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

A division of Research In Motion Limited

REPORT NO.: RTS-2605-1105-03

PRODUCT MODEL NO.: RDH71CW
TYPE NAME: BlackBerry® smartphone
FCC ID: L6ARDH70CW
IC: 2503A-RDH70CW

DATE: May 09, 2011

Statement of Performance:

The BlackBerry® smartphone, model RDH71CW, part number CER-30956-001 Rev. 2, and its accessories perform within the requirements of the test standards when configured and operated under RIM's operation instructions.

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:

Savtej S. Sandhu
Regulatory Compliance Specialist
Date: May 10, 2011

Reviewed by:

Heng Lin
Regulatory Compliance Specialist
Date: May 11, 2011

Reviewed and Approved by:

Masud S. Attayi, P.Eng.
Manager, Regulatory Compliance
Date: May 16, 2011

Table of Contents

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, October, 2010
- Industry Canada, RSS-210, Issue 8, December 2010, Licence-exempt Radio Apparatus
- Industry Canada, RSS-GEN, Issue 3, December 2010, General Requirements and Information for the Certification of Radio Apparatus

B. Associated Documents

1. R008_RDH71CW_HW_Declaration_CER-30956-001_Rev 2

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 following locations:

RIM Testing Services EMI test facilities

305 Phillip Street	440 Phillip Street
Waterloo, Ontario	Waterloo, Ontario
Canada, N2L 3W8	Canada, N2L 5R9
Phone: 519 888 7465	Phone: 519 888 7465
Fax: 519 888 6906	Fax: 519 888 6906

The testing was performed from February 14 to April 19, 2011.

The sample EUT included:

SAMPLE	MODEL	CER NUMBER	PIN	SOFTWARE
1	RDH71CW	CER-30956-001 Rev. 1	329F4819	MFI Bundle
2	RDH71CW	CER-30956-001 Rev. 2	32DF5EB5	V6.1.0.46 (Platform:5.0.0.123) Bundle 421
3	RDH71CW	CER-30956-001 Rev. 2	32DF5EB6	V6.1.0.46 (Platform:5.0.0.123) Bundle 421
4	RDH71CW	CER-30956-001 Rev. 2	32DF5ED6	V6.1.0.46 (Platform:5.0.0.123) Bundle 421

AC Line Conducted Emissions testing was performed on sample 3.
Radiated Emissions testing was performed on samples 3 and 4.
Conducted Emissions testing was performed on Sample 1 and 2.

Only the characteristics that may have been affected by the changes from model RDH71CW Rev 1 to RDH71CW Rev 2 were re-tested. For more information, see R008_RDH71CW_HW_Declaration_CER-30956-001_Rev 2.

BlackBerry® smartphone Accessories Tested

1) Alt. Fixed Blade Charger, part number HDW-24481-001 (model number RIM-C-4ADUUS-001 with an output voltage of 5.0 volts dc.
2) Captive Cable Charger, part number HDW-17957-003, with an output voltage of 5.0 volts DC, 750 mA.
3) Alt. 1 Stereo Headset, part number HDW-24529-001, with a lead length of 1.1 metres
4) Alt. 2 Stereo Headset, part number HDW-24529-001, with a lead length of 1.1 metres
5) USB Data Cable, part number HDW-28109-003, 1.20 metres long.

D. Support Equipment Used for the Testing of the EUT

No support equipment used. See section *G. Compliance Test Equipment Used*.

E. Test Results Chart

SPECIFICATION		TEST TYPE	Meets Requirements	TEST DATA
FCC CFR 47	IC			APPENDIX
Part 15.207	RSS-210 RSS-GEN	Conducted AC Line Emission	Pass	1
Part 15.209 Part 15.247	RSS-210 RSS-GEN	BT Radiated Spurious Emissions	Pass	2
Part 15.209 Part 15.247	RSS-210 RSS-GEN	BT Radiated Band Edge Compliance	Pass	2
Part 15.209 Part 15.247	RSS-210 RSS-GEN	802.11 b/g/n Radiated Spurious Emissions	Pass	2
Part 15.209 Part 15.247	RSS-210 RSS-GEN	802.11 b/g/n Radiated Band Edge Compliance	Pass	2
Part 15.247(a)	RSS-210	BT, 20 dB Bandwidth	Pass	3
Part 15.247(a)	RSS-210	BT, Carrier Frequency Separation	Pass	3
Part 15.247(a)	RSS-210	BT, Number of Hopping Frequencies	Pass	3
Part 15.247(a)	RSS-210	BT, Time of Occupancy (Dwell Time)	Pass	3
Part 15.247(b)	RSS-210	BT, Maximum Peak Conducted Output Power	Pass	3
Part 15.247(c)	RSS-210	BT, Band-Edge Compliance of RF Conducted Emissions	Pass	3
Part 15.247(c)	RSS-210	BT, Spurious RF Conducted Emissions	Pass	3
Part 15.247(b)	RSS-210	802.11b/g/n, 6 dB Bandwidth	Pass	4
Part 15.247(b)	RSS-210	802.11b/g/n, Maximum Conducted Output Power	Pass	4
Part 15.247(b)	RSS-210	802.11b/g/n, Band-Edge	Pass	4
Part 15.247(b)	RSS-210	802.11b/g/n, Peak Power Spectral Density	Pass	4
Part 15.247(b)	RSS-210	802.11b/g/n, Spurious RF Conducted Emissions	Pass	4

F. 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® smartphone was in battery charging mode. The input voltage was 120 V, 60 Hz.
The following test configurations were measured:

Test Configuration	Operating Mode(s)	Charger + Accessories
1	Bluetooth Tx	Captive Cable Charger + Alt. 2 Stereo Headset
2	802.11b Tx	Alt. Fixed Blade Charger + Alt. 1 Stereo Headset + USB Cable 1.2m

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 worst case test margin of 8.75 dB below the quasi-peak limit at 0.150 MHz using the quasi-peak detector with the Alt. Fixed Blade Charger in Test Configuration 2.

See APPENDIX 1 for the test data.

Measurement Uncertainty ±3.0 dB

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 done in a semi-anechoic chamber (SAC) below 1 GHz and a semi-anechoic chamber (SAC with floor absorbers) above 1 GHz. The SAC's FCC registration number is **778487** and the Industry Canada (IC) file number is **2503B-1**. The SAC with floor absorber's FCC registration number is **959115** and the IC file number is **2503C-1**.

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

The BlackBerry® smartphone was measured in standalone configuration with Bluetooth transmitting in single frequency mode at low channel (0), middle channel (39) and high channel (78) for packet type "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 BlackBerry® smartphone was measured in standalone configuration transmitting on channels 1, 6 & 11 at 1 Mbps for 802.11b mode, on channel 6 at 6 Mbps for 802.11g mode, and on channel 6 at MCS 0 and MCS 7 for 802.11n 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 worst case test margin was 9.97 dB below the accepted limit at 19214.684 MHz.

The 802.11b/g/n harmonics were investigated up to the 10th harmonic. The sample EUT emissions were in the noise floor (NF).
See APPENDIX 2 for the test data.

b) Band-Edge Compliance of RF Radiated Emissions

The BlackBerry® smartphone met the requirements for band-edge compliance of RF radiated emissions for Bluetooth and 802.11b/g/n as per the requirements of 15.247, 15.209, and RSS-210/RSS-GEN.
See APPENDIX 2 for the test data

Measurement Uncertainty ±4.6 dB

3) BLUETOOTH RF CONDUCTED EMISSIONS

The Bluetooth conducted RF emissions from the BlackBerry® smartphone were measured using the methods outlined in FCC CFR 47 Part 15, Subpart C.

a) 20 dB Bandwidth
The BlackBerry® smartphone 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. The worst case 20 dB Bandwidth was 0.937 MHz for channel 39 in normal data rate mode and 1.290 MHz for channel 0 in EDR mode.
See APPENDIX 3 for the test data.

b) Carrier Frequency Separation
The BlackBerry® smartphone 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.
See APPENDIX 3 for the test data.

c) Number of Hopping Frequencies
The BlackBerry® smartphone 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 3 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 3 for the test data.

e) Maximum Peak Conducted Output Power
The BlackBerry® smartphone 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. The worst case Conducted Output Power level was 7.33 dBm (0.00541 W) for Channel 0 in normal data rate mode and 7.33 dBm (0.00541 W) for channel 0 in EDR mode.
See APPENDIX 3 for the test data.

f) Band-Edge Compliance of RF Conducted Emissions
The BlackBerry® smartphone 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.
See APPENDIX 3 for the test data.

g) Spurious RF Conducted Emissions
The BlackBerry® smartphone 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.
See APPENDIX 3 for the test data.

4) 802.11b/g/n RF CONDUCTED EMISSIONS

The 802.11b/g/n conducted RF emissions from the BlackBerry® smartphone were measured using the methods outlined in FCC CFR 47 Part 15, Subpart C.

a) 6dB Bandwidth
The EUT met the requirements of the 6 dB bandwidth as per 47 CFR 15.247(b) and RSS-210. Low channel (1), middle channel (6) and high channel (11) were measured. The worst case 6 dB Bandwidth was 11.23 MHz for channel 6 in 802.11b mode, 16.63 MHz for channel 6 in 802.11g mode, and 17.87 MHz for channel 11 in 802.11n mode.
See APPENDIX 4 for the test data.

b) Maximum Conducted Output Power
The EUT met the requirements of the maximum conducted output power as per 47 CFR 15.247(b) and RSS-210. Low channel (1), middle channel (6) and high channel (11) were measured. The worst case Conducted Output Power level was 18.54 dBm (71.45 mW) for channel 11 in 802.11b mode, 17.32 dBm (53.95 mW) for channel 11 in 802.11g mode, and 17.15 dBm (51.88 mW) for channel 11 in 802.11n mode.
See APPENDIX 4 for the test data

c) Band-Edge Compliance of RF Conducted Emissions
The EUT met the requirements of band-edge compliance of RF conducted emissions as per 47 CFR 15.247(b) and RSS-210. Low channel (1) and high channel (11) were measured.
See APPENDIX 4 for the test data.

d) Peak Power Spectral Density
The EUT met the requirements of peak power spectral density as per 47 CFR 15.247(b) and RSS-210. Low channel (1), middle channel (6) and high channel (11) were measured.
See APPENDIX 4 for the test data.

e) 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 30 MHz to 26 GHz. Low channel (1), middle channel (6) and high channel (11) were measured.
See APPENDIX 4 for the test data.

G. Compliance Test Equipment Used

UNIT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL DUE DATE (YY MM DD)	USE
EMI Test Receiver	Rohde & Schwarz	ESIB 40	100255	11-11-28	Conducted/Radiated Emissions
EMI Test Receiver	Rohde & Schwarz	ESU 40	100162	11-11-29	Conducted/Radiated Emissions
Hybrid Log Antenna	EMC Automation	HLP-3003C	017401	12-01-13	Radiated Emissions
Horn Antenna	CMT	LHA 0180	R52734-001	12-01-21	Radiated Emissions
Horn Antenna	ETS-Lindgren	3117	47563	11-07-15	Radiated Emissions
Preamplifier	Rohde & Schwarz	TS-ANA4-SP	001	11-12-01	Radiated Emissions
Preamplifier	Sonoma	310N/11909A	185831	11-11-14	Radiated Emissions
Preamplifier	Rohde & Schwarz	TS-ANA-SP	001	11-12-01	Radiated Emissions
L.I.S.N.	Rohde & Schwarz	ENV216	100060	11-12-10	Conducted Emissions
Environment Monitor	Omega	iTHX-SD	0380561	11-10-13	Radiated Emissions
EMC Analyzer	Agilent	E7405A	US40240226	11-12-10	Radiated Emissions
Spectrum Analyzer	HP	8563E	3745A08112	11-09-30	RF Conducted Emissions
DC Power Supply	HP	6632B	US37472178	11-08-30	RF Conducted Emissions
Environment Monitor	Omega	iTHX-SD	0340060	11-10-13	RF Conducted Emissions
Temperature Probe	Control Company	15-077-21	51129471	11-04-29	Frequency Stability
Environmental Chamber	Test Equity	107	0900246	N/R	Frequency Stability
Bluetooth Tester	Rohde & Schwarz	CBT	119549	11-12-08	RF Conducted Emissions
Bluetooth Tester	Rohde & Schwarz	CBT35	100368	11-11-27	Radiated Emissions
Bluetooth Tester	Rohde & Schwarz	CBT35	100370	11-11-29	Radiated Emissions
Power Meter	Agilent	N1911A	MY45100905	11-05-01	RF Conducted / Frequency Stability
Power Sensor	Agilent	N1921A	SG45240281	11-05-22	RF Conducted / Frequency Stability
Digital Multimeter	Hewlett Packard	34401A	US36042324	11-10-28	Conducted/Radiated Emissions
Environment Monitor	Omega	iTHX-SD	0380567	11-10-13	Radiated Emissions

APPENDIX 1 – AC CONDUCTED EMISSIONS TEST DATA/PLOTS

AC Conducted Emission Test Results

The following tests were performed by Savtej Sandhu.

Test Configuration 1

The BlackBerry® smartphone was tested on April 18, 2011.

The environmental test conditions were: Temperature: 25 ºC
Relative Humidity: 34 %

Frequency (MHz)	Line	Reading (QP) (dBµV)	Correction Factor (dB)	Corrected Reading (QP) (dB)	Limit (QP) (dBµV)	Limit (AV) (dBµV)	Margin (QP) Limits (dB)
0.150	L1	44.11	11.20	55.31	66.00	56.00	-10.69
0.150	N	37.80	11.23	49.04	66.00	56.00	-16.96
0.200	L1	37.23	10.86	48.09	63.60	53.60	-15.51
0.209	L1	36.35	10.80	47.15	63.30	53.30	-16.15
0.222	L1	32.30	10.70	43.00	62.70	52.70	-19.70
0.407	L1	35.40	10.00	45.40	57.70	47.70	-12.30
0.407	N	28.75	10.01	38.76	57.70	47.70	-18.94
0.506	L1	34.90	9.91	44.81	56.00	46.00	-11.19
0.605	N	27.43	9.86	37.29	56.00	46.00	-18.71
0.672	L1	34.65	9.84	44.49	56.00	46.00	-11.51
0.722	N	28.02	9.83	37.85	56.00	46.00	-18.15
0.735	L1	31.17	9.83	41.00	56.00	46.00	-15.01
0.785	L1	33.88	9.82	43.70	56.00	46.00	-12.30
0.861	N	27.13	9.82	36.95	56.00	46.00	-19.05
0.906	N	27.52	9.81	37.33	56.00	46.00	-18.67
1.023	N	27.15	9.81	36.96	56.00	46.00	-19.04
1.365	N	26.26	9.81	36.07	56.00	46.00	-19.93
1.415	N	26.97	9.81	36.78	56.00	46.00	-19.23
1.487	N	25.55	9.81	35.36	56.00	46.00	-20.64
1.514	L1	32.53	9.80	42.34	56.00	46.00	-13.66

AC Conducted Emissions Test Results cont'd

Test Configuration 1

Frequency (MHz)	Line	Reading (QP) (dBµV)	Correction Factor (dB)	Corrected Reading (QP) (dB)	Limit (QP) (dBµV)	Limit (AV) (dBµV)	Margin (QP) Limits (dB)
1.707	N	24.57	9.82	34.39	56.00	46.00	-21.61
2.148	N	24.25	9.83	34.09	56.00	46.00	-21.91
2.162	L1	28.64	9.83	38.47	56.00	46.00	-17.53
3.750	L1	27.75	9.89	37.65	56.00	46.00	-18.35
3.899	N	22.55	9.90	32.45	56.00	46.00	-23.55
10.379	L1	26.46	9.97	36.43	60.00	50.00	-23.57
11.400	L1	27.67	9.99	37.67	60.00	50.00	-22.33

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

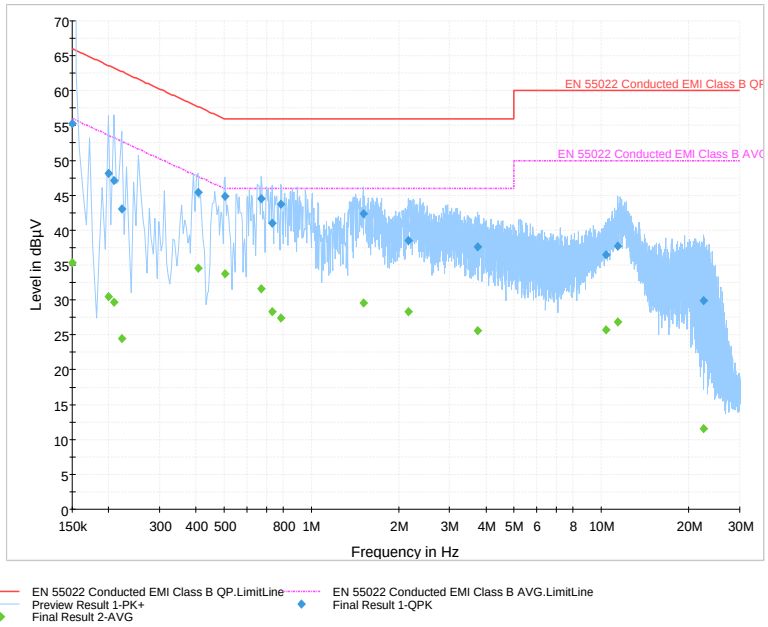
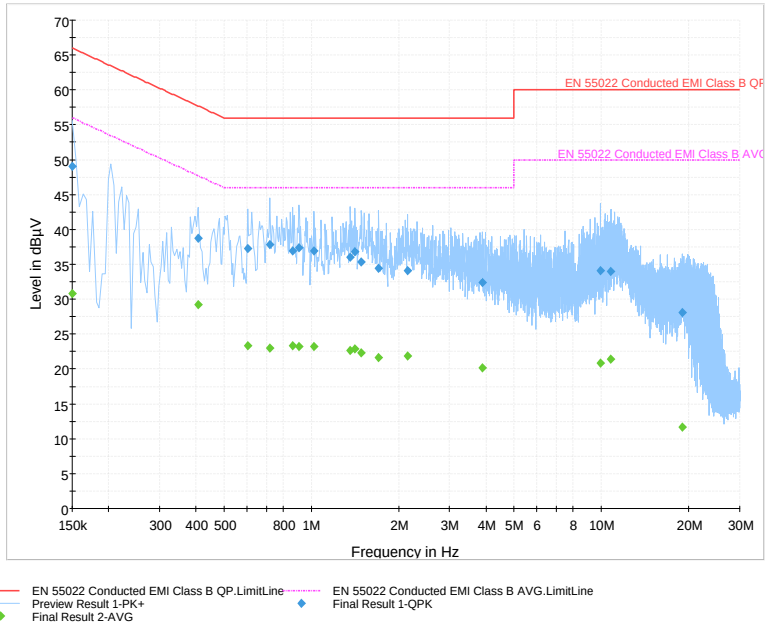


Figure 1-2: N Lines



AC Conducted Emission Test Results

Test Configuration 2

The BlackBerry® smartphone was tested on April 18, 2011.

The environmental test conditions were: Temperature: 25 ºC
Relative Humidity: 34 %

Frequency (MHz)	Line	Reading (QP) (dBµV)	Correction Factor (dB)	Corrected Reading (QP) (dB)	Limit (QP) (dBµV)	Limit (AV) (dBµV)	Margin (QP) Limits (dB)
0.150	L1	46.05	11.20	57.25	66.00	56.00	**-8.75**
0.150	N	45.42	11.23	56.65	66.00	56.00	-9.35
0.164	N	44.37	11.14	55.51	65.30	55.30	-9.79
0.168	L1	43.88	11.08	54.96	65.10	55.10	-10.14
0.177	N	43.08	11.05	54.12	64.60	54.60	-10.48
0.191	L1	42.57	10.92	53.50	64.00	54.00	-10.51
0.200	L1	42.22	10.86	53.08	63.60	53.60	-10.52
0.200	N	41.27	10.89	52.15	63.60	53.60	-11.45
0.209	N	40.79	10.82	51.61	63.30	53.30	-11.69
0.213	L1	42.42	10.77	53.19	63.10	53.10	-9.92
0.222	L1	40.28	10.70	50.98	62.70	52.70	-11.72
0.245	N	38.62	10.57	49.19	61.90	51.90	-12.71
0.254	L1	38.63	10.48	49.12	61.60	51.60	-12.48
0.254	N	38.08	10.50	48.58	61.60	51.60	-13.02
0.267	N	36.95	10.41	47.36	61.20	51.20	-13.84
0.308	N	33.75	10.17	43.92	60.00	50.00	-16.08
0.339	N	31.86	10.12	41.98	59.20	49.20	-17.22
0.344	L1	33.78	10.10	43.88	59.10	49.10	-15.22
0.353	L1	33.24	10.08	43.32	58.90	48.90	-15.58
0.438	N	26.30	9.96	36.26	57.10	47.10	-20.84

AC Conducted Emissions Test Results cont'd

Test Configuration 2

Frequency (MHz)	Line	Reading (QP) (dBµV)	Correction Factor (dB)	Corrected Reading (QP) (dB)	Limit (QP) (dBµV)	Limit (AV) (dBµV)	Margin (QP) Limits (dB)
0.452	L1	27.55	9.94	37.49	56.80	46.80	-19.31
0.942	N	26.17	9.81	35.98	56.00	46.00	-20.02
0.996	L1	32.59	9.80	42.39	56.00	46.00	-13.61
2.045	L1	31.89	9.83	41.72	56.00	46.00	-14.28
2.103	N	26.10	9.83	35.94	56.00	46.00	-20.07
2.378	L1	31.67	9.84	41.52	56.00	46.00	-14.49
3.597	N	28.72	9.90	38.61	56.00	46.00	-17.39
4.110	N	28.87	9.91	38.78	56.00	46.00	-17.23
4.146	L1	30.30	9.90	40.20	56.00	46.00	-15.80

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

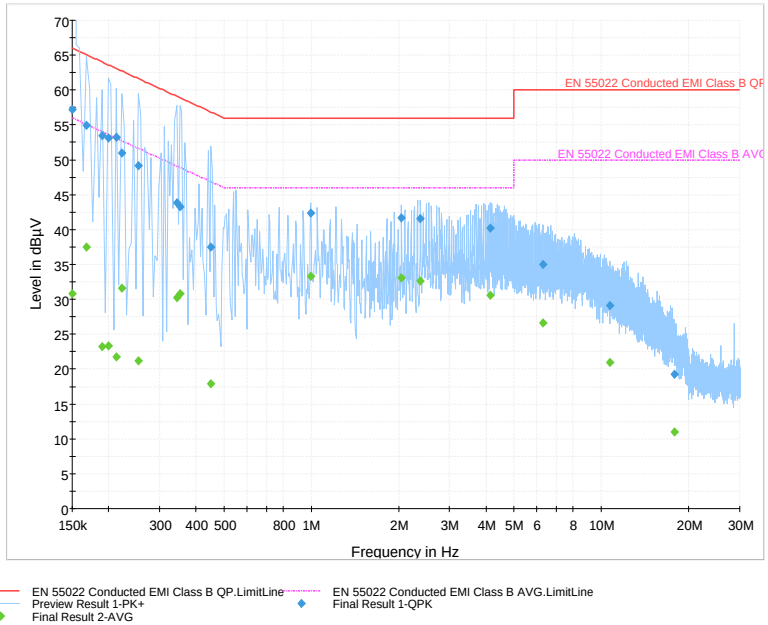
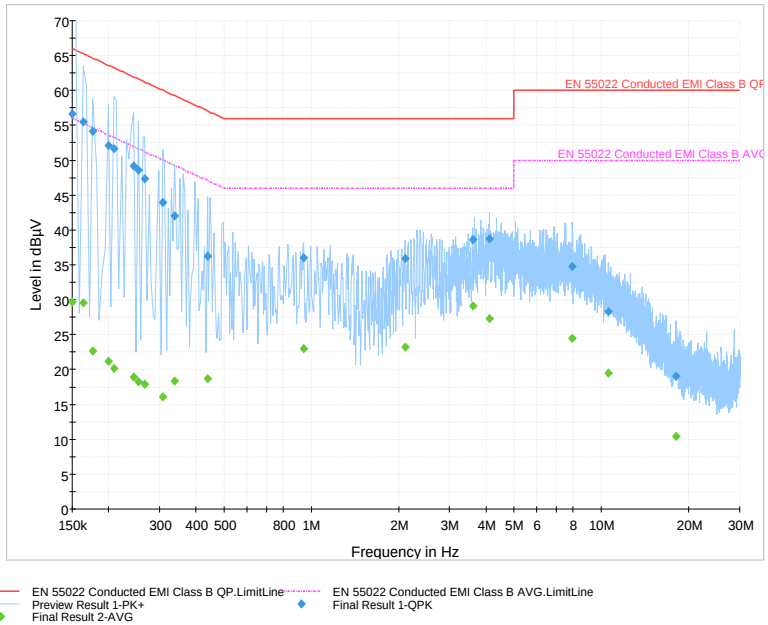


Figure 1-4: N Lines



APPENDIX 2 – BLUETOOTH AND 802.11b/g/n RADIATED EMISSIONS TEST DATA

Radiated Emissions Test Results
Bluetooth Band

Date of Test: March 02, 2011
Measurements were performed by Kevin Rose.

The environmental test conditions were: Temperature: 24 ºC
Relative Humidity: 9 %

The test distance was 3.0 metres with a EUT height of 0.8 metres, and sweep frequency of 30 MHz to 1 GHz.

The BlackBerry® smartphone in Bluetooth Tx mode was in USB up position.

The frequency sweep measurements were performed in single frequency mode on channels 0, 39 and 78 using packet types "DH5", "2-DH5" and "3-DH5".

All emissions had a test margin of greater than 25.0 dB.

Date of Test: March 31 to April 07, 2011
Measurements were performed by Adam Rusinek.

The environmental test conditions were: Temperature: 24 - 26 ºC
Relative Humidity: 35 - 44 %

The test distance was 3.0 metres with a EUT height of 0.8 metres, and sweep frequency of 1GHz to 25GHz.

The BlackBerry® smartphone in Bluetooth Tx mode was in USB up position.

The frequency sweep measurements were performed in single frequency mode on channels 0, 39 and 78 using packet types "DH5", "2-DH5" and "3-DH5".

Radiated Emissions Test Results cont'd
Bluetooth Band cont'd

Frequency (MHz)	Channel	Packet Type	Antenna		Test Angle (Deg.)	RBW / VBW	Measured Level (dBµV)	Correction Factor for preamp/antenna/ cables/ filter (dB/m)	Field Strength Level (reading+corr) (dBµV/m)	Limit @ 3.0 m (dBµV/m)	Test Margin (dB)
			Pol. (V/H)	Height (metres)							
12012.544	0	DH5	V	2.35	120.00	1MHz/ 3MHz	29.13	23.68	52.81	74.00	-21.19
12012.544	0	DH5	V	2.35	120.00	1MHz/ 10Hz	20.36	23.64	44.00	54.00	-10.00
19214.684	0	DH5	H	2.00	272.00	1MHz/ 3MHz	42.56	14.73	57.29	74.00	-16.71
19214.684	0	DH5	H	2.00	272.00	1MHz/ 10Hz	29.30	14.73	44.03	54.00	**-9.97**
12012.544	0	2DH5	V	2.35	120.00	1MHz/ 3MHz	29.13	23.68	52.81	74.00	-21.19
12012.544	0	2DH5	V	2.35	120.00	1MHz/ 10Hz	20.36	23.64	44.00	54.00	-10.00
19217.456	0	2DH5	H	2.00	270.00	1MHz/ 3MHz	42.08	14.73	56.81	74.00	-17.19
19217.456	0	2DH5	H	2.00	270.00	1MHz/ 10Hz	25.21	14.73	39.94	54.00	-14.06
19215.936	0	3DH5	H	1.76	268.00	1MHz/ 3MHz	42.79	14.73	57.52	74.00	-16.48
19215.936	0	3DH5	H	1.76	268.00	1MHz/ 10Hz	26.63	14.73	41.36	54.00	-12.64
19526.818	39	DH5	H	1.70	267.00	1MHz/ 3MHz	37.22	15.29	52.51	74.00	-21.49
19526.818	39	DH5	H	1.70	267.00	1MHz/ 10Hz	24.38	15.29	39.67	54.00	-14.33
19526.306	39	2DH5	H	1.69	261.00	1MHz/ 3MHz	37.16	15.29	52.45	74.00	-21.55
19526.306	39	2DH5	H	1.69	261.00	1MHz/ 10Hz	24.35	15.29	39.64	54.00	-14.36
19528.008	39	3DH5	H	1.64	263.00	1MHz/ 3MHz	38.39	15.29	53.68	74.00	-20.32
19528.008	39	3DH5	H	1.64	263.00	1MHz/ 10Hz	24.03	15.29	39.32	54.00	-14.68

Radiated Emissions Test Results cont'd
Bluetooth Band cont'd

Frequency (MHz)	Channel	Packet Type	Antenna Pol. (V/H)	Antenna Height (metres)	Test Angle (Deg.)	RBW / VBW	Measured Level (dBµV)	Correction Factor for preamp/antenna/ cables/ filter (dB/m)	Field Strength Level (reading+corr) (dBµV/m)	Limit @ 3.0 m (dBµV/m)	Test Margin (dB)
19838.766	78	DH5	H	2.06	266.00	1MHz/ 3MHz	40.34	15.65	55.99	74.00	-18.01
19838.766	78	DH5	H	2.06	266.00	1MHz/ 10Hz	26.93	15.65	42.58	54.00	-11.42
19839.082	78	2DH5	H	3.57	12.00	1MHz/ 3MHz	36.81	15.65	52.46	74.00	-21.54
19839.082	78	2DH5	H	3.57	12.00	1MHz/ 10Hz	24.11	15.65	39.76	54.00	-14.24
19838.724	78	3DH5	V	2.57	1.00	1MHz/ 3MHz	37.03	15.65	52.68	74.00	-21.32
19838.724	78	3DH5	V	2.57	1.00	1MHz/ 10Hz	24.06	15.65	39.71	54.00	-14.29

All other emissions had a test margin of greater than 25.0 dB.

Band-Edge Compliance of RF Radiated Emissions Test Results
Bluetooth Band

Date of test: April 19, 2011
Measurements were performed by Kevin Rose.

The environmental test conditions were: Temperature: 23 º C
Relative Humidity: 18 %

The BlackBerry® smartphone was in standalone, vertical position and pattern type "Static PBRS" in "DH5", "2-DH5" and "3-DH5" modulation 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, Packet Type DH5										
0	2402	Horn	V	PK	1 MHz	97.37	46.19	51.18	74	-22.82
0	2402	Horn	H	PK	1 MHz	97.50	50.21	47.29	74	-26.71
0	2402	Horn	V	AVE.	10 Hz	66.77	46.19	20.58	54	-33.42
0	2402	Horn	H	AVE.	10 Hz	66.82	50.21	16.61	54	-37.39
High Channel, Packet Type DH5										
78	2480	Horn	V	PK	1 MHz	94.14	53.90	40.24	74	-33.76
78	2480	Horn	H	PK	1 MHz	93.07	52.02	41.05	74	-32.95
78	2480	Horn	V	AVE.	10 Hz	64.18	53.90	10.28	54	-43.72
78	2480	Horn	H	AVE.	10 Hz	63.27	52.02	11.25	54	-42.75
Low Channel, Packet Type 2-DH5										
0	2402	Horn	V	PK	1 MHz	95.91	43.91	52.00	74	-22.00
0	2402	Horn	H	PK	1 MHz	96.75	44.54	52.21	74	-21.79
0	2402	Horn	V	AVE.	10 Hz	65.52	43.91	21.61	54	-32.39
0	2402	Horn	H	AVE.	10 Hz	65.56	44.54	21.02	54	-32.98
High Channel, Packet Type 2-DH5										
78	2480	Horn	V	PK	1 MHz	92.45	51.13	41.32	74	-32.68
78	2480	Horn	H	PK	1 MHz	91.65	49.67	41.98	74	-32.02
78	2480	Horn	V	AVE.	10 Hz	62.95	51.13	11.82	54	-42.18
78	2480	Horn	H	AVE.	10 Hz	62.25	49.67	12.58	54	-41.42

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

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, Packet Type 3-DH5										
0	2402	Horn	V	PK	1 MHz	95.03	43.51	51.52	74	-22.48
0	2402	Horn	H	PK	1 MHz	96.35	45.75	50.60	74	-23.40
0	2402	Horn	V	AVE.	10 Hz	64.31	43.51	20.80	54	-33.20
0	2402	Horn	H	AVE.	10 Hz	64.46	45.75	18.71	54	-35.29
High Channel, Packet Type 3-DH5										
78	2480	Horn	V	PK	1 MHz	92.33	47.84	44.49	74	-29.51
78	2480	Horn	H	PK	1 MHz	91.07	47.89	43.18	74	-30.82
78	2480	Horn	V	AVE.	10 Hz	61.45	47.84	13.61	54	-40.39
78	2480	Horn	H	AVE.	10 Hz	57.98	47.89	10.09	54	-43.91

See figures 2-1 to 2-12 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

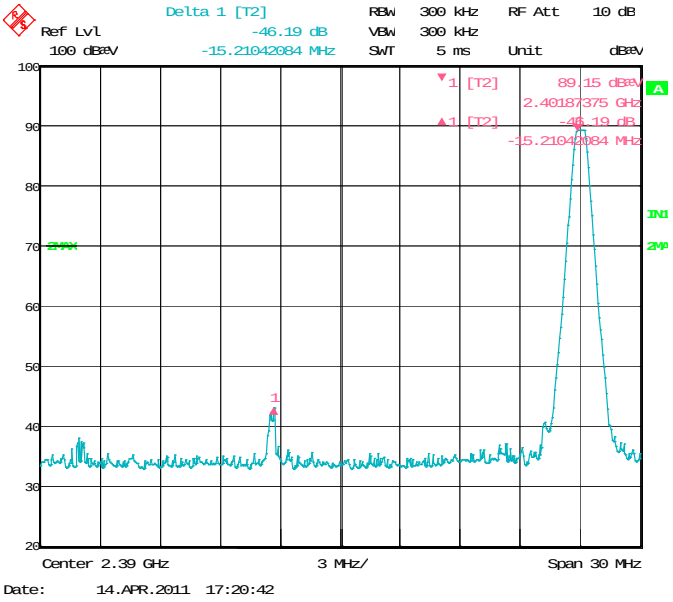


Figure 2-2: Band-Edge Compliance of RF Rad. Emi**ssions.**
Bluetooth, Single freq., Static PBRS,
DH5, Channel 0, Pol: H, Detector: PK

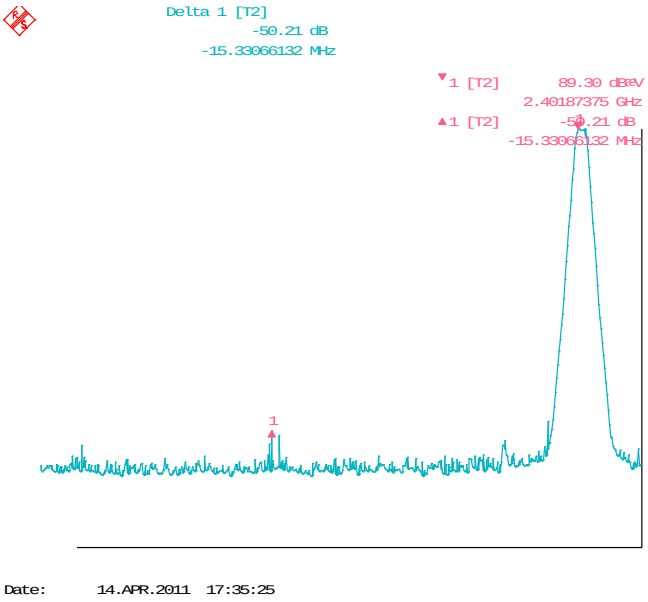


Figure 2-3: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
DH5, Channel 78, Pol: V, Detector: PK

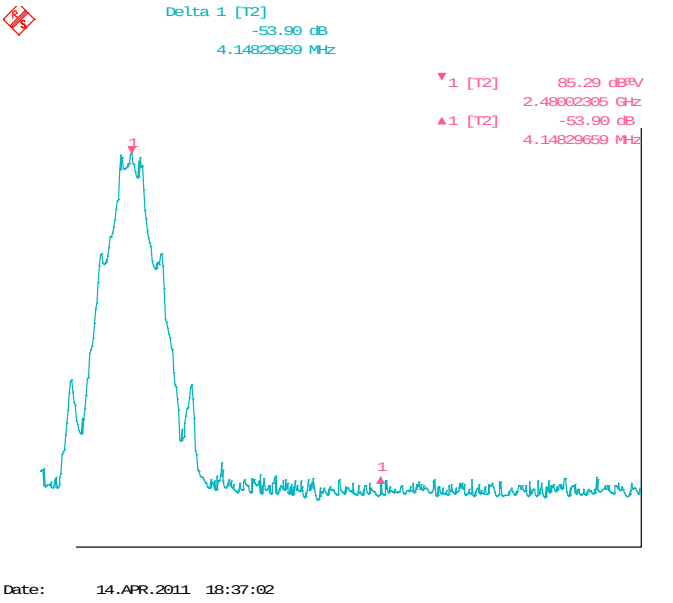
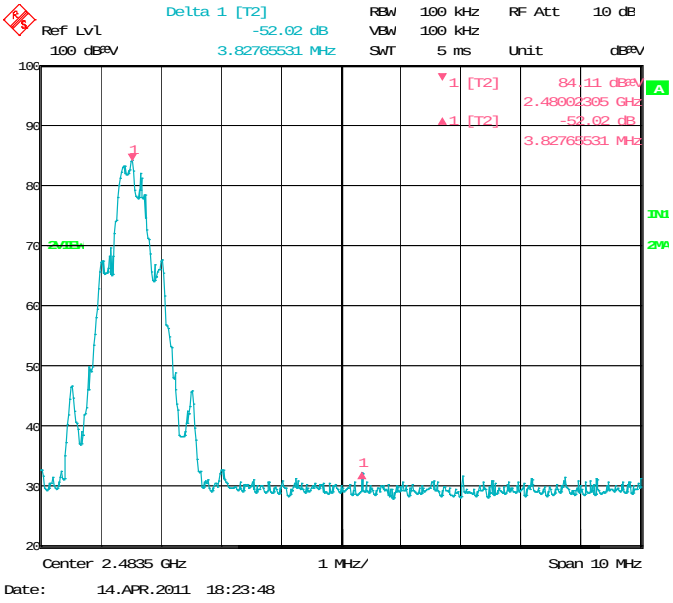


Figure 2-4: Band-Edge Compliance of RF Rad. Emissions
Bluetooth, Single freq., Static PBRS,
DH5, Channel 78, Pol: H, Detector: PK



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,
2-DH5, Channel 0, Pol: V, Detector: PK

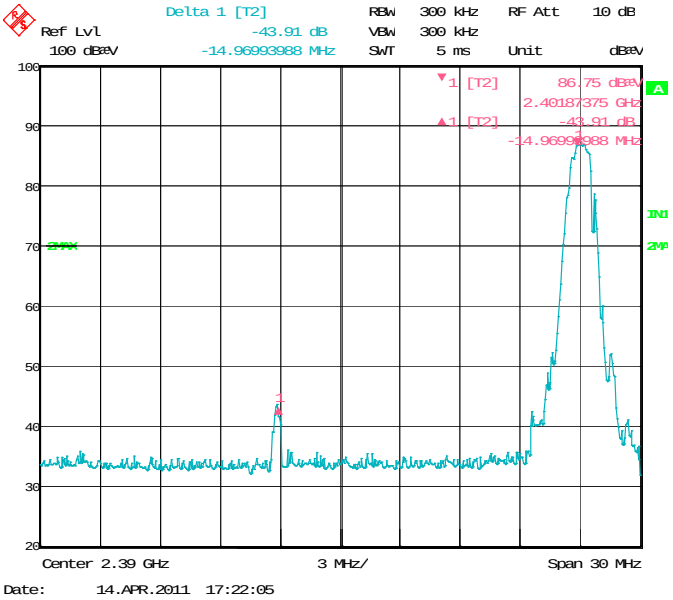


Figure 2-6: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
2-DH5, Channel 0, Pol: H, Detector: PK

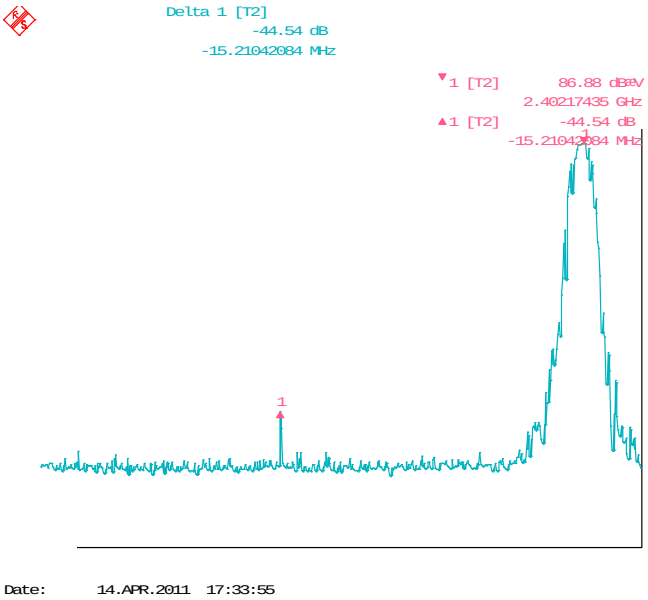


Figure 2-7: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
2-DH5, Channel 78, Pol: V, Detector: PK

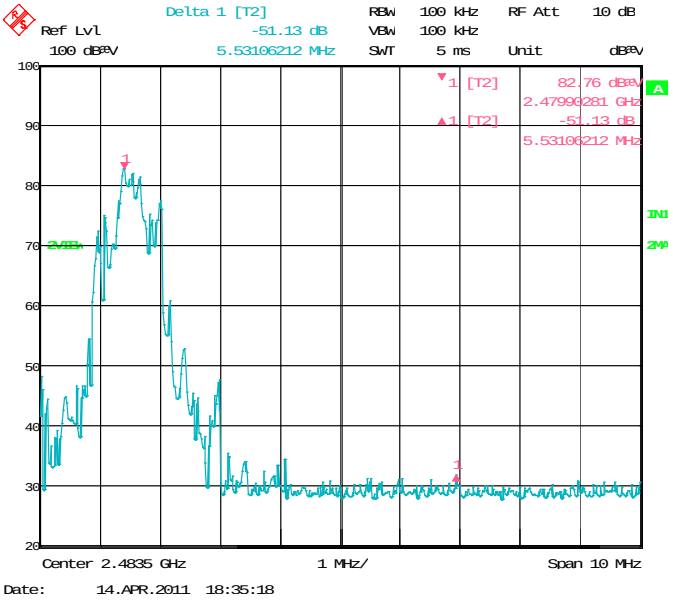
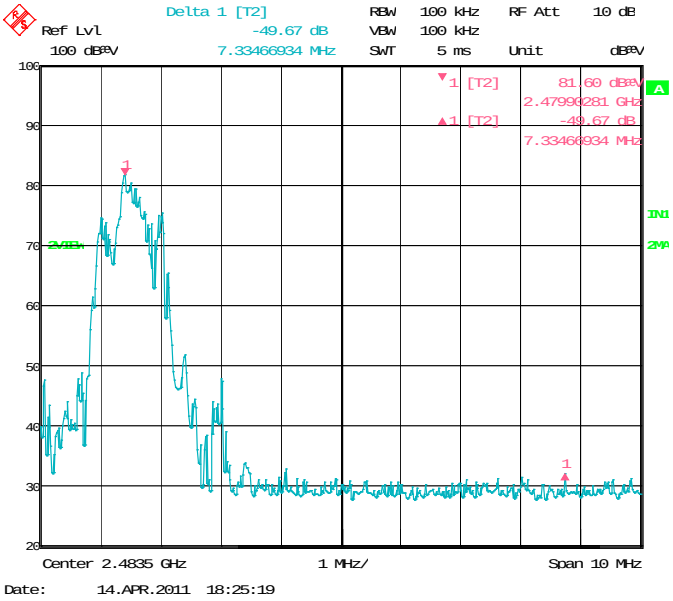


Figure 2-8: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
2-DH5, Channel 78, Pol: H, Detector: PK



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

Figure 2-9: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 0, Pol: V, Detector: PK

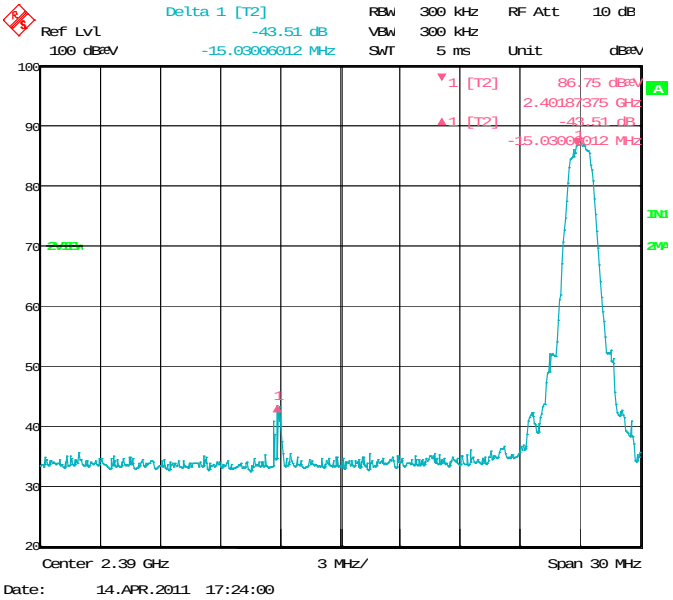


Figure 2-10: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 0, Pol: H, Detector: PK

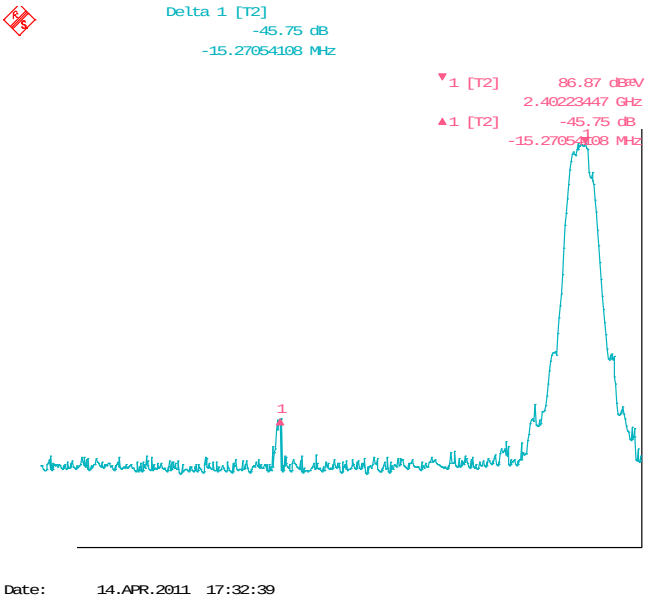


Figure 2-11: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 78, Pol: V, Detector: PK

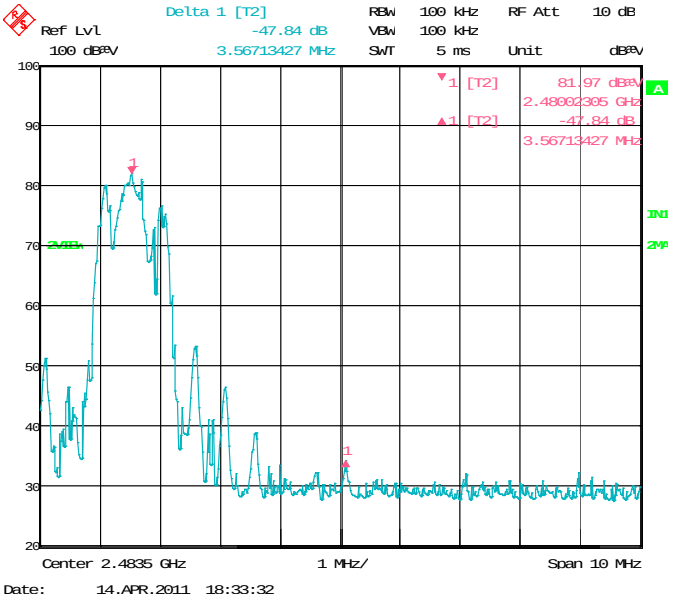
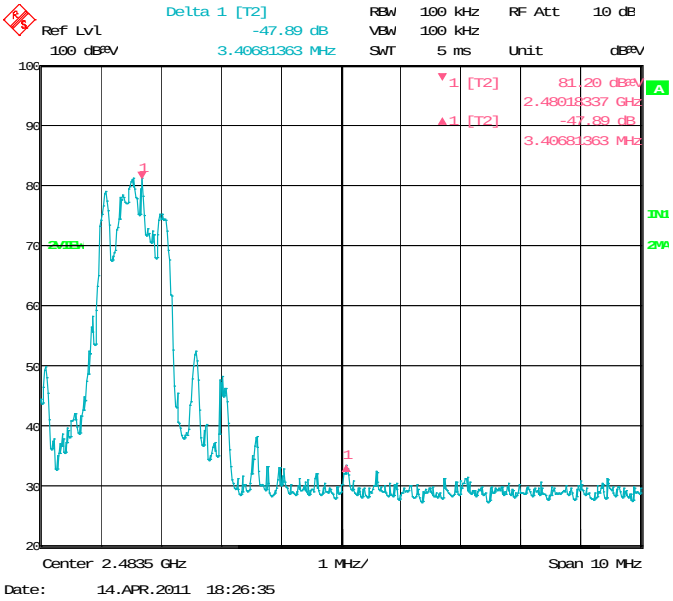


Figure 2-12: Band-Edge Compliance of RF Rad. Emissions.
Bluetooth, Single freq., Static PBRS,
3-DH5, Channel 78, Pol: H, Detector: PK



Radiated Emissions Test Results cont'd
802.11b/g/n Band

Date of Test: March 11, 2011

The environmental test conditions were: Temperature: 24 ºC
Relative Humidity: 10 %

The test distance was 3.0 metres with a EUT height of 0.8 metres, and sweep frequency of 30 MHz to 1 GHz.

The BlackBerry® smartphone was in horizontal down position.

The frequency sweep measurements were performed in 802.11b Tx mode at 1 Mbps on channels 1, 6 and 11, in 802.11g Tx mode at 6 Mbps on channel 6, and in 802.11n Tx mode at MCS 0 and MCS7 on channels 6.

All emissions had a test margin of greater than 25.0 dB.

Date of Test: April 07 and 08, 2011

The environmental test conditions were: Temperature: 24 - 25 ºC
Relative Humidity: 35 - 38 %

The test distance was 3.0 metres with a EUT height of 0.8 metres, and sweep frequency of 1GHz to 25GHz.

The BlackBerry® smartphone was in horizontal down position.

The frequency sweep measurements were performed in 802.11b Tx mode at 1 Mbps on channels 1, 6 and 11, in 802.11g Tx mode at 6 Mbps on channel 6, and in 802.11n Tx mode at MCS 0 and MCS7 on channel 6.

All emissions had a test margin of greater than 25.0 dB.

802.11b/g/n Band-Edge Compliance of RF Radiated Emissions

Date of Tests: April 19, 2011
Measurements performed by Kevin Rose.

The environmental test conditions were: Temperature: 23 ºC
Relative Humidity: 18 %

802.11b Band

The measurements were performed on BlackBerry® smartphone in standalone, vertical configuration on channels 1 and 11 for 802.11b mode at 1 Mbps.

The test distance was 3 metres.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
1	2412.00	Horn	V	PK	1 MHz	98.93	46.66	52.27	74.00	-21.73
1	2412.00	Horn	H	PK	1 MHz	104.30	47.68	56.62	74.00	-17.38
1	2412.00	Horn	V	AV	10 Hz	91.25	46.66	44.59	54.00	-9.41
1	2412.00	Horn	H	AV	10 Hz	96.67	47.68	48.99	54.00	-5.01

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
11	2480.00	Horn	V	PK	1 MHz	97.28	49.10	48.18	74.00	-25.82
11	2480.00	Horn	H	PK	1 MHz	107.08	51.86	55.22	74.00	-18.78
11	2480.00	Horn	V	AV	10 Hz	90.09	49.10	40.99	54.00	-13.01
11	2480.00	Horn	H	AV	10 Hz	99.54	51.86	47.68	54.00	-6.32

802.11g Band

The measurements were performed on the BlackBerry® smartphone in standalone, vertical configuration on channels 1 and 11 for 802.11g mode at 6 Mbps.

The test distance was 3 metres.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
1	2412.00	Horn	V	PK	1 MHz	99.78	33.45	66.33	74.00	-7.67
1	2412.00	Horn	H	PK	1 MHz	105.40	37.72	67.68	74.00	-6.32
1	2412.00	Horn	V	AV	10 Hz	73.07	33.45	39.62	54.00	-14.38
1	2412.00	Horn	H	AV	10 Hz	76.81	37.72	39.09	54.00	-14.91

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
11	2480.00	Horn	V	PK	1 MHz	98.22	38.98	59.24	74.00	-14.76
11	2480.00	Horn	H	PK	1 MHz	107.70	37.88	69.82	74.00	-4.18
11	2480.00	Horn	V	AV	10 Hz	71.92	38.98	32.94	54.00	-21.06
11	2480.00	Horn	H	AV	10 Hz	78.52	37.88	40.64	54.00	-13.36

802.11n Band

The measurements were performed on the BlackBerry® smartphone in standalone, vertical configuration on channels 1 and 11 for 802.11n mode at MCS 0.

The test distance was 3 metres.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
1	2412.00	Horn	V	PK	1 MHz	100.27	31.99	68.28	74.00	-5.72
1	2412.00	Horn	H	PK	1 MHz	103.96	34.41	69.55	74.00	-4.45
1	2412.00	Horn	V	AV	10 Hz	72.55	31.99	40.56	54.00	-13.44
1	2412.00	Horn	H	AV	10 Hz	75.75	34.41	41.34	54.00	-12.66

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
11	2480.00	Horn	V	PK	1 MHz	98.15	33.53	64.62	74.00	-9.38
11	2480.00	Horn	H	PK	1 MHz	107.16	35.69	71.47	74.00	-2.53
11	2480.00	Horn	V	AV	10 Hz	71.76	33.53	38.23	54.00	-15.77
11	2480.00	Horn	H	AV	10 Hz	78.09	35.69	42.40	54.00	-11.60

See figures 2-13 to 2-16 for the plots of the 802.11b band-edge compliance.
See figures 2-17 to 2-20 for the plots of the 802.11g band-edge compliance.
See figures 2-21 to 2-24 for the plots of the 802.11n band-edge compliance.

802.11b/g/n Band-Edge Compliance of RF Radiated Emissions cont'd

Figure 2-13: Band-Edge Compliance of RF Radiated Emission 802.11b, Channel 1, 2412 MHz, Max Pol: V, Detector: PK

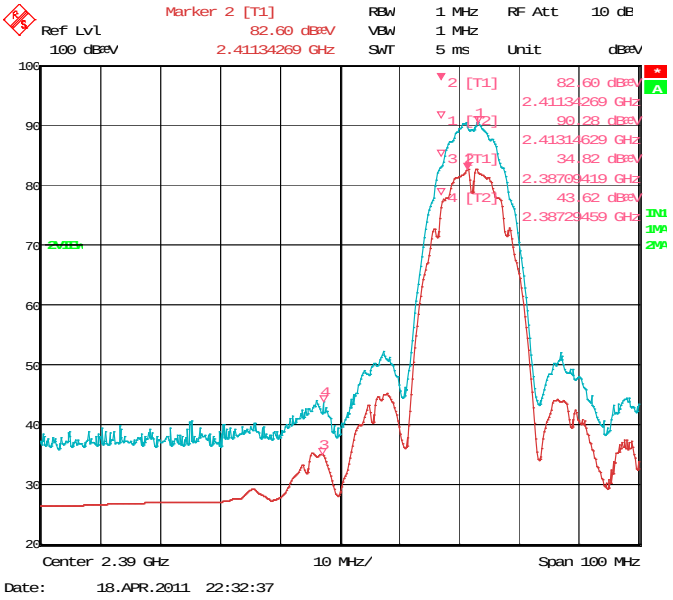


Figure 2-14: Band-Edge Compliance of RF Radiated Emission 802.11b, Channel 1, 2412 MHz, Max Pol: H, Detector: PK

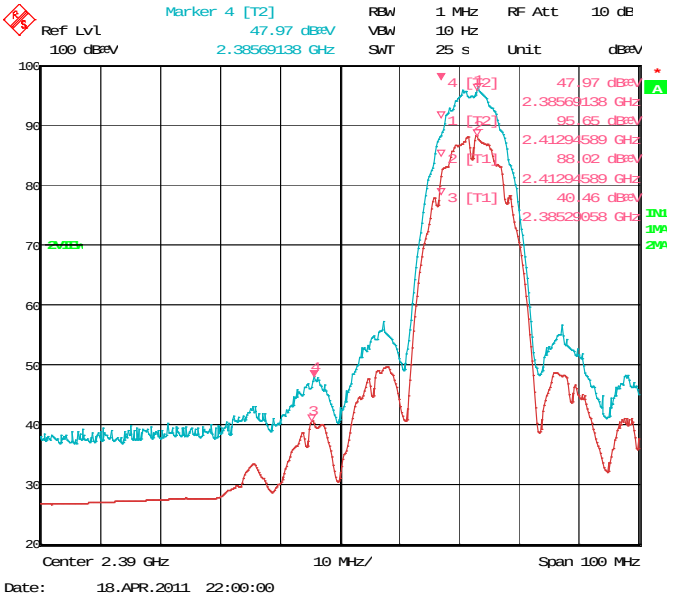


Figure 2-15: Band-Edge Compliance of RF Radiated Emission 802.11b, Channel 11, 2462 MHz, Max Pol: V, Detector: PK

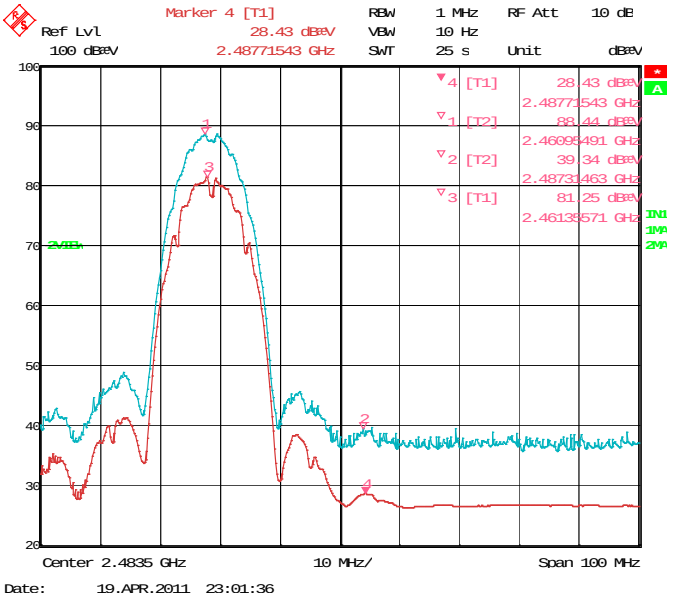


Figure 2-16: Band-Edge Compliance of RF Radiated Emission 802.11b, Channel 11, 2462 MHz, Max Pol: H, Detector: PK

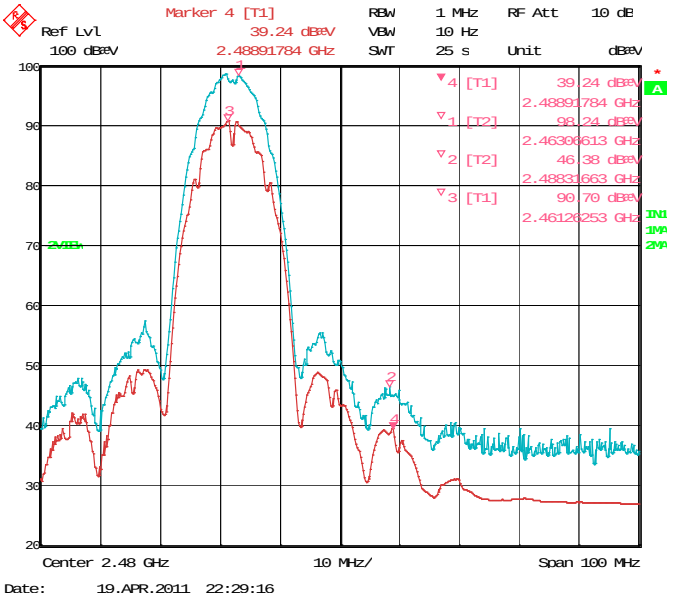


Figure 2-17: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 1, 2412 MHz, Max Pol: V, Detector: PK

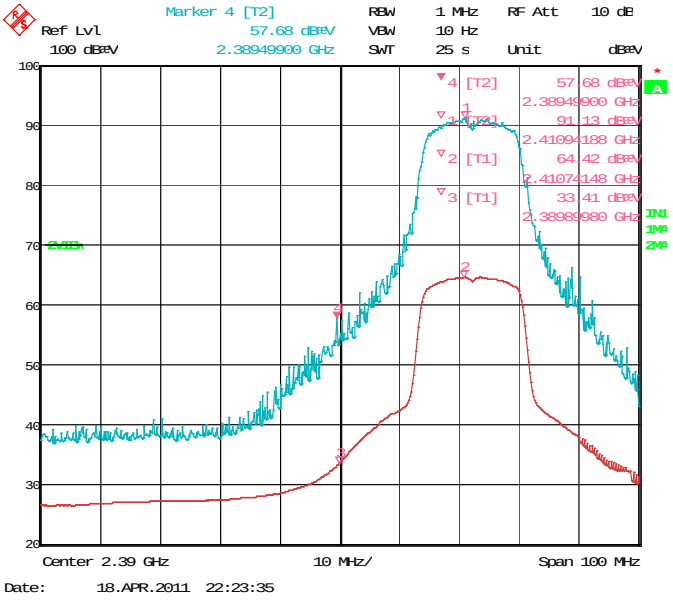


Figure 2-18: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 1, 2412 MHz, Max Pol: H, Detector: PK

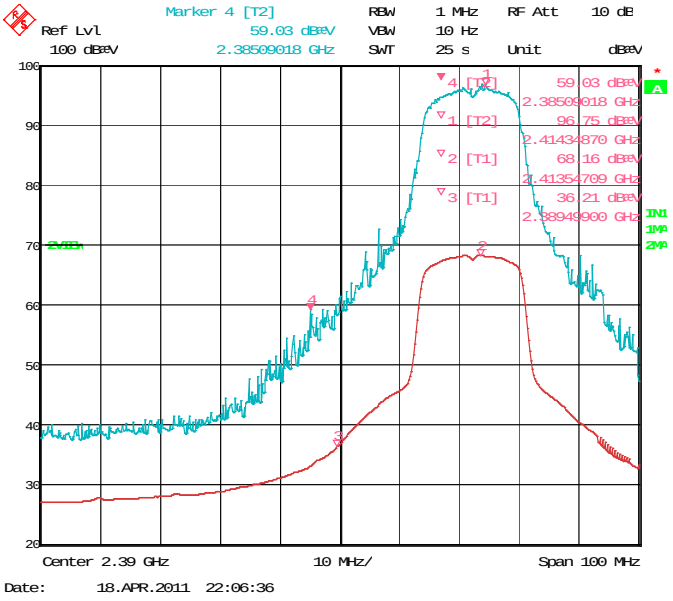


Figure 2-19: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 11, 2462 MHz, Max Pol: V, Detector: PK

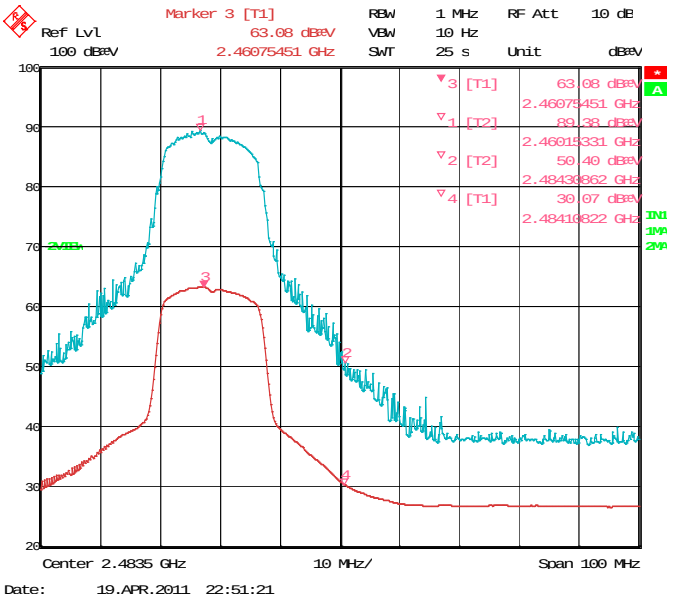


Figure 2-20: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 11, 2462 MHz, Max Pol: H, Detector: PK

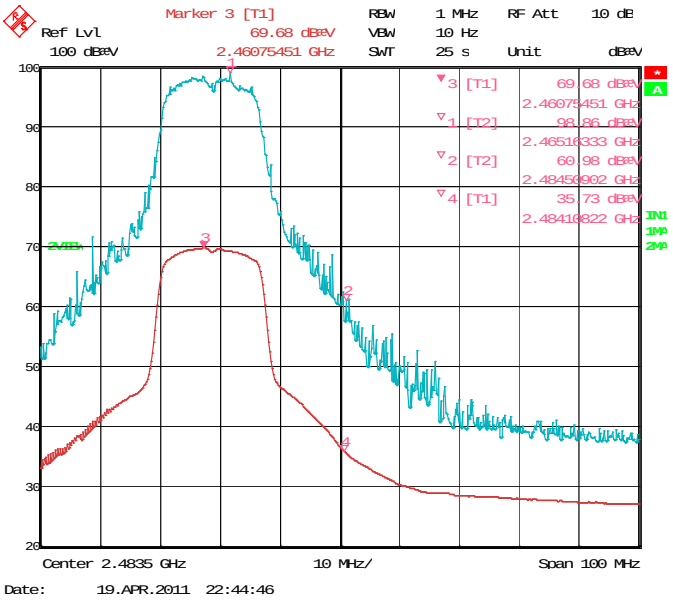


Figure 2-21: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 1, 2412 MHz, Max Pol: V, Detector: PK

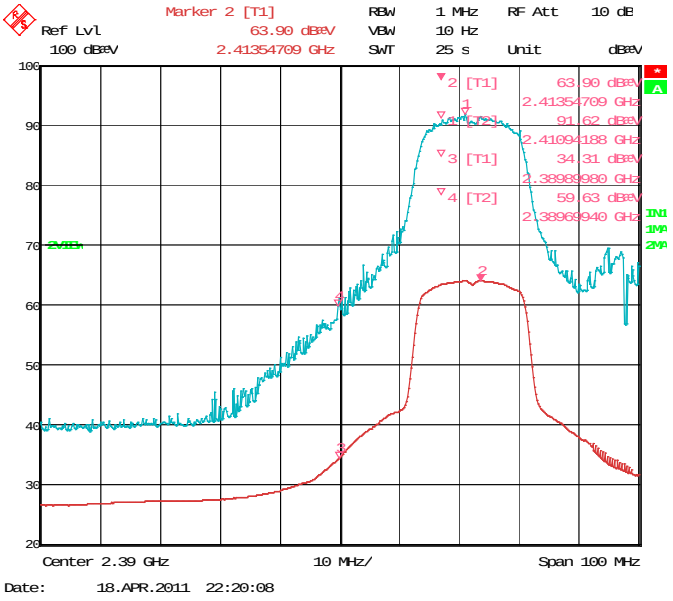


Figure 2-22: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 1, 2412 MHz, Max Pol: H, Detector: PK

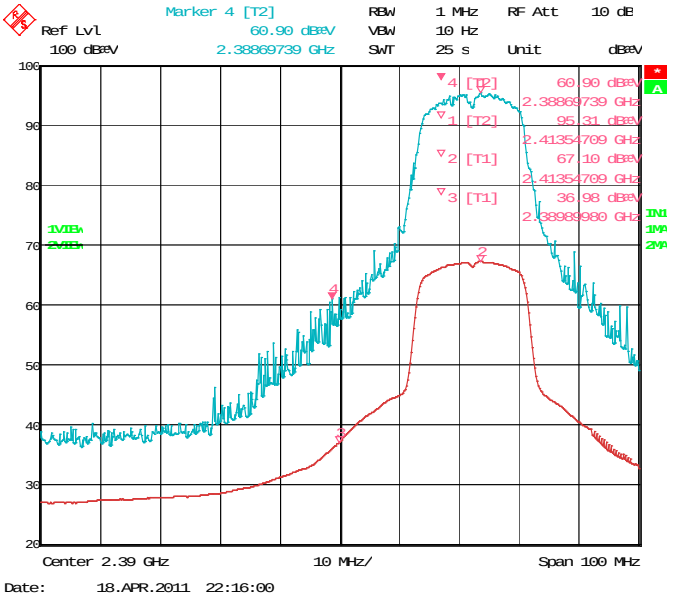


Figure 2-23: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 11, 2462 MHz, Max Pol: V, Detector: PK

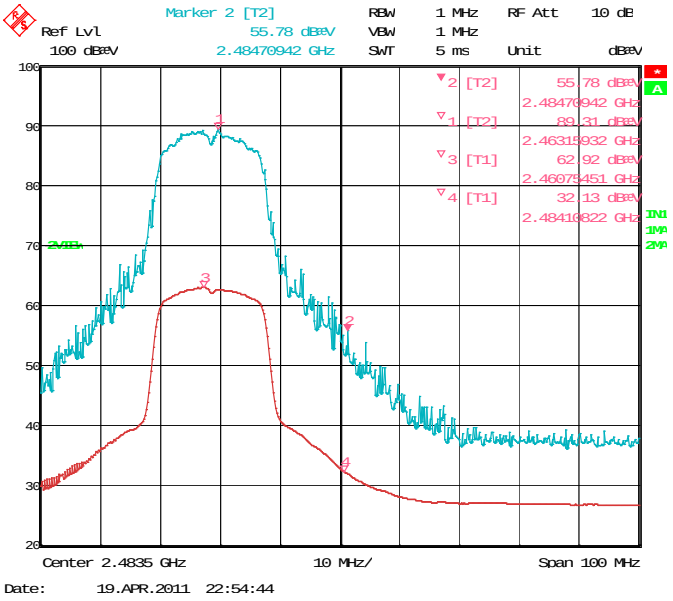
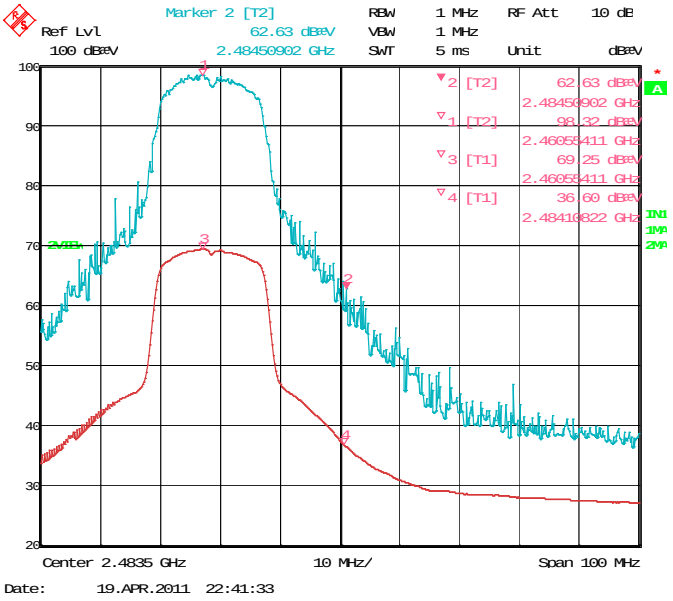


Figure 2-24: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 11, 2462 MHz, Max Pol: H, Detector: PK



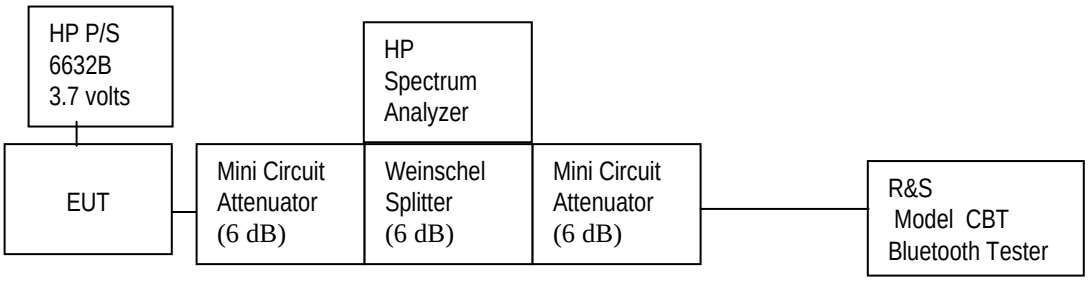
APPENDIX 3 – BLUETOOTH CONDUCTED EMISSIONS TEST DATA/PLOTS

Bluetooth RF Conducted Emission Test Results

Bluetooth power output from BlackBerry® smartphone was at maximum for all the recorded measurements shown below.
The measurements were performed by Maurice Battler.

Date of test: April 11, 2011

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.

The environmental test conditions were: Temperature: 23 ºC
Relative Humidity: 47 %

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 PBRS" and packet type "DH5" during the measurements.

Bluetooth Channel	Limit (MHz)	Measured Level (MHz)
0	≤1.0	0.927
39	≤1.0	0.937
78	≤1.0	0.930

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

Figure 3-1: 20 dB Bandwidth

Single freq., Static PBRS, DH5

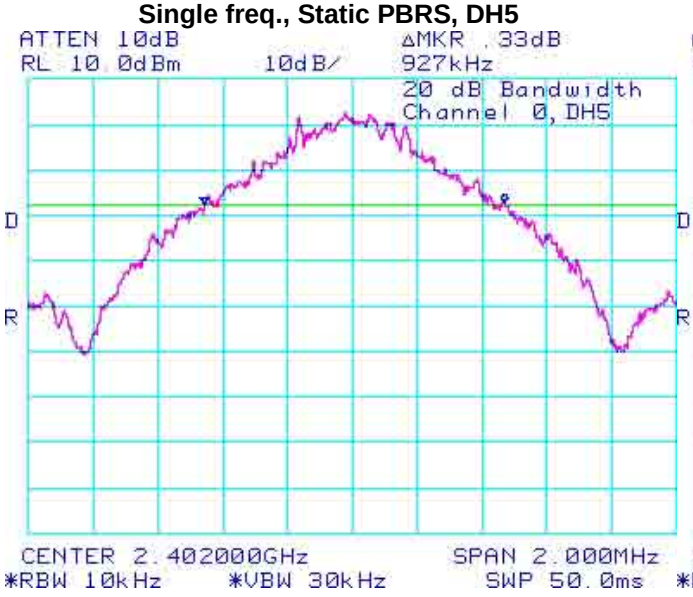
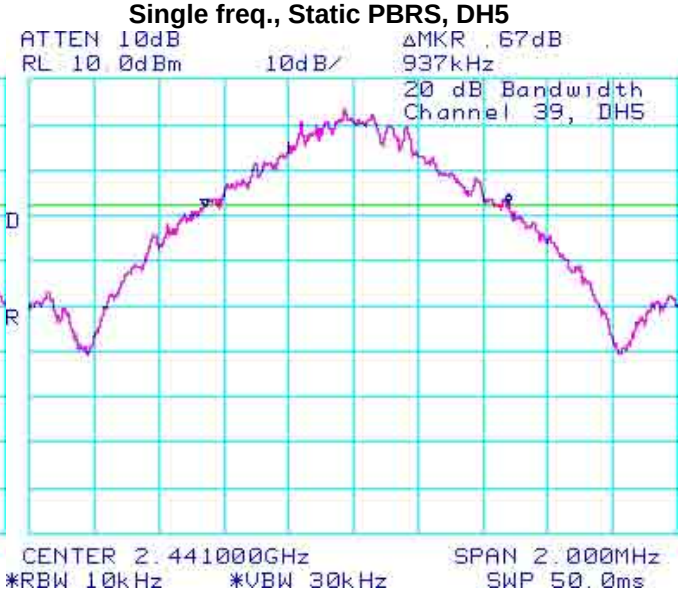


Figure 3-2: 20 dB Bandwidth

Single freq., Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-3: 20 dB Bandwidth

Single freq., Static PBRS, DH5

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

Bluetooth Channel	Limit (MHz)	Measured Level (MHz)
0	≤1.5	1.290
39	≤1.5	1.283
78	≤1.5	1.227

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

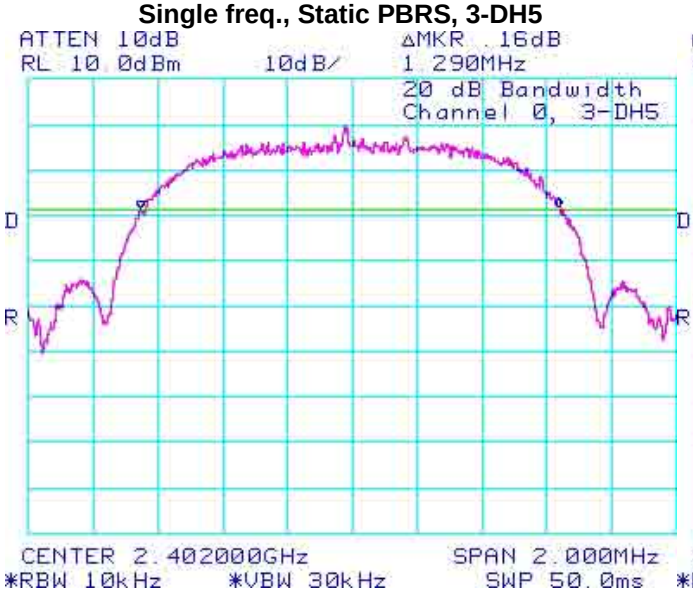


Figure 3-5: 20 dB Bandwidth

Single freq., Static PBRS, 3-DH5

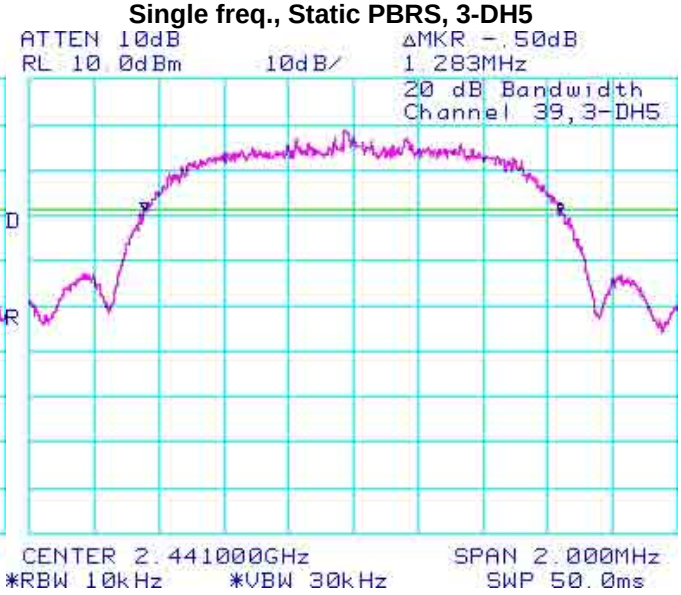
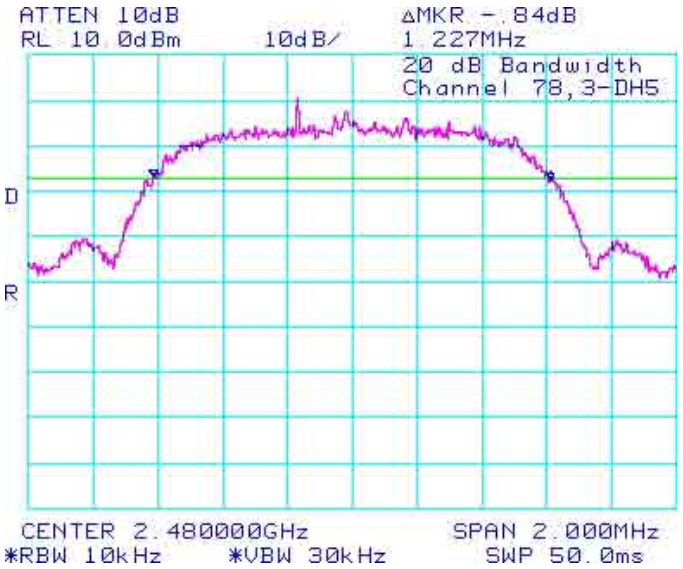


Figure 3-6: 20 dB Bandwidth

Single freq., Static PBRS, 3-DH5



Bluetooth RF Conducted Emission Test Results cont'd

Carrier Frequency Separation

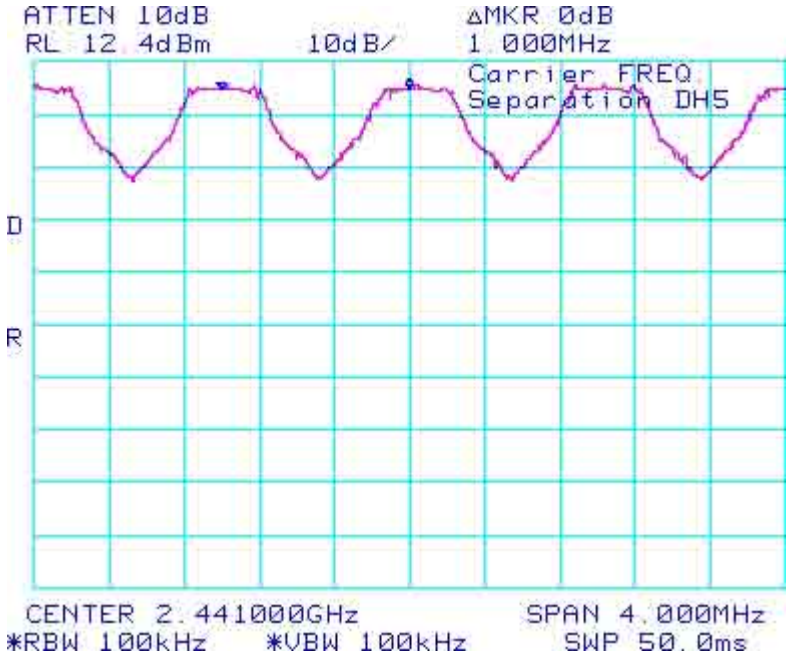
The EUT met the requirements of the Carrier Frequency Separation as per 47 CFR 15.247(a) and RSS-210. Channel 38 to 39 was measured. Bluetooth was operating in frequency hopping (Euro/US) mode.

Using pattern type "Static PBRS" 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

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 PBRS" 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

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 PBRS" and packet type "DH5" during the measurements.

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

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

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

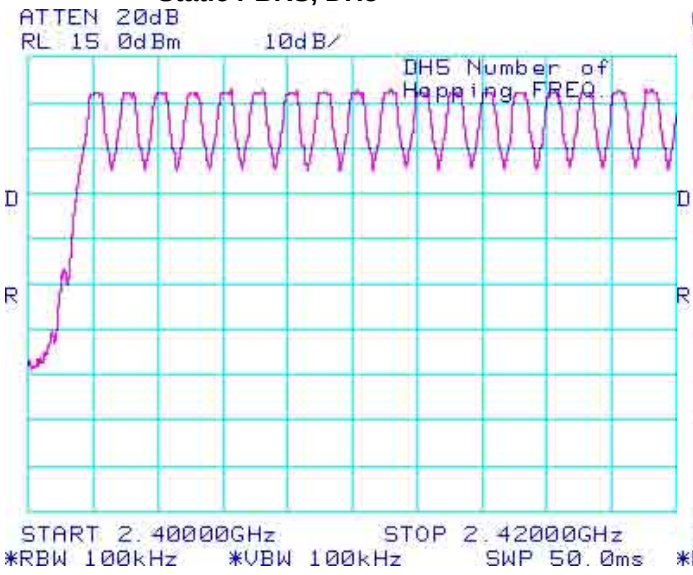
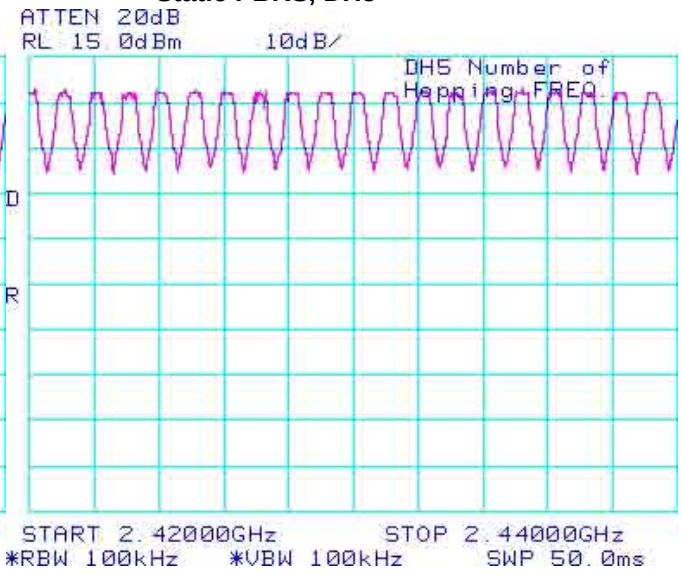


Figure 3-10: Number of Hopping Frequencies
Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-11: Number of Hopping Frequencies
Static PBRS, DH5

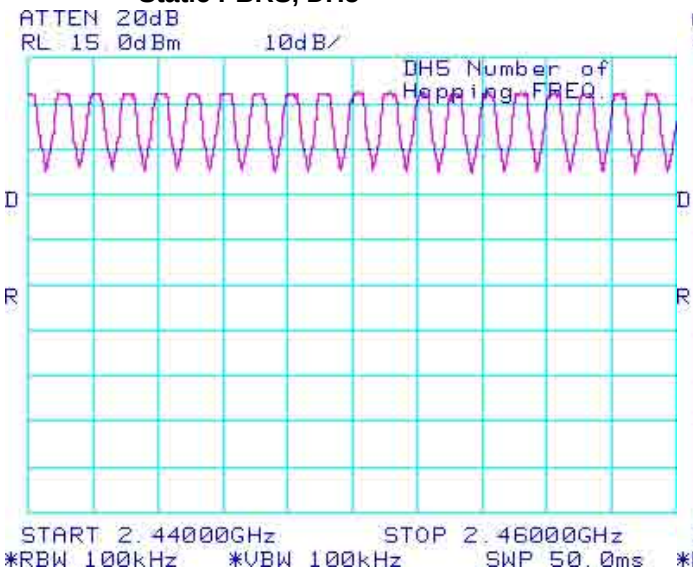
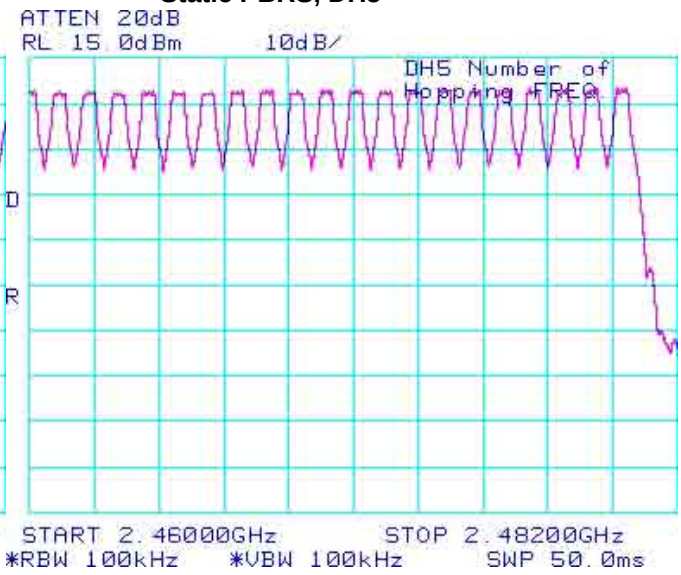


Figure 3-12: Number of Hopping Frequencies
Static PBRS, DH5



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 RF Conducted Emission Test Results cont'd

Bluetooth Channel	Mode	Tx Time (ms)	Dwell Time/31.6 sec. (msec.)	Limit (msec.)	Margin (msec.)
0	DH1	0.4203	0.4203 x 320.0 = 134.50	400	265.50
39	DH1	0.4182	0.4182 x 320.0 = 133.82	400	266.18
78	DH1	0.4203	0.4203 x 320.0 = 134.50	400	265.50
0	DH3	1.6750	1.6750 x 159.9 = 267.83	400	132.17
39	DH3	1.6800	1.6800 x 159.9 = 268.63	400	131.37
78	DH3	1.6800	1.6800 x 159.9 = 268.63	400	131.37
0	DH5	2.9300	2.9300 x 106.8 = 312.92	400	87.08
39	DH5	2.9155	2.9155 x 106.8 = 311.38	400	88.62
78	DH5	2.9254	2.9254 x 106.8 = 312.43	400	87.57

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

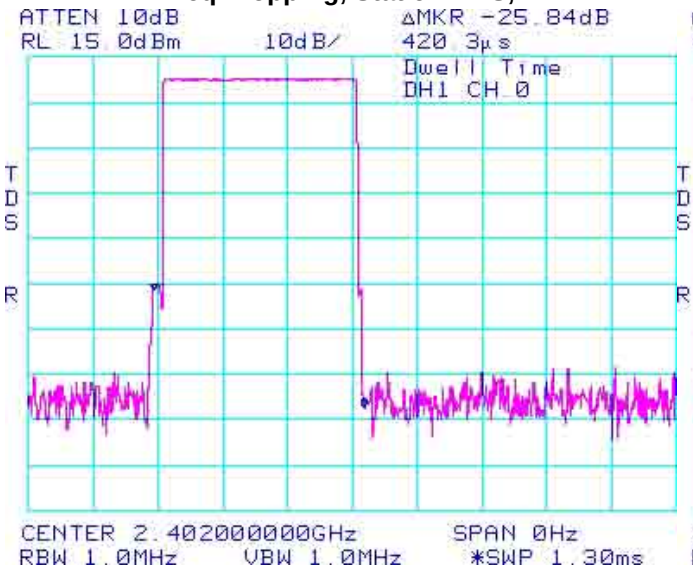
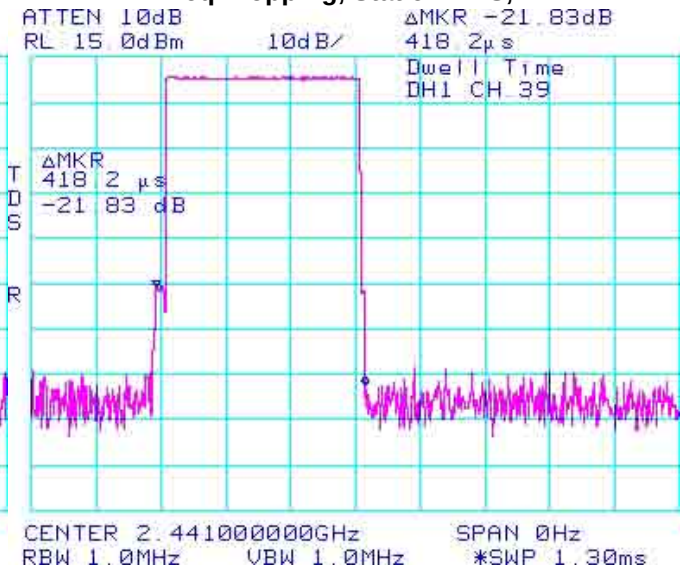


Figure 3-14: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH1



Bluetooth RF Conducted Emission Test Results cont'd

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

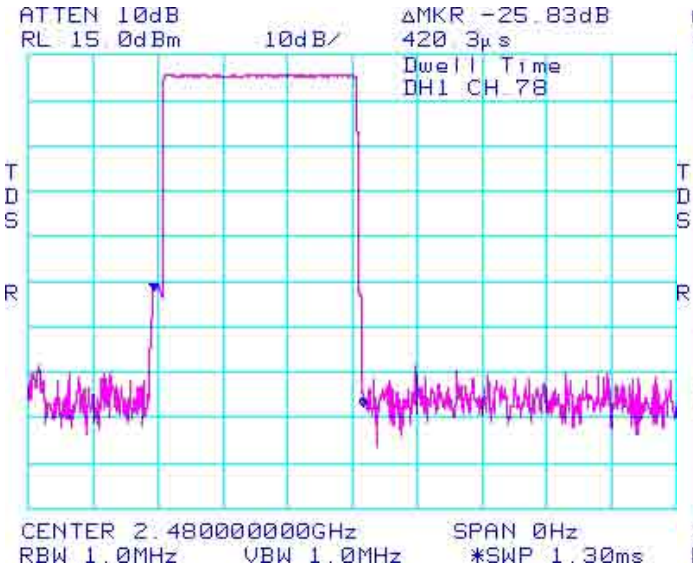


Figure 3-16: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH3

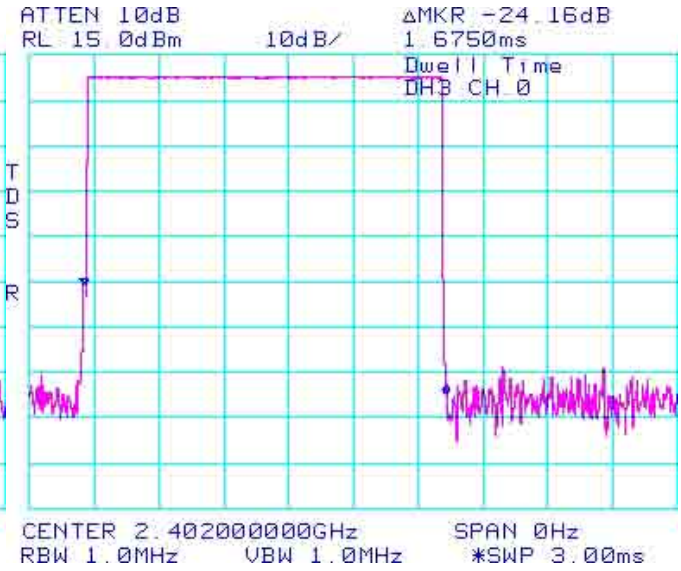


Figure 3-17: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH3

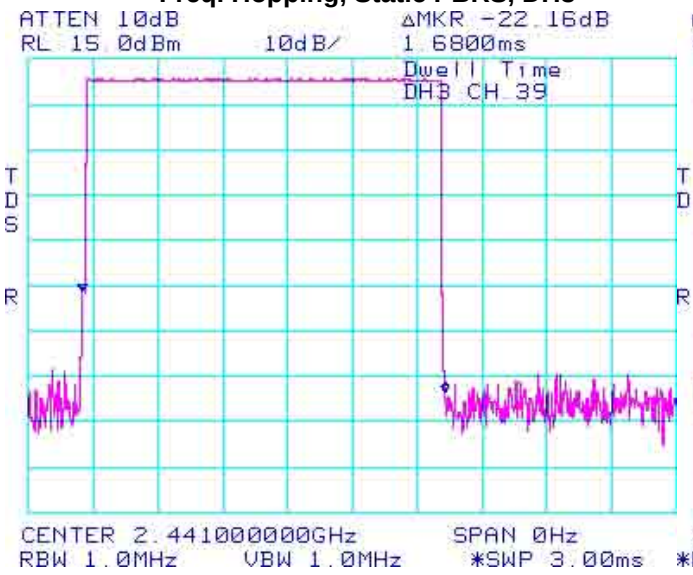
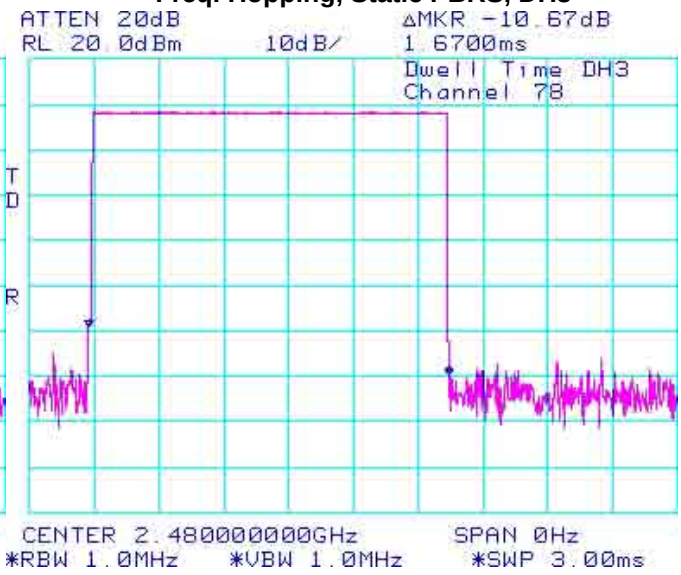


Figure 3-18 : Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH3



Bluetooth RF Conducted Emission Test Results cont'd

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

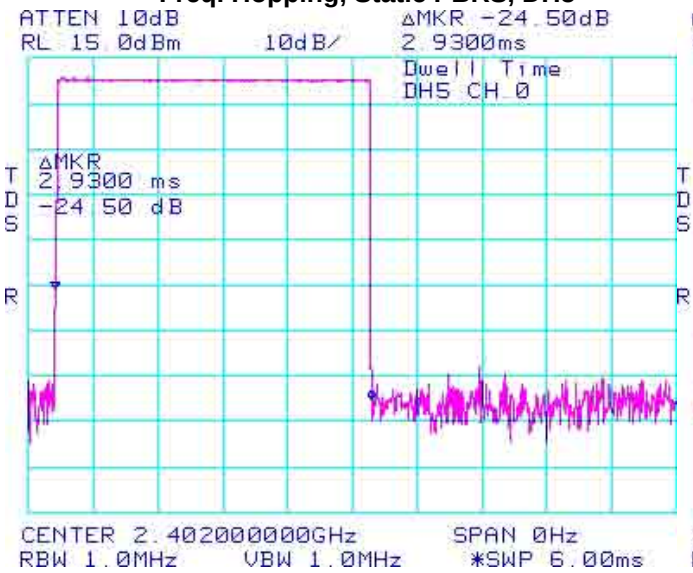


Figure 3-20: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH5

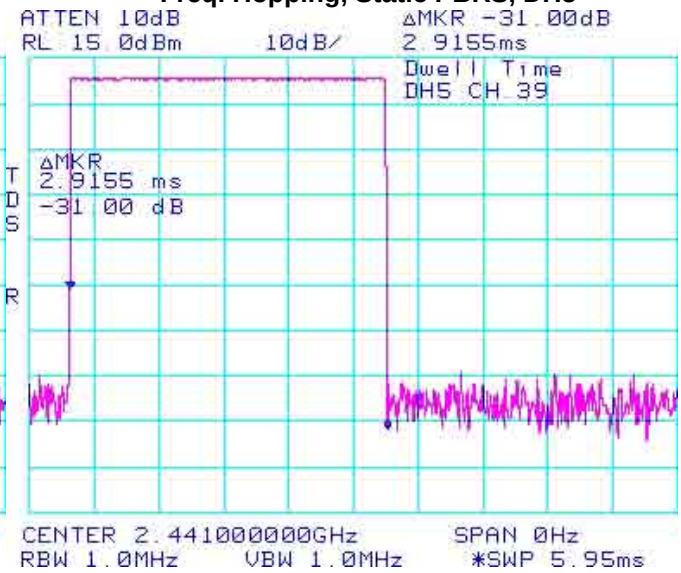
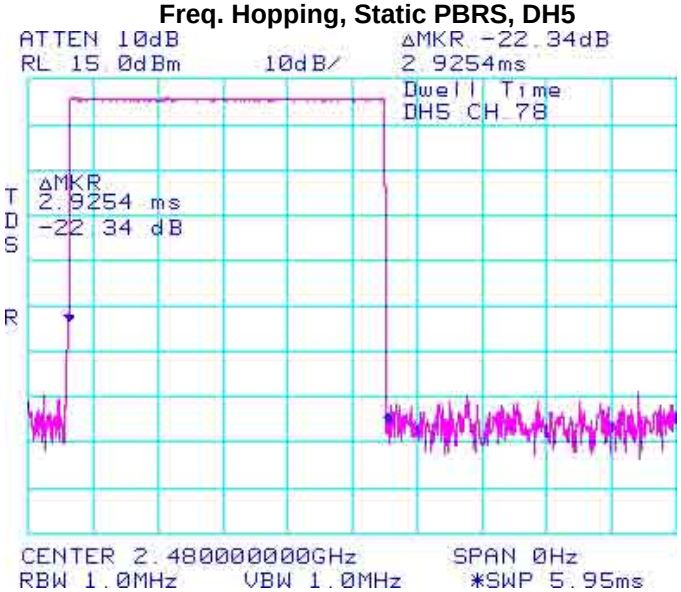


Figure 3-21: Time of Occupancy (Dwell Time)
Freq. Hopping, Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Maximum Peak Conducted Output Power

The EUT met the requirements of the maximum peak conducted output power of class 1 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 PBRS" and packet type "DH5" during the measurements.

Bluetooth Channel	Measured Level (dBm)	Measured Level (W)	Class 1 Limit (dBm)
0	7.33	0.00541	0.0 to 20.0
39	7.00	0.00501	0.0 to 20.0
78	6.67	0.00465	0.0 to 20.0

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

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

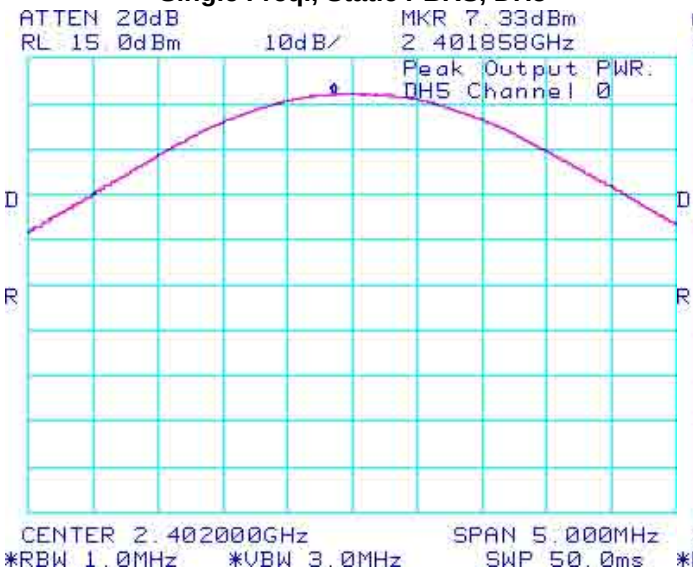
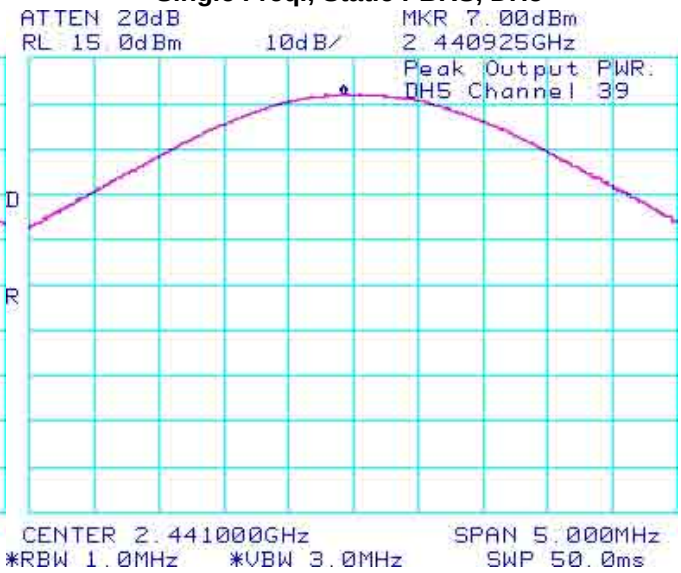
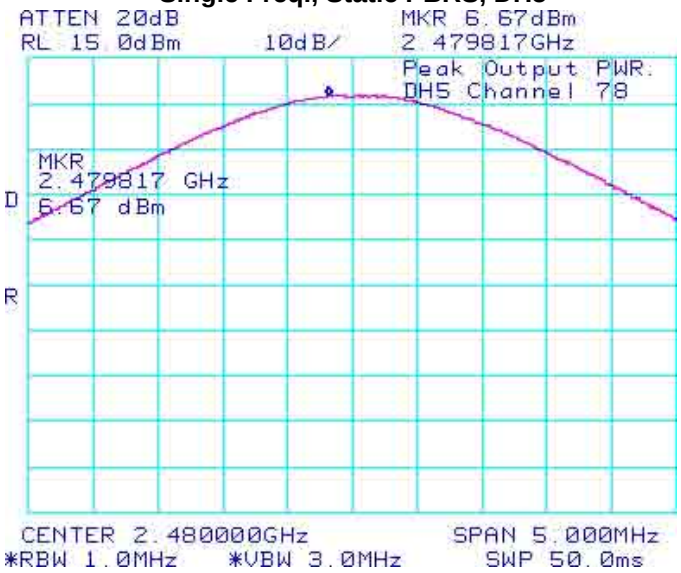


Figure 3-23: Max. Peak Conducted Output Power Single Freq., Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

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



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

Bluetooth Channel	Measured Level (dBm)	Measured Level (W)	Class 1 Limit (dBm)
0	7.33	0.00541	0.0 to 20.0
39	7.00	0.00501	0.0 to 20.0
78	6.67	0.00465	0.0 to 20.0

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

Bluetooth RF Conducted Emission Test Results cont'd

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

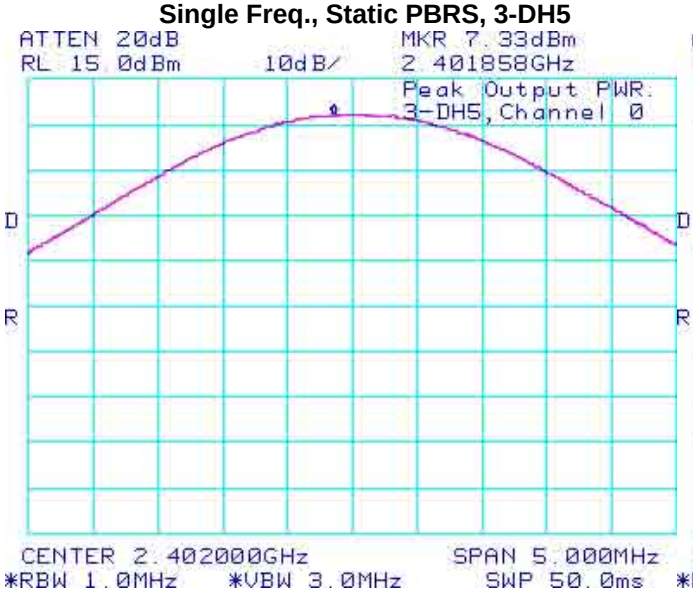


Figure 3-26: Max. Peak Conducted Output Power
Single Freq., Static PBRS, 3-DH5

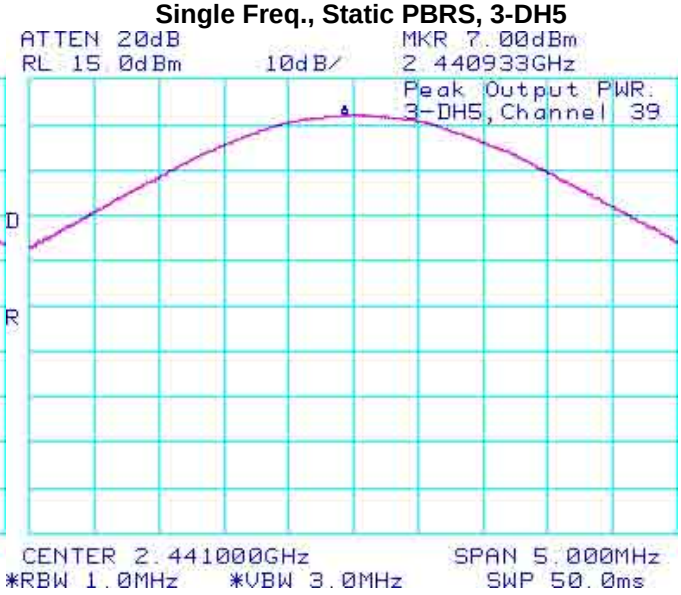
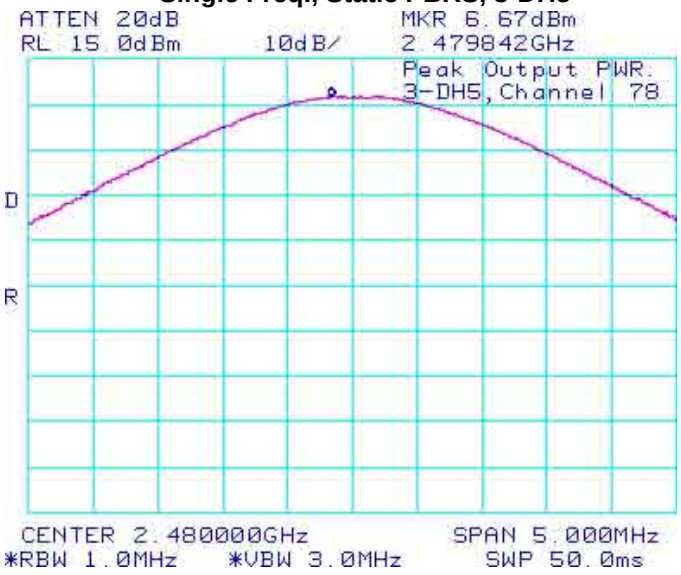


Figure 3-27: Max. Peak Conducted Output Power
Single Freq., Static PBRS, 3-DH5



Bluetooth RF Conducted Emission Test Results cont'd

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 PBRS" and packet type "DH5" during the measurements.

Bluetooth Channel	Operating Mode	Measured Level (dBc)	Limit (dBc)	Margin (dB)
0	Single Frequency	-39.33	-20	-19.33
78	Single Frequency	-38.67	-20	-18.67
0	Hopping	-41.34	-20	-21.34
78	Hopping	-39.34	-20	-19.34

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

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

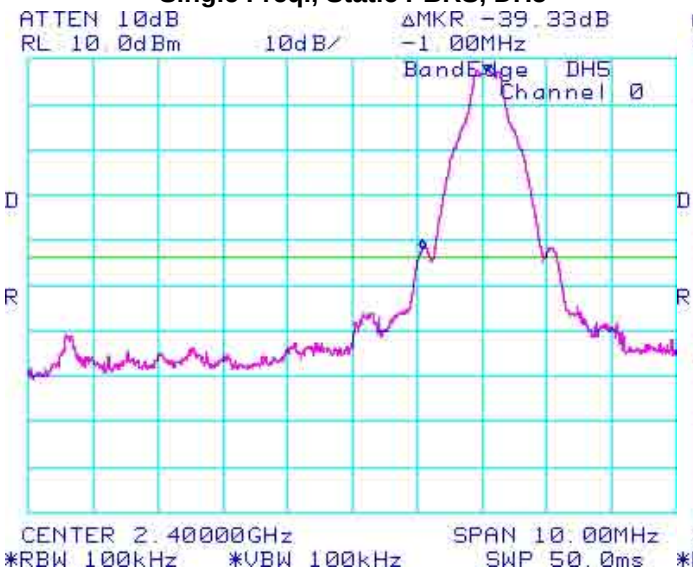
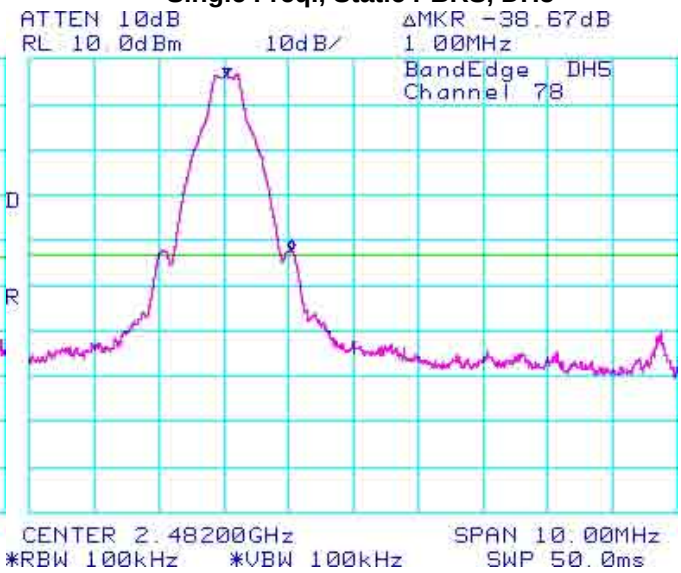


Figure 3-29: Band Edge Compliance
Single Freq., Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

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

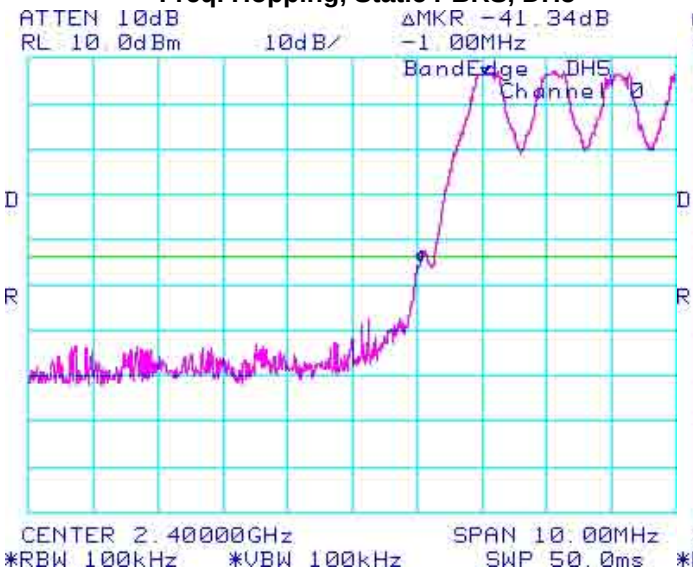
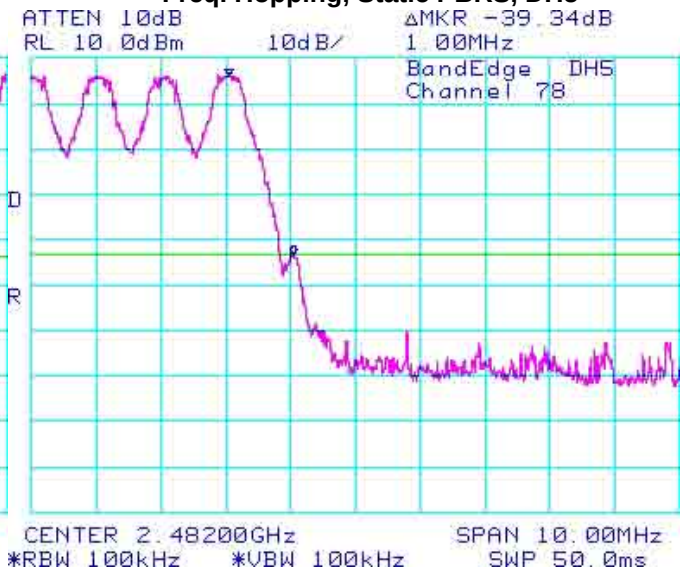


Figure 3-31: Band Edge Compliance
Freq. Hopping, Static PBRS, DH5



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

Bluetooth Channel	Operating Mode	Measured Level (dBc)	Limit (dBc)	Margin (dB)
0	Single Frequency	-36.50	-20	-16.50
78	Single Frequency	-28.33	-20	-8.33
0	Hopping	-34.50	-20	-14.50
78	Hopping	-29.16	-20	-9.16

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

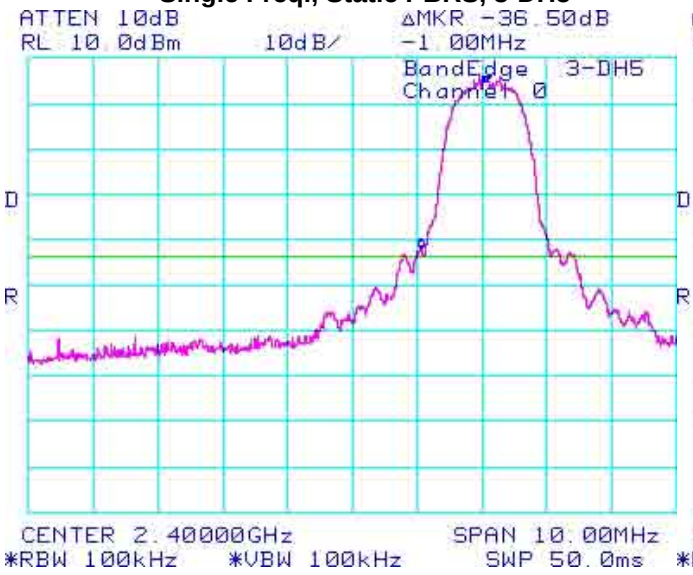


Figure 3-33: Band Edge Compliance
Single Freq., Static PBRS, 3-DH5

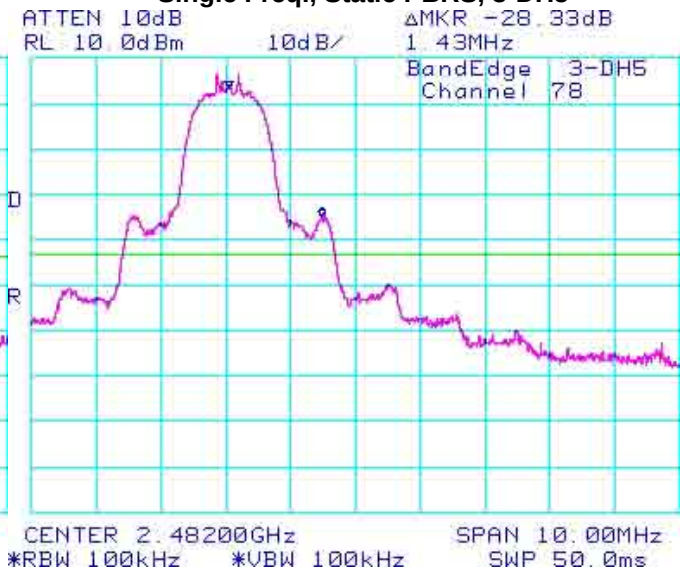


Figure 3-34: Band Edge Compliance
Freq. Hopping, Static PBRS, 3-DH5

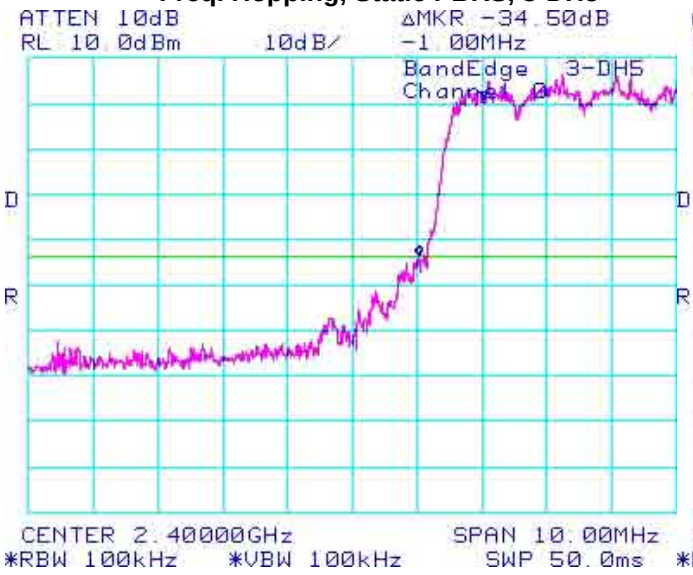
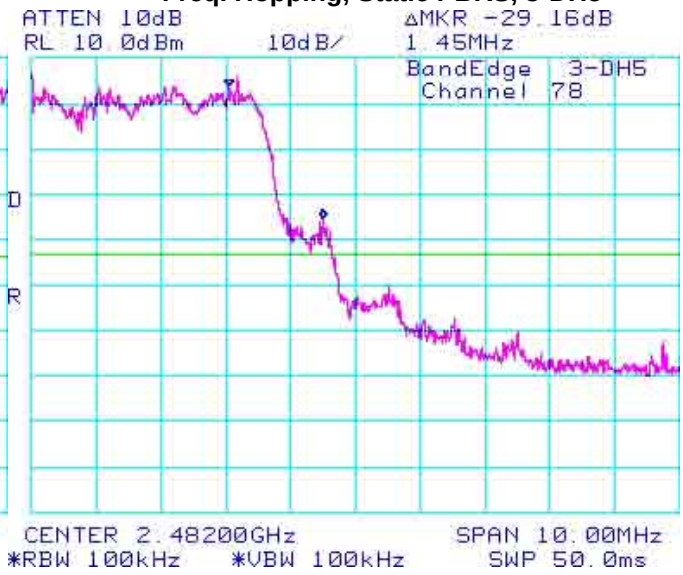


Figure 3-35: Band Edge Compliance
Freq. Hopping, Static PBRS, 3-DH5



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 PBRS" 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	7.33	-43.67	-51.00	-20
39	7.00	-41.83	-48.83	-20
78	6.67	-40.00	-46.67	-20
Hopping mode	6.67	-40.33	-47.00	-20

See figures 3-36 to 3-39 for the plots of the spurious RF conducted emissions.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-36: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5,

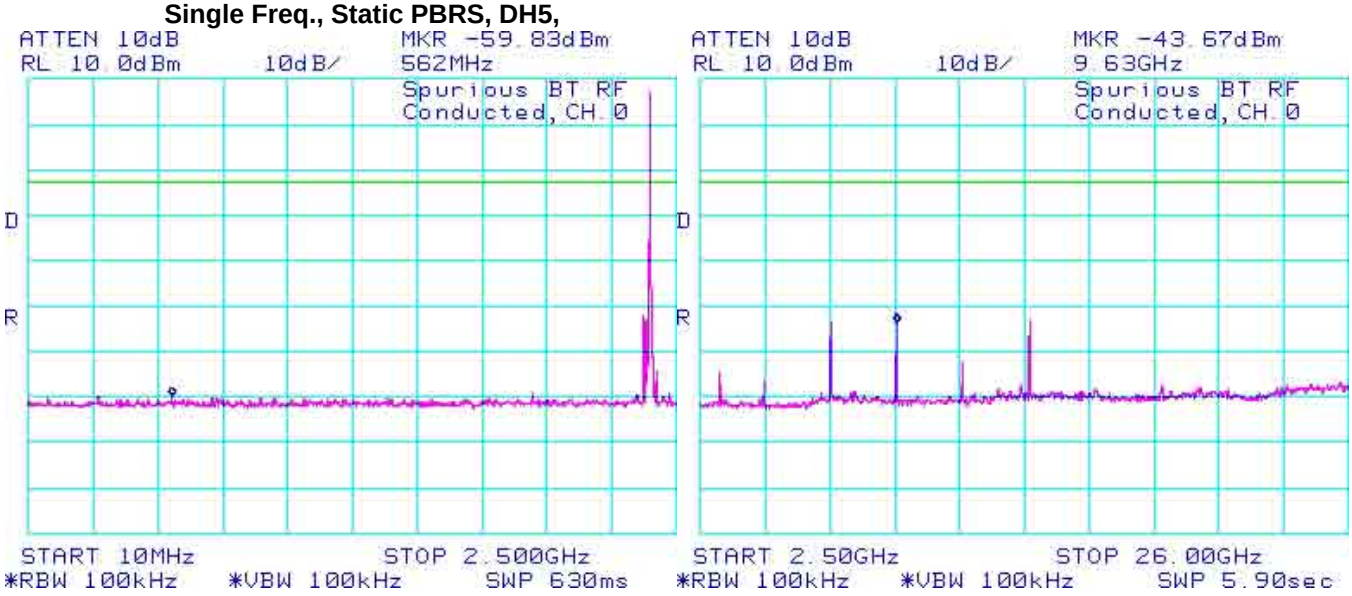
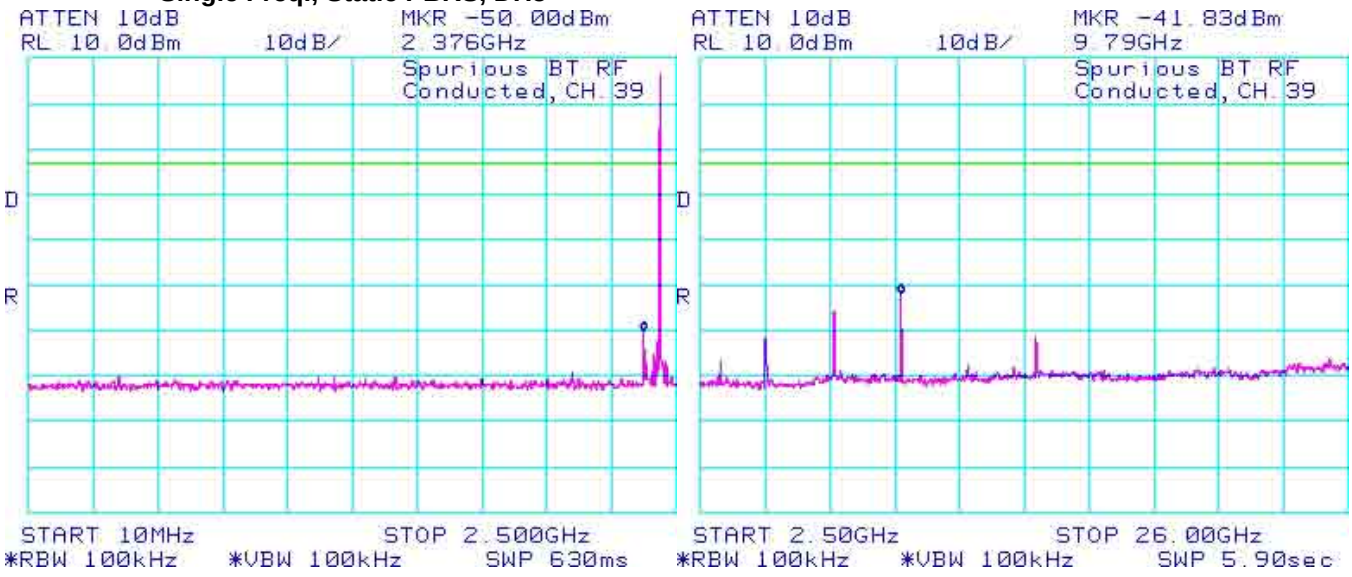


Figure 3-37: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 3-38: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5

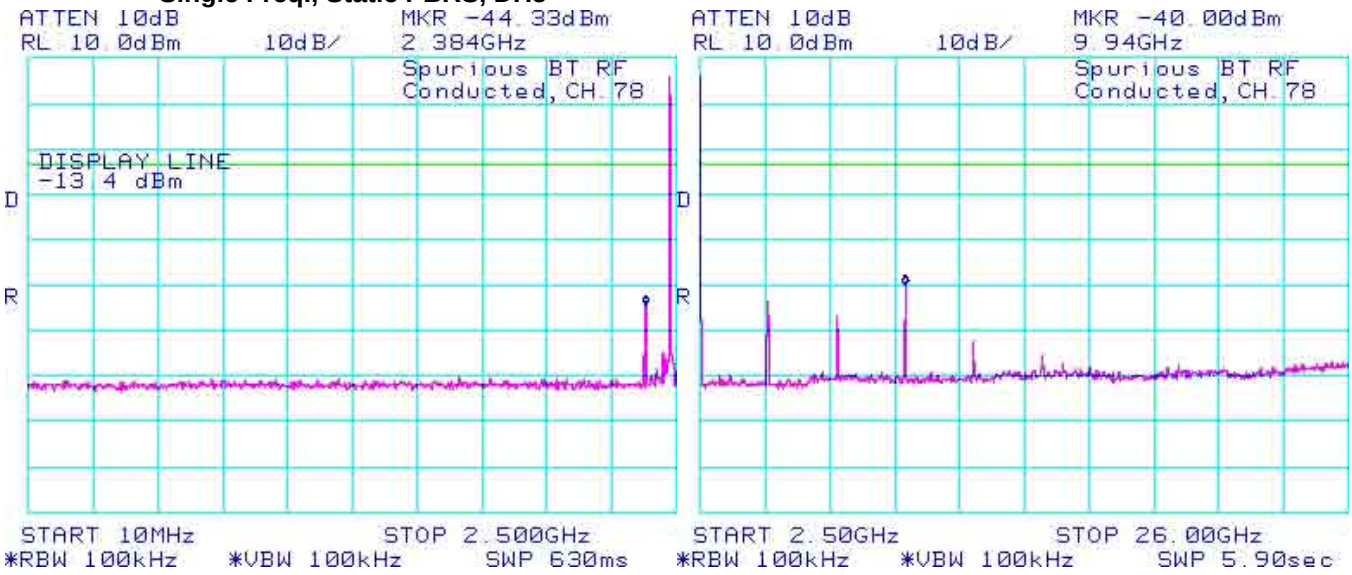
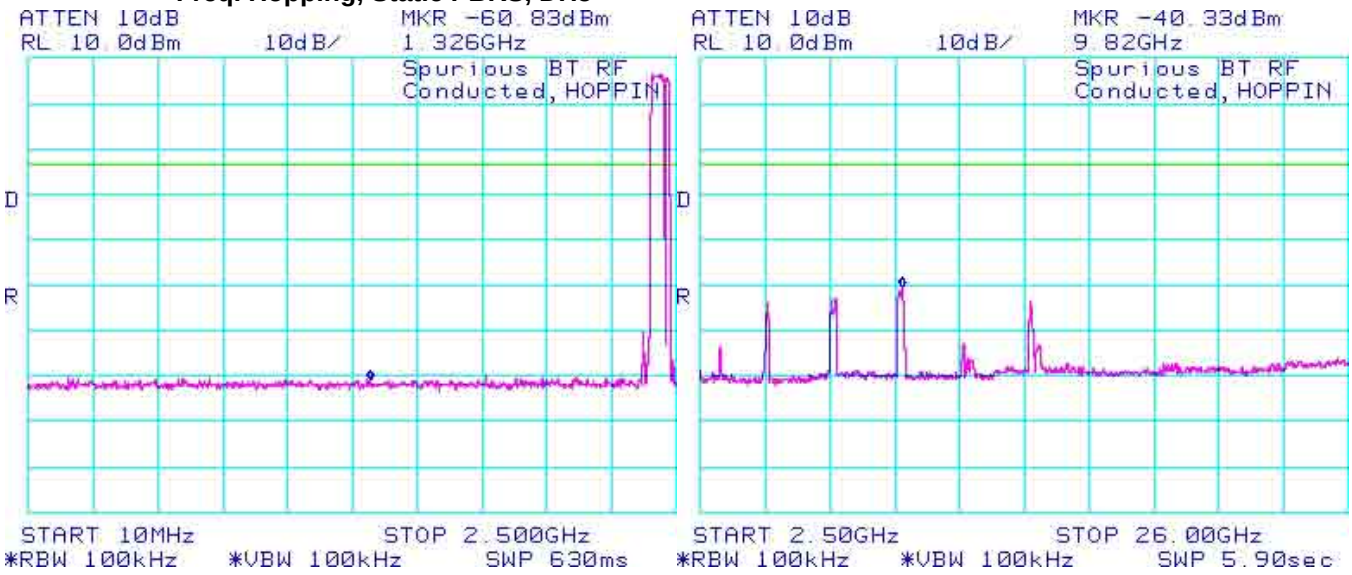


Figure 3-39: Spurious RF Conducted Emissions
Freq. Hopping, Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Using pattern type "Static PBRS" 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	7.33	-49.17	-56.50	-20
39	7.00	-45.50	-52.50	-20
78	6.67	-45.17	-51.84	-20
Hopping mode	6.67	-48.83	-55.50	-20

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

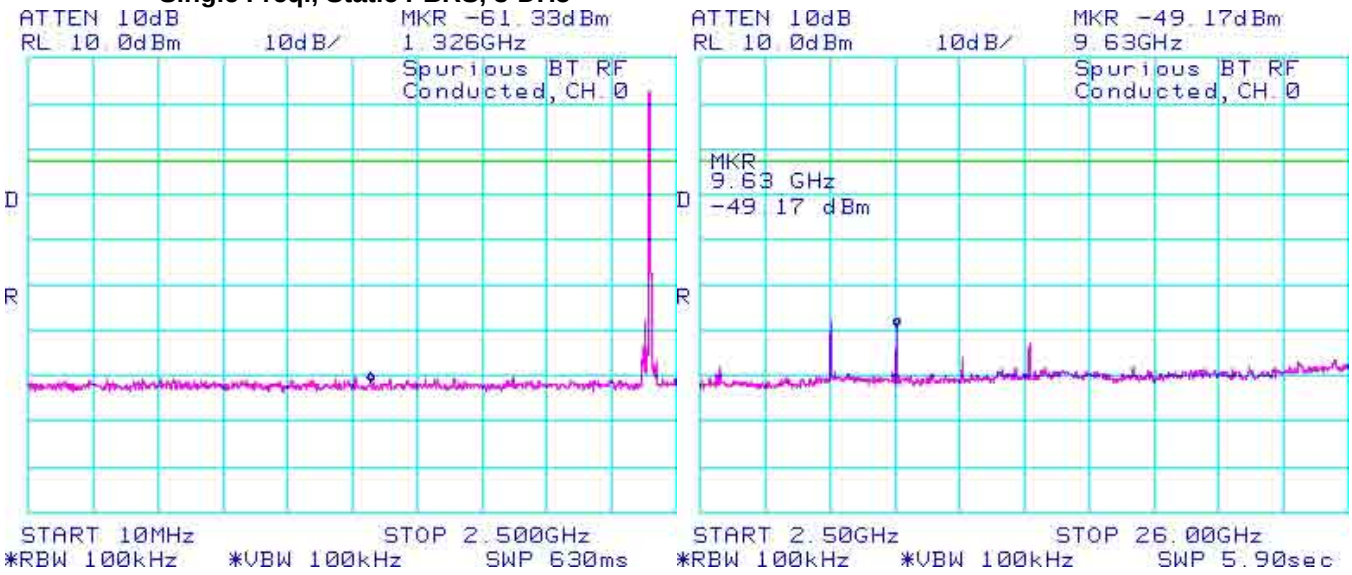
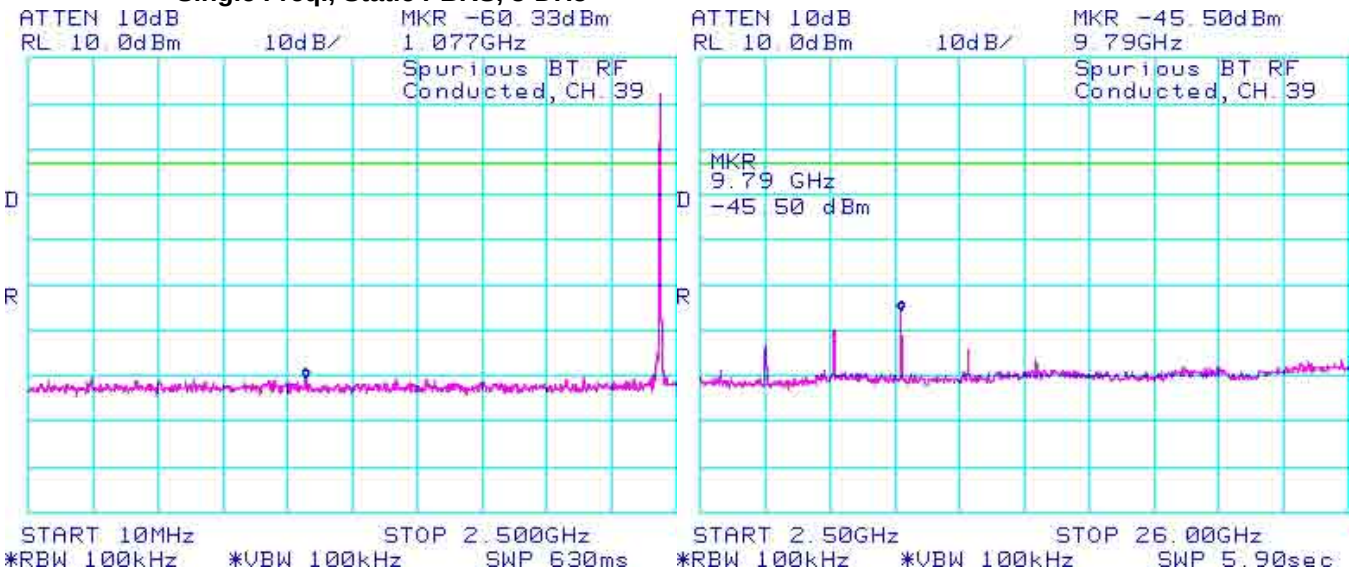


Figure 3-41: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 3-DH5



Bluetooth RF Conducted Emission Test Results cont'd

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

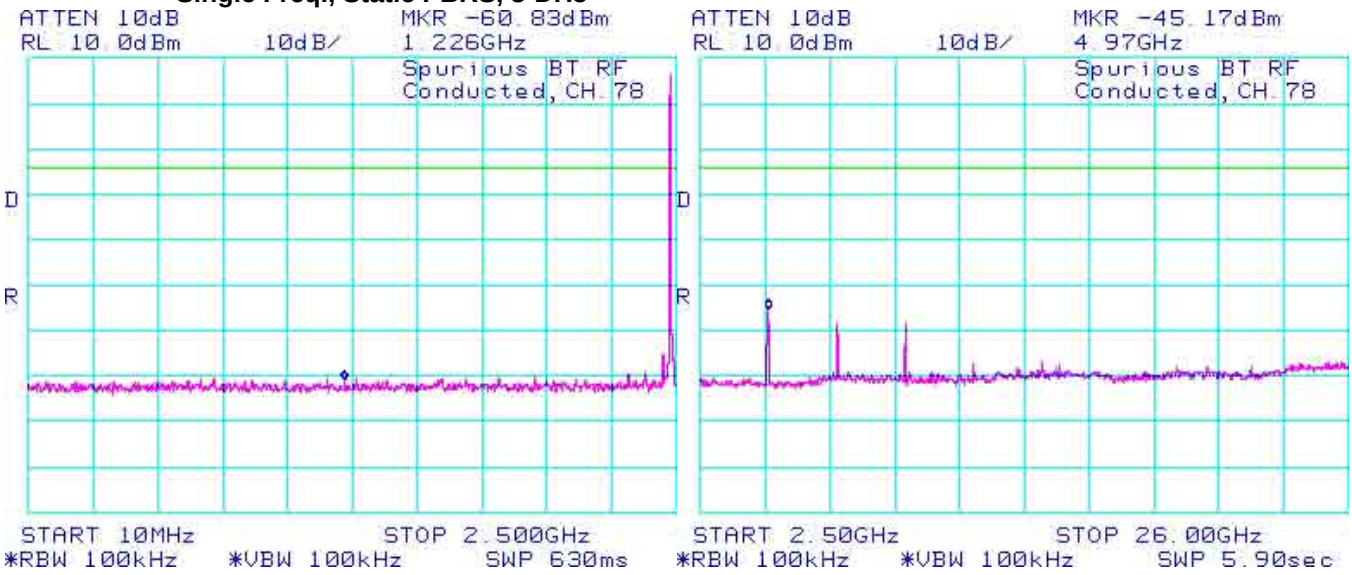
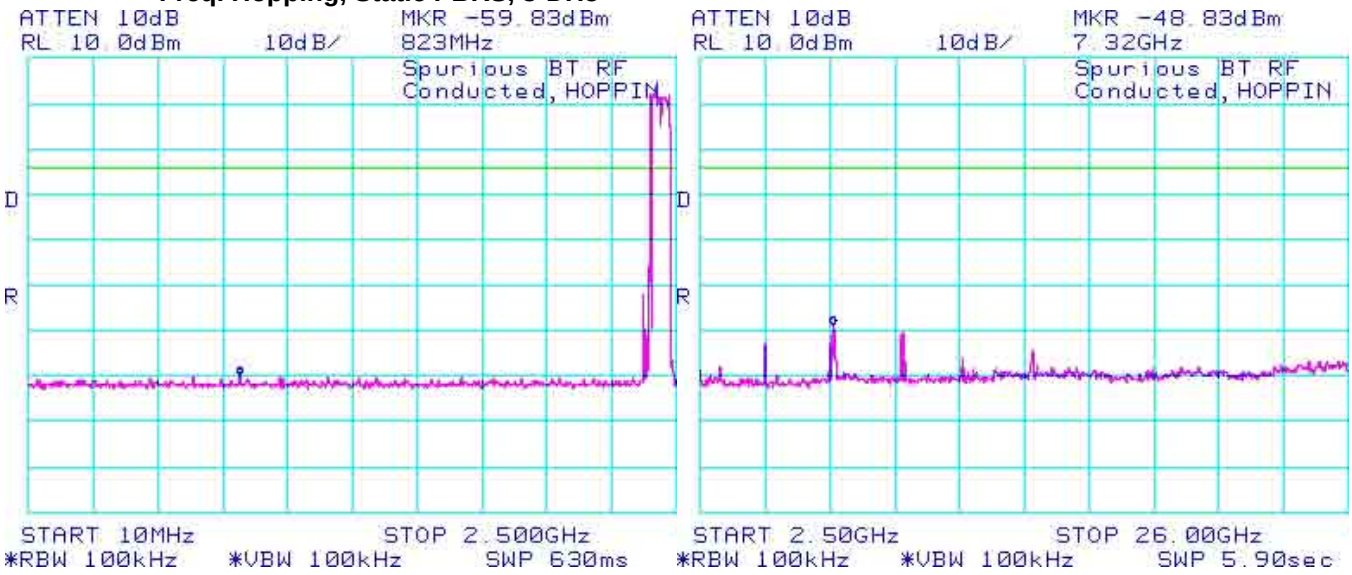


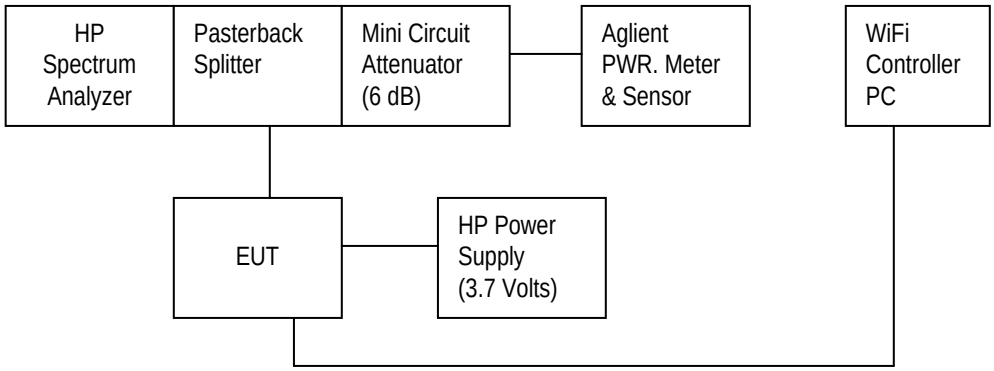
Figure 3-43 : Spurious RF Conducted Emissions
Freq. Hopping, Static PBRS, 3-DH5



APPENDIX 4 – 802.11b/g/n CONDUCTED EMISSIONS TEST DATA/PLOTS

802.11b/g/n RF Conducted Emission Test Results

Test Setup Diagram



A reference offset of 20.4 dB was applied to the spectrum analyzer and 6.6 dB was applied to the Power Meter reference level for the attenuators and coaxial cable loss in the test circuit.

Date of test: February 14, 2011
The measurements on the BlackBerry® smartphone were performed by Maurice Battler.

The environmental test conditions were: Temperature: 24 ºC
Relative Humidity: 32 %

802.11b/g/n RF Conducted Emission Test Results cont'd

6 dB Bandwidth

The EUT met the requirements of the 6 dB bandwidth as per 47 CFR 15.247(a)(2) and RSS-210. Channels 1, 6 and 11 were measured at 1 Mbps, 5.5 Mbps, and 11Mbps each for 802.11b mode, 6 Mbps, 24 Mbps, and 54 Mbps each for 802.11g mode, and MCS 0, 4, and 7 for 802.11n mode.

Channel	Data Rate	Limit (kHz)	Measured Level (MHz)
1	1 Mbps	≥ 500	10.17
	5.5 Mbps	≥ 500	10.27
	11 Mbps	≥ 500	10.77
	6 Mbps	≥ 500	16.17
	24 Mbps	≥ 500	16.60
	54 Mbps	≥ 500	16.57
	MCS 0	≥ 500	17.03
	MCS 4	≥ 500	17.73
	MCS 7	≥ 500	17.73
6	1 Mbps	≥ 500	10.10
	5.5 Mbps	≥ 500	11.17
	11 Mbps	≥ 500	11.23
	6 Mbps	≥ 500	16.43
	24 Mbps	≥ 500	16.60
	54 Mbps	≥ 500	16.63
	MCS 0	≥ 500	17.07
	MCS 4	≥ 500	17.83
	MCS 7	≥ 500	17.80
11	1 Mbps	≥ 500	10.13
	5.5 Mbps	≥ 500	11.20
	11 Mbps	≥ 500	11.17
	6 Mbps	≥ 500	16.47
	24 Mbps	≥ 500	16.60
	54 Mbps	≥ 500	16.60
	MCS 0	≥ 500	17.17
	MCS 4	≥ 500	17.80
	MCS 7	≥ 500	17.87

802.11b/g/n RF Conducted Emission Test Results cont'd

See figures 4-1 to 4-9 for the plots of the 6 dB bandwidth measurements for Channels 1, 6, and 11, at 1 Mbps each for 802.11b mode, 6 Mbps each for 802.11g mode, and MCS 0 each for 802.11n mode.

Figure 4-1: 6 dB Bandwidth
802.11b, Channel 1, 1 Mbps

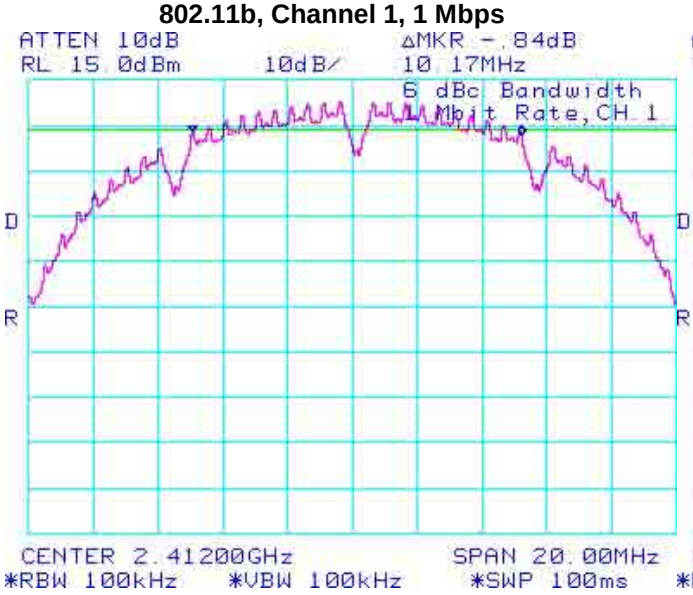


Figure 4-2: 6 dB Bandwidth
802.11b, Channel 6, 1 Mbps

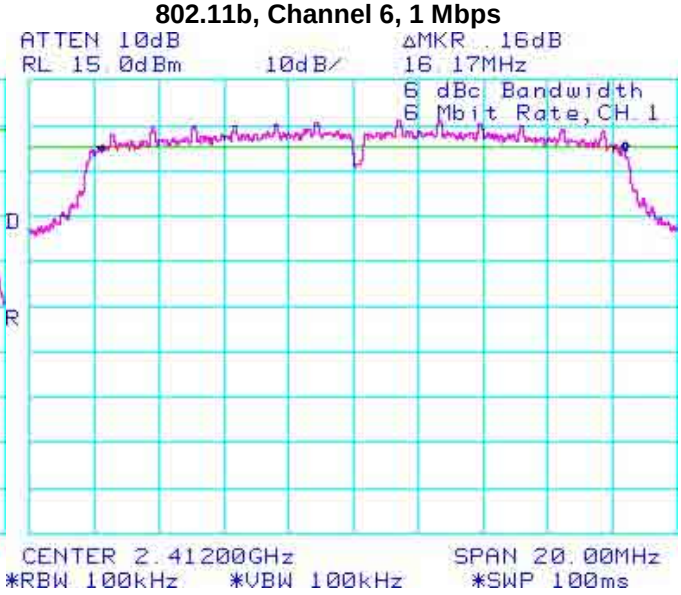


Figure 4-3: 6 dB Bandwidth
802.11b, Channel 11, 1 Mbps

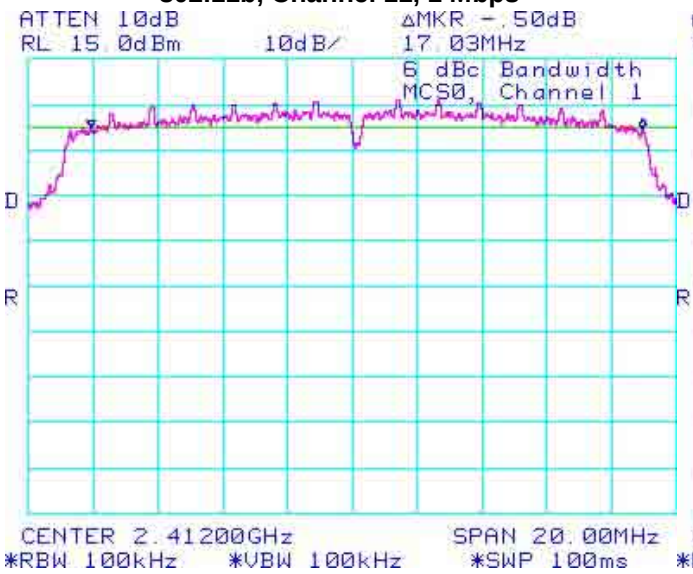
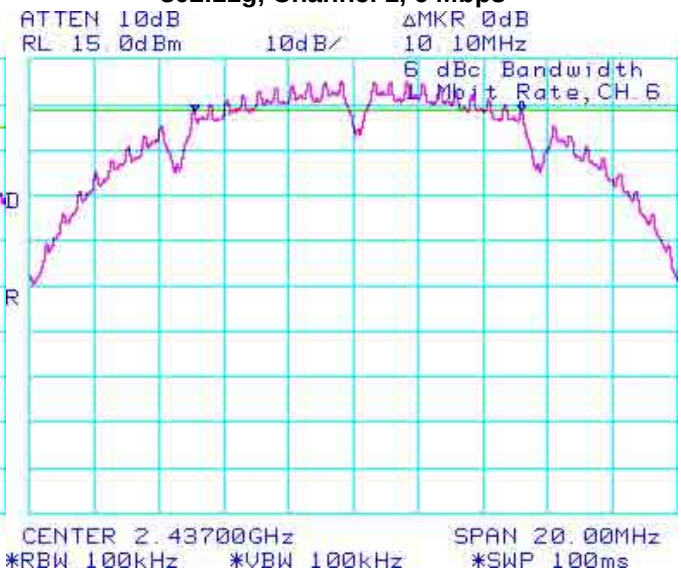


Figure 4-4: 6 dB Bandwidth
802.11g, Channel 1, 6 Mbps



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-5: 6 dB Bandwidth
802.11g, Channel 6, 6 Mbps

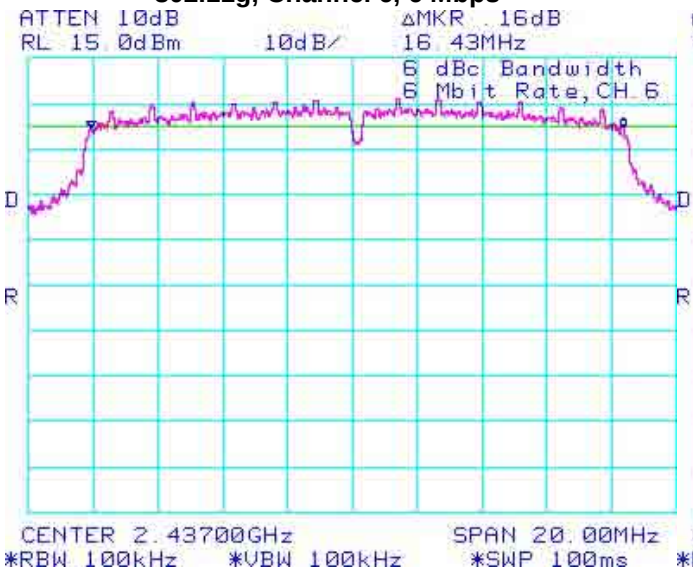


Figure 4-6: 6 dB Bandwidth
802.11g, Channel 11, 6 Mbps

Figure 4-7: 6 dB Bandwidth
802.11n, Channel 1, MCS 0

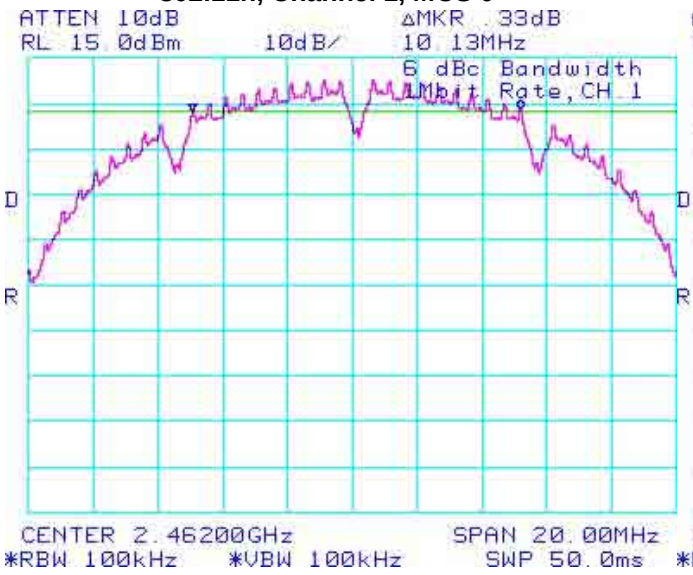


Figure 4-8: 6 dB Bandwidth
802.11n, Channel 6, MCS 0

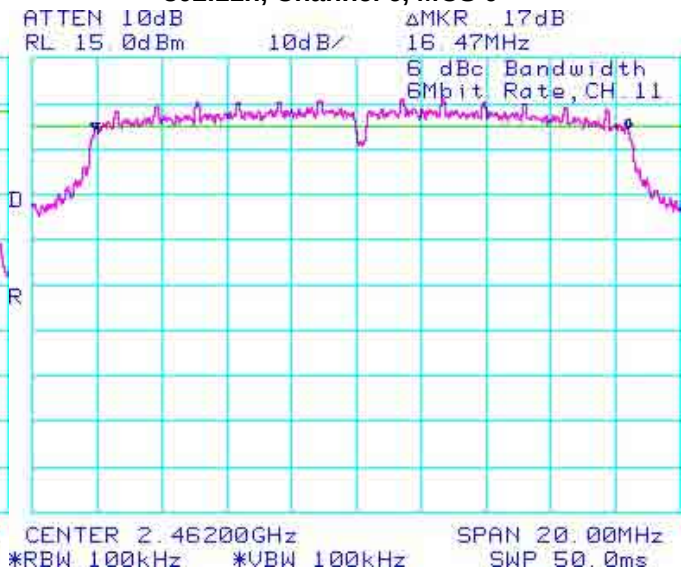


Figure 4-9: 6 dB Bandwidth

802.11n, Channel 11, MCS 0

802.11b/g/n RF Conducted Emission Test Results cont'd

Maximum Conducted Output Power

The EUT met the requirements of the maximum conducted output power of class 1 as per 47 CFR 15.247(b)(3) and RSS-210. Channels 1, 6 and 11 were measured at 1 Mbps, 5.5 Mbps, and 11 Mbps each for 802.11b mode, 6 Mbps, 24 Mbps, and 54 Mbps each for 802.11g mode, and MCS 0, 4 and 7 for 802.11n mode using an Aglient power meter, model N1911A with model N1921A power sensor. A reference offset of 18.4 dB was applied to the power meter reference level for the coaxial cable loss and attenuators in the test circuit.

Channel	Data Rate	Class 2 Limit (W)	Measured Level (dBm)	Measured Level (mW)
1	1 Mbps	< 1.00	17.92	61.94
	5.5 Mbps	< 1.00	17.83	60.67
	11 Mbps	< 1.00	17.83	60.67
	6 Mbps	< 1.00	16.60	45.71
	24 Mbps	< 1.00	15.16	32.81
	54 Mbps	< 1.00	15.19	33.04
	MCS 0	< 1.00	16.59	45.60
	MCS 4	< 1.00	15.08	32.21
	MCS 7	< 1.00	14.82	30.34
6	1 Mbps	< 1.00	18.15	65.31
	5.5 Mbps	< 1.00	18.17	65.61
	11 Mbps	< 1.00	18.10	64.57
	6 Mbps	< 1.00	16.99	50.00
	24 Mbps	< 1.00	15.42	34.83
	54 Mbps	< 1.00	15.28	33.73
	MCS 0	< 1.00	16.80	47.86
	MCS 4	< 1.00	15.44	34.99
	MCS 7	< 1.00	15.05	31.99

802.11b/g/n RF Conducted Emission Test Results cont'd

Channel	Data Rate	Class 2 Limit (W)	Measured Level (dBm)	Measured Level (mW)
11	1 Mbps	< 1.00	18.51	70.96
	5.5 Mbps	< 1.00	18.52	71.12
	11 Mbps	< 1.00	18.54	71.45
	6 Mbps	< 1.00	17.32	53.95
	24 Mbps	< 1.00	15.80	38.02
	54 Mbps	< 1.00	15.77	37.76
	MCS 0	< 1.00	17.15	51.88
	MCS 4	< 1.00	15.68	36.98
	MCS 7	< 1.00	15.30	33.88

802.11b/g/n RF Conducted Emission Test Results cont'd

Band Edge Compliance

The EUT met the requirements of the band edge compliance as per 47 CFR 15.247(c) and RSS-210. Channels 1 and 11 were measured at 1 Mbps, 5.5 Mbps, and 11 Mbps each for 802.11b mode, 6 Mbps, 24 Mbps, and 54 Mbps each for 802.11g mode, and MCS 0, 4 and 7 for 802.11n mode.

Channel	Data Rate	Limit (dBc)	Measured Level (dBc)	Margin (dBc)
1	1 Mbps	< -20	-40.16	-20.16
	5.5 Mbps	< -20	-42.00	-22.00
	11 Mbps	< -20	-41.00	-21.00
	6 Mbps	< -20	-25.33	-5.33
	24 Mbps	< -20	-28.00	-8.00
	54 Mbps	< -20	-28.01	-8.01
	MCS 0	< -20	-24.17	-4.17
	MCS 4	< -20	-26.67	-6.67
	MCS 7	< -20	-28.16	-8.16
11	1 Mbps	< -20	-43.33	-23.33
	5.5 Mbps	< -20	-48.50	-28.50
	11 Mbps	< -20	-48.00	-28.00
	6 Mbps	< -20	-31.66	-11.66
	24 Mbps	< -20	-37.16	-17.16
	54 Mbps	< -20	-39.00	-19.00
	MCS 0	< -20	-30.84	-10.84
	MCS 4	< -20	-37.33	-17.33
	MCS 7	< -20	-38.83	-18.83

See figures 4-10 to 4-15 for the plots of the band edge compliance measurements for Channels 1 and 11, at 1 Mbps each for 802.11b mode, 6 Mbps each for 802.11g mode, and MCS 0 each for 802.11n mode.

802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-10: Band Edge Compliance
802.11b, Channel 1, 1 Mbps

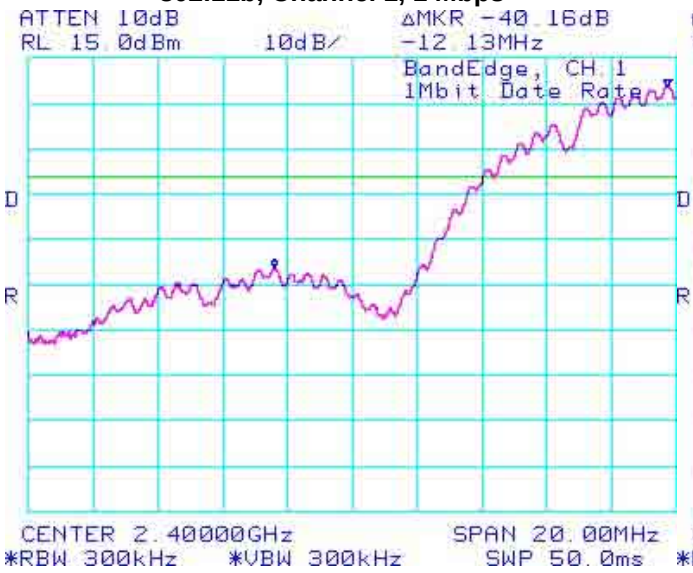


Figure 4-11: Band Edge Compliance
802.11b, Channel 11, 1 Mbps

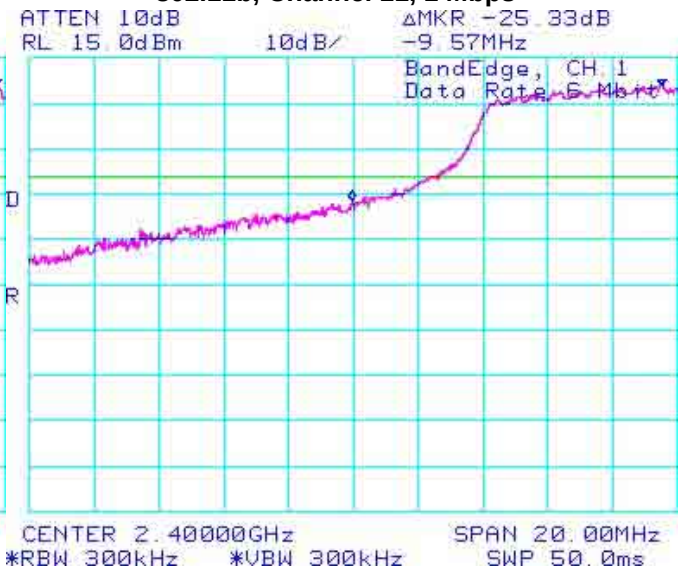


Figure 4-12: Band Edge Compliance
802.11g, Channel 1, 6 Mbps

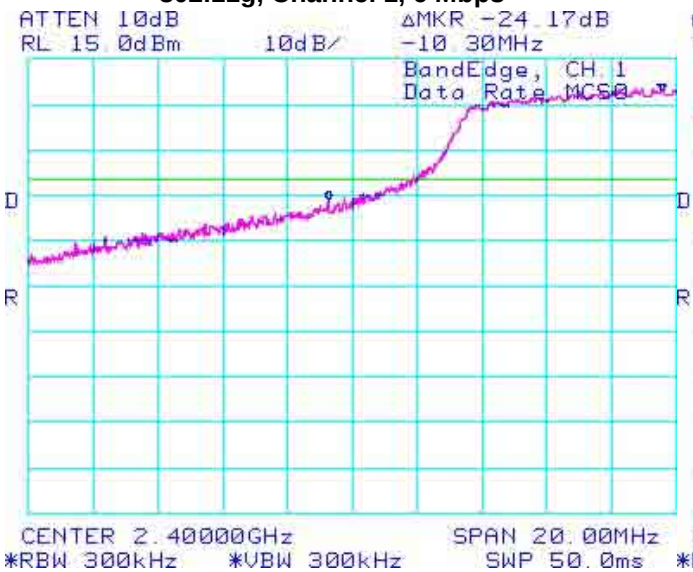
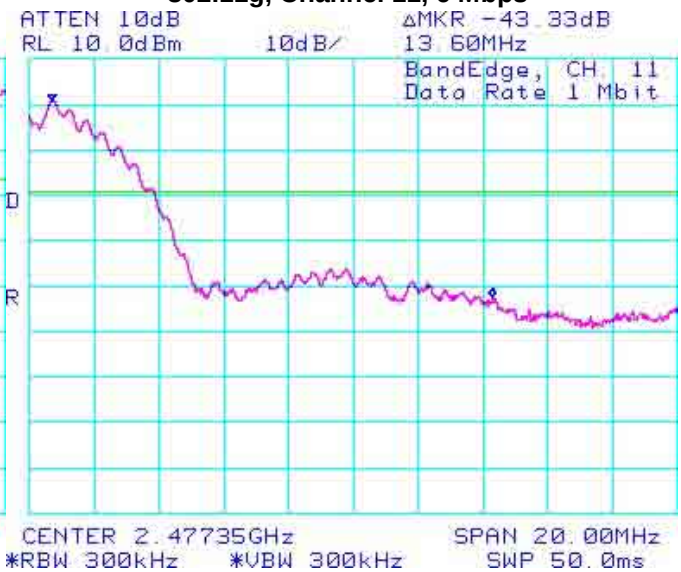


Figure 4-13: Band Edge Compliance
802.11g, Channel 11, 6 Mbps



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-14: Band Edge Compliance
802.11n, Channel 1, MCS 0

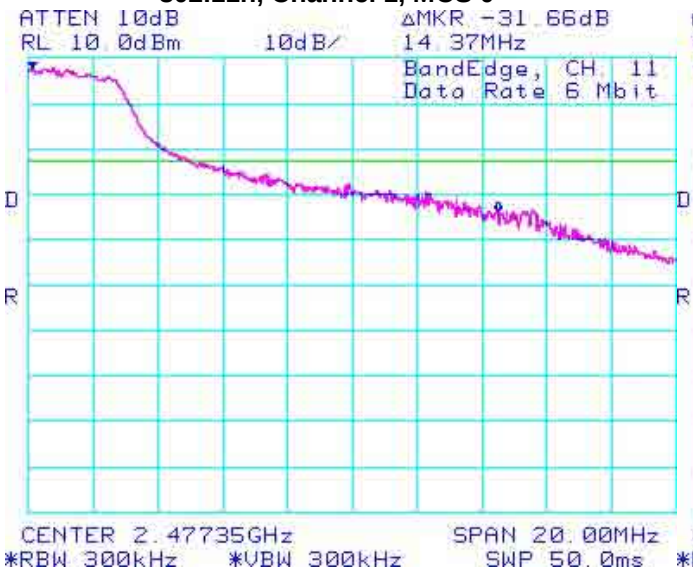


Figure 4-15: Band Edge Compliance
802.11n, Channel 11, MCS 0

802.11b/g/n RF Conducted Emission Test Results cont'd

Peak Power Spectral Density

The EUT met the requirements of the peak power spectral density as per 47 CFR 15.247(d) and RSS-210. Channels 1, 6 and 11 were measured at 1 Mbps, 5.5 Mbps, and 11 Mbps each for 802.11b mode, 6 Mbps, 24 Mbps, and 54 Mbps each for 802.11g mode, and MCS 0, 4, and 7 for 802.11n mode.

Channel	Data Rate	Limit (dBm)	Measured Level (dBm)	Margin (dBm)
1	1 Mbps	< 8.00	-2.00	-10.00
	5.5 Mbps	< 8.00	-3.83	-11.83
	11 Mbps	< 8.00	-3.00	-11.00
	6 Mbps	< 8.00	-6.83	-14.83
	24 Mbps	< 8.00	-7.83	-15.83
	54 Mbps	< 8.00	-8.33	-16.33
	MCS 0	< 8.00	-6.17	-14.17
	MCS 4	< 8.00	-8.17	-16.17
	MCS 7	< 8.00	-9.17	-17.17
6	1 Mbps	< 8.00	-2.33	-10.33
	5.5 Mbps	< 8.00	-4.50	-12.50
	11 Mbps	< 8.00	-3.17	-11.17
	6 Mbps	< 8.00	-6.67	-14.67
	24 Mbps	< 8.00	-7.67	-15.67
	54 Mbps	< 8.00	-8.00	-16.00
	MCS 0	< 8.00	-6.17	-14.17
	MCS 4	< 8.00	-8.17	-16.17
	MCS 7	< 8.00	-8.67	-16.67
11	1 Mbps	< 8.00	-2.00	-10.00
	5.5 Mbps	< 8.00	-3.50	-11.50
	11 Mbps	< 8.00	-2.67	-10.67
	6 Mbps	< 8.00	-6.50	-14.50
	24 Mbps	< 8.00	-7.50	-15.50
	54 Mbps	< 8.00	-8.00	-16.00
	MCS 0	< 8.00	-5.83	-13.83
	MCS 4	< 8.00	-8.17	-16.17
	MCS 7	< 8.00	-8.50	-16.50

802.11b/g/n RF Conducted Emission Test Results cont'd

See figures 4-16 to 4-24 for the plots of the peak power spectral density for Channels 1, 6 and 11, at 1 Mbps each for 802.11b mode, 6 Mbps each for 802.11g mode, and MCS 0 for 802.11n mode.

Figure 4-16: Peak Power Spectral Density
802.11b, Channel 1, 1 Mbps

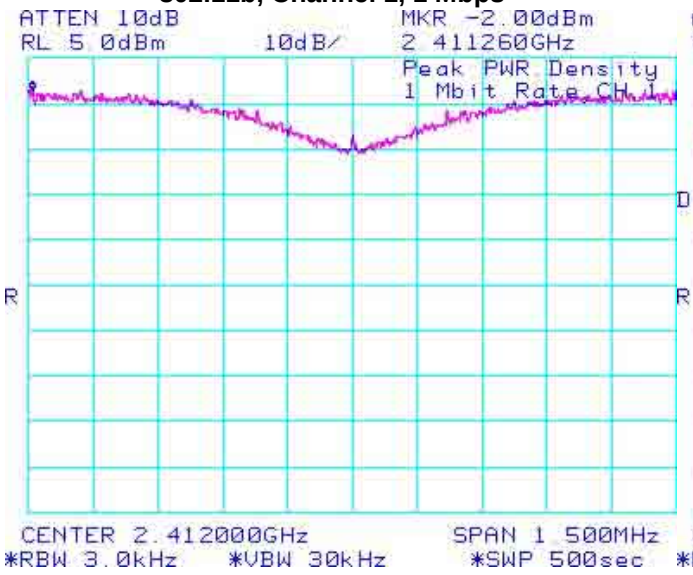


Figure 4-17: Peak Power Spectral Density
802.11b, Channel 6, 1 Mbps

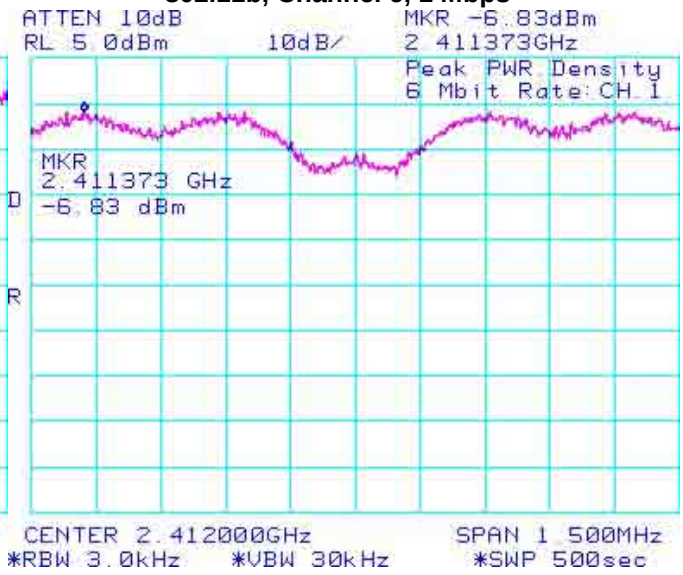
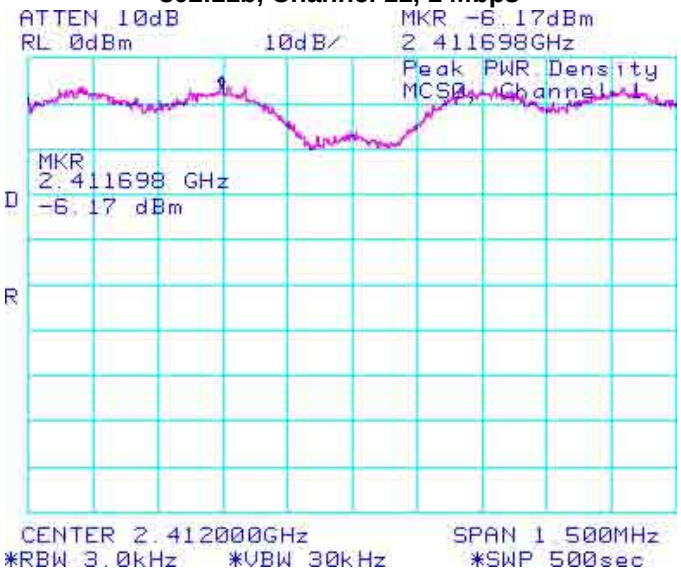


Figure 4-18: Peak Power Spectral Density
802.11b, Channel 11, 1 Mbps



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-19: Peak Power Spectral Density
802.11g, Channel 1, 6 Mbps

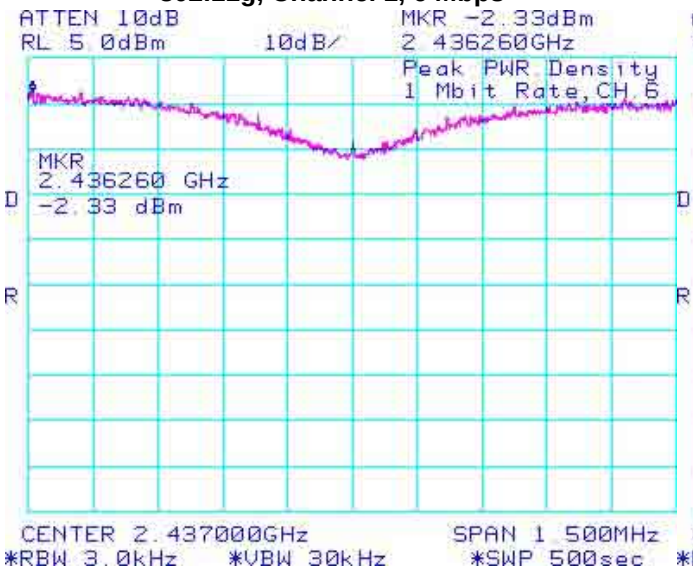


Figure 4-20: Peak Power Spectral Density
802.11g, Channel 6, 6 Mbps

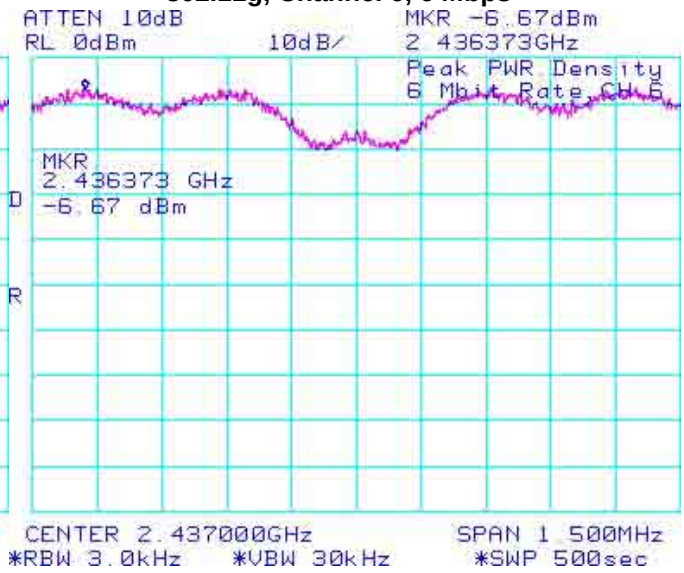
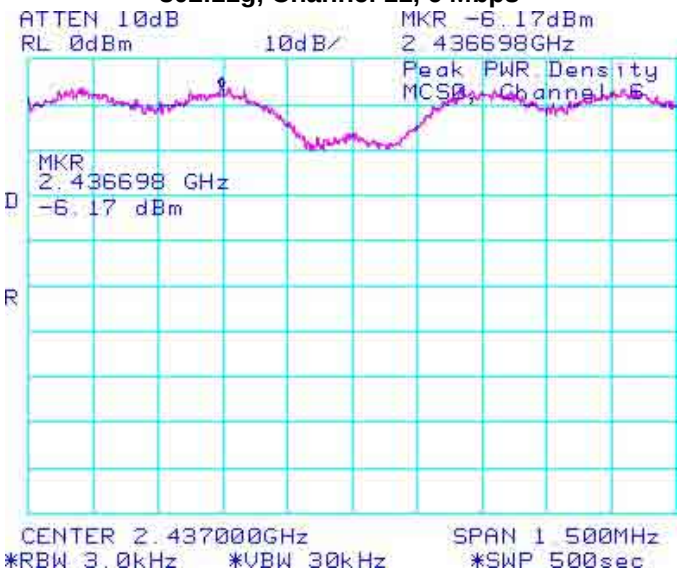


Figure 4-21: Peak Power Spectral Density
802.11g, Channel 11, 6 Mbps



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-22: Peak Power Spectral Density
802.11n, Channel 1, MCS 0

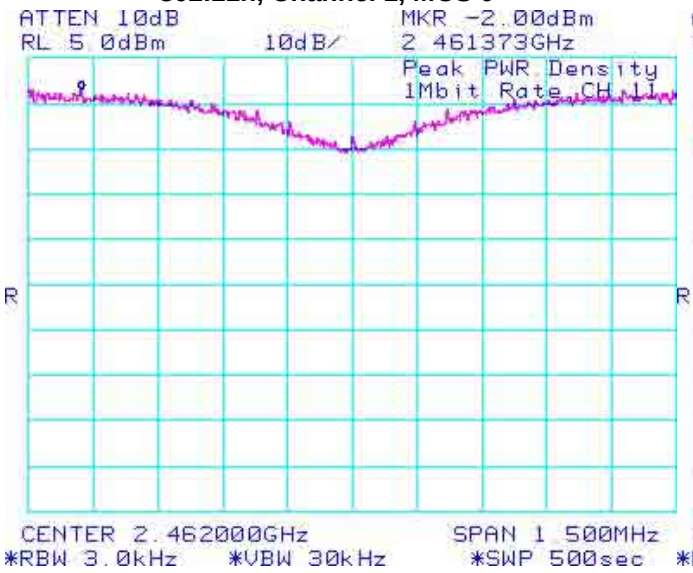


Figure 4-23: Peak Power Spectral Density
802.11n, Channel 6, MCS 0

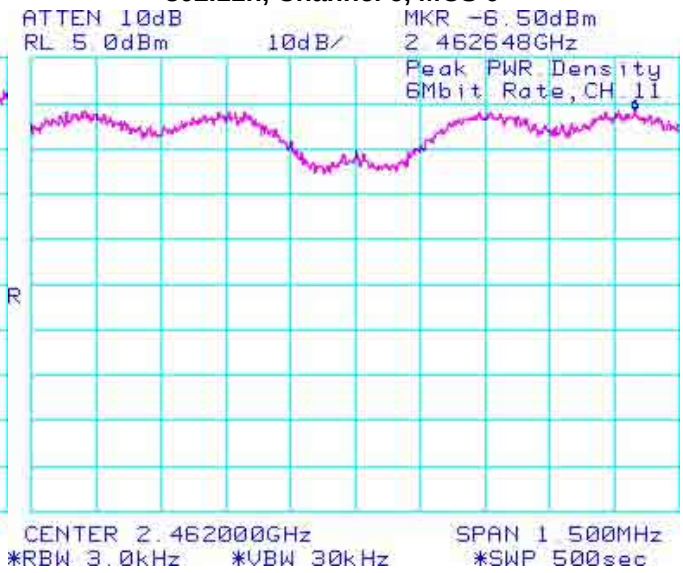
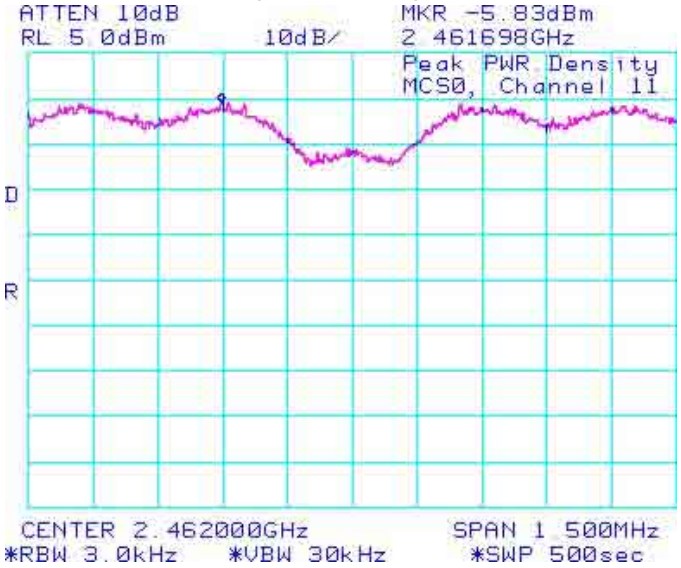


Figure 4-24: Peak Power Spectral Density
802.11n, Channel 11, MCS 0



802.11b/g/n 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. Channels 1, 6 and 11 were measured at 1 Mbps, 5.5 Mbps, and 11 Mbps each for 802.11b mode, 6 Mbps, 24 Mbps, and 54 Mbps each for 802.11g mode, and MCS 0, 4, and 7 for 802.11n mode. Peak power was measured using an Agilent power meter, model N1911A with model N1921A power sensor. A reference offset of 18.4 dB was applied to the power meter reference level for the coaxial cable loss and attenuators in the test circuit.

Channel	Data Rate	Power (dBm)	Max. Measured Level (dBm)	Max. Measured Level from Carrier (dBc)	Limit (dBc)
1	1 Mbps	17.92	-50.5	-68.42	-20
	5.5 Mbps	17.83	-50.67	-68.50	-20
	11 Mbps	17.83	-46.50	-64.33	-20
	6 Mbps	16.60	-45.83	-62.43	-20
	24 Mbps	15.16	-50.60	-65.76	-20
	54 Mbps	15.19	-49.17	-64.36	-20
	MCS 0	16.59	-49.17	-65.76	-20
	MCS 4	15.08	-49.17	-64.25	-20
	MCS 7	14.82	-47.17	-61.99	-20
6	1 Mbps	18.15	-50.50	-68.65	-20
	5.5 Mbps	18.17	-47.67	-65.84	-20
	11 Mbps	18.10	-49.83	-67.93	-20
	6 Mbps	16.99	-49.17	-66.16	-20
	24 Mbps	15.42	-50.17	-65.59	-20
	54 Mbps	15.28	-50.17	-65.45	-20
	MCS 0	16.80	48.00	31.20	-20
	MCS 4	15.44	-50.00	-65.44	-20
	MCS 7	15.05	-50.00	-65.05	-20

802.11b/g/n RF Conducted Emission Test Results cont'd

Channel	Data Rate	Power (dBm)	Max. Measured Level (dBm)	Max. Measured Level from Carrier (dBc)	Limit (dBc)
11	1 Mbps	18.51	-48.67	-67.18	-20
	5.5 Mbps	18.52	-46.83	-65.35	-20
	11 Mbps	18.54	-45.83	-64.37	-20
	6 Mbps	17.32	-50.67	-67.99	-20
	24 Mbps	15.80	-49.83	-65.63	-20
	54 Mbps	15.77	-50.33	-66.10	-20
	MCS 0	17.15	-49.33	-66.48	-20
	MCS 4	15.68	-50.00	-65.68	-20
	MCS 7	15.30	-47.83	-63.13	-20

The emissions were in the NF.

See figures 4-25 to 4-33 for the plots of the spurious RF conducted emissions for Channels 1, 6 and 11, at 1 Mbps each for 802.11b mode, 6 Mbps each for 802.11g mode, and MCS 0 each for 802.11n mode.

802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-25: Spurious Conducted RF Emissions

802.11b, Channel 1, 1 Mbps

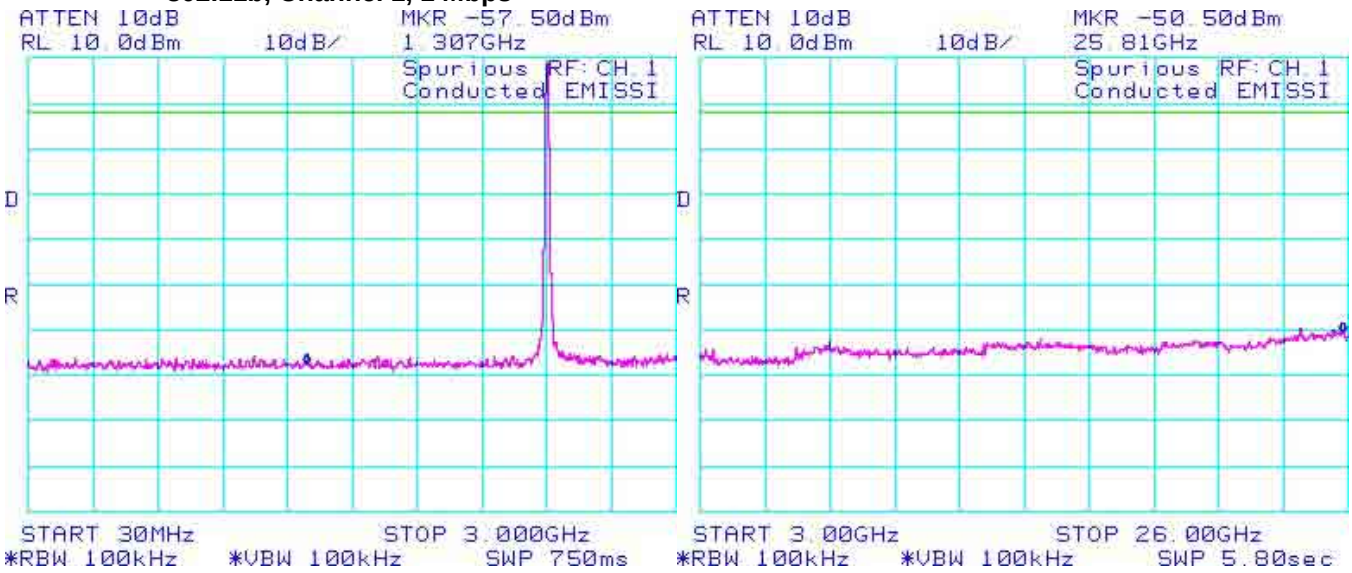
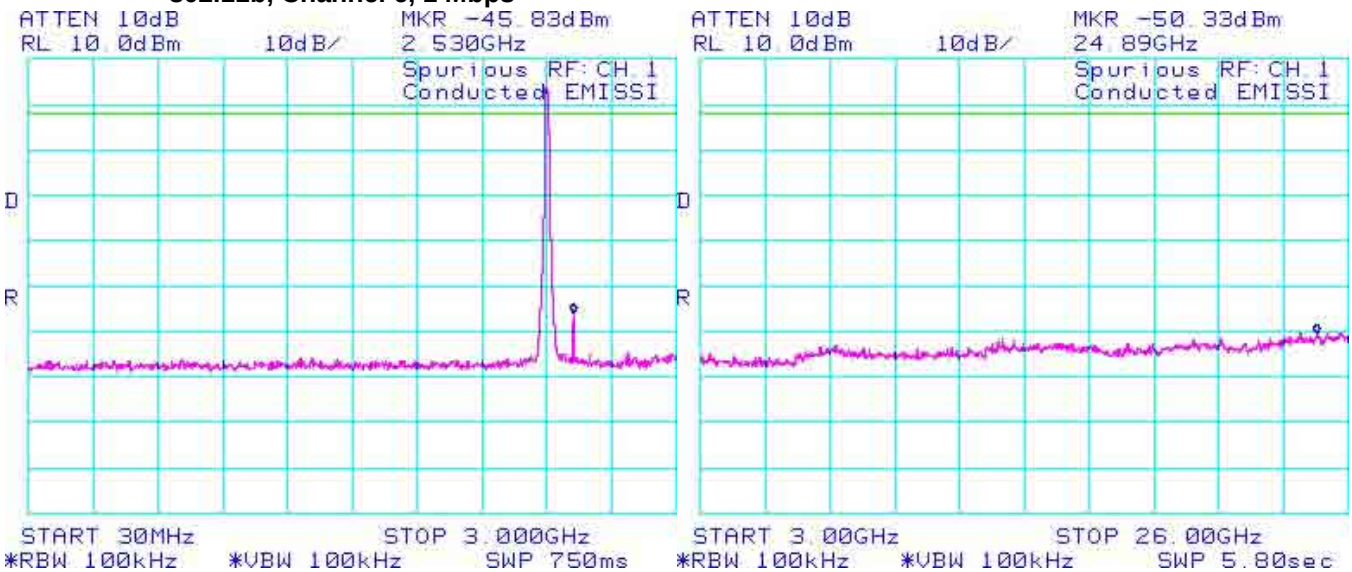


Figure 4-26 : Spurious Conducted RF Emissions

802.11b, Channel 6, 1 Mbps



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-27: Spurious Conducted RF Emissions

802.11b, Channel 11, 1 Mbps

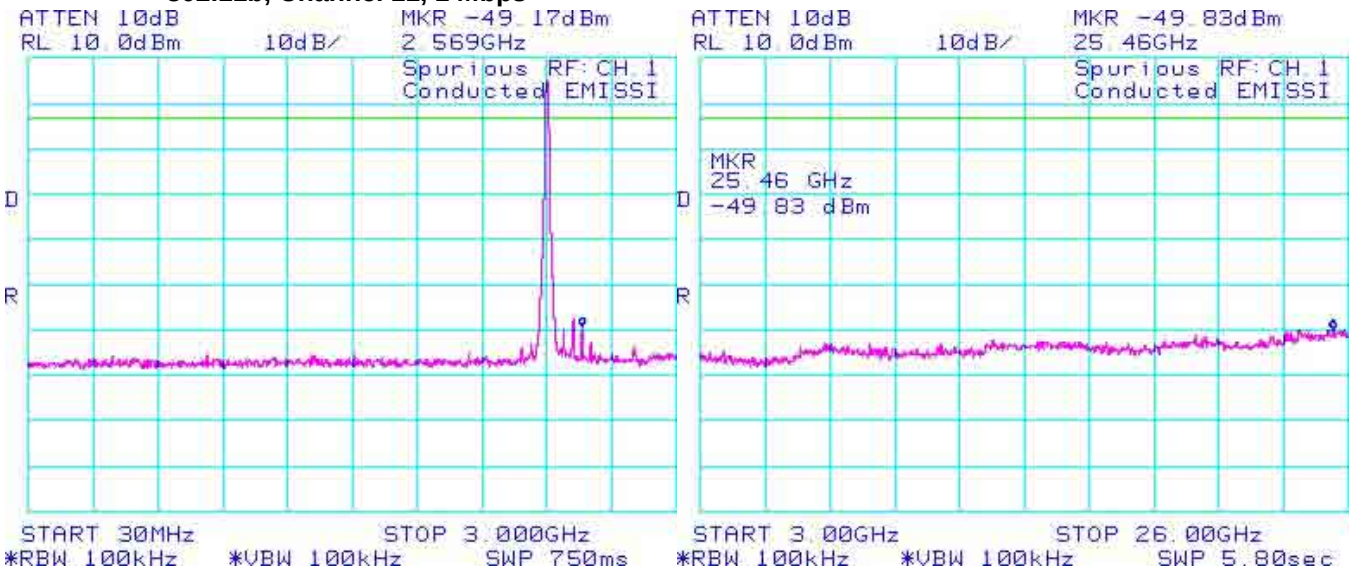
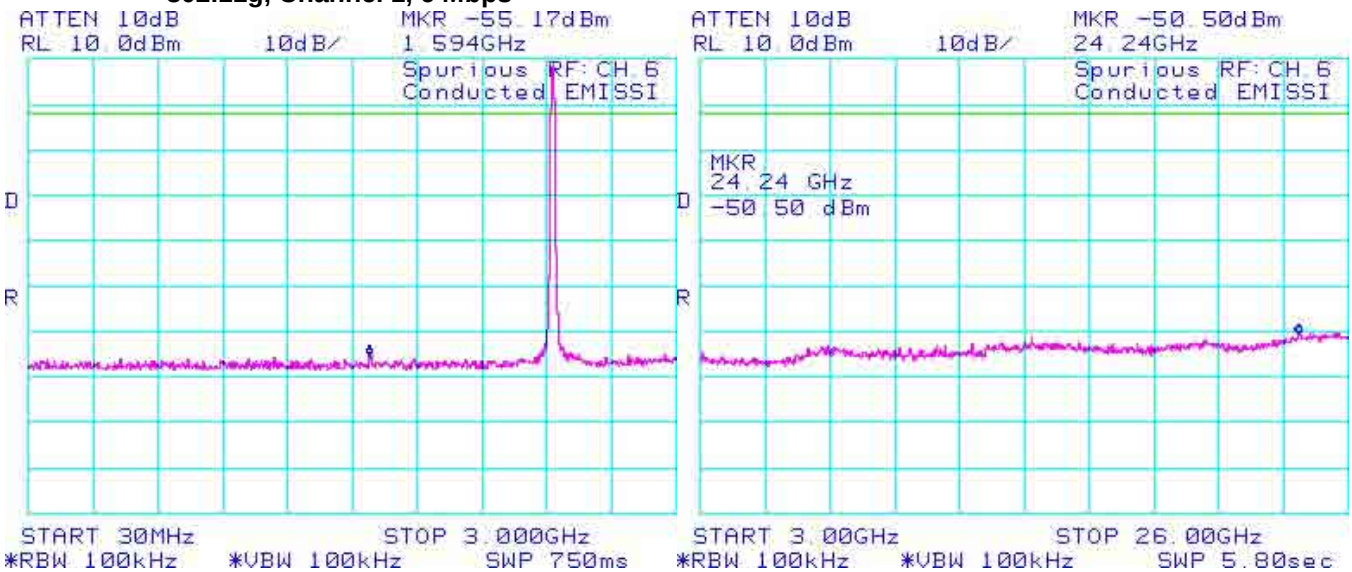


Figure 4-28: Spurious Conducted RF Emissions

802.11g, Channel 1, 6 Mbps



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-29: Spurious Conducted RF Emissions
802.11g, Channel 6, 6 Mbps

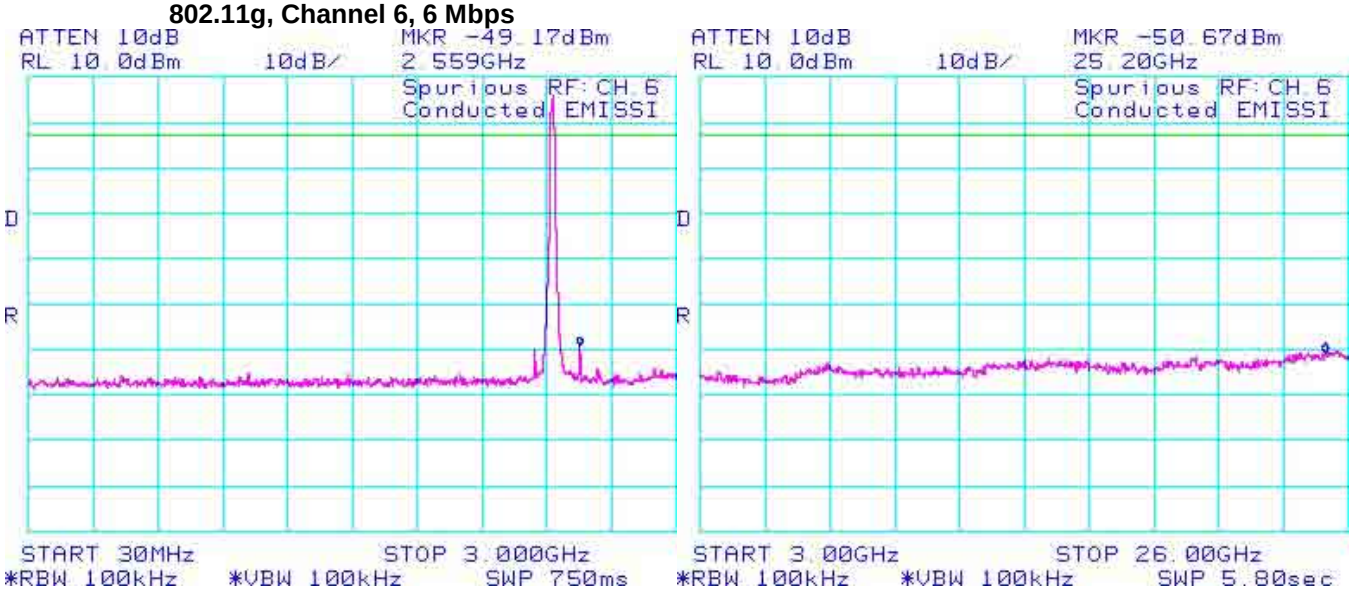
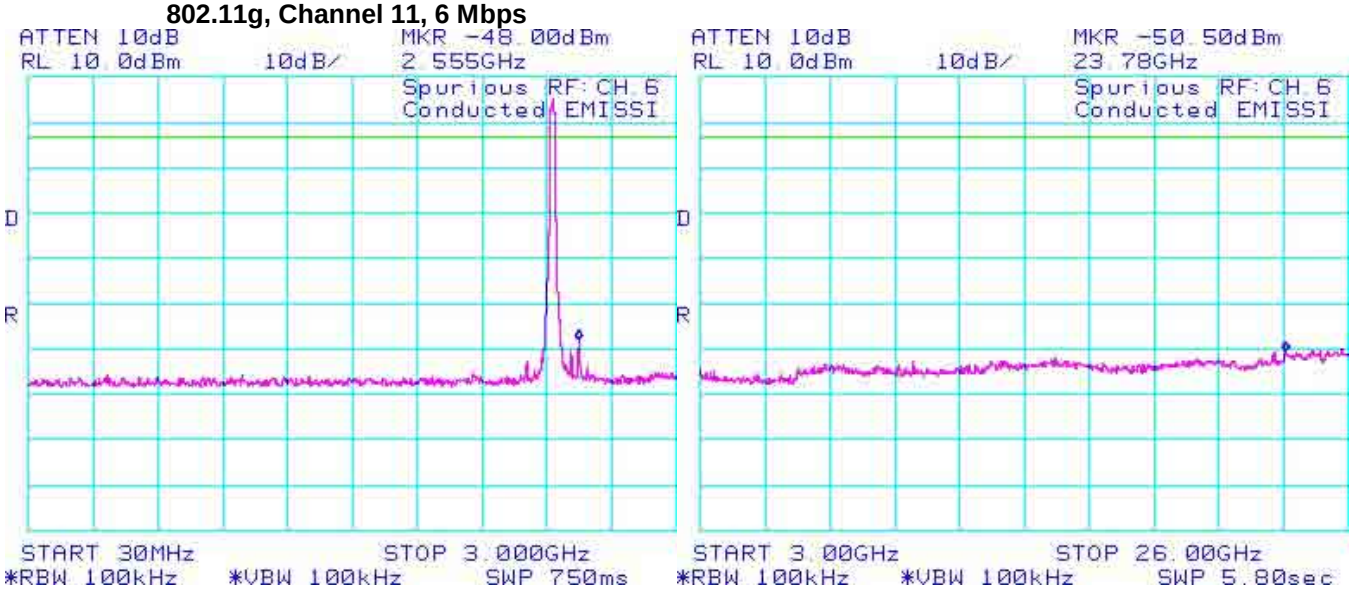


Figure 4-30: Spurious Conducted RF Emissions
802.11g, Channel 11, 6 Mbps



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-31: Spurious Conducted RF Emissions
802.11n, Channel 1, MCS 0

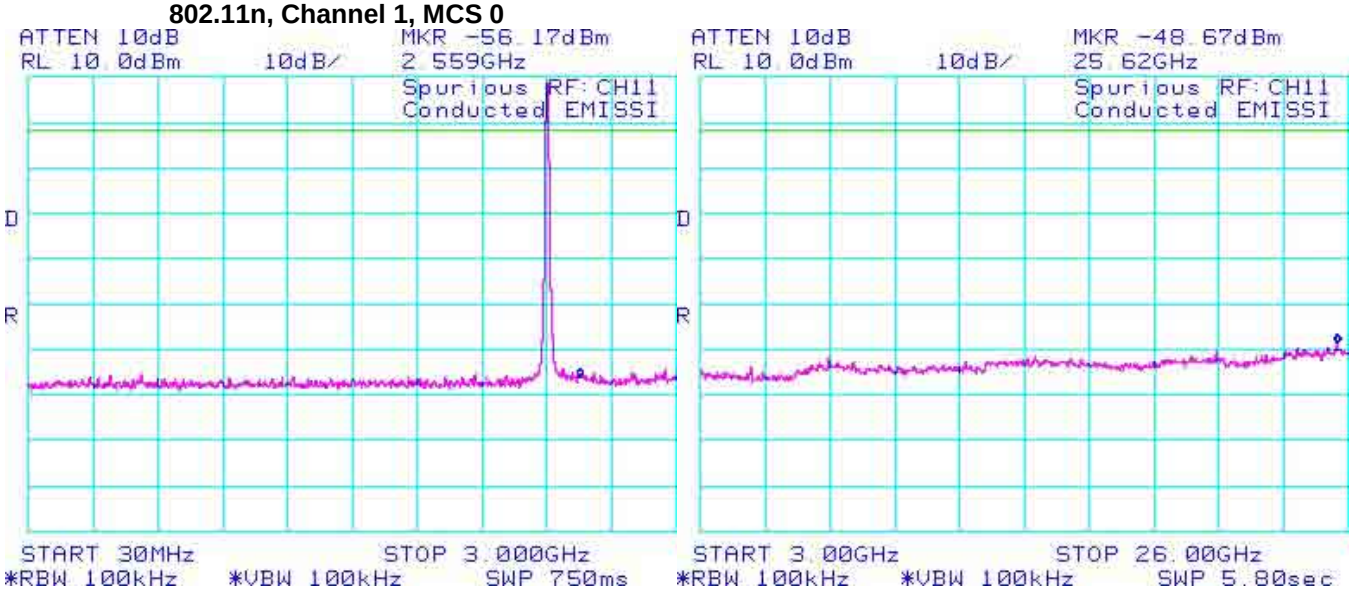
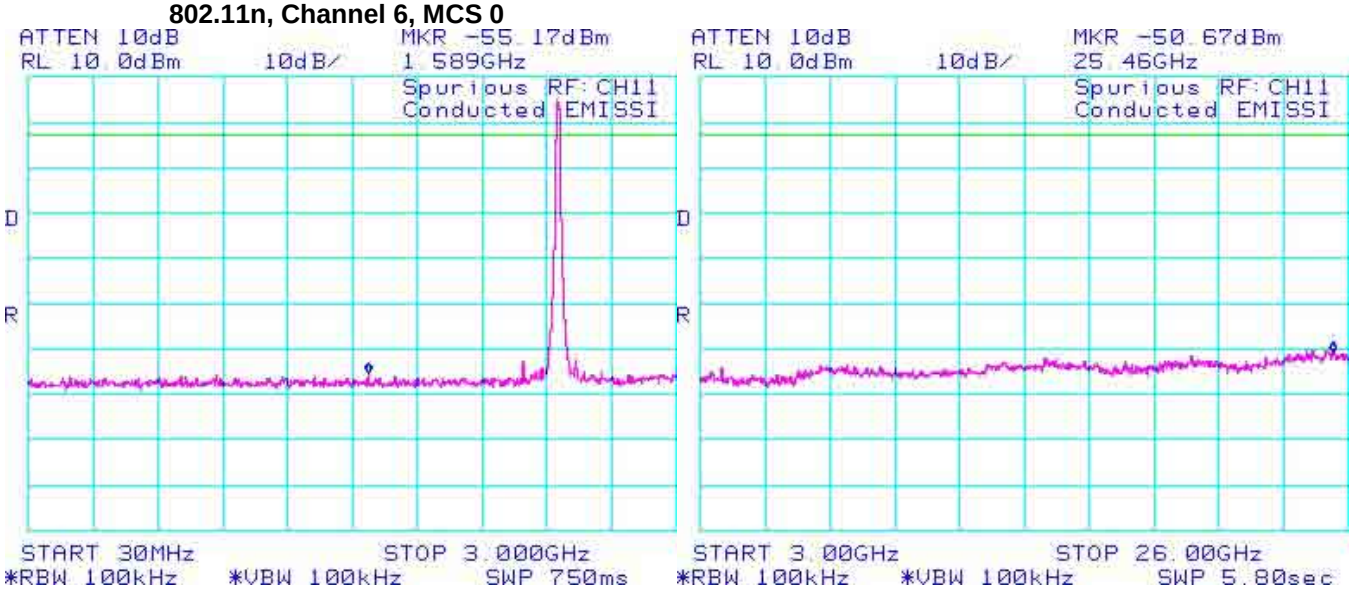


Figure 4-32: Spurious Conducted RF Emissions
802.11n, Channel 6, MCS 0



802.11b/g/n RF Conducted Emission Test Results cont'd

Figure 4-33: Spurious Conducted RF Emissions
802.11n, Channel 11, MCS 0