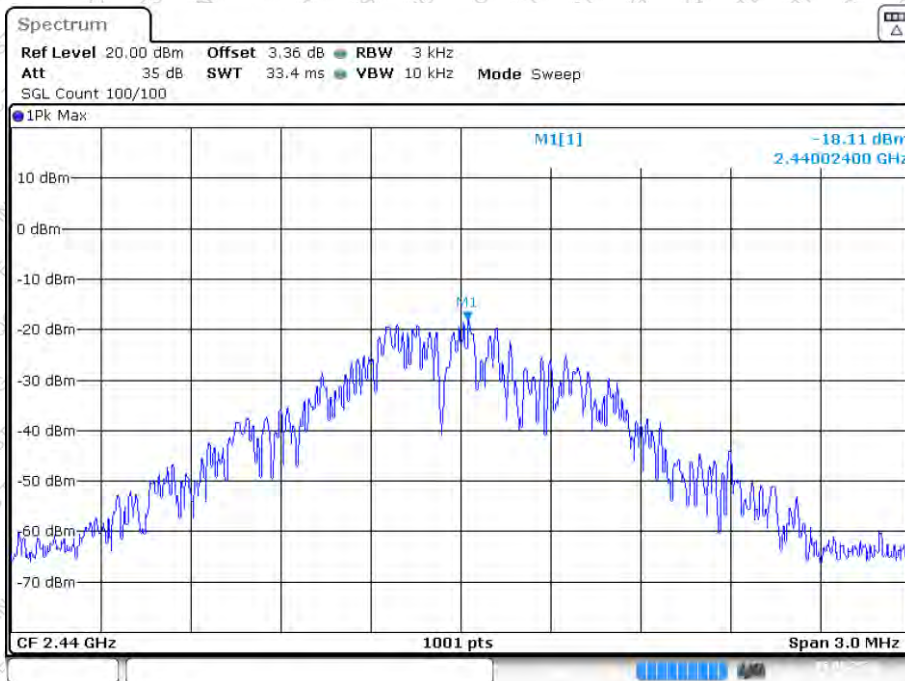


PSD NVNT BLE 1M 2402MHz Ant1



Date: 6 AUG 2024 16:05:39

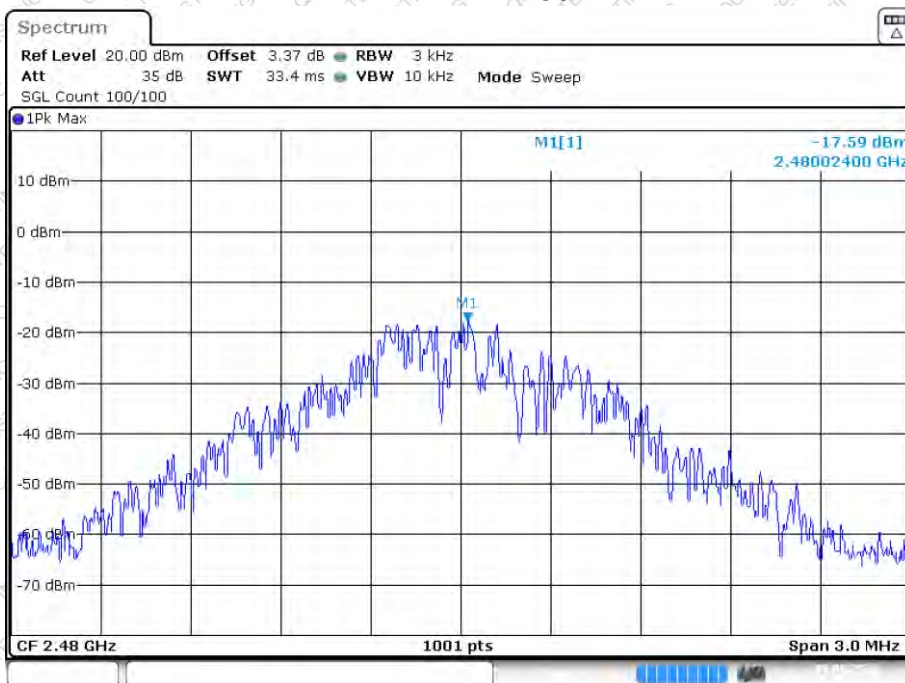
PSD NVNT BLE 1M 2440MHz Ant1



Date: 6 AUG 2024 16:07:24



PSD NVNT BLE 1M 2480MHz Ant1



Date: 6.AUG.2024 16:08:20

9. Spurious Emission in Non-restricted & restricted Bands

9.1 Conducted Emission Method

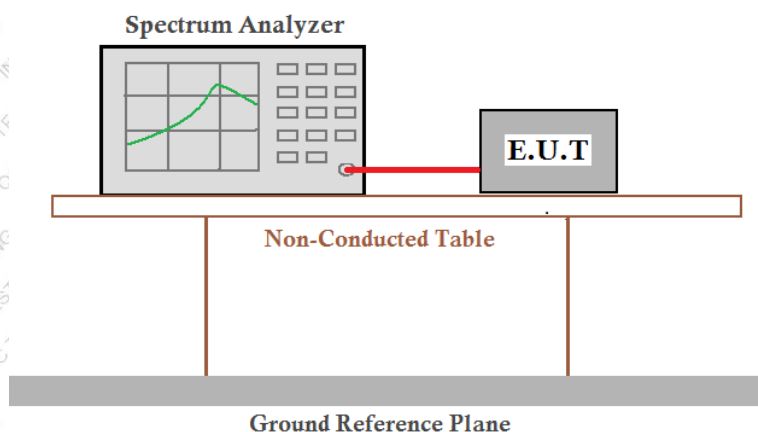
9.1.1 Applicable Standard

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 | 24 °C | Humidity | 50 % |
| ATM Pressure | 101.1kPa | Antenna Gain | -0.68dBi |
| Test by | LBi Li | Test result | PASS |

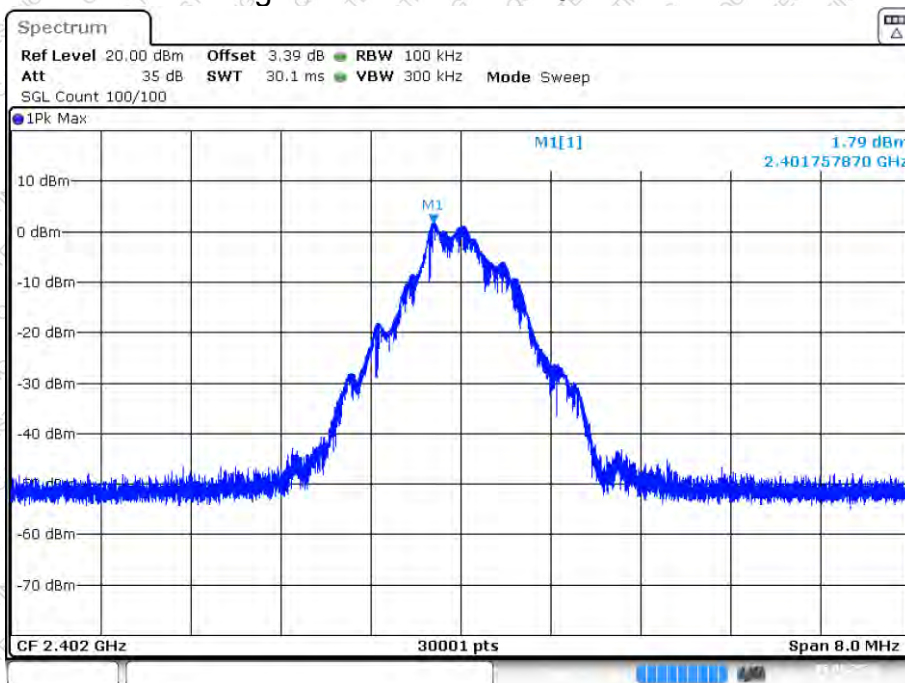
Please refer to following plots.

Band Edge:

| Modulation | Frequency (MHz) | Antenna | Max Value (dBc) | Limit (dBc) | Verdict |
|------------|-----------------|---------|-----------------|-------------|---------|
| BLE | Lowest | 2402 | -47.88 | -20 | Pass |
| | Highest | 2480 | -45.68 | -20 | Pass |

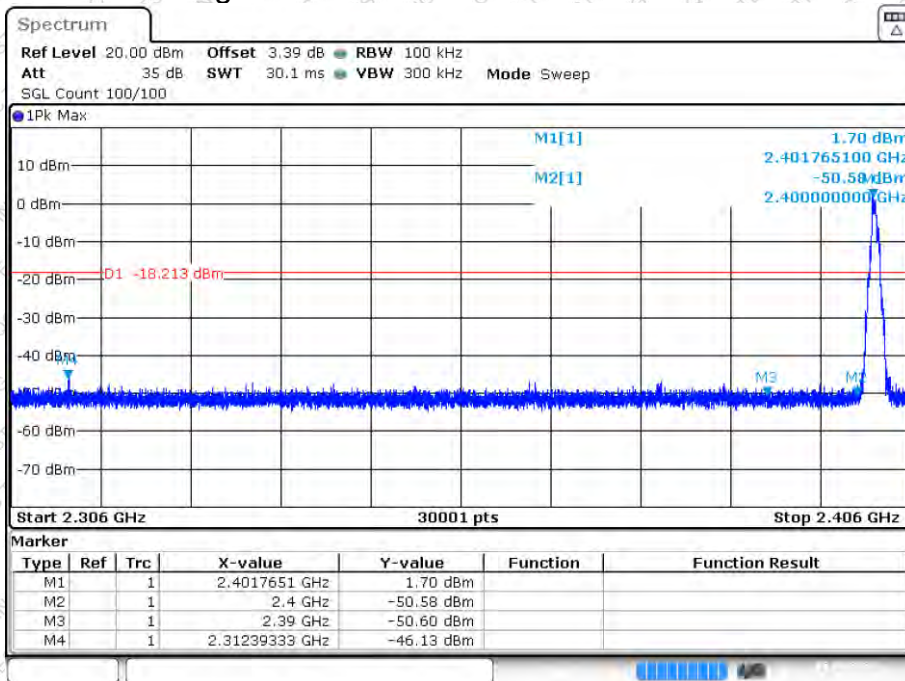


Band Edge NVNT BLE 1M 2402MHz Ant1 Ref



Date: 6 AUG 2024 16:05:46

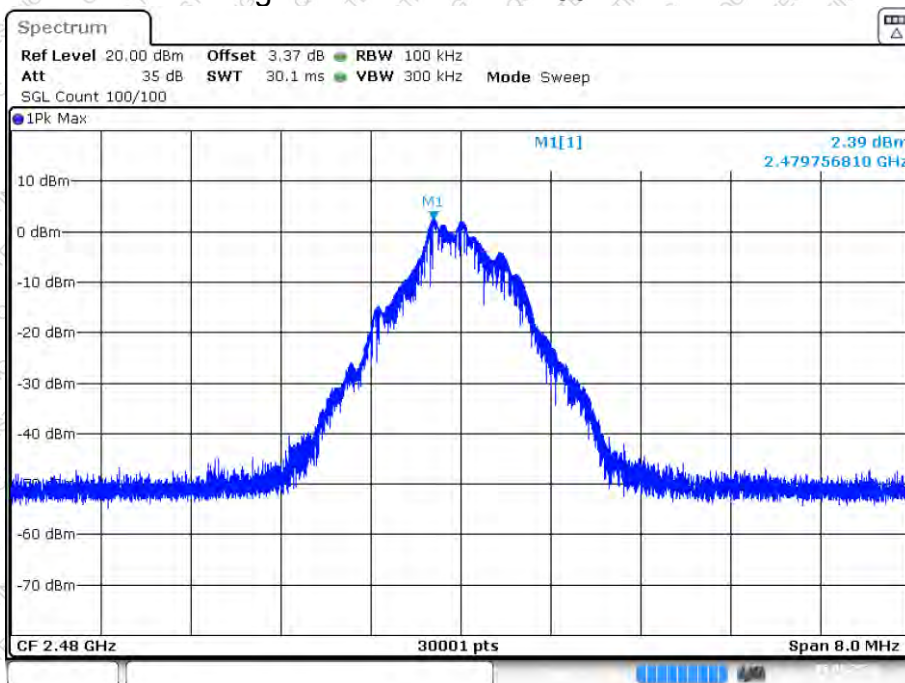
Band Edge NVNT BLE 1M 2402MHz Ant1 Emission



Date: 6 AUG 2024 16:05:52

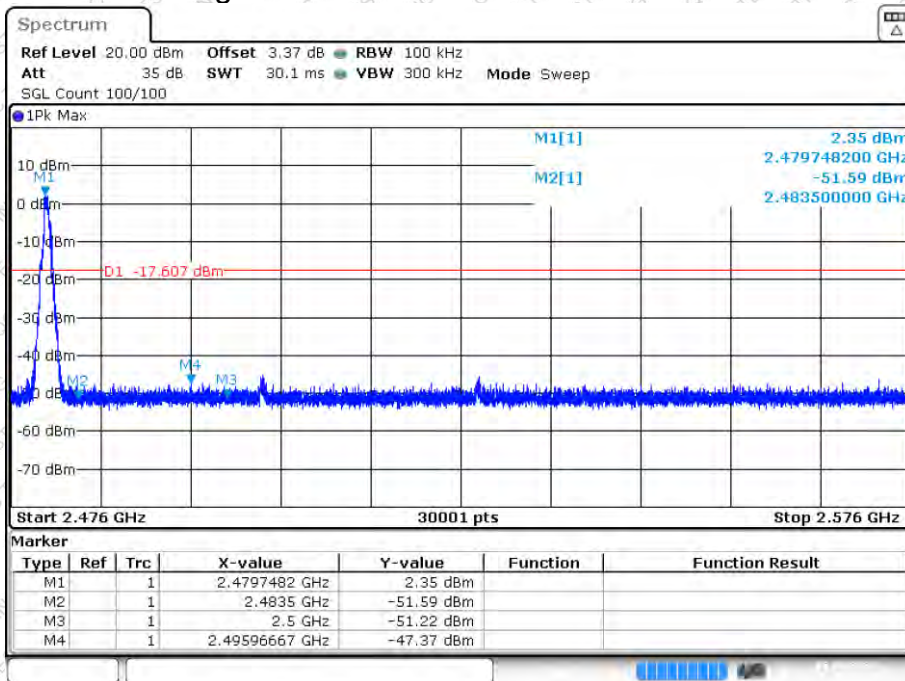


Band Edge NVNT BLE 1M 2480MHz Ant1 Ref



Date: 6 AUG 2024 16:08:27

Band Edge NVNT BLE 1M 2480MHz Ant1 Emission



Date: 6 AUG 2024 16:08:33

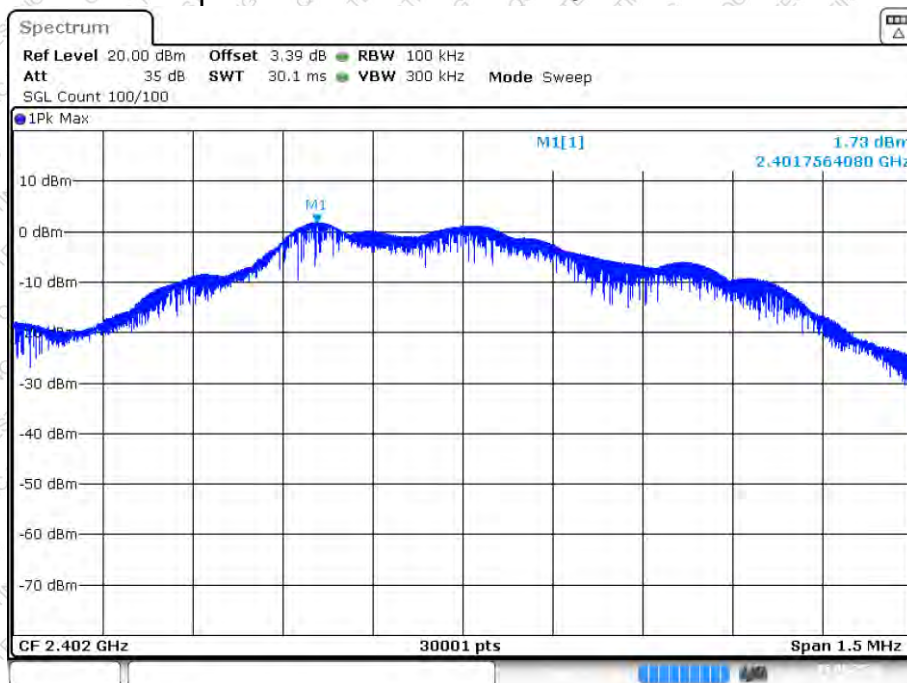


Conducted RF Spurious Emission:

| Modulation | Frequency (MHz) | Antenna | Max Value (dBc) | Limit (dBc) | Verdict |
|------------|-----------------|---------|-----------------|-------------|---------|
| BLE | Lowest | 2402 | -41.88 | -20 | Pass |
| | Middle | 2440 | -40.26 | -20 | Pass |
| | Highest | 2480 | -35.19 | -20 | Pass |

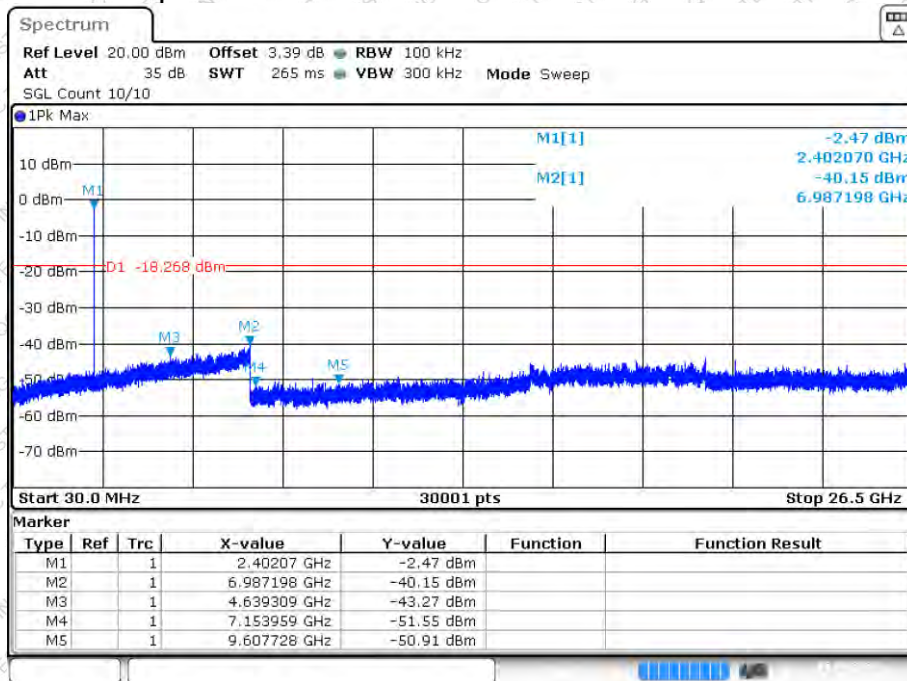


Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Ref



Date: 6 AUG 2024 16:05:59

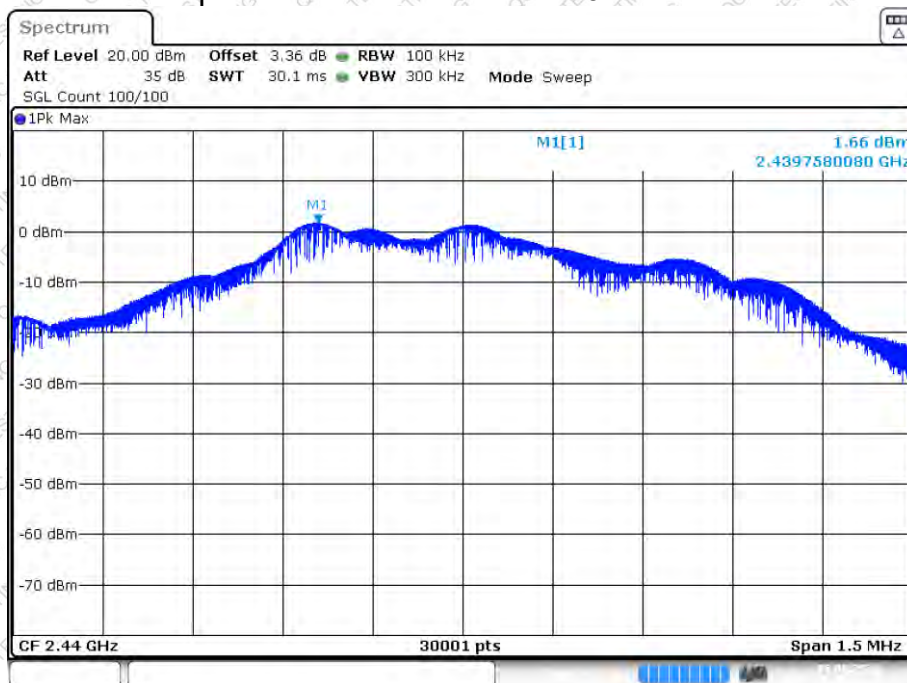
Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Emission



Date: 6 AUG 2024 16:06:12

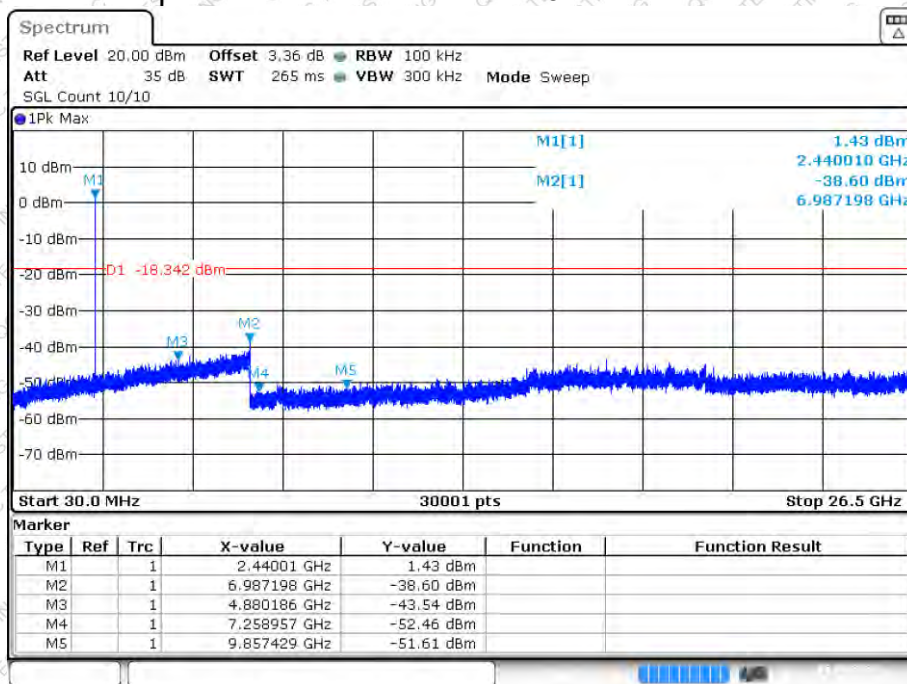


Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Ref



Date: 6 AUG 2024 16:07:32

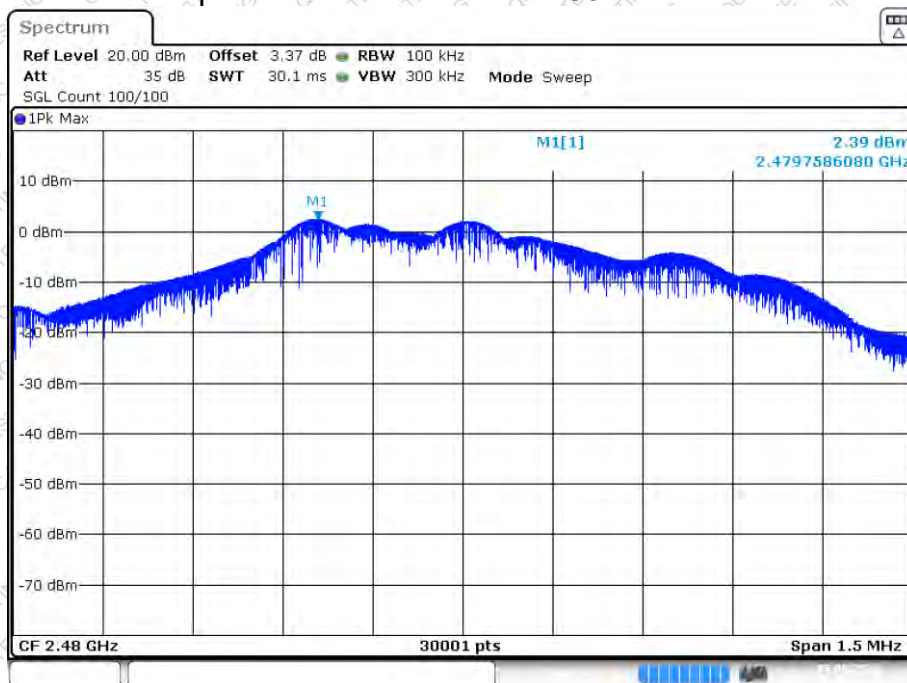
Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Emission



Date: 6 AUG 2024 16:07:45

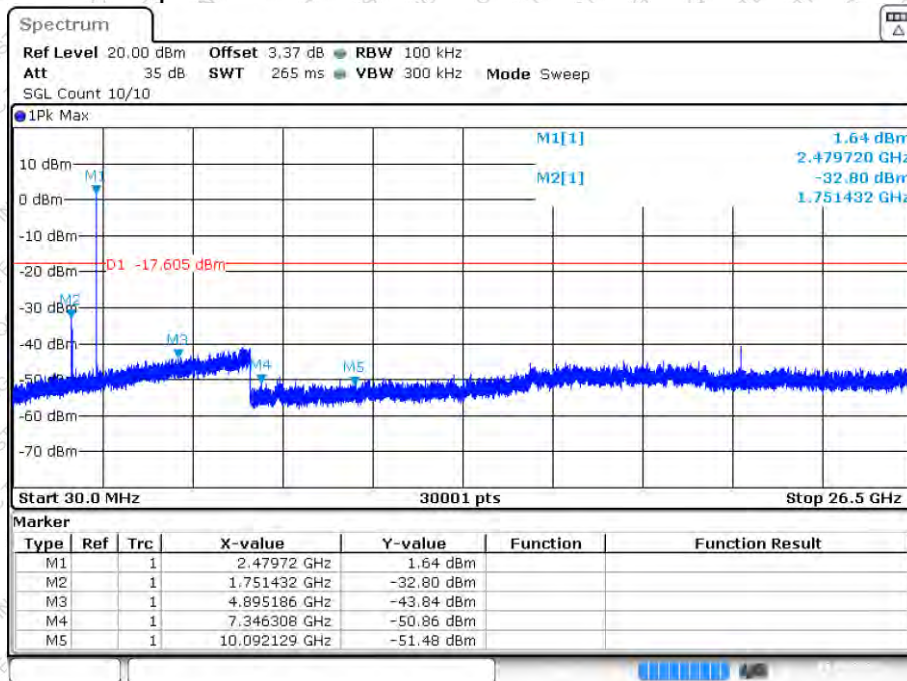


Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Ref



Date: 6 AUG 2024 16:08:41

Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Emission



Date: 6 AUG 2024 16:08:54

9.2 Radiated Emission Method

9.2.1 Applicable Standard

FCC Part15 C Section 15.209 and 15.205

9.2.2 Limit

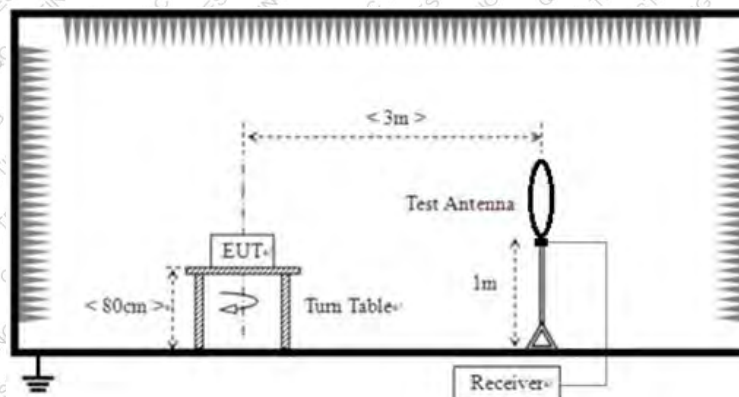
| Frequency | Limit (uV/m) | Value | Measurement Distance |
|-------------------|--------------|-------|----------------------|
| 0.009MHz-0.490MHz | 2400/F(KHz) | QP | 300m |
| 0.490MHz-1.705MHz | 24000/F(KHz) | QP | 30m |
| 1.705MHz-30MHz | 30 | QP | 30m |

| Frequency | Field Strengths Limits (uV/m at 3 m) | Field Strengths Limits (dBuV/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 | / | 74.0 | Peak |
| | | 54.0 | Average |

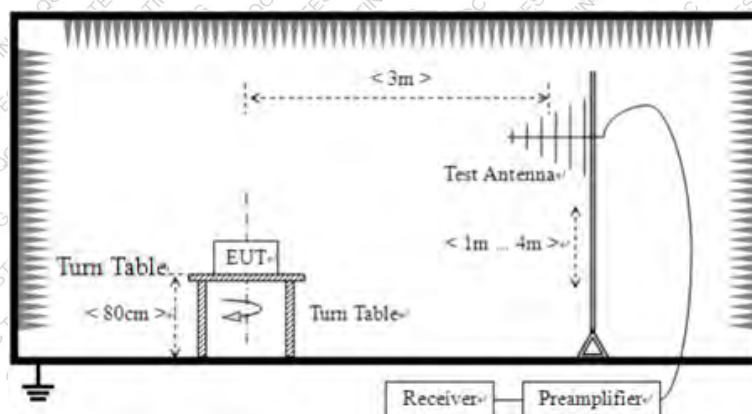
Note: $\text{dBuV/m} = 20\log(\mu\text{V/m})$

9.2.3 Test setup

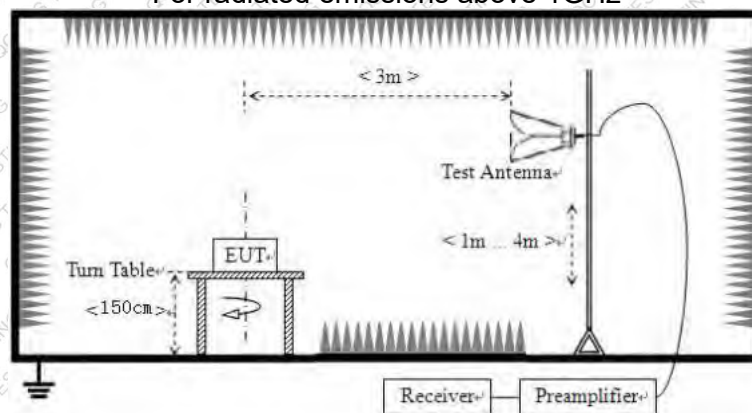
For radiated emissions from 9kHz to 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



9.2.4 EMI Test Receiver Setup

| Frequency | RBW | VBW | IF B/W | Measurement |
|-------------------|---------|---------|---------|-------------|
| 9KHz-150KHz | 200Hz | 600Hz | / | QP |
| 150KHz-30MHz | 9KHz | 30KHz | / | QP |
| 30 MHz – 1000 MHz | 100 kHz | 300 kHz | 120 kHz | QP |
| Above 1 GHz | 1 MHz | 3 MHz | / | Peak |
| | 1 MHz | 10 Hz | / | Average |

Remark: For the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission test in these three bands are based on measurements employing an average detector.

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 | 26 °C | Humidity | 54 % |
| ATM Pressure | 101.1kPa | Antenna Gain | -0.68dBi |
| Test by | LBi Li | Test result | PASS |

Test voltage: DC 3.7V

Remarks:

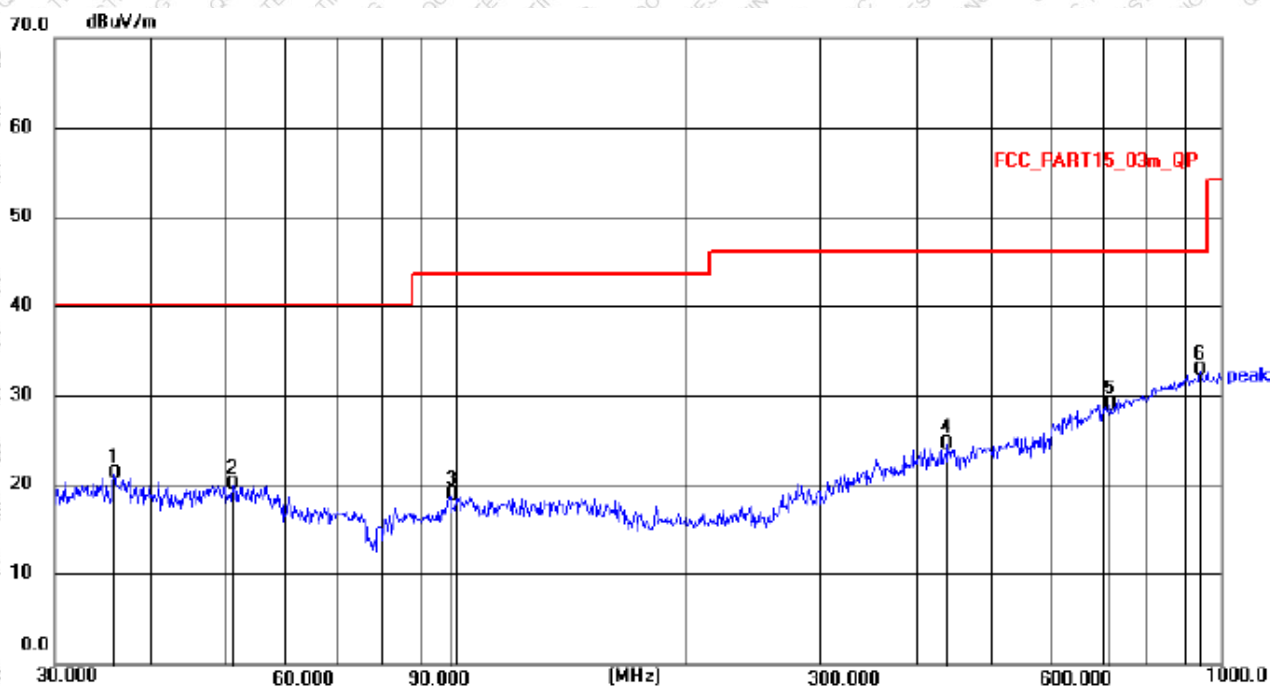
1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.
2. The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.



Below 1GHz

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

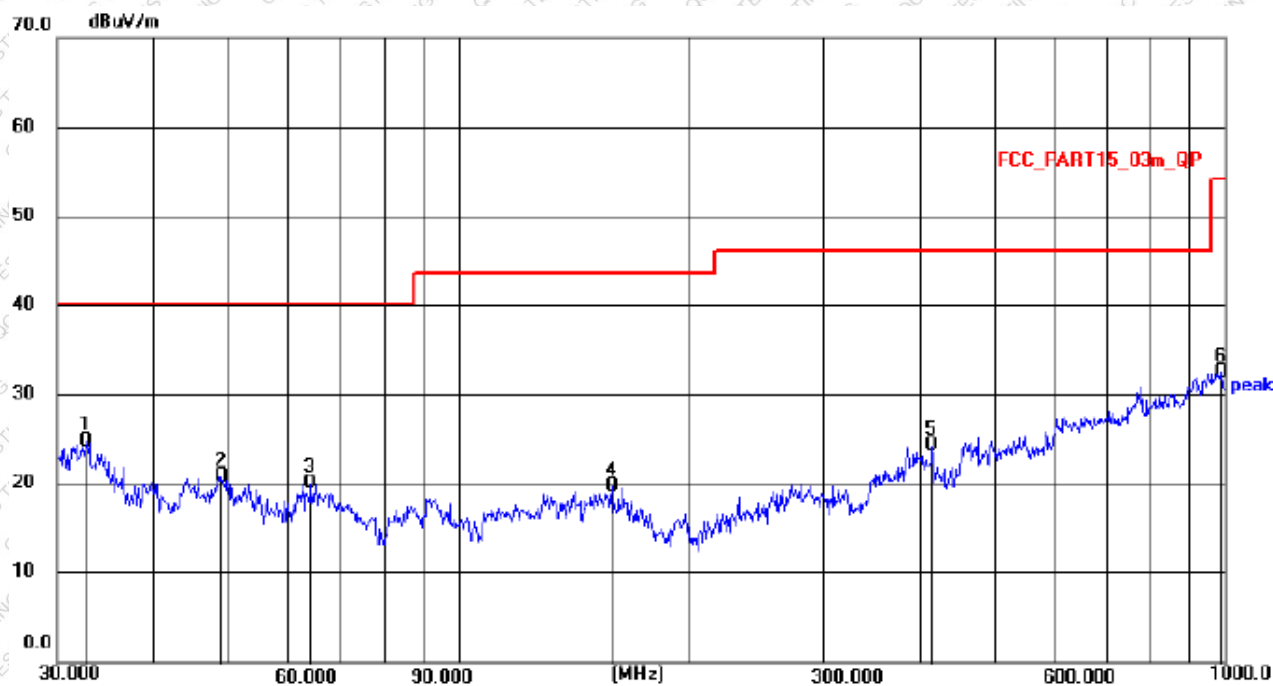
Horizontal:



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1 | 35.8746 | 7.42 | 13.82 | 21.24 | 40.00 | 18.76 | QP |
| 2 | 51.1208 | 5.47 | 14.56 | 20.03 | 40.00 | 19.97 | QP |
| 3 | 98.8324 | 7.88 | 10.90 | 18.78 | 43.50 | 24.72 | QP |
| 4 | 438.6553 | 5.98 | 18.67 | 24.65 | 46.00 | 21.35 | QP |
| 5 | 716.6820 | 5.72 | 23.23 | 28.95 | 46.00 | 17.05 | QP |
| 6 * | 938.8324 | 6.06 | 26.72 | 32.78 | 46.00 | 13.22 | QP |



Vertical:



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1 * | 32.7486 | 11.76 | 12.97 | 24.73 | 40.00 | 15.27 | QP |
| 2 | 49.0144 | 6.29 | 14.46 | 20.75 | 40.00 | 19.25 | QP |
| 3 | 64.2074 | 7.20 | 12.86 | 20.06 | 40.00 | 19.94 | QP |
| 4 | 158.6673 | 5.36 | 14.41 | 19.77 | 43.50 | 23.73 | QP |
| 5 | 414.7223 | 6.42 | 17.89 | 24.31 | 46.00 | 21.69 | QP |
| 6 | 989.5353 | 5.52 | 26.91 | 32.43 | 54.00 | 21.57 | QP |



Above 1GHz

Test channel: Lowest channel

| Frequency (MHz) | Read Level (dBμV) | polarization | Factor (dB/m) | Level (dBμV/m) | Limit Line (dBμV/m) | Margin (dB) | Detector |
|-----------------|-------------------|--------------|---------------|----------------|---------------------|-------------|----------|
| 2310 | 52.22 | H | -11.46 | 40.76 | 74 | 33.24 | peak |
| 2310 | 51.01 | V | -11.48 | 39.53 | 74 | 34.47 | peak |
| 2390 | 54.63 | H | -11.16 | 43.47 | 74 | 30.53 | peak |
| 2390 | 52.88 | V | -11.22 | 41.66 | 74 | 32.34 | peak |
| 4804 | 50.71 | H | -5.98 | 44.73 | 74 | 29.27 | peak |
| 4804 | 48.42 | V | -6.12 | 42.30 | 74 | 31.70 | 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 | 50.93 | H | -5.71 | 45.22 | 74 | 28.78 | peak |
| 4880 | 49.93 | V | -5.84 | 44.09 | 74 | 29.91 | 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 | 53.77 | H | -10.81 | 42.96 | 74 | 31.04 | peak |
| 2483.5 | 55.06 | V | -10.91 | 44.15 | 74 | 29.85 | peak |
| 2500 | 52.09 | H | -10.75 | 41.34 | 74 | 32.66 | peak |
| 2500 | 52.39 | V | -10.85 | 41.54 | 74 | 32.46 | peak |
| 4960 | 50.04 | H | -5.45 | 44.59 | 74 | 29.41 | peak |
| 4960 | 49.49 | V | -5.56 | 43.93 | 74 | 30.07 | 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.
3. If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

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