EMI Test Report

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

A division of Research In Motion Limited

REPORT NO.: RTS-6045-1306-12

PRODUCT MODEL NO.: RFU81UW
TYPE NAME: BlackBerry® smartphone
FCC ID: L6ARFU80UW
IC: 2503A-RFU80UW

DATE: June 12, 2013

RTS is accredited
according to
EN ISO/IEC 17025 by:

592

Statement of Performance:

The BlackBerry® smartphone, model RFU81UW, part number CER-56900-001 Rev1-x01-00, and its accessories perform within the requirements of the test standards when configured and operated under RIM's operation instructions.

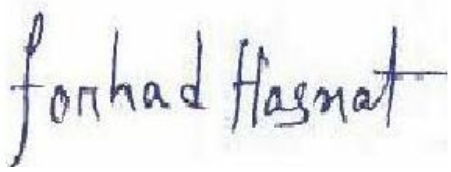
Declaration:

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

Reviewed by:



Forhad Hasnat
Regulatory Compliance Specialist

Reviewed and Approved by:

Masud S. Attayi, P.Eng.
Manager, Regulatory Compliance

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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, October, 2012
- FCC CFR 47 Part 15, Subpart E, October, 2012
- 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) Test Report 1-6234_13-01-03-A
2) Test Report 1-6234_13-01-04

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 May 28 to June 10, 2013.

The sample EUT included:

SAMPLE	MODEL	CER NUMBER	PIN	SOFTWARE
1	RFU81UW	CER-56900-001 Rev1-x01-00	2ADAED7E	127.0.1.2678
2	RFU81UW	CER-56900-001 Rev1-x01-00	2ADAED31	MFI-54932-012

Bluetooth RF conducted measurements were performed on samples 1.
802.11 b/g/n RF conducted measurements were performed on sample 2.

D. Support Equipment Used for the Testing of the EUT

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

E. Test Results Chart

SPECIFICATION		TEST TYPE	Meets Requirements	TEST DATA
FCC CFR 47	IC			APPENDIX
Part 15.209 Part 15.247	RSS-210, A8.5 RSS-GEN, 7.2.2	BT/ Radiated Spurious Emissions	Pass	TR 1-6234_13-01-03-A
Part 15.209 Part 15.247	RSS-210, A8.5 RSS-GEN, 7.2.2	BT/BLE Radiated Band Edge Compliance	Pass	TR 1-6234_13-01-03-A
Part 15.209 Part 15.247	RSS-210, A8.5 RSS-GEN, 7.2.2	802.11b/g/n Radiated Spurious Emissions	Pass	TR 1-6234_13-01-04
Part 15.209 Part 15.247	RSS-210 RSS-GEN, 7.2.2	802.11b/g/n Radiated Band Edge Compliance	Pass	TR 1-6234_13-01-04
Part 15.247(a)	RSS-210 A8.1(a)	BT, 20 dB Bandwidth	Pass	1
Part 15.247(a)	RSS-210 A8.1(b)	BT, Carrier Frequency Separation	Pass	1
Part 15.247(a)	RSS-210 A8.1(d)	BT, Number of Hopping Frequencies	Pass	1
Part 15.247(a)	RSS-210 A8.1(d)	BT, Time of Occupancy (Dwell Time)	Pass	1
Part 15.247(b)	RSS-210 A8.4(4)	BT, Maximum Peak Conducted Output Power	Pass	1
Part 15.247(d)	RSS-210, A8.5	BT, Band-Edge Compliance of RF Conducted Emissions	Pass	1
Part 15.247(d)	RSS-210, A8.5	BT, Spurious RF Conducted Emissions	Pass	1

Test Results Chart cont'd

SPECIFICATION		TEST TYPE	Meets Requirements	TEST DATA
FCC CFR 47	IC			APPENDIX
Part 15.247(a)	RSS-210, A8.2(a)	802.11b/g/n, 6 dB Bandwidth	Pass	2
Part 15.247(b)	RSS-210, A8.4(4)	802.11b/g/n, Maximum Conducted Output Power	Pass	2
Part 15.247(b)	RSS-210, A8.5	802.11b/g/n, Band-Edge	Pass	2
Part 15.247(e)	RSS-210, A8.2(b)	802.11b/g/n, Peak Power Spectral Density	Pass	2
Part 15.247(d)	RSS-210, A8.5	802.11b/g/n, Spurious RF Conducted Emissions	Pass	2

F. Summary of Results

1) i) 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 0.918 MHz for channels 78 in normal data rate mode and 1.315 MHz for channel 39 in EDR mode.
See APPENDIX 1 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 1 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 1 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 1 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 6.30 dBm (0.0043 W) for Channel 78 in normal data rate mode and 5.30 dBm (0.00339 W) for channels 0, 39 and 78 in EDR mode.
See APPENDIX 1 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 1 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 1 for the test data.

2) 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 10.48 MHz for channel 1 in 802.11b mode, 16.44 MHz for channels 1 and 6 in 802.11g mode, and 17.57 MHz for channel 1 in 802.11n mode.
See APPENDIX 2 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 17.74 dBm (59.43 mW) for channel 6 in 802.11b 15.85 (38.02 mW) for channel 6 in 802.11g and 15.65dBm (36.73mW) for channel 11 in 802.11n mode.
See APPENDIX 2 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 2 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 2 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 2 for the test data.

G. Compliance Test Equipment Used

UNIT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL DUE DATE (YY MM DD)	USE
DC Power Supply	HP	6632B	US37472178	13-09-25	RF Conducted Emissions
Environment Monitor	Omega	iTHX-SD	0340060	13-10-30	RF Conducted Emissions
Environmental Chamber	Test Equity	107	0900246	N/R	Frequency Stability
Bluetooth Tester	Rohde & Schwarz	CBT	119549	13-12-04	RF Conducted Emissions
Power Meter	Agilent	N1911A	MY45100951	13-08-16	RF Conducted / Frequency Stability
Power Sensor	Agilent	N1921A	MY45241383	13-09-11	RF Conducted / Frequency Stability
Spectrum Analyzer	Rohde & Schwarz	FSV	101820	13-11-28	RF Conducted Emissions
Spectrum Analyzer	Rohde & Schwarz	FSP	100884	13-11-22	RF Conducted Emissions
EMI Test Receiver	Rohde & Schwarz	ESU 40	100162	13-11-30	Conducted/Radiated Emissions

H. Test Automation Software Used

N/A

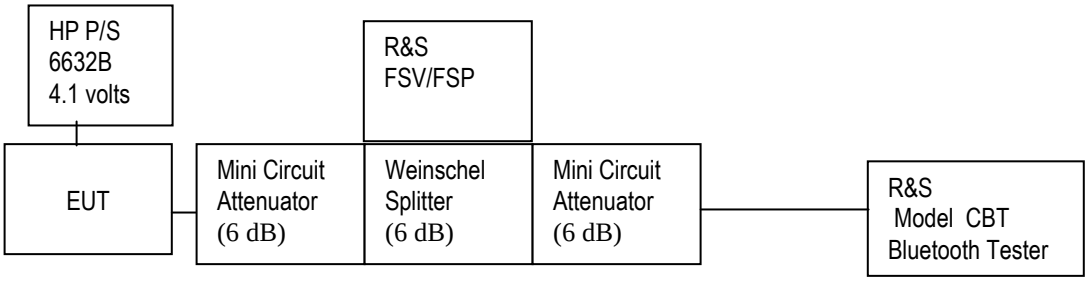
APPENDIX 1 – BLUETOOTH CONDUCTED EMISSIONS TEST DATA/PLOTS

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 Berkin Can.

Date of test: May 29, 2013

Test Setup Diagram



UNIT	MANUFACTURER	MODEL	SERIAL NUMBER
Attenuator 1	Mini-Circuits	BW-S6W2+	0647
Attenuator 2	Mini-Circuits	BW-S6W2+	0648
Attenuator 3	Mini-Circuits	BW-S20-2W263+	1234
Splitter 1	Weinschel	1515	MES 92

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: 25 ºC
Relative Humidity: 42 %

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	0.915
39	≤1.0	0.915
78	≤1.0	**0.918**

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

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

Figure 1-2: 20 dB Bandwidth
Single freq., Static PBRS, DH5

Bluetooth RF Conducted Emission Test Results cont'd

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

Using Pattern type "Static PBRS" and packet type "2-DH5" during the measurements.

Bluetooth Channel	Limit (MHz)	Measured Level (MHz)
0	≤1.5	1.310
39	≤1.5	1.313
78	≤1.5	1.291

See figures 1-4 to 1-6 for the plots of the 20 dB bandwidth measurements.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-4: 20 dB Bandwidth
Single freq., Static PBRS, 2-DH5

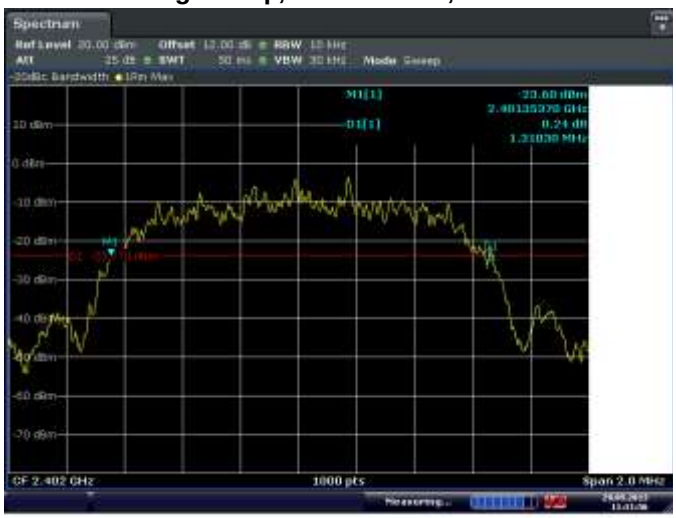


Figure 1-5: 20 dB Bandwidth
Single freq., Static PBRS, 2-DH5

Figure 1-6: 20 dB Bandwidth
Single freq., Static PBRS, 2-DH5

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

Bluetooth Channel	Limit (MHz)	Measured Level (MHz)
0	≤1.5	1.306
39	≤1.5	**1.315**
78	≤1.5	1.294

See figures 1-7 to 1-9 for the plots of the 20 dB bandwidth measurements.

Figure 1-7: 20 dB Bandwidth
Single freq., Static PBRS, 3-DH5

Figure 1-8: 20 dB Bandwidth
Single freq., Static PBRS, 3-DH5

Figure 1-9: 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 1-10 for the plot of the Carrier Frequency Separation measurement.

Figure 1-10: Carrier Frequency Separation, Freq. Hopping, Static PBRS, DH5, Channels 38 to 39

Date: 29.MAY.2013 11:48:45

Bluetooth RF Conducted Emission Test Results cont'd

Using Pattern type "Static PBRS" and packet type "2-DH5" during the measurements.

Bluetooth Channels	Limit (MHz)	Measured Level (MHz)
38 to 39	≥ 0.025 or 20 dB bandwidth	0.999

See figure 1-11 for the plot of the Carrier Frequency Separation measurement.

Figure 1-11: Carrier Frequency Separation, Freq. Hopping, Static PBRS, 2-DH5, Channels 38 to 39

Date: 29.MAY.2013 11:51:30

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	0.997

See figure 1-12 for the plot of the Carrier Frequency Separation measurement.

Figure 1-12: 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 1-13 to 1-16 for the plots of the number of hopping frequencies.

Figure 1-13: Number of Hopping Frequencies
Static PBRS, DH5

Figure 1-14: Number of Hopping Frequencies
Static PBRS, DH5

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-15: Number of Hopping Frequencies Static PBRS, DH5

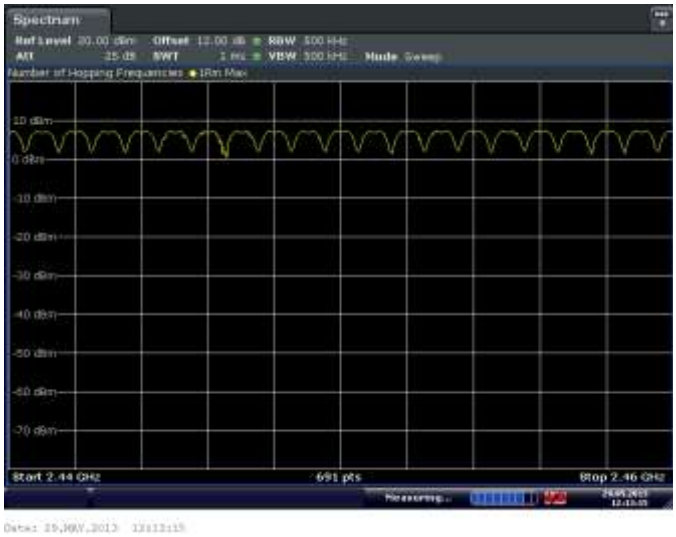


Figure 1-16: Number of Hopping Frequencies Static PBRS, DH5

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	0.4070	0.407 x 320.0 = 130.24	400	269.76
39	DH1	0.4070	0.407 x 320.0 = 130.24	400	269.76
78	DH1	0.4090	0.409 x 320.0 = 130.88	400	269.12
0	DH3	1.6650	1.665 x 159.9 = 266.23	400	133.77
39	DH3	1.6570	1.657 x 159.9 = 264.95	400	135.05
78	DH3	1.6610	1.661 x 159.9 = 265.59	400	134.41
0	DH5	2.9200	2.92 x 106.8 = 311.86	400	88.14
39	DH5	2.8990	2.899 x 106.8 = 309.61	400	90.39
78	DH5	2.9070	2.907 x 106.8 = 310.47	400	89.53

See figures 1-17 to 1-25 for the plots of the dwell time.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-17: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH1

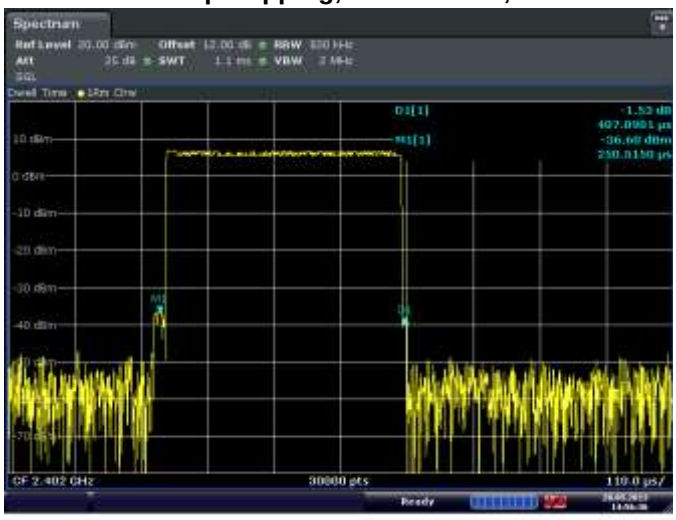
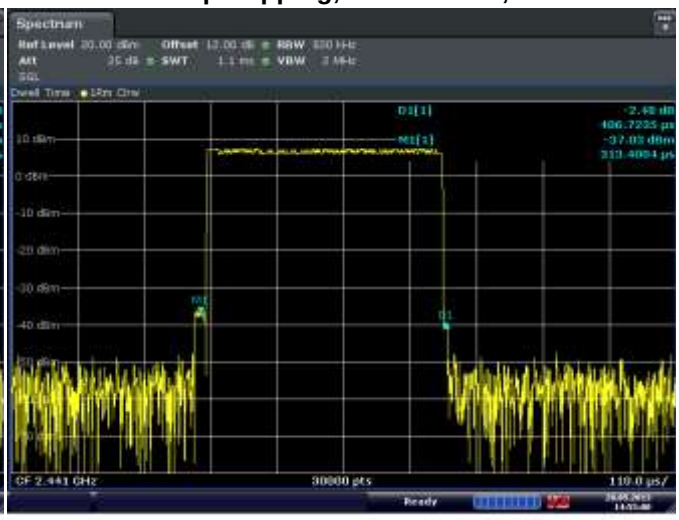


Figure 1-18: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH1



Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-19: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH1

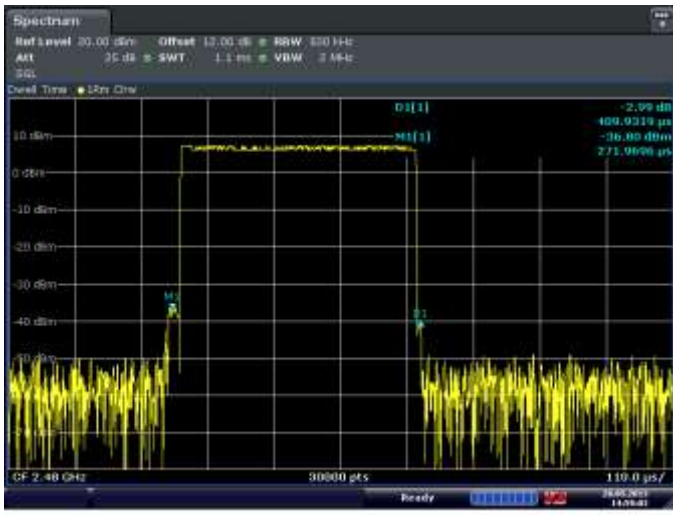


Figure 1-20: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH3

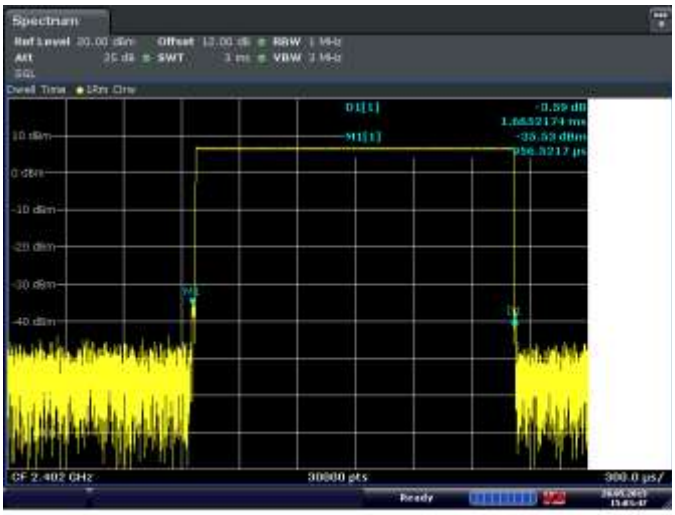


Figure 1-21: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH3

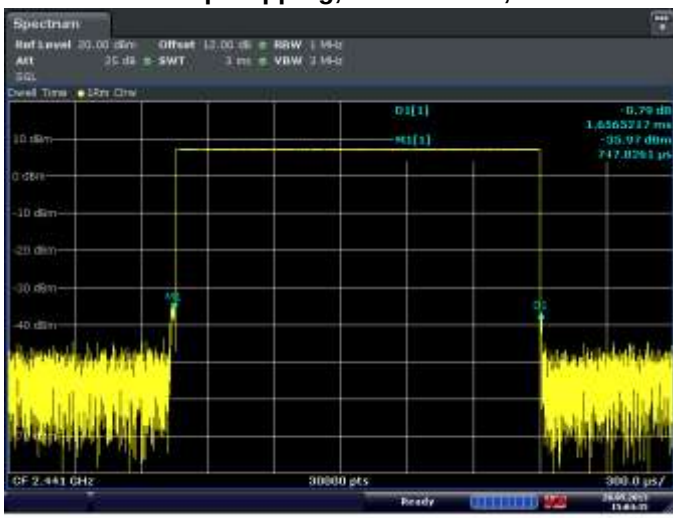
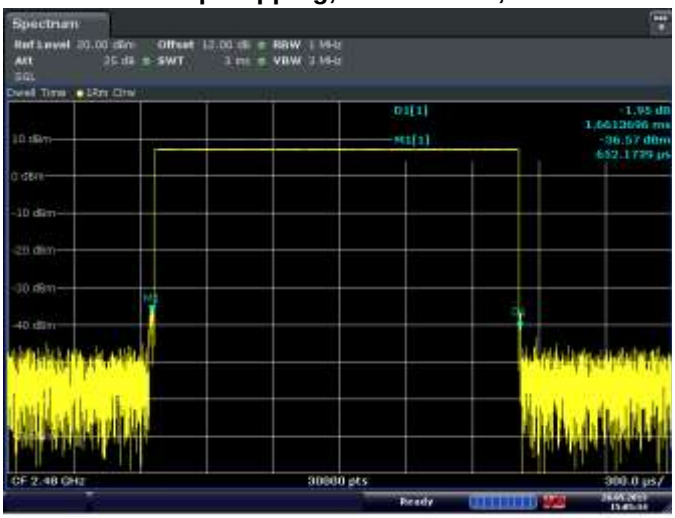


Figure 1-22: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH3



Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-23: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH5

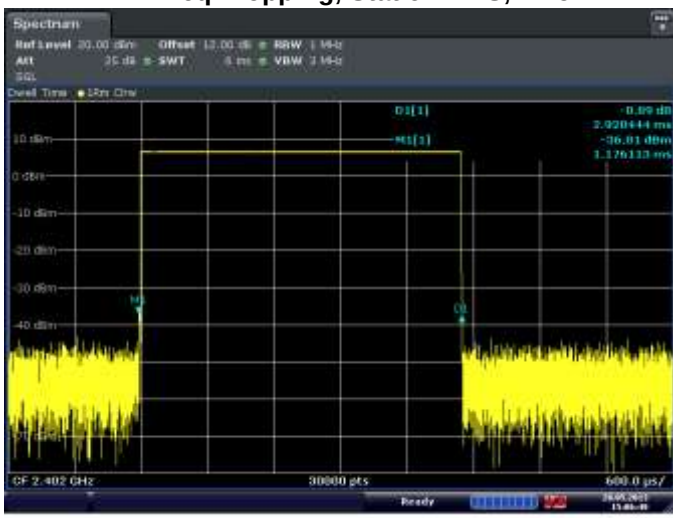


Figure 1-24: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH5

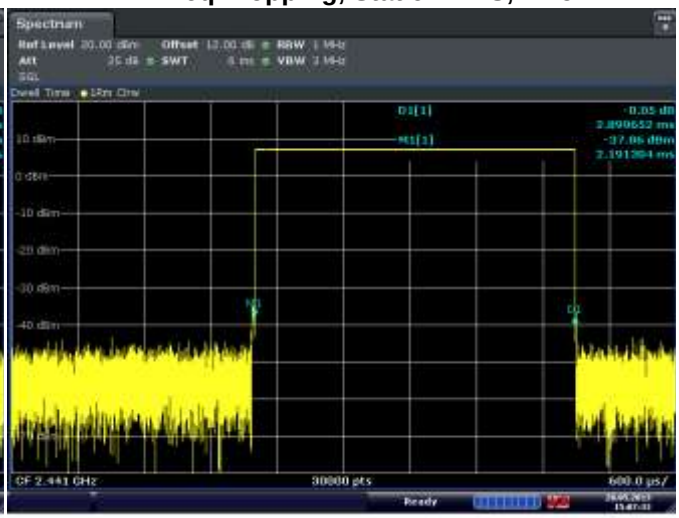
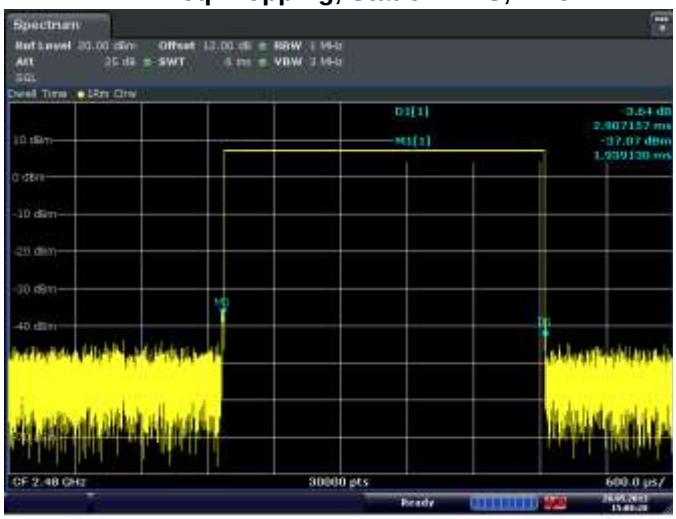


Figure 1-25: Time of Occupancy (Dwell Time) Freq. Hopping, Static PBRS, DH5



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	6.20	0.00417	0.0 to 20.0
39	6.20	0.00417	0.0 to 20.0
78	**6.30**	**0.00427**	0.0 to 20.0

Using Pattern type "Static PBRS" and packet type "2-DH5" during the measurements.

Bluetooth Channel	Measured Level (dBm)	Measured Level (W)	Class 1 Limit (dBm)
0	**5.30**	**0.00339**	0.0 to 20.0
39	**5.30**	**0.00339**	0.0 to 20.0
78	**5.30**	**0.00339**	0.0 to 20.0

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	4.80	0.00302	0.0 to 20.0
39	4.90	0.00309	0.0 to 20.0
78	4.80	0.00302	0.0 to 20.0

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	-58.72	-20	-38.72
78	Single Frequency	-56.5	-20	-36.50
0	Hopping	-60.52	-20	-40.52
78	Hopping	-55.12	-20	-35.12

See figures 1-35 to 1-38 for the plots of the band edge compliance measurements.

Figure 1-35: Band Edge Compliance
Single Freq., Static PBRS, DH5

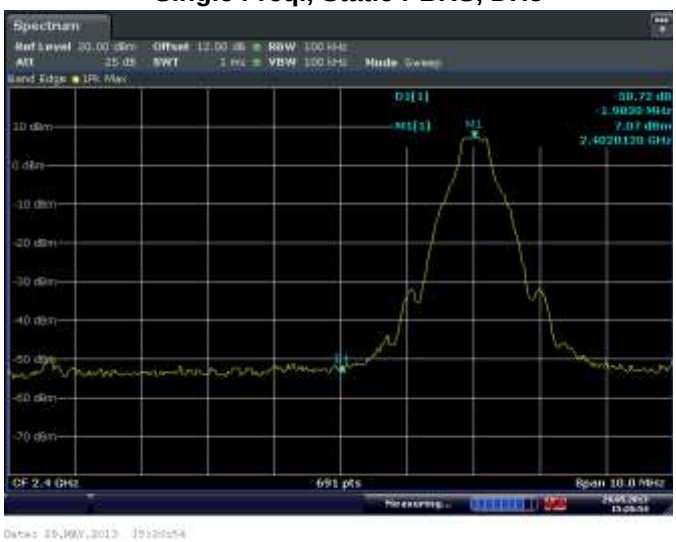


Figure 1-36: Band Edge Compliance
Single Freq., Static PBRS, DH5

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-37: Band Edge Compliance Freq. Hopping, Static PBRS, DH5

Figure 1-38: Band Edge Compliance Freq. Hopping, Static PBRS, DH5

Using pattern type "Static PBRS" and packet type "2-DH5" during the measurements.

Bluetooth Channel	Operating Mode	Measured Level (dBc)	Limit (dBc)	Margin (dB)
0	Single Frequency	-50.83	-20	-30.83
78	Single Frequency	-55.3	-20	-35.30
0	Hopping	-52.22	-20	-32.22
78	Hopping	-55.31	-20	-35.31

See figures 1-39 to 1-42 for the plots of the band edge compliance measurements.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-39: Band Edge Compliance
Single Freq., Static PBRS, 2-DH5

Figure 1-40: Band Edge Compliance
Single Freq., Static PBRS, 2-DH5

Figure 1-41: Band Edge Compliance
Freq. Hopping, Static PBRS, 2-DH5

Figure 1-42: Band Edge Compliance
Freq. Hopping, Static PBRS, 2-DH5

Bluetooth RF Conducted Emission Test Results cont'd

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	-51.65	-20	-31.65
78	Single Frequency	-51.69	-20	-31.69
0	Hopping	-53.78	-20	-33.78
78	Hopping	-56.25	-20	-36.25

See figures 1-43 to 1-46 for the plots of the band edge compliance measurements.

Figure 1-43: Band Edge Compliance
Single Freq., Static PBRS, 3-DH5

Figure 1-44: Band Edge Compliance
Single Freq., Static PBRS, 3-DH5

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-45: Band Edge Compliance
Freq. Hopping, Static PBRS, 3-DH5

Figure 1-46: 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	6.20	-40.29	-46.49	-20.00
39	6.20	-40.90	-47.10	-20.00
78	6.30	-37.03	-43.33	-20.00
Hopping mode	6.20	-38.94	-45.14	-20.00

See figures 1-47 to 1-50 for the plots of the spurious RF conducted emissions.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-47: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5,

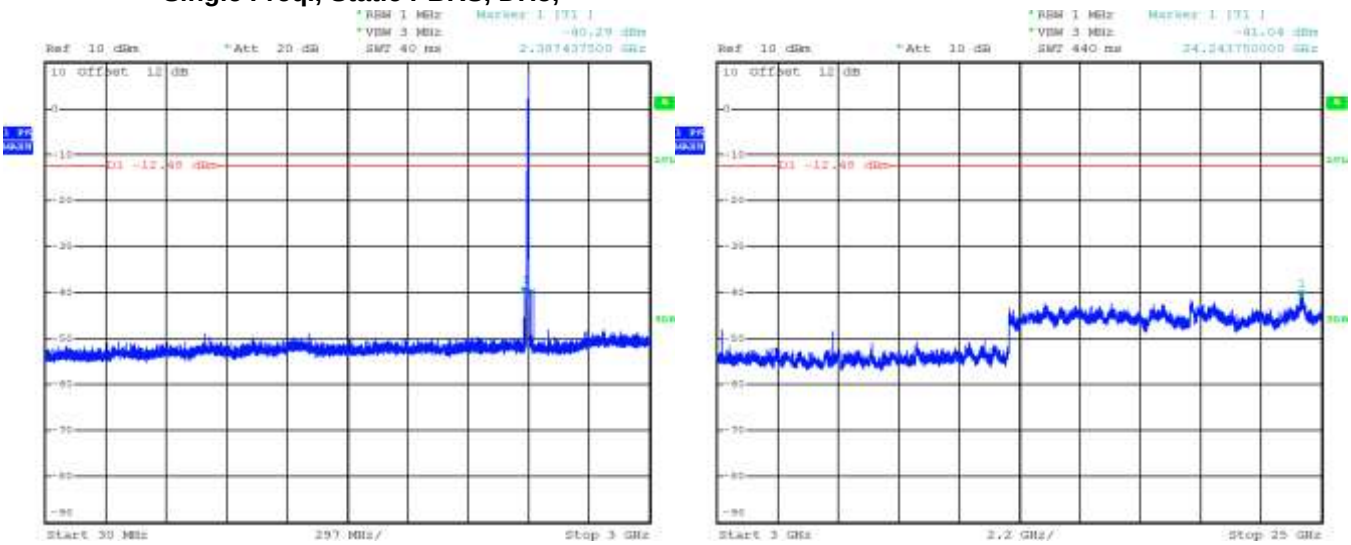
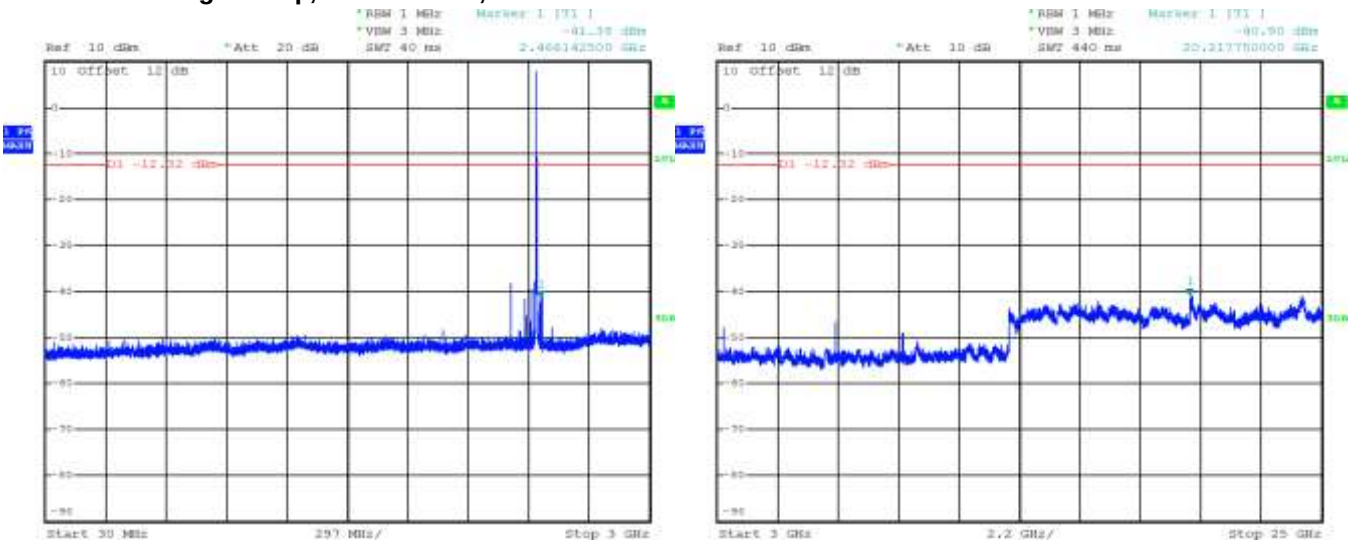


Figure 1-48: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-49: Spurious RF Conducted Emissions
Single Freq., Static PBRS, DH5

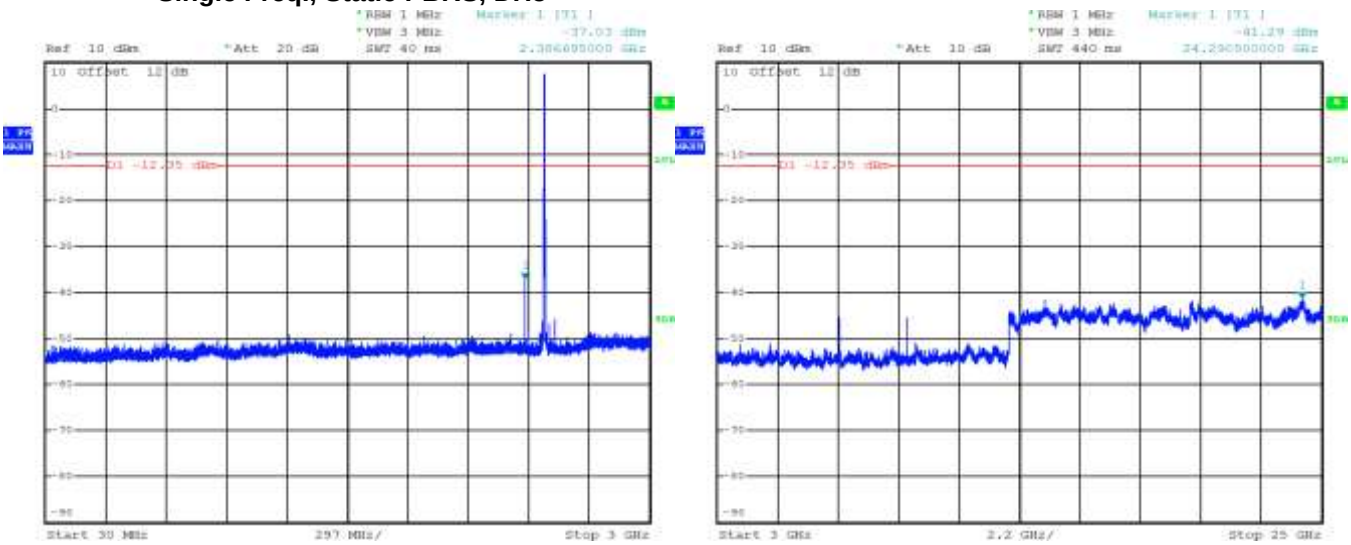
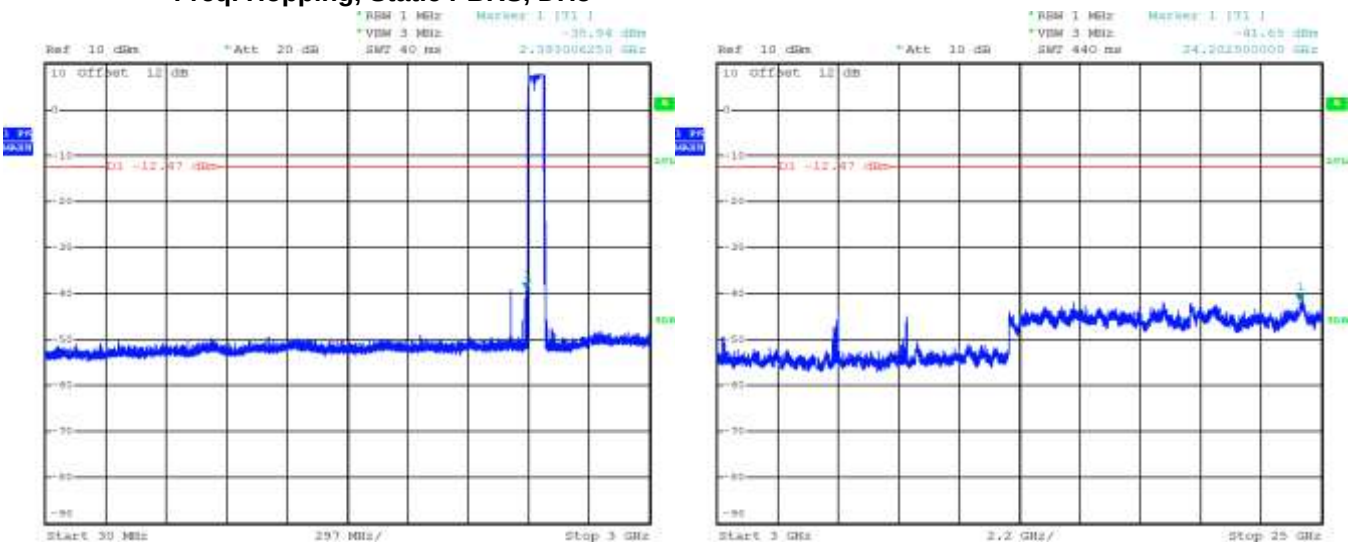


Figure 1-50: Spurious RF Conducted Emissions
Freq. Hopping, Static PBRS, DH5



Bluetooth RF Conducted Emission Test Results cont'd

Using pattern type "Static PBRS" and packet type "2-DH5" during the measurements.

Bluetooth Channel	Channel Power (dBm)	Max. Measured Level (dBm)	Max. Measured Level from carrier (dBc)	Limit (dBc)
0	4.80	-38.81	-43.61	-20.00
39	4.90	-41.27	-46.17	-20.00
78	4.80	-38.24	-43.04	-20.00
Hopping mode	4.80	-41.09	-45.89	-20.00

See figures 1-51 to 1-54 for the plots of the spurious RF conducted emissions.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-51: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 2-DH5

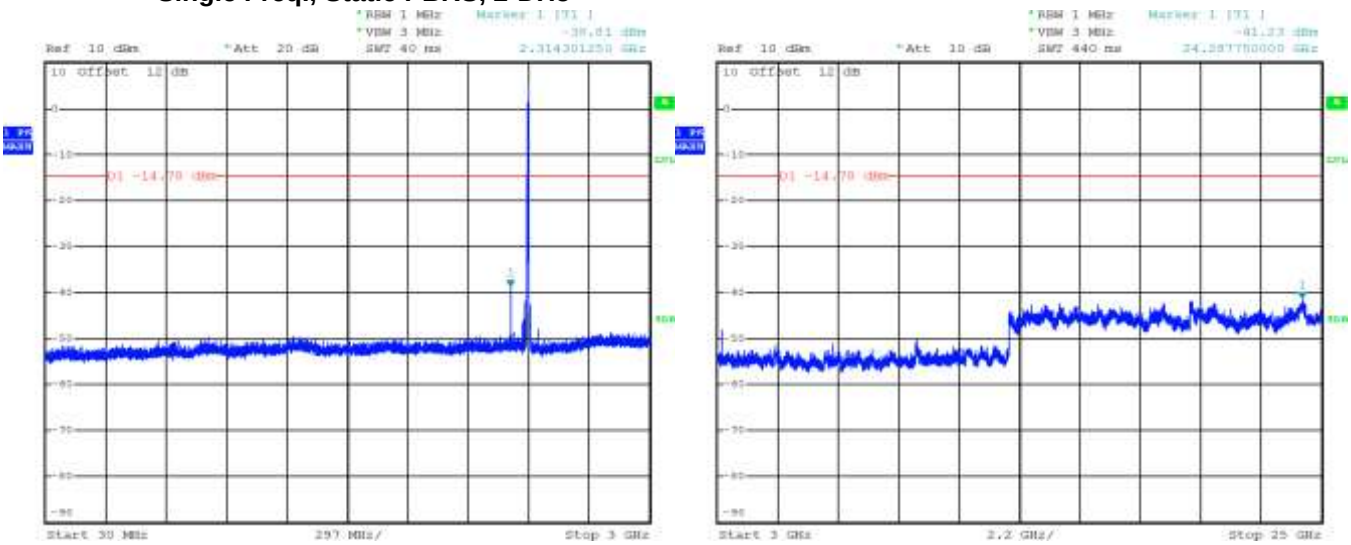
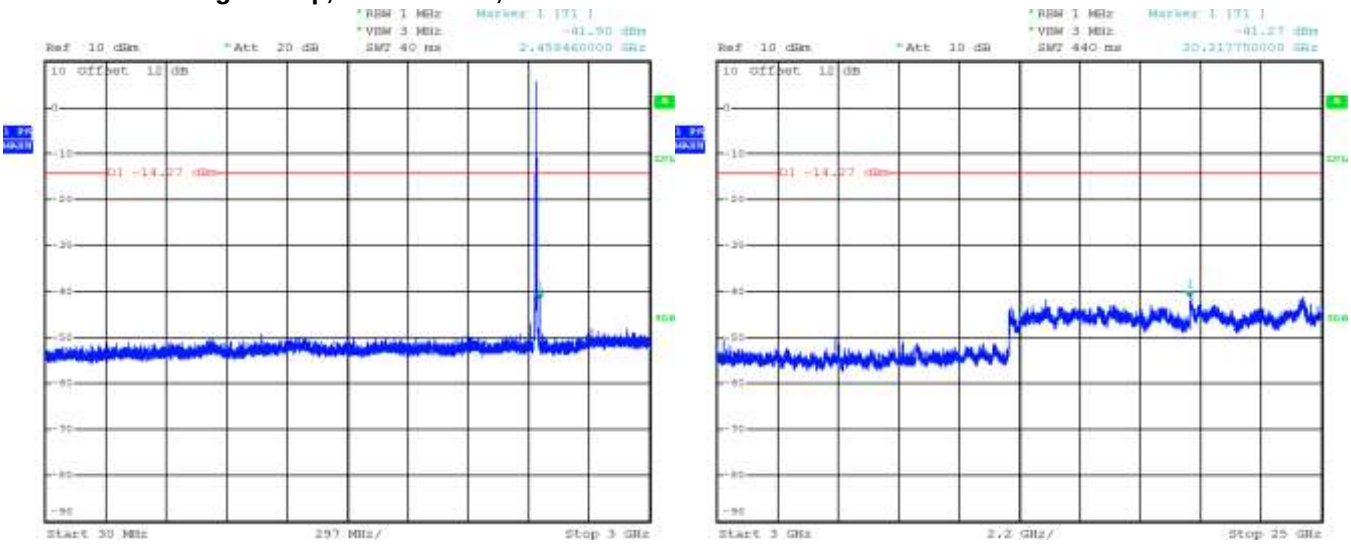


Figure 1-52: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 2-DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-53: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 2-DH5

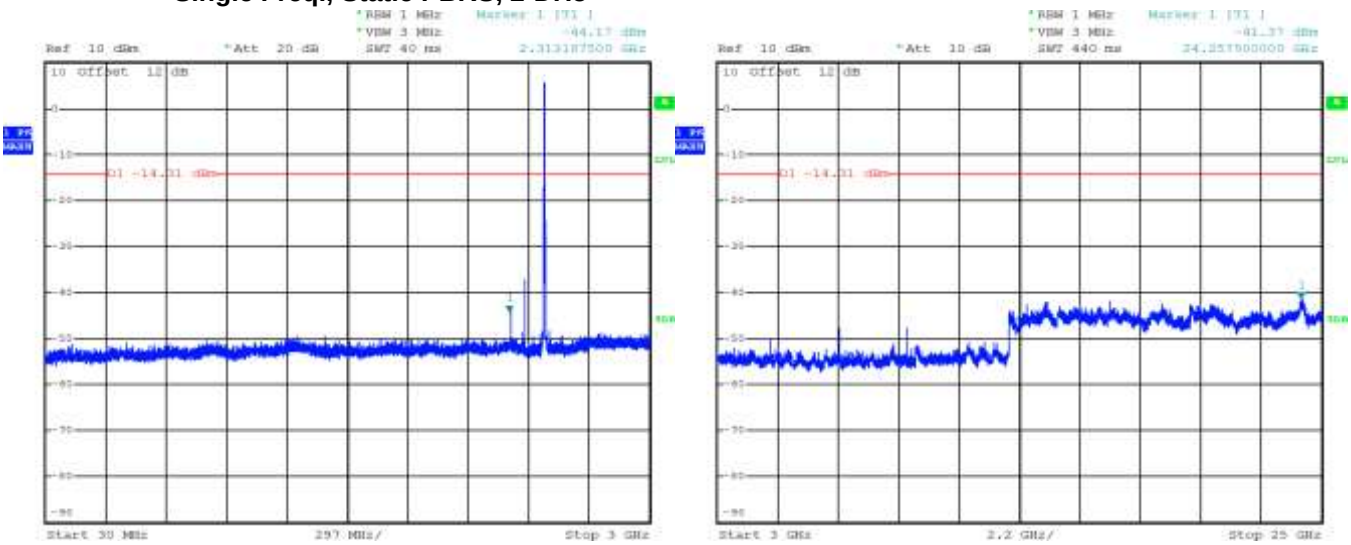
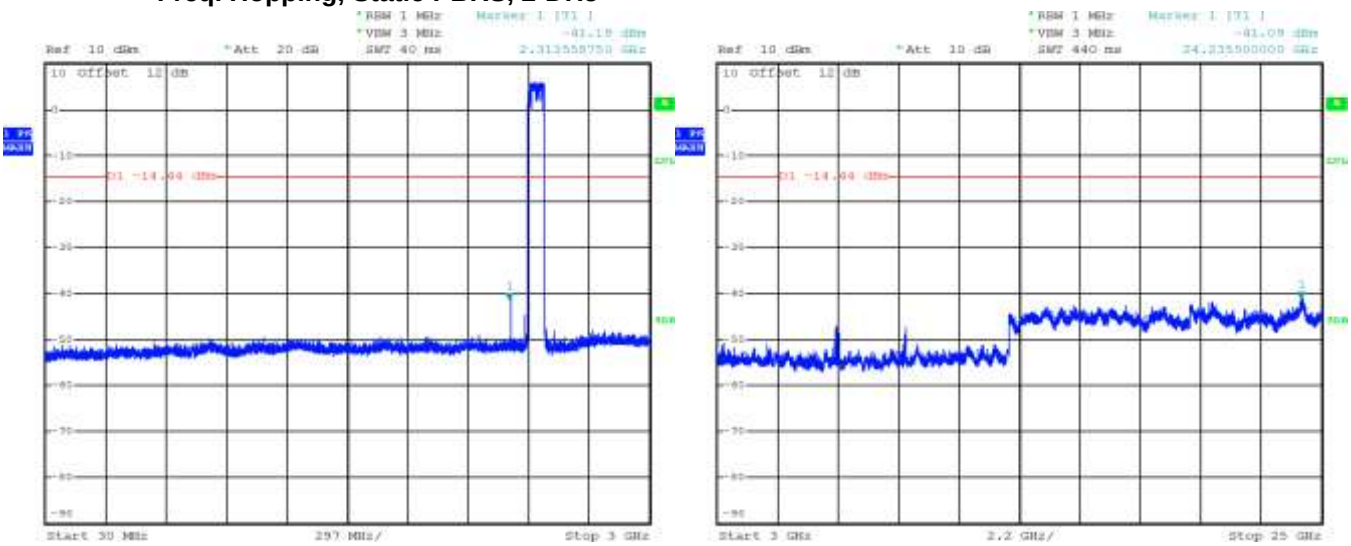


Figure 1-54: Spurious RF Conducted Emissions
Freq. Hopping, Static PBRS, 2-DH5



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	5.30	-41.36	-46.66	-20.00
39	5.30	-41.49	-46.79	-20.00
78	5.30	-37.76	-43.06	-20.00
Hopping mode	5.30	-38.53	-43.83	-20.00

See figures 1-55 to 1-58 for the plots of the spurious RF conducted emissions.

Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-55: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 3-DH5

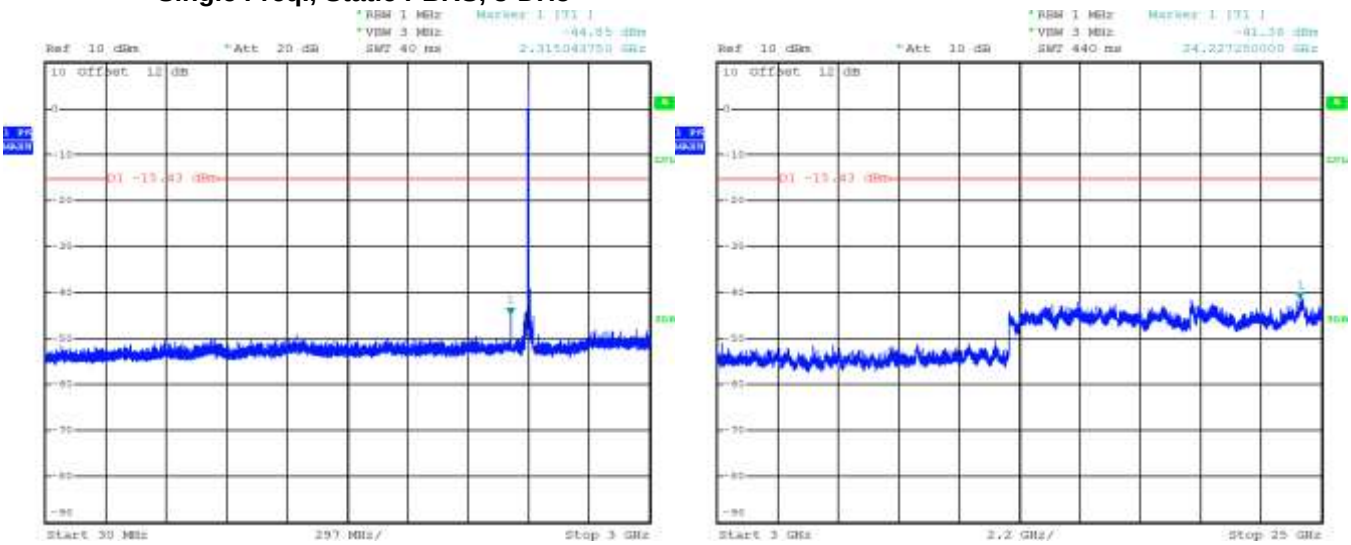
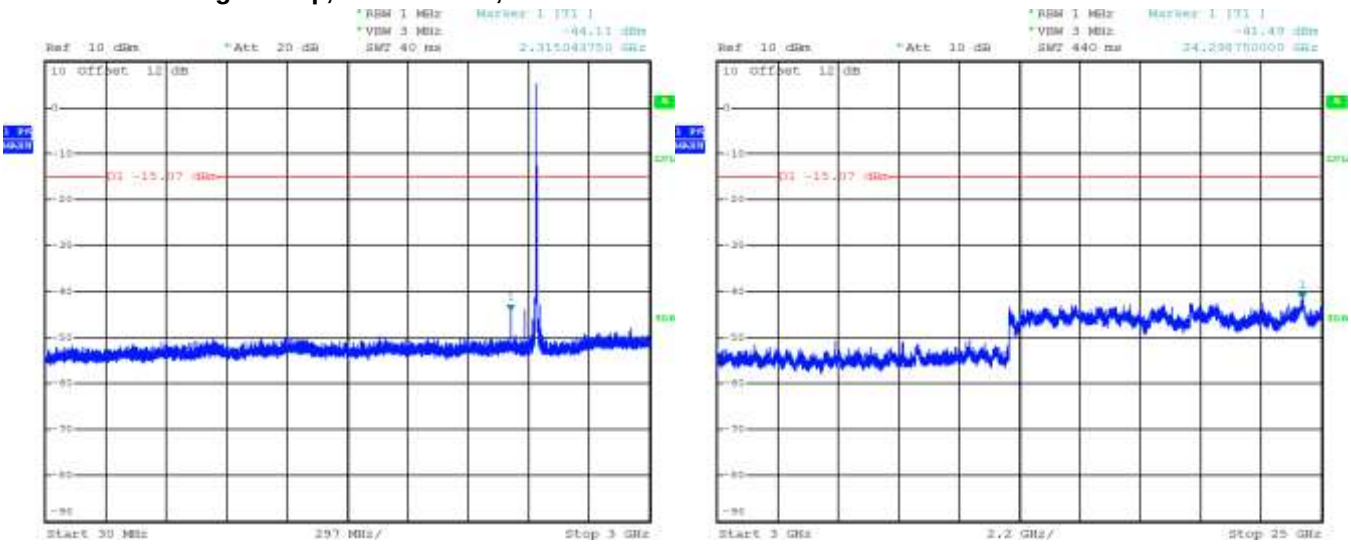


Figure 1-56: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 3-DH5



Bluetooth RF Conducted Emission Test Results cont'd

Figure 1-57: Spurious RF Conducted Emissions
Single Freq., Static PBRS, 3-DH5

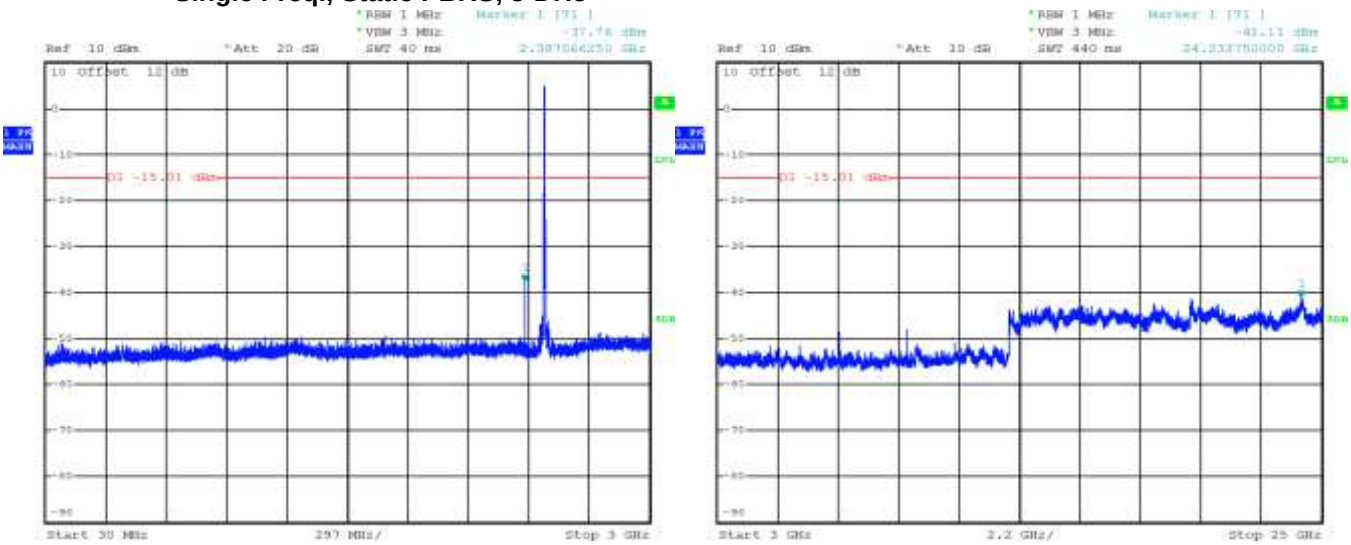
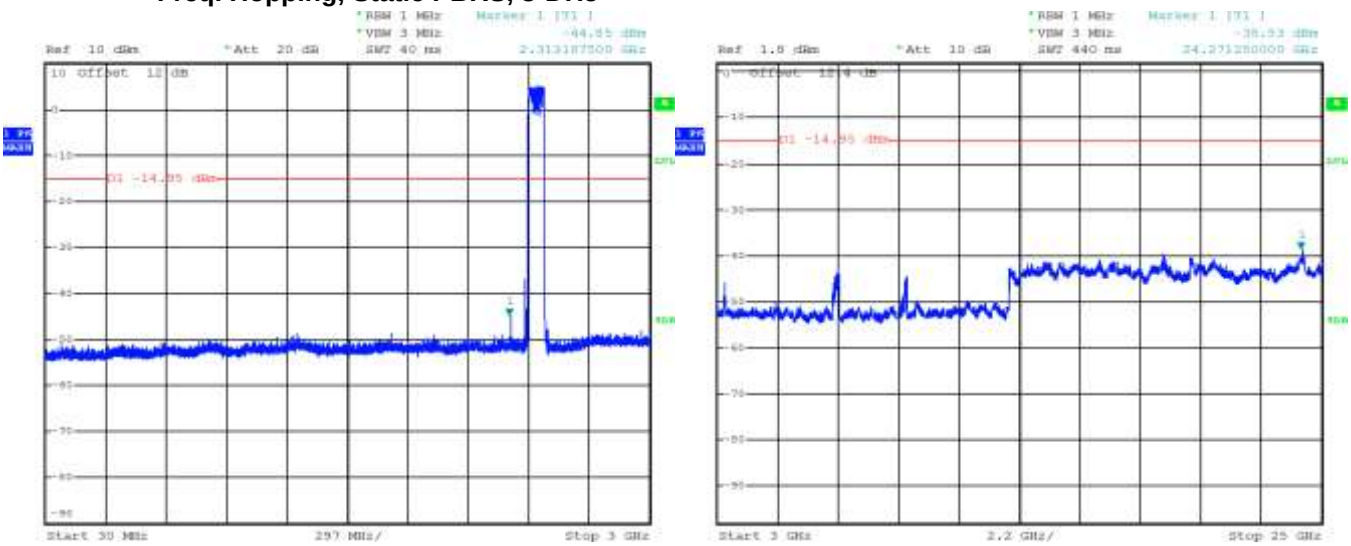


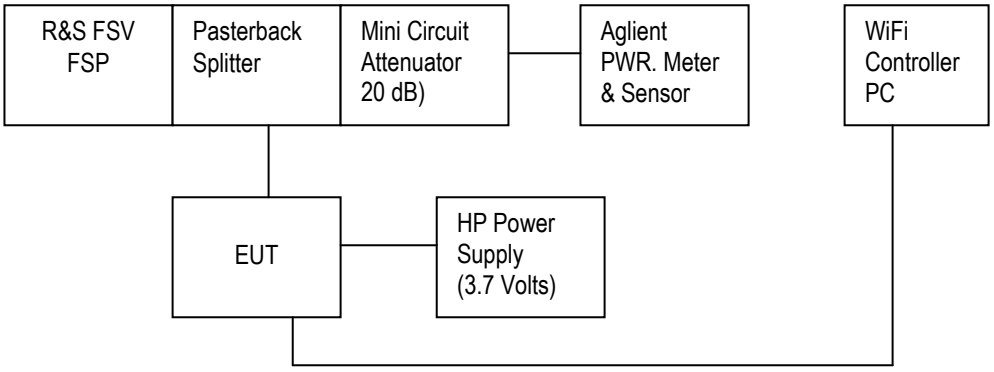
Figure 1-58: Spurious RF Conducted Emissions
Freq. Hopping, Static PBRS, 3-DH5



APPENDIX 2 – 802.11b/g/n CONDUCTED EMISSIONS TEST DATA/PLOTS

802.11b/g/n RF Conducted Emission Test Results

Test Setup Diagram



UNIT	MANUFACTURER	MODEL	SERIAL NUMBER
Attenuator 1	Mini-Circuits	BW-S6W2+	0647
Attenuator 2	Mini-Circuits	BW-S6W2+	0648
Attenuator 3	Mini-Circuits	BW-S20-2W263+	1234
Splitter 1	Weinschel	1515	MES 92

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: June 5, 2013
The measurements on the BlackBerry® smartphone were performed by Berkin Can.

The environmental test conditions were: Temperature: 23.5C
Relative Humidity: 26.7 %

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	10.01
	5.5 Mbps	≥ 500	10.16
	11 Mbps	≥ 500	**10.48**
	6 Mbps	≥ 500	15.66
	24 Mbps	≥ 500	16.38
	54 Mbps	≥ 500	**16.44**
	MCS 0	≥ 500	16.15
	MCS 4	≥ 500	17.51
	MCS 7	≥ 500	**17.57**
6	1 Mbps	≥ 500	10.01
	5.5 Mbps	≥ 500	10.10
	11 Mbps	≥ 500	10.01
	6 Mbps	≥ 500	15.69
	24 Mbps	≥ 500	16.38
	54 Mbps	≥ 500	**16.44**
	MCS 0	≥ 500	15.95
	MCS 4	≥ 500	17.40
	MCS 7	≥ 500	17.51
11	1 Mbps	≥ 500	9.55
	5.5 Mbps	≥ 500	10.16
	11 Mbps	≥ 500	10.22
	6 Mbps	≥ 500	15.77
	24 Mbps	≥ 500	16.41
	54 Mbps	≥ 500	16.41
	MCS 0	≥ 500	15.42
	MCS 4	≥ 500	17.54
	MCS 7	≥ 500	17.17

See figures 2-1 to 2-9 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 2-1: 6 dB Bandwidth
802.11b, Channel 1, 1 Mbps

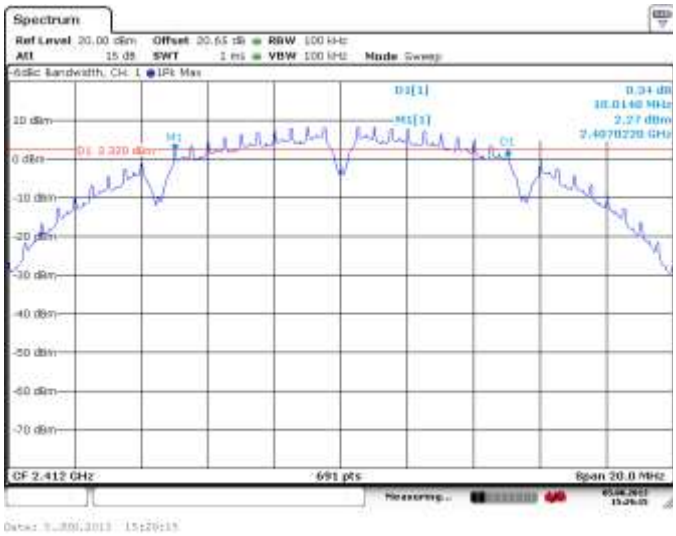


Figure 2-2: 6 dB Bandwidth
802.11b, Channel 6, 1 Mbps

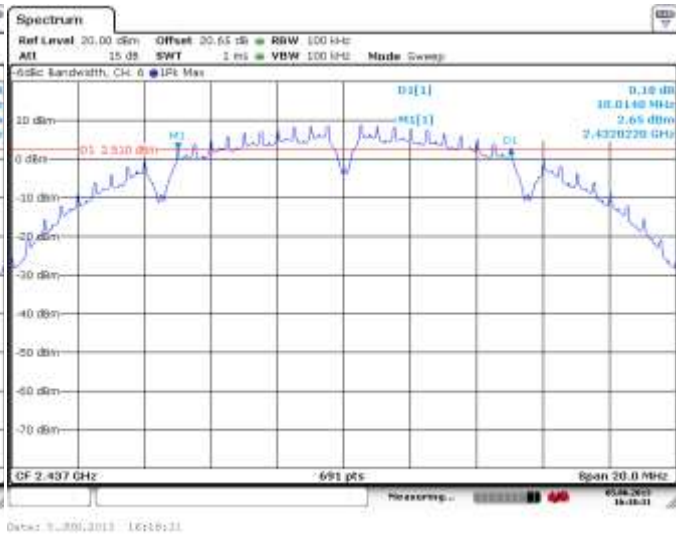


Figure 2-3: 6 dB Bandwidth
802.11b, Channel 11, 1 Mbps

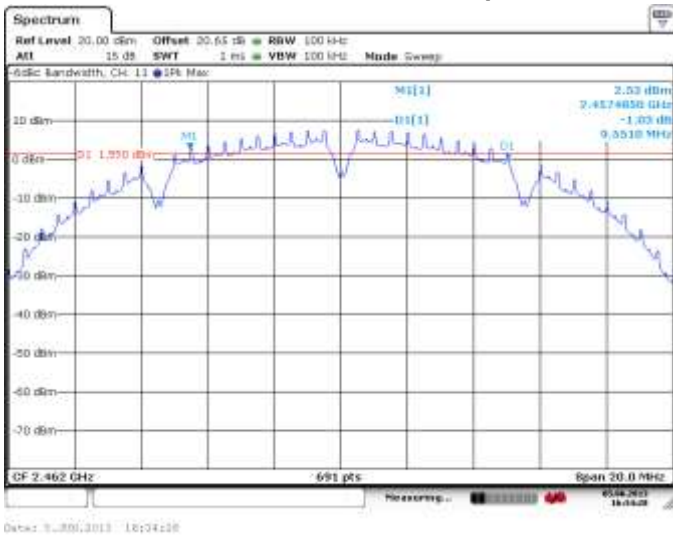


Figure 2-4: 6 dB Bandwidth
802.11g, Channel 1, 6 Mbps

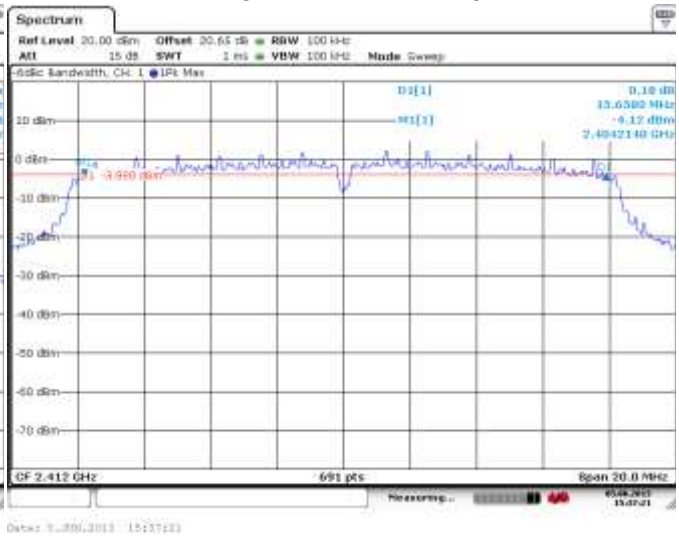


Figure 2-5: 6 dB Bandwidth
802.11g, Channel 6, 6 Mbps

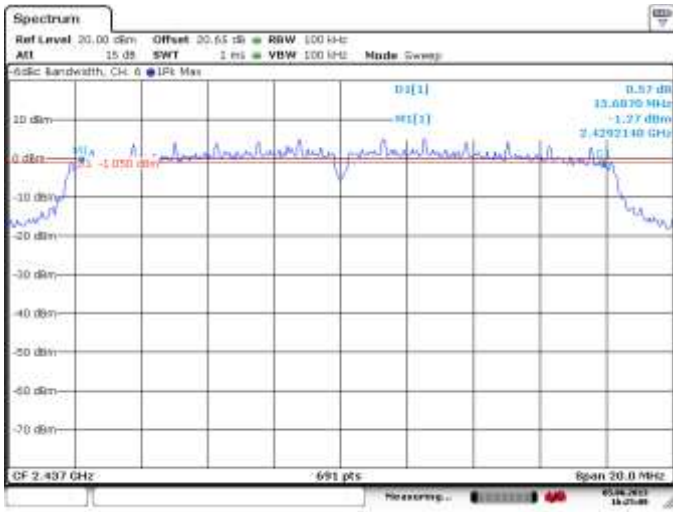


Figure 2-6: 6 dB Bandwidth
802.11g, Channel 11, 6 Mbps

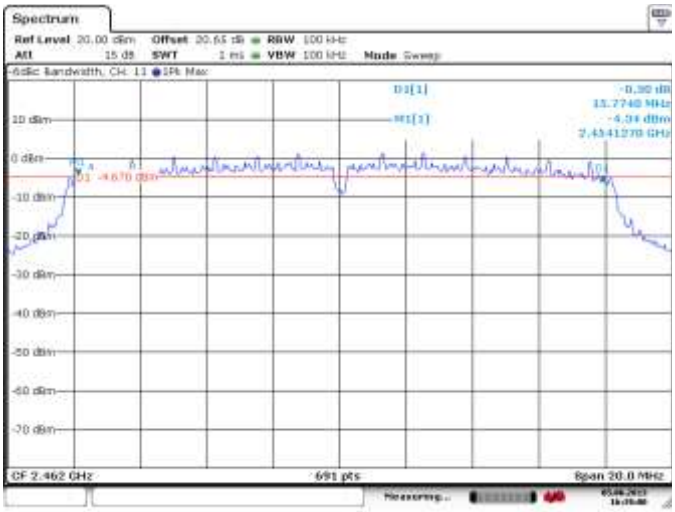


Figure 2-7: 6 dB Bandwidth
802.11n, Channel 1, MCS 0

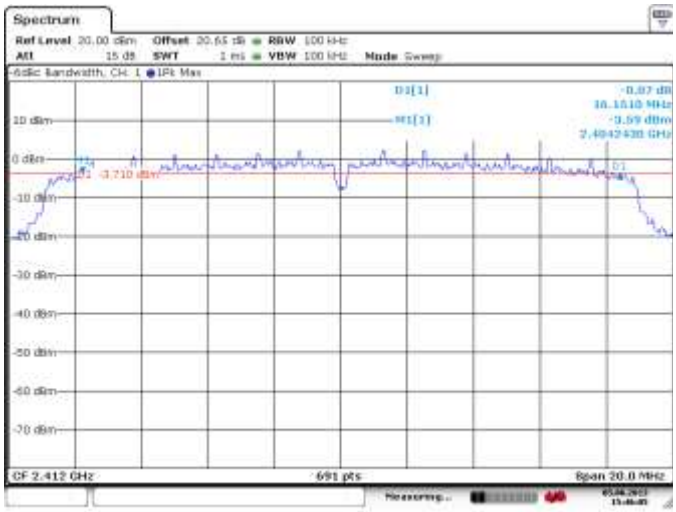


Figure 2-8: 6 dB Bandwidth
802.11n, Channel 6, MCS 0

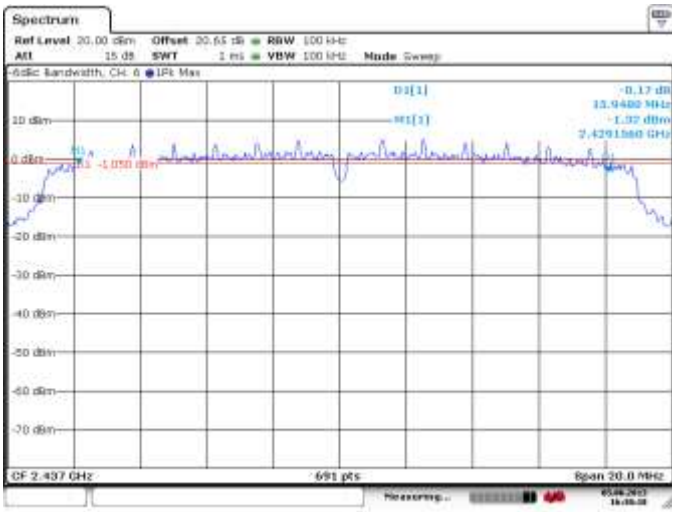
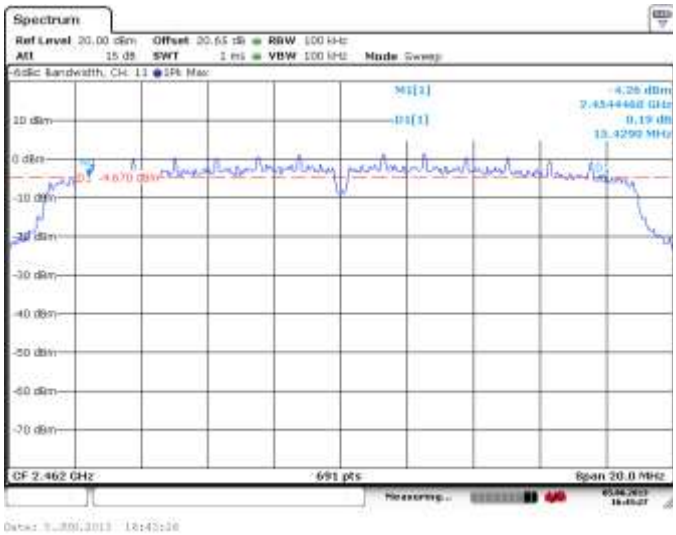


Figure 2-9: 6 dB Bandwidth

802.11n, Channel 11, MCS 0



Maximum Conducted Output Power

The EUT met the requirements of the maximum conducted output power of class 2 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 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	Class 2 Limit (W)	Measured Level (dBm)	Measured Level (mW)
1	1 Mbps	< 1.00	17.51	56.36
	5.5 Mbps	< 1.00	17.40	54.95
	11 Mbps	< 1.00	17.14	51.76
	6 Mbps	< 1.00	13.33	21.53
	24 Mbps	< 1.00	11.84	15.28
	54 Mbps	< 1.00	10.00	10.00
	MCS 0	< 1.00	13.21	20.94
	MCS 4	< 1.00	11.75	14.96
	MCS 7	< 1.00	9.06	8.05
6	1 Mbps	< 1.00	**17.74**	**59.43**
	5.5 Mbps	< 1.00	17.59	57.41
	11 Mbps	< 1.00	17.27	53.33
	6 Mbps	< 1.00	**15.80**	**38.02**
	24 Mbps	< 1.00	12.05	16.03
	54 Mbps	< 1.00	9.73	9.40
	MCS 0	< 1.00		
	MCS 4	< 1.00	11.46	14.00
	MCS 7	< 1.00	8.59	7.23

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	16.69	46.67
	5.5 Mbps	< 1.00	16.44	44.06
	11 Mbps	< 1.00	16.26	42.27
	6 Mbps	< 1.00	12.40	17.38
	24 Mbps	< 1.00	10.89	12.27
	54 Mbps	< 1.00	9.09	8.11
	MCS 0	< 1.00	12.41	17.42
	MCS 4	< 1.00	11.09	12.85
	MCS 7	< 1.00	8.14	6.52

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	-38.2	-18.20
	5.5 Mbps	< -20	-38.86	-18.86
	11 Mbps	< -20	-38.38	-18.38
	6 Mbps	< -20	-29.70	-9.70
	24 Mbps	< -20	-30.60	-10.60
	54 Mbps	< -20	-32.58	-12.58
	MCS 0	< -20	-29.23	-9.23
	MCS 4	< -20	-29.10	-9.10
	MCS 7	< -20	-31.43	-11.43
11	1 Mbps	< -20	-39.01	-19.01
	5.5 Mbps	< -20	-39.80	-19.80
	11 Mbps	< -20	-39.57	-19.57
	6 Mbps	< -20	-34.78	-14.78
	24 Mbps	< -20	-35.69	-15.69
	54 Mbps	< -20	-37.62	-17.62
	MCS 0	< -20	-33.53	-13.53
	MCS 4	< -20	-35.05	-15.05
	MCS 7	< -20	-36.66	-16.66

See figures 2-10 to 2-15 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.

Figure 2-10: Band Edge Compliance
802.11b, Channel 1, 1 Mbps

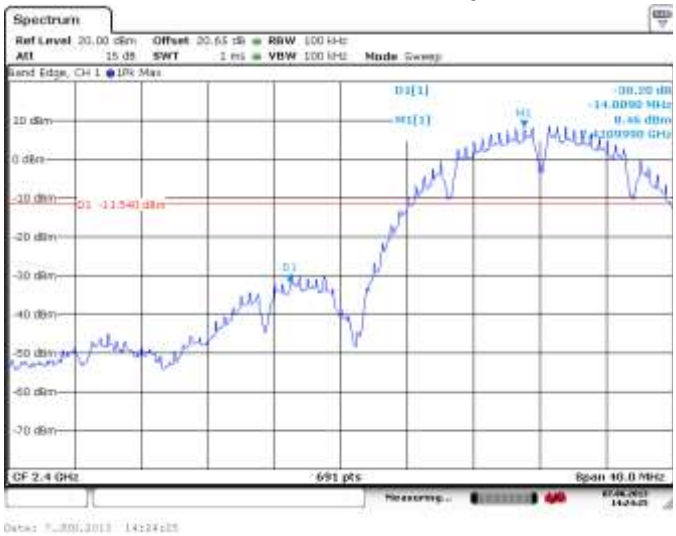


Figure 2-11: Band Edge Compliance
802.11b, Channel 11, 1 Mbps

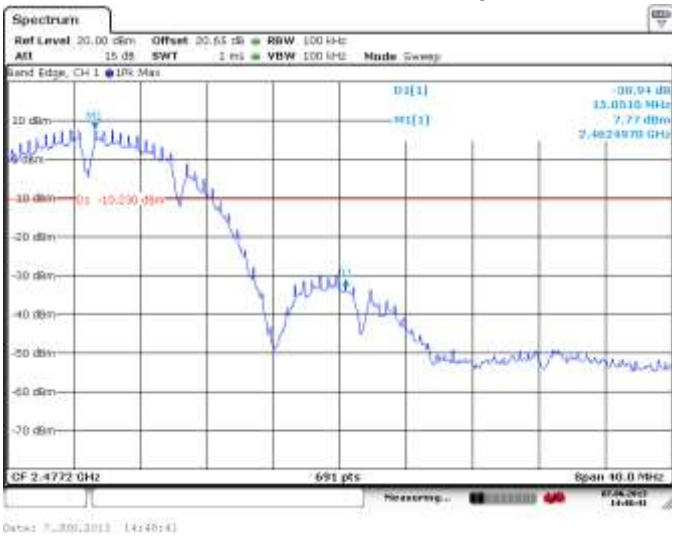


Figure 2-12: Band Edge Compliance
802.11g, Channel 1, 6 Mbps

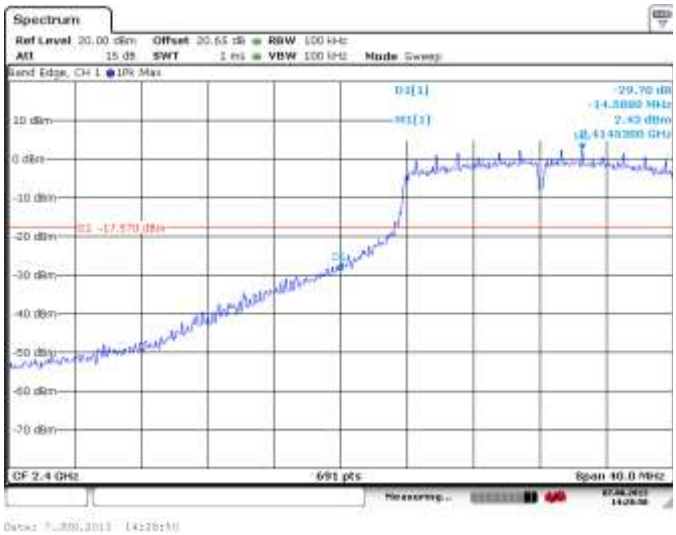


Figure 2-13: Band Edge Compliance
802.11g, Channel 11, 6 Mbps

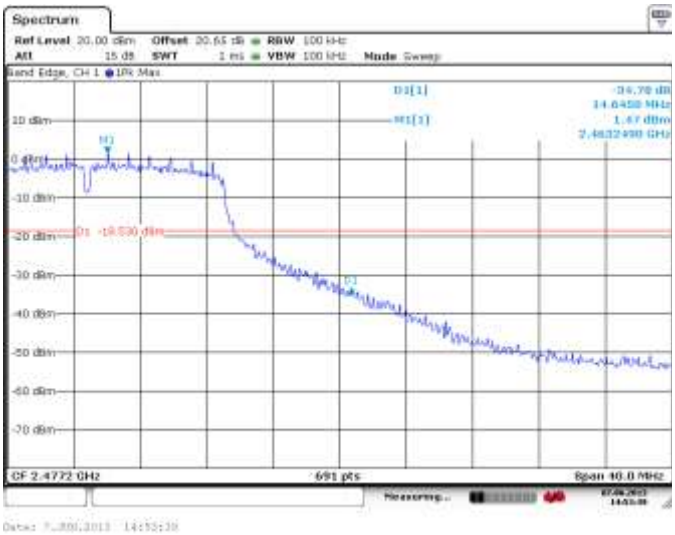


Figure 2-14: Band Edge Compliance 802.11n, Channel 1, MCS 0

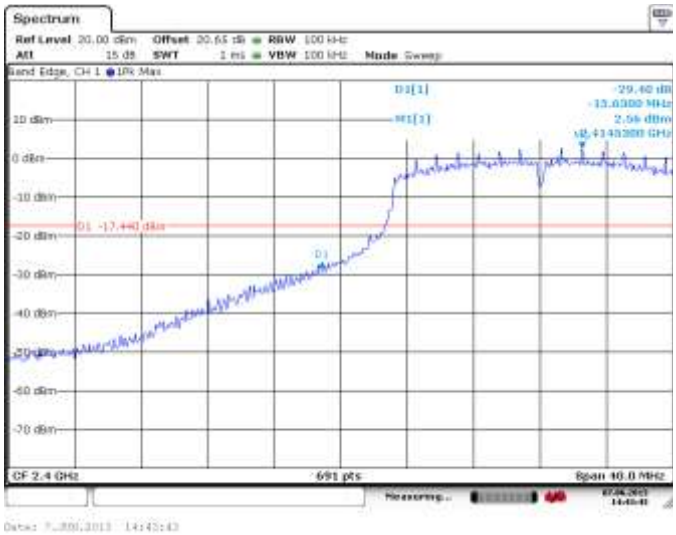
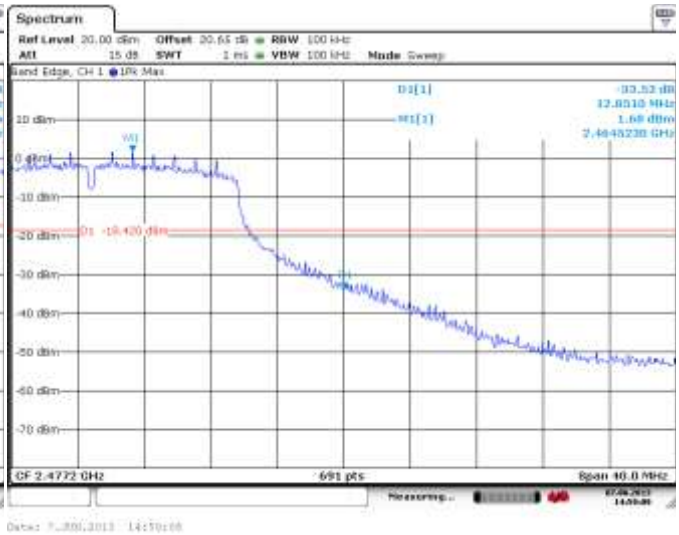


Figure 2-15: Band Edge Compliance 802.11n, Channel 11, MCS 0



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	-3.37	-11.37
	5.5 Mbps	< 8.00	-5.57	-13.57
	11 Mbps	< 8.00	-6.18	-14.18
	6 Mbps	< 8.00	-10.85	-18.85
	24 Mbps	< 8.00	-11.82	-19.82
	54 Mbps	< 8.00	-12.92	-20.92
	MCS 0	< 8.00	-11.21	-19.21
	MCS 4	< 8.00	-11.59	-19.59
	MCS 7	< 8.00	-13.10	-21.10
6	1 Mbps	< 8.00	-3.40	-11.40
	5.5 Mbps	< 8.00	-4.66	-12.66
	11 Mbps	< 8.00	-5.56	-13.56
	6 Mbps	< 8.00	-8.63	-16.63
	24 Mbps	< 8.00	-11.32	-19.32
	54 Mbps	< 8.00	-13.19	-21.19
	MCS 0	< 8.00	-8.64	-16.64
	MCS 4	< 8.00	-10.84	-18.84
	MCS 7	< 8.00	-11.58	-19.58
11	1 Mbps	< 8.00	-4.30	-12.30
	5.5 Mbps	< 8.00	-6.40	-14.40
	11 Mbps	< 8.00	-6.59	-14.59
	6 Mbps	< 8.00	-11.78	-19.78
	24 Mbps	< 8.00	-12.01	-20.01
	54 Mbps	< 8.00	-13.24	-21.24
	MCS 0	< 8.00	-11.06	-19.06
	MCS 4	< 8.00	-12.33	-20.33
	MCS 7	< 8.00	-14.18	-22.18

See figures 2-16 to 2-24 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 2-16: Peak Power Spectral Density 802.11b, Channel 1, 1 Mbps

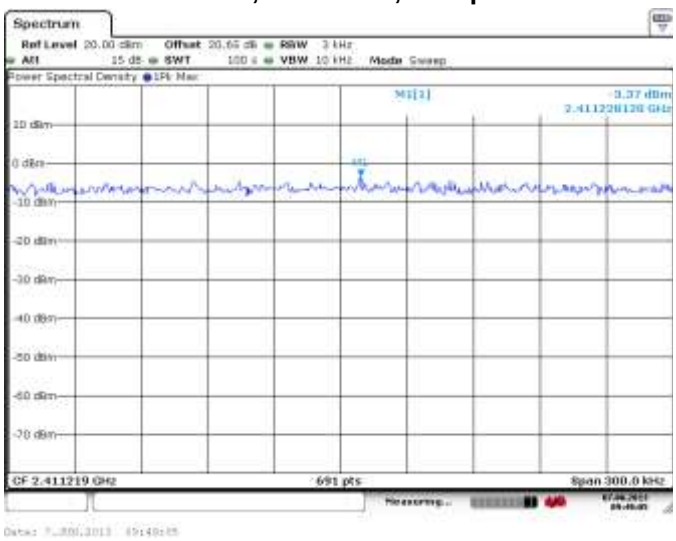


Figure 2-17: Peak Power Spectral Density 802.11b, Channel 6, 1 Mbps

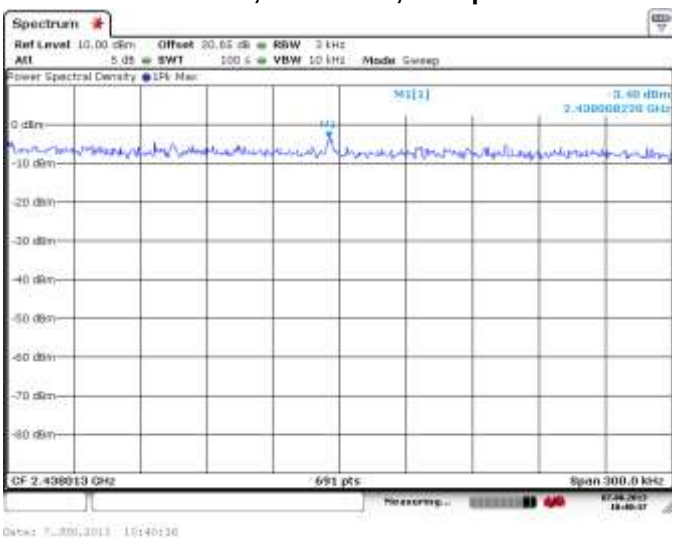


Figure 2-18: Peak Power Spectral Density 802.11b, Channel 11, 1 Mbps

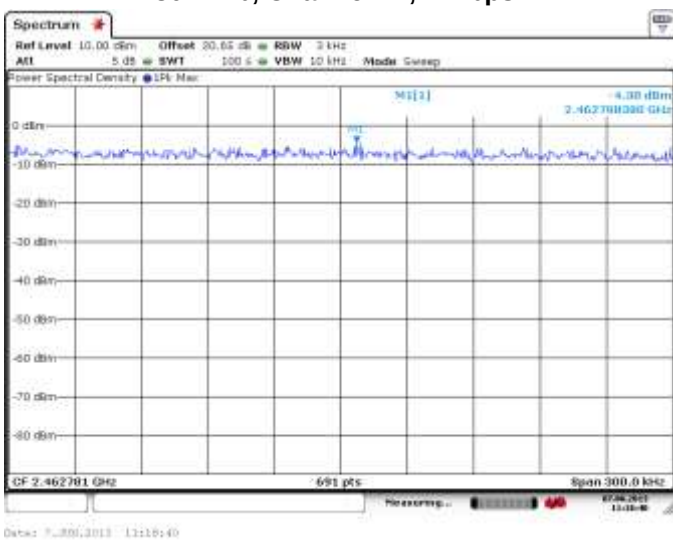


Figure 2-19: Peak Power Spectral Density
802.11g, Channel 1, 6 Mbps

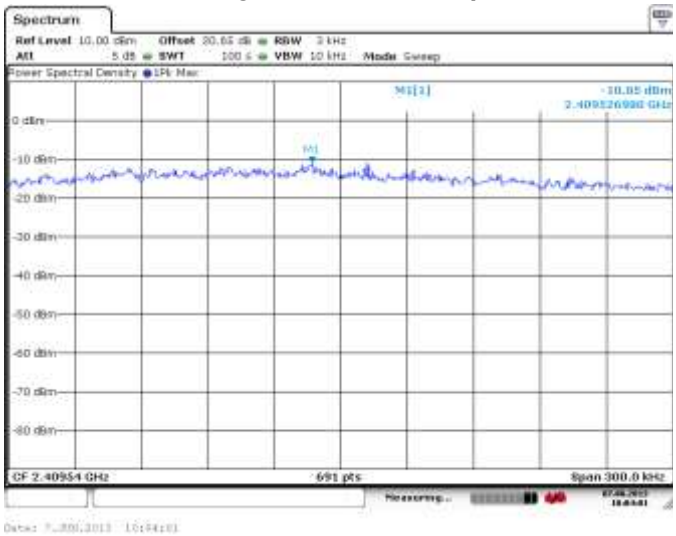


Figure 2-20: Peak Power Spectral Density
802.11g, Channel 6, 6 Mbps

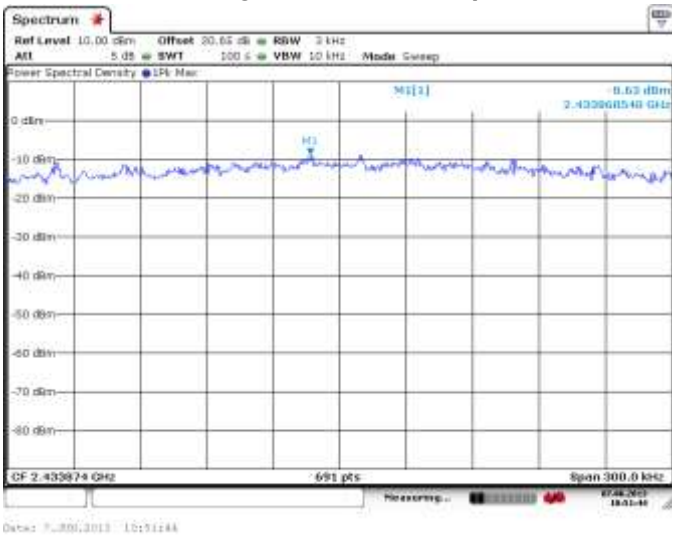


Figure 2-21: Peak Power Spectral Density
802.11g, Channel 11, 6 Mbps

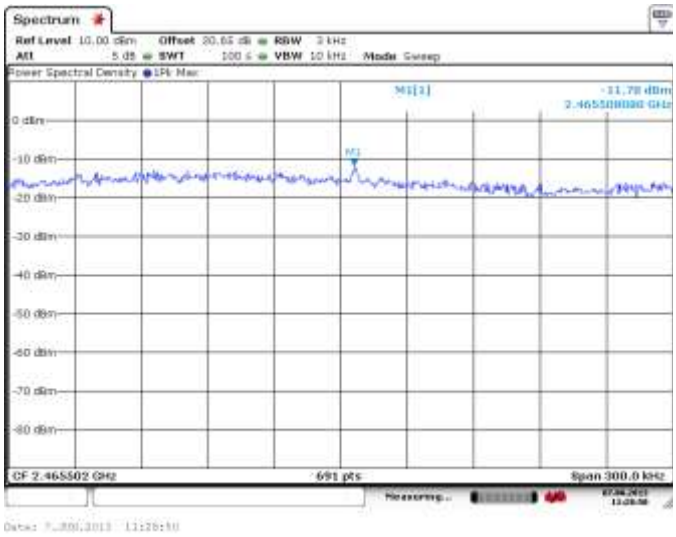


Figure 2-22: Peak Power Spectral Density
802.11n, Channel 1, MCS 0

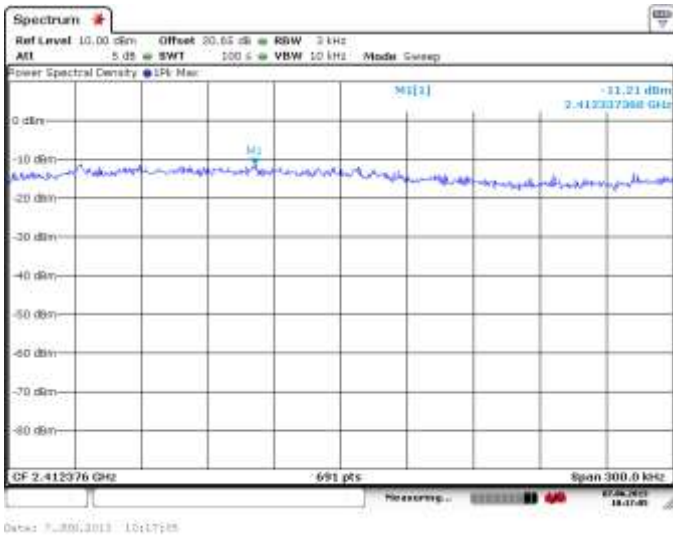


Figure 2-23: Peak Power Spectral Density
802.11n, Channel 6, MCS 0

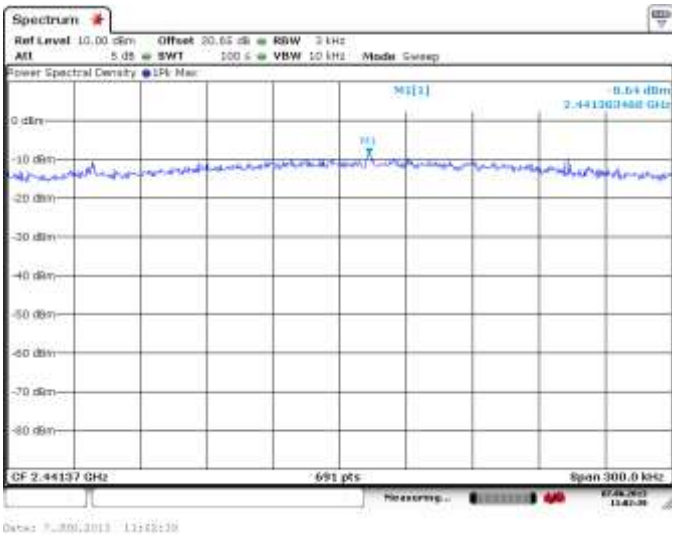
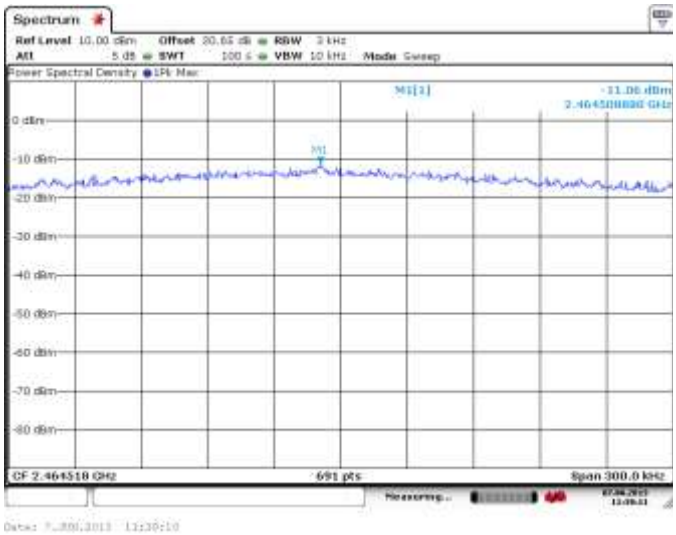


Figure 2-24: Peak Power Spectral Density
802.11n, Channel 11, MCS 0



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	17.51	-24.10	-41.61	-20
	5.5 Mbps	17.4	-36.71	-54.11	-20
	11 Mbps	17.14	-38.12	-55.26	-20
	6 Mbps	13.33	-32.11	-45.44	-20
	24 Mbps	11.84	-29.61	-41.45	-20
	54 Mbps	10	-33.62	-43.62	-20
	MCS 0	13.21	-31.04	-44.25	-20
	MCS 4	11.75	-31.16	-42.91	-20
	MCS 7	9.06	-34.10	-43.16	-20
6	1 Mbps	17.74	-32.57	-50.31	-20
	5.5 Mbps	17.59	-37.64	-55.23	-20
	11 Mbps	17.27	-38.36	-55.63	-20
	6 Mbps	15.8	-31.68	-47.48	-20
	24 Mbps	12.05	-29.40	-41.45	-20
	54 Mbps	9.73	-33.34	-43.07	-20
	MCS 0	15.65	-31.38	-47.03	-20
	MCS 4	11.46	-32.68	-44.14	-20
	MCS 7	8.59	-32.63	-41.22	-20

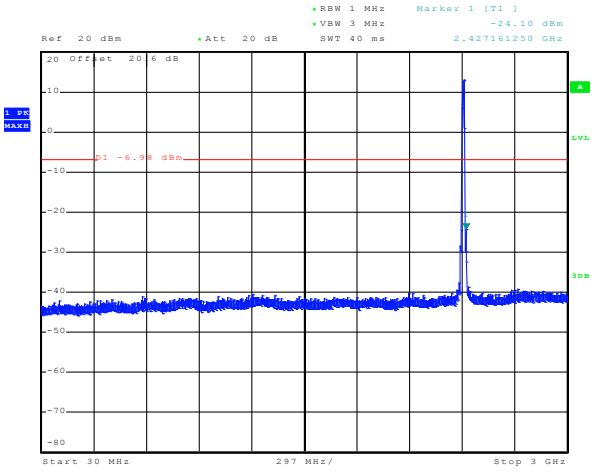
802.11b/g/n RF Conducted Emission Test Results cont'd

Channel	Data Rate	Power (dBm)	Max. Measured Level (dBm)	Max. Measured Level from Carrier (dBc)	Limit (dBc)
11	1 Mbps	16.69	-25.08	-41.77	-20
	5.5 Mbps	16.44	-37.72	-54.16	-20
	11 Mbps	16.26	-27.31	-43.57	-20
	6 Mbps	12.4	-32.51	-44.91	-20
	24 Mbps	10.89	-28.84	-39.73	-20
	54 Mbps	9.09	-32.71	-41.8	-20
	MCS 0	12.41	-22.08	-34.49	-20
	MCS 4	11.09	-23.88	-34.97	-20
	MCS 7	8.14	-31.07	-39.21	-20

The emissions were in the NF.

See figures 2-25 to 2-33 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.

Figure 2-25: Spurious Conducted RF Emissions
802.11b, Channel 1, 1 Mbps



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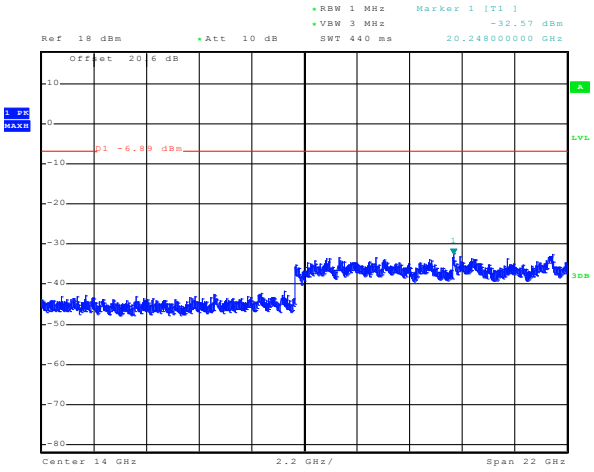
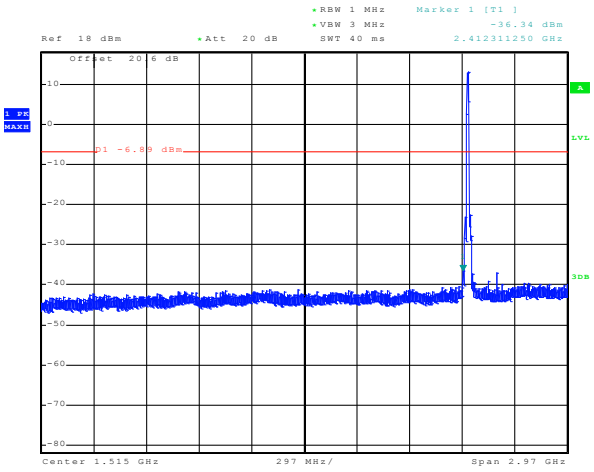
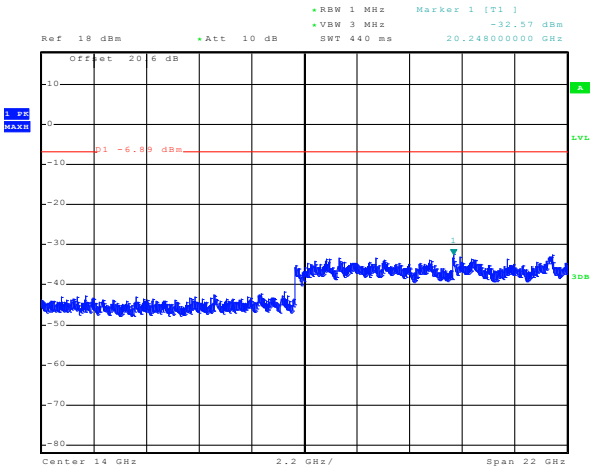


Date: 10.JUN.2013 11:27:59

Figure 2-26 : Spurious Conducted RF Emissions
802.11b, Channel 6, 1 Mbps

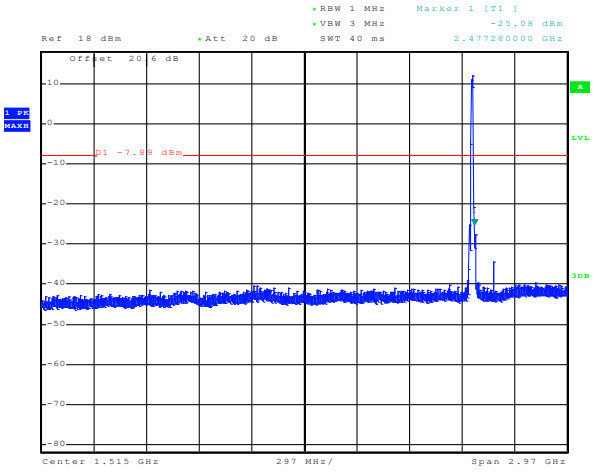


Date: 10.JUN.2013 10:51:41

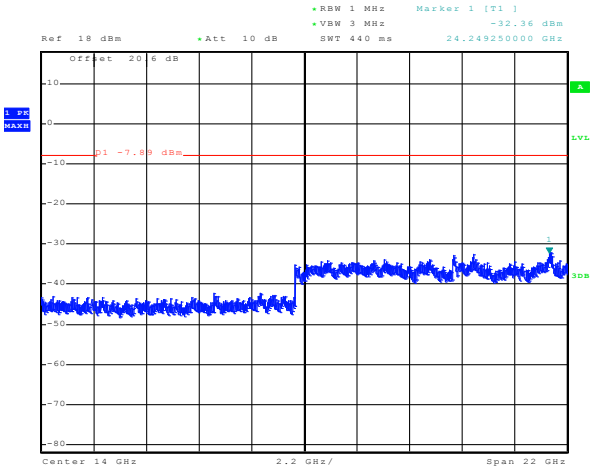


Date: 10.JUN.2013 11:27:59

Figure 2-27: Spurious Conducted RF Emissions
802.11b, Channel 11, 1 Mbps

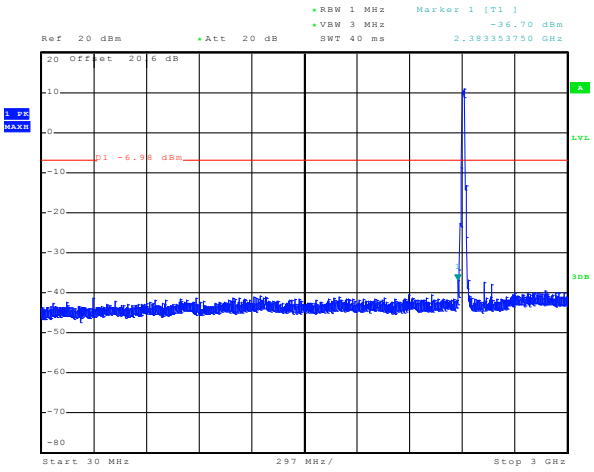


Date: 10.JUN.2013 10:59:02

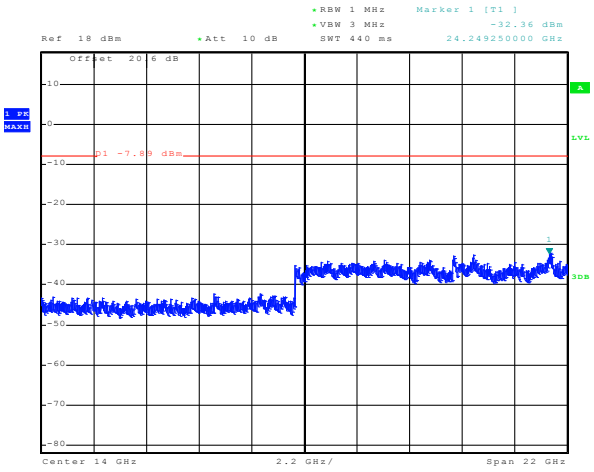


Date: 10.JUN.2013 11:31:38

Figure 2-28: Spurious Conducted RF Emissions
802.11g, Channel 1, 6 Mbps

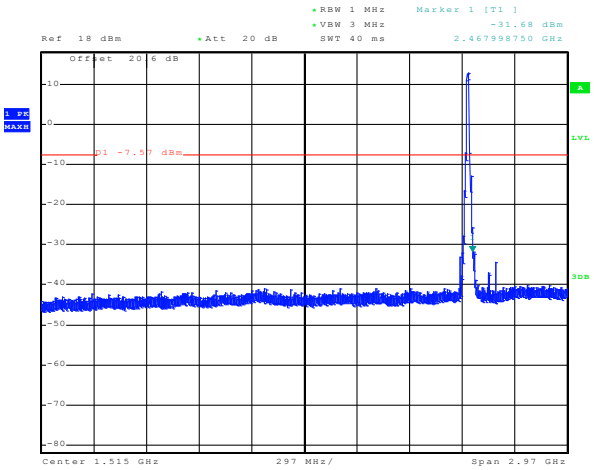


Date: 10.JUN.2013 10:29:01

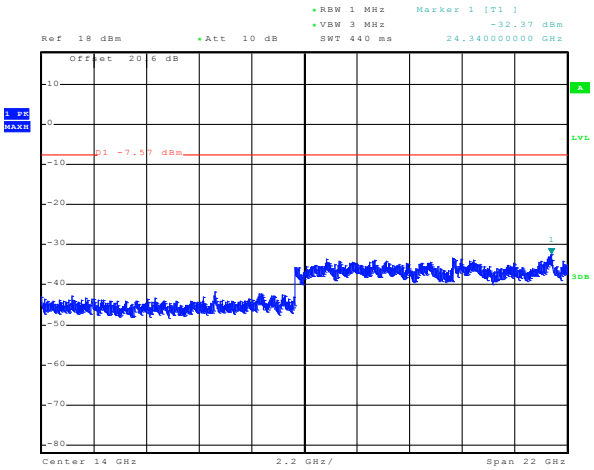


Date: 10.JUN.2013 11:31:38

Figure 2-29: Spurious Conducted RF Emissions
802.11g, Channel 6, 6 Mbps

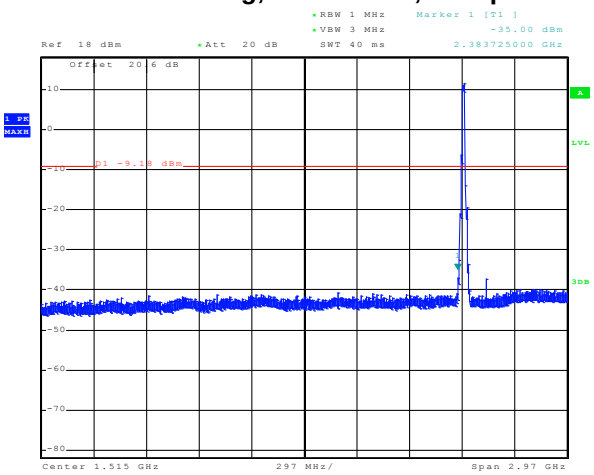


Date: 10.JUN.2013 10:53:35

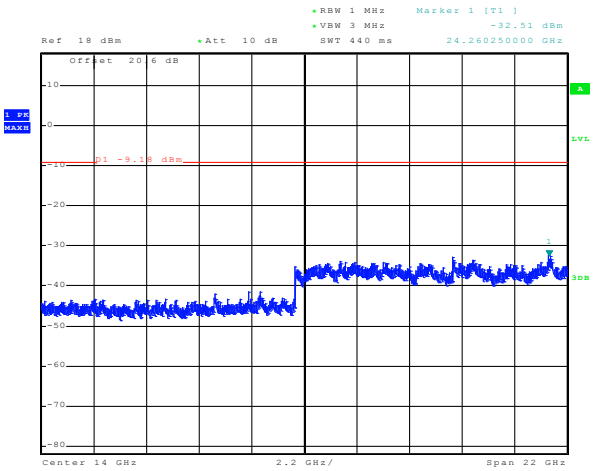


Date: 10.JUN.2013 11:29:01

Figure 2-30: Spurious Conducted RF Emissions
802.11g, Channel 11, 6 Mbps

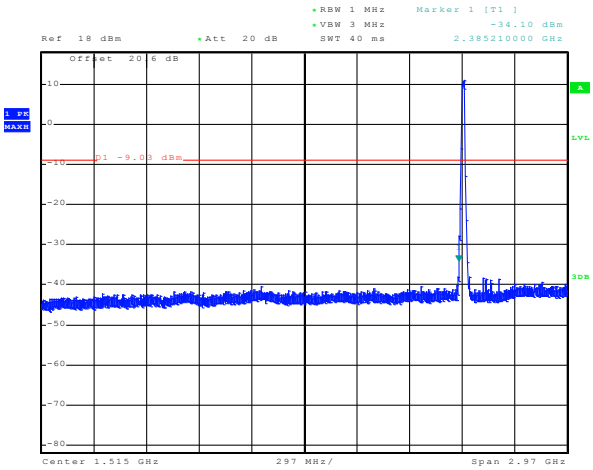


Date: 10.JUN.2013 11:04:57

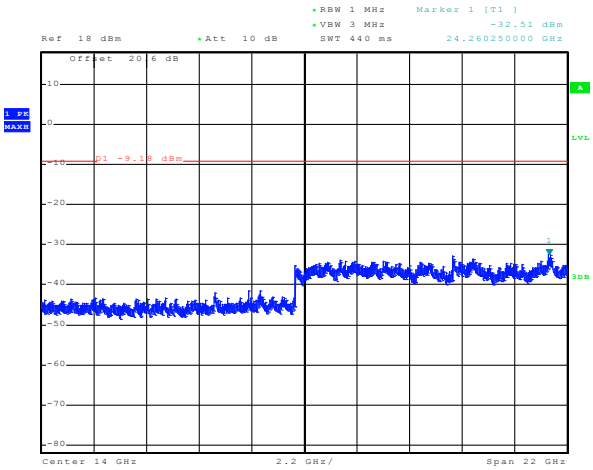


Date: 10.JUN.2013 11:32:23

Figure 2-31: Spurious Conducted RF Emissions
802.11n, Channel 1, MCS 0

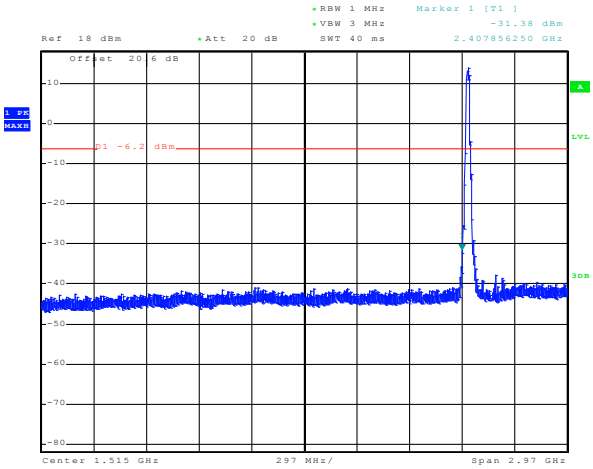


Date: 10.JUN.2013 10:49:05

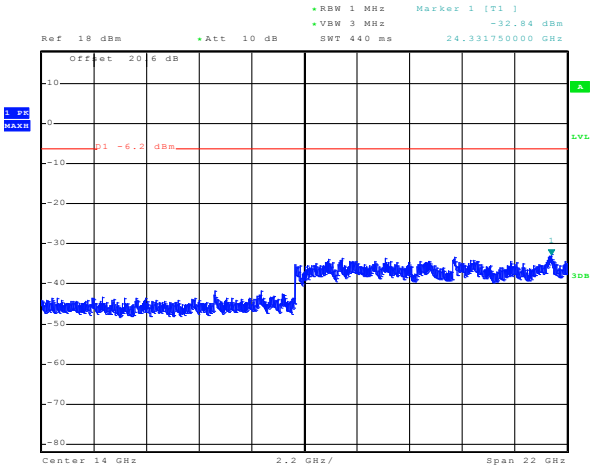


Date: 10.JUN.2013 11:32:23

Figure 2-32: Spurious Conducted RF Emissions
802.11n, Channel 6, MCS 0

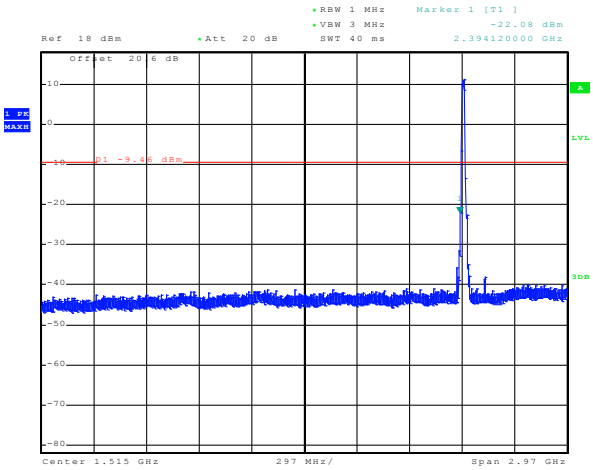


Date: 10.JUN.2013 10:55:44

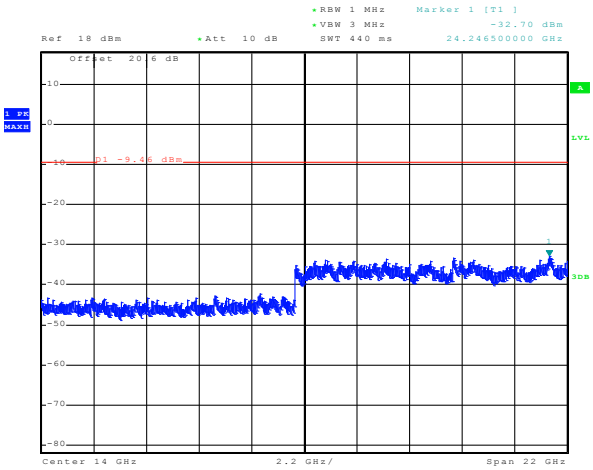


Date: 10.JUN.2013 11:29:46

Figure 2-33: Spurious Conducted RF Emissions
802.11n, Channel 11, MCS 0



Date: 10.JUN.2013 11:06:51



Date: 10.JUN.2013 11:32:58