# TEST REPORT

| | |
|---|---|
| Applicant Name : | Shenzhen Youmi Intelligent Technology Co., Ltd. |
| Address : | 406-407 Jinqi Zhigu Building, 4/F, 1 Tangling Road, Nanshan District, Shenzhen City, China |
| Report Number : | RA230607-32261E-RFB |
| FCC ID: | 2ATZ4-A15TAB |
| IC: | 26074-A15TAB |

**Test Standard (s)**

FCC PART 15.247; RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2; RSS-247, ISSUE 2, FEBRUARY 2017

**Sample Description**

| | |
|---|---|
| Product Type: | Smart Tablet Computer |
| Model No.: | A15 Tab |
| Multiple Model(s) No.: | N/A |
| Trade Mark: | UMIDIGI |
| Date Received: | 2023/06/07 |
| Report Date: | 2023/06/21 |

| | |
|---|---|
| Test Result: | Pass* |

* In the configuration tested, the EUT complied with the standards above.

**Prepared and Checked By:**

Roger Ling
EMC Engineer

**Approved By:**

Candy Li
EMC Engineer

# TABLE OF CONTENTS

# DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | RA230607-32261E-RFB | Original Report | 2023/06/21 |

# GENERAL INFORMATION

## Product Description for Equipment under Test (EUT)

| | |
|---|---|
| HVIN | T30-T616-(UM-A13) |
| FVIN | UMIDIGI_A15_Tab |
| Frequency Range | BLE_1M/2M: 2402-2480MHz<br>Wi-Fi: 2412-2462MHz |
| Maximum Conducted Output Power | BLE: 0.38dBm<br>Wi-Fi:10.10dBm |
| Modulation Technique | BLE: GFSK<br>Wi-Fi: DSSS, OFDM |
| Antenna Specification* | 2.2dBi (provided by the applicant) |
| Voltage Range | DC 3.8V from battery or DC 5V/9V/12V from adapter |
| Sample serial number | RE&CE: 26M1-1<br>RF: 26M1-3 (Assigned by ATC) |
| Sample/EUT Status | Good condition |
| Adapter information | Model: QZ-02002AC00<br>Input: AC 100-240V, 50/60Hz, 0.5A<br>Output: DC 5.0V, 3.0A or 9.0V, 2.22A or DC 12.0V, 1.67A, 20.0W |

## Objective

This report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules and RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247, Issue 2, February 2017 of the Innovation, Science and Economic Development Canada rules.

## Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliant Testing of Unlicensed Wireless Devices and RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247, Issue 2, February 2017.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

## Measurement Uncertainty

| Parameter | | Uncertainty |
|---|---|---|
| Occupied Channel Bandwidth | | 5% |
| RF Frequency | | $0.082*10^{-7}$ |
| RF output power, conducted | | 0.71dB |
| Unwanted Emission, conducted | | 1.6dB |
| AC Power Lines Conducted Emissions | | 2.72dB |
| Audio Frequency Response | | 0.1dB |
| Low Pass Filter Response | | 1.2dB |
| Modulation Limiting | | 1% |
| Emissions, Radiated | 9kHz - 30MHz | 2.06dB |
| | 30MHz - 1GHz | 5.08dB |
| | 1GHz - 18GHz | 4.96dB |
| | 18GHz - 26.5GHz | 5.16dB |
| | 26.5GHz - 40GHz | 4.64dB |
| Temperature | | 1℃ |
| Humidity | | 6% |
| Supply voltages | | 0.4% |

*Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

## Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the Floor 1, KuMaKe Building, Dongzhou Community, Guangming Street, Guangming District, Shenzhen, Guangdong, China

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189.

Accredited by American Association for Laboratory Accreditation (A2LA). The Certificate Number is 4297.01

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 30241.

# SYSTEM TEST CONFIGURATION

## Description of Test Configuration

For Wi-Fi mode, total 11 channels are provided to testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 1 | 2412 | 8 | 2447 |
| 2 | 2417 | 9 | 2452 |
| 3 | 2422 | 10 | 2457 |
| 4 | 2427 | 11 | 2462 |
| 5 | 2432 | / | / |
| 6 | 2437 | / | / |
| 7 | 2442 | / | / |

For 802.11b, 802.11g, 802.11n-HT20, EUT was tested with Channel 1, 6 and 11.
For 802.11n-HT40, EUT was tested with Channel 3, 6 and 9.

For BLE mode, 40 channels are provided to testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 0 | 2402 | 20 | 2442 |
| 1 | 2404 | 21 | 2444 |
| 2 | 2406 | 22 | 2446 |
| 3 | 2408 | 23 | 2448 |
| 4 | 2410 | 24 | 2450 |
| 5 | 2412 | 25 | 2452 |
| 6 | 2414 | 26 | 2454 |
| 7 | 2416 | 27 | 2456 |
| 8 | 2418 | 28 | 2458 |
| 9 | 2420 | 29 | 2460 |
| 10 | 2422 | 30 | 2462 |
| 11 | 2424 | 31 | 2464 |
| 12 | 2426 | 32 | 2466 |
| 13 | 2428 | 33 | 2468 |
| 14 | 2430 | 34 | 2470 |
| 15 | 2432 | 35 | 2472 |
| 16 | 2434 | 36 | 2474 |
| 17 | 2436 | 37 | 2476 |
| 18 | 2438 | 38 | 2478 |
| 19 | 2440 | 39 | 2480 |

EUT was tested with Channel 0, 19 and 39.

## Equipment Modifications

No modification was made to the EUT tested.

## EUT Exercise Software

EUT was test in engineering mode and the power level as below:

The worst case was performed under:

| Mode | Data rate | Power Level* | | |
|---|---|---|---|---|
| | | Low Channel | Middle Channel | High Channel |
| 802.11b | 1Mbps | 9 | 9 | 9 |
| 802.11g | 6Mbps | 8 | 8 | 8 |
| 802.11n-HT20 | MCS0 | 8 | 8 | 8 |
| 802.11n-HT40 | MCS0 | 8 | 8 | 8 |
| BLE | 1Mbps | Default | Default | Default |
| | 2Mbps | Default | Default | Default |

The worse-case data rates are determined to be as follows for each mode based upon investigations by measuring the output power and PSD across all data rated bandwidths, and modulations.

The power level was provided by the applicant.

## Support Equipment List and Details

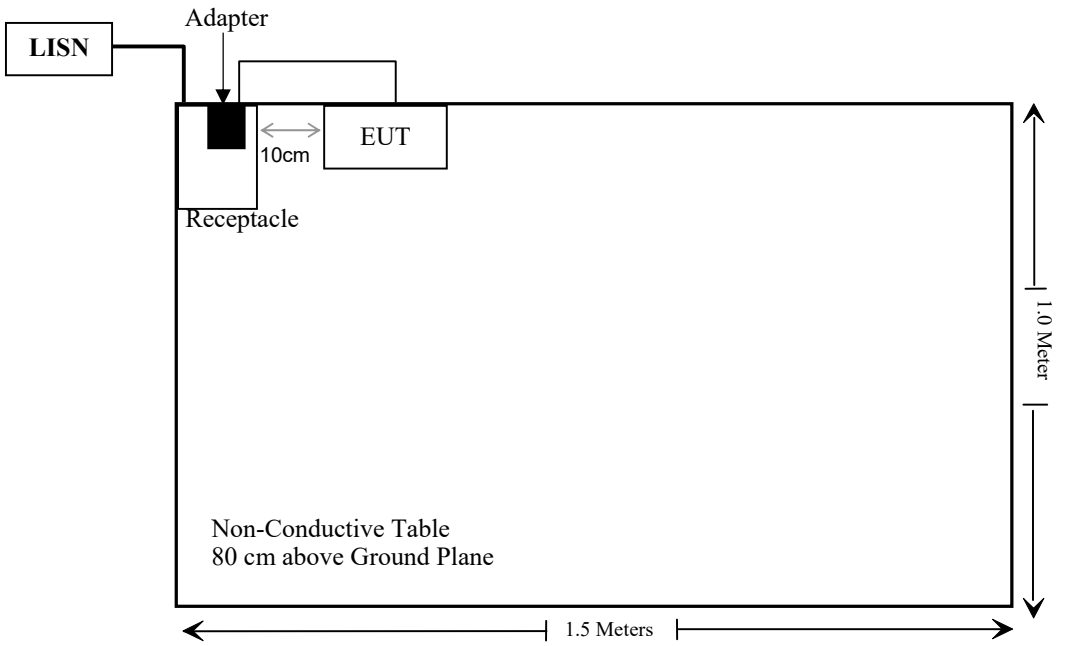
| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| / | / | / | / |

## External I/O Cable

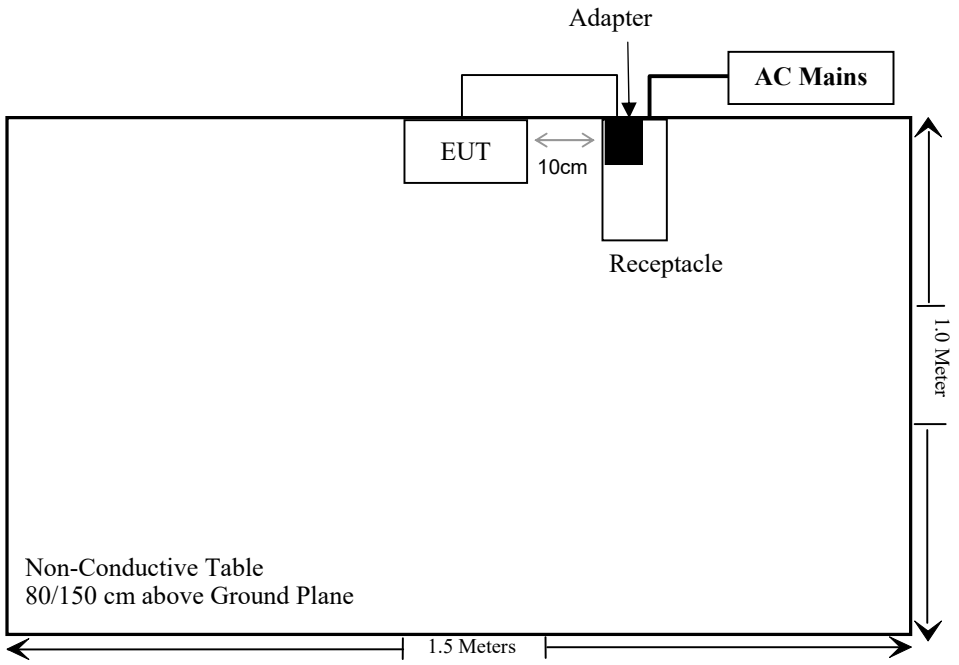
| Cable Description | Length (m) | From Port | To |
|---|---|---|---|
| Un-shielding Detachable USB Cable | 1.0 | EUT | Adapter |

## Block Diagram of Test Setup

**For conducted emission**




For Radiated Emissions:




Note: The support table edge was flush with the center of turntable.

# SUMMARY OF TEST RESULTS

| FCC Rules | RSS Rules | Description of Test | Result |
|---|---|---|---|
| FCC§15.247 (i), §1.1307 (b) (1) &§2.1093 | / | RF Exposure | Compliant |
| / | RSS-102 § 2.5.1 | Exemption Limits For Routine Evaluation-SAR evaluation | Compliant |
| §15.203 | RSS-Gen§6.8 | Antenna Requirement | Compliant |
| §15.207 (a) | RSS-Gen§8.8 | AC Line Conducted Emissions | Compliant |
| §15.205, §15.209, §15.247(d) | RSS-GEN § 8.10 &RSS-247 § 5.5 | Spurious Emissions | Compliant |
| §15.247 (a)(2) | RSS- Gen§6.7 RSS-247 § 5.2 (a) | 99% Occupied Bandwidth &6 dB Emission Bandwidth | Compliant |
| §15.247(b)(3) | RSS-247 § 5.4(d) | Maximum Conducted Output Power | Compliant |
| §15.247(d) | RSS-247 § 5.5 | 100kHz Bandwidth of Frequency Band Edge | Compliant |
| §15.247(e) | RSS-247 §5.2 (b) | Power Spectral Density | Compliant |

# TEST EQUIPMENT LIST

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| **Conducted emission test** | | | | | |
| Rohde& Schwarz | EMI Test Receiver | ESCI | 100784 | 2022/11/25 | 2023/11/24 |
| Rohde & Schwarz | L.I.S.N. | ENV216 | 101314 | 2022/11/25 | 2023/11/24 |
| Anritsu Corp | 50 Coaxial Switch | MP59B | 6100237248 | 2022/12/07 | 2023/12/06 |
| Unknown | RF Coaxial Cable | No.17 | N0350 | 2022/11/25 | 2023/11/24 |
| Conducted Emission Test Software: e3 19821b (V9) | | | | | |
| **Radiated emission test** | | | | | |
| Rohde& Schwarz | Test Receiver | ESR | 102725 | 2022/11/25 | 2023/11/24 |
| Rohde&Schwarz | Spectrum Analyzer | FSV40 | 101949 | 2022/11/25 | 2023/11/24 |
| SONOMA INSTRUMENT | Amplifier | 310 N | 186131 | 2022/11/08 | 2023/11/07 |
| A.H. Systems, inc. | Preamplifier | PAM-0118P | 135 | 2022/11/08 | 2023/11/07 |
| Quinstar | Amplifier | QLW-18405536-J0 | 15964001002 | 2022/11/08 | 2023/11/07 |
| Schwarzbeck | Bilog Antenna | VULB9163 | 9163-323 | 2021/07/06 | 2024/07/05 |
| Schwarzbeck | Horn Antenna | BBHA9120D | 9120D-1067 | 2022/11/30 | 2025/11/29 |
| Schwarzbeck | HORN ANTENNA | BBHA9170 | 9170-359 | 2022/12/26 | 2025/12/25 |
| Radiated Emission Test Software: e3 19821b (V9) | | | | | |
| Unknown | RF Coaxial Cable | No.10 | N050 | 2022/11/25 | 2023/11/24 |
| Unknown | RF Coaxial Cable | No.11 | N1000 | 2022/11/25 | 2023/11/24 |
| Unknown | RF Coaxial Cable | No.12 | N040 | 2022/11/25 | 2023/11/24 |
| Unknown | RF Coaxial Cable | No.13 | N300 | 2022/11/25 | 2023/11/24 |
| Unknown | RF Coaxial Cable | No.14 | N800 | 2022/11/25 | 2023/11/24 |
| Unknown | RF Coaxial Cable | No.15 | N600 | 2022/11/25 | 2023/11/24 |
| Unknown | RF Coaxial Cable | No.16 | N650 | 2022/11/25 | 2023/11/24 |
| Mini-Circuits | High Pass Filter | NHP-600+ | 15542 | 2022/11/25 | 2023/11/24 |
| **RF Conducted Test** | | | | | |
| Rohde&Schwarz | Spectrum Analyzer | FSV-40 | 101590 | 2022/11/25 | 2023/11/24 |
| Tonscend | RF Control Unit | JS0806-2 | 19G8060182 | 2022/10/24 | 2023/10/23 |
| Agilent | Power Sensor | U2021XA | MY5425003 | 2023/02/25 | 2024/02/24 |
| WEINSCHEL | 10dB Attenuator | 5324 | AU 3842 | 2022/11/25 | 2023/11/24 |

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

# FCC§15.247 (i), §1.1307 (b)(1)&§2.1093 – RF EXPOSURE

## Applicable Standard

According to FCC §2.1093 and §1.1307(b)(1), systems operating under the provisions of this sectionshall be operated in a manner that ensure that the public is not exposed to radio frequency energylevel in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

**Measurement Result**

**For worst case:**

| Mode | Frequency (MHz) | Max tune-up conducted power (dBm) | Max tune-up conducted power (mW) | Distance (mm) | Calculated value | Threshold (1-g SAR) | SAR Test Exclusion |
|---|---|---|---|---|---|---|---|
| BLE | 2402-2480 | 0.5 | 1.12 | 5 | 0.4 | 3.0 | Yes |

**Result: No SAR test is required**

For **Wi-Fi mode**, please refer to the SAR report: RA230607-32261E-20A.

# RSS-102 § 2.5.1 –EXEMPTION LIMITS FOR ROUTINE EVALUATION-SAR EVALUATION

## Applicable Standard

According to RSS-102 Issue 5§ (2.5.1), SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

**Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]**

| Frequency (MHz) | Exemption Limits (mW) | | | | |
|---|---|---|---|---|---|
| | At separation distance of ≤5 mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| ≤300 | 71 mW | 101 mW | 132 mW | 162 mW | 193 mW |
| 450 | 52 mW | 70 mW | 88 mW | 106 mW | 123 mW |
| 835 | 17 mW | 30 mW | 42 mW | 55 mW | 67 mW |
| 1900 | 7 mW | 10 mW | 18 mW | 34 mW | 60 mW |
| 2450 | 4 mW | 7 mW | 15 mW | 30 mW | 52 mW |
| 3500 | 2 mW | 6 mW | 16 mW | 32 mW | 55 mW |
| 5800 | 1 mW | 6 mW | 15 mW | 27 mW | 41 mW |

| Frequency (MHz) | Exemption Limits (mW) | | | | |
|---|---|---|---|---|---|
| | At separation distance of 30 mm | At separation distance of 35 mm | At separation distance of 40 mm | At separation distance of 45 mm | At separation distance of ≥50 mm |
| ≤300 | 223 mW | 254 mW | 284 mW | 315 mW | 345 mW |
| 450 | 141 mW | 159 mW | 177 mW | 195 mW | 213 mW |
| 835 | 80 mW | 92 mW | 105 mW | 117 mW | 130 mW |
| 1900 | 99 mW | 153 mW | 225 mW | 316 mW | 431 mW |
| 2450 | 83 mW | 123 mW | 173 mW | 235 mW | 309 mW |
| 3500 | 86 mW | 124 mW | 170 mW | 225 mW | 290 mW |
| 5800 | 56 mW | 71 mW | 85 mW | 97 mW | 106 mW |

4. The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.
5. Transmitters operating between 0.003-10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in Section 4.

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

## Test Result:

For worst case:

**For BLE mode:**

The higher of the conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power:

(2480-2450)/(3500-2450)= (4-P)/(4-2)

The exemption limit of 2480MHz is P= 3.94mW

The antenna gain is 2.2dBi

The maximum tune up conducted power is 0.5dBm

The maximum tune up EIRP is 2.7 dBm (1.86mW), which less than 3.94mW@2480MHz exemption limit

**So the stand-alone SAR test is not required.**

For **Wi-Fi mode**, please refer to the SAR report: RA230607-32261E-20B.

# § 15.203&RSS-Gen §6.8ANTENNA REQUIREMENT

## Applicable Standard

According to § 15.203, 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 shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

Antenna must be permanently attached to the unit.
Antenna must use a unique type of connector to attach to the EUT.
Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

## Antenna Connector Construction

The EUT has one internal antenna arrangement which were permanently attached for Wi-Fi and BLE, the antenna gain is 2.2dBi, fulfill the requirement of this section. Please refer to the EUT photos.

| Antenna Type | Antenna Gain | Impedance | Frequency Range |
|---|---|---|---|
| FPC | 2.2dBi | 50Ω | 2.4~2.5GHz |

**Result: Compliant**

# § 15.207 (a)&RSS-GEN §8.8 AC LINE CONDUCTED EMISSIONS

## Applicable Standard

FCC § 15.207 (a)&RSS-GEN §8.8

Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 μH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

| Table 4 - AC Power Lines Conducted Emission Limits | | |
|---|---|---|
| Frequency range (MHz) | Conducted limit (dBμV) | |
| | Quasi-Peak | Average |
| 0.15 – 0.5 | 66 to 56[1] | 56 to 46[1] |
| 0.5 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

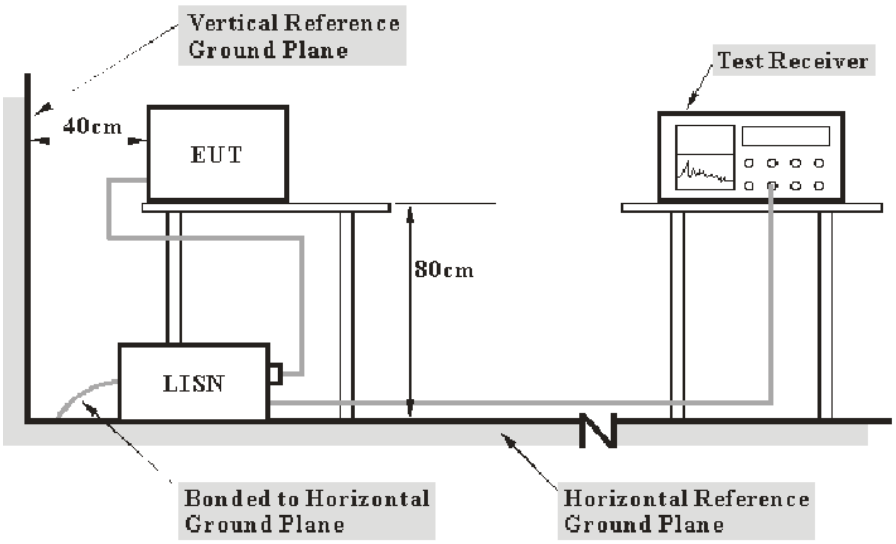
**Note 1:** The level decreases linearly with the logarithm of the frequency.

For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:

(a) Perform the AC power-line conducted emissions test with the antenna connected to determine compliance with the limits of table 4 outside the transmitter's fundamental emission band.

(b) Retest with a dummy load instead of the antenna to determine compliance with the limits of table 4 within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network that simulates the antenna in the fundamental frequency band.

## EUT Setup




Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207& RSS-247/RSS-Gen limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and formed a bundle 30 to 40cm long in the middle.

## EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range | IF B/W |
|---|---|
| 150 kHz – 30 MHz | 9 kHz |

## Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

## Factor & Over Limit Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

Factor = LISN VDF + Cable Loss

The "**Over limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over limit of -7dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

Over Limit = Level – Limit
Level = Read Level + Factor

## Test Data

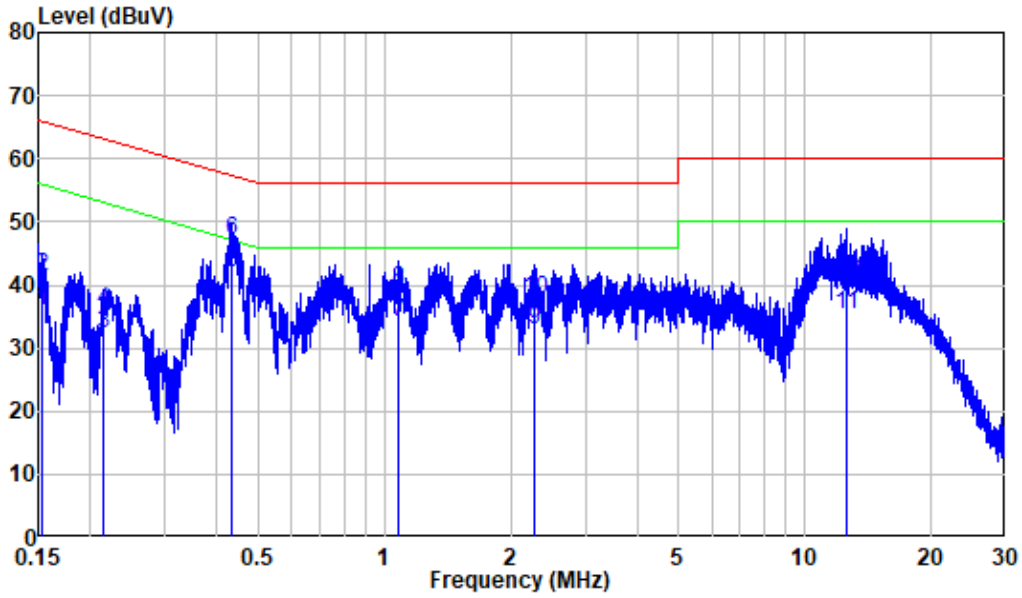
### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 ℃ |
| **Relative Humidity:** | 49 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Jerry Wu on 2023-06-20.*

*EUT operation mode: Transmitting (worst case is 802.11b mode, Middle channel)*

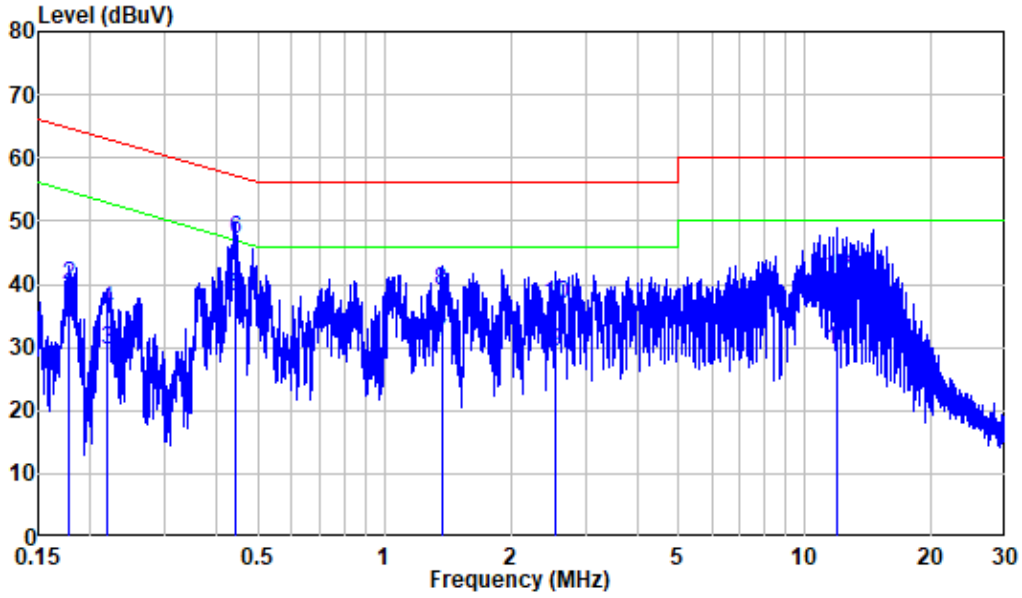
**AC 120V/60 Hz, Line**




Site : Shielding Room
Condition: Line
Job No. : RA230607-32261E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz

| | Freq | Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dB | dBuV | dBuV | dBuV | dB | |
| 1 | 0.153 | 10.36 | 25.63 | 35.99 | 55.82 | -19.83 | Average |
| 2 | 0.153 | 10.36 | 30.94 | 41.30 | 65.82 | -24.52 | QP |
| 3 | 0.215 | 10.31 | 22.04 | 32.35 | 53.01 | -20.66 | Average |
| 4 | 0.215 | 10.31 | 25.64 | 35.95 | 63.01 | -27.06 | QP |
| 5 | 0.433 | 10.52 | 31.59 | 42.11 | 47.20 | -5.09 | Average |
| 6 | 0.433 | 10.52 | 36.59 | 47.11 | 57.20 | -10.09 | QP |
| 7 | 1.077 | 10.45 | 23.76 | 34.21 | 46.00 | -11.79 | Average |
| 8 | 1.077 | 10.45 | 28.88 | 39.33 | 56.00 | -16.67 | QP |
| 9 | 2.282 | 10.42 | 22.39 | 32.81 | 46.00 | -13.19 | Average |
| 10 | 2.282 | 10.42 | 27.31 | 37.73 | 56.00 | -18.27 | QP |
| 11 | 12.524 | 10.37 | 25.03 | 35.40 | 50.00 | -14.60 | Average |
| 12 | 12.524 | 10.37 | 30.09 | 40.46 | 60.00 | -19.54 | QP |

**AC 120V/60 Hz, Neutral**




Site : Shielding Room
Condition: Neutral
Job No. : RA230607-32261E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz

| | Freq | Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dB | dBuV | dBuV | dBuV | dB | |
| 1 | 0.177 | 10.28 | 23.48 | 33.76 | 54.62 | -20.86 | Average |
| 2 | 0.177 | 10.28 | 29.66 | 39.94 | 64.62 | -24.68 | QP |
| 3 | 0.219 | 10.30 | 19.41 | 29.71 | 52.85 | -23.14 | Average |
| 4 | 0.219 | 10.30 | 25.58 | 35.88 | 62.85 | -26.97 | QP |
| 5 | 0.442 | 10.44 | 27.57 | 38.01 | 47.03 | -9.02 | Average |
| 6 | 0.442 | 10.44 | 36.77 | 47.21 | 57.03 | -9.82 | QP |
| 7 | 1.366 | 10.41 | 20.52 | 30.93 | 46.00 | -15.07 | Average |
| 8 | 1.366 | 10.41 | 28.50 | 38.91 | 56.00 | -17.09 | QP |
| 9 | 2.557 | 10.51 | 18.63 | 29.14 | 46.00 | -16.86 | Average |
| 10 | 2.557 | 10.51 | 26.19 | 36.70 | 56.00 | -19.30 | QP |
| 11 | 11.925 | 10.48 | 19.25 | 29.73 | 50.00 | -20.27 | Average |
| 12 | 11.925 | 10.48 | 30.44 | 40.92 | 60.00 | -19.08 | QP |

# FCC§15.205, §15.209,§15.247(d)&RSS-GEN § 8.10 & RSS-247 § 5.5SPURIOUS EMISSIONS

## Applicable Standard

FCC §15.247 (d); §15.209;§15.205;

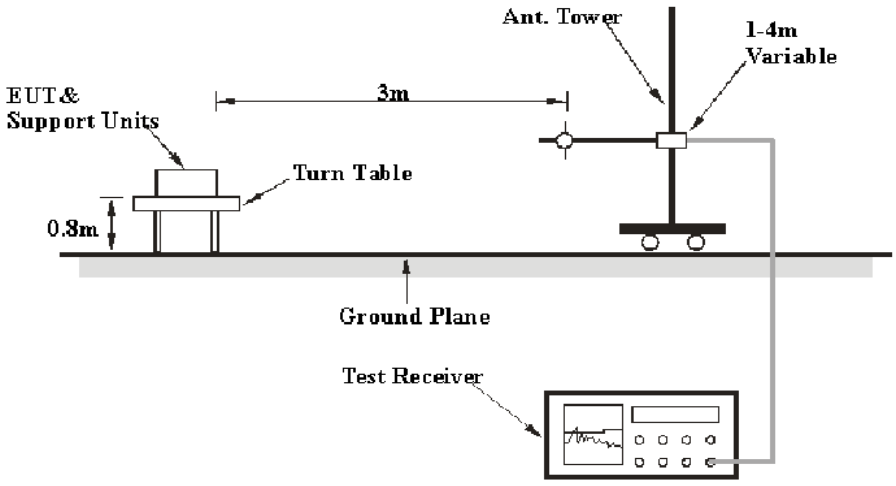
According to RSS-GEN § 8.10 & RSS-247 § 5.5

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.(c)Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

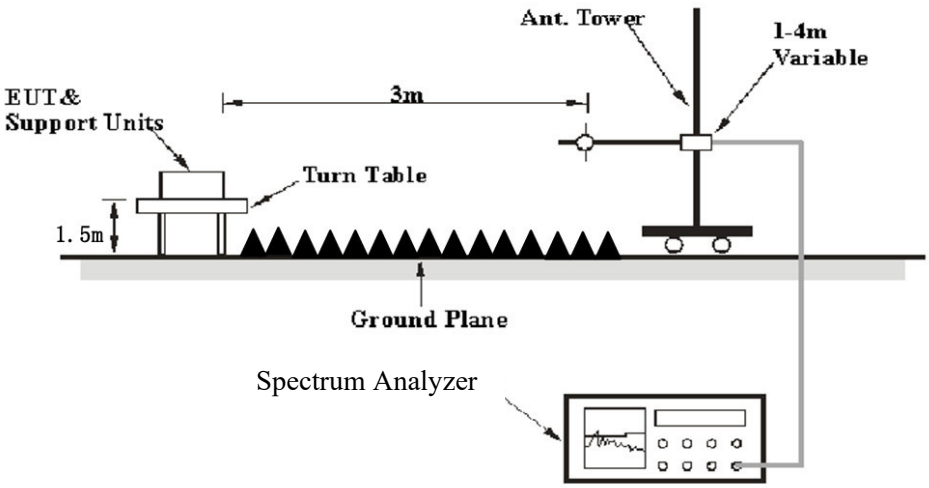
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

## EUT Setup

**Below 1 GHz:**



**Above 1GHz:**




The radiated emission tests were performed in the 3meters test site, using the setup accordance with the ANSI C63.10-2013& RSS-Gen. The specification used was the FCC 15.209, and FCC 15.247 & RSS-Gen limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40cm long in the middle.

## EMI Test Receiver& Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

| Frequency Range | RBW | Video B/W | IF B/W | Measurement |
|---|---|---|---|---|
| 30MHz – 1000 MHz | 100 kHz | 300 kHz | 120kHz | QP |
| Above 1 GHz | 1MHz | 3 MHz | / | PK |
| | 1MHz | 10 Hz[Note 1] | / | Average |
| | 1MHz | ＞1/T [Note 2] | / | Average |

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

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.

## Factor& Over Limit/Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Over Limit/Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

Over Limit/Margin = Level / Corrected Amplitude–Limit
Level / Corrected Amplitude = Read Level + Factor

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23~25 ℃ |
| **Relative Humidity:** | 53~60 % |
| **ATM Pressure:** | 101.0 ~101.3kPa |

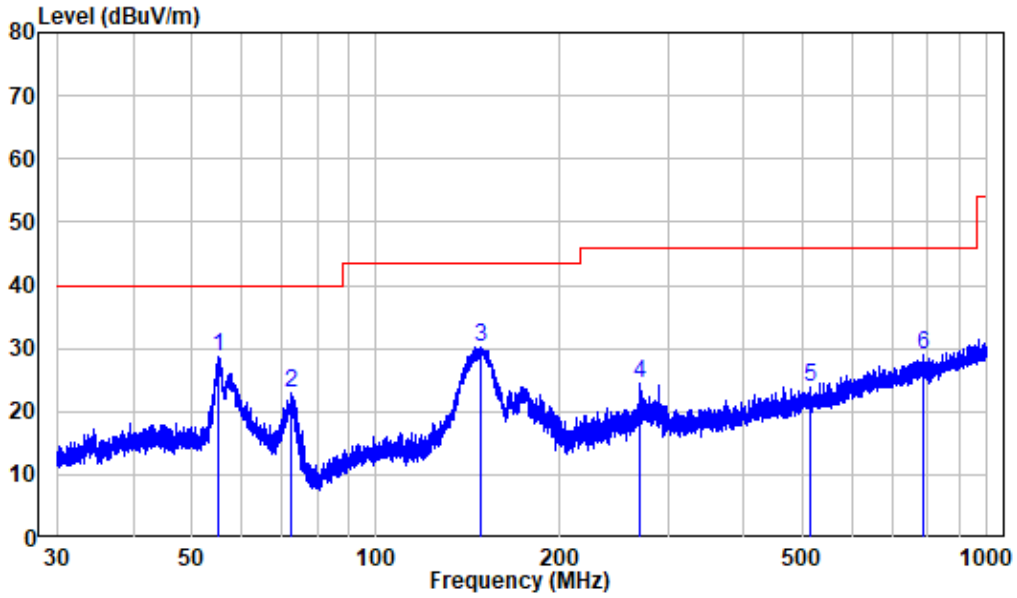
*The testing was performed by Jimmy Zheng on 2023-06-20 for below 1GHz and on 2023-06-07for above 1GHz*

*EUT operation mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case X-axes of orientation were recorded)*

**30 MHz~1 GHz:** *(worst case is 802.11b mode, middle channel)*

*Note: When the result of Peak less than the limit of QP by more than 6dB, just the peak value was recorded.*

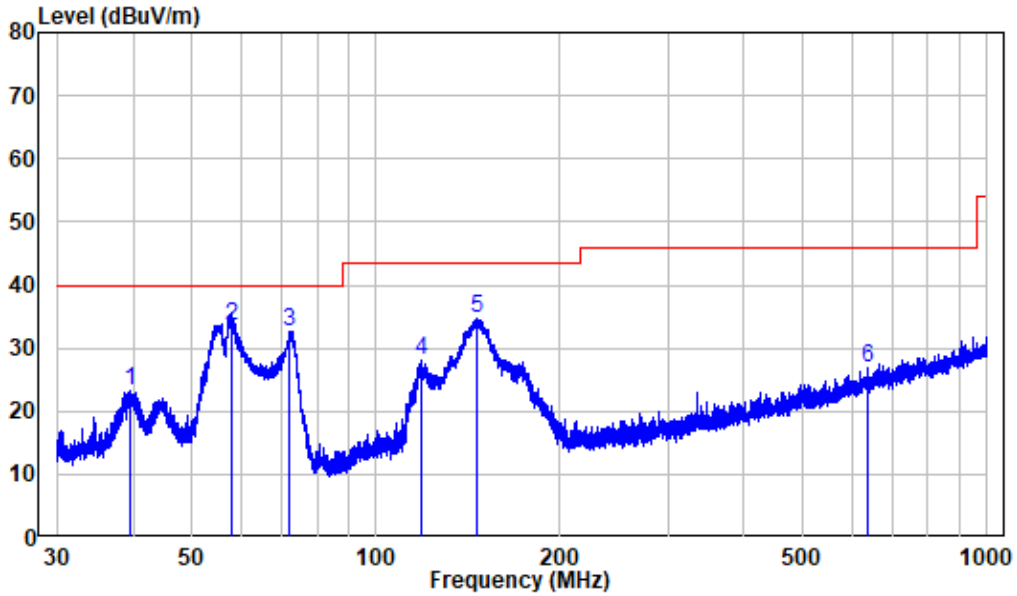
Horizontal




Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230607-32261E-RF
Test Mode: 2.4G WIFI Transmitting

| | Freq | Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 55.293 | -10.26 | 38.94 | 28.68 | 40.00 | -11.32 | Peak |
| 2 | 72.623 | -15.77 | 38.66 | 22.89 | 40.00 | -17.11 | Peak |
| 3 | 148.376 | -15.36 | 45.61 | 30.25 | 43.50 | -13.25 | Peak |
| 4 | 270.968 | -10.17 | 34.74 | 24.57 | 46.00 | -21.43 | Peak |
| 5 | 514.309 | -4.28 | 28.19 | 23.91 | 46.00 | -22.09 | Peak |
| 6 | 786.816 | -0.07 | 28.92 | 28.85 | 46.00 | -17.15 | Peak |

Vertical




Site : chamber
Condition: 3m VERTICAL
Job No. : RA230607-32261E-RF
Test Mode: 2.4G WIFI Transmitting

| | Freq | Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 39.645 | -10.42 | 33.78 | 23.36 | 40.00 | -16.64 | Peak |
| 2 | 58.076 | -9.93 | 43.58 | 33.65 | 40.00 | -6.35 | QP |
| 3 | 72.084 | -15.63 | 48.34 | 32.71 | 40.00 | -7.29 | Peak |
| 4 | 118.653 | -13.28 | 41.36 | 28.08 | 43.50 | -15.42 | Peak |
| 5 | 145.861 | -15.50 | 50.11 | 34.61 | 43.50 | -8.89 | Peak |
| 6 | 640.050 | -1.92 | 28.91 | 26.99 | 46.00 | -19.01 | Peak |

**1 GHz-25 GHz:**

**Wi-Fi:**

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Corrected. Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| **802.11b** | | | | | | | | | |
| Low Channel(2412MHz) | | | | | | | | | |
| 2325.52 | 66.02 | PK | 244 | 1.4 | H | -10.49 | 55.53 | 74 | -18.47 |
| 2325.52 | 51.11 | AV | 244 | 1.4 | H | -10.49 | 40.62 | 54 | -13.38 |
| 2325.36 | 66.89 | PK | 136 | 1.1 | V | -10.49 | 56.40 | 74 | -17.60 |
| 2325.36 | 51.84 | AV | 136 | 1.1 | V | -10.49 | 41.35 | 54 | -12.65 |
| 2390 | 64.02 | PK | 217 | 2.3 | H | -10.62 | 53.40 | 74 | -20.60 |
| 2390 | 52.28 | AV | 217 | 2.3 | H | -10.62 | 41.66 | 54 | -12.34 |
| 2390 | 65.04 | PK | 107 | 1.4 | V | -10.62 | 54.42 | 74 | -19.58 |
| 2390 | 52.75 | AV | 107 | 1.4 | V | -10.62 | 42.13 | 54 | -11.87 |
| 4824 | 58.85 | PK | 301 | 2.4 | H | -5.55 | 53.30 | 74 | -20.70 |
| 4824 | 54.11 | AV | 301 | 2.4 | H | -5.55 | 48.56 | 54 | -5.44 |
| 4824 | 59.42 | PK | 23 | 1.8 | V | -5.55 | 53.87 | 74 | -20.13 |
| 4824 | 54.74 | AV | 23 | 1.8 | V | -5.55 | 49.19 | 54 | -4.81 |
| Middle Channel(2437MHz) | | | | | | | | | |
| 4874 | 59.93 | PK | 76 | 1.1 | H | -5.29 | 54.64 | 74 | -19.36 |
| 4874 | 53.71 | AV | 76 | 1.1 | H | -5.29 | 48.42 | 54 | -5.58 |
| 4874 | 59.62 | PK | 131 | 2 | V | -5.29 | 54.33 | 74 | -19.67 |
| 4874 | 55.27 | AV | 131 | 2 | V | -5.29 | 49.98 | 54 | -4.02 |
| High Channel(2462 MHz) | | | | | | | | | |
| 2483.5 | 68.50 | PK | 165 | 2.2 | H | -10.46 | 58.04 | 74 | -15.96 |
| 2483.5 | 59.17 | AV | 165 | 2.2 | H | -10.46 | 48.71 | 54 | -5.29 |
| 2483.5 | 69.65 | PK | 88 | 1.9 | V | -10.46 | 59.19 | 74 | -14.81 |
| 2483.5 | 60.46 | AV | 88 | 1.9 | V | -10.46 | 50 | 54 | -4.00 |
| 2483.52 | 68.44 | PK | 287 | 1.7 | H | -10.46 | 57.98 | 74 | -16.02 |
| 2483.52 | 59.33 | AV | 287 | 1.7 | H | -10.46 | 48.87 | 54 | -5.13 |
| 2483.55 | 69.76 | PK | 38 | 2.4 | V | -10.46 | 59.3 | 74 | -14.70 |
| 2483.55 | 60.30 | AV | 38 | 2.4 | V | -10.46 | 49.84 | 54 | -4.16 |
| 4924 | 61.07 | PK | 44 | 1.6 | H | -5.03 | 56.04 | 74 | -17.96 |
| 4924 | 54.55 | AV | 44 | 1.6 | H | -5.03 | 49.52 | 54 | -4.48 |
| 4924 | 61.50 | PK | 132 | 2.2 | V | -5.03 | 56.47 | 74 | -17.53 |
| 4924 | 55.59 | AV | 132 | 2.2 | V | -5.03 | 50.56 | 54 | -3.44 |

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Corrected. Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| 802.11g | | | | | | | | | |
| Low Channel(2412MHz) | | | | | | | | | |
| 2389.9 | 70.53 | PK | 13 | 2.1 | H | -10.62 | 59.91 | 74 | -14.09 |
| 2389.9 | 52.74 | AV | 13 | 2.1 | H | -10.62 | 42.12 | 54 | -11.88 |
| 2389.92 | 71.35 | PK | 312 | 2.2 | V | -10.62 | 60.73 | 74 | -13.27 |
| 2389.92 | 52.99 | AV | 312 | 2.2 | V | -10.62 | 42.37 | 54 | -11.63 |
| 2390 | 69.35 | PK | 268 | 1.6 | H | -10.62 | 58.73 | 74 | -15.27 |
| 2390 | 52.02 | AV | 268 | 1.6 | H | -10.62 | 41.40 | 54 | -12.60 |
| 2390 | 70.21 | PK | 218 | 1.1 | V | -10.62 | 59.59 | 74 | -14.41 |
| 2390 | 53.31 | AV | 218 | 1.1 | V | -10.62 | 42.69 | 54 | -11.31 |
| 4824 | 60.27 | PK | 130 | 1.3 | H | -5.55 | 54.72 | 74 | -19.28 |
| 4824 | 48.57 | AV | 130 | 1.3 | H | -5.55 | 43.02 | 54 | -10.98 |
| 4824 | 58.55 | PK | 112 | 2 | V | -5.55 | 53.00 | 74 | -21.00 |
| 4824 | 48.00 | AV | 112 | 2 | V | -5.55 | 42.45 | 54 | -11.55 |
| Middle Channel(2437MHz) | | | | | | | | | |
| 4874 | 61.17 | PK | 92 | 1.9 | H | -5.29 | 55.88 | 74 | -18.12 |
| 4874 | 48.78 | AV | 92 | 1.9 | H | -5.29 | 43.49 | 54 | -10.51 |
| 4874 | 59.03 | PK | 172 | 2 | V | -5.29 | 53.74 | 74 | -20.26 |
| 4874 | 48.24 | AV | 172 | 2 | V | -5.29 | 42.95 | 54 | -11.05 |
| High Channel(2462 MHz) | | | | | | | | | |
| 2483.5 | 80.53 | PK | 194 | 2.5 | H | -10.46 | 70.07 | 74 | -3.93 |
| 2483.5 | 54.39 | AV | 194 | 2.5 | H | -10.46 | 43.93 | 54 | -10.07 |
| 2483.5 | 80.91 | PK | 147 | 2 | V | -10.46 | 70.45 | 74 | -3.55 |
| 2483.5 | 55.59 | AV | 147 | 2 | V | -10.46 | 45.13 | 54 | -8.87 |
| 2483.55 | 77.57 | PK | 186 | 2.3 | H | -10.46 | 67.11 | 74 | -6.89 |
| 2483.55 | 54.17 | AV | 186 | 2.3 | H | -10.46 | 43.71 | 54 | -10.29 |
| 2483.7 | 78.34 | PK | 254 | 2.2 | V | -10.46 | 67.88 | 74 | -6.12 |
| 2483.7 | 55.80 | AV | 254 | 2.2 | V | -10.46 | 45.34 | 54 | -8.66 |
| 4924 | 58.11 | PK | 15 | 2 | H | -5.03 | 53.08 | 74 | -20.92 |
| 4924 | 46.04 | AV | 15 | 2 | H | -5.03 | 41.01 | 54 | -12.99 |
| 4924 | 58.74 | PK | 18 | 1.4 | V | -5.03 | 53.71 | 74 | -20.29 |
| 4924 | 46.84 | AV | 18 | 1.4 | V | -5.03 | 41.81 | 54 | -12.19 |

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Corrected. Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| **802.11n20** | | | | | | | | | |
| Low Channel(2412MHz) | | | | | | | | | |
| 2389.59 | 72.70 | PK | 154 | 2.5 | H | -10.62 | 62.08 | 74 | -11.92 |
| 2389.59 | 53.39 | AV | 154 | 2.5 | H | -10.62 | 42.77 | 54 | -11.23 |
| 2389.94 | 72.15 | PK | 245 | 2.2 | V | -10.62 | 61.53 | 74 | -12.47 |
| 2389.94 | 52.77 | AV | 245 | 2.2 | V | -10.62 | 42.15 | 54 | -11.85 |
| 2390 | 72.55 | PK | 308 | 1.5 | H | -10.62 | 61.93 | 74 | -12.07 |
| 2390 | 52.31 | AV | 308 | 1.5 | H | -10.62 | 41.69 | 54 | -12.31 |
| 2390 | 70.99 | PK | 278 | 1.2 | V | -10.62 | 60.37 | 74 | -13.63 |
| 2390 | 51.90 | AV | 278 | 1.2 | V | -10.62 | 41.28 | 54 | -12.72 |
| 4824 | 61.04 | PK | 315 | 1.3 | H | -5.55 | 55.49 | 74 | -18.51 |
| 4824 | 47.18 | AV | 315 | 1.3 | H | -5.55 | 41.63 | 54 | -12.37 |
| 4824 | 61.42 | PK | 54 | 2.1 | V | -5.55 | 55.87 | 74 | -18.13 |
| 4824 | 47.83 | AV | 54 | 2.1 | V | -5.55 | 42.28 | 54 | -11.72 |
| Middle Channel(2437MHz) | | | | | | | | | |
| 4874 | 61.61 | PK | 26 | 1.7 | H | -5.29 | 56.32 | 74 | -17.68 |
| 4874 | 47.37 | AV | 26 | 1.7 | H | -5.29 | 42.08 | 54 | -11.92 |
| 4874 | 62.73 | PK | 124 | 2.3 | V | -5.29 | 57.44 | 74 | -16.56 |
| 4874 | 48.50 | AV | 124 | 2.3 | V | -5.29 | 43.21 | 54 | -10.79 |
| High Channel(2462 MHz) | | | | | | | | | |
| 2483.5 | 75.78 | PK | 328 | 1.8 | H | -10.46 | 65.32 | 74 | -8.68 |
| 2483.5 | 53.49 | AV | 328 | 1.8 | H | -10.46 | 43.03 | 54 | -10.97 |
| 2483.5 | 76.98 | PK | 114 | 1.9 | V | -10.46 | 66.52 | 74 | -7.48 |
| 2483.5 | 53.95 | AV | 114 | 1.9 | V | -10.46 | 43.49 | 54 | -10.51 |
| 2484.13 | 77.05 | PK | 87 | 2.5 | H | -10.46 | 66.59 | 74 | -7.41 |
| 2484.13 | 54.89 | AV | 87 | 2.5 | H | -10.46 | 44.43 | 54 | -9.57 |
| 2483.56 | 77.93 | PK | 219 | 1.5 | V | -10.46 | 67.47 | 74 | -6.53 |
| 2483.56 | 55.40 | AV | 219 | 1.5 | V | -10.46 | 44.94 | 54 | -9.06 |
| 4924 | 62.12 | PK | 37 | 2.1 | H | -5.03 | 57.09 | 74 | -16.91 |
| 4924 | 47.87 | AV | 37 | 2.1 | H | -5.03 | 42.84 | 54 | -11.16 |
| 4924 | 63.25 | PK | 289 | 1.8 | V | -5.03 | 58.22 | 74 | -15.78 |
| 4924 | 48.78 | AV | 289 | 1.8 | V | -5.03 | 43.75 | 54 | -10.25 |

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Corrected. Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| **802.11n40** | | | | | | | | | |
| Low Channel (2422MHz) | | | | | | | | | |
| 2389.94 | 77.47 | PK | 169 | 1 | H | -10.62 | 66.85 | 74 | -7.15 |
| 2389.94 | 54.63 | AV | 169 | 1 | H | -10.62 | 44.01 | 54 | -9.99 |
| 2389.71 | 75.89 | PK | 48 | 2.4 | V | -10.62 | 65.27 | 74 | -8.73 |
| 2389.71 | 54.16 | AV | 48 | 2.4 | V | -10.62 | 43.54 | 54 | -10.46 |
| 2390 | 76.25 | PK | 314 | 2.1 | H | -10.62 | 65.63 | 74 | -8.37 |
| 2390 | 54.54 | AV | 314 | 2.1 | H | -10.62 | 43.92 | 54 | -10.08 |
| 2390 | 75.02 | PK | 229 | 1.4 | V | -10.62 | 64.40 | 74 | -9.60 |
| 2390 | 53.01 | AV | 229 | 1.4 | V | -10.62 | 42.39 | 54 | -11.61 |
| 4844 | 58.65 | PK | 107 | 1.9 | H | -5.52 | 53.13 | 74 | -20.87 |
| 4844 | 45.90 | AV | 107 | 1.9 | H | -5.52 | 40.38 | 54 | -13.62 |
| 4844 | 59.19 | PK | 227 | 1.6 | V | -5.52 | 53.67 | 74 | -20.33 |
| 4844 | 46.28 | AV | 227 | 1.6 | V | -5.52 | 40.76 | 54 | -13.24 |
| Middle Channel (2437MHz) | | | | | | | | | |
| 4874 | 58.84 | PK | 250 | 2.4 | H | -5.29 | 53.55 | 74 | -20.45 |
| 4874 | 46.30 | AV | 250 | 2.4 | H | -5.29 | 41.01 | 54 | -12.99 |
| 4874 | 59.37 | PK | 170 | 2 | V | -5.29 | 54.08 | 74 | -19.92 |
| 4874 | 46.86 | AV | 170 | 2 | V | -5.29 | 41.57 | 54 | -12.43 |
| High Channel (2452MHz) | | | | | | | | | |
| 2483.5 | 80.12 | PK | 148 | 1 | H | -10.46 | 69.66 | 74 | -4.34 |
| 2483.5 | 56.89 | AV | 148 | 1 | H | -10.46 | 46.43 | 54 | -7.57 |
| 2483.5 | 78.53 | PK | 332 | 1.4 | V | -10.46 | 68.07 | 74 | -5.93 |
| 2483.5 | 56.84 | AV | 332 | 1.4 | V | -10.46 | 46.38 | 54 | -7.62 |
| 2484.71 | 81.42 | PK | 105 | 2.4 | H | -10.45 | 70.97 | 74 | -3.03 |
| 2484.71 | 58.48 | AV | 105 | 2.4 | H | -10.45 | 48.03 | 54 | -5.97 |
| 2483.52 | 80.66 | PK | 17 | 1 | V | -10.46 | 70.2 | 74 | -3.80 |
| 2483.52 | 57.97 | AV | 17 | 1 | V | -10.46 | 47.51 | 54 | -6.49 |
| 4904 | 59.05 | PK | 305 | 1.1 | H | -5.06 | 53.99 | 74 | -20.01 |
| 4904 | 47.20 | AV | 305 | 1.1 | H | -5.06 | 42.14 | 54 | -11.86 |
| 4904 | 59.37 | PK | 246 | 1.6 | V | -5.06 | 54.31 | 74 | -19.69 |
| 4904 | 47.53 | AV | 246 | 1.6 | V | -5.06 | 42.47 | 54 | -11.53 |

**Note:**
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected Amplitude - Limit
The other spurious emission which is 20dB to the limit or in the noise floor level was not recorded.

**BLE:**

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Corrected. Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| **BLE1M** | | | | | | | | | |
| Low Channel (2402MHz) | | | | | | | | | |
| 2382.56 | 65.85 | PK | 260 | 1.6 | H | -10.64 | 55.21 | 74 | -18.79 |
| 2382.56 | 52.36 | AV | 260 | 1.6 | H | -10.64 | 41.72 | 54 | -12.28 |
| 2382.7 | 67.26 | PK | 328 | 2.4 | V | -10.64 | 56.62 | 74 | -17.38 |
| 2382.7 | 53.51 | AV | 328 | 2.4 | V | -10.64 | 42.87 | 54 | -11.13 |
| 2390 | 64.42 | PK | 62 | 2.1 | H | -10.62 | 53.80 | 74 | -20.20 |
| 2390 | 52.35 | AV | 62 | 2.1 | H | -10.62 | 41.73 | 54 | -12.27 |
| 2390 | 65.46 | PK | 259 | 2.3 | V | -10.62 | 54.84 | 74 | -19.16 |
| 2390 | 53.21 | AV | 259 | 2.3 | V | -10.62 | 42.59 | 54 | -11.41 |
| 4804 | 59.09 | PK | 234 | 2 | H | -5.57 | 53.52 | 74 | -20.48 |
| 4804 | 45.36 | AV | 234 | 2 | H | -5.57 | 39.79 | 54 | -14.21 |
| 4804 | 58.88 | PK | 59 | 1.1 | V | -5.57 | 53.31 | 74 | -20.69 |
| 4804 | 45.32 | AV | 59 | 1.1 | V | -5.57 | 39.75 | 54 | -14.25 |
| Middle Channel (2440 MHz) | | | | | | | | | |
| 4880 | 59.26 | PK | 94 | 2.1 | H | -5.24 | 54.02 | 74 | -19.98 |
| 4880 | 45.56 | AV | 94 | 2.1 | H | -5.24 | 40.32 | 54 | -13.68 |
| 4880 | 59.13 | PK | 29 | 1.6 | V | -5.24 | 53.89 | 74 | -20.11 |
| 4880 | 46.12 | AV | 29 | 1.6 | V | -5.24 | 40.88 | 54 | -13.12 |
| High Channel (2480 MHz) | | | | | | | | | |
| 2483.5 | 65.18 | PK | 222 | 2.2 | H | -10.46 | 54.72 | 74 | -19.28 |
| 2483.5 | 52.44 | AV | 222 | 2.2 | H | -10.46 | 41.98 | 54 | -12.02 |
| 2483.5 | 66.76 | PK | 37 | 1.3 | V | -10.46 | 56.3 | 74 | -17.70 |
| 2483.5 | 53.56 | AV | 37 | 1.3 | V | -10.46 | 43.1 | 54 | -10.90 |
| 2484.05 | 67.53 | PK | 217 | 1.5 | H | -10.46 | 57.07 | 74 | -16.93 |
| 2484.05 | 53.14 | AV | 217 | 1.5 | H | -10.46 | 42.68 | 54 | -11.32 |
| 2484.1 | 68.79 | PK | 57 | 1.4 | V | -10.46 | 58.33 | 74 | -15.67 |
| 2484.1 | 54.00 | AV | 57 | 1.4 | V | -10.46 | 43.54 | 54 | -10.46 |
| 4960 | 57.60 | PK | 106 | 2.3 | H | -4.90 | 52.70 | 74 | -21.30 |
| 4960 | 43.23 | AV | 106 | 2.3 | H | -4.90 | 38.33 | 54 | -15.67 |
| 4960 | 58.12 | PK | 346 | 2.4 | V | -4.90 | 53.22 | 74 | -20.78 |
| 4960 | 44.44 | AV | 346 | 2.4 | V | -4.90 | 39.54 | 54 | -14.46 |

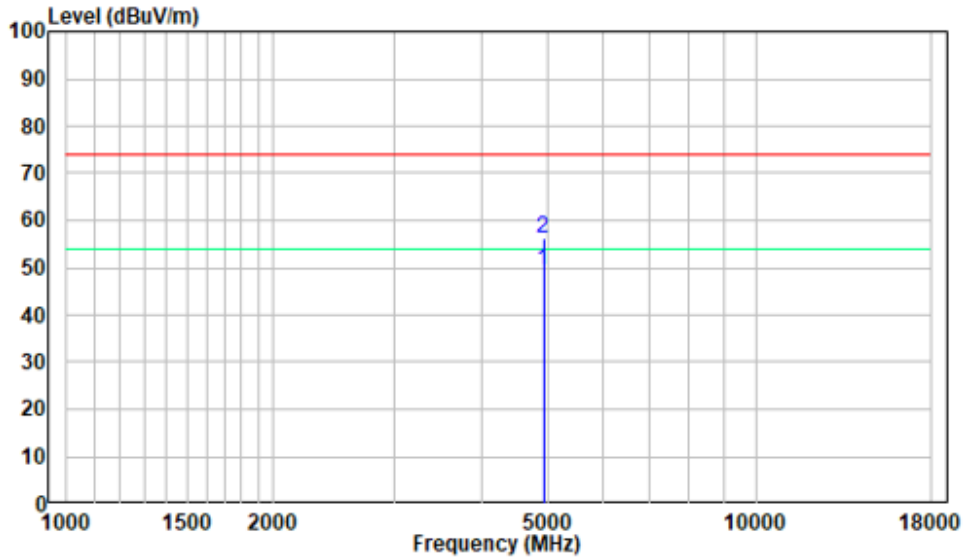
| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Corrected. Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| **BLE2M** | | | | | | | | | |
| Low Channel (2402MHz) | | | | | | | | | |
| 2339.52 | 65.77 | PK | 93 | 1 | H | -10.64 | 55.13 | 74 | -18.87 |
| 2339.52 | 52.33 | AV | 93 | 1 | H | -10.64 | 41.69 | 54 | -12.31 |
| 2340.4 | 66.45 | PK | 52 | 1.9 | V | -10.65 | 55.80 | 74 | -18.20 |
| 2340.4 | 53.16 | AV | 52 | 1.9 | V | -10.65 | 42.51 | 54 | -11.49 |
| 2390 | 63.95 | PK | 168 | 2.4 | H | -10.62 | 53.33 | 74 | -20.67 |
| 2390 | 52.20 | AV | 168 | 2.4 | H | -10.62 | 41.58 | 54 | -12.42 |
| 2390 | 65.41 | PK | 89 | 2 | V | -10.62 | 54.79 | 74 | -19.21 |
| 2390 | 53.51 | AV | 89 | 2 | V | -10.62 | 42.89 | 54 | -11.11 |
| 4804 | 58.83 | PK | 332 | 1.7 | H | -5.57 | 53.26 | 74 | -20.74 |
| 4804 | 44.59 | AV | 332 | 1.7 | H | -5.57 | 39.02 | 54 | -14.98 |
| 4804 | 59.85 | PK | 252 | 2.4 | V | -5.57 | 54.28 | 74 | -19.72 |
| 4804 | 45.67 | AV | 252 | 2.4 | V | -5.57 | 40.10 | 54 | -13.90 |
| Middle Channel (2440 MHz) | | | | | | | | | |
| 4880 | 57.82 | PK | 337 | 1.8 | H | -5.24 | 52.58 | 74 | -21.42 |
| 4880 | 45.08 | AV | 337 | 1.8 | H | -5.24 | 39.84 | 54 | -14.16 |
| 4880 | 60.22 | PK | 353 | 1.8 | V | -5.24 | 54.98 | 74 | -19.02 |
| 4880 | 46.05 | AV | 353 | 1.8 | V | -5.24 | 40.81 | 54 | -13.19 |
| High Channel (2480 MHz) | | | | | | | | | |
| 2483.5 | 66.59 | PK | 117 | 2.3 | H | -10.46 | 56.13 | 74 | -17.87 |
| 2483.5 | 52.27 | AV | 117 | 2.3 | H | -10.46 | 41.81 | 54 | -12.19 |
| 2483.5 | 67.13 | PK | 261 | 1.4 | V | -10.46 | 56.67 | 74 | -17.33 |
| 2483.5 | 53.67 | AV | 261 | 1.4 | V | -10.46 | 43.21 | 54 | -10.79 |
| 2483.52 | 67.13 | PK | 253 | 1.6 | H | -10.46 | 56.67 | 74 | -17.33 |
| 2483.52 | 53.54 | AV | 253 | 1.6 | H | -10.46 | 43.08 | 54 | -10.92 |
| 2483.56 | 68.32 | PK | 323 | 2.2 | V | -10.46 | 57.86 | 74 | -16.14 |
| 2483.56 | 54.34 | AV | 323 | 2.2 | V | -10.46 | 43.88 | 54 | -10.12 |
| 4960 | 58.43 | PK | 114 | 2.3 | H | -4.90 | 53.53 | 74 | -20.47 |
| 4960 | 44.70 | AV | 114 | 2.3 | H | -4.90 | 39.80 | 54 | -14.20 |
| 4960 | 57.71 | PK | 259 | 2.3 | V | -4.90 | 52.81 | 74 | -21.19 |
| 4960 | 44.66 | AV | 259 | 2.3 | V | -4.90 | 39.76 | 54 | -14.24 |

**Note:**
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is 20dB to the limit or in the noise floor level was not recorded.

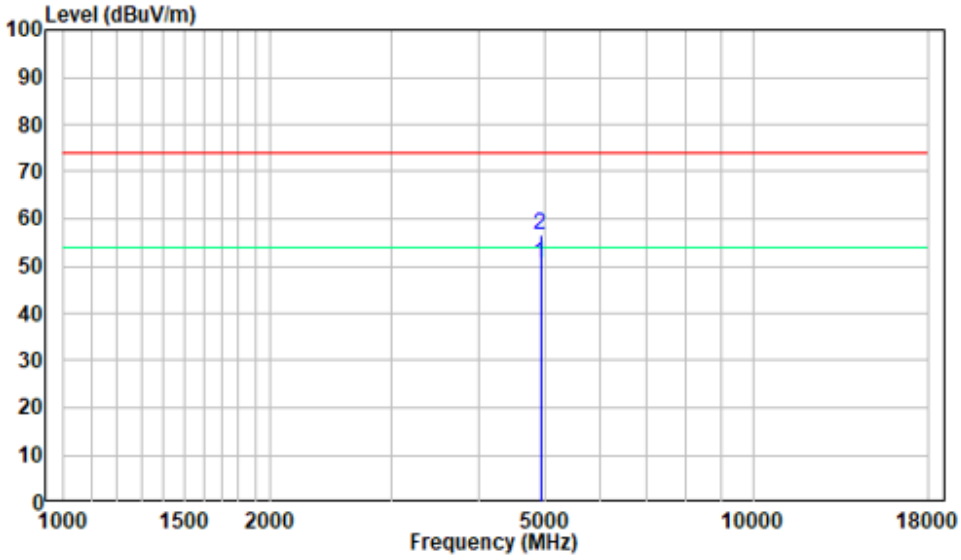
**1-18 GHz:**

**Pre-scan for 802.11b High Channel**

**Horizontal**



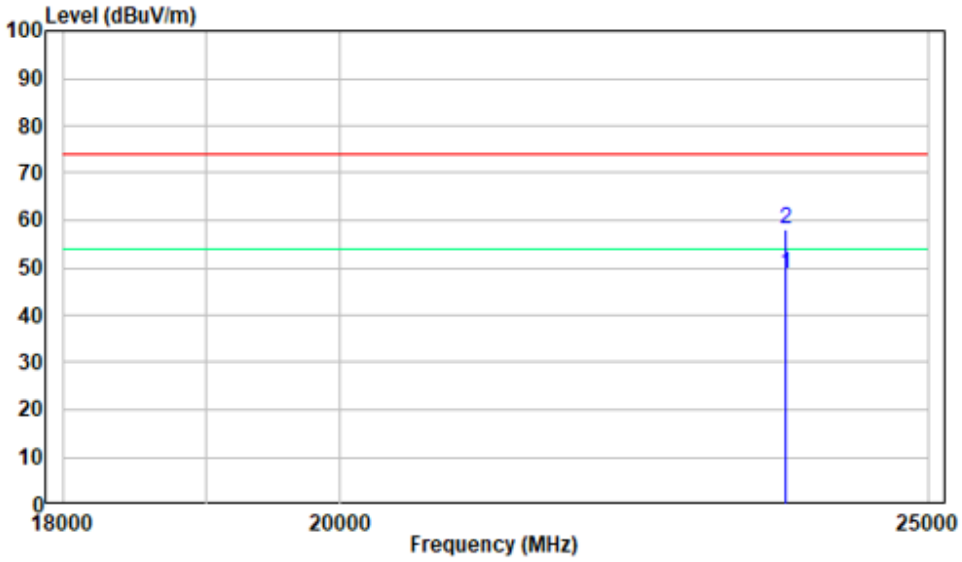

**Vertical**



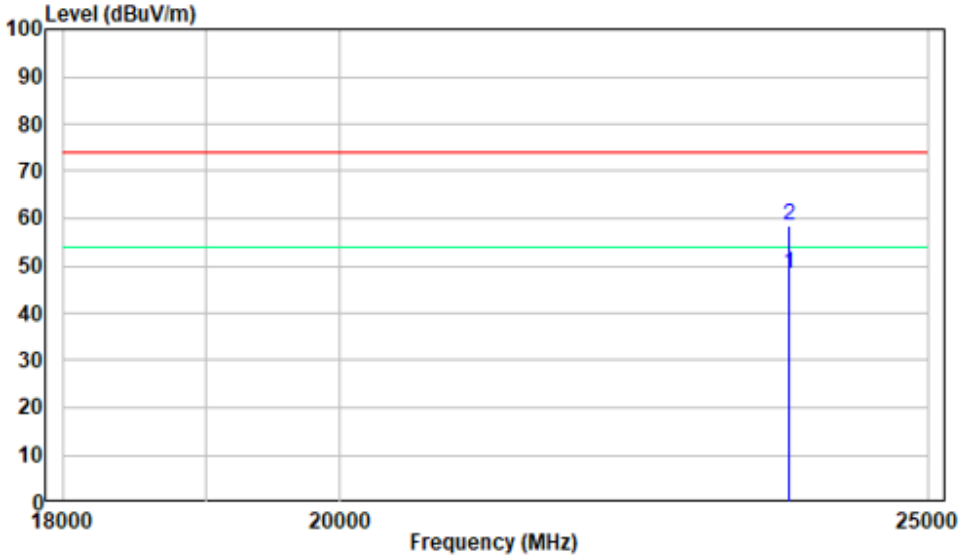
**18 -25GHz:**

**Pre-scan for 802.11b High Channel**

**Horizontal**




**Vertical**



# §15.247 (a)(2)&RSS-Gen§6.7RSS-247 § 5.2 (a)99% OCCUPIED BANDWIDTH &6dB EMISSION BANDWIDTH

## Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

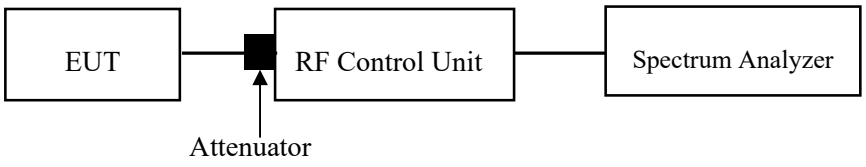
The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "6 dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated 6 dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

## Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.8.1 & Clause 6.9.3

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.




## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26 ℃ |
| **Relative Humidity:** | 48 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Amanda Wei on 2023-06-12.*

*EUT operation mode: Transmitting*

Test Result Compliant. Please refer to the Appendix BLE & Appendix Wi-Fi.

# §15.247(b)(3)&RSS-247 § 5.4(d)MAXIMUM CONDUCTED OUTPUT POWER

## Applicable Standard

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.

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

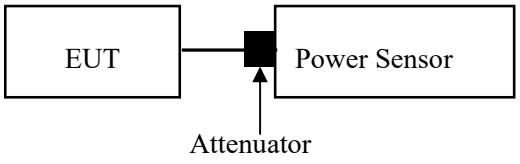
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the 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.

## Test Procedure

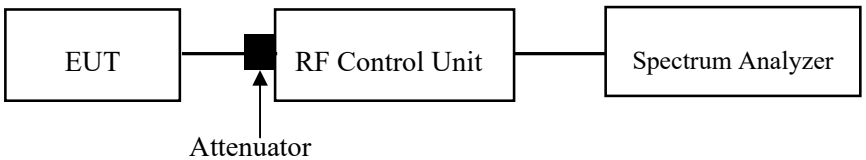
Test Method: ANSI C63.10-2013 Clause 11.9.1.1 for BLE & Clause 11.9.2.3.2 for Wi-Fi

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

For Wi-Fi mode:




For BLE mode:



## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26 ℃ |
| **Relative Humidity:** | 48 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Amanda Wei on 2023-06-12.*

*EUT operation mode: Transmitting*

Test Result Compliant. Please refer to the Appendix BLE & Appendix Wi-Fi.

# § 15.247(d)&RSS-247 § 5.5 100kHz BANDWIDTH OF FREQUENCY BAND EDGE

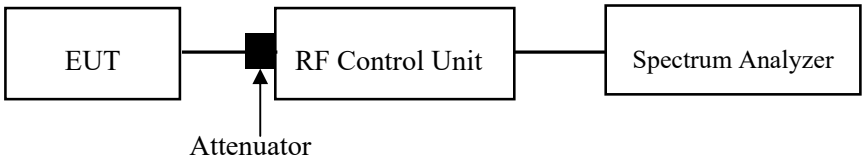
## Applicable Standard

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

## Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.11

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. 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.
3. 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.
4. 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.
5. Repeat above procedures until all measured frequencies were complete.




## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26 ℃ |
| **Relative Humidity:** | 48 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Amanda Wei on 2023-06-12.*

*EUT operation mode: Transmitting*

Test Result Compliant. Please refer to the Appendix BLE & Appendix Wi-Fi.

# §15.247(e)&RSS-247 § 5.2 (b)POWER SPECTRAL DENSITY

## Applicable Standard

FCC: 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.

RSS: The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than8 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 section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

## Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.10.2

Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.

1. Set the RBW to: 3kHz≤ RBW≤100 kHz.
2. Set the VBW ≥ 3×RBW.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Method: ANSI C63.10-2013 Clause 11.10.3 Method AVGPSD-1

The following procedure may be used when the maximum (average) conducted output power was used to determine compliance to the fundamental output power limit. This is the baseline method for determining the maximum (average) conducted PSD level. If the instrument has a power averaging (rms) detector, then it must be used; otherwise, use the sample detector. The EUT must be configured to transmit continuously (D ⩾ 98%), or else sweep triggering/signal gating must be implemented to ensure that measurements are made only when the EUT is transmitting at its maximum power control level (no transmitter OFF time to be considered):

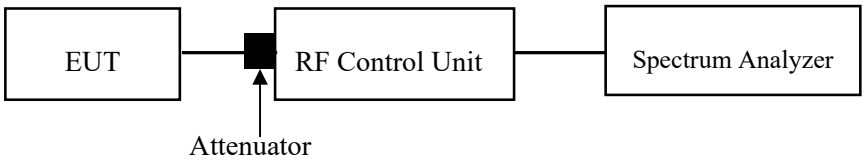
1. Set instrument center frequency to DTS channel center frequency.
2. Set span to at least 1.5 times the OBW.
3. Set the RBW to: 3kHz≤ RBW≤100 kHz.
4. Set the VBW ≥ 3×BW.
5. Detector = power averaging (rms) or sample detector (when rms not available)
6. Ensure that the number of measurement points in the sweep ⩾ [2 × span / RBW].
7. Sweep time = auto couple.
8. Employ trace averaging (rms) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level.

10. If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

Test Method: ANSI C63.10-2013 Clause 11.10.5 Method AVGPSD-2

The following procedure is applicable when the EUT cannot be configured to transmit continuously (i.e., D < 98%), when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e., duty cycle variations are less than ±2%):

1. Measure the duty cycle (D) of the transmitter output signal as described in 11.6.
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. Set the RBW to: 3kHz≤ RBW≤100 kHz.
5. Set the VBW ≥ 3×BW.
6. Detector = power averaging (rms) or sample detector (when rms not available)
7. Ensure that the number of measurement points in the sweep ≥ [2 × span / RBW].
8. Sweep time = auto couple.
9. Do not use sweep triggering; allow sweep to "free run."
10. Employ trace averaging (rms) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).




## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26 ℃ |
| **Relative Humidity:** | 48 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Amanda Wei on 2023-06-12.*

*EUT operation mode: Transmitting*

Test Result: Compliant. Please refer to the Appendix Wi-Fi and Appendix BLE.

# APPENDIX Wi-Fi

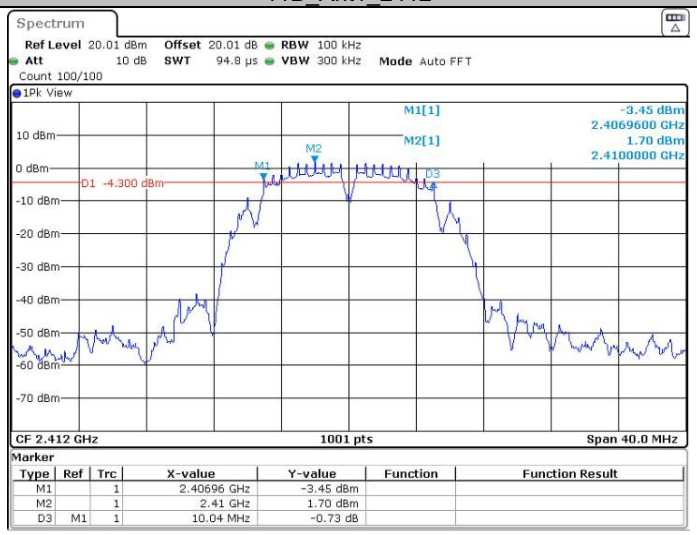
## Appendix A: DTS Bandwidth

### Test Result

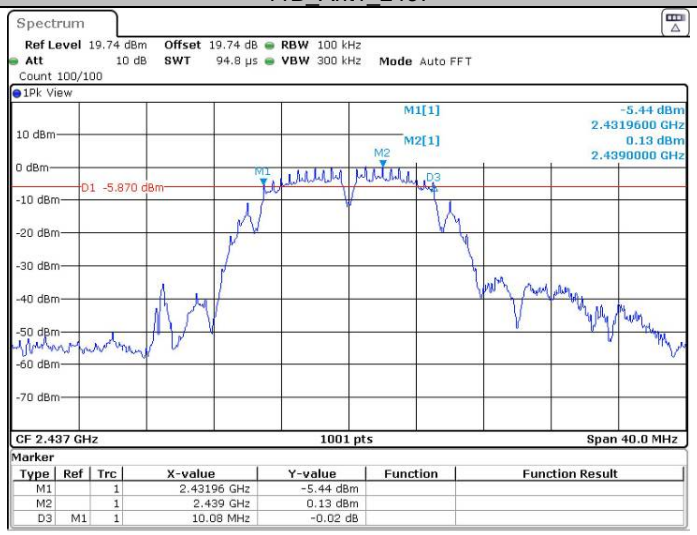
| Test Mode | Antenna | Frequency[MHz] | DTS BW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 10.04 | 2406.96 | 2417.00 | 0.5 | PASS |
| | | 2437 | 10.08 | 2431.96 | 2442.04 | 0.5 | PASS |
| | | 2462 | 10.04 | 2456.96 | 2467.00 | 0.5 | PASS |
| 11G | Ant1 | 2412 | 15.72 | 2404.44 | 2420.16 | 0.5 | PASS |
| | | 2437 | 15.72 | 2428.84 | 2444.56 | 0.5 | PASS |
| | | 2462 | 16.08 | 2454.08 | 2470.16 | 0.5 | PASS |
| 11N20SISO | Ant1 | 2412 | 16.12 | 2404.44 | 2420.56 | 0.5 | PASS |
| | | 2437 | 16.12 | 2428.44 | 2444.56 | 0.5 | PASS |
| | | 2462 | 16.92 | 2453.60 | 2470.52 | 0.5 | PASS |
| 11N40SISO | Ant1 | 2422 | 35.12 | 2404.48 | 2439.60 | 0.5 | PASS |
| | | 2437 | 35.52 | 2419.08 | 2454.60 | 0.5 | PASS |
| | | 2452 | 36.08 | 2433.84 | 2469.92 | 0.5 | PASS |

## Test Graphs

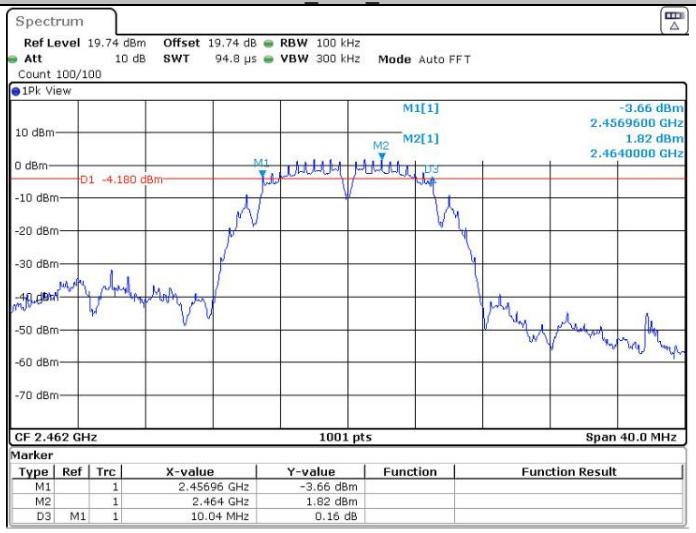
11B_Ant1_2412




11B_Ant1_2437

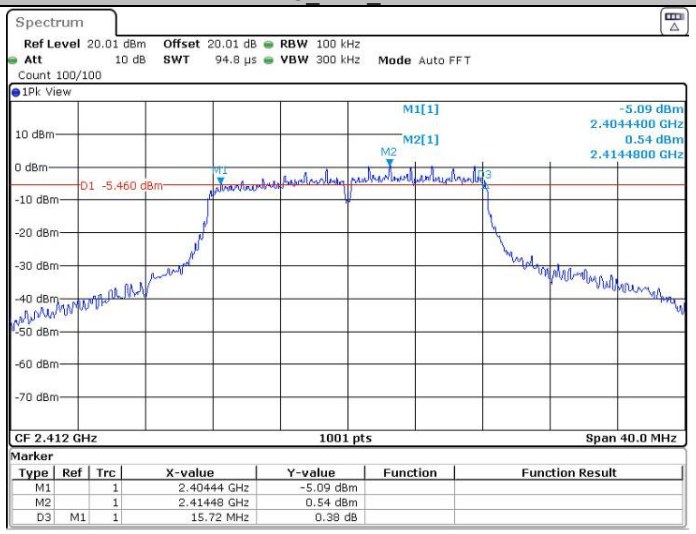


11B_Ant1_2462



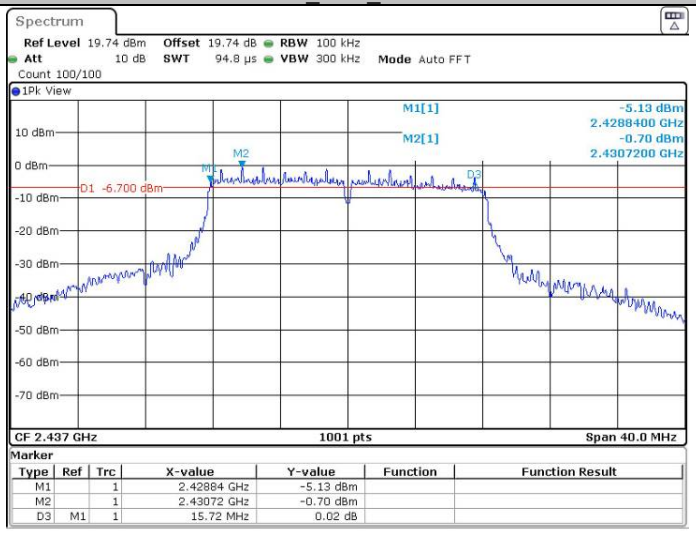

Date: 12.JUN.2023 20:44:49

11G_Ant1_2412




Date: 12.JUN.2023 20:50:44

11G_Ant1_2437

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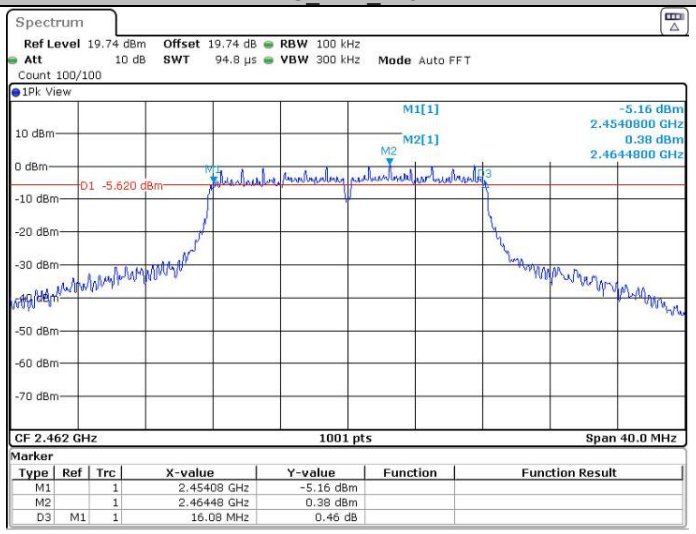
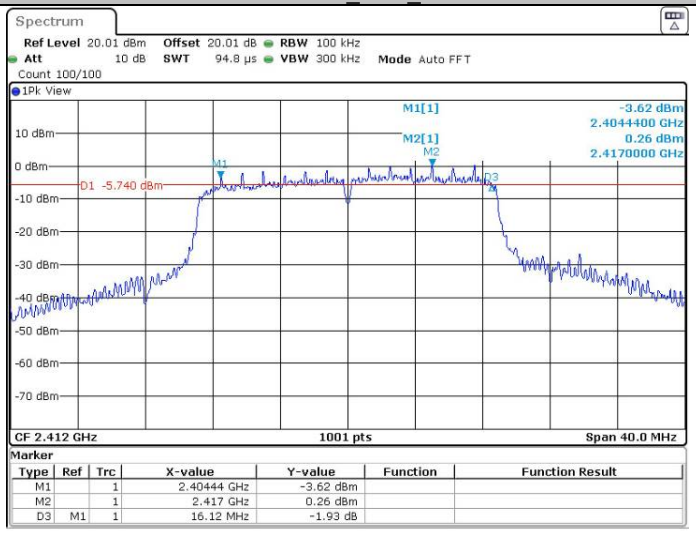
11G_Ant1_2462



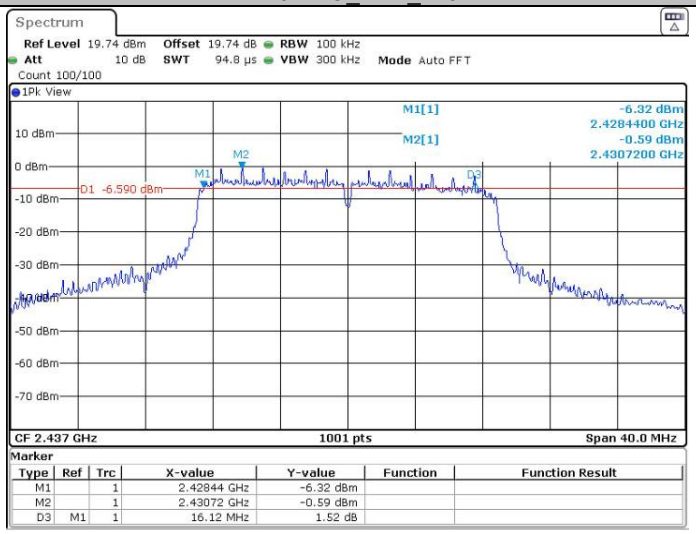

Date: 12.JUN.2023 20:54:38

11N20SISO_Ant1_2412



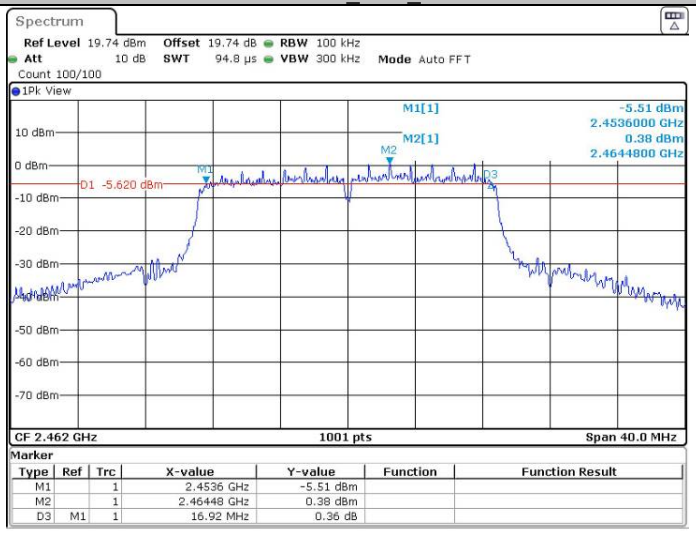

Date: 12.JUN.2023 20:56:15

11N20SISO_Ant1_2437



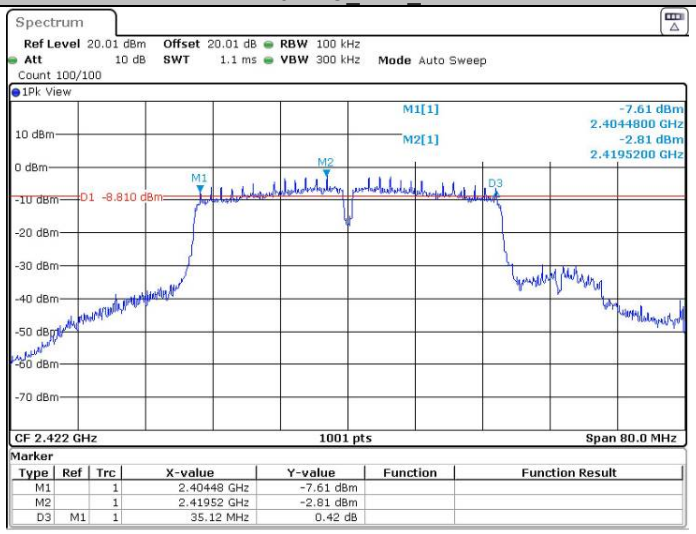

Date: 12.JUN.2023 20:58:32

11N20SISO_Ant1_2462



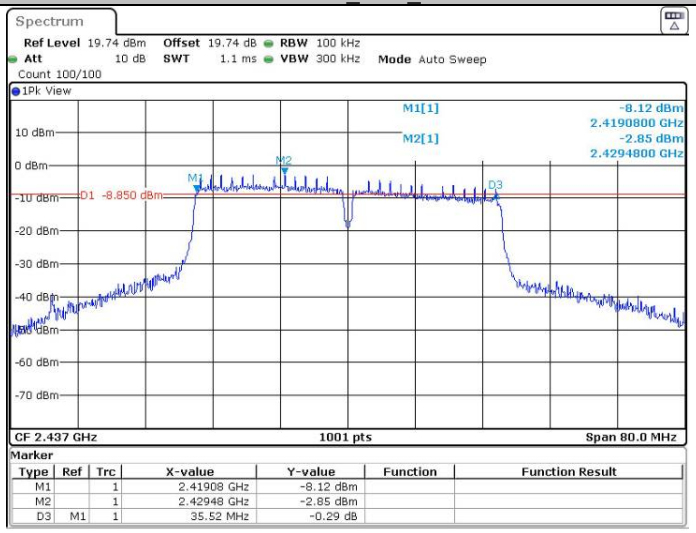

Date: 12.JUN.2023 21:01:12

11N40SISO_Ant1_2422



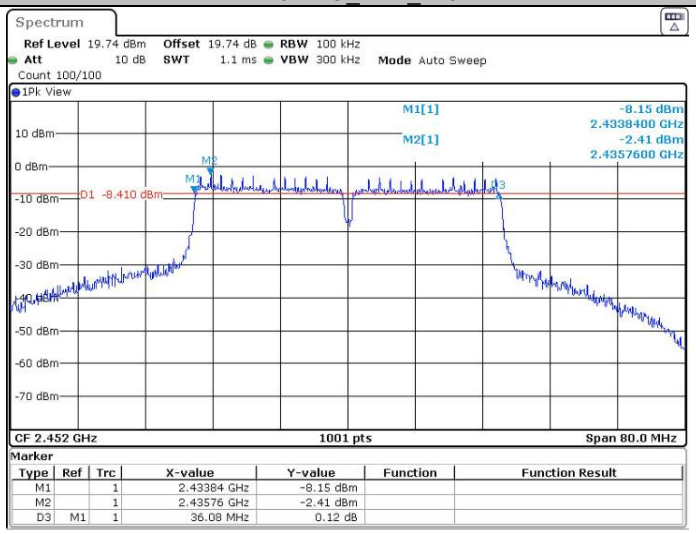

Date: 12.JUN.2023 21:03:22

11N40SISO_Ant1_2437




Date: 12.JUN.2023 21:06:16

11N40SISO_Ant1_2452




Date: 12.JUN.2023 21:08:13

## Appendix B: Occupied Channel Bandwidth

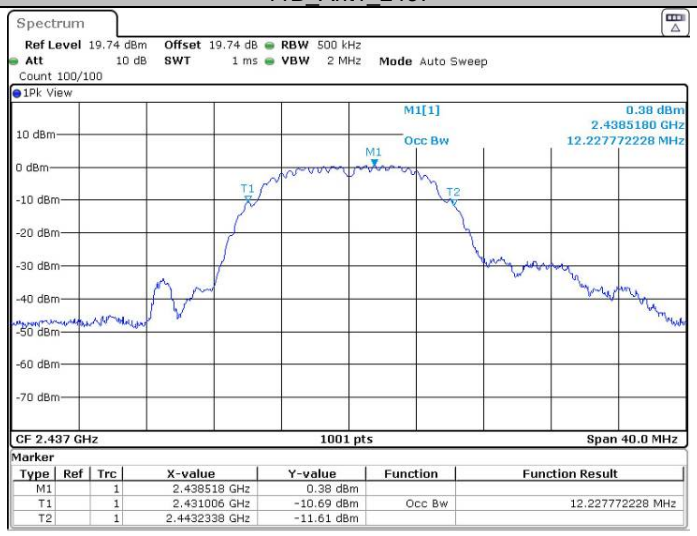
### Test Result

| Test Mode | Antenna | ChannelFrequency[MHz] | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 11.988 | 2405.966 | 2417.954 | --- | --- |
| | | 2437 | 12.228 | 2431.006 | 2443.234 | --- | --- |
| | | 2462 | 12.108 | 2455.926 | 2468.034 | --- | --- |
| 11G | Ant1 | 2412 | 17.143 | 2403.608 | 2420.751 | --- | --- |
| | | 2437 | 17.263 | 2428.169 | 2445.432 | --- | --- |
| | | 2462 | 17.303 | 2453.409 | 2470.711 | --- | --- |
| 11N20SISO | Ant1 | 2412 | 17.902 | 2403.249 | 2421.151 | --- | --- |
| | | 2437 | 18.022 | 2427.809 | 2445.831 | --- | --- |
| | | 2462 | 18.102 | 2453.009 | 2471.111 | --- | --- |
| 11N40SISO | Ant1 | 2422 | 35.964 | 2404.098 | 2440.062 | --- | --- |
| | | 2437 | 36.523 | 2418.538 | 2455.062 | --- | --- |
| | | 2452 | 37.083 | 2433.299 | 2470.382 | --- | --- |

## Test Graphs

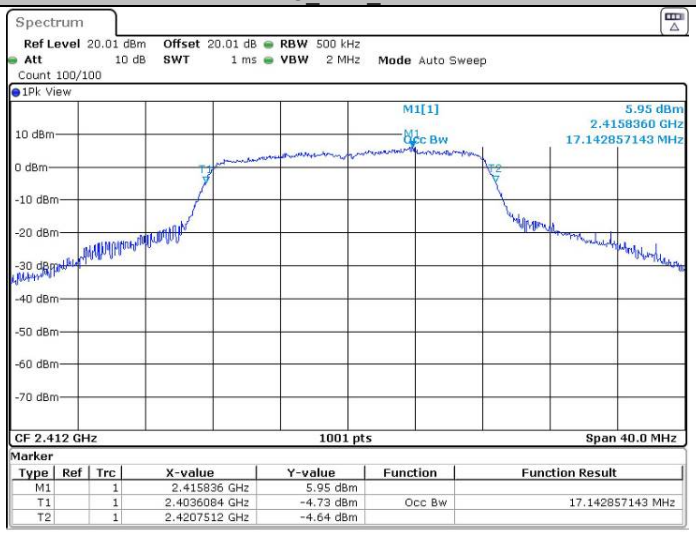
11B_Ant1_2412


11B_Ant1_2437

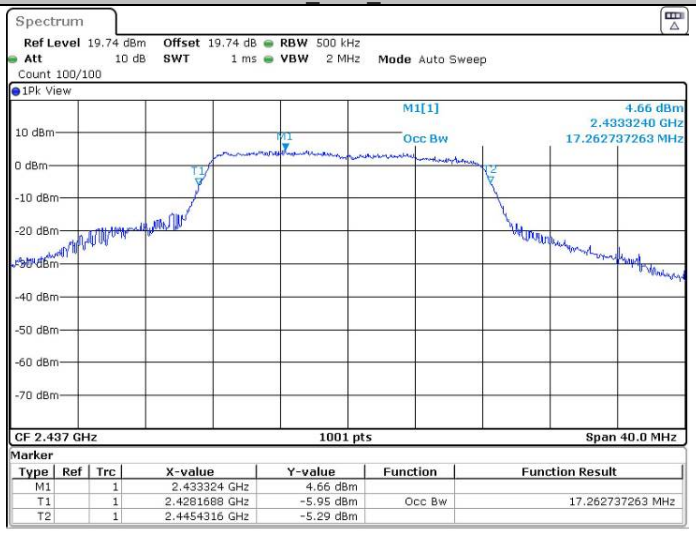


11B_Ant1_2462

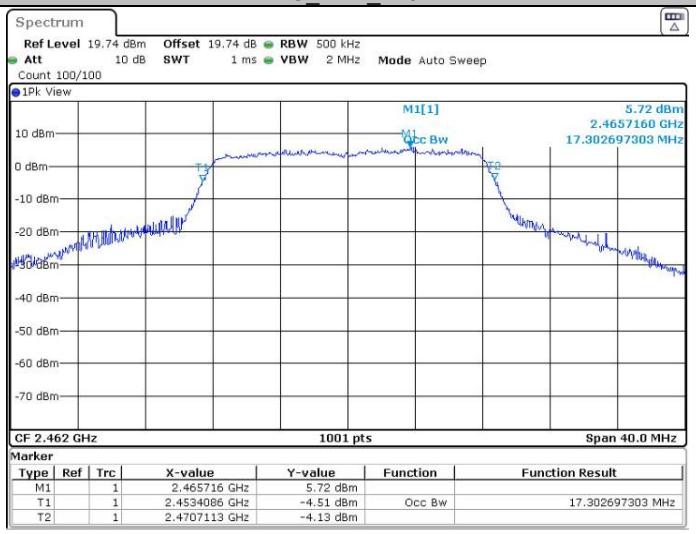

11G_Ant1_2412



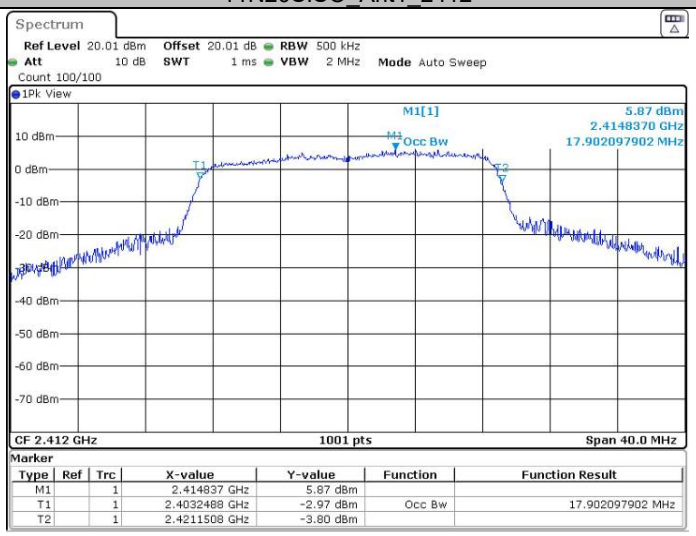
11G_Ant1_2437



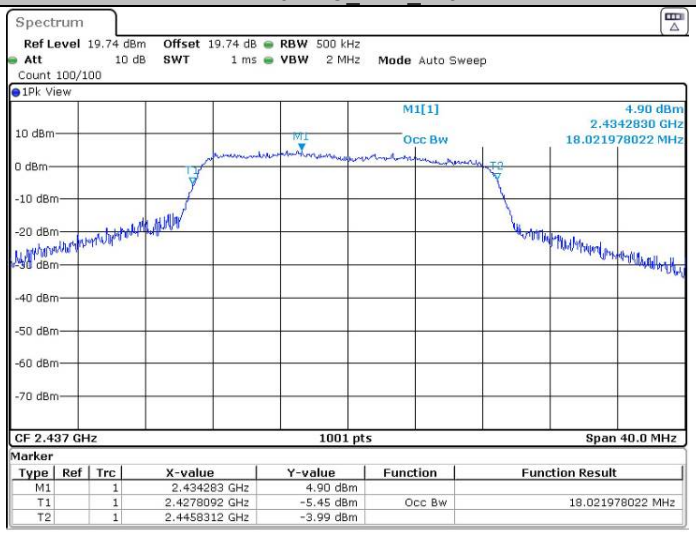

11G_Ant1_2462



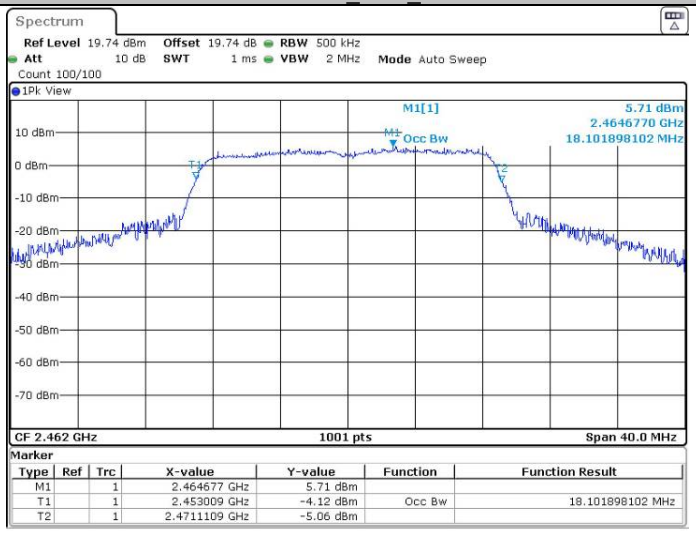
11N20SISO_Ant1_2412



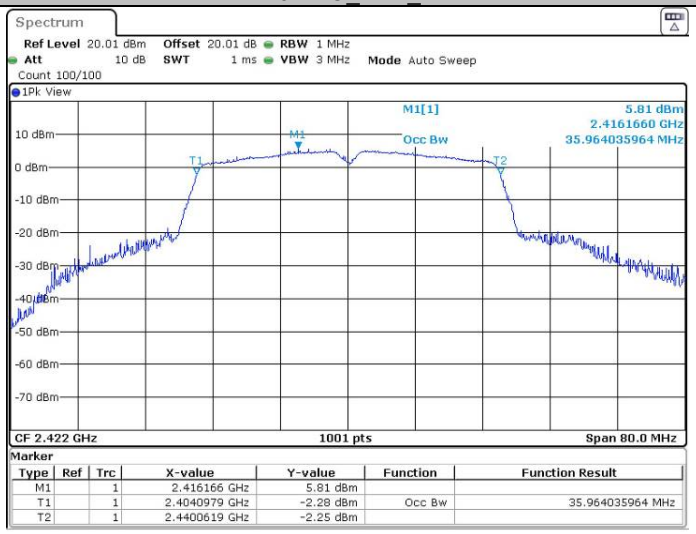

11N20SISO_Ant1_2437



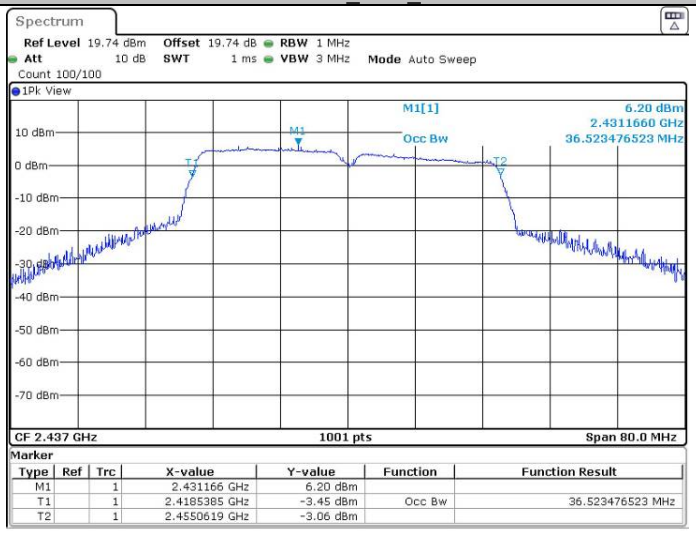
11N20SISO_Ant1_2462



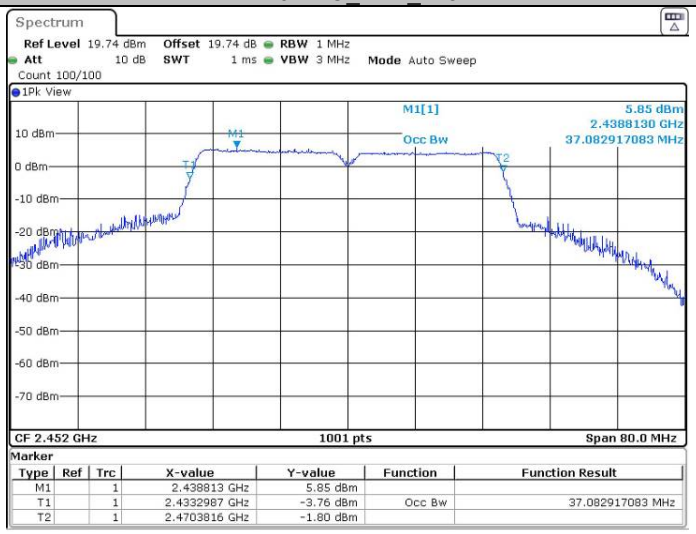

11N40SISO_Ant1_2422



11N40SISO_Ant1_2437




11N40SISO_Ant1_2452



## Appendix C: Maximum conducted output power

### Test Result

| Test Mode | Antenna | Frequency[MHz] | Average Power[dBm] | Conducted Limit[dBm] | Verdict |
|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 9.26 | ≤30.00 | PASS |
| | | 2437 | 8.16 | ≤30.00 | PASS |
| | | 2462 | **9.65** | ≤30.00 | PASS |
| 11G | Ant1 | 2412 | **10.10** | ≤30.00 | PASS |
| | | 2437 | 9.15 | ≤30.00 | PASS |
| | | 2462 | 9.63 | ≤30.00 | PASS |
| 11N20SISO | Ant1 | 2412 | **10.09** | ≤30.00 | PASS |
| | | 2437 | 9.17 | ≤30.00 | PASS |
| | | 2462 | 9.72 | ≤30.00 | PASS |
| 11N40SISO | Ant1 | 2422 | 9.29 | ≤30.00 | PASS |
| | | 2437 | 8.99 | ≤30.00 | PASS |
| | | 2452 | **10.08** | ≤30.00 | PASS |
| Note: the antenna gain=2.2dBi, the maximum EIRP=12.3dBm<36dBm | | | | | |

## Appendix D: Maximum power spectral density

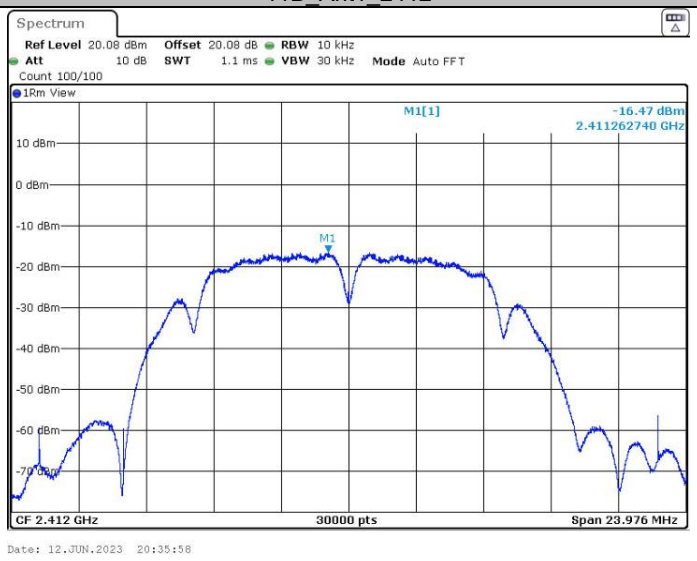
### Test Result

| Test Mode | Antenna | Frequency[MHz] | Result[dBm/10kHz] | Limit[dBm/3kHz] | Verdict |
|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | -16.47 | ≤8.00 | PASS |
| | | 2437 | -18.14 | ≤8.00 | PASS |
| | | 2462 | -16.15 | ≤8.00 | PASS |
| 11G | Ant1 | 2412 | -17.51 | ≤8.00 | PASS |
| | | 2437 | -18.62 | ≤8.00 | PASS |
| | | 2462 | -17.54 | ≤8.00 | PASS |
| 11N20SISO | Ant1 | 2412 | -17.59 | ≤8.00 | PASS |
| | | 2437 | -18.68 | ≤8.00 | PASS |
| | | 2462 | -17.66 | ≤8.00 | PASS |
| 11N40SISO | Ant1 | 2422 | -19.83 | ≤8.00 | PASS |
| | | 2437 | -19.96 | ≤8.00 | PASS |
| | | 2452 | -19.58 | ≤8.00 | PASS |

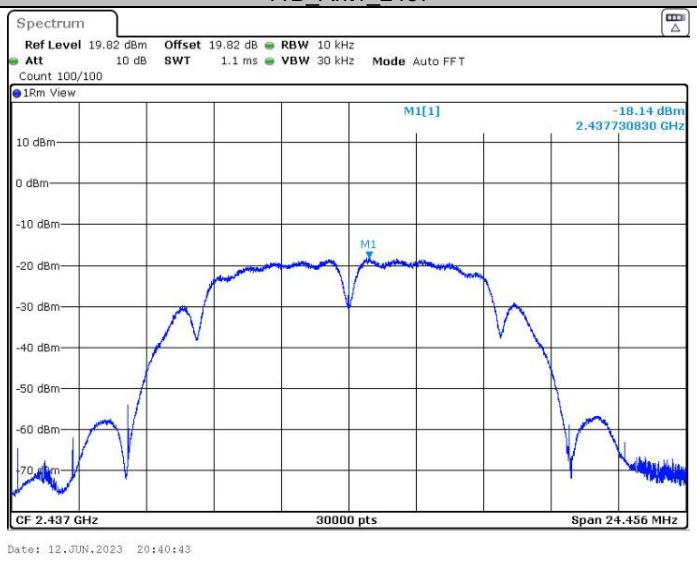
Note: The Duty Cycle Factor is compensated in the graph.

## Test Graphs

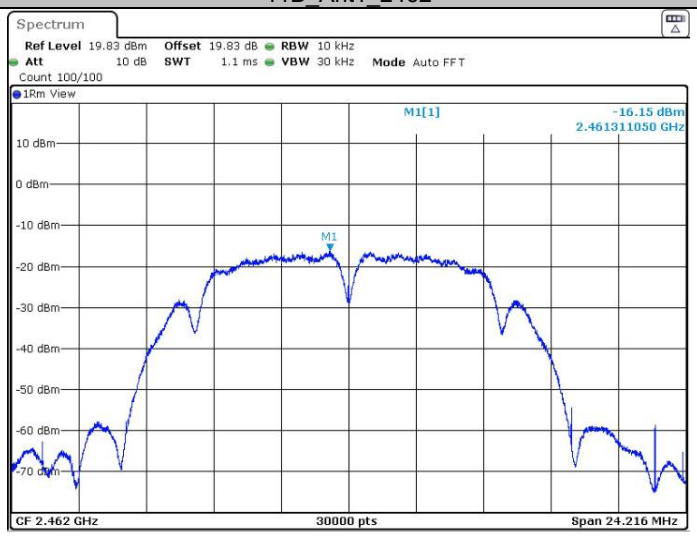
11B_Ant1_2412



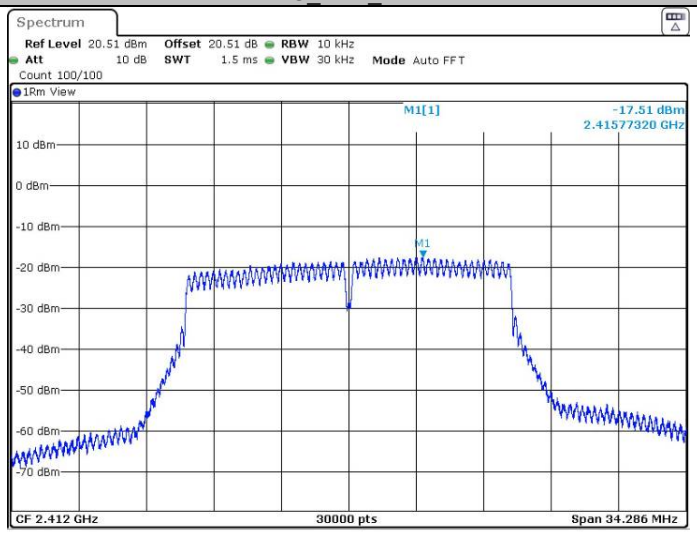

11B_Ant1_2437



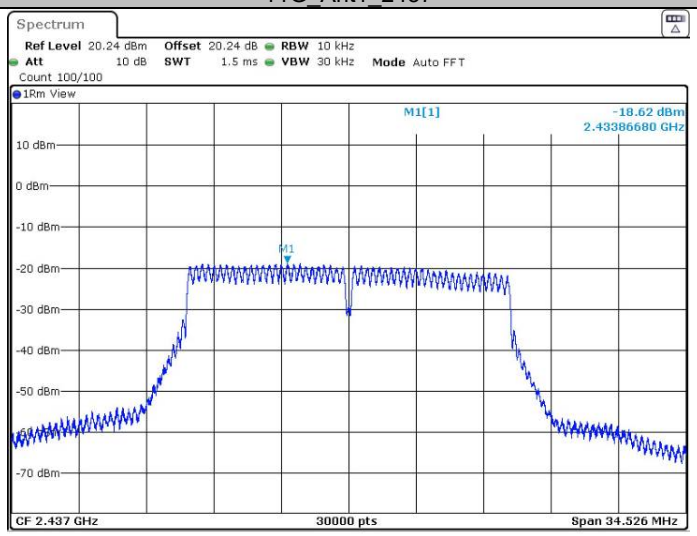
11B_Ant1_2462



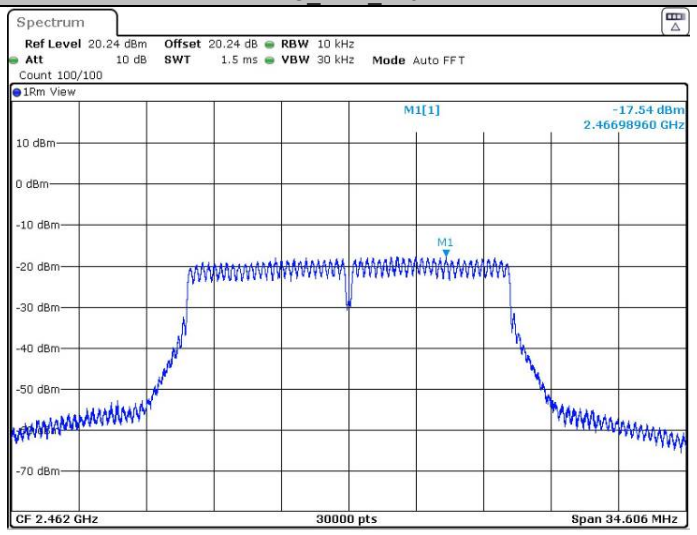

11G_Ant1_2412

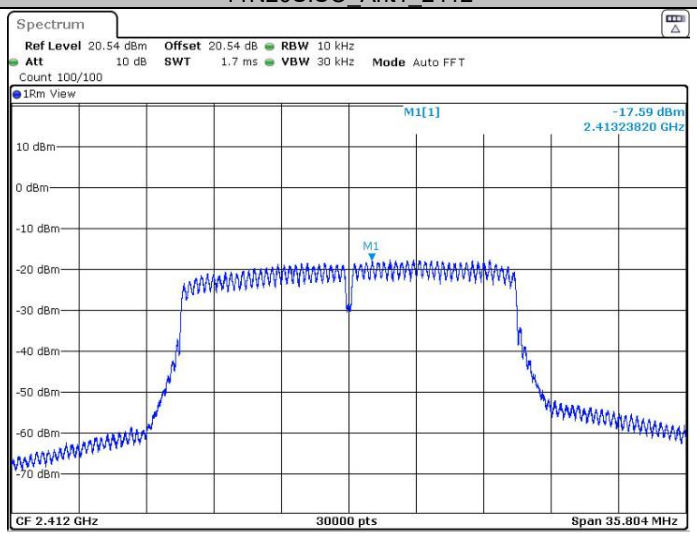
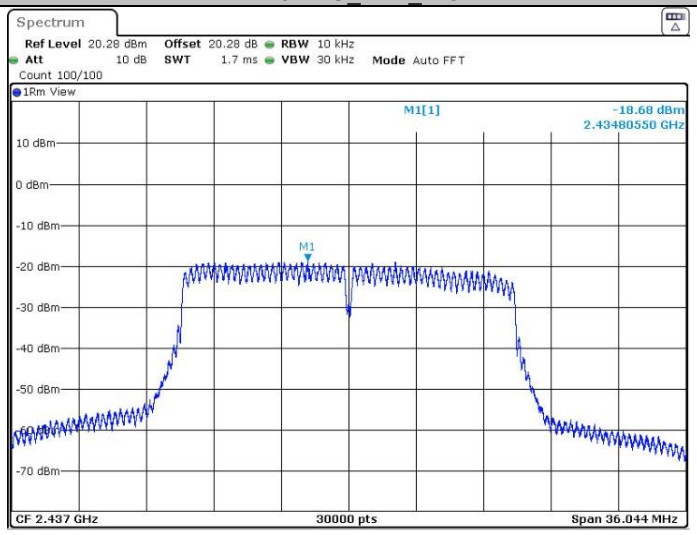


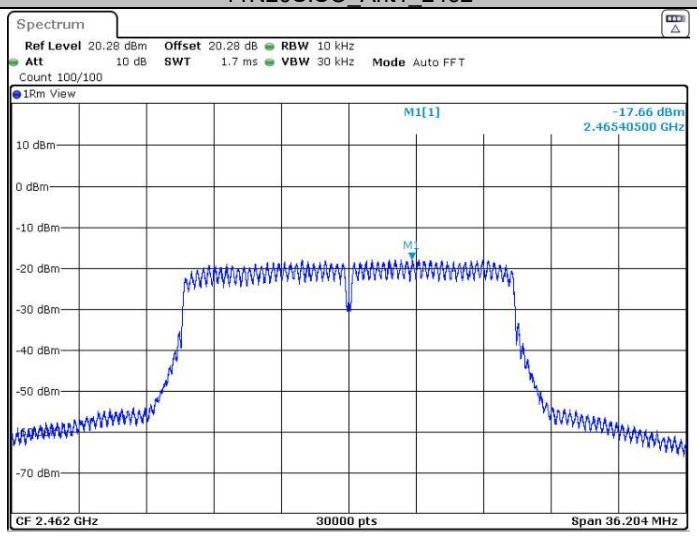
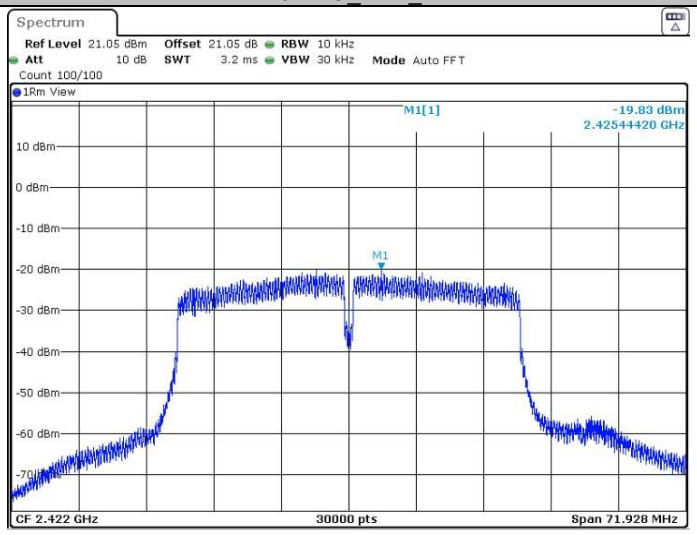
11G_Ant1_2437

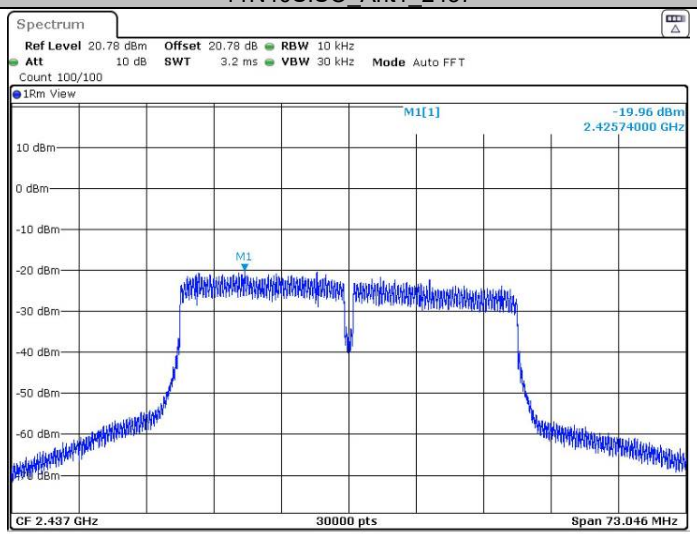
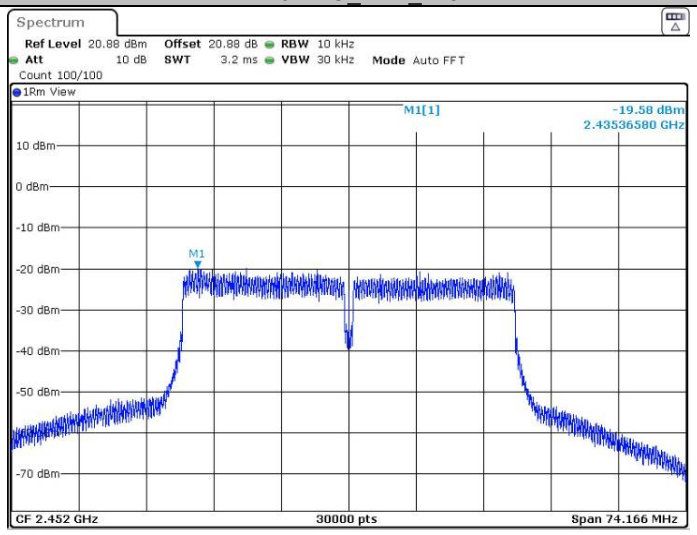



11G_Ant1_2462



| 11N20SISO_Ant1_2412 |
| --- |
|  |
| 11N20SISO_Ant1_2437 |
|  |

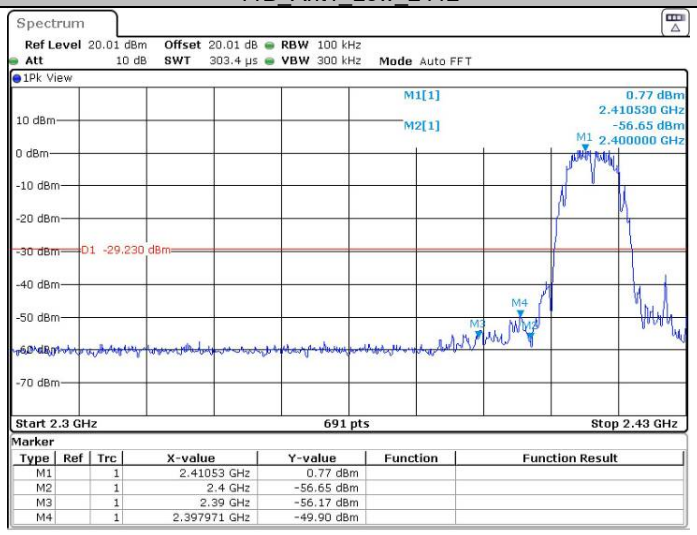
| 11N20SISO_Ant1_2462 |
| --- |
|  |
| 11N40SISO_Ant1_2422 |
|  |

| 11N40SISO_Ant1_2437 |
| --- |
|  |
| 11N40SISO_Ant1_2452 |
|  |

# Appendix E: Band edge measurements

## Test Graphs

11B_Ant1_Low_2412

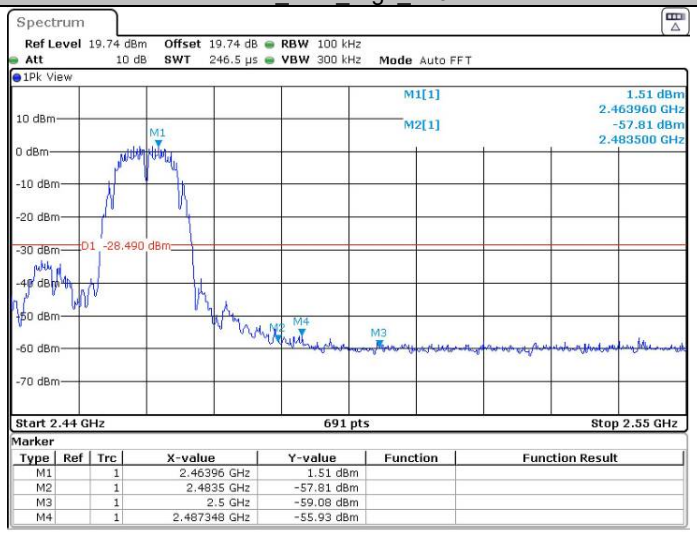



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.41053 GHz | 0.77 dBm | | |
| M2 | | 1 | 2.4 GHz | -56.65 dBm | | |
| M3 | | 1 | 2.39 GHz | -56.17 dBm | | |
| M4 | | 1 | 2.397971 GHz | -49.90 dBm | | |

Date: 12.JUN.2023 20:36:07

11B_Ant1_High_2462

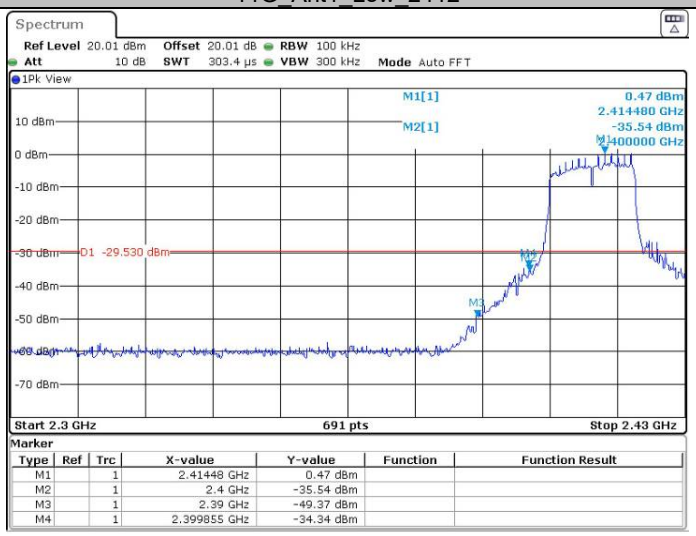



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.46396 GHz | 1.51 dBm | | |
| M2 | | 1 | 2.4835 GHz | -57.81 dBm | | |
| M3 | | 1 | 2.5 GHz | -59.08 dBm | | |
| M4 | | 1 | 2.487348 GHz | -55.93 dBm | | |

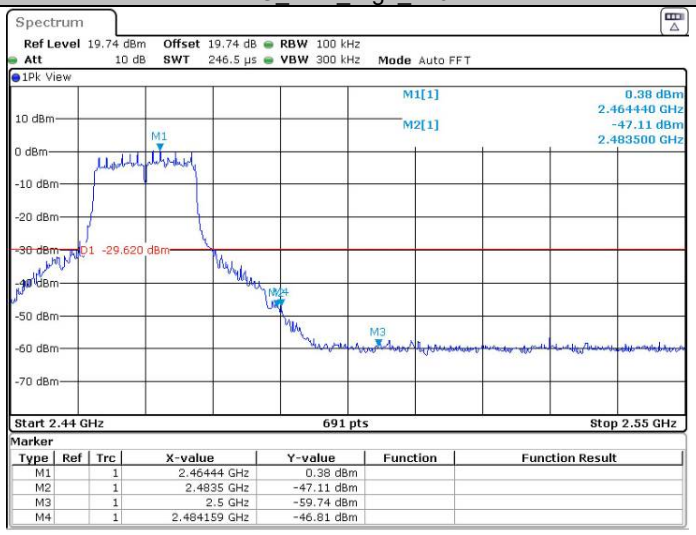
Date: 12.JUN.2023 20:45:39

11G_Ant1_Low_2412



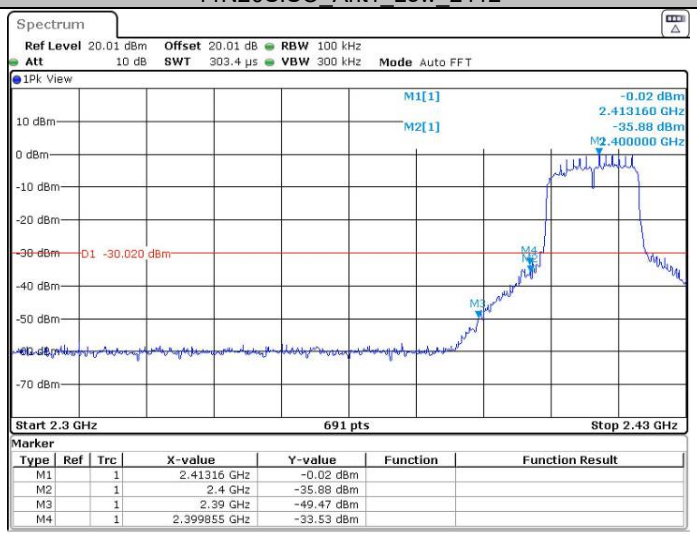

Date: 12.JUN.2023 20:51:33

11G_Ant1_High_2462



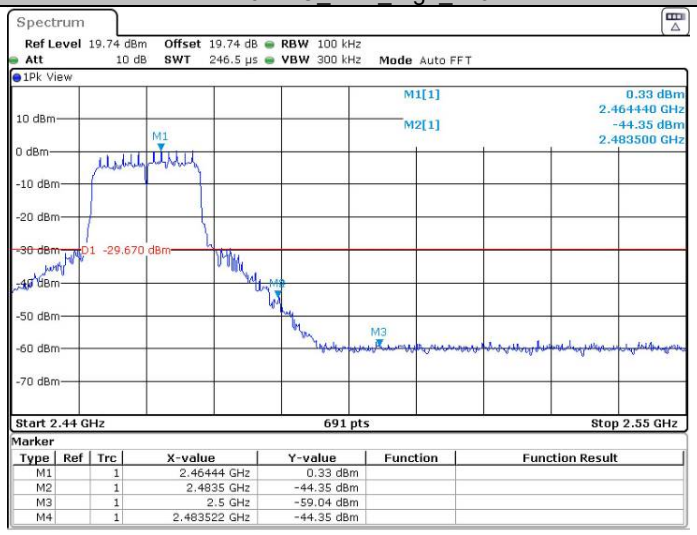

Date: 12.JUN.2023 20:55:27

11N20SISO_Ant1_Low_2412



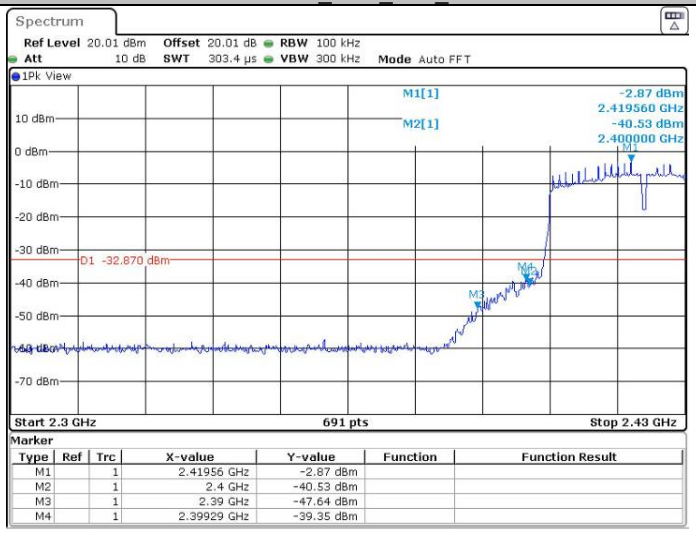

Date: 12.JUN.2023 20:57:04

11N20SISO_Ant1_High_2462



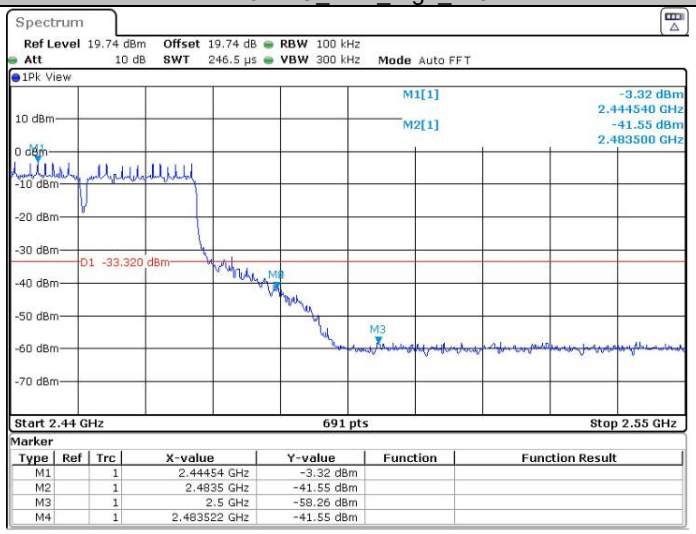

Date: 12.JUN.2023 21:02:01

11N40SISO_Ant1_Low_2422




Date: 12.JUN.2023 21:04:11

11N40SISO_Ant1_High_2452




Date: 12.JUN.2023 21:09:02

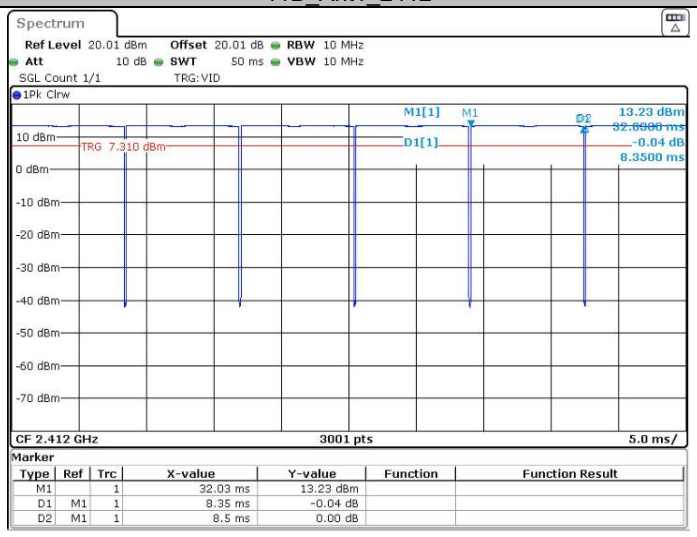
## Appendix F: Duty Cycle

### Test Result

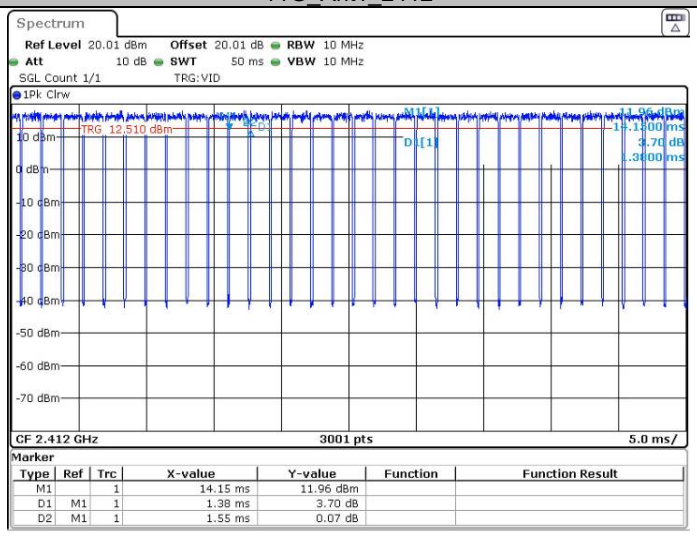
| Test Mode | Antenna | Frequency[ MHz] | Transmission Duration [ms] | Transmissio n Period [ms] | Duty Cycle [%] | Duty cycle Correction Factor(dB) | 1/T Minimum VBW(kHz) |
|---|---|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 8.35 | 8.50 | 98.24 | / | / |
| 11G | Ant1 | 2412 | 1.38 | 1.55 | 89.03 | 0.50 | 0.72 |
| 11N20SISO | Ant1 | 2412 | 1.30 | 1.47 | 88.44 | 0.53 | 0.77 |
| 11N40SISO | Ant1 | 2422 | 0.63 | 0.80 | 78.75 | 1.04 | 1.59 |

## Test Graphs

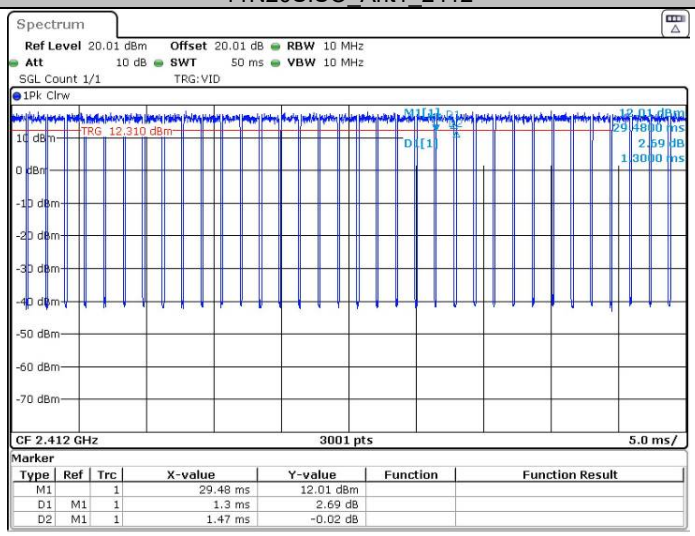
11B_Ant1_2412



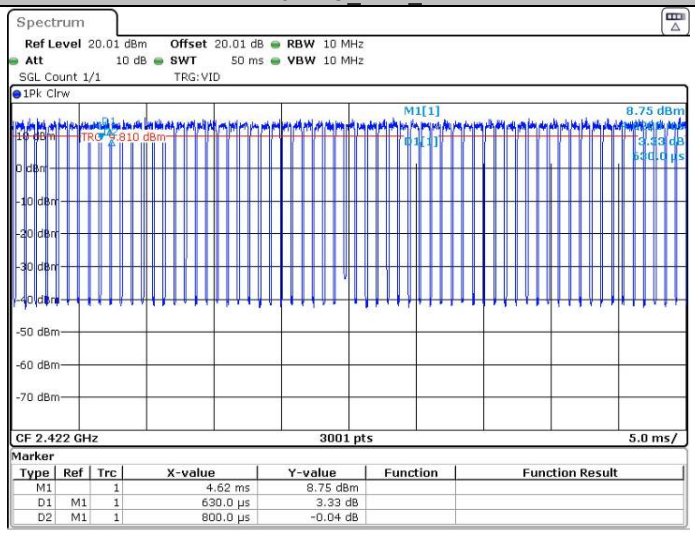

11G_Ant1_2412



11N20SISO_Ant1_2412




11N40SISO_Ant1_2422



# APPENDIX BLE

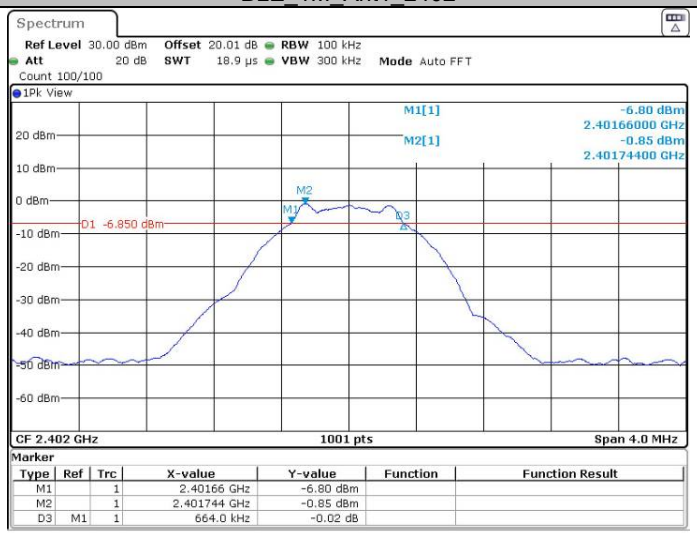
## Appendix A: DTS Bandwidth

### Test Result

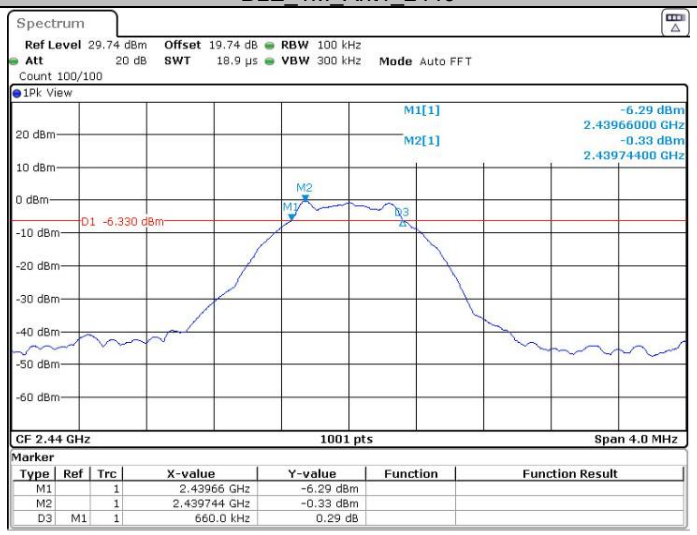
| Test Mode | Antenna | Frequency[MHz] | DTS BW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | 0.66 | 2401.66 | 2402.32 | 0.5 | PASS |
| | | 2440 | 0.66 | 2439.66 | 2440.32 | 0.5 | PASS |
| | | 2480 | 0.66 | 2479.66 | 2480.32 | 0.5 | PASS |
| BLE_2M | Ant1 | 2402 | 1.16 | 2401.40 | 2402.56 | 0.5 | PASS |
| | | 2440 | 1.16 | 2439.40 | 2440.56 | 0.5 | PASS |
| | | 2480 | 1.16 | 2479.40 | 2480.56 | 0.5 | PASS |

## Test Graphs

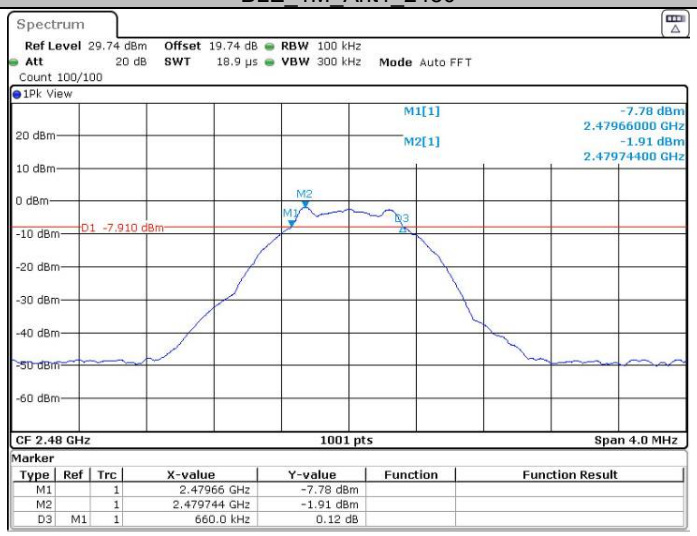
BLE_1M_Ant1_2402




BLE_1M_Ant1_2440



BLE_1M_Ant1_2480

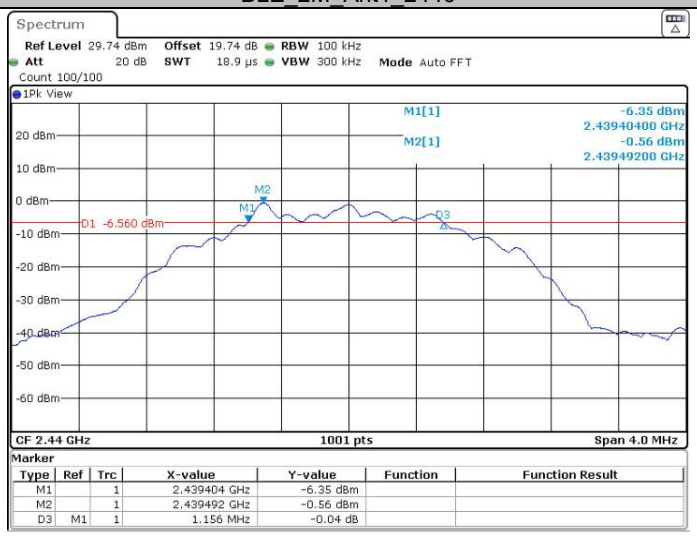



Date: 12.JUN.2023 20:26:29

BLE_2M_Ant1_2402


Date: 12.JUN.2023 20:27:41

BLE_2M_Ant1_2440




Date: 12.JUN.2023 20:28:54

BLE_2M_Ant1_2480


Date: 12.JUN.2023 20:30:48

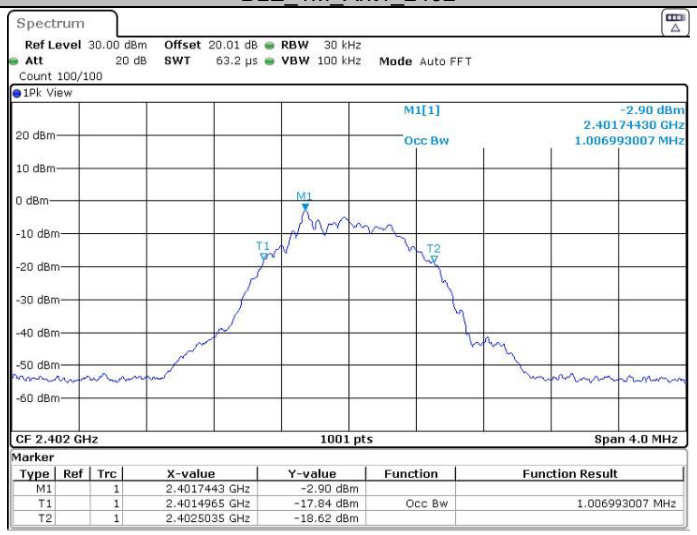
## Appendix B: Occupied Channel Bandwidth

### Test Result

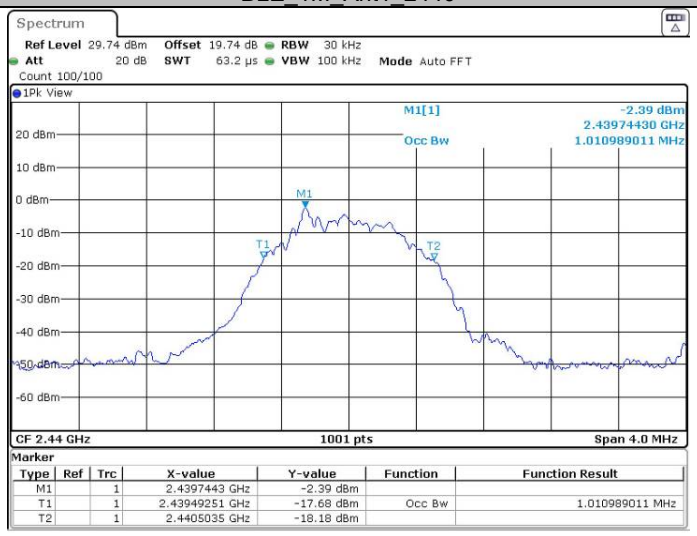
| Test Mode | Antenna | Frequency[MHz] | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | 1.007 | 2401.497 | 2402.503 | --- | --- |
| | | 2440 | 1.011 | 2439.493 | 2440.503 | --- | --- |
| | | 2480 | 1.011 | 2479.493 | 2480.503 | --- | --- |
| BLE_2M | Ant1 | 2402 | 2.014 | 2401.005 | 2403.019 | --- | --- |
| | | 2440 | 2.014 | 2439.005 | 2441.019 | --- | --- |
| | | 2480 | 2.014 | 2479.001 | 2481.015 | --- | --- |

## Test Graphs

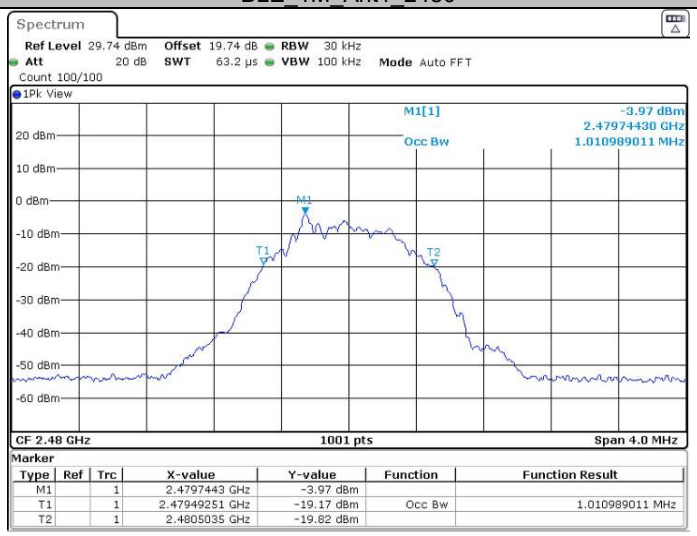
BLE_1M_Ant1_2402




BLE_1M_Ant1_2440

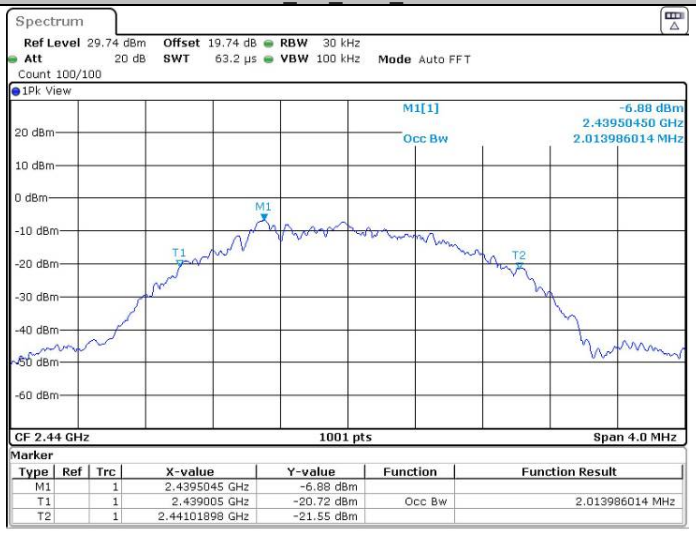


BLE_1M_Ant1_2480

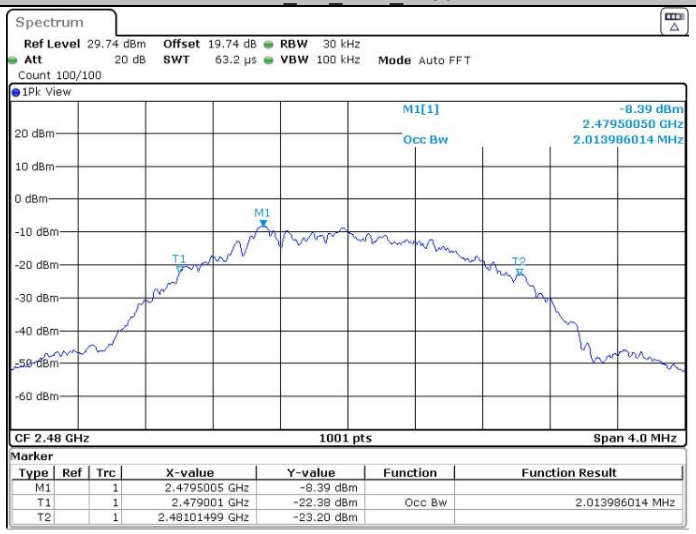



BLE_2M_Ant1_2402

BLE_2M_Ant1_2440




BLE_2M_Ant1_2480



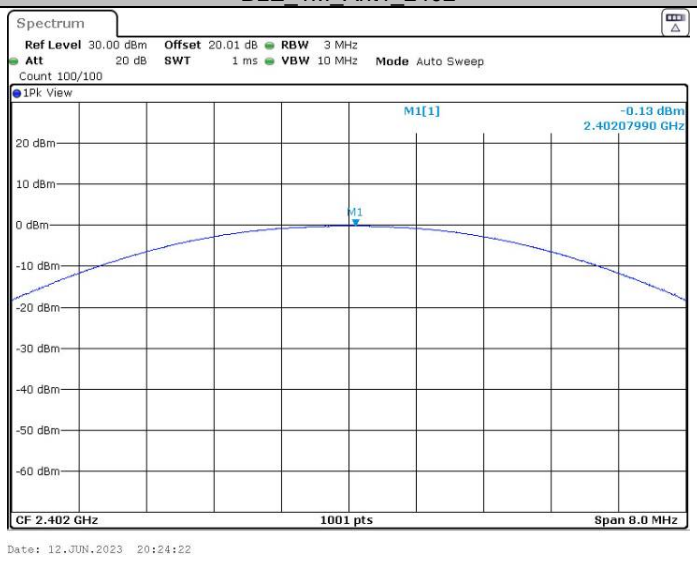
# Appendix C: Maximum conducted output power

## Test Result

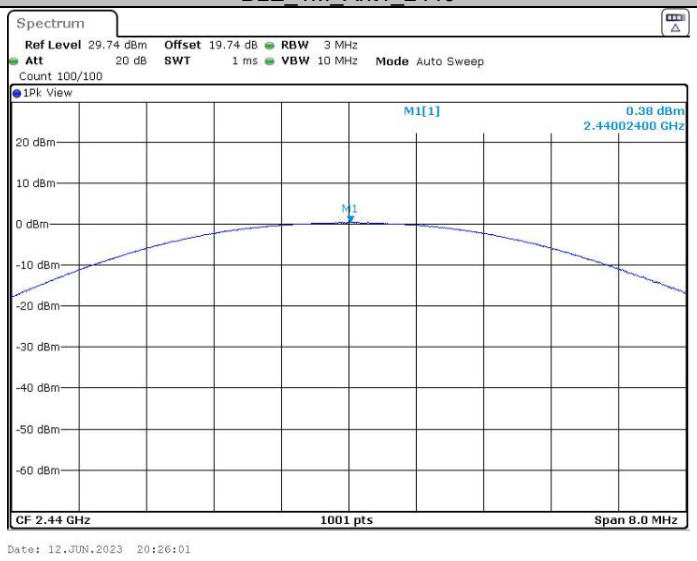
| Test Mode | Antenna | Frequency[MHz] | Conducted Peak Power[dBm] | Conducted Limit[dBm] | Verdict |
|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | -0.13 | ≤30 | PASS |
| | | 2440 | **0.38** | ≤30 | PASS |
| | | 2480 | -1.19 | ≤30 | PASS |
| BLE_2M | Ant1 | 2402 | -0.28 | ≤30 | PASS |
| | | 2440 | **0.34** | ≤30 | PASS |
| | | 2480 | -1.23 | ≤30 | PASS |
| Note: the antenna gain=2.2dBi, the maximum EIRP=2.58dBm<36dBm | | | | | |

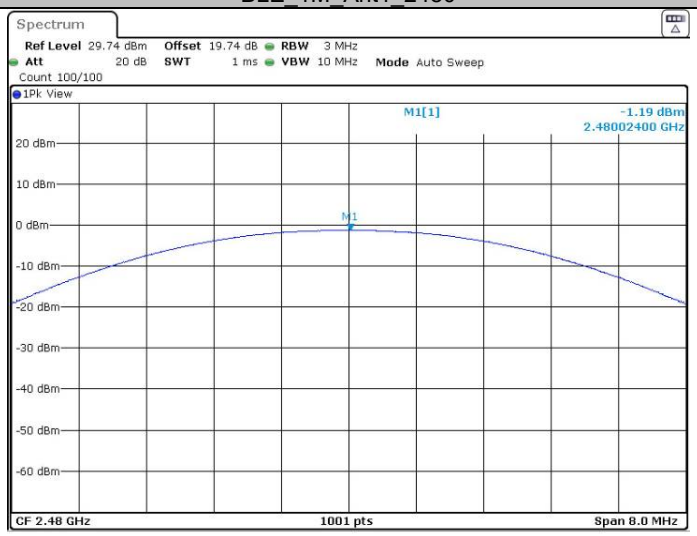
## Test Graphs

BLE_1M_Ant1_2402

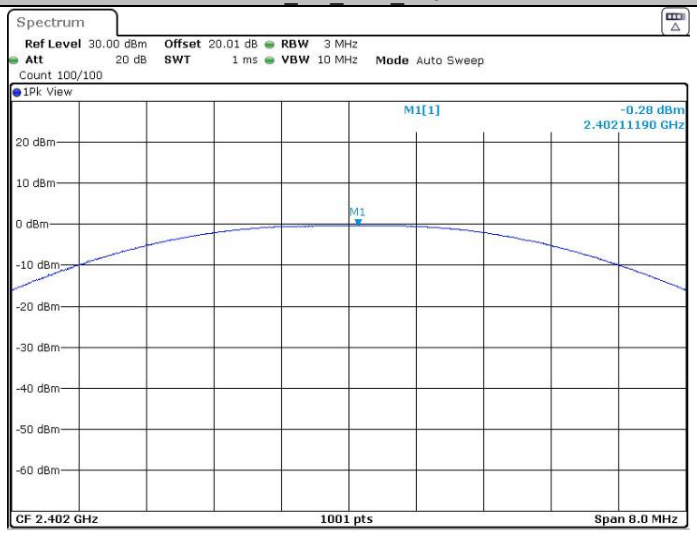



BLE_1M_Ant1_2440

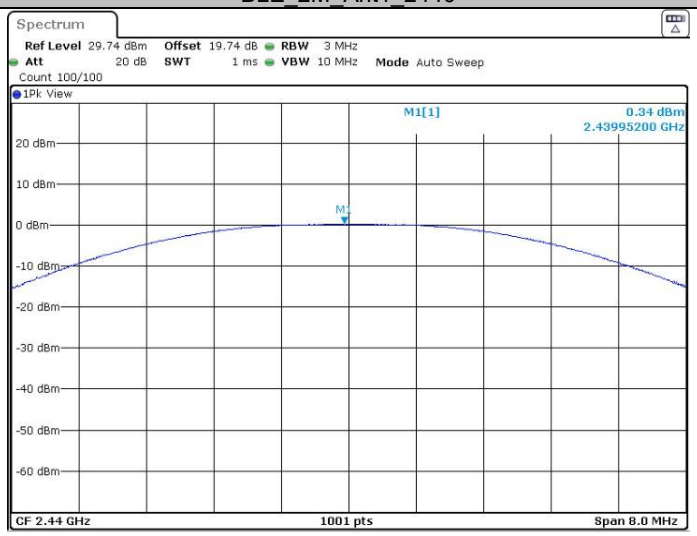


| BLE_1M_Ant1_2480 |
| --- |
|  |

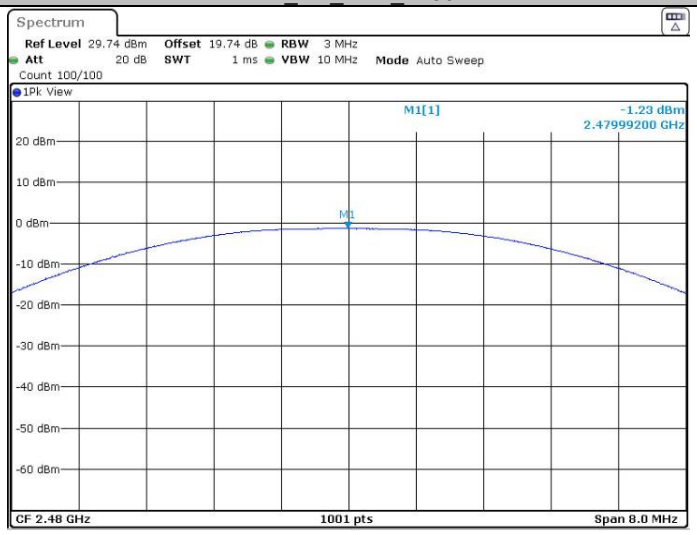


| BLE_2M_Ant1_2402 |
| --- |
|  |

BLE_2M_Ant1_2440




BLE_2M_Ant1_2480



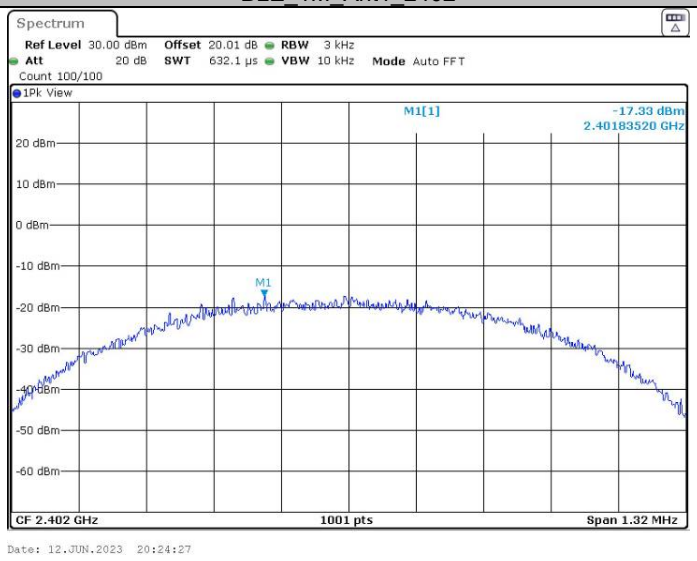
## Appendix D: Maximum power spectral density

### Test Result

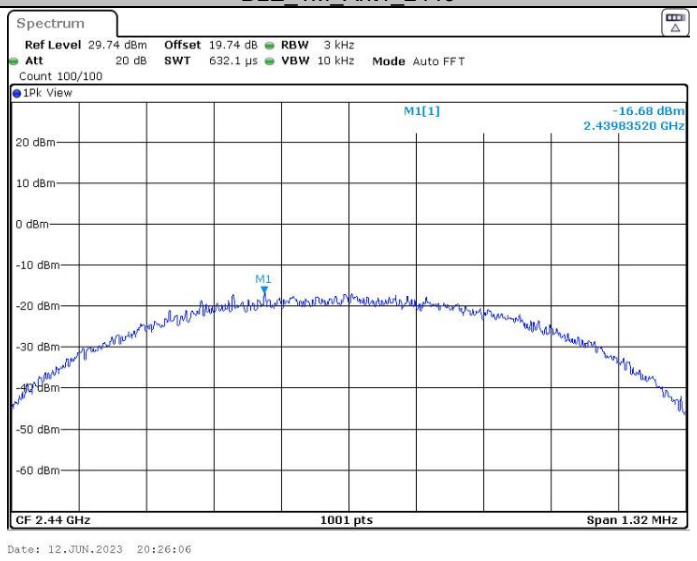
| Test Mode | Antenna | Frequency[MHz] | Result[dBm/3kHz] | Limit[dBm/3kHz] | Verdict |
|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | -17.33 | ≤8.00 | PASS |
| | | 2440 | -16.68 | ≤8.00 | PASS |
| | | 2480 | -18.37 | ≤8.00 | PASS |
| BLE_2M | Ant1 | 2402 | -20.50 | ≤8.00 | PASS |
| | | 2440 | -19.91 | ≤8.00 | PASS |
| | | 2480 | -21.47 | ≤8.00 | PASS |

## Test Graphs

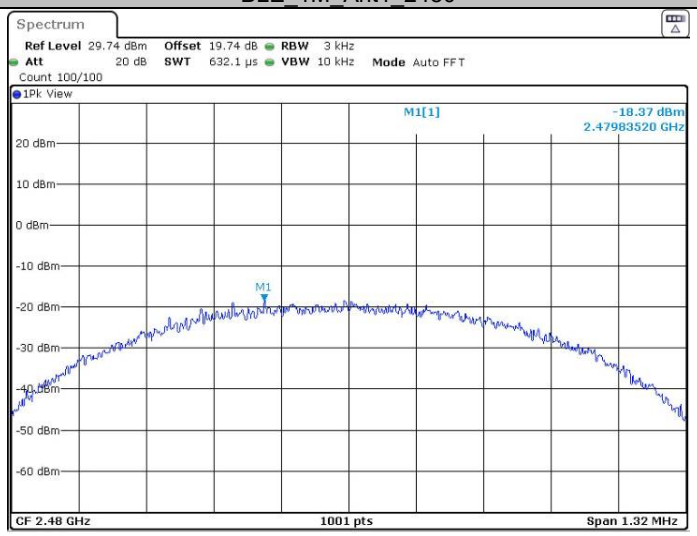
BLE_1M_Ant1_2402



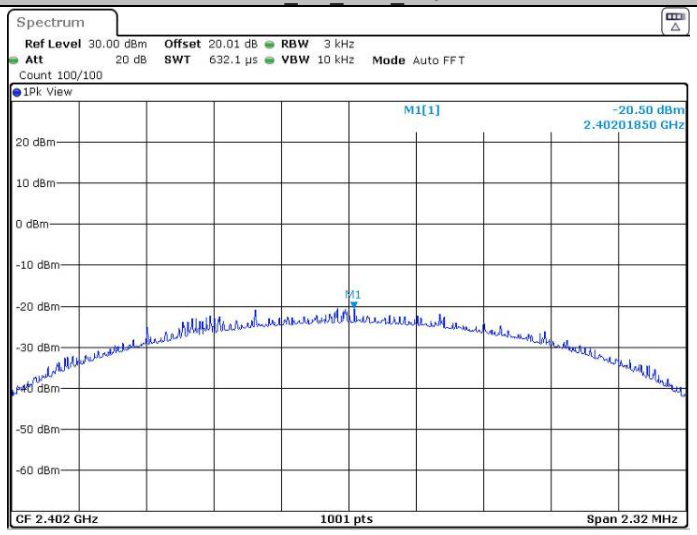

BLE_1M_Ant1_2440



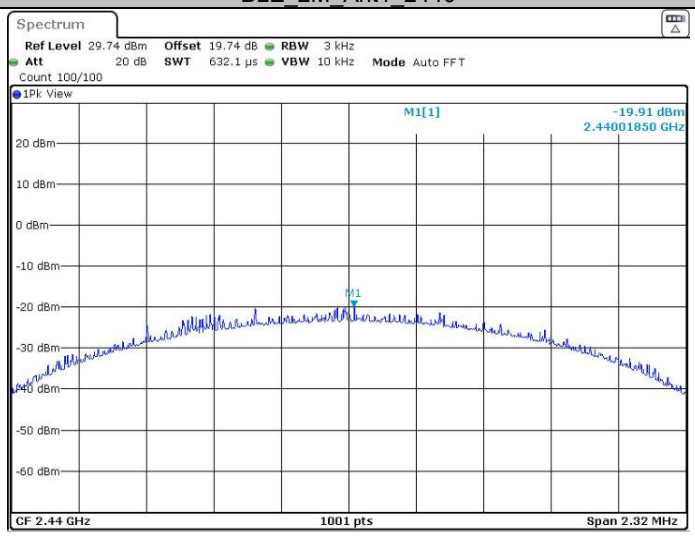
BLE_1M_Ant1_2480



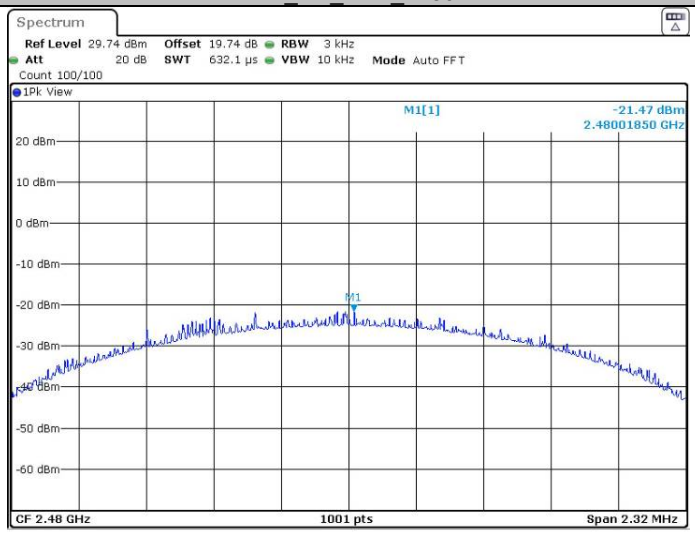

BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



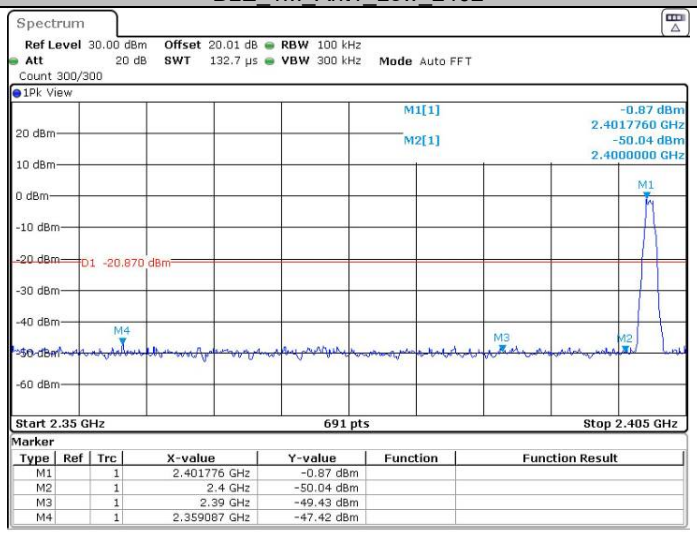

BLE_2M_Ant1_2480



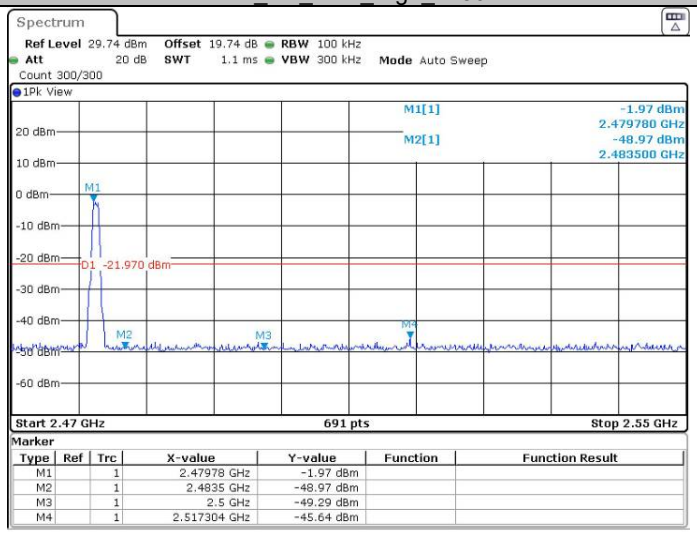
# Appendix E: Band edge measurements

## Test Graphs

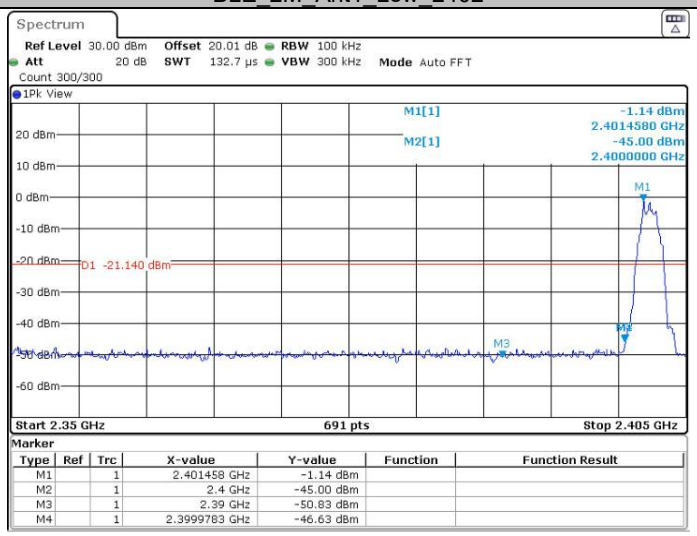
BLE_1M_Ant1_Low_2402



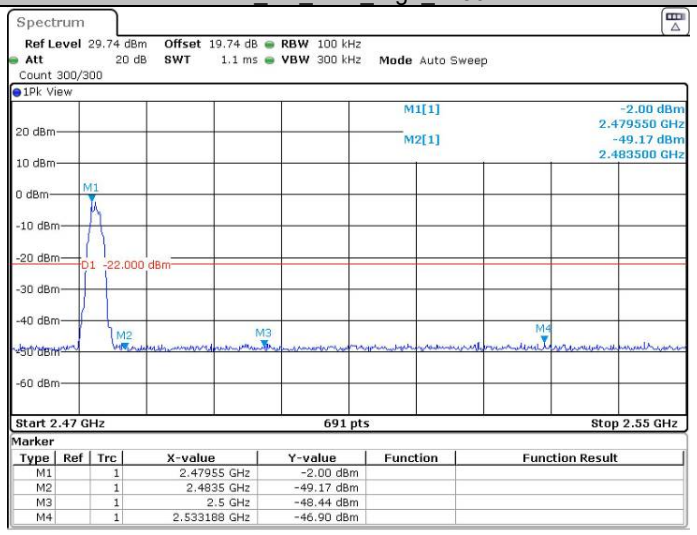

BLE_1M_Ant1_High_2480



BLE_2M_Ant1_Low_2402




BLE_2M_Ant1_High_2480



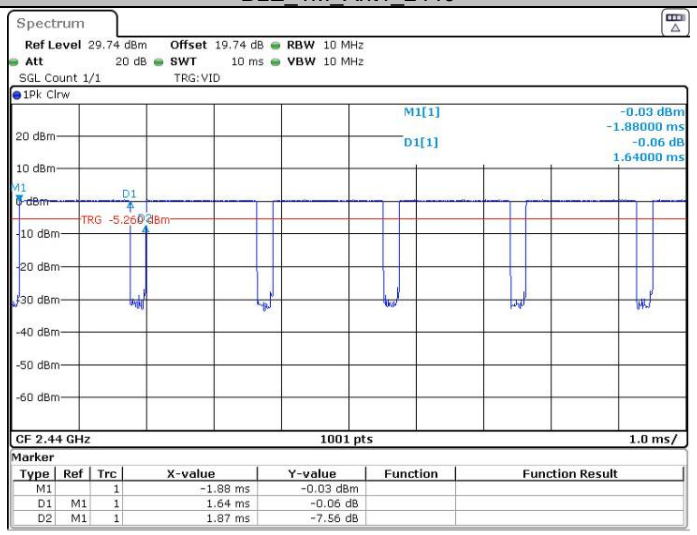
## Appendix F: Duty Cycle

### Test Result

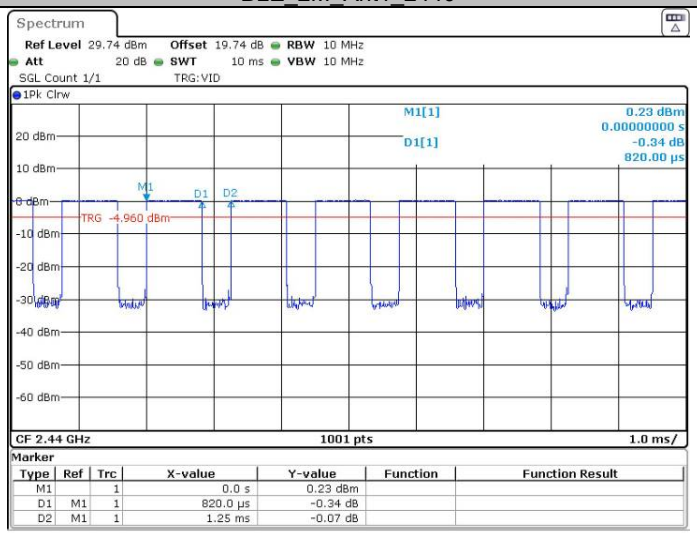
| Test Mode | Antenna | Frequency[MHz] | ON Time [ms] | Period [ms] | Duty Cycle [%] | Duty Cycle Factor[dB] | 1/T Minimum VBW (kHz) |
|---|---|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2440 | 1.64 | 1.87 | 87.70 | 0.57 | 0.61 |
| BLE_2M | Ant1 | 2440 | 0.82 | 1.25 | 65.60 | 1.88 | 1.22 |

## Test Graphs

BLE_1M_Ant1_2440




BLE_2M_Ant1_2440




******* END OF REPORT *******