

## FCC PART 15.247

### TEST REPORT

For

## Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, 518057  
China

**FCC ID: YAMPD48XUVS**

|                                        |                                                                                                                                                                                                                                                             |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Report Type:</b><br>Original Report | <b>Product Name:</b><br>DIGITAL PORTABLE RADIO                                                                                                                                                                                                              |
| <b>Report Number:</b> RDG210330013-00D |                                                                                                                                                                                                                                                             |
| <b>Report Date:</b> 2021-06-25         |                                                                                                                                                                                                                                                             |
| <b>Reviewed By:</b>                    | Gavin Xu<br>RF Engineer                                                                                                                                                                                                                                     |
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## GENERAL INFORMATION

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

|                             |                |                                                      |
|-----------------------------|----------------|------------------------------------------------------|
| <b>Product Name:</b>        |                | DIGITAL PORTABLE RADIO                               |
| <b>Test Model:</b>          |                | PD482 Uv                                             |
| <b>Multiple Models:</b>     |                | PD485 Uv, PD486 Uv, PD488 Uv                         |
| <b>Model Difference:</b>    |                | Refer to the DOS letter                              |
| <b>Rated Input Voltage:</b> |                | DC 7.2V from battery or DC 12V charging from adapter |
| <b>Adapter Information</b>  | <b>Model:</b>  | HKA01212010-XQ                                       |
|                             | <b>Input:</b>  | AC 100-240V 50/60Hz 0.5A                             |
|                             | <b>Output:</b> | DC 12.0V 1.0A 12.0W                                  |
| <b>Serial Number:</b>       |                | RDG210330013-RF-S1                                   |
| <b>EUT Received Date:</b>   |                | 2021.03.31                                           |
| <b>EUT Received Status:</b> |                | Good                                                 |

### Technical Specification

|                                               |                              |
|-----------------------------------------------|------------------------------|
| <b>Operation Frequency Range (MHz):</b>       | 2402-2480                    |
| <b>Max. RF Output Power (Conducted)(dBm):</b> | 1.94                         |
| <b>Antenna Gain (dBi)<sup>▲</sup>:</b>        | 0                            |
| <b>Modulation Type:</b>                       | GFSK, $\pi/4$ -DQPSK, 8-DPSK |

### Objective

This report is prepared on behalf of **Hytera Communications Corporation Limited** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules

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

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

FCC Part 15C DTS submissions with FCC ID: YAMPD48XUVS  
FCC Part 22&74&80&90 TNF submissions with FCC ID: YAMPD48XUVS

### Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

## Measurement Uncertainty

| Parameter                         | Measurement Uncertainty                                                                                              |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Occupied Channel Bandwidth        | ±5 %                                                                                                                 |
| RF output power, conducted        | ±0.61dB                                                                                                              |
| Power Spectral Density, conducted | ±0.61 dB                                                                                                             |
| Unwanted Emissions, radiated      | 30M~200MHz: 4.55 dB, 200M~1GHz: 5.92 dB, 1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB |
| Unwanted Emissions, conducted     | ±1.5 dB                                                                                                              |
| Temperature                       | ±1 °C                                                                                                                |
| Humidity                          | ±5%                                                                                                                  |
| DC and low frequency voltages     | ±0.4%                                                                                                                |
| Duty Cycle                        | 1%                                                                                                                   |
| AC Power Lines Conducted Emission | 3.12 dB (150 kHz to 30 MHz)                                                                                          |

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

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1<sup>st</sup> Road, Tangxia Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

## Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

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

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## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in engineering mode.

### EUT Exercise Software

The software: "blue test3.exe" was used during test, which was provided by manufacturer.  
The maximum power level was configured by the software as below table:

| Mode                     | Channel | Test Frequency (MHz) | Power Level Setting |
|--------------------------|---------|----------------------|---------------------|
| BDR<br>(GFSK)            | Low     | 2402                 | 50                  |
|                          | Middle  | 2441                 | 50                  |
|                          | High    | 2480                 | 50                  |
| EDR<br>( $\pi/4$ -DQPSK) | Low     | 2402                 | 50                  |
|                          | Middle  | 2441                 | 50                  |
|                          | High    | 2480                 | 50                  |
| EDR<br>(8DPSK)           | Low     | 2402                 | 50                  |
|                          | Middle  | 2441                 | 50                  |
|                          | High    | 2480                 | 50                  |

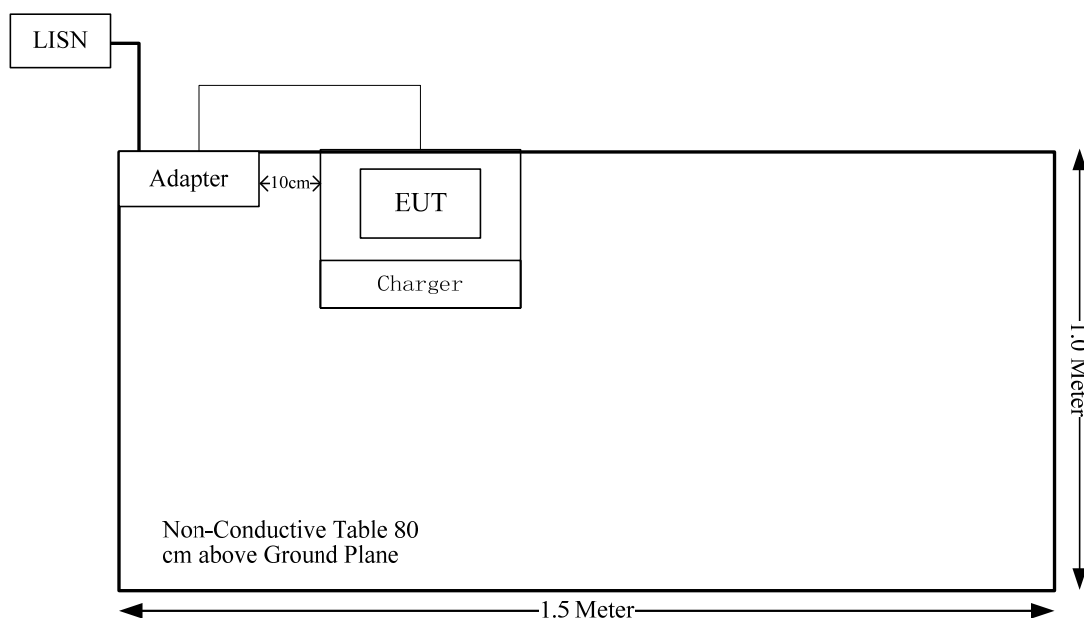
### Local Support Equipment List and Details

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

### Support Cable List and Details

| Cable Description | Shielding Type | Ferrite Core | Length(m) | From    | To  |
|-------------------|----------------|--------------|-----------|---------|-----|
| Adapter cable     | No             | No           | 1.8       | Adapter | EUT |

### Block Diagram of Test Setup



## Test Equipment List

| Manufacturer               | Description               | Model              | Serial Number   | Calibration Date | Calibration Due Date |
|----------------------------|---------------------------|--------------------|-----------------|------------------|----------------------|
| AC Line Conducted emission |                           |                    |                 |                  |                      |
| R&S                        | LISN                      | ENV 216            | 101614          | 2020-09-12       | 2021-09-12           |
| R&S                        | EMI Test Receiver         | ESCI               | 101121          | 2020-07-07       | 2021-07-07           |
| MICRO-COAX                 | Coaxial Cable             | C-NJNJ-50          | C-0200-01       | 2020-09-05       | 2021-09-05           |
| R&S                        | Test Software             | EMC32              | Version 9.10.00 | N/A              | N/A                  |
| Radiation Below 1GHz Test  |                           |                    |                 |                  |                      |
| Sunol Sciences             | Antenna                   | JB3                | A060611-2       | 2020-08-25       | 2023-08-25           |
| R&S                        | EMI Test Receiver         | ESCI               | 100224          | 2020-09-12       | 2021-09-12           |
| Unknown                    | Coaxial Cable             | C-NJNJ-50          | C-1000-01       | 2020-09-05       | 2021-09-05           |
| Unknown                    | Coaxial Cable             | C-NJNJ-50          | C-0400-02       | 2020-09-05       | 2021-09-05           |
| Unknown                    | Coaxial Cable             | C-NJNJ-50          | C-0530-01       | 2020-09-24       | 2021-09-24           |
| Sonoma                     | Amplifier                 | 310N               | 185914          | 2020-10-13       | 2021-10-13           |
| Farad                      | Test Software             | EZ-EMC             | V1.1.4.2        | N/A              | N/A                  |
| Radiation Above 1GHz Test  |                           |                    |                 |                  |                      |
| ETS-Lindgren               | Horn Antenna              | 3115               | 000 527 35      | 2018-10-12       | 2021-10-12           |
| Ducommun Technologies      | Horn Antenna              | ARH-4223-02        | 1007726-01 1304 | 2020-12-05       | 2023-12-04           |
| Agilent                    | Spectrum Analyzer         | E4440A             | SG43360054      | 2020-07-07       | 2021-07-07           |
| Unknown                    | Coaxial Cable             | C-SJSJ-50          | C-0800-01       | 2020-09-05       | 2021-09-05           |
| Unknown                    | Coaxial Cable             | C-2.4J2.4J-50      | C-0700-02       | 2020-06-27       | 2021-06-27           |
| Mini-Circuit               | Amplifier                 | ZVA-213-S+         | 54201245        | 2020-09-05       | 2021-09-05           |
| Quinstar                   | Amplifier                 | QLW-18405536-JO    | 15964001001     | 2020-06-27       | 2021-06-27           |
| Farad                      | Test Software             | EZ-EMC             | V1.1.4.2        | N/A              | N/A                  |
| E-Microwave                | Band-stop Filters         | OBSF-2400-2483.5-S | OE01601525      | 2021-06-16       | 2022-06-16           |
| Mini Circuits              | High Pass Filter          | VHF-6010+          | 31118           | 2021-06-16       | 2022-06-16           |
| RF Conducted               |                           |                    |                 |                  |                      |
| R&S                        | Spectrum Analyzer         | FSU 26             | 200256          | 2020-07-07       | 2021-07-07           |
| R&S                        | EMI Test Receiver         | ESR3               | 102453          | 2020-09-12       | 2021-09-12           |
| yzjingcheng                | Coaxial Cable             | KTRFBU-141-50      | 41005011        | 2020-09-05       | 2021-09-05           |
| E-Microwave                | Blocking Control          | EMDCB-00036        | 0E01201048      | 2021-05-06       | 2022-05-06           |
| Agilent                    | USB Wideband Power Sensor | U2022XA            | MY5417006       | 2020-09-23       | 2021-09-23           |

\* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Environmental Conditions

| Test Items         | Conducted Emissions | Radiated Emissions (Below 1GHz) | Radiated Emissions (Above 1GHz) | RF Conducted          |
|--------------------|---------------------|---------------------------------|---------------------------------|-----------------------|
| Temperature:       | 23.9℃               | 22.1℃                           | 28.5℃                           | 26.8~27.9 ℃           |
| Relative Humidity: | 63%                 | 51.2 %                          | 43%                             | 45~65 %               |
| ATM Pressure:      | 100.5kPa            | 100 kPa                         | 100.4kPa                        | 100~100.6kPa          |
| Tester:            | Walker Chen         | Walker Yuan                     | Lee Li                          | Wayne Wei             |
| Test Date:         | 2021-06-16          | 2021-06-11                      | 2021-05-28                      | 2021-05-25~2021-06-23 |

**SUMMARY OF TEST RESULTS**

| S/N | FCC Rules                         | Description of Test              | Result     |
|-----|-----------------------------------|----------------------------------|------------|
| 1   | §15.247 (i)<br>§1.1310<br>§2.1093 | RF Exposure                      | Compliance |
| 2   | §15.203                           | Antenna requirement              | Compliance |
| 3   | §15.207(a)                        | AC line conducted emissions      | Compliance |
| 4   | §15.205<br>§15.209<br>§15.247(d)  | Spurious emissions               | Compliance |
| 5   | §15.247(a)(1)                     | Channel separation               | Compliance |
| 6   | §15.247(a)(1)                     | 20 dB bandwidth                  | Compliance |
| 7   | §15.247(a)(1)(iii)                | Quantity of hopping channel test | Compliance |
| 8   | §15.247(a)(1)(iii)                | Time of occupancy (dwell time)   | Compliance |
| 9   | §15.247(b)(1)                     | Peak output power measurement    | Compliance |
| 10  | §15.247(d)                        | Band edges                       | Compliance |

## 1 - RF EXPOSURE

---

### Applicable Standard

According to §15.247(i) and §1.1310, 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 KDB447498 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

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

### Measurement Result

The max conducted power including tune-up tolerance is 2.0 dBm (1.58 mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$   
 $= 1.58/5 \cdot (\sqrt{2.480}) = 0.5 < 3.0$

**So the stand-alone SAR evaluation is not necessary.**

## 2 - ANTENNA REQUIREMENT

### Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

### Antenna Connector Construction

The EUT has one internal antenna arrangement for BT, fulfill the requirement of this section. Please refer to below information and the EUT photos:

| Antenna Type | Input Impedance<br>(Ohm) | Antenna Gain<br>/Frequency Range |
|--------------|--------------------------|----------------------------------|
| FPC          | 50                       | 0dBi/2.4~2.5GHz                  |

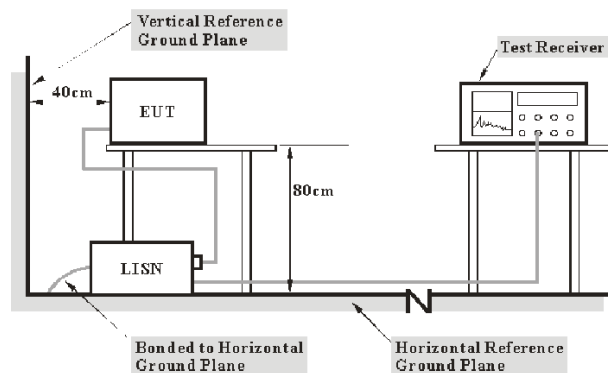
**Result:** Compliance.

### 3 – AC LINE CONDUCTED EMISSIONS

#### Applicable Standard

FCC§15.207(a)

#### Test System 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.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisen with a 120 V/60 Hz AC power source.

#### EMI Test Receiver Setup

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

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

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

#### Test Procedure

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

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase (“hot”) line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:  $V_C = V_R + A_C + VDF$ ;  $C_f = A_C + VDF$

Herein,

$V_C$  (cord. Reading): corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

VDF: voltage division factor of AMN

$C_f$ : Correction Factor

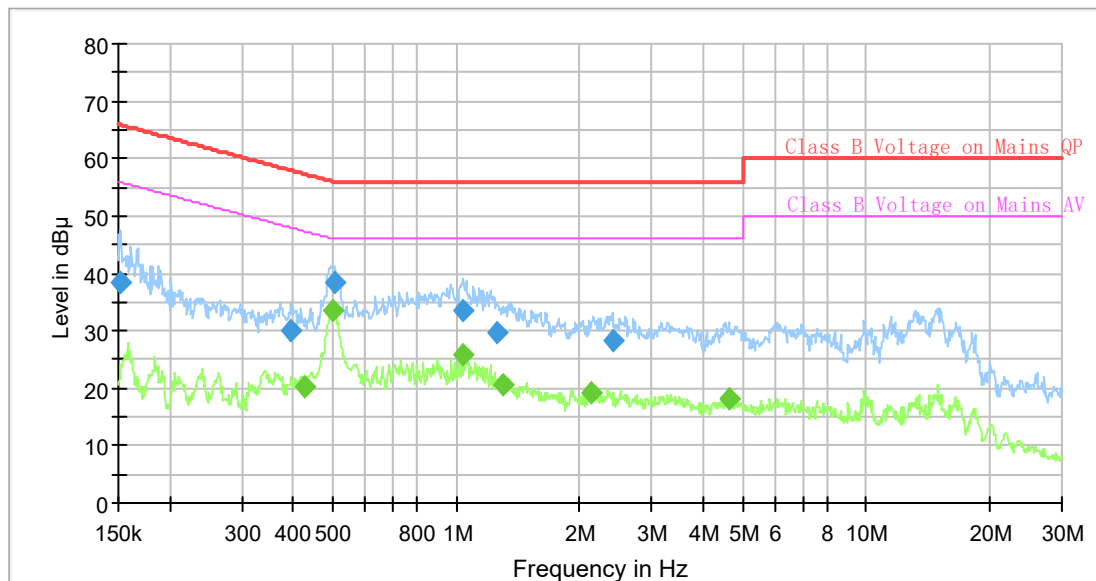
The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:  $\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$

## Test Data

*Test Mode: Transmitting*

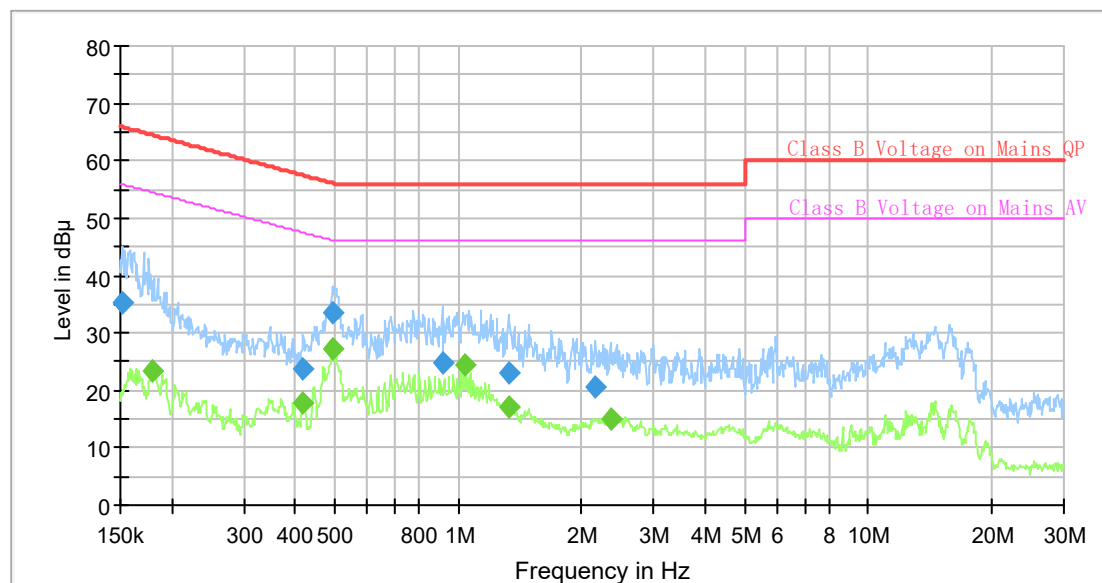
**Test Result:** Compliance. Please refer to following tables and plots.

**AC120V, 60 Hz, Line:**



## Final Result

| Frequency (MHz) | QuasiPeak (dB μV) | Average (dB μV) | Limit (dB μV) | Margin (dB) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|-------------------|-----------------|---------------|-------------|-----------------|------|------------|
| 0.152261        | 38.38             | ---             | 65.88         | 27.50       | 9.000           | L1   | 9.6        |
| 0.394736        | 30.00             | ---             | 57.96         | 27.96       | 9.000           | L1   | 9.6        |
| 0.427528        | ---               | 20.21           | 47.30         | 27.09       | 9.000           | L1   | 9.6        |
| 0.499013        | ---               | 33.62           | 46.02         | 12.40       | 9.000           | L1   | 9.6        |
| 0.504016        | 38.27             | ---             | 56.00         | 17.73       | 9.000           | L1   | 9.6        |
| 1.043973        | 33.47             | ---             | 56.00         | 22.53       | 9.000           | L1   | 9.7        |
| 1.043973        | ---               | 25.79           | 46.00         | 20.21       | 9.000           | L1   | 9.7        |
| 1.255549        | 29.58             | ---             | 56.00         | 26.42       | 9.000           | L1   | 9.7        |
| 1.300158        | ---               | 20.74           | 46.00         | 25.26       | 9.000           | L1   | 9.7        |
| 2.140929        | ---               | 19.31           | 46.00         | 26.69       | 9.000           | L1   | 9.7        |
| 2.401163        | 28.14             | ---             | 56.00         | 27.86       | 9.000           | L1   | 9.7        |
| 4.661308        | ---               | 18.11           | 46.00         | 27.89       | 9.000           | L1   | 9.7        |

**AC120V, 60 Hz, Neutral:****Final Result**

| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Average (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------------|----------------------|--------------------|-------------|-----------------|------|------------|
| 0.151504        | 35.23                  | ---                  | 65.92              | 30.69       | 9.000           | N    | 9.6        |
| 0.179502        | ---                    | 23.36                | 54.51              | 31.15       | 9.000           | N    | 9.6        |
| 0.419083        | ---                    | 17.97                | 47.47              | 29.50       | 9.000           | N    | 9.6        |
| 0.419083        | 23.59                  | ---                  | 57.47              | 33.88       | 9.000           | N    | 9.6        |
| 0.494060        | ---                    | 27.25                | 46.10              | 18.85       | 9.000           | N    | 9.6        |
| 0.494060        | 33.42                  | ---                  | 56.10              | 22.68       | 9.000           | N    | 9.6        |
| 0.912443        | 24.75                  | ---                  | 56.00              | 31.25       | 9.000           | N    | 9.6        |
| 1.043973        | ---                    | 24.48                | 46.00              | 21.52       | 9.000           | N    | 9.6        |
| 1.326356        | 23.17                  | ---                  | 56.00              | 32.83       | 9.000           | N    | 9.6        |
| 1.326356        | ---                    | 17.08                | 46.00              | 28.92       | 9.000           | N    | 9.6        |
| 2.162391        | 20.56                  | ---                  | 56.00              | 35.44       | 9.000           | N    | 9.6        |
| 2.365502        | ---                    | 15.02                | 46.00              | 30.98       | 9.000           | N    | 9.6        |

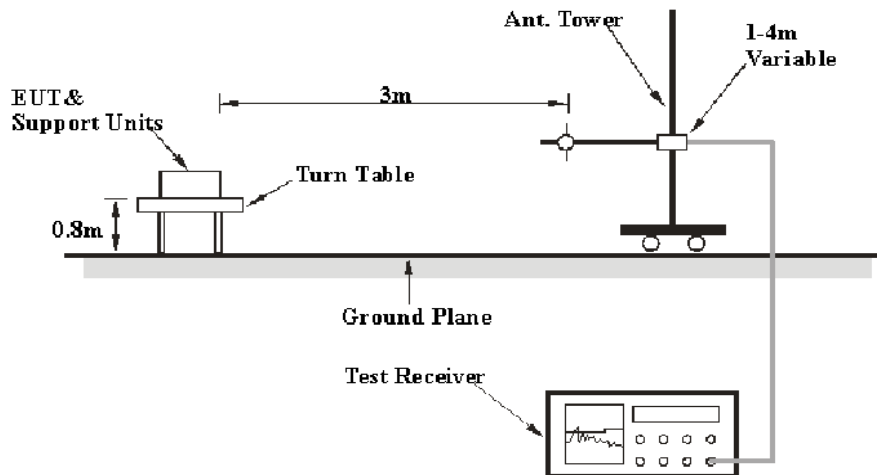
## 4 - SPURIOUS EMISSIONS

### Applicable Standard

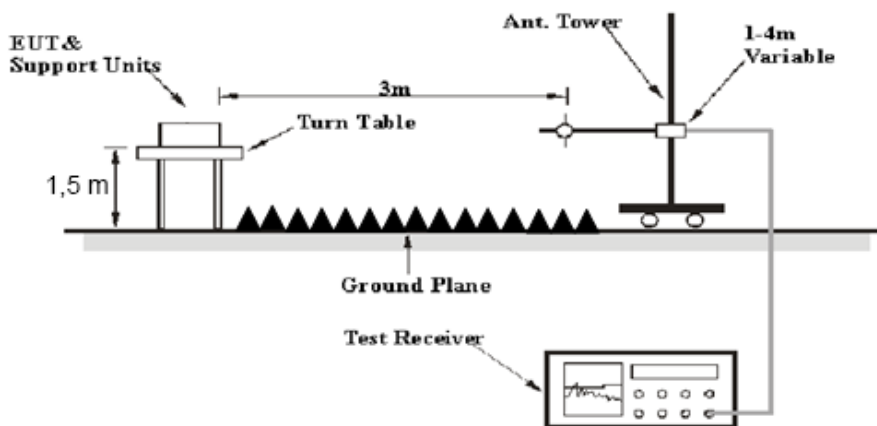
FCC §15.247 (d); §15.209; §15.205;

### Test System Setup

#### Below 1GHz:



#### Above 1GHz:



The radiated emission Below 1GHz tests were performed in the 3 meters chamber, above 1GHz tests were performed in the 3 meters chamber B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

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

The spacing between the peripherals was 10 cm.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

According to FCC public notice: DA-00-705, during the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

| Frequency Range   | RBW     | Video B/W | IF B/W  | Measurement |
|-------------------|---------|-----------|---------|-------------|
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz   | 120 kHz | QP          |
| Above 1 GHz       | 1MHz    | 3 MHz     | /       | PK          |
|                   | 1MHz    | 10 Hz     | /       | AV          |

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

## Test Procedure

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

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

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude 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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Data

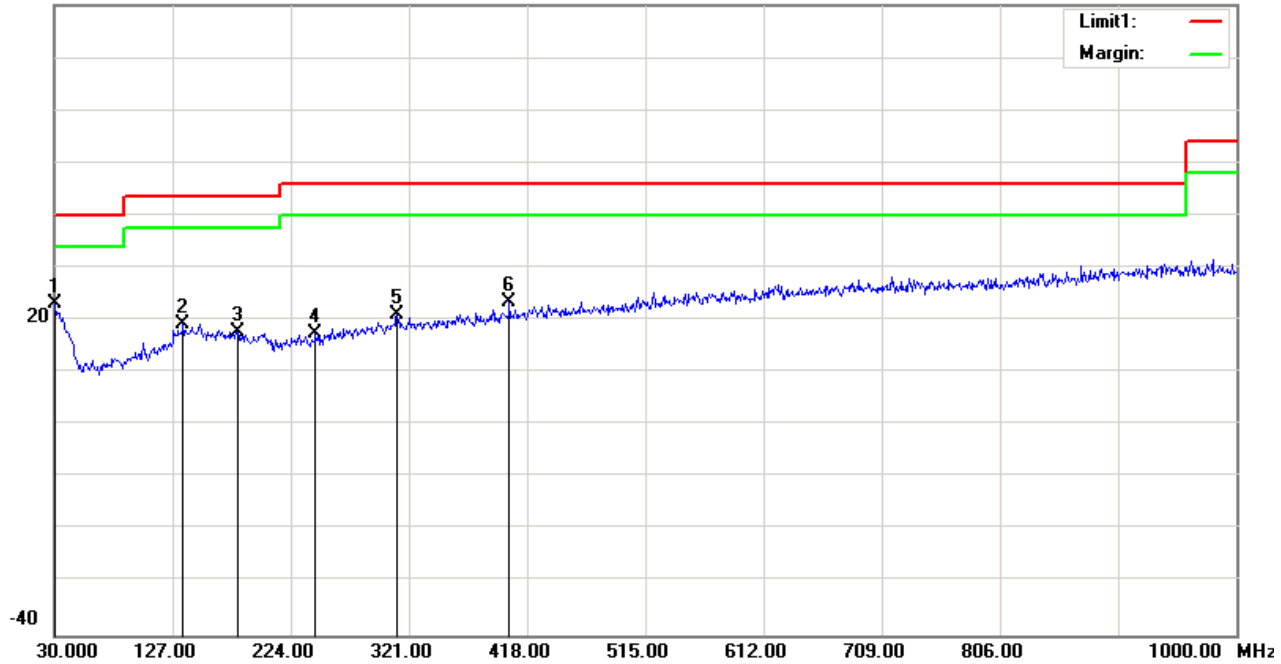
*Test Mode: Transmitting*

**Test Result:** Compliance

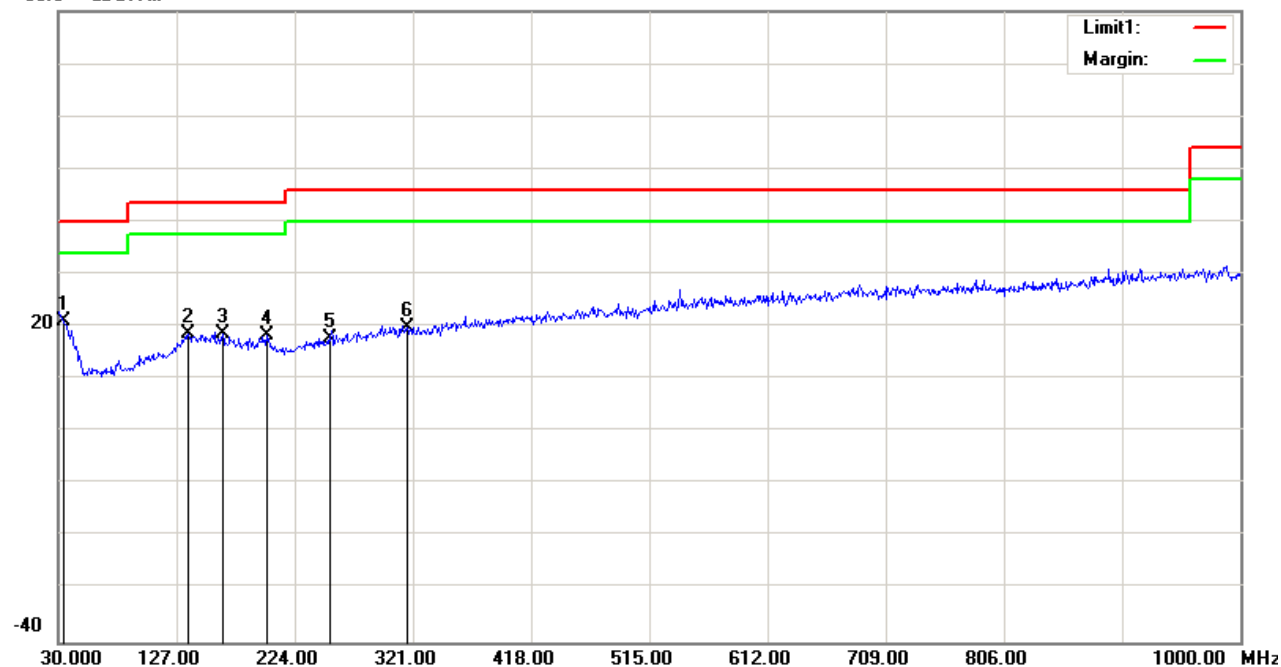
*Please Refer to the following data.*

## 1) 30MHz-1GHz (GFSK high channel was the worst)

Horizontal:

80.0 dB $\mu$ V/m

| No. | Frequency<br>(MHz) | Reading<br>(dB $\mu$ V) | Detector | Corrected<br>(dB/m) | Result<br>(dB $\mu$ V/m) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----|--------------------|-------------------------|----------|---------------------|--------------------------|-------------------------|----------------|
| 1   | 30.0000            | 27.17                   | peak     | -4.10               | 23.07                    | 40.00                   | 16.93          |
| 2   | 135.7300           | 28.60                   | peak     | -9.31               | 19.29                    | 43.50                   | 24.21          |
| 3   | 180.3500           | 27.59                   | peak     | -9.83               | 17.76                    | 43.50                   | 25.74          |
| 4   | 244.3700           | 27.14                   | peak     | -9.83               | 17.31                    | 46.00                   | 28.69          |
| 5   | 311.3000           | 28.14                   | peak     | -6.98               | 21.16                    | 46.00                   | 24.84          |
| 6   | 403.4500           | 28.56                   | peak     | -5.07               | 23.49                    | 46.00                   | 22.51          |

**Vertical:**80.0 dB $\mu$ V/m

| No. | Frequency<br>(MHz) | Reading<br>(dB $\mu$ V) | Detector | Corrected<br>(dB/m) | Result<br>(dB $\mu$ V/m) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----|--------------------|-------------------------|----------|---------------------|--------------------------|-------------------------|----------------|
| 1   | 34.8500            | 27.65                   | peak     | -6.63               | 21.02                    | 40.00                   | 18.98          |
| 2   | 136.7000           | 28.03                   | peak     | -9.25               | 18.78                    | 43.50                   | 24.72          |
| 3   | 164.8300           | 28.04                   | peak     | -9.40               | 18.64                    | 43.50                   | 24.86          |
| 4   | 200.7200           | 27.79                   | peak     | -9.30               | 18.49                    | 43.50                   | 25.01          |
| 5   | 253.1000           | 27.21                   | peak     | -9.53               | 17.68                    | 46.00                   | 28.32          |
| 6   | 316.1500           | 26.99                   | peak     | -7.03               | 19.96                    | 46.00                   | 26.04          |

**2) 1GHz-25GHz:**

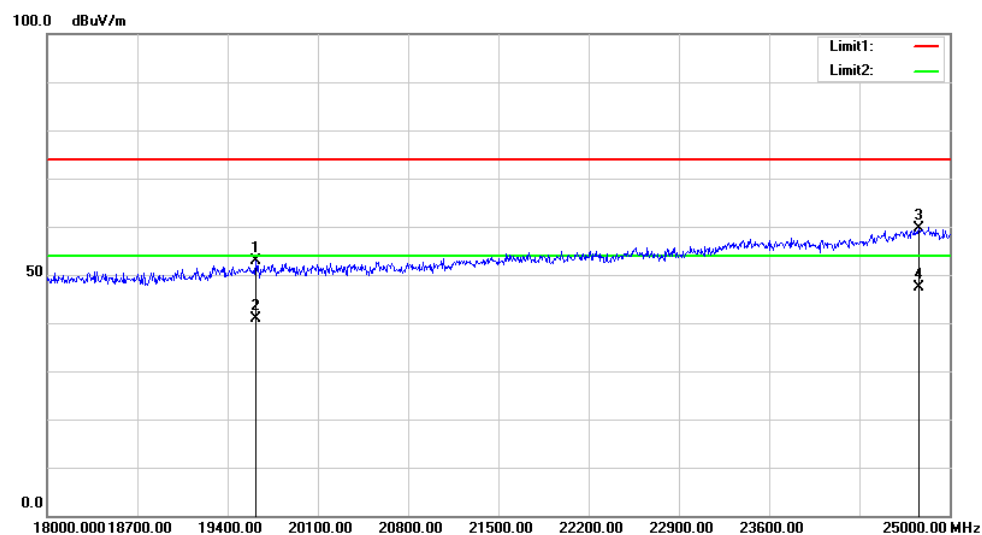
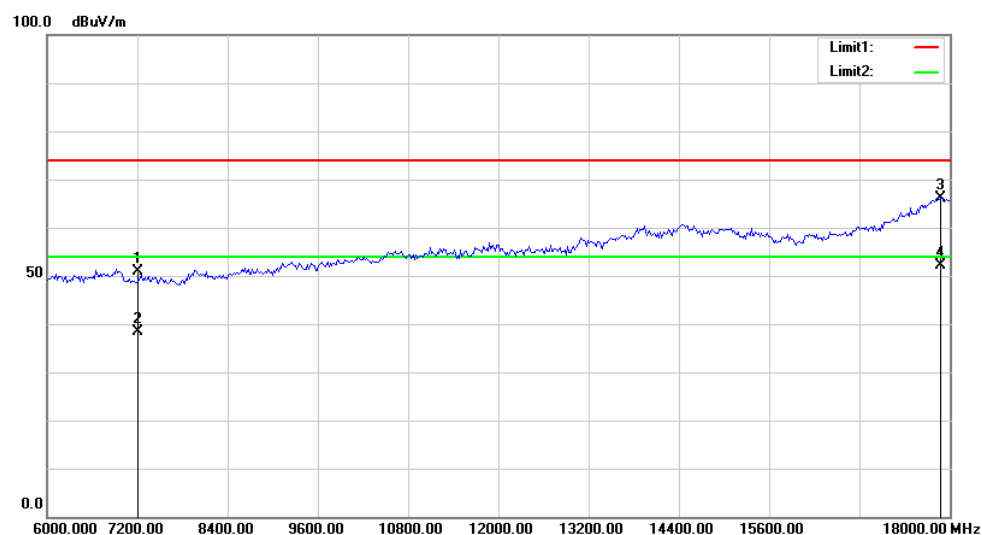
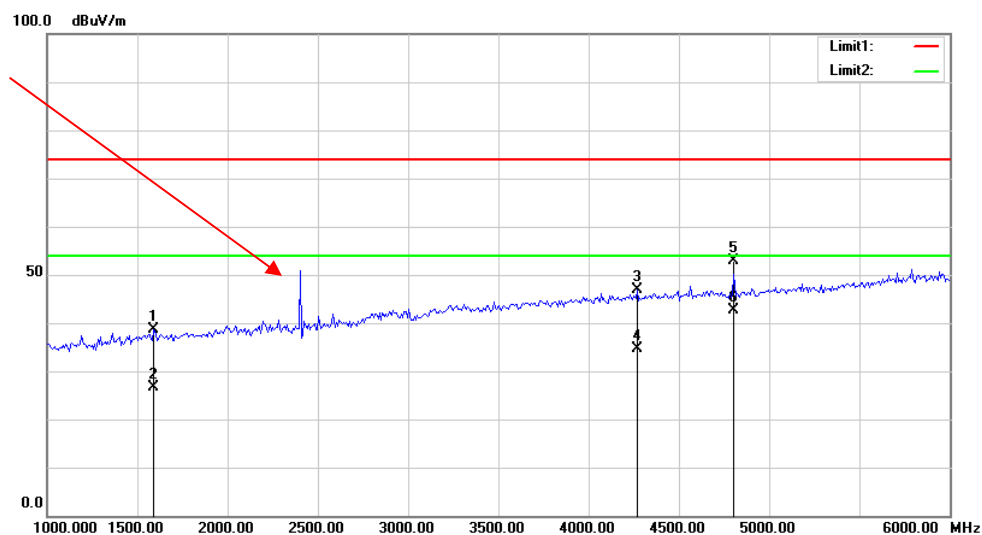
BDR Mode (GFSK) was the worst

| Frequency<br>(MHz)       | Receiver          |        | Rx Antenna     |                  | Cable<br>loss<br>(dB) | Amplifier<br>Gain<br>(dB) | Corrected<br>Amplitude<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------------|-------------------|--------|----------------|------------------|-----------------------|---------------------------|------------------------------------|-------------------|----------------|
|                          | Reading<br>(dBμV) | Remark | Polar<br>(H/V) | Factor<br>(dB/m) |                       |                           |                                    |                   |                |
| Low Channel: 2402 MHz    |                   |        |                |                  |                       |                           |                                    |                   |                |
| 2402.00                  | 63.41             | PK     | H              | 28.10            | 1.80                  | 0.00                      | 93.31                              | N/A               | N/A            |
| 2402.00                  | 58.32             | AV     | H              | 28.10            | 1.80                  | 0.00                      | 88.22                              | N/A               | N/A            |
| 2402.00                  | 62.88             | PK     | V              | 28.10            | 1.80                  | 0.00                      | 92.78                              | N/A               | N/A            |
| 2402.00                  | 57.12             | AV     | V              | 28.10            | 1.80                  | 0.00                      | 87.02                              | N/A               | N/A            |
| 2390.00                  | 29.33             | PK     | H              | 28.08            | 1.80                  | 0.00                      | 59.21                              | 74.00             | 14.79          |
| 2390.00                  | 17.17             | AV     | H              | 28.08            | 1.80                  | 0.00                      | 47.05                              | 54.00             | 6.95           |
| 4804.00                  | 42.39             | PK     | H              | 32.91            | 3.17                  | 25.60                     | 52.87                              | 74.00             | 21.13          |
| 4804.00                  | 32.07             | AV     | H              | 32.91            | 3.17                  | 25.60                     | 42.55                              | 54.00             | 11.45          |
| 7206.00                  | 35.89             | PK     | H              | 35.74            | 4.82                  | 25.60                     | 50.85                              | 74.00             | 23.15          |
| 7206.00                  | 23.42             | AV     | H              | 35.74            | 4.82                  | 25.60                     | 38.38                              | 54.00             | 15.62          |
| 3187.00                  | 43.80             | PK     | V              | 30.55            | 2.20                  | 25.91                     | 50.64                              | 74.00             | 23.36          |
| Middle Channel: 2441 MHz |                   |        |                |                  |                       |                           |                                    |                   |                |
| 2441.00                  | 63.77             | PK     | H              | 28.18            | 1.82                  | 0.00                      | 93.77                              | N/A               | N/A            |
| 2441.00                  | 58.68             | AV     | H              | 28.18            | 1.82                  | 0.00                      | 88.68                              | N/A               | N/A            |
| 2441.00                  | 63.24             | PK     | V              | 28.18            | 1.82                  | 0.00                      | 93.24                              | N/A               | N/A            |
| 2441.00                  | 57.48             | AV     | V              | 28.18            | 1.82                  | 0.00                      | 87.48                              | N/A               | N/A            |
| 4882.00                  | 40.32             | PK     | H              | 33.06            | 3.27                  | 25.66                     | 50.99                              | 74.00             | 23.01          |
| 4882.00                  | 28.99             | AV     | H              | 33.06            | 3.27                  | 25.66                     | 39.66                              | 54.00             | 14.34          |
| 7323.00                  | 35.98             | PK     | H              | 36.04            | 4.62                  | 25.73                     | 50.91                              | 74.00             | 23.09          |
| 7323.00                  | 23.62             | AV     | H              | 36.04            | 4.62                  | 25.73                     | 38.55                              | 54.00             | 15.45          |
| High Channel: 2480 MHz   |                   |        |                |                  |                       |                           |                                    |                   |                |
| 2480.00                  | 64.25             | PK     | H              | 28.26            | 1.84                  | 0.00                      | 94.35                              | N/A               | N/A            |
| 2480.00                  | 59.67             | AV     | H              | 28.26            | 1.84                  | 0.00                      | 89.77                              | N/A               | N/A            |
| 2480.00                  | 63.74             | PK     | V              | 28.26            | 1.84                  | 0.00                      | 93.84                              | N/A               | N/A            |
| 2480.00                  | 58.61             | AV     | V              | 28.26            | 1.84                  | 0.00                      | 88.71                              | N/A               | N/A            |
| 2483.50                  | 29.31             | PK     | H              | 28.27            | 1.84                  | 0.00                      | 59.42                              | 74.00             | 14.58          |
| 2483.50                  | 17.80             | AV     | H              | 28.27            | 1.84                  | 0.00                      | 47.91                              | 54.00             | 6.09           |
| 4960.00                  | 39.96             | PK     | H              | 33.22            | 3.23                  | 25.63                     | 50.78                              | 74.00             | 23.22          |
| 4960.00                  | 28.63             | AV     | H              | 33.22            | 3.23                  | 25.63                     | 39.45                              | 54.00             | 14.55          |
| 7440.00                  | 35.62             | PK     | H              | 36.34            | 4.41                  | 25.85                     | 50.52                              | 74.00             | 23.48          |
| 7440.00                  | 23.26             | AV     | H              | 36.34            | 4.41                  | 25.85                     | 38.16                              | 54.00             | 15.84          |

### 3) Worst plots (GFSK low channel was the worst)

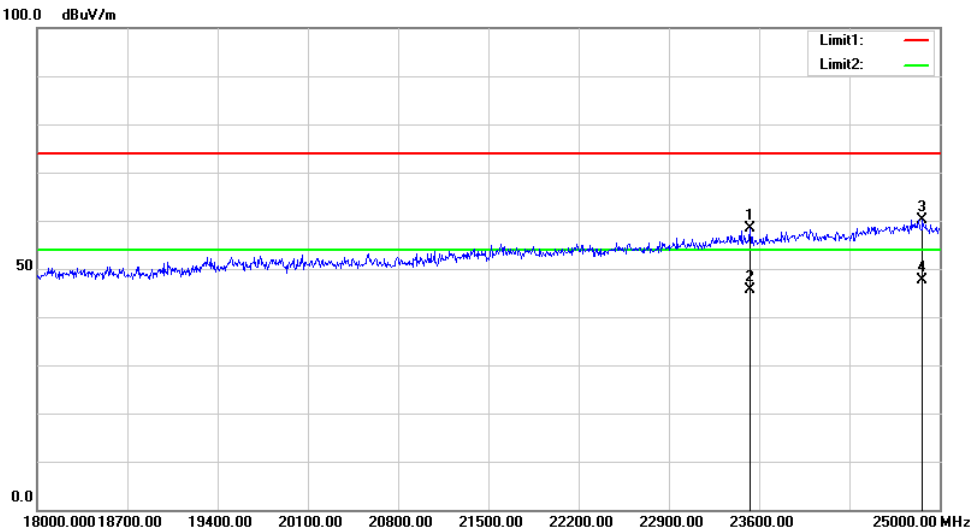
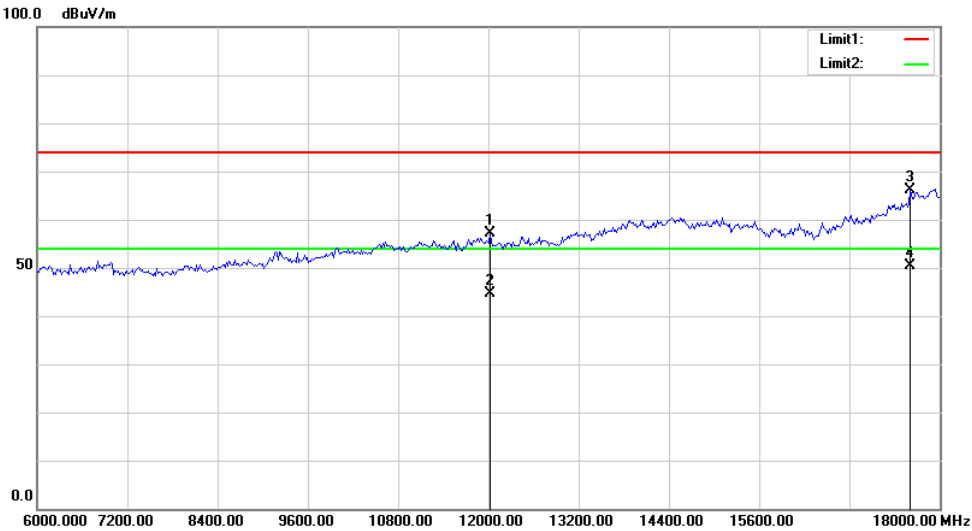
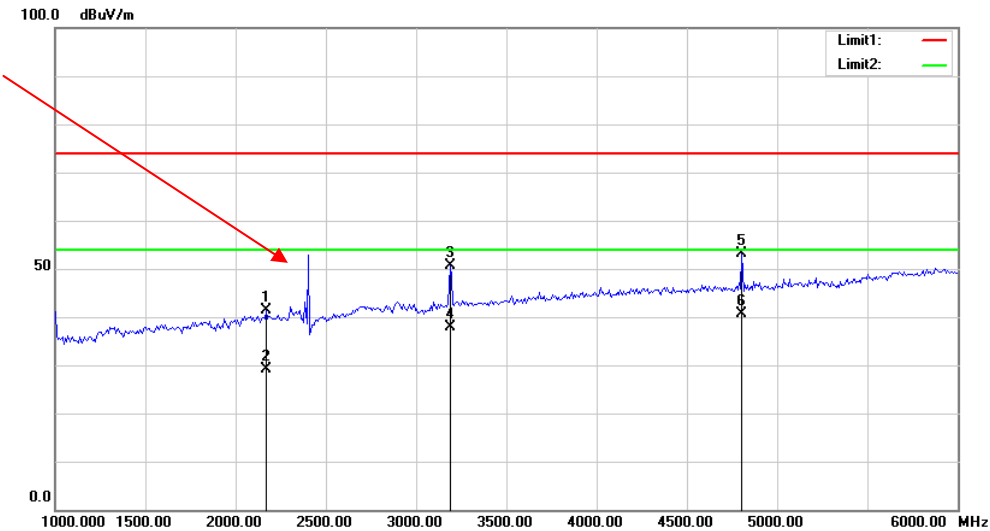
#### Horizontal:

Fundamental  
Test with Band  
Rejection Filter



Vertical

Fundamental  
Test with Band  
Rejection Filter



## 5 - CHANNEL SEPARATION TEST

### Applicable Standard

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

### Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

### Test Data

*Test Mode: Transmitting*

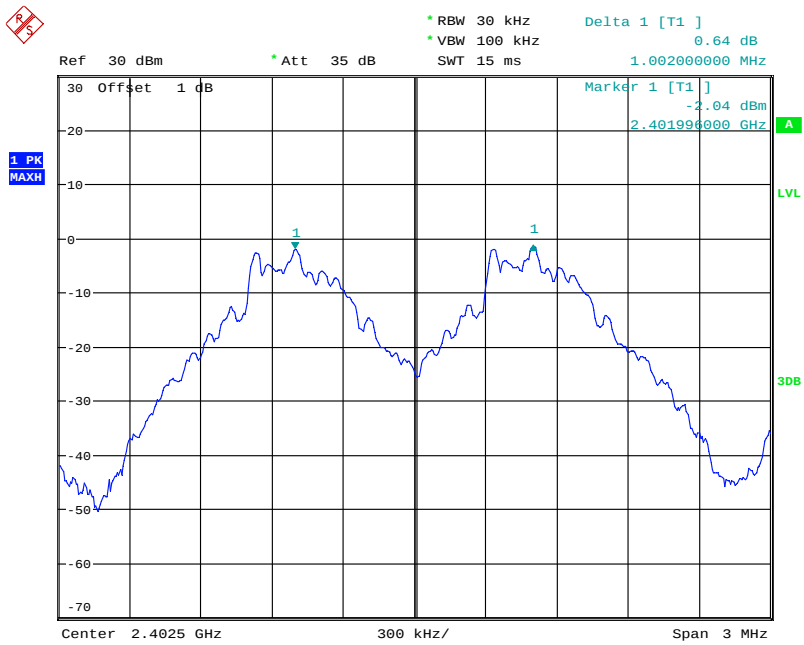
**Test Result:** Compliance. Please refer to following tables and plots.

| Mode                          | Channel | Frequency (MHz) | Channel Separation (MHz) | Limit (MHz) |
|-------------------------------|---------|-----------------|--------------------------|-------------|
| <i>BDR</i><br>( <i>GFSK</i> ) | Low     | 2402            | 1.002                    | 0.61        |
|                               | Middle  | 2441            | 1.002                    | 0.62        |
|                               | High    | 2480            | 0.996                    | 0.62        |
| EDR<br>( $\pi/4$ -DQPSK)      | Low     | 2402            | 1.008                    | 0.81        |
|                               | Middle  | 2441            | 1.002                    | 0.81        |
|                               | High    | 2480            | 1.002                    | 0.81        |
| EDR<br>(8DPSK)                | Low     | 2402            | 0.996                    | 0.80        |
|                               | Middle  | 2441            | 1.002                    | 0.80        |
|                               | High    | 2480            | 1.002                    | 0.80        |

*Note: Limit =  $(2/3) \times 20\text{dB bandwidth}$*

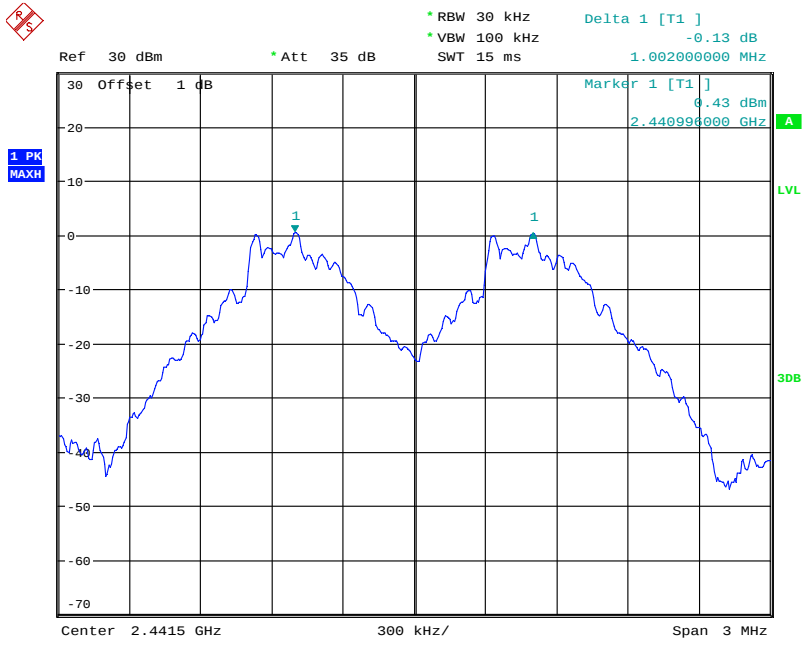
BDR Mode (GFSK):

Low Channel



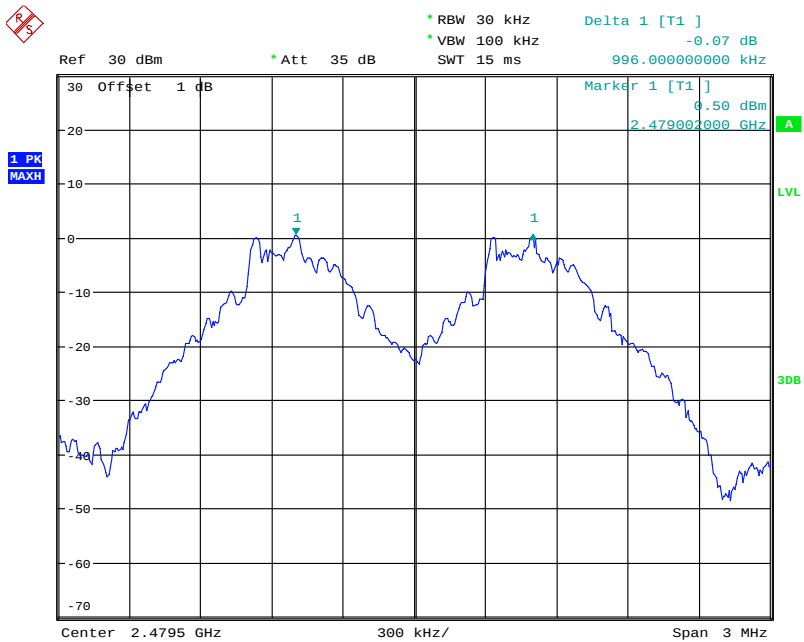
Date: 25.MAY.2021 16:08:21

Middle Channel



Date: 25.MAY.2021 16:09:18

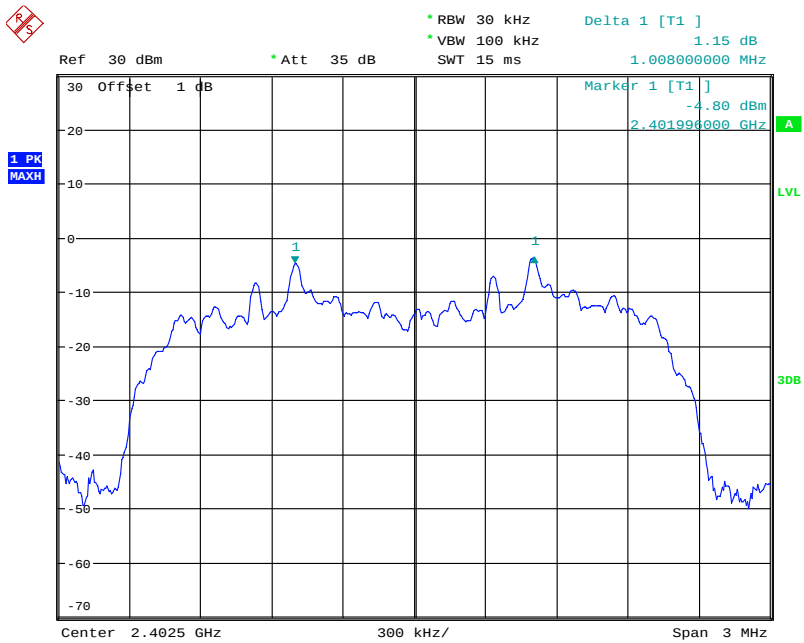
High Channel



Date: 25.MAY.2021 16:10:08

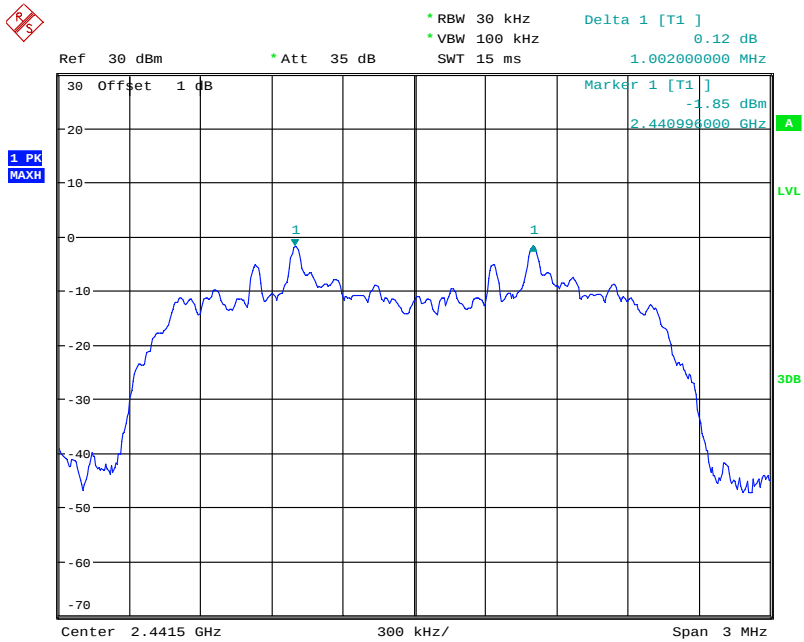
EDR Mode ( $\pi/4$ -DQPSK):

Low Channel



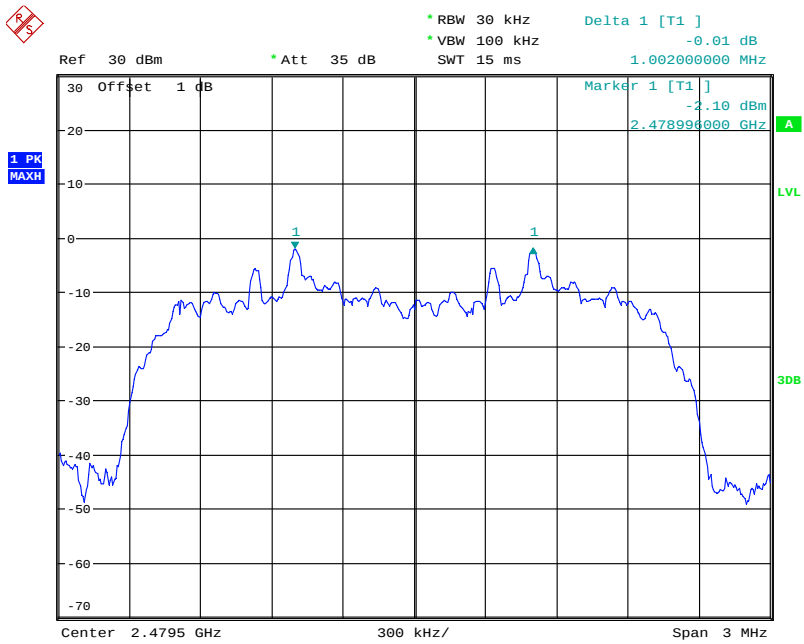
Date: 25.MAY.2021 16:14:05

Middle Channel



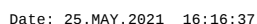
Date: 25.MAY.2021 16:14:53

High Channel



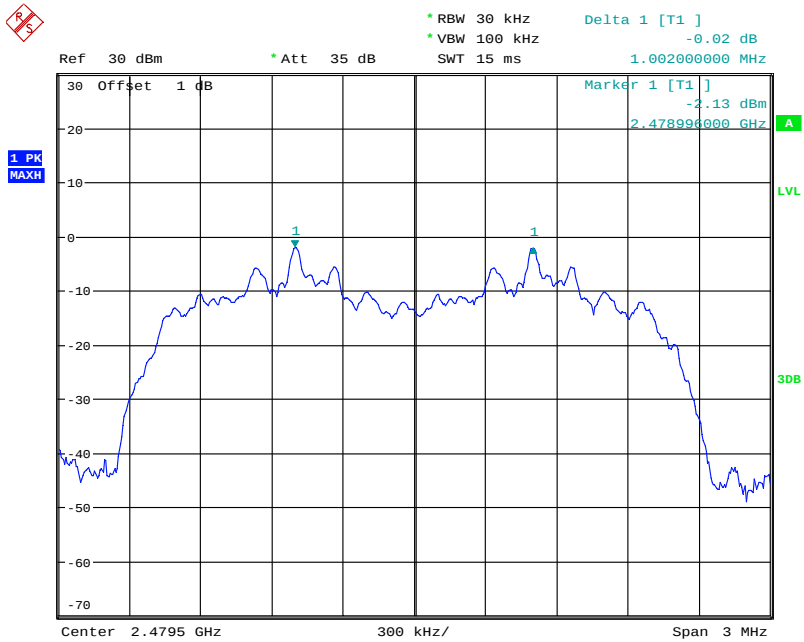
Date: 25.MAY.2021 16:15:37

## Low Channel



Date: 25.MAY.2021 16:17:18

High Channel



Date: 25.MAY.2021 16:18:22

## 6 – 20 dB BANDWIDTH TESTING

### Applicable Standard

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.

### 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 on the test table without connection to measurement instrument. Turn on the EUT. 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.

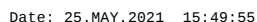
### Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

| Mode                       | Channel | Frequency (MHz) | 20 dB Bandwidth (MHz) |
|----------------------------|---------|-----------------|-----------------------|
| BDR Mode (GFSK)            | Low     | 2402            | 0.916                 |
|                            | Middle  | 2441            | 0.932                 |
|                            | High    | 2480            | 0.928                 |
| EDR Mode ( $\pi/4$ -DQPSK) | Low     | 2402            | 1.212                 |
|                            | Middle  | 2441            | 1.216                 |
|                            | High    | 2480            | 1.216                 |
| EDR Mode (8DPSK)           | Low     | 2402            | 1.200                 |
|                            | Middle  | 2441            | 1.204                 |
|                            | High    | 2480            | 1.204                 |

## Low Channel



1 PK  
MAXH

Ref 30 dBm \* Att 35 dB \* RBW 20 kHz \* VBW 50 kHz Delta 1 [T1 ] -0.47 dB  
SWT 20 ms 932.000000000 kHz

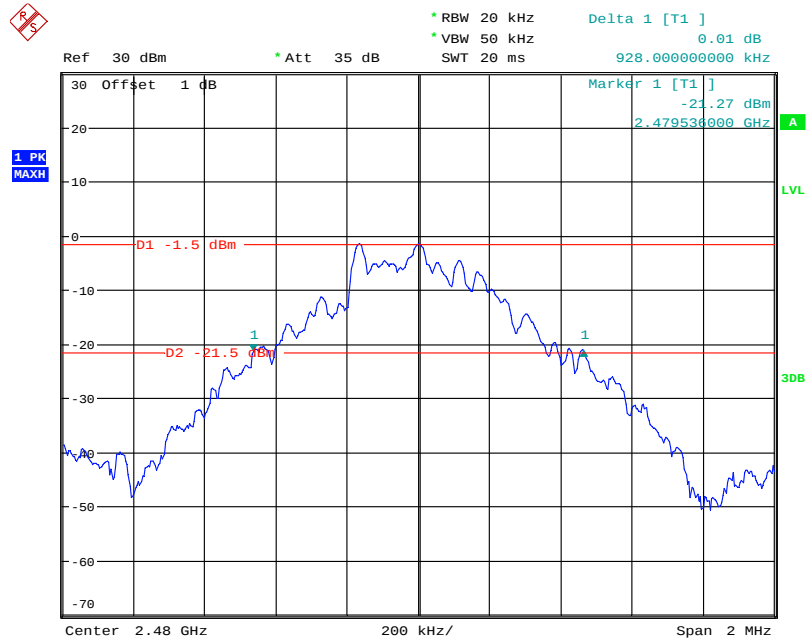
30 Offset 1 dB Marker 1 [T1 ] -21.34 dBm  
2.440536000 GHz

D1 -1.54 dBm D2 -21.54 dBm

Center 2.441 GHz 200 kHz/ Span 2 MHz

Date: 25.MAY.2021 15:51:25

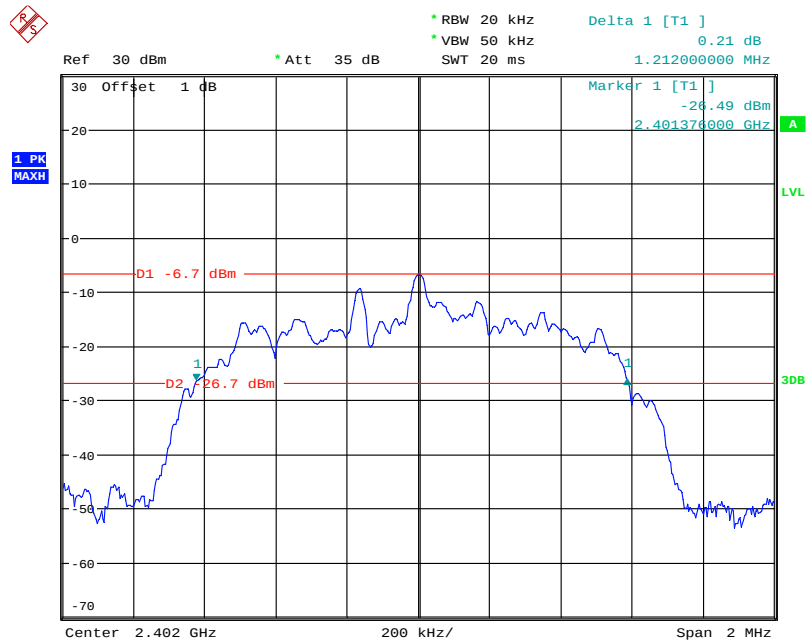
### High Channel



Date: 25.MAY.2021 15:52:31

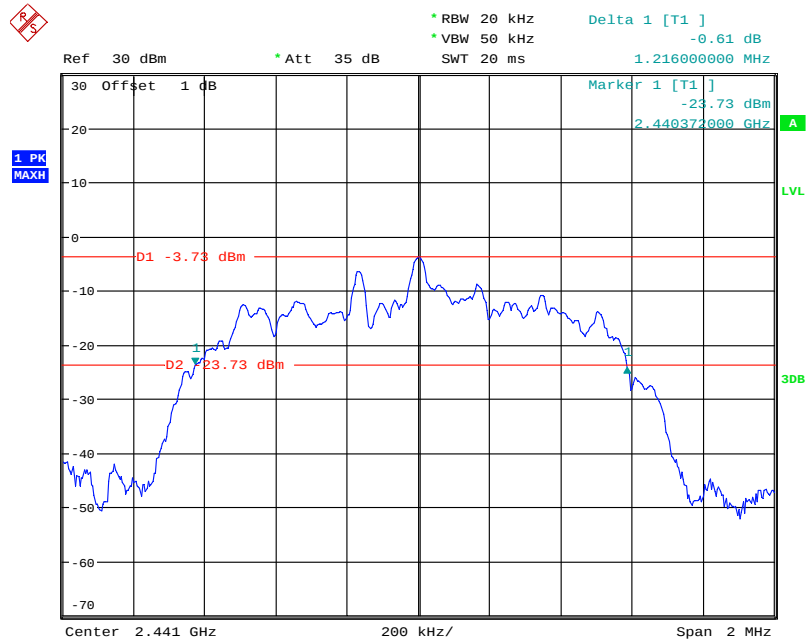
EDR Mode ( $\pi/4$ -DQPSK):

### Low Channel



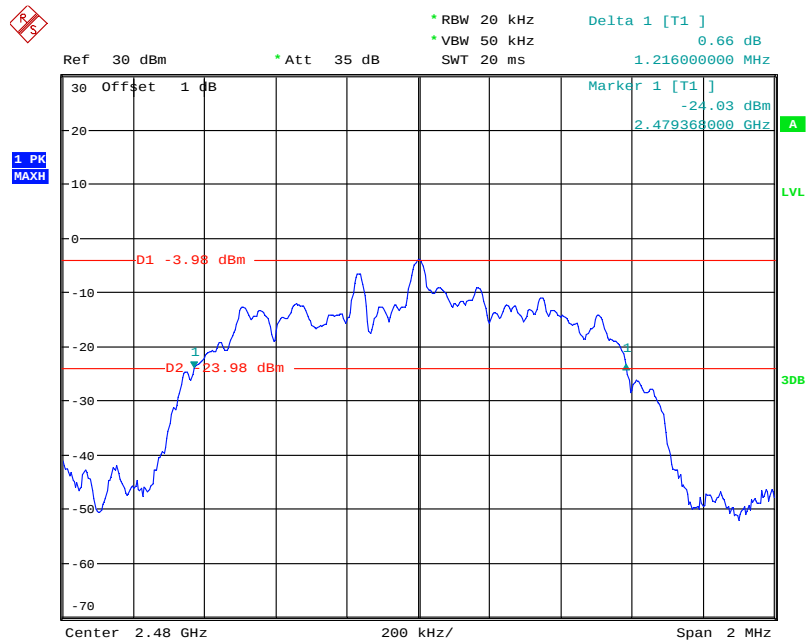
Date: 25.MAY.2021 15:54:38

### Middle Channel



Date: 25.MAY.2021 15:56:10

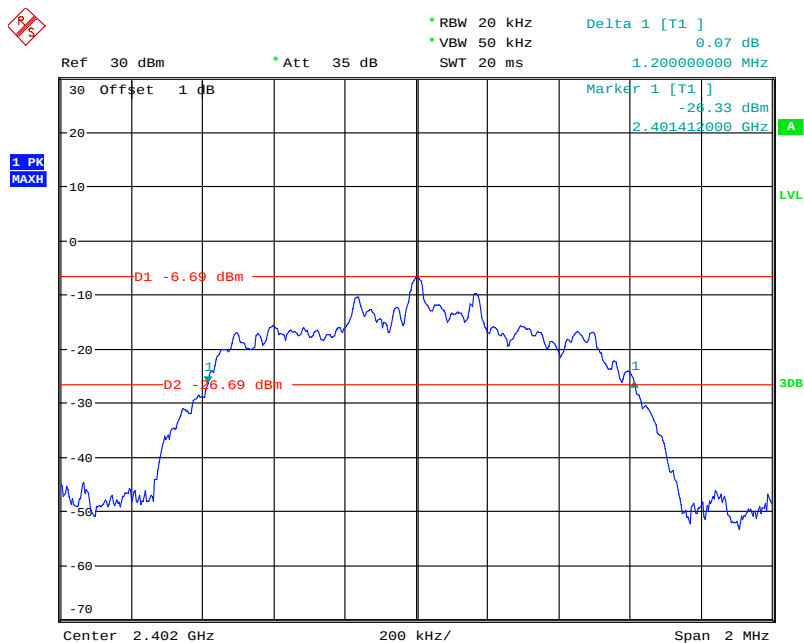
### High Channel



Date: 25.MAY.2021 15:57:29

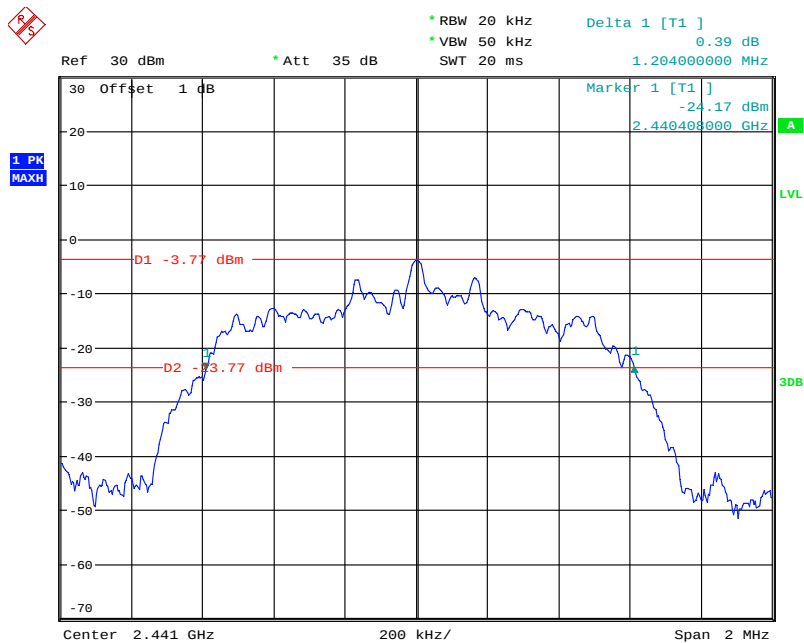
EDR Mode (8DPSK):

### Low Channel



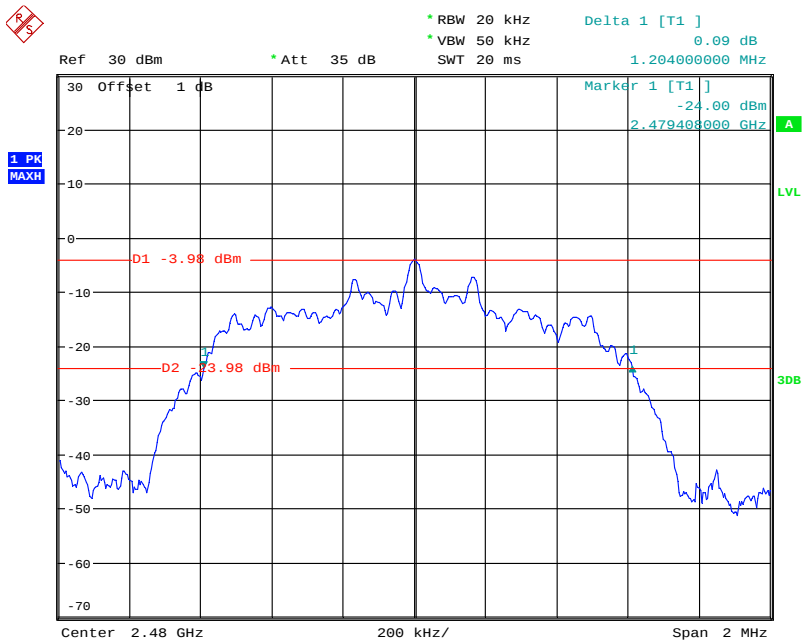
Date: 25.MAY.2021 15:59:00

### Middle Channel



Date: 25.MAY.2021 16:00:08

High Channel



Date: 25.MAY.2021 16:02:11

## 7 - QUANTITY OF HOPPING CHANNEL TEST

### Applicable Standard

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.

### Test Procedure

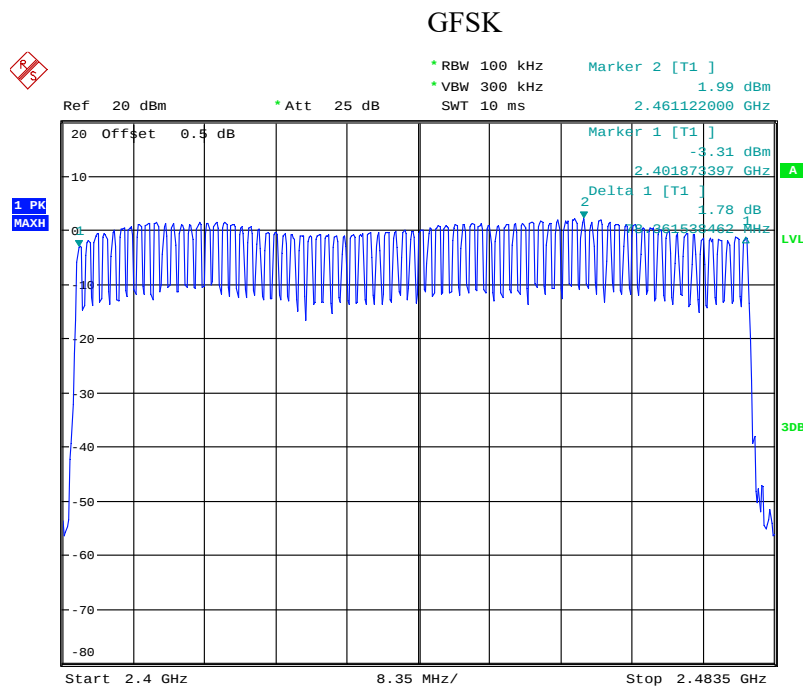
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

### Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

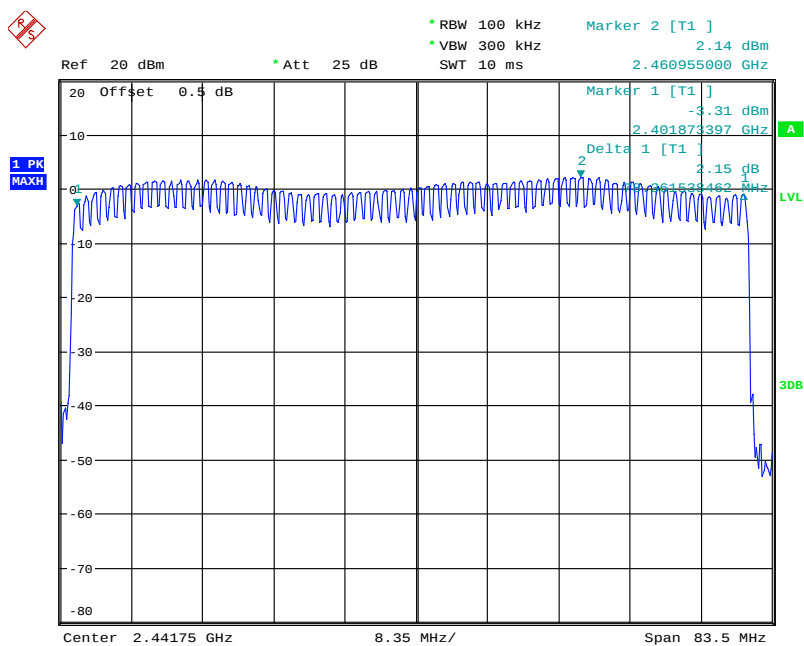
| Test mode      | Frequency Range (MHz) | Number of Hopping Channel | Limit |
|----------------|-----------------------|---------------------------|-------|
| GFSK           | 2400-2483.5           | 79                        | ≥15   |
| $\pi/4$ -DQPSK | 2400-2483.5           | 79                        | ≥15   |
| 8DPSK          | 2400-2483.5           | 79                        | ≥15   |



Date: 26.MAY.2021 16:40:42

[illegible]

8DPSK



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## 8 - TIME OF OCCUPANCY (DWELL TIME)

### Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz 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.

### Test Procedure

The EUT was worked in channel hopping; the time of single pulses was tested.

### Test Data

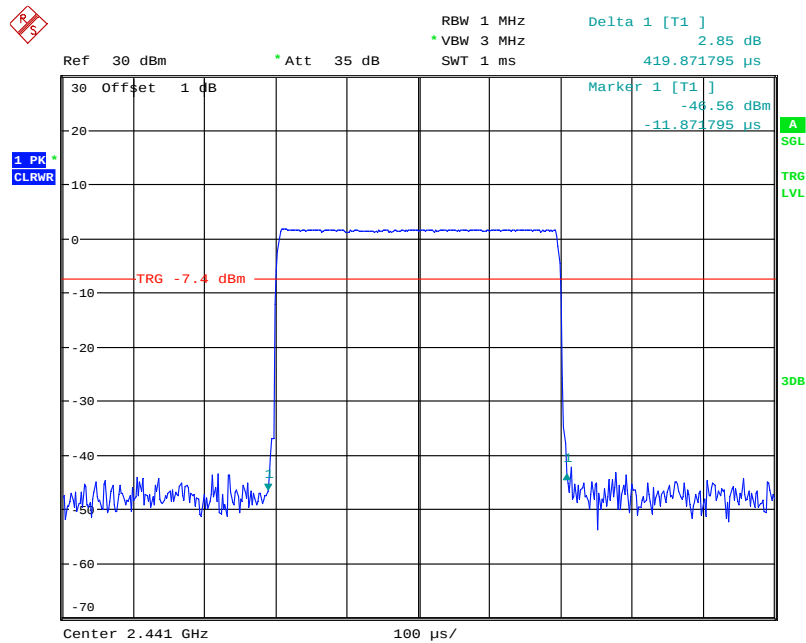
*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

| Mode                                                                                                                                                                                                                       | Packet type | Channel | Frequency (MHz) | Puse width (ms) | Result (s) | Limit (s) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|-----------------|-----------------|------------|-----------|
| GFSK                                                                                                                                                                                                                       | DH1         | Middle  | 2441            | 0.420           | 0.134      | 0.4       |
|                                                                                                                                                                                                                            | DH3         | Middle  | 2441            | 1.705           | 0.273      |           |
|                                                                                                                                                                                                                            | DH5         | Middle  | 2441            | 2.956           | 0.315      |           |
| $\pi/4$ -DQPSK                                                                                                                                                                                                             | 2DH1        | Middle  | 2441            | 0.435           | 0.139      |           |
|                                                                                                                                                                                                                            | 2DH3        | Middle  | 2441            | 1.721           | 0.275      |           |
|                                                                                                                                                                                                                            | 2DH5        | Middle  | 2441            | 2.960           | 0.316      |           |
| 8DPSK                                                                                                                                                                                                                      | 3DH1        | Middle  | 2441            | 0.440           | 0.141      |           |
|                                                                                                                                                                                                                            | 3DH3        | Middle  | 2441            | 1.699           | 0.272      |           |
|                                                                                                                                                                                                                            | 3DH5        | Middle  | 2441            | 2.960           | 0.316      |           |
| Note:<br>DH1:Dwell time=Pulse time (ms) $\times$ (1600/2/79) $\times$ 31.6 s<br>DH3:Dwell time=Pulse time (ms) $\times$ (1600/4/79) $\times$ 31.6 s<br>DH5:Dwell time=Pulse time (ms) $\times$ (1600/6/79) $\times$ 31.6 s |             |         |                 |                 |            |           |

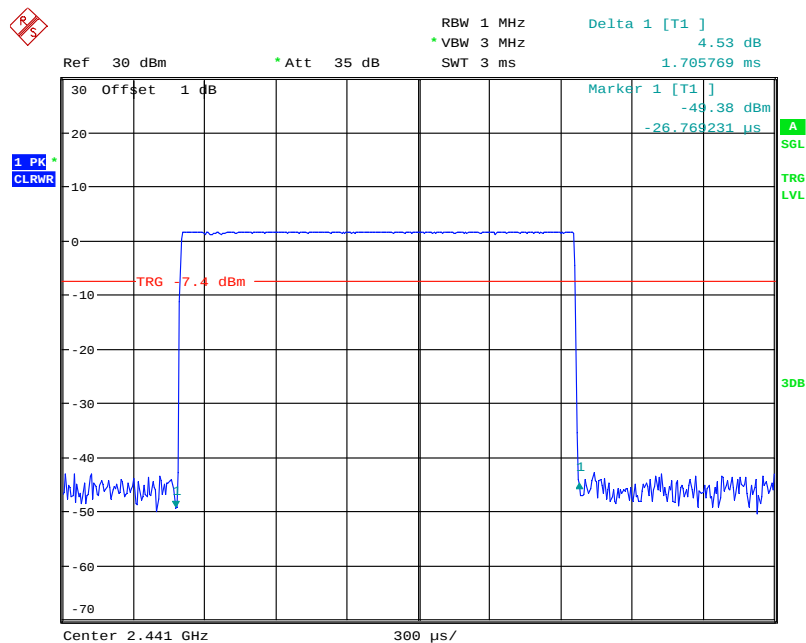
BDR Mode (GFSK):

### DH1: Middle Channel



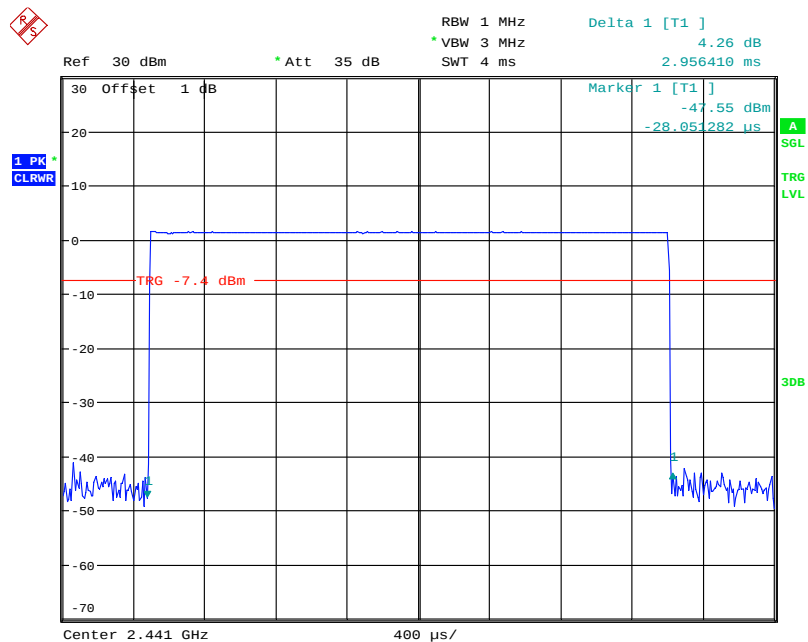
Date: 25.MAY.2021 16:57:12

### DH3: Middle Channel



Date: 25.MAY.2021 17:01:27

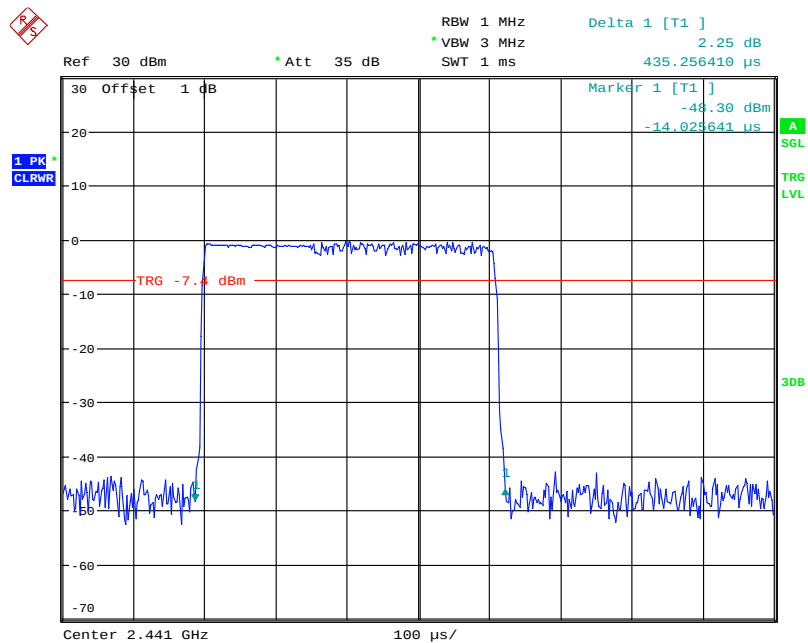
### DH5: Middle Channel



Date: 25.MAY.2021 17:05:24

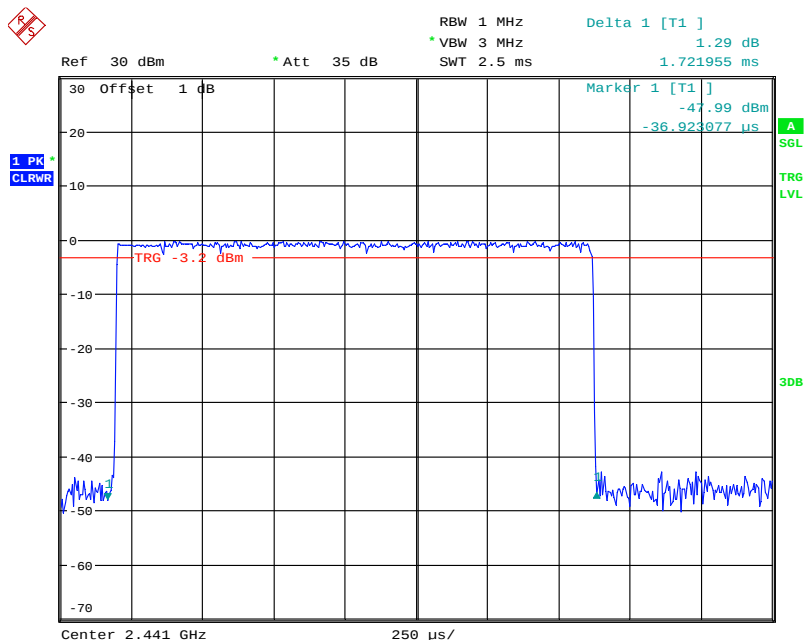
EDR Mode ( $\pi/4$ -DQPSK):

### 2DH1: Middle Channel



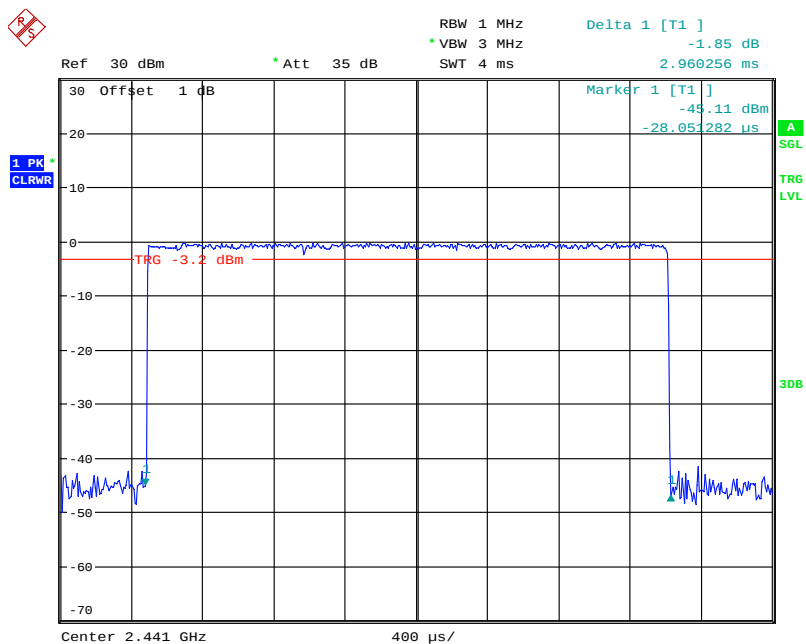
Date: 25.MAY.2021 17:07:58

### 2DH3: Middle Channel



Date: 25.MAY.2021 17:11:59

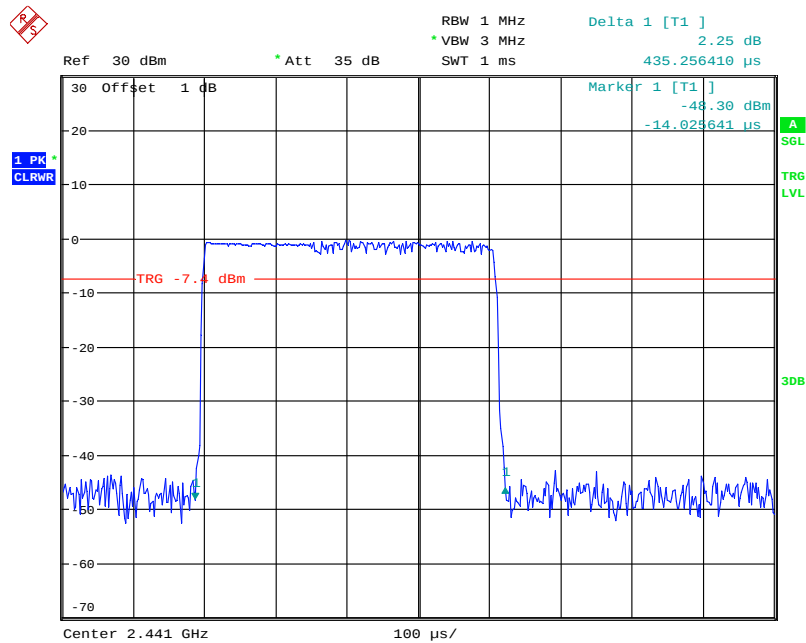
### 2DH5: Middle Channel



Date: 25.MAY.2021 17:20:20

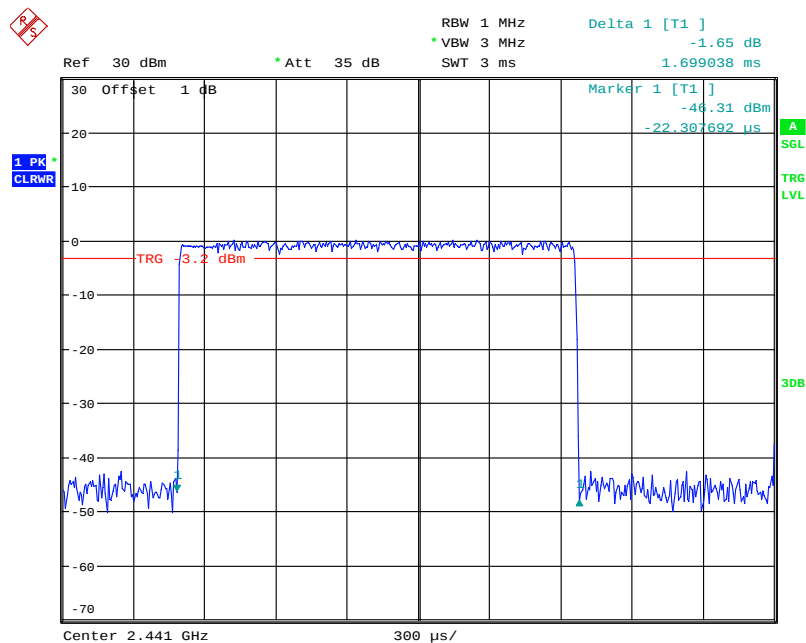
EDR Mode (8DPSK):

### 3DH1: Middle Channel



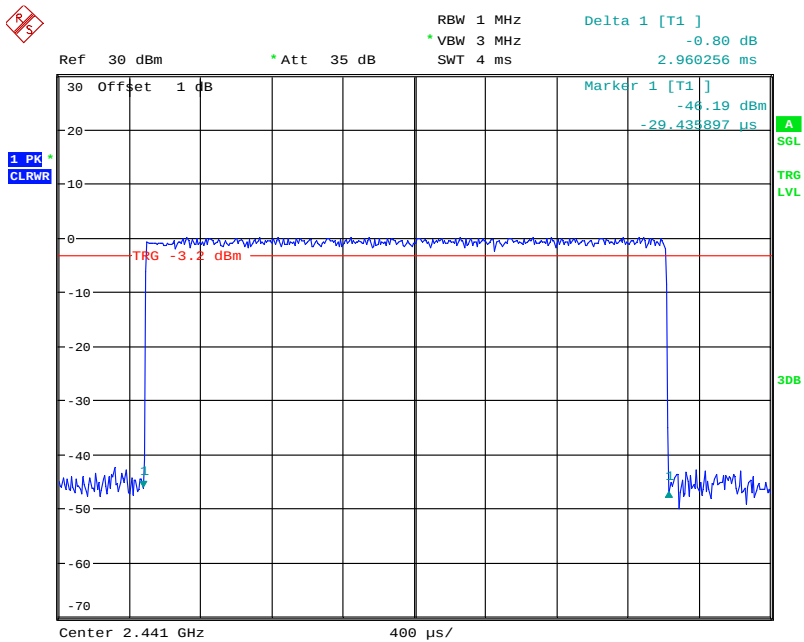
Date: 25.MAY.2021 17:07:58

### 3DH3: Middle Channel



Date: 25.MAY.2021 17:23:38

3DH5: Middle Channel



Date: 25.MAY.2021 17:27:26

## 9 - PEAK OUTPUT POWER MEASUREMENT

### Applicable Standard

According to §15.247(b) (1), for 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

### Test Procedure

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

### Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

| Mode                       | Frequency (MHz) | Peak Conducted Output power (dBm) | Limit (dBm) |
|----------------------------|-----------------|-----------------------------------|-------------|
| BDR Mode (GFSK)            | 2402            | -0.52                             | 21          |
|                            | 2441            | 1.82                              | 21          |
|                            | 2480            | <b>1.94</b>                       | 21          |
| EDR Mode ( $\pi/4$ -DQPSK) | 2402            | -2.48                             | 21          |
|                            | 2441            | 0.42                              | 21          |
|                            | 2480            | 0.17                              | 21          |
| EDR Mode (8DPSK)           | 2402            | -2.02                             | 21          |
|                            | 2441            | 0.82                              | 21          |
|                            | 2480            | 0.69                              | 21          |

## 10 - BAND EDGES TESTING

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### Applicable Standard

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

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW/ VBW of spectrum analyzer to 100/300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

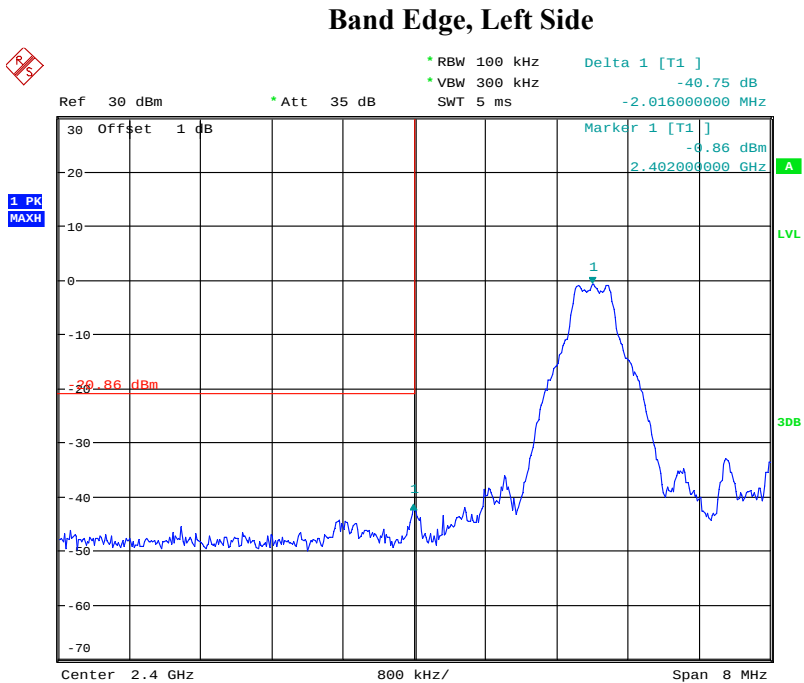
### Test Data

*Test Mode: Transmitting*

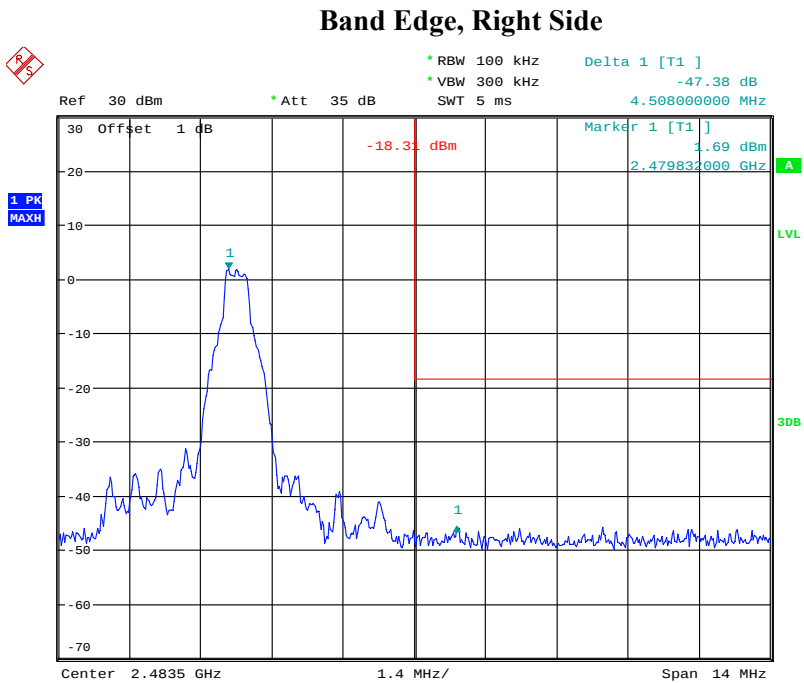
**Test Result:** Compliance. Please refer to following tables and plots.

Single Channel

BDR Mode (GFSK):



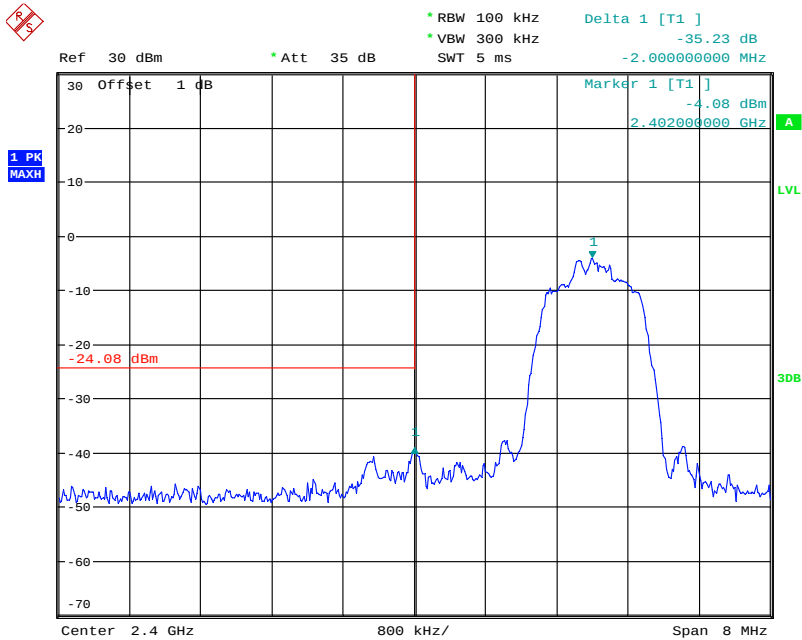
Date: 25.MAY.2021 16:43:39



Date: 25.MAY.2021 15:53:19

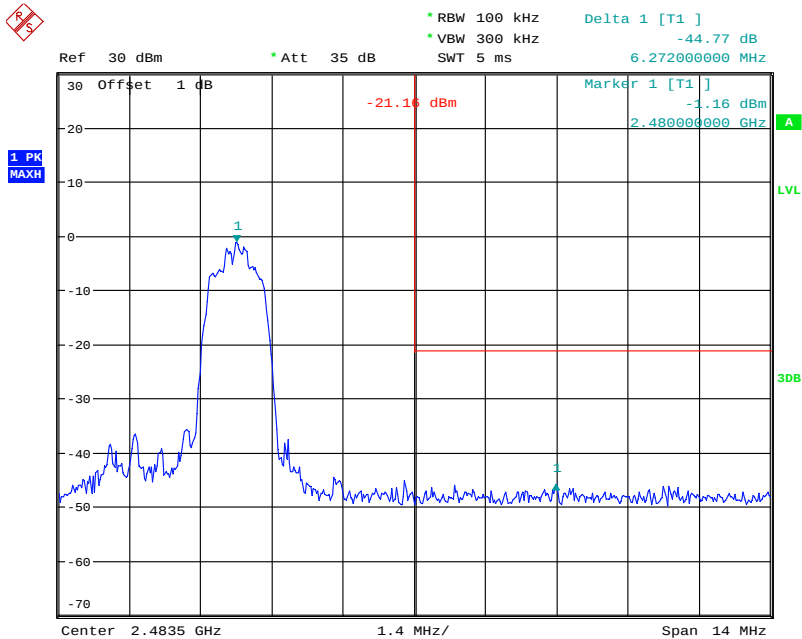
EDR Mode ( $\pi/4$ -DQPSK):

Band Edge, Left Side



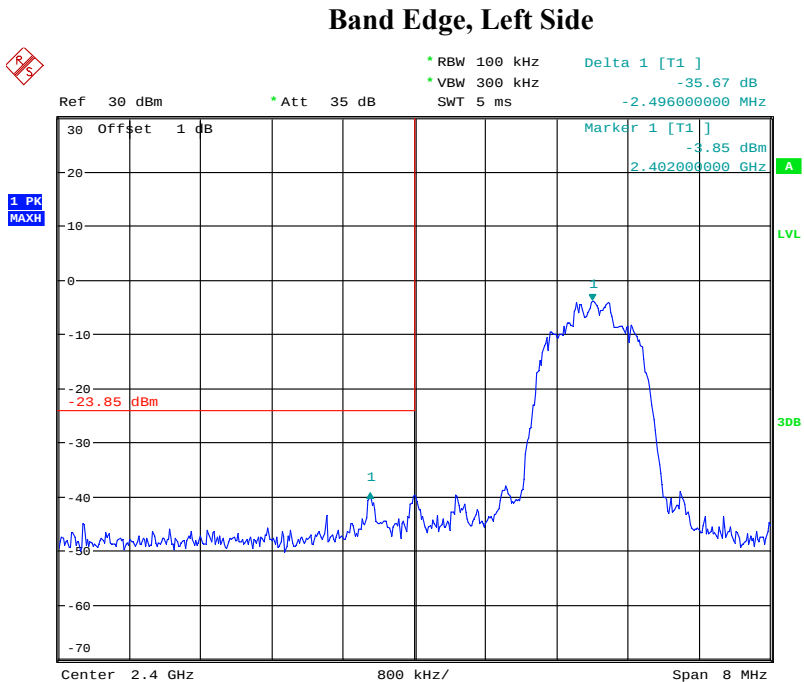
Date: 25.MAY.2021 15:55:25

Band Edge, Right Side

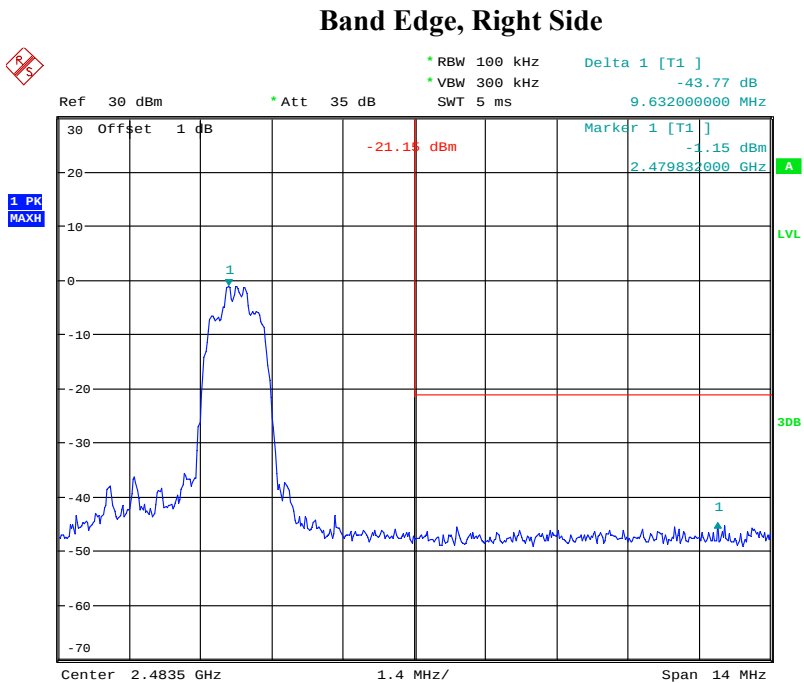


Date: 25.MAY.2021 15:58:16

EDR Mode (8DPSK)



Date: 25.MAY.2021 15:59:43

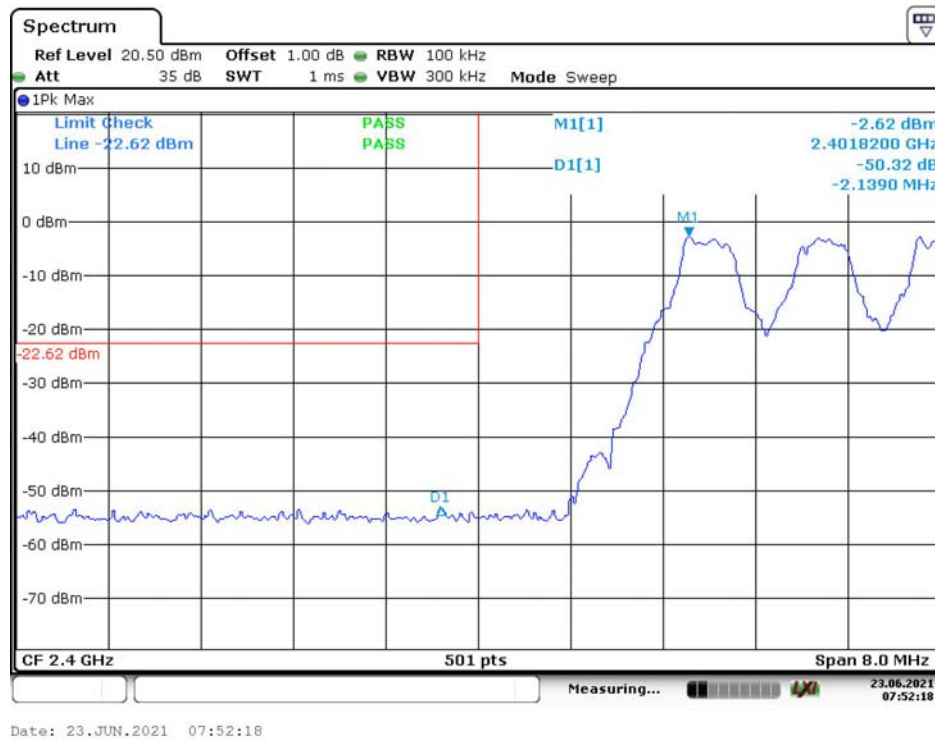


Date: 25.MAY.2021 16:02:49

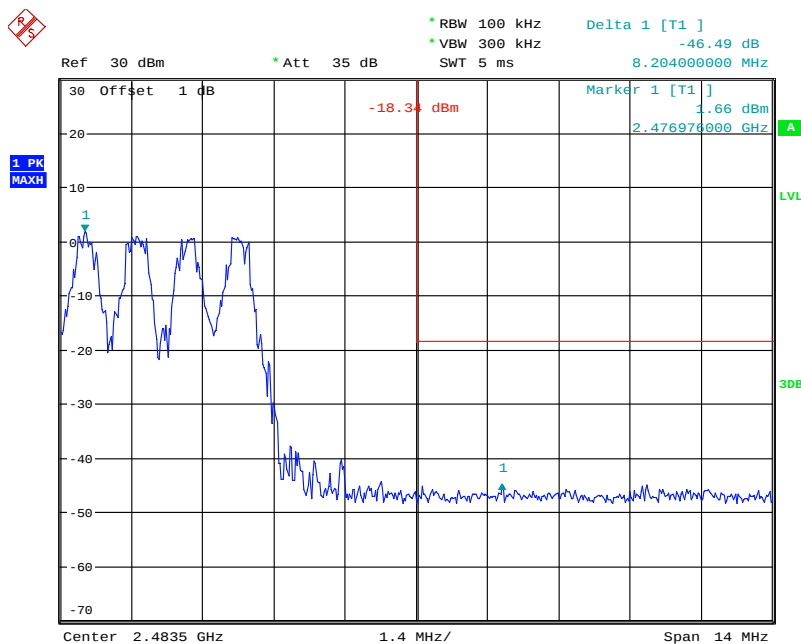
# Hopping Mode

BDR Mode (GFSK):

## Band Edge, Left Side



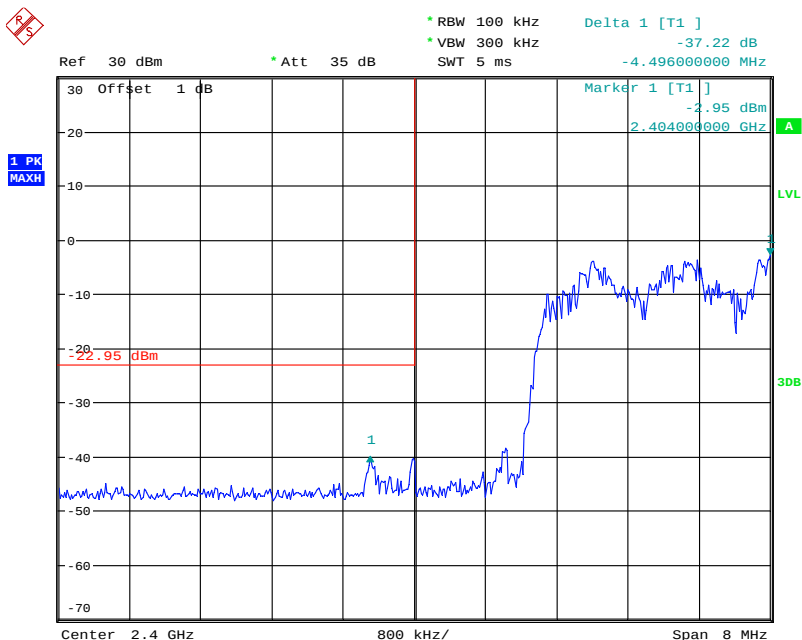
## Band Edge, Right Side



Date: 25.MAY.2021 16:30:23

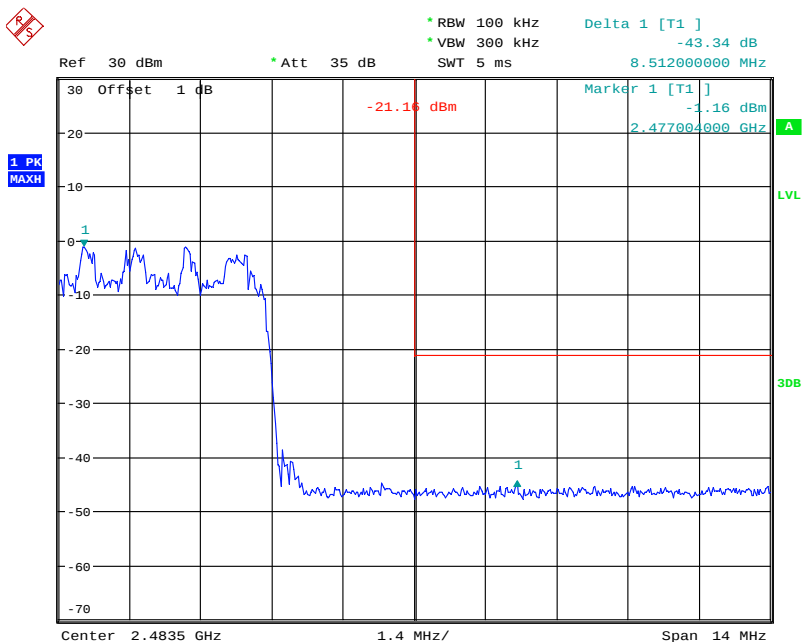
EDR Mode ( $\pi/4$ -DQPSK):

### Band Edge, Left Side



Date: 25.MAY.2021 16:32:38

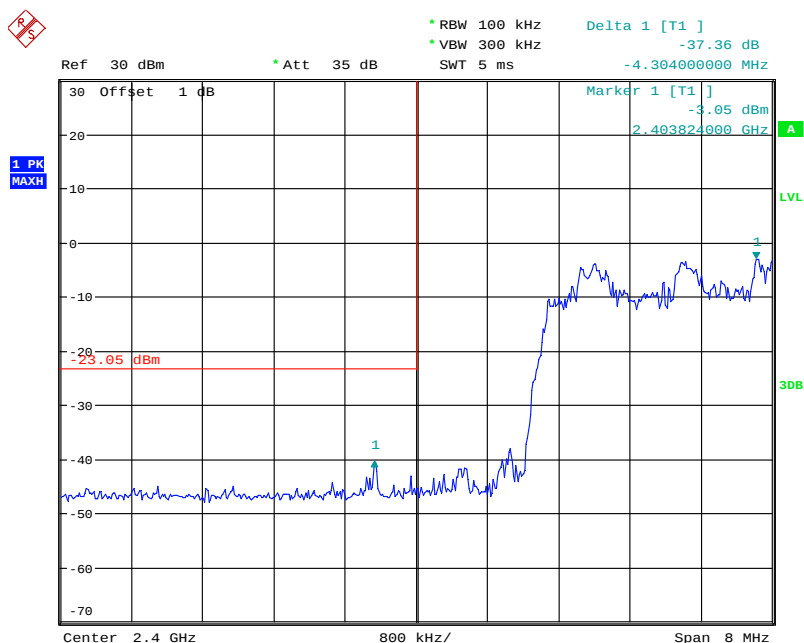
### Band Edge, Right Side



Date: 25.MAY.2021 16:36:50

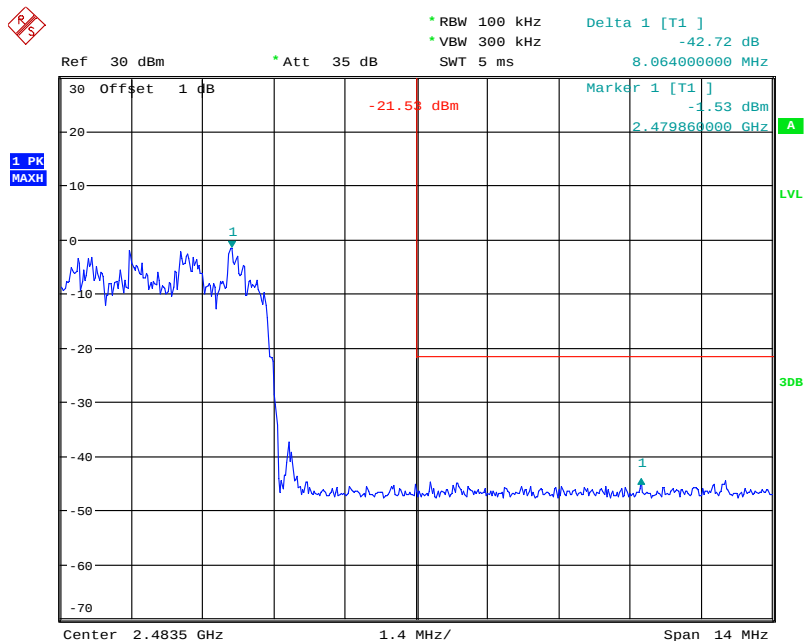
EDR Mode (8DPSK):

### Band Edge, Left Side



Date: 25.MAY.2021 16:39:22

### Band Edge, Right Side



Date: 25.MAY.2021 16:42:18

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