# STC Test Report

Date : 2013-06-14 

No. : HM168219

**Applicant (MUE001):** Musical Electronics Limited.
Flat H, J, K, 12/F., World Tech Centre, 95 How Ming Street, Kwun Tong, Kowloon, HK

**Manufacturer:** Musical Electronics (Qing Yuan) Limited.
Tai He Industrial Park, Qing Xin County, Qing Yuan, Guang Dong, China

**Description of Sample(s):**

| | |
|---|---|
| Product: | G-BOOM Wireless Boombox |
| Brand Name: | G-project |
| Model Number: | G-650 |
| FCC ID: | AUIG650A |

**Date Sample(s) Received:** 2013-01-29

**Date Tested:** 2013-01-30 to 2013-06-18

**Investigation Requested:** Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2012 and ANSI C63.4:2009 for FCC Certification.

**Conclusion(s):** The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

**Remark(s):** ---

Dr. LEE Kam Chuen
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.

**CONTENT:**

## 1.0 General Details

### 1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
10 Dai Wang Street, Taipo Industrial Estate
New Territories, Hong Kong

### 1.2 Equipment Under Test [EUT]
**Description of Sample(s)**

| | |
|---|---|
| Product: | G-BOOM Wireless Boombox |
| Manufacturer: | Musical Electronics (Qing Yuan) Limited.<br>Tai He Industrial Park, Qing Xin County, Qing Yuan, Guang Dong, China |
| Brand Name: | G-project |
| Model Number: | G-650 |
| Input Voltage: | 12Vd.c. with Jack |

The AC/DC adaptor was provided by the applicant with following details:
Brand name: N/A; Model no.: GQ30-120200-AU; Input: 100-240Va.c. 50/60Hz 1.0A Max.; Output: 12Vd.c. 2.0A.

### 1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a Musical Electronics Limited, G-BOOM Wireless Boomobx, it is Audio System, modulation by IC; and type is frequency hopping speed spectrum Modulation.

### 1.3 Date of Order

2013-01-29

### 1.4 Submitted Sample(s):

1 Sample

### 1.5 Test Duration

2013-01-30 to 2013-06-18

### 1.6 Country of Origin

China

### 1.7 RF Module Details

| | |
|---|---|
| Module Model Number: | BM160 |
| Module FCC ID: | N/A |
| Module Transmission Type: | Bluetooth V2.1+EDR |
| Modulation: | FHSS (GFSK / π/4-DQPSK / 8DPSK) |
| Data Rates: | 1MBps: GFSK |
| | 2 MBps: π/4-DQPSK |
| | 3 MBps: 8DPSK |
| Frequency Range: | 2400-2483.5MHz |
| Carrier Frequencies: | 2402MHz – 2480MHz |

Module Specification (specification provided by manufacturer)

### 1.8 Antenna Details

| | |
|---|---|
| Antenna Type: | PCB Layout Inverted F |
| Antenna Length: | 23 mm |
| Antenna Gain: | 2.12dBi |

## 2.0 Technical Details

### 2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2012 Regulations and ANSI C63.4:2009 for FCC Certification.

### 2.2 Test Standards and Results Summary Tables

**EMISSION**
**Results Summary**

| Test Condition | Test Requirement | Test Method | Class / Severity | Test Result | | |
|---|---|---|---|---|---|---|
| | | | | Pass | Fail | N/A |
| Output Power of Fundamental Emissions | FCC 47CFR 15.247(b)(1) | ANSI C63.4:2009 | N/A | ☒ | ☐ | ☐ |
| RF Conducted Spurious Emission | FCC 47CFR 15.247(c) | N/A | N/A | ☒ | ☐ | ☐ |
| Radiated Spurious Emissions | FCC 47CFR 15.209 | ANSI C63.4:2009 | N/A | ☒ | ☐ | ☐ |
| AC Mains Conducted Emissions | FCC 47CFR 15.207 | ANSI C63.4:2009 | N/A | ☒ | ☐ | ☐ |
| Number of Operating Channel | FCC 47CFR 15.247(a)(2)(b)(1) | N/A | N/A | ☒ | ☐ | ☐ |
| Band-edge compliance of Conducted Emission | FCC 47CFR 15.247(c) | N/A | N/A | ☒ | ☐ | ☐ |
| Pseudorandom Hopping Algorithm | FCC 47CFR 15.247(a)(1) | N/A | N/A | ☒ | ☐ | ☐ |
| Time of Occupancy | FCC 47CFR 15.247(a)(1)(iii) | N/A | N/A | ☒ | ☐ | ☐ |
| 20dB Bandwidth | FCC 47CFR 15.247(a)(2) | N/A | N/A | ☒ | ☐ | ☐ |
| Hopping Channel Separation | FCC 47CFR 15.247(a)(1) | N/A | N/A | ☒ | ☐ | ☐ |
| Antenna requirement | FCC 47CFR 15.203 | N/A | N/A | ☒ | ☐ | ☐ |

Note: N/A – Not Applicable

### 2.3 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate in the table below is the worst case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items | Mode | Data Rate |
|---|---|---|
| Max. Conducted Output Power | GFSK / π/4-DQPSK / 8DPSK | 1MBps / 2MBps / 3MBps |
| Hopping Channel Separation | GFSK / π/4-DQPSK / 8DPSK | 1MBps / 2MBps / 3MBps |
| Number of Hopping Frequency | 8DPSK | 3MBps |
| Dwell Time | DH1 / DH3 / DH5 | 3MBps |
| Radiated Emissions Below 1GHz | GFSK | 1MBps |
| Radiated Emission Above 1GHz | GFSK | 1MBps |
| Band Edge Emissions | GFSK / π/4-DQPSK / 8DPSK | 1MBps / 2MBps / 3MBps |

## 3.0 Test Results

### 3.1 Emission

#### 3.1.1 Maximum Peak Output Power

| | |
|---|---|
| Test Requirement: | FCC 47CFR 15.247(b)(1) |
| Test Method: | N/A |
| Test Date: | 2013-01-30 |
| Mode of Operation: | Tx mode |

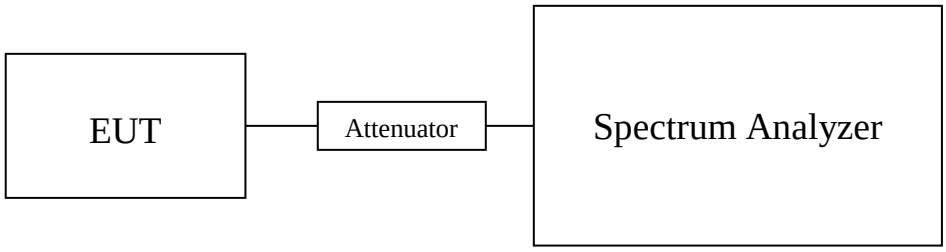
**Test Method:**

The RF output of the EUT was connected to the spectrum analyzer. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in dBm.

**Spectrum Analyzer Setting:**

RBW = 3 MHz, VBW= 3MHz, Sweep = Auto, Span = 10MHz
Detector = Peak, Trace = Max. hold

**Test Setup:**



**Limits for Peak Output Power of Fundamental & Harmonics Emissions [FCC 47CFR 15.247]:**

| |
|---|
| The maximum peak output power shall not exceeded the following limits:<br>For frequency hopping systems employing at least 75 hopping channels: 1 Watt<br>For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts<br>For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt |

**Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass**
**Maximum conducted output power**

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2402 | 0.000736 |

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2441 | 0.000487 |

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2480 | 0.000641 |

**Results of Bluetooth Communication mode (π/4-DQPSK) (Fundamental Power): Pass**
**Maximum conducted output power**

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2402 | 0.000371 |

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2442 | 0.000192 |

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2480 | 0.000238 |

**Results of Bluetooth Communication mode (8 DPSK) (Fundamental Power): Pass**
**Maximum conducted output power**

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2402 | 0.000381 |

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2442 | 0.000241 |

| Transmitter Frequency (MHz) | Maximum conducted output power (Watt) |
|---|---|
| 2480 | 0.000231 |

Limit: 0.125W (125mW)
Calculated measurement uncertainty : 30MHz to 1GHz 1.7dB
1GHz to 18GHz 1.7dB

### 3.1.2 Radiated Spurious Emissions

| | |
|---|---|
| Test Requirement: | FCC 47CFR 15.209 |
| Test Method: | ANSI C63.4:2009 |
| Test Date: | 2013-05-30 |
| Mode of Operation: | Bluetooth mode (Powered by battery)/ Bluetooth mode (Powered by adaptor)/ Aux-in mode (Connected to iPod – Powered by battery)/ Aux-in mode (Connected to iPod with charging function – Powered by adaptor)/ Charging mode (Powered by adaptor) |

**Test Method:**

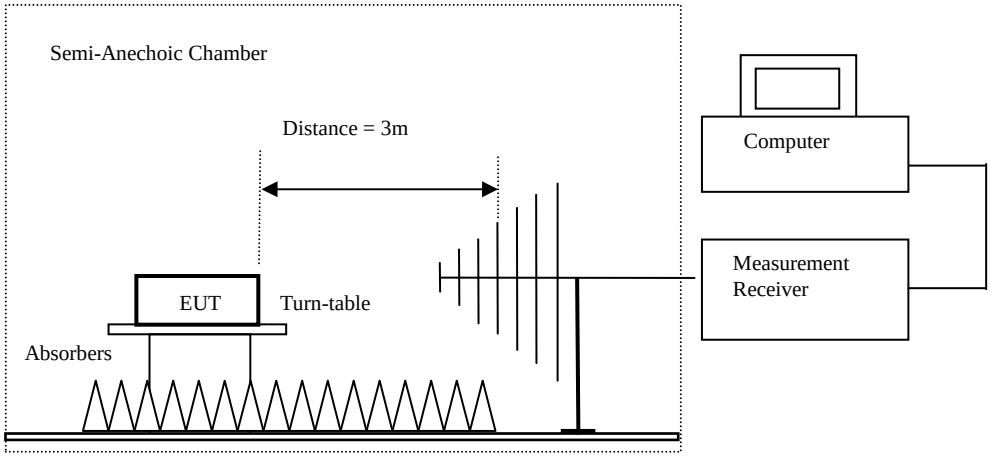
The sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

*: Semi-anechoic chamber located on the STC (Dongguan) Company Ltd. 68 Fumin Nan Road, Dalang, Dongguan, Guangdong, PRC with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 629686.

**Spectrum Analyzer Setting:**

| | | |
|---|---|---|
| 9KHz – 30MHz (Pk & Av) | RBW: | 10kHz |
| | VBW: | 30kHz |
| | Sweep: | Auto |
| | Span: | Fully capture the emissions being measured |
| | Trace: | Max. hold |
| 30MHz – 1GHz (QP) | RBW: | 120kHz |
| | VBW: | 120kHz |
| | Sweep: | Auto |
| | Span: | Fully capture the emissions being measured |
| | Trace: | Max. hold |
| Above 1GHz (Pk & Av) | RBW: | 3MHz |
| | VBW: | 3MHz |
| | Sweep: | Auto |
| | Span: | Fully capture the emissions being measured |
| | Trace: | Max. hold |

**Test Setup:**




Ground Plane

- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used.

**Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:**

| Frequency Range | Quasi-Peak Limits |
|---|---|
| [MHz] | [µV/m] |
| 0.009-0.490 | 2400/F (kHz) |
| 0.490-1.705 | 24000/F (kHz) |
| 1.705-30 | 30 |
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above960 | 500 |

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

**Result of Bluetooth mode (2402.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2402.0 MHz) (GFSK mode) (30MHz – 1GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2402.0 MHz) (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4804.7 | 17.0 | 32.7 | 49.7 | 74.0 | 24.3 | Vertical |

**Result of Bluetooth mode (2402.0 MHz) (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4804.7 | 4.0 | 32.7 | 36.7 | 54.0 | 17.3 | Vertical |

**Result of Bluetooth mode (2441.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Results of Bluetooth mode (2441.0 MHz) (GFSK mode) (30MHz – 1000MHz): PASS**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2441.0 MHz) (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4882.9 | 12.5 | 32.8 | 45.3 | 74.0 | 28.7 | Vertical |

**Result of Bluetooth mode (2441.0 MHz) (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4882.9 | 1.5 | 32.8 | 34.3 | 54.0 | 19.7 | Vertical |

**Result of Bluetooth mode (2480.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Results of Bluetooth mode (2480.0 MHz) (GFSK mode) (30MHz – 1000MHz): PASS**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2480.0 MHz) (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4960.3 | 15.3 | 33 | 48.3 | 74.0 | 25.7 | Vertical |

**Result of Bluetooth mode (2480.0 MHz) (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4960.3 | 2.2 | 33 | 35.2 | 54.0 | 18.8 | Vertical |

**Result of Bluetooth mode Band Edge measurement (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 2387.3 | 1.9 | 28 | 29.9 | 74.0 | 44.1 | Vertical |
| 2491.3 | 2.7 | 28 | 30.7 | 74.0 | 43.3 | Vertical |

**Result of Bluetooth mode Band Edge measurement (GFSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 2387.3 | 0.3 | 28 | 28.3 | 54.0 | 25.7 | Vertical |
| 2491.3 | 0.7 | 28 | 28.7 | 54.0 | 25.3 | Vertical |

**Result of Bluetooth mode (2402.0 MHz) (π/4-DQPSK mode) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2402.0 MHz) (π/4-DQPSK mode) (30MHz – 1GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2402.0 MHz) (π/4-DQPSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4804.7 | 6.6 | 32.7 | 39.3 | 74.0 | 34.7 | Vertical |

**Result of Bluetooth mode (2402.0 MHz) (π/4-DQPSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4804.7 | 0.4 | 32.7 | 33.1 | 54.0 | 20.9 | Vertical |

**Result of Bluetooth mode (2441.0 MHz) (π/4-DQPSK mode) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Results of Bluetooth mode (2441.0 MHz) (π/4-DQPSK mode) (30MHz – 1000MHz): PASS**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2441.0 MHz) (π/4-DQPSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4882.3 | 5.9 | 32.8 | 38.7 | 74.0 | 35.3 | Vertical |

**Result of Bluetooth mode (2441.0 MHz) (π/4-DQPSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4882.3 | -0.1 | 32.8 | 32.7 | 54.0 | 21.3 | Vertical |

**Result of Bluetooth mode (2480.0 MHz) (π/4-DQPSK mode) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Results of Bluetooth mode (2480.0 MHz) (π/4-DQPSK mode) (30MHz – 1000MHz): PASS**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2480.0 MHz) (π/4-DQPSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4960.7 | 6.1 | 33.0 | 39.1 | 74.0 | 34.9 | Vertical |

**Result of Bluetooth mode (2480.0 MHz) (π/4-DQPSK mode) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4960.7 | -0.3 | 33.0 | 32.7 | 54.0 | 21.3 | Vertical |

**Result of Bluetooth mode Band Edge measurement (π/4-DQPSK mode)) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 2387.3 | 4.1 | 28 | 32.1 | 74.0 | 41.9 | Vertical |
| 2496.1 | 2.3 | 28 | 30.3 | 74.0 | 43.7 | Vertical |

**Result of Bluetooth mode Band Edge measurement (π/4-DQPSK mode)) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 2387.3 | 0.3 | 28 | 28.3 | 54.0 | 25.7 | Vertical |
| 2496.1 | 0.1 | 28 | 28.1 | 54.0 | 25.9 | Vertical |

**Result of Bluetooth mode (2402.0 MHz) (8DPSK) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2402.0 MHz) (8DPSK) (30MHz – 1GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Bluetooth mode (2402.0 MHz) (8DPSK) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4804.1 | 6.0 | 32.7 | 38.7 | 74.0 | 35.3 | Vertical |

**Result of Bluetooth mode (2402.0 MHz) (8DPSK) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4804.1 | 0.7 | 32.7 | 33.4 | 54.0 | 20.6 | Vertical |

**Result of Tx mode (2441.0 MHz) (8DPSK) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Results of Tx mode (2441.0 MHz) (8DPSK) (30MHz – 1000MHz): PASS**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Tx mode (2441.0 MHz) (8DPSK) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4882.3 | 5.0 | 32.8 | 37.8 | 74.0 | 36.2 | Vertical |

**Result of Tx mode (2441.0 MHz) (8DPSK) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4882.3 | -0.1 | 32.8 | 32.7 | 54.0 | 21.3 | Vertical |

**Result of Tx mode (2480.0 MHz) (8DPSK) (9kHz – 30MHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Results of Tx mode (2480.0 MHz) (8DPSK) (30MHz – 1000MHz): PASS**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level | Correction Factor | Field Strength | Field Strength | Limit | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | µV/m | µV/m | |
| Emissions detected are more than 20 dB below the FCC Limits | | | | | | |

**Result of Tx mode (2480.0 MHz) (8DPSK) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4960.3 | 6.3 | 33.0 | 39.3 | 74.0 | 34.7 | Vertical |

**Result of Tx mode (2480.0 MHz) (8DPSK) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 4960.3 | -0.1 | 33.0 | 32.9 | 54.0 | 21.1 | Vertical |

**Result of Bluetooth mode Band Edge measurement (8DPSK mode)) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Peak Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 2388.1 | 1.7 | 28 | 29.7 | 74.0 | 44.3 | Vertical |
| 2491.3 | 2.4 | 28 | 30.4 | 74.0 | 43.6 | Vertical |

**Result of Bluetooth mode Band Edge measurement (8DPSK mode)) (1 – 26GHz): Pass**

| Field Strength of Spurious Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Average Value | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 2488.1 | -0.7 | 28 | 27.3 | 54.0 | 26.7 | Vertical |
| 2491.3 | -0.2 | 28 | 27.8 | 54.0 | 26.2 | Vertical |

Remarks:

* Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty: (30MHz - 1GHz): 4.6dB
(1GHz - 26GHz): 4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

**Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:**

| Frequency Range | Quasi-Peak Limits |
|---|---|
| [MHz] | [µV/m] |
| 0.009-0.490 | 2400/F (kHz) |
| 0.490-1.705 | 24000/F (kHz) |
| 1.705-30 | 30 |
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above960 | 500 |

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

**Result of Bluetooth mode (Powered by battery) (30MHz – 1GHz): Pass**

| Radiated Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Quasi-Peak | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 183.2 | 6.7 | 11.5 | 18.2 | 43.5 | 25.3 | Horizontal |
| 285.6 | 10.7 | 15.1 | 25.8 | 46.0 | 20.2 | Horizontal |
| 296.0 | 14.0 | 15.5 | 29.5 | 46.0 | 16.5 | Horizontal |
| 329.8 | 8.7 | 16.9 | 25.6 | 46.0 | 20.4 | Horizontal |
| 185.2 | 4.5 | 11.3 | 15.8 | 43.5 | 27.7 | Vertical |
| 53.8 | 14.0 | 9.2 | 23.2 | 40.0 | 16.8 | Vertical |

**Result of Bluetooth mode (Powered by adaptor) (30MHz – 1GHz): Pass**

| Radiated Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Quasi-Peak | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 199.7 | 13.6 | 11.7 | 25.3 | 43.5 | 18.2 | Horizontal |
| 257.1 | 22.0 | 14.2 | 36.2 | 46.0 | 9.8 | Horizontal |
| 297.0 | 27.5 | 15.6 | 43.1 | 46.0 | 2.9 | Horizontal |
| 348.7 | 22.7 | 17.4 | 40.1 | 46.0 | 5.9 | Horizontal |
| 224.1 | 14.0 | 13.4 | 27.4 | 46.0 | 18.6 | Vertical |
| 335.0 | 18.8 | 16.4 | 35.2 | 46.0 | 10.8 | Vertical |

**Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:**

| Frequency Range | Quasi-Peak Limits |
|---|---|
| [MHz] | [µV/m] |
| 0.009-0.490 | 2400/F (kHz) |
| 0.490-1.705 | 24000/F (kHz) |
| 1.705-30 | 30 |
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above960 | 500 |

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

**Result of Aux-in mode (Connected to iPod – Powered by battery) (30MHz – 1GHz): Pass**

| Radiated Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Quasi-Peak | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 160.0 | 13.4 | 11.0 | 24.4 | 43.5 | 19.1 | Horizontal |
| 228.0 | 20.3 | 13.2 | 33.5 | 46.0 | 12.5 | Horizontal |
| 264.0 | 19.2 | 14.4 | 33.6 | 46.0 | 12.4 | Horizontal |
| 297.9 | 10.1 | 15.6 | 25.7 | 46.0 | 20.3 | Horizontal |
| 408.0 | 18.0 | 18.7 | 36.7 | 46.0 | 9.3 | Horizontal |
| 299.2 | 4.4 | 15.9 | 20.3 | 46.0 | 25.7 | Vertical |

**Result of Aux-in mode (Connected to iPod with charging function – Powered by adaptor) (30MHz – 1GHz): Pass**

| Radiated Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Quasi-Peak | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 108.0 | 13.9 | 9.9 | 23.8 | 43.5 | 19.7 | Horizontal |
| 229.8 | 20.2 | 13.3 | 33.5 | 46.0 | 12.5 | Horizontal |
| 285.4 | 19.1 | 15.1 | 34.2 | 46.0 | 11.8 | Horizontal |
| 336.1 | 24.4 | 17.1 | 41.5 | 46.0 | 4.5 | Horizontal |
| 35.6 | 9.0 | 14.4 | 23.4 | 46.0 | 22.6 | Vertical |
| 300.5 | 13.7 | 15.9 | 29.6 | 46.0 | 16.4 | Vertical |

**Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:**

| Frequency Range | Quasi-Peak Limits |
|---|---|
| [MHz] | [µV/m] |
| 0.009-0.490 | 2400/F (kHz) |
| 0.490-1.705 | 24000/F (kHz) |
| 1.705-30 | 30 |
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above960 | 500 |

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

**Result of Charging mode (Powered by adaptor) (30MHz – 1GHz): Pass**

| Radiated Emissions | | | | | | |
|---|---|---|---|---|---|---|
| Quasi-Peak | | | | | | |
| Frequency | Measured Level @3m | Correction Factor | Field Strength | Limit @3m | Margin | E-Field Polarity |
| MHz | dBµV | dB/m | dBµV/m | dBµV/m | dBµV/m | |
| 197.8 | 11.3 | 11.7 | 23.0 | 43.5 | 20.5 | Horizontal |
| 263.5 | 14.0 | 14.4 | 28.4 | 46.0 | 17.6 | Horizontal |
| 318.5 | 9.8 | 16.5 | 26.3 | 46.0 | 19.7 | Horizontal |
| 52.9 | 13.7 | 9.3 | 23.0 | 40.0 | 17.0 | Vertical |
| 188.1 | 5.8 | 11.5 | 17.3 | 43.5 | 26.2 | Vertical |
| 323.6 | 6.9 | 16.1 | 23.0 | 46.0 | 23.0 | Vertical |

Remarks:
Calculated measurement uncertainty (30MHz – 1GHz): 4.6dB
Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

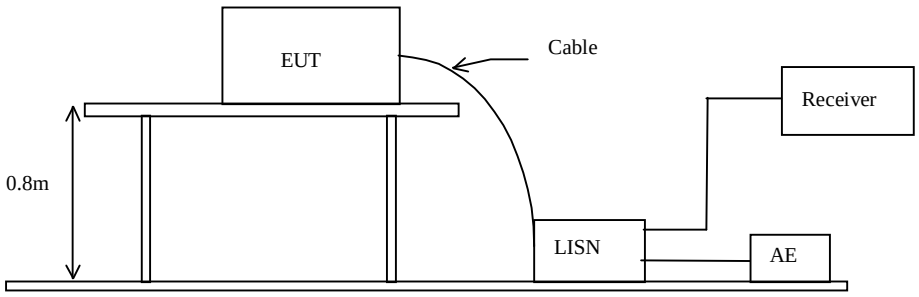
### 3.1.3 Conducted Emissions (0.15MHz to 30MHz)

| | |
|---|---|
| Test Requirement: | FCC 47CFR 15.207 |
| Test Method: | ANSI C63.4:2009 |
| Test Date: | 2013-01-30 |
| Mode of Operation: | Bluetooth communication mode/<br>Aux-in mode (Connected to iPod with charging function) |
| Test Voltage: | 117Va.c., 60Hz |

**Test Method:**

The test was performed in accordance with ANSI C63.4: 2009, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

**Test Setup:**



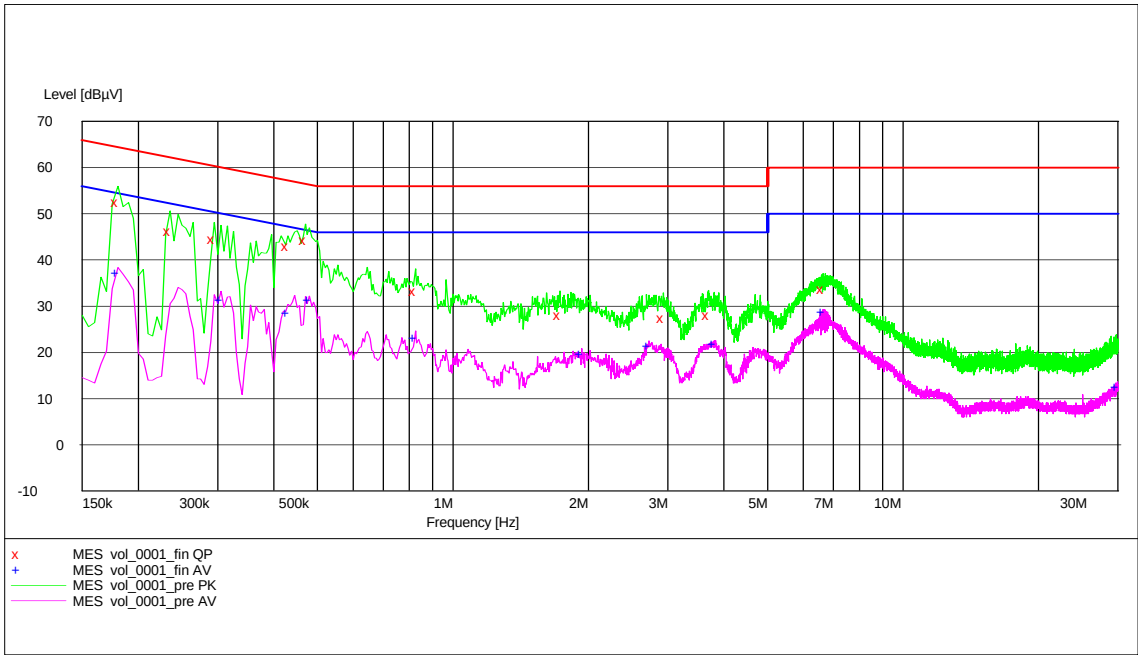
**Limit for Conducted Emissions (FCC 47 CFR 15.207):**

| Frequency Range [MHz] | Quasi-Peak Limits [dBµV] | Average [dBµV] |
|---|---|---|
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

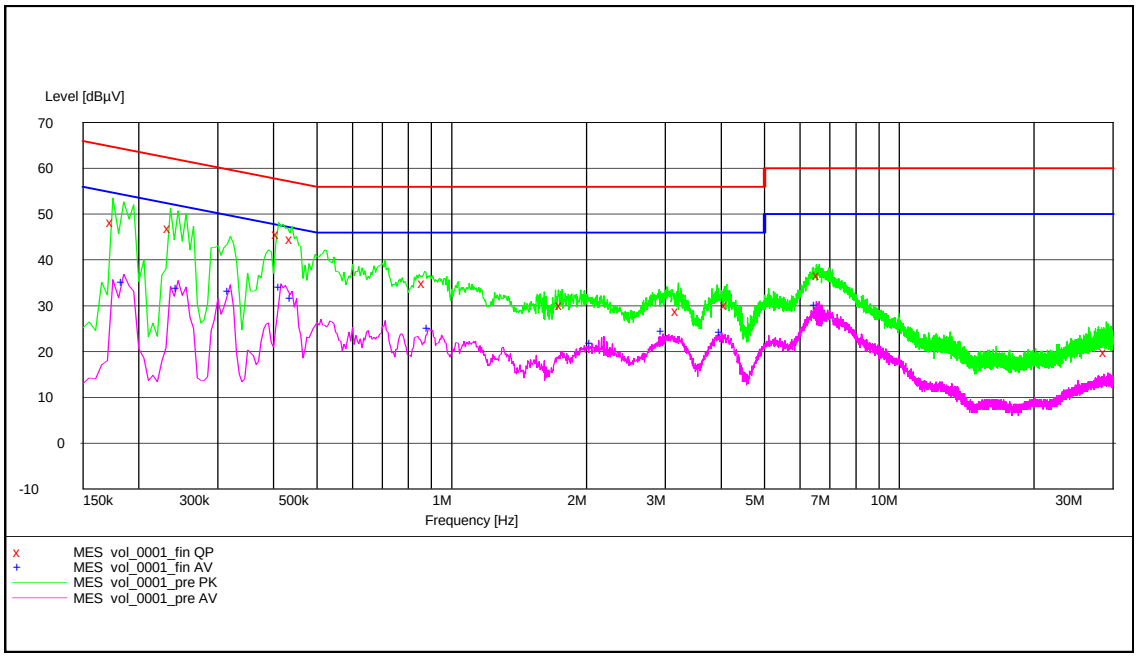
**Results of Bluetooth communication mode: PASS**
Please refer to the following diagram for individual results.



**Results of Bluetooth communication mode: PASS**

| Conductor | Frequency | Quasi-peak | | Average | |
|---|---|---|---|---|---|
| | | Level | Limit | Level | Limit |
| Live or Neutral | MHz | dBµV | dBµV | dBµV | dBµV |
| Live | 0.180 | -*- | -*- | 37.2 | 55.0 |
| Live | 0.235 | 46.4 | 62.0 | -*- | -*- |
| Live | 0.305 | -*- | -*- | 31.3 | 50.0 |
| Live | 0.430 | 43.1 | 57.0 | -*- | -*- |
| Live | 0.470 | 44.3 | 57.0 | -*- | -*- |
| Live | 0.480 | -*- | -*- | 31.4 | 46.0 |
| Live | 2.935 | 27.5 | 56.0 | -*- | -*- |
| Live | 3.810 | -*- | -*- | 21.8 | 46.0 |
| Live | 6.640 | -*- | -*- | 28.8 | 50.0 |
| Neutral | 0.180 | 52.4 | 65.0 | -*- | -*- |
| Neutral | 0.295 | 44.5 | 60.0 | -*- | -*- |
| Neutral | 0.430 | -*- | -*- | 28.4 | 47.0 |
| Neutral | 0.825 | 33.3 | 56.0 | 23.1 | 46.0 |
| Neutral | 1.730 | 28.0 | 56.0 | -*- | -*- |
| Neutral | 1.930 | -*- | -*- | 19.6 | 46.0 |
| Neutral | 2.725 | -*- | -*- | 21.3 | 46.0 |
| Neutral | 3.700 | 28.0 | 56.0 | -*- | -*- |
| Neutral | 6.640 | 33.6 | 60.0 | -*- | -*- |
| Neutral | 29.920 | -*- | -*- | 12.4 | 50.0 |

**Results of Aux-in mode (Connected to iPod with charging function): PASS**
Please refer to the following diagram for individual results.



**Results of Aux-in mode (Connected to iPod with charging function): PASS**

| Conductor | Frequency | Quasi-peak | | Average | |
|---|---|---|---|---|---|
| | | Level | Limit | Level | Limit |
| Live or Neutral | MHz | dBµV | dBµV | dBµV | dBµV |
| Live | 0.235 | 46.9 | 62.0 | -*- | -*- |
| Live | 0.320 | -*- | -*- | 33.2 | 50.0 |
| Live | 0.410 | 45.7 | 58.0 | -*- | -*- |
| Live | 0.415 | -*- | -*- | 34.2 | 48.0 |
| Live | 0.440 | 44.6 | 57.0 | 31.7 | 47.0 |
| Live | 0.890 | -*- | -*- | 25.1 | 46.0 |
| Live | 4.005 | -*- | -*- | 24.3 | 46.0 |
| Live | 4.110 | 30.1 | 56.0 | -*- | -*- |
| Live | 6.530 | -*- | -*- | 30.1 | 50.0 |
| Live | 6.620 | 36.7 | 60.0 | -*- | -*- |
| Neutral | 0.175 | 48.3 | 65.0 | -*- | -*- |
| Neutral | 0.185 | -*- | -*- | 35.2 | 54.0 |
| Neutral | 0.245 | -*- | -*- | 33.9 | 52.0 |
| Neutral | 0.870 | 34.9 | 56.0 | -*- | -*- |
| Neutral | 1.765 | 30.1 | 56.0 | -*- | -*- |
| Neutral | 2.060 | -*- | -*- | 22.0 | 46.0 |
| Neutral | 2.965 | -*- | -*- | 24.4 | 46.0 |
| Neutral | 3.205 | 28.9 | 56.0 | -*- | -*- |
| Neutral | 28.945 | 19.9 | 60.0 | -*- | -*- |

Remarks:
Calculated measurement uncertainty (0.15MHz – 30MHz): 3.2dB
-*- Emission(s) that is far below the corresponding limit line.

### 3.1.4 20dB Bandwidth Measurement

| | |
|---|---|
| Test Requirement: | FCC 47CFR 15.247(a)(1) |
| Test Method: | ANSI C63.4:2009 |
| Test Date: | 2013-06-18 |
| Mode of Operation: | Communication mode |

**Remark:**
The result has been done on all the possible configurations for searching the worst cases.

**Test Method:**

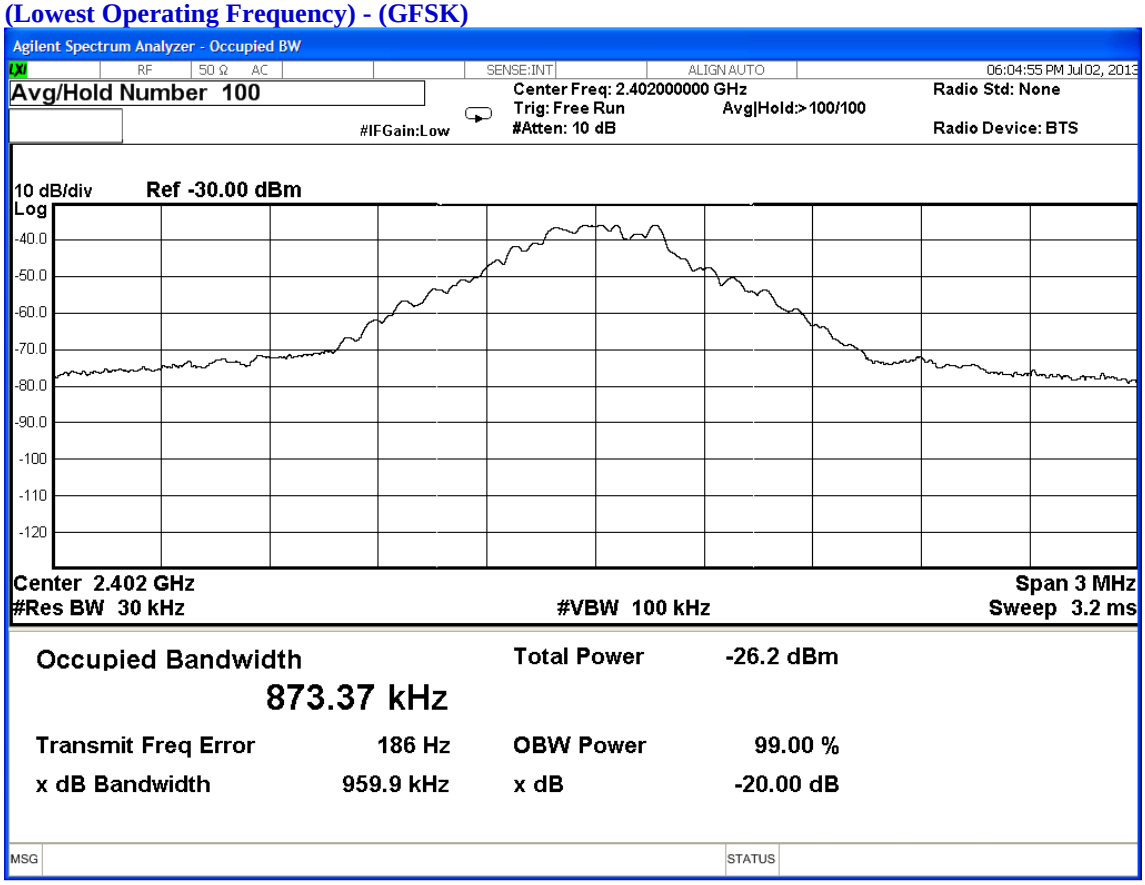
The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

**Test Setup:**

As Test Setup of clause 3.1.1 in this test report.

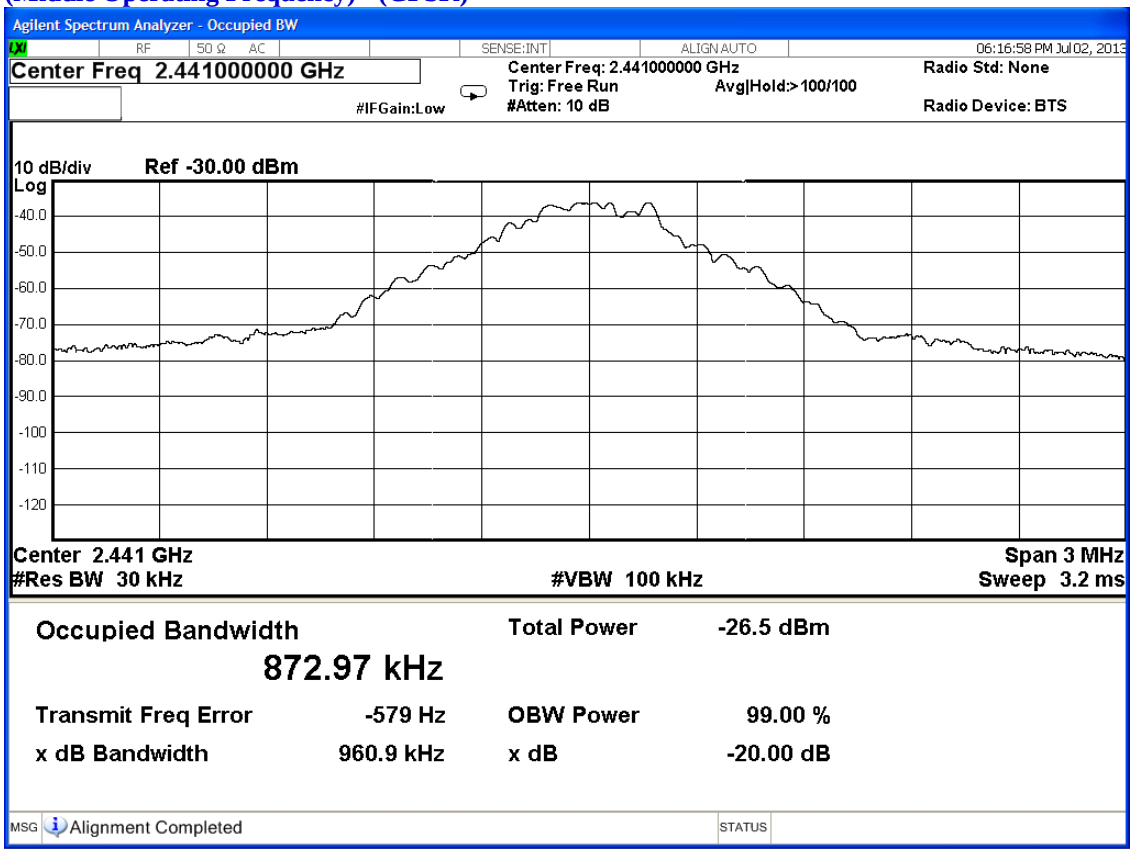
| Fundamental Frequency [MHz] | 20dB Bandwidth [kHz] | FCC Limits [MHz] |
|---|---|---|
| 2402 | 959.9 | Within 2400-2483.5 |

**(Lowest Operating Frequency) - (GFSK)**



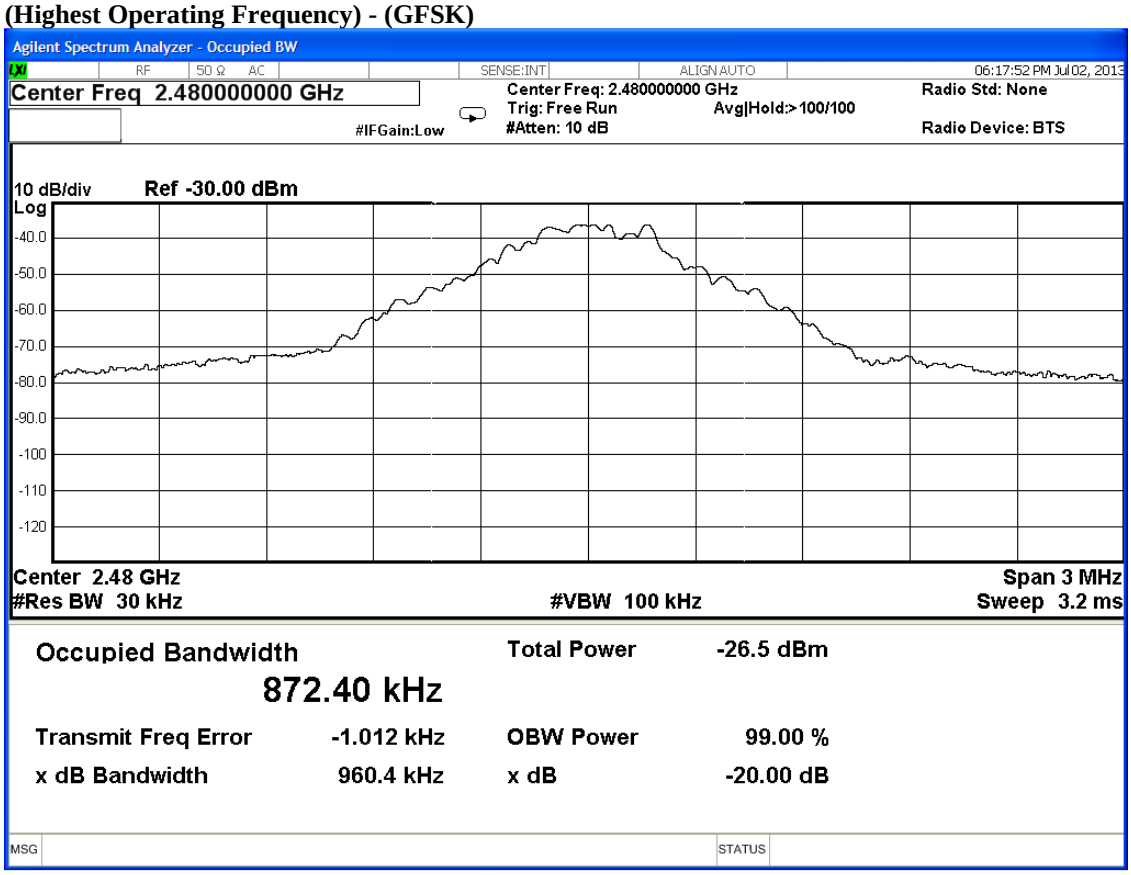
| Fundamental Frequency [MHz] | 20dB Bandwidth [kHz] | FCC Limits [MHz] |
|---|---|---|
| 2441 | 960.6 | Within 2400-2483.5 |

**(Middle Operating Frequency) - (GFSK)**



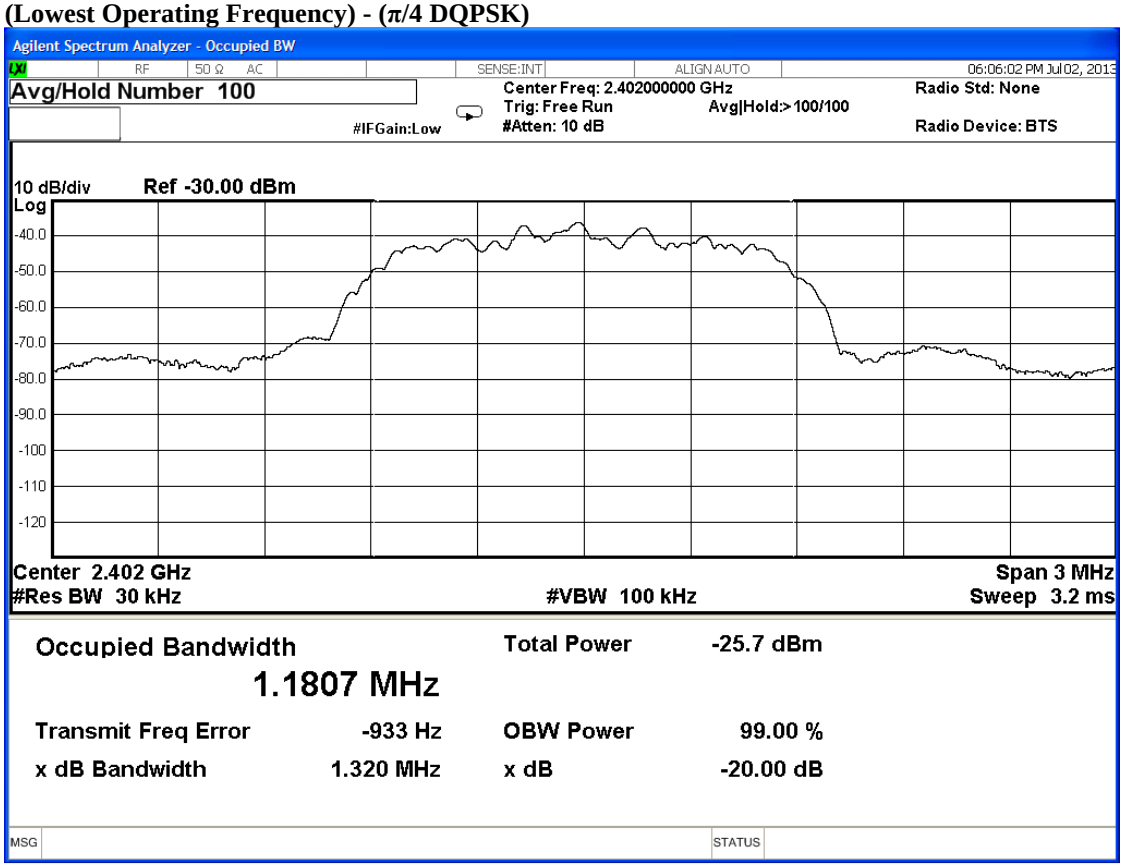
| Fundamental Frequency [MHz] | 20dB Bandwidth [kHz] | FCC Limits [MHz] |
|---|---|---|
| 2480 | 960.4 | Within 2400-2483.5 |

**(Highest Operating Frequency) - (GFSK)**



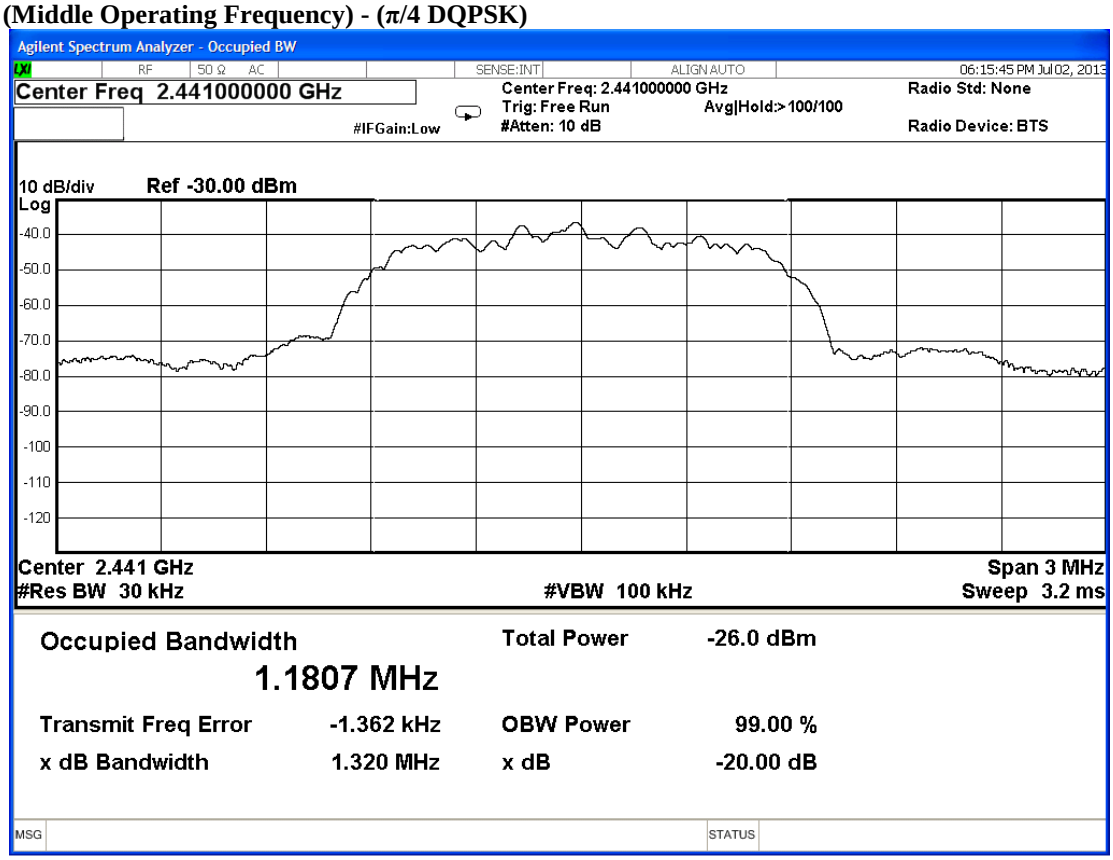
| Fundamental Frequency [MHz] | 20dB Bandwidth [MHz] | FCC Limits [MHz] |
|---|---|---|
| 2402 | 1.32 | Within 2400-2483.5 |

**(Lowest Operating Frequency) - (π/4 DQPSK)**



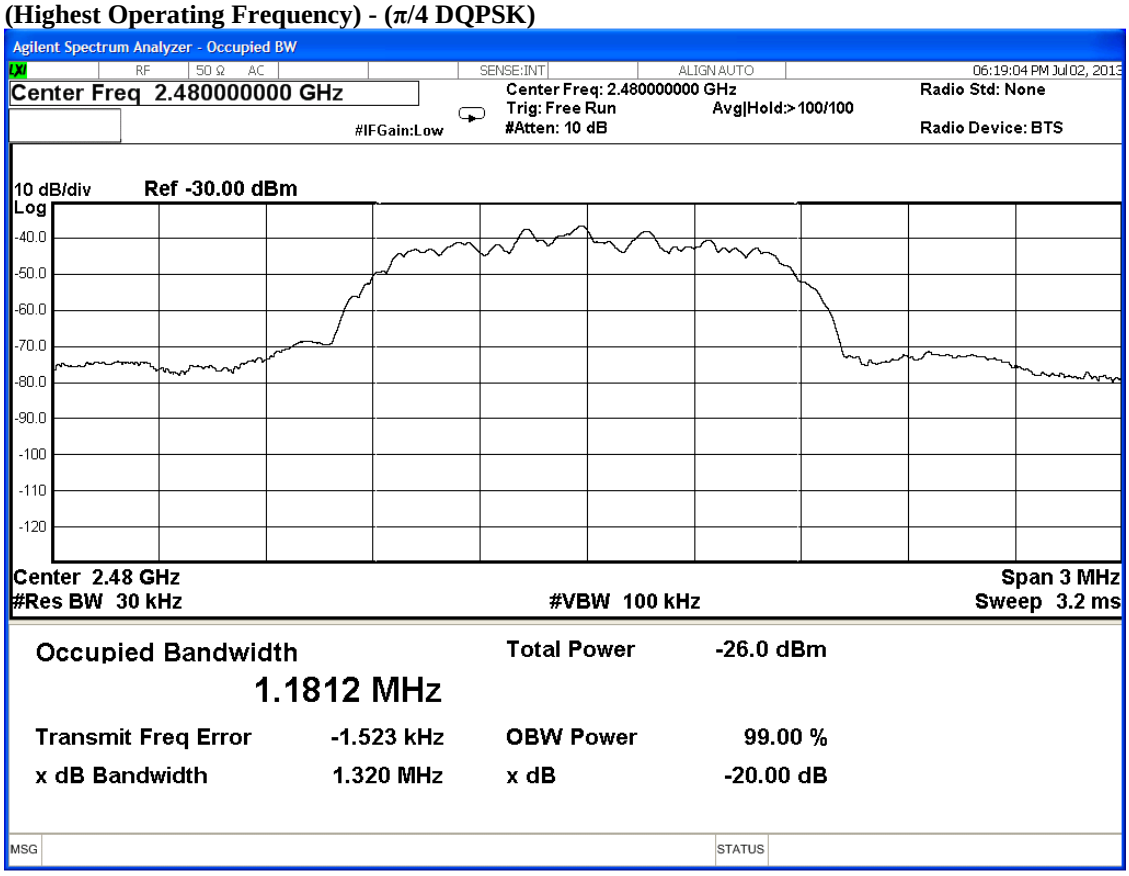
| Fundamental Frequency [MHz] | 20dB Bandwidth [MHz] | FCC Limits [MHz] |
|---|---|---|
| 2441 | 1.32 | Within 2400-2483.5 |

**(Middle Operating Frequency) - (π/4 DQPSK)**



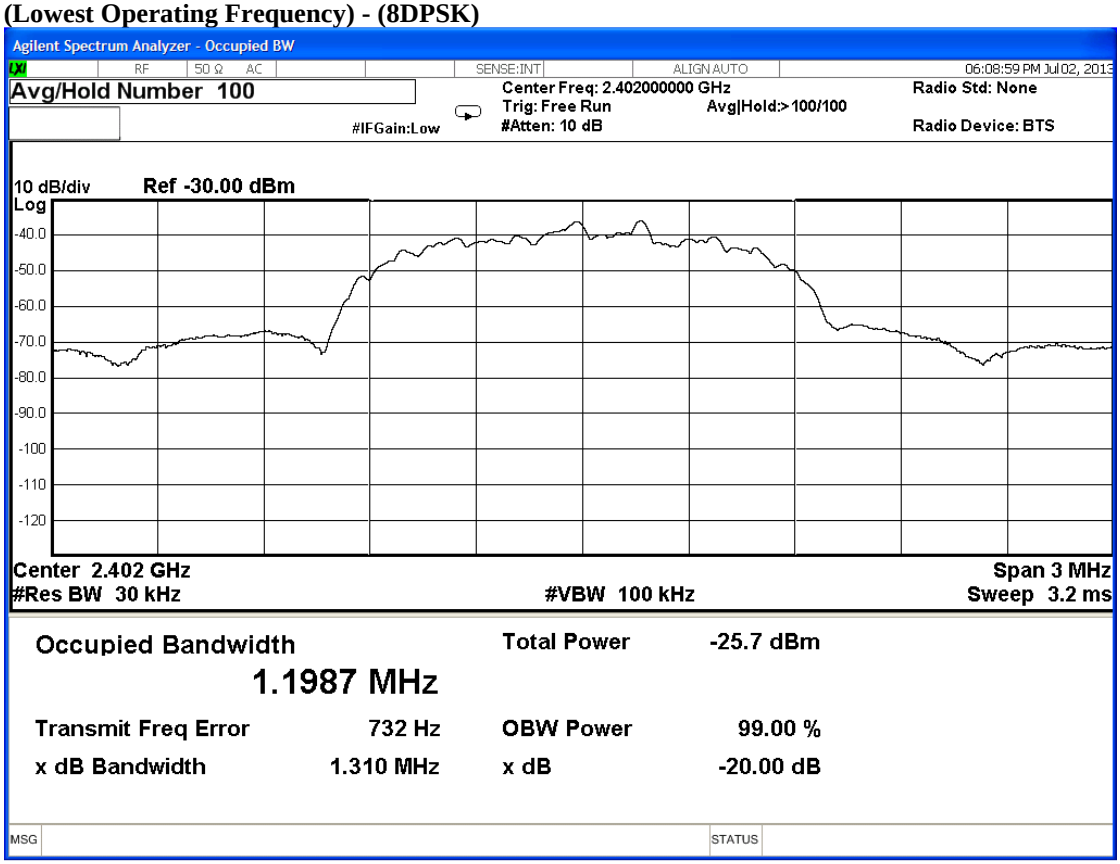
| Fundamental Frequency [MHz] | 20dB Bandwidth [MHz] | FCC Limits [MHz] |
|---|---|---|
| 2480 | 1.32 | Within 2400-2483.5 |

**(Highest Operating Frequency) - (π/4 DQPSK)**



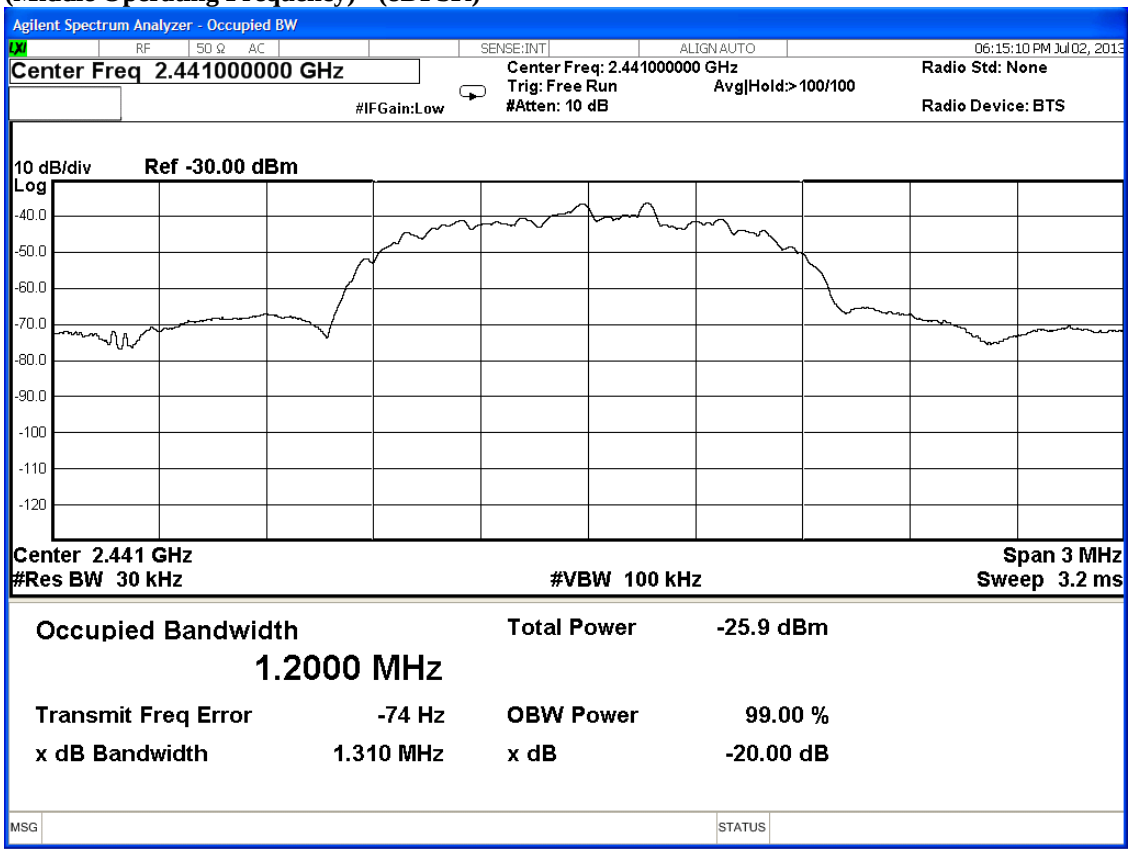
| Fundamental Frequency [MHz] | 20dB Bandwidth [MHz] | FCC Limits [MHz] |
|---|---|---|
| 2402 | 1.31 | Within 2400-2483.5 |

**(Lowest Operating Frequency) - (8DPSK)**



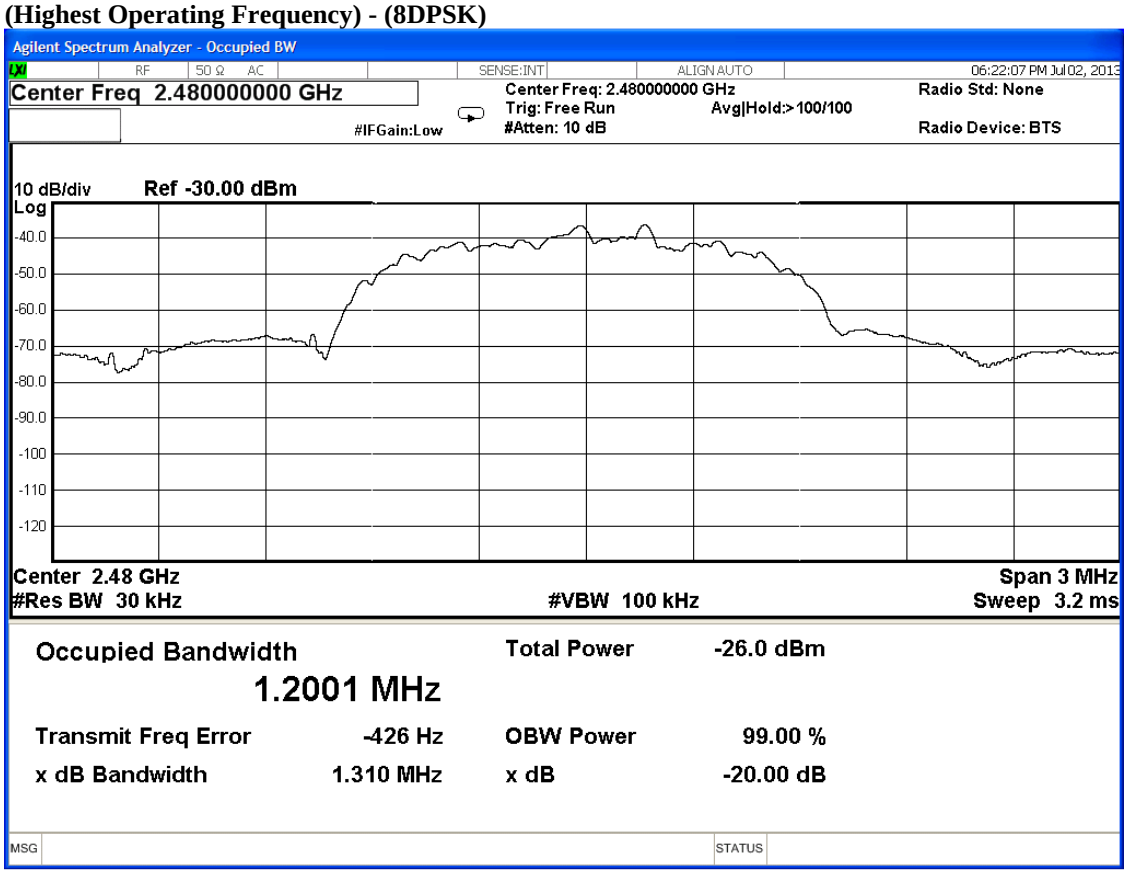
| Fundamental Frequency [MHz] | 20dB Bandwidth [MHz] | FCC Limits [MHz] |
|---|---|---|
| 2441 | 1.31 | Within 2400-2483.5 |

**(Middle Operating Frequency) - (8DPSK)**



| Fundamental Frequency [MHz] | 20dB Bandwidth [MHz] | FCC Limits [MHz] |
|---|---|---|
| 2480 | 1.31 | Within 2400-2483.5 |

**(Highest Operating Frequency) - (8DPSK)**



**Channel Centre Frequency**

**Requirements:**
Frequency hopping system in the 2400-2483.5MHz band shall use at least 79 (Channel 0 to 78) non-overlapping channels.

The EUT operates in according with the Bluetooth system specification within the 2400 - 2483.5 MHz frequency band.
RF channels for Bluetooth systems are spaced 1 MHz and are ordered in channel number k. In order to comply with out-of-band regulations, a lower frequency guard band of 2.0 MHz and a higher frequency guard band of 3.5MHz is used.

The operating frequencies of each channel are as follows:

First RF channel start from 2400MHz + 2MHz guard band = 2402MHz
Frequency of RF Channel = 2402+k MHz, k = 0,…,78 (Channel separation = 1MHz)

**Hopping Channel Separation**

**Requirements:**

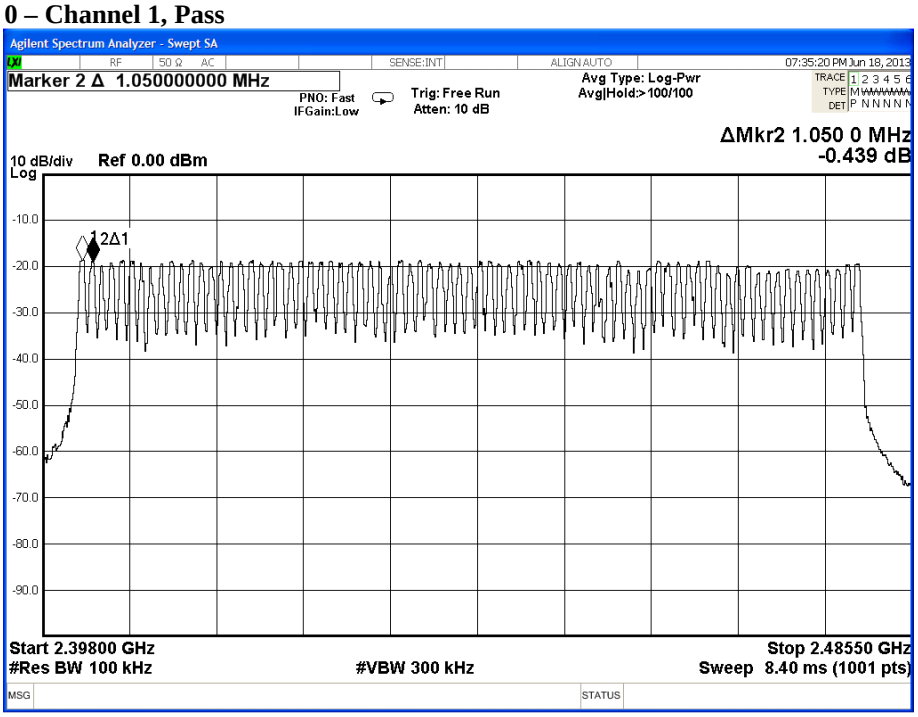
Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

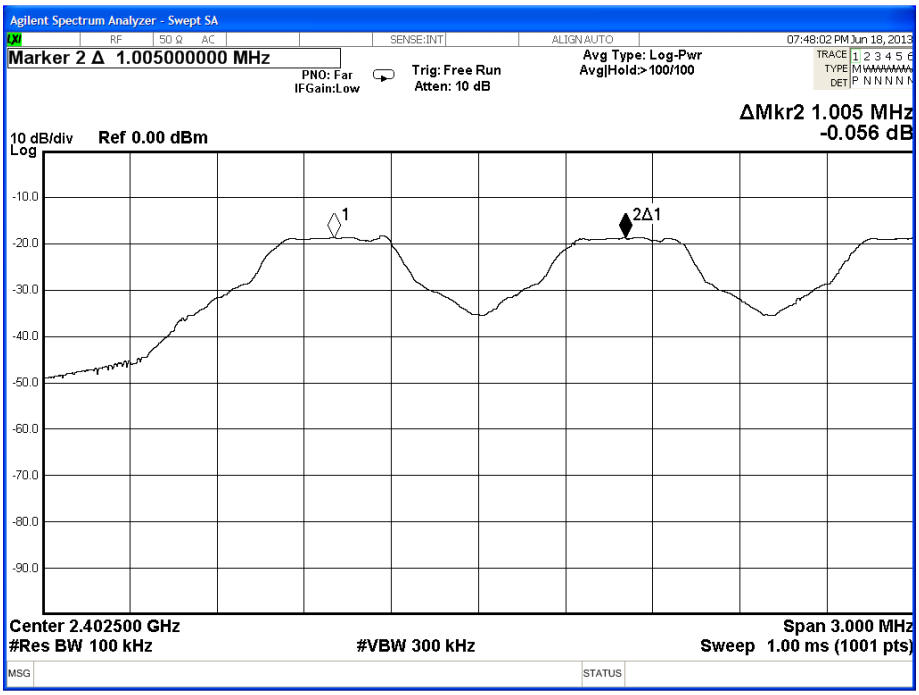
**Limit:**

The measured minimum bandwidth * 2/3 = 1.381MHz * 2/3 = 921kHz

**Channel separation = 1.01MHz (GFSK)**

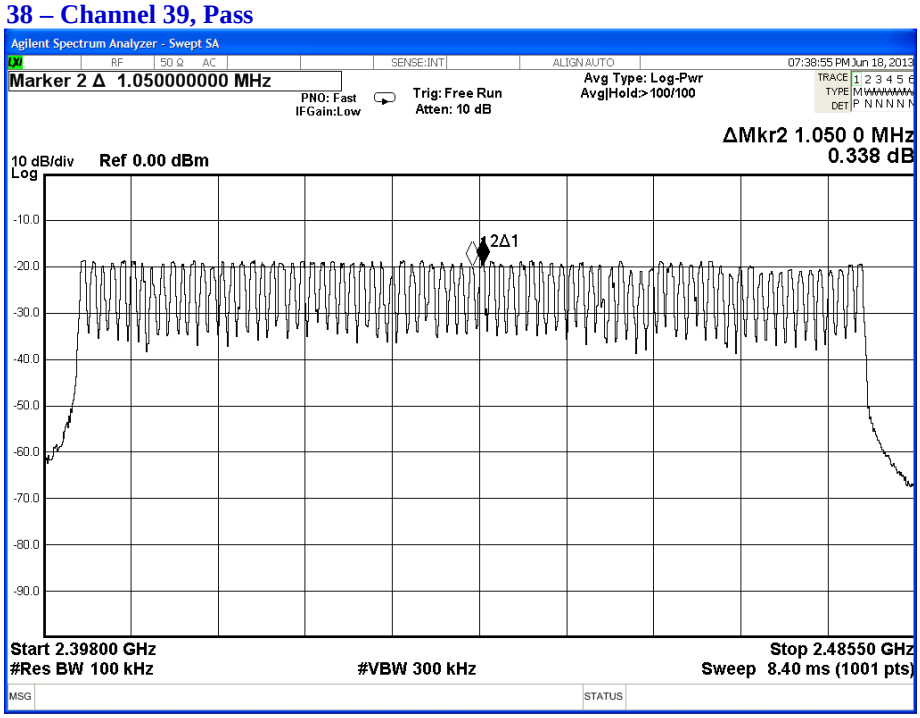
**Channel 0 – Channel 1, Pass**

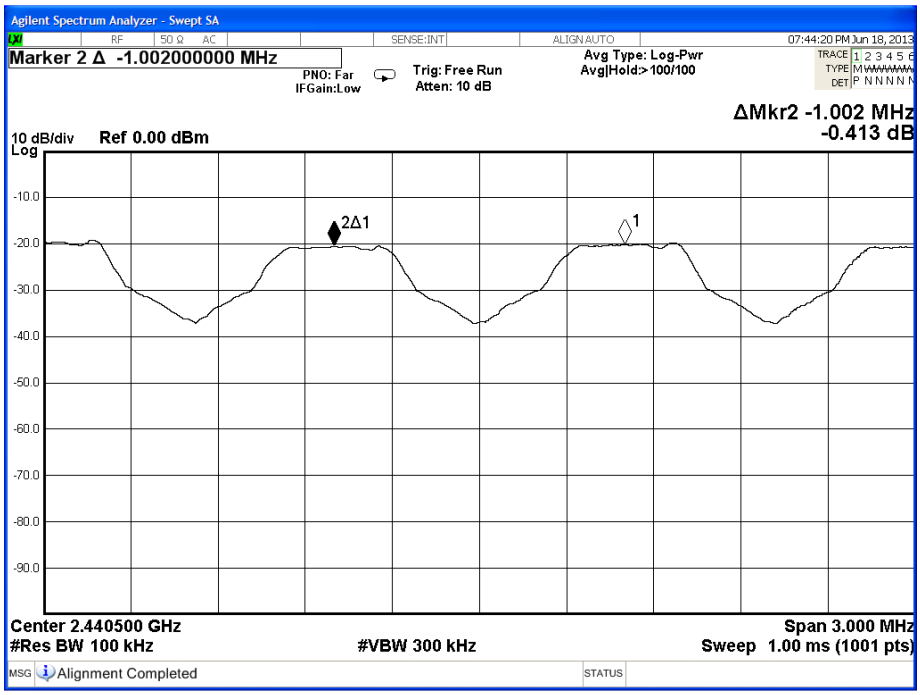


**Channel separation = 1.00MHz (GFSK)**

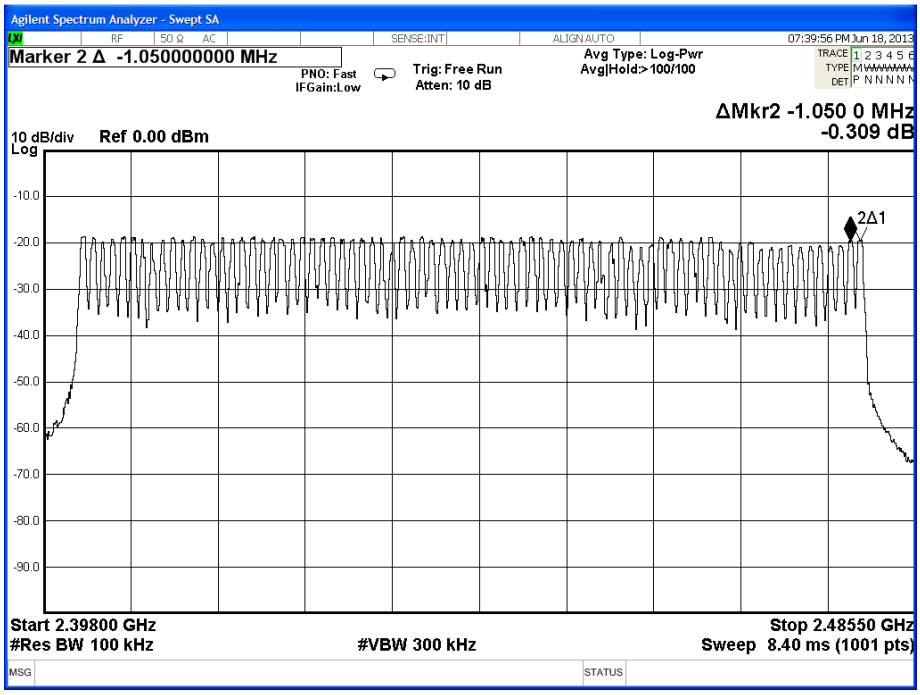
**Channel 38 – Channel 39, Pass**

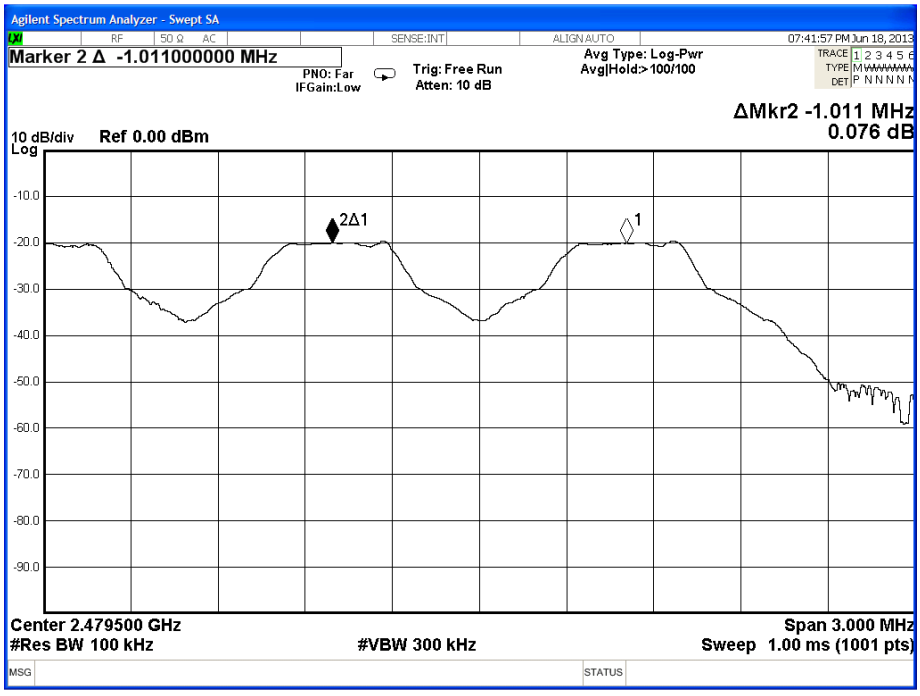


**Channel separation = 1.01MHz (GFSK)**

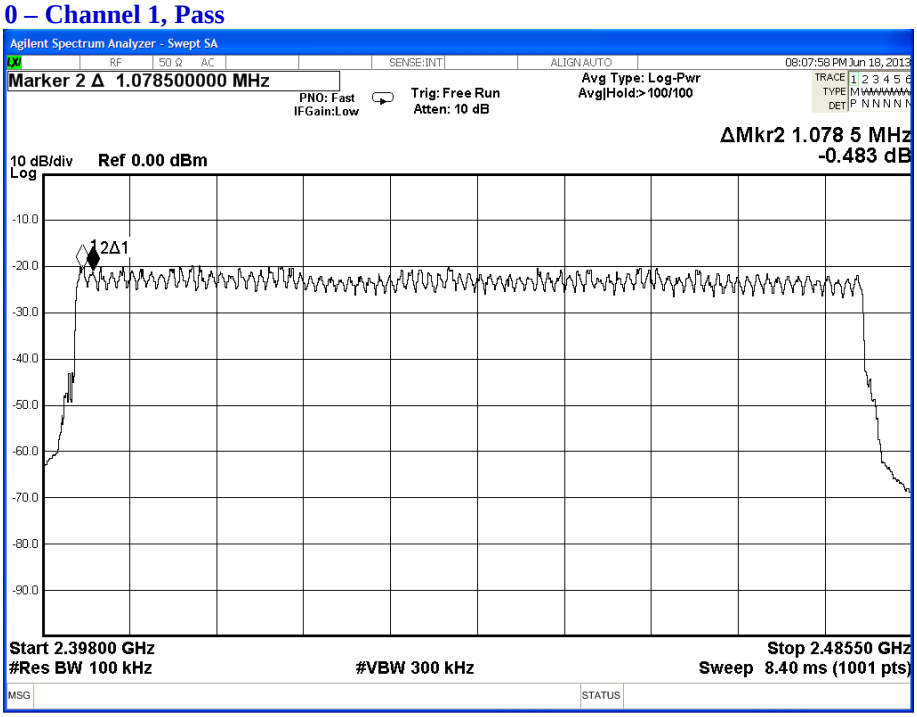
**Channel 77 – Channel 78, Pass**

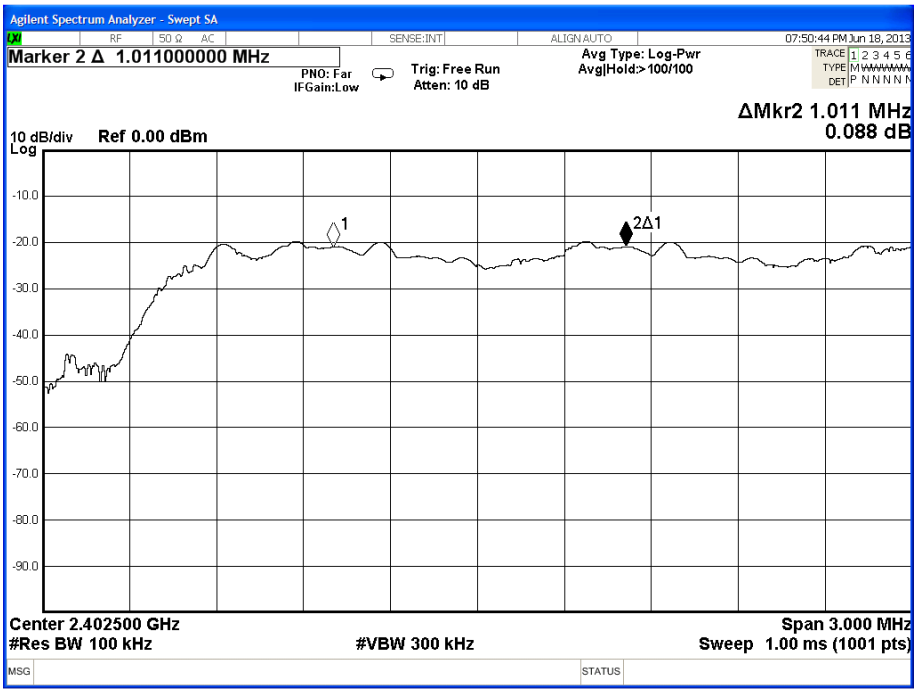


**Channel separation = 1.01MHz (π/4 DQPSK)**

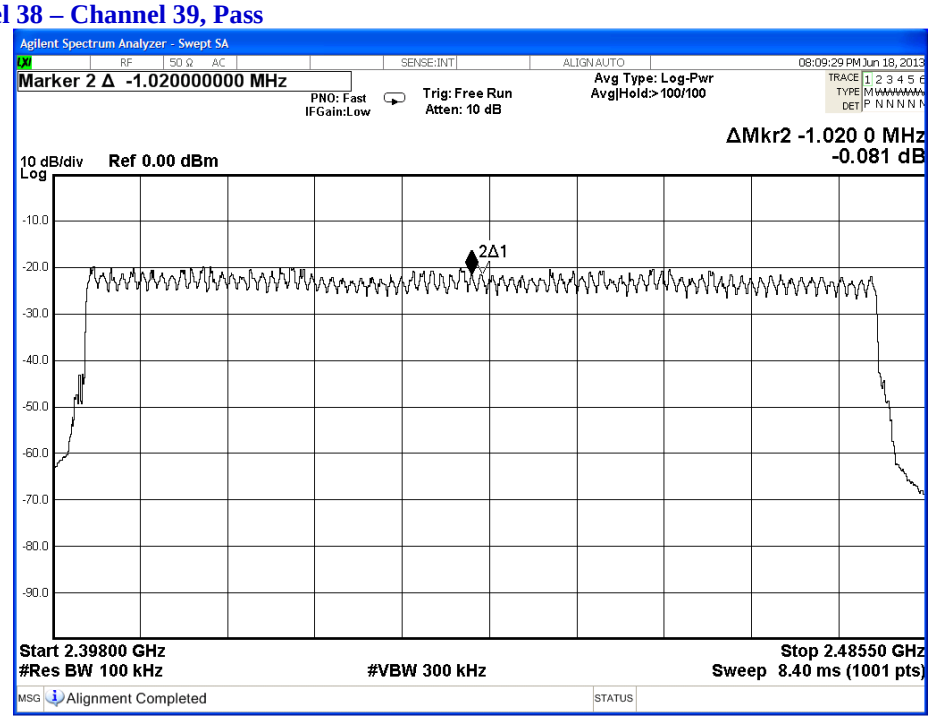
**Channel 0 – Channel 1, Pass**

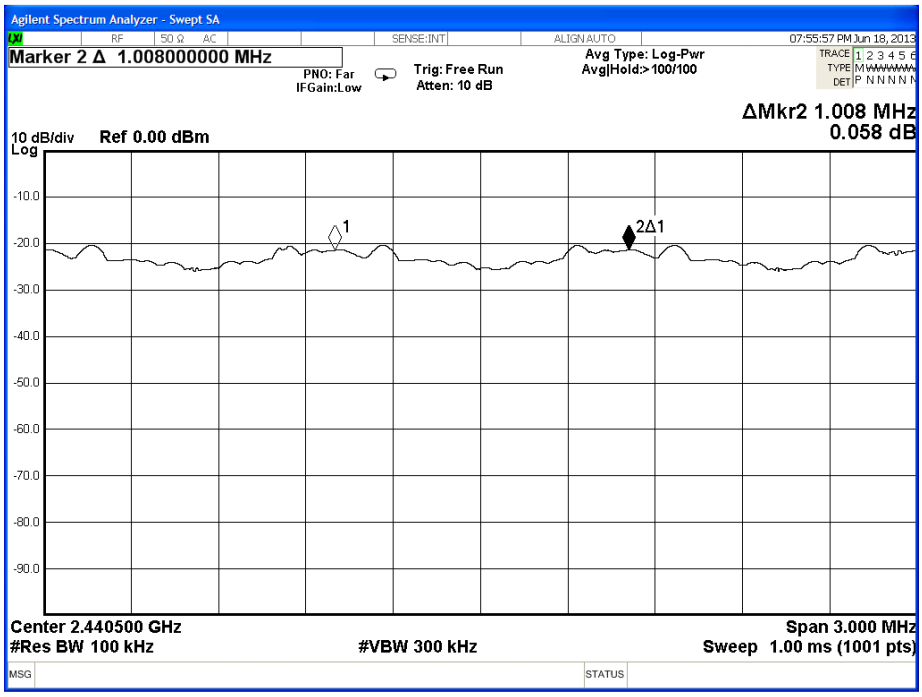


**Channel separation = 1.01MHz (π/4 DQPSK)**

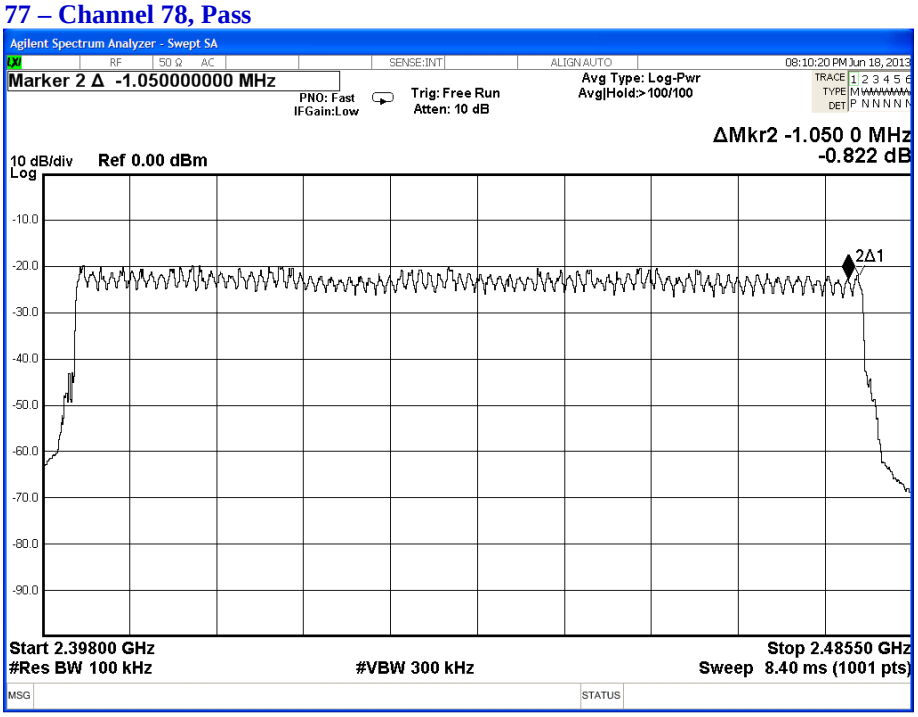
**Channel 38 – Channel 39, Pass**

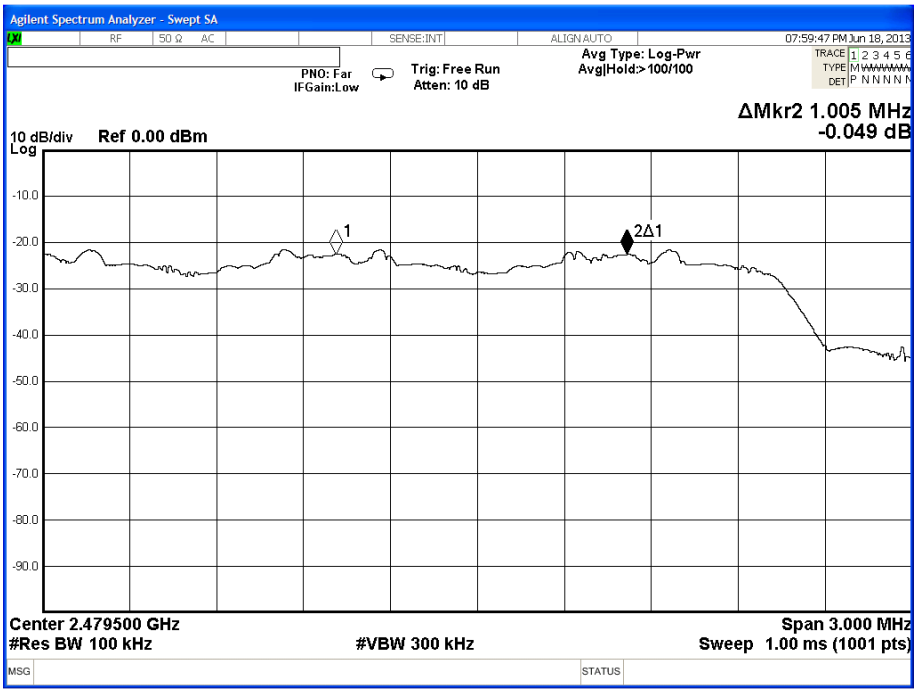


**Channel separation = 1.01MHz (π/4 DQPSK)**

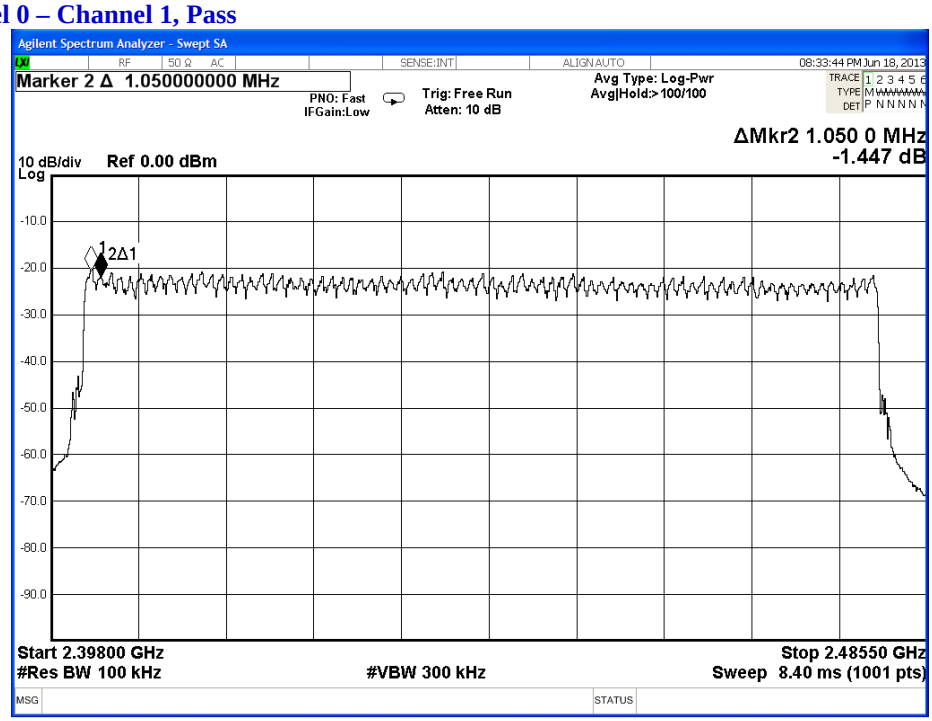
**Channel 77 – Channel 78, Pass**

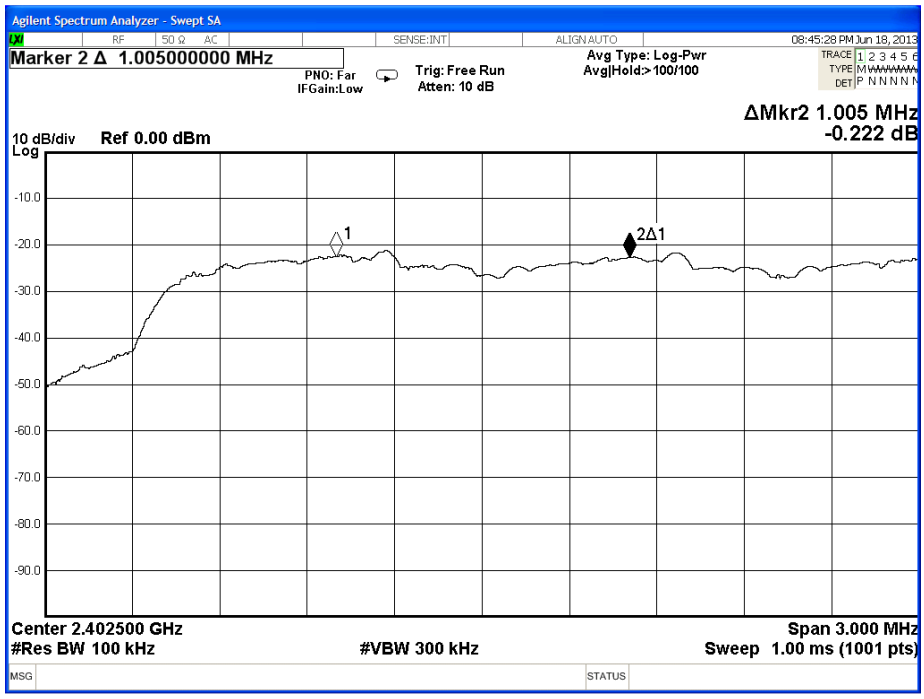


**Channel separation = 1.01MHz (8DPSK)**

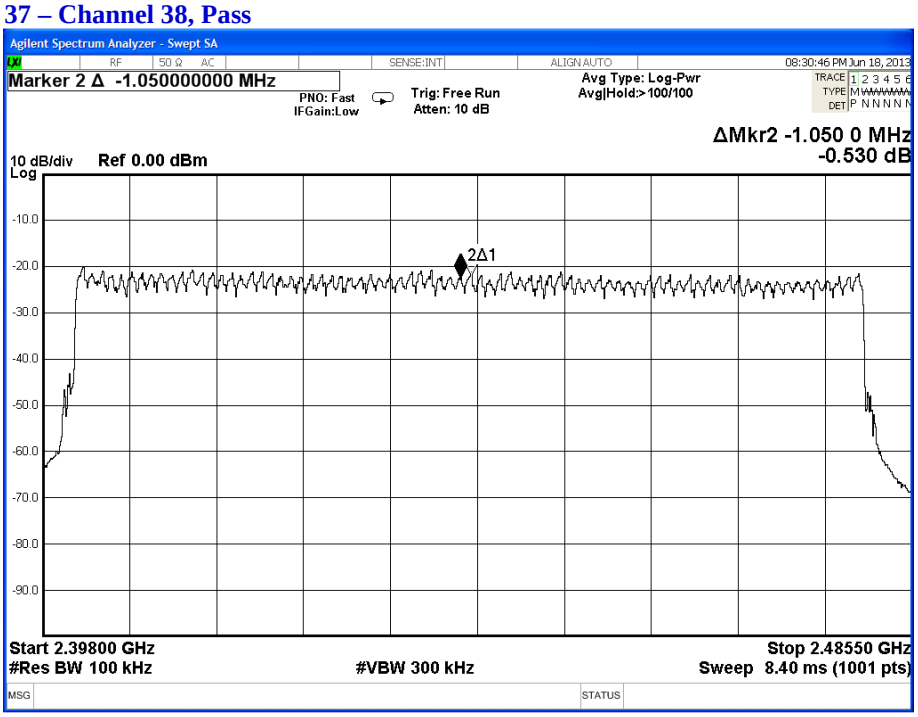
**Channel 0 – Channel 1, Pass**

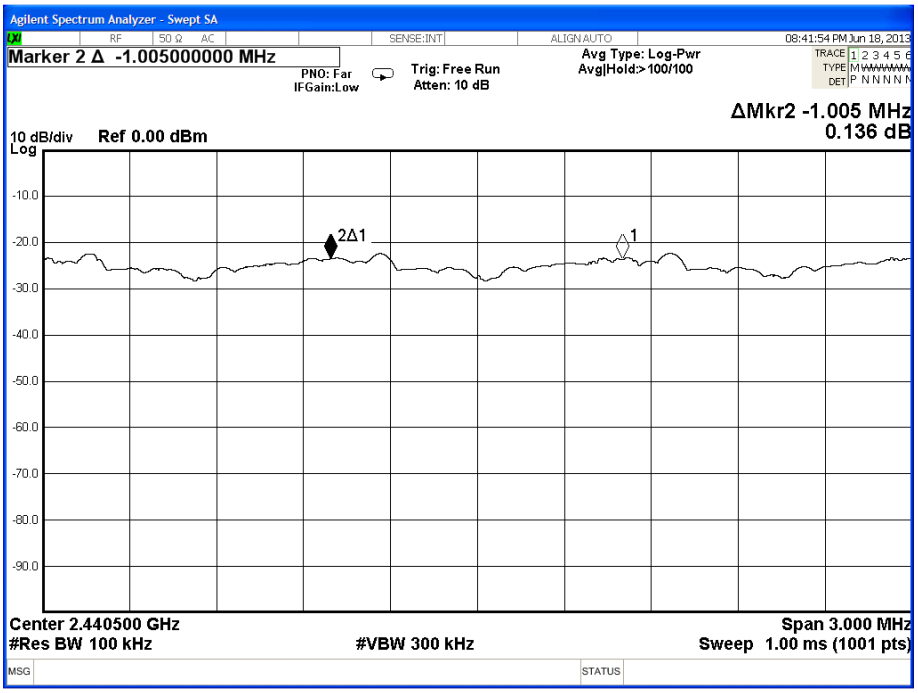


**Channel separation = 1.01MHz (8DPSK)**

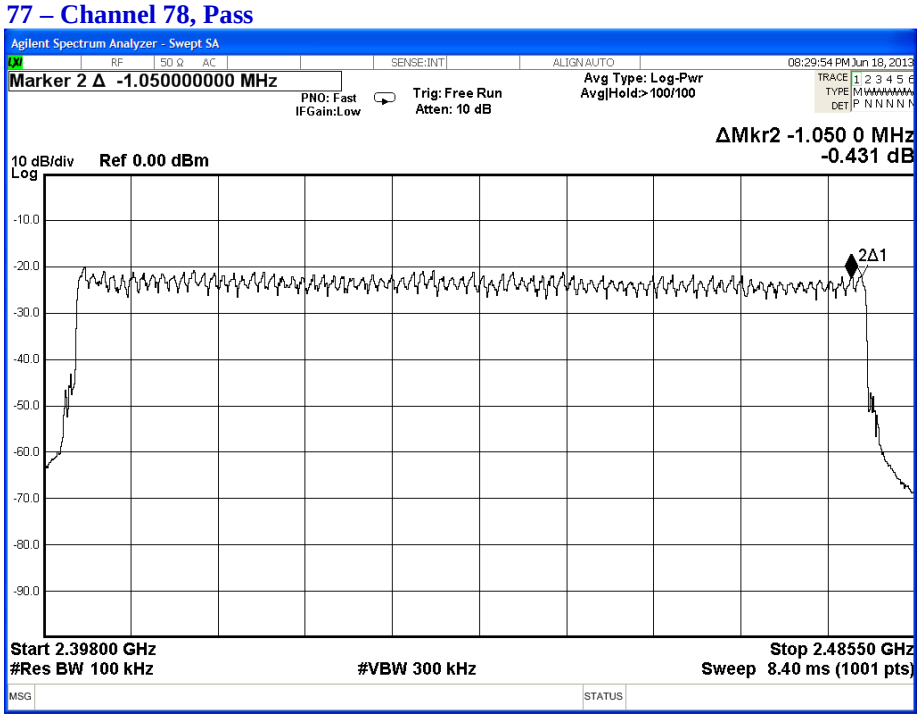
**Channel 37 – Channel 38, Pass**

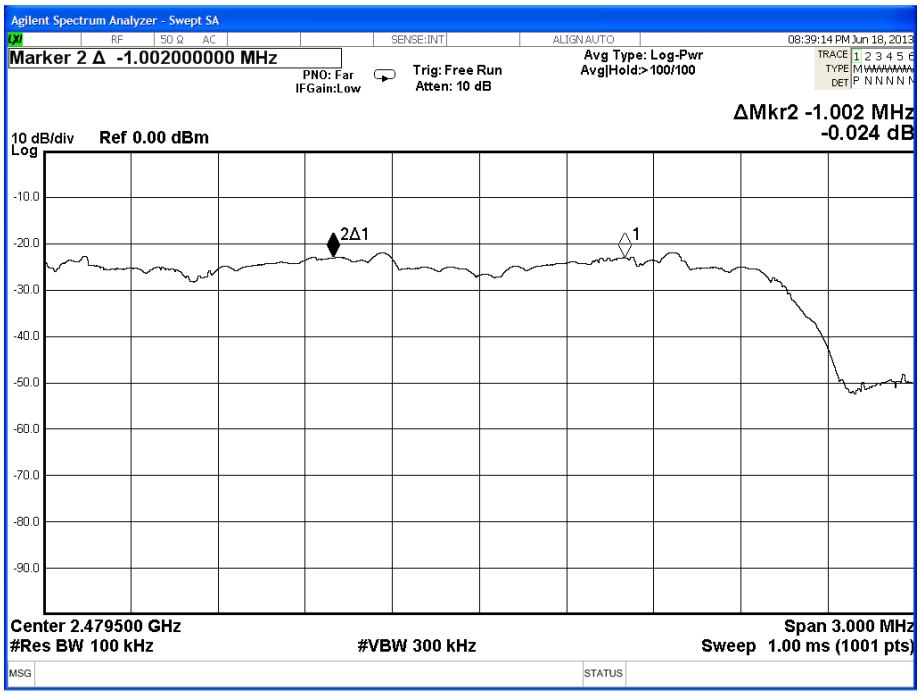


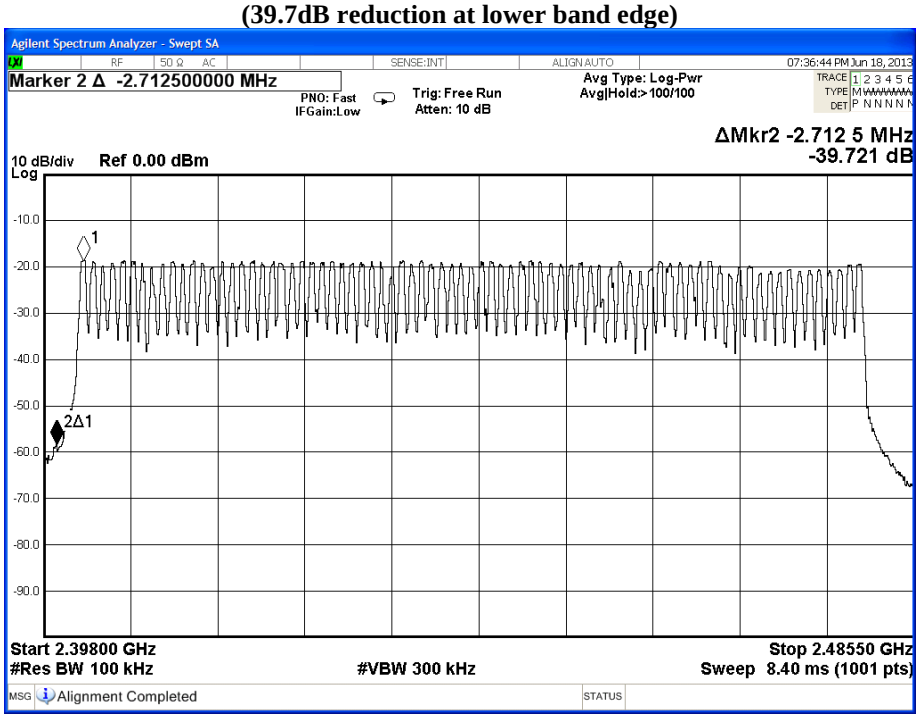
**Channel separation = 1.00MHz (8DPSK)**

**Channel 77 – Channel 78, Pass**

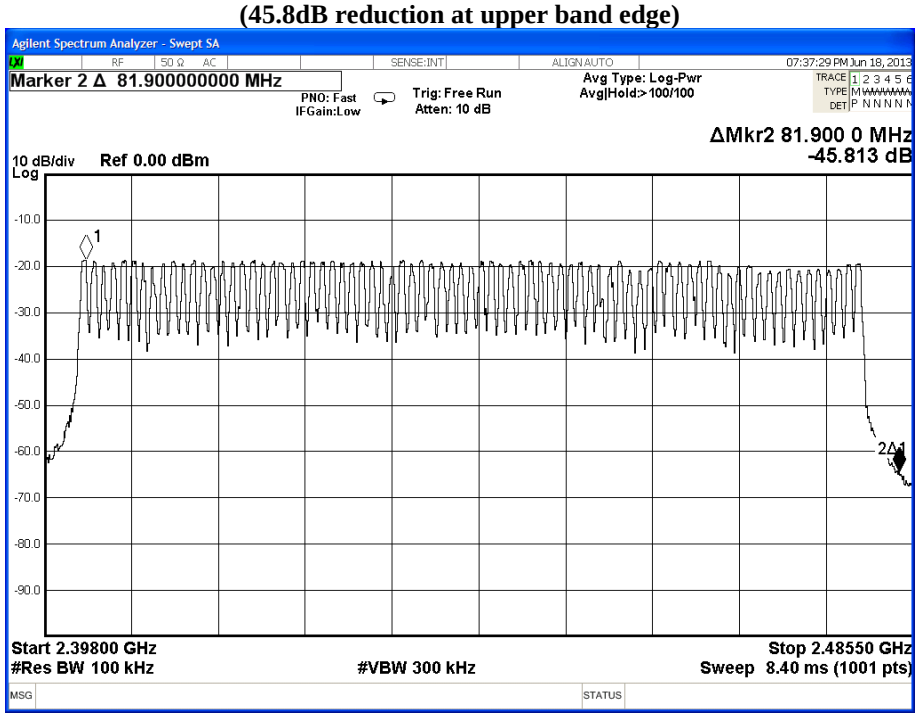


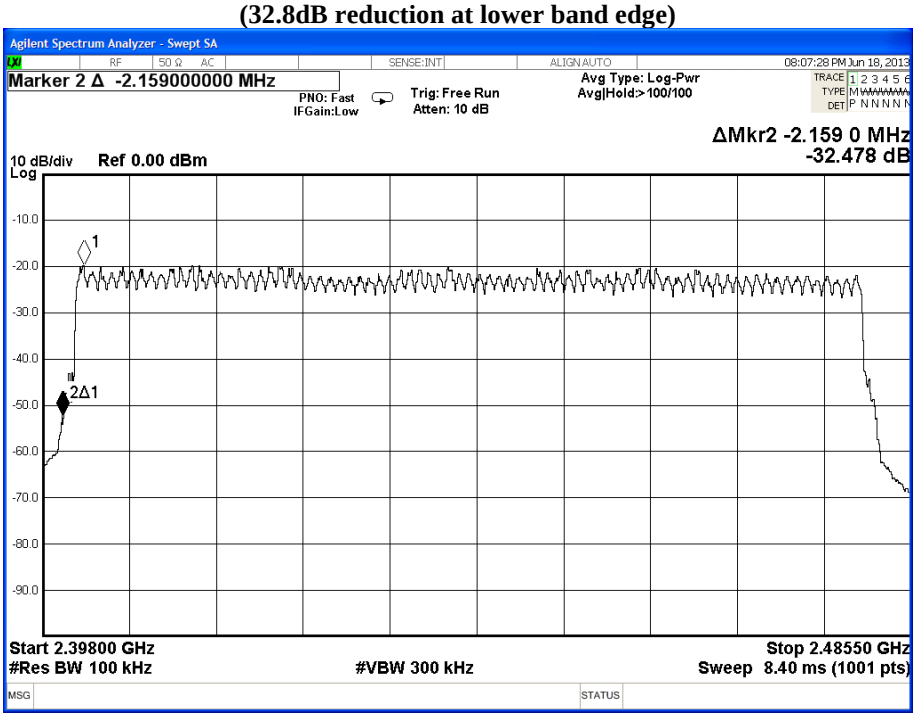
**Band-edge Compliance of RF Emissions – Lowest (GFSK)**
**(39.7dB reduction at lower band edge)**



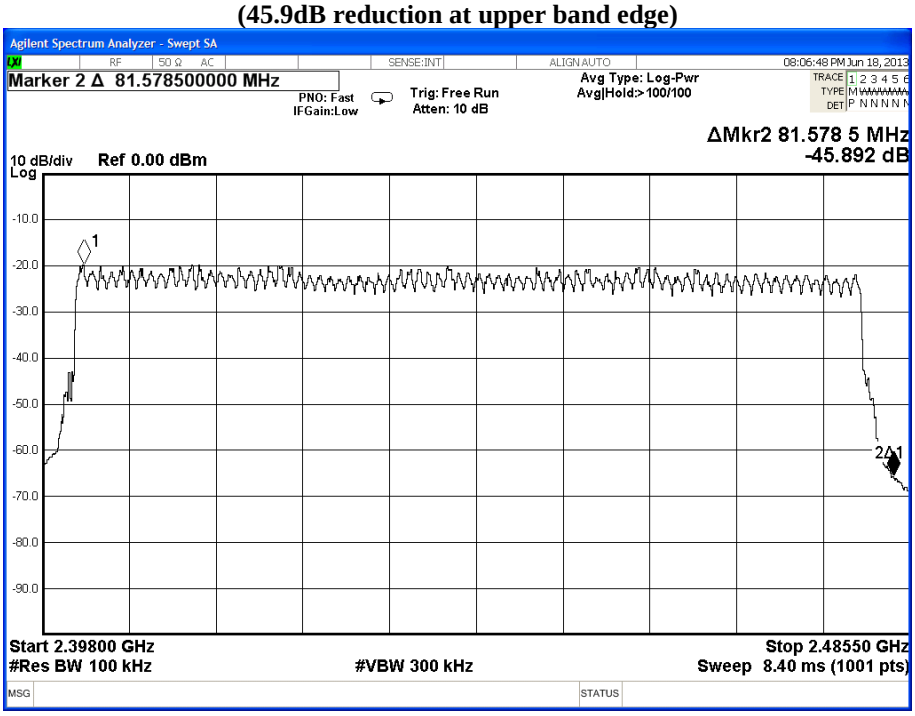
**Band-edge Compliance of RF Emissions – Highest (GFSK)**
**(45.8dB reduction at upper band edge)**



**Band-edge Compliance of RF Emissions – Lowest (π/4 DQPSK)**
**(32.8dB reduction at lower band edge)**

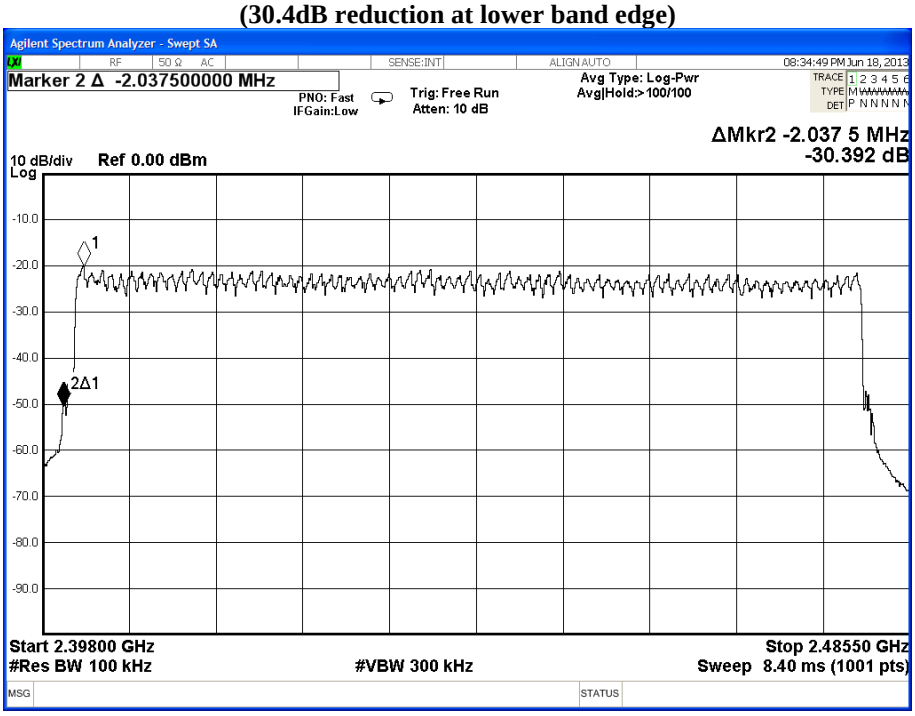


**Band-edge Compliance of RF Emissions – Highest (π/4 DQPSK)**
**(45.9dB reduction at upper band edge)**

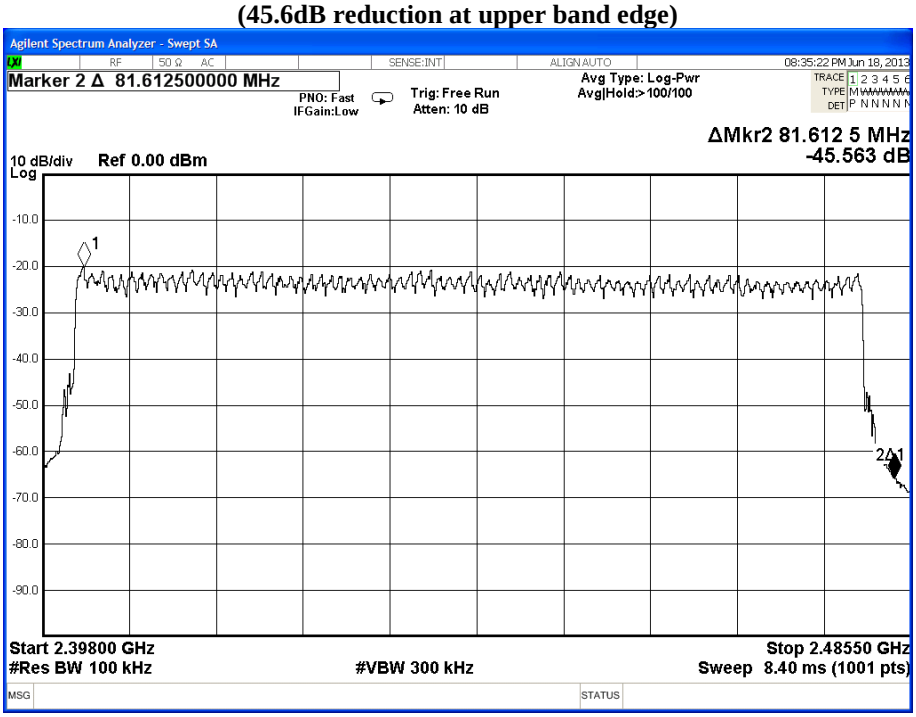


**Band-edge Compliance of RF Emissions – Lowest (8DPSK)**

**(30.4dB reduction at lower band edge)**



**Band-edge Compliance of RF Emissions – Highest (8DPSK)**
**(45.6dB reduction at upper band edge)**



**Antenna Requirement**

**Test Requirements: § 15.203**

**Test Specification:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

**Test Results:**

The EUT has 1 [Inverted-F Antenna (PCB layout)] which is permanently attached to the main unit and attached on PCB board, the antenna gain = 2.12dBi. All component install on inside of EUT. User unable to remove or changed the Antenna.

**Pseudorandom Hopping Algorithm**

**Requirements:**

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

**EUT Pseudorandom Hopping Algorithm**

The EUT is a Bluetooth device, the Pseudo-random hopping pattern; hopping characteristics and algorithm are based on the Bluetooth specification.

**Occupancy Time (Dwell time)**

**Requirements:**

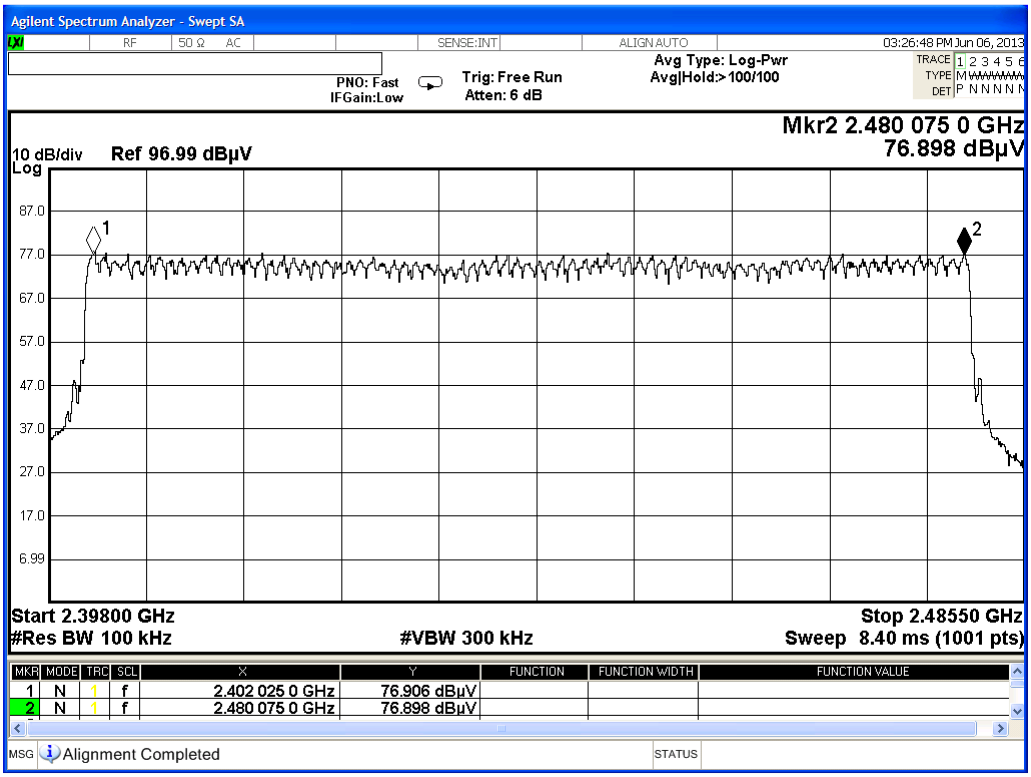
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channel employed.
No requirements for Digital Transmission System.

**Dwell Time = Pulse Duration * hop rate / number of channel * observation duration**

**Observed duration: 0.4s x79 = 31.6s**

**Measurement Data**:

**Channel Occupied in 8DPSK: 79 of 79 Channel**



**DH5 Packet:**

DH5 Packet permit maximum 1600/79/6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds

**Fig. A**
**[Pulse duration of Lowest Channel]**

**Pulse duration = 2.881ms**

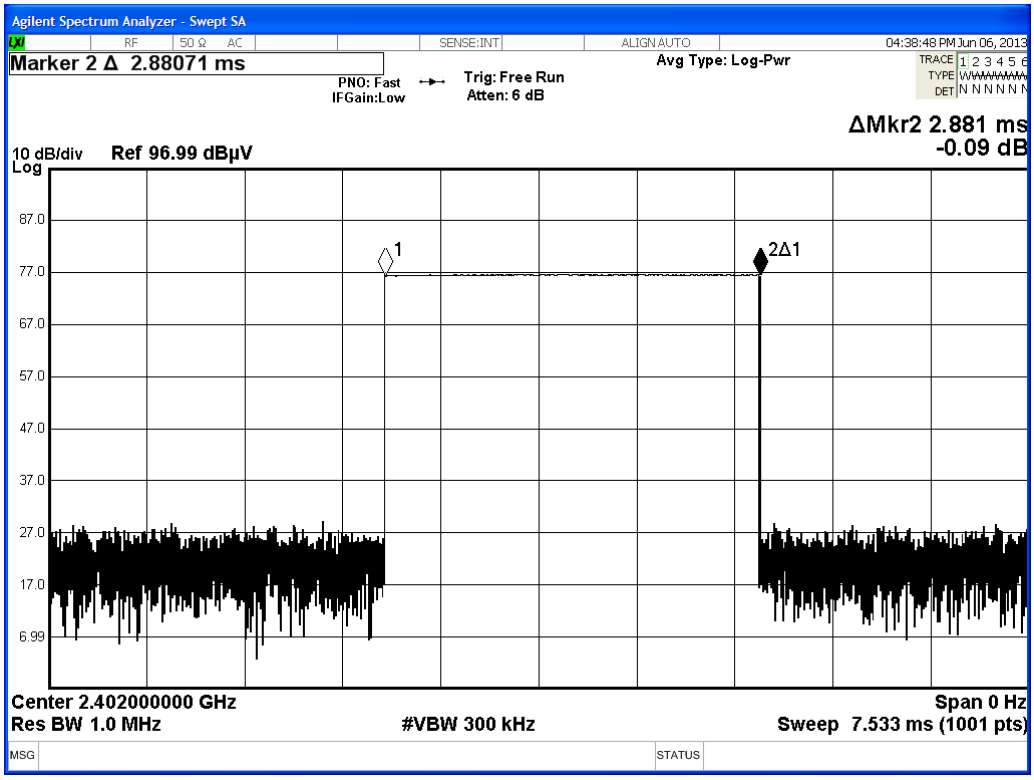


**Fig. B**
**[Pulse duration of Middle Channel]**
**Pulse duration = 2.862ms**

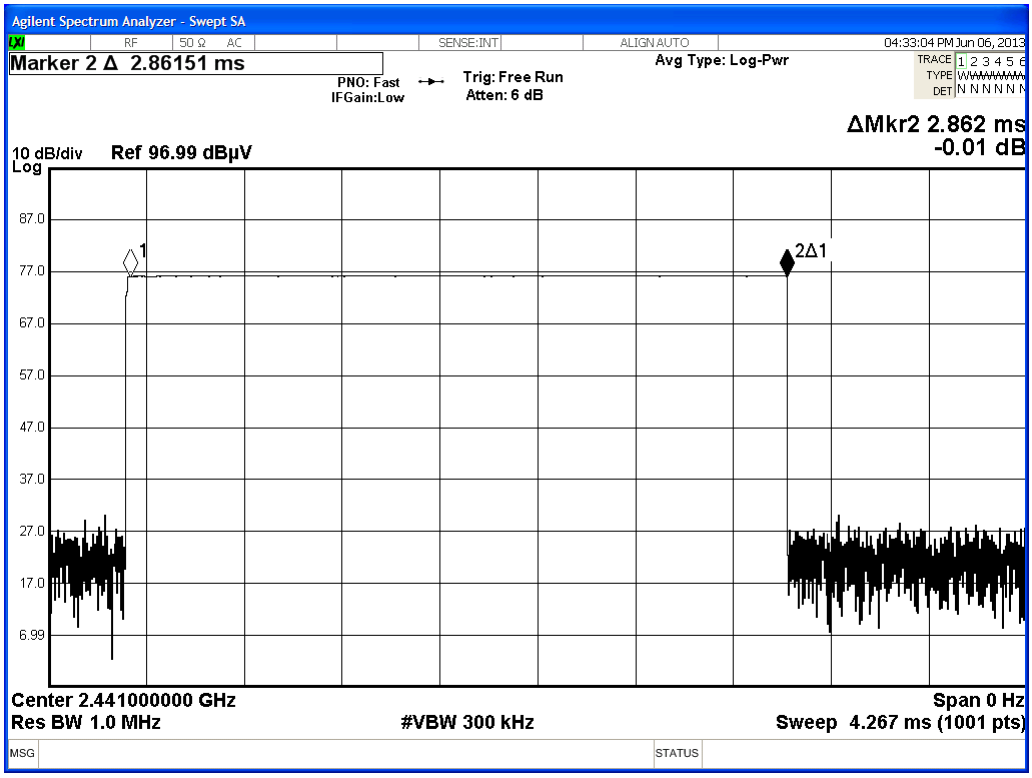
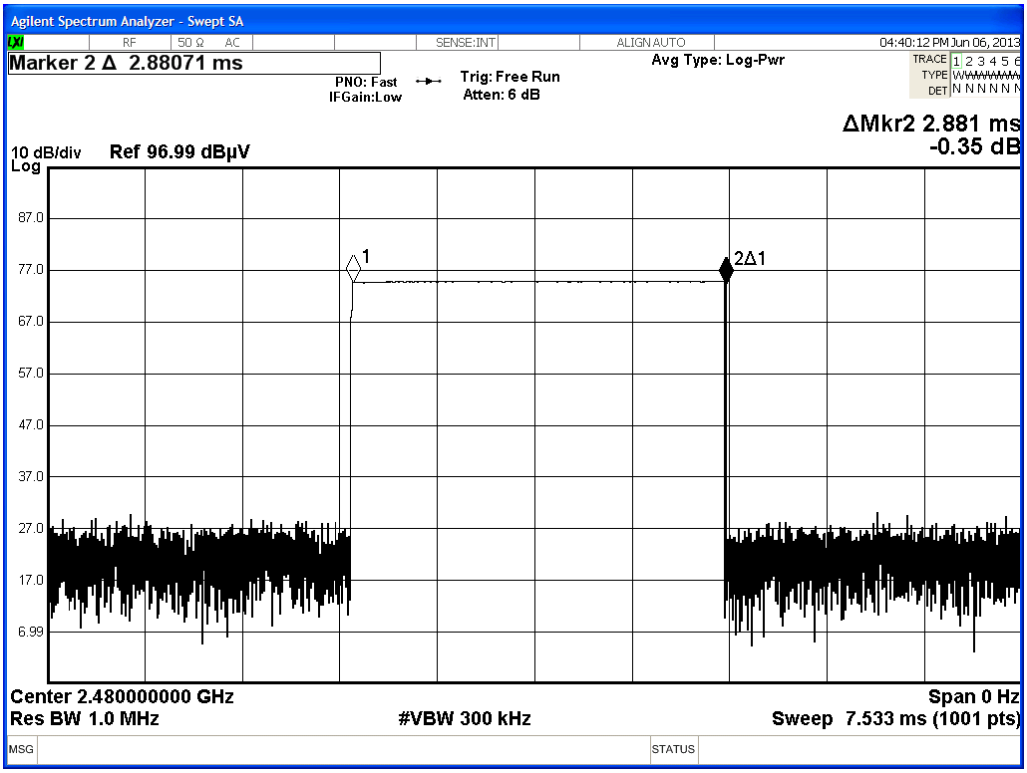


**Fig. C**
**[Pulse duration of Highest Channel]**
**Pulse duration = 2.881ms**



**DH3 Packet:**

DH3 Packet permit maximum 1600/79/4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times 5.06 x 31.6 = 160 within 31.6 seconds

**Fig. D**
**[Pulse duration of Lowest Channel]**
**Pulse duration = 1.625ms**

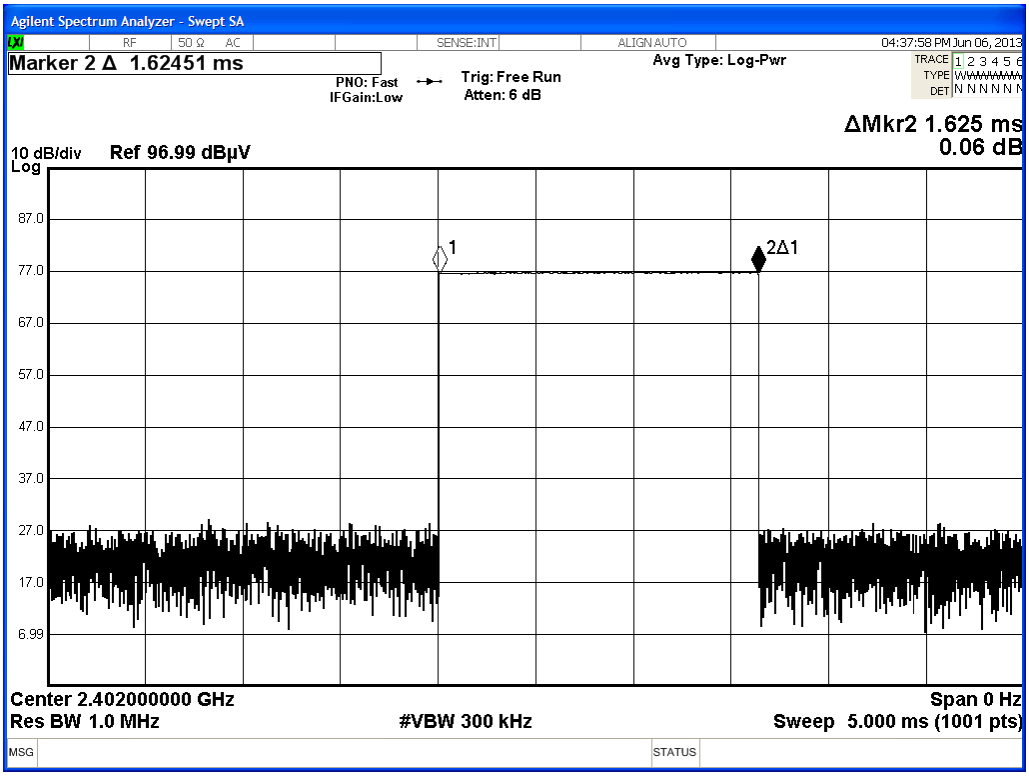


**Fig. E**
**[Pulse duration of Middle Channel]**
**Pulse duration = 1.624ms**

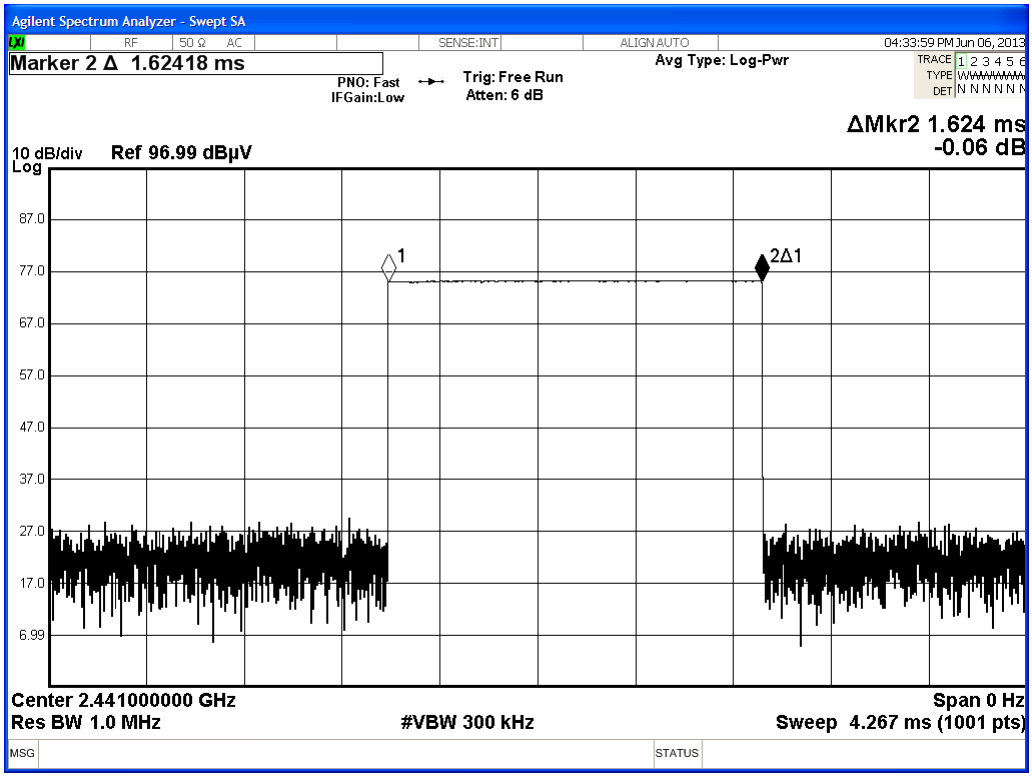
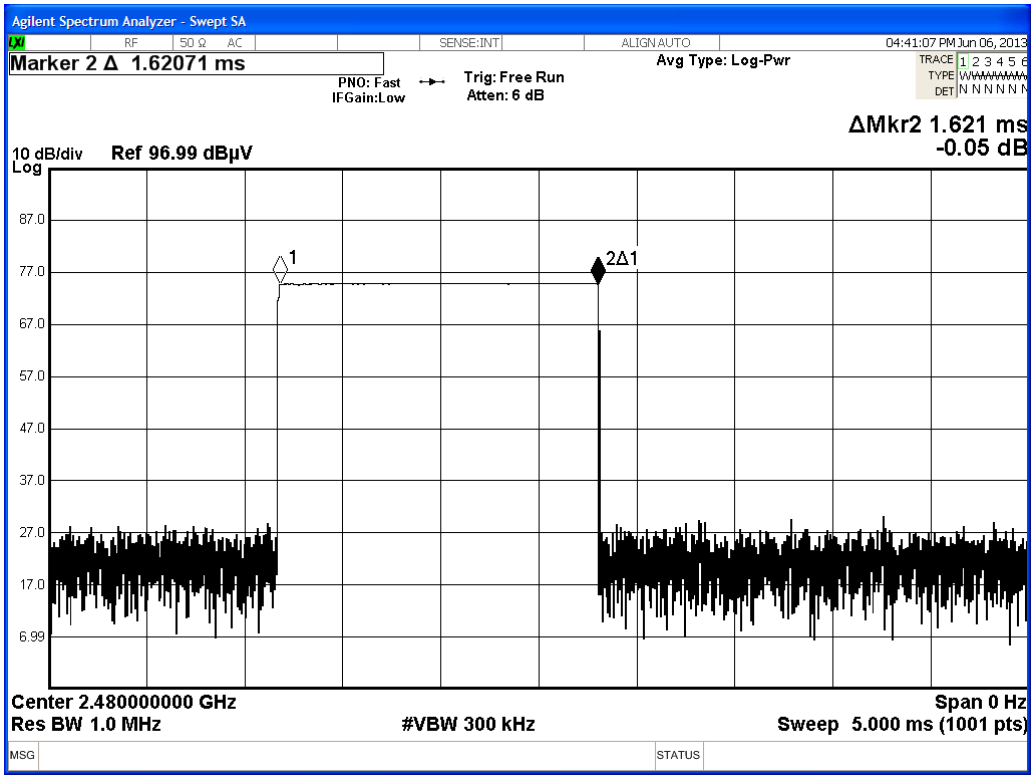


**Fig. F**
**[Pulse duration of Highest Channel]**
**Pulse duration = 1.621ms**



**DH1 Packet:**

DH1 Packet permit maximum 1600/79/2 = 10.12 hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times 10.12 x 31.6 = 320 within 31.6 seconds

**Fig. G**
**[Pulse duration of Lowest Channel]**
**Pulse duration = 0.370ms**

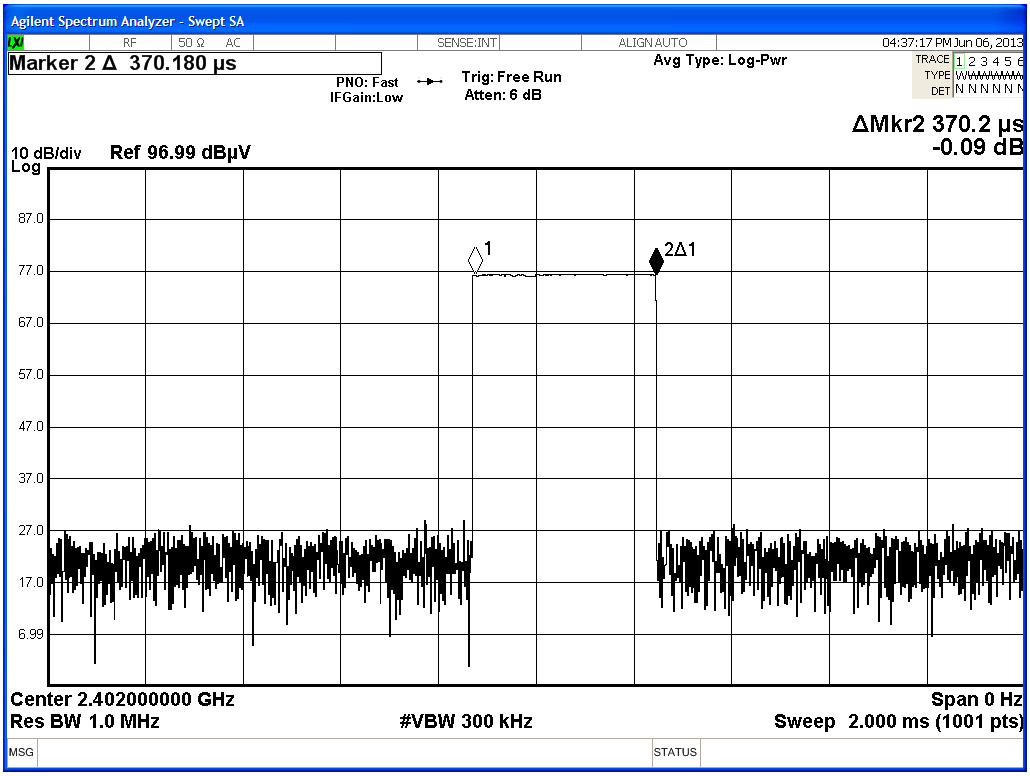


**Fig. H**
**[Pulse duration of Middle Channel]**
**Pulse duration = 0.372ms**

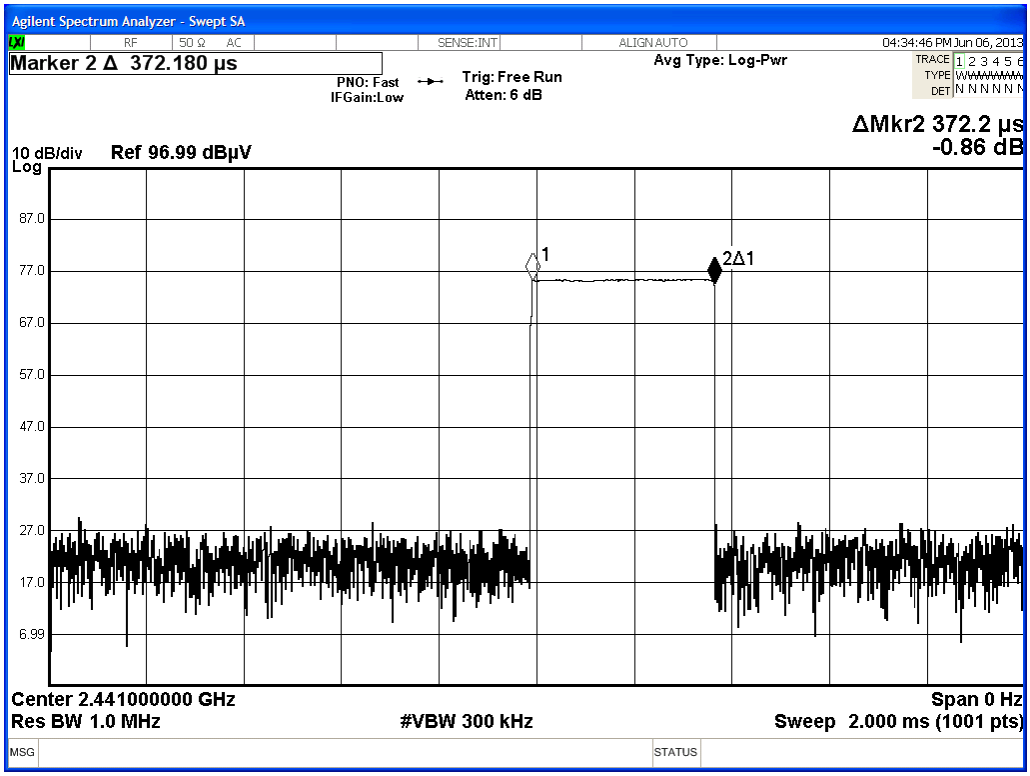
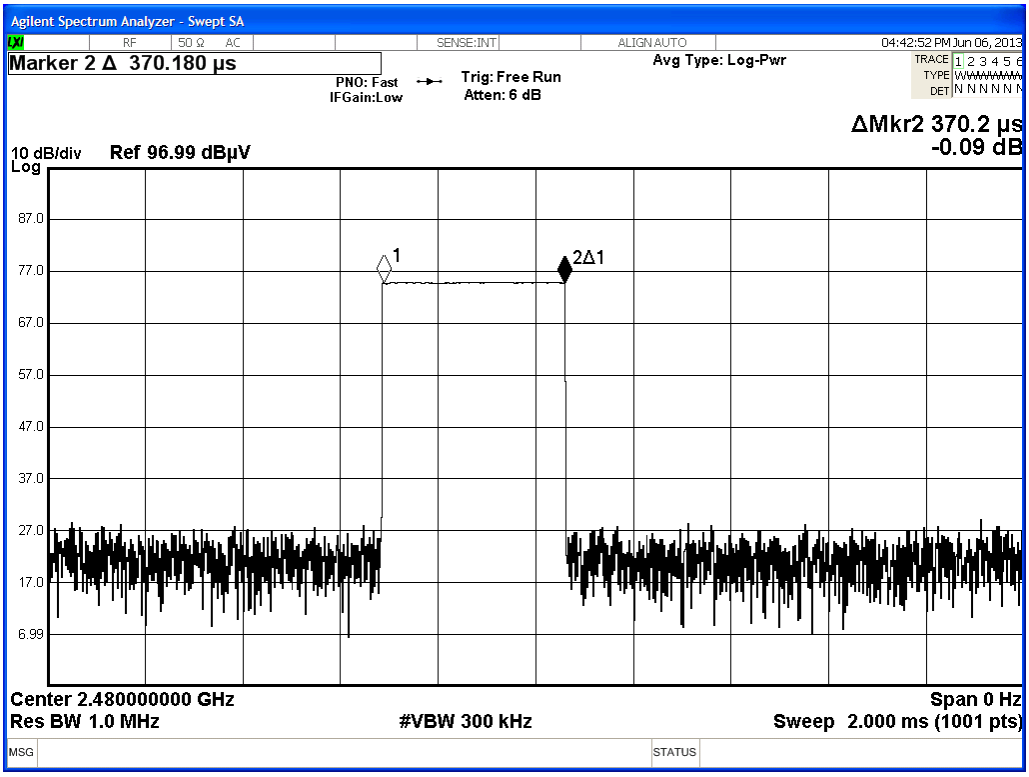


**Fig. I**
**[Pulse duration of Highest Channel]**
**Pulse duration = 0.370ms**




**Time of occupancy (Dwell Time)**:

| Data Packet | Frequency (MHz) | Pulse Duration (ms) | Dwell Time (s) | Limits (s) | Test Results |
|---|---|---|---|---|---|
| DH5 | 2402 | 2.881 | 0.307 | 0.400 | Complies |
| DH5 | 2442 | 2.862 | 0.305 | 0.400 | Complies |
| DH5 | 2480 | 2.881 | 0.307 | 0.400 | Complies |
| DH3 | 2402 | 1.625 | 0.260 | 0.400 | Complies |
| DH3 | 2442 | 1.624 | 0.260 | 0.400 | Complies |
| DH3 | 2480 | 1.621 | 0.259 | 0.400 | Complies |
| DH1 | 2402 | 0.370 | 0.118 | 0.400 | Complies |
| DH1 | 2442 | 0.372 | 0.119 | 0.400 | Complies |
| DH1 | 2480 | 0.370 | 0.118 | 0.400 | Complies |

**Appendix A**

**List of Measurement Equipment**

# LIST OF MEASUREMENT EQUIPMENT

## Radiated Emission

| EQP NO. | DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | LAST CAL | DUE CAL |
|---|---|---|---|---|---|---|
| EM299 | DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA | ETS-LINDGREN | 3115 | 00114120 | 2012/01/25 | 2014/01/25 |
| EM300 | PYRAMIDAL STANDARD GAIN HORN ANTENNA | ETS-LINDGREN | 3160-09 | 00130130 | 2012-01-24 | 2014-01-24 |
| EM215 | MULTIDEVICE CONTROLLER | EMCO | 2090 | 00024676 | N/A | N/A |
| EM216 | MINI MAST SYSTEM | EMCO | 2075 | 00026842 | N/A | N/A |
| EM217 | ELECTRIC POWERED TURNTABLE | EMCO | 2088 | 00029144 | N/A | N/A |
| EM218 | ANECHOIC CHAMBER | ETS-LINDGREN | FACT-3 | -- | 2012/10/25 | 2013/10/25 |
| EM174 | BICONILOG ANTENNA | EMCO | 3142B | 1671 | 2012/05/31 | 2014/05/31 |
| EM229 | EMI TEST RECEIVER | R&S | ESIB40 | 100248 | 2013/05/07 | 2014/05/07 |
| EM022 | LOOP ANTENNA | EMCO | 6502 | 1189-2424 | 2011/09/14 | 2013/09/14 |
| EM200 | DUAL CHANNEL POWER METER | R & S | NRVD | 100592 | 2011/10/10 | 2013/10/10 |
| EM201 | 10V INSERTION UNIT | R & S | URV5-Z2 | 100089 | 2011/10/10 | 2013/10/10 |

## Line Conducted

| EQP NO. | DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | LAST CAL | DUE CAL |
|---|---|---|---|---|---|---|
| EM232 | LISN | SCHAFFNER | NNB41 | 04/100082 | 2013/04/15 | 2014/05/07 |
| EM145 | EMI TEST RECEIVER | R & S | ESCS 30 | 830245/021 | 2013/05/07 | 2014/05/07 |
| EM179 | IMPULSE LIMITER | ROHDE & SCHWARZ | ESH3-Z2 | 357-8810.52/54 | 2013/01/27 | 2014/01/27 |
| EM154 | SHIELDING ROOM | SIEMENS MATSUSHITA COMPONENTS | N/A | 803-740-057-99A | 2012/02/03 | 2017/02/03 |

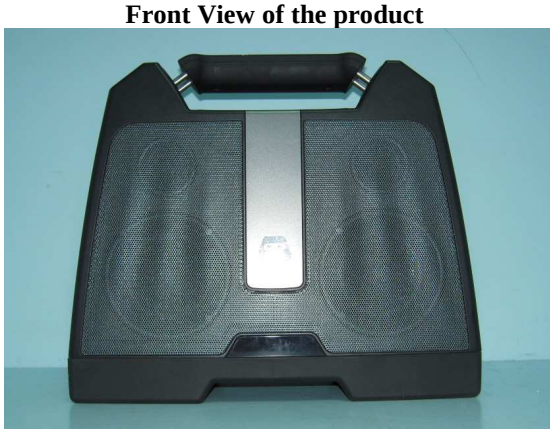
Remarks:-

CM Corrective Maintenance
N/A Not Applicable or Not Available
TBD To Be Determined

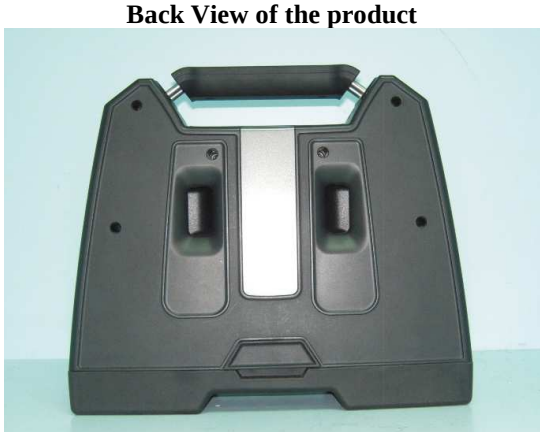
**Appendix C**

**Photographs of EUT**

**Front View of the product**



**Back View of the product**



**Rear View of the product (Left)**

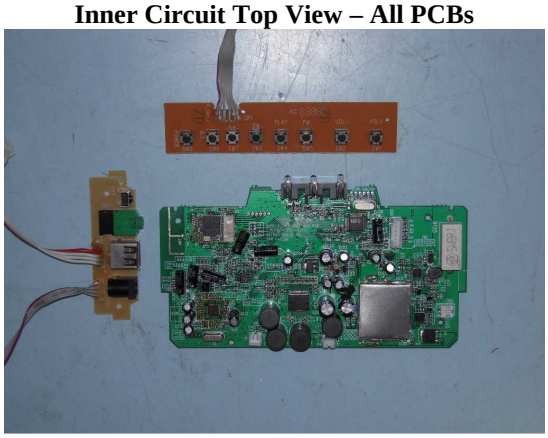
**Rear View of the product (Right)**

**Top View of the product**

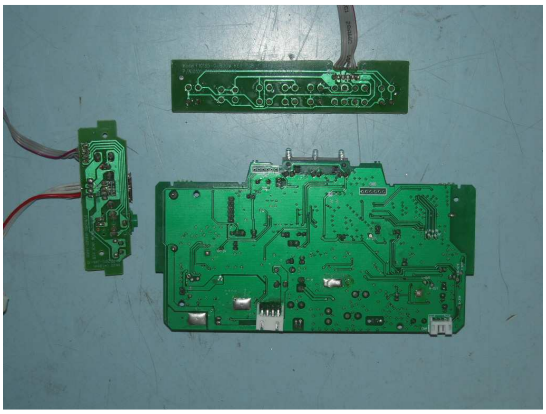
**Bottom View of the product**

**Photographs of EUT**

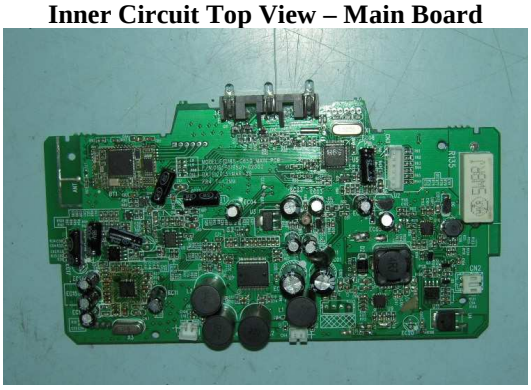
**Inner Circuit Top View – All PCBs**



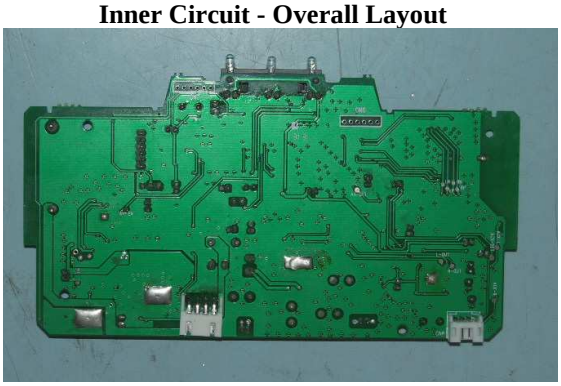
**Inner Circuit Bottom View - – All PCBs**



**Inner Circuit Top View – Main Board**



**Inner Circuit - Overall Layout**



**Photographs of EUT**

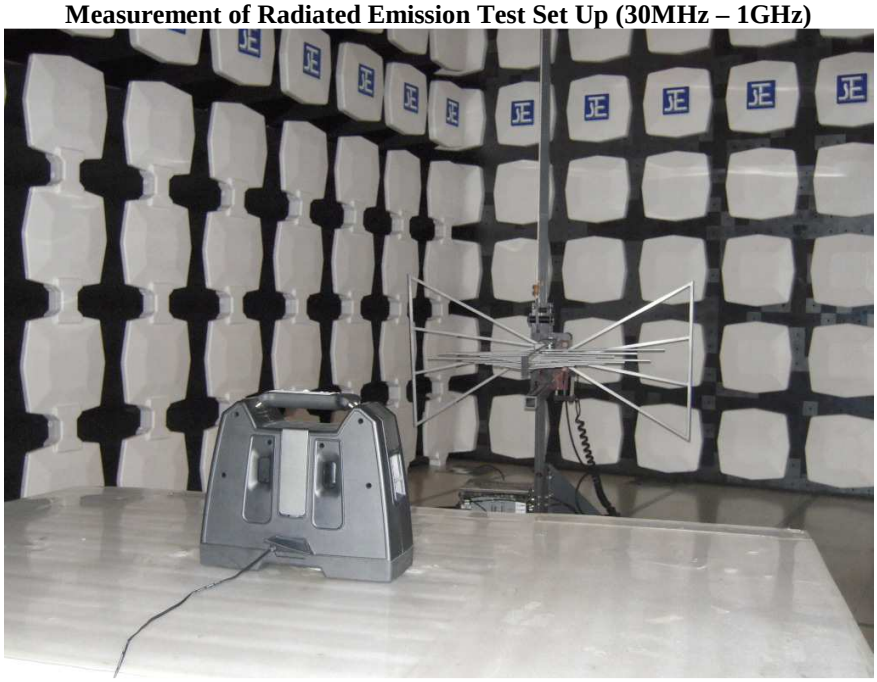
**Bluetooth Mode**

**Measurement of Radiated Emission Test Set Up (Below 30MHz)**

**Photographs of EUT**

**Bluetooth Mode**

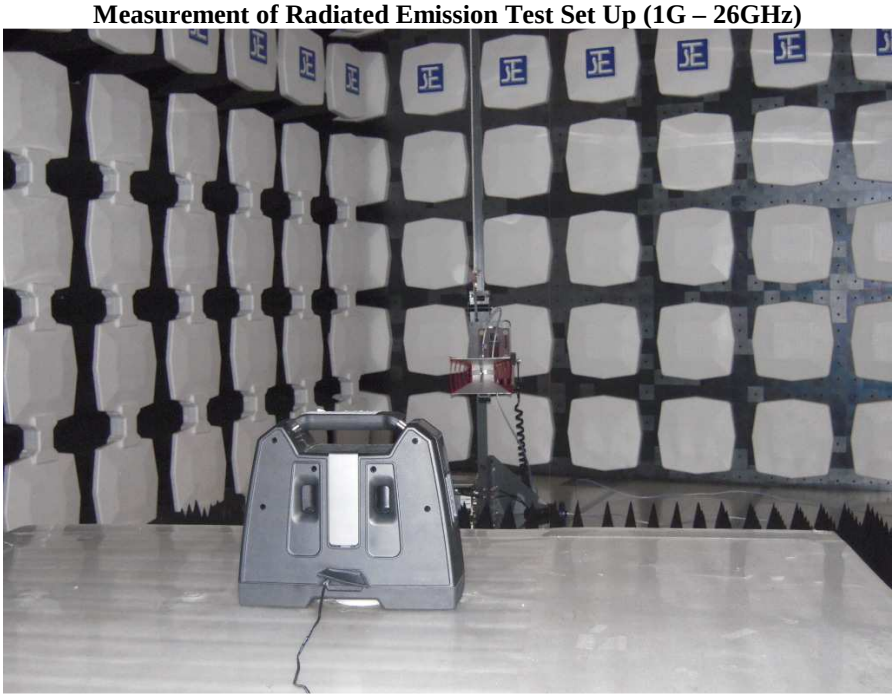
**Measurement of Radiated Emission Test Set Up (30MHz – 1GHz)**



**Photographs of EUT**

**Bluetooth Mode**

**Measurement of Radiated Emission Test Set Up (1G – 26GHz)**



**Photographs of EUT**

**Aux-in mode (Connected to iPod with charging function – Powered by adaptor**
**Measurement of Radiated Emission Test Set Up**

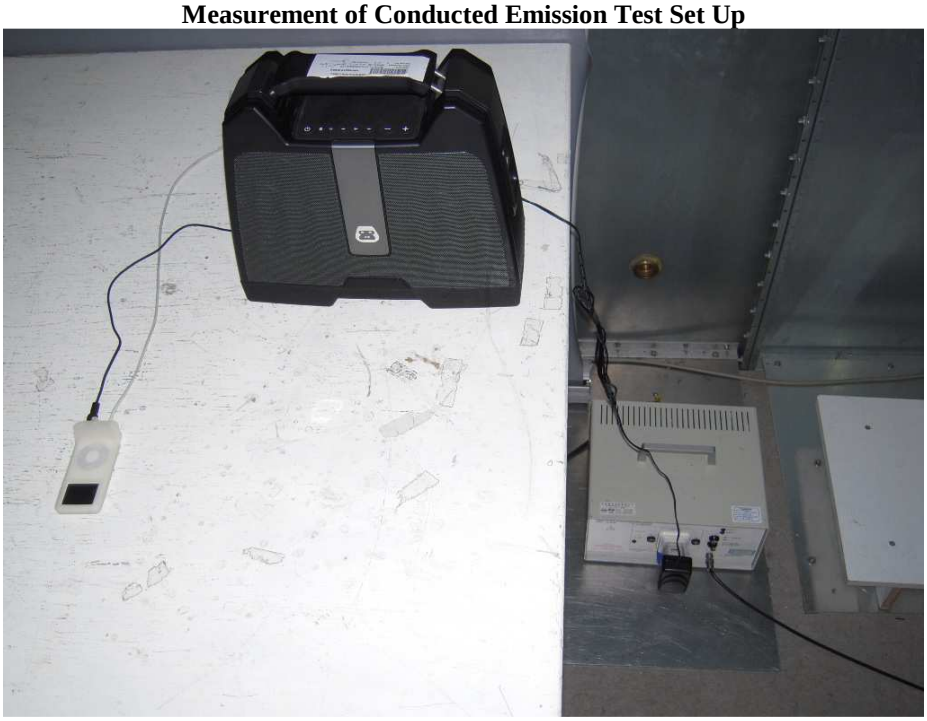
**Photographs of EUT**

**Bluetooth Mode**

**Measurement of Conducted Emission Test Set Up**

**Photographs of EUT**

**Measurement of Conducted Emission Test Set Up**



******* End of Test Report *******