

**Test Report on**  
**Tri-Band CDMA Cellular Phone with Bluetooth**

<b>Certification</b>	
FCC Part 15.247 IC RSS-210	
FCC ID:	<b>OVF-K4802</b>
Model:	<b>K48, K48-02, M2000, G2GO</b>

<b>STATEMENT OF CERTIFICATION</b>	
<i>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.</i>	
<b>STATEMENT OF COMPLIANCE</b>	
<i>This product has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C-63.4-2001.</i>	
<b>Date of Test:</b>	May 13– May 14, 2009
<b>Test performed by:</b>	Kyocera Wireless Corp. 10300 Campus Point Drive San Diego, CA – 92121
<b>Report Prepared by:</b>	Thuy To, Regulatory Engineer
<b>Report Approved by:</b>	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

<b>Applicant:</b>	Kyocera Wireless Corp. 10300 Campus Point Drive San Diego CA 92121
<b>FCC ID:</b>	OVF-K4802
<b>Product:</b>	Tri-Band CDMA Cellular Phone with Bluetooth
<b>Model Numbers:</b>	K48, K48-02, M2000, G2GO
<b>EUT Serial Number:</b>	BZ -X---1CYT70
<b>Type:</b>	[X] ] Prototype, [ ] Pre-Production, [ ] Production
<b>Equipment Category:</b>	Portable
<b>TX Frequency (MHz):</b>	2402 to 2480
<b>Channel Number:</b>	79
<b>Channel Spacing (MHz):</b>	1
<b>Bluetooth version:</b>	<input type="checkbox"/> 1.1 <input type="checkbox"/> 1.2 <input type="checkbox"/> 2.0 <input checked="" type="checkbox"/> 2.0 + EDR
<b>Modulation:</b>	Frequency Hopping Spread Spectrum (FHSS)
<b>Max. Output Power (dBm)</b>	2.31 dBm
<b>Antenna:</b>	Internal
<b>Antenna Gain (dBi):</b>	2.0 (Peak)
<b>FCC Rule Parts:</b>	§15.247

## **2 Description of Bluetooth Transmitter**

The OVF-K4802 phones 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 2.0 dBi.

**3 20 dB Bandwidth**

<b>FCC:</b> § 15.247 a1	<b>IC:</b> RSS-210 §6.2.2(o) a1
<b>Measurement Procedure:</b>	
<p>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.</p> <p><u>Frequencies of Interest:</u> Spectrum was investigated from 2400 MHz – 2483.5 MHz.</p>	

**List of Figures:**

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

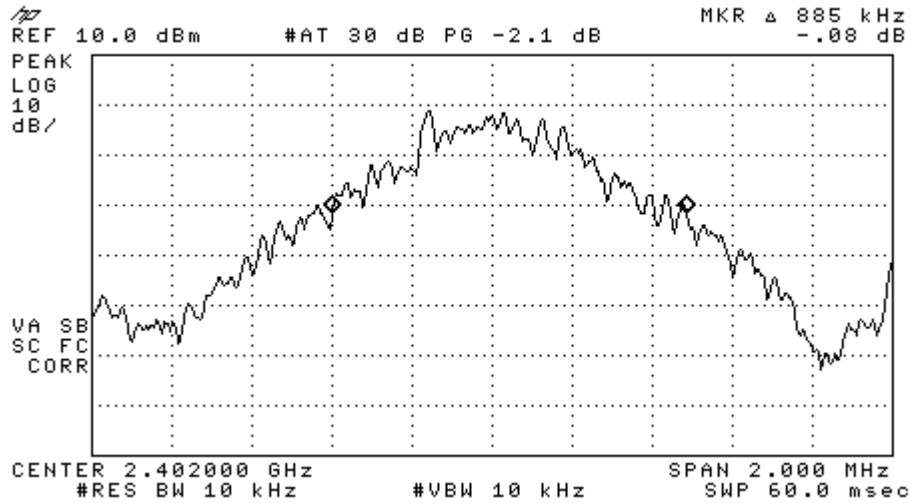


Figure 3-1a: 20dB Bandwidth basic rate, Channel 0.

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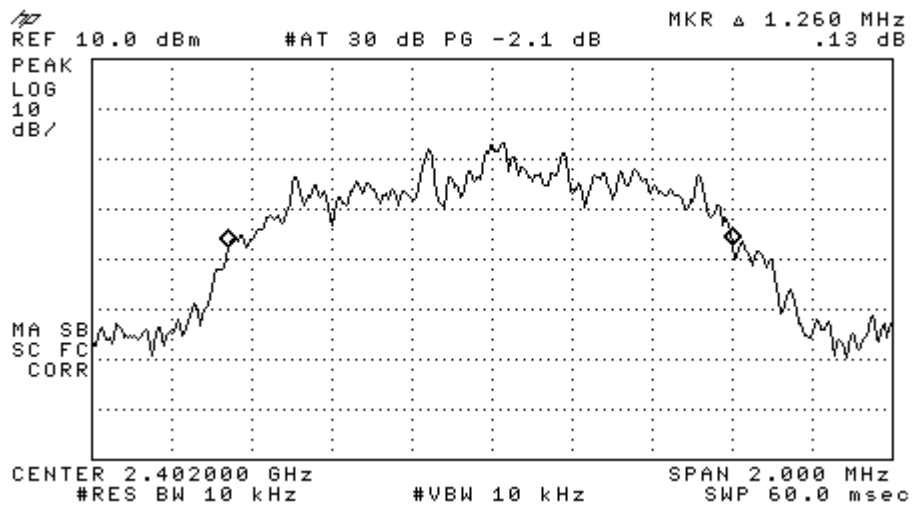


Figure 3-1b: 20dB Bandwidth EDR 2Mbps, Channel 0.

RT

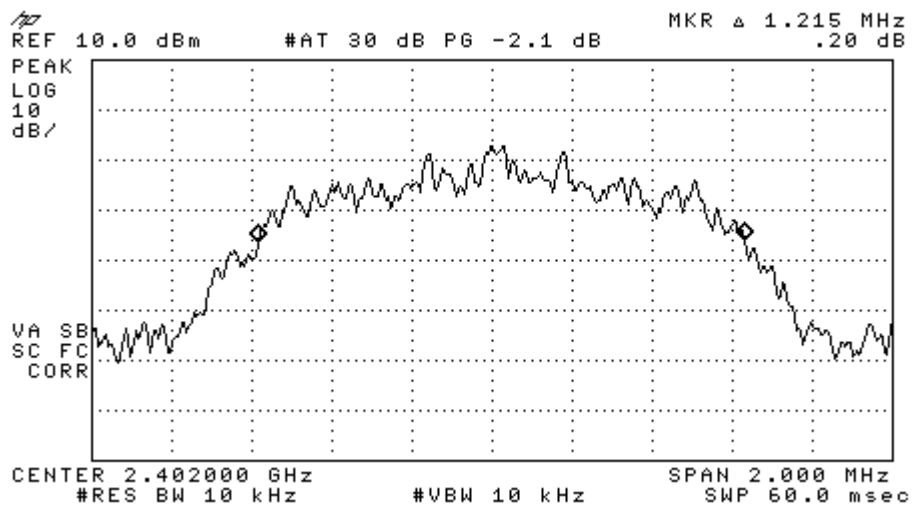


Figure 3-1c: 20dB Bandwidth EDR 3Mbps, Channel 0.

RL

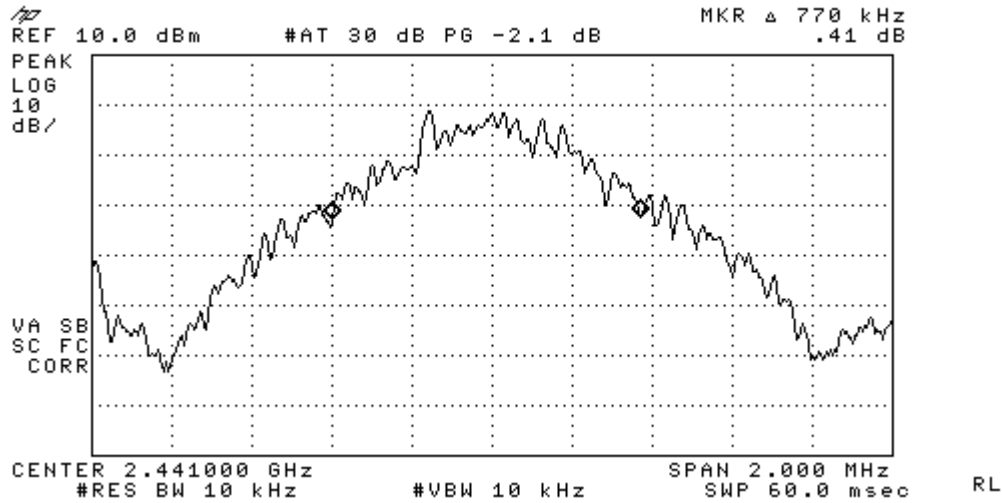


Figure 3-2a: 20dB Bandwidth basic rate, Channel 39.

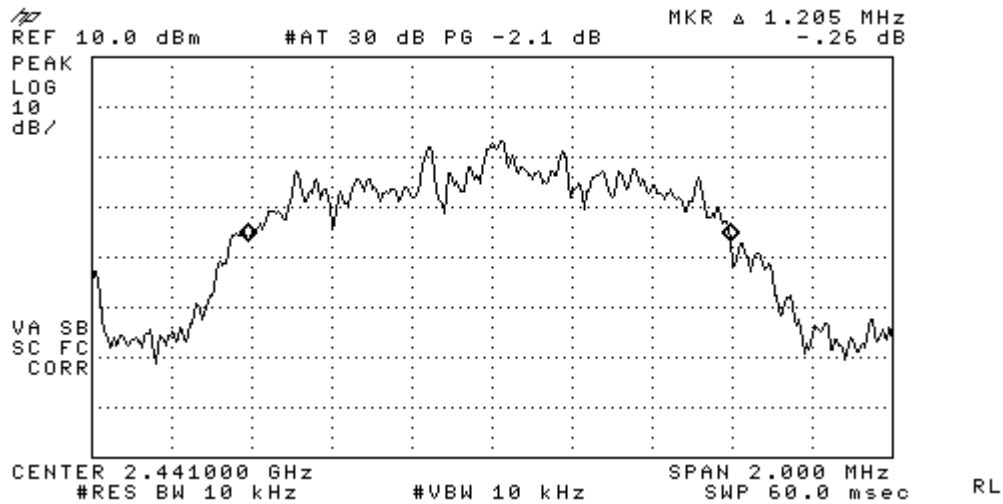


Figure 3-2b: 20dB Bandwidth EDR 2Mbps, Channel 39.

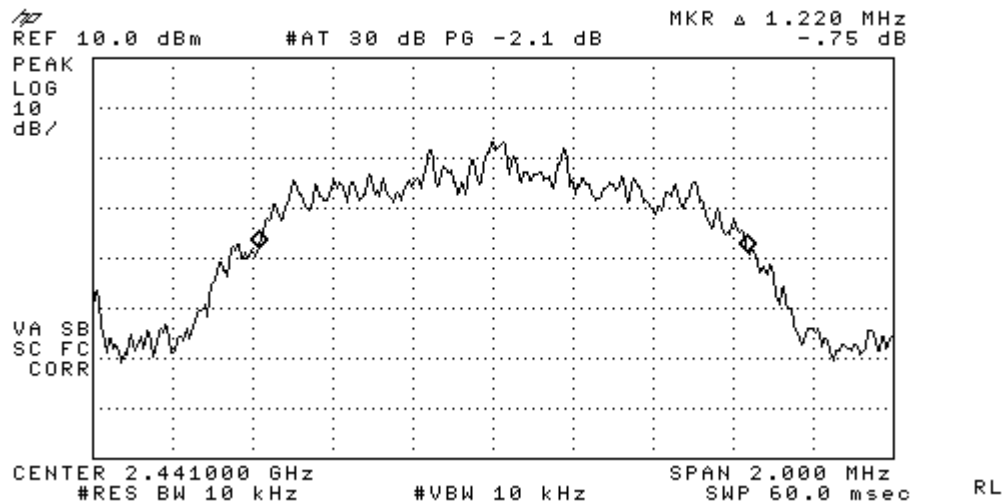
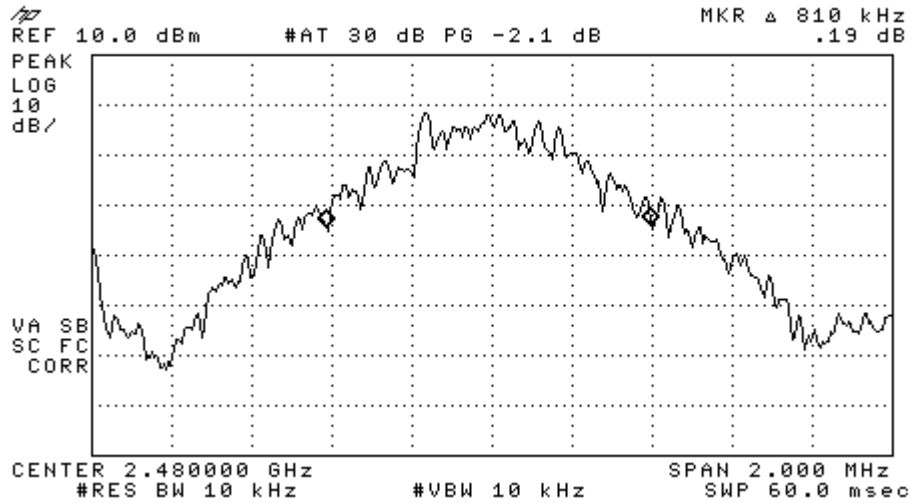
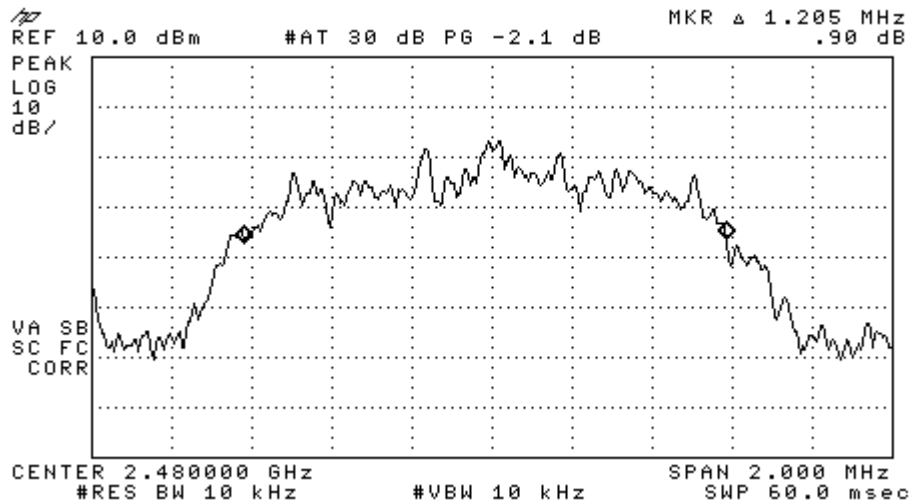


Figure 6-2c: 20dB Bandwidth EDR 3Mbps, Channel 39.



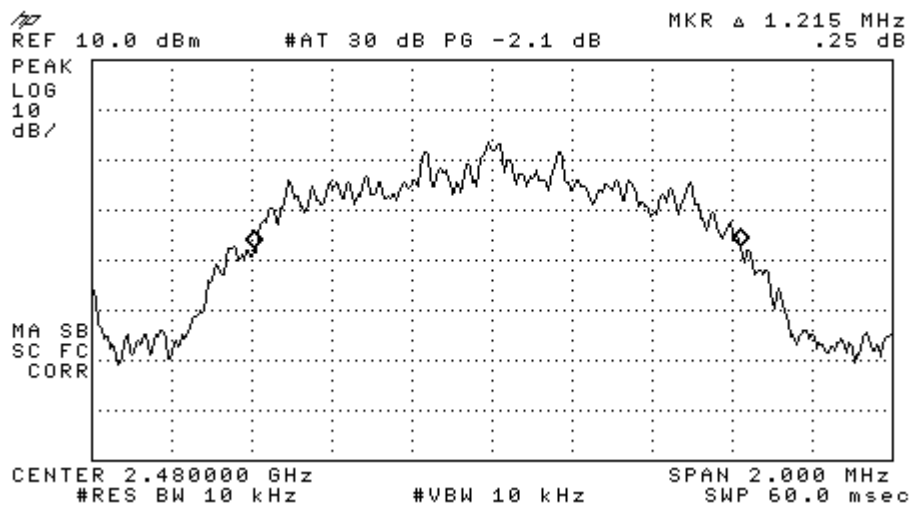
RL

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



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



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



**Results:**

Channel	Modulation	Results	Comments
0	Basic Rate	885 kHz	Delta marker on the spectrum analyzer was moved from the center frequency until -20dBc to measure the 20dB-bandwidth.
	EDR – 2Mbps	1.260 MHz	
	EDR – 3Mbps	1.215 MHz	
39	Basic Rate	770 kHz	
	EDR – 2Mbps	1.205 MHz	
	EDR – 3Mbps	1.220 MHz	
78	Basic Rate	810 kHz	
	EDR – 2Mbps	1.205 MHz	
	EDR – 3Mbps	1.215 MHz	

#### 4 Carrier Frequency Separation

<b>FCC:</b> § 15.247 a1	<b>IC:</b> RSS-210 §A8.1(2)
<b>Measurement Procedure:</b>	
<p>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.</p> <p><u>Frequencies of Interest:</u> Spectrum was investigated from 2400 MHz – 2483.5 MHz.</p> <p><u>Comments:</u> The carrier frequency separation is independent of modulation and packet length (DH1, DH3, etc.).</p>	

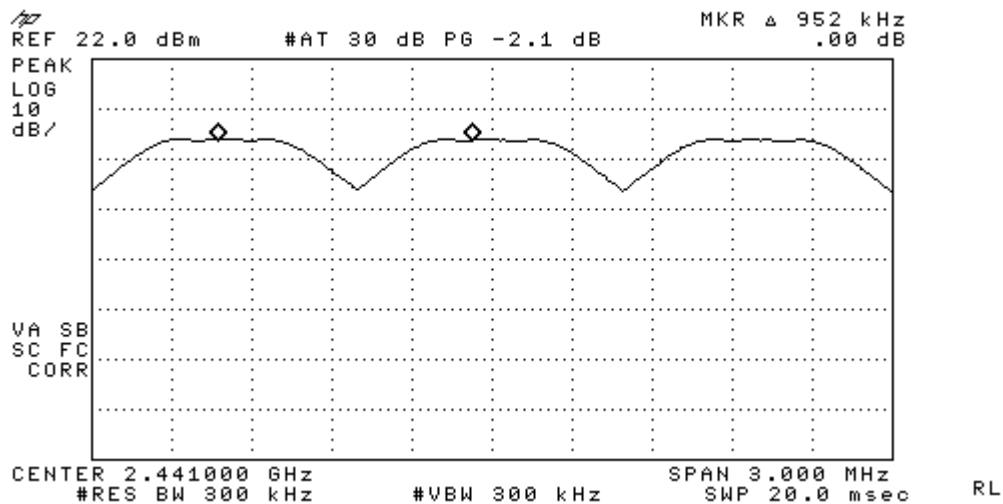


Figure 4: Carrier Frequency Separation between channels 38, 39 (mid-channel) & 40.

#### Results and Limits:

Limits	Frequency Separation	2/3 of 20 dB Bandwidth	Result
a) $\geq 25$ kHz or 20 dB Bandwidth, whichever is greater 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.	952 kHz	840 kHz <sup>1</sup>	Pass

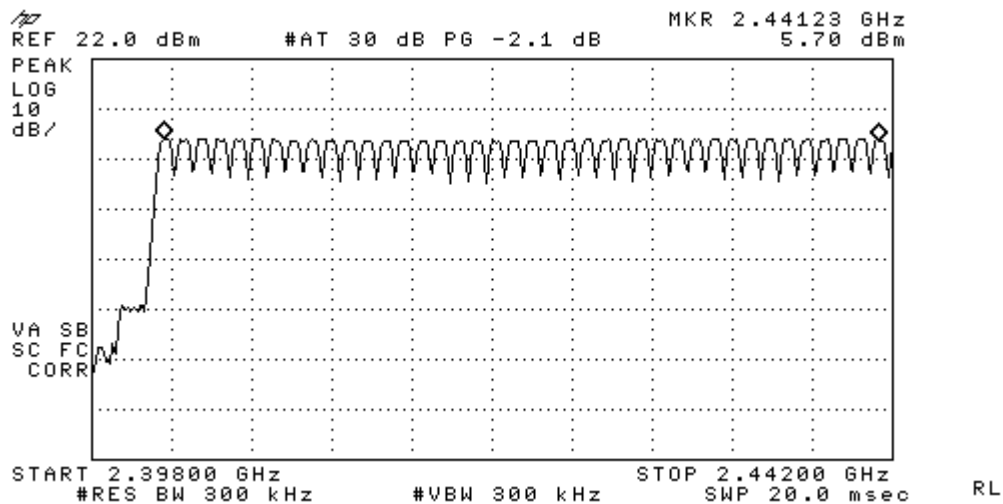
<sup>1</sup> 2/3 \* 1260 kHz = 840 kHz.

## 5 Number of Hopping Frequencies

<b>FCC:</b> § 15.247 a1 iii	<b>IC:</b> RSS-210 §A8.1 (4)
<b>Measurement Procedure:</b>	
<p>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.</p> <p><u>Frequencies of Interest:</u> Spectrum was investigated from 2400 MHz – 2483.5 MHz.</p> <p><u>Comments:</u> The number of frequency hopping is independent of modulation and packet length (DH1, DH3, etc.).</p>	

**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)**

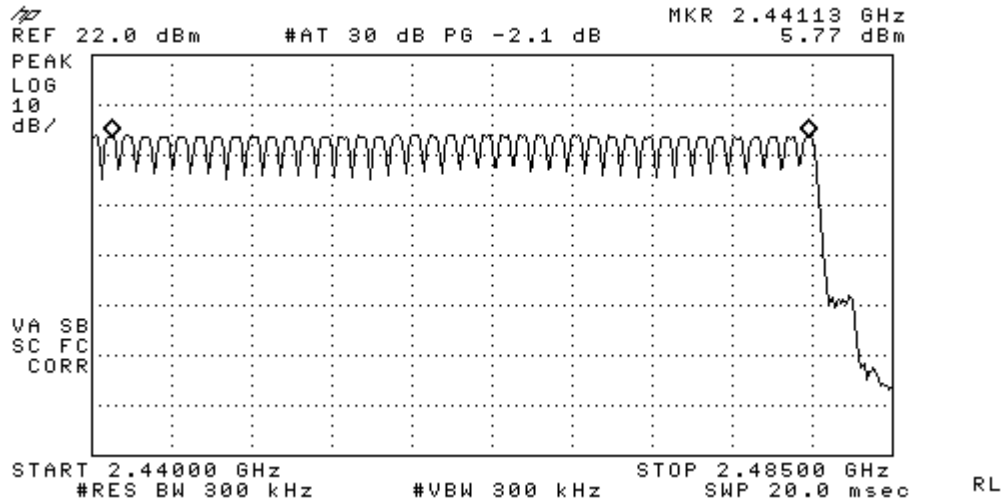


Figure 5b: Number of Hopping Frequencies (Channels 39-78)

**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)

<b>FCC:</b> § 15.247 a1 ii, § 15.247 f	<b>IC:</b> RSS-210 §A8.1 (4)
<b>Measurement Procedure:</b>	
<p>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.</p>	
<b>Comments:</b>	
<p>The dwell time is independent of modulation and packet length (DH1, DH3, etc.).</p> <p>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:</p> <p>Duration of one transmission*(1600 hops/sec)/(No. of time-slots)/(79 channels)*31.6 sec</p> <p>For a DH1 (1 time-slot) packet type, ideally the duration of one transmission is 625 μs. Therefore, the dwell time is given by:</p> <p><math>625 \mu\text{s} * 1600 / \text{s} / (1 \text{ time-slot}) / 79 * 31.6 \text{ s} = 0.4 \text{ s}</math>.</p>	
<b>Spectrum Analyzer Parameters:</b>	
<p>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).</p>	

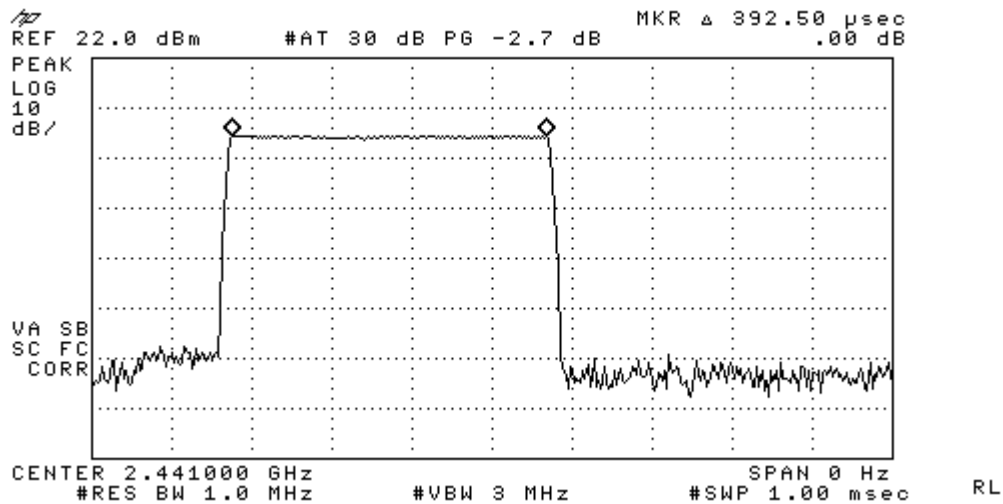


Figure 6: Duration of one transmission (Channel 39)

11

### Results and Limits:

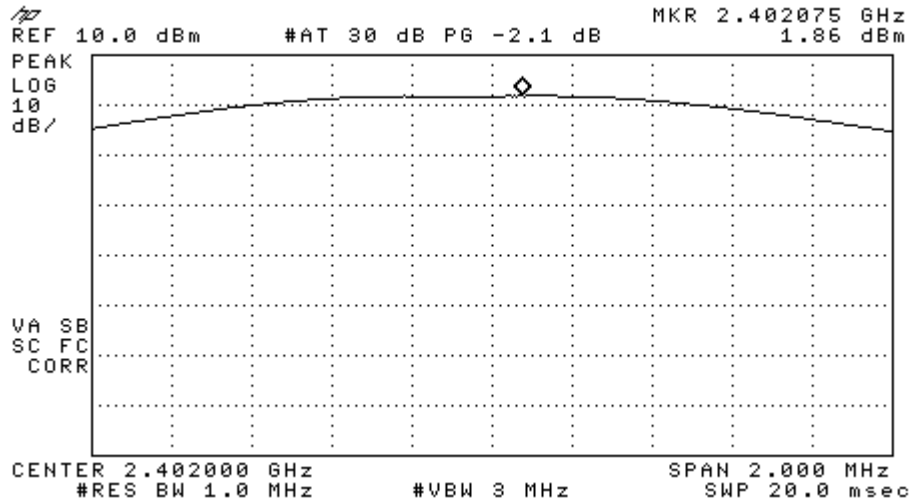
Limits	Channel	Results	Comments
≤ 0.4 s (in a period of 31.6 s)	Hopping (DH1 packet)	0.2512 s {[(395μ*1600)/1]/79}*31.6	Mid-channel (CH 39) was measured here.

## 7 Peak Output Power

<b>FCC:</b> § 15.247 b1	<b>IC:</b> RSS-210 §A8.4 (2)
<b>Measurement Procedure:</b>	
<p>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.</p>	
<p><u>Frequencies of Interest:</u> Spectrum was investigated from 2400 MHz – 2483.5 MHz.</p>	

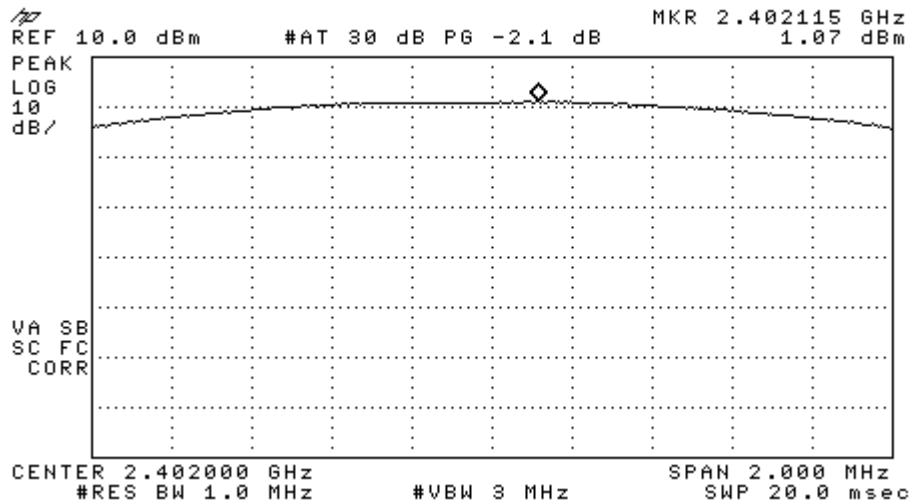
### List of Figures:

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



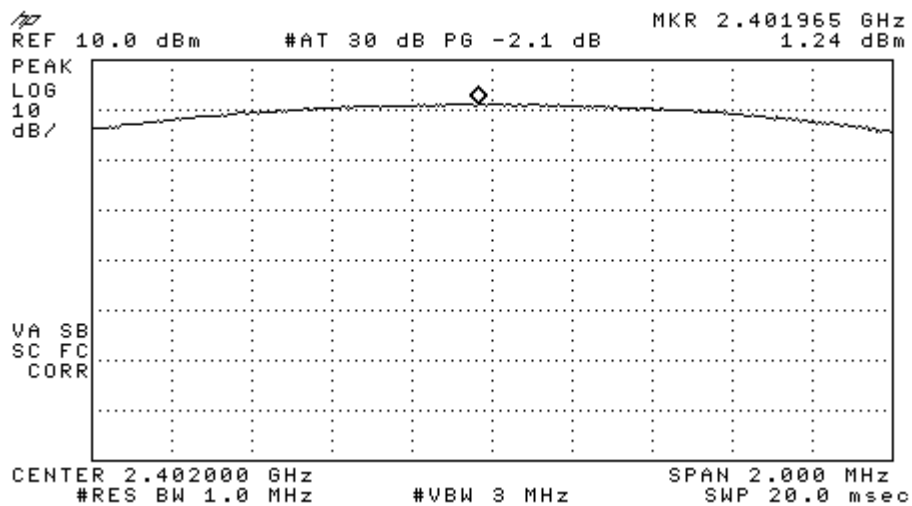
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Figure 7-1a: Peak Output Power, Channel 0.



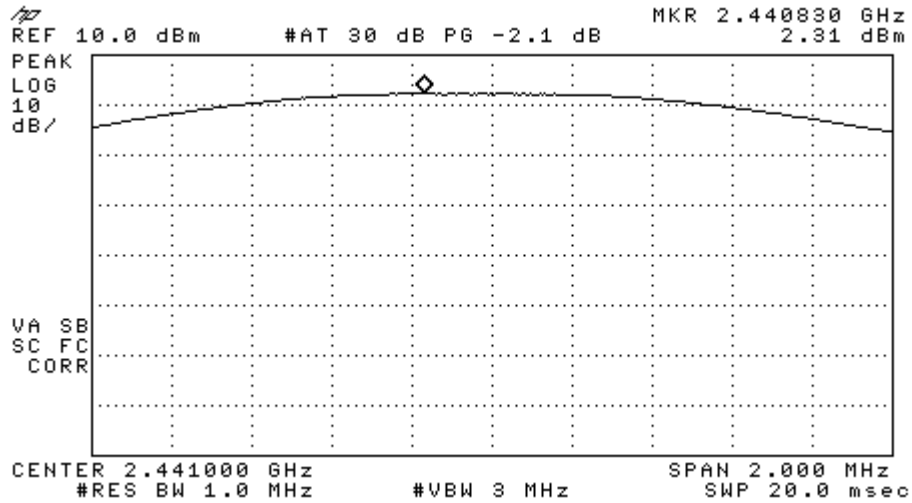
RL

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



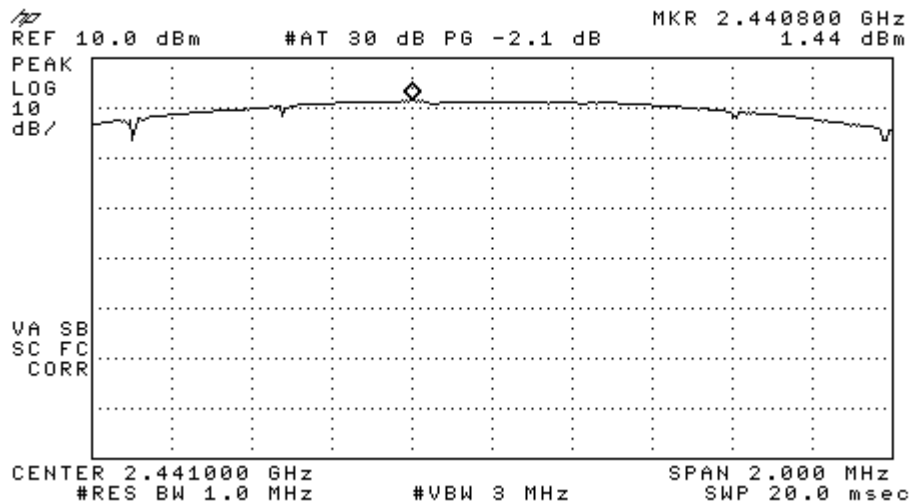
RL

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



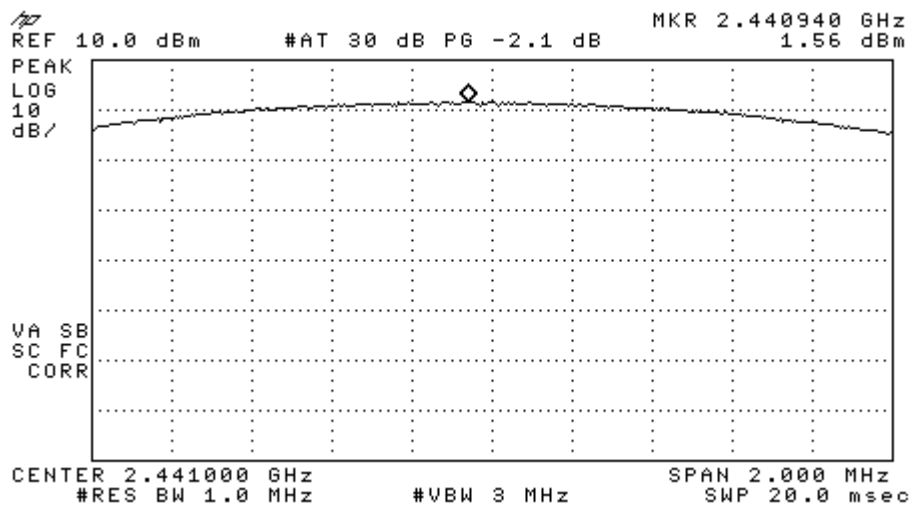
RL

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



RL

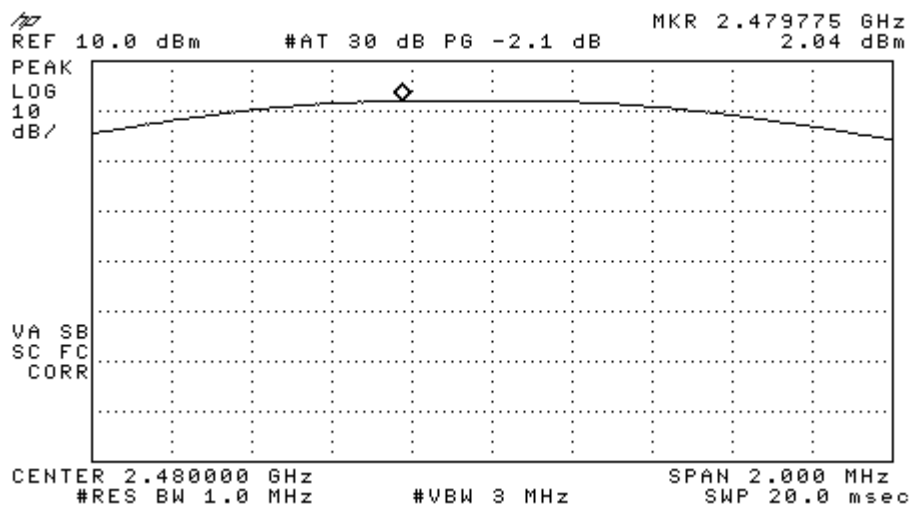
Figure 7-2b: EDR 2Peak Output Power, Channel 39.



RL

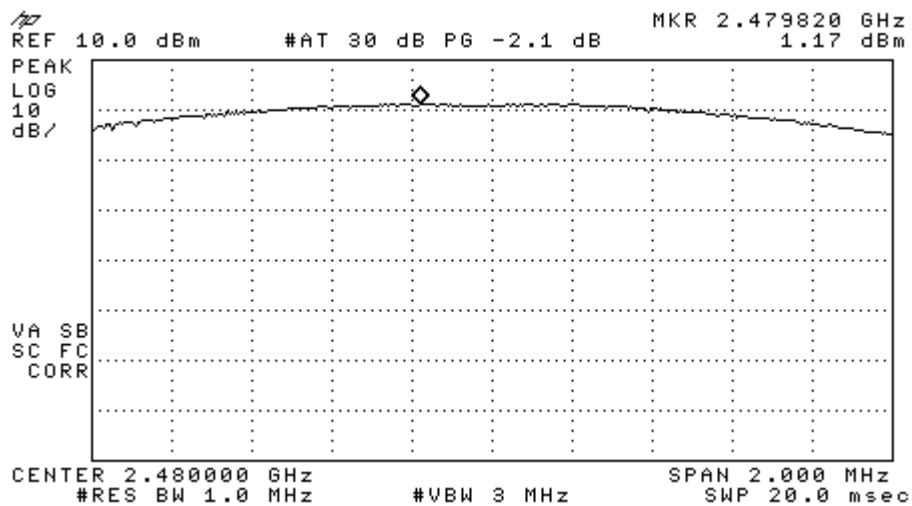
Figure 7-2c: EDR 3Peak Output Power, Channel 39.





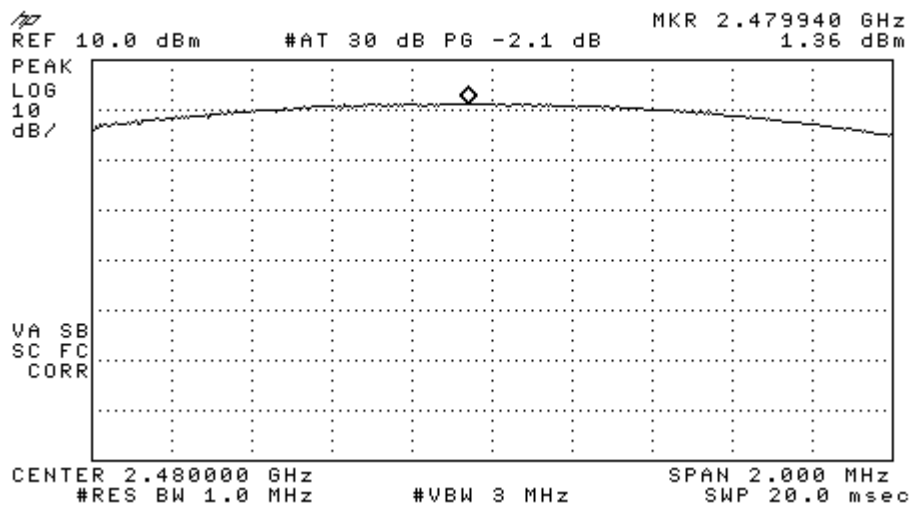
RL

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



RL

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



RL

Figure 7-3c: EDR 3 Peak 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	1.86	Signal loss from the cable connecting the Bluetooth output port and spectrum analyzer is calibrated out.
	EDR – 2Mbps		1.07	
	EDR – 3Mbps		1.24	
	Basic Rate	39	2.31	
	EDR – 2Mbps		1.44	
	EDR – 3Mbps		1.56	
	Basic Rate	78	2.04	
	EDR – 2Mbps		1.17	
	EDR – 3Mbps		1.36	

## 8 Band-edge Compliance of Conducted Emissions

<b>FCC:</b> § 15.247 c	<b>IC:</b> RSS-210 §A8.5
<b>Measurement Procedure:</b>	
<p>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.</p> <p><u>Frequencies of Interest:</u> Spectrum was investigated from 2400 MHz – 2483.5 MHz.</p>	

**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

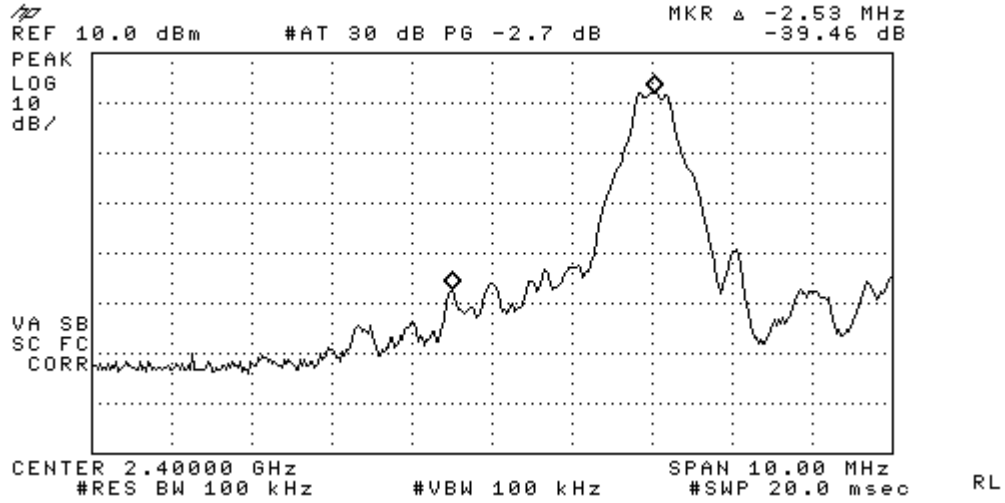


Figure 8-1a: Basic Rate Low band edge with hopping disabled.

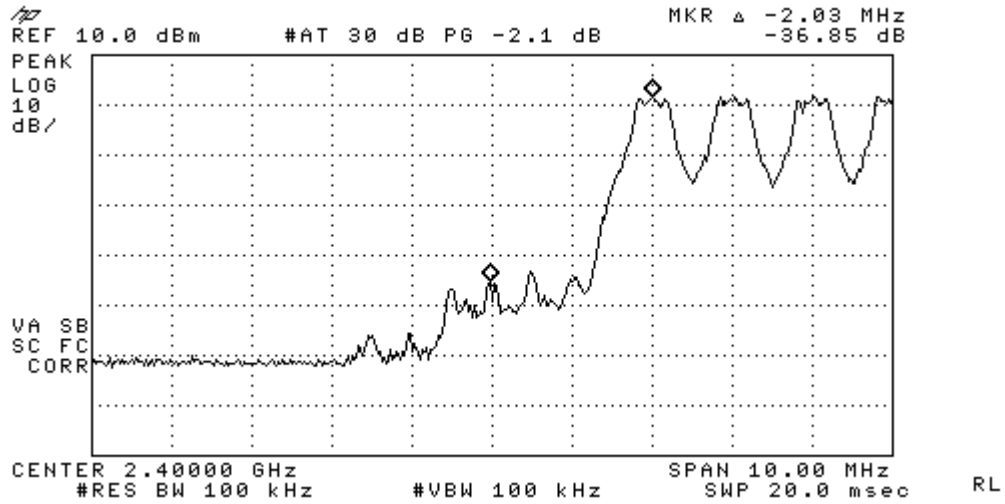


Figure 8-1b: Basic Rate Low band edge with hopping enabled.

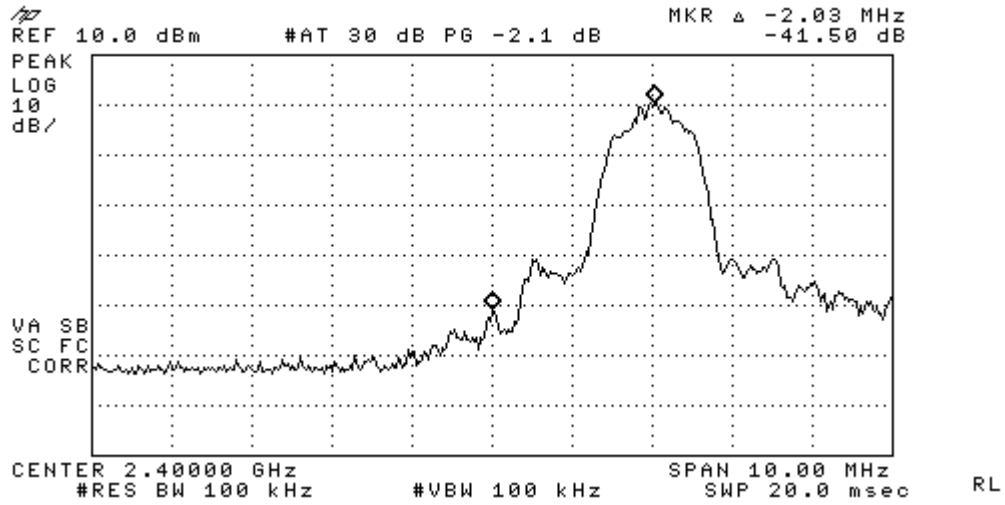


Figure 8-2a: EDR – 2Mbps Low band edge with hopping disabled.

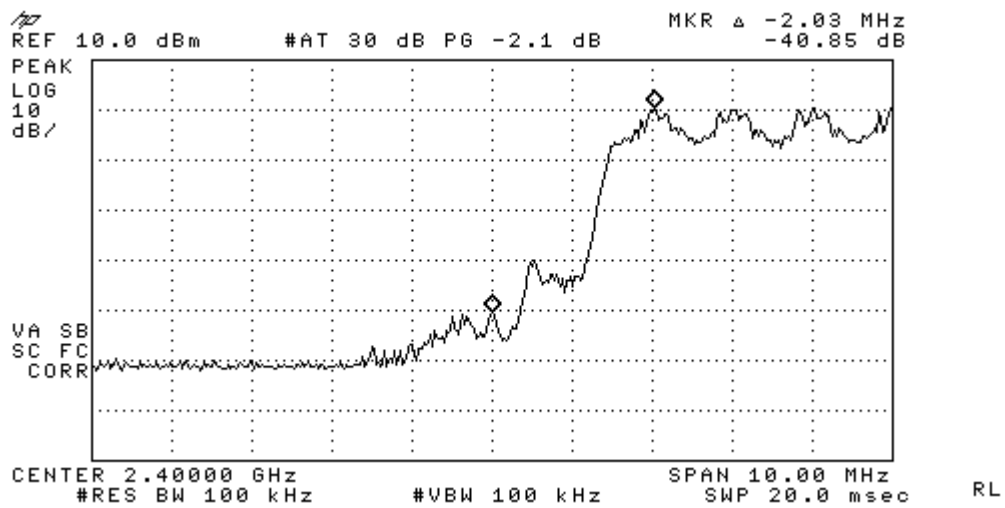


Figure 8-2b: EDR – 2Mbps Low band edge with hopping enabled.

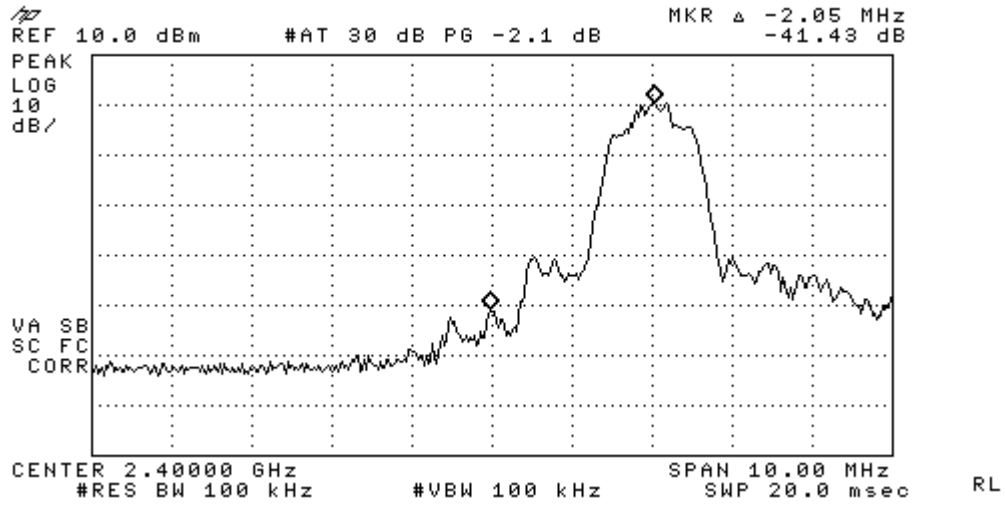


Figure 8-3a: EDR – 3Mbps Low band edge with hopping disabled.

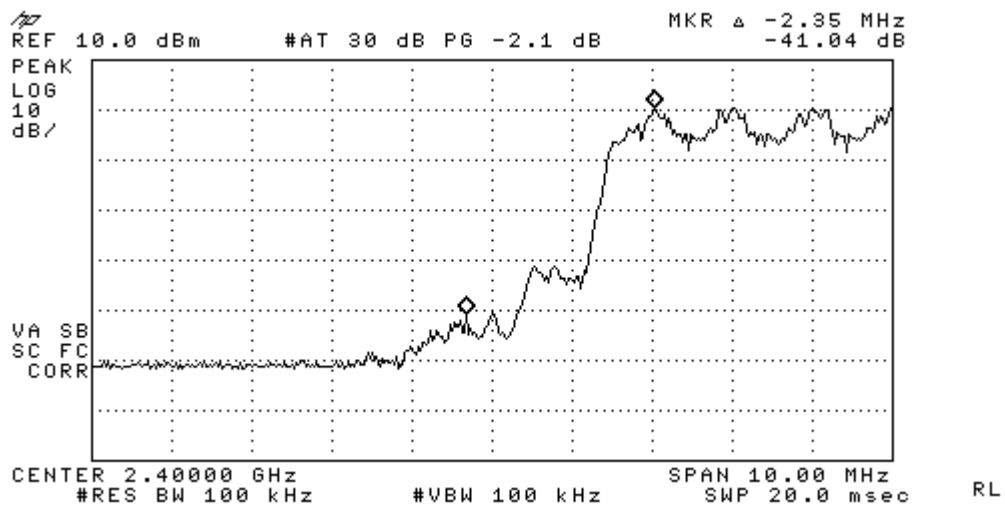


Figure 8-3b: EDR – 3Mbps Low band edge with hopping enabled.

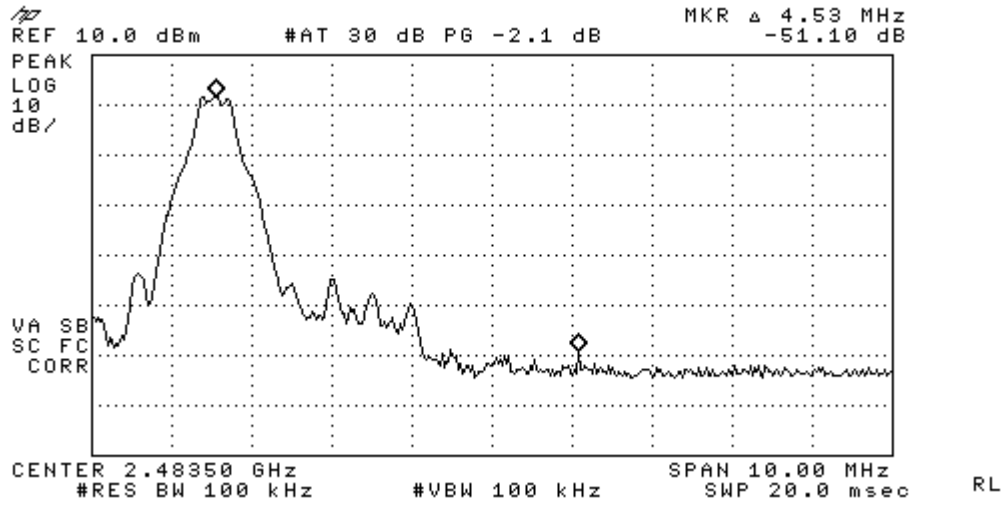


Figure 8-4a: Basic Rate High band edge with hopping disabled.

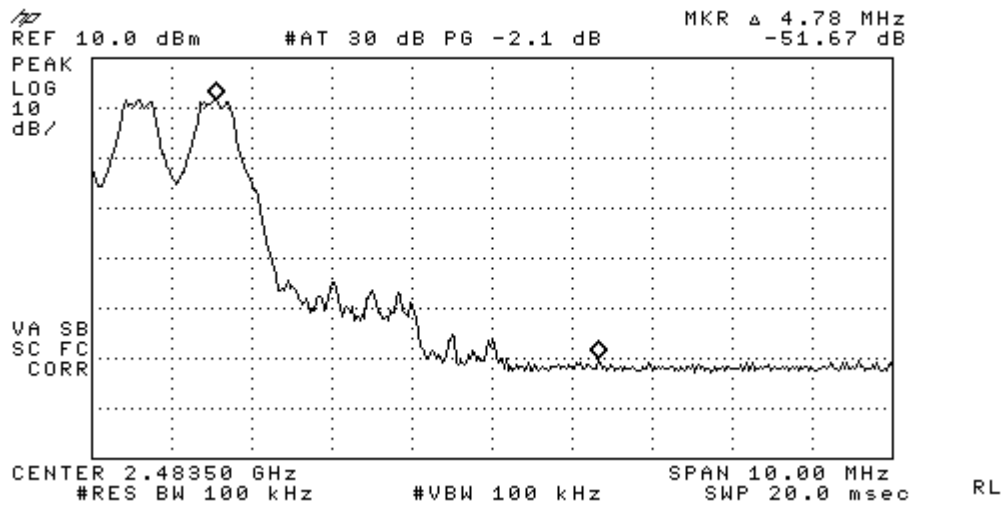


Figure 8-4b: Basic Rate High band edge with hopping enabled.

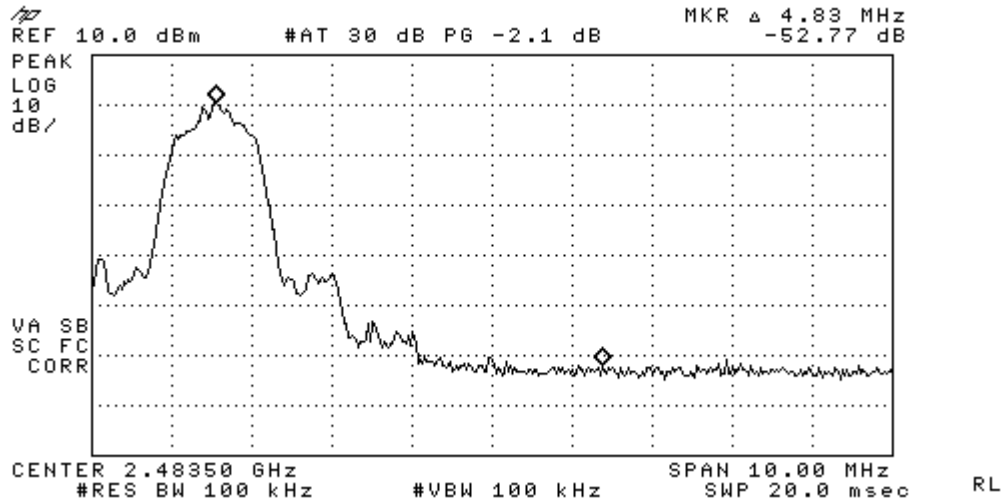


Figure 8-5a: EDR – 2Mbps High band edge with hopping disabled.

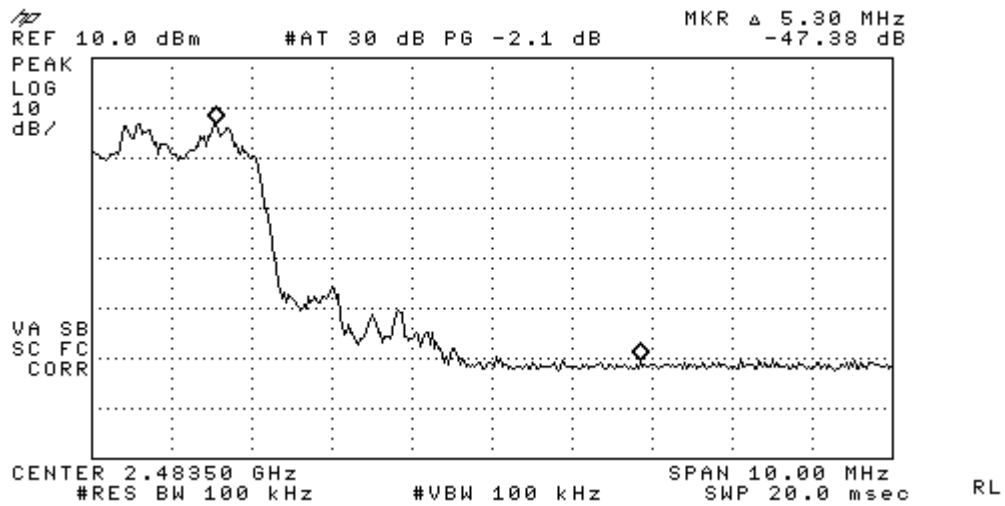


Figure 8-5b: EDR – 2Mbps High band edge with hopping enabled.



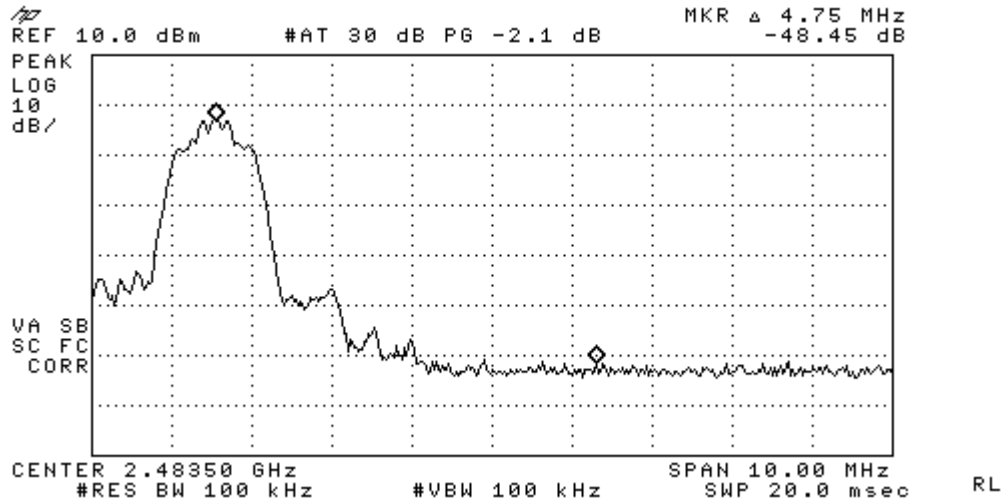


Figure 8-6a: EDR – 3Mbps High band edge with hopping disabled.

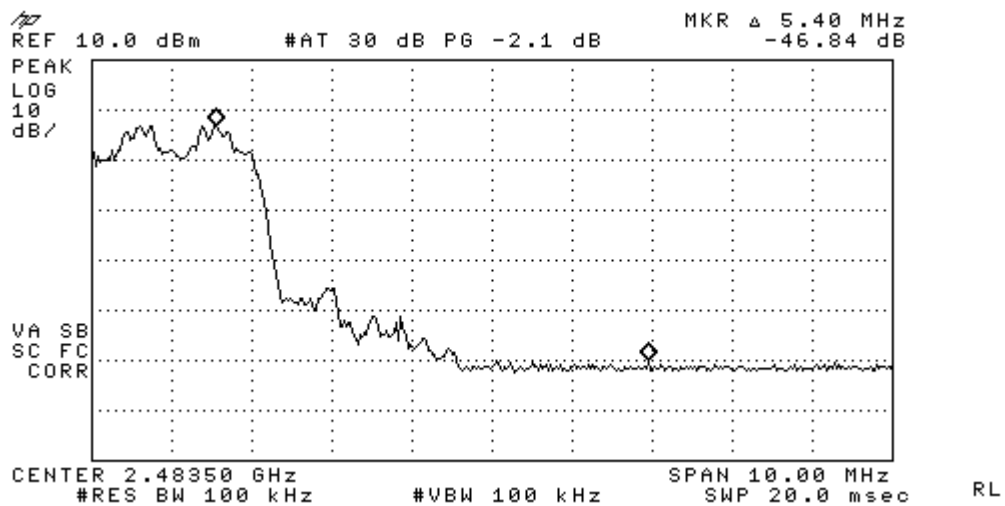


Figure 8-6b: EDR – 3Mbps High band edge with hopping enabled.

**Results and Limits:**

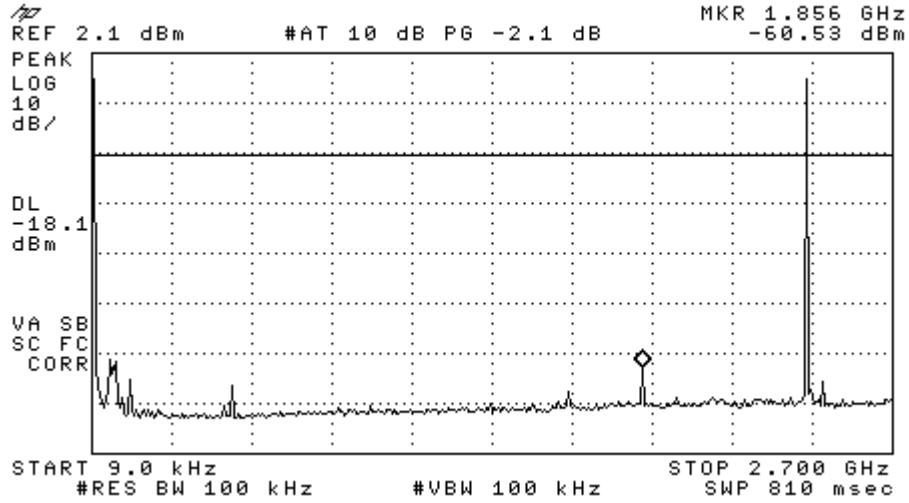
Limits	Edge	Modulation	Channel	Results	Comments
≤ -20 dBc	Low Band Edge	Basic Rate	0	-39.46	In any 100kHz band, the highest radio frequency power outside the band (2400-2483.5 MHz) is measured to be at least 20 dB below the desired power of intentional radiator within the band.
			Hopping	-36.85	
		EDR – 2Mbps	0	-41.50	
			Hopping	-40.85	
		EDR – 3Mbps	0	-41.43	
			Hopping	-41.04	
	High Band Edge	Basic Rate	78	-51.10	
			Hopping	-51.67	
		EDR – 2Mbps	78	-52.77	
			Hopping	-47.38	
EDR – 3Mbps	78	-48.45			
	Hopping	-46.84			

## 9 Spurious RF Conducted Emissions

<b>FCC:</b> § 15.247 c	<b>IC:</b> RSS-210 §A8.5
<b>Measurement Procedure:</b>	
<p>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.</p> <p><u>Frequencies of Interest:</u> Spectrum was investigated from 9kHz – 25 GHz.</p> <p><u>Comments:</u> Spurious RF Conducted Emission testing was performed only with Basic Rate since the conducted power was highest in comparison with the other modulation.</p>	

**List of Figures:**

Figure	Channel	Plot Description
9-1a	0	Conducted spurious emissions, 9kHz to 2.7GHz
9-1b		Conducted spurious emissions, 2.7GHz to 25GHz
9-2a	39	Conducted spurious emissions, 9kHz to 2.7GHz
9-2b		Conducted spurious emissions, 2.7GHz to 25GHz
9-3a	78	Conducted spurious emissions, 9kHz to 2.7GHz
9-3b		Conducted spurious emissions, 2.7GHz to 25GHz



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

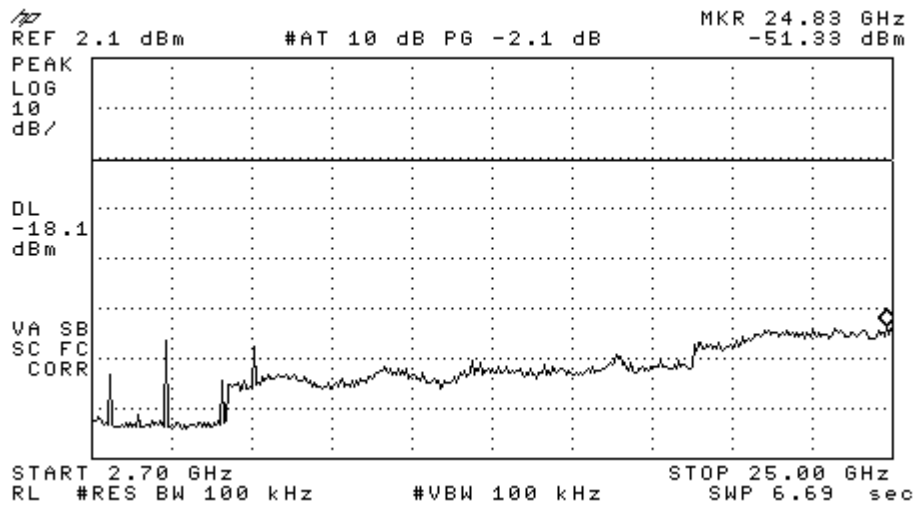


Figure 9-1b: Basic Rate Conducted Spurious Emissions (CH 0)

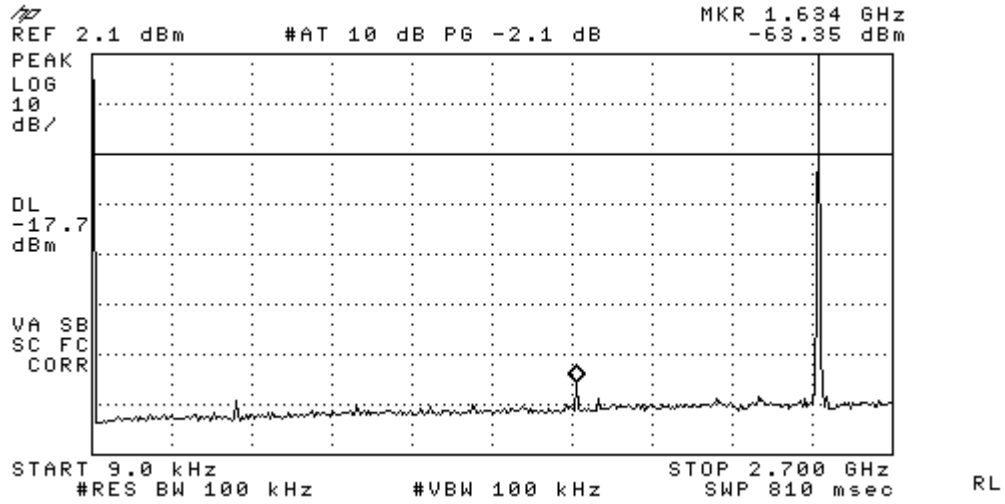


Figure 9-2a. Conducted Spurious Emissions (CH 39)

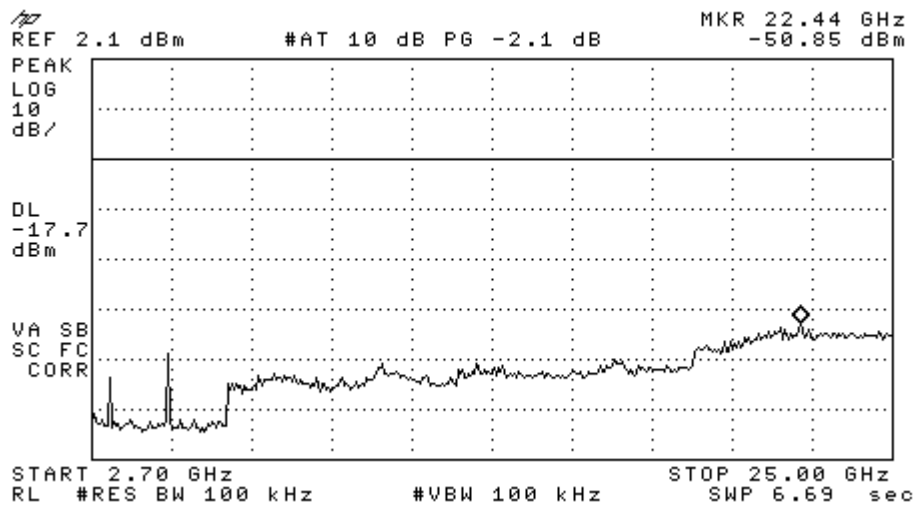


Figure 9-2b. Conducted Spurious Emissions (CH 39)

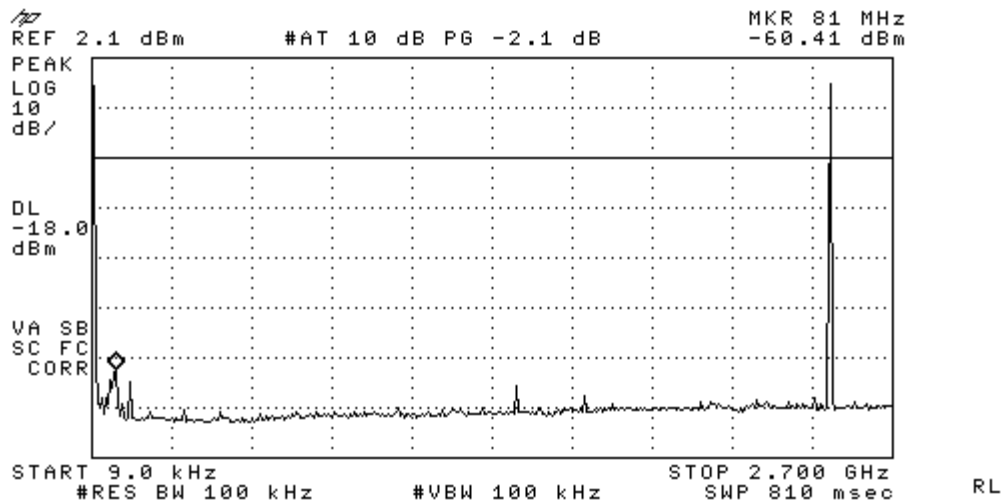


Figure 9-3a. Conducted Spurious Emissions (CH 78)

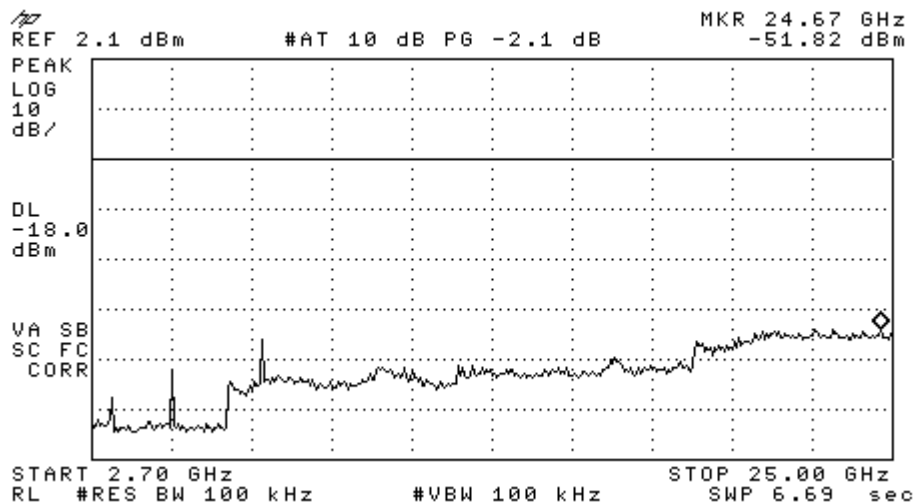


Figure 9-3b. Conducted Spurious Emissions (CH 78)

**Results and Limits:**

Limits	Channel	Result	Comments
-20 dBc	0	-49.47dBm	Maximum of emissions is reported here, in the frequency spectrum 9kHz to 25GHz.
	39	-48.54dBm	
	78	-49.78dBm	

**10 AC Power Line Conducted Emissions**

<b>FCC:</b> § 15.247 c, § 15.207	<b>IC:</b> RSS-210 §6.6
<b>Measurement Procedures:</b>	
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**

<b>FCC:</b> § 15.247 c, § 15.209 a	<b>IC:</b> RSS-210 §A2.9 (2)
<b>Measurement Procedures:</b>	
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	8595E	3911A03899	07/19/09
Spectrum Analyzer	Hewlett Packard	8594E	3810A04238	04/03/10