# TEST REPORT

| | | |
|---|---|---|
| **Report Reference No. ..... :** | **TRE1709012701** | R/C…….: 65656 |
| **FCC ID ..... :** | **2AN36-FWS222** | |
| **Applicant's name ..... :** | **CVICLOUD CORPORATION** | |
| Address.....: | 9F., No.11, Lane 3, Sec.1, Chung-Cheng East Road, Tamsui, New Taipei City 25147, Taiwan | |
| Manufacturer.....: | CviLux Corporation | |
| Address.....: | 9F., No.9, Lane 3, Sec.1, Chung-Cheng East Road, Tamsui, New Taipei City 25147, Taiwan | |
| **Test item description ..... :** | **BBE PLUS Portable 3D Waterproof Bluetooth speaker** | |
| Trade Mark .....: | O'pro9 | |
| Model/Type reference.....: | FWS222 | |
| Listed Model(s) .....: | FWS222-XX-XXX(where X can be 0~9,A~Z or blank) | |
| **Standard ..... :** | **FCC CFR Title 47 Part 15 Subpart C Section 15.247** | |
| Date of receipt of test sample……....: | Sept. 15, 2017 | |
| Date of testing……..: | Sept. 15, 2017 - Oct. 23, 2017 | |
| Date of issue……....: | Oct. 23, 2017 | |
| **Result..... ……..:** | **PASS** | |

| | | |
|---|---|---|
| Compiled by ( Position+Printed name+Signature): | File administrators Becky Liang | Becky Liang |
| Supervised by (Position+Printed name+Signature): | Project Engineer Jeff Sun | Jeff Sun |
| Approved by (Position+Printed name+Signature): | RF Manager Hans Hu | Hans Hu |

| | |
|---|---|
| **Testing Laboratory Name ..... :** | **Shenzhen Huatongwei International Inspection Co., Ltd.** |
| Address.....: | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China |

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*The test report merely correspond to the test sample.*

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# 1. TEST STANDARDS AND REPORT VERSION

## 1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10-2013: American National Standard forTesting Unlicensed Wireless Devicese

## 1.2. Report version

| Version No. | Date of issue | Description |
|---|---|---|
| 00 | Oct. 23, 2017 | Original |
| | | |
| | | |
| | | |
| | | |

# 2. TEST DESCRIPTION

| Test Item | Section in CFR 47 | Result | Test Engineer |
|---|---|---|---|
| Antenna Requirement | 15.203/15.247 (c) | Pass | William Wang |
| AC Power Line Conducted Emissions | 15.207 | Pass | William Wang |
| Conducted Peak Output Power | 15.247 (b)(1) | Pass | William Wang |
| 20 dB Bandwidth | 15.247 (a)(1) | Pass | William Wang |
| Carrier Frequencies Separation | 15.247 (a)(1) | Pass | William Wang |
| Hopping Channel Number | 15.247 (a)(1) | Pass | William Wang |
| Dwell Time | 15.247 (a)(1) | Pass | William Wang |
| Pseudorandom Frequency Hopping Sequence | 15.247(b)(4) | Pass | William Wang |
| Restricted band | 15.247(d)/15.205 | Pass | William Wang |
| Radiated Emissions | 15.247(d)/15.209 | Pass | William Wang |

Note: The measurement uncertainty is not included in the test result.

# 3. SUMMARY

## 3.1. Client Information

| | |
|---|---|
| Applicant: | CVICLOUD CORPORATION |
| Address: | 9F., No.11, Lane 3, Sec.1, Chung-Cheng East Road, Tamsui, New Taipei City 25147, Taiwan |
| Manufacturer: | CviLux Corporation |
| Address: | 9F., No.9, Lane 3, Sec.1, Chung-Cheng East Road, Tamsui, New Taipei City 25147, Taiwan |

## 3.2. Product Description

| | |
|---|---|
| Name of EUT: | BBE PLUS Portable 3D Waterproof Bluetooth speaker |
| Trade Mark: | O'pro9 |
| Model/Type reference: | FWS222 |
| Listed Model(s): | FWS222-XX-XXX(where X can be 0~9,A~Z or blank) |
| Power supply: | DC 5V from USB port (internal battery 3.7V) |
| Adapter information: | - |
| Hardware version: | V1.1 |
| Software version: | V1.3 |
| **Bluetooth** | |
| Version: | Supported BT4.2+EDR |
| Modulation: | GFSK, π/4DQPSK, 8DPSK |
| Operation frequency: | 2402MHz~2480MHz |
| Channel number: | 79 |
| Channel separation: | 1MHz |
| Antenna type: | Integral Antenna |
| Antenna gain: | 0.50 dBi |

## 3.3. Operation state

➢ **Test frequency list**

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

| Channel | Frequency (MHz) |
|---|---|
| 00 | 2402 |
| 01 | 2403 |
| ⋮ | ⋮ |
| 39 | 2441 |
| ⋮ | ⋮ |
| 77 | 2479 |
| 78 | 2480 |

➢ **TEST MODE**

| |
|---|
| For RF test items: |
| The engineering test program was provided and enabled to make EUT continuous transmit |
| For AC power line conducted emissions: |
| The EUT was set to connect with the Bluetooth instrument under large package sizes transmission. |
| For Radiated suprious emissions test item: |
| The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data recorded in the report. |

## 3.4. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| | / | Manufacturer: | / |
| | | Model No.: | / |
| | / | Manufacturer: | / |
| | | Model No.: | / |

## 3.5. Modifications

No modifications were implemented to meet testing criteria.

# 4. TEST ENVIRONMENT

## 4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

## 4.2. Test Facility

**CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

**A2LA-Lab Cert. No.: 3902.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory 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-Registration No.: 762235**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

**IC-Registration No.:5377B-1**

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377B-1.

**ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

## 4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

| | |
|---|---|
| Temperature: | 15~35°C |
| Relative Humidity: | 30~60 % |
| Air Pressure: | 950~1050mba |

## 4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1” and TR-100028-02 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2” and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

| Test Items | Measurement Uncertainty | Notes |
|---|---|---|
| Transmitter power conducted | 0.57 dB | (1) |
| Transmitter power Radiated | 2.20 dB | (1) |
| Conducted spurious emissions 9kHz~40GHz | 1.60 dB | (1) |
| Radiated spurious emissions 9kHz~40GHz | 2.20 dB | (1) |
| Conducted Emissions 9kHz~30MHz | 3.39 dB | (1) |
| Radiated Emissions 30~1000MHz | 4.24 dB | (1) |
| Radiated Emissions 1~18GHz | 5.16 dB | (1) |
| Radiated Emissions 18~40GHz | 5.54 dB | (1) |
| Occupied Bandwidth | --------- | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## 4.5. Equipments Used during the Test

| Conducted Emissions | | | | | |
|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. |
| 1 | Artificial Mains | Rohde&Schwarz | ESH2-Z5 | 100028 | 2016/11/13 |
| 2 | EMI Test Receiver | Rohde&Schwarz | ESCI3 | 100038 | 2016/11/13 |
| 3 | Pulse Limiter | Rohde&Schwarz | ESHSZ2 | 100044 | 2016/11/13 |
| 4 | EMI Test Software | Rohde&Schwarz | ES-K1 V1.71 | - | - |

| Radiated Emissions | | | | | |
|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. |
| 1 | EMI test receiver | Rohde&Schwarz | ESI 26 | 100009 | 2016/11/13 |
| 2 | Loop Antenna | Rohde&Schwarz | HFH2-Z2 | 100020 | 2016/11/13 |
| 3 | Ultra-Broadband Antenna | ShwarzBeck | VULB9163 | 538 | 2016/11/13 |
| 4 | Horn antenna | ShwarzBeck | 9120D | 1011 | 2016/11/13 |
| 5 | Horn Antenna | SCHWARZBECK | BBHA9170 | 25841 | 2016/11/13 |
| 6 | Amplifier | Sonoma | 310N | E009-13 | 2016/11/13 |
| 7 | JS Amplifier | Rohde&Schwarz | JS4-00101800-28-5A | F201504 | 2016/11/13 |
| 8 | Amplifier | Compliance Direction systems | PAP1-4060 | 120 | 2016/11/13 |
| 9 | High pass filter | Compliance Direction systems | BSU-6 | 34202 | 2016/11/13 |
| 10 | EMI test Software | Rohde&Schwarz | ESK1 | - | - |
| 11 | EMI test Software | Audix | E3 | - | - |
| 12 | TURNTABLE | MATURO | TT2.0 | - | - |
| 13 | ANTENNA MAST | MATURO | TAM-4.0-P | - | - |

| RF Conducted methods | | | | | |
|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. |
| 1 | Spectrum Analyzer | Rohde&Schwarz | FSP | 1164.4391.40 | 2016/11/13 |
| 2 | MXA Signal Analyzer | Agilent Technologies | N9020A | MY5050187 | 2016/11/13 |

The Cal.Interval was one year.

# 5. TEST CONDITIONS AND RESULTS

## 5.1. Antenna requirement

**Requirement**

**FCC CFR Title 47 Part 15 Subpart C Section 15.203:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of anantenna 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.

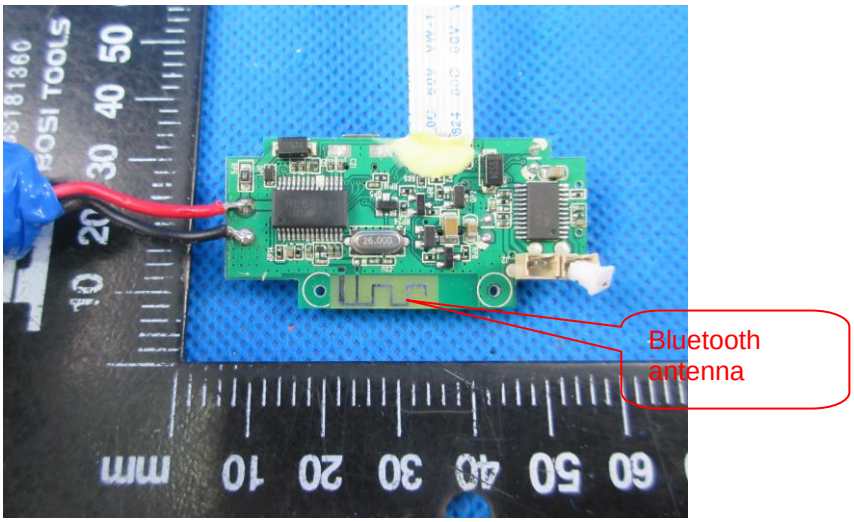
**FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):**

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

**Test Result:**

☒ **Passed** ☐ **Not Applicable**

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



## 5.2. Conducted Emissions (AC Main)

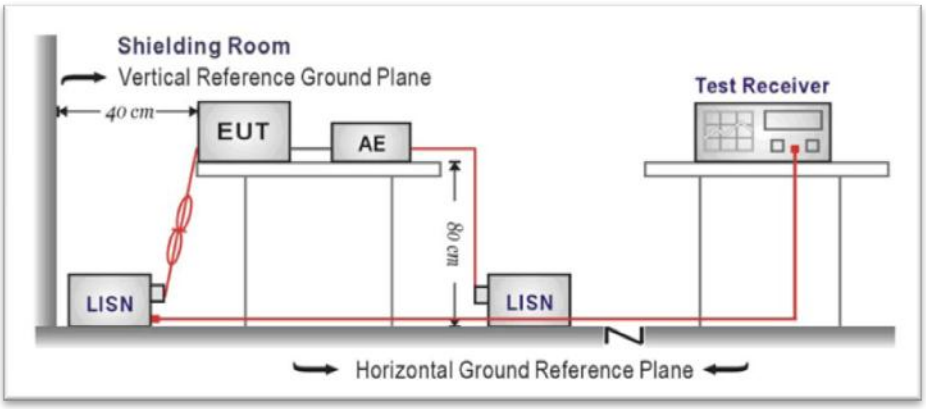
**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.207

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

* Decreases with the logarithm of the frequency.

**TEST CONFIGURATION**




**TEST PROCEDURE**

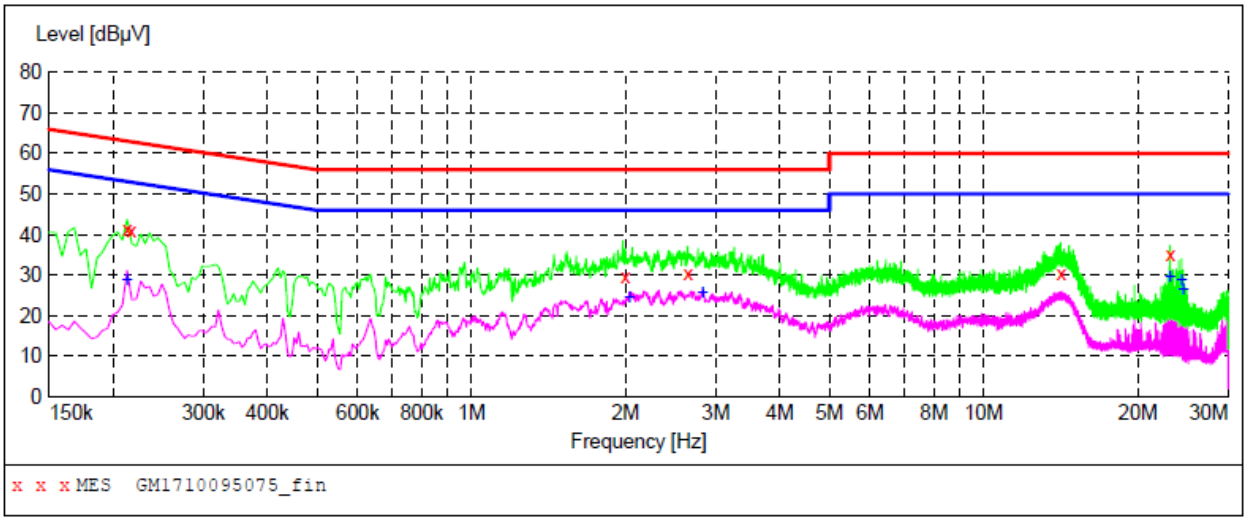
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor,was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Note:
1) Transd= Cable lose + Pulse Limiter Factor + Artificial Mains Factor
2) Margin= Limit - Level

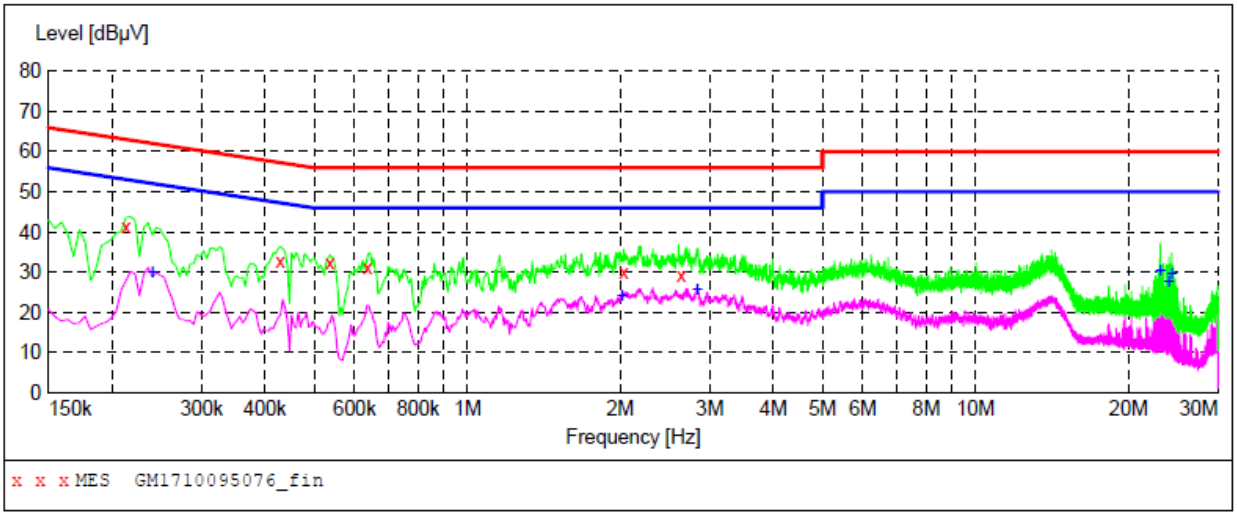
| Test Line: | L |
|---|---|




| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.213000 | 41.50 | 10.3 | 63 | 21.6 | QP | L1 | GND |
| 0.217500 | 41.10 | 10.3 | 63 | 21.8 | QP | L1 | GND |
| 1.999500 | 29.80 | 10.2 | 56 | 26.2 | QP | L1 | GND |
| 2.652000 | 30.30 | 10.2 | 56 | 25.7 | QP | L1 | GND |
| 14.167500 | 30.50 | 10.5 | 60 | 29.5 | QP | L1 | GND |
| 23.127000 | 35.20 | 10.7 | 60 | 24.8 | QP | L1 | GND |

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.213000 | 29.00 | 10.3 | 53 | 24.1 | AV | L1 | GND |
| 2.035500 | 24.50 | 10.2 | 46 | 21.5 | AV | L1 | GND |
| 2.827500 | 25.70 | 10.2 | 46 | 20.3 | AV | L1 | GND |
| 23.127000 | 29.60 | 10.7 | 50 | 20.4 | AV | L1 | GND |
| 24.346500 | 28.90 | 10.7 | 50 | 21.1 | AV | L1 | GND |
| 24.531000 | 26.60 | 10.7 | 50 | 23.4 | AV | L1 | GND |

| Test Line: | N |
|---|---|




| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.213000 | 41.30 | 10.3 | 63 | 21.8 | QP | N | GND |
| 0.429000 | 32.70 | 10.2 | 57 | 24.6 | QP | N | GND |
| 0.537000 | 32.20 | 10.2 | 56 | 23.8 | QP | N | GND |
| 0.636000 | 31.20 | 10.2 | 56 | 24.8 | QP | N | GND |
| 2.031000 | 30.10 | 10.2 | 56 | 25.9 | QP | N | GND |
| 2.638500 | 29.20 | 10.2 | 56 | 26.8 | QP | N | GND |

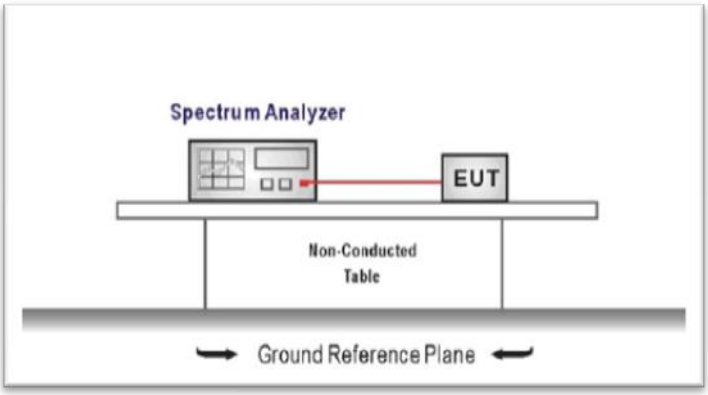
| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.240000 | 30.00 | 10.3 | 52 | 22.1 | AV | N | GND |
| 2.017500 | 24.00 | 10.2 | 46 | 22.0 | AV | N | GND |
| 2.832000 | 25.60 | 10.2 | 46 | 20.4 | AV | N | GND |
| 23.127000 | 30.30 | 10.7 | 50 | 19.7 | AV | N | GND |
| 24.040500 | 27.70 | 10.7 | 50 | 22.3 | AV | N | GND |
| 24.346500 | 29.50 | 10.7 | 50 | 20.5 | AV | N | GND |

## 5.3. Conducted Peak Output Power

**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW≥ the 20 dB bandwidth of the emission being measured, VBW≥RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

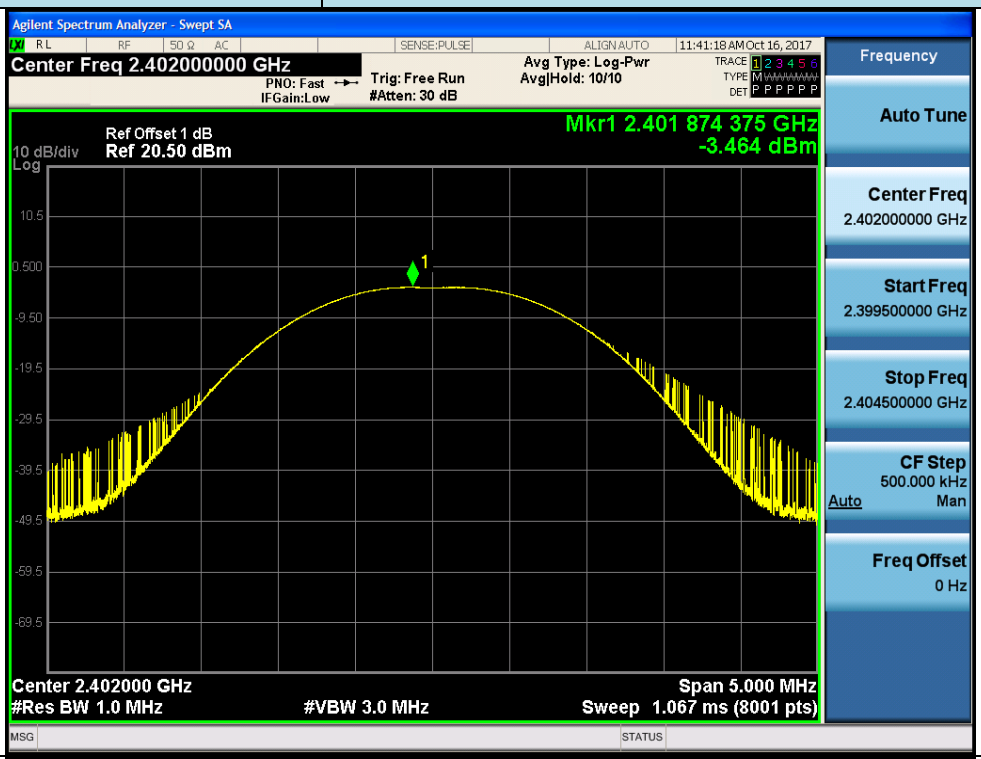
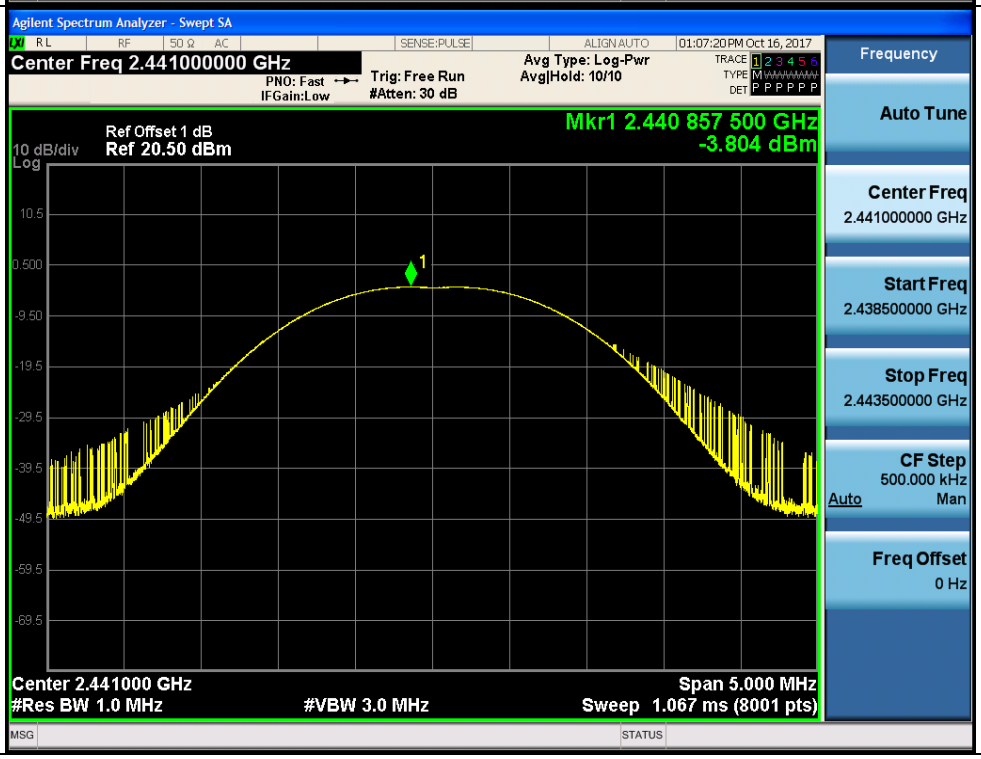
**TEST MODE:**

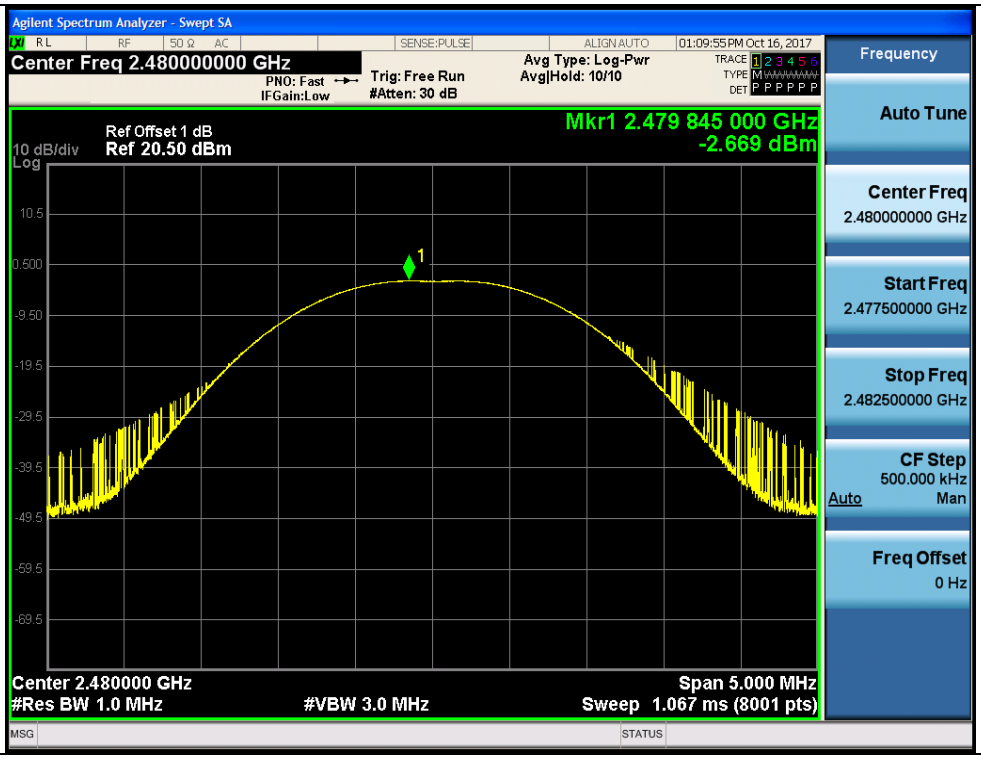
Please refer to the clause 3.3

**TEST RESULTS**

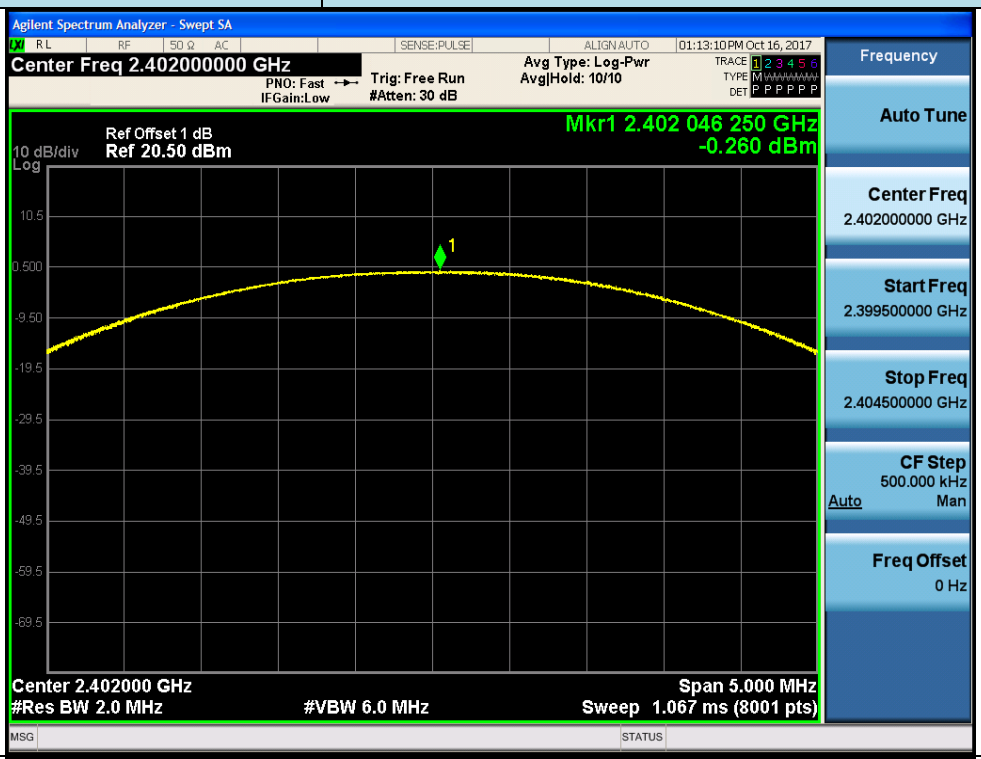
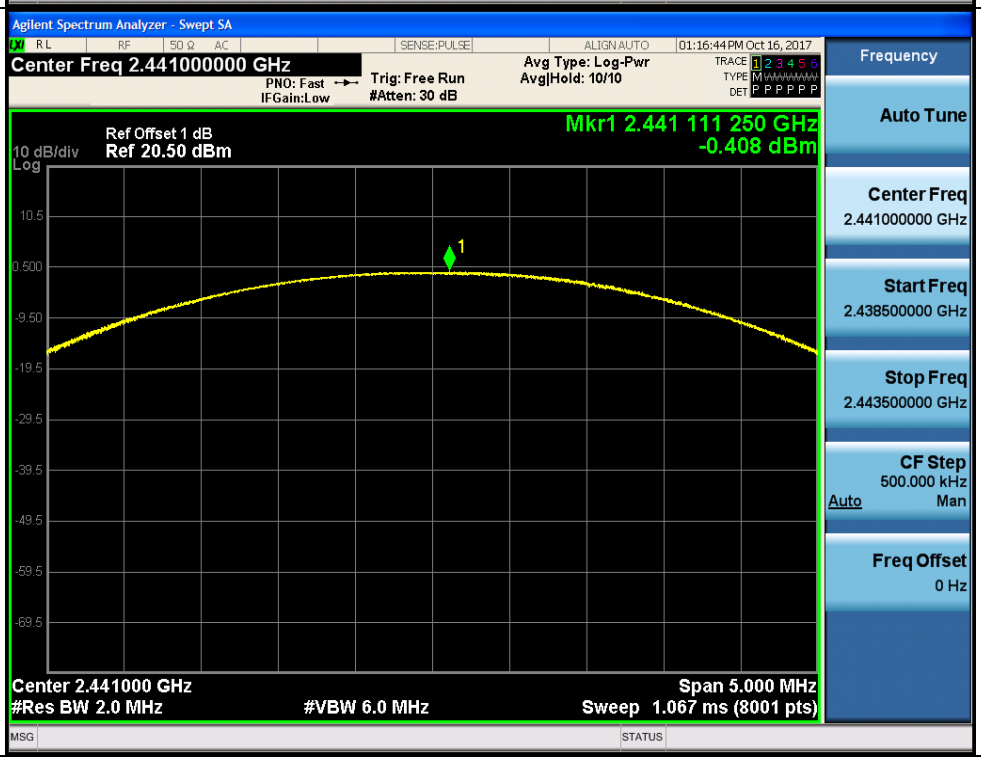
☒ **Passed** ☐ **Not Applicable**

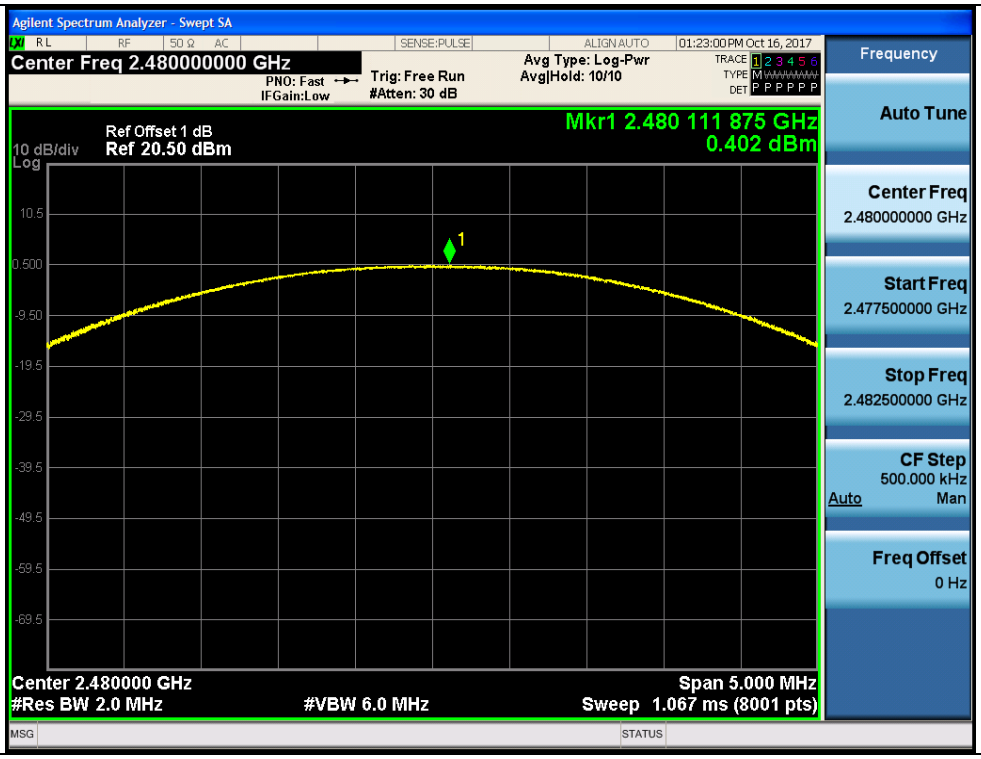
| Modulation type | Channel | PK Output power (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| GFSK | 00 | -3.464 | ≤ 30.00 | Pass |
| | 39 | -3.804 | | |
| | 78 | -2.669 | | |
| π/4DQPSK | 00 | -0.260 | ≤ 21.00 | Pass |
| | 39 | -0.408 | | |
| | 78 | 0.402 | | |
| 8DPSK | 00 | 0.415 | ≤ 21.00 | Pass |
| | 39 | 0.397 | | |
| | 78 | 1.310 | | |

| Modulation Type: | GFSK |
|---|---|
| CH00 |  |
| CH39 |  |

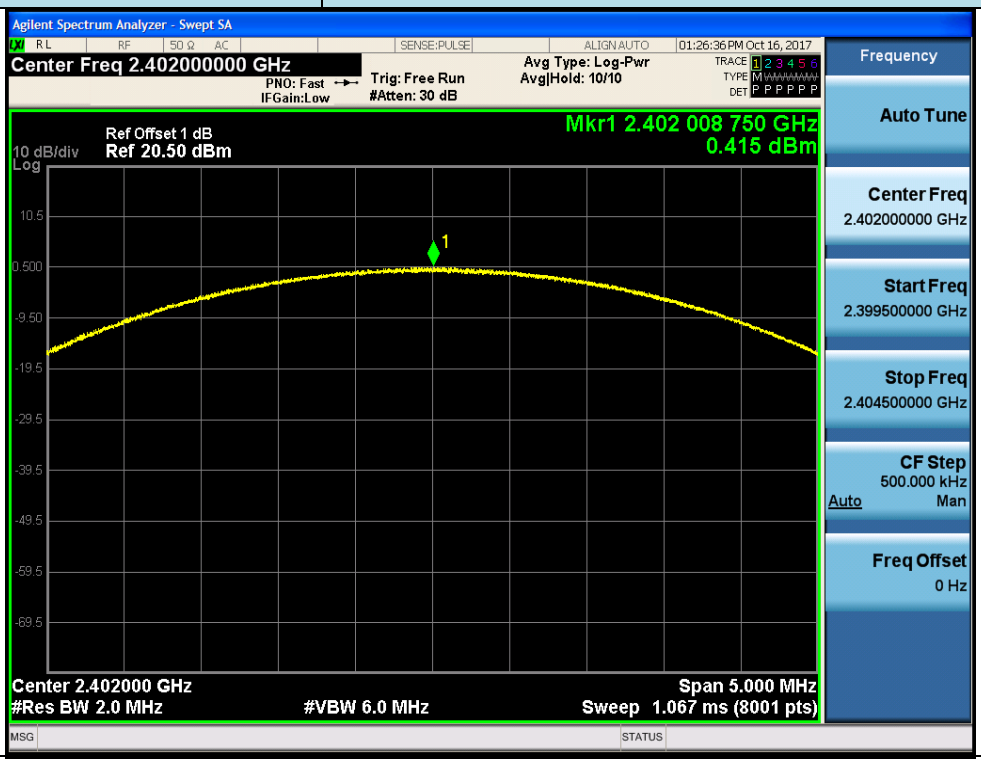
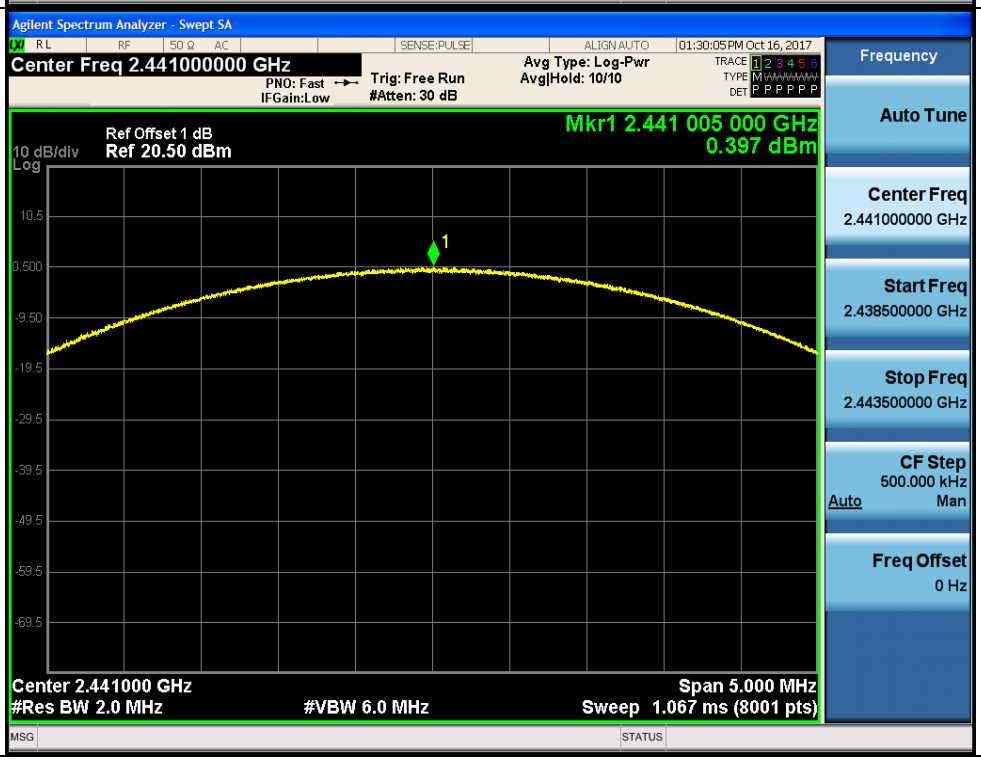
| | |
|---|---|
| CH78 |  |

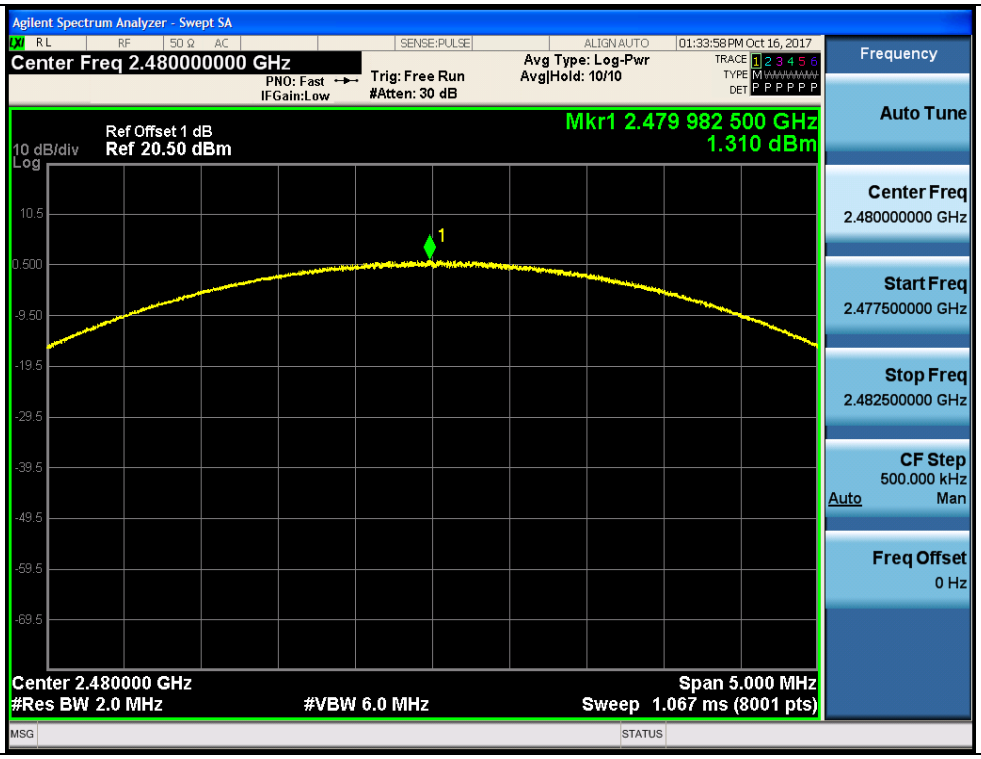
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
01:09:55 PM Oct 16, 2017
Ref Offset 1 dB
10 dB/div
Ref 20.50 dBm
Log
Mkr1 2.479 845 000 GHz
-2.669 dBm
Center 2.480000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.067 ms (8001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.477500000 GHz
Stop Freq
2.482500000 GHz
CF Step
500.000 kHz
Auto
Man
Freq Offset
0 Hz

| Modulation Type: | π/4DQPSK |
|---|---|
| CH00 |  |
| CH39 |  |

| | |
|---|---|
| CH78 |  |

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
01:23:00 PM Oct 16, 2017
Ref Offset 1 dB
10 dB/div
Ref 20.50 dBm
Log
Mkr1 2.480 111 875 GHz
0.402 dBm
Center 2.480000 GHz
#Res BW 2.0 MHz
#VBW 6.0 MHz
Span 5.000 MHz
Sweep 1.067 ms (8001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.477500000 GHz
Stop Freq
2.482500000 GHz
CF Step
500.000 kHz
Auto
Man
Freq Offset
0 Hz

| Modulation Type: | 8DPSK |
|---|---|
| CH00 |  |
| CH39 |  |

| | |
|---|---|
| CH78 |  |

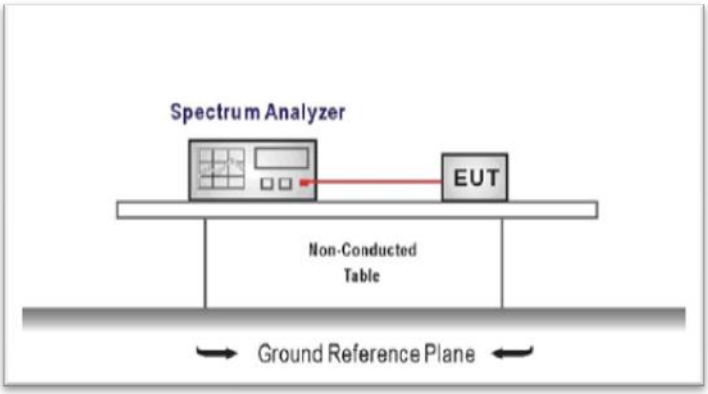
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
01:33:58 PM Oct 16, 2017
Ref Offset 1 dB
10 dB/div
Ref 20.50 dBm
Log
Mkr1 2.479 982 500 GHz
1.310 dBm
Center 2.480000 GHz
#Res BW 2.0 MHz
#VBW 6.0 MHz
Span 5.000 MHz
Sweep 1.067 ms (8001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.477500000 GHz
Stop Freq
2.482500000 GHz
CF Step
500.000 kHz
Auto
Man
Freq Offset
0 Hz

## 5.4. 20 dB Bandwidth

**LIMIT**

N/A

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

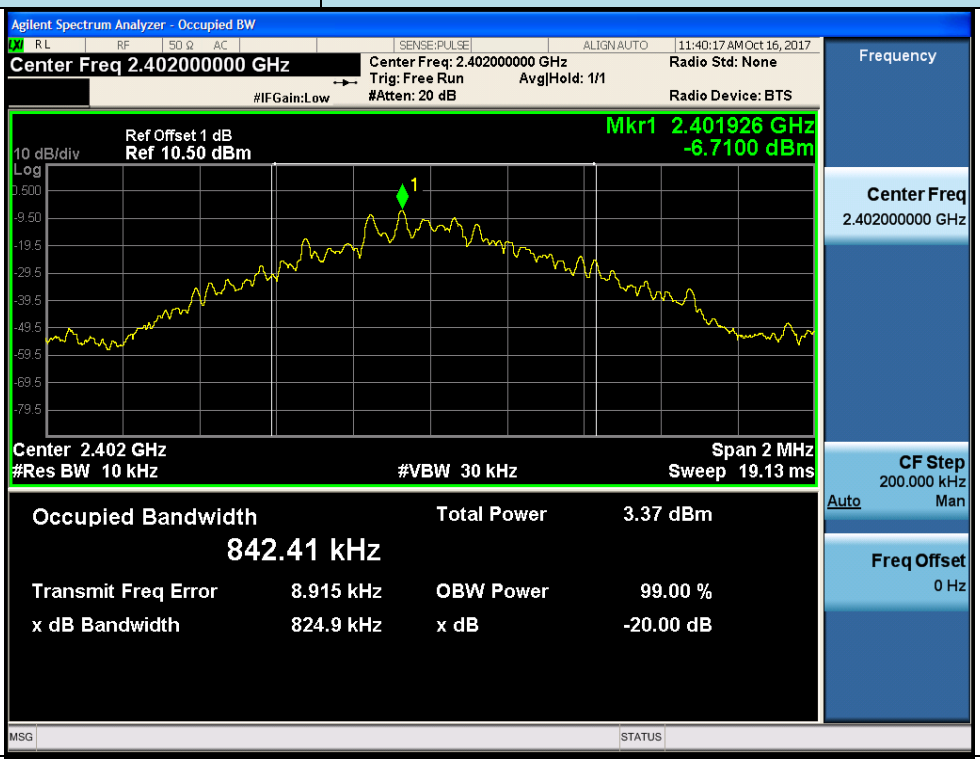
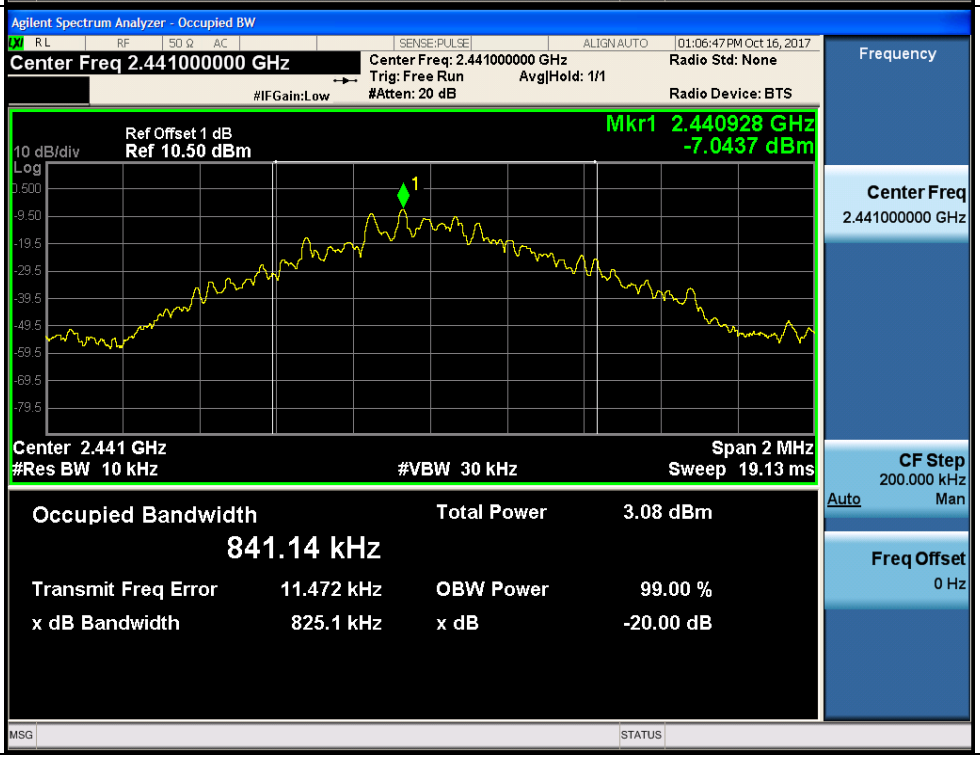
**TEST MODE:**

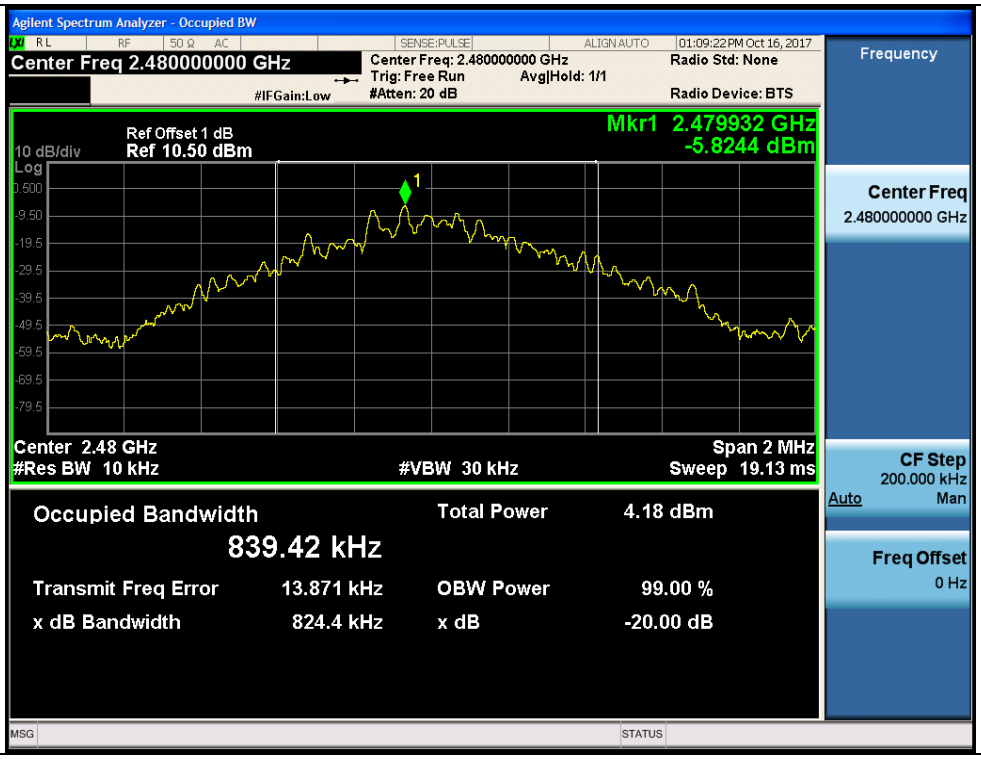
Please refer to the clause 3.3

**TEST RESULTS**

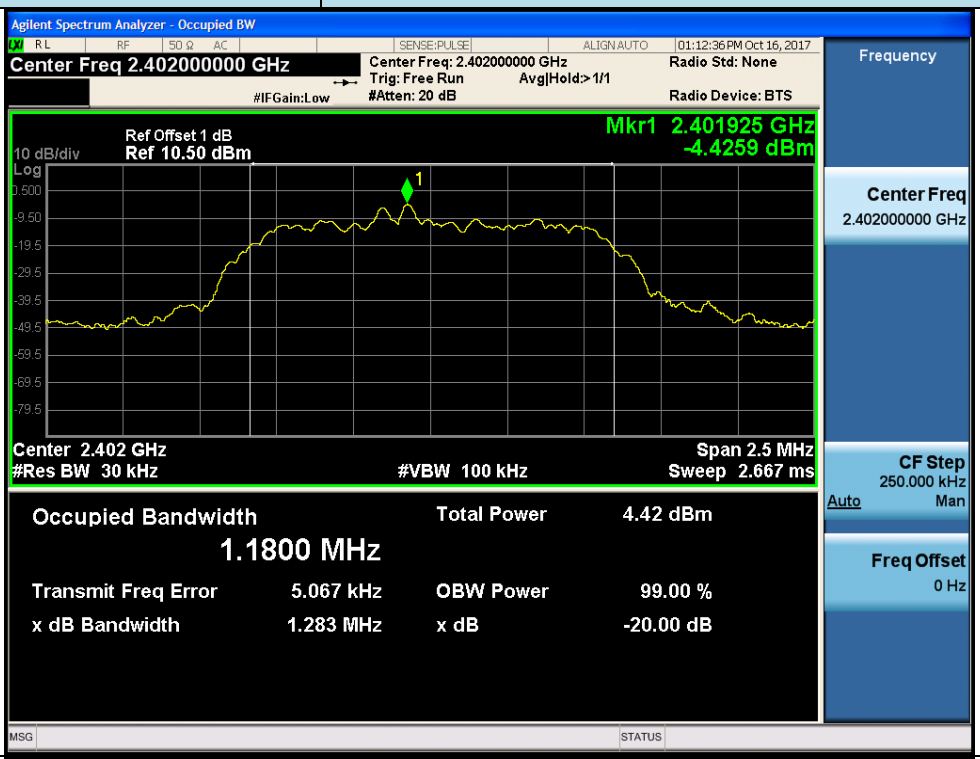
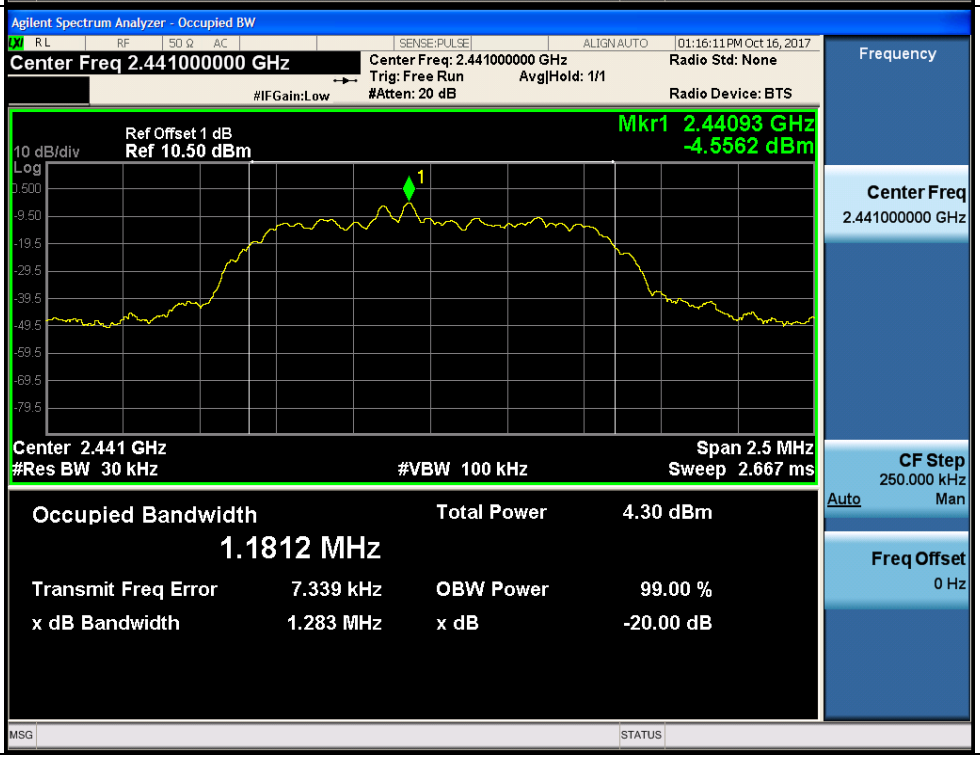
☒ **Passed** ☐ **Not Applicable**

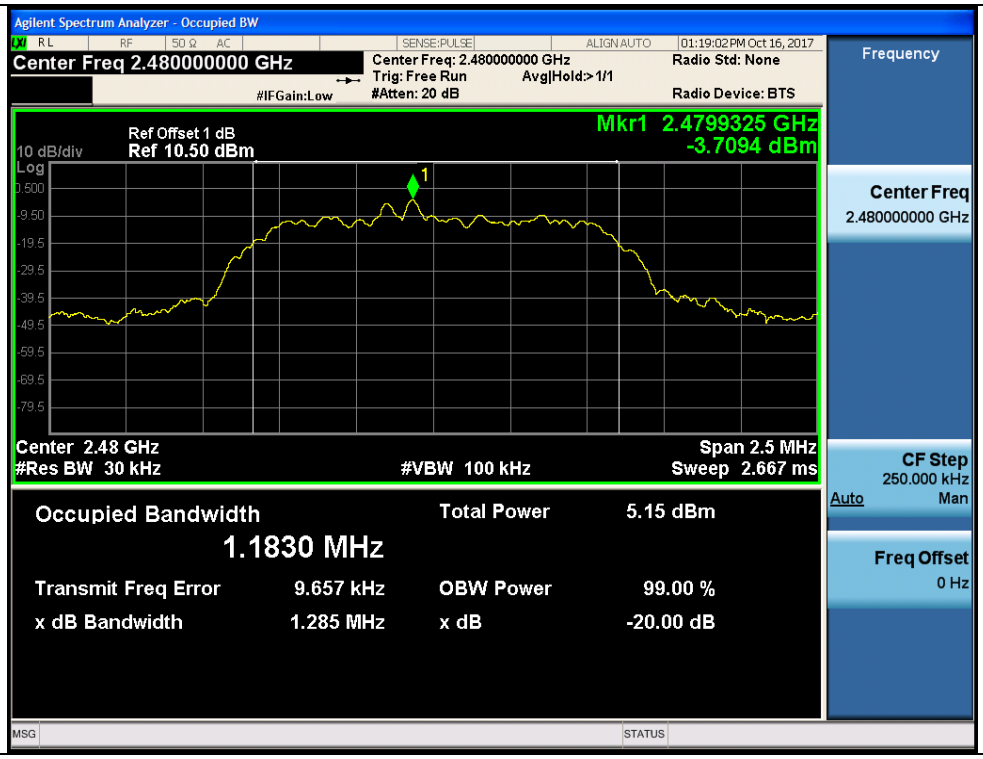
| Modulation type | Channel | 20 dB Bandwidth (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|
| GFSK | 00 | 0.8249 | - | Pass |
| | 39 | 0.8251 | | |
| | 78 | 0.8244 | | |
| π/4DQPSK | 00 | 1.283 | - | Pass |
| | 39 | 1.283 | | |
| | 78 | 1.285 | | |
| 8DPSK | 00 | 1.295 | - | Pass |
| | 39 | 1.294 | | |
| | 78 | 1.296 | | |

| Modulation Type: | GFSK |
|---|---|
| CH00 |  |
| CH39 |  |

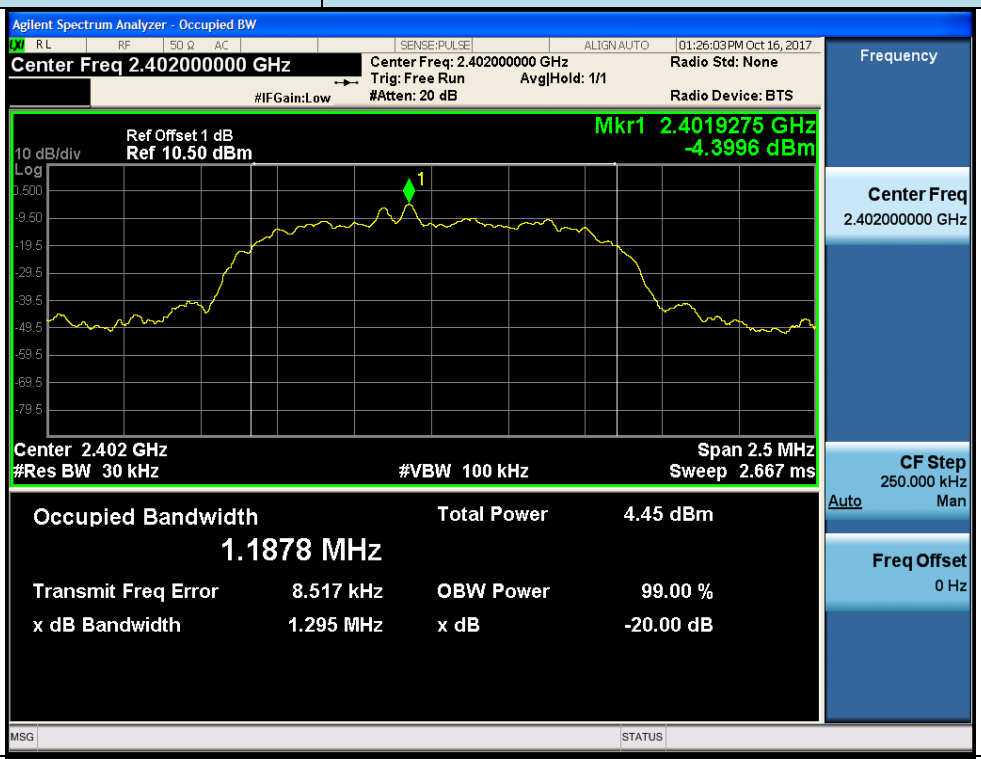
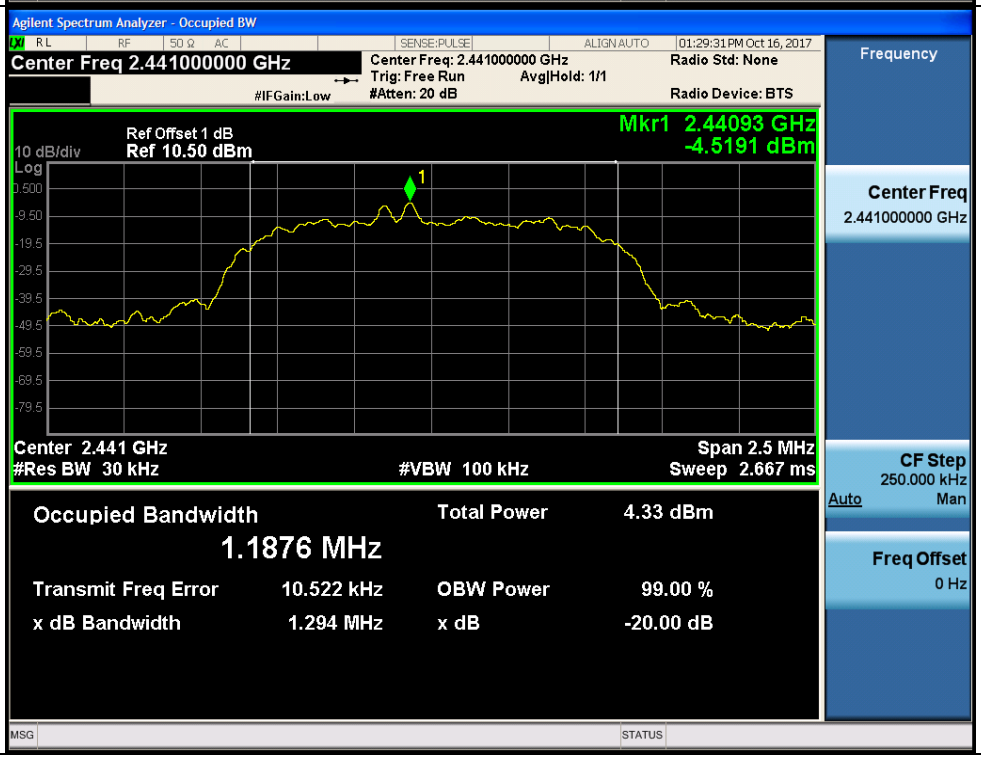
| | |
|---|---|
| CH78 |  |

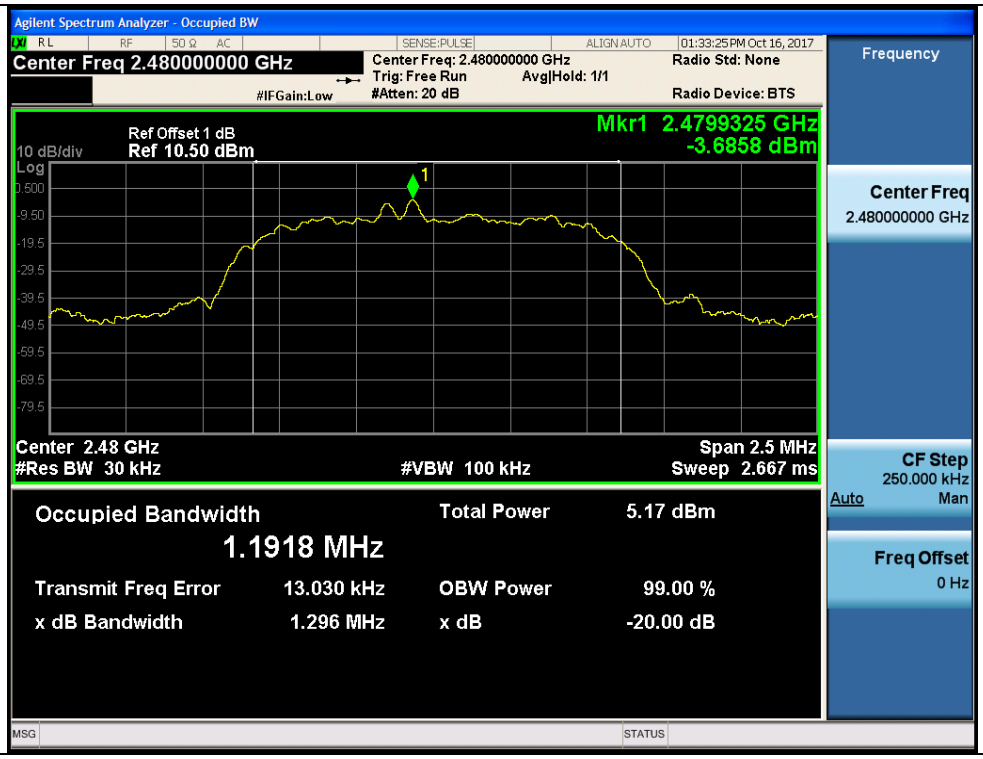
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 1/1
#Atten: 20 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
01:09:22 PM Oct 16, 2017
Frequency
Ref Offset 1 dB
10 dB/div
Ref 10.50 dBm
Log
Mkr1 2.479932 GHz
-5.8244 dBm
Center 2.48 GHz
#Res BW 10 kHz
#VBW 30 kHz
Span 2 MHz
Sweep 19.13 ms
Occupied Bandwidth
839.42 kHz
Total Power 4.18 dBm
Transmit Freq Error 13.871 kHz
OBW Power 99.00 %
x dB Bandwidth 824.4 kHz
x dB -20.00 dB
Center Freq
2.480000000 GHz
CF Step
200.000 kHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

| Modulation Type: | π/4DQPSK |
|---|---|
| CH00 |  |
| CH39 |  |

| | |
|---|---|
| CH78 |  |

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>1/1
#Atten: 20 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
01:19:02 PM Oct 16, 2017
Frequency
Ref Offset 1 dB
10 dB/div
Ref 10.50 dBm
Log
Mkr1 2.4799325 GHz
-3.7094 dBm
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.5 MHz
Sweep 2.667 ms
Occupied Bandwidth
1.1830 MHz
Total Power 5.15 dBm
Transmit Freq Error 9.657 kHz
OBW Power 99.00 %
x dB Bandwidth 1.285 MHz
x dB -20.00 dB
Center Freq
2.480000000 GHz
CF Step
250.000 kHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

| Modulation Type: | 8DPSK |
|---|---|
| CH00 |  |
| CH39 |  |

| | |
|---|---|
| CH78 |  |

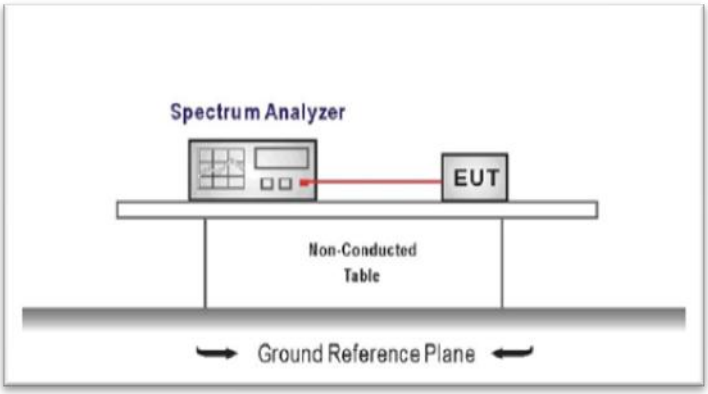
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 1/1
#Atten: 20 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
01:33:25 PM Oct 16, 2017
Frequency
Ref Offset 1 dB
10 dB/div
Ref 10.50 dBm
Log
Mkr1 2.4799325 GHz
-3.6858 dBm
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.5 MHz
Sweep 2.667 ms
Occupied Bandwidth
1.1918 MHz
Total Power 5.17 dBm
Transmit Freq Error 13.030 kHz
OBW Power 99.00 %
x dB Bandwidth 1.296 MHz
x dB -20.00 dB
Center Freq
2.480000000 GHz
CF Step
250.000 kHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

## 5.5. Carrier Frequencies Separation

**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20 dB bandwidth of the hopping channel, whichever is greater.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels
   RBW ≥ 1% of the span, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

**TEST MODE:**

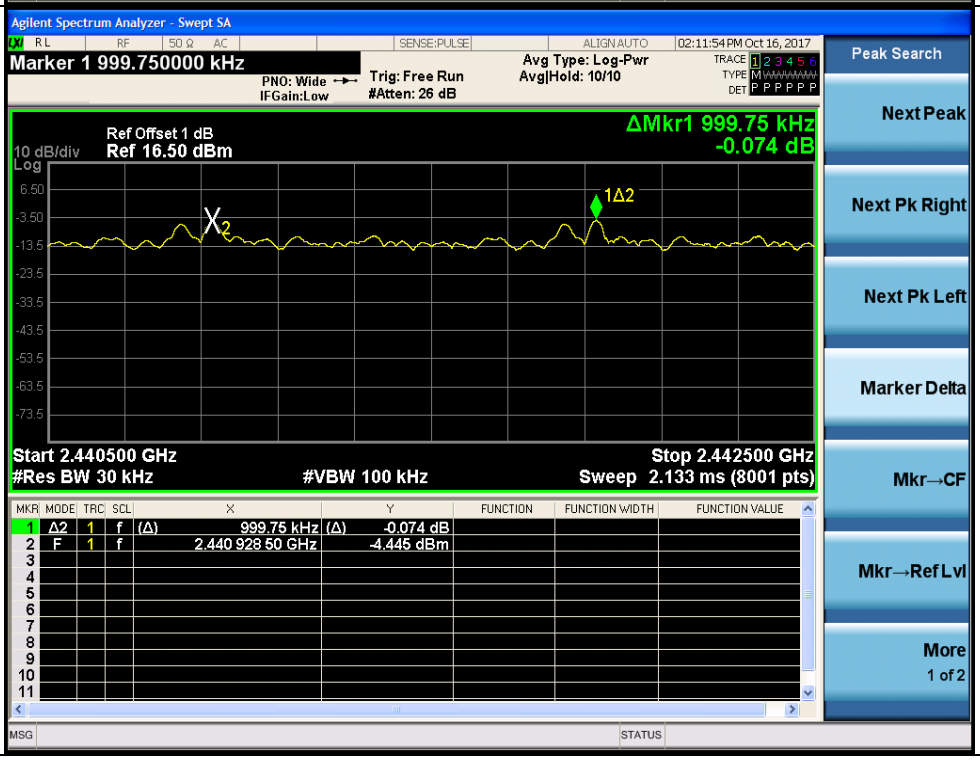
Please refer to the clause 3.3

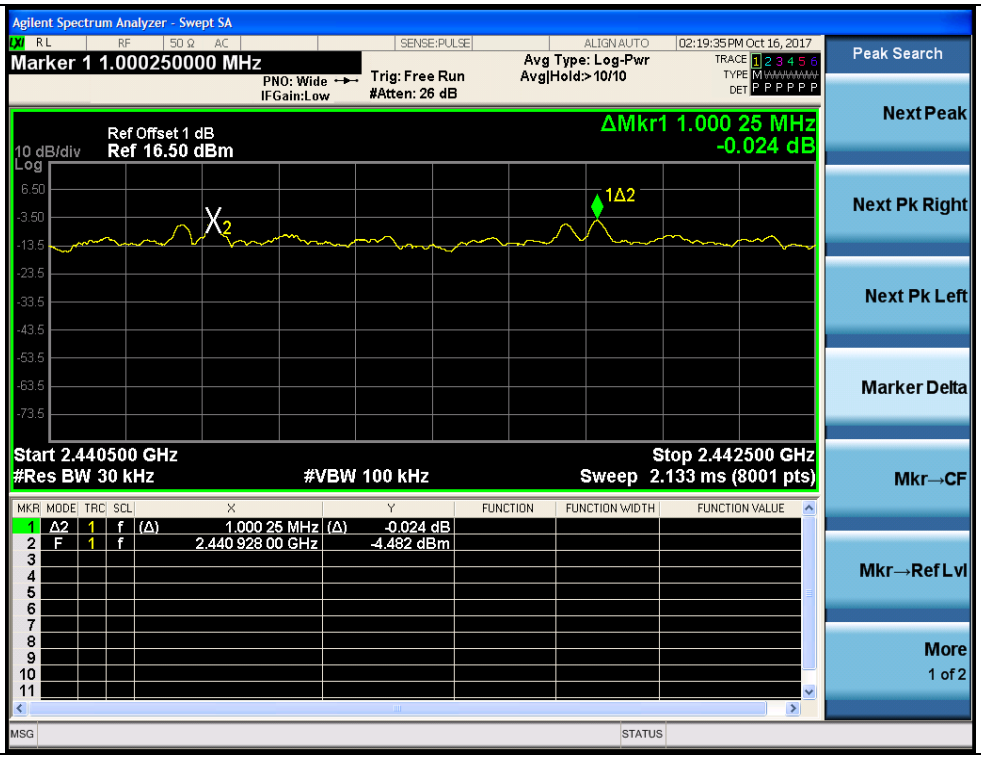
**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

| Modulation type | Channel | Carrier Frequencies Separation (MHz) | Limit (MHz) * | Result |
|---|---|---|---|---|
| GFSK | 39 | 1.093 | ≥0.825 | Pass |
| π/4DQPSK | 39 | 1.000 | ≥0.857 | Pass |
| 8DPSK | 39 | 1.000 | ≥0.864 | Pass |

Note:
*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the section 5.4.
π/4DQPSK limit = 2/3 * The maximum 20 dB Bandwidth for π/4DQPSK modulation on the section 5.4.
8DPSK limit = 2/3 * The maximum 20 dB Bandwidth for 8DPSK modulation on the section 5.4

| | |
|---|---|
| GFSK | |
| π/4DQPSK |  |

| | |
|---|---|
| 8DPSK |  |

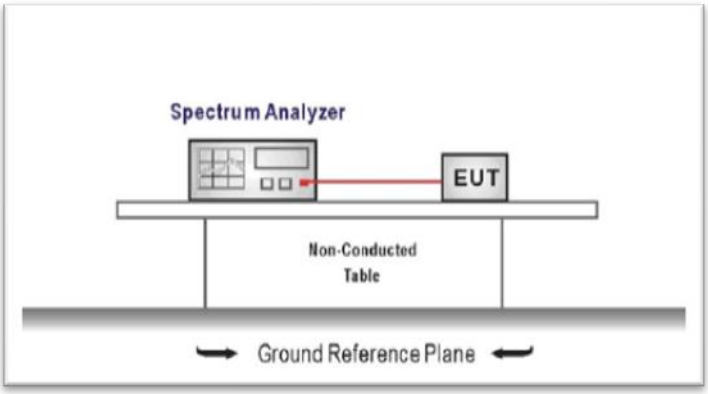
Agilent Spectrum Analyzer - Swept SA
Marker 1 1.000250000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
02:19:35 PM Oct 16, 2017
Ref Offset 1 dB
10 dB/div
Ref 16.50 dBm
Log
ΔMkr1 1.000 25 MHz
-0.024 dB
Start 2.440500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Stop 2.442500 GHz
Sweep 2.133 ms (8001 pts)
1 Δ2 1 f (Δ) 1.000 25 MHz (Δ) -0.024 dB
2 F 1 f 2.440 928 00 GHz -4.482 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

## 5.6. Hopping Channel Number

**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems in the 2400–2483.5 MHz band shall use at least **15** channels.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = the frequency band of operation
   RBW ≥ 1% of the span, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

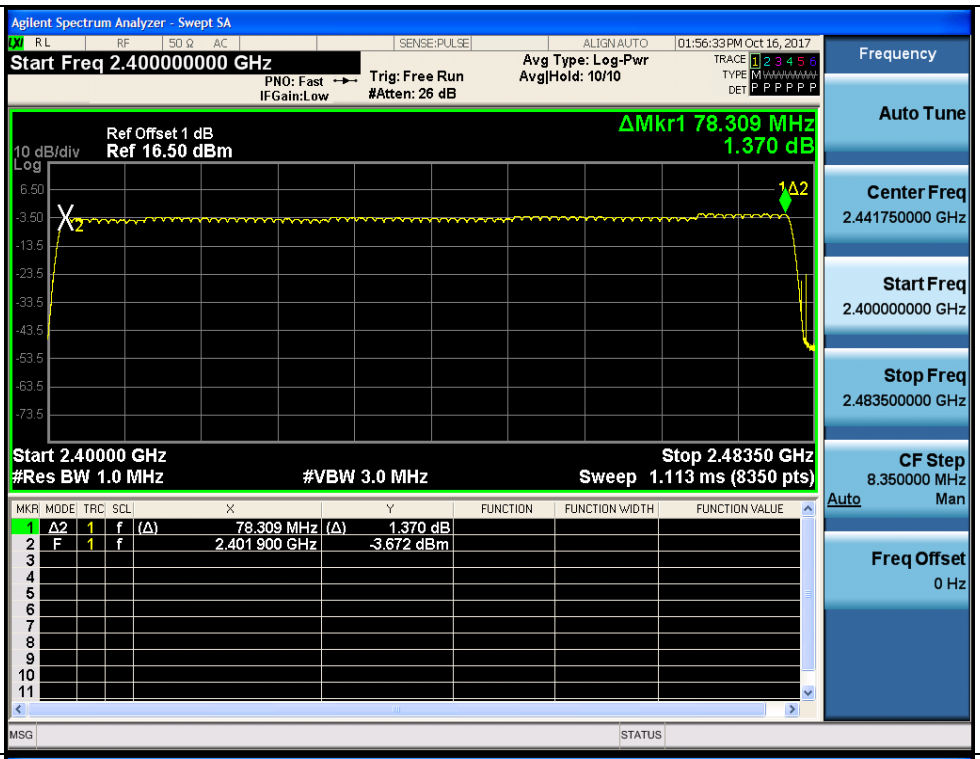
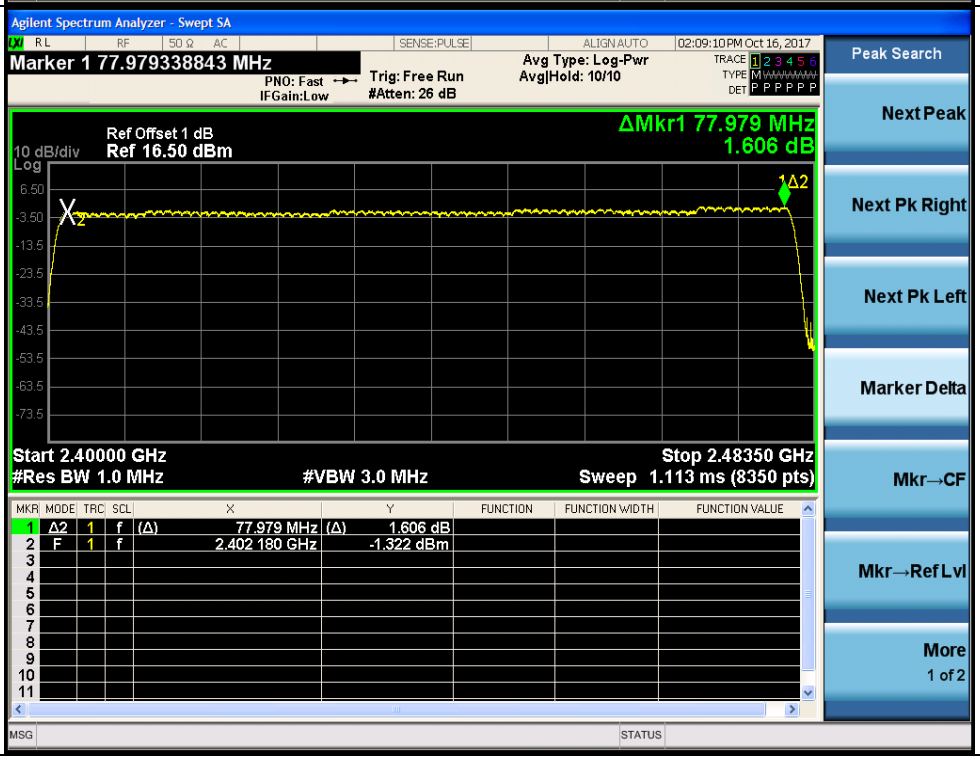
**TEST MODE:**

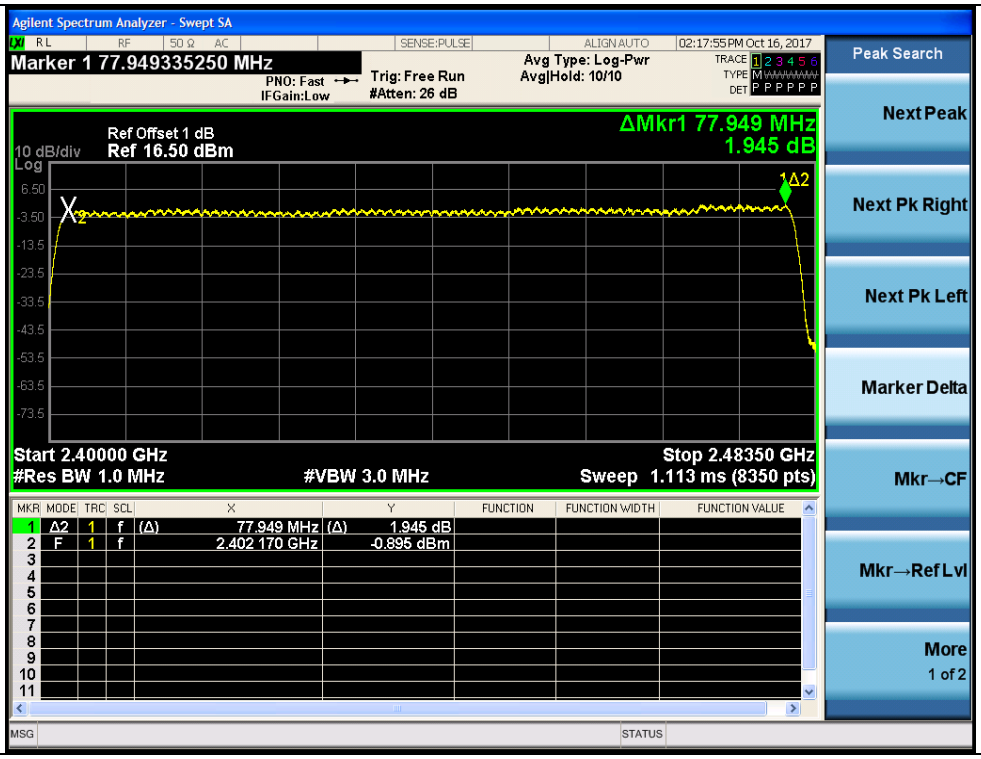
Please refer to the clause 3.3

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

| Modulation type | Channel number | Limit | Result |
|---|---|---|---|
| GFSK | 79 | ≥15.00 | Pass |
| π/4DQPSK | 79 | | |
| 8DPSK | 79 | | |

| | |
|---|---|
| GFSK |  |
| π/4DQPSK |  |

| | |
|---|---|
| 8DPSK |  |

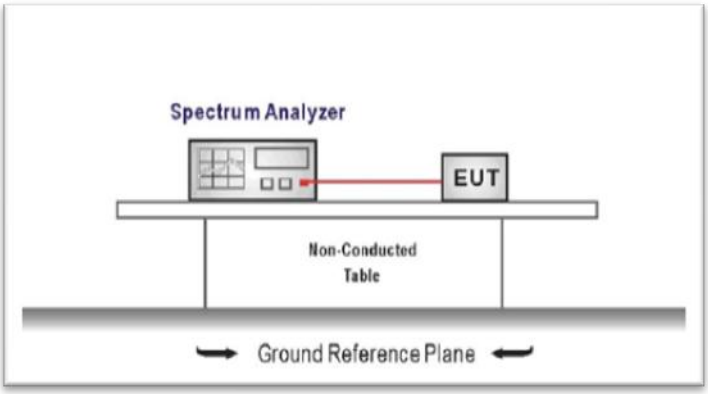
Agilent Spectrum Analyzer - Swept SA
Marker 1 77.949335250 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
02:17:55 PM Oct 16, 2017
Ref Offset 1 dB
10 dB/div
Ref 16.50 dBm
ΔMkr1 77.949 MHz
1.945 dB
Start 2.40000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 2.48350 GHz
Sweep 1.113 ms (8350 pts)
1 Δ 2 (Δ) 77.949 MHz (Δ) 1.945 dB
2 F 1 f 2.402 170 GHz -0.895 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

## 5.7. Dwell Time

**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW ≥ RBW
   Sweep = as necessary to capture the entire dwell time per hopping channel,
   Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

**TEST MODE:**

Please refer to the clause 3.3

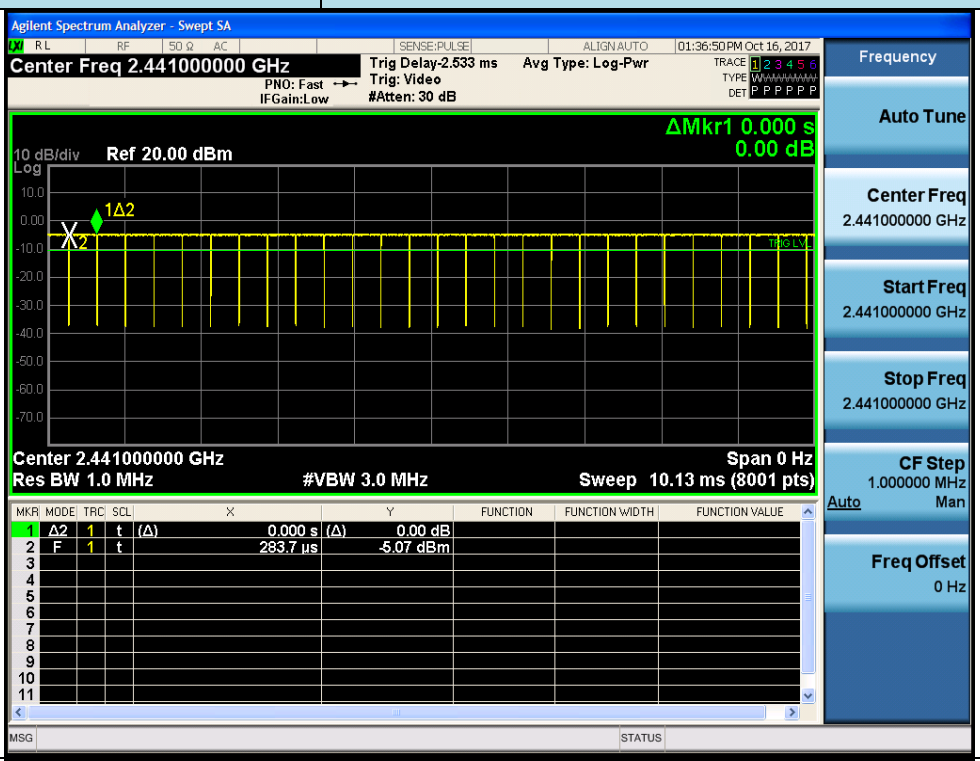
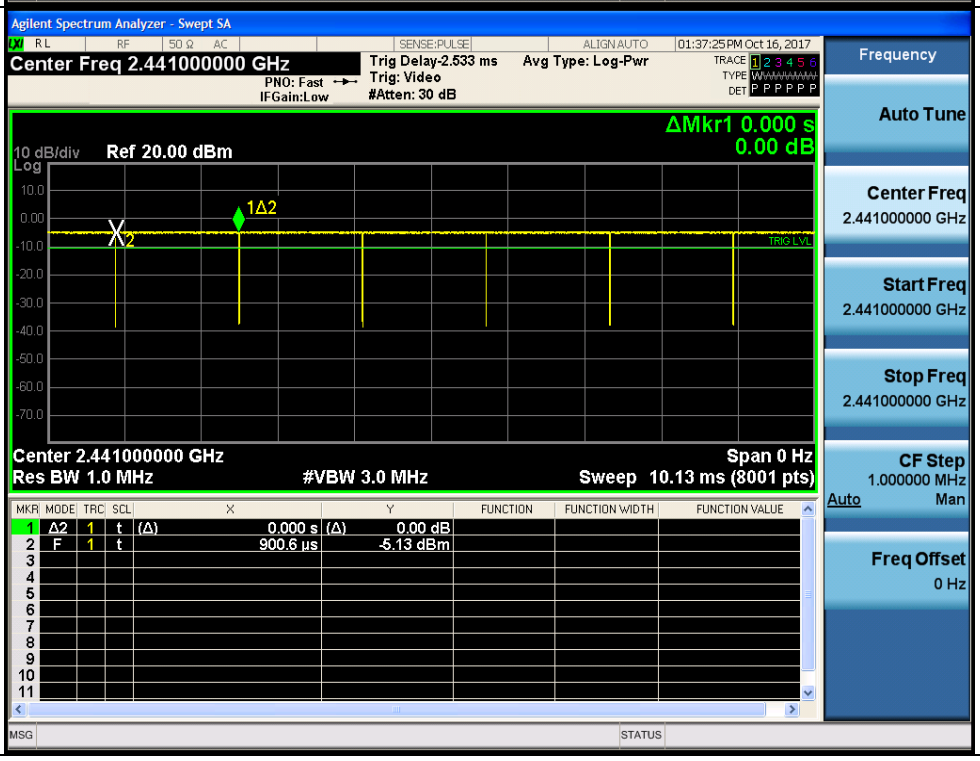
**TEST RESULTS**

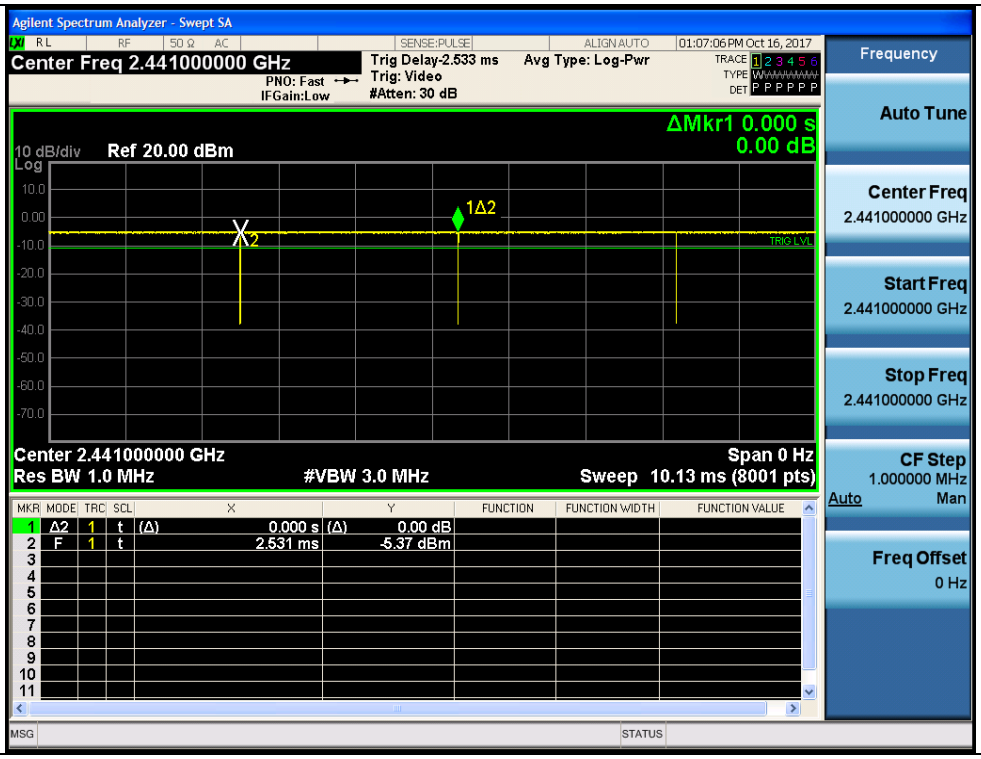
☒ **Passed** ☐ **Not Applicable**

| Modulation type | Channel | Dwell time (Second) | Limit (Second) | Result |
|---|---|---|---|---|
| GFSK | DH1 | 0.115 | ≤ 0.40 | Pass |
| | DH3 | 0.259 | | |
| | DH5 | 0.306 | | |
| π/4DQPSK | 2DH1 | 0.118 | ≤ 0.40 | Pass |
| | 2DH3 | 0.259 | | |
| | 2DH5 | 0.306 | | |
| 8DPSK | 3DH1 | 0.118 | ≤ 0.40 | Pass |
| | 3DH3 | 0.259 | | |
| | 3DH5 | 0.306 | | |

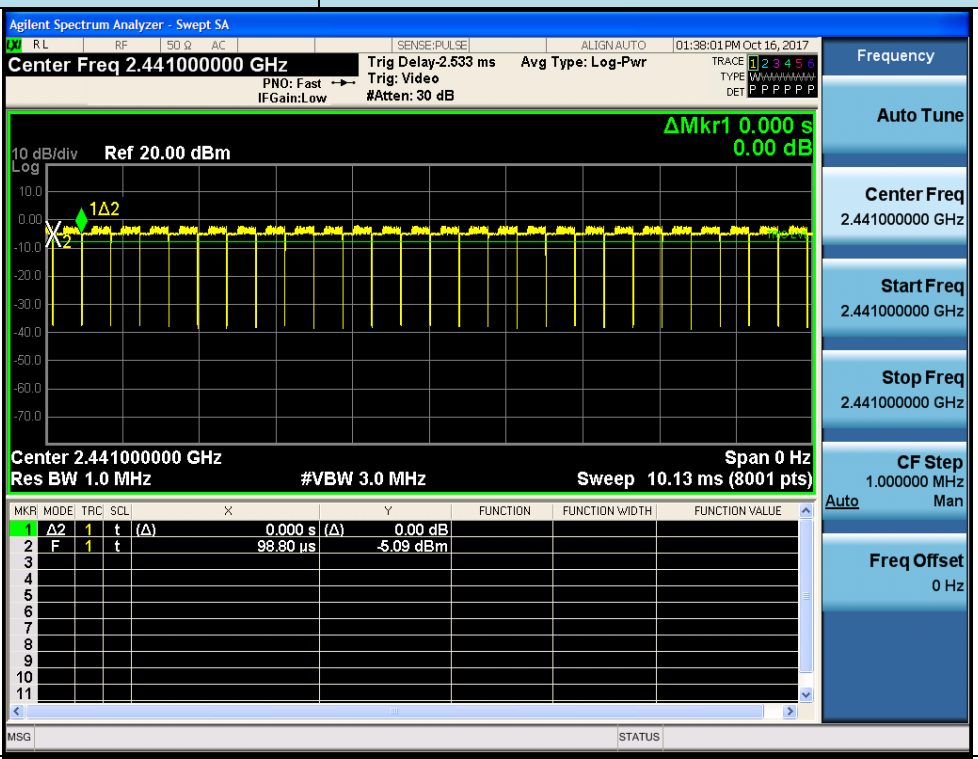
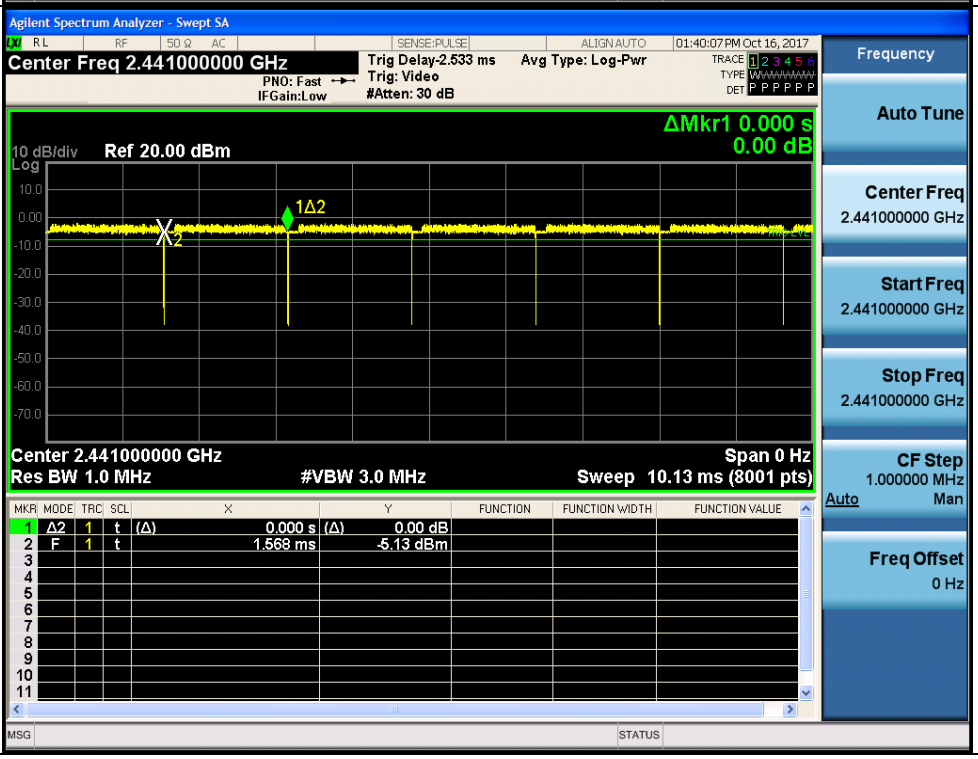
Note:

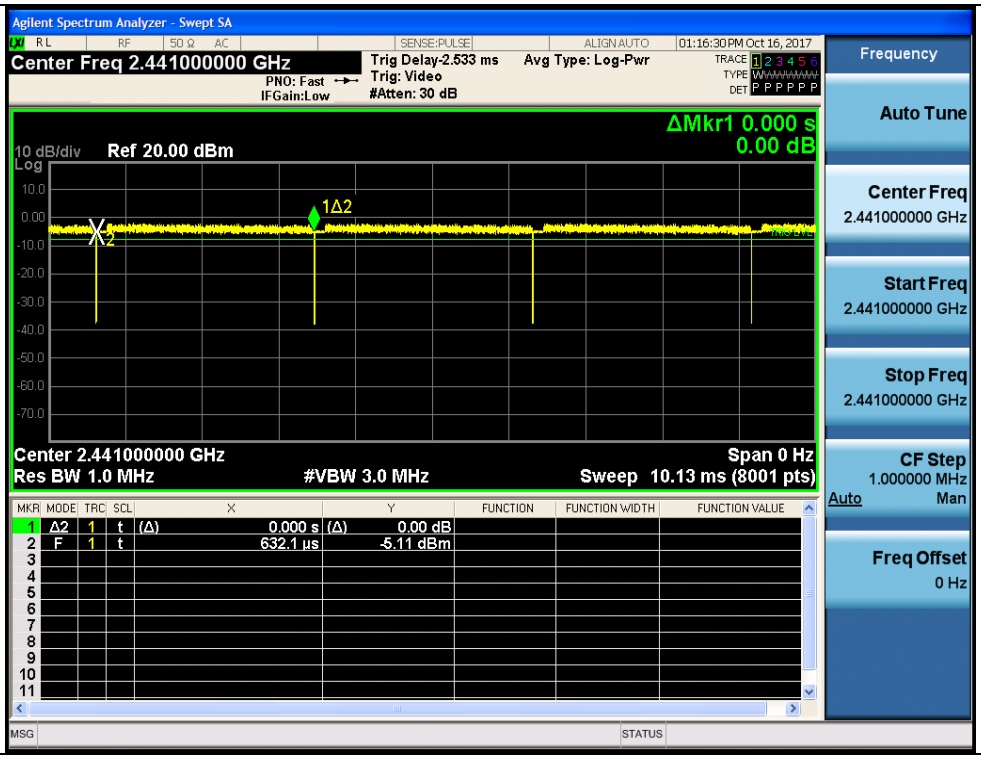
1. We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.
2. Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2DH1, 3DH1
   Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2DH3, 3DH3
   Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2DH5, 3DH5

| Modulation Type: | GFSK |
|---|---|
| DH1 |  |
| DH3 |  |

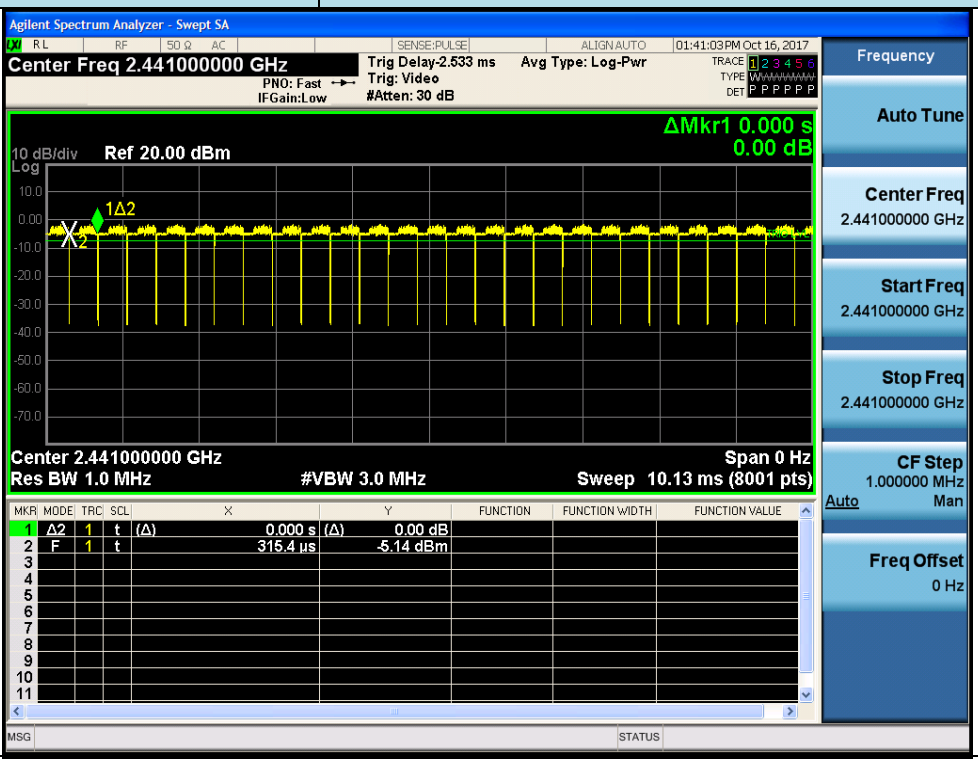
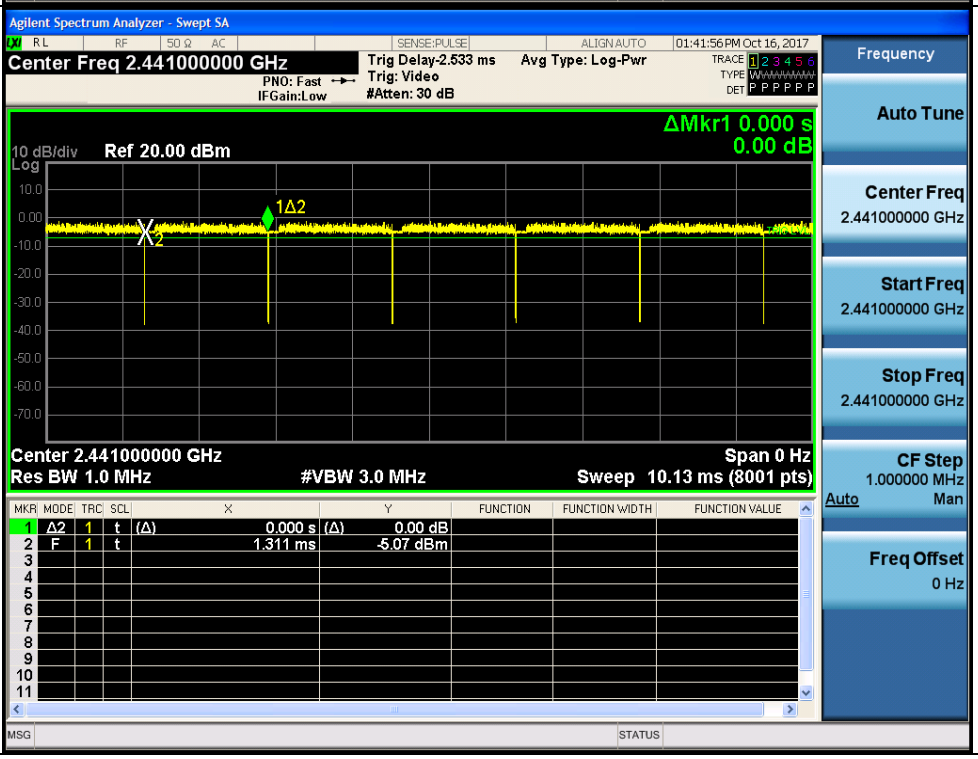
| | |
|---|---|
| DH5 |  |

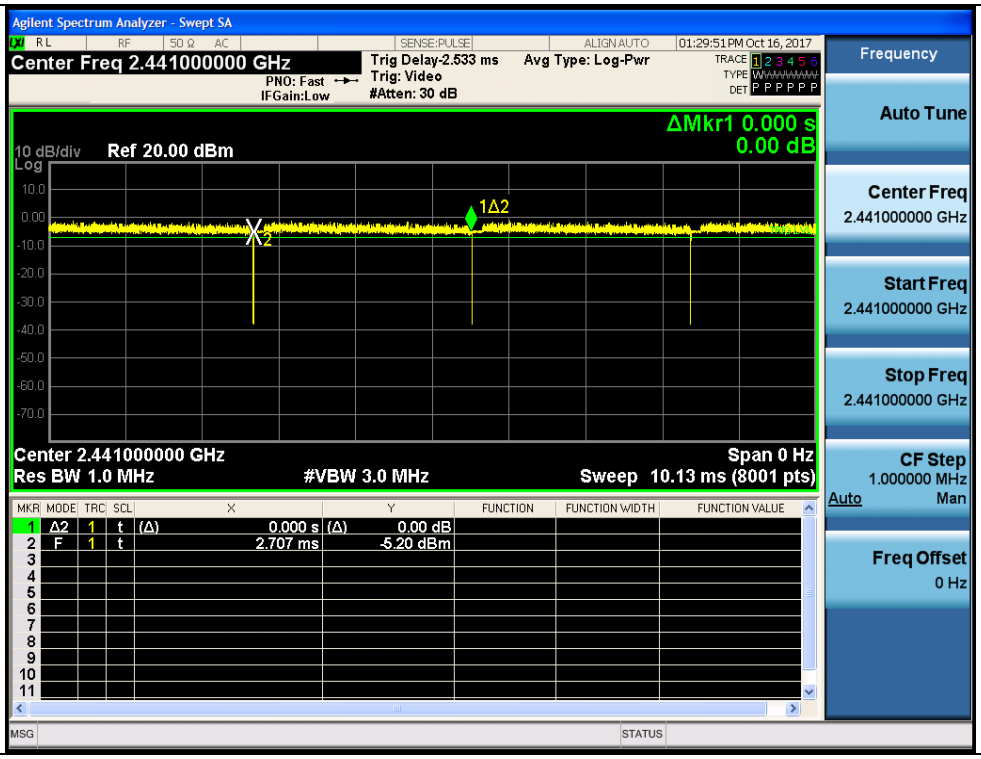
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-2.533 ms
Trig: Video
#Atten: 30 dB
Avg Type: Log-Pwr
01:07:06 PM Oct 16, 2017
ΔMkr1 0.000 s
0.00 dB
10 dB/div Log
Ref 20.00 dBm
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 Δ2 1 t (Δ) 0.000 s (Δ) 0.00 dB
2 F 1 t 2.531 ms -5.37 dBm
Frequency
Auto Tune
Center Freq 2.441000000 GHz
Start Freq 2.441000000 GHz
Stop Freq 2.441000000 GHz
CF Step 1.000000 MHz
Auto Man
Freq Offset 0 Hz

| Modulation Type: | π/4DQPSK |
|---|---|
| 2DH1 |  |
| 2DH3 |  |

| | |
|---|---|
| 2DH5 |  |

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-2.533 ms
Trig: Video
#Atten: 30 dB
Avg Type: Log-Pwr
01:16:30 PM Oct 16, 2017
ΔMkr1 0.000 s
0.00 dB
10 dB/div
Log
Ref 20.00 dBm
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 Δ2 1 t (Δ) 0.000 s (Δ) 0.00 dB
2 F 1 t 632.1 µs -5.11 dBm
Frequency
Auto Tune
Center Freq
2.441000000 GHz
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

| Modulation Type: | 8DPSK |
|---|---|
| 3DH1 |  |
| 3DH3 |  |

| | |
|---|---|
| 3DH5 |  |

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-2.533 ms
Trig: Video
#Atten: 30 dB
Avg Type: Log-Pwr
01:29:51 PM Oct 16, 2017
ΔMkr1 0.000 s
0.00 dB
10 dB/div Log
Ref 20.00 dBm
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 Δ2 1 t (Δ) 0.000 s (Δ) 0.00 dB
2 F 1 t 2.707 ms -5.20 dBm
Frequency
Auto Tune
Center Freq 2.441000000 GHz
Start Freq 2.441000000 GHz
Stop Freq 2.441000000 GHz
CF Step 1.000000 MHz
Auto Man
Freq Offset 0 Hz
MSG
STATUS

## 5.8. Pseudorandom Frequency Hopping Sequence

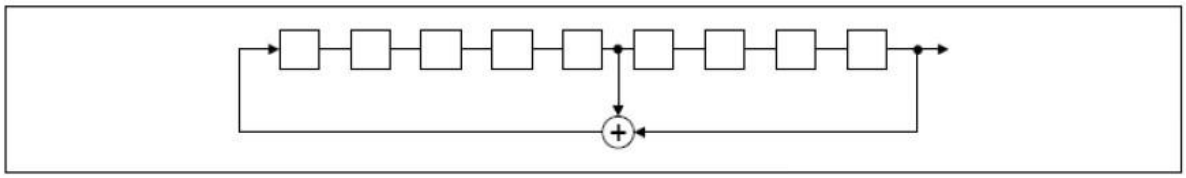
**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

**TEST RESULTS**

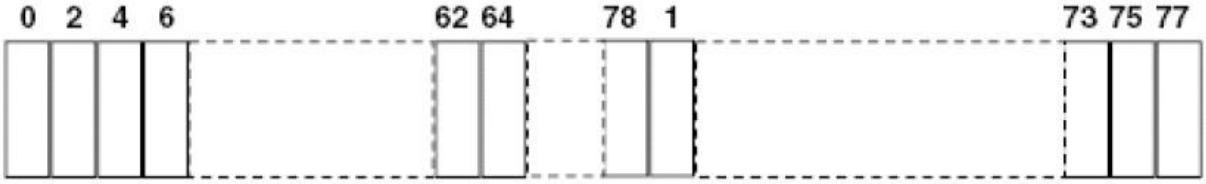
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the friststage.The sequence begins with the frist one of 9 consecutive ones,forexample:the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*

An explame of pseudorandom frequency hopping sequence as follows:



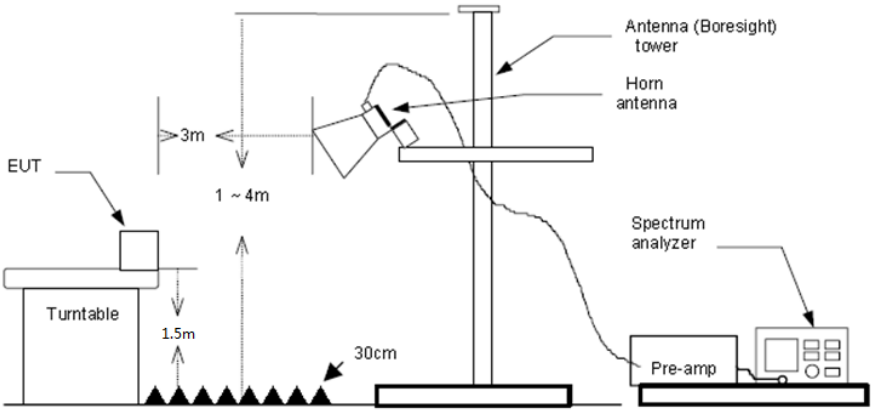

Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

## 5.9. Restricted band (radiated)

**LIMIT**

**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):**
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1 MHz, VBW=3 MHz Peak detector for Peak value
   RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

**TEST MODE:**
Please refer to the clause 3.3

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Note:
1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor
2) Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report.
3) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

| CH00 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | Test value |
| 2310.00 | 34.65 | 28.05 | 6.62 | 37.65 | 31.67 | 74.00 | -42.33 | Horizontal | Peak |
| 2353.25 | 41.21 | 27.83 | 6.69 | 37.77 | 37.96 | 74.00 | -36.04 | Horizontal | Peak |
| 2390.03 | 37.04 | 27.65 | 6.75 | 37.87 | 33.57 | 74.00 | -40.43 | Horizontal | Peak |
| 2310.00 | 35.73 | 28.05 | 6.62 | 37.65 | 32.75 | 74.00 | -41.25 | Vertical | Peak |
| 2390.03 | 39.83 | 27.65 | 6.75 | 37.87 | 36.36 | 74.00 | -37.64 | Vertical | Peak |
| 2310.00 | 22.86 | 28.05 | 6.62 | 37.65 | 19.88 | 54.00 | -34.12 | Horizontal | Average |
| 2390.03 | 22.41 | 27.65 | 6.75 | 37.87 | 18.94 | 54.00 | -35.06 | Horizontal | Average |
| 2310.00 | 22.58 | 28.05 | 6.62 | 37.65 | 19.60 | 54.00 | -34.40 | Vertical | Average |
| 2390.03 | 22.16 | 27.65 | 6.75 | 37.87 | 18.69 | 54.00 | -35.31 | Vertical | Average |

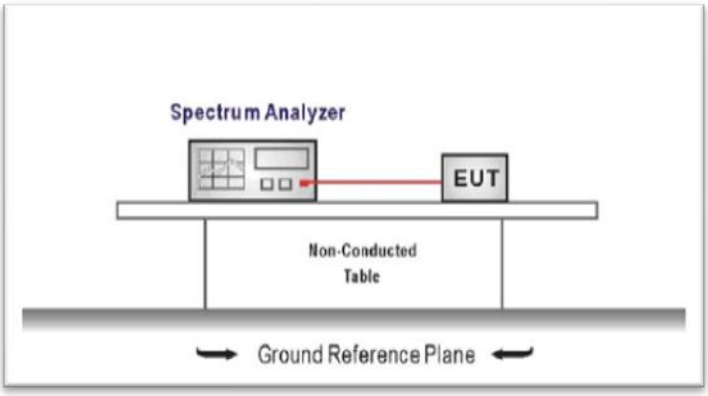
| CH78 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | Test value |
| 2483.50 | 48.90 | 27.26 | 6.83 | 37.87 | 45.12 | 74.00 | -28.88 | Horizontal | Peak |
| 2495.83 | 54.42 | 27.22 | 6.84 | 37.87 | 50.61 | 74.00 | -23.39 | Horizontal | Peak |
| 2500.00 | 35.71 | 27.20 | 6.84 | 37.87 | 31.88 | 74.00 | -42.12 | Horizontal | Peak |
| 2483.50 | 47.59 | 27.26 | 6.83 | 37.87 | 43.81 | 74.00 | -30.19 | Vertical | Peak |
| 2492.80 | 64.33 | 27.23 | 6.83 | 37.87 | 60.52 | 74.00 | -13.48 | Vertical | Peak |
| 2500.00 | 40.14 | 27.20 | 6.84 | 37.87 | 36.31 | 74.00 | -37.69 | Vertical | Peak |
| 2483.50 | 38.81 | 27.26 | 6.83 | 37.87 | 35.03 | 54.00 | -18.97 | Horizontal | Average |
| 2500.00 | 22.72 | 27.20 | 6.84 | 37.87 | 18.89 | 54.00 | -35.11 | Horizontal | Average |
| 2483.50 | 36.68 | 27.26 | 6.83 | 37.87 | 32.90 | 54.00 | -21.10 | Vertical | Average |
| 2500.00 | 22.40 | 27.20 | 6.84 | 37.87 | 18.57 | 54.00 | -35.43 | Vertical | Average |

## 5.10. Band edge and Spurious Emissions (conducted)

**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

**TEST CONFIGURATION**




**TEST PROCEDURE**

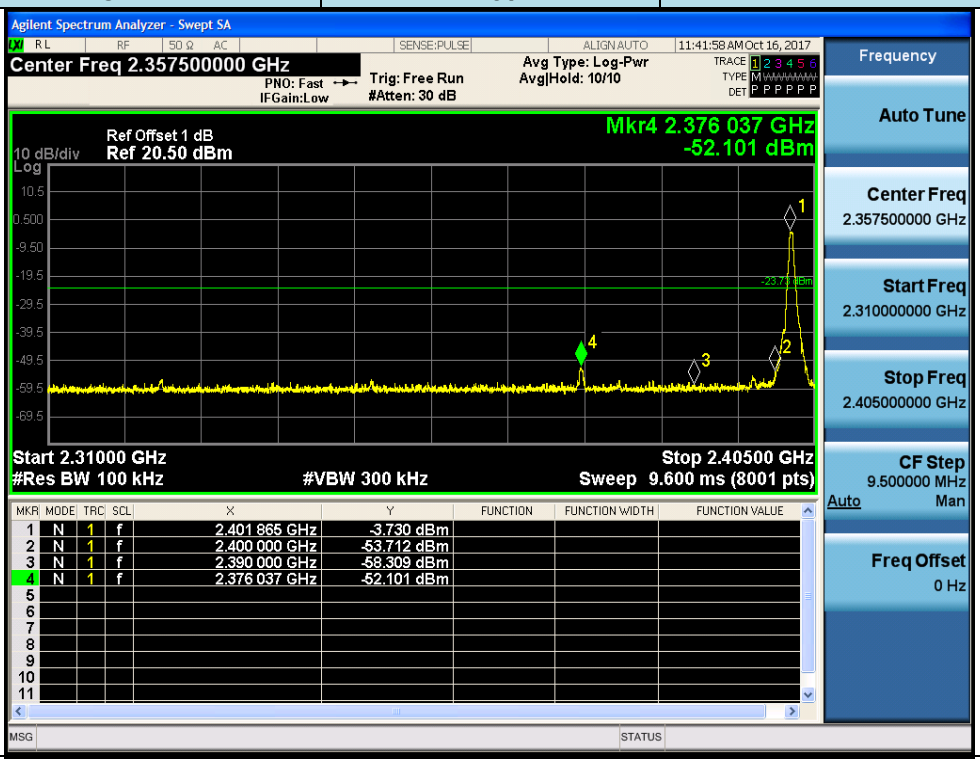
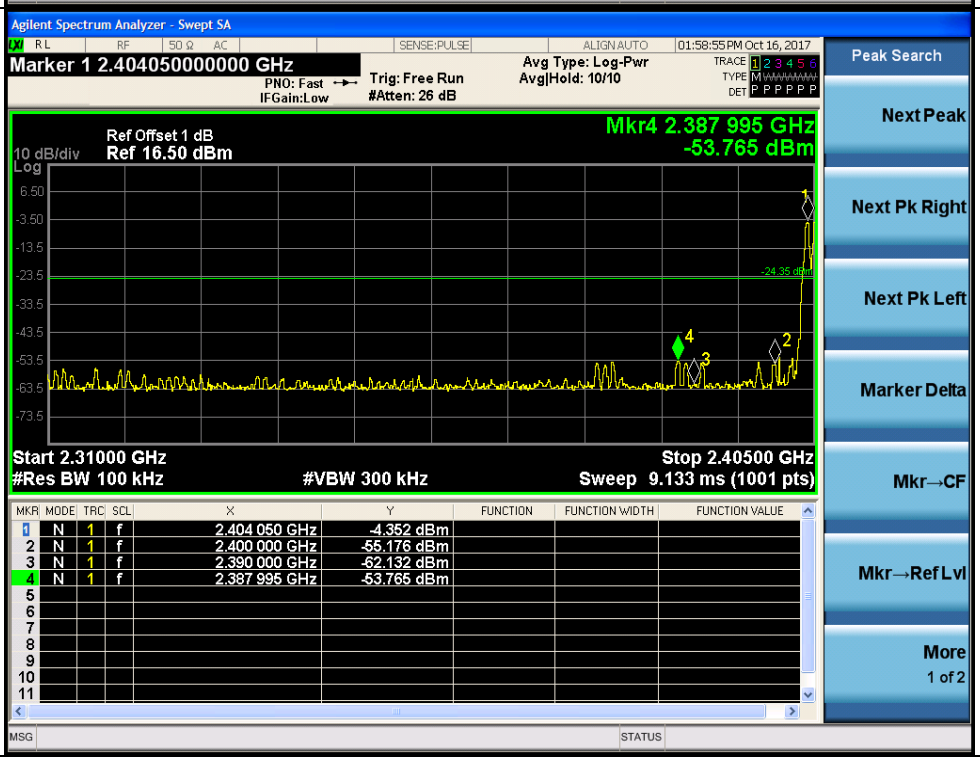
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

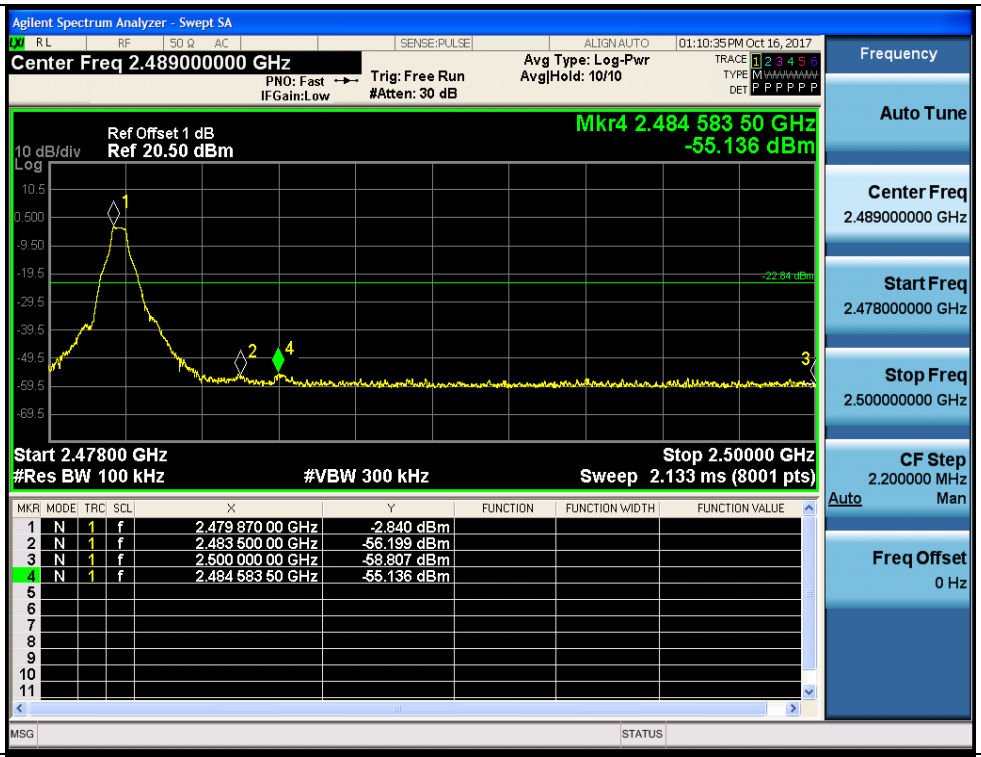
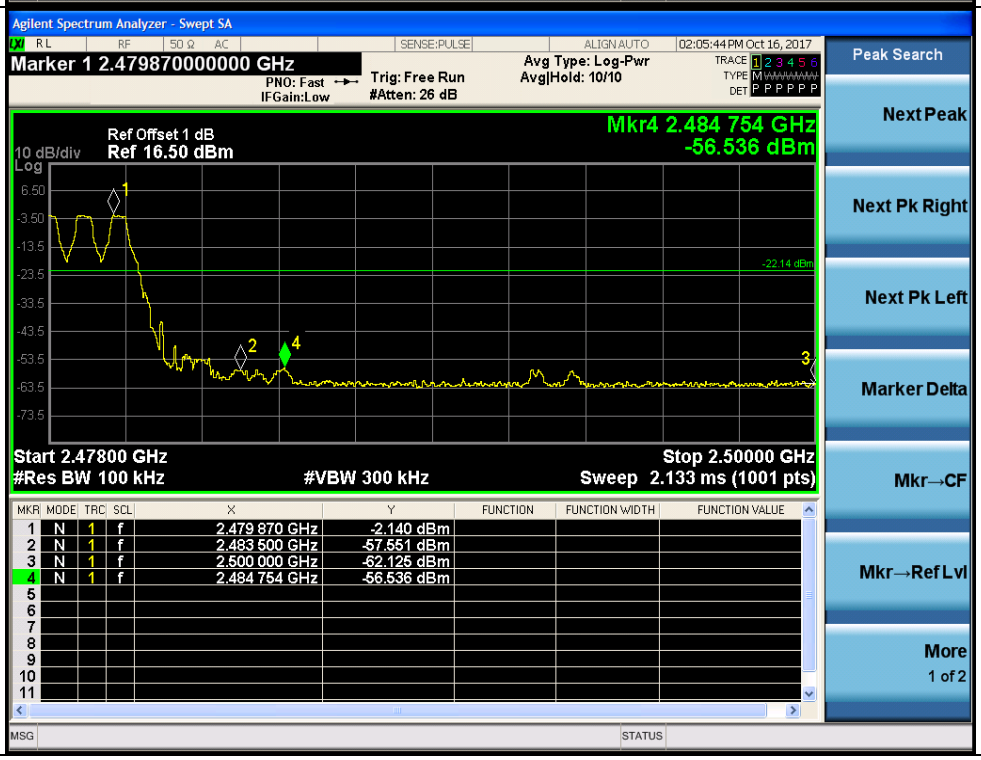
**TEST MODE:**

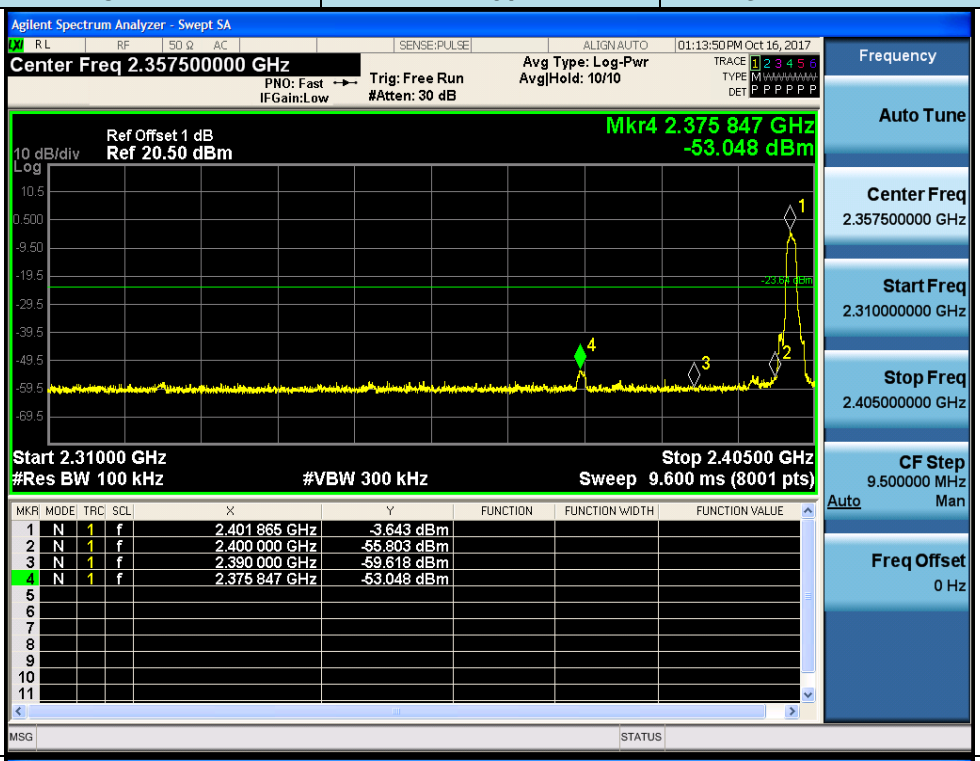
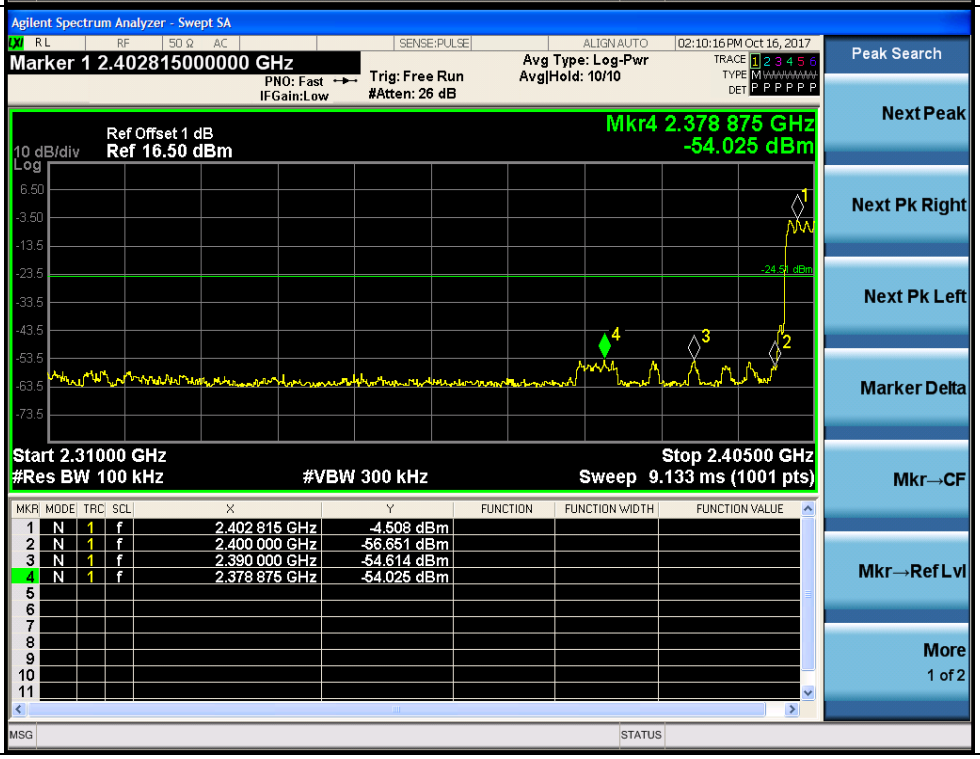
Please refer to the clause 3.3

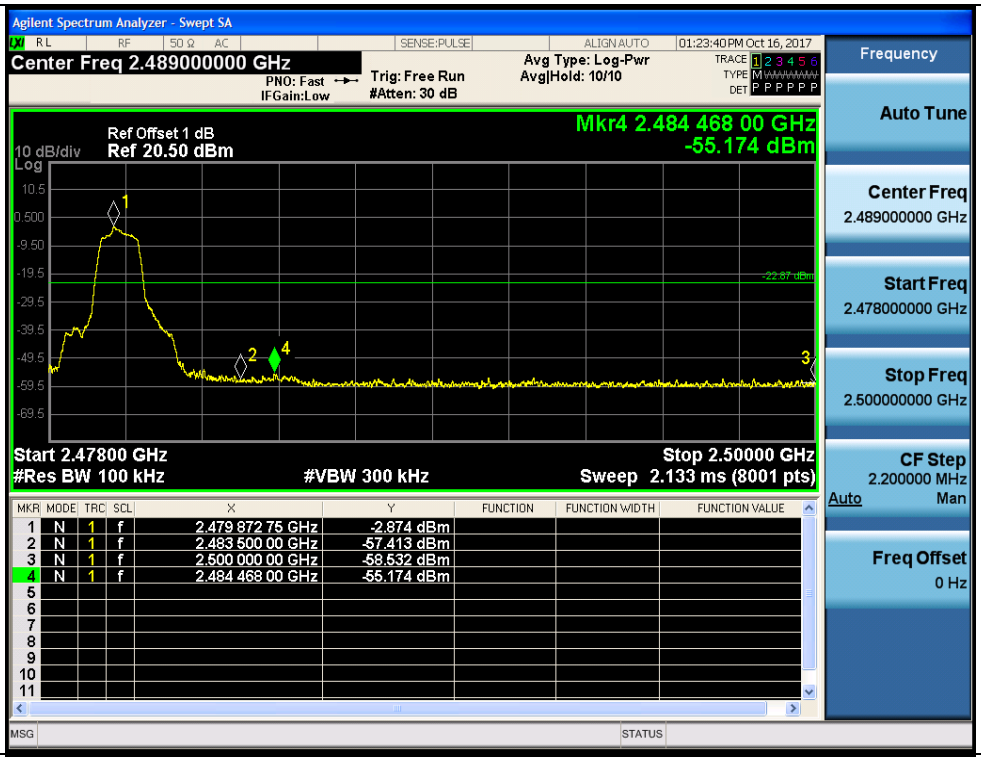
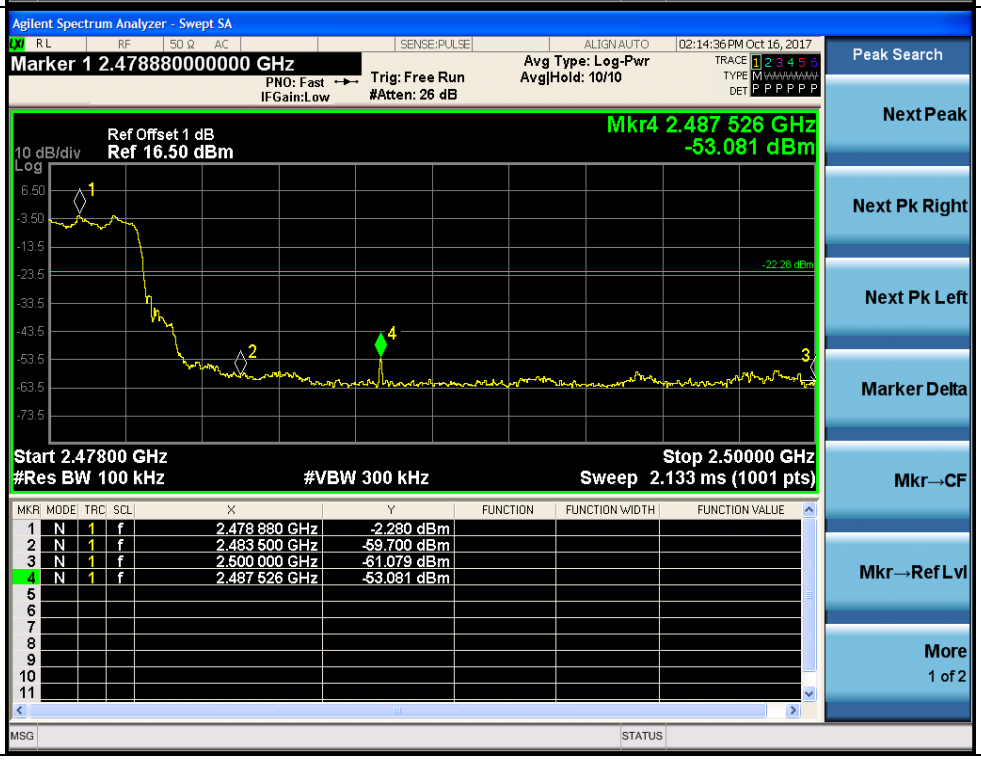
**TEST RESULTS**

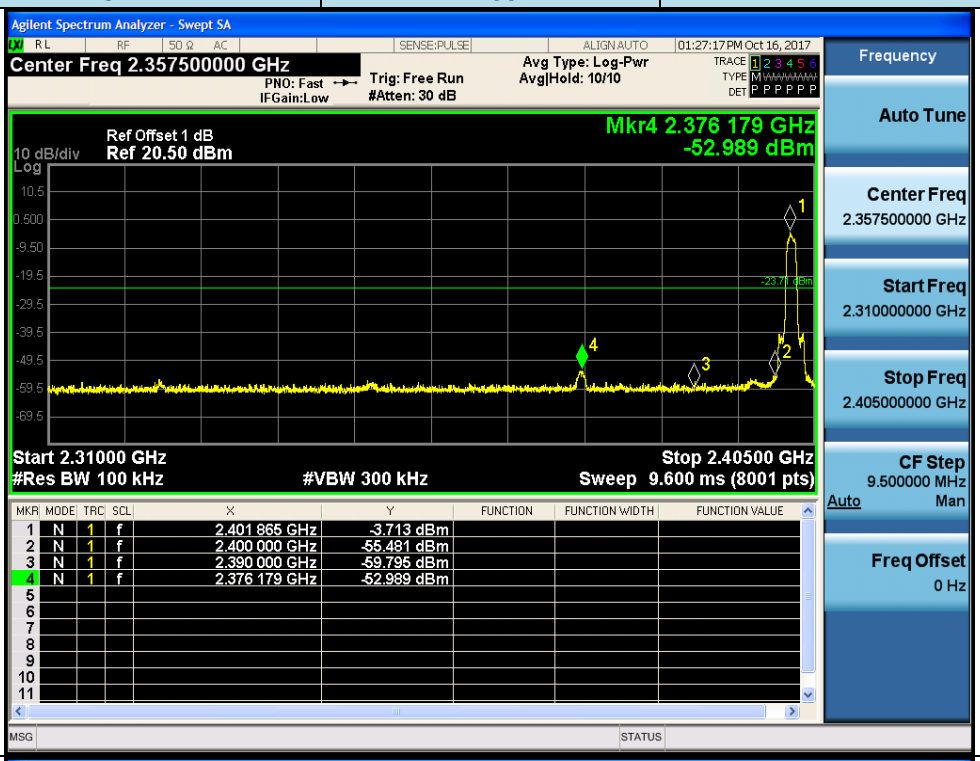
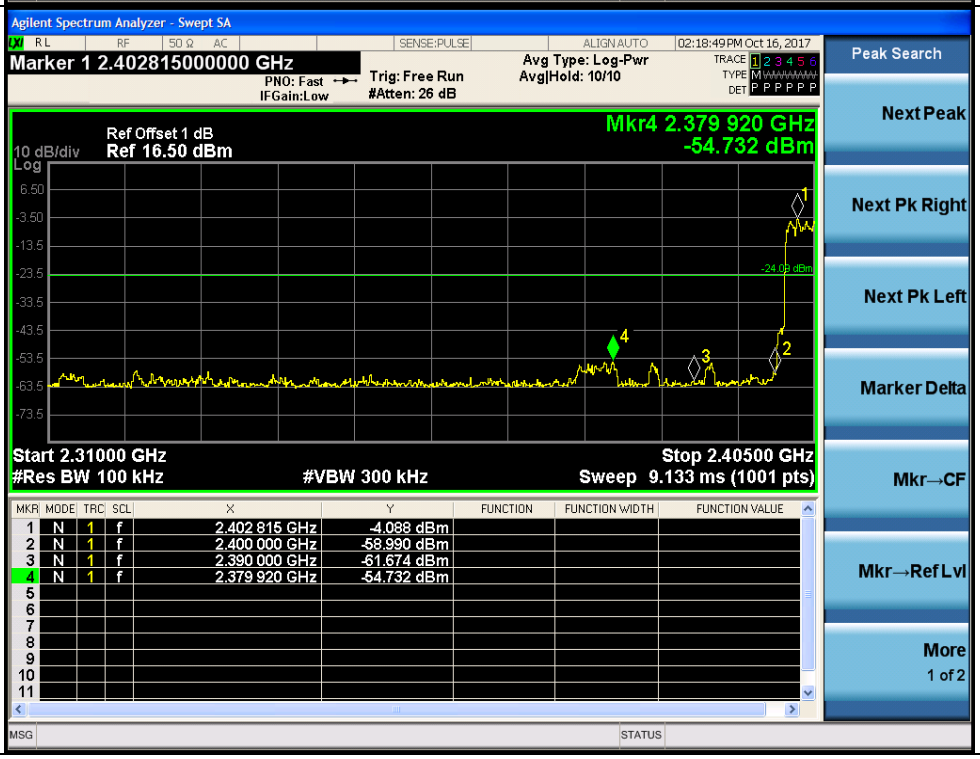
☒ **Passed** ☐ **Not Applicable**

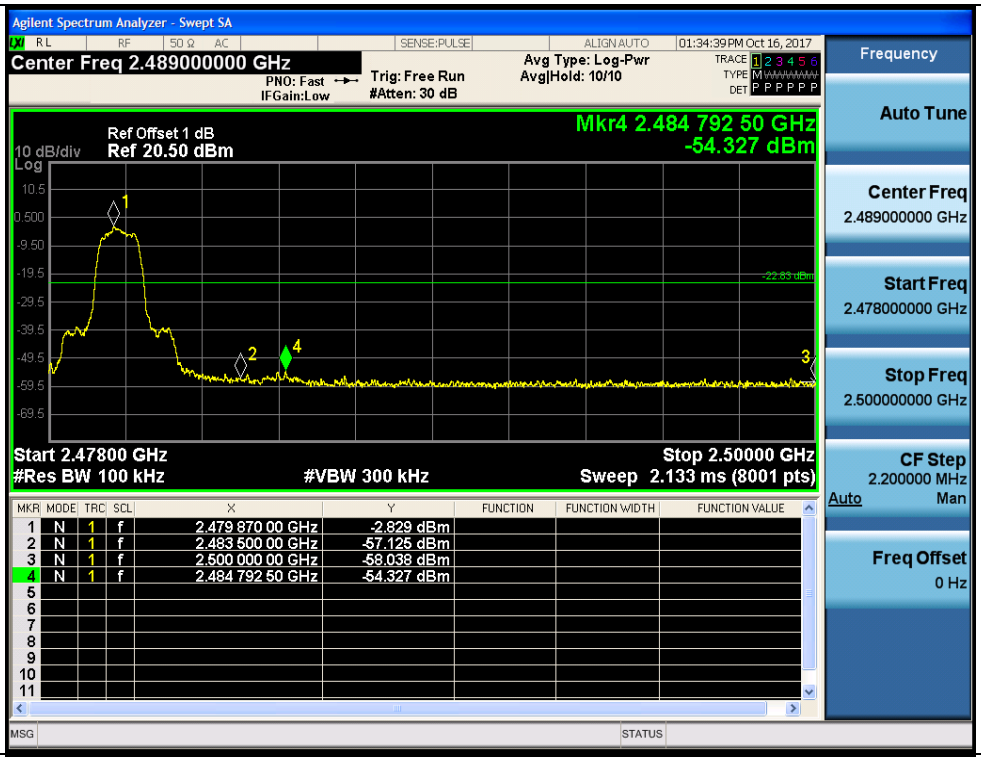
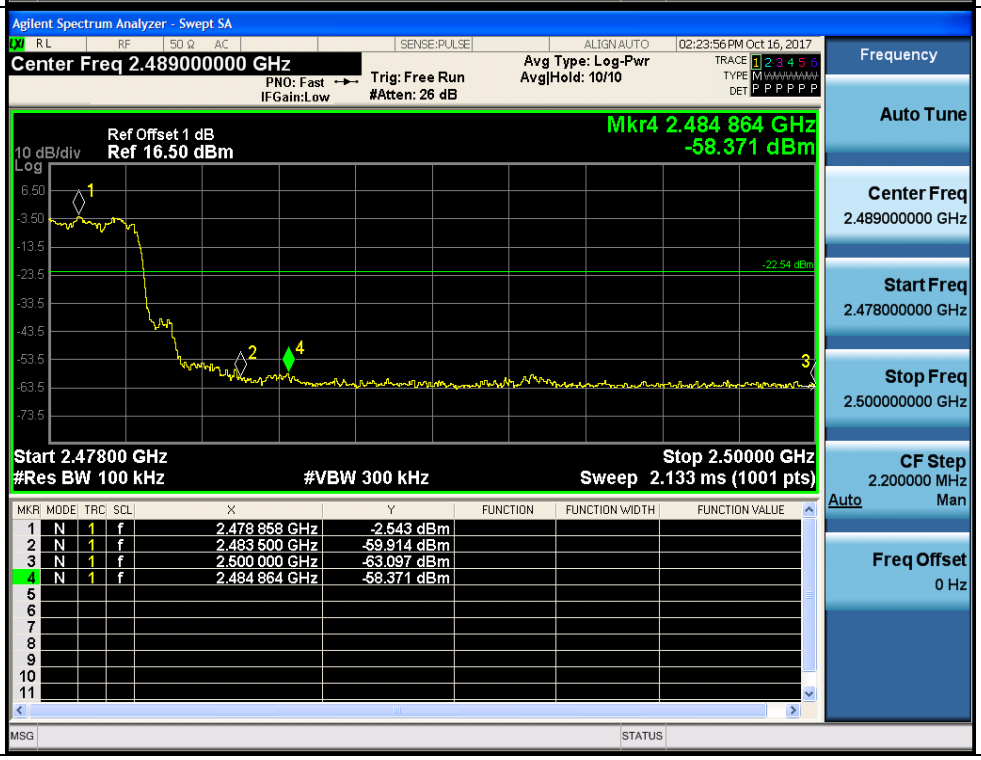
| Test Item: | Band edge | Modulation type: | GFSK |
|---|---|---|---|
| CH00<br><br>No hopping mode |  | | |
| CH00<br><br>Hopping mode |  | | |

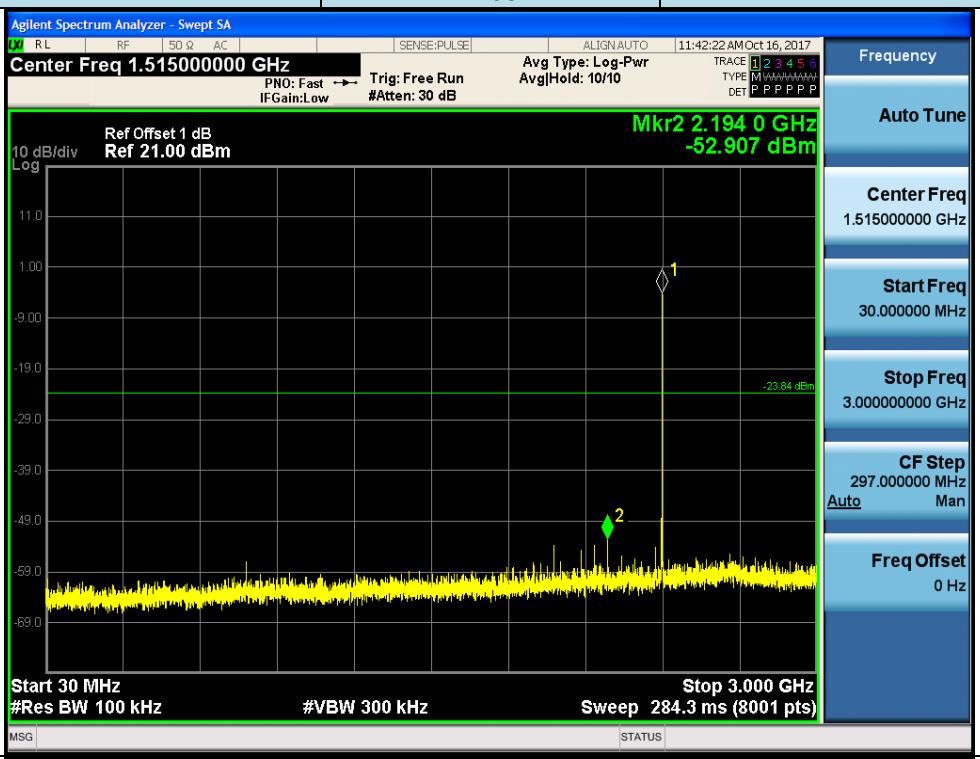
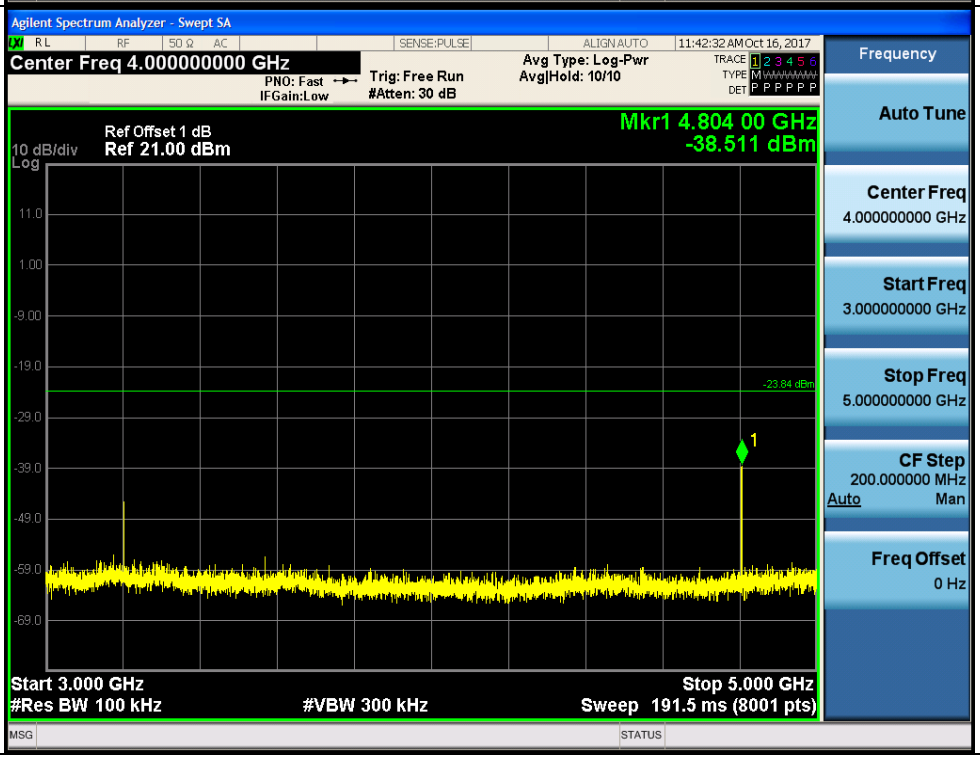
| | |
|---|---|
| CH78<br><br>No hopping mode |  |
| CH78<br><br>Hopping mode |  |

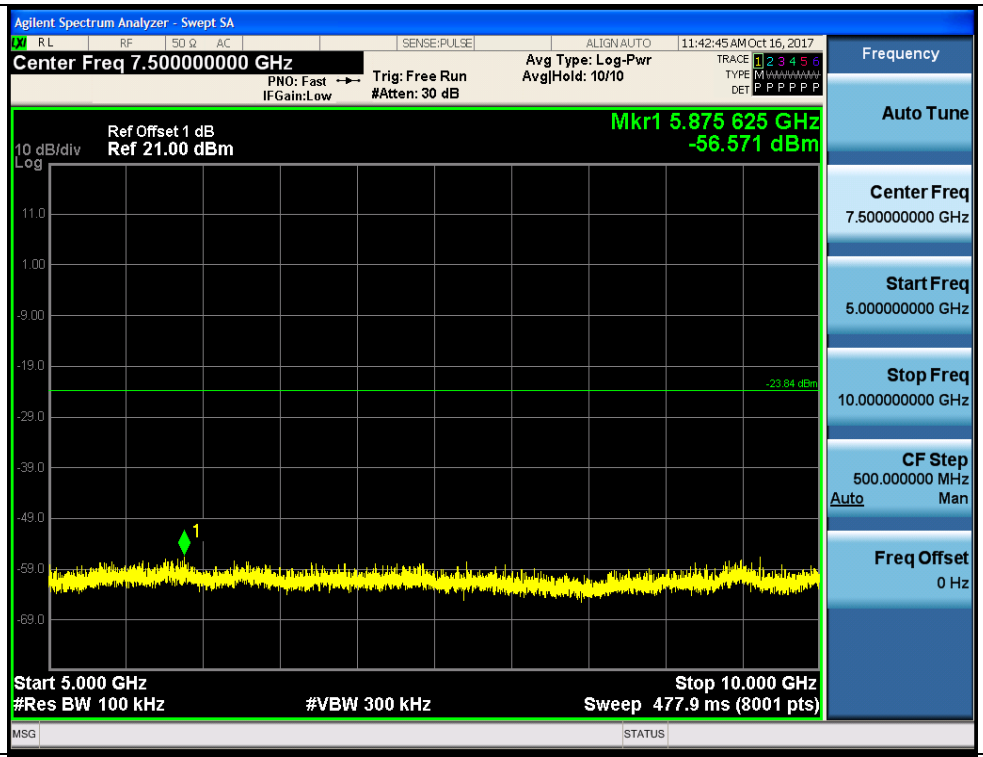
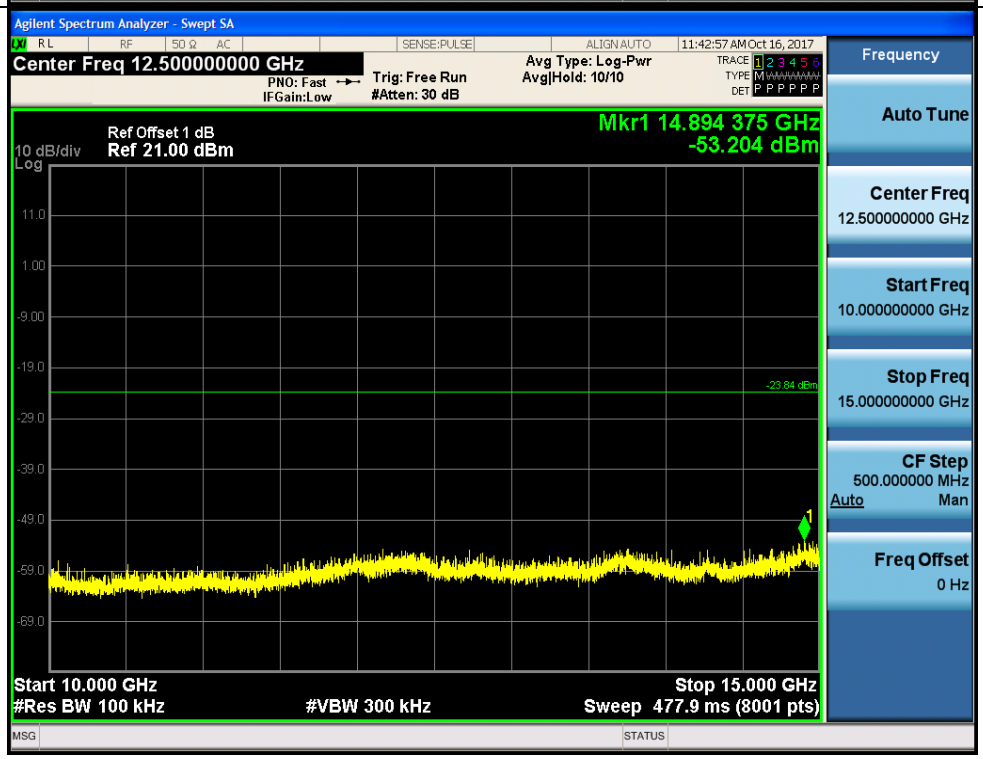
| Test Item: | Band edge | Modulation type: | π/4DQPSK |
|---|---|---|---|
| CH00<br><br>No hopping mode |  | | |
| CH00<br><br>Hopping mode |  | | |

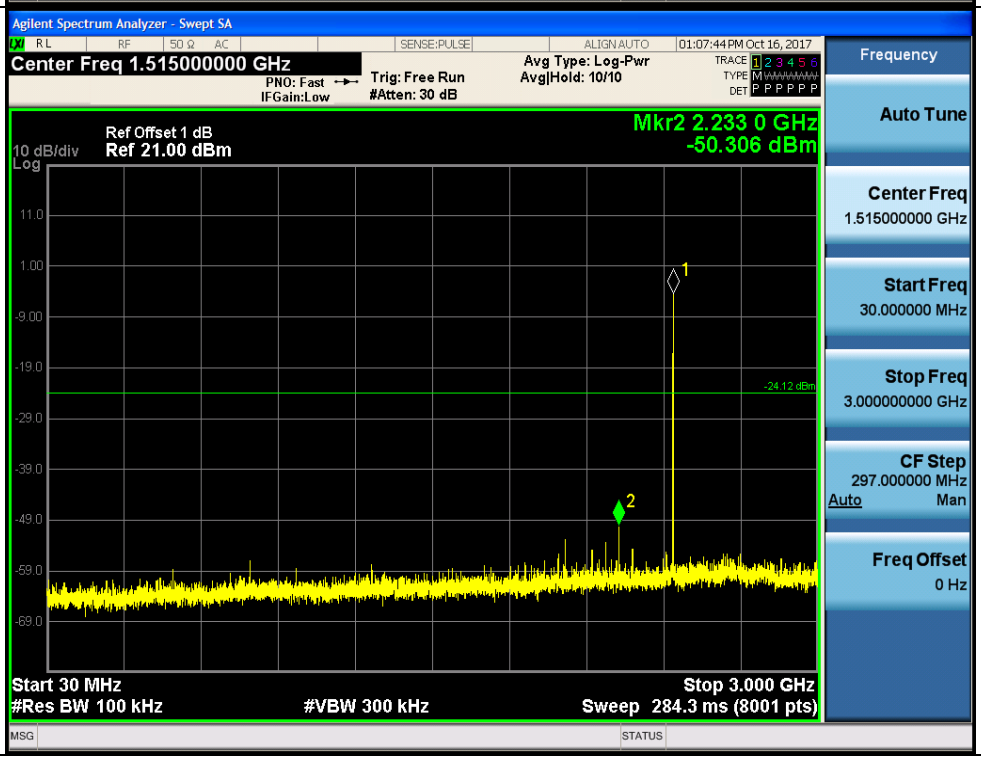
| | |
|---|---|
| CH78<br><br>No hopping mode |  |
| CH78<br><br>Hopping mode |  |

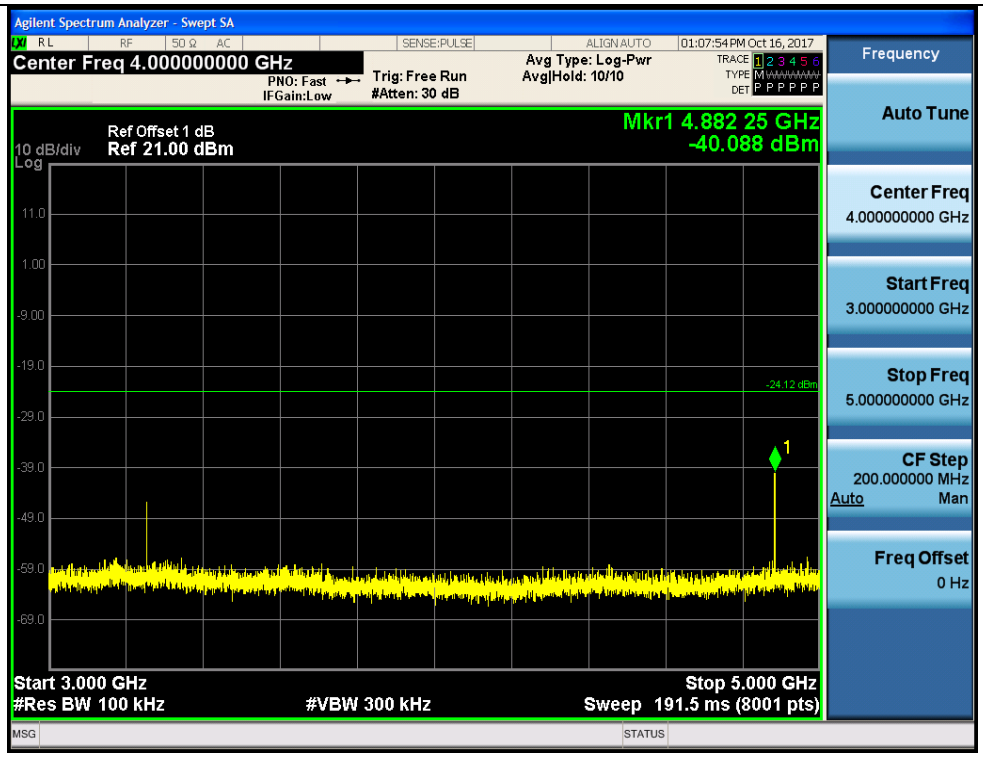
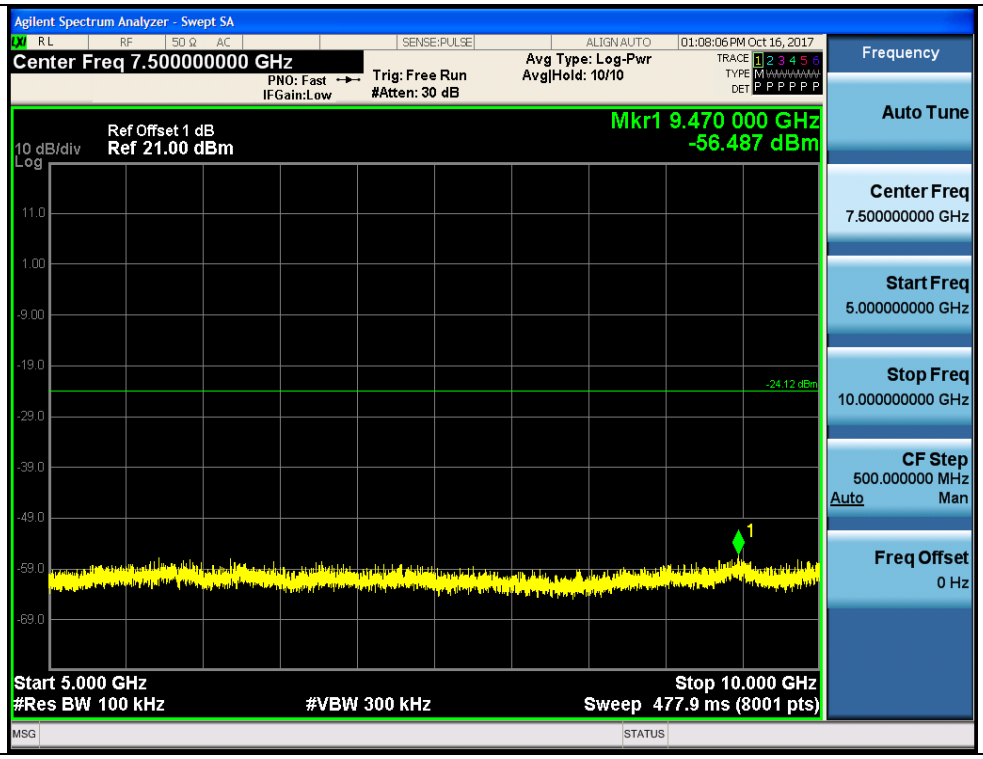
| Test Item: | Band edge | Modulation type: | 8DPSK |
|---|---|---|---|
| CH00<br><br>No hopping mode |  | | |
| CH00<br><br>Hopping mode |  | | |

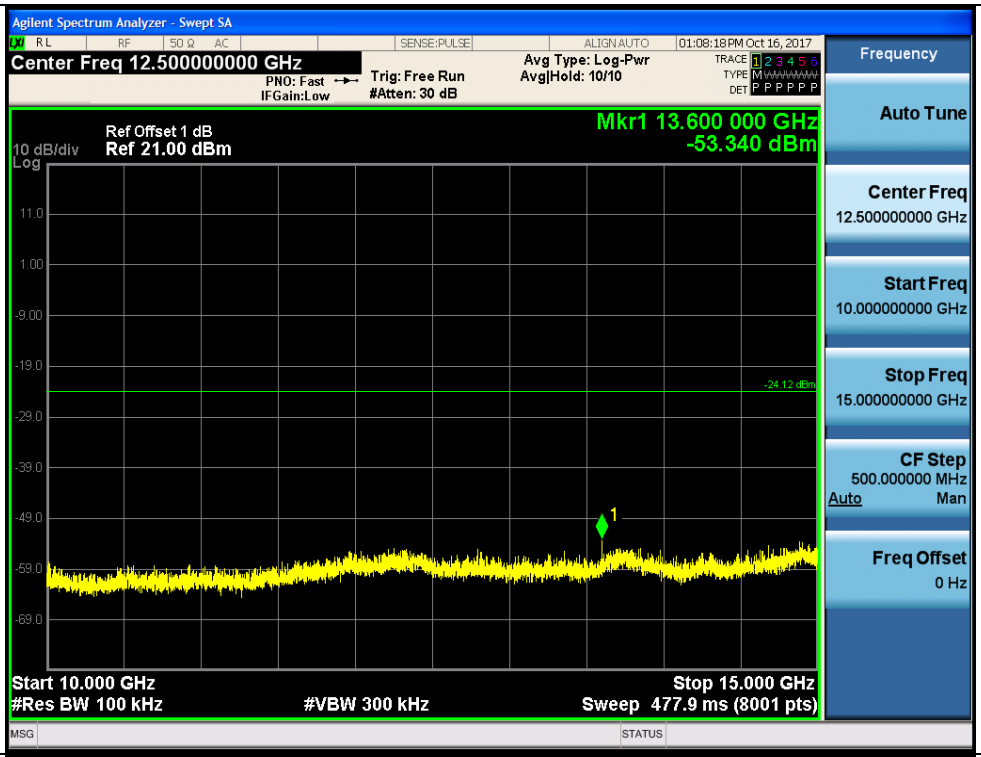
| | |
|---|---|
| CH78<br><br>No hopping mode |  |
| CH78<br><br>Hoppig mode |  |

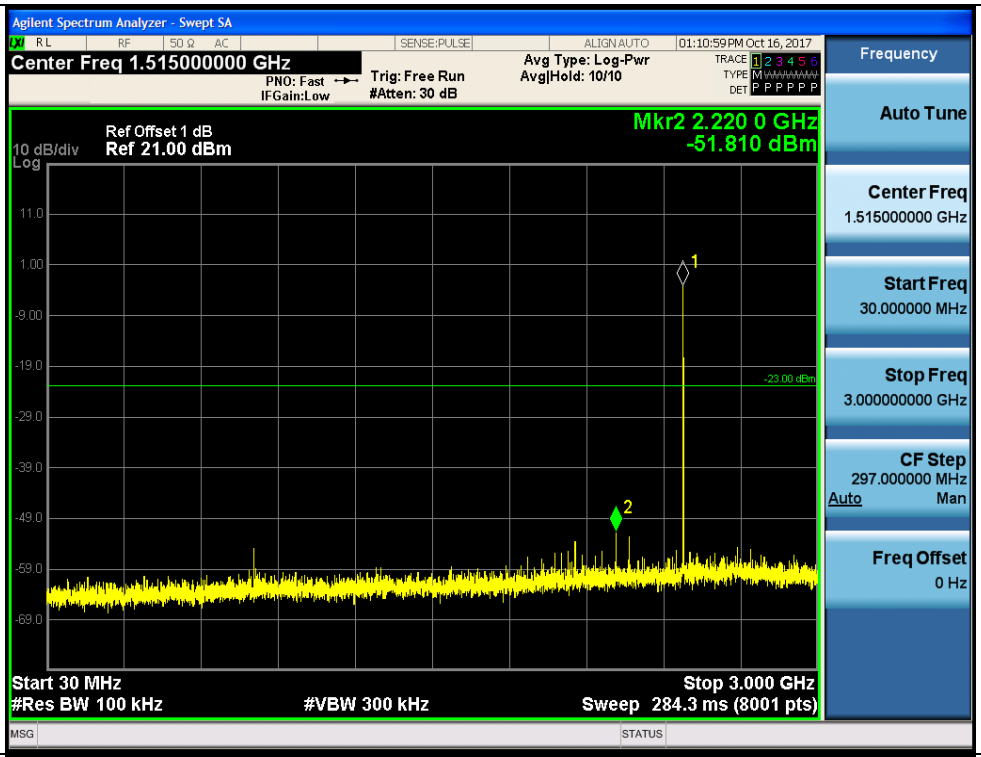
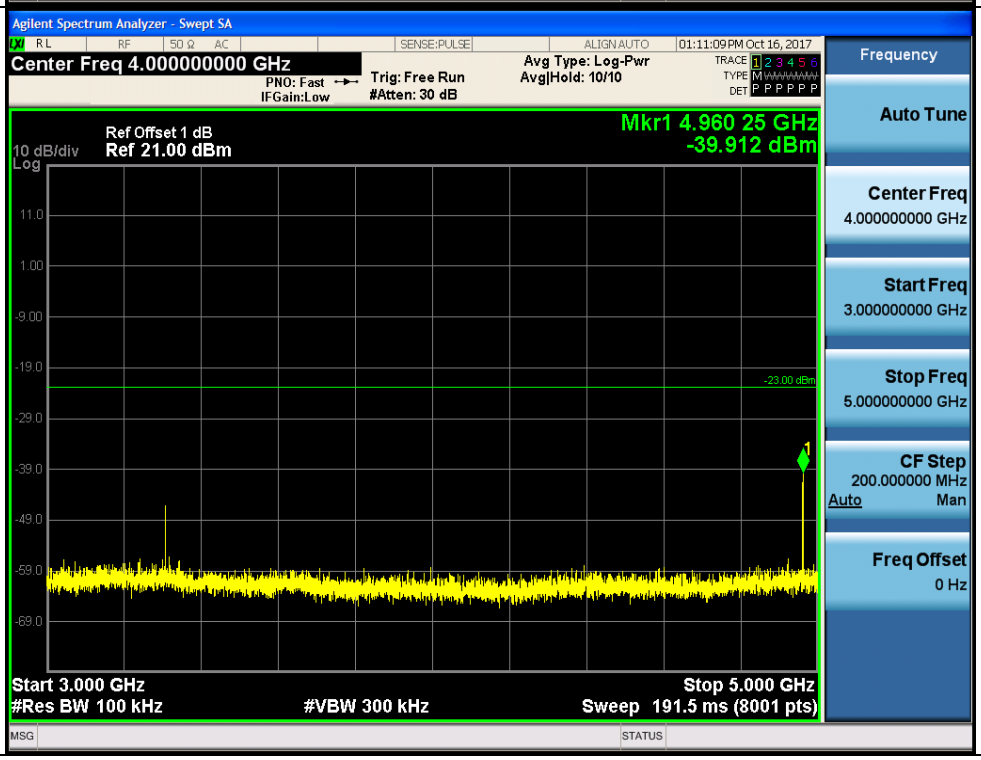
| Test Item: | SE | Modulation type: | GFSK |
|---|---|---|---|
| CH00<br><br>30MHz~3GHz |  | | |
| CH00<br><br>3GHz~5GHz |  | | |

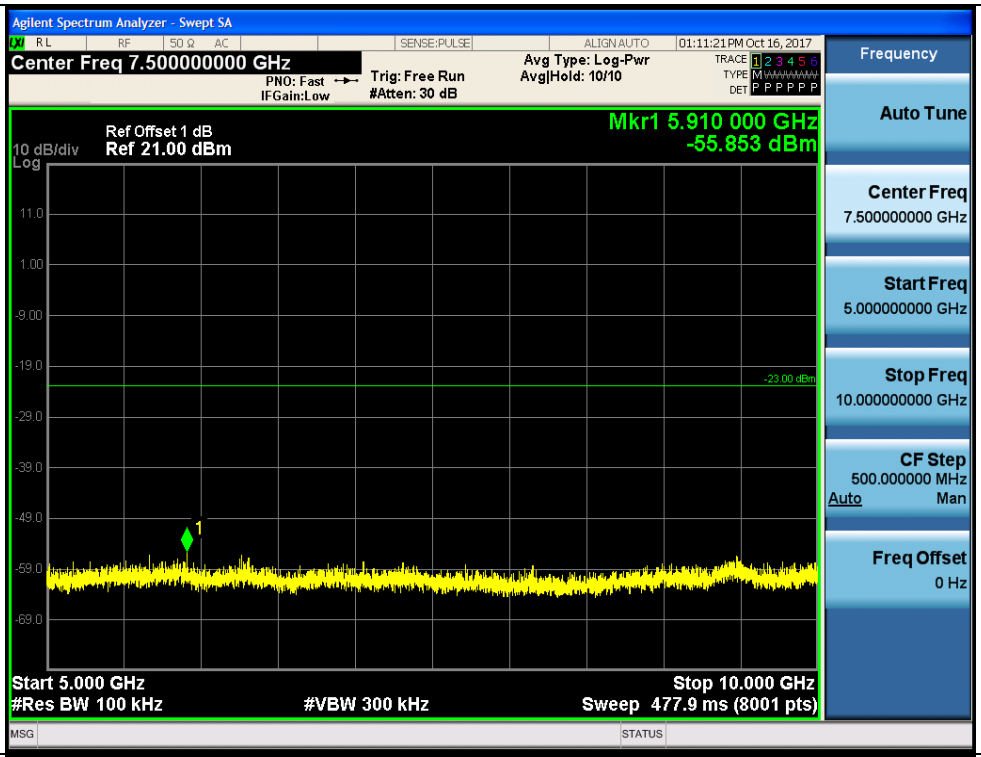
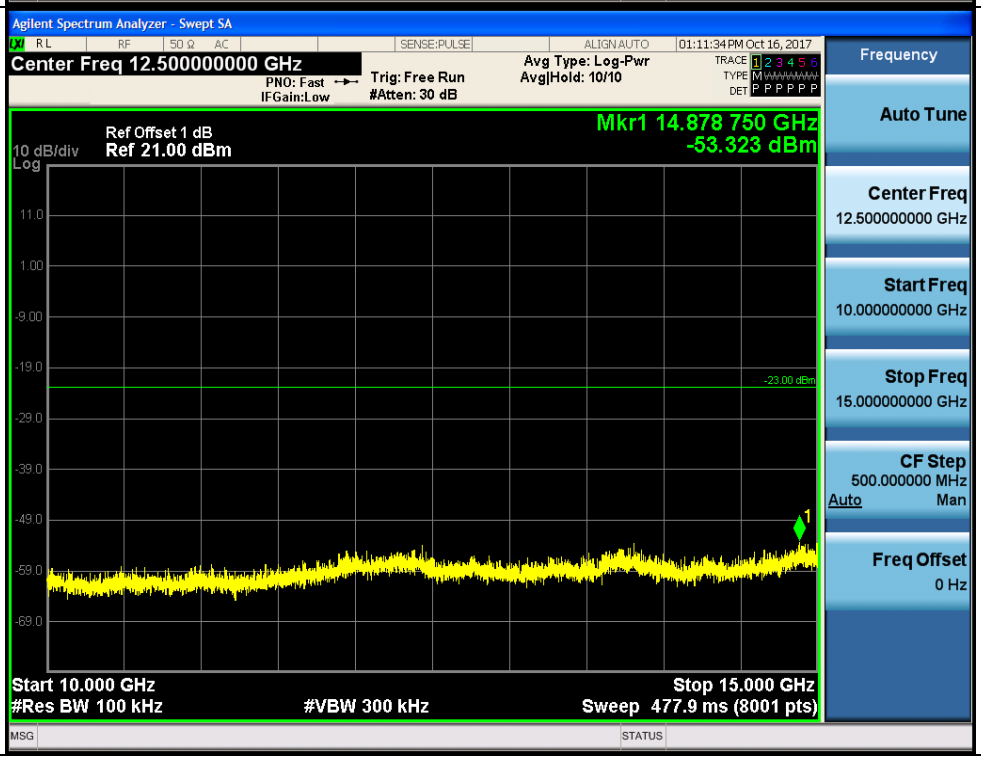
| | |
|---|---|
| CH00<br><br>5GHz~10GHz |  |
| CH00<br><br>10GHz~15GHz |  |

| | |
|---|---|
| CH00<br><br>15GHz~25GHz | |
| CH39<br><br>30MHz~3GHz |  |

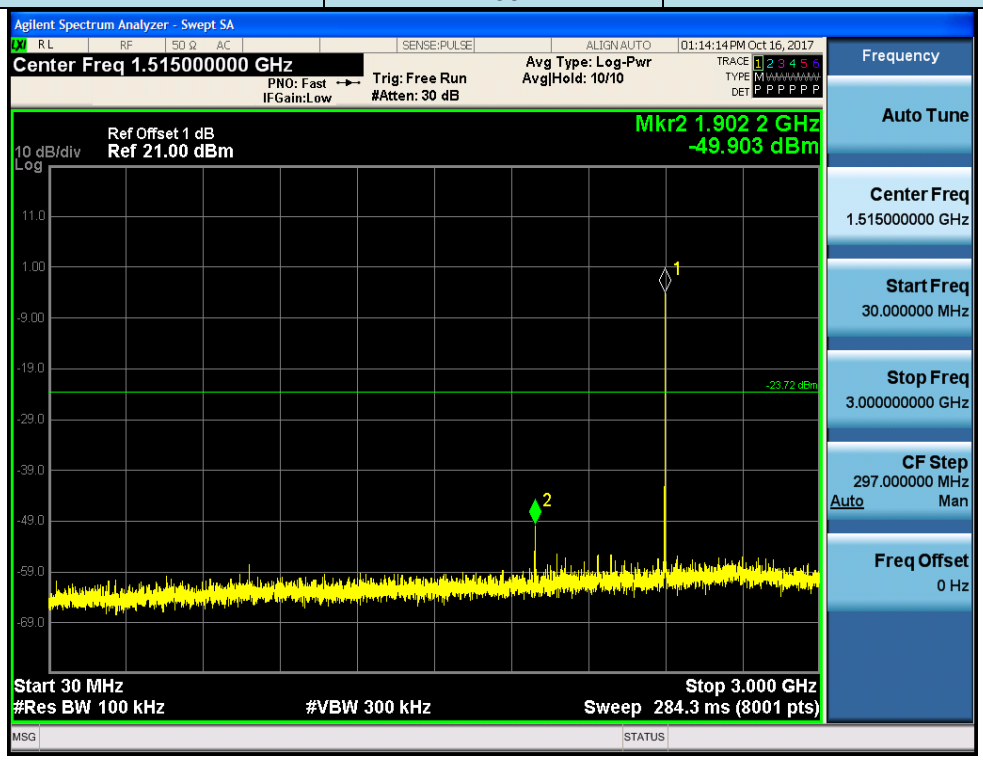
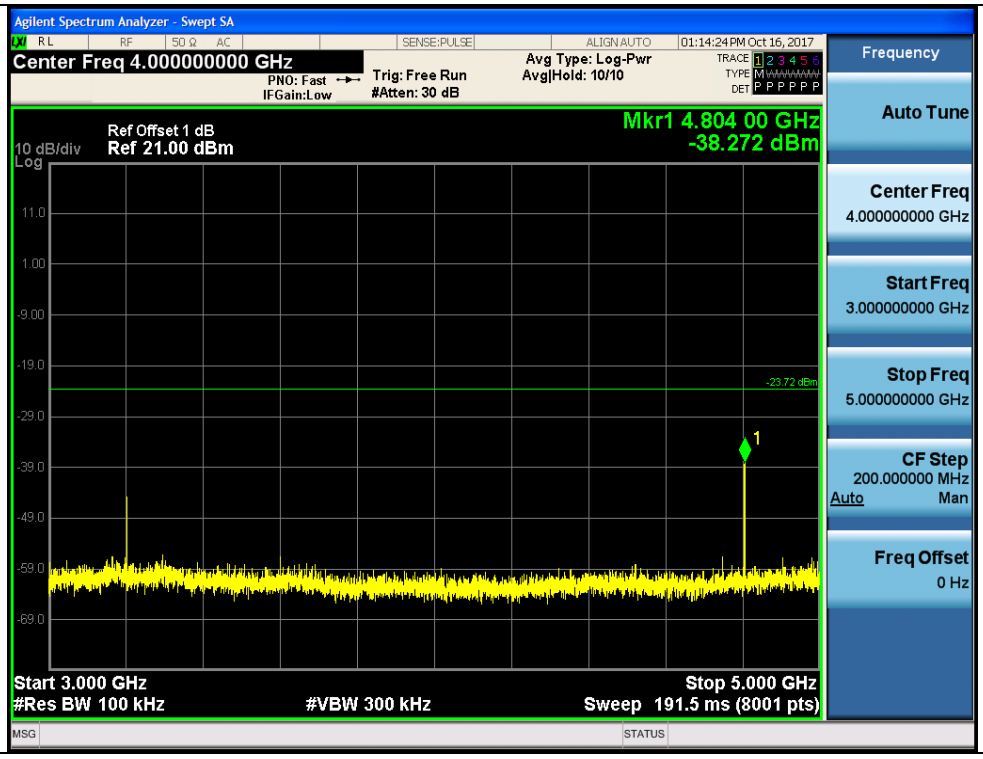
| | |
|---|---|
| CH39<br><br>3GHz~5GHz |  |
| CH39<br><br>5GHz~10GHz |  |

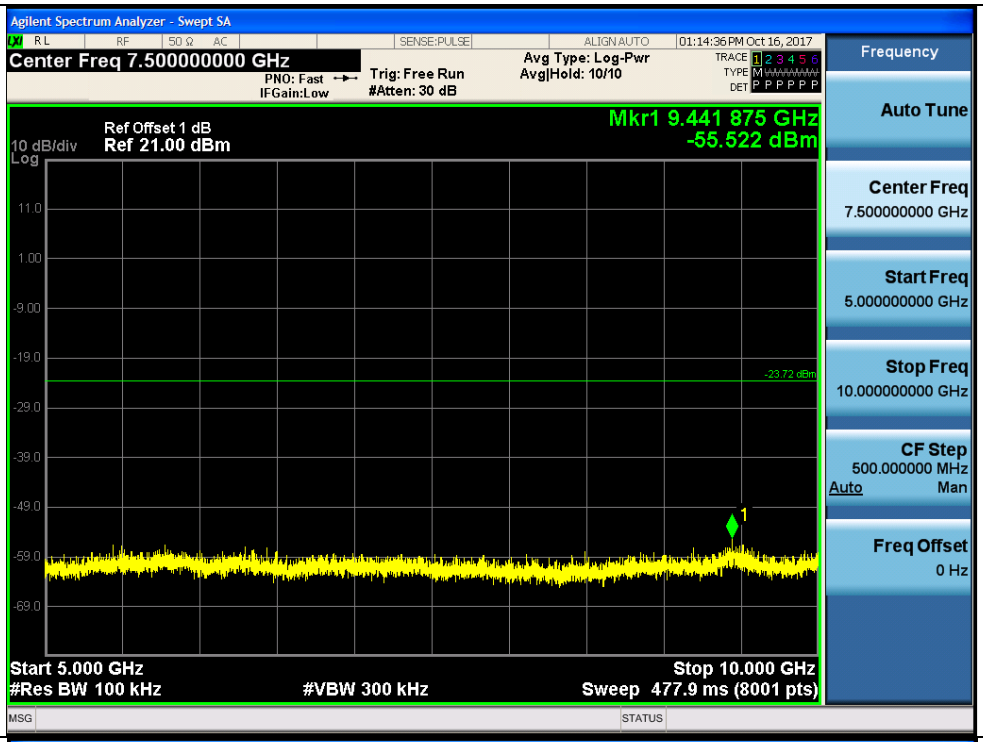
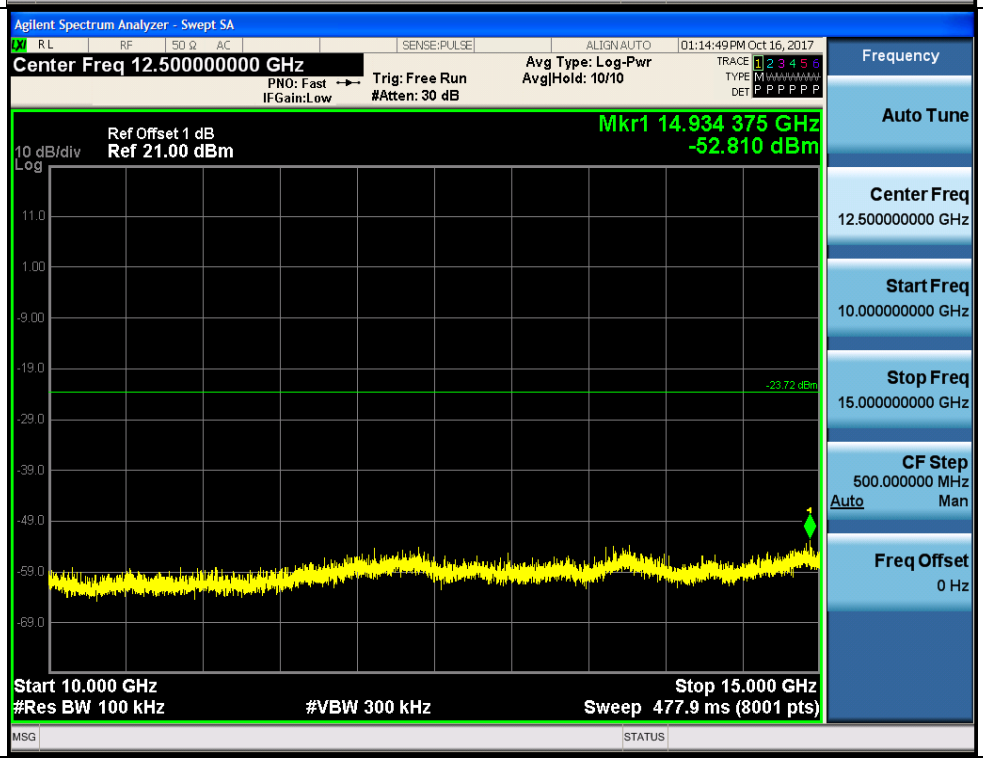
| | |
|---|---|
| CH39<br><br>10GHz~15GHz |  |
| CH39<br><br>15GHz~25GHz | |

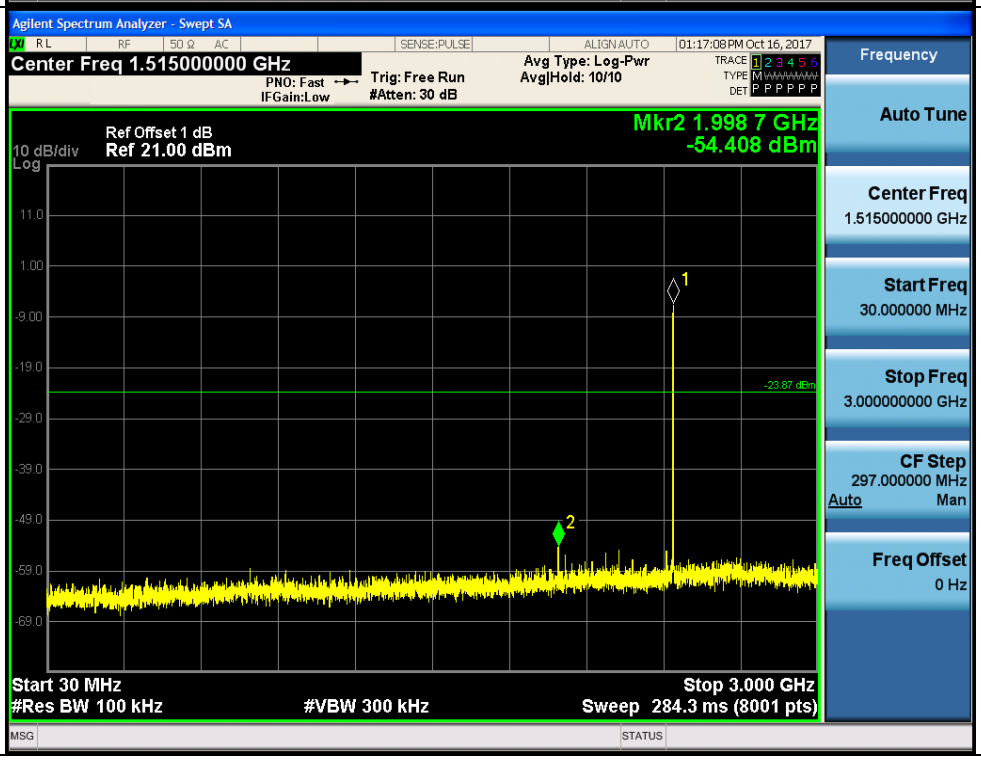
| | |
|---|---|
| CH78<br><br>30MHz~3GHz |  |
| CH78<br><br>3GHz~5GHz |  |

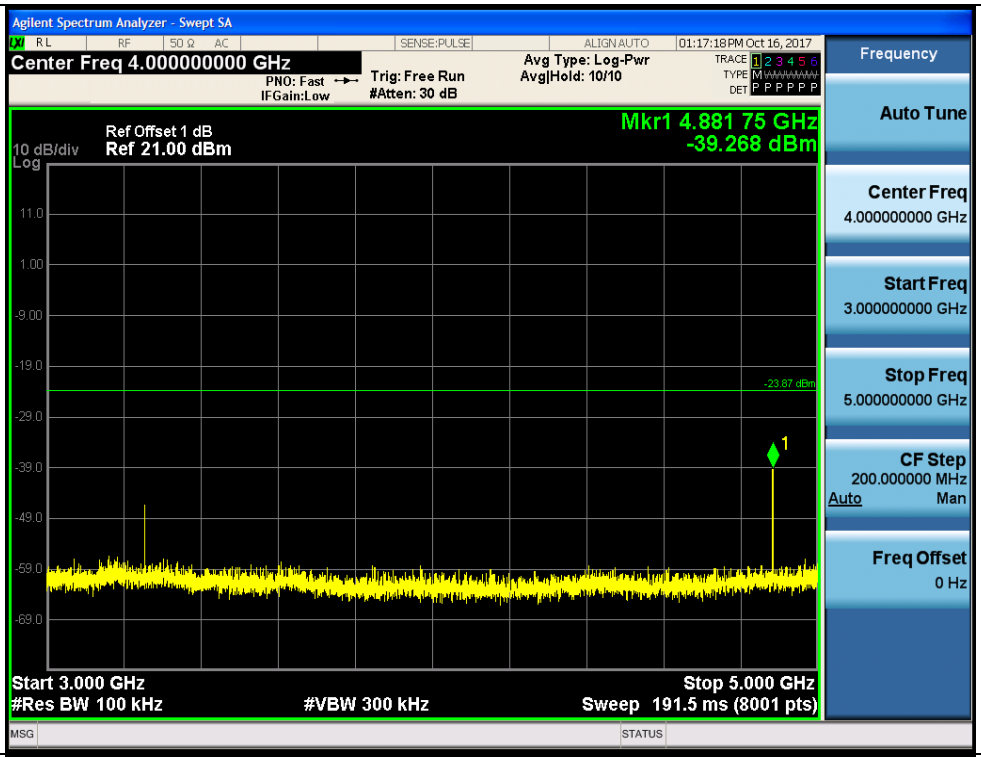
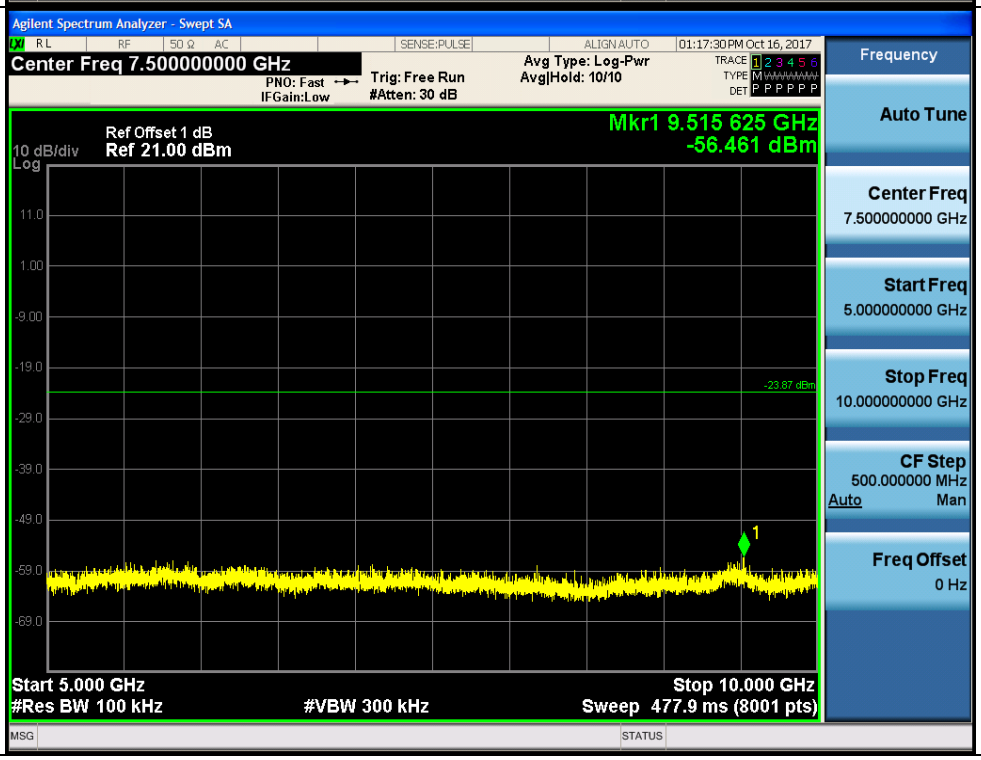
| | |
|---|---|
| CH78<br><br>5GHz~10GHz |  |
| CH78<br><br>10GHz~15GHz |  |

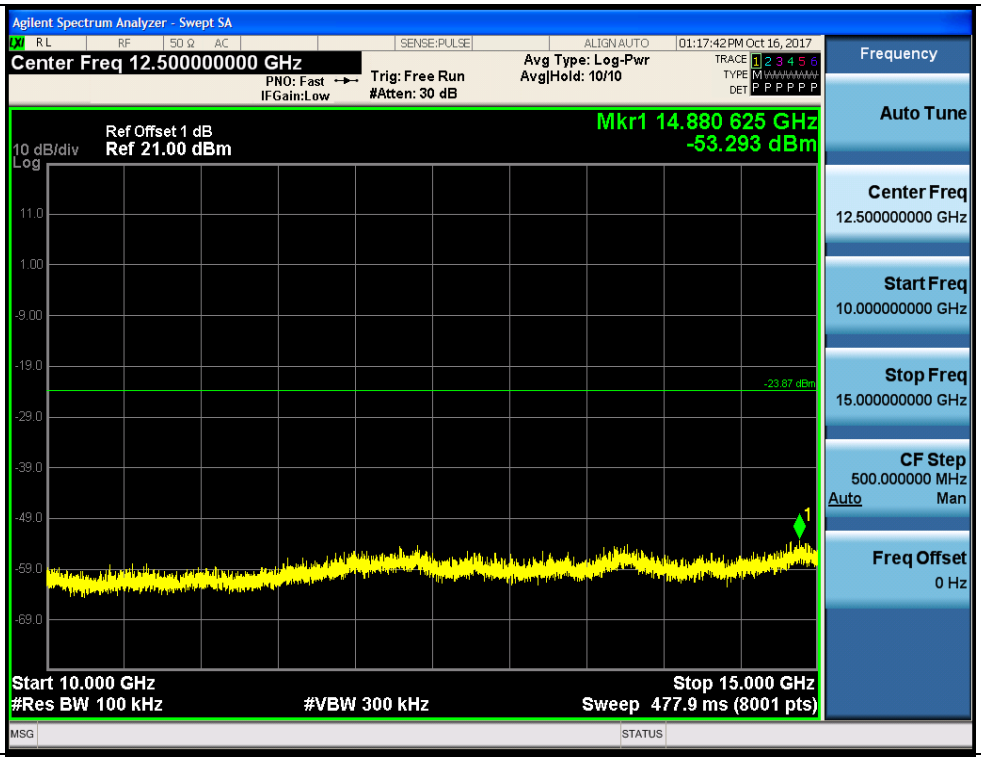
| | |
|---|---|
| CH78<br><br>15GHz~25GHz | |

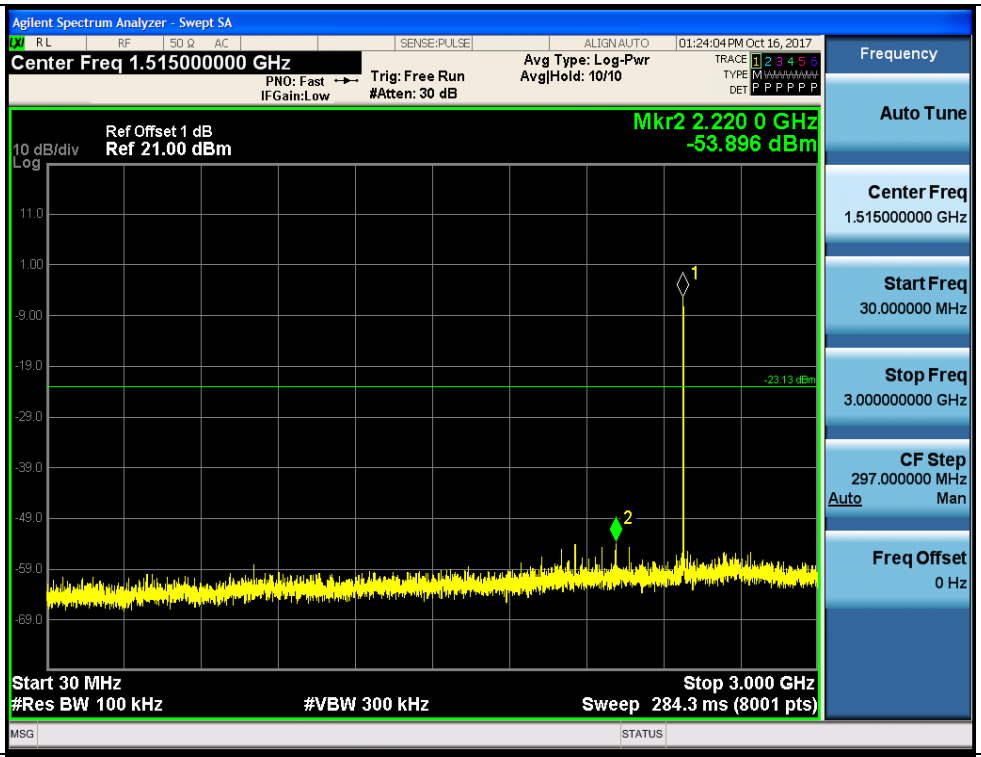
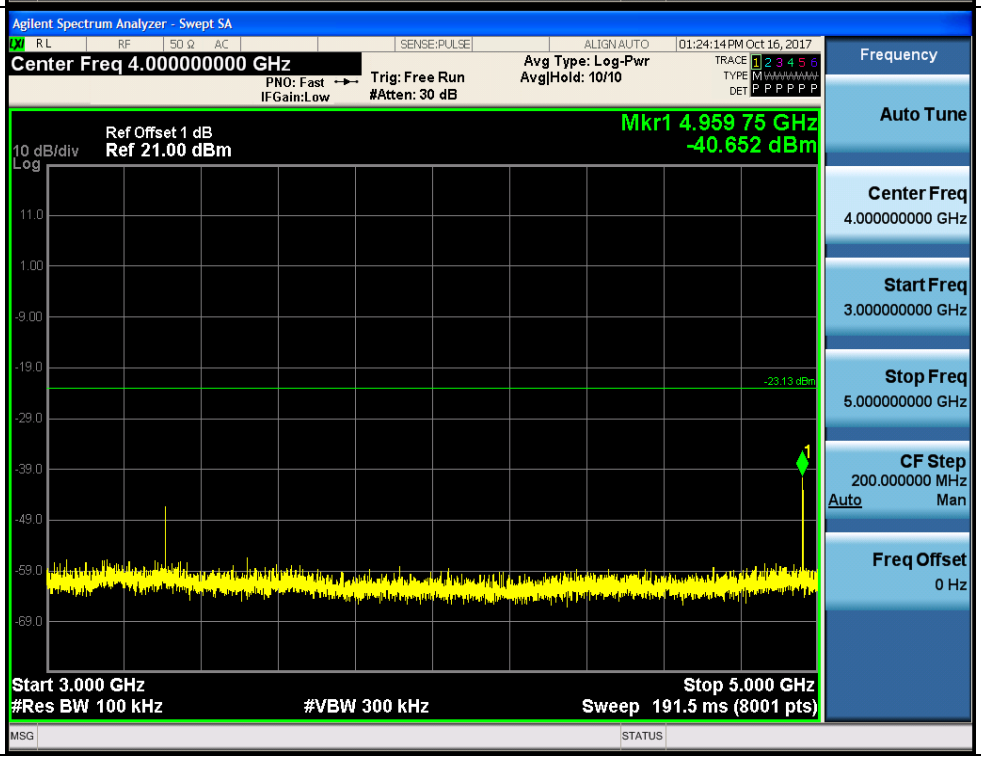
| Test Item: | SE | Modulation type: | π/4DQPSK |
|---|---|---|---|
| CH00<br><br>30MHz~3GHz |  | | |
| CH00<br><br>3GHz~5GHz |  | | |

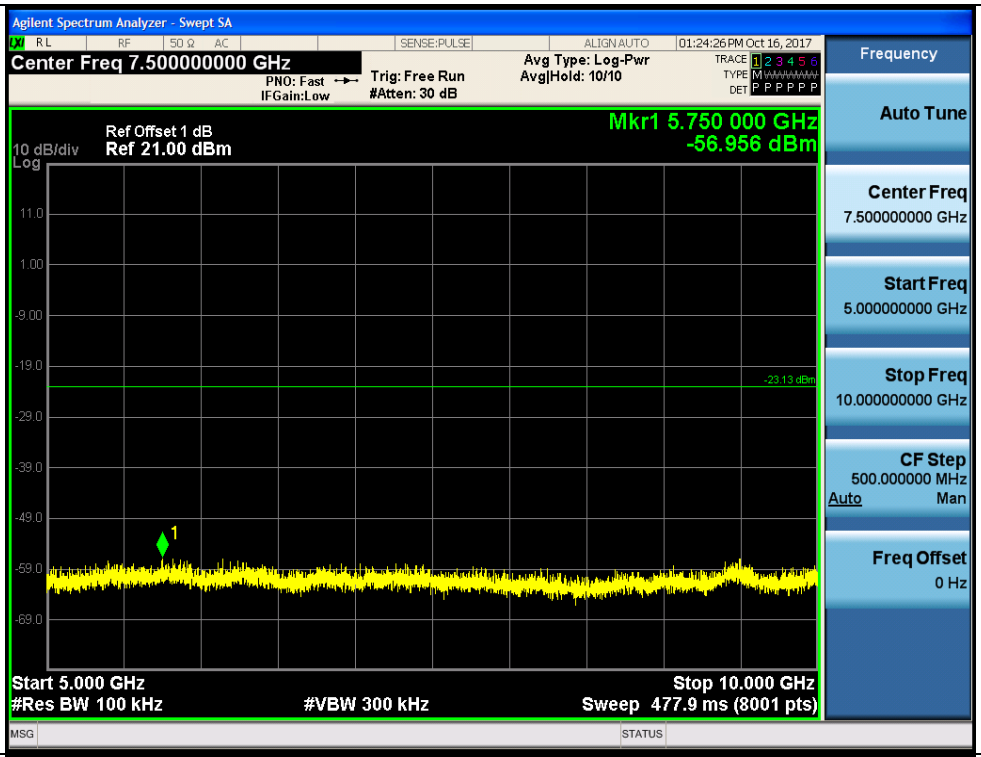
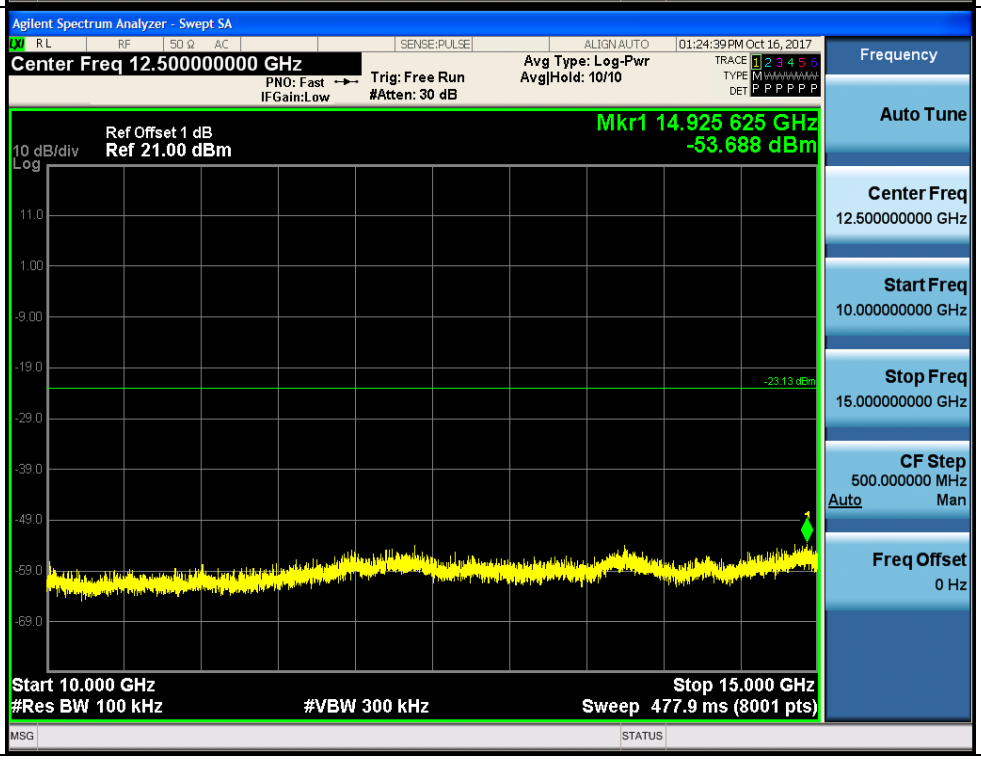
| | |
|---|---|
| CH00<br><br>5GHz~10GHz |  |
| CH00<br><br>10GHz~15GHz |  |

| | |
|---|---|
| CH00<br><br>15GHz~25GHz | |
| CH39<br><br>30MHz~3GHz |  |

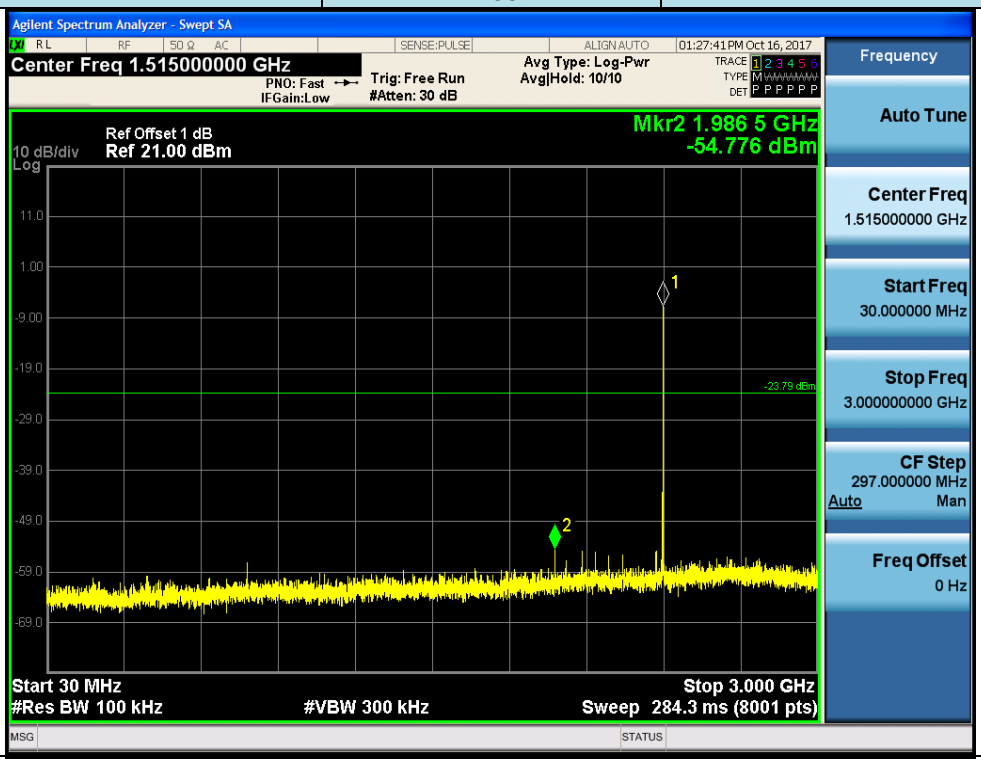
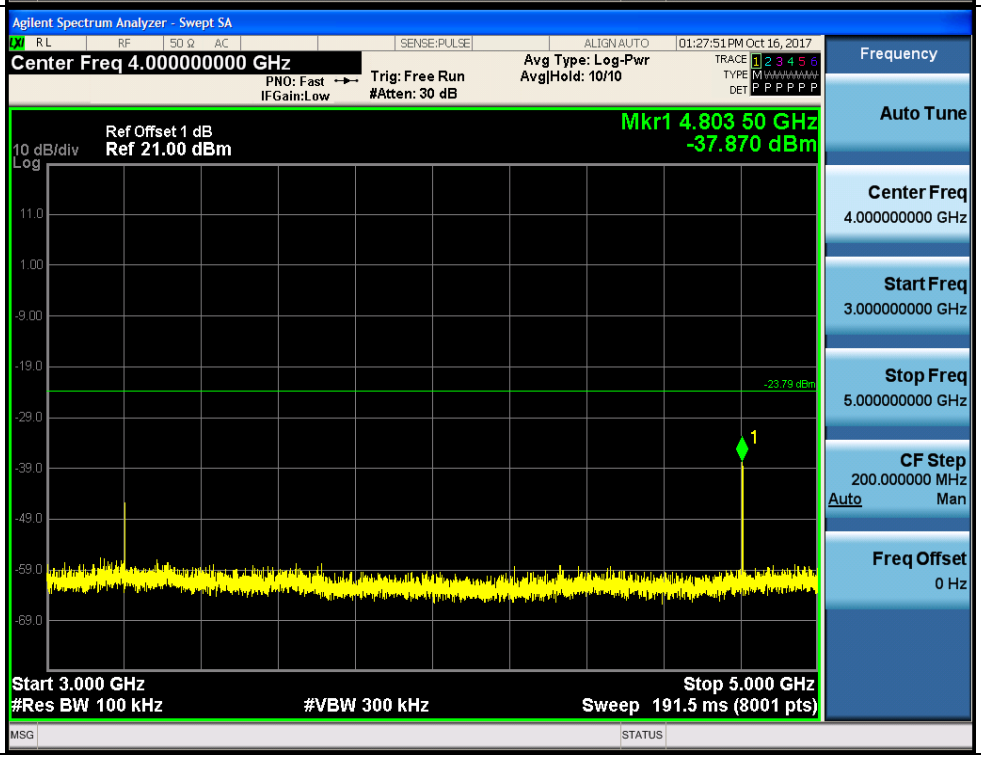
| | |
|---|---|
| CH39<br><br>3GHz~5GHz |  |
| CH39<br><br>5GHz~10GHz |  |

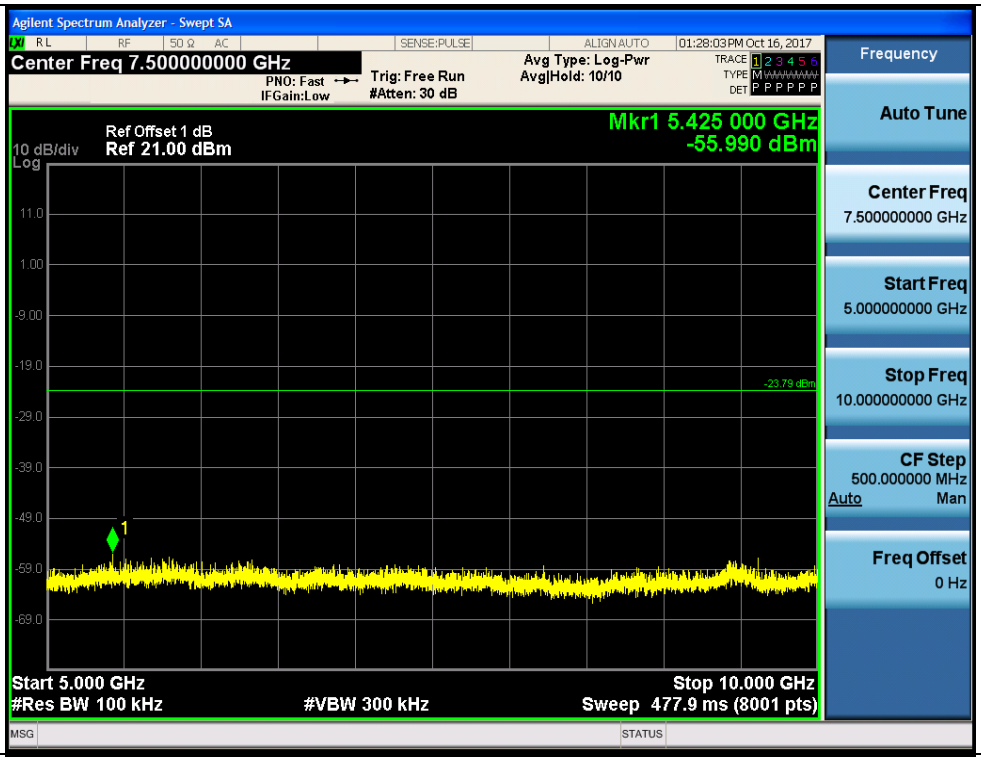
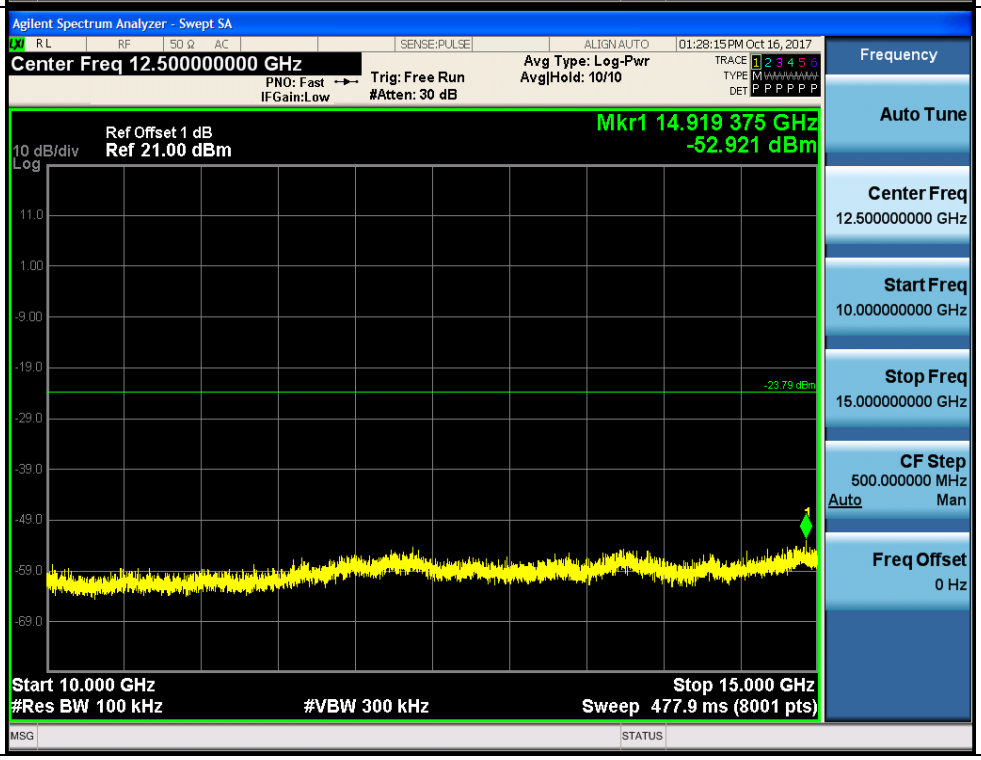
| | |
|---|---|
| CH39<br><br>10GHz~15GHz |  |
| CH39<br><br>15GHz~25GHz | |

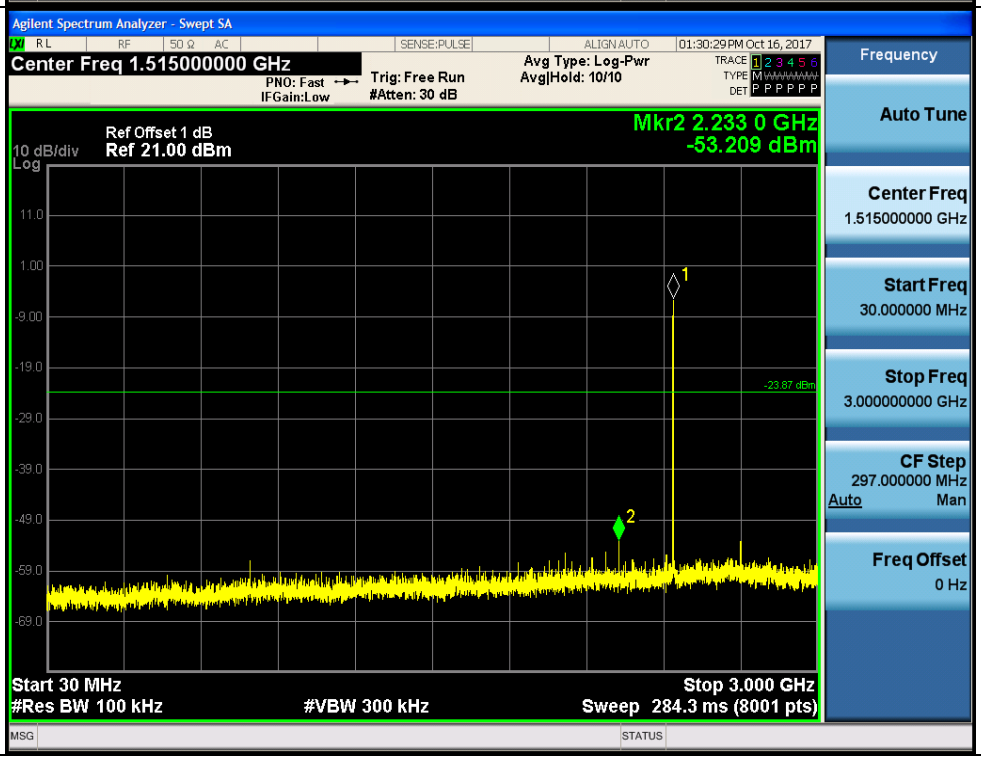
| | |
|---|---|
| CH78<br><br>30MHz~3GHz |  |
| CH78<br><br>3GHz~5GHz |  |

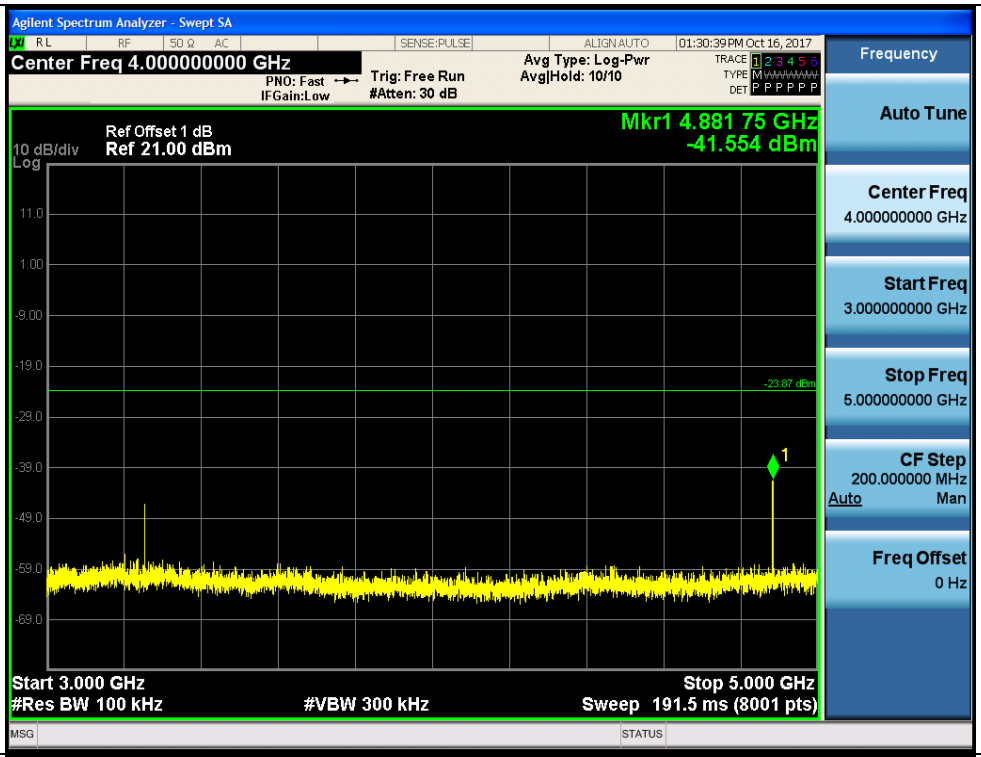
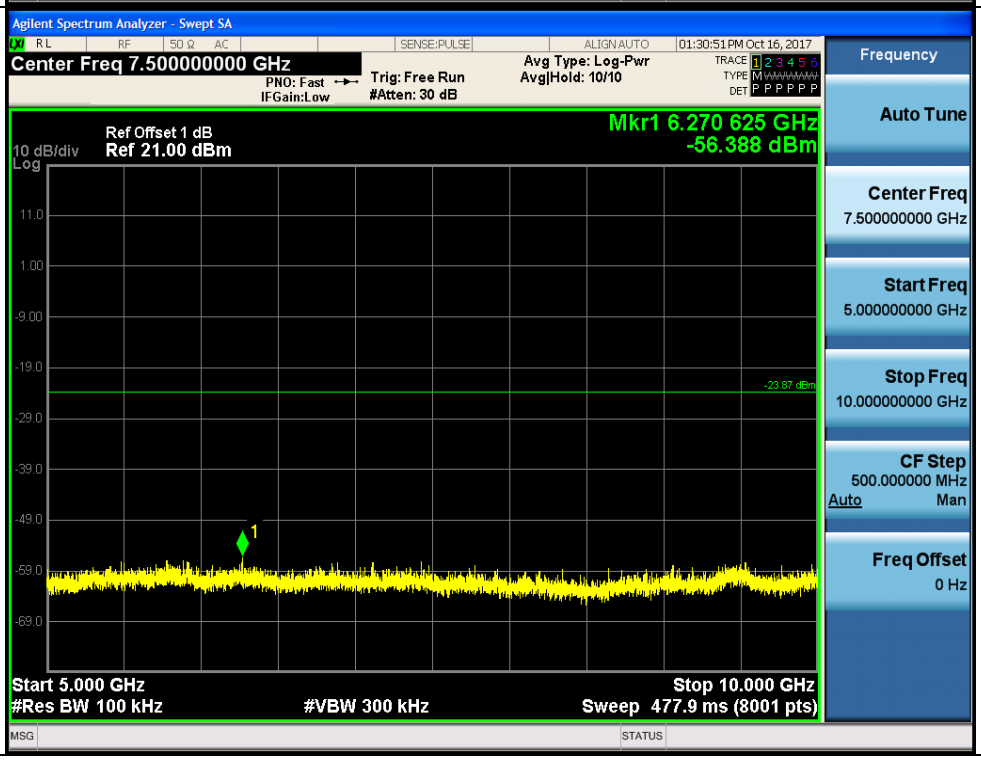
| | |
|---|---|
| CH78<br><br>5GHz~10GHz |  |
| CH78<br><br>10GHz~15GHz |  |

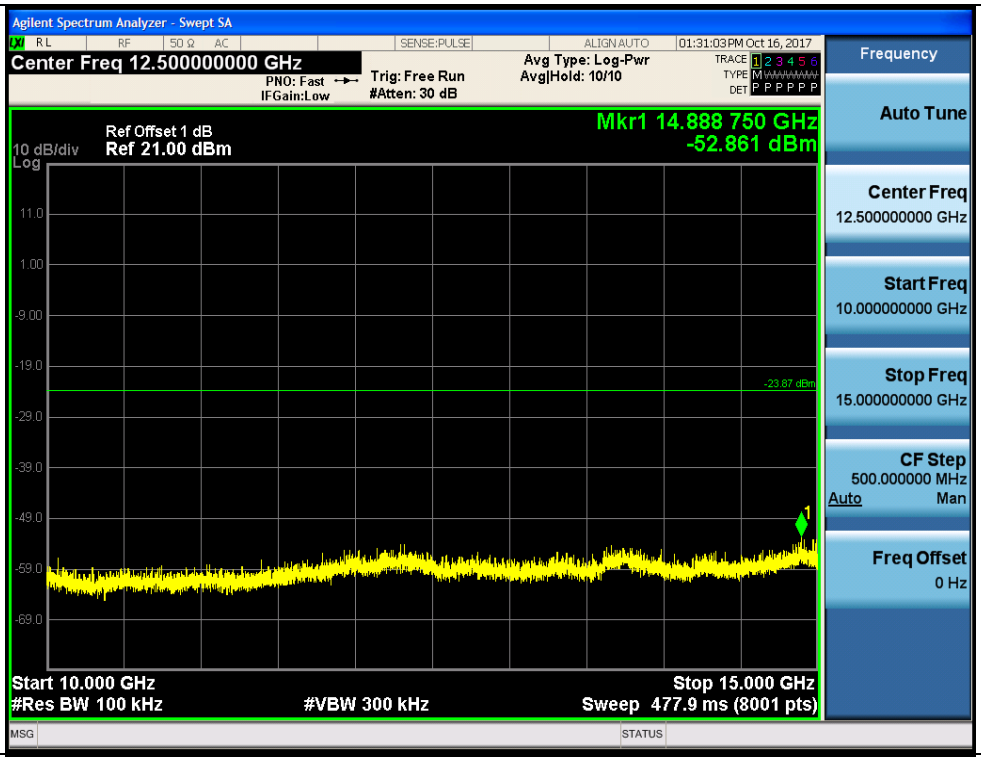
| | |
|---|---|
| CH78<br><br>15GHz~25GHz | |

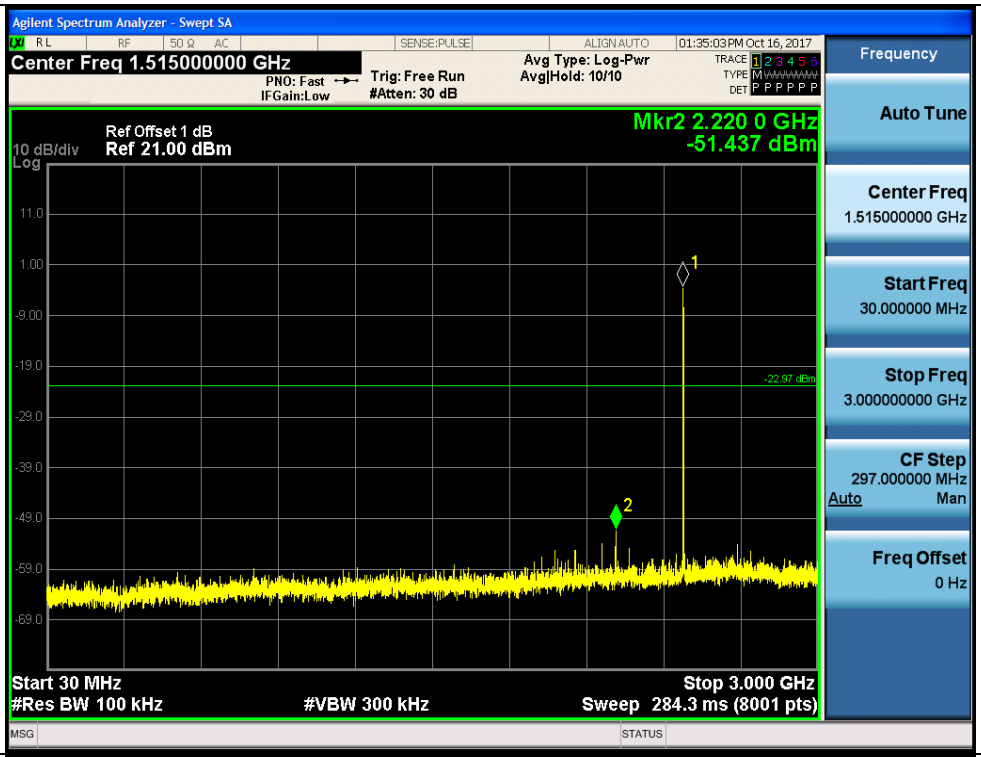
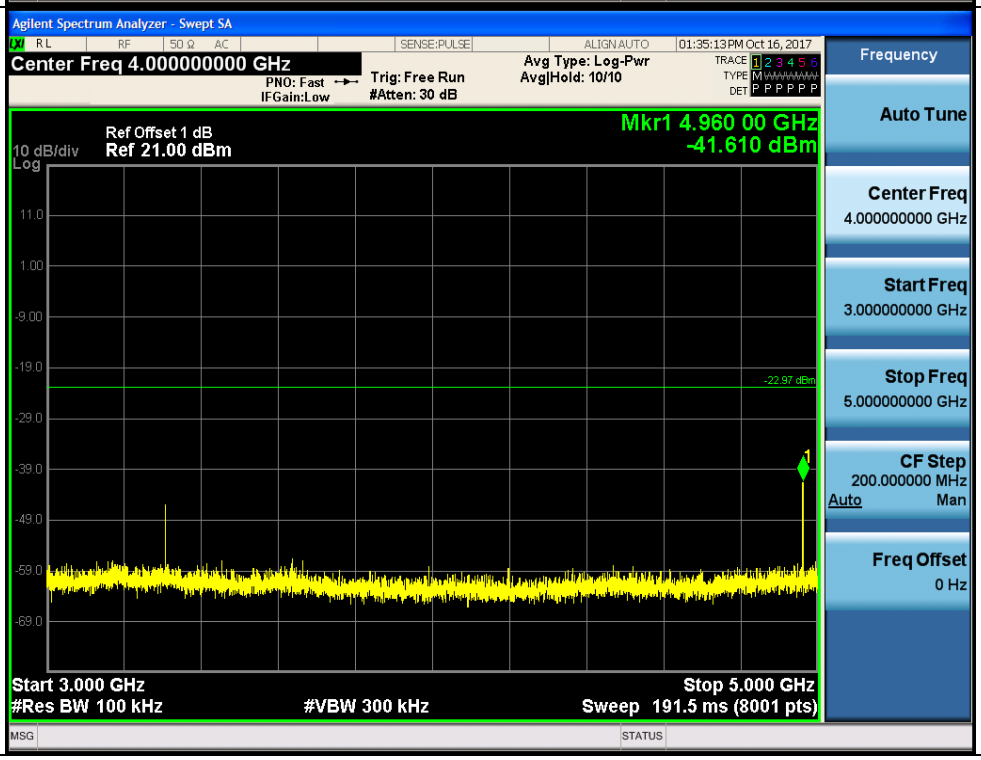
| Test Item: | SE | Modulation type: | 8DPSK |
|---|---|---|---|
| CH00<br><br>30MHz~3GHz |  | | |
| CH00<br><br>3GHz~5GHz |  | | |

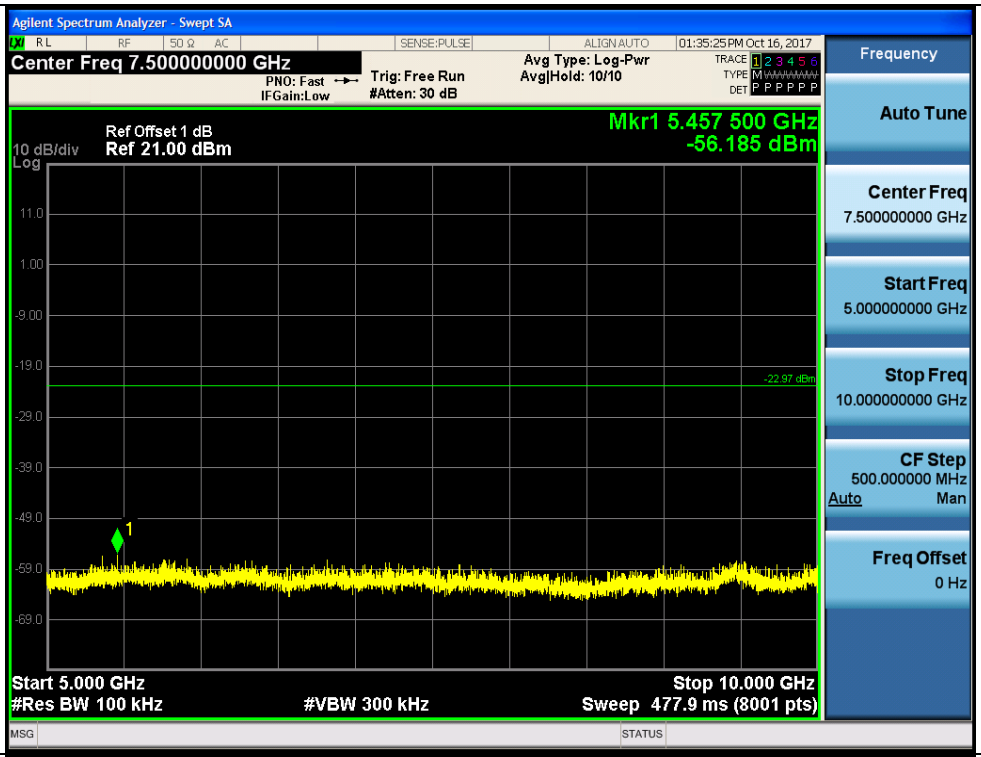
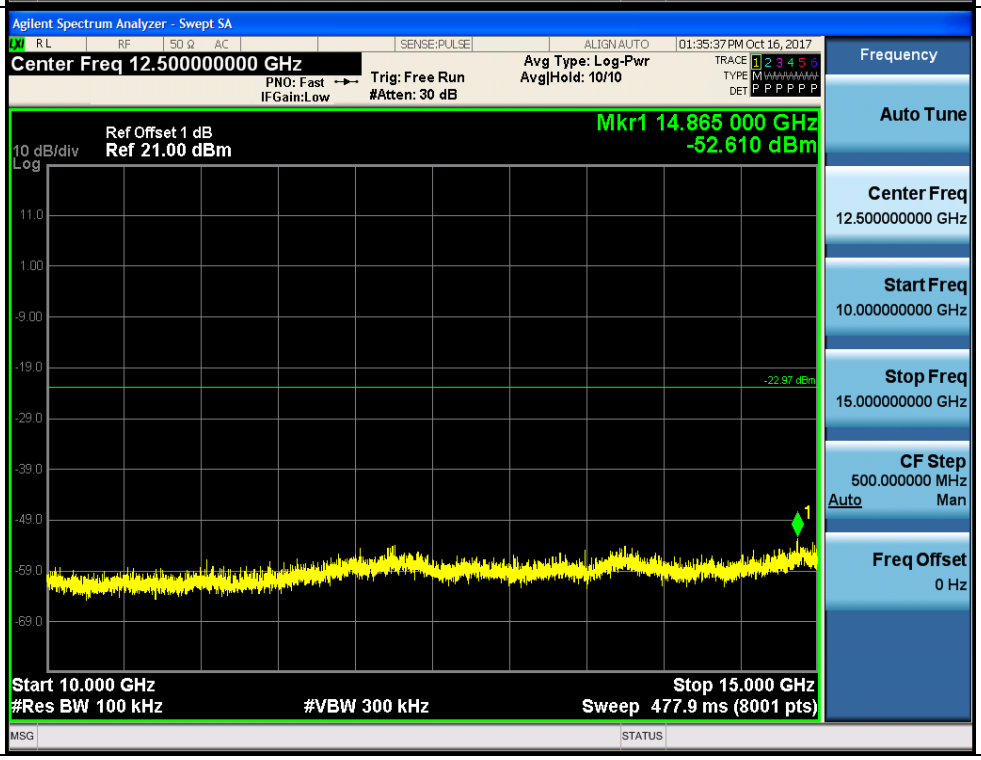
| | |
|---|---|
| CH00<br><br>5GHz~10GHz |  |
| CH00<br><br>10GHz~15GHz |  |

| | |
|---|---|
| CH00<br><br>15GHz~25GHz | |
| CH39<br><br>30MHz~3GHz |  |

| | |
|---|---|
| CH39<br><br>3GHz~5GHz |  |
| CH39<br><br>5GHz~10GHz |  |

| | |
|---|---|
| CH39<br><br>10GHz~15GHz |  |
| CH39<br><br>15GHz~25GHz | |

| | |
|---|---|
| CH78<br><br>30MHz~3GHz |  |
| CH78<br><br>3GHz~5GHz |  |

| | |
|---|---|
| CH78<br><br>5GHz~10GHz |  |
| CH78<br><br>10GHz~15GHz |  |

| | |
|---|---|
| CH78<br><br>15GHz~25GHz | |

## 5.11. Spurious Emissions (radiated)

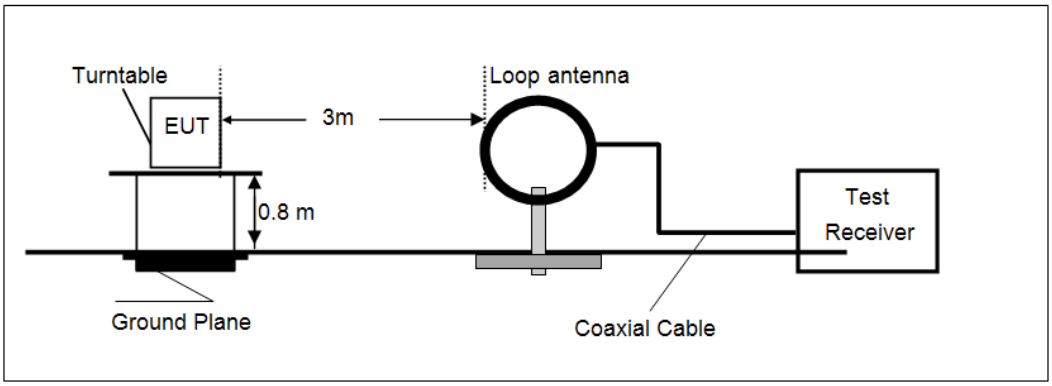
**LIMIT**

**FCC CFR Title 47 Part 15 Subpart C Section 15.209**

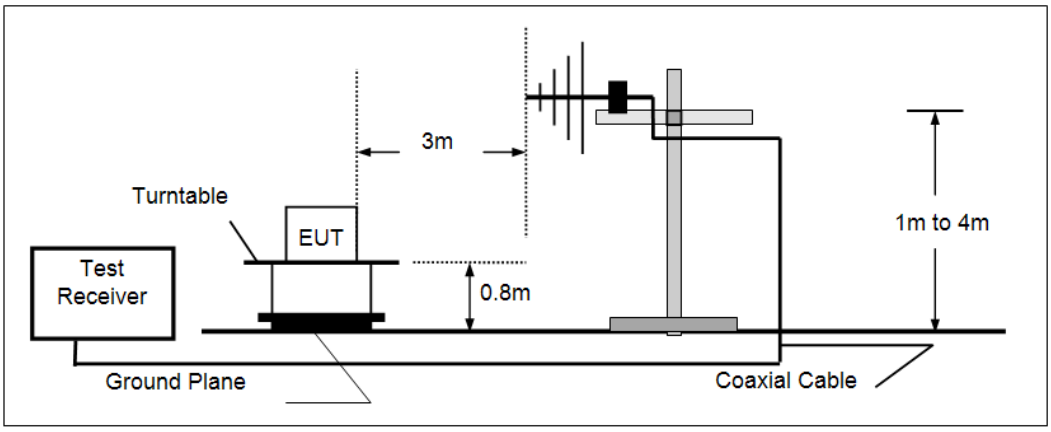
| Frequency | Limit (dBuV/m @3m) | Value |
|---|---|---|
| 30 MHz ~ 88 MHz | 40.00 | Quasi-peak |
| 88 MHz ~ 216 MHz | 43.50 | Quasi-peak |
| 216 MHz ~ 960 MHz | 46.00 | Quasi-peak |
| 960 MHz ~ 1 GHz | 54.00 | Quasi-peak |
| Above 1 GHz | 54.00 | Average |
| | 74.00 | Peak |

**TEST CONFIGURATION**

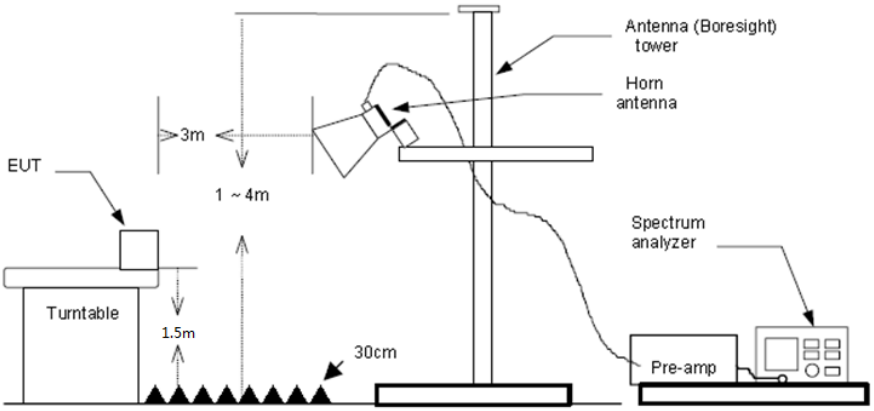
- Below 30 MHz




- 30 MHz ~1000 MHz



➢ Above 1 GHz




**TEST PROCEDURE**

1. The EUT was tested according to ANSI C63.10:2013.
2. The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna.
5. Use the following spectrum analyzer settings
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Below 1 GHz, RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=QP, Trace=max hold; If the emission level of the EUT measured by the peak detectoris 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
   (3) Above 1 GHz, RBW=1 MHz, VBW=3 MHz Peak detector for Peak value
   RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

**TEST MODE:**

Please refer to the clause 3.3

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

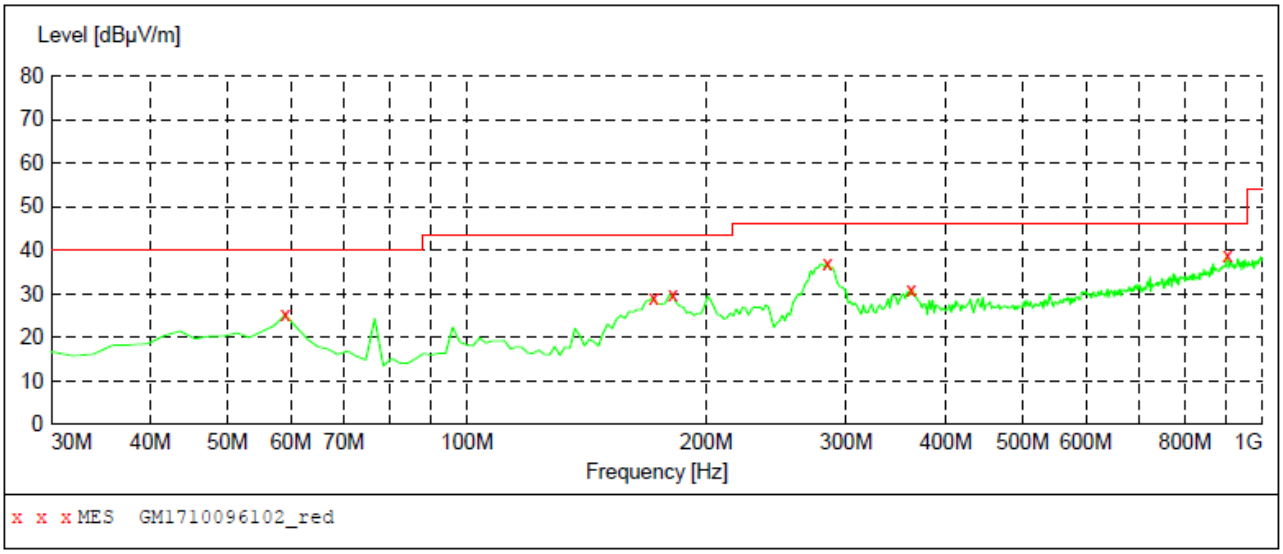
Note:
1) Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2) The emission levels of other frequencies are very lower than the limit and not show in test report.
3) Below 1 GHz,Have pre-scan all modulation mode, found the GFSK modulation High channel which it was worst case, so only the worst case's data on the test report.
4) Above 1 GHz,Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report
5) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

➢ **9 kHz ~ 30 MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

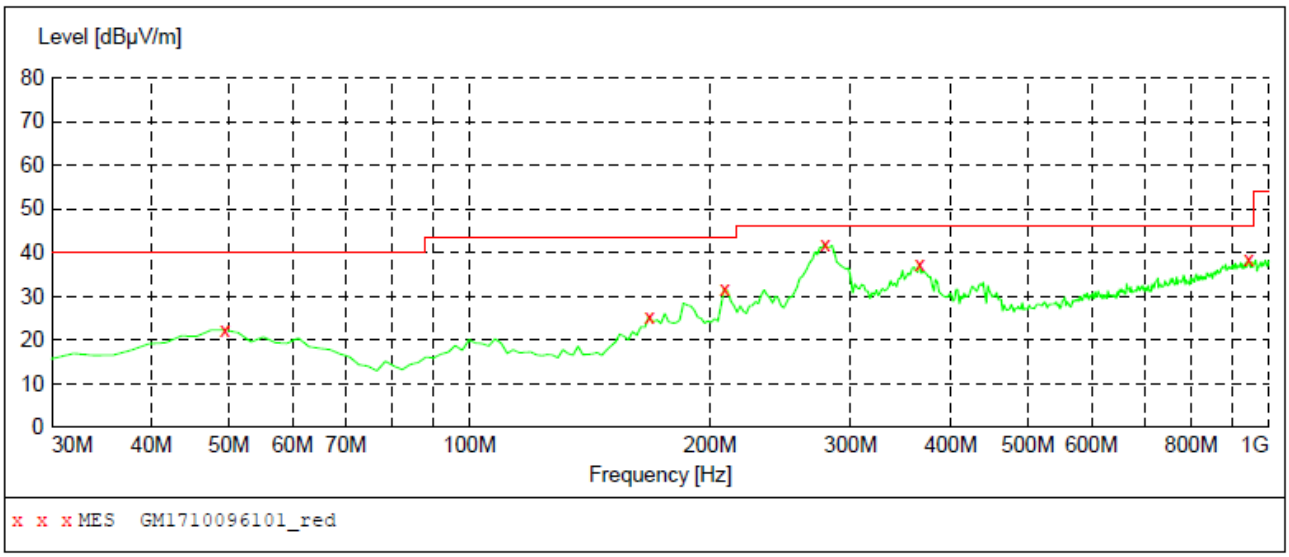
➢ **30 MHz ~ 1 GHz**

| Polarization: | Vertical |
|---|---|




| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---|---|---|---|---|---|---|---|---|
| 59.100000 | 25.20 | -9.8 | 40.0 | 14.8 | QP | 100.0 | 72.00 | VERTICAL |
| 171.620000 | 29.20 | -12.9 | 43.5 | 14.3 | QP | 100.0 | 320.00 | VERTICAL |
| 181.320000 | 29.90 | -12.1 | 43.5 | 13.6 | QP | 100.0 | 360.00 | VERTICAL |
| 284.140000 | 37.20 | -7.6 | 46.0 | 8.8 | QP | 100.0 | 280.00 | VERTICAL |
| 361.740000 | 31.00 | -5.6 | 46.0 | 15.0 | QP | 100.0 | 292.00 | VERTICAL |
| 904.940000 | 38.70 | 6.8 | 46.0 | 7.3 | QP | 100.0 | 149.00 | VERTICAL |

| Polarization: | Horizontal |
|---|---|




| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---|---|---|---|---|---|---|---|---|
| 49.400000 | 22.30 | -8.7 | 40.0 | 17.7 | QP | 300.0 | 339.00 | HORIZONTAL |
| 167.740000 | 25.40 | -13.0 | 43.5 | 18.1 | QP | 100.0 | 194.00 | HORIZONTAL |
| 208.480000 | 31.70 | -10.5 | 43.5 | 11.8 | QP | 100.0 | 154.00 | HORIZONTAL |
| 278.320000 | 42.00 | -7.8 | 46.0 | 4.0 | QP | 100.0 | 141.00 | HORIZONTAL |
| 365.620000 | 37.30 | -5.5 | 46.0 | 8.7 | QP | 100.0 | 167.00 | HORIZONTAL |
| 943.740000 | 38.50 | 7.2 | 46.0 | 7.5 | QP | 100.0 | 179.00 | HORIZONTAL |

➢ **Above 1 GHz**

| CH00 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | Test value |
| 1746.25 | 46.55 | 25.29 | 5.86 | 37.03 | 40.67 | 74.00 | -33.33 | Vertical | Peak |
| 3200.50 | 44.90 | 28.80 | 7.72 | 38.20 | 43.22 | 74.00 | -30.78 | Vertical | Peak |
| 4736.60 | 34.32 | 31.35 | 9.51 | 37.05 | 38.13 | 74.00 | -35.87 | Vertical | Peak |
| 7921.00 | 33.23 | 36.78 | 12.68 | 34.74 | 47.95 | 74.00 | -26.05 | Vertical | Peak |
| 1498.91 | 41.56 | 25.80 | 5.28 | 36.59 | 36.05 | 74.00 | -37.95 | Horizontal | Peak |
| 3200.50 | 44.81 | 28.80 | 7.72 | 38.20 | 43.13 | 74.00 | -30.87 | Horizontal | Peak |
| 4809.50 | 35.43 | 31.58 | 9.55 | 36.93 | 39.63 | 74.00 | -34.37 | Horizontal | Peak |
| 6696.01 | 33.47 | 34.20 | 11.48 | 35.18 | 43.97 | 74.00 | -30.03 | Horizontal | Peak |

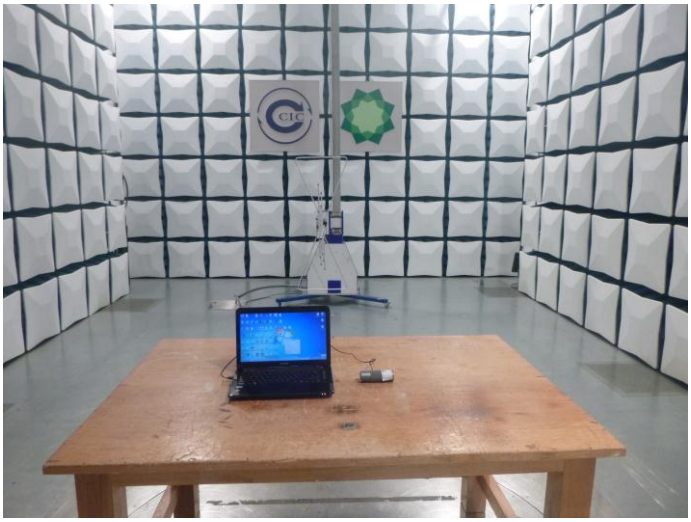
| CH39 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | Test value |
| 1385.18 | 45.57 | 25.94 | 4.97 | 36.47 | 40.01 | 74.00 | -33.99 | Vertical | Peak |
| 3003.17 | 41.85 | 28.61 | 7.48 | 38.23 | 39.71 | 74.00 | -34.29 | Vertical | Peak |
| 4883.52 | 36.53 | 31.43 | 9.59 | 36.73 | 40.82 | 74.00 | -33.18 | Vertical | Peak |
| 7338.62 | 32.21 | 36.30 | 12.01 | 34.90 | 45.62 | 74.00 | -28.38 | Vertical | Peak |
| 1795.84 | 42.97 | 25.39 | 5.95 | 37.13 | 37.18 | 74.00 | -36.82 | Horizontal | Peak |
| 3258.04 | 42.88 | 28.45 | 7.79 | 38.30 | 40.82 | 74.00 | -33.18 | Horizontal | Peak |
| 4883.52 | 45.06 | 31.43 | 9.59 | 36.73 | 49.35 | 74.00 | -24.65 | Horizontal | Peak |
| 7981.72 | 32.89 | 37.03 | 12.39 | 34.58 | 47.73 | 74.00 | -26.27 | Horizontal | Peak |

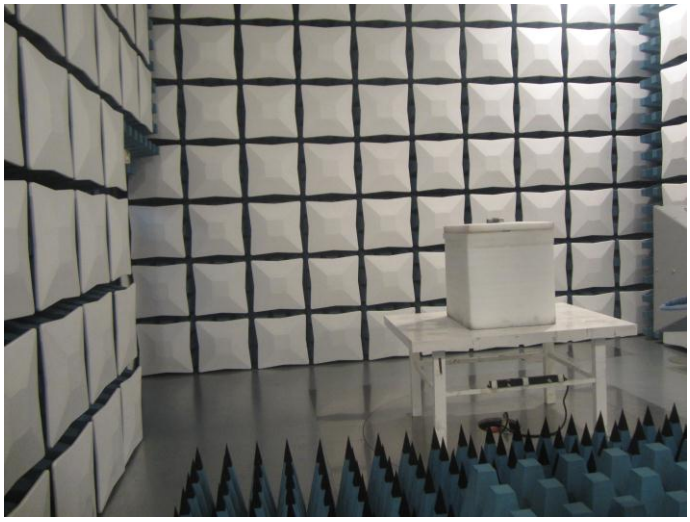
| CH78 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | Test value |
| 1385.18 | 47.50 | 25.94 | 4.97 | 36.47 | 41.94 | 74.00 | -32.06 | Vertical | Peak |
| 2995.54 | 45.51 | 28.60 | 7.48 | 38.23 | 43.36 | 74.00 | -30.64 | Vertical | Peak |
| 4958.68 | 39.02 | 31.46 | 9.64 | 36.52 | 43.60 | 74.00 | -30.40 | Vertical | Peak |
| 6611.33 | 33.60 | 34.20 | 11.37 | 35.34 | 43.83 | 74.00 | -30.17 | Vertical | Peak |
| 1385.18 | 42.72 | 25.94 | 4.97 | 36.47 | 37.16 | 74.00 | -36.84 | Horizontal | Peak |
| 3308.19 | 44.39 | 28.20 | 7.85 | 38.39 | 42.05 | 74.00 | -31.95 | Horizontal | Peak |
| 4958.68 | 40.67 | 31.46 | 9.64 | 36.52 | 45.25 | 74.00 | -28.75 | Horizontal | Peak |
| 8484.55 | 33.62 | 36.85 | 12.87 | 34.37 | 48.97 | 74.00 | -25.03 | Horizontal | Peak |

# 6. TEST SETUP PHOTOS

Conducted Emissions (AC Mains)

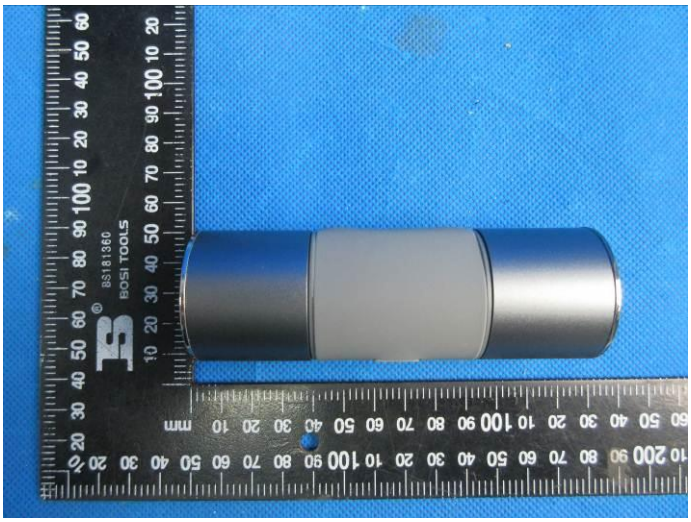
Radiated Emissions

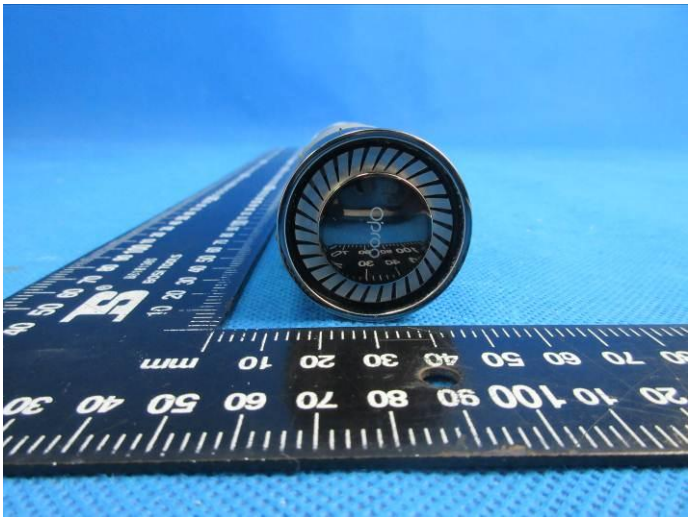


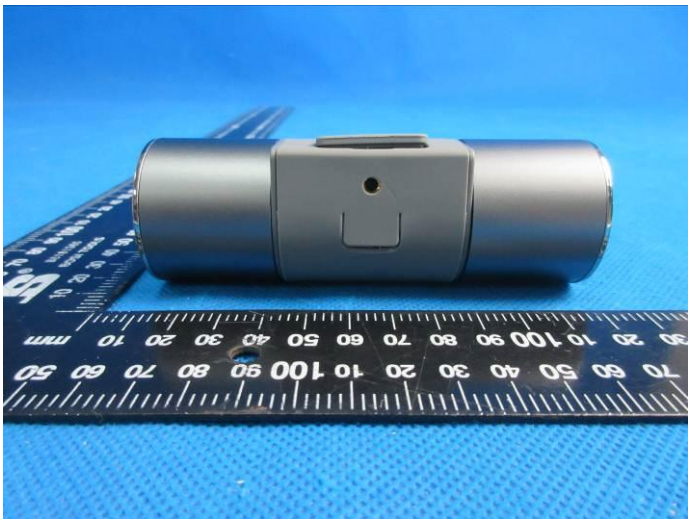


# 7. EXTERANAL AND INTERNAL PHOTOS

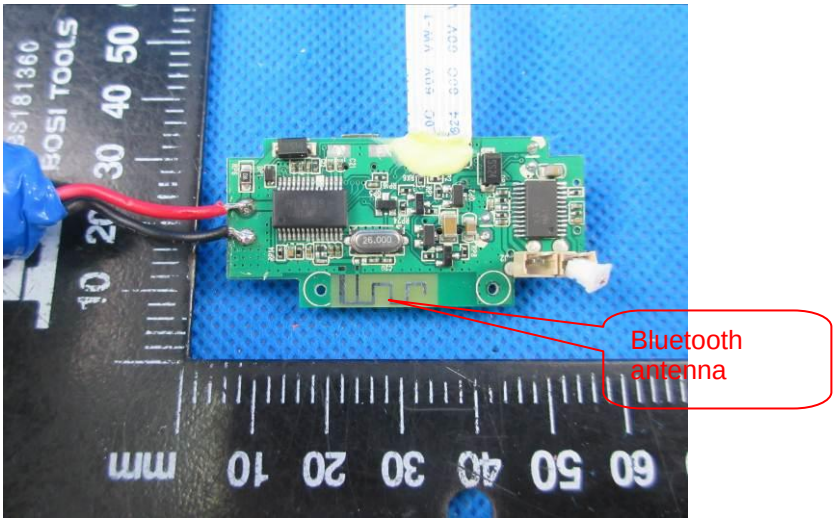
## EXTERANAL PHOTOS

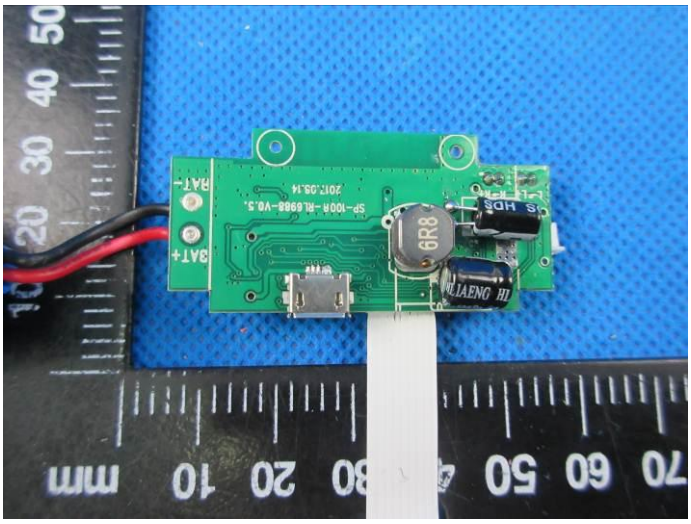


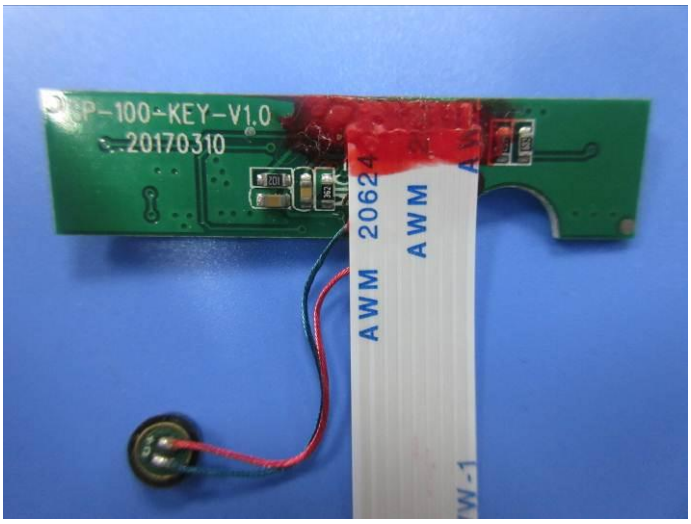



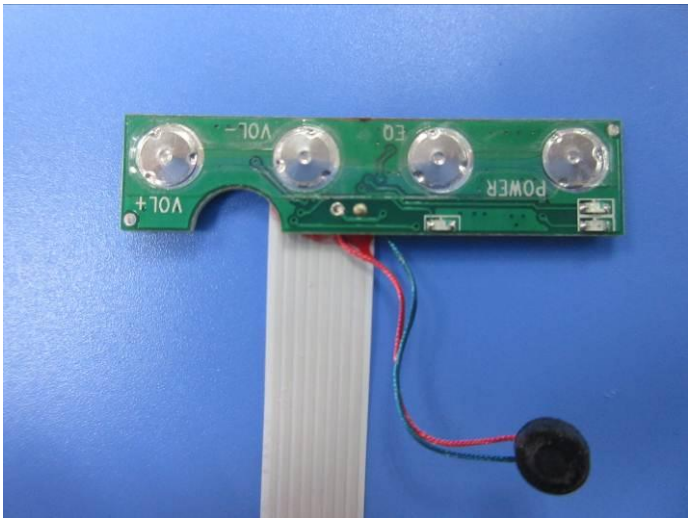


# INTERNAL PHOTOS






**.....End of Report.....**