# FCC PART 15.247
# RSS-GEN, ISSUE 4, NOVEMBER 2014
# RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

## Hammerhead Navigation Inc.

450 W 33rd Street, 12th Floor New York, NY 10001 United States

**FCC ID: 2ADMX-HK1**
**IC: 12534A-HK1**

| **Report Type:** | **Product Name:** |
|---|---|
| Original Report | Hammerhead Karoo |

| | |
|---|---|
| **Report Number:** | RDG171206006-00A |
| **Report Date:** | 2018-01-19 |
| **Reviewed By:** | Jerry Zhang<br>EMC Manager<br>Jerry Zhang |
| **Test Laboratory:** | Bay Area Compliance Laboratories Corp. (Dongguan)<br>No.69 Pulongcun, Puxinhu Industry Area,<br>Tangxia, Dongguan, Guangdong, China<br>Tel: +86-769-86858888<br>Fax: +86-769-86858891<br>www.baclcorp.com.cn |

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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# GENERAL INFORMATION

## Product Description for Equipment under Test (EUT)

| | |
|---|---|
| **EUT Name:** | Hammerhead Karoo |
| **EUT Model:** | Karoo |
| **FCC ID:** | 2ADMX-HK1 |
| **IC:** | 12534A-HK1 |
| **Rated Input Voltage:** | DC3.8V from battery or DC 5V from USB port |
| **External Dimension:** | Length (99.4mm)*Width (72mm)*High (27.8mm) |
| **Serial Number:** | 171206006 |
| **EUT Received Date:** | 2017.12.13 |

## Objective

This report is prepared on behalf of ***Hammerhead Navigation Inc.*** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules and RSS-247, Issue 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

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 and RSS-247, Issue 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

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

FCC Part 22H, 24E PCB submissions with FCC ID: 2ADMX-HK1.
FCC Part 15.247 DTS submission with FCC ID: 2ADMX-HK1.
FCC Part 15.249 DXX submission with FCC ID: 2ADMX-HK1.
RSS-247 DTSs, RSS-132, RSS-133, RSS-210 submissions with IC: 12534A-HK1.

## 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" , RSS-247, Issue 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

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 |
| Unwanted Emissions, radiated | 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical<br>200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical<br>1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB |
| Unwanted Emissions, conducted | ±1.5 dB |
| Temperature | ±1℃ |
| 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) |

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218,the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

# SYSTEM TEST CONFIGURATION

## Description of Test Configuration

The system was configured for testing in engineering mode.The device supports Bluetooth BDR(GFSK), and EDR(π/4-DQPSK&8-DPSK).

## EUT Exercise Software

The Engineering Mode configured the maximum power level as default setting.

## Equipment Modifications

No modification was made to the EUT.

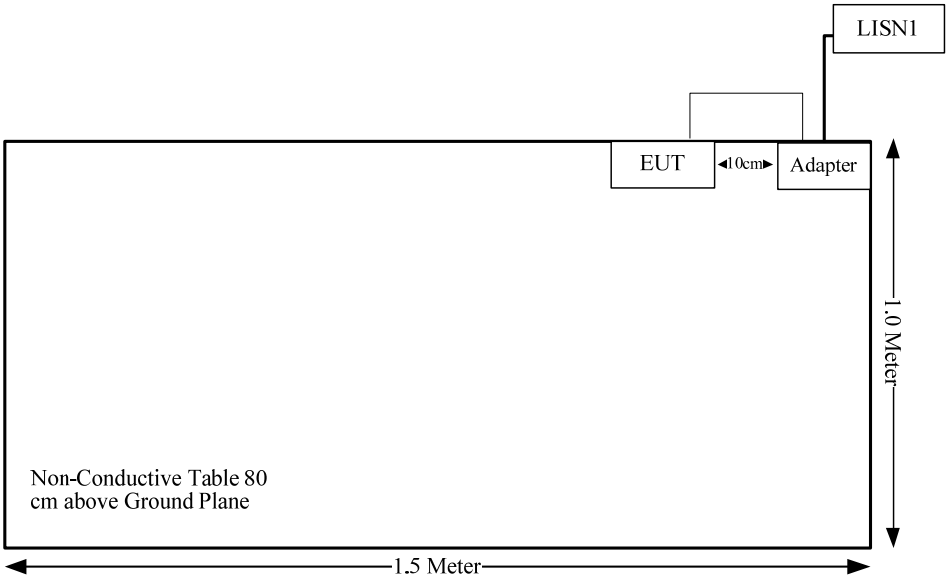
## Local Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Huawei | Adapter | HW-050100C3W | N/A |

## Support Cable List and Details

| Cable Description | Shielding Type | Ferrite Core | Length (m) | From | To |
|---|---|---|---|---|---|
| USB Cable | Yes | No | 1.0 | Adapter | EUT |

## Block Diagram of Test Setup



# SUMMARY OF TEST RESULTS

| Rules | Description of Test | Result |
|---|---|---|
| FCC §15.247 (i) & §1.1310 & §2.1093<br>RSS-102 §4 | RF Exposure | Compliance |
| FCC§15.203<br>RSS-GEN Clause 8.3 | Antenna Requirement | Compliance |
| FCC§15.207 (a)<br>RSS-Gen Clause 8.8 | Conducted Emissions | Compliance |
| FCC§15.205, §15.209, §15.247(d)<br>RSS-247 Clause 5.5,<br>RSS-Gen Clause 8.10 | Spurious Emissions | Compliance |
| FCC§15.247 (a)(1)<br>RSS-247 Clause 5.1 b)<br>RSS-Gen Clause 6.6 | Emission Bandwidth | Compliance |
| FCC§15.247(a)(1)<br>RSS-247 Clause 5.1 b) | Channel Separation Test | Compliance |
| FCC§15.247(a)(1)(iii)<br>RSS-247 Clause 5.1 d) | Time of Occupancy (Dwell Time) | Compliance |
| FCC§15.247(a)(1)(iii)<br>RSS-247 Clause 5.1 d) | Quantity of hopping channel Test | Compliance |
| FCC§15.247(b)(1)<br>RSS-247 Clause 5.4 b) | Peak Output Power Measurement | Compliance |
| FCC§15.247(d)<br>RSS-247 Clause 5.5 | Band Edges | Compliance |

# FCC §15.247 (i) & §1.1310 & §2.1093, RSS-102 §4- RF EXPOSURE

## Applicable Standard

According to§15.247(i),§1.1310 and §2.1093.

According to RSS-102 §4 Table 3, SAR limits for device used by the general public

| Body Region | Average SAR (W/Kg) | Averaging Time (minutes) | Mass Average (g) |
|---|---|---|---|
| Whole Body | 0.08 | 6 | Whole Body |
| Localized Head, Neck and Trunk | 1.6 | 6 | 1 |
| Localized Limbs | 4 | 6 | 10 |

## Test Result

Compliant, please refer to the SAR report: RDG171206006-20.

# FCC §15.203 & RSS-GEN§8.3 - 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.

According to RSS-Gen §8.3, The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.
Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

## Antenna Connector Construction

The EUT has one internal antenna arrangement for BT/WLAN, and the antenna gain is 0.72 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

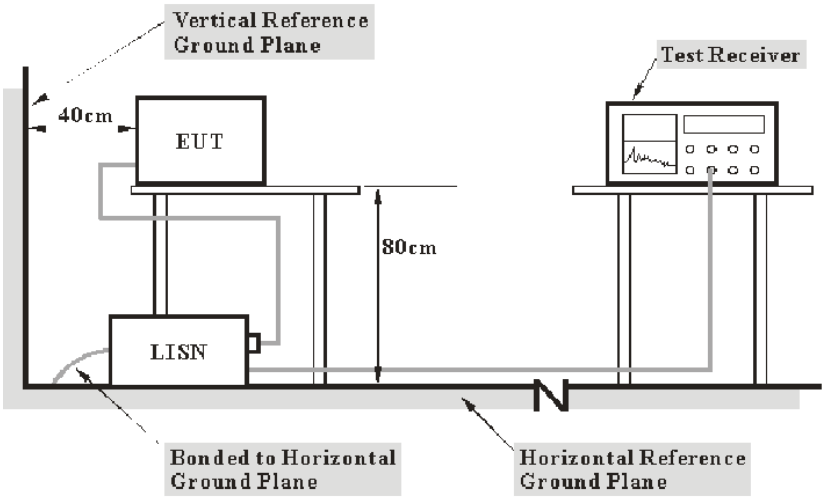
**Result:** Compliance.

# FCC §15.207 (a) & RSS-GEN CLAUSE 8.8 – AC LINE CONDUCTED EMISSIONS

## Applicable Standard

FCC§15.207(a) and RSS-GEN CLAUSE 8.8

## EUT Setup




Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits and RSS-Gen limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN 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 outlet of the first 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.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

Herein,
$V_C$: corrected voltage amplitude
$V_R$: reading voltage amplitude
$A_c$: attenuation caused by cable loss
VDF: voltage division factor of AMN or ISN

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:

Margin = Limit – Corrected Amplitude

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Receiver | ESCS 30 | 830245/006 | 2017-12-11 | 2018-12-11 |
| R&S | L.I.S.N | ESH2-Z5 | 892107/021 | 2017-09-25 | 2018-09-25 |
| R&S | Two-line V-network | ENV 216 | 101614 | 2017-12-08 | 2018-12-08 |
| R&S | Test Software | EMC32 | Version8.53.0 | N/A | N/A |
| N/A | Coaxial Cable | C-NJNJ-50 | C-0200-01 | 2017-09-05 | 2018-09-05 |

*** 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).

## Test Data

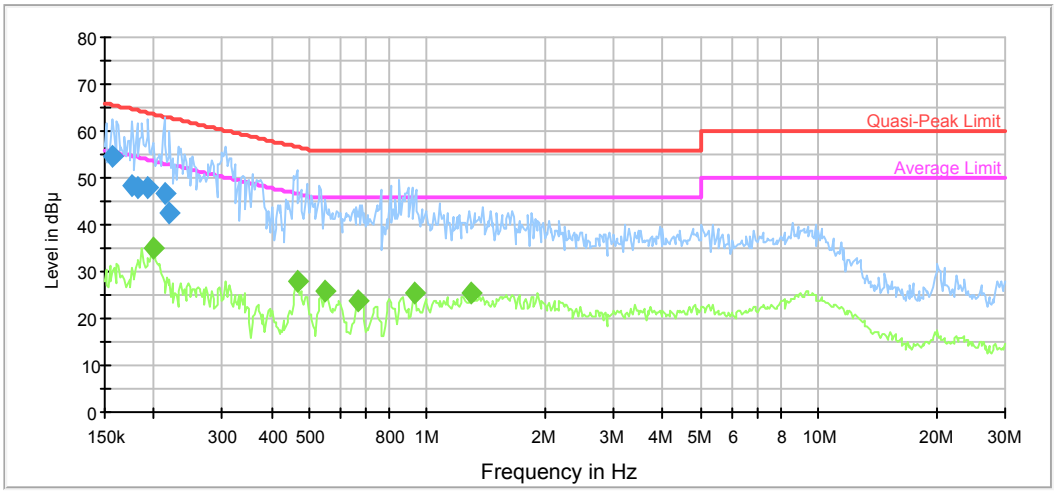
### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25.1 °C |
| **Relative Humidity:** | 35 % |
| **ATM Pressure:** | 101.2 kPa |

*The testing was performed by Alex You on 2017-12-13.*

***Test Mode:*** *Transmitting*

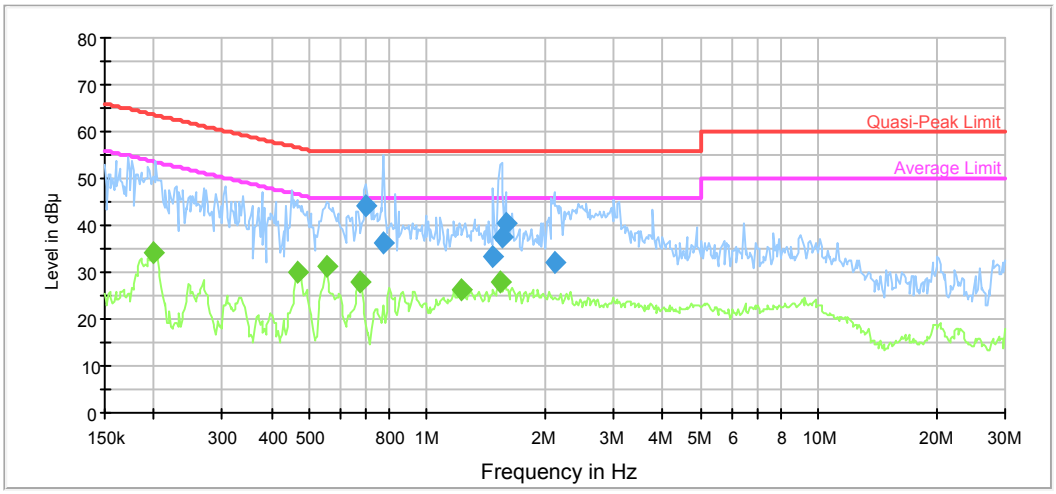
**AC120V, 60 Hz, Line:**




| Frequency (MHz) | QuasiPeak (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.157346 | 54.7 | 9.000 | L1 | 11.1 | 10.9 | 65.6 | Compliance |
| 0.175915 | 48.4 | 9.000 | L1 | 10.9 | 16.3 | 64.7 | Compliance |
| 0.181612 | 47.8 | 9.000 | L1 | 10.8 | 16.6 | 64.4 | Compliance |
| 0.193566 | 48.0 | 9.000 | L1 | 10.7 | 15.9 | 63.9 | Compliance |
| 0.212988 | 46.8 | 9.000 | L1 | 10.5 | 16.3 | 63.1 | Compliance |
| 0.219886 | 42.6 | 9.000 | L1 | 10.5 | 20.3 | 62.8 | Compliance |

| Frequency (MHz) | Average (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.199835 | 35.0 | 9.000 | L1 | 10.6 | 18.6 | 53.6 | Compliance |
| 0.468757 | 27.8 | 9.000 | L1 | 9.9 | 18.7 | 46.5 | Compliance |
| 0.549741 | 25.9 | 9.000 | L1 | 9.9 | 20.1 | 46.0 | Compliance |
| 0.665597 | 23.6 | 9.000 | L1 | 9.8 | 22.4 | 46.0 | Compliance |
| 0.930151 | 25.4 | 9.000 | L1 | 9.8 | 20.6 | 46.0 | Compliance |
| 1.289541 | 25.3 | 9.000 | L1 | 9.8 | 20.7 | 46.0 | Compliance |

**AC120V, 60 Hz, Neutral:**




| Frequency (MHz) | QuasiPeak (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.698191 | 44.0 | 9.000 | N | 9.8 | 12.0 | 56.0 | Compliance |
| 0.774393 | 36.1 | 9.000 | N | 9.8 | 19.9 | 56.0 | Compliance |
| 1.476605 | 33.3 | 9.000 | N | 9.7 | 22.7 | 56.0 | Compliance |
| 1.548915 | 37.7 | 9.000 | N | 9.7 | 18.3 | 56.0 | Compliance |
| 1.586387 | 40.5 | 9.000 | N | 9.7 | 15.5 | 56.0 | Compliance |
| 2.113432 | 32.2 | 9.000 | N | 9.8 | 23.8 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.199835 | 34.2 | 9.000 | N | 10.6 | 19.4 | 53.6 | Compliance |
| 0.465037 | 30.1 | 9.000 | N | 9.9 | 16.5 | 46.6 | Compliance |
| 0.554139 | 31.3 | 9.000 | N | 9.9 | 14.7 | 46.0 | Compliance |
| 0.670921 | 27.9 | 9.000 | N | 9.8 | 18.1 | 46.0 | Compliance |
| 1.229340 | 26.2 | 9.000 | N | 9.8 | 19.8 | 46.0 | Compliance |
| 1.536622 | 27.7 | 9.000 | N | 9.7 | 18.3 | 46.0 | Compliance |

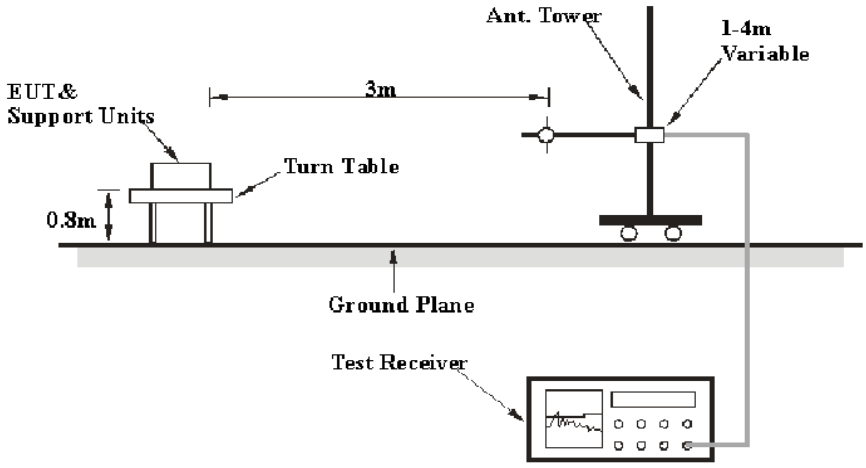
# FCC §15.209, §15.205 & §15.247(d) & RSS-247 §5.5&RSS-GEN§8.10 - SPURIOUS EMISSIONS

## Applicable Standard

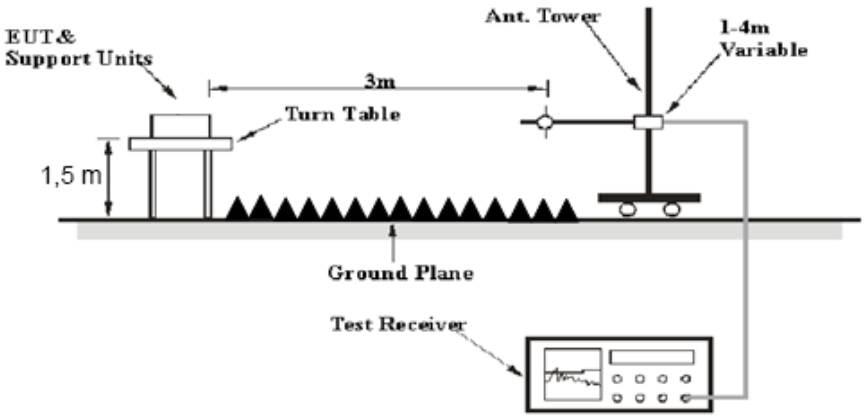
FCC §15.247 (d); §15.209; §15.205 and RSS-247 Clause 5.5, RSS-GEN Clause 8.10

## EUT Setup

**Below 1GHz:**




**Above 1GHz:**




The radiated emission Below 1GHz tests were performed in the 3 meters chamber test site, above 1GHz 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 15.209, FCC 15.247 limits and RSS-247 Clause 5.5, RSS-GEN Clause 8.10 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.

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 |

## 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.

Emission under limit more than 20dB or under noise floor have not been recorded in the report.

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Receiver | ESCI | 100224 | 2017-12-11 | 2018-12-11 |
| Sunol Sciences | Antenna | JB3 | A060611-1 | 2017-11-10 | 2020-11-10 |
| HP | Amplifier | 8447D | 2727A05902 | 2017-09-05 | 2018-09-05 |
| N/A | Coaxial Cable | C-NJNJ-50 | C-0400-01 | 2017-09-05 | 2018-09-05 |
| N/A | Coaxial Cable | C-NJNJ-50 | C-0075-01 | 2017-09-05 | 2018-09-05 |
| N/A | Coaxial Cable | C-NJNJ-50 | C-1000-01 | 2017-09-05 | 2018-09-05 |
| R&S | Spectrum Analyzer | FSEM | 831259/019 | 2017-07-18 | 2018-07-18 |
| TDK RF | Horn Antenna | HRN-0118 | 130 084 | 2016-01-05 | 2019-01-04 |
| Mini-Circuit | Amplifier | ZVA-183-S+ | 596001149 | 2017-09-05 | 2018-09-05 |
| Quinstar | Amplifier | QLW-18405536-JO | 15964001001 | 2017-06-27 | 2018-06-27 |
| Ducommun Technolagies | Horn Antenna | ARH-4223-02 | 1007726-02 1304 | 2016-11-18 | 2019-11-18 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |
| Chengdu Ouli | Band Rejection Filter | 2400-2483.5 | 002 | 2017-09-05 | 2018-09-05 |

*** 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).

## 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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – Corrected Amplitude

## Test Data

### Environmental Conditions

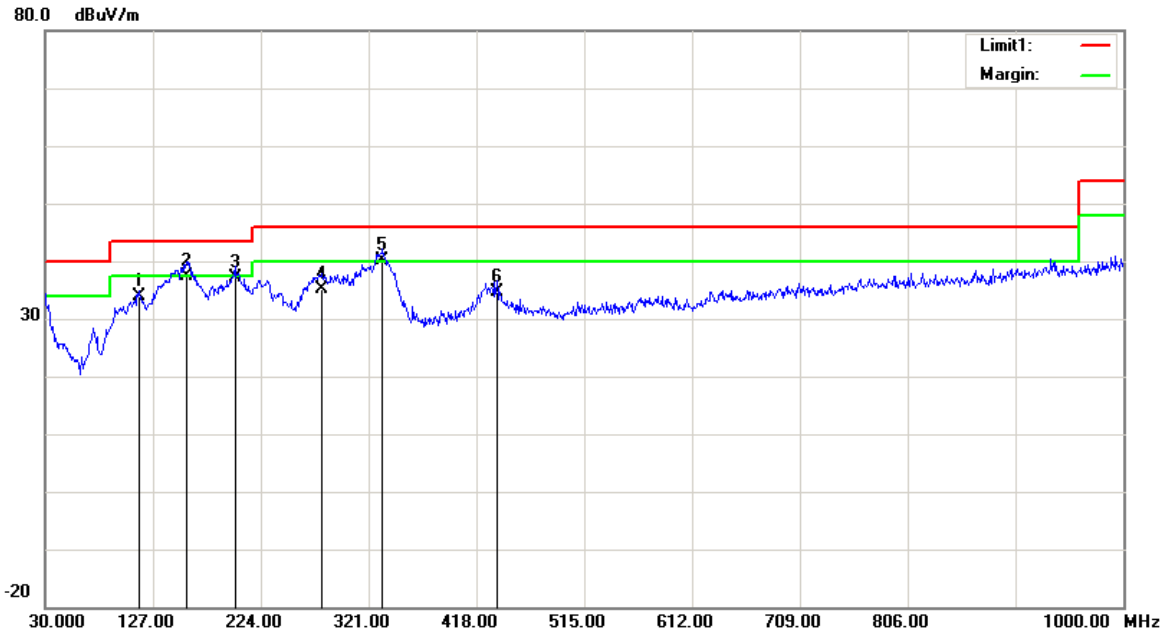
| | |
|---|---|
| **Temperature:** | 23.4~23.7 °C |
| **Relative Humidity:** | 41~43 % |
| **ATM Pressure:** | 101.3~102 kPa |

** The testing was performed by Blake Yang from 2017-12-14 to 2017-12-15.*

*Test Mode: Transmitting*

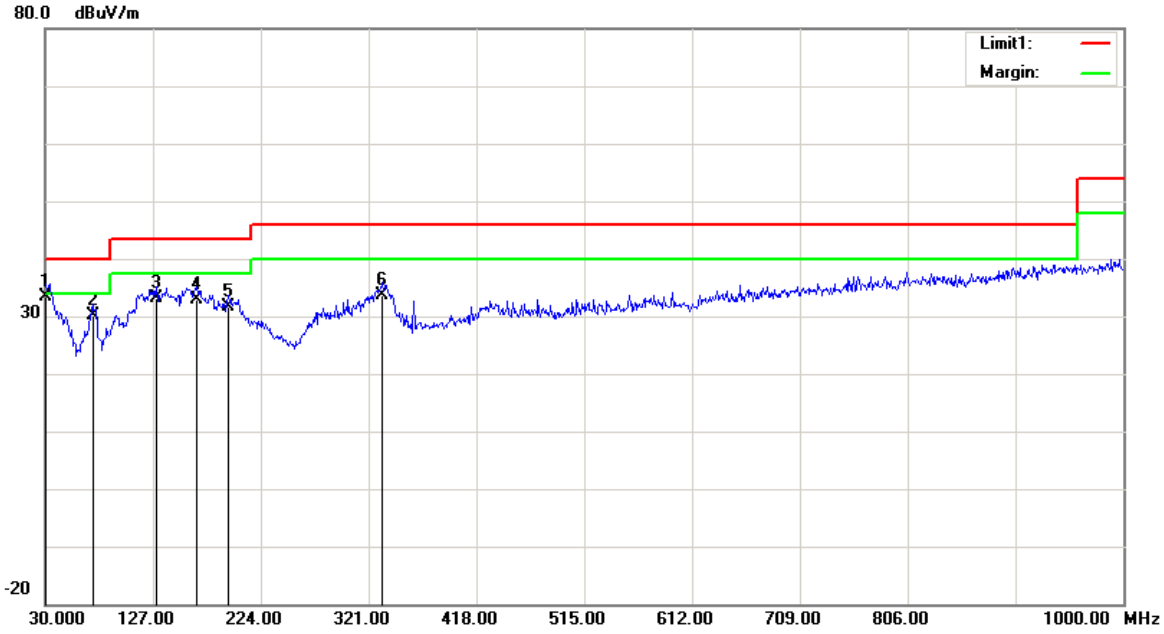
**1) 30MHz-1GHz**(GFSK Low channel was the worst)

**Horizontal:**




| Frequency (MHz) | Receiver Reading (dBµV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 114.3900 | 39.09 | QP | -5.29 | 33.80 | 43.50 | 9.70 |
| 157.0700 | 43.98 | QP | -6.48 | 37.50 | 43.50 | 6.00 |
| 200.7200 | 43.31 | QP | -6.21 | 37.10 | 43.50 | 6.40 |
| 279.2900 | 38.83 | QP | -3.63 | 35.20 | 46.00 | 10.80 |
| 333.6100 | 43.72 | QP | -3.62 | 40.10 | 46.00 | 5.90 |
| 436.4300 | 36.42 | QP | -1.72 | 34.70 | 46.00 | 11.30 |

**Vertical:**




| Frequency (MHz) | Receiver Reading (dBµV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 30.0000 | 32.42 | QP | 1.08 | 33.50 | 40.00 | 6.50 |
| 72.6800 | 41.28 | QP | -11.18 | 30.10 | 40.00 | 9.90 |
| 129.9100 | 38.24 | QP | -5.14 | 33.10 | 43.50 | 10.40 |
| 166.7700 | 40.04 | QP | -7.04 | 33.00 | 43.50 | 10.50 |
| 194.9000 | 38.68 | QP | -7.08 | 31.60 | 43.50 | 11.90 |
| 333.6100 | 37.32 | QP | -3.62 | 33.70 | 46.00 | 12.30 |

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

*BDR Mode (GFSK):*

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBµV) | Detector | Polar (H/V) | Factor (dB/m) | | | | | |
| Low Channel: 2402 MHz | | | | | | | | | |
| 2402.00 | 62.23 | PK | H | 24.82 | 5.41 | 0.00 | 92.46 | N/A | N/A |
| 2402.00 | 42.55 | AV | H | 24.82 | 5.41 | 0.00 | 72.78 | N/A | N/A |
| 2402.00 | 68.17 | PK | V | 24.82 | 5.41 | 0.00 | 98.40 | N/A | N/A |
| 2402.00 | 48.42 | AV | V | 24.82 | 5.41 | 0.00 | 78.65 | N/A | N/A |
| 2390.00 | 26.56 | PK | V | 24.80 | 5.36 | 0.00 | 56.72 | 74.00 | 17.28 |
| 2390.00 | 10.32 | AV | V | 24.80 | 5.36 | 0.00 | 40.48 | 54.00 | 13.52 |
| 4804.00 | 40.54 | PK | V | 29.71 | 7.25 | 27.36 | 50.14 | 74.00 | 23.86 |
| 4804.00 | 26.25 | AV | V | 29.71 | 7.25 | 27.36 | 35.85 | 54.00 | 18.15 |
| 7206.00 | 39.31 | PK | V | 33.93 | 8.94 | 27.19 | 54.99 | 74.00 | 19.01 |
| 7206.00 | 24.84 | AV | V | 33.93 | 8.94 | 27.19 | 40.52 | 54.00 | 13.48 |
| 6220.00 | 45.34 | PK | V | 32.28 | 8.40 | 26.42 | 59.60 | 74.00 | 14.40 |
| 6220.00 | 32.68 | AV | V | 32.28 | 8.40 | 26.42 | 46.94 | 54.00 | 7.06 |
| Middle Channel: 2441 MHz | | | | | | | | | |
| 2441.00 | 60.76 | PK | H | 24.89 | 5.41 | 0.00 | 91.06 | N/A | N/A |
| 2441.00 | 41.26 | AV | H | 24.89 | 5.41 | 0.00 | 71.56 | N/A | N/A |
| 2441.00 | 67.01 | PK | V | 24.89 | 5.41 | 0.00 | 97.31 | N/A | N/A |
| 2441.00 | 48.20 | AV | V | 24.89 | 5.41 | 0.00 | 78.50 | N/A | N/A |
| 4882.00 | 41.68 | PK | V | 29.86 | 7.59 | 27.56 | 51.57 | 74.00 | 22.43 |
| 4882.00 | 27.17 | AV | V | 29.86 | 7.59 | 27.56 | 37.06 | 54.00 | 16.94 |
| 7323.00 | 40.03 | PK | V | 34.12 | 9.29 | 27.26 | 56.18 | 74.00 | 17.82 |
| 7323.00 | 26.05 | AV | V | 34.12 | 9.29 | 27.26 | 42.20 | 54.00 | 11.8 |
| High Channel: 2480 MHz | | | | | | | | | |
| 2480.00 | 59.86 | PK | H | 24.96 | 5.41 | 0.00 | 90.23 | N/A | N/A |
| 2480.00 | 40.79 | AV | H | 24.96 | 5.41 | 0.00 | 71.16 | N/A | N/A |
| 2480.00 | 66.15 | PK | V | 24.96 | 5.41 | 0.00 | 96.52 | N/A | N/A |
| 2480.00 | 47.26 | AV | V | 24.96 | 5.41 | 0.00 | 77.63 | N/A | N/A |
| 2483.50 | 28.64 | PK | V | 24.97 | 5.41 | 0.00 | 59.02 | 74.00 | 14.98 |
| 2483.50 | 12.77 | AV | V | 24.97 | 5.41 | 0.00 | 43.15 | 54.00 | 10.85 |
| 4960.00 | 40.64 | PK | V | 30.02 | 7.63 | 27.37 | 50.92 | 74.00 | 23.08 |
| 4960.00 | 27.65 | AV | V | 30.02 | 7.63 | 27.37 | 37.93 | 54.00 | 16.07 |
| 7440.00 | 40.98 | PK | V | 34.30 | 9.09 | 27.22 | 57.15 | 74.00 | 16.85 |
| 7440.00 | 26.71 | AV | V | 34.30 | 9.09 | 27.22 | 42.88 | 54.00 | 11.12 |

*EDR Mode (π/4-DQPSK):*

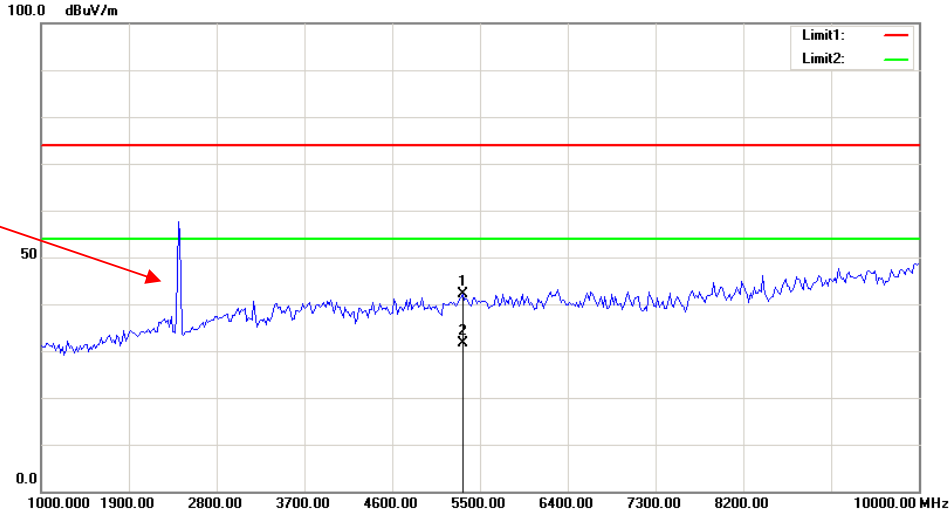
| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Detector | Polar (H/V) | Factor (dB/m) | | | | | |
| Low Channel: 2402 MHz | | | | | | | | | |
| 2402.00 | 59.47 | PK | H | 24.82 | 5.41 | 0.00 | 89.70 | N/A | N/A |
| 2402.00 | 40.84 | AV | H | 24.82 | 5.41 | 0.00 | 71.07 | N/A | N/A |
| 2402.00 | 65.01 | PK | V | 24.82 | 5.41 | 0.00 | 95.24 | N/A | N/A |
| 2402.00 | 46.52 | AV | V | 24.82 | 5.41 | 0.00 | 76.75 | N/A | N/A |
| 2390.00 | 25.34 | PK | V | 24.80 | 5.36 | 0.00 | 55.50 | 74.00 | 18.50 |
| 2390.00 | 11.74 | AV | V | 24.80 | 5.36 | 0.00 | 41.90 | 54.00 | 12.10 |
| 4804.00 | 41.13 | PK | V | 29.71 | 7.25 | 27.36 | 50.73 | 74.00 | 23.27 |
| 4804.00 | 27.68 | AV | V | 29.71 | 7.25 | 27.36 | 37.28 | 54.00 | 16.72 |
| 7206.00 | 40.94 | PK | V | 33.93 | 8.94 | 27.19 | 56.62 | 74.00 | 17.38 |
| 7206.00 | 27.74 | AV | V | 33.93 | 8.94 | 27.19 | 43.42 | 54.00 | 10.58 |
| Middle Channel: 2441 MHz | | | | | | | | | |
| 2441.00 | 59.34 | PK | H | 24.89 | 5.41 | 0.00 | 89.64 | N/A | N/A |
| 2441.00 | 40.65 | AV | H | 24.89 | 5.41 | 0.00 | 70.95 | N/A | N/A |
| 2441.00 | 64.72 | PK | V | 24.89 | 5.41 | 0.00 | 95.02 | N/A | N/A |
| 2441.00 | 46.05 | AV | V | 24.89 | 5.41 | 0.00 | 76.35 | N/A | N/A |
| 4882.00 | 41.21 | PK | V | 29.86 | 7.59 | 27.56 | 51.10 | 74.00 | 22.9 |
| 4882.00 | 28.18 | AV | V | 29.86 | 7.59 | 27.56 | 38.07 | 54.00 | 15.93 |
| 7323.00 | 40.86 | PK | V | 34.12 | 9.29 | 27.26 | 57.01 | 74.00 | 16.99 |
| 7323.00 | 27.78 | AV | V | 34.12 | 9.29 | 27.26 | 43.93 | 54.00 | 10.07 |
| High Channel: 2480 MHz | | | | | | | | | |
| 2480.00 | 59.02 | PK | H | 24.96 | 5.41 | 0.00 | 89.39 | N/A | N/A |
| 2480.00 | 40.64 | AV | H | 24.96 | 5.41 | 0.00 | 71.01 | N/A | N/A |
| 2480.00 | 64.12 | PK | V | 24.96 | 5.41 | 0.00 | 94.49 | N/A | N/A |
| 2480.00 | 45.37 | AV | V | 24.96 | 5.41 | 0.00 | 75.74 | N/A | N/A |
| 2483.50 | 27.35 | PK | V | 24.97 | 5.41 | 0.00 | 57.73 | 74.00 | 16.27 |
| 2483.50 | 12.64 | AV | V | 24.97 | 5.41 | 0.00 | 43.02 | 54.00 | 10.98 |
| 4960.00 | 40.24 | PK | V | 30.02 | 7.63 | 27.37 | 50.52 | 74.00 | 23.48 |
| 4960.00 | 28.45 | AV | V | 30.02 | 7.63 | 27.37 | 38.73 | 54.00 | 15.27 |
| 7440.00 | 40.04 | PK | V | 34.30 | 9.09 | 27.22 | 56.21 | 74.00 | 17.79 |
| 7440.00 | 27.35 | AV | V | 34.30 | 9.09 | 27.22 | 43.52 | 54.00 | 10.48 |

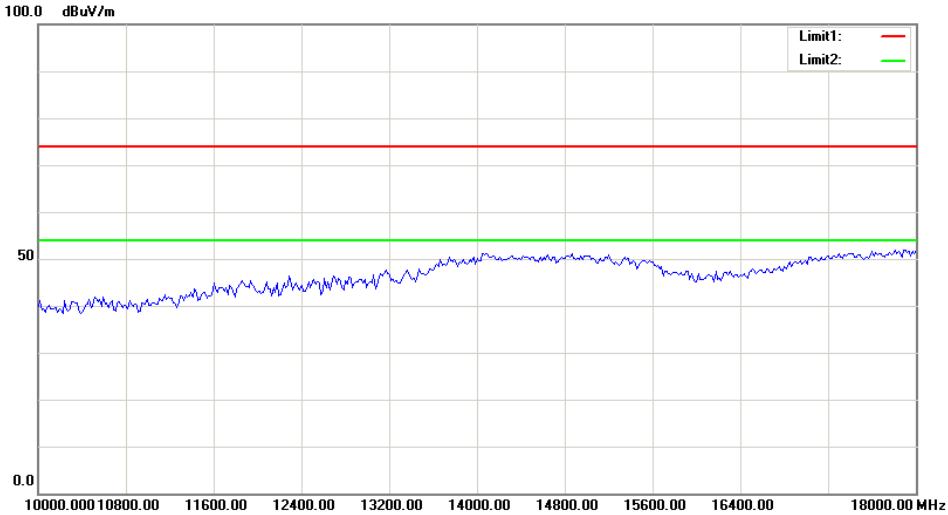
*EDR Mode (8-DPSK):*

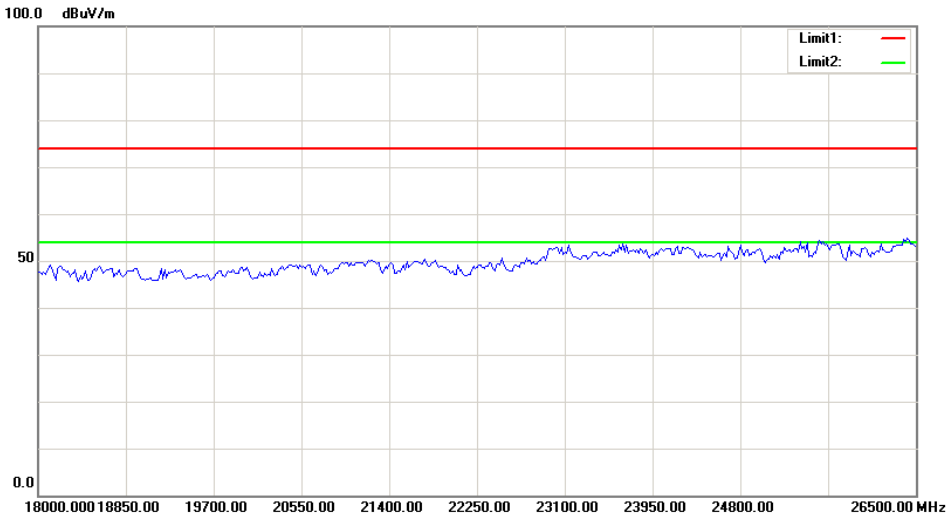
| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Detector | Polar (H/V) | Factor (dB/m) | | | | | |
| Low Channel: 2402 MHz | | | | | | | | | |
| 2402.00 | 59.78 | PK | H | 24.82 | 5.41 | 0.00 | 90.01 | N/A | N/A |
| 2402.00 | 40.65 | AV | H | 24.82 | 5.41 | 0.00 | 70.88 | N/A | N/A |
| 2402.00 | 65.25 | PK | V | 24.82 | 5.41 | 0.00 | 95.48 | N/A | N/A |
| 2402.00 | 46.58 | AV | V | 24.82 | 5.41 | 0.00 | 76.81 | N/A | N/A |
| 2390.00 | 24.62 | PK | V | 24.80 | 5.36 | 0.00 | 54.78 | 74.00 | 19.22 |
| 2390.00 | 10.87 | AV | V | 24.80 | 5.36 | 0.00 | 41.03 | 54.00 | 12.97 |
| 4804.00 | 41.47 | PK | V | 29.71 | 7.25 | 27.36 | 51.07 | 74.00 | 22.93 |
| 4804.00 | 28.15 | AV | V | 29.71 | 7.25 | 27.36 | 37.75 | 54.00 | 16.25 |
| 7206.00 | 40.82 | PK | V | 33.93 | 8.94 | 27.19 | 56.50 | 74.00 | 17.50 |
| 7206.00 | 27.68 | AV | V | 33.93 | 8.94 | 27.19 | 43.36 | 54.00 | 10.64 |
| Middle Channel: 2441 MHz | | | | | | | | | |
| 2441.00 | 59.35 | PK | H | 24.89 | 5.41 | 0.00 | 89.65 | N/A | N/A |
| 2441.00 | 40.28 | AV | H | 24.89 | 5.41 | 0.00 | 70.58 | N/A | N/A |
| 2441.00 | 65.05 | PK | V | 24.89 | 5.41 | 0.00 | 95.35 | N/A | N/A |
| 2441.00 | 46.52 | AV | V | 24.89 | 5.41 | 0.00 | 76.82 | N/A | N/A |
| 4882.00 | 40.63 | PK | V | 29.86 | 7.59 | 27.56 | 50.52 | 74.00 | 23.48 |
| 4882.00 | 28.08 | AV | V | 29.86 | 7.59 | 27.56 | 37.97 | 54.00 | 16.03 |
| 7323.00 | 40.26 | PK | V | 34.12 | 9.29 | 27.26 | 56.41 | 74.00 | 17.59 |
| 7323.00 | 27.83 | AV | V | 34.12 | 9.29 | 27.26 | 43.98 | 54.00 | 10.02 |
| High Channel: 2480 MHz | | | | | | | | | |
| 2480.00 | 58.89 | PK | H | 24.96 | 5.41 | 0.00 | 89.26 | N/A | N/A |
| 2480.00 | 39.44 | AV | H | 24.96 | 5.41 | 0.00 | 69.81 | N/A | N/A |
| 2480.00 | 64.97 | PK | V | 24.96 | 5.41 | 0.00 | 95.34 | N/A | N/A |
| 2480.00 | 45.29 | AV | V | 24.96 | 5.41 | 0.00 | 75.66 | N/A | N/A |
| 2483.50 | 25.06 | PK | V | 24.97 | 5.41 | 0.00 | 55.44 | 74.00 | 18.56 |
| 2483.50 | 11.67 | AV | V | 24.97 | 5.41 | 0.00 | 42.05 | 54.00 | 11.95 |
| 4960.00 | 40.06 | PK | V | 30.02 | 7.63 | 27.37 | 50.34 | 74.00 | 23.66 |
| 4960.00 | 27.14 | AV | V | 30.02 | 7.63 | 27.37 | 37.42 | 54.00 | 16.58 |
| 7440.00 | 39.38 | PK | V | 34.30 | 9.09 | 27.22 | 55.55 | 74.00 | 18.45 |
| 7440.00 | 26.73 | AV | V | 34.30 | 9.09 | 27.22 | 42.90 | 54.00 | 11.1 |

**Worst plots(BDR low channel)**
**Horizontal**

Fundamental Test with Band Rejection Filter

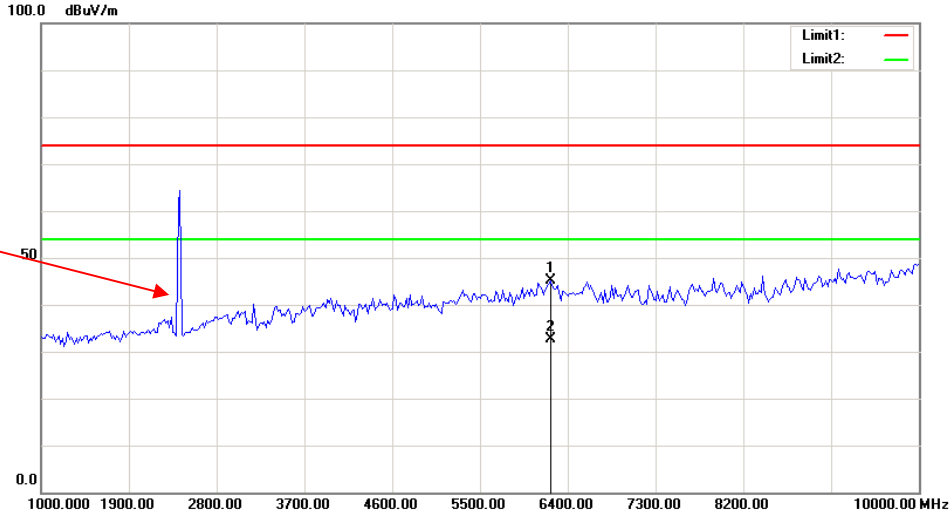


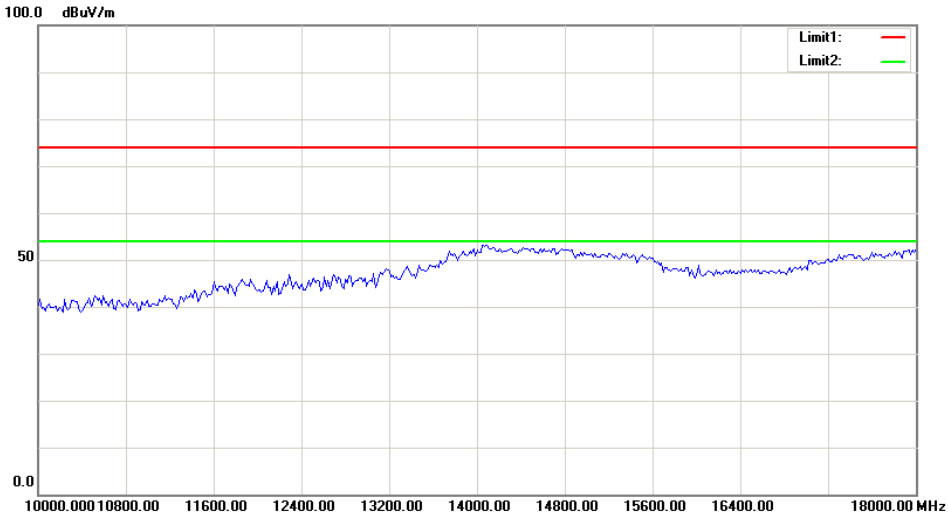



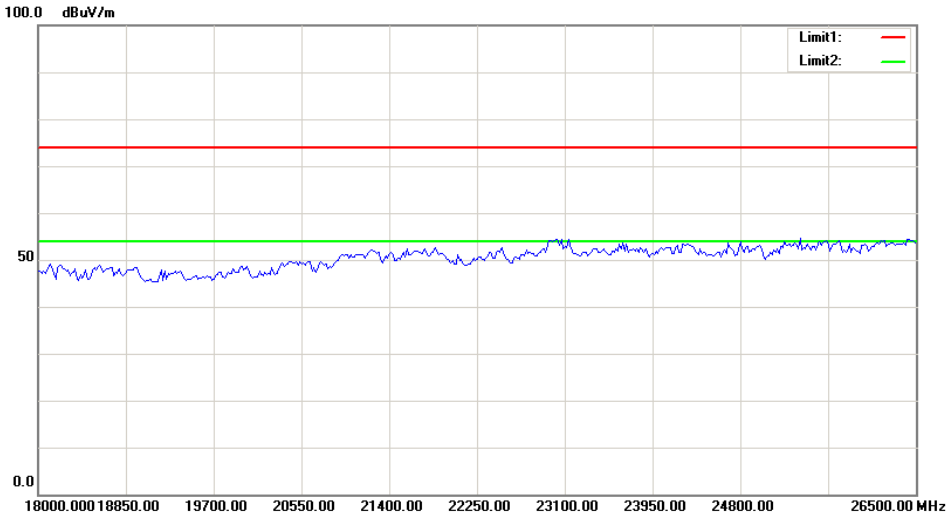



**Vertical**

Fundamental Test with Band Rejection Filter



# FCC §15.247(a) (1)& RSS-247 CLAUSE 5.1 b) - CHANNEL SEPARATION TEST

## Applicable Standard

According to FCC §15.247(a) (1)&RSS-247 Clause 5.1 b)

Frequency hopping systems shall have hoping 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 Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Reciever | ESCI | 101121 | 2017-03-02 | 2018-03-02 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each Time | / |

*** 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).

## 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

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22.3 °C |
| **Relative Humidity:** | 35 % |
| **ATM Pressure:** | 102.2 kPa |

** The testing was performed by Emma Zhang on 2017-12-18.*

**Test Result:** Compliance.

Please refer to following tables and plots

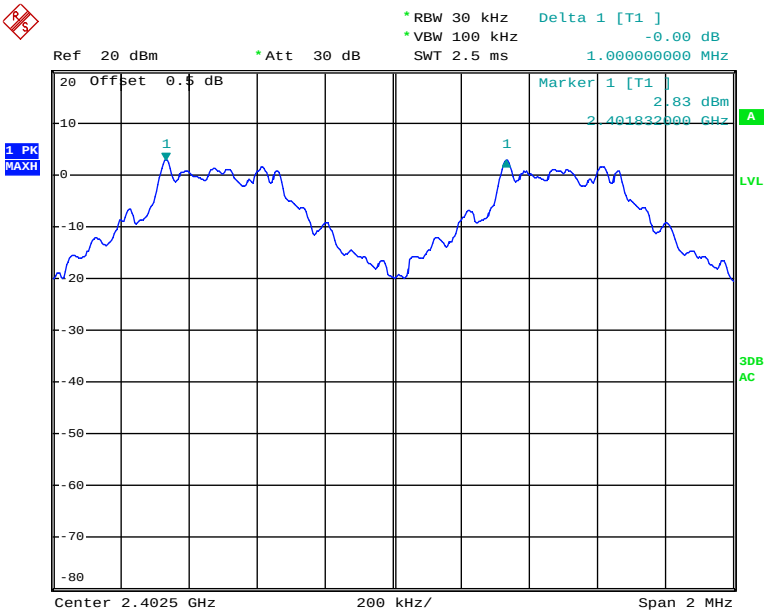
*Test Mode: Transmitting*

| Mode | Channel | Frequency (MHz) | Channel Separation (MHz) | Limit (MHz) |
|---|---|---|---|---|
| *BDR (GFSK)* | Low | 2402 | 1.000 | 0.63 |
| | Middle | 2441 | 1.000 | 0.63 |
| | High | 2480 | 0.996 | 0.62 |
| EDR (π/4-DQPSK) | Low | 2402 | 1.000 | 0.84 |
| | Middle | 2441 | 1.004 | 0.84 |
| | High | 2480 | 1.000 | 0.84 |
| *EDR (8-DPSK)* | Low | 2402 | 1.004 | 0.85 |
| | Middle | 2441 | 1.000 | 0.85 |
| | High | 2480 | 1.004 | 0.85 |

*Note: Limit= (2/3) × 20dB bandwidth*

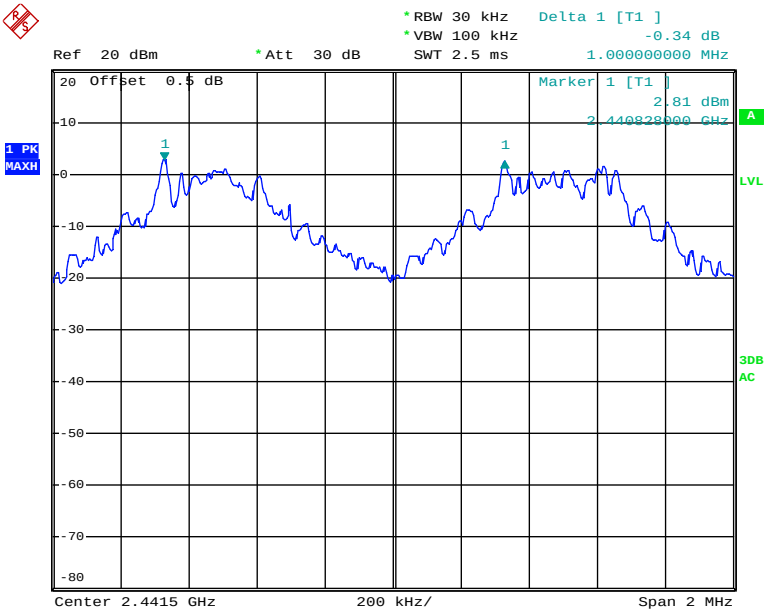
*BDR Mode (GFSK):*

**Low Channel**



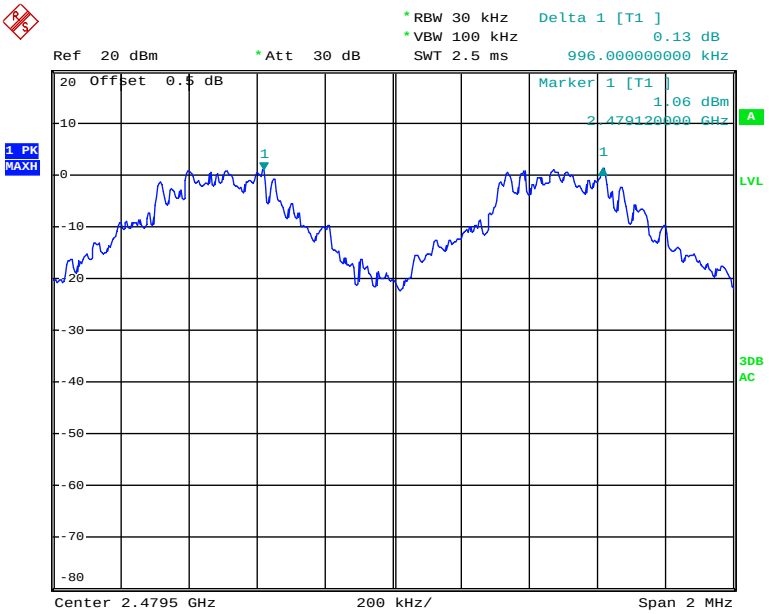

Date: 18.DEC.2017 13:09:29

## Middle Channel




Date: 18.DEC.2017 13:11:25

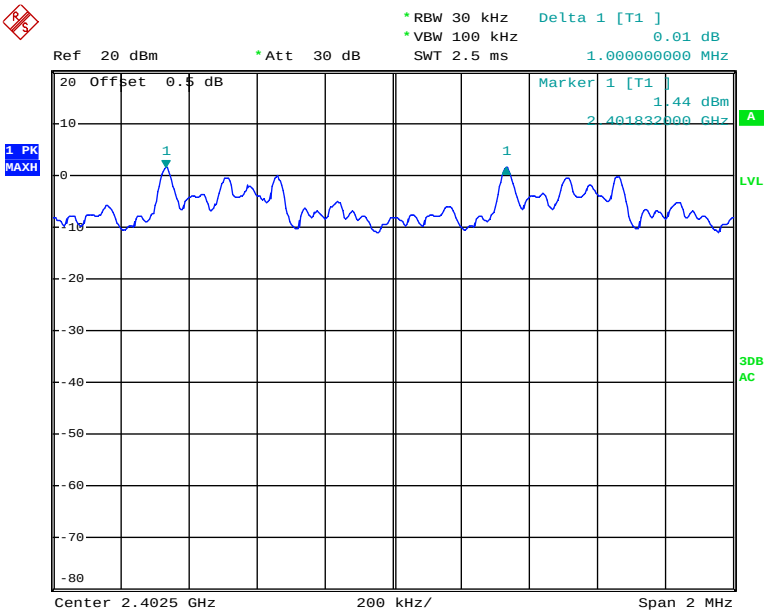
## High Channel




Date: 18.DEC.2017 13:12:49

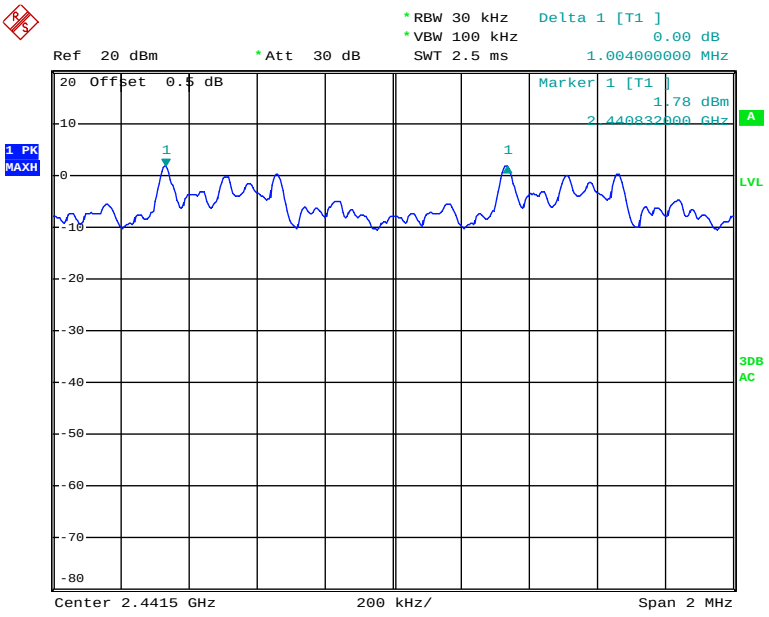
*EDR Mode (π/4-DQPSK):*

**Low Channel**



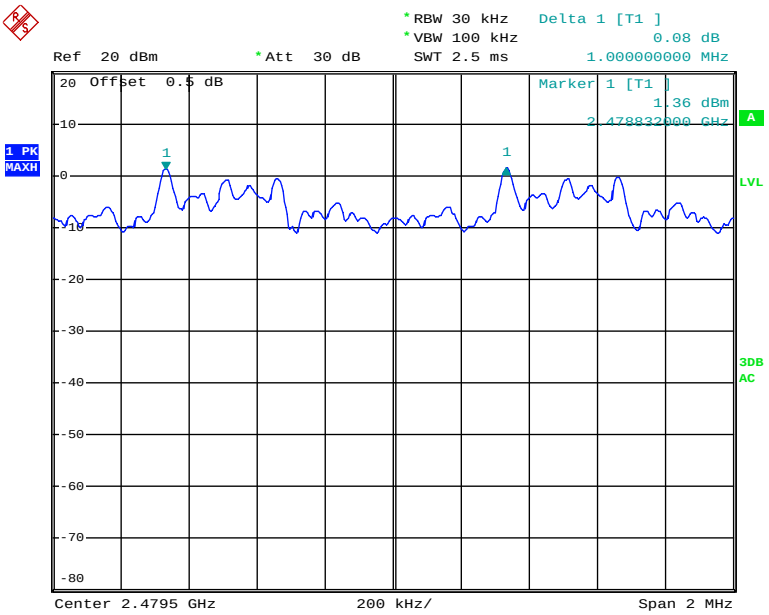

Date: 18.DEC.2017 13:19:21

**Middle Channel**




Date: 18.DEC.2017 13:20:54

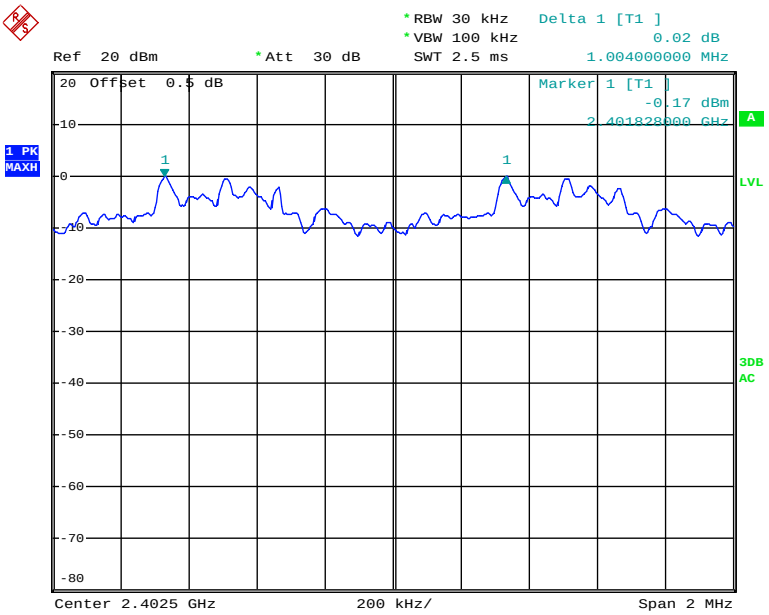
**High Channel**




Date: 18.DEC.2017 13:22:05

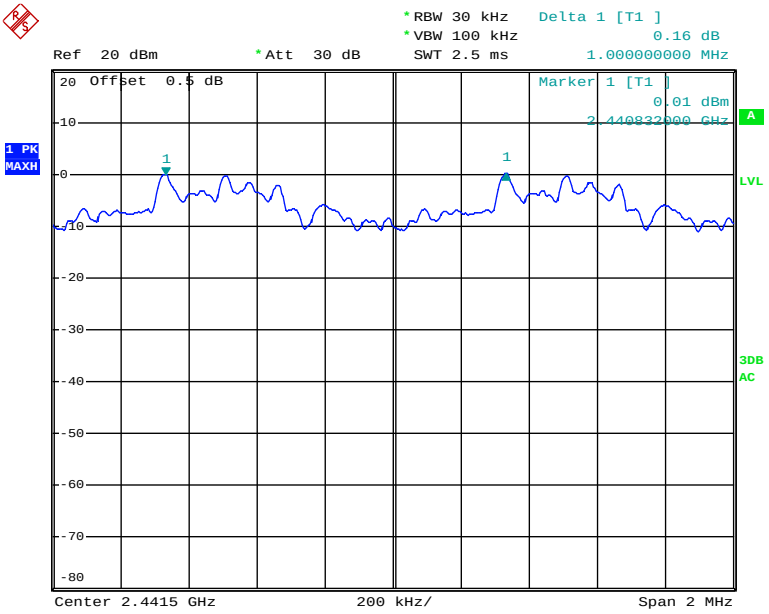
*EDR Mode (8-DPSK):*

**Low Channel**



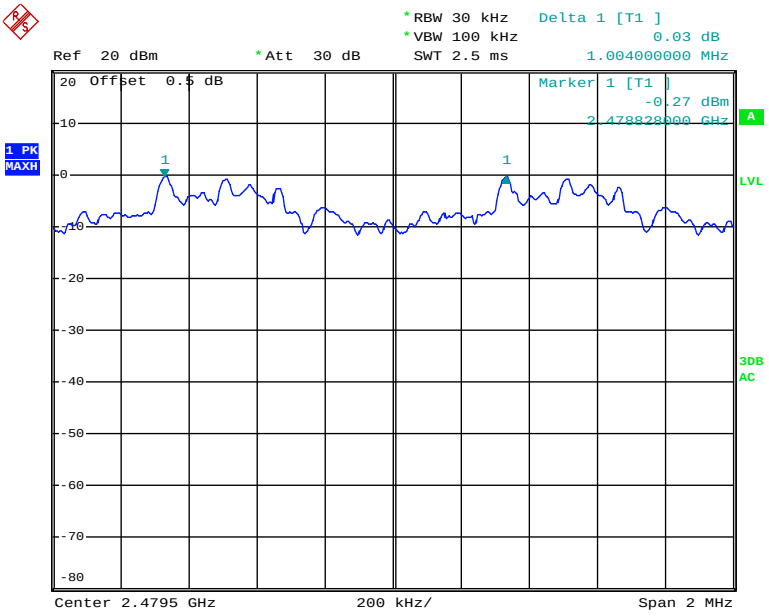

Date: 18.DEC.2017 13:23:49

## Middle Channel




Date: 18.DEC.2017 13:25:33

## High Channel




Date: 18.DEC.2017 13:26:52

# FCC §15.247(a) (1)& RSS-247 CLUASE 5.1&RSS-GEN CLAUSE 6.6 – BANDWIDTH TESTING

## Applicable Standard

According to FCC §15.247(a) (1):

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.

According to RSS-247 Clause 5.1 b):

b) FHSs 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

## 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. Use Occupied bandwidth test function, measure the 99% Occupied bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Reciever | ESCI | 101121 | 2017-03-02 | 2018-03-02 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each Time | / |

*** 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).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22.3 °C |
| **Relative Humidity:** | 35 % |
| **ATM Pressure:** | 102.2 kPa |

** The testing was performed by Emma Zhang on 2017-12-18.*

**Test Result:** Compliance.

Please refer to following tables and plots

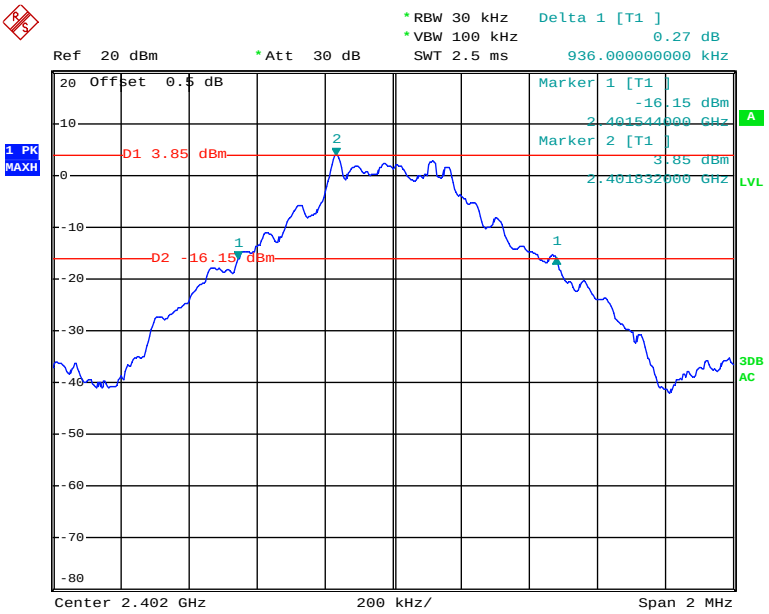
*Test Mode: Transmitting*

| Mode | Channel | Frequency (MHz) | 20 dB Bandwidth (MHz) | 99% occupied Bandwidth (MHz) |
|---|---|---|---|---|
| BDR Mode (GFSK) | Low | 2402 | 0.94 | 0.84 |
| | Middle | 2441 | 0.94 | 0.85 |
| | High | 2480 | 0.93 | 0.85 |
| EDR Mode (π/4-DQPSK) | Low | 2402 | 1.26 | 1.17 |
| | Middle | 2441 | 1.26 | 1.16 |
| | High | 2480 | 1.26 | 1.17 |
| EDR Mode (8-DPSK) | Low | 2402 | 1.27 | 1.16 |
| | Middle | 2441 | 1.27 | 1.17 |
| | High | 2480 | 1.27 | 1.16 |

**20dB Bandwidth:**

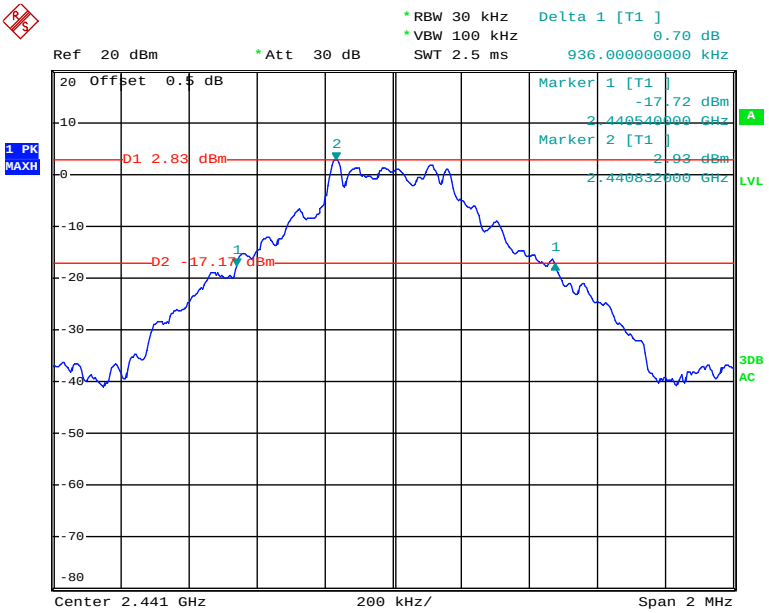
*BDR Mode (GFSK):*

**Low Channel**



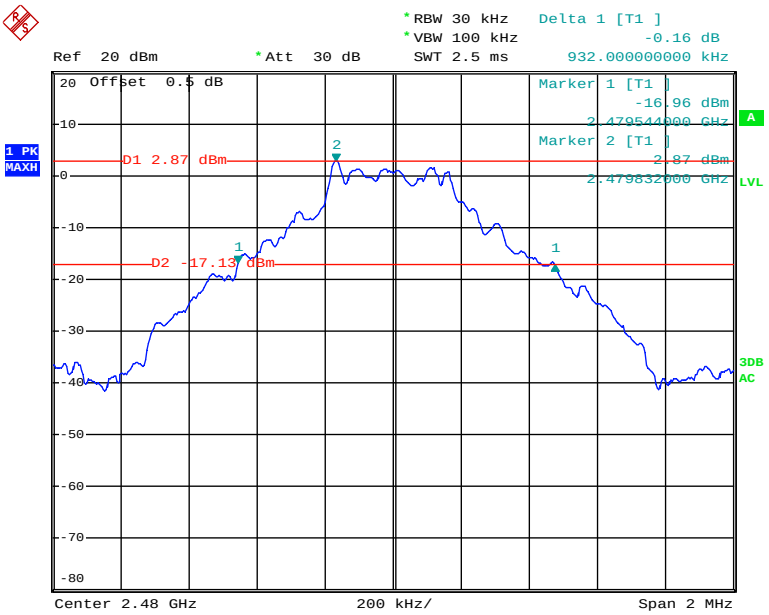

Date: 18.DEC.2017 11:20:16

**Middle Channel**




Date: 18.DEC.2017 11:22:09

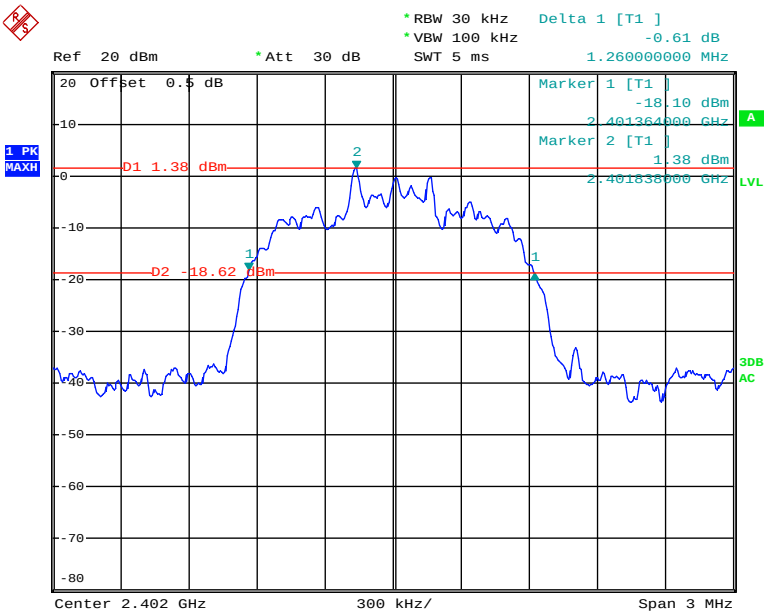
**High Channel**




Date: 18.DEC.2017 11:23:05

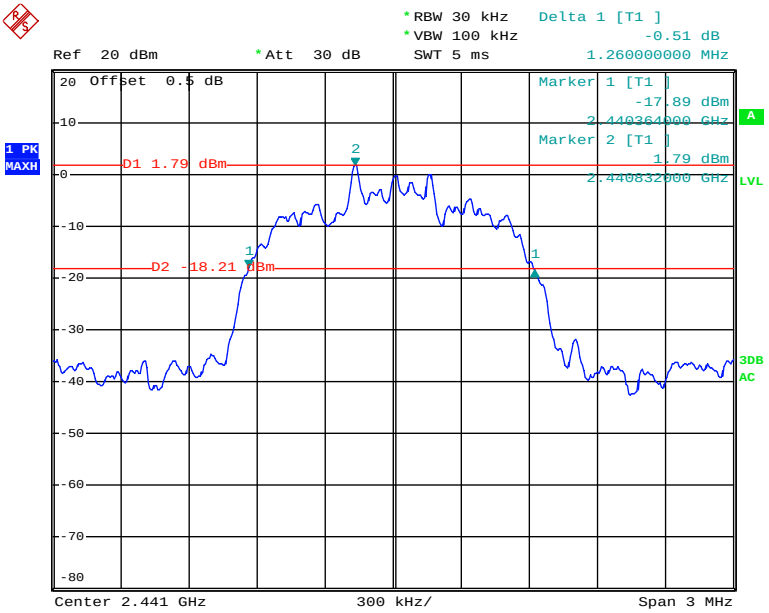
*EDR Mode (π/4-DQPSK):*

**Low Channel**



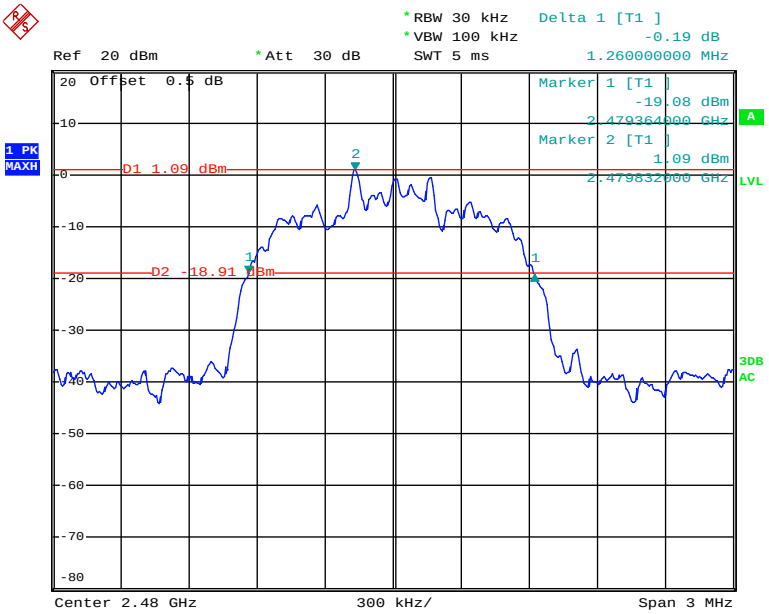

Date: 18.DEC.2017 11:26:52

## Middle Channel




Date: 18.DEC.2017 11:25:50

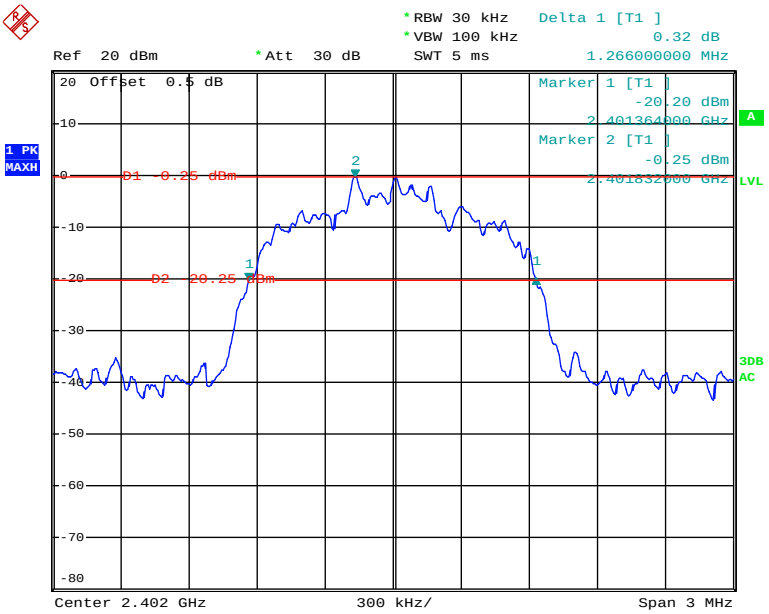
## High Channel




Date: 18.DEC.2017 11:24:40

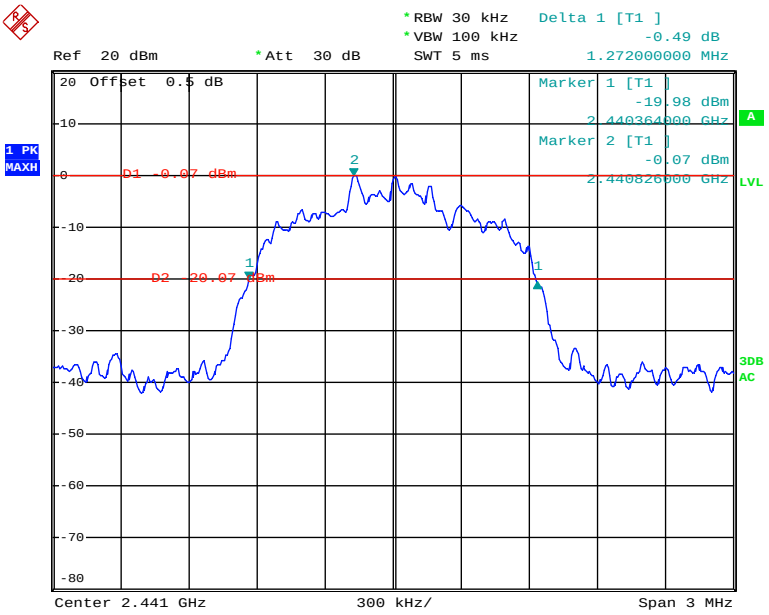
*EDR Mode (8-DPSK):*

**Low Channel**



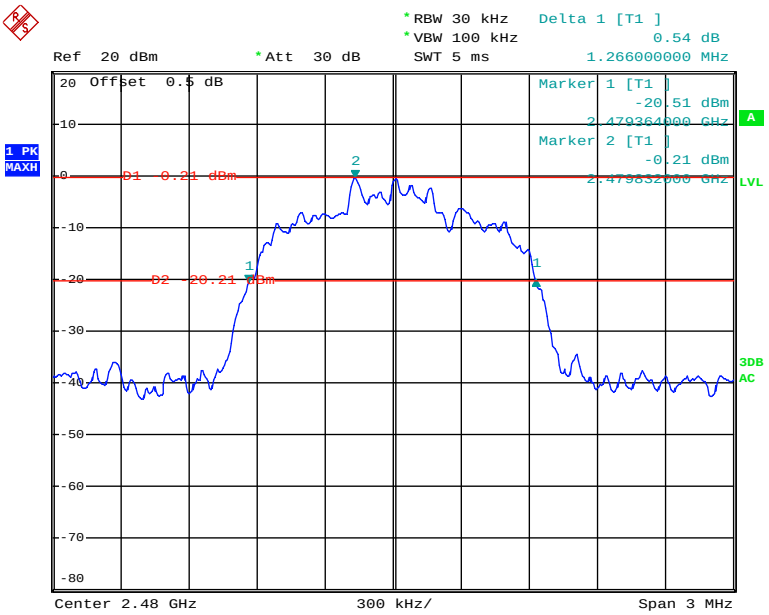

Date: 18.DEC.2017 11:28:12

**Middle Channel**




Date: 18.DEC.2017 11:29:19

**High Channel**

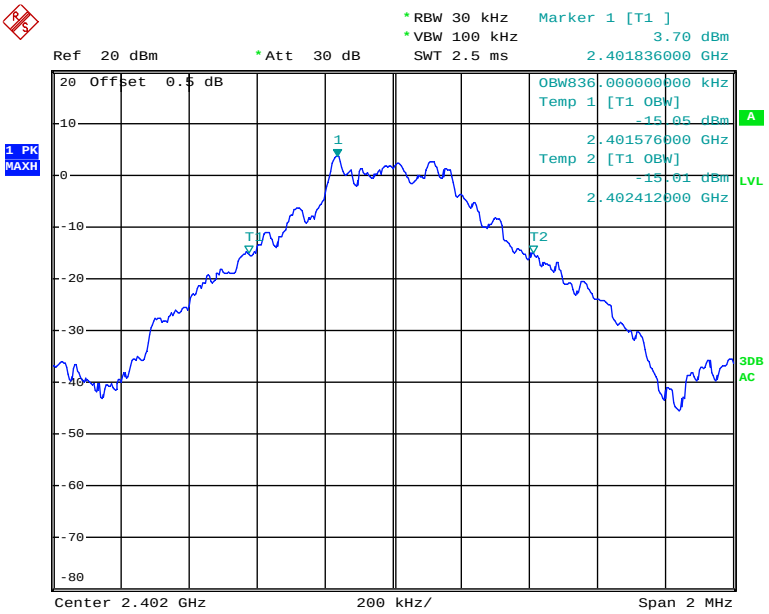



Date: 18.DEC.2017 11:30:19

## 99% Occupied Bandwidth:

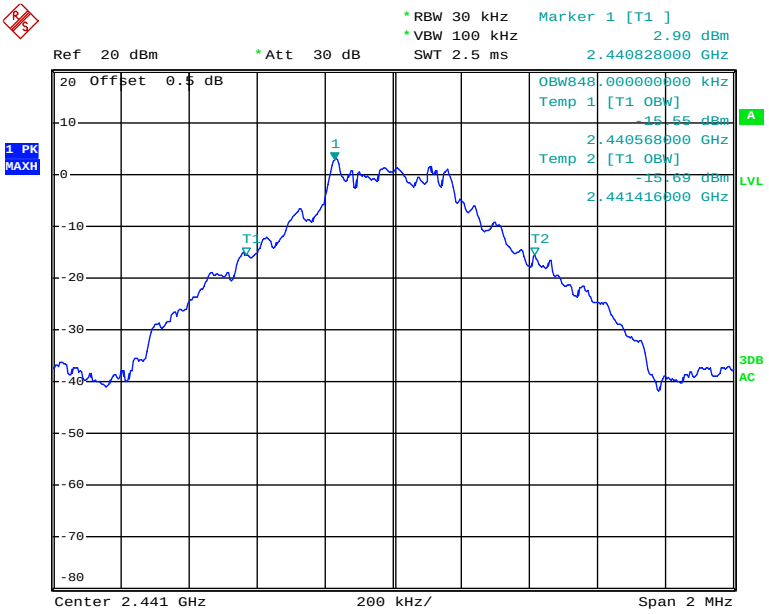
*BDR Mode (GFSK):*

**Low Channel**



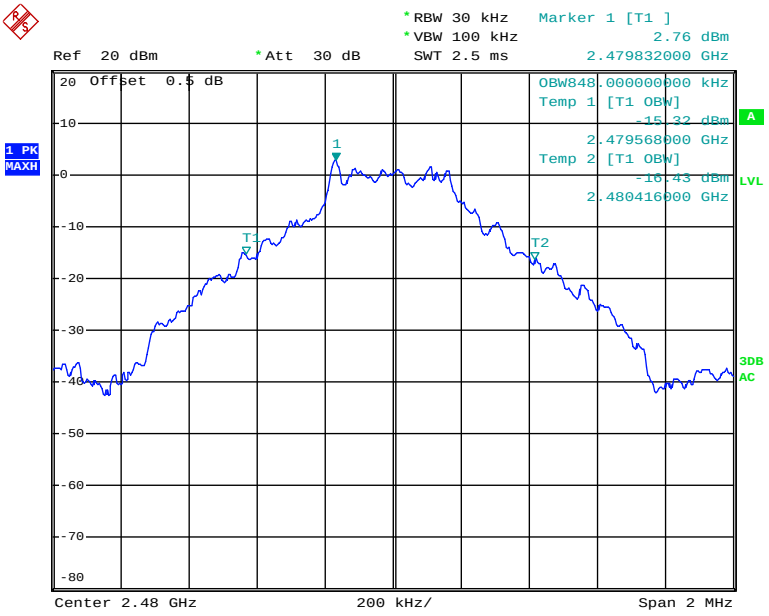

Date: 18.DEC.2017 11:20:27

## Middle Channel




Date: 18.DEC.2017 11:22:20

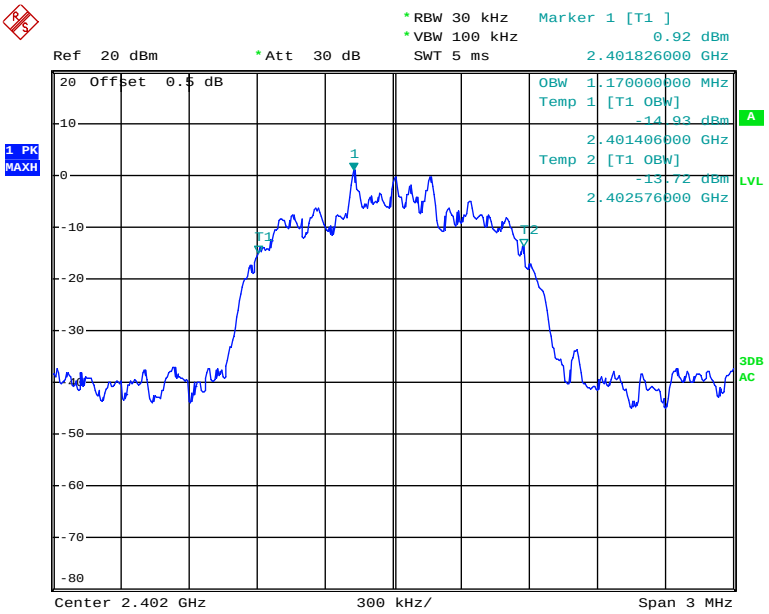
## High Channel




Date: 18.DEC.2017 11:23:14

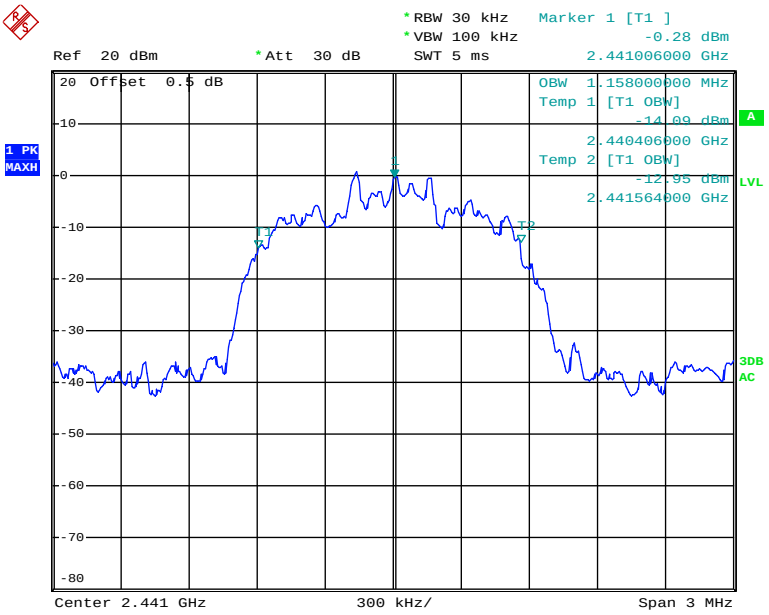
*EDR Mode (π/4-DQPSK):*

**Low Channel**



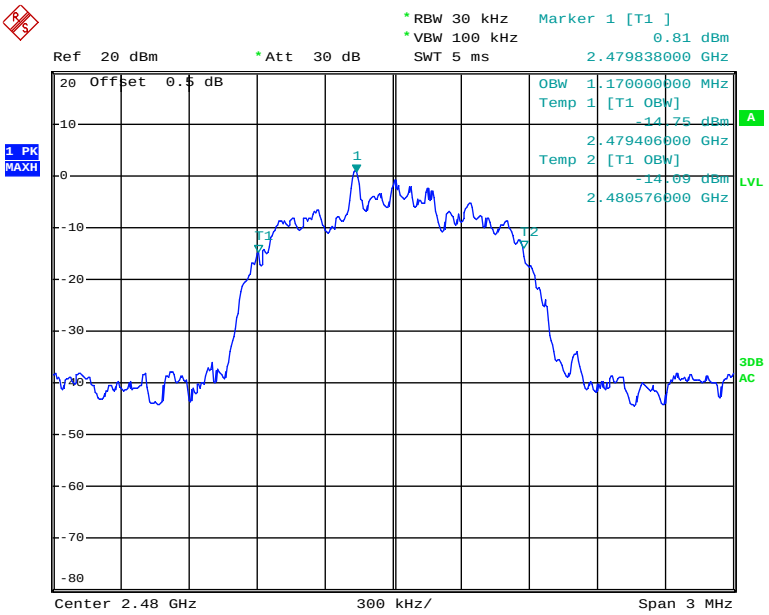

Date: 18.DEC.2017 11:27:02

**Middle Channel**




Date: 18.DEC.2017 11:26:00

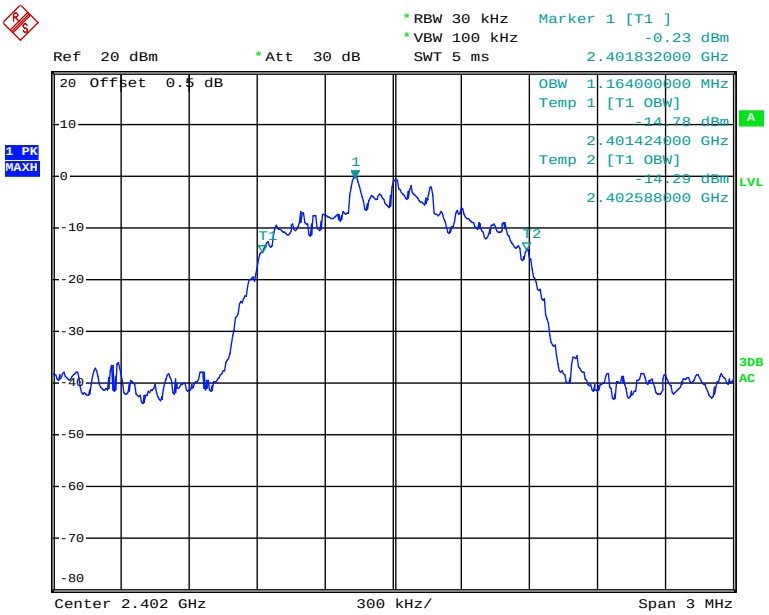
**High Channel**




Date: 18.DEC.2017 11:24:49

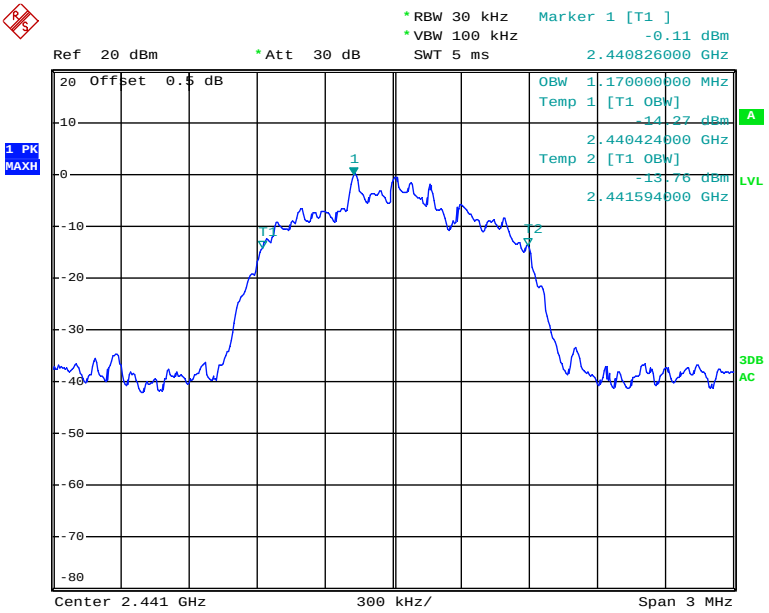
*EDR Mode (8-DPSK):*

**Low Channel**



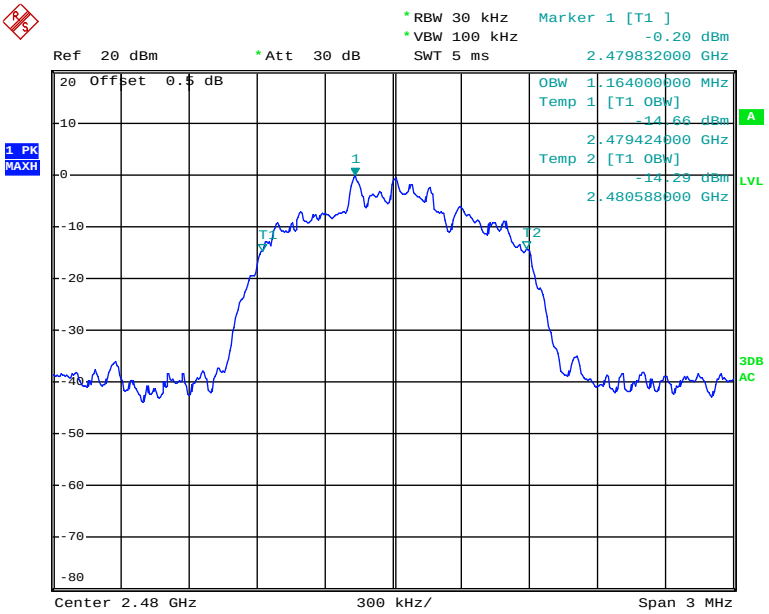

Date: 18.DEC.2017 11:28:22

## Middle Channel




Date: 18.DEC.2017 11:29:29

## High Channel




Date: 18.DEC.2017 11:30:31

# FCC §15.247(a) (1) (iii) & RSS-247 CLAUSE 5.1 d) - QUANTITY OF HOPPING CHANNEL TEST

## Applicable Standard

According to FCC §15.247(a) (1) (iii) &RSS-247 Clause 5.1 d)

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 Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Reciever | ESCI | 101121 | 2017-03-02 | 2018-03-02 |
| Unknown | RF Attenuator | 3dB | 3dB-1 | Each Time | / |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each Time | / |

*** 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).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22.3 °C |
| **Relative Humidity:** | 35 % |
| **ATM Pressure:** | 102.2 kPa |

** The testing was performed by Emma Zhang on 2017-12-18.*

**Test Result:** Compliance.

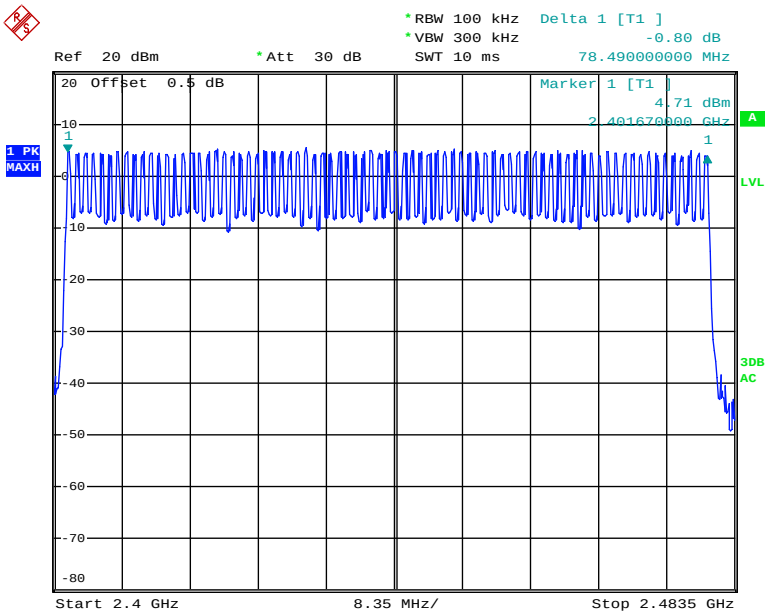
Please refer to following tables and plots

*Test Mode: Transmitting*

*BDR Mode (GFSK):*

| Frequency Range (MHz) | Number of Hopping Channel | Limit |
|---|---|---|
| 2400-2483.5 | 79 | ≥15 |

**Number of Hopping Channels**

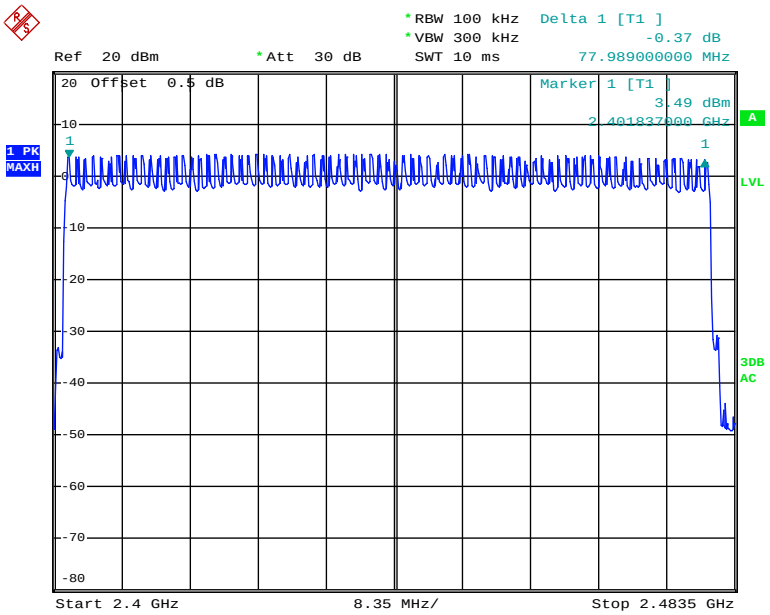



Date: 18.DEC.2017 11:38:48

*EDR Mode (π/4-DQPSK):*

| Frequency Range (MHz) | Number of Hopping Channel | Limit |
|---|---|---|
| 2400-2483.5 | 79 | ≥15 |

**Number of Hopping Channels**

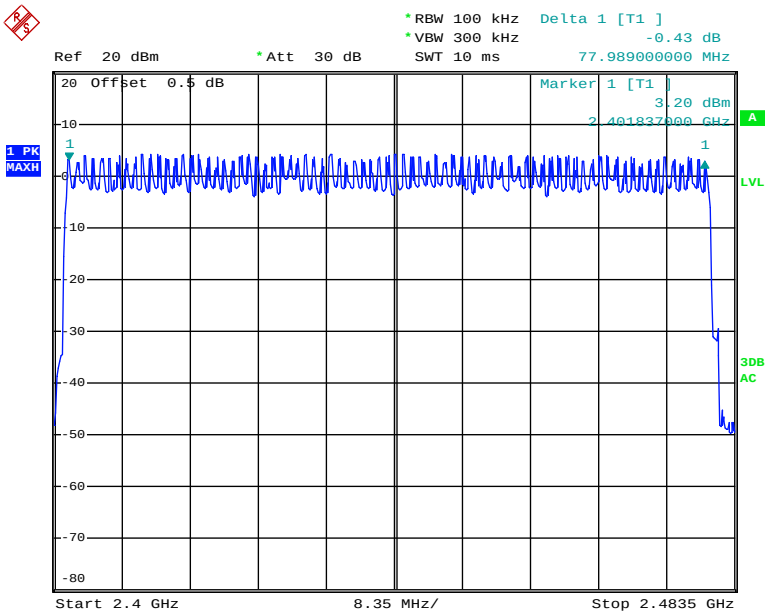



Date: 18.DEC.2017 11:47:37

*EDR Mode (8-DPSK):*

| Frequency Range (MHz) | Number of Hopping Channel | Limit |
|---|---|---|
| 2400-2483.5 | 79 | ≥15 |

**Number of Hopping Channels**




Date: 18.DEC.2017 11:54:52

# FCC §15.247(a) (1) (iii) & RSS-247 CLAUSE 5.1 d) - TIME OF OCCUPANCY (DWELL TIME)

## Applicable Standard

According to FCC §15.247(a) (1) (iii) & RSS-247 Clause 5.1 d)

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 Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Reciever | ESCI | 101121 | 2017-03-02 | 2018-03-02 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each Time | / |

*** 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).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22.3~25.2 °C |
| **Relative Humidity:** | 35~47 % |
| **ATM Pressure:** | 101.3~102.2 kPa |

** The testing was performed by Emma Zhang on 2017-12-18 & 2018-01-19.*

**Test Result:** Compliance.

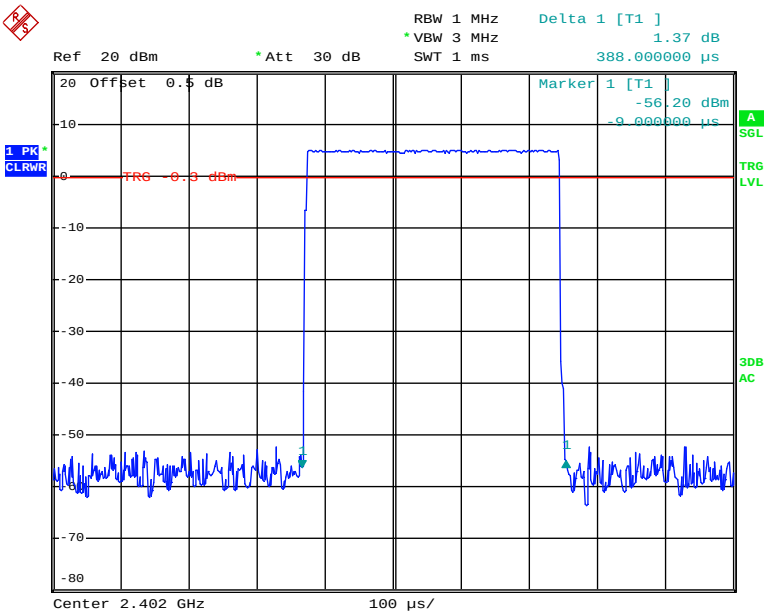
Please refer to following tables and plots

*Test Mode: Transmitting*

*BDR Mode (GFSK):*

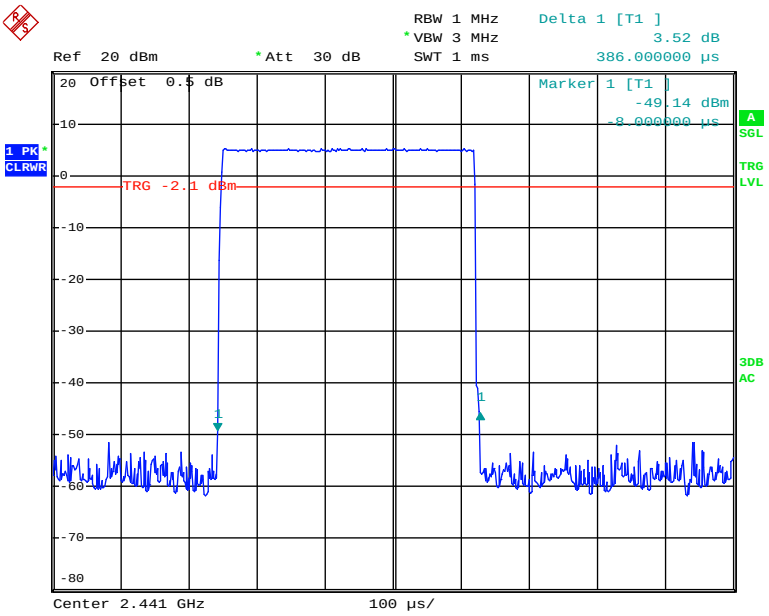
| Mode | Channel | Pulse Width (ms) | Dwell Time (s) | Limit (s) | Result |
|---|---|---|---|---|---|
| ***DH1*** | Low | 0.388 | 0.124 | 0.4 | Compliance |
| | Middle | 0.386 | 0.124 | 0.4 | Compliance |
| | High | 0.388 | 0.124 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/2/79 ) ×31.6 s | | | | |
| ***DH3*** | Low | 1.656 | 0.265 | 0.4 | Compliance |
| | Middle | 1.656 | 0.265 | 0.4 | Compliance |
| | High | 1.660 | 0.266 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s | | | | |
| ***DH5*** | Low | 2.910 | 0.31 | 0.4 | Compliance |
| | Middle | 2.910 | 0.31 | 0.4 | Compliance |
| | High | 2.910 | 0.31 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s | | | | |

**DH1: Low Channel**



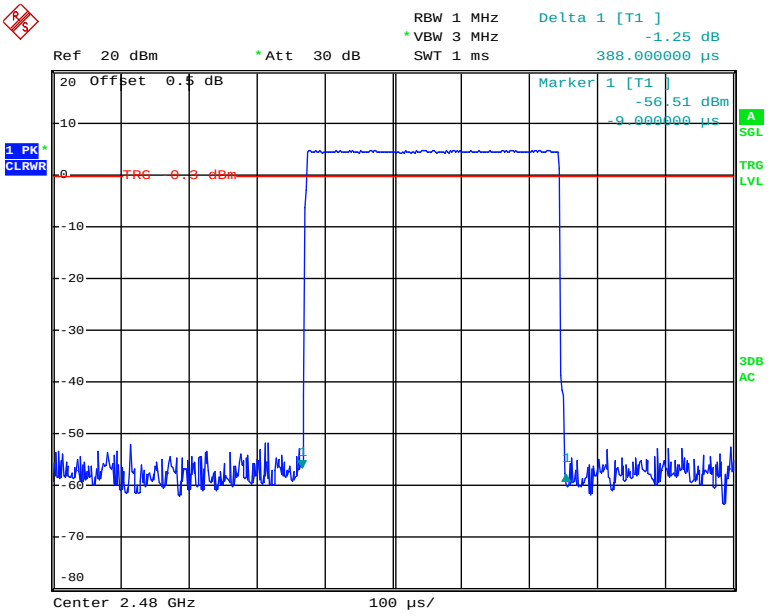

Date: 18.DEC.2017 13:51:48

## DH1: Middle Channel



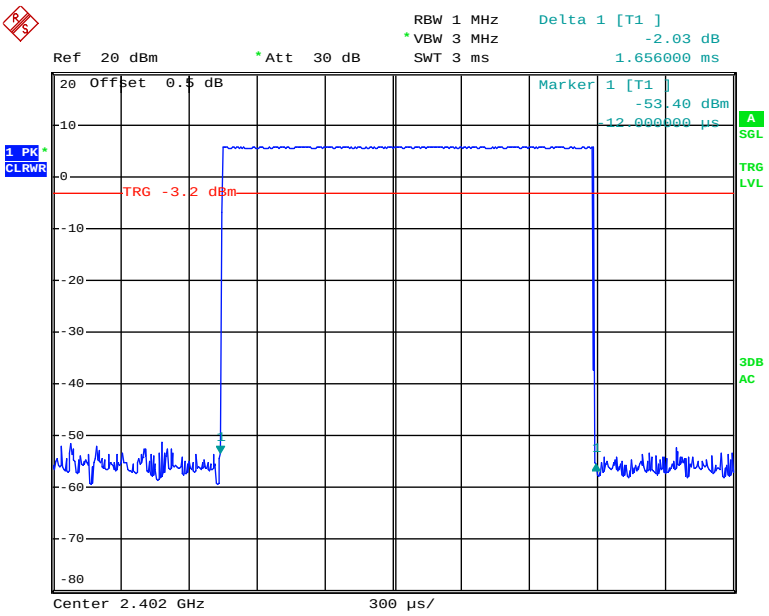

Date: 18.DEC.2017 11:39:08

## DH1: High Channel



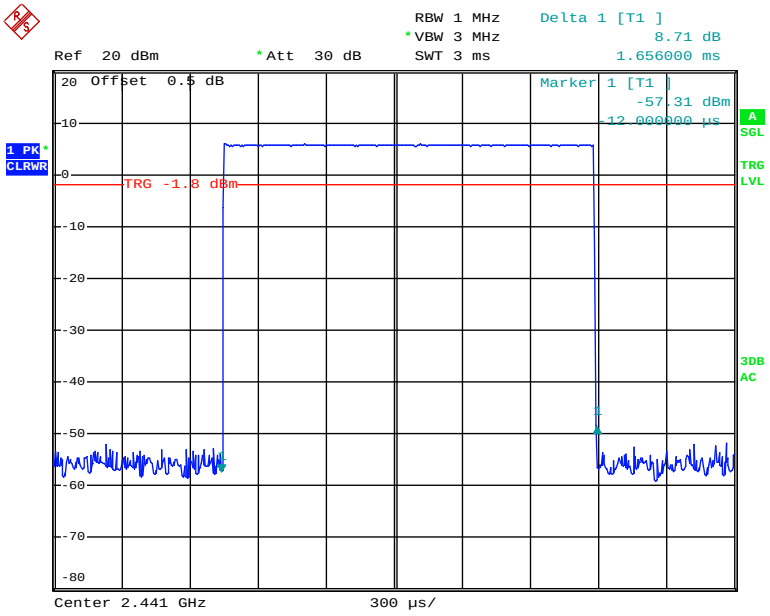

Date: 18.DEC.2017 13:53:06

## DH3: Low Channel



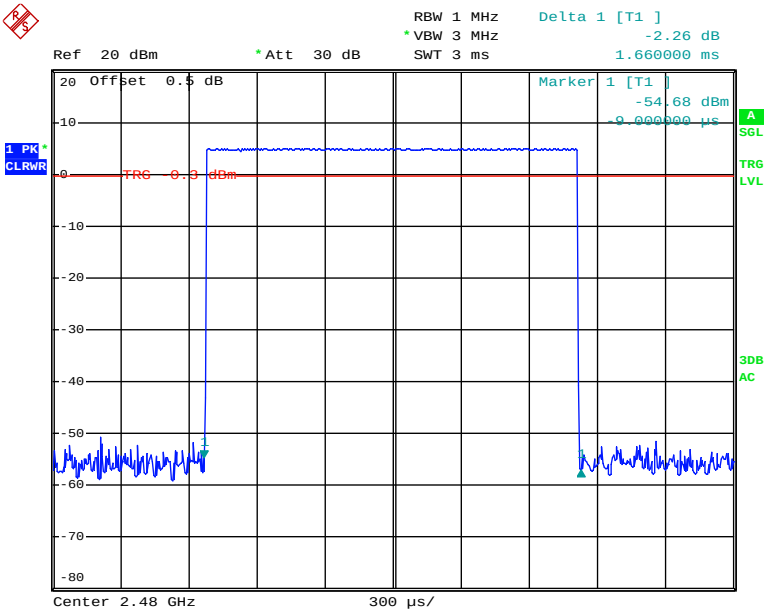

Date: 18.DEC.2017 12:10:20

## DH3: Middle Channel



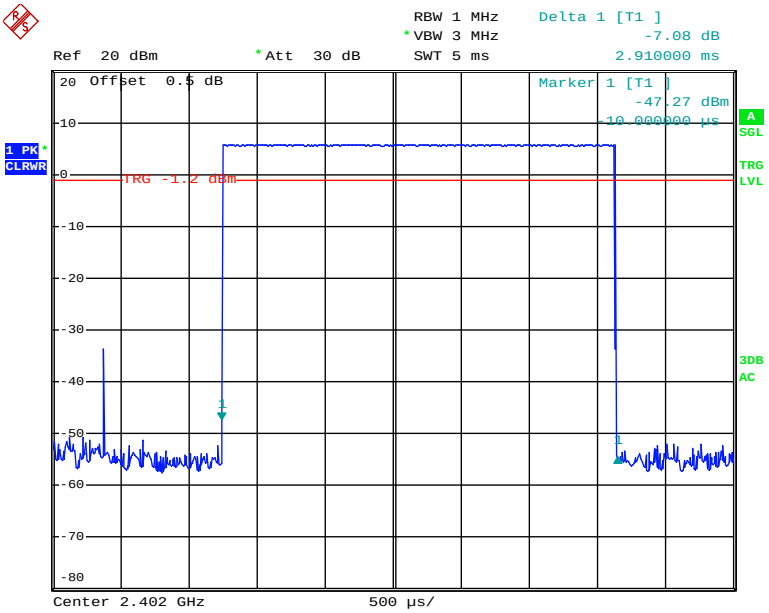

Date: 18.DEC.2017 12:10:26

## DH3: High Channel



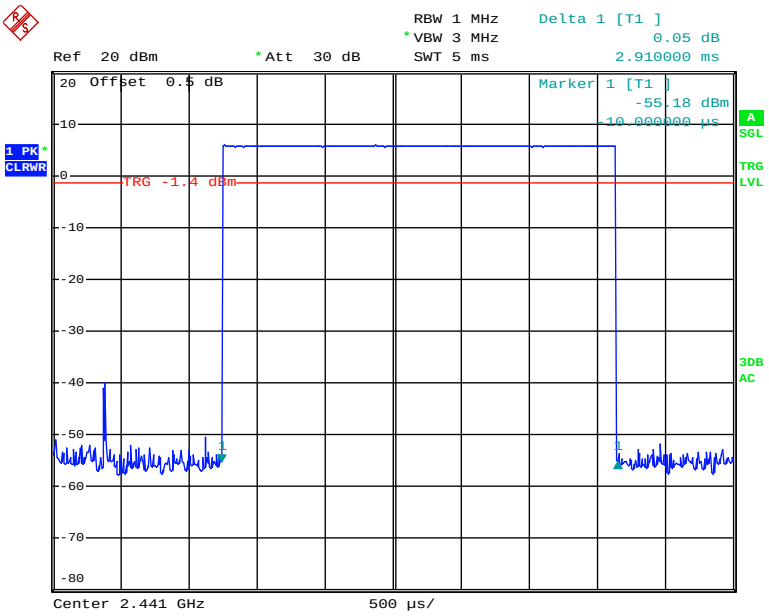

Date: 18.DEC.2017 13:55:13

## DH5: Low Channel



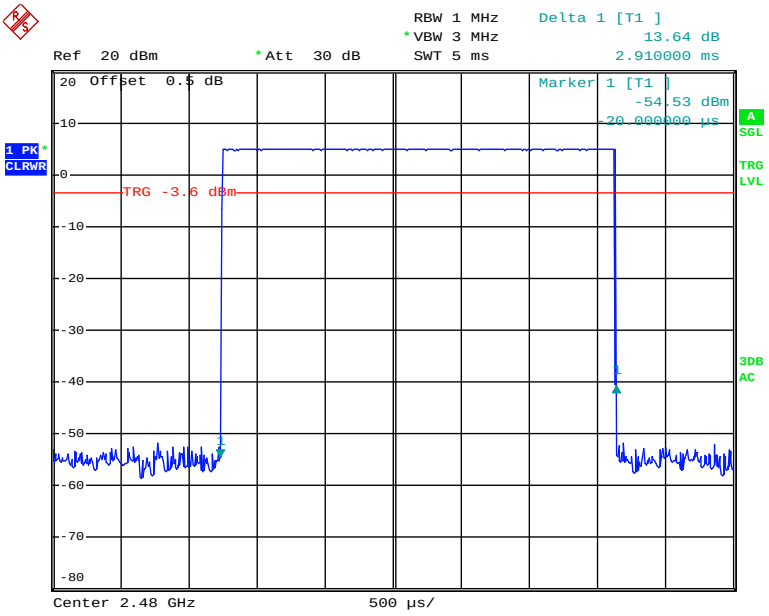

Date: 18.DEC.2017 12:12:06

## DH5: Middle Channel




Date: 18.DEC.2017 12:12:12

## DH5: High Channel

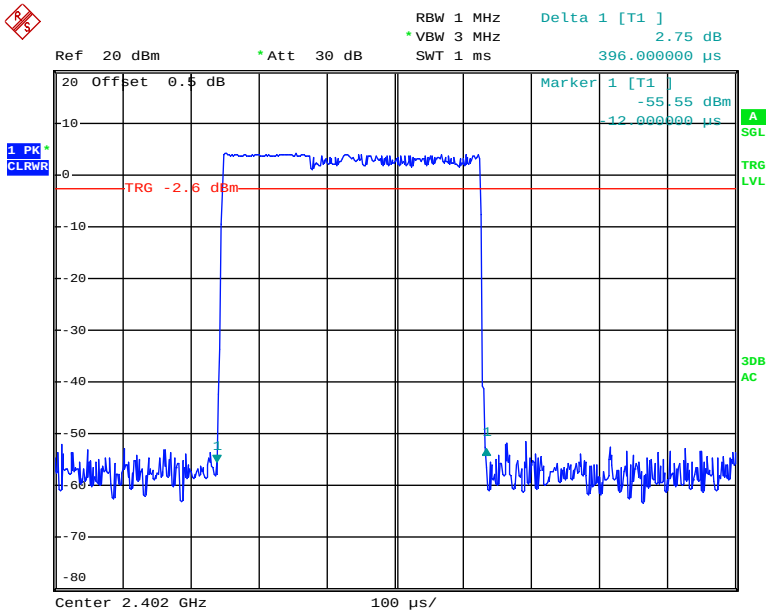



Date: 18.DEC.2017 12:12:19

*EDR Mode (π/4-DQPSK):*

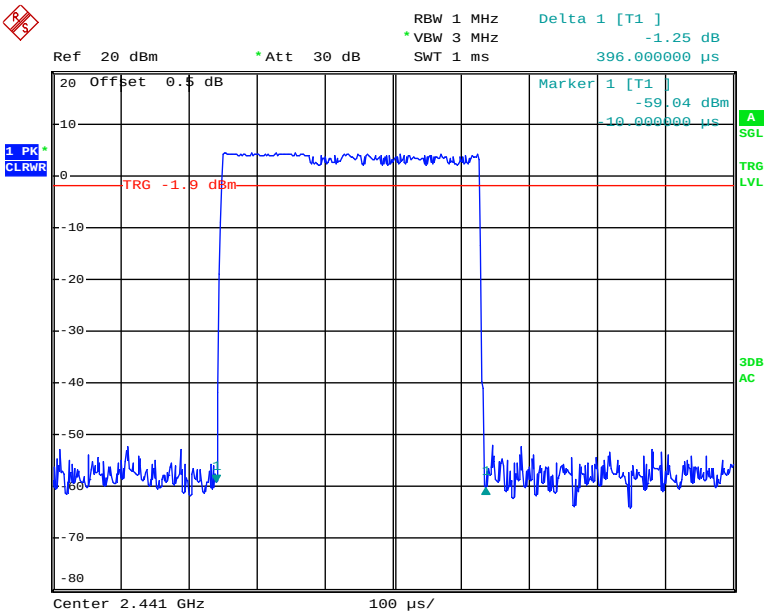
| Mode | Channel | Pulse Width (ms) | Dwell Time (s) | Limit (s) | Result |
|---|---|---|---|---|---|
| ***2DH1*** | Low | 0.396 | 0.127 | 0.4 | Compliance |
| | Middle | 0.396 | 0.127 | 0.4 | Compliance |
| | High | 0.390 | 0.125 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/2/79 ) ×31.6 s | | | | |
| ***2DH3*** | Low | 1.660 | 0.266 | 0.4 | Compliance |
| | Middle | 1.656 | 0.265 | 0.4 | Compliance |
| | High | 1.656 | 0.265 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s | | | | |
| ***2DH5*** | Low | 2.910 | 0.31 | 0.4 | Compliance |
| | Middle | 2.920 | 0.31 | 0.4 | Compliance |
| | High | 2.919 | 0.311 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s | | | | |

**2DH1: Low Channel**



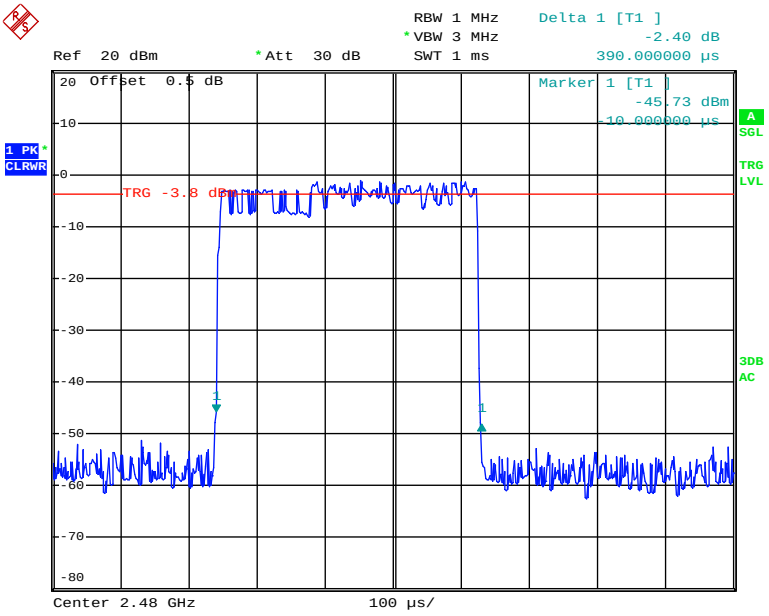

Date: 18.DEC.2017 11:47:47

## 2DH1: Middle Channel



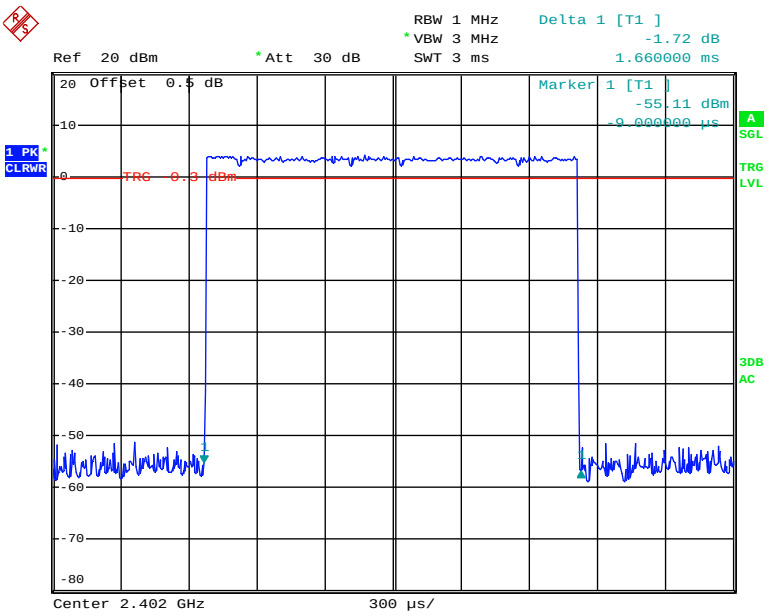

Date: 18.DEC.2017 11:47:53

## 2DH1: High Channel



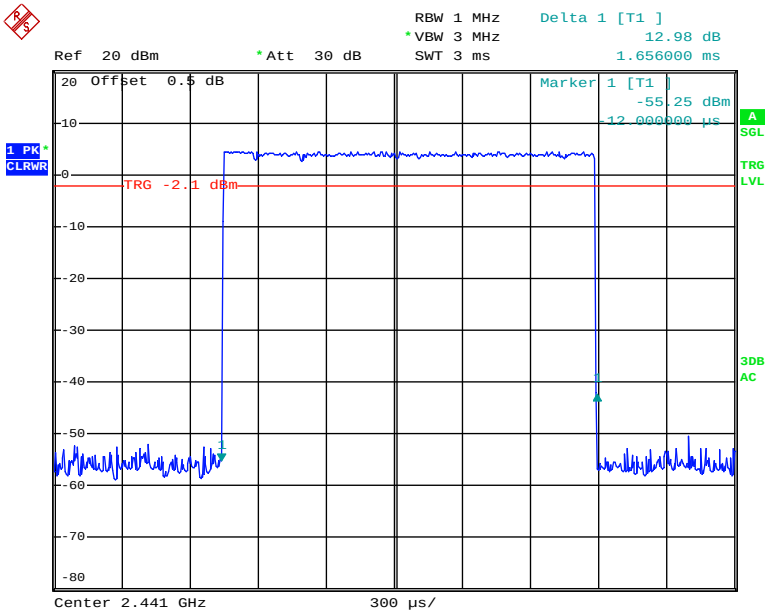

Date: 18.DEC.2017 11:48:00

## 2DH3: Low Channel



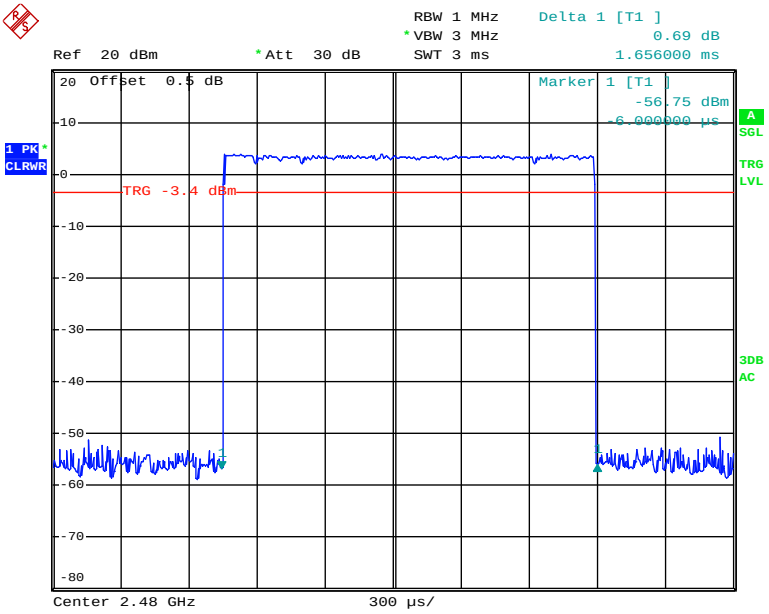

Date: 18.DEC.2017 14:00:12

## 2DH3: Middle Channel



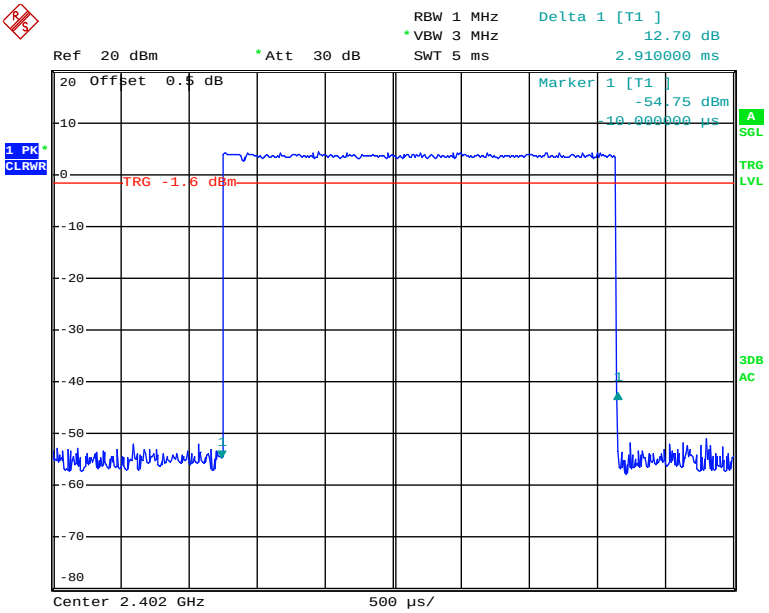

Date: 18.DEC.2017 12:08:21

## 2DH3: High Channel



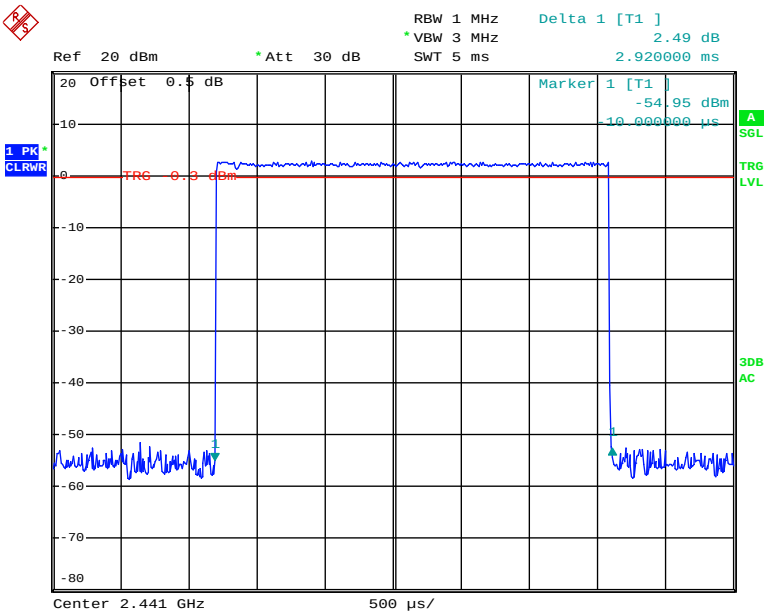

Date: 18.DEC.2017 12:08:27

## 2DH5: Low Channel



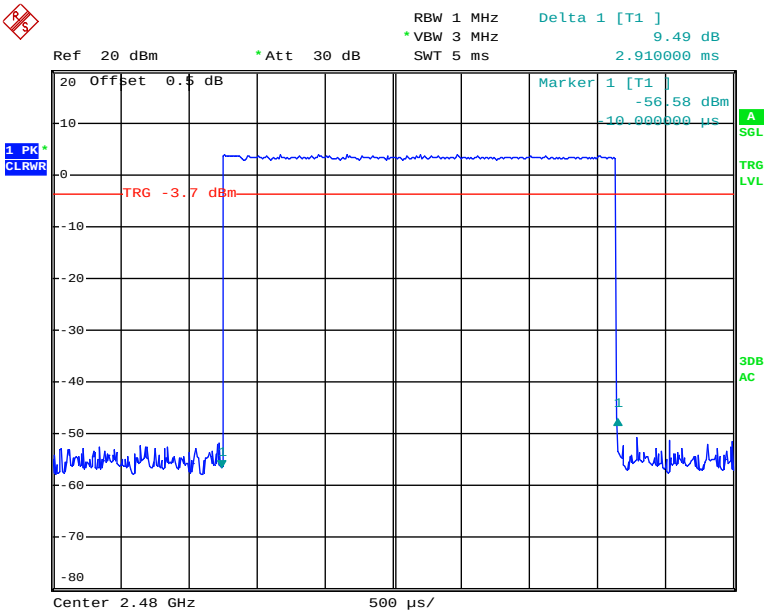

Date: 18.DEC.2017 12:06:33

## 2DH5: Middle Channel




Date: 19.JAN.2018 19:53:17

## 2DH5: High Channel

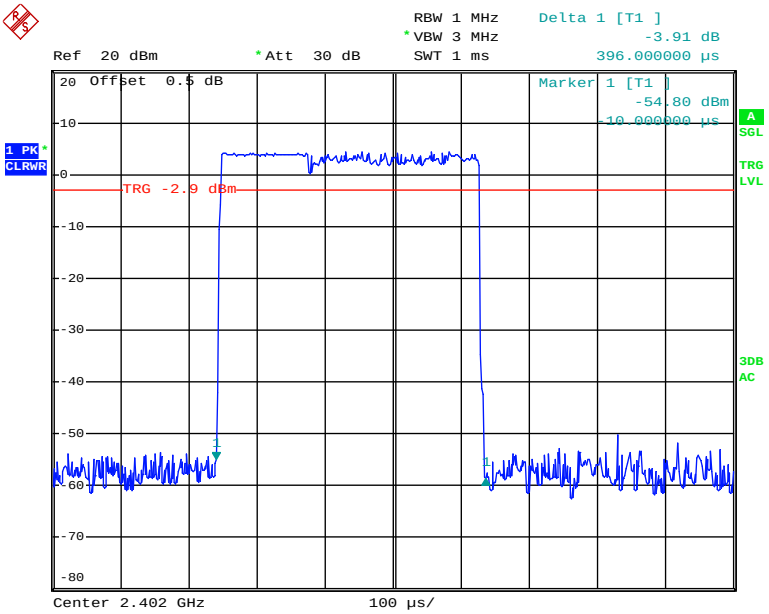



Date: 18.DEC.2017 12:06:45

*EDR Mode (8-DPSK):*

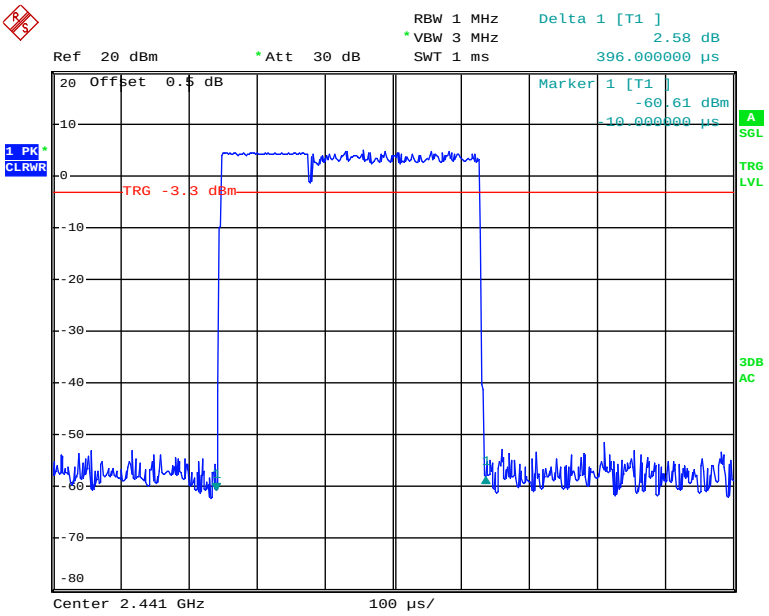
| Mode | Channel | Pulse Width (ms) | Dwell Time (s) | Limit (s) | Result |
|---|---|---|---|---|---|
| ***3DH1*** | Low | 0.396 | 0.127 | 0.4 | Compliance |
| | Middle | 0.396 | 0.127 | 0.4 | Compliance |
| | High | 0.39 | 0.125 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/2/79 ) ×31.6 s | | | | |
| ***3DH3*** | Low | 1.656 | 0.265 | 0.4 | Compliance |
| | Middle | 1.658 | 0.265 | 0.4 | Compliance |
| | High | 1.658 | 0.265 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s | | | | |
| ***3DH5*** | Low | 2.930 | 0.313 | 0.4 | Compliance |
| | Middle | 2.916 | 0.311 | 0.4 | Compliance |
| | High | 2.916 | 0.311 | 0.4 | Compliance |
| | Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s | | | | |

**3DH1: Low Channel**



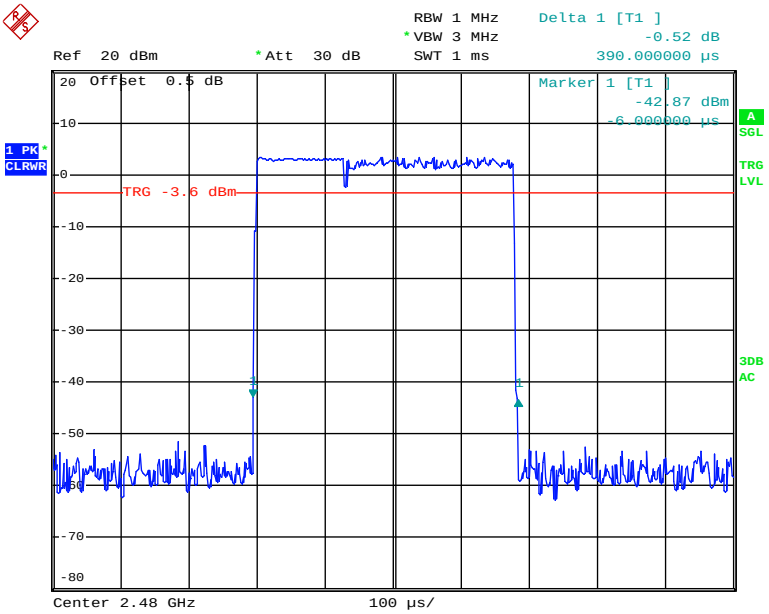

Date: 18.DEC.2017 11:59:41

## 3DH1: Middle Channel



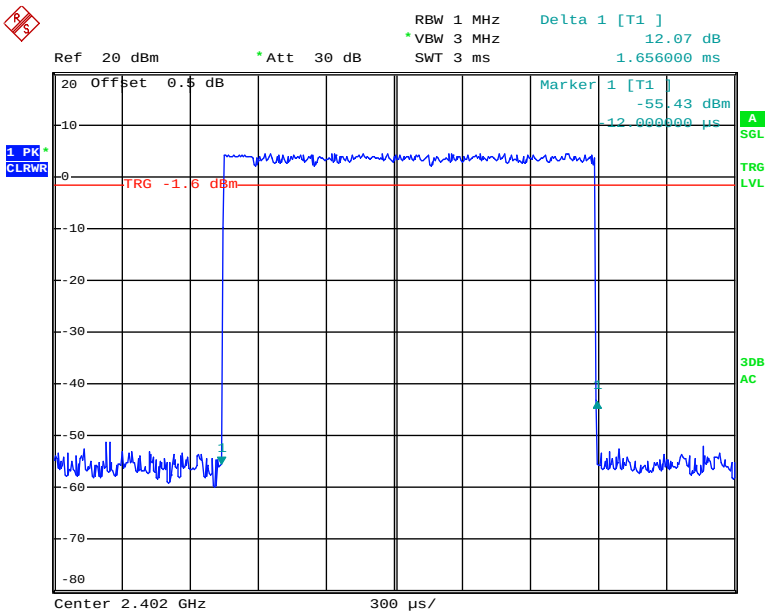

Date: 18.DEC.2017 11:59:49

## 3DH1: High Channel



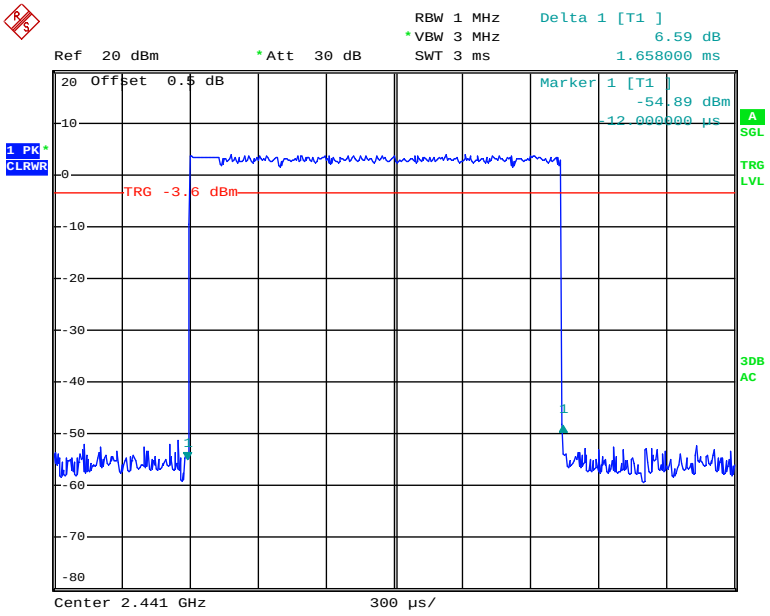

Date: 18.DEC.2017 13:34:13

## 3DH3: Low Channel



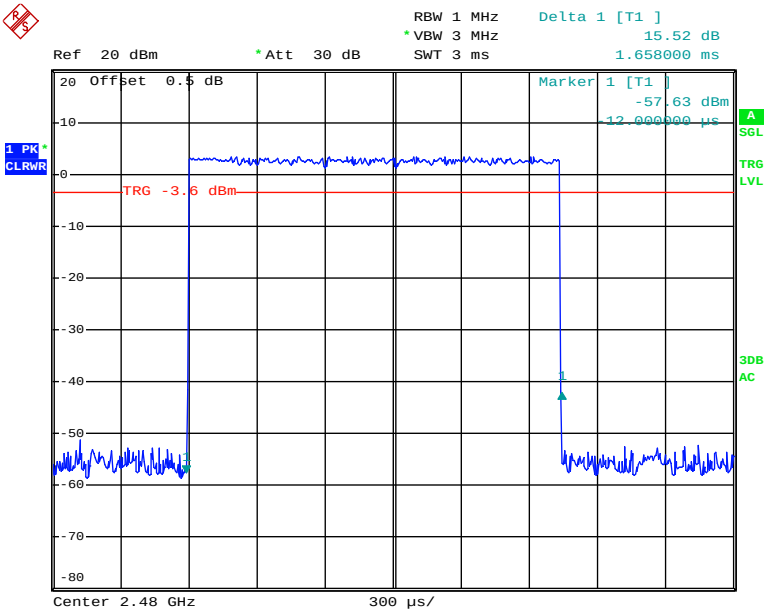

Date: 18.DEC.2017 12:01:32

## 3DH3: Middle Channel



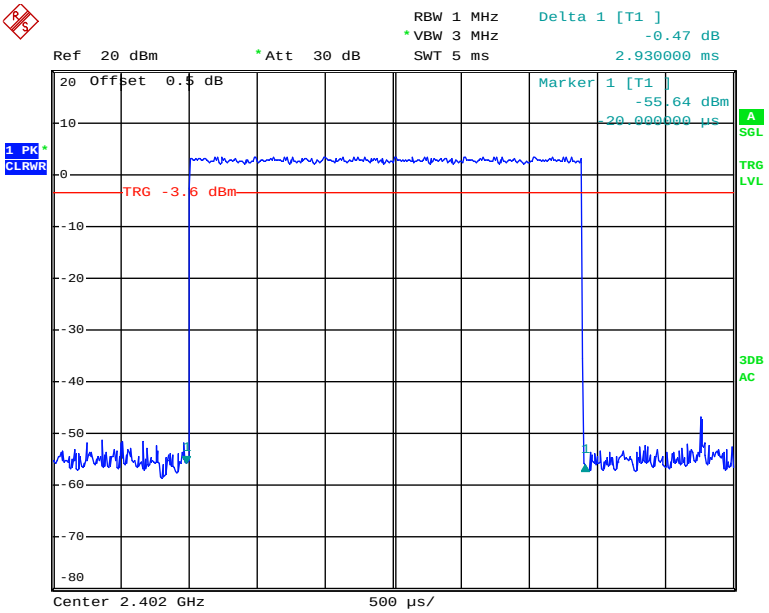

Date: 18.DEC.2017 13:38:21

## 3DH3: High Channel



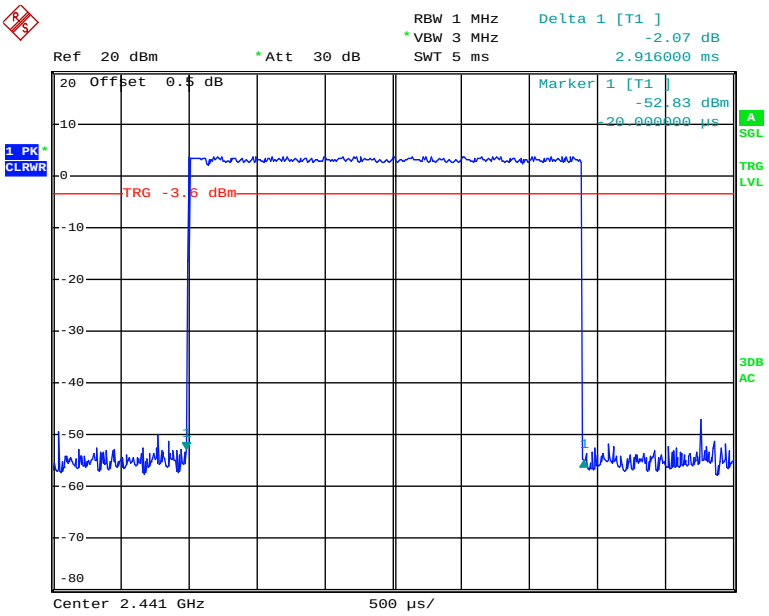

Date: 18.DEC.2017 13:37:15

## 3DH5: Low Channel



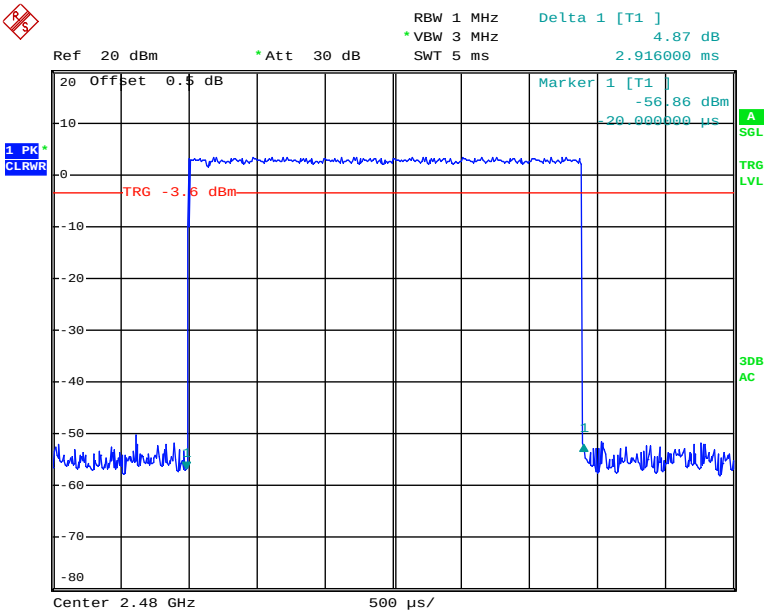

Date: 18.DEC.2017 13:44:05

## 3DH5: Middle Channel




Date: 18.DEC.2017 13:42:57

## 3DH5: High Channel




Date: 18.DEC.2017 13:40:59

# FCC §15.247(b) (1) & RSS-247 CLAUSE 5.4 b) - PEAK OUTPUT POWER MEASUREMENT

## Applicable Standard

According to FCC §15.247(b) (1)

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

According to RSS-247 Clause 5.4 b)

b) For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

## 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 Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Agilent | USB Wideband Power Sensor | U2022XA | MY5417006 | 2017-12-11 | 2018-12-11 |
| Agilent | USB Wideband Power Sensor | U2022XA | MY5417014 | 2017-12-11 | 2018-12-11 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each Time | / |

*** 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).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22.3 °C |
| **Relative Humidity:** | 35 % |
| **ATM Pressure:** | 102.2 kPa |

** The testing was performed by Emma Zhang on 2017-12-18.*

**Test Result:** Compliance

*Test Mode: Transmitting*

| Mode | Frequency (MHz) | Peak Conducted Output power (dBm) | Limit (dBm) |
|---|---|---|---|
| BDR Mode (GFSK) | 2402 | 6.02 | 30 |
| | 2441 | 4.92 | 30 |
| | 2480 | 4.8 | 30 |
| EDR Mode (π/4-DQPSK) | 2402 | 3.92 | 30 |
| | 2441 | 4.1 | 30 |
| | 2480 | 3.55 | 30 |
| EDR Mode (8-DPSK) | 2402 | 4.16 | 30 |
| | 2441 | 4.28 | 30 |
| | 2480 | 4.04 | 30 |

Note: The data above was tested in conducted mode.

# FCC §15.247(d) & RSS-247 CLAUSE 5.5 - BAND EDGES TESTING

## Applicable Standard

According to 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)).

According to RSS-247 Clause 5.5

> In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

## 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 Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Reciever | ESCI | 101121 | 2017-03-02 | 2018-03-02 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each Time | / |

*** 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).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22.3 °C |
| **Relative Humidity:** | 35 % |
| **ATM Pressure:** | 102.2 kPa |

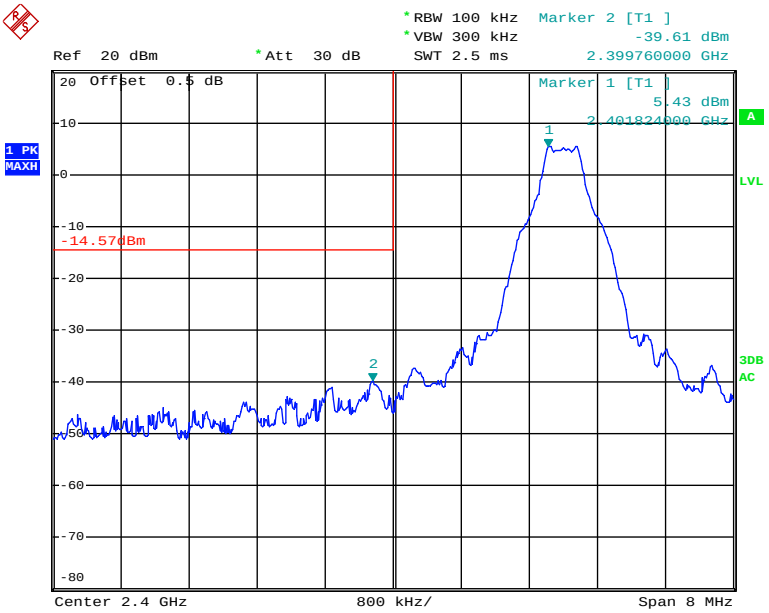
** The testing was performed by Emma Zhang on 2017-12-18.*

**Test Result:** Compliance

The emissions out of band was under limit 20dBc, please refer to the below plots.

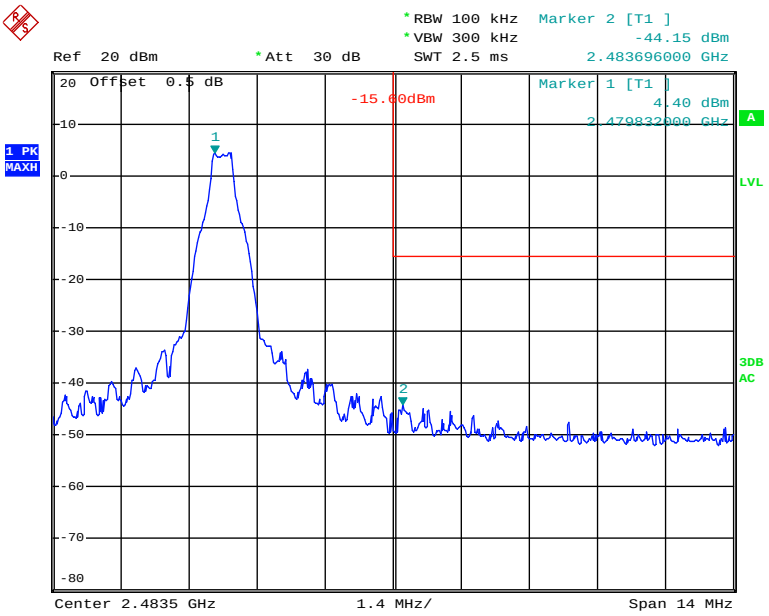
*BDR Mode (GFSK):*

**Band Edge, Left Side**




Date: 18.DEC.2017 11:20:58

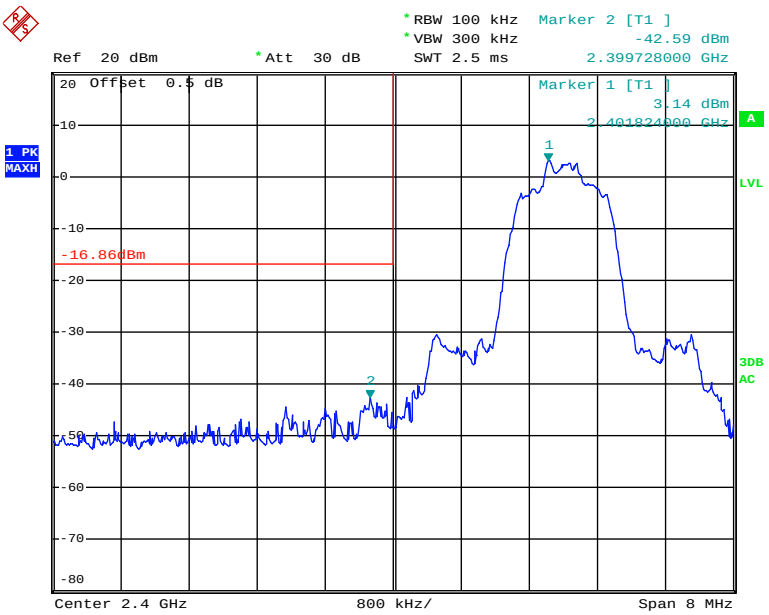
**Band Edge, Right Side**




Date: 18.DEC.2017 11:23:45

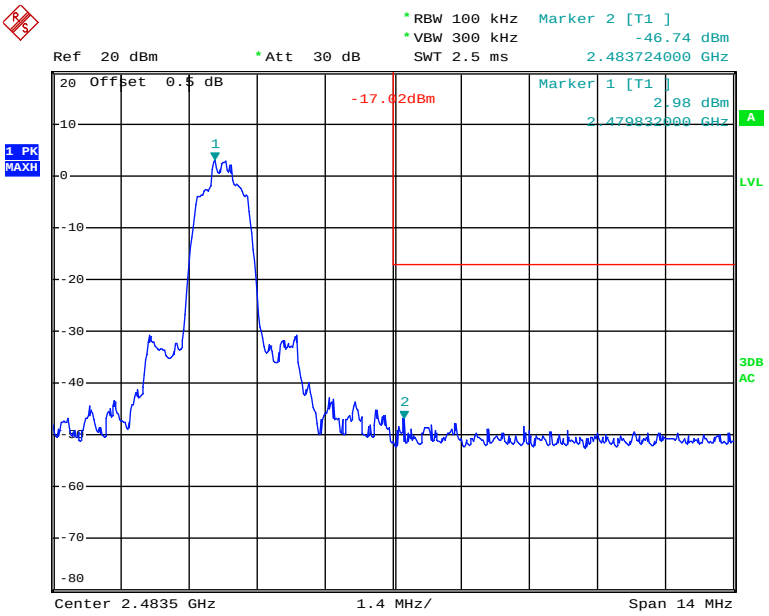
*EDR Mode (π/4-DQPSK):*

**Band Edge, Left Side**




Date: 18.DEC.2017 11:27:28

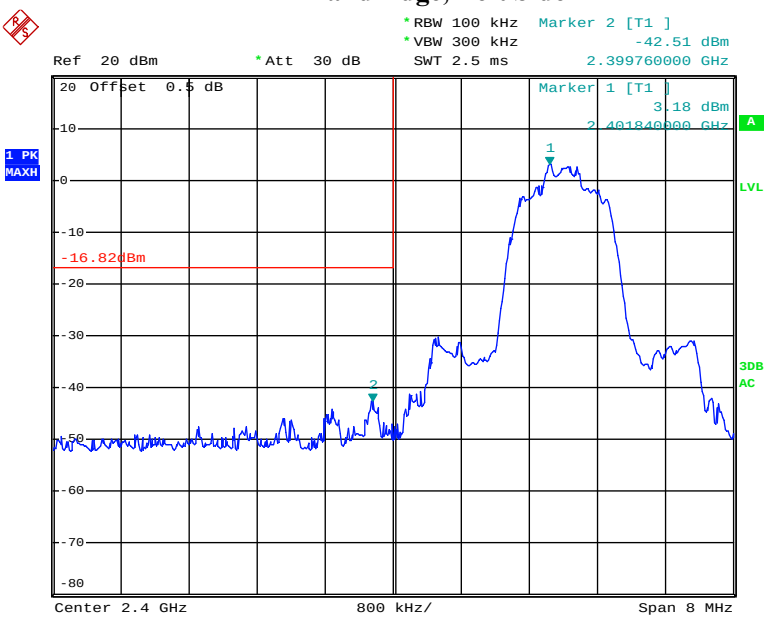
**Band Edge, Right Side**




Date: 18.DEC.2017 11:25:14

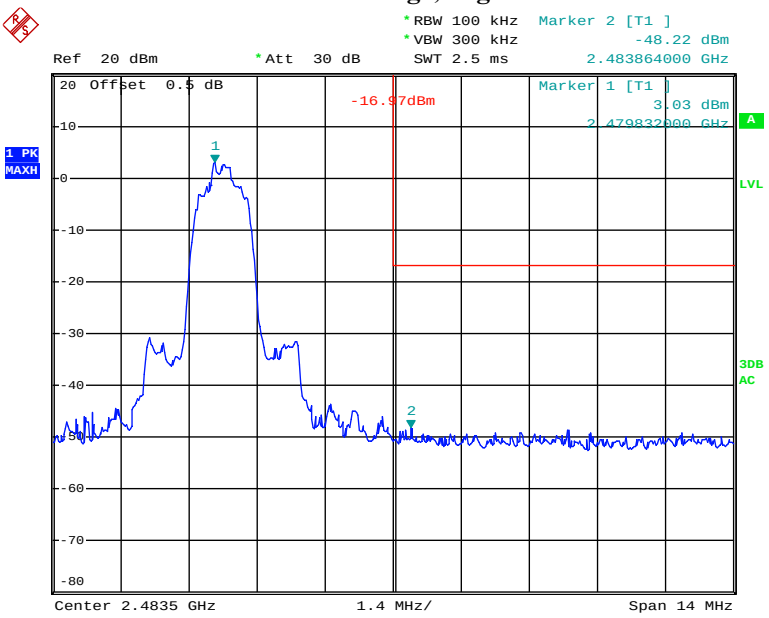
*EDR Mode (8-DPSK):*

**Band Edge, Left Side**




Date: 18.DEC.2017 11:28:47

**Band Edge, Right Side**




Date: 18.DEC.2017 11:30:57

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