# Test Report on

# Dual-Band CDMA Cellular Phone with Bluetooth

| FCC Part 15.247 Certification | |
|---|---|
| FCC ID: | **OVFKWC-K3801** |
| Model: | **K38-01** |

**STATEMENT OF CERTIFICATION**

*The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the measurements of the sample's radio frequency interference emissions characteristics as of the dates and at the times of the test under the conditions herein specified.*

**STATEMENT OF COMPLIANCE**

*This product has been shown to be capable of compliance with the applicable technical standards as indicted in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C-63.4-2001.*

| | |
|---|---|
| **Date of Test:** | August 1 – August 18, 2008 |
| **Test performed by:** | Kyocera Wireless Corp.<br>10300 Campus Point Drive<br>San Diego, CA – 92121 |
| **Report Prepared by:** | Thuy To, Regulatory Engineer |
| **Report Reviewed by:** | C. K. Li, Director of Regulatory Engineering |

CCS USA, Inc. performed the tests that required an OATS site.

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# 1 General Information

| | |
|---|---|
| **Applicant:** | Kyocera Wireless Corp.<br>10300 Campus Point Drive<br>San Diego CA 92121 |
| **FCC ID:** | OVFKWC-K3801 |
| **Product:** | Dual-Band CDMA Cellular Phone with Bluetooth |
| **Model Numbers:** | K38-01 |
| **EUT Serial Number:** | FFLM0000003299 |
| **Type:** | [ ] Prototype, [X] Pre-Production, [ ] Production |
| **Equipment Category:** | Portable |
| **TX Frequency (MHz):** | 2402 to 2480 |
| **Channel Number:** | 79 |
| **Channel Spacing (MHz):** | 1 |
| **Bluetooth version:** | ☐ 1.1 ☐ 1.2 ☐ 2.0 ☒ 2.0 + EDR |
| **Modulation:** | Frequency Hopping Spread Spectrum (FHSS) |
| **Max. Output Power (dBm)** | 3.73 dBm |
| **Antenna:** | Internal |
| **Antenna Gain (dBi):** | -3.5 (Peak) |
| **FCC Rule Parts:** | §15.247 |

## 2 Description of Bluetooth Transmitter

The OVFKWC-K3801phones offer Bluetooth as a feature. The Bluetooth transmitter uses Frequency Hopping Spread Spectrum (FHSS) technique and operates in the 2400 – 2483 MHz band. The transmitter is a Class 2 Bluetooth device and designed to communicate with other Bluetooth devices as per the industrial standard. The maximum gain of the internal Bluetooth antenna is measured to be -3.5 dBi.

## 3 20 dB Bandwidth

| FCC: § 15.247 a1 |
|---|
| **Measurement Procedure:**<br><br>The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the low, mid and high channels of Bluetooth transmitter were enabled separately to investigate the 20dB-bandwidth for each channel. A fully charged battery was used as supply voltage.<br><br>Frequencies of Interest: Spectrum was investigated from 2400 MHz – 2483.5 MHz. |

***List of Figures:***

| Figure | Channel | Plot Description |
|---|---|---|
| 3-1a | 0 | 20 dB Bandwidth Basic rate |
| 3-1b | | 20 dB Bandwidth Enhanced Data Rate (EDR 2Mbps) |
| 3-1c | | 20 dB Bandwidth Enhanced Data Rate (EDR 3Mbps) |
| 3-2a | 39 | 20 dB Bandwidth Basic rate |
| 3-2b | | 20 dB Bandwidth Enhanced Data Rate (EDR 2Mbps) |
| 3-2c | | 20 dB Bandwidth Enhanced Data Rate (EDR 3Mbps) |
| 3-3a | 78 | 20 dB Bandwidth Basic rate |
| 3-3b | | 20 dB Bandwidth Enhanced Data Rate (EDR 2Mbps) |
| 3-3c | | 20 dB Bandwidth Enhanced Data Rate (EDR 3Mbps) |

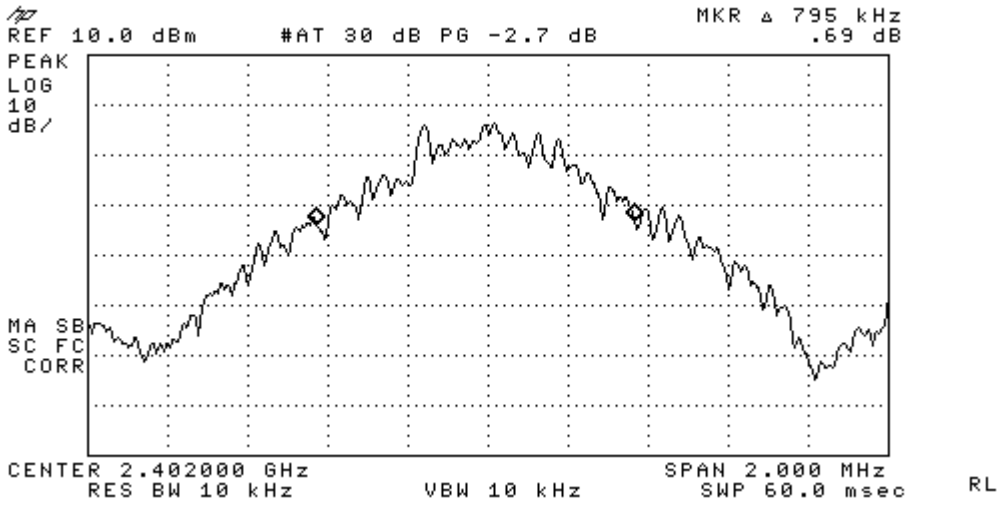


**Figure 3-1a: 20 dB Bandwidth basic rate, Channel 0.**

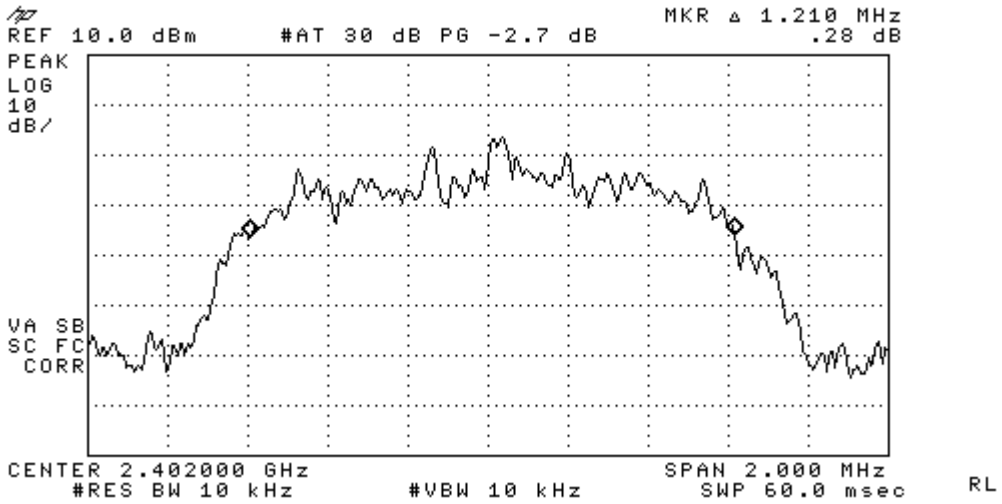


**Figure 3-1b: 20 dB Bandwidth EDR 2Mbps, Channel 0.**

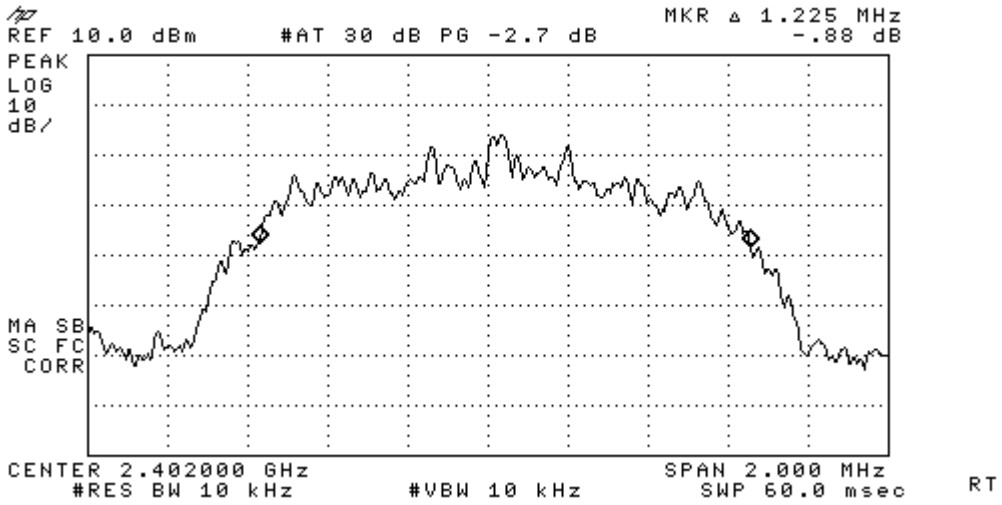


**Figure 3-1c: 20 dB Bandwidth EDR 3Mbps, Channel 0.**

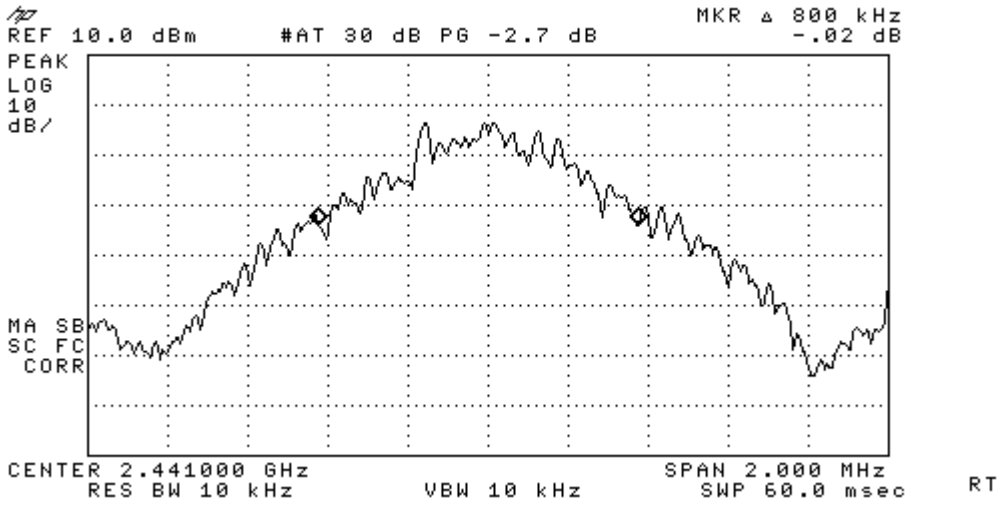


**Figure 3-2a: 20 dB Bandwidth basic rate, Channel 39.**

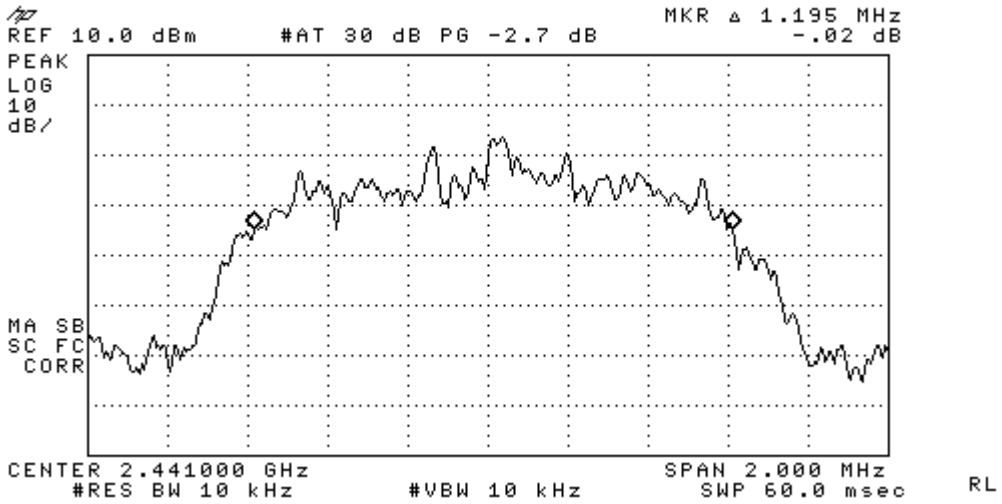


**Figure 3-2b: 20 dB Bandwidth EDR 2Mbps, Channel 39.**

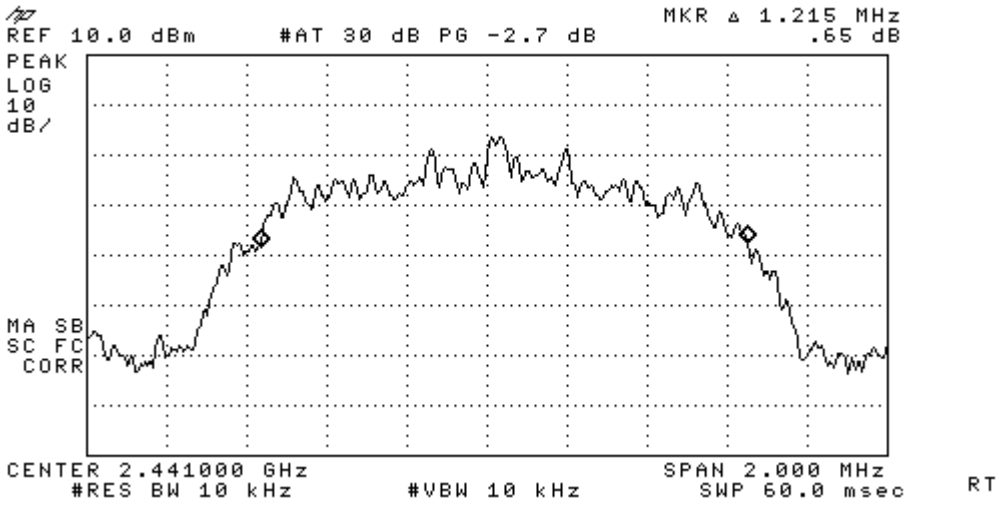


**Figure 6-2c: 20 dB Bandwidth EDR 3Mbps, Channel 39.**

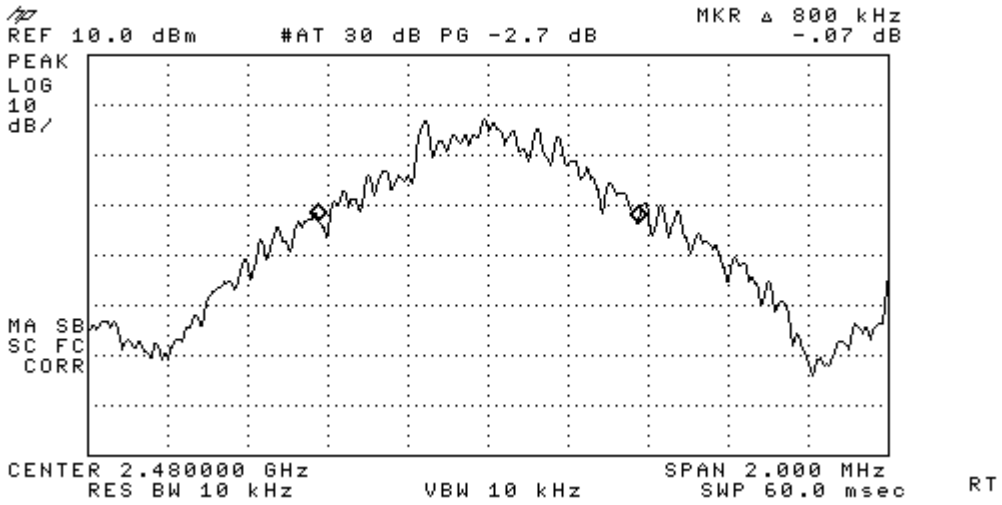


**Figure 3-3a: 20 dB Bandwidth basic rate, Channel 78.**

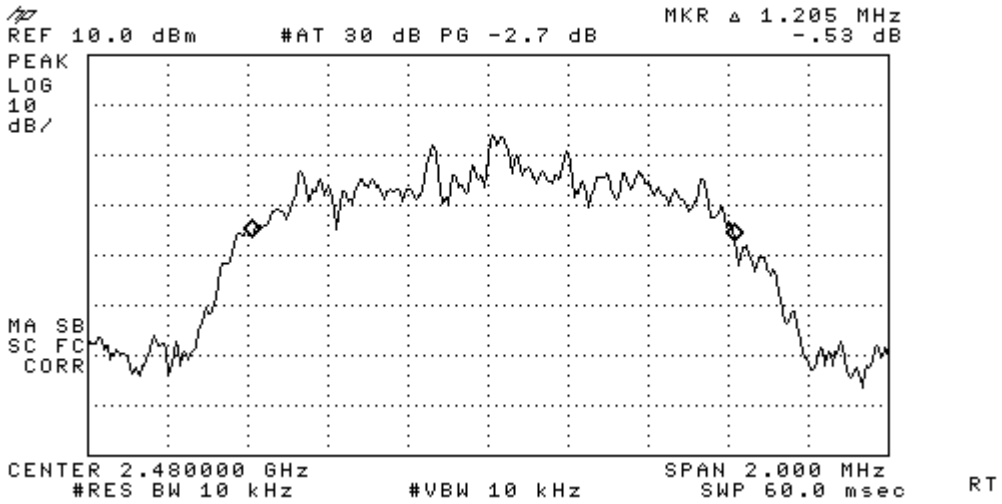


**Figure 3-3b: 20 dB Bandwidth EDR 2Mbps, Channel 78.**

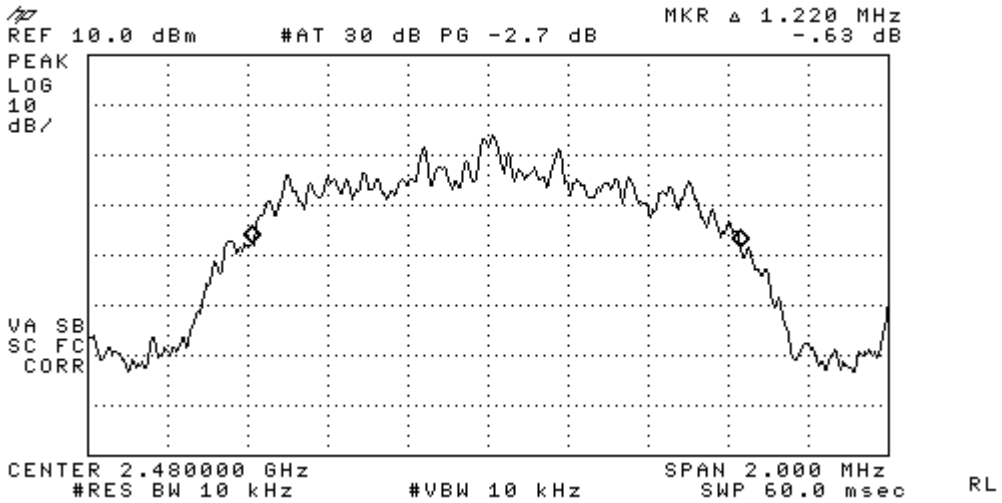


**Figure 3-3c: 20 dB Bandwidth EDR 3Mbps, Channel 78.**

***Results:***

| Channel | Modulation | Results | Comments |
|---|---|---|---|
| 0 | Basic Rate | 795 kHz | Delta marker on the spectrum analyzer was moved from the center frequency until –20dBc to measure the 20dB-bandwidth. |
| | EDR – 2Mbps | 1.210 MHz | |
| | EDR – 3Mbps | 1.225 MHz | |
| 39 | Basic Rate | 800 kHz | |
| | EDR – 2Mbps | 1.195 MHz | |
| | EDR – 3Mbps | 1.215 MHz | |
| 78 | Basic Rate | 800 kHz | |
| | EDR – 2Mbps | 1.205 MHz | |
| | EDR – 3Mbps | 1.220 MHz | |

## 4 Carrier Frequency Separation

| FCC: § 15.247 a1 |
|---|
| **Measurement Procedure:**<br><br>The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the Bluetooth transmitter was set in hopping mode to investigate the carrier frequency separation between mid-channel and its adjacent channels. A fully charged battery was used as supply voltage.<br><br>Frequencies of Interest: Spectrum was investigated from 2400 MHz – 2483.5 MHz.<br><br>Comments:<br>The carrier frequency separation is independent of modulation and packet length (DH1, DH3, etc.). |

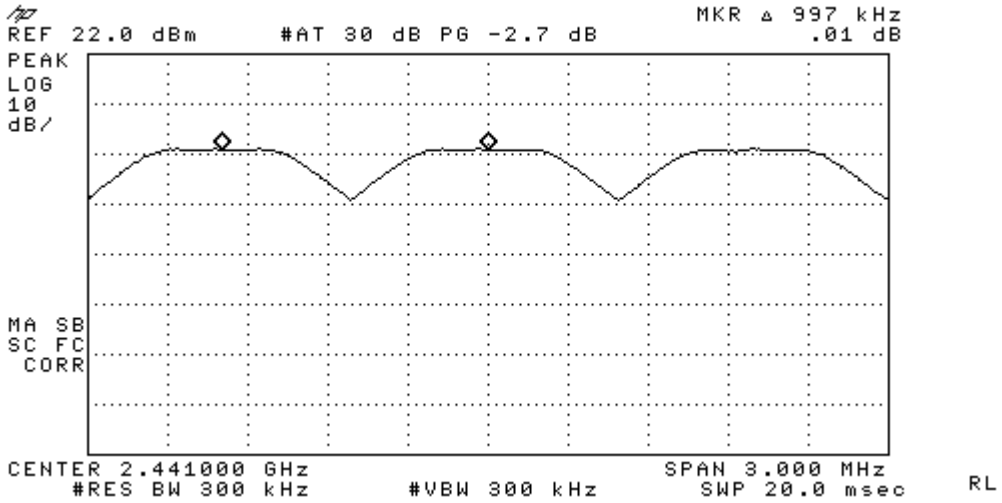


**Figure 4: Carrier Frequency Separation between channels 38, 39 (mid-channel) & 40.**

***Results and Limits:***

| Limits | Frequency Separation | 2/3 of 20 dB Bandwidth | Result |
|---|---|---|---|
| a) ≥ 25 kHz or 20 dB Bandwidth, whichever is greater<br>b) For FH systems operating in 2400-2483.5MHz and with output power less than 125mW the carrier frequency separation should be greater than 25kHz or 2/3 of 20dB Bandwidth. | 997kHz | 816.16kHz | Pass |

## 5 Number of Hopping Frequencies

| FCC: § 15.247 a1 iii |
|---|
| **Measurement Procedure:**<br><br>The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the Bluetooth transmitter was set in hopping mode to investigate the number of hopping frequencies. A fully charged battery was used as supply voltage.<br><br>Frequencies of Interest: Spectrum was investigated from 2400 MHz – 2483.5 MHz.<br><br>Comments:<br>The number of frequency hopping is independent of modulation and packet length (DH1,<br>DH3, etc.). |

***List of Figures:***

| Figure | Channel | Plot Description |
|---|---|---|
| 5a | Hopping | Number of Hopping Frequencies (Channels 0-39) |
| 5b | | Number of Hopping Frequencies (Channels 39-78) |

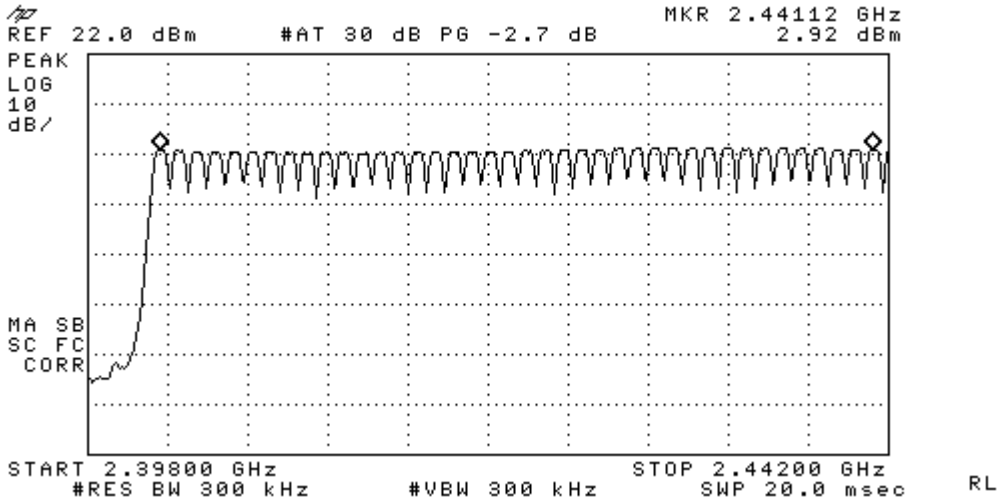


**Figure 5a: Number of Hopping Frequencies (Channels 0-39)**

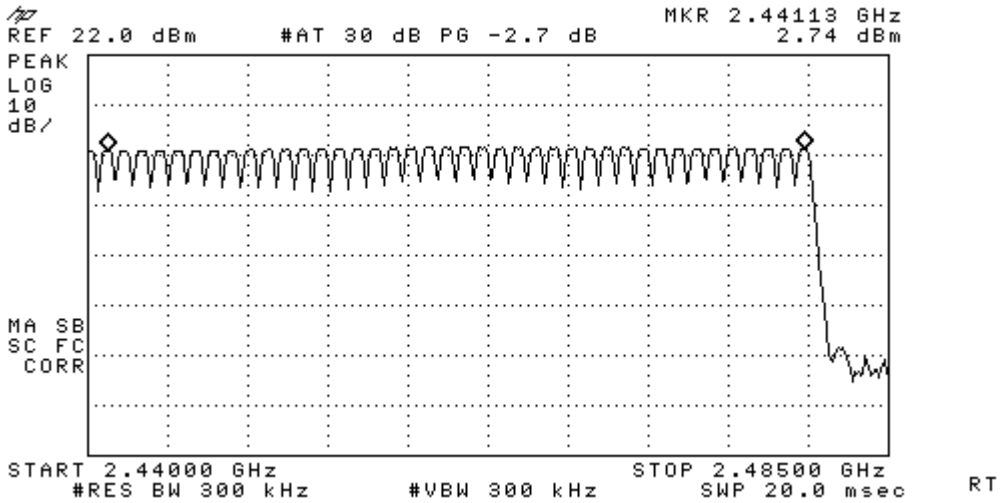


**Figure 5b: Number of Hopping Frequencies (Channels 39-78)**

***Results and Limits:***

| Limits | Channel | Results | Comments |
|---|---|---|---|
| At least 15 non-overlapping channels | Hopping | 79 (Channels 0-78) | Pass |

## 6 Time of Occupancy (Dwell Time)

**FCC: § 15.247 a1 ii, § 15.247 f**

**Measurement Procedure:**

The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the Bluetooth transmitter was set in hopping mode to capture one of the transmissions of mid-channel. A fully charged battery was used as supply voltage.

Comments:
The dwell time is independent of modulation and packet length (DH1, DH3, etc.).

According to the Bluetooth Core Specification v1.1, we have 1600 hops in a second for a one slot packet type. One frequency hop lasts 625 μs; this increment is called a time slot. In a period of 31.6 seconds, the time of occupancy for any given channel is calculated as follows:

Duration of one transmission*(1600 hops/sec)/(No. of time-slots)/(79 channels)*31.6 sec

For a DH1 (1 time-slot) packet type, ideally the duration of one transmission is 625 μs. Therefore, the dwell time is given by:

625 μs*1600/s/(1 time-slot)/79*31.6 s= 0.4 s.

Spectrum Analyzer Parameters:
The measurement is conducted with zero span centered at mid-channel (2441 MHz) with sweep time sufficient enough to capture one transmission (in this case, ≥ 625 μs).

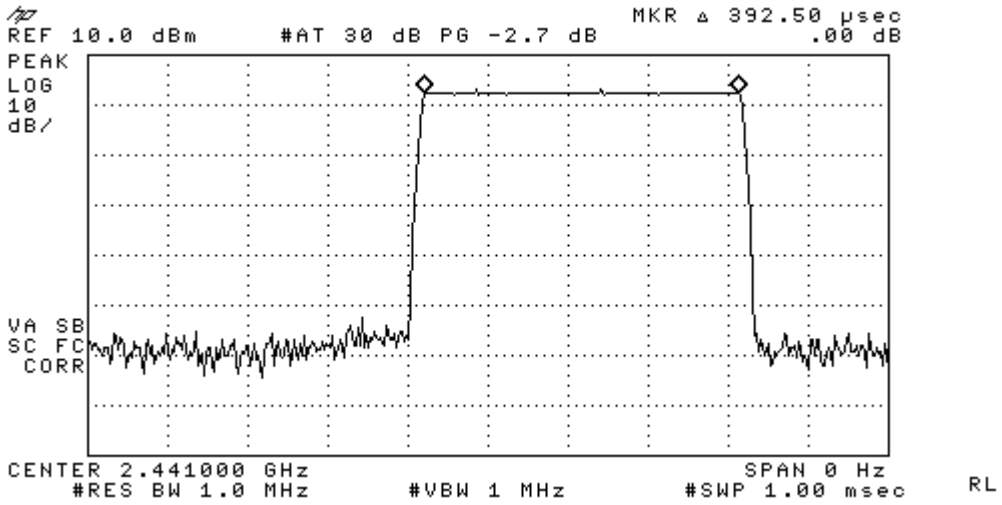


**Figure 6: Duration of one transmission (Channel 39)**

***Results and Limits:***

| Limits | Channel | Results | Comments |
|---|---|---|---|
| ≤ 0.4 s<br>(in a period of 31.6 s) | Hopping<br>(DH1 packet) | 0.2512 s<br>{[(417.5μ*1600)/1] /79}*31.6 | Mid-channel (CH 39) was measured here. |

# 7 Peak Output Power

| FCC: § 15.247 b1 |
|---|
| **Measurement Procedure:**<br><br>The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the low, mid and high channels of Bluetooth transmitter were enabled separately to investigate the peak output power for each channel. A fully charged battery was used as supply voltage.<br><br>Frequencies of Interest: Spectrum was investigated from 2400 MHz – 2483.5 MHz. |

***List of Figures:***

| Figure | Channel | Plot Description |
|---|---|---|
| 7-1a | 0 | Peak Output Power – Basic Rate |
| 7-1b | | Peak Output Power – EDR 2Mbps |
| 7-1c | | Peak Output Power – EDR 3Mbps |
| 7-2a | 39 | Peak Output Power – Basic Rate |
| 7-2b | | Peak Output Power – EDR 2Mbps |
| 7-2c | | Peak Output Power – EDR 3Mbps |
| 7-3a | 78 | Peak Output Power – Basic Rate |
| 7-3b | | Peak Output Power – EDR 2Mbps |
| 7-3c | | Peak Output Power – EDR 3Mbps |

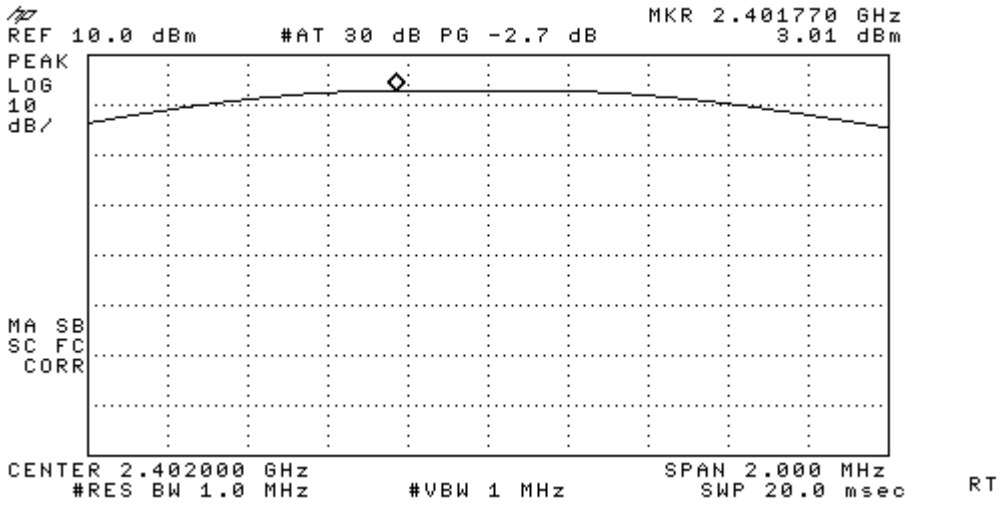


**Figure 7-1a: Peak Output Power, Channel 0.**

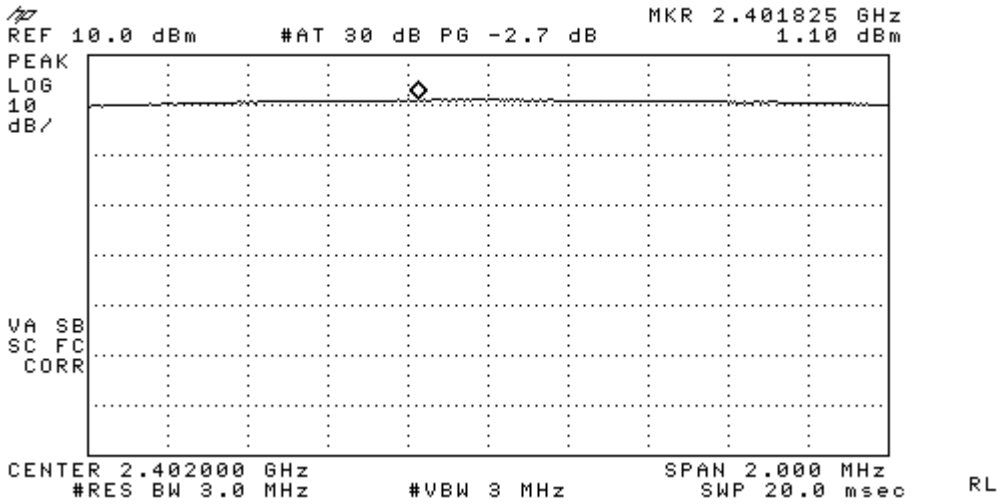


**Figure 7-1b: EDR 2 Peak Output Power, Channel 0.**

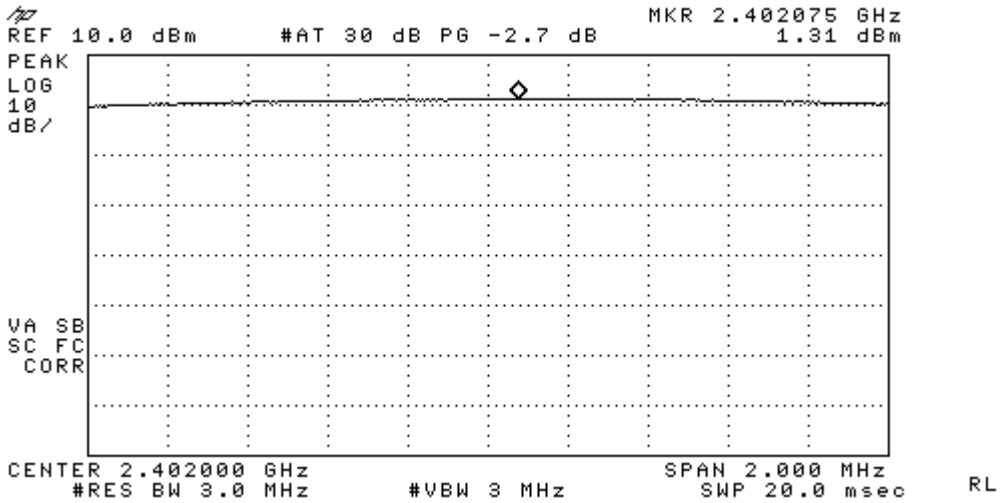


**Figure 7-1c: EDR 3 Peak Output Power, Channel 0.**

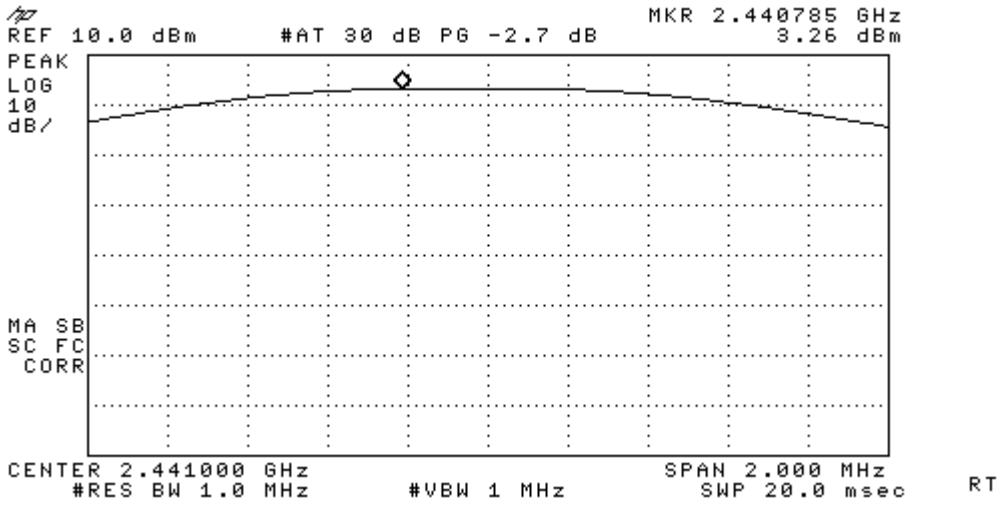


**Figure 7-2a: Peak Output Power, Channel 39.**

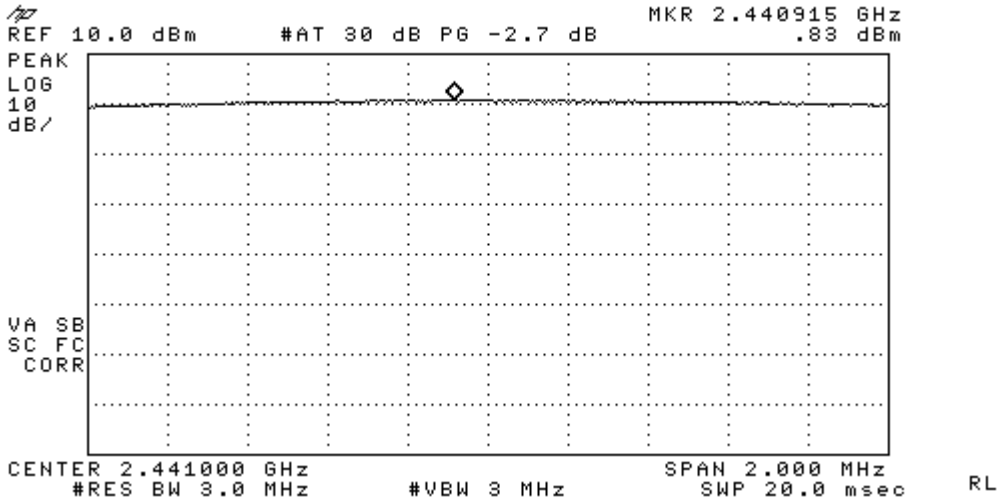


**Figure 7-2b: EDR 2Peak Output Power, Channel 39.**

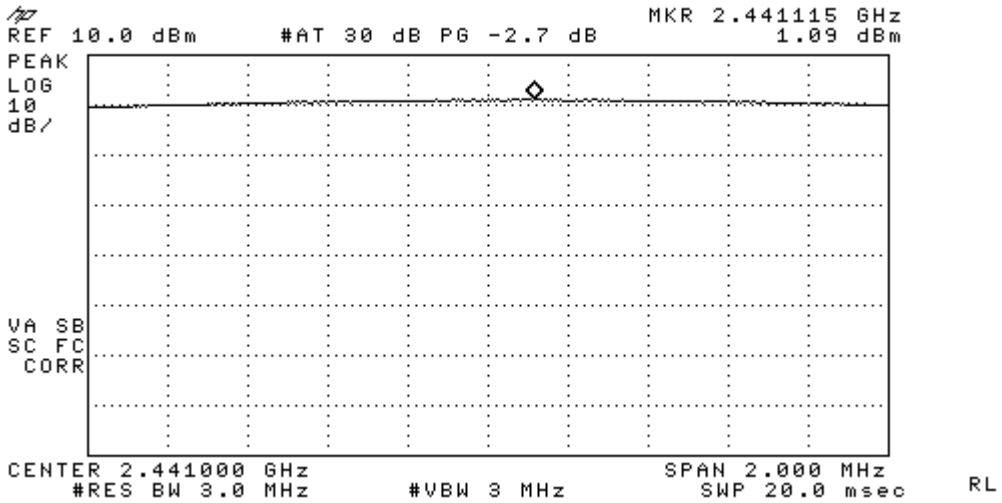


**Figure 7-2c: EDR 3Peak Output Power, Channel 39.**

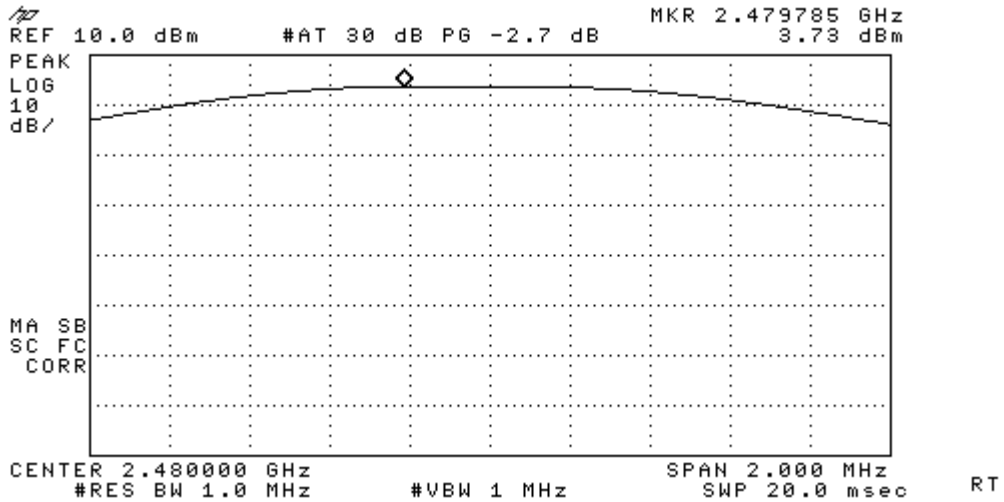


**Figure 7-3a: Peak Output Power, Channel 78.**

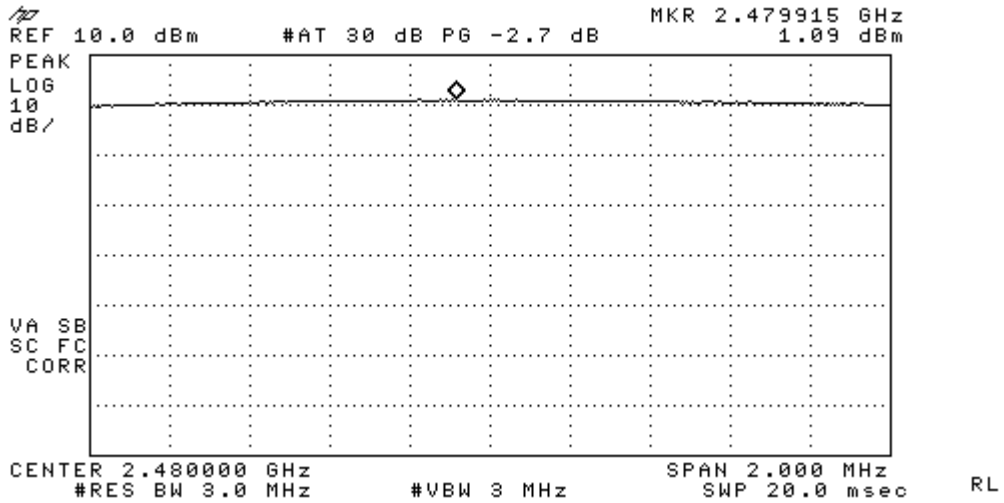


**Figure 7-3b: EDR 2Peak Output Power, Channel 78.**

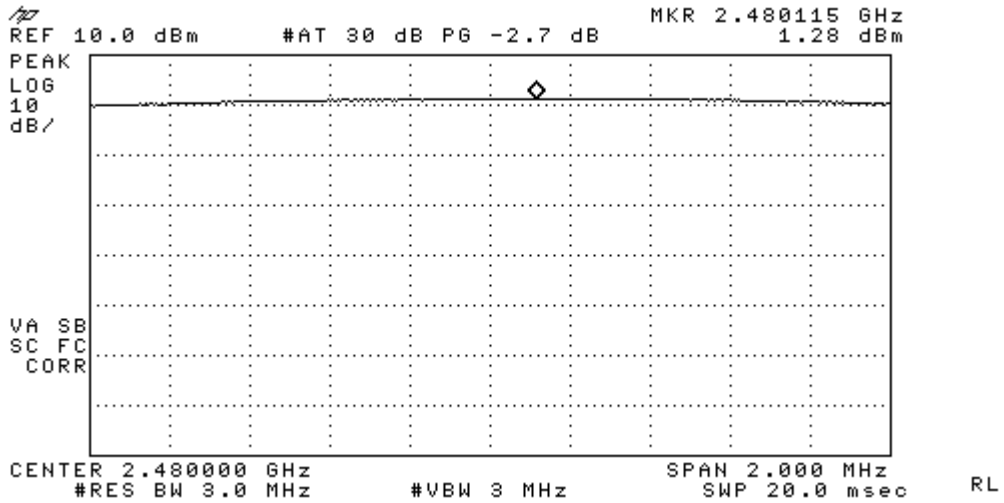


**Figure 7-3c: EDR 3Peak Output Power, Channel 78.**

***Results and Limits:***

| Limits | Rate | Channel | Results | Comments |
|---|---|---|---|---|
| < 1 watt (for systems with at least 75 hopping channels) | Basic Rate | 0 | 3.01 dBm | Signal loss from the cable connecting the Bluetooth output port and spectrum analyzer is calibrated out. |
| | EDR – 2Mbps | | 1.10 dBm | |
| | EDR – 3Mbps | | 1.31 dBm | |
| | Basic Rate | 39 | 3.26 dBm | |
| | EDR – 2Mbps | | 0.83 dBm | |
| | EDR – 3Mbps | | 1.09 dBm | |
| | Basic Rate | 78 | 3.73 dBm | |
| | EDR – 2Mbps | | 1.09 dBm | |
| | EDR – 3Mbps | | 1.28 dBm | |

## 8 Band-edge Compliance of Conducted Emissions

**FCC: § 15.247 c**

**Measurement Procedure:**

The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the low and high channels of Bluetooth transmitter were enabled separately to investigate the band-edge compliance of conducted emissions. To ensure the band-edge compliance when the channels are hopping, measurements were also conducted at low and high channels in this mode. A fully charged battery was used as supply voltage.

Frequencies of Interest: Spectrum was investigated from 2400 MHz – 2483.5 MHz.

***List of Figures:***

| Figure | Channel/Edge | Modulation | Plot Description |
|---|---|---|---|
| 8-1a | 0 – Low Band Edge | Basic Rate | Hopping disabled |
| 8-1b | | | Hopping enabled |
| 8-2a | | EDR – 2Mbps | Hopping disabled |
| 8-2b | | | Hopping enabled |
| 8-3a | | EDR – 3Mbps | Hopping disabled |
| 8-3b | | | Hopping enabled |
| 8-4a | 78 – High Band Edge | Basic Rate | Hopping disabled |
| 8-4b | | | Hopping enabled |
| 8-5a | | EDR – 2Mbps | Hopping disabled |
| 8-5b | | | Hopping enabled |
| 8-6a | | EDR – 3Mbps | Hopping disabled |
| 8-6b | | | Hopping enabled |

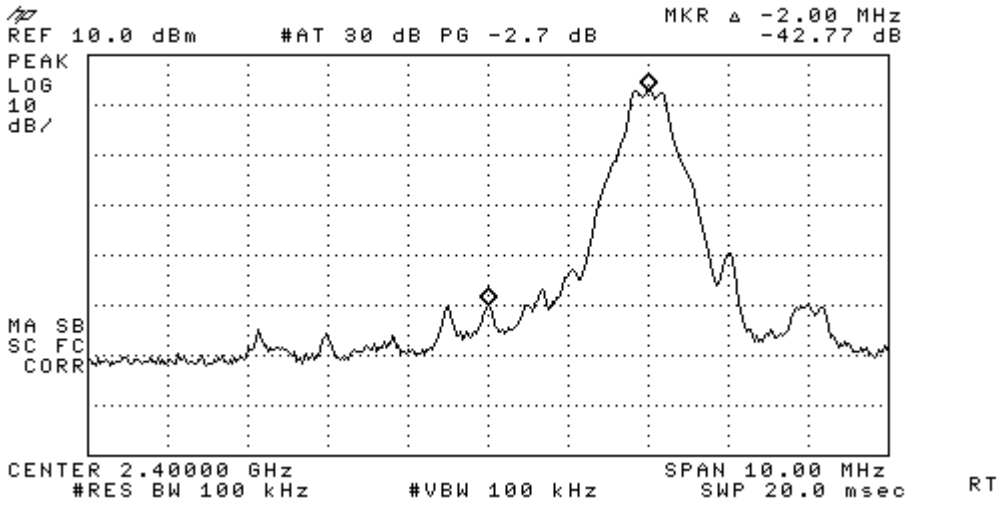


**Figure 8-1a: Basic Rate Low band edge with hopping disabled.**

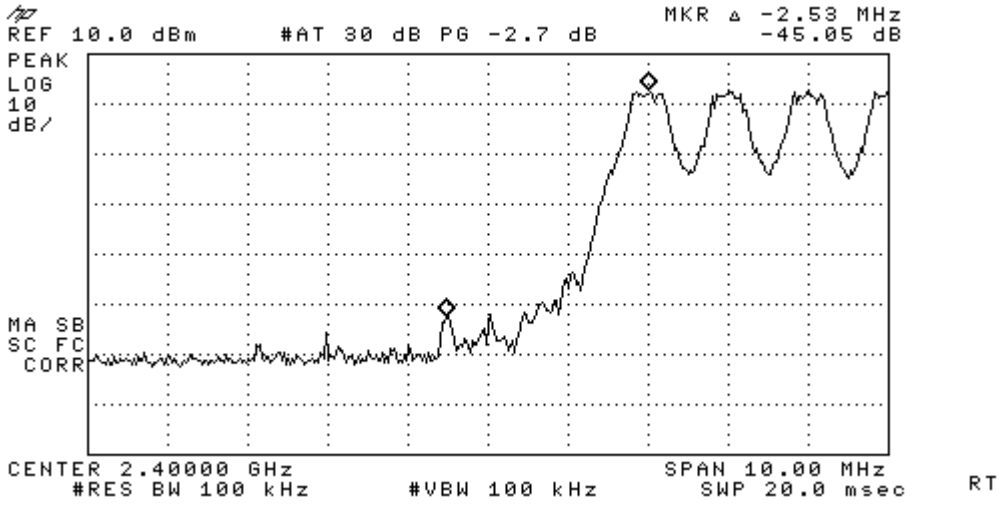


**Figure 8-1b: Basic Rate Low band edge with hopping enabled.**

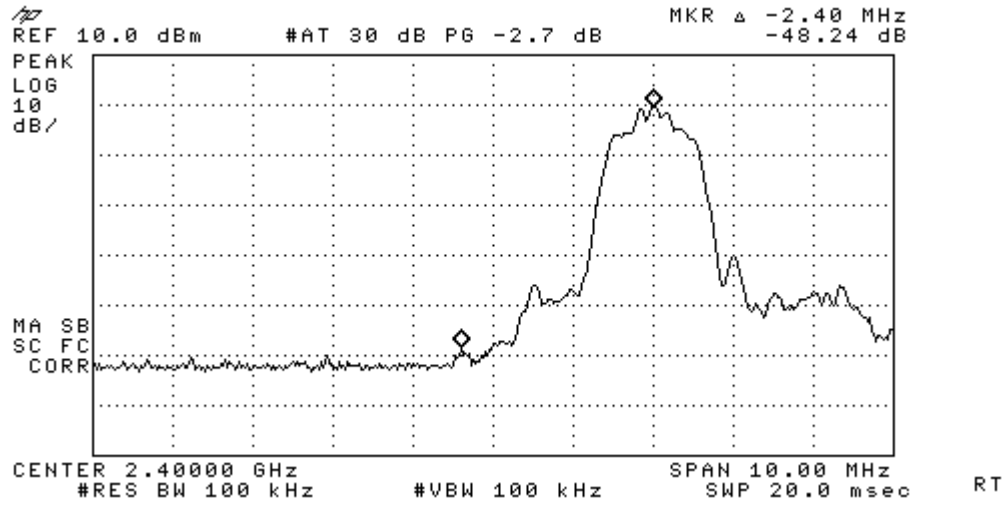


**Figure 8-2a: EDR –2Mbps Low band edge with hopping disabled.**

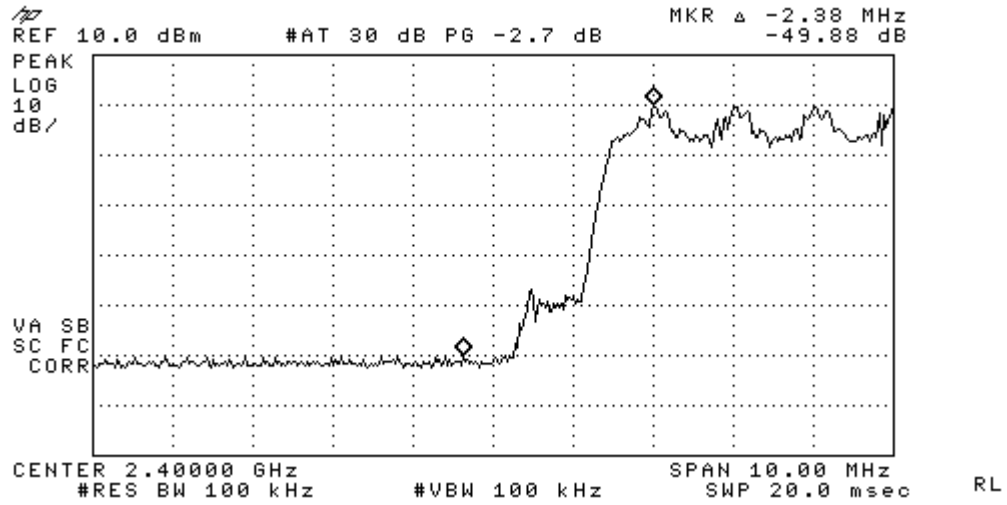


**Figure 8-2b: EDR –2Mbps Low band edge with hopping enabled.**

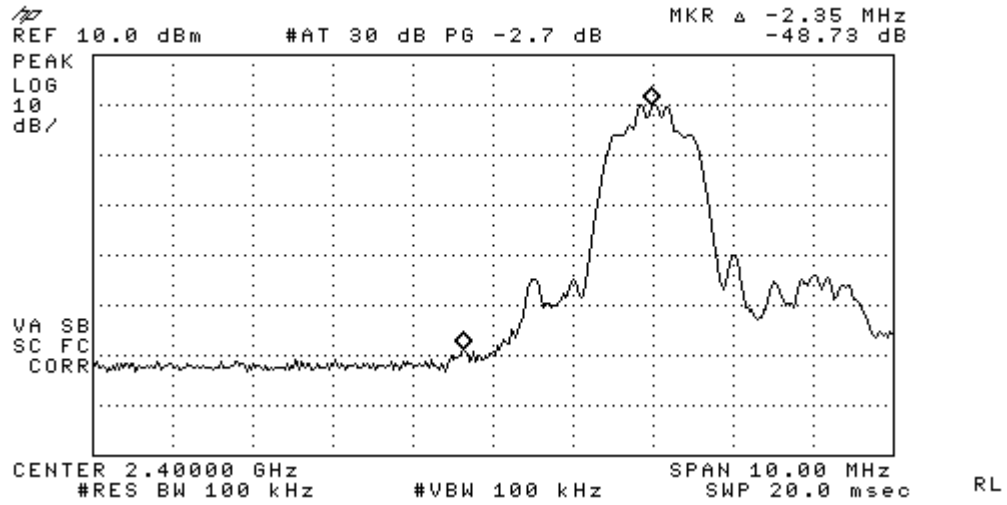


**Figure 8-3a: EDR –3Mbps Low band edge with hopping disabled.**

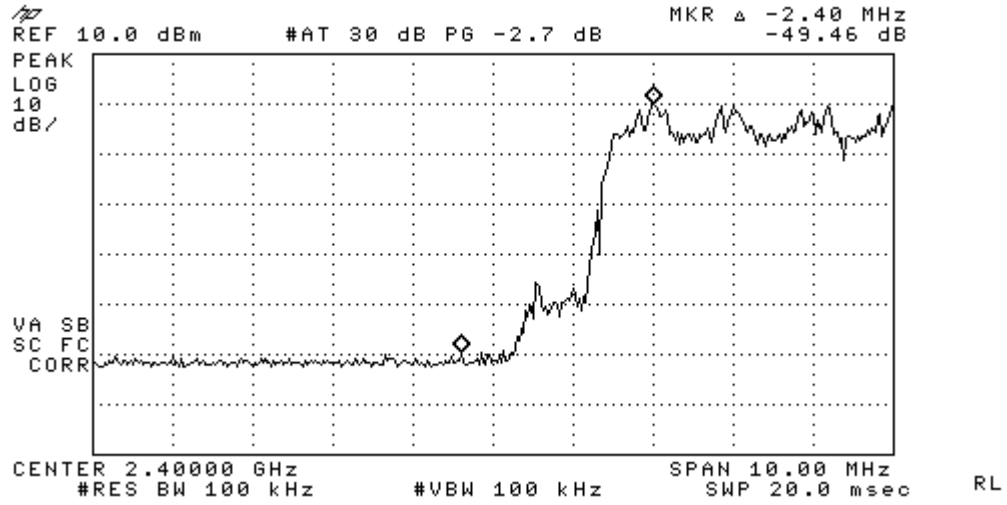


**Figure 8-3b: EDR –3Mbps Low band edge with hopping enabled.**

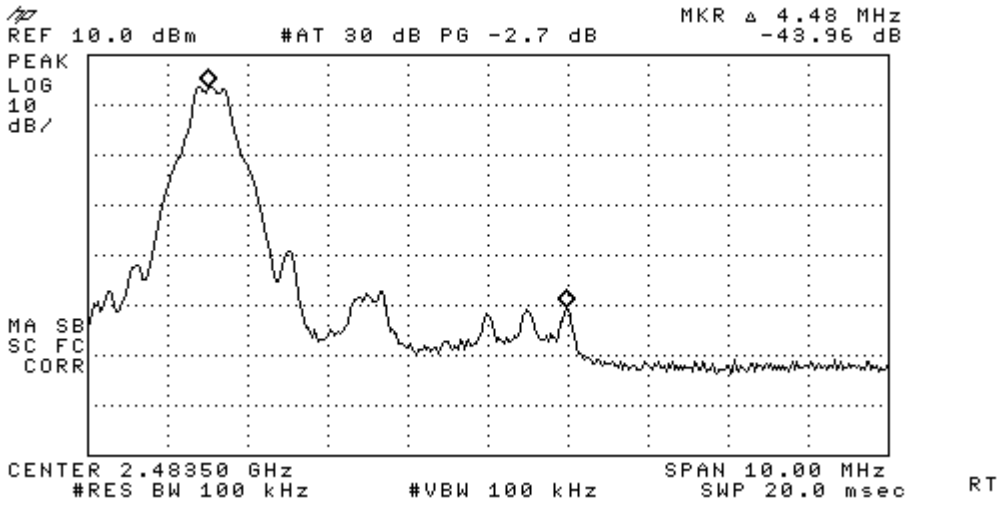


**Figure 8-4a: Basic Rate High band edge with hopping disabled.**

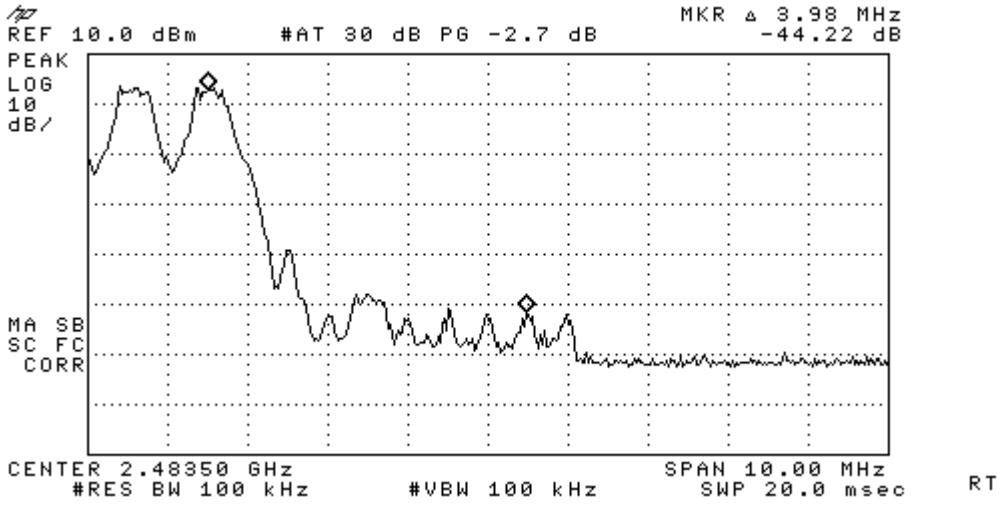


**Figure 8-4b: Basic Rate High band edge with hopping enabled.**

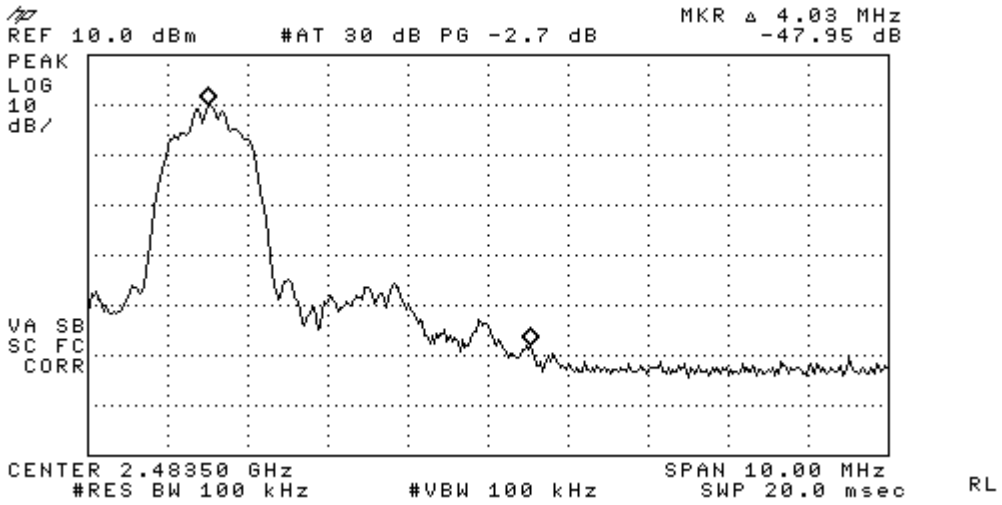


**Figure 8-5a: EDR –2Mbps High band edge with hopping disabled.**

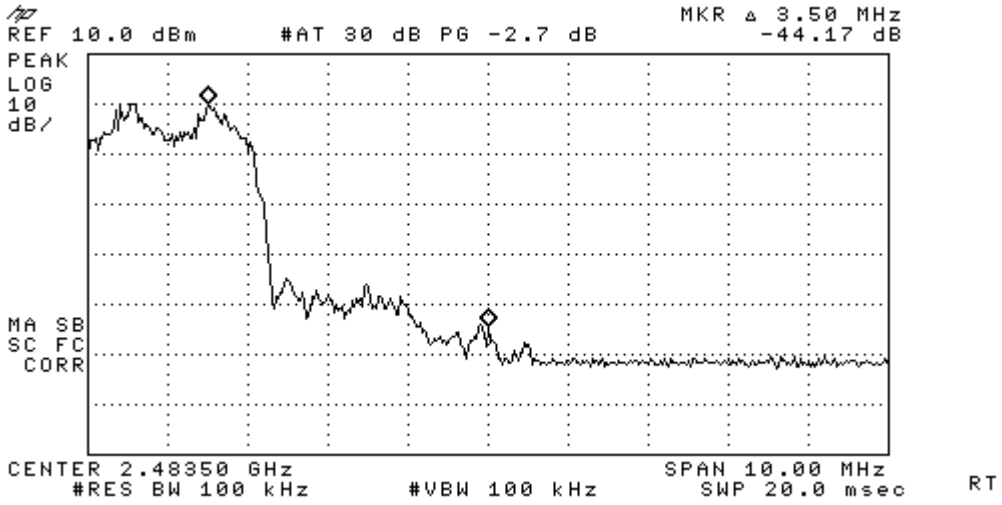


**Figure 8-5b: EDR –2Mbps High band edge with hopping enabled.**

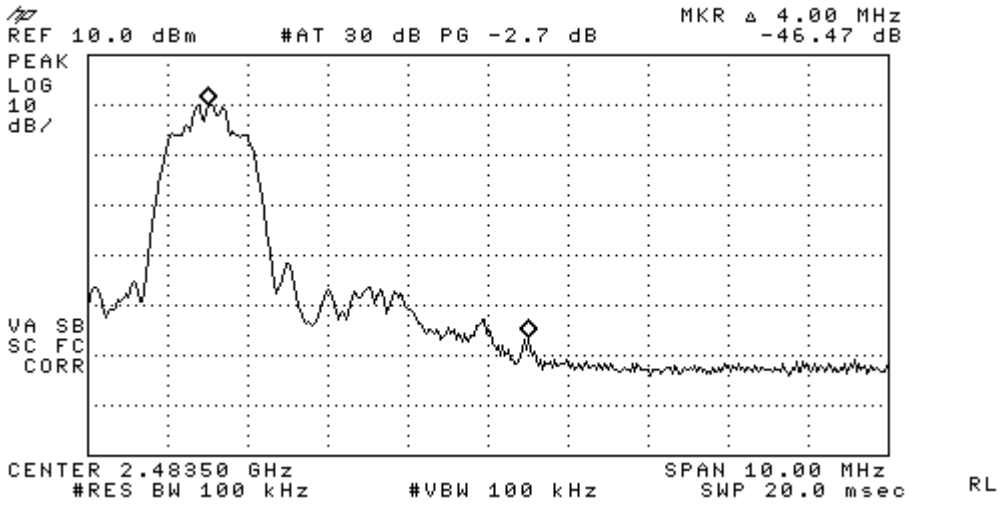


**Figure 8-6a: EDR –3Mbps High band edge with hopping disabled.**

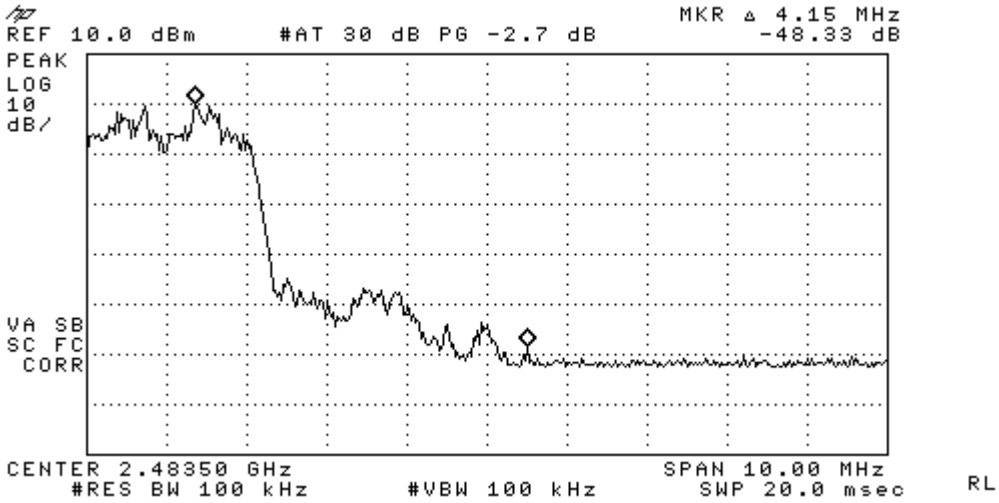


**Figure 8-6b: EDR –3Mbps High band edge with hopping enabled.**

***Results and Limits:***

| Limits | Edge | Modulation | Channel | Results | Comments |
|---|---|---|---|---|---|
| ≤ -20 dBc | Low Band Edge | Basic Rate | 0 | -42.77dBc | In any 100kHz band, the highest radio frequency power outside the band (2400-2483.5 MHz) is measured to be at least 20 dB below the desired power of intentional radiator within the band. |
| | | | Hopping | -45.05dBc (Ch 0) | |
| | | EDR – 2Mbps | 0 | -48.24dBc | |
| | | | Hopping | -49.88dBc (Ch 0) | |
| | | EDR – 3Mbps | 0 | -48.73dBc | |
| | | | Hopping | -49.46dBc (Ch 0) | |
| | High Band Edge | Basic Rate | 78 | -43.96dBc | |
| | | | Hopping | -44.22dBc (Ch 78) | |
| | | EDR – 2Mbps | 78 | -47.95dBc | |
| | | | Hopping | 44.17dBc (Ch 78) | |
| | | EDR – 3Mbps | 78 | -46.47dBc | |
| | | | Hopping | -48.33dBc (Ch 78) | |

# 9 Spurious RF Conducted Emissions

| FCC: § 15.247 c |
|---|
| **Measurement Procedure:**<br><br>The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the low, mid and high channels of Bluetooth transmitter were enabled separately and the frequency spectrum was investigated for any spurious emissions. A fully charged battery was used as supply voltage.<br><br>Frequencies of Interest: Spectrum was investigated from 9kHz – 25 GHz. |

***List of Figures:***

| Figure | Modulation | Channel | Plot Description |
|---|---|---|---|
| 9-1a | Basic Rate | 0 | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-1b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-2a | EDR – 2Mbps | | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-2b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-3a | EDR – 3Mbps | | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-3b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-4a | Basic Rate | 39 | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-4b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-5a | EDR – 2Mbps | | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-5b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-6a | EDR – 3Mbps | | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-6b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-7a | Basic Rate | 78 | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-7b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-8a | EDR – 2Mbps | | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-8b | | | Conducted spurious emissions, 2.7GHz to 22GHz |
| 9-9a | EDR – 3Mbps | | Conducted spurious emissions, 9kHz to 2.7GHz |
| 9-9b | | | Conducted spurious emissions, 2.7GHz to 22GHz |

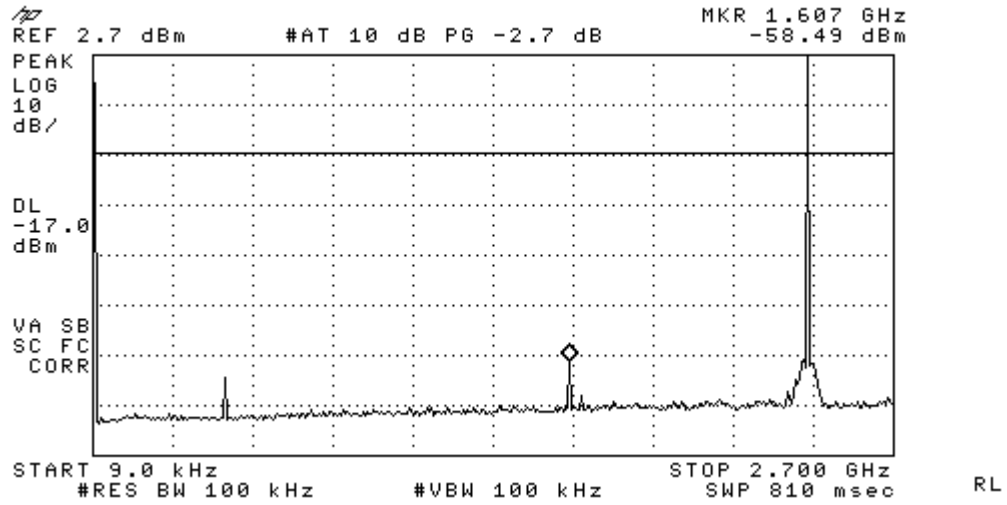


**Figure 9-1a: Basic Rate Conducted Spurious Emissions (CH 0)**

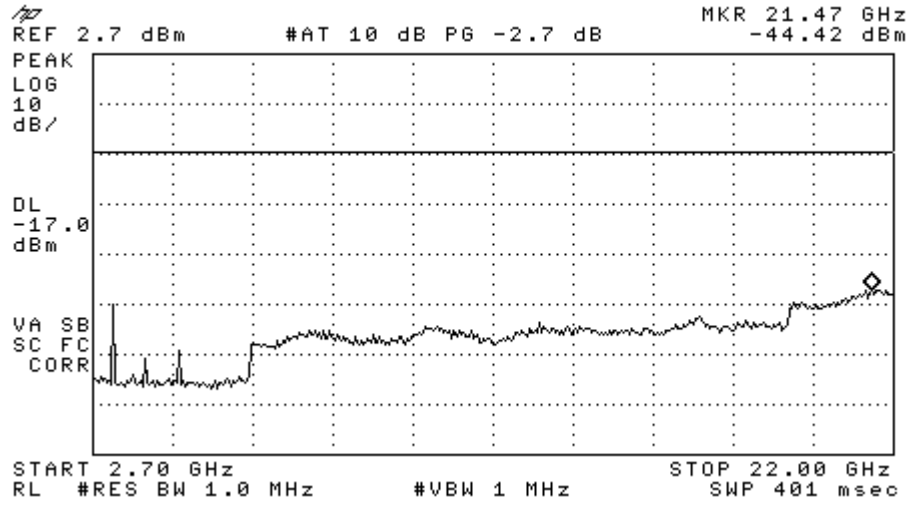


**Figure 9-1b: Basic Rate Conducted Spurious Emissions (CH 0)**

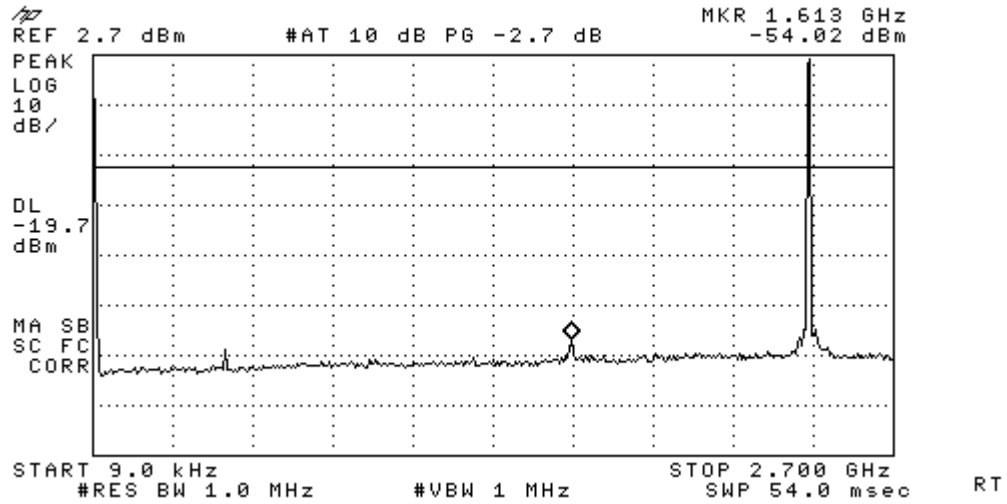


**Figure 9-2a: EDR – 2Mbps Conducted Spurious Emissions (CH 0)**

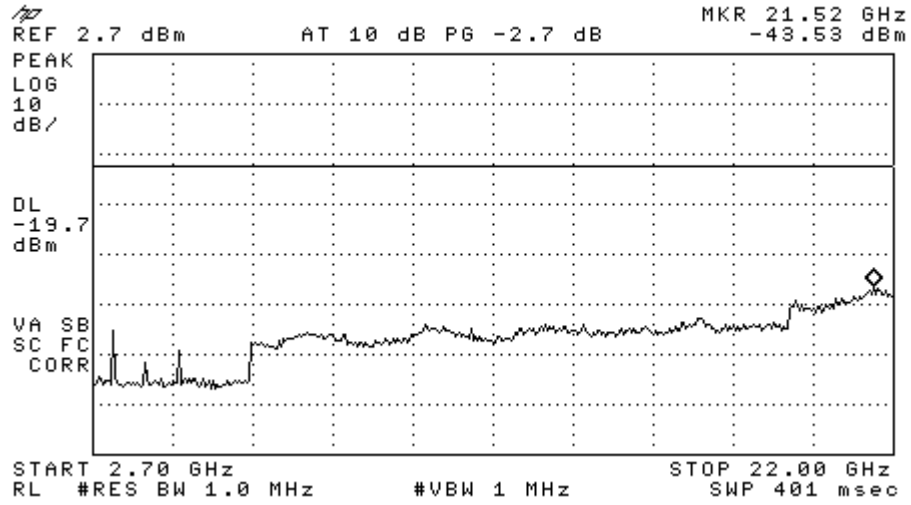


**Figure 9-2b: EDR – 2Mbps Conducted Spurious Emissions (CH 0)**

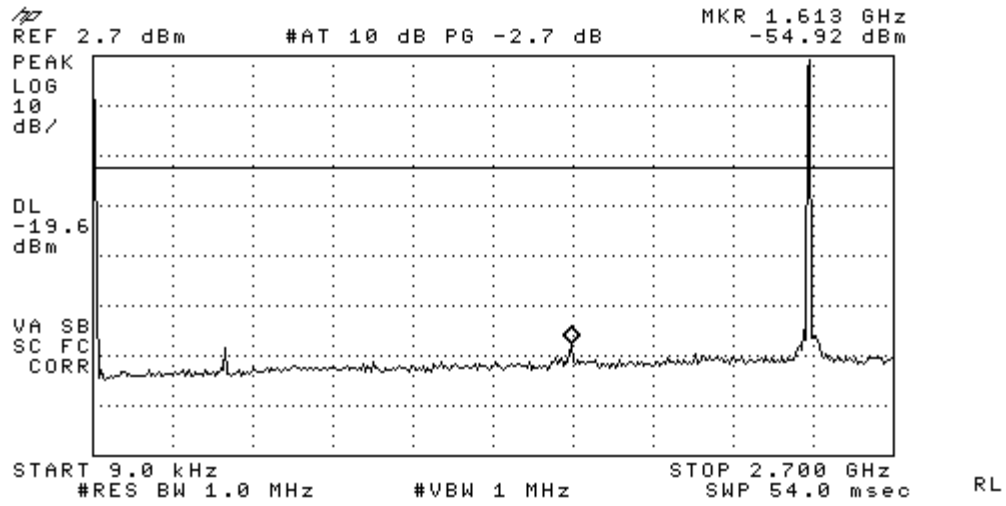


**Figure 9-3a: EDR – 3Mbps Conducted Spurious Emissions (CH 0)**

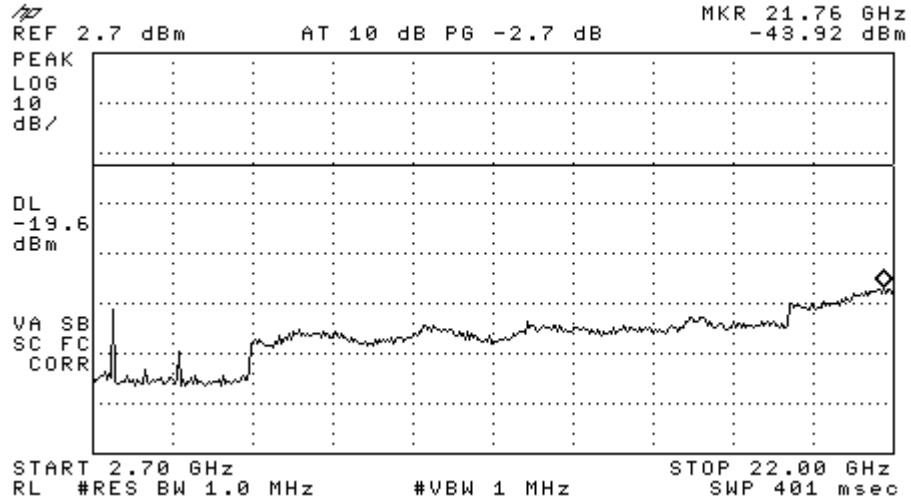


**Figure 9-3b: EDR – 3Mbps Conducted Spurious Emissions (CH 0)**

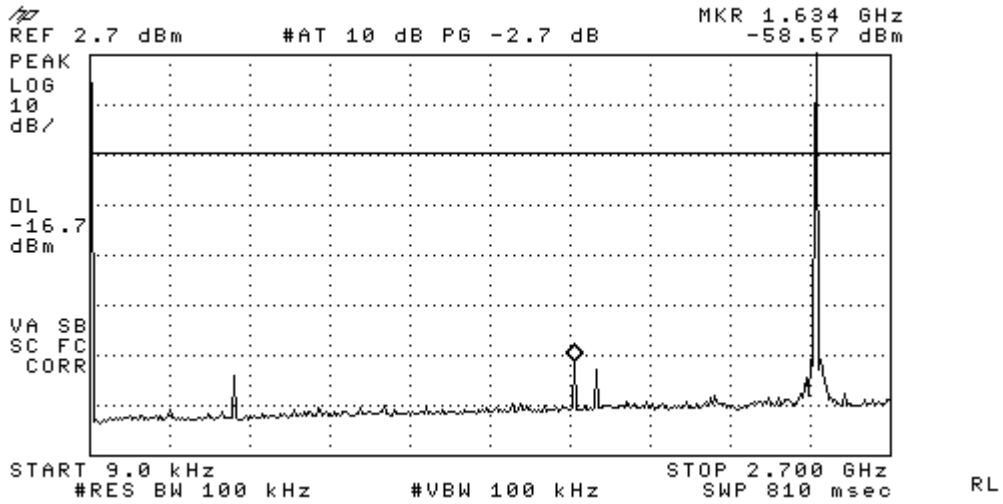


**Figure 9-4a: Basic Rate Conducted Spurious Emissions (CH 39)**

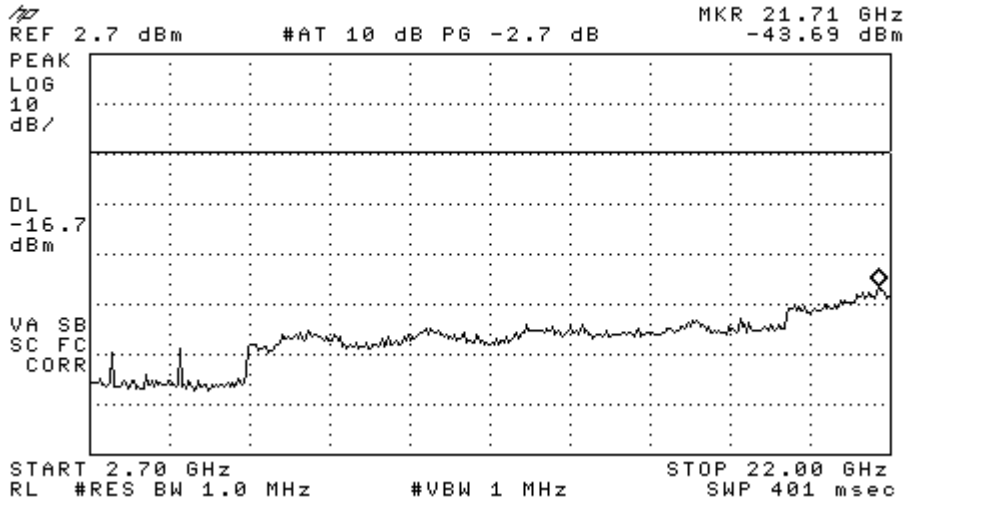


**Figure 9-4b: Basic Rate Conducted Spurious Emissions (CH 39)**

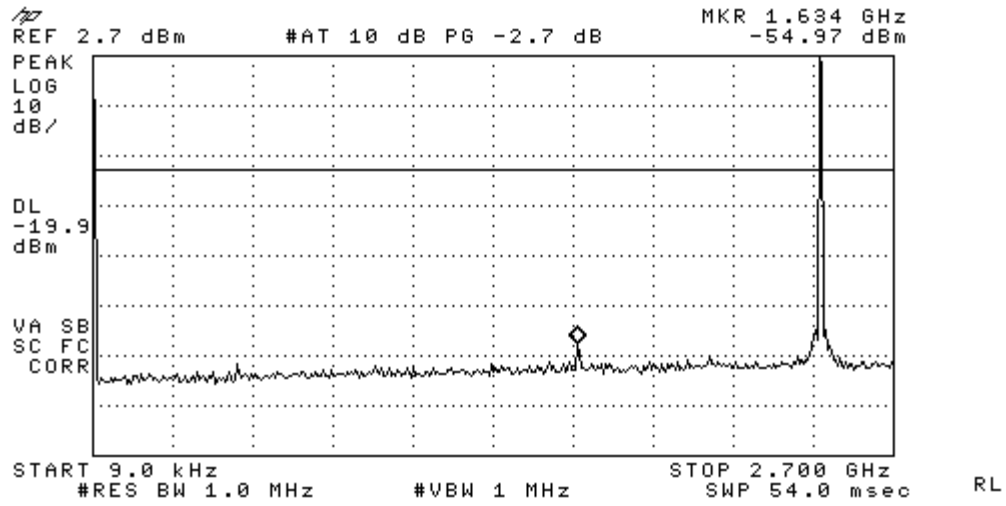


**Figure 9-5a: EDR – 2Mbps Conducted Spurious Emissions (CH 39)**

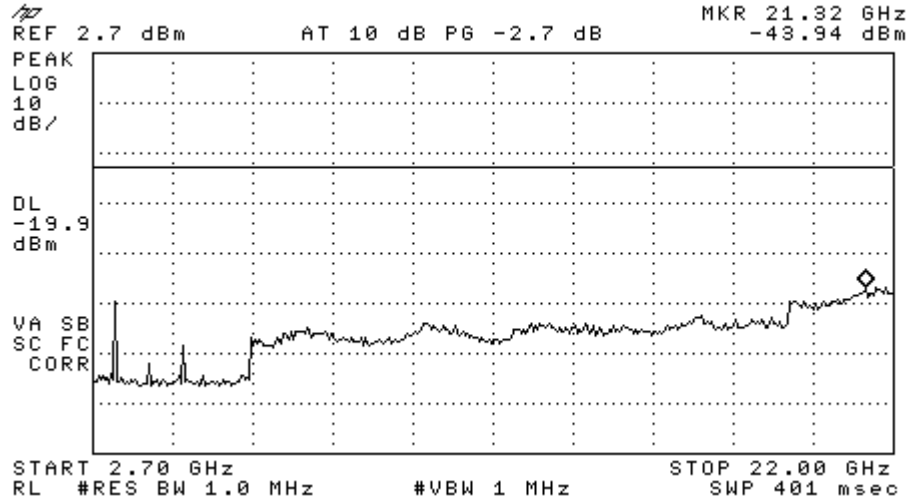


**Figure 9-5b: EDR – 2Mbps Conducted Spurious Emissions (CH 39)**

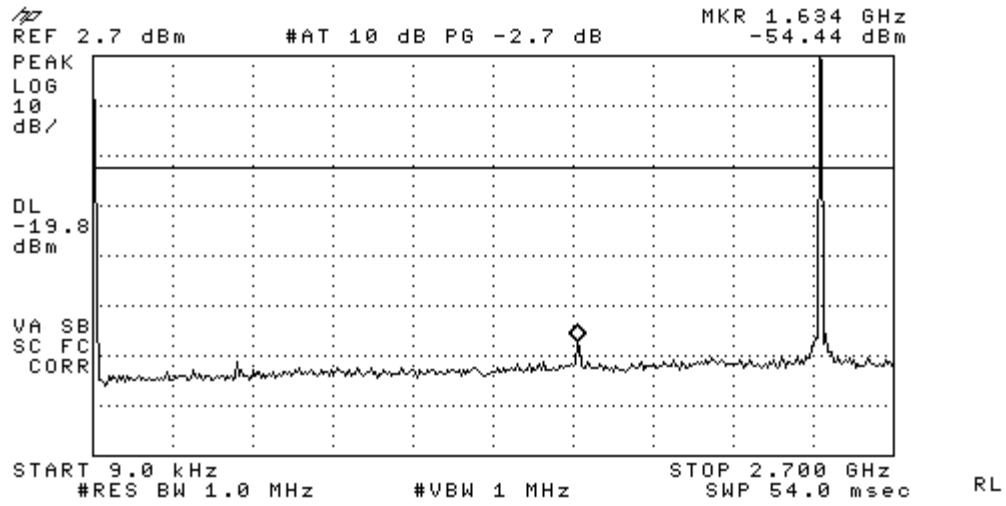


**Figure 9-6a: EDR – 3Mbps Conducted Spurious Emissions (CH 39)**

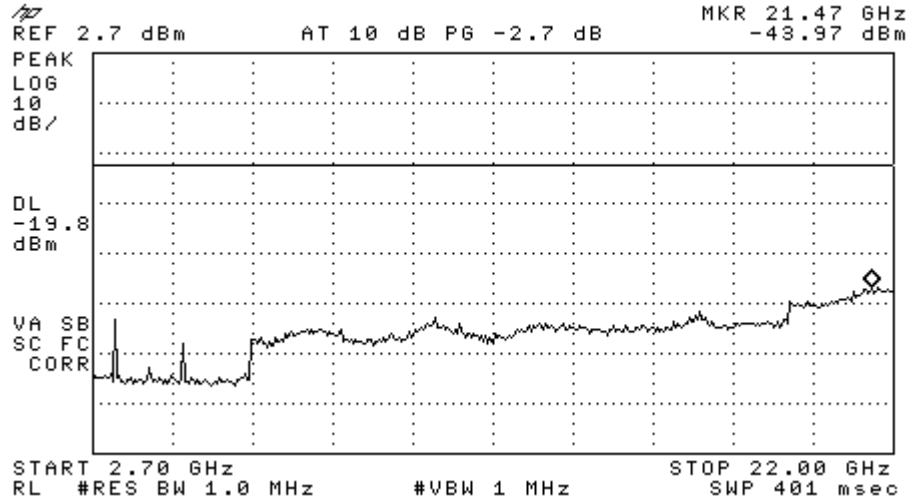


**Figure 9-6b: EDR – 3Mbps Conducted Spurious Emissions (CH 39)**

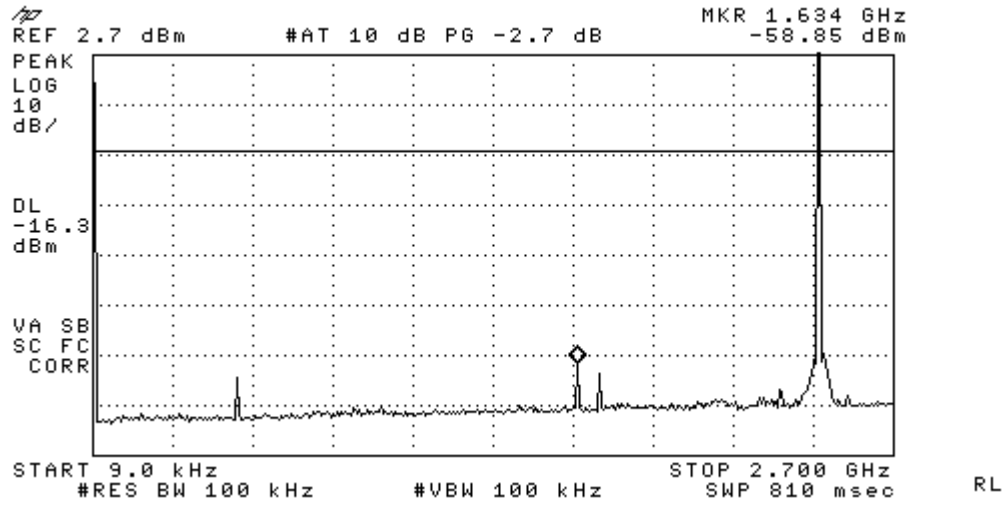


**Figure 9-7a: Basic Rate Conducted Spurious Emissions (CH 78)**

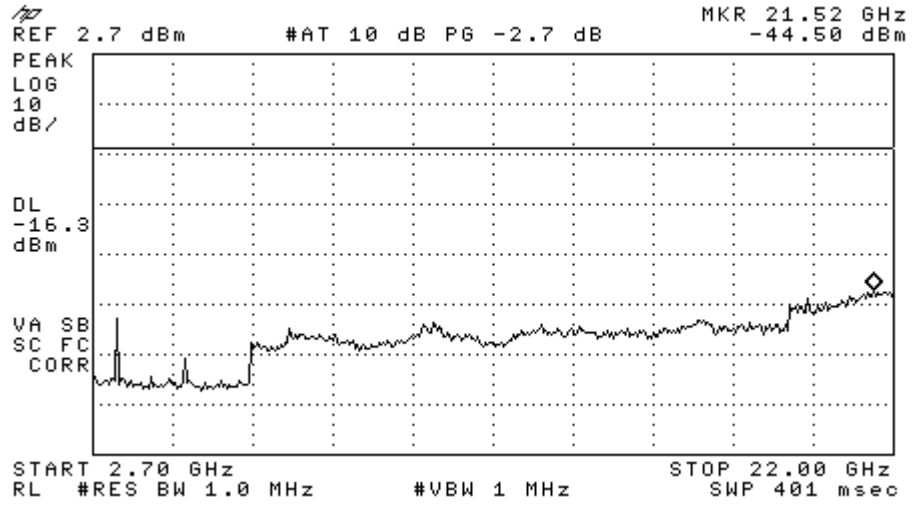


**Figure 9-7b: Basic Rate Conducted Spurious Emissions (CH 78)**

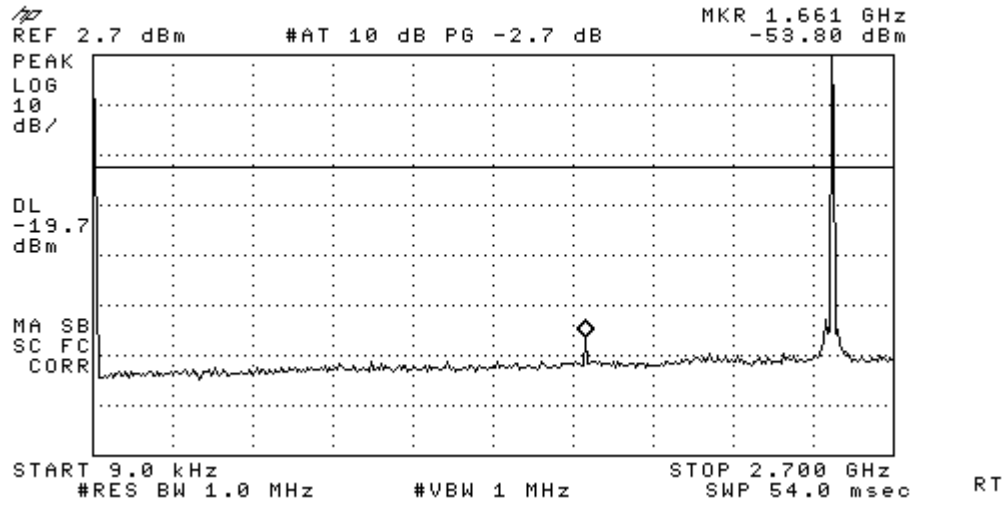


**Figure 9-8a: EDR – 2Mbps Conducted Spurious Emissions (CH 78)**

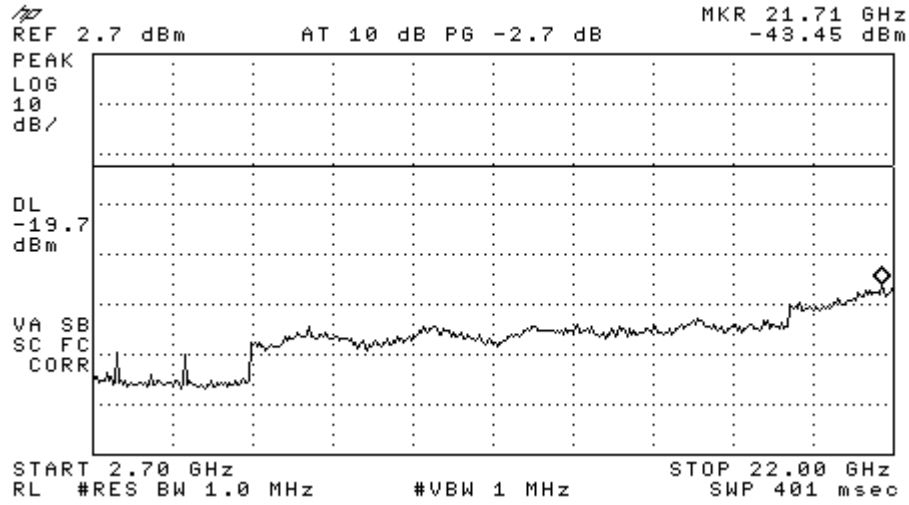


**Figure 9-8b: EDR – 2Mbps Conducted Spurious Emissions (CH 78)**

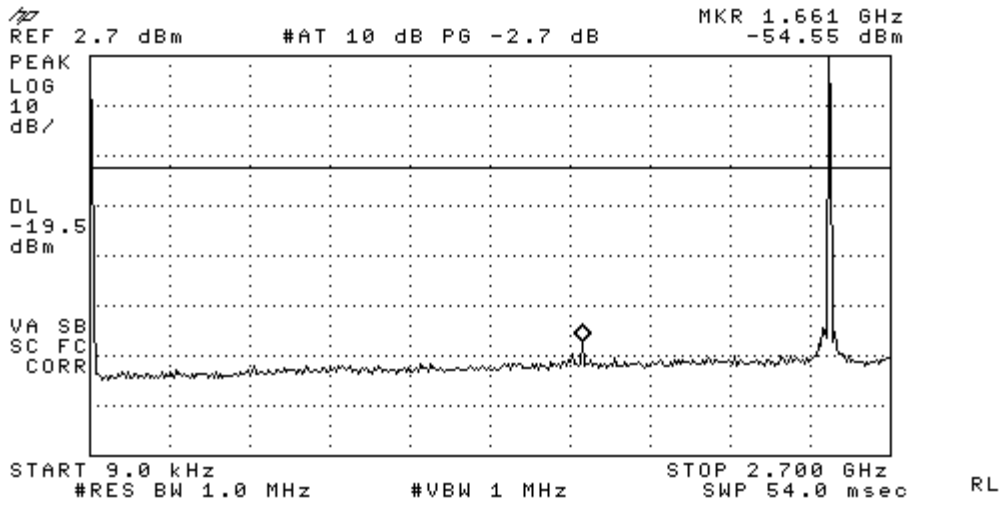


**Figure 9-9a: EDR – 3Mbps Conducted Spurious Emissions (CH 78)**

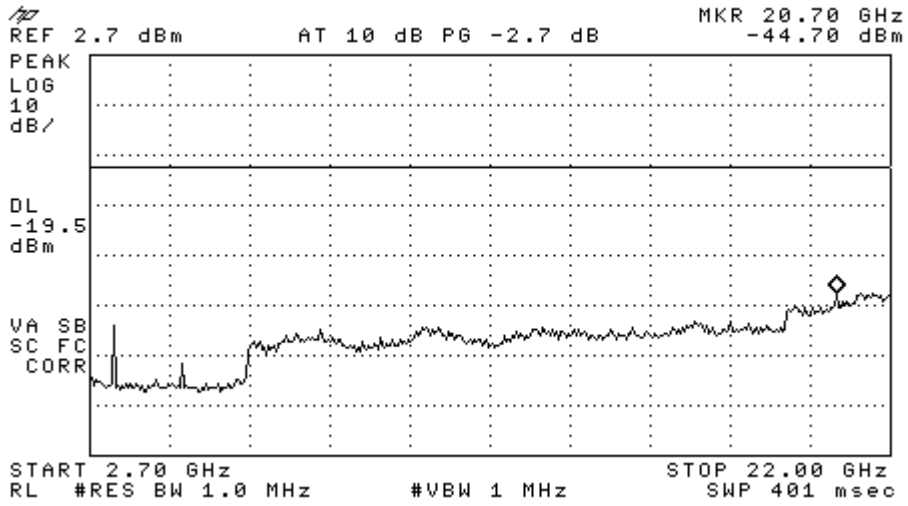


**Figure 9-9b: EDR – 3Mbps Conducted Spurious Emissions (CH 78)**

***Results and Limits:***

| Limit | Modulation | Channel | Result | Comments |
|---|---|---|---|---|
| -20 dBc | Basic Rate | 0 | -47.43dBc | Maximum of emissions is reported here, in the frequency spectrum 9kHz to 22GHz. |
| | EDR – 2Mbps | | -43.80dBc | |
| | EDR – 3Mbps | | -44.31dBc | |
| | Basic Rate | 39 | -46.95dBc | |
| | EDR – 2Mbps | | -44.05dBc | |
| | EDR – 3Mbps | | -44.19dBc | |
| | Basic Rate | 78 | -48.23dBc | |
| | EDR – 2Mbps | | -43.74dBc | |
| | EDR – 3Mbps | | -45.17dBc | |

## 10 AC Power Line Conducted Emissions

| FCC: § 15.247 c, § 15.207 |
|---|
| **Measurement Procedures:**<br><br>The AC power line conducted emissions emission test was performed at Compliance Certification Service, California. The test report is attached as a separate document. |

## 11 Spurious Radiated Emissions

| FCC: § 15.247 c, § 15.209 a |
|---|
| **Measurement Procedures:**<br><br>The radiated spurious emission test was performed at Compliance Certification Service, California. The test report is attached as a separate document. |

## 12 Test Equipment

| Description | Manufacturer | Model Number | Serial Number | Cal Due Date |
|---|---|---|---|---|
| Spectrum Analyzer | Hewlett Packard | 8593EM | 3710A00203 | 03/04/10 |
| Spectrum Analyzer | Hewlett Packard | 8594E | 3810A04238 | 04/03/10 |