

EMI Test Report

Tested in accordance with
Federal Communications Commission (FCC)
Personal Communications Services
CFR 47, Part 15 Subpart C
and
Industry Canada, RSS-210



Research In Motion Limited

REPORT NO.: RIM-0102-0408-01

PRODUCT MODEL NO: RAL11IN
TYPE NAME: BlackBerry Wireless Handheld
FCC ID: L6ARAL11IN
IC: 2503A-RAL11IN

Date: _____ 09 September 2004 _____

Declaration

Statement of Performance:

The BlackBerry Wireless Handheld, model RAL11IN 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 equipment used was suitable for the tests performed and within the manufacturers published specifications and operating parameters.

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

Tested by



Maurice Battler
Compliance Specialist

Date: 09 September 2004



Masud S. Attayi, P.Eng.
Senior Compliance and Certification Engineer

Date: 13 September 2004

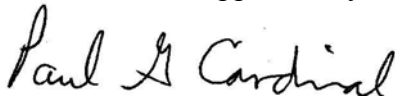
Reviewed by:



Paul Lock
Senior Compliance Specialist

Date: 20 September 2004

Reviewed and Approved by:



Paul G. Cardinal, Ph.D.
Manager, Compliance and Certification

Date: 20 September 2004

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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 5, Nov./2001, Low Power Licence-Exempt Radiocommunication Devices

B) Associated Document

1. Test report number RIM-102-0408-02

C) Product Identification

The equipment under test (EUT) was tested at the Research In Motion (RIM) EMI test facility, located at:

305 Phillip Street
Waterloo, Ontario
Canada, N2L 3W8
Phone: 519 888 7465
Fax: 519 888 6906
Web Site: www.rim.com

The testing began on June 28, 2004 and completed on July 21, 2004. The sample equipment under test (EUT) included:

- 1a. BlackBerry Wireless Handheld, model number RAL11IN, ASY-07523-001 Rev. A, serial number 7520REV2-033, FCC ID L6ARAL11IN, IC: 2503A-RAL11IN.
- 1b. BlackBerry Wireless Handheld, model number RAL11IN, ASY-07523-001 Rev. A, serial number 7520REV2-022, FCC ID L6ARAL11IN, IC: 2503A-RAL11IN
2. Headset, model number HDW-03458-001. The lead length was 1.25 metres long.

The BlackBerry Wireless Handheld is an 800 MHz portable unit that uses two digital technologies: Quad 16QAM and Time Division Multiple Access (TDMA). This device also has Bluetooth functionality operating in the frequency range of 2402 to 2480 MHz.

D) Support Equipment Used for the Testing of the EUT

1. DC power supply, HP, model number 6632B, serial number US37472178
2. Communication Tester, Rohde & Schwarz, model CMU 200, serial number 100251
3. Communication Tester, Rohde & Schwarz, model CMU 200, serial number 837493/073

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 Conducted Emissions	See test report RIM-102-0408-02	
FCC CFR 47 Part 15.209	Radiated Emissions	Yes	Masud Attayi
FCC CFR 47 Part 15.247(a) IC RSS-210	20 dB Bandwidth, Carrier Freq. Separation Number of Hopping freq. Dwell Time	Yes	Maurice Battler
FCC CFR 47 Part 15.247(b) IC RSS-210	Max. Peak Output Power	Yes	Maurice Battler
FCC CFR 47 Part 15.247(c) IC RSS-210	Band Edge Compliance Spurious Bluetooth RF Conducted Emissions	Yes	Maurice Battler

G) Modifications to EUT

No modifications were required to the EUT.

H) Summary of Results

o AC CONDUCTED EMISSIONS

The conducted emissions from the EUT were measured using the methods outlined in CISPR Recommendation 22.

To view the test results, see test report number RIM-0102-0408-02.

o RADIATED 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 wooden table, 100 cm high that was positioned on a remotely rotatable 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. At this point 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 done in a semi-anechoic chamber. The semi-anechoic chamber 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 at maximum output power in frequency hopping mode (channels 0 to 78).

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. Emissions were in the noise floor (NF).

Sample Calculation:

Field Strength (dB μ V/m) is calculated as follows:

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

Measurement Uncertainty ± 4.0 dB

To view the test data see APPENDIX 1.

o BLUETOOTH RF CONDUCTED EMISSIONS

1). 20 dB Bandwidth

The EUT passed the 20 dB bandwidth requirement 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.

2). Carrier Frequency Separation

The EUT passed 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.

3). Number of Hopping frequencies

The EUT passed 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.

4). Time of Occupancy (Dwell Time)

The EUT passed 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.

5). Maximum Peak Conducted Output Power

The EUT passed 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.

6). Band-Edge Compliance of RF Conducted Emissions

The EUT passed 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.

7). Spurious RF Conducted Emissions

The EUT passed 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.

Report No. RIM-0102-0408-01

Test Date: June 28 to July 21, 2004

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	04-11-06	Radiated Emissions
Preamplifier system	TDK RF Solutions	PA-02	080010	04-11-06	Radiated Emissions
EMC Analyzer	Agilent	E7405A	US40240226	05-07-29	Radiated Emissions
Hybrid Log Antenna	TDK	HLP-3003C	017301	04-12-16	Radiated Emissions
Horn Antenna	TDK	HRN-0118	130092	04-09-16	Radiated Emissions
Horn Antenna	TDK	HRN-0118	30201	05-01-08	Radiated Emissions
Horn Antenna	Emco	3116	2538	04-09-22	Radiated Emissions
Preamplifier	TDK	18-26	3002	04-11-27	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	974	04-09-25	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	973	04-12-01	Radiated Emissions
Spectrum Analyzer	HP	8563E	3745A08112	04-07-31	Conducted Emissions
DC Power Supply	HP	6632B	US37472178	05-08-01	Conducted Emissions
Environment Monitor	Control Company	1870	230355190	06-01-11	Radiated/Conducted Emissions
Environment Monitor	Control Company	1870	230355189	06-01-11	RF Conducted Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	100251	05-04-21	Conducted Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	837493/073	05-05-29	Radiated/Conducted Emissions

APPENDIX 1

RADIATED EMISSIONS TEST DATA

Report No. RIM-0102-0408-01

Test Date: June 28 to July 21, 2004

Radiated Emissions Test Results

Test Distance was 3.0 metres.

Bluetooth Band

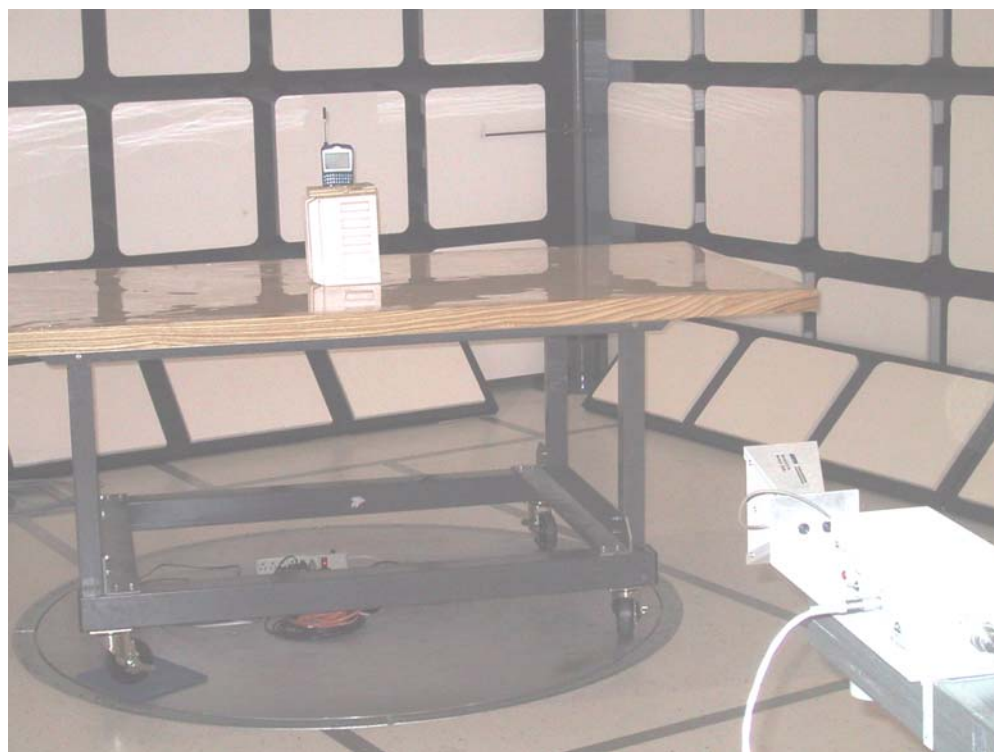
July 21, 2004

The measurements were performed in frequency hopping mode (channels 0 to 78) at maximum output power.

Type	Channel	Frequency	Antenna		Reading	Corrected Reading	Average Limit (at 1 metre)	Peak Limit (at 1 metre)	Diff. To Limit
		(MHz)	Type	Pol	(dBuV)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
Handheld Standalone,Vertical position									
2 nd	0 - 78	4804-4960	Horn	V	NF	NF	63.5	83.5	
2 nd	0 - 78	4804-4960	Horn	H	NF	NF			
The harmonics were investigated up to the 10th harmonic. The NF was below the average limit. No emissions could be found.									
Handheld Standalone, horizontal position									
2 nd	0 - 78	4804-4960	Horn	V	NF	NF	63.5	83.5	
2 nd	0 - 78	4804-4960	Horn	H	NF	NF			
The harmonics were investigated up to the 10th harmonic. The NF was below the average limit. No emissions could be found.									
Handheld Standalone, on it's side									
2 nd	0 - 78	4804-4960	Horn	V	NF	NF	63.5	83.5	
2 nd	0 - 78	4804-4960	Horn	H	NF	NF			
The harmonics were investigated up to the 10th harmonic. The NF was below the average limit. No emissions could be found.									

Due to the noise floor at three metres, the emissions were repeated at a test distance of one metre. The emissions passed the 63.5 dBuV/m average one metre limit.

Radiated Emissions Test Photos



APPENDIX 2

BLUETOOTH RF CONDUCTED EMISSIONS TEST DATA/PLOTS

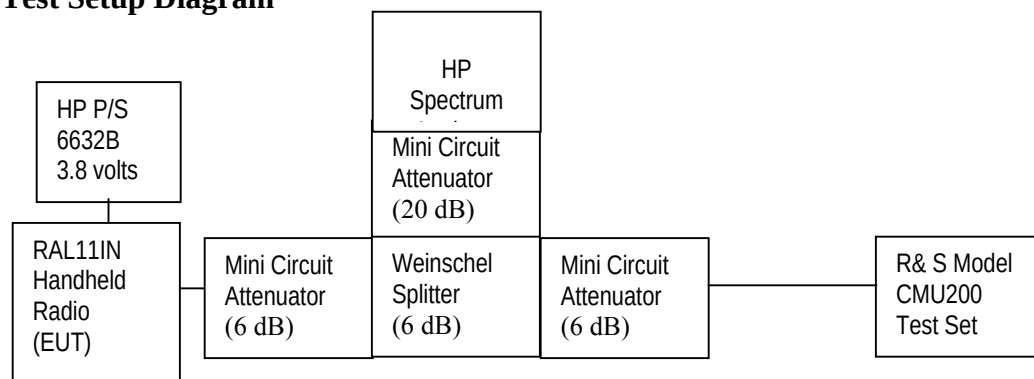
Bluetooth RF Conducted Emission Test Results

Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	HP	8563E	374A08112	30 Hz – 26.5 GHz
Splitter	Weinschel	1515	ME092	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S20W2	-	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S6W2	-	DC – 18 GHz
Attenuator	Mini Circuit	MCL BW-S6W2	-	DC – 18 GHz
Universal Radio Communication Tester	Rohde & Schwarz	CMU200	100251	-
DC Power Supply	HP	6632B	US37472178	-

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

Test Setup Diagram



A reference offset of 32.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

RF Conducted Emission Test Results cont'd

20 dB Bandwidth

The EUT passed the 20 dB bandwidth requirement 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 Value (MHz)
0	≤ 1.0	0.760
39	≤ 1.0	0.727
78	≤ 1.0	0.707

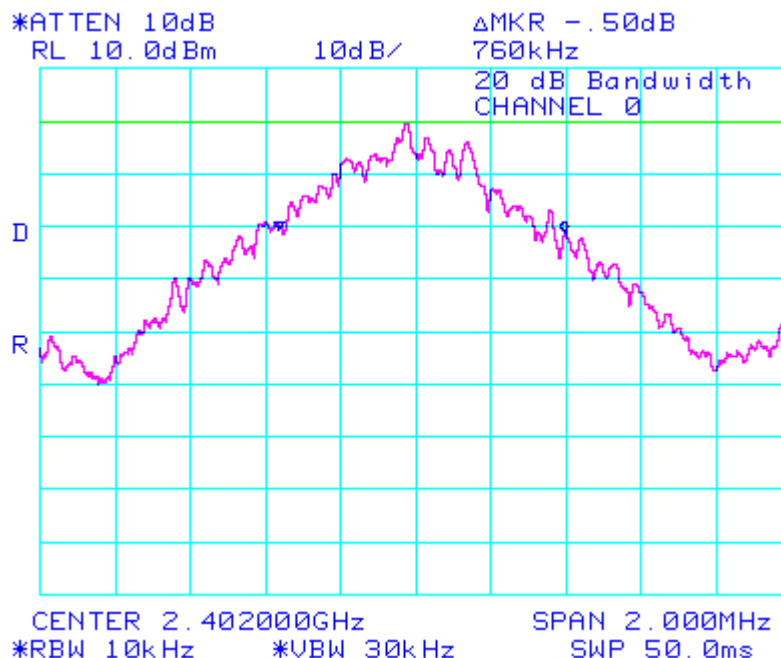
See figures 1 to 3 for the plots of the 20 dB bandwidth measurements.

The environmental test conditions were: Temperature 24°C

Pressure 977 mb

Relative Humidity 33%

Figure 1: 20 dB Bandwidth, channel 0



RF Conducted Emission Test Results cont'd

Figure 2: 20 dB Bandwidth, channel 39

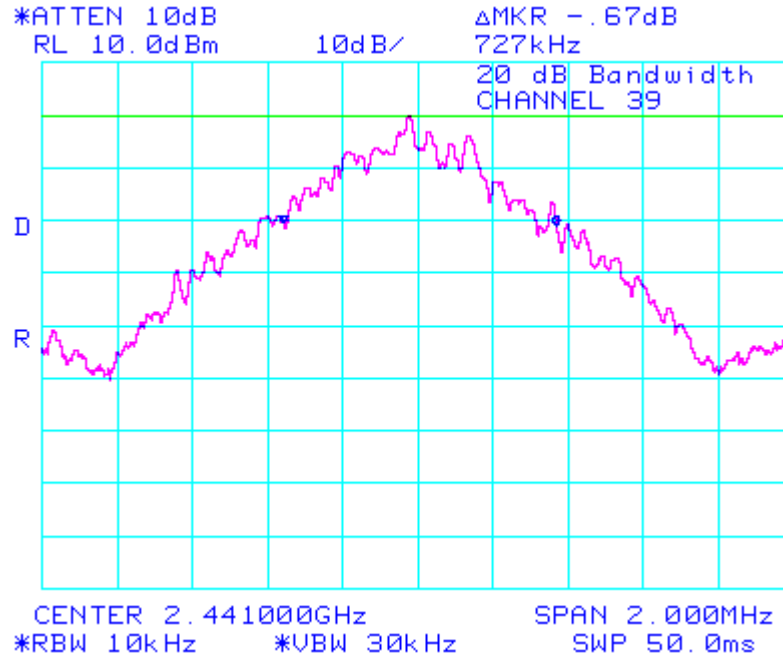
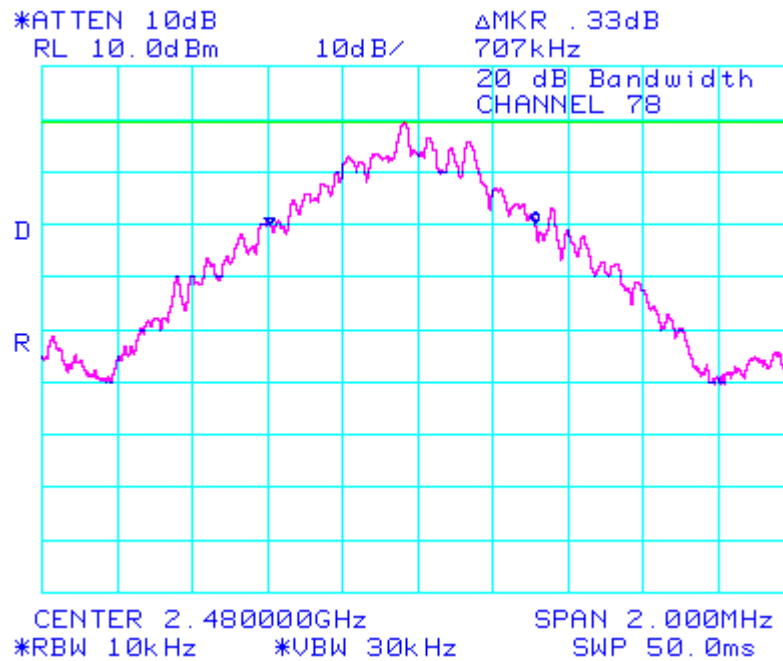


Figure 3: 20 dB Bandwidth, channel 78



RF Conducted Emission Test Results cont'd

Carrier Frequency Separation

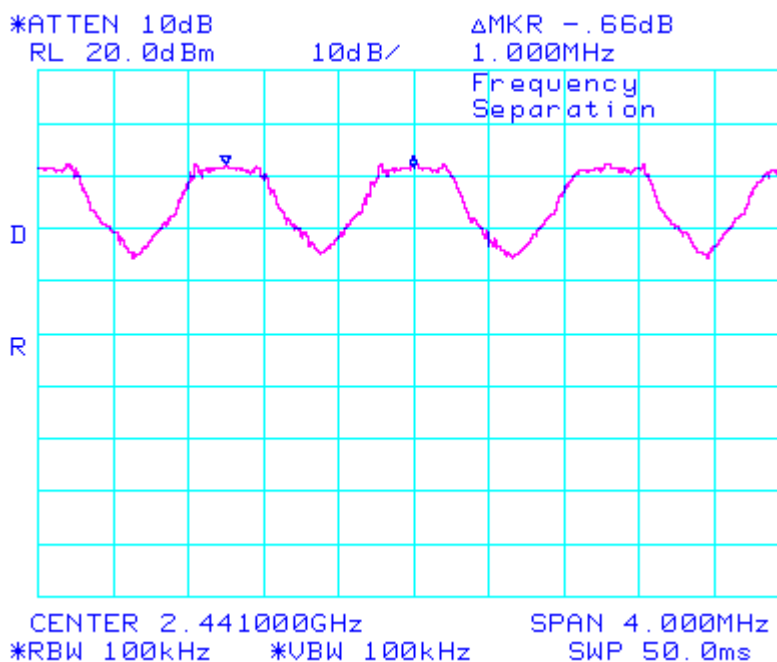
The EUT passed the Carrier Frequency Separation requirement as per 47 CFR 15.247(a) and RSS-210. Channel 38 to 39 was measured. Bluetooth was operating in frequency hopping (Euro/US) mode using pattern type Static PRBS and packet type DH5 during the measurements.

Bluetooth Channels	Limit (MHz)	Measured Value (MHz)
38 to 39	≥ 0.025 or 20 dB bandwidth	1.000

The environmental test conditions were: Temperature 25°C
Pressure 976 mb
Relative Humidity 34%

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

Figure 4: Carrier Frequency Separation, channel 38 to 39



RF Conducted Emission Test Results cont'd

Number of Hopping Frequencies

The EUT passed the number of hopping frequencies requirement 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 (MHz)	Number of Hopping Frequencies
≥ 75	79

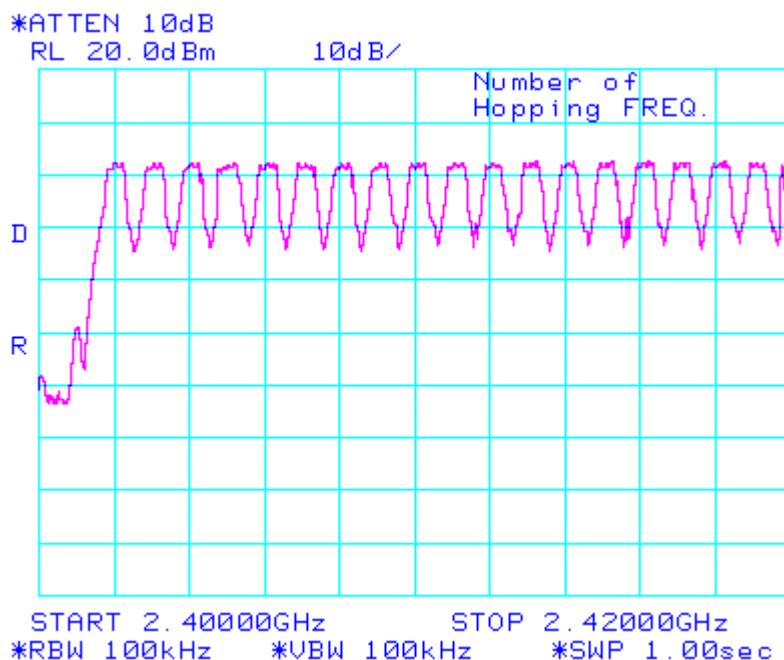
The environmental test conditions were: Temperature 25°C

Pressure 976 mb

Relative Humidity 33%

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

Figure 5: Number of Hopping Frequencies



RF Conducted Emission Test Results cont'd

Figure 6: Number of Hopping Frequencies

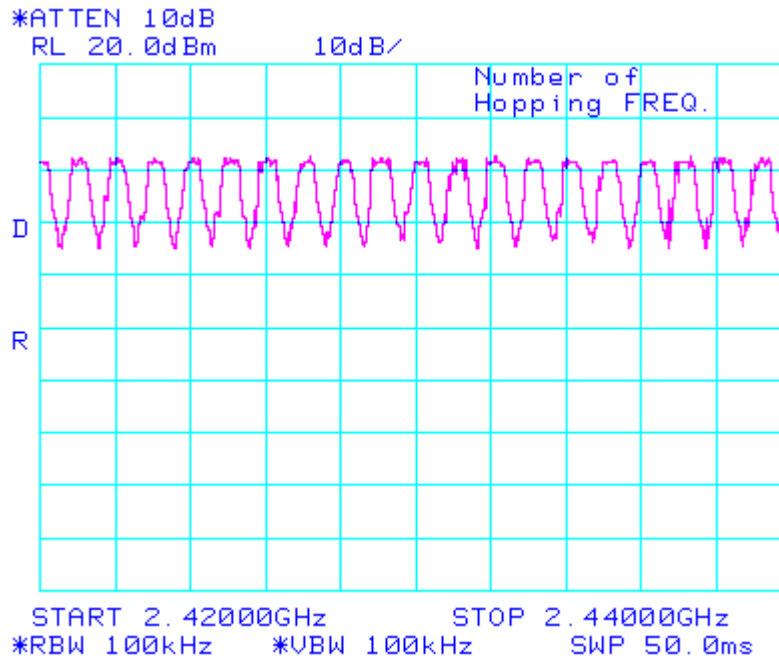
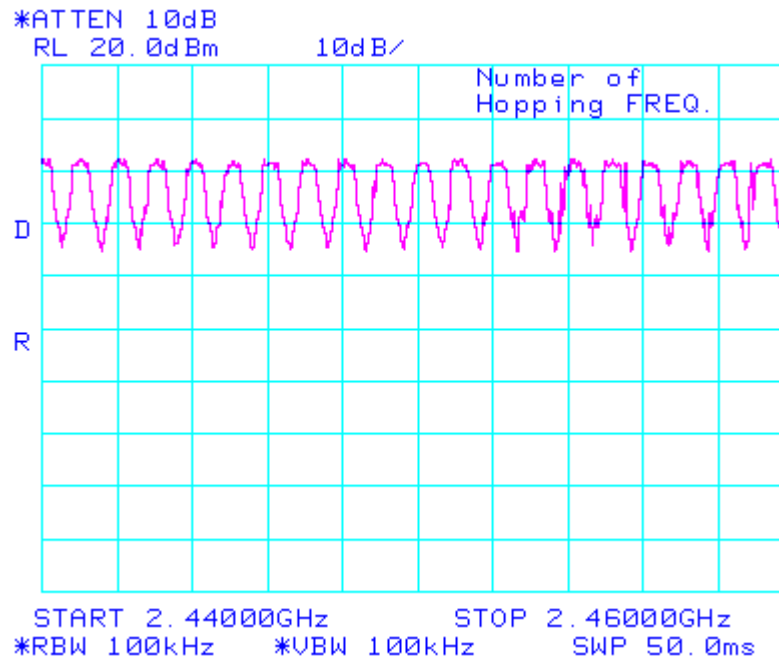
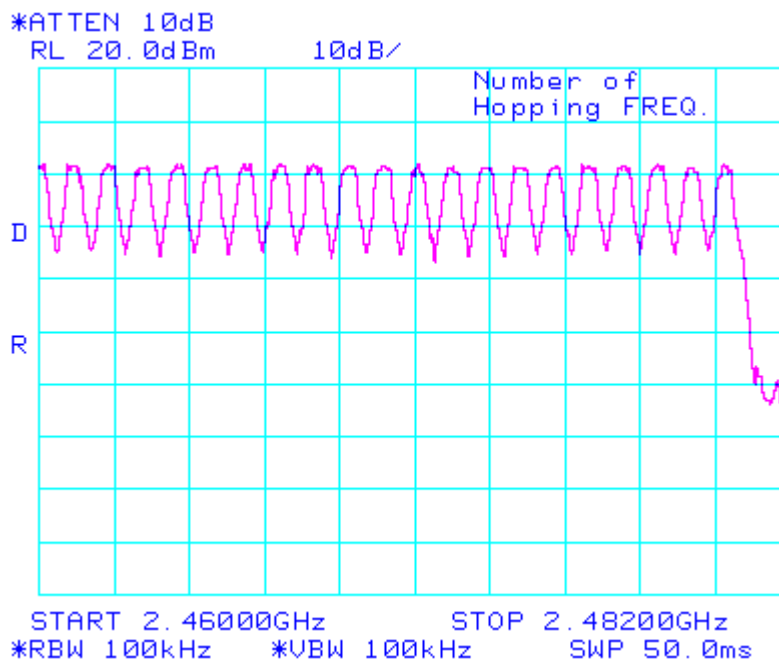


Figure 7: Number of Hopping Frequencies



RF Conducted Emission Test Results cont'd

Figure 8: Number of Hopping Frequencies



Time of Occupancy (Dwell Time)

The EUT passed the time of occupancy (dwell time) requirement 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 μ sec. 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. Therefore for 30 seconds there are 303.81 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 30 seconds there are 151.8 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 30 seconds there are 101.4 times of appearance.

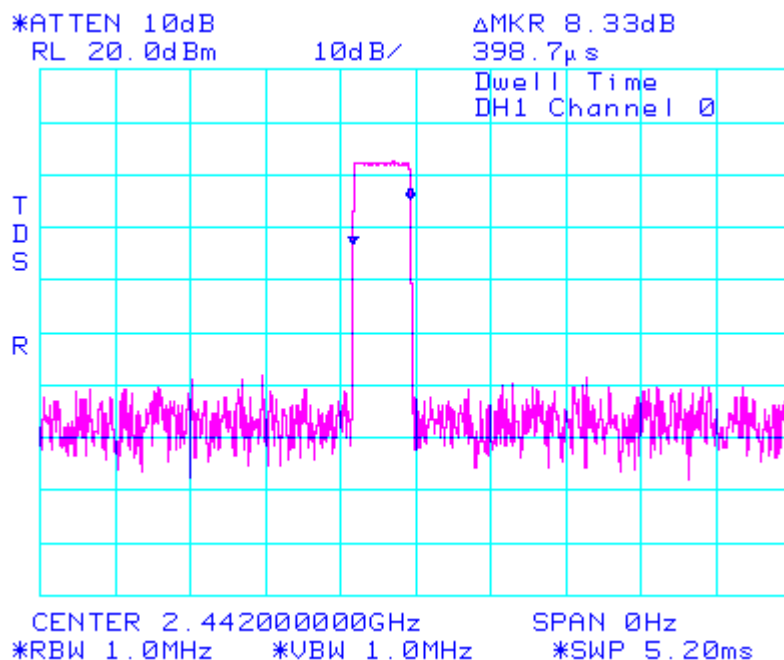
RF Conducted Emission Test Results cont'd

Bluetooth Channel	Mode	Tx Time (ms)	Dwell Time/30 sec. (msec.)	Limit (msec.)	Margin (msec.)
0	DH1	0.3987	$0.3987 \times 303.81 = 121.1$	400	278.9
39	DH1	0.3987	$0.3987 \times 303.81 = 121.1$	400	278.9
78	DH1	0.3987	$0.3987 \times 303.81 = 121.1$	400	278.9
0	DH3	1.7167	$1.7167 \times 151.8 = 260.6$	400	139.4
39	DH3	1.6813	$1.6813 \times 151.8 = 255.2$	400	144.8
78	DH3	1.6900	$1.6900 \times 151.8 = 256.5$	400	143.5
0	DH5	2.9300	$2.9300 \times 101.4 = 297.1$	400	102.9
39	DH5	2.9200	$2.9200 \times 101.4 = 296.1$	400	103.9
78	DH5	2.9300	$2.9300 \times 101.4 = 298.1$	400	101.9

The environmental test conditions were: Temperature 25°C
Pressure 976 mb
Relative Humidity 33%

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

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



RF Conducted Emission Test Results cont'd

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

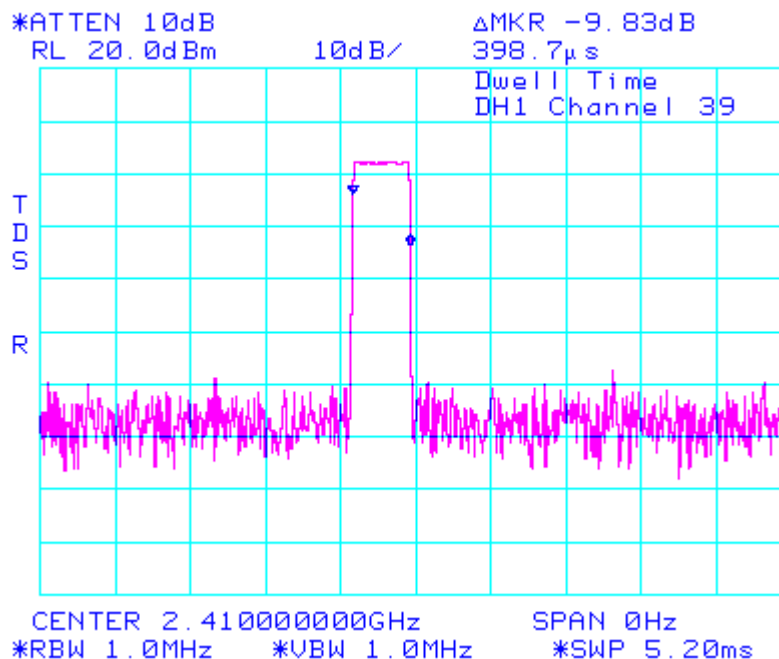
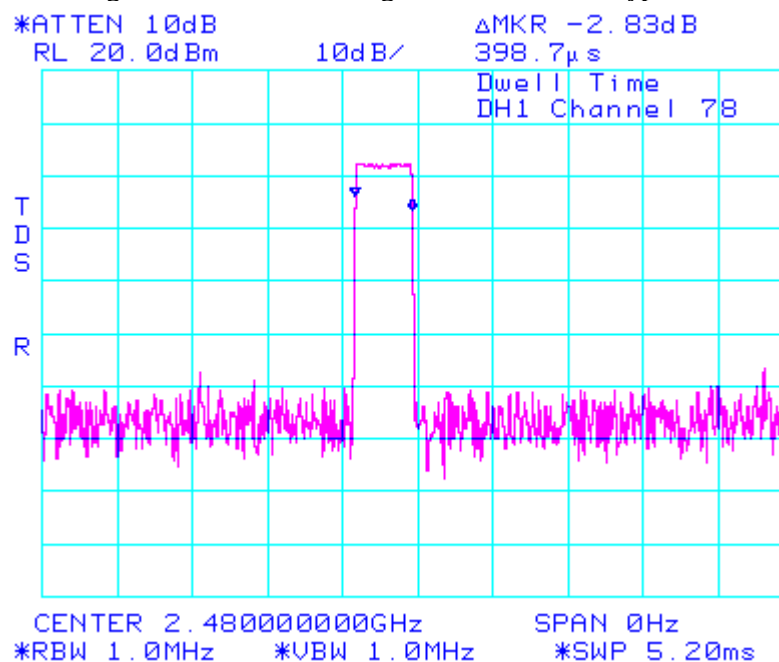


Figure 11: Dwell Time, High Channel, Packet Type DH1



RF Conducted Emission Test Results cont'd

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

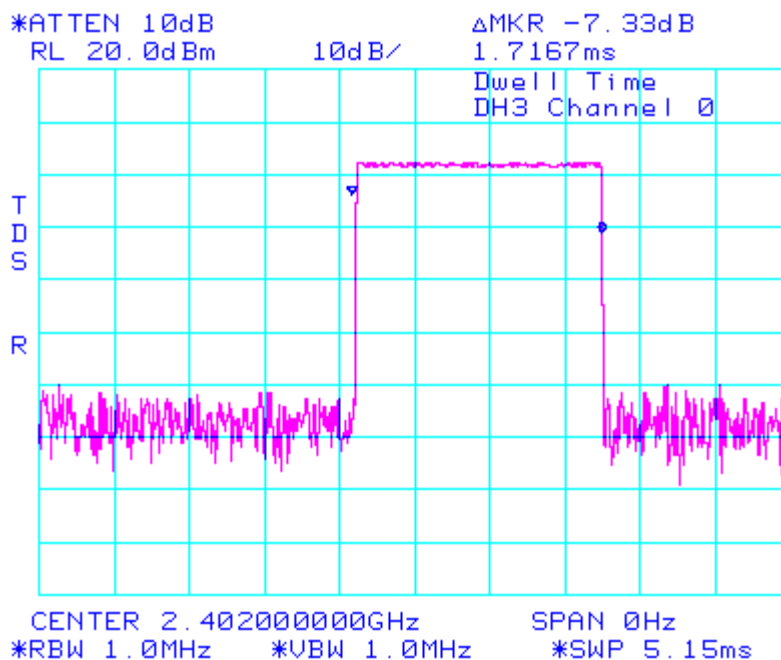
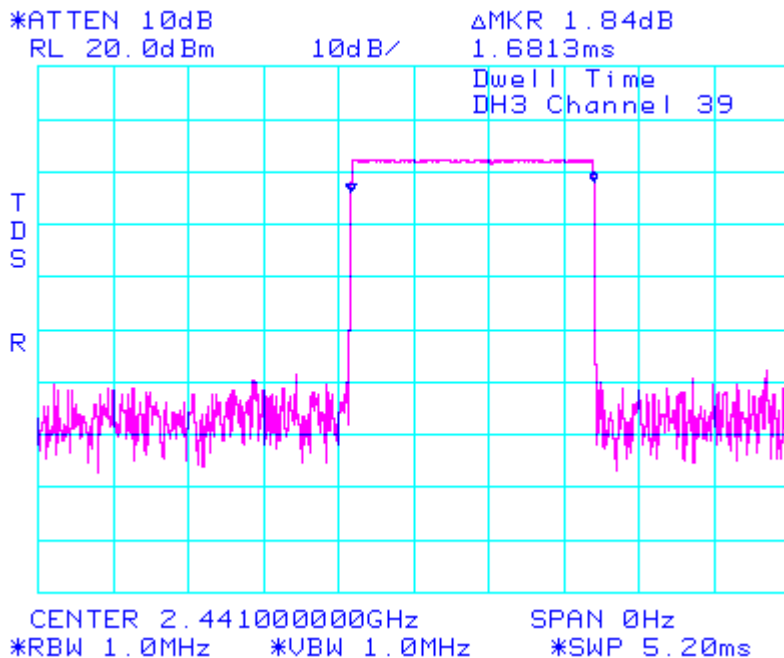


Figure 13: Dwell Time, Middle Channel, Packet Type DH3



RF Conducted Emission Test Results cont'd

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

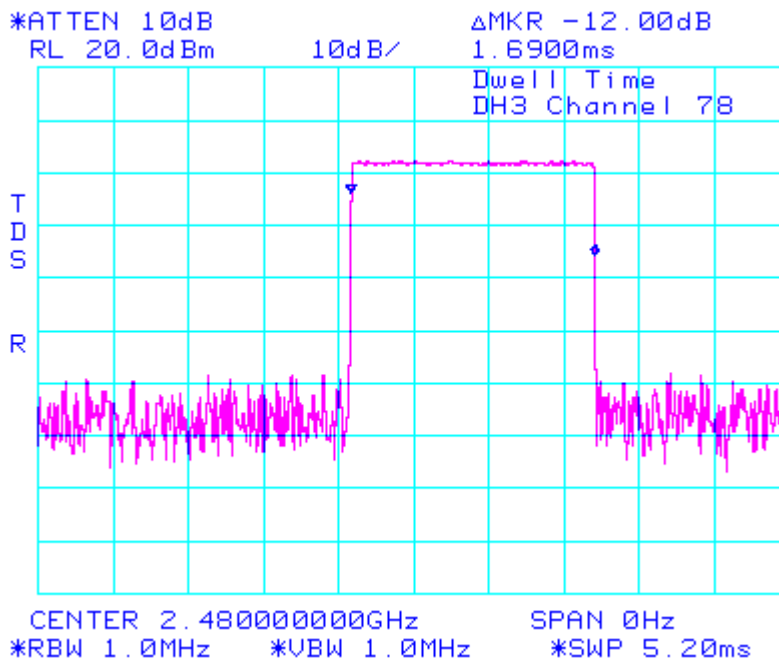
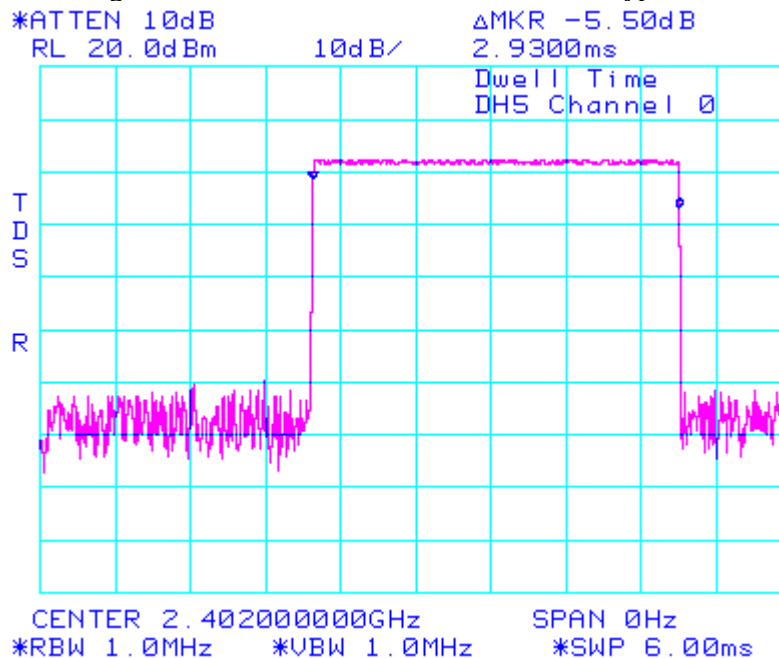


Figure 15: Dwell Time, Low Channel, Packet Type DH5



RF Conducted Emission Test Results cont'd

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

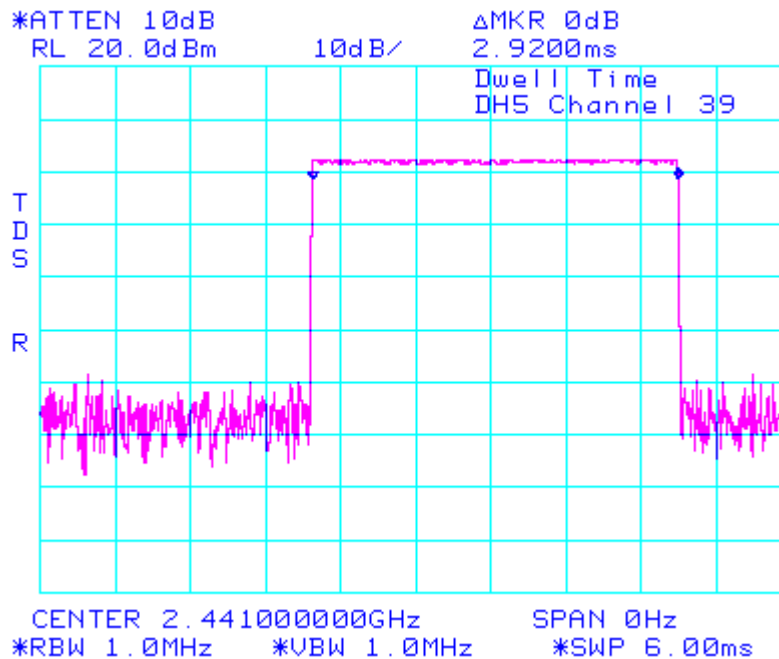
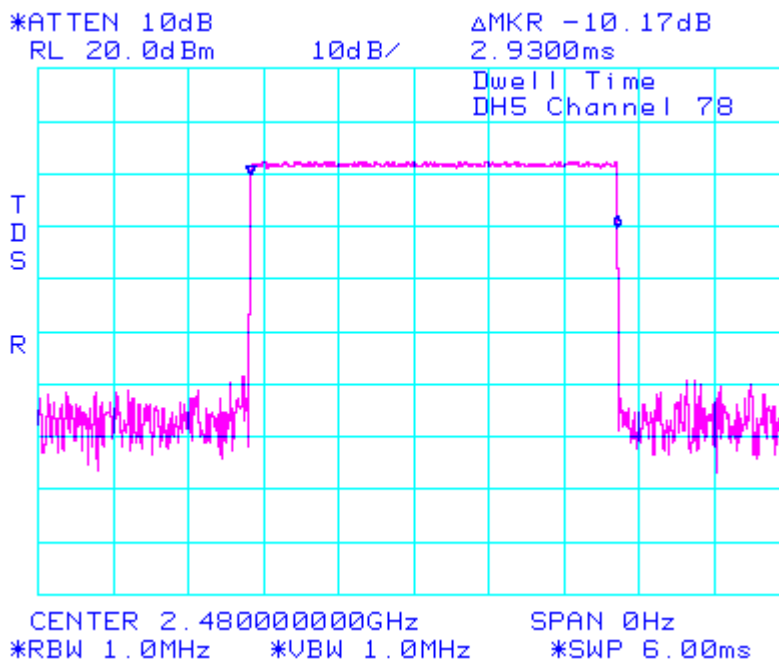


Figure 17: Dwell Time, High Channel, Packet Type DH5



RF Conducted Emission Test Results cont'd

Maximum Peak Conducted Output Power

The EUT passed the maximum peak conducted output power requirement 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 32.4 dB was applied to the spectrum analyzer reference level for the coaxial cable loss in the test circuit.

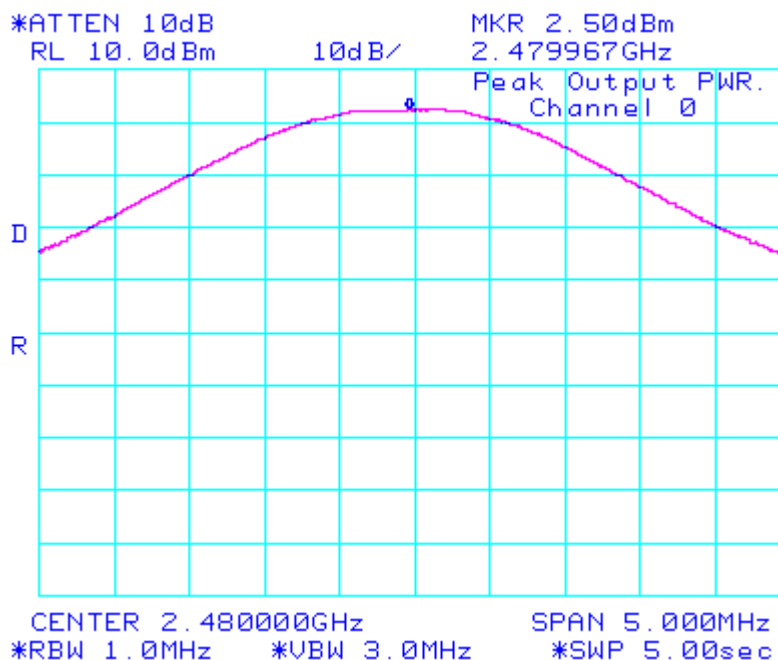
Bluetooth Channel	Measured Value (dBm)	Limit (dBm)
0	2.50	-6.0 to 4.0
39	2.67	-6.0 to 4.0
78	2.33	-6.0 to 4.0

The environmental test conditions were:

Temperature	25°C
Pressure	976 mb
Relative Humidity	33%

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

Figure 18: Maximum Peak Conducted Output Power



RF Conducted Emission Test Results cont'd

Figure 19: Maximum Peak Conducted Output Power

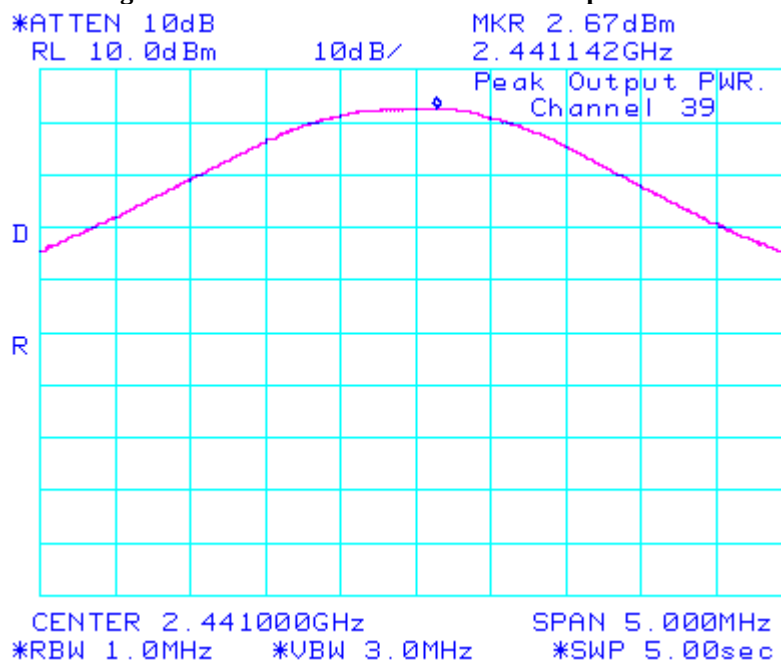
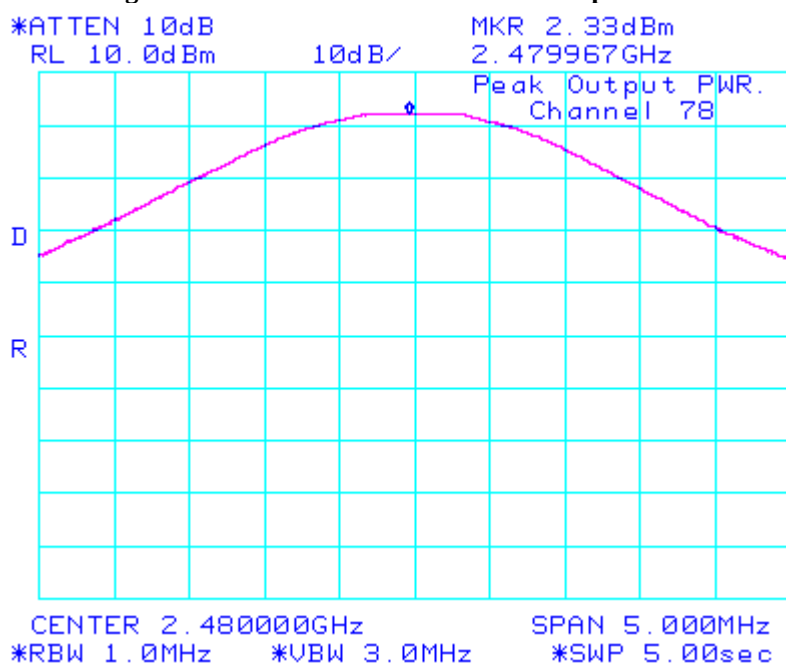


Figure 20: Maximum Peak Conducted Output Power



RF Conducted Emission Test Results cont'd

Band Edge Compliance

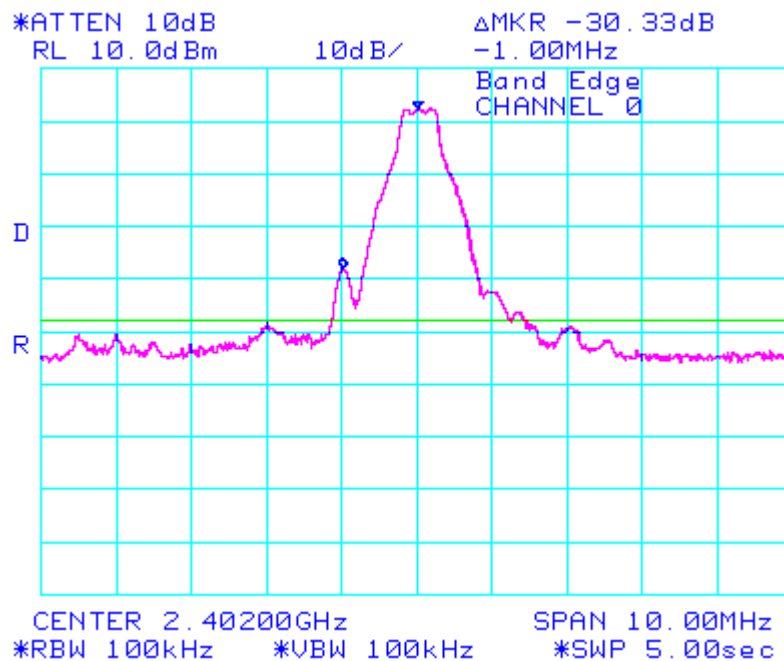
The EUT passed the band edge compliance requirement as per 47 CFR 15.247(c) and RSS-210. Low channel (0) and high channel (78) were measured. Bluetooth was operating in single frequency and hopping mode using pattern type Static PRBS and packet type DH5 during the measurements.

Bluetooth Channel	Operating Mode	Measured Value (dBc)	Limit (dBc)	Margin (dB)
0	Single Frequency	-30.33	20	10.33
0	Hopping	-31.50	20	11.50
78	Single Frequency	-37.34	20	17.34
78	Hopping	-38.67	20	18.67

The environmental test conditions were: Temperature 25°C
Pressure 976 mb
Relative Humidity 33%

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

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



RF Conducted Emission Test Results cont'd

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

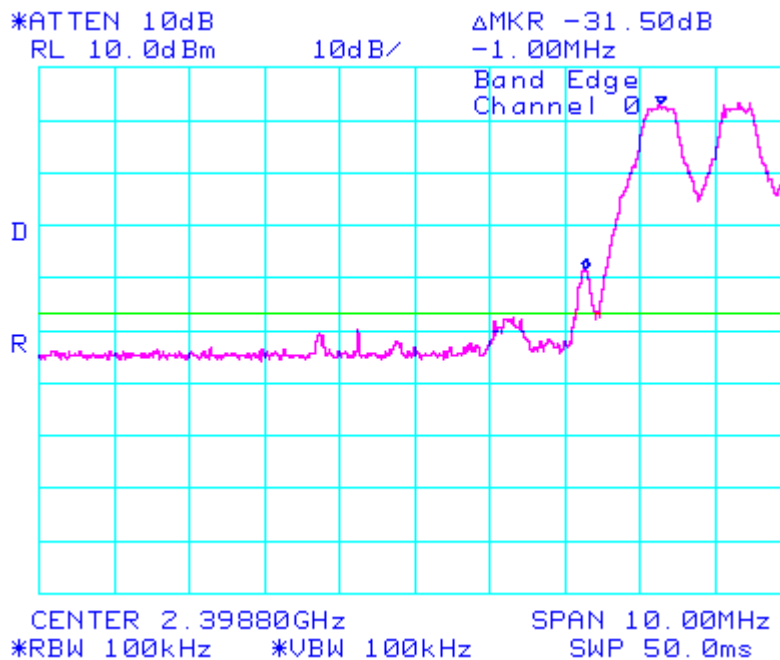
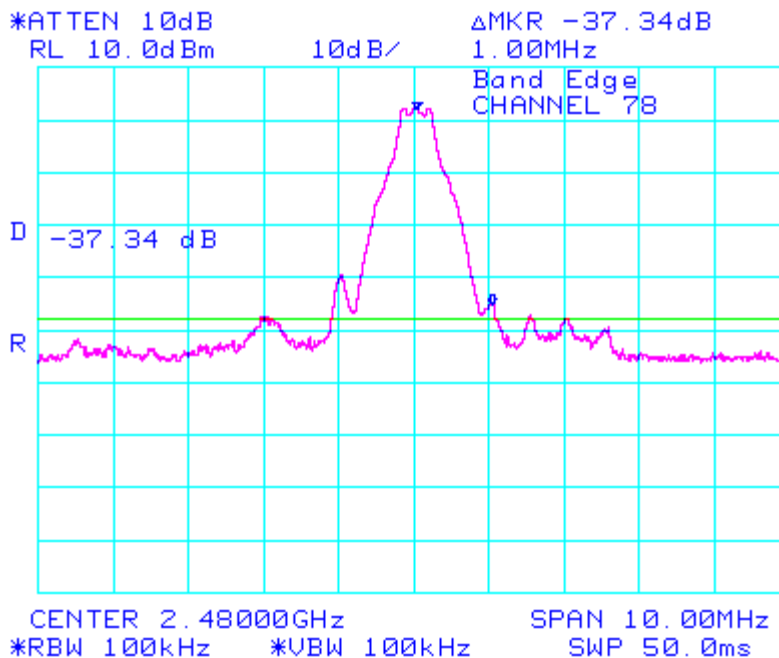
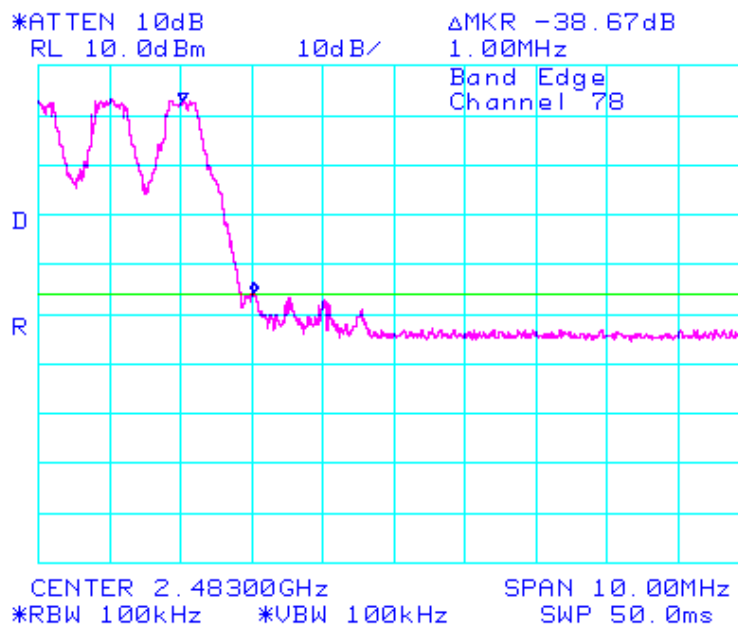


Figure 23: Band Edge Compliance, Single Frequency Mode, Channel 78



RF Conducted Emission Test Results cont'd

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



Spurious Bluetooth RF Conducted Emissions

The EUT passed the spurious Bluetooth RF Conducted Emissions requirement as per 47 CFR 15.247(c) 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 and also frequency hopping mode. A reference offset of 32.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit. No emissions could be seen above the noise floor (NF) of the spectrum analyzer.

Bluetooth Channel	Max. Measured Value from dBc	Limit (dBc)
0	(NF)	-20 dB
39	(NF)	-20 dB
78	(NF)	-20 dB
Hopping mode	(NF)	-20 dB

The environmental test conditions were: Temperature 23° C
Pressure 985 mb
Relative Humidity 37%

See figures 25 to 32 for the plots of the Spurious Bluetooth RF Conducted Emissions.

RF Conducted Emission Test Results cont'd

Figure 25: Spurious Bluetooth RF Conducted Emissions, Channel 0

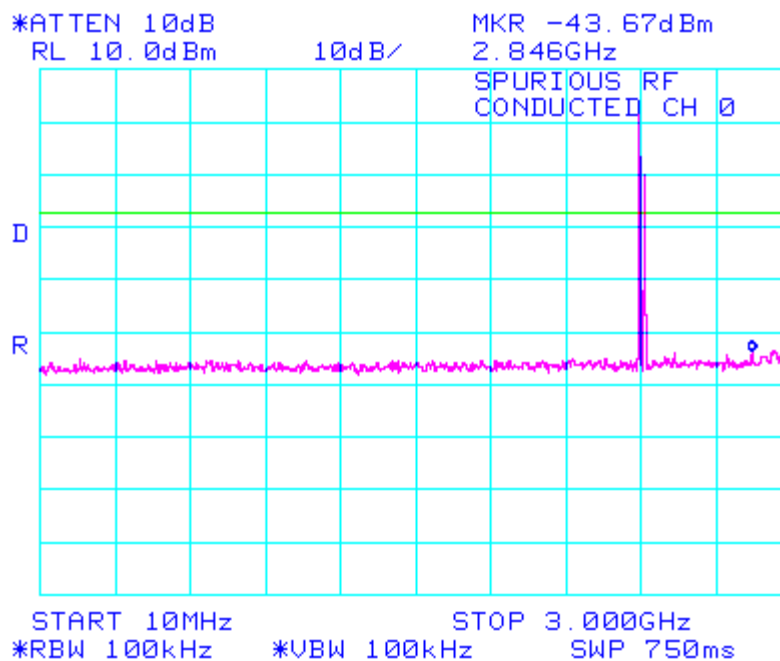
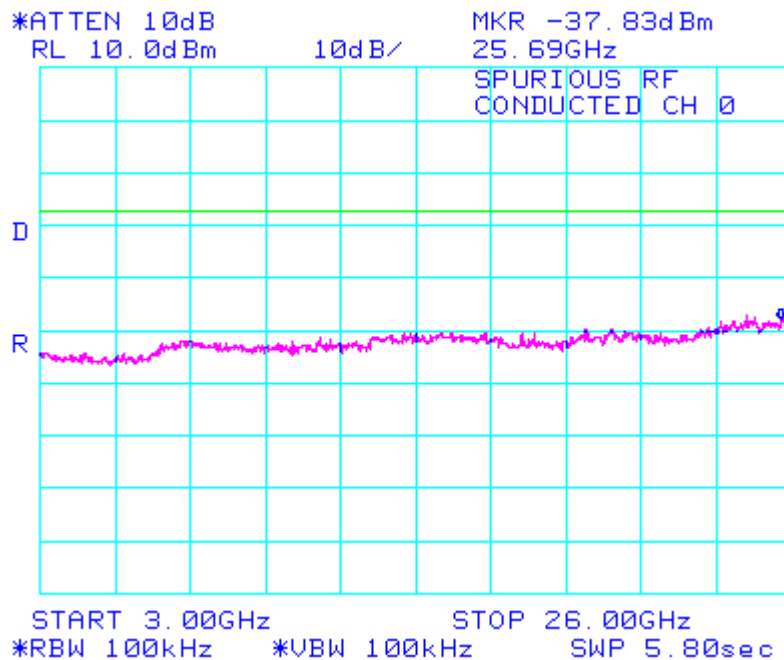


Figure 26: Spurious Bluetooth RF Conducted Emissions, Channel 0



RF Conducted Emission Test Results cont'd

Figure 27: Spurious Bluetooth RF Conducted Emissions, Channel 39

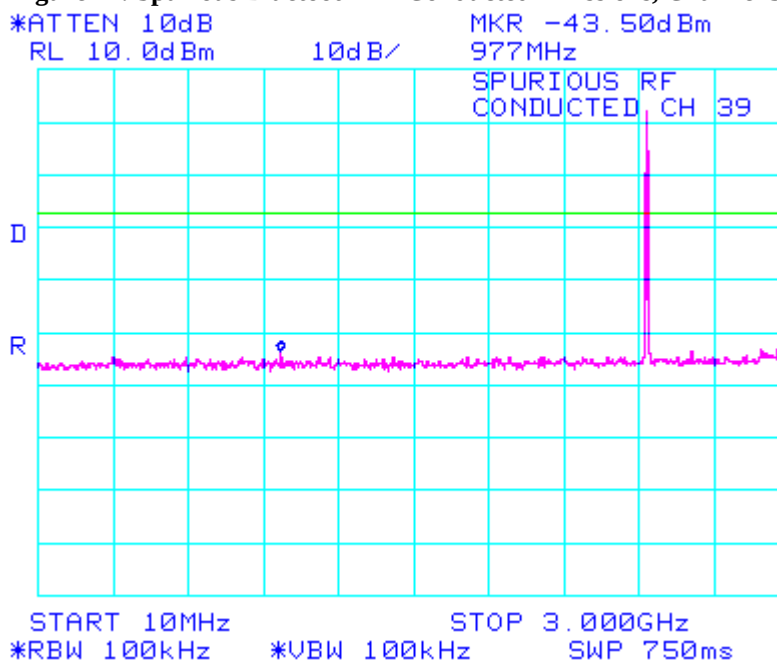
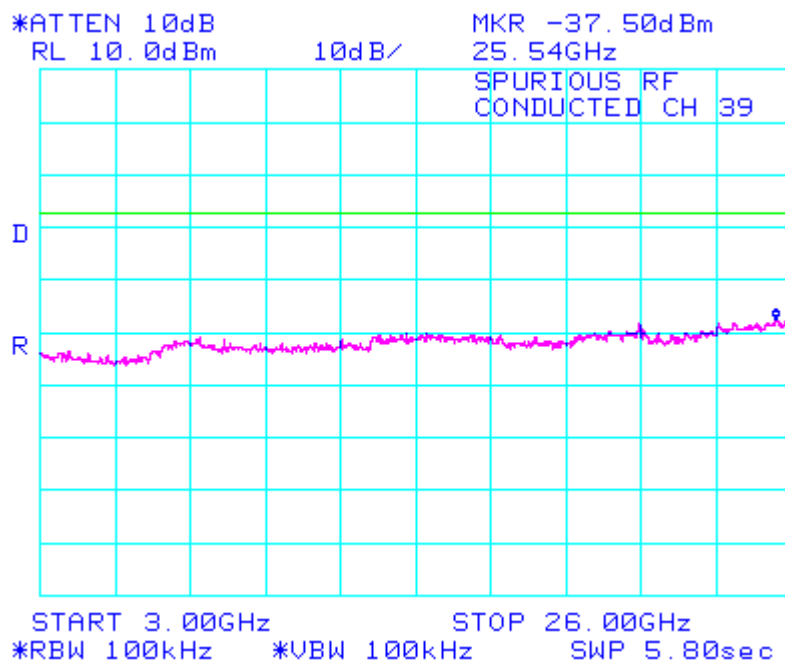


Figure 28: - Spurious Bluetooth RF Conducted Emissions, Channel 39



RF Conducted Emission Test Results cont'd

Figure 29: Spurious Bluetooth RF Conducted Emissions, Channel 78

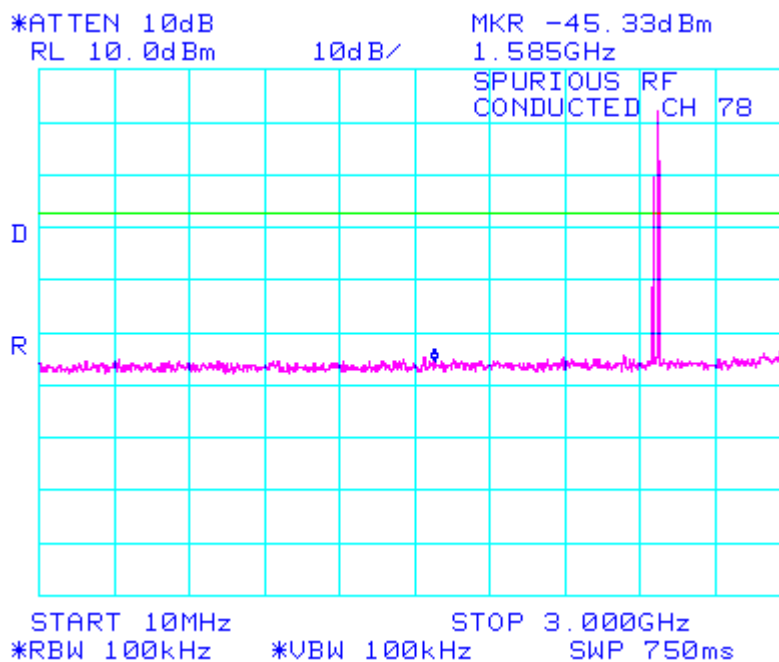
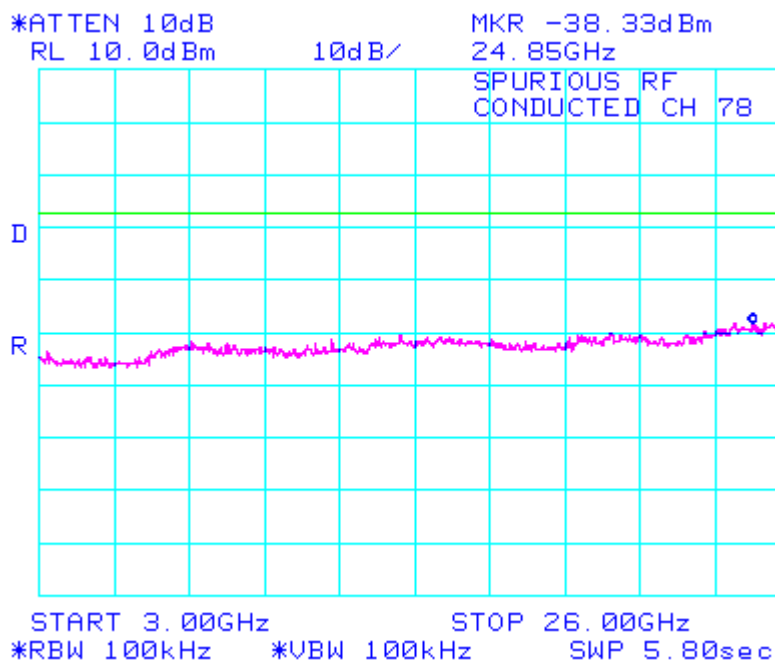


Figure 30: Spurious Bluetooth RF Conducted Emissions, Channel 78



RF Conducted Emission Test Results cont'd

Figure 31: Spurious Bluetooth RF Conducted Emissions, Frequency Hopping Mode

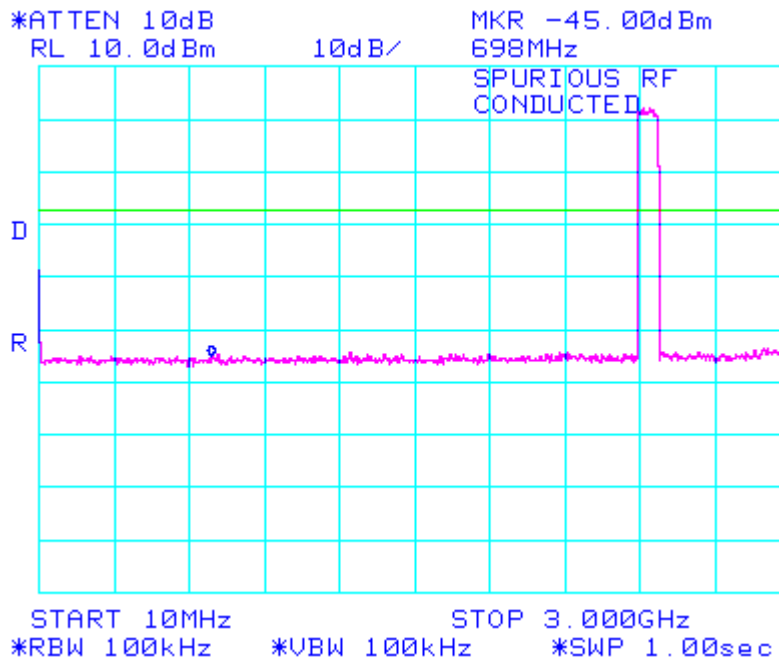
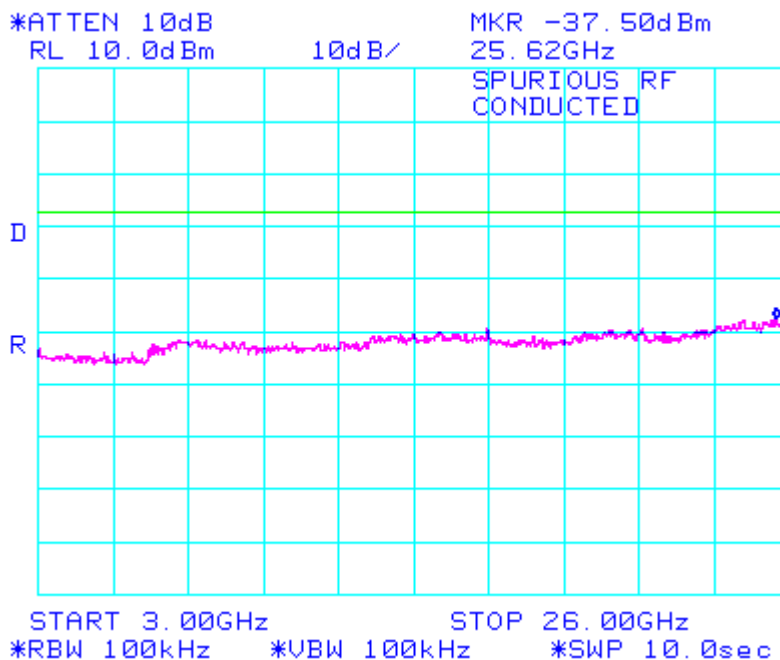


Figure 32: Spurious Bluetooth RF Conducted Emissions, Frequency Hopping Mode



Bluetooth RF Conducted Emission Test-Setup Photo

