Excellence in Compliance Testing

# Certification Test Report

**FCC ID: AZ489FT4900**
**IC: 109U-89FT4900**

**FCC Rule Part: 15.247**
**IC Radio Standards Specification: RSS-210**

**ACS Report Number: 10-2119.W06.11.A**

Manufacturer: **Motorola, Inc.**
Model: **CLU1060BBLAA**

Test Begin Date: **December 9, 2010**
Test End Date: **December 20, 2010**

Report Issue Date: **December 21, 2010**

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200897-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.


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**Advanced Compliance Solutions, Inc.**




**This report contains 56 pages**

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# 1 GENERAL

## 1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

## 1.2 Manufacturer Information:

Motorola, Inc.
8000 W. Sunrise Blvd.
Plantation, FL 33322

## 1.3 Product description

The CLP1060 (Model No.: CLU1060BBLAA) is a 1watt output power two-way UHF 450MHz-470MHz radio with Bluetooth wireless capability.

The product is marketed in Canada as:
CLP1063/ CLU1063BBLAA, single package models
CLP1063/ CLU1063BBLAB, Bulk Pack models

| Mode of Operation | Frequency Range (MHz) | Number of Channels | Channel Separation (kHz) | Data Rates Supported (kbps) |
|---|---|---|---|---|
| GFSK | 2402 - 2480 | 79 | 1000 | 1000 |
| π/4-DQPSK | 2402 - 2480 | 79 | 1000 | 2000 |
| 8DPSK | 2402 - 2480 | 79 | 1000 | 3000 |

Test Sample Serial Number(s): The samples provided without serial number labels.

Test Sample Condition: Good

## 1.4 Test Methodology and Considerations

The radio was prescanned in three orthogonal orientations corresponding to the low, middle and high channels of the operating band. Final measurements were performed with the EUT orientation leading to the worst case emissions. The unit was set linked to a CBT Bluetooth Test Equipment. Measurements were performed for the EUT on the GFSK, π/4-DQPSK and 8DPSK modulations formats.

### 1.5 Emission Designators

The Bluetooth transmitter produces 3 distinct modulation formats. The emissions designators for the modulation types used by the Bluetooth transmitter are as follows:

EMISSIONS DESIGNATORS:

GFSK: 1M14F1D
Π/4 DQPSK: 1M37G1D
8DPSK: 1M35G1D

# 2 TEST FACILITIES

## 2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 581606
Industry Canada Lab Code: 4175C

## 2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200897-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

## 2.3 Radiated & Conducted Emissions Test Site Description

### 2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with metallic loaded springs. An EMCO Model 1050 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

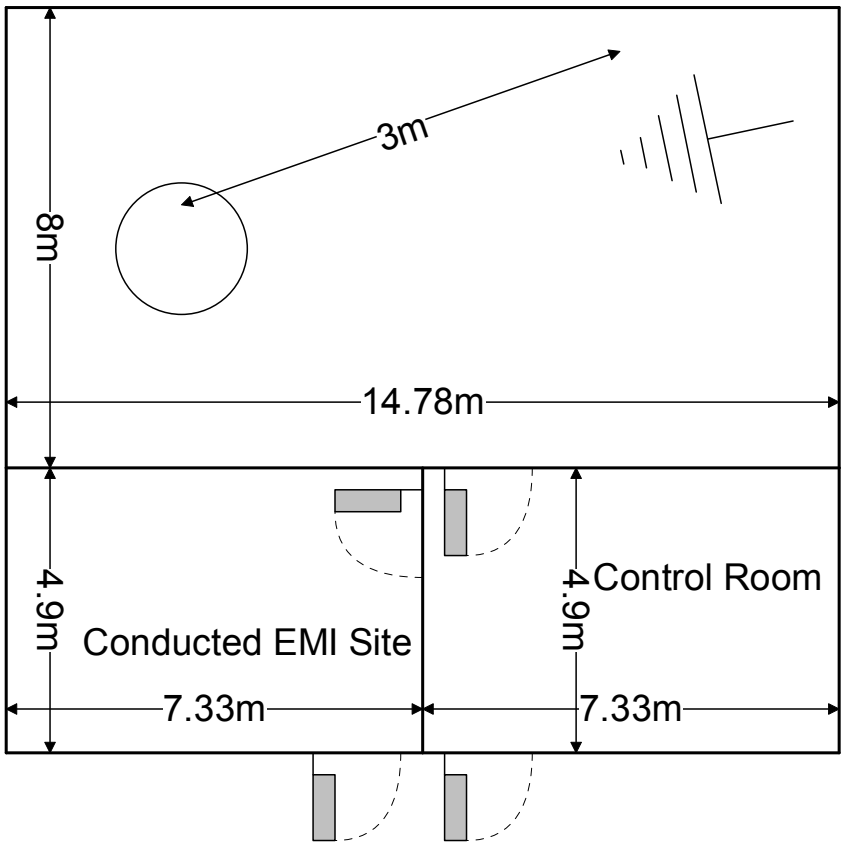



**Figure 2.3.1-1: Semi-Anechoic Chamber Test Site**

### 2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 $m^3$. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

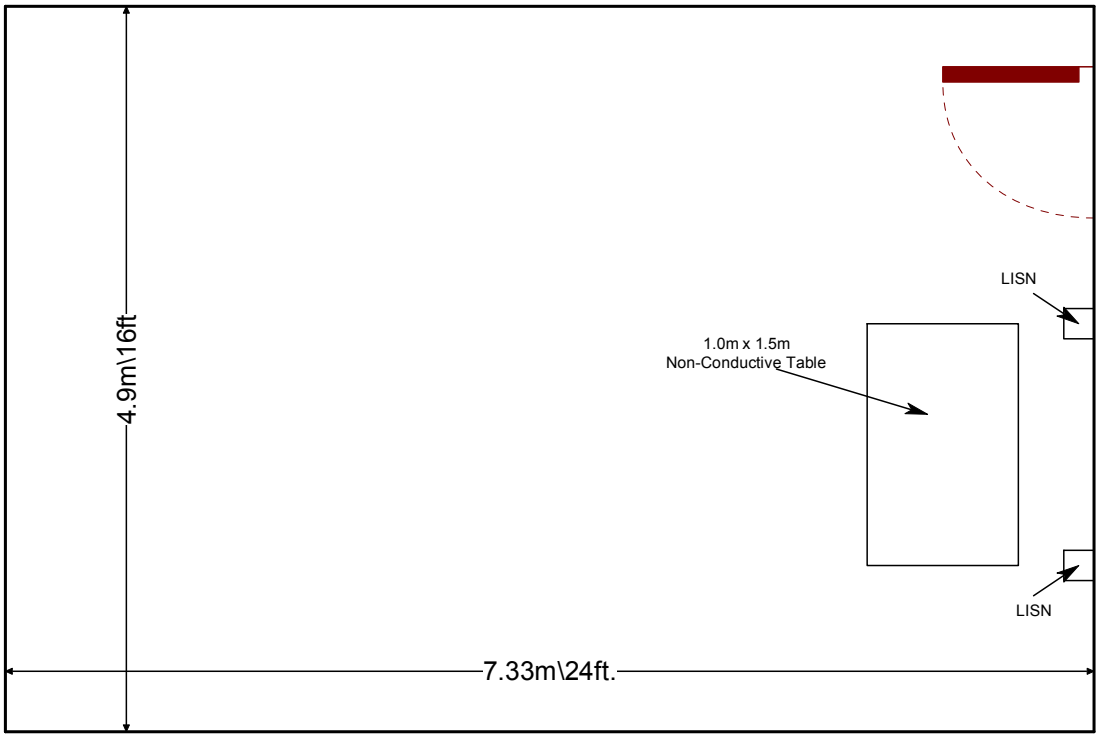



**Figure 2.3.2-1: AC Mains Conducted EMI Site**

## 3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, December 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue3, December 2010.

## 4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

**Table 4-1: Test Equipment**

| AssetID | Manufacturer | Model # | Equipment Type | Serial # | Cal Due Date |
|---|---|---|---|---|---|
| 2002 | EMCO | 3108 | Antennas | 2147 | 9/10/2011 |
| 2004 | EMCO | 3146 | Antennas | 1385 | 9/10/2011 |
| 2006 | EMCO | 3115 | Antennas | 2573 | 2/21/2011 |
| 2008 | COM-Power | AH-826 | Antennas | 81009 | NCR |
| 2011 | Hewlett-Packard | HP 8447D | Amplifiers | 2443A03952 | 1/4/2011 |
| 2012 | Hewlett-Packard | HP83017A | Amplifiers | 3123A00324 | 12/30/2010 |
| 2013 | Hewlett Packard | HP8566B | Spectrum Analyzers | 2407A03233 | 8/5/2012 |
| 2014 | Hewlett Packard | HP 85650A | Quasi Peak Adapter | 2430A00559 | 8/5/2012 |
| 2022 | EMCO | LISN3825/2R | LISN | 1095 | 8/10/2011 |
| 2037 | ACS Boca | Chamber EMI Cable Set | Cable Set | 2037 | 12/30/2010 |
| 2044 | QMI | N/A | Cables | 2044 | 1/6/2011 |
| 2045 | ACS Boca | Conducted Cable Set | Cable Set | 2045 | 9/6/2011 |
| re40 | Agilent Technologies | E7405A | Spectrum Analyzers | US39150132 | 7/20/2011 |
| 2056 | Hewlett Packard | 11971K | Mixer | 2332A00424 | 8/5/2012 |

*Note:
The asset 2008 is a standard gain horn antenna. Hence, recurring calibration beyond initial calibration per the manufacturer is not required only in case of damage, suspected deterioration or use at distance closer than $2xa^2/\lambda$, as per ANSI C63.4 requirements.

## 5 SUPPORT EQUIPMENT

**Table 5-1: Support Equipment (Config 1)**

| Item | Equipment Type | Manufacturer | Model Number | Serial Number |
|---|---|---|---|---|
| 1 | EUT | Motorola, Inc. | CLU1060BBLAA | N/A |

**Table 5-2: Support Equipment (Config 2)**

| Item | Equipment Type | Manufacturer | Model Number | Serial Number |
|---|---|---|---|---|
| 1 | EUT | Motorola, Inc. | CLU1060BBLAA | N/A |
| 2 | Charger | Motorola, Inc. | DA03-4042040-U | N/A |
| 3 | I.T.E Power Supply | Motorola, Inc. | FMP5541A | N/A |

## 6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

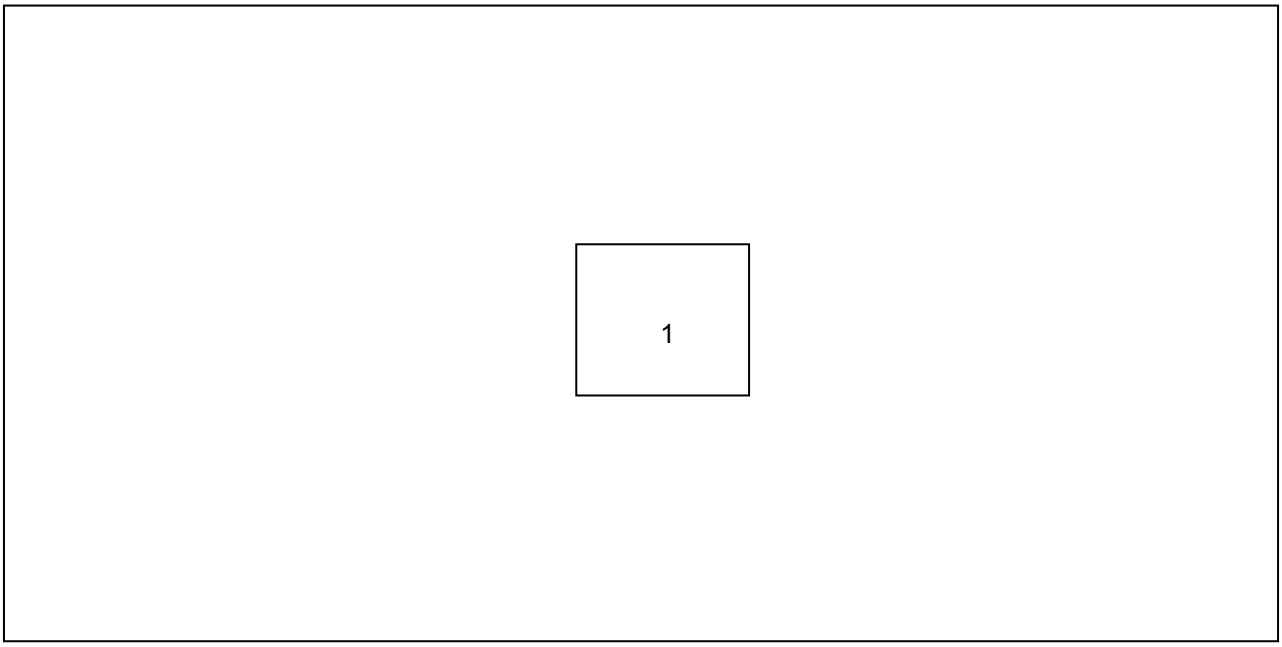



**Figure 6-1: Support Equipment (Config 1)**

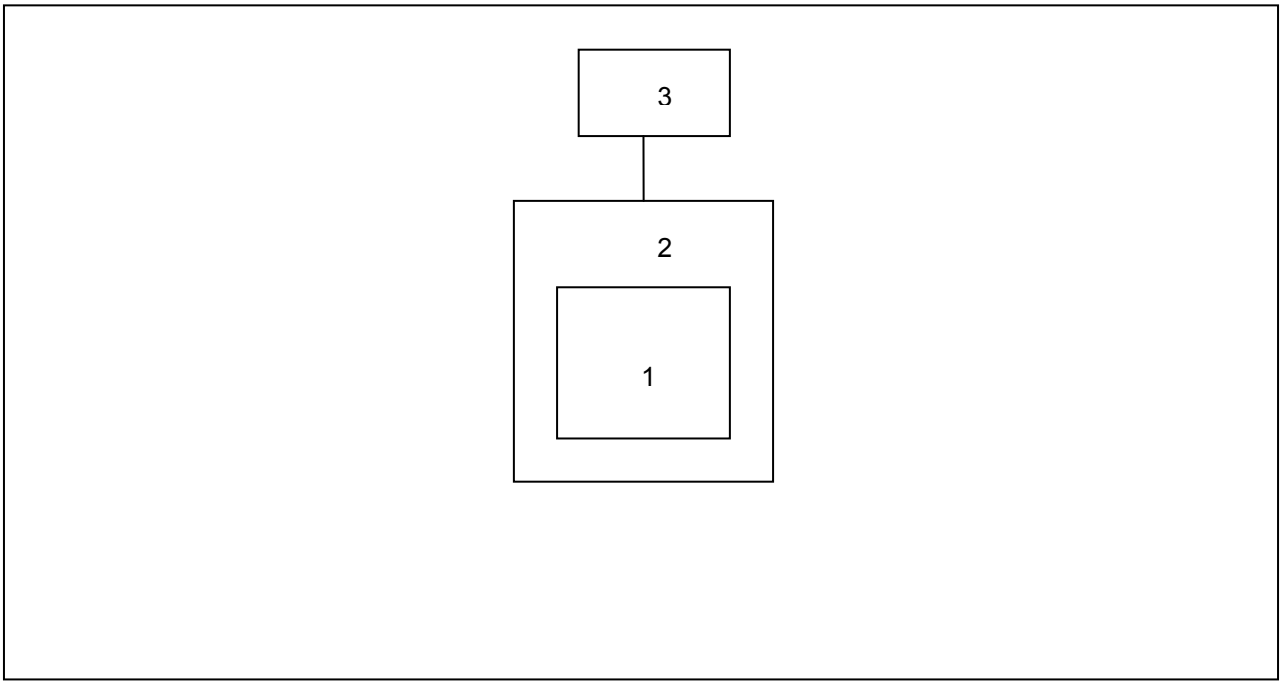



**Figure 6-2: Support Equipment (Config 2)**

# 7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

## 7.1 Antenna Requirement – FCC: Section 15.203

The unit uses a -2 dBi wire antenna for the Bluetooth Radio

## 7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.2

### 7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

**Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss**
**Margin = Applicable Limit - Corrected Reading**

### 7.2.2 Measurement Results

Results of the test are shown below in and Table 7.2.2-1.

**Table 7.2.2-1: Conducted EMI Results**

| Line Tested | Frequency (MHz) | Recorded Value (dBµV) | | Correction Factor (dB) | Corrected Value (dBµV) | | Limits (dBµV) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Peak | Avg | | Peak | Avg | QP | Avg | QP | Avg |
| **Phase** | 0.18 | 43.05 | ------- | 0.32 | 43.37 | ------- | 64.49 | 54.49 | 21.13 | 11.13 |
| **Phase** | 0.24 | 38.13 | ------- | 0.20 | 38.33 | ------- | 62.11 | 52.11 | 23.78 | 13.78 |
| **Phase** | 0.27 | 34.63 | ------- | 0.20 | 34.83 | ------- | 61.14 | 51.14 | 26.31 | 16.31 |
| **Phase** | 0.33 | 35.04 | ------- | 0.30 | 35.34 | ------- | 59.47 | 49.47 | 24.13 | 14.13 |
| **Phase** | 1.60 | 33.18 | ------- | 0.27 | 33.45 | ------- | 56.00 | 46.00 | 22.55 | 12.55 |
| **Phase** | 2.21 | 34.48 | ------- | 0.27 | 34.75 | ------- | 56.00 | 46.00 | 21.25 | 11.25 |
| | | | | | | | | | | |
| **Neutral** | 0.16 | 46.29 | ------- | 0.26 | 46.55 | ------- | 65.21 | 55.21 | 18.66 | 8.66 |
| **Neutral** | 0.21 | 39.38 | ------- | 0.22 | 39.60 | ------- | 63.22 | 53.22 | 23.62 | 13.62 |
| **Neutral** | 0.28 | 34.39 | ------- | 0.22 | 34.61 | ------- | 60.69 | 50.69 | 26.08 | 16.08 |
| **Neutral** | 0.37 | 30.23 | ------- | 0.32 | 30.55 | ------- | 58.41 | 48.41 | 27.87 | 17.87 |
| **Neutral** | 0.42 | 29.26 | ------- | 0.21 | 29.47 | ------- | 57.47 | 47.47 | 28.00 | 18.00 |
| **Neutral** | 2.40 | 32.67 | ------- | 0.40 | 33.07 | ------- | 56.00 | 46.00 | 22.93 | 12.93 |

## 7.3 Radiated Emissions – FCC: Section 15.109(Unintentional Radiation) IC: RSS-210 2.6

### 7.3.1 Measurement Procedure

Radiated emissions tests were performed over the frequency range of 30 MHz to 12.5 GHz. Measurements of the radiated field strength were made at a distance of 3 m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1 GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 kHz using a Quasi-peak detector. Above 1GHz, measurements are taken with the RBW set to 1MHz and the VBW set to 3 MHz and 10 Hz for peak and average measurements, respectively.

### 7.3.2 Measurement Results

Results of the test are given in Table 7.3-1 below:

**Table 7.3-1: Radiated Emissions Tabulated Data**

| Frequency (MHz) | Level (dBµV) | | Antenna Polarity | Correction Factors | Corrected Level (dBµV/m) | | Limit (dBµV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (dB) | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **899.986** | 37.19 | 31.65 | V | 0.60 | ------- | 32.25 | ------ | 46.0 | ------- | 13.7 |
| **899.986** | 39.80 | 37.24 | H | 0.60 | ------- | 37.84 | ------ | 46.0 | ------- | 8.2 |
| **51.31** | 41.79 | 32.30 | V | -16.24 | ------- | 16.06 | ------ | 40.0 | ------- | 23.9 |
| **1800** | 45.93 | 33.70 | H | -3.73 | 42.20 | 29.97 | 74.0 | 54.0 | 31.8 | 24.0 |
| **1800** | 47.13 | 36.27 | V | -3.73 | 43.40 | 32.54 | 74.0 | 54.0 | 30.6 | 21.5 |
| **3600** | 46.16 | 35.02 | H | 3.23 | 49.39 | 38.25 | 74.0 | 54.0 | 24.6 | 15.7 |
| **3600** | 46.58 | 36.67 | V | 3.23 | 49.81 | 39.90 | 74.0 | 54.0 | 24.2 | 14.1 |

* Note: All emissions above 3600 MHz were attenuated below the permissible limit.

## 7.4 Peak Output Power - FCC Section 15.247(b)(2) IC: RSS-210 A8.4(1)

### 7.4.1 Measurement Procedure (Conducted Method)

The RF output port of the EUT was connected to the input of the spectrum analyzer through a Tee-connector, with the third port connected to a CBT Bluetooth tester through a 20 dB attenuator.

### 7.4.2 Measurement Results

Results are shown below in Tables 7.4.2-1 to Tables 7.4.2-1 below:

**Table 7.4.2-1: RF Output Power (GFSK)**

| Frequency (MHz) | Reading (dBm) | Insertion Loss (dB) | Power (dBm) |
|---|---|---|---|
| 2402 | -8.26 | 11.39 | 3.12 |
| 2441.00 | -8.09 | 11.39 | 3.30 |
| 2480.00 | -7.76 | 11.39 | 3.63 |

**Table 7.4.2-2: RF Output Power (π/4 DQPSK)**

| Frequency (MHz) | Reading (dBm) | Insertion Loss (dB) | Power (dBm) |
|---|---|---|---|
| 2402 | -7.80 | 11.39 | 3.59 |
| 2441.00 | -7.41 | 11.39 | 3.98 |
| 2480.00 | -7.10 | 11.39 | 4.28 |

**Table 7.4.2-1: RF Output Power (8DPSK)**

| Frequency (MHz) | Reading (dBm) | Insertion Loss (dB) | Power (dBm) |
|---|---|---|---|
| 2402 | -7.89 | 11.39 | 3.50 |
| 2441.00 | -7.22 | 11.39 | 4.17 |
| 2480.00 | -6.94 | 11.39 | 4.44 |

## 7.5 Channel Usage Requirements

### 7.5.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

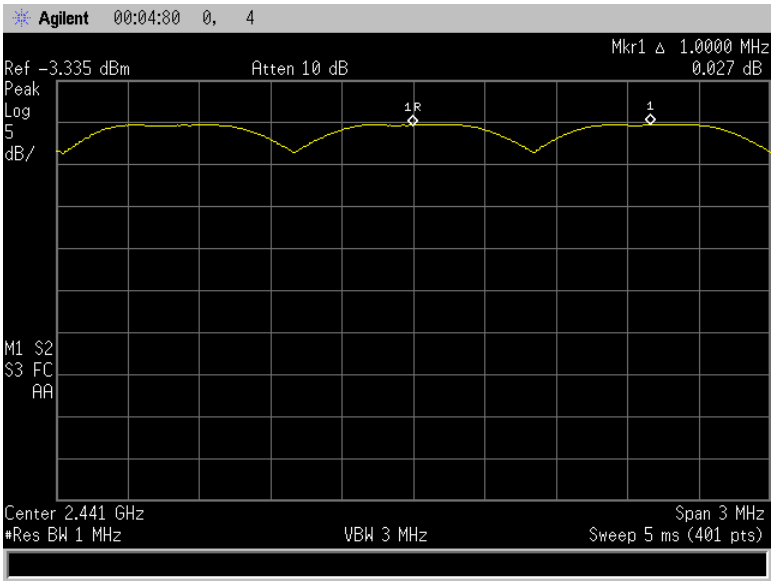
#### *7.5.1.1* Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through a Tee-connector, with the third port connected to a CBT Bluetooth tester through a 20 dB attenuator. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to ≥ 1% of the span.

#### *7.5.1.2* Measurement Results

Results are shown below in Figure 7.5.1.2-1.

**Figure 7.5.1.2-1: Carrier Frequency Separation**



### 7.5.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

#### *7.5.2.1* Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through a Tee-connector, with the third port connected to a CBT Bluetooth tester through a 20 dB attenuator. The span of the spectrum analyzer was set wide enough to capture the number of hopping channels.

#### *7.5.2.2* Measurement Results

Results are shown below in Figures 7.5.2-1 to 7.5.2-3.

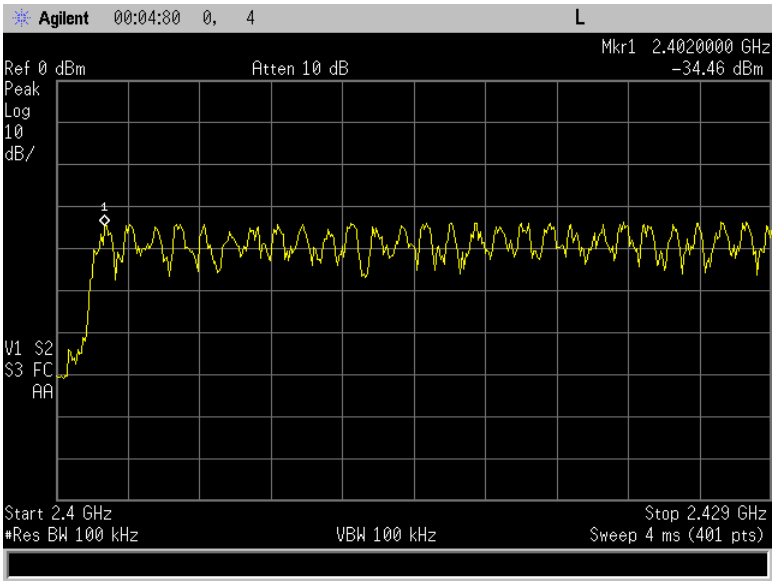



**Figure 7.5.2-1: Number of Hopping Channels (1 – 28)**

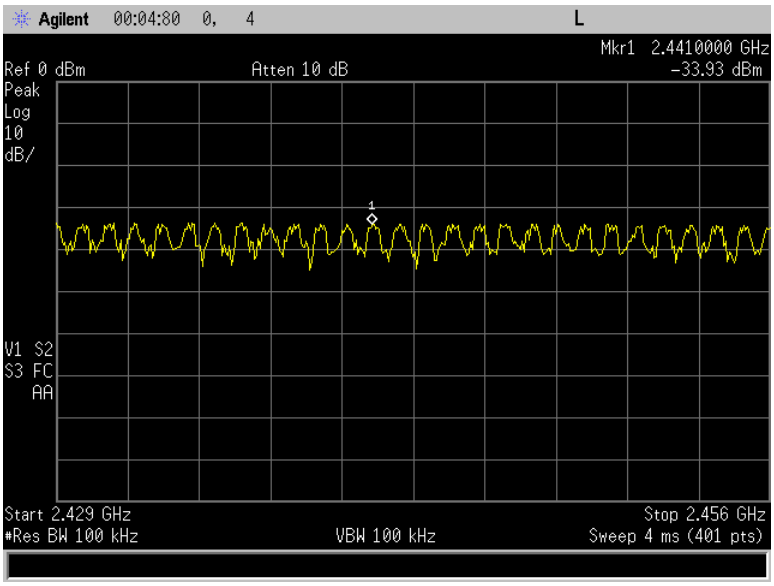



**Figure 7.5.2-2: Number of Hopping Channels (29 – 54)**

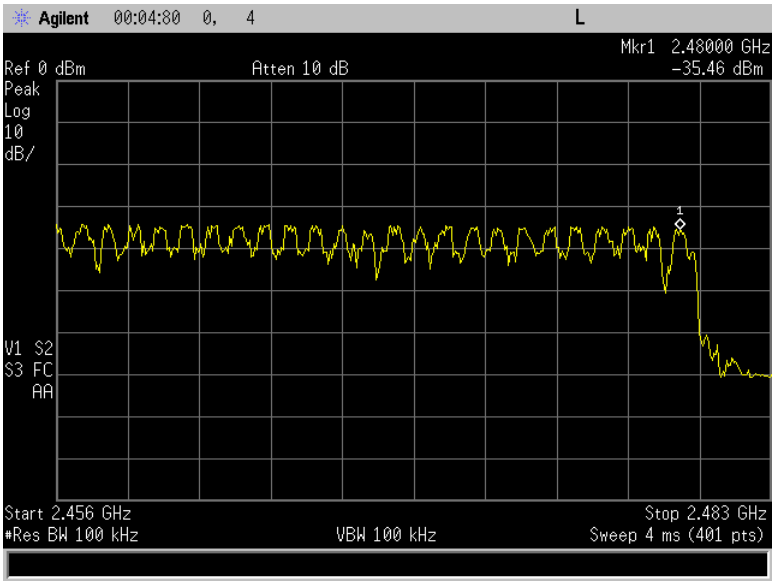



**Figure 7.5.2-3: Number of Hopping Channels (55 -79)**

### 7.5.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

#### *7.5.3.1* Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through a Tee-connector, with the third port connected to a CBT Bluetooth tester through a 20 dB attenuator. The span of the spectrum analyzer was set 0 Hz centered on a hopping channel. The RBW was set to 1 MHz and the sweep time adjusted to capture the entire dwell time per channel with peak detector max hold function.

#### *7.5.3.2* Measurement Results

Results are shown below in Table 7.5.3.2-1 and Figures 7.5.3.2-1 to 7.5.3.2-3.

**Table 7.5.3.2-1: Dwell Time on a 31.6 Second Cycle**

| Packet Format | Number of Hops Per Sec. (NHPS) | Number of Hops per Channel Per Sec. (NHPCPS) | Number of hops on a 31.6 s Cycle (NHPC) | Measured Dwell Times | Dwell Times on a 31.6 s Cycle | Limit (s) | Status |
|---|---|---|---|---|---|---|---|
| DH1 | 800.00 | 10.13 | 320.00 | 0.400 | 128.00 | 400.00 | PASS |
| DH3 | 400.00 | 5.06 | 160.00 | 1.675 | 268.00 | 400.00 | PASS |
| DH5 | 266.67 | 3.38 | 106.67 | 2.925 | 312.00 | 400.00 | PASS |

*Notes:

NHPS = (1600 /sec)/ (NT+NR) (where NT and NR are the number of transmit and receive packets, respectively)
NHPCPS = NHPS/79
NHPC = NHPCPS * 31.6s
Dwell Time per Cycle = NHPC* Measured Dwell Time

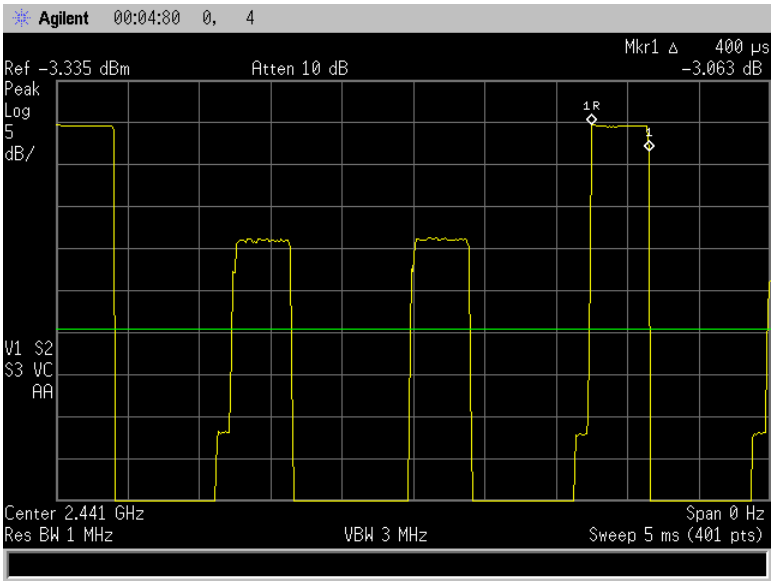



**Figure 7.5.3.2-1: Channel Dwell Time – DH1**

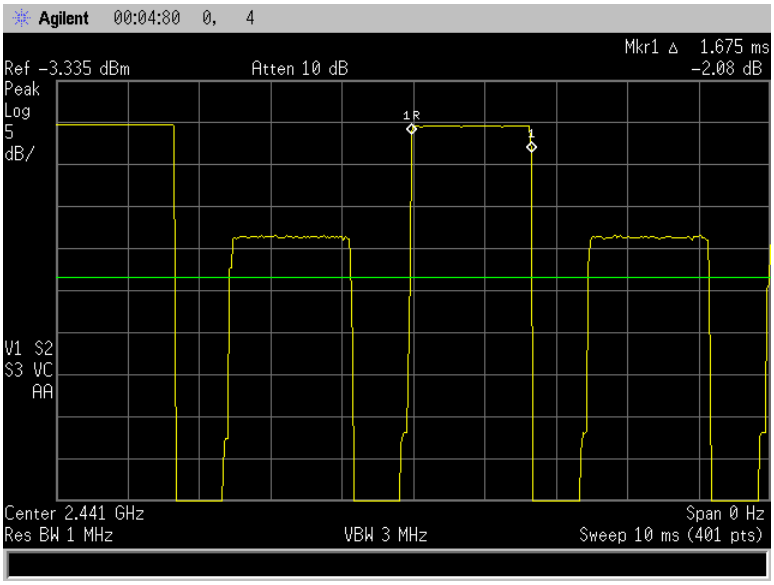



**Figure 7.5.3.2-2: Channel Dwell Time – DH3**

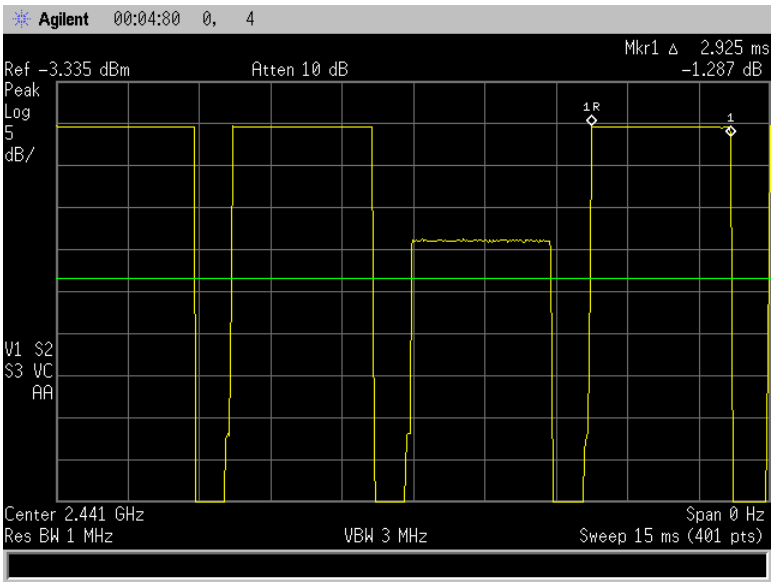



**Figure 7.5.3.2-3: Channel Dwell Time – DH5**

### 7.5.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

#### *7.5.4.1* Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through a Tee-connector, with the third port connected to a CBT Bluetooth tester through a 20 dB attenuator. The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The 99% occupied bandwidth was measured with the RBW set to 1% to 3% of the approximate emission width. The trace was set to max hold with a peak detector active. The 99 % occupied bandwidth was measured 26 dB down from the reference level.

#### *7.5.4.2* Measurement Results

Results are shown below in Tables 7.5.4.2-1 through 7.5.4.2-3and Figures 7.5.4.2-1 through 7.5.4.2-18.

**Table 7.5.4.2-1: 20dB / 99% Bandwidth (GFSK)**

| Frequency [MHz] | 20dB Bandwidth [kHz] | 99% Bandwidth [kHz] |
|---|---|---|
| 2402 | 944.9 | 1125 |
| 2441 | 945 | 1140 |
| 2480 | 945 | 1140 |

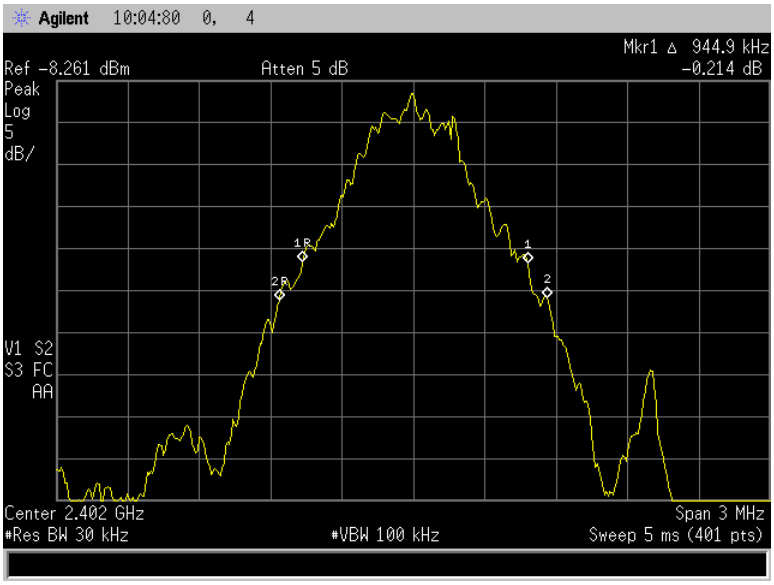



**Figure 7.5.4.2-1: 20dB BW Low Channel (GFSK)**

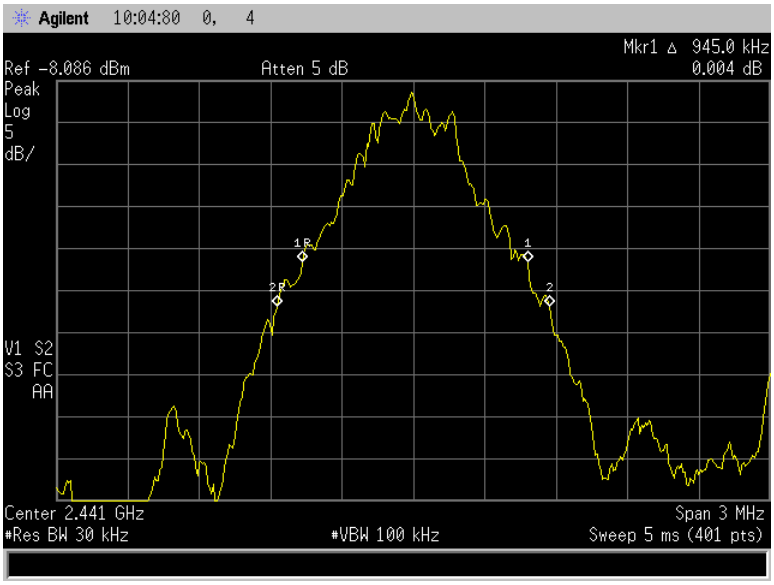



**Figure 7.5.4.2-2: 20dB BW Middle Channel (GFSK)**

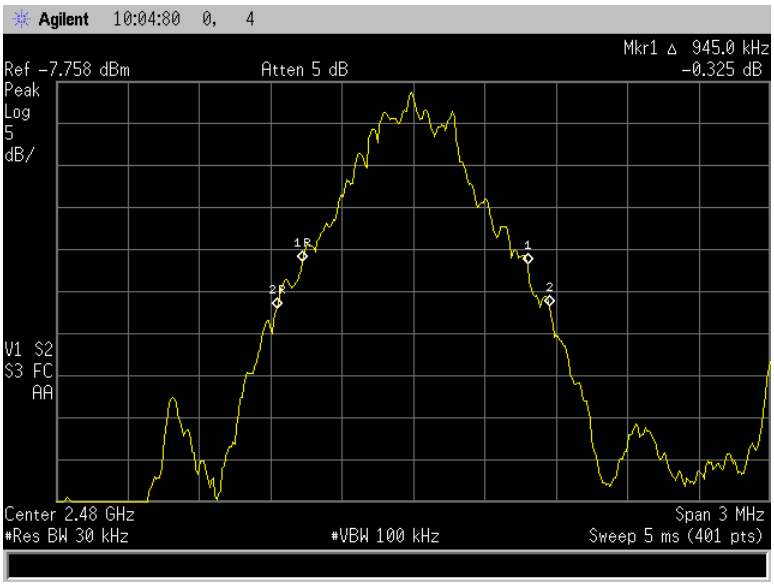



**Figure 7.5.4.2-3: 20dB BW High Channel (GFSK)**

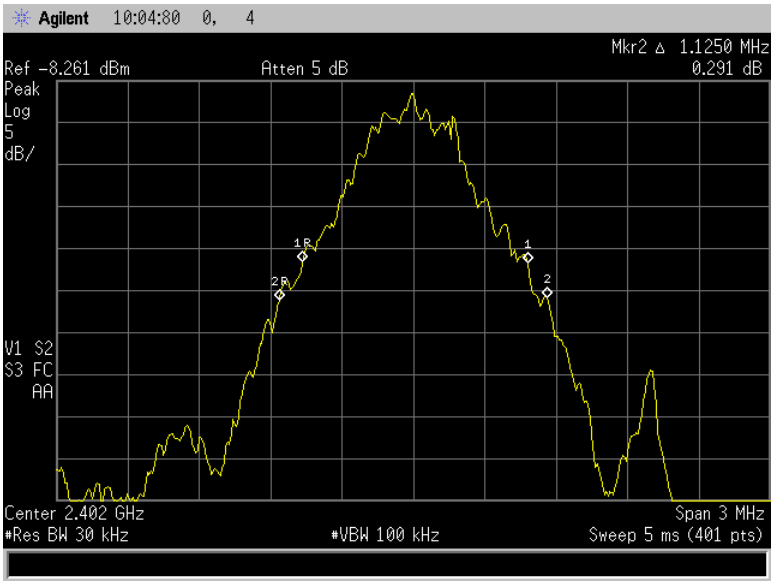



**Figure 7.5.4.2-4: 99% OBW Low Channel (GFSK)**

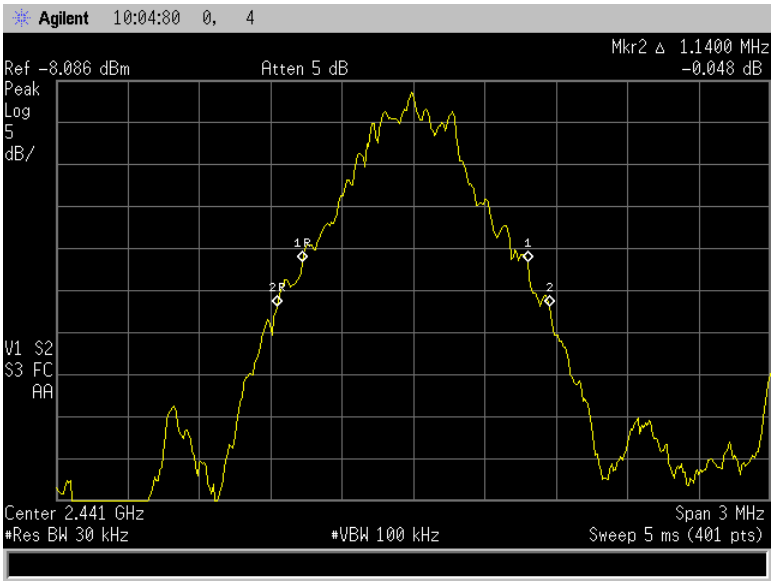



**Figure 7.5.4.2-5: 99% OBW Middle Channel (GFSK)**

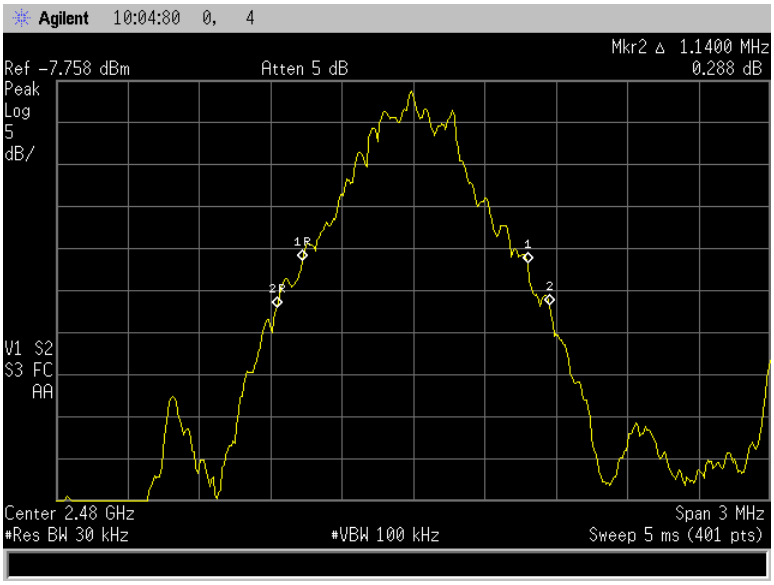



**Figure 7.5.4.2-6: 99% OBW High Channel (GFSK)**

**Table 7.5.4.2-2: 20dB / 99% Bandwidth (π/4 DQPSK)**

| Frequency [MHz] | 20dB Bandwidth [kHz] | 99% Bandwidth [kHz] |
|---|---|---|
| 2402 | 1305 | 1372.5 |
| 2441 | 1282.5 | 1372.5 |
| 2480 | 1282.5 | 1372.5 |

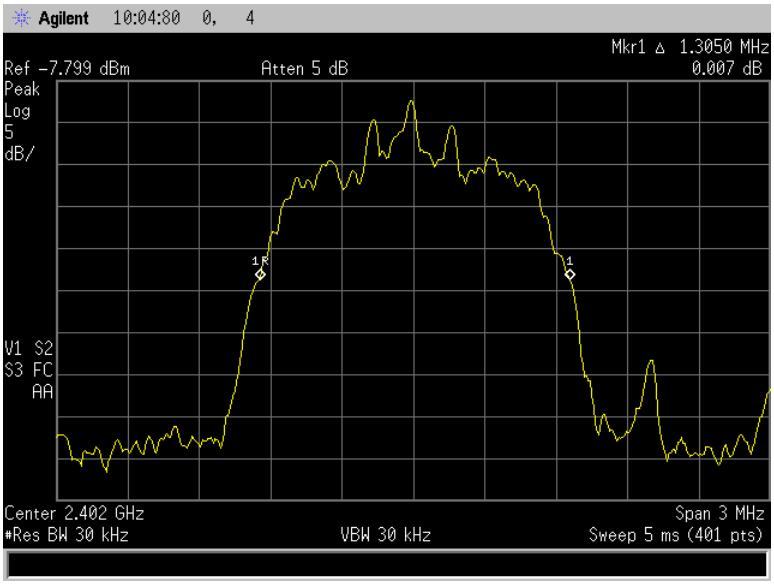



**Figure 7.5.4.2-7: 20dB BW Low Channel (π/4 DQPSK)**

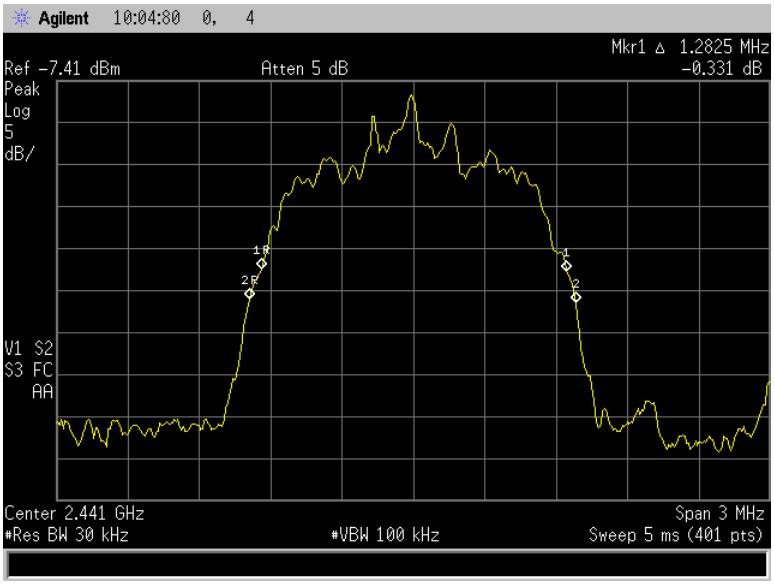



**Figure 7.5.4.2-8: 20dB BW Middle Channel (π/4 DQPSK)**

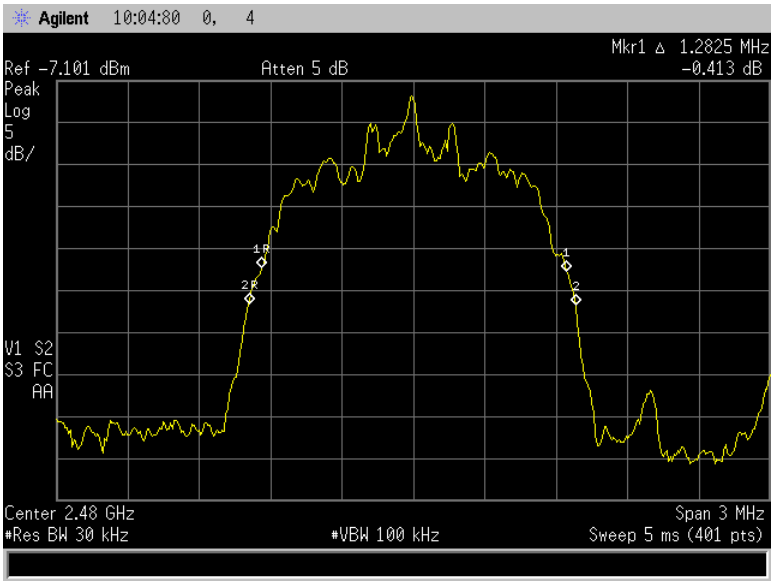



**Figure 7.5.4.2-9: 20dB BW High Channel (π/4 DQPSK)**

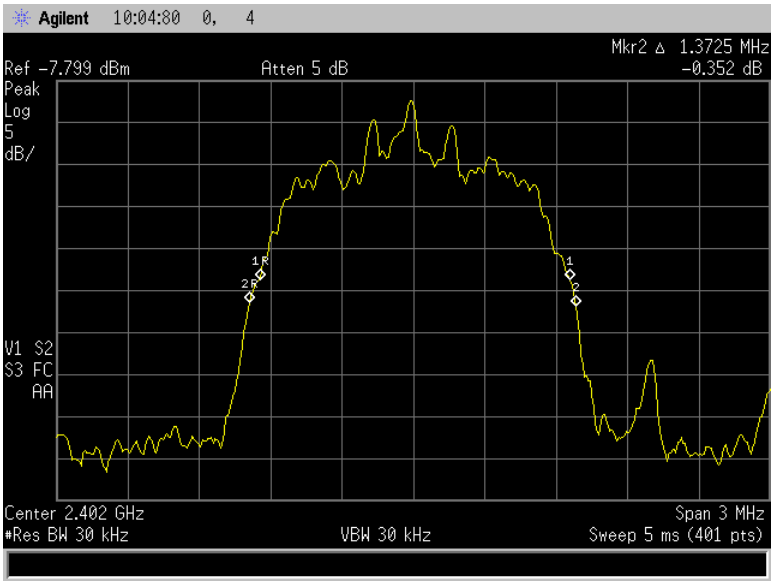



**Figure 7.5.4.2-10: 99% OBW Low Channel (π/4 DQPSK)**

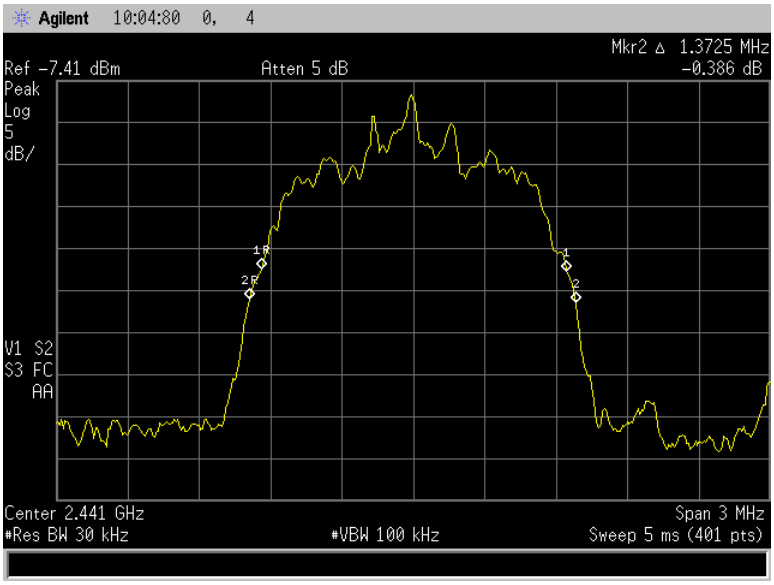



**Figure 7.5.4.2-11: 99% OBW Middle Channel (π/4 DQPSK)**

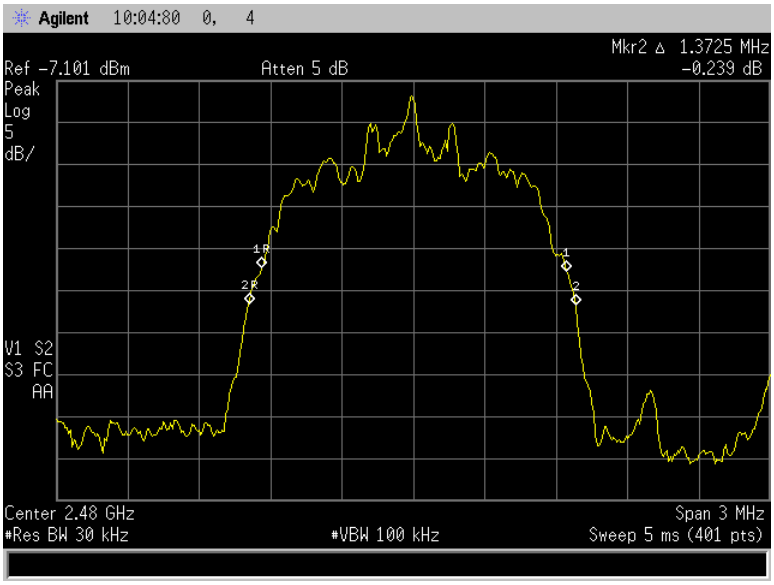



**Figure 7.5.4.2-12: 99% OBW High Channel (π/4 DQPSK)**

**Table 7.5.4.2-1: 20dB / 99% Bandwidth (8DPSK)**

| Frequency [MHz] | 20dB Bandwidth [kHz] | 99% Bandwidth [kHz] |
|---|---|---|
| 2402 | 1297.5 | 1342.5 |
| 2441 | 1297.5 | 1357.5 |
| 2480 | 1297.5 | 1342.5 |

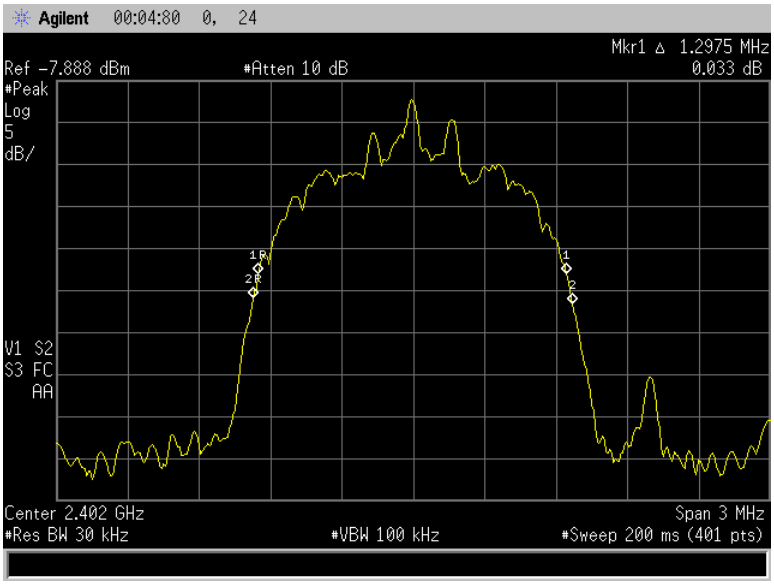



**Figure 7.5.4.2-13: 20dB BW Low Channel (8DPSK)**

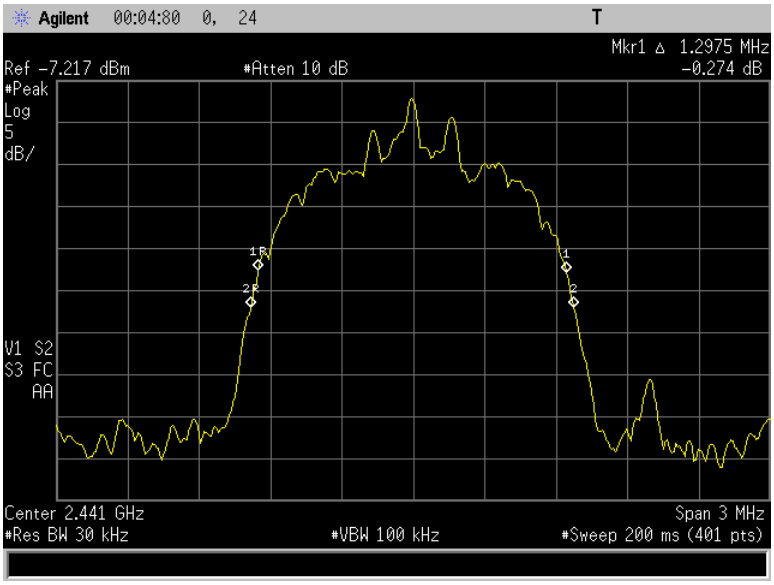



**Figure 7.5.4.2-14: 20dB BW Middle Channel (8DPSK)**

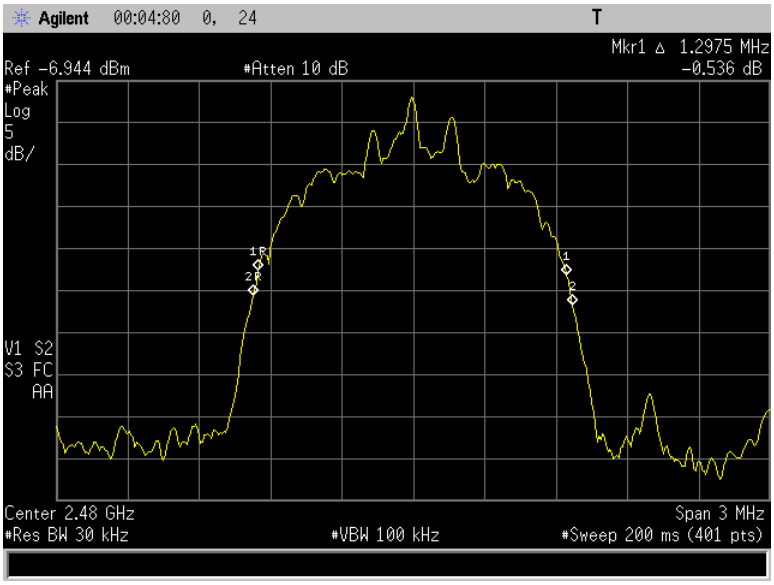



**Figure 7.5.4.2-15: 20dB BW High Channel (8DPSK)**

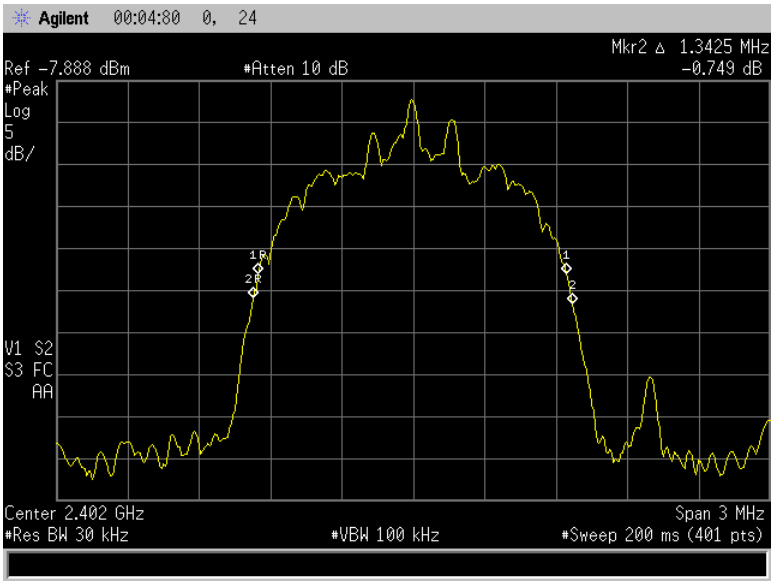



**Figure 7.5.4.2-16: 99% OBW Low Channel (8DPSK)**

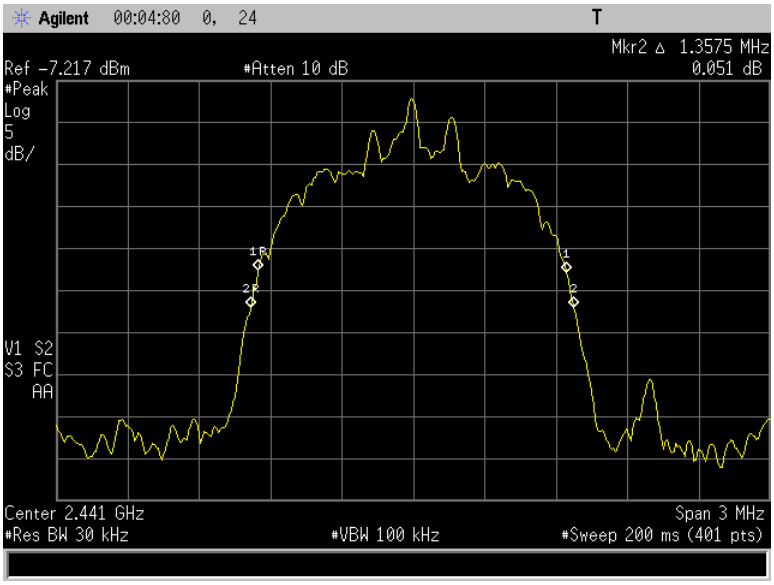



**Figure 7.5.4.2-17: 99% OBW Middle Channel (8DPSK)**

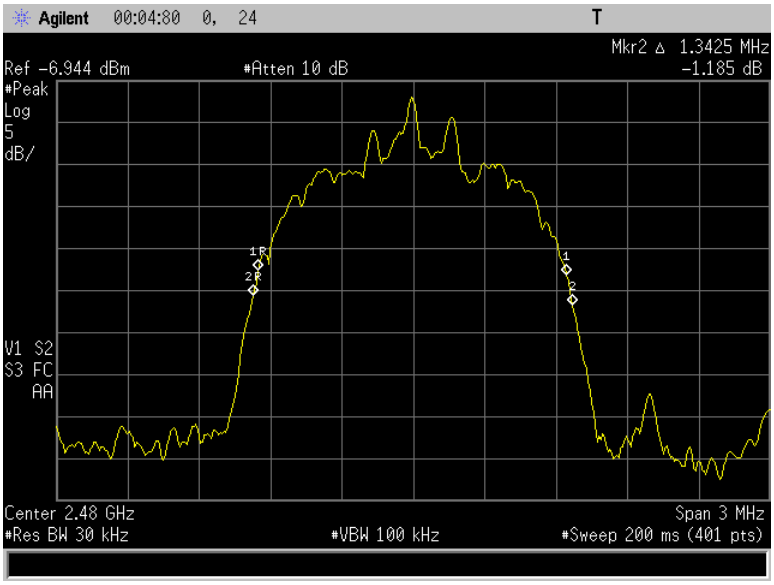



**Figure 7.5.4.2-18: 99% OBW High Channel (8DPSK)**

## 7.6 Band-Edge Compliance and Spurious Emissions-FCC 15.247d IC:RSS-210 2.6, A8.5

### 7.6.1 Band-Edge Compliance of RF Conducted Emissions

#### *7.6.1.1* Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through a Tee-connector, with the third port connected to a CBT Bluetooth tester through a 20 dB attenuator. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, which is ≥ 1% of the span, and the VBW was set to 100 kHz.

#### *7.6.1.2* Measurement Results

Results are shown in Table 7.6.1.2-1 to 7.6.1.2-3 and Figures 7.6.1.2-1 to 7.6.1.12 below.

**Table 7.6.1.2-1: Conducted Band Edge - GFSK**

| | Measured Delta (dB) | | Limit (dB) | Margin (dB) | |
|---|---|---|---|---|---|
| | Single TX | Hopping Mode | | Single TX | Hopping Mode |
| **Lower Band-Edge** | 37.54 | 40.95 | 20.00 | 17.54 | 20.95 |
| **Upper Band-Edge** | 56.56 | 58.02 | 20.00 | 36.56 | 38.02 |

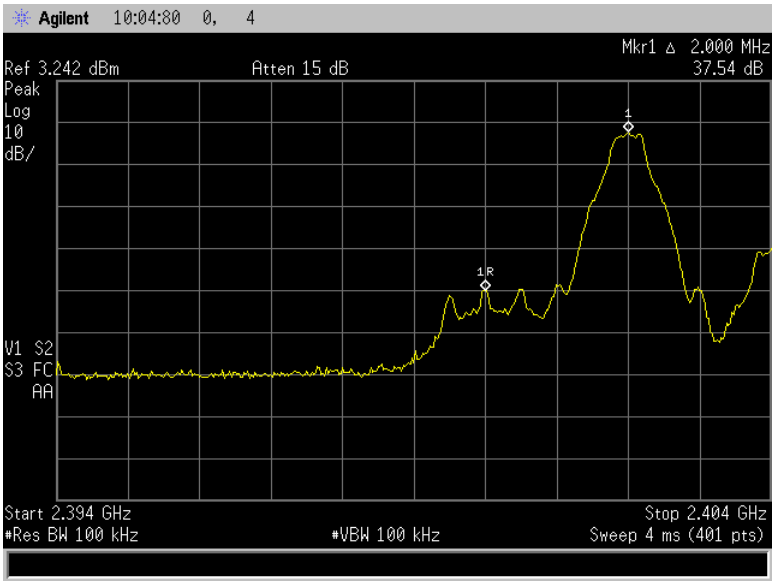



**Figure 7.6.1.2-1: Lower Band-edge (GFSK)**

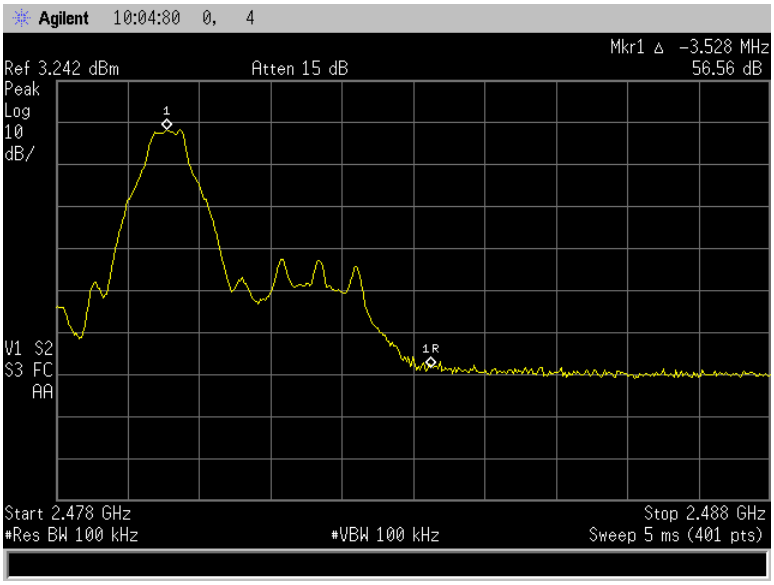



**Figure 7.6.1.2-2: Upper Band-edge (GFSK)**

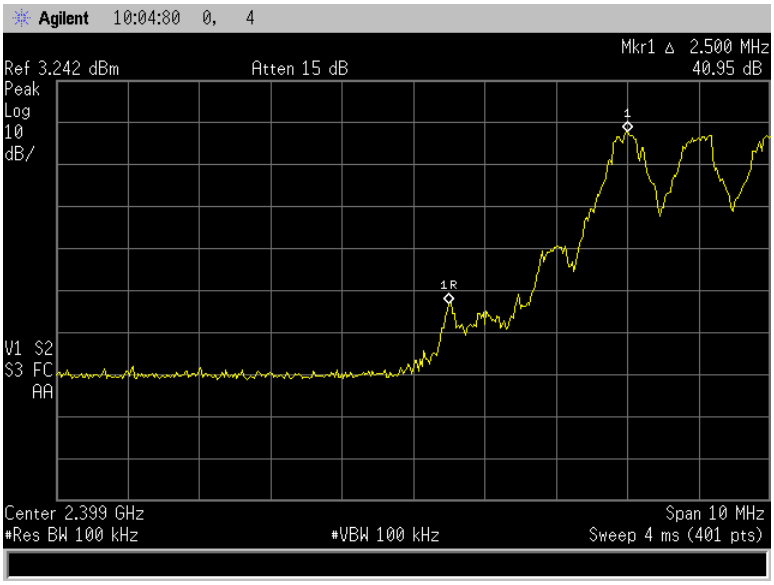



**Figure 7.6.1.2-3: Lower Band-edge – Hopping Mode (GFSK)**

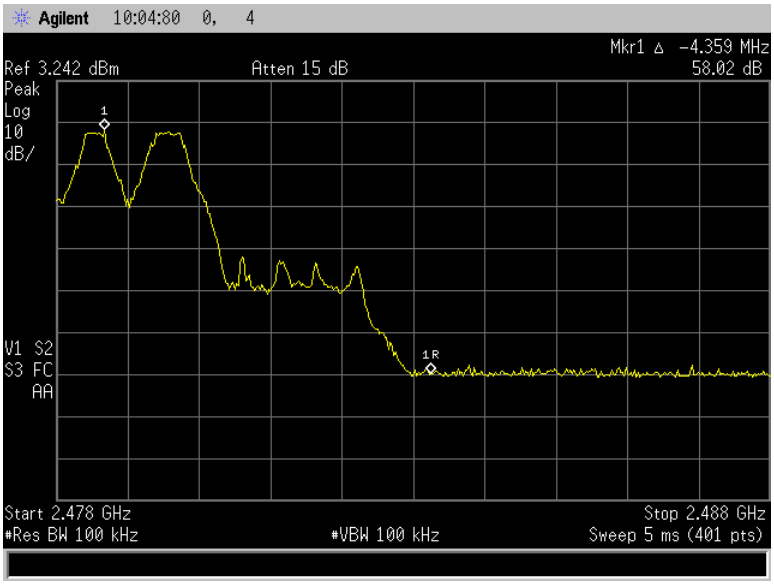



**Figure 7.6.1.2-4: Upper Band-edge – Hopping Mode (GFSK)**

Table 7.6.1.2-2: Conducted Band Edge - π/4 DQPSK

| | Measured Delta (dB) | | | Margin (dB) | |
|---|---|---|---|---|---|
| | Single TX | Hopping Mode | Limit (dB) | Single TX | Hopping Mode |
| Lower Band-Edge | 42.61 | 42.34 | 20.00 | 22.61 | 22.34 |
| Upper Band-Edge | 44.14 | 45.57 | 20.00 | 24.14 | 25.57 |

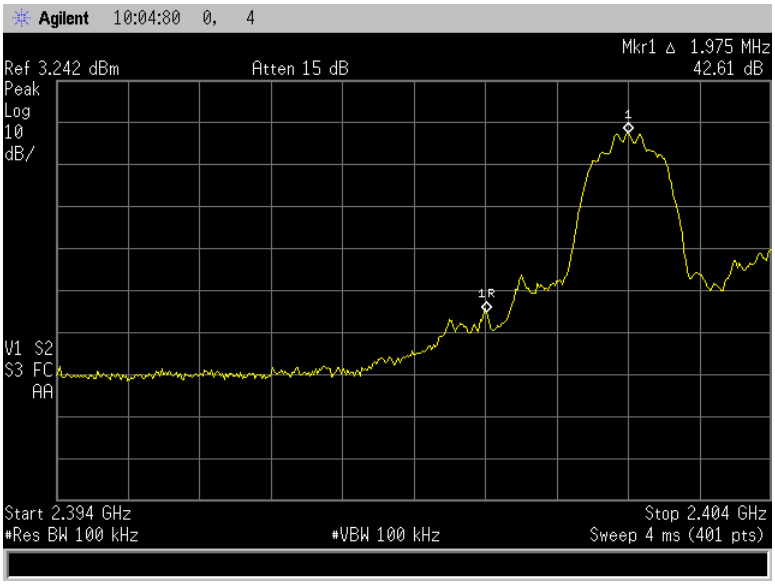



Figure 7.6.1.2-1: Lower Band-edge (π/4 DQPSK)

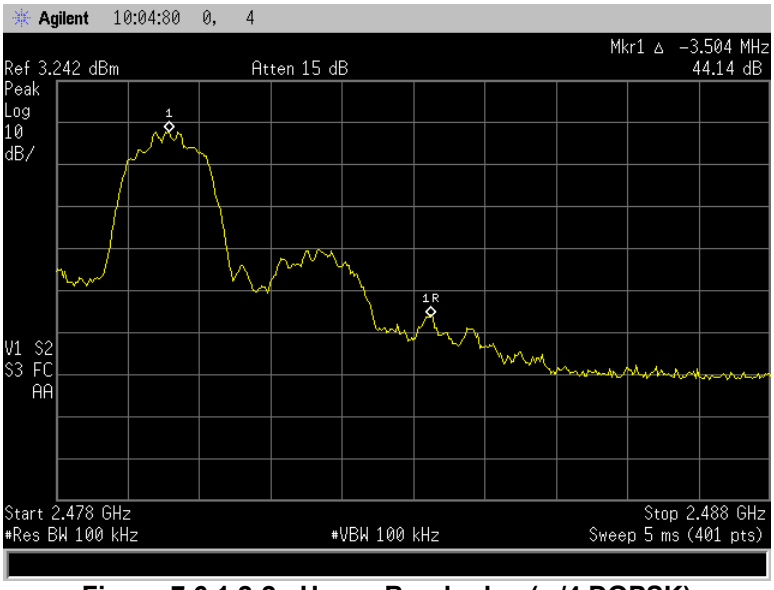



Figure 7.6.1.2-2: Upper Band-edge (π/4 DQPSK)

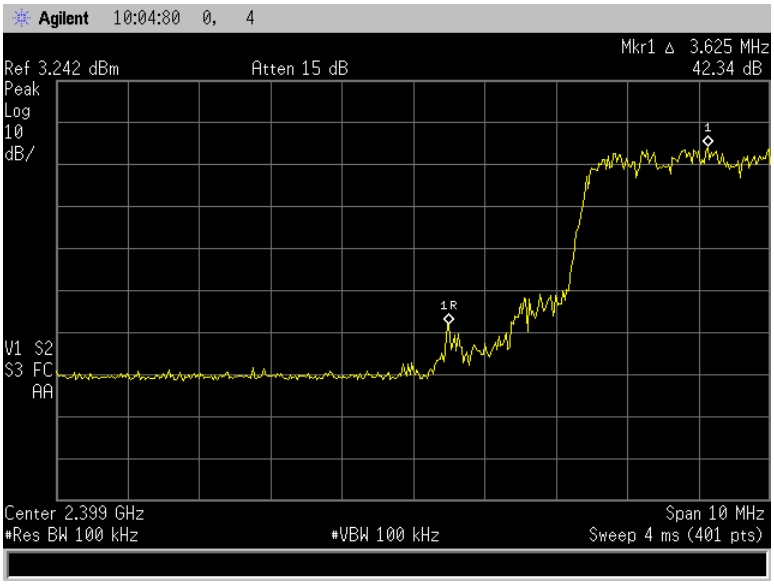



**Figure 7.6.1.2-3: Lower Band-edge – Hopping Mode (π/4 DQPSK)**

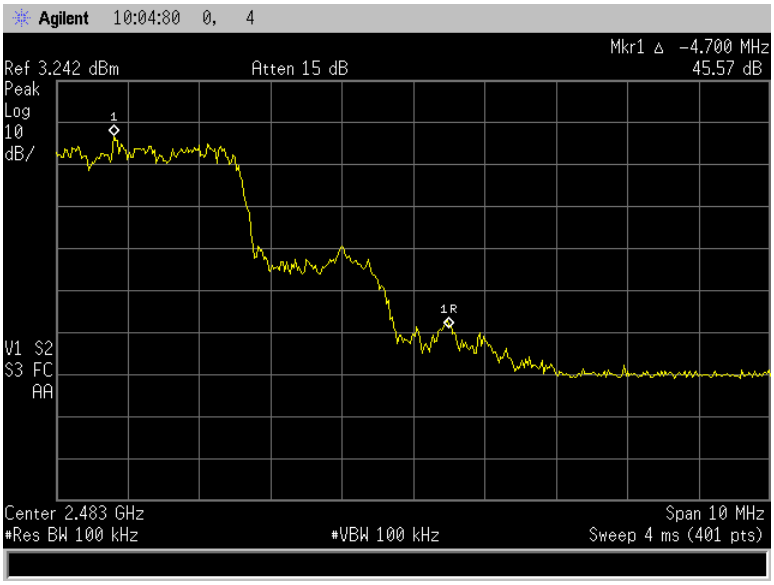



**Figure 7.6.1.2-4: Upper Band-edge – Hopping Mode (π/4 DQPSK)**

Table 7.6.1.2-3: Conducted Band Edge – 8DPSK

| | Measured Delta (dB) | | | Margin (dB) | |
|---|---|---|---|---|---|
| | Single TX | Hopping Mode | Limit (dB) | Single TX | Hopping Mode |
| Lower Band-Edge | 43.30 | 43.94 | 20.00 | 23.30 | 23.94 |
| Upper Band-Edge | 45.10 | 44.01 | 20.00 | 25.10 | 24.01 |

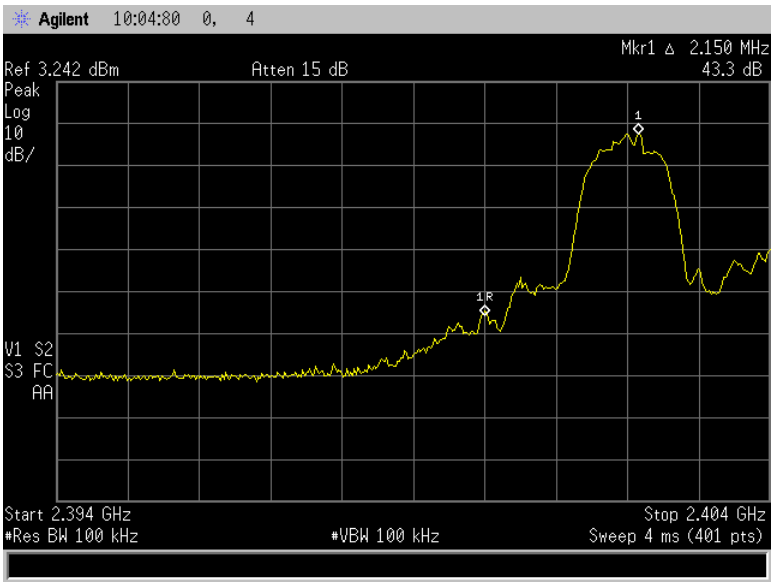



Figure 7.6.1.2-1: Lower Band-edge (8DPSK)

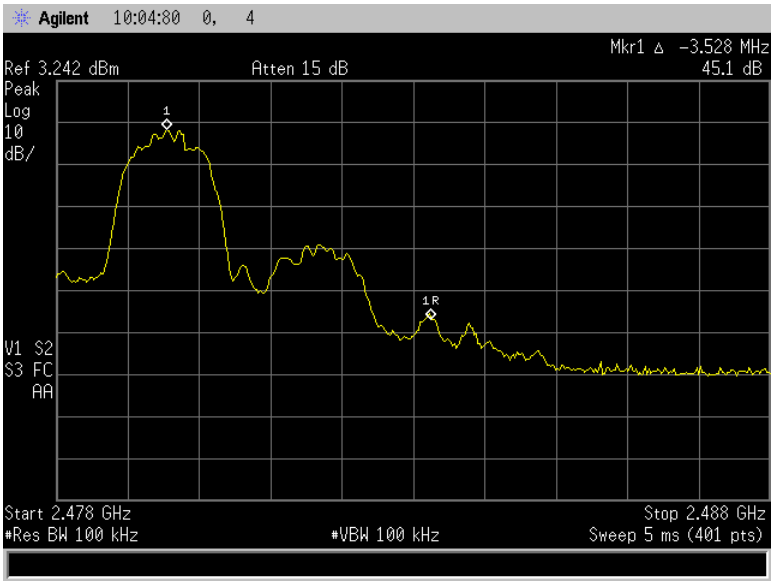



Figure 7.6.1.2-2: Upper Band-edge (8DPSK)

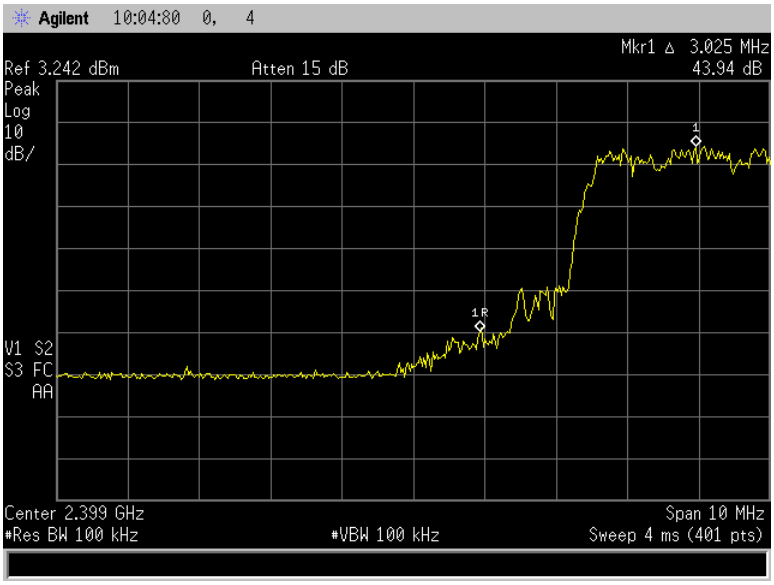



**Figure 7.6.1.2-3: Lower Band-edge – Hopping Mode (8DPSK)**

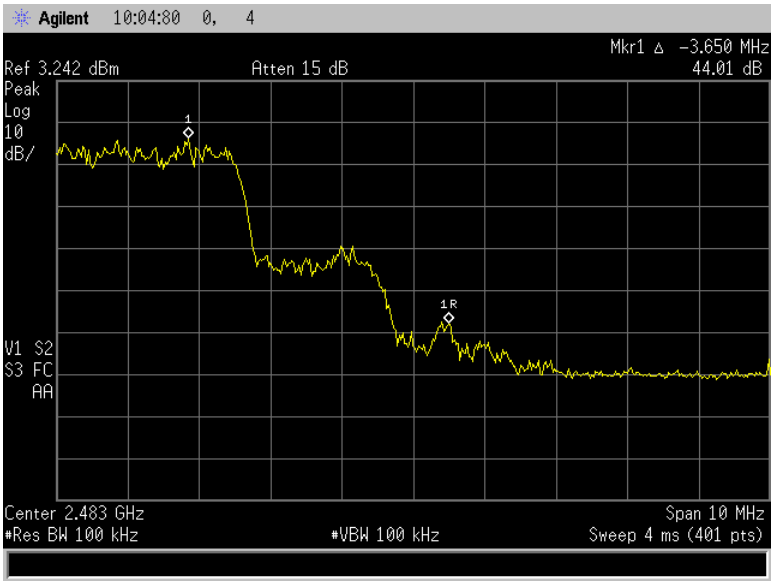



**Figure 7.6.1.2-4: Upper Band-edge – Hopping Mode (8DPSK)**

### 7.6.2 Band-Edge Compliance of Radiated Spurious Emissions

#### *7.6.2.1* Measurement Procedure

The EUT was investigated at the low and high channels of operation to determine band-edge compliance. All antenna types were evaluated. Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emission

#### *7.6.2.2* Measurement Results

Band-edge compliance is displayed in Table 7.6.1.2-1 to 7.6.1.2-3 and Figures 7.6.1.2-1 – 7.6.1.2-6.

**Table 7.6.2.2-1: Upper Band-edge -GFSK**

| Frequency (MHz) | Uncorrected Level (dBµV) | | Antenna Polarity | Correction Factors | Fundamental Level (dBµV/m) | | Marker-Delta (dB) | Band-Edge Level (dBµV/m) | | Limit (dBµV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (dB) | pk | Qpk/Avg | | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **2480** | 96.30 | 94.44 | H | -0.88 | 95.42 | 62.88 | 51.70 | 43.72 | 11.18 | 74.0 | 54.0 | 30.28 | 42.82 |
| **2480** | 93.80 | 93.80 | V | -0.88 | 92.92 | 62.24 | 49.10 | 43.82 | 13.14 | 74.0 | 54.0 | 30.18 | 40.86 |

* Note: The duty cycle correction factor of 30.68 dB computed using the dwell time over 100 ms, was applied to the measured average measurements.

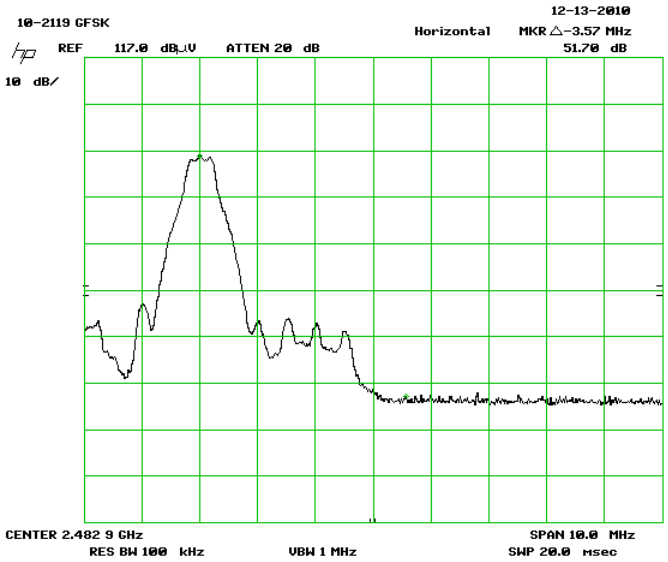



**Figure 7.6.1.2-1: Upper Band-edge (GFSK - Horizontal)**

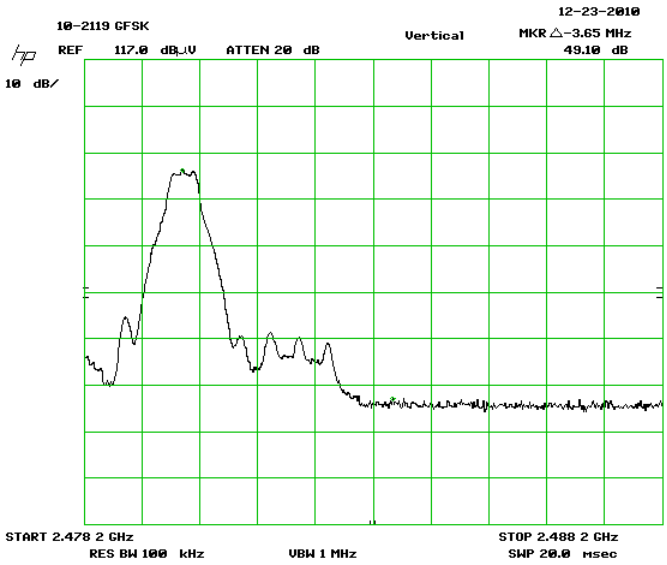



**Figure 7.6.1.2-2: Upper Band-edge (GFSK - Vertical)**

**Table 7.6.1.2-2: Upper Band-edge - π/4 DQPSK**

| Frequency (MHz) | Uncorrected Level (dBµV) | | Antenna Polarity | Correction Factors | Fundamental Level (dBµV/m) | | Marker-Delta (dB) | Band-Edge Level (dBµV/m) | | Limit (dBµV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (dB) | pk | Qpk/Avg | | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **2480** | 94.00 | 89.92 | H | -0.88 | 93.12 | 58.36 | 43.90 | 49.22 | 14.46 | 74.0 | 54.0 | 24.78 | 39.54 |
| **2480** | 95.40 | 91.50 | V | -0.88 | 94.52 | 59.94 | 44.40 | 50.12 | 15.54 | 74.0 | 54.0 | 23.88 | 38.46 |

* Note: The duty cycle correction factor of 30.68 dB computed using the dwell time over 100 ms, was applied to the measured average measurements.

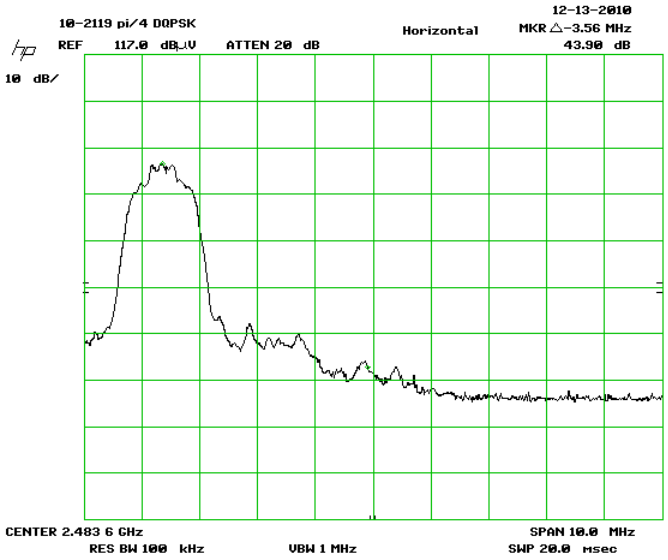



**Figure 7.6.1.2-3: Upper Band-edge (π/4 DQPSK - Horizontal)**

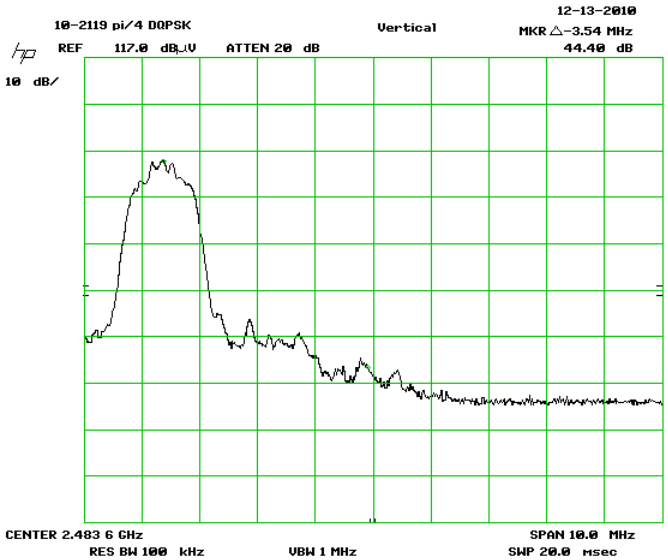



**Figure 7.6.1.2-4: Upper Band-edge (π/4 DQPSK - Vertical)**

**Table 7.6.1.2-3: Upper Band-edge – 8DPSK**

| Frequency (MHz) | Uncorrected Level (dBµV) | | Antenna Polarity | Correction Factors | Fundamental Level (dBµV/m) | | Marker-Delta (dB) | Band-Edge Level (dBµV/m) | | Limit (dBµV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (dB) | pk | Qpk/Avg | | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **2480** | 93.40 | 89.92 | H | -0.88 | 92.52 | 58.36 | 44.30 | 48.22 | 14.06 | 74.0 | 54.0 | 25.78 | 39.94 |
| **2480** | 94.60 | 91.50 | V | -0.88 | 93.72 | 59.94 | 45.00 | 48.72 | 14.94 | 74.0 | 54.0 | 25.28 | 39.06 |

* Note: The duty cycle correction factor of 30.68 dB computed using the dwell time over 100 ms, was applied to the measured average measurements.

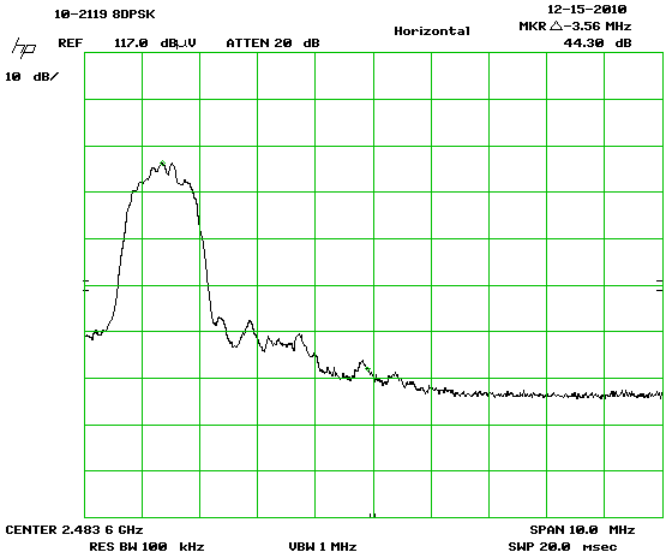



**Figure 7.6.1.2-5: Upper Band-edge (8DPSK - Horizontal)**

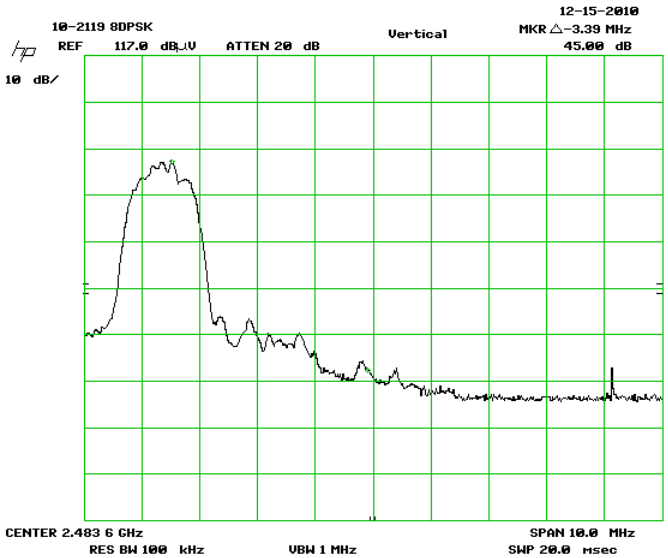



**Figure 7.6.1.2-6: Upper Band-edge (8DPSK - Vertical)**

**RF Conducted Spurious Emissions**

### *7.6.2.3* Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through a Tee-connector, with the third port connected to a CBT Bluetooth tester through a 20 dB attenuator. The EUT was investigated for conducted spurious emissions from 30MHz to 26.5 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz. A peak detector function was used with the trace set to max hold.

### *7.6.2.4* Measurement Results

Results are shown below in Tables 7.6.2.3-1 to 7.6.2.3-3 and Figures 7.6.2.2-1 to 7.6.2.2-18:

**Table 7.6.2.3-1: RF Spurious Emissions GFSK**

| Frequency (MHz) | Reading (dBm) | Insertion Loss (dB) | Spurious Level (dBm) | Limit (dBm) | Margin to Limit (dB) |
|---|---|---|---|---|---|
| **Low Channel** | | | | | |
| 2402 | -9.17 | 11.39 | 2.22 | ----- | ----- |
| 4804.00 | -41.52 | 20.84 | -20.68 | -17.78 | 2.90 |
| **Middle Channel** | | | | | |
| 2441.00 | -8.80 | 11.39 | 2.59 | ----- | ----- |
| 4882.00 | -40.11 | 20.84 | -19.27 | -17.41 | 1.86 |
| **High Channel** | | | | | |
| 2480.00 | -8.45 | 11.39 | 2.94 | ----- | ----- |
| 4960.00 | -40.56 | 20.84 | -19.72 | -17.06 | 2.66 |

* Note: All emissions above the second harmonics were attenuated below the emissions limits and the noise floor of the measurement equipment.

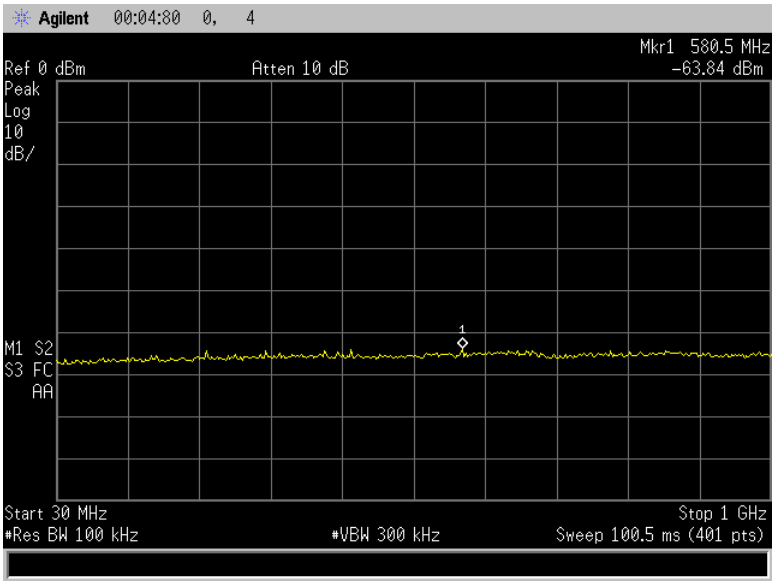



**Figure 7.6.2.3-1: 30 MHz – 1 GHz – Low Channel (GFSK)**

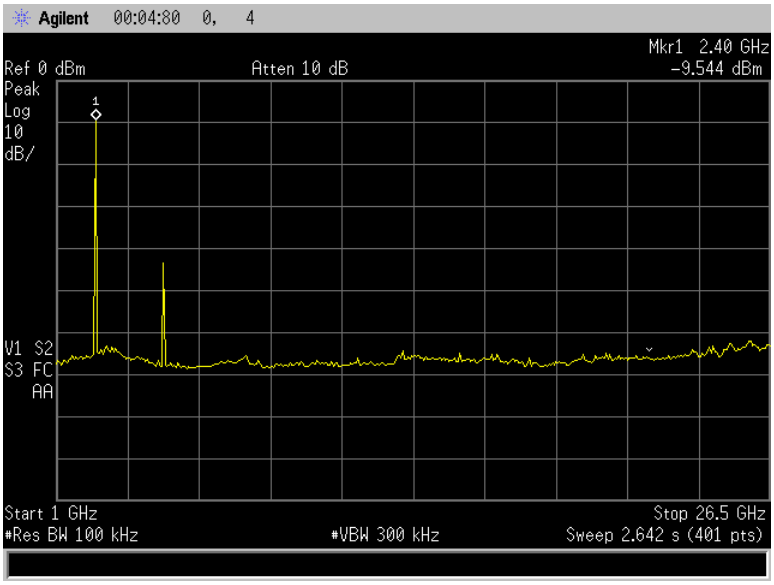



**Figure 7.6.2.2-3: 1 GHz – 26.5 GHz – Low Channel (GFSK)**

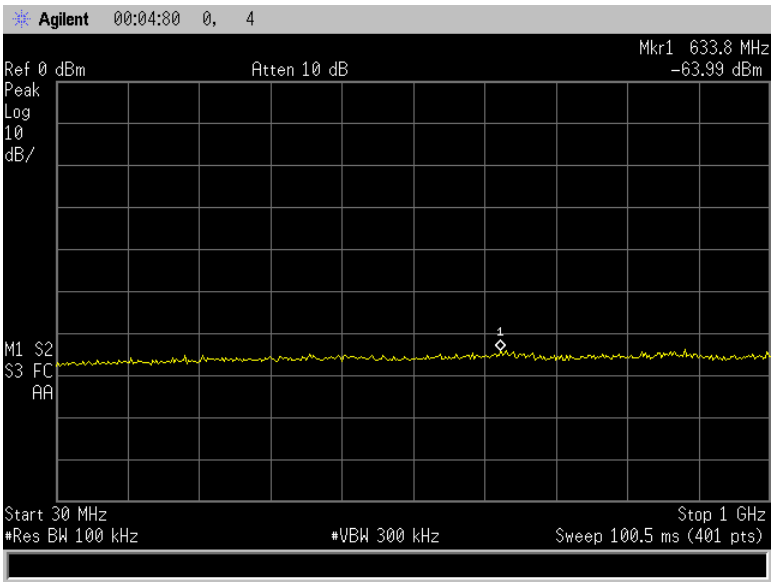



**Figure 7.6.2.3-3: 30 MHz – 1 GHz –Mid Channel (GFSK)**

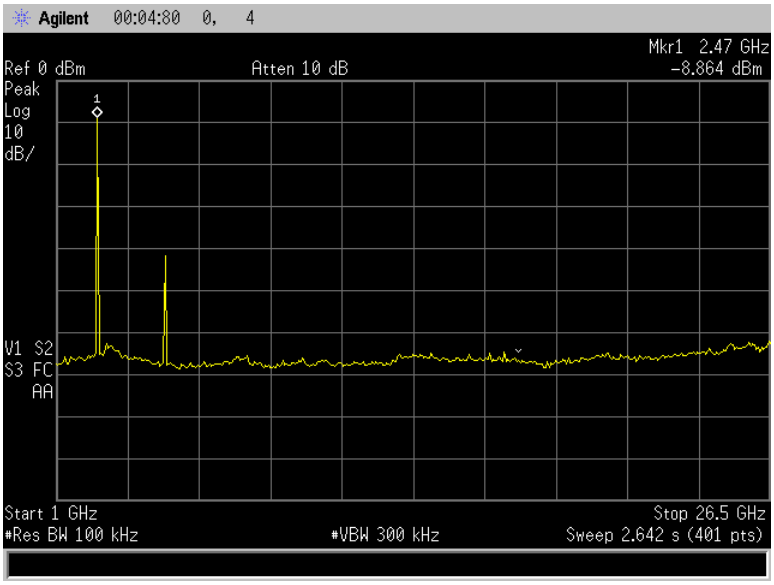



**Figure 7.6.2.3-4: 1 GHz – 26.5 GHz – Mid Channel (GFSK)**

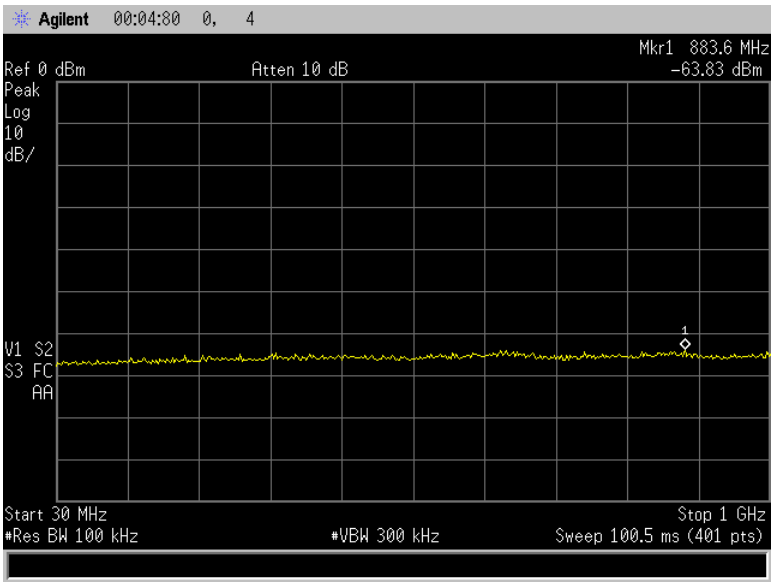



**Figure 7.6.2.3-5: 30 MHz – 1 GHz – High Channel (GFSK)**

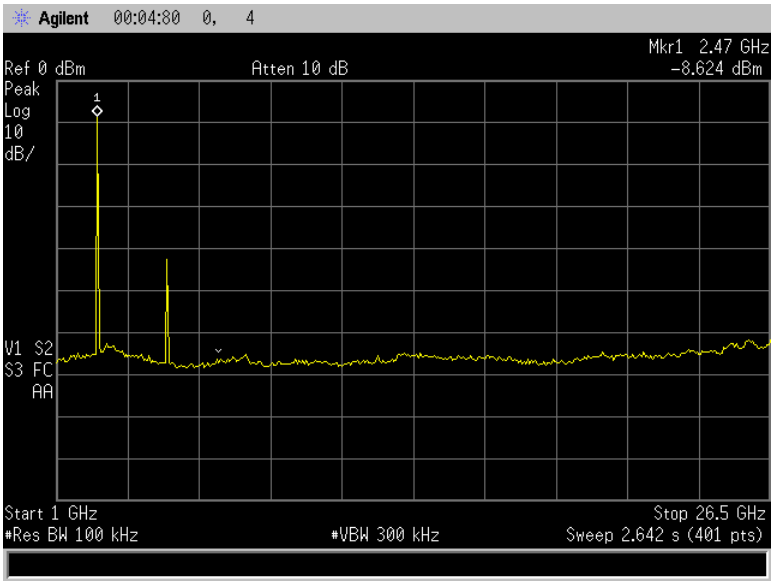



**Figure 7.6.2.3-6: 1 GHz – 26.5 GHz –High Channel (GFSK)**

**Table 7.6.2.3-2: RF Spurious Emissions π/4 DQPSK**

| Frequency (MHz) | Reading (dBm) | Insertion Loss (dB) | Spurious Level (dBm) | Limit (dBm) | Margin to Limit (dB) |
|---|---|---|---|---|---|
| **Low Channel** | | | | | |
| 2402 | -9.27 | 11.39 | 2.12 | ----- | ----- |
| 4804.00 | -48.59 | 20.84 | -27.75 | -17.88 | 9.87 |
| **Middle Channel** | | | | | |
| 2441.00 | -8.71 | 11.39 | 2.68 | ----- | ----- |
| 4882.00 | -46.33 | 20.84 | -25.49 | -17.32 | 8.17 |
| **High Channel** | | | | | |
| 2480.00 | -8.57 | 11.39 | 2.81 | ----- | ----- |
| 4960.00 | -48.66 | 20.84 | -27.82 | -17.19 | 10.63 |

* Note: All emissions above the second harmonics were attenuated below the emissions limits and the noise floor of the measurement equipment.

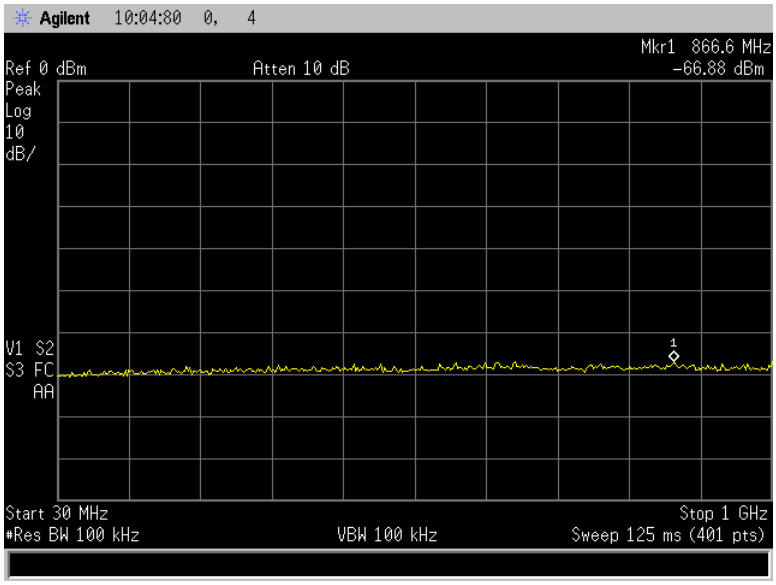



**Figure 7.6.2.3-7: 30 MHz – 1 GHz – Low Channel (π/4 DQPSK)**

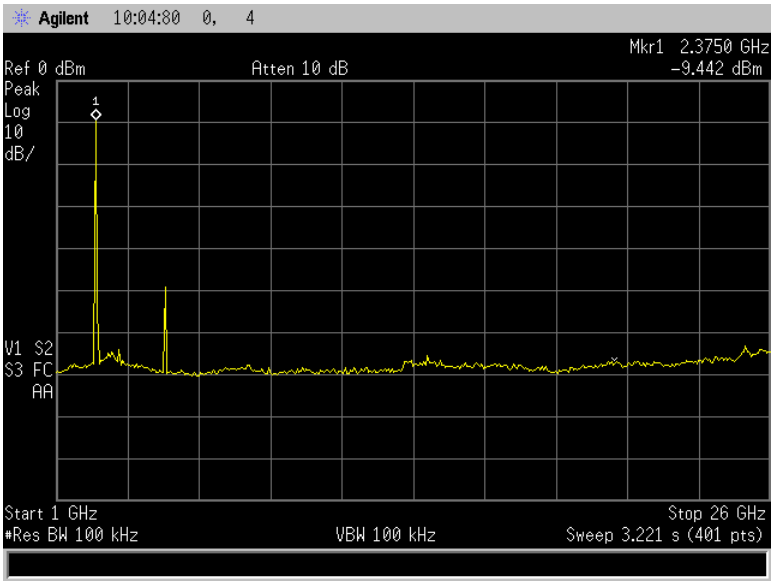



**Figure 7.6.2.3-8: 1 GHz – 26.5 GHz – Low Channel (π/4 DQPSK)**

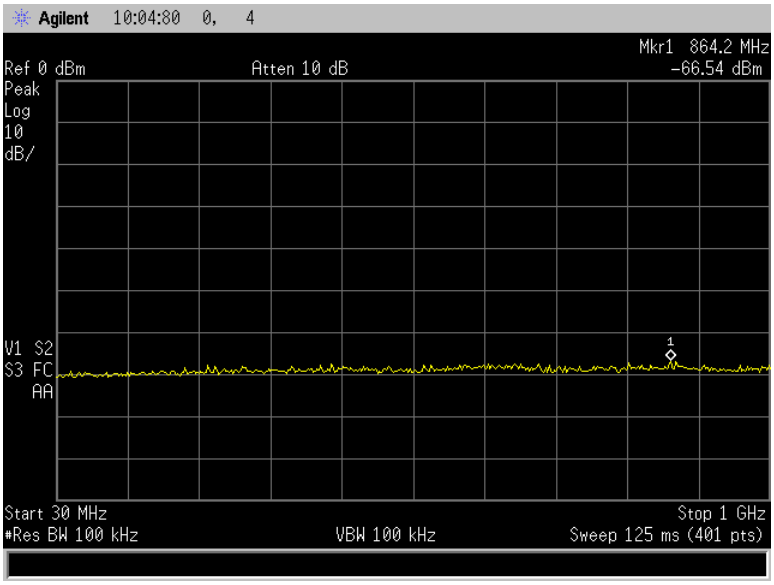



**Figure 7.6.2.-9: 30 MHz – 1 GHz –Mid Channel (π/4 DQPSK)**

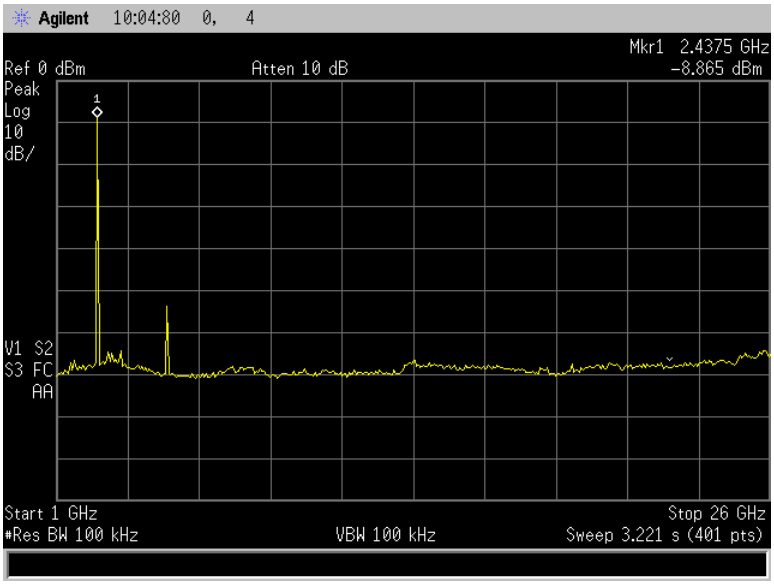



**Figure 7.6.2.3-10: 1 GHz – 26.5 GHz – Mid Channel (π/4 DQPSK)**

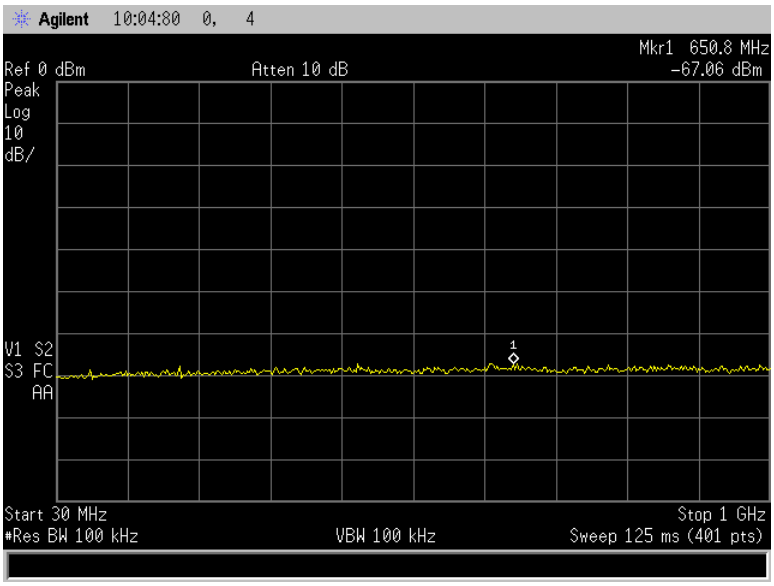



**Figure 7.6.2.3-11: 30 MHz – 1 GHz – High Channel (π/4 DQPSK)**

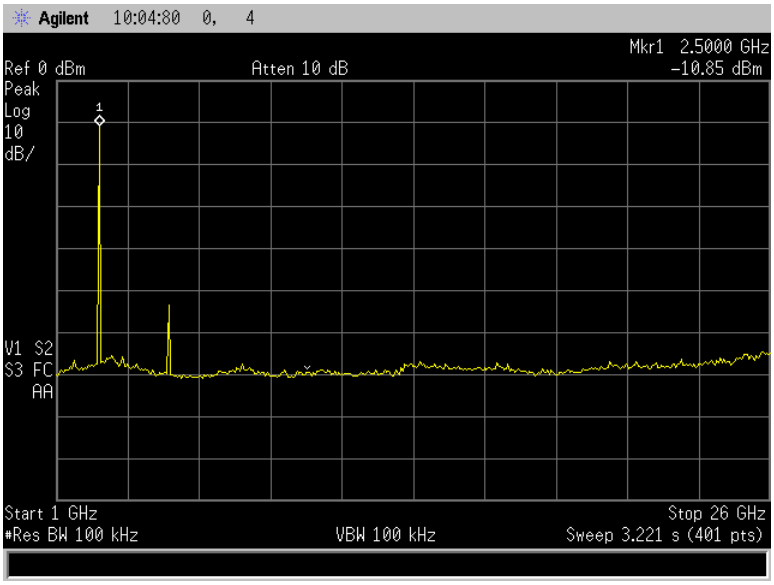



**Figure 7.6.2.3-12: 1 GHz – 26.5 GHz –High Channel (π/4 DQPSK)**

Table 7.6.2.3-3: RF Spurious Emissions 8DPSK

| Frequency (MHz) | Reading (dBm) | Insertion Loss (dB) | Spurious Level (dBm) | Limit (dBm) | Margin to Limit (dB) |
|---|---|---|---|---|---|
| Low Channel | | | | | |
| 2402 | -9.22 | 11.39 | 2.16 | ----- | ----- |
| 4804.00 | -48.16 | 20.84 | -27.32 | -17.84 | 9.48 |
| Middle Channel | | | | | |
| 2441.00 | -8.71 | 11.39 | 2.68 | ----- | ----- |
| 4882.00 | -47.32 | 20.84 | -26.48 | -17.32 | 9.16 |
| High Channel | | | | | |
| 2480.00 | -9.05 | 11.39 | 2.34 | ----- | ----- |
| 4960.00 | -48.78 | 20.84 | -27.94 | -17.66 | 10.28 |

* Note: All emissions above the second harmonics were attenuated below the emissions limits and the noise floor of the measurement equipment.

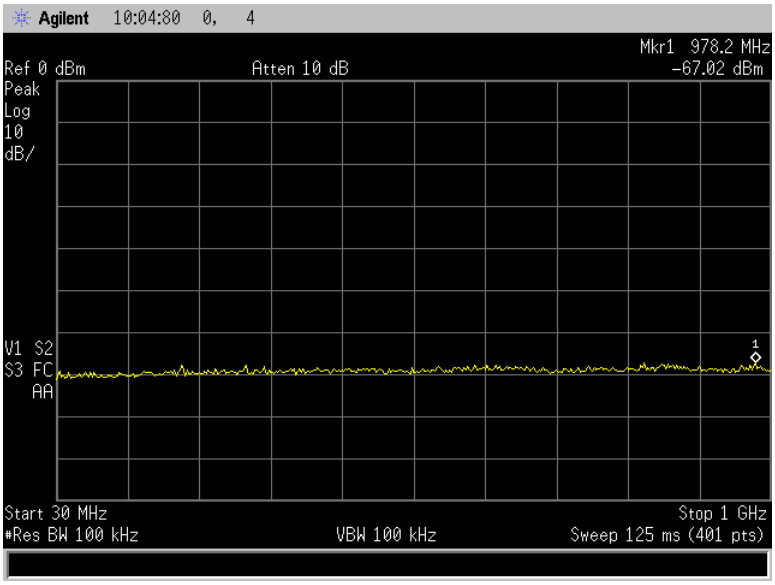



Figure 7.6.2.3-13: 30 MHz – 1 GHz – Low Channel (8DPSK)

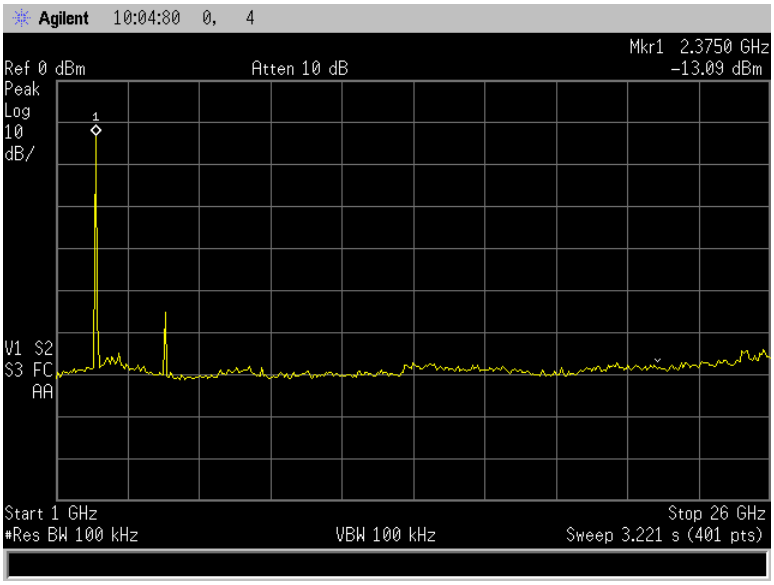



**Figure 7.6.2.3-14: 1 GHz – 26.5 GHz – Low Channel (8DPSK)**

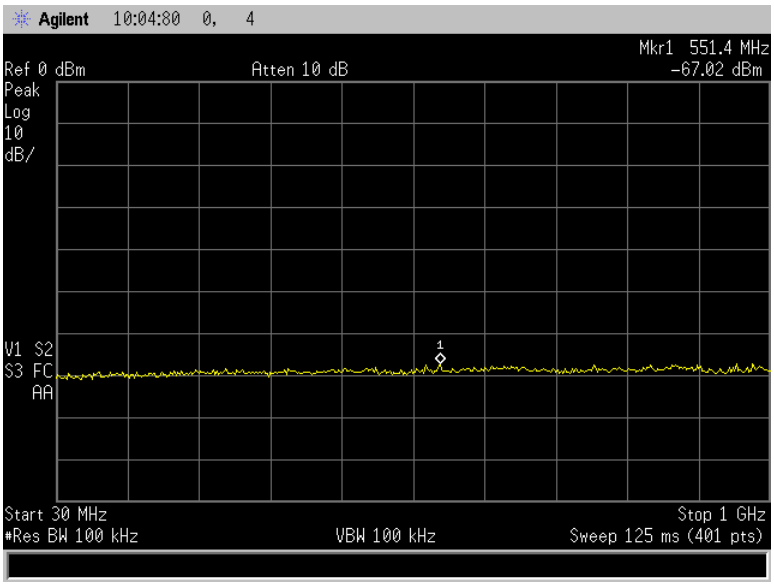



**Figure 7.6.2.3-15: 30 MHz – 1 GHz –Mid Channel (8DPSK)**

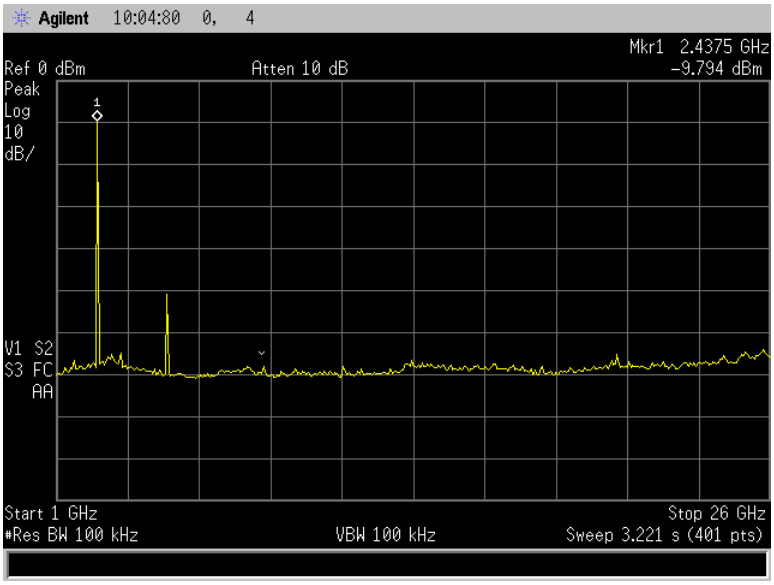



**Figure 7.6.2.3-16: 1 GHz – 26.5 GHz – Mid Channel (8DPSK)**

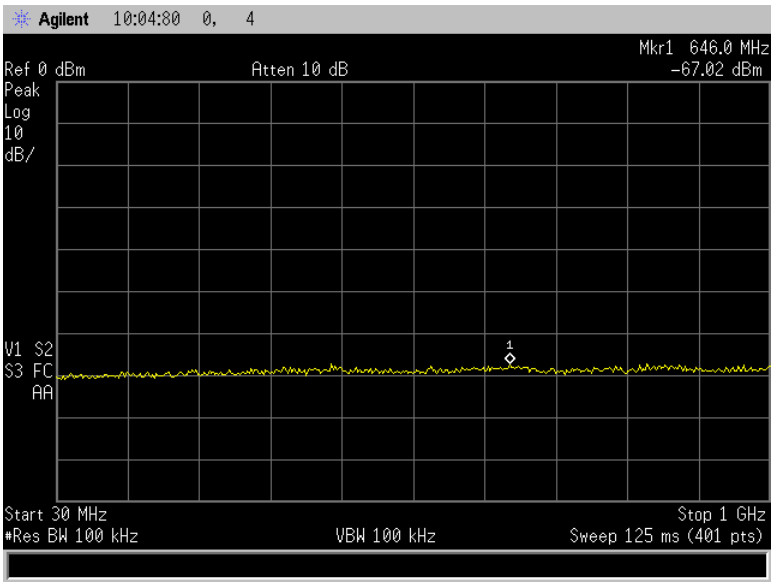



**Figure 7.6.2.3-17: 30 MHz – 1 GHz – High Channel (8DPSK)**

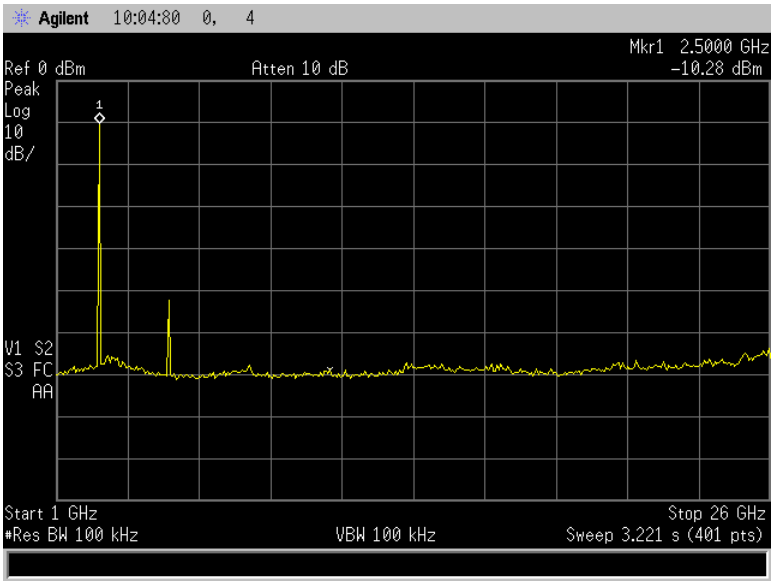



**Figure 7.6.2.3-18: 1 GHz – 26.5 GHz –High Channel (8DPSK)**

### 7.6.3 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-210 2.6

#### *7.6.3.1* Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 26.5 GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3MHz respectively.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

#### *7.6.3.2* Measurement Results

Radiated spurious emissions found in the band of 30MHz to 26.5 GHz, including modulation products resulting from the collocated transmitters, are reported in Tables 7.6.3.2-1 to 7.6.3.2-3 below. The measurements were performed using the DH5 data packet format which led to the longest dwell time, which was used to further reduce the average measurements.

**Table 7.6.3.2-1: Radiated Spurious Emissions Tabulated Data (GFSK)**

| Frequency (MHz) | Level (dBµV) | | Ant. Polarity | Ant. Height | TT Position | Correction Factors | Corrected Level (dBµV/m) | | Limit (dBµV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (cm) | (o) | (dB) | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **Low Channel** | | | | | | | | | | | | |
| **4804** | 58.04 | 53.74 | H | 153 | 199 | 6.31 | 64.35 | 29.37 | 74.0 | 54.0 | 9.7 | 24.6 |
| **4804** | 60.23 | 55.93 | V | 116 | 224 | 6.31 | 66.54 | 31.56 | 74.0 | 54.0 | 7.5 | 22.4 |
| **Middle Channel** | | | | | | | | | | | | |
| **4882** | 60.34 | 56.54 | H | 124 | 190 | 6.64 | 66.98 | 32.50 | 74.0 | 54.0 | 7.0 | 21.5 |
| **4882** | 59.90 | 55.77 | V | 114 | 224 | 6.64 | 66.54 | 31.73 | 74.0 | 54.0 | 7.5 | 22.3 |
| **High Channel** | | | | | | | | | | | | |
| **4960** | 60.97 | 57.35 | H | 147 | 191 | 6.97 | 67.94 | 33.64 | 74.0 | 54.0 | 6.1 | 20.4 |
| **4960** | 58.41 | 53.98 | V | 100 | 8 | 6.97 | 65.38 | 30.27 | 74.0 | 54.0 | 8.6 | 23.7 |

* Note: All emissions above 4960 MHz were attenuated below the permissible limit and the noise floor of the measurement equipment.
The duty cycle correction factor of 30.68 dB computed using the dwell time over 100 ms, was applied to the measured average measurements.

**Table 7.6.3.2-2: Radiated Spurious Emissions Tabulated Data (π/4 DQPSK)**

| Frequency (MHz) | Level (dBµV) | | Ant. Polarity | Ant. Height | TT Position | Correction Factors | Corrected Level (dBµV/m) | | Limit (dBµV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (cm) | (o) | (dB) | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **Low Channel** | | | | | | | | | | | | |
| **4804** | 52.02 | 41.85 | H | 144 | 168 | 6.31 | 58.33 | 17.48 | 74.0 | 54.0 | 15.7 | 36.5 |
| **4804** | 52.30 | 41.63 | V | 100 | 184 | 6.31 | 58.61 | 17.26 | 74.0 | 54.0 | 15.4 | 36.7 |
| **Middle Channel** | | | | | | | | | | | | |
| **4882** | 55.08 | 44.47 | H | 92 | 144 | 6.64 | 61.72 | 20.43 | 74.0 | 54.0 | 12.3 | 33.6 |
| **4882** | 53.12 | 42.84 | V | 100 | 28 | 6.64 | 59.76 | 18.80 | 74.0 | 54.0 | 14.2 | 35.2 |
| **High Channel** | | | | | | | | | | | | |
| **4960** | 54.08 | 43.18 | H | 155 | 190 | 6.97 | 61.05 | 19.47 | 74.0 | 54.0 | 12.9 | 34.5 |
| **4960** | 53.89 | 42.12 | V | 113 | 196 | 6.97 | 60.86 | 18.41 | 74.0 | 54.0 | 13.1 | 35.6 |

* Note: All emissions above 4960 MHz were attenuated below the permissible limit and the noise floor of the measurement equipment.
The duty cycle correction factor of 30.68 dB computed using the dwell time over 100 ms, was applied to the measured average measurements.

**Table 7.6.3.2-3: Radiated Spurious Emissions Tabulated Data (8DPSK)**

| Frequency (MHz) | Level (dBµV) | | Ant. Polarity | Ant. Height | TT Position | Correction Factors | Corrected Level (dBµV/m) | | Limit (dBµV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (cm) | (o) | (dB) | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **Low Channel** | | | | | | | | | | | | |
| **4804** | 52.59 | 42.57 | H | 144 | 168 | 6.31 | 58.90 | 18.20 | 74.0 | 54.0 | 15.1 | 35.8 |
| **4804** | 52.57 | 42.24 | V | 100 | 184 | 6.31 | 58.88 | 17.87 | 74.0 | 54.0 | 15.1 | 36.1 |
| **Middle Channel** | | | | | | | | | | | | |
| **4882** | 53.12 | 41.44 | H | 147 | 199 | 6.64 | 59.76 | 17.40 | 74.0 | 54.0 | 14.2 | 36.6 |
| **4882** | 52.18 | 40.40 | V | 100 | 28 | 6.64 | 58.82 | 16.36 | 74.0 | 54.0 | 15.2 | 37.6 |
| **High Channel** | | | | | | | | | | | | |
| **4960** | 54.03 | 41.72 | H | 155 | 190 | 6.97 | 61.00 | 18.01 | 74.0 | 54.0 | 13.0 | 36.0 |
| **4960** | 51.63 | 39.40 | V | 163 | 201 | 6.97 | 58.60 | 15.69 | 74.0 | 54.0 | 15.4 | 38.3 |

* Note: All emissions above 4960 MHz were attenuated below the permissible limit and the noise floor of the measurement equipment.
The duty cycle correction factor of 30.68 dB computed using the dwell time over 100 ms, was applied to the measured average measurements.

#### *7.6.3.3* Sample Calculation:

$R_C = R_U + CF_T$

Where:

| | | |
|---|---|---|
| $CF_T$ | = | Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only) |
| $R_U$ | = | Uncorrected Reading |
| $R_C$ | = | Corrected Level |
| AF | = | Antenna Factor |
| CA | = | Cable Attenuation |
| AG | = | Amplifier Gain |
| DC | = | Duty Cycle Correction Factor |

**Example Calculation: Peak**
Corrected Level: 58.04 + 6.31 = 64.35dBµV/m
Margin: 74dBuV/m – 64.35dBµV/m = 9.65dB

**Example Calculation: Average**
Corrected Level: 53.74 + 6.31 - 30.68= 29.37dBµV
Margin: 54dBuV – 29.37dBµV = 24.63dB

**Example Calculation: Duty Cycle Correction for Average Measurements**
Duty Cycle Correction = 20* log(Dwell Time /100 msec.) dB
=20*log(2.925/100) = -30.68 dB

## 8 CONCLUSION

In the opinion of ACS, Inc. the CLU1060BBLAA , manufactured by Motorola, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

# END REPORT