# TEST REPORT

| | |
|---|---|
| Applicant Name : | Polygroup Evergreen Limited |
| Address : | Unit 606, 6th Floor, Fairmont House, No.8 Cotton Tree Drive, Central,Hong Kong |
| Report Number : | RA230301-09499E-RFB |
| FCC ID: | 2A62O-TBC007 |
| IC: | 28592-TBC007 |

**Test Standard (s)**

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

**ample Description**

| | |
|---|---|
| Product Type: | Controller |
| Model No.: | TBC007-24V |
| Multiple Model(s) No.: | N/A |
| Trade Mark: | N/A |
| Date Received: | 2023/03/01 |
| Report Date: | 2023/04/18 |

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

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

**Prepared and Checked By:**

Nick Fang

EMC Engineer

**Approved By:**

Candy Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".
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# DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | RA230301-09499E-RFB | Original Report | 2023-04-18 |

# GENERAL INFORMATION

## Product Description for Equipment under Test (EUT)

| | |
|---|---|
| HVIN | TBC007-24V |
| FVIN | 2.8.15 |
| Frequency Range | BLE 1M: 2402-2480MHz<br>Wi-Fi: 2412-2462MHz |
| Maximum Conducted Output Power | BLE 1M: 5.33dBm (peak)<br>Wi-Fi:14.98dBm (average) |
| Modulation Technique | BLE: GFSK<br>Wi-Fi: DSSS, OFDM |
| Antenna Specification* | 3.42dBi (It is provided by the applicant) |
| Voltage Range | DC 24V from adapter |
| Sample serial number | 23UJ_2 for Conducted and Radiated Emissions<br>23UJ_1 for RF Conducted Test<br>(Assigned by ATC) |
| Sample/EUT Status | Good condition |
| Adapter information | Model:TS-48W24V<br>Input: AC 120V~60Hz, 0.83A<br>Output: DC 24V, 2A |

## 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.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209, 15.247 rules and RSS-Gen, RSS-247.

## 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 |
| 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 429 7.01.

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

Channel List

| 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 | / | / |

EUT was tested with Channel 1, 6 and 11 for 802.11b/g/n20 mode.
Channel 3, 6 and 9 for 802.11n40 mode.

| 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

"EspRFTestTool.exe"* was used. The software and power level was provided by the applicant.

The device was tested with the worst case was performed as below:

| Mode | Data rate | Power level* | | |
|---|---|---|---|---|
| | | Low channel | Middle channel | High channel |
| 802.11b | 1Mbps | 0 | 0 | 0 |
| 802.11g | 6Mbps | 0 | 0 | 0 |
| 802.11n-HT20 | MCS0 | 0 | 0 | 0 |
| 802.11n-HT40 | MCS0 | 0 | 0 | 0 |
| BLE | / | 6 | 6 | 6 |

## Local Support Equipment List and Details

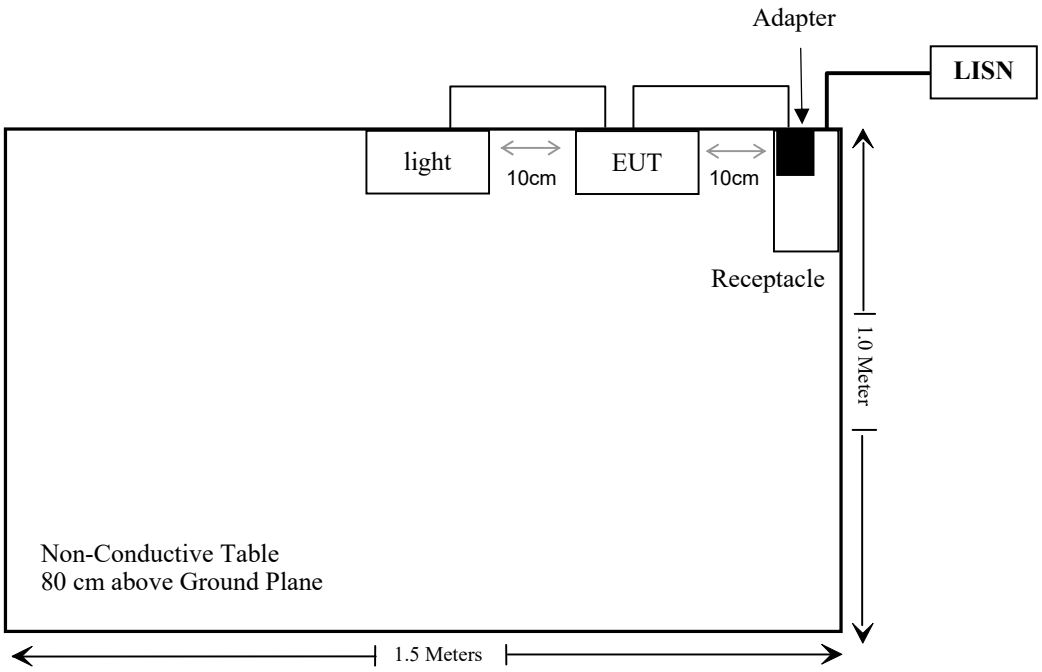
| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| / | / | / | / |

## External I/O Cable

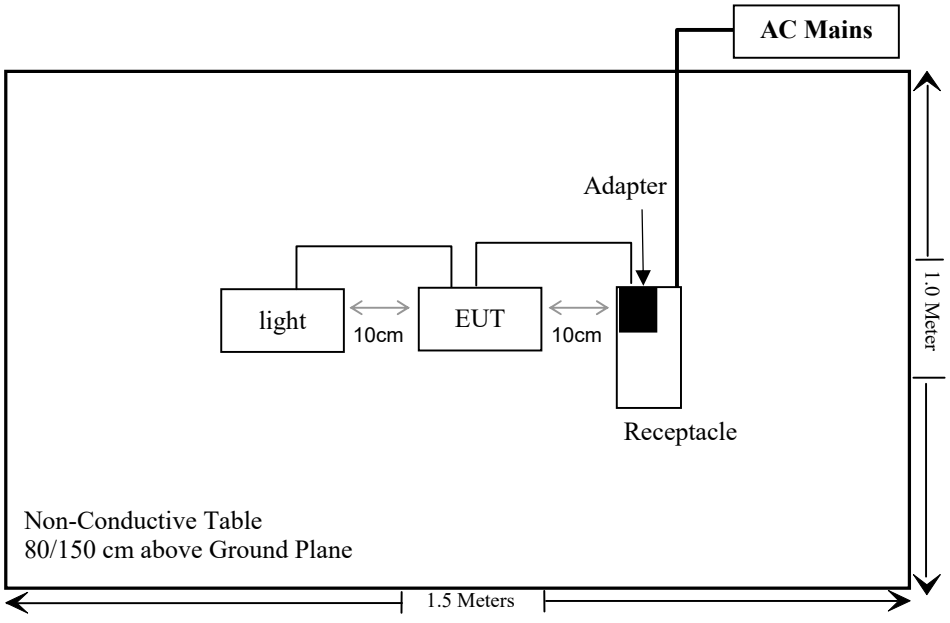
| Cable Description | Length (m) | From Port | To |
|---|---|---|---|
| / | / | / | / |

## Block Diagram of Test Setup

For conducted emission:




For radiated emission:



# SUMMARY OF TEST RESULTS

| FCC Rules | ISEDC Rules | Description of Test | Result |
|---|---|---|---|
| §15.247 (i), §2.1091 | RSS-102 § 2.5.2 | Maximum Permissible Exposure (MPE)& RF Exposure | 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 | 100 kHz 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 Emissions 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 Emissions 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 |

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| **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 |
| Unknown | RF Coaxial Cable | No.31 | RF-01 | Each time | |

*** 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) (3) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

## Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemptionfrom further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

| RF Source frequency (MHz) | Threshold ERP (watts) |
|---|---|
| 0.3-1.34 | 1,920 $R^2$. |
| 1.34-30 | 3,450 $R^2/f^2$. |
| 30-300 | 3.83 $R^2$. |
| 300-1,500 | 0.0128 $R^2f$. |
| 1,500-100,000 | 19.2$R^2$. |

Ris the minimum separation distance in meters
f = frequency in MHz

## Result

| Mode | Frequency (MHz) | Tune up conducted power | Antenna Gain | | ERP | | Evaluation Distance (m) | ERP Limit (W) |
|---|---|---|---|---|---|---|---|---|
| | | (dBm) | (dBi) | (dBd) | (dBm) | (W) | | |
| BT | 2402-2480 | 9.0 | 3.42 | 1.27 | 10.27 | 0.011 | 0.2 | 0.768 |
| BLE | 2402-2480 | 6.0 | 3.42 | 1.27 | 7.27 | 0.005 | 0.2 | 0.768 |
| 2.4G Wi-Fi | 2412-2462 | 16.0 | 3.42 | 1.27 | 17.27 | 0.053 | 0.2 | 0.768 |

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The BT cannot transmit at the same time with the Wi-Fi
3. 0dBd=2.15dBi

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

**Result: Compliant.**

# RSS-102 § 2.5.2 –EXEMPTION LIMITS FOR ROUTINE EVALUATION-RF EXPOSURE EVALUATION

## Applicable Standard

According to RSS-102 § (2.5.2):

**2.5.2 Exemption Limits for Routine Evaluation — RF Exposure Evaluation**

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $22.48/f^{0.5}$ W (adjusted for tune-up tolerance), where $f$ is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where $f$ is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

## Calculated Data:

| Mode | Frequency (MHz) | Maximum tune-up conducted power | Antenna Gain | Maximum tune-up EIRP | | Evaluation Distance (cm) | Limit (W) |
|---|---|---|---|---|---|---|---|
| | | (dBm) | (dBi) | (dBm) | (W) | | |
| BT | 2402-2480 | 9.0 | 3.42 | 12.42 | 0.017 | 20 | 2.68 |
| BLE | 2402-2480 | 6.0 | 3.42 | 10.42 | 0.011 | 20 | 2.68 |
| 2.4G Wi-Fi | 2412-2462 | 16.0 | 3.42 | 19.42 | 0.087 | 20 | 2.68 |

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The BT cannot transmit at the same time with the Wi-Fi

To maintain compliance with the ISED's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

**Result:** The RF Exposure evaluation can be exempted.

# § 15.203 & RSS-Gen §6.8 ANTENNA 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:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.
c. 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 was permanently attached and the maximum antenna gain is3.42dBi, fulfill the requirement of this section. Please refer to the EUT photos.

| Antenna Type | Antenna Gain | Impedance | Frequency Range |
|---|---|---|---|
| PCB | 3.42dBi | 50 Ω | 2.4~2.5GHz |

**Result:** Compliance

# § 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 |

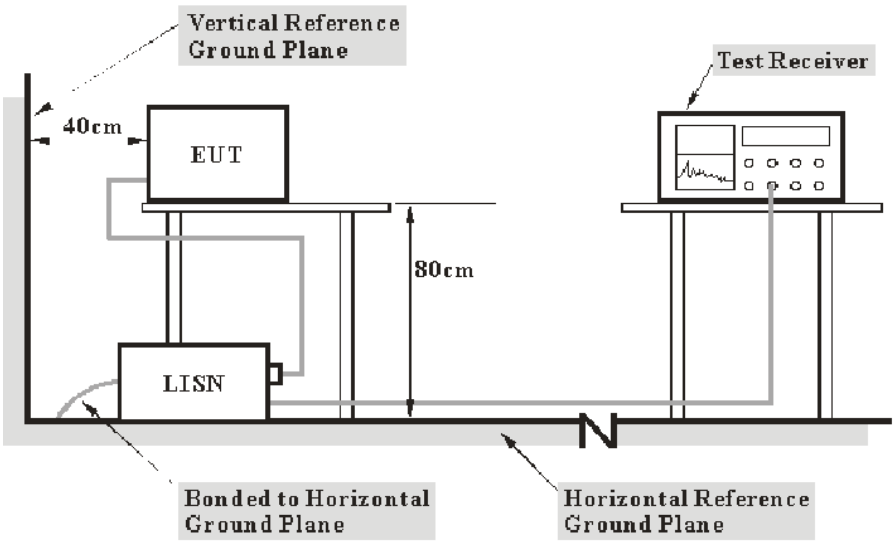
**Note 1:** The level decreases linearly with the logarithm of the frequency.

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 40 cm long in the middle.

## EMI Test Receiver Setup

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

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.

## Corrected Factor & Margin Calculation

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

Transd 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, a over limit of -7 dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

Over Limit = Level – Limit
Level= Reading level+ Transd Factor

## Test Data

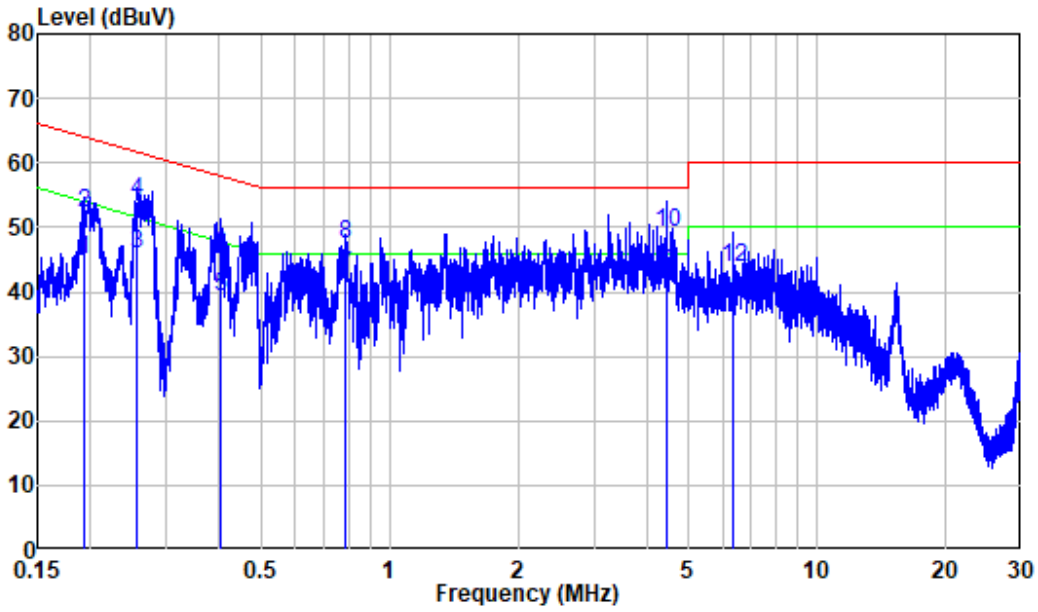
### Environmental Conditions

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

*The testing was performed by Jerry on 2023-04-12.*

*EUT operation mode: Transmitting(worst case is 802.11g, middle channel)*

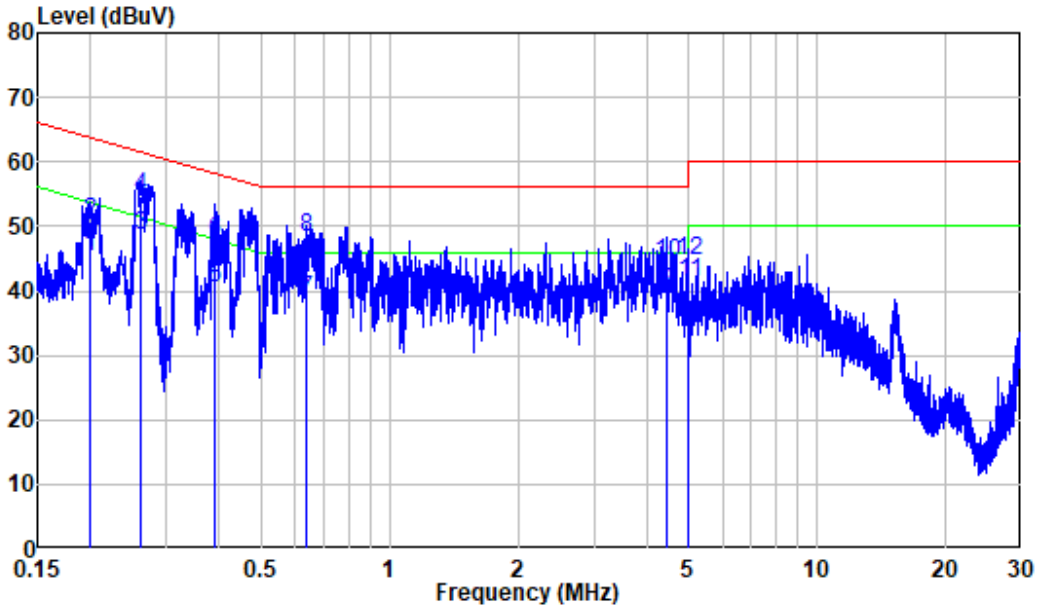
**AC 120V/60 Hz, Line**




Site : Shielding Room
Condition: Line
Job No. : RA230301-09499E-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 | 0.192 | 10.29 | 34.84 | 45.13 | 53.94 | -8.81 | Average |
| 2 | 0.192 | 10.29 | 41.90 | 52.19 | 63.94 | -11.75 | QP |
| 3 | 0.257 | 10.30 | 35.51 | 45.81 | 51.53 | -5.72 | Average |
| 4 | 0.257 | 10.30 | 43.62 | 53.92 | 61.53 | -7.61 | QP |
| 5 | 0.404 | 10.30 | 28.95 | 39.25 | 47.77 | -8.52 | Average |
| 6 | 0.404 | 10.30 | 35.29 | 45.59 | 57.77 | -12.18 | QP |
| 7 | 0.787 | 10.41 | 32.16 | 42.57 | 46.00 | -3.43 | Average |
| 8 | 0.787 | 10.41 | 36.88 | 47.29 | 56.00 | -8.71 | QP |
| 9 | 4.442 | 10.42 | 32.59 | 43.01 | 46.00 | -2.99 | Average |
| 10 | 4.442 | 10.42 | 38.80 | 49.22 | 56.00 | -6.78 | QP |
| 11 | 6.352 | 10.38 | 27.95 | 38.33 | 50.00 | -11.67 | Average |
| 12 | 6.352 | 10.38 | 33.47 | 43.85 | 60.00 | -16.15 | QP |

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




Site : Shielding Room
Condition: Neutral
Job No. : RA230301-09499E-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 | 0.199 | 9.80 | 35.60 | 45.40 | 53.65 | -8.25 | Average |
| 2 | 0.199 | 9.80 | 40.85 | 50.65 | 63.65 | -13.00 | QP |
| 3 | 0.261 | 9.80 | 38.76 | 48.56 | 51.38 | -2.82 | Average |
| 4 | 0.261 | 9.80 | 44.94 | 54.74 | 61.38 | -6.64 | QP |
| 5 | 0.390 | 9.80 | 30.65 | 40.45 | 48.06 | -7.61 | Average |
| 6 | 0.390 | 9.80 | 37.93 | 47.73 | 58.06 | -10.33 | QP |
| 7 | 0.639 | 9.81 | 28.89 | 38.70 | 46.00 | -7.30 | Average |
| 8 | 0.639 | 9.81 | 38.50 | 48.31 | 56.00 | -7.69 | QP |
| 9 | 4.433 | 9.84 | 30.06 | 39.90 | 46.00 | -6.10 | Average |
| 10 | 4.433 | 9.84 | 34.68 | 44.52 | 56.00 | -11.48 | QP |
| 11 | 5.001 | 9.85 | 31.40 | 41.25 | 50.00 | -8.75 | Average |
| 12 | 5.001 | 9.85 | 34.80 | 44.65 | 60.00 | -15.35 | QP |

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

## Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

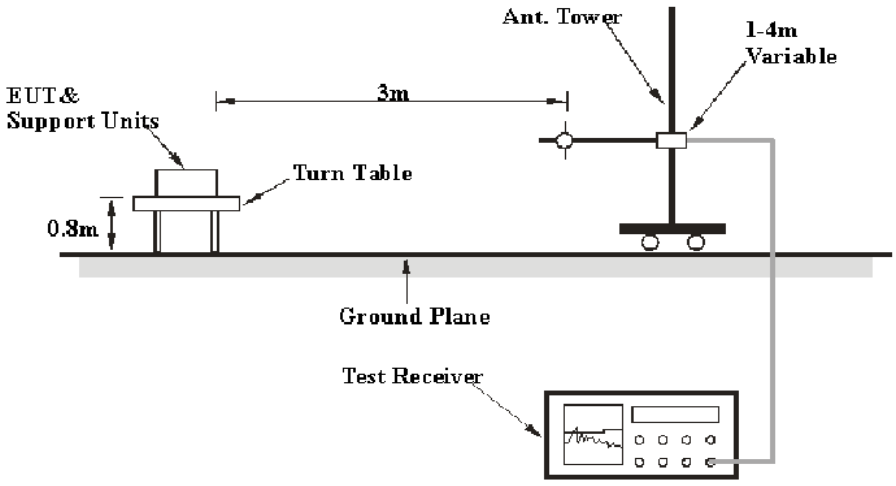
According to RSS-GEN § 8.10 & RSS-247 § 5.5

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.

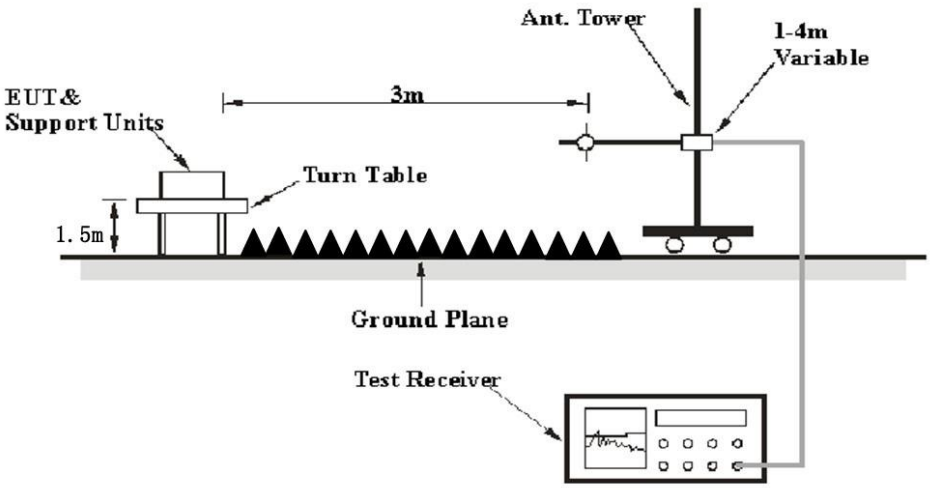
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided 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 3 meters 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 40 cm 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 |
|---|---|---|---|---|
| 30 MHz – 1000 MHz | 100 kHz | 300 kHz | 120 kHz | 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.

## Corrected Amplitude & 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 or 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:

Margin/Over Limit = Corrected Amplitude/Level-Limit
Corrected Amplitude/Level = Reading + Corrected Factor

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23.6~24℃ |
| **Relative Humidity:** | 50~56% |
| **ATM Pressure:** | 101.0 kPa |

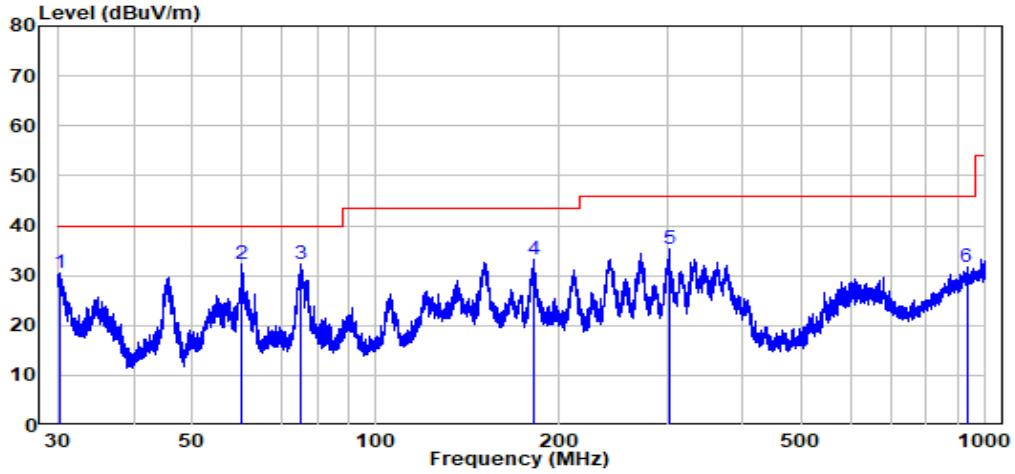
*The testing was performed by Jason Liu on 2023-04-12 for below 1GHz, Jimi Zheng on 2023-04-11and 2023-04-12 for above 1GHz.*

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

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

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

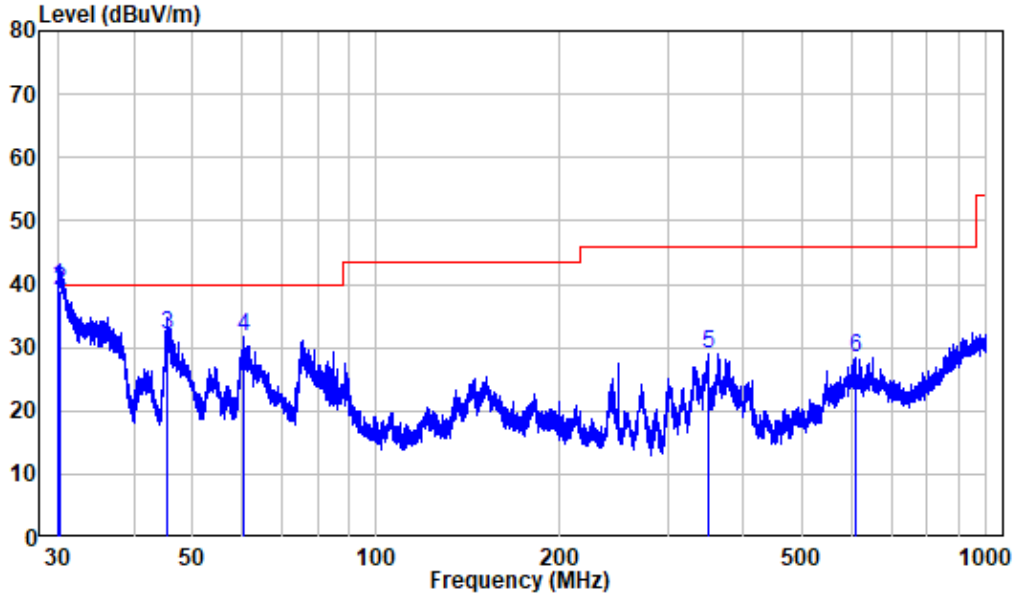
Horizontal




Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230301-09499E-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 | 30.384 | -14.33 | 44.79 | 30.46 | 40.00 | -9.54 | Peak |
| 2 | 60.227 | -13.82 | 46.05 | 32.23 | 40.00 | -7.77 | Peak |
| 3 | 75.281 | -13.43 | 45.65 | 32.22 | 40.00 | -7.78 | Peak |
| 4 | 181.841 | -10.34 | 43.62 | 33.28 | 43.50 | -10.22 | Peak |
| 5 | 302.614 | -15.49 | 50.75 | 35.26 | 46.00 | -10.74 | Peak |
| 6 | 931.863 | 0.39 | 31.21 | 31.60 | 46.00 | -14.40 | Peak |

Vertical




Site : chamber
Condition: 3m VERTICAL
Job No. : RA230301-09499E-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 | 30.000 | -14.30 | 53.70 | 39.40 | 40.00 | -0.60 | QP |
| 2 | 30.370 | -14.33 | 53.40 | 39.07 | 40.00 | -0.93 | QP |
| 3 | 45.475 | -14.29 | 46.20 | 31.91 | 40.00 | -8.09 | QP |
| 4 | 60.625 | -13.83 | 45.45 | 31.62 | 40.00 | -8.38 | Peak |
| 5 | 349.097 | -12.15 | 41.25 | 29.10 | 46.00 | -16.90 | Peak |
| 6 | 610.992 | -9.60 | 38.07 | 28.47 | 46.00 | -17.53 | Peak |

**For Wi-Fi**

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Absolute Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| **802.11b** | | | | | | | | | |
| Low Channel 2412MHz | | | | | | | | | |
| 2328.96 | 66.15 | PK | 338 | 1.9 | H | -10.57 | 55.58 | 74 | -18.42 |
| 2328.96 | 52.10 | AV | 338 | 1.9 | H | -10.57 | 41.53 | 54 | -12.47 |
| 2313.96 | 66.32 | PK | 216 | 1.6 | V | -10.41 | 55.91 | 74 | -18.09 |
| 2313.96 | 52.01 | AV | 216 | 1.6 | V | -10.41 | 41.60 | 54 | -12.40 |
| 2390 | 65.91 | PK | 138 | 2.3 | H | -10.70 | 55.21 | 74 | -18.79 |
| 2390 | 53.06 | AV | 138 | 2.3 | H | -10.70 | 42.36 | 54 | -11.64 |
| 2390 | 65.34 | PK | 255 | 2.2 | V | -10.70 | 54.64 | 74 | -19.36 |
| 2390 | 53.03 | AV | 255 | 2.2 | V | -10.70 | 42.33 | 54 | -11.67 |
| 4824 | 64.19 | PK | 200 | 1.8 | H | -6.10 | 58.09 | 74 | -15.91 |
| 4824 | 55.32 | AV | 200 | 1.8 | H | -6.10 | 49.22 | 54 | -4.78 |
| 4824 | 65.61 | PK | 359 | 1.2 | V | -6.10 | 59.51 | 74 | -14.49 |
| 4824 | 56.80 | AV | 359 | 1.2 | V | -6.10 | 50.70 | 54 | -3.30 |
| Middle Channel 2437MHz | | | | | | | | | |
| 4874 | 63.84 | PK | 187 | 1.4 | H | -5.95 | 57.89 | 74 | -16.11 |
| 4874 | 54.16 | AV | 187 | 1.4 | H | -5.95 | 48.21 | 54 | -5.79 |
| 4874 | 64.60 | PK | 259 | 1.6 | V | -5.95 | 58.65 | 74 | -15.35 |
| 4874 | 55.03 | AV | 259 | 1.6 | V | -5.95 | 49.08 | 54 | -4.92 |
| High Channel 2462MHz | | | | | | | | | |
| 2483.5 | 65.36 | PK | 272 | 1.9 | H | -10.55 | 54.81 | 74 | -19.19 |
| 2483.5 | 53.48 | AV | 272 | 1.9 | H | -10.55 | 42.93 | 54 | -11.07 |
| 2483.5 | 65.71 | PK | 331 | 1.7 | V | -10.55 | 55.16 | 74 | -18.84 |
| 2483.5 | 53.47 | AV | 331 | 1.7 | V | -10.55 | 42.92 | 54 | -11.08 |
| 2488.25 | 68.48 | PK | 344 | 2.4 | H | -10.51 | 57.97 | 74 | -16.03 |
| 2488.25 | 53.57 | AV | 344 | 2.4 | H | -10.51 | 43.06 | 54 | -10.94 |
| 2489.4 | 67.55 | PK | 11 | 2.2 | V | -10.50 | 57.05 | 74 | -16.95 |
| 2489.4 | 53.59 | AV | 11 | 2.2 | V | -10.50 | 43.09 | 54 | -10.91 |
| 4924 | 64.62 | PK | 315 | 1.9 | H | -5.67 | 58.95 | 74 | -15.05 |
| 4924 | 55.27 | AV | 315 | 1.9 | H | -5.67 | 49.60 | 54 | -4.40 |
| 4924 | 65.07 | PK | 223 | 2.3 | V | -5.67 | 59.40 | 74 | -14.60 |
| 4924 | 56.46 | AV | 223 | 2.3 | V | -5.67 | 50.79 | 54 | -3.21 |

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Absolute Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| 802.11g | | | | | | | | | |
| Low Channel 2412MHz | | | | | | | | | |
| 2333.88 | 66.45 | PK | 182 | 2.2 | H | -10.62 | 55.83 | 74 | -18.17 |
| 2333.88 | 52.35 | AV | 182 | 2.2 | H | -10.62 | 41.73 | 54 | -12.27 |
| 2332.44 | 66.64 | PK | 334 | 1.9 | V | -10.60 | 56.04 | 74 | -17.96 |
| 2332.44 | 52.39 | AV | 334 | 1.9 | V | -10.60 | 41.79 | 54 | -12.21 |
| 2390 | 65.23 | PK | 129 | 2 | H | -10.70 | 54.53 | 74 | -19.47 |
| 2390 | 53.21 | AV | 129 | 2 | H | -10.70 | 42.51 | 54 | -11.49 |
| 2390 | 65.14 | PK | 284 | 2.2 | V | -10.70 | 54.44 | 74 | -19.56 |
| 2390 | 53.23 | AV | 284 | 2.2 | V | -10.70 | 42.53 | 54 | -11.47 |
| 4824 | 61.58 | PK | 162 | 1.2 | H | -6.10 | 55.48 | 74 | -18.52 |
| 4824 | 46.90 | AV | 162 | 1.2 | H | -6.10 | 40.80 | 54 | -13.20 |
| 4824 | 62.45 | PK | 146 | 2 | V | -6.10 | 56.35 | 74 | -17.65 |
| 4824 | 48.36 | AV | 146 | 2 | V | -6.10 | 42.26 | 54 | -11.74 |
| Middle Channel 2437MHz | | | | | | | | | |
| 4874 | 62.63 | PK | 115 | 1.1 | H | -5.95 | 56.68 | 74 | -17.32 |
| 4874 | 48.39 | AV | 115 | 1.1 | H | -5.95 | 42.44 | 54 | -11.56 |
| 4874 | 63.50 | PK | 106 | 1.1 | V | -5.95 | 57.55 | 74 | -16.45 |
| 4874 | 49.84 | AV | 106 | 1.1 | V | -5.95 | 43.89 | 54 | -10.11 |
| High Channel 2462MHz | | | | | | | | | |
| 2483.5 | 66.66 | PK | 249 | 1.4 | H | -10.55 | 56.11 | 74 | -17.89 |
| 2483.5 | 53.55 | AV | 249 | 1.4 | H | -10.55 | 43 | 54 | -11.00 |
| 2483.5 | 66.44 | PK | 235 | 1.1 | V | -10.55 | 55.89 | 74 | -18.11 |
| 2483.5 | 53.54 | AV | 235 | 1.1 | V | -10.55 | 42.99 | 54 | -11.01 |
| 2485.45 | 67.67 | PK | 221 | 1.4 | H | -10.53 | 57.14 | 74 | -16.86 |
| 2485.45 | 53.70 | AV | 221 | 1.4 | H | -10.53 | 43.17 | 54 | -10.83 |
| 2488.4 | 67.71 | PK | 126 | 1.1 | V | -10.51 | 57.2 | 74 | -16.80 |
| 2488.4 | 53.67 | AV | 126 | 1.1 | V | -10.51 | 43.16 | 54 | -10.84 |
| 4924 | 63.10 | PK | 31 | 2.2 | H | -5.67 | 57.43 | 74 | -16.57 |
| 4924 | 49.76 | AV | 31 | 2.2 | H | -5.67 | 44.09 | 54 | -9.91 |
| 4924 | 64.90 | PK | 195 | 1.9 | V | -5.67 | 59.23 | 74 | -14.77 |
| 4924 | 50.75 | AV | 195 | 1.9 | V | -5.67 | 45.08 | 54 | -8.92 |

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Absolute Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| 802.11n20 | | | | | | | | | |
| Low Channel 2412MHz | | | | | | | | | |
| 2357.4 | 68.69 | PK | 155 | 2 | H | -10.77 | 57.92 | 74 | -16.08 |
| 2357.4 | 53.22 | AV | 155 | 2 | H | -10.77 | 42.45 | 54 | -11.55 |
| 2359.68 | 67.71 | PK | 346 | 1.8 | V | -10.77 | 56.94 | 74 | -17.06 |
| 2359.68 | 53.24 | AV | 346 | 1.8 | V | -10.77 | 42.47 | 54 | -11.53 |
| 2390 | 65.67 | PK | 117 | 2 | H | -10.70 | 54.97 | 74 | -19.03 |
| 2390 | 53.23 | AV | 117 | 2 | H | -10.70 | 42.53 | 54 | -11.47 |
| 2390 | 65.86 | PK | 341 | 1.7 | V | -10.70 | 55.16 | 74 | -18.84 |
| 2390 | 53.25 | AV | 341 | 1.7 | V | -10.70 | 42.55 | 54 | -11.45 |
| 4824 | 62.90 | PK | 291 | 1.5 | H | -6.10 | 56.80 | 74 | -17.20 |
| 4824 | 47.83 | AV | 291 | 1.5 | H | -6.10 | 41.73 | 54 | -12.27 |
| 4824 | 63.88 | PK | 359 | 1.4 | V | -6.10 | 57.78 | 74 | -16.22 |
| 4824 | 48.71 | AV | 359 | 1.4 | V | -6.10 | 42.61 | 54 | -11.39 |
| Middle Channel 2437MHz | | | | | | | | | |
| 4874 | 64.18 | PK | 324 | 2.1 | H | -5.95 | 58.23 | 74 | -15.77 |
| 4874 | 48.65 | AV | 324 | 2.1 | H | -5.95 | 42.7 | 54 | -11.30 |
| 4874 | 64.76 | PK | 13 | 1.4 | V | -5.95 | 58.81 | 74 | -15.19 |
| 4874 | 49.39 | AV | 13 | 1.4 | V | -5.95 | 43.44 | 54 | -10.56 |
| High Channel 2462MHz | | | | | | | | | |
| 2483.5 | 66.34 | PK | 140 | 2 | H | -10.55 | 55.79 | 74 | -18.21 |
| 2483.5 | 53.55 | AV | 140 | 2 | H | -10.55 | 43 | 54 | -11.00 |
| 2483.5 | 65.45 | PK | 134 | 2 | V | -10.55 | 54.9 | 74 | -19.10 |
| 2483.5 | 53.58 | AV | 134 | 2 | V | -10.55 | 43.03 | 54 | -10.97 |
| 2495.1 | 67.67 | PK | 10 | 1.2 | H | -10.46 | 57.21 | 74 | -16.79 |
| 2495.1 | 53.65 | AV | 10 | 1.2 | H | -10.46 | 43.19 | 54 | -10.81 |
| 2485.85 | 67.70 | PK | 68 | 1.6 | V | -10.53 | 57.17 | 74 | -16.83 |
| 2485.85 | 53.72 | AV | 68 | 1.6 | V | -10.53 | 43.19 | 54 | -10.81 |
| 4924 | 64.82 | PK | 178 | 2.2 | H | -5.67 | 59.15 | 74 | -14.85 |
| 4924 | 49.39 | AV | 178 | 2.2 | H | -5.67 | 43.72 | 54 | -10.28 |
| 4924 | 64.97 | PK | 29 | 1.3 | V | -5.67 | 59.30 | 74 | -14.70 |
| 4924 | 50.45 | AV | 29 | 1.3 | V | -5.67 | 44.78 | 54 | -9.22 |

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Absolute Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| 802.11n40 | | | | | | | | | |
| Low Channel 2422MHz | | | | | | | | | |
| 2310.39 | 66.61 | PK | 96 | 1.1 | H | -10.37 | 56.24 | 74 | -17.76 |
| 2310.39 | 52.15 | AV | 96 | 1.1 | H | -10.37 | 41.78 | 54 | -12.22 |
| 2364.08 | 68.03 | PK | 88 | 1.4 | V | -10.76 | 57.27 | 74 | -16.73 |
| 2364.08 | 53.22 | AV | 88 | 1.4 | V | -10.76 | 42.46 | 54 | -11.54 |
| 2390 | 65.36 | PK | 274 | 1.6 | H | -10.70 | 54.66 | 74 | -19.34 |
| 2390 | 53.24 | AV | 274 | 1.6 | H | -10.70 | 42.54 | 54 | -11.46 |
| 2390 | 66.14 | PK | 154 | 1.7 | V | -10.70 | 55.44 | 74 | -18.56 |
| 2390 | 53.25 | AV | 154 | 1.7 | V | -10.70 | 42.55 | 54 | -11.45 |
| 4844 | 60.27 | PK | 217 | 1.8 | H | -6.09 | 54.18 | 74 | -19.82 |
| 4844 | 46.55 | AV | 217 | 1.8 | H | -6.09 | 40.46 | 54 | -13.54 |
| 4844 | 61.04 | PK | 345 | 2.1 | V | -6.09 | 54.95 | 74 | -19.05 |
| 4844 | 47.68 | AV | 345 | 2.1 | V | -6.09 | 41.59 | 54 | -12.41 |
| Middle Channel 2437MHz | | | | | | | | | |
| 4874 | 60.94 | PK | 312 | 1.3 | H | -5.95 | 54.99 | 74 | -19.01 |
| 4874 | 47.16 | AV | 312 | 1.3 | H | -5.95 | 41.21 | 54 | -12.79 |
| 4874 | 61.83 | PK | 195 | 1.5 | V | -5.95 | 55.88 | 74 | -18.12 |
| 4874 | 48.15 | AV | 195 | 1.5 | V | -5.95 | 42.2 | 54 | -11.80 |
| High Channel 2452MHz | | | | | | | | | |
| 2483.5 | 65.97 | PK | 241 | 1 | H | -10.55 | 55.42 | 74 | -18.58 |
| 2483.5 | 53.55 | AV | 241 | 1 | H | -10.55 | 43 | 54 | -11.00 |
| 2483.5 | 66.92 | PK | 143 | 1.4 | V | -10.55 | 56.37 | 74 | -17.63 |
| 2483.5 | 53.60 | AV | 143 | 1.4 | V | -10.55 | 43.05 | 54 | -10.95 |
| 2492.79 | 68.33 | PK | 265 | 1.2 | H | -10.48 | 57.85 | 74 | -16.15 |
| 2492.79 | 53.66 | AV | 265 | 1.2 | H | -10.48 | 43.18 | 54 | -10.82 |
| 2494.47 | 67.84 | PK | 329 | 2.4 | V | -10.46 | 57.38 | 74 | -16.62 |
| 2494.47 | 53.65 | AV | 329 | 2.4 | V | -10.46 | 43.19 | 54 | -10.81 |
| 4904 | 61.19 | PK | 168 | 1 | H | -5.77 | 55.42 | 74 | -18.58 |
| 4904 | 47.52 | AV | 168 | 1 | H | -5.77 | 41.75 | 54 | -12.25 |
| 4904 | 62.16 | PK | 166 | 1.2 | V | -5.77 | 56.39 | 74 | -17.61 |
| 4904 | 48.56 | AV | 166 | 1.2 | V | -5.77 | 42.79 | 54 | -11.21 |

**BLE 1M:**

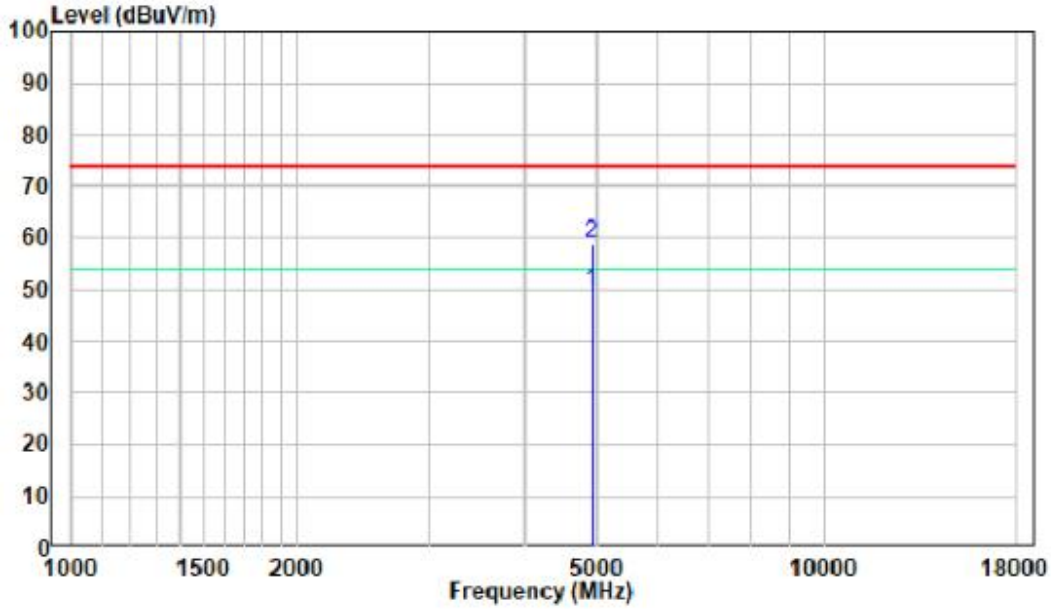
| Frequency (MHz) | Receiver | | Turntable Degree | Rx Antenna | | Factor (dB/m) | Absolute Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | PK/Ave | | Height (m) | Polar (H/V) | | | | |
| BLE1M | | | | | | | | | |
| Low Channel 2402MHz | | | | | | | | | |
| 2351.1 | 68.21 | PK | 296 | 2.1 | H | -10.79 | 57.42 | 74 | -16.58 |
| 2351.1 | 53.58 | AV | 296 | 2.1 | H | -10.79 | 42.79 | 54 | -11.21 |
| 2338.7 | 66.66 | PK | 351 | 1.1 | V | -10.67 | 55.99 | 74 | -18.01 |
| 2338.7 | 52.70 | AV | 351 | 1.1 | V | -10.67 | 42.03 | 54 | -11.97 |
| 2390 | 65.97 | PK | 290 | 2.2 | H | -10.70 | 55.27 | 74 | -18.73 |
| 2390 | 53.21 | AV | 290 | 2.2 | H | -10.70 | 42.51 | 54 | -11.49 |
| 2390 | 65.43 | PK | 75 | 1.2 | V | -10.70 | 54.73 | 74 | -19.27 |
| 2390 | 53.26 | AV | 75 | 1.2 | V | -10.70 | 42.56 | 54 | -11.44 |
| 4804 | 61.16 | PK | 170 | 1.5 | H | -6.11 | 55.05 | 74 | -18.95 |
| 4804 | 48.80 | AV | 170 | 1.5 | H | -6.11 | 42.69 | 54 | -11.31 |
| 4804 | 61.40 | PK | 23 | 1.6 | V | -6.11 | 55.29 | 74 | -18.71 |
| 4804 | 49.06 | AV | 23 | 1.6 | V | -6.11 | 42.95 | 54 | -11.05 |
| Middle Channel 2440MHz | | | | | | | | | |
| 4880 | 61.80 | PK | 178 | 1.5 | H | -5.91 | 55.89 | 74 | -18.11 |
| 4880 | 49.11 | AV | 178 | 1.5 | H | -5.91 | 43.2 | 54 | -10.80 |
| 4880 | 61.55 | PK | 214 | 2.3 | V | -5.91 | 55.64 | 74 | -18.36 |
| 4880 | 49.59 | AV | 214 | 2.3 | V | -5.91 | 43.68 | 54 | -10.32 |
| High Channel 2480MHz | | | | | | | | | |
| 2483.5 | 65.57 | PK | 9 | 1 | H | -10.55 | 55.02 | 74 | -18.98 |
| 2483.5 | 53.54 | AV | 9 | 1 | H | -10.55 | 42.99 | 54 | -11.01 |
| 2483.5 | 66.31 | PK | 42 | 1.7 | V | -10.55 | 55.76 | 74 | -18.24 |
| 2483.5 | 53.78 | AV | 42 | 1.7 | V | -10.55 | 43.23 | 54 | -10.77 |
| 2496.7 | 67.73 | PK | 65 | 2.3 | H | -10.45 | 57.28 | 74 | -16.72 |
| 2496.7 | 54.03 | AV | 65 | 2.3 | H | -10.45 | 43.58 | 54 | -10.42 |
| 2499.76 | 67.86 | PK | 45 | 2.4 | V | -10.42 | 57.44 | 74 | -16.56 |
| 2499.76 | 54.10 | AV | 45 | 2.4 | V | -10.42 | 43.68 | 54 | -10.32 |
| 4960 | 61.82 | PK | 286 | 1.4 | H | -5.47 | 56.35 | 74 | -17.65 |
| 4960 | 49.53 | AV | 286 | 1.4 | H | -5.47 | 44.06 | 54 | -9.94 |
| 4960 | 61.25 | PK | 48 | 1.6 | V | -5.47 | 55.78 | 74 | -18.22 |
| 4960 | 49.70 | AV | 48 | 1.6 | V | -5.47 | 44.23 | 54 | -9.77 |

**Note:**
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Absolute Level (Corrected Amplitude) = Factor + Reading
Margin = Absolute Level (Corrected Amplitude) – Limit
The other spurious emission which is in the noise floor level was not recorded.
The test result of peak was less than the limit of average, so just peak value were recorded.

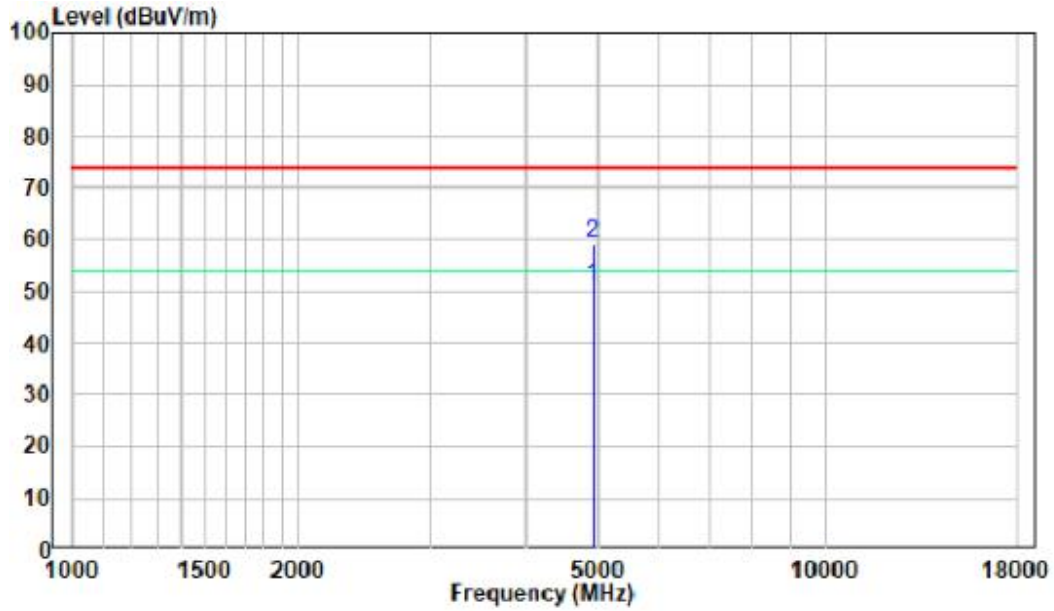
**1 GHz - 18 GHz:** (Pre-Scan plots)

**2.4G WIFI 802.11b, High channel**

Horizontal



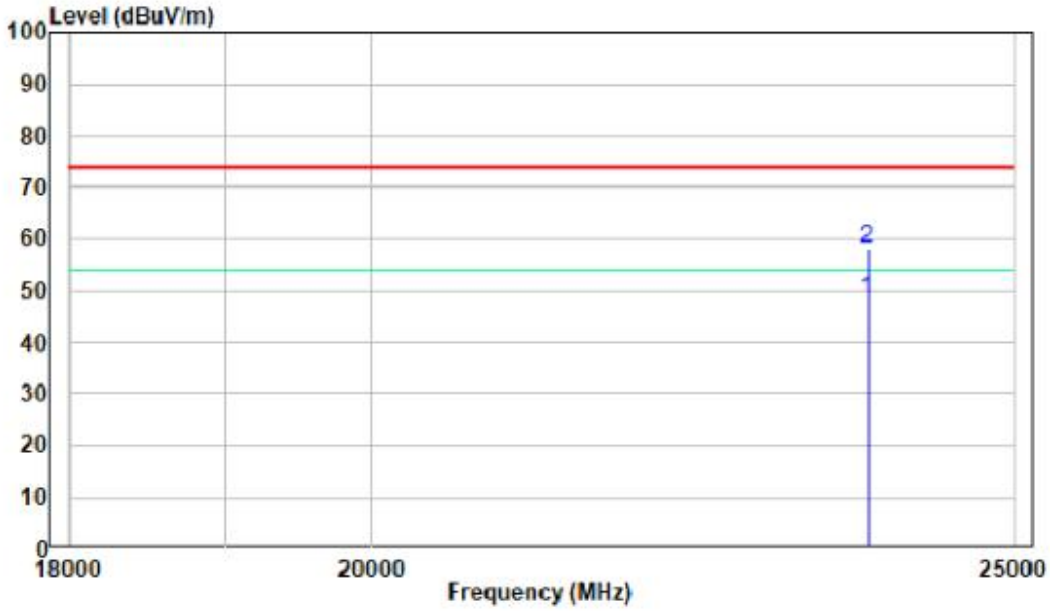

Vertical



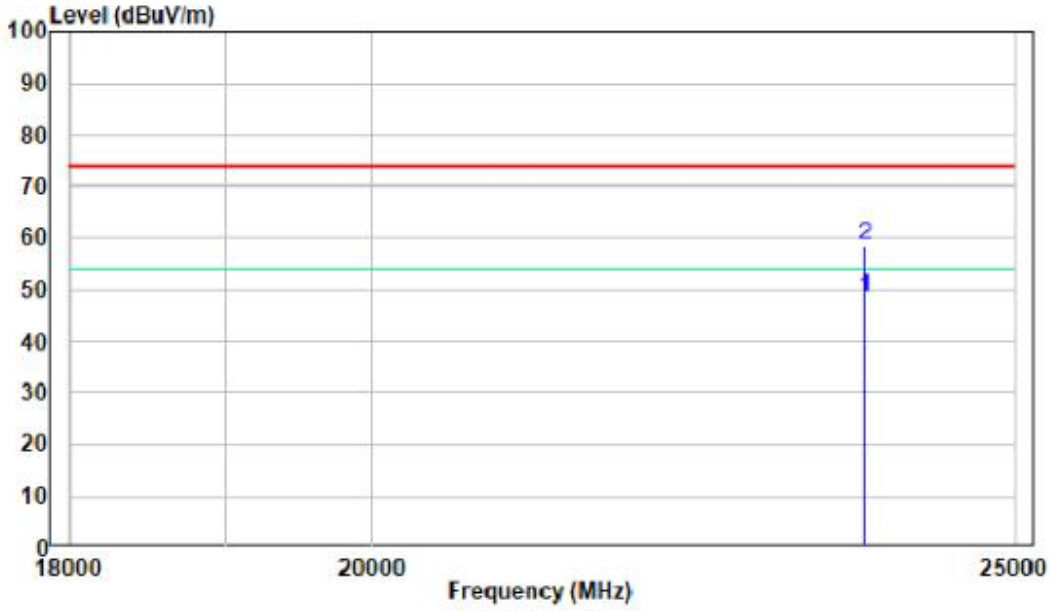
**18-25GHz:** (Pre-Scan plots)

**2.4G WIFI 802.11b, High channel**

Horizontal




Vertical



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

The following conditions shall be observed for measuring the occupied bandwidth and 6 dB bandwidth:
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

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

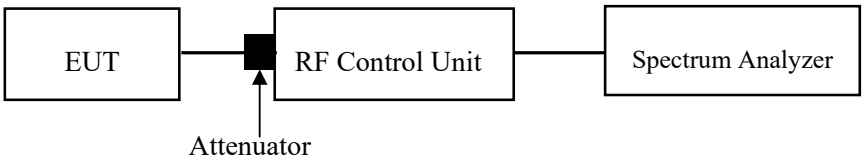
• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / 6 dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 6 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

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

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed

in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).




## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26~27℃ |
| **Relative Humidity:** | 52~56% |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nick Fang on 2023-04-13 and 2023-04-18.*

*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).

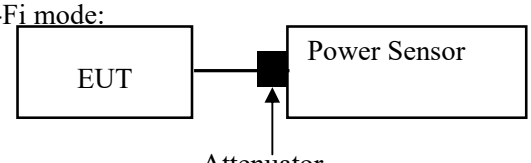
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the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

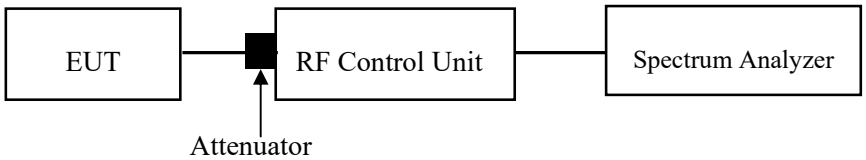
Test Method: ANSI C63.10-2013 Clause 11.9.1.1 for BLE & Clause 11.9.2.3 for Wi-Fi

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:** | 26~27℃ |
| **Relative Humidity:** | 52~56% |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nick Fang on 2023-04-13 and 2023-04-18.*

*EUT operation mode: Transmitting*

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

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

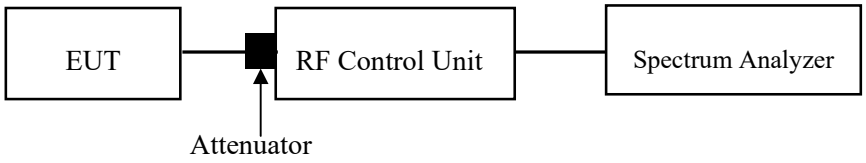
## Applicable Standard

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:** | 26~27℃ |
| **Relative Humidity:** | 52~56% |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nick Fang on 2023-04-13 and 2023-04-18.*

*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

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.

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

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

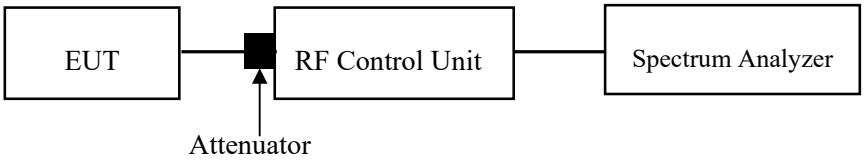
Test Method: ANSI C63.10-2013 Clause 11.10.3 &11.10.5

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

1. Measure the duty cycle (*D*) of the transmitter output signal as described in ANSI C63.10-201311.6.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = Power Averaging (rms).
6. Ensure that the number of measurement points in the sweep ≥ [2 ×span / RBW].
7. Sweep time = auto couple.
8. Trace mode = trace averaging (rms) mode over a minimum of 100 traces.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.
11. 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 istransmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e.,duty cycle variations are

less than ±2%), add [10 log (1 / D)], where D is the duty cycle measured in step 1), to the measured PSD tocompute the average PSD during the actual transmission time.

12. When the EUT transmits continuously (or with a $D \geqslant 98\%$), step 11 is not required.
13. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.




## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26~27℃ |
| **Relative Humidity:** | 52~56% |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nick Fang on 2023-04-13 and 2023-04-18.*

*EUT operation mode: Transmitting*

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

# APPENDIX Wi-Fi

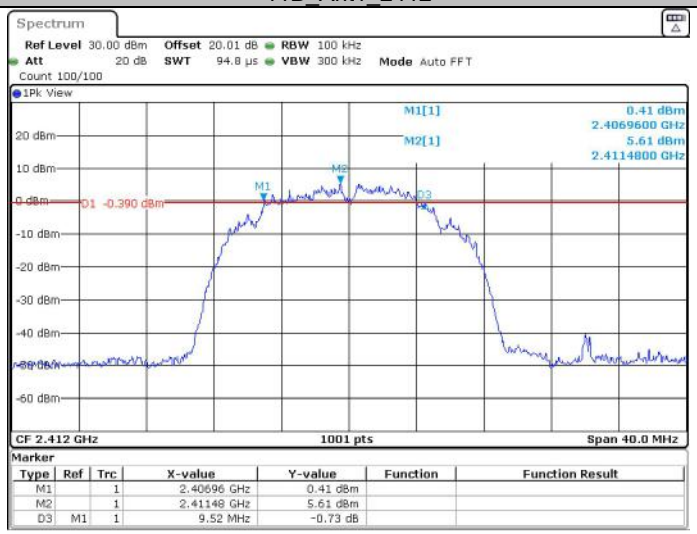
## Appendix A: DTS Bandwidth

### Test Result

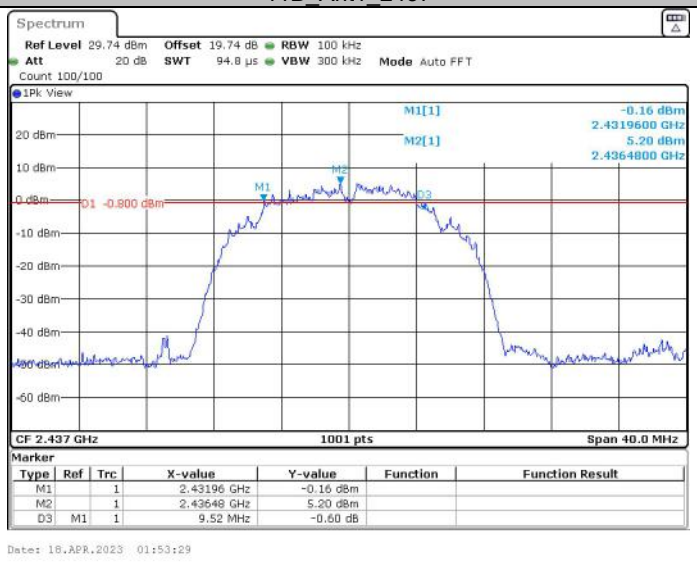
| Test Mode | Antenna | Frequency[MHz] | DTS BW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 9.52 | 2406.96 | 2416.48 | 0.5 | PASS |
| | | 2437 | 9.52 | 2431.96 | 2441.48 | 0.5 | PASS |
| | | 2462 | 9.52 | 2456.96 | 2466.48 | 0.5 | PASS |
| 11G | Ant1 | 2412 | 16.32 | 2403.80 | 2420.12 | 0.5 | PASS |
| | | 2437 | 16.32 | 2428.80 | 2445.12 | 0.5 | PASS |
| | | 2462 | 16.36 | 2453.80 | 2470.16 | 0.5 | PASS |
| 11N20SISO | Ant1 | 2412 | 16.80 | 2403.56 | 2420.36 | 0.5 | PASS |
| | | 2437 | 16.80 | 2428.56 | 2445.36 | 0.5 | PASS |
| | | 2462 | 16.84 | 2453.56 | 2470.40 | 0.5 | PASS |
| 11N40SISO | Ant1 | 2422 | 31.92 | 2406.08 | 2438.00 | 0.5 | PASS |
| | | 2437 | 31.84 | 2421.08 | 2452.92 | 0.5 | PASS |
| | | 2452 | 31.92 | 2436.08 | 2468.00 | 0.5 | PASS |

## Test Graphs

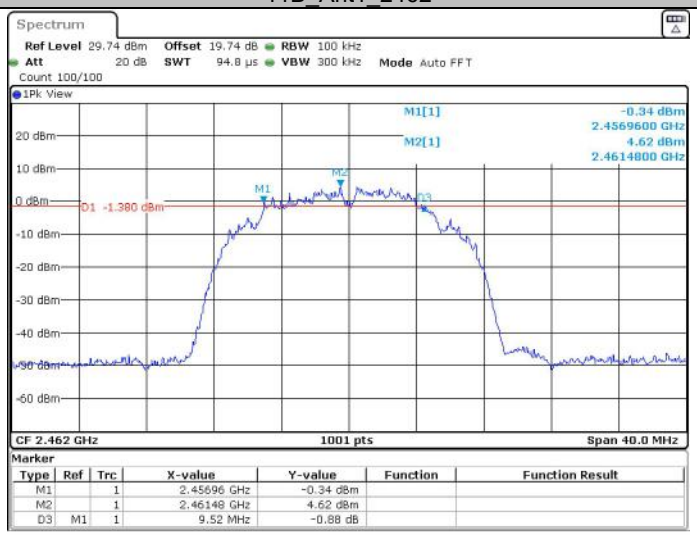
11B_Ant1_2412



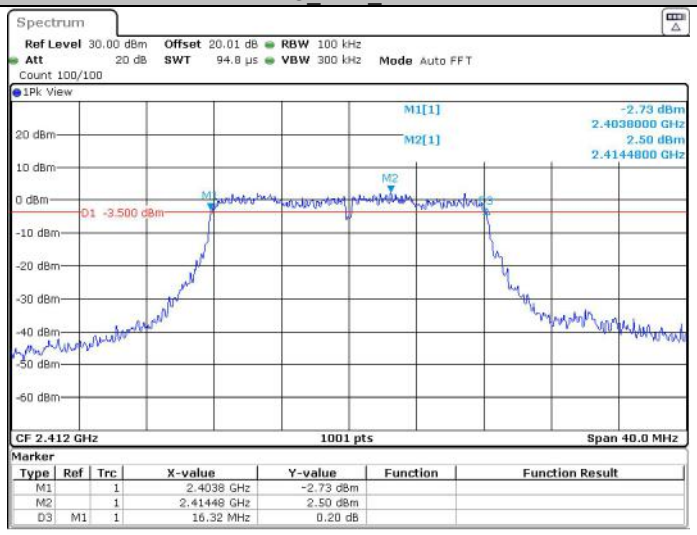

11B_Ant1_2437



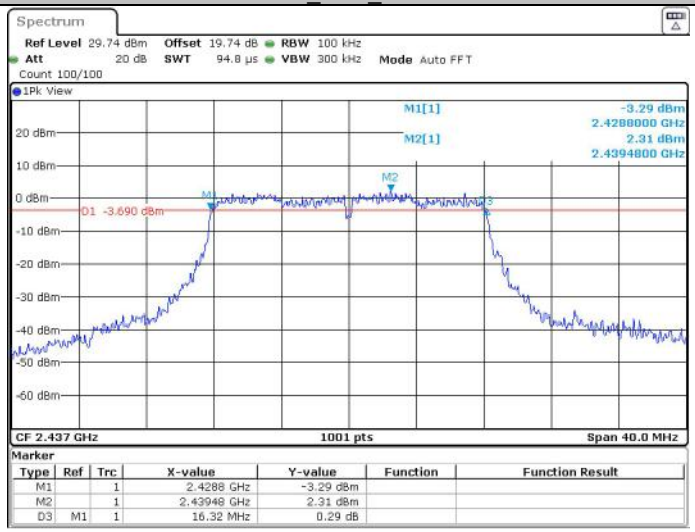
11B_Ant1_2462



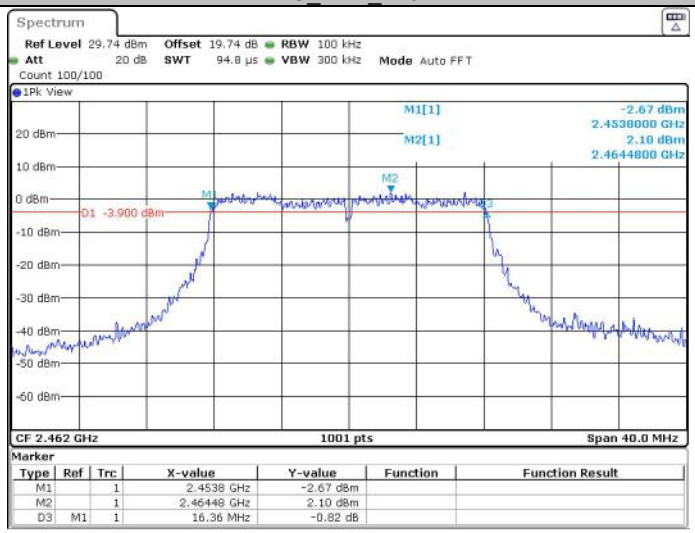

11G_Ant1_2412



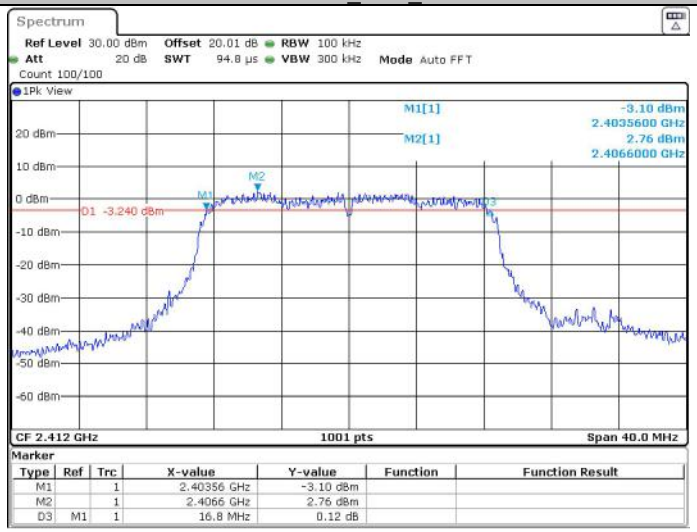
11G_Ant1_2437



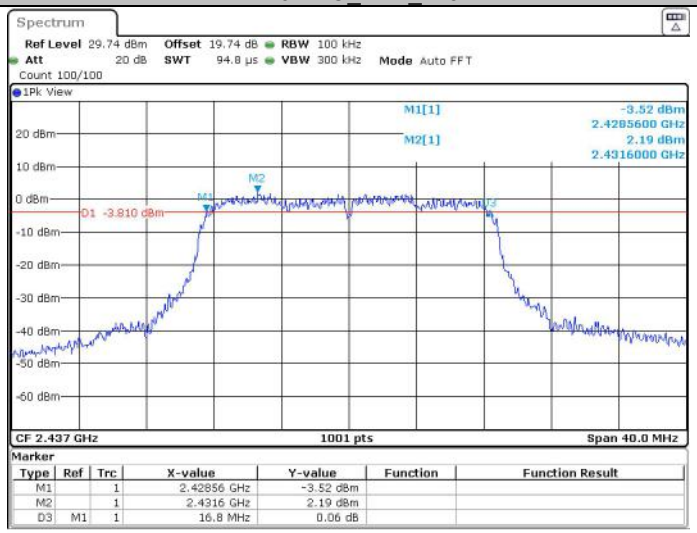

11G_Ant1_2462



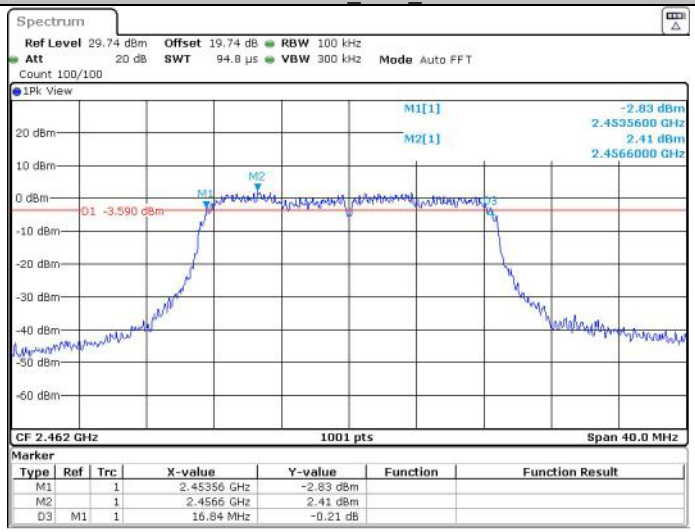
11N20SISO_Ant1_2412



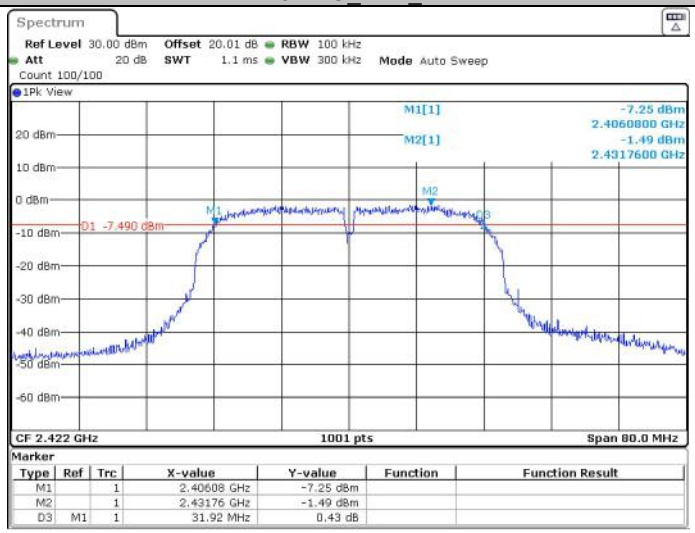

11N20SISO_Ant1_2437



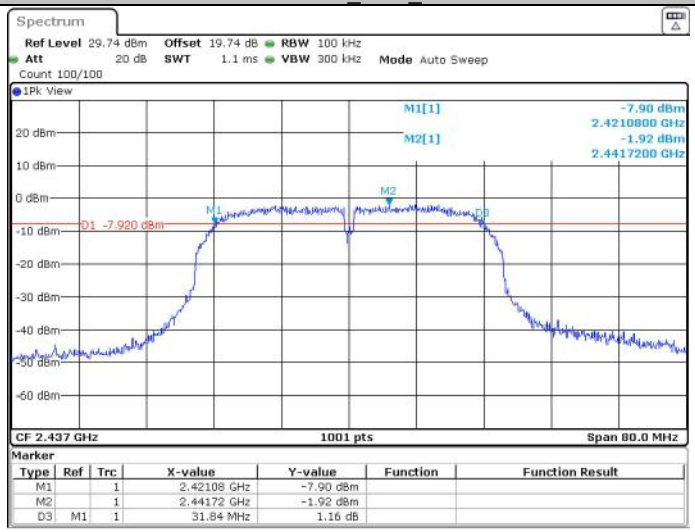
11N20SISO_Ant1_2462



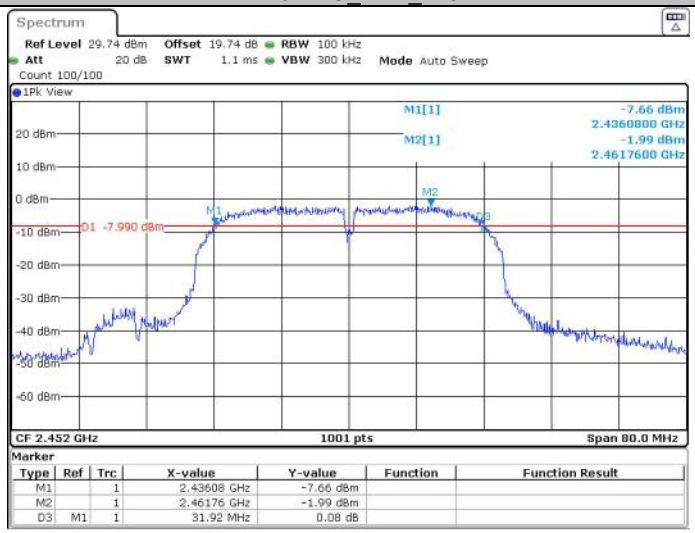

11N40SISO_Ant1_2422



11N40SISO_Ant1_2437




11N40SISO_Ant1_2452



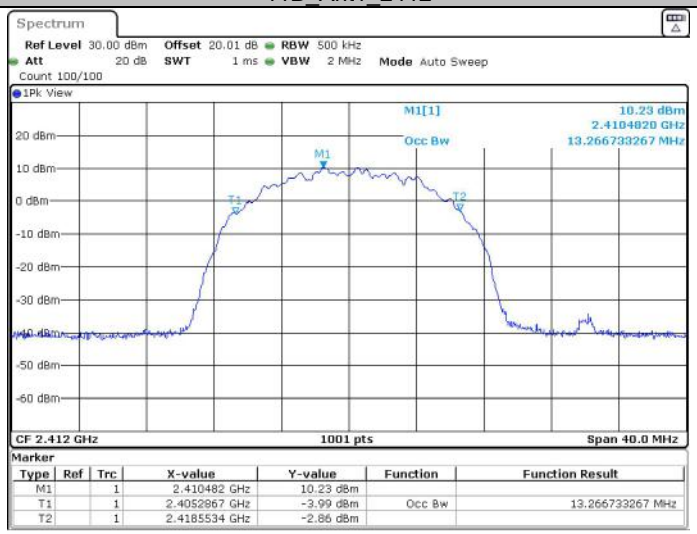
## Appendix B: Occupied Channel Bandwidth

### Test Result

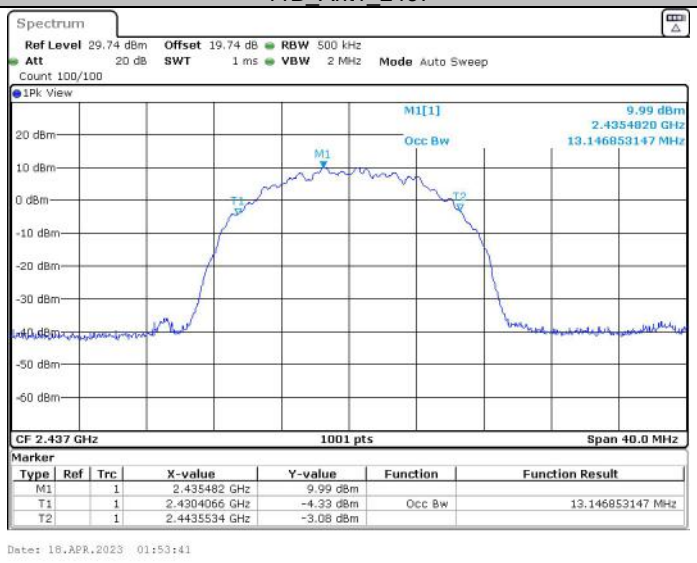
| Test Mode | Antenna | ChannelFrequency[MHz] | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 13.267 | 2405.287 | 2418.553 | --- | --- |
| | | 2437 | 13.147 | 2430.407 | 2443.553 | --- | --- |
| | | 2462 | 13.227 | 2455.327 | 2468.553 | --- | --- |
| 11G | Ant1 | 2412 | 16.503 | 2403.808 | 2420.312 | --- | --- |
| | | 2437 | 16.503 | 2428.808 | 2445.312 | --- | --- |
| | | 2462 | 16.503 | 2453.808 | 2470.312 | --- | --- |
| 11N20SISO | Ant1 | 2412 | 17.143 | 2403.449 | 2420.591 | --- | --- |
| | | 2437 | 17.143 | 2428.449 | 2445.591 | --- | --- |
| | | 2462 | 17.143 | 2453.449 | 2470.591 | --- | --- |
| 11N40SISO | Ant1 | 2422 | 34.046 | 2405.057 | 2439.103 | --- | --- |
| | | 2437 | 33.966 | 2420.137 | 2454.103 | --- | --- |
| | | 2452 | 34.046 | 2435.057 | 2469.103 | --- | --- |

## Test Graphs

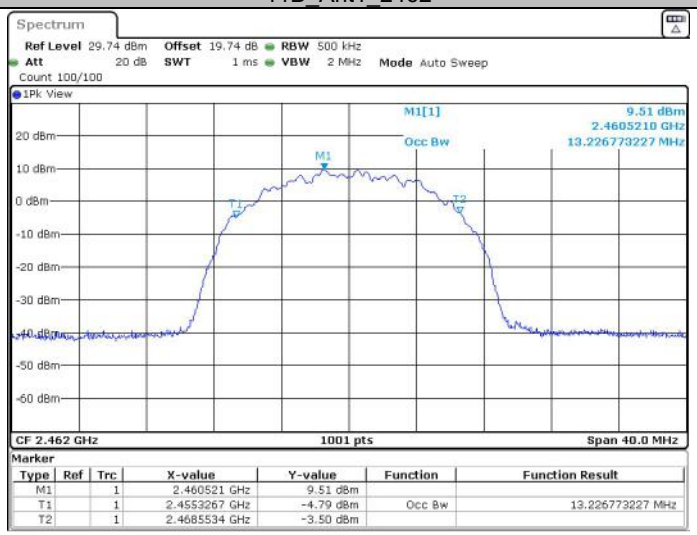
11B_Ant1_2412



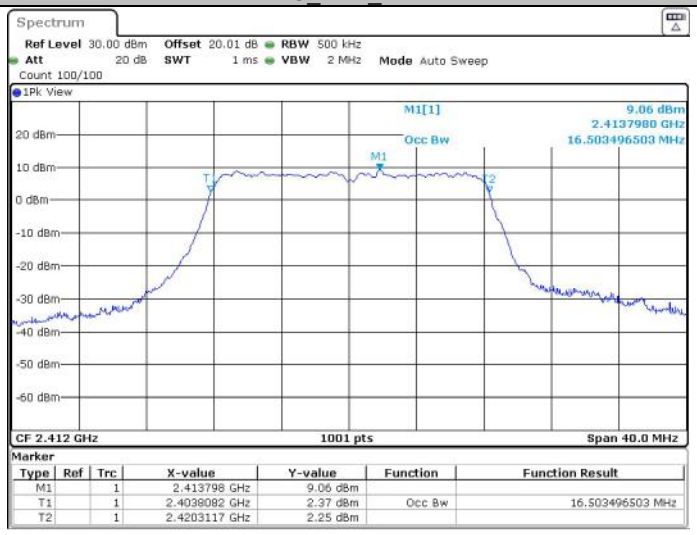

11B_Ant1_2437



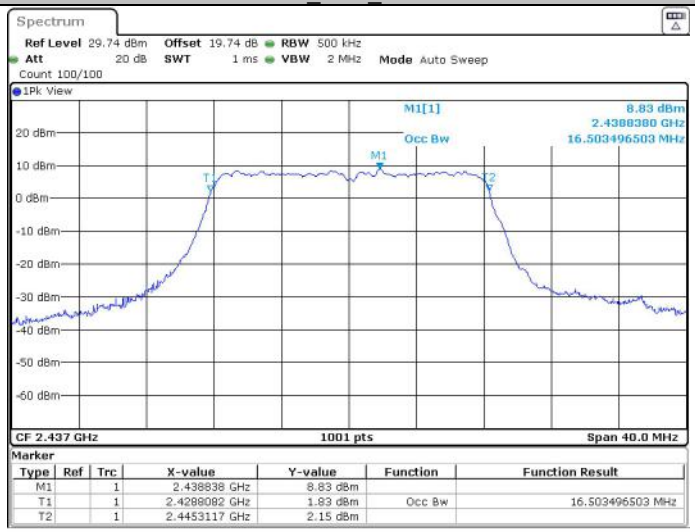
11B_Ant1_2462



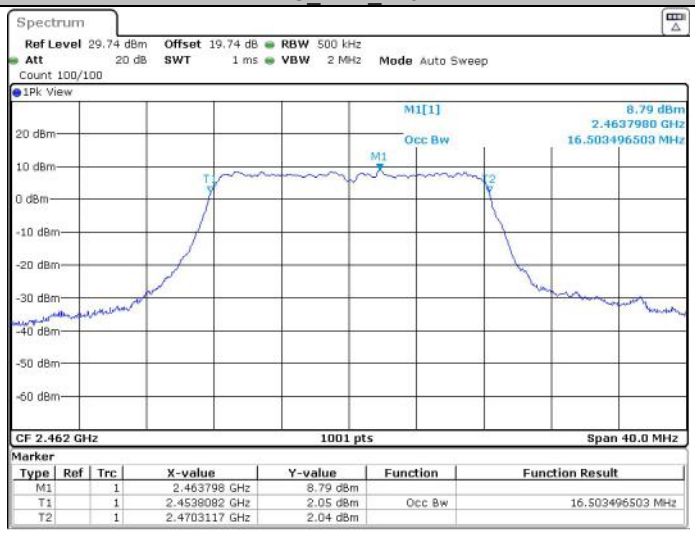

11G_Ant1_2412



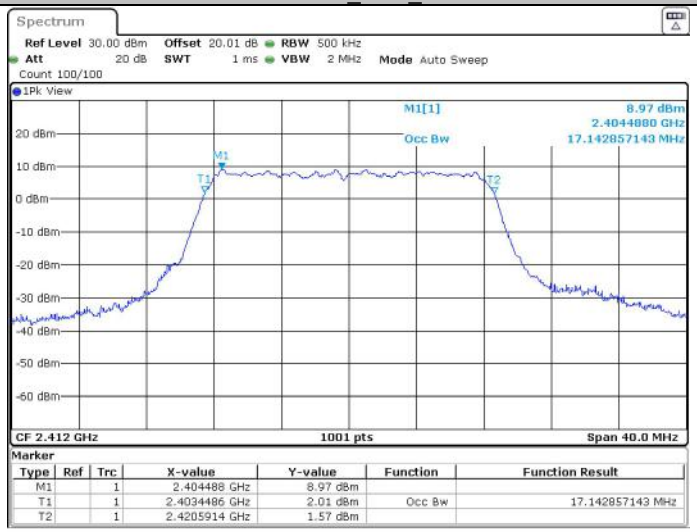
11G_Ant1_2437



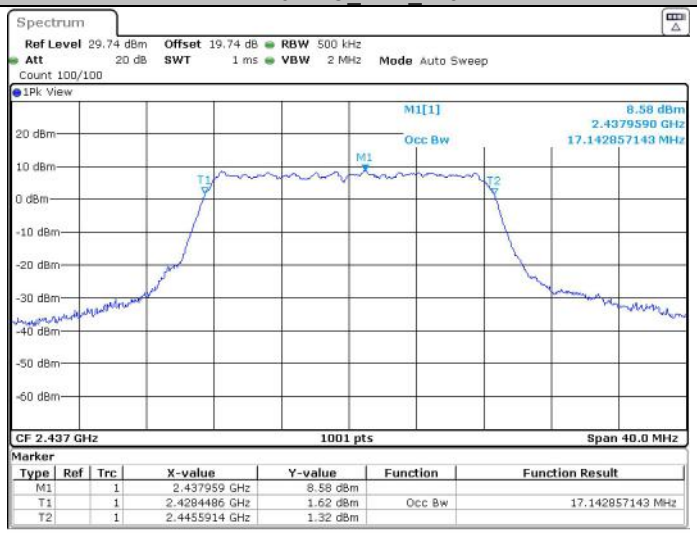

11G_Ant1_2462



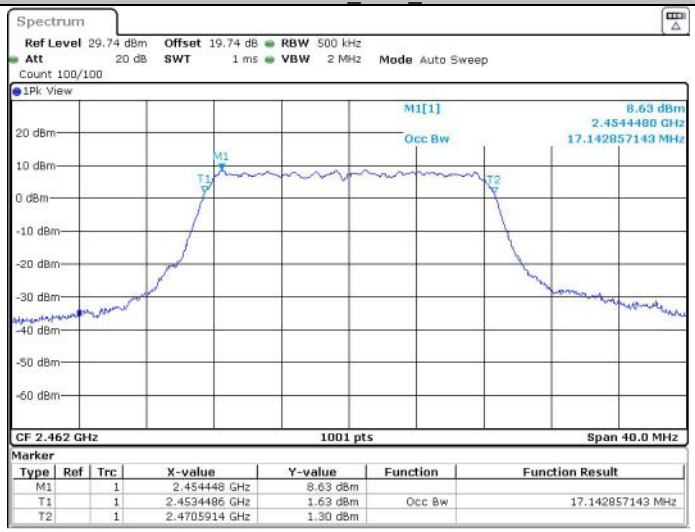
11N20SISO_Ant1_2412



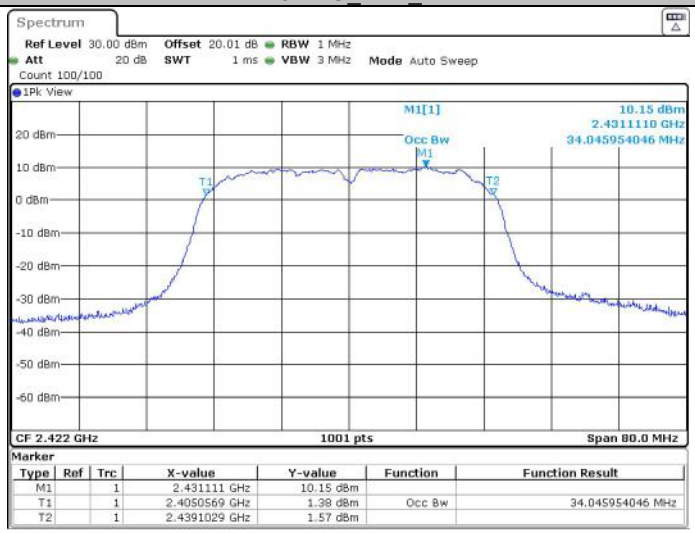

11N20SISO_Ant1_2437



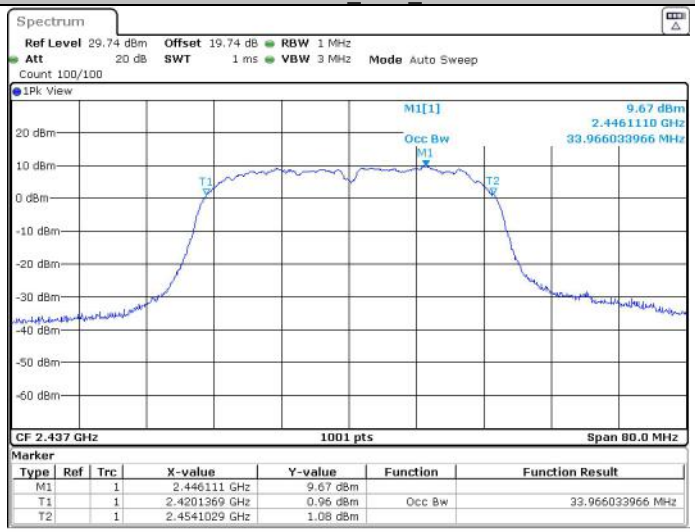
11N20SISO_Ant1_2462



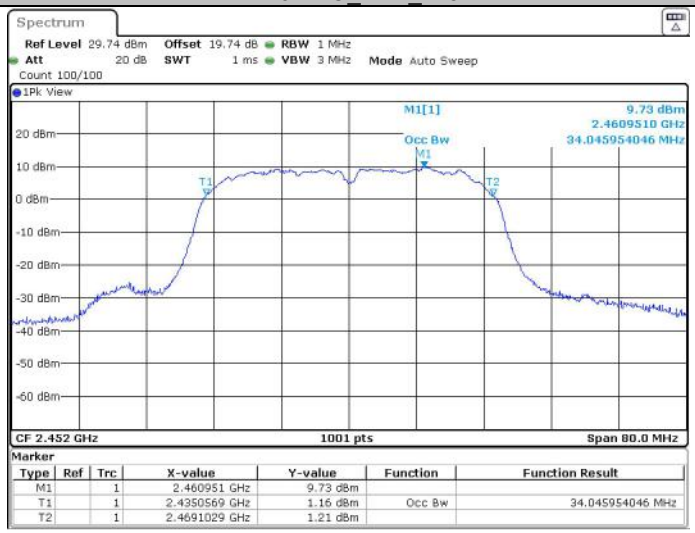

11N40SISO_Ant1_2422



11N40SISO_Ant1_2437




11N40SISO_Ant1_2452



## Appendix C: Maximum conducted output power

### Test Result Average

| Test Mode | Antenna | Frequency[MHz] | AveragePower[dBm] | Conducted Limit[dBm] | Verdict |
|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 12.90 | ≤30.00 | PASS |
| | | 2437 | 12.51 | ≤30.00 | PASS |
| | | 2462 | 12.64 | ≤30.00 | PASS |
| 11G | Ant1 | 2412 | 14.98 | ≤30.00 | PASS |
| | | 2437 | 14.75 | ≤30.00 | PASS |
| | | 2462 | 14.78 | ≤30.00 | PASS |
| 11N20SISO | Ant1 | 2412 | 14.69 | ≤30.00 | PASS |
| | | 2437 | 14.50 | ≤30.00 | PASS |
| | | 2462 | 14.50 | ≤30.00 | PASS |
| 11N40SISO | Ant1 | 2422 | 14.17 | ≤30.00 | PASS |
| | | 2437 | 14.02 | ≤30.00 | PASS |
| | | 2452 | 14.21 | ≤30.00 | PASS |

Note: Antenna Gain is 3.42 dBi, the max. EIRP is 18.4 dBm, the RSS-247 limit is 36dBm

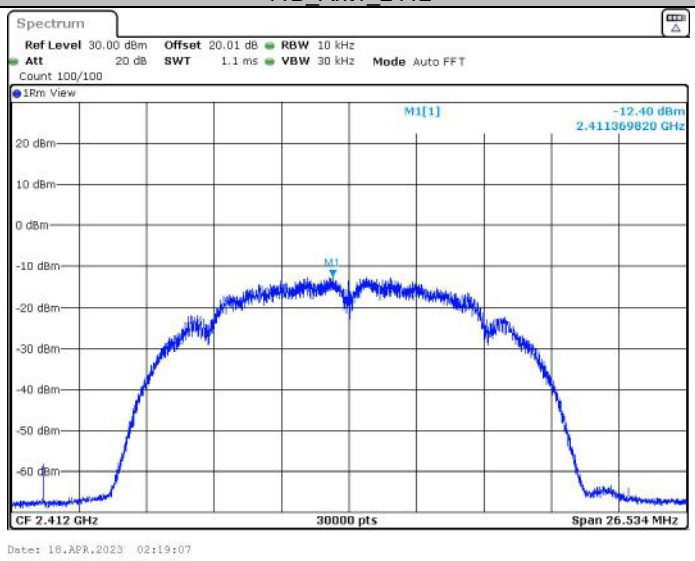
## Appendix D: Maximum power spectral density

### Test Result

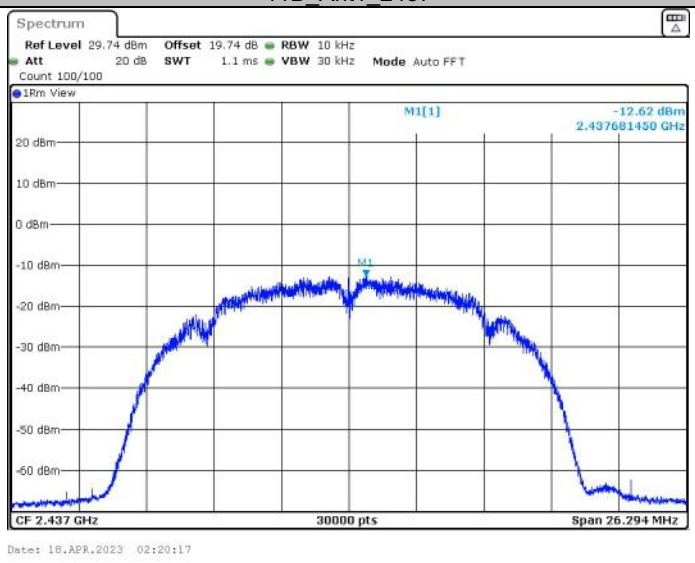
| Test Mode | Antenna | Frequency[MHz] | Result[dBm/10kHz] | Limit[dBm/3kHz] | Verdict |
|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | -12.4 | ≤8.00 | PASS |
| | | 2437 | -12.62 | ≤8.00 | PASS |
| | | 2462 | -12.96 | ≤8.00 | PASS |
| 11G | Ant1 | 2412 | -12.6 | ≤8.00 | PASS |
| | | 2437 | -12.53 | ≤8.00 | PASS |
| | | 2462 | -12.36 | ≤8.00 | PASS |
| 11N20SISO | Ant1 | 2412 | -12.64 | ≤8.00 | PASS |
| | | 2437 | -12.4 | ≤8.00 | PASS |
| | | 2462 | -12.94 | ≤8.00 | PASS |
| 11N40SISO | Ant1 | 2422 | -15.39 | ≤8.00 | PASS |
| | | 2437 | -15.25 | ≤8.00 | PASS |
| | | 2452 | -15.95 | ≤8.00 | PASS |

## Test Graphs

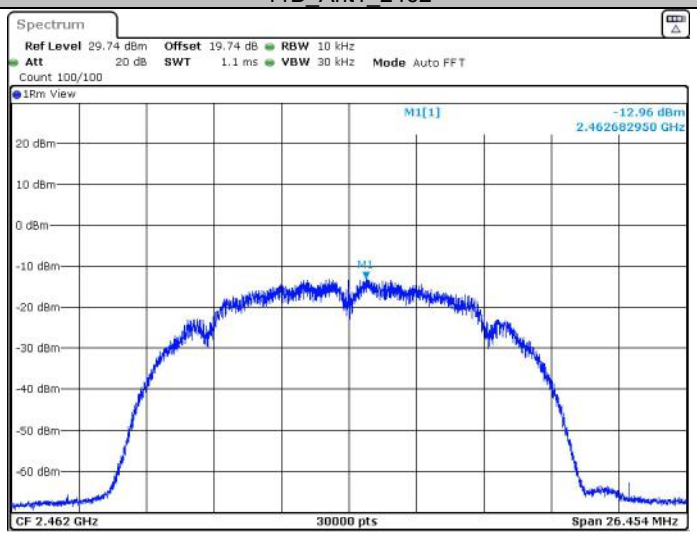
11B_Ant1_2412



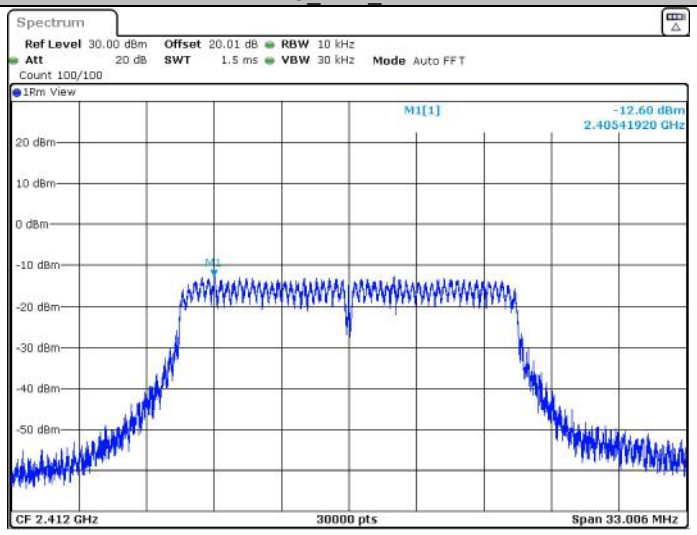

11B_Ant1_2437



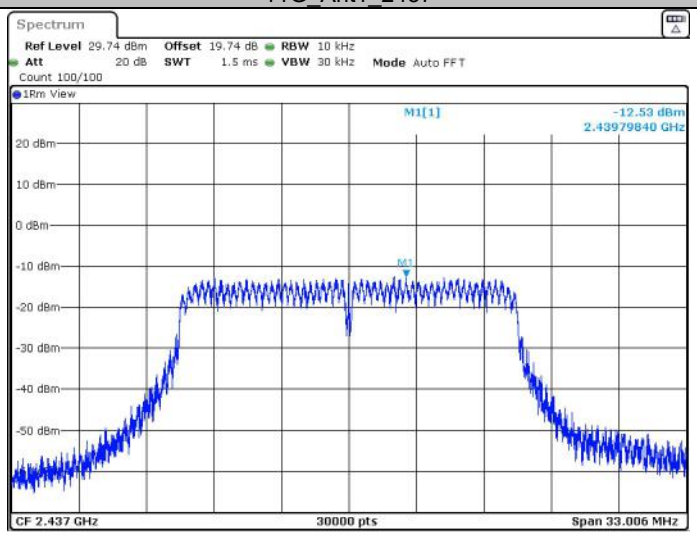
11B_Ant1_2462



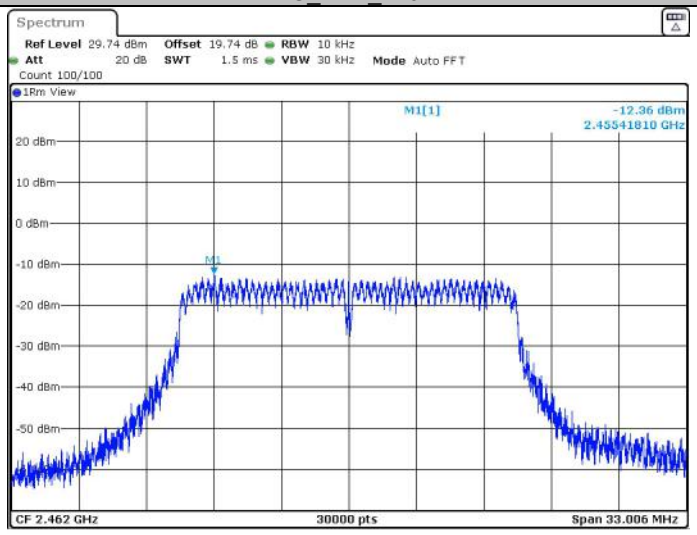

11G_Ant1_2412

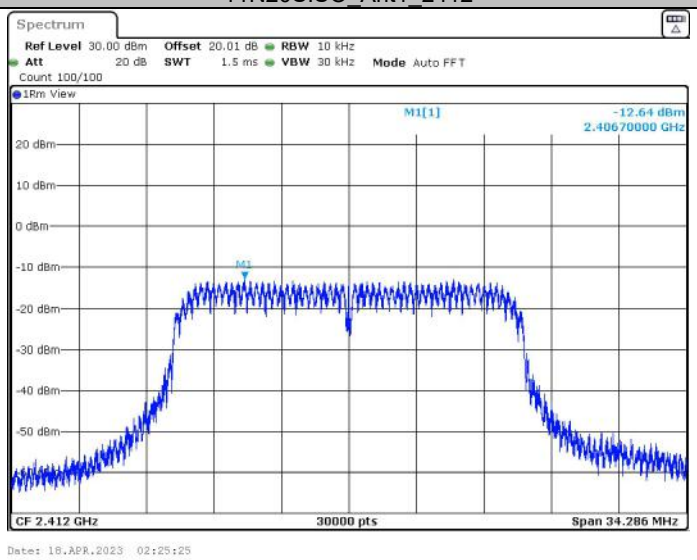
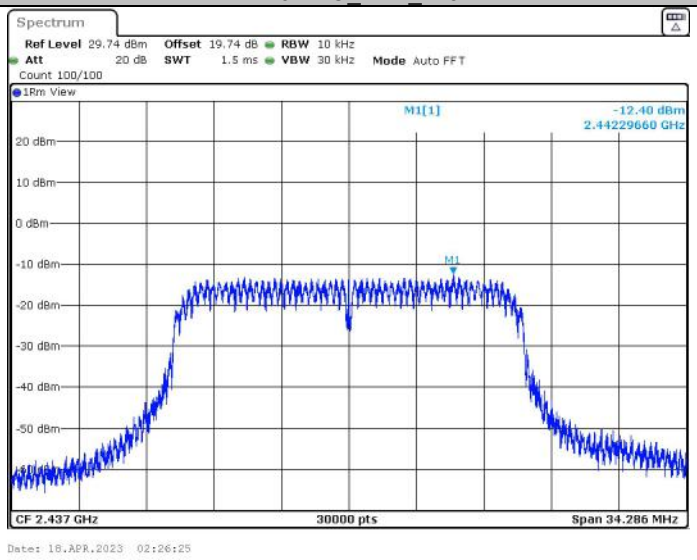


11G_Ant1_2437

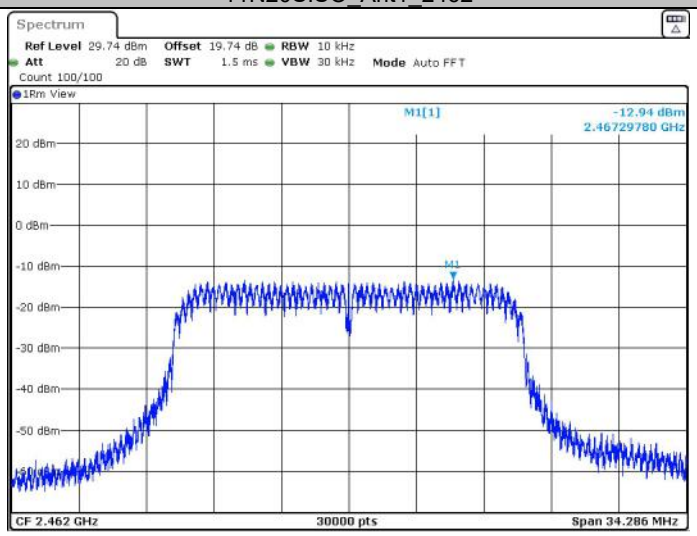



11G_Ant1_2462

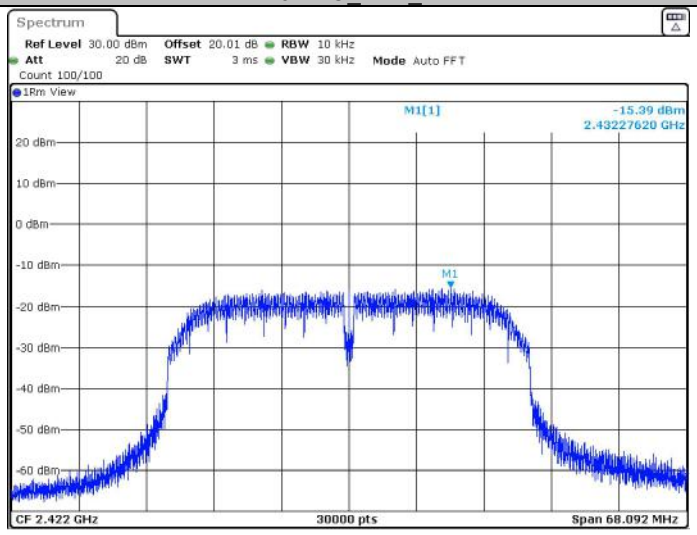


| 11N20SISO_Ant1_2412 |
| --- |
|  |
| 11N20SISO_Ant1_2437 |
|  |

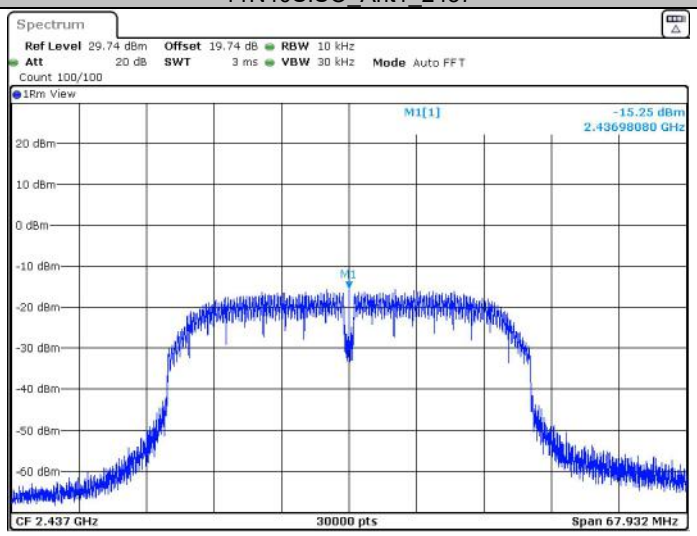
11N20SISO_Ant1_2462



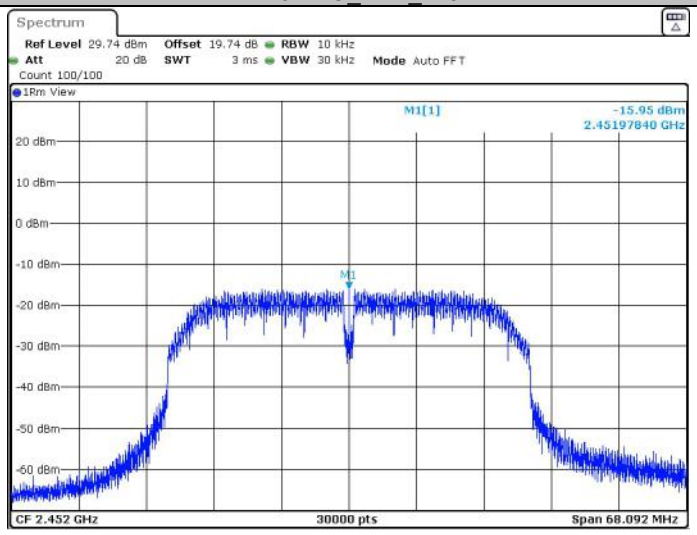

11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



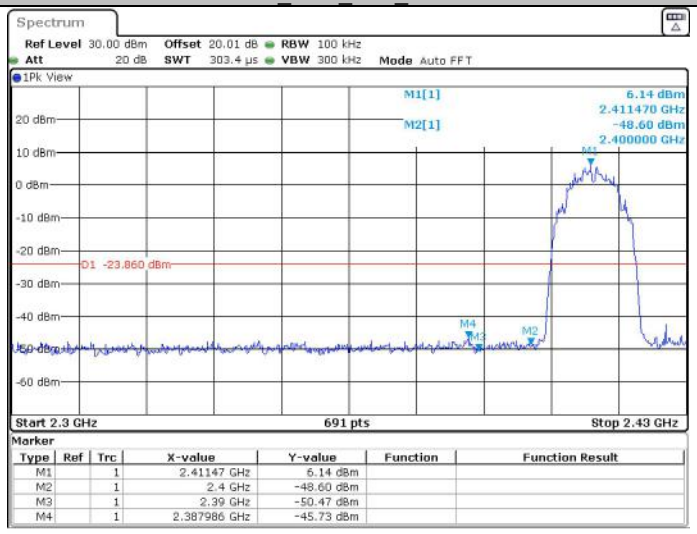

11N40SISO_Ant1_2452



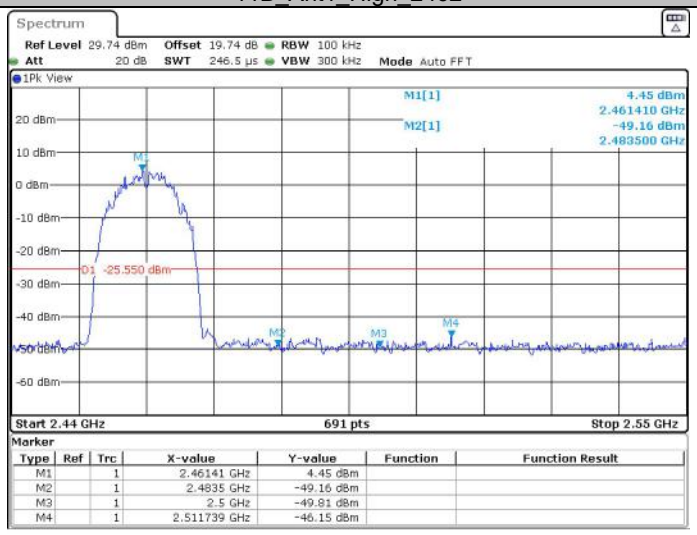
# Appendix E: Band edge measurements

## Test Graphs

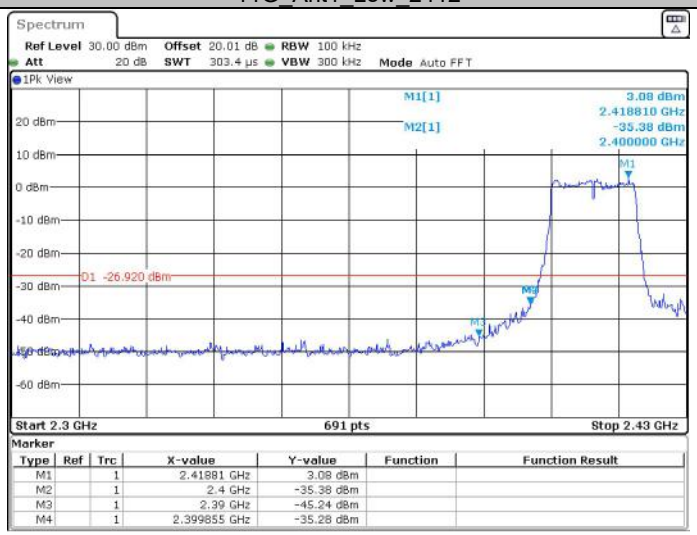
11B_Ant1_Low_2412




11B_Ant1_High_2462

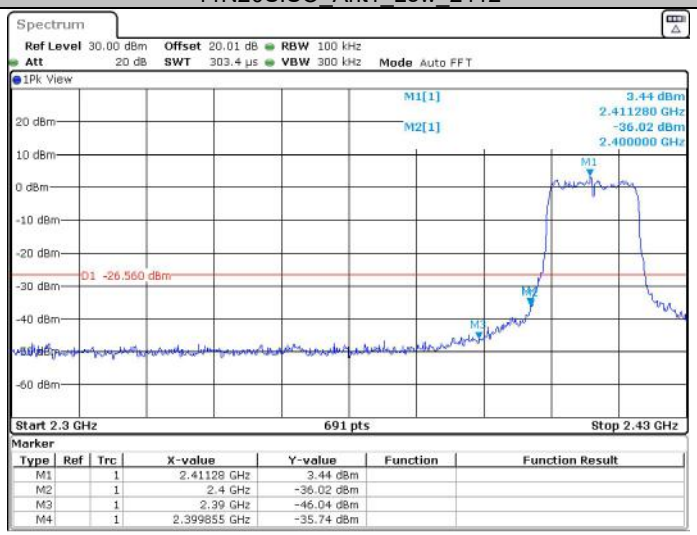


11G_Ant1_Low_2412

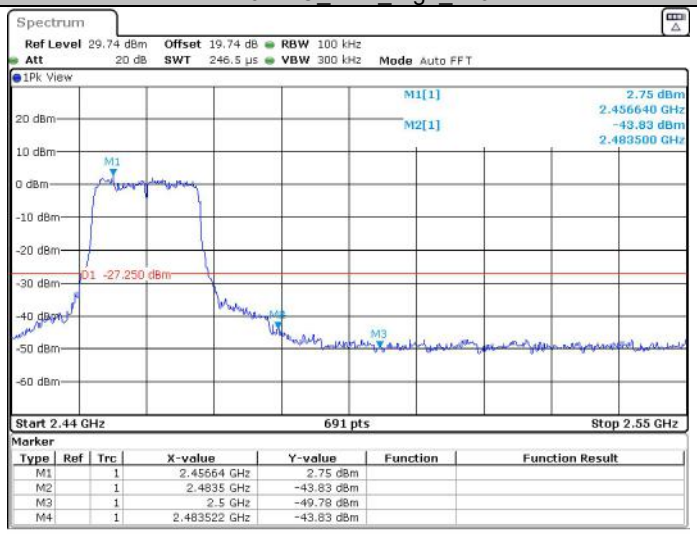



11G_Ant1_High_2462

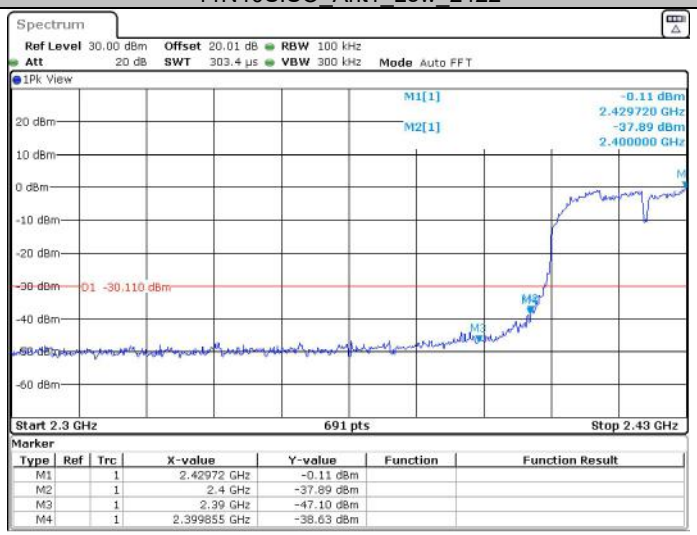
11N20SISO_Ant1_Low_2412



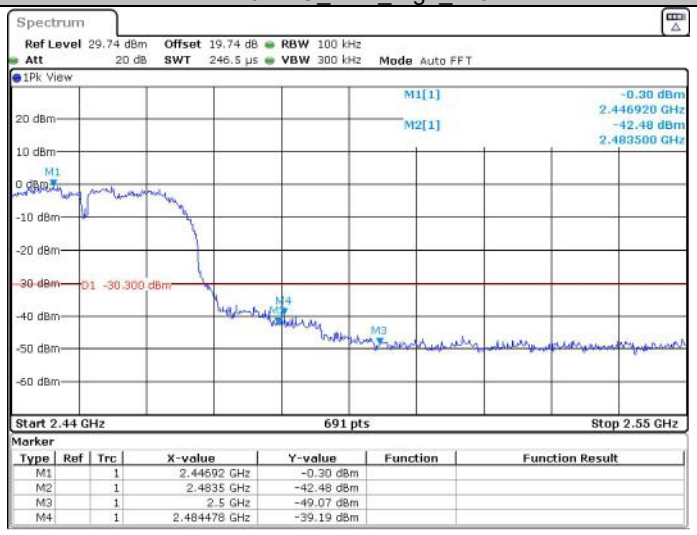

11N20SISO_Ant1_High_2462



11N40SISO_Ant1_Low_2422




11N40SISO_Ant1_High_2452



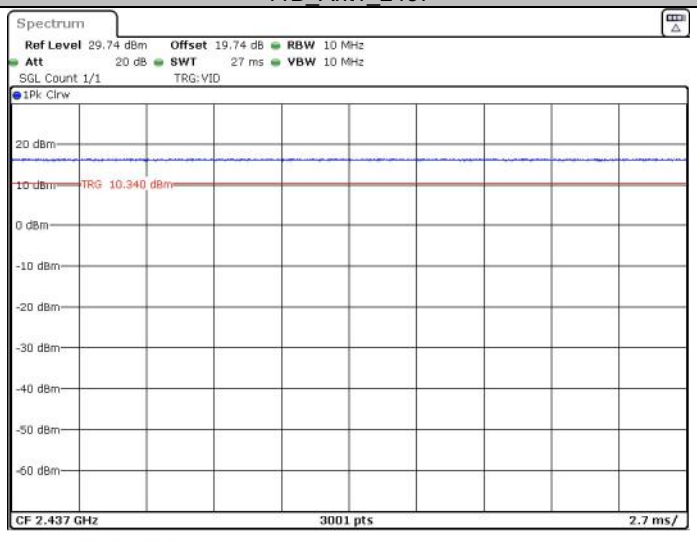
## Appendix F: DutyCycle

### Test Result

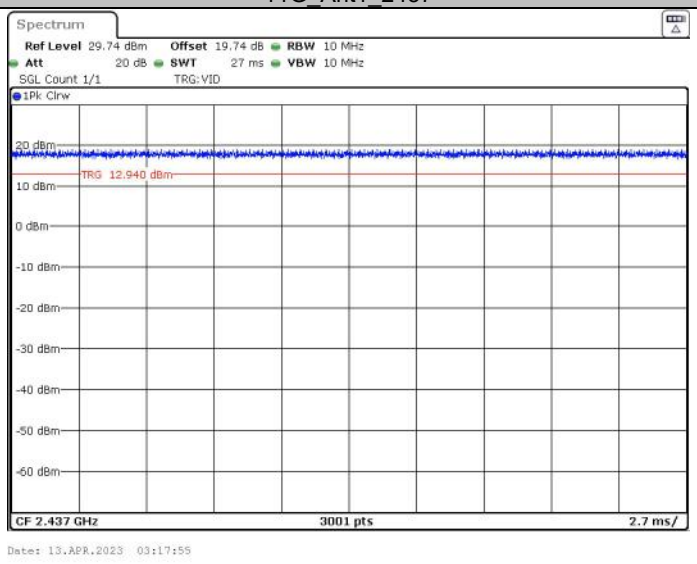
| Test Mode | Antenna | Frequency[MHz] | TransmissionDuration [ms] | Transmission Period [ms] | Duty Cycle [%] |
|---|---|---|---|---|---|
| 11B | Ant1 | 2437 | 27.00 | 27.00 | 100.00 |
| 11G | Ant1 | 2437 | 27.00 | 27.00 | 100.00 |
| 11N20SISO | Ant1 | 2437 | 27.00 | 27.00 | 100.00 |
| 11N40SISO | Ant1 | 2437 | 27.00 | 27.00 | 100.00 |

## Test Graphs

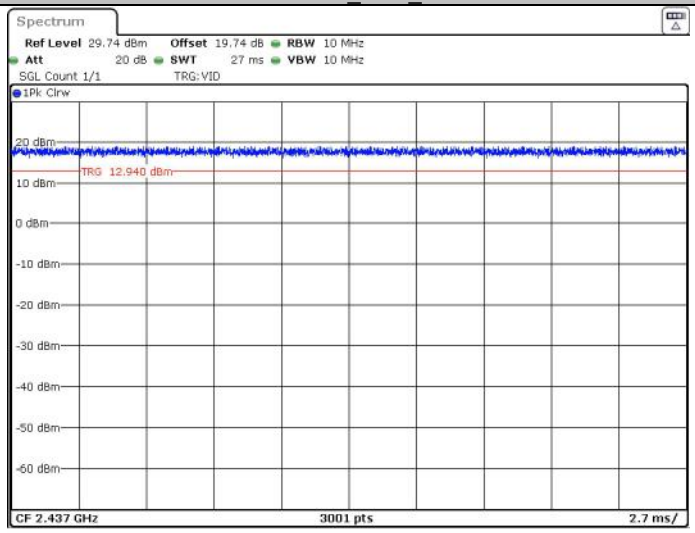
11B_Ant1_2437



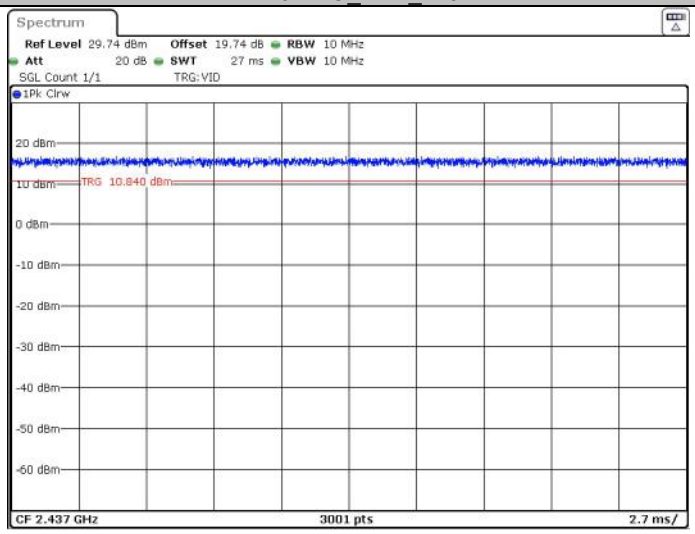

11G_Ant1_2437



11N20SISO_Ant1_2437




11N40SISO_Ant1_2437



# APPENDIX BLE

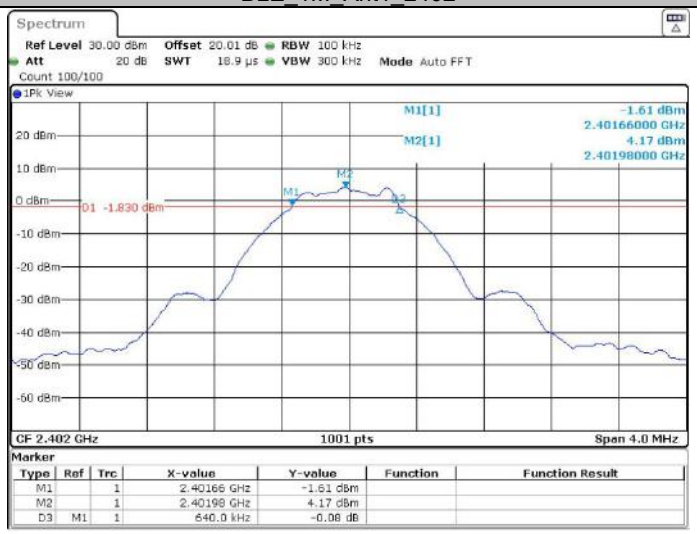
## Appendix A: DTS Bandwidth

### Test Result

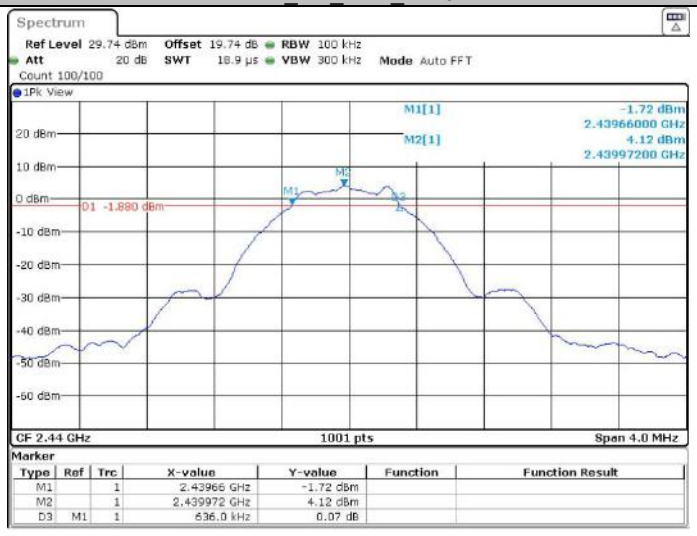
| Test Mode | Antenna | Frequency[MHz] | DTS BW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | 0.64 | 2401.66 | 2402.30 | 0.5 | PASS |
| | | 2440 | 0.64 | 2439.66 | 2440.30 | 0.5 | PASS |
| | | 2480 | 0.64 | 2479.66 | 2480.30 | 0.5 | PASS |

## Test Graphs

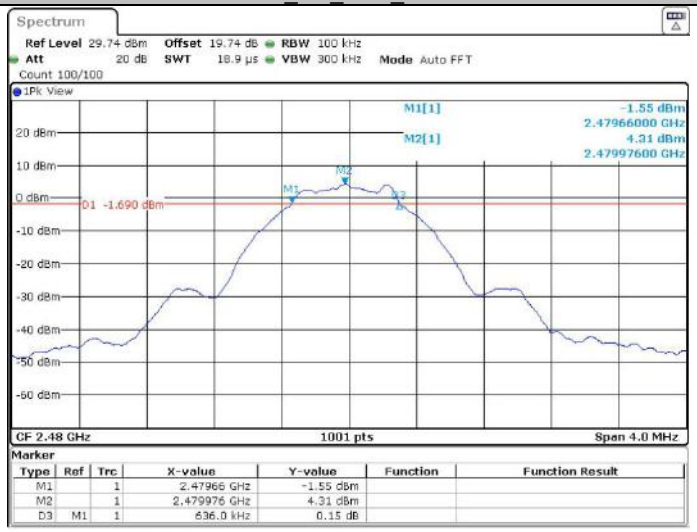
BLE_1M_Ant1_2402




BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



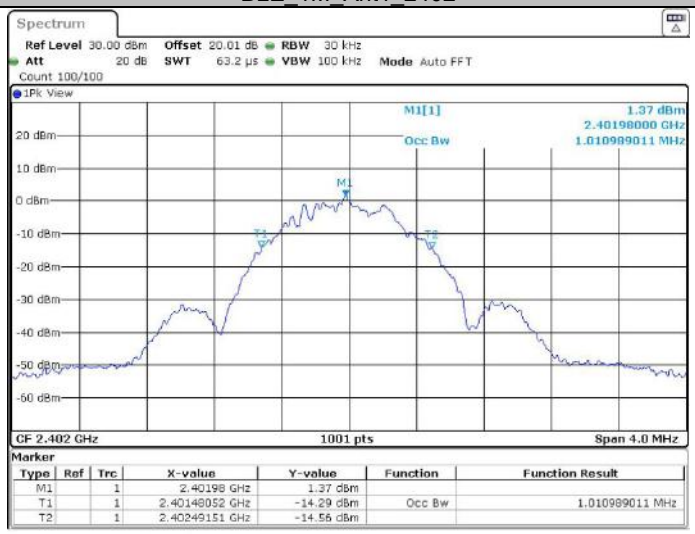
## Appendix B: Occupied Channel Bandwidth

### Test Result

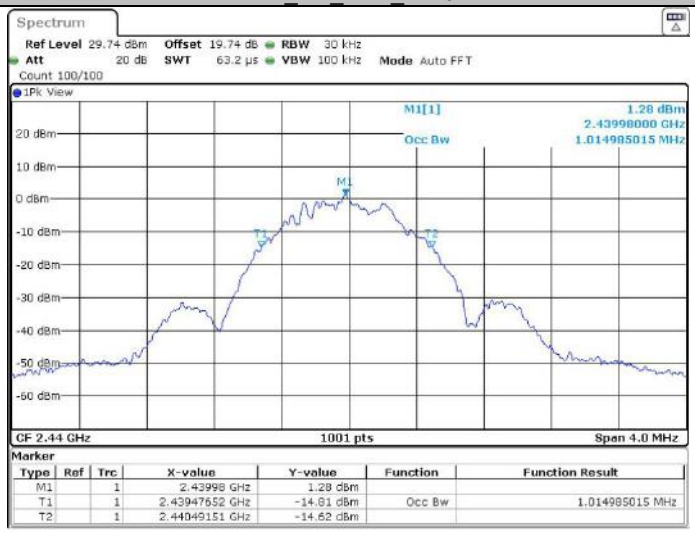
| Test Mode | Antenna | Frequency[MHz] | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | 1.011 | 2401.481 | 2402.492 | --- | --- |
| | | 2440 | 1.015 | 2439.477 | 2440.492 | --- | --- |
| | | 2480 | 1.015 | 2479.477 | 2480.492 | --- | --- |

## Test Graphs

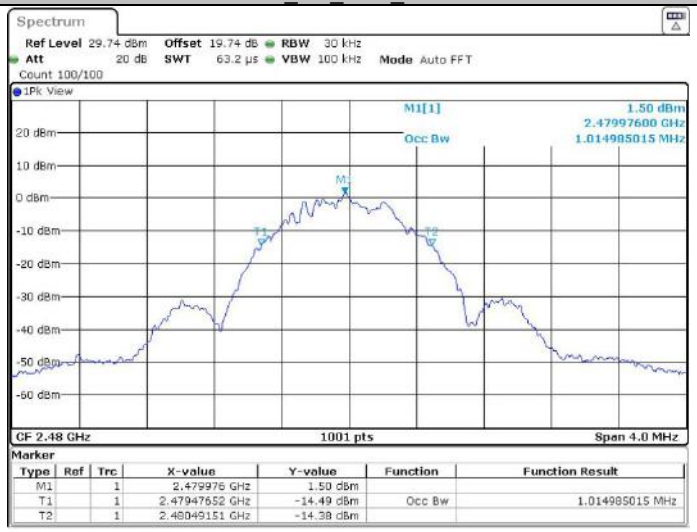
BLE_1M_Ant1_2402




BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



# Appendix C: Maximum conducted output power

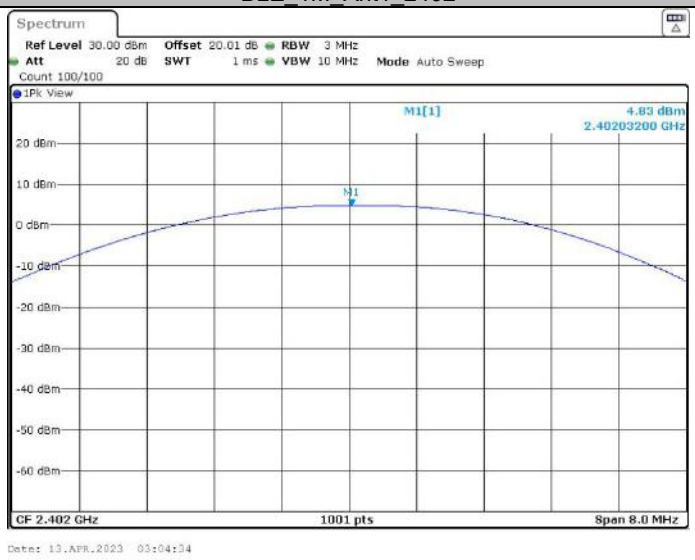
## Test Result Peak

| Test Mode | Antenna | Frequency[MHz] | Conducted Peak Powert[dBm] | Conducted Limit[dBm] | Verdict |
|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | 4.83 | ≤30 | PASS |
| | | 2440 | 5.17 | ≤30 | PASS |
| | | 2480 | 5.33 | ≤30 | PASS |

Note: Antenna Gain is 3.42 dBi, the max. EIRP is 8.75 dBm, the RSS-247 limit is 36dBm

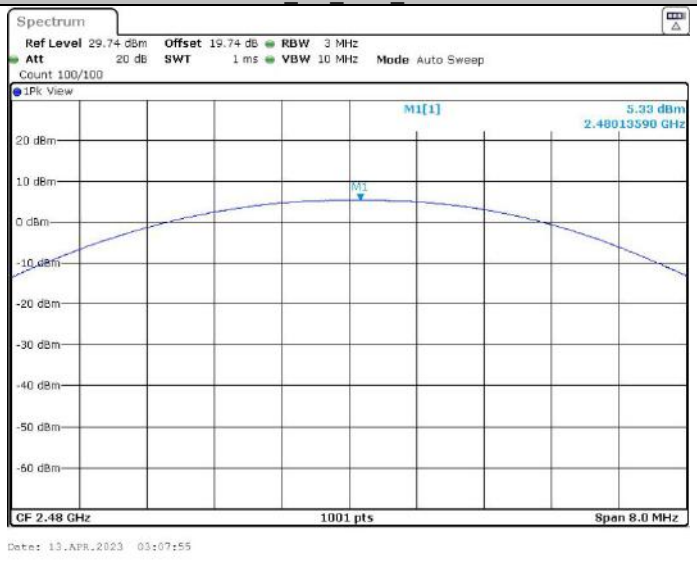
## Test Graphs Peak

BLE_1M_Ant1_2402




BLE_1M_Ant1_2440

BLE_1M_Ant1_2480



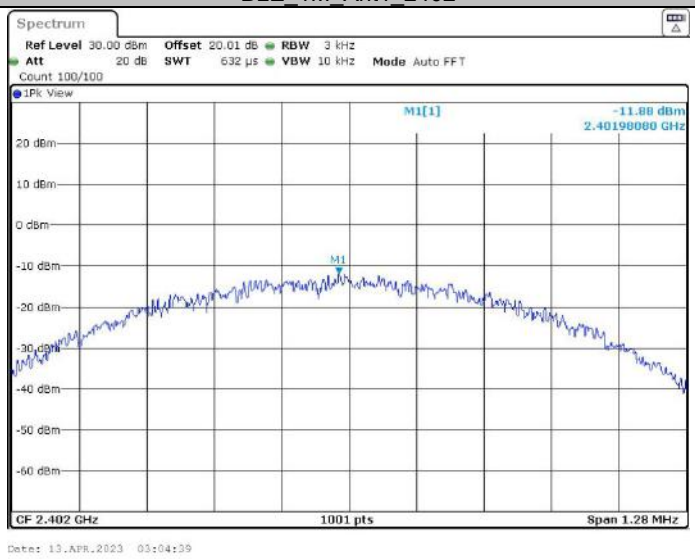
## Appendix D: Maximum power spectral density

### Test Result

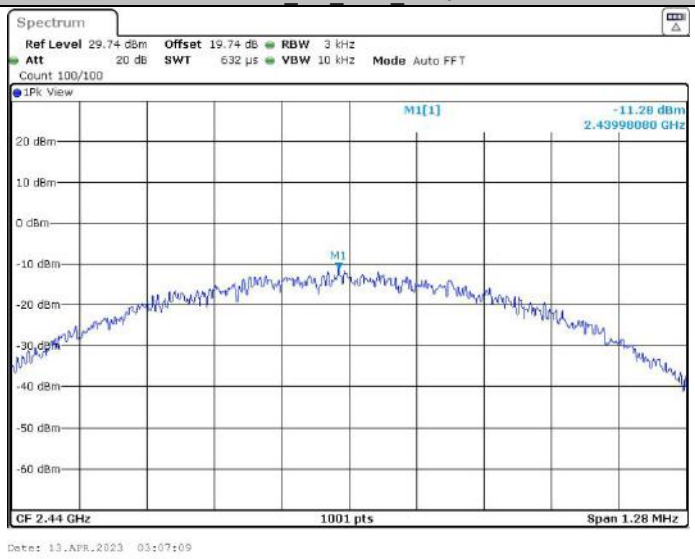
| Test Mode | Antenna | Frequency[MHz] | Result[dBm/3kHz] | Limit[dBm/3kHz] | Verdict |
|---|---|---|---|---|---|
| BLE_1M | Ant1 | 2402 | -11.88 | ≤8.00 | PASS |
| | | 2440 | -11.28 | ≤8.00 | PASS |
| | | 2480 | -10.99 | ≤8.00 | PASS |

## Test Graphs

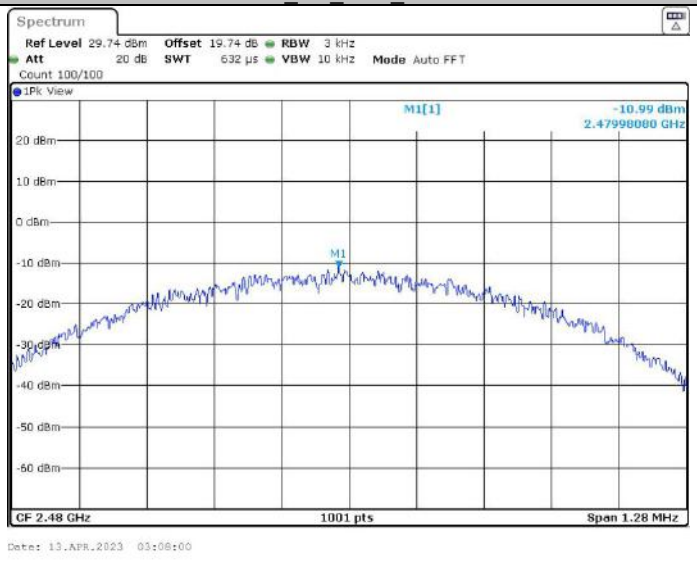
BLE_1M_Ant1_2402




BLE_1M_Ant1_2440



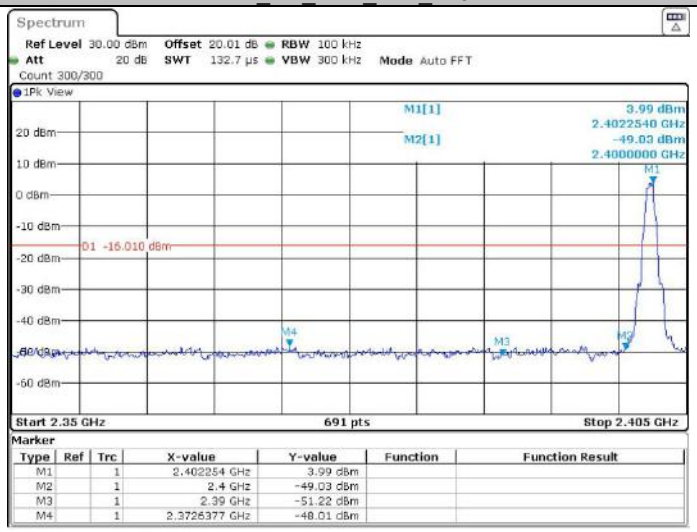
BLE_1M_Ant1_2480



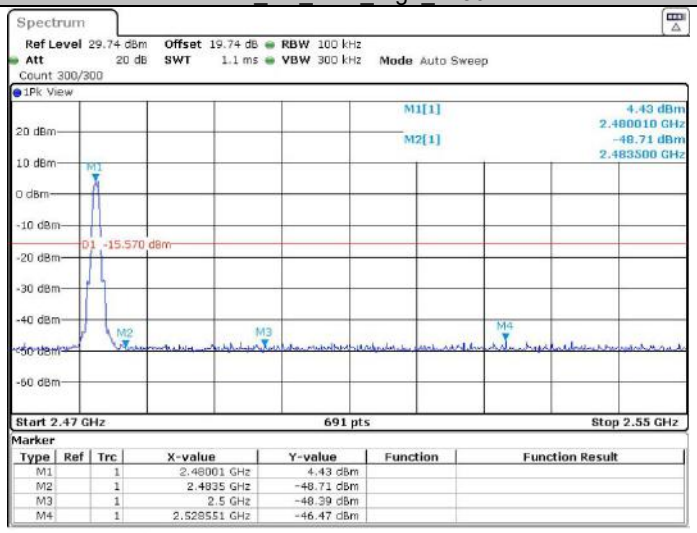
# Appendix E: Band edge measurements

## Test Graphs

BLE_1M_Ant1_Low_2402




BLE_1M_Ant1_High_2480



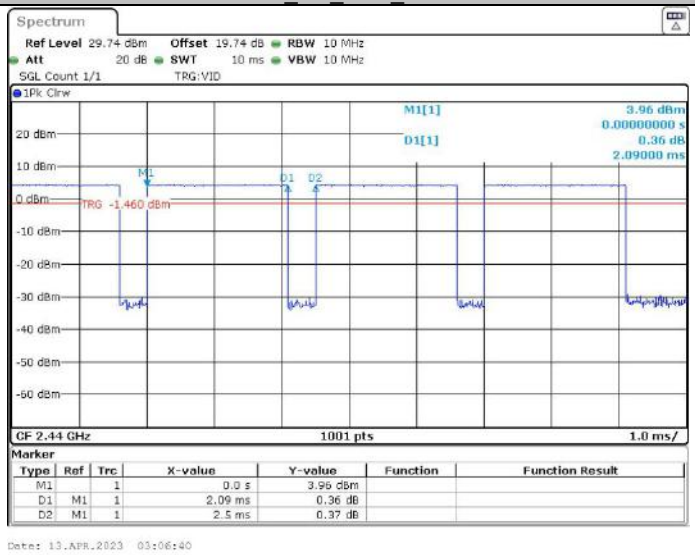
# Appendix F: Duty Cycle

## Test Result

| Test Mode | Frequency[MHz] | ON Time [ms] | Period [ms] | Duty Cycle [%] | Duty Cycle Factor[dB] | 1/T (kHz) | VBW Setting (kHz) |
|---|---|---|---|---|---|---|---|
| BLE_1M | 2440 | 2.09 | 2.50 | 83.60 | 0.78 | 0.48 | 1 |

## Test Graphs

BLE_1M_Ant1_2440




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