EMC Test Report

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

REPORT NO.: RTS-6058-1408-08_rev1

This report supersedes the report RTS-6058-1408-08 dated August 11, 2014

PRODUCT MODEL NO.: RHB121LW
TYPE NAME: BlackBerry® smartphone
FCC ID: L6ARHB120LW

DATE: September 04, 2014

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

592

Report Revision History:

Rev1:

1. Addition of calibration intervals in section G.
2. Updated referenced test report number in section B and E.
3. Change in limits for Peak Power Spectral Density in Appendix 3.

Statement of Performance:

The BlackBerry® smartphone, model RHB121LW, part number CER-59877-001-Rev2-905-01, and its accessories perform within the requirements of the test standards when configured and operated under BlackBerry'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
Compliance Specialist I

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, 2013
- FCC CFR 47 Part 15, Subpart E, October, 2013
- KDB 789033 D02 General UNII Test Procedures
- KDB 905462 D06 802.11 Channel Plans

B. Associated Documents

1) MultiSourceDeclaration_R139-R140_10.3.0.890_Reg_only
2) RHB121LW-R140-HWD_CER-59877-001- Rev1-905-00
3) RHB121LW-R140-HWD_CER-59877-001- Rev2-905-01
4) Test Report RTS-6058-1408-07_rev1
5) Test Report RTS-6026-1302-22_rev1

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C. Product Identification

Manufactured by BlackBerry Limited whose headquarters is located at:
2200 University Ave. E
Waterloo, Ontario
Canada, N2K 0A7
Phone: 519 888 7465
Fax: 519 888 7884

The equipment under test (EUT) was tested at the following locations:
BlackBerry RTS EMC 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 July 7 – August 5, 2014.

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SAMPLE	MODEL	CER NUMBER	PIN	SOFTWARE
1	RHB121LW	CER-59877-001-Rev1-905-00	2FFEB308	OS Version: 10.3.0.686 Bundle: 686
2	RHB121LW	CER-59877-001-Rev2-905-01	2FFEC316	OS Version: 10.3.0.890 Bundle: 890
3	RHB121LW	CER-59877-001-Rev1-905-00	2FFEB310	OS Version: 10.3.0.686 Bundle: 686
4	RHB121LW	CER-59877-001-Rev2-905-01	2FFEC31A	OS Version: 10.3.0.890 Bundle: 890
5	RHB121LW	CER-59877-001-Rev1-905-00	2FFEB2F0	OS Version: 10.3.0.686 Bundle: 686

Conducted Emissions testing was performed on sample 5.
Radiated Emissions testing was performed on samples 1, 2, 3 and 4.

Only the characteristics that may have been affected by the changes from RHB121LW Rev1 to Rev2 were re-tested. For more details, please view documents RHB121LW-R140-HWD_CER-59877-001-Rev1-905-00 and RHB121LW-R140-HWD_CER-59877-001-Rev2-905-01.

To view the differences between software bundles 10.3.0.686 and 10.3.0.890 for RHB121LW, see document: MultiSourceDeclaration_R139-R140_10.3.0.890_Reg_only.

D. Support Equipment Used for the Testing of the EUT

1) Lenovo Thinkpad laptop, type 4236-D84, S/N PB-HX502 12/02, product ID 4236D84

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E. Test Results Chart

SPECIFICATION	TEST TYPE	Meets Requirements	TEST DATA
FCC CFR 47			APPENDIX
Part 15.207	AC Powerline Conducted Emission	Pass	See Test Report RTS-6058-1408-07_rev1
Part 15.209 Part 15.247	BT/BLE Radiated Spurious Emissions	Pass	1
Part 15.209 Part 15.247	BT/BLE Radiated Band Edge Compliance	Pass	1
Part 15.209 Part 15.247	802.11b/g/n Radiated Spurious Emissions	Pass	1
Part 15.209 Part 15.247	802.11b/g/n Radiated Band Edge Compliance	Pass	1
Part 15.209 Part 15.407	802.11a/n Radiated Spurious Emissions	Pass	See Test Report RTS-6058-1408-07_rev1
Part 15.209 Part 15.407	802.11a/n Radiated Band Edge Compliance	Pass	See Test Report RTS-6058-1408-07_rev1
Part 15.247(a)	BT, 20 dB Bandwidth	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(a)	BT, Carrier Frequency Separation	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(a)	BT, Number of Hopping Frequencies	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(a)	BT, Time of Occupancy (Dwell Time)	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(b)	BT, Maximum Peak Conducted Output Power	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(c)	BT, Band-Edge Compliance of RF Conducted Emissions	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(c)	BT, Spurious RF Conducted Emissions	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(a)	BLE, 6 dB Bandwidth	Pass	See Test Report RTS-6026-1302-22_rev1

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Test Results Chart cont'd

SPECIFICATION	TEST TYPE	Meets Requirements	TEST DATA
FCC CFR 47			APPENDIX
Part 15.247(b)	BLE, Maximum Conducted Output Power	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(c)	BLE, Band-Edge	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(d)	BLE, Peak Power Spectral Density	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(c)	BLE, Spurious RF Conducted Emissions	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(a)	802.11b/g/n, 6 dB Bandwidth	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(b)	802.11b/g/n, Maximum Conducted Output Power	Pass	2
Part 15.247(c)	802.11b/g/n, Band-Edge	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(d)	802.11b/g/n, Peak Power Spectral Density	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.247(c)	802.11b/g/n, Spurious RF Conducted Emissions	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.407	802.11a/n, 6 dB Bandwidth	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.407	802.11a/n, Maximum Conducted Output Power	Pass	3
Part 15.407	802.11a/n, Band-Edge	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.407	802.11a/n, Peak Power Spectral Density	Pass	3
Part 15.407	802.11a/n, Spurious RF Conducted Emissions	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.209 Part 15.225(a)	Near Field Communications, Radiated Emissions	Pass	See Test Report RTS-6058-1408-07_rev1

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Part 15.225(e)	Near Field Communications, Occupied Bandwidth	Pass	See Test Report RTS-6026-1302-22_rev1
Part 15.225(e)	Near Field Communications, Frequency Stability	Pass	See Test Report RTS-6026-1302-22_rev1

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F. Summary of Results

1) BLUETOOTH, BLUETOOTH LOW ENERGY AND 802.11b/g/n 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 modified semi-anechoic chamber (modified 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 modified SAC'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 BlackBerry'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 .

The BlackBerry® smartphone was measured in standalone configuration with Bluetooth Low Energy transmitting in single frequency mode at low channel (0), middle channel (20) and high channel (39). The system's radiated emission levels were compared with respect to the FCC CFR 47 Part 15, Subpart C, 15.247 .

The BlackBerry® smartphone was measured in standalone configuration transmitting on channels 1, 6 & 11 at 1 Mbps for 802.11b mode, at 6 Mbps for 802.11g mode, and at MCS 0 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 .

The Bluetooth harmonics were investigated up to the 10th harmonic. The sample EUT emissions were in the noise floor (NF).

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The Bluetooth Low Energy harmonics were investigated up to the 10th harmonic. The sample EUT emissions were in the noise floor (NF).
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, Bluetooth Low Energy and 802.11b/g/n as per the requirements of 15.247, 15.209.

Measurement Uncertainty ±4.2 dB
See APPENDIX 1 for the test data

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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) Maximum Conducted Output Power
The EUT met the requirements of the maximum conducted output power as per 47 CFR 15.247(b). Low channel (1), middle channel (6) and high channel (11) were measured. The worst case Conducted Output Power level was 19.78 dBm (95.06 mW) for channel 6 in 802.11b mode, 19.31 dBm (85.31 mW) for channel 6 in 802.11g mode, and 15.42 dBm (34.83 mW) for channel 6 in 802.11n mode.
See APPENDIX 2 for the test data

3) 802.11a/n RF CONDUCTED EMISSIONS

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

a) Maximum Conducted Output Power
The EUT met the requirements of the maximum conducted output power as per 47 CFR 15.407. Channels 36, 48, 64, 100, 140 and 165 were measured. The worst case Conducted Output Power level was 14.33 dBm (27.10 mW) for channel 140 in 802.11a mode. The worst case Conducted Output Power level was was 14.41 dBm (27.61 mW) for channel 140 in 802.11n mode.
See APPENDIX 5 for the test data

b) Peak Power Spectral Density
The EUT met the requirements of peak power spectral density as per 47 CFR 15.407. Channels 36, 64, 100, 140 and 165 were measured.
See APPENDIX 3 for the test data.

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G. Compliance Test Equipment Used

UNIT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL DUE DATE (YY MM DD)	CALIBRATION INTERVAL	USE
EMI Test Receiver	Rohde & Schwarz	ESIB 40	100255	14-12-11	1 Year	Conducted/Radiated Emissions
EMI Test Receiver	Rohde & Schwarz	ESU 40	100162	14-12-08	1 Year	Conducted/Radiated Emissions
Hybrid Log Antenna	EMC Automation	HLP-3003C	017301	14-08-13	2 Years	Radiated Emissions
Horn Antenna	CMT	3116	R52734-001	16-03-31	2 Years	Radiated Emissions
Horn Antenna	EMCO	3116	2538	14-10-30	2 Years	Radiated Emissions
Horn Antenna	ETS-Lindgren	3117	2538	15-08-07	2 Years	Radiated Emissions
Active Loop Antenna	EMCO	6507	00032	15-08-21	2 Years	Radiated Emissions
Preamplifier	Rohde & Schwarz	TS-ANA4-SP	001	14-10-13	1 Year	Radiated Emissions
Preamplifier	Sonoma	310N/11909A	185831	14-10-10	1 Year	Radiated Emissions
Preamplifier	Rohde & Schwarz	TS-ANA-SP	001	14-10-13	1 Year	Radiated Emissions
L.I.S.N.	Rohde & Schwarz	ENV216	100060	15-10-08	1 Year	Conducted Emissions
Environment Monitor	Omega	iTHX-SD	0380561	14-10-30	3 Years	Radiated Emissions
EMC Analyzer	Agilent	E7405A	US40240226	15-01-23	1 Year	Radiated Emissions
DC Power Supply	HP	6632B	US37472178	14-09-03	1 Year	RF Conducted Emissions
Environment Monitor	Omega	iTHX-SD	0340060	16-09-11	3 Years	RF Conducted Emissions
Environmental Chamber	Test Equity	107	0900246	N/R	N/R	Frequency Stability
Bluetooth Tester	Rohde & Schwarz	CBT	119549	14-11-28	1 Year	RF Conducted Emissions
Bluetooth Tester	Rohde & Schwarz	CBT35	100368	14-11-28	1 Year	Radiated Emissions
Bluetooth Tester	Rohde & Schwarz	CBT35	100370	14-11-28	1 Year	Radiated Emissions
Power Meter	Agilent	N1911A	MY45100951	15-09-10	1 Year	RF Conducted / Frequency Stability
Power Sensor	Agilent	N1921A	MY45241383	15-09-11	1 Year	RF Conducted / Frequency Stability
Environment Monitor	Omega	iTHX-SD	0380567	14-10-30	3 Years	Radiated Emissions

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APPENDIX 1 – BLUETOOTH, BLUETOOTH LOW ENERGY AND 802.11b/g/n RADIATED EMISSIONS TEST DATA

Radiated Emissions Test Results
Bluetooth Band

Date of Test: July 4, 2014
Measurements were performed by Rex Zhang.

The environmental test conditions were: Temperature: 25.1ºC
Relative Humidity: 48.6 %

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

The BlackBerry® smartphone in Bluetooth TX mode was in horizontal 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 emission levels were at least 25 dB below the limit.

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

Date of Test: July 14 - 15 and August 5, 2014
Measurements were performed by Kevin Guo

The environmental test conditions were: Temperature: 23.4 – 24.5ºC
Relative Humidity: 33.9 – 44.3 %

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

The BlackBerry® smartphone in Bluetooth TX mode was in horizontal down 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 emission levels were at least 25 dB below the limit.

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

Date of test: July 29, 2014
Measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 25.5 º C
Relative Humidity: 32.7 %

The BlackBerry® smartphone was in standalone, Vertical Up position and pattern type "Static PBRS" in "DH5", "2-DH5" and "3-DH5" modulation during the measurements.

The test distance was 3.0 meters.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector	VBW	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	97.36	55.72	41.64	74.00	-32.36
0	2402	Horn	H	PK	1 MHz	98.60	56.76	41.84	74.00	-32.16
0	2402	Horn	V	AVE.	10 Hz	90.28	55.72	34.56	54.00	-19.44
0	2402	Horn	H	AVE.	10 Hz	91.57	56.76	34.81	54.00	-19.19
High Channel, Packet Type DH5										
78	2480	Horn	V	PK	1 MHz	100.07	57.68	42.39	74.00	-31.61
78	2480	Horn	H	PK	1 MHz	98.84	56.82	42.02	74.00	-31.98
78	2480	Horn	V	AVE.	10 Hz	93.05	57.68	35.37	54.00	-18.63
78	2480	Horn	H	AVE.	10 Hz	91.76	56.82	34.94	54.00	-19.06
Low Channel, Packet Type 2-DH5										
0	2402	Horn	V	PK	1 MHz	95.94	52.95	42.99	74.00	-31.01
0	2402	Horn	H	PK	1 MHz	97.41	54.56	42.85	74.00	-31.15
0	2402	Horn	V	AVE.	10 Hz	86.36	52.95	33.41	54.00	-20.59
0	2402	Horn	H	AVE.	10 Hz	87.80	54.56	33.24	54.00	-20.76
High Channel, Packet Type 2-DH5										
78	2480	Horn	V	PK	1 MHz	98.70	55.41	43.29	74.00	-30.71
78	2480	Horn	H	PK	1 MHz	97.45	54.18	43.27	74.00	-30.73
78	2480	Horn	V	AVE.	10 Hz	88.95	55.41	33.54	54.00	-20.46
78	2480	Horn	H	AVE.	10 Hz	87.74	54.18	33.56	54.00	-20.44

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

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector	VBW	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	96.27	53.43	42.84	74.00	-31.16
0	2402	Horn	H	PK	1 MHz	98.51	55.13	43.38	74.00	-30.62
0	2402	Horn	V	AVE.	10 Hz	86.34	53.43	32.91	54.00	-21.09
0	2402	Horn	H	AVE.	10 Hz	87.79	55.13	32.66	54.00	-21.34
High Channel, Packet Type 3-DH5										
78	2480	Horn	V	PK	1 MHz	98.99	54.66	44.33	74.00	-29.67
78	2480	Horn	H	PK	1 MHz	97.69	53.87	43.82	74.00	-30.18
78	2480	Horn	V	AVE.	10 Hz	88.95	54.66	34.29	54.00	-19.71
78	2480	Horn	H	AVE.	10 Hz	87.62	53.87	33.75	54.00	-20.25

See figures 1-1 to 1-12 for the plots of the Bluetooth band-edge compliance.

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

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

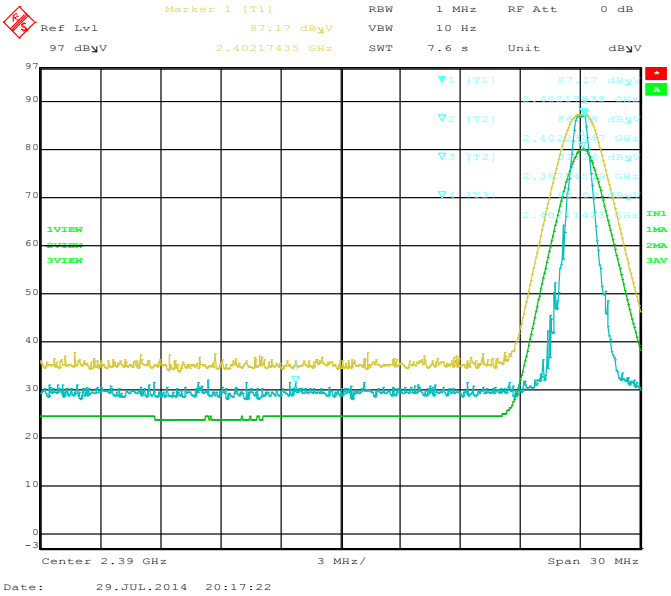


Figure 1-2: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, DH5, Channel 0, Pol: H, Detector: PK

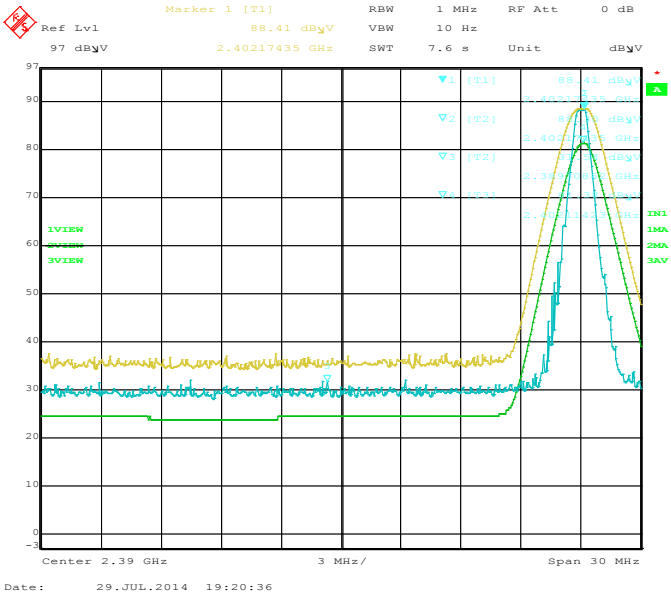


Figure 1-3: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, DH5, Channel 78, Pol: V, Detector: PK

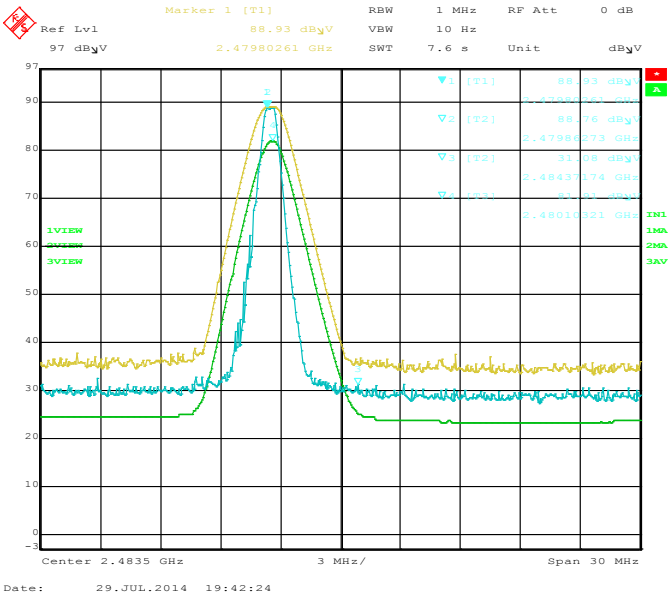
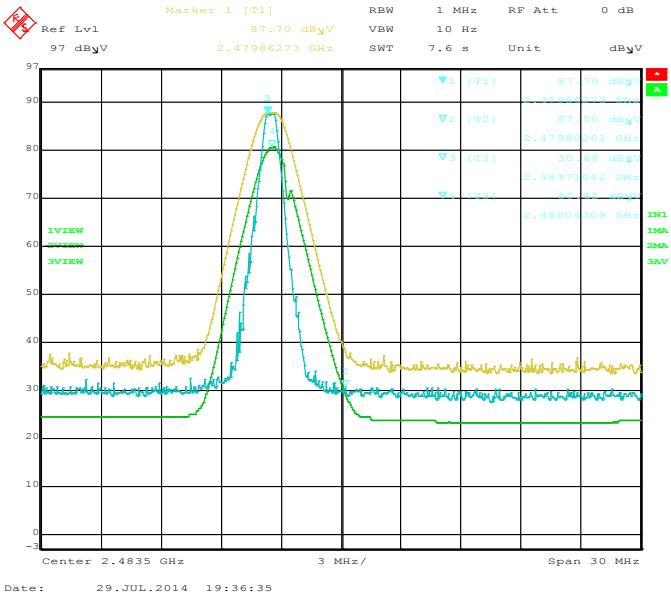


Figure 1-4: Band-Edge Compliance of RF Rad. Emissions Bluetooth, Single freq., Static PBRS, DH5, Channel 78, Pol: H, Detector: PK



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

Figure 1-5: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 2-DH5, Channel 0, Pol: V, Detector: PK

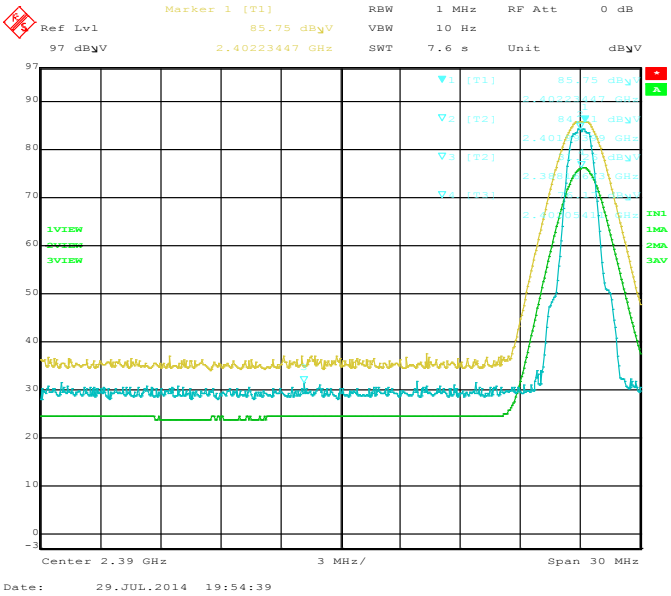


Figure 1-6: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 2-DH5, Channel 0, Pol: H, Detector: PK

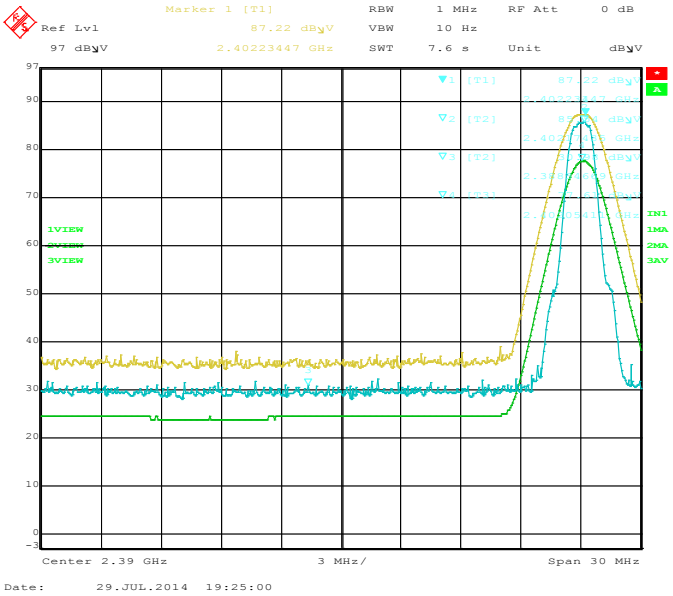


Figure 1-7: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 2-DH5, Channel 78, Pol: V, Detector: PK

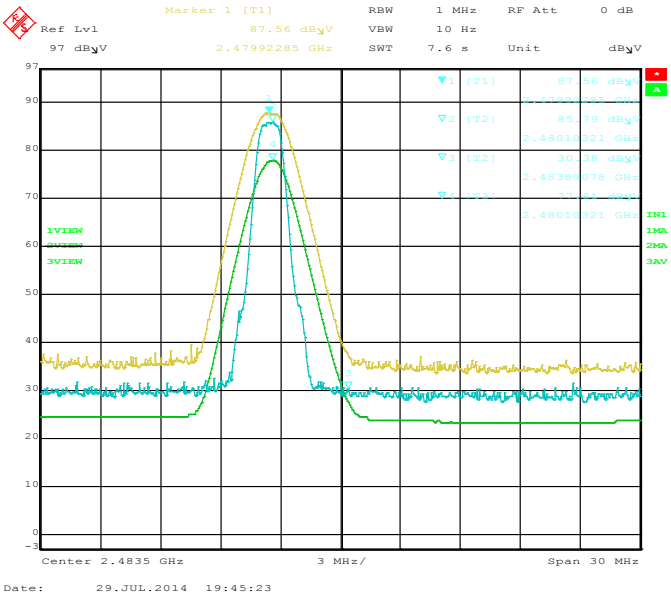
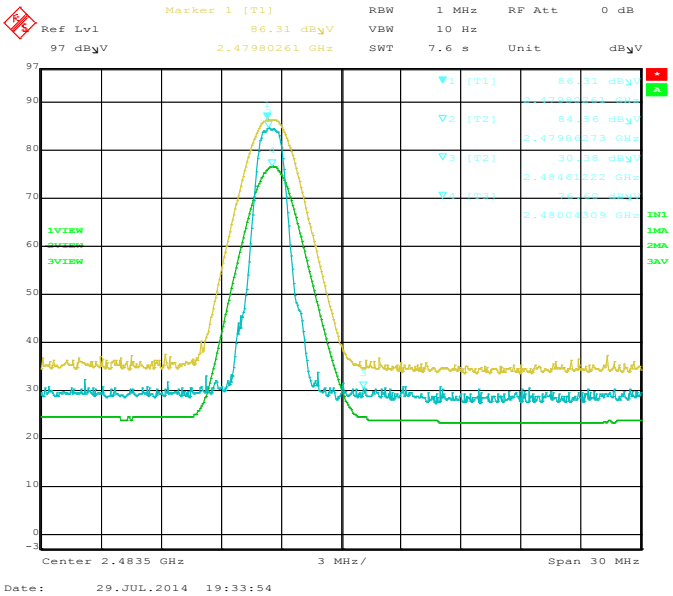


Figure 1-8: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 2-DH5, Channel 78, Pol: H, Detector: PK



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

Figure 1-9: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 0, Pol: V, Detector: PK

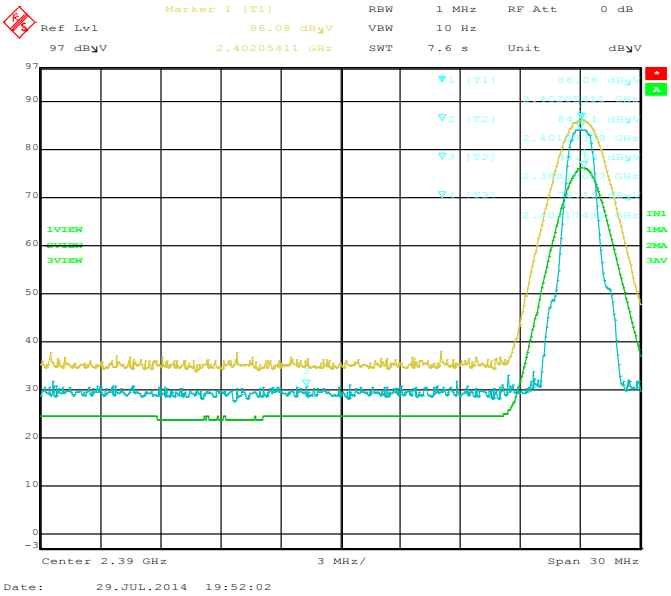


Figure 1-10: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 0, Pol: H, Detector: PK

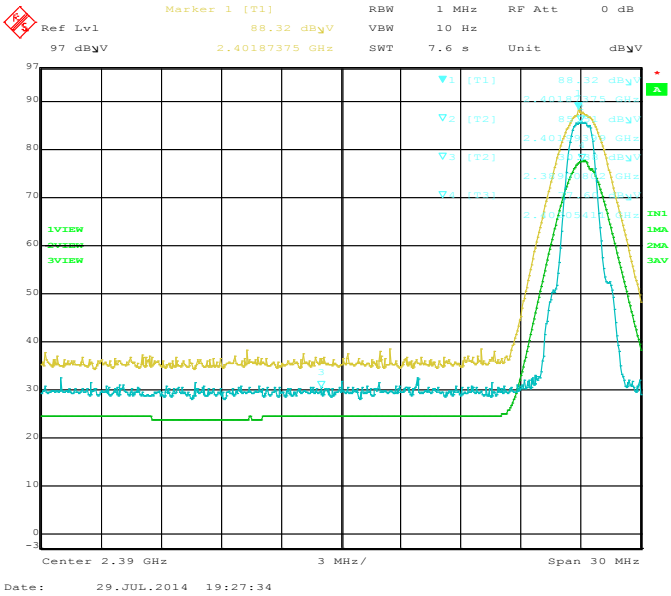


Figure 1-11: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 78, Pol: V, Detector: PK

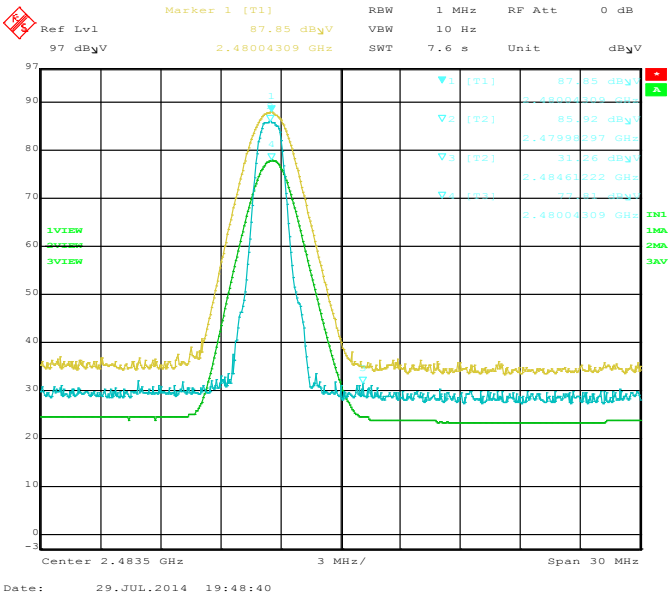
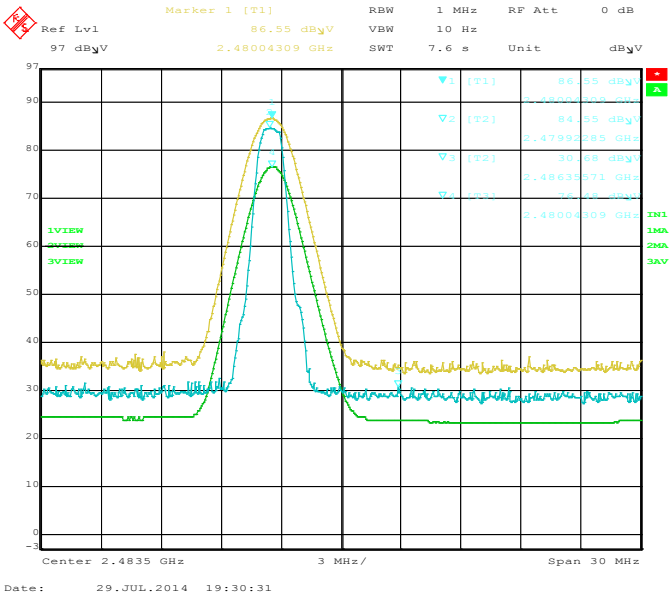


Figure 1-12: Band-Edge Compliance of RF Rad. Emissions. Bluetooth, Single freq., Static PBRS, 3-DH5, Channel 78, Pol: H, Detector: PK



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Radiated Emissions Test Results cont'd
Bluetooth Low Energy Band

Date of Test: July 7, 2014
Measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 26.0 ºC
Relative Humidity: 47.4 %

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

The BlackBerry® smartphone in Bluetooth Low Energy TX mode was in horizontal position.

The frequency sweep measurements were performed in single frequency mode on channels 0, 20 and 39.

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

Date of Test: July 14 - 15, 2014 and August 5, 2014
Measurements were performed by Masud Attayi.

The environmental test conditions were: Temperature: 23.4 – 24.5ºC
Relative Humidity: 38.9 – 42.7%

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

The BlackBerry® smartphone in Bluetooth Low Energy TX mode was in horizontal down position.

The frequency sweep measurements were performed in single frequency mode on channels 0, 20 and 39.

All other emission levels were at least 25 dB below the limit.

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

Date of test: July 29, 2014
Measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 25.5º C
Relative Humidity: 32.7 %

The BlackBerry® smartphone was in Vertical Up position.

The test distance was 3.0 meters.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector	VBW	Corrected Reading (dBuV/m)	Delta Marker (dB)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
Low Channel, LE										
0	2402	Horn	V	PK	1 MHz	95.25	53.92	41.33	74.00	-32.67
0	2402	Horn	H	PK	1 MHz	96.38	55.05	41.33	74.00	-32.67
0	2402	Horn	V	AVE.	10 Hz	90.39	53.92	36.47	54.00	-17.53
0	2402	Horn	H	AVE.	10 Hz	91.53	55.05	36.48	54.00	-17.52
High Channel, LE										
39	2480	Horn	V	PK	1 MHz	98.48	55.70	42.78	74.00	-31.22
39	2480	Horn	H	PK	1 MHz	96.87	54.64	42.23	74.00	-31.77
39	2480	Horn	V	AVE.	10 Hz	93.68	55.70	37.98	54.00	-16.02
39	2480	Horn	H	AVE.	10 Hz	92.05	54.64	37.41	54.00	-16.59

See figures 1-13 to 1-16 for the plots of the Bluetooth Low Energy band-edge compliance.

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

Figure 1-13: Band-Edge Compliance of RF Rad. Emissions. Bluetooth Low Energy, Single freq., LE, Channel 0, Pol: V, Detector: PK

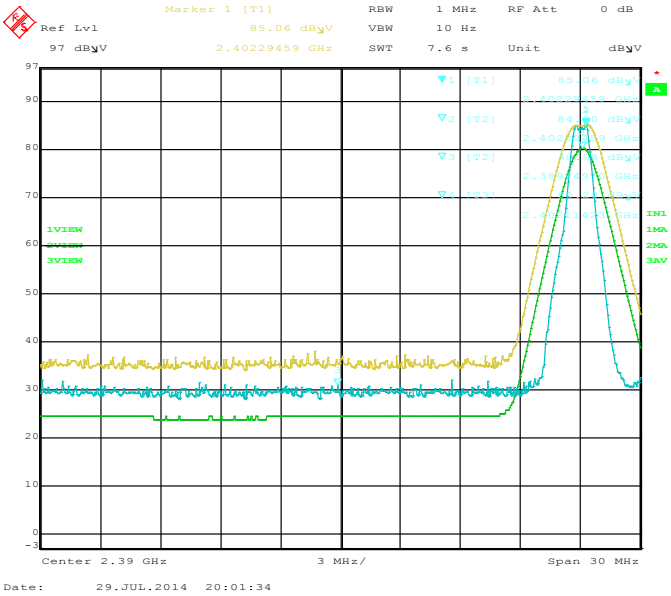


Figure 1-14: Band-Edge Compliance of RF Rad. Emissions. Bluetooth Low Energy, Single freq., LE, Channel 0, Pol: H, Detector: PK

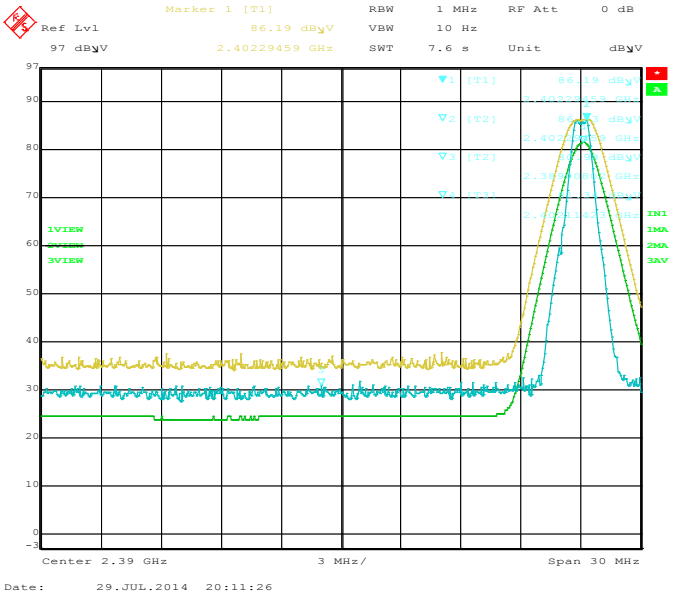


Figure 1-15: Band-Edge Compliance of RF Rad. Emissions. Bluetooth Low Energy, Single freq., LE, Channel 39, Pol: V, Detector: PK

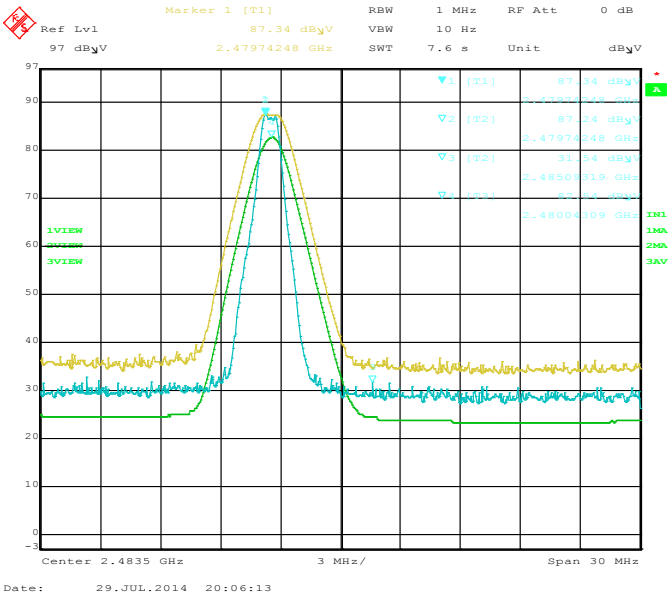
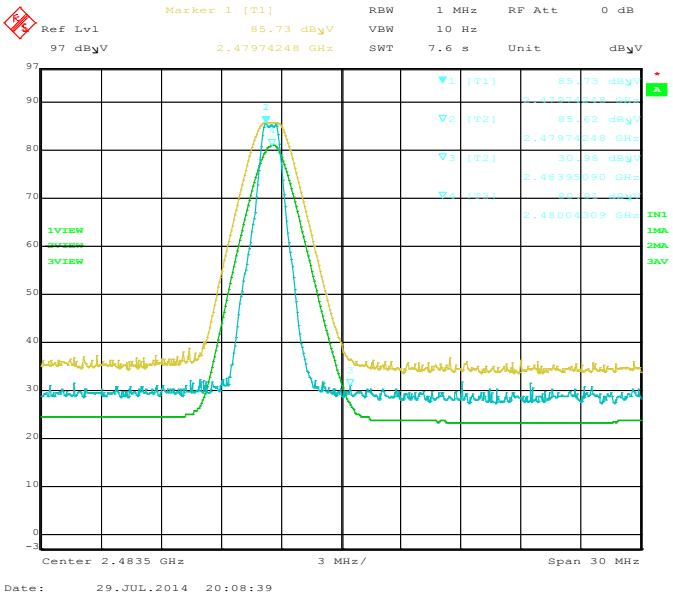


Figure 1-16: Band-Edge Compliance of RF Rad. Emissions Bluetooth Low Energy, Single freq., LE, Channel 39, Pol: H, Detector: PK



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

Date of Test: July 25 – 28, 2014
Measurements performed by Rex Zhang.

The environmental test conditions were: Temperature: 26.3 – 26.5ºC
Relative Humidity: 34.7 - 42.5%

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

The BlackBerry® smartphone was in Vertical Up 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 channels 1, 6 and 11, and in 802.11n TX mode at MCS 0 on channels 1, 6 and 11.

All other emission levels were at least 25 dB below the limit.

Date of Test: July 22 - 28 and August 5, 2014
Measurements performed by Kevin Guo.

The environmental test conditions were: Temperature: 23.4 – 24.5 ºC
Relative Humidity: 33.9 – 44.3 %

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

The BlackBerry® smartphone was in USB 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 channels 1, 6 and 11, and in 802.11n TX mode at MCS 0 on channels 1, 6 and 11.

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

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

Date of Tests: July 24, 2014
Measurements performed by Rex Zhang.

The environmental test conditions were: Temperature: 23.8 ºC
Relative Humidity: 26.9 %

802.11b Band

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

The test distance was 3 meters.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
1.0	2412.00	Horn	V	PK	1 MHz	48.51	48.51	74.00	-25.49
1.0	2412.00	Horn	H	PK	1 MHz	47.98	47.98	74.00	-26.02
1.0	2412.00	Horn	V	AV	10 Hz	35.71	35.71	54.00	-18.29
1.0	2412.00	Horn	H	AV	10 Hz	36.73	36.73	54.00	-17.27

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
11.0	2462.00	Horn	V	PK	1 MHz	48.07	48.07	74.00	-25.93
11.0	2462.00	Horn	H	PK	1 MHz	50.91	50.91	74.00	-23.09
11.0	2462.00	Horn	V	AV	10 Hz	36.10	36.10	54.00	-17.90
11.0	2462.00	Horn	H	AV	10 Hz	38.60	38.60	54.00	-15.40

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802.11g Band

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

The test distance was 3 meters.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
1.0	2412.00	Horn	V	PK	1 MHz	55.47	55.47	74.00	-18.53
1.0	2412.00	Horn	H	PK	1 MHz	57.54	57.54	74.00	-16.46
1.0	2412.00	Horn	V	AV	10 Hz	38.47	38.47	54.00	-15.53
1.0	2412.00	Horn	H	AV	10 Hz	39.58	39.58	54.00	-14.42

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
11.0	2462.00	Horn	V	PK	1 MHz	54.98	54.98	74.00	-19.02
11.0	2462.00	Horn	H	PK	1 MHz	56.49	56.49	74.00	-17.51
11.0	2462.00	Horn	V	AV	10 Hz	38.15	38.15	54.00	-15.85
11.0	2462.00	Horn	H	AV	10 Hz	39.81	39.81	54.00	-14.19

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802.11n Band

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

The test distance was 3 meters.

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
1.0	2412.00	Horn	V	PK	1 MHz	56.49	56.49	74.00	-17.51
1.0	2412.00	Horn	H	PK	1 MHz	58.60	58.60	74.00	-15.40
1.0	2412.00	Horn	V	AV	10 Hz	38.47	38.47	54.00	-15.53
1.0	2412.00	Horn	H	AV	10 Hz	40.87	40.87	54.00	-13.13

Channel	Freq. (MHz)	Rx Antenna Type	Rx Antenna POL.	Detector (MHz)	VBW For Peak (dBuV/m)	Peak Corrected Reading (dBuV/m)	Corrected Band edge (dBuV/m)	Limit (dBuV/m)	Diff. To Limit (dB)
11.0	2462.00	Horn	V	PK	1 MHz	55.04	55.04	74.00	-18.96
11.0	2462.00	Horn	H	PK	1 MHz	56.82	56.82	74.00	-17.18
11.0	2462.00	Horn	V	AV	10 Hz	38.15	38.15	54.00	-15.85
11.0	2462.00	Horn	H	AV	10 Hz	40.53	40.53	54.00	-13.47

See figures 1-17 to 1-20 for the plots of the 802.11b band-edge compliance.
See figures 1-21 to 1-24 for the plots of the 802.11g band-edge compliance.
See figures 1-25 to 1-28 for the plots of the 802.11n band-edge compliance.

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

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

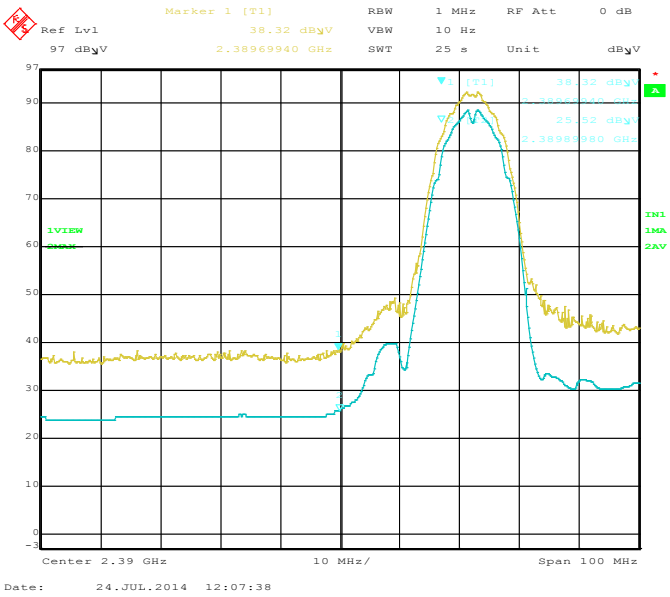

Figure 1-18: Band-Edge Compliance of RF Radiated Emission 802.11b, Channel 1, 2412 MHz, Max Pol: H, Detector: PK

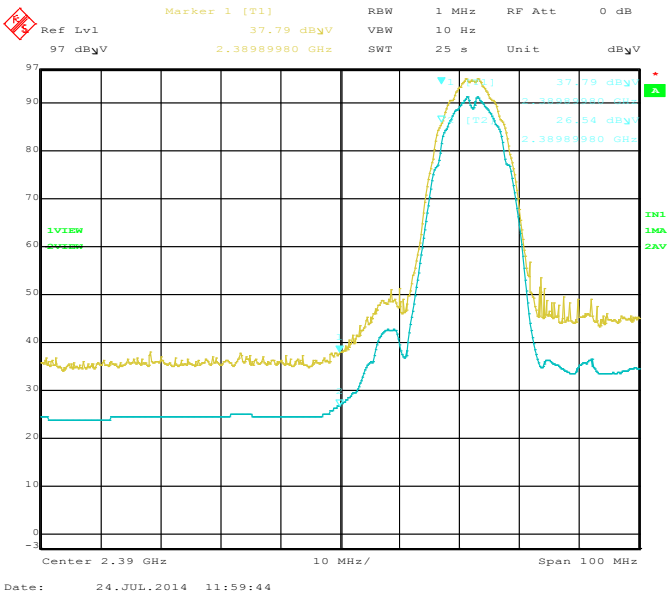

Figure 1-19: Band-Edge Compliance of RF Radiated Emission 802.11b, Channel 11, 2462 MHz, Max Pol: V, Detector: PK

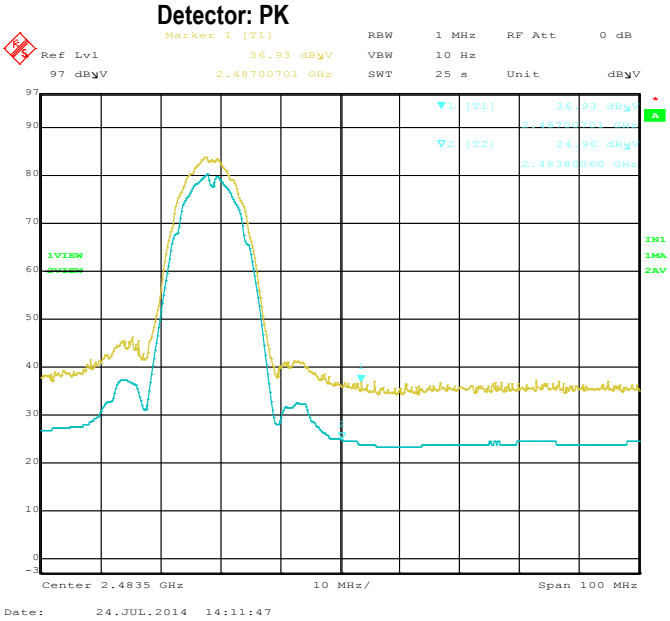

Figure 1-20: Band-Edge Compliance of RF Radiated Emission 802.11b, Channel 11, 2462 MHz, Max Pol: H, Detector: PK

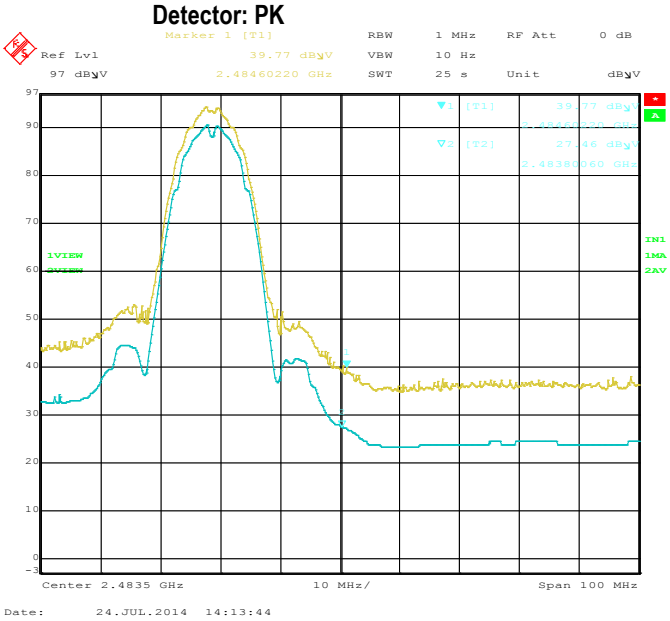

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Figure 1-21: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 1, 2412 MHz, Max Pol: V, Detector: PK

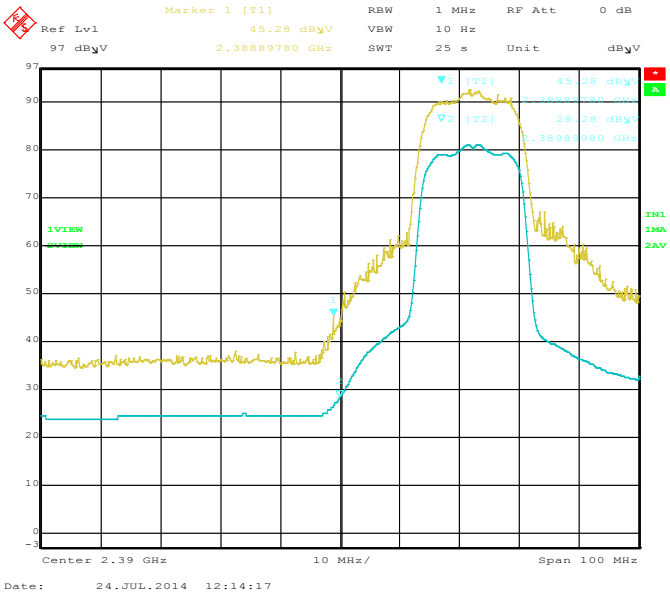

Figure 1-22: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 1, 2412 MHz, Max Pol: H, Detector: PK

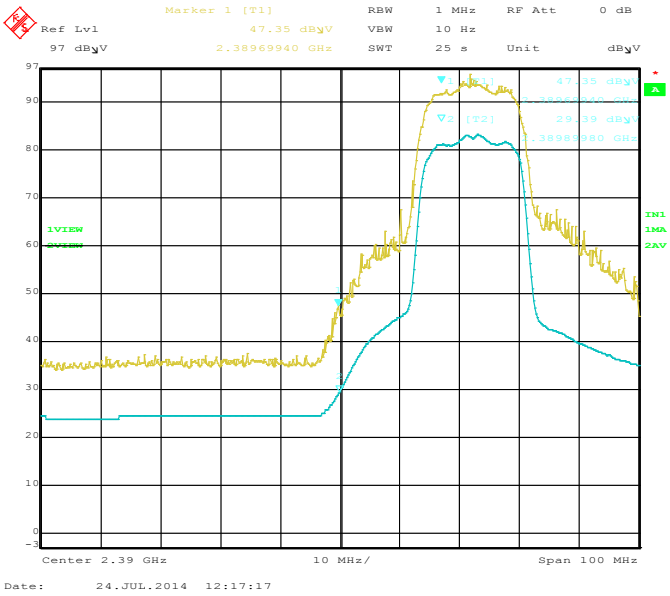

Figure 1-23: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 11, 2462 MHz, Max Pol: V, Detector: PK

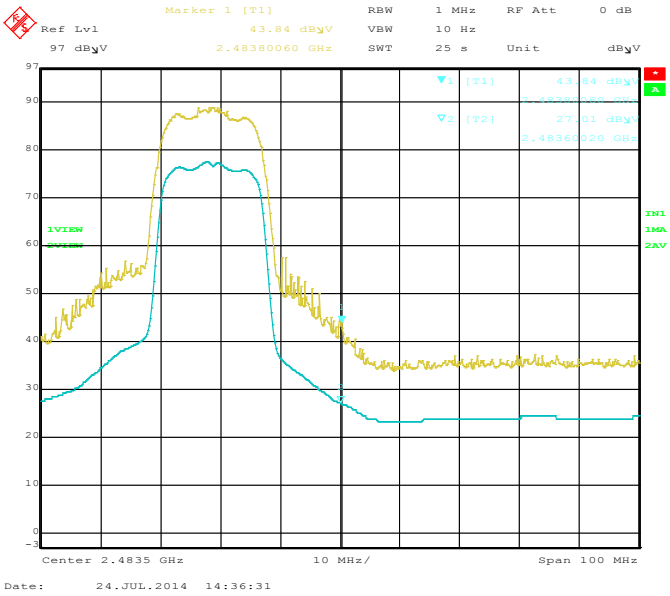

Figure 1-24: Band-Edge Compliance of RF Radiated Emission 802.11g, Channel 11, 2462 MHz, Max Pol: H, Detector: PK

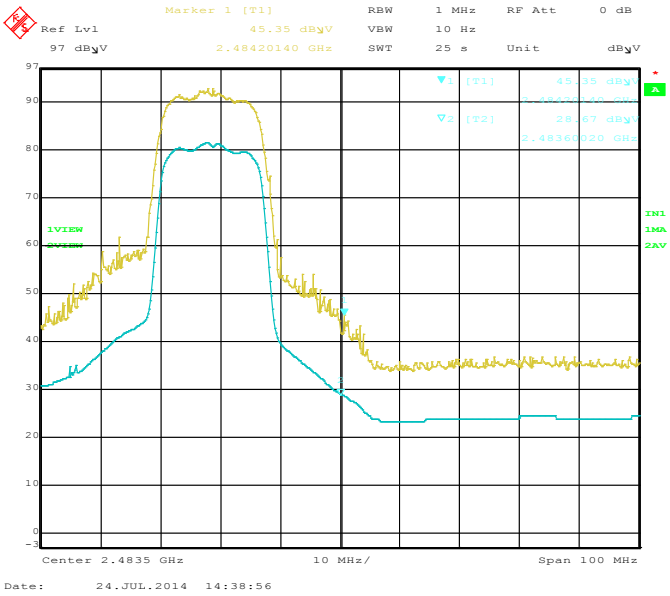

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Figure 1-25: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 1, 2412 MHz, Max Pol: V, Detector: PK

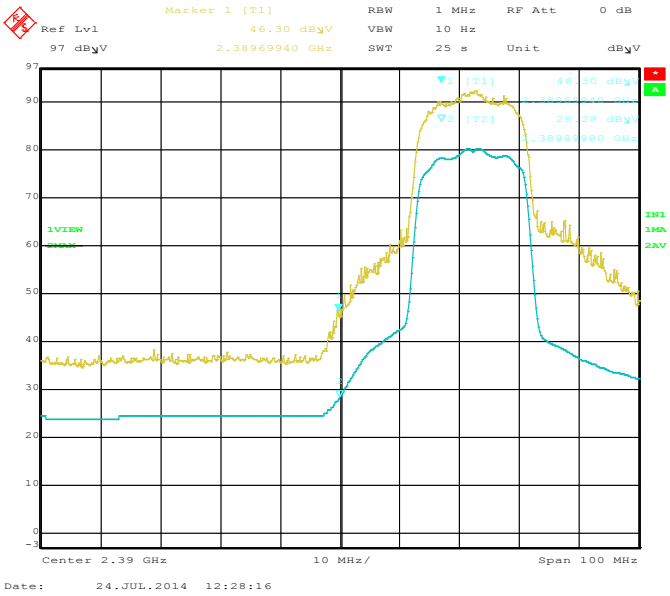


Figure 1-26: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 1, 2412 MHz, Max Pol: H, Detector: PK

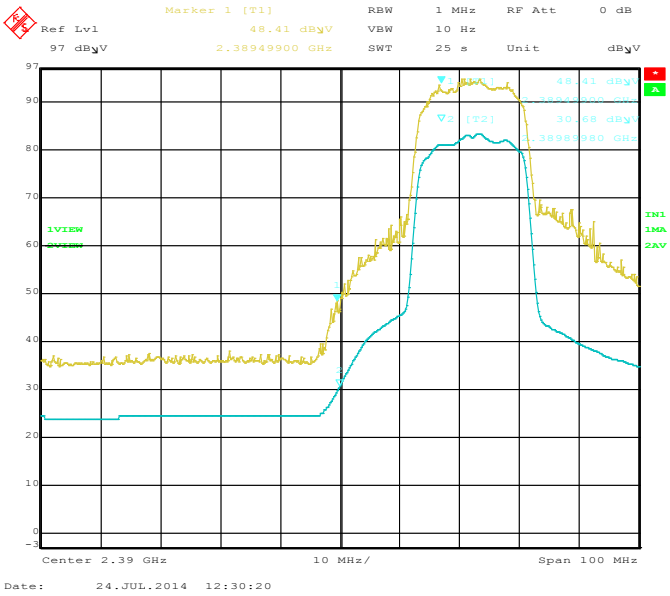


Figure 1-27: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 11, 2462 MHz, Max Pol: V, Detector: PK

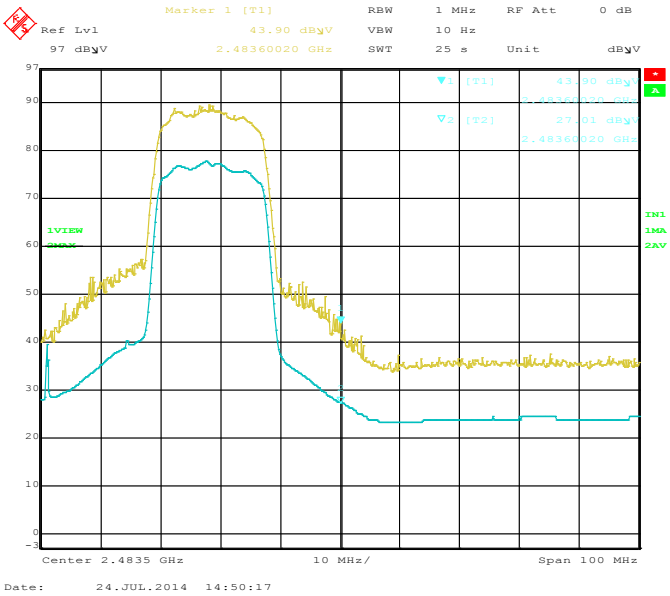
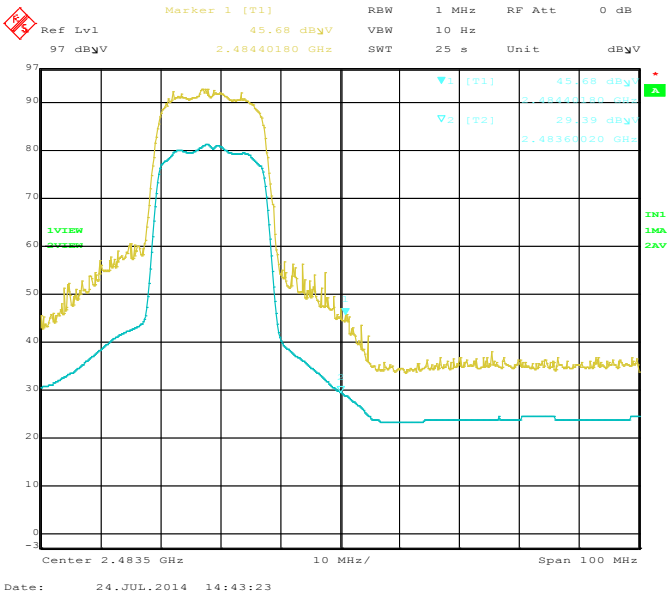


Figure 1-28: Band-Edge Compliance of RF Radiated Emission 802.11n, Channel 11, 2462 MHz, Max Pol: H, Detector: PK



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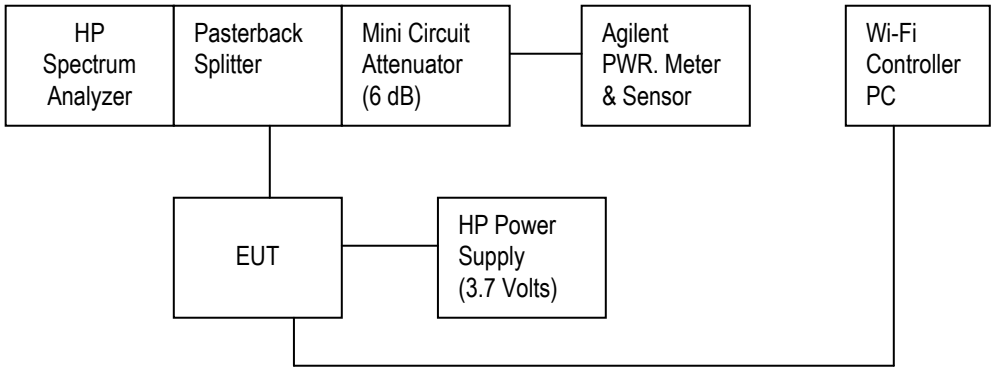
APPENDIX 2 – 802.11b/g/n CONDUCTED EMISSIONS TEST DATA/PLOTS

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: July 15, 2014
The measurements on the BlackBerry® smartphone were performed by Chuan Tran.

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

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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 2 as per 47 CFR 15.247(b)(3). 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	17.26	53.21
	5.5 Mbps	< 1.00	17.29	53.58
	11 Mbps	< 1.00	17.09	51.17
	6 Mbps	< 1.00	15.07	32.14
	24 Mbps	< 1.00	14.67	29.31
	54 Mbps	< 1.00	14.22	26.42
	MCS 0	< 1.00	14.24	26.55
	MCS 4	< 1.00	14.26	26.67
	MCS 7	< 1.00	14.22	26.42
6	1 Mbps	< 1.00	**19.78**	95.06
	5.5 Mbps	< 1.00	19.75	94.41
	11 Mbps	< 1.00	19.60	91.20
	6 Mbps	< 1.00	**19.31**	85.31
	24 Mbps	< 1.00	16.91	49.09
	54 Mbps	< 1.00	15.44	34.99
	MCS 0	< 1.00	**15.42**	34.83
	MCS 4	< 1.00	15.38	34.51
	MCS 7	< 1.00	15.33	34.12

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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	18.61	72.61
	5.5 Mbps	< 1.00	18.64	73.11
	11 Mbps	< 1.00	18.40	69.18
	6 Mbps	< 1.00	13.04	20.14
	24 Mbps	< 1.00	12.68	18.54
	54 Mbps	< 1.00	12.17	16.48
	MCS 0	< 1.00	12.15	16.41
	MCS 4	< 1.00	12.20	16.60
	MCS 7	< 1.00	12.26	16.83

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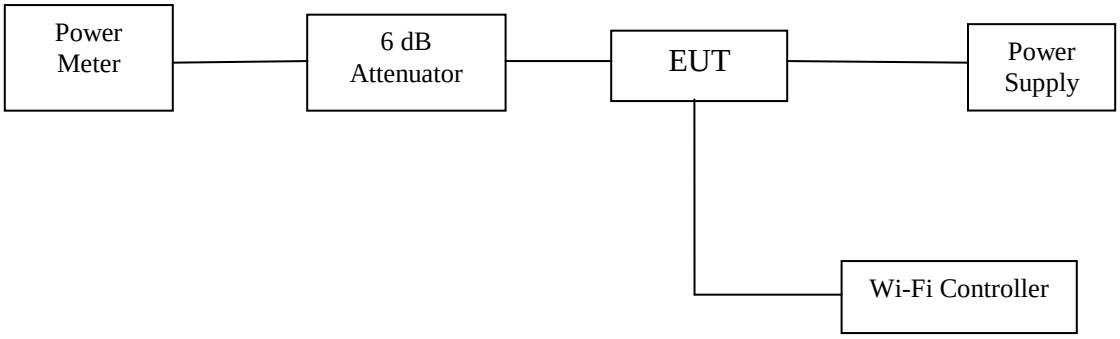
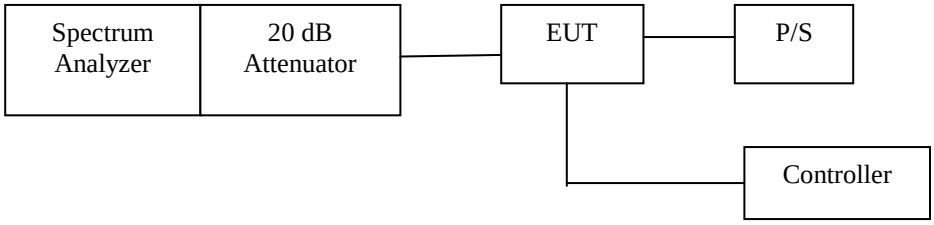
APPENDIX 3 – 802.11a/n CONDUCTED EMISSIONS TEST DATA/PLOTS

802.11a/n RF Conducted Emission Test Results

Test Setup Diagram





A reference offset of 8.9 dB was applied to the spectrum analyzer and 7.4 dB to the Power Meter reference level for the attenuators and coaxial cable loss in the test circuit.

Date of test: July 15, 2014
The measurements were performed by Chuan Pao Tran.

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

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802.11a RF Conducted Emission Test Results

Maximum Conducted Output Power

The EUT met the requirements of the maximum conducted output power of class 2 as per 47 CFR 15.407 . Channels 36, 48, 64, 100, 140 and 165 were measured for 802.11a mode using an Agilent power meter, model N1911A with model N1921A power sensor. A reference offset of 8.9 dB was applied to the power meter reference level for the coaxial cable loss and attenuators in the test circuit.

Channel	Data Rate	Power Limit (mW)	Measured Level (dBm)	Measured Level (mW)
36	6 Mbps	< 250.0	14.08	25.59
	24 Mbps	< 250.0	13.65	23.17
	54 Mbps	< 250.0	13.14	20.61
48	6 Mbps	< 250.0	13.86	24.32
	24 Mbps	< 250.0	13.42	21.98
	54 Mbps	< 250.0	12.94	19.68
64	6 Mbps	< 250.0	13.59	22.86
	24 Mbps	< 250.0	13.65	23.17
	54 Mbps	< 250.0	13.64	23.12
100	6 Mbps	< 250.0	13.05	20.18
	24 Mbps	< 250.0	13.04	20.14
	54 Mbps	< 250.0	13.07	20.28
140	6 Mbps	< 250.0	**14.38**	27.42
	24 Mbps	< 250.0	14.38	27.42
	54 Mbps	< 250.0	14.37	27.35
165	6 Mbps	< 1000	11.46	14.00
	24 Mbps	< 1000	10.90	12.30
	54 Mbps	< 1000	10.50	11.22

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802.11n RF Conducted Emission Test Results

Maximum Conducted Output Power

The EUT met the requirements of the maximum conducted output power of class 2 as per 47 CFR 15.407. Channels 36, 48, 64, 100, 140 and 165 were measured for 802.11n mode using an Agilent power meter, model N1911A with model N1921A power sensor. A reference offset of 8.9 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)
36	MCS0	< 250.0	13.14	20.61
	MCS4	< 250.0	13.11	20.46
	MCS7	< 250.0	13.11	20.46
48	MCS0	< 250.0	12.99	19.91
	MCS4	< 250.0	13.00	19.95
	MCS7	< 250.0	12.94	19.68
64	MCS0	< 250.0	13.61	22.96
	MCS4	< 250.0	13.63	23.07
	MCS7	< 250.0	13.67	23.28
100	MCS0	< 250.0	13.08	20.32
	MCS4	< 250.0	13.08	20.32
	MCS7	< 250.0	13.02	20.04
140	MCS0	< 250.0	**14.41**	27.61
	MCS4	< 250.0	14.37	27.35
	MCS7	< 250.0	14.40	27.54
165	MCS0	< 1000	10.41	10.99
	MCS4	< 1000	10.47	11.14
	MCS7	< 1000	10.42	11.02

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802.11a 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 15.407 . Channels 36, 48, 64, 100, 140 and 165 were measured at 6 Mbps, 24 Mbps, and 54 Mbps each for 802.11a mode.

Channel	Data Rate	Limit (dBm)	Measured Level (dBm)	Margin (dBm)
36	6 Mbps	< 11.00	2.77	-1.23
	24 Mbps	< 11.00	3.10	-0.90
	54 Mbps	< 11.00	3.18	-0.82
48	6 Mbps	< 11.00	2.97	-1.03
	24 Mbps	< 11.00	2.98	-1.02
	54 Mbps	< 11.00	3.05	-0.95
64	6 Mbps	< 11.00	3.00	-8.00
	24 Mbps	< 11.00	2.87	-8.13
	54 Mbps	< 11.00	2.82	-8.18
100	6 Mbps	< 11.00	2.66	-8.34
	24 Mbps	< 11.00	2.67	-8.33
	54 Mbps	< 11.00	2.62	-8.38
140	6 Mbps	< 11.00	4.36	-6.64
	24 Mbps	< 11.00	4.44	-6.56
	54 Mbps	< 11.00	4.37	-6.63
165	6 Mbps	< 33.00	-13.32	-46.32
	24 Mbps	< 33.00	-14.38	-47.38
	54 Mbps	< 33.00	-14.27	-47.27

See figures 3-1 to 3-6 for the plots of the peak power spectral density for Channel 36, 48, 64, 100, 140, and 165 at 6 Mbps each for 802.11a mode.

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802.11n RF Conducted Emission Test Results

Peak Power Spectral Density

The EUT met the requirements of the peak power spectral density as per 47 CFR 15.407 . Channels 36, 64 and 165 were measured at MCS 0, MCS 4 and MCS 7 each for 802.11n mode.

Channel	Data Rate	Limit (dBm)	Measured Level (dBm)	Margin (dBm)
36	6 Mbps	< 11.00	2.70	-1.30
	24 Mbps	< 11.00	2.75	-1.25
	54 Mbps	< 11.00	2.72	-1.28
64	6 Mbps	< 11.00	2.36	-8.64
	24 Mbps	< 11.00	2.38	-8.62
	54 Mbps	< 11.00	2.37	-8.63
165	6 Mbps	< 33.00	-14.05	-47.05
	24 Mbps	< 33.00	-12.87	-45.87
	54 Mbps	< 33.00	-14.31	-47.31

See figures 3-7 to 3-9 for the plots of the peak power spectral density for Channel 36, 64 and 165 at MCS 0 each for 802.11n mode.

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802.11a RF Conducted Emission Test Results cont'd

Figure 3-1: Peak Power Spectral Density 802.11a, Channel 36, 6 Mbps

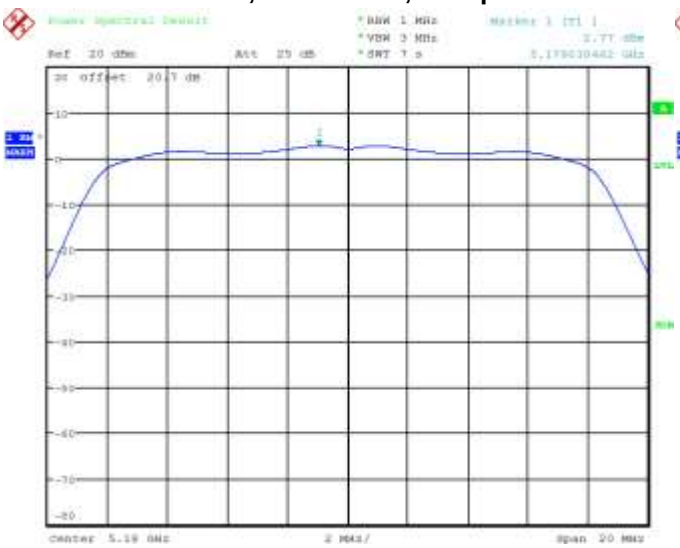


Figure 3-2: Peak Power Spectral Density 802.11a, Channel 48, 6 Mbps

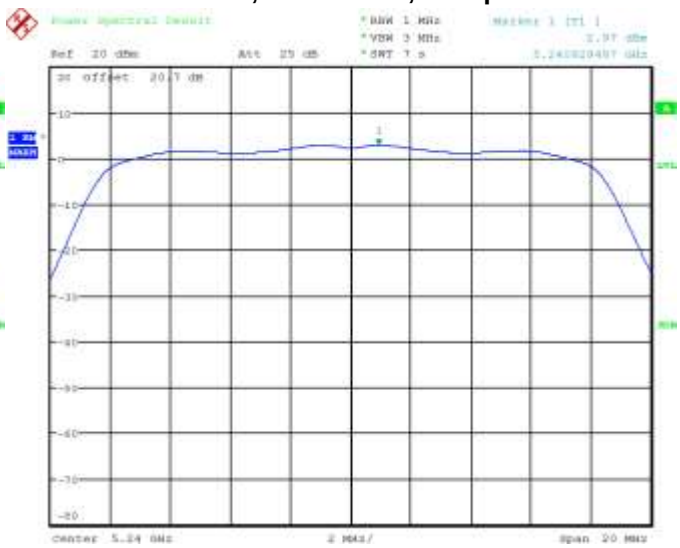


Figure 3-3: Peak Power Spectral Density 802.11a, Channel 64, 6 Mbps

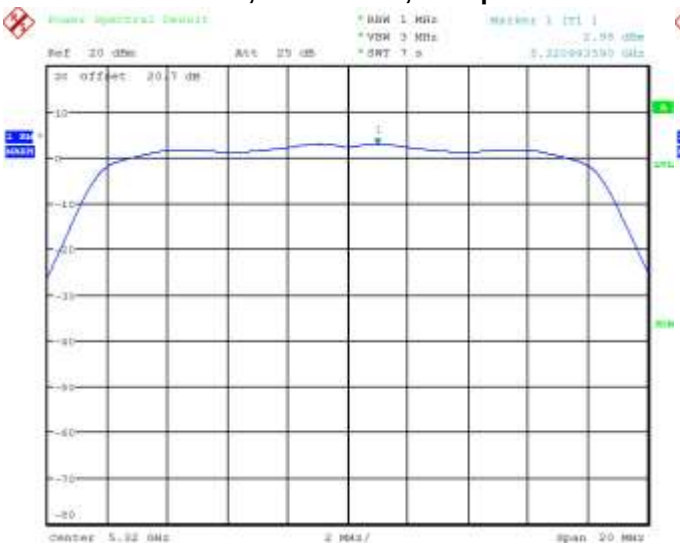
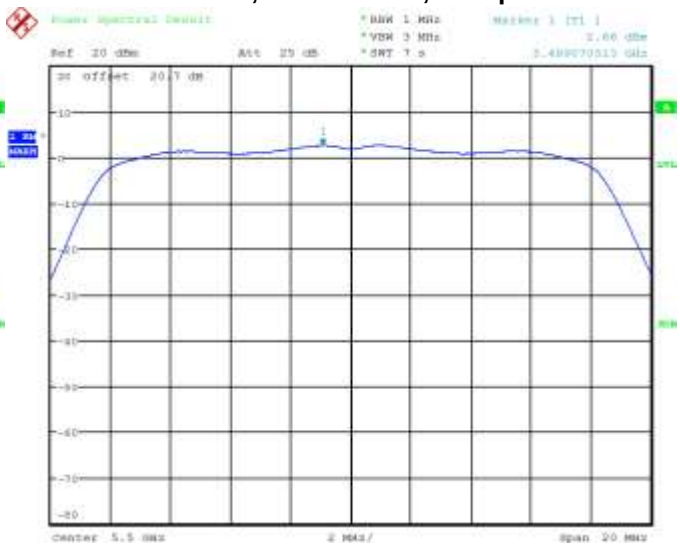


Figure 3-4: Peak Power Spectral Density 802.11a, Channel 100, 6 Mbps



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802.11a RF Conducted Emission Test Results cont'd

Figure 3-5: Peak Power Spectral Density
802.11a, Channel 140, 6 Mbps

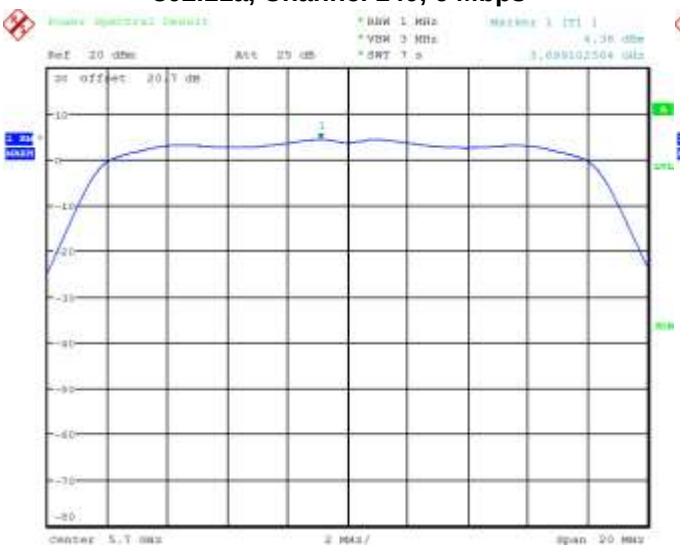
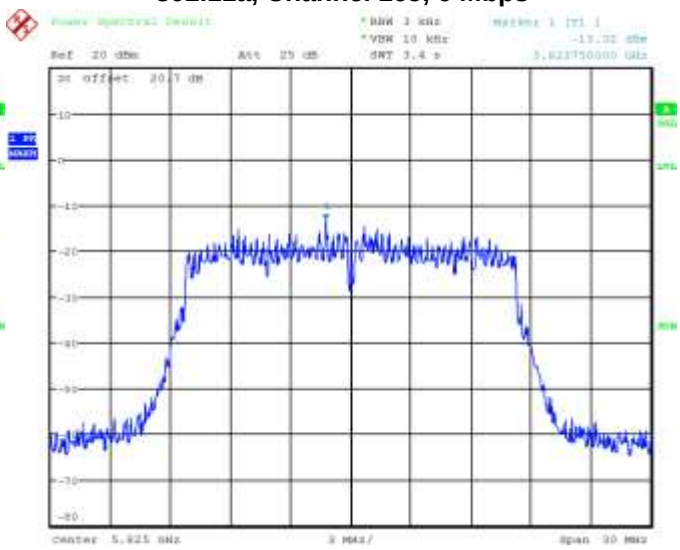


Figure 3-6: Peak Power Spectral Density
802.11a, Channel 165, 6 Mbps



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802.11n RF Conducted Emission Test Results

Figure 3-7: Peak Power Spectral Density
802.11n, Channel 36, MCS 0

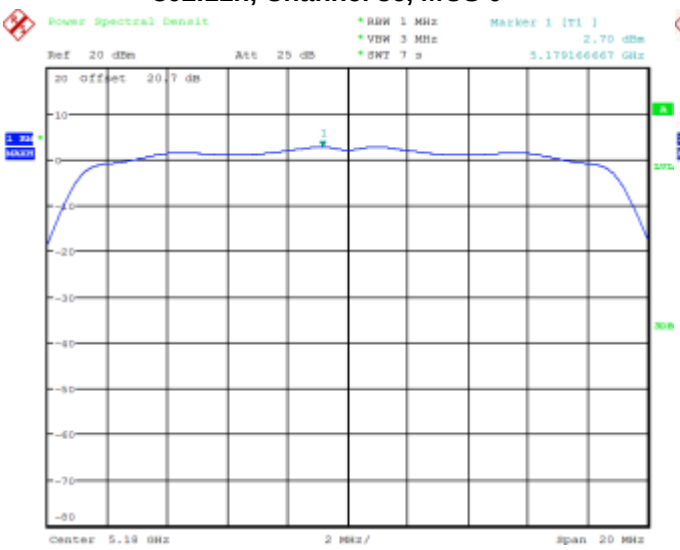


Figure 3-8: Peak Power Spectral Density
802.11n, Channel 64, MCS 0

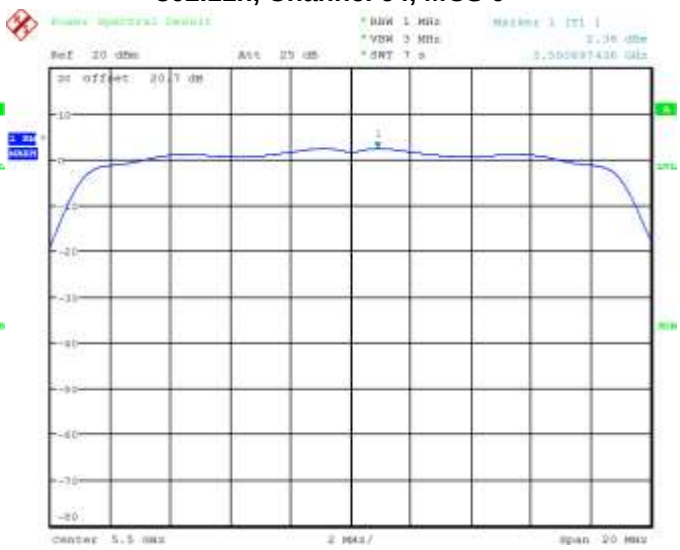
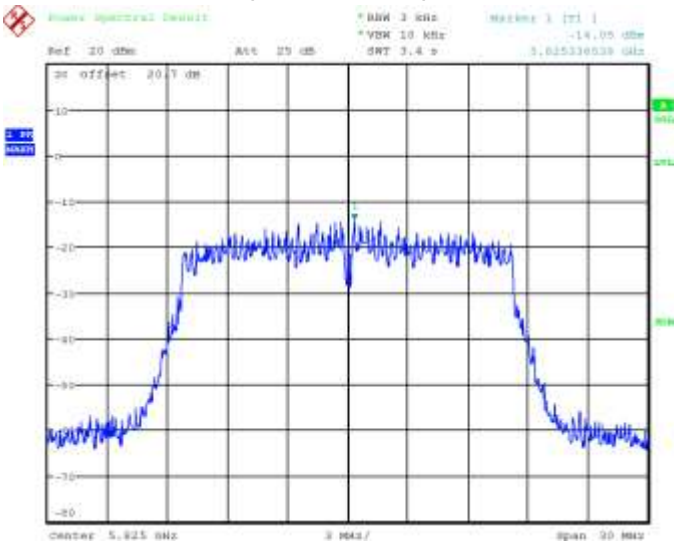


Figure 3-9: Peak Power Spectral Density
802.11n, Channel 165, MCS 0



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