EMI Test Report

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

RIM Testing Services (RTS)

A division of Research In Motion Limited

REPORT NO.: RTS-1723-0902-07_Rev1

PRODUCT MODEL NO.: RBX11BW
TYPE NAME: BlackBerry® Smart Card Reader
FCC ID: L6ARBX10BW
IC: 2503A-RBX10BW

This Rev1 test report supersedes the previous version RTS-1723-0902-07 dated 26th February 2009

DATE: 20 April, 2009

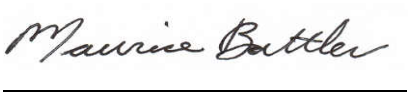
Statement of Performance:

The BlackBerry® Smart Card Reader, model RBX11BW, part number CER-24238-001 Rev. 1 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.

Documented by:



Maurice Battler
Compliance Specialist
Date: 20 April, 2009

Reviewed by:

Masud S. Attayi, P.Eng.
Team Lead, Regulatory Compliance
Date: 21 April 2009

Approved by:

Paul G. Cardinal, Ph.D.
Director
Date: 21 April, 2009

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A. Scope

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

- FCC CFR 47 Part 15, Subpart C, July 10, 2008
- Industry Canada, RSS-210, Issue 7, June 2007, Low Power Licence-Exempt Radiocommunication Devices
- Industry Canada, RSS-GEN, Issue 2, June 2007, General Requirements and Information for the Certification of Radiocommunication Equipment

B. Associated Documents

No associated documents.

C. Product Identification

Manufactured by Research In Motion Limited whose headquarters is located at:

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

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

440 Phillip Street
Waterloo, Ontario
Canada, N2L 5R9
Phone: 519 888 7465
Fax: 519 888 6906

The testing was performed from February 09 to 26, 2009.

The sample EUT included:

SAMPLE	MODEL	PART NUMBER	PIN
1	RBX11BW	CER-24238-001 Rev. 1	50010E58
2	RBX11BW	CER-24238-001 Rev. 1	50010E64
3	RBX11BW	CER-24238-001 Rev. 1	50010DB1
4	RBX11BW	CER-24238-001 Rev. 1	50010E62

BlackBerry® Smart Card Reader Accessories Tested

1) Folding Blade Charger, part number HDW-17955-001 with an output voltage of 5.0 volts dc, 700 mA with an attached USB cable with a length of 1.80 metres.
2) Captive Cable Charger part number HDW-17957-003 with an output voltage of 5.0 volts dc, 700 mA and attached USB cable with a lead length of 1.80 metres.

D. Support Equipment Used for the Testing of the EUT

No support equipment required; for list of equipment refer to section H, Compliance Test Equipment Used.

E. Test Results Chart

SPECIFICATION		TEST TYPE	Meets Requirements	TEST DATA APPENDIX
FCC CFR 47	IC			
Part 15.207	RSS-GEN, 7.2.2	Conducted AC Line Emission	Yes	1
Part 15.209 Part 15.247	RSS-210, A8.5	Radiated Spurious Emissions and Radiated Band Edge Compliance	Yes	2
Part 15.247(a)	RSS-210, A8.1	Bluetooth 20 dB Bandwidth	Yes	3
Part 15.247(a)	RSS-210, A8.1	Bluetooth Carrier Frequency Separation	Yes	3
Part 15.247(a)	RSS-210, A8.1d	Bluetooth Number of Hopping Frequencies	Yes	3
Part 15.247(a)	RSS-210, A8.1c	Bluetooth Time of Occupancy (Dwell Time)	Yes	3
Part 15.247(b)	RSS-210, A8.4	Bluetooth Maximum Peak Conducted Output Power	Yes	3
Part 15.247(c)	RSS-210, A8.5	Bluetooth Band-Edge Compliance of RF Conducted Emissions	Yes	3
Part 15.247(c)	RSS-210, A8.5	Bluetooth Spurious RF Conducted Emissions	Yes	3

F. Modifications to EUT

No modifications were required on the EUT.

G. Summary of Results

1) AC LINE CONDUCTED EMISSIONS

The conducted emissions were measured using the test procedure outlined in CISPR Recommendation 22 through a 50 Ohm Line Impedance Stabilization Network (LISN), which was inserted in the power line to the equipment to provide the specified impedance for measurements. The EUT was placed on a nonconductive wooden table, 80 cm high that was positioned 40 cm from a vertical ground plane. The RF output of the network was connected to an EMI receiver system with characteristics that duplicate those of the receiver specified in CISPR Publication 16.
BlackBerry® Smart Card Reader, PIN 50010E64 was in battery charging mode. The input voltage was 120 V, 60 Hz.

The following test configurations were measured:
1. The BlackBerry® Smart Card Reader in Bluetooth Tx mode was connected to the Folding Blade Charger.
2. The BlackBerry® Smart Card Reader in Bluetooth Tx mode was connected to the Captive Cable Charger.

The sample EUT's conducted emissions were compared with respect to the FCC CFR 47 Part 15, Subpart C and IC RSS-210 limits. The sample EUT had a worse case test margin of 19.85 dB below the limit at 0.155 MHz using the quasi peak detector in test configuration 2.

Measurement Uncertainty ±3.0 dB

To view the test data see APPENDIX 1.

2) RADIATED EMISSIONS

a) Radiated Spurious and Harmonic Emissions

The EUT was placed on a nonconductive styrofoam table, 80 cm high 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 polarizations 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 **2503B-1**.
The EUT was configured and operated to produce the maximum radiated emissions while still keeping within RIM's specifications.

The BlackBerry® Smart Card Reader PIN 50010DB1 and PIN 50010E62 were measured in standalone configuration with Bluetooth transmitting in single frequency mode at low channel (0), middle channel (39) and high channel (78) for packet types "DH5", "2-DH5" and "3-DH5. 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 radiated spurious and harmonics for normal data rate (DH5) and EDR (2-DH5, 3-DH5) were investigated up to the 10th harmonic.
The sample EUT emissions had a test margin greater than 25.0 dB.
To view the test data see APPENDIX 2.

Measurement Uncertainty ±4.6 dB

3) BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS

The Band-Edge Compliance of RF Radiated Emissions for Bluetooth met the requirements as per 15.247, 15.209, and RSS-210/RSS-GEN.
To view the test data see APPENDIX 2.

4) 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. The result includes both normal data rate and EDR.
To view the test data see APPENDIX 3.

b) 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. The result includes both normal data rate and EDR.
To view the test data see APPENDIX 3.

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.
To view the test data see APPENDIX 3.

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.
To view the test data see APPENDIX 3.

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. The result includes both normal data rate and EDR.
To view the test data see APPENDIX 3.

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. The result includes both normal data rate and EDR.
To view the test data see APPENDIX 3.

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. The result includes both normal data rate and EDR.

To view the test data see APPENDIX 3.

H. Compliance Test Equipment Used

UNIT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL DUE DATE (YY MM DD)	USE
EMI Test Receiver	Rohde & Schwarz	ESIB 40	100255	09-12-02	Conducted Emissions
L.I.S.N.	Rohde & Schwarz	ENV216	100060	10-04-21	Conducted Emissions
Preamplifier System	TDK RF Solutions	PA-02	080010	09-11-05	Radiated Emissions
Preamplifier	Sonoma	310N/11909A	185831	09-11-05	Radiated Emissions
Hybrid Log Antenna	TDK	HLP-3003C	017401	09-09-26	Radiated Emissions
Horn Antenna	TDK	HRN-0118	030101	10-07-22	Radiated Emissions
Horn Antenna	Emco	3116	2538	10-09-15	Radiated Emissions
Preamplifier	TDK	18-26	030002	10-11-26	Radiated Emissions
EMC Analyzer	Agilent	E7405A	US40240226	09-11-17	Radiated Emissions
Bluetooth Tester	Rohde & Schwarz	CBT	100368	09-10-03	Radiated Emissions
Environment Monitor	Control Company	1870	230355190	10-01-30	Radiated Emissions
Environment Monitor	Control Company	1870	80117164	10-01-08	Conducted Emissions
Environment Monitor	Control Company	1870	230355189	10-01-30	RF Conducted Emissions
Spectrum Analyzer	HP	8563E	3745A08112	09-09-22	RF Conducted Emissions
DC Power Supply	HP	6632B	US37472178	09-09-24	RF Conducted Emissions
Bluetooth Tester	Rohde & Schwarz	CBT	100034	09-12-10	RF Conducted Emissions
Temperature Probe	Control Company	15-077-21	51129471	09-05-12	Frequency Stability
Environmental Chamber	ESPEC Corp.	SH-240S1	91005607	N/R	Frequency Stability
Digital Multimeter	Hewlett Packard	34401A	US36042324	10-01-28	Conducted/Radiated Emissions

APPENDIX 1 – AC CONDUCTED EMISSIONS TEST DATA/PLOTS

Bluetooth AC Conducted Emission Test Results

Test Configuration 1

Date of test: February 17, 2009

The measurements were performed by: Heng Lin and Savtej Sandhu.

The environmental test conditions were: Temperature 25º C
Pressure 1018 mb
Relative Humidity 31 %

FCC CFR 47 Part 15, Subpart B and IC ICES-003, Class B

Frequency (MHz)	Line	Reading (QP) (dBµV)	Correction Factor (dB)	Corrected Reading (QP) (dB)	Limit (QP) (dBµV)	Limit (AV) (dBµV)	Margin (QP) Limits (dB)
0.159	L1	30.67	10.03	40.70	65.52	55.52	-24.82
0.168	N	31.57	10.03	41.60	65.06	55.06	-23.46
0.186	N	29.92	9.98	39.90	64.21	54.21	-24.31

All other emission levels had a test margin of greater than 25 dB.

Measurements were done with the quasi-peak detector.

See figure 1-1 and figure 1-2 for the measurement plot of the L1 and N lines of AC power line conducted emissions.

AC Conducted Emissions Test Graphs

Test Configuration 1

Figure 1-1: L1 lines

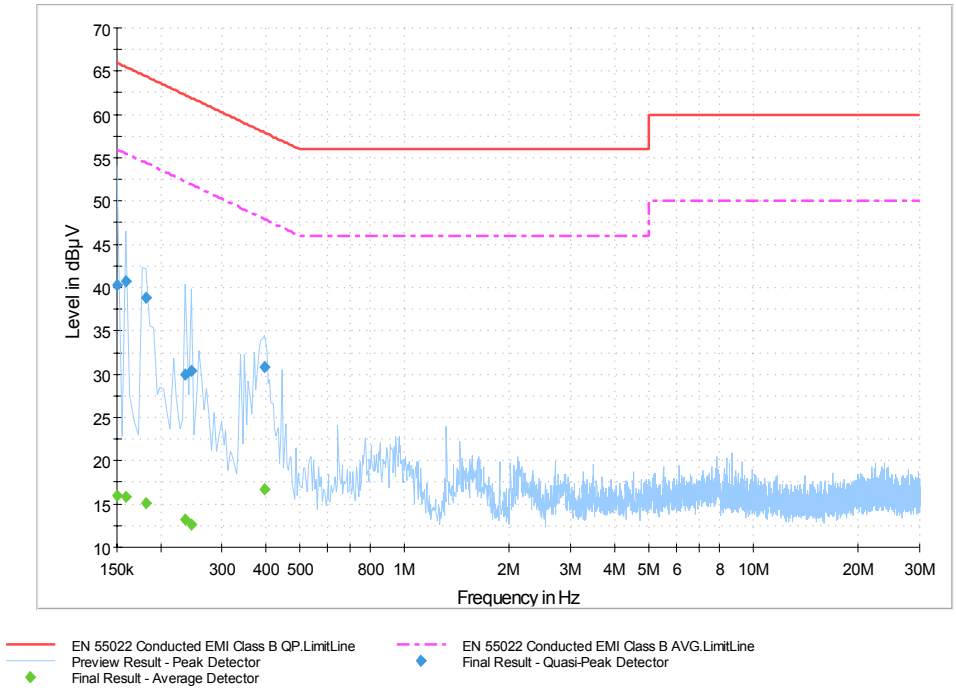
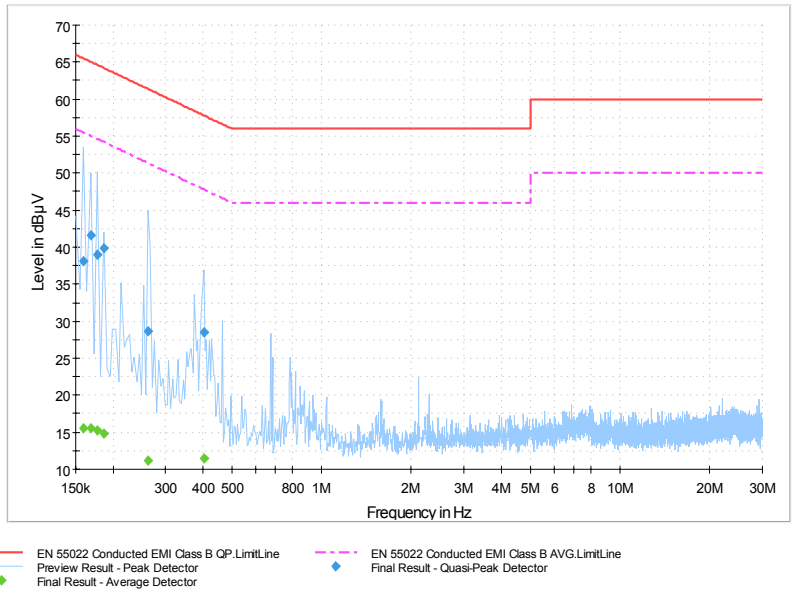


Figure 1-2: N Lines



Bluetooth AC Conducted Emission Test Results cond't

Test Configuration 2

Date of test: February 11, 2009

The measurements were performed by Heng Lin.

The environmental test conditions were: Temperature 25º C
Pressure 1018 mb
Relative Humidity 31 %

FCC CFR 47 Part 15, Subpart B and IC ICES-003, Class B

Frequency (MHz)	Line	Reading (QP) (dBµV)	Correction Factor (dB)	Corrected Reading (QP) (dB)	Limit (QP) (dBµV)	Limit (AV) (dBµV)	Margin (QP) Limits (dB)
0.155	L1	33.29	10.01	43.30	65.75	55.75	-22.45
0.155	N	36.05	9.85	45.90	65.75	55.75	**-19.85**
0.168	N	31.67	10.03	41.70	65.06	55.06	-23.36
0.173	L1	33.12	9.88	43.00	64.84	65.84	-21.84
0.438	L1	26.38	9.72	36.10	57.10	47.10	-21.00
0.443	N	23.43	9.87	33.30	57.01	47.01	-23.71

All other emission levels had a test margin of greater than 25 dB.

Measurements were done with the quasi-peak detector.

See figure 1-3 and figure 1-4 for the measurement plot of the L1 and N lines of AC power line conducted emissions.

AC Conducted Emissions Test Graphs

Test Configuration 2

Figure 1-3: L1 lines

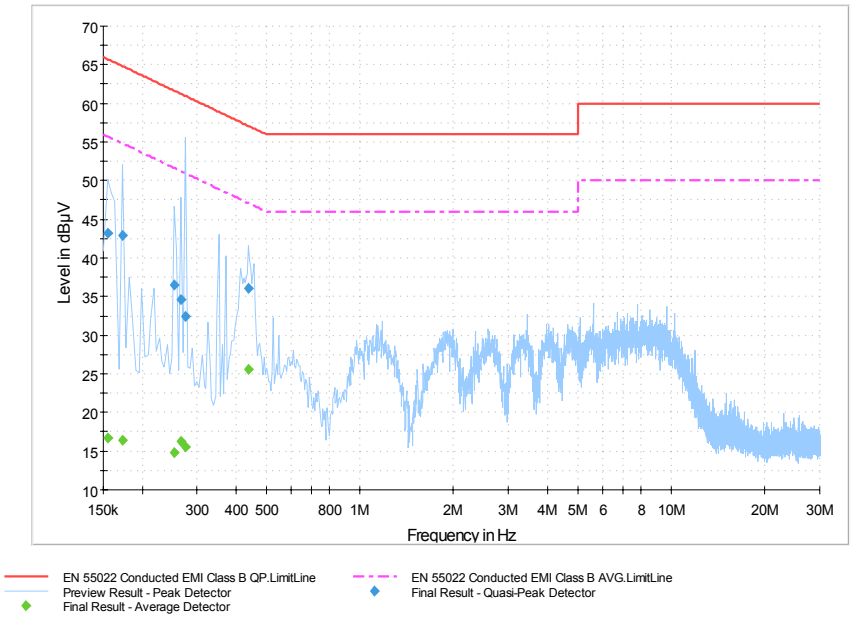
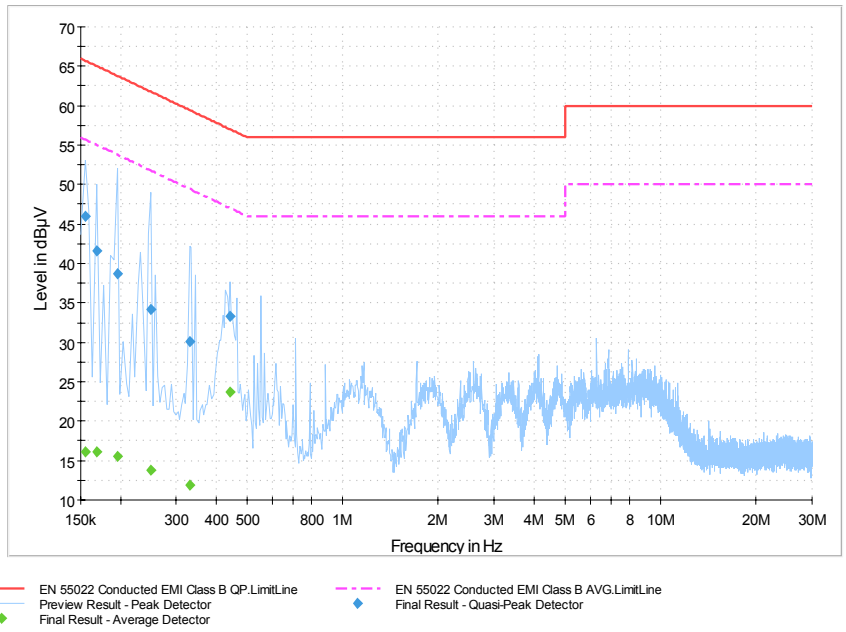


Figure 1-4: N Lines



APPENDIX 2 – RADIATED EMISSIONS TEST DATA

Radiated Emissions Test Results

Bluetooth Band

Date of Test: January 11 to 20, 2009

The measurements were performed by Andrew Fleming.

Test Distance was 3.0 metres with a height of 0.8 metres, 30 MHz to 25 GHz.

The environmental test conditions were:	Temperature	23 to 25ºC
	Pressure	992 to 1013 mb
	Relative Humidity	22 to 31%

The BlackBerry® Smart Card Readers, PIN 50010DB1 and 50010E62 were in standalone, vertical position.
The frequency sweep measurements were performed in Tx mode using packet types "DH5", "2-DH5" and "3-DH5" on channels 0, 39 and 78 at maximum output power.

All emissions had a test margin greater than 25.0 dB.

Radiated Emissions Test Data Results cont'd

Bluetooth Band

Date of Test: February 26, 2009 Test Distance was 1.0 metre.
The corrected readings were adjusted to take into account the 3.0 to 1.0 metre distance factor.
The measurements were performed in single frequency and hopping mode (channels 0 to 78) at maximum output power.
The frequency sweep measurements were performed in single frequency mode using packet type "DH5", "2-DH5" and "3-DH5".

Type	Channel	Frequency (MHz)	Antenna Type	Antenna Pol	Reading (Peak) (dBuV)	Corrected Reading (dBuV)	Detector (AVE/PK)	Peak Limit (dBuV/m)	Diff. To Limit (dB)
Single frequency mode Low Channel, packet type "DH5", USB side down									
2nd	0	4804.0	Horn	V	-	1	PK.	74	-
2nd	0	4804.0	Horn	H	-				
The emissions were investigated up to the 10th harmonic. Emissions were in the noise floor (NF).									
Single frequency mode Low Channel, packet type "2-DH5" USB side down.									
2nd	0	4804.0	Horn	V	-	-	PK.	74	-
2nd	0	4804.0	Horn	H	-				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF.									
Single frequency mode Low Channel, packet type "3-DH5" USB side down.									
2nd	0	4804.0	Horn	V	-	-	PK.	74	-
2nd	0	4804.0	Horn	H	-				
The emissions were investigated up to the 10th harmonic. Emissions were in the NF.									
Hopping mode, packet type "DH5", USB side down.									
2nd	0	4804.0	Horn	V	NF	NF	PK	74.00	-
2nd	0	4804.0	Horn	H	NF				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF									

Bluetooth Radiated Emissions Test Results cont'd

Bluetooth Band

Type	Channel	Frequency (MHz)	Antenna Type	Antenna Pol	Reading (Peak) (dBuV)	Corrected Reading (dBuV)	Detector (AVE/PK)	Peak Limit (dBuV/m)	Diff. To Limit (dB)
Single frequency mode Middle Channel, packet type "DH5", USB side down									
2nd	39	4882.0	Horn	V	-	-	PK.	74	-
2nd	39	4882.0	Horn	H	-				
The emissions were investigated up to the 10th harmonic. Emissions were in the NF.									
Single frequency mode Middle Channel, packet type "2-DH5" USB side down.									
2nd	39	4882.0	Horn	V	-	-	PK.	74	-
2nd	39	4882.0	Horn	H	-				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF.									
Single frequency mode Middle Channel, packet type "3-DH5" USB side down.									
2nd	39	4882.0	Horn	V	-	-	PK	74	-
2nd	39	4882.0	Horn	H	-				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF.									
Hopping mode, packet type "DH5", USB side down.									
2nd	39	4882.0	Horn	V	NF	-	PK	74.00	-
2nd	39	4882.0	Horn	H	NF				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF									

Bluetooth Radiated Emissions Test Results cont'd

Bluetooth Band

Type	Channel	Frequency (MHz)	Antenna Type	Antenna Pol	Reading (Peak) (dBuV)	Corrected Reading (dBuV)	Detector (AVE/PK)	Peak Limit (dBuV/m)	Diff. To Limit (dB)
Single frequency mode high Channel, packet type "DH5", USB side down									
2nd	78	4960.0	Horn	V	-	-	PK.	74	-
2nd	78	4960.0	Horn	H	-				
The emissions were investigated up to the 10th harmonic. Emissions were in the NF.									
Single frequency mode high Channel, packet type "2-DH5" USB side down.									
2nd	78	4960.0	Horn	V	-	-	PK.	74	-
2nd	78	4960.0	Horn	H	-				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF.									
Single frequency mode High Channel, packet type "3-DH5" USB side down.									
2nd	78	4960.0	Horn	V	-	-	PK	74	-
2nd	78	4960.0	Horn	H	-				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF.									
Hopping mode, packet type "DH5", USB side down									
2nd	78	4960.0	Horn	V	NF	-	PK	74.00	-
2nd	78	4960.0	Horn	H	NF				
The harmonics were investigated up to the 10th harmonic. Emissions were in the NF									

Band-Edge Compliance of RF Radiated Emissions Test Results

Date of test: February 23, 2009

The measurements were performed by Andrew Fleming and Arjun Rai Bhatti.

The environmental test conditions were: Temperature 24ºC
Pressure 1021 mb
Humidity 22 %

BlackBerry® smartphone PIN 50010DB1 was in standalone, vertical, Pattern type "Static PBRS" and packet type "DH5" during the measurements.

The test distance was 3.0 metres.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (PK, AVE.)	VBW (MHz)	Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
Low Channel										
0	2402.0	Horn	V	PK	1 MHz	89.01	46.42	42.59	74	-31.41
0	2402.0	Horn	H	PK	1 MHz	94.35	50.29	44.06	74	-29.94
0	2402.0	Horn	V	AVE.	10 Hz	72.29	46.42	25.87	54	-28.13
0	2402.0	Horn	H	AVE.	10 Hz	75.76	50.29	25.49	54	-28.53
High Channel										
78	2480.0	Horn	V	PK	1 MHz	89.99	44.67	45.32	74	-28.68
78	2480.0	Horn	H	PK	1 MHz	93.37	45.15	48.22	74	-25.78
78	2480.0	Horn	V	AVE.	10 Hz	71.99	44.67	27.32	54	-26.68
78	2480.0	Horn	H	AVE.	10 Hz	76.17	45.15	31.02	54	-22.98

Band-Edge Compliance of RF Radiated Emissions Test Results cont'd

BlackBerry® smartphone PIN 50010DB1 was in standalone, vertical, Pattern type "Static PBRS" and packet type "3-DH5" during the measurements.

The test distance was 3.0 metres.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (PK, AVE.)	VBW (MHz)	Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
Low Channel										
0	2402.0	Horn	V	PK	1 MHz	88.44	47.25	41.19	74	-32.81
0	2402.0	Horn	H	PK	1 MHz	92.83	50.47	42.36	74	-31.64
0	2402.0	Horn	V	AVE.	10 Hz	70.52	47.25	23.27	54	-30.73
0	2402.0	Horn	H	AVE.	10 Hz	73.84	50.47	23.37	54	-30.63
High Channel										
78	2480.0	Horn	V	PK	1 MHz	88.82	41.14	47.68	74	-26.32
78	2480.0	Horn	H	PK	1 MHz	91.95	41.71	50.24	74	-23.76
78	2480.0	Horn	V	AVE.	10 Hz	69.19	41.14	28.05	54	-25.95
78	2480.0	Horn	H	AVE.	10 Hz	71.79	41.71	30.08	54	-23.92

See figures 2-1 to 2-8 for the plots of the Bluetooth band-edge compliance.

Bluetooth Band-Edge Compliance of RF Radiated Emissions cont'd

Figure 2-1: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
DH5, Channel 0, Pol: V, Detector: PK

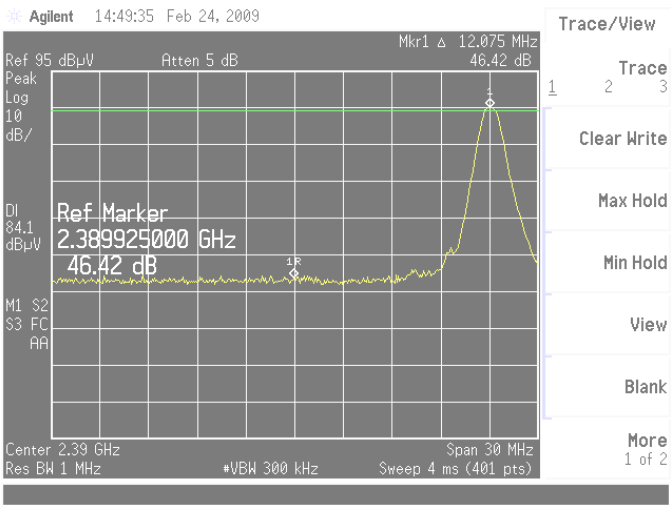


Figure 2-2: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
DH5, Channel 0, Pol: H, Detector: PK

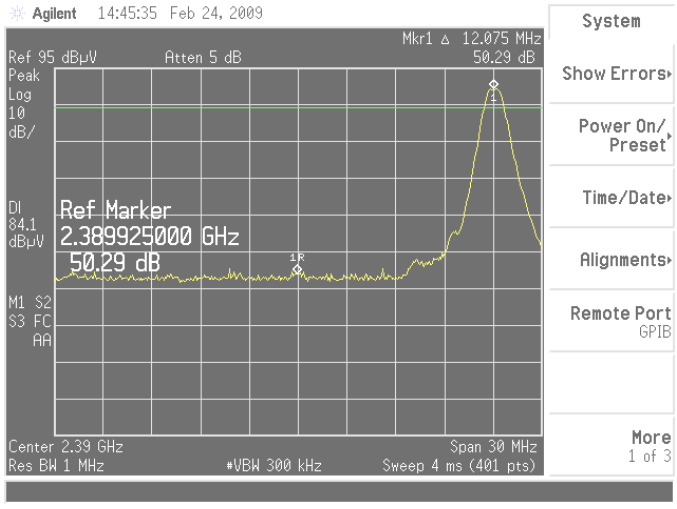


Figure 2-3: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
DH5, Channel 78, Pol: V, Detector: PK

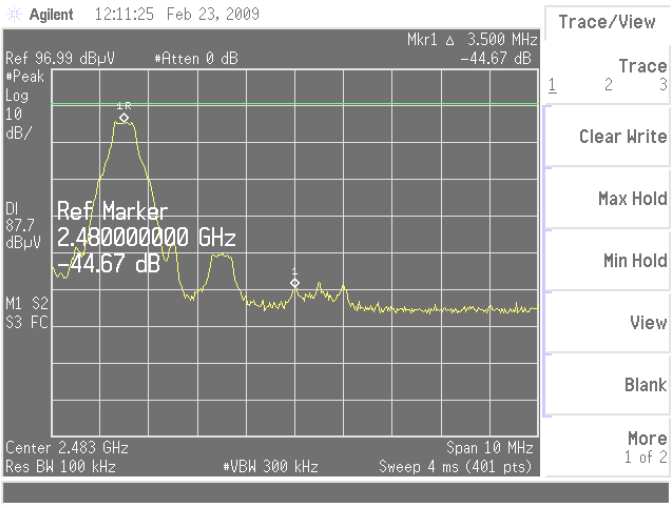
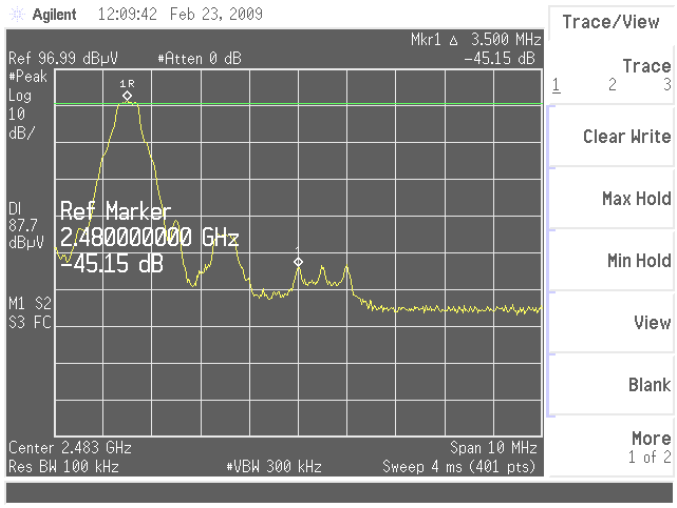


Figure 2-4: Band-Edge Compliance of RF Rad. Emissions
Bluetooth, Single freq., Static PBRS,
DH5, Channel 78, Pol: H, Detector: PK



Bluetooth Band-Edge Compliance of RF Radiated Emissions cont'd

Figure 2-5: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 0, Pol: V, Detector: PK

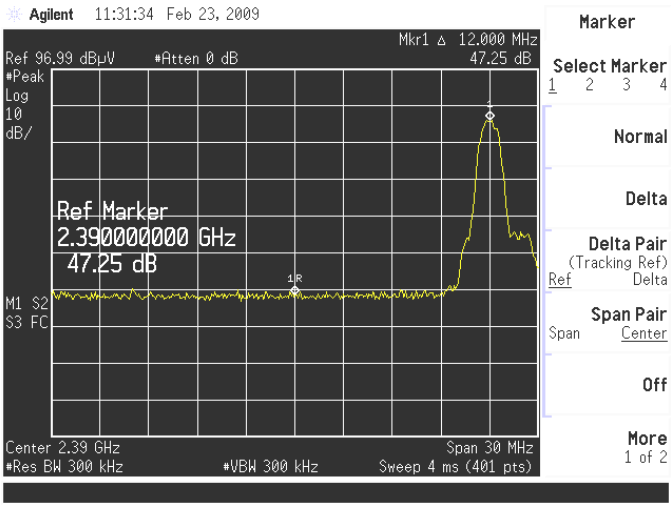


Figure 2-6: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 0, Pol: H, Detector: PK

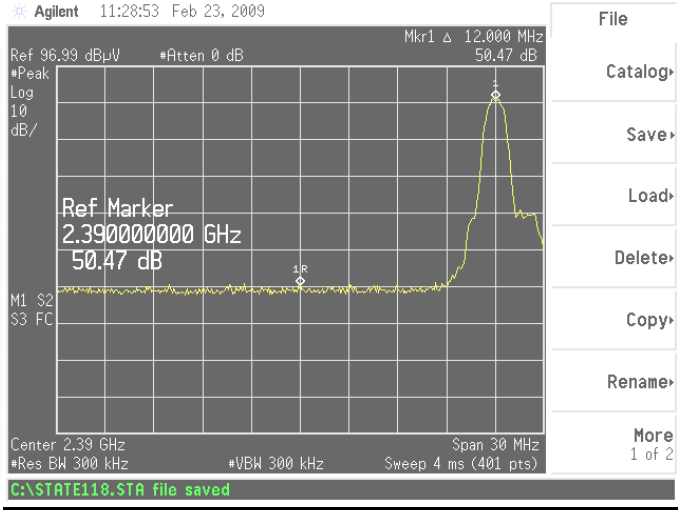


Figure 2-7: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 78, Pol: V, Detector: PK

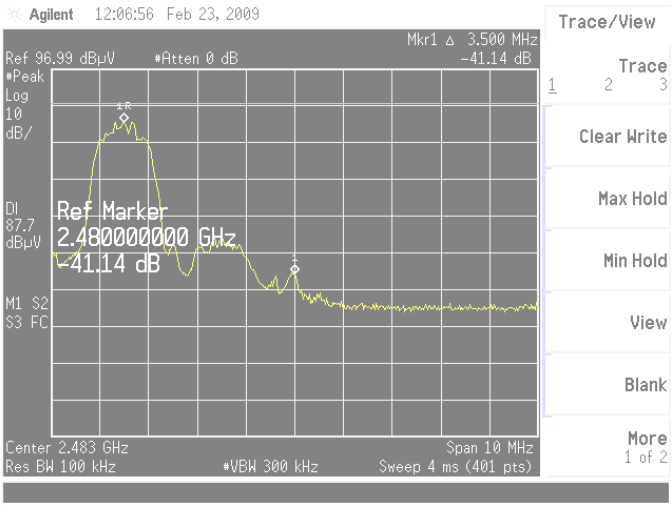
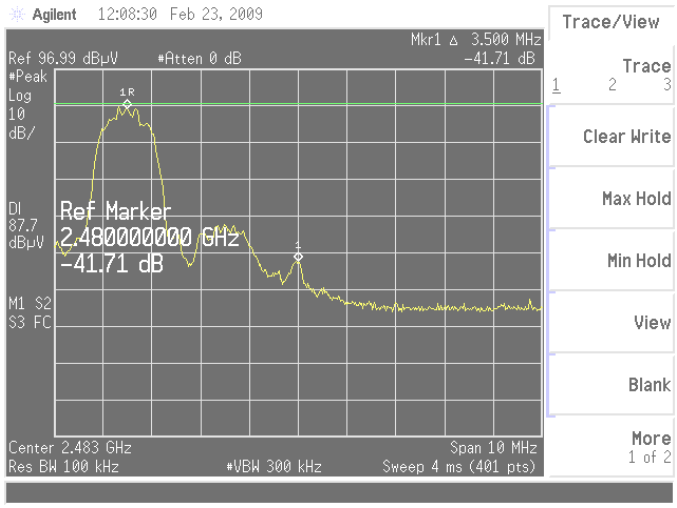


Figure 2-8: Band-Edge Compliance of RF Rad. Emissions
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 78, Pol: H, Detector: PK



APPENDIX 3 – BLUETOOTH CONDUCTED EMISSIONS TEST DATA/PLOTS

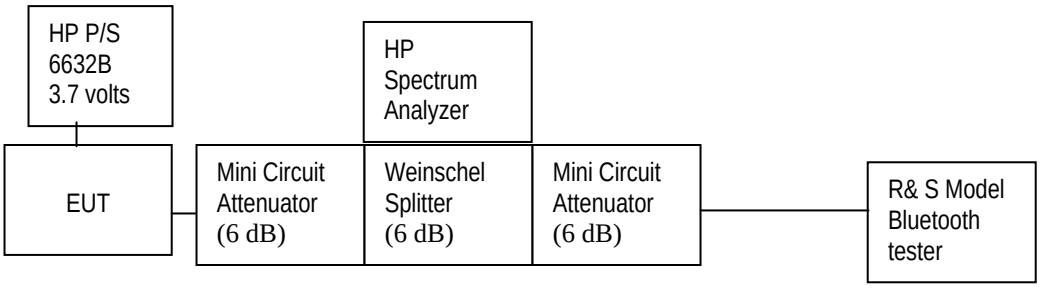
Bluetooth RF Conducted Emission Test Results

Date of test: February 09 to 10, 2009

The measurements were performed by Maurice Battler.

Bluetooth power output from BlackBerry® Smart Card reader PIN 50010E58 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.

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	0.937
39	≤1.0	0.933
78	≤1.0	0.933

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

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-1: 20 dB Bandwidth
Single freq., Static PBRS, DH5

Figure 3-2: 20 dB Bandwidth
Single freq., Static PBRS, DH5

Figure 3-3: 20 dB Bandwidth
Single freq., Static PBRS, DH5

Bluetooth RF Conducted Emission Test Results cont'd

Using Pattern type "Static PRBS" and packet type "3-DH5" during the measurements.

Bluetooth Channel	Limit (MHz)	Measured Level (MHz)
0	≤1.5	1.257
39	≤1.5	1.260
78	≤1.5	1.257

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

See figures 3-4 to 3-6 for the plots of the 20 dB bandwidth measurements.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-4: 20 dB Bandwidth
Single freq., Static PBRS, 3-DH5

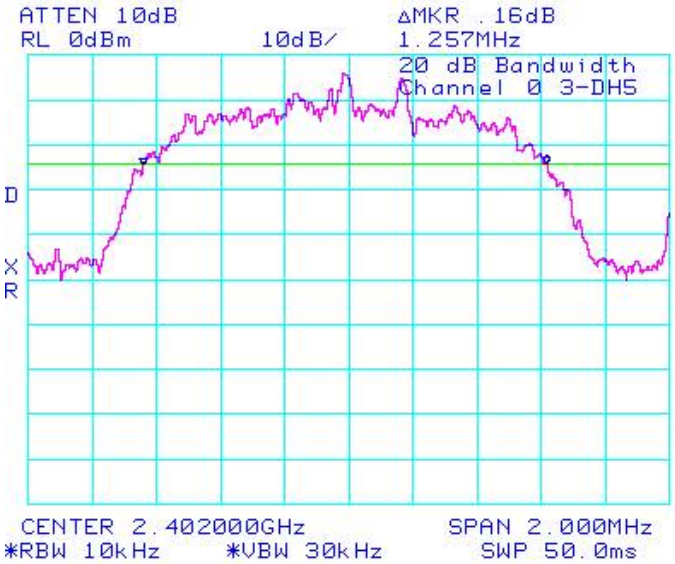


Figure 3-5: 20 dB Bandwidth
Single freq., Static PBRS, 3-DH5

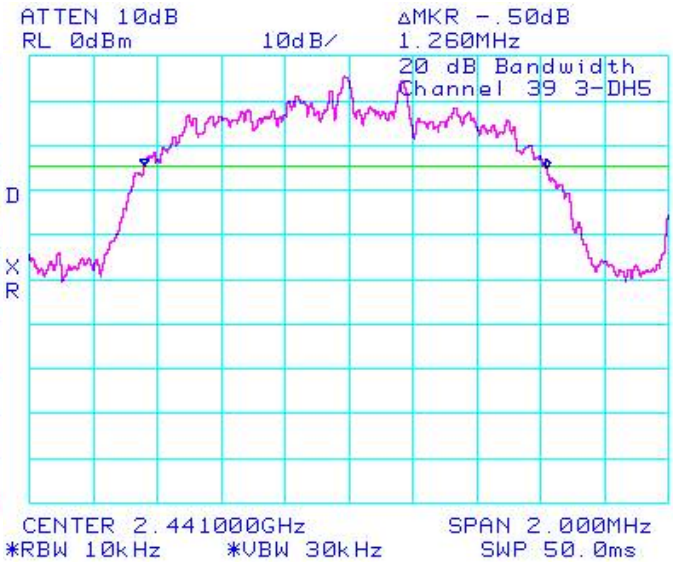


Figure 3-6: 20 dB Bandwidth
Single freq., Static PBRS, 3-DH5

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.

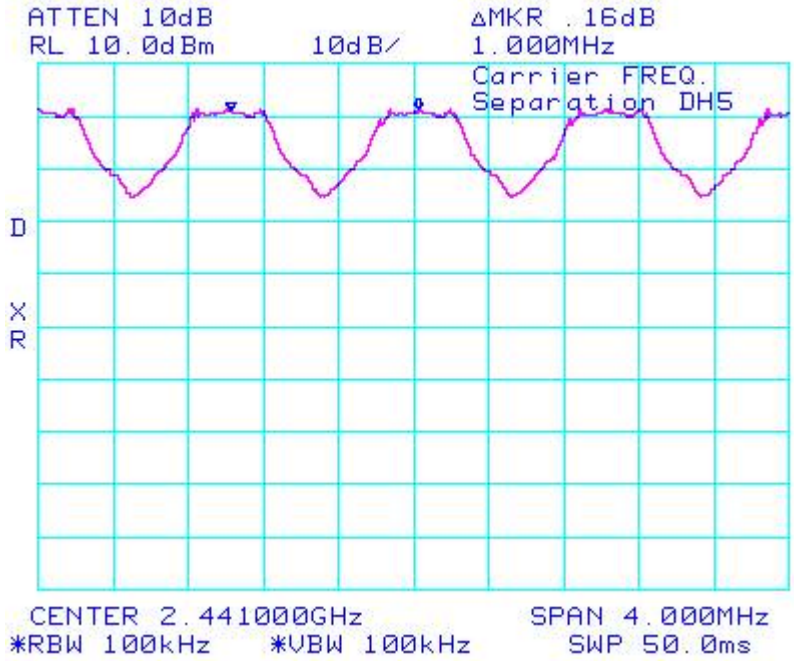
Bluetooth Channels	Limit (MHz)	Measured Level (MHz)
38 to 39	≥ 0.025 or 20 dB bandwidth	1.000

The environmental test conditions were:

Temperature	24ºC
Pressure	977 mb
Relative Humidity	32%

See figure 3-7 for the plot of the Carrier Frequency Separation measurement.

Figure 3-7: Carrier Frequency Separation, Freq. Hopping, Static PBRS, DH5, Channels 38 to 39



Bluetooth RF Conducted Emission Test Results cont'd

Using Pattern type "Static PRBS" and packet type "3-DH5" during the measurements.

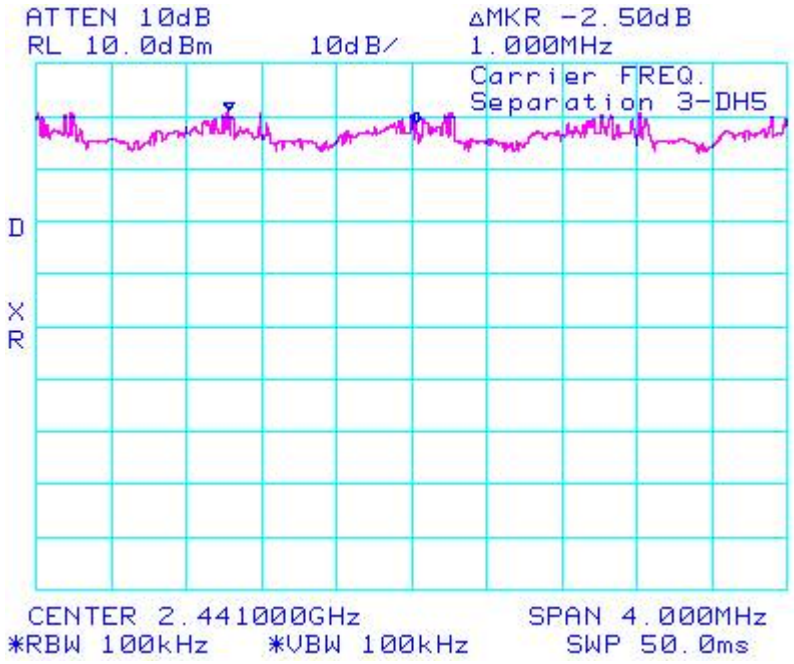
Bluetooth Channels	Limit (MHz)	Measured Level (MHz)
38 to 39	≥ 0.025 or 20 dB bandwidth	1.000

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

See figure 3-8 for the plot of the Carrier Frequency Separation measurement.

Figure 3-8: Carrier Frequency Separation, Freq. Hopping, Static PBRS, 3-DH5, Channels 38 to 39



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	24ºC
Pressure	997 mb
Relative Humidity	32%

See figures 3-9 to 3-12 for the plots of the number of hopping frequencies.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-6: Number of Hopping Frequencies
Static PBRS, DH5

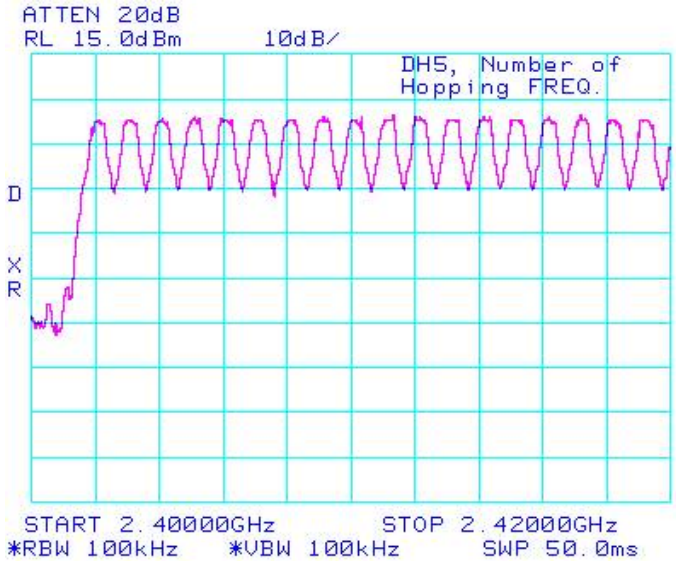


Figure 3-7: Number of Hopping Frequencies
Static PBRS, DH5

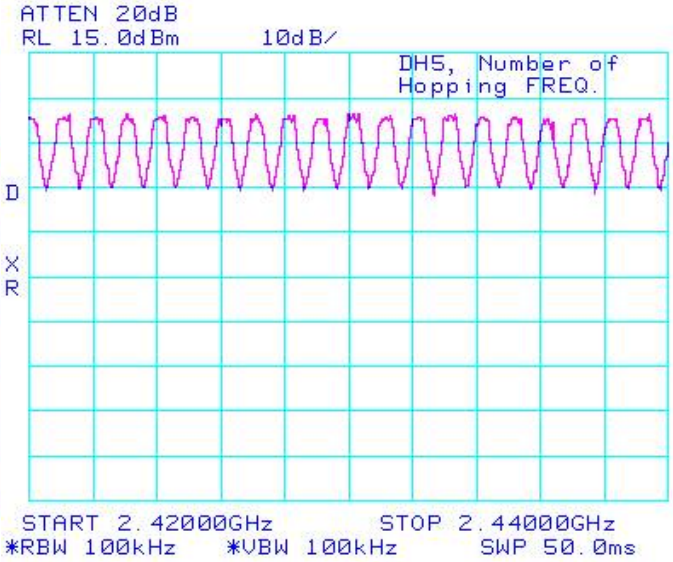


Figure 3-8: Number of Hopping Frequencies
Static PBRS, DH5

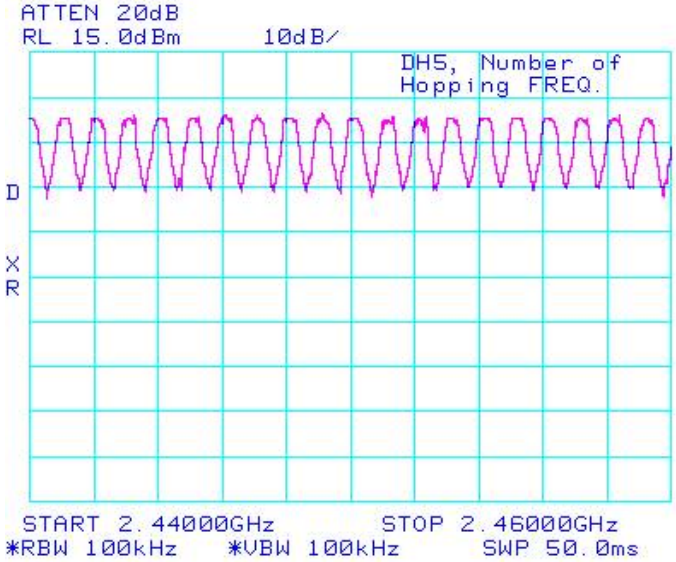
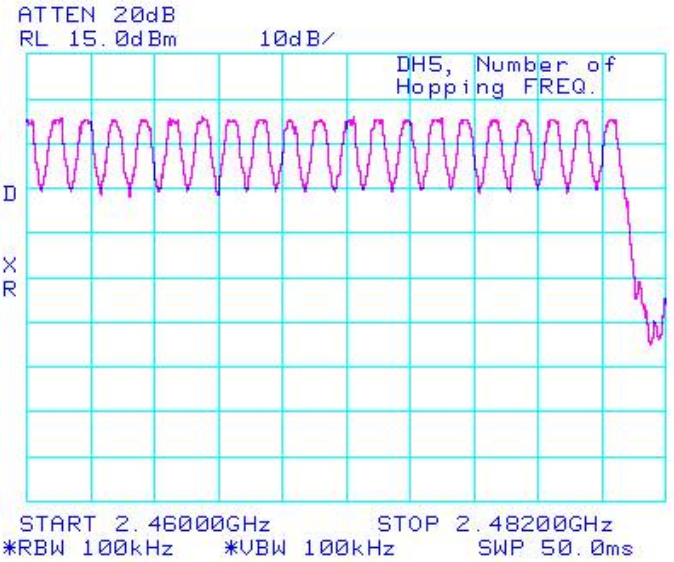


Figure 3-9: Number of Hopping Frequencies
Static PBRS, DH5



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	0.4250	0.4250 x 320.0 = 136.00	400	264.00
39	DH1	0.4250	0.4250 x 320.0 = 136.00	400	264.00
78	DH1	0.4222	0.4222 x 320.0 = 135.10	400	264.90
0	DH3	1.6750	1.6750 x 159.9 = 267.83	400	132.17
39	DH3	1.6750	1.6750 x 159.9 = 267.83	400	132.17
78	DH3	1.6750	1.6750 x 159.9 = 267.83	400	132.17
0	DH5	2.9300	2.9300x 106.8 = 312.92	400	87.08
39	DH5	2.9300	2.9300x 106.8 = 312.92	400	87.08
78	DH5	2.9300	2.9300x 106.8 = 312.92	400	87.08

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

See figures 3-13 to 3-21 for the plots of the dwell time.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-13: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH1

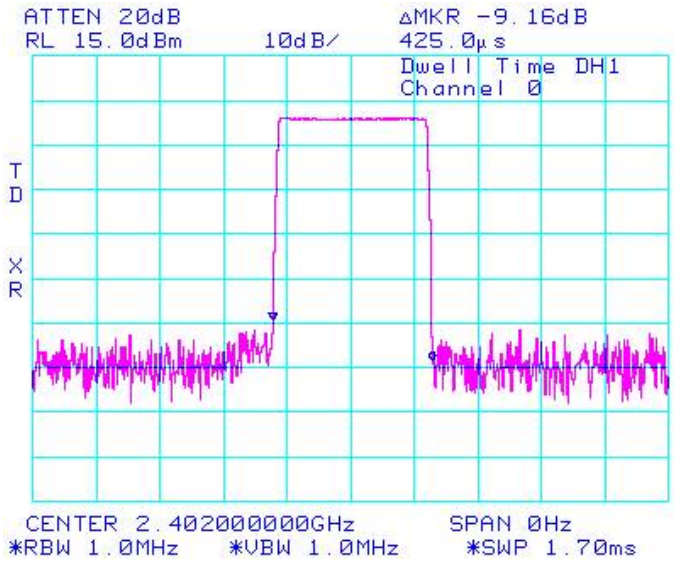


Figure 3-14: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH1

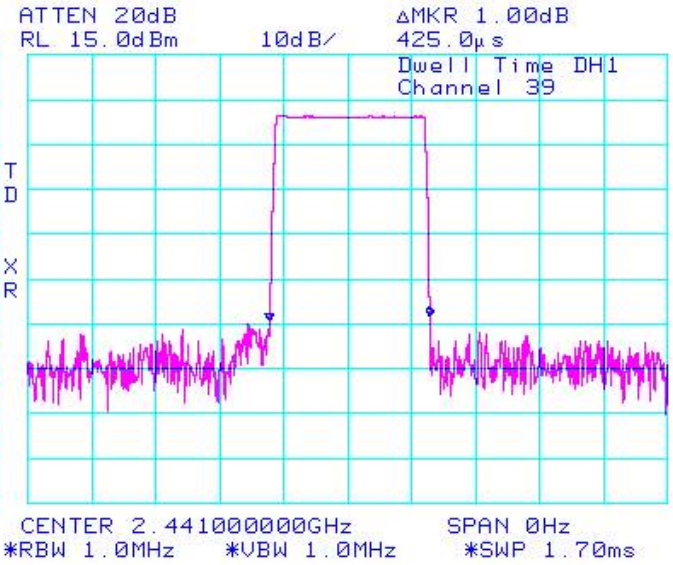


Figure 3-15: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH1

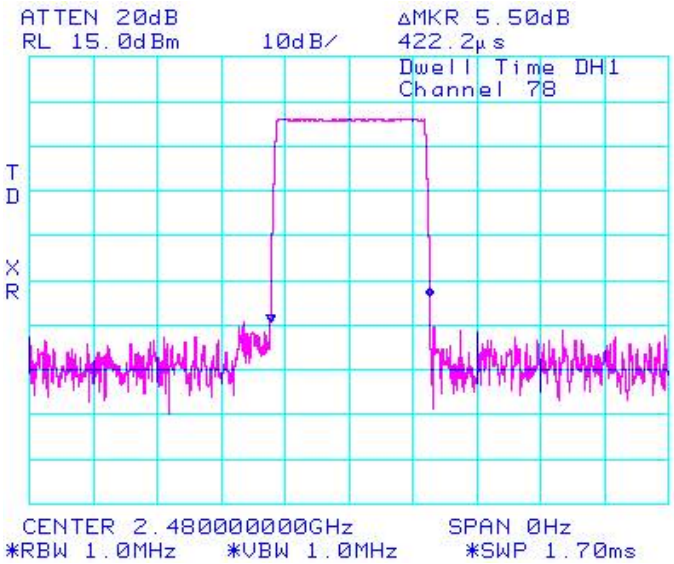
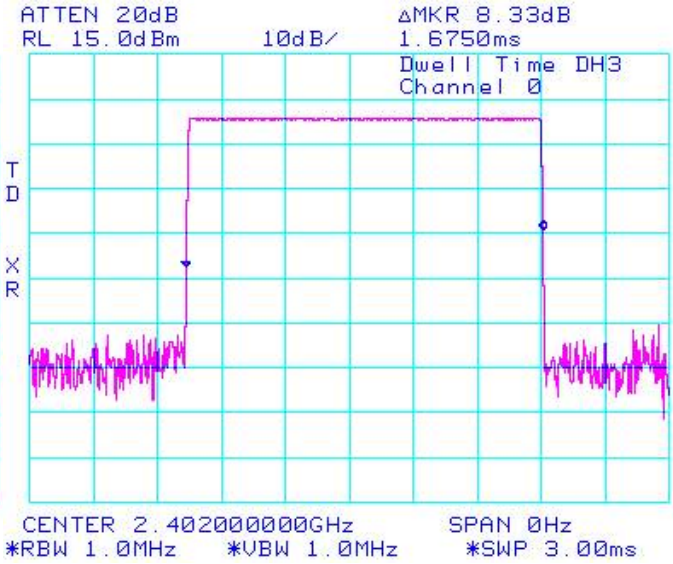


Figure 3-16: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH3



Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-17: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH3

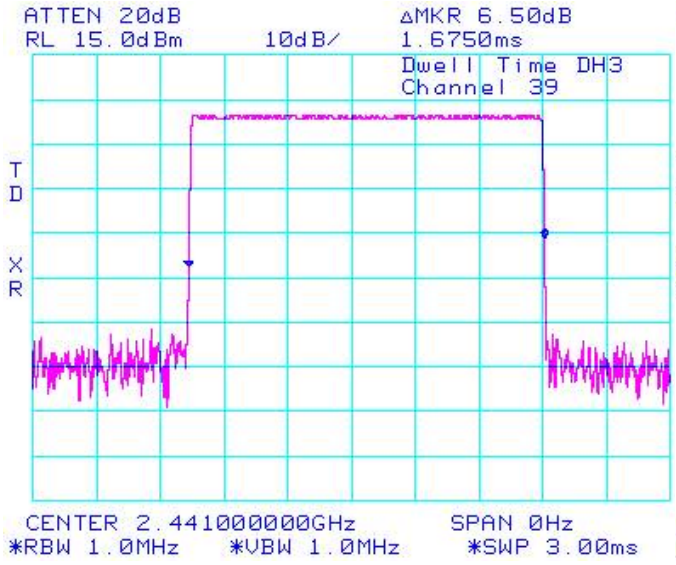


Figure 3-18 : Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH3

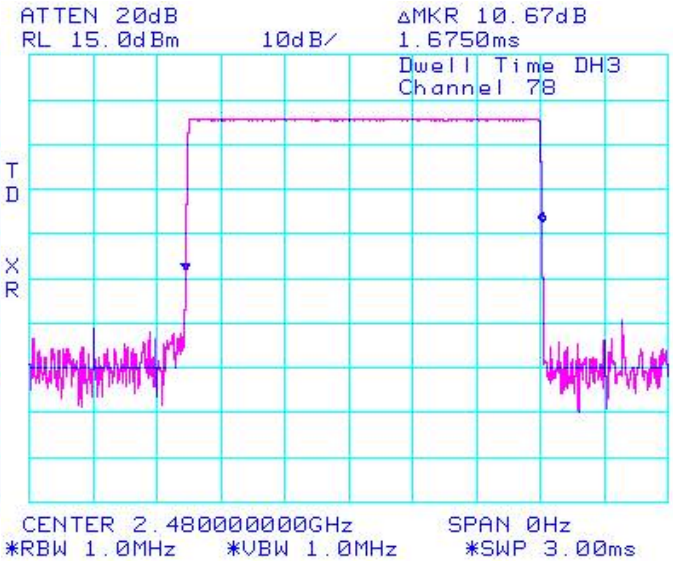


Figure 3-19: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH5

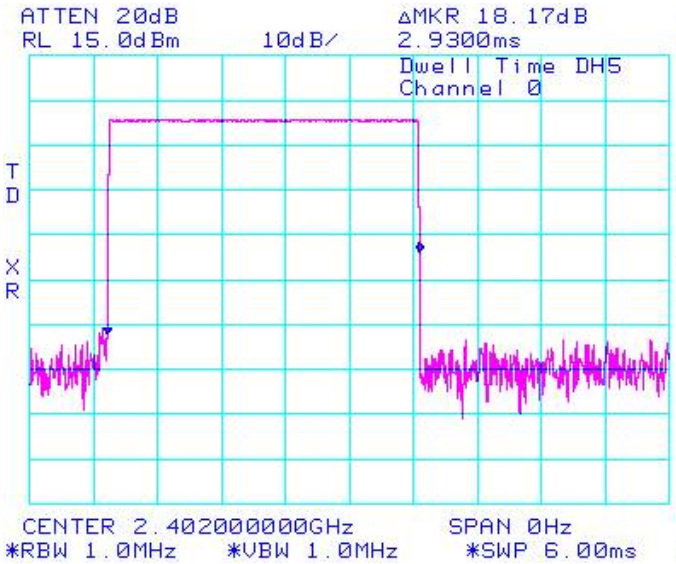
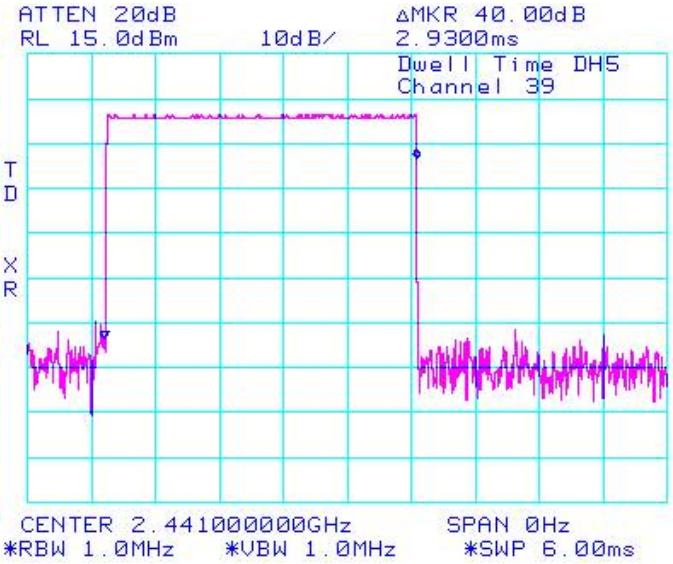
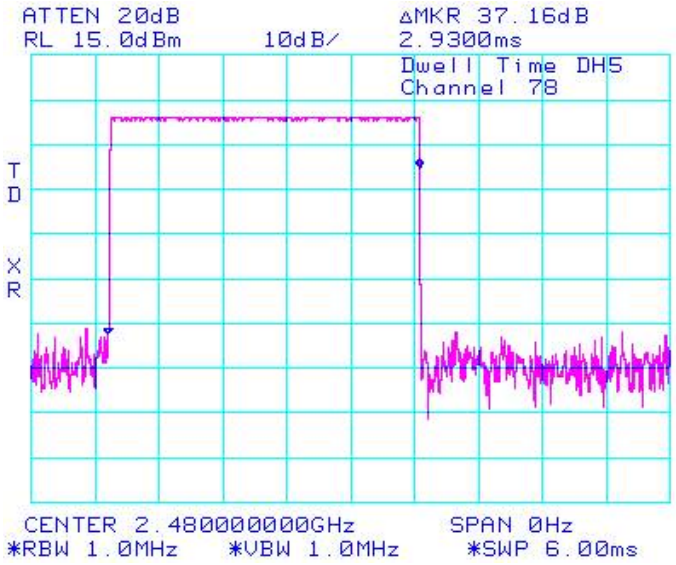


Figure 3-20: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-21: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH5



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.

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

Bluetooth Channel	Measured Level (dBm)	Class 2 Limit (dBm)
0	1.50	-6.0 to 4.0
39	2.00	-6.0 to 4.0
78	1.50	-6.0 to 4.0

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

See figures 3-22 to 3-24 for the plots of the maximum peak conducted output power.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-22: Max. Peak Conducted Output Power
Single Freq., Static PBRS, DH5

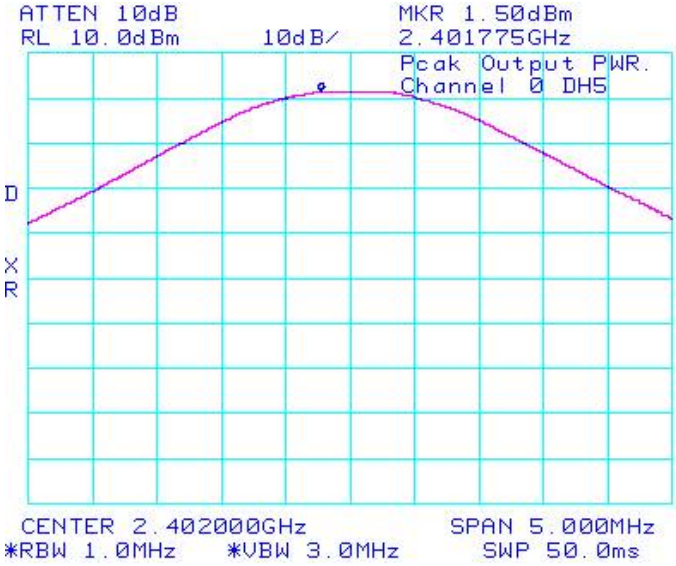


Figure 3-23: Max. Peak Conducted Output Power
Single Freq., Static PBRS, DH5

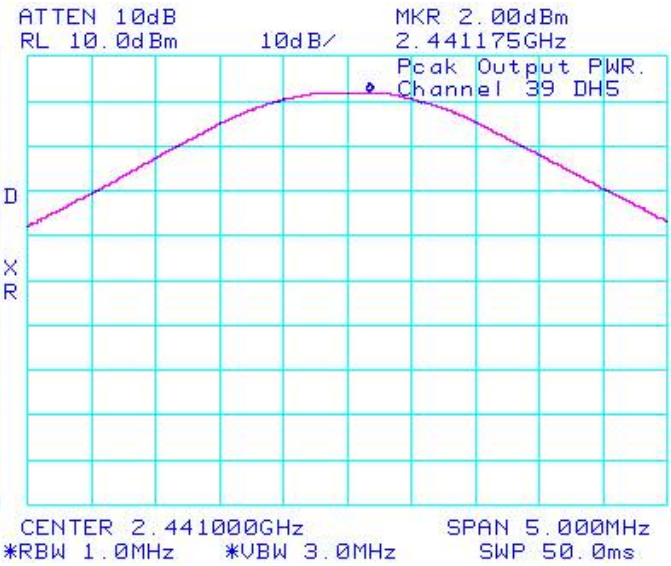
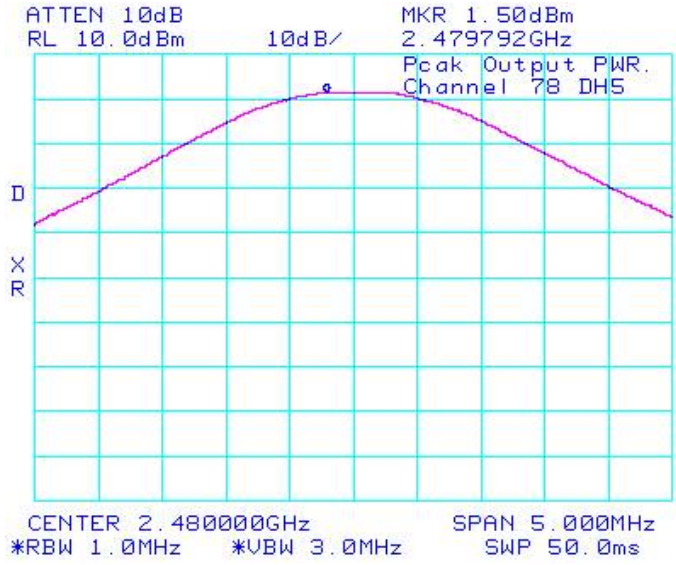


Figure 3-24: Max. Peak Conducted Output Power
Single Freq., Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Using Pattern type "Static PRBS" and packet type "3-DH5" during the measurements.

Bluetooth Channel	Measured Level (dBm)	Class 2 Limit (dBm)
0	1.50	-6.0 to 4.0
39	1.67	-6.0 to 4.0
78	0.83	-6.0 to 4.0

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

See figures 3-25 to 3-27 for the plots of the maximum peak conducted output power.

Figure 3-25: Max. Peak Conducted Output Power
Single Freq., Static PBRS, 3-DH5

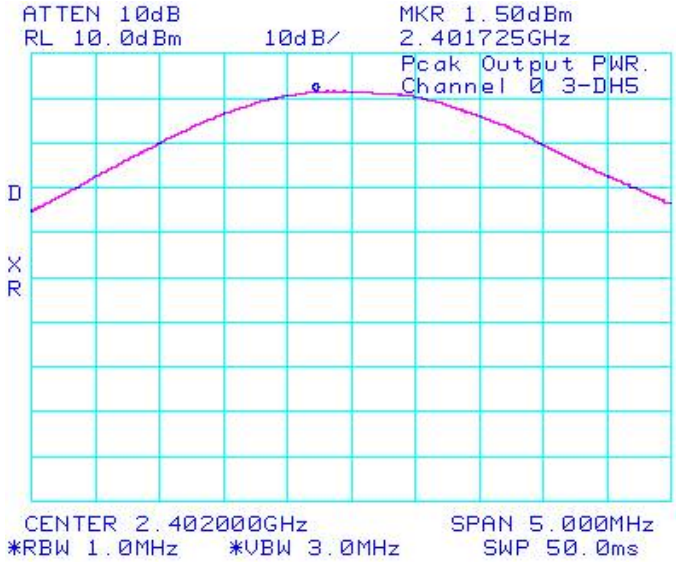
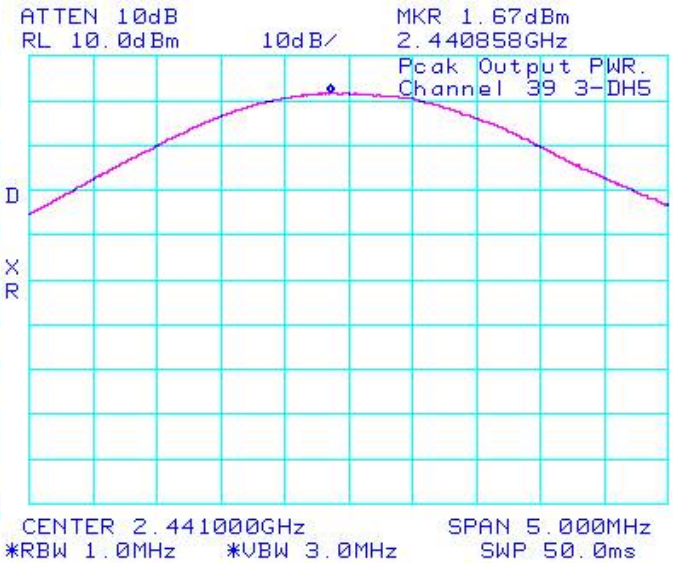
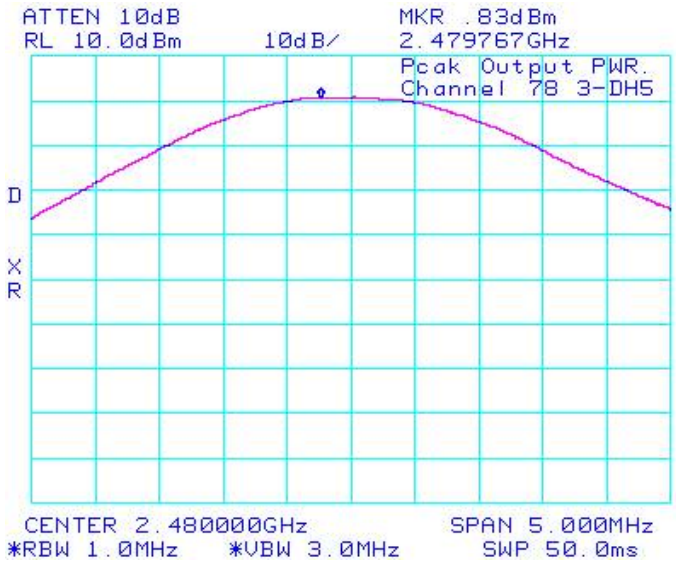


Figure 3-26: Max. Peak Conducted Output Power
Single Freq., Static PBRS, 3-DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-27: Max. Peak Conducted Output Power
Single Freq., Static PBRS, 3-DH5



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	-37.17	-20	-17.17
78	Single Frequency	--36.66	-20	-16.66
0	Hopping	-37.66	-20	-17.66
78	Hopping	-37.50	-20	-17.50

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

See figures 3-28 to 3-31 for the plots of the band edge compliance measurements.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-28: Band Edge Compliance
Single Freq., Static PBRS, DH5

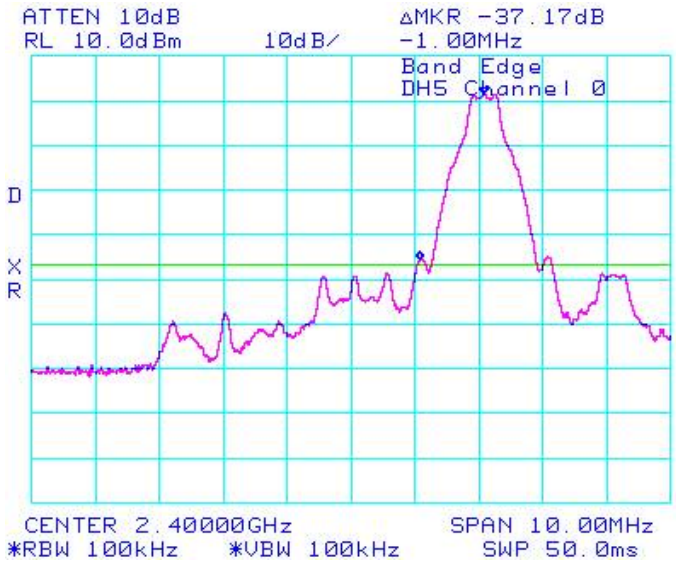


Figure 3-29: Band Edge Compliance
Single Freq., Static PBRS, DH5

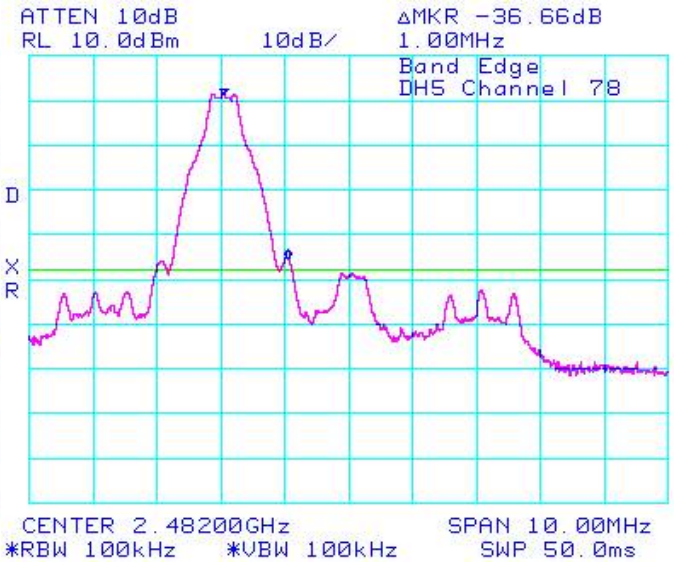


Figure 3-30: Band Edge Compliance
Freq. Hopping, Static PBRS, DH5

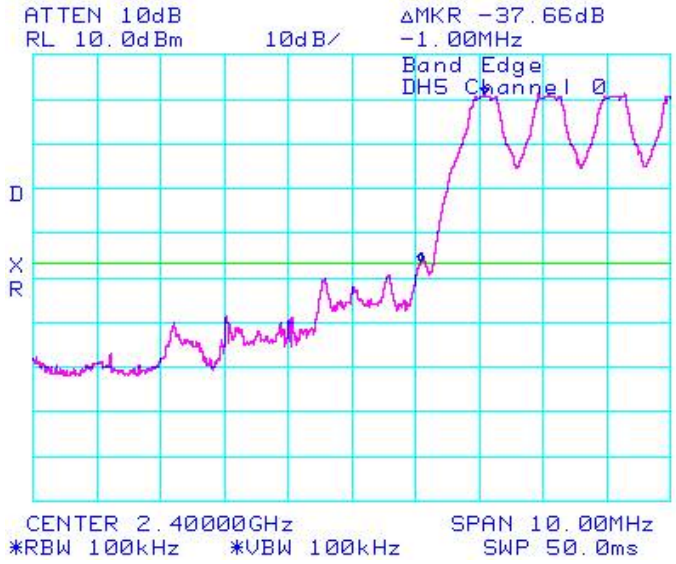
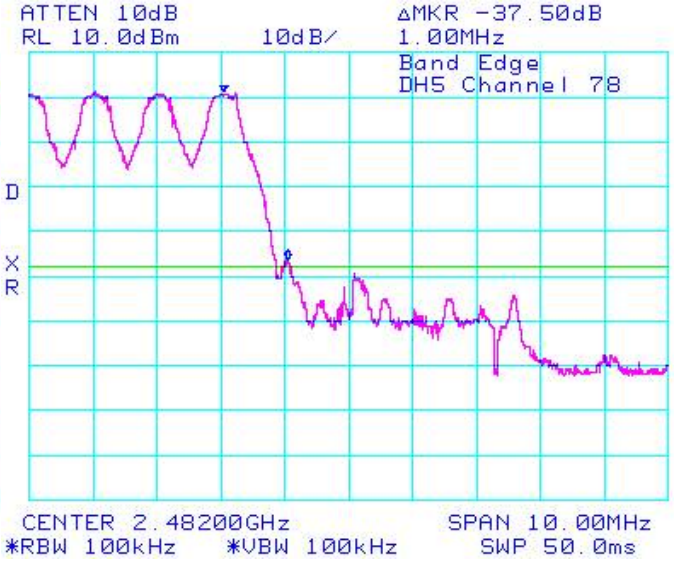


Figure 3-31: Band Edge Compliance
Freq. Hopping, Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Using pattern type "Static PRBS" and packet type "3-DH5" during the measurements.

Bluetooth Channel	Operating Mode	Measured Level (dBc)	Limit (dBc)	Margin (dB)
0	Single Frequency	-34.33	-20	-14.33
78	Single Frequency	-33.00	-20	-13.00
0	Hopping	-33.00	-20	-13.00
78	Hopping	-29.83	-20	-9.83

The environmental test conditions were:

Temperature	32ºC
Pressure	997 mb
Relative Humidity	24%

See figures 3-32 to 3-35 for the plots of the band edge compliance measurements.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-32: Band Edge Compliance
Single Freq., Static PBRS, 3-DH5

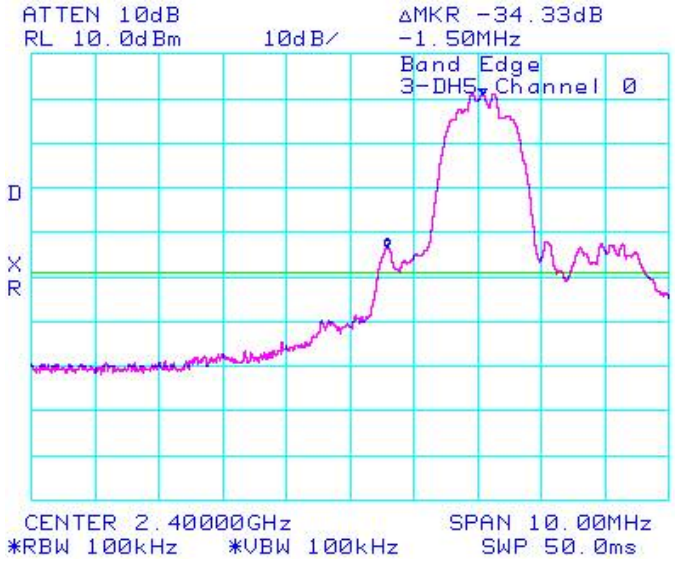


Figure 3-33: Band Edge Compliance
Single Freq., Static PBRS, 3-DH5

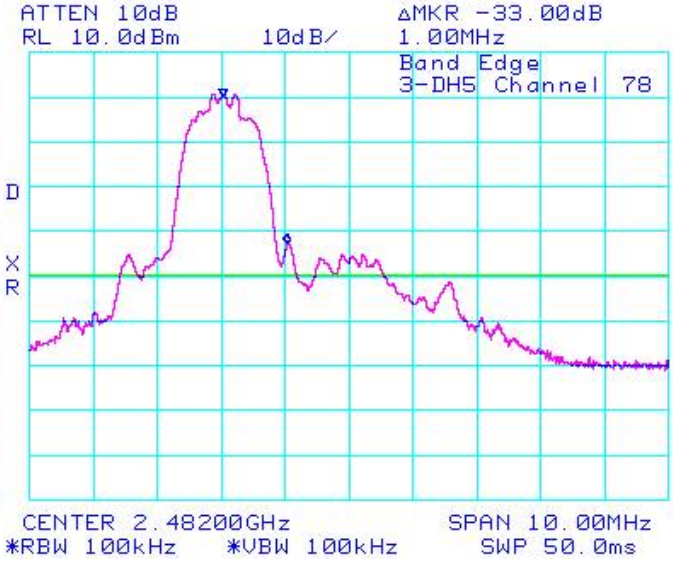


Figure 3-34: Band Edge Compliance
Freq. Hopping, Static PBRS, 3-DH5

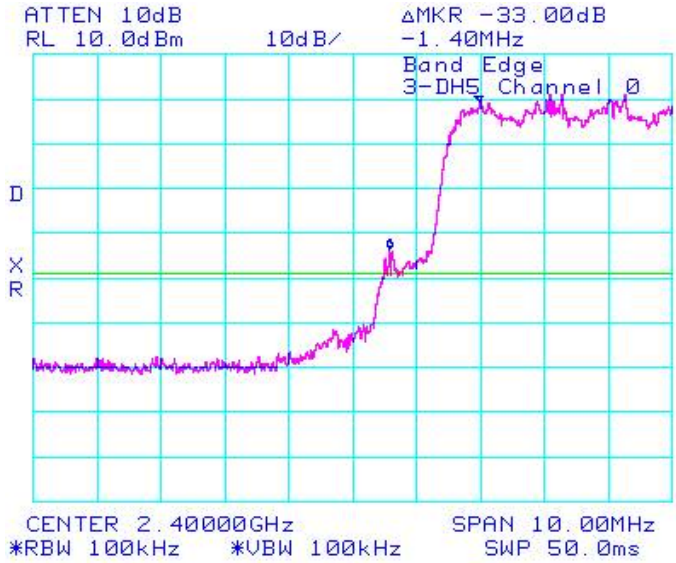
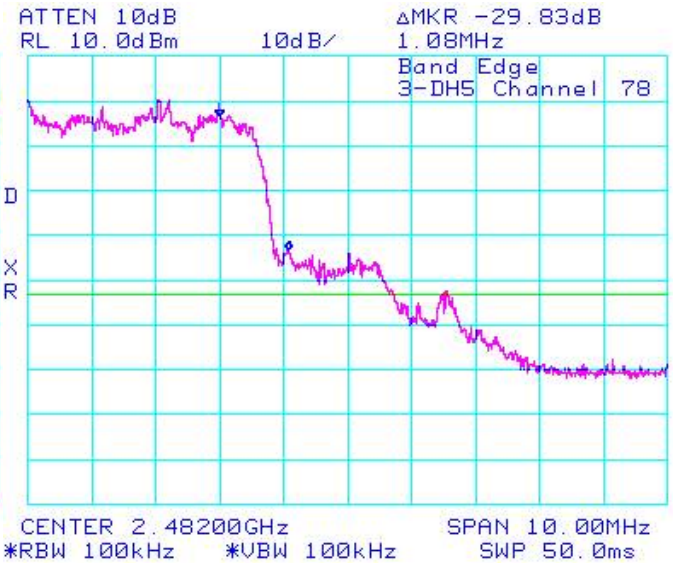


Figure 3-35: Band Edge Compliance
Freq. Hopping, Static PBRS, 3-DH5



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), mid channel (39) and high channel (78) were measured. Bluetooth was operating in single frequency and hopping mode. 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.

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

Bluetooth Channel	Channel Power (dBm)	Max. Measured Level (dBm)	Max. Measured Level from carrier (dBc)	Limit (dBc)
0	1.50	-47.67	-49.17	-20
39	2.00	-51.17	-53.17	-20
78	1.50	-56.17	-57.67	-20
Hopping mode	1.50	-52.00	-53.50	-20

The environmental test conditions were:

Temperature	24ºC
Pressure	997 mb
Relative Humidity	32%

See figures 2-36 to 2-39 for the plots of the spurious RF conducted emissions.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 2-36: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5,

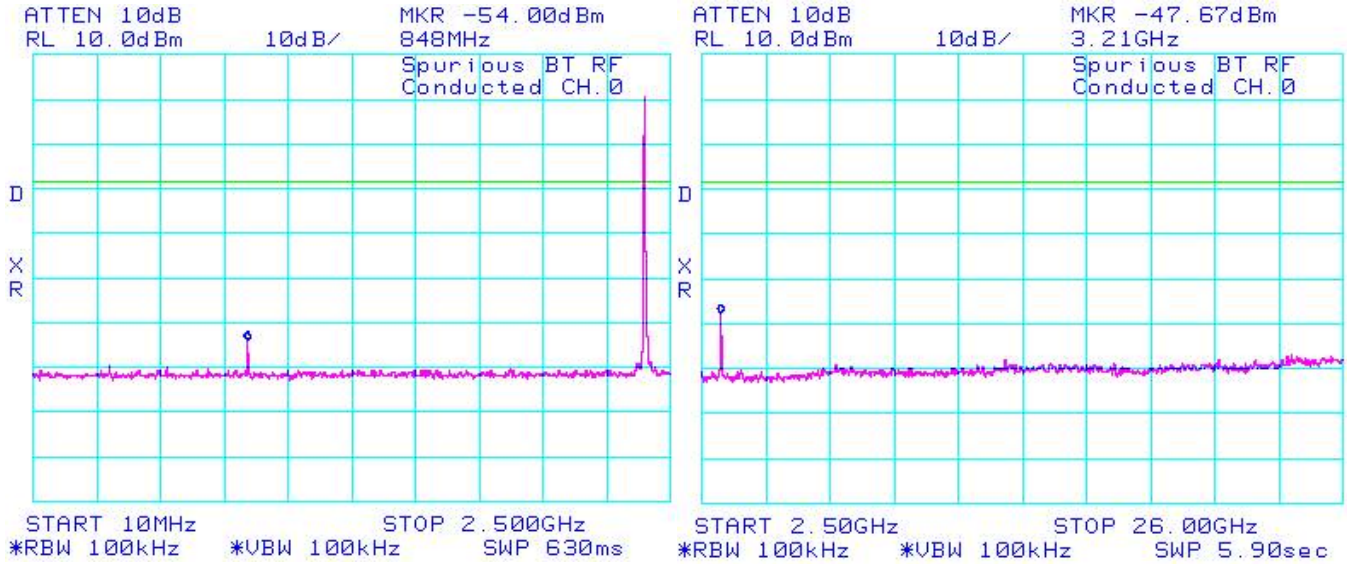
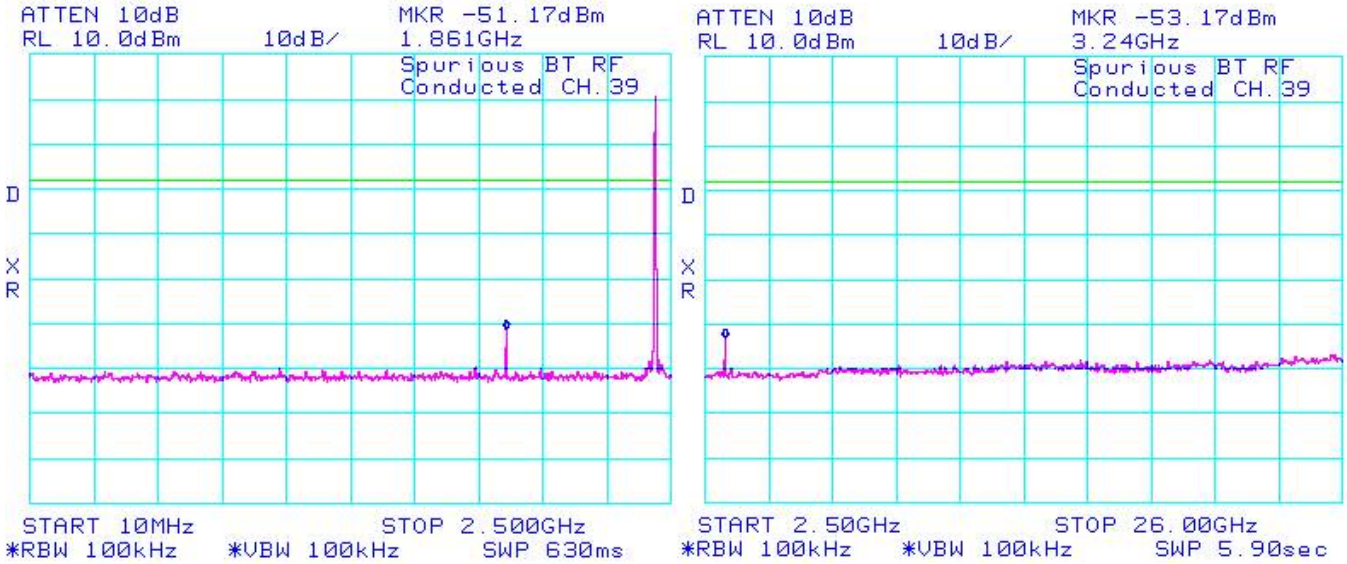


Figure 2-37: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 2-38: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5

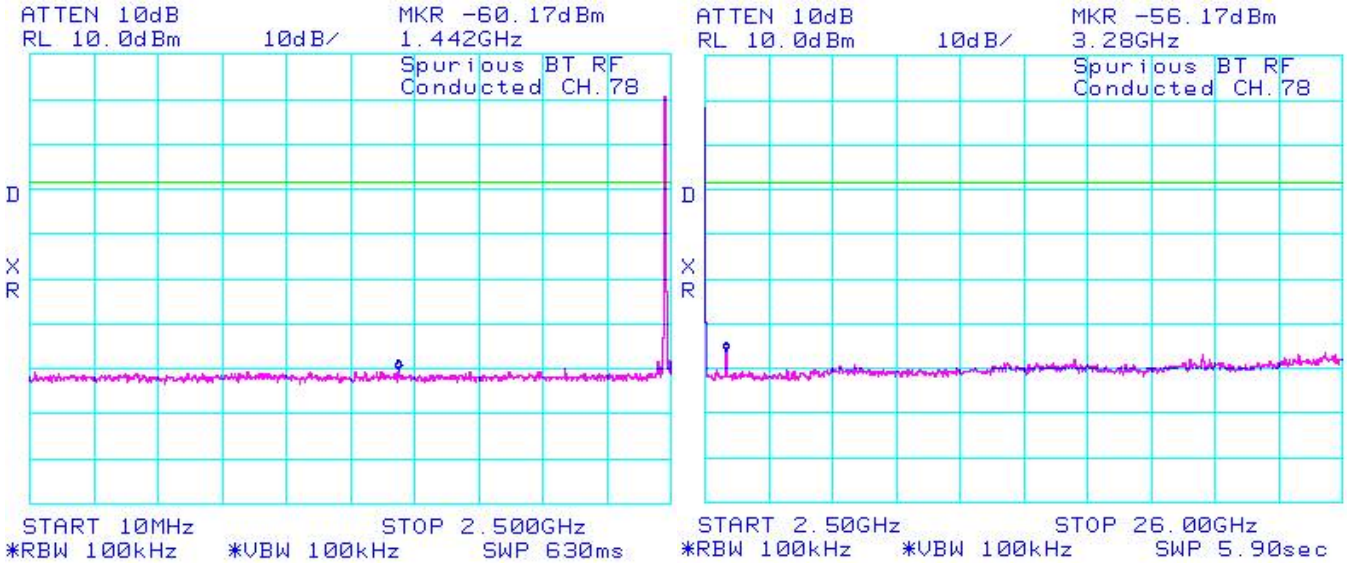
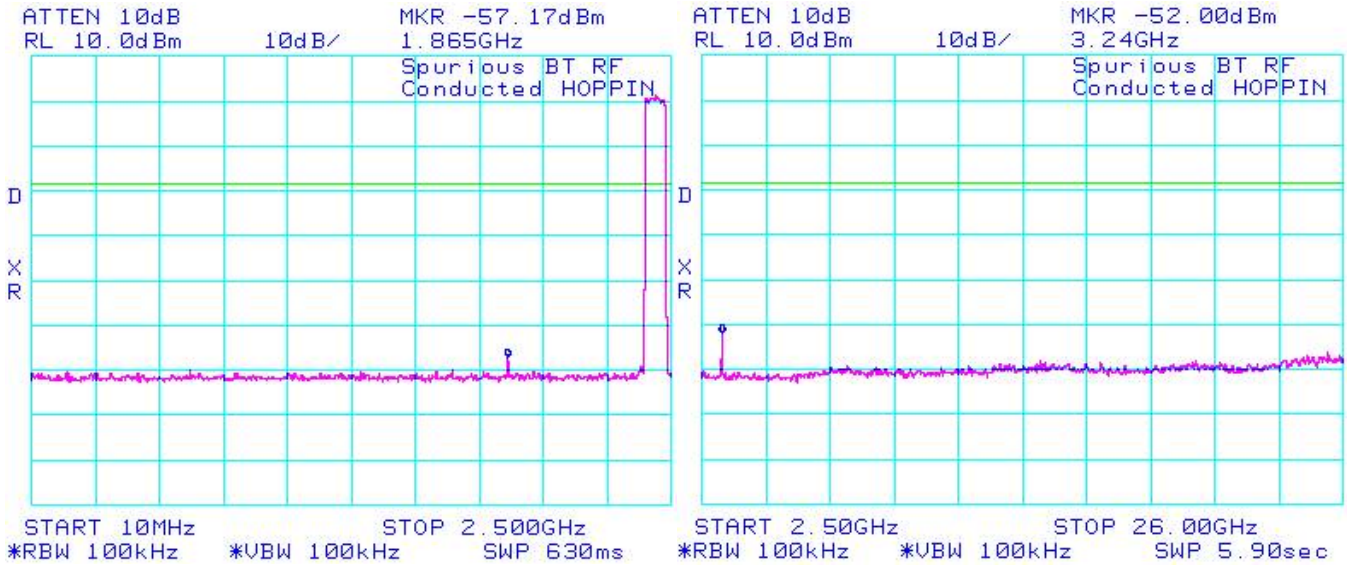


Figure 2-39: Spurious RF Conducted Emissions
Freq. Hopping, Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Using pattern type "Static PRBS" and packet type "3-DH5" during the measurements.

Bluetooth Channel	Channel Power (dBm)	Max. Measured Level (dBm)	Max. Measured Level from carrier (dBc)	Limit (dBc)
0	1.50	-52.67	-54.17	-20
39	1.67	-55.67	-57.34	-20
78	0.83	-57.83	-57.66	-20
Hopping mode	0.83	-56.33	-57.16	-20

The environmental test conditions were:

Temperature	24ºC
Pressure	977 mb
Relative Humidity	32%

See figures 3-40 to 3-43 for the plots of the spurious RF conducted emissions.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-40 : Spurious RF Conducted Emissions
Single Freq., Static PBRS, 3-DH5

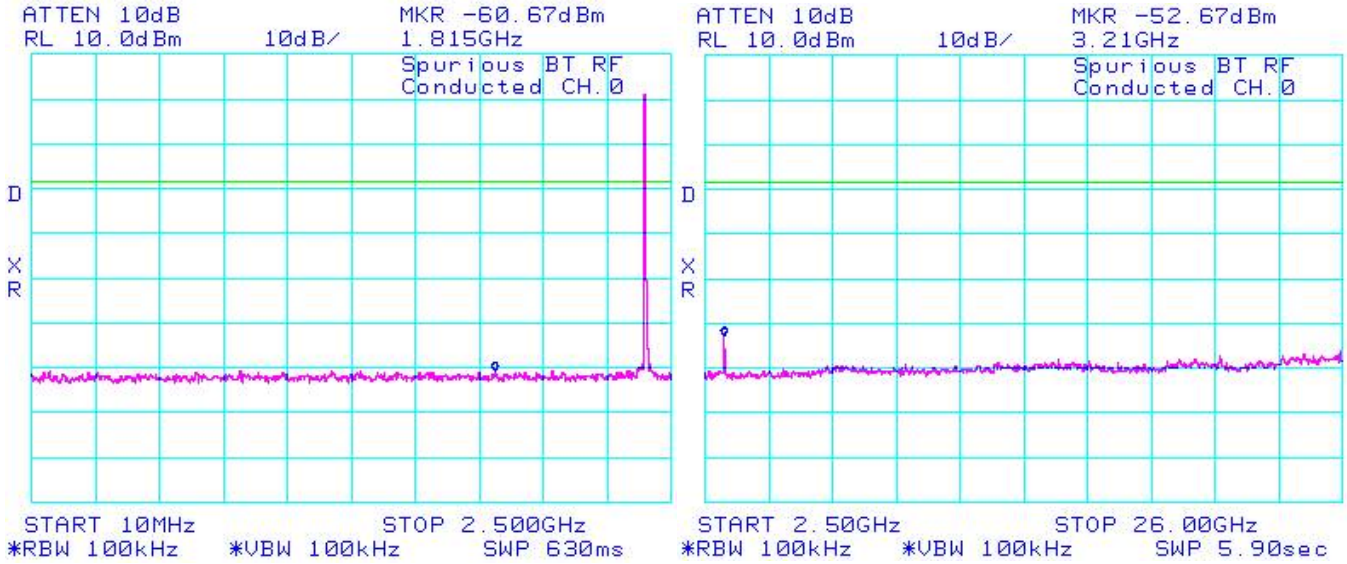
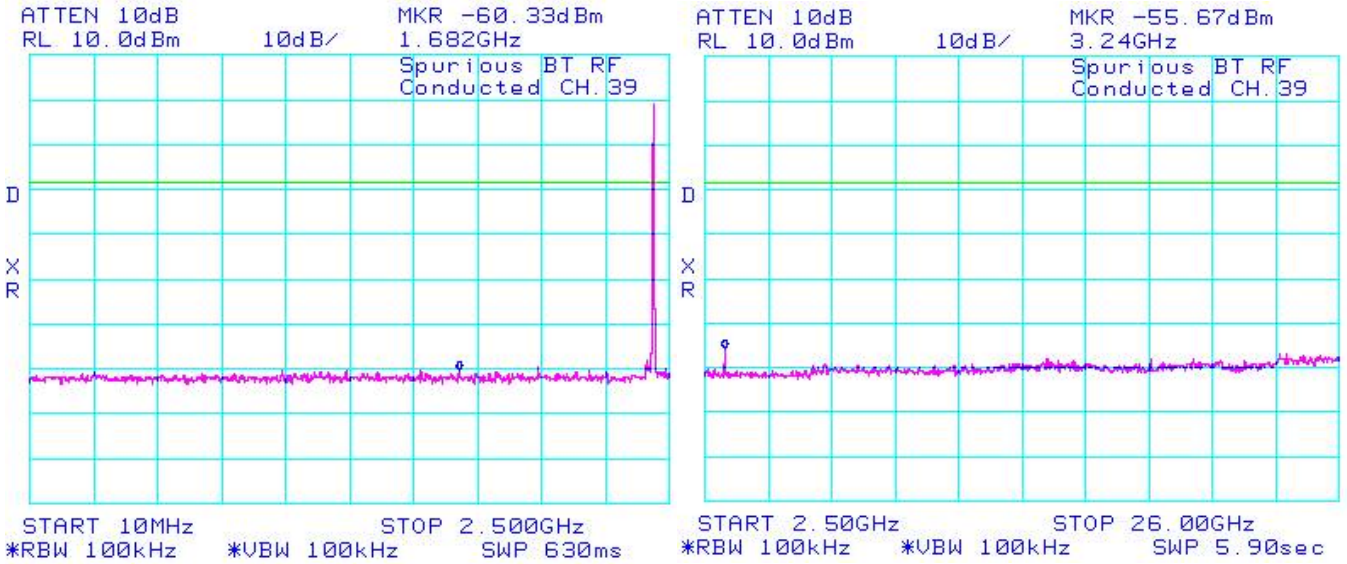


Figure 3-41: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 3-DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-42: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 3-DH5

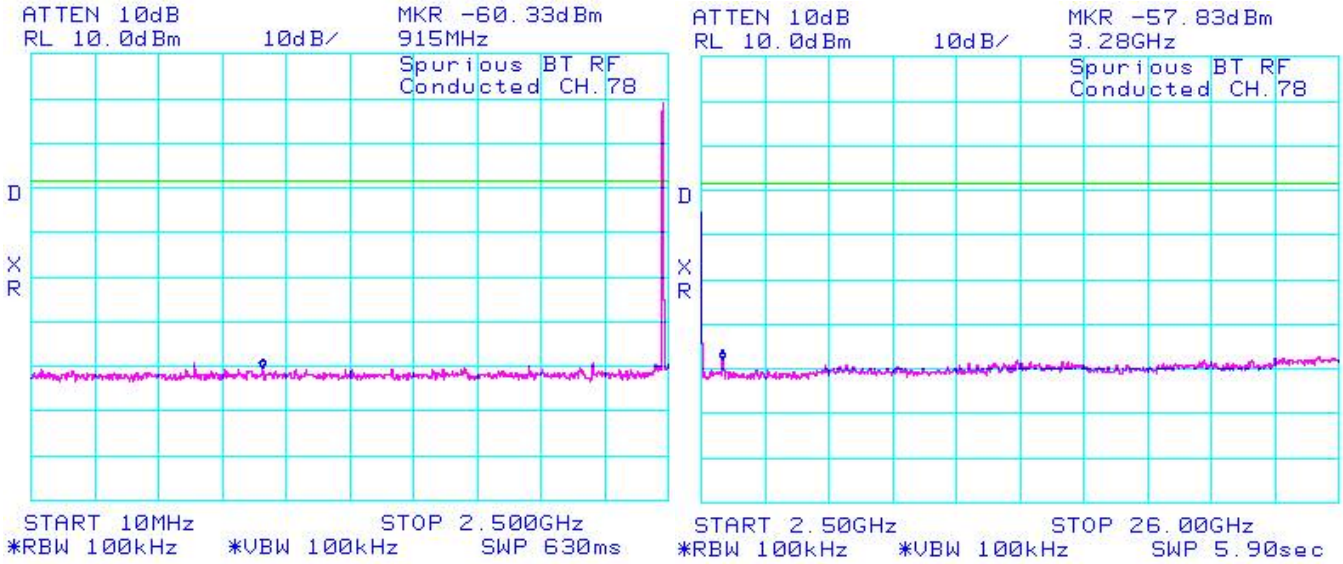


Figure 3-43 : Spurious RF Conducted Emissions
Freq. Hopping, Static PBRS, 3-DH5