# Test Report

| | | |
|---|---|---|
| **Applicant** | : | zhong shan haideng Optoelectronic Technology Co., Ltd |
| **Address** | : | 2nd Floor, No. 10 Fuheng East Middle, Henglan Town, Zhongshan City, Guangdong Province |
| **Product Name** | : | Aquarium Light |
| **Brand Mark** | : | N/A |
| **Model** | : | YG-300 |
| **Series model** | : | YG-500, YG-700, YG-900, YG-1200, YG-1500 |
| **FCC ID** | : | 2BOON-YG300 |
| **Report Number** | : | BLA-EMC-202504-A2401 |
| **Date of Receipt** | : | Apr. 14, 2025 |
| **Date of Test** | : | Apr. 14, 2025 to Apr. 28, 2025 |
| **Test Standard** | : | 47 CFR Part 15, Subpart C 15.247 |
| **Test Result** | : | Pass |

**Compiled by:** Mark Chen **Review by:** Xavier **Approved by:** Blue Zheng

BlueAsia of Technical Services(Shenzhen) Co., Ltd. BLA

**Issued Date: Apr. 29, 2025**

**BlueAsia of Technical Services(Shenzhen) Co.,Ltd.**
Address: Building C, No. 107, Shihuan Road, Shiyan Sub-District, Baoan District, Shenzhen, Guangdong Province, China

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# Revise Record

| Version No. | Date | Description |
|---|---|---|
| 01 | Apr. 29, 2025 | Original |
| | | |
| | | |
| | | |

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# 1 General information

## 1.1 General information

| | |
|---|---|
| Applicant | zhong shan haideng Optoelectronic Technology Co., Ltd |
| Address | 2nd Floor, No. 10 Fuheng East Middle, Henglan Town, Zhongshan City, Guangdong Province |
| Manufacturer | zhong shan haideng Optoelectronic Technology Co., Ltd |
| Address | 2nd Floor, No. 10 Fuheng East Middle, Henglan Town, Zhongshan City, Guangdong Province |
| Factory | zhong shan haideng Optoelectronic Technology Co., Ltd |
| Address | 2nd Floor, No. 10 Fuheng East Middle, Henglan Town, Zhongshan City, Guangdong Province |

## 1.2 General description of EUT

| | | |
|---|---|---|
| Product name | Aquarium Light | |
| Model no. | YG-300 | |
| Series Model No. | YG-300, YG-500, YG-700, YG-900, YG-1200, YG-1500 | |
| Differences of Series model | The above models are identical in PCB layout, internal structure and components, only model name and the size of appearance are different. | |
| Operation Frequency | 2402MHz-2480MHz | |
| Modulation Type | GFSK | |
| Rate data | 1Mbps, 2Mbps | |
| Channel Spacing | 2MHz | |
| Number of Channels | 40 | |
| Antenna Type | Wire antenna | |
| Antenna Gain | 2.79dBi (Provided by customer) | |
| Power supply | Adapter | Model: CT-0020V04-00001<br>Input: 100-240VAC 50/60Hz<br>Output: DC 20V/1200mA |
| Test Voltage | AC 120V | |

| | |
|---|---|
| Hardware Version | N/A |
| Software Version | N/A |
| *Note: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.* | |

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# 2 Test summary

| No. | Test item | FCC standard | Test Method(Clause) | Result |
|---|---|---|---|---|
| 1 | Antenna Requirement | §15.203 | N/A | Pass |
| 2 | Conducted Emissions at AC Power Line (150kHz-30MHz) | §15.207 | ANSI C63.10-2013 Clause 6.2 | Pass |
| 3 | Conducted Peak Output Power | §15.247(b)(3) | ANSI C63.10-2013 Cluase 7.8.5 | Pass |
| 4 | Minimum 6dB Bandwidth | §15.247a(2) | ANSI C63.10-2013 Cluase 11.8.1 | Pass |
| 5 | Power Spectrum Density | §15.247(d) | ANSI C63.10-2013 Cluase 11.10.2 | Pass |
| 6 | Conducted Band Edges Measurement | §15.247(d) | ANSI C63.10-2013 Cluase 11.13 | Pass |
| 7 | Conducted Spurious Emissions | §15.247(d) | ANSI C63.10-2013 Cluase 11.11 | Pass |
| 8 | Radiated Spurious Emissions | §15.209<br>§15.247(d) | ANSI C63.10-2013 Cluase 6.4,6.5,6.6 | Pass |
| 9 | Radiated Emissions which fall in the restricted bands | §15.209<br>§15.247(d) | ANSI C63.10-2013 Cluase 11.12 | Pass |

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# 3 Test Configuration

## 3.1 Test mode

| Test Mode Note 1 | Description |
|---|---|
| TX | Keep the EUT in continuously transmitting with modulation mode. |
| RX | Keep the EUT in receiving mode |
| TX Low channel | Keep the EUT in continuously transmitting mode in low channel |
| TX middle channel | Keep the EUT in continuously transmitting mode in middle channel |
| TX high channel | Keep the EUT in continuously transmitting mode in high channel |

*Note 1: The EUT was configured to measure its highest possible emission and/or immunity level. The test modes were adapted according to the operation manual for use.*

| Power level setup in software | | | |
|---|---|---|---|
| Test Software Name | LeKit | | |
| Mode | Channel | Frequency (MHz) | Soft Set |
| TX | CH00 | 2402 | TX level : Default |
| | CH20 | 2442 | |
| | CH39 | 2480 | |

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## 3.2 Operation Frequency each of channel

| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---|---|---|---|---|---|---|---|
| 0 | 2402MHz | 10 | 2422MHz | 20 | 2442MHz | 30 | 2462MHz |
| 1 | 2404MHz | 11 | 2424MHz | 21 | 2444MHz | 31 | 2464MHz |
| … | … | … | … | … | … | … | … |
| 8 | 2418MHz | 18 | 2438MHz | 28 | 2458MHz | 38 | 2478MHz |
| 9 | 2420MHz | 19 | 2440MHz | 29 | 2460MHz | 39 | 2480MHz |

## 3.3 Test channel

| Channel | Frequency |
|---|---|
| The lowest channel | 2402MHz |
| The middle channel | 2442MHz |
| The Highest channel | 2480MHz |

## 3.4 Auxiliary equipment

| Device Type | Manufacturer | Model Name | Serial No. | Remark |
|---|---|---|---|---|
| PC | Lenovo | E460C | N/A | From lab (No.BLA-ZC-BS-2022005) |

**Note:**

"--" mean no any auxiliary device during testing.

## 3.5 Test environment

| Environment | Temperature | Voltage |
|---|---|---|
| Normal | 25°C | AC 120V |

# 4 Laboratory information

## 4.1 Laboratory and accreditations

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

| | |
|---|---|
| Company name: | BlueAsia of Technical Services(Shenzhen) Co., Ltd. |
| Address: | Building C, No. 107, Shihuan Road, Shiyan Sub-District, Baoan District, Shenzhen, Guangdong Province, China |
| CNAS accredited No.: | L9788 |
| A2LA Cert. No.: | 5071.01 |
| FCC Designation No.: | CN1252 |
| ISED CAB identifier No.: | CN0028 |
| Telephone: | +86-755-28682673 |
| FAX: | +86-755-28682673 |

## 4.2 Measurement uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

| Parameter | Expanded Uncertainty |
|---|---|
| Radiated Emission(9kHz-30MHz) | ±4.34dB |
| Radiated Emission(30Mz-1000MHz) | ±4.24dB |
| Radiated Emission(1GHz-18GHz) | ±4.68dB |
| AC Power Line Conducted Emission(150kHz-30MHz) | ±3.45dB |
| Occupied Channel Bandwidth | ±5 % |
| RF output power, conducted | ±1.5 dB |
| Power Spectral Density, conducted | ±3.0 dB |
| Unwanted Emissions, conducted | ±3.0 dB |
| Temperature | ±3 °C |
| Supply voltages | ±3 % |
| Time | ±5 % |

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# 5 Test equipment

**Radiated Spurious Emissions (Below 1GHz)**

| Equipment | Name | Model | Manufacture | S/N | Cal. Date | Due. Date |
|---|---|---|---|---|---|---|
| BLA-EMC-002-01 | Anechoic chamber | 9*6*6 chamber | SKET | N/A | 2024/3/27 | 2027/3/26 |
| BLA-EMC-002-02 | Control room | 966 control room | SKET | N/A | 2024/3/27 | 2027/3/26 |
| BLA-EMC-009 | EMI receiver | ESR7 | R&S | 101199 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-043 | Loop antenna | FMZB1519B | Schwarzbeck | 00102 | 2024/06/29 | 2026/06/28 |
| BLA-EMC-065 | Broadband antenna | VULB9168 | Schwarzbeck | 01065P | 2024/06/29 | 2026/06/27 |
| BLA-XC-01 | Coaxial Cable | N/A | BlueAsia | V01 | N/A | N/A |
| BLA-XC-02 | Coaxial Cable | N/A | BlueAsia | V02 | N/A | N/A |

**Radiated Spurious Emissions (Above 1GHz)**

| Equipment | Name | Model | Manufacture | S/N | Cal. Date | Due. Date |
|---|---|---|---|---|---|---|
| BLA-EMC-001-01 | Anechoic chamber | 9*6*6 chamber | SKET | N/A | 2023/11/16 | 2026/11/15 |
| BLA-EMC-001-02 | Control Room | 966 control room | SKET | N/A | 2023/11/16 | 2025/11/15 |
| BLA-EMC-008 | Spectrum | FSP40 | R&S | 100817 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-012 | Broadband antenna | VULB9168 | Schwarzbeck | 00836 P:00227 | 2022/10/12 | 2025/10/11 |
| BLA-EMC-013 | Horn Antenna | BBHA9120D | Schwarzbeck | 01892 | 2024/06/29 | 2026/06/28 |
| BLA-EMC-014 | Amplifier | PA_000318G-45 | SKET | PA2018043003 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-046 | Filter bank | 2.4G/5G Filter bank | SKET | N/A | 2024/06/28 | 2025/06/27 |
| BLA-EMC-061 | Receiver | ESPI7 | R&S | 101477 | 2024/06/28 | 2025/06/27 |
| BLA-EMC-066 | Amplifier | LNPA_30M01G-30 | SKET | SK2021060801 | 2024/06/28 | 2025/06/27 |
| BLA-EMC-086 | Amplifier | LNPA_18G40G-50dB | SKET | SK2022071301 | 2024/06/28 | 2025/06/27 |
| BLA-EMC-087 | Horn Antenna | BBHA 9170 | Schwarzbeck | 1106 | 2024/06/29 | 2026/06/28 |

| | | | | | | |
|---|---|---|---|---|---|---|
| BLA-XC-03 | Coaxial Cable | N/A | BlueAsia | V03 | N/A | N/A |
| BLA-XC-04 | Coaxial Cable | N/A | BlueAsia | V04 | N/A | N/A |

**RF conducted**

| Equipment | Name | Model | Manufacture | S/N | Cal. Date | Due. Date |
|---|---|---|---|---|---|---|
| BLA-EMC-003-003 | Shield room | 5*3*3 | SKET | N/A | 2023/11/16 | 2025/11/15 |
| BLA-EMC-016 | Signal Generator | N5182A | Agilent | MY52420567 | 2024/06/28 | 2025/06/27 |
| BLA-EMC-038 | Spectrum | N9020A | Agilent | MY49100060 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-042 | Power sensor | RPR3006W | DARE | 14I00889SN042 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-044 | Radio communication tester | CMW500 | R&S | 132429 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-064 | Signal Generator | N5182B | KEYSIGHT | MY58108892 | 2024/06/28 | 2025/06/27 |
| BLA-EMC-079 | Spectrum | N9020A | Agilent | MY54420161 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-088 | Audio Analyzer | ATS-1 | Audio Precision | ATS141094 | 2024/06/28 | 2025/06/27 |

**Conducted Emissions**

| Equipment | Name | Model | Manufacture | S/N | Cal. Date | Due. Date |
|---|---|---|---|---|---|---|
| BLA-EMC-003-001 | Shield room | 8*3*3 | SKET | N/A | 2023/11/16 | 2025/11/15 |
| BLA-EMC-009 | EMI receiver | ESR7 | R&S | 101199 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-011 | LISN | ENV216 | R&S | 101372 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-033 | Impedance transformer | DC-2GHz | DFXP | N/A | 2024/06/28 | 2025/06/27 |
| BLA-EMC-041 | LISN | AT166-2 | ATTEN | AKK1806000003 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-045 | Impedance stable network | ISNT8-cat6 | TESEQ | 53580 | 2024/08/08 | 2025/08/07 |
| BLA-EMC-095 | Single-channel vehicle artificial power network | NNBM 8124 | Schwarzbeck | 01045 | 2024/06/28 | 2025/06/27 |
| BLA-EMC-096 | Single-channel vehicle artificial power network | NNBM 8124 | Schwarzbeck | 01075 | 2024/06/28 | 2025/06/27 |

| | | | | | | |
|---|---|---|---|---|---|---|
| BLA-XC-05 | Coaxial Cable | N/A | BlueAsia | V05 | N/A | N/A |

**Test Software Record:**

| Software No. | Software Name | Manufacture | Software version | Test site |
|---|---|---|---|---|
| BLA-EMC-S001 | EZ-EMC | EZ | EEMC-3A1+ | RE |
| BLA-EMC-S002 | EZ-EMC | EZ | EEMC-3A1+ | RE |
| BLA-EMC-S003 | EZ-EMC | EZ | EEMC-3A1+ | CE |
| BLA-EMC-S010 | MTS 8310 | MW | 2.0.0.0 | RF |

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# 6 Test result

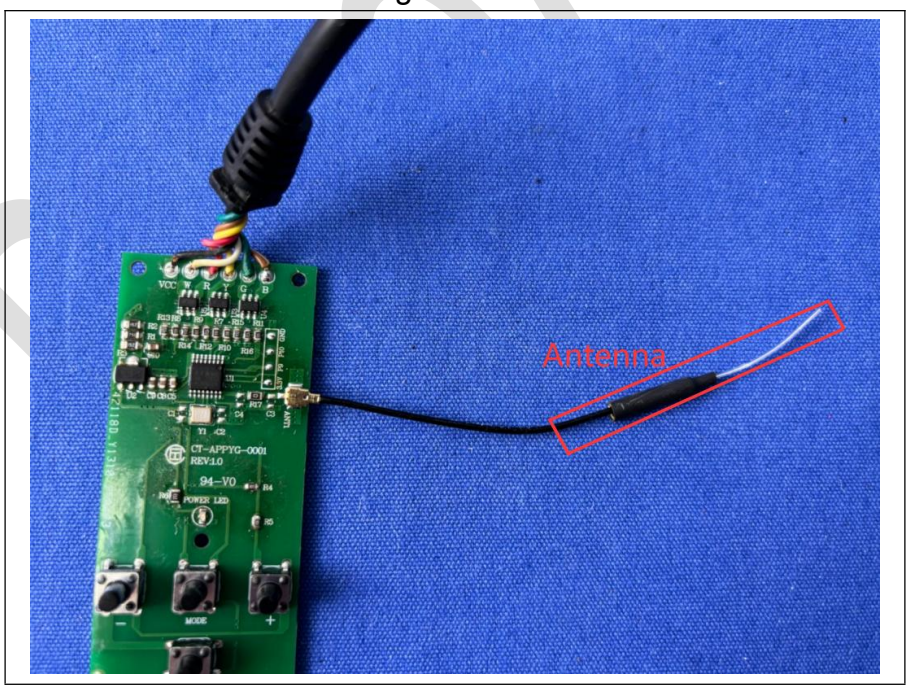
## 6.1 Antenna requirement

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | N/A |

### 6.1.1 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 an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of a so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT antenna:
The antenna is Wire antenna. The best case gain of the antenna is 2.79dBi.



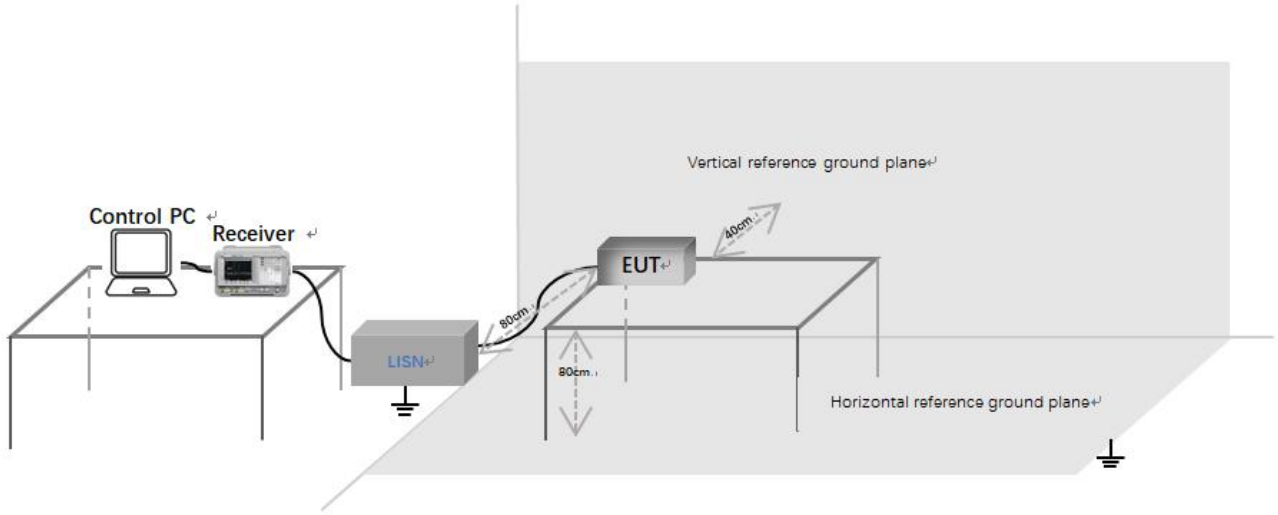
## 6.2 Conducted emissions at AC power line (150 kHz-30 MHz)

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 6.2 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

### 6.2.1 Limit

| **Frequency of emission(MHz)** | **Conducted limit(dBμV)** | |
|---|---|---|
| | **Quasi-peak** | **Average** |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |
| *Decreases with the logarithm of the frequency. | | |

### 6.2.2 Test setup




Description of test setup connection:

*a) Connect the control PC to the receiver through a USB to GPIB cable;*

*b) The receiver is connected to the LISN through a coaxial line;*

*c) Connect the power port of LISN to the EUT.*

### 6.2.3 Procedure

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50H + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

LISN=Read Level+ Cable Loss+ LISN Factor

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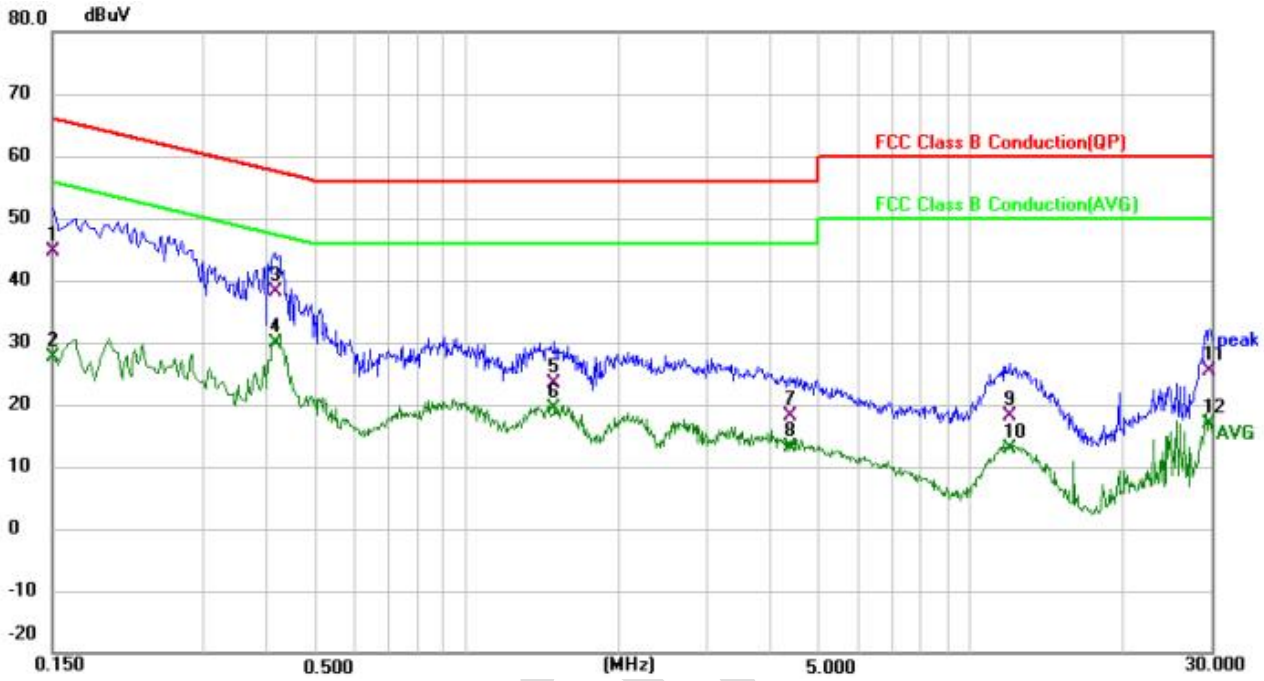
### 6.2.4 Test data

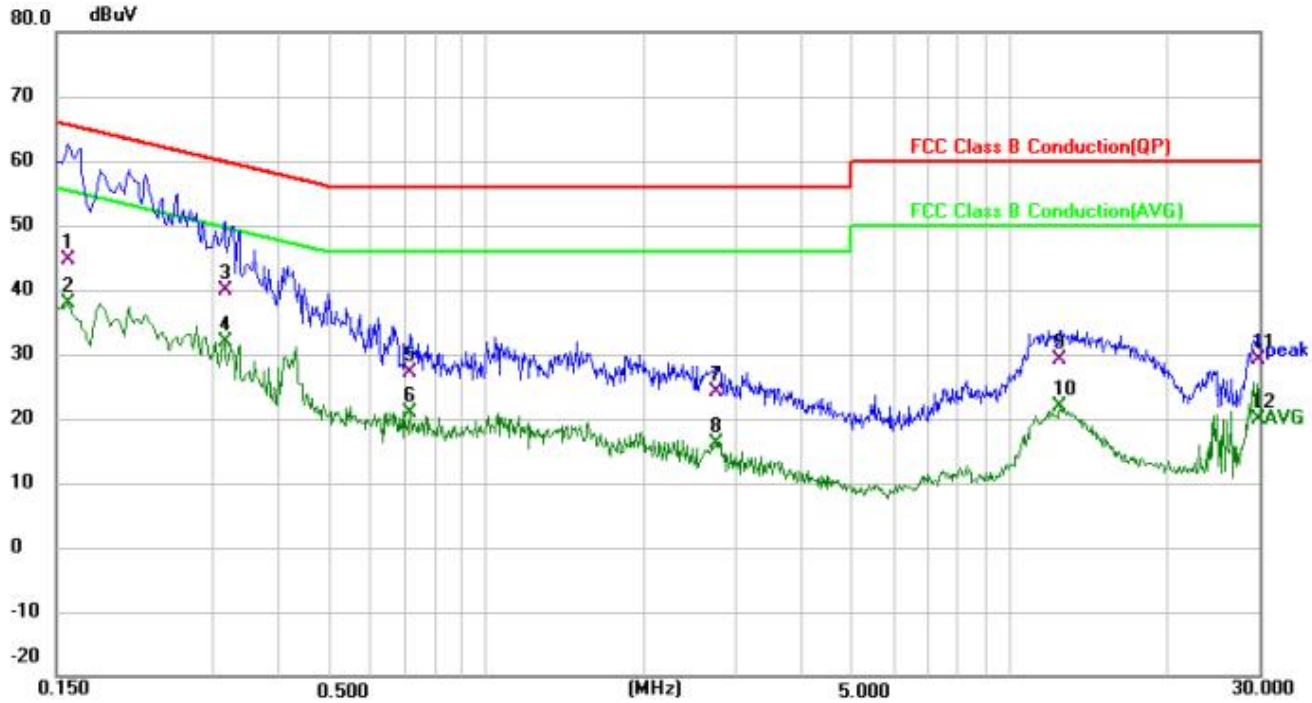
[Test Mode: TX]; [Line: Line] ;[Voltage:120V/60Hz]




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.1500 | 34.50 | 10.13 | 44.63 | 66.00 | -21.37 | QP |
| 2 | | 0.1500 | 17.61 | 10.13 | 27.74 | 56.00 | -28.26 | AVG |
| 3 | | 0.4140 | 28.40 | 9.85 | 38.25 | 57.57 | -19.32 | QP |
| 4 | * | 0.4140 | 20.06 | 9.85 | 29.91 | 47.57 | -17.66 | AVG |
| 5 | | 1.4940 | 13.45 | 9.85 | 23.30 | 56.00 | -32.70 | QP |
| 6 | | 1.4940 | 9.54 | 9.85 | 19.39 | 46.00 | -26.61 | AVG |
| 7 | | 4.4020 | 7.85 | 10.16 | 18.01 | 56.00 | -37.99 | QP |
| 8 | | 4.4020 | 3.03 | 10.16 | 13.19 | 46.00 | -32.81 | AVG |
| 9 | | 11.9900 | 18.89 | -0.86 | 18.03 | 60.00 | -41.97 | QP |
| 10 | | 11.9900 | 13.86 | -0.86 | 13.00 | 50.00 | -37.00 | AVG |
| 11 | | 29.8380 | 12.17 | 13.23 | 25.40 | 60.00 | -34.60 | QP |
| 12 | | 29.8380 | 3.63 | 13.23 | 16.86 | 50.00 | -33.14 | AVG |

**Test Result: Pass**

[Test Mode: TX]; [Line: Neutral] ;[Voltage:120V/60Hz]




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.1580 | 34.56 | 10.13 | 44.69 | 65.57 | -20.88 | QP |
| 2 | * | 0.1580 | 27.70 | 10.13 | 37.83 | 55.57 | -17.74 | AVG |
| 3 | | 0.3140 | 30.10 | 9.83 | 39.93 | 59.86 | -19.93 | QP |
| 4 | | 0.3140 | 22.00 | 9.83 | 31.83 | 49.86 | -18.03 | AVG |
| 5 | | 0.7140 | 17.33 | 9.74 | 27.07 | 56.00 | -28.93 | QP |
| 6 | | 0.7140 | 11.22 | 9.74 | 20.96 | 46.00 | -25.04 | AVG |
| 7 | | 2.7500 | 14.12 | 9.91 | 24.03 | 56.00 | -31.97 | QP |
| 8 | | 2.7500 | 6.13 | 9.91 | 16.04 | 46.00 | -29.96 | AVG |
| 9 | | 12.4980 | 30.30 | -1.26 | 29.04 | 60.00 | -30.96 | QP |
| 10 | | 12.4980 | 23.18 | -1.26 | 21.92 | 50.00 | -28.08 | AVG |
| 11 | | 29.9700 | 15.98 | 13.14 | 29.12 | 60.00 | -30.88 | QP |
| 12 | | 29.9700 | 6.73 | 13.14 | 19.87 | 50.00 | -30.13 | AVG |

**Test Result: Pass**

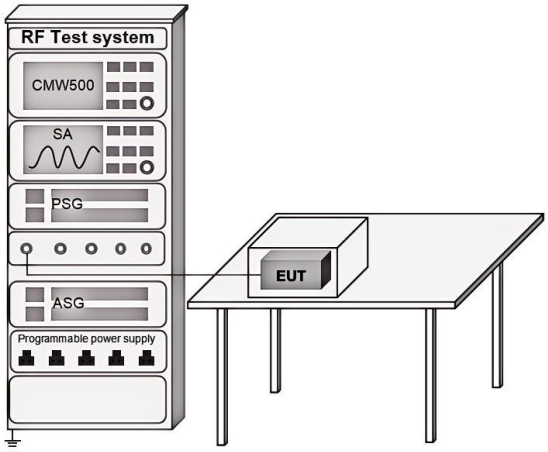
## 6.3 Conducted peak output Power

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 7.8.5 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

### 6.3.1 Limit

| Frequency range(MHz) | Output power of the intentional radiator(watt) |
|---|---|
| 902-928 | 1 for ≥50 hopping channels |
| | 0.25 for 25≤ hopping channels <50 |
| | 1 for digital modulation |
| 2400-2483.5 | 1 for ≥75 non-overlapping hopping channels |
| | 0.125 for all other frequency hopping systems |
| | 1 for digital modulation |
| 5725-5850 | 1 for frequency hopping systems and digital modulation |

### 6.3.2 Test setup




### 6.3.3 Test data

Pass: Please refer to appendix A for details

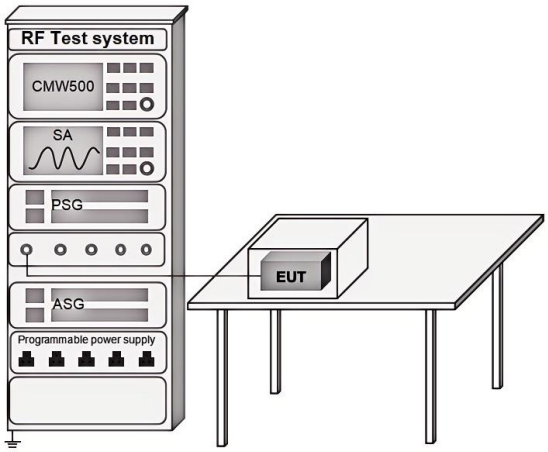
## 6.4 Minimum 6dB bandwidth

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 11.8.1 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

### 6.4.1 Limit

≥500 kHz

### 6.4.2 Test setup




### 6.4.3 Test data

Pass: Please refer to appendix A for details

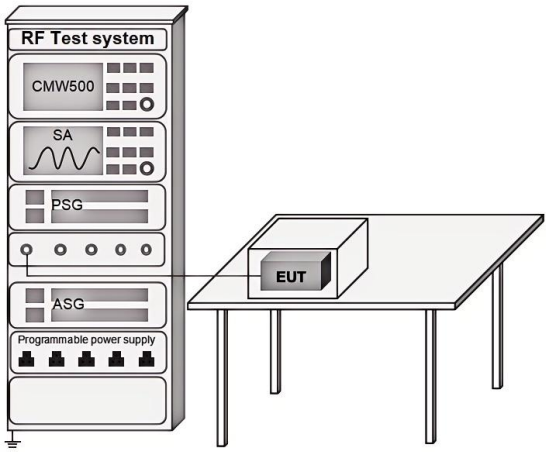
## 6.5 Power spectrum density

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 11.10.2 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

### 6.5.1 Limit

≤8dBm in any 3 kHz band during any time interval of continuous transmission

### 6.5.2 Test setup




### 6.5.3 Test data

Pass: Please refer to appendix A for details

## 6.6 Conducted Band Edges Measurement

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

### 6.6.1 Limit

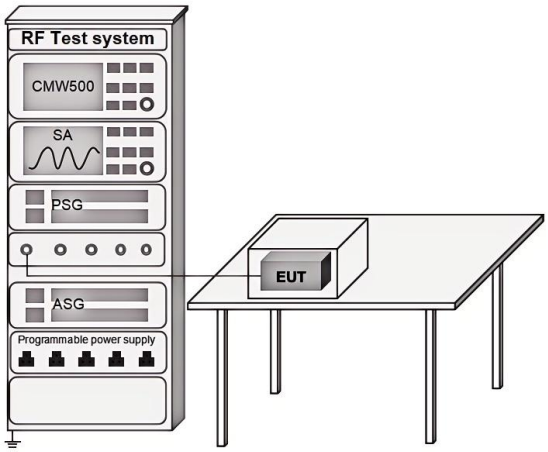
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 20dB.

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)).

### 6.6.2 Test setup



### 6.6.3 Test data

Pass: Please refer to appendix A for details

BlueAsia

## 6.7 Conducted spurious emissions

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 7.8.6 & Section 11.11 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

### 6.7.1 Limit

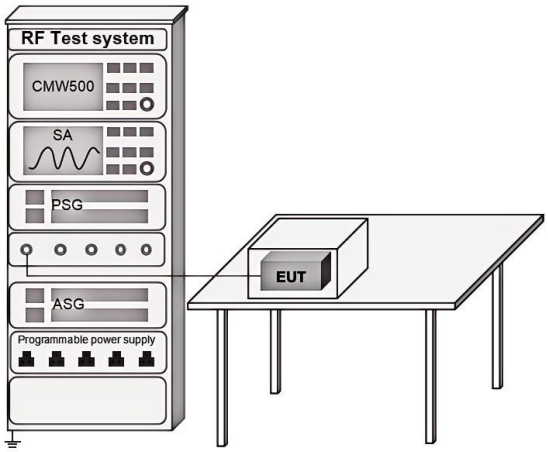
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 20dB.

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)).

### 6.7.2 Test setup



### 6.7.3 Test data

Pass: Please refer to appendix A for details

## 6.8 Radiated spurious emissions

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 6.4,6.5,6.6 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

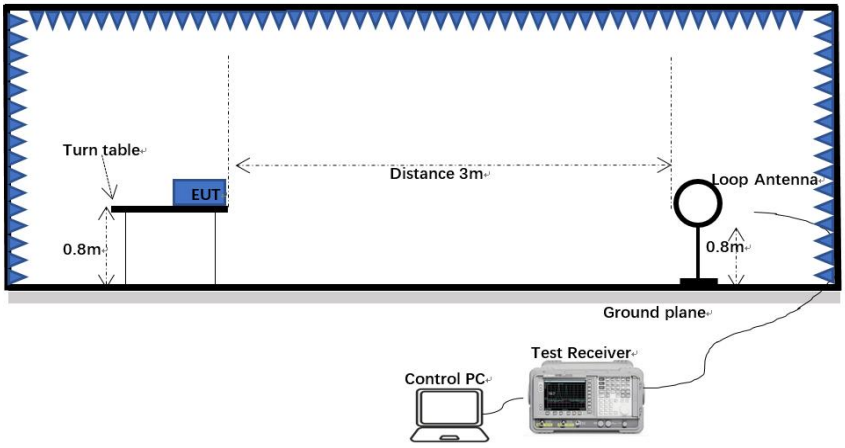
### 6.8.1 Limit

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

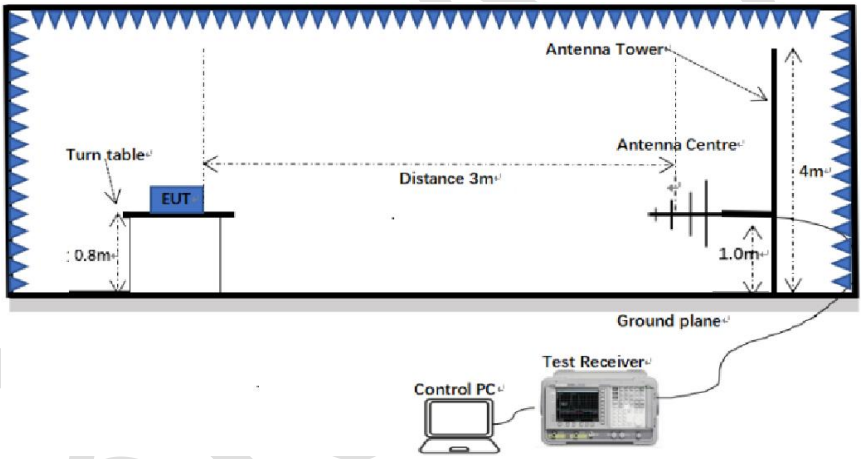
*Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.*

### 6.8.2 Test setup

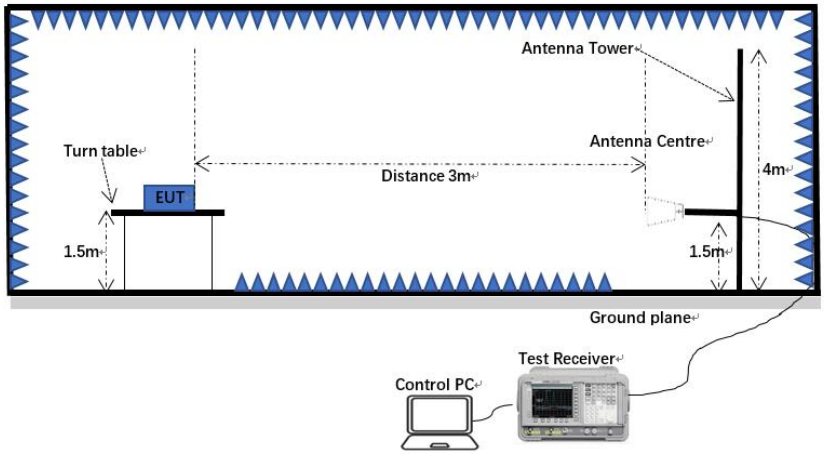
Below 1GHz：




30MHz-1GHz：




Above 1GHz：



### 6.8.3 Procedure

a) For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b) For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c) The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d) 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.

e) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g) 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.

h) Test the EUT in the lowest channel, the middle channel, the highest channel.

i) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j) Repeat above procedures until all frequencies measured was complete.

*Note 1: Scan from 9 kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown.*

*Note 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.*

*Note 3: The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:*

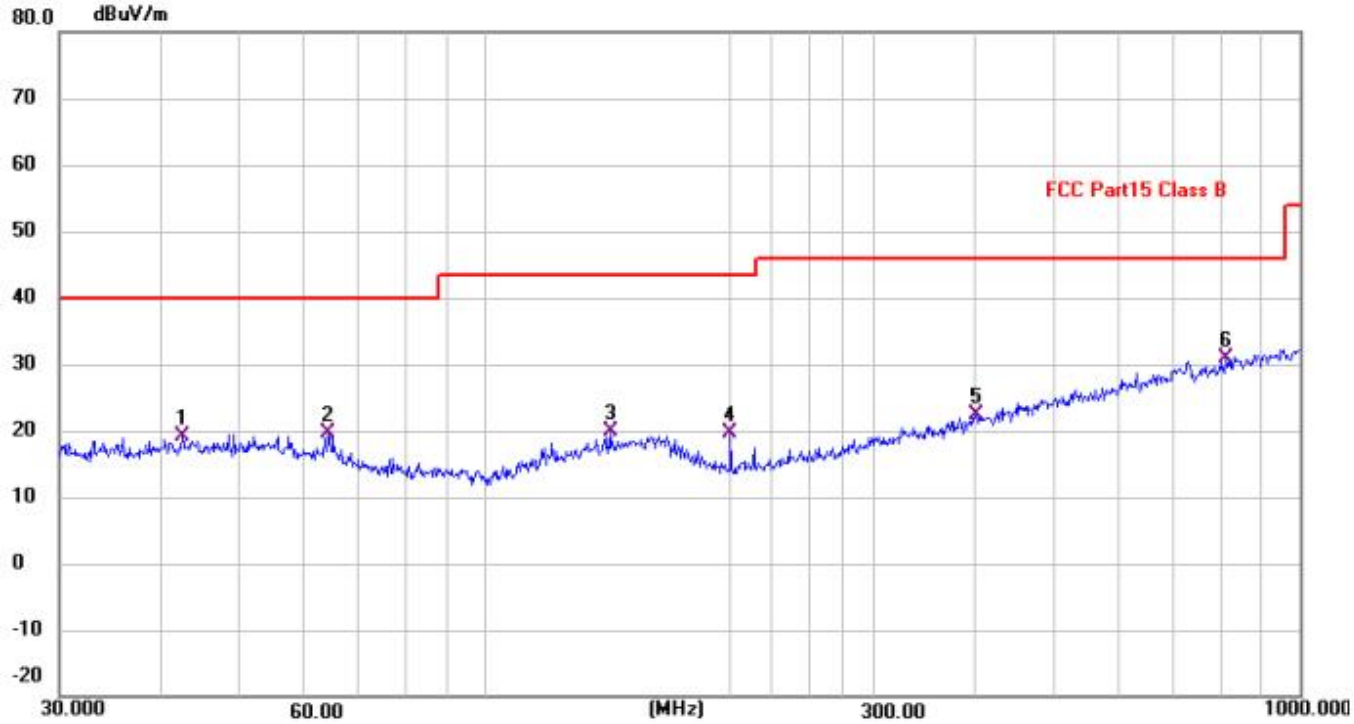
Level (dBuV) = Reading (dBuV) + Factor (dB/m)

### 6.8.4 Test data

Below 1GHz

*Remark: During the test, pre-scan the BLE1M/BLE2M mode, and found the BLE1M low channel mode which it is worse case.*

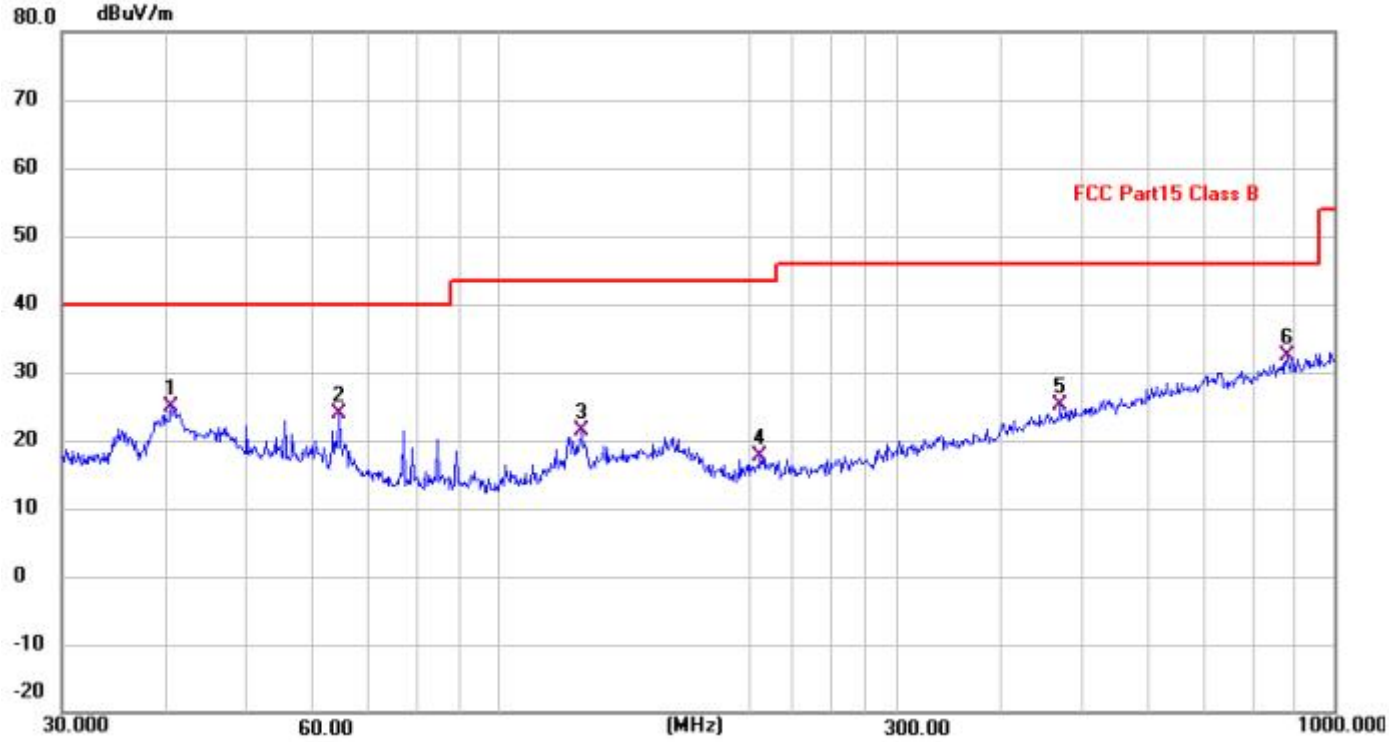
[Test mode: TX]; [Polarity: Horizontal]




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 42.4508 | -0.63 | 19.71 | 19.08 | 40.00 | -20.92 | QP |
| 2 | 64.2074 | 1.70 | 17.95 | 19.65 | 40.00 | -20.35 | QP |
| 3 | 142.3243 | -0.24 | 20.19 | 19.95 | 43.50 | -23.55 | QP |
| 4 | 199.9855 | 3.55 | 16.20 | 19.75 | 43.50 | -23.75 | QP |
| 5 | 400.4318 | -0.81 | 23.17 | 22.36 | 46.00 | -23.64 | QP |
| 6 * | 813.1115 | 0.75 | 30.03 | 30.78 | 46.00 | -15.22 | QP |

**Test Result: Pass**

[Test mode: TX]; [Polarity: Vertical]




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 40.5591 | 5.27 | 19.51 | 24.78 | 40.00 | -15.22 | QP |
| 2 | 64.4331 | 5.87 | 17.93 | 23.80 | 40.00 | -16.20 | QP |
| 3 | 125.8864 | 2.29 | 19.01 | 21.30 | 43.50 | -22.20 | QP |
| 4 | 205.6751 | 1.42 | 16.16 | 17.58 | 43.50 | -25.92 | QP |
| 5 | 470.5232 | 0.61 | 24.43 | 25.04 | 46.00 | -20.96 | QP |
| 6 * | 878.3214 | 1.67 | 30.83 | 32.50 | 46.00 | -13.50 | QP |

**Test Result: Pass**

Above 1GHz:

*Remark: During the test, pre-scan the BLE1M/BLE2M mode, and found the BLE1M mode which it is worse case.*

[Test mode: TX low channel]; [Polarity: Horizontal]

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 4804.000 | 37.58 | 6.31 | 43.89 | 74.00 | -30.11 | peak |
| 2 | | 5841.000 | 39.23 | 8.89 | 48.12 | 74.00 | -25.88 | peak |
| 3 | | 7206.000 | 38.01 | 10.39 | 48.40 | 74.00 | -25.60 | peak |
| 4 | | 8202.750 | 38.52 | 11.48 | 50.00 | 74.00 | -24.00 | peak |
| 5 | | 9608.000 | 36.20 | 13.01 | 49.21 | 74.00 | -24.79 | peak |
| 6 | * | 10599.75 | 36.95 | 13.59 | 50.54 | 74.00 | -23.46 | peak |

**Test Result: Pass**

[Test mode: TX low channel]; [Polarity: Vertical]

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 4804.000 | 37.90 | 6.31 | 44.21 | 74.00 | -29.79 | peak |
| 2 | | 5711.750 | 38.96 | 8.74 | 47.70 | 74.00 | -26.30 | peak |
| 3 | | 7206.000 | 37.97 | 10.39 | 48.36 | 74.00 | -25.64 | peak |
| 4 | | 7979.500 | 39.47 | 11.47 | 50.94 | 74.00 | -23.06 | peak |
| 5 | | 9608.000 | 35.76 | 13.01 | 48.77 | 74.00 | -25.23 | peak |
| 6 | * | 11375.25 | 37.24 | 13.99 | 51.23 | 74.00 | -22.77 | peak |

**Test Result: Pass**

[Test mode: TX middle channel]; [Polarity: Horizontal]

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 4884.000 | 38.72 | 6.45 | 45.17 | 74.00 | -28.83 | peak |
| 2 | | 5829.250 | 38.85 | 8.93 | 47.78 | 74.00 | -26.22 | peak |
| 3 | | 7326.000 | 37.17 | 10.21 | 47.38 | 74.00 | -26.62 | peak |
| 4 | | 7815.000 | 40.43 | 10.72 | 51.15 | 74.00 | -22.85 | peak |
| 5 | | 9768.000 | 36.97 | 13.75 | 50.72 | 74.00 | -23.28 | peak |
| 6 | * | 10893.50 | 38.68 | 13.21 | 51.89 | 74.00 | -22.11 | peak |

**Test Result: Pass**

[Test mode: TX middle channel]; [Polarity: Vertical]

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 4884.000 | 38.36 | 6.45 | 44.81 | 74.00 | -29.19 | peak |
| 2 | | 5841.000 | 38.85 | 8.89 | 47.74 | 74.00 | -26.26 | peak |
| 3 | | 7326.000 | 36.15 | 10.21 | 46.36 | 74.00 | -27.64 | peak |
| 4 | | 8214.500 | 39.39 | 11.41 | 50.80 | 74.00 | -23.20 | peak |
| 5 | | 9768.000 | 35.61 | 13.75 | 49.36 | 74.00 | -24.64 | peak |
| 6 | * | 11669.00 | 38.09 | 13.86 | 51.95 | 74.00 | -22.05 | peak |

**Test Result: Pass**

[Test mode: TX High channel]; [Polarity: Horizontal]

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 4959.750 | 42.88 | 7.41 | 50.29 | 74.00 | -23.71 | peak |
| 2 | | 5829.250 | 39.87 | 8.93 | 48.80 | 74.00 | -25.20 | peak |
| 3 | | 7440.000 | 38.87 | 11.03 | 49.90 | 74.00 | -24.10 | peak |
| 4 | | 9460.000 | 39.05 | 12.97 | 52.02 | 74.00 | -21.98 | peak |
| 5 | | 9920.000 | 35.77 | 13.16 | 48.93 | 74.00 | -25.07 | peak |
| 6 | * | 11410.50 | 38.49 | 14.33 | 52.82 | 74.00 | -21.18 | peak |

**Test Result: Pass**

[Test mode: TX High channel]; [Polarity: Vertical]

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 4960.000 | 39.29 | 7.41 | 46.70 | 74.00 | -27.30 | peak |
| 2 | | 5805.750 | 39.67 | 9.00 | 48.67 | 74.00 | -25.33 | peak |
| 3 | | 7440.000 | 38.88 | 11.03 | 49.91 | 74.00 | -24.09 | peak |
| 4 | | 9330.750 | 38.91 | 13.29 | 52.20 | 74.00 | -21.80 | peak |
| 5 | | 9920.000 | 36.36 | 13.16 | 49.52 | 74.00 | -24.48 | peak |
| 6 | * | 11504.50 | 37.95 | 14.87 | 52.82 | 74.00 | -21.18 | peak |

**Test Result: Pass**

## 6.9 Radiated emissions which fall in the restricted bands

| | |
|---|---|
| **Test Standard** | 47 CFR Part 15, Subpart C 15.247 |
| **Test Method** | ANSI C63.10 (2013) Section 6.10.5 |
| **Test Mode (Pre-Scan)** | TX |
| **Test Mode (Final Test)** | TX |

### 6.9.1 Limit

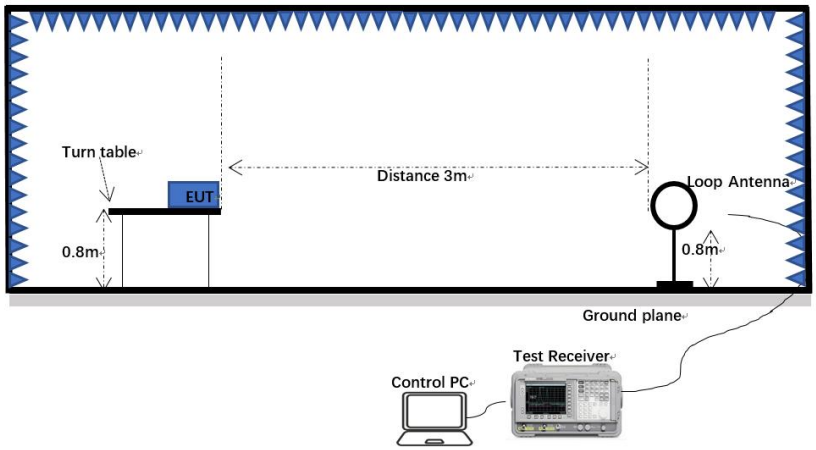
| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

*Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.*

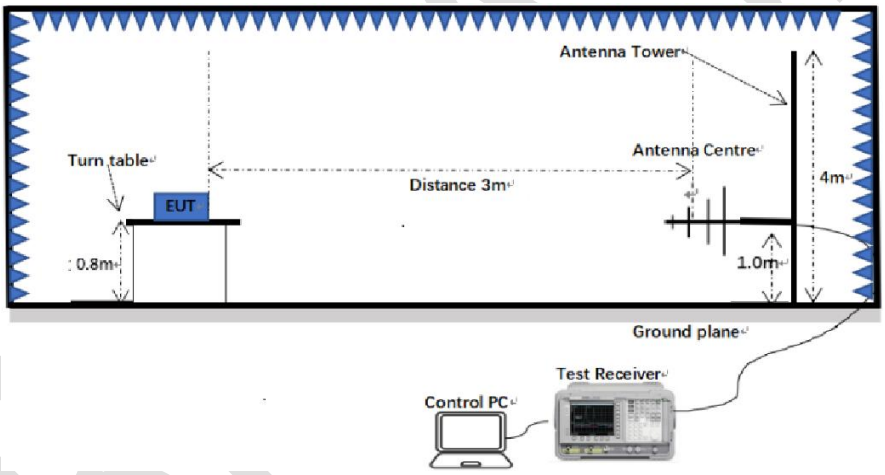
BlueAsia

### 6.9.2 Test setup

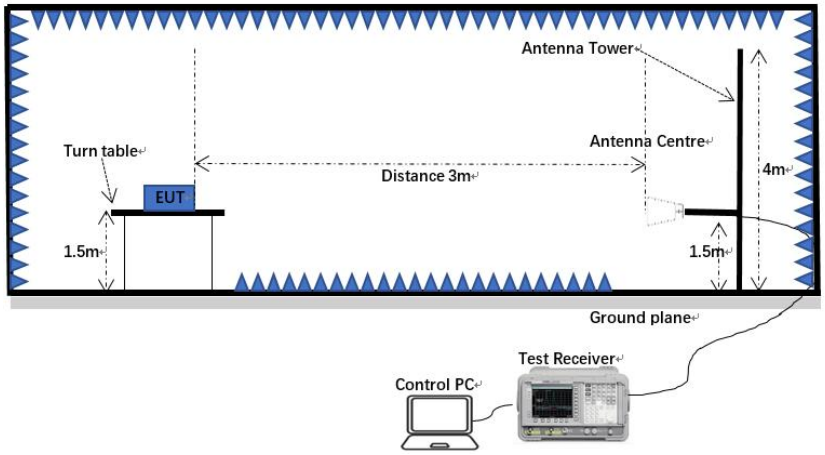
Below 1GHz：




30MHz-1GHz：




Above 1GHz：



### 6.9.3 Procedure

a) For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b) For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c) The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d) 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.

e) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g) 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.

h) Test the EUT in the lowest channel, the middle channel, the highest channel.

i) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

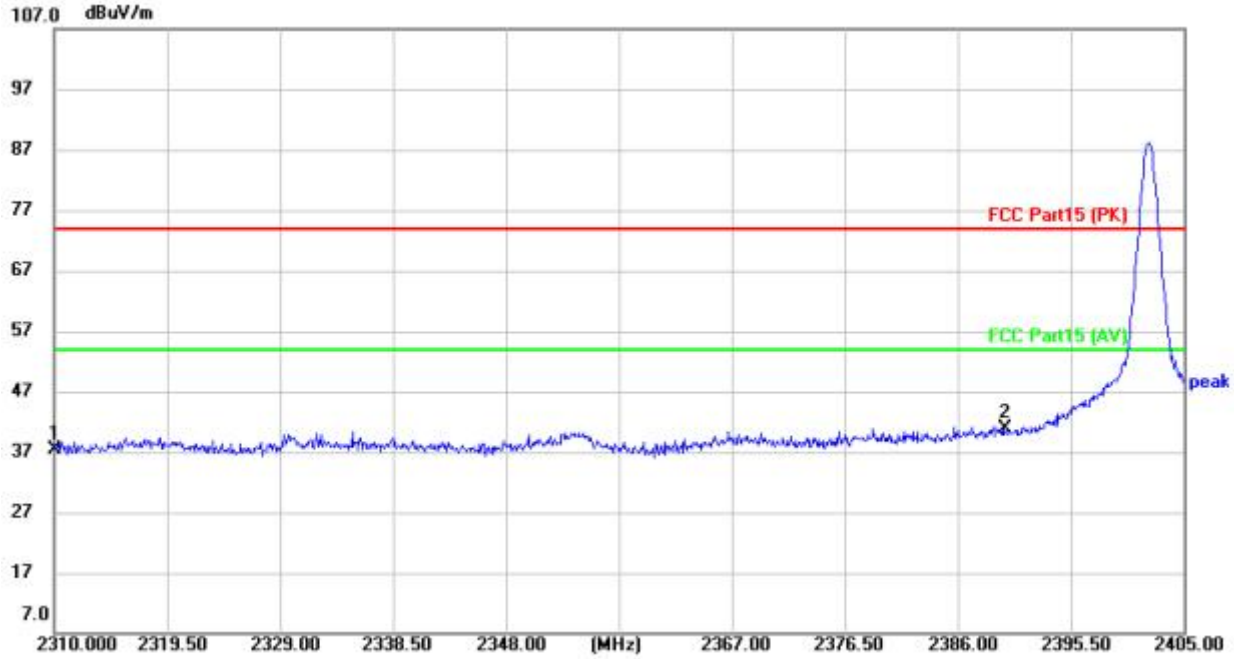
j) Repeat above procedures until all frequencies measured was complete.

*Note 1: Level (dBuV) = Reading (dBuV) + Factor (dB/m)*
*Note 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.*

### 6.9.4 Test data

*Remark: During the test, pre-scan the BLE1M/BLE2M mode, and found the BLE1M mode which it is worse case.*

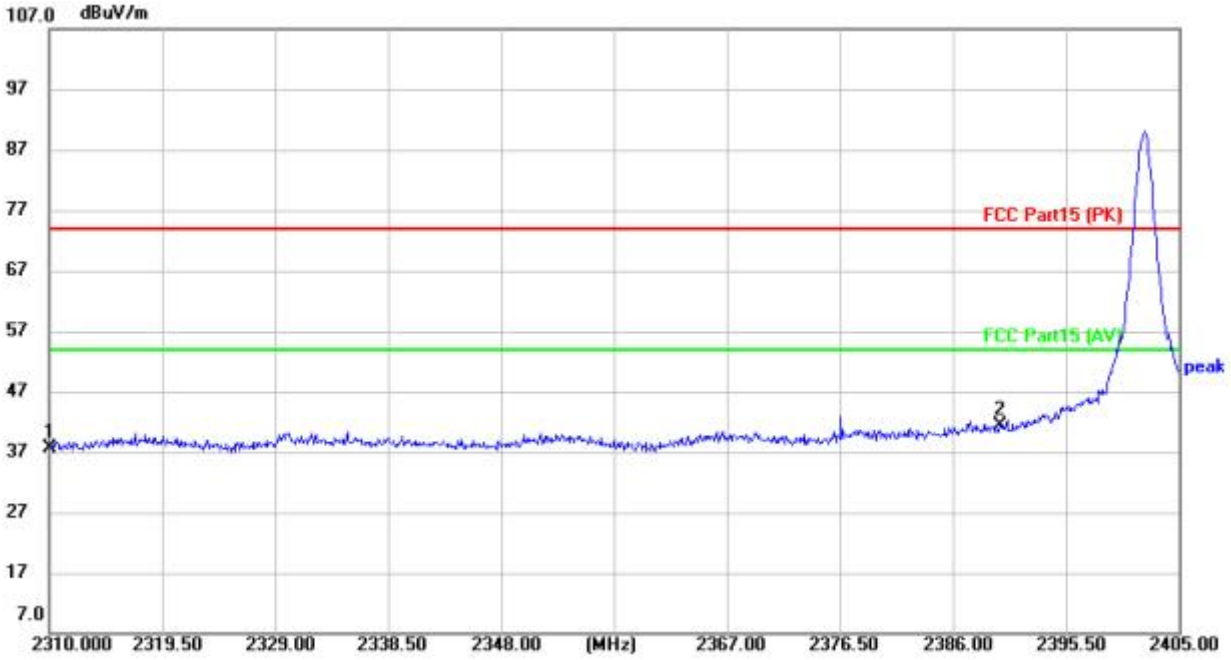
[Test mode: TX low channel]; [Polarity: Horizontal]




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 2310.000 | 40.26 | -2.87 | 37.39 | 74.00 | -36.61 | peak |
| 2 | * | 2390.000 | 43.29 | -2.44 | 40.85 | 74.00 | -33.15 | peak |

**Test Result: Pass**

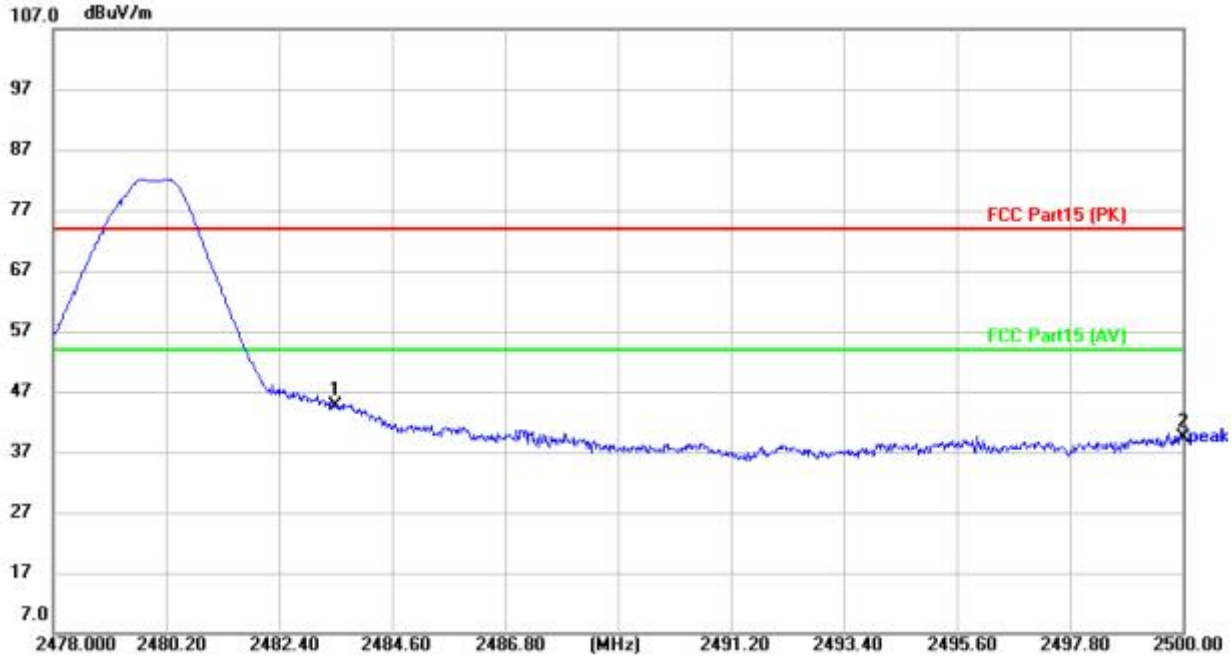
[Test mode:TX low channel]; [Polarity: Vertical]




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 2310.000 | 40.52 | -2.87 | 37.65 | 74.00 | -36.35 | peak |
| 2 | * | 2390.000 | 43.75 | -2.44 | 41.31 | 74.00 | -32.69 | peak |

**Test Result: Pass**

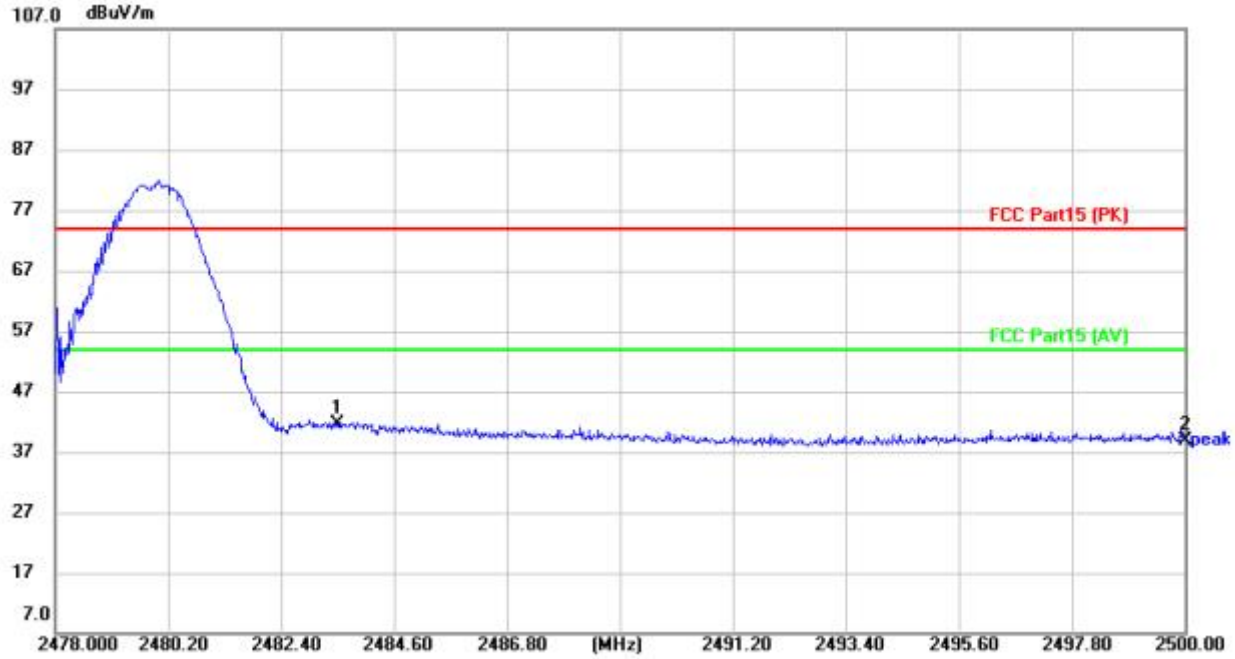
[Test mode: TX High channel]; [Polarity: Horizontal]




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | * | 2483.500 | 47.61 | -2.91 | 44.70 | 74.00 | -29.30 | peak |
| 2 | | 2500.000 | 42.50 | -3.00 | 39.50 | 74.00 | -34.50 | peak |

**Test Result: Pass**

[Test mode:TX High channel]; [Polarity: Vertical]




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | * | 2483.500 | 44.66 | -2.91 | 41.75 | 74.00 | -32.25 | peak |
| 2 | | 2500.000 | 41.80 | -3.00 | 38.80 | 74.00 | -35.20 | peak |

**Test Result: Pass**

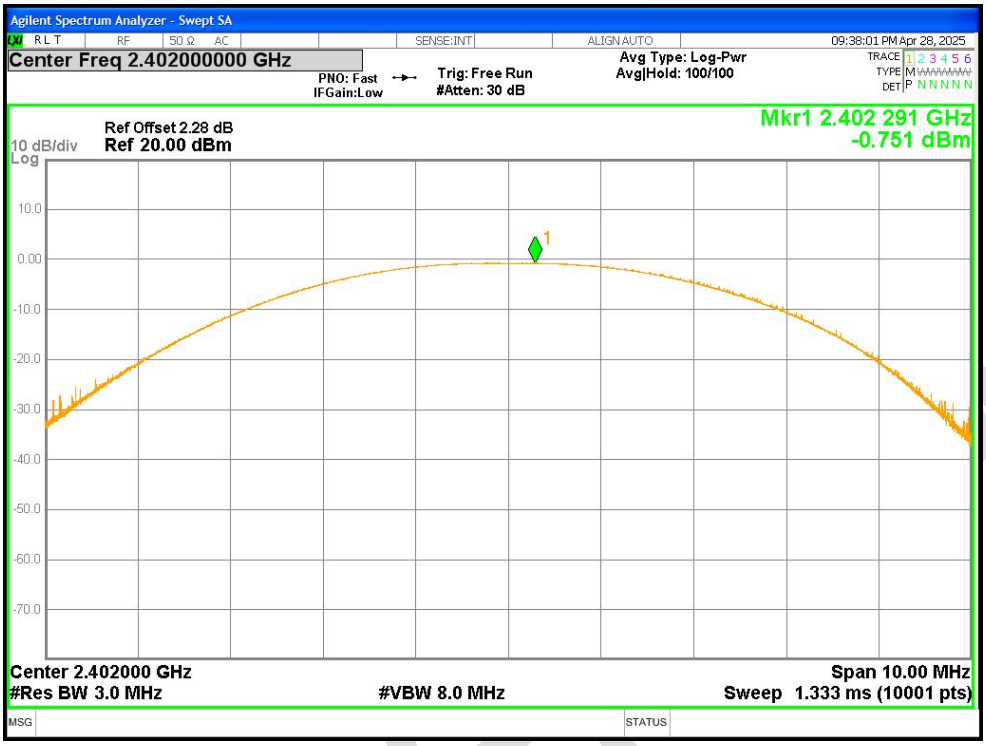
# 7 Appendix A

## 7.1 Maximum Conducted Output Power

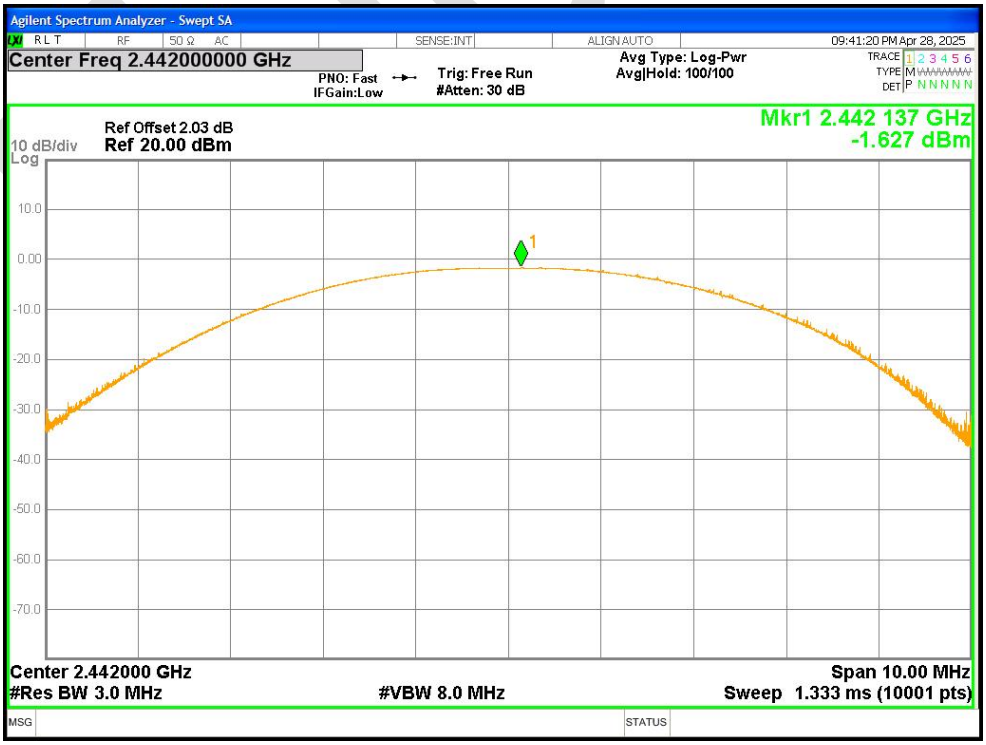
| Condition | Mode | Frequency (MHz) | Antenna | Conducted Power (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|
| NVNT | BLE 1M | 2402 | Ant1 | -0.751 | 30 | Pass |
| NVNT | BLE 1M | 2442 | Ant1 | -1.627 | 30 | Pass |
| NVNT | BLE 1M | 2480 | Ant1 | -2.073 | 30 | Pass |
| NVNT | BLE 2M | 2402 | Ant1 | **-0.73** | 30 | Pass |
| NVNT | BLE 2M | 2442 | Ant1 | -1.619 | 30 | Pass |
| NVNT | BLE 2M | 2480 | Ant1 | -2.146 | 30 | Pass |

BlueAsia

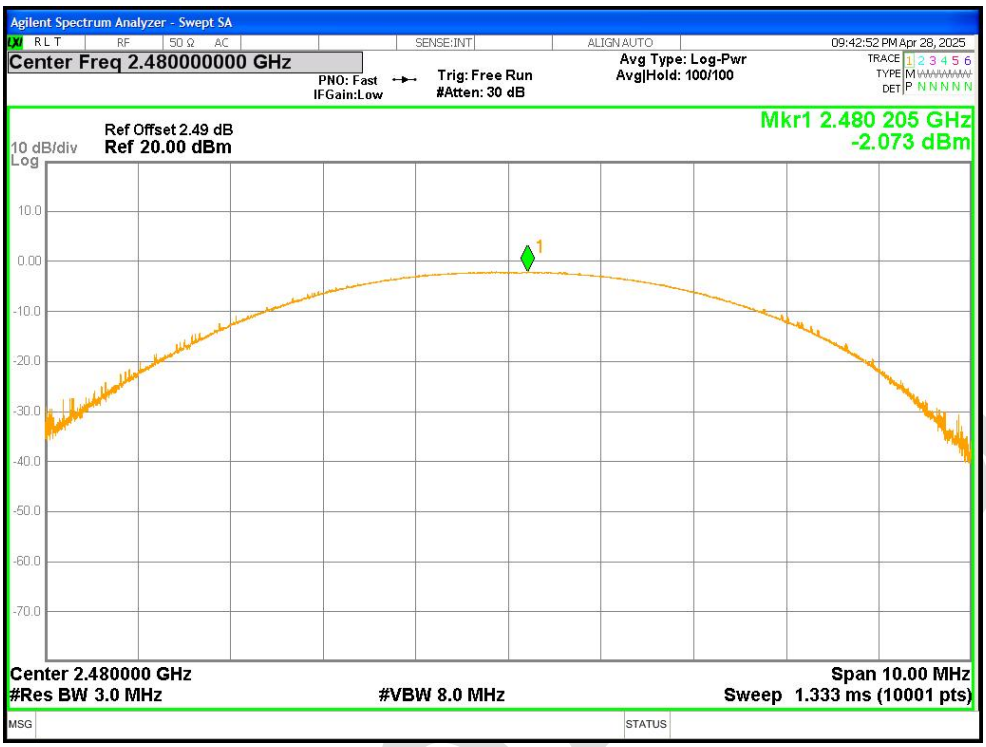
Power NVNT BLE 1M 2402MHz Ant1



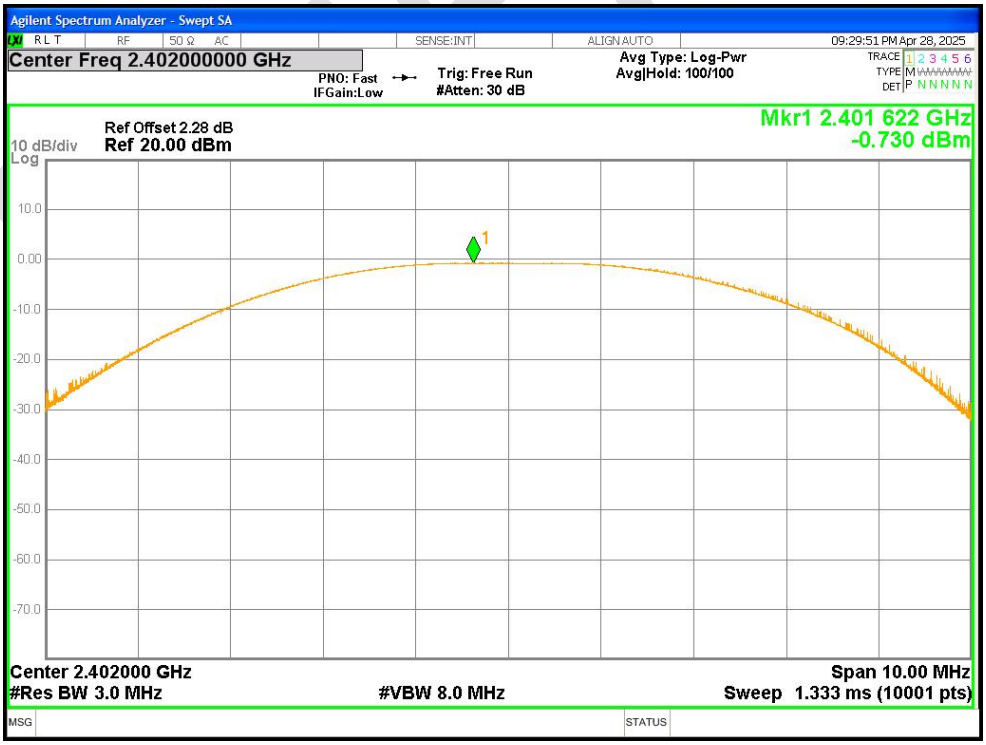

Power NVNT BLE 1M 2442MHz Ant1



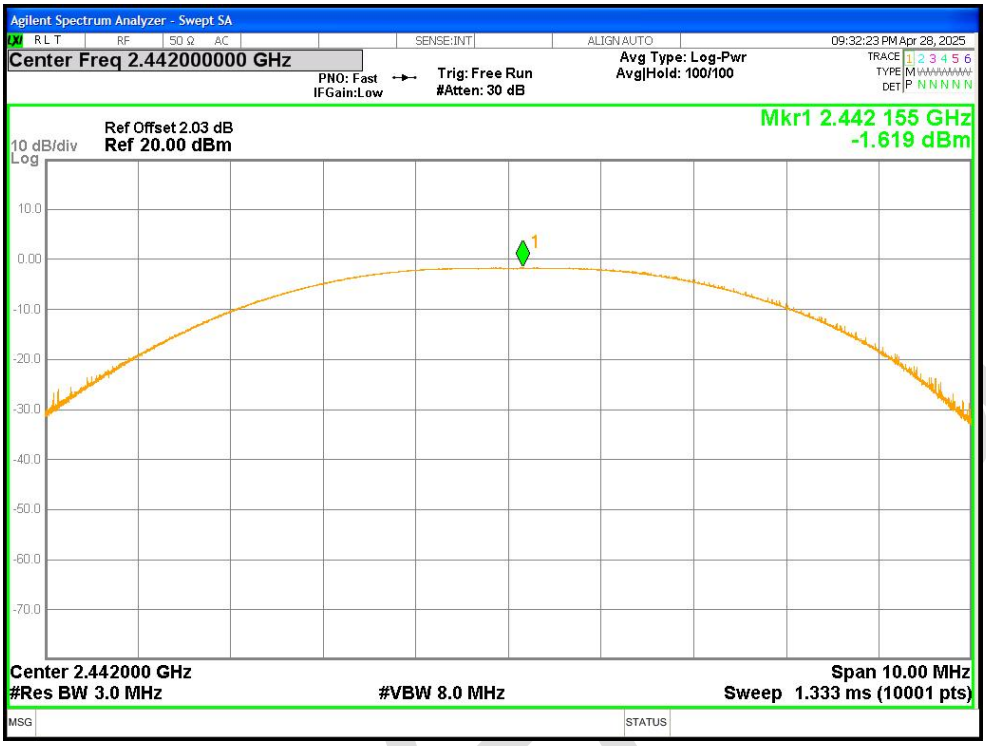
Power NVNT BLE 1M 2480MHz Ant1



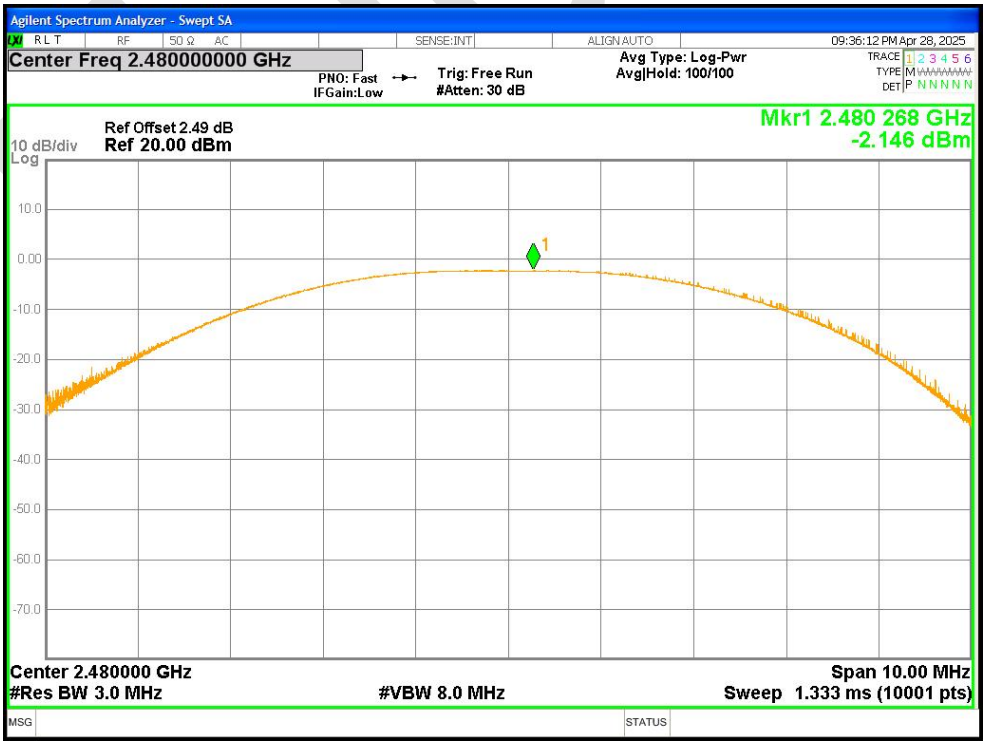

Power NVNT BLE 2M 2402MHz Ant1



Power NVNT BLE 2M 2442MHz Ant1




Power NVNT BLE 2M 2480MHz Ant1



## 7.2 -6dB Bandwidth

| Condition | Mode | Frequency (MHz) | Antenna | -6 dB Bandwidth (MHz) | Limit -6 dB Bandwidth (MHz) | Verdict |
|---|---|---|---|---|---|---|
| NVNT | BLE 1M | 2402 | Ant1 | 0.652 | 0.5 | Pass |
| NVNT | BLE 1M | 2442 | Ant1 | 0.661 | 0.5 | Pass |
| NVNT | BLE 1M | 2480 | Ant1 | 0.676 | 0.5 | Pass |
| NVNT | BLE 2M | 2402 | Ant1 | 1.128 | 0.5 | Pass |
| NVNT | BLE 2M | 2442 | Ant1 | 1.186 | 0.5 | Pass |
| NVNT | BLE 2M | 2480 | Ant1 | 1.092 | 0.5 | Pass |

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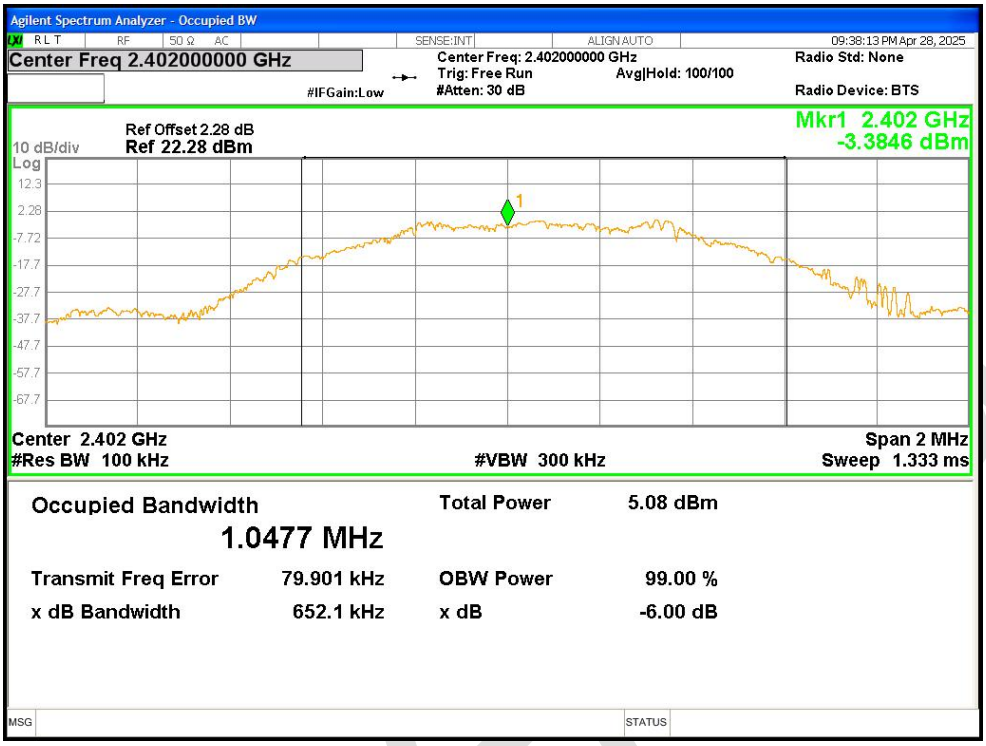
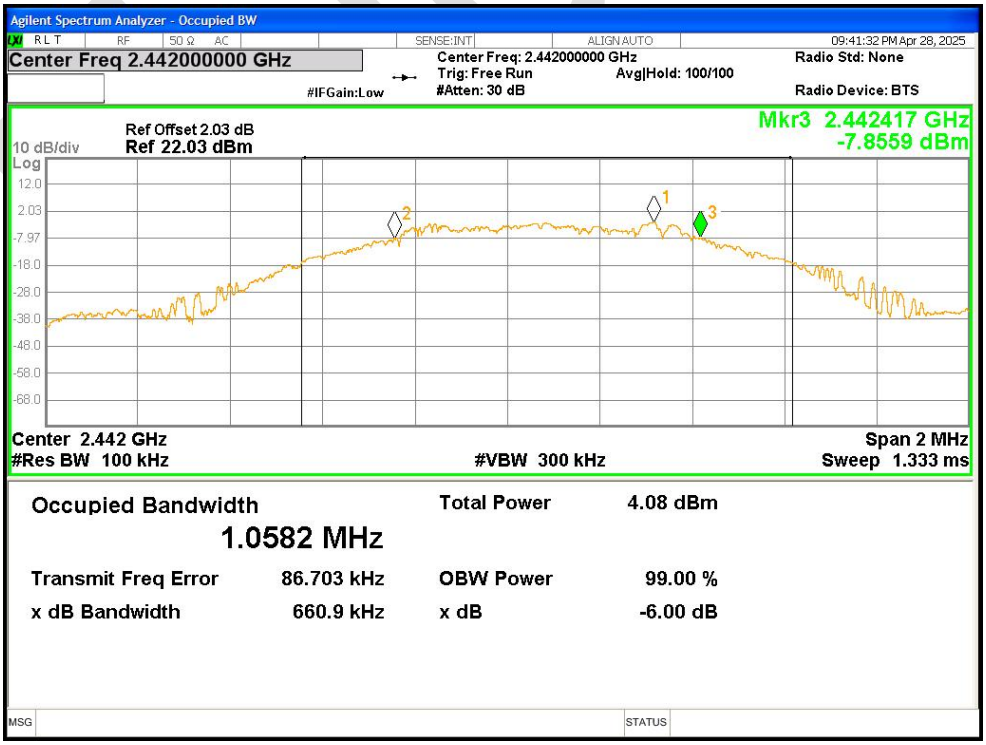
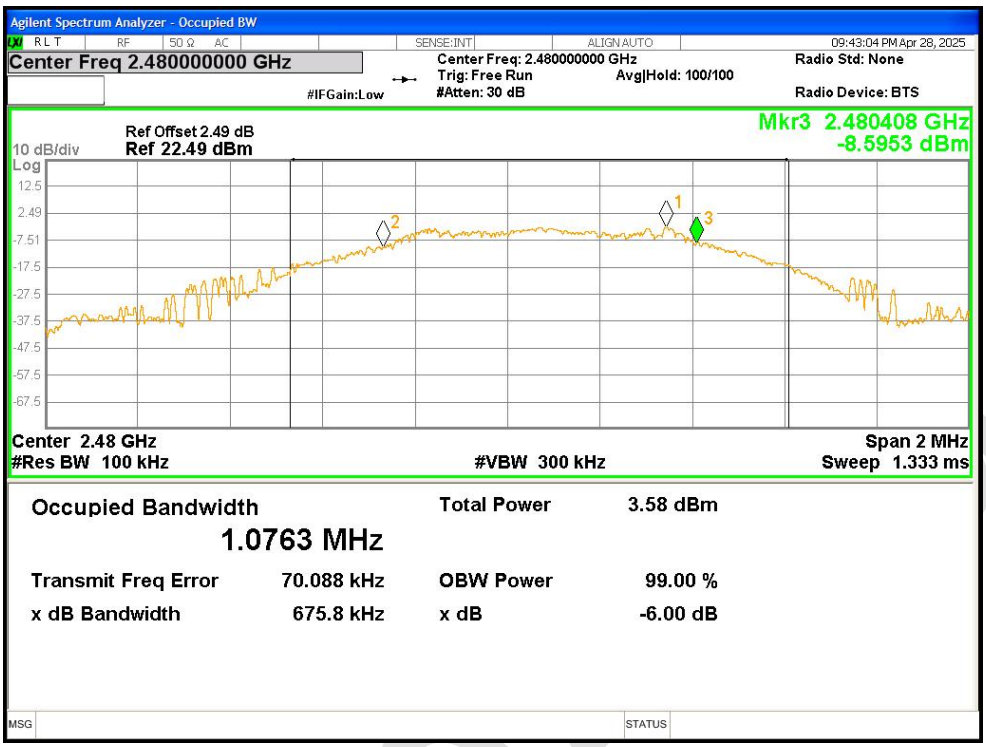
-6dB Bandwidth NVNT BLE 1M 2402MHz Ant1



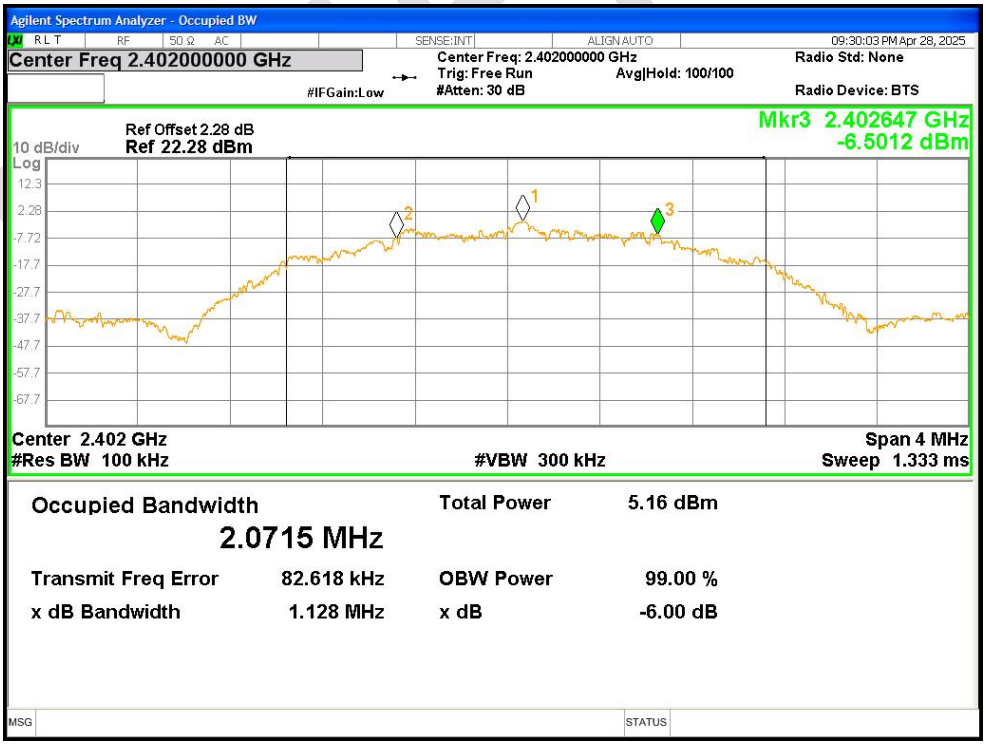

-6dB Bandwidth NVNT BLE 1M 2442MHz Ant1



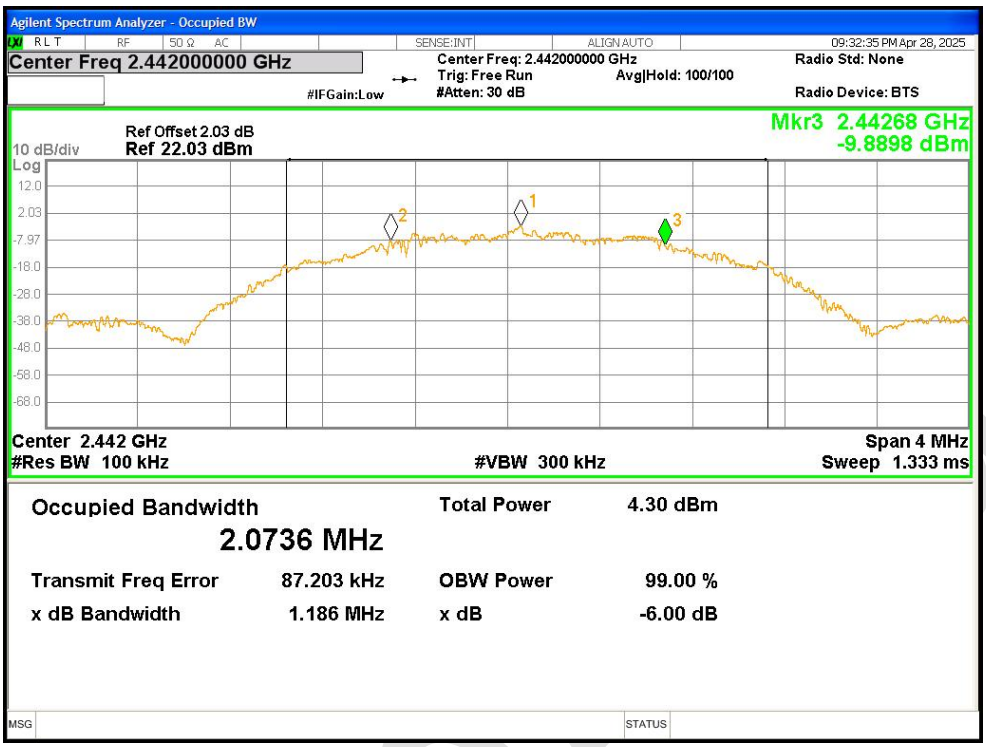
-6dB Bandwidth NVNT BLE 1M 2480MHz Ant1



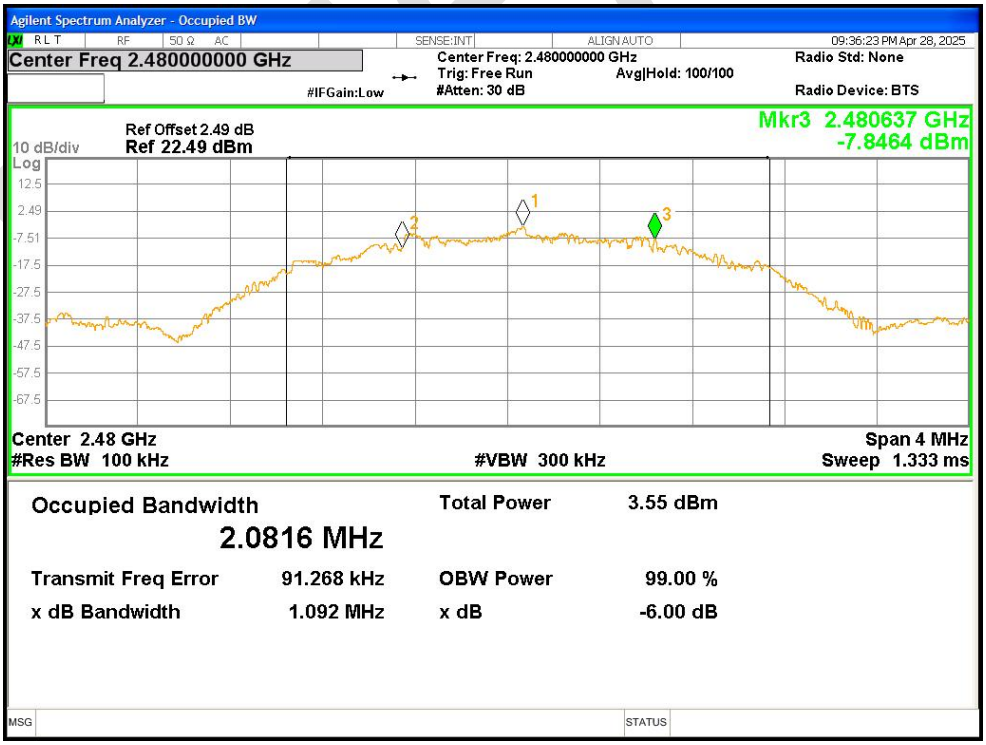

-6dB Bandwidth NVNT BLE 2M 2402MHz Ant1



-6dB Bandwidth NVNT BLE 2M 2442MHz Ant1




-6dB Bandwidth NVNT BLE 2M 2480MHz Ant1



## 7.3 Occupied Channel Bandwidth

| Condition | Mode | Frequency (MHz) | Antenna | 99% OBW (MHz) |
|---|---|---|---|---|
| NVNT | BLE 1M | 2402 | Ant1 | 1.0217 |
| NVNT | BLE 1M | 2442 | Ant1 | 1.0294 |
| NVNT | BLE 1M | 2480 | Ant1 | 1.0491 |
| NVNT | BLE 2M | 2402 | Ant1 | 2.0628 |
| NVNT | BLE 2M | 2442 | Ant1 | 2.0571 |
| NVNT | BLE 2M | 2480 | Ant1 | 2.0661 |

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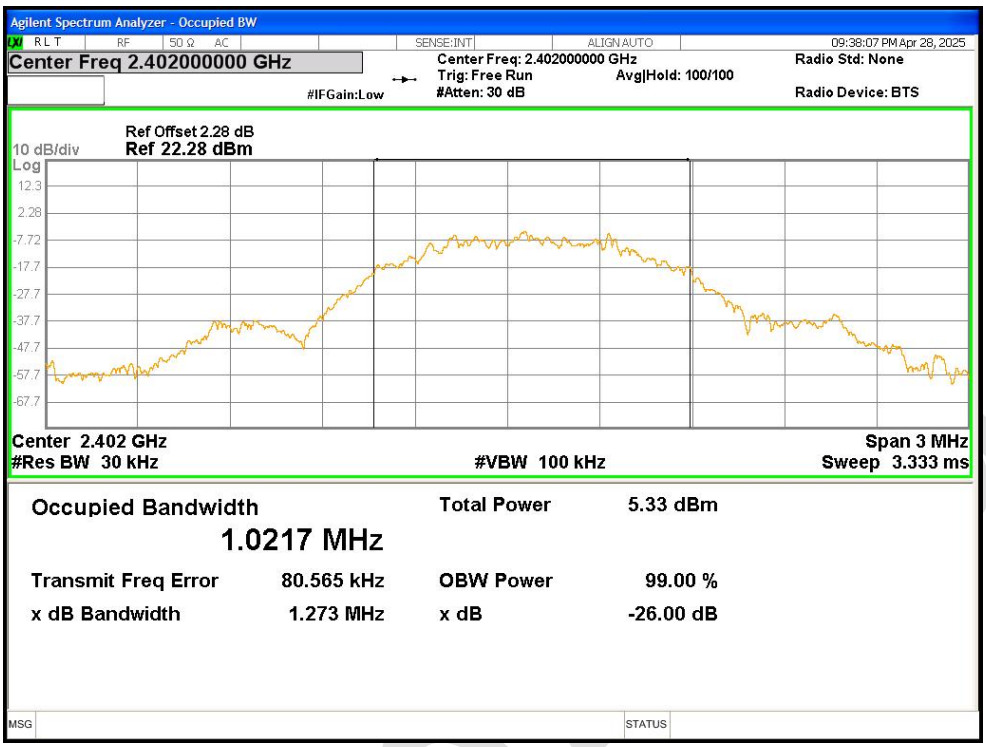
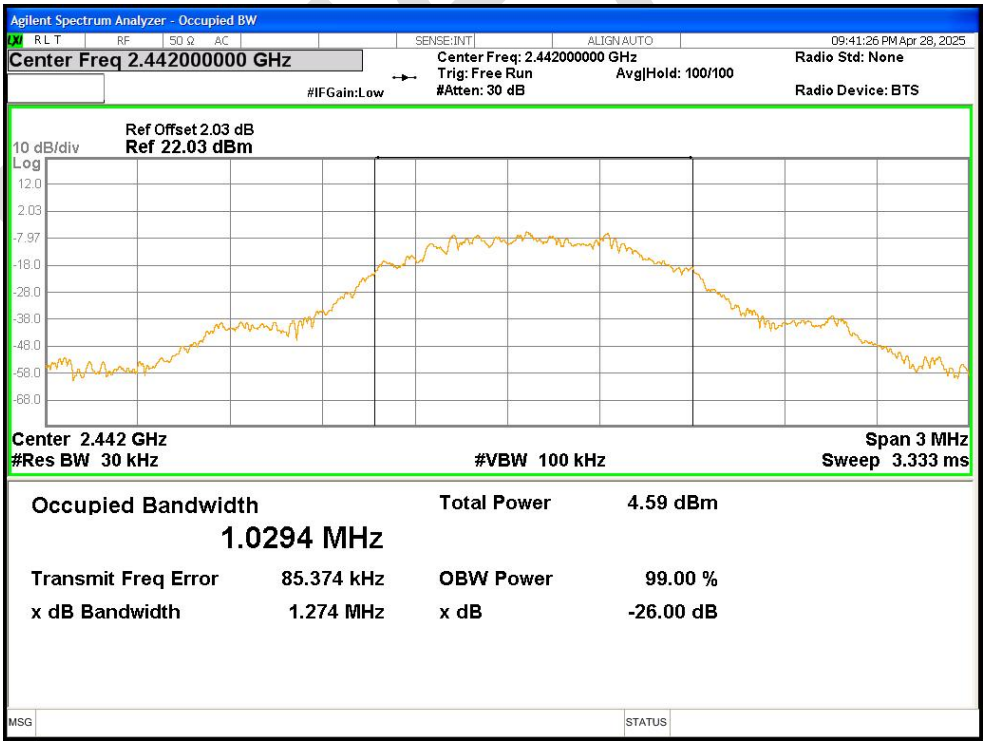
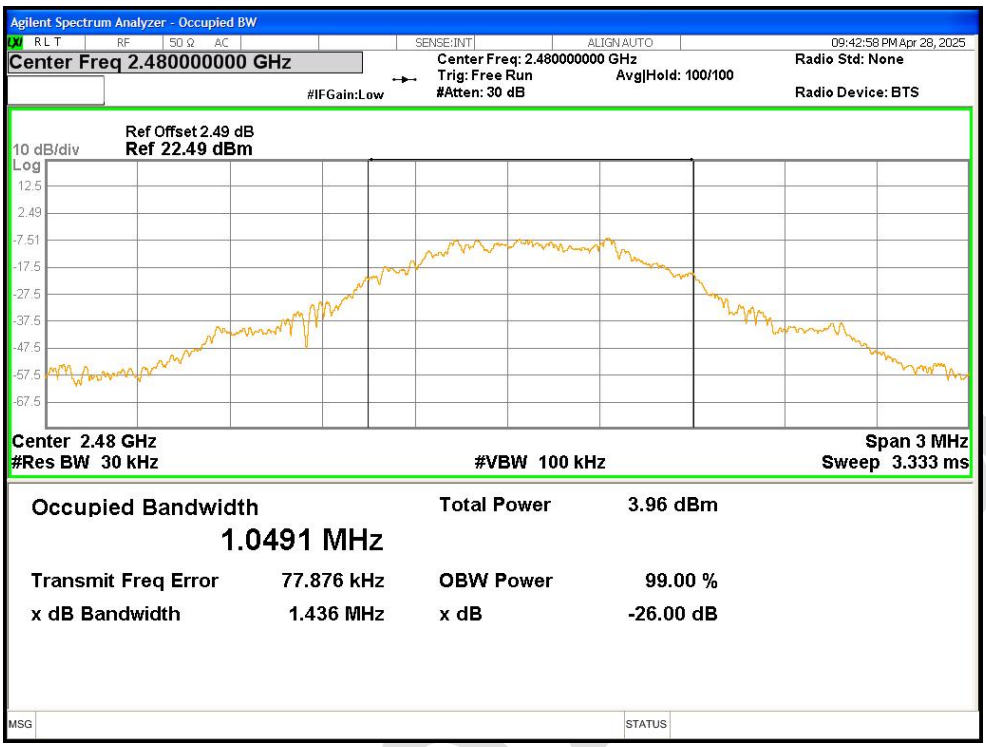
OBW NVNT BLE 1M 2402MHz Ant1



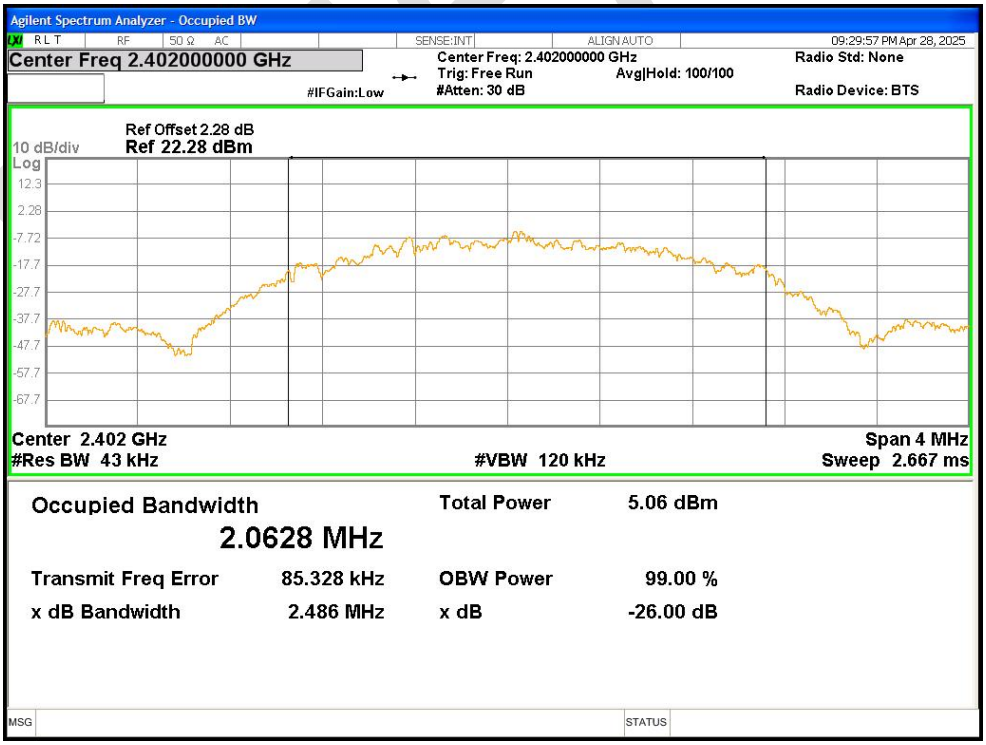

OBW NVNT BLE 1M 2442MHz Ant1



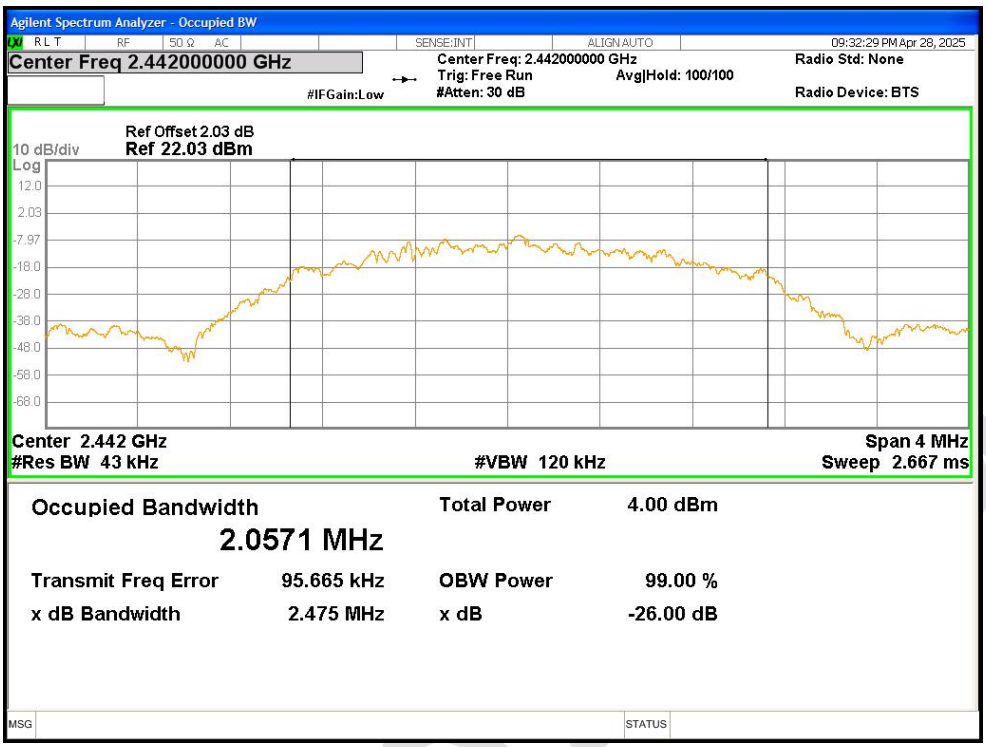
OBW NVNT BLE 1M 2480MHz Ant1



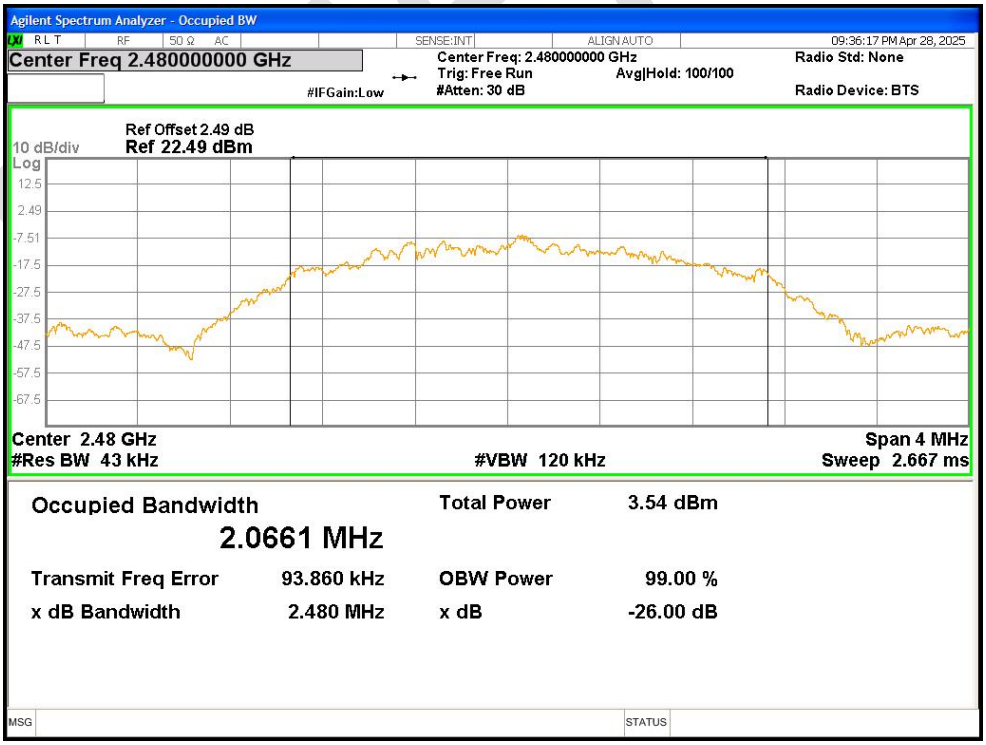

OBW NVNT BLE 2M 2402MHz Ant1



OBW NVNT BLE 2M 2442MHz Ant1




OBW NVNT BLE 2M 2480MHz Ant1

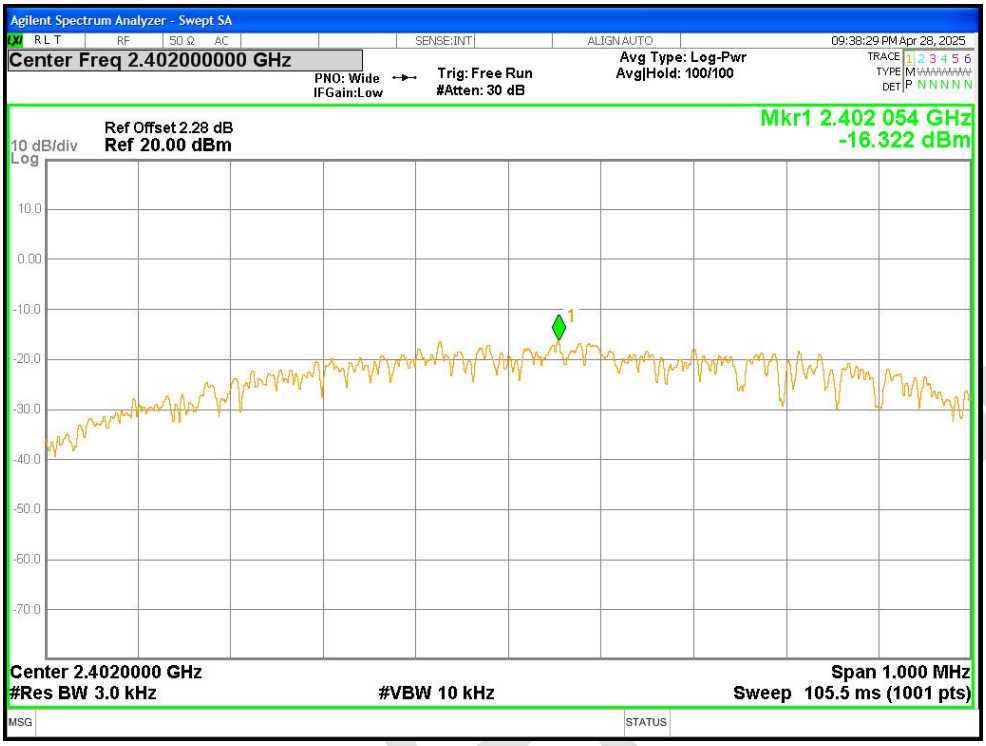


## 7.4 Maximum Power Spectral Density Level

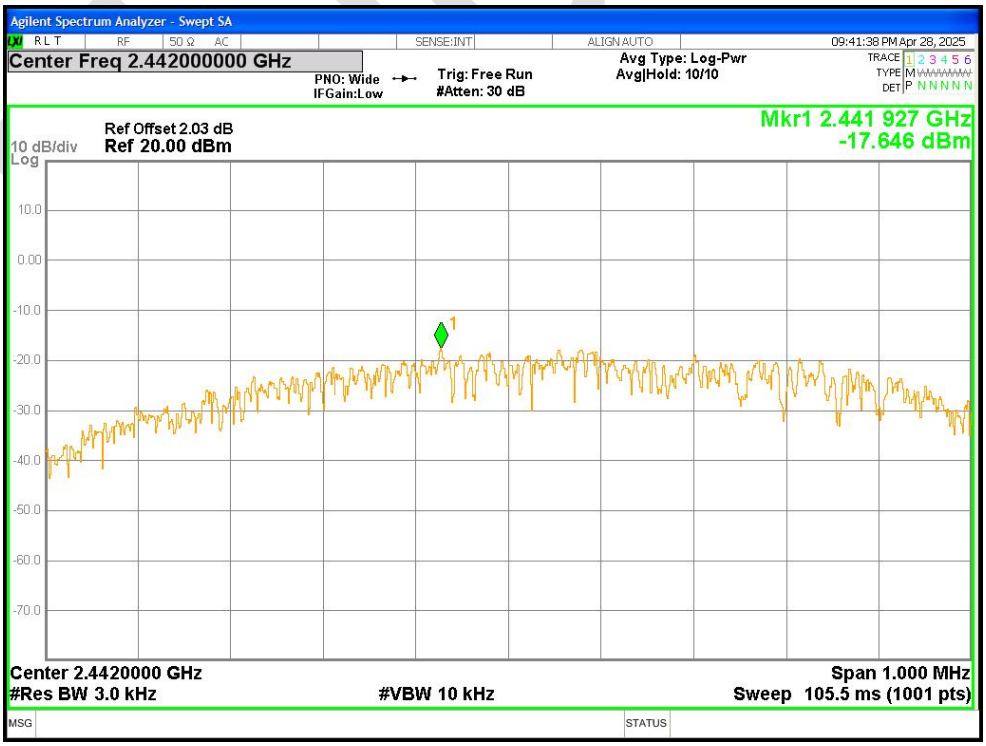
| Condition | Mode | Frequency (MHz) | Antenna | Max PSD (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|
| NVNT | BLE 1M | 2402 | Ant1 | -16.322 | 8 | Pass |
| NVNT | BLE 1M | 2442 | Ant1 | -17.646 | 8 | Pass |
| NVNT | BLE 1M | 2480 | Ant1 | -17.765 | 8 | Pass |
| NVNT | BLE 2M | 2402 | Ant1 | -18.631 | 8 | Pass |
| NVNT | BLE 2M | 2442 | Ant1 | -19.958 | 8 | Pass |
| NVNT | BLE 2M | 2480 | Ant1 | -20.597 | 8 | Pass |

BlueAsia

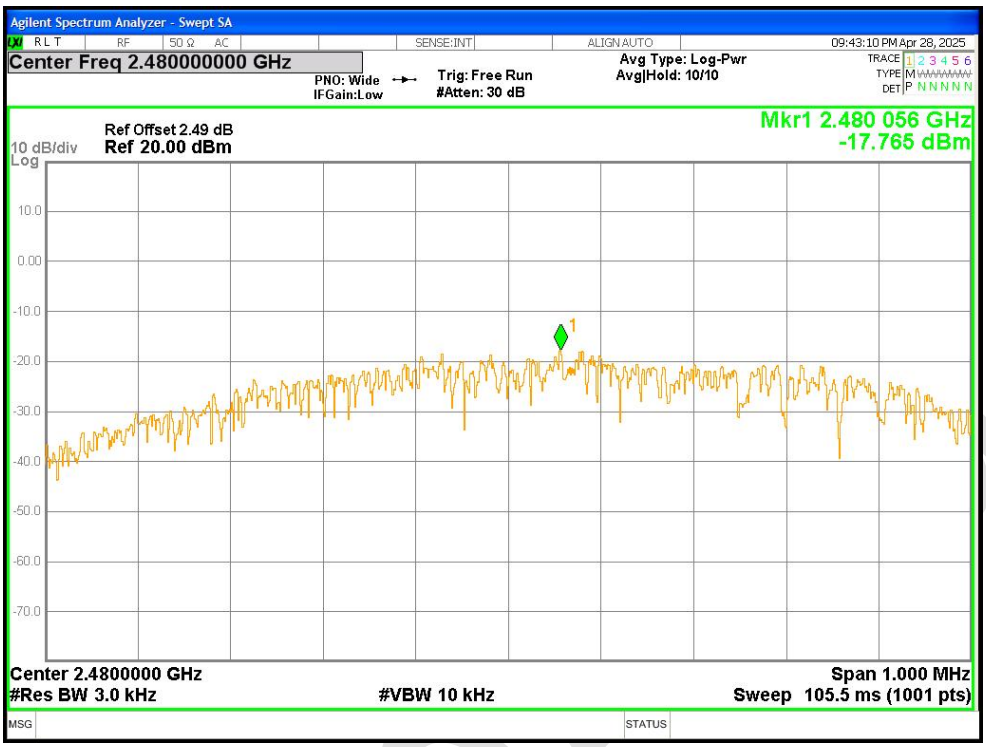
PSD NVNT BLE 1M 2402MHz Ant1



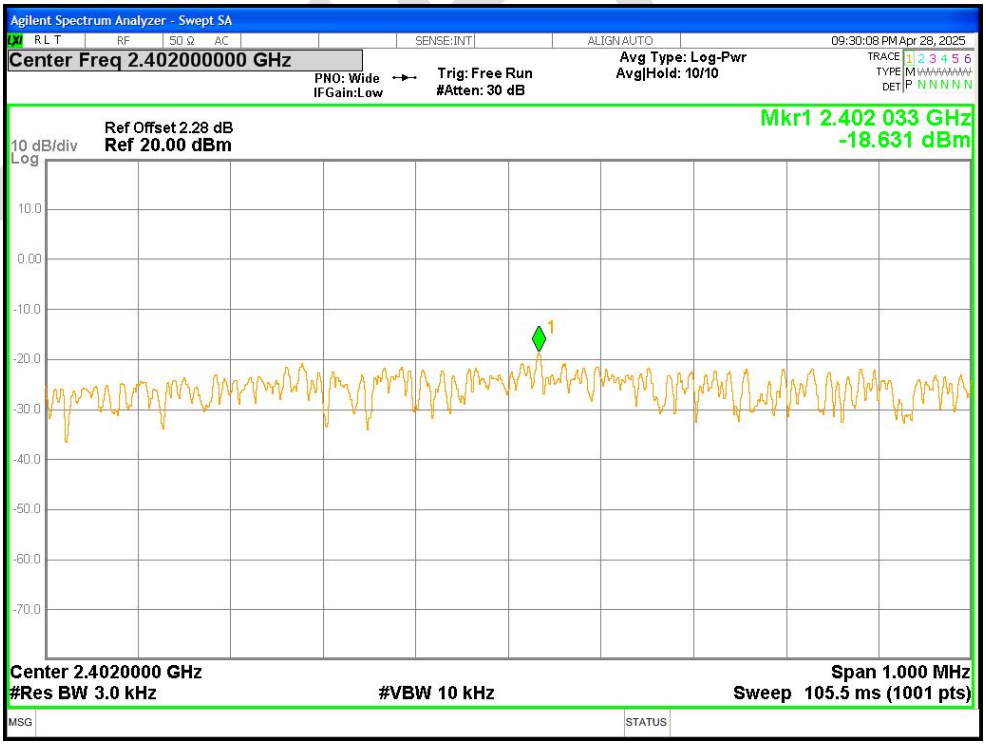

PSD NVNT BLE 1M 2442MHz Ant1



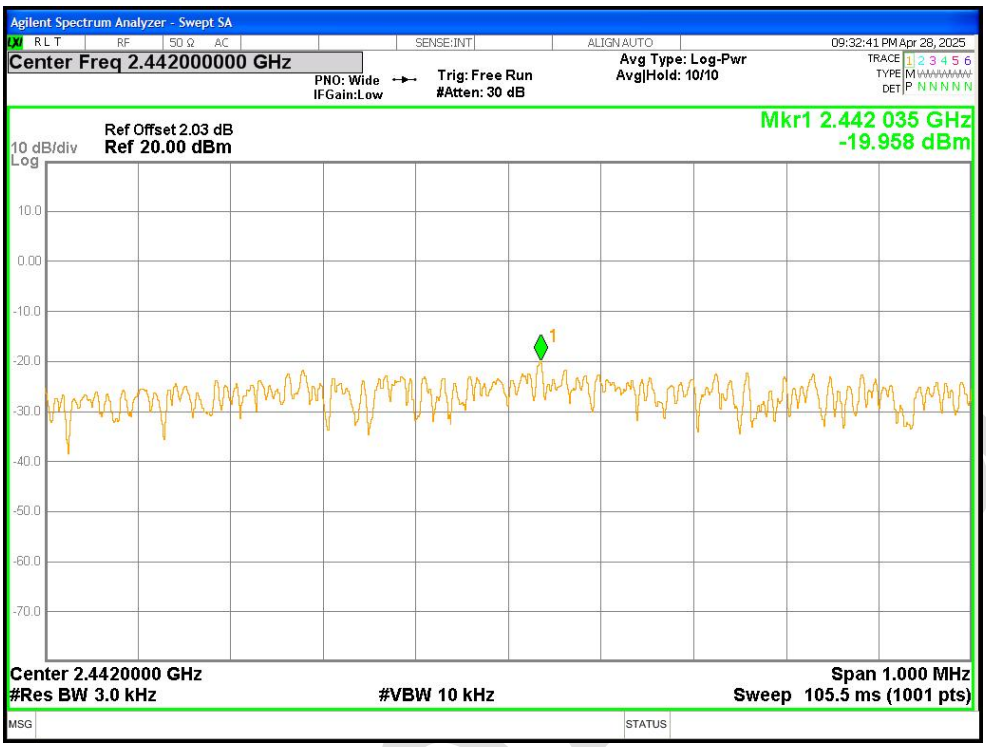
PSD NVNT BLE 1M 2480MHz Ant1

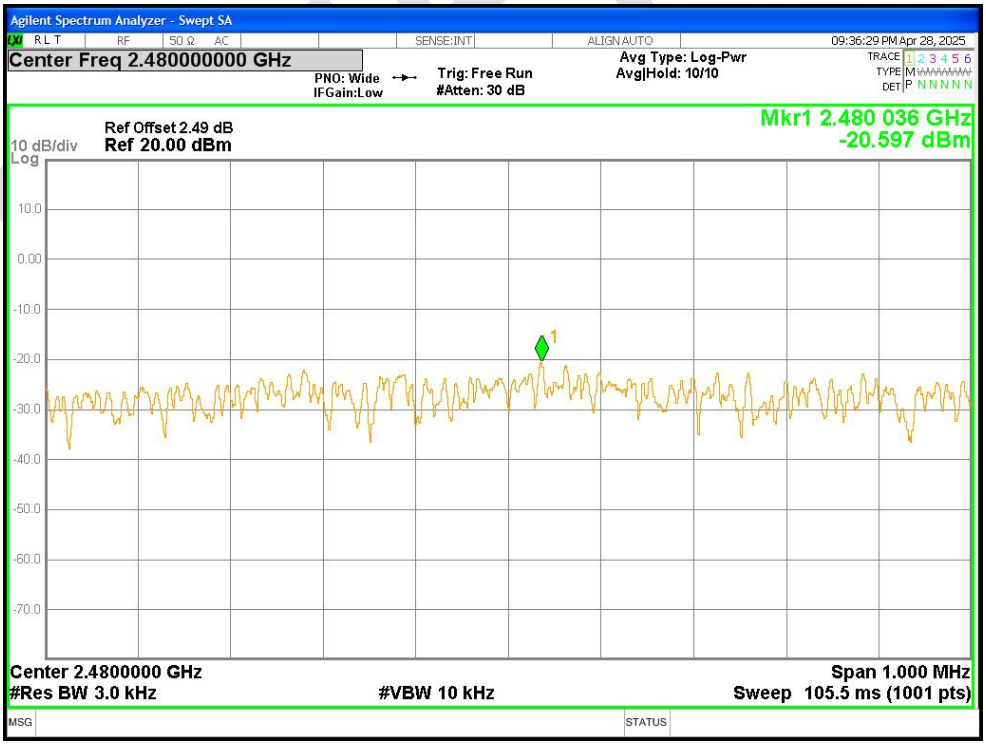



PSD NVNT BLE 2M 2402MHz Ant1



PSD NVNT BLE 2M 2442MHz Ant1




PSD NVNT BLE 2M 2480MHz Ant1