Test Report on

Tri-Band CDMA Cellular Phone with Bluetooth

Certification	
FCC Part 15.247 IC RSS-210	
FCC ID:	**OVF-K5302**
Model:	**K53-02, S2300**

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:	January 11-12, 2010
Test performed by:	Kyocera Wireless Corp. 10300 Campus Point Drive San Diego, CA – 92121
Report Prepared by:	Thuy To, Regulatory Engineer
Report Approved 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. 10300 Campus Point Drive San Diego CA 92121
FCC ID:	OVF-K33BIC06
Product:	Tri-Band CDMA Cellular Phone with Bluetooth
Model Numbers:	K53-02, S2300
EUT Serial Number:	FFS23000001883
Type:	[X]] Prototype, [ ] 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)	1.93 dBm
Antenna:	Internal
Antenna Gain (dBi):	0.5 (Peak)
FCC Rule Parts:	§15.247

2 Description of Bluetooth Transmitter

The OVF-K5302 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 0.5 dBi.

3 20 dB Bandwidth

FCC: § 15.247 a1	IC:	RSS-210 §6.2.2(o) a1

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, 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.

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

List of Figures:

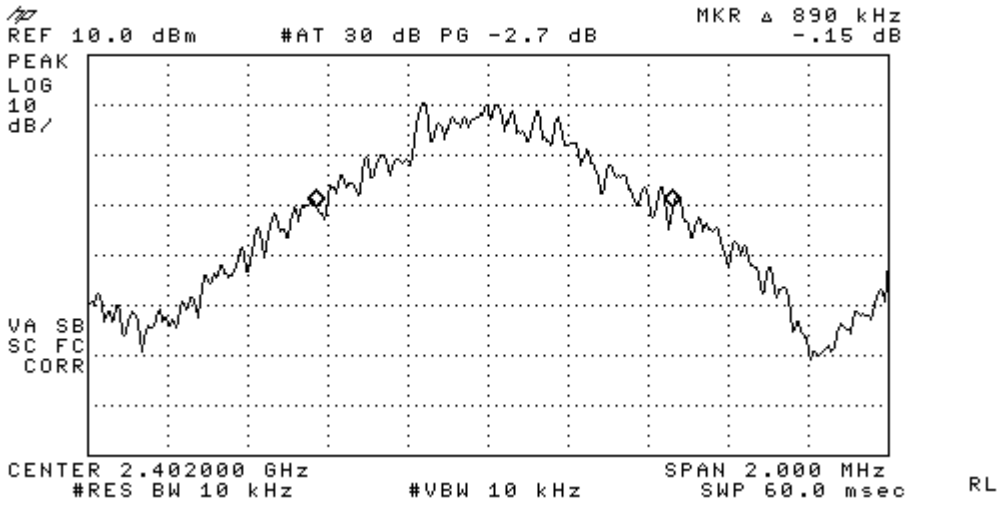

Figure 3-1a: 20dB Bandwidth basic rate, Channel 0.

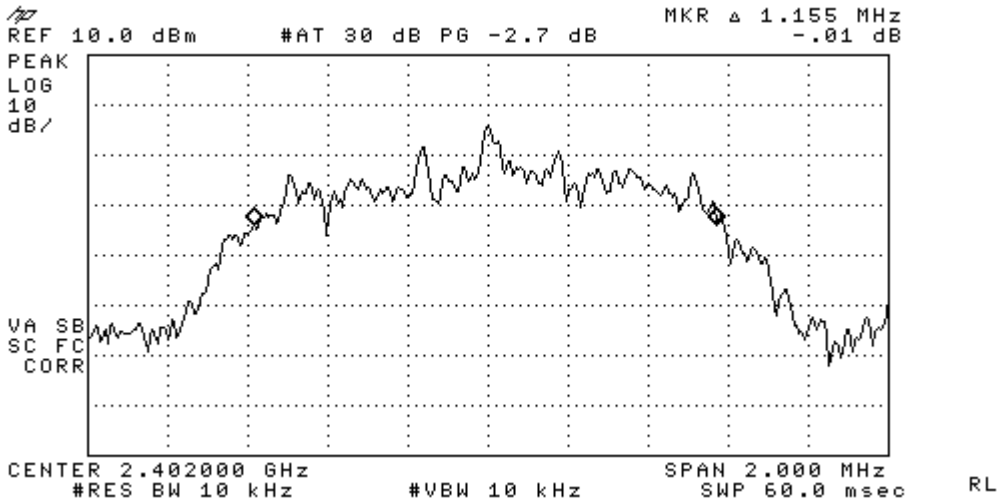

Figure 3-1b: 20dB Bandwidth EDR 2Mbps, Channel 0.

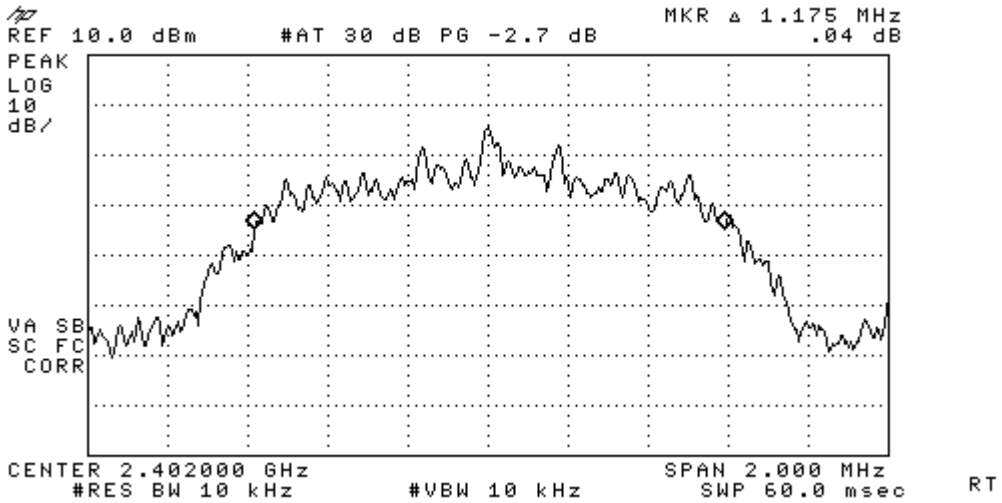

Figure 3-1c: 20dB Bandwidth EDR 3Mbps, Channel 0.

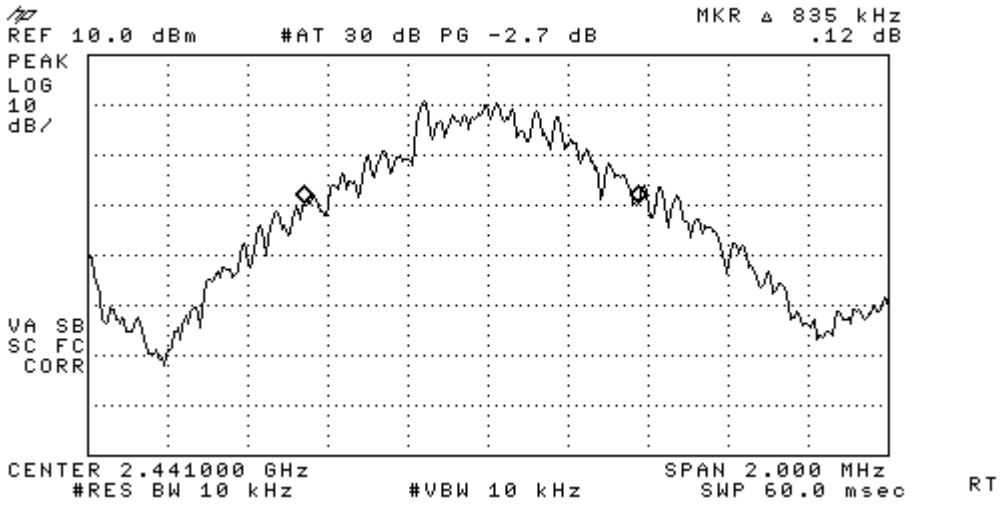

Figure 3-2a: 20dB Bandwidth basic rate, Channel 39.

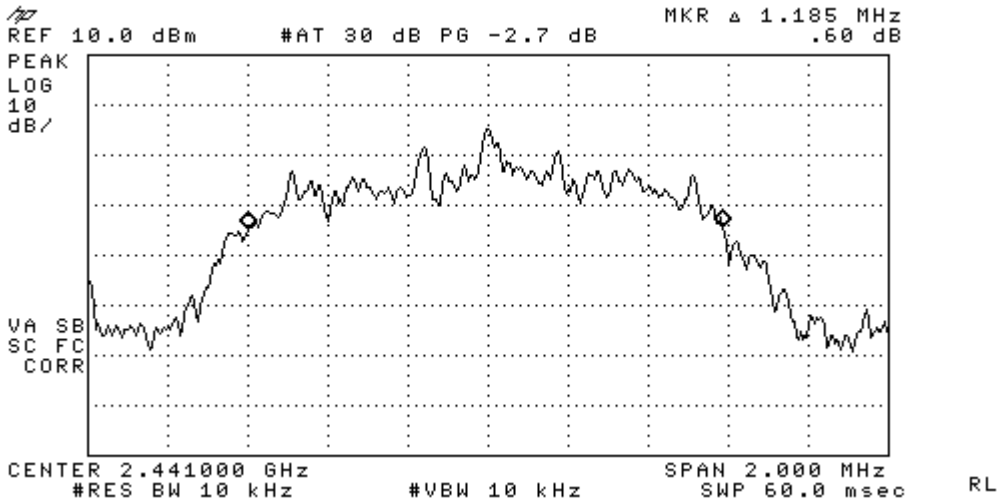

Figure 3-2b: 20dB Bandwidth EDR 2Mbps, Channel 39.

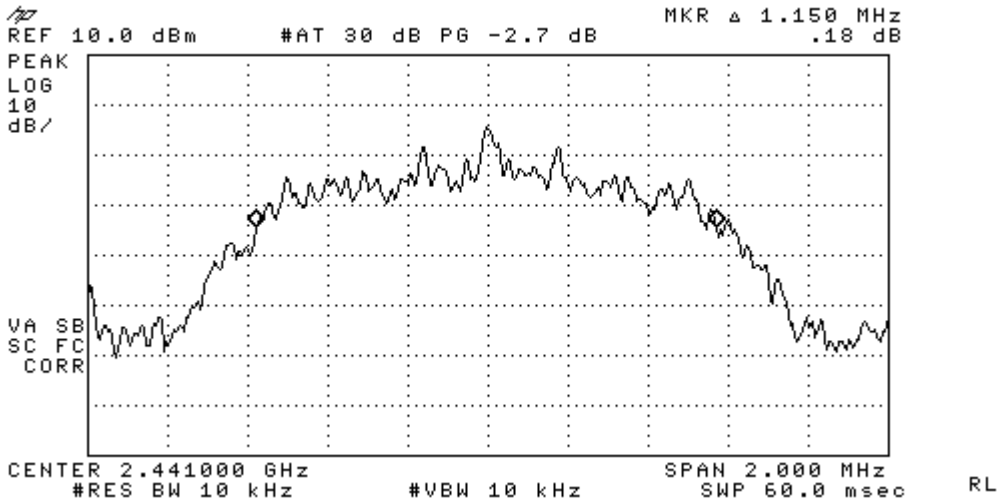

Figure 6-2c: 20dB Bandwidth EDR 3Mbps, Channel 39.

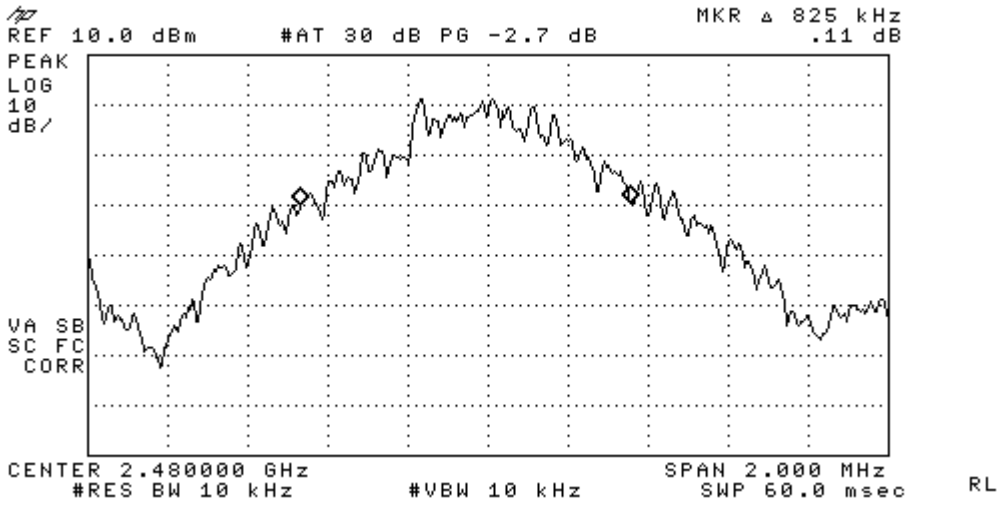

Figure 3-3a: 20dB Bandwidth basic rate, Channel 78.

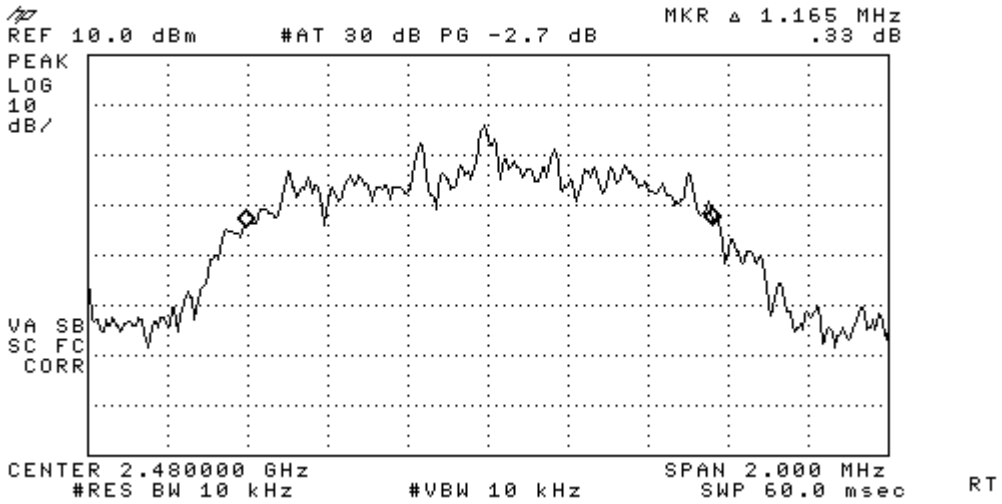

Figure 3-3b: 20dB Bandwidth EDR 2Mbps, Channel 78.

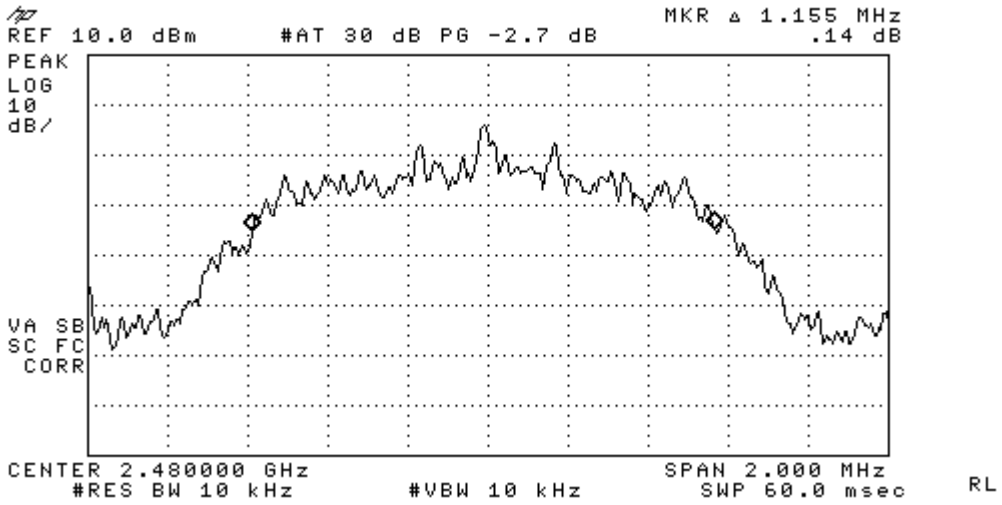

Figure 3-3c: 20dB Bandwidth EDR 3Mbps, Channel 78.

Results:

Channel	Modulation	Results	Comments
0	Basic Rate	890 kHz	Delta marker on the spectrum analyzer was moved from the center frequency until –20dBc to measure the 20dB-bandwidth.
	EDR – 2Mbps	1.155 MHz	
	EDR – 3Mbps	1.175 MHz	
39	Basic Rate	835 kHz	
	EDR – 2Mbps	1.185 MHz	
	EDR – 3Mbps	1.150 MHz	
78	Basic Rate	825 kHz	
	EDR – 2Mbps	1.165 MHz	
	EDR – 3Mbps	1.155 MHz	

4 Carrier Frequency Separation

FCC: § 15.247 a1	IC:	RSS-210 §A8.1(2)

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 investigate the carrier frequency separation between mid-channel and its adjacent channels. A fully charged battery was used as supply voltage.

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

Comments:
The carrier frequency separation is independent of modulation and packet length (DH1, DH3, etc.).

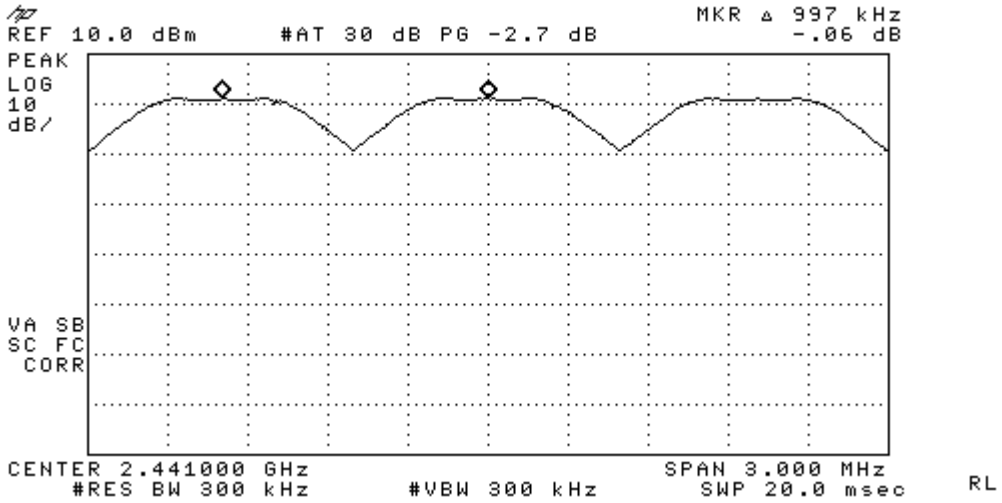

Figure 4: Carrier Frequency Separation between channels 38, 39 (mid-channel) & 40.

Results and Limits:

Limits	Frequency Separation	2/3 of 20 dB Bandwidth	Result
a) ≥ 25 kHz or 20 dB Bandwidth, whichever is greater 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.	997kz	790 kHz[1]	Pass

[1] 2/3 * 1185 kHz = 806.7 kHz.

5 Number of Hopping Frequencies

FCC: § 15.247 a1 iii	IC:	RSS-210 §A8.1 (4)

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 investigate the number of hopping frequencies. A fully charged battery was used as supply voltage.

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

Comments:
The number of frequency hopping is independent of modulation and packet length (DH1, 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)

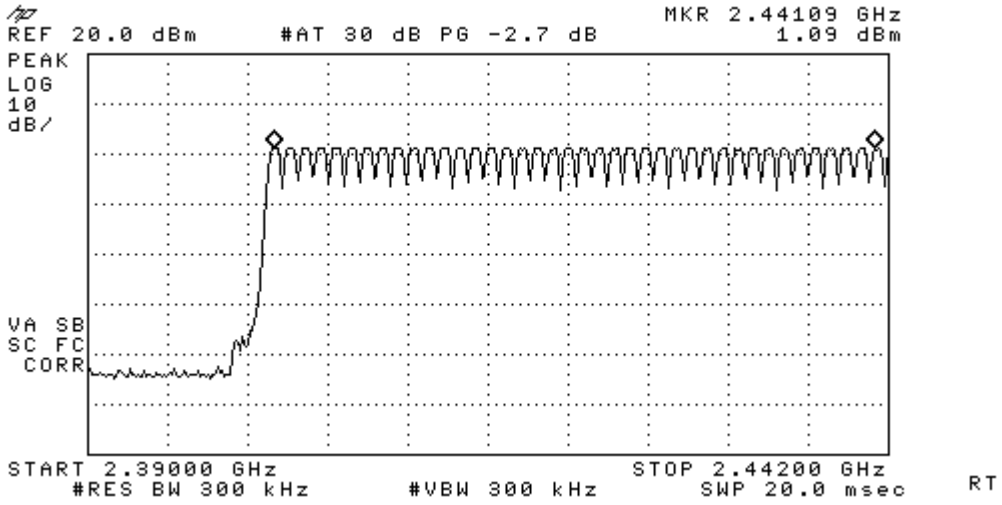

Figure 5a: Number of Hopping Frequencies (Channels 0-39)

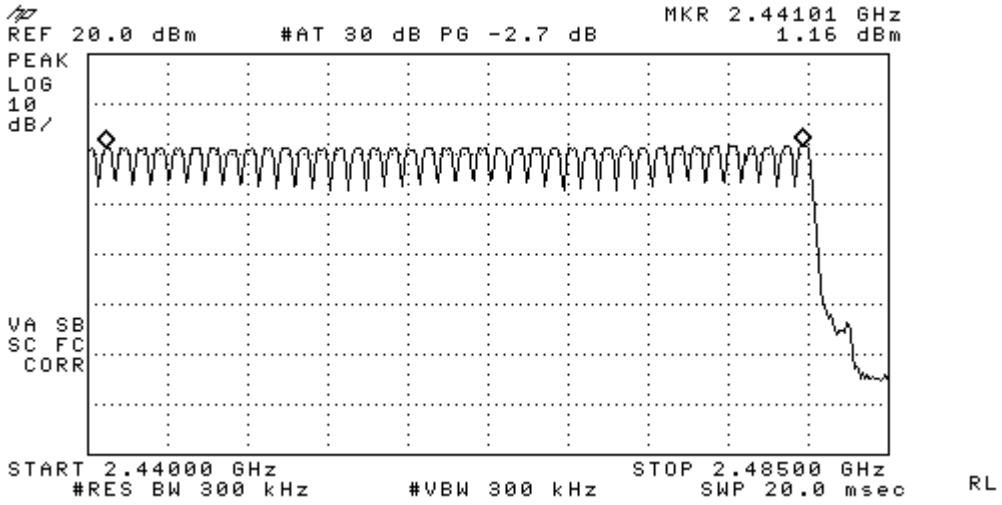

Figure 5b: Number of Hopping Frequencies (Channels 39-78)

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	IC:	RSS-210 §A8.1 (4)

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).

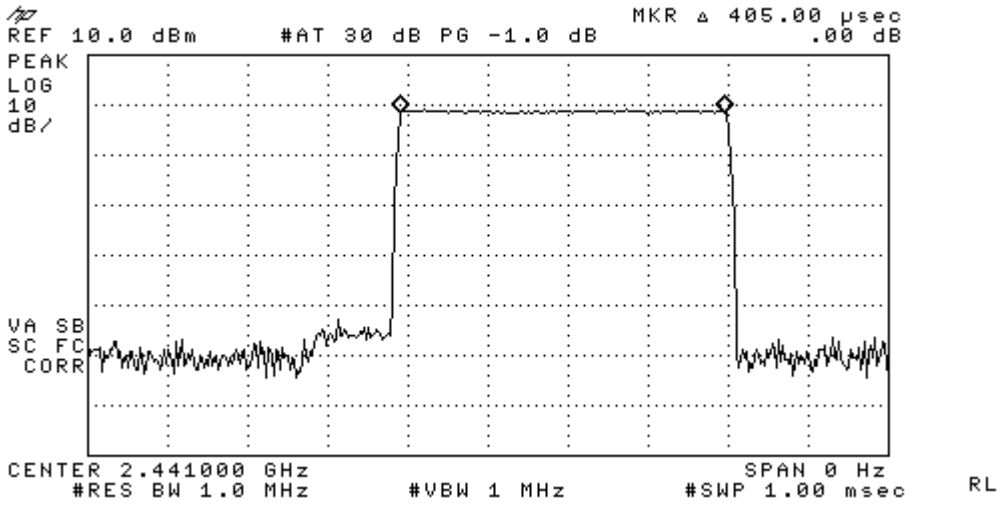

Figure 6: Duration of one transmission (Channel 39)

Results and Limits:

Limits	Channel	Results	Comments
≤ 0.4 s (in a period of 31.6 s)	Hopping (DH1 packet)	0.2592 s {[(405μ*1600)/1] /79}*31.6	Mid-channel (CH 39) was measured here.

7 Peak Output Power

FCC: § 15.247 b1	IC:	RSS-210 §A8.4 (2)

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, 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.

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

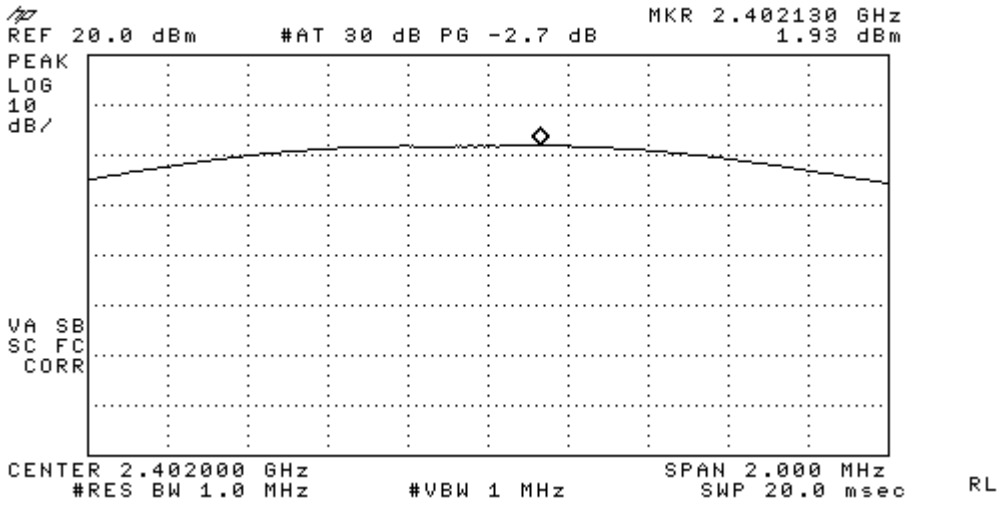

Figure 7-1a: Peak Output Power, Channel 0.

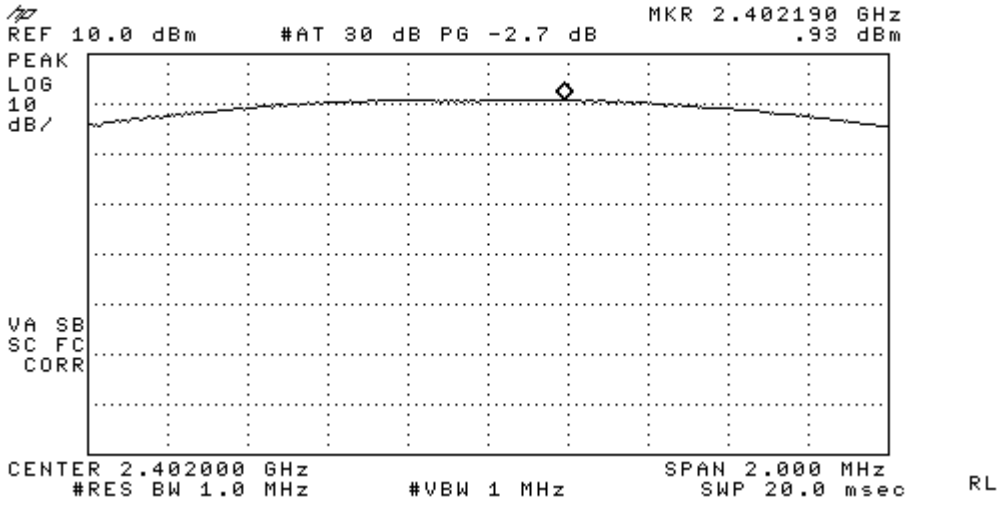

Figure 7-1b: EDR 2 Peak Output Power, Channel 0.

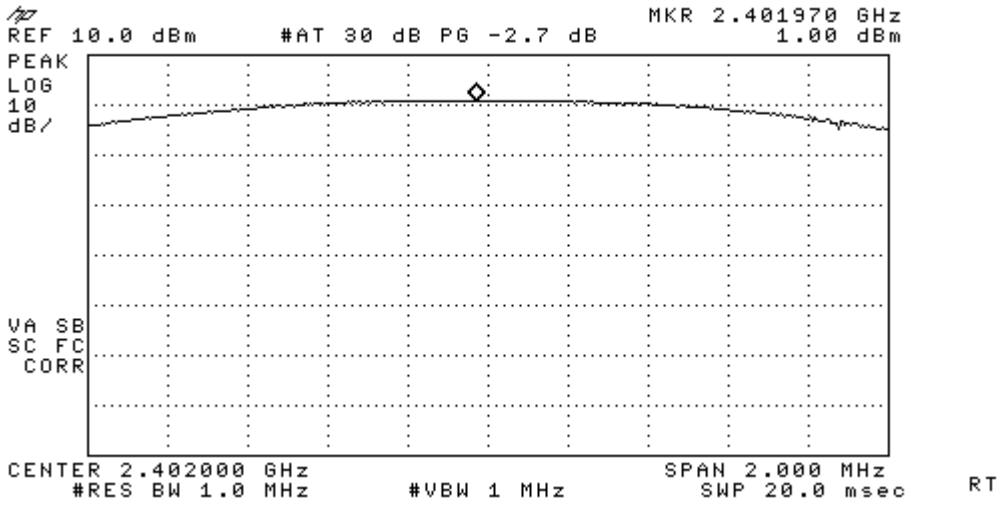

Figure 7-1c: EDR 3 Peak Output Power, Channel 0.

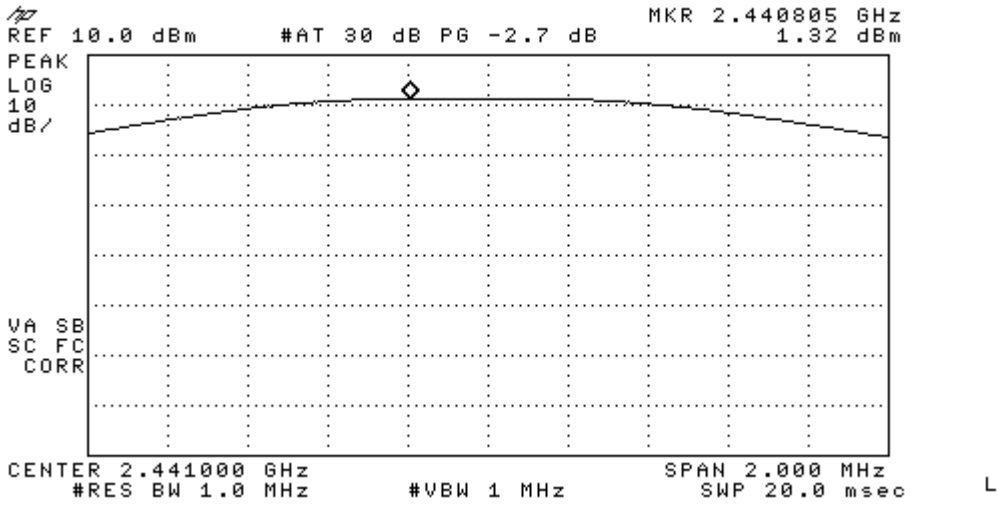

Figure 7-2a: Peak Output Power, Channel 39.

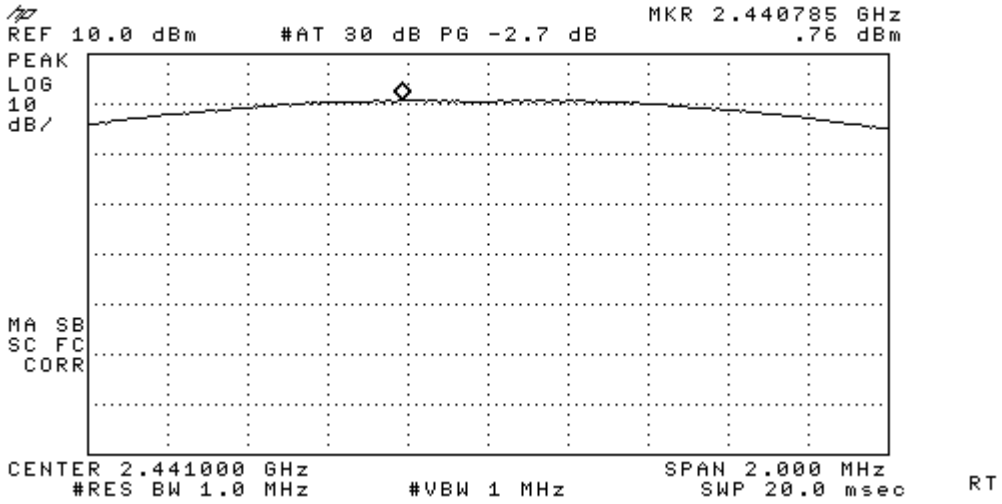

Figure 7-2b: EDR 2Peak Output Power, Channel 39.

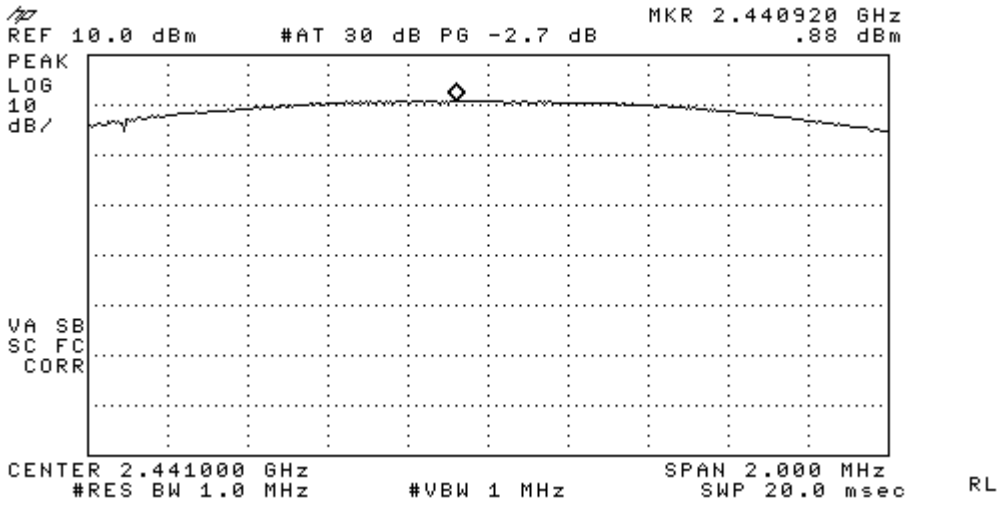

Figure 7-2c: EDR 3Peak Output Power, Channel 39.

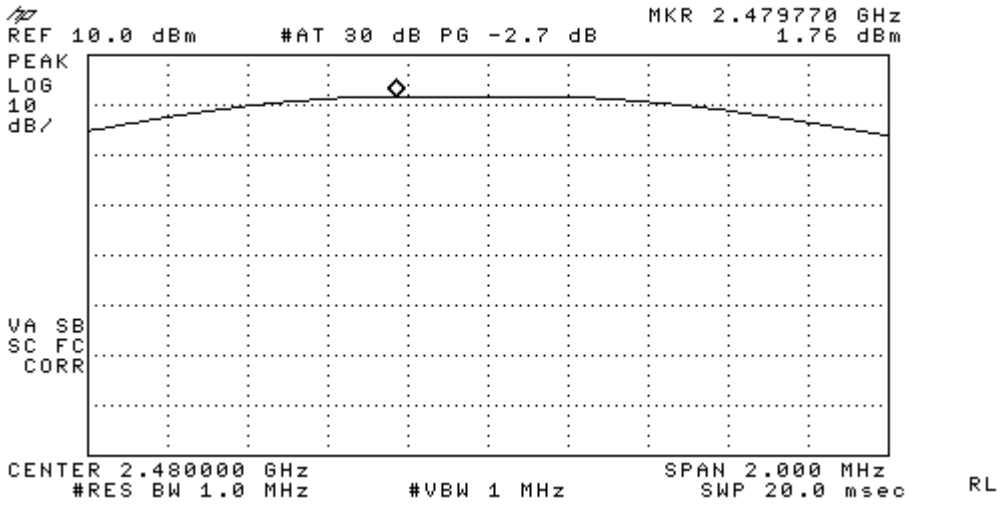

Figure 7-3a: Peak Output Power, Channel 78.

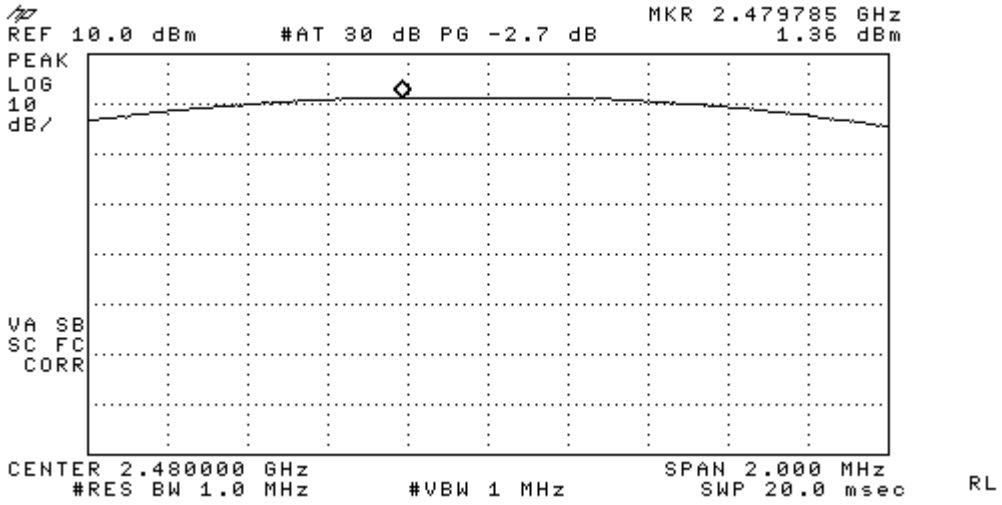

Figure 7-3b: EDR 2Peak Output Power, Channel 78.

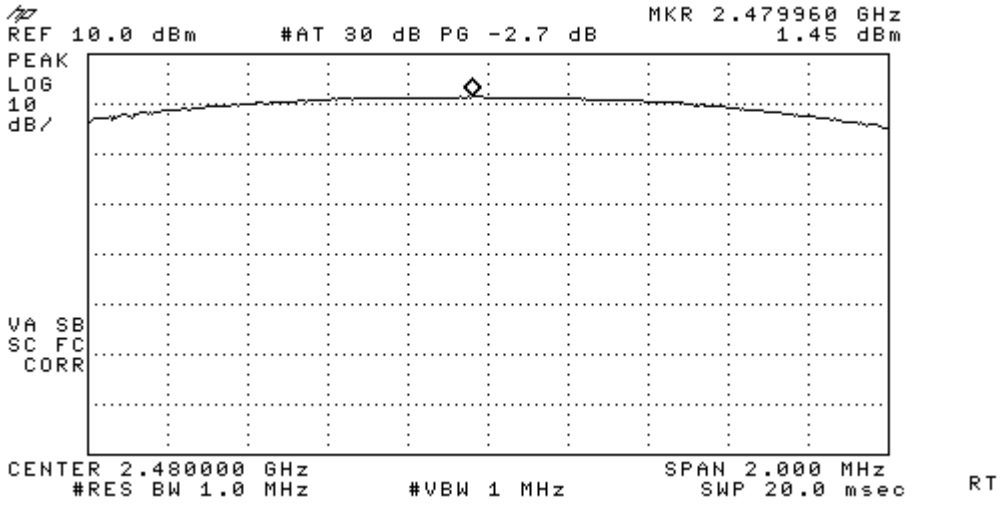

Figure 7-3c: EDR 3Peak Output Power, Channel 78.

Results and Limits:

Limits	Rate	Channel	Results	Comments
< 1 watt (for systems with at least 75 hopping channels)	Basic Rate	0	1.93 dBm	Signal loss from the cable connecting the Bluetooth output port and spectrum analyzer is calibrated out.
	EDR – 2Mbps		0.93 dBm	
	EDR – 3Mbps		1.00 dBm	
	Basic Rate	39	1.32 dBm	
	EDR – 2Mbps		0.76 dBm	
	EDR – 3Mbps		0.88 dBm	
	Basic Rate	78	1.76 dBm	
	EDR – 2Mbps		1.36 dBm	
	EDR – 3Mbps		1.45 dBm	

8 Band-edge Compliance of Conducted Emissions

FCC: § 15.247 c	IC:	RSS-210 §A8.5

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

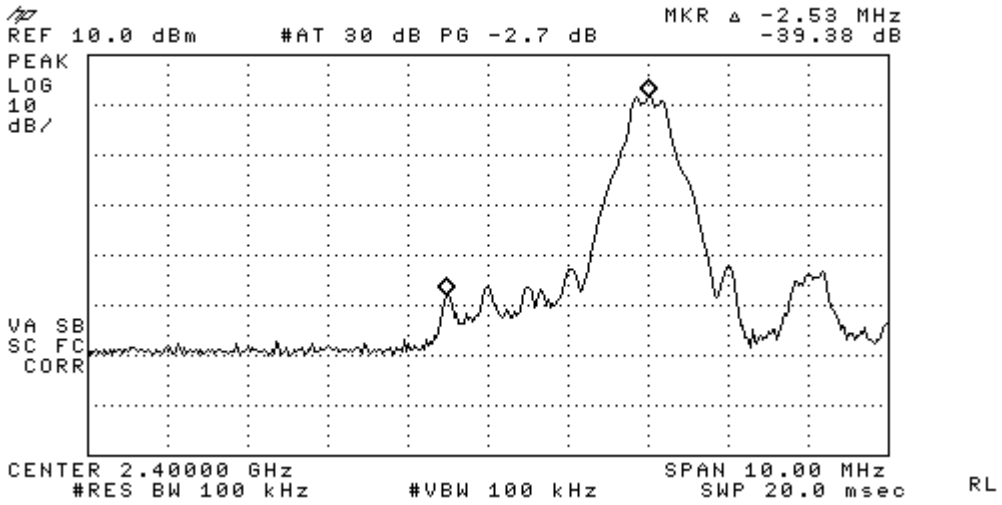

Figure 8-1a: Basic Rate Low band edge with hopping disabled.

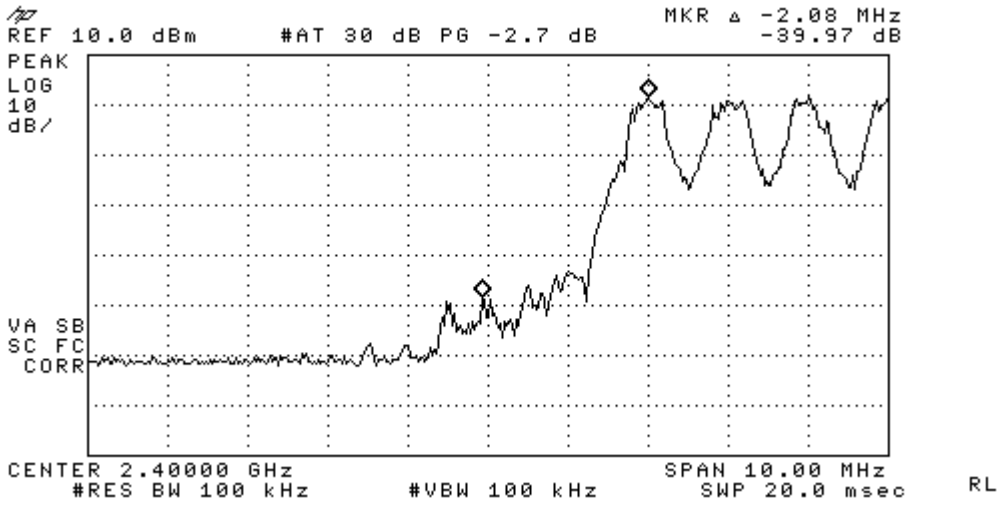

Figure 8-1b: Basic Rate Low band edge with hopping enabled.

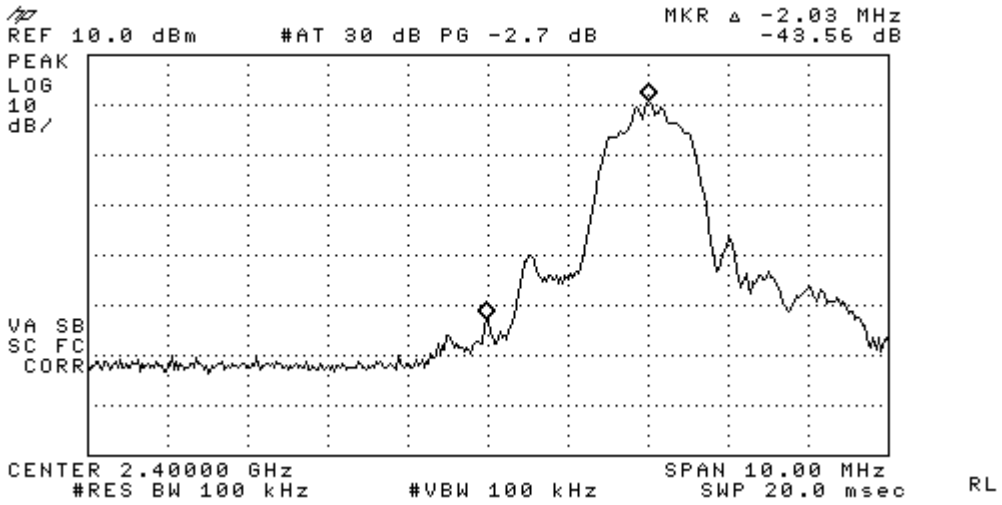

Figure 8-2a: EDR – 2Mbps Low band edge with hopping disabled.

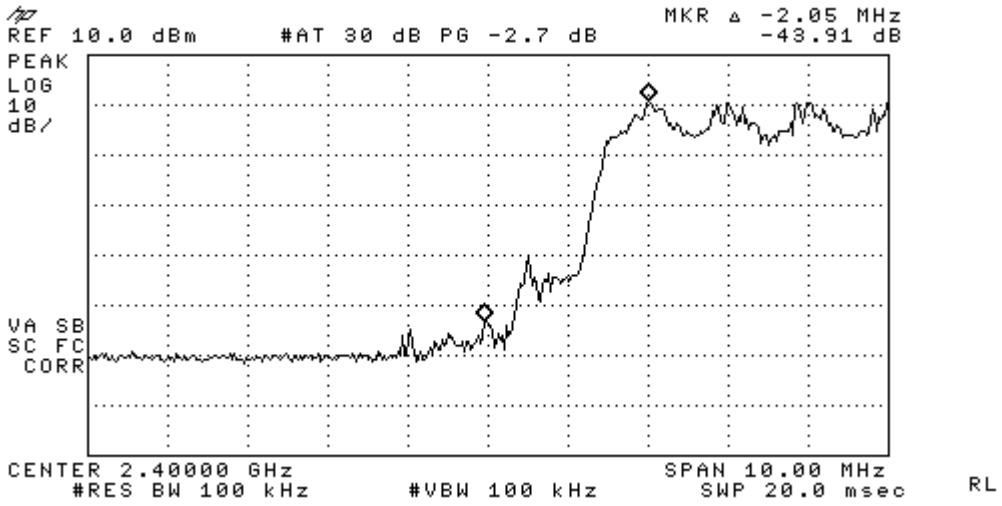

Figure 8-2b: EDR – 2Mbps Low band edge with hopping enabled.

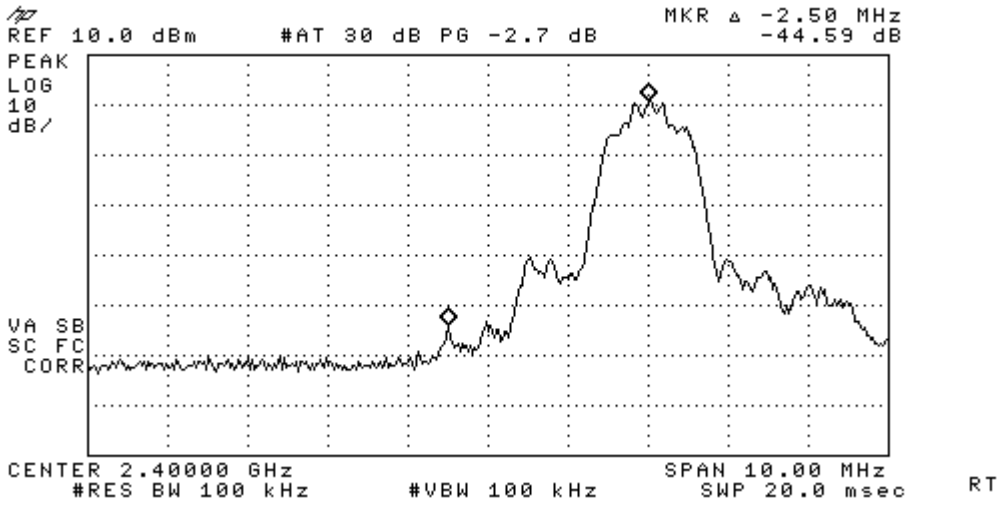

Figure 8-3a: EDR – 3Mbps Low band edge with hopping disabled.

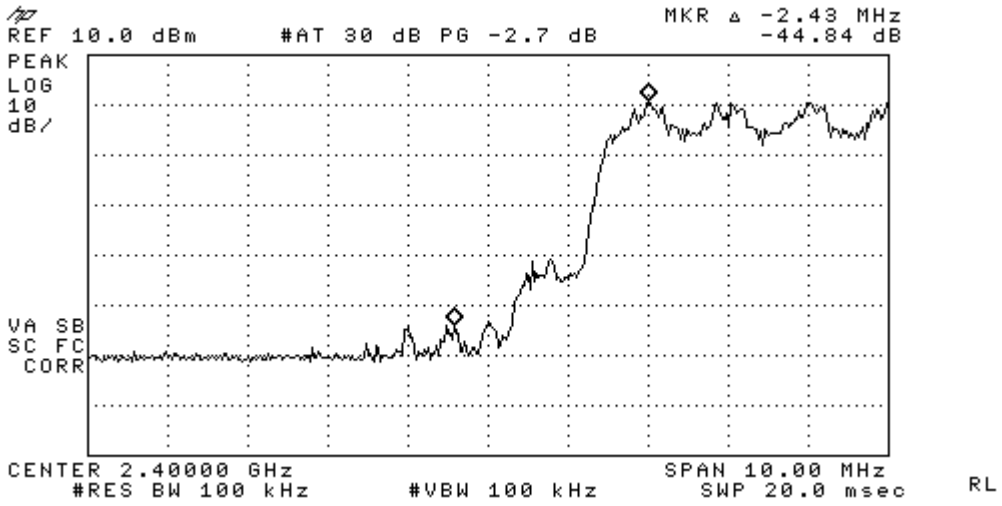

Figure 8-3b: EDR – 3Mbps Low band edge with hopping enabled.

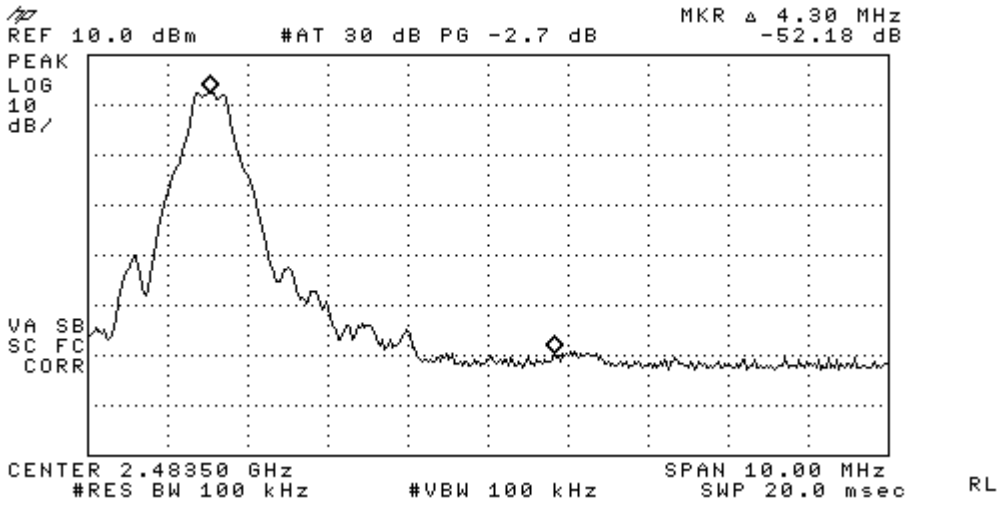

Figure 8-4a: Basic Rate High band edge with hopping disabled.

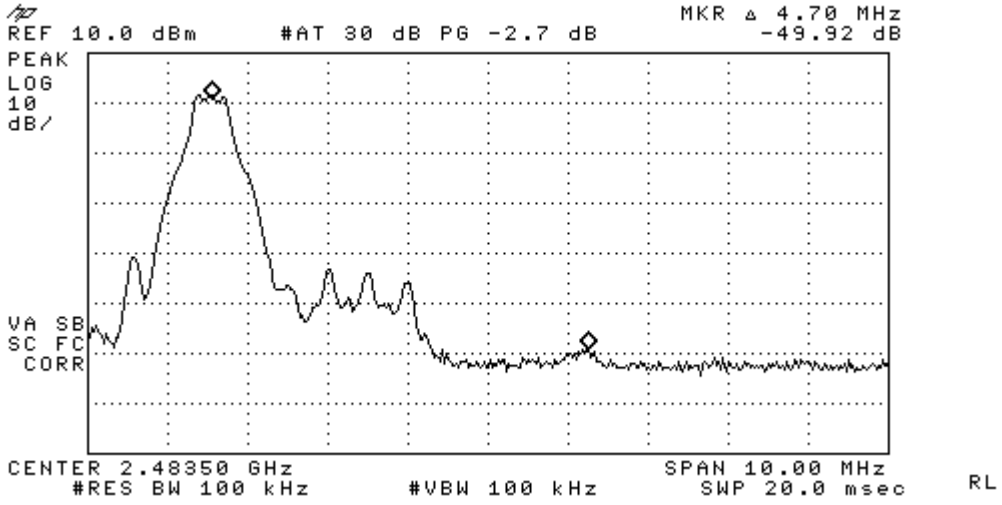

Figure 8-4b: Basic Rate High band edge with hopping enabled.

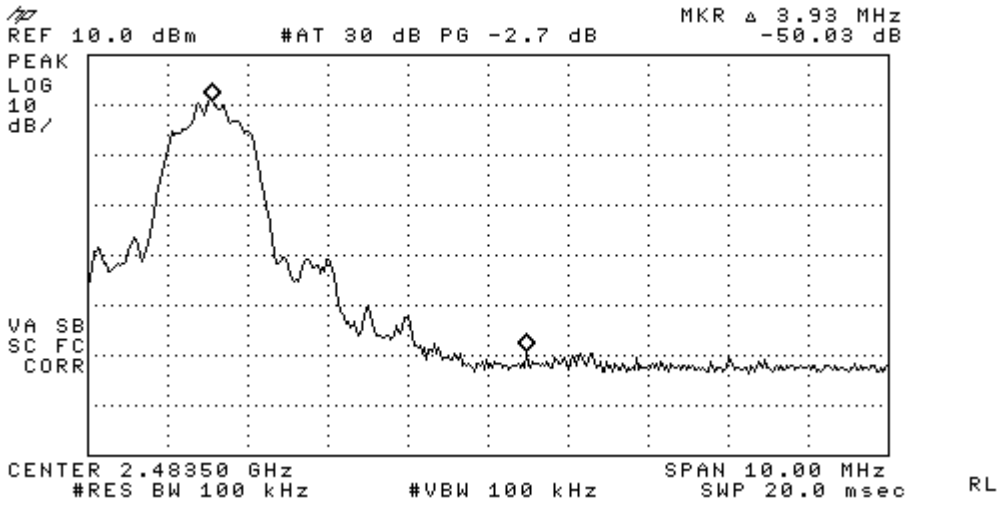

Figure 8-5a: EDR – 2Mbps High band edge with hopping disabled.

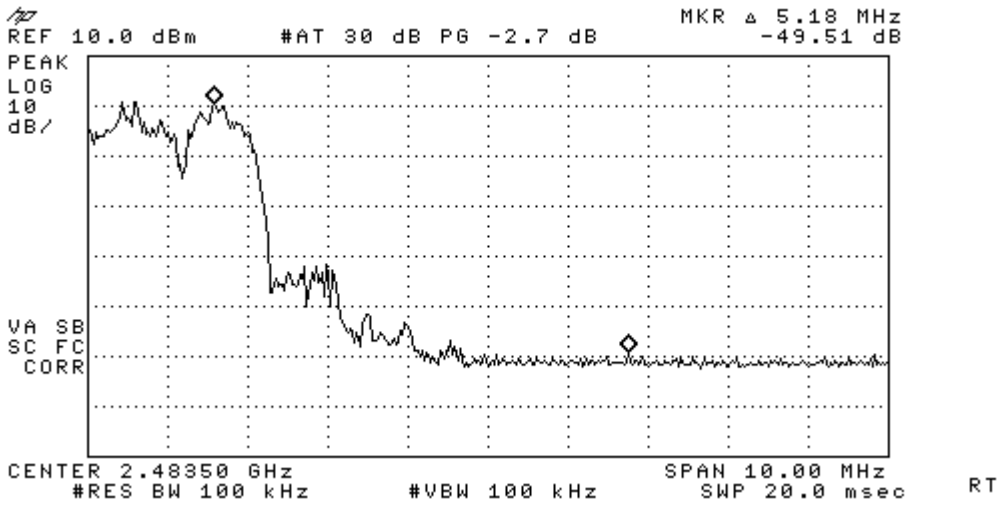

Figure 8-5b: EDR – 2Mbps High band edge with hopping enabled.

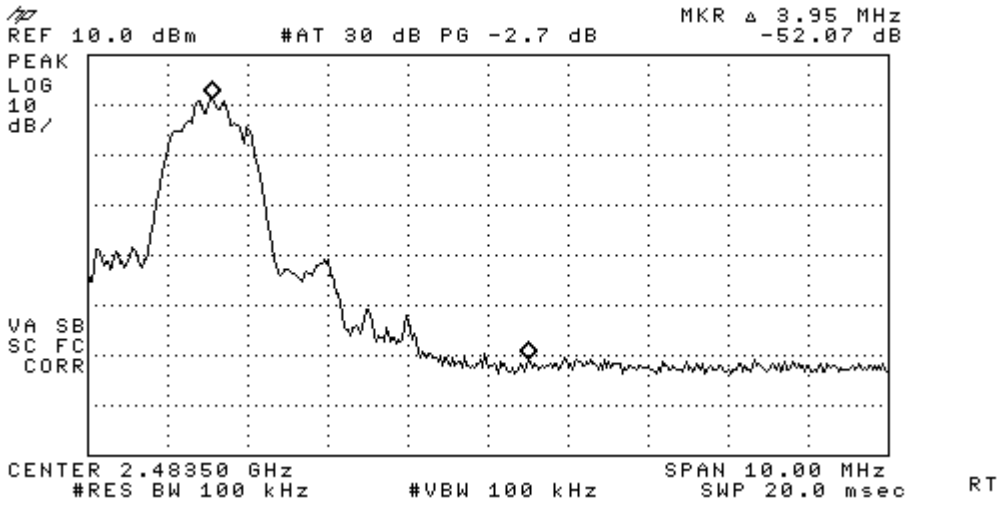

Figure 8-6a: EDR – 3Mbps High band edge with hopping disabled.

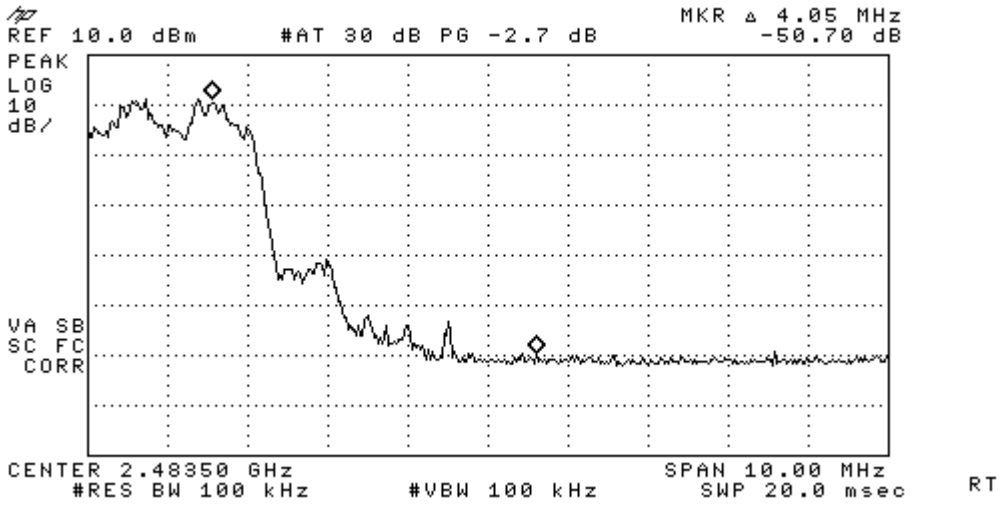

Figure 8-6b: EDR – 3Mbps High band edge with hopping enabled.

Results and Limits:

Limits	Edge	Modulation	Channel	Results	Comments
≤ -20 dBc	Low Band Edge	Basic Rate	0	-39.38dBc	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	-39.97dBc (Ch 0)	
		EDR – 2Mbps	0	-43.56dBc	
			Hopping	-43.91dBc (Ch 0)	
		EDR – 3Mbps	0	-44.59dBc	
			Hopping	-44.84dBc (Ch 0)	
	High Band Edge	Basic Rate	78	-52.18dBc	
			Hopping	-49.92dBc (Ch 78)	
		EDR – 2Mbps	78	-50.03dBc	
			Hopping	-49.51dBc (Ch 78)	
		EDR – 3Mbps	78	-52.07dBc	
			Hopping	-50.70dBc (Ch 78)	

9 Spurious RF Conducted Emissions

FCC: § 15.247 c	IC:	RSS-210 §A8.5

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, 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.

Frequencies of Interest: Spectrum was investigated from 9kHz – 25 GHz.

Comments:
Spurious RF Conducted Emission testing was performed only with Basic Rate since the conducted power was highest in comparison with the other modulation.

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

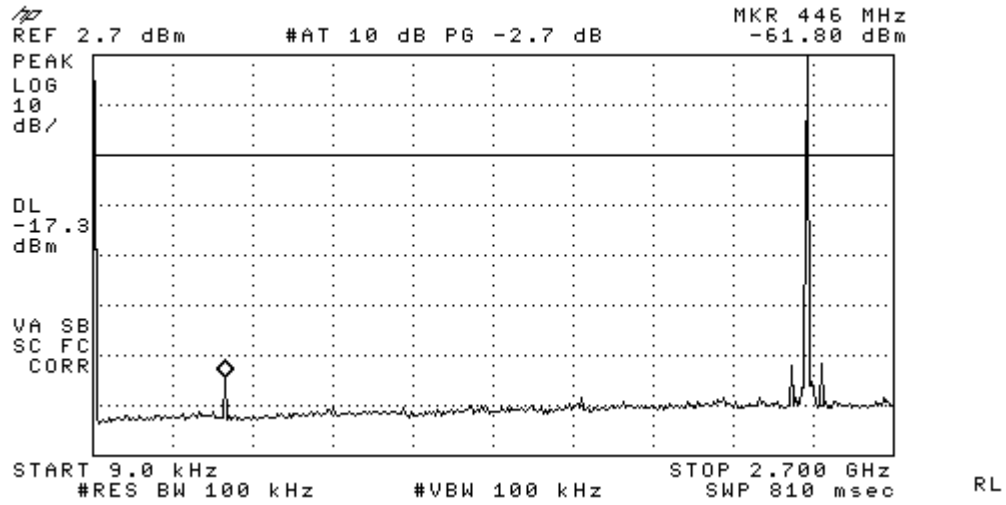

Figure 9-1a: Basic Rate Conducted Spurious Emissions (CH 0)

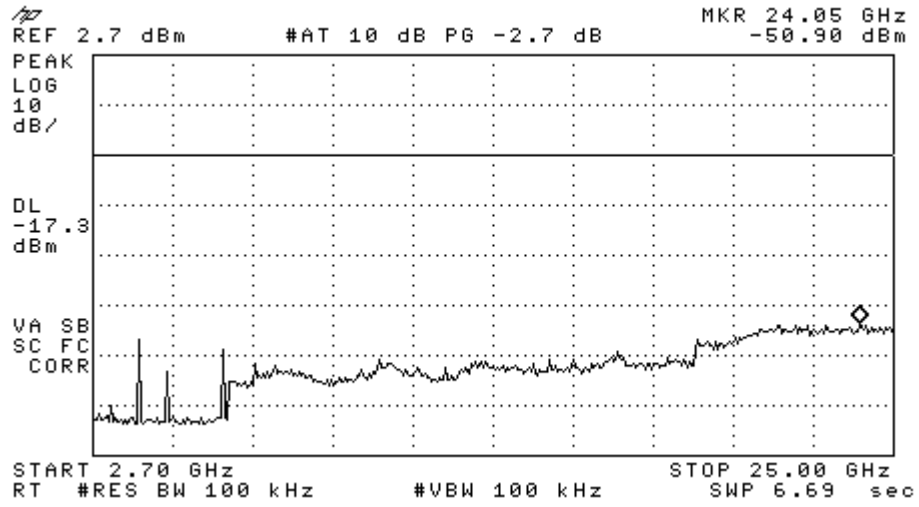

Figure 9-1b: Basic Rate Conducted Spurious Emissions (CH 0)

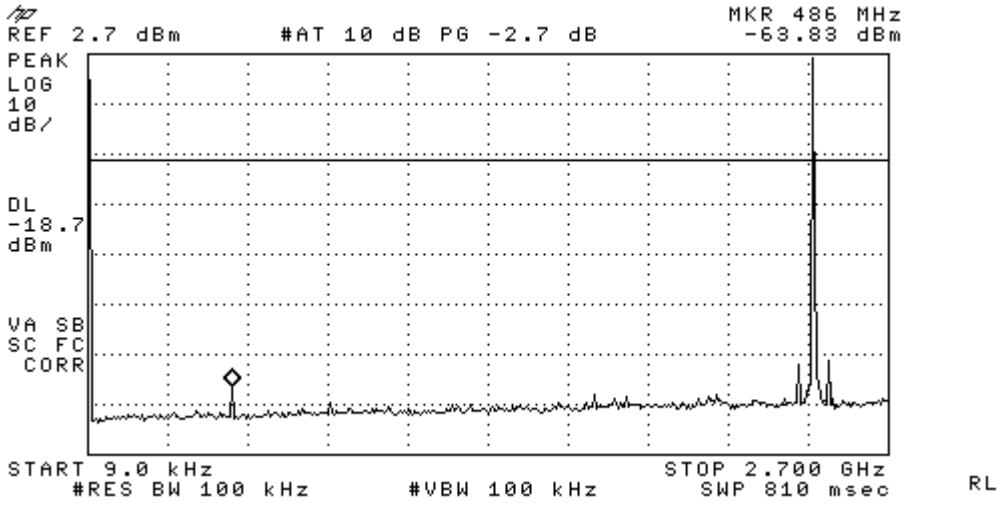

Figure 9-2a. Conducted Spurious Emissions (CH 39)

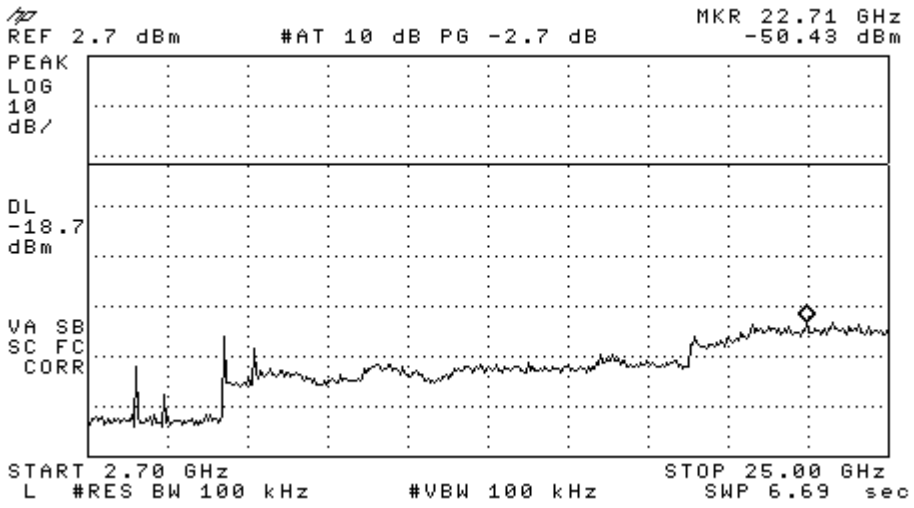

Figure 9-2b. Conducted Spurious Emissions (CH 39)

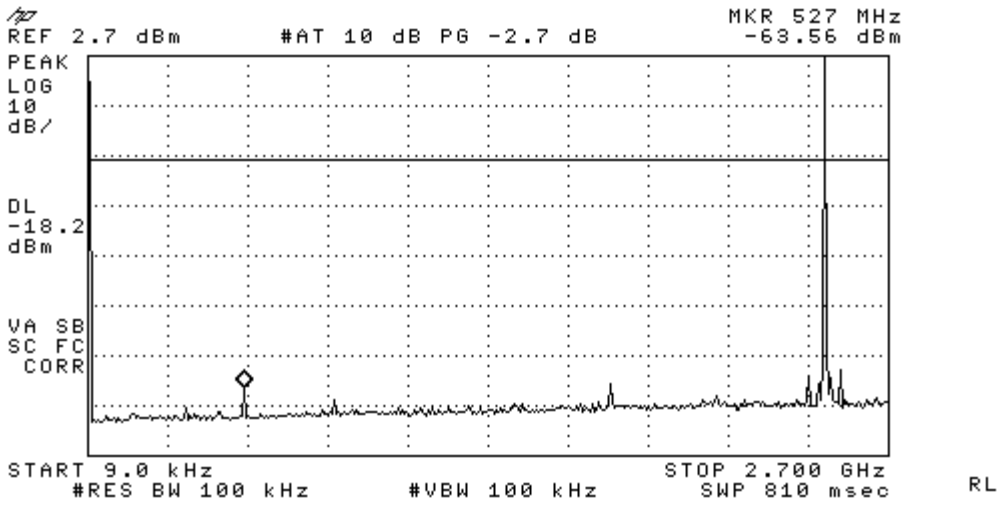

Figure 9-3a. Conducted Spurious Emissions (CH 78)

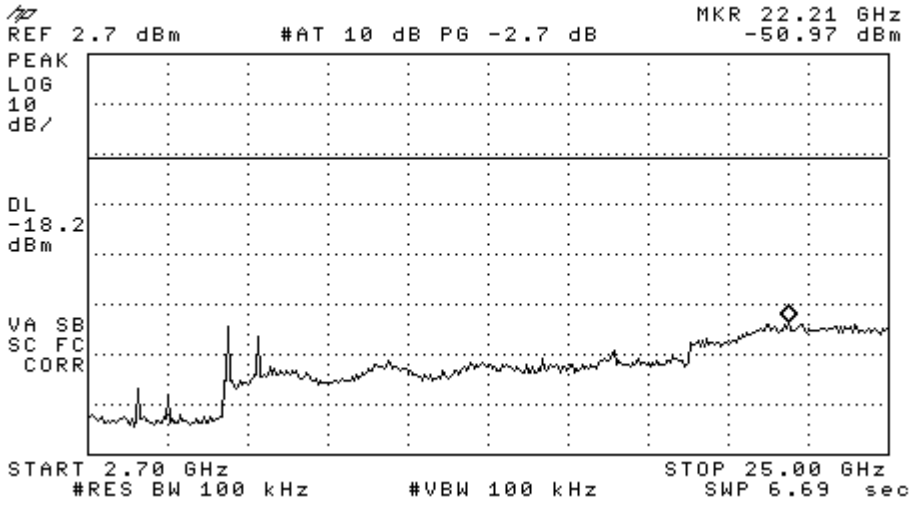

Figure 9-3b. Conducted Spurious Emissions (CH 78)

Results and Limits:

Limits	Channel	Result	Comments
-20 dBc	0	-50.90dBm	Maximum of emissions is reported here, in the frequency spectrum 9kHz to 25GHz.
	39	-50.43dBm	
	78	-50.97dBm	

10 AC Power Line Conducted Emissions

FCC: § 15.247 c, § 15.207	IC:	RSS-210 §6.6
Measurement Procedures: 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	IC:	RSS-210 §A2.9 (2)
Measurement Procedures: 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