Test Report

on

Dual-Band Tri-mode AMPS/CDMA Cellular Phone with Bluetooth

Certification FCC Part 15.247 IC RSS-210	
FCC ID:	**OVFKWC-KX5-5X0**
Models:	**KX5-5X0**

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 15, 2005 – August 19, 2005
Test performed by:	Kyocera Wireless Corp. 10300 Campus Point Drive San Diego, CA – 92121
Report Prepared by:	Jagadish Nadakuduti, Engineer
Report Reviewed by:	C. K. Li, Senior Staff Manager

Nemko 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:	OVFKWC-KX5-5X0
Product:	Dual-Band Tri-mode Cellular Phone with Bluetooth
Model Numbers:	KX5-5X0
EUT Serial Number:	A9DX----1CTQQ2
Type:	[ ] Prototype, [X] Pre-Production, [ ] Production
Equipment Category:	Short Range Device
TX Frequency (MHz):	2402 to 2480
Channel Number:	79
Channel Spacing (MHz):	1
Modulation:	Frequency Hopping Spread Spectrum (FHHS)
Max. Output Power (dBm)	2
Antenna:	Internal
Antenna Gain (dBi):	+2 (Peak)
FCC Rule Parts:	§15.247

2 Description of Bluetooth Transmitter

The OVFKWC-KX5-5X0 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 dBi.

KX5-5X0

3 Carrier Frequency Separation

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 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.	

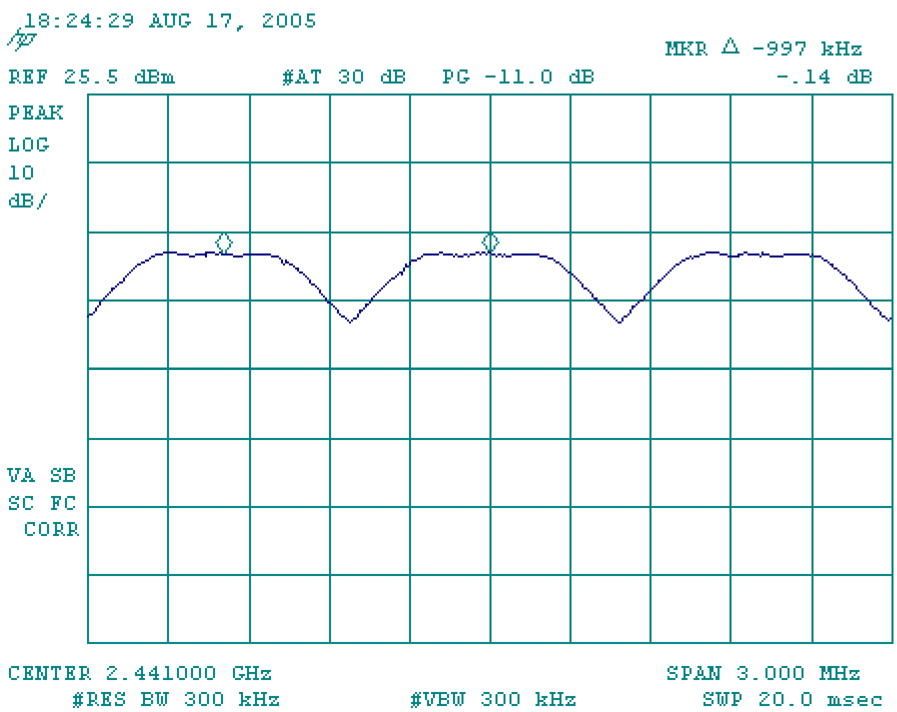

Figure 3. Carrier Frequency Separation between channels 38, 39 (mid-channel) & 40.

Results and Limits:

Limits	Channel	Results	Comments
≥ 25 kHz or 20 dB BW	Hopping	0.997 MHz	Carrier frequency separation between channels 38 and 39.

4 Number of Hopping Frequencies

FCC:	§ 15.247 a1 iii	IC:	RSS-210 §6.2.2(o) a3

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.

List of Figures:

Figure	Channel	Plot Description
4a	Hopping	Number of Hopping Frequencies (Channels 0-39)
4b		Number of Hopping Frequencies (Channels 39-78)

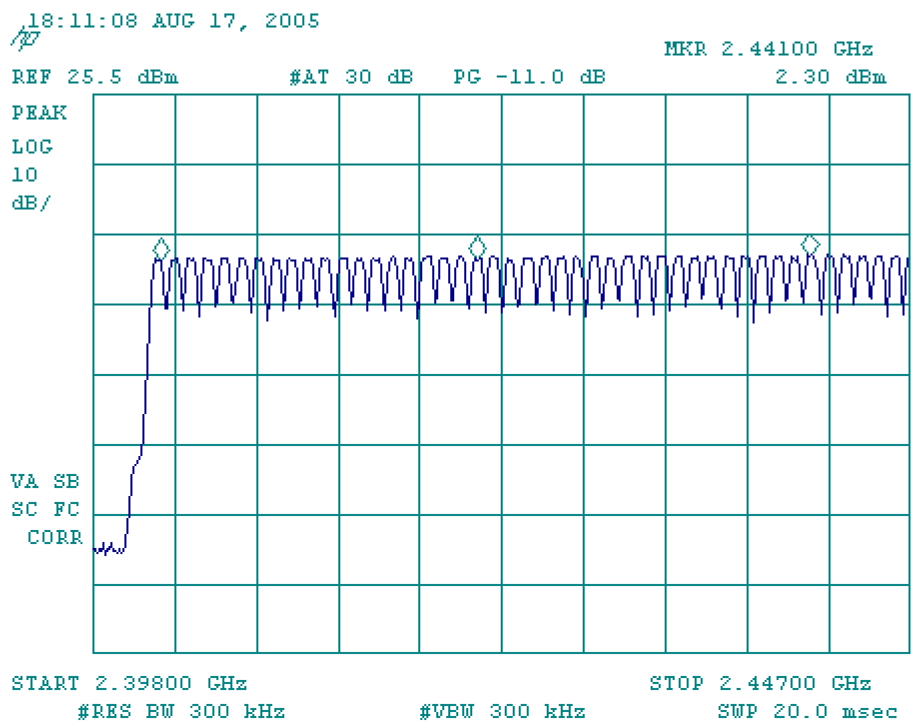

Figure 4a. Number of Hopping Frequencies (Channels 0-39)**.**

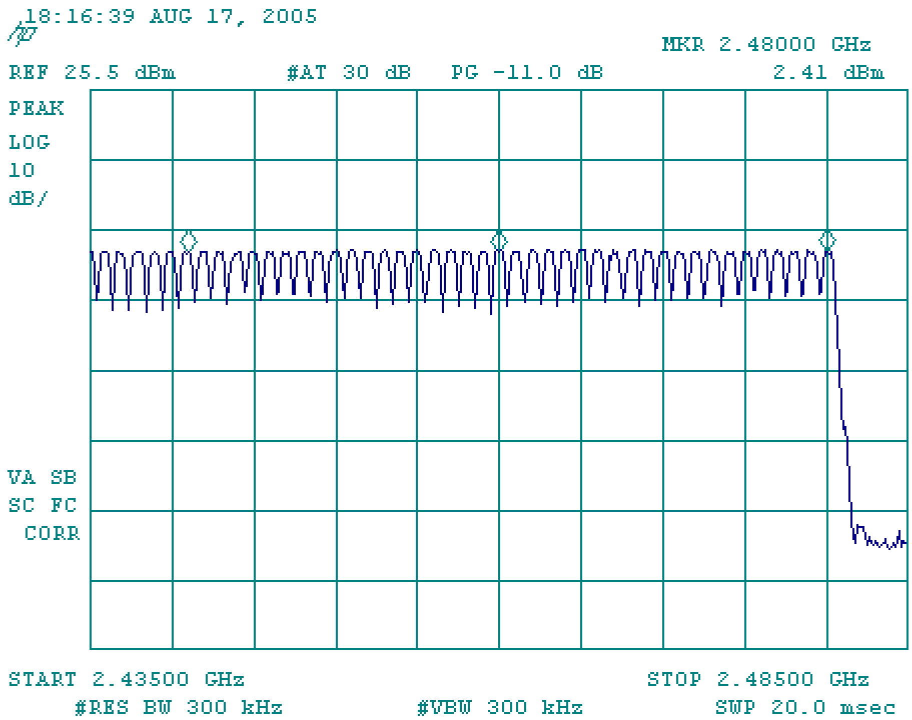

Figure 4b. Number of Hopping Frequencies (Channels 39-78)**.**

Results and Limits:

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

5 Time of Occupancy (Dwell Time)

FCC:	§ 15.247 a1 ii, § 15.247 f	IC:	RSS-210 §6.2.2(o) a3

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 packet length (DH1, DH3, etc.).

According to the Bluetooth Core Specification v1.1, we have 1600 hops in a second for a 1 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).

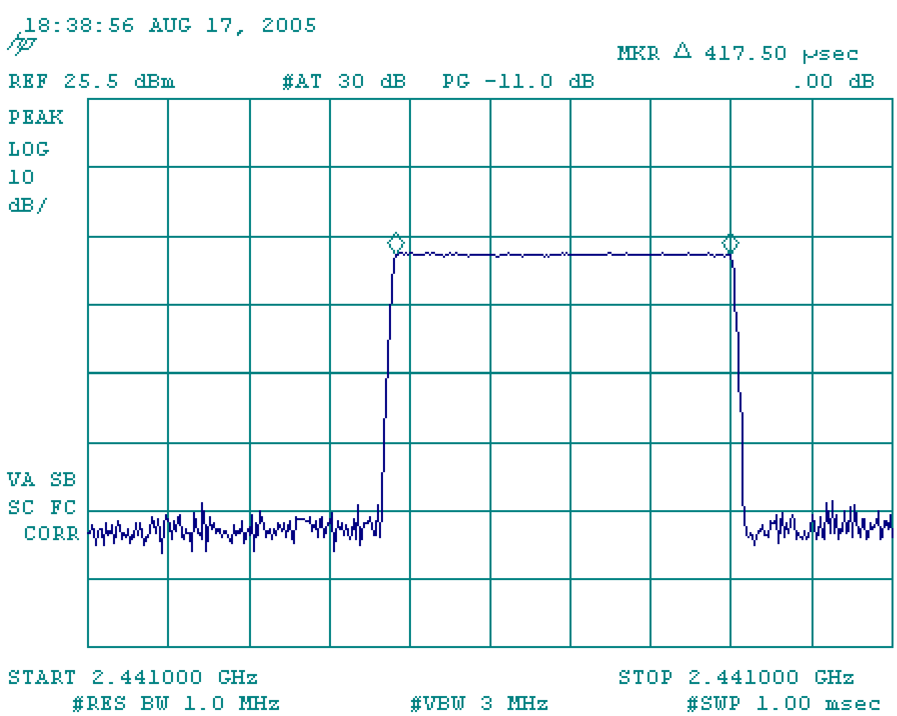

Figure 5. Duration of one transmission (Channels 39)**.**

Results and Limits:

Limits	Channel	Results	Comments
≤ 0.4 s (in a period of 31.6 s)	Hopping (DH1 packet)	0.2672 s (417.5μ*1600/1/79*31.6)	Mid-channel (CH 39) was measured here.

6 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 20 dB-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	Channel	Plot Description
6a	0	20 dB Bandwidth, Channel 0
6b	39	20 dB Bandwidth, Channel 39
6c	78	20 dB Bandwidth, Channel 78

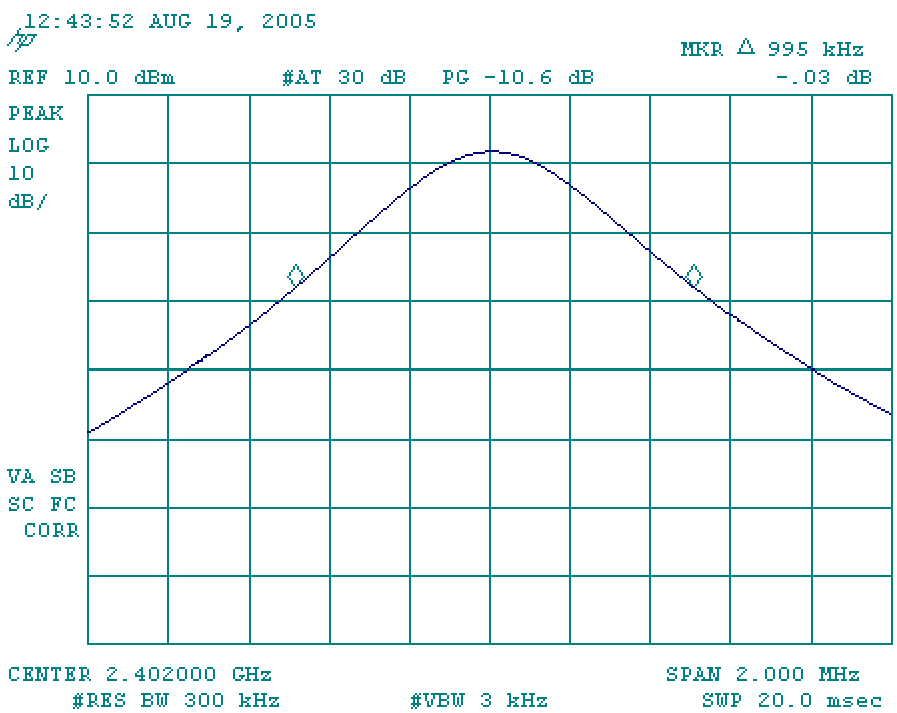

Figure 6a. 20 dB Bandwidth, Channel 0.

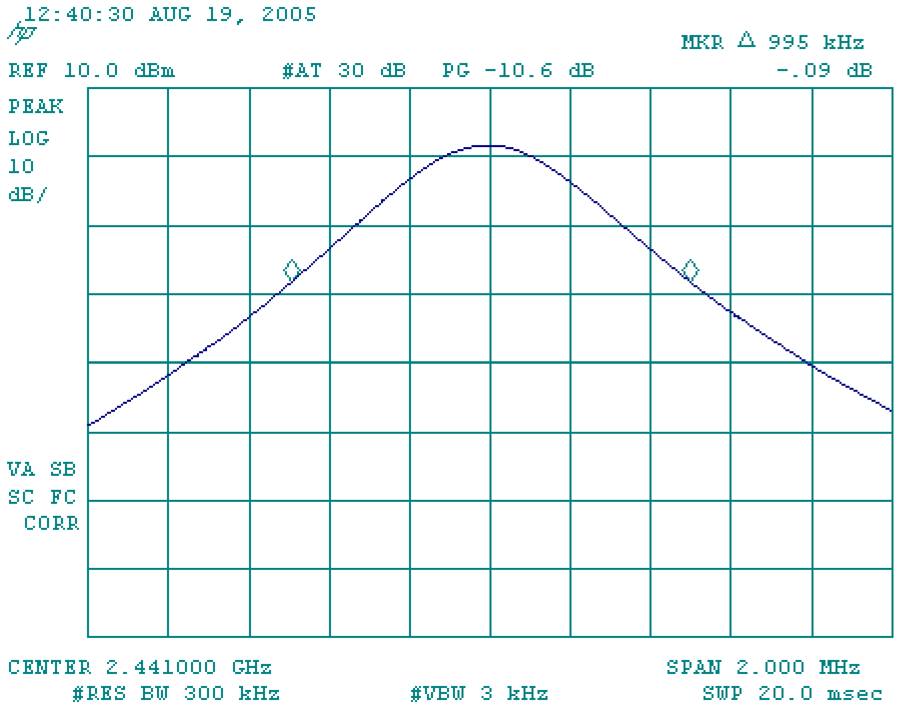

Figure 6b. 20 dB Bandwidth, Channel 39.

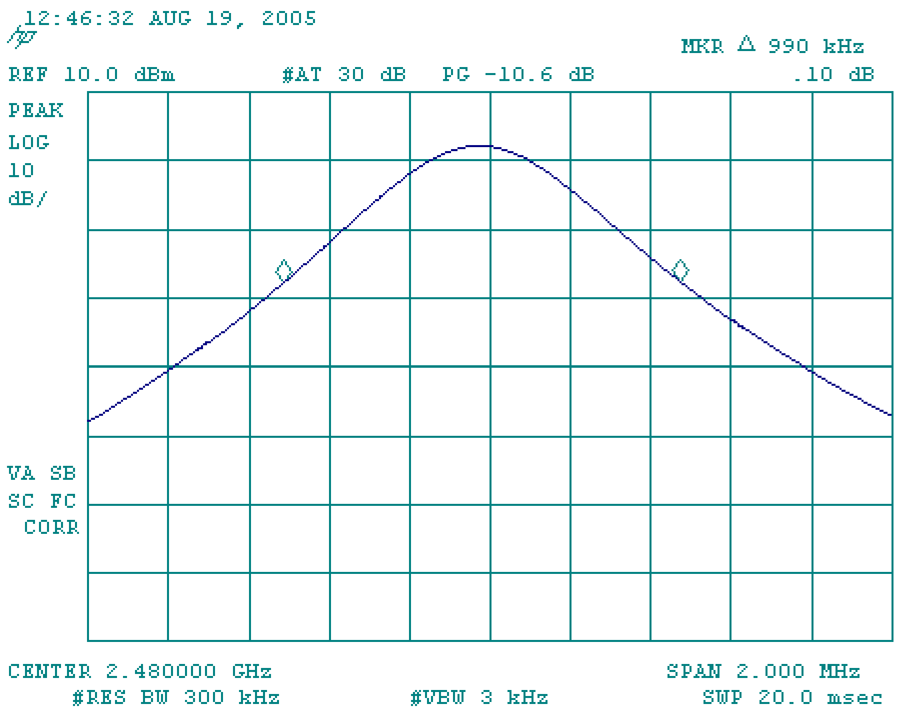

Figure 6c. 20 dB Bandwidth, Channel 78.

Results and Limits:

Limits	Channel	Results	Comments
< 1 MHz	0	0.995 MHz	Delta marker on the spectrum analyzer was moved from the center frequency till –20dBc to measure the 20 dB-bandwidth.
	39	0.995 MHz	
	78	0.990 MHz	

7 Peak Output Power

FCC: § 15.247 b1	IC: RSS-210 §6.2.2(o) a3

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
7a	0	Peak Output Power, Channel 0
7b	39	Peak Output Power, Channel 39
7c	78	Peak Output Power, Channel 78

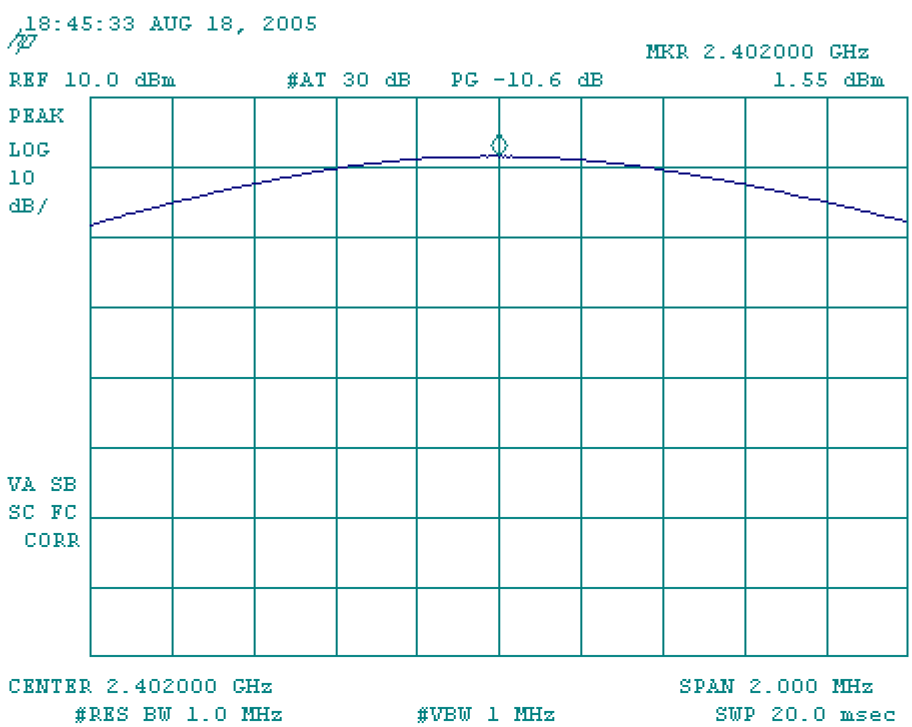

Figure 7a. Peak Output Power, Channel 0.

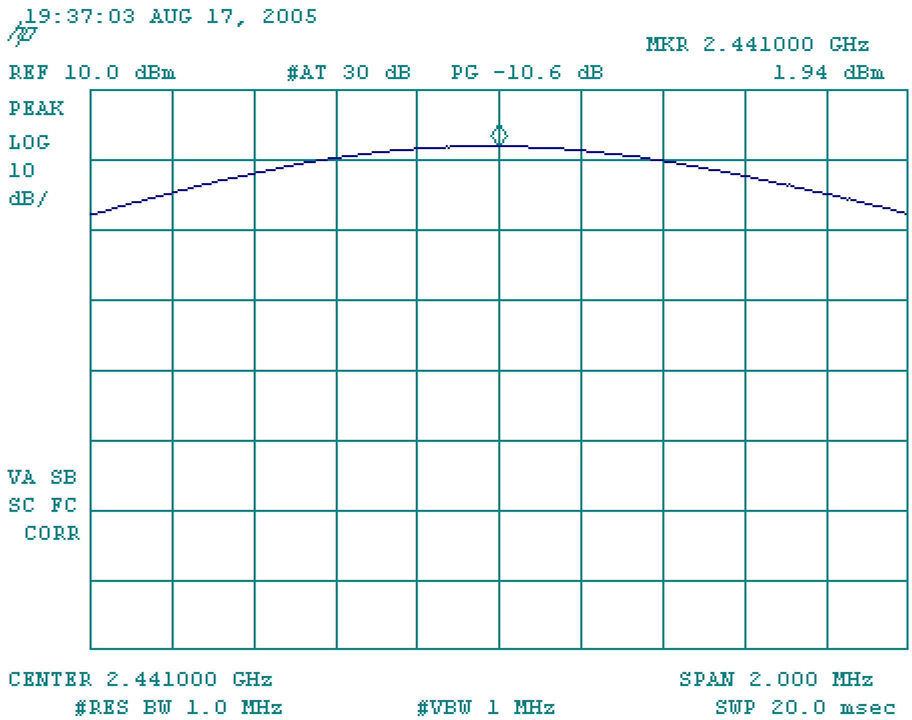

Figure 7b. Peak Output Power, Channel 39.

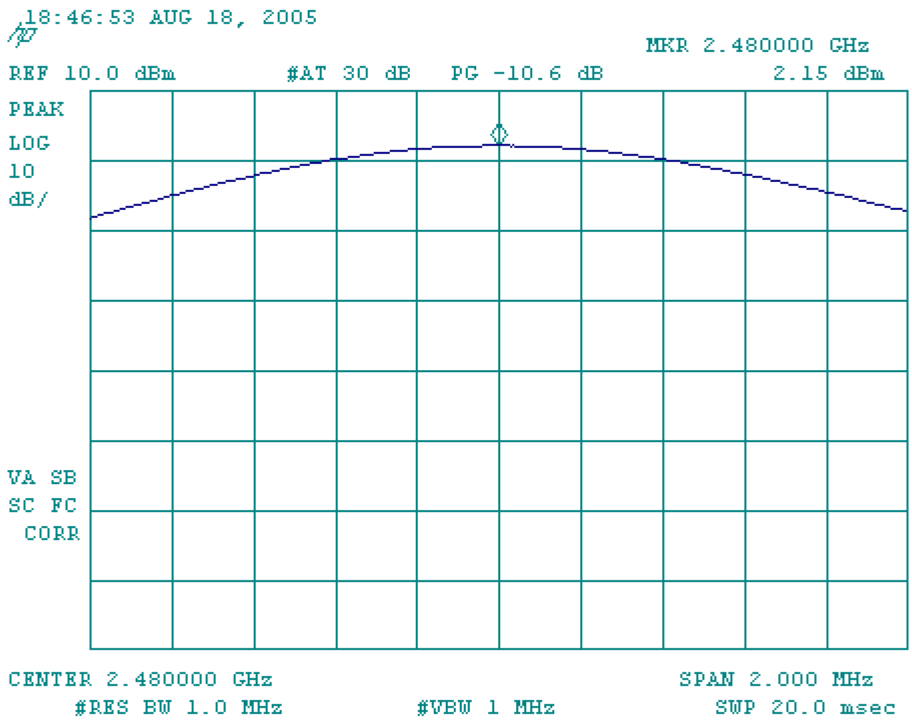

Figure 7c. Peak Output Power, Channel 78.

Results and Limits:

Limits	Channel	Results	Comments
< 1 watt (for systems with at least 75 hopping channels)	0	1.55 dBm	Signal loss from the cable connecting the Bluetooth output port and spectrum analyzer is calibrated out.
	39	1.94 dBm	
	78	2.15 dBm	

8 Band-edge Compliance of Conducted Emissions

FCC: § 15.247 c	IC: RSS-210 §6.2.2(o) e1

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	Plot Description
8-1a	0	Low band edge with hopping disabled
8-1b	Hopping	Low band edge with hopping enabled
8-2a	78	High band edge with hopping disabled
8-2b	Hopping	High band edge with hopping enabled

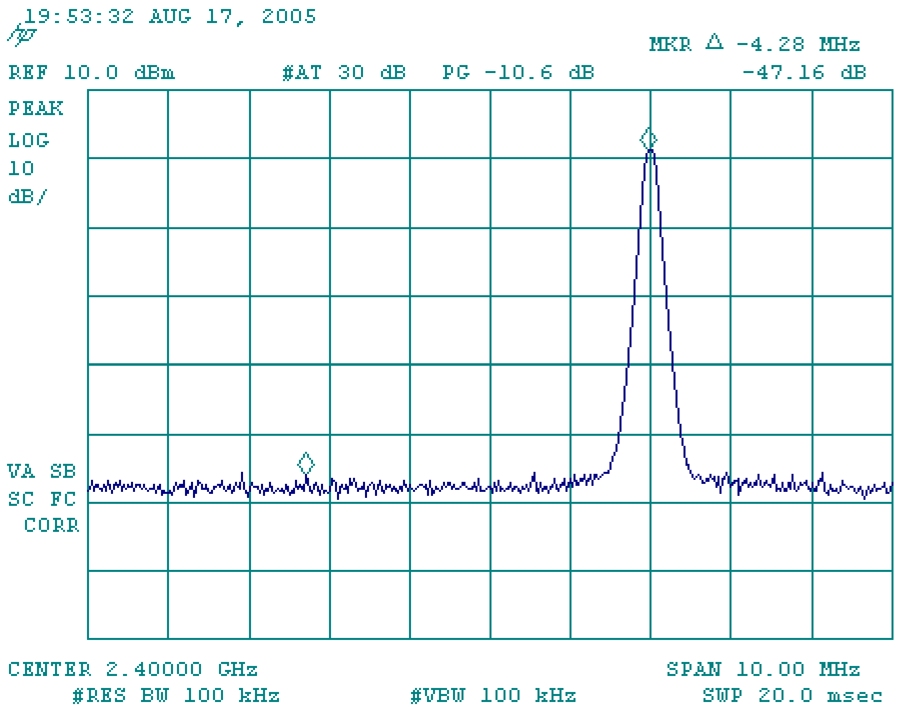

Figure 8-1a. Low band edge with hopping disabled.

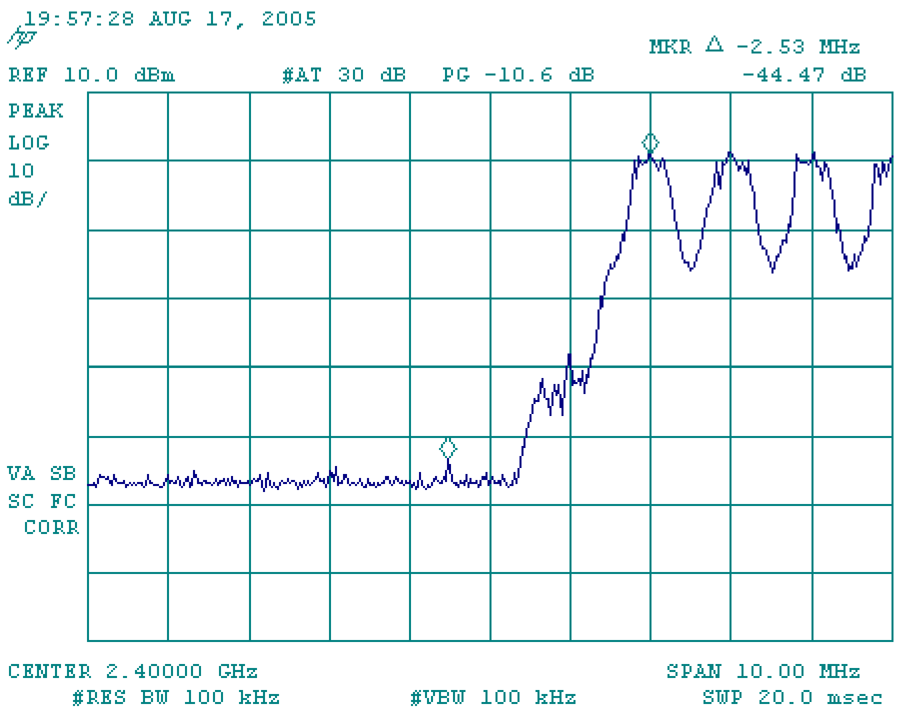

Figure 8-1b. Low band edge with hopping enabled.

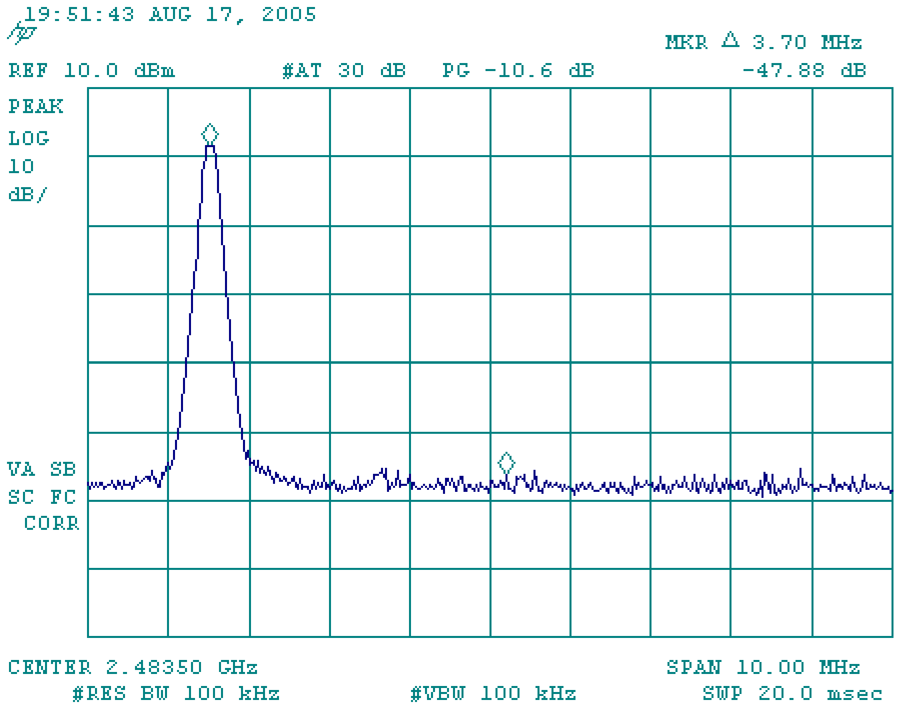

Figure 8-2a. High band edge with hopping disabled.

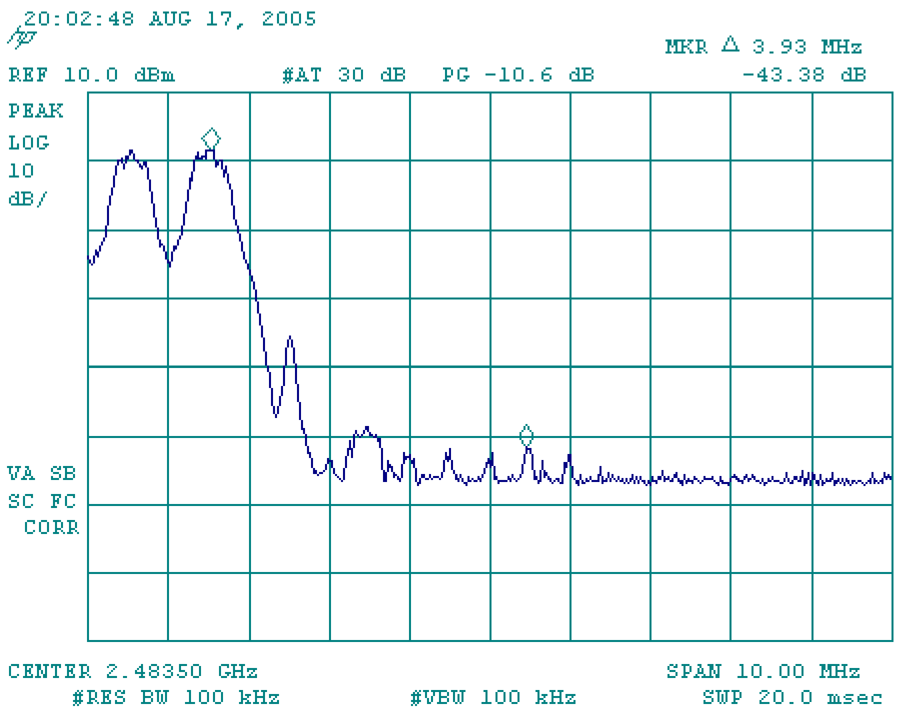

Figure 8-2b. High band edge with hopping enabled.

Results and Limits:

Limits	Channel	Results	Comments
≤ -20 dBc	0	-47.16 dBc	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	-44.47 dBc (CH 0)	
	78	-47.88 dBc	
	Hopping	-43.38 dBc (CH 78)	

9 Spurious RF Conducted Emissions

FCC:	§ 15.247 c	IC:	RSS-210 §6.2.2(o) e1

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.

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

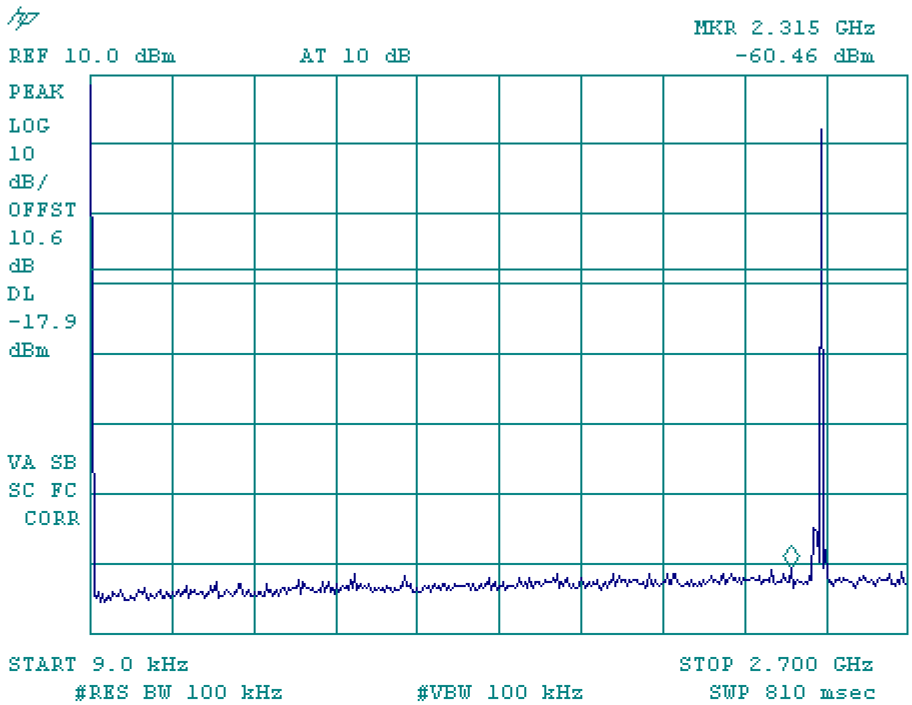

Figure 9-1a. Conducted Spurious Emissions (CH 0)

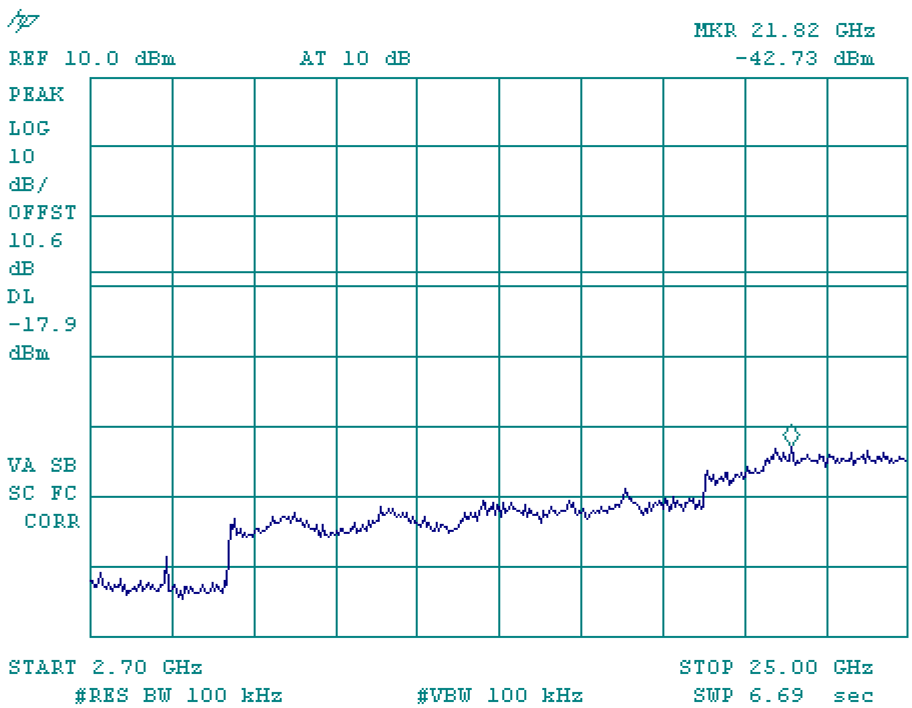

Figure 9-1b. Conducted Spurious Emissions (CH 0)

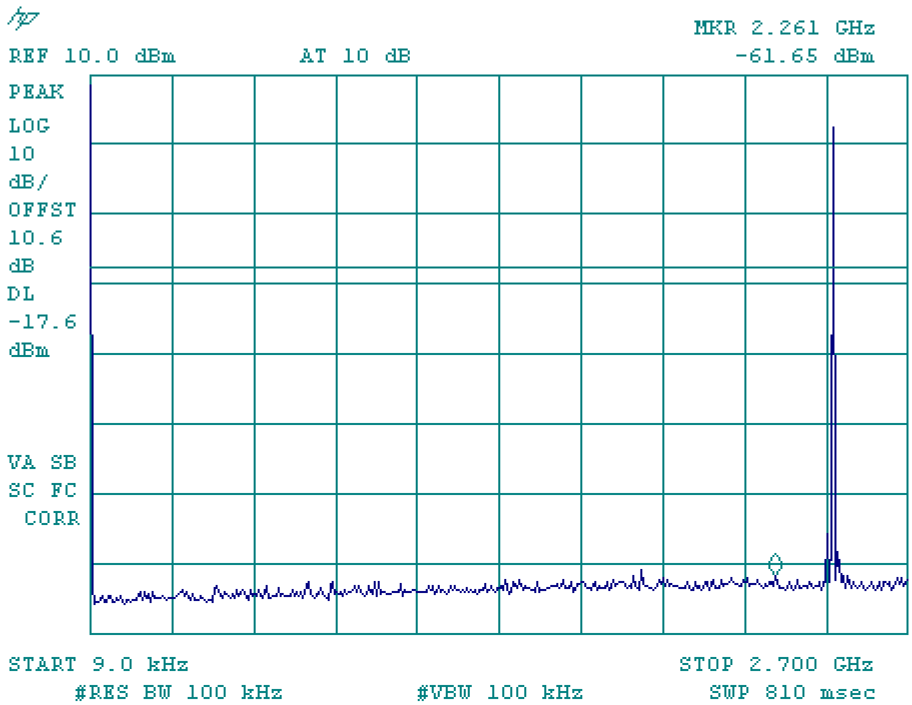

Figure 9-2a. Conducted Spurious Emissions (CH 39)

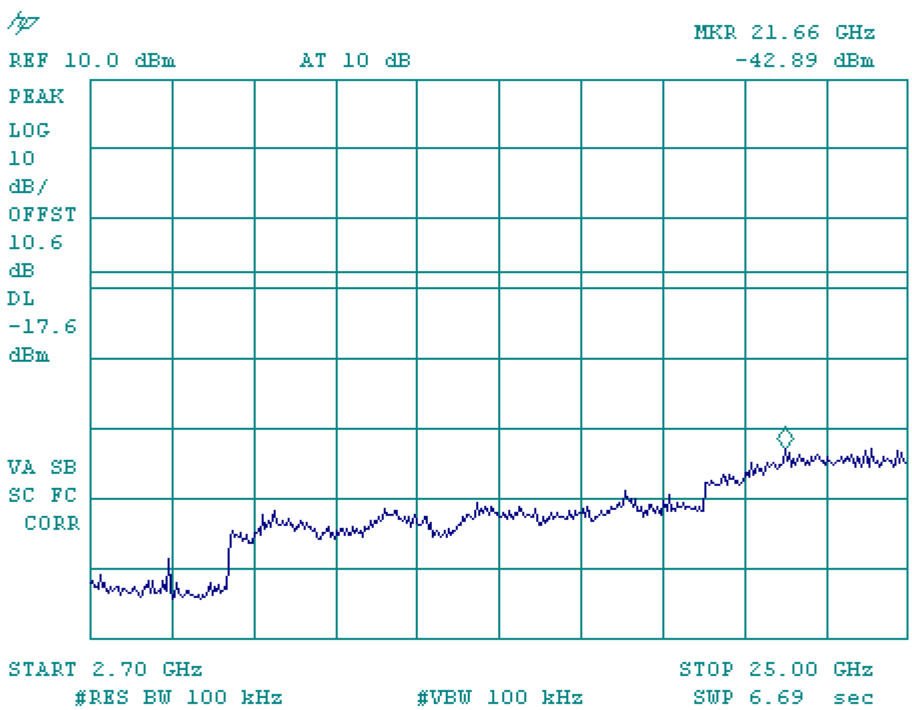

Figure 9-2b. Conducted Spurious Emissions (CH 39)

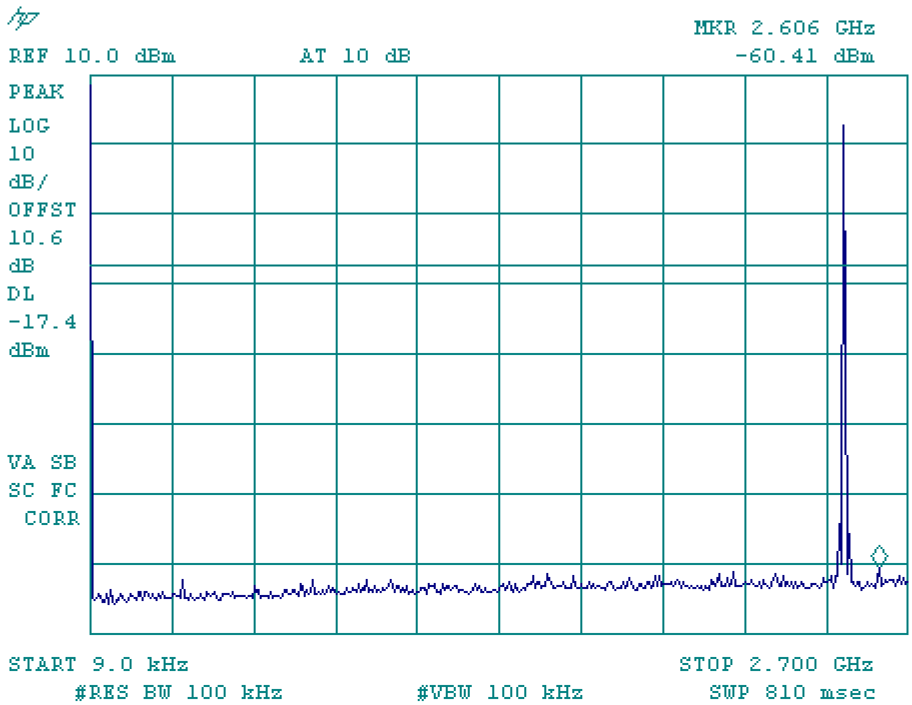

Figure 9-3a. Conducted Spurious Emissions (CH 78)

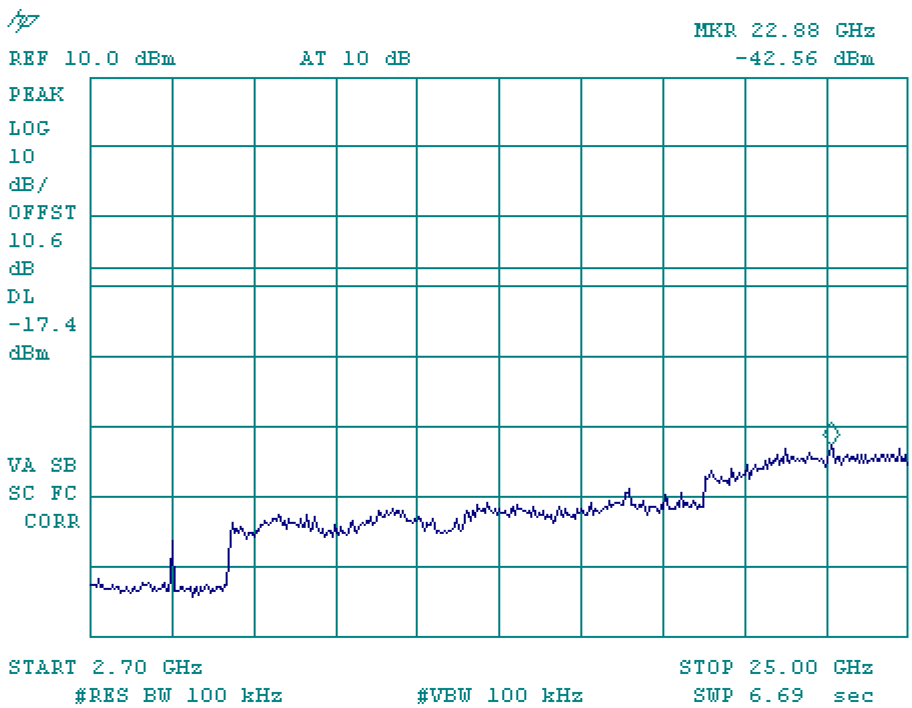

Figure 9-3b. Conducted Spurious Emissions (CH 78)

Results and Limits:

Limits	Channel	Result	Comments
-20 dBc	0	-44.83 dBc	Maximum of emissions is reported here, in the frequency spectrum 9kHz to 25GHz.
	39	-45.29 dBc	
	78	-45.16 dBc	

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 Nemko in San Diego, California. The test report is attached as a separate document.			

11 Spurious Radiated Emissions

FCC:	§ 15.247 c, § 15.209 a	IC:	RSS-210 §6.2.2(o) e1
Measurement Procedures: The radiated spurious emission test was performed at Nemko in San Diego, California. The test report is attached as a separate document.			

12 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Cal Due Date
Power Meter	Giga-tronics	8541C	1835203	12/20/2005
Power Meter Sensor	Giga-tronics	80601A	1830321	06/16/2006
Spectrum Analyzer	Hewlett Packard	8593EM	3710A00203	03/14/2006
Spectrum Analyzer	Hewlett Packard	8594E	3810A04238	04/16/2006