

EMI Test Report

Tested in accordance with
Federal Communications Commission (FCC)
Personal Communications Services
CFR 47, Part 15 Subpart C

RIM Testing Services (RTS)

A division of Research In Motion Limited

REPORT NO.: RTS-0373-0606-02

PRODUCT MODEL NO.: RBF20CW
TYPE NAME: BlackBerry
FCC ID: L6ARBF20CW
IC: 2503A-RBF20CW

DATE: July 31, 2006

RTS RIM Testing Services	EMI Test Report for the BlackBerry Handheld Model RBF20CW	
Test Report No. RTS-0373-0606-02	Dates of Test June 27, July 6-10 2006	Author Data M. Attayi

Statement of Performance:

The BlackBerry Handheld, model RBF20CW, ASY-11785-XYZ Rev K_ASY-11783-001 Rev G, and accessories when configured and operated per RIM's operation instructions, performs within the requirements of the test standards.

Declaration:

We hereby certify that:

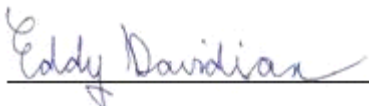
The test data reported herein is an accurate record of the performance of the sample(s) tested.

The test results are valid for the tested unit (s) only.

The test equipment used was suitable for the tests performed and within manufacturer's published specifications and operating parameters.

The test methods were consistent with the methods described in the relevant standards.

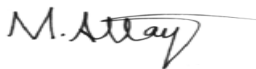
Tested by:



Edward A. Davidian
Compliance Specialist
Date: 31 July 2006



Maurice Battler
Compliance Specialist
Date: 31 July 2006



Masud S. Attayi, P.Eng.
Senior Compliance Engineer,
Date: 31 July 2006

Approved by:



Paul G. Cardinal, Ph.D.
Manager
Date: 1 August 2006

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A. Scope

This report details the results of compliance tests which were performed in accordance to the requirements of:

- o FCC CFR 15 Subpart C, Dec. 8, 2003
- o Industry Canada, RSS-210, Issue 6, September 2005, Low Power Licence-Exempt Radiocommunication Devices

B. Associated Documents

Test report number RTS-0373-0606-01 (submission not required as per DoC)

C. Product Identification

The equipment under test (EUT) was tested at the RIM Testing Services (RTS) EMI test facility, located at:

305 Phillip Street
Waterloo, Ontario
Canada, N2L 3W8
Phone: 519 888 7465
Fax: 519 888 6906

The testing was performed June 27, July 6-10 2006. The sample EUT included:

1. BlackBerry model number RBF20CW, ASY-11785-XYZ Rev K_ASY-11783-001 Rev G, Sample 04.
2. BlackBerry model number RBF20CW, ASY-11785-XYZ Rev K_ASY-11783-001 Rev G, Sample 05.

The transmit frequency bands operating in North America for the Handheld are: Cellular 824 to 849 MHz, PCS 1850 to 1910 MHz and Bluetooth 2402 to 2480 MHz.

D. Support Equipment Used for the Testing of the EUT

- 1) Communication Tester, Rohde & Schwarz, model CMU 200, serial number 837493/073
- 2) DC Power Supply, HP, model 6632B, serial number US37472178
- 3) Communication Tester, Rohde & Schwarz, model CMU 200, serial number 100251

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E. Test Voltage

The ac input voltage was 120 volts, 60 Hz where applicable. This configuration was per RIM's specifications.

F. Test Results Chart

SPECIFICATION	TEST TYPE	MEETS REQUIREMENTS	PERFORMED BY
FCC CFR 47 Part 15.207 IC RSS-210	AC Line Conducted Emissions	See test report RTS-0373-0606-01	-
FCC CFR 47 Part 15.209, 15.247 IC RSS-210	Radiated Emissions Radiated Band Edge Compliance	Yes	Masud Attayi and Edward Davidian
FCC CFR 47 Part 15.247(a), (b), and (c) IC RSS-210	20 dB Bandwidth Carrier Freq. Separation Number of Hopping freq. Dwell Time Max. Peak Output Power Band Edge Compliance Spurious RF Conducted Emissions	Yes	Maurice Battler

G. Modifications to EUT

No modifications were required on the EUT.

H. Summary of Results

1) AC LINE CONDUCTED EMISSIONS

To view the test results, see test report number RTS-0373-0606-01.

2) RADIATED EMISSIONS

a) Radiated Spurious and Harmonic Emissions

The radiated emissions from the EUT were measured as per FCC Part 15.247 and IC RSS-210. The EUT was placed on a nonconductive styrofoam table, 100 cm high

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that was positioned on a remotely controlled turntable. The test distance used between the EUT and the receiving antenna was three metres. The turntable was rotated to determine the azimuth of the peak emissions. Then the emissions were maximized by elevating the antenna in the range of 1 to 4 metres. The maximum emission level was recorded. The frequency range measured was from 30 MHz to 25.0 GHz. Both the horizontal and vertical polarisations of the emissions were measured.

The measurements were performed in a semi-anechoic chamber. The semi-anechoic chamber's FCC registration number is **778487** and the Industry Canada file number is **IC4240**.

The EUT was configured and operated to produce the maximum radiated emissions while still keeping within RIM's specifications.

The Handheld was measured in standalone configuration with Bluetooth transmitting in single frequency mode at low channel (0), middle channel (39) and high channel (78) and frequency hopping mode.

The system's radiated emission levels were compared with respect to the FCC CFR 47 Part 15, Subpart C, 15.247 and RSS-210.

The Bluetooth harmonics were investigated up to the 10th harmonic. The sample EUT had a worse case test margin of 12.8 dB at 4960.0 MHz using the peak detector and a worse case test margin of 4.7 dB at 4960.0 MHz using the average detector.

b) Band-Edge Compliance of RF Radiated Emissions

The Band-Edge Compliance of RF Radiated Emissions met the requirements as per 15.209.

See APPENDIX 1 for the test data.

Sample Calculation:

Field Strength (dBµV/M) is calculated as follows:

FS = Measured Level (dBµV) + A.F. (dB/m) + Cable Loss (dB) - Preamp (dB) + Filter Loss (dB)

Measurement Uncertainty ±4.0 dB

3) BLUETOOTH RF CONDUCTED EMISSIONS

a) 20 dB Bandwidth

The EUT met the requirements of the 20 dB bandwidth as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured.

See APPENDIX 2 for the test data.

b) Carrier Frequency Separation

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The EUT met the requirements of the carrier frequency separation as per 47 CFR 15.247(a) and RSS-210. Channel 38 to 39 was measured.
See APPENDIX 2 for the test data.

c) **Number of Hopping Frequencies**

The EUT met the requirements of the number of hopping frequencies as per 47 CFR 15.247(a) and RSS-210. The number of hopping channels measured was 79.

See APPENDIX 2 for the test data.

d) **Time of Occupancy (Dwell Time)**

The EUT met the requirements of the dwell time as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured in DH1, DH3 and DH5 modes. Bluetooth was operating in frequency hopping (Euro/US) mode during the measurements.

See APPENDIX 2 for the test data.

e) **Maximum Peak Conducted Output Power**

The EUT met the requirements of the maximum peak conducted output power as per 47 CFR 15.247(b) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured.

See APPENDIX 2 for the test data.

f) **Band-Edge Compliance of RF Conducted Emissions**

The EUT met the requirements of the band-edge compliance of RF conducted emissions as per 47 CFR 15.247(c) and RSS-210. Channels 0 and 78 were measured in frequency hopping (Euro/US) mode and single frequency mode.

See APPENDIX 2 for the test data.

g) **Spurious RF Conducted Emissions**

The EUT met the requirements of the spurious RF conducted emissions as per 47 CFR 15.247(c) and RSS-210. The frequency range measured was 10 MHz to 26 GHz. Low channel (0), middle channel (39) and high channel (78) were measured in single frequency mode and frequency hopping (Euro/US) mode.

See APPENDIX 2 for the test data.

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I. Compliance Test Equipment Used

<u>UNIT</u>	<u>MANUFACTURER</u>	<u>MODEL</u>	<u>SERIAL NUMBER</u>	<u>CAL DUE DATE</u> (YY MM DD)	<u>USE</u>
Preamplifier	Sonoma	310N/11909A	185831	06-11-27	Radiated Emissions
Preamplifier system	TDK RF Solutions	PA-02	080010	06-11-25	Radiated Emissions
Hybrid Log Antenna	TDK	HLP-3003C	017401	06-07-21	Radiated Emissions
Horn Antenna	TDK	HRN-0118	130092	06-09-24	Radiated Emissions
Horn Antenna	TDK	HRN-0118	30101	06-07-21	Radiated Emissions
Horn Antenna	Emco	3116	2538	06-09-27	Radiated Emissions
Preamplifier	TDK	18-26	3002	06-11-28	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	973	06-12-13	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	974	06-09-21	Radiated Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	837493/073	07-03-20	Radiated Emissions
EMI Receiver	Rohde & Schwarz	ESIB-40	100255	07-05-11	Radiated Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	100251	07-04-23	Conducted Emissions
Spectrum Analyzer	HP	8563E	3745A08112	06-09-10	RF Conducted Emissions
DC Power Supply	HP	6632B	US37472178	07-09-14	RF Conducted Emissions
Environment Monitor	Control Company	1870	230355190	06-12-23	Radiated Emissions
Environment Monitor	Control Company	1870	230355189	06-12-23	RF Conducted Emissions
Temperature Probe	Hart Scientific	61161-302	21352860	06-09-28	Frequency Stability
Environmental Chamber	ESPEC Corp.	SH-240S1	91005607	N/R	Frequency Stability

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APPENDIX 1 – RADIATED EMISSIONS TEST DATA

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Radiated Emissions Test Results

The environmental test conditions were: Temperature 23°C
Pressure 1014 mb
Relative Humidity 32%

Test Distance was 3.0 metres Bluetooth Band

Using Pattern type "Static PRBS" and packet type "DH5" during the measurements.

Type	Channel	Frequency	Antenna		Reading (Peak)	Corrected Reading	Detector	Peak Limit	Diff. To Limit
		(MHz)	Type	Pol	(dBuV)	(dBuV)	AVE/PK	(dBuV/m)	(dB)
Handheld Standalone, Vertical									
Single frequency mode Low Channel									
2 nd	0	4804.0	Horn	V	40.9	60.5	PK.	74	-13.5
2 nd	0	4804.0	Horn	H	NF				
2 nd	0	4804.0	Horn	V	27.7	47.3	AVE.	54	-6.7
2 nd	0	4804.0	Horn	H	NF				
The harmonics were investigated up to the 10 th harmonic. Emissions above the 2 nd harmonic were in the noise floor (NF)									
Single frequency mode Middle Channel									
2 nd	39	4882.0	Horn	V	40.7	60.3	PK.	74	-13.7
2 nd	39	4882.0	Horn	H	NF				
2 nd	39	4882.0	Horn	V	29.5	49.1	AVE.	54	-4.9
2 nd	39	4882.0	Horn	H	NF				
The harmonics were investigated up to the 10 th harmonic. Emissions above the 2 nd harmonic were in the NF									
Single frequency mode High Channel									
2 nd	78	4960.0	Horn	V	41.6	61.2	PK.	74	-12.8
2 nd	78	4960.0	Horn	H	NF				
2 nd	78	4960.0	Horn	V	29.7	49.3	AVE.	54	-4.7
2 nd	78	4960.0	Horn	H	NF				

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The harmonics were investigated up to the 10th harmonic.
Emissions above the 2nd harmonic were in the NF

Radiated Emissions Test Results con't

Bluetooth Band

Type	Channel	Frequency	Antenna		Reading (Peak)	Corrected Reading	Detector	Peak Limit	Diff. To Limit
		(MHz)	Type	Pol	(dBuV)	(dBuV)	AVE/PK	(dBuV/m)	(dB)
Handheld Standalone, vertical Hopping mode.									
2 nd	0-78	4960.0	Horn	V	40.8	60.4	PK.	74	-13.6
2 nd	0-78	4960.0	Horn	H	NF				
2 nd	0-78	4960.0	Horn	V	27.4	47	AVE.	54	-7
2 nd	0-78	4960.0	Horn	H	NF				
The harmonics were investigated up to the 10 th harmonic. Emissions above the 2 nd harmonic were in the noise floor (NF)									

Bluetooth Band-Edge Compliance of RF Radiated Emissions

Handheld standalone, vertical, Bluetooth in single frequency mode, channel 78.

The test distance was 3 metres.

Channel	Freq. (MHz)	Rx Antenna		Detector	VBW (MHz)	Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
		Type	POL.	(PK, AVE.)						
78	2480.00	Horn	V	PK	1 MHz	74.36	35.1	39.26	74	-34.74
78	2480.00	Horn	H	PK	1 MHz	74.76	35.1	39.66	74	-34.34
78	2480.00	Horn	V	AV.	10 Hz	63.46	35.1	28.36	54	-25.64
78	2480.00	Horn	H	AV.	10 Hz	63.86	35.1	28.76	54	-25.24

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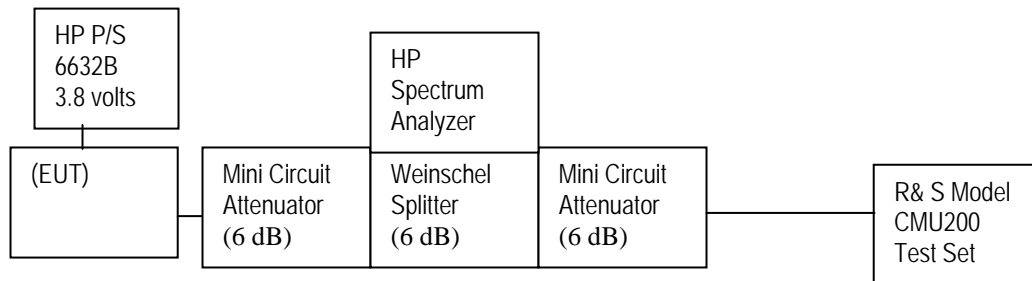
APPENDIX 2 – BLUETOOTH CONDUCTED EMISSIONS TEST DATA/PLOTS

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Bluetooth RF Conducted Emission Test Results

Bluetooth power output was at maximum for all the recorded measurements shown below.

Test Setup Diagram



A reference offset of 12.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

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Bluetooth RF Conducted Emission Test Results cont'd

20 dB Bandwidth

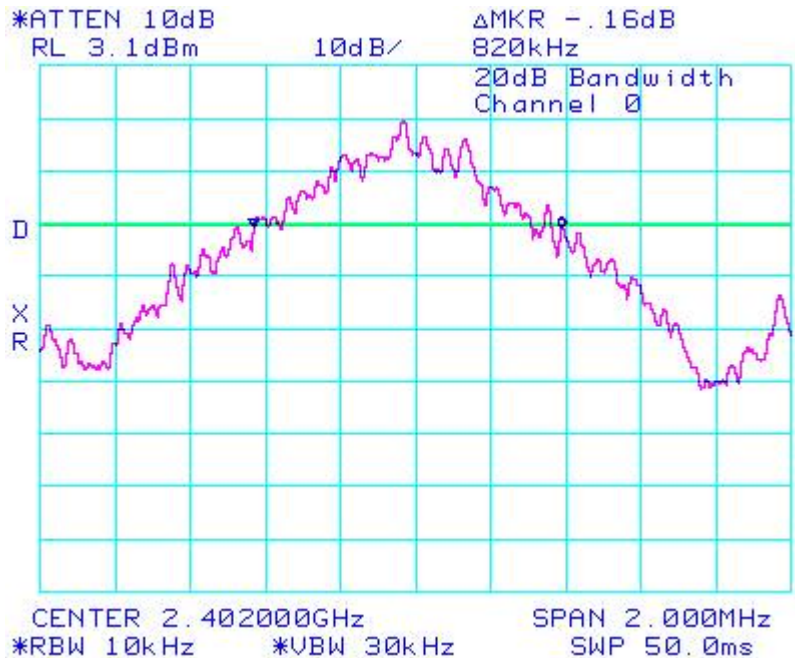
The EUT met the requirements of the 20 dB bandwidth as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured. Bluetooth was operating in single frequency mode using pattern type Static PRBS and packet type DH5 during the measurements.

Bluetooth Channel	Limit (MHz)	Measured Level (MHz)
0	<=1.0	0.820
39	<=1.0	0.903
78	<=1.0	0.903

See figures 1 to 3 for the plots of the 20 dB bandwidth measurements.

The environmental test conditions were: Temperature 24°C
Pressure 1009 mb
Relative Humidity 36%

Figure 1: 20 dB Bandwidth, channel 0



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Bluetooth RF Conducted Emission Test Results cont'd

Figure 2: 20 dB Bandwidth, channel 39

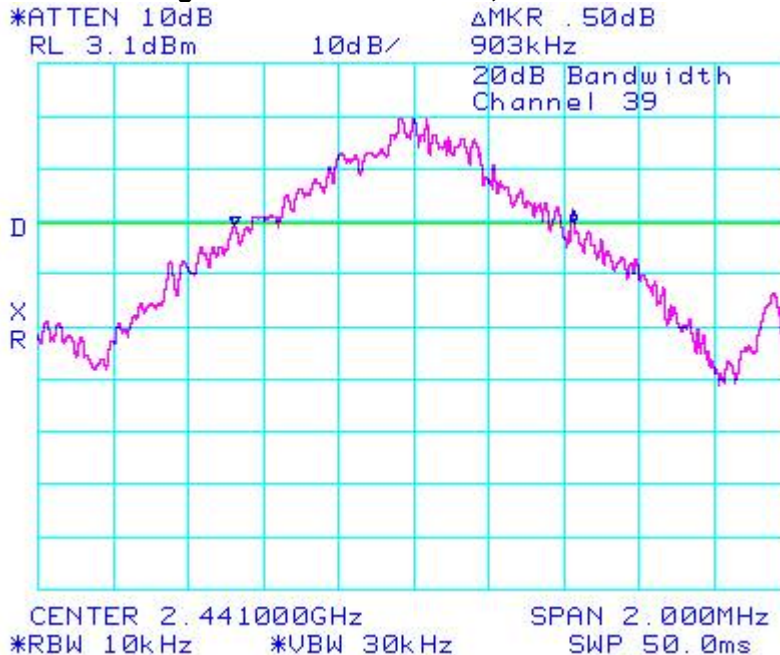
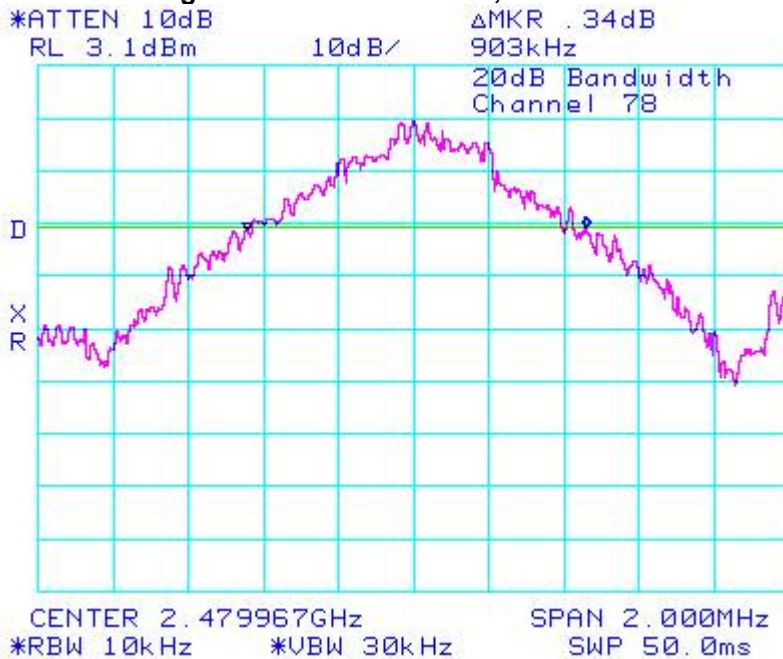


Figure 3: 20 dB Bandwidth, channel 78



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Bluetooth RF Conducted Emission Test Results cont'd

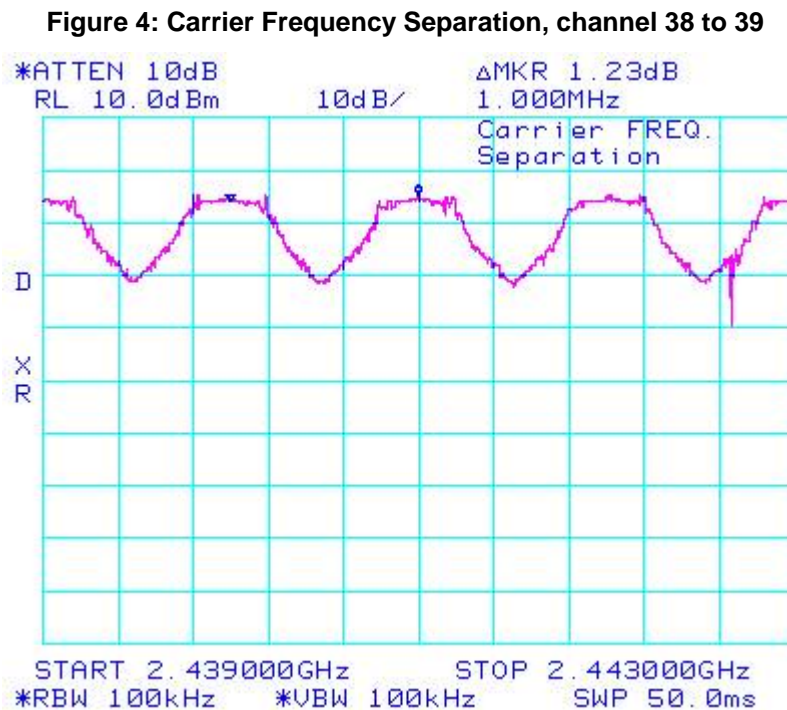
Carrier Frequency Separation

The EUT met the requirements of the Carrier Frequency Separation as per 47 CFR 15.247(a) and RSS-210. Channel 38 to 39 was measured. Bluetooth was operating in frequency hopping (Euro/US) mode using pattern type Static PRBS and packet type DH5 during the measurements.

Bluetooth Channels	Limit (MHz)	Measured Level (MHz)
38 to 39	>= 0.025 or 20 dB bandwidth	1.000

The environmental test conditions were: Temperature 24°C
 Pressure 1009 mb
 Relative Humidity 36%

See figure 4 for the plot of the Carrier Frequency Separation measurement.



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Bluetooth RF Conducted Emission Test Results cont'd

Number of Hopping Frequencies

The EUT met the requirements of the number of hopping frequencies as per 47 CFR 15.247(a) and RSS-210.

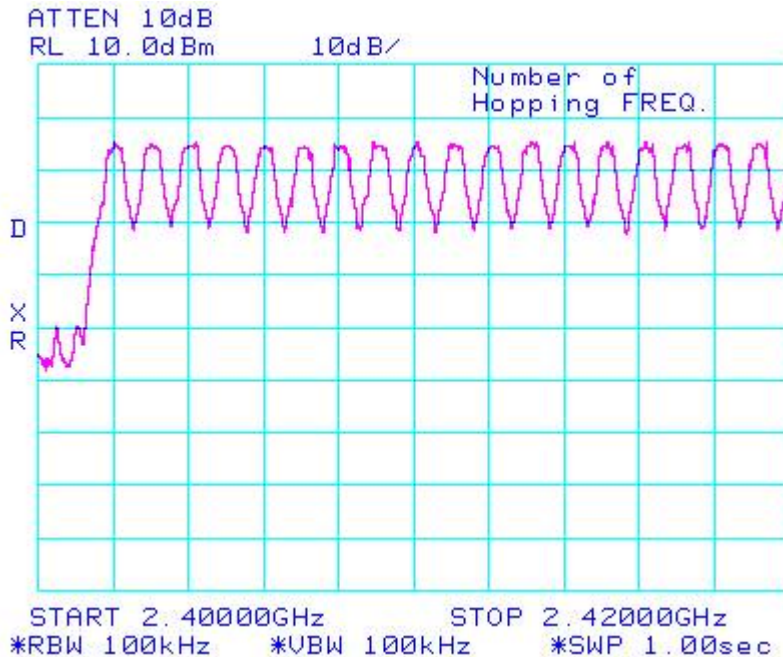
Bluetooth was operating in frequency hopping (Euro/US) mode using pattern type Static PRBS and packet type DH5 during the measurements.

Limit (CH)	Number of Hopping Frequencies (CH)
≥ 75	79

The environmental test conditions were: Temperature 24°C
 Pressure 1009 mb
 Relative Humidity 36%

See figures 5 to 8 for the plots of the number of hopping frequencies.

Figure 5: Number of Hopping Frequencies



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Bluetooth RF Conducted Emission Test Results cont'd

Figure 6: Number of Hopping Frequencies

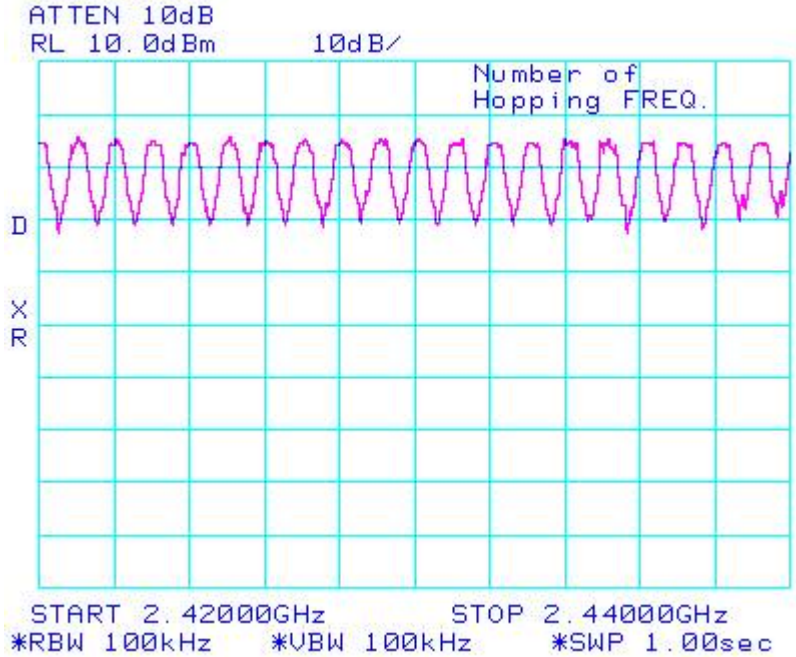
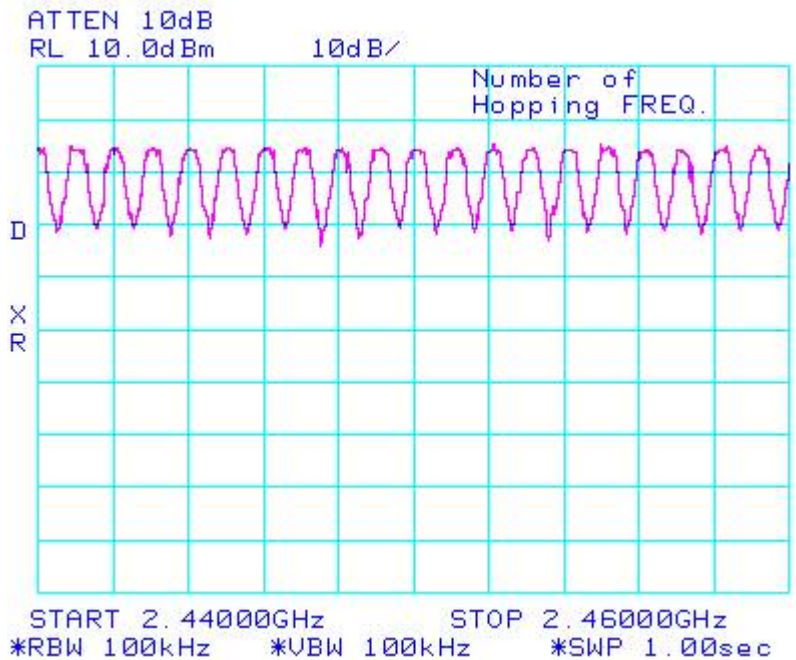


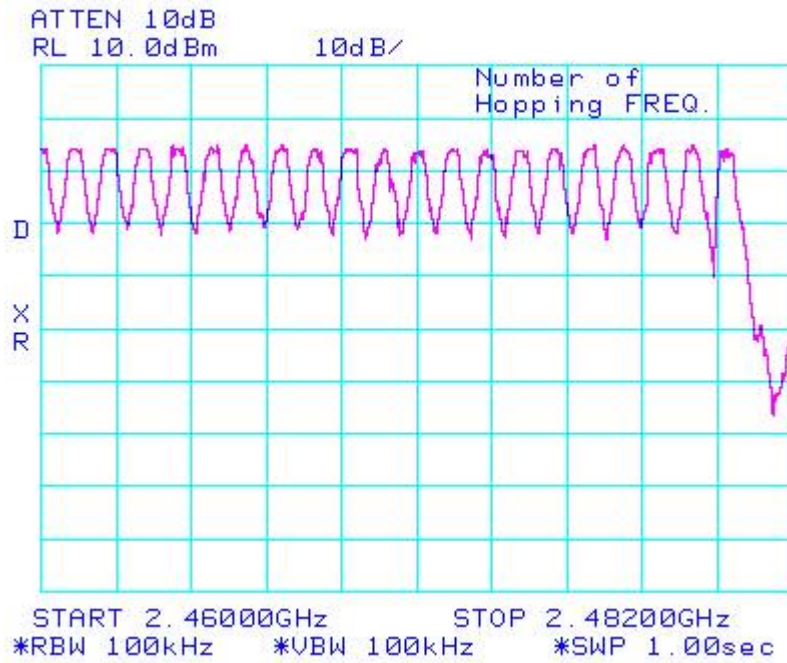
Figure 7: Number of Hopping Frequencies



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Bluetooth RF Conducted Emission Test Results cont'd

Figure 8: Number of Hopping Frequencies



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Bluetooth RF Conducted Emission Test Results cont'd

Time of Occupancy (Dwell Time)

The EUT met the requirements of the time of occupancy (dwell time) as per 47 CFR 15.247(a) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured in packet types DH1, DH3 and DH5. Bluetooth was operating in frequency hopping (Euro/US) mode during the measurements.

The frequency hopping is 1600 hops per second for a dwell time of 625 µsec. for 79 channels.

A DH1 packet needs one time slot for transmitting and one time slot for receiving. The frequency hopping is 800 hops per second with 79 channels which is 10.127 times per second. As per 15.247(a) (iii) "The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed". Therefore for 31.6 seconds (79x0.4) there are 320.0 times of appearance.

A DH3 packet needs one time slot for transmitting and one time slot for receiving. The frequency hopping is 400 hops per second with 79 channels which is 5.06 times per second. Therefore for 31.6 seconds there are 159.9 times of appearance.

A DH5 packet needs one time slot for transmitting and one time slot for receiving. The frequency hopping is 266.7 hops per second with 79 channels which is 3.38 times per second. Therefore for 31.6 seconds there are 106.8 times of appearance.

Bluetooth Channel	Mode	Tx Time (ms)	Dwell Time/31.6 sec. (msec.)	Limit (msec.)	Margin (msec.)
0	DH1	0.5200	.520 x 320.0 = 166.4	400	233.6
39	DH1	0.5200	.520 x 320.0 = 166.4	400	233.6
78	DH1	0.5200	.520 x 320.0 = 166.4	400	233.6
0	DH3	1.7667	1.7667 x 159.9 = 282.5	400	117.5
39	DH3	1.7600	1.7600 x 159.9 = 281.4	400	118.6
78	DH3	1.7533	1.7533 x 159.9 = 280.4	400	119.6
0	DH5	3.0128	3.0128 x 106.8 = 321.8	400	78.2
39	DH5	3.0213	3.0213 x 106.8 = 322.7	400	77.3
78	DH5	3.0213	3.0213 x 106.8 = 322.7	400	77.3

The environmental test conditions were: Temperature 23°C
Pressure 1011 mb
Relative Humidity 34%

See figures 9 to 17 for the plots of the dwell time.

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Bluetooth RF Conducted Emission Test Results cont'd

Figure 9: Dwell Time, Low Channel, Packet Type DH1

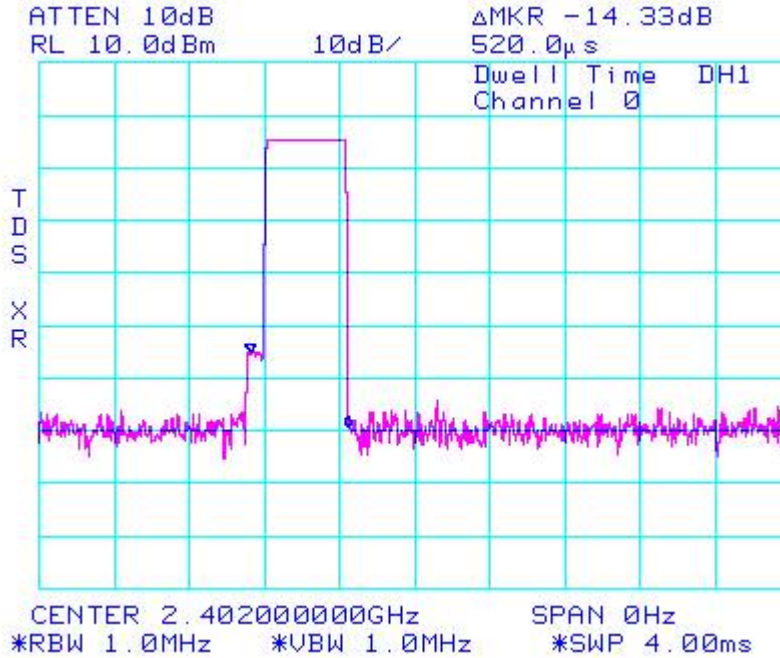
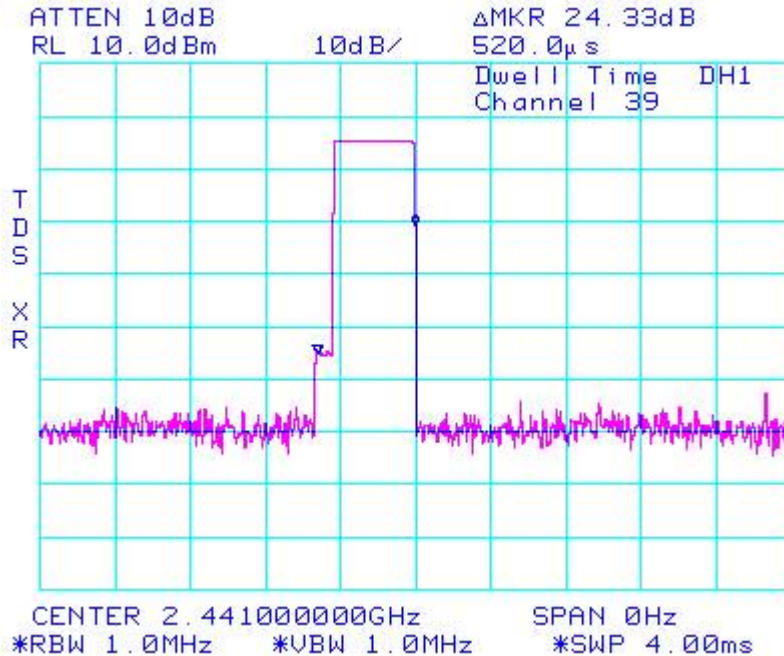


Figure 10: Dwell Time, Middle Channel, Packet Type DH1



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Bluetooth RF Conducted Emission Test Results cont'd

Figure 11: Dwell Time, High Channel, Packet Type DH1

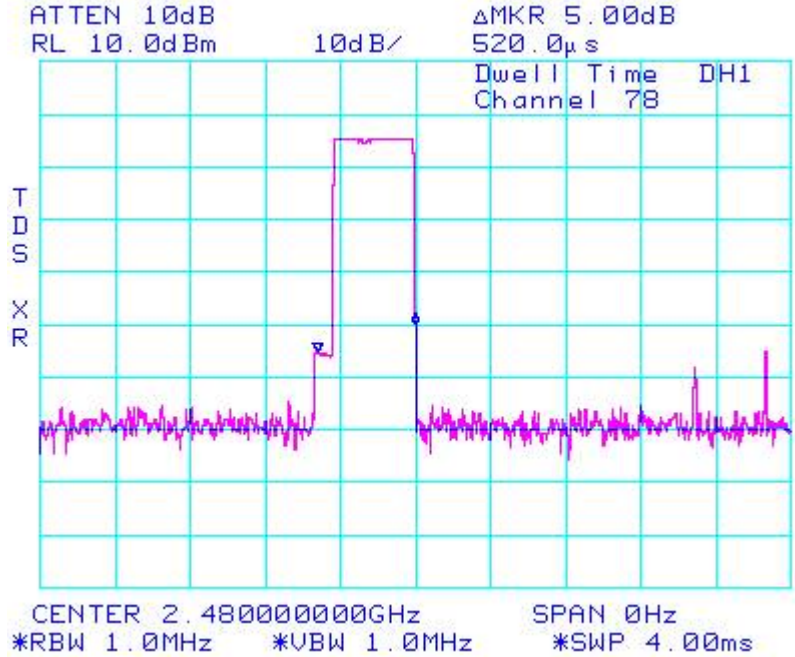
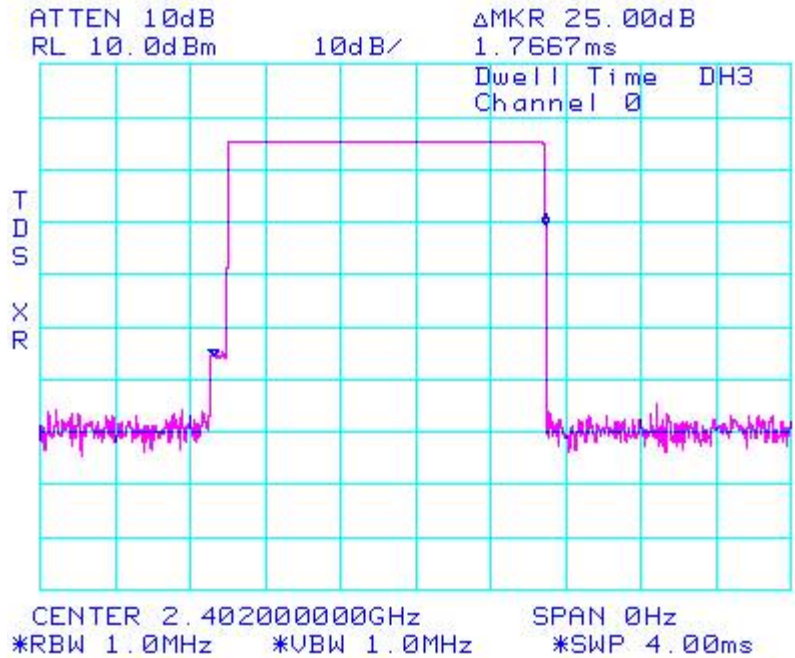


Figure 12: Dwell Time, Low Channel, Packet Type DH3



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Bluetooth RF Conducted Emission Test Results cont'd

Figure 13: Dwell Time, Middle Channel, Packet Type DH3

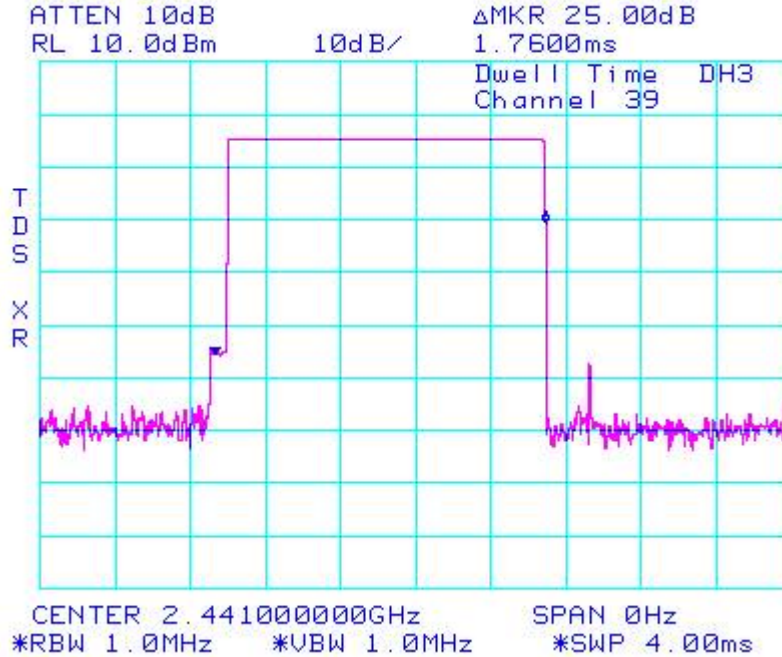
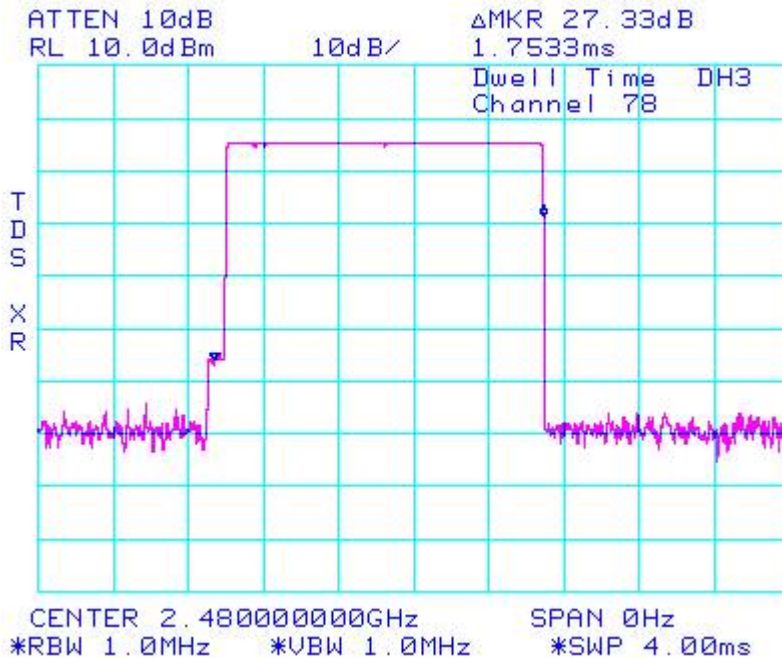


Figure 14: Dwell Time, High Channel, Packet Type DH3



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Figure 15: Dwell Time, Low Channel, Packet Type DH5

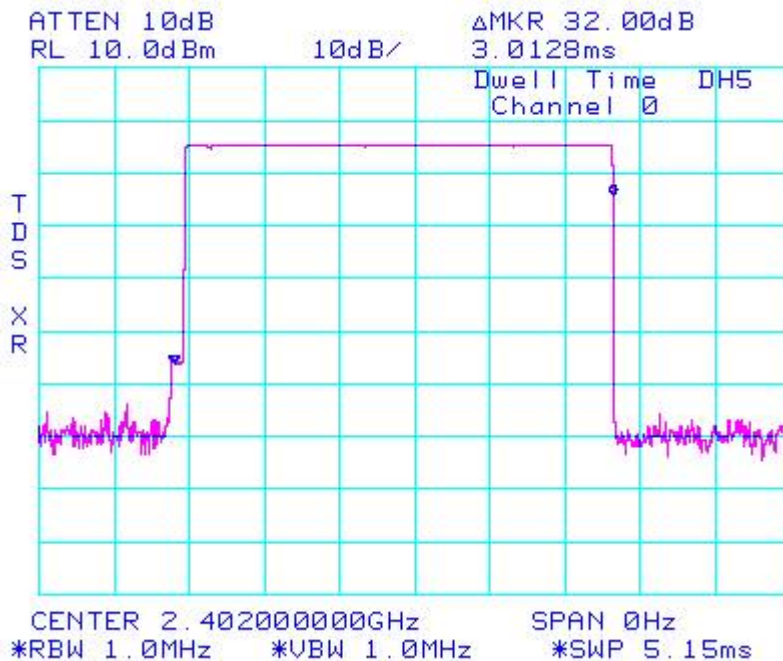
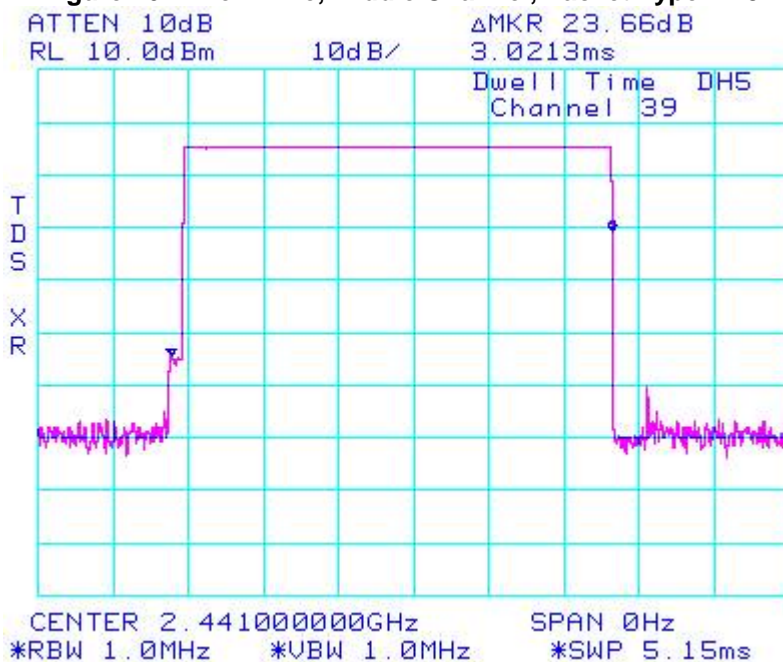


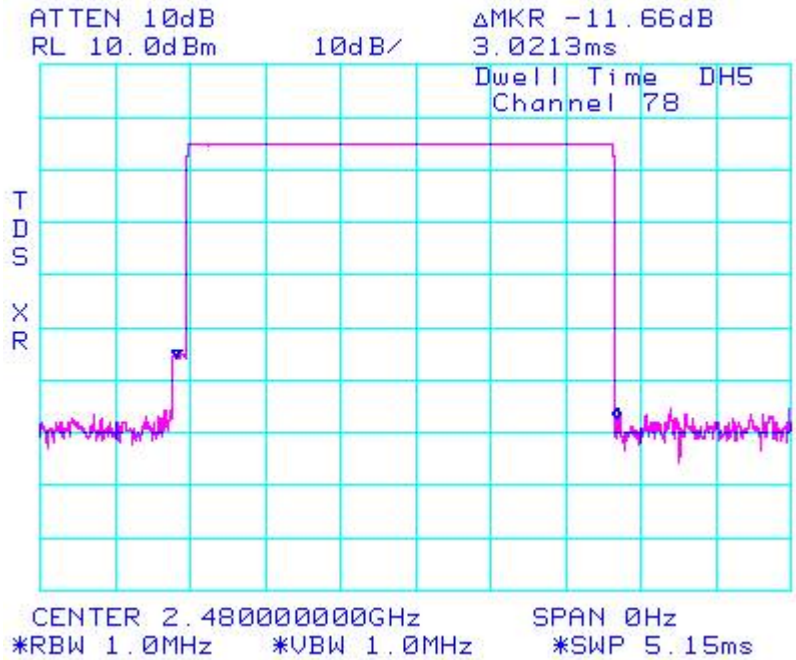
Figure 16: Dwell Time, Middle Channel, Packet Type DH5



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Figure 17: Dwell Time, High Channel, Packet Type DH5



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Maximum Peak Conducted Output Power

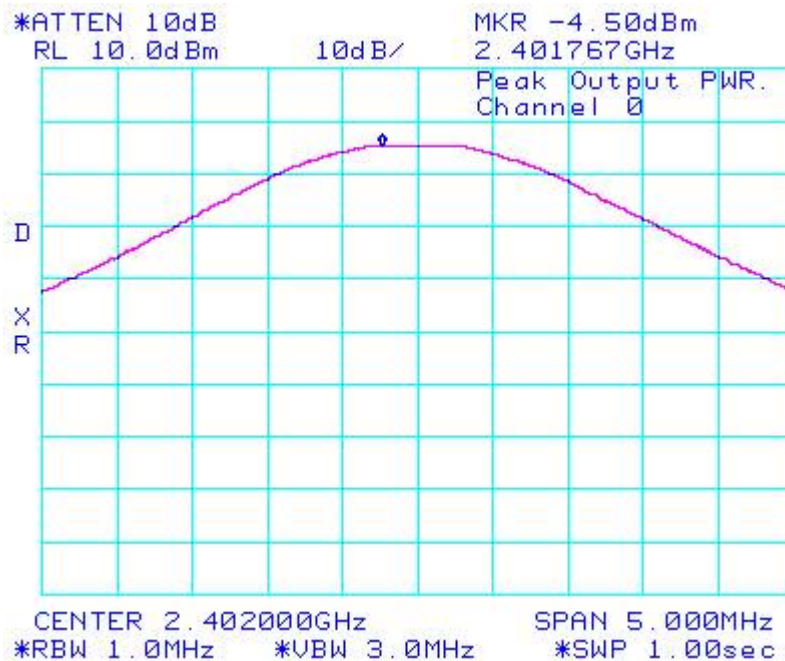
The EUT met the requirements of the maximum peak conducted output power of class 2 as per 47 CFR 15.247(b) and RSS-210. Low channel (0), middle channel (39) and high channel (78) were measured. Bluetooth was operating in single frequency mode during the measurements. A reference offset of 12.4 dB was applied to the spectrum analyzer reference level for the coaxial cable loss and attenuators in the test circuit.

Bluetooth Channel	Measured Level (dBm)	Class 2 Limit (dBm)
0	-4.5	-6.0 to 4.0
39	-4.5	-6.0 to 4.0
78	-5.0	-6.0 to 4.0

The environmental test conditions were: Temperature 24°C
 Pressure 1009 mb
 Relative Humidity 36%

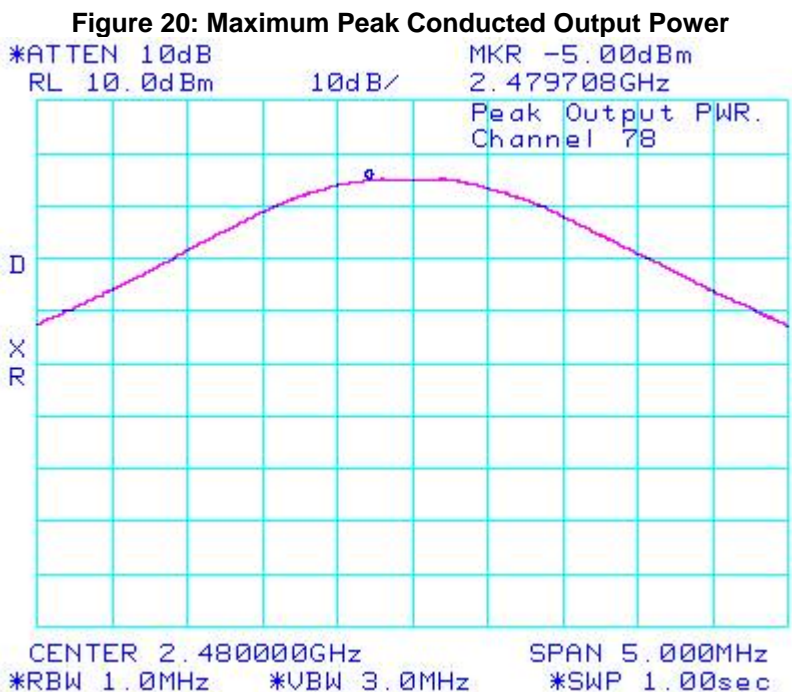
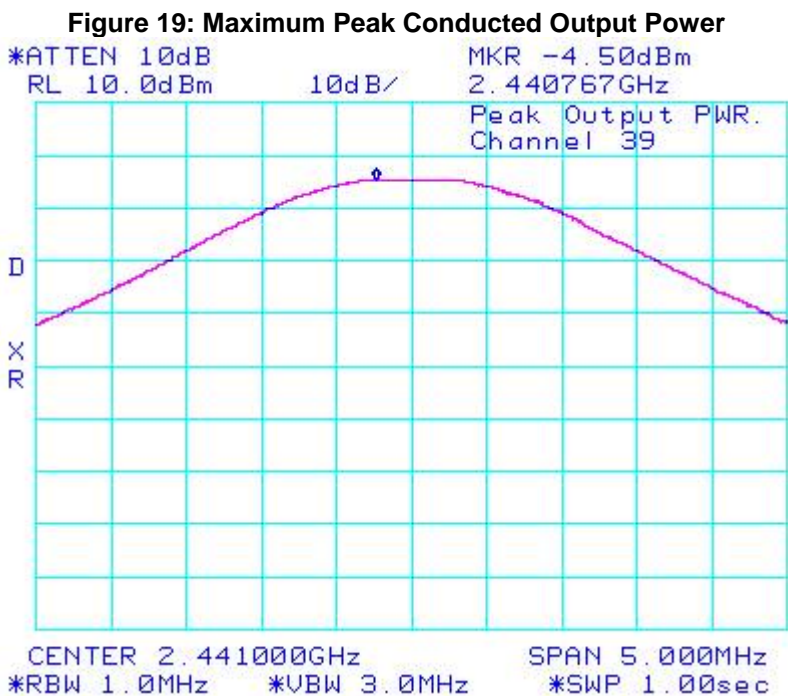
See figures 18 to 20 for the plots of the maximum peak conducted output power.

Figure 18: Maximum Peak Conducted Output Power



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Band Edge Compliance

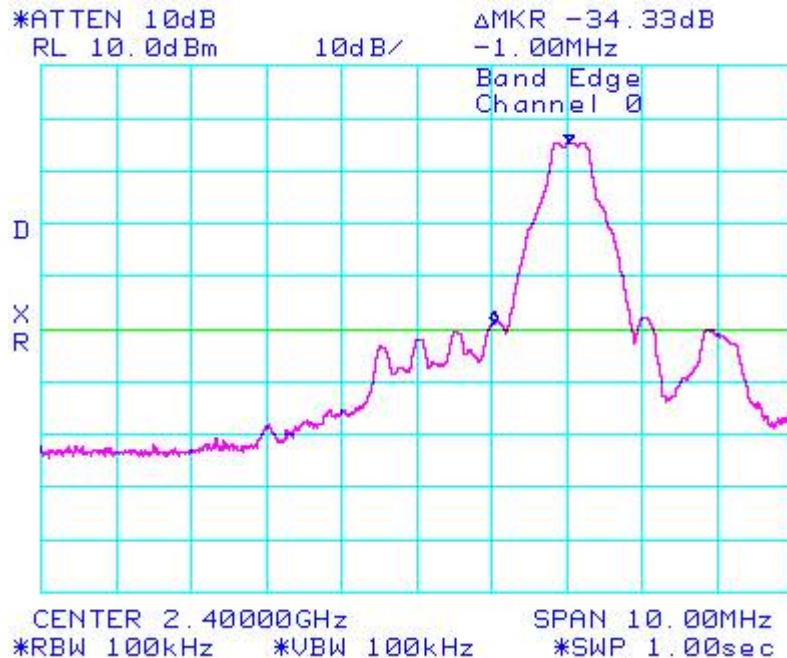
The EUT met the requirements of the band edge compliance as per 47 CFR 15.247(c) and RSS-210. Low channel (0) and high channel (78) were measured. Bluetooth was operating in single frequency and hopping mode using pattern type Static PRBS and packet type DH5 during the measurements.

Bluetooth Channel	Operating Mode	Measured Level (dBc)	Limit (dBc)	Margin (dB)
0	Single Frequency	-34.33	-20	-14.33
0 - 78	Hopping	-35.17	-20	-15.17
78	Single Frequency	-33.00	-20	-13.00
0 - 78	Hopping	-33.84	-20	-13.84

The environmental test conditions were: Temperature 24°C
Pressure 1009 mb
Relative Humidity 35%

See figures 21 to 24 for the plots of the band edge compliance measurements.

Figure 21: Band Edge Compliance, Single Frequency Mode, Channel 0



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Figure 22: Band Edge Compliance, Hopping Frequency Mode, Channel 0

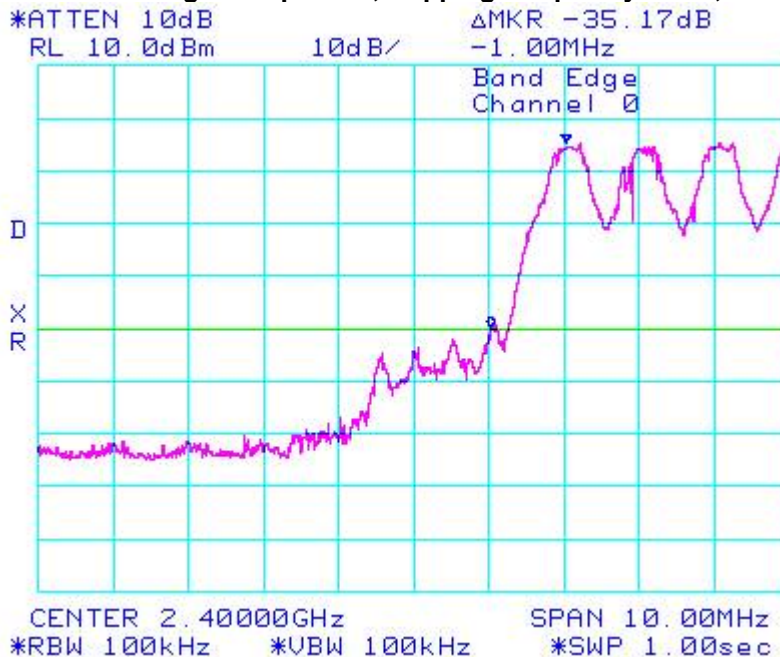
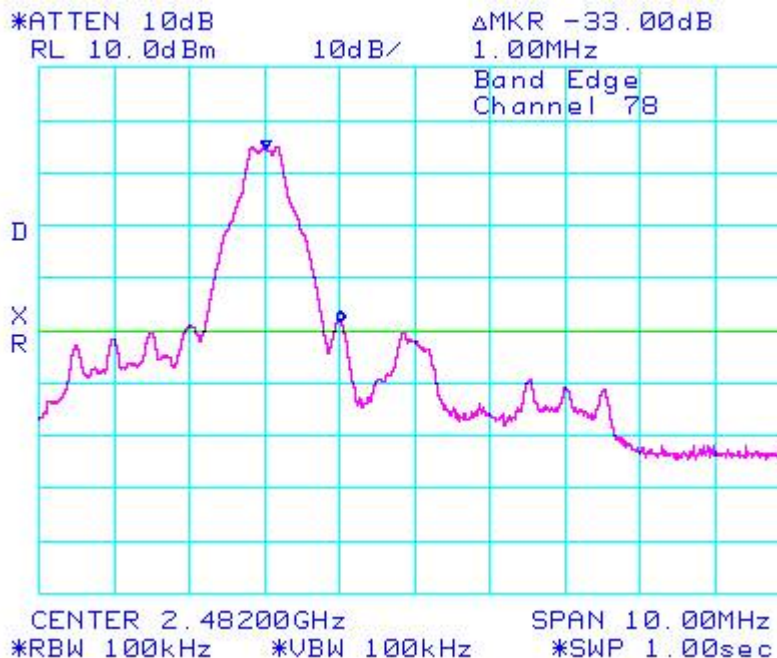


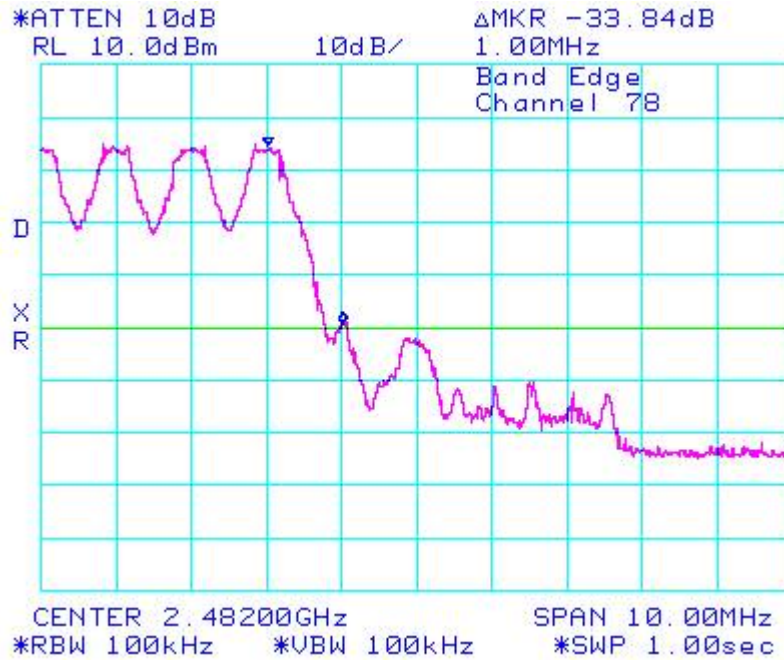
Figure 23: Band Edge Compliance, Single Frequency Mode, Channel 78



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Figure 24: Band Edge Compliance, Hopping Frequency Mode, Channel 78



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Bluetooth RF Conducted Emission Test Results cont'd

Spurious RF Conducted Emissions

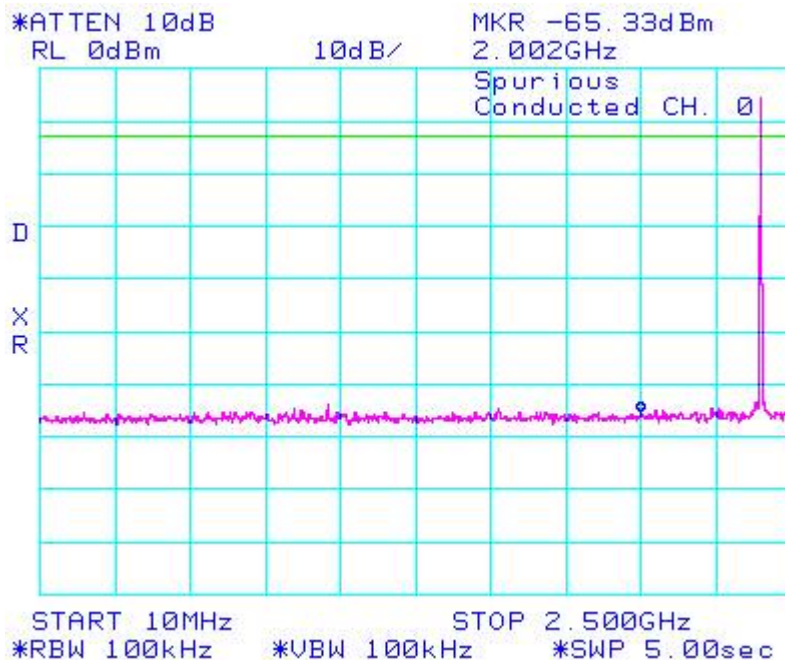
The EUT met the requirements of the spurious RF conducted emissions as per 47 CFR 15.247(c) and RSS-210. Low channel (0) and high channel (78) were measured. Bluetooth was operating in single frequency mode using pattern type Static PRBS and packet type DH5 during the measurements. A reference offset of 12.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

Bluetooth Channel	Channel Power (dBm)	Max. Measured Level (dBm)	Max. Measured Level from carrier (dBc)	Limit (dBc)
0	-4.5	-43.50	-39.00	-20
39	-4.5	-44.50	-40.00	-20
78	-5.0	-47.67	-42.67	-20
Hopping mode	-4.5	-44.83	-40.33	-20

The environmental test conditions were: Temperature 24°C
Pressure 1009 mb
Relative Humidity 35%

See figures 25 to 33 for the plots of the Spurious RF Conducted Emissions.

Figure 25: Spurious RF Conducted Emissions, Channel 0



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Bluetooth RF Conducted Emission Test Results cont'd

Figure 26: Spurious RF Conducted Emissions, Channel 0

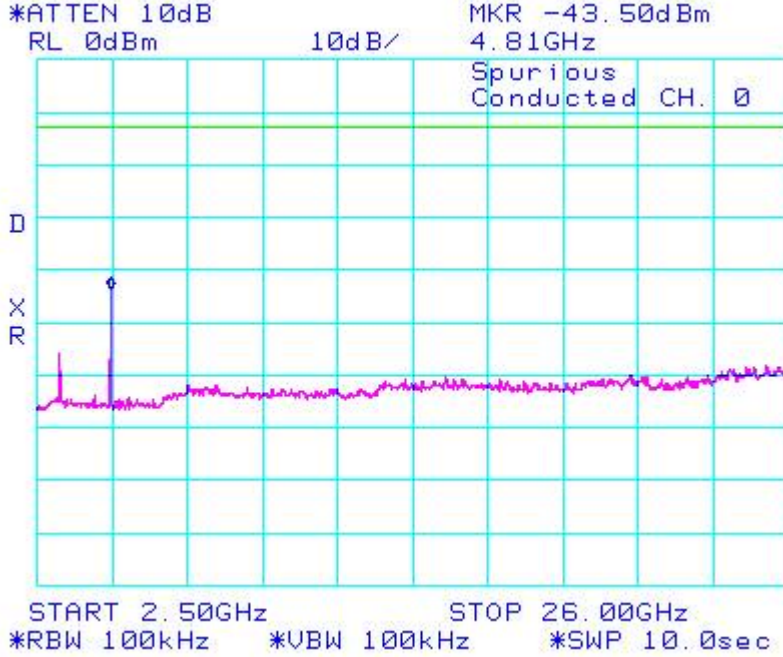


Figure 27: Spurious RF Conducted Emissions, Channel 39



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Figure 28: - Spurious RF Conducted Emissions, Channel 39

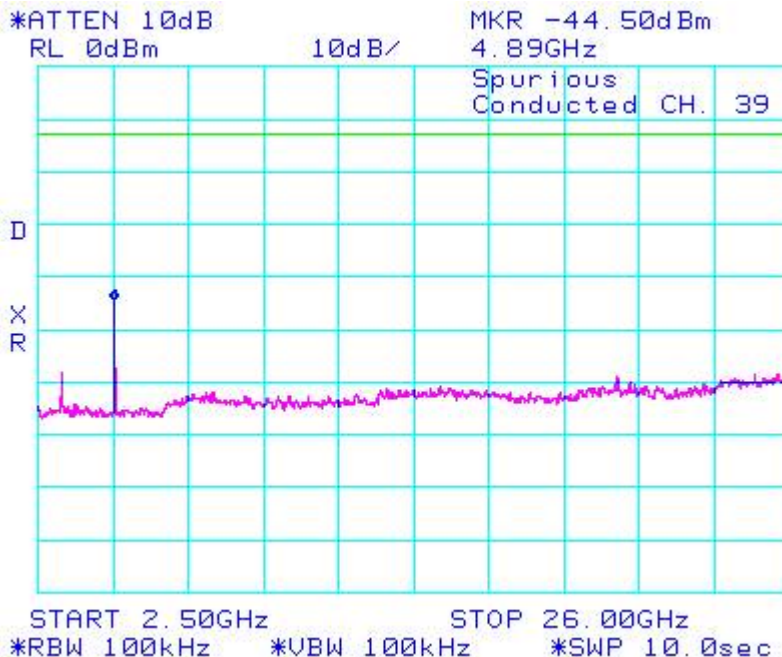
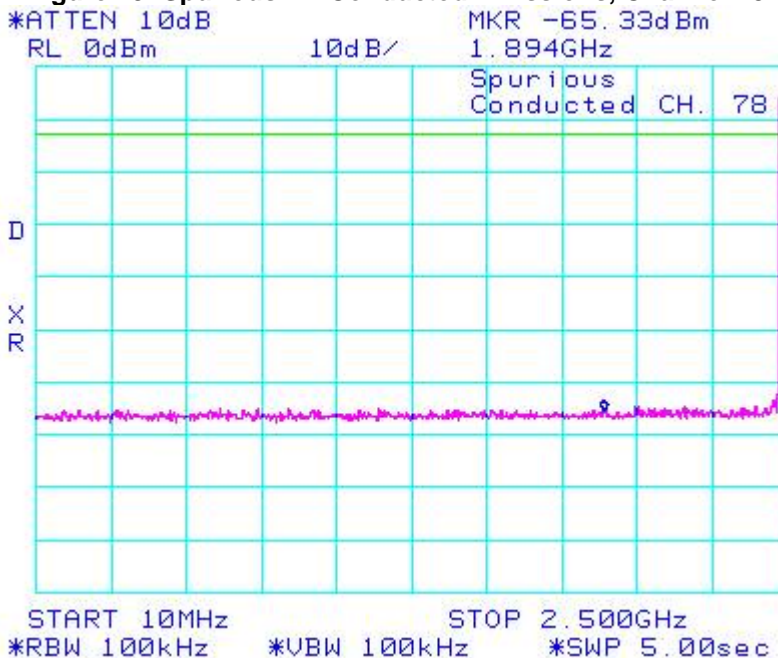


Figure 29: Spurious RF Conducted Emissions, Channel 78



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Figure 30: Spurious RF Conducted Emissions, Channel 78

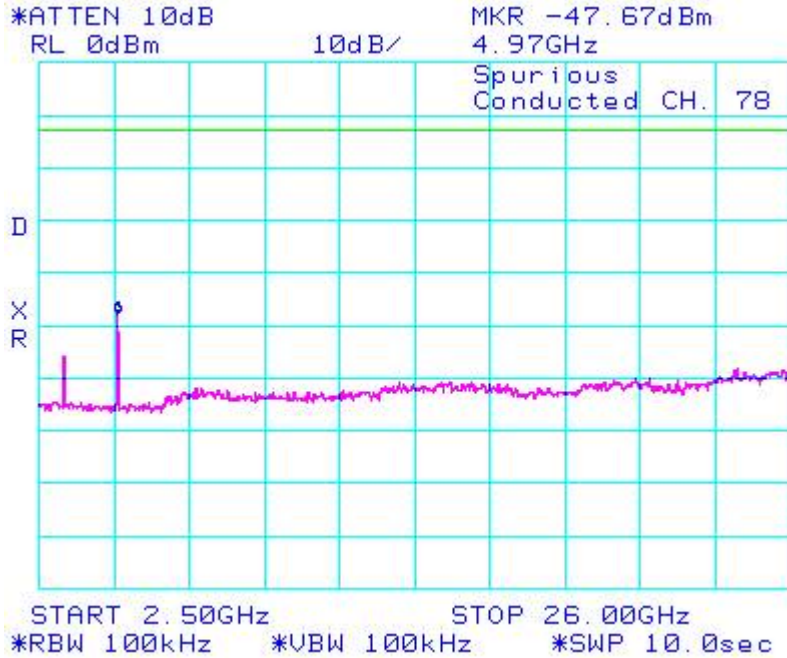
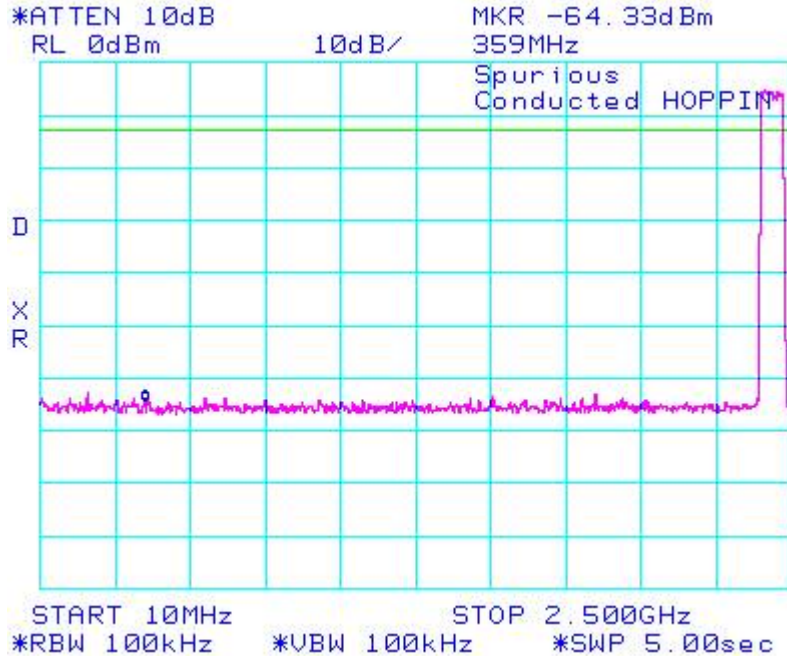


Figure 31: Spurious RF Conducted Emissions, Frequency Hopping Mode



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Bluetooth RF Conducted Emission Test Results cont'd

Figure 32: Spurious RF Conducted Emissions, Frequency Hopping Mode

