# TEST REPORT

| | |
|---|---|
| **Product Name:** | Truly Wireless Stereo Earbuds |
| **Trade Mark:** | EDIFIER |
| **Model No. / HVIN:** | TWS5 |
| **Add. Model No. / HVIN:** | N/A |
| **Report Number:** | 181108042RFC-1 |
| **Test Standards:** | FCC 47 CFR Part 15 Subpart C<br>RSS-247 Issue 2<br>RSS-Gen Issue 5 |
| **FCC ID:** | Z9G-EDF81 |
| **IC:** | 10004A-EDF81 |
| **Test Result:** | PASS |
| **Date of Issue:** | December 10, 2018 |

Prepared for:

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Approved by: _____ Billy Li, Technical Director

Date: December 10, 2018

UnionTrust Laboratories * Certified *

# Version

| Version No. | Date | Description |
|---|---|---|
| V1.0 | December 10, 2018 | Original |

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# 1. GENERAL INFORMATION

## 1.1 CLIENT INFORMATION

| | |
|---|---|
| **Applicant:** | Edifier International Limited |
| **Address of Applicant:** | P.O. Box 6264 General Post Office Hong Kong China |
| **Manufacturer:** | Beijing Edifier Technology Co., Ltd. |
| **Address of Manufacturer:** | 8th floor, ZuoAn Building,NO.68 BeiSiHuanXiLu, Haidian District, Beijing 100080,CHINA |

## 1.2 EUT INFORMATION

### 1.2.1 General Description of EUT

| | | |
|---|---|---|
| **Product Name:** | Truly Wireless Stereo Earbuds | |
| **Model No. / HVIN:** | TWS5 | |
| **Add. Model No. / HVIN:** | N/A | |
| **Trade Mark:** | EDIFIER | |
| **DUT Stage:** | Identical Prototype | |
| **EUT Supports Function:** | 2.4 GHz ISM Band: | Bluetooth 5.0<br>(LE/ 2LE/ LE Code mode is not supported) |
| **Sample Received Date:** | November 15, 2018 | |
| **Sample Tested Date:** | November 21, 2018 to November 27, 2018 | |

### 1.2.2 Description of Accessories

| **Battery (Charging case)** | |
|---|---|
| **Model No.:** | SP702334HE-500mAh |
| **Battery Type:** | Lithium-ion Polymer Rechargeable Battery |
| **Rated Voltage:** | 3.7 Vdc |
| **Limited Charge Voltage:** | 4.2 Vdc |
| **Rated Capacity:** | 500 mAh |

| **Battery (Headphones)** | |
|---|---|
| **Model No.:** | SP601115HE-60mAh |
| **Battery Type:** | Lithium-ion Polymer Rechargeable Battery |
| **Rated Voltage:** | 3.7 Vdc |
| **Limited Charge Voltage:** | 4.2 Vdc |
| **Rated Capacity:** | 60 mAh |

| **Charging cable** | |
|---|---|
| **Description:** | USB Micro-B Plug Cable |
| **Cable Type:** | Unshielded without ferrite |
| **Length:** | 0.5 Meter |

## 1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

| | | |
|---|---|---|
| **Frequency Band:** | 2400 MHz to 2483.5 MHz | |
| **Frequency Range:** | 2402 MHz to 2480 MHz | |
| **Bluetooth Version:** | Bluetooth BR + EDR | |
| **Modulation Technique:** | Frequency Hopping Spread Spectrum(FHSS) | |
| **Type of Modulation:** | GFSK, π/4DQPSK, 8DPSK | |
| **Number of Channels:** | 79 | |
| **Channel Separation:** | 1 MHz | |
| **Hopping Channel Type:** | Adaptive Frequency Hopping Systems | |
| **Antenna Type:** | LDS Antenna | |
| **Antenna Gain:** | Right Ear | -0.64 dBi |
| | Left Ear | -0.58 dBi |
| **Maximum Peak Power:** | Right Ear | 7.15 dBm |
| | Left Ear | 6.86 dBm |
| **Normal Test Voltage:** | 3.7 V Battery | |

## 1.4 OTHER INFORMATION

| **Operation Frequency Each of Channel** |
|---|
| **f = 2402 + k MHz, k = 0,…,78** |
| Note:<br>**f** is the operating frequency (MHz);<br>**k** is the operating channel. |

| **Modulation Configure** | | | |
|---|---|---|---|
| **Modulation** | **Packet** | **Packet Type** | **Packet Size** |
| GFSK | 1-DH1 | 4 | 27 |
| | 1-DH3 | 11 | 183 |
| | 1-DH5 | 15 | 339 |
| π/4 DQPSK | 2-DH1 | 20 | 54 |
| | 2-DH3 | 26 | 367 |
| | 2-DH5 | 30 | 679 |
| 8DPSK | 3-DH1 | 24 | 83 |
| | 3-DH3 | 27 | 552 |
| | 3-DH5 | 31 | 1021 |

## 1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

| Description | Manufacturer | Model No. | Serial Number | Supplied by |
|---|---|---|---|---|
| Notebook | Lenovo | E450 | SL10G10780 | UnionTrust |

## 1.6 TEST LOCATION

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

## 1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

**CNAS-Lab Code: L9069**
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

**IC-Registration No.: 21600-1**
The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

**A2LA-Lab Certificate No.: 4312.01**
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

**FCC Accredited Lab.**
Designation Number: CN1194
Test Firm Registration Number: 259480

## 1.8 DEVIATION FROM STANDARDS

None.

## 1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

## 1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

## 1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Conducted emission 9KHz-150KHz | ±3.8 dB |
| 2 | Conducted emission 150KHz-30MHz | ±3.4 dB |
| 3 | Radiated emission 9KHz-30MHz | ±4.9 dB |
| 4 | Radiated emission 30MHz-1GHz | ±4.7 dB |
| 5 | Radiated emission 1GHz-18GHz | ±5.1 dB |
| 6 | Radiated emission 18GHz-26GHz | ±5.2 dB |
| 7 | Radiated emission 26GHz-40GHz | ±5.2 dB |
| 8 | Radio frequency | $\pm 6.3 \times 10^{-8}$ |
| 9 | Occupied Channel Bandwidth | ±2.3 % |
| 10 | RF output power, conducted | ±0.52 dB |
| 11 | Spurious emissions ,conducted | ±1.48 dB |

## 2. TEST SUMMARY

| FCC 47 CFR Part 15 Subpart C Test Cases | | | |
|---|---|---|---|
| **Test Item** | **Test Requirement** | **Test Method** | **Result** |
| **Antenna Requirement** | FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c)<br>RSS-Gen Issue 5, Section 6.8 | N/A | PASS |
| **AC Power Line Conducted Emission** | FCC 47 CFR Part 15 Subpart C Section 15.207<br>RSS-Gen Issue 5, Section 8.8 | ANSI C63.10-2013 Section 6.2 | N/A<br>(See note 1, 2) |
| **Conducted Peak Output Power** | FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(1)<br>RSS-247 Issue 2, Section 5.4(b) | ANSI C63.10-2013 Section 7.8.5 | PASS |
| **20 dB Bandwidth** | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)<br>RSS-247 Issue 2, Section 5.1(a) | ANSI C63.10-2013 Section 6.9.2 | PASS |
| **Occupied Bandwidth** | RSS-Gen section 6.7 | RSS-Gen section 6.7 | PASS |
| **Carrier Frequencies Separation** | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)<br>RSS-247 Issue 2, Section 5.1(b) | ANSI C63.10-2013 Section 7.8.2 | PASS |
| **Number of Hopping Channel** | FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(1)<br>RSS-247 Issue 2, Section 5.1(d) | ANSI C63.10-2013 Section 7.8.3 | PASS |
| **Dwell Time** | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)<br>RSS-247 Issue 2, Section 5.1(d) | ANSI C63.10-2013 Section 7.8.4 | PASS |
| **Conducted Out of Band Emission** | FCC 47 CFR Part 15 Subpart C Section 15.247(d)<br>RSS-247 Issue 2, Section 5.5 | ANSI C63.10-2013 Section 6.10.4 & Section 7.8.8 | PASS |
| **Radiated Emissions** | FCC 47 CFR Part 15 Subpart C Section 15.205/15.209<br>RSS-Gen Issue 5, Section 6.13/8.9/8.10 | ANSI C63.10-2013 Section 6.3 & 6.5 & 6.6 | PASS |
| **Band Edge Measurement** | FCC 47 CFR Part 15 Subpart C Section 15.205/15.209<br>RSS-247 Issue 2, Section 5.5 | ANSI C63.10-2013 Section 6.10.5 | PASS |

**Note:**

1) N/A: In this whole report not application.
2) Place headphones into the charging case, they will turn off automatically, and the bluetooth does not work.

# 3. EQUIPMENT LIST

| Radiated Emission Test Equipment List | | | | | | |
|---|---|---|---|---|---|---|
| **Used** | **Equipment** | **Manufacturer** | **Model No.** | **Serial Number** | **Cal. date (mm dd, yyyy)** | **Cal. Due date (mm dd, yyyy)** |
| ☑ | 3M Chamber & Accessory Equipment | ETS-LINDGREN | 3M | N/A | Dec. 20, 2015 | Dec. 19, 2018 |
| ☑ | Receiver | R&S | ESIB26 | 100114 | Dec. 10, 2017 | Dec. 10, 2018 |
| ☑ | Loop Antenna | ETS-LINDGREN | 6502 | 00202525 | Dec. 22, 2017 | Dec. 22, 2018 |
| ☑ | Broadband Antenna | ETS-LINDGREN | 3142E | 00201566 | Dec. 17, 2017 | Dec. 17, 2018 |
| ☑ | Preamplifier | HP | 8447F | 2805A02960 | Dec. 10, 2017 | Dec. 10, 2018 |
| ☑ | Horn Antenna (Pre-amplifier) | ETS-LINDGREN | 3117-PA | 00201874 | May 22, 2018 | May 22, 2019 |
| ☑ | Horn Antenna (Pre-amplifier) | ETS-LINDGREN | 3116C-PA | 00202652 | Dec. 17, 2017 | Dec. 17, 2018 |
| ☑ | Multi device Controller | ETS-LINDGREN | 7006-001 | 00160105 | N/A | N/A |
| ☑ | Band Rejection Filter (2400MHz~2500MHz) | Micro-Tronics | BRM50702 | G248 | June 06, 2018 | June 06, 2019 |
| ☑ | Test Software | Audix | e3 | Software Version: 9.160323 | | |

| Conducted RF test Equipment List | | | | | | |
|---|---|---|---|---|---|---|
| **Used** | **Equipment** | **Manufacturer** | **Model No.** | **Serial Number** | **Cal. date (mm dd, yyyy)** | **Cal. Due date (mm dd, yyyy)** |
| ☑ | EXA Spectrum Analyzer | KEYSIGHT | N9010A | MY51440197 | Dec.10, 2017 | Dec. 10, 2018 |
| ☑ | USB Wideband Power Sensor | KEYSIGHT | U2021XA | MY55430035 | Dec. 10, 2017 | Dec. 10, 2018 |

# 4. TEST CONFIGURATION

## 4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

### 4.1.1 Normal or Extreme Test Conditions

| Environment Parameter | Selected Values During Tests | | |
|---|---|---|---|
| Test Condition | Ambient | | |
| | Temperature (°C) | Voltage | Relative Humidity (%) |
| NT/NV | +15 to +35 | 3.7V Battery | 20 to 75 |
| **Remark:**<br>1) NV: Normal Voltage; NT: Normal Temperature | | | |

### 4.1.2 Record of Normal Environment

| Test Item | Temperature (°C) | Relative Humidity (%) | Pressure (kPa) | Tested by |
|---|---|---|---|---|
| Conducted Peak Output Power | 24.5 | 52 | 99.98 | Tony Kang |
| 20 dB Bandwidth & Occupied Bandwidth | | | | |
| Carrier Frequencies Separation | | | | |
| Number of Hopping Channel | | | | |
| Dwell Time | | | | |
| Conducted Out of Band Emission | | | | |
| Radiated Emissions | 25.8 | 55 | 99.8 | Andy Lin |
| Band Edge Measurement | | | | |

## 4.2 TEST CHANNELS

| Mode | Tx/Rx Frequency | Test RF Channel Lists | | |
|---|---|---|---|---|
| | | Lowest(L) | Middle(M) | Highest(H) |
| GFSK (DH1, DH3, DH5) | 2402 MHz to 2480 MHz | Channel 0 | Channel 39 | Channel 78 |
| | | 2402 MHz | 2441 MHz | 2480 MHz |
| π/4DQPSK (DH1, DH3, DH5) | 2402 MHz to 2480 MHz | Channel 0 | Channel 39 | Channel 78 |
| | | 2402 MHz | 2441 MHz | 2480 MHz |
| 8DPSK (DH1, DH3, DH5) | 2402 MHz to 2480 MHz | Channel 0 | Channel 39 | Channel 78 |
| | | 2402 MHz | 2441 MHz | 2480 MHz |

## 4.3 EUT TEST STATUS

| Type of Modulation | Tx Function | Description |
|---|---|---|
| GFSK/π/4DQPSK/ 8DPSK | 1Tx | 1. Keep the EUT in continuously transmitting with Modulation test single<br>2. Keep the EUT in continuously transmitting with Modulation test Hopping Frequency. |

| Power Setting | |
|---|---|
| Right Ear | 250 |
| Left Ear | 250 |

| Test Software |
|---|
| InstallBlueSuiteCda_3_1_4_758 (BlueTest 3) |

## 4.4 PRE-SCAN

### 4.4.1 Pre-scan under all packets at middle channel

**Left Ear**

| Conducted Average Power (dBm) for packets | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Type of Modulation** | **GFSK** | | | **π/4DQPSK** | | | **8DPSK** | | |
| Packets | 1-DH1 | 1-DH3 | 1-DH5 | 2-DH1 | 2-DH3 | 2-DH5 | 3-DH1 | 3-DH3 | 3-DH5 |
| Power (dBm) | 1.19 | 4.51 | **5.15** | 1.14 | 4.41 | **5.10** | 1.19 | 4.43 | **5.12** |

**Right Ear**

| Conducted Average Power (dBm) for packets | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Type of Modulation** | **GFSK** | | | **π/4DQPSK** | | | **8DPSK** | | |
| Packets | 1-DH1 | 1-DH3 | 1-DH5 | 2-DH1 | 2-DH3 | 2-DH5 | 3-DH1 | 3-DH3 | 3-DH5 |
| Power (dBm) | -1.51 | 1.72 | **2.52** | -1.44 | 1.65 | **2.46** | -1.43 | 1.65 | **2.39** |

### 4.4.2 Worst-case data packets

| Type of Modulation | Worst-case data rates |
|---|---|
| **GFSK** | 1-DH5 |
| **π/4DQPSK** | 2-DH5 |
| **8DPSK** | 3-DH5 |

### 4.4.3 Tested channel detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data packets and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

| **Type of Modulation** | **GFSK** | | | **π/4DQPSK** | | | **8DPSK** | | |
|---|---|---|---|---|---|---|---|---|---|
| Data Packets | 1-DH1 | 1-DH3 | 1-DH5 | 2-DH1 | 2-DH3 | 2-DH5 | 3-DH1 | 3-DH3 | 3-DH5 |
| Available Channel | 0 to 78 | | | | | | | | |
| **Test Item** | **Test channel and choose of data packets** | | | | | | | | |
| AC Power Line Conducted Emission | Frequency Hopping Channel 0 to 78 | | | | | | | | |
| | Link | | | | | | | | |
| Conducted Peak Output Power | Channel 0 & 39 & 78 | | | | | | | | |
| | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ |
| 20 dB Bandwidth | Channel 0 & 39 & 78 | | | | | | | | |
| | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ |
| Carrier Frequencies Separation | Frequency Hopping Channel 0 to 78 | | | | | | | | |
| | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ |
| Number of Hopping Channel | Frequency Hopping Channel 0 to 78 | | | | | | | | |
| | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ |
| Dwell Time | Channel 39 | | | | | | | | |
| | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ |
| Conducted Out of Band Emission | Channel 0 & 39 & 78 | | | | | | | | |
| | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ |
| Radiated Emissions _Left Ear | Channel 0 & 39 & 78 | | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ | ☐ |
| Band Edge Measurements (Radiated) _Left Ear | Channel 0 & 78 | | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ | ☐ |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Radiated Emissions _ Right Ear | Channel 0 & 39 & 78 | | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☑ |
| Band Edge Measurements (Radiated) _ Right Ear | Channel 0 & 78 | | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☑ |

Remark:
1. The mark "☑" means is chosen for testing;
2. The mark "☐" means is not chosen for testing.

## 4.5 TEST SETUP

### 4.5.1 For Radiated Emissions test setup

**Figure 1. Below 30MHz**

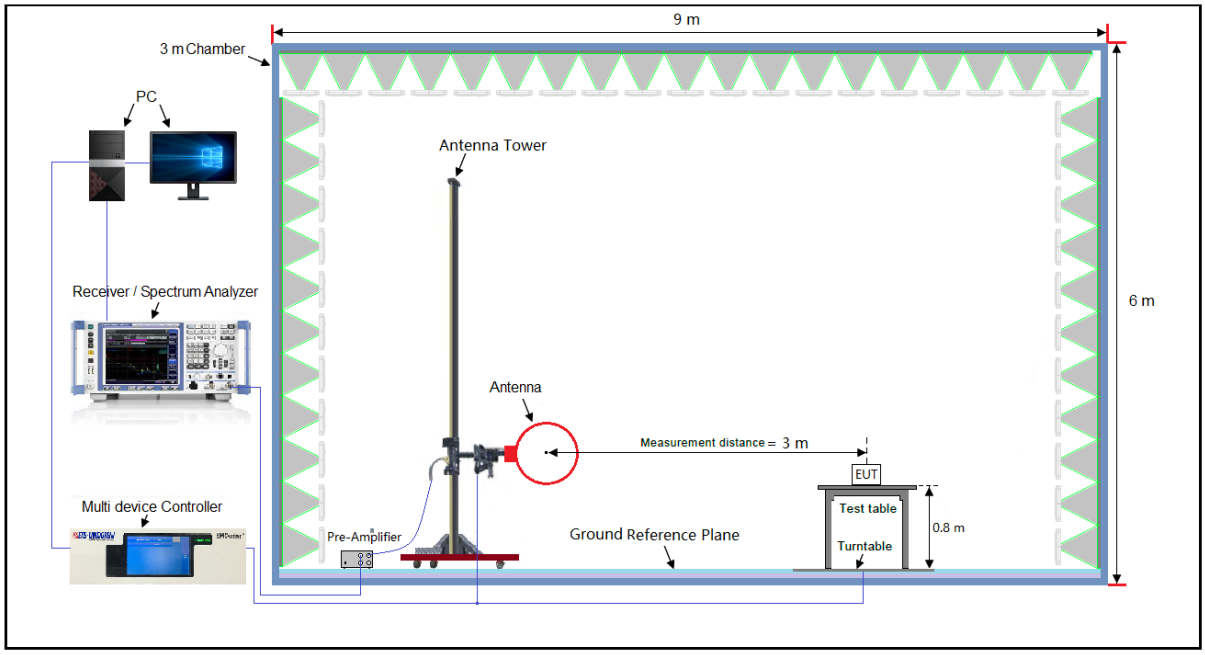



**Figure 2. 30MHz to 1GHz**

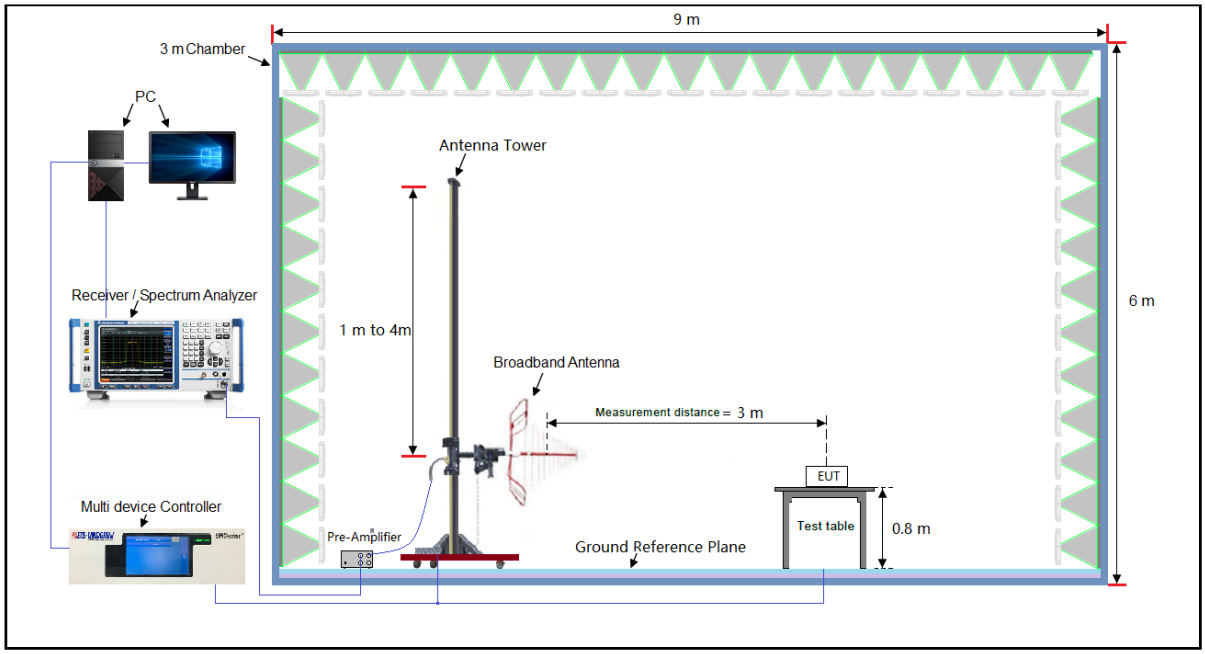
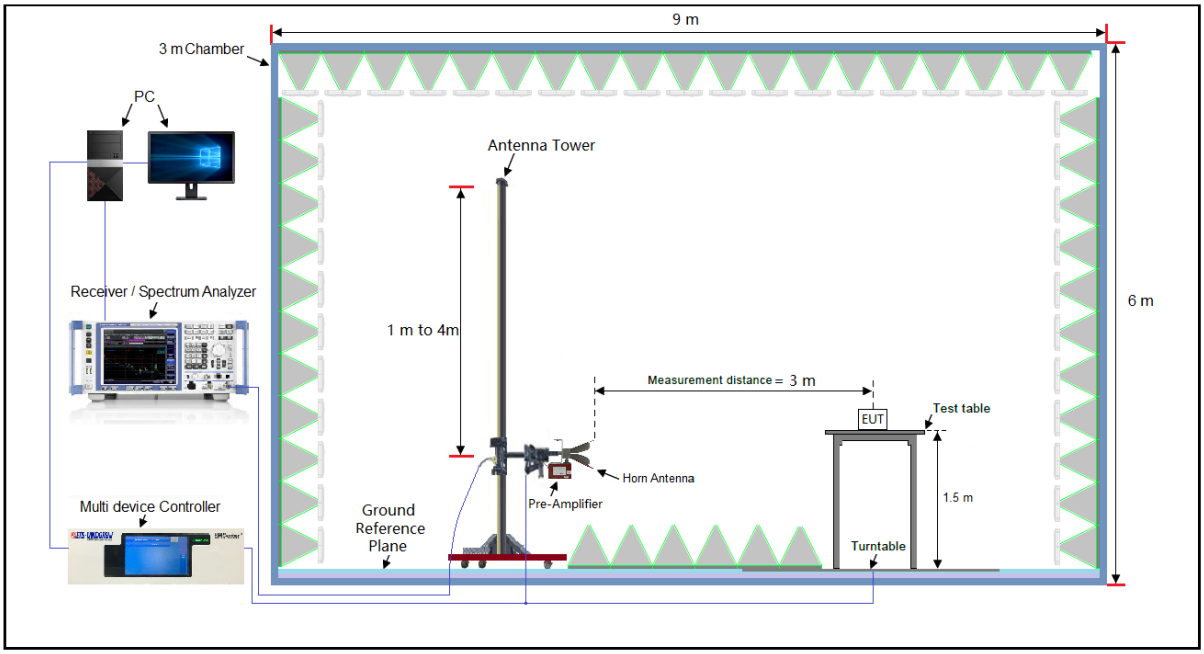
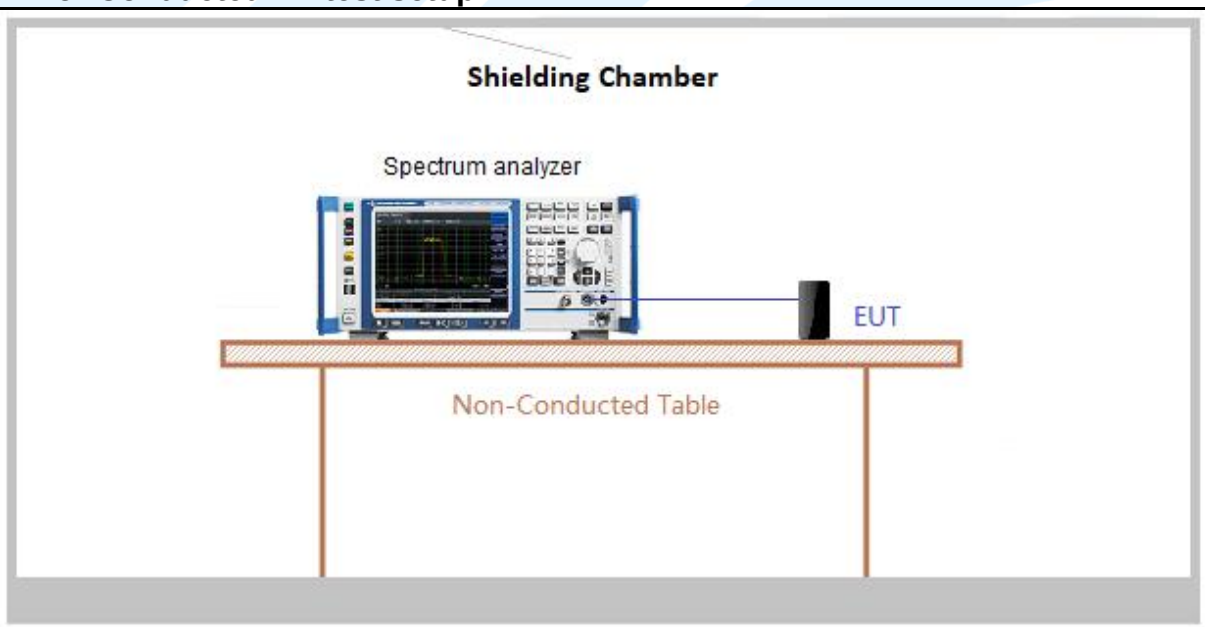


**Figure 3. Above 1GHz**




### 4.5.2 For Conducted RF test setup



## 4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.7 V Battery. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

| Frequency | Mode | Antenna Port | Worst-case axis positioning |
|---|---|---|---|
| Above 1GHz | 1TX | Chain 0 | X axis |

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

## 4.7 DUTY CYCLE

**Test Procedure:** ANSI C63.10-2013 Clause 11.6.

**Test Results**

**Left Ear**

| Type of Modulation | Packets | On Time (msec) | Period (msec) | Duty Cycle (linear) | Duty Cycle (%) | Duty Cycle Factor (dB) | 1/ T Minimum VBW (kHz) | Average Factor (dB) |
|---|---|---|---|---|---|---|---|---|
| GFSK | 1-DH5 | 0.860 | 2.891 | 0.30 | 29.73 | 5.27 | 1.16 | -10.54 |

**Right Ear**

| Type of Modulation | Packets | On Time (msec) | Period (msec) | Duty Cycle (linear) | Duty Cycle (%) | Duty Cycle Factor (dB) | 1/ T Minimum VBW (kHz) | Average Factor (dB) |
|---|---|---|---|---|---|---|---|---|
| GFSK | 1-DH5 | 0.859 | 2.894 | 0.30 | 29.66 | 5.28 | 1.16 | -10.56 |

**Remark:**

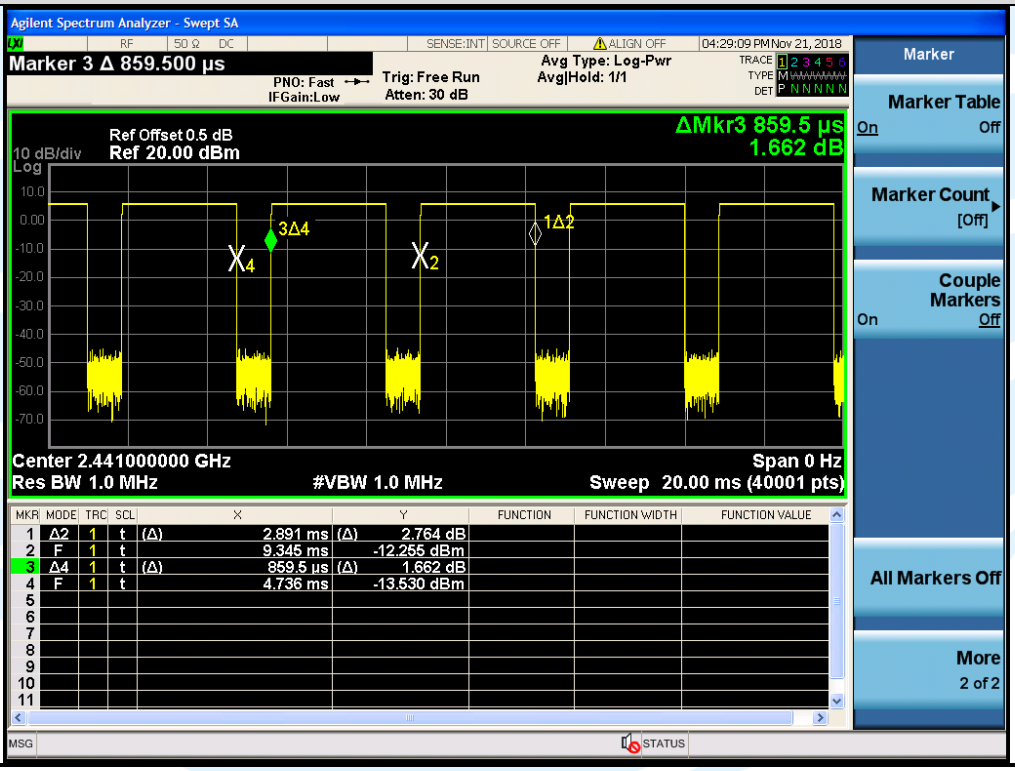
1) Duty cycle= On Time/ Period;

2) Duty Cycle factor = 10 * log(1/ Duty cycle);

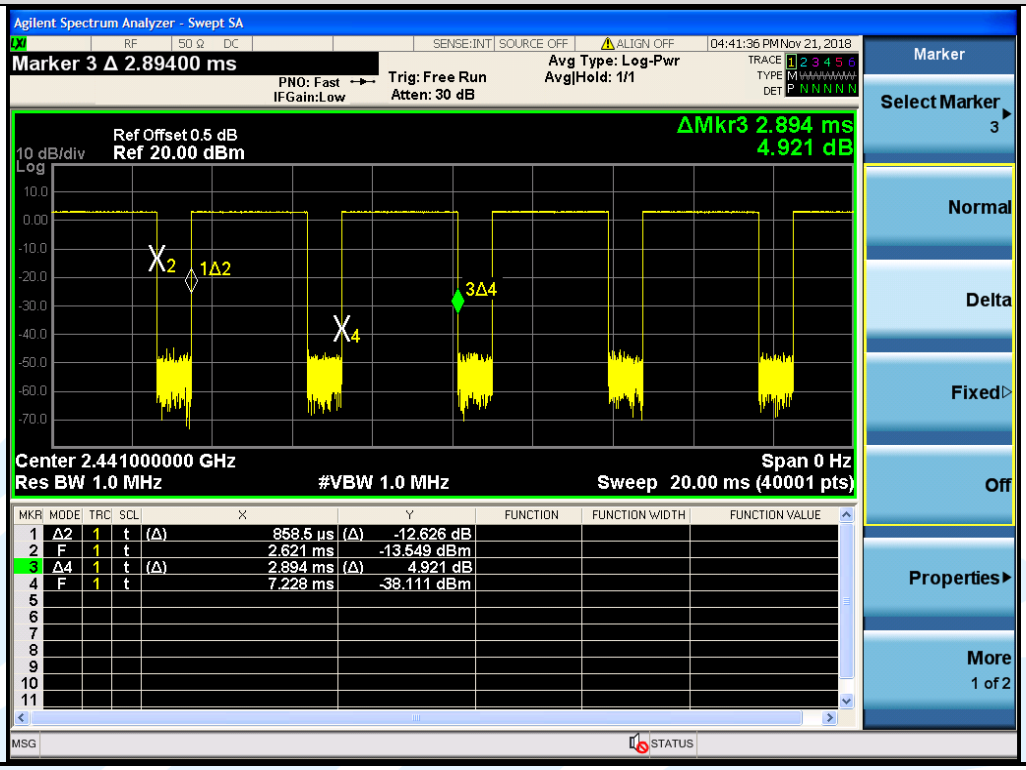
3) Average factor = 20 $\log_{10}$ Duty Cycle.

**The test plot as follows**

**GFSK_ 1-DH5_Left Ear**



| GFSK_ 1-DH5_Right Ear |
|---|



# 5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

## 5.1 REFERENCE DOCUMENTS FOR TESTING

| No. | Identity | Document Title |
|---|---|---|
| 1 | FCC 47 CFR Part 2 | Frequency allocations and radio treaty matters; general rules and regulations |
| 2 | FCC 47 CFR Part 15 | Radio Frequency Devices |
| 3 | RSS-247 Issue 2 | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices |
| 4 | RSS-Gen Issue 5 | General Requirements for Compliance of Radio Apparatus |
| 5 | ANSI C63.10-2013 | American National Standard for Testing Unlicesed Wireless Devices |

## 5.2 ANTENNA REQUIREMENT

| Standard Requirement |
|---|
| **15.203 requirement:**<br>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, 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.<br>**15.247(b) (4) requirement:**<br>The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.<br>**RSS-Gen Issue 5, Section 6.8 requirement:**<br>According to RSS-Gen Issue 5, section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. |
| **EUT Antenna:** |
| Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is -0.58 dBi. |

## 5.3 CONDUCTED PEAK OUTPUT POWER

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section15.247 (b)(1)
RSS-247 Issue 2, Section 5.4(b)

**Test Method:** ANSI C63.10-2013 Section 7.8.5

**Limit:** 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).
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:** Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

a) Use the following spectrum analyzer settings:
1) Span: Approximately 5 x 20 dB bandwidth, centered on a hopping channel.
2) RBW > 20 dB bandwidth of the emission being measured.
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.

b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
e) A plot of the test results and setup description shall be included in the test report.

**Test Setup:** Refer to section 4.5.3 for details.

**Instruments Used:** Refer to section 3 for details

**Test Results:** Pass

**Left Ear**

| Type of Modulation | Peak Output Power (dBm) | | | Peak Output Power (mW) | | |
|---|---|---|---|---|---|---|
| | Channel 0 | Channel 39 | Channel 78 | Channel 0 | Channel 39 | Channel 78 |
| GFSK | 6.14 | 5.75 | 6.61 | 4.11 | 3.76 | 4.58 |
| π/4 DQPSK | 5.93 | 5.75 | **6.86** | 3.92 | 3.76 | **4.85** |
| 8DPSK | 6.19 | 5.74 | 6.69 | 4.16 | 3.75 | 4.66 |

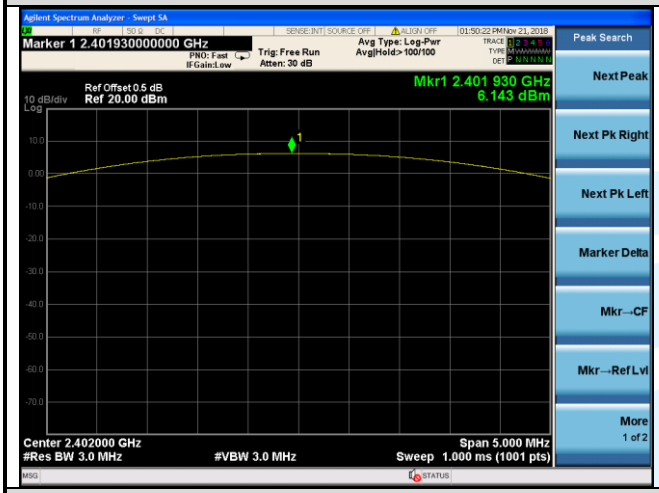
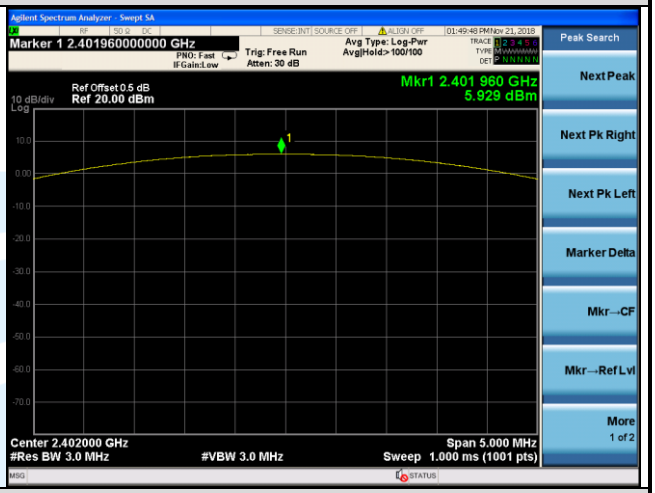
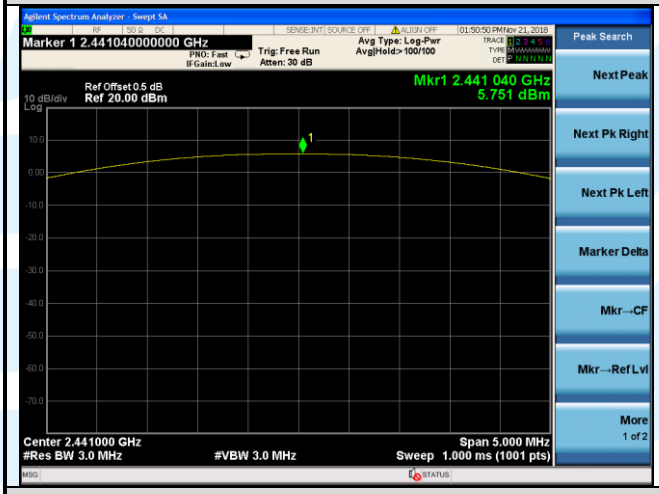
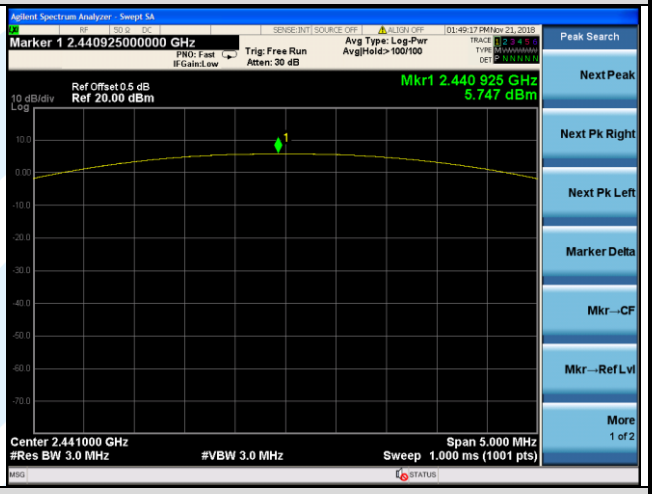
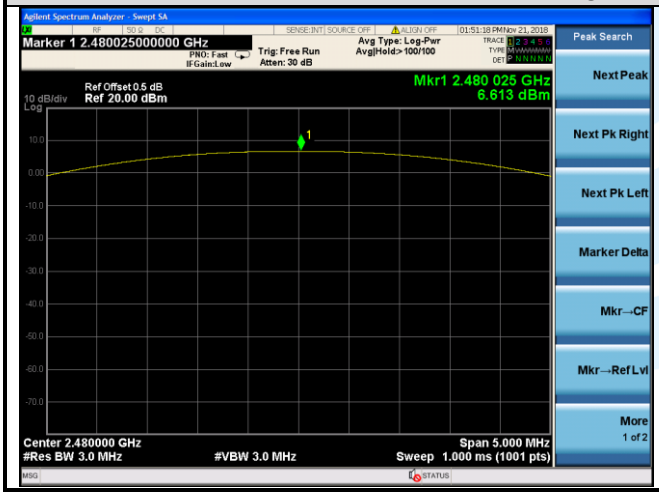
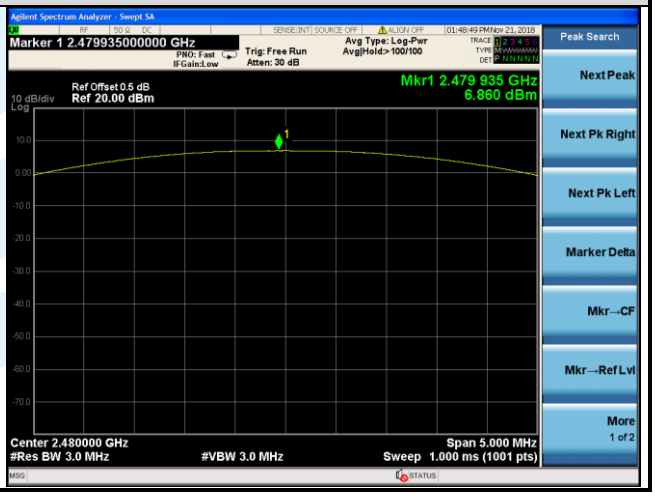
**Right Ear**

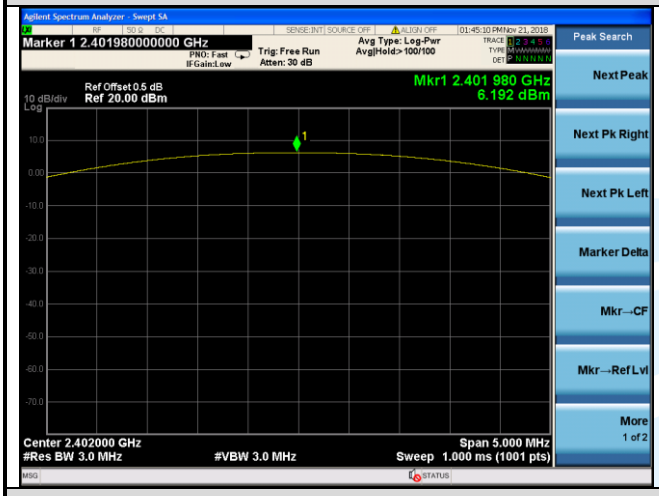
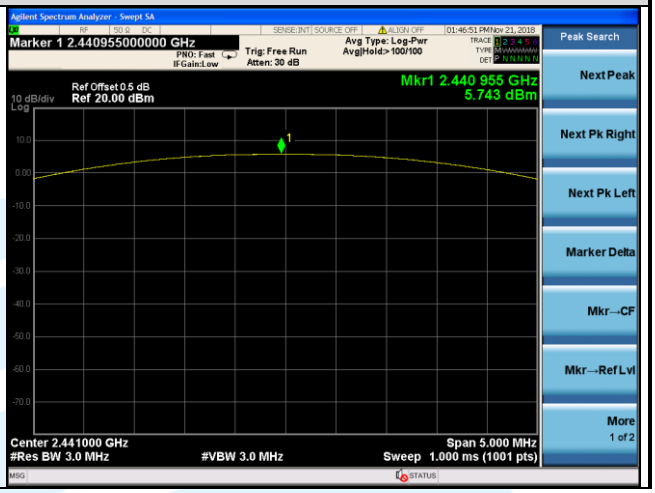
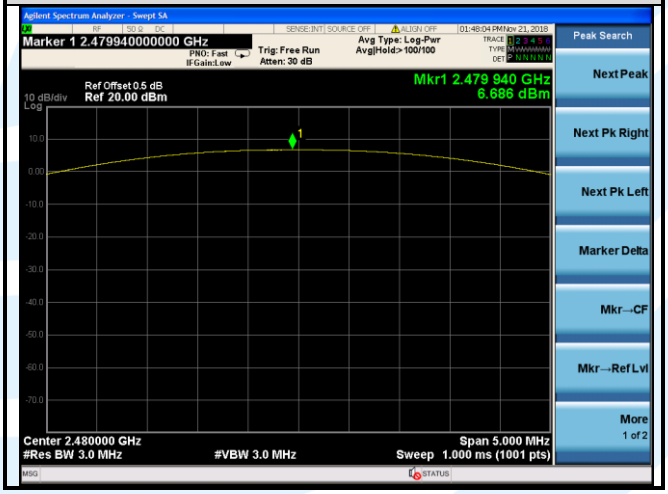
| Type of Modulation | Peak Output Power (dBm) | | | Peak Output Power (mW) | | |
|---|---|---|---|---|---|---|
| | Channel 0 | Channel 39 | Channel 78 | Channel 0 | Channel 39 | Channel 78 |
| GFSK | 3.50 | 3.15 | 4.12 | 2.24 | 2.07 | 2.58 |
| π/4 DQPSK | 6.06 | 5.41 | 6.15 | 4.04 | 3.47 | 4.12 |
| 8DPSK | **7.15** | 5.98 | 6.51 | **5.19** | 3.96 | 4.48 |

Note: The antenna gain of -0.58 dBi less than 6dBi maximum permission antenna gain value based on 125 mW peak output power limit.

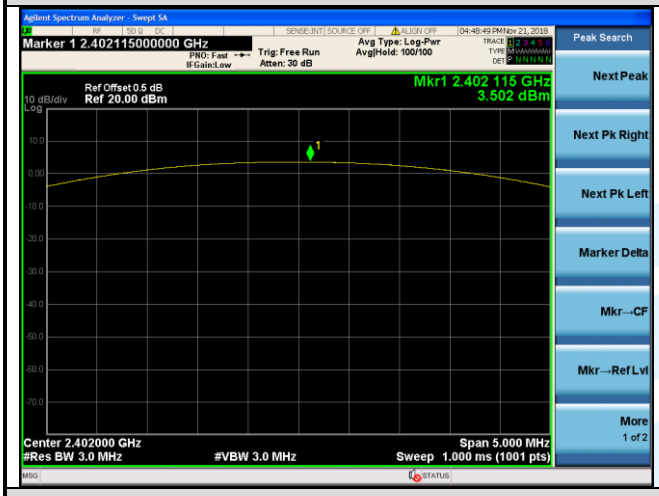
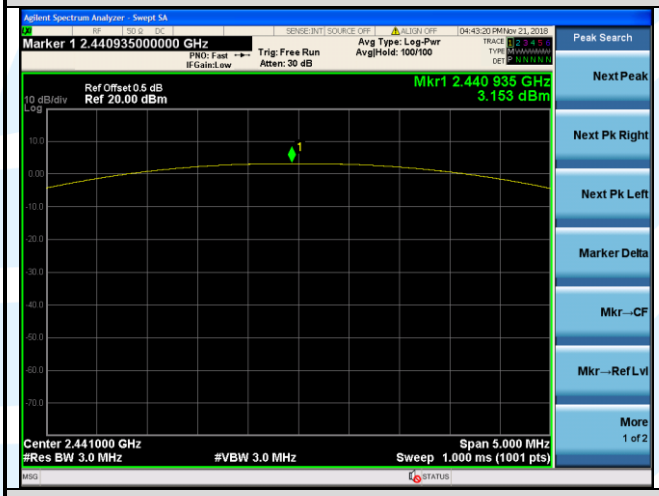
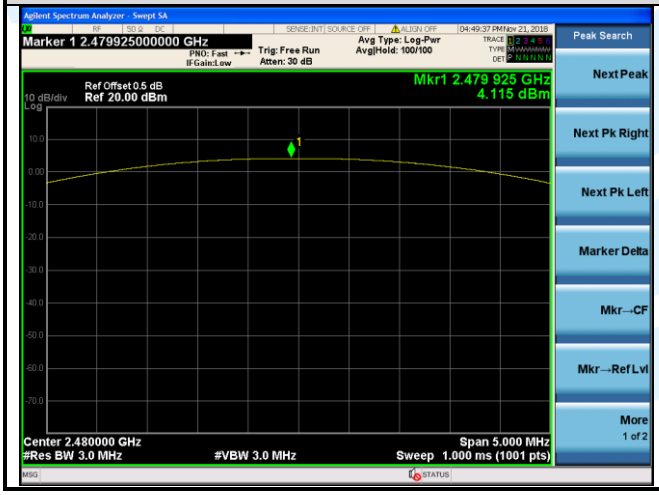
**The test plots as follows:**

**Left Ear**

| GFSK | π/4 DQPSK |
|---|---|
| **Lowest Channel** | |
|  |  |
| **Middle Channel** | |
|  |  |
| **Highest Channel** | |
|  |  |

| 8DPSK | |
|---|---|
| **Lowest Channel** | **Middle Channel** |
|  |  |
| **Highest Channel** | |
|  | |

**Right Ear**

| GFSK | π/4 DQPSK |
|---|---|
| **Lowest Channel** | |
|  | |
| **Middle Channel** | |
|  | |
| **Highest Channel** | |
|  | |

| 8DPSK | |
|---|---|
| **Lowest Channel** | **Middle Channel** |
| | |
| **Highest Channel** | |
| | |

# 5.4 20 DB BANDWIDTH & OCCUPIED BANDWIDTH

| | |
|---|---|
| **Test Requirement:** | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)<br>RSS-247 Issue 2, Section 5.1(a)<br>RSS-Gen section 6.7 |
| **Test Method:** | ANSI C63.10-2013 Section 6.9.2<br>RSS-Gen section 6.7 |
| **Limit:** | None; for reporting purposes only. |
| **Test Procedure:** | Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.<br>Use the following spectrum analyzer settings:<br><br>a) Span = approximately 2 to 5 times the OBW, centered on a hopping channel.<br>b) RBW = 1% to 5% of the OBW.<br>c) VBW ≥ 3 x RBW<br>d) Sweep = auto;<br>e) Detector function = peak<br>f) Trace = max hold<br>g) All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down bandwidth of the emission.<br><br>Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset. |
| **Test Setup:** | Refer to section 4.5.3 for details. |
| **Instruments Used:** | Refer to section 3 for details |
| **Test Results:** | Pass |

**Left Ear**

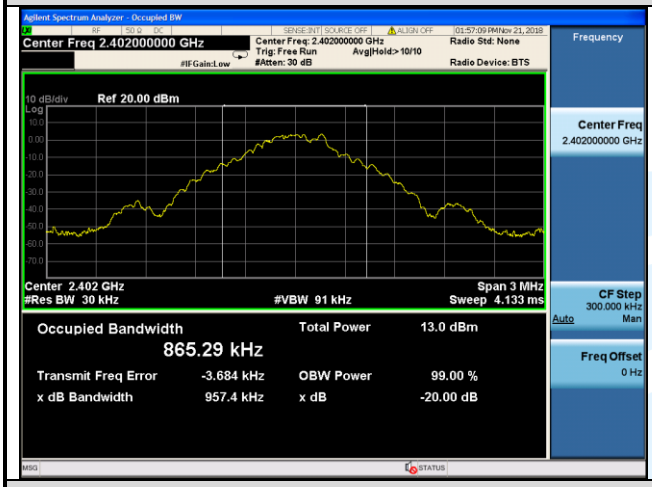
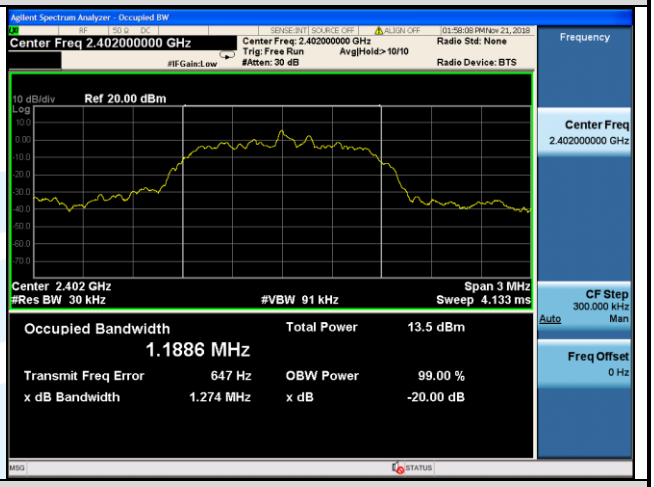
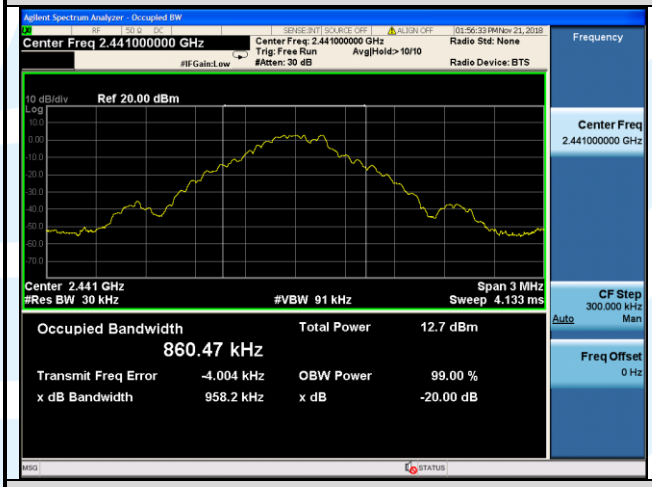
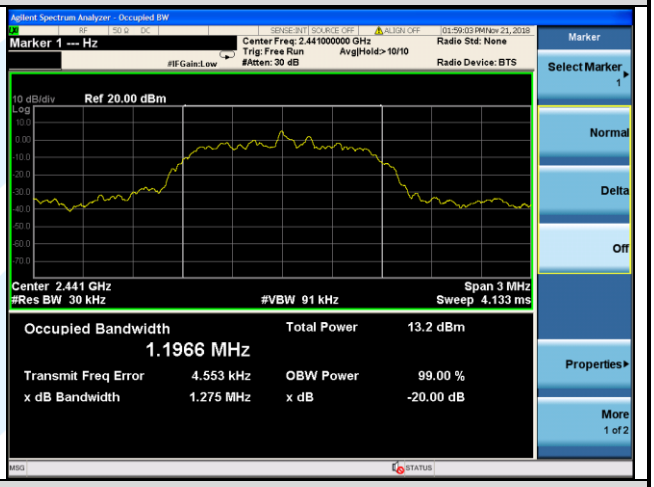
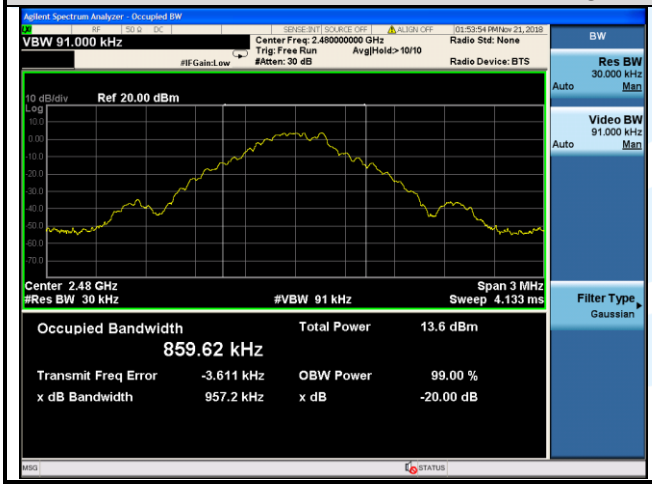
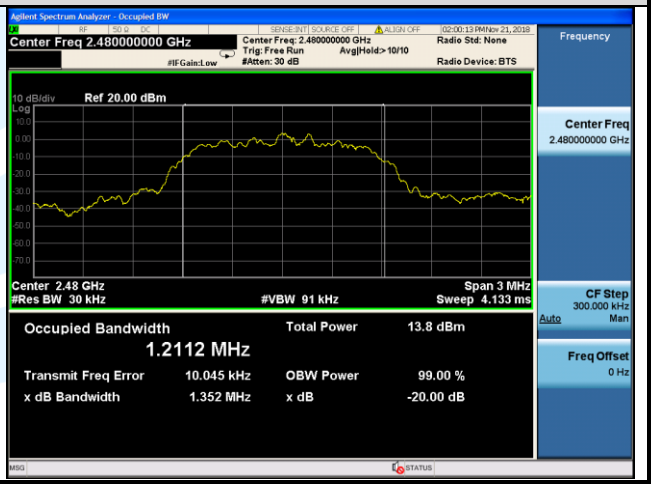
| Type of Modulation | 20 dB Bandwidth (MHz) | | | Occupied Bandwidth (MHz) | | |
|---|---|---|---|---|---|---|
| | Channel 0 | Channel 39 | Channel 78 | Channel 0 | Channel 39 | Channel 78 |
| GFSK | 0.957 | 0.958 | 0.957 | 0.8653 | 0.8605 | 0.8596 |
| π/4 DQPSK | 1.274 | 1.275 | 1.352 | 1.1886 | 1.1966 | 1.2112 |
| 8DPSK | 1.307 | 1.307 | 1.310 | 1.1910 | 1.1903 | 1.1899 |

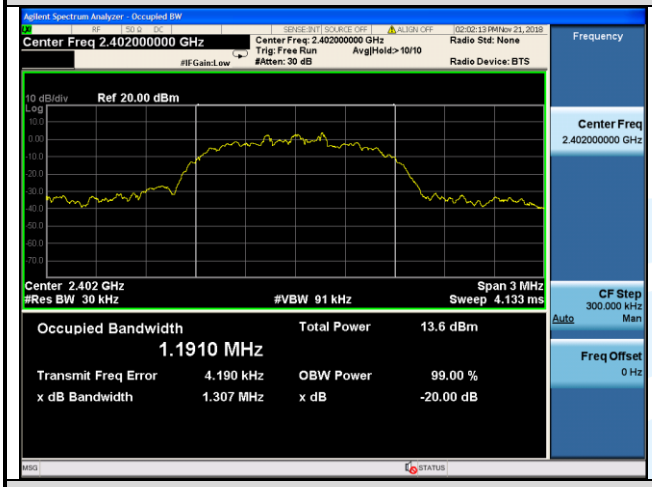
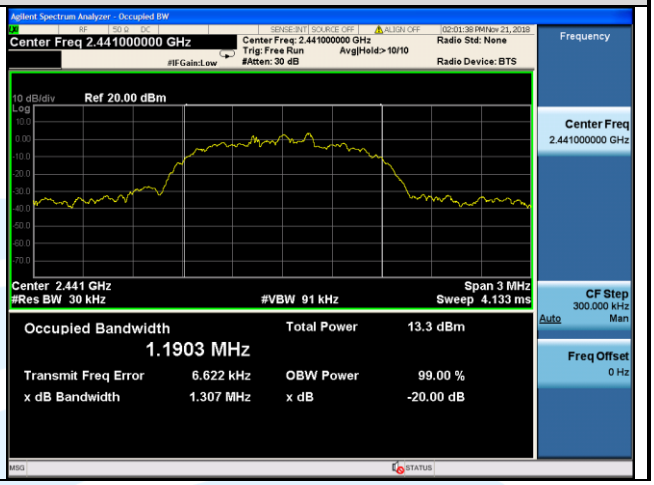
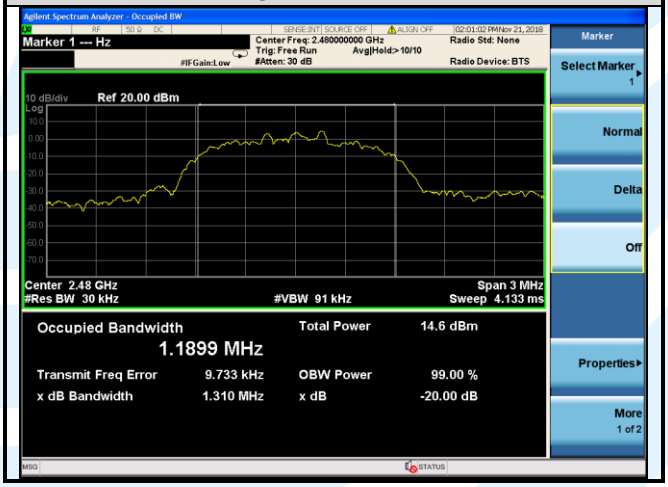
**Right Ear**

| Type of Modulation | 20 dB Bandwidth (MHz) | | | Occupied Bandwidth (MHz) | | |
|---|---|---|---|---|---|---|
| | Channel 0 | Channel 39 | Channel 78 | Channel 0 | Channel 39 | Channel 78 |
| GFSK | 0.959 | 0.959 | 0.957 | 0.8707 | 0.8712 | 0.8685 |
| π/4 DQPSK | 1.335 | 1.335 | 1.338 | 1.1967 | 1.2056 | 1.2126 |
| 8DPSK | 1.268 | 1.313 | 1.318 | 1.1880 | 1.2050 | 1.2083 |

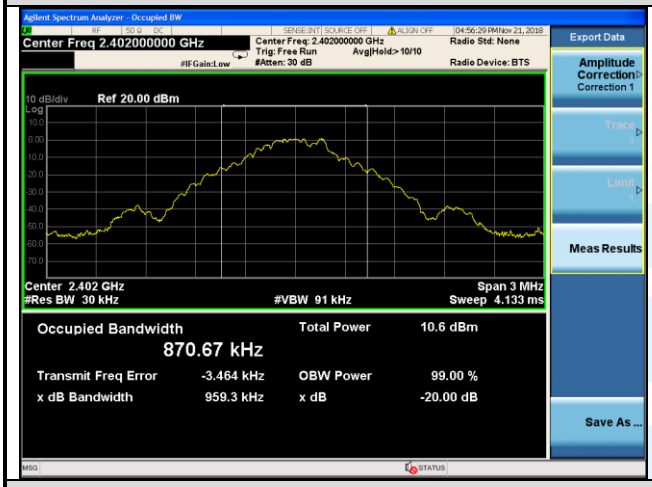
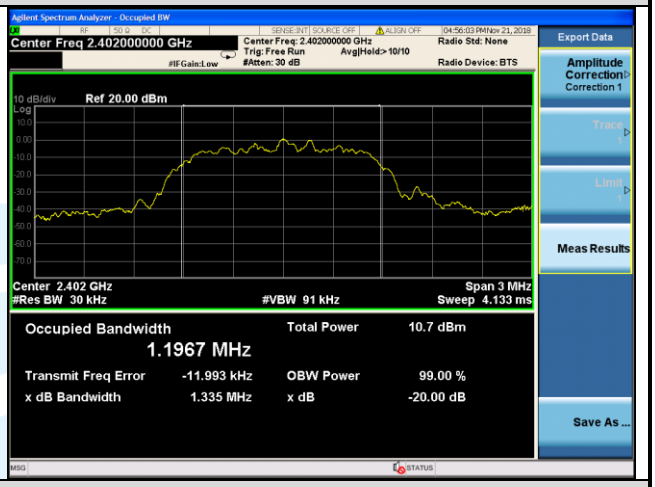
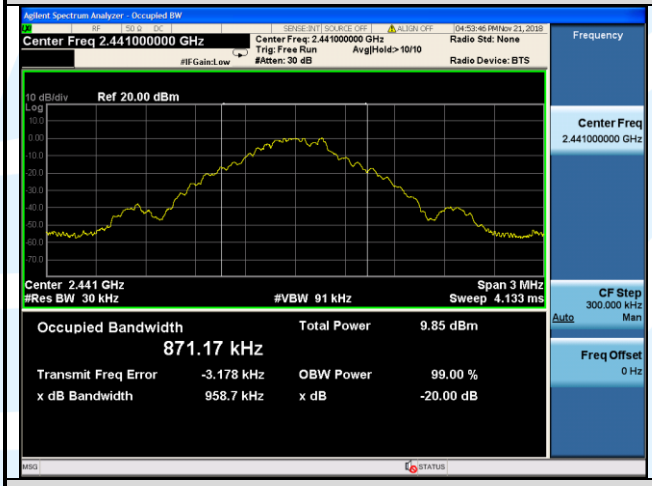
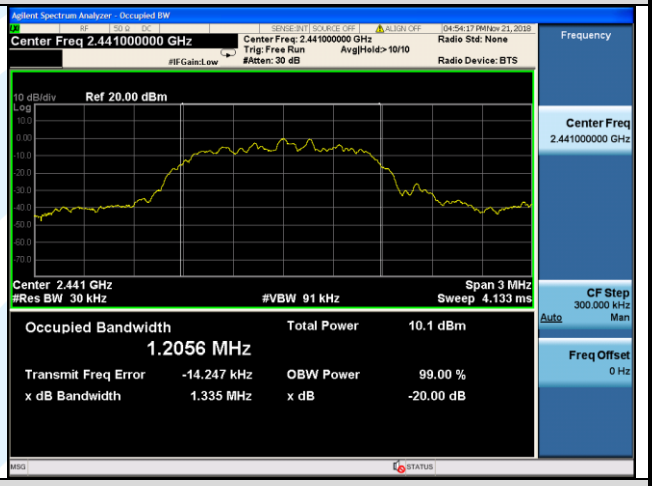
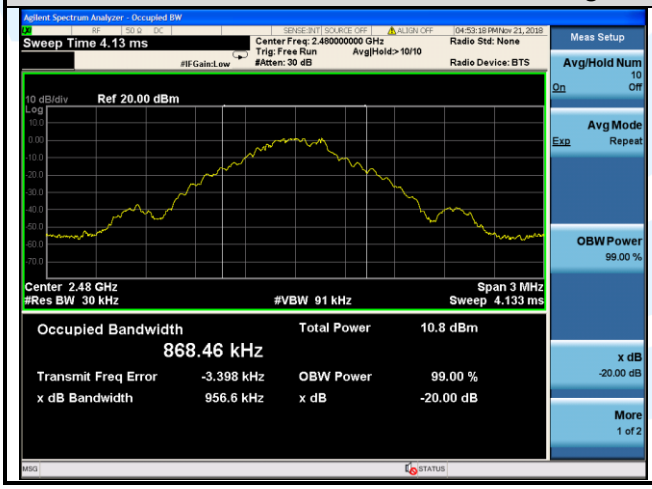
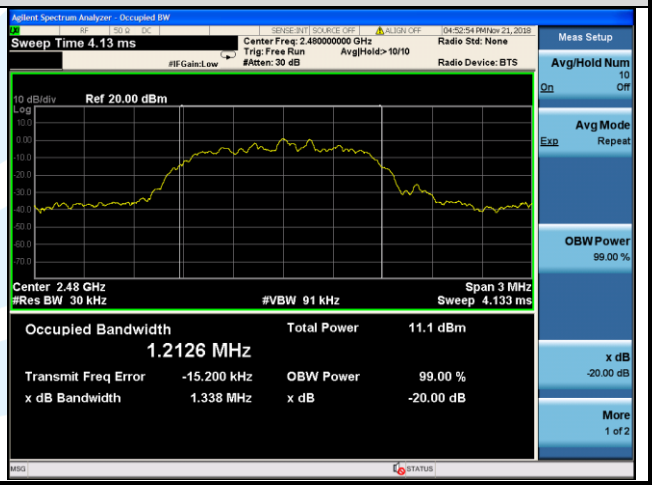
**The test plots as follows:**

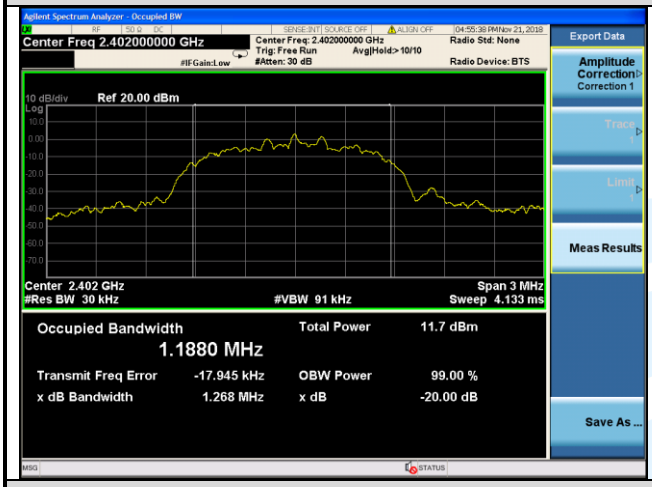
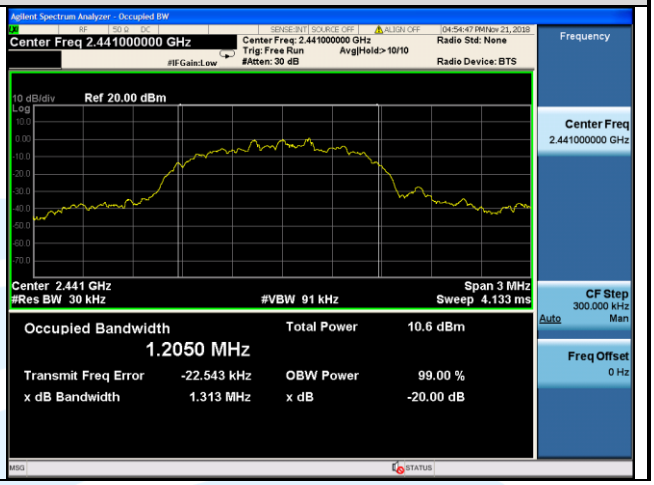
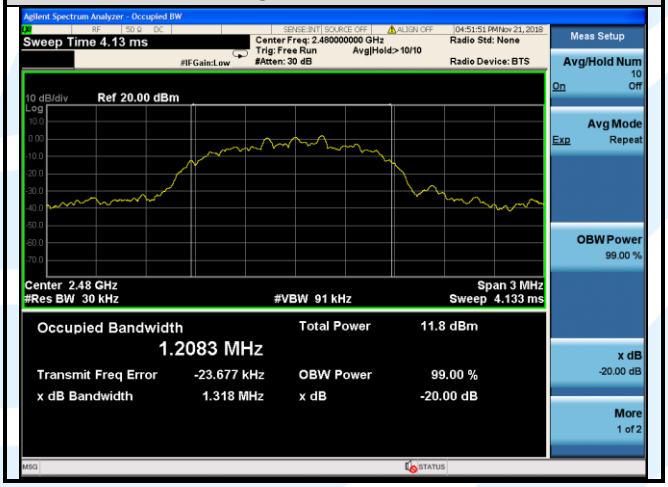
**Left Ear**

| GFSK | π/4 DQPSK |
|---|---|
| **Lowest Channel** | |
|  |  |
| **Middle Channel** | |
|  |  |
| **Highest Channel** | |
|  |  |

| 8DPSK | |
|---|---|
| **Lowest Channel** | **Middle Channel** |
|  |  |
| **Highest Channel** | |
|  | |

**Right Ear**

| GFSK | π/4 DQPSK |
|---|---|
| **Lowest Channel** | |
|  |  |
| **Middle Channel** | |
|  |  |
| **Highest Channel** | |
|  |  |

| 8DPSK | |
|---|---|
| **Lowest Channel** | **Middle Channel** |
|  |  |
| **Highest Channel** | |
|  | |