# FCC TEST REPORT

| | | |
|---|---|---|
| **Product** | : | Mobile Phone |
| **Trade mark** | : | MI |
| **Model/Type reference** | : | 2016102 |
| **Report Number** | : | 1610280464RFC-1 |
| **Date of Issue** | : | Dec. 13, 2016 |
| **FCC ID** | : | 2AFZZ-RT6102 |
| **Test Standards** | : | FCC 47 CFR Part 15 Subpart C |
| **Test result** | : | PASS |

Prepared for:

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**The Rainbow City of China Resources, NO.68, Qinghe Middle Street, Haidian District, Beijing, China**

Prepared by:

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Approved by: Billy Li — Technical Director

Date: Dec. 13, 2016

UnionTrust Laboratories UnionTrust * Certified *

# Version

| Version No. | Date | Description |
|---|---|---|
| V1.0 | Dec. 13, 2016 | Original |

# Content

# 1 General Information

## 1.1 Client Information

| | |
|---|---|
| Applicant: | Xiaomi Communications Co., Ltd. |
| Address of Applicant: | The Rainbow City of China Resources, NO.68, Qinghe Middle Street, Haidian District, Beijing, China |
| Manufacturer: | Xiaomi Communications Co., Ltd. |
| Address of Manufacturer: | The Rainbow City of China Resources, NO.68, Qinghe Middle Street, Haidian District, Beijing, China |

## 1.2 General Description of EUT

| | | |
|---|---|---|
| Product Name: | Mobile Phone | |
| Model No.(EUT): | 2016102 | |
| Add Model No.: | N/A | |
| Trade Mark: | MI | |
| EUT Supports Radios application: | GSM850/900/1800/1900<br>WCDMA Band I/Band II/Band V/Band VIII<br>LTE FDD Band 1 /Band 3 /Band 4 /Band 5 /Band 7 /Band 8 /Band 20<br>LTE TDD Band 38 /Band 40<br>Wlan 2400MHz-2483.5MHz 802.11b/g/n(HT20&HT40)<br>Wlan 5150MHz-5350MHz, 5470MHz-5725MHz, 5725MHz-5850MHz only support 802.11a<br>Bluetooth V3.0+EDR&Bluetooth V4.0 BLE<br>GPS, Glonass | |
| Power Supply: | AC adapter | Model: MDY-08-EF<br>Input: 100-240V~50/60Hz 0.35A MAX<br>Output: DC 5.0V ⎓ 2000mA |
| | Battery | Model: BN43<br>Brand: MI<br>Rated Voltage: 3.85Vdc<br>Battery Capacity: 4000mAh(Li-on Rechargeable) |
| USB Micro-B Plug cable: | 117cm(Shielded without ferrite ) | |
| Sample Received Date: | Sep. 12, 2016 | |
| Sample Tested Date: | Sep. 22, 2016 ~ Dec. 13, 2016 | |

## 1.3 Product Specification subjective to this standard

| | |
|---|---|
| Operation Frequency: | 2400MHz-2483.5MHz |
| Bluetooth Version: | V3.0+EDR |
| Modulation Technique: | Frequency Hopping Spread Spectrum(FHSS) |
| Modulation Type: | GFSK, π/4 DQPSK, 8DPSK |
| Number of Channel: | 79 |
| Channel Separation: | 1MHz |
| Hopping Channel Type: | Adaptive Frequency Hopping systems |
| Sample Type: | Portable device |
| Antenna Type: | LDS Antenna |
| Antenna Gain: | 0.96 dBi |
| Normal Test Voltage: | 3.85Vdc |

| | |
|---|---|
| Software Version: | MIUI8 |
| Hardware Version: | P3 |

| Operation Frequency each of channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 0 | 2402MHz | 20 | 2422MHz | 40 | 2442MHz | 60 | 2462MHz |
| 1 | 2403MHz | 21 | 2423MHz | 41 | 2443MHz | 61 | 2463MHz |
| 2 | 2404MHz | 22 | 2424MHz | 42 | 2444MHz | 62 | 2464MHz |
| 3 | 2405MHz | 23 | 2425MHz | 43 | 2445MHz | 63 | 2465MHz |
| 4 | 2406MHz | 24 | 2426MHz | 44 | 2446MHz | 64 | 2466MHz |
| 5 | 2407MHz | 25 | 2427MHz | 45 | 2447MHz | 65 | 2467MHz |
| 6 | 2408MHz | 26 | 2428MHz | 46 | 2448MHz | 66 | 2468MHz |
| 7 | 2409MHz | 27 | 2429MHz | 47 | 2449MHz | 67 | 2469MHz |
| 8 | 2410MHz | 28 | 2430MHz | 48 | 2450MHz | 68 | 2470MHz |
| 9 | 2411MHz | 29 | 2431MHz | 49 | 2451MHz | 69 | 2471MHz |
| 10 | 2412MHz | 30 | 2432MHz | 50 | 2452MHz | 70 | 2472MHz |
| 11 | 2413MHz | 31 | 2433MHz | 51 | 2453MHz | 71 | 2473MHz |
| 12 | 2414MHz | 32 | 2434MHz | 52 | 2454MHz | 72 | 2474MHz |
| 13 | 2415MHz | 33 | 2435MHz | 53 | 2455MHz | 73 | 2475MHz |
| 14 | 2416MHz | 34 | 2436MHz | 54 | 2456MHz | 74 | 2476MHz |
| 15 | 2417MHz | 35 | 2437MHz | 55 | 2457MHz | 75 | 2477MHz |
| 16 | 2418MHz | 36 | 2438MHz | 56 | 2458MHz | 76 | 2478MHz |
| 17 | 2419MHz | 37 | 2439MHz | 57 | 2459MHz | 77 | 2479MHz |
| 18 | 2420MHz | 38 | 2440MHz | 58 | 2460MHz | 78 | 2480MHz |
| 19 | 2421MHz | 39 | 2441MHz | 59 | 2461MHz | N/A | |

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

## 1.4 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 |

2) Cable

| Cable No. | Description | Connector Type | Cable Type/Length | Supplied by |
|---|---|---|---|---|
| 1 | Antenna Cable | SMA | 30cm | UnionTrust |

## 1.5 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

Tests were sub-contracted. (FCC 47 CFR Part 15 Subpart C Section 15.205/15.207/15.209)
Compliance Certification Services (Shenzhen) Inc.
No.10-1 Mingkeda Logistics Park, No.18 Huanguan South RD. Guan lan Town, Baoan Distr, Shenzhen, Guangdong, China.
Tel: 86 0755 28055000 Fax: 86 0755 29055221

## 1.6 Test Facility

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

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

Compliance Certification Services (Shenzhen) Inc.
FCC Registration Number is **441872**.

## 1.7 Deviation from Standards

None.

## 1.8 Abnormalities from Standard Conditions

None.

## 1.9 Other Information Requested by the Customer

None.

## 1.10 Measurement Uncertainty (95% confidence levels, k=1.96)

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Radio Frequency | ±6.3 x 10-8 |
| 2 | RF power, conducted | ±0.52 dB |
| 3 | Spurious emissions, radiated (Below 1GHz) | ±5.3 dB |
| | Spurious emissions, radiated (Above 1GHz) | ±5.1 dB |
| 4 | Conduction emission (9KHz~150KHz) | ±3.8 dB |
| | Conduction emission (150KHz~30MHz) | ±3.4 dB |
| 5 | Temperature | ±0.64 °C |
| 6 | Humidity | ±2.8 % |
| 7 | Supply voltages | ±0.49 % |

# 2 Test Summary

Tests for radiated and conducted emissions were performed. All measurements were performed according to the 2013 version of ANSI C63.10

| Test Item | Test Requirement | Test method | Result |
|---|---|---|---|
| **Antenna Requirement** | FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c) | ANSI C63.10-2013 | PASS |
| **AC Power Line Conducted Emission** | FCC 47 CFR Part 15 Subpart C Section 15.207 | ANSI C63.10-2013 | PASS* |
| **Conducted Peak Output Power** | FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(1) | DA 00-705 | PASS |
| **20 dB Bandwidth** | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1) | DA 00-705 | PASS |
| **Carrier Frequencies Separation** | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1) | DA 00-705 | PASS |
| **Number of Hopping Channel** | FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(1) | DA 00-705 | PASS |
| **Dwell Time** | FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1) | DA 00-705 | PASS |
| **Pseudorandom Frequency Hopping Sequence** | FCC 47 CFR Part 15 Subpart C Section 15.247(a)(1)(g)(h) | DA 00-705 | PASS |
| **Conducted Out of Band Emission** | FCC 47 CFR Part 15 Subpart C Section 15.247(d) | DA 00-705 | PASS |
| **Radiated Emissions** | FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 | DA 00-705 | PASS* |
| **Band Edge Measurement** | FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 | DA 00-705 | PASS* |

Remark:

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

"*": In this whole report "*" means tests were sub-contracted Item.

# 3 Equipment List

| 3M Semi/full-anechoic Chamber | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial Number** | **Cal. Due date (mm-dd-yyyy)** | **Cal. Interval** |
| PSA Series Spectrum Analyzer | Agilent | E4446A | US44300399 | 02-20-2017 | 1 Year |
| Turn Table | N/A | N/A | N/A | N.C.R | N.C.R |
| Controller | Sunol Sciences | SC104V | 022310-1 | N.C.R | N.C.R |
| Controller | CT | N/A | N/A | N.C.R | N.C.R |
| Bilog Antenna | SCHAFFNER | CBL6143 | 5063 | 02-21-2017 | 1 Year |
| Horn Antenna | SCHWARZBECK | BBHA9120 | D286 | 02-20-2017 | 1 Year |
| Loop Antenna | COM-POWER | AL-130 | 121044 | 02-20-2017 | 1 Year |
| High Noise Amplifier | Agilent | 8449B | 3008A01838 | 02-21-2017 | 1 Year |
| Horn Antenna | Schwarzbeck | BBHA9120 | D286 | 02-21-2017 | 1 Year |
| Temp. / Humidity Meter | Anymetre | JR913 | N/A | 02-21-2017 | N.C.R |
| Antenna Tower | SUNOL | TLT2 | N/A | N.C.R | N.C.R |
| Test S/W | FARAO | LZ-RF / CCS-SZ-3A2 | | | |

| Conducted Emission test | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial Number** | **Cal. Due date (mm-dd-yyyy)** | **Cal. Interval** |
| EMI Test Receiver | R&S | ESCI | 100783 | 02-21-2017 | 1 Year |
| L.I.S.N | R&S | ENV216 | 101543-WX | 02-21-2017 | N.C.R |

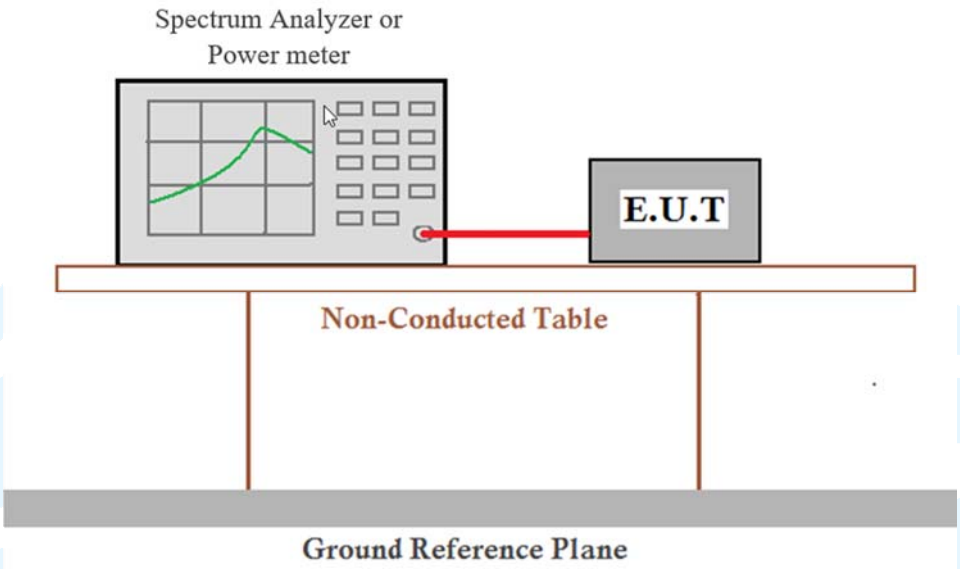
| RF test system/ Conducted RF test | | | | | | |
|---|---|---|---|---|---|---|
| **Used** | **Equipment** | **Manufacturer** | **Model No.** | **Serial Number** | **Cal. date (mm-dd-yyyy)** | **Cal. Due date (mm-dd-yyyy)** |
| ☒ | EXA Spectrum Analyzer | KEYSIGHT | N9010A | MY51440197 | 01-27-2016 | 01-26-2017 |
| ☒ | Receiver | R&S | ESR7 | 1316.3003K07-101181-K3 | 02-23-2016 | 02-22-2017 |
| ☐ | Receiver | R&S | ESIB26 | 100114 | 08-06-2015 | 08-05-2017 |
| ☒ | USB Wideband Power Sensor | KEYSIGHT | U2021XA | MY55430035 | 01-09-2016 | 01-08-2017 |
| ☒ | USB Wideband Power Sensor | KEYSIGHT | U2021XA | MY55430023 | 12-16-2015 | 12-15-2017 |
| ☐ | EXG-B RF Analog Signal Generator | KEYSIGHT | N5171B | MY53051777 | 01-09-2016 | 01-08-2017 |
| ☐ | MXG X-Series RF Vector Signal Generator | KEYSIGHT | N5182B | MY51350267 | 01-08-2016 | 01-07-2017 |
| ☐ | 4ch. Simultaneous Sampling 14 Bits 2MS/s | KEYSIGHT | U2531A | TW55193502 | 11-09-2015 | 11-08-2017 |
| ☐ | Communication Tester | R&S | CMU200 | 114713 | 12-07-2015 | 12-06-2017 |
| ☐ | Band rejection filter (5150MHz~5880MHz) | micro-tronics | BRM50716 | G1868 | 06-15-2016 | 06-14-2017 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ☐ | Band rejection filter (2400MHz~2500MHz) | micro-tronics | BRM50702 | G248 | 06-21-2016 | 06-20-2017 |
| ☐ | DC Source | KIKUSUI | PWR400L | LK003024 | 09-21-2016 | 09-20-2017 |
| ☐ | Temp & Humidity chamber | Ispec | GL(U)04K A(W) | 1692H201P3 | 09-21-2016 | 09-20-2017 |

# 4 Test Requirement

## 4.1 Test setup

### 4.1.1 For Conducted test setup




### 4.1.2 For Radiated Emissions test setup

**Radiated Emissions setup:**

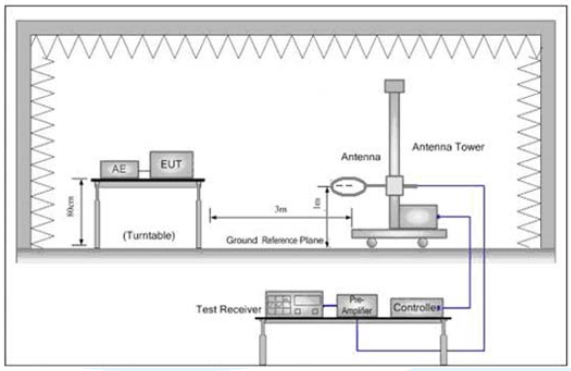



Figure 1. Below 30MHz

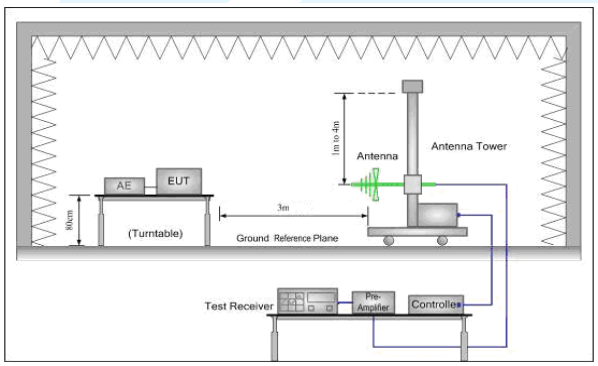



Figure 2. 30MHz to 1GHz

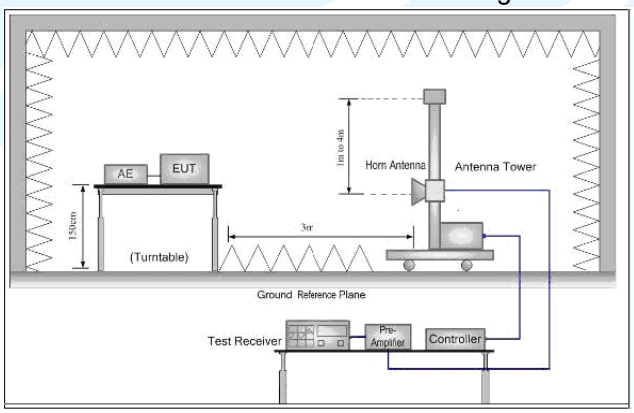
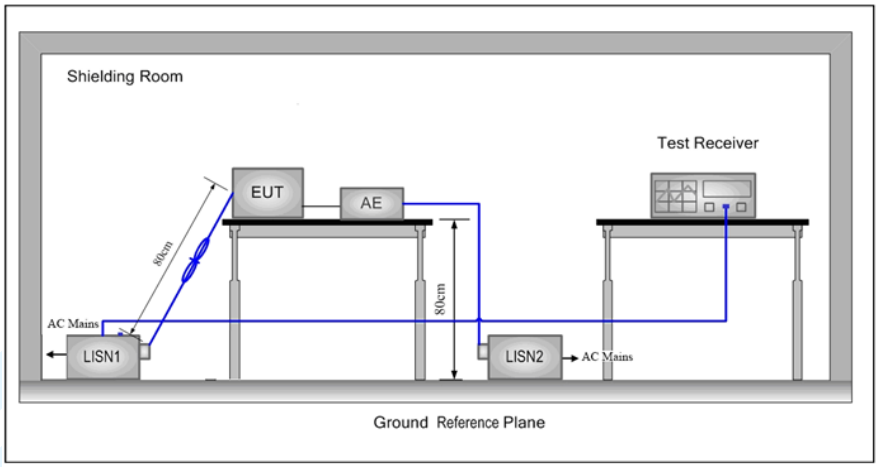



Figure 3. Above 1GHz

### 4.1.3 For Conducted Emissions test setup

**Conducted Emissions setup**




## 4.2 Test Environment

| Operating Environment: | |
|---|---|
| Temperature: | 22.2 °C |
| Humidity: | 56 % RH |
| Atmospheric Pressure: | 100.78 Kpa |

## 4.3 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 3.85Vdc rechargeable Li-on 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 Band(GHz) | Mode | Antenna Port | Worst-case Orientation |
|---|---|---|---|
| Below 1GHz | 1TX | Chain 0 | X-Portrait |
| Above 1GHz | 1TX | Chain 0 | X-Portrait |

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 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. 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.

## 4.4 Test Condition

### 4.4.1 Test channel

| Modulation Type | Tx/Rx | RF Channel | | |
|---|---|---|---|---|
| | | Low(L) | Middle(M) | High(H) |
| GFSK/ π/4 DQPSK/ 8DPSK (DH1,DH3,DH5) | 2402MHz ~2480 MHz | Channel 0 | Channel 39 | Channel 78 |
| | | 2402MHz | 2441MHz | 2480MHz |

### 4.4.2 Test mode

**Pre-scan under all packets at lowest channel**

| Modulation Type | GFSK | | | π/4 DQPSK | | | 8DPSK | | |
|---|---|---|---|---|---|---|---|---|---|
| **Packets** | 1-DH1 | 1-DH3 | 1-DH5 | 2-DH1 | 2-DH3 | 2-DH5 | 3-DH1 | 3-DH3 | 3-DH5 |
| **AVg Power** | **5.73** | 5.66 | 5.71 | **3.49** | 3.24 | 3.27 | **3.53** | 3.26 | 3.27 |

**So, the worst-case packets see table below:**

| Modulation Type | Worst-case packets |
|---|---|
| GFSK | 1-DH1 |
| π/4 DQPSK | 2-DH1 |
| 8DPSK | 3-DH1 |

**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.

| Modulation Technology | FHSS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Modulation Type | GFSK | | | π/4 DQPSK | | | 8DPSK | | |
| Packets | DH1 | DH3 | DH5 | DH1 | DH3 | DH5 | DH1 | DH3 | DH5 |
| Available Channel | 0 to 78 | | | | | | | | |
| **Test Item** | **Test Channel** | | | | | | | | |
| 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 | Frequency Hopping Channel 0 to 78 | | | | | | | | |

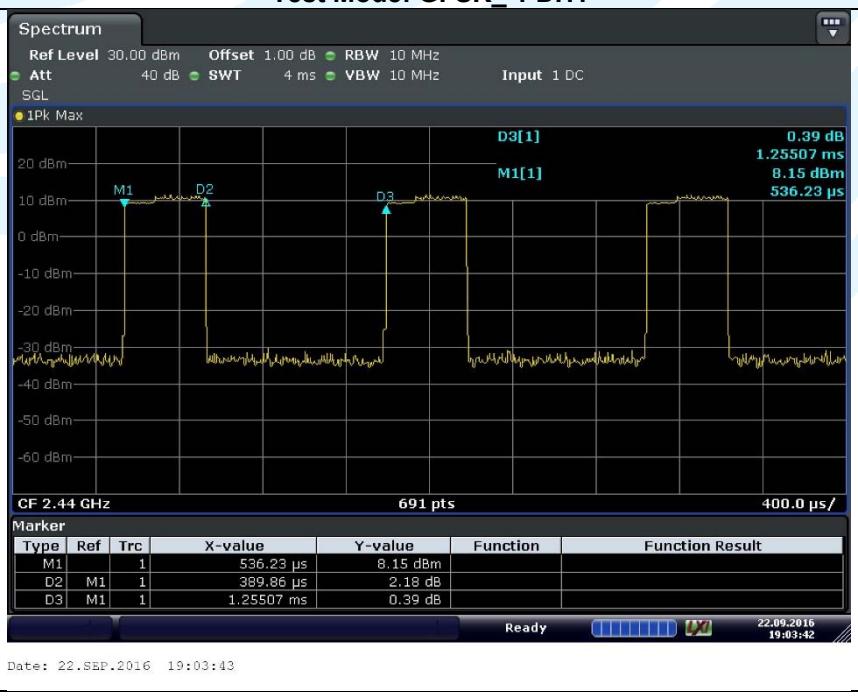
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Channel | ☒ | ☐ | ☐ | ☒ | ☐ | ☐ | ☒ | ☐ | ☐ |
| Dwell Time | Channel 0 & 39 & 78 | | | | | | | | |
| | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |
| Pseudorandom Frequency Hopping Sequence | Frequency Hopping Channel 0 to 78 | | | | | | | | |
| | ☒ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Conducted Out of Band Emission | Channel 0 & 39 & 78 | | | | | | | | |
| | ☒ | ☐ | ☐ | ☒ | ☐ | ☐ | ☒ | ☐ | ☐ |
| Radiated Emissions | Channel 0 & 39 & 78 | | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☒ | ☐ | ☐ |
| Band Edge Measurements (Radiated) | Channel 0 & 78 | | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☒ | ☐ | ☐ |
| Remark:<br>The mark "☒" means is chosen for testing<br>The mark "☐" means is not chosen for testing | | | | | | | | | |

### 4.4.3 Duty Cycle

| Modulation Type | packets | On Time (msec) | Period (msec) | Duty Cycle (linear) | Duty Cycle (%) | Duty Cycle Factor (dB) | 1/ T Minimum VBW (kHz) |
|---|---|---|---|---|---|---|---|
| GFSK | 3 DH1 | 0.38986 | 1.25507 | 0.31 | 31.06 | 5.08 | 2.57 |
| Remark:<br>1) Duty cycle= On Time/ Period<br>2) Duty Cycle factor = 10 * log(1/ Duty cycle) | | | | | | | |

**The test plot as follows:**

**Test Mode: GFSK_ 1 DH1**



# 5 Radio Technical Requirements Specification

**Reference documents for testing:**

| No. | Identity | Document Title |
|---|---|---|
| 1 | FCC CFR 47 Part 2 | Frequency allocations and radio treaty matters; general rules and regulations |
| 2 | FCC CFR 47 Part 15 | Radio Frequency Devices |
| 3 | ANSI C63.10-2013 | American National Standard for Testing Unlicesed Wireless Devices |
| 4 | FCC Public Notice DA 00-705 | Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems |

## 5.1 Antenna Requirement

**15.203 requirement:**

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.

**15.247(b) (4) requirement:**

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.

| **EUT Antenna:** | |
|---|---|
| Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 0.96 dBi. | |

## 5.2 Pseudorandom Frequency Hopping Sequence

**Technical Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.247(b)(g)(h)
**Test Method:** DA 00-705

**Frequency Hopping System:**

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

**EUT Pseudorandom Frequency Hopping Sequence:**

Pseudorandom Frequency Hopping Sequence Table as below:

Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48, 72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45 etc.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

## 5.3 Conducted Peak Output Power

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section15.247 (b)(1)

**Test Method:** DA 00-705

**Limit:** 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.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

**Test Procedure:**

a) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

b) Measure out each test modes' peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Test Setup:** Refer to section 4.1.1 for details.

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

**Test Mode:** Transmitter mode

**Test Results:** Pass

**Test Data:**

**Maximum Conducted Peak Output Power:**

| Modulation Type | Peak Output Power (dBm) | | | Peak Output Power (mW) | | |
|---|---|---|---|---|---|---|
| | Channel 0 | Channel 39 | Channel 78 | Channel 0 | Channel 39 | Channel 78 |
| GFSK | 6.01 | 7.03 | 5.71 | 3.99 | 5.05 | 3.72 |
| π/4 DQPSK | 5.98 | 6.97 | 5.67 | 3.96 | 4.98 | 3.69 |
| 8DPSK | 6.65 | 7.57 | 6.33 | 4.62 | 5.71 | 4.30 |

Note: the antenna gain of 0.96 dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.

## 5.4 20 dB Bandwidth

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)

**Test Method:** DA 00-705

**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.
Use the following spectrum analyzer settings:

a) Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
b) RBW ≥ 1% of the 20 dB bandwidth
c) VBW ≥ RBW
d) Sweep = auto;
e) Detector function = peak
f) Trace = max hold
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.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Test Setup:** Refer to section 4.1.1 for details.

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

**Test Mode:** Transmitter mode

**Test Results:** Pass

**Test Data:**

**Occupied Bandwidth:**

| Modulation Type | 20 dB Bandwidth (MHz) | | | 99% Bandwidth (MHz) | | |
|---|---|---|---|---|---|---|
| | Channel 0 | Channel 39 | Channel 78 | Channel 0 | Channel 39 | Channel 78 |
| GFSK | 0.9483 | 0.9484 | 0.9481 | 0.89384 | 0.89275 | 0.89432 |
| π/4 DQPSK | 1.275 | 1.275 | 1.275 | 1.1697 | 1.1691 | 1.1687 |
| 8DPSK | 1.284 | 1.283 | 1.281 | 1.1711 | 1.1712 | 1.1714 |

**The test plot as follows:**

| GFSK | π/4 DQPSK |
|---|---|
|  |  |
| Channel 0 | Channel 0 |
|  |  |
| Channel 39 | Channel 39 |
|  |  |
| Channel 78 | Channel 78 |

**8DPSK**


Channel 0


Channel 39


Channel 78

## 5.5 Carrier Frequencies Separation

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)

**Test Method:** DA 00-705

**Limit:** 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.
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

**Test Procedure:** Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

a) Set span = wide enough to capture the peaks of two adjacent channels
b) Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
c) Video (or Average) Bandwidth (VBW) ≥ RBW
d) Sweep = auto;
e) Detector function = peak;
f) Trace = max hold
g) Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Test Setup:** Refer to section 4.1.1 for details.

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

**Test Mode:** Hopping Frequencies Transmitter mode

**Test Results:** Pass

**Test Data:**

**Carrier Frequencies Separation:**

| Modulation Type | Adjacent Channel Separation (MHz) | | | Minimum Limit (MHz) | | |
|---|---|---|---|---|---|---|
| | Channel 0 | Channel 39 | Channel 78 | Channel 0 | Channel 39 | Channel 78 |
| GFSK | 1.002 | 0.996 | 0.996 | 0.6322 | 0.6323 | 0.6321 |
| π/4 DQPSK | 0.999 | 0.996 | 1.002 | 0.8500 | 0.8500 | 0.8500 |
| 8DPSK | 1.002 | 1.005 | 1.002 | 0.8560 | 0.8553 | 0.8540 |

Note: The minimum limit is two-third 20 dB bandwidth.

**The test plot as follows:**

| GFSK | π/4 DQPSK |
|---|---|
|  |  |
| Channel 0 | Channel 0 |
|  |  |
| Channel 39 | Channel 39 |
|  |  |
| Channel 78 | Channel 78 |

**8DPSK**


Channel 0


Channel 39


Channel 78

## 5.6 Number of Hopping Channel

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.247(b)(1)

**Test Method:** DA 00-705

**Limit:** Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

**Test Procedure:** Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

a) Span = the frequency band of operation
b) RBW ≥ 1% of the span
c) VBW ≥ RBW
d) Sweep = auto
e) Detector function = peak
f) Trace mode = max hold
g) Allow the trace to stabilize, observed the band of 2400MHz to 2483.5MHz, than count it out the number of channels for comparing with the FCC rules.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Test Setup:** Refer to section 4.1.1 for details.

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

**Test Mode:** Hopping Frequencies Transmitter mode

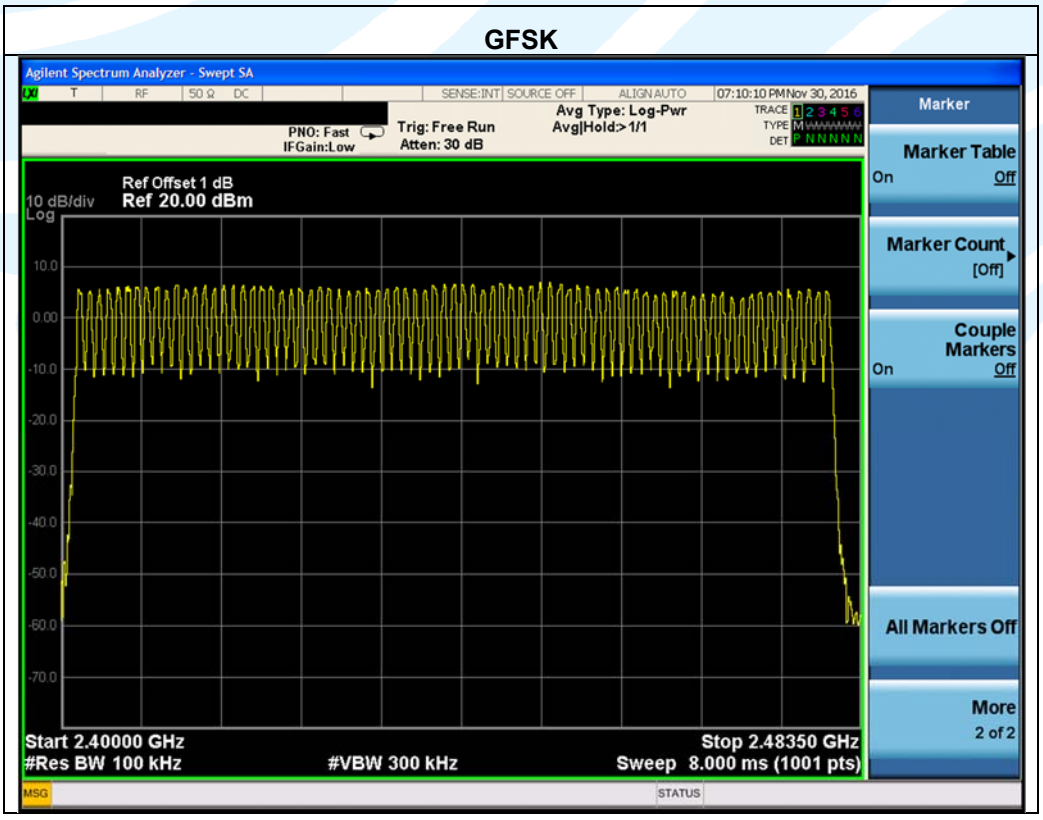
**Test Results:** Pass

**Test Data:**

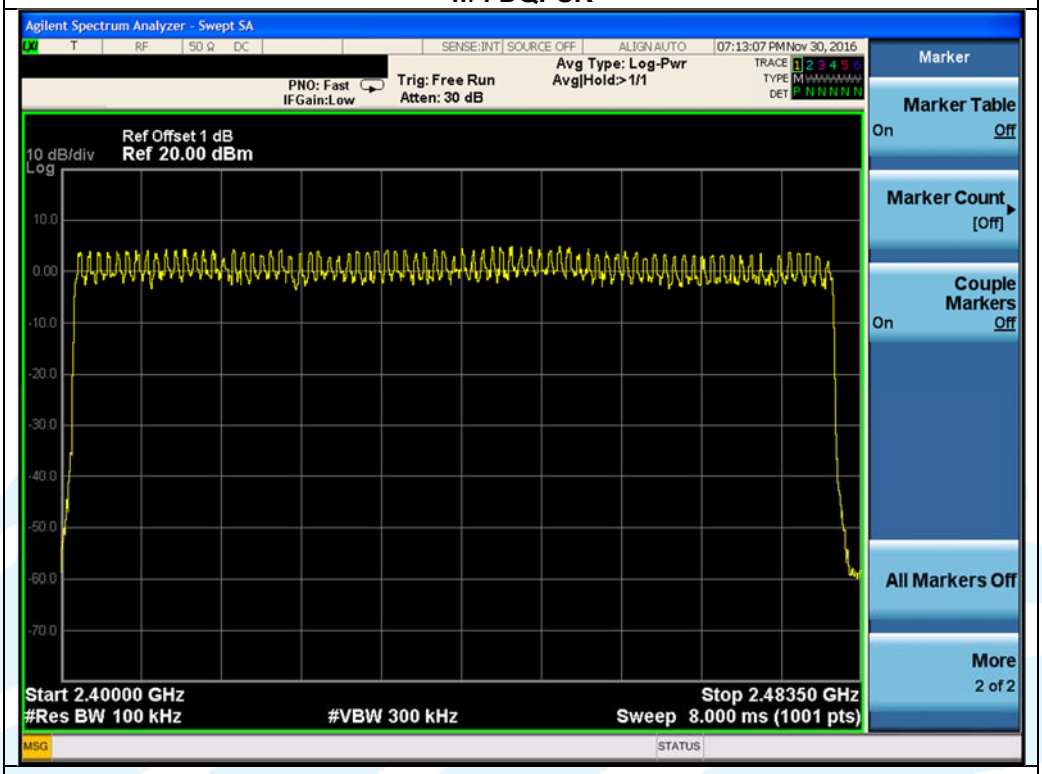
| Modulation Type | GFSK | π/4 DQPSK | 8DPSK |
|---|---|---|---|
| Number of Hopping Channel | 79 | 79 | 79 |

**The test plot as follows:**

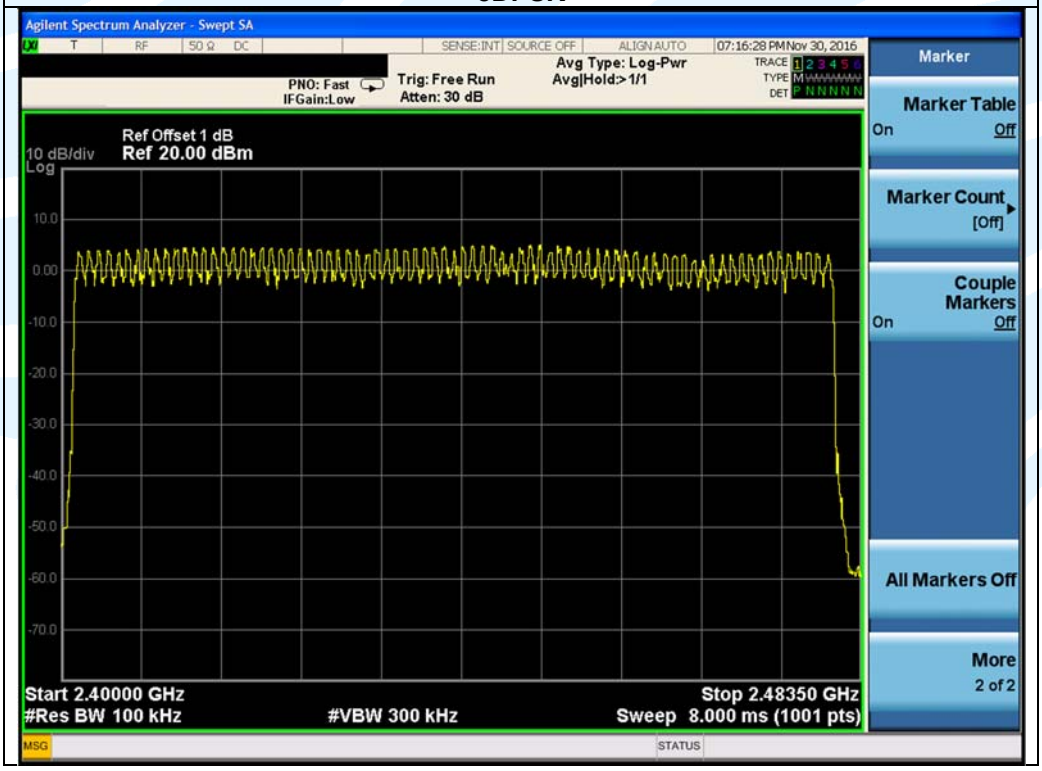
**GFSK**



π/4 DQPSK




8DPSK



## 5.7 Dwell Time

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.247(a)(1)

**Test Method:** DA 00-705

**Limit:** 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.

**Test Procedure:** Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

a) Span = zero span, centered on a hopping channel
b) RBW = 1 MHz
c) VBW ≥ RBW
d) Sweep = as necessary to capture the entire dwell time per hopping channel
e) Detector function = peak
f) Trace = max hold
g) Use the marker-delta function to determine the dwell time

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Test Setup:** Refer to section 4.1.1 for details.

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

**Test Mode:** Hopping Frequencies Transmitter mode

**Test Results:** Pass

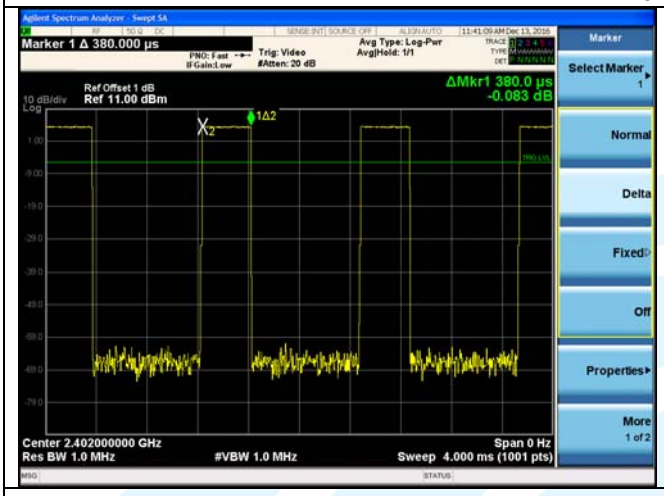
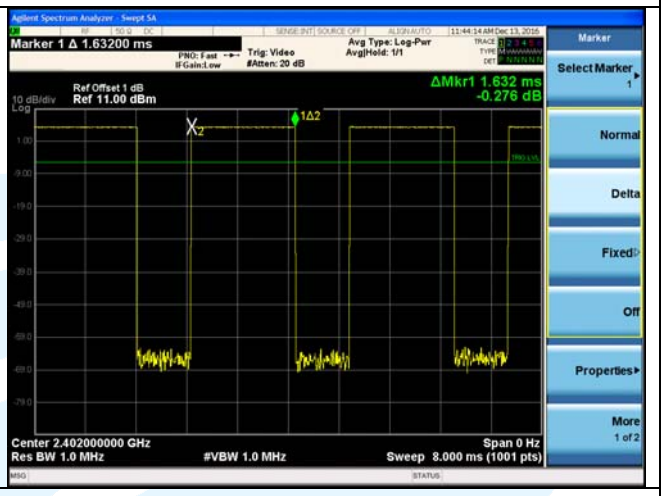
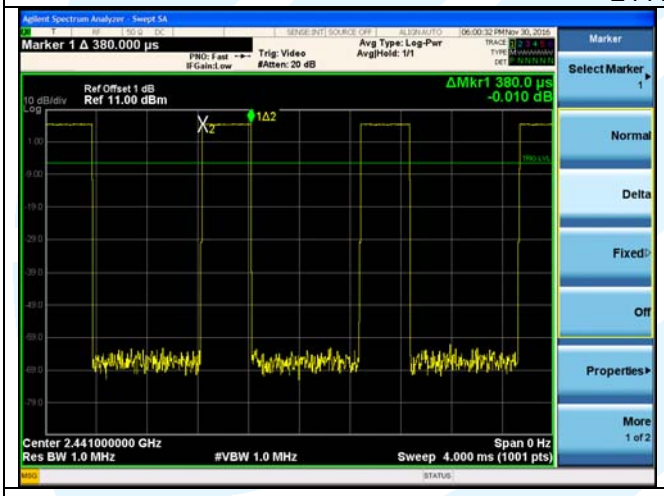
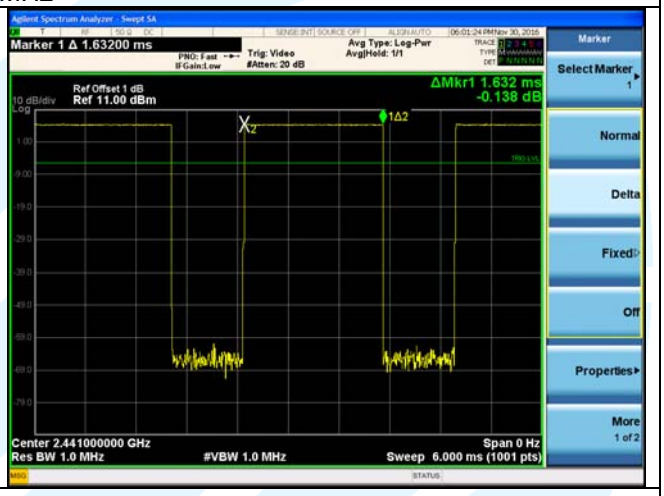
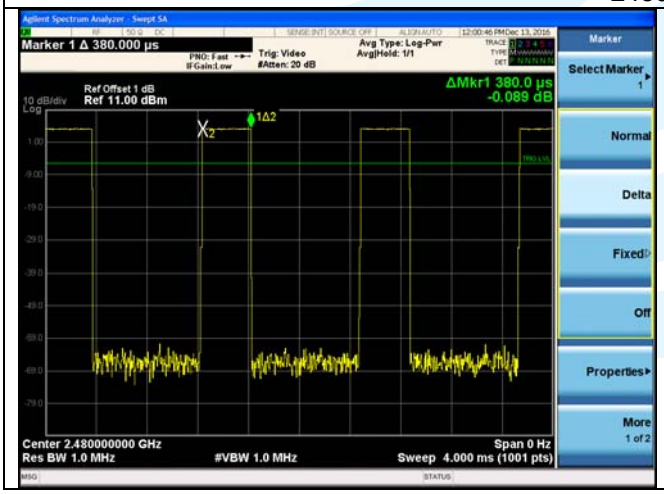
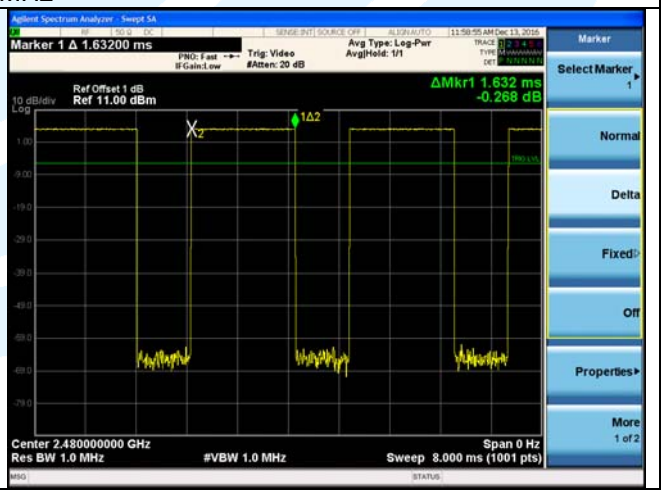
**Test Data:**

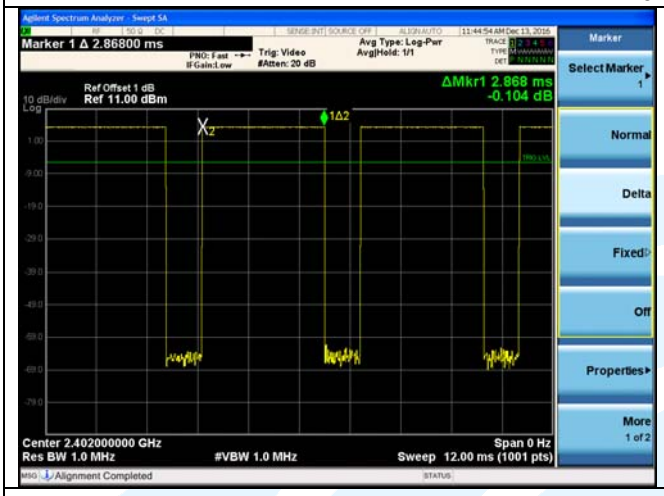
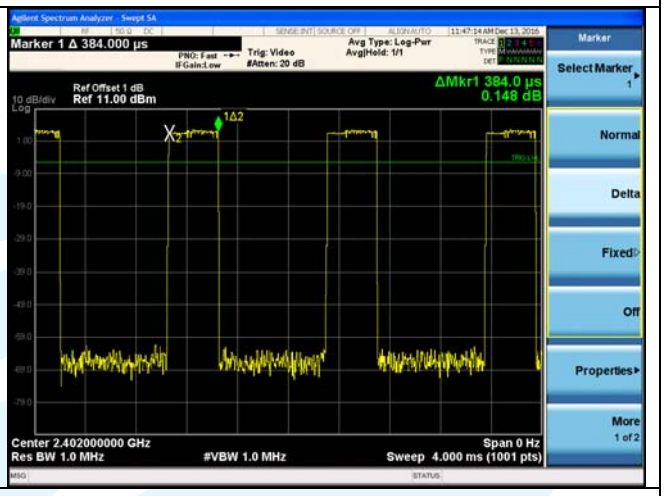
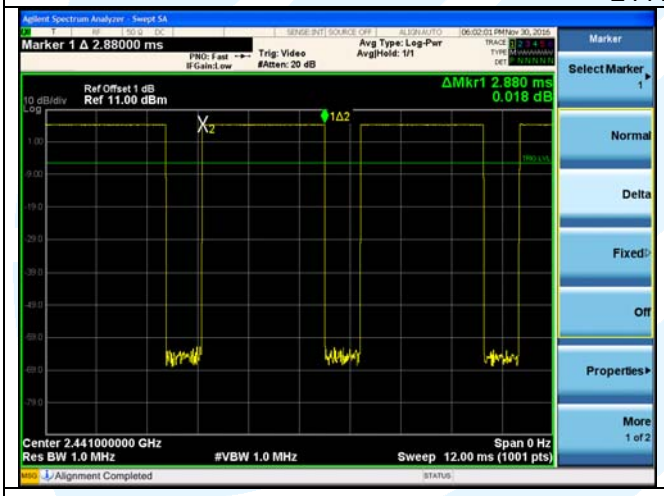
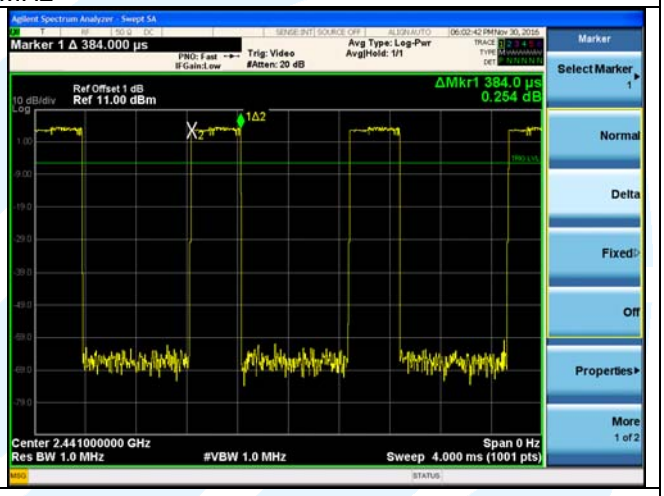
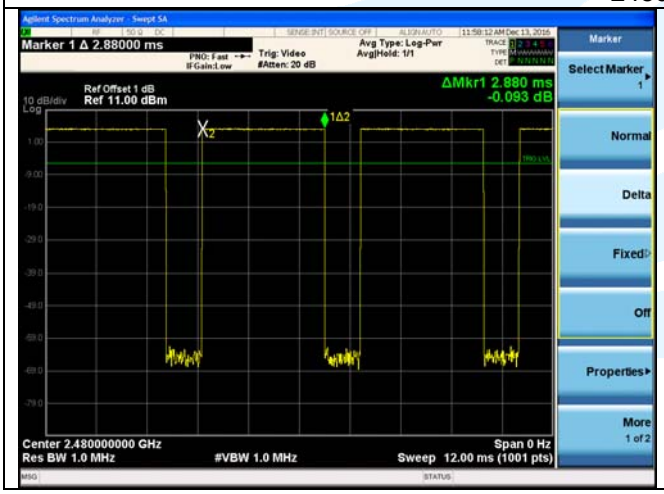
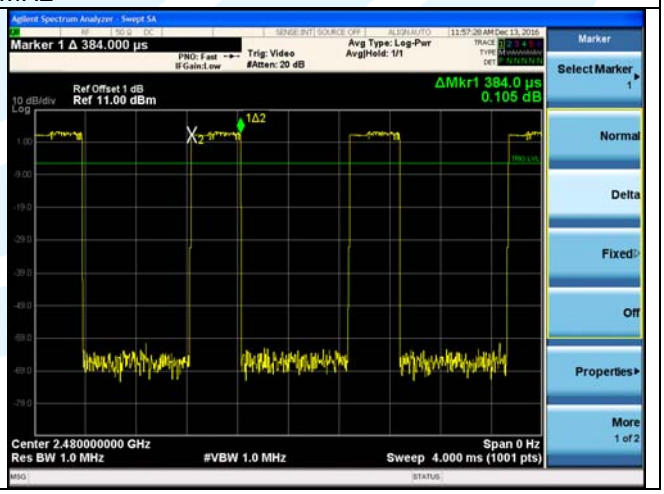
| Modulation | Test Frequency | Packet | Time Slot Length | Dwell Time | Limit |
|---|---|---|---|---|---|
| | | | ms | ms | ms |
| GFSK | 2402MHz | DH1 | 0.380 | 121.60 | < 400 |
| | | DH3 | 1.632 | 261.12 | < 400 |
| | | DH5 | 2.868 | 305.92 | < 400 |
| | 2441MHz | DH1 | 0.380 | 121.60 | < 400 |
| | | DH3 | 1.632 | 261.12 | < 400 |
| | | DH5 | 2.880 | 307.20 | < 400 |
| | 2480MHz | DH1 | 0.380 | 121.60 | < 400 |
| | | DH3 | 1.632 | 261.12 | < 400 |
| | | DH5 | 2.880 | 307.20 | < 400 |
| π/4 DQPSK | 2402MHz | 2DH1 | 0.384 | 122.88 | < 400 |
| | | 2DH3 | 1.640 | 262.40 | < 400 |
| | | 2DH5 | 2.880 | 307.20 | < 400 |
| | 2441MHz | 2DH1 | 0.384 | 122.88 | < 400 |
| | | 2DH3 | 1.638 | 262.08 | < 400 |
| | | 2DH5 | 2.880 | 307.20 | < 400 |
| | 2480MHz | 2DH1 | 0.384 | 122.88 | < 400 |
| | | 2DH3 | 1.640 | 262.40 | < 400 |
| | | 2DH5 | 2.880 | 307.20 | < 400 |
| 8DPSK | 2402MHz | 3DH1 | 0.384 | 122.88 | < 400 |
| | | 3DH3 | 1.632 | 261.12 | < 400 |
| | | 3DH5 | 2.892 | 308.48 | < 400 |
| | 2441MHz | 3DH1 | 0.384 | 122.88 | < 400 |
| | | 3DH3 | 1.638 | 262.08 | < 400 |
| | | 3DH5 | 2.880 | 307.20 | < 400 |
| | 2480MHz | 3DH1 | 0.384 | 122.88 | < 400 |
| | | 3DH3 | 1.624 | 259.84 | < 400 |
| | | 3DH5 | 2.880 | 307.20 | < 400 |

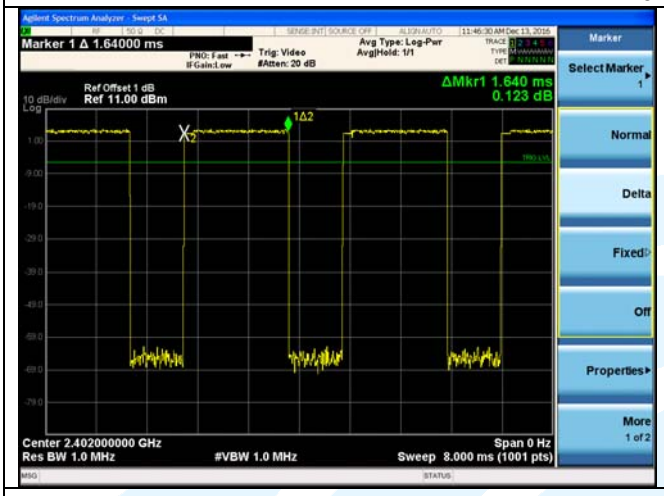
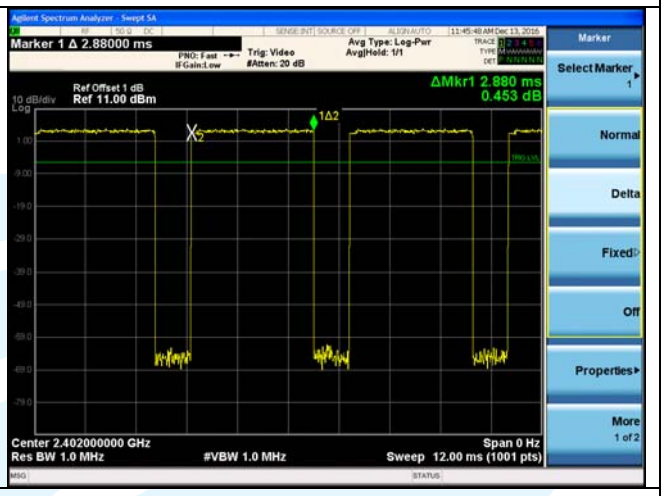
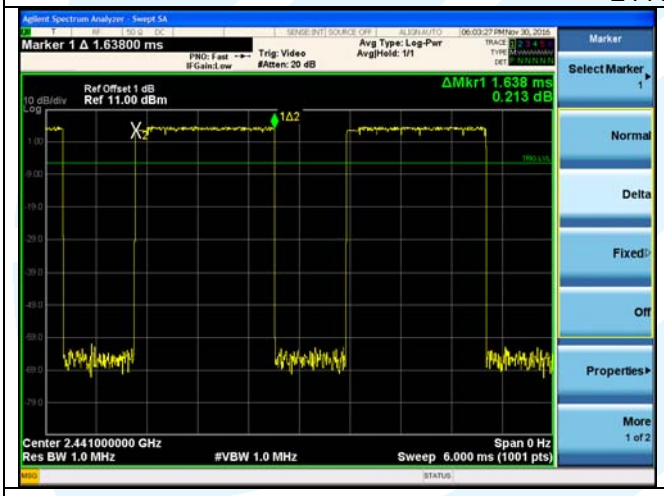
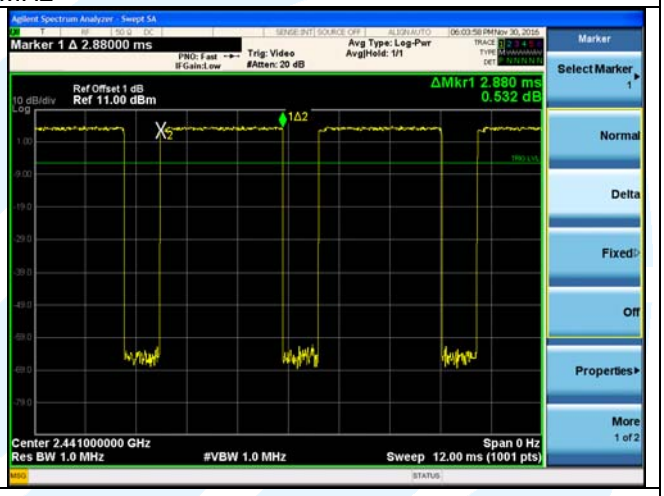
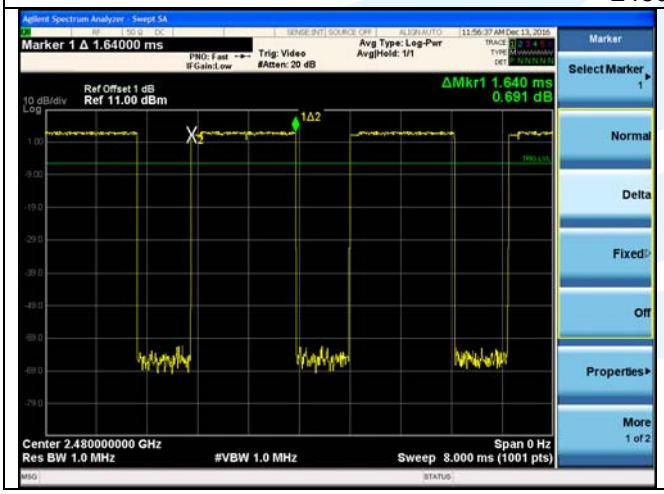
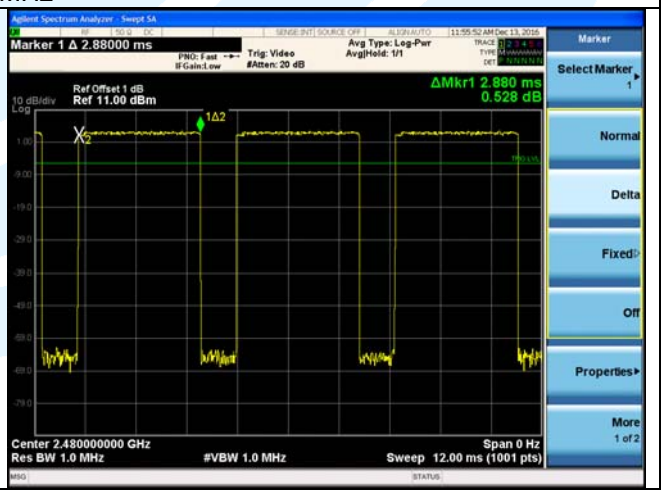
Remark:

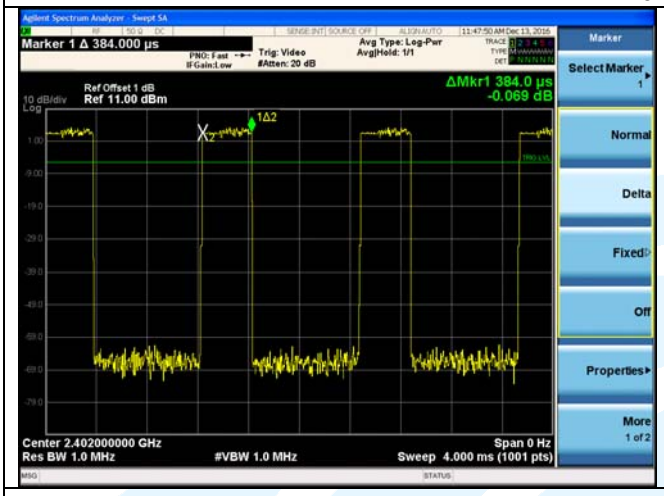
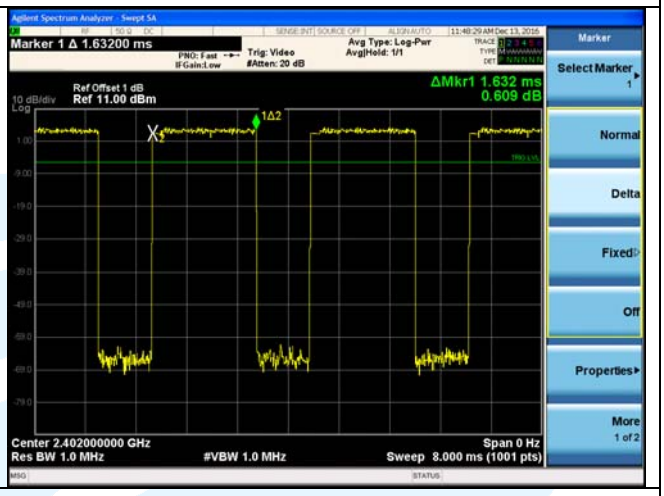
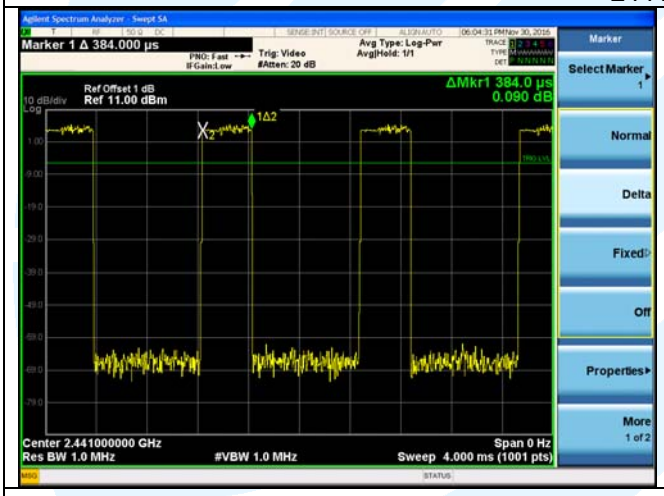
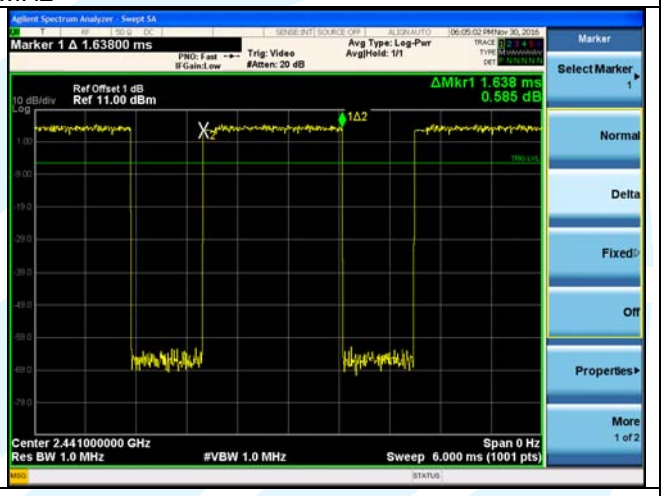
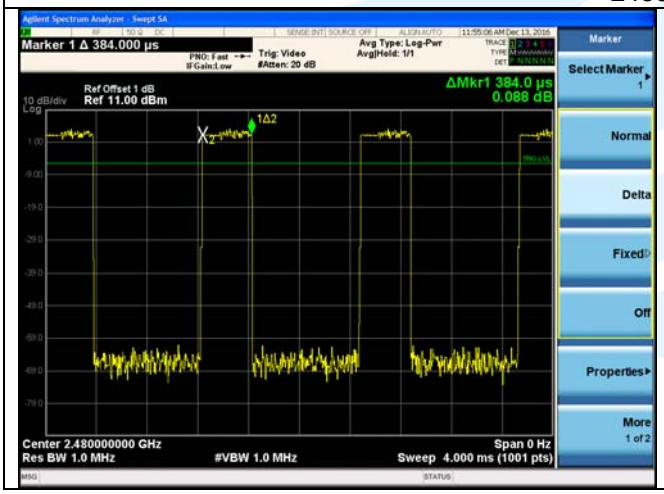
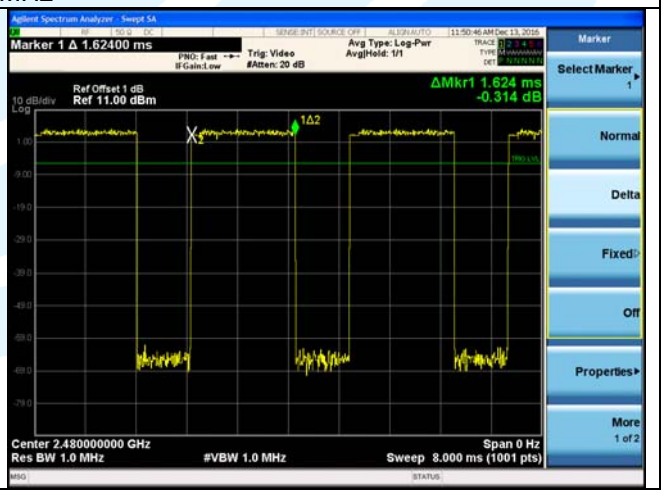
1. The test period: T = 0.4 Second * 79 Channel = 31.6 s
2. Dwell time = time slot length * (Hopping rate / Number of hopping channels) * Period

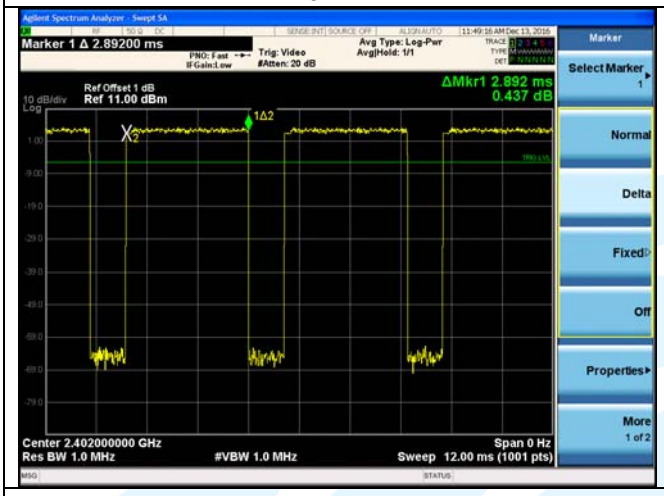
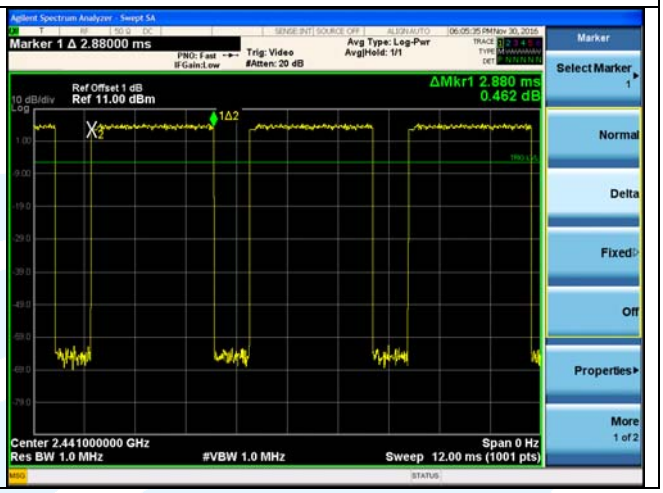
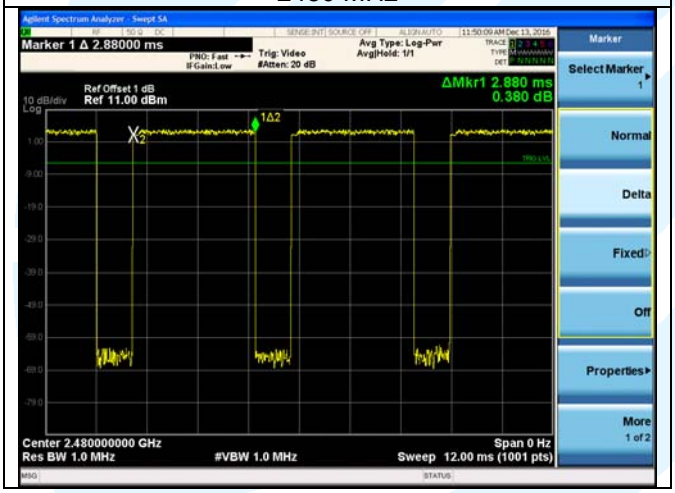
**The test plot as follows:**

| GFSK_DH1 | GFSK_DH3 |
|---|---|
| 2402 MHz | |
|  |  |
| 2441 MHz | |
|  |  |
| 2480 MHz | |
|  |  |

| GFSK_DH5 | π/4 DQPSK_2DH1 |
|---|---|
| 2402 MHz | |
|  |  |
| 2441 MHz | |
|  |  |
| 2480 MHz | |
|  |  |

| π/4 DQPSK_2DH3 | π/4 DQPSK_2DH5 |
|---|---|
| 2402 MHz | |
|  |  |
| 2441 MHz | |
|  |  |
| 2480 MHz | |
|  |  |

| 8DPSK_3DH1 | 8DPSK_3DH3 |
|---|---|
| 2402 MHz | |
|  |  |
| 2441 MHz | |
|  |  |
| 2480 MHz | |
|  |  |

| 8DPSK_3DH5 | |
|---|---|
| 2402 MHz | 2441 MHz |
|  |  |
| 2480 MHz | |
|  | |

## 5.8 Conducted Out of Band Emission

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.247(d)

**Test Method:** DA 00-705

**Limit:** In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

**Test Procedure:** Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

a) Suitable frequency span
b) RBW = 100 KHz
c) VBW ≥ RBW
d) Sweep = auto
e) Detector function = peak
f) Trace = max hold
g) The band edges was measured and recorded.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Test Setup:** Refer to section 4.1.1 for details.

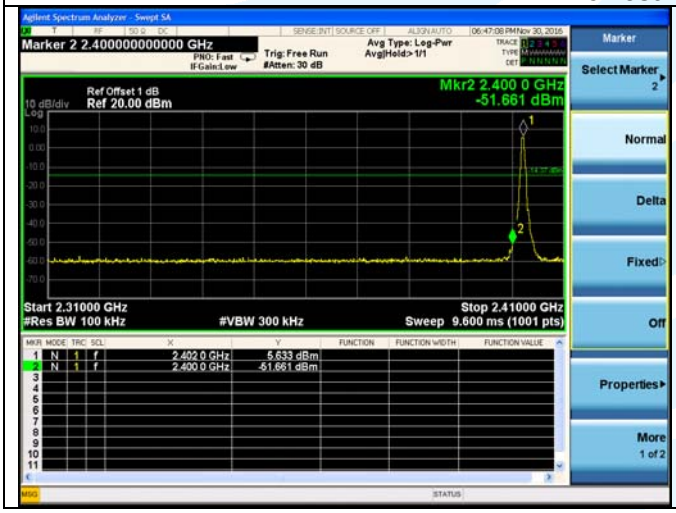
**Instruments Used:** Refer to section 3 for details

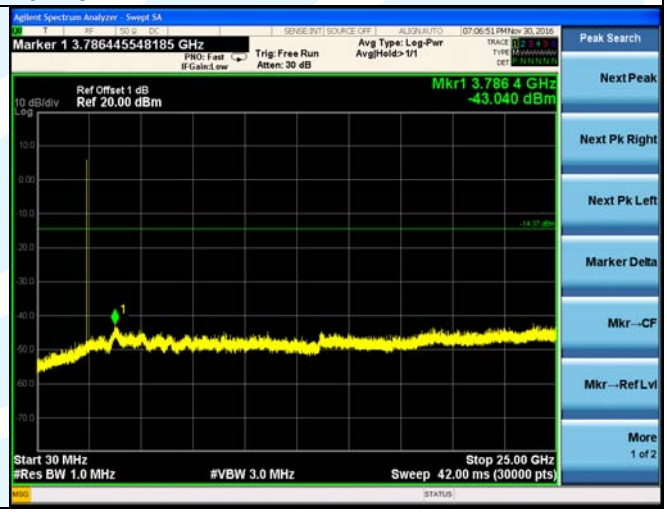
**Test Mode:** Hopping Frequencies Transmitter mode

**Test Results:** Pass

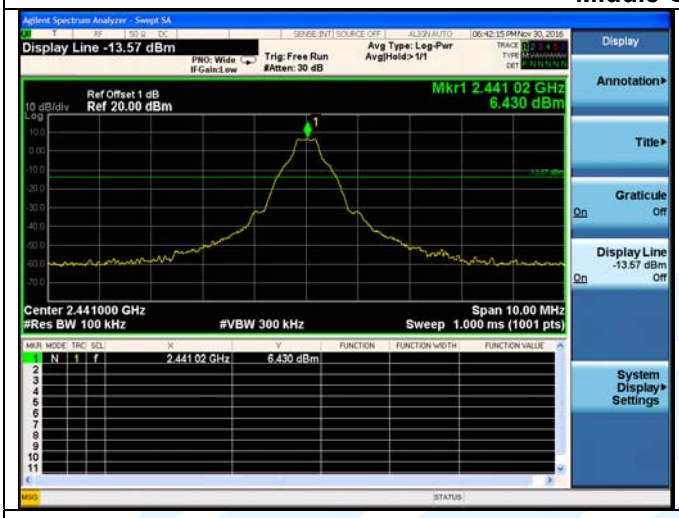
**The test plot as follows:**

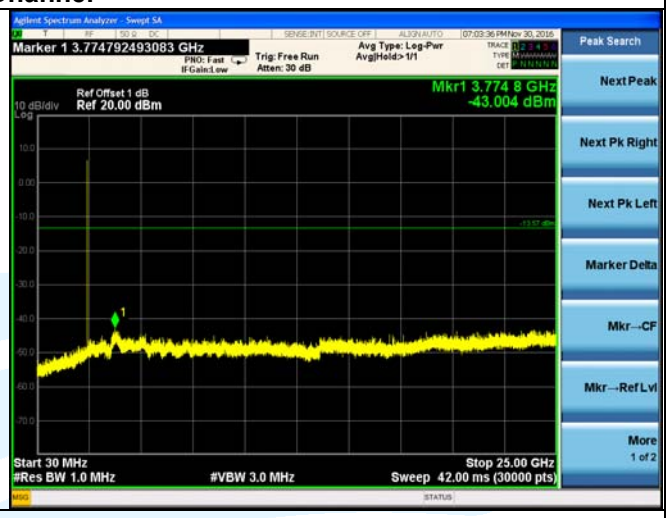
| GFSK_1-DH1 | |
|---|---|
| **In-Band Reference Level** | **Out of Band Emission** |
| **Lowest Channel** | |



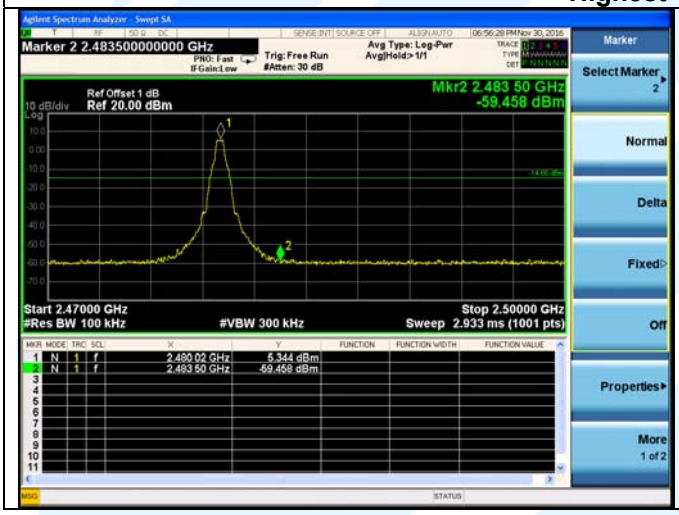



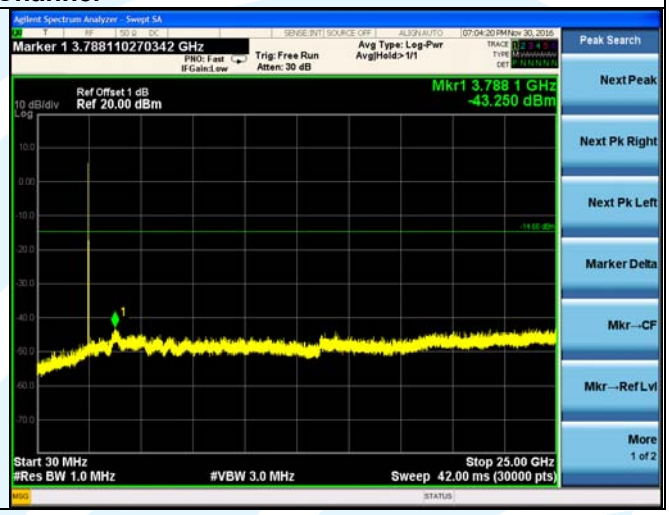
**Middle Channel**



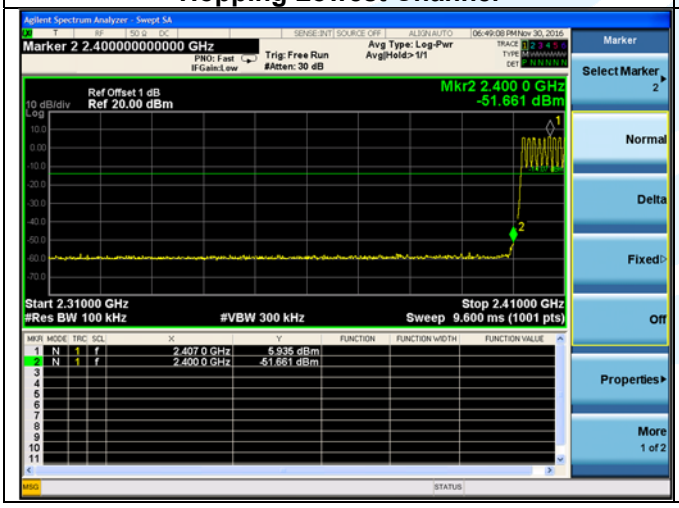




**Highest Channel**

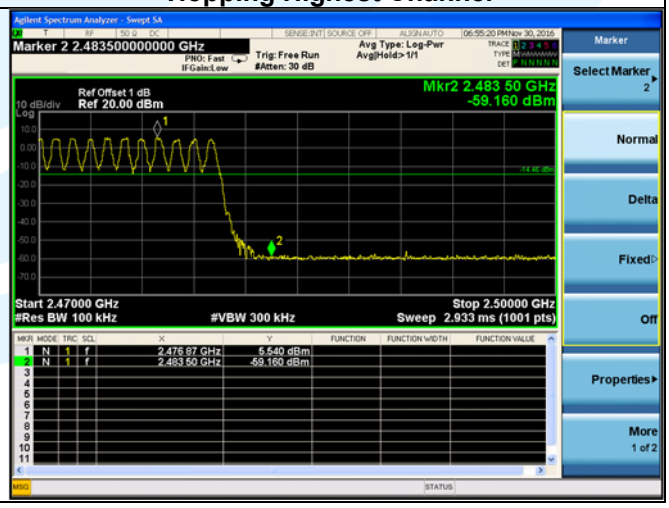


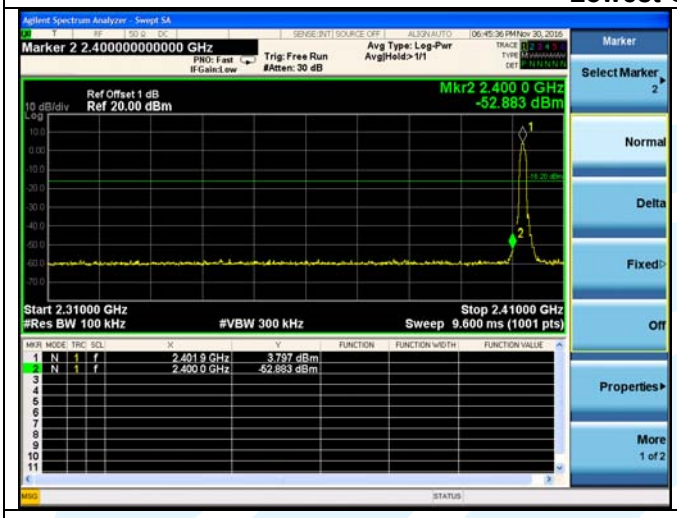
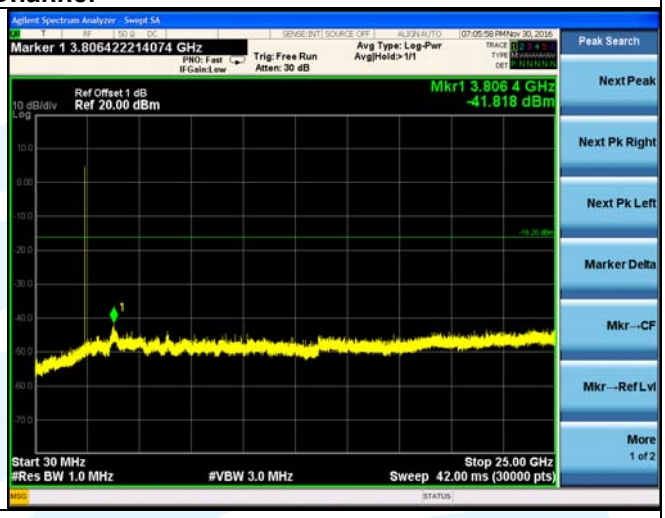
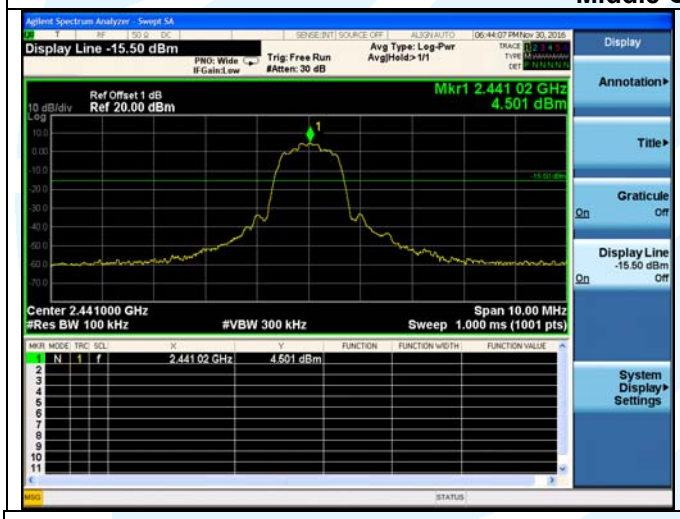
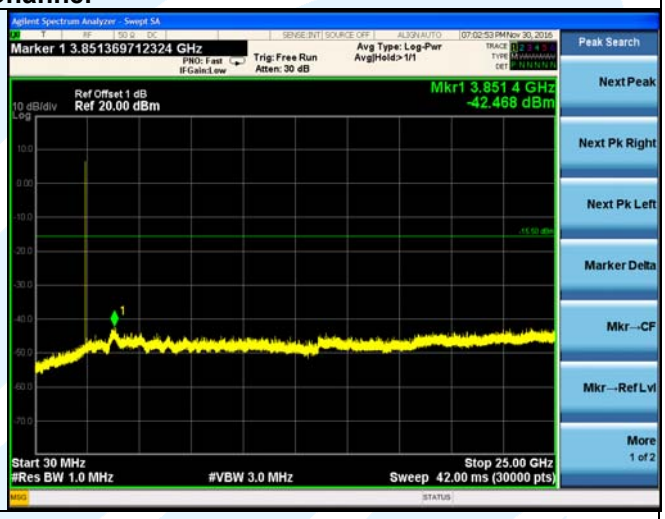
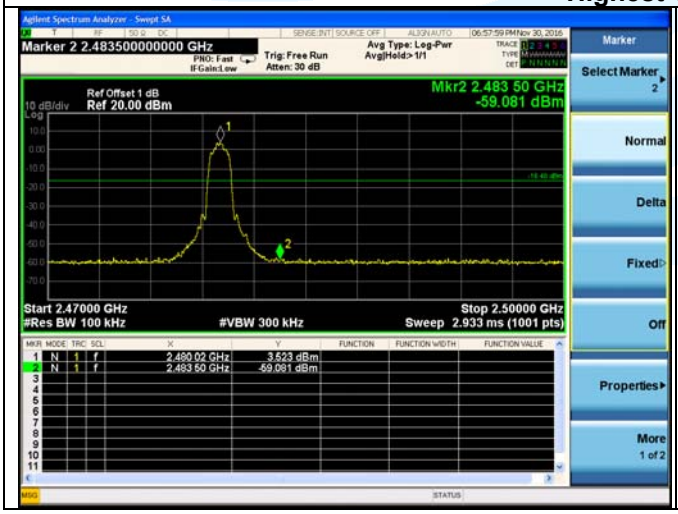
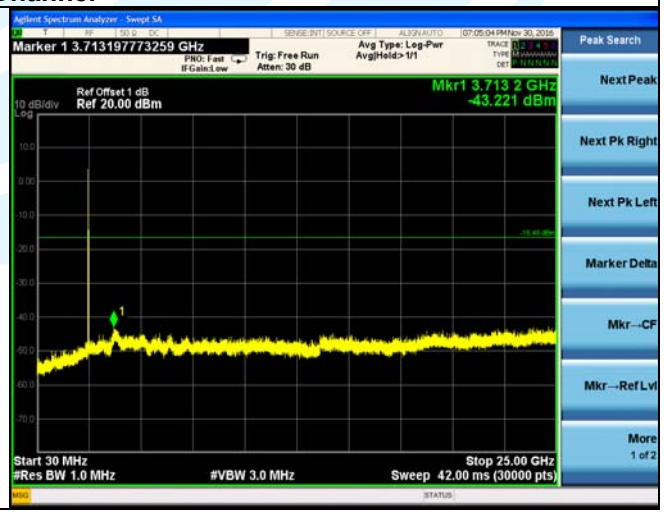



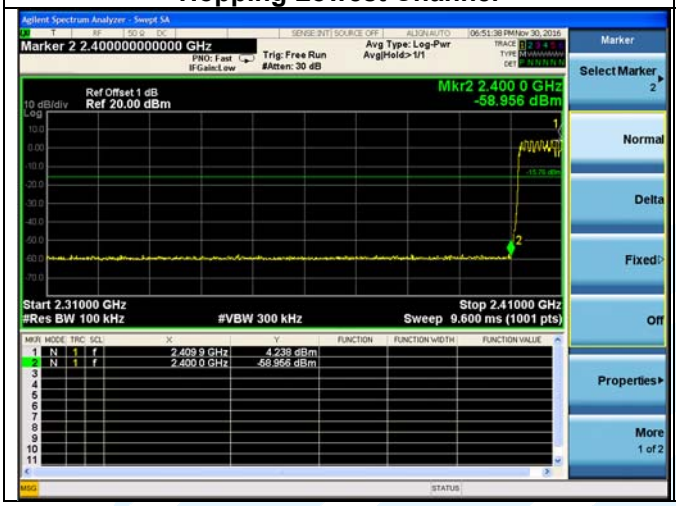
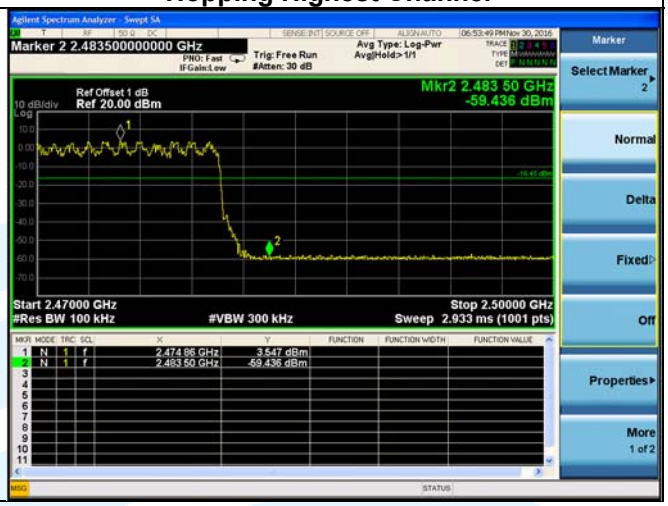

**Hopping Lowest Channel**




**Hopping Highest Channel**



| 8DPSK_3-DH1 | |
|---|---|
| **In-Band Reference Level** | **Out of Band Emission** |
| **Lowest Channel** | |
|  |  |
| **Middle Channel** | |
|  |  |
| **Highest Channel** | |
|  |  |

| Hopping Lowest Channel | Hopping Highest Channel |
| --- | --- |
|  |  |

## 5.9 Radiated Spurious Emissions

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.205/15.209

**Test Method:** DA 00-705

**Limit:**

| Frequency | Field strength (microvolt/meter) | Limit (dBμV/m) | Remark | Measurement distance (m) |
|---|---|---|---|---|
| 0.009MHz-0.490MHz | 2400/F(kHz) | - | - | 300 |
| 0.490MHz-1.705MHz | 24000/F(kHz) | - | - | 30 |
| 1.705MHz-30MHz | 30 | - | - | 30 |
| 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| Above 1GHz | 500 | 54.0 | Average | 3 |

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

The emissions were measured using the following resolution bandwidths:

| Frequency | Detector | RBW | VBW | Remark |
|---|---|---|---|---|
| 0.009MHz-0.090MHz | Peak | 10kHz | 30kHz | Peak |
| 0.009MHz-0.090MHz | Average | 10kHz | 30kHz | Average |
| 0.090MHz-0.110MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| 0.110MHz-0.490MHz | Peak | 10kHz | 30kHz | Peak |
| 0.110MHz-0.490MHz | Average | 10kHz | 30kHz | Average |
| 0.490MHz -30MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| 30MHz-1GHz | Quasi-peak | 100 kHz | 300kHz | Quasi-peak |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | Peak | 1MHz | 10Hz | Average |

Harmonic and Spurious emissions that were identified as coming from the EUT were checked in Peak and in Average Mode. The high frequency, which started from 10 to26.5GHz.

Peak measurements and average measurements are made. All emissions were determined to have a peak-to-average ratio of less than 20dB.

**Test Procedure:**

**Below 1GHz test procedure as below:**

a) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both

horizontal and vertical polarizations of the antenna are set to make the measurement.

d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable was turned from 0 degrees to 360 degrees to find the maximum reading.

e) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f) Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel

**Above 1GHz test procedure as below:**

g) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber change form table 0.8 meter to 1.5 meter( Above 18GHz the distance is 1 meter and table is 1.5 meter).

h) Test the EUT in the lowest channel , the Highest channel

i) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.

j) Repeat above procedures until all frequencies measured was complete.

| | |
|---|---|
| **Test Setup:** | Refer to section 4.1.2 for details. |
| **Instruments Used:** | Refer to section 3 for details |
| **Test Mode:** | Transmitter mode |
| **Test Results:** | Pass |

### 5.9.1 Radiated Emission Test Data (9 KHz ~ 30MHz)

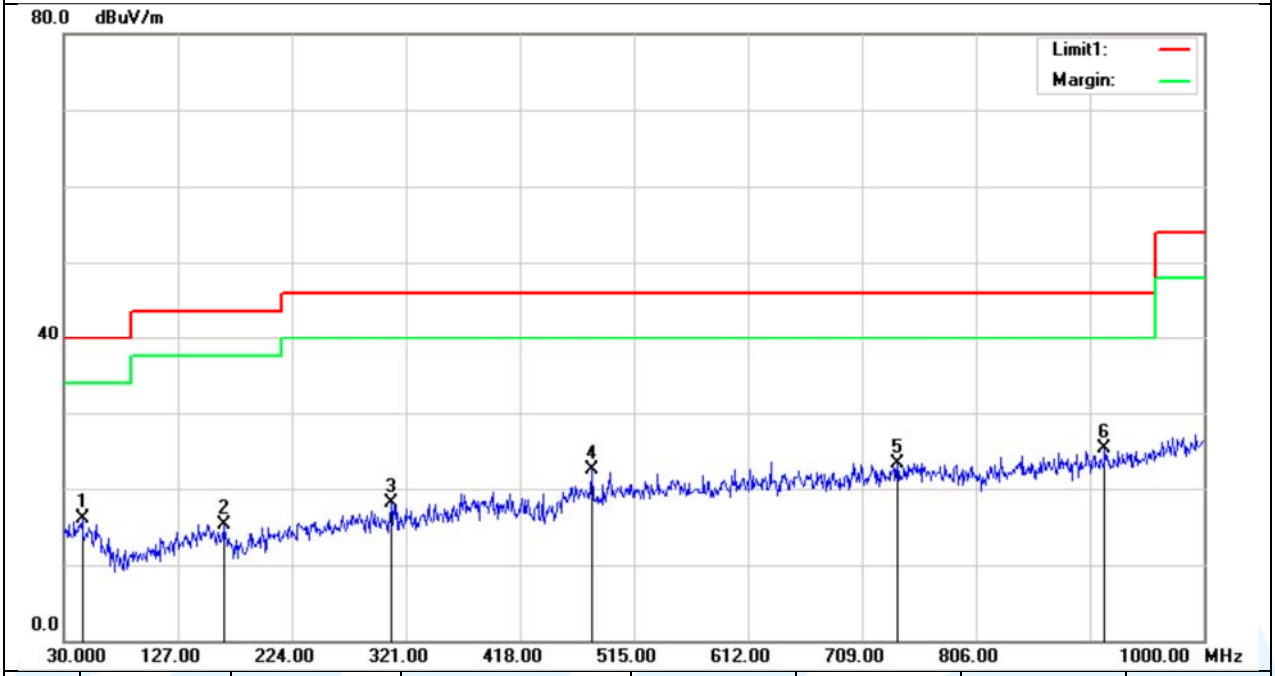
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

### 5.9.2 Radiated Emission Test Data (Above 18 GHz)

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

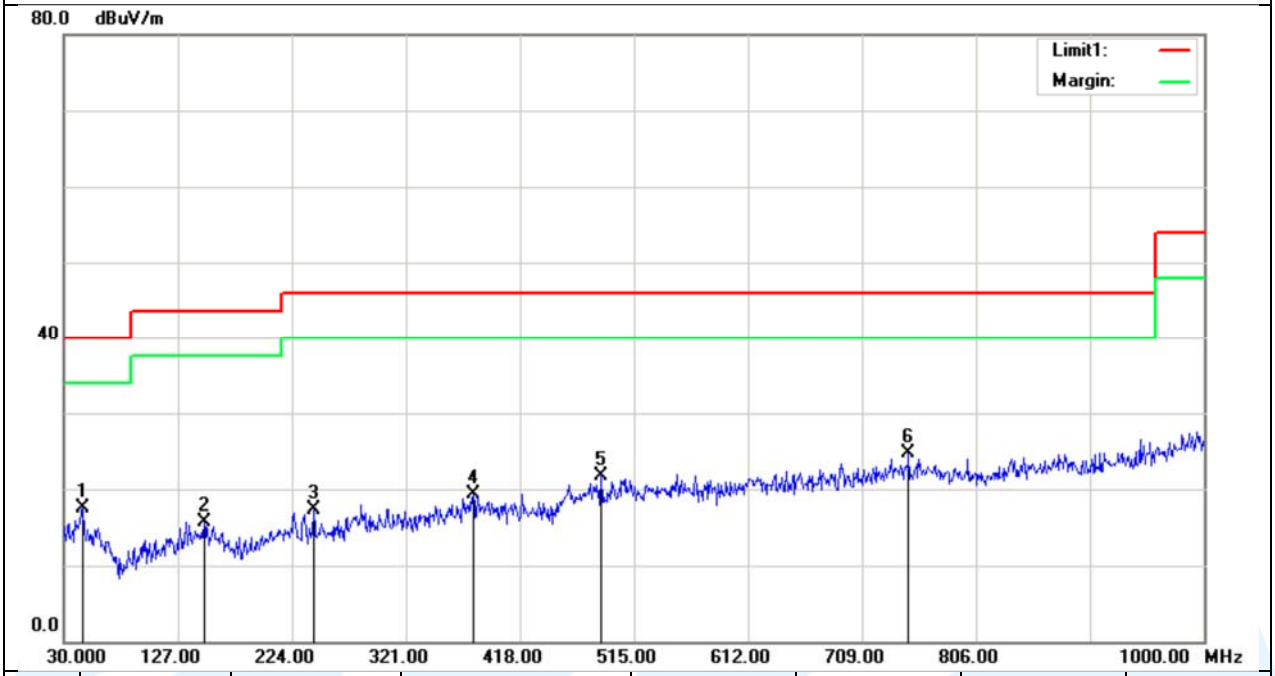
### 5.9.3 Radiated Emission Test Data (30MHz ~ 1 GHz Worst Case)

**Horizontal**




| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 45.5200 | 27.90 | -11.83 | 16.07 | 40.00 | -23.93 | Qp |
| 2 | 165.8000 | 27.69 | -12.34 | 15.35 | 43.50 | -28.15 | Qp |
| 3 | 308.3900 | 28.01 | -9.96 | 18.05 | 46.00 | -27.95 | Qp |
| 4 | 479.1100 | 29.79 | -7.32 | 22.47 | 46.00 | -23.53 | Qp |
| 5 | 739.0700 | 26.97 | -3.61 | 23.36 | 46.00 | -22.64 | Qp |
| 6* | 915.6100 | 27.25 | -2.00 | 25.25 | 46.00 | -20.75 | Qp |

**Vertical**




| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 46.4900 | 29.38 | -11.93 | 17.45 | 40.00 | -22.55 | Qp |
| 2 | 149.3100 | 27.56 | -11.87 | 15.69 | 43.50 | -27.81 | Qp |
| 3 | 242.4300 | 28.25 | -10.87 | 17.38 | 46.00 | -28.62 | Qp |
| 4 | 378.2300 | 27.71 | -8.40 | 19.31 | 46.00 | -26.69 | Qp |
| 5 | 486.8700 | 28.97 | -7.17 | 21.80 | 46.00 | -24.20 | Qp |
| 6* | 748.7700 | 28.17 | -3.52 | 24.65 | 46.00 | -21.35 | Qp |

### 5.9.4 Radiated Emission Test Data (1GHz ~ 18GHz)

| Tx_2402 MHz | | | | | | |
|---|---|---|---|---|---|---|
| .No. | Frequency (MHz) | Result (dBuV) | Limit (dBuV/m) | Margin (dB) | Remark | Ant. Polar. |
| 1 | 4804.0000 | 42.11 | 74 | -31.89 | Peak | Horizontal |
| 2 | 4804.0000 | 31.01 | 54 | -22.99 | Average | Horizontal |
| 3 | 7206.0000 | 46.32 | 74 | -27.68 | Peak | Horizontal |
| 4 | 7206.0000 | 34.57 | 54 | -19.43 | Average | Horizontal |
| 5 | 4804.0000 | 41.39 | 74 | -32.61 | Peak | Vertical |
| 6 | 4804.0000 | 30.25 | 54 | -23.75 | Average | Vertical |
| 7 | 7206.0000 | 45.46 | 74 | -28.54 | Peak | Vertical |
| 8 | 7206.0000 | 33.88 | 54 | -20.12 | Average | Vertical |

| Tx_2441 MHz | | | | | | |
|---|---|---|---|---|---|---|
| .No. | Frequency (MHz) | Result (dBuV) | Limit (dBuV/m) | Margin (dB) | Remark | Ant. Polar. |
| 1 | 4882.0000 | 42.93 | 74 | -31.07 | Peak | Horizontal |
| 2 | 4882.0000 | 31.21 | 54 | -22.79 | Average | Horizontal |
| 3 | 7323.0000 | 46.42 | 74 | -27.58 | Peak | Horizontal |
| 4 | 7323.0000 | 34.82 | 54 | -19.18 | Average | Horizontal |
| 5 | 4882.0000 | 42.1 | 74 | -31.9 | Peak | Vertical |
| 6 | 4882.0000 | 30.21 | 54 | -23.79 | Average | Vertical |
| 7 | 7323.0000 | 45.69 | 74 | -28.31 | Peak | Vertical |
| 8 | 7323.0000 | 33.62 | 54 | -20.38 | Average | Vertical |

| Tx_2480 MHz | | | | | | |
|---|---|---|---|---|---|---|
| .No. | Frequency (MHz) | Result (dBuV) | Limit (dBuV/m) | Margin (dB) | Remark | Ant. Polar. |
| 1 | 4960.0000 | 43.06 | 74 | -30.94 | Peak | Horizontal |
| 2 | 4960.0000 | 31.23 | 54 | -22.77 | Average | Horizontal |
| 3 | 7440.0000 | 46.62 | 74 | -27.38 | Peak | Horizontal |
| 4 | 7440.0000 | 34.2 | 54 | -19.8 | Average | Horizontal |
| 5 | 4960.0000 | 42.53 | 74 | -31.47 | Peak | Vertical |
| 6 | 4960.0000 | 30.66 | 54 | -23.34 | Average | Vertical |
| 7 | 7440.0000 | 44.7 | 74 | -29.3 | Peak | Vertical |
| 8 | 7440.0000 | 32.98 | 54 | -21.02 | Average | Vertical |

**Remark:**
Scan from 9 kHz to 25GHz, the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

## 5.10 Band Edge Measurements (Radiated)

**Test Requirement:** FCC 47 CFR Part 15 Subpart C Section 15.205/15.209

**Test Method:** DA 00-705

**Limit:**

| Frequency | Limit (dBμV/m @3m) | Remark |
|---|---|---|
| 30MHz-88MHz | 40.0 | Quasi-peak Value |
| 88MHz-216MHz | 43.5 | Quasi-peak Value |
| 216MHz-960MHz | 46.0 | Quasi-peak Value |
| 960MHz-1GHz | 54.0 | Quasi-peak Value |
| Above 1GHz | 54.0 | Average Value |
| | 74.0 | Peak Value |

**Test Procedure:** Radiated band edge measurements at 2390MHz and 2483MHz were made with the unit transmitting in the low end of the channel range and the high end closest to the restricted bands respectively. The emissions were made on the 966 Semi-Chamber. Use (resolution bandwidth (RBW) = 1 MHz, video bandwidth (VBW) = 3 MHz for peak levels and RBW = 1 MHz and VBW = 10 Hz or 1/T for average levels).

1. Use radiated spurious emission test procedure described in 5.9 clause. The transmitter output (antenna port) was connected to the test receiver.
2. Set the PK and AV limit line.
3. Record the fundamental emission and emissions out of the band-edge.
4. Determine band-edge compliance as required.

**Test Setup:** Refer to section 4.1.2 for details.

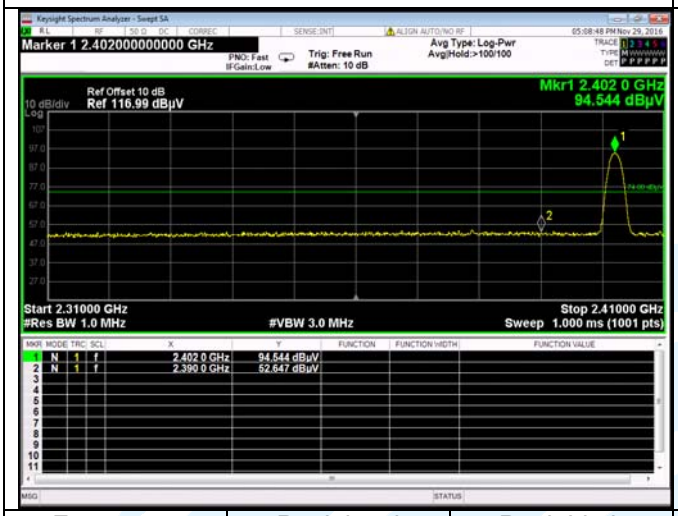
**Instruments Used:** Refer to section 3 for details

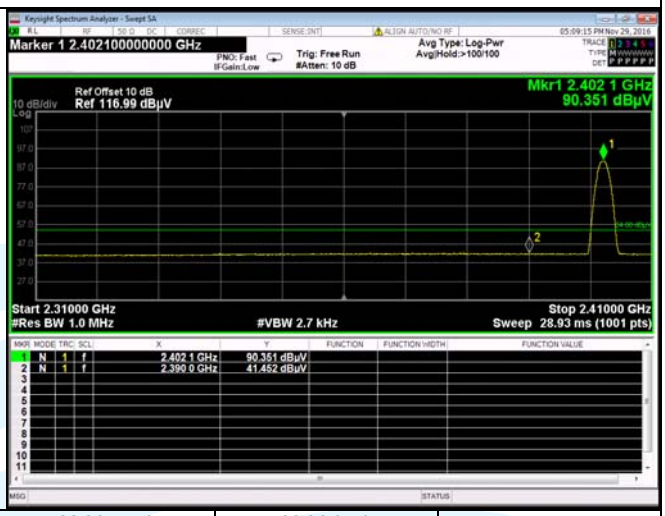
**Test Mode:** Transmitter mode

**Test Results:** Pass

**Test Data:**

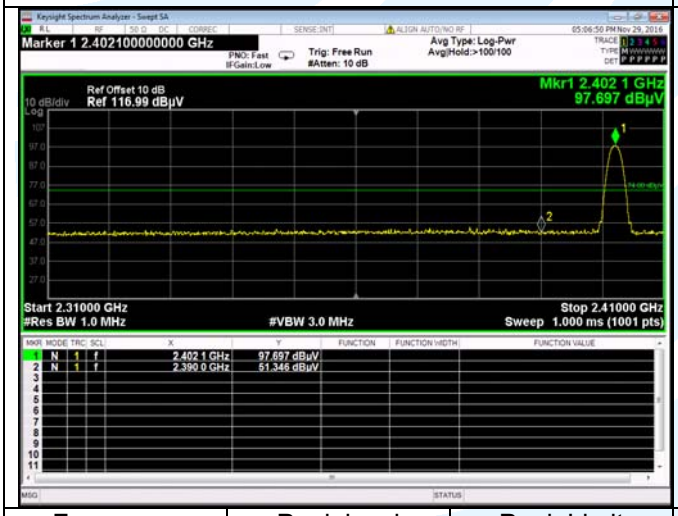
| Frequency (MHz) | 2402 | Ant. Polar. | Horizontal |
|---|---|---|---|
| Detector: Peak | | Detector: AV | |

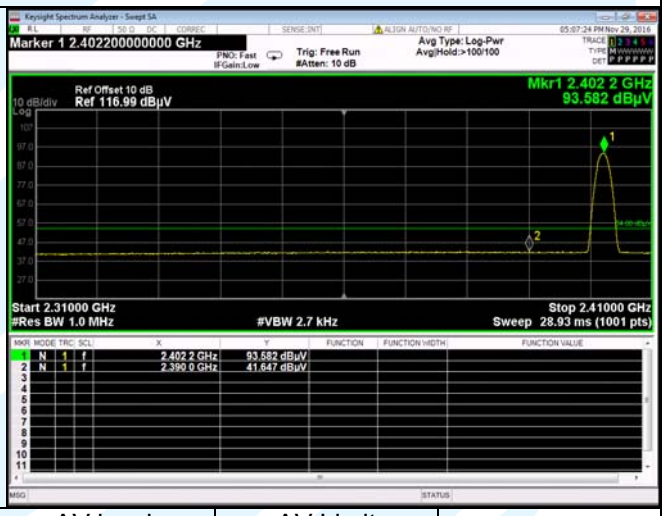



| Frequency (MHz) | Peak level (dBuv/m) | Peak Limit (dBuv/m) | AV level (dBuv/m) | AV Limit (dBuv/m) | Conclusion |
|---|---|---|---|---|---|
| 2390 | 52.647 | 74 | 41.452 | 54 | Pass |

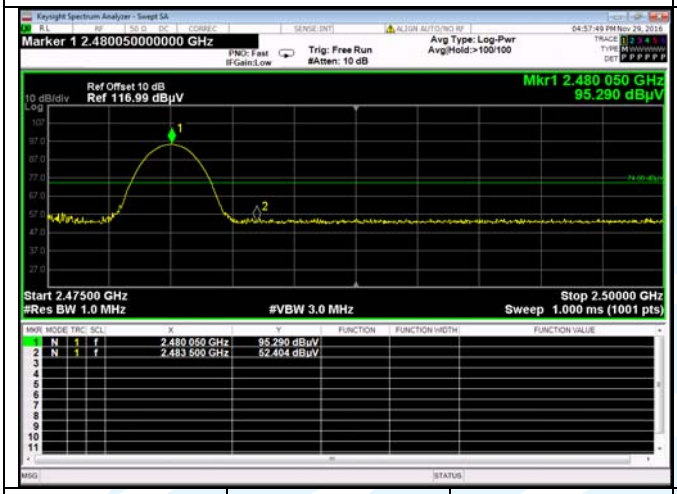
| Frequency (MHz) | 2402 | Ant. Polar. | Vertical |
|---|---|---|---|
| Detector: Peak | | Detector: AV | |

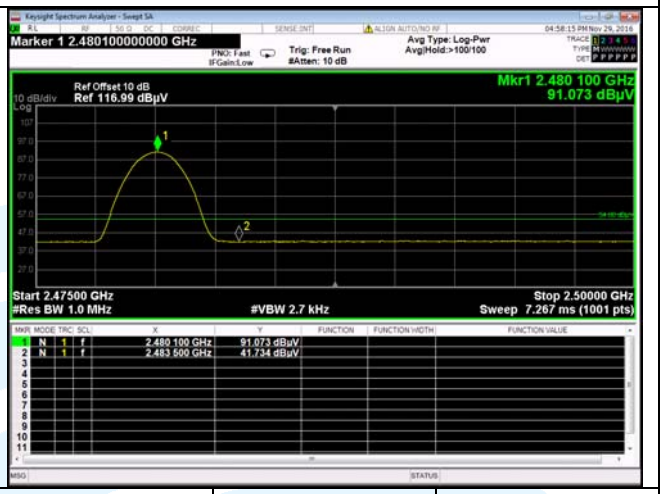



| Frequency (MHz) | Peak level (dBuv/m) | Peak Limit (dBuv/m) | AV level (dBuv/m) | AV Limit (dBuv/m) | Conclusion |
|---|---|---|---|---|---|
| 2390 | 51.346 | 74 | 41.647 | 54 | Pass |

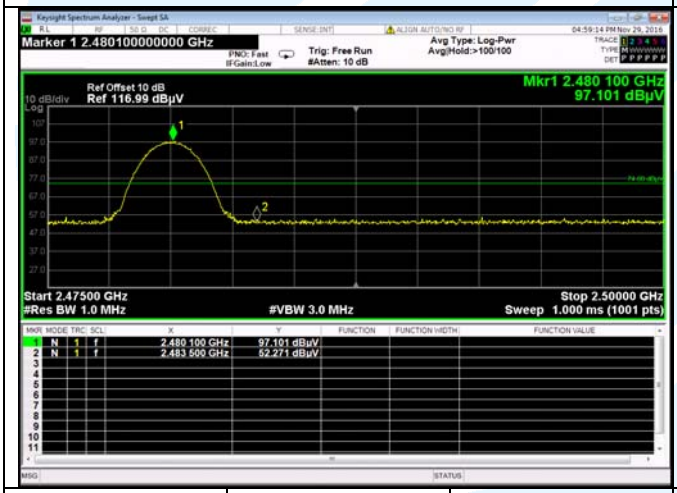
| Frequency (MHz) | 2480 | Ant. Polar. | Horizontal |
|---|---|---|---|
| Detector: Peak | | Detector: AV | |

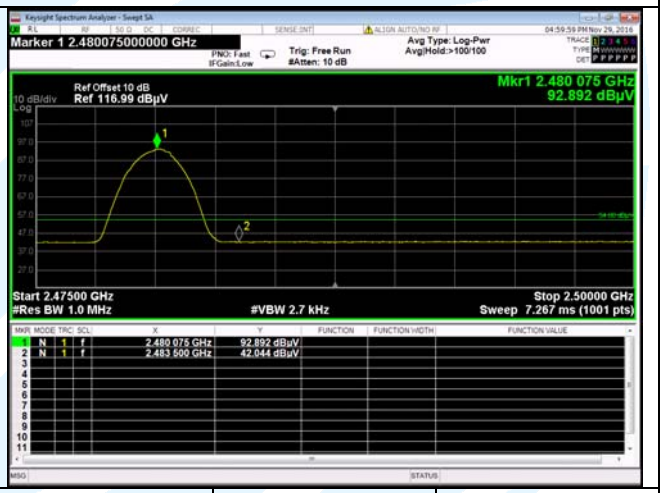



| Frequency (MHz) | Peak level (dBuv/m) | Peak Limit (dBuv/m) | AV level (dBuv/m) | AV Limit (dBuv/m) | Conclusion |
|---|---|---|---|---|---|
| 2483.5 | 52.404 | 74 | 41.734 | 54 | Pass |

| Frequency (MHz) | 2480 | Ant. Polar. | Vertical |
|---|---|---|---|
| Detector: Peak | | Detector: AV | |




| Frequency (MHz) | Peak level (dBuv/m) | Peak Limit (dBuv/m) | AV level (dBuv/m) | AV Limit (dBuv/m) | Conclusion |
|---|---|---|---|---|---|
| 2483.5 | 52.271 | 74 | 42.044 | 54 | Pass |

## 5.11 Conducted Emissions

**Test Requirement:** 47 CFR Part 15C Section 15.207
**Test Method:** ANSI C63.10
**Test Frequency Range:** 150KHz to 30MHz
**Limit:**

| Frequency range (MHz) | Limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

NOTE : The lower limit is applicable at the transition frequency

**Test Procedure:** Test frequency range :150KHz-30MHz

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

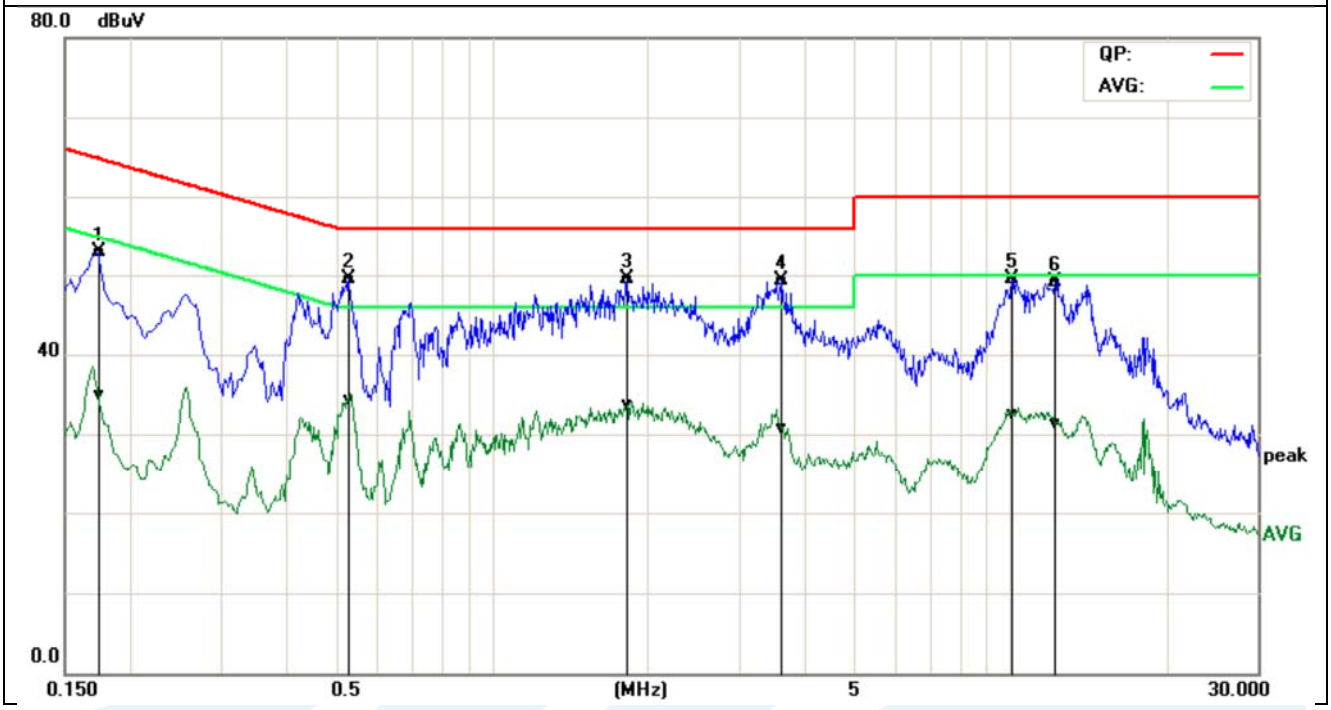
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

**Test Setup:** Refer to section 4.1.3 for details.
**Instruments Used:** Refer to section 3 for details
**Test Mode:** Transmitter mode
**Test Results:** Pass

**Measurement Data**
An initial pre-scan was performed on the live and neutral lines with peak detector.
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

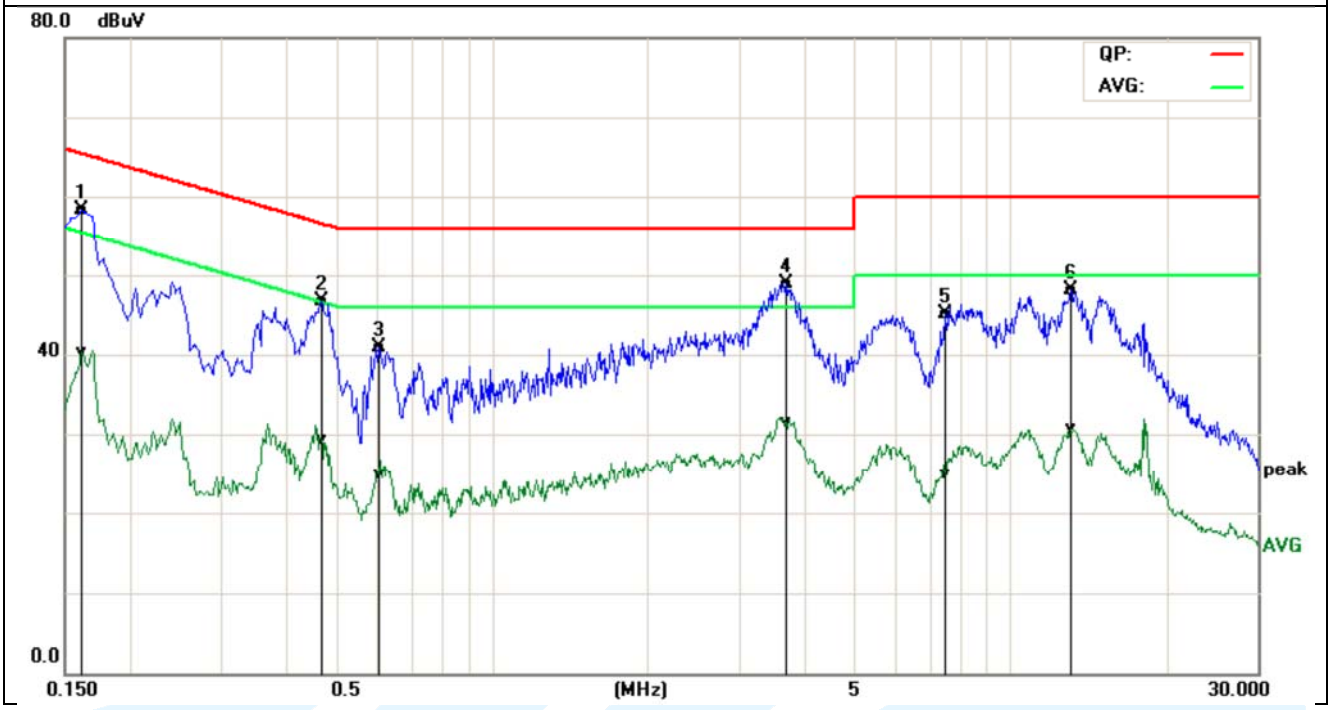
**Test plot as follows:**

**Live Line**




| No. | Frequency | QuasiPeak reading | Average reading | Correction factor | QuasiPeak result | Average result | QuasiPeak limit | Average limit | QuasiPeak margin | Average margin | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dBuV) | (dB) | (dBuV) | (dBuV) | (dBuV) | (dBuV) | (dB) | (dB) | |
| 1P | 0.1740 | 33.30 | 15.31 | 19.58 | 52.88 | 34.89 | 64.76 | 54.77 | -11.88 | -19.88 | Pass |
| 2P | 0.5299 | 29.88 | 14.70 | 19.65 | 49.53 | 34.35 | 56.00 | 46.00 | -6.47 | -11.65 | Pass |
| 3* | 1.8220 | 29.84 | 13.91 | 19.71 | 49.55 | 33.62 | 56.00 | 46.00 | -6.45 | -12.38 | Pass |
| 4P | 3.6340 | 29.63 | 11.08 | 19.68 | 49.31 | 30.76 | 56.00 | 46.00 | -6.69 | -15.24 | Pass |
| 5P | 10.1220 | 29.39 | 12.41 | 20.14 | 49.53 | 32.55 | 60.00 | 50.00 | -10.47 | -17.45 | Pass |
| 6P | 12.2100 | 28.97 | 11.34 | 20.04 | 49.01 | 31.38 | 60.00 | 50.00 | -10.99 | -18.62 | Pass |

**Neutral Line**




| No. | Frequency | QuasiPeak reading | Average reading | Correction factor | QuasiPeak result | Average result | QuasiPeak limit | Average limit | QuasiPeak margin | Average margin | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dBuV) | (dB) | (dBuV) | (dBuV) | (dBuV) | (dBuV) | (dB) | (dB) | |
| 1P | 0.1620 | 38.54 | 20.61 | 19.72 | 58.26 | 40.33 | 65.36 | 55.36 | -7.10 | -15.03 | Pass |
| 2P | 0.4700 | 27.12 | 9.63 | 19.64 | 46.76 | 29.27 | 56.51 | 46.51 | -9.75 | -17.24 | Pass |
| 3P | 0.6060 | 21.14 | 5.29 | 19.67 | 40.81 | 24.96 | 56.00 | 46.00 | -15.19 | -21.04 | Pass |
| 4* | 3.7020 | 29.26 | 11.76 | 19.73 | 48.99 | 31.49 | 56.00 | 46.00 | -7.01 | -14.51 | Pass |
| 5P | 7.4940 | 25.30 | 5.11 | 19.80 | 45.10 | 24.91 | 60.00 | 50.00 | -14.90 | -25.09 | Pass |
| 6P | 13.1220 | 28.31 | 10.84 | 19.88 | 48.19 | 30.72 | 60.00 | 50.00 | -11.81 | -19.28 | Pass |

# APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

See test photographs attached in Appendix 1 for the actual connections between Product and support equipment.

# APPENDIX 2 PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photographs.

*** End of Report ***