# FCC Part 15.247

# TEST REPORT

For

# Sabine Technologies Co.,Ltd.

**KeShi Bldg ., Information Rd., Haidian District, Beijing, China**

## FCC ID: 2AK54-SABINE-M810

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | SOLO KTV |

**Report Producer :**   Shan Tsai        *Shan Tsai*

**Report Number :**   RXZ190815005-00B

**Report Date :**   2019-08-28

**Reviewed By:**   Jerry Chang        *Jerry J. Chang*

**Prepared By: Bay Area Compliance Laboratories Corp.(Taiwan)**

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# Revision History

| Revision | No. | Report Number | Issue Date | Description | Author/ Revised by |
|---|---|---|---|---|---|
| 1.0 | RXZ190815005 | RXZ190815005-00B | 2019-08-28 | Original Report | Shan Tsai |

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# 1   General Information

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

| | |
|---|---|
| Applicant | Sabine Technologies Co.,Ltd. |
| | KeShi Bldg ., Information Rd., Haidian District, Beijing, China |
| Manufacturer | Sabine Technologies Co.,Ltd. |
| | KeShi Bldg ., Information Rd., Haidian District, Beijing, China |
| Brand(Trade) Name | SABINETEK |
| Product (Equipment) | SOLO KTV |
| Main Model Name | Sabine-M810 |
| Series Model Name | N/A |
| Model Discrepancy | N/A |
| Frequency Range | 2402 ~ 2480 MHz |
| Transmit Power | BR(GFSK) Mode: 9.02 dBm (0.008W) <br> EDR($\pi$/4-DQPSK) Mode: 7.56 dBm (0.0057W) <br> EDR(8DPSK) Mode: 8.01 dBm (0.0063W) |
| 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 | PCB Antenna / 0.5 dBi |
| Power Operation <br> (Voltage Range) | ☐ AC 120V/60Hz <br>     ☐ Adapter <br>     ☐ By AC Power Cord <br>     ☐ PoE |
| | ☒ DC Type <br>     ☒ Battery: 3.7Vdc <br>     ☐ DC Power Supply <br>     ☒ External from USB Cable: 5Vdc <br> ☐ External DC Adapter |
| | ☐ Host System |
| Received Date | Aug 15, 2019 |
| Date of Test | Aug 19, 2019 ~ Aug 26, 2019 |

*All measurement and test data in this report was gathered from production sample serial number: 190815005*

*(Assigned by BACL, Taiwan).*

## 1.2    Objective

This report is prepared on behalf of *Sabine Technologies Co.,Ltd.* 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)

N/A.

## 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.

## 1.5    Test Facility

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

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

☐68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180) and the FCC designation No.TW3180 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.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

# 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 |

## 2.2　Equipment Modifications

No modification was made to the EUT.

## 2.3　EUT Exercise Software

The software was used "CSR 3"

| Test Software | | Bluetooth MP Tool | | |
|---------------|---|-------------------|---|---|
| Test Frequency | | 2402MHz | 2441MHz | 2480MHz |
| Power Level Setting | GFSK | 9 | 9 | 9 |
| | π/4-DQPSK | 9 | 9 | 9 |
| | 8DPSK | 9 | 9 | 9 |

## 2.4　Support Equipment List and Details

| Description | Manufacturer | Model Number | BSMI | FCC ID | S/N |
|-------------|--------------|--------------|------|--------|-----|
| NB | DELL | E6410 | N/A | PD98260NGU | 10912240367 |
| Adapter | ZTE | STC-A51A-Z | N/A | N/A | 1124749435 |

## 2.5　External Cable List and Details

| Cable Description | Length (m) | From | To |
|-------------------|------------|------|-----|
| Micro USB cable | 1 | EUT | Adapter |
| Test Fixture cable | 1 | NB | EUT |

## 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:**

```
┌──────────┐  ┌──────────┐                              ┌──────────┐  ┌──────────┐
│ AC Mains │──│  LISN    │                              │  LISN    │──│ AC Mains │
└──────────┘  └──────────┘                              └──────────┘  └──────────┘
        ┌───────│──────────────────────────────────────────│─────────────────┐   ▲
        │   ┌─────────┐   ┌──────────────┐   ┌──────────┐  ┌─────────┐        │   │
        │   │ Adapter │───│      NB      │───│   EUT    │──│ Adapter │        │   │
        │   └─────────┘   └──────────────┘   └──────────┘  └─────────┘        │ 1.0 Meter
        │                                                                     │   │
        │  Non-Conductive Table 80cm above                                    │   │
        │  Ground Plane                                                       │   ▼
        └─────────────────────────────────────────────────────────────────────┘
        ◄────────────────────────── 1.5 Meter ──────────────────────────────►
```
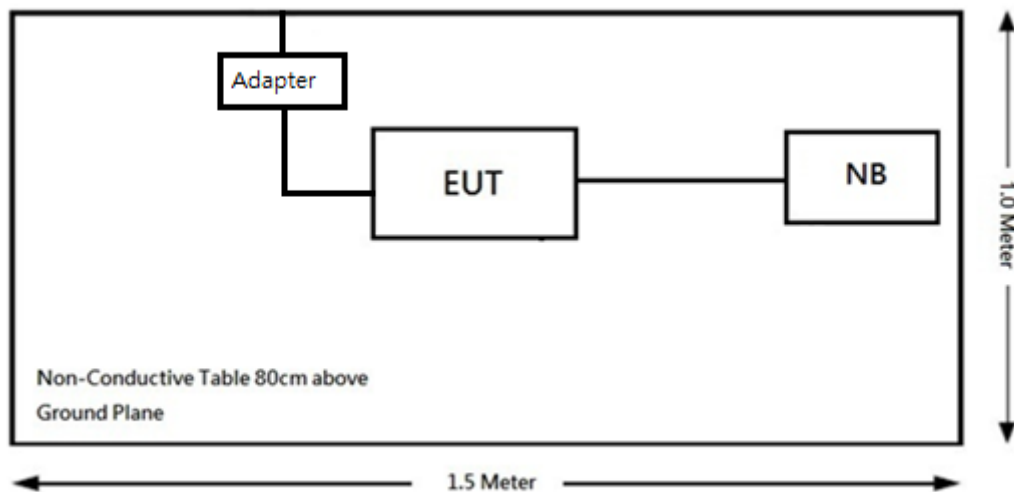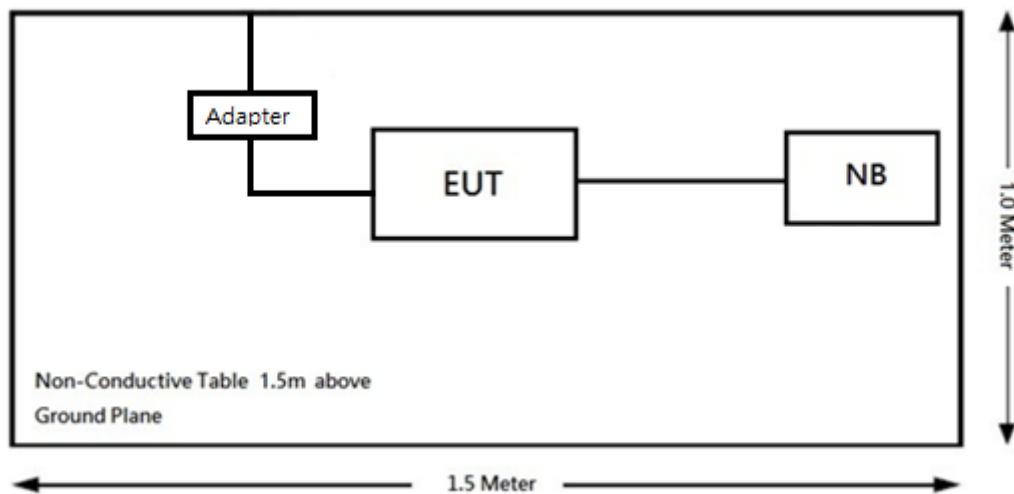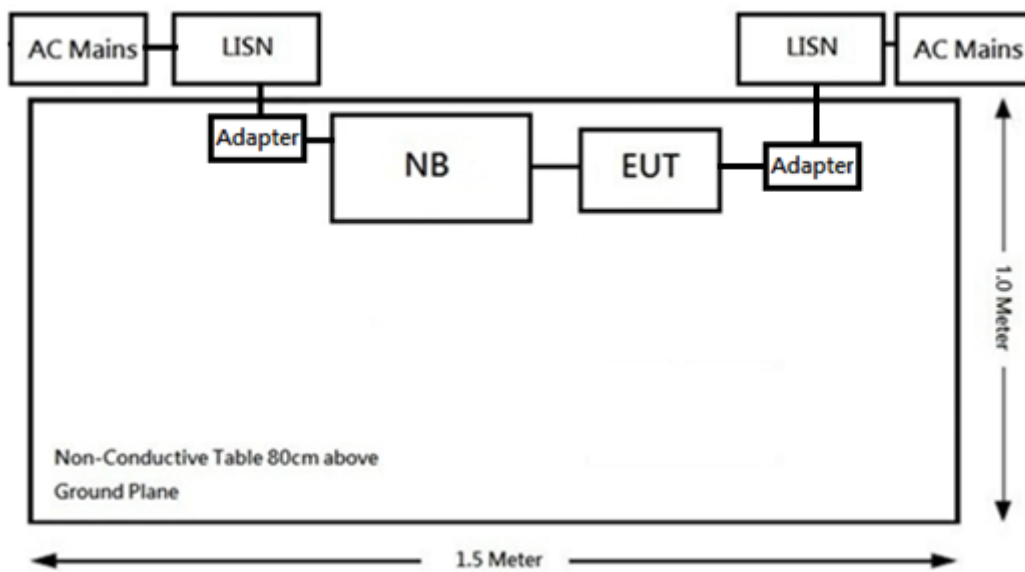
# 3   Summary of Test Results

| FCC Rules | Description of Test | Results |
|---|---|---|
| §15.247(i), § 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)(3) | 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 | 2019/02/21 | 2020/02/20 |
| LISN | Rohde & Schwarz | ENV216 | 101248 | 2019/06/26 | 2020/06/25 |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101419 | 2018/10/23 | 2019/10/22 |
| Pulse Limiter | Rohde & Schwarz | ESH3Z2 | TXZEM104 | 2019/08/02 | 2020/08/01 |
| RF Cable | EMEC | EM-CB5D | 001 | 2019/07/01 | 2020/06/30 |
| Software | AUDIX | E3 | V9.150826k | N.C.R | N.C.R |
| Radiated Room (966-A) | | | | | |
| Bilog Antenna with 6 dB Attenuator | SUNOL SCIENCES & MINI-CIRCUITS | JB6/UNAT-6+ | A050115/15542_01 | 2018/12/11 | 2019/12/10 |
| Horn Antenna | EMCO | SAS-571 | 1020 | 2019/04/17 | 2020/04/16 |
| Horn Antenna | ETS-Lindgren | 3116 | 62638 | 2018/08/29 | 2019/08/28 |
| Preamplifier | Sonoma | 310N | 130602 | 2019/06/26 | 2020/06/25 |
| Preamplifier | EM Electronics Corp. | EM01G18G | 060657 | 2018/12/07 | 2019/12/06 |
| Microware Preamplifier | EM Electronics Corporation | EM18G40G | 060656 | 2019/01/11 | 2020/01/10 |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101419 | 2018/10/23 | 2019/10/22 |
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101435 | 2019/02/13 | 2020/02/12 |
| Micro flex Cable | UTIFLEX | UFB197C-1-2362-70U-70U | 225757-001 | 2019/07/01 | 2020/06/30 |
| Micro flex Cable | UTIFLEX | UFA210A-1-3149-300300 | MFR64639 226389-001 | 2019/07/01 | 2020/06/30 |
| Micro flex Cable | UTIFLEX | FSCM 64639 / (2M) | 93D0127 | 2019/07/01 | 2020/06/30 |
| Microflex Cable | Woken | SFL402-100CM | S02-160323-039 | 2019/07/01 | 2020/06/30 |
| Micro flex Cable | ROSNOL | K1K50-UP0264-K1K50-450CM | 160309-1 | 2019/03/04 | 2020/03/03 |
| Micro flex Cable | ROSNOL | K1K50-UP0264-K1K50-80CM | 160309-2 | 2019/01/16 | 2020/01/15 |
| Turn Table | Champro | TT-2000 | 060772-T | N.C.R | N.C.R |
| Antenna Tower | Champro | AM-BS-4500-B | 060772-A | N.C.R | N.C.R |
| Controller | Champro | EM1000 | 60772 | N.C.R | N.C.R |

| Software | Farad | EZ_EMC | BACL-03A1 | N.C.R | N.C.R |
|---|---|---|---|---|---|
| NSA | BACL | 966-A | N/A | 2019/07/08 | 2020/07/07 |
| VSWR | BACL | 966-A | N/A | 2019/07/15 | 2020/07/14 |
| Conducted Room | | | | | |
| Spectrum Analyzer | Rohde & Schwarz | FSU26 | 200268 | 2019/05/10 | 2020/05/09 |
| Cable | WOKEN | SFL402 | S02-160323-07 | 2019/02/11 | 2020/02/10 |
| Attenuator | MINI-CIRCUITS | BW-S10W5+ | N/A | 2019/03/07 | 2020/03/07 |
| Power Sensor | KEYSIGHT | U2021XA | MY54080018 | 2019/03/06 | 2020/03/05 |

*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), § 2.1093 - RF Exposure

## 5.1 Applicable Standard

According to FCC §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 ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·

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

1. f(GHz) is the RF channel transmit frequency in GHz.

2. Power and distance are rounded to the nearest mW and mm before calculation.

3. The result is rounded to one decimal place for comparison.

4. 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 ≤ 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 4.1 f) is applied to determine SAR test exclusion.

## 5.2 RF Exposure Evaluation Result

| Frequency (MHz) | Tune-up Power | | Evaluation Distance (mm) | SAR Exclusion Result | SAR Exclusion Limit (1g SAR) |
|---|---|---|---|---|---|
| | (dBm) | (mW) | | | |
| 2402-2480 | 9.5 | 8.913 | 5 | 2.8 | 3 |

**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 | Type | Antenna Gain | Result |
|---|---|---|---|
| Beijing Sabine Technology CO.,LTD. | PCB Antenna | 0.5 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 µH/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 (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Quasi-Peak | Average |
| 0.15-0.5 | 66 to 56 [Note 1] | 56 to 46 [Note 2] |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Note 1: Decreases with the logarithm of the frequency.*
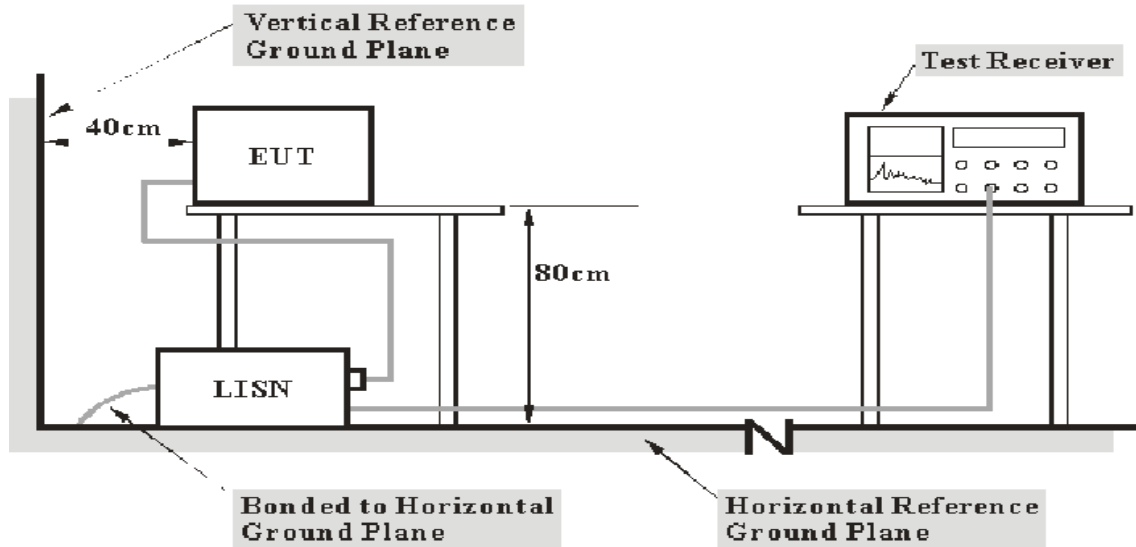*Note 2: A linear average detector is required*

## 7.2    Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Taiwan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

| Port | Expanded Measurement uncertainty |
|---|---|
| AC Mains | 2.71 dB (k=2, 95% level of confidence) |

## 7.3 EUT Setup



Vertical Reference Ground Plane

40cm

EUT

Test Receiver

80cm

LISN

Bonded to Horizontal Ground Plane

Horizontal Reference Ground Plane

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.

## 7.4 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 |

## 7.5 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.

## 7.6   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:

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

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:

$$Over\ Limit = Level - Limit\ Line$$

## 7.7   Environmental Conditions

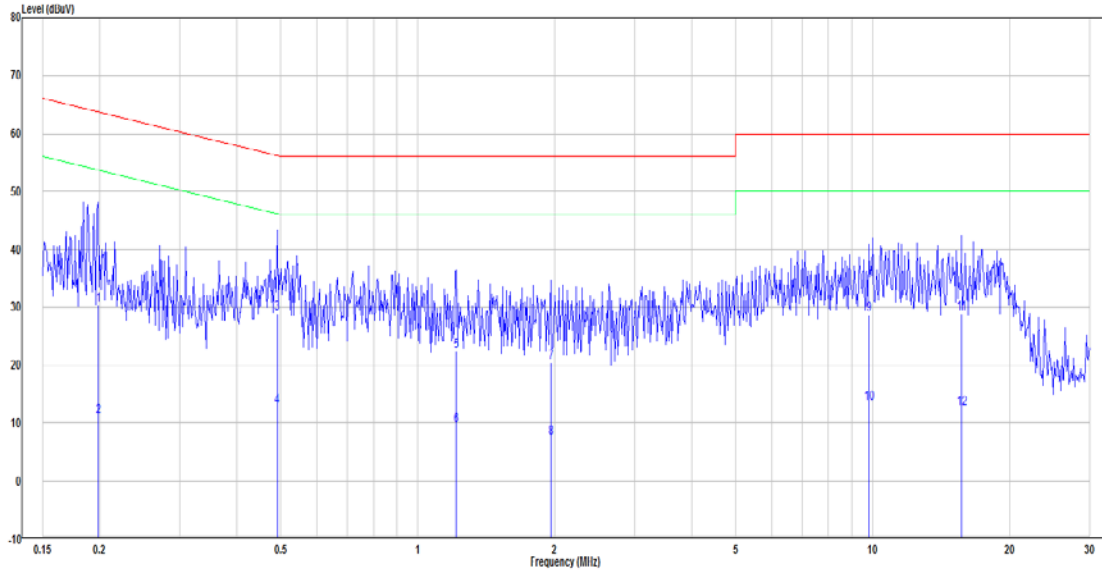| | |
|---|---|
| **Temperature:** | 24 ℃ |
| **Relative Humidity:** | 55 % |
| **ATM Pressure:** | 1010 hPa |

*The testing was performed by Woods Chen on 2019-08-21*

### 7.8    Test Results

*Test Mode: Transmitting*

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



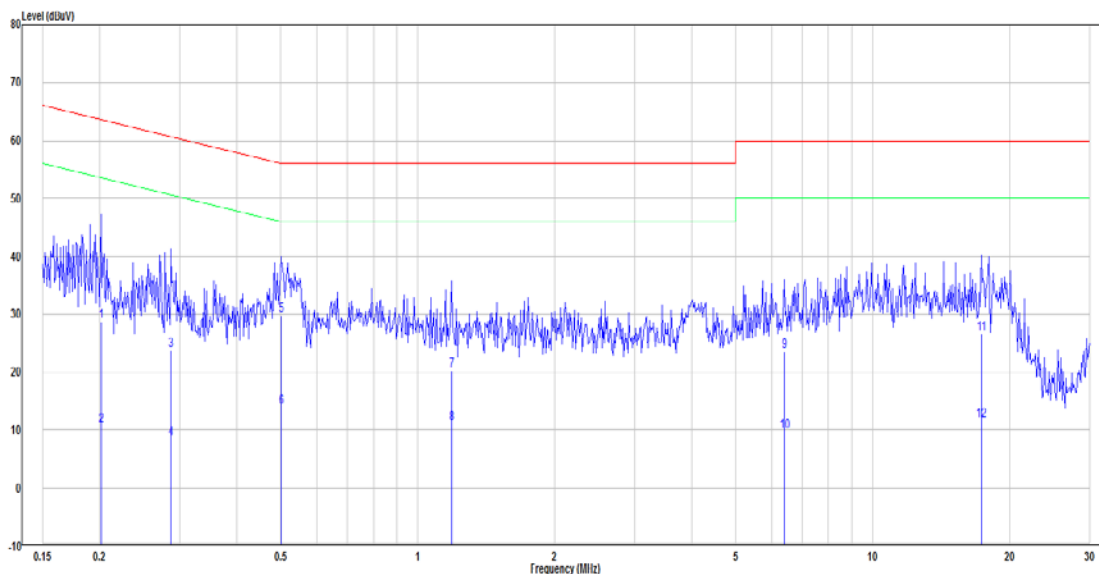| No. | Frequency | Reading | Correct | Result | Limit | Over limit | Remark |
|-----|-----------|---------|---------|--------|-------|-----------|--------|
|     | (MHz)     | (dBµV)  | Factor(dB) | (dBµV) | (dBµV) | (dB)     |        |
| 1   | 0.198     | 20.77   | 9.59    | 30.36  | 63.68 | -33.32    | QP      |
| 2   | 0.198     | 1.61    | 9.59    | 11.2   | 53.68 | -42.48    | Average |
| 3   | 0.491     | 19.34   | 9.60    | 28.94  | 56.15 | -27.21    | QP      |
| 4   | 0.491     | 3.30    | 9.60    | 12.9   | 46.15 | -33.25    | Average |
| 5   | 1.217     | 12.82   | 9.64    | 22.46  | 56.00 | -33.54    | QP      |
| 6   | 1.217     | -0.13   | 9.64    | 9.51   | 46.00 | -36.49    | Average |
| 7   | 1.964     | 10.76   | 9.66    | 20.42  | 56.00 | -35.58    | QP      |
| 8   | 1.964     | -2.18   | 9.66    | 7.48   | 46.00 | -38.52    | Average |
| 9   | 9.823     | 18.99   | 9.82    | 28.81  | 60.00 | -31.19    | QP      |
| 10  | 9.823     | 3.66    | 9.82    | 13.48  | 50.00 | -36.52    | Average |
| 11  | 15.693    | 19.03   | 9.86    | 28.89  | 60.00 | -31.11    | QP      |
| 12  | 15.693    | 2.66    | 9.86    | 12.52  | 50.00 | -37.48    | Average |

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

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

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



| No. | Frequency | Reading | Correct | Result | Limit | Over limit | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBµV) | Factor(dB) | (dBµV) | (dBµV) | (dB) | |
| 1 | 0.201 | 19.19 | 9.59 | 28.78 | 63.56 | -34.78 | QP |
| 2 | 0.201 | 1.27 | 9.59 | 10.86 | 53.56 | -42.7 | Average |
| 3 | 0.287 | 14.22 | 9.59 | 23.81 | 60.62 | -36.81 | QP |
| 4 | 0.287 | -1.09 | 9.59 | 8.5 | 50.62 | -42.12 | Average |
| 5 | 0.501 | 20.16 | 9.60 | 29.76 | 56.00 | -26.24 | QP |
| 6 | 0.501 | 4.30 | 9.60 | 13.9 | 46.00 | -32.1 | Average |
| 7 | 1.187 | 10.71 | 9.63 | 20.34 | 56.00 | -35.66 | QP |
| 8 | 1.187 | 1.45 | 9.63 | 11.08 | 46.00 | -34.92 | Average |
| 9 | 6.398 | 13.84 | 9.78 | 23.62 | 60.00 | -36.38 | QP |
| 10 | 6.398 | -0.02 | 9.78 | 9.76 | 50.00 | -40.24 | Average |
| 11 | 17.338 | 16.64 | 9.93 | 26.57 | 60.00 | -33.43 | QP |
| 12 | 17.338 | 1.73 | 9.93 | 11.66 | 50.00 | -38.34 | Average |

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

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

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

## 8.1   Applicable Standard

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

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

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 – 0.110<br>0.495 – 0.505<br>2.1735 – 2.1905<br>4.125 – 4.128<br>4.17725 – 4.17775<br>4.20725 – 4.20775<br>6.215 – 6.218<br>6.26775 – 6.26825<br>6.31175 – 6.31225<br>8.291 – 8.294<br>8.362 – 8.366<br>8.37625 – 8.38675<br>8.41425 – 8.41475<br>12.29 – 12.293<br>12.51975 – 12.52025<br>12.57675 – 12.57725<br>13.36 – 13.41 | 16.42 – 16.423<br>16.69475 – 16.69525<br>25.5 – 25.67<br>37.5 – 38.25<br>73 –   74.6<br>74.8 –   75.2<br>108 – 121.94<br>123 – 138<br>149.9 –   150.05<br>156.52475 – 156.52525<br>156.7 – 156.9<br>162.0125 –167.17<br>167.72 – 173.2<br>240 – 285<br>322 – 335.4<br>399.9 – 410<br>608 –   614 | 960 – 1240<br>1300 –   1427<br>1435 – 1626.5<br>1645.5 – 1646.5<br>1660 – 1710<br>1718.8 – 1722.2<br>2200 – 2300<br>2310 – 2390<br>2483.5 – 2500<br>2690 – 2900<br>3260 –   3267<br>3.332 – 3.339<br>3 3458 – 3 358<br>3.600 – 4.400 | 4. 5 – 5. 15<br>5. 35 – 5. 46<br>7.25 –   7.75<br>8.025 – 8.5<br>9.0 –   9.2<br>9.3 –   9.5<br>10.6 –   12.7<br>13.25 – 13.4<br>14.47 – 14.5<br>15.35 – 16.2<br>17.7 – 21.4<br>22.01 – 23.12<br>23.6 – 24.0<br>31.2 – 31.8<br>36.43 – 36.5<br>Above 38.6 |

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

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

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

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

## 8.2   Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.
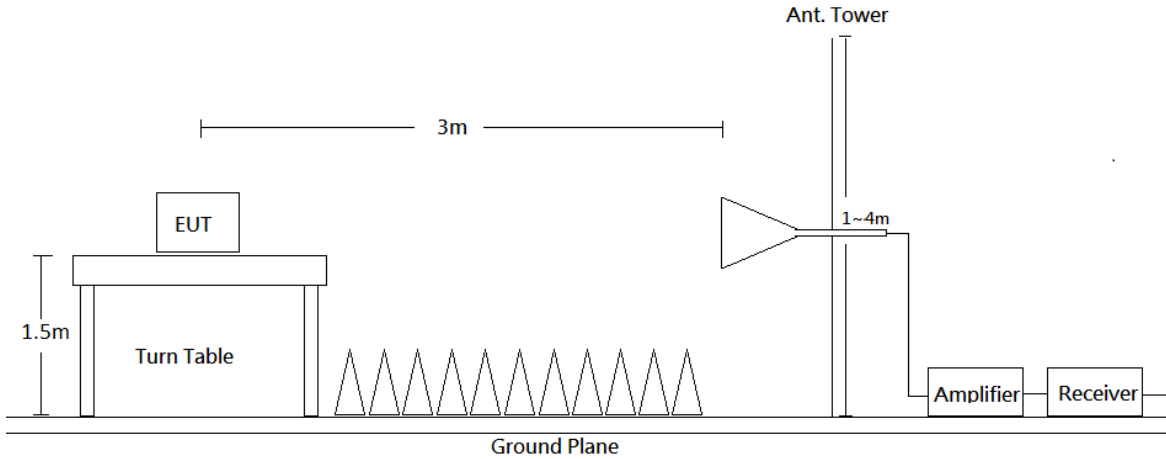
| Frequency | Measurement uncertainty |
|---|---|
| 30 MHz~200 MHz | 3.75 dB (k=2, 95% level of confidence) |
| 200 MHz~1 GHz | 4.21 dB (k=2, 95% level of confidence) |
| 1 GHz~6 GHz | 4.83 dB (k=2, 95% level of confidence) |
| 6 GHz~18 GHz | 5.18 dB (k=2, 95% level of confidence) |
| 18 GHz~26 GHz | 4.55 dB (k=2, 95% level of confidence) |
| 26 GHz~40 GHz | 4.67 dB (k=2, 95% level of confidence) |

## 8.3    EUT Setup

Below 1 GHz:
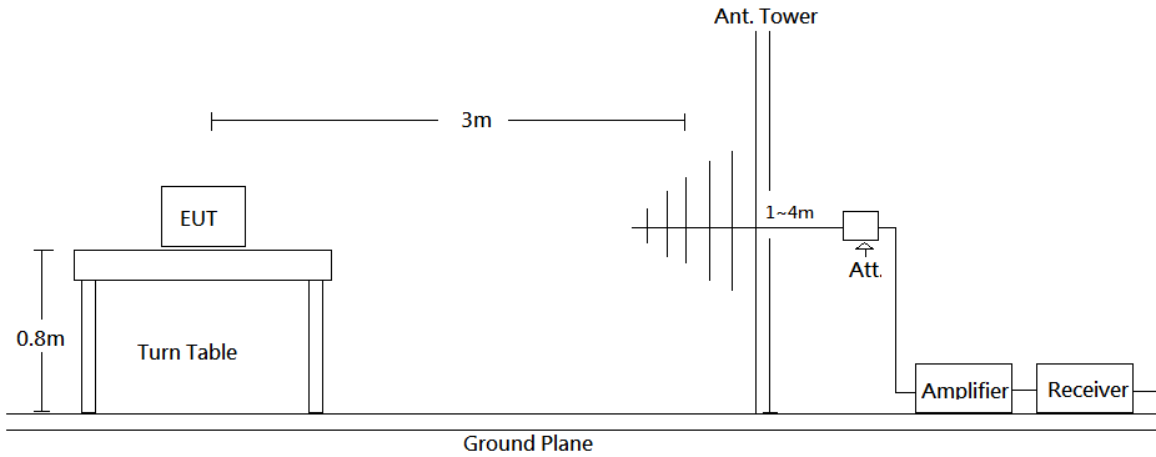


Above 1 GHz:



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.

## 8.4    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 |

## 8.5    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.

## 8.6    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:

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

## 8.7    Test Results Summary

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

## 8.8    Environmental Conditions

| Radiation | | Conducted | |
|---|---|---|---|
| **Temperature:** | 20~25.3 ℃ | **Temperature:** | 25.3 ℃ |
| **Relative Humidity:** | 53~62 % | **Relative Humidity:** | 62 % |
| **ATM Pressure:** | 1010 hPa | **ATM Pressure:** | 1010 hPa |

*The Radiation Spurious Emissions testing was performed by David lee on 2019-08-20 ~ 2019-08-26.*

*The Conducted Spurious Emissions testing was performed by David Hsu on 2019-08-19.*
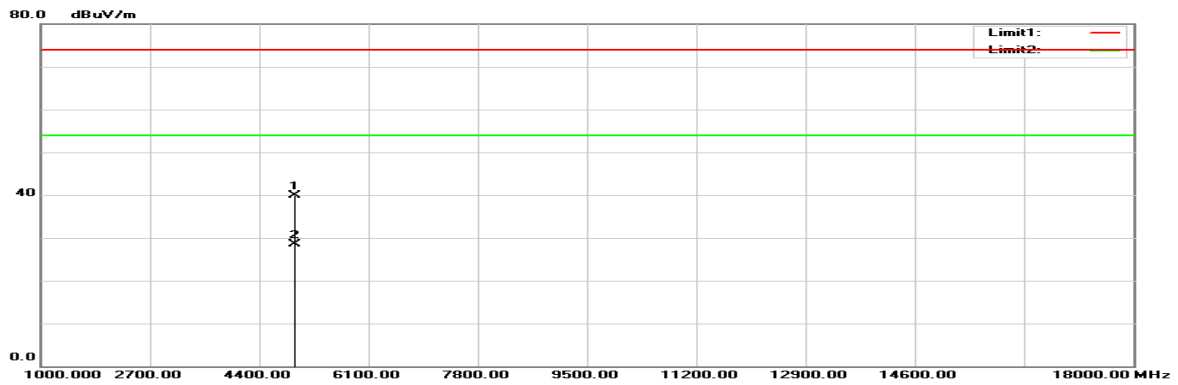
## 8.9    Test Results

### BR (GFSK) Mode

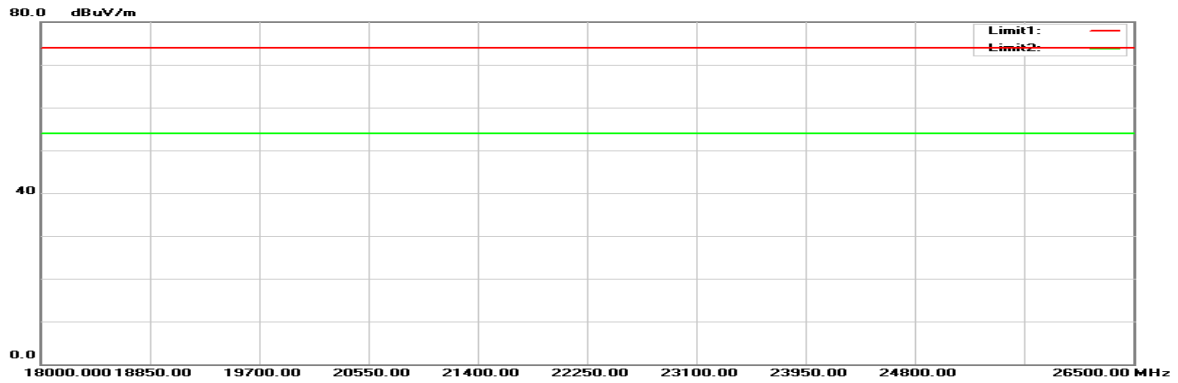**Horizontal** (*worst case is BR (GFSK) mode high channel*)
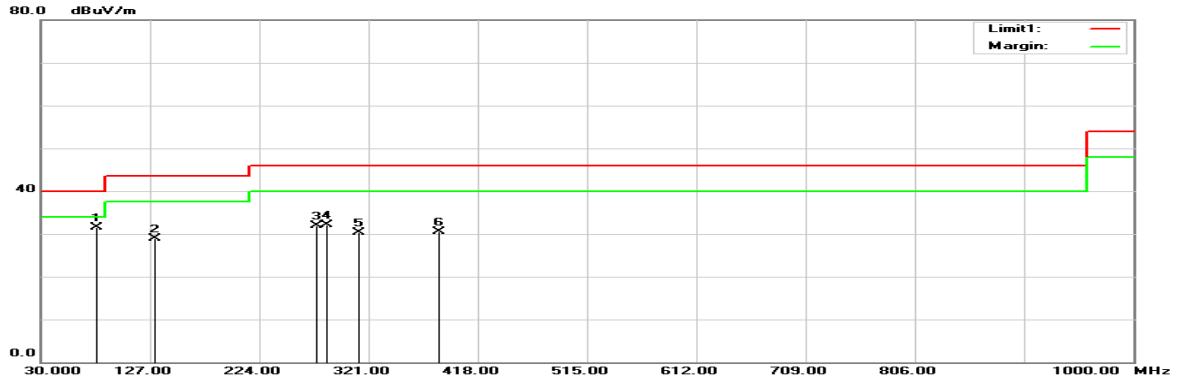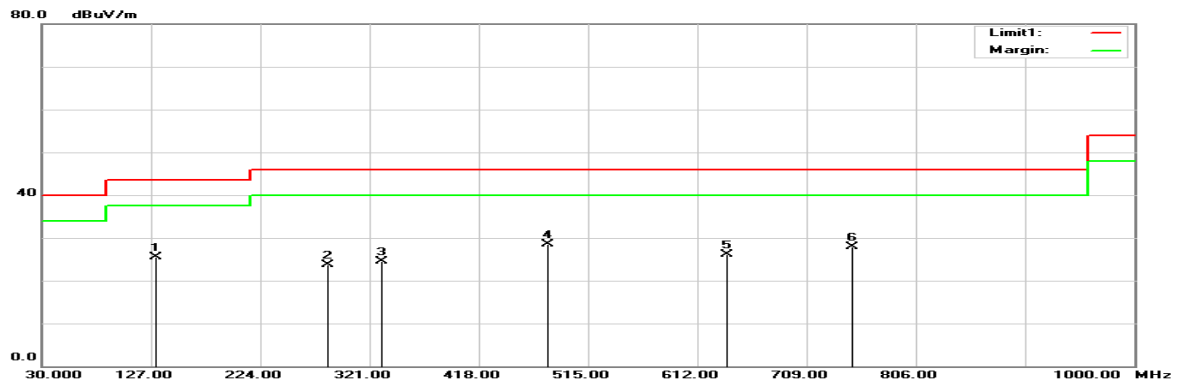
30MHz-1GHz:



1GHz-18GHz:



18GHz-26.5GHz:
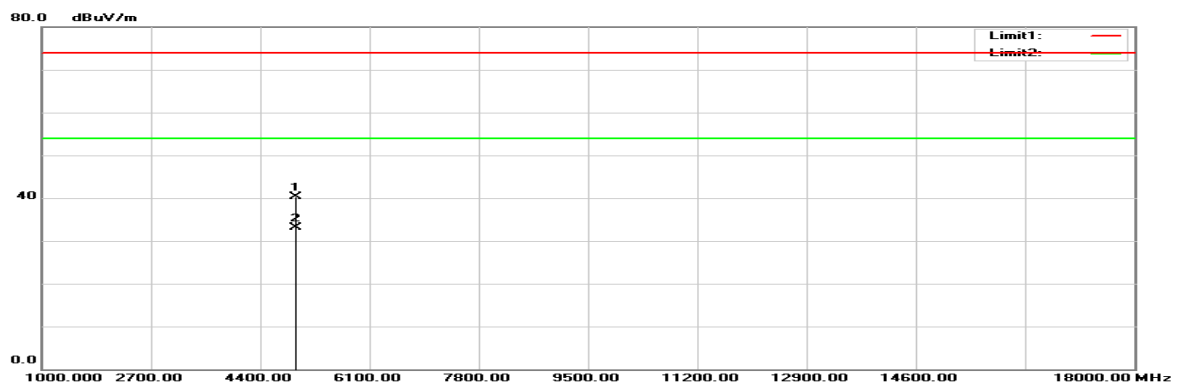
**Vertical** (*worst case is BR (GFSK) mode high channel*)
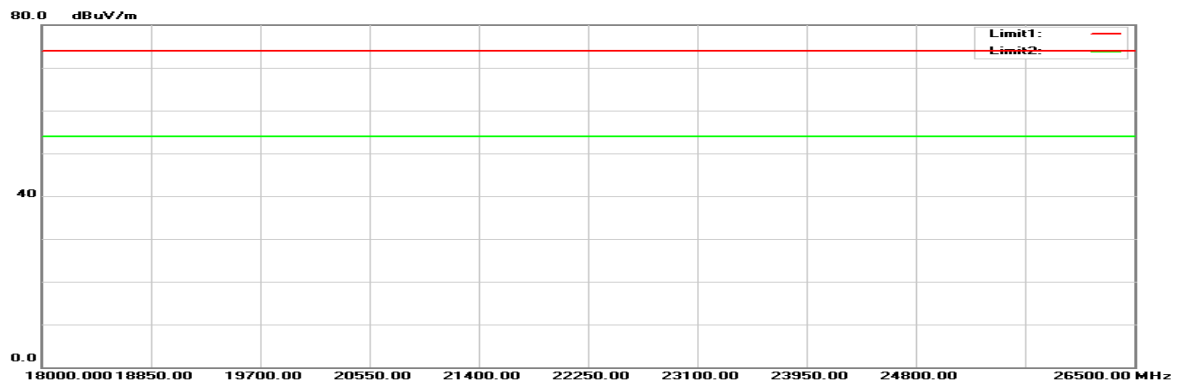
30MHz-1GHz:

1GHz-18GHz:
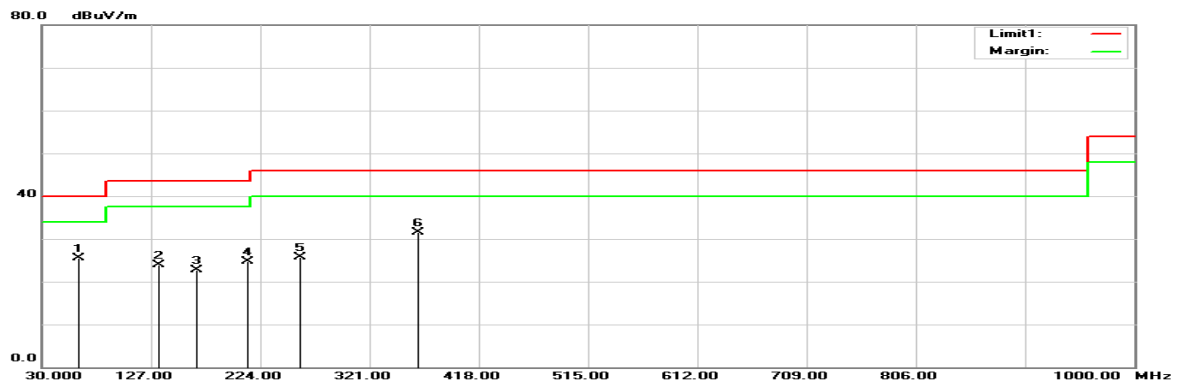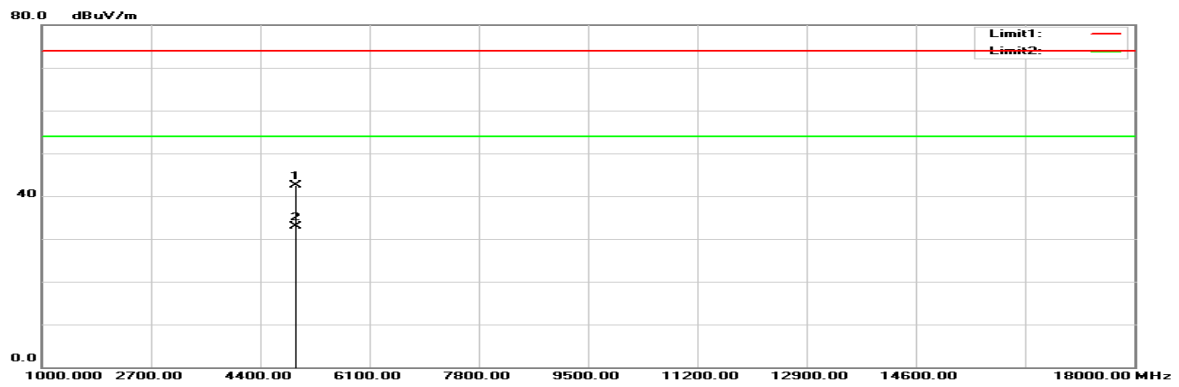
18GHz-26.5GHz:

## EDR (π/4-DQPSK) Mode

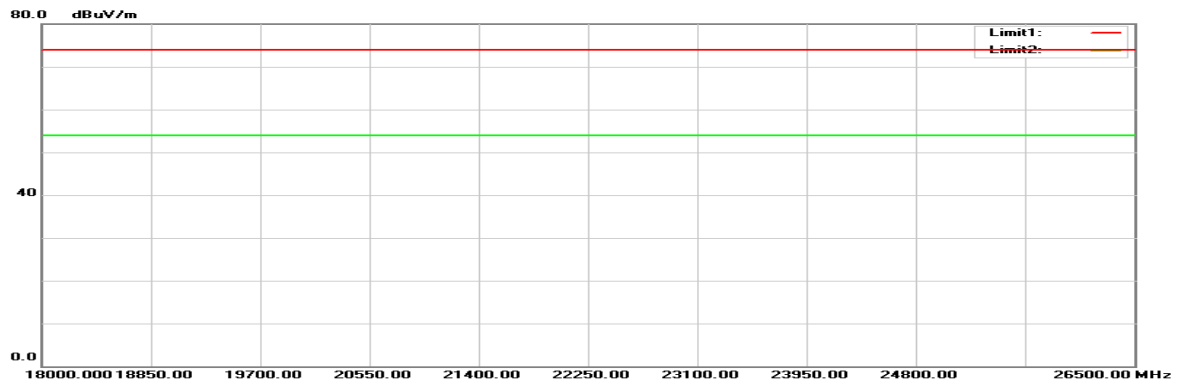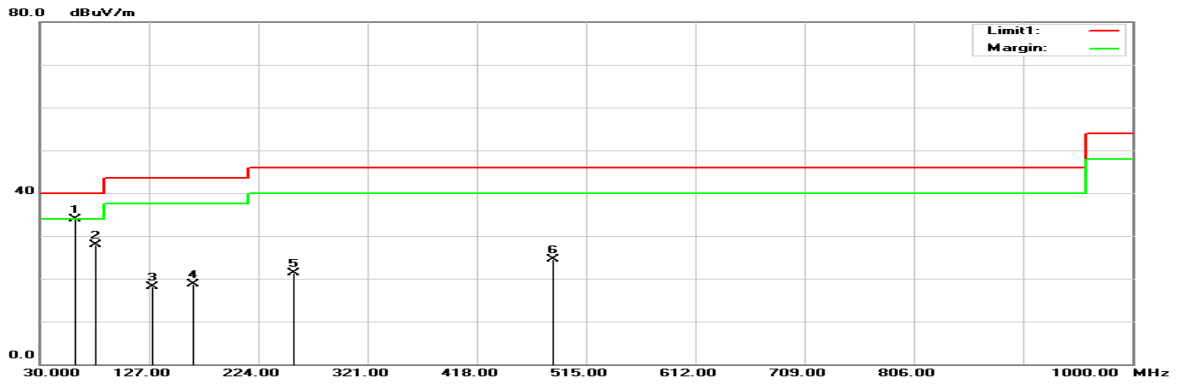**Horizontal** (*worst case is EDR (π/4-DQPSK) mode high channel*)

30MHz-1GHz:



1GHz-18GHz:



18GHz-26.5GHz:

**Vertical** (*worst case is EDR (π/4-DQPSK) mode high channel*)

30MHz-1GHz:



1GHz-18GHz:



18GHz-26.5GHz:

## EDR (8DPSK) Mode

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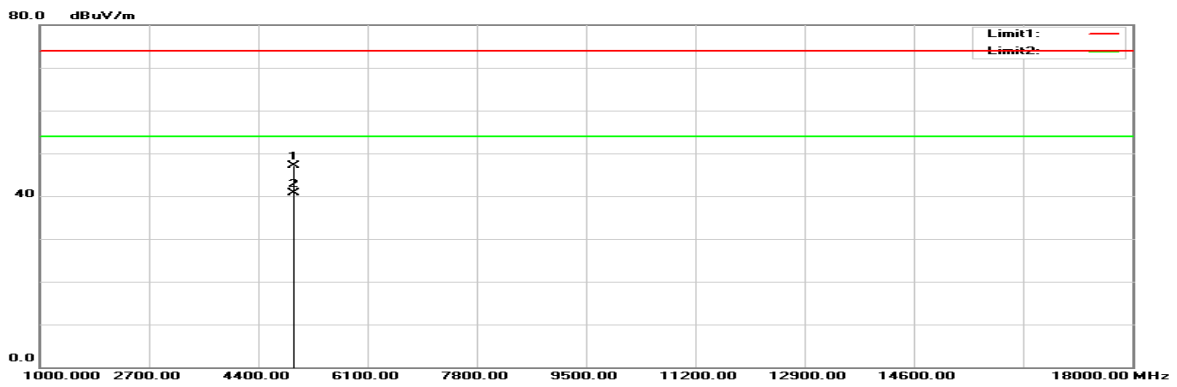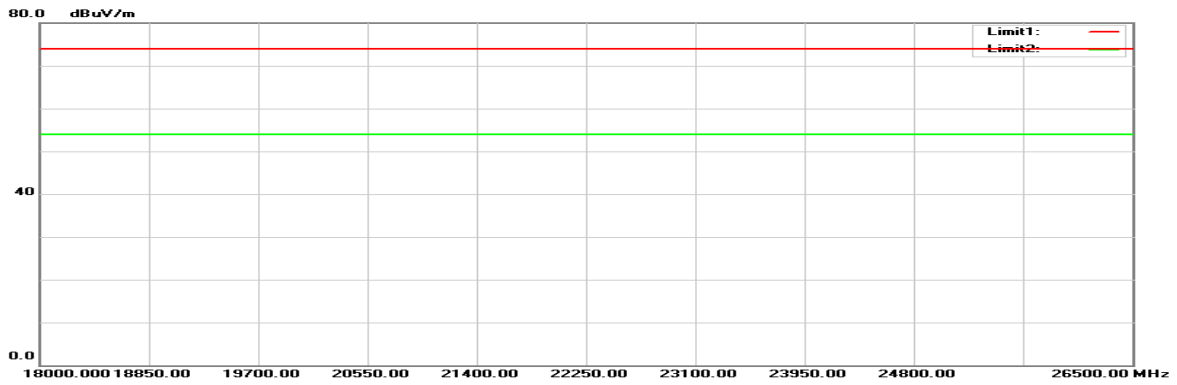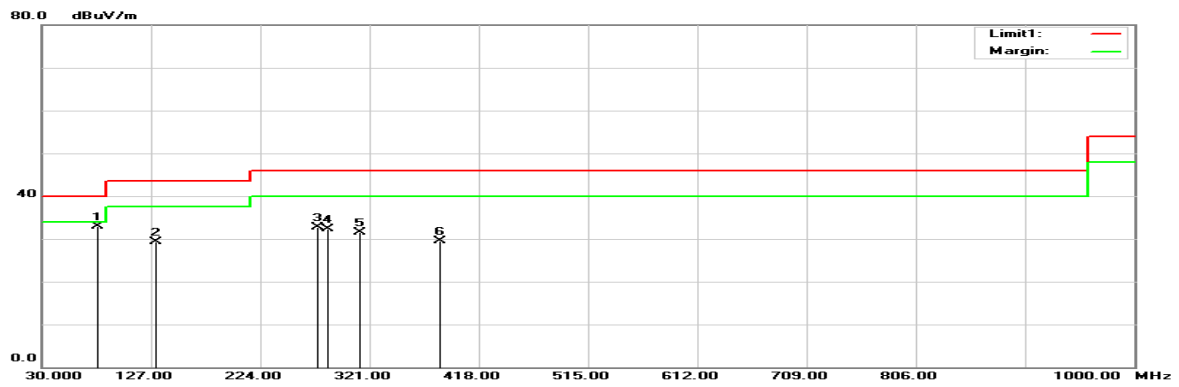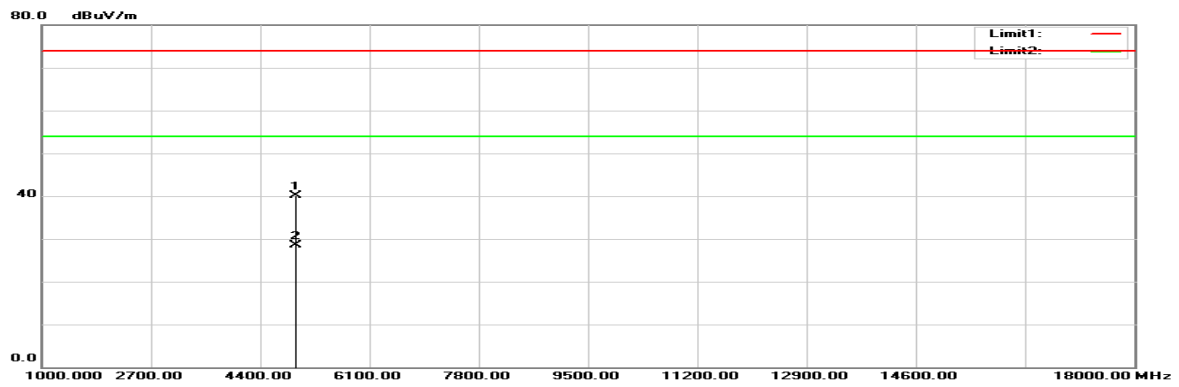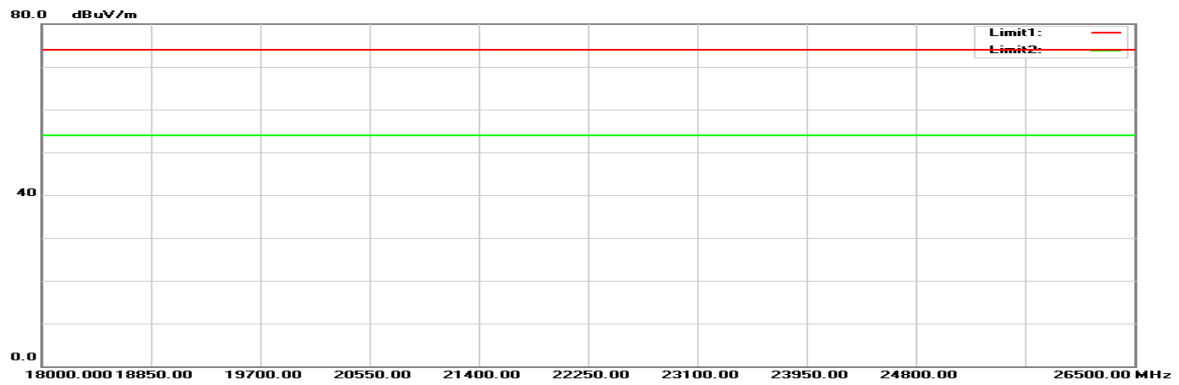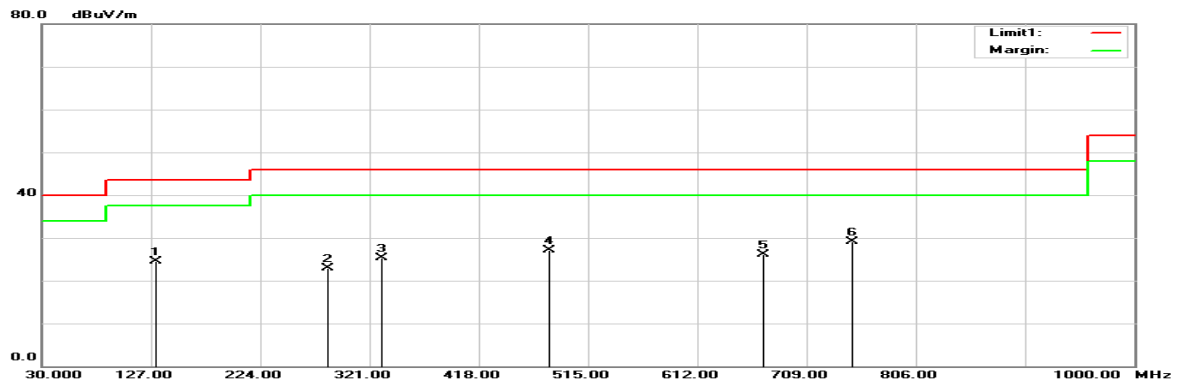
30MHz-1GHz:



1GHz-18GHz:



18GHz-26.5GHz:
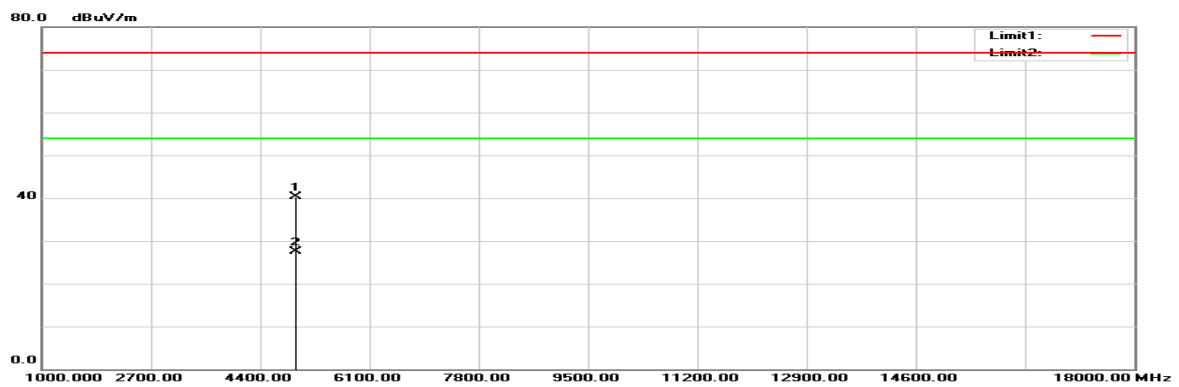
**Vertical** (*worst case is EDR (8DPSK) mode high channel*)

30MHz-1GHz:

1GHz-18GHz:

18GHz-26.5GHz:
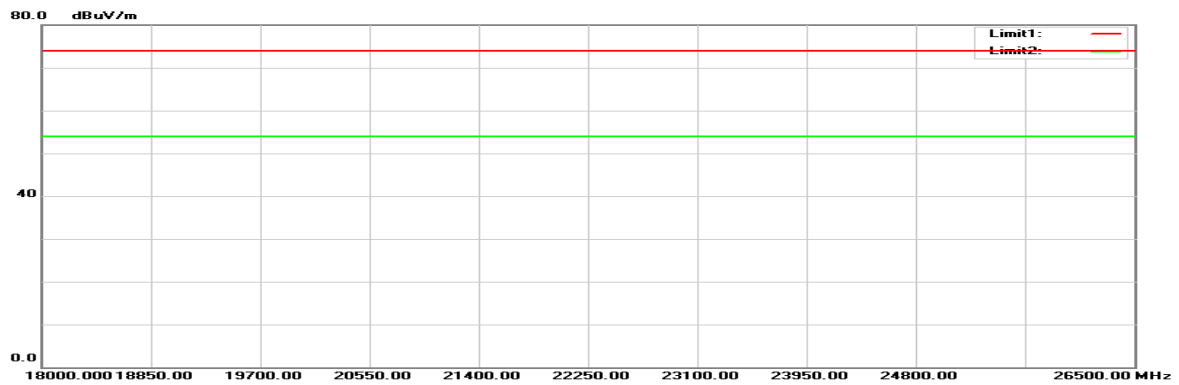
**Below 1GHz**

**Horizontal**

| Frequency | Reading | Correct | Result | Limit | Margin | Height | Degree | Remark |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB) | (cm) | (°) | |
| *BR (GFSK)* | | | | | | | | |
| 79.4700 | 47.31 | -15.77 | 31.54 | 40.00 | -8.46 | 100 | 145 | QP |
| 131.8500 | 38.42 | -9.54 | 28.88 | 43.50 | -14.62 | 100 | 163 | QP |
| 275.4100 | 40.63 | -8.78 | 31.85 | 46.00 | -14.15 | 100 | 149 | QP |
| 284.1400 | 40.78 | -8.62 | 32.16 | 46.00 | -13.84 | 100 | 253 | QP |
| 312.2700 | 38.45 | -8.10 | 30.35 | 46.00 | -15.65 | 100 | 93 | QP |
| 384.0500 | 37.16 | -6.73 | 30.43 | 46.00 | -15.57 | 100 | 182 | QP |
| *EDR (π/4-DQPSK)* | | | | | | | | |
| 62.9800 | 42.07 | -16.64 | 25.43 | 40.00 | -14.57 | 100 | 96 | QP |
| 133.7900 | 33.48 | -9.60 | 23.88 | 43.50 | -19.62 | 100 | 319 | QP |
| 167.7400 | 33.56 | -10.76 | 22.80 | 43.50 | -20.70 | 100 | 74 | QP |
| 213.3300 | 36.06 | -11.33 | 24.73 | 43.50 | -18.77 | 100 | 91 | QP |
| 259.8900 | 35.69 | -9.89 | 25.80 | 46.00 | -20.20 | 100 | 314 | QP |
| 363.6800 | 38.64 | -7.09 | 31.55 | 46.00 | -14.45 | 100 | 309 | QP |
| *EDR (8DPSK)* | | | | | | | | |
| 79.4700 | 48.59 | -15.77 | 32.82 | 40.00 | -7.18 | 100 | 360 | QP |
| 131.8500 | 38.78 | -9.54 | 29.24 | 43.50 | -14.26 | 100 | 175 | QP |
| 275.4100 | 41.53 | -8.78 | 32.75 | 46.00 | -13.25 | 100 | 149 | QP |
| 284.1400 | 41.02 | -8.62 | 32.40 | 46.00 | -13.60 | 100 | 152 | QP |
| 312.2700 | 39.62 | -8.10 | 31.52 | 46.00 | -14.48 | 100 | 84 | QP |
| 384.0500 | 36.22 | -6.73 | 29.49 | 46.00 | -16.51 | 100 | 173 | QP |

**Vertical**

| Frequency | Reading | Correct | Result | Limit | Margin | Height | Degree | Remark |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | Factor(dB/m) | (dBμV/m) | (dBμV/m) | (dB) | (cm) | (°) | |
| *BR (GFSK)* | | | | | | | | |
| 131.8500 | 35.05 | -9.54 | 25.51 | 43.50 | -17.99 | 100 | 118 | QP |
| 284.1400 | 32.27 | -8.62 | 23.65 | 46.00 | -22.35 | 100 | 316 | QP |
| 331.6700 | 32.30 | -7.70 | 24.60 | 46.00 | -21.40 | 100 | 131 | QP |
| 479.1100 | 33.82 | -5.36 | 28.46 | 46.00 | -17.54 | 100 | 34 | QP |
| 638.1900 | 29.79 | -3.65 | 26.14 | 46.00 | -19.86 | 100 | 0 | QP |
| 749.7400 | 30.31 | -2.47 | 27.84 | 46.00 | -18.16 | 100 | 269 | QP |
| *EDR (π/4-DQPSK)* | | | | | | | | |
| 61.0400 | 50.80 | -16.83 | 33.97 | 40.00 | -6.03 | 100 | 27 | QP |
| 79.4700 | 43.77 | -15.77 | 28.00 | 40.00 | -12.00 | 100 | 228 | QP |
| 129.9100 | 27.53 | -9.48 | 18.05 | 43.50 | -25.45 | 100 | 280 | QP |
| 165.8000 | 29.27 | -10.60 | 18.67 | 43.50 | -24.83 | 100 | 124 | QP |
| 256.0100 | 31.45 | -10.13 | 21.32 | 46.00 | -24.68 | 100 | 19 | QP |
| 485.9000 | 29.74 | -5.27 | 24.47 | 46.00 | -21.53 | 100 | 360 | QP |
| *EDR (8DPSK)* | | | | | | | | |
| 131.8500 | 34.08 | -9.54 | 24.54 | 43.50 | -18.96 | 100 | 118 | QP |
| 284.1400 | 31.58 | -8.62 | 22.96 | 46.00 | -23.04 | 100 | 332 | QP |
| 331.6700 | 33.02 | -7.70 | 25.32 | 46.00 | -20.68 | 100 | 120 | QP |
| 481.0500 | 32.52 | -5.34 | 27.18 | 46.00 | -18.82 | 100 | 31 | QP |
| 671.1700 | 29.49 | -3.29 | 26.20 | 46.00 | -19.80 | 100 | 258 | QP |
| 749.7400 | 31.59 | -2.47 | 29.12 | 46.00 | -16.88 | 100 | 266 | QP |

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 (MHz) | Reading (dBμV) | Correct Factor(dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Degree (°) | Remark |
|---|---|---|---|---|---|---|---|---|
| *BR (GFSK)*, Low channel | | | | | | | | |
| 2390.000 | 49.16 | -4.06 | 45.10 | 74.00 | -28.90 | 200 | 240 | peak |
| 2390.000 | 35.41 | -4.06 | 31.35 | 54.00 | -22.65 | 200 | 240 | AVG |
| 2402.000 | 95.76 | -3.96 | 91.80 | N/A | N/A | 200 | 122 | peak |
| 2402.000 | 83.10 | -3.96 | 79.14 | N/A | N/A | 200 | 122 | AVG |
| 4804.000 | 38.14 | 1.51 | 39.65 | 74.00 | -34.35 | 100 | 99 | peak |
| 4804.000 | 27.35 | 1.51 | 28.86 | 54.00 | -25.14 | 100 | 99 | AVG |
| *BR (GFSK)*, Middle channel | | | | | | | | |
| 2441.000 | 94.39 | -3.53 | 90.86 | N/A | N/A | 200 | 103 | peak |
| 2441.000 | 82.07 | -3.53 | 78.54 | N/A | N/A | 200 | 103 | AVG |
| 4882.000 | 39.57 | 2.37 | 41.94 | 74.00 | -32.06 | 100 | 243 | peak |
| 4882.000 | 28.63 | 2.37 | 31.00 | 54.00 | -23.00 | 100 | 243 | AVG |
| *BR (GFSK)*, High channel | | | | | | | | |
| 2480.000 | 94.10 | -3.10 | 91.00 | N/A | N/A | 200 | 99 | peak |
| 2480.000 | 81.40 | -3.10 | 78.30 | N/A | N/A | 200 | 99 | AVG |
| 2483.500 | 52.56 | -3.06 | 49.50 | 74.00 | -24.50 | 200 | 105 | peak |
| 2483.500 | 40.54 | -3.06 | 37.48 | 54.00 | -16.52 | 200 | 105 | AVG |
| 4960.000 | 37.42 | 2.39 | 39.81 | 74.00 | -34.19 | 100 | 168 | peak |
| 4960.000 | 26.18 | 2.39 | 28.57 | 54.00 | -25.43 | 100 | 168 | AVG |

### Vertical

| Frequency (MHz) | Reading (dBμV) | Correct Factor(dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Degree (°) | Remark |
|---|---|---|---|---|---|---|---|---|
| *BR (GFSK)*, Low channel | | | | | | | | |
| 2390.000 | 48.08 | -4.06 | 44.02 | 74.00 | -29.98 | 100 | 138 | peak |
| 2390.000 | 35.16 | -4.06 | 31.10 | 54.00 | -22.90 | 100 | 138 | AVG |
| 2402.000 | 98.71 | -3.96 | 94.75 | N/A | N/A | 100 | 126 | peak |
| 2402.000 | 85.57 | -3.96 | 81.61 | N/A | N/A | 100 | 126 | AVG |
| 4804.000 | 40.62 | 1.51 | 42.13 | 74.00 | -31.87 | 100 | 72 | peak |
| 4804.000 | 32.35 | 1.51 | 33.86 | 54.00 | -20.14 | 100 | 72 | AVG |
| *BR (GFSK)*, Middle channel | | | | | | | | |
| 2441.000 | 97.98 | -3.53 | 94.45 | N/A | N/A | 100 | 128 | peak |
| 2441.000 | 83.98 | -3.53 | 80.45 | N/A | N/A | 100 | 128 | AVG |
| 4882.000 | 37.92 | 2.37 | 40.29 | 74.00 | -33.71 | 100 | 260 | peak |
| 4882.000 | 31.94 | 2.37 | 34.31 | 54.00 | -19.69 | 100 | 260 | AVG |
| 7323.000 | 38.35 | 8.91 | 47.26 | 74.00 | -26.74 | 100 | 23 | peak |
| 7323.000 | 29.16 | 8.91 | 38.07 | 54.00 | -15.93 | 100 | 23 | AVG |
| *BR (GFSK)*, High channel | | | | | | | | |
| 2480.000 | 97.98 | -3.10 | 94.88 | N/A | N/A | 100 | 179 | peak |
| 2480.000 | 83.73 | -3.10 | 80.63 | N/A | N/A | 100 | 179 | AVG |
| 2483.500 | 54.86 | -3.06 | 51.80 | 74.00 | -22.20 | 100 | 172 | peak |
| 2483.500 | 43.29 | -3.06 | 40.23 | 54.00 | -13.77 | 100 | 172 | AVG |
| 4960.000 | 37.85 | 2.39 | 40.24 | 74.00 | -33.76 | 100 | 17 | peak |
| 4960.000 | 30.62 | 2.39 | 33.01 | 54.00 | -20.99 | 100 | 17 | 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 (MHz) | Reading (dBμV) | Correct Factor(dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Degree (°) | Remark |
|---|---|---|---|---|---|---|---|---|
| *EDR (π/4-DQPSK)*, Low channel | | | | | | | | |
| 2390.000 | 49.95 | -4.06 | 45.89 | 74.00 | -28.11 | 200 | 120 | peak |
| 2390.000 | 37.22 | -4.06 | 33.16 | 54.00 | -20.84 | 200 | 120 | AVG |
| 2402.000 | 95.92 | -3.96 | 91.96 | N/A | N/A | 200 | 168 | peak |
| 2402.000 | 81.60 | -3.96 | 77.64 | N/A | N/A | 200 | 168 | AVG |
| 4804.000 | 40.86 | 1.51 | 42.37 | 74.00 | -31.63 | 100 | 307 | peak |
| 4804.000 | 31.07 | 1.51 | 32.58 | 54.00 | -21.42 | 100 | 307 | AVG |
| *EDR (π/4-DQPSK)*, Middle channel | | | | | | | | |
| 2441.000 | 95.50 | -3.53 | 91.97 | N/A | N/A | 200 | 165 | peak |
| 2441.000 | 81.57 | -3.53 | 78.04 | N/A | N/A | 200 | 165 | AVG |
| 4882.000 | 37.92 | 2.37 | 40.29 | 74.00 | -33.71 | 100 | 270 | peak |
| 4882.000 | 29.29 | 2.37 | 31.66 | 54.00 | -22.34 | 100 | 270 | AVG |
| *EDR (π/4-DQPSK)*, High channel | | | | | | | | |
| 2480.000 | 97.79 | -3.10 | 94.69 | N/A | N/A | 200 | 165 | peak |
| 2480.000 | 82.37 | -3.10 | 79.27 | N/A | N/A | 200 | 165 | AVG |
| 2483.500 | 54.83 | -3.06 | 51.77 | 74.00 | -22.23 | 200 | 172 | peak |
| 2483.500 | 40.81 | -3.06 | 37.75 | 54.00 | -16.25 | 200 | 172 | AVG |
| 4960.000 | 40.02 | 2.39 | 42.41 | 74.00 | -31.59 | 100 | 173 | peak |
| 4960.000 | 30.59 | 2.39 | 32.98 | 54.00 | -21.02 | 100 | 173 | AVG |

**Vertical**

| Frequency (MHz) | Reading (dBμV) | Correct Factor(dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Degree (°) | Remark |
|---|---|---|---|---|---|---|---|---|
| *EDR (π/4-DQPSK)*, Low channel | | | | | | | | |
| 2390.000 | 51.03 | -4.06 | 46.97 | 74.00 | -27.03 | 100 | 248 | peak |
| 2390.000 | 37.05 | -4.06 | 32.99 | 54.00 | -21.01 | 100 | 248 | AVG |
| 2402.000 | 95.00 | -3.96 | 91.04 | N/A | N/A | 100 | 292 | peak |
| 2402.000 | 80.24 | -3.96 | 76.28 | N/A | N/A | 100 | 292 | AVG |
| 4804.000 | 43.14 | 1.51 | 44.65 | 74.00 | -29.35 | 100 | 349 | peak |
| 4804.000 | 34.94 | 1.51 | 36.45 | 54.00 | -17.55 | 100 | 349 | AVG |
| *EDR (π/4-DQPSK)*, Middle channel | | | | | | | | |
| 2441.000 | 94.58 | -3.53 | 91.05 | N/A | N/A | 100 | 302 | peak |
| 2441.000 | 79.39 | -3.53 | 75.86 | N/A | N/A | 100 | 302 | AVG |
| 4882.000 | 38.79 | 2.37 | 41.16 | 74.00 | -32.84 | 100 | 237 | peak |
| 4882.000 | 31.35 | 2.37 | 33.72 | 54.00 | -20.28 | 100 | 237 | AVG |
| *EDR (π/4-DQPSK)*, High channel | | | | | | | | |
| 2480.000 | 95.27 | -3.10 | 92.17 | N/A | N/A | 100 | 311 | peak |
| 2480.000 | 80.99 | -3.10 | 77.89 | N/A | N/A | 100 | 311 | AVG |
| 2483.500 | 52.71 | -3.06 | 49.65 | 74.00 | -24.35 | 100 | 311 | peak |
| 2483.500 | 39.40 | -3.06 | 36.34 | 54.00 | -17.66 | 100 | 311 | AVG |
| 4960.000 | 44.81 | 2.39 | 47.20 | 74.00 | -26.80 | 100 | 333 | peak |
| 4960.000 | 38.28 | 2.39 | 40.67 | 54.00 | -13.33 | 100 | 333 | 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 (MHz) | Reading (dBµV) | Correct Factor(dB/m) | Result (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Height (cm) | Degree ( ° ) | Remark |
|---|---|---|---|---|---|---|---|---|
| *EDR (8DPSK)*, Low channel | | | | | | | | |
| 2390.000 | 46.56 | -4.06 | 42.50 | 74.00 | -31.50 | 200 | 101 | peak |
| 2390.000 | 34.04 | -4.06 | 29.98 | 54.00 | -24.02 | 200 | 101 | AVG |
| 2402.000 | 94.42 | -3.96 | 90.46 | N/A | N/A | 200 | 123 | peak |
| 2402.000 | 79.88 | -3.96 | 75.92 | N/A | N/A | 200 | 123 | AVG |
| 4804.000 | 37.92 | 1.51 | 39.43 | 74.00 | -34.57 | 100 | 154 | peak |
| 4804.000 | 26.58 | 1.51 | 28.09 | 54.00 | -25.91 | 100 | 154 | AVG |
| *EDR (8DPSK)*, Middle channel | | | | | | | | |
| 2441.000 | 93.60 | -3.53 | 90.07 | N/A | N/A | 200 | 104 | peak |
| 2441.000 | 79.24 | -3.53 | 75.71 | N/A | N/A | 200 | 104 | AVG |
| 4882.000 | 38.37 | 2.37 | 40.74 | 74.00 | -33.26 | 100 | 185 | peak |
| 4882.000 | 24.18 | 2.37 | 26.55 | 54.00 | -27.45 | 100 | 185 | AVG |
| *EDR (8DPSK)*, High channel | | | | | | | | |
| 2480.000 | 93.35 | -3.10 | 90.25 | N/A | N/A | 200 | 99 | peak |
| 2480.000 | 78.41 | -3.10 | 75.31 | N/A | N/A | 200 | 99 | AVG |
| 2483.500 | 53.87 | -3.06 | 50.81 | 74.00 | -23.19 | 200 | 101 | peak |
| 2483.500 | 36.53 | -3.06 | 33.47 | 54.00 | -20.53 | 200 | 101 | AVG |
| 4960.000 | 37.78 | 2.39 | 40.17 | 74.00 | -33.83 | 100 | 68 | peak |
| 4960.000 | 26.03 | 2.39 | 28.42 | 54.00 | -25.58 | 100 | 68 | AVG |

**Vertical**

| Frequency (MHz) | Reading (dBµV) | Correct Factor(dB/m) | Result (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Height (cm) | Degree ( ° ) | Remark |
|---|---|---|---|---|---|---|---|---|
| *EDR (8DPSK)*, Low channel | | | | | | | | |
| 2390.000 | 46.42 | -4.06 | 42.36 | 74.00 | -31.64 | 100 | 119 | peak |
| 2390.000 | 34.47 | -4.06 | 30.41 | 54.00 | -23.59 | 100 | 119 | AVG |
| 2402.000 | 97.41 | -3.96 | 93.45 | N/A | N/A | 100 | 126 | peak |
| 2402.000 | 80.90 | -3.96 | 76.94 | N/A | N/A | 100 | 126 | AVG |
| 4804.000 | 38.06 | 1.51 | 39.57 | 74.00 | -34.43 | 100 | 323 | peak |
| 4804.000 | 24.47 | 1.51 | 25.98 | 54.00 | -28.02 | 100 | 323 | AVG |
| *EDR (8DPSK)*, Middle channel | | | | | | | | |
| 2441.000 | 96.92 | -3.53 | 93.39 | N/A | N/A | 100 | 130 | peak |
| 2441.000 | 82.35 | -3.53 | 78.82 | N/A | N/A | 100 | 130 | AVG |
| 4882.000 | 38.73 | 2.37 | 41.10 | 74.00 | -32.90 | 100 | 15 | peak |
| 4882.000 | 25.20 | 2.37 | 27.57 | 54.00 | -26.43 | 100 | 15 | AVG |
| *EDR (8DPSK)*, High channel | | | | | | | | |
| 2480.000 | 97.25 | -3.10 | 94.15 | N/A | N/A | 100 | 179 | peak |
| 2480.000 | 82.41 | -3.10 | 79.31 | N/A | N/A | 100 | 179 | AVG |
| 2483.500 | 56.68 | -3.06 | 53.62 | 74.00 | -20.38 | 100 | 116 | peak |
| 2483.500 | 38.63 | -3.06 | 35.57 | 54.00 | -18.43 | 100 | 116 | AVG |
| 4960.000 | 37.84 | 2.39 | 40.23 | 74.00 | -33.77 | 100 | 215 | peak |
| 4960.000 | 25.13 | 2.39 | 27.52 | 54.00 | -26.48 | 100 | 215 | AVG |

Result = Reading + Correct Factor

Margin = Result – Limit

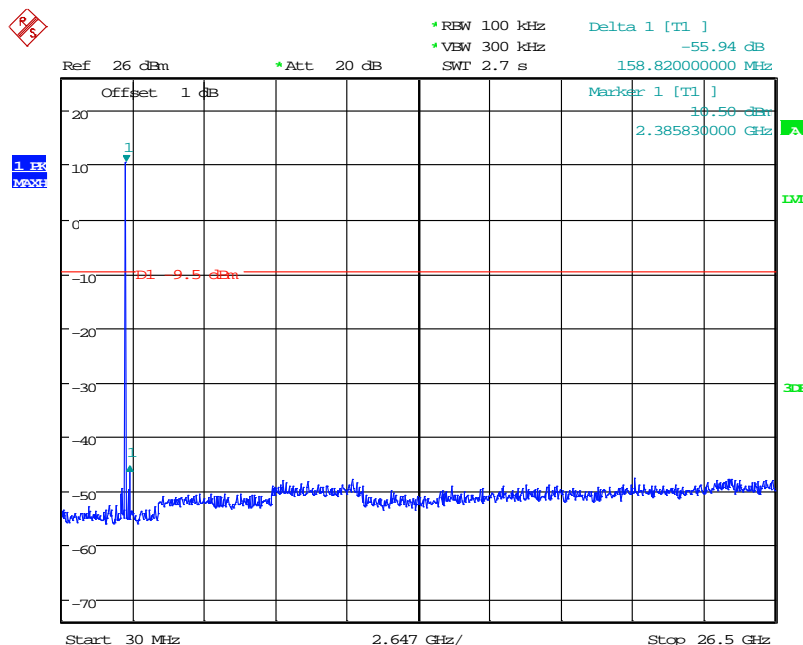Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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 |
|---------|-----------------|-----------------------------------|-------------|--------|
| *BR Mode (GFSK)* | | | | |
| Low | 2402 | 55.94 | ≥ 20 | PASS |
| Mid | 2441 | 54.96 | ≥ 20 | PASS |
| High | 2480 | 45.55 | ≥ 20 | PASS |
| *EDR Mode (π/4-DQPSK):* | | | | |
| Low | 2402 | 52.79 | ≥ 20 | PASS |
| Mid | 2441 | 49.20 | ≥ 20 | PASS |
| High | 2480 | 52.23 | ≥ 20 | PASS |
| *EDR Mode (8DPSK):* | | | | |
| Low | 2402 | 50.71 | ≥ 20 | PASS |
| Mid | 2441 | 51.13 | ≥ 20 | PASS |
| High | 2480 | 53.05 | ≥ 20 | PASS |

## BR Mode (GFSK)

### Low Channel



Date: 19.AUG.2019  19:34:18

## Middle Channel

RBW 100 kHz　　Delta 1 [T1 ]
VBW 300 kHz　　　　-54.96 dB
Ref 26 dBm　　　Att 20 dB　　SWT 2.7 s　　-158.820000000 MHz

Offset 1 dB　　　　　　　　Marker 1 [T1 ]
10.73 dBm
2.438770000 GHz

D1 -9.27 dBm

Start 30 MHz　　　　　2.647 GHz/　　　　　Stop 26.5 GHz
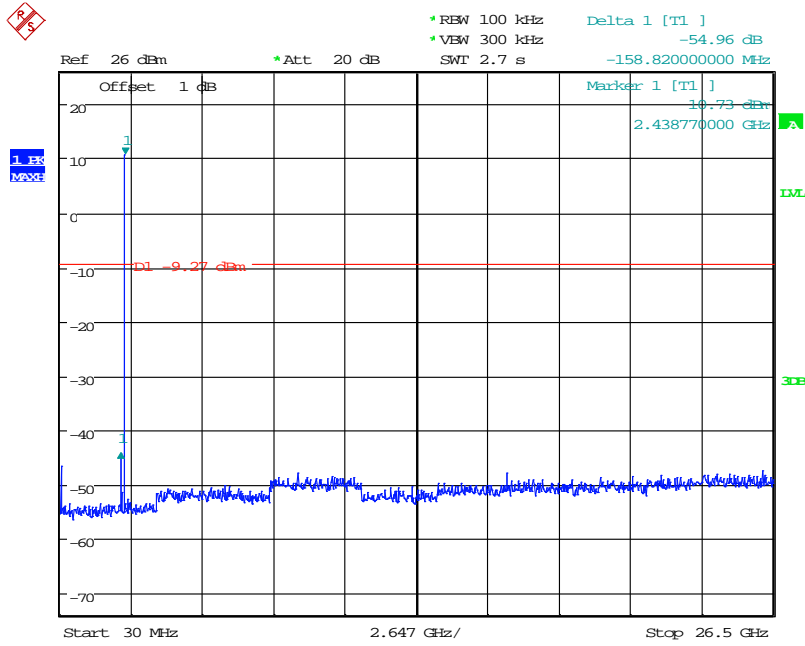
Date: 19.AUG.2019  19:36:34

## High Channel

RBW 100 kHz　　Delta 1 [T1 ]
VBW 300 kHz　　　　-45.55 dB
Ref 10 dBm　　　Att 30 dB　　SWT 2.7 s　　23.558300000 GHz

Offset 1 dB　　　　　　　　Marker 1 [T1 ]
-7.41 dBm
2.465240000 GHz

D1 -27.41 dBm

Start 30 MHz　　　　　2.647 GHz/　　　　　Stop 26.5 GHz
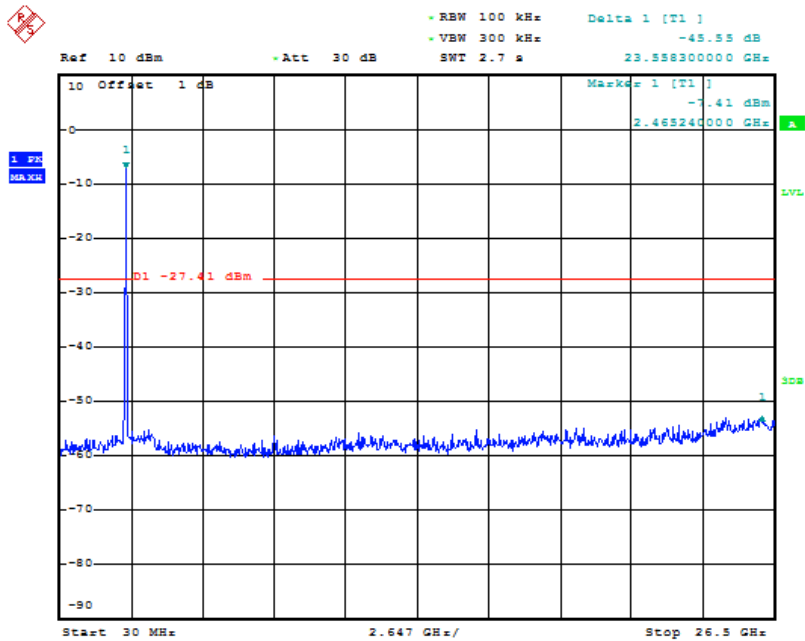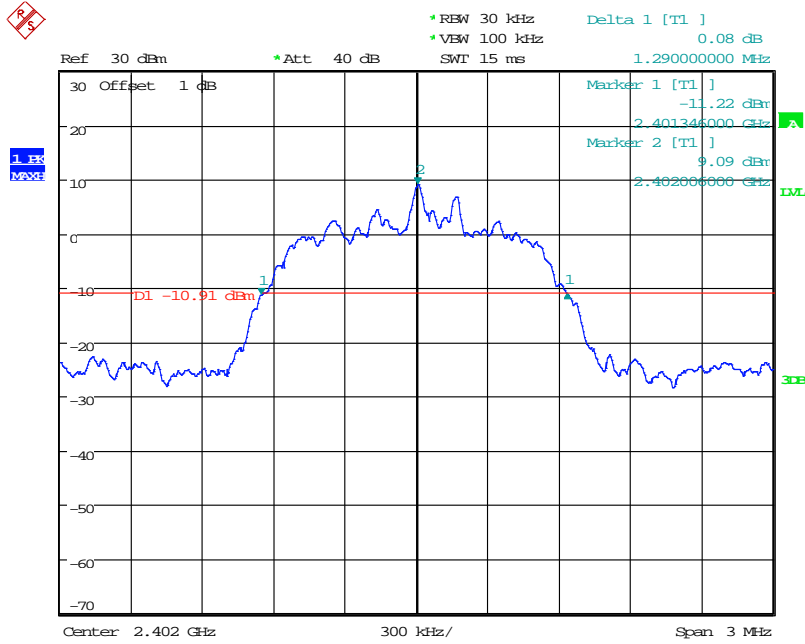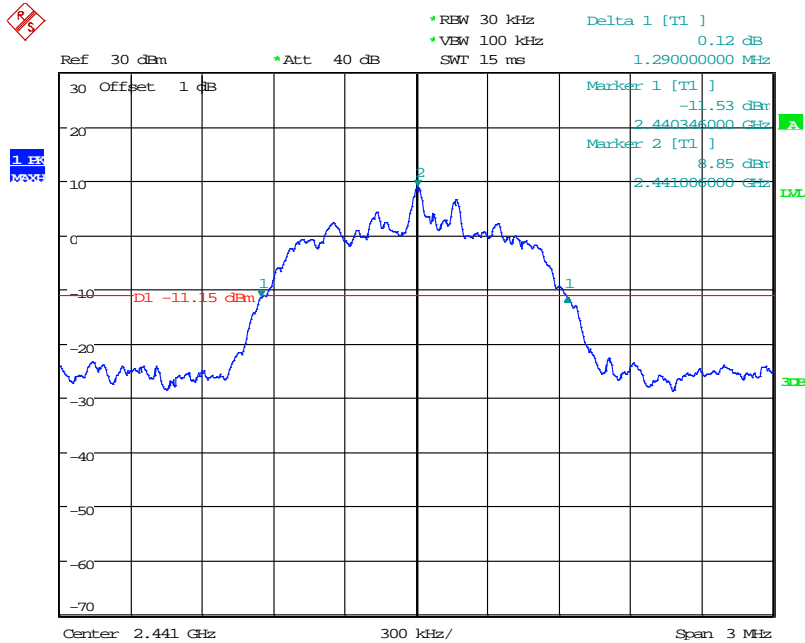
Date: 19.AUG.2019 14:13:05

## EDR Mode (π/4-DQPSK)
## Low Channel
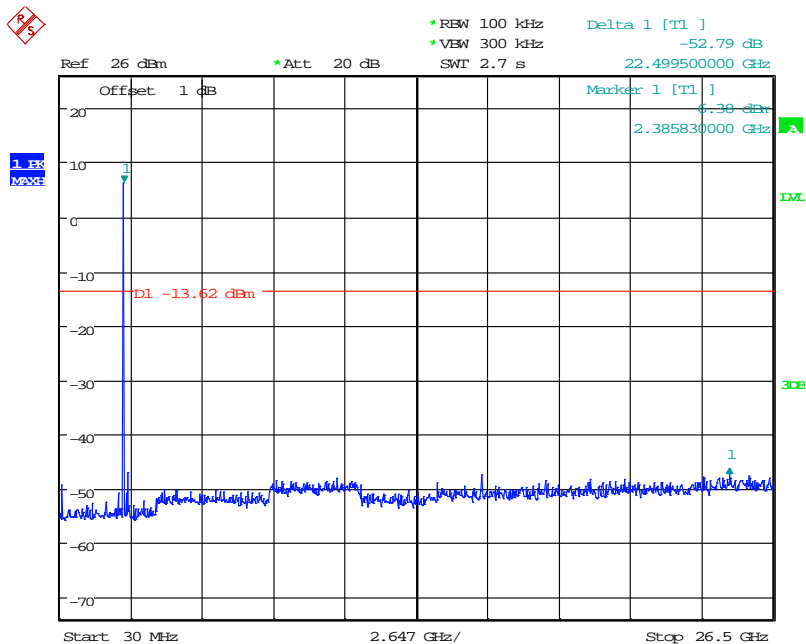


Date: 19.AUG.2019  19:46:34

## Middle Channel
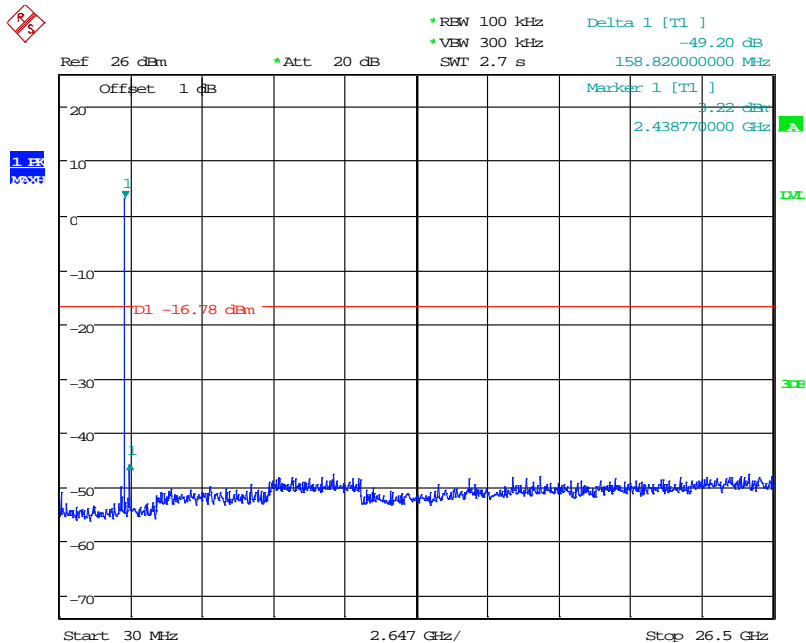


Date: 19.AUG.2019  19:48:27

## High Channel



RBW 100 kHz    Delta 1 [T1 ]
VBW 300 kHz        -52.23 dB
Ref  26 dBm       Att  20 dB    SWT 2.7 s      -158.820000000 MHz
Offset  1 dB                     Marker 1 [T1 ]
                                        5.62 dBm
                                2.465240000 GHz
D1 -14.88 dBm

Start  30 MHz          2.647 GHz/          Stop  26.5 GHz
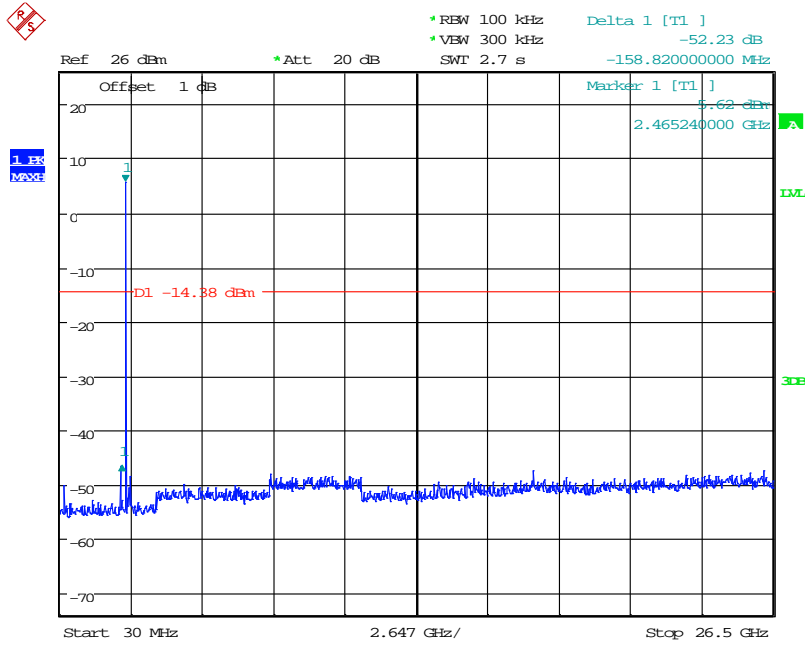
Date: 19.AUG.2019  19:50:36

## EDR Mode (8DPSK)

## Low Channel



RBW 100 kHz    Delta 1 [T1 ]
VBW 300 kHz        -50.71 dB
Ref  26 dBm       Att  20 dB    SWT 2.7 s      158.820000000 MHz
Offset  1 dB                     Marker 1 [T1 ]
                                        3.12 dBm
                                2.385830000 GHz
D1 -16.88 dBm

Start  30 MHz          2.647 GHz/          Stop  26.5 GHz
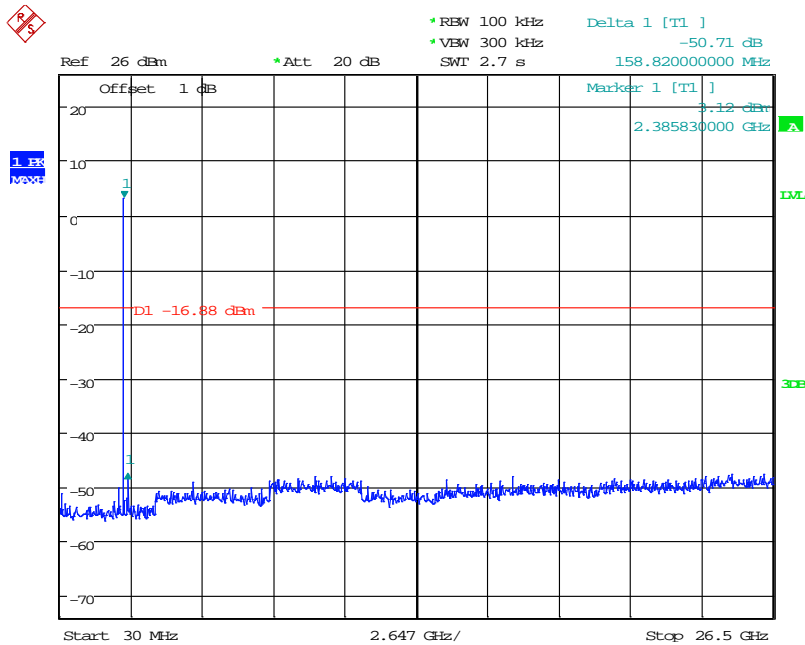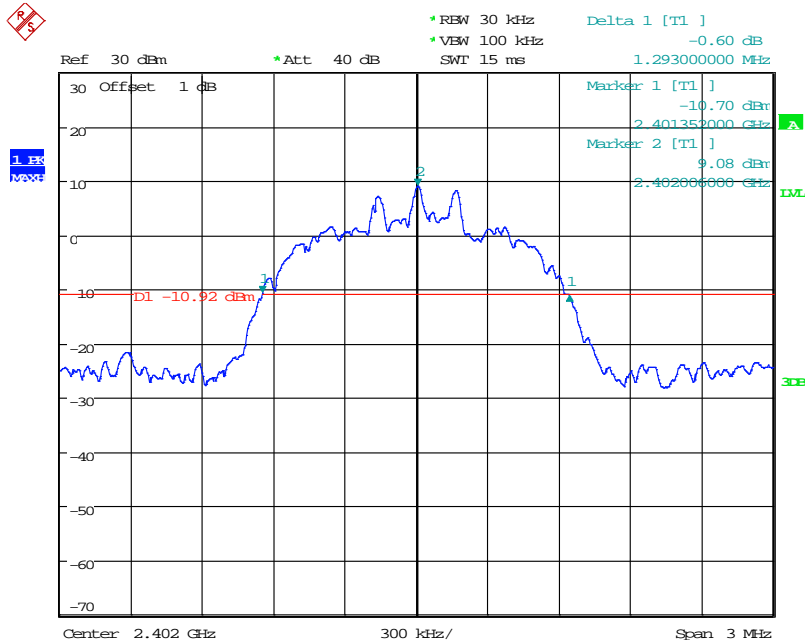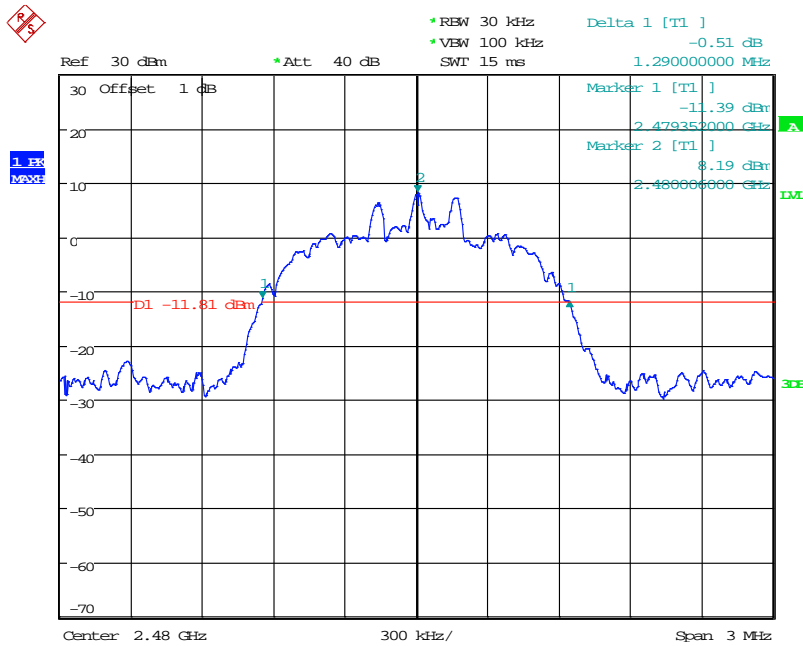
Date: 19.AUG.2019  19:54:09

## Middle Channel
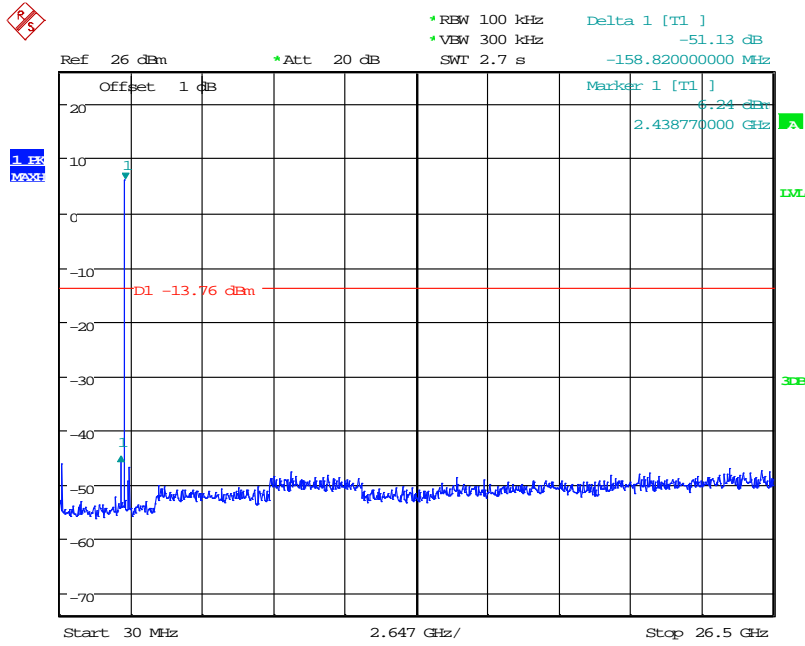


Date: 19.AUG.2019  19:58:00

## High Channel
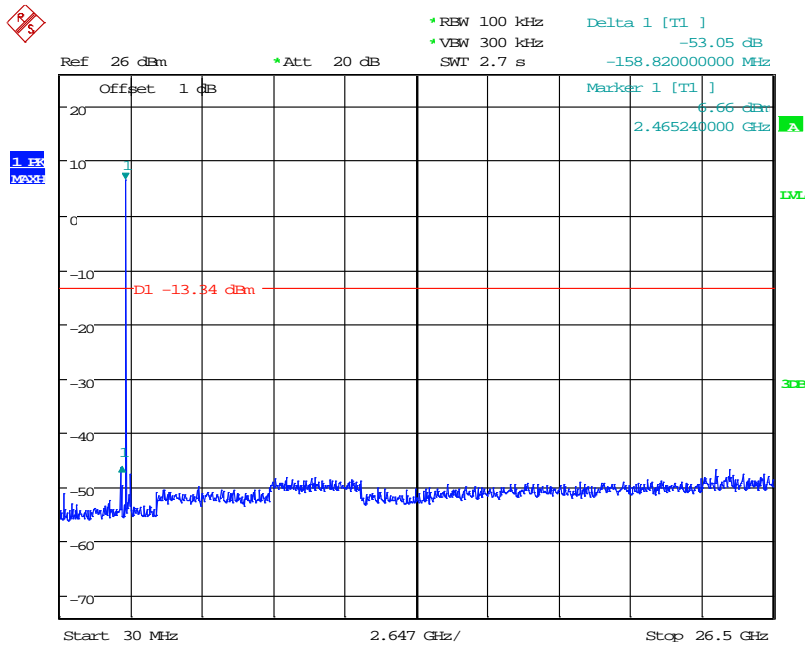


Date: 19.AUG.2019  20:00:09

# 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:** | 25.3 ℃ |
| **Relative Humidity:** | 62 % |
| **ATM Pressure:** | 1010 hPa |

*The testing was performed by David Hsu on 2019-08-19.*

## 9.4　Test Results

| Channel | Frequency (MHz) | 20 dBc BW (MHz) |
|---|---|---|
| *BR Mode (GFSK)* | | |
| Low | 2402 | 0.89 |
| Middle | 2441 | 0.89 |
| High | 2480 | 0.90 |
| *EDR Mode (π/4-DQPSK)* | | |
| Low | 2402 | 1.29 |
| Middle | 2441 | 1.29 |
| High | 2480 | 1.29 |
| *EDR Mode (8DPSK)* | | |
| Low | 2402 | 1.29 |
| Middle | 2441 | 1.29 |
| High | 2480 | 1.29 |

Please refer to the following plots

### BR Mode (GFSK)
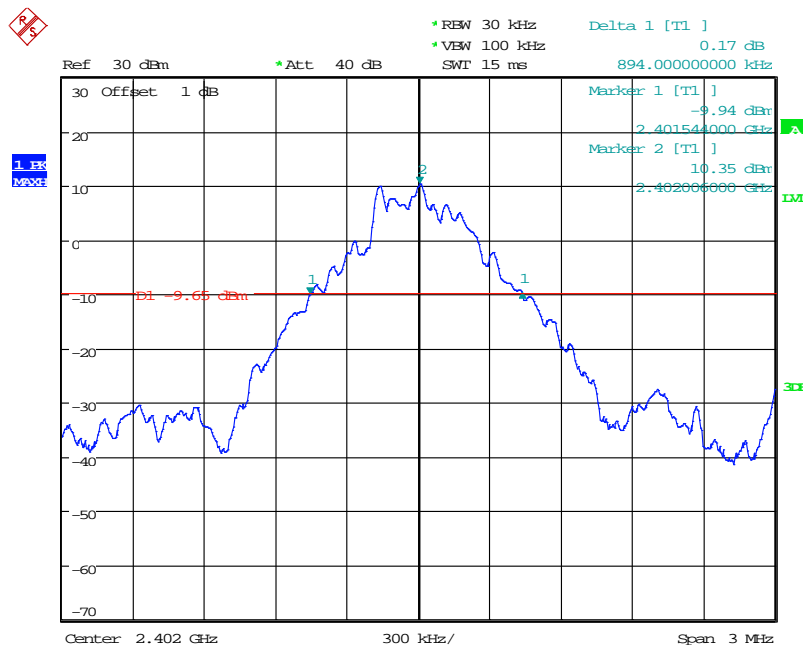
### Low Channel



Date: 19.AUG.2019  19:32:02

## Middle Channel

RBW 30 kHz        Delta 1 [T1 ]
VBW 100 kHz              -0.04 dB
Ref 30 dBm        *Att 40 dB     SWT 15 ms         894.000000000 kHz

Marker 1 [T1 ]
-10.12 dBm
2.440541000 GHz
Marker 2 [T1 ]
10.12 dBm
2.441006000 GHz

Center 2.441 GHz          300 kHz/          Span 3 MHz
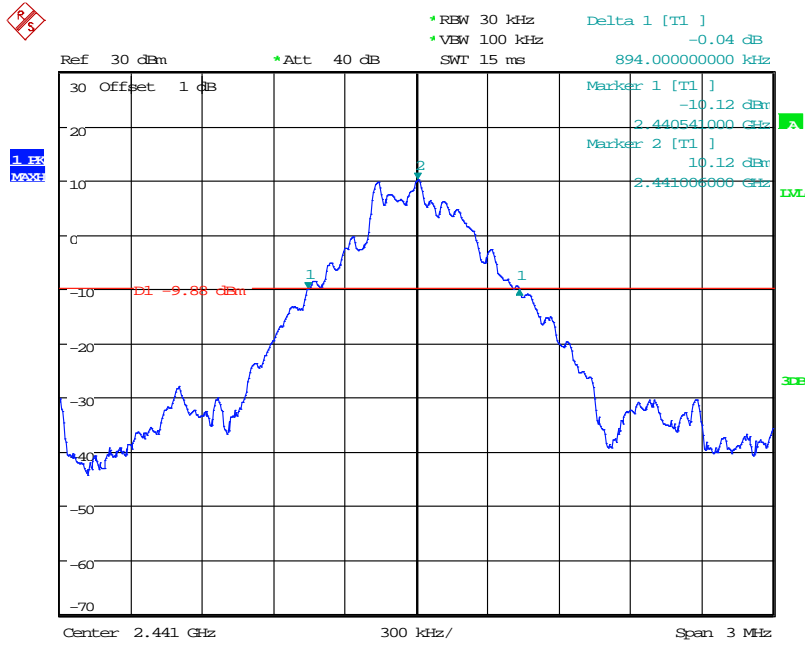
Date: 19.AUG.2019  19:35:58

## High Channel

RBW 30 kHz        Delta 1 [T1 ]
VBW 100 kHz              -0.23 dB
Ref 30 dBm        *Att 40 dB     SWT 15 ms         897.000000000 kHz

Marker 1 [T1 ]
-10.67 dBm
2.479541000 GHz
Marker 2 [T1 ]
9.50 dBm
2.480006000 GHz

Center 2.48 GHz          300 kHz/          Span 3 MHz
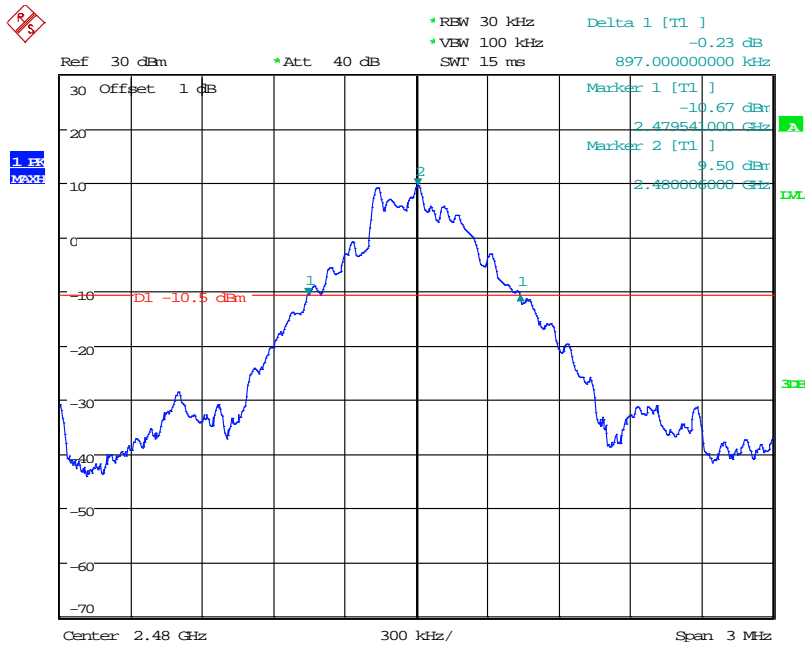
Date: 19.AUG.2019  19:38:12

# EDR Mode (π/4-DQPSK)
## Low Channel



Date: 19.AUG.2019  19:45:40

## Middle Channel



Date: 19.AUG.2019  19:47:51
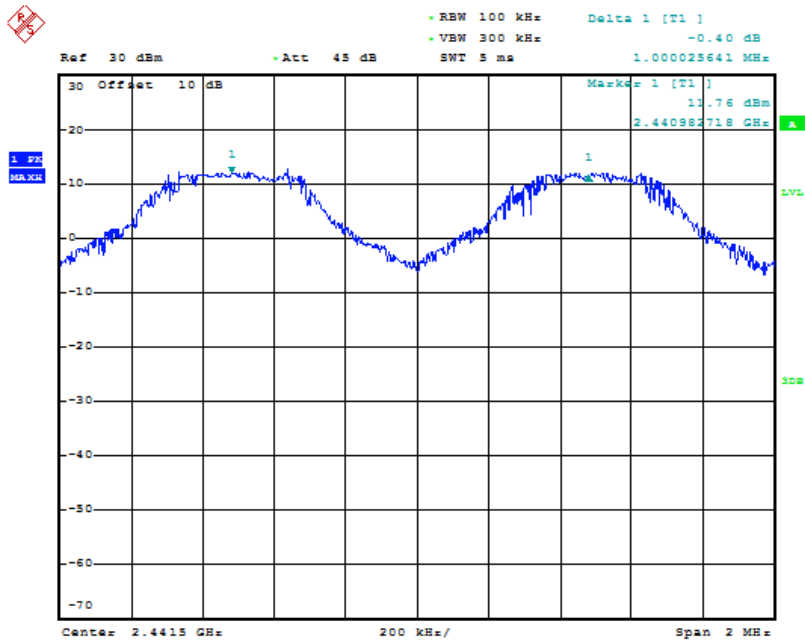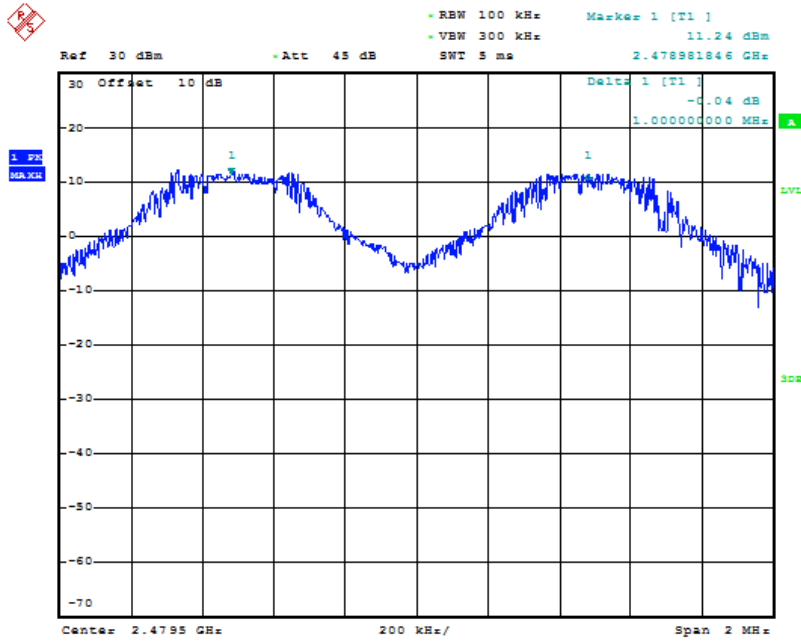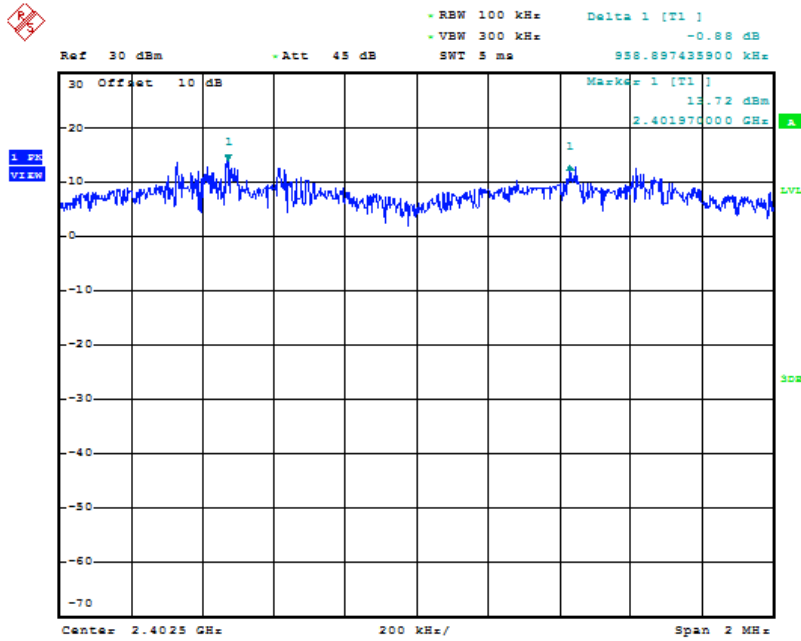
## High Channel
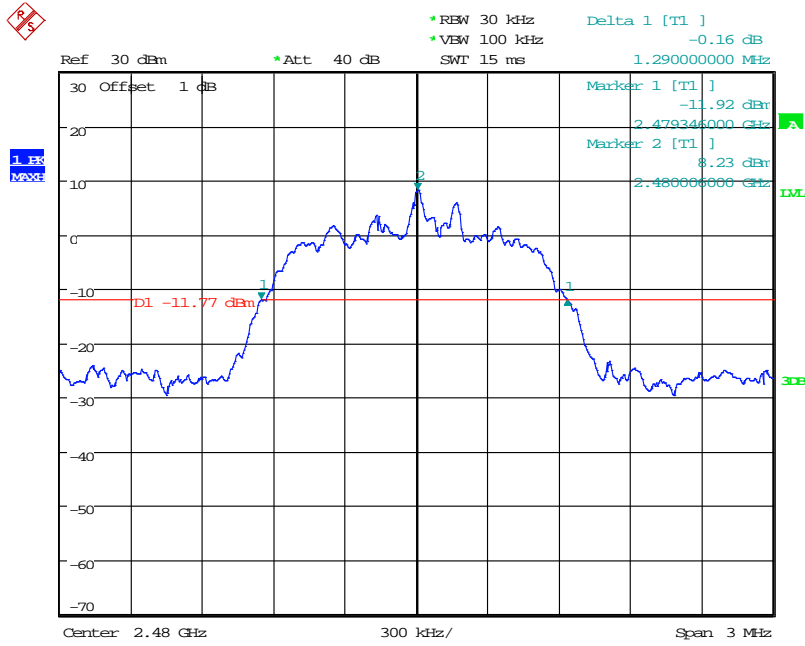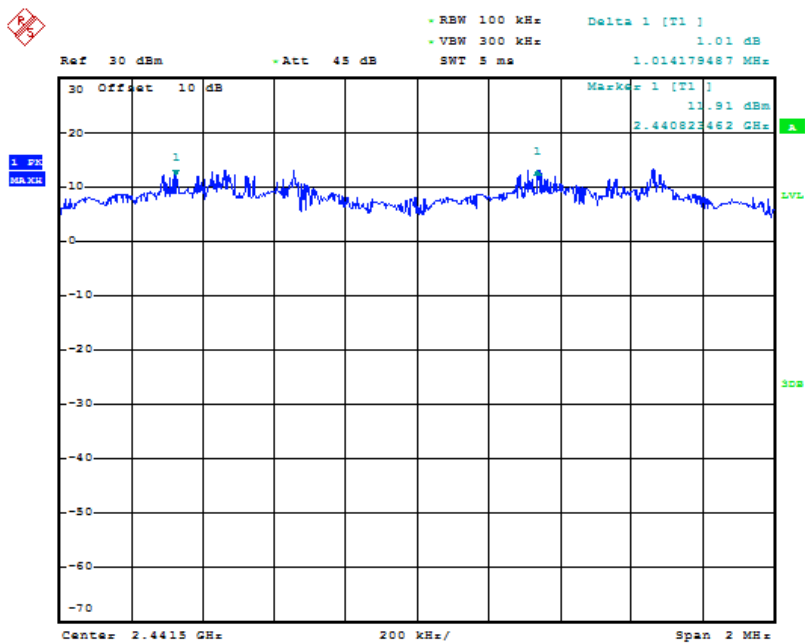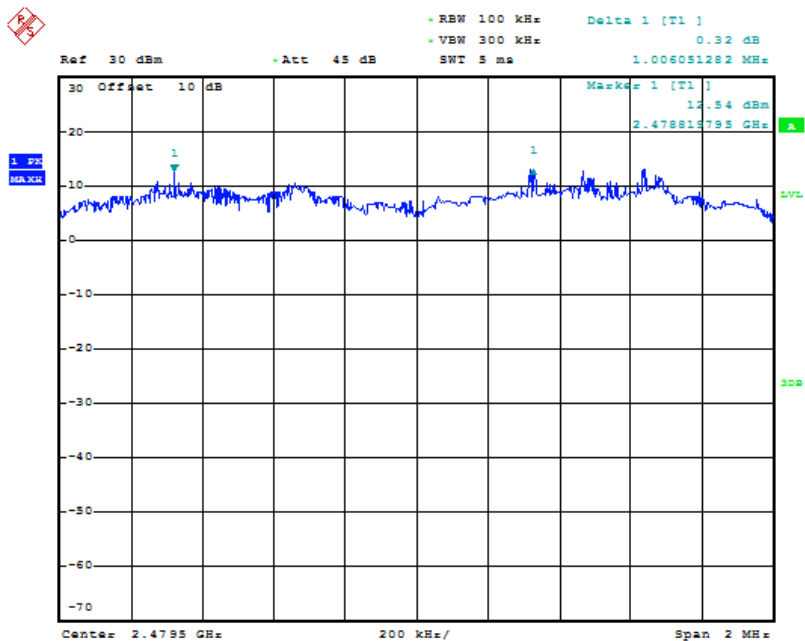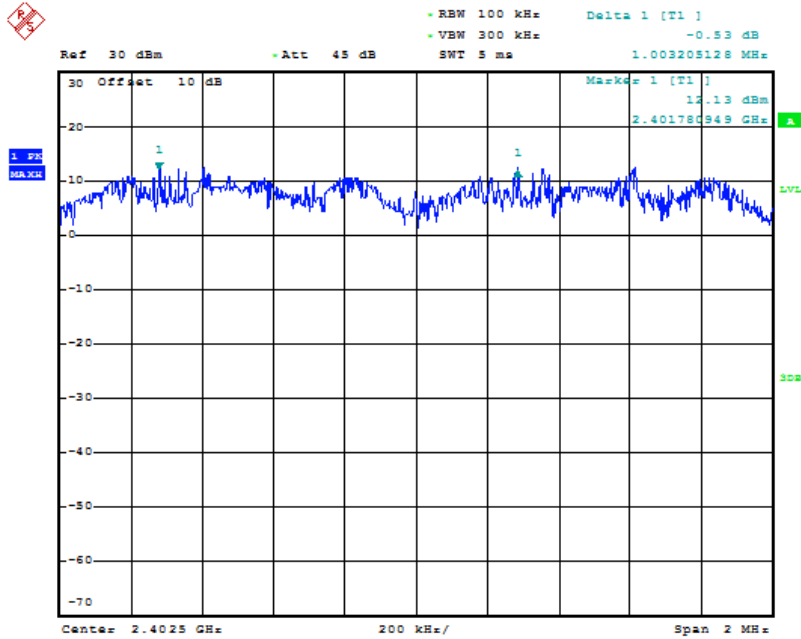


Date: 19.AUG.2019  19:49:41

## EDR Mode (8DPSK)

### Low Channel



Date: 19.AUG.2019  19:53:15

## Middle Channel
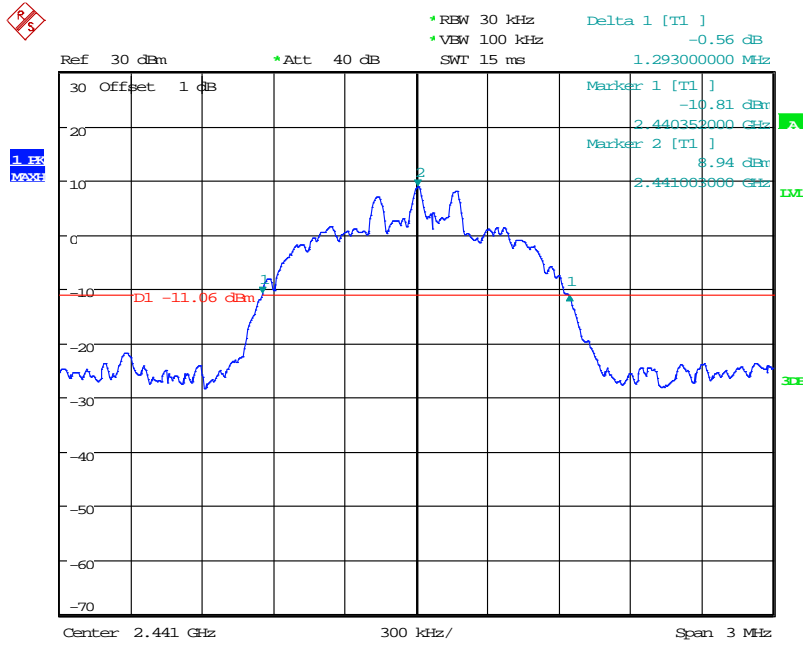


Date: 19.AUG.2019  19:57:24

## High Channel



Date: 19.AUG.2019  19:59:15

# 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:** | 25.3 ℃ |
| **Relative Humidity:** | 62 % |
| **ATM Pressure:** | 1010 hPa |

*The testing was performed by David Hsu on 2019-08-19.*

## 10.4  Test Results

| Channel | Channel Separation (MHz) | 20 dBc BW (MHz) | Two-thirds of the 20 dB bandwidth (MHz) | Channel Separation Limit | Result |
|---|---|---|---|---|---|
| *BR Mode (GFSK)* | | | | | |
| Low | 1.00 | 0.89 | 0.593 | >two-thirds of the 20 dB bandwidth | Compliance |
| Middle | 1.00 | 0.89 | 0.593 | >two-thirds of the 20 dB bandwidth | Compliance |
| High | 1.00 | 0.90 | 0.600 | >two-thirds of the 20 dB bandwidth | Compliance |
| *EDR Mode (π/4-DQPSK)* | | | | | |
| Low | 0.96 | 1.29 | 0.860 | >two-thirds of the 20 dB bandwidth | Compliance |
| Middle | 1.01 | 1.29 | 0.860 | >two-thirds of the 20 dB bandwidth | Compliance |
| High | 1.00 | 1.29 | 0.860 | >two-thirds of the 20 dB bandwidth | Compliance |
| *EDR Mode (8DPSK)* | | | | | |
| Low | 1.00 | 1.29 | 0.860 | >two-thirds of the 20 dB bandwidth | Compliance |
| Middle | 1.00 | 1.29 | 0.860 | >two-thirds of the 20 dB bandwidth | Compliance |
| High | 1.05 | 1.29 | 0.860 | >two-thirds of the 20 dB bandwidth | Compliance |

Please refer to the following plots

# BR Mode (GFSK)
## Low Channel
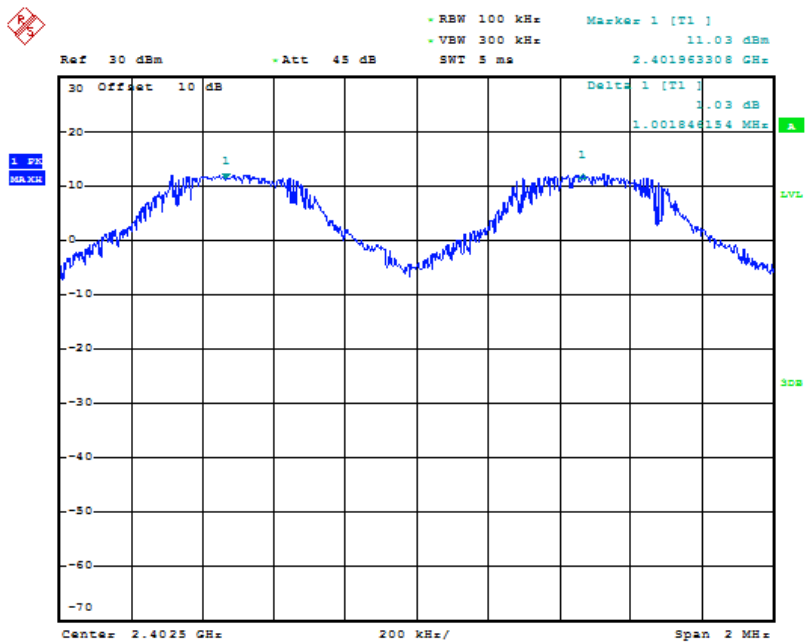


Date: 19.AUG.2019  12:23:20

## Middle Channel



Date: 19.AUG.2019  12:14:50

## High Channel



Date: 19.AUG.2019  12:12:31

## EDR Mode (π/4-DQPSK)

### Low Channel



Date: 19.AUG.2019  12:36:01

## Middle Channel



Date: 19.AUG.2019  12:34:32

## High Channel



Date: 19.AUG.2019  12:32:07

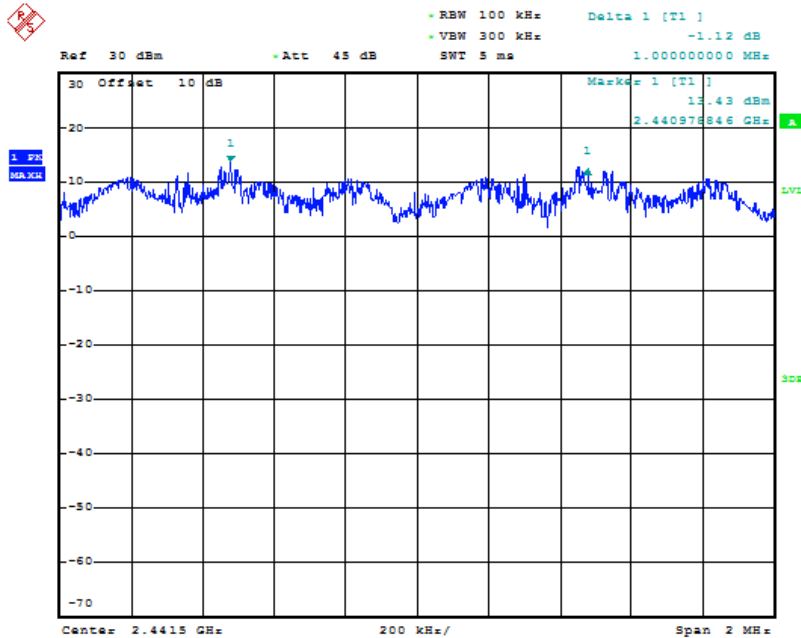## EDR Mode (8DPSK)
## Low Channel



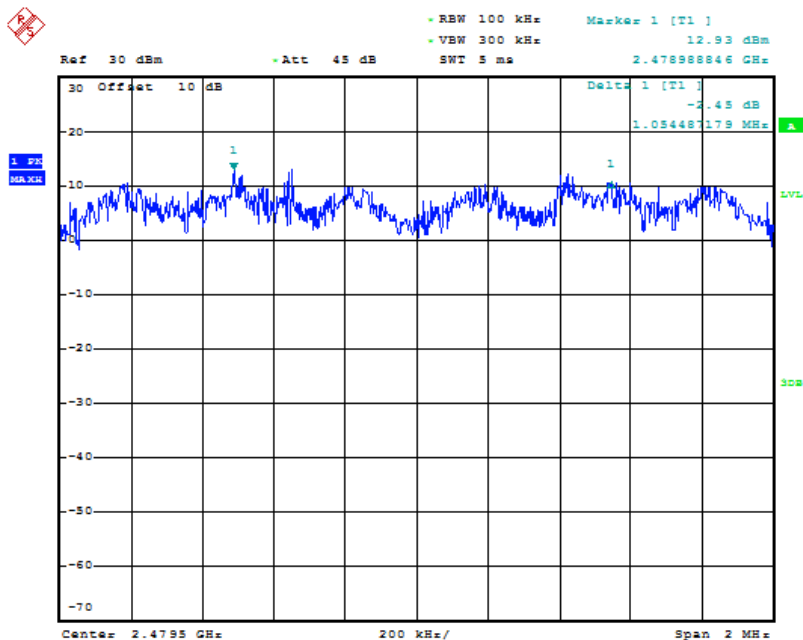Date: 19.AUG.2019  12:40:27

## Middle Channel



Date: 19.AUG.2019  12:39:14

# High Channel



```
                                          RBW 100 kHz     Marker 1 [T1 ]
                                          VBW 300 kHz               12.93 dBm
        Ref   30 dBm          Att   45 dB  SWT 5 ms       2.478988846 GHz
        30 Offset   10 dB                              Delta 1 [T1 ]
                                                                -2.45 dB
                                                       1.054487179 MHz
```

```
Center  2.4795 GHz              200 kHz/              Span  2 MHz
```

Date: 19.AUG.2019  12:38:07

# 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 ≤ channel spacing and where possible RBW should be set >> 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:** | 25.3 ℃ |
| **Relative Humidity:** | 62 % |
| **ATM Pressure:** | 1010 hPa |

*The testing was performed by David Hsu on 2019-08-19.*

## 11.4 Test Results

| Test mode: BR mode / 2402 ~ 2480MHz (*GFSK*) | | | | | | |
|---|---|---|---|---|---|---|
| **Mode** | **Pulse Time (ms)** | **Hopping Number** | **Period Time (s)** | **Total of Dwell (ms)** | **Limit (ms)** | **Result** |
| DH1 | 0.385 | 320 | 31.6 | 123.20 | <400 | PASS |
| DH3 | 1.644 | 160 | 31.6 | 263.04 | <400 | PASS |
| DH5 | 2.097 | 110 | 31.6 | 230.67 | <400 | PASS |
| **Test mode: EDR mode / 2402 ~ 2480MHz (*π/4-DQPSK*)** | | | | | | |
| **Mode** | **Pulse Time (ms)** | **Hopping Number** | **Period Time (s)** | **Total of Dwell (ms)** | **Limit (ms)** | **Result** |
| 2DH1 | 0.399 | 320 | 31.6 | 127.68 | <400 | PASS |
| 2DH3 | 1.656 | 160 | 31.6 | 264.96 | <400 | PASS |
| 2DH5 | 2.902 | 130 | 31.6 | 377.26 | <400 | PASS |
| **Test mode: EDR mode / 2402 ~ 2480MHz (*8DPSK*)** | | | | | | |
| **Mode** | **Pulse Time (ms)** | **Hopping Number** | **Period Time (s)** | **Total of Dwell (ms)** | **Limit (ms)** | **Result** |
| 3DH1 | 0.402 | 320 | 31.6 | 128.64 | <400 | PASS |
| 3DH3 | 1.652 | 160 | 31.6 | 264.32 | <400 | PASS |
| 3DH5 | 2.905 | 110 | 31.6 | 319.55 | <400 | PASS |

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

Note 2: Hopping Number / 10 = Divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

Note 3: Hopping Number = Hopping Number/10 * 10, Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of all hopping channels.

Please refer to the following plots

## BR Mode (GFSK)

### DH1: Pulse Width



```
                                          RBW 500 kHz      Delta 1 [T1 ]
                                         *VBW 500 kHz            -0.59 dB
         Ref  16 dBm       *Att  10 dB    SWT 1 ms          385.269231 µs
            Offset  1 dB          1                   1   Marker 1 [T1 ]
      10                                                        10.21 dBm
                                                           -394.564103 µs
       0                                                              TRG
                                                                      LVL
     -10     TRG -8.2 dBm
     -20
     -30
     -40                                                              3DB
     -50
     -60
     -70
     -80
         Center 2.402 GHz              100 µs/
```
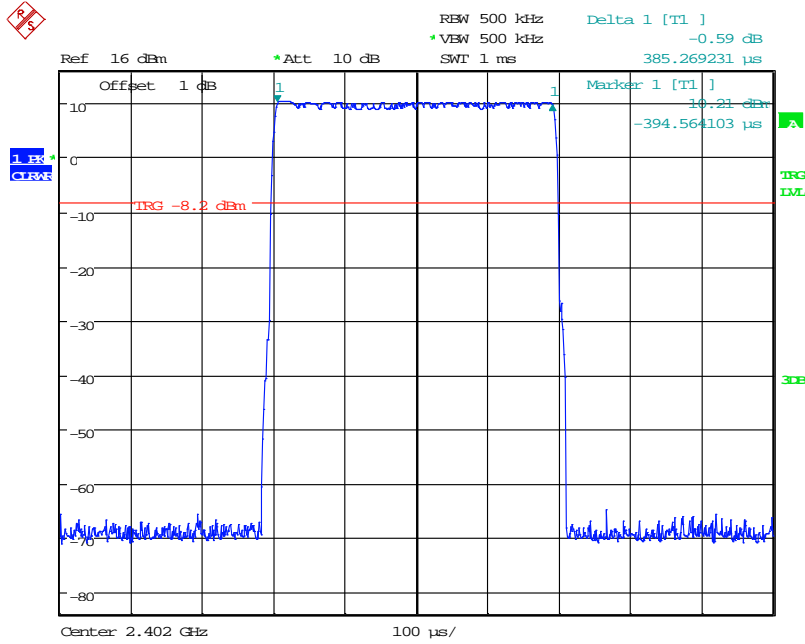
Date: 19.AUG.2019  20:31:23

### DH1: Hopping Number



```
                                          RBW 500 kHz
                                         *VBW 500 kHz
         Ref  16 dBm       *Att  10 dB    SWT 31.6 s
            Offset  1 dB                                               A
                                                                      SGL
                                                                      LVL
                                                                      3DB
     -60
     -70
     -80
         Center 2.402 GHz              3.16 s/
```
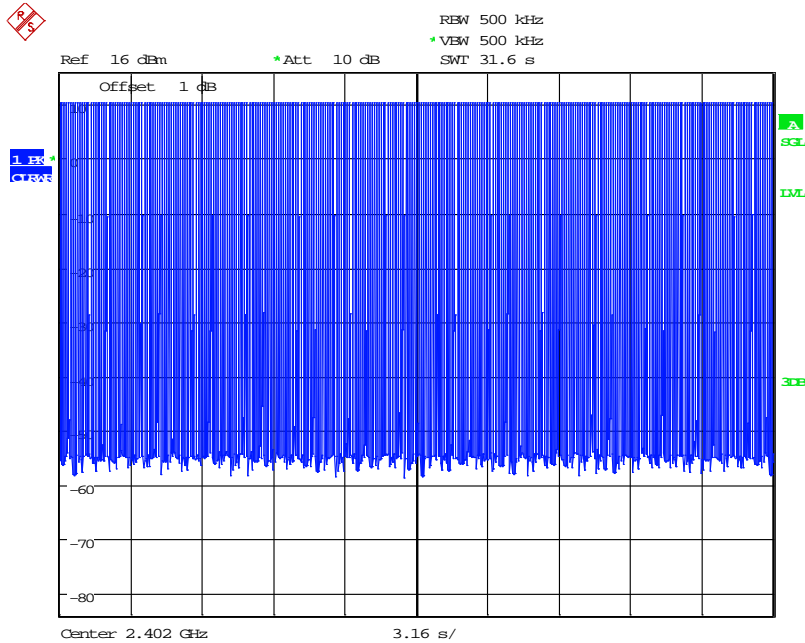
Date: 19.AUG.2019  20:31:56

## DH1: Hopping Number /10

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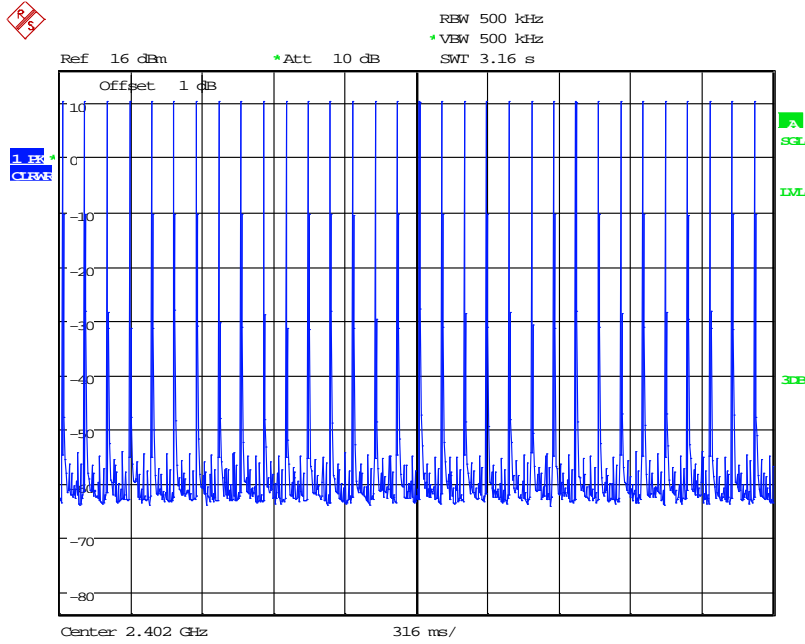


Date: 19.AUG.2019   20:32:24

## DH3: Pulse Width
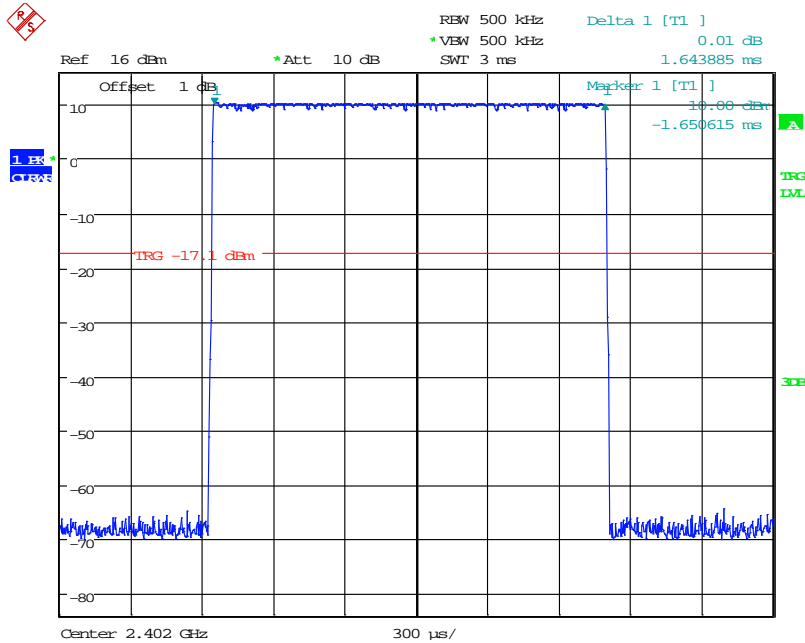


Date: 19.AUG.2019   20:33:50

## DH3: Hopping Number
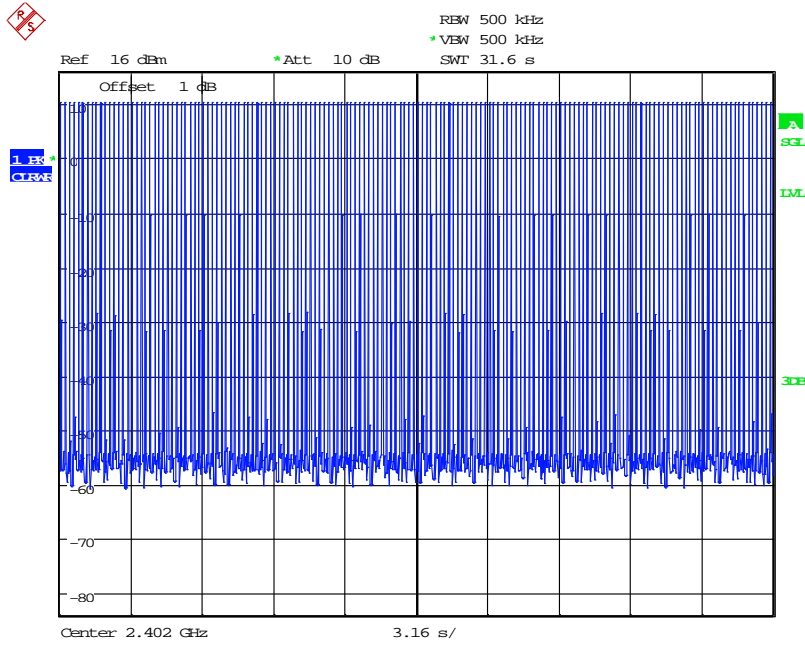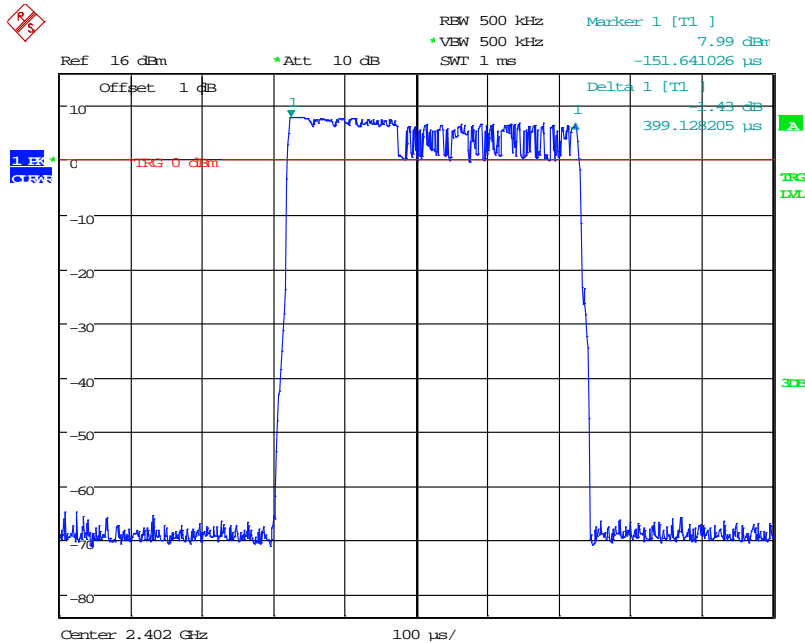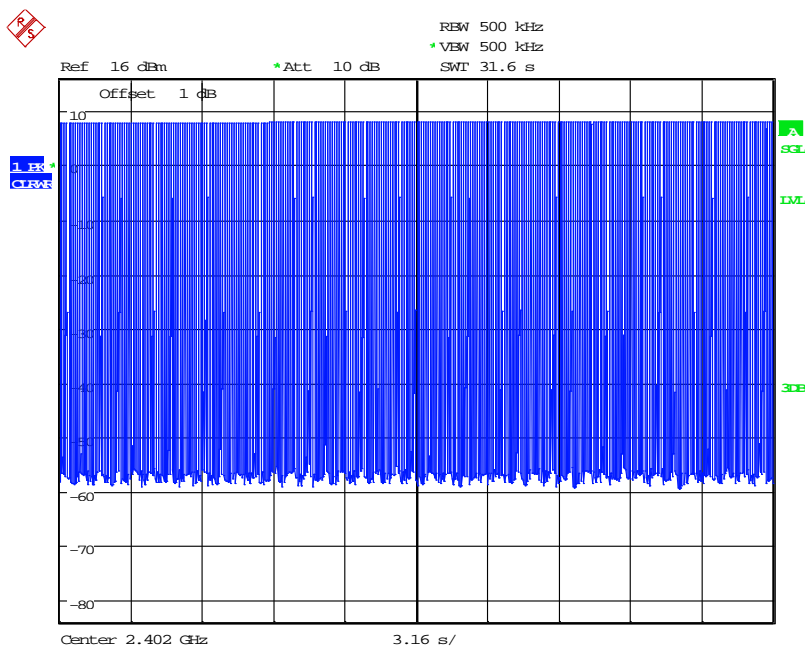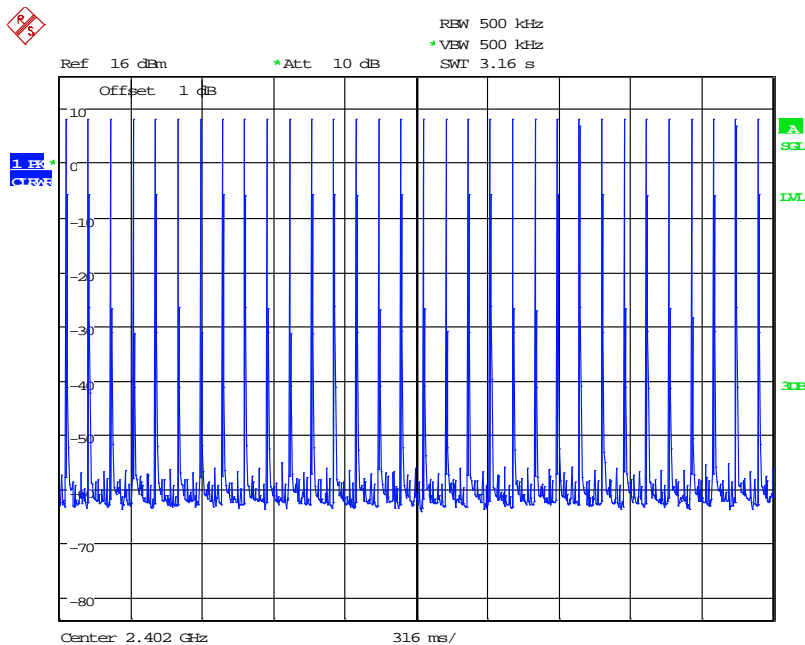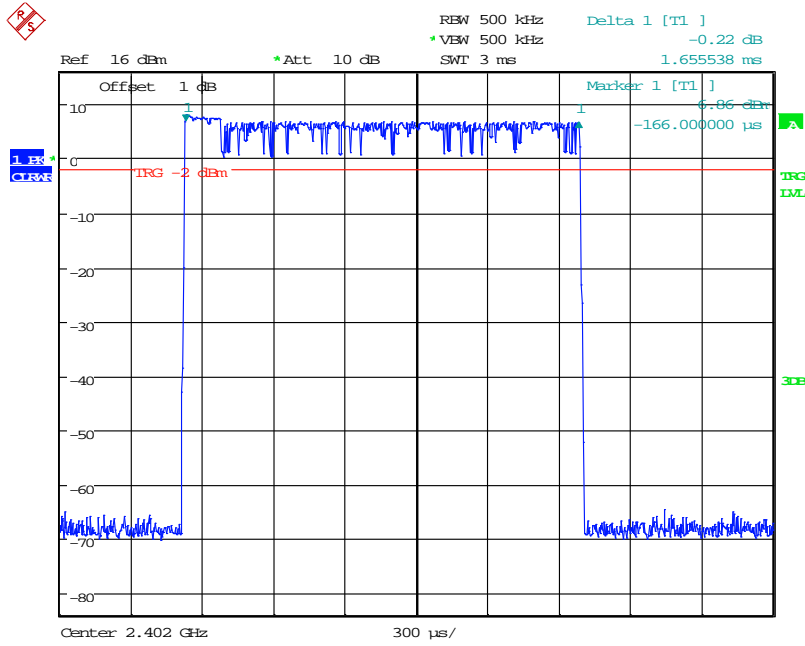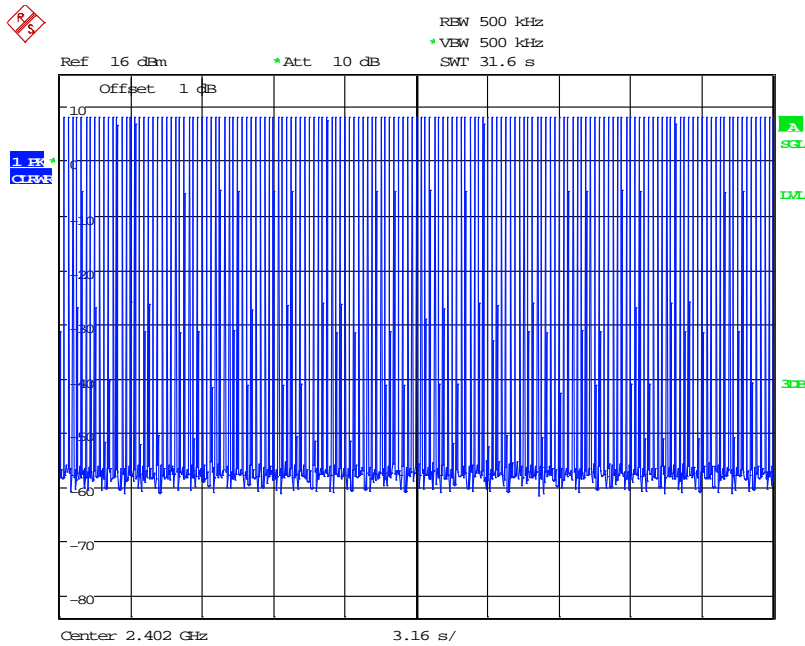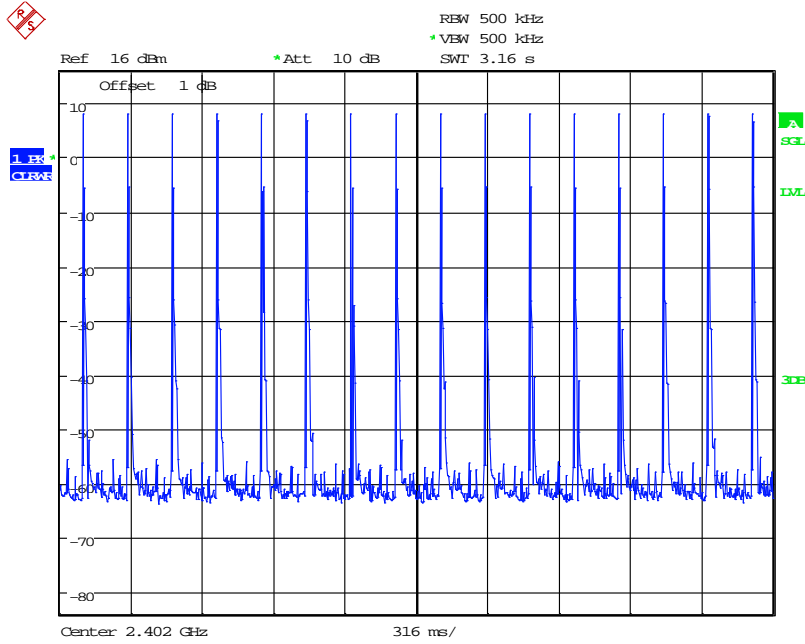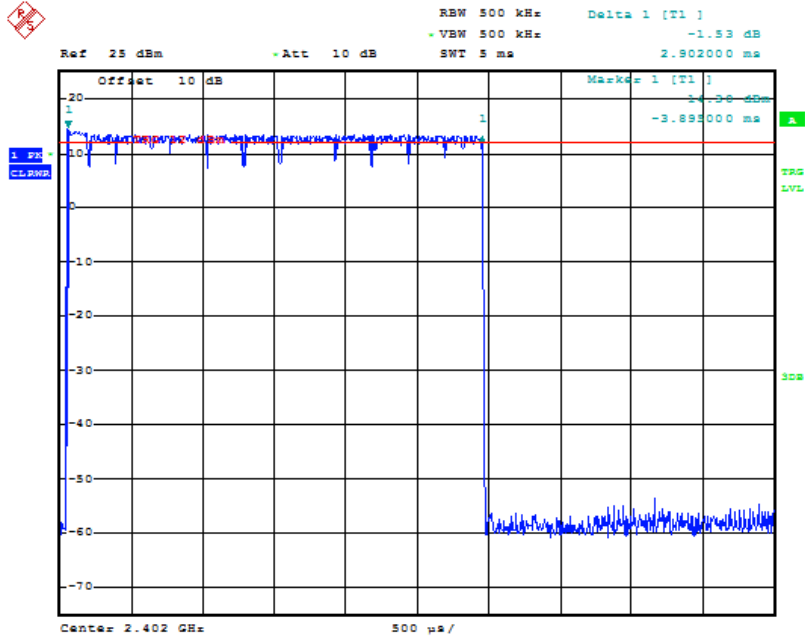


Date: 19.AUG.2019  20:34:23

## DH3: Hopping Number /10

**(Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)**
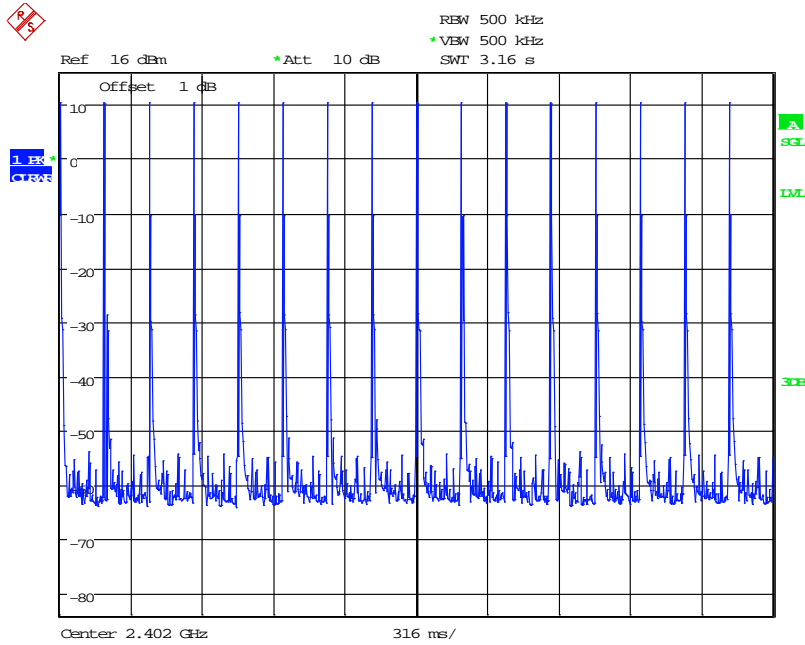


Date: 19.AUG.2019  20:34:41

## DH5: Pulse Width
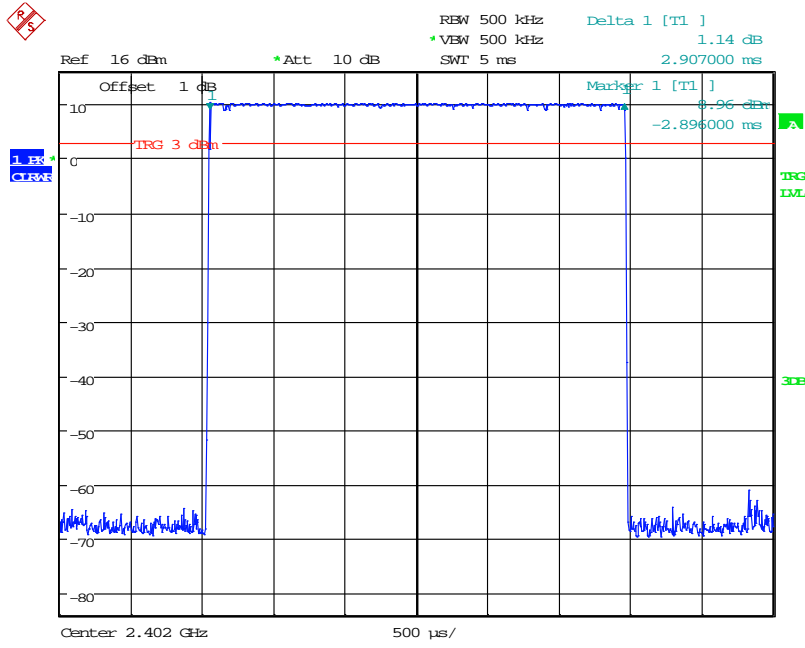


Date: 19.AUG.2019  20:37:21

## DH5: Hopping Number
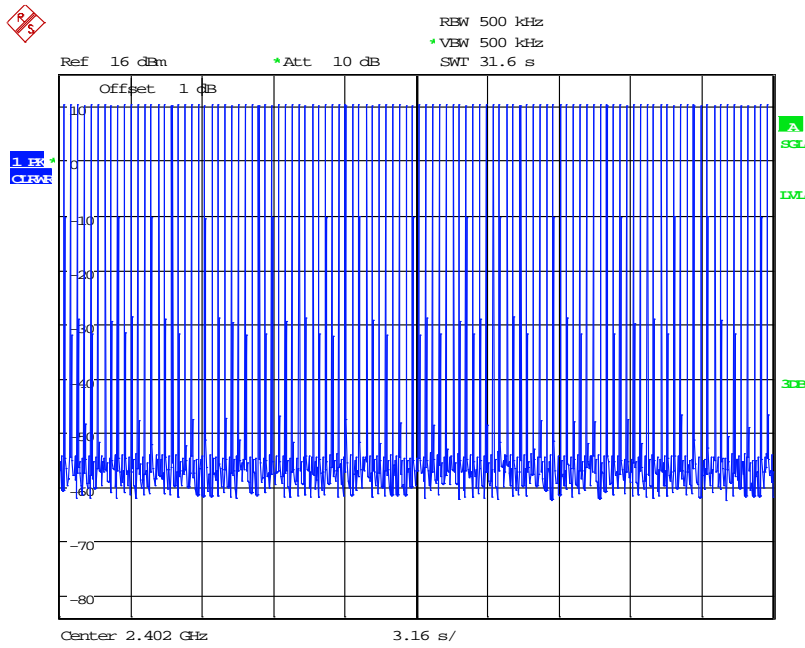


Date: 19.AUG.2019  20:37:55

## DH5: Hopping Number /10

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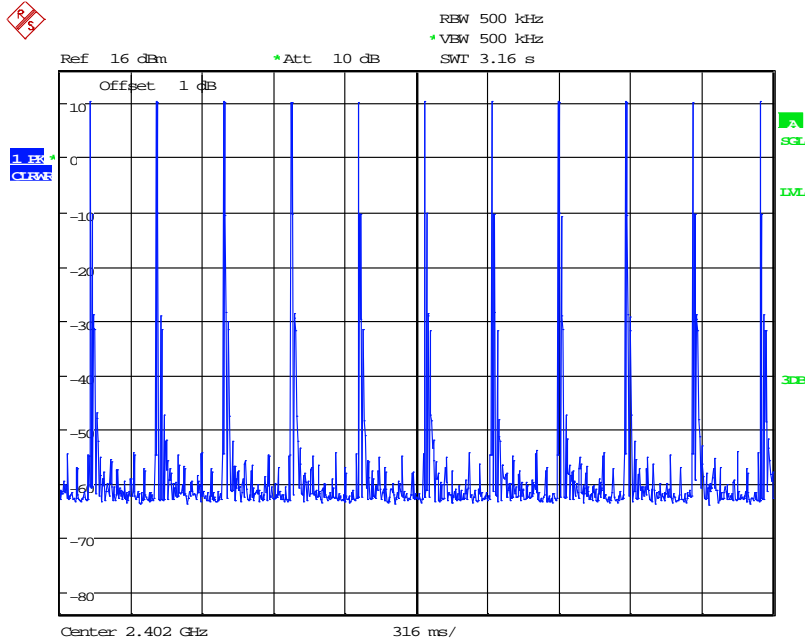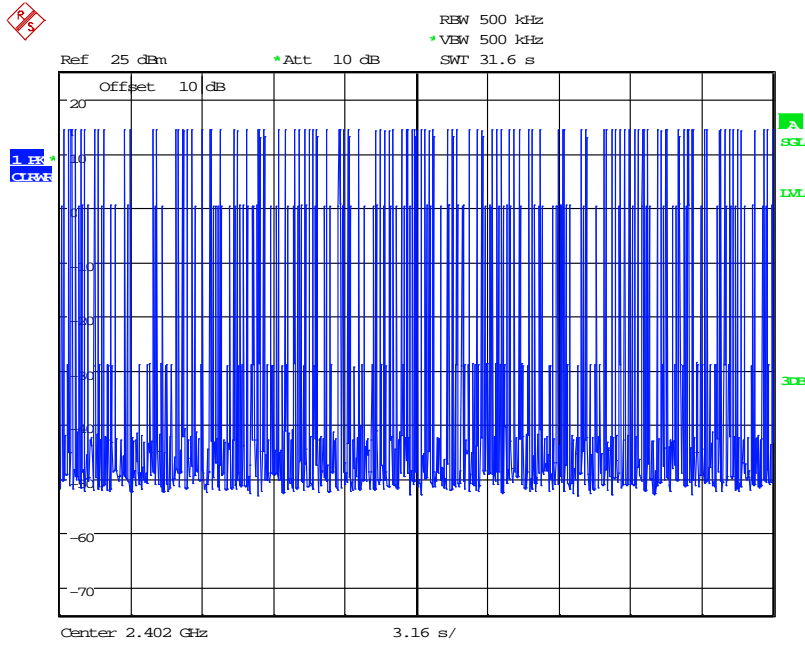


Date: 19.AUG.2019  20:38:02

## EDR Mode (π/4-DQPSK)

## 2DH1: Pulse Width



Date: 19.AUG.2019  20:43:15

## 2DH1: Hopping Number

Date: 19.AUG.2019  20:43:48

## 2DH1: Hopping Number /10

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

Date: 19.AUG.2019  20:43:54

## 2DH3: Pulse Width
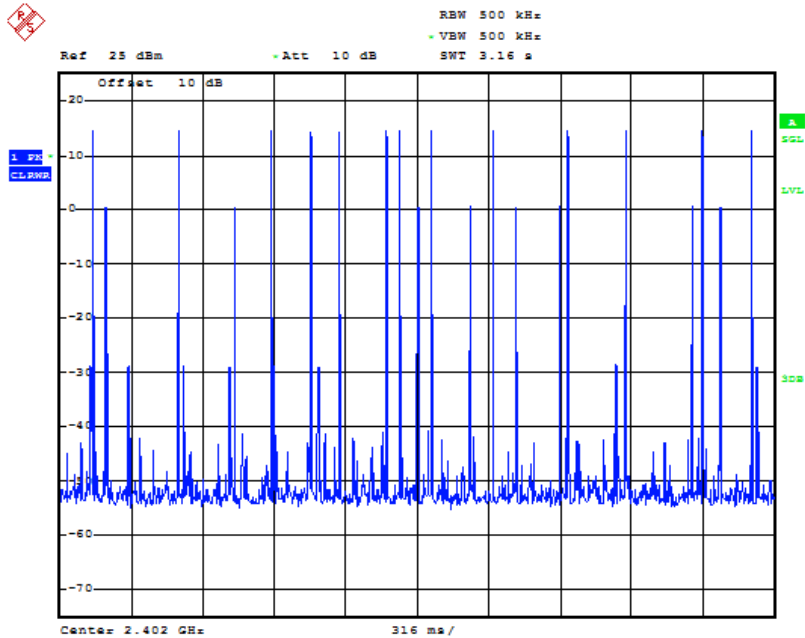


Date: 19.AUG.2019  20:47:13

## 2DH3: Hopping Number



Date: 19.AUG.2019  20:47:46

## 2DH3: Hopping Number /10

### (Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)



Date: 19.AUG.2019  20:47:56

## 2DH5: Pulse Width



Date: 20.AUG.2019  15:34:12

## 2DH5: Hopping Number

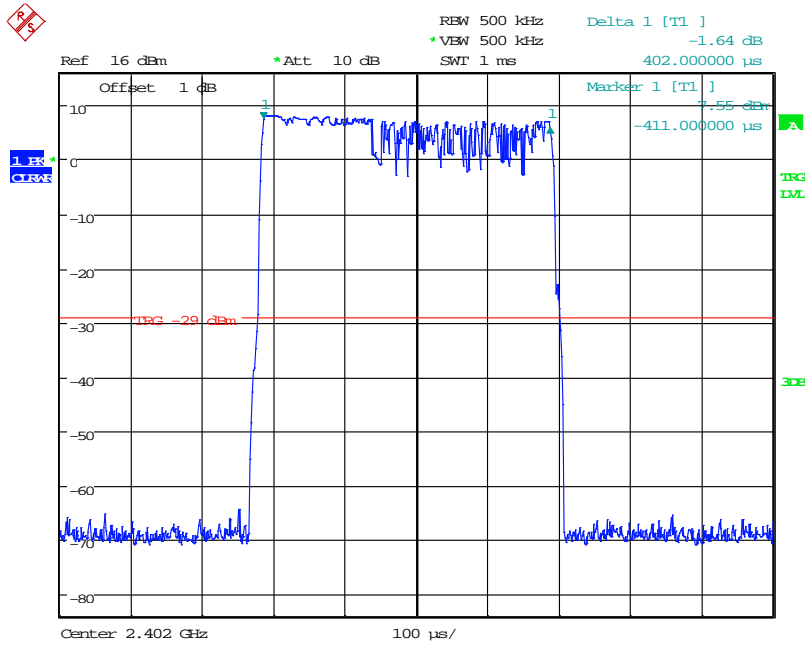

Date: 20.AUG.2019  15:34:45

## 2DH5: Hopping Number /10

**(Hopping Number = 13 in 1/10 period of highest signals, Second High signals were other channel)**
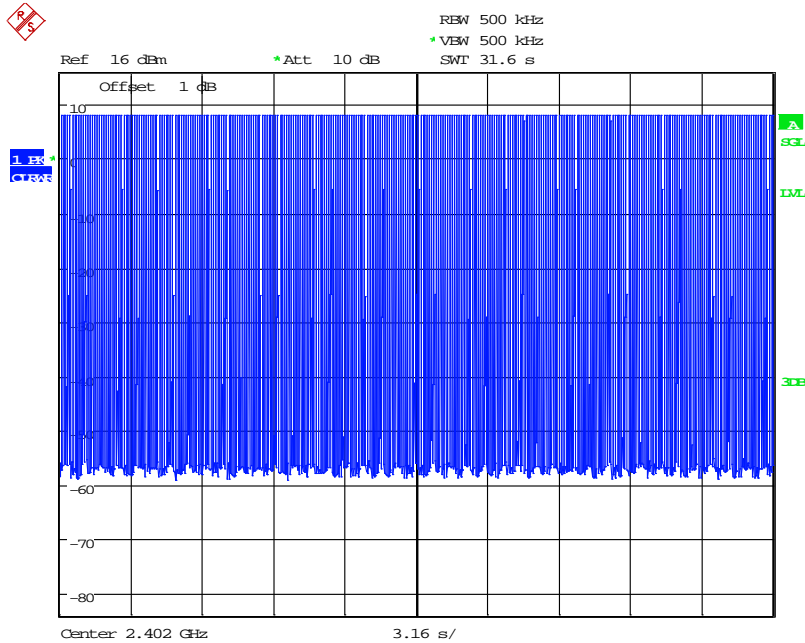


Date: 20.AUG.2019  15:34:52

# EDR Mode (8DPSK)

## 3DH1: Pulse Width



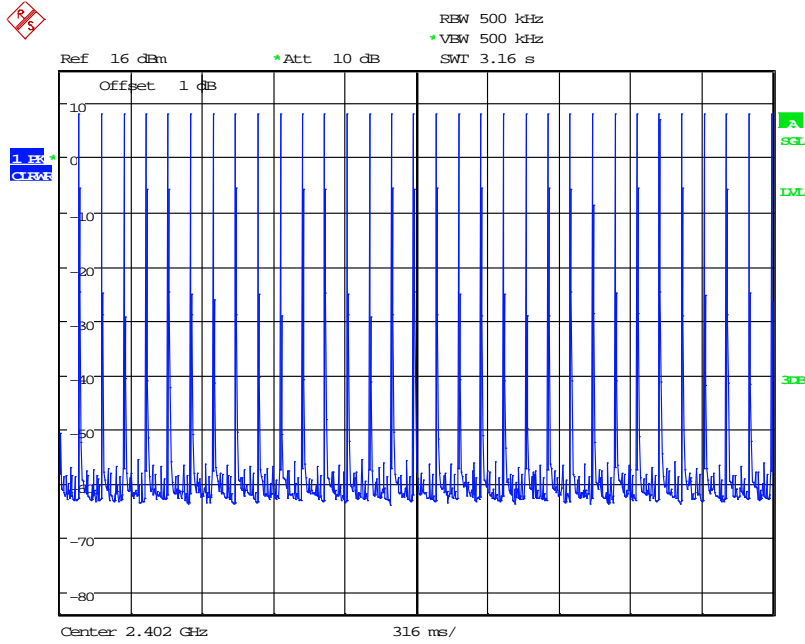Date: 19.AUG.2019  20:12:59
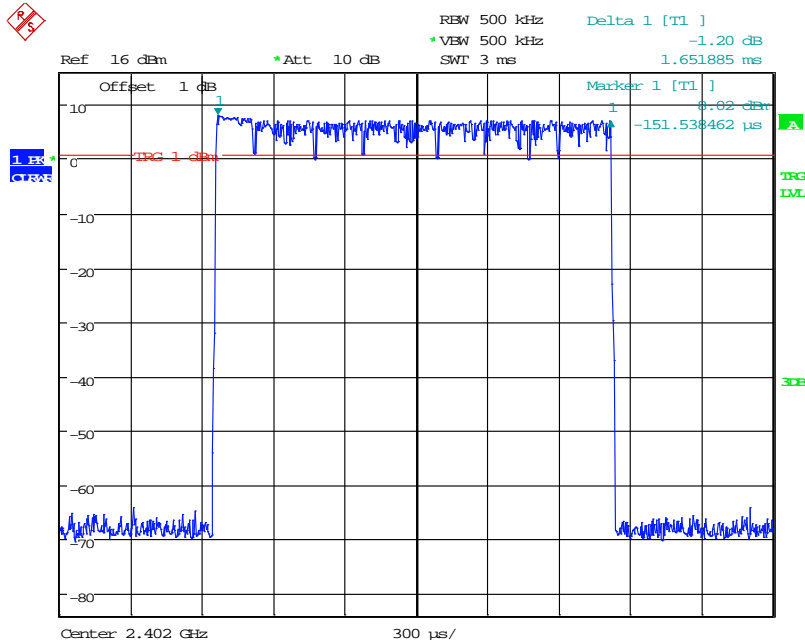
## 3DH1: Hopping Number



Date: 19.AUG.2019  20:13:31

## 3DH1: Hopping Number /10

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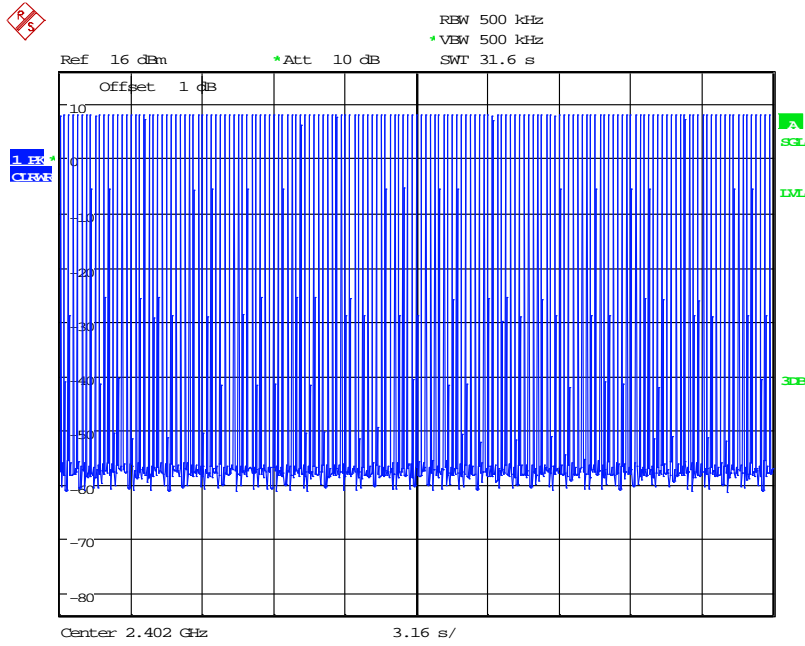


Date: 19.AUG.2019  20:14:29

## 3DH3: Pulse Width
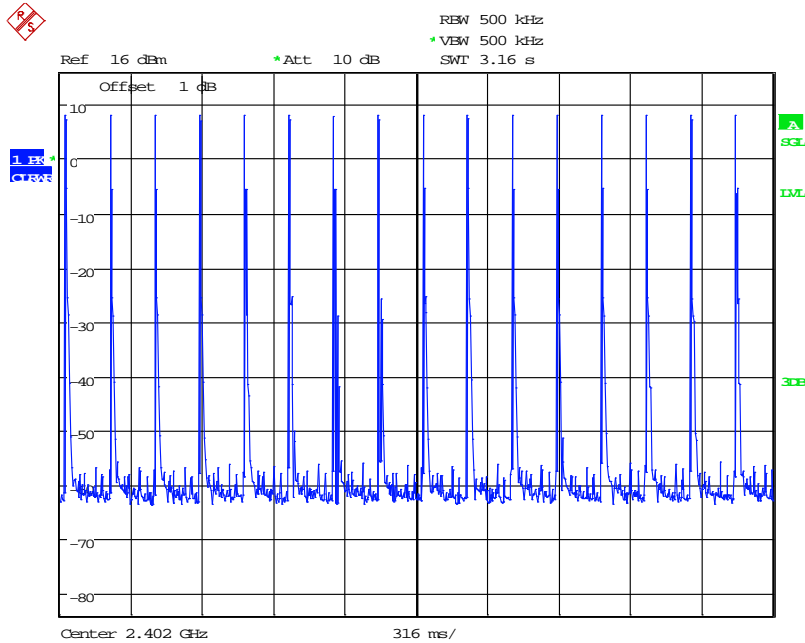


Date: 19.AUG.2019  20:17:32

## 3DH3: Hopping Number



Date: 19.AUG.2019  20:18:05

## 3DH3: Hopping Number /10

**(Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)**



Date: 19.AUG.2019  20:18:13

## 3DH5: Pulse Width



Date: 19.AUG.2019  20:20:31

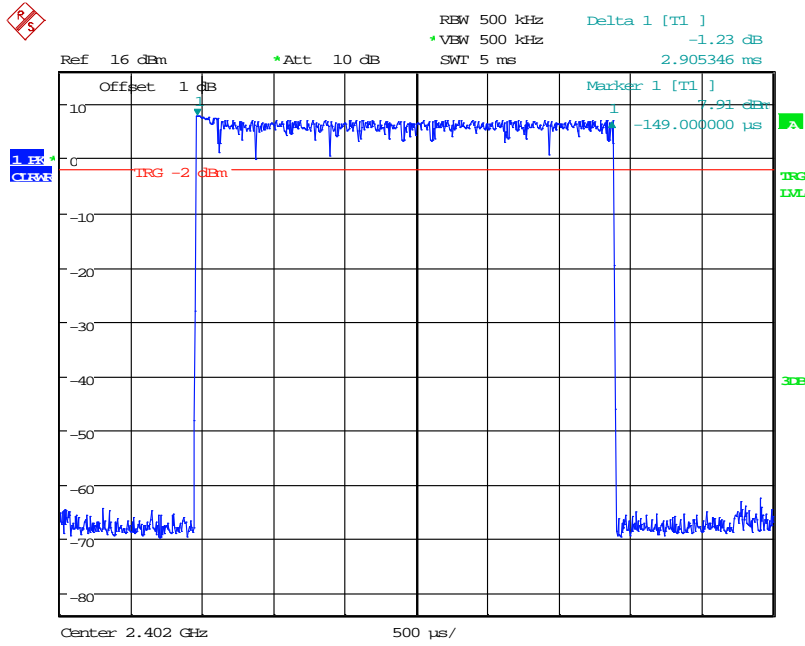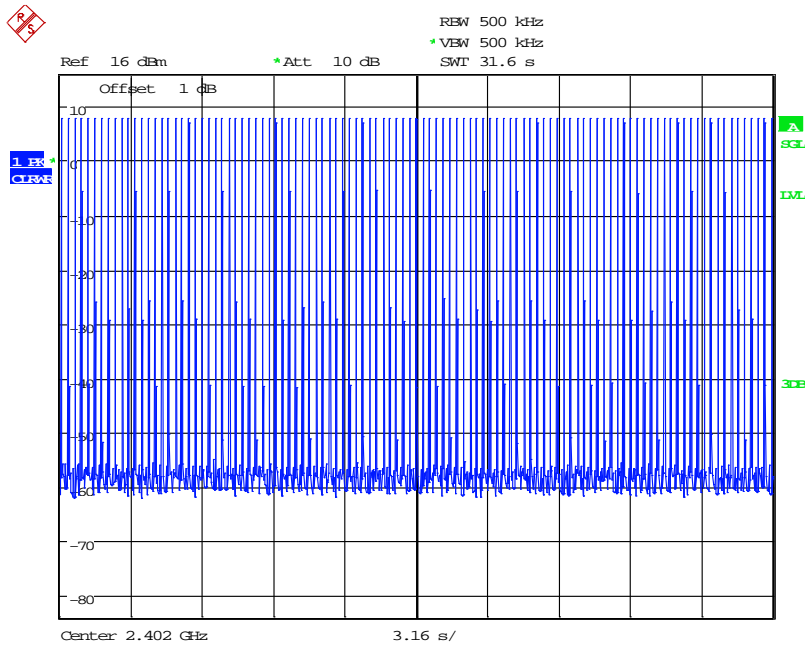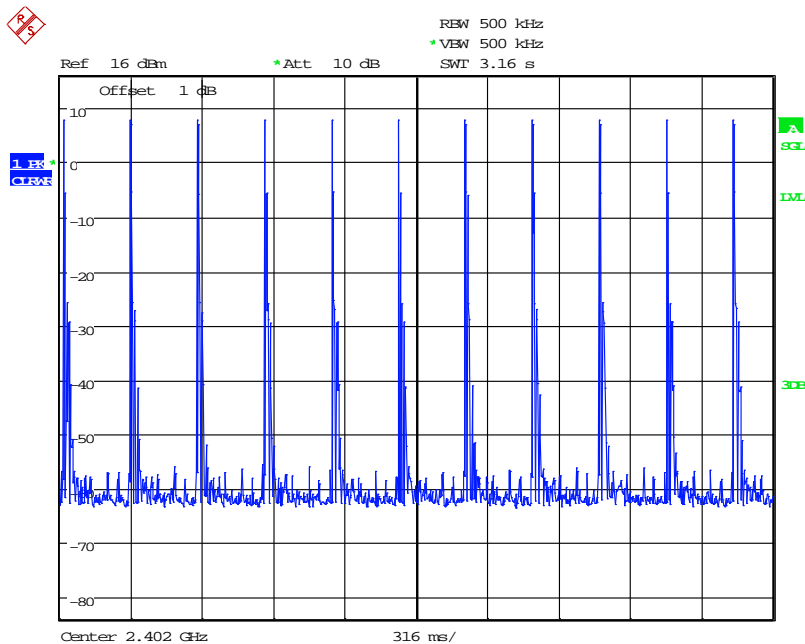## 3DH5: Hopping Number



Date: 19.AUG.2019  20:21:03

## 3DH5: Hopping Number /10

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



Date: 19.AUG.2019  20:21:52

# 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:** | 25.3 ℃ |
| **Relative Humidity:** | 62 % |
| **ATM Pressure:** | 1010 hPa |

*The testing was performed by David Hsu on 2019-08-19~2019-08-20*

## 12.4 Test Results

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

Please refer to the following plots

### BR Mode (GFSK)
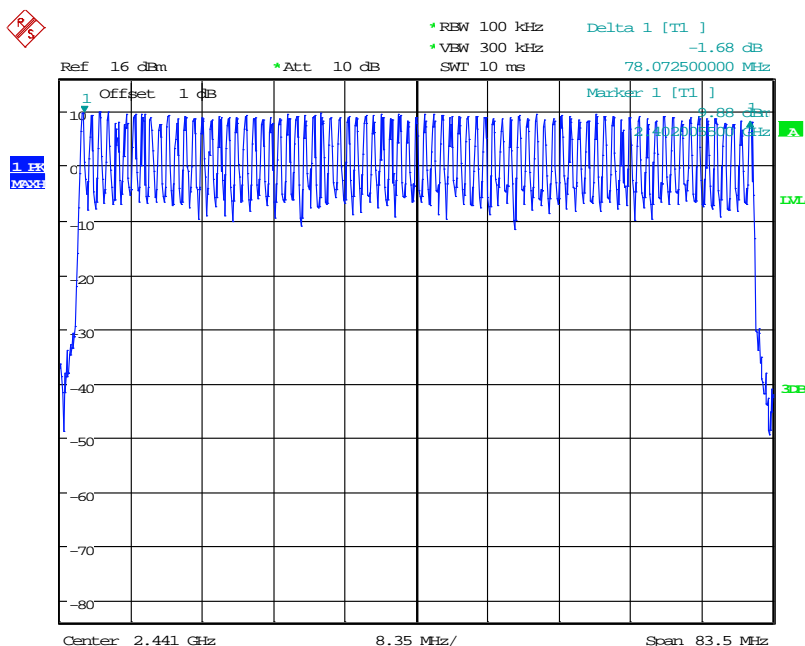


Date: 19.AUG.2019  20:28:56

## EDR Mode (π/4-DQPSK)
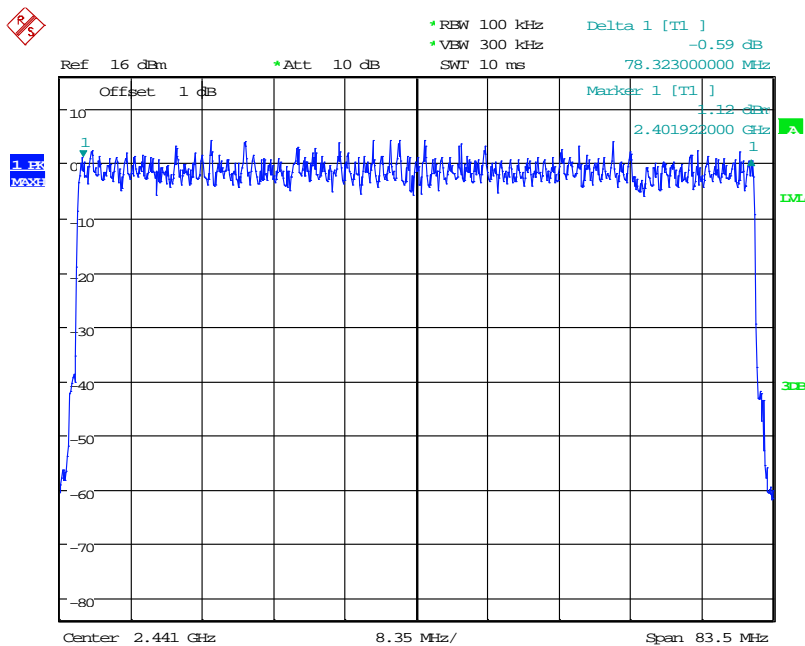


Date: 20.AUG.2019  15:17:11

## EDR Mode (8DPSK)
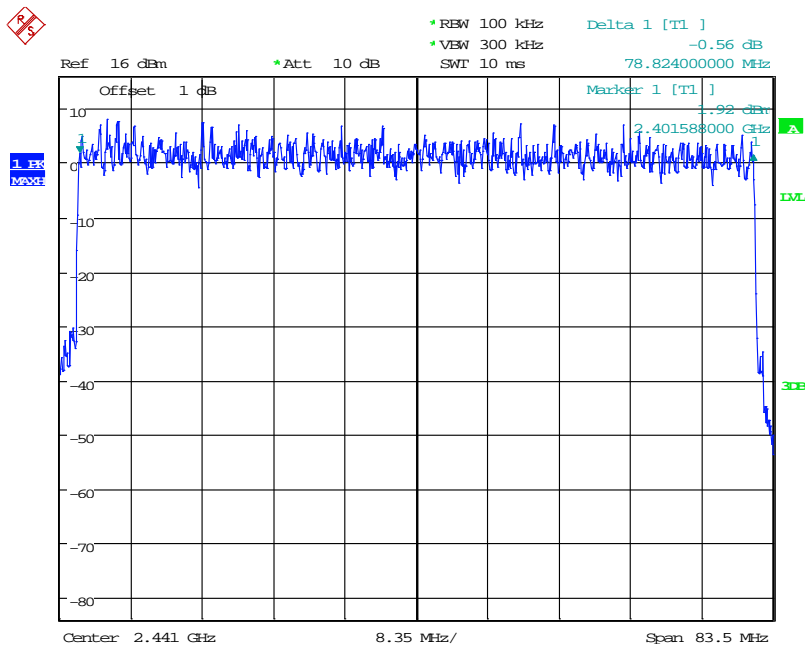


Date: 19.AUG.2019  20:09:50

# 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:** | 25.3 ℃ |
| **Relative Humidity:** | 62 % |
| **ATM Pressure:** | 1010 hPa |

*The testing was performed by David Hsu on 2019-08-19.*

## 13.4  Test Results

| Channel | Frequency (MHz) | Peak Conducted Output Power | | Limit (W) | Result |
|---|---|---|---|---|---|
| | | (dBm) | (W) | | |
| *BR Mode (GFSK)* | | | | | |
| Low | 2402 | 9.02 | 0.0080 | 0.125 | Compliance |
| Middle | 2441 | 8.83 | 0.0076 | 0.125 | Compliance |
| High | 2480 | 8.41 | 0.0069 | 0.125 | Compliance |
| *EDR Mode (π/4-DQPSK)* | | | | | |
| Low | 2402 | 7.56 | 0.0057 | 0.125 | Compliance |
| Middle | 2441 | 7.46 | 0.0056 | 0.125 | Compliance |
| High | 2480 | 7.01 | 0.0050 | 0.125 | Compliance |
| *EDR Mode (8DPSK)* | | | | | |
| Low | 2402 | 8.01 | 0.0063 | 0.125 | Compliance |
| Middle | 2441 | 7.89 | 0.0062 | 0.125 | Compliance |
| High | 2480 | 7.36 | 0.0054 | 0.125 | 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:** | 25.3 ℃ |
| **Relative Humidity:** | 62 % |
| **ATM Pressure:** | 1010 hPa |

*The testing was performed by David Hsu on 2019-08-19.*

## 14.4 Test Results

| Channel | Frequency (MHz) | Delta Peak to Band Emission (dBc) | Limit (dBc) | Result |
|---|---|---|---|---|
| *BR Mode (GFSK)* | | | | |
| Low | 2402 | 40.05 | ≥ 20 | PASS |
| High | 2480 | 60.43 | ≥ 20 | PASS |
| *BR Hopping Mode (GFSK)* | | | | |
| Low | 2402-2480 | 45.20 | ≥ 20 | PASS |
| High | 2402-2480 | 60.60 | ≥ 20 | PASS |
| *EDR Mode (π/4-DQPSK)* | | | | |
| Low | 2402 | 39.81 | ≥ 20 | PASS |
| High | 2480 | 55.74 | ≥ 20 | PASS |
| *EDR Hopping Mode (π/4-DQPSK)* | | | | |
| Low | 2402-2480 | 59.69 | ≥ 20 | PASS |
| High | 2402-2480 | 60.76 | ≥ 20 | PASS |
| *EDR Mode (8DPSK)* | | | | |
| Low | 2402 | 41.04 | ≥ 20 | PASS |
| High | 2480 | 56.35 | ≥ 20 | PASS |
| *EDR Hopping Mode (8DPSK)* | | | | |
| Low | 2402-2480 | 40.98 | ≥ 20 | PASS |
| High | 2402-2480 | 60.98 | ≥ 20 | PASS |

Please refer to the following plots

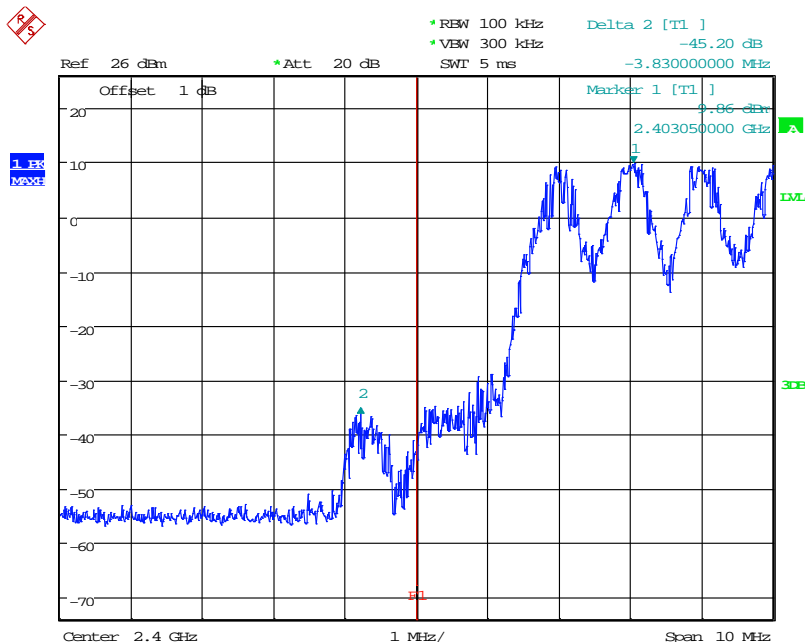# BR Mode (GFSK)
## Band Edge, CH Low
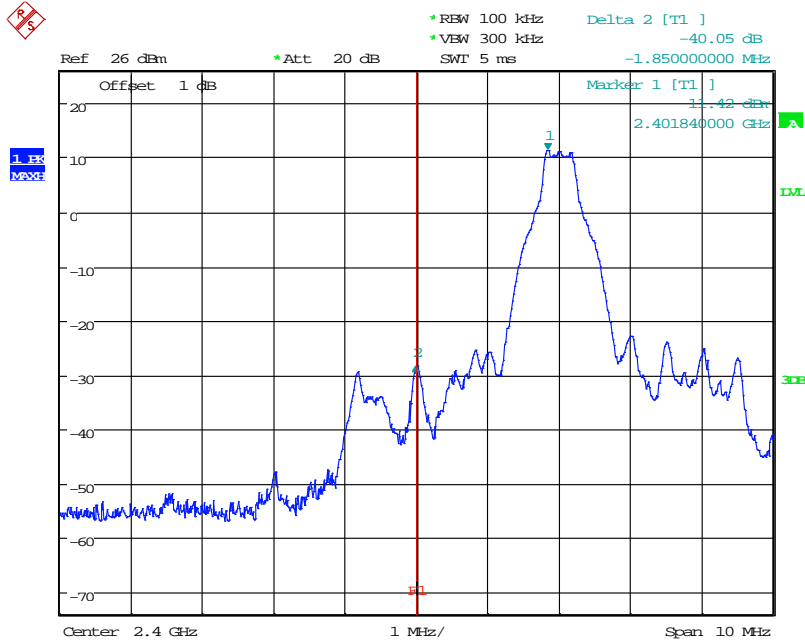


Date: 19.AUG.2019  19:32:38
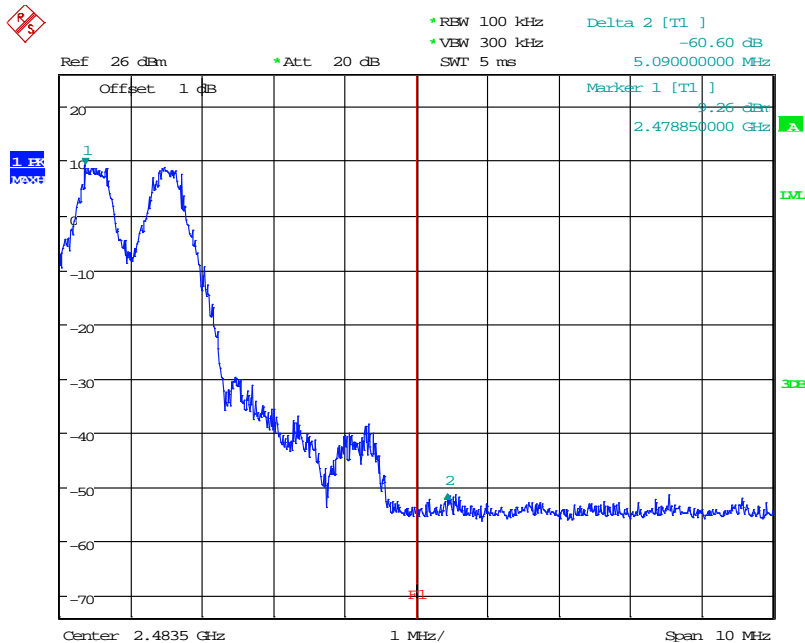
## Band Edge, CH High
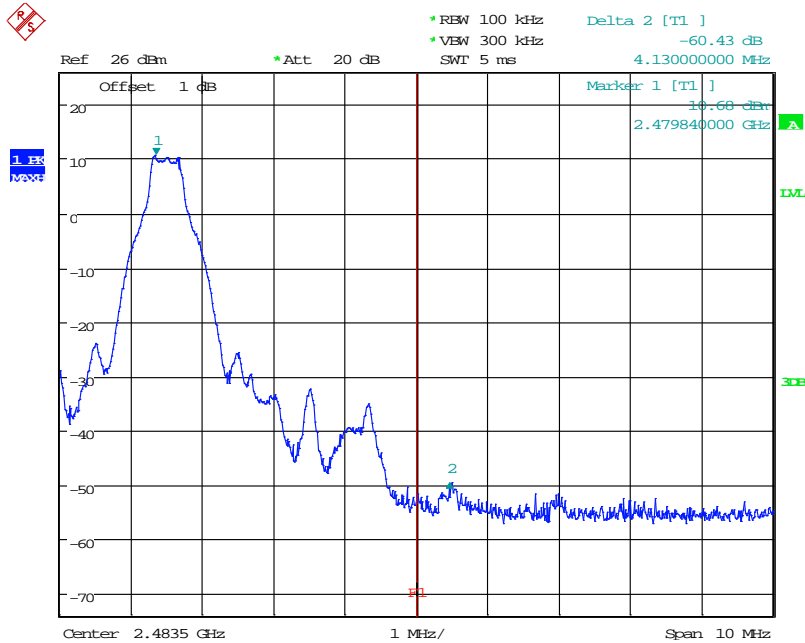


Date: 19.AUG.2019  19:38:49

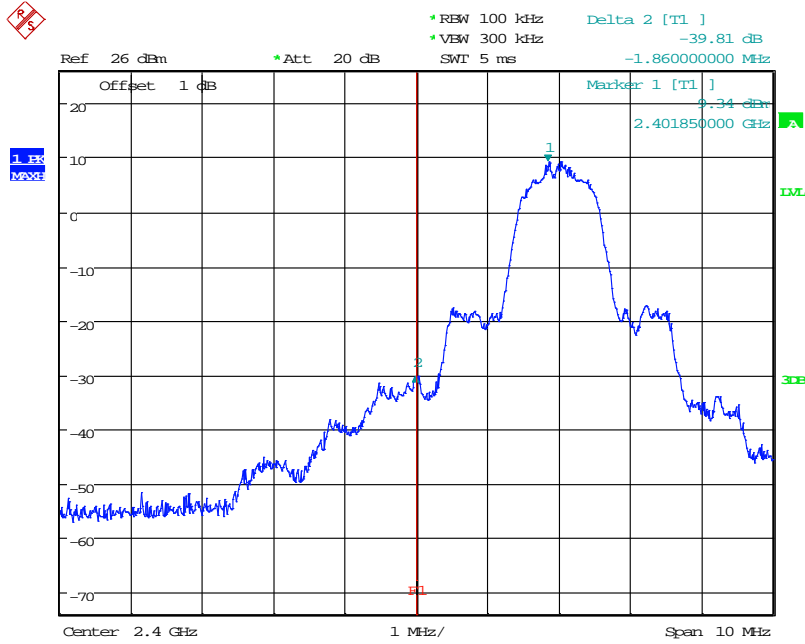## BR Hopping Mode (GFSK)
## Band Edge, CH Low



Date: 19.AUG.2019  20:23:35
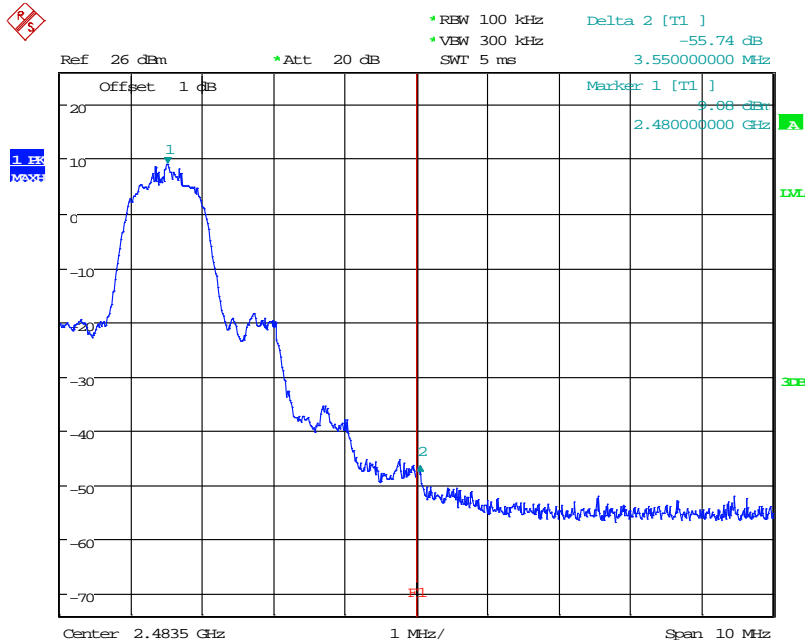
## Band Edge, CH High



Date: 19.AUG.2019  20:24:13
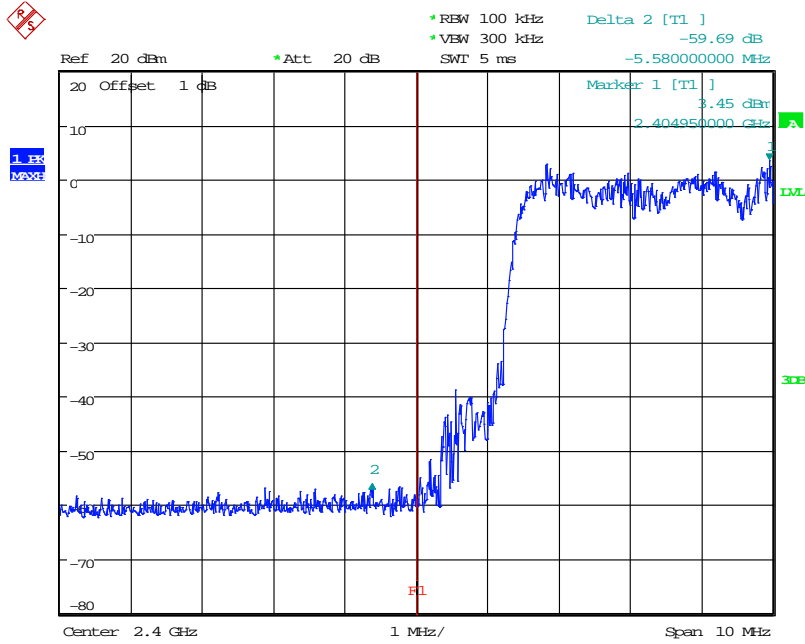
## EDR Mode (π/4-DQPSK)
### Band Edge, CH Low



```
                                    *RBW 100 kHz    Delta 2 [T1 ]
                                    *VBW 300 kHz          -39.81 dB
     Ref  26 dBm      *Att  20 dB   SWT 5 ms        -1.860000000 MHz
       Offset  1 dB                          Marker 1 [T1 ]
    20                                             9.34 dBm
                                                 2.401850000 GHz   A
    10                                1
     0                                                             1VL
   -10
   -20
   -30           2
   -40
   -50                                                            3DB
   -60
   -70           E1
     Center 2.4 GHz        1 MHz/              Span 10 MHz
```

Date: 19.AUG.2019  19:46:16

### Band Edge, CH High



```
                                    *RBW 100 kHz    Delta 2 [T1 ]
                                    *VBW 300 kHz          -55.74 dB
     Ref  26 dBm      *Att  20 dB   SWT 5 ms        3.550000000 MHz
       Offset  1 dB                          Marker 1 [T1 ]
    20                                             9.00 dBm
                                                 2.480000000 GHz   A
    10          1
     0                                                             1VL
   -10
   -20
   -30
   -40
   -50               2                                            3DB
   -60
   -70               E1
     Center 2.4835 GHz      1 MHz/              Span 10 MHz
```
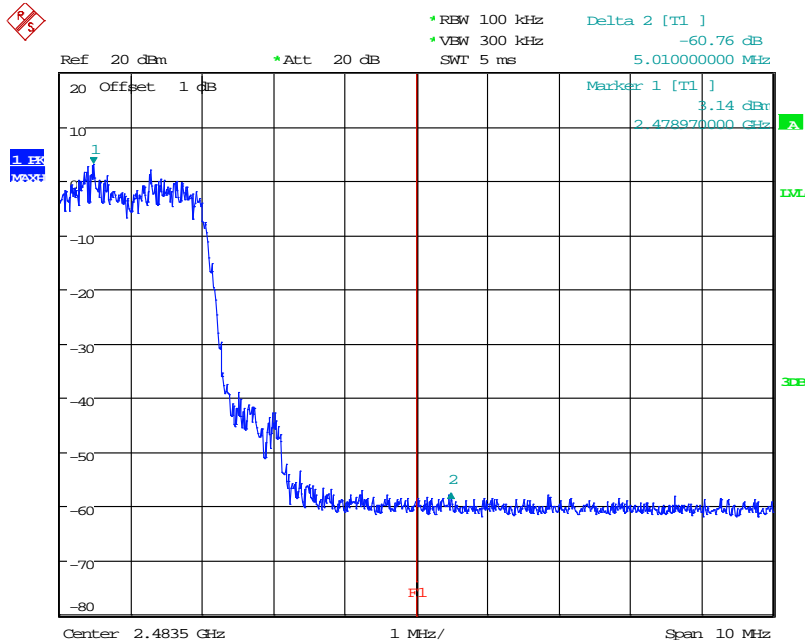
Date: 19.AUG.2019  19:50:18

## EDR Hopping Mode (π/4-DQPSK)
## Band Edge, CH Low
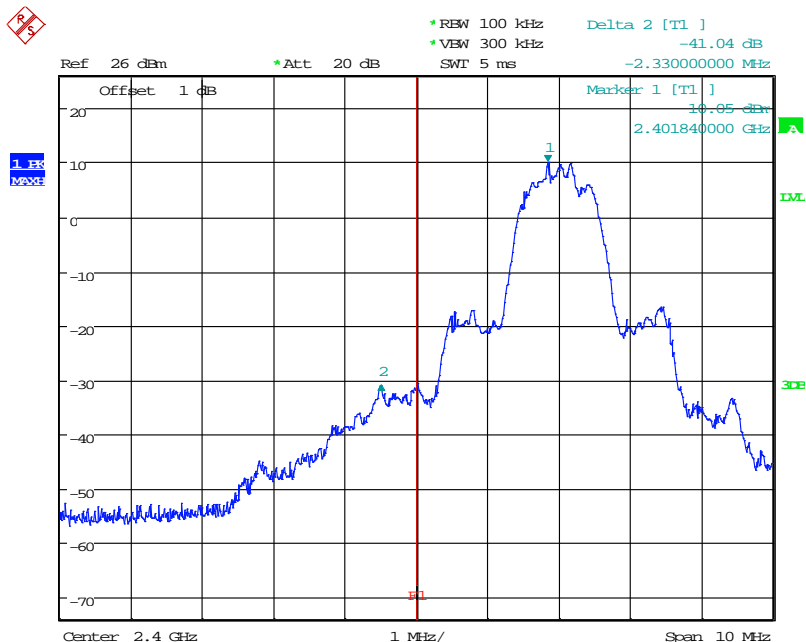


Date: 20.AUG.2019  15:08:38

## Band Edge, CH High

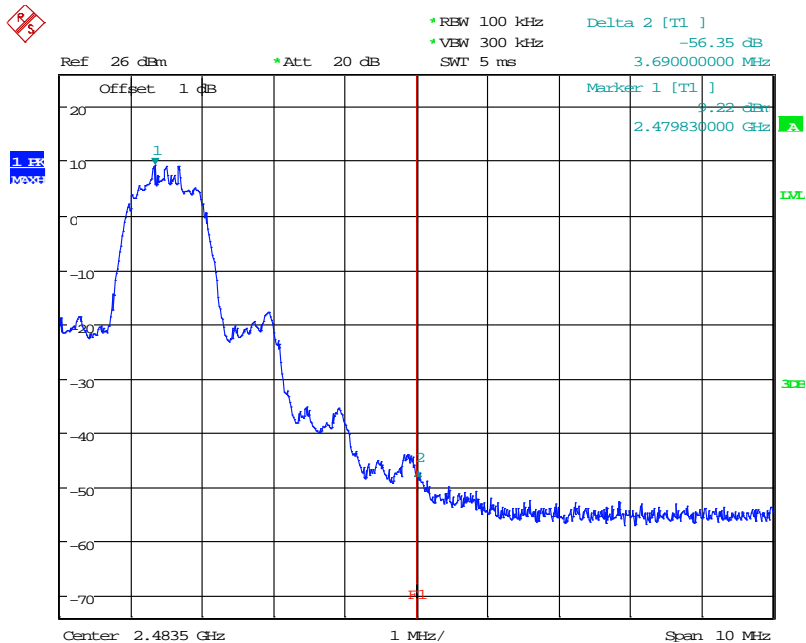

Date: 20.AUG.2019  15:09:11

## EDR Mode (8DPSK)

## Band Edge, CH Low

```
                                          * RBW  100 kHz      Delta 2 [T1 ]
                                          * VBW  300 kHz            -41.04 dB
        Ref   26 dBm        * Att  20 dB    SWT  5 ms         -2.330000000 MHz
           Offset   1 dB                             Marker 1 [T1 ]
                                                              10.05 dBm
                                                           2.401840000 GHz
```

Date: 19.AUG.2019  19:53:51

## Band Edge, CH High

```
                                          * RBW  100 kHz      Delta 2 [T1 ]
                                          * VBW  300 kHz            -56.35 dB
        Ref   26 dBm        * Att  20 dB    SWT  5 ms          3.690000000 MHz
           Offset   1 dB                             Marker 1 [T1 ]
                                                              9.22 dBm
                                                           2.479830000 GHz
```
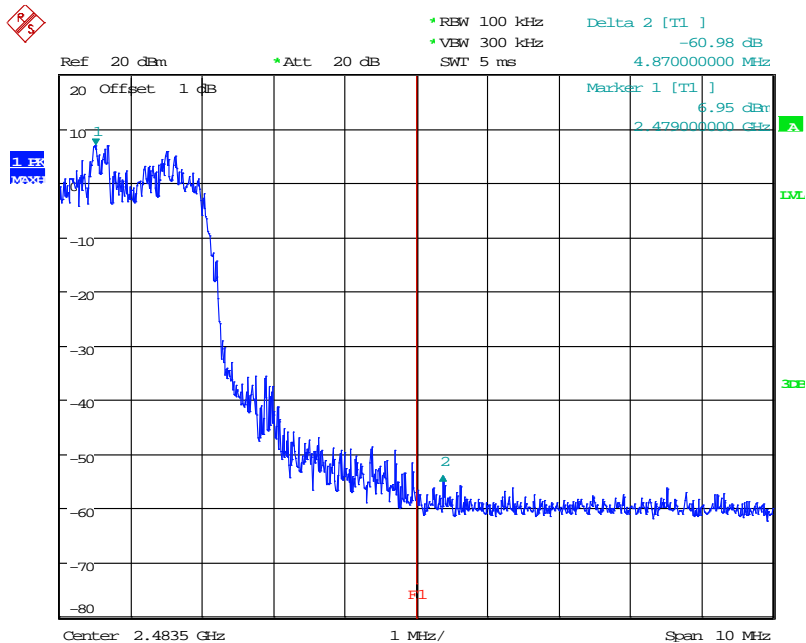
Date: 19.AUG.2019  19:59:51

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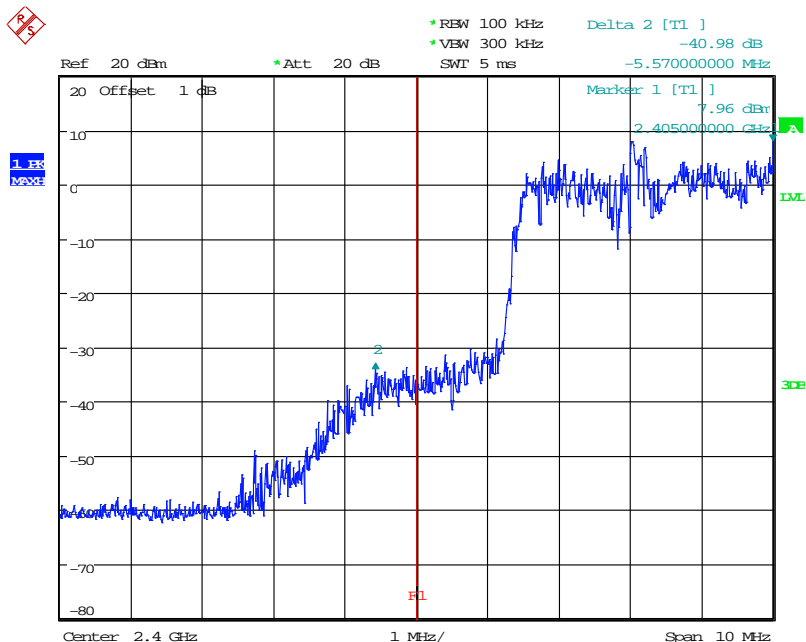


Date: 19.AUG.2019  20:02:20

### Band Edge, CH High



Date: 19.AUG.2019  20:02:46

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