

## FCC Part 15.247

## TEST REPORT

For

### CC&C Technologies Inc.

8F, 150, Jian Yi Road, Zhonghe District, New Taipei City, Taiwan 235, R. O. C.

**FCC ID: PANBT505**

**Report Type:**  
Original Report

**Product Type:**  
Bluetooth 5.0 Dual-mode Dongle

**Report Producer :** Jane Chen

*Jane Chen*

**Report Number :** RXZ210511001RF02

**Report Date :** 2021-07-02

**Reviewed By:** Andy Shih

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## Revision History

| Revision | No.          | Report Number    | Issue Date | Description     | Author/<br>Revised by |
|----------|--------------|------------------|------------|-----------------|-----------------------|
| 1.0      | RXZ210511001 | RXZ210511001RF02 | 2021-07-02 | Original Report | Jane Chen             |

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# 1 General Information

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

|                                    |                                                                                                                                                                                                                                                |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant                          | CC&C Technologies Inc.<br>8F, 150, Jian Yi Road, Zhonghe District, New Taipei City,<br>Taiwan 235, R. O. C.                                                                                                                                    |
| Manufacturer                       | CC&C Technologies Inc.<br>8F, 150, Jian Yi Road, Zhonghe District, New Taipei City,<br>Taiwan 235, R. O. C.                                                                                                                                    |
| Brand(Trade) Name                  | CC&C                                                                                                                                                                                                                                           |
| Product (Equipment)                | Bluetooth 5.0 Dual-mode Dongle                                                                                                                                                                                                                 |
| Main Model Name                    | BT-505                                                                                                                                                                                                                                         |
| Frequency Range                    | 2402 ~ 2480 MHz                                                                                                                                                                                                                                |
| Transmit Power                     | BR(GFSK) Mode: 6.86 dBm (0.005W)<br>EDR( $\pi/4$ -DQPSK) Mode: 9.32 dBm (0.009W)<br>EDR(8DPSK) Mode: 10.02 dBm (0.010W)                                                                                                                        |
| Modulation Technique               | BR Mode: GFSK<br>EDR Mode: $\pi/4$ -DQPSK, 8DPSK                                                                                                                                                                                               |
| Transmit Data Rate                 | BR(GFSK) Mode: 1 Mbps<br>EDR( $\pi/4$ -DQPSK) Mode: 2 Mbps<br>EDR(8DPSK) Mode: 3 Mbps                                                                                                                                                          |
| Number of Channels                 | 79 Channels                                                                                                                                                                                                                                    |
| Antenna Specification              | Printed Antenna / -4.10 dBi                                                                                                                                                                                                                    |
| Power Operation<br>(Voltage Range) | <input type="checkbox"/> AC 120V/60Hz<br><input type="checkbox"/> Adapter I/P:<br><input type="checkbox"/> By AC Power Cord<br><input type="checkbox"/> PoE                                                                                    |
|                                    | <input checked="" type="checkbox"/> DC Type<br><input type="checkbox"/> Battery<br><input type="checkbox"/> DC Power Supply<br><input checked="" type="checkbox"/> External from USB 5V, 500mA<br><input type="checkbox"/> External DC Adapter |
|                                    | <input type="checkbox"/> Host System                                                                                                                                                                                                           |
| Received Date                      | June 10, 2021                                                                                                                                                                                                                                  |
| Date of Test                       | June 18, 2021 ~ June 22, 2021                                                                                                                                                                                                                  |

*\*All measurement and test data in this report was gathered from production sample serial number:  
RXZ210511001-02 (Assigned by BACL, New Taipei Laboratory).*

## 1.2 Objective

This report is prepared on behalf of *CC&C Technologies Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine the Bluetooth BR and EDR mode of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

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

FCC Part 15.247 DTS Submittal with FCC ID: PANBT505

## 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 Meas Guidance v05r02

## 1.5 Statement of Compliance

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

Test Result: ☐ Valid acceptance ☐ False acceptance ☐ False rejection ☐ Valid rejection

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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.

## 1.6 Measurement Uncertainty

| Parameter                     |               | Uncertainty   |
|-------------------------------|---------------|---------------|
| AC Mains                      |               | +/- 3.82 dB   |
| RF output power, conducted    |               | +/- 0.84 dB   |
| Occupied Bandwidth            |               | +/- 0.162 MHz |
| Unwanted Emissions, conducted |               | +/- 1.672 dBm |
| Emissions, radiated           | 30 MHz~1GHz   | +/- 5.46 dB   |
|                               | 1 GHz~6 GHz   | +/- 5.24 dB   |
|                               | 6 GHz~18 GHz  | +/- 5.62 dB   |
|                               | 18 GHz~40 GHz | +/- 5.86 dB   |
| Temperature                   |               | +/- 0.401 °C  |
| Humidity                      |               | +/- 2.6 %     |

## 1.7 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. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

## 2 System Test Configuration

### 2.1 Description of Test Configuration

For BT mode, 79 channels are provided to testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 1       | 2402            | 40      | 2441            |
| 2       | 2403            | --      | --              |
| 3       | 2404            | --      | --              |
| 4       | 2405            | 77      | 2478            |
| --      | --              | 78      | 2479            |
| 39      | 2440            | 79      | 2480            |

For BT Modes were tested with channel 1, 40 and 79.

### 2.2 Equipment Modifications

No modification was made to the EUT.

### 2.3 EUT Exercise Software

| Test Software       |                | RTLBATAPP |         |         |
|---------------------|----------------|-----------|---------|---------|
| Test Frequency      |                | 2402MHz   | 2441MHz | 2480MHz |
| Power Level Setting | GFSK           | Default   | Default | Default |
|                     | $\pi/4$ -DQPSK | Default   | Default | Default |
|                     | 8DPSK          | Default   | Default | Default |

### 2.4 Support Equipment List and Details

| Description | Manufacturer | Model Number | S/N     |
|-------------|--------------|--------------|---------|
| NB          | DELL         | E6410        | 8N7PXN1 |
| AC adapter  | DELL         | DA90PE3-00   | N/A     |

### 2.5 External Cable List and Details

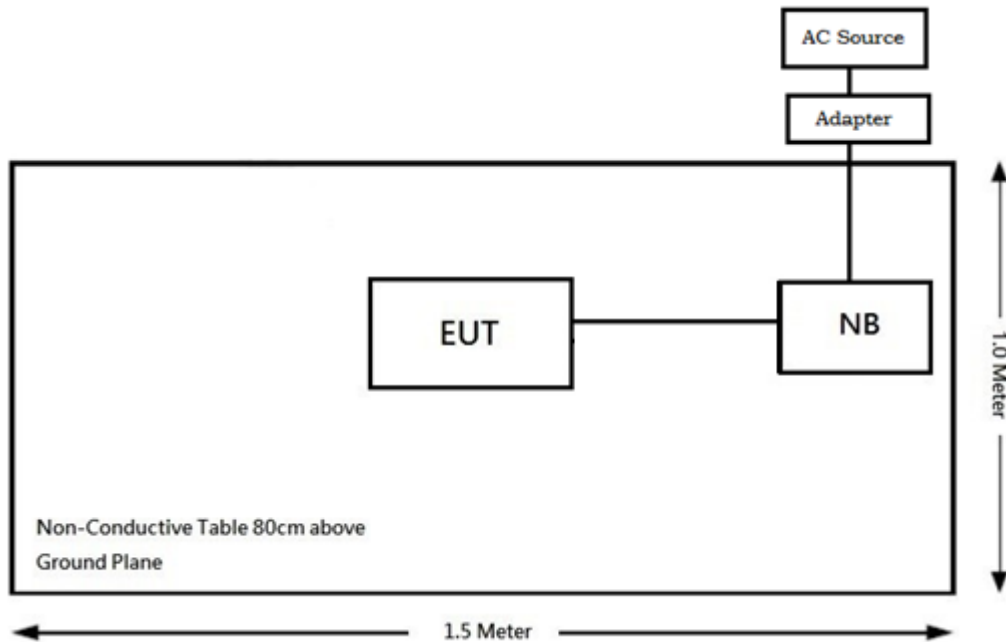
| Cable Description | Length (m) | From | To  |
|-------------------|------------|------|-----|
| N/A               | N/A        | N/A  | N/A |

## 2.6 Block Diagram of Test Setup

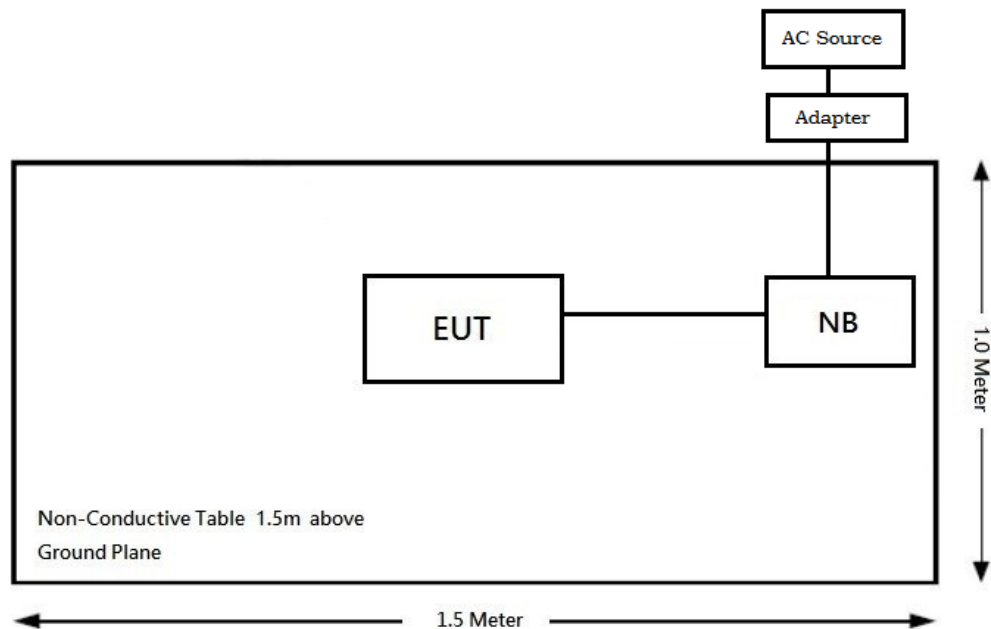
See test photographs attached in annex setup photos for the actual connections between EUT and support equipment.

### Radiation:

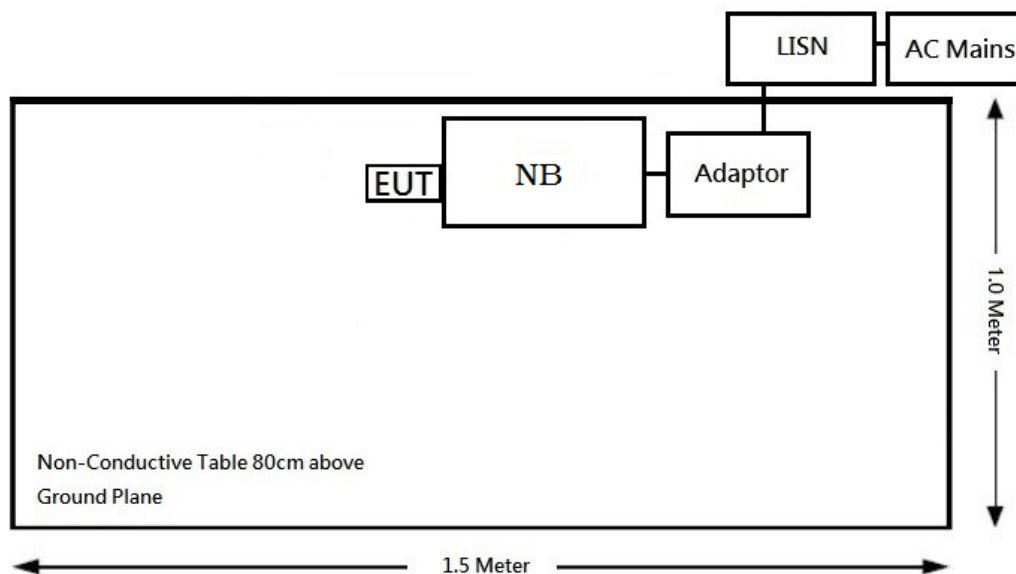
Below 1GHz:



Above 1GHz:



## Conduction:



### 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)(1)                | 20 dB Emission Bandwidth                 | Compliance |
| §15.247 (a)(1)               | Channel Separation Test                  | Compliance |
| §15.247(a)(1)(iii)           | Time of Occupancy (Dwell Time)           | Compliance |
| §15.247(a)(1)(iii)           | Quantity of hopping channel Test         | Compliance |
| §15.247(b)(1)                | Maximum Peak Output Power                | Compliance |
| §15.247(d)                   | 100 kHz Bandwidth of Frequency Band Edge | 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                   | 101612            | 2020/12/30       | 2021/12/29           |
| LISN                               | COM-POWER                      | LI-550A                  | 211726            | 2020/12/30       | 2021/12/29           |
| EMI Test Receiver                  | Rohde & Schwarz                | ESR3                     | 102099            | 2021/6/2         | 2022/6/1             |
| Pulse Limiter                      | Rohde & Schwarz                | ESH3Z2                   | TXZEM104          | 2020/7/31        | 2021/7/31            |
| RF Cable                           | EMEC                           | EM-CB5D                  | 1                 | 2021/6/11        | 2022/6/11            |
| 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+              | A050115/1554_2_01 | 2021/1/19        | 2022/1/18            |
| EMI Test Receiver                  | Rohde & Schwarz                | ESR7                     | 101419            | 2020/11/12       | 2021/11/11           |
| Horn Antenna                       | EMCO                           | SAS-571                  | 1020              | 2021/4/23        | 2022/4/22            |
| Horn Antenna                       | ETS-Lindgren                   | 3116                     | 62638             | 2020/8/20        | 2021/8/19            |
| Preamplifier                       | Sonoma                         | 310N                     | 130602            | 2021/6/8         | 2022/6/7             |
| Preamplifier                       | A.H.                           | PAM-0118P                | 466               | 2020/11/05       | 2021/11/04           |
| Microwave Preamplifier             | EM Electronics Corporation     | EM18G40G                 | 60656             | 2020/12/30       | 2021/12/29           |
| Spectrum Analyzer                  | Rohde & Schwarz                | FSV40                    | 101435            | 2021/1/7         | 2022/1/6             |
| Micro flex Cable                   | UTIFLEX                        | UFB197C-1-2362-70U-70U   | 225757-001        | 2021/2/1         | 2022/1/31            |
| Coaxial Cable                      | COMMATE                        | PEWC                     | 8Dr               | 2020/12/25       | 2021/12/24           |
| Coaxial Cable                      | UTIFLEX                        | UFB311A-Q-1440-300300    | 220490-006        | 2021/2/1         | 2022/1/31            |
| Micro flex Cable                   | ROSNOL                         | K1K50-UP0264-K1K50-450CM | 160309-1          | 2021/2/1         | 2022/1/31            |
| 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             | WOKEN           | SFL402       | S02-160323-07 | 2021/1/28 | 2022/1/28 |
| Power Sensor      | KEYSIGHT        | U2021XA      | MY54080018    | 2021/1/28 | 2022/1/28 |
| Attenuator        | MINI-CIRCUITS   | BW-S10W5+    | N/A           | 2021/6/15 | 2024/6/14 |
| Power Splitter    | Mini-Circuits   | ZFRSC-183-S+ | S F448201614  | 2020/6/23 | 2021/6/23 |

**\*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 | Tunp-up<br>Average Power |      | Evaluation<br>Distance | Calculated<br>Value | Threshold | SAR Test<br>Exclusion |
|------|-----------|--------------------------|------|------------------------|---------------------|-----------|-----------------------|
|      | (MHz)     | (dBm)                    | (mW) | (mm)                   |                     | (1-g SAR) |                       |
| BT   | 2402-2480 | 7                        | 5.01 | 5                      | 1.6                 | 3         | Yes                   |
| BLE  | 2402-2480 | 7                        | 5.01 | 5                      | 1.6                 | 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 Information

| Manufacturer            | Model      | Type            | Antenna Gain | Result     |
|-------------------------|------------|-----------------|--------------|------------|
| CC&C Technologies, Inc. | BT-330S-V2 | Printed Antenna | -4.10 dBi    | Compliance |

The EUT has one integral antenna arrangement, which was permanently attached; fulfill the requirement of this section.

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

### 7.1 Applicable Standard

According to §15.207

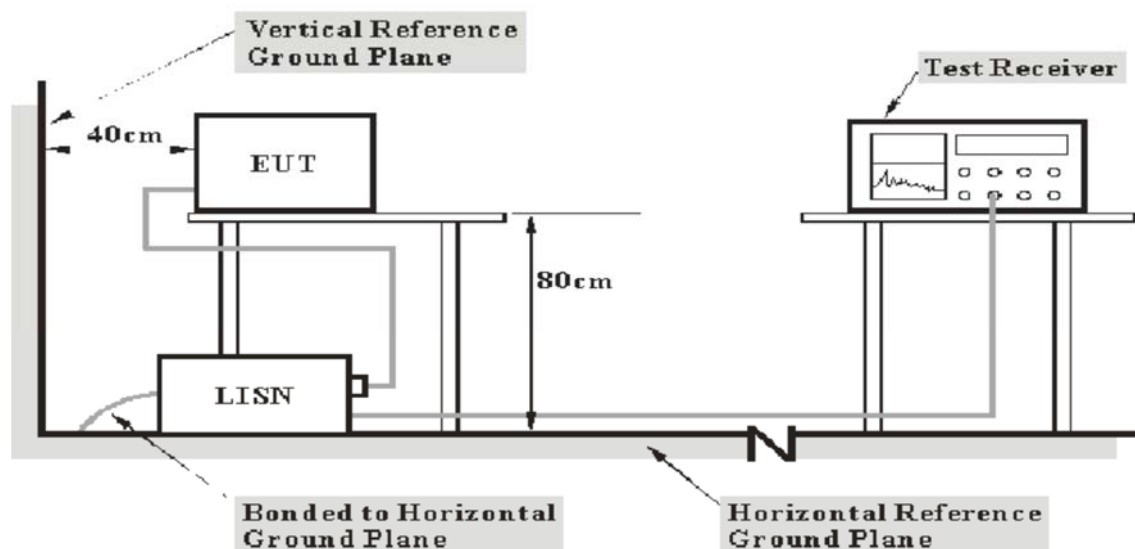
For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured 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 <sup>Note 1</sup> | 56 to 46 <sup>Note 2</sup> |
| 0.5-5                          | 56                         | 46                         |
| 5-30                           | 60                         | 50                         |

Note 1: Decreases with the logarithm of the frequency.

Note 2: A linear average detector is required

### 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 Environmental Conditions

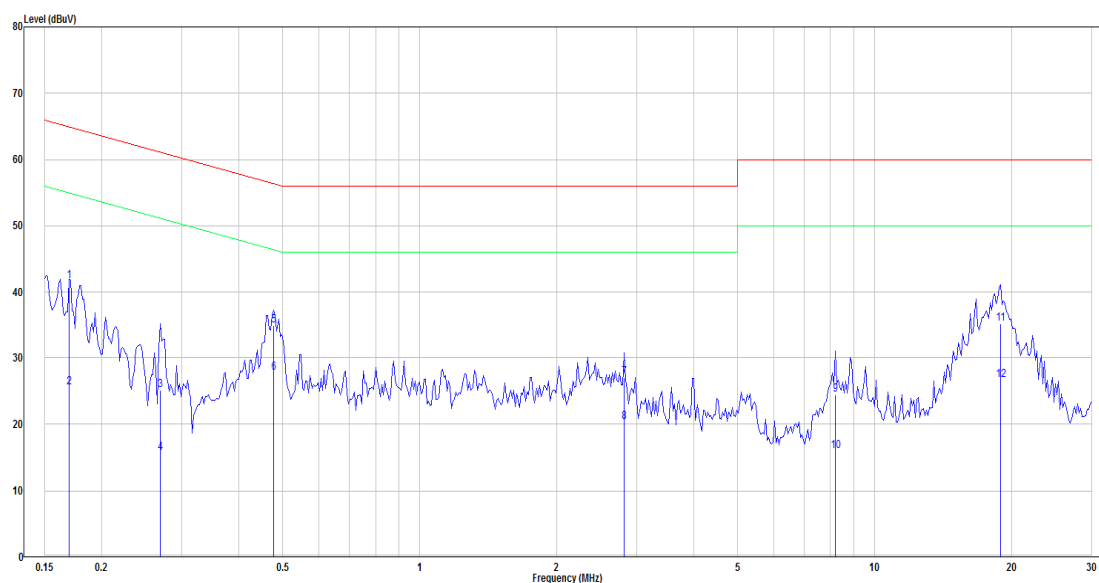
|                    |          |
|--------------------|----------|
| Temperature:       | 22.5 °C  |
| Relative Humidity: | 45 %     |
| ATM Pressure:      | 1010 hPa |

*The testing was performed by Ken Yu on 2021-06-22.*

## 7.7 Test Results

Test Mode: Transmitting

Main: AC120 V, 60 Hz, Line



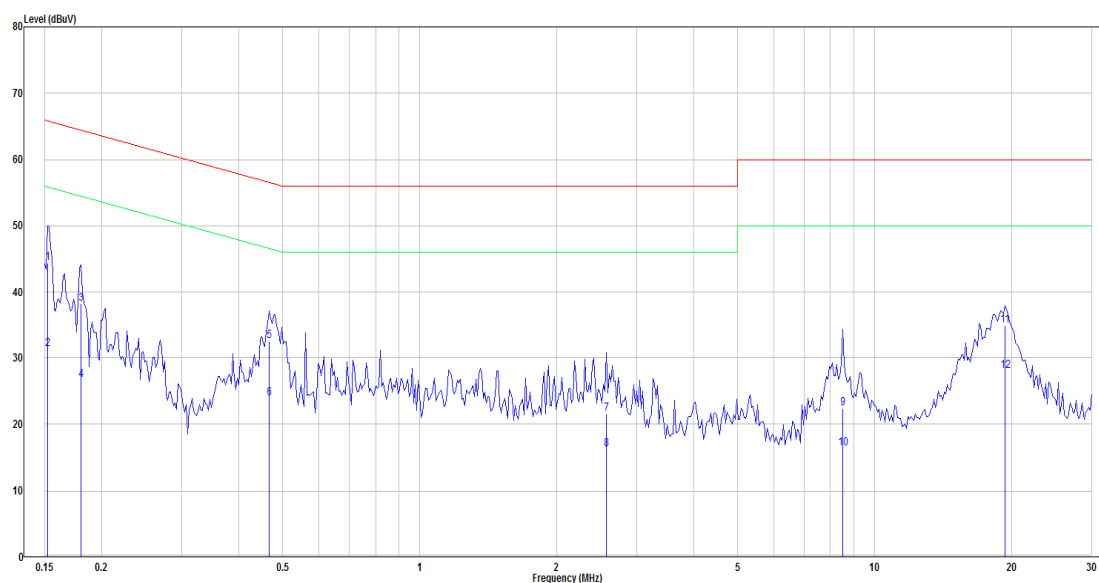
| No. | Frequency<br>(MHz) | Reading<br>(dBμV) | Correct<br>Factor(dB) | Result<br>(dBμV) | Limit<br>(dBμV) | Over limit<br>(dB) | Remark  |
|-----|--------------------|-------------------|-----------------------|------------------|-----------------|--------------------|---------|
| 1   | 0.170              | 22.07             | 19.59                 | 41.66            | 64.98           | -23.32             | QP      |
| 2   | 0.170              | 5.95              | 19.59                 | 25.54            | 54.98           | -29.44             | Average |
| 3   | 0.269              | 5.58              | 19.58                 | 25.16            | 61.15           | -35.99             | QP      |
| 4   | 0.269              | -3.90             | 19.58                 | 15.68            | 51.15           | -35.47             | Average |
| 5   | 0.478              | 15.22             | 19.58                 | 34.80            | 56.37           | -21.57             | QP      |
| 6   | 0.478              | 8.16              | 19.58                 | 27.74            | 46.37           | -18.63             | Average |
| 7   | 2.818              | 7.34              | 19.66                 | 27.00            | 56.00           | -29.00             | QP      |
| 8   | 2.818              | 0.70              | 19.66                 | 20.36            | 46.00           | -25.64             | Average |
| 9   | 8.195              | 4.67              | 19.76                 | 24.43            | 60.00           | -35.57             | QP      |
| 10  | 8.195              | -3.85             | 19.76                 | 15.91            | 50.00           | -34.09             | Average |
| 11  | 18.925             | 15.22             | 19.84                 | 35.06            | 60.00           | -24.94             | QP      |
| 12  | 18.925             | 6.84              | 19.84                 | 26.68            | 50.00           | -23.32             | 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<br>(MHz) | Reading<br>(dBμV) | Correct<br>Factor(dB) | Result<br>(dBμV) | Limit<br>(dBμV) | Over limit<br>(dB) | Remark  |
|-----|--------------------|-------------------|-----------------------|------------------|-----------------|--------------------|---------|
| 1   | 0.152              | 24.82             | 19.59                 | 44.41            | 65.87           | -21.46             | QP      |
| 2   | 0.152              | 11.70             | 19.59                 | 31.29            | 55.87           | -24.58             | Average |
| 3   | 0.180              | 18.46             | 19.59                 | 38.05            | 64.47           | -26.42             | QP      |
| 4   | 0.180              | 7.04              | 19.59                 | 26.63            | 54.47           | -27.84             | Average |
| 5   | 0.467              | 12.94             | 19.58                 | 32.52            | 56.56           | -24.04             | QP      |
| 6   | 0.467              | 4.33              | 19.58                 | 23.91            | 46.56           | -22.65             | Average |
| 7   | 2.570              | 1.93              | 19.65                 | 21.58            | 56.00           | -34.42             | QP      |
| 8   | 2.570              | -3.41             | 19.65                 | 16.24            | 46.00           | -29.76             | Average |
| 9   | 8.515              | 2.63              | 19.76                 | 22.39            | 60.00           | -37.61             | QP      |
| 10  | 8.515              | -3.43             | 19.76                 | 16.33            | 50.00           | -33.67             | Average |
| 11  | 19.366             | 14.88             | 19.87                 | 34.75            | 60.00           | -25.25             | QP      |
| 12  | 19.366             | 8.11              | 19.87                 | 27.98            | 50.00           | -22.02             | 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:

| <b>MHz</b>          | <b>MHz</b>            | <b>MHz</b>      | <b>GHz</b>    |
|---------------------|-----------------------|-----------------|---------------|
| 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:

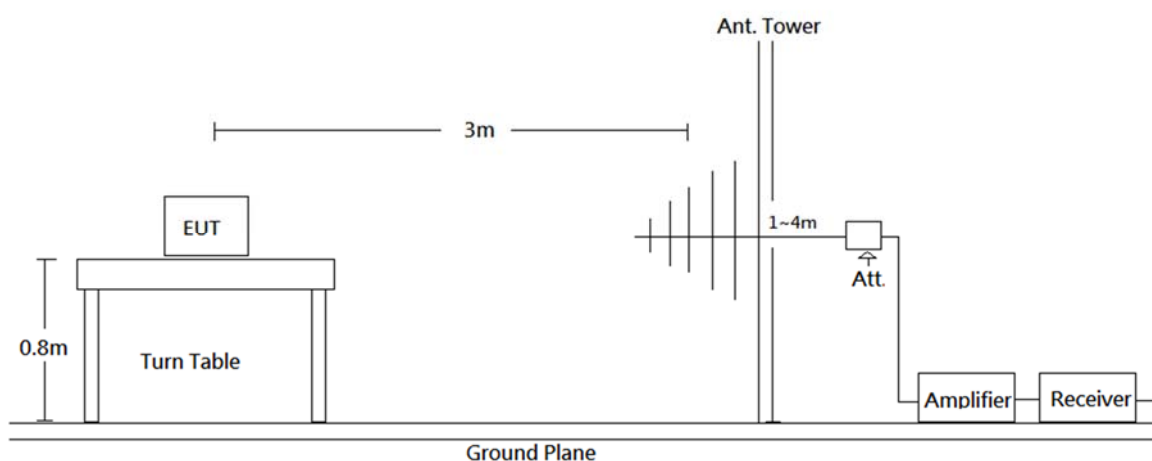
| <b>Frequency<br/>(MHz)</b> | <b>Field Strength<br/>(micro volts/meter)</b> | <b>Measurement Distance<br/>(meters)</b> |
|----------------------------|-----------------------------------------------|------------------------------------------|
| 0.009 - 0.490              | 2400/F(kHz)                                   | 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.

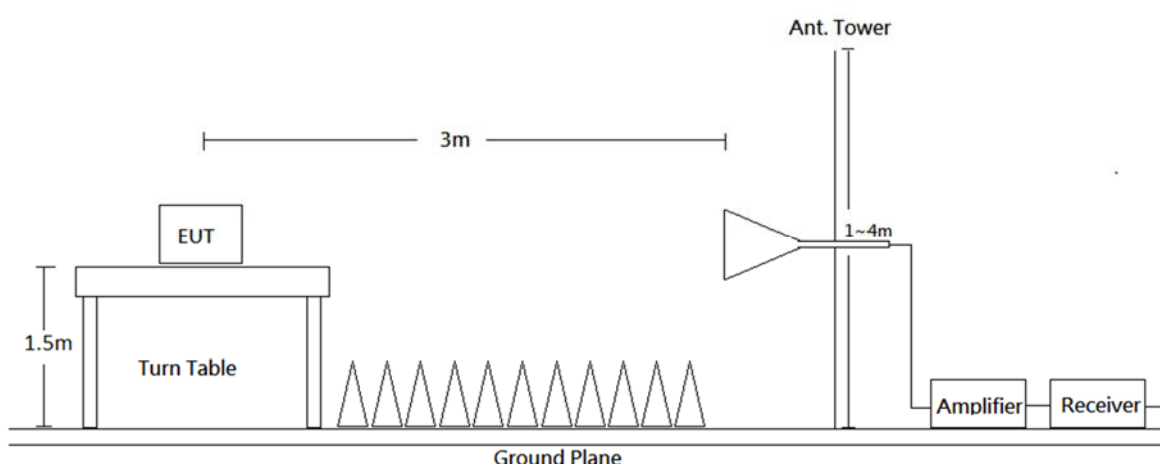
As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the 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   | Measurement method |
|-----------------|---------|-------|--------------------|
| 30-1000 MHz     | 120 kHz | /     | QP                 |
| Above 1 GHz     | 1 MHz   | 3 MHz | PK                 |
|                 | 1 MHz   | 10 Hz | Ave                |

### 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 Summary

According to the data in the following table, the EUT complied with the FCC §15.209 Limit.

### 8.7 Environmental Conditions

| Radiation Spurious Emissions |          | Conducted Spurious Emissions |          |
|------------------------------|----------|------------------------------|----------|
| Temperature:                 | 24.8 °C  | Temperature:                 | 24.3 °C  |
| Relative Humidity:           | 63 %     | Relative Humidity:           | 52 %     |
| ATM Pressure:                | 1010 hPa | ATM Pressure:                | 1010 hPa |

The Radiation Spurious Emissions testing was performed by Ken Yu on 2021-06-18~2021-06-21.

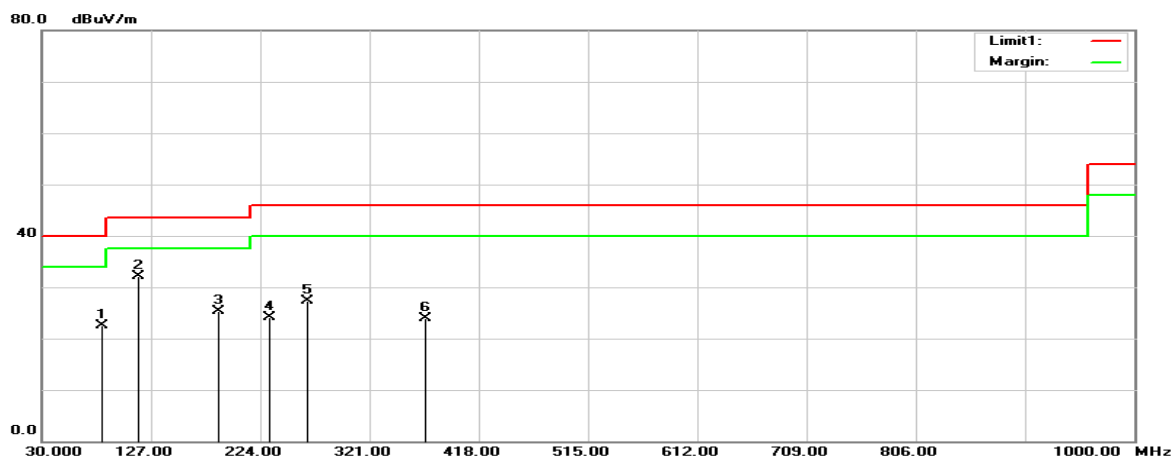
The Conducted Spurious Emissions testing was performed by David Hsu on 2021-06-18.

## 8.8 Test Results

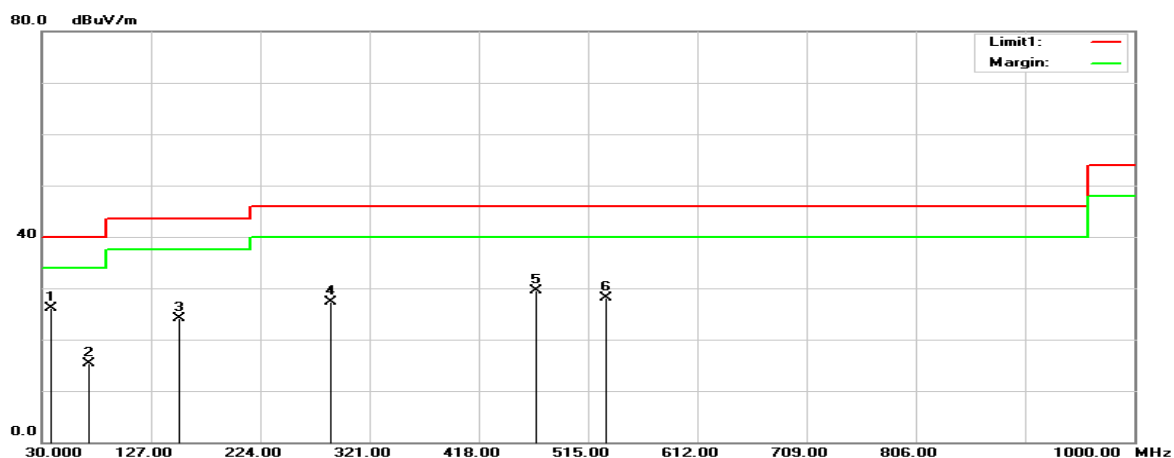
**Test Mode: Transmitting** (Pre-scan with three orthogonal axis, and worse case as Y axis.)

30MHz-1GHz: (worst case is EDR (8DPSK) mode low channel)

### Horizontal



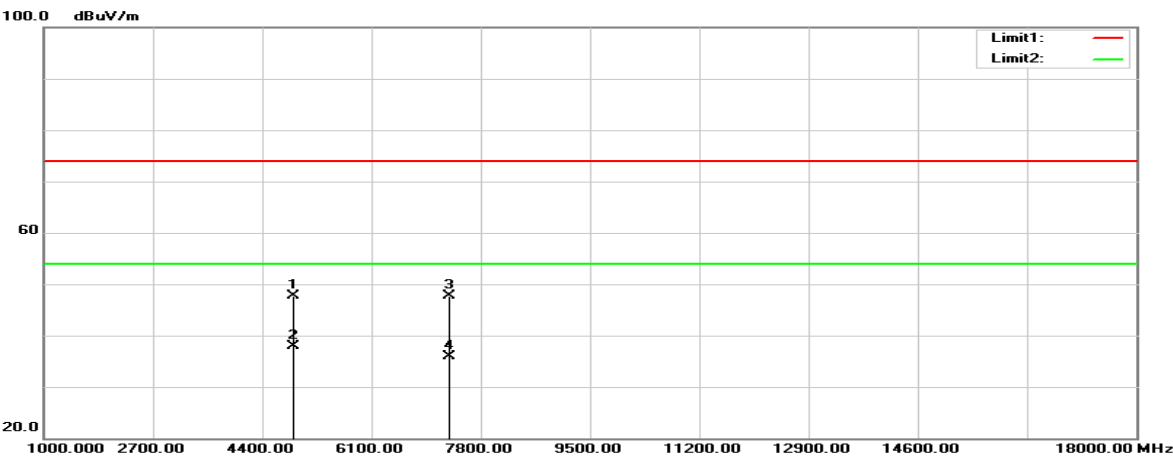
### Vertical



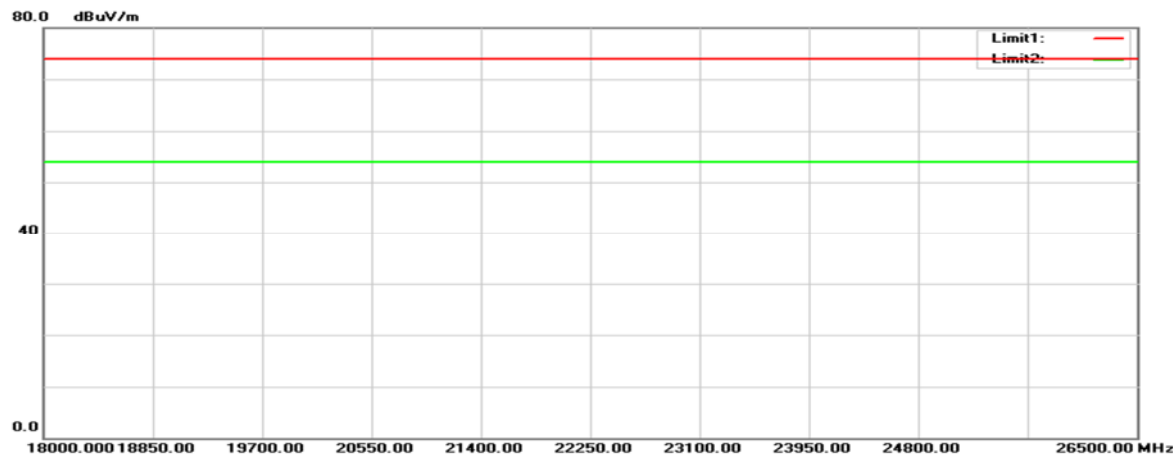
BR (GFSK) Mode

Horizontal (worst case is BR (GFSK) mode middle channel)

1GHz-18GHz:

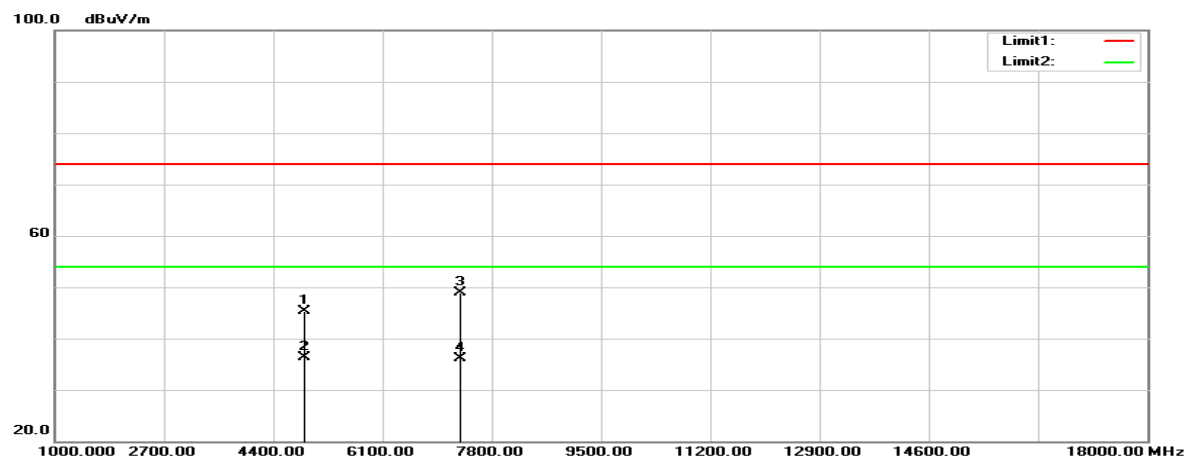


18GHz-26.5GHz:

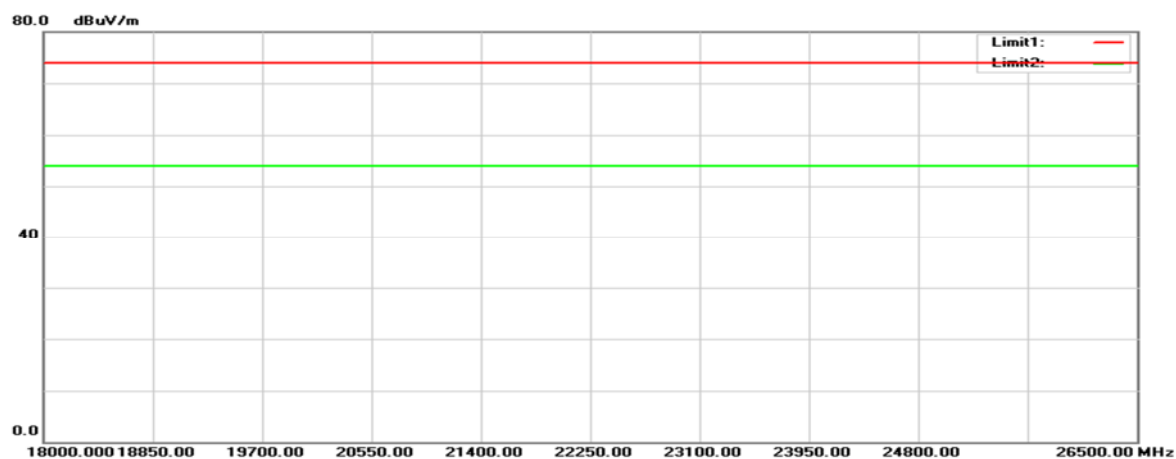


**Vertical** (worst case is BR (GFSK) mode middle channel)

1GHz-18GHz:

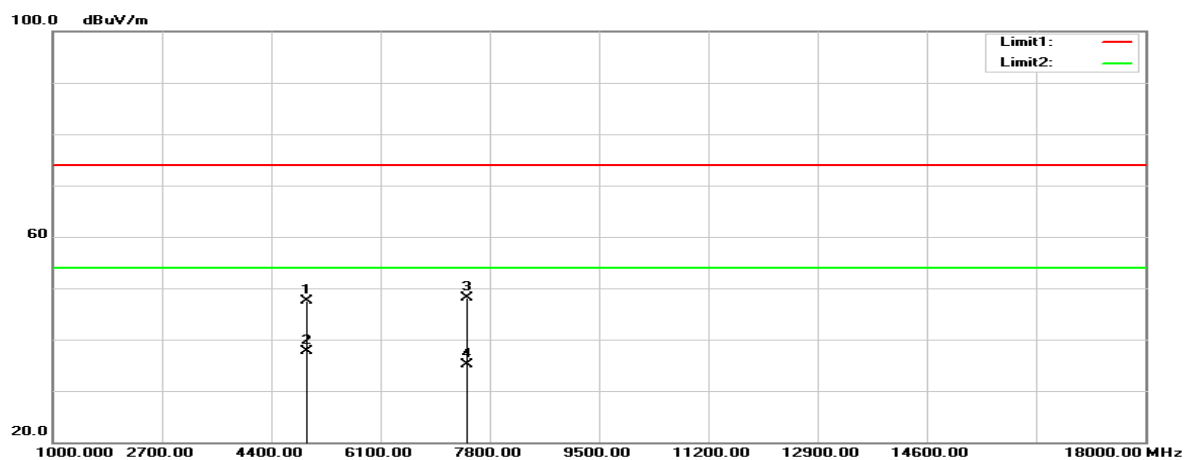


18GHz-26.5GHz:

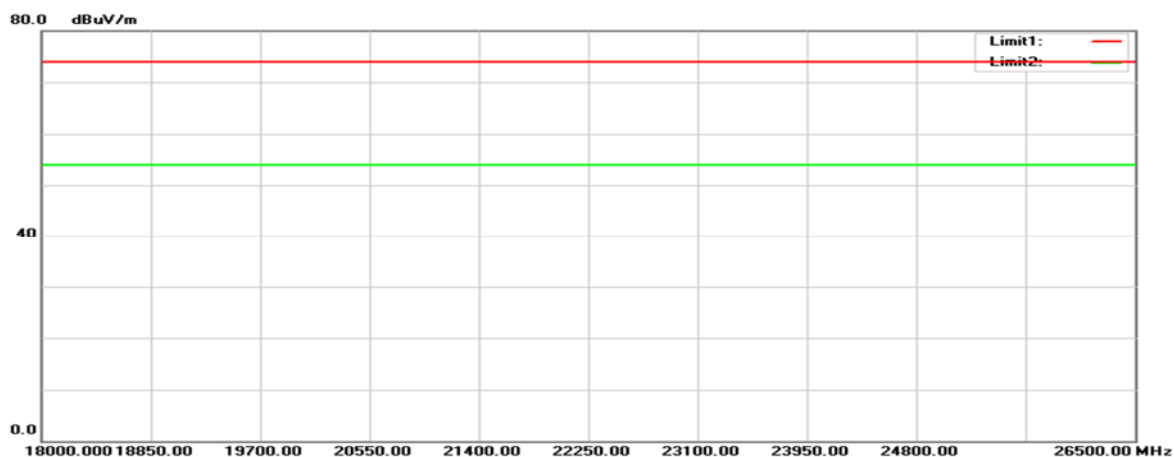


**EDR ( $\pi/4$ -DQPSK) Mode****Horizontal** (worst case is EDR ( $\pi/4$ -DQPSK) mode high channel)

1GHz-18GHz:

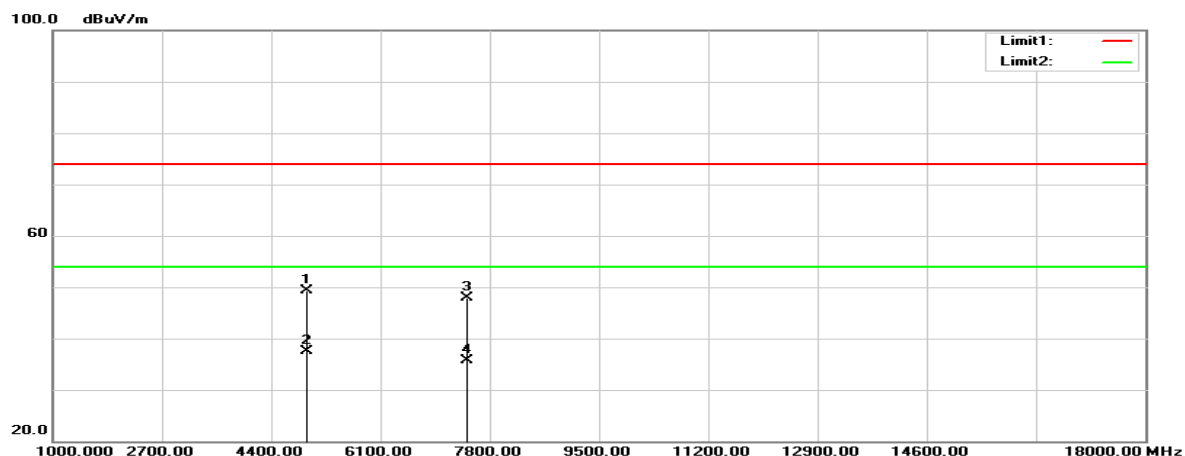


18GHz-26.5GHz:

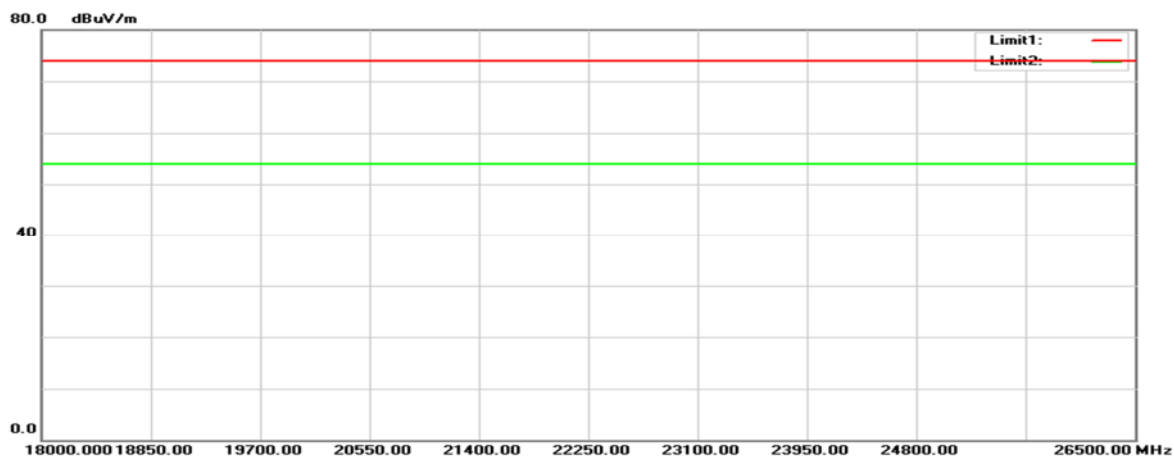


**Vertical** (worst case is EDR ( $\pi/4$ -DQPSK) mode high channel)

1GHz-18GHz:



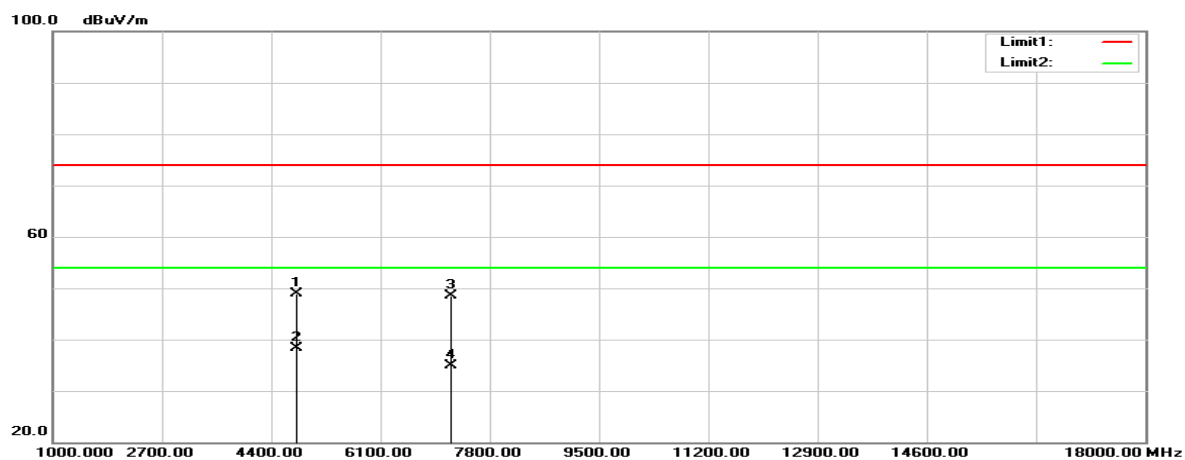
18GHz-26.5GHz:



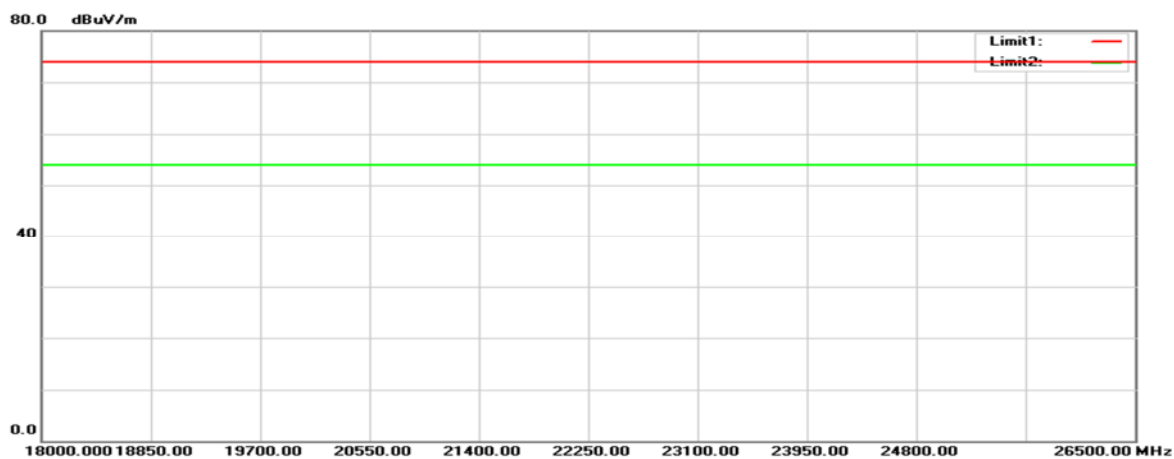
## EDR (8DPSK) Mode

**Horizontal** (worst case is EDR (8DPSK) mode low channel)

1GHz-18GHz:

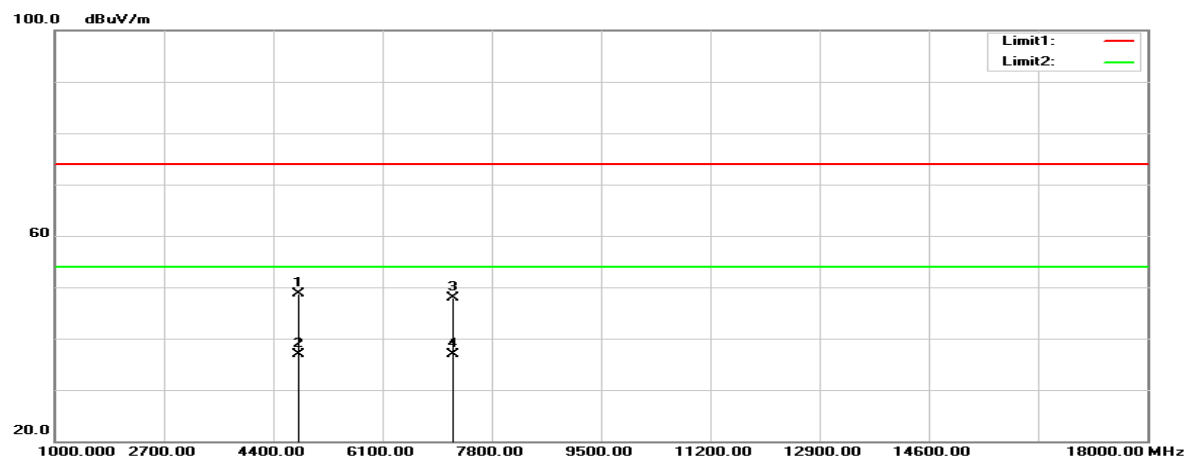


18GHz-26.5GHz:

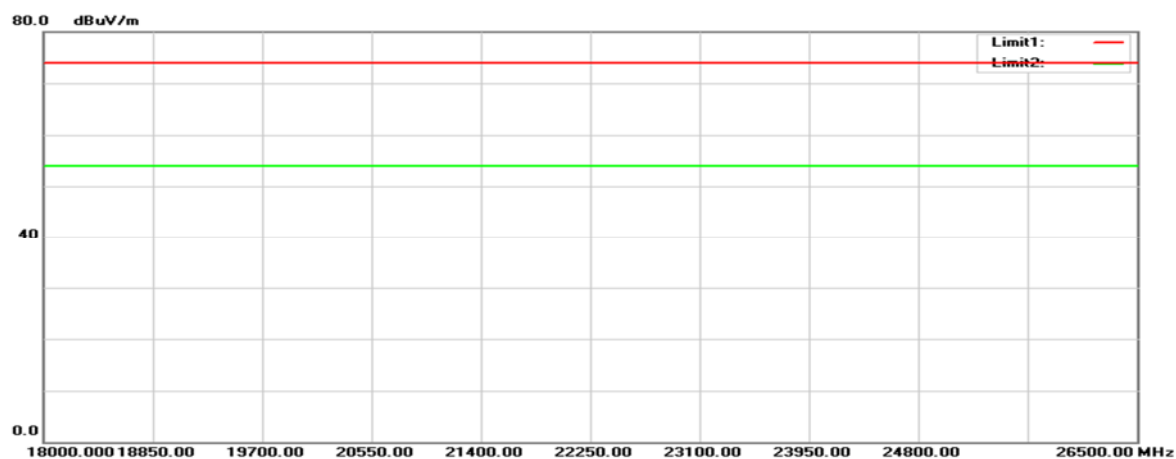


**Vertical** (worst case is EDR (8DPSK) mode low channel)

1GHz-18GHz:



18GHz-26.5GHz:



**Below 1GHz****Horizontal**

| Frequency | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|-----------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   | (cm)   | ( ° )  |        |
| 83.3500   | 39.13   | -16.66       | 22.47    | 40.00    | -17.53 | 100    | 45     | peak   |
| 116.3300  | 43.06   | -10.92       | 32.14    | 43.50    | -11.36 | 100    | 279    | peak   |
| 187.1400  | 38.17   | -12.89       | 25.28    | 43.50    | -18.22 | 100    | 275    | peak   |
| 232.7300  | 36.63   | -12.54       | 24.09    | 46.00    | -21.91 | 100    | 154    | peak   |
| 265.7100  | 38.06   | -10.80       | 27.26    | 46.00    | -18.74 | 100    | 161    | peak   |
| 370.4700  | 32.50   | -8.63        | 23.87    | 46.00    | -22.13 | 100    | 149    | peak   |

**Vertical**

| Frequency | Reading | Correct      | Result   | Limit    | Margin | Height | Degree | Remark |
|-----------|---------|--------------|----------|----------|--------|--------|--------|--------|
| (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   | (cm)   | ( ° )  |        |
| 38.7300   | 35.40   | -9.38        | 26.02    | 40.00    | -13.98 | 112    | 1      | QP     |
| 71.7100   | 31.51   | -16.14       | 15.37    | 40.00    | -24.63 | 109    | 213    | QP     |
| 152.2200  | 35.10   | -10.98       | 24.12    | 43.50    | -19.38 | 121    | 105    | QP     |
| 287.0500  | 37.40   | -10.10       | 27.30    | 46.00    | -18.70 | 100    | 134    | peak   |
| 468.4400  | 35.79   | -6.31        | 29.48    | 46.00    | -16.52 | 100    | 51     | peak   |
| 531.4900  | 33.74   | -5.63        | 28.11    | 46.00    | -17.89 | 100    | 28     | 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 |
|----------------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|---------------|--------|
| <i>BR (GFSK), Low channel</i>    |                   |                         |                    |                   |                |                |               |        |
| 2390.000                         | 55.38             | -10.23                  | 45.15              | 74.00             | -28.85         | 136            | 201           | peak   |
| 2390.000                         | 45.06             | -10.23                  | 34.83              | 54.00             | -19.17         | 136            | 201           | AVG    |
| 2402.100                         | 106.43            | -10.13                  | 96.30              | N/A               | N/A            | 136            | 201           | peak   |
| 2402.100                         | 97.58             | -10.13                  | 87.45              | N/A               | N/A            | 136            | 201           | AVG    |
| 4804.000                         | 53.93             | -3.28                   | 50.65              | 74.00             | -23.35         | 150            | 227           | peak   |
| 4804.000                         | 45.52             | -3.28                   | 42.24              | 54.00             | -11.76         | 150            | 227           | AVG    |
| 7206.000                         | 45.09             | 3.10                    | 48.19              | 74.00             | -25.81         | 150            | 46            | peak   |
| 7206.000                         | 32.40             | 3.10                    | 35.50              | 54.00             | -18.50         | 150            | 46            | AVG    |
| <i>BR (GFSK), Middle channel</i> |                   |                         |                    |                   |                |                |               |        |
| 2390.000                         | 56.48             | -10.23                  | 46.25              | 74.00             | -27.75         | 139            | 206           | peak   |
| 2390.000                         | 43.95             | -10.23                  | 33.72              | 54.00             | -20.28         | 139            | 206           | AVG    |
| 2440.922                         | 107.76            | -9.81                   | 97.95              | N/A               | N/A            | 139            | 206           | peak   |
| 2440.922                         | 98.85             | -9.81                   | 89.04              | N/A               | N/A            | 139            | 206           | AVG    |
| 2483.500                         | 55.29             | -9.26                   | 46.03              | 74.00             | -27.97         | 139            | 206           | peak   |
| 2483.500                         | 43.96             | -9.26                   | 34.70              | 54.00             | -19.30         | 139            | 206           | AVG    |
| 4882.000                         | 50.72             | -3.02                   | 47.70              | 74.00             | -26.30         | 131            | 220           | peak   |
| 4882.000                         | 40.93             | -3.02                   | 37.91              | 54.00             | -16.09         | 131            | 220           | AVG    |
| 7323.000                         | 43.62             | 4.08                    | 47.70              | 74.00             | -26.30         | 150            | 204           | peak   |
| 7323.000                         | 31.75             | 4.08                    | 35.83              | 54.00             | -18.17         | 150            | 204           | AVG    |
| <i>BR (GFSK), High channel</i>   |                   |                         |                    |                   |                |                |               |        |
| 2480.004                         | 107.49            | -9.31                   | 98.18              | N/A               | N/A            | 115            | 206           | peak   |
| 2480.004                         | 98.54             | -9.31                   | 89.23              | N/A               | N/A            | 115            | 206           | AVG    |
| 2483.500                         | 57.01             | -9.26                   | 47.75              | 74.00             | -26.25         | 115            | 206           | peak   |
| 2483.500                         | 44.98             | -9.26                   | 35.72              | 54.00             | -18.28         | 115            | 206           | AVG    |
| 4960.000                         | 50.60             | -2.69                   | 47.91              | 74.00             | -26.09         | 150            | 123           | peak   |
| 4960.000                         | 42.79             | -2.69                   | 40.10              | 54.00             | -13.90         | 150            | 123           | AVG    |
| 7440.000                         | 43.32             | 4.25                    | 47.57              | 74.00             | -26.43         | 150            | 254           | peak   |
| 7440.000                         | 31.11             | 4.25                    | 35.36              | 54.00             | -18.64         | 150            | 254           | AVG    |

**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 |
|----------------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|---------------|--------|
| <i>BR (GFSK), Low channel</i>    |                   |                         |                    |                   |                |                |               |        |
| 2390.000                         | 54.55             | -10.23                  | 44.32              | 74.00             | -29.68         | 134            | 222           | peak   |
| 2390.000                         | 43.91             | -10.23                  | 33.68              | 54.00             | -20.32         | 134            | 222           | AVG    |
| 2401.900                         | 101.72            | -10.14                  | 91.58              | N/A               | N/A            | 134            | 222           | peak   |
| 2401.900                         | 92.26             | -10.14                  | 82.12              | N/A               | N/A            | 134            | 222           | AVG    |
| 4804.000                         | 50.63             | -3.28                   | 47.35              | 74.00             | -26.65         | 155            | 261           | peak   |
| 4804.000                         | 39.98             | -3.28                   | 36.70              | 54.00             | -17.30         | 155            | 261           | AVG    |
| 7206.000                         | 44.41             | 3.10                    | 47.51              | 74.00             | -26.49         | 150            | 359           | peak   |
| 7206.000                         | 32.81             | 3.10                    | 35.91              | 54.00             | -18.09         | 150            | 359           | AVG    |
| <i>BR (GFSK), Middle channel</i> |                   |                         |                    |                   |                |                |               |        |
| 2390.000                         | 55.11             | -10.23                  | 44.88              | 74.00             | -29.12         | 121            | 219           | peak   |
| 2390.000                         | 43.84             | -10.23                  | 33.61              | 54.00             | -20.39         | 121            | 219           | AVG    |
| 2440.922                         | 102.55            | -9.81                   | 92.74              | N/A               | N/A            | 121            | 219           | peak   |
| 2440.922                         | 93.73             | -9.81                   | 83.92              | N/A               | N/A            | 121            | 219           | AVG    |
| 2483.500                         | 55.48             | -9.26                   | 46.22              | 74.00             | -27.78         | 121            | 219           | peak   |
| 2483.500                         | 43.80             | -9.26                   | 34.54              | 54.00             | -19.46         | 121            | 219           | AVG    |
| 4882.000                         | 48.29             | -3.02                   | 45.27              | 74.00             | -28.73         | 148            | 326           | peak   |
| 4882.000                         | 39.27             | -3.02                   | 36.25              | 54.00             | -17.75         | 148            | 326           | AVG    |
| 7323.000                         | 44.86             | 4.08                    | 48.94              | 74.00             | -25.06         | 150            | 330           | peak   |
| 7323.000                         | 32.05             | 4.08                    | 36.13              | 54.00             | -17.87         | 150            | 330           | AVG    |
| <i>BR (GFSK), High channel</i>   |                   |                         |                    |                   |                |                |               |        |
| 2479.840                         | 105.87            | -9.31                   | 96.56              | N/A               | N/A            | 101            | 202           | peak   |
| 2479.840                         | 97.10             | -9.31                   | 87.79              | N/A               | N/A            | 101            | 202           | AVG    |
| 2483.500                         | 56.30             | -9.26                   | 47.04              | 74.00             | -26.96         | 101            | 202           | peak   |
| 2483.500                         | 44.50             | -9.26                   | 35.24              | 54.00             | -18.76         | 101            | 202           | AVG    |
| 4960.000                         | 50.44             | -2.69                   | 47.75              | 74.00             | -26.25         | 147            | 35            | peak   |
| 4960.000                         | 40.47             | -2.69                   | 37.78              | 54.00             | -16.22         | 147            | 35            | AVG    |
| 7440.000                         | 43.39             | 4.25                    | 47.64              | 74.00             | -26.36         | 150            | 108           | peak   |
| 7440.000                         | 30.81             | 4.25                    | 35.06              | 54.00             | -18.94         | 150            | 108           | 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 |
|-------------------------------------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|---------------|--------|
| <i>EDR (<math>\pi/4</math>-DQPSK), Low channel</i>    |                   |                         |                    |                   |                |                |               |        |
| 2390.000                                              | 54.79             | -10.23                  | 44.56              | 74.00             | -29.44         | 142            | 209           | peak   |
| 2390.000                                              | 43.82             | -10.23                  | 33.59              | 54.00             | -20.41         | 142            | 209           | AVG    |
| 2402.200                                              | 110.28            | -10.13                  | 100.15             | N/A               | N/A            | 142            | 209           | peak   |
| 2402.200                                              | 99.85             | -10.13                  | 89.72              | N/A               | N/A            | 142            | 209           | AVG    |
| 4804.000                                              | 53.57             | -3.28                   | 50.29              | 74.00             | -23.71         | 152            | 345           | peak   |
| 4804.000                                              | 41.89             | -3.28                   | 38.61              | 54.00             | -15.39         | 152            | 345           | AVG    |
| 7206.000                                              | 44.17             | 3.10                    | 47.27              | 74.00             | -26.73         | 150            | 357           | peak   |
| 7206.000                                              | 31.94             | 3.10                    | 35.04              | 54.00             | -18.96         | 150            | 357           | AVG    |
| <i>EDR (<math>\pi/4</math>-DQPSK), Middle channel</i> |                   |                         |                    |                   |                |                |               |        |
| 2390.000                                              | 54.88             | -10.23                  | 44.65              | 74.00             | -29.35         | 136            | 207           | peak   |
| 2390.000                                              | 43.91             | -10.23                  | 33.68              | 54.00             | -20.32         | 136            | 207           | AVG    |
| 2441.164                                              | 110.04            | -9.81                   | 100.23             | N/A               | N/A            | 136            | 207           | peak   |
| 2441.164                                              | 99.28             | -9.81                   | 89.47              | N/A               | N/A            | 136            | 207           | AVG    |
| 2483.500                                              | 56.60             | -9.26                   | 47.34              | 74.00             | -26.66         | 136            | 207           | peak   |
| 2483.500                                              | 44.05             | -9.26                   | 34.79              | 54.00             | -19.21         | 136            | 207           | AVG    |
| 4882.000                                              | 52.03             | -3.02                   | 49.01              | 74.00             | -24.99         | 155            | 193           | peak   |
| 4882.000                                              | 40.76             | -3.02                   | 37.74              | 54.00             | -16.26         | 155            | 193           | AVG    |
| 7323.000                                              | 45.12             | 4.08                    | 49.20              | 74.00             | -24.80         | 150            | 42            | peak   |
| 7323.000                                              | 31.97             | 4.08                    | 36.05              | 54.00             | -17.95         | 150            | 42            | AVG    |
| <i>EDR (<math>\pi/4</math>-DQPSK), High channel</i>   |                   |                         |                    |                   |                |                |               |        |
| 2480.086                                              | 110.67            | -9.31                   | 101.36             | N/A               | N/A            | 117            | 208           | peak   |
| 2480.086                                              | 99.82             | -9.31                   | 90.51              | N/A               | N/A            | 117            | 208           | AVG    |
| 2483.500                                              | 57.59             | -9.26                   | 48.33              | 74.00             | -25.67         | 117            | 208           | peak   |
| 2483.500                                              | 45.31             | -9.26                   | 36.05              | 54.00             | -17.95         | 117            | 208           | AVG    |
| 4960.000                                              | 50.25             | -2.69                   | 47.56              | 74.00             | -26.44         | 150            | 273           | peak   |
| 4960.000                                              | 40.39             | -2.69                   | 37.70              | 54.00             | -16.30         | 150            | 273           | AVG    |
| 7440.000                                              | 43.86             | 4.25                    | 48.11              | 74.00             | -25.89         | 150            | 330           | peak   |
| 7440.000                                              | 30.91             | 4.25                    | 35.16              | 54.00             | -18.84         | 150            | 330           | AVG    |

**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 |
|----------------------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|---------------|--------|
| <i>EDR (π/4-DQPSK), Low channel</i>    |                   |                         |                    |                   |                |                |               |        |
| 2390.000                               | 54.90             | -10.23                  | 44.67              | 74.00             | -29.33         | 110            | 217           | peak   |
| 2390.000                               | 43.91             | -10.23                  | 33.68              | 54.00             | -20.32         | 110            | 217           | AVG    |
| 2402.200                               | 104.38            | -10.13                  | 94.25              | N/A               | N/A            | 110            | 217           | peak   |
| 2402.200                               | 93.27             | -10.13                  | 83.14              | N/A               | N/A            | 110            | 217           | AVG    |
| 4804.000                               | 47.61             | -3.28                   | 44.33              | 74.00             | -29.67         | 130            | 145           | peak   |
| 4804.000                               | 41.14             | -3.28                   | 37.86              | 54.00             | -16.14         | 130            | 145           | AVG    |
| 7206.000                               | 45.60             | 3.10                    | 48.70              | 74.00             | -25.30         | 150            | 337           | peak   |
| 7206.000                               | 33.06             | 3.10                    | 36.16              | 54.00             | -17.84         | 150            | 337           | AVG    |
| <i>EDR (π/4-DQPSK), Middle channel</i> |                   |                         |                    |                   |                |                |               |        |
| 2390.000                               | 54.88             | -10.23                  | 44.65              | 74.00             | -29.35         | 116            | 217           | peak   |
| 2390.000                               | 43.87             | -10.23                  | 33.64              | 54.00             | -20.36         | 116            | 217           | AVG    |
| 2441.164                               | 103.70            | -9.81                   | 93.89              | N/A               | N/A            | 116            | 217           | peak   |
| 2441.164                               | 92.96             | -9.81                   | 83.15              | N/A               | N/A            | 116            | 217           | AVG    |
| 2483.500                               | 55.31             | -9.26                   | 46.05              | 74.00             | -27.95         | 116            | 217           | peak   |
| 2483.500                               | 43.95             | -9.26                   | 34.69              | 54.00             | -19.31         | 116            | 217           | AVG    |
| 4882.000                               | 47.12             | -3.02                   | 44.10              | 74.00             | -29.90         | 148            | 2             | peak   |
| 4882.000                               | 38.93             | -3.02                   | 35.91              | 54.00             | -18.09         | 148            | 2             | AVG    |
| 7323.000                               | 44.47             | 4.08                    | 48.55              | 74.00             | -25.45         | 150            | 240           | peak   |
| 7323.000                               | 32.23             | 4.08                    | 36.31              | 54.00             | -17.69         | 150            | 240           | AVG    |
| <i>EDR (π/4-DQPSK), High channel</i>   |                   |                         |                    |                   |                |                |               |        |
| 2480.168                               | 106.64            | -9.31                   | 97.33              | N/A               | N/A            | 105            | 195           | peak   |
| 2480.168                               | 95.78             | -9.31                   | 86.47              | N/A               | N/A            | 105            | 195           | AVG    |
| 2483.500                               | 56.24             | -9.26                   | 46.98              | 74.00             | -27.02         | 105            | 195           | peak   |
| 2483.500                               | 44.49             | -9.26                   | 35.23              | 54.00             | -18.77         | 105            | 195           | AVG    |
| 4960.000                               | 51.93             | -2.69                   | 49.24              | 74.00             | -24.76         | 150            | 359           | peak   |
| 4960.000                               | 40.18             | -2.69                   | 37.49              | 54.00             | -16.51         | 150            | 359           | AVG    |
| 7440.000                               | 43.75             | 4.25                    | 48.00              | 74.00             | -26.00         | 150            | 325           | peak   |
| 7440.000                               | 31.42             | 4.25                    | 35.67              | 54.00             | -18.33         | 150            | 325           | 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 |
|------------------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|---------------|--------|
| <i>EDR (8DPSK), Low channel</i>    |                   |                         |                    |                   |                |                |               |        |
| 2390.000                           | 55.57             | -10.23                  | 45.34              | 74.00             | -28.66         | 126            | 206           | peak   |
| 2390.000                           | 44.46             | -10.23                  | 34.23              | 54.00             | -19.77         | 126            | 206           | AVG    |
| 2402.100                           | 111.07            | -10.13                  | 100.94             | N/A               | N/A            | 126            | 206           | peak   |
| 2402.100                           | 99.75             | -10.13                  | 89.62              | N/A               | N/A            | 126            | 206           | AVG    |
| 4804.000                           | 52.20             | -3.28                   | 48.92              | 74.00             | -25.08         | 150            | 210           | peak   |
| 4804.000                           | 41.68             | -3.28                   | 38.40              | 54.00             | -15.60         | 150            | 210           | AVG    |
| 7206.000                           | 45.31             | 3.10                    | 48.41              | 74.00             | -25.59         | 150            | 13            | peak   |
| 7206.000                           | 31.72             | 3.10                    | 34.82              | 54.00             | -19.18         | 150            | 13            | AVG    |
| <i>EDR (8DPSK), Middle channel</i> |                   |                         |                    |                   |                |                |               |        |
| 2390.000                           | 56.38             | -10.23                  | 46.15              | 74.00             | -27.85         | 134            | 209           | peak   |
| 2390.000                           | 44.01             | -10.23                  | 33.78              | 54.00             | -20.22         | 134            | 209           | AVG    |
| 2441.164                           | 110.30            | -9.81                   | 100.49             | N/A               | N/A            | 134            | 209           | peak   |
| 2441.164                           | 98.93             | -9.81                   | 89.12              | N/A               | N/A            | 134            | 209           | AVG    |
| 2483.500                           | 55.39             | -9.26                   | 46.13              | 74.00             | -27.87         | 134            | 209           | peak   |
| 2483.500                           | 43.96             | -9.26                   | 34.70              | 54.00             | -19.30         | 134            | 209           | AVG    |
| 4882.000                           | 51.50             | -3.02                   | 48.48              | 74.00             | -25.52         | 150            | 33            | peak   |
| 4882.000                           | 39.37             | -3.02                   | 36.35              | 54.00             | -17.65         | 150            | 33            | AVG    |
| 7323.000                           | 44.85             | 4.08                    | 48.93              | 74.00             | -25.07         | 150            | 1             | peak   |
| 7323.000                           | 31.95             | 4.08                    | 36.03              | 54.00             | -17.97         | 150            | 1             | AVG    |
| <i>EDR (8DPSK), High channel</i>   |                   |                         |                    |                   |                |                |               |        |
| 2479.922                           | 110.88            | -9.31                   | 101.57             | N/A               | N/A            | 114            | 209           | peak   |
| 2479.922                           | 99.64             | -9.31                   | 90.33              | N/A               | N/A            | 114            | 209           | AVG    |
| 2483.500                           | 56.78             | -9.26                   | 47.52              | 74.00             | -26.48         | 114            | 209           | peak   |
| 2483.500                           | 45.29             | -9.26                   | 36.03              | 54.00             | -17.97         | 114            | 209           | AVG    |
| 4960.000                           | 52.24             | -2.69                   | 49.55              | 74.00             | -24.45         | 147            | 265           | peak   |
| 4960.000                           | 41.80             | -2.69                   | 39.11              | 54.00             | -14.89         | 147            | 265           | AVG    |
| 7440.000                           | 44.92             | 4.25                    | 49.17              | 74.00             | -24.83         | 150            | 202           | peak   |
| 7440.000                           | 31.04             | 4.25                    | 35.29              | 54.00             | -18.71         | 150            | 202           | AVG    |

**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 |
|------------------------------------|-------------------|-------------------------|--------------------|-------------------|----------------|----------------|-----------------|--------|
| <i>EDR (8DPSK), Low channel</i>    |                   |                         |                    |                   |                |                |                 |        |
| 2390.000                           | 55.54             | -10.23                  | 45.31              | 74.00             | -28.69         | 109            | 213             | peak   |
| 2390.000                           | 43.87             | -10.23                  | 33.64              | 54.00             | -20.36         | 109            | 213             | AVG    |
| 2402.100                           | 106.39            | -10.13                  | 96.26              | N/A               | N/A            | 109            | 213             | peak   |
| 2402.100                           | 95.07             | -10.13                  | 84.94              | N/A               | N/A            | 109            | 213             | AVG    |
| 4804.000                           | 52.05             | -3.28                   | 48.77              | 74.00             | -25.23         | 144            | 65              | peak   |
| 4804.000                           | 40.24             | -3.28                   | 36.96              | 54.00             | -17.04         | 144            | 65              | AVG    |
| 7206.000                           | 44.86             | 3.10                    | 47.96              | 74.00             | -26.04         | 150            | 123             | peak   |
| 7206.000                           | 33.78             | 3.10                    | 36.88              | 54.00             | -17.12         | 150            | 123             | AVG    |
| <i>EDR (8DPSK), Middle channel</i> |                   |                         |                    |                   |                |                |                 |        |
| 2390.000                           | 55.39             | -10.23                  | 45.16              | 74.00             | -28.84         | 123            | 219             | peak   |
| 2390.000                           | 43.90             | -10.23                  | 33.67              | 54.00             | -20.33         | 123            | 219             | AVG    |
| 2440.922                           | 103.80            | -9.81                   | 93.99              | N/A               | N/A            | 123            | 219             | peak   |
| 2440.922                           | 92.50             | -9.81                   | 82.69              | N/A               | N/A            | 123            | 219             | AVG    |
| 2483.500                           | 55.92             | -9.26                   | 46.66              | 74.00             | -27.34         | 123            | 219             | peak   |
| 2483.500                           | 43.75             | -9.26                   | 34.49              | 54.00             | -19.51         | 123            | 219             | AVG    |
| 4882.000                           | 50.77             | -3.02                   | 47.75              | 74.00             | -26.25         | 150            | 355             | peak   |
| 4882.000                           | 39.02             | -3.02                   | 36.00              | 54.00             | -18.00         | 150            | 355             | AVG    |
| 7323.000                           | 45.07             | 4.08                    | 49.15              | 74.00             | -24.85         | 150            | 310             | peak   |
| 7323.000                           | 32.28             | 4.08                    | 36.36              | 54.00             | -17.64         | 150            | 310             | AVG    |
| <i>EDR (8DPSK), High channel</i>   |                   |                         |                    |                   |                |                |                 |        |
| 2480.004                           | 105.02            | -9.31                   | 95.71              | N/A               | N/A            | 121            | 218             | peak   |
| 2480.004                           | 93.87             | -9.31                   | 84.56              | N/A               | N/A            | 121            | 218             | AVG    |
| 2483.500                           | 55.60             | -9.26                   | 46.34              | 74.00             | -27.66         | 121            | 218             | peak   |
| 2483.500                           | 44.27             | -9.26                   | 35.01              | 54.00             | -18.99         | 121            | 218             | AVG    |
| 4960.000                           | 51.90             | -2.69                   | 49.21              | 74.00             | -24.79         | 150            | 359             | peak   |
| 4960.000                           | 40.46             | -2.69                   | 37.77              | 54.00             | -16.23         | 150            | 359             | AVG    |
| 7440.000                           | 43.77             | 4.25                    | 48.02              | 74.00             | -25.98         | 150            | 290             | peak   |
| 7440.000                           | 31.60             | 4.25                    | 35.85              | 54.00             | -18.15         | 150            | 290             | AVG    |

Result = Reading + Correct Factor

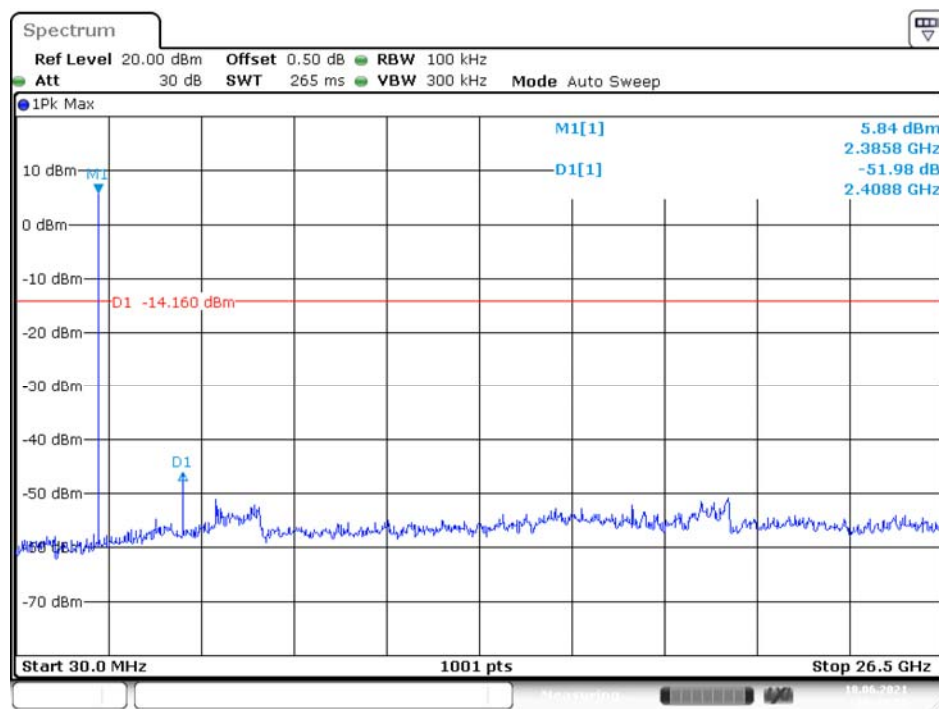
Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

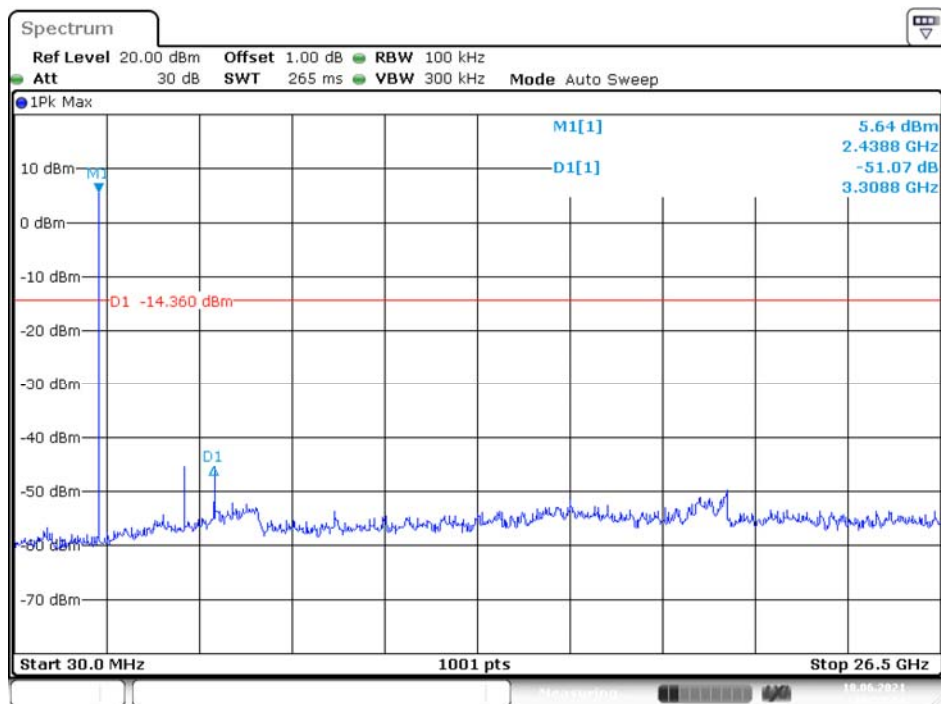
Spurious emissions more than 20 dB below the limit were not reported.

**Conducted Spurious Emissions:**

| Channel                                     | Frequency (MHz) | Delta Peak to Band Emission (dBc) | Limit (dBc) | Result |
|---------------------------------------------|-----------------|-----------------------------------|-------------|--------|
| <i>BR Mode (GFSK)</i>                       |                 |                                   |             |        |
| Low                                         | 2402            | 51.98                             | $\geq 20$   | PASS   |
| Mid                                         | 2441            | 51.07                             | $\geq 20$   | PASS   |
| High                                        | 2480            | 52.59                             | $\geq 20$   | PASS   |
| <i>EDR Mode (<math>\pi/4</math>-DQPSK):</i> |                 |                                   |             |        |
| Low                                         | 2402            | 51.80                             | $\geq 20$   | PASS   |
| Mid                                         | 2441            | 50.45                             | $\geq 20$   | PASS   |
| High                                        | 2480            | 49.36                             | $\geq 20$   | PASS   |
| <i>EDR Mode (8DPSK):</i>                    |                 |                                   |             |        |
| Low                                         | 2402            | 51.43                             | $\geq 20$   | PASS   |
| Mid                                         | 2441            | 47.62                             | $\geq 20$   | PASS   |
| High                                        | 2480            | 49.48                             | $\geq 20$   | PASS   |

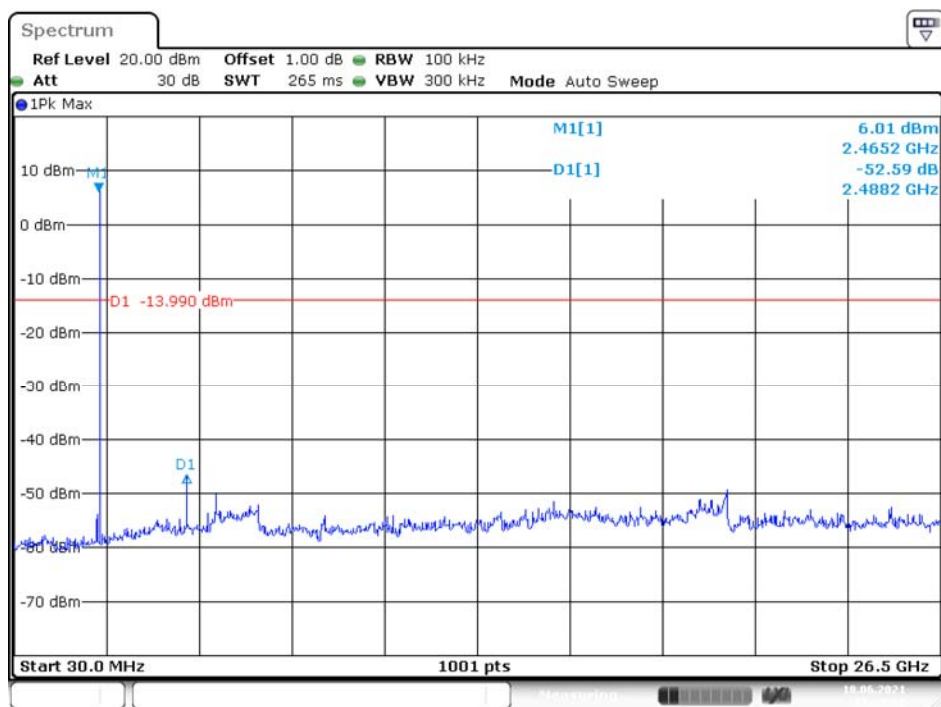
**BR Mode (GFSK)****Low Channel**

## Middle Channel

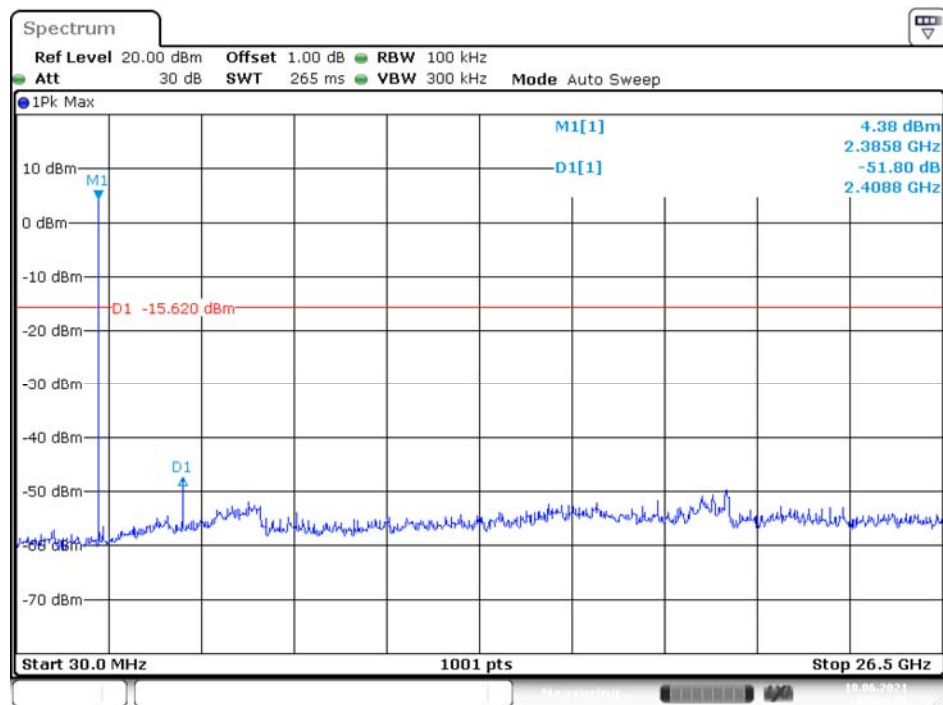


Date: 18 JUN 2021 16:52:34

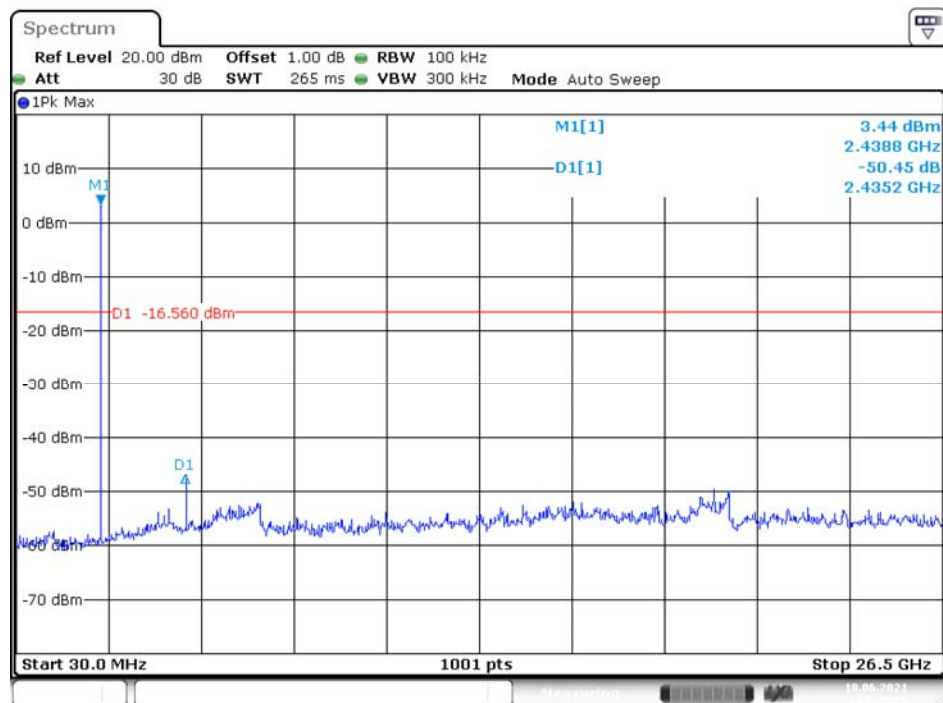
## High Channel



Date: 18 JUN 2021 17:01:26

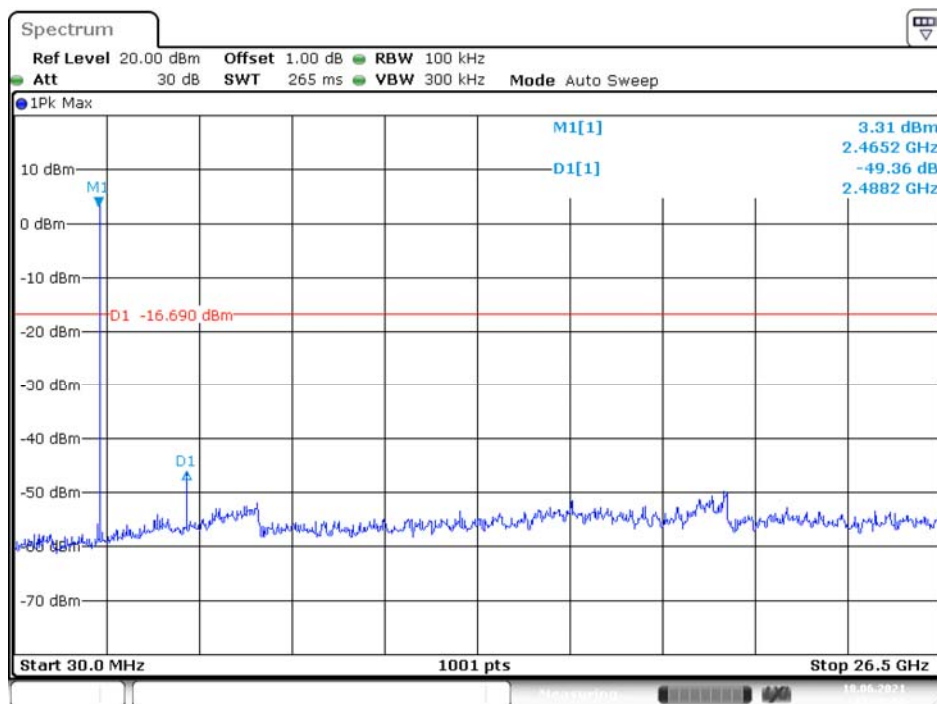
**EDR Mode ( $\pi/4$ -DQPSK)****Low Channel**

Date: 18 JUN 2021 17:34:22

**Middle Channel**

Date: 18 JUN 2021 17:23:56

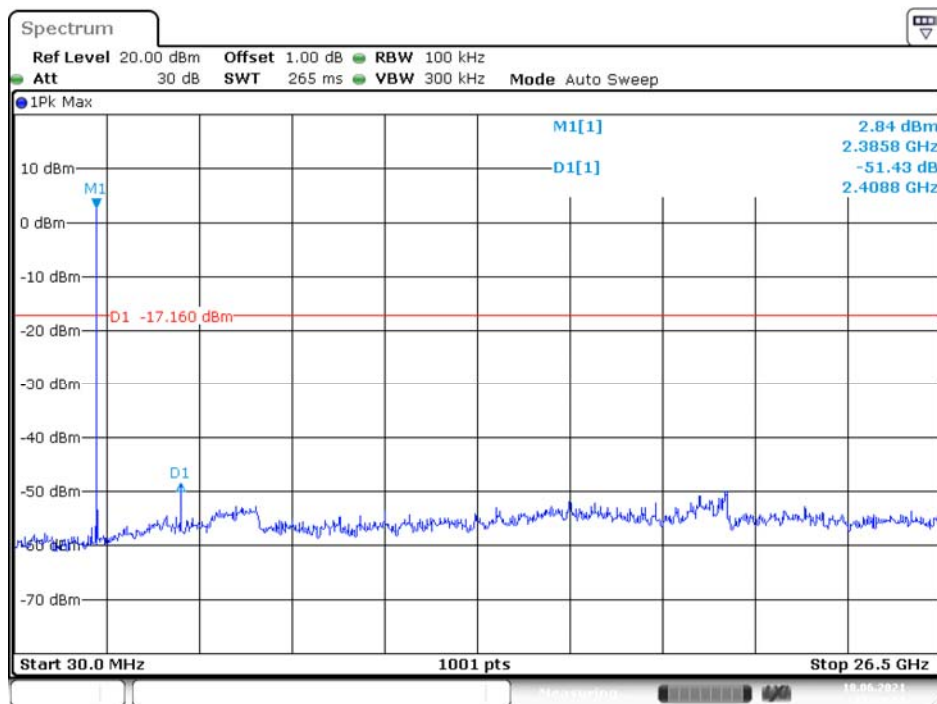
## High Channel



Date: 18 JUN 2021 17:26:10

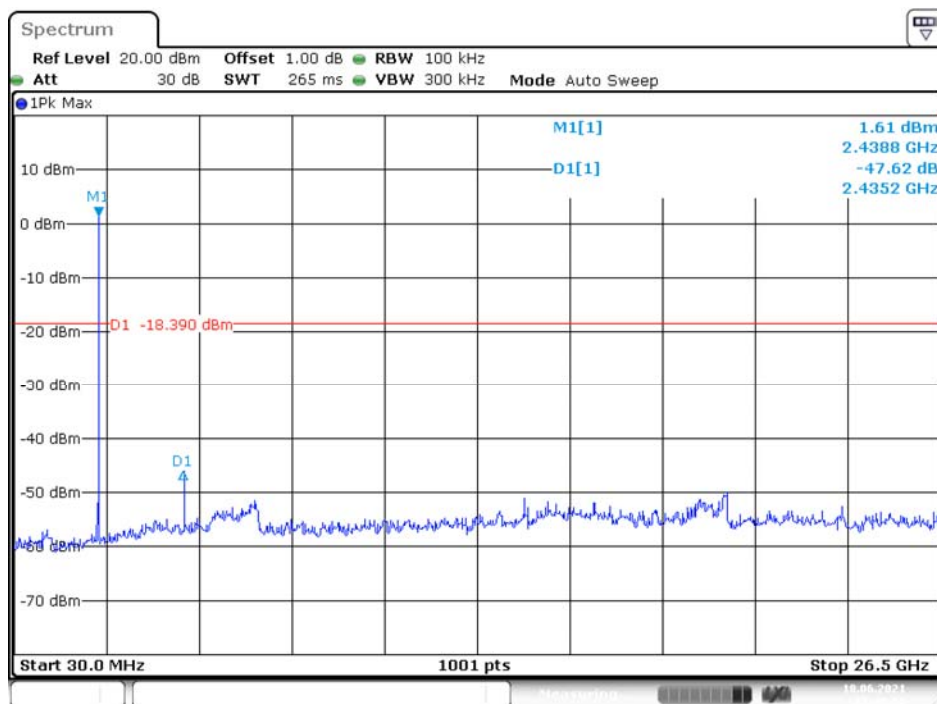
## EDR Mode (8DPSK)

### Low Channel



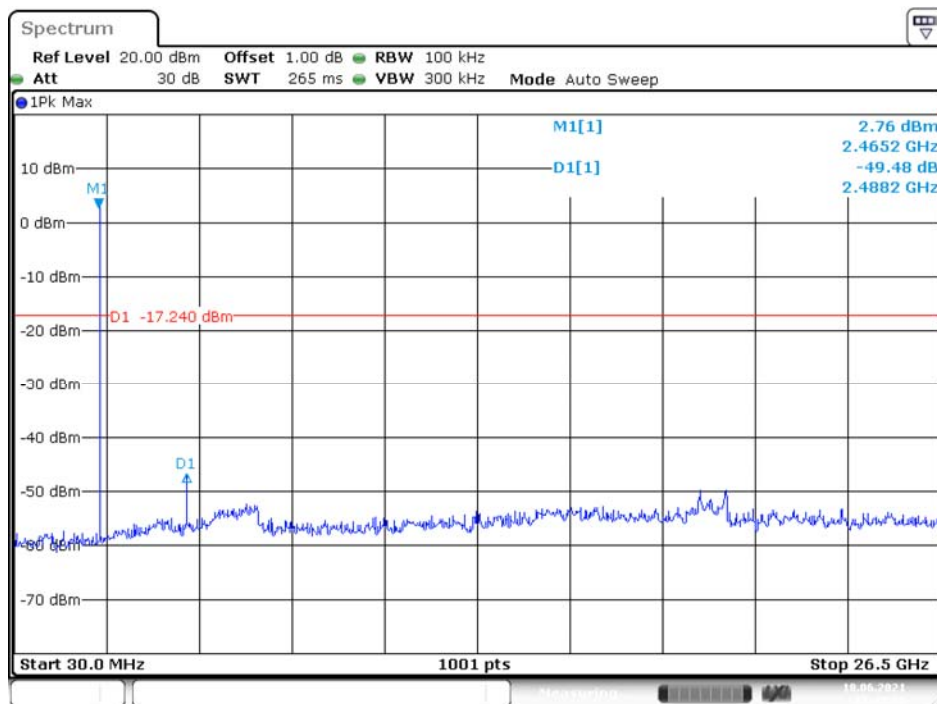
Date: 18 JUN 2021 17:38:11

### Middle Channel



Date: 18.JUN.2021 17:40:10

### High Channel



Date: 18.JUN.2021 17:43:40

## 9 FCC §15.247(a)(1) – 20 dB Emission Bandwidth

### 9.1 Applicable Standard

According to FCC §15.247(a) (1) the maximum 20 dB bandwidth of the hopping channel shall be presented.

### 9.2 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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- (3) Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- (4) Repeat above procedures until all frequencies measured were complete.

### 9.3 Environmental Conditions

|                    |          |
|--------------------|----------|
| Temperature:       | 24.3 °C  |
| Relative Humidity: | 52 %     |
| ATM Pressure:      | 1010 hPa |

*The testing was performed by David Hsu on 2021-06-18.*

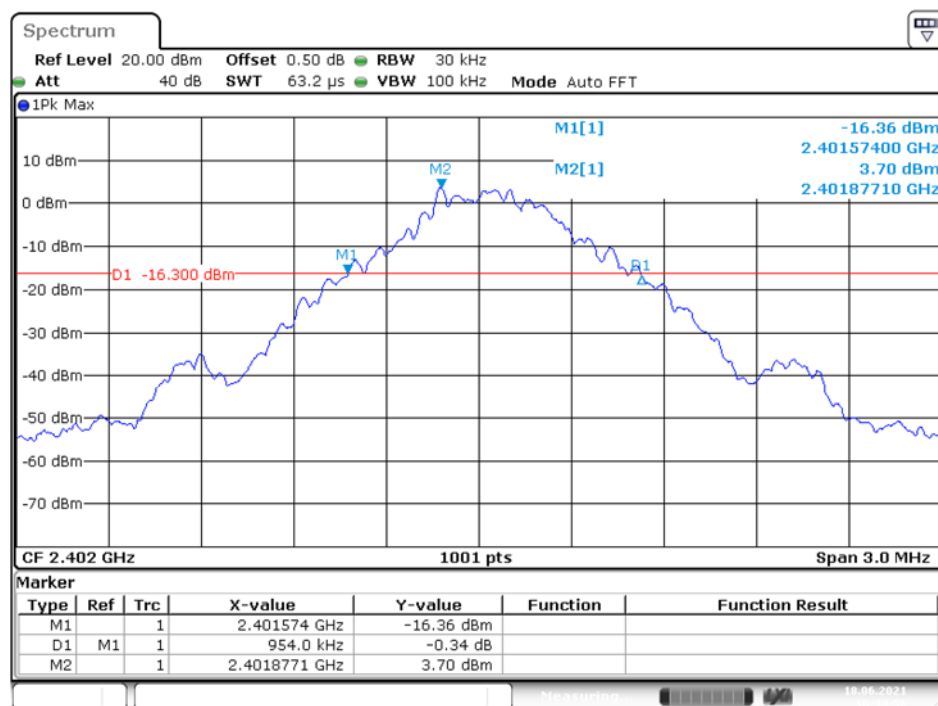
## 9.4 Test Results

| Channel                                    | Frequency<br>(MHz) | 20 dBc BW<br>(MHz) |
|--------------------------------------------|--------------------|--------------------|
| <i>BR Mode (GFSK)</i>                      |                    |                    |
| Low                                        | 2402               | 0.95               |
| Middle                                     | 2441               | 0.96               |
| High                                       | 2480               | 0.95               |
| <i>EDR Mode (<math>\pi/4</math>-DQPSK)</i> |                    |                    |
| Low                                        | 2402               | 1.29               |
| Middle                                     | 2441               | 1.28               |
| High                                       | 2480               | 1.28               |
| <i>EDR Mode (8DPSK)</i>                    |                    |                    |
| Low                                        | 2402               | 1.29               |
| Middle                                     | 2441               | 1.29               |
| High                                       | 2480               | 1.29               |

Please refer to the following plots

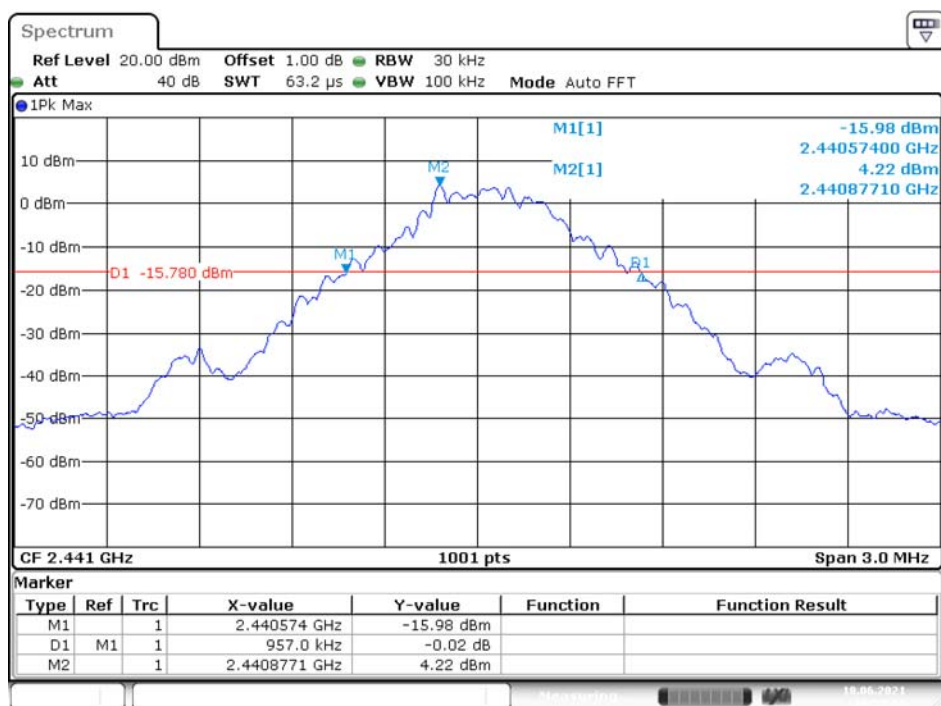
### BR Mode (GFSK)

#### Low Channel



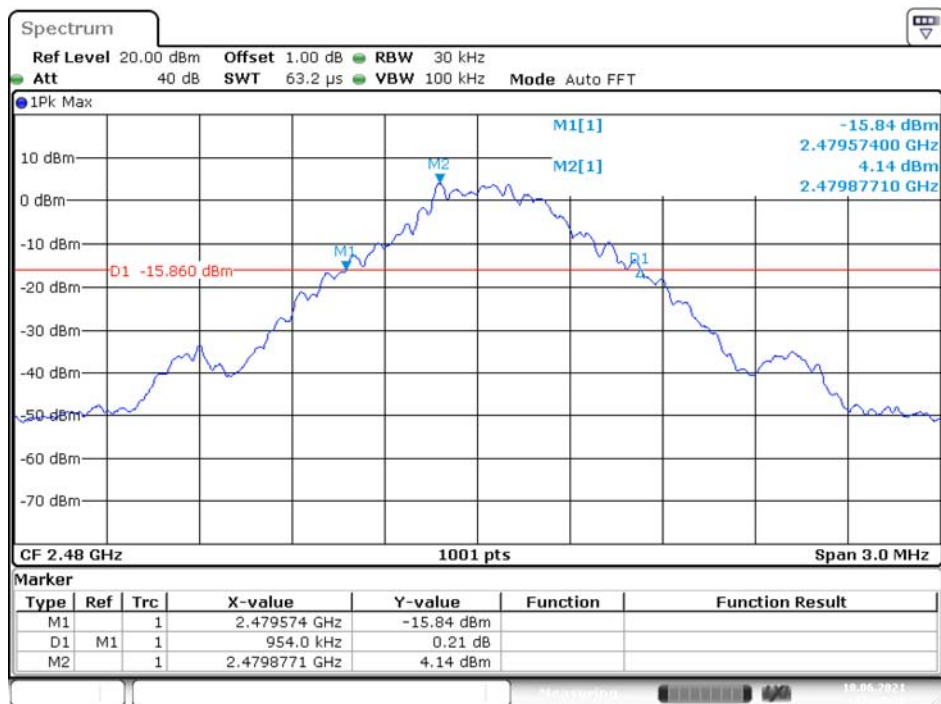
Date: 18.JUN.2021 16:44:56

## Middle Channel



Date: 18.JUN.2021 16:52:03

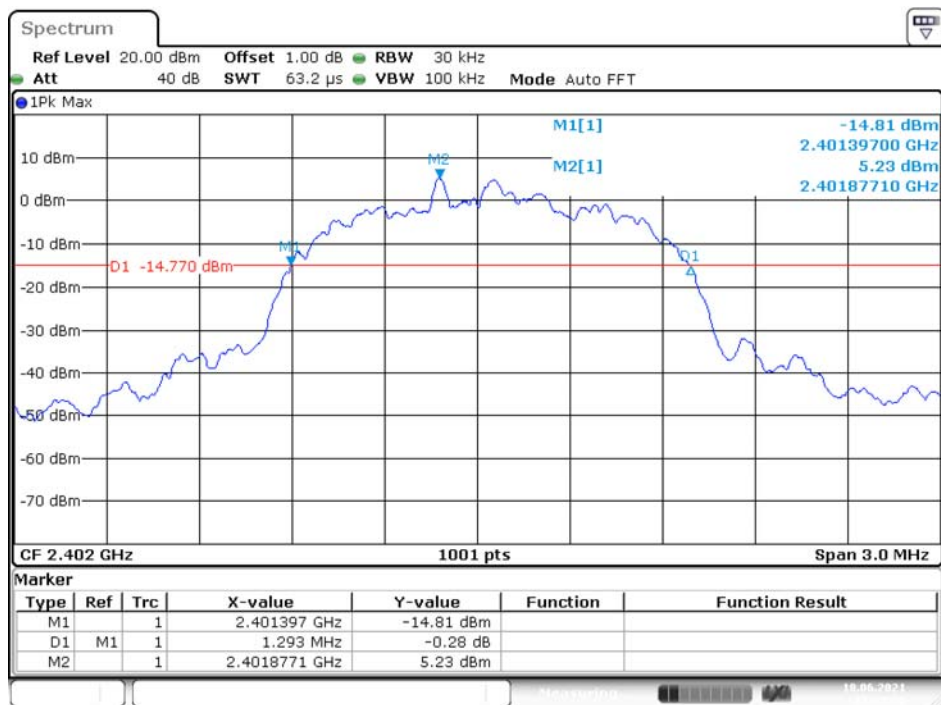
## High Channel



Date: 18.JUN.2021 17:00:40

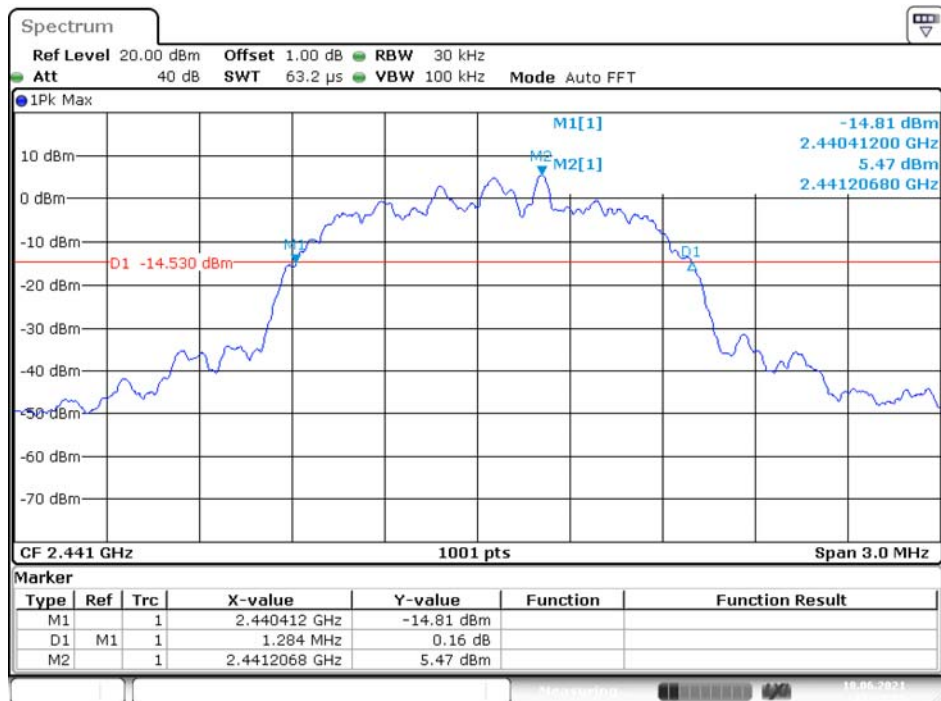
EDR Mode ( $\pi/4$ -DQPSK)

## Low Channel



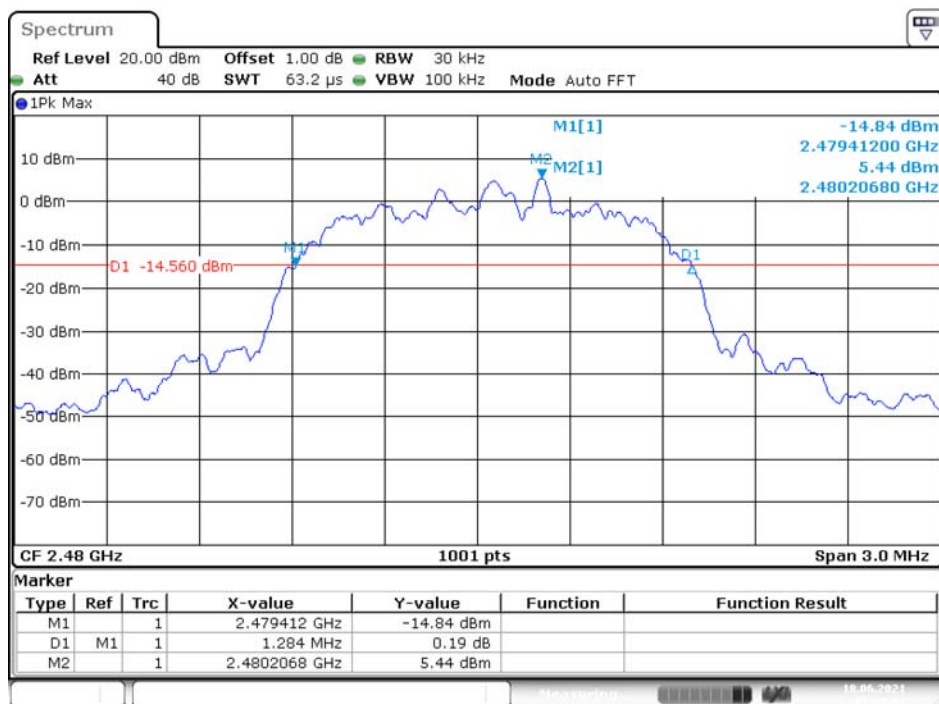
Date: 18.JUN.2021 17:33:36

## Middle Channel



Date: 18.JUN.2021 17:23:26

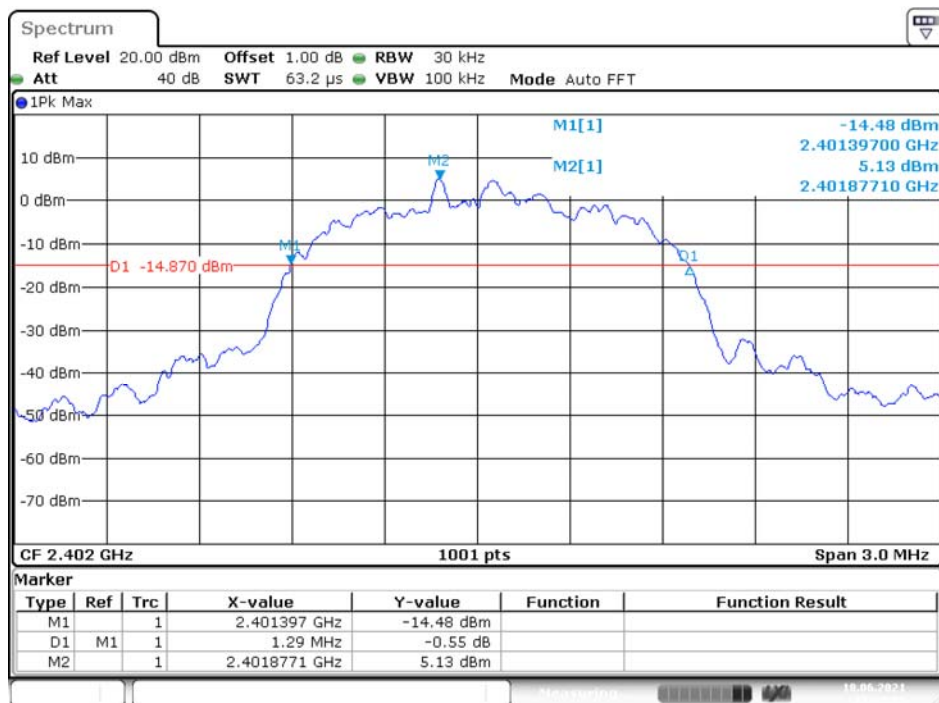
## High Channel



Date: 18.JUN.2021 17:25:24

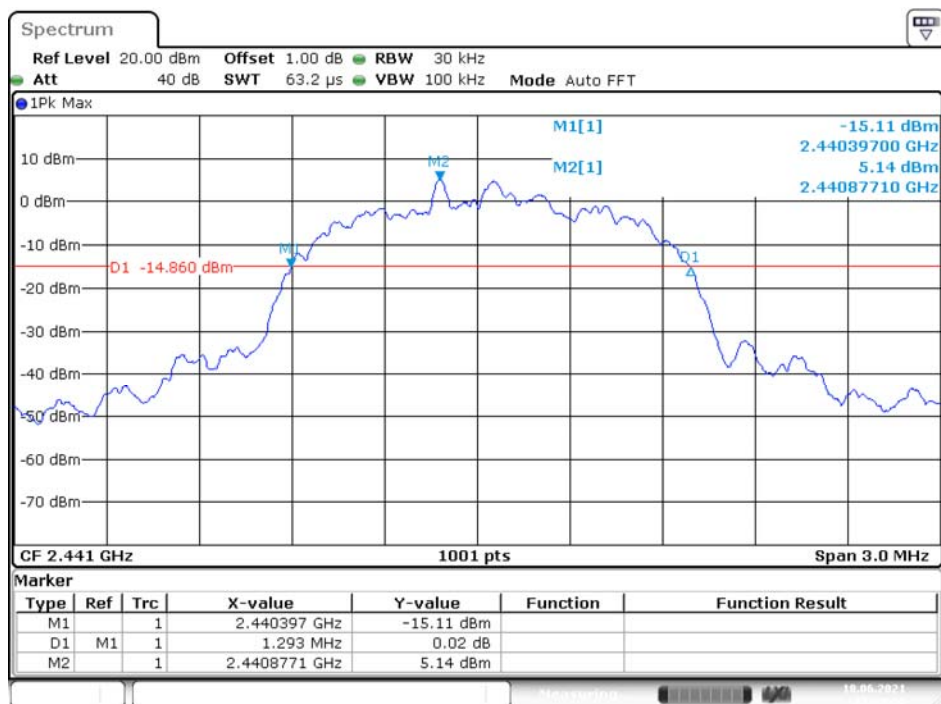
## EDR Mode (8DPSK)

## Low Channel



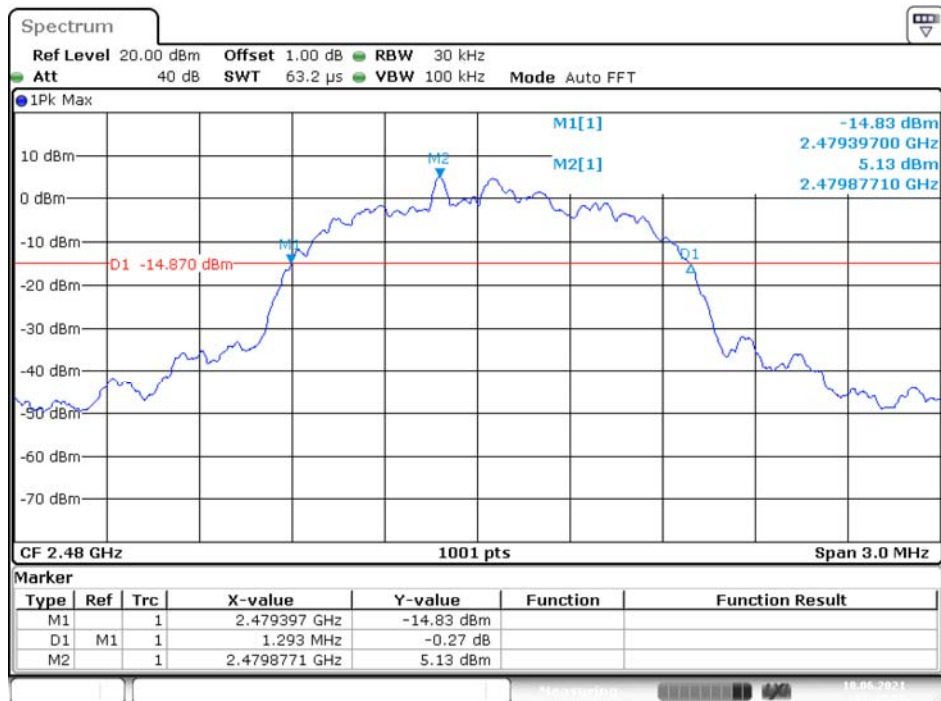
Date: 18.JUN.2021 17:37:25

## Middle Channel



Date: 18.JUN.2021 17:39:40

## High Channel



Date: 18.JUN.2021 17:42:54

## 10 FCC §15.247(a)(1) – Channel Separation Test

### 10.1 Applicable Standard

According to FCC §15.247(a) (1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### 10.2 Test Procedure

1. Set the EUT in transmitting mode, max hold the channel.
2. Set the adjacent channel of the EUT and max hold another trace.
3. Measure the channel separation.

### 10.3 Environmental Conditions

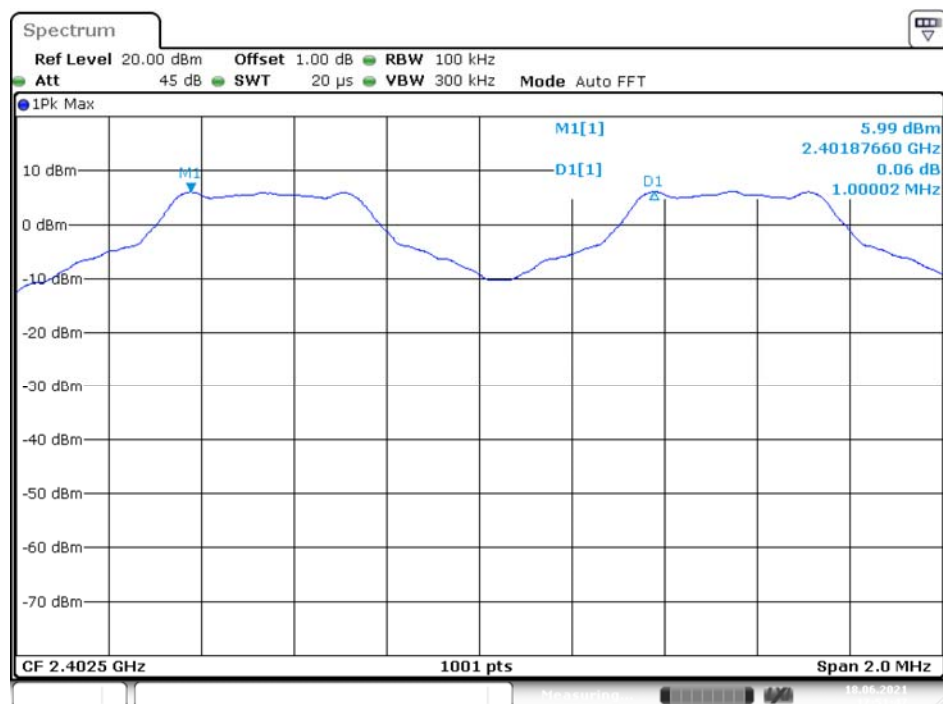
|                    |          |
|--------------------|----------|
| Temperature:       | 24.3 °C  |
| Relative Humidity: | 52 %     |
| ATM Pressure:      | 1010 hPa |

*The testing was performed by David Hsu on 2021-06-18.*

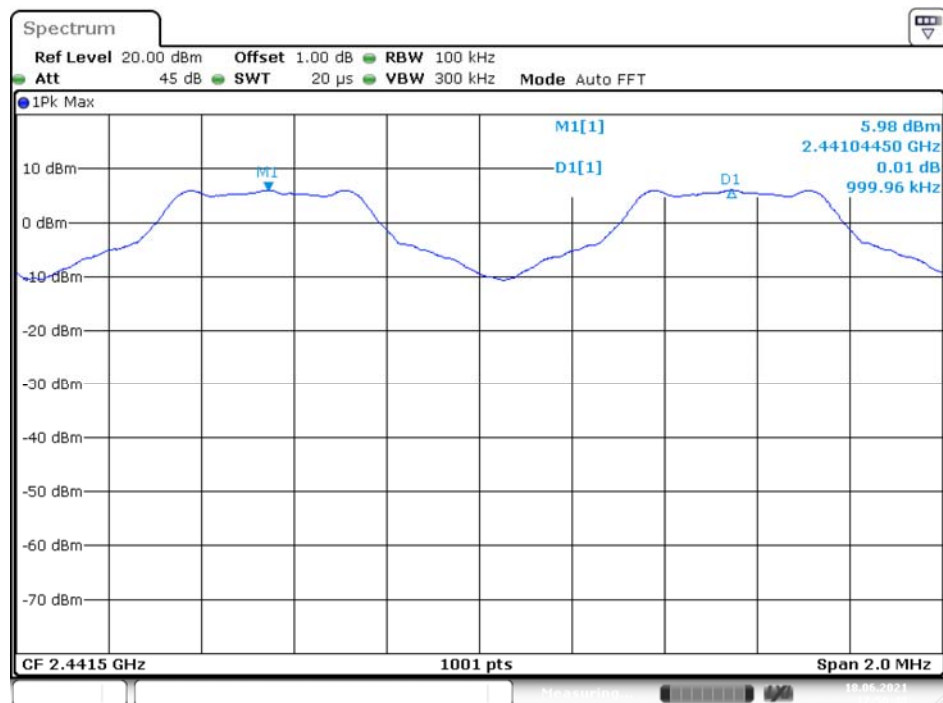
**10.4 Test Results**

| Channel                                    | Channel Separation (MHz) | 20 dBc BW (MHz) | Two-thirds of the 20 dB bandwidth (MHz) | Channel Separation Limit           | Result     |
|--------------------------------------------|--------------------------|-----------------|-----------------------------------------|------------------------------------|------------|
| <i>BR Mode (GFSK)</i>                      |                          |                 |                                         |                                    |            |
| Low                                        | 1.000                    | 0.95            | 0.636                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| Middle                                     | 0.999                    | 0.96            | 0.638                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| High                                       | 0.999                    | 0.95            | 0.636                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| <i>EDR Mode (<math>\pi/4</math>-DQPSK)</i> |                          |                 |                                         |                                    |            |
| Low                                        | 0.995                    | 1.29            | 0.862                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| Middle                                     | 0.989                    | 1.28            | 0.856                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| High                                       | 0.998                    | 1.28            | 0.856                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| <i>EDR Mode (8DPSK)</i>                    |                          |                 |                                         |                                    |            |
| Low                                        | 0.990                    | 1.29            | 0.860                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| Middle                                     | 0.995                    | 1.29            | 0.862                                   | >two-thirds of the 20 dB bandwidth | Compliance |
| High                                       | 1.001                    | 1.29            | 0.862                                   | >two-thirds of the 20 dB bandwidth | Compliance |

Please refer to the following plots

**BR Mode (GFSK)****Low Channel**

Date: 18.JUN.2021 17:51:47

**Middle Channel**

Date: 18.JUN.2021 17:50:48

**Spectrum**

Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz  
 Att 45 dB SWT 20  $\mu$ s VBW 300 kHz Mode Auto FFT

1Pk Max

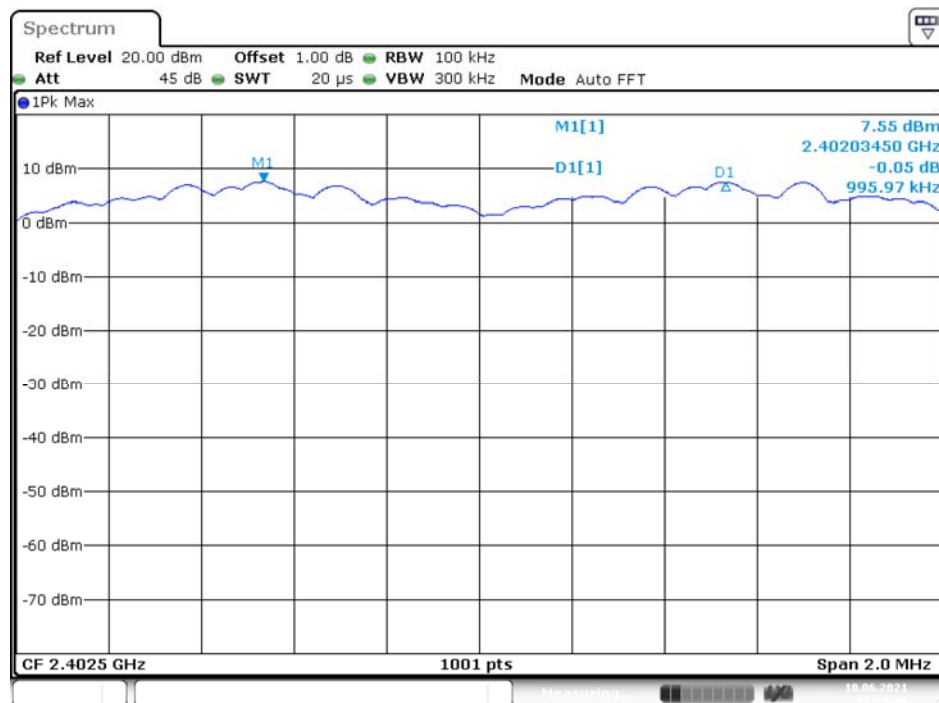
M1 [1] 6.17 dBm  
 2.47904450 GHz  
 -0.09 dB

D1 [1] 999.96 kHz

CF 2.4795 GHz 1001 pts Span 2.0 MHz

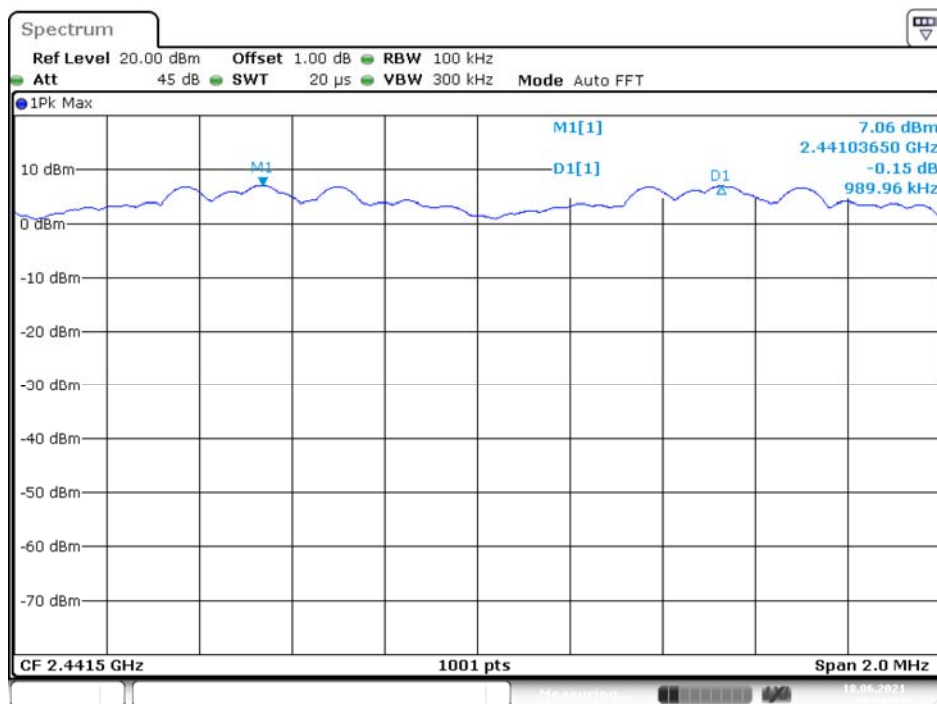
Date: 18 JUN 2021 17:49:23

## Low Channel



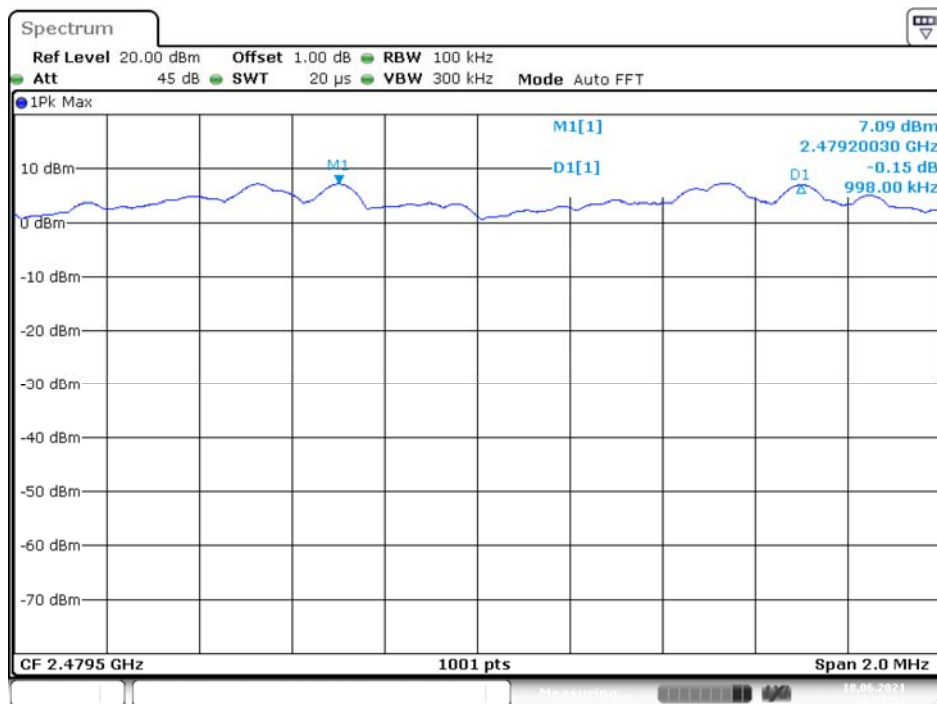
Date: 18.JUN.2021 18:25:49

### Middle Channel

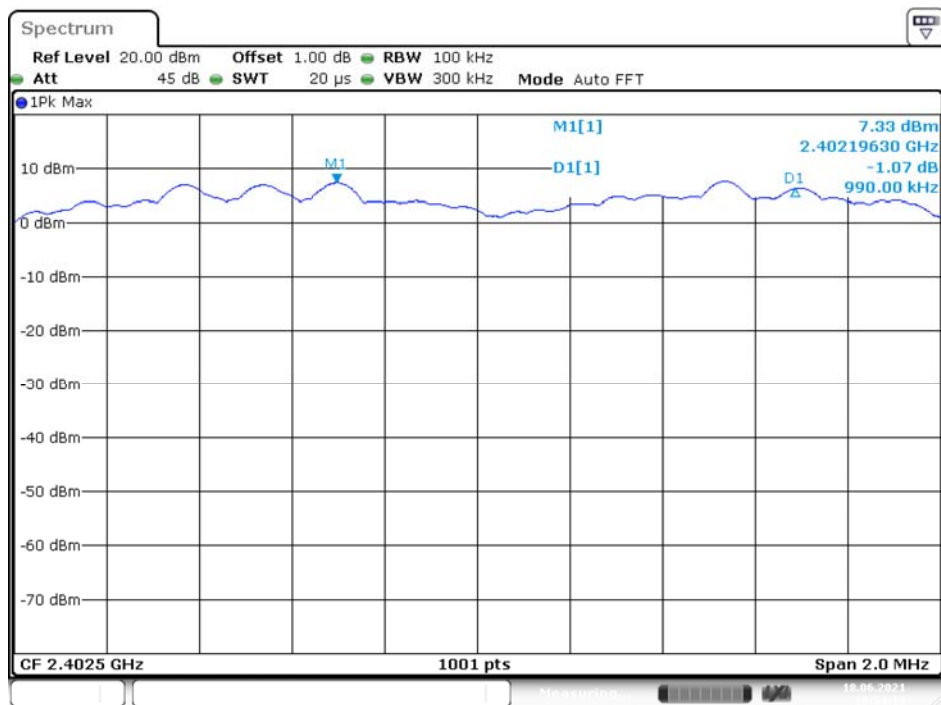


Date: 18 JUN 2021 18:24:42

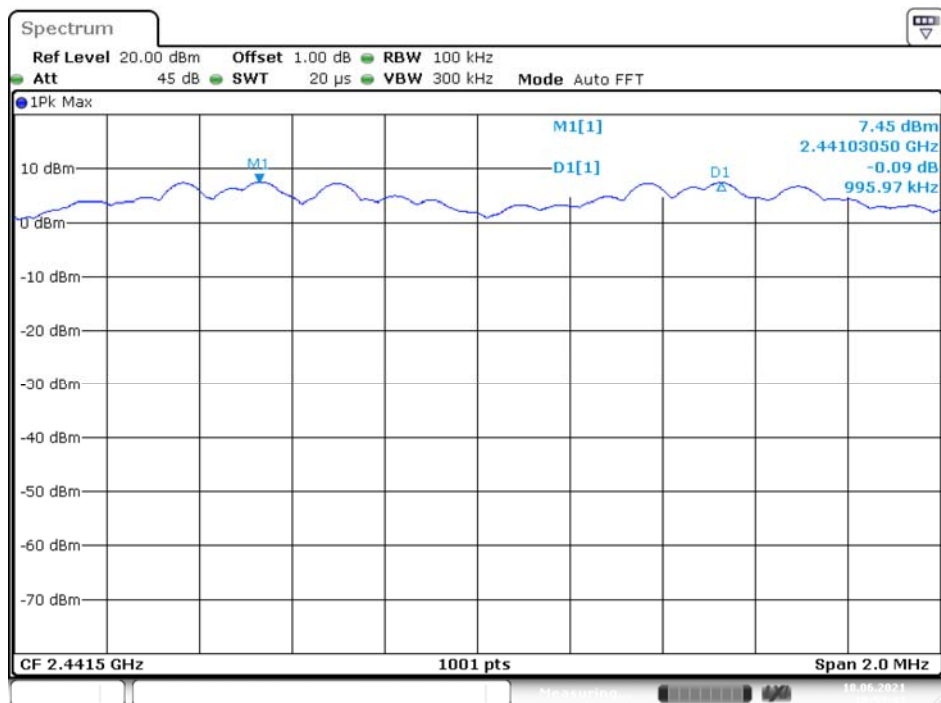
### High Channel



Date: 18 JUN 2021 18:23:51

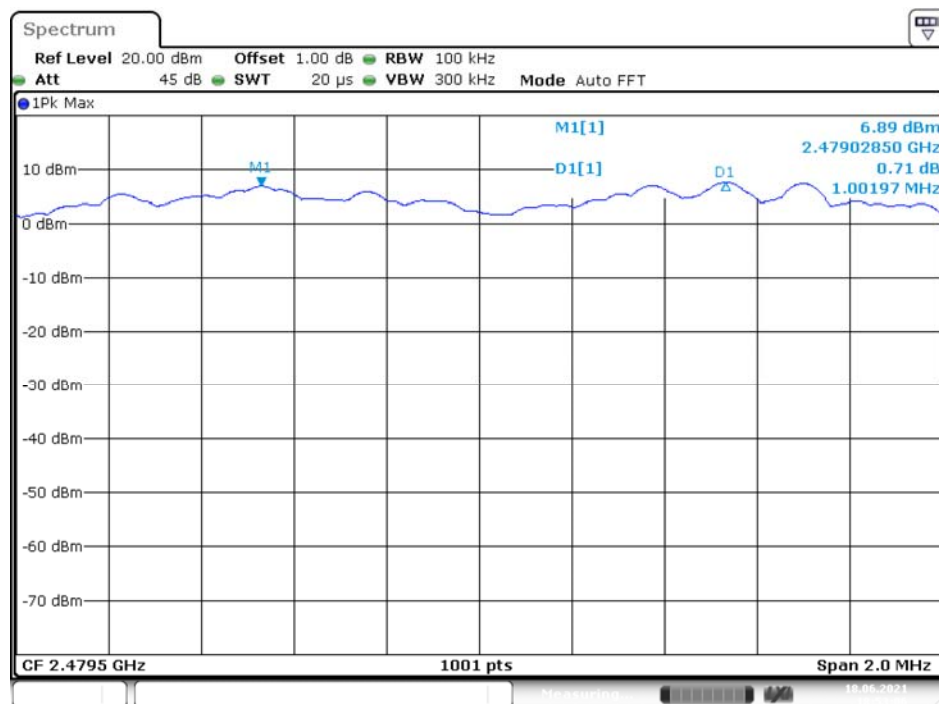
**EDR Mode (8DPSK)****Low Channel**

Date: 18.JUN.2021 18:54:11

**Middle Channel**

Date: 18.JUN.2021 18:53:44

## High Channel



Date: 18 JUN 2021 18:53:06

## 11 FCC§15.247(a)(1)(iii) –Time of Occupancy (Dwell Time)

### 11.1 Applicable Standard

According to FCC §15.247(a) (1) (iii).

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 11.2 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel  $RBW \leq$  channel spacing and where possible  $RBW$  should be set  $\gg 1/T$ , where  $T$  is the expected dwell time per channel Sweep = as necessary to capture the entire dwell time per hopping channel Detector function = peak Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements.

Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

### 11.3 Environmental Conditions

|                    |          |
|--------------------|----------|
| Temperature:       | 24.3 °C  |
| Relative Humidity: | 52 %     |
| ATM Pressure:      | 1010 hPa |

*The testing was performed by David Hsu on 2021-06-18.*

## 11.4 Test Results

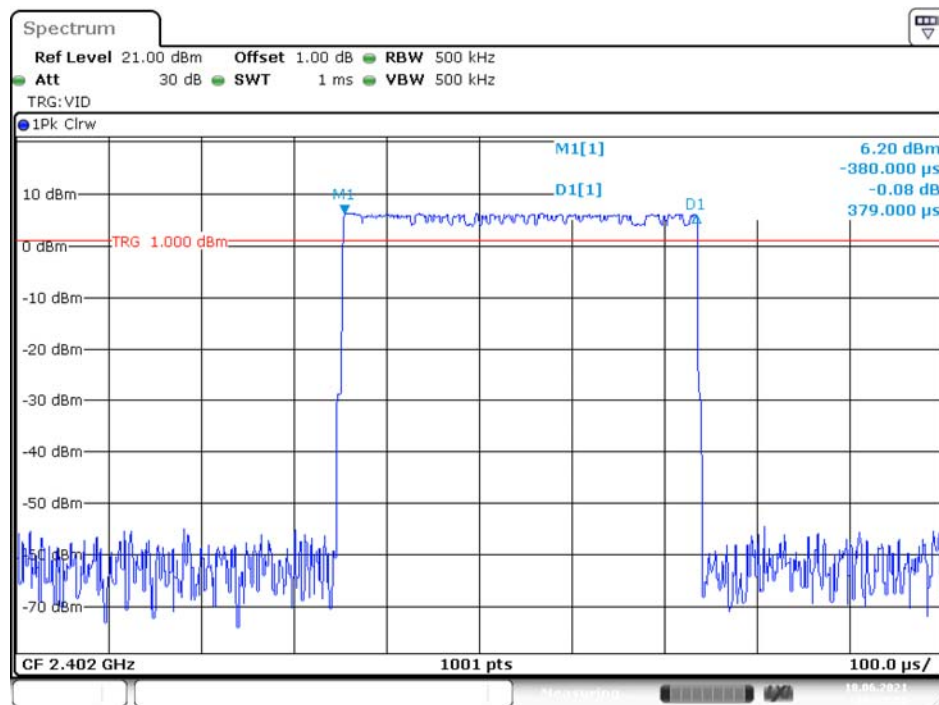
| Test mode: BR mode / 2402 ~ 2480MHz (GFSK)             |                    |                   |                    |                        |               |        |
|--------------------------------------------------------|--------------------|-------------------|--------------------|------------------------|---------------|--------|
| Mode                                                   | Pulse Time<br>(ms) | Hopping<br>Number | Period Time<br>(s) | Total of Dwell<br>(ms) | Limit<br>(ms) | Result |
| DH1                                                    | 0.379              | 320               | 31.6               | 121.28                 | <400          | PASS   |
| DH3                                                    | 1.635              | 150               | 31.6               | 245.25                 | <400          | PASS   |
| DH5                                                    | 2.880              | 110               | 31.6               | 316.80                 | <400          | PASS   |
| Test mode: EDR mode / 2402 ~ 2480MHz ( $\pi/4$ -DQPSK) |                    |                   |                    |                        |               |        |
| Mode                                                   | Pulse Time<br>(ms) | Hopping<br>Number | Period Time<br>(s) | Total of Dwell<br>(ms) | Limit<br>(ms) | Result |
| 2DH1                                                   | 0.388              | 320               | 31.6               | 124.16                 | <400          | PASS   |
| 2DH3                                                   | 1.640              | 150               | 31.6               | 246.00                 | <400          | PASS   |
| 2DH5                                                   | 2.885              | 120               | 31.6               | 346.20                 | <400          | PASS   |
| Test mode: EDR mode / 2402 ~ 2480MHz (8DPSK)           |                    |                   |                    |                        |               |        |
| Mode                                                   | Pulse Time<br>(ms) | Hopping<br>Number | Period Time<br>(s) | Total of Dwell<br>(ms) | Limit<br>(ms) | Result |
| 3DH1                                                   | 0.388              | 320               | 31.6               | 124.16                 | <400          | PASS   |
| 3DH3                                                   | 1.644              | 150               | 31.6               | 246.60                 | <400          | PASS   |
| 3DH5                                                   | 2.890              | 100               | 31.6               | 289.00                 | <400          | PASS   |

Note 1: A period time =  $0.4 \times 79 = 31.6$  (s), Total of Dwell = Pulse Time \* Hopping Number

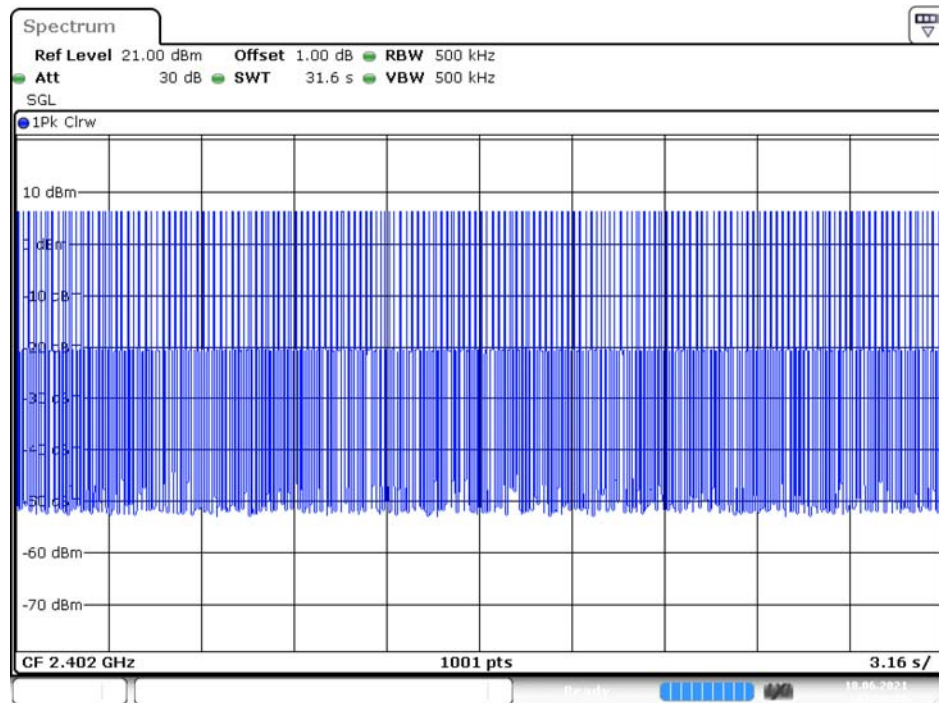
Note 2: Hopping Number = Hopping Number/10 \* 10

Note 3: Hopping Number/10 = Total of highest signals in 3.16s. (Second high signals were other channel)

Please refer to the following plots

**BR Mode (GFSK)****DH1: Pulse Width**

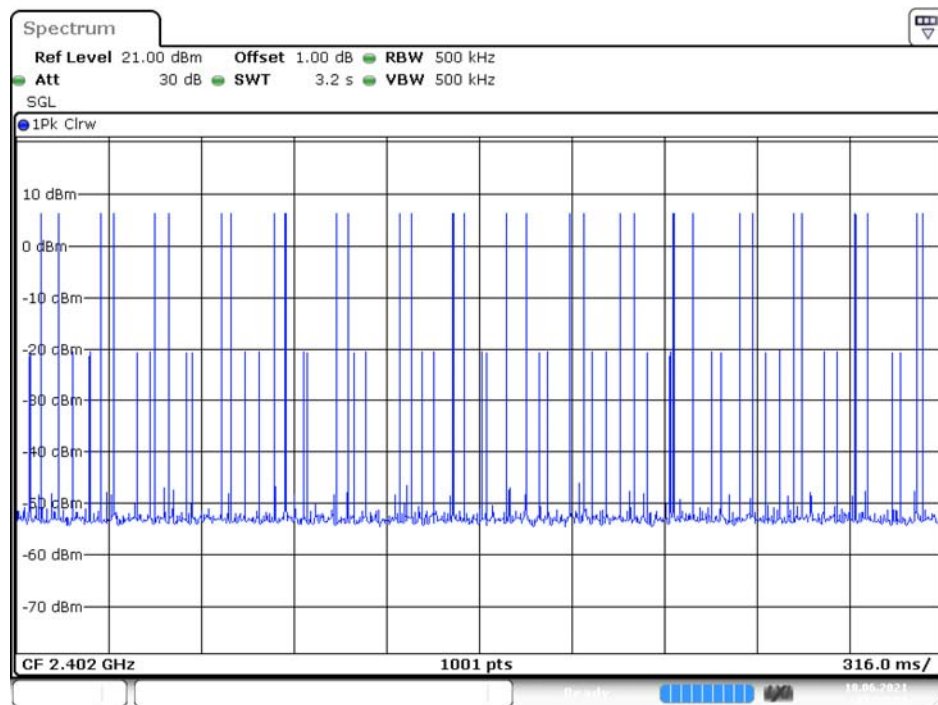
Date: 18.JUN.2021 18:11:59

**DH1: Hopping Number**

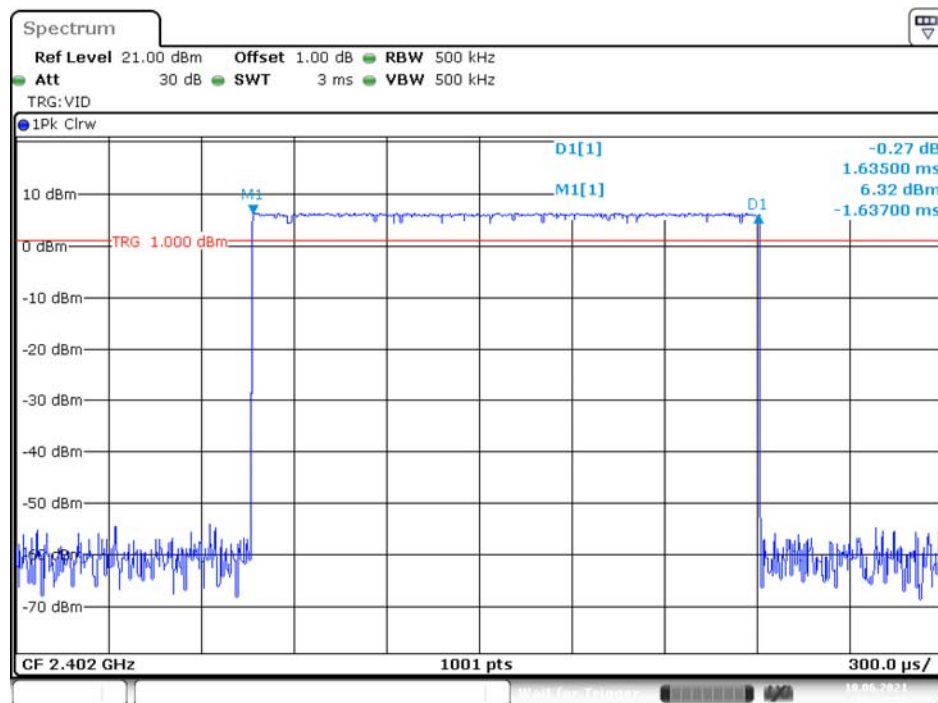
Date: 18.JUN.2021 17:56:23

**DH1: Hopping Number /10**

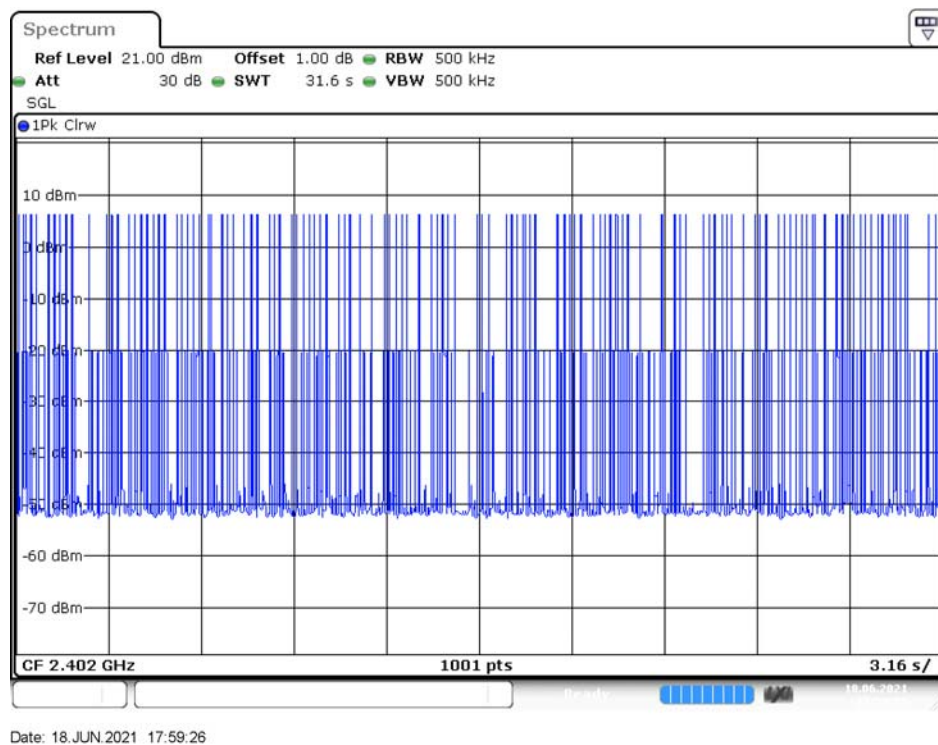
(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



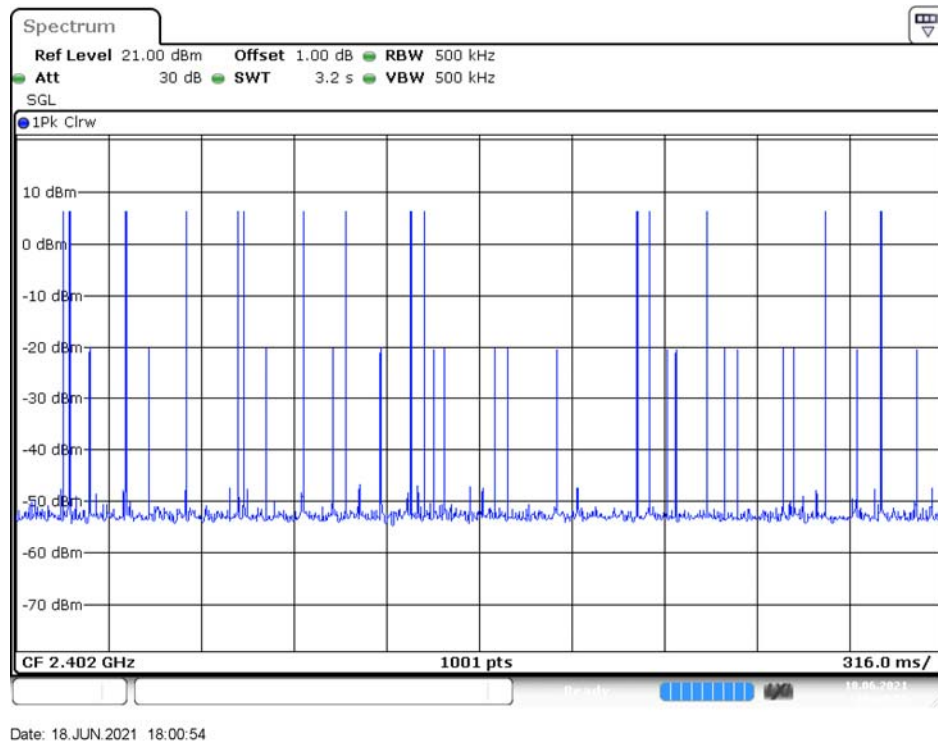
Date: 18.JUN.2021 17:57:52

**DH3: Pulse Width**

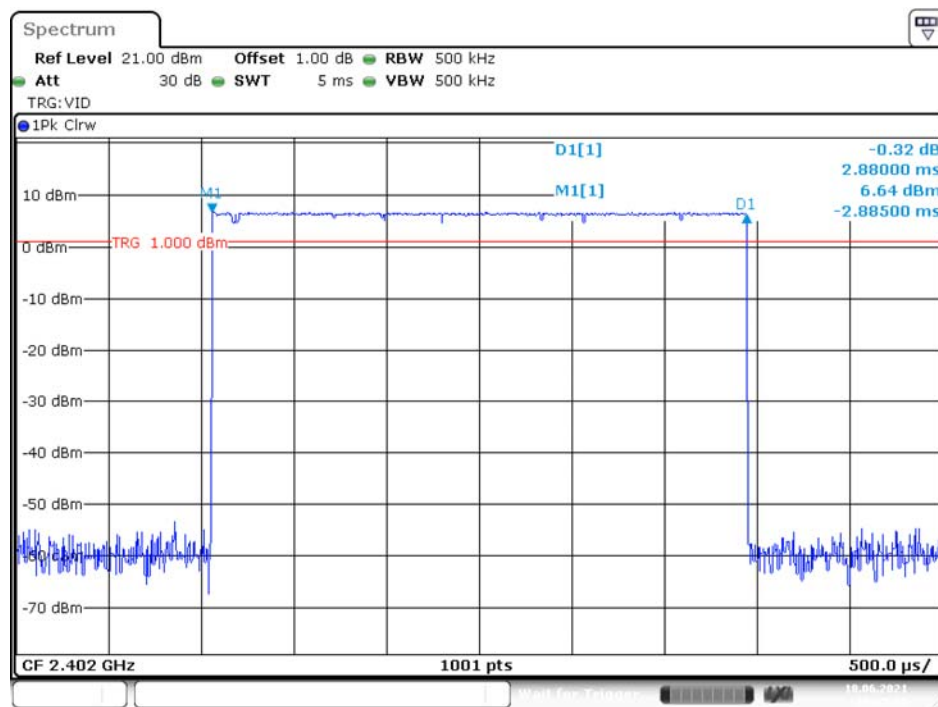
Date: 18.JUN.2021 18:08:00

**DH3: Hopping Number****DH3: Hopping Number /10**

(Hopping Number = 15 in 1/10 period of highest signals, Second High signals were other channel)

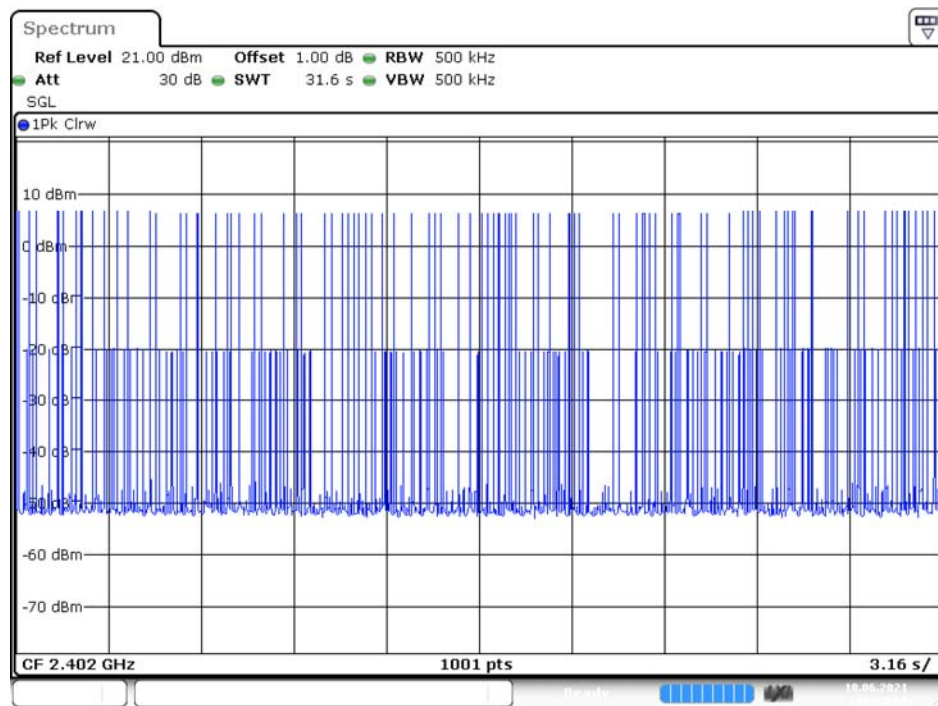


### DH5: Pulse Width



Date: 18 JUN 2021 18:05:39

### DH5: Hopping Number



Date: 18 JUN 2021 18:02:41

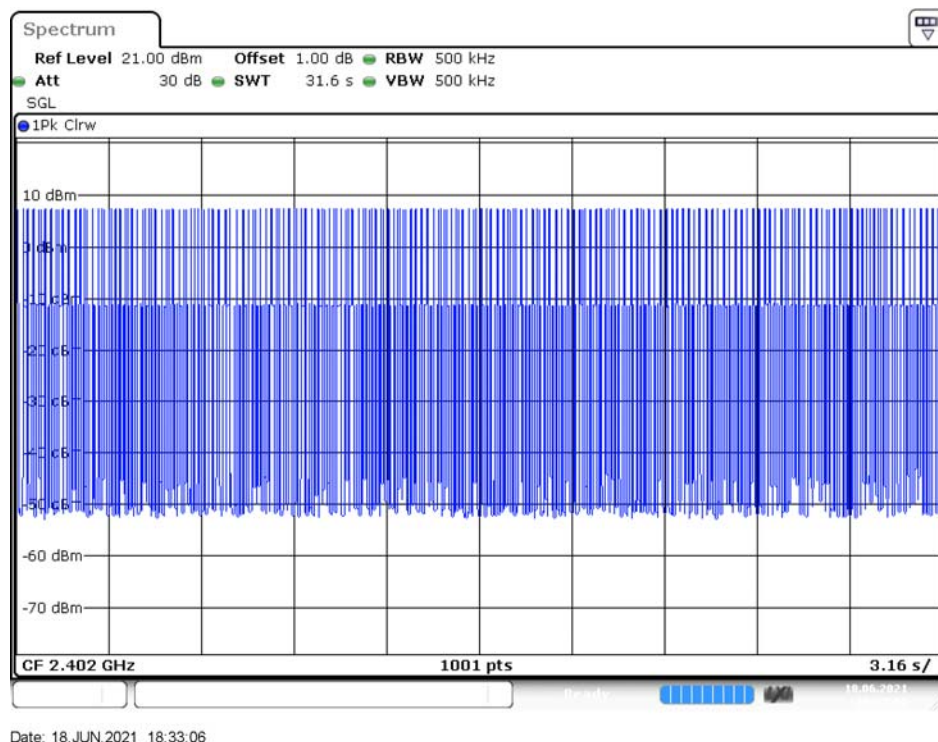
**(Hopping Number = 11 in 1/10 period of highest signals, Second High signals were other channel)**



## 2DH1: Pulse Width

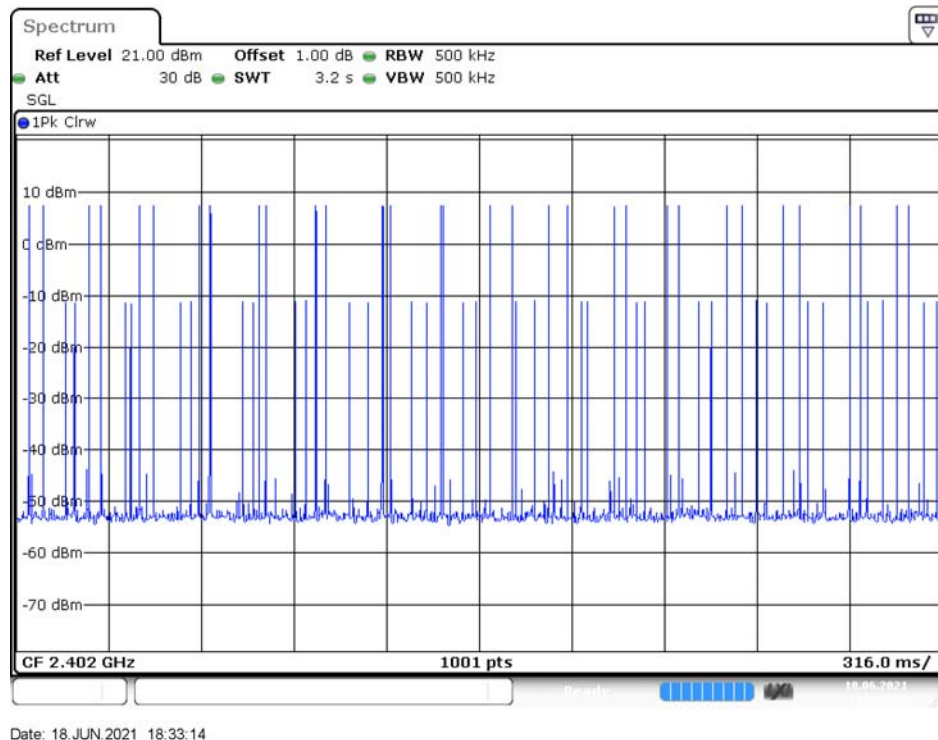


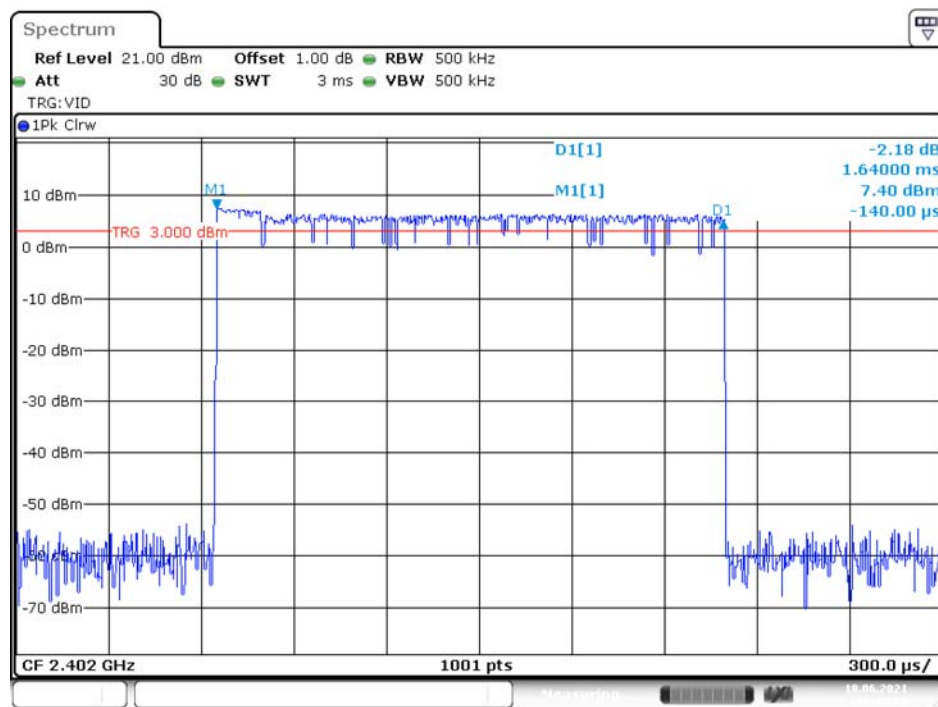
## 2DH1: Hopping Number



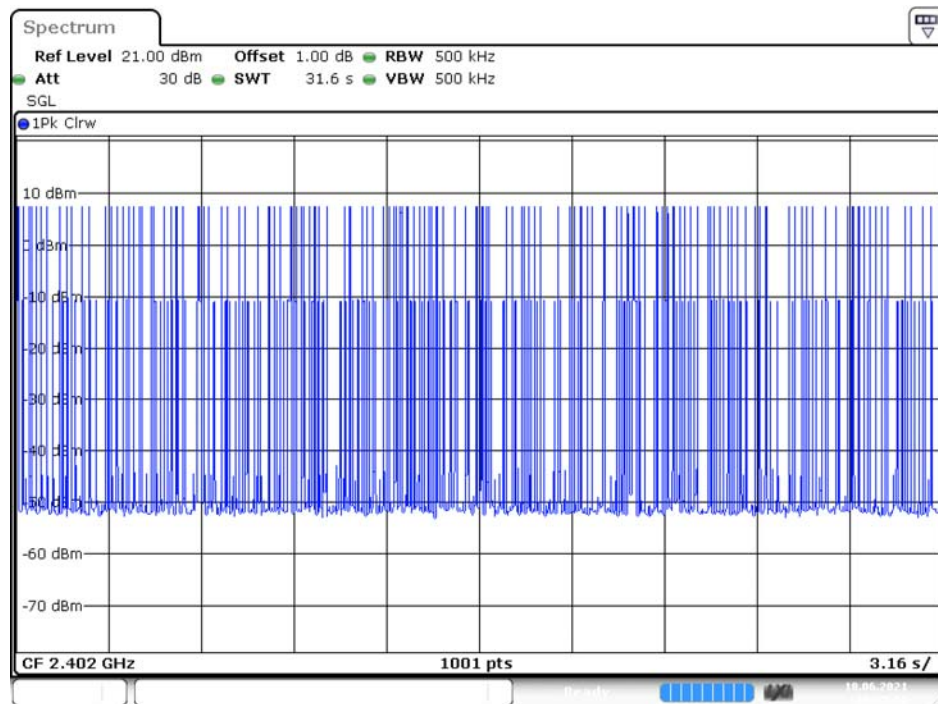
## 2DH1: Hopping Number /10

(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



**2DH3: Pulse Width**

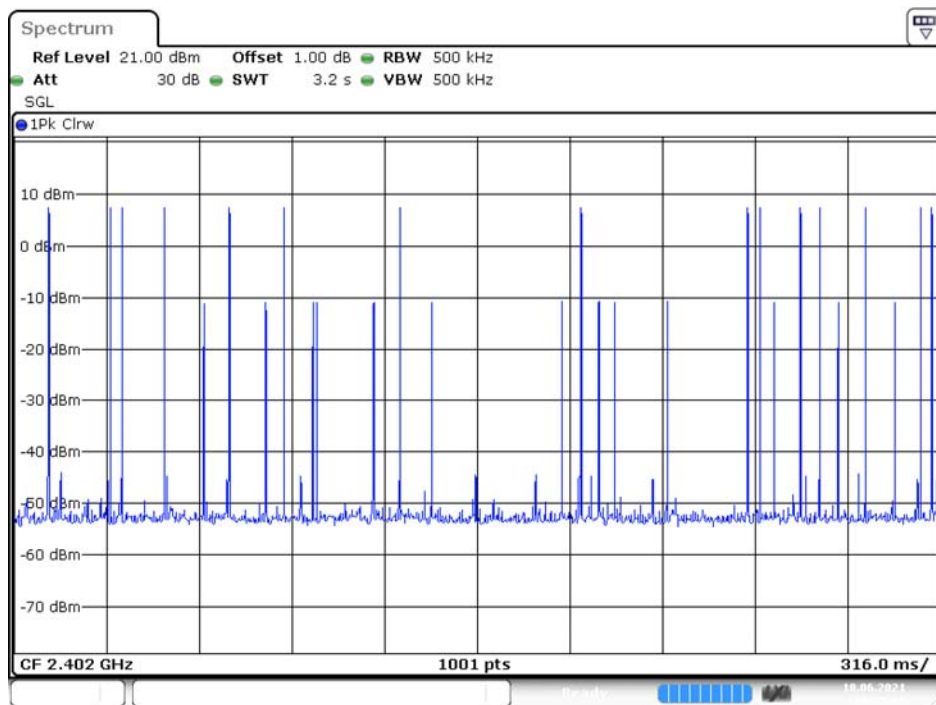
Date: 18 JUN 2021 18:42:53

**2DH3: Hopping Number**

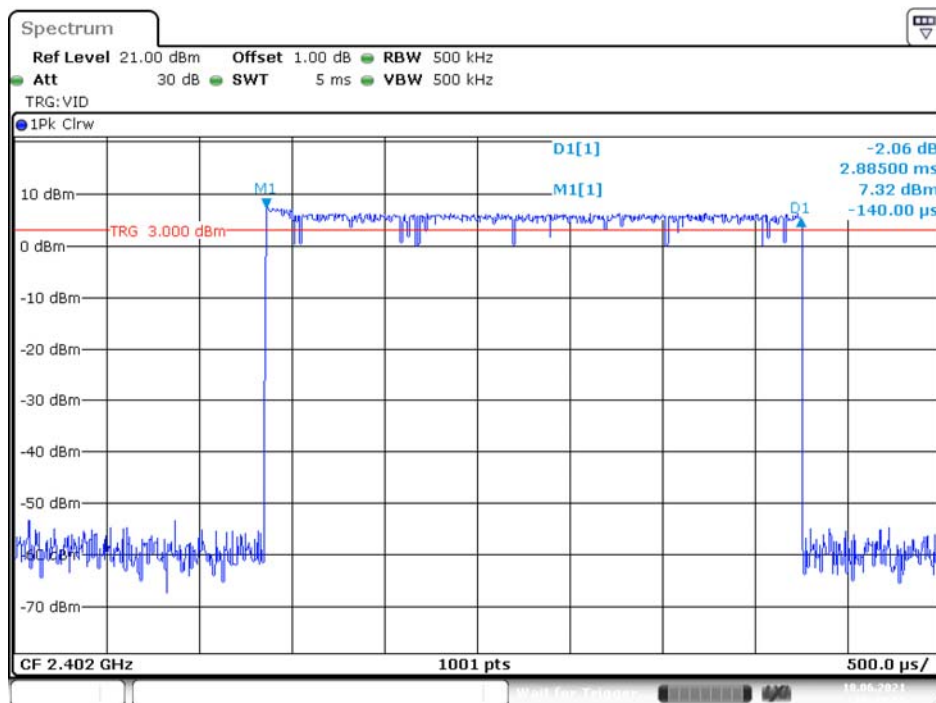
Date: 18 JUN 2021 18:35:18

**2DH3: Hopping Number /10**

(Hopping Number = 15 in 1/10 period of highest signals, Second High signals were other channel)

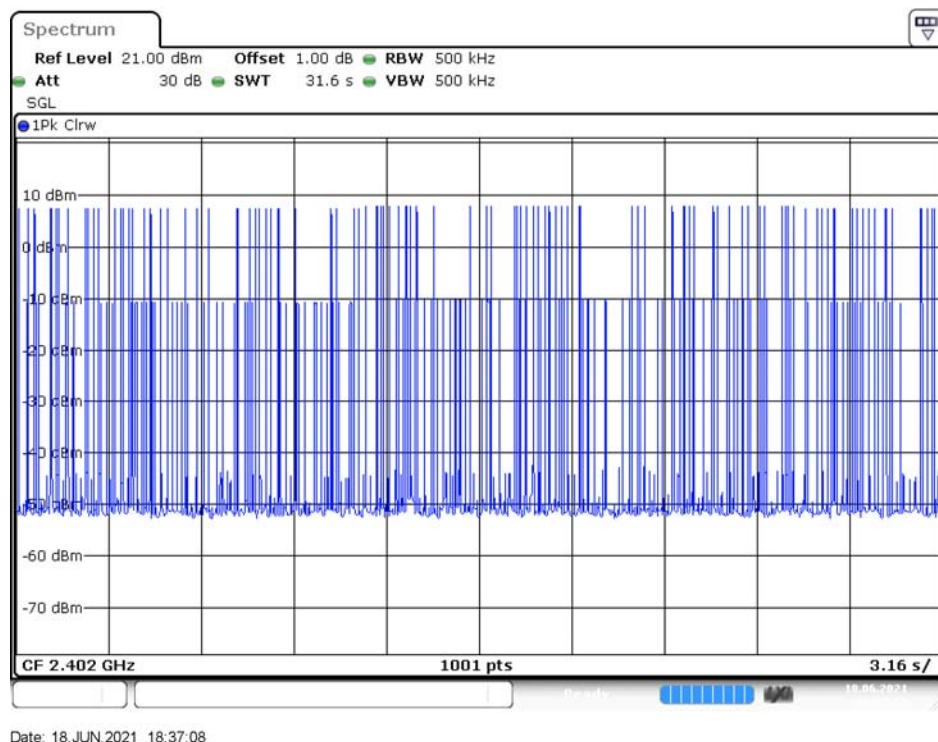


Date: 18.JUN.2021 18:35:44

**2DH5: Pulse Width**

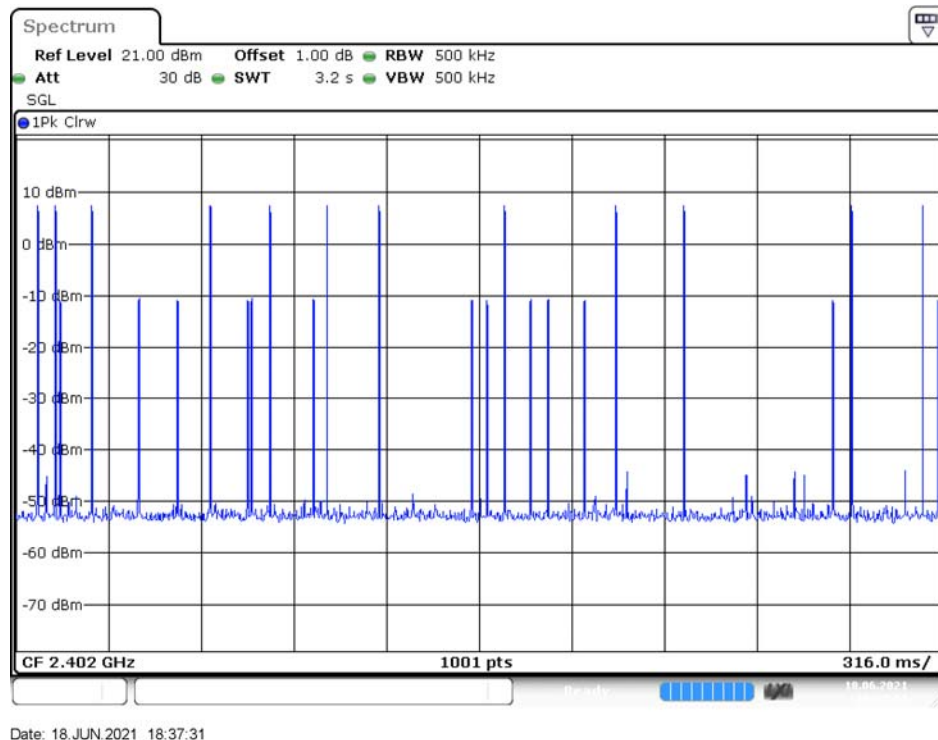
Date: 18.JUN.2021 18:41:15

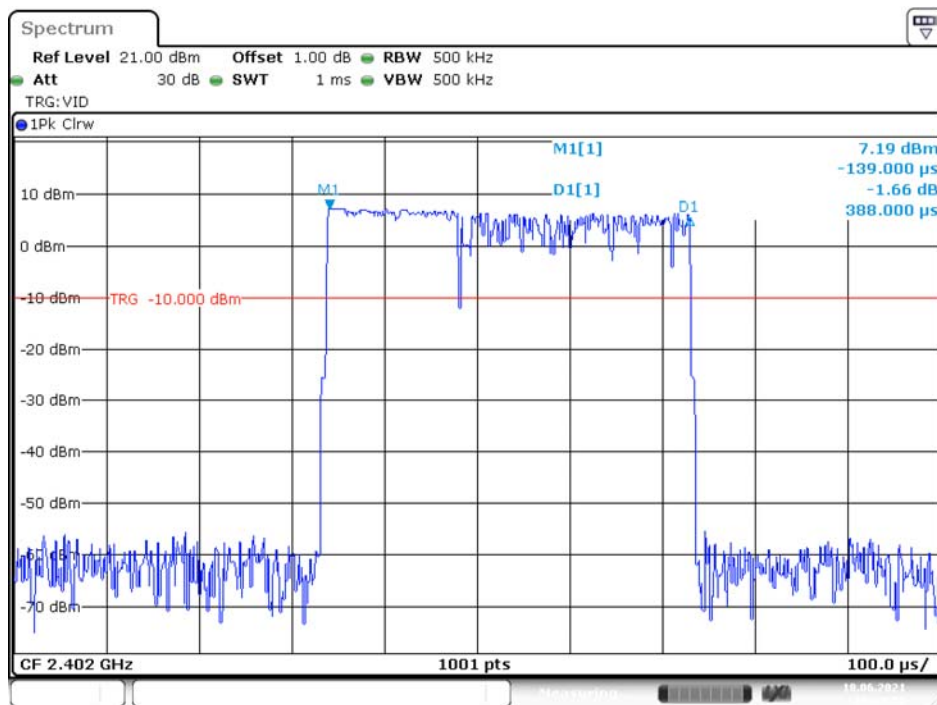
## 2DH5: Hopping Number



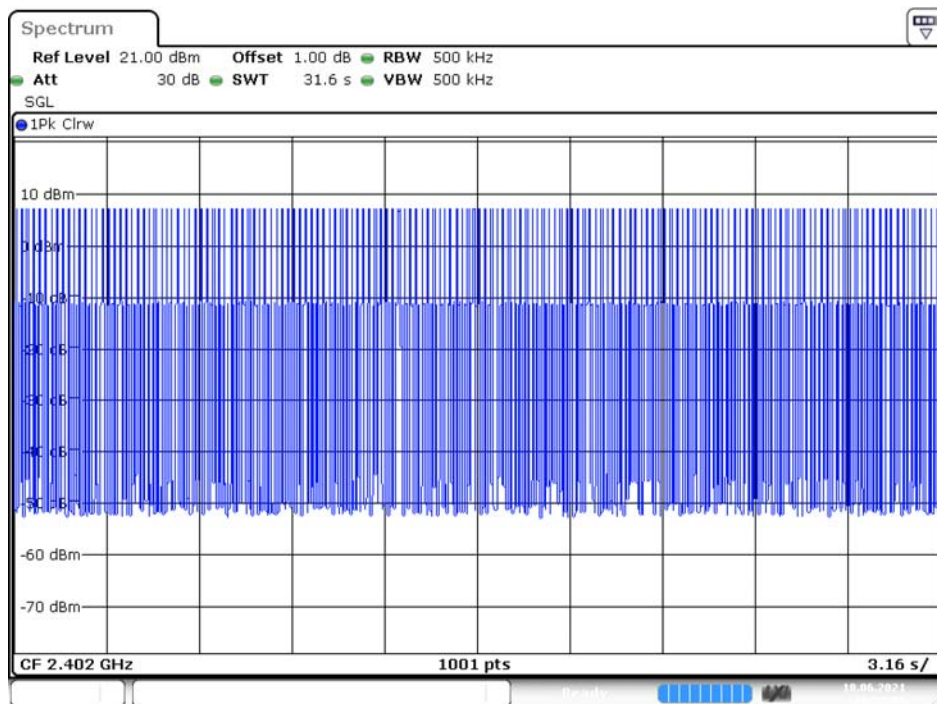
## 2DH5: Hopping Number /10

(Hopping Number = 12 in 1/10 period of highest signals, Second High signals were other channel)



**EDR Mode (8DPSK)****3DH1: Pulse Width**

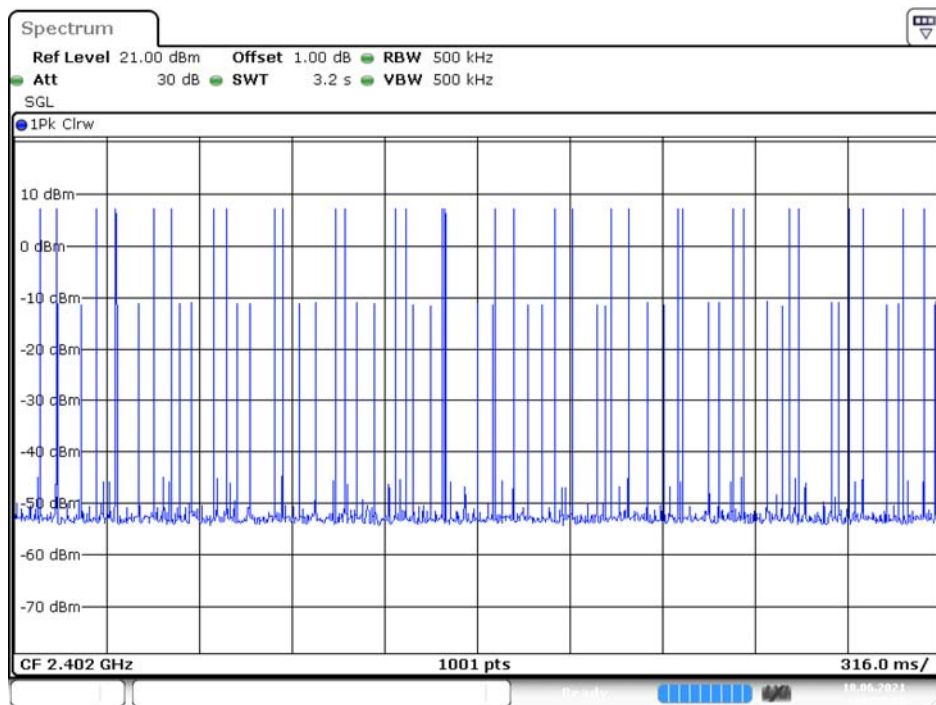
Date: 18.JUN.2021 19:09:51

**3DH1: Hopping Number**

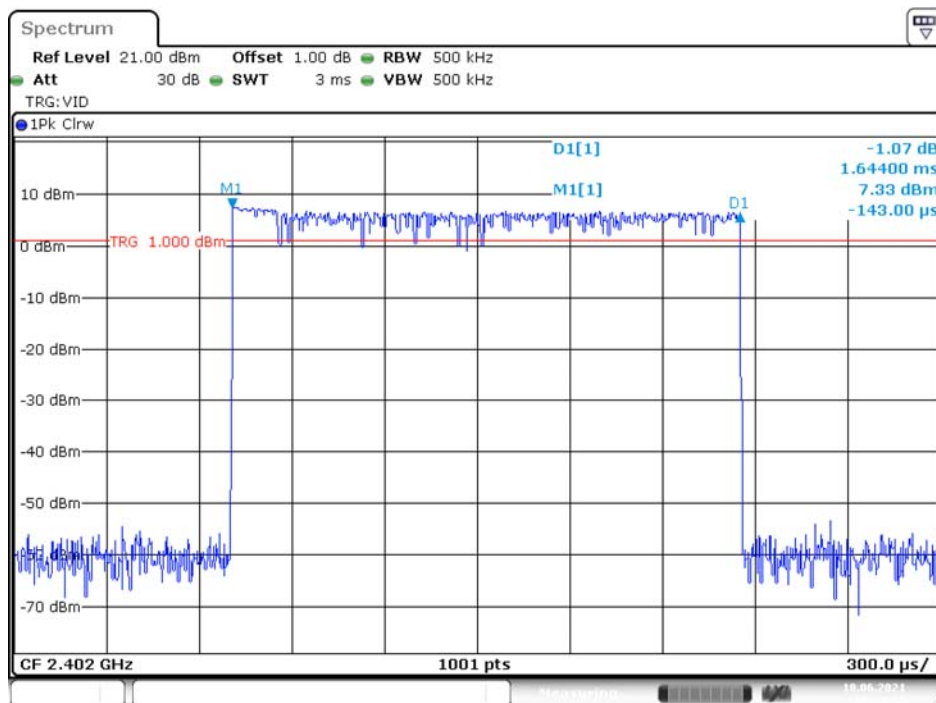
Date: 18.JUN.2021 18:57:06

**3DH1: Hopping Number /10**

(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)

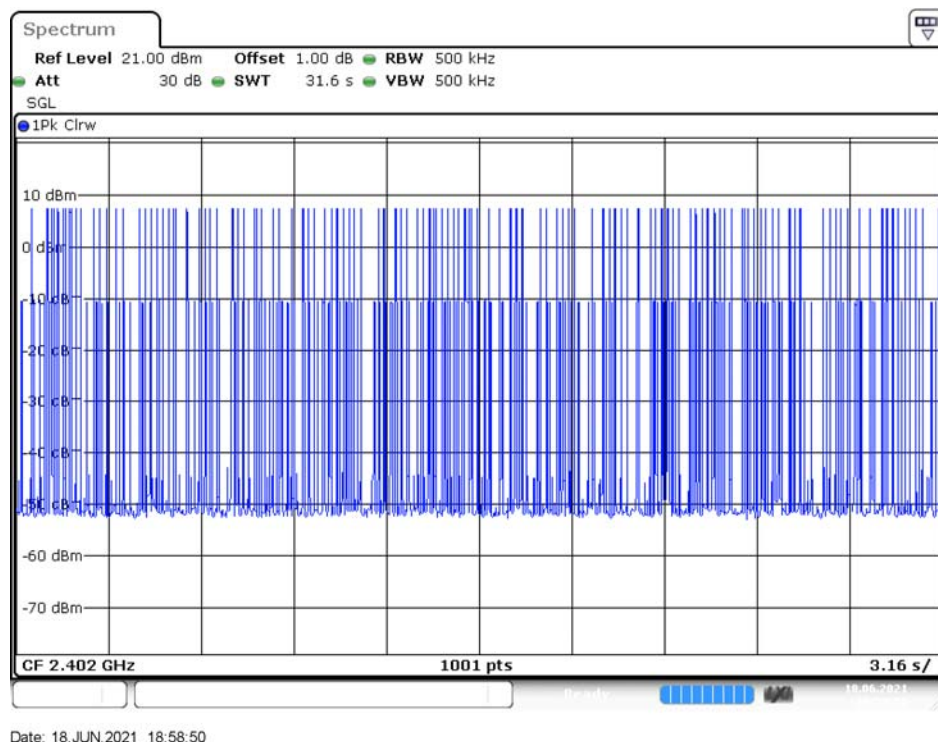


Date: 18.JUN.2021 18:57:16

**3DH3: Pulse Width**

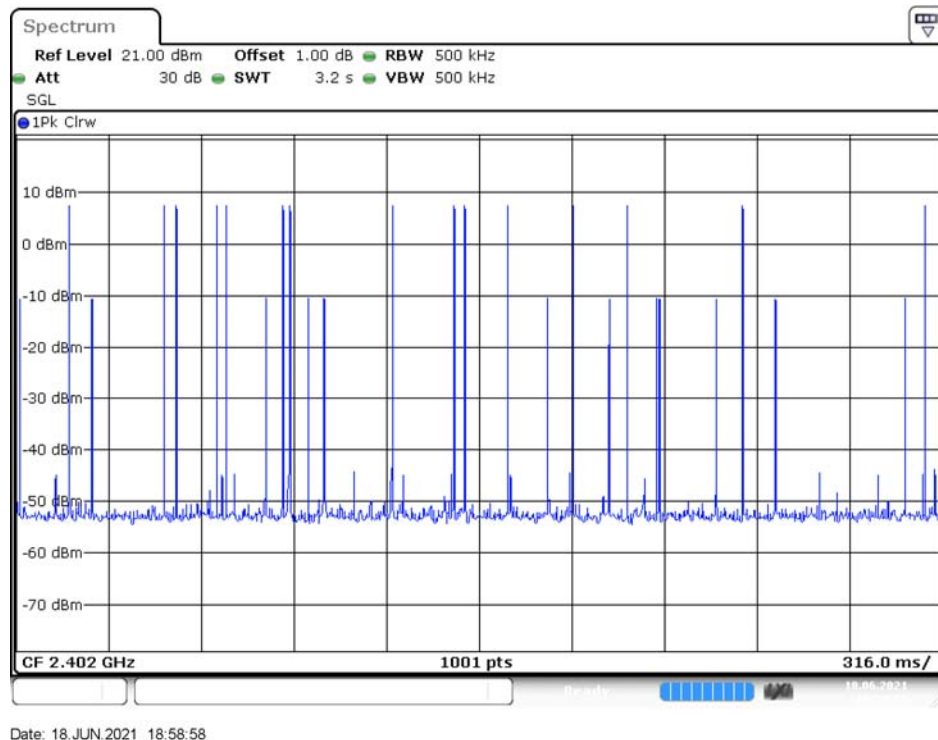
Date: 18.JUN.2021 19:08:34

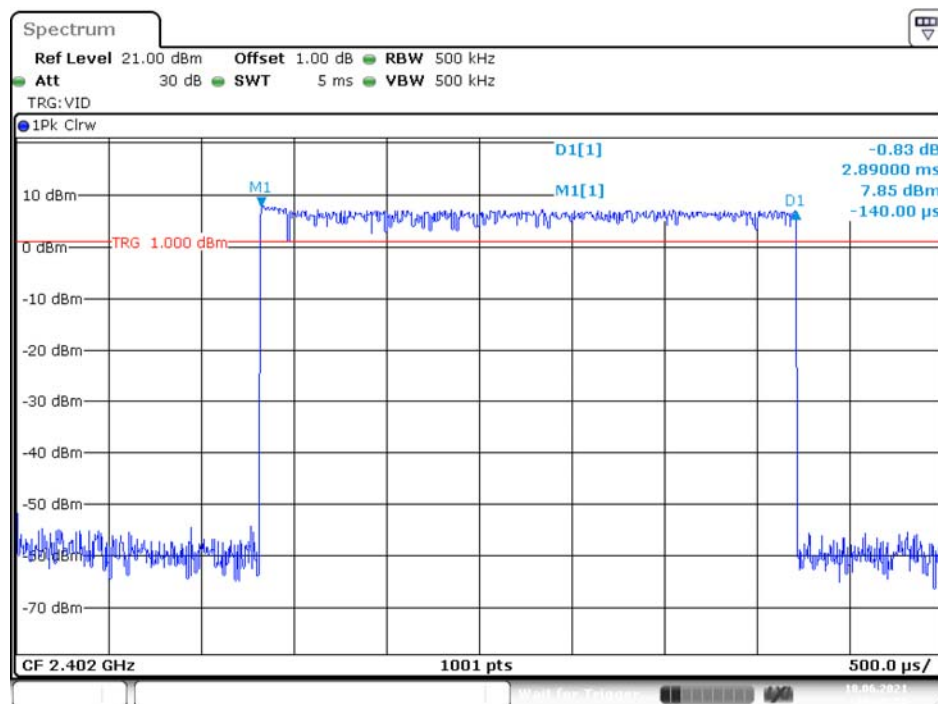
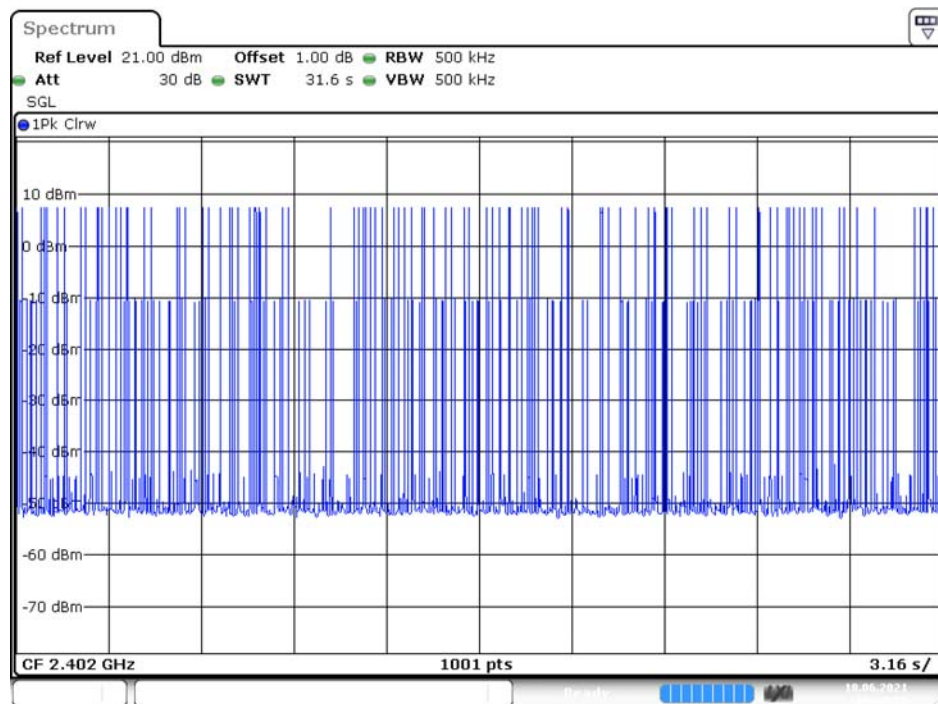
### 3DH3: Hopping Number



### 3DH3: Hopping Number /10

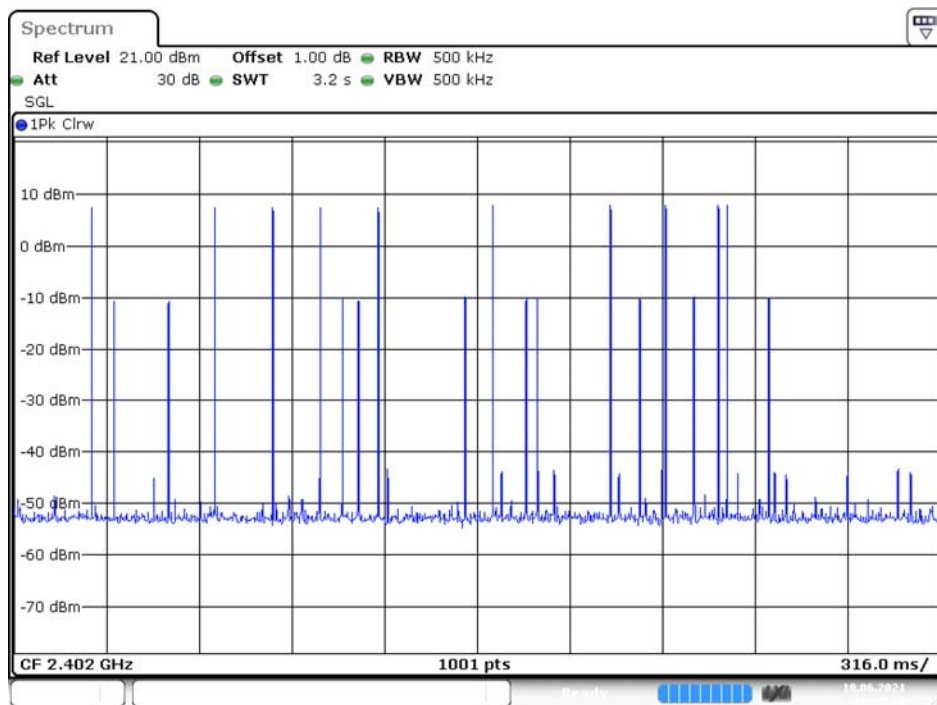
(Hopping Number = 15 in 1/10 period of highest signals, Second High signals were other channel)



**3DH5: Pulse Width****3DH5: Hopping Number**

**3DH5: Hopping Number /10**

(Hopping Number = 10 in 1/10 period of highest signals, Second High signals were other channel)



Date: 18 JUN 2021 19:02:12

## 12 FCC §15.247(a)(1)(iii) –Quantity of hopping channel Test

### 12.1 Applicable Standard

According to FCC §15.247(a) (1) (iii).

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 12.2 Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

### 12.3 Environmental Conditions

|                    |          |
|--------------------|----------|
| Temperature:       | 24.3 °C  |
| Relative Humidity: | 52 %     |
| ATM Pressure:      | 1010 hPa |

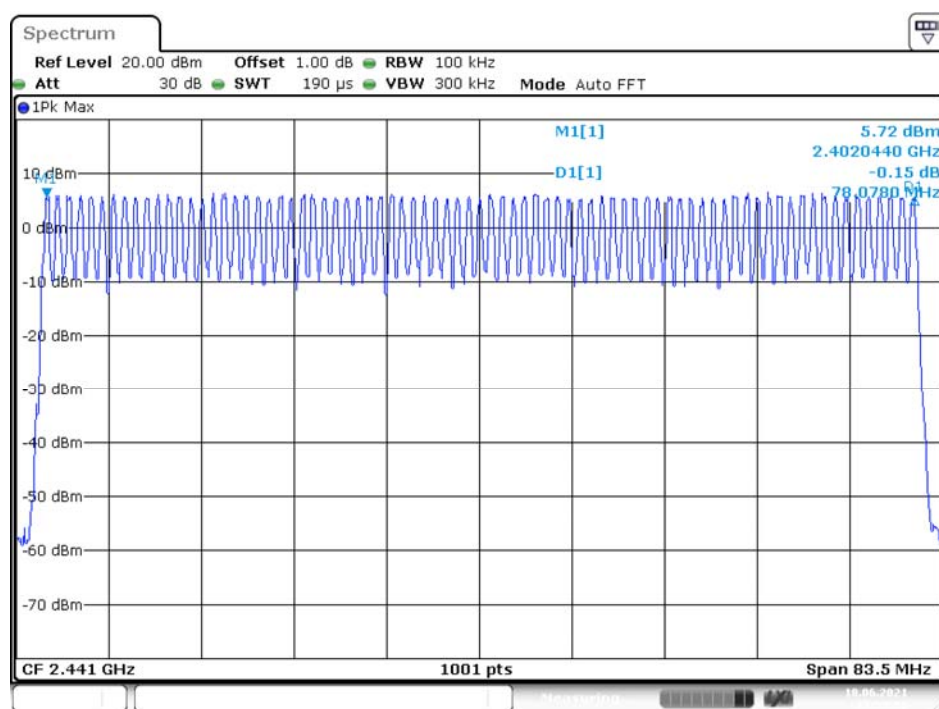
*The testing was performed by David Hsu on 2021-06-18.*

## 12.4 Test Results

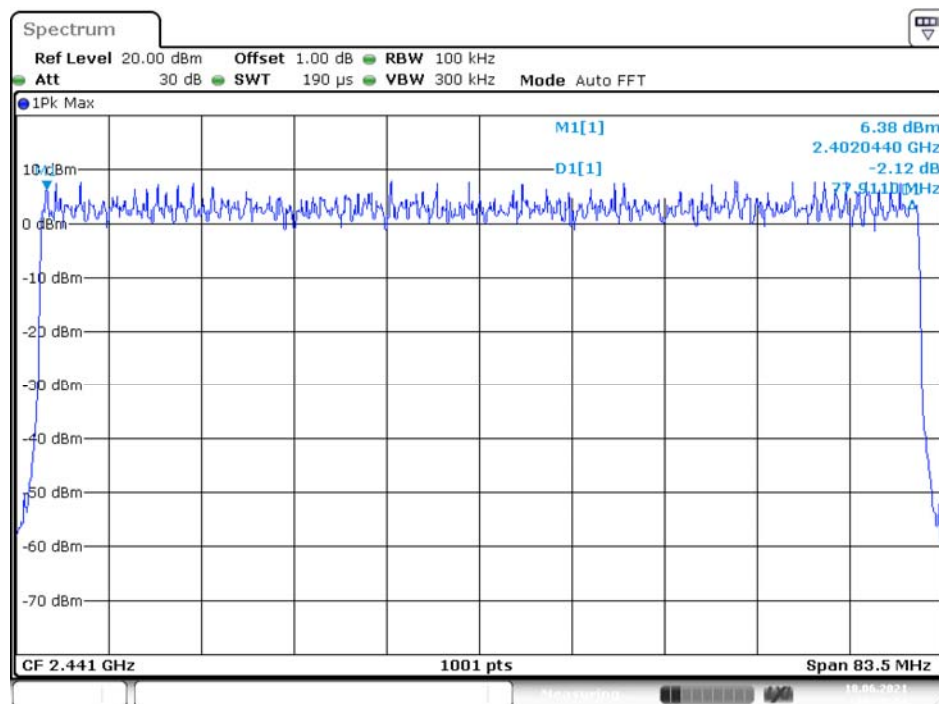
| Mode           | Frequency Range (MHz) | Number of Hopping Channel (CH) | Limit (CH) | Result     |
|----------------|-----------------------|--------------------------------|------------|------------|
| GFSK           | 2402-2480             | 79                             | >15        | Compliance |
| $\pi/4$ -DQPSK | 2402-2480             | 79                             | >15        | Compliance |
| 8DPSK          | 2402-2480             | 79                             | >15        | Compliance |

Please refer to the following plots

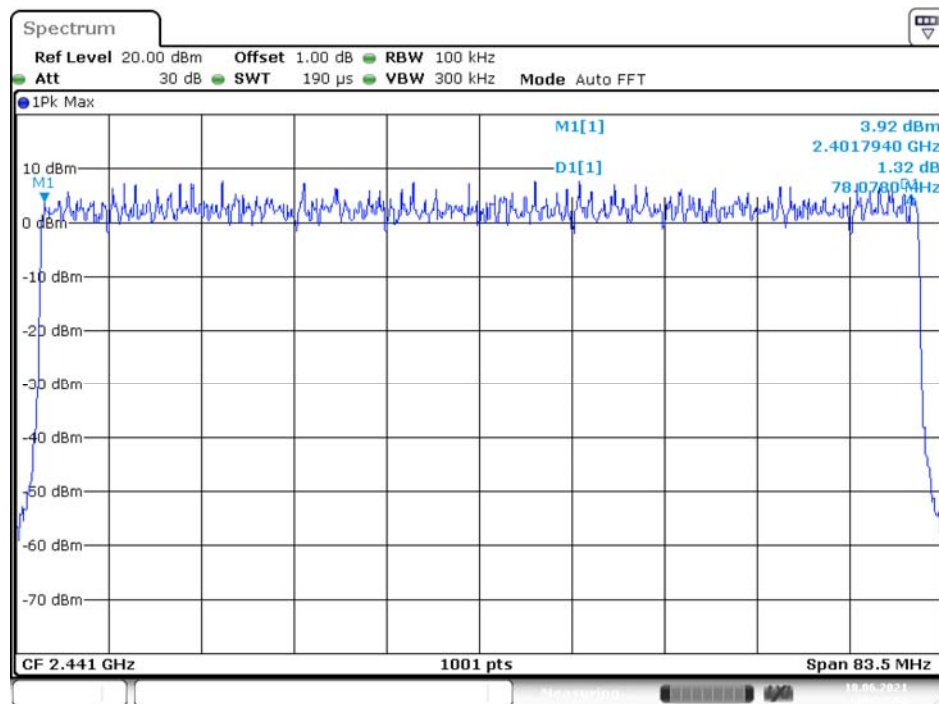
### BR Mode (GFSK)



Date: 18 JUN 2021 17:52:52

**EDR Mode ( $\pi/4$ -DQPSK)**

Date: 18 JUN 2021 18:26:54

**EDR Mode (8DPSK)**

Date: 18 JUN 2021 18:55:10

## 13 FCC §15.247(b)(1) – Maximum Output Power

### 13.1 Applicable Standard

According to FCC §15.247(b) (1).

Frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725- 5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

### 13.2 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.

### 13.3 Test Environmental Conditions

|                    |              |
|--------------------|--------------|
| Temperature:       | 23.2~24.5 °C |
| Relative Humidity: | 53~57 %      |
| ATM Pressure:      | 1010 hPa     |

The testing was performed by David Hsu on 2021-06-18~2021-06-21.

### 13.4 Test Results

| RF Test Results            |                    |                             |       |              |            |
|----------------------------|--------------------|-----------------------------|-------|--------------|------------|
| Channel                    | Frequency<br>(MHz) | Peak Conducted Output Power |       | Limit<br>(W) | Result     |
|                            |                    | (dBm)                       | (W)   |              |            |
| BR Mode (GFSK)             |                    |                             |       |              |            |
| Low                        | 2402               | 6.55                        | 0.005 | 0.125        | Compliance |
| Middle                     | 2441               | 6.86                        | 0.005 | 0.125        | Compliance |
| High                       | 2480               | 6.79                        | 0.005 | 0.125        | Compliance |
| EDR Mode ( $\pi/4$ -DQPSK) |                    |                             |       |              |            |
| Low                        | 2402               | 9.32                        | 0.009 | 0.125        | Compliance |
| Middle                     | 2441               | 9.24                        | 0.008 | 0.125        | Compliance |
| High                       | 2480               | 9.16                        | 0.008 | 0.125        | Compliance |
| EDR Mode (8DPSK)           |                    |                             |       |              |            |
| Low                        | 2402               | 10.02                       | 0.010 | 0.125        | Compliance |
| Middle                     | 2441               | 9.42                        | 0.009 | 0.125        | Compliance |
| High                       | 2480               | 9.89                        | 0.001 | 0.125        | Compliance |

| Channel                    | Frequency<br>(MHz) | Average Conducted Output Power |       | Limit<br>(W) | Result     |
|----------------------------|--------------------|--------------------------------|-------|--------------|------------|
|                            |                    | (dBm)                          | (W)   |              |            |
| BR Mode (GFSK)             |                    |                                |       |              |            |
| Low                        | 2402               | 6.27                           | 0.004 | N/A          | Compliance |
| Middle                     | 2441               | 6.58                           | 0.004 | N/A          | Compliance |
| High                       | 2480               | 6.52                           | 0.004 | N/A          | Compliance |
| EDR Mode ( $\pi/4$ -DQPSK) |                    |                                |       |              |            |
| Low                        | 2402               | 6.69                           | 0.005 | N/A          | Compliance |
| Middle                     | 2441               | 6.57                           | 0.005 | N/A          | Compliance |
| High                       | 2480               | 6.52                           | 0.004 | N/A          | Compliance |
| EDR Mode (8DPSK)           |                    |                                |       |              |            |
| Low                        | 2402               | 6.68                           | 0.005 | N/A          | Compliance |
| Middle                     | 2441               | 6.08                           | 0.004 | N/A          | Compliance |
| High                       | 2480               | 6.64                           | 0.005 | N/A          | Compliance |

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

### 14.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

### 14.2 Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

RBW = 100 kHz VBW = 300 kHz

Sweep = coupled

Detector function = peak Trace = max hold

### 14.3 Test Environmental Conditions

|                    |          |
|--------------------|----------|
| Temperature:       | 24.3 °C  |
| Relative Humidity: | 52 %     |
| ATM Pressure:      | 1010 hPa |

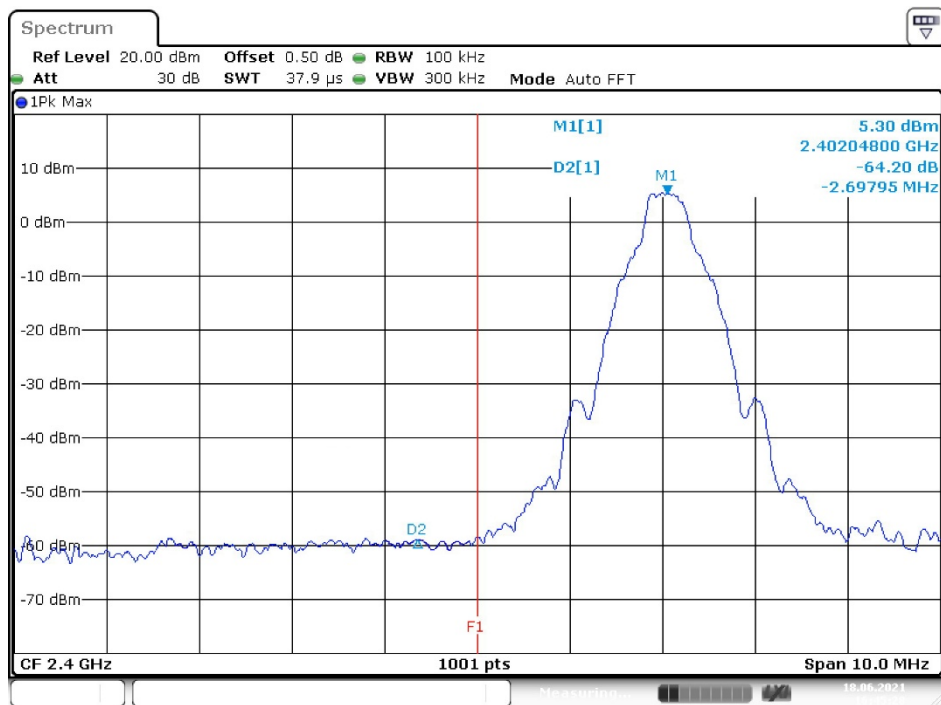
*The testing was performed by David Hsu on 2021-06-18.*

**14.4 Test Results**

| Channel                                            | Frequency (MHz) | Delta Peak to Band Emission (dBc) | Limit (dBc) | Result |
|----------------------------------------------------|-----------------|-----------------------------------|-------------|--------|
| <i>BR Mode (GFSK)</i>                              |                 |                                   |             |        |
| Low                                                | 2402            | 64.20                             | $\geq 20$   | PASS   |
| High                                               | 2480            | 62.72                             | $\geq 20$   | PASS   |
| <i>BR Hopping Mode (GFSK)</i>                      |                 |                                   |             |        |
| Low                                                | 2402-2480       | 62.52                             | $\geq 20$   | PASS   |
| High                                               | 2402-2480       | 63.17                             | $\geq 20$   | PASS   |
| <i>EDR Mode (<math>\pi/4</math>-DQPSK)</i>         |                 |                                   |             |        |
| Low                                                | 2402            | 58.52                             | $\geq 20$   | PASS   |
| High                                               | 2480            | 62.87                             | $\geq 20$   | PASS   |
| <i>EDR Hopping Mode (<math>\pi/4</math>-DQPSK)</i> |                 |                                   |             |        |
| Low                                                | 2402-2480       | 60.63                             | $\geq 20$   | PASS   |
| High                                               | 2402-2480       | 64.07                             | $\geq 20$   | PASS   |
| <i>EDR Mode (8DPSK)</i>                            |                 |                                   |             |        |
| Low                                                | 2402            | 58.83                             | $\geq 20$   | PASS   |
| High                                               | 2480            | 63.97                             | $\geq 20$   | PASS   |
| <i>EDR Hopping Mode (8DPSK)</i>                    |                 |                                   |             |        |
| Low                                                | 2402-2480       | 60.51                             | $\geq 20$   | PASS   |
| High                                               | 2402-2480       | 63.97                             | $\geq 20$   | PASS   |

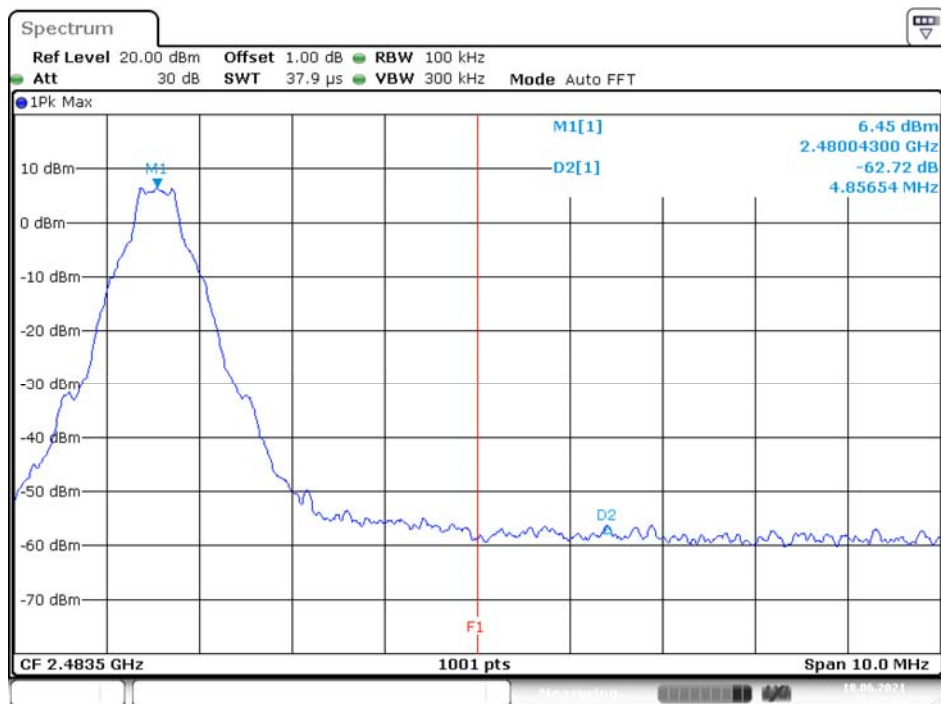
Please refer to the following plots

### BR Mode (GFSK) Band Edge, CH Low

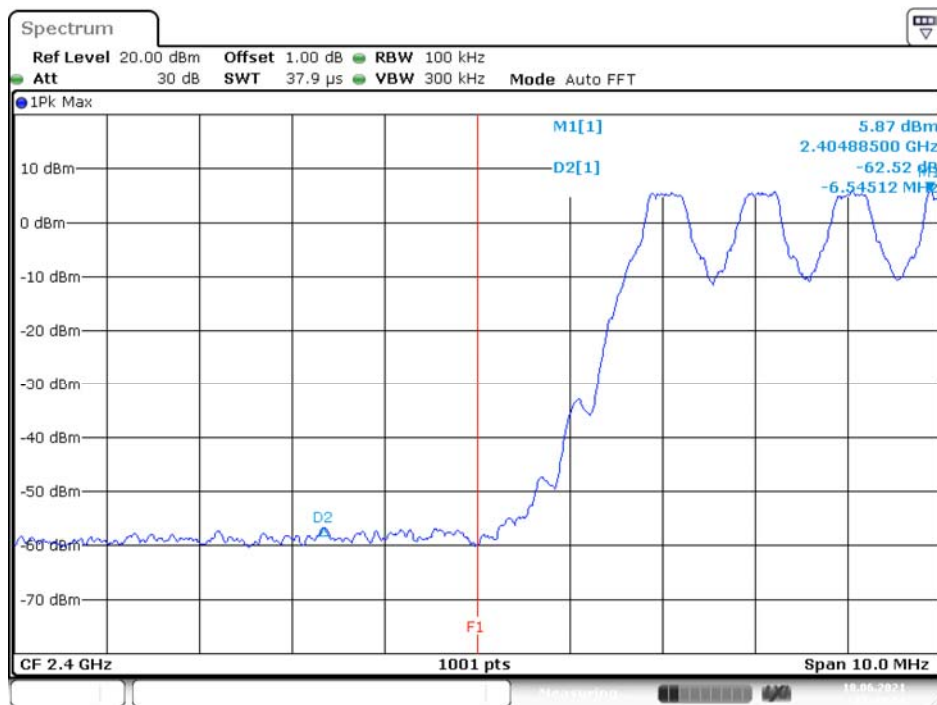


Date: 18 JUN.2021 16:45:28

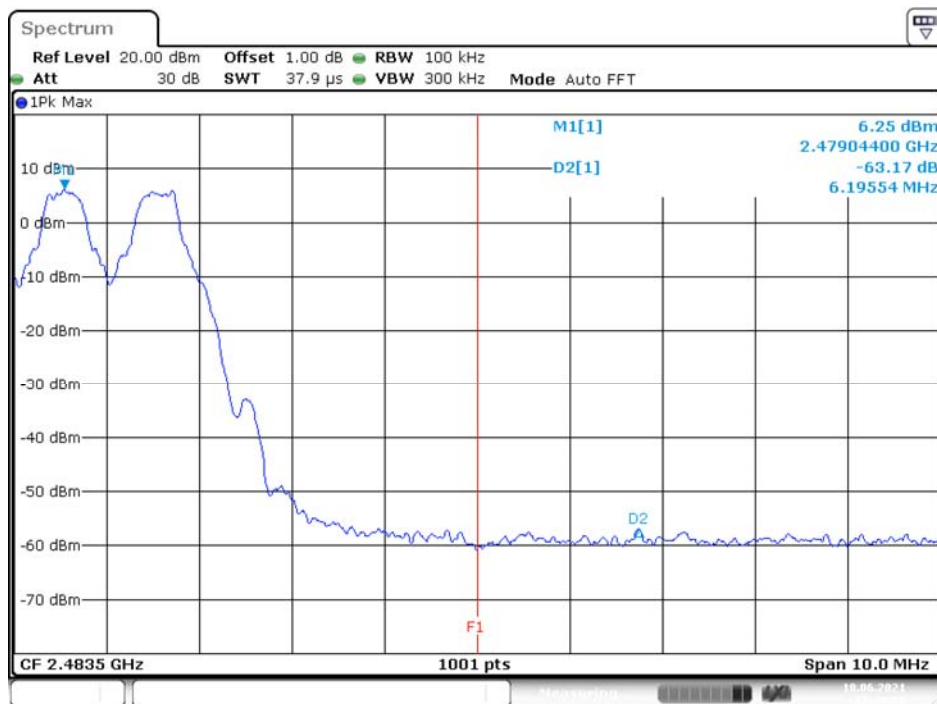
### Band Edge, CH High



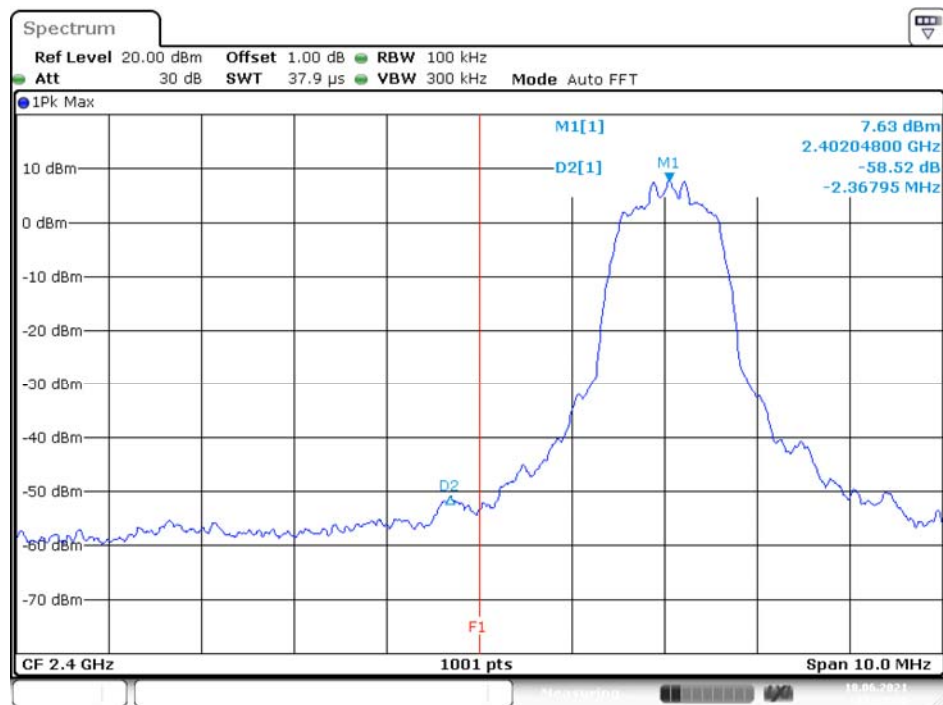
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**BR Hopping Mode (GFSK)****Band Edge, CH Low**

Date: 18.JUN.2021 17:48:24

**Band Edge, CH High**

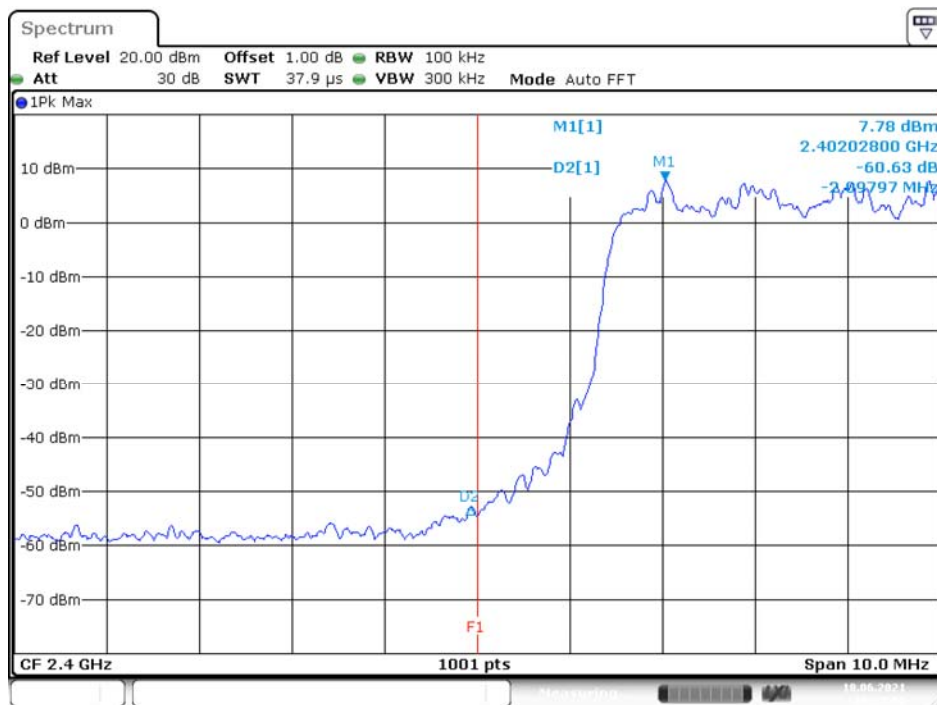
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**EDR Mode ( $\pi/4$ -DQPSK)****Band Edge, CH Low**

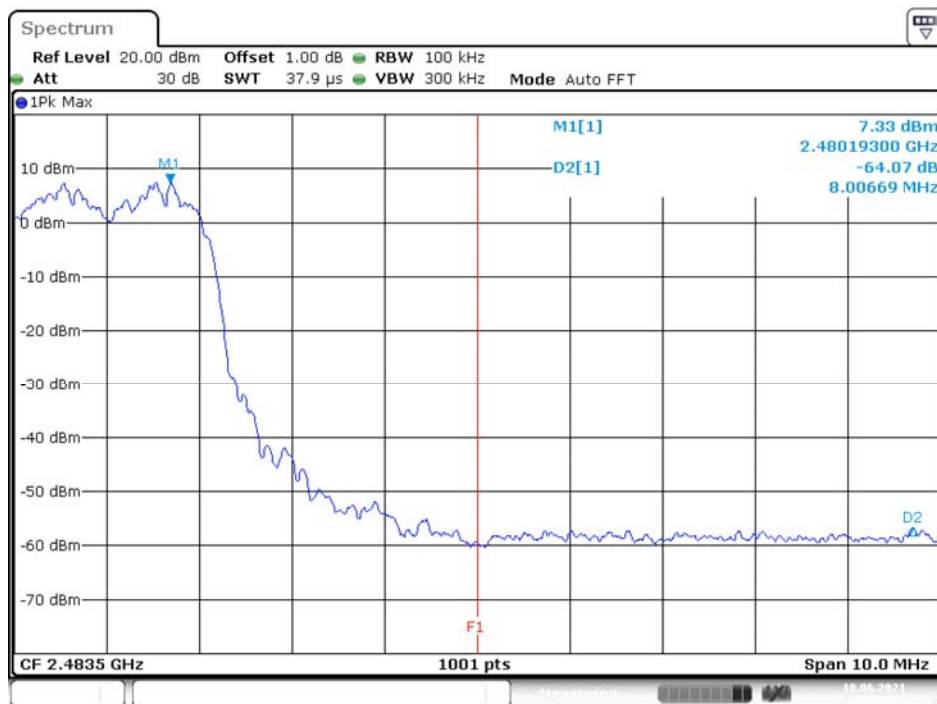
Date: 18 JUN.2021 17:21:30

**Band Edge, CH High**

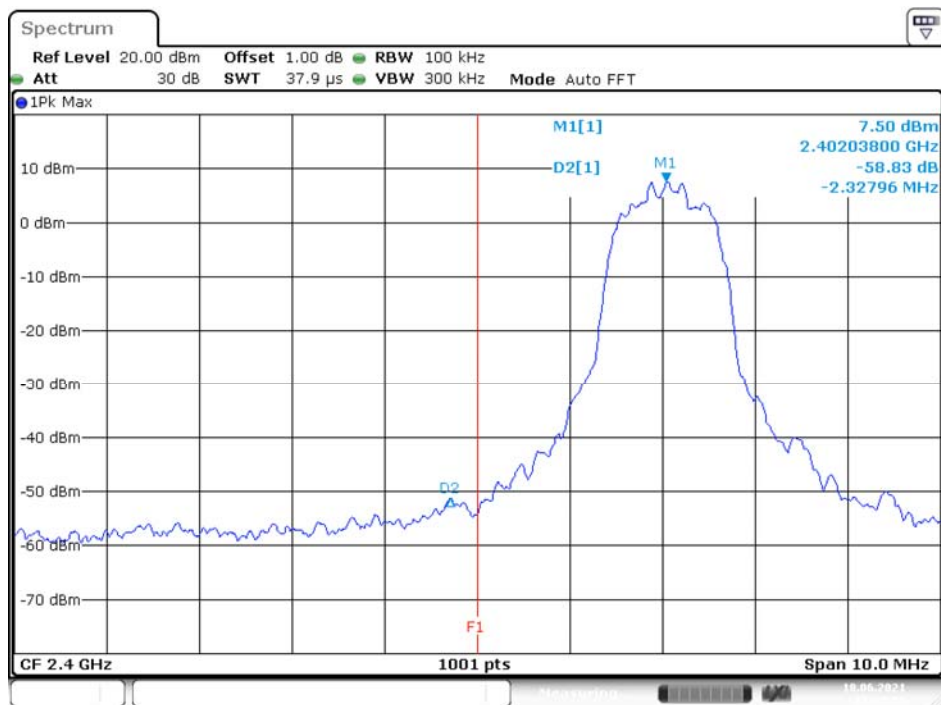
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**EDR Hopping Mode ( $\pi/4$ -DQPSK)****Band Edge, CH Low**

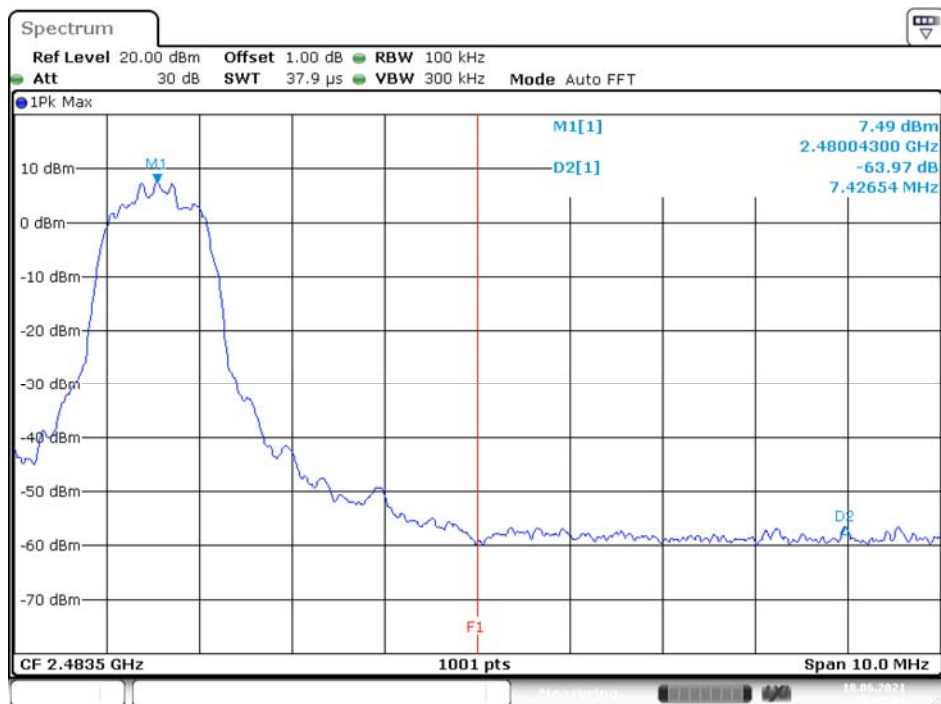
Date: 18.JUN.2021 18:22:07

**Band Edge, CH High**

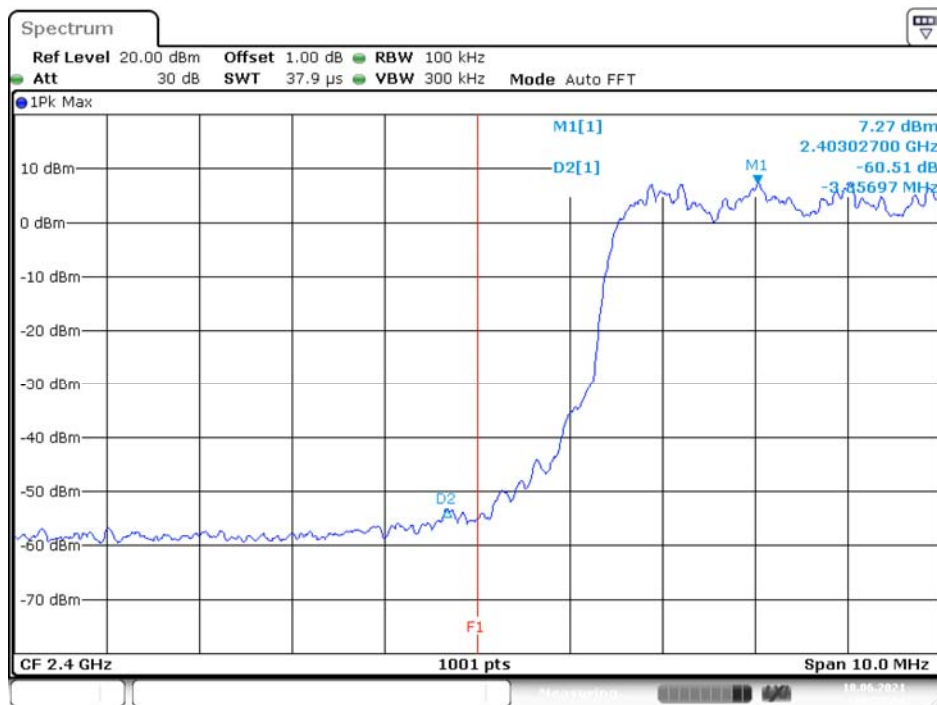
Date: 18.JUN.2021 18:23:21

**EDR Mode (8DPSK)****Band Edge, CH Low**

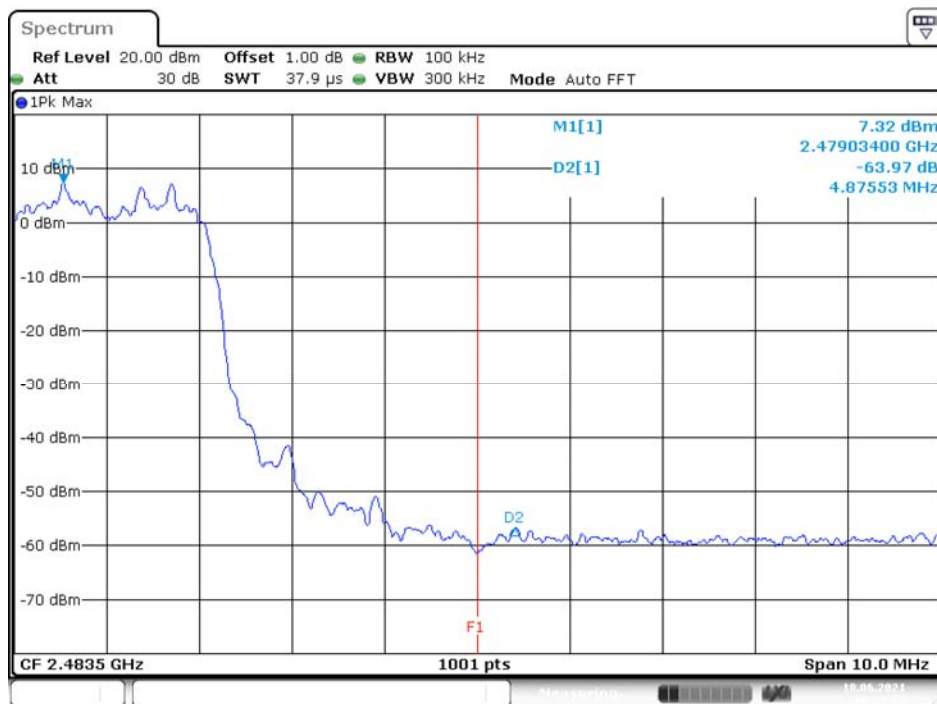
Date: 18 JUN 2021 17:37:56

**Band Edge, CH High**

Date: 18 JUN 2021 17:43:24

**EDR Hopping Mode (8DPSK)****Band Edge, CH Low**

Date: 18 JUN.2021 18:51:45

**Band Edge, CH High**

Date: 18 JUN.2021 18:52:27

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