

## FCC Part 15.247

## TEST REPORT

For

### M5Stack Technology Co., Ltd

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Street,Nanshan District,Shenzhen,Guangdong,China

**FCC ID: 2AN3WM5ATOMU**

**Report Type:**  
Original Report

**Product Type:**  
M5AtomU

**Report Producer :** Jane Chen

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## Revision History

| Revision | No.          | Report Number    | Issue Date | Description     | Author/<br>Revised by |
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# 1 General Information

## 1.1 Product Description for Equipment under Test (EUT)

|                                    |                                                                                                                                                                                                                                         |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant                          | M5Stack Technology Co., Ltd                                                                                                                                                                                                             |
|                                    | 106,1st Floor, Building 1, Bright Technology Park 88 Zhuguang North Road, XiliTaoyuan Street, Nanshan District, Shenzhen, Guangdong, China                                                                                              |
| Manufacturer                       | M5Stack Technology Co., Ltd                                                                                                                                                                                                             |
|                                    | 106,1st Floor, Building 1, Bright Technology Park 88 Zhuguang North Road, XiliTaoyuan Street, Nanshan District, Shenzhen, Guangdong, China                                                                                              |
| Brand(Trade) Name                  | M5Stack                                                                                                                                                                                                                                 |
| Product (Equipment)                | M5AtomU                                                                                                                                                                                                                                 |
| Main Model Name                    | AtomU                                                                                                                                                                                                                                   |
| Series Model Name                  | BoksLINK                                                                                                                                                                                                                                |
| Model Discrepancy                  | The major electrical and mechanical constructions of series models are identical to the basic model, except interfaces. The model, AtomU is the testing sample, and the final test data are shown on this test report.                  |
| Frequency Range                    | IEEE 802.11b/g /IEEE 802.11n HT20 Mode: 2412 ~ 2462 MHz<br>IEEE 802.11n HT40 Mode: 2422 ~ 2452 MHz<br>BLE(1M): 2402 ~ 2480 MHz                                                                                                          |
| Transmit Power                     | IEEE 802.11b Mode: 9.47 dBm<br>IEEE 802.11g Mode: 9.42 dBm<br>IEEE 802.11n HT20 Mode: 9.31 dBm<br>IEEE 802.11n HT40 Mode: 9.48 dBm<br>BLE(1M) Mode : 9.24 dBm                                                                           |
| Modulation Technique               | IEEE 802.11b Mode: DSSS<br>IEEE 802.11g/ n HT20/ n HT40 Mode: OFDM<br>BLE(1M) Mode: GFSK                                                                                                                                                |
| Power Operation<br>(Voltage Range) | <input type="checkbox"/> AC Type<br><input type="checkbox"/> Adapter<br><input type="checkbox"/> By AC Power Cord<br><input type="checkbox"/> PoE                                                                                       |
|                                    | <input checked="" type="checkbox"/> DC 5V<br><input type="checkbox"/> Battery<br><input type="checkbox"/> DC Power Supply<br><input checked="" type="checkbox"/> External from USB Port<br><input type="checkbox"/> External DC Adapter |
|                                    | <input type="checkbox"/> Host System                                                                                                                                                                                                    |
|                                    |                                                                                                                                                                                                                                         |
| Received Date                      | Dec. 14, 2021                                                                                                                                                                                                                           |
| Date of Test                       | Dec. 26, 2021 ~ Feb. 8, 2022                                                                                                                                                                                                            |

\*All measurement and test data in this report was gathered from production sample serial number:

RXZ211213004-01 (Assigned by BACL (New Taipei Laboratory)).

## **1.2 Objective**

This report is prepared on behalf of *M5Stack Technology Co., Ltd* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

## **1.3 Related Submittal(s)/Grant(s)**

FCC Part 15.247 DSS submissions with FCC ID: 2AN3WM5ATOMU

## **1.4 Test Methodology**

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices  
KDB 558074 D01 15.247 Meas Guidance v05r02

## **1.5 Statement of Compliance**

Decision Rule: No, (The test results do not include MU judgment)

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Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

**1.6 Measurement Uncertainty**

| Parameter                         |               | Uncertainty  |
|-----------------------------------|---------------|--------------|
| AC Mains                          |               | +/- 2.36 dB  |
| RF output power, conducted        |               | +/- 0.93 dB  |
| Power Spectral Density, conducted |               | +/- 0.93 dBm |
| Occupied Bandwidth                |               | +/- 0.35 MHz |
| Unwanted Emissions, conducted     |               | +/- 1.69 dBm |
| Emissions, radiated               | 30 MHz~1GHz   | +/- 5.22 dB  |
|                                   | 1 GHz~18 GHz  | +/- 6.12 dB  |
|                                   | 18 GHz~40 GHz | +/- 4.99 dB  |
| Temperature                       |               | +/- 1.27 °C  |
| Humidity                          |               | +/- 3 %      |

**1.7 Environmental Conditions**

| Test Site                                | Test Data             | Temperature (°C) | Relative Humidity (%) | ATM Pressure (hPa) | Test Engineer |
|------------------------------------------|-----------------------|------------------|-----------------------|--------------------|---------------|
| AC Line Conducted Emissions              | 2022/1/10             | 19.6             | 53                    | 1010               | David         |
| Radiation Spurious Emissions             | 2022/1/7~2022/2/8     | 19.2~21.9        | 60~68                 | 1010               | Aaron         |
| Conducted Spurious Emissions             | 2021/12/26~2021/12/27 | 22.1~22.3        | 44~47                 | 1010               | Howard        |
| 6 dB Emission Bandwidth                  | 2021/12/26~2021/12/27 | 22.1~22.3        | 44~47                 | 1010               | Howard        |
| Maximum Output Power                     | 2021/12/26~2021/12/27 | 22.1~22.3        | 44~47                 | 1010               | Howard        |
| 100 kHz Bandwidth of Frequency Band Edge | 2021/12/26~2021/12/27 | 22.1~22.3        | 44~47                 | 1010               | Howard        |
| Power Spectral Density                   | 2021/12/26~2021/12/27 | 22.1~22.3        | 44~47                 | 1010               | Howard        |

**1.8 Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) to collect test data is located on

☒ 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3732) and the FCC designation No.TW3732 under the Mutual Recognition Agreement (MRA) in FCC Test.

## 2 System Test Configuration

### 2.1 Description of Test Configuration

For WIFI 2.4G mode, there are totally 11 channels.

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

For 802.11 b/g/n20 Modes were tested with channel 1, 6 and 11.

For 802.11n40 Mode were tested with channel 3, 6 and 9.

For BLE mode, there are totally 40 channels.

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 0       | 2402            | 20      | 2442            |
| 1       | 2404            | --      | --              |
| 2       | 2406            | --      | --              |
| 3       | 2408            | 37      | 2476            |
| --      | --              | 38      | 2478            |
| 19      | 2440            | 39      | 2480            |

For BLE Modes were tested with channel 0, 19 and 39.

The system was configured for testing in engineering mode, which was provided by manufacturer.

### 2.2 Equipment Modifications

No modification was made to the EUT.

### 2.3 EUT Exercise Software

The test software was used “QATol\_Dbg v1.0”

| Test Frequency      |          | Low | Mid | High |
|---------------------|----------|-----|-----|------|
| Power Level Setting | B Mode   | 64  | 64  | 64   |
|                     | G Mode   | 60  | 60  | 60   |
|                     | N20 Mode | 60  | 60  | 60   |
|                     | N40 Mode | 60  | 60  | 60   |
|                     | BLE 1M   | 8   | 8   | 8    |

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

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

802.11b: 1Mbps

802.11g: 6Mbps

802.11n HT20: MCS0

802.11n HT40: MCS0

BLE 1M : 1 Mbps

## 2.4 Test Mode

Model: AtomU for all test item.

## 2.5 Support Equipment List and Details

| Description | Manufacturer | Model Number | S/N     |
|-------------|--------------|--------------|---------|
| NB          | DELL         | E6410        | 8N7PXN1 |

## 2.6 External Cable List and Details

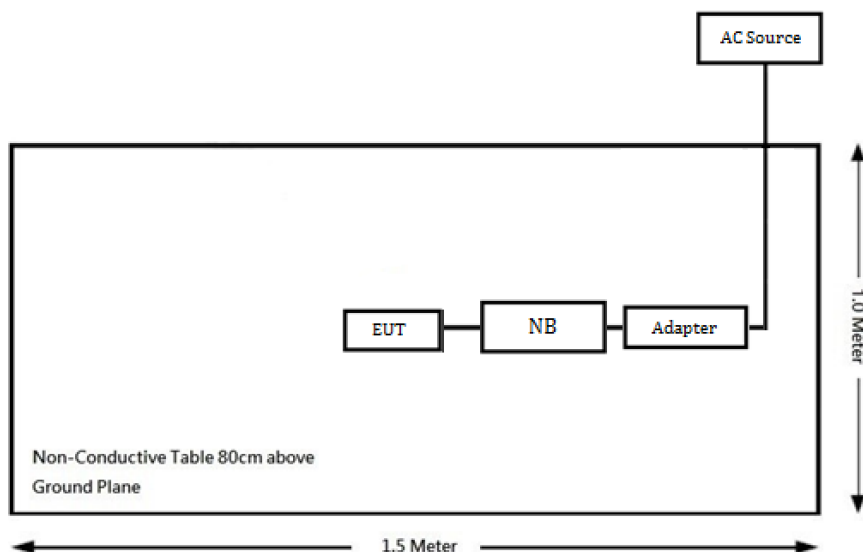
| Cable Description   | Length (m) | From | To |
|---------------------|------------|------|----|
| USB extension cable | 1.5        | EUT  | NB |

## 2.7 Block Diagram of Test Setup

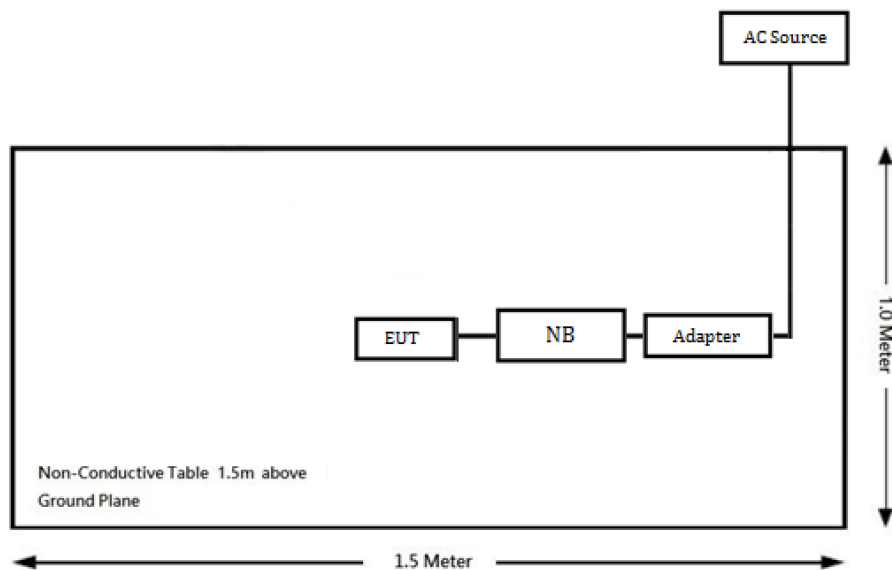
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

### Radiation:

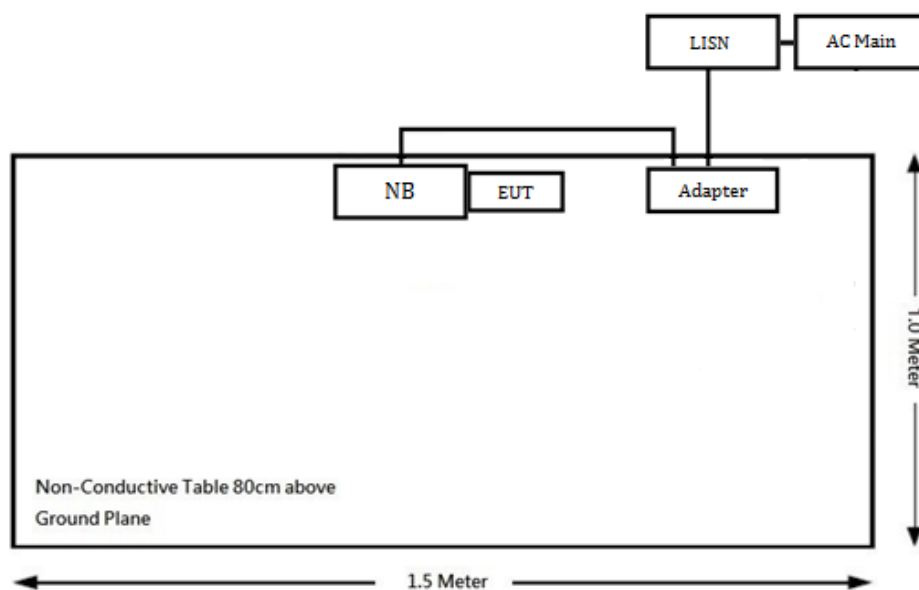
Below 1GHz:



Above 1GHz:



Conduction:



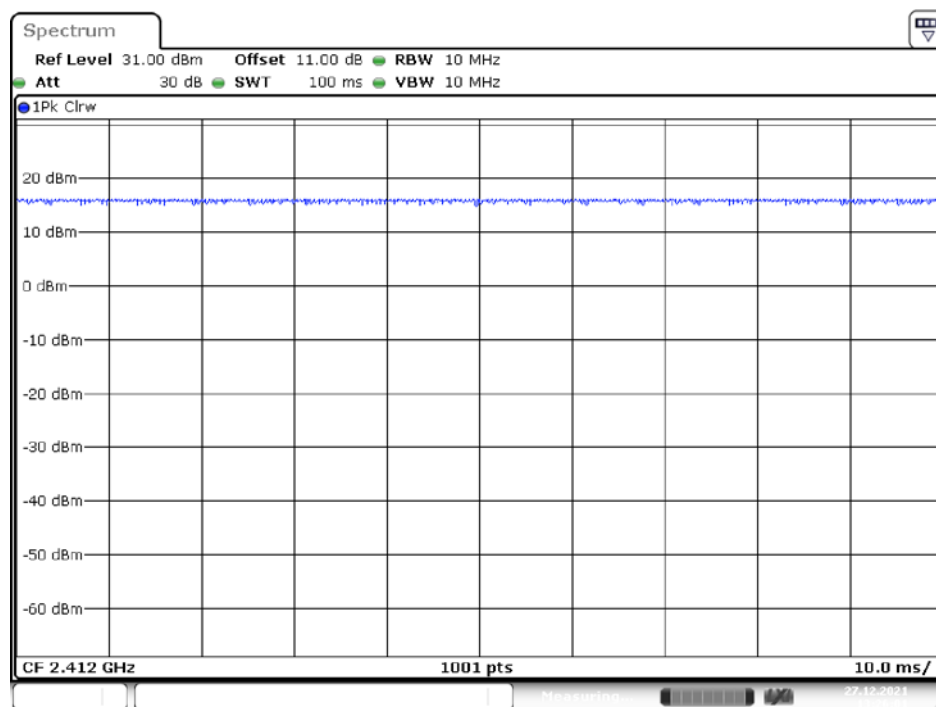
## 2.8 Duty Cycle

The duty cycle as below:

| Radio Mode | T <sub>on</sub><br>(ms) | T <sub>on</sub> +T <sub>off</sub><br>(ms) | Duty Cycle<br>(%) |
|------------|-------------------------|-------------------------------------------|-------------------|
| 802.11b    | /                       | /                                         | 100               |
| 802.11g    | /                       | /                                         | 100               |
| 802.11n20  | /                       | /                                         | 100               |
| 802.11n40  | /                       | /                                         | 100               |
| BLE(1M)    | 2.09                    | 2.5                                       | 84                |

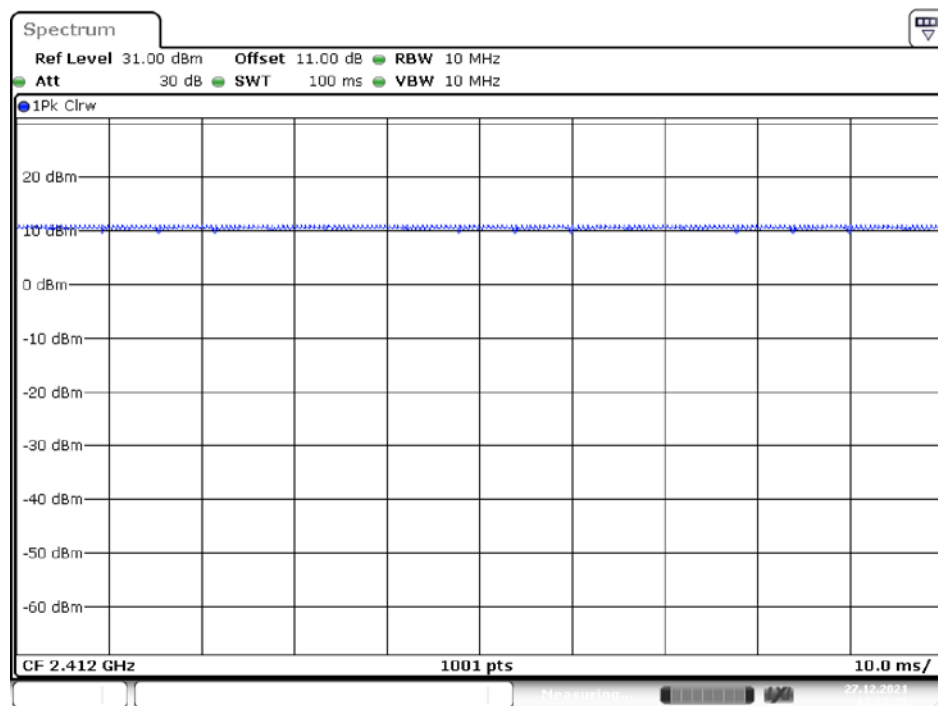
Please refer to the following plots.

### B Mode



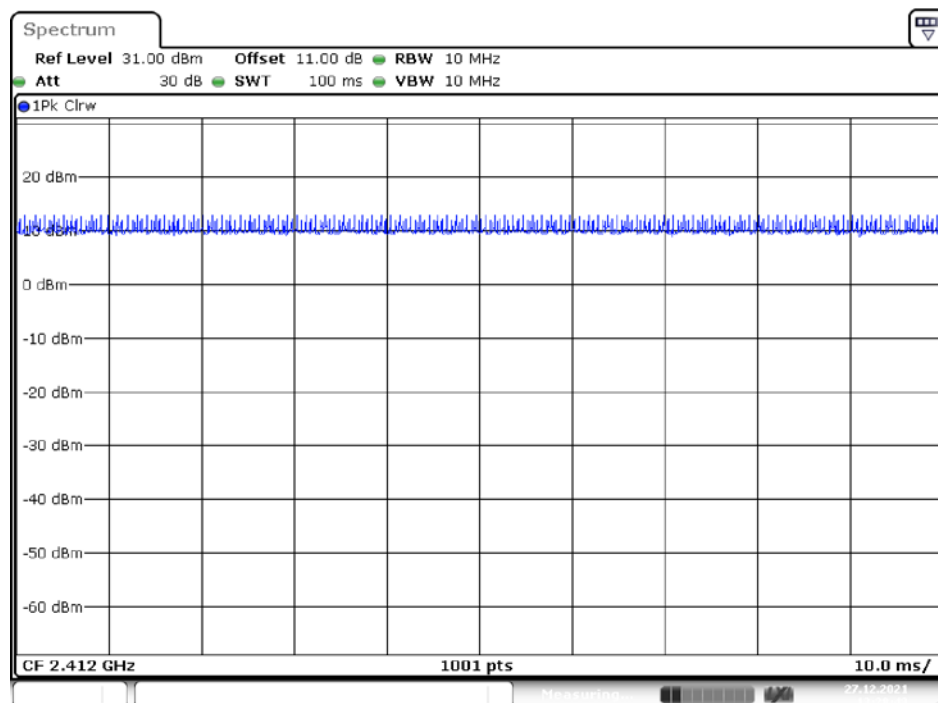
Date: 27.DEC.2021 13:26:01

## G Mode



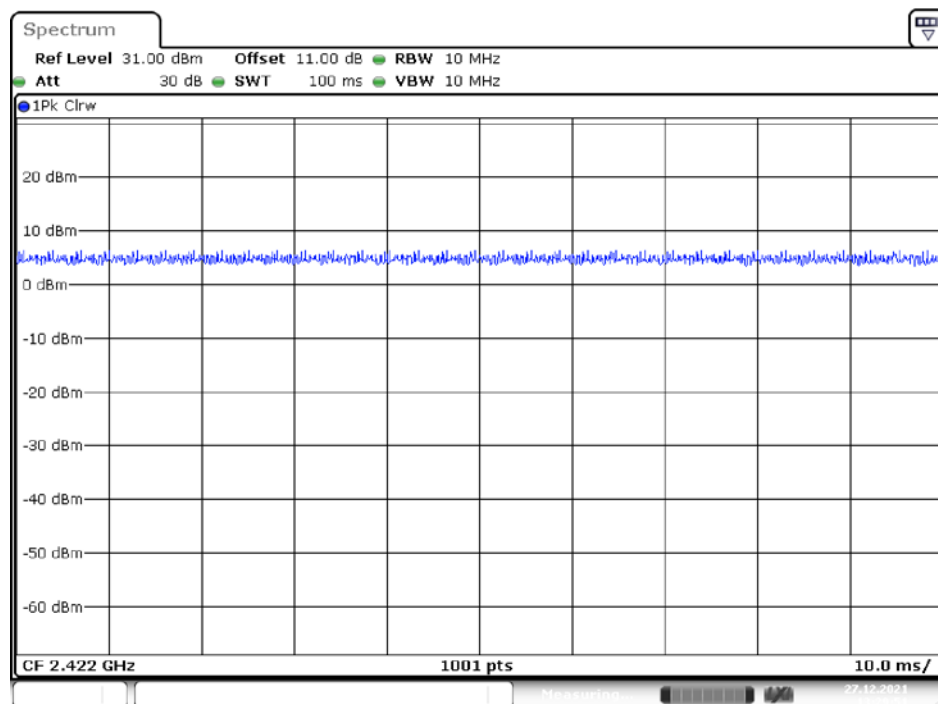
Date: 27.DEC.2021 13:27:29

## N20 Mode



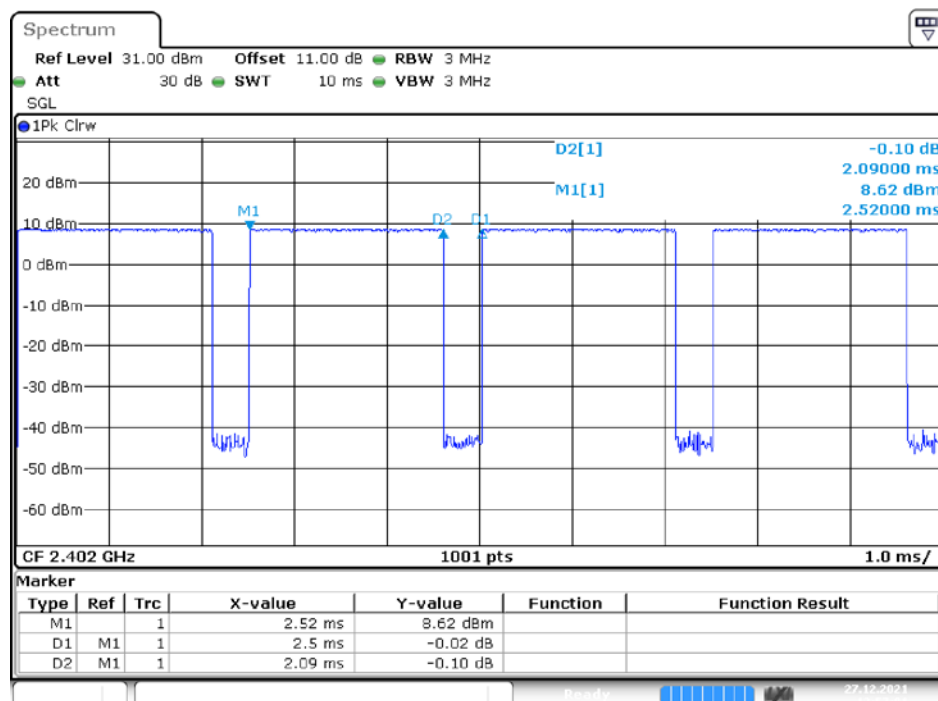
Date: 27.DEC.2021 13:28:43

# N40 Mode



Date: 27.DEC.2021 13:29:51

# BLE(1M) Mode



Date: 27.DEC.2021 13:57:01

### 3 Summary of Test Results

| FCC Rules                    | Description of Test                      | Results    |
|------------------------------|------------------------------------------|------------|
| §15.247(i), §1.1310, §2.1093 | RF Exposure                              | Compliance |
| §15.203                      | Antenna Requirement                      | Compliance |
| §15.207(a)                   | AC Line Conducted Emissions              | Compliance |
| §15.205, §15.209, §15.247(d) | Spurious Emissions                       | Compliance |
| §15.247(a)(2)                | 6 dB Emission Bandwidth                  | Compliance |
| §15.247(b)(3)                | Maximum Peak Output Power                | Compliance |
| §15.247(d)                   | 100 kHz Bandwidth of Frequency Band Edge | Compliance |
| §15.247(e)                   | Power Spectral Density                   | Compliance |

#### 4 Test Equipment List and Details

| Description                        | Manufacturer                   | Model                    | Serial Number    | Calibration Date | Calibration Due Date |
|------------------------------------|--------------------------------|--------------------------|------------------|------------------|----------------------|
| AC Line Conduction Room (CON-A)    |                                |                          |                  |                  |                      |
| LISN                               | Rohde & Schwarz                | ENV216                   | 101248           | 2021/6/8         | 2022/6/7             |
| EMI Test Receiver                  | Rohde & Schwarz                | ESW8                     | 100947           | 2021/7/23        | 2022/7/22            |
| Pulse Limiter                      | Rohde & Schwarz                | ESH3Z2                   | TXZEM104         | 2021/7/29        | 2022/7/28            |
| RF Cable                           | EMEC                           | EM-CB5D                  | 1                | 2021/6/11        | 2022/6/10            |
| Software                           | AUDIX                          | E3                       | V9.150826k       | N.C.R            | N.C.R                |
| Radiated Room (966-A)              |                                |                          |                  |                  |                      |
| Bilog Antenna with 6 dB Attenuator | SUNOL SCIENCES & MINI-CIRCUITS | JB6/UNAT-6+              | A050115/15542_01 | 2021/1/19        | 2022/1/18            |
| EMI Test Receiver                  | Rohde & Schwarz                | ESR7                     | 101419           | 2021/11/9        | 2022/11/8            |
| Horn Antenna                       | EMCO                           | SAS-571                  | 1020             | 2021/4/23        | 2022/4/22            |
| Horn Antenna                       | ETS-Lindgren                   | 3116                     | 62638            | 2021/8/11        | 2022/8/10            |
| Preamplifier                       | Sonoma                         | 310N                     | 130602           | 2021/6/8         | 2022/6/7             |
| Microwave Preamplifier             | EM Electronics Corporation     | EM18G40G                 | 60656            | 2021/12/22       | 2022/12/21           |
| Preamplifier                       | A.H. system Inc.               | PAM-0118P                | 470              | 2021/3/15        | 2022/3/14            |
| Spectrum Analyzer                  | Rohde & Schwarz                | FSV40                    | 101204           | 2021/06/10       | 2022/06/09           |
| Micro flex Cable                   | UTIFLEX                        | UFB197C-1-2362-70U-70U   | 225757-001       | 2021/2/1         | 2022/1/31            |
| Coaxial Cable                      | COMMATE                        | PEWC                     | 8Dr              | 2021/12/19       | 2022/12/18           |
| Coaxial Cable                      | UTIFLEX                        | UFB311A-Q-1440-300300    | 220490-006       | 2021/2/1         | 2022/1/31            |
| Coaxial Cable                      | JUNFLON                        | J12J102248-00-B-5        | AUG-07-15-044    | 2021/12/19       | 2022/12/18           |
| Cable                              | EMC                            | EMC105-SM-SM-10000       | 201003           | 2021/2/3         | 2022/2/2             |
| Coaxial Cable                      | ROSNOL                         | K1K50-UP0264-K1K50-450CM | 160309-1         | 2021/2/1         | 2022/1/31            |
|                                    |                                |                          |                  | 2022/1/24        | 2023/1/23            |

|                   |                 |                             |            |           |           |
|-------------------|-----------------|-----------------------------|------------|-----------|-----------|
| Coaxial Cable     | ROSNOL          | K1K50-UP0264-<br>K1K50-50CM | 15120-1    | 2021/1/28 | 2022/1/27 |
|                   |                 |                             |            | 2022/1/18 | 2023/1/17 |
| Software          | Farad           | EZ_EMC                      | BACL-03A1  | N.C.R     | N.C.R     |
| Conducted Room    |                 |                             |            |           |           |
| Spectrum Analyzer | Rohde & Schwarz | FSV40                       | 101140     | 2021/1/7  | 2022/1/6  |
| Cable             | UTIFLEX         | UFA210A                     | 9435       | 2021/10/5 | 2022/10/4 |
| Power Sensor      | KEYSIGHT        | U2021XA                     | MY54080018 | 2021/1/28 | 2022/1/27 |
| Attenuator        | MINI-CIRCUITS   | BW-S10W5+                   | 1419       | 2021/1/28 | 2022/1/27 |

**\*Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements.

## 5 FCC §15.247(i), §1.1310, § 2.1093 – RF Exposure

### 5.1 Applicable Standard

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

According to KDB 447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot$

$[\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

1.  $f(\text{GHz})$  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.

### 5.2 RF Exposure Evaluation Result

**RF Exposure evaluation:**

| Mode      | Frequency Range (MHz) | Tunp-up Power |       | Evaluation Distance (mm) | Calculated Value | Threshold | SAR Test Exclusion |
|-----------|-----------------------|---------------|-------|--------------------------|------------------|-----------|--------------------|
|           |                       | (dBm)         | (mW)  |                          |                  | (1-g SAR) |                    |
| WIFI 2.4G | 2412-2462             | 9.5           | 8.913 | 5                        | 2.8              | 3         | Yes                |
| BLE       | 2402-2480             | 9.5           | 8.913 | 5                        | 2.8              | 3         | Yes                |
| BT        | 2402-2480             | 9.5           | 8.913 | 5                        | 2.8              | 3         | Yes                |

**Result:** SAR test is exempted.

## 6 FCC §15.203 – Antenna Requirements

### 6.1 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.

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 does not exceed 6dBi.

### 6.2 Antenna List and Details

| Manufacturer | Model      | Type         | Antenna Gain |
|--------------|------------|--------------|--------------|
| PROANT       | PRO-OB-440 | PIFA Antenna | 2 dBi        |

**Result: Compliance**

## 7 FCC §15.207(a) – AC Line Conducted Emissions

### 7.1 Applicable Standard

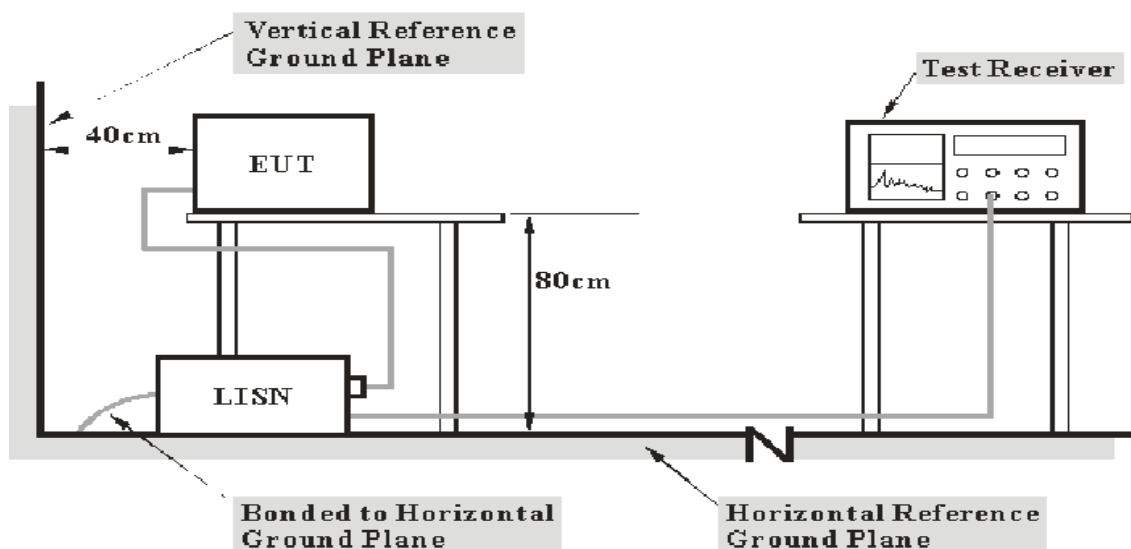
According to §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

| Frequency of Emission<br>(MHz) | Conducted Limit (dBuV) |                   |
|--------------------------------|------------------------|-------------------|
|                                | Quasi-Peak             | Average           |
| 0.15-0.5                       | 66 to 56 (Note 1)      | 56 to 46 (Note 1) |
| 0.5-5                          | 56                     | 46                |
| 5-30                           | 60                     | 50                |

Note 1: Decreases with the logarithm of the frequency.

### 7.2 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 limits.

### 7.3 EMI Test Receiver Setup

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

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

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

### 7.4 Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

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

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

### 7.5 Corrected Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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

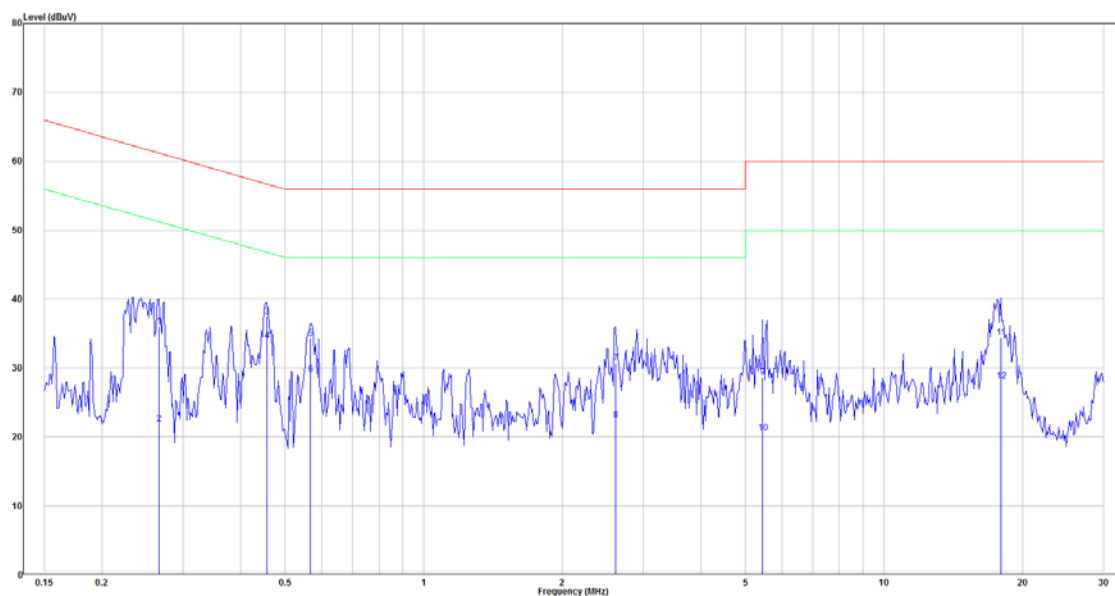
$$\text{Over Limit} = \text{Level} - \text{Limit Line}$$

## 7.6 Test Results

Test Mode: Transmitting

**WIFI Mode** (Worst case is 802.11n HT20 mode, Middle Channel)

**Main: AC120 V, 60 Hz, Line**



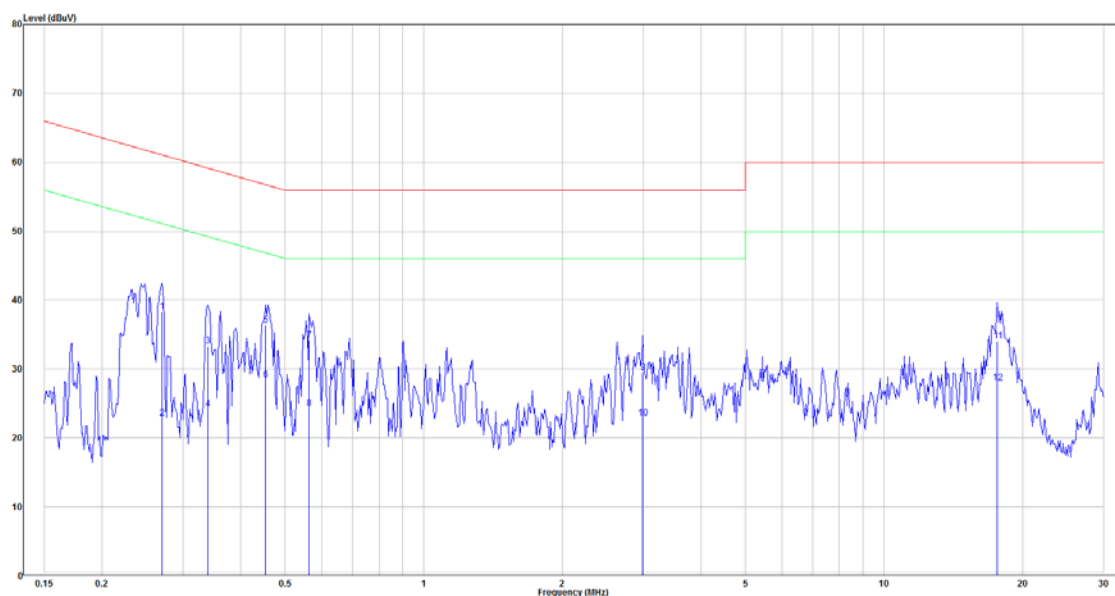
| No. | Frequency<br>(MHz) | Reading<br>(dBμV) | Correct<br>Factor(dB) | Result<br>(dBμV) | Limit<br>(dBμV) | Over limit<br>(dB) | Remark  |
|-----|--------------------|-------------------|-----------------------|------------------|-----------------|--------------------|---------|
| 1   | 0.266              | 16.44             | 19.58                 | 36.02            | 61.25           | -25.23             | QP      |
| 2   | 0.266              | 2.28              | 19.58                 | 21.86            | 51.25           | -29.39             | Average |
| 3   | 0.456              | 17.86             | 19.59                 | 37.45            | 56.76           | -19.31             | QP      |
| 4   | 0.456              | 14.42             | 19.59                 | 34.01            | 46.76           | -12.75             | Average |
| 5   | 0.567              | 14.72             | 19.59                 | 34.31            | 56.00           | -21.69             | QP      |
| 6   | 0.567              | 9.44              | 19.59                 | 29.03            | 46.00           | -16.97             | Average |
| 7   | 2.608              | 11.02             | 19.66                 | 30.68            | 56.00           | -25.32             | QP      |
| 8   | 2.608              | 2.82              | 19.66                 | 22.48            | 46.00           | -23.52             | Average |
| 9   | 5.447              | 8.95              | 19.73                 | 28.68            | 60.00           | -31.32             | QP      |
| 10  | 5.447              | 0.83              | 19.73                 | 20.56            | 50.00           | -29.44             | Average |
| 11  | 17.944             | 14.52             | 19.85                 | 34.37            | 60.00           | -25.63             | QP      |
| 12  | 17.944             | 8.27              | 19.85                 | 28.12            | 50.00           | -21.88             | Average |

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

**Main: AC120 V, 60 Hz, Neutral**

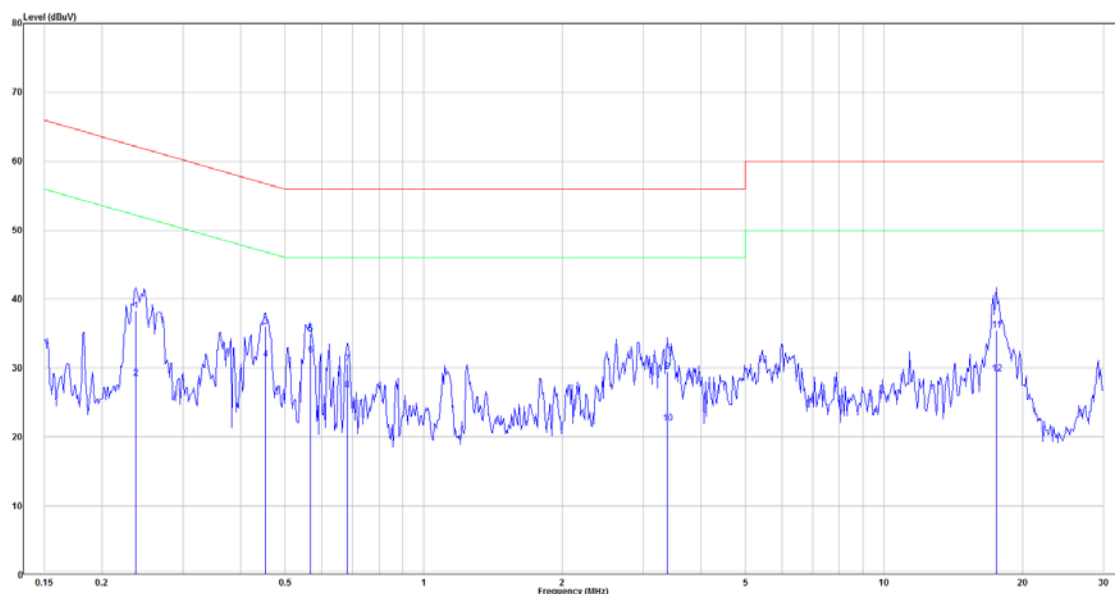
| No. | Frequency | Reading | Correct    | Result | Limit  | Over limit | Remark  |
|-----|-----------|---------|------------|--------|--------|------------|---------|
|     | (MHz)     | (dBμV)  | Factor(dB) | (dBμV) | (dBμV) | (dB)       |         |
| 1   | 0.270     | 18.73   | 19.57      | 38.30  | 61.12  | -22.82     | QP      |
| 2   | 0.270     | 3.30    | 19.57      | 22.87  | 51.12  | -28.25     | Average |
| 3   | 0.339     | 13.70   | 19.57      | 33.27  | 59.22  | -25.95     | QP      |
| 4   | 0.339     | 4.55    | 19.57      | 24.12  | 49.22  | -25.10     | Average |
| 5   | 0.454     | 16.78   | 19.58      | 36.36  | 56.80  | -20.44     | QP      |
| 6   | 0.454     | 8.80    | 19.58      | 28.38  | 46.80  | -18.42     | Average |
| 7   | 0.564     | 14.56   | 19.58      | 34.14  | 56.00  | -21.86     | QP      |
| 8   | 0.564     | 4.73    | 19.58      | 24.31  | 46.00  | -21.69     | Average |
| 9   | 2.993     | 9.80    | 19.66      | 29.46  | 56.00  | -26.54     | QP      |
| 10  | 2.993     | 3.21    | 19.66      | 22.87  | 46.00  | -23.13     | Average |
| 11  | 17.661    | 14.18   | 19.91      | 34.09  | 60.00  | -25.91     | QP      |
| 12  | 17.661    | 8.10    | 19.91      | 28.01  | 50.00  | -21.99     | Average |

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

**BLE Mode** (Worst case is BLE mode, Middle Channel)**Main: AC120 V, 60 Hz, Line**

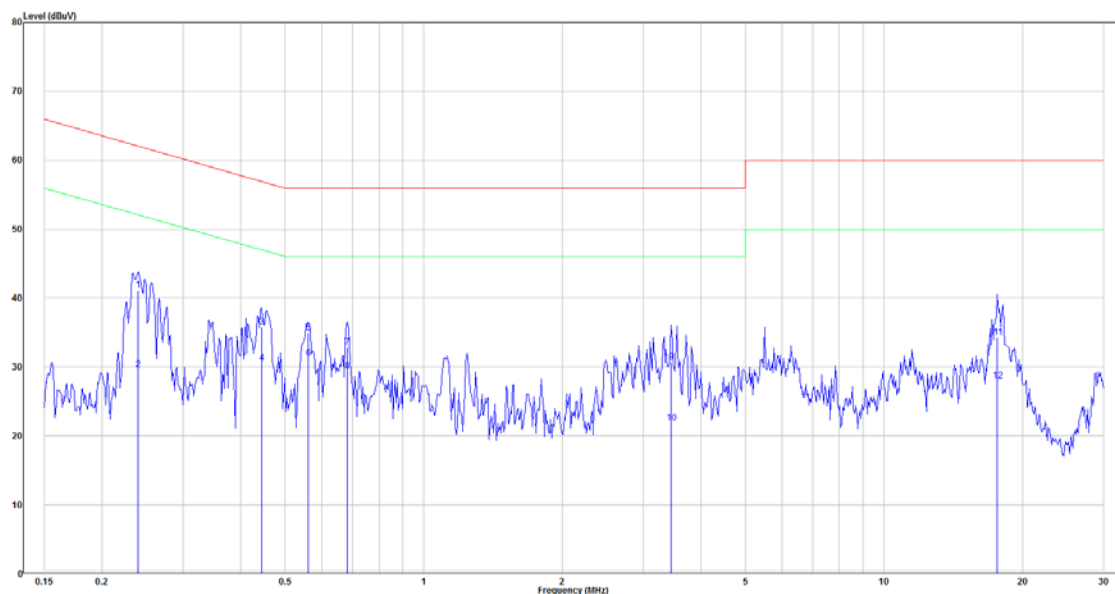
| No. | Frequency<br>(MHz) | Reading<br>(dBμV) | Correct<br>Factor(dB) | Result<br>(dBμV) | Limit<br>(dBμV) | Over limit<br>(dB) | Remark  |
|-----|--------------------|-------------------|-----------------------|------------------|-----------------|--------------------|---------|
| 1   | 0.237              | 18.69             | 19.58                 | 38.27            | 62.22           | -23.95             | QP      |
| 2   | 0.237              | 8.93              | 19.58                 | 28.51            | 52.22           | -23.71             | Average |
| 3   | 0.454              | 16.44             | 19.59                 | 36.03            | 56.80           | -20.77             | QP      |
| 4   | 0.454              | 11.66             | 19.59                 | 31.25            | 46.80           | -15.55             | Average |
| 5   | 0.567              | 15.32             | 19.59                 | 34.91            | 56.00           | -21.09             | QP      |
| 6   | 0.567              | 12.31             | 19.59                 | 31.90            | 46.00           | -14.10             | Average |
| 7   | 0.683              | 10.98             | 19.59                 | 30.57            | 56.00           | -25.43             | QP      |
| 8   | 0.683              | 7.23              | 19.59                 | 26.82            | 46.00           | -19.18             | Average |
| 9   | 3.381              | 9.79              | 19.67                 | 29.46            | 56.00           | -26.54             | QP      |
| 10  | 3.381              | 2.32              | 19.67                 | 21.99            | 46.00           | -24.01             | Average |
| 11  | 17.568             | 15.61             | 19.85                 | 35.46            | 60.00           | -24.54             | QP      |
| 12  | 17.568             | 9.35              | 19.85                 | 29.20            | 50.00           | -20.80             | Average |

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

**Main: AC120 V, 60 Hz, Neutral**

| No. | Frequency | Reading | Correct    | Result | Limit  | Over limit | Remark  |
|-----|-----------|---------|------------|--------|--------|------------|---------|
|     | (MHz)     | (dBμV)  | Factor(dB) | (dBμV) | (dBμV) | (dB)       |         |
| 1   | 0.239     | 21.53   | 19.57      | 41.10  | 62.13  | -21.03     | QP      |
| 2   | 0.239     | 10.07   | 19.57      | 29.64  | 52.13  | -22.49     | Average |
| 3   | 0.444     | 16.25   | 19.58      | 35.83  | 56.98  | -21.15     | QP      |
| 4   | 0.444     | 11.01   | 19.58      | 30.59  | 46.98  | -16.39     | Average |
| 5   | 0.561     | 15.41   | 19.58      | 34.99  | 56.00  | -21.01     | QP      |
| 6   | 0.561     | 11.61   | 19.58      | 31.19  | 46.00  | -14.81     | Average |
| 7   | 0.683     | 13.26   | 19.59      | 32.85  | 56.00  | -23.15     | QP      |
| 8   | 0.683     | 9.85    | 19.59      | 29.44  | 46.00  | -16.56     | Average |
| 9   | 3.454     | 11.02   | 19.68      | 30.70  | 56.00  | -25.30     | QP      |
| 10  | 3.454     | 2.21    | 19.68      | 21.89  | 46.00  | -24.11     | Average |
| 11  | 17.661    | 14.41   | 19.91      | 34.32  | 60.00  | -25.68     | QP      |
| 12  | 17.661    | 8.04    | 19.91      | 27.95  | 50.00  | -22.05     | Average |

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

## 8 FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions

### 8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                 | MHz                   | MHz             | GHz           |
|---------------------|-----------------------|-----------------|---------------|
| 0.090 – 0.110       | 16.42 – 16.423        | 608 – 614       | 4.5 – 5.15    |
| 0.495 – 0.505       | 16.69475 – 16.69525   | 960 – 1240      | 5.35 – 5.46   |
| 2.1735 – 2.1905     | 16.80425 – 16.80475   | 1300 – 1427     | 7.25 – 7.75   |
| 4.125 – 4.128       | 25.5 – 25.67          | 1435 – 1626.5   | 8.025 – 8.5   |
| 4.17725 – 4.17775   | 37.5 – 38.25          | 1645.5 – 1646.5 | 9.0 – 9.2     |
| 4.20725 – 4.20775   | 73 – 74.6             | 1660 – 1710     | 9.3 – 9.5     |
| 6.215 – 6.218       | 74.8 – 75.2           | 1718.8 – 1722.2 | 10.6 – 12.7   |
| 6.26775 – 6.26825   | 108 – 121.94          | 2200 – 2300     | 13.25 – 13.4  |
| 6.31175 – 6.31225   | 123 – 138             | 2310 – 2390     | 14.47 – 14.5  |
| 8.291 – 8.294       | 149.9 – 150.05        | 2483.5 – 2500   | 15.35 – 16.2  |
| 8.362 – 8.366       | 156.52475 – 156.52525 | 2690 – 2900     | 17.7 – 21.4   |
| 8.37625 – 8.38675   | 156.7 – 156.9         | 3260 – 3267     | 22.01 – 23.12 |
| 8.41425 – 8.41475   | 162.0125 – 167.17     | 3.332 – 3.339   | 23.6 – 24.0   |
| 12.29 – 12.293      | 167.72 – 173.2        | 3.3458 – 3.358  | 31.2 – 31.8   |
| 12.51975 – 12.52025 | 240 – 285             | 3.600 – 4.400   | 36.43 – 36.5  |
| 12.57675 – 12.57725 | 322 – 335.4           |                 | Above 38.6    |
| 13.36 – 13.41       | 399.9 – 410           |                 |               |

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

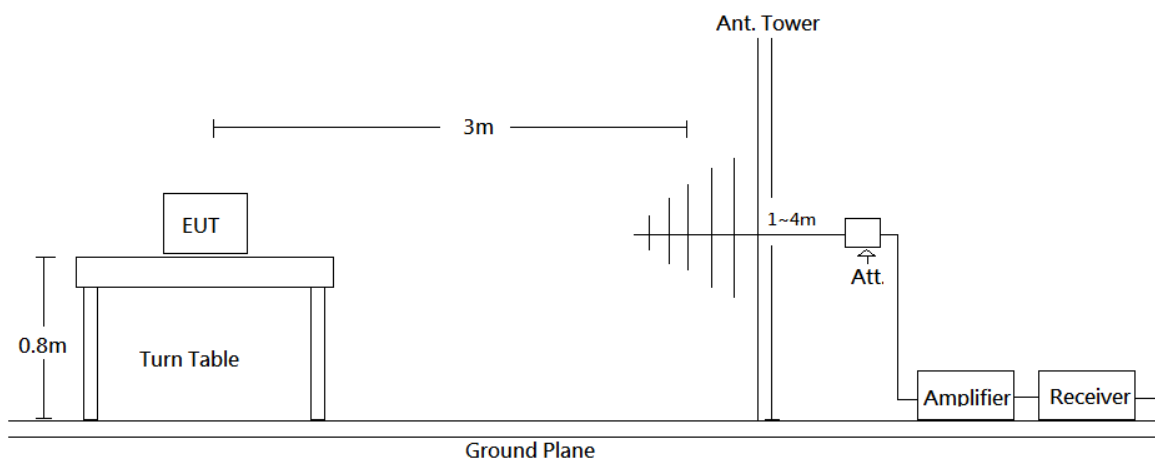
| Frequency (MHz) | Field Strength (micro volts/meter) | Measurement Distance (meters) |
|-----------------|------------------------------------|-------------------------------|
| 0.009 - 0.490   | 2400/F(kHz)                        | 300                           |
| 0.490 - 1.705   | 24000/F(kHz)                       | 30                            |
| 1.705 - 30.0    | 30                                 | 30                            |
| 30 - 88         | 100**                              | 3                             |
| 88 - 216        | 150**                              | 3                             |
| 216 - 960       | 200**                              | 3                             |
| Above 960       | 500                                | 3                             |

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

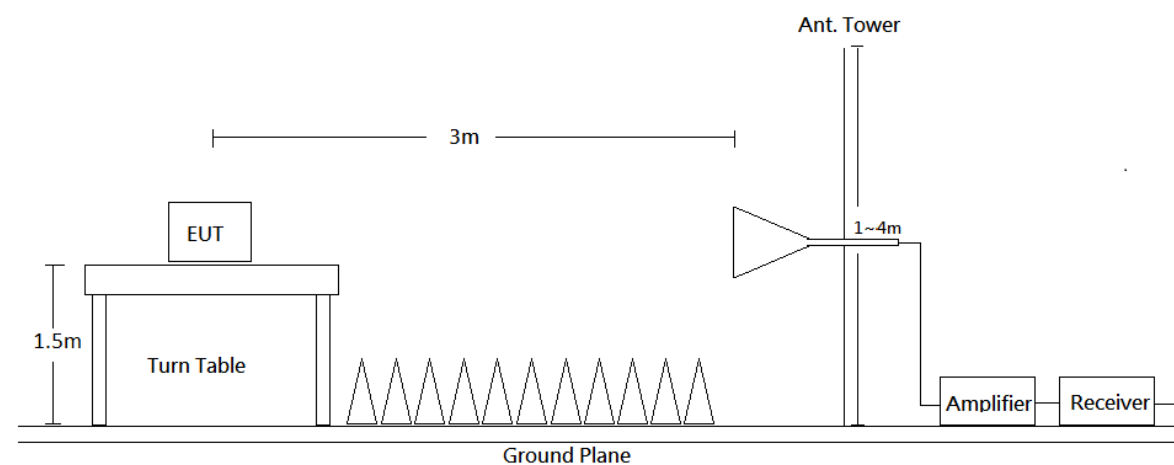
As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the 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).

## 8.2 EUT Setup

Below 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

### 8.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

| Frequency Range | RBW     | VBW   | Duty cycle | Measurement method |
|-----------------|---------|-------|------------|--------------------|
| 30-1000 MHz     | 120 kHz | /     | /          | QP                 |
| Above 1 GHz     | 1 MHz   | 3 MHz | /          | PK                 |
|                 | 1 MHz   | 10 Hz | >98%       | Ave                |
|                 | 1 MHz   | 1/T   | <98%       | Ave                |

Note: T is minimum transmission duration.

### 8.4 Test Procedure

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

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

### 8.5 Corrected Factor & Margin Calculation

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

$$\text{Correct Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Result} - \text{Limit}$$

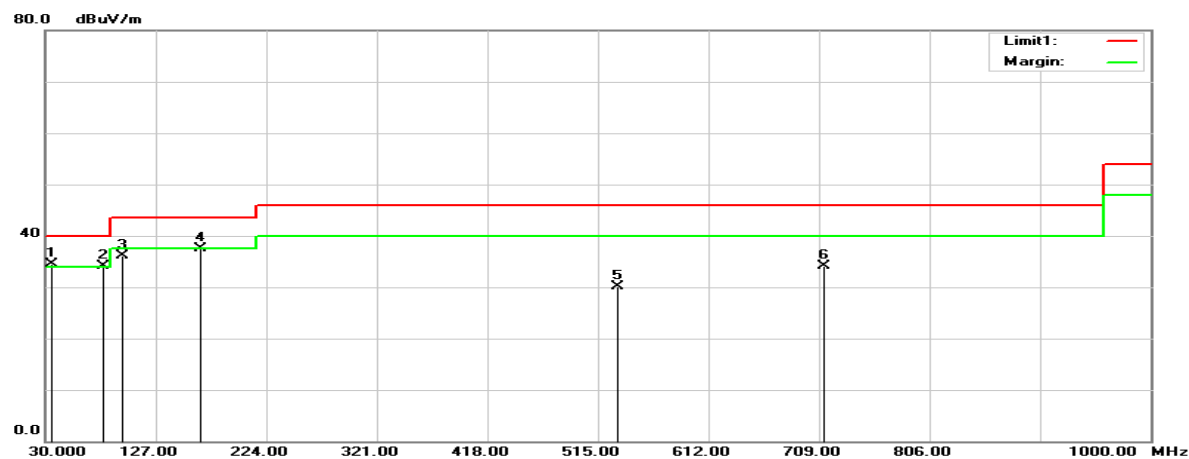
## 8.6 Test Results

Test Mode: Transmitting

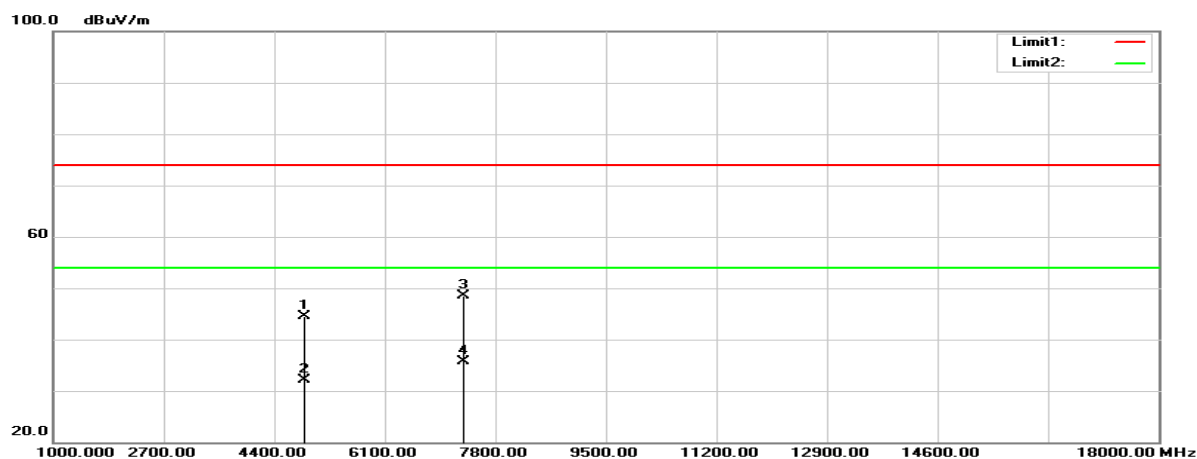
**WIFI Mode** (Pre-scan with three orthogonal axis, and worse case as X axis.)

**Horizontal** (worst case is 802.11n HT20 mode Middle channel)

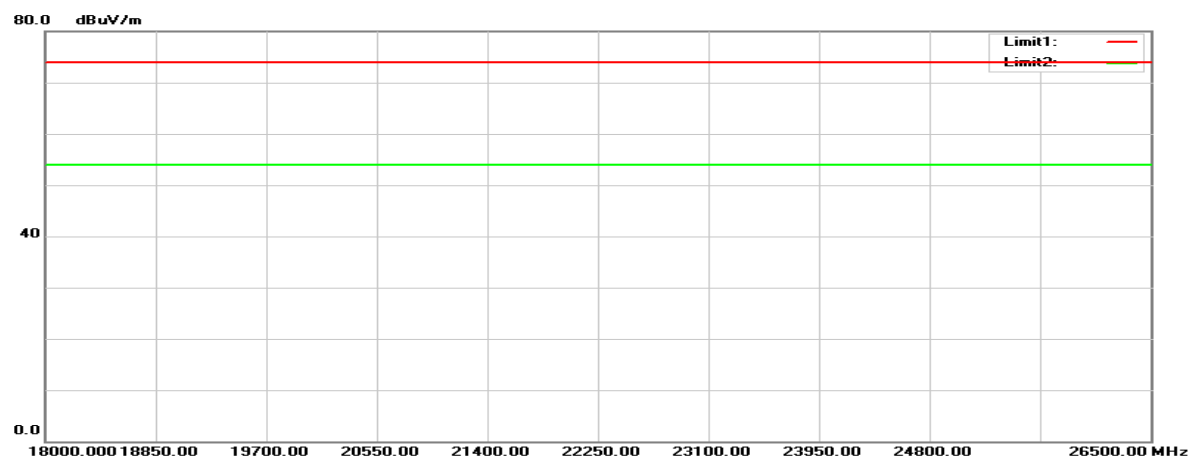
30MHz-1GHz:



1GHz-18GHz:

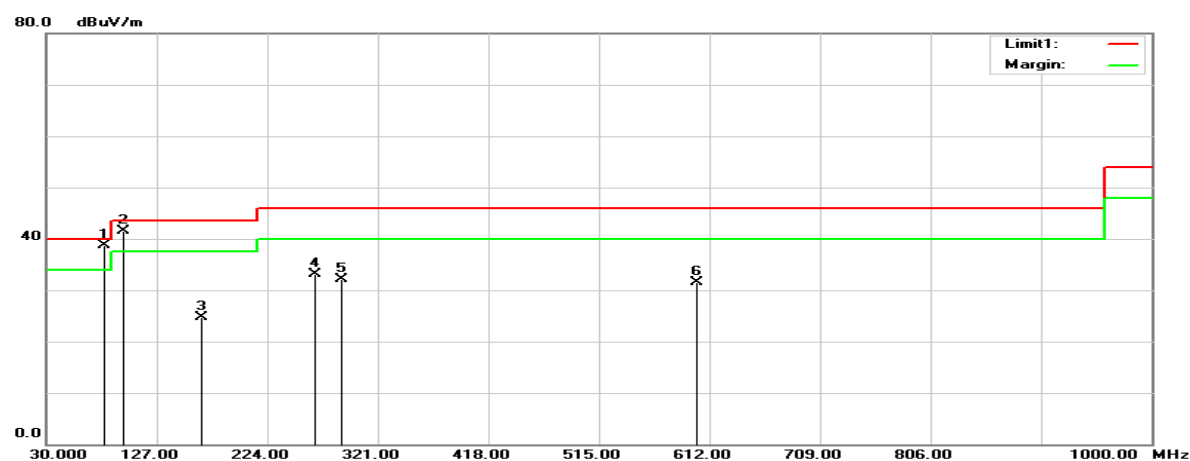


18GHz-26.5GHz:

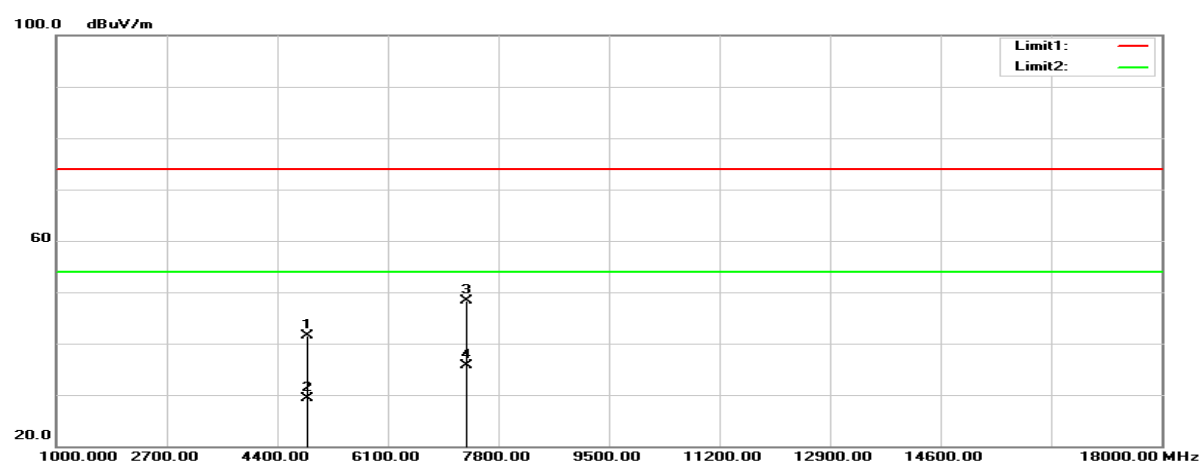


# **Vertical** (worst case is 802.11n HT20 mode Middle channel)

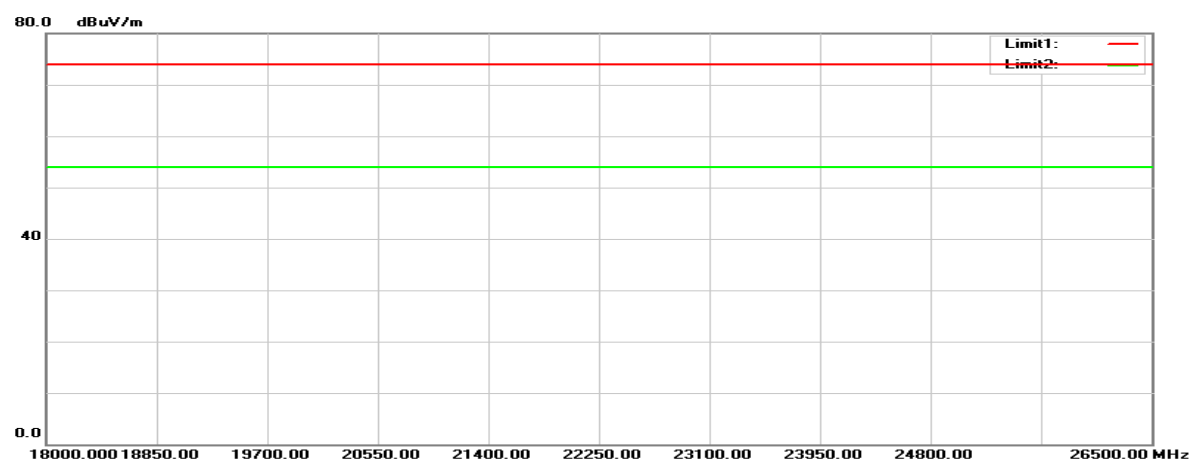
30MHz-1GHz:



1GHz-18GHz:



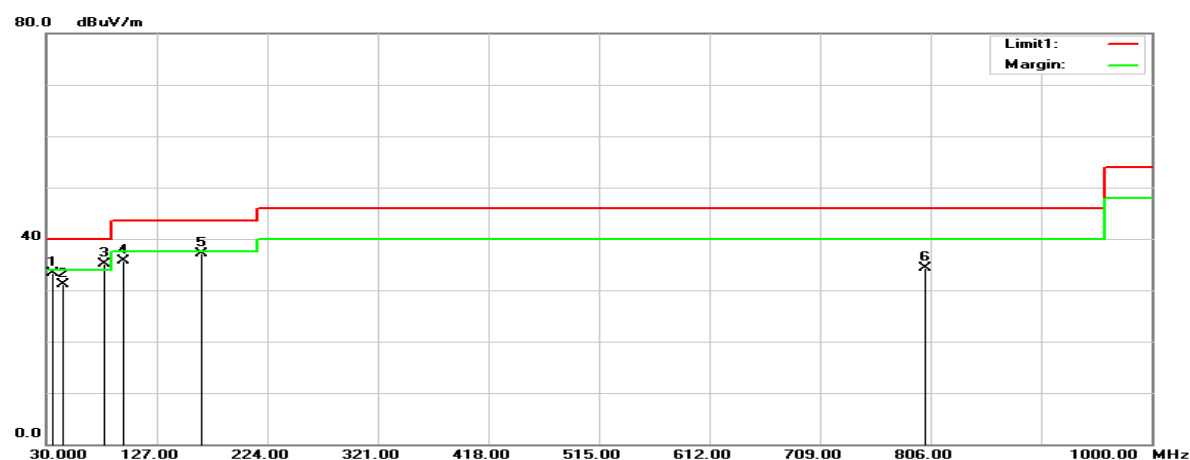
18GHz-26.5GHz:



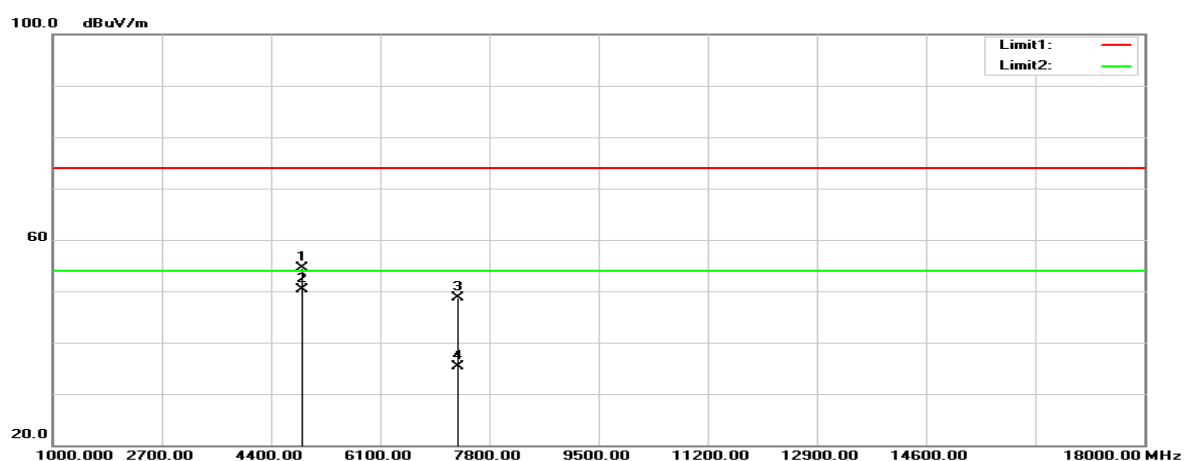
**BLE(1M) Mode** (Pre-scan with three orthogonal axis, and worse case as X axis.)

**Horizontal** (worst case is BLE (1M) mode Middle channel)

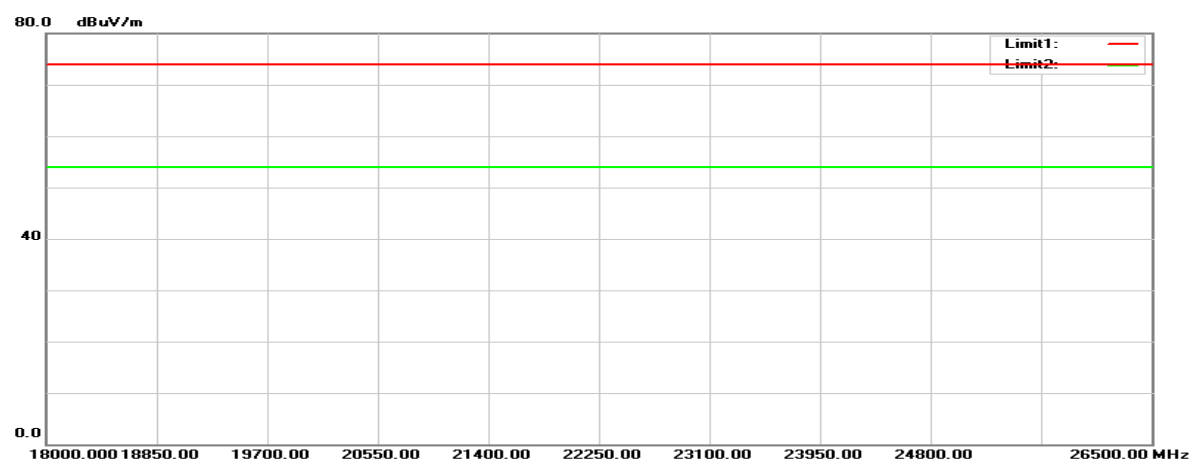
30MHz-1GHz



1GHz-18GHz

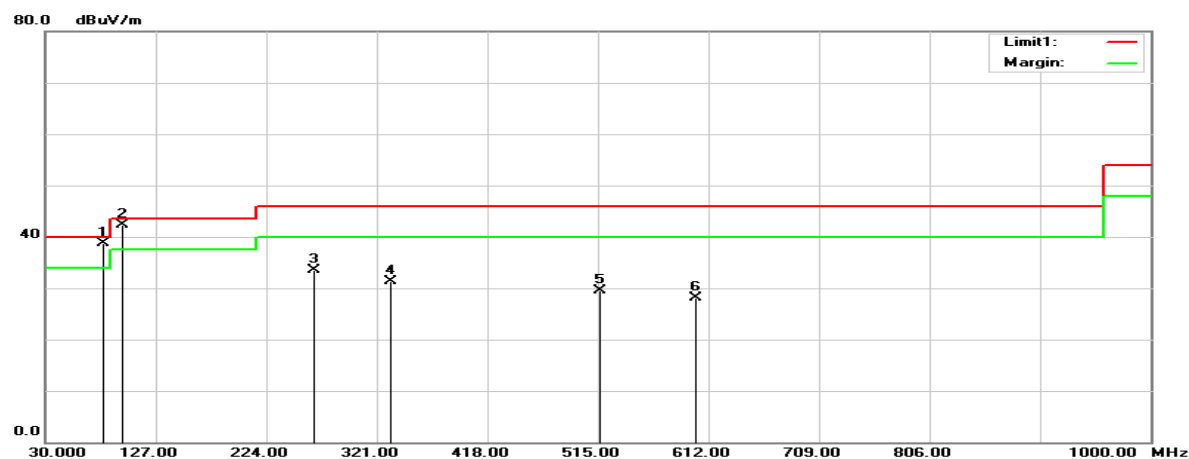


18GHz-26.5GHz:

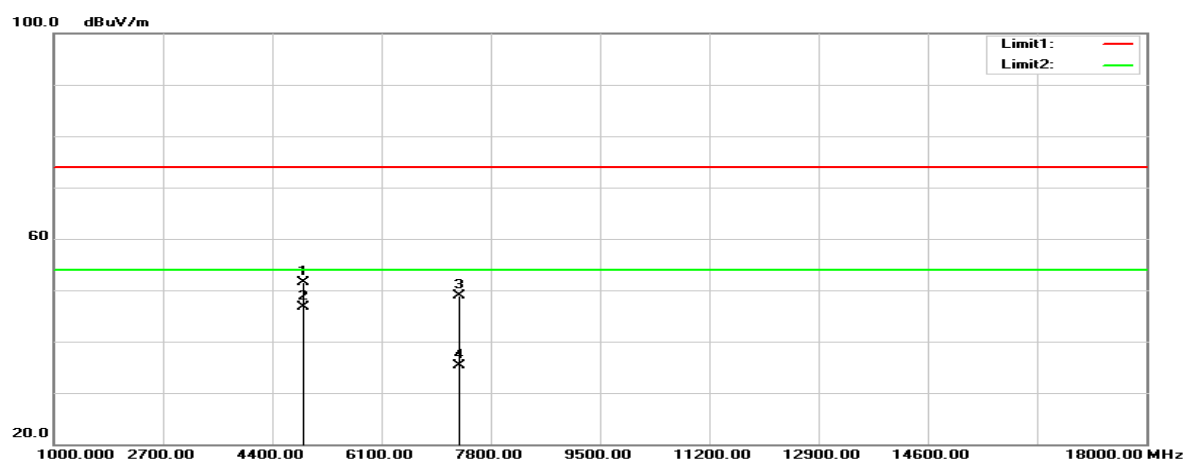


# **Vertical** (worst case is BLE (1M) mode Middle channel)

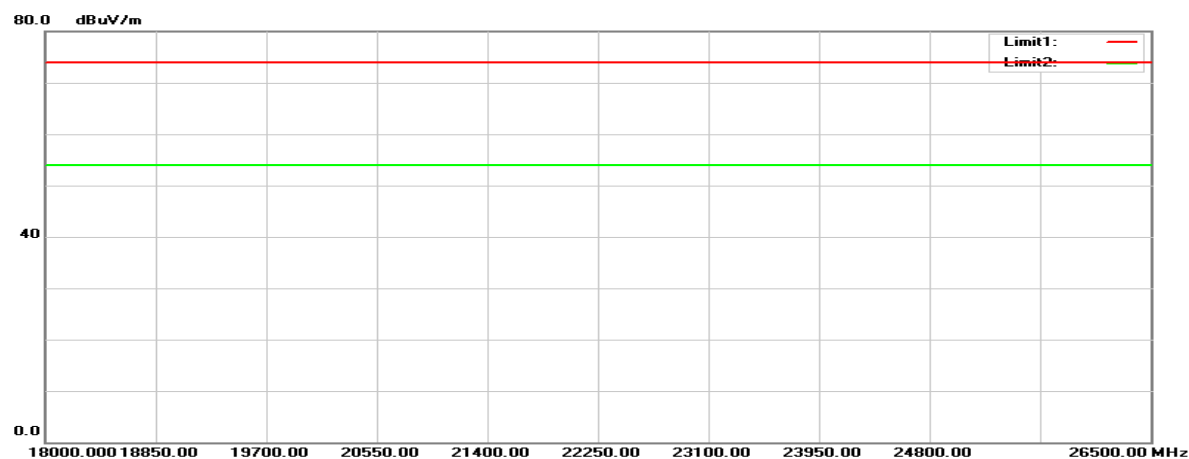
30MHz-1GHz



1GHz-18GHz



18GHz-26.5GHz:



**Below 1GHz****WIFI Mode****Horizontal**

| Frequency | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|-----------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)     | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| 35.8200   | 42.46   | -7.87        | 34.59    | 40.00    | -5.41  | 100    | 165    | peak   |
| 81.4100   | 50.64   | -16.62       | 34.02    | 40.00    | -5.98  | 100    | 177    | peak   |
| 97.9000   | 50.72   | -14.71       | 36.01    | 43.50    | -7.49  | 100    | 15     | peak   |
| 165.8000  | 49.18   | -11.71       | 37.47    | 43.50    | -6.03  | 100    | 125    | peak   |
| 532.4600  | 35.72   | -5.64        | 30.08    | 46.00    | -15.92 | 100    | 21     | peak   |
| 713.8500  | 36.65   | -2.64        | 34.01    | 46.00    | -11.99 | 100    | 198    | peak   |

**Vertical**

| Frequency | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|-----------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)     | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| 81.4100   | 55.30   | -16.62       | 38.68    | 40.00    | -1.32  | 100    | 158    | peak   |
| 97.9000   | 56.27   | -14.71       | 41.56    | 43.50    | -1.94  | 100    | 144    | peak   |
| 165.8000  | 36.48   | -11.71       | 24.77    | 43.50    | -18.73 | 100    | 11     | peak   |
| 265.7100  | 43.99   | -10.80       | 33.19    | 46.00    | -12.81 | 100    | 204    | peak   |
| 288.9900  | 42.12   | -10.00       | 32.12    | 46.00    | -13.88 | 100    | 195    | peak   |
| 600.3600  | 36.58   | -5.13        | 31.45    | 46.00    | -14.55 | 100    | 11     | peak   |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**BLE(1M) Mode****Horizontal**

| Frequency | Reading      | Correct      | Result         | Limit          | Margin | Height | Degree | Remark |
|-----------|--------------|--------------|----------------|----------------|--------|--------|--------|--------|
| (MHz)     | (dB $\mu$ V) | Factor(dB/m) | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   | (cm)   | ( ° )  |        |
| 35.8200   | 41.11        | -7.87        | 33.24          | 40.00          | -6.76  | 100    | 324    | peak   |
| 44.5500   | 44.72        | -13.59       | 31.13          | 40.00          | -8.87  | 100    | 145    | peak   |
| 81.4100   | 51.65        | -16.62       | 35.03          | 40.00          | -4.97  | 100    | 65     | peak   |
| 97.9000   | 50.51        | -14.71       | 35.80          | 43.50          | -7.70  | 100    | 95     | peak   |
| 165.8000  | 48.74        | -11.71       | 37.03          | 43.50          | -6.47  | 100    | 147    | peak   |
| 801.1500  | 35.22        | -1.01        | 34.21          | 46.00          | -11.79 | 100    | 111    | peak   |

**Vertical**

| Frequency | Reading      | Correct      | Result         | Limit          | Margin | Height | Degree | Remark |
|-----------|--------------|--------------|----------------|----------------|--------|--------|--------|--------|
| (MHz)     | (dB $\mu$ V) | Factor(dB/m) | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   | (cm)   | ( ° )  |        |
| 81.4100   | 55.26        | -16.62       | 38.64          | 40.00          | -1.36  | 100    | 247    | peak   |
| 97.9000   | 56.98        | -14.71       | 42.27          | 43.50          | -1.23  | 100    | 95     | peak   |
| 265.7100  | 44.39        | -10.80       | 33.59          | 46.00          | -12.41 | 100    | 165    | peak   |
| 332.6400  | 40.76        | -9.46        | 31.30          | 46.00          | -14.70 | 100    | 115    | peak   |
| 516.9400  | 35.18        | -5.71        | 29.47          | 46.00          | -16.53 | 100    | 14     | peak   |
| 600.3600  | 33.28        | -5.13        | 28.15          | 46.00          | -17.85 | 100    | 95     | peak   |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Above 1GHz****Horizontal**

| Frequency<br>(MHz)     | Reading<br>(dBμV) | Correct<br>Factor(dB/m) | Result<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) | Height<br>(cm) | Degree<br>( ° ) | Remark |
|------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|-----------------|--------|
| B Mode, Low channel    |                   |                         |                    |                   |                |                |                 |        |
| 2359.840               | 59.12             | -9.71                   | 49.41              | 74.00             | -24.59         | 151            | 210             | peak   |
| 2359.840               | 44.88             | -9.71                   | 35.17              | 54.00             | -18.83         | 151            | 210             | AVG    |
| 4824.000               | 44.46             | -2.15                   | 42.31              | 74.00             | -31.69         | 151            | 157             | peak   |
| 4824.000               | 31.41             | -2.15                   | 29.26              | 54.00             | -24.74         | 151            | 157             | AVG    |
| 7236.000               | 43.25             | 4.55                    | 47.80              | 74.00             | -26.20         | 148            | 181             | peak   |
| 7236.000               | 30.52             | 4.55                    | 35.07              | 54.00             | -18.93         | 148            | 181             | AVG    |
| B Mode, Middle channel |                   |                         |                    |                   |                |                |                 |        |
| 4874.000               | 46.49             | -1.92                   | 44.57              | 74.00             | -29.43         | 113            | 315             | peak   |
| 4874.000               | 34.11             | -1.92                   | 32.19              | 54.00             | -21.81         | 113            | 315             | AVG    |
| 7311.000               | 43.37             | 5.08                    | 48.45              | 74.00             | -25.55         | 144            | 48              | peak   |
| 7311.000               | 30.64             | 5.08                    | 35.72              | 54.00             | -18.28         | 144            | 48              | AVG    |
| B Mode, High channel   |                   |                         |                    |                   |                |                |                 |        |
| 2497.408               | 57.99             | -8.25                   | 49.74              | 74.00             | -24.26         | 125            | 212             | peak   |
| 2497.408               | 44.38             | -8.25                   | 36.13              | 54.00             | -17.87         | 125            | 212             | AVG    |
| 4924.000               | 47.65             | -1.63                   | 46.02              | 74.00             | -27.98         | 110            | 325             | peak   |
| 4924.000               | 35.29             | -1.63                   | 33.66              | 54.00             | -20.34         | 110            | 325             | AVG    |
| 7386.000               | 43.87             | 5.20                    | 49.07              | 74.00             | -24.93         | 152            | 46              | peak   |
| 7386.000               | 30.45             | 5.20                    | 35.65              | 54.00             | -18.35         | 152            | 46              | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Vertical**

| Frequency              | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|------------------------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)                  | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| B Mode, Low channel    |         |              |          |          |        |        |        |        |
| 2375.072               | 58.93   | -9.58        | 49.35    | 74.00    | -24.65 | 190    | 124    | peak   |
| 2375.072               | 44.67   | -9.58        | 35.09    | 54.00    | -18.91 | 190    | 124    | AVG    |
| 4824.000               | 43.60   | -2.15        | 41.45    | 74.00    | -32.55 | 142    | 200    | peak   |
| 4824.000               | 31.23   | -2.15        | 29.08    | 54.00    | -24.92 | 142    | 200    | AVG    |
| 7236.000               | 43.01   | 4.55         | 47.56    | 74.00    | -26.44 | 149    | 360    | peak   |
| 7236.000               | 30.56   | 4.55         | 35.11    | 54.00    | -18.89 | 149    | 360    | AVG    |
| B Mode, Middle channel |         |              |          |          |        |        |        |        |
| 4874.000               | 43.46   | -1.92        | 41.54    | 74.00    | -32.46 | 149    | 1      | peak   |
| 4874.000               | 31.20   | -1.92        | 29.28    | 54.00    | -24.72 | 149    | 1      | AVG    |
| 7311.000               | 43.28   | 5.08         | 48.36    | 74.00    | -25.64 | 147    | 137    | peak   |
| 7311.000               | 30.62   | 5.08         | 35.70    | 54.00    | -18.30 | 147    | 137    | AVG    |
| B Mode, High channel   |         |              |          |          |        |        |        |        |
| 2488.528               | 58.41   | -8.38        | 50.03    | 74.00    | -23.97 | 184    | 123    | peak   |
| 2488.528               | 44.70   | -8.38        | 36.32    | 54.00    | -17.68 | 184    | 123    | AVG    |
| 4924.000               | 47.86   | -1.63        | 46.23    | 74.00    | -27.77 | 105    | 229    | peak   |
| 4924.000               | 33.89   | -1.63        | 32.26    | 54.00    | -21.74 | 105    | 229    | AVG    |
| 7386.000               | 42.17   | 5.20         | 47.37    | 74.00    | -26.63 | 154    | 70     | peak   |
| 7386.000               | 30.50   | 5.20         | 35.70    | 54.00    | -18.30 | 154    | 70     | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Horizontal**

| Frequency              | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|------------------------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)                  | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| G Mode, Low channel    |         |              |          |          |        |        |        |        |
| 2367.568               | 58.99   | -9.64        | 49.35    | 74.00    | -24.65 | 151    | 211    | Peak   |
| 2367.568               | 44.85   | -9.64        | 35.21    | 54.00    | -18.79 | 151    | 211    | AVG    |
| 4824.000               | 44.57   | -2.15        | 42.42    | 74.00    | -31.58 | 151    | 202    | peak   |
| 4824.000               | 31.29   | -2.15        | 29.14    | 54.00    | -24.86 | 151    | 202    | AVG    |
| 7236.000               | 42.91   | 4.55         | 47.46    | 74.00    | -26.54 | 147    | 150    | peak   |
| 7236.000               | 30.55   | 4.55         | 35.10    | 54.00    | -18.90 | 147    | 150    | AVG    |
| G Mode, Middle channel |         |              |          |          |        |        |        |        |
| 4874.000               | 43.76   | -1.92        | 41.84    | 74.00    | -32.16 | 148    | 322    | peak   |
| 4874.000               | 31.58   | -1.92        | 29.66    | 54.00    | -24.34 | 148    | 322    | AVG    |
| 7311.000               | 43.37   | 5.08         | 48.45    | 74.00    | -25.55 | 145    | 1      | peak   |
| 7311.000               | 30.64   | 5.08         | 35.72    | 54.00    | -18.28 | 145    | 1      | AVG    |
| G Mode, High channel   |         |              |          |          |        |        |        |        |
| 2490.448               | 58.71   | -8.34        | 50.37    | 74.00    | -23.63 | 125    | 210    | peak   |
| 2490.448               | 44.76   | -8.34        | 36.42    | 54.00    | -17.58 | 125    | 210    | AVG    |
| 4924.000               | 47.04   | -1.63        | 45.41    | 74.00    | -28.59 | 104    | 0      | peak   |
| 4924.000               | 33.11   | -1.63        | 31.48    | 54.00    | -22.52 | 104    | 0      | AVG    |
| 7386.000               | 43.81   | 5.20         | 49.01    | 74.00    | -24.99 | 141    | 273    | peak   |
| 7386.000               | 30.56   | 5.20         | 35.76    | 54.00    | -18.24 | 141    | 273    | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Vertical**

| Frequency              | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|------------------------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)                  | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| G Mode, Low channel    |         |              |          |          |        |        |        |        |
| 2386.048               | 58.07   | -9.49        | 48.58    | 74.00    | -25.42 | 194    | 125    | peak   |
| 2386.048               | 44.50   | -9.49        | 35.01    | 54.00    | -18.99 | 194    | 125    | AVG    |
| 4824.000               | 44.13   | -2.15        | 41.98    | 74.00    | -32.02 | 152    | 143    | peak   |
| 4824.000               | 31.35   | -2.15        | 29.20    | 54.00    | -24.80 | 152    | 143    | AVG    |
| 7236.000               | 43.19   | 4.55         | 47.74    | 74.00    | -26.26 | 147    | 96     | peak   |
| 7236.000               | 30.55   | 4.55         | 35.10    | 54.00    | -18.90 | 147    | 96     | AVG    |
| G Mode, Middle channel |         |              |          |          |        |        |        |        |
| 4874.000               | 43.67   | -1.92        | 41.75    | 74.00    | -32.25 | 152    | 167    | peak   |
| 4874.000               | 31.20   | -1.92        | 29.28    | 54.00    | -24.72 | 152    | 167    | AVG    |
| 7311.000               | 43.58   | 5.08         | 48.66    | 74.00    | -25.34 | 151    | 240    | peak   |
| 7311.000               | 30.65   | 5.08         | 35.73    | 54.00    | -18.27 | 151    | 240    | AVG    |
| G Mode, High channel   |         |              |          |          |        |        |        |        |
| 2496.352               | 59.41   | -8.26        | 51.15    | 74.00    | -22.85 | 208    | 129    | peak   |
| 2496.352               | 45.03   | -8.26        | 36.77    | 54.00    | -17.23 | 208    | 129    | AVG    |
| 4924.000               | 46.42   | -1.63        | 44.79    | 74.00    | -29.21 | 150    | 130    | peak   |
| 4924.000               | 31.96   | -1.63        | 30.33    | 54.00    | -23.67 | 150    | 130    | AVG    |
| 7386.000               | 42.51   | 5.20         | 47.71    | 74.00    | -26.29 | 152    | 71     | peak   |
| 7386.000               | 30.51   | 5.20         | 35.71    | 54.00    | -18.29 | 152    | 71     | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Horizontal**

| Frequency<br>(MHz)       | Reading<br>(dBμV) | Correct<br>Factor(dB/m) | Result<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) | Height<br>(cm) | Degree<br>( ° ) | Remark |
|--------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|-----------------|--------|
| N20 Mode, Low channel    |                   |                         |                    |                   |                |                |                 |        |
| 2350.320                 | 58.21             | -9.79                   | 48.42              | 74.00             | -25.58         | 127            | 214             | peak   |
| 2350.320                 | 45.02             | -9.79                   | 35.23              | 54.00             | -18.77         | 127            | 214             | AVG    |
| 4824.000                 | 43.52             | -2.15                   | 41.37              | 74.00             | -32.63         | 148            | 72              | peak   |
| 4824.000                 | 31.32             | -2.15                   | 29.17              | 54.00             | -24.83         | 148            | 72              | AVG    |
| 7236.000                 | 42.80             | 4.55                    | 47.35              | 74.00             | -26.65         | 153            | 299             | peak   |
| 7236.000                 | 30.59             | 4.55                    | 35.14              | 54.00             | -18.86         | 153            | 299             | AVG    |
| N20 Mode, Middle channel |                   |                         |                    |                   |                |                |                 |        |
| 4874.000                 | 43.69             | -1.92                   | 41.77              | 74.00             | -32.23         | 150            | 60              | peak   |
| 4874.000                 | 31.50             | -1.92                   | 29.58              | 54.00             | -24.42         | 150            | 60              | AVG    |
| 7311.000                 | 43.68             | 5.08                    | 48.76              | 74.00             | -25.24         | 152            | 307             | peak   |
| 7311.000                 | 30.69             | 5.08                    | 35.77              | 54.00             | -18.23         | 152            | 307             | AVG    |
| N20 Mode, High channel   |                   |                         |                    |                   |                |                |                 |        |
| 2485.600                 | 58.58             | -8.42                   | 50.16              | 74.00             | -23.84         | 125            | 217             | peak   |
| 2485.600                 | 44.85             | -8.42                   | 36.43              | 54.00             | -17.57         | 125            | 217             | AVG    |
| 4924.000                 | 45.63             | -1.63                   | 44.00              | 74.00             | -30.00         | 151            | 3               | peak   |
| 4924.000                 | 32.23             | -1.63                   | 30.60              | 54.00             | -23.40         | 151            | 3               | AVG    |
| 7386.000                 | 43.37             | 5.20                    | 48.57              | 74.00             | -25.43         | 153            | 256             | peak   |
| 7386.000                 | 30.54             | 5.20                    | 35.74              | 54.00             | -18.26         | 153            | 256             | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Vertical**

| Frequency<br>(MHz)       | Reading<br>(dBμV) | Correct<br>Factor(dB/m) | Result<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) | Height<br>(cm) | Degree<br>( ° ) | Remark |
|--------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|-----------------|--------|
| N20 Mode, Low channel    |                   |                         |                    |                   |                |                |                 |        |
| 2389.072                 | 58.36             | -9.47                   | 48.89              | 74.00             | -25.11         | 209            | 127             | peak   |
| 2389.072                 | 44.83             | -9.47                   | 35.36              | 54.00             | -18.64         | 209            | 127             | AVG    |
| 4824.000                 | 43.65             | -2.15                   | 41.50              | 74.00             | -32.50         | 152            | 183             | peak   |
| 4824.000                 | 31.33             | -2.15                   | 29.18              | 54.00             | -24.82         | 152            | 183             | AVG    |
| 7236.000                 | 43.10             | 4.55                    | 47.65              | 74.00             | -26.35         | 149            | 176             | peak   |
| 7236.000                 | 30.61             | 4.55                    | 35.16              | 54.00             | -18.84         | 149            | 176             | AVG    |
| N20 Mode, Middle channel |                   |                         |                    |                   |                |                |                 |        |
| 4874.000                 | 43.54             | -1.92                   | 41.62              | 74.00             | -32.38         | 152            | 55              | peak   |
| 4874.000                 | 31.28             | -1.92                   | 29.36              | 54.00             | -24.64         | 152            | 55              | AVG    |
| 7311.000                 | 43.62             | 5.08                    | 48.70              | 74.00             | -25.30         | 146            | 157             | peak   |
| 7311.000                 | 30.71             | 5.08                    | 35.79              | 54.00             | -18.21         | 146            | 157             | AVG    |
| N20 Mode, High channel   |                   |                         |                    |                   |                |                |                 |        |
| 2493.136                 | 59.13             | -8.31                   | 50.82              | 74.00             | -23.18         | 210            | 129             | peak   |
| 2493.136                 | 44.96             | -8.31                   | 36.65              | 54.00             | -17.35         | 210            | 129             | AVG    |
| 4924.000                 | 44.22             | -1.63                   | 42.59              | 74.00             | -31.41         | 148            | 107             | peak   |
| 4924.000                 | 31.35             | -1.63                   | 29.72              | 54.00             | -24.28         | 148            | 107             | AVG    |
| 7386.000                 | 42.60             | 5.20                    | 47.80              | 74.00             | -26.20         | 151            | 183             | peak   |
| 7386.000                 | 30.55             | 5.20                    | 35.75              | 54.00             | -18.25         | 151            | 183             | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Horizontal**

| Frequency                | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|--------------------------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)                    | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| N40 Mode, Low channel    |         |              |          |          |        |        |        |        |
| 2389.596                 | 58.72   | -9.46        | 49.26    | 74.00    | -24.74 | 123    | 220    | peak   |
| 2389.596                 | 45.53   | -9.46        | 36.07    | 54.00    | -17.93 | 123    | 220    | AVG    |
| 4844.000                 | 43.52   | -2.11        | 41.41    | 74.00    | -32.59 | 147    | 19     | peak   |
| 4844.000                 | 31.36   | -2.11        | 29.25    | 54.00    | -24.75 | 147    | 19     | AVG    |
| 7266.000                 | 42.50   | 4.83         | 47.33    | 74.00    | -26.67 | 142    | 7      | peak   |
| 7266.000                 | 30.55   | 4.83         | 35.38    | 54.00    | -18.62 | 142    | 7      | AVG    |
| N40 Mode, Middle channel |         |              |          |          |        |        |        |        |
| 4874.000                 | 44.85   | -1.92        | 42.93    | 74.00    | -31.07 | 152    | 280    | peak   |
| 4874.000                 | 31.44   | -1.92        | 29.52    | 54.00    | -24.48 | 152    | 280    | AVG    |
| 7311.000                 | 42.87   | 5.08         | 47.95    | 74.00    | -26.05 | 147    | 214    | peak   |
| 7311.000                 | 30.70   | 5.08         | 35.78    | 54.00    | -18.22 | 147    | 214    | AVG    |
| N40 Mode, High channel   |         |              |          |          |        |        |        |        |
| 2484.564                 | 60.75   | -8.44        | 52.31    | 74.00    | -21.69 | 124    | 220    | peak   |
| 2484.564                 | 46.70   | -8.44        | 38.26    | 54.00    | -15.74 | 124    | 220    | AVG    |
| 4904.000                 | 43.77   | -1.71        | 42.06    | 74.00    | -31.94 | 145    | 293    | peak   |
| 4904.000                 | 31.71   | -1.71        | 30.00    | 54.00    | -24.00 | 145    | 293    | AVG    |
| 7356.000                 | 43.02   | 5.18         | 48.20    | 74.00    | -25.80 | 152    | 155    | peak   |
| 7356.000                 | 30.72   | 5.18         | 35.90    | 54.00    | -18.10 | 152    | 155    | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Vertical**

| Frequency                | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|--------------------------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)                    | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| N40 Mode, Low channel    |         |              |          |          |        |        |        |        |
| 2384.712                 | 57.44   | -9.50        | 47.94    | 74.00    | -26.06 | 206    | 111    | peak   |
| 2384.712                 | 44.71   | -9.50        | 35.21    | 54.00    | -18.79 | 206    | 111    | AVG    |
| 4844.000                 | 43.56   | -2.11        | 41.45    | 74.00    | -32.55 | 155    | 142    | peak   |
| 4844.000                 | 31.29   | -2.11        | 29.18    | 54.00    | -24.82 | 155    | 142    | AVG    |
| 7266.000                 | 42.99   | 4.83         | 47.82    | 74.00    | -26.18 | 146    | 136    | peak   |
| 7266.000                 | 30.60   | 4.83         | 35.43    | 54.00    | -18.57 | 146    | 136    | AVG    |
| N40 Mode, Middle channel |         |              |          |          |        |        |        |        |
| 4874.000                 | 44.27   | -1.92        | 42.35    | 74.00    | -31.65 | 153    | 226    | peak   |
| 4874.000                 | 31.21   | -1.92        | 29.29    | 54.00    | -24.71 | 153    | 226    | AVG    |
| 7311.000                 | 43.81   | 5.08         | 48.89    | 74.00    | -25.11 | 146    | 86     | peak   |
| 7311.000                 | 30.73   | 5.08         | 35.81    | 54.00    | -18.19 | 146    | 86     | AVG    |
| N40 Mode, High channel   |         |              |          |          |        |        |        |        |
| 2483.952                 | 59.88   | -8.44        | 51.44    | 74.00    | -22.56 | 207    | 109    | peak   |
| 2483.952                 | 46.27   | -8.44        | 37.83    | 54.00    | -16.17 | 207    | 109    | AVG    |
| 4904.000                 | 43.85   | -1.71        | 42.14    | 74.00    | -31.86 | 158    | 210    | peak   |
| 4904.000                 | 31.28   | -1.71        | 29.57    | 54.00    | -24.43 | 158    | 210    | AVG    |
| 7356.000                 | 42.77   | 5.18         | 47.95    | 74.00    | -26.05 | 146    | 321    | peak   |
| 7356.000                 | 30.70   | 5.18         | 35.88    | 54.00    | -18.12 | 146    | 321    | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Horizontal**

| Frequency                    | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|------------------------------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)                        | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| BLE(1M) Mode, Low channel    |         |              |          |          |        |        |        |        |
| 2390.000                     | 59.71   | -9.46        | 50.25    | 74.00    | -23.75 | 145    | 33     | peak   |
| 2390.000                     | 48.07   | -9.46        | 38.61    | 54.00    | -15.39 | 145    | 33     | AVG    |
| 4804.000                     | 56.02   | -2.17        | 53.85    | 74.00    | -20.15 | 105    | 148    | peak   |
| 4804.000                     | 51.25   | -2.17        | 49.08    | 54.00    | -4.92  | 105    | 148    | AVG    |
| 7206.000                     | 43.64   | 4.18         | 47.82    | 74.00    | -26.18 | 158    | 72     | peak   |
| 7206.000                     | 29.36   | 4.18         | 33.54    | 54.00    | -20.46 | 158    | 72     | AVG    |
| BLE(1M) Mode, Middle channel |         |              |          |          |        |        |        |        |
| 4880.000                     | 56.41   | -1.88        | 54.53    | 74.00    | -19.47 | 108    | 168    | peak   |
| 4880.000                     | 52.14   | -1.88        | 50.26    | 54.00    | -3.74  | 108    | 168    | AVG    |
| 7320.000                     | 43.53   | 5.10         | 48.63    | 74.00    | -25.37 | 152    | 75     | peak   |
| 7320.000                     | 30.28   | 5.10         | 35.38    | 54.00    | -18.62 | 152    | 75     | AVG    |
| BLE(1M) Mode, High channel   |         |              |          |          |        |        |        |        |
| 2488.420                     | 66.49   | -8.38        | 58.11    | 74.00    | -15.89 | 143    | 60     | peak   |
| 2488.420                     | 52.09   | -8.38        | 43.71    | 54.00    | -10.29 | 143    | 60     | AVG    |
| 4960.000                     | 56.77   | -1.49        | 55.28    | 74.00    | -18.72 | 101    | 175    | peak   |
| 4960.000                     | 53.20   | -1.49        | 51.71    | 54.00    | -2.29  | 101    | 175    | AVG    |
| 7440.000                     | 43.03   | 5.23         | 48.26    | 74.00    | -25.74 | 150    | 36     | peak   |
| 7440.000                     | 29.54   | 5.23         | 34.77    | 54.00    | -19.23 | 150    | 36     | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Vertical**

| Frequency                    | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|------------------------------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)                        | (dBμV)  | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB)   | (cm)   | ( ° )  |        |
| BLE(1M) Mode, Low channel    |         |              |          |          |        |        |        |        |
| 2374.700                     | 56.87   | -9.58        | 47.29    | 74.00    | -26.71 | 180    | 94     | peak   |
| 2374.700                     | 44.31   | -9.58        | 34.73    | 54.00    | -19.27 | 180    | 94     | AVG    |
| 4804.000                     | 53.49   | -2.17        | 51.32    | 74.00    | -22.68 | 146    | 122    | peak   |
| 4804.000                     | 48.30   | -2.17        | 46.13    | 54.00    | -7.87  | 146    | 122    | AVG    |
| 7206.000                     | 43.41   | 4.18         | 47.59    | 74.00    | -26.41 | 150    | 285    | peak   |
| 7206.000                     | 29.75   | 4.18         | 33.93    | 54.00    | -20.07 | 150    | 285    | AVG    |
| BLE(1M) Mode, Middle channel |         |              |          |          |        |        |        |        |
| 4880.000                     | 53.46   | -1.88        | 51.58    | 74.00    | -22.42 | 145    | 131    | peak   |
| 4880.000                     | 48.63   | -1.88        | 46.75    | 54.00    | -7.25  | 145    | 131    | AVG    |
| 7320.000                     | 43.80   | 5.10         | 48.90    | 74.00    | -25.10 | 157    | 36     | peak   |
| 7320.000                     | 30.15   | 5.10         | 35.25    | 54.00    | -18.75 | 157    | 36     | AVG    |
| BLE(1M) Mode, High channel   |         |              |          |          |        |        |        |        |
| 2488.750                     | 59.60   | -8.38        | 51.22    | 74.00    | -22.78 | 180    | 165    | peak   |
| 2488.750                     | 45.91   | -8.38        | 37.53    | 54.00    | -16.47 | 180    | 165    | AVG    |
| 4960.000                     | 54.39   | -1.49        | 52.90    | 74.00    | -21.10 | 145    | 100    | peak   |
| 4960.000                     | 49.86   | -1.49        | 48.37    | 54.00    | -5.63  | 145    | 100    | AVG    |
| 7440.000                     | 42.60   | 5.23         | 47.83    | 74.00    | -26.17 | 152    | 75     | peak   |
| 7440.000                     | 29.71   | 5.23         | 34.94    | 54.00    | -19.06 | 152    | 75     | AVG    |

Result = Reading + Correct Factor

Margin = Result – Limit

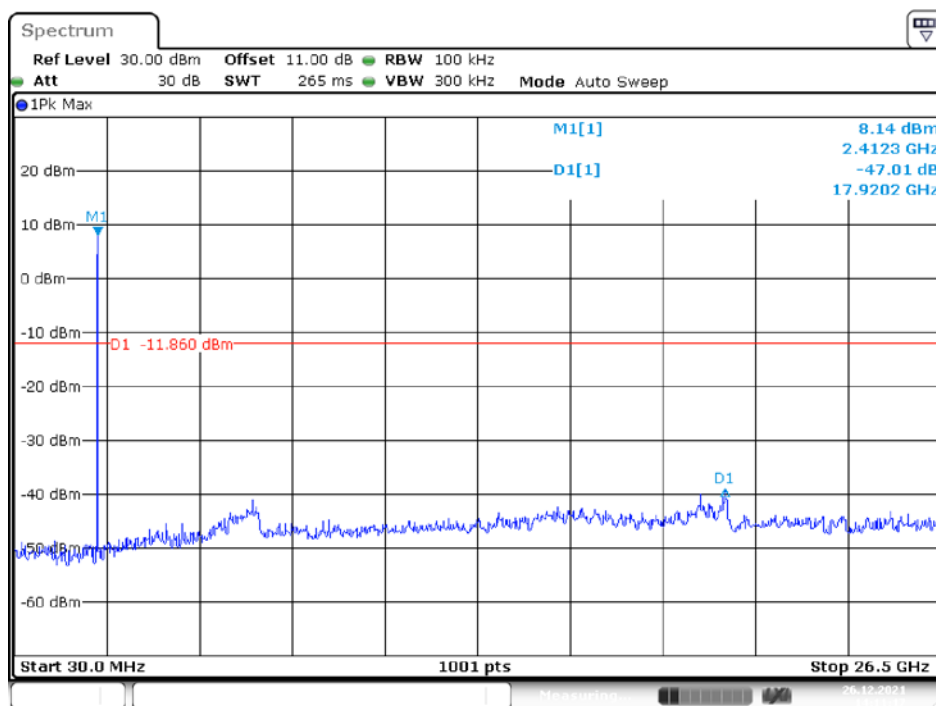
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

**Conducted Spurious Emissions:**

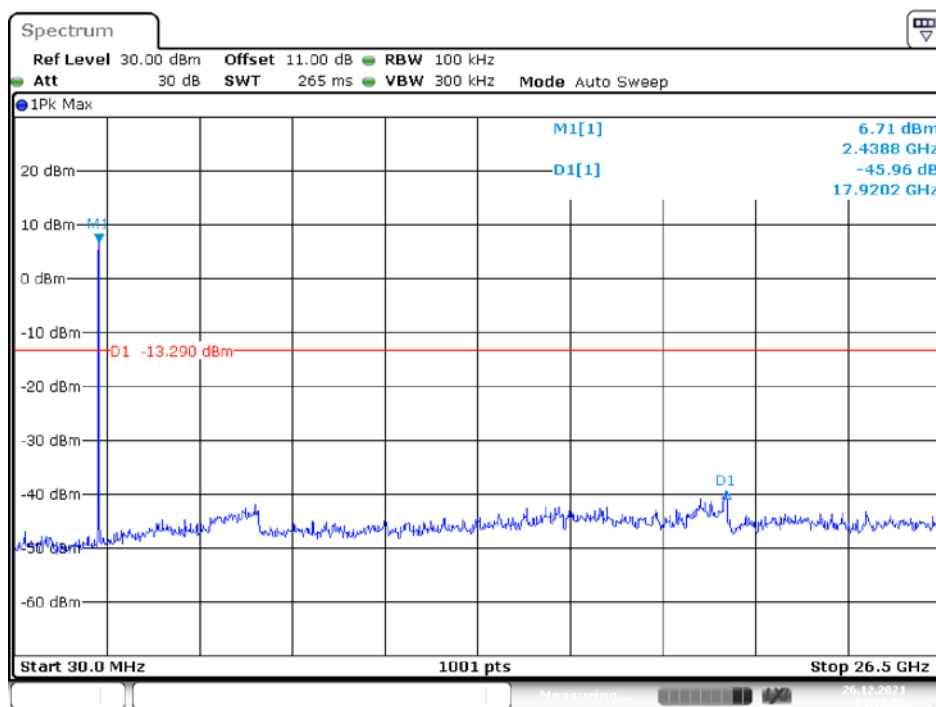
| Channel      | Frequency (MHz) | Delta Peak to Band Emission (dBc) | Limit (dBc) | Result |
|--------------|-----------------|-----------------------------------|-------------|--------|
| B Mode       |                 |                                   |             |        |
| Low          | 2412            | 47.01                             | $\geq 20$   | PASS   |
| Middle       | 2437            | 45.96                             | $\geq 20$   | PASS   |
| High         | 2462            | 47.34                             | $\geq 20$   | PASS   |
| G Mode       |                 |                                   |             |        |
| Low          | 2412            | 41.64                             | $\geq 20$   | PASS   |
| Middle       | 2437            | 41.67                             | $\geq 20$   | PASS   |
| High         | 2462            | 41.77                             | $\geq 20$   | PASS   |
| N20 Mode     |                 |                                   |             |        |
| Low          | 2412            | 42.78                             | $\geq 20$   | PASS   |
| Middle       | 2437            | 42.46                             | $\geq 20$   | PASS   |
| High         | 2462            | 41.83                             | $\geq 20$   | PASS   |
| N40 Mode     |                 |                                   |             |        |
| Low          | 2422            | 39.40                             | $\geq 20$   | PASS   |
| Middle       | 2437            | 40.36                             | $\geq 20$   | PASS   |
| High         | 2452            | 36.30                             | $\geq 20$   | PASS   |
| BLE(1M) Mode |                 |                                   |             |        |
| Low          | 2402            | 44.41                             | $\geq 20$   | PASS   |
| Middle       | 2440            | 48.10                             | $\geq 20$   | PASS   |
| High         | 2480            | 46.25                             | $\geq 20$   | PASS   |

## B Mode Low Channel



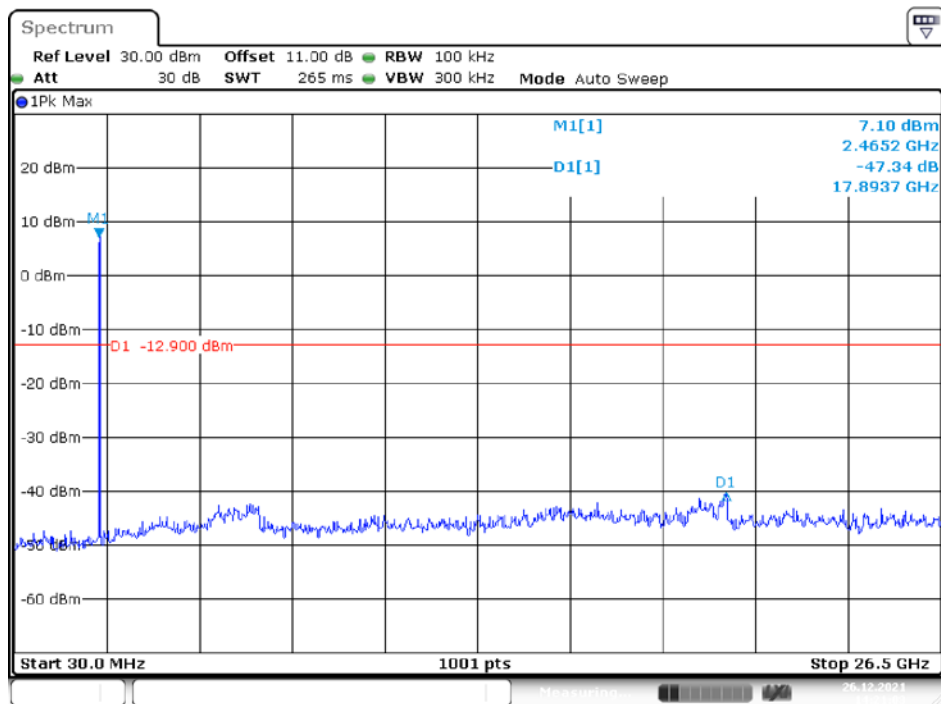
Date: 26.DEC.2021 14:11:18

## Middle Channel



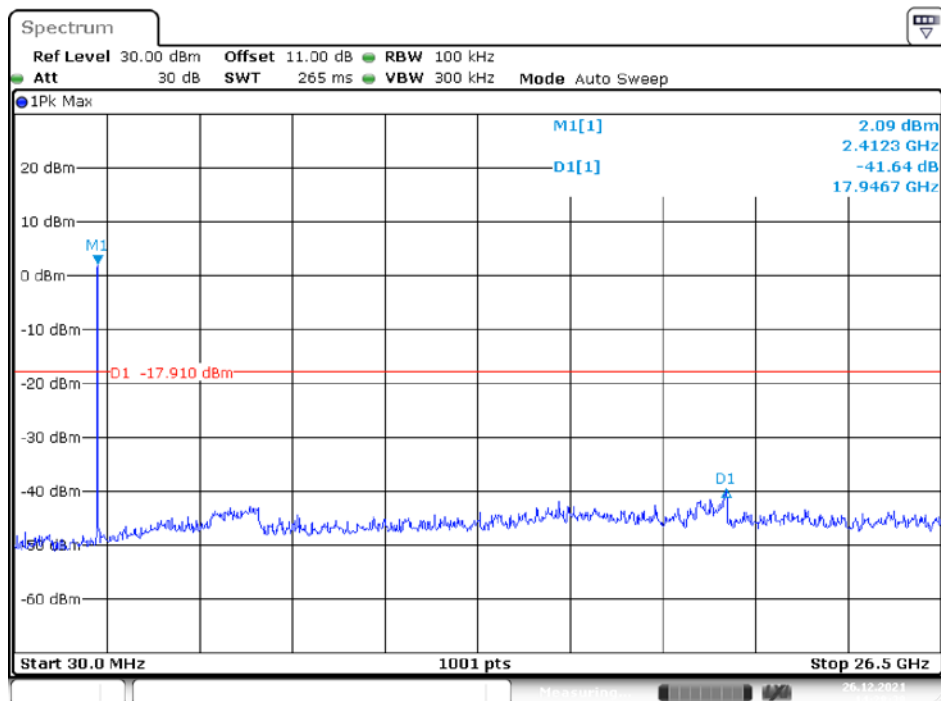
Date: 26.DEC.2021 14:14:59

## High Channel



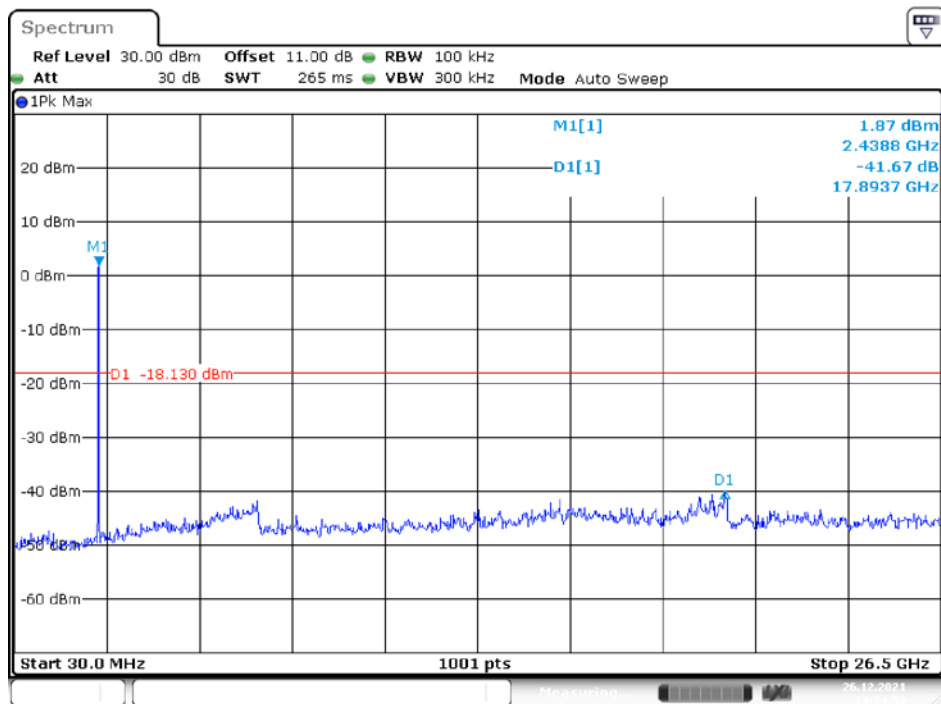
Date: 26.DEC.2021 14:21:03

## G Mode Low Channel



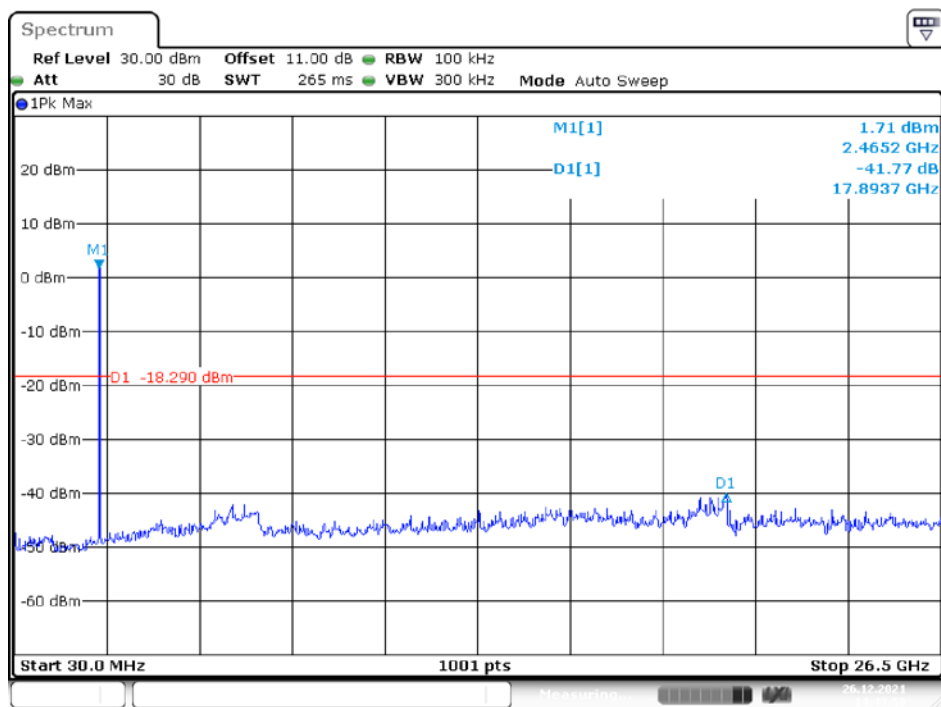
Date: 26.DEC.2021 14:28:38

### Middle Channel



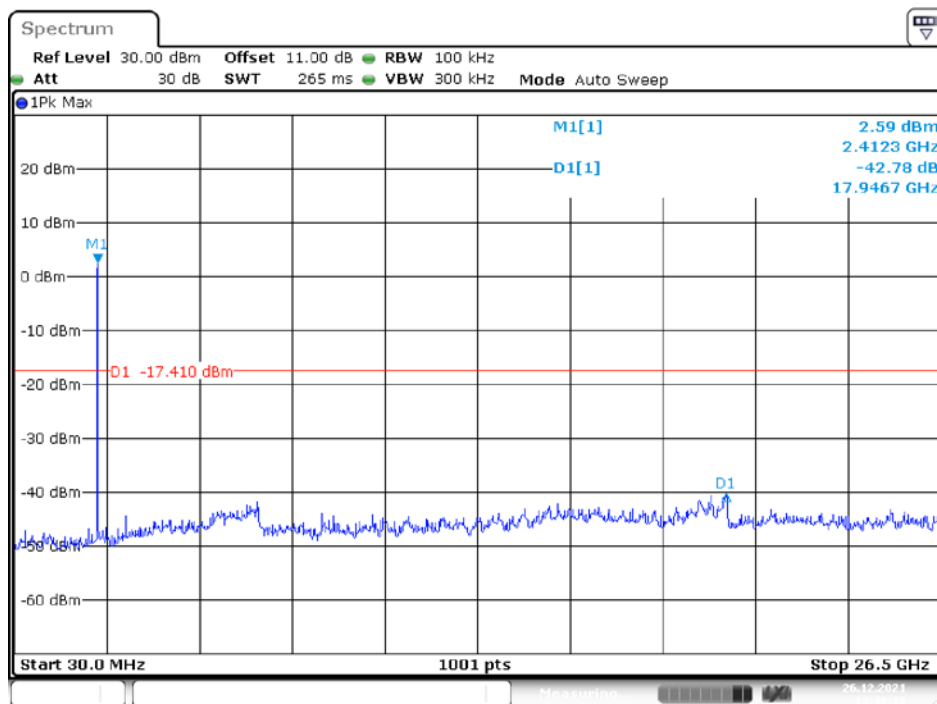
Date: 26.DEC.2021 14:34:53

### High Channel



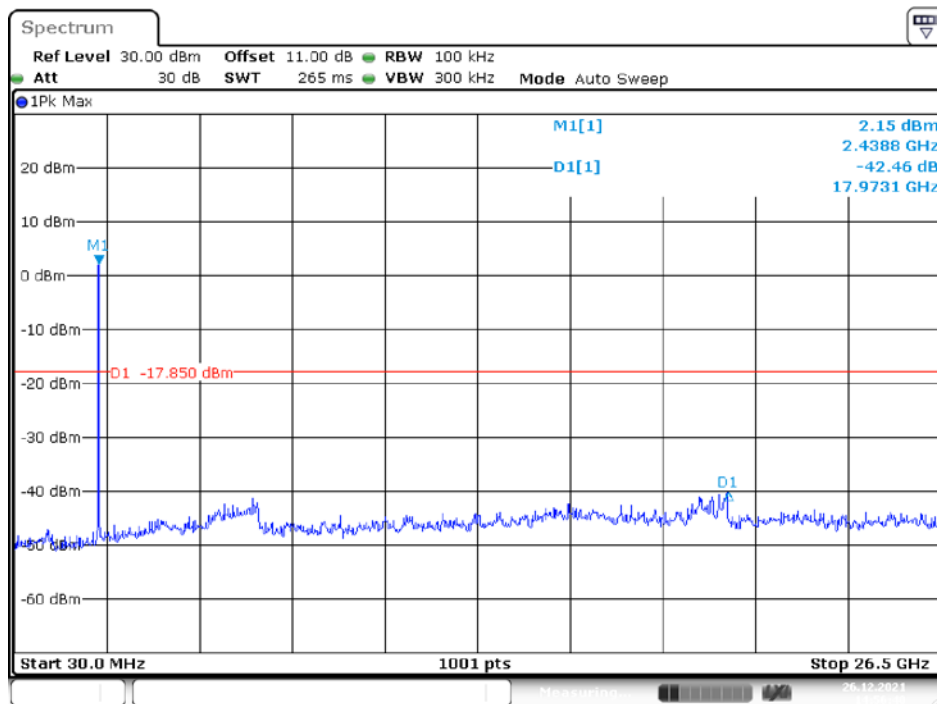
Date: 26.DEC.2021 14:43:51

## N20 Mode Low Channel



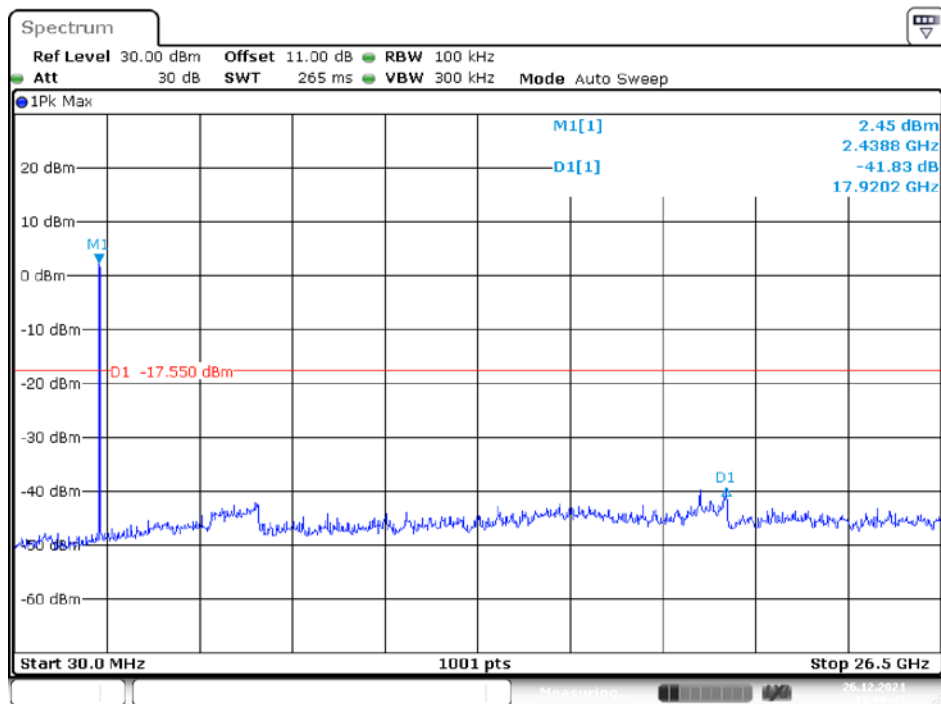
Date: 26.DEC.2021 14:48:18

## Middle Channel



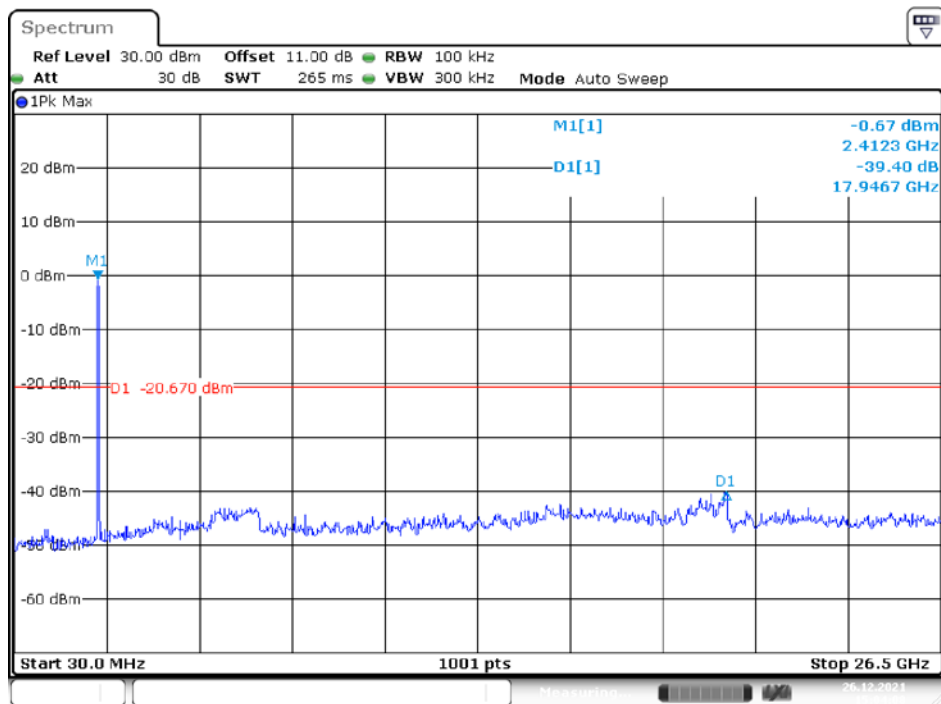
Date: 26.DEC.2021 14:56:40

## High Channel



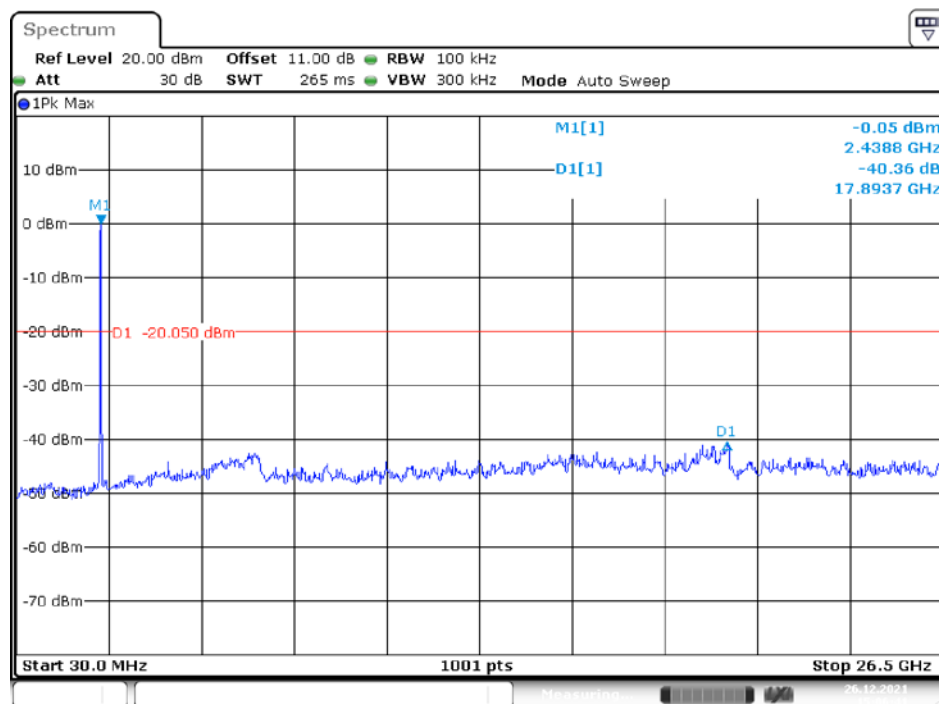
Date: 26.DEC.2021 15:00:43

## N40 Mode Low Channel



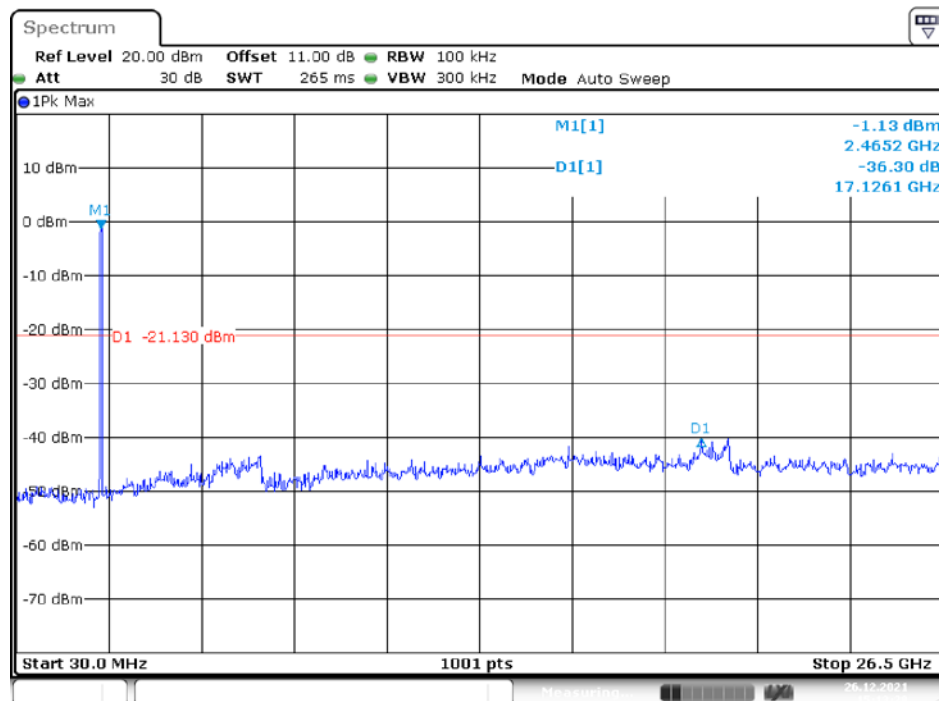
Date: 26.DEC.2021 15:04:03

# Middle Channel



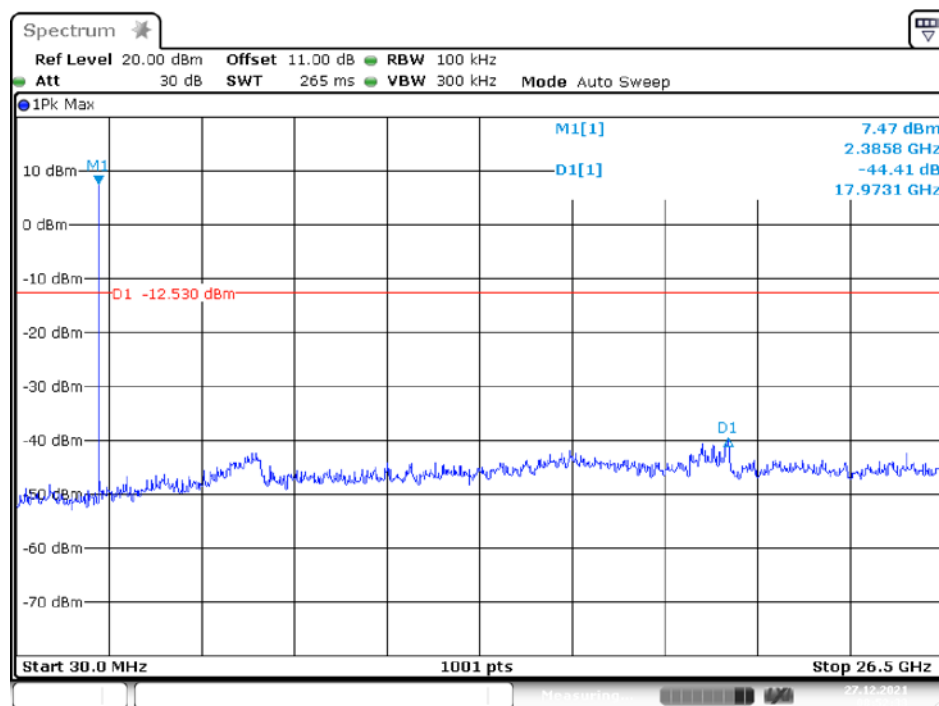
Date: 26.DEC.2021 15:06:41

# High Channel



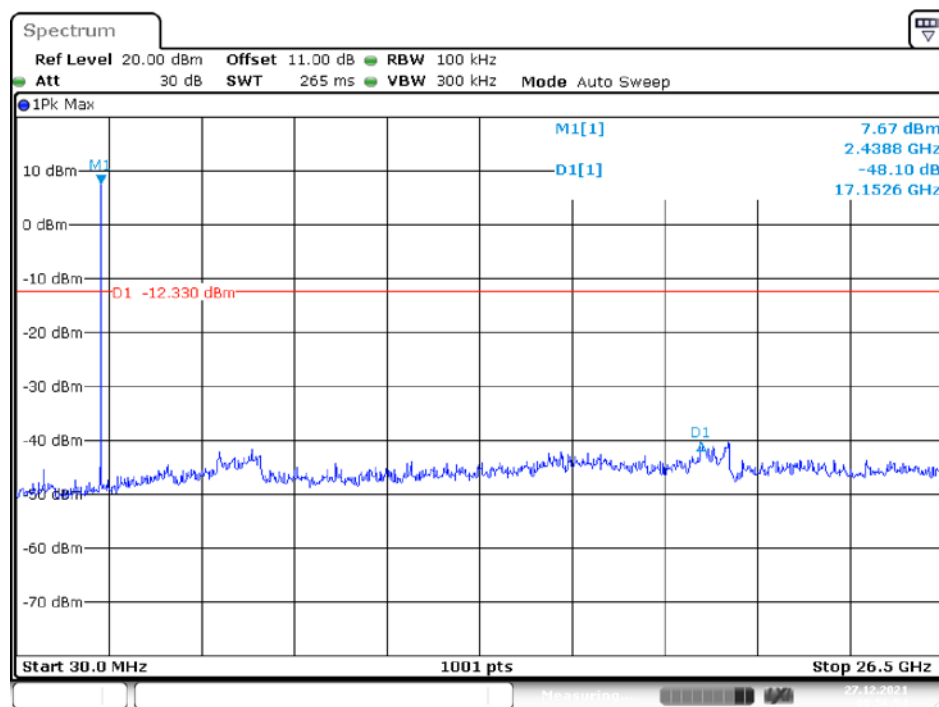
Date: 26.DEC.2021 15:13:28

## BLE(1M) Mode Low Channel



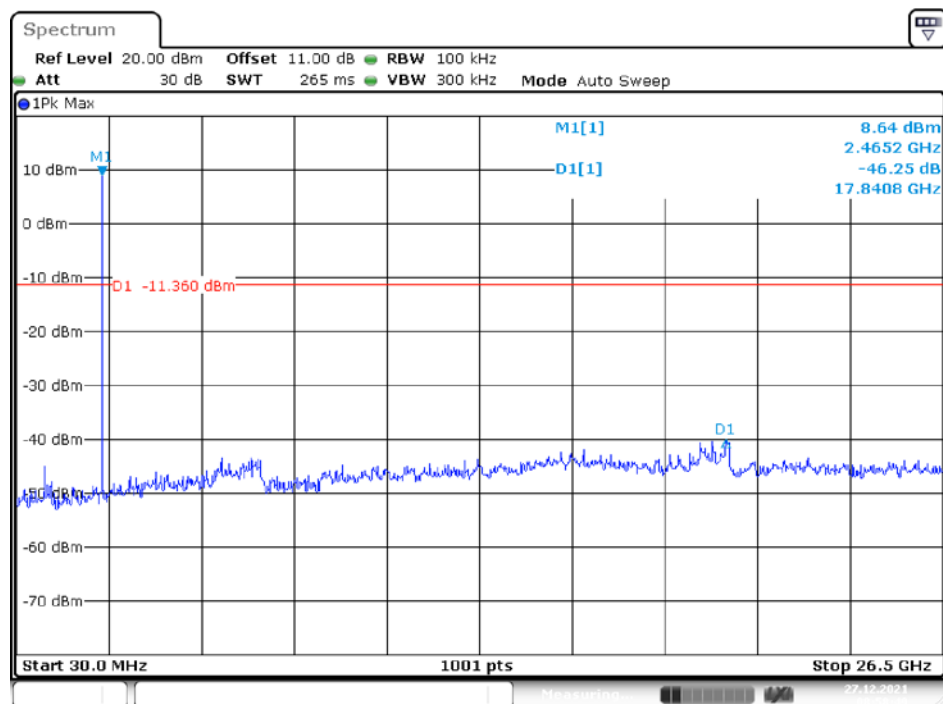
Date: 27.DEC.2021 08:52:34

## Middle Channel



Date: 27.DEC.2021 08:56:54

# High Channel



Date: 27.DEC.2021 08:58:49

## 9 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

### 9.1 Applicable Standard

According to FCC §15.247(a)(2).

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.

### 9.2 Test Procedure

The steps for the first option are as follows:

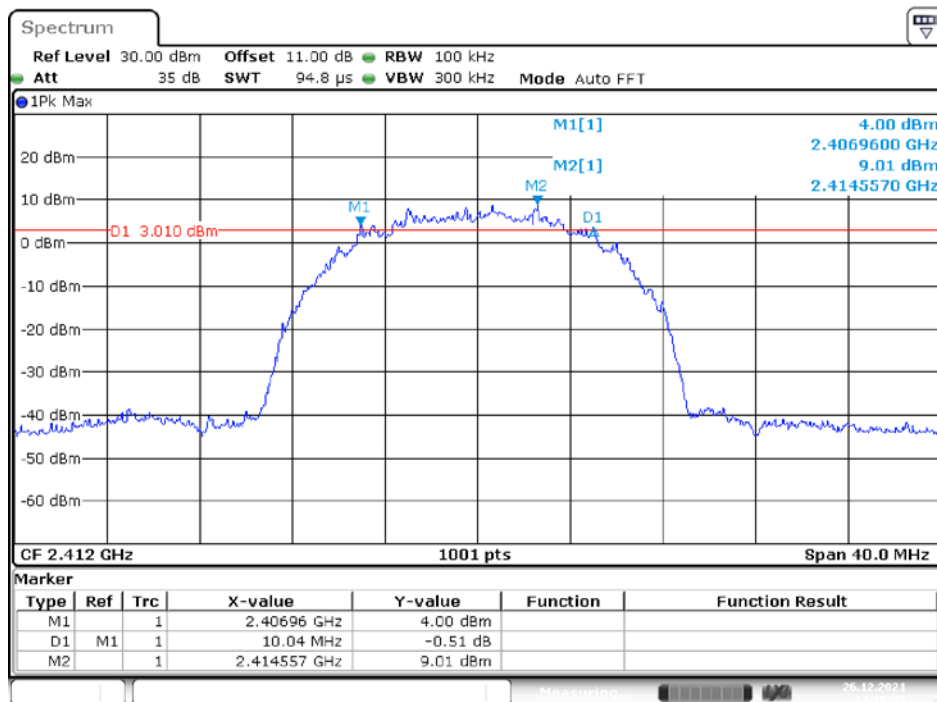
- a) Set RBW = 100 kHz.
- b) Set the VBW  $\geq [3 \times \text{RBW}]$ .
- c) Detector = peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**9.3 Test Results**

| Channel      | Frequency<br>(MHz) | 6 dB Emission<br>Bandwidth<br>(MHz) | Limit<br>(kHz) | Result |
|--------------|--------------------|-------------------------------------|----------------|--------|
| B Mode       |                    |                                     |                |        |
| Low          | 2412               | 10.04                               | > 500          | PASS   |
| Middle       | 2437               | 10.04                               | > 500          | PASS   |
| High         | 2462               | 10.04                               | > 500          | PASS   |
| G Mode       |                    |                                     |                |        |
| Low          | 2412               | 16.44                               | > 500          | PASS   |
| Middle       | 2437               | 16.44                               | > 500          | PASS   |
| High         | 2462               | 16.44                               | > 500          | PASS   |
| N20 Mode     |                    |                                     |                |        |
| Low          | 2412               | 17.60                               | > 500          | PASS   |
| Middle       | 2437               | 17.60                               | > 500          | PASS   |
| High         | 2462               | 17.60                               | > 500          | PASS   |
| N40 Mode     |                    |                                     |                |        |
| Low          | 2422               | 36.40                               | > 500          | PASS   |
| Middle       | 2437               | 36.40                               | > 500          | PASS   |
| High         | 2452               | 36.40                               | > 500          | PASS   |
| BLE(1M) Mode |                    |                                     |                |        |
| Low          | 2402               | 0.65                                | > 500          | PASS   |
| Middle       | 2440               | 0.65                                | > 500          | PASS   |
| High         | 2480               | 0.65                                | > 500          | PASS   |

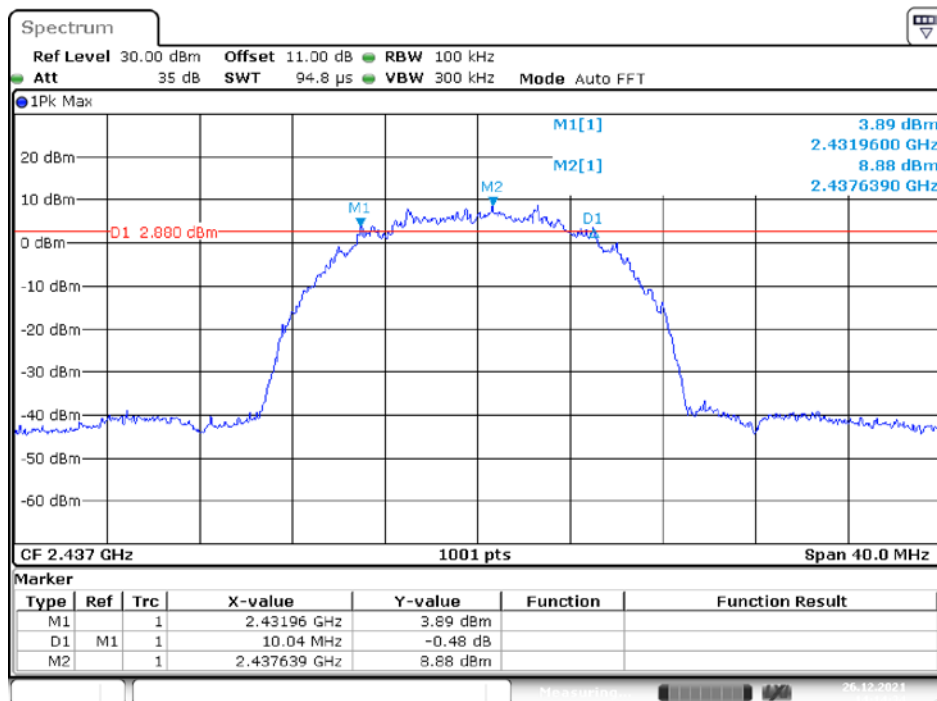
Please refer to the following plots

### B Mode Low Channel



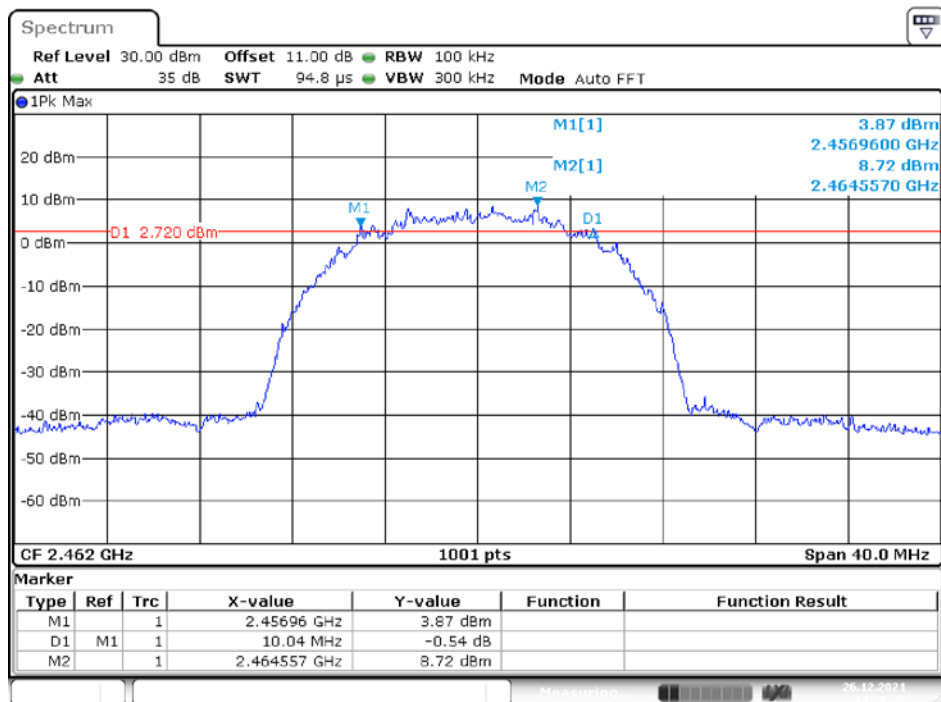
Date: 26.DEC.2021 14:10:33

### Middle Channel

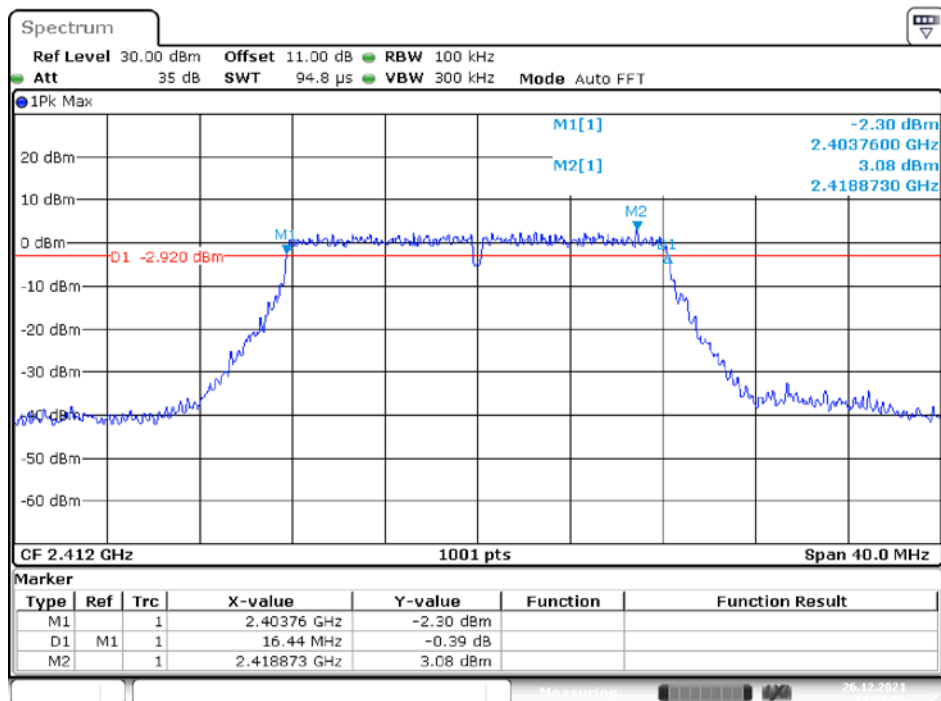


Date: 26.DEC.2021 14:14:34

## High Channel

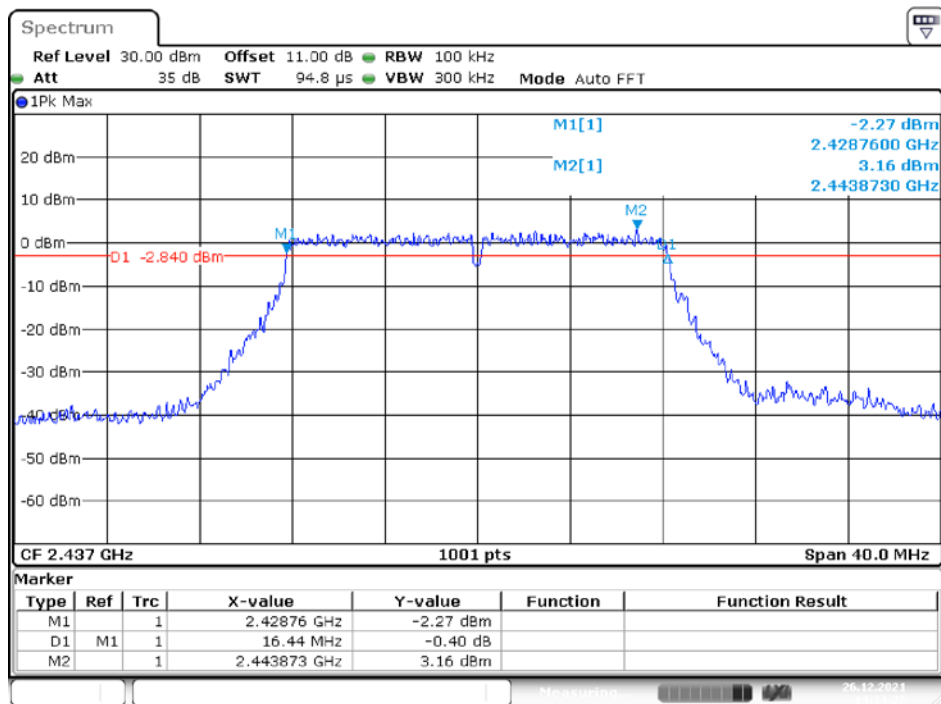


Date: 26.DEC.2021 14:20:22

G Mode  
Low Channel

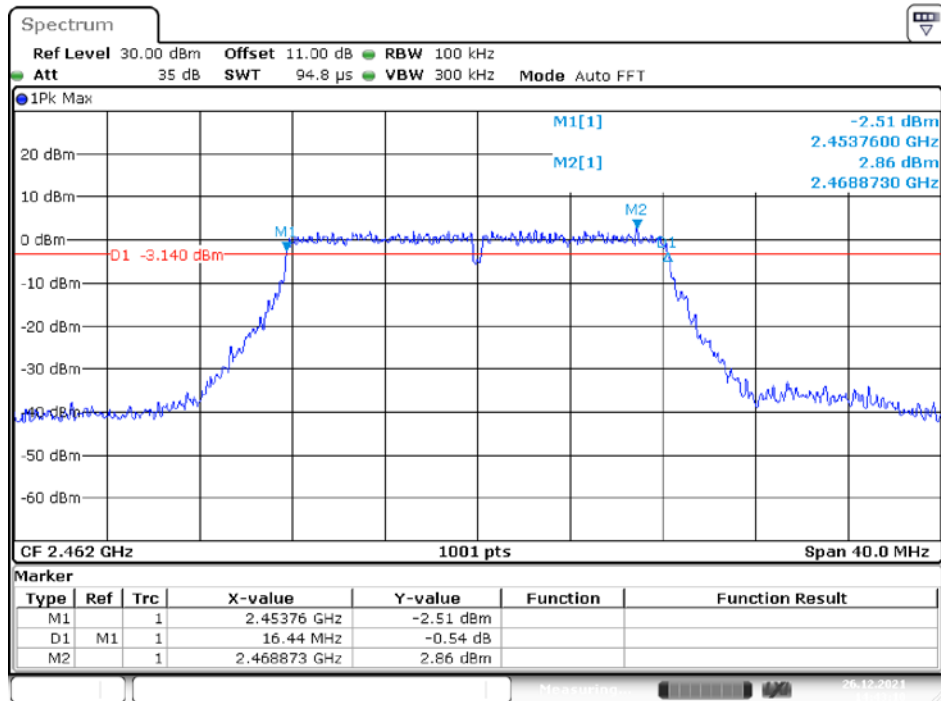
Date: 26.DEC.2021 14:27:57

## Middle Channel



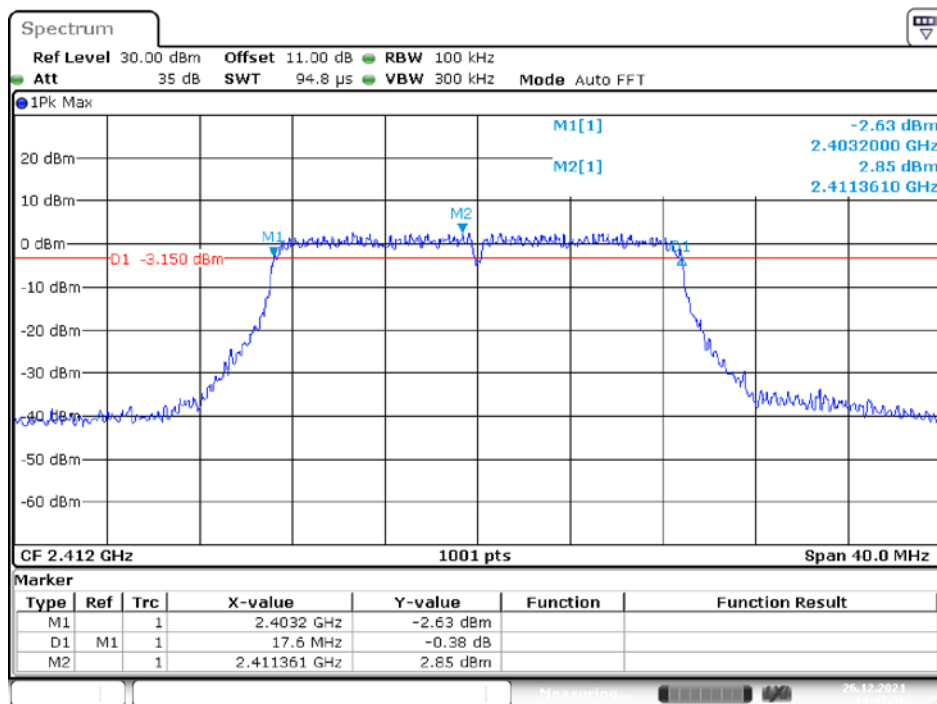
Date: 26.DEC.2021 14:34:28

## High Channel



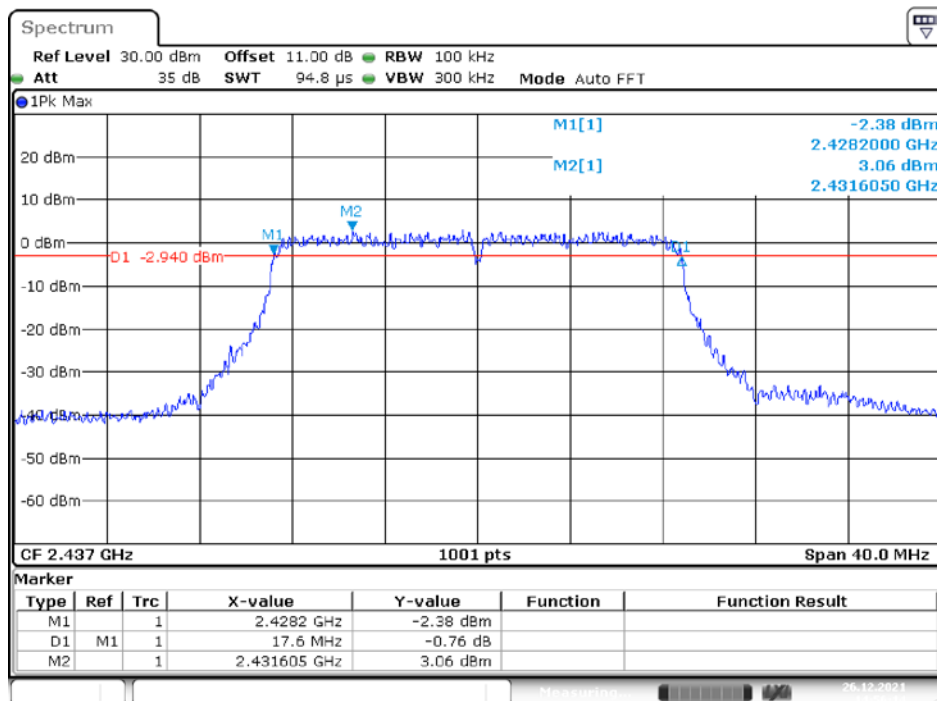
Date: 26.DEC.2021 14:43:10

## N20 Mode Low Channel



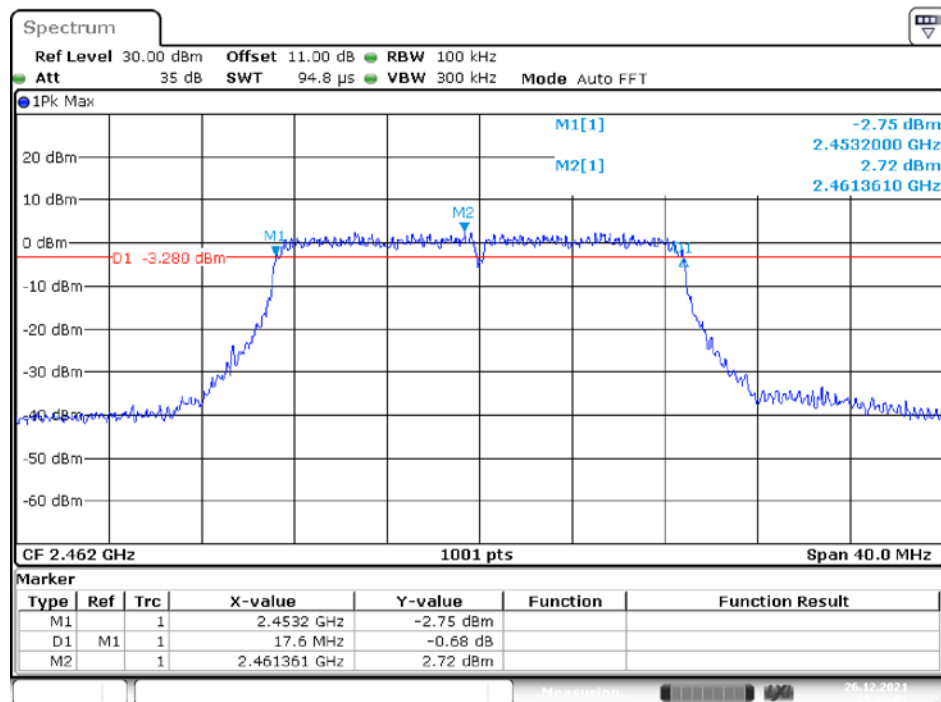
Date: 26.DEC.2021 14:47:37

## Middle Channel



Date: 26.DEC.2021 14:56:14

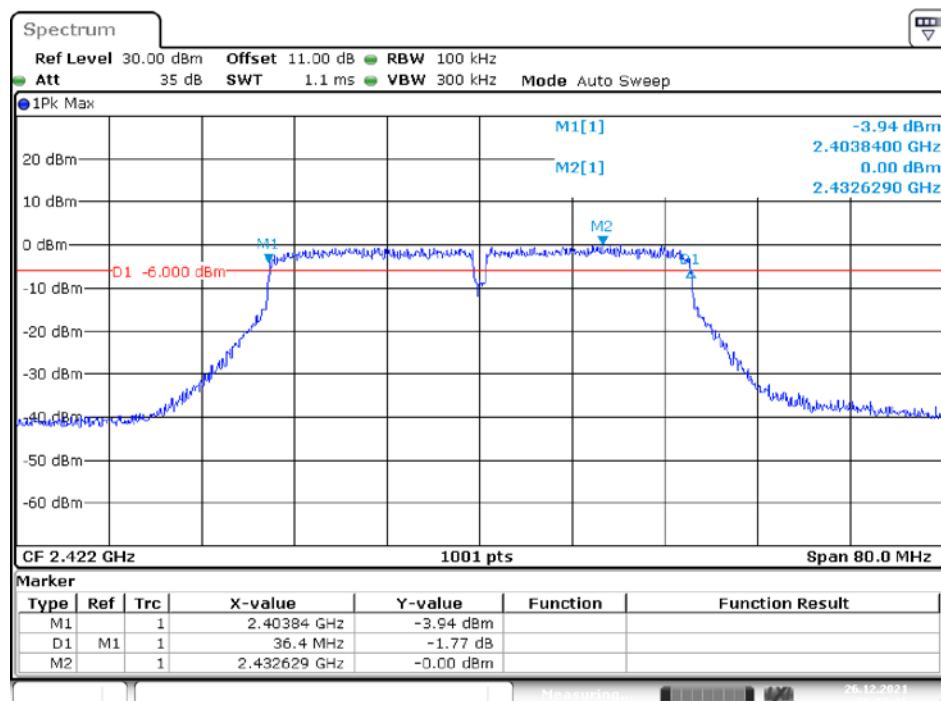
## High Channel



Date: 26.DEC.2021 15:00:01

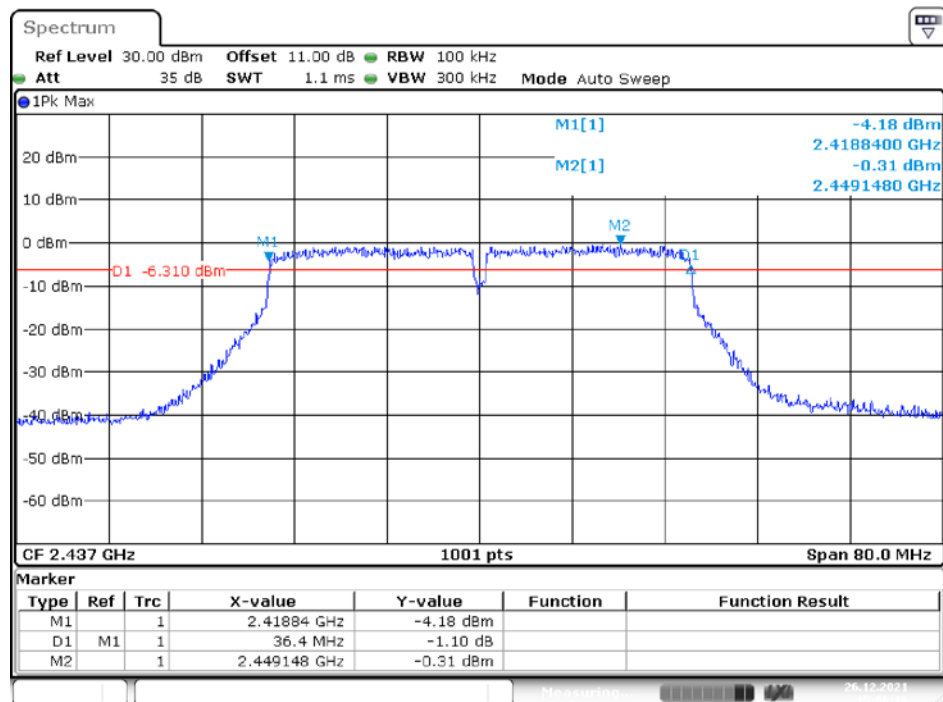
## N40 Mode

## Low Channel



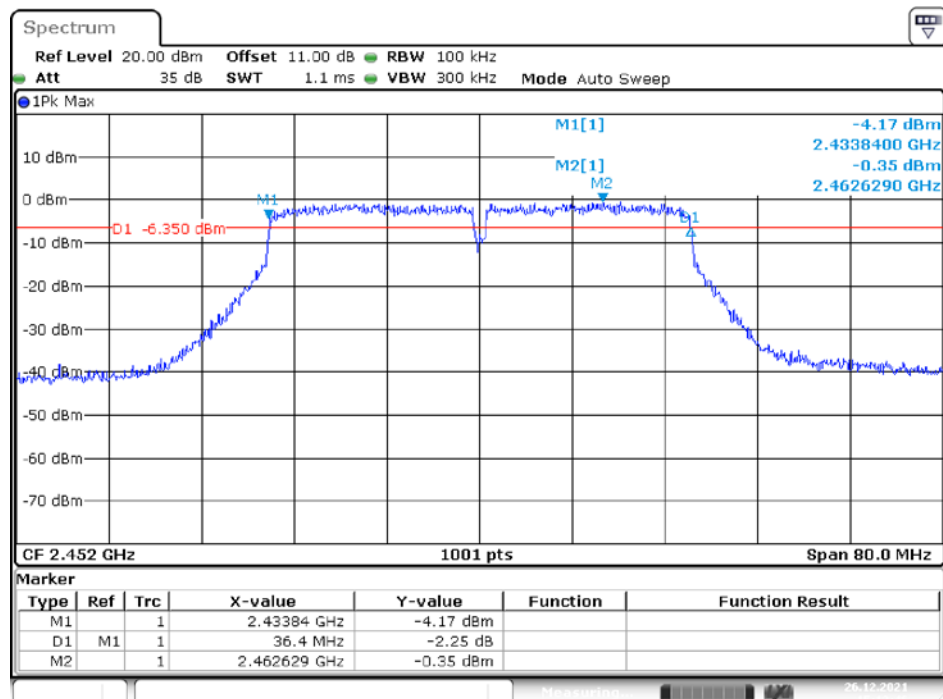
Date: 26.DEC.2021 15:03:27

## Middle Channel

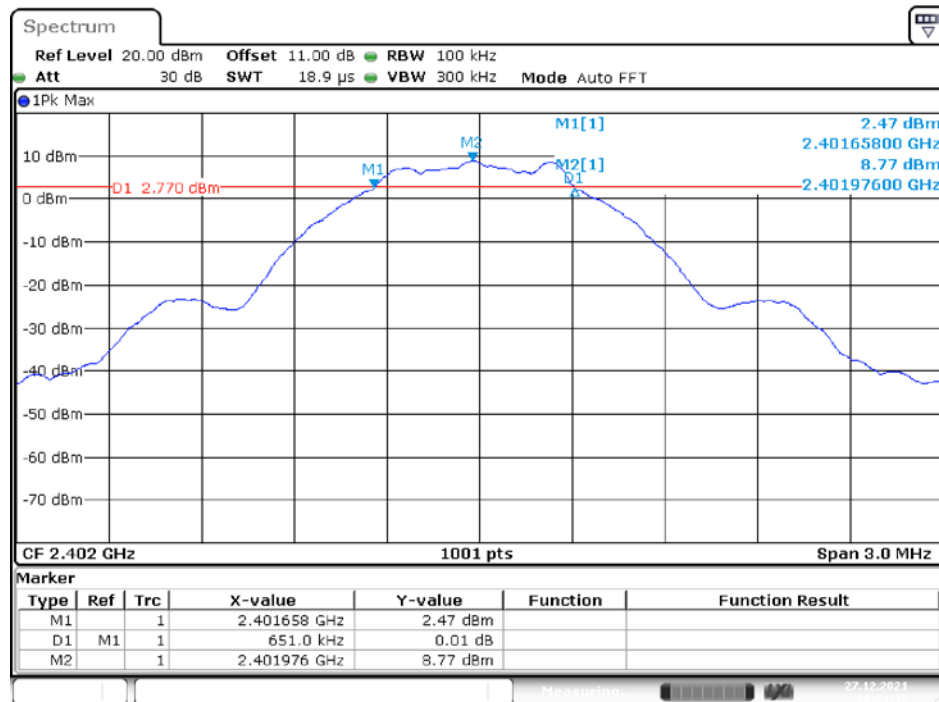


Date: 26.DEC.2021 15:06:16

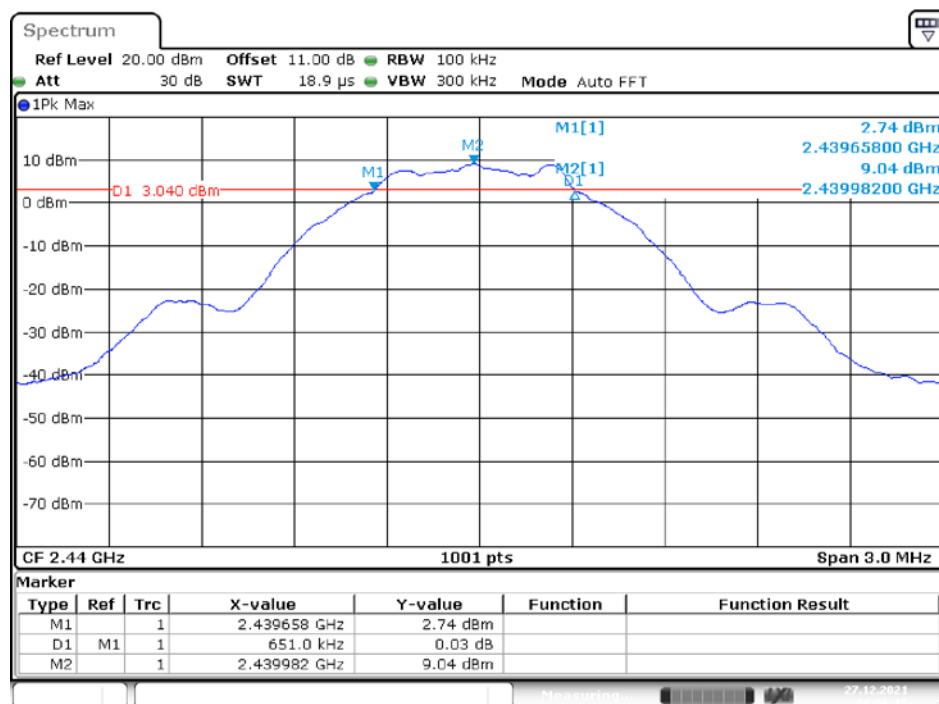
## High Channel



Date: 26.DEC.2021 15:12:47

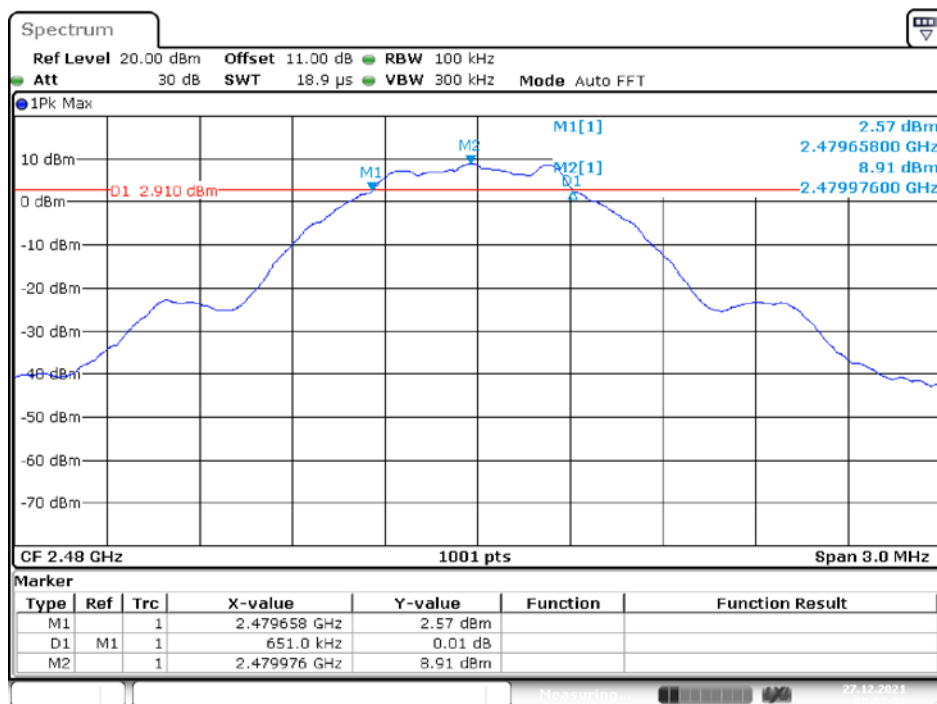
**BLE(1M) Mode****Low Channel**

Date: 27.DEC.2021 08:51:37

**Middle Channel**

Date: 27.DEC.2021 08:56:14

# High Channel



Date: 27.DEC.2021 08:57:52

## **10 FCC §15.247(b)(3) – Maximum Output Power**

### **10.1 Applicable Standard**

According to FCC §15.247(b) (3).

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.

### **10.2 Test Procedure**

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 measuring equipment.

### 10.3 Test Results

#### Conducted Peak Output Power

| Channel           | Frequency (MHz) | Power (dBm) | Power (W) | Limit (W) | Result |
|-------------------|-----------------|-------------|-----------|-----------|--------|
| 802.11b Mode      |                 |             |           |           |        |
| Low               | 2412            | 9.38        | 0.009     | 1         | PASS   |
| Middle            | 2437            | 9.41        | 0.009     | 1         | PASS   |
| High              | 2462            | 9.47        | 0.009     | 1         | PASS   |
| 802.11g Mode      |                 |             |           |           |        |
| Low               | 2412            | 9.41        | 0.009     | 1         | PASS   |
| Middle            | 2437            | 9.42        | 0.009     | 1         | PASS   |
| High              | 2462            | 9.35        | 0.009     | 1         | PASS   |
| 802.11n HT20 Mode |                 |             |           |           |        |
| Low               | 2412            | 9.27        | 0.008     | 1         | PASS   |
| Middle            | 2437            | 9.21        | 0.008     | 1         | PASS   |
| High              | 2462            | 9.31        | 0.009     | 1         | PASS   |
| 802.11n HT40 Mode |                 |             |           |           |        |
| Low               | 2422            | 9.48        | 0.009     | 1         | PASS   |
| Middle            | 2437            | 9.12        | 0.008     | 1         | PASS   |
| High              | 2452            | 9.46        | 0.009     | 1         | PASS   |
| BLE(1M) Mode      |                 |             |           |           |        |
| Low               | 2402            | 9.01        | 0.008     | 1         | PASS   |
| Middle            | 2440            | 9.24        | 0.008     | 1         | PASS   |
| High              | 2480            | 9.11        | 0.008     | 1         | PASS   |

## 11 FCC§15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

### 11.1 Applicable Standard

According to FCC §15.247(d).

In any 100kHz 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 20dB 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 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 30dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### 11.2 Test Procedure

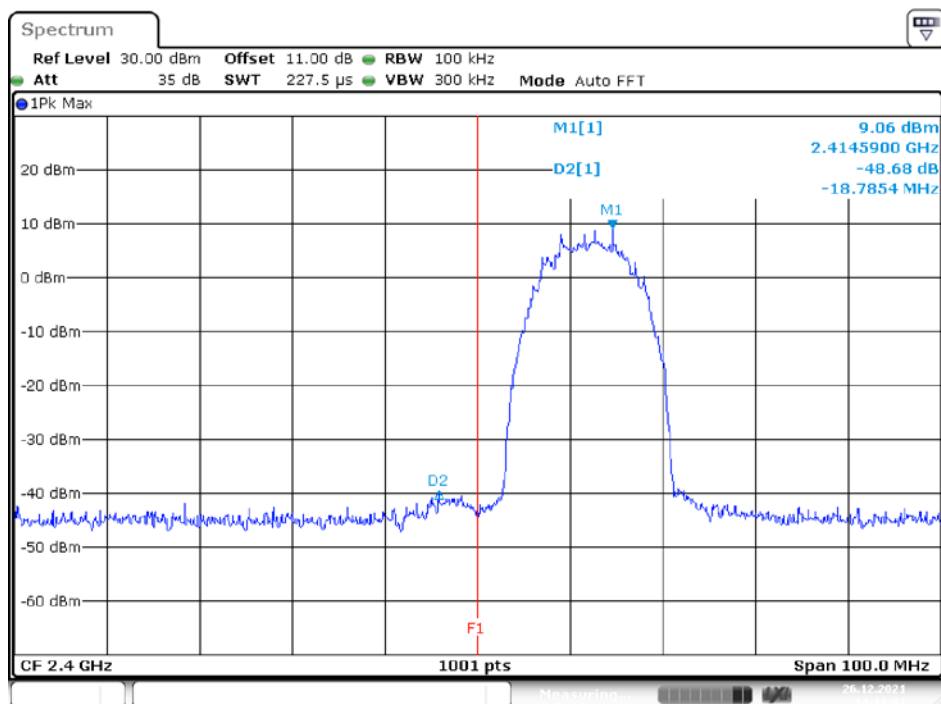
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then 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.

**11.3 Test Results**

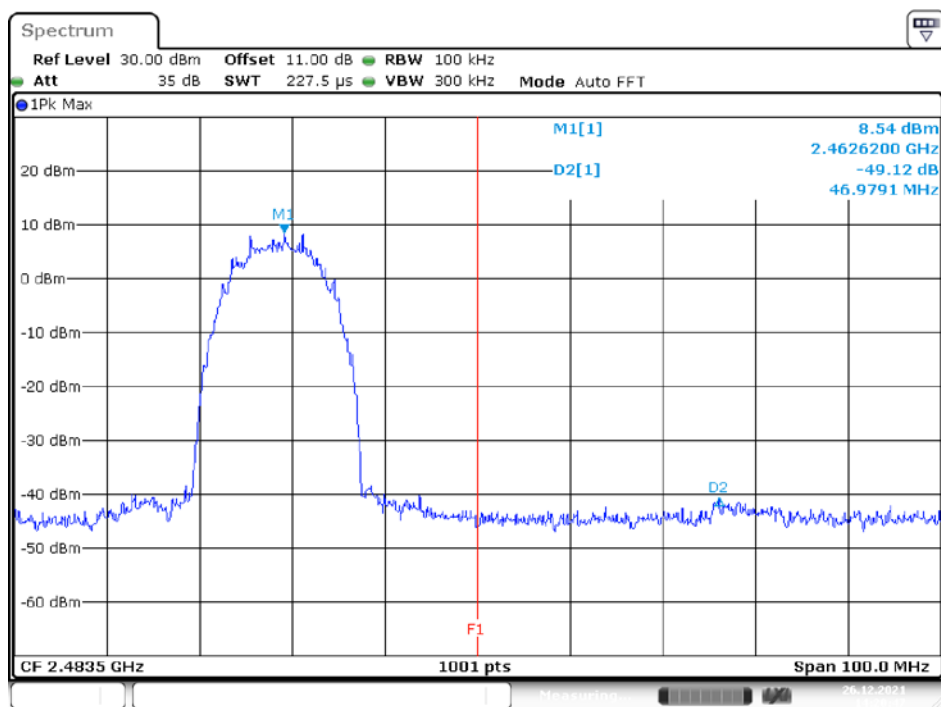
| Channel      | Frequency<br>(MHz) | Delta Peak to<br>Band Emission<br>(dBc) | Limit<br>(dBc) | Result |
|--------------|--------------------|-----------------------------------------|----------------|--------|
| B Mode       |                    |                                         |                |        |
| Low          | 2412               | 48.68                                   | $\geq 20$      | PASS   |
| High         | 2462               | 49.12                                   | $\geq 20$      | PASS   |
| G Mode       |                    |                                         |                |        |
| Low          | 2412               | 39.98                                   | $\geq 20$      | PASS   |
| High         | 2462               | 43.08                                   | $\geq 20$      | PASS   |
| N20 Mode     |                    |                                         |                |        |
| Low          | 2412               | 38.49                                   | $\geq 20$      | PASS   |
| High         | 2462               | 43.37                                   | $\geq 20$      | PASS   |
| N40 Mode     |                    |                                         |                |        |
| Low          | 2422               | 27.63                                   | $\geq 20$      | PASS   |
| High         | 2452               | 37.22                                   | $\geq 20$      | PASS   |
| BLE(1M) Mode |                    |                                         |                |        |
| Low          | 2402               | 50.23                                   | $\geq 20$      | PASS   |
| High         | 2480               | 51.39                                   | $\geq 20$      | PASS   |

Please refer to the following plots.

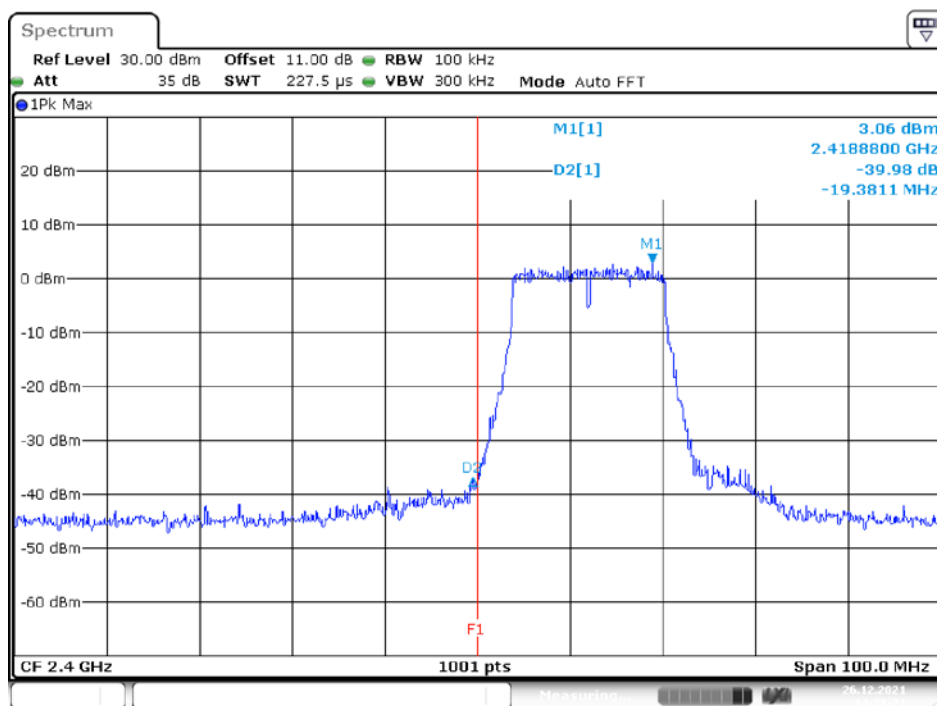
### B Mode Band Edge, Left Side



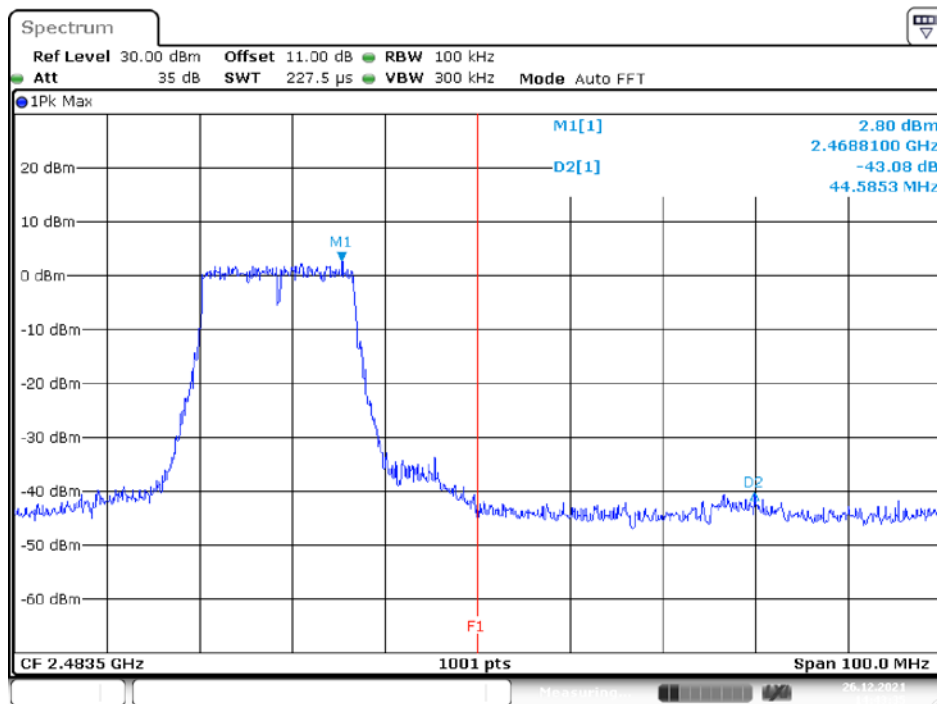
### Band Edge, Right Side



## G Mode Band Edge, Left Side

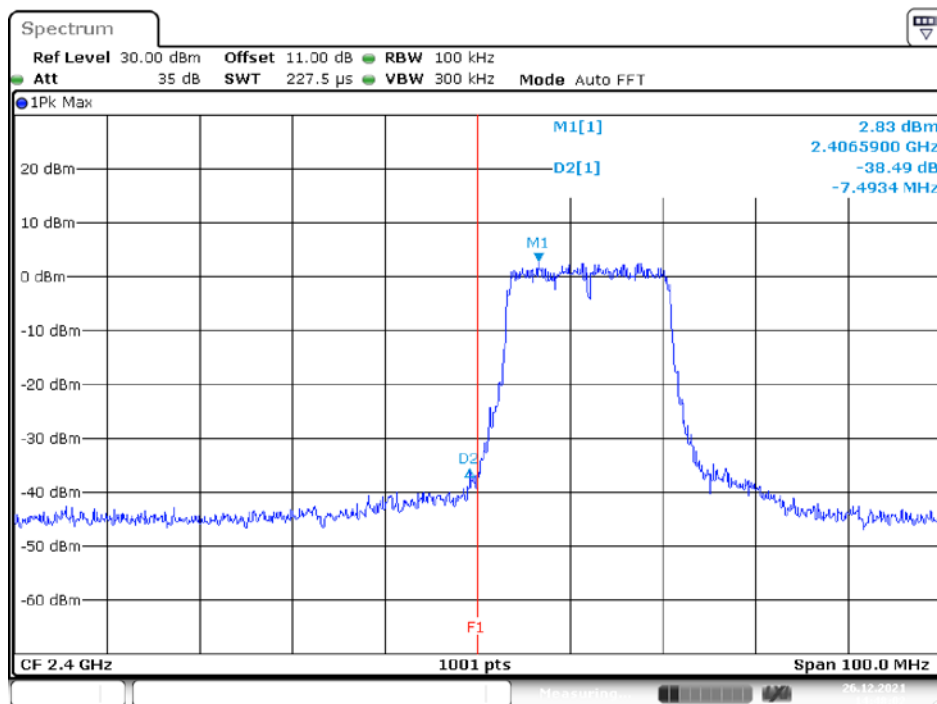


## Band Edge, Right Side

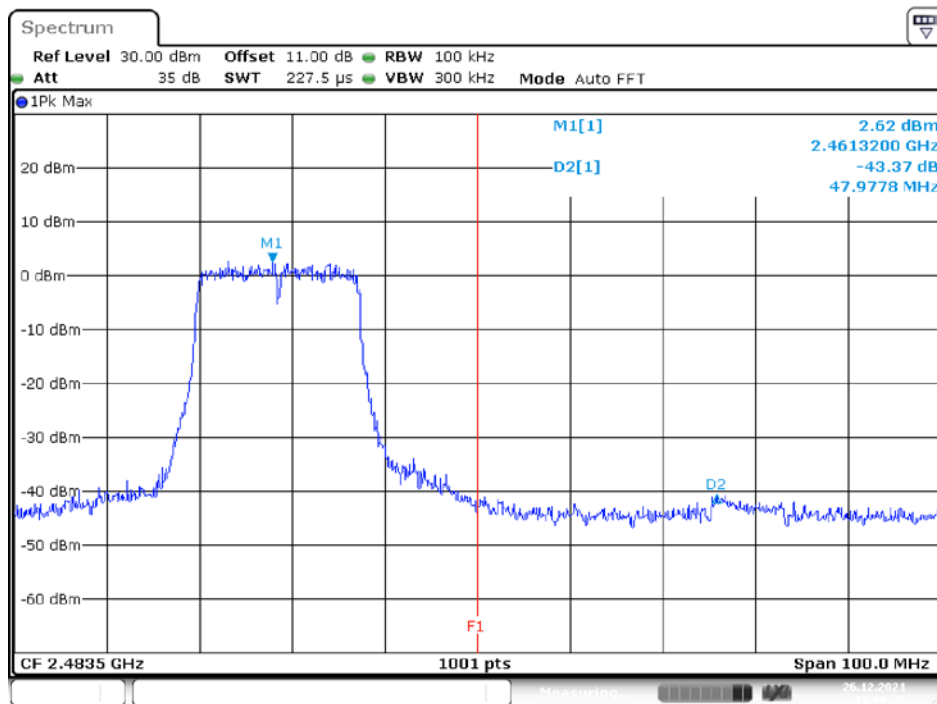


## N20 Mode

### Band Edge, Left Side

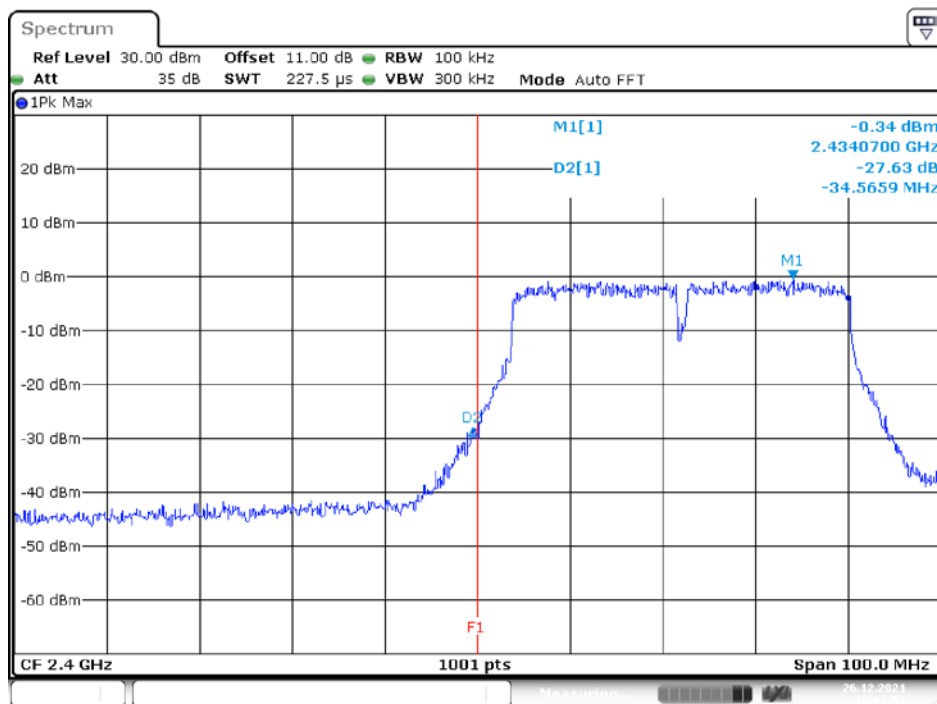


### Band Edge, Right Side

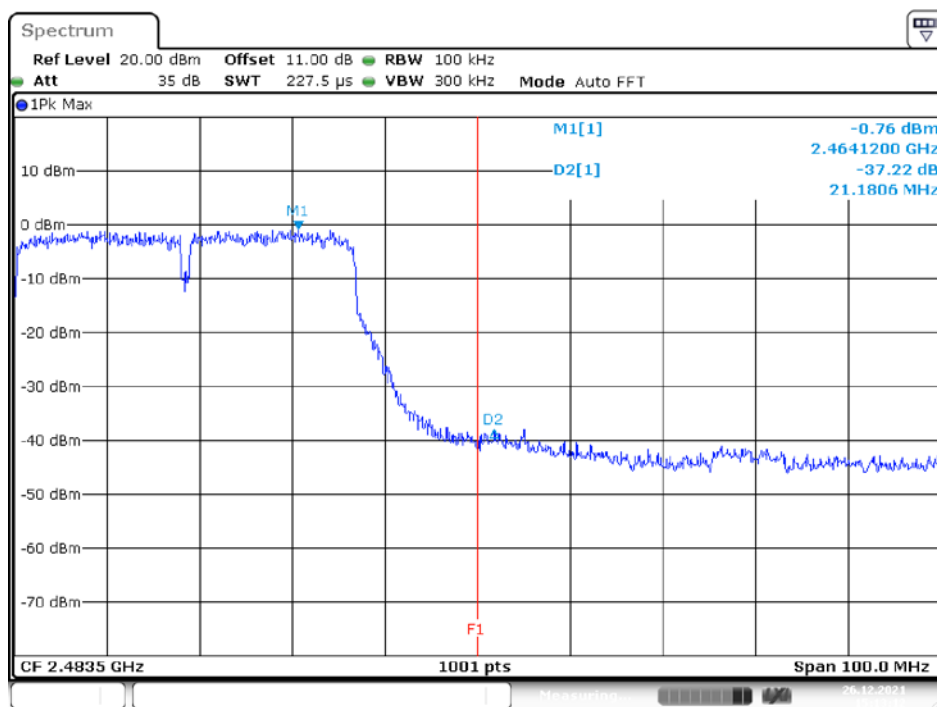


## N40 Mode

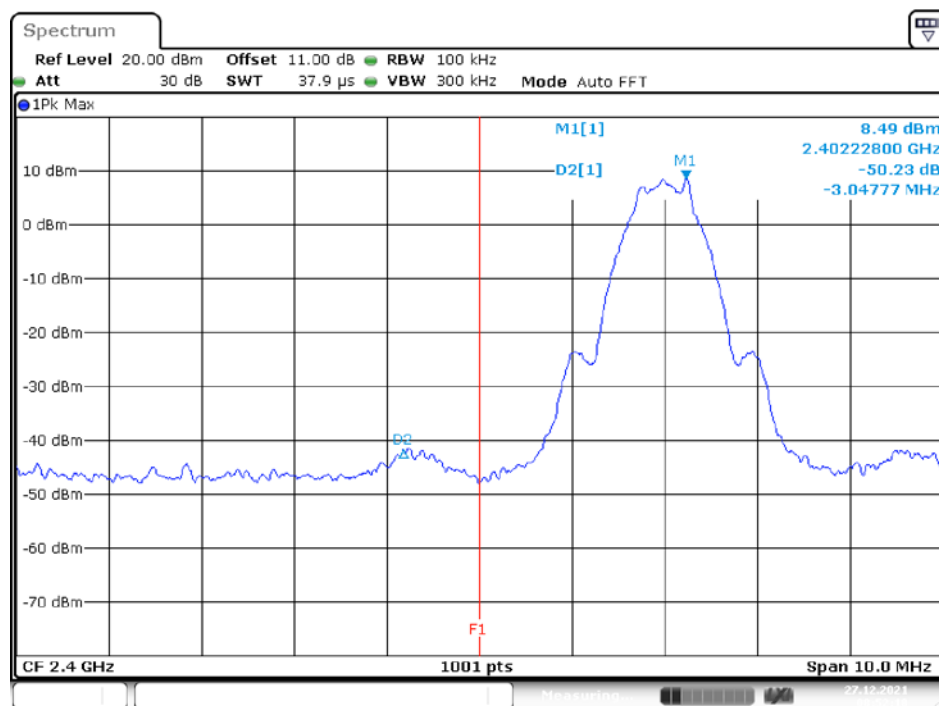
### Band Edge, Left Side



### Band Edge, Right Side

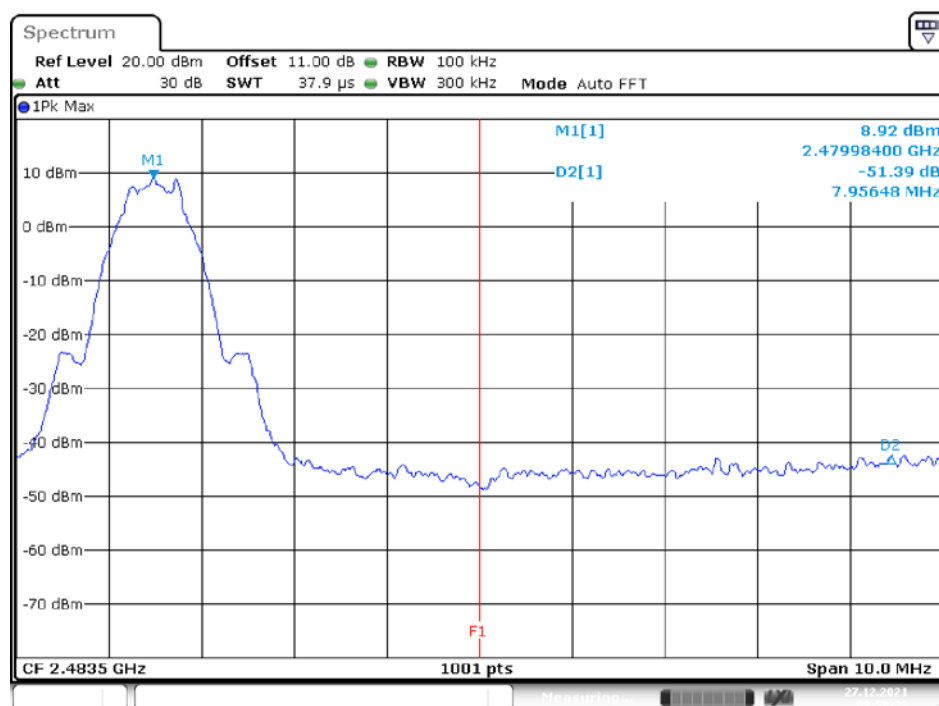


# **BLE(1M) Mode** **Band Edge, Low Channel**



Date: 27.DEC.2021 08:52:18

# **Band Edge, High Channel**



Date: 27.DEC.2021 08:58:33

## 12 FCC §15.247(e) – Power Spectral Density

### 12.1 Applicable Standard

According to FCC §15.247(e).

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.

### 12.2 Test Procedure

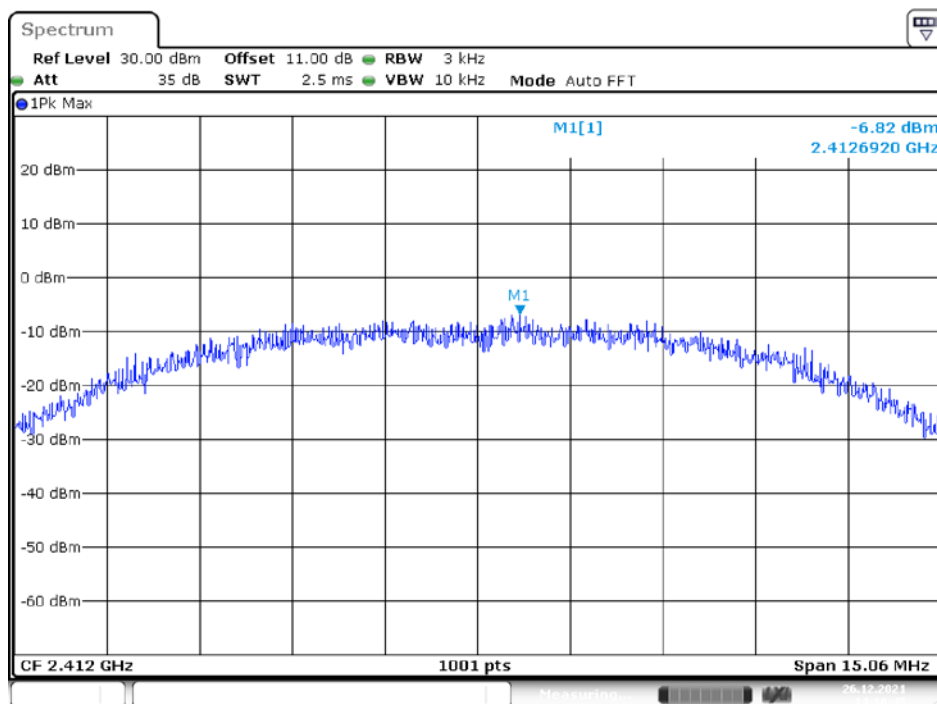
- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set the VBW  $\geq [3 \times \text{RBW}]$ .
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat

**12.3 Test Results**

| Channel      | Frequency<br>(MHz) | Power Spectral<br>Density<br>(dBm/3 kHz) | Limit<br>(dBm/3 kHz) | Result |
|--------------|--------------------|------------------------------------------|----------------------|--------|
| B Mode       |                    |                                          |                      |        |
| Low          | 2412               | -6.82                                    | 8                    | PASS   |
| Middle       | 2437               | -6.88                                    | 8                    | PASS   |
| High         | 2462               | -6.95                                    | 8                    | PASS   |
| G Mode       |                    |                                          |                      |        |
| Low          | 2412               | -12.31                                   | 8                    | PASS   |
| Middle       | 2437               | -12.35                                   | 8                    | PASS   |
| High         | 2462               | -12.55                                   | 8                    | PASS   |
| N20 Mode     |                    |                                          |                      |        |
| Low          | 2412               | -11.64                                   | 8                    | PASS   |
| Middle       | 2437               | -11.67                                   | 8                    | PASS   |
| High         | 2462               | -11.82                                   | 8                    | PASS   |
| N40 Mode     |                    |                                          |                      |        |
| Low          | 2422               | -12.97                                   | 8                    | PASS   |
| Middle       | 2437               | -13.37                                   | 8                    | PASS   |
| High         | 2452               | -13.39                                   | 8                    | PASS   |
| BLE(1M) Mode |                    |                                          |                      |        |
| Low          | 2402               | -6.93                                    | 8                    | PASS   |
| Middle       | 2440               | -6.40                                    | 8                    | PASS   |
| High         | 2480               | -6.45                                    | 8                    | PASS   |

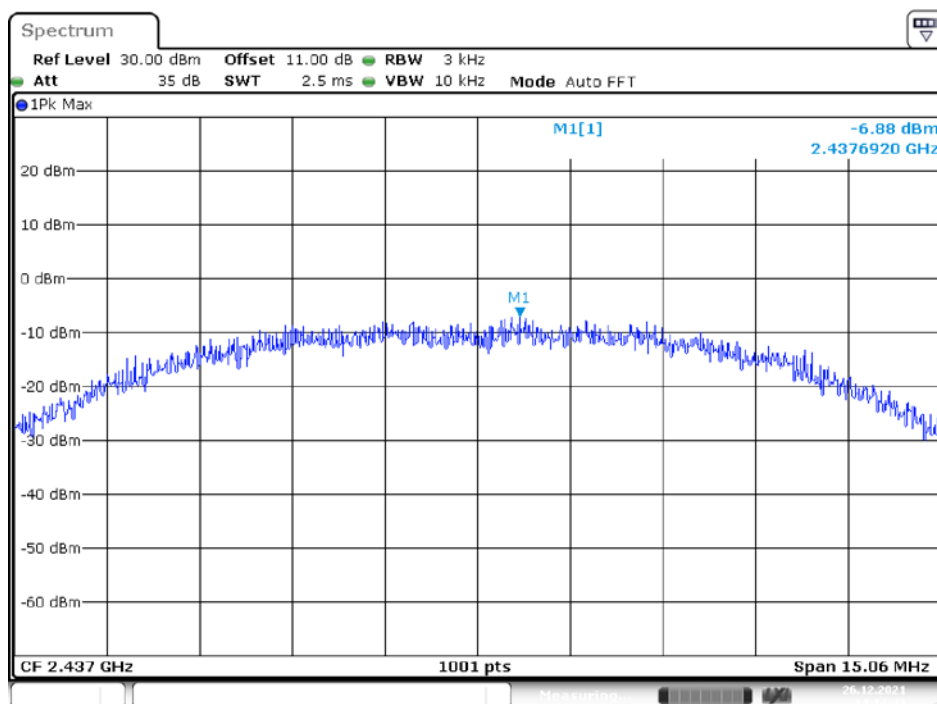
Please refer to the following plots

### B Mode Low Channel



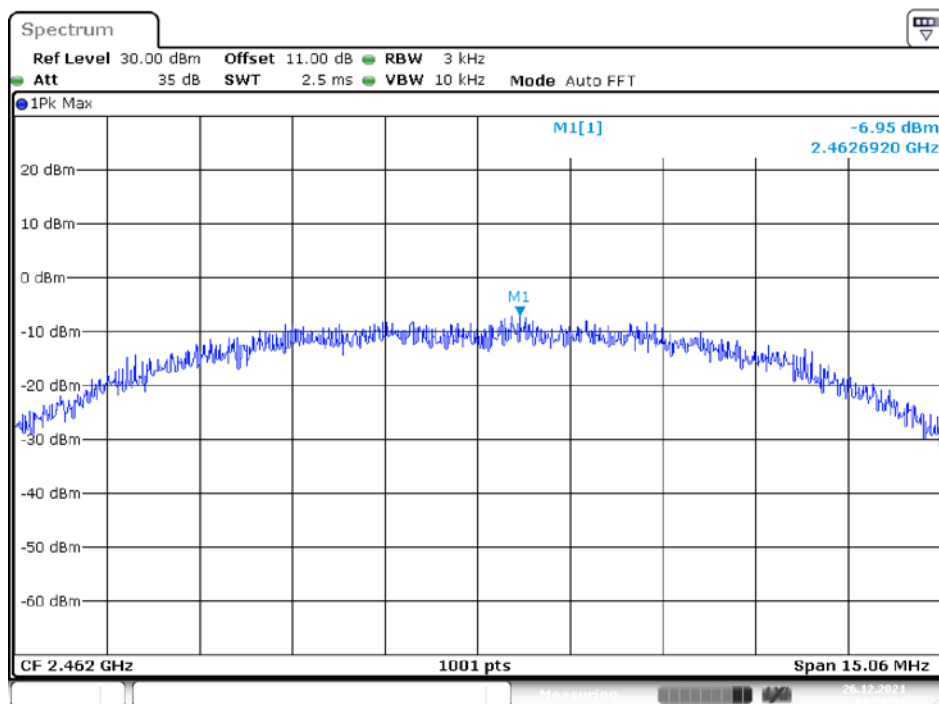
Date: 26.DEC.2021 14:10:45

### Middle Channel



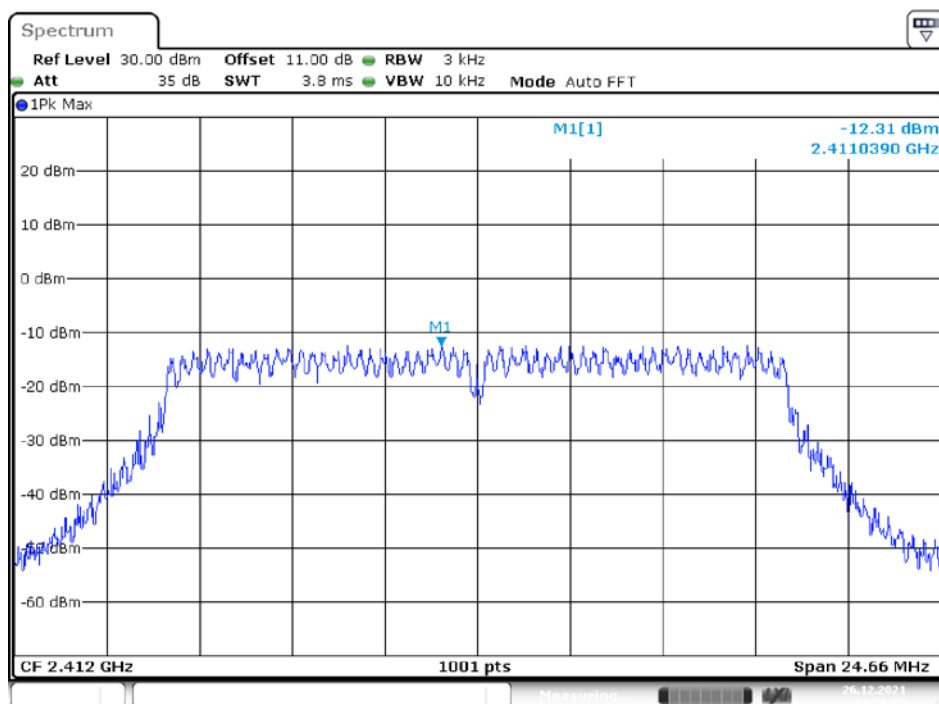
Date: 26.DEC.2021 14:14:43

## High Channel



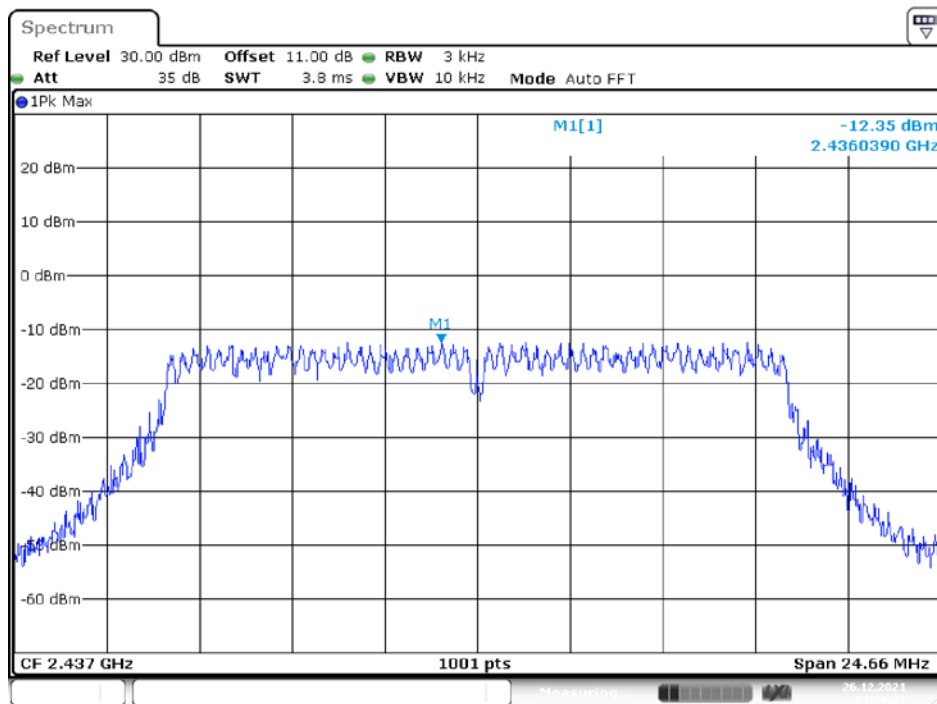
Date: 26.DEC.2021 14:20:31

## G Mode Low Channel



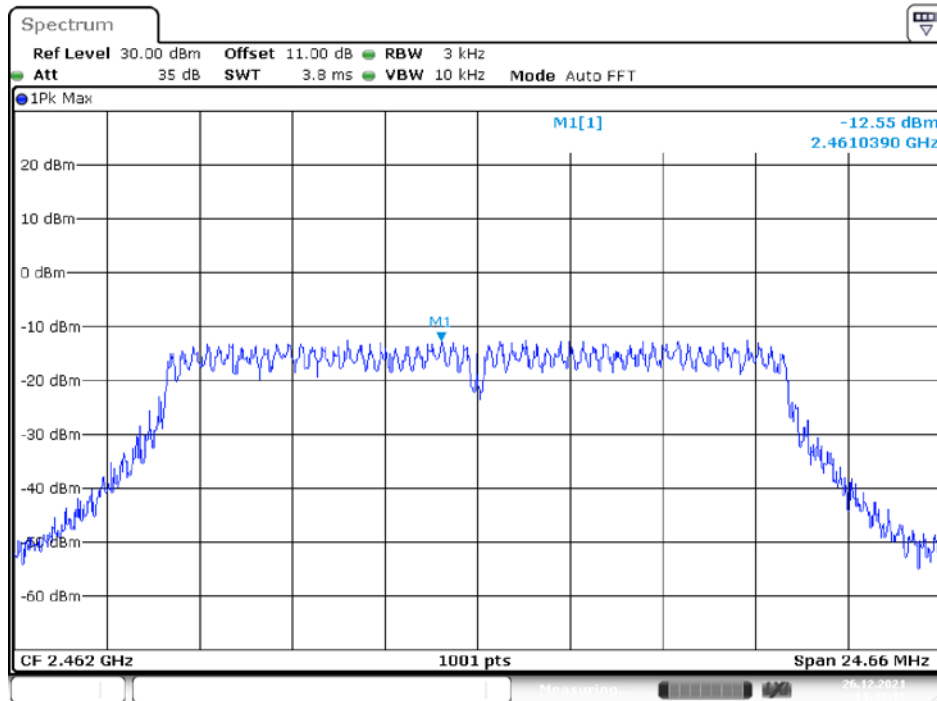
Date: 26.DEC.2021 14:28:05

### Middle Channel



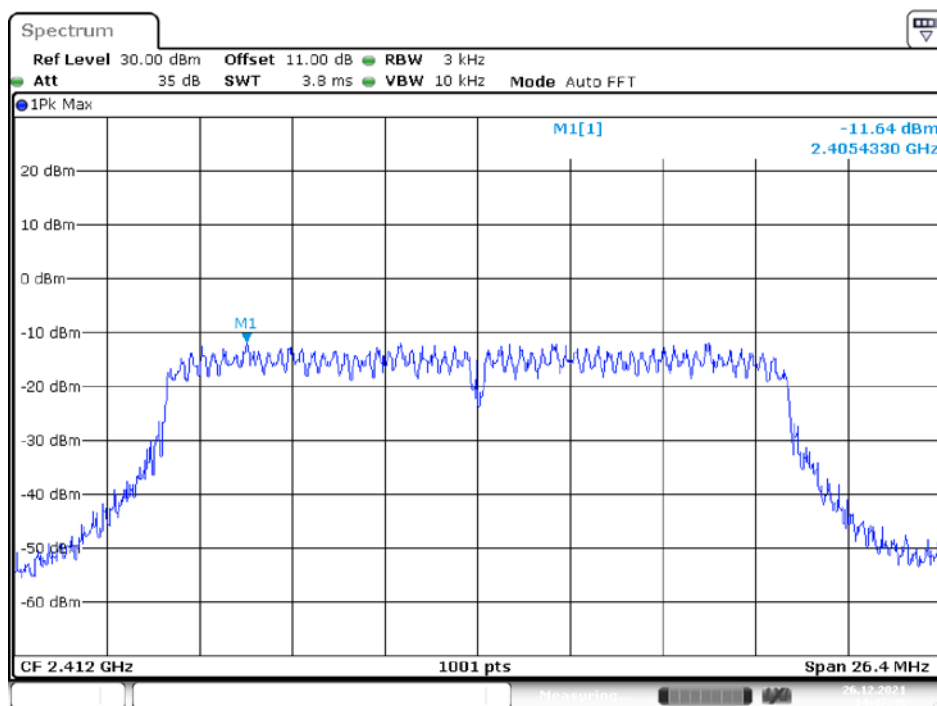
Date: 26.DEC.2021 14:34:37

### High Channel



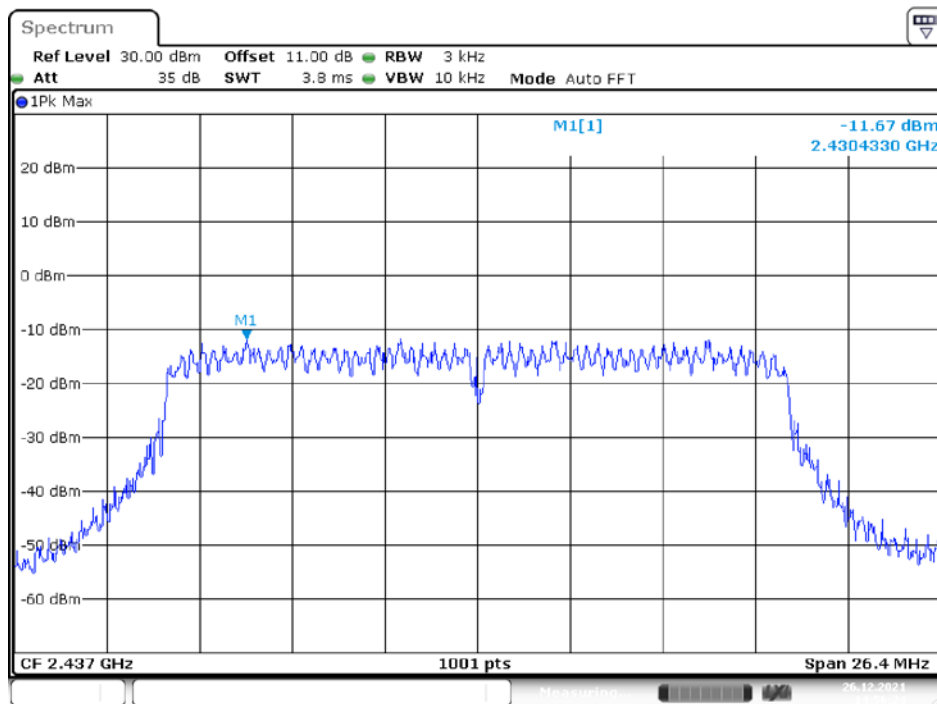
Date: 26.DEC.2021 14:43:19

## N20 Mode Low Channel



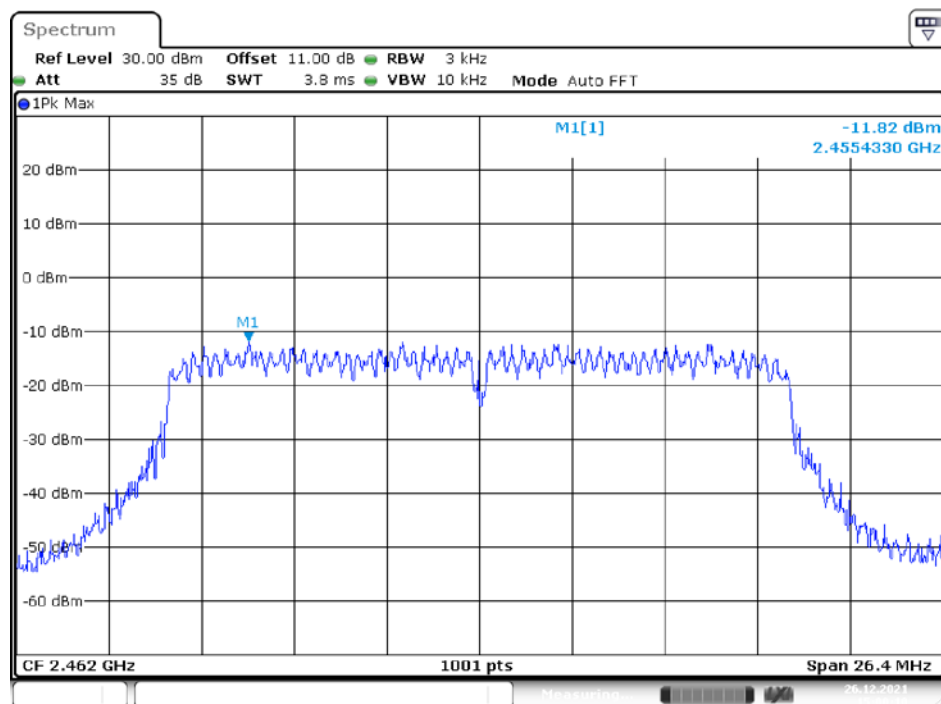
Date: 26.DEC.2021 14:47:46

## Middle Channel



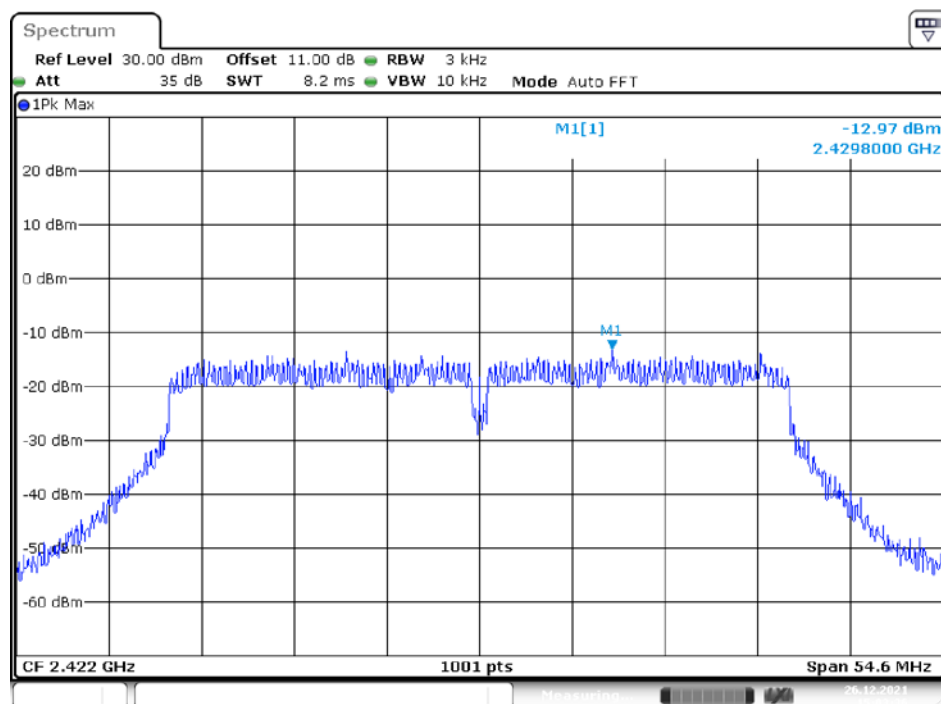
Date: 26.DEC.2021 14:56:24

## High Channel



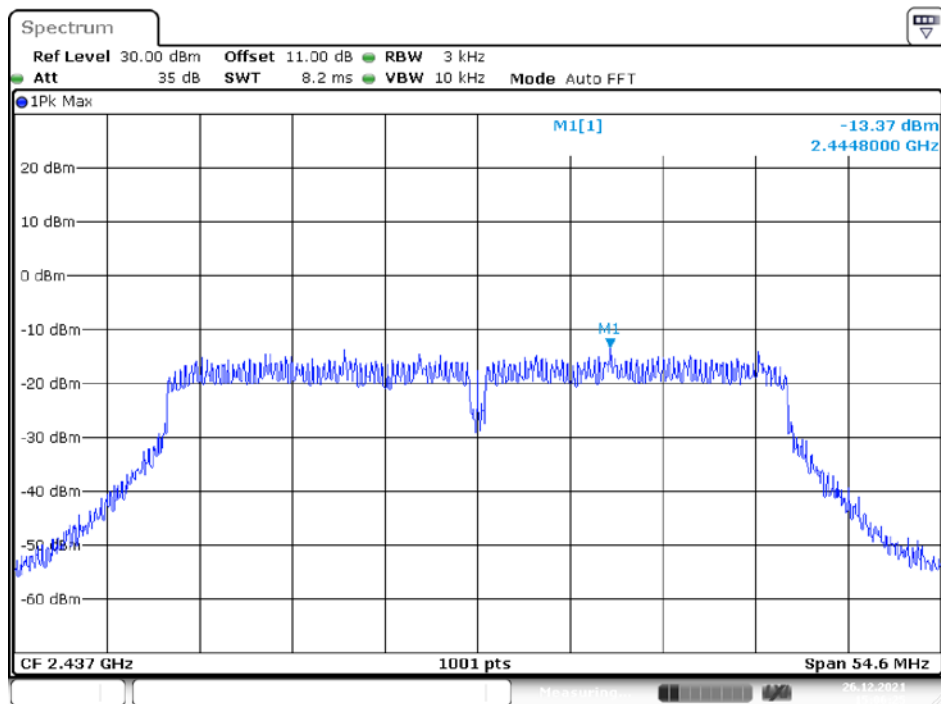
Date: 26.DEC.2021 15:00:11

## N40 Mode Low Channel



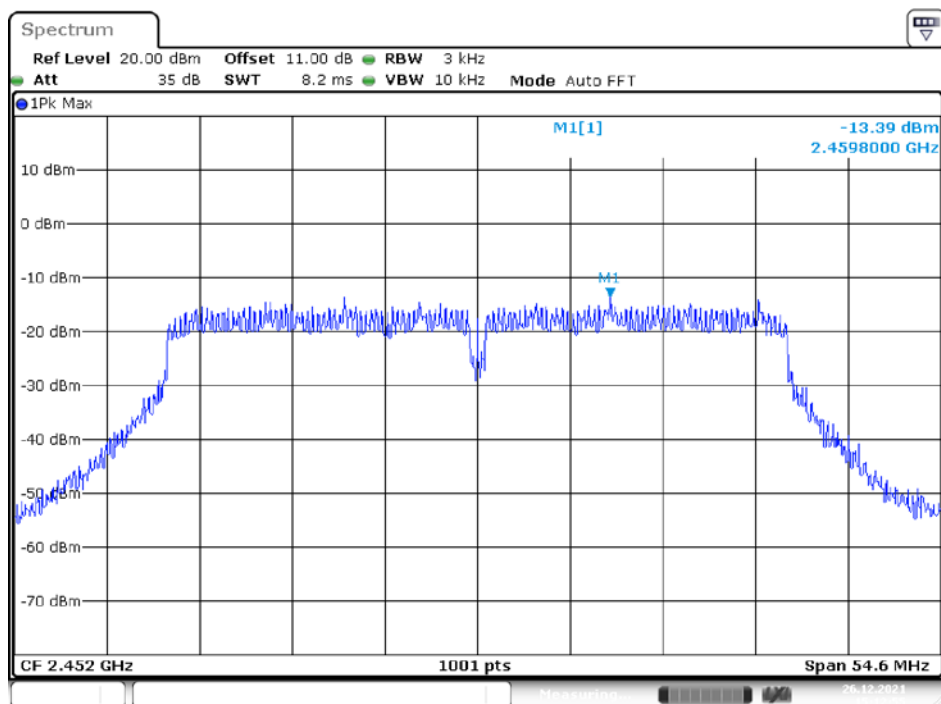
Date: 26.DEC.2021 15:03:36

### Middle Channel



Date: 26.DEC.2021 15:06:25

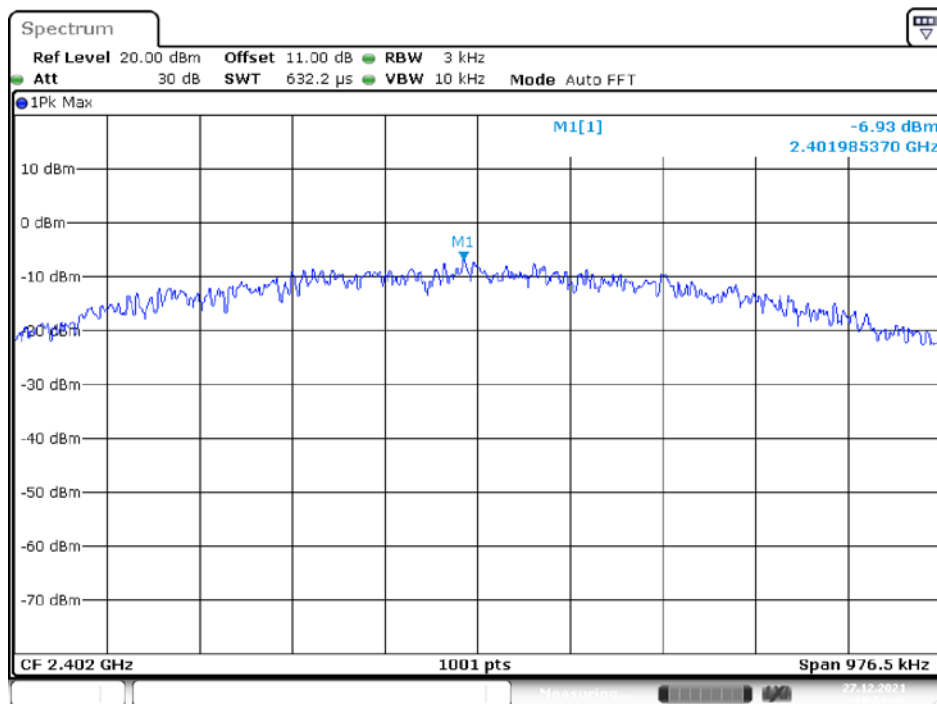
### High Channel



Date: 26.DEC.2021 15:12:58

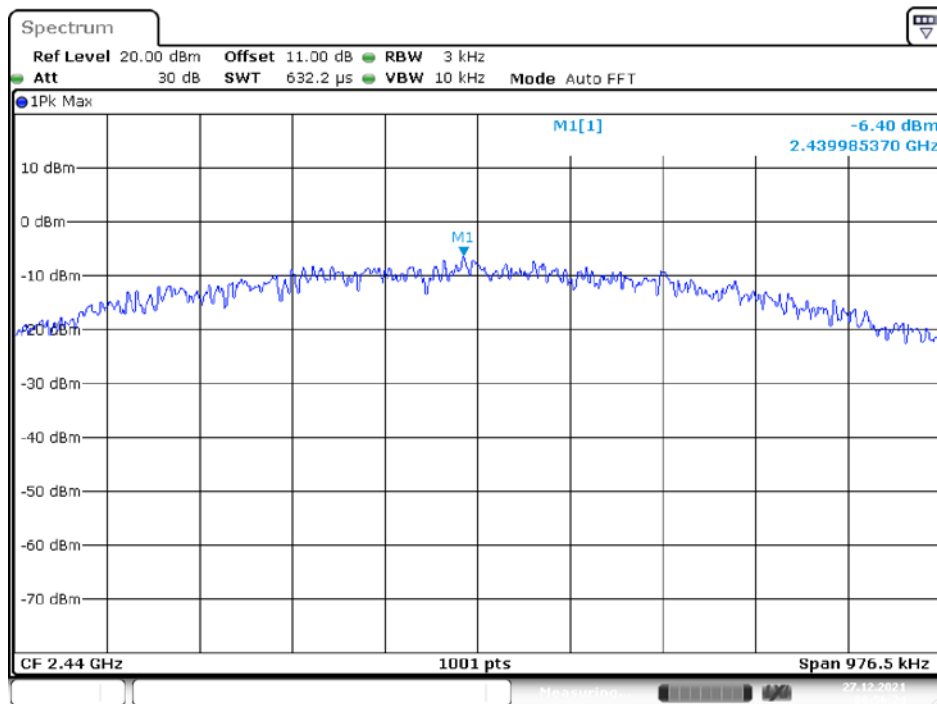
## BLE(1M) Mode

### Low Channel



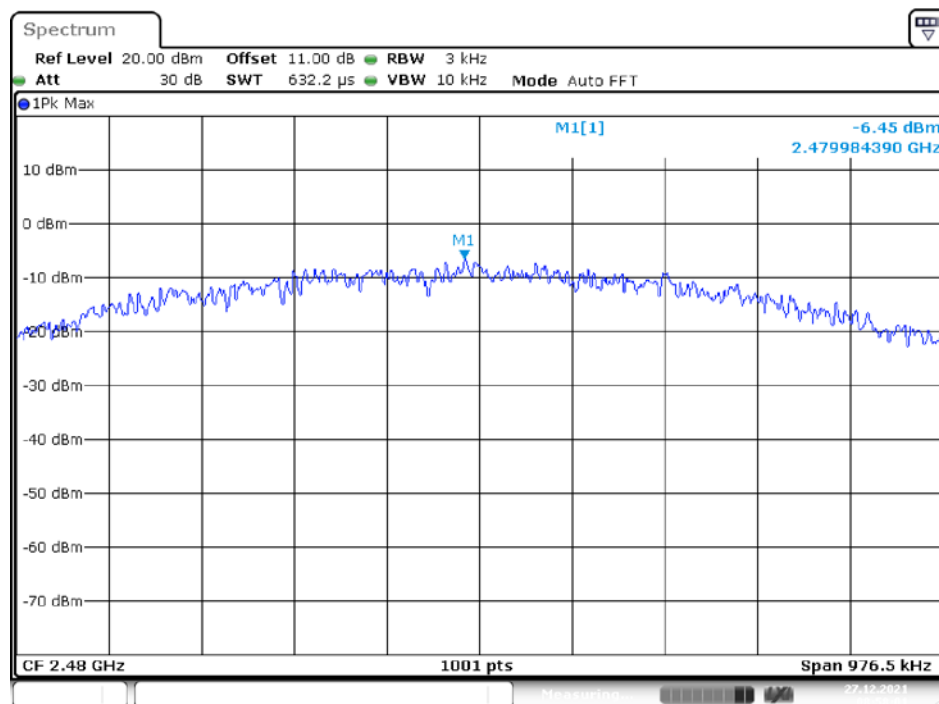
Date: 27.DEC.2021 08:51:47

### Middle Channel



Date: 27.DEC.2021 08:56:23

# High Channel



Date: 27.DEC.2021 08:58:01

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