EMI Test Report

Tested in accordance with
Federal Communications Commission (FCC)
Personal Communications Services
CFR 47, Parts 2, 22, 24, 27

REPORT NO.: RTS-6046-1308-21B

PRODUCT MODEL NO.:	RFW121LW, RFV121LW
TYPE NAME:	BlackBerry® smartphone
FCC ID:	L6ARFW110LW, L6ARFV120LW

EMISSION DESIGNATOR (GSM):	247KGXW
EMISSION DESIGNATOR (EDGE):	245KG7W
EMISSION DESIGNATOR (WCDMA):	4M17F9W
EMISSION DESIGNATOR (LTE QPSK):	See details in Appendix
EMISSION DESIGNATOR (LTE 16QAM):	See details in Appendix

DATE: October 25, 2013

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

592

Statement of Performance:

The BlackBerry® smartphone, model RFW121LW, part number CER 54733-001 Rev 2-x08-00 and accessories when configured and operated per BlackBerry's operation instructions performs within the requirements of the test standards.

The BlackBerry® smartphone, model RFV121LW, part number CER 54734-001 Rev 2-x08-00 and accessories when configured and operated per BlackBerry's operation instructions performs within the requirements of the test standards.

Declaration:

We hereby certify that:
The test data reported herein is an accurate record of the performance of the sample(s) tested.
The test results are valid for the tested unit (s) only.
The test equipment used was suitable for the tests performed and within manufacturer's published specifications and operating parameters.
The test methods were consistent with the methods described in the relevant standards.

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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 2, Subpart J, Equipment Authorization Procedures, Oct, 2012.
- FCC CFR 47 Part 22, Subpart H, Cellular Radiotelephone Services, Oct., 2012.
- FCC CFR 47 Part 24 Subpart E, Broadband PCS, Oct., 2012.
- FCC CFR 47 Part 27, Subpart C, Technical Standards, Oct, 2012.

B. Associated Documents

1. BlackBerrySystemSimilarity_RFW121LW_RFV121LW

C. Product Identification

Manufactured by BlackBerry 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:

BlackBerry RTS 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 July 4 to 18, Aug 15-16 and Oct 18-22, 2013.

BlackBerry® smartphone Samples Tested

Sample	Model	CER NUMBER	PIN	Software Information
1	RFW121LW	CER 54733-001 Rev 2-x08-00	2FFFE444	OS: 10.2.0.519
2	RFW121LW	CER 54733-001 Rev 2-x08-00	2FFFE459	OS: 10.2.0.519
3	RFW121LW	CER 54733-001 Rev 2-x08-00	2FFFE438	OS: 10.2.0.519
4	RFW121LW	CER 54733-001 Rev 2-x08-00	2FFFE448	OS: 10.2.0.519
5	RFW121LW	CER 54733-001 Rev 2-x08-00	2FFFE45F	OS: 10.2.0.519
6	RFW121LW	CER 54733-001 Rev 2-x08-00	2FFFE470	OS: 10.2.0.519
7	RFV121LW	CER 54734-001 Rev 2-x08-00	2FFF5957	OS: 10.2.0.519
8	RFV121LW	CER 54734-001 Rev 2-x08-00	2FFFE960	OS: 10.2.0.519
9	RFV121LW	CER 54734-001 Rev 2-x08-00	2FFFE965	OS: 10.2.0.519

RF Conducted Emissions testing was performed on samples 1, 2, 7.
Radiated Emissions testing was performed on samples 3, 4, 5, 6, 8 and 9.

Only the characteristics that may have been affected by the changes from RFW121LW to RFV121LW were re-tested.
For more information, see BlackBerrySystemSimilarity_RFW121LW_RFV121LW.

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 FCC CFR 47	TEST TYPE	RESULT	TEST DATA APPENDIX
Part 2.1051 Part 22.917 Part 24.238	GSM850 / PCS1900 Conducted Spurious Emissions	Pass	1A
Part 2.1049 Part 22.917 Part 24.238	GSM 850 / PCS1900 Occupied Bandwidth and Channel Mask	Pass	1A
Part 2.1055 Part 24.235	GSM 850 /PCS1900 Frequency Stability vs. Temperature and Voltage	Pass	1B
Part 22.913(a)(2) Part 24.232(c)	GSM850 ERP PCS1900 EIRP	Pass	1C
Part 2.1053 Part 22.917 Part 24.238	GSM850 / PCS1900 Radiated Spurious/Harmonic Emissions	Pass	1C
Part 2.1051 Part 22.917 Part 24.238 Part 27.53(h)	WCDMA Band II/IV/V Conducted Spurious Emissions	Pass	2A
Part 2.1049 Part 22.917 Part 24.238 Part 27.53(h)(1)	WCDMA Band II/IV/V Occupied Bandwidth and Channel Mask	Pass	2A
Part 2.1055(a)(d) Part 24.235 Part 27.54	WCDMA Band II/IV/V Frequency Stability vs. Temperature and Voltage	Pass	2B
Part 22.913(a)(2) Part 24.232(c) Part 27.50(d)(4)	WCDMA Band V ERP WCDMA Band II EIRP WCDMA Band IV EIRP	Pass	2C
Part 2.1053 Part 22.917 Part 24.238 Part 27.53(h)	WCDMA Band II/IV/V Radiated Spurious/Harmonic Emissions	Pass	2C
Part 2.1051 Part 24.238(a) Part 24.50 (d)	LTE Band 2 Conducted Spurious Emissions	Pass	3A
Part 2.1049 Part 24.238	LTE Band 2 Occupied Bandwidth and Channel Mask	Pass	3A
Part 24.232 (d)	LTE Band 2 Peak to Average Ratio measurements	Pass	3A
Part 2.1055(a)(d) Part 24.235	LTE Band 2 Frequency Stability vs. Temperature and Voltage	Pass	3B

Part 24.232(b)(c)	LTE Band 2 EIRP	Pass	3C
Part 24.238	LTE Band 2 Radiated Spurious/Harmonic Emissions	Pass	3C
Part 2.1051 Part 22.917	LTE Band 5 Conducted Spurious Emissions	Pass	4A
Part 2.1049 Part 22.917	LTE Band 5 Occupied Bandwidth and Channel Mask	Pass	4A
Part 2.1055(a)(d)	LTE Band 5 Frequency Stability vs. Temperature and Voltage	Pass	4B
Part 22.913(a)(2)	LTE Band 5 ERP	Pass	4C
Part 22.917	LTE Band 5 Radiated Spurious/Harmonic Emissions	Pass	4C
Part 2.1051 Part 27.53(h)	LTE Band 4 Conducted Spurious Emissions	Pass	5A
Part 2.1049 Part 27.53(h)(1)	LTE Band 4 Occupied Bandwidth and Channel Mask	Pass	5A
Part 27.50 (d)(5)	LTE Band 4 Peak to Average Ratio measurements	Pass	5A
Part 2.1055 Part 27.54	LTE Band 4 Frequency Stability vs. Temperature and Voltage	Pass	5B
Part 2.1053 Part 27.50(d)(4)	LTE Band 4 EIRP	Pass	5C
Part 2.1053 Part 27.53(h)	LTE Band 4 Radiated Spurious/Harmonic Emissions	Pass	5C
Part 2.1051 Part 27.53(g)	LTE Band 17 Conducted Spurious Emissions	Pass	6A
Part 2.1049 Part 27.53(g)	LTE Band 17 Occupied Bandwidth and Channel Mask	Pass	6A
Part 27.50 (d)(5)	LTE Band 17 Peak to Average Ratio measurements	Pass	6A
Part 2.1055 Part 27.54	LTE Band 17 Frequency Stability vs. Temperature and Voltage	Pass	6B
Part 2.1053 Part 27.50(c)(9)	LTE Band 17 ERP	Pass	6C
Part 2.1053 Part 27.53(g)	LTE Band 17 Radiated Spurious/Harmonic Emissions	Pass	6C

F.Summary of Results

1) Conducted Emission Measurements

The following tests were performed on model RFW121LW.

- The BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the GSM850 as per 47 CFR 2.1051, CFR 22.917, CFR 22.901(d).The EUT was measured on the low, middle and high channels. The frequency range investigated was from 30 MHz to 10 GHz.
See APPENDIX 1A for test data.

The BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the PCS1900 as per 47 CFR 2.1051, CFR 24.238(a). The EUT was measured on the low, middle and high channels. The frequency range investigated was from 30 MHz to 20 GHz.
See APPENDIX 1A for test data

- The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the GSM850 as per 47 CFR 2.202, CFR 22.917 and. The EUT was measured in GSM and EDGE mode on the low, middle and high channels. The worst case occupied bandwidth was 247.5 kHz on the middle channel in CALL mode, and 243.1 kHz on middle channel in EDGE mode.
See APPENDIX 1A for test data.

The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the PCS1900 as per 47 CFR 2.202, CFR 24.238.The EUT was measured in GSM and EDGE mode on the low, middle and high channels. The worst case occupied bandwidth was 246.0 kHz on middle channel in CALL mode, and 244.6 kHz on the middle channel in EDGE mode.
See APPENDIX 1A for test data.

- The BlackBerry® smartphone met the requirements of the Frequency Stability in the GSM850 as per 47 CFR 2.1055. The EUT was measured in GSM850 mode on the low, middle and high channels.
See APPENDIX 1B for test data.

The BlackBerry® smartphone met the requirements of the Frequency Stability in the PCS1900 as per 47 CFR 2.1055, CFR 24.235. The EUT was measured in PCS1900 mode on the low, middle and high channels.
See APPENDIX1B for test data.

- The BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the WCDMA band V as per 47 CFR 2.1051, CFR 22.917, CFR 22.901(d). The EUT was measured on the low, middle and high channels. The frequency range investigated was from 30 MHz to 10 GHz.
See APPENDIX 2A for test data.

The BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the WCDMA band II as per 47 CFR 2.1051, CFR 24.238(a). The EUT was measured on the low, middle and high channels. The frequency range investigated was from 30 MHz to 20 GHz.
See APPENDIX 2A for test data

- The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the WCDMA band V as per 47 CFR 2.202, CFR 22.917. The EUT was measured in Voice and HSUPA mode on the low, middle and high channels. The worst case occupied bandwidth was 4.168 MHz on the low channel in Loopback mode, and 4.160 MHz on the low channel in HSUPA mode.
See APPENDIX 2A for test data.

The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the WCDMA band II as per 47 CFR 2.202, CFR 24.238. The EUT was measured in Voice and HSUPA mode on the low, middle and high channels. The worst case occupied bandwidth was 4.161 MHz on the middle and high channels in Loopback mode, and 4.160 MHz on the middle and high channels in HSUPA mode.
See APPENDIX 2A for test data.

- The BlackBerry® smartphone met the requirements of the Frequency Stability in the WCDMA band V as per 47 CFR 2.1055. The EUT was measured in WCDMA band V mode on the low, middle and high channels.
See APPENDIX 2B for test data.

The BlackBerry® smartphone met the requirements of the Frequency Stability in the WCDMA band II as per 47 CFR 2.1055, CFR 24.235. The EUT was measured in WCDMA band II mode on the low, middle and high channels.
See APPENDIX 2B for test data.

The following tests were performed on model RFV121LW.

The EUT met the requirements of the Tx Conducted Spurious Emissions in the WCDMA Band IV as per 47 CFR 2.1051, CFR 27.53 and RSS-139, 6.5. The EUT was measured on the low, middle and high channels. The frequency range investigated was from 30 MHz to 20 GHz.

See APPENDIX 2A for test data

The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the WCDMA band IV as per 47 CFR 2.1051, CFR 27.53 and RSS-139, 6.5. The EUT was measured in Voice and HSUPA mode on the low, middle and high channels. The worst case occupied bandwidth was 4.155 MHz on the middle and high channels in Loopback mode, and 4.155 MHz on the middle channel in HSUPA mode.
See APPENDIX 2A for test data.

The EUT met the requirements of the Frequency Stability in the WCDMA Band IV as per 47 CFR 2.1055, CFR 27.54 and RSS-139, 6.3. The EUT was measured in WCDMA Band IV mode on the low, middle and high channels.
See APPENDIX 2B for test data.

The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the LTE Band 2 as per 47 CFR 2.202, CFR 24.238 and RSS-GEN, 4.6. The EUT was measured on the low, middle and high channels. The worst case occupied bandwidth was 18.00 MHz on the middle channel in 20MHz BW, 100 resource blocks and QPSK modulation.
See Appendix 3A for test data

The BlackBerry® smartphone met the requirements of the Tx Peak to Average Ratio in the LTE Band 2 as per 47 CFR 24.232 (5)(d). The EUT was measured on the low, middle and high channels in 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz bandwidths for LTE Band 2 with QPSK and 16-QAM modulations. Different resource block allocations were also investigated, a minimum one resource block case was also tested. The worst case Peak to Average Ratio was 9.10 dB on mid channel in 20MHz bandwidth with 100 resource blocks.
See APPENDIX 3A for test data

The BlackBerry® smartphone met the requirements of the Frequency Stability in the LTE Band 2 as per 47 CFR 2.1055, CFR 24.235 and RSS-133, 6.3. The EUT was measured in LTE Band 2 mode on the low, middle and high channels in 20MHz BW with 100 resource blocks and QPSK modulation.
See APPENDIX 3B for test data.

The BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the LTE Band 5 as per 47 CFR 2.1051, CFR 22.917, CFR 22.901(d), RSS-132, 5.5 and RSS-GEN, 4.9. The EUT was measured on the low, middle and high channels in 1.4MHz, 3MHz, 5MHz and 10MHz as per scalable bandwidths for LTE Band 5 with QPSK and 16-QAM modulations. Different resource block allocations were investigated, a minimum one resource block case was also tested. The frequency range investigated was from 30 MHz to 10 GHz.
See APPENDIX 4A for test data.

The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the LTE Band 5 as per 47 CFR 2.202, CFR 22.917 and RSS-GEN, 4.6. The EUT was measured on the low, middle and high channels in 1.4MHz, 3MHz, 5MHz and 10MHz bandwidths for LTE Band 5 with QPSK and 16-QAM modulations. Different resource block allocations were investigated, a minimum one resource block case was also tested. The worst case occupied bandwidth was 9.10 MHz on the mid and high channels in 10MHz BW, 50 resource blocks and QPSK modulation.
See APPENDIX 4A for test data.

The BlackBerry® smartphone met the requirements of the Frequency Stability in the LTE Band 5 as per 47 CFR 2.1055, CFR 22.917 and RSS-132, 5.3. The EUT was measured on the low, middle and high channels in 1.4MHz, 3MHz, 5MHz and 10MHz as per scalable bandwidths for LTE Band 5 with QPSK and 16-QAM modulations. Different resource block allocations were investigated, a minimum one resource block case was also tested.
See APPENDIX 4B for test data.

The BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the LTE Band 4 as per 47 CFR 2.1051, CFR 27.53 and RSS-139, 6.5. The EUT was measured on the low, middle and high channels in 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz bandwidths for LTE Band 4 with QPSK and 16-QAM modulations. Different resource block allocations were investigated, a minimum one resource block case was also tested. The frequency range investigated was from 30 MHz to 20 GHz.

The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the LTE Band 4 as per 47 CFR 2.1049, CFR 27.53 and RSS-GEN, 4.6. The EUT was measured on the low, middle and high channels. The worst case occupied bandwidth was 18.04 MHz on the middle channel in 20MHz BW, 100 resource blocks and QPSK modulation.
See Appendix 5A for test data

The BlackBerry® smartphone met the requirements of the Tx Peak to Average Ratio in the LTE Band 4 as per 47 CFR 27.50 (5)(d) and RSS-139, 6.4. The EUT was measured on the low, middle and high channels in 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz bandwidths for LTE Band 4 with QPSK and 16-QAM modulations. Different resource block allocations were also investigated, a minimum one resource block case was also tested. The worst case Peak to Average Ratio was 9.24 dB on middle channel in 10MHz bandwidth with 100 resource blocks.
See APPENDIX 5A for test data

The BlackBerry® smartphone met the requirements of the Frequency Stability in the LTE Band 4 as per 47 CFR 2.1055, CFR 27.54 and RSS-139, 6.3. The EUT was measured in LTE Band 4 mode on the low, middle and high channels in 20MHz BW with 100 resource blocks and QPSK modulation.
See APPENDIX 5B for test data.

The BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the LTE Band 17 as per 47 CFR 2.1051, CFR 27.53. The EUT was measured on the low, middle and high channels in 5MHz and 10MHz, bandwidths for LTE Band 17 with QPSK and 16-QAM modulations. Different resource block allocations were investigated, a minimum one resource block case was also tested. The frequency range investigated was from 30 MHz to 20 GHz.
See Appendix 6A for test data

The BlackBerry® smartphone met the requirements of the Occupied Bandwidth and channel mask in the LTE Band 17 as per 47 CFR 2.1049, CFR 27.53. The EUT was measured on the low, middle and high channels. The worst case occupied bandwidth was 9.120 MHz on the low channel in 10MHz BW, 50 resource blocks and 16-QAM modulation.
See Appendix 6A for test data

The BlackBerry® smartphone met the requirements of the Tx Peak to Average Ratio in the LTE Band 17 as per 47 CFR 27.50 (5)(d). The EUT was measured on the low, middle and high channels in 5MHz and 10MHz bandwidths for LTE Band 17 with QPSK and 16-QAM modulations. Different resource block allocations were also investigated, a minimum one resource block case was also tested. The worst case Peak to Average Ratio was 9.94 dB on middle channel in 10MHz bandwidth with 100 resource blocks.
See APPENDIX 6A for test data

The BlackBerry® smartphone met the requirements of the Frequency Stability in the LTE Band 17 as per 47 CFR 2.1055, CFR 27.54. The EUT was measured in LTE Band 17 mode on the low, middle and high channels in 20MHz BW with 100 resource blocks and QPSK modulation.
See APPENDIX 6B for test data.

2) Radiated Emission Measurements

The radiated spurious emissions/harmonics and ERP/EIRP were measured for GSM 850 and PCS 1900. The results are within the limits. The BlackBerry® smartphone was placed on a nonconductive styrofoam table, 80 cm high that was positioned on a remotely controlled turntable. The test distance used between the BlackBerry® smartphone and the receiving antenna was three meters. Then the emissions were maximized by elevating the antenna in the range of 1 to 4 meters. The turntable was rotated to determine the azimuth of the peak emissions. Both the horizontal and vertical polarizations of the emissions were measured. The maximum emissions level was recorded. The BlackBerry® smartphone was then substituted with an antenna placed in the same location as the BlackBerry® smartphone. A Dipole antenna was used for the ERP measurements and a Horn antenna was used for EIRP measurements. The substitution antenna was connected into a signal generator that was set to the test frequency.

The emissions were maximized by elevating the antenna in the range of 1 to 4 meters. The signal generator output was then adjusted to match the BlackBerry® smartphone output reading. The signal generator output was recorded. Both the horizontal and vertical polarizations of the emissions were measured.

The following measurements were done in a semi-anechoic chamber (SAC) below 1 GHz and a modified Semi-anechoic Chamber ((SAC) with floor absorber) above 1 GHz. The SAC's FCC registration number is **778487** and the Industry Canada (IC) file number is **2503B-1**. The modified SAC with floor absorber's FCC registration number is **959115** and the IC file number is **2503C-1**. The BlackBerry® smartphone was measured on the low, middle and high channels.

The following tests were performed on model RFV121LW.

a) The radiated spurious emissions/harmonics and ERP/EIRP were measured for GSM 850 and PCS 1900. The results are within the limits.

- The highest ERP in the 850 band Call mode measured was 30.49 dBm (1.12 W) at 836.60 MHz (channel 190)

- The highest ERP in the 850 band EDGE mode measured was 28.25 dBm (0.67 W) at 836.60 MHz (channel 190).

- The highest EIRP in the PCS band Call mode measured was 30.89 dBm (1.23 W) at 1850.20 MHz (channel 512).

- The highest EIRP in the PCS band EDGE mode measured was 28.33 dBm (0.68 W) at 1850.20 MHz (channel 512).

The radiated spurious emission and carrier harmonics were measured up to the 10th harmonic for low, middle, and high channels in the GSM 850 and PCS 1900. Each band was measured in CALL and EDGE modes, with both the horizontal and vertical polarizations.

- The worst margin was 24.05 dB below the limit at 2472.800MHz in Call mode in band GSM850.
- All margins in the GSM850 for harmonic emissions were at least 25 dB below the limit for all test frequencies in EDGE mode.
- The worst margin was 20.84 dB below the limit at 3819.508MHz in Call mode in band PCS1900.
- All margins in the PCS1900 for harmonic emissions were at least 25 dB below the limit for all test frequencies in EDGE mode.

See Appendix 1C for test data.

b) The radiated spurious emissions/harmonics and ERP/EIRP were measured for WCDMA Band II/IV/V.

- The highest ERP in the WCDMA band V, Call Service mode was 21.92 dBm (0.16 W) at 826.40 MHz (channel 4132).
- The highest ERP in the WCDMA band V, HSUPA mode was 20.04 dBm (0.10 W) at 836.40 MHz (channel 4182).
- The highest EIRP in the WCDMA band II, Call Service mode measured was 24.49 dBm (0.28 W) at 1852.4 MHz (channel 9262).
- The highest EIRP in the WCDMA band II, HSUPA mode measured was 22.30 dBm (0.17 W) at 1852.4 MHz (channel 9262).
- The highest EIRP in the WCDMA band IV, Call Service mode measured was 26.48 dBm (0.44 W) at 1732.6 MHz (channel 1413).
- The highest EIRP in the WCDMA band IV, HSUPA mode measured was 24.89 dBm (0.31 W) at 1732.6 MHz (channel 1413).

The radiated carrier harmonics were measured up to the 10th harmonic for low, middle and high channels in the WCDMA band V and WCDMA Band II. Each band was measured in Call, and HSUPA modes. Both the horizontal and vertical polarizations were measured.

- All margins in the WCDMA Band V for harmonic emissions were at least 25 dB below the limit for all test frequencies.

- All margins in the WCDMA Band II for harmonic emissions were at least 25 dB below the limit for all test frequencies.

- All margins in the WCDMA Band IV for harmonic emissions were at least 25 dB below the limit for all test frequencies.

See Appendix 2C for test data.

c) The radiated spurious emissions/harmonics and ERP were measured for LTE Band 2.

The EUT was measured on the low, middle and high channels in 1.4MHz, 15MHz and 20MHz bandwidths for LTE Band 2 with QPSK and 16-QAM modulations. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE Band 2 measured was 23.46dBm (0.22 W) at 1857.50MHz (channel 18675) in 15MHz BW, 1 resource block and QPSK modulation and
- The highest EIRP in the LTE Band 2 measured was 22.45 dBm (0.18 W) at 1857.50 MHz (channel 18675) in 15MHz BW, 1 resource block and 16-QAM modulation.

The radiated carrier harmonics were measured up to the 10th harmonic. The EUT was measured on the low, middle and high channels in the worst bandwidth 15MHz bandwidth for LTE Band 2 with QPSK and 16-QAM modulations as per conducted power. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- All margins in the LTE Band 2 for harmonic emissions were at least 25 dB below the limit for all test frequencies.

See Appendix 3C for test data.

d) The radiated spurious emissions/harmonics and ERP were measured for LTE Band 5.

The EUT was measured on the low, middle and high channels in 3MHz and 10MHz bandwidths for LTE Band 5 with QPSK and 16-QAM modulations. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE Band 5 measured was 21.52 dBm (0.14 W) at 834.00 MHz (channel 20500) in 3MHz BW, 6 resource block and QPSK modulation.

- The highest EIRP in the LTE Band 5 measured was 20.56 dBm (0.11 W) at 834.00 MHz (channel 20500) in 3MHz BW, 6 resource block and 16-QAM modulation.

The radiated carrier harmonics were measured up to the 10th harmonic. The EUT was measured on the low, middle and high channels in the worst bandwidth 3MHz

bandwidths for LTE Band 5 with QPSK and 16-QAM modulations as per conducted power. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- All margins in the LTE Band 5 for harmonic emissions were at least 25 dB below the accepted limits for all test frequencies.

See Appendix 4C for test data.

e) The radiated spurious emissions/harmonics and ERP were measured for LTE Band 4.

The EUT was measured on the low, middle and high channels in 1.4MHz, 5MHz and 20MHz bandwidths for LTE Band 4 with QPSK and 16-QAM modulations. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE Band 4 measured was 25.51 dBm (0.36 W) at 1732.50 MHz (channel 20175) in 1.4MHz BW, 1 resource block and QPSK modulation.
- The highest EIRP in the LTE Band 4 measured was 24.38 dBm (0.27 W) at 1732.50 MHz (channel 20175) in 1.4MHz BW, 1 resource block and 16-QAM modulation.

The radiated carrier harmonics were measured up to the 10^{th} harmonic. The EUT was measured on the low, middle and high channels in the worst bandwidth 5MHz bandwidth for LTE Band 4 with QPSK and 16-QAM modulations as per conducted power. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- All margins in the LTE Band 4 for harmonic emissions were at least 25 dB below the limit for all test frequencies.

See Appendix 5C for test data.

f) The radiated spurious emissions/harmonics and ERP were measured for LTE Band 17.

The EUT was measured on the low, middle and high channels in 5MHz and 10MHz bandwidths for LTE band 17 with QPSK and 16-QAM modulations. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE band 17 measured was 23.05 dBm (0.20 W) at 706.50 MHz (channel 23755) in 5MHz BW, 1 resource block and QPSK modulation.
- The highest EIRP in the LTE band 17 measured was 22.06 dBm (0.16 W) at 706.50 MHz (channel 23755) in 5MHz BW, 1 resource block and 16-QAM modulation.

The radiated carrier harmonics were measured up to the 10th harmonic. The EUT was measured on the low, middle and high channels in the worst bandwidth 10MHz bandwidth for LTE Band 17 with QPSK and 16-QAM modulations as per conducted power. Worst resource block case was tested. Both the horizontal and vertical polarizations were measured.

- All margins in the LTE Band 17 for harmonic emissions were at least 25 dB below the limit for all test frequencies.

See Appendix 6C for test data.

3) Co-Location Radiated Measurements

The radiated emissions were measured up to 18 GHz for middle channels for simultaneous transmission in the following test configuration combinations:

- GSM 850 + Bluetooth(DH5) + 802.11b
- PCS 1900 + Bluetooth(2DH5) + 802.11g
- WCDMA Band II + Bluetooth(3DH5)+ 802.11n(2.4GHz).
- WCDMA Band IV + Bluetooth(DH5) + 802.11b
- WCDMA Band V + Bluetooth(DH5) + 802.11a
- LTE B2 + Bluetooth(2DH5) + 802.11b
- LTE B4 + Bluetooth(3DH5) + 802.11g
- LTE B5 + Bluetooth(DH5) + 802.11n(2.4GHz)
- LTE B17 + Bluetooth(2DH5) + 802.11a

Both the horizontal and vertical polarizations were measured. The emissions due to different simultaneous transmission did not increase the amplitude of any emissions nor did it produce any new inter-modulation products as a result of mixing.

Sample Calculation:

Corrected Signal level (CSL) is calculated as follows:
CSL (dBm) = Measured Level (dBµV) – Antenna Gain (dBi) + Free Space loss (dB) – 107(dB) + Cable Loss (dB) - Preamp (dB) + Filter Loss (dB) -2.15(dB)

Measurement Uncertainty ±4.5 dB

G. Compliance Test Equipment Used

UNIT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL DUE DATE (YY MM DD)	USE
Preamplifier	Sonoma	310N/11909A	185831	13-10-10	Radiated Emissions
Preamplifier system	TDK RF Solutions	PA-02	080010	13-10-10	Radiated Emissions
Preamplifier	Rohde & Schwarz	TS-ANA4-SP	001	14-02-13	Radiated Emissions
Preamplifier	Rohde & Schwarz	TS-ANA-SP	001	14-02-13	Radiated Emissions
Hybrid Log Antenna	EMC Automation	HLP-3003C	017301	14-08-13	Radiated Emissions
Horn Antenna	EMC Automation	HRN-0118	030101	14-08-07	Radiated Emissions
Horn Antenna	EMC Automation	HRN-0118	030201	15-05-07	Radiated Emissions
Horn Antenna	Emco	3117	47563	15-08-07	Radiated Emissions
Horn Antenna	ETS	3116	2538	14-09-29	Radiated Emissions
Dipole Antenna	Schwarzbeck	UHAP	974	14-11-27	Radiated Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	837493/073	13-11-26	Radiated Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	112394	13-11-25	Radiated Emissions
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	109747	13-10-18	RF Conducted Emissions
EMI Receiver	Rohde & Schwarz	ESIB-40	100255	13-11-30	Radiated Emissions
EMI Receiver	Rohde & Schwarz	ESU-40	100162	13-11-30	Radiated Emissions
DC Power Supply	HP	6632B	US37472178	13-09-25	RF Conducted Emissions
Environment Monitor	Omega	iTHX-SD	0380561	13-10-30	Radiated Emissions
Environment Monitor	Omega	iTHX-SD	0340060	13-10-30	RF Conducted Emissions
Environment Monitor	Omega	iTHX-SD	0380567	13-10-30	Radiated Emissions

Compliance Test Equipment Used cont'd

UNIT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL DUE DATE (YY MM DD)	USE
Universal Radio Communication Tester	Rohde & Schwarz	CMW500	101469	13-12-10	Radiated /RF Conducted Emission
Universal Radio Communication Tester	Rohde & Schwarz	CMW500	109949	13-12-08	Radiated /RF Conducted Emission
Signal Generator	Agilent	E8257D	MY45140527	14-12-10	Radiated Emissions
Signal Generator	Agilent	83630B	3844A00927	14-11-23	Radiated Emissions
Spectrum Analyzer	Rohde & Schwarz	FSV	101820	13-11-28	RF Conducted Emissions
Spectrum Analyzer	Rohde & Schwarz	FSP	100884	13-11-22	RF Conducted Emissions

H. Test Software used

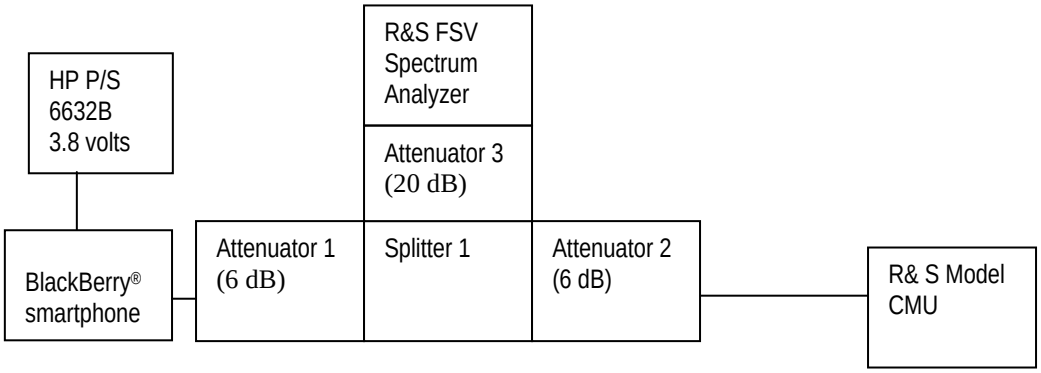
SOFTWARE	COMPANY	VERSION	USE
EMC32	Rohde & Schwarz	8.53.0	Radiated Emissions
TDK Standard Emission Test	TDK RF Solutions	8.53.1.62	Radiated Emissions

APPENDIX 1A – GSM CONDUCTED RF EMISSIONS TEST DATA/PLOTS

GSM Conducted RF Emission Test Data

This appendix contains measurement data pertaining to conducted spurious emissions, –26 dBc bandwidth, 99% power bandwidth and the channel mask on BlackBerry® smartphone.

Test Setup Diagram



A reference offset of 31.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

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

The environmental test conditions were:

Temperature: 25.1 ºC
Relative Humidity: 41.3 %

The following measurements were performed by Berkin Can.

GSM Conducted RF Emission Test Data cont'd

The following tests were performed on model RFW121LW.

The conducted spurious emissions – As per 47 CFR 2.1051, CRF 22.917, CFR 24.238(a) were measured from 30 MHz to 20 GHz.

–26 dBc Bandwidth and Occupied Bandwidth (99%)

For each carrier frequency of low, middle and high, the modulation spectrum was measured by both methods of 99% power bandwidth and –26 dBc bandwidth.
The resolution bandwidth required for out-of-band emissions in the 1 MHz bands immediately outside and adjacent to the frequency block, was determined to be at least 1% of the emission bandwidth.
The worst case –26dBc bandwidth for the GSM850 band was measured to be 277.9 kHz, and for the PCS1900 band was measured to be 274.9 kHz as shown below. Results were derived in a 3.0 kHz resolution bandwidth.
On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.

Test Data for GSM850 band and PCS1900 band in Call mode

GSM850 band Frequency (MHz)	-26dBc Bandwidth (kHz)	99% Occupied Bandwidth (kHz)
824.2	273.5	244.6
837.6	277.9	**247.5**
848.8	275.0	244.6

PCS1900 band Frequency (MHz)	-26dBc Bandwidth (kHz)	99% Occupied Bandwidth (kHz)
1850.2	270.0	244.0
1880.0	274.9	**246.0**
1909.8	271.8	242.0

Measurement Plots for 850 and 1900 bands in Call mode

See Figures 1-1a to 1-12a for the plots of the conducted spurious emissions.
See Figures 1-13a to 1-24a for the plots of 26dBc/99% Occupied Bandwidth.
See Figures 1-25a to 1-28a for the plots of the Channel mask.
See figures 1-51a to 1-53a for the plots of Peak to Average Ratio.

GSM Conducted RF Emission Test Data cont'd

Test Data for GSM850 and PCS1900 bands in EDGE mode

GSM850 band Frequency (MHz)	99% Occupied Bandwidth (kHz)
824.2	241.7
837.6	**243.1**
848.8	241.7

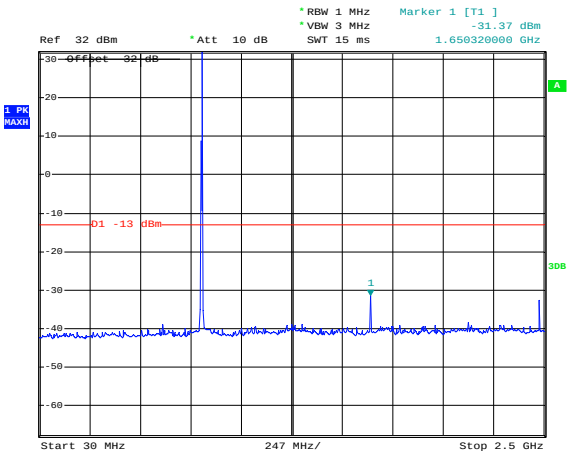
PCS1900 band Frequency (MHz)	99% Occupied Bandwidth (kHz)
1850.2	241.7
1880.0	**244.6**
1909.8	241.7

Measurement Plots for GSM850 and PCS1900 bands in EDGE mode

See Figures 1-29a to 1-34a for the plots of the 99% Occupied Bandwidth EDGE results.
See Figures 1-35a to 1-38a for the plots of channel mask EDGE results.
See Figures 1-39a to 1-50a for the plots of the conducted spurious emissions EDGE results

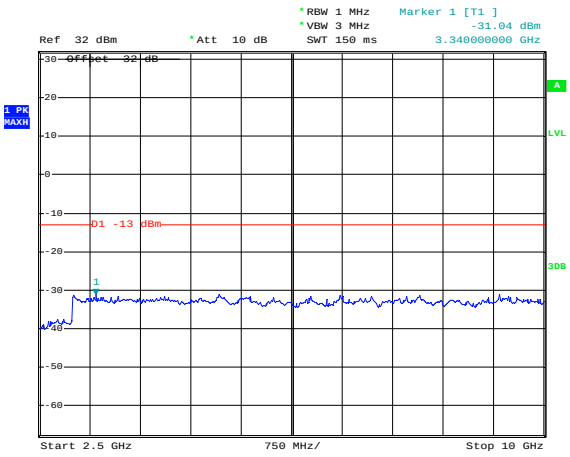
GSM Conducted RF Emission Test Data cont'd

Figure 1-a: GSM850 band, Spurious Conducted Emissions, Low channel



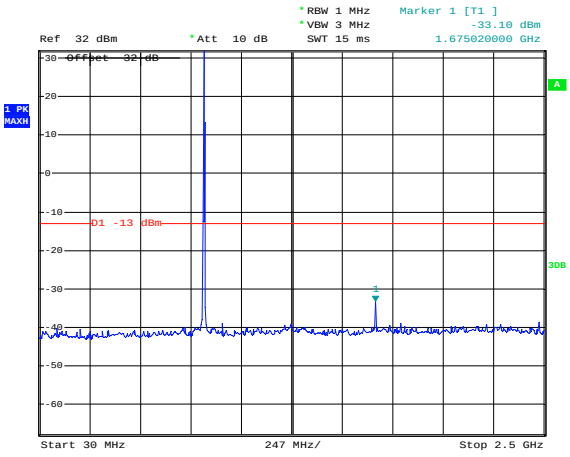
Date: 2.JUL.2013 18:42:58

Figure 1-1a: GSM850 band, Spurious Conducted Emissions, Low channel



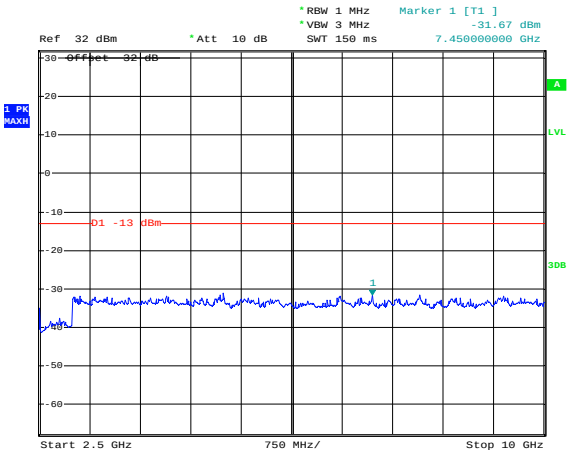
Date: 2.JUL.2013 18:47:24

Figure 1-2a: GSM850 band, Spurious Conducted Emissions, Middle Channel



Date: 2.JUL.2013 18:43:22

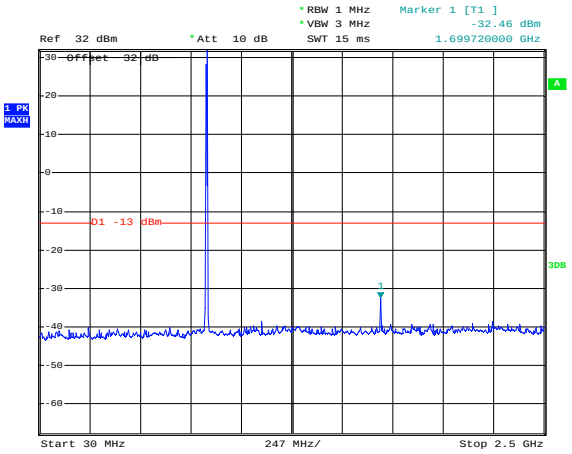
Figure 1-3a: GSM850 band, Spurious Conducted Emissions, Middle Channel



Date: 2.JUL.2013 18:44:52

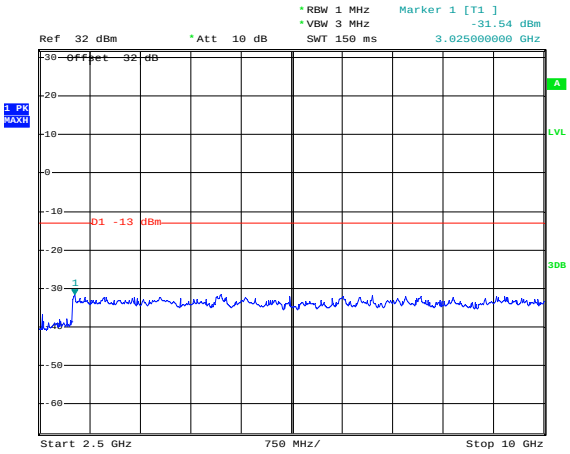
GSM Conducted RF Emission Test Data cont'd

Figure 1-4a: GSM850 band, Spurious Conducted Emissions, High Channel



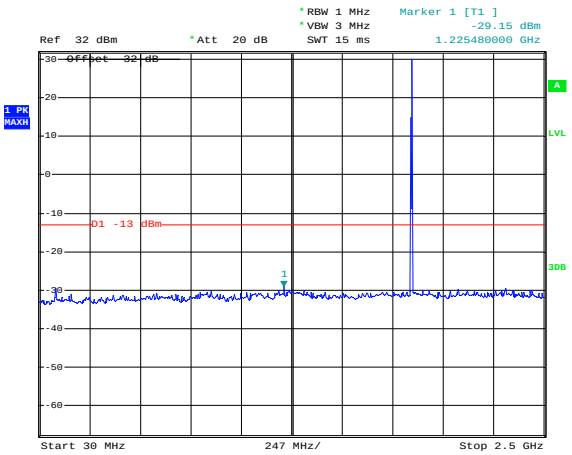
Date: 2.JUL.2013 18:43:42

Figure 1-5a: GSM850 band, Spurious Conducted Emissions, High Channel



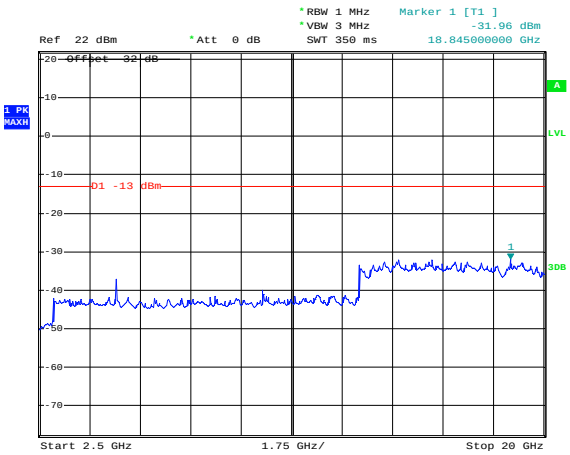
Date: 2.JUL.2013 18:44:28

Figure 1-7a: PCS1900 band, Spurious Conducted Emissions, Low Channel



Date: 2.JUL.2013 18:53:01

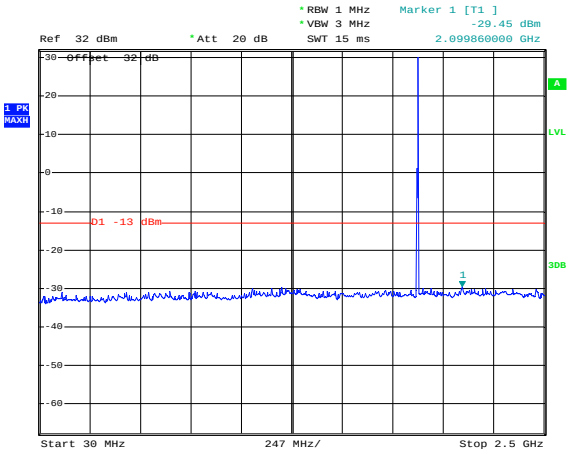
Figure 1-8a: PCS1900 band, Spurious Conducted Emissions, Low Channel



Date: 2.JUL.2013 18:57:07

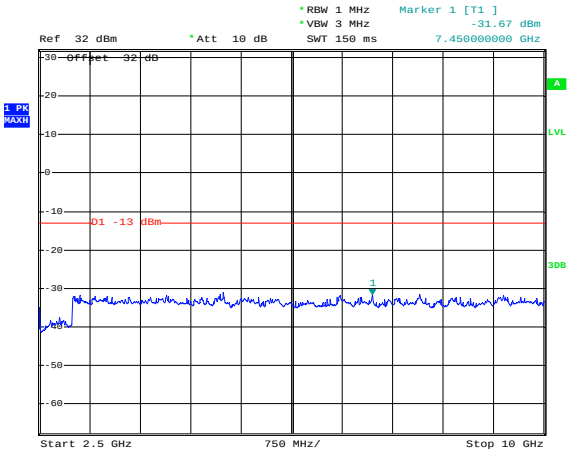
GSM Conducted RF Emission Test Data cont'd

Figure 1-9a: PCS1900 band, Spurious Conducted Emissions, Middle Channel



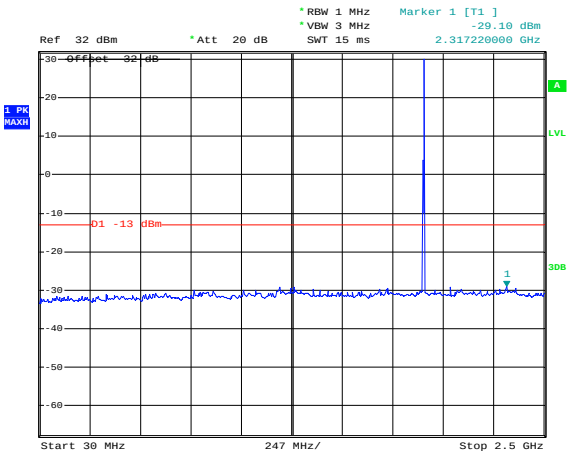
Date: 2.JUL.2013 18:53:55

Figure 1-10a: PCS1900 band, Spurious Conducted Emissions, Middle Channel



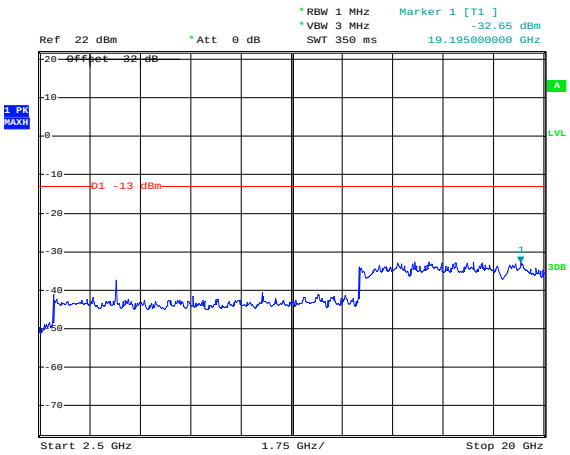
Date: 2.JUL.2013 18:44:52

Figure 1-11a: PCS1900 band, Spurious Conducted Emissions, High Channel



Date: 2.JUL.2013 18:55:44

Figure 1-12a: PCS1900 band, Spurious Conducted Emissions, High Channel



Date: 2.JUL.2013 18:56:16

GSM Conducted RF Emission Test Data cont'd

Figure 1-13a: -26dBc bandwidth, GSM850 band Low Channel in GSM mode

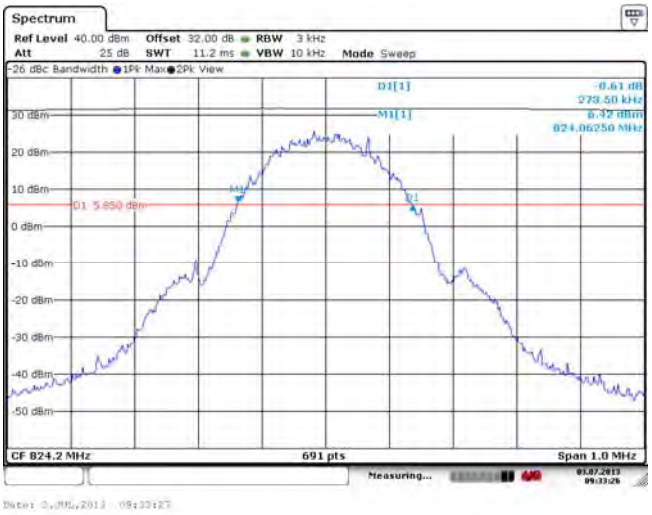


Figure 1-14a: Occupied Bandwidth, GSM850 band Low Channel in GSM mode

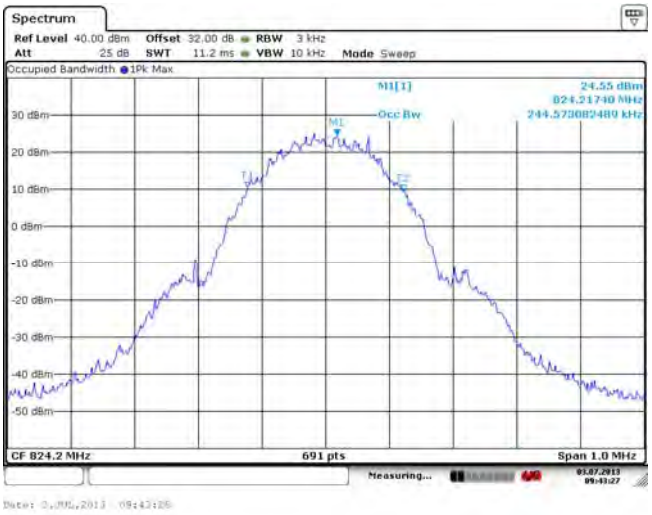


Figure 1-15a: -26dBc bandwidth, GSM850 band Middle Channel in GSM mode

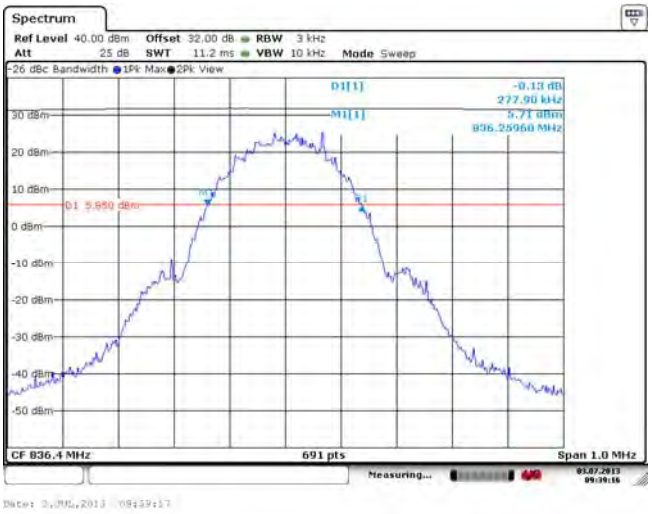
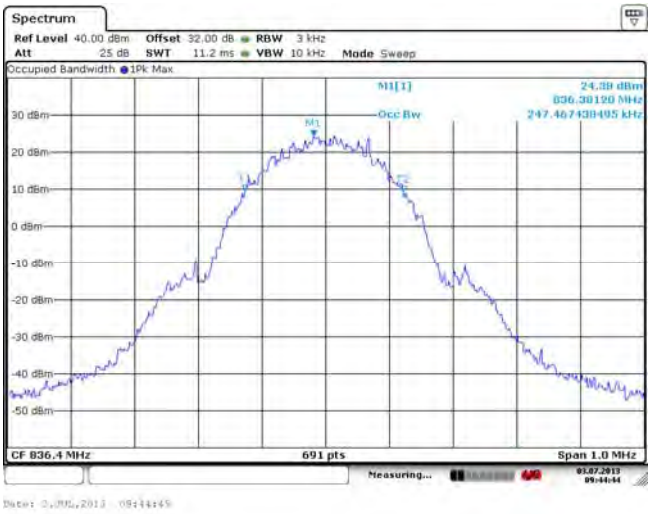


Figure 1-16a: Occupied Bandwidth, GSM850 band Middle Channel in GSM mode



GSM Conducted RF Emission Test Data cont'd

Figure 1-17a: -26dBc bandwidth, GSM850 band High Channel in GSM mode

Figure 1-18a: Occupied Bandwidth, GSM850 band High Channel in GSM mode

Figure 1-19a: -26dBc bandwidth, PCS1900 Low Channel in GSM mode

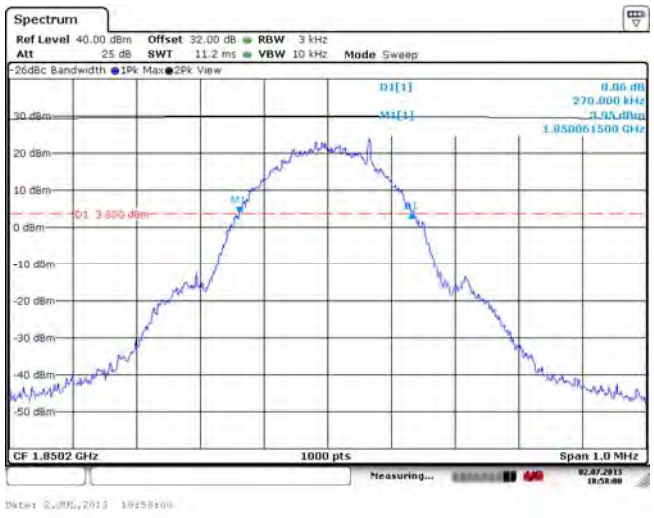
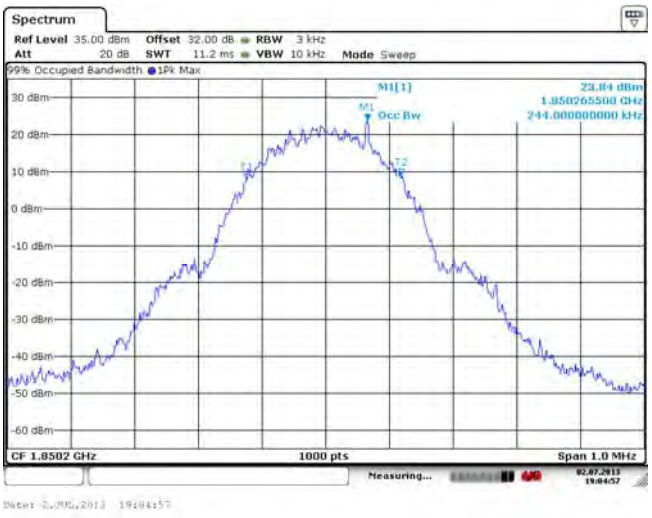


Figure 1-20a: Occupied Bandwidth, PCS1900 Low Channel in GSM mode



GSM Conducted RF Emission Test Data cont'd

Figure 1-21a: -26dBc bandwidth, PCS1900 Middle Channel in GSM mode

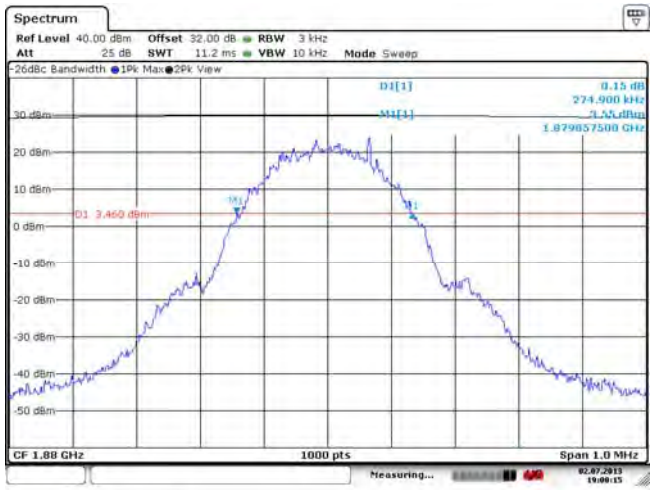


Figure 1-22a: Occupied Bandwidth, PCS1900 Middle Channel in GSM mode

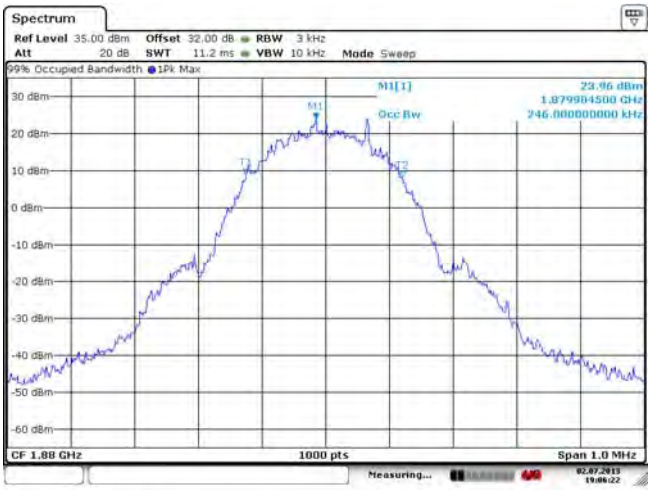


Figure 1-23a: -26dBc bandwidth, PCS1900 High Channel in GSM mode

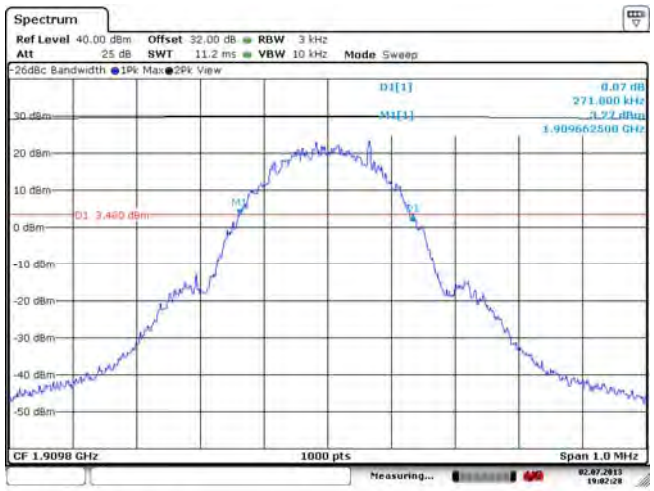


Figure 1-24a: Occupied Bandwidth, PCS1900 High Channel in GSM mode

GSM Conducted RF Emission Test Data cont'd

Figure 1-25a: GSM850 band, Low Channel Mask in GSM mode

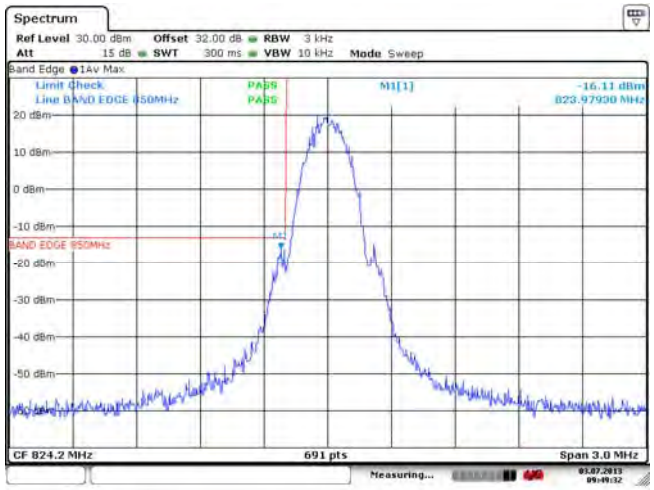


Figure 1-26a: GSM850 band High Channel Mask in GSM mode

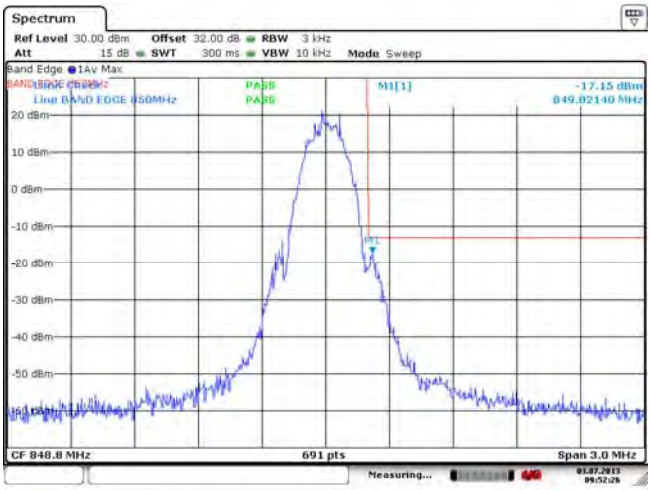


Figure 1-27a: PCS1900, Low Channel Mask in GSM mode

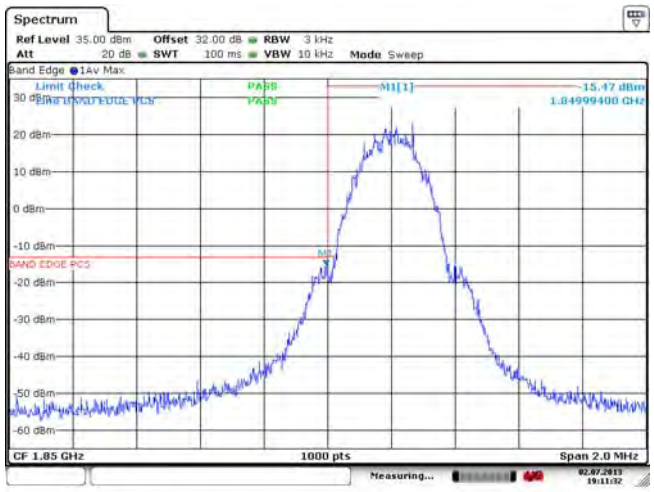
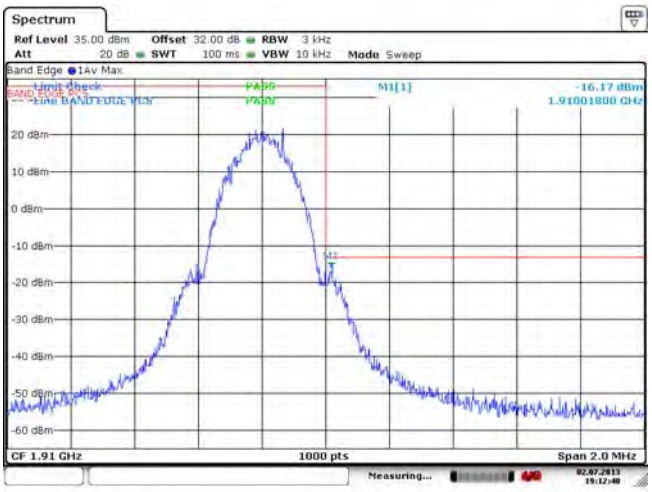


Figure 1-28a: PCS1900, High Channel Mask in GSM mode



GSM Conducted RF Emission Test Data cont'd

Figure 1-51a: PCS1900 Band, PAR Low Channel

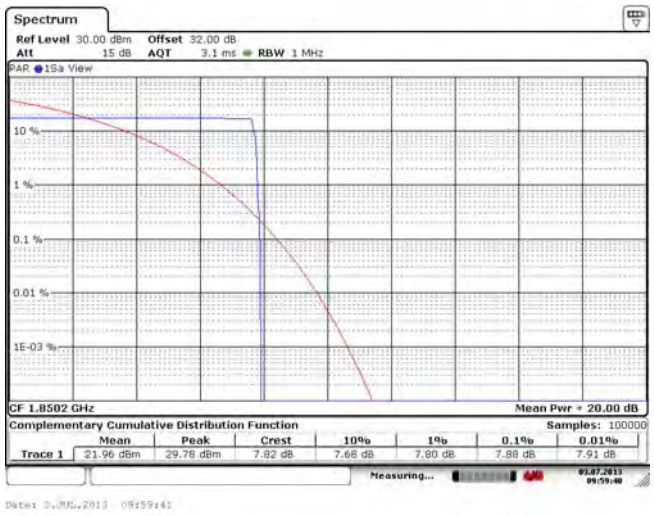


Figure 1-52a: PCS1900 Band, PAR Mid Channel

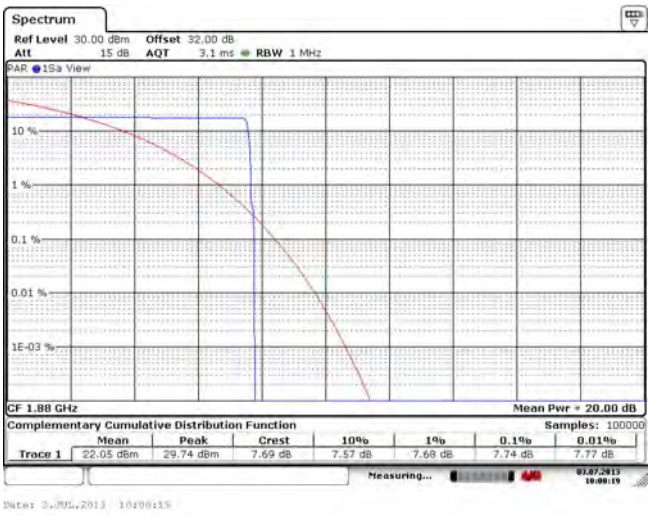
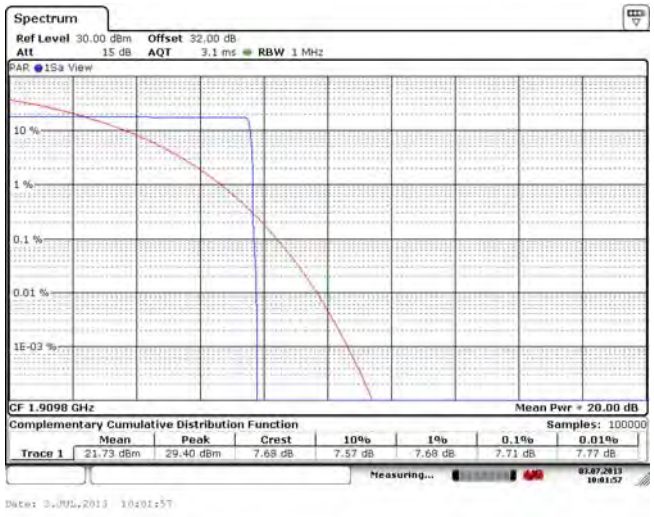


Figure 1-53a: PCS1900 Band, PAR High Channel



GSM Conducted RF Emission Test Data cont'd

Figure 1-29a: Occupied Bandwidth, GSM850 Band, Low Channel in EDGE mode

Figure 1-30a: Occupied Bandwidth, GSM850 Band, Middle Channel in EDGE mode

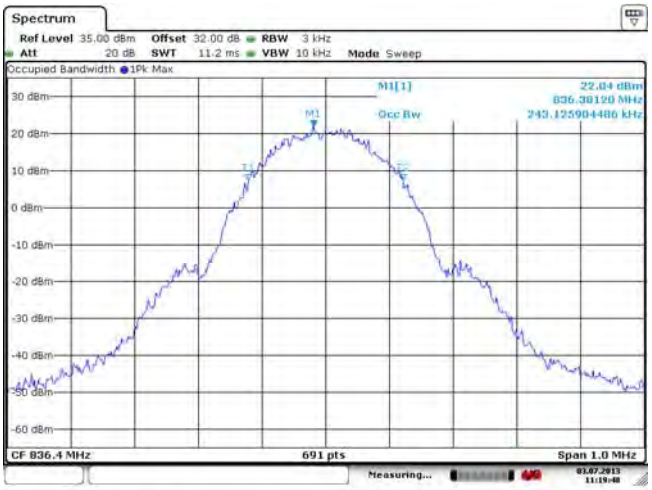


Figure 1-31a: Occupied Bandwidth, GSM850 band, High Channel in EDGE mode

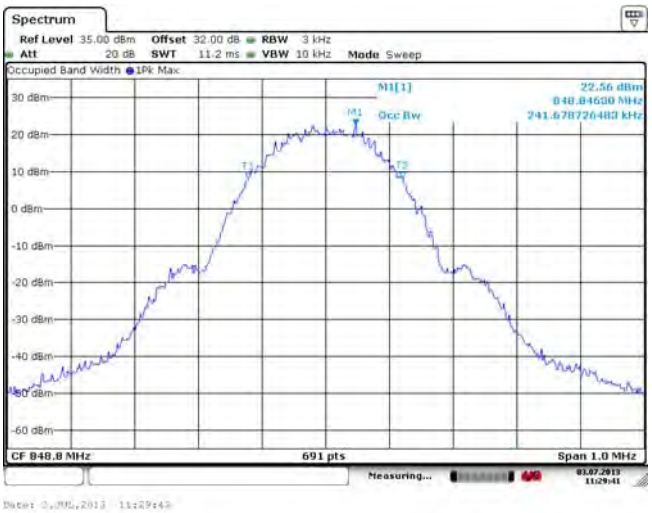
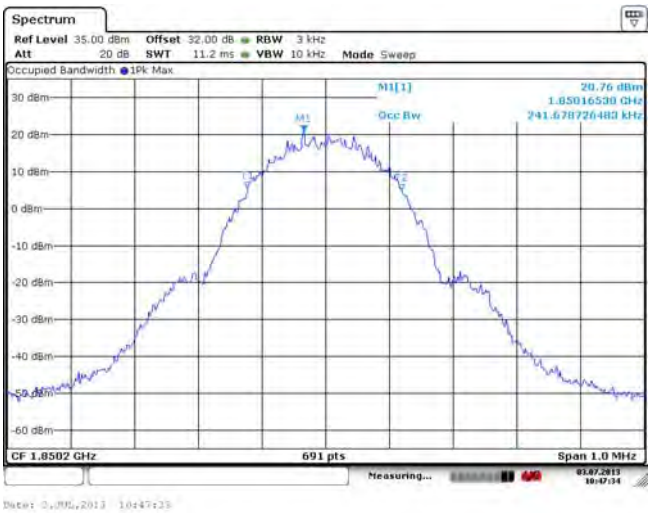


Figure 1-32a: Occupied Bandwidth, PCS1900 Band, Low Channel in EDGE mode



GSM Conducted RF Emission Test Data cont'd

Figure 1-33a: Occupied Bandwidth, PCS1900 Band, Middle Channel in EDGE mode

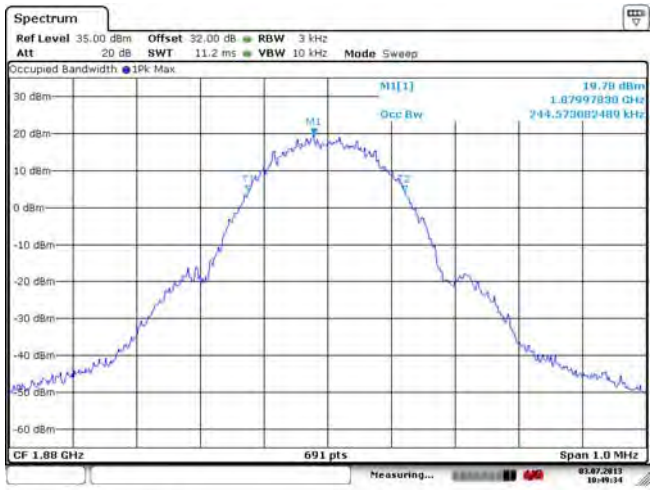


Figure 1-34a: Occupied Bandwidth, PCS1900 Band, High Channel in EDGE mode

Figure 1-35a: GSM850 Band, Low Channel Mask in EDGE mode

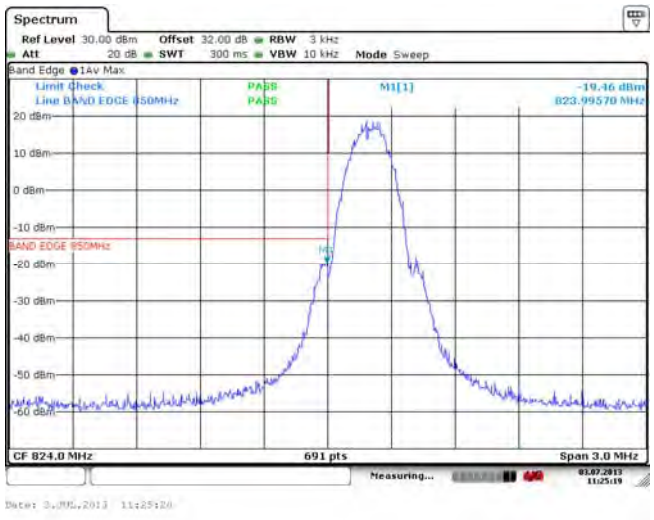
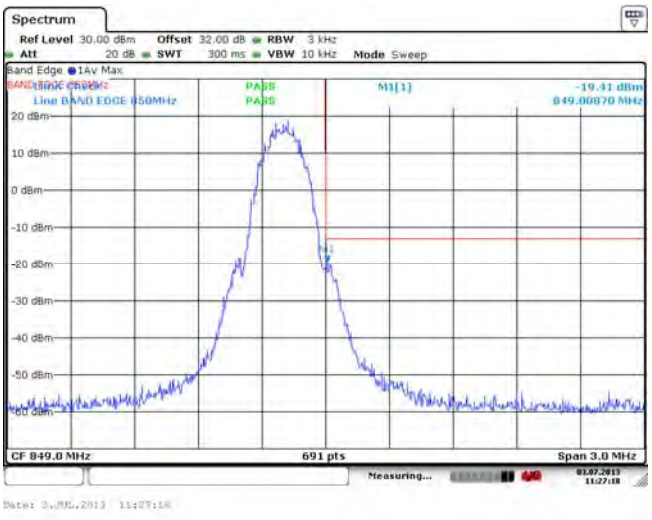


Figure 1-36a: GSM850 Band, High Channel Mask in EDGE mode



GSM Conducted RF Emission Test Data cont'd

Figure 1-37a: PCS1900 Band, Low Channel Mask in EDGE mode

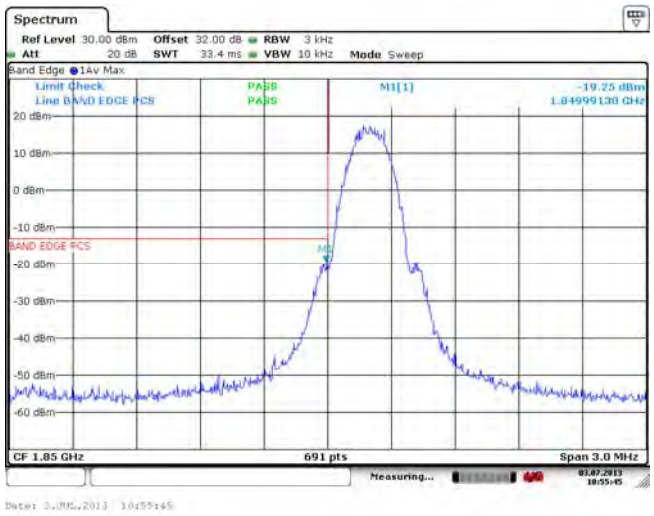
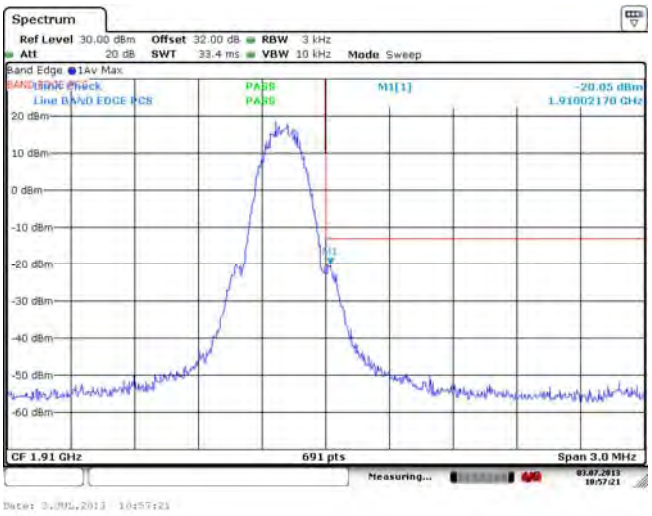


Figure 1-38a: PCS1900 Band, High Channel Mask in EDGE mode



GSM Conducted RF Emission Test Data cont'd

Figure 1-39a: GSM850 band, Spurious Conducted Emissions, Low channel in Edge Mode

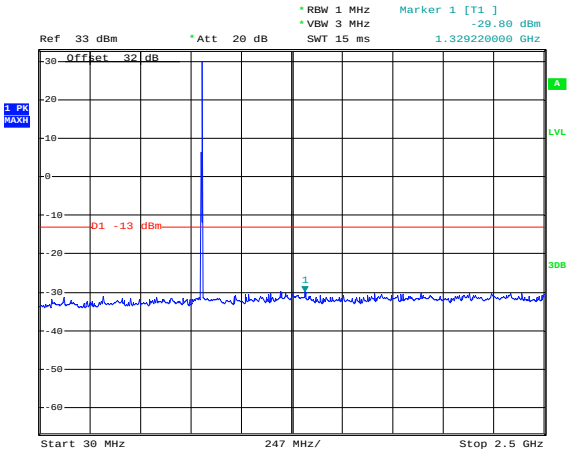


Figure 1-40a: GSM850 band, Spurious Conducted Emissions, Low channel in Edge Mode

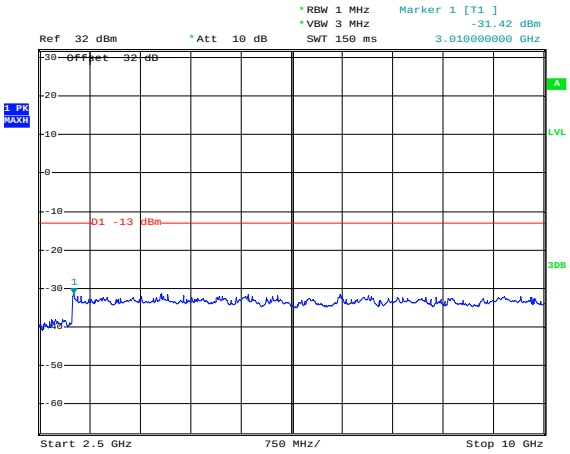


Figure 1-41a: GSM850 band, Spurious Conducted Emissions, Middle channel in Edge Mode

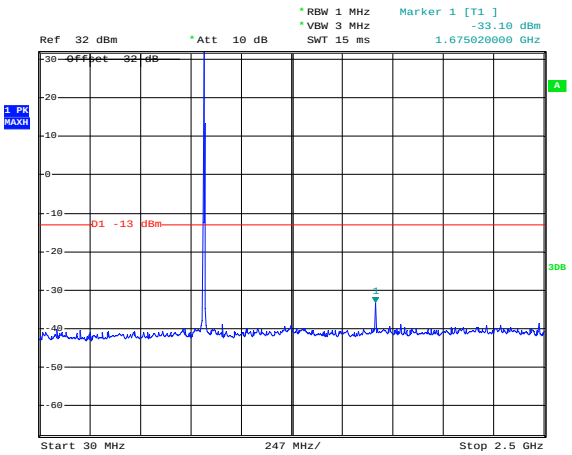
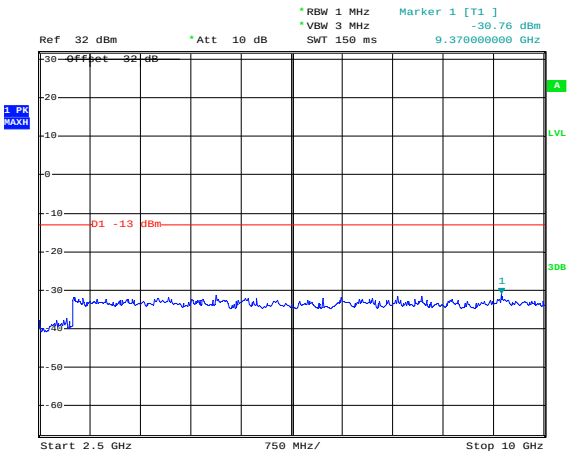
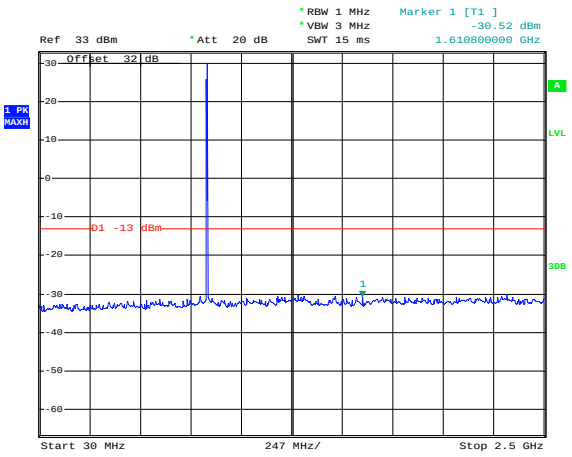


Figure 1-42a: GSM850 band, Spurious Conducted Emissions, Middle channel in Edge Mode



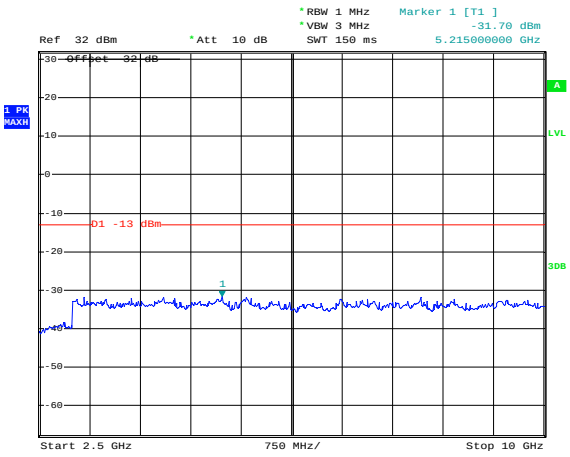
GSM Conducted RF Emission Test Data cont'd

Figure 1-43a: GSM850 band, Spurious Conducted Emissions, High channel in Edge Mode



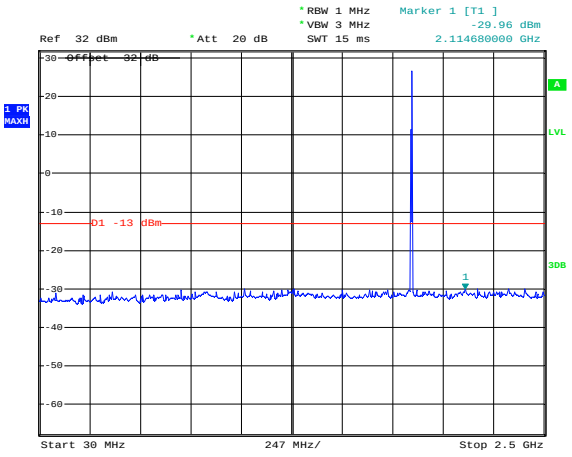
Date: 3.JUL.2013 11:58:57

Figure 1-44a: GSM850 band, Spurious Conducted Emissions, High channel in Edge Mode



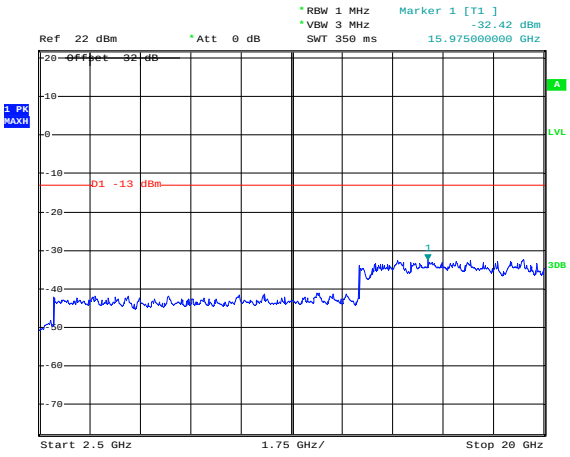
Date: 3.JUL.2013 11:59:52

Figure 1-45a: PCS1900 band, Spurious Conducted Emissions, Low channel in Edge Mode



Date: 3.JUL.2013 13:52:17

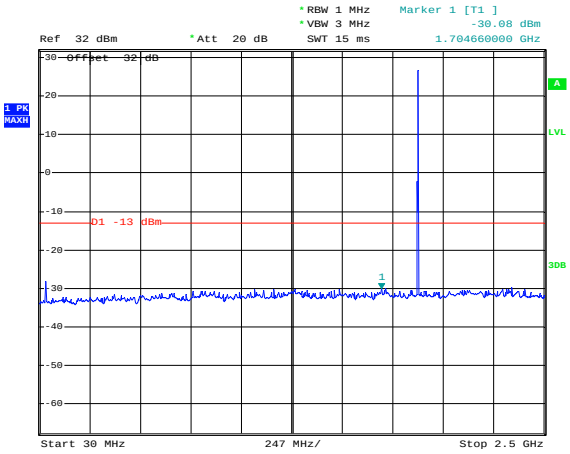
Figure 1-46a: PCS1900 band, Spurious Conducted Emissions, Low channel in Edge Mode



Date: 3.JUL.2013 13:53:59

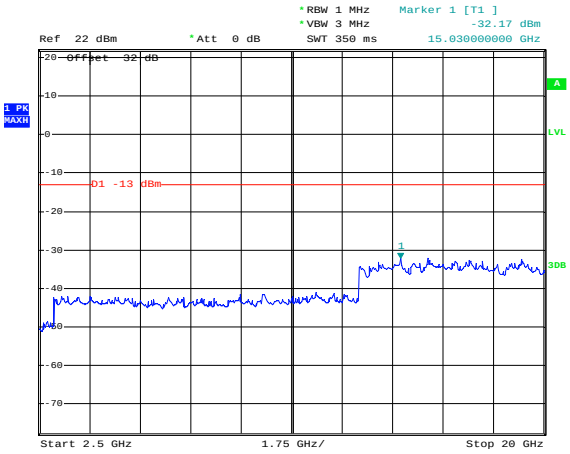
GSM Conducted RF Emission Test Data cont'd

Figure 1-47a: PCS1900 band, Spurious Conducted Emissions, middle channel in Edge Mode



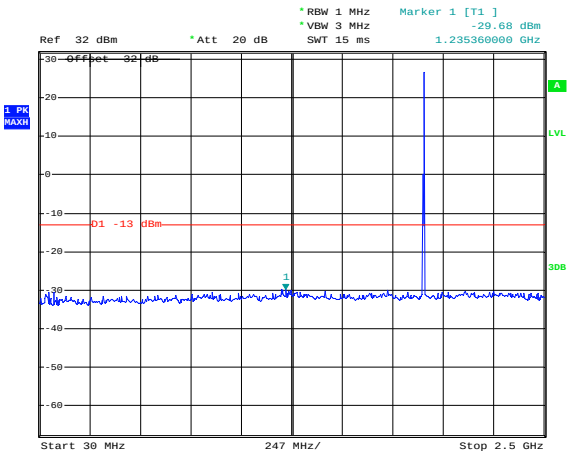
Date: 3.JUL.2013 13:52:45

Figure 1-48a: PCS1900 band, Spurious Conducted Emissions, middle channel in Edge Mode



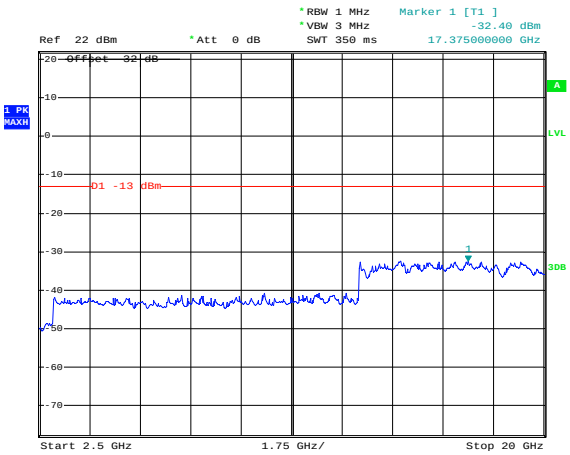
Date: 3.JUL.2013 13:54:25

Figure 1-49a: PCS1900 band, Spurious Conducted Emissions, High channel in Edge Mode



Date: 3.JUL.2013 13:53:18

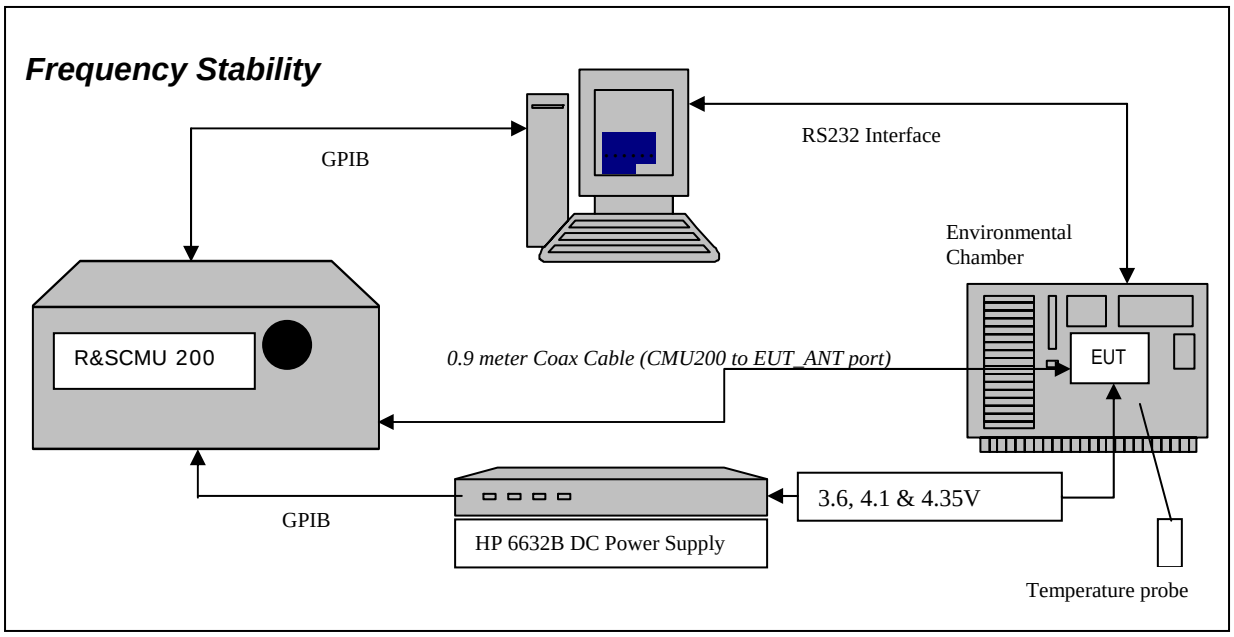
Figure 1-50a: PCS1900 band, Spurious Conducted Emissions, High channel in Edge Mode



Date: 3.JUL.2013 13:55:14

APPENDIX 1B – GSM FREQUENCY STABILITY TEST DATA

GSM Frequency Stability Test Data



The following tests were performed on model RFW121LW.

The measurements were performed by Berkin Can.

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurements
2.995 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

24.235 *Frequency Stability*.
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
The EUT meets the requirements as stated in CFR 47 chapter 1, Section 24.235, CFR 47 chapter 1, Section 22.917 Frequency Stability.
Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, power, data, temperatures, and stepped voltages controlled via a GPIB interface linked to the Environmental chamber, a DC power supply, and the Communications Test Set. A 0.9-metre coax cable was calibrated to characterize the insertion loss for the transmitted frequencies between the RF input/output of the CMU 200 and the EUT antenna port.
Calibration for the Cable Loss was performed in the RF Laboratory using the Agilent power meter and Agilent Signal Generator.

Test setup:

The EUT was placed in the Temperature chamber and connected to CMU 200 outside as shown in the figure above. Dry air was pumped inside the temperature chamber to maintain a backpressure during the test. The EUT was kept in the off condition at all times except when the measurements were to be made.

The chamber was switched on and the temperature was set to -30°C.
After the chamber stabilized at -30 °C there was a soak period of one hour to alleviate moisture in the chamber, the EUT voltage was enabled.
The system software recorded the frequency, power, and associated measurements.

A Computer system controlled the automated software. This application was given the command of activating all machines intrinsic to the temperature and voltage tests controlling the CMU 200 via the GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The EUT dialogue was passed through a serial connection.

The EUT repetitively transmitted 100 bursts for each set of programmed parameters recording temperature, voltage settings, and systematically selected frequencies. The power supply was cycled from minimum voltage 3.6 volts, to 4.1 and to 4.35 volts maximum voltage. The frequency error was measured at a maximum output power and recorded by the automated system test software.

The EUT output power and frequency was measured at 3.6 volts, 4.1 and 4.35 volts. The transmit frequency was varied in 3 steps consisting of 824.2, 836.4, and 848.8 MHz for the GSM850 band, 1850.2, 1880.0 and 1909.8 MHz for the PCS1900 band. This frequency was recorded in MHz and deviation from nominal, in Parts Per Million.
After the initial one-hour soak at the beginning of the tests, a period of thirty minutes soak was initialized between each ascending temperature step, before proceeding to the next measurement test cycle.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

1. Switch on the HP 6632B power supply; CMU 200 Communications test Set, and Environmental Chamber.
2. Start test program
3. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
4. Set power supply voltage to 3.6 volts.
5. Set up CMU 200 Radio Communication Tester.
6. Command the CMU 200 to switch to the low channel.
7. Enable the voltage to the EUT, and connect a link to the CMU 200 test set.
8. EUT is commanded to Transmit 100 Bursts.
9. Software logs the following data from the CMU 200, power supply and temperature chamber: Traffic Channel Number, Traffic Channel Frequency, Power Level, Chamber Temperature, Supply Voltage, Power and Frequency Error.
10. The CMU 200 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
11. Repeat steps 5 to 10 changing the supply voltage to 4.1 Volts
12. Increase temperature by 10°C and soak for 1/2 hour.
13. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
14. Repeat steps 5 to 10 changing the supply voltage to 4.35 volts

Procedure 5 to 10 was repeated at room temperature (20°C) with the power supply voltage set to 3.6, 4.1 and 4.35 volts.

The maximum frequency error in the GSM850 band measured was -0.0394 PPM.
The maximum frequency error in the PCS1900 band measured was -0.0256 PPM.

Date of Test: June 18, 2013

GSM850 results: channels 128, 189 and 251 @ 20°C maximum transmitted power

Traffic Channel Number	GSM850 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
128	824.20	3.6	20	-5.84	-0.0071
189	836.40	3.6	20	3.42	0.0041
251	848.60	3.6	20	5.04	0.0059

Traffic Channel Number	GSM850 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
128	824.20	4.1	20	5.51	0.0067
189	836.40	4.1	20	7.00	0.0084
251	848.60	4.1	20	10.83	0.0128

Traffic Channel Number	GSM850 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
128	824.20	4.35	20	7.40	0.0090
189	836.40	4.35	20	5.74	0.0069
251	848.60	4.35	20	7.77	0.0092

GSM850 Results: channel 128 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
128	824.20	3.6	-30	-22.96	-0.0279
128	824.20	3.6	-20	-17.36	-0.0211
128	824.20	3.6	-10	9.37	0.0114
128	824.20	3.6	0	-4.50	-0.0055
128	824.20	3.6	10	-11.81	-0.0143
128	824.20	3.6	20	-5.84	-0.0071
128	824.20	3.6	30	-4.81	-0.0058
128	824.20	3.6	40	7.79	0.0095
128	824.20	3.6	50	4.88	0.0059
128	824.20	3.6	60	5.16	0.0063
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
128	824.20	4.1	-30	-28.95	-0.0351
128	824.20	4.1	-20	-19.35	-0.0235
128	824.20	4.1	-10	11.30	0.0137
128	824.20	4.1	0	-9.51	-0.0115
128	824.20	4.1	10	-9.11	-0.0111
128	824.20	4.1	20	5.51	0.0067
128	824.20	4.1	30	-22.27	-0.0270
128	824.20	4.1	40	-4.63	-0.0056
128	824.20	4.1	50	-6.54	-0.0079
128	824.20	4.1	60	-6.28	-0.0076
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
128	824.20	4.35	-30	-31.46	-0.0382
128	824.20	4.35	-20	-27.33	-0.0332
128	824.20	4.35	-10	15.43	0.0187
128	824.20	4.35	0	-4.42	-0.0054
128	824.20	4.35	10	-11.89	-0.0144
128	824.20	4.35	20	7.40	0.0090
128	824.20	4.35	30	-15.25	-0.0185
128	824.20	4.35	40	3.81	0.0046
128	824.20	4.35	50	-9.62	-0.0117
128	824.20	4.35	60	-9.17	-0.0111

GSM850 Results: channel 189 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
189	836.40	3.6	-30	-23.45	-0.0280
189	836.40	3.6	-20	-18.94	-0.0226
189	836.40	3.6	-10	12.32	0.0147
189	836.40	3.6	0	-5.44	-0.0065
189	836.40	3.6	10	-9.57	-0.0114
189	836.40	3.6	20	3.42	0.0041
189	836.40	3.6	30	-8.99	-0.0107
189	836.40	3.6	40	5.86	0.0070
189	836.40	3.6	50	-4.05	-0.0048
189	836.40	3.6	60	5.60	0.0067
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
189	836.40	4.1	-30	-24.29	-0.0290
189	836.40	4.1	-20	-21.55	-0.0258
189	836.40	4.1	-10	15.91	0.0190
189	836.40	4.1	0	-7.58	-0.0091
189	836.40	4.1	10	-7.87	-0.0094
189	836.40	4.1	20	7.00	0.0084
189	836.40	4.1	30	-16.19	-0.0194
189	836.40	4.1	40	3.35	0.0040
189	836.40	4.1	50	-6.66	-0.0080
189	836.40	4.1	60	-7.52	-0.0090
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
189	836.40	4.35	-30	**-32.99**	**-0.0394**
189	836.40	4.35	-20	-29.12	-0.0348
189	836.40	4.35	-10	20.14	0.0241
189	836.40	4.35	0	-4.55	-0.0054
189	836.40	4.35	10	-12.14	-0.0145
189	836.40	4.35	20	5.74	0.0069
189	836.40	4.35	30	-19.98	-0.0239
189	836.40	4.35	40	-7.31	-0.0087
189	836.40	4.35	50	-9.72	-0.0116
189	836.40	4.35	60	-8.60	-0.0103

GSM850 Results: channel 251 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
251	848.8	3.6	-30	-28.31	-0.0334
251	848.8	3.6	-20	-16.38	-0.0193
251	848.8	3.6	-10	15.03	0.0177
251	848.8	3.6	0	-5.78	-0.0068
251	848.8	3.6	10	-8.03	-0.0095
251	848.8	3.6	20	5.04	0.0059
251	848.8	3.6	30	-24.71	-0.0291
251	848.8	3.6	40	8.64	0.0102
251	848.8	3.6	50	4.49	0.0053
251	848.8	3.6	60	4.05	0.0048
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
251	848.8	4.1	-30	-30.15	-0.0355
251	848.8	4.1	-20	-23.90	-0.0282
251	848.8	4.1	-10	14.90	0.0176
251	848.8	4.1	0	-11.75	-0.0138
251	848.8	4.1	10	-10.98	-0.0129
251	848.8	4.1	20	10.83	0.0128
251	848.8	4.1	30	-17.72	-0.0209
251	848.8	4.1	40	-5.43	-0.0064
251	848.8	4.1	50	-5.59	-0.0066
251	848.8	4.1	60	-7.42	-0.0087
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
251	848.8	4.35	-30	-25.06	-0.0295
251	848.8	4.35	-20	-29.00	-0.0342
251	848.8	4.35	-10	20.63	0.0243
251	848.8	4.35	0	4.81	0.0057
251	848.8	4.35	10	-10.63	-0.0125
251	848.8	4.35	20	7.77	0.0092
251	848.8	4.35	30	-14.29	-0.0168
251	848.8	4.35	40	-12.17	-0.0143
251	848.8	4.35	50	-10.84	-0.0128
251	848.8	4.35	60	-5.87	-0.0069

PCS results: channels 512, 661, & 810 @ 20°C maximum transmitted power

Traffic Channel Number	PCS Frequency (MHz	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
512	1850.20	3.6	20	-4.71	-0.0025
661	1880.00	3.6	20	-7.09	-0.0038
810	1909.80	3.6	20	-19.04	-0.0100

Traffic Channel Number	PCS Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
512	1850.20	4.1	20	-27.88	-0.0151
661	1880.00	4.1	20	-17.36	-0.0092
810	1909.80	4.1	20	-17.12	-0.0090

Traffic Channel Number	PCS Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
512	1850.20	4.35	20	-14.33	-0.0077
661	1880.00	4.35	20	-12.99	-0.0069
810	1909.80	4.35	20	-16.99	-0.0089

PCS1900 Results: channel 512 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
512	1850.20	3.6	-30	-27.62	-0.0149
512	1850.20	3.6	-20	-21.24	-0.0115
512	1850.20	3.6	-10	-23.51	-0.0127
512	1850.20	3.6	0	-9.90	-0.0054
512	1850.20	3.6	10	-10.74	-0.0058
512	1850.20	3.6	20	-4.71	-0.0025
512	1850.20	3.6	30	10.42	0.0056
512	1850.20	3.6	40	-26.06	-0.0141
512	1850.20	3.6	50	11.00	0.0059
512	1850.20	3.6	60	11.24	0.0061
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
512	1850.20	4.1	-30	-40.71	-0.0220
512	1850.20	4.1	-20	-35.62	-0.0193
512	1850.20	4.1	-10	-29.67	-0.0160
512	1850.20	4.1	0	-12.90	-0.0070
512	1850.20	4.1	10	-22.63	-0.0122
512	1850.20	4.1	20	-27.88	-0.0151
512	1850.20	4.1	30	16.11	0.0087
512	1850.20	4.1	40	-27.56	-0.0149
512	1850.20	4.1	50	-9.26	-0.0050
512	1850.20	4.1	60	-7.69	-0.0042
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
512	1850.20	4.35	-30	-35.24	-0.0190
512	1850.20	4.35	-20	-43.47	-0.0235
512	1850.20	4.35	-10	-31.54	-0.0170
512	1850.20	4.35	0	-12.84	-0.0069
512	1850.20	4.35	10	-15.90	-0.0086
512	1850.20	4.35	20	-14.33	-0.0077
512	1850.20	4.35	30	14.83	0.0080
512	1850.20	4.35	40	-22.49	-0.0122
512	1850.20	4.35	50	-15.07	-0.0081
512	1850.20	4.35	60	-18.89	-0.0102

PCS1900 Results: channel 661 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
661	1880.00	3.6	-30	-24.46	-0.0130
661	1880.00	3.6	-20	-24.30	-0.0129
661	1880.00	3.6	-10	-21.18	-0.0113
661	1880.00	3.6	0	-11.60	-0.0062
661	1880.00	3.6	10	-12.26	-0.0065
661	1880.00	3.6	20	-7.09	-0.0038
661	1880.00	3.6	30	17.02	0.0091
661	1880.00	3.6	40	-22.24	-0.0118
661	1880.00	3.6	50	15.36	0.0082
661	1880.00	3.6	60	11.69	0.0062
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
661	1880.00	4.1	-30	-37.31	-0.0198
661	1880.00	4.1	-20	-34.31	-0.0183
661	1880.00	4.1	-10	-32.48	-0.0173
661	1880.00	4.1	0	-11.72	-0.0062
661	1880.00	4.1	10	-18.16	-0.0097
661	1880.00	4.1	20	-17.36	-0.0092
661	1880.00	4.1	30	19.80	0.0105
661	1880.00	4.1	40	-20.89	-0.0111
661	1880.00	4.1	50	-6.17	-0.0033
661	1880.00	4.1	60	-10.99	-0.0058
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
661	1880.00	4.35	-30	-33.00	-0.0176
661	1880.00	4.35	-20	-28.96	-0.0154
661	1880.00	4.35	-10	-32.51	-0.0173
661	1880.00	4.35	0	-12.70	-0.0068
661	1880.00	4.35	10	-18.60	-0.0099
661	1880.00	4.35	20	-12.99	-0.0069
661	1880.00	4.35	30	18.11	0.0096
661	1880.00	4.35	40	-14.93	-0.0079
661	1880.00	4.35	50	-16.87	-0.0090
661	1880.00	4.35	60	-15.03	-0.0080

PCS1900 Results: channel 810 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
810	1909.80	3.6	-30	-22.96	-0.0120
810	1909.80	3.6	-20	-28.10	-0.0147
810	1909.80	3.6	-10	-22.34	-0.0117
810	1909.80	3.6	0	7.09	0.0037
810	1909.80	3.6	10	-17.29	-0.0091
810	1909.80	3.6	20	-19.04	-0.0100
810	1909.80	3.6	30	20.10	0.0105
810	1909.80	3.6	40	-16.05	-0.0084
810	1909.80	3.6	50	17.08	0.0089
810	1909.80	3.6	60	12.52	0.0066
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
810	1909.80	4.1	-30	-39.79	-0.0208
810	1909.80	4.1	-20	-32.52	-0.0170
810	1909.80	4.1	-10	-33.72	-0.0177
810	1909.80	4.1	0	-12.99	-0.0068
810	1909.80	4.1	10	-20.63	-0.0108
810	1909.80	4.1	20	-17.12	-0.0090
810	1909.80	4.1	30	18.61	0.0097
810	1909.80	4.1	40	-23.63	-0.0124
810	1909.80	4.1	50	-12.55	-0.0066
810	1909.80	4.1	60	-12.29	-0.0064
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
810	1909.80	4.35	-30	**-48.84**	**-0.0256**
810	1909.80	4.35	-20	-23.88	-0.0125
810	1909.80	4.35	-10	-29.53	-0.0155
810	1909.80	4.35	0	4.07	0.0021
810	1909.80	4.35	10	-17.40	-0.0091
810	1909.80	4.35	20	-16.99	-0.0089
810	1909.80	4.35	30	17.17	0.0090
810	1909.80	4.35	40	-11.48	-0.0060
810	1909.80	4.35	50	-17.11	-0.0090
810	1909.80	4.35	60	-15.65	-0.0082

APPENDIX 1C – GSM RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following tests were performed on model RFW121LW.

Date of test: July 7, 2013

The following measurements were performed by Rex Zhang.
The environmental tests conditions were: Temperature: 25.6 °C
Relative Humidity: 39.3 %

The BlackBerry® smartphone was standalone, USB down and LCD Screen pointing to RX antenna when the turntable is at 0 degree position.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

GSM850 Band in Call Mode

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method / Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	128	824.20	850	Dipole	V	-29.97	-22.99	V-V	11.58	28.71	0.74	38.50	9.79
F0	128	824.20	850	Dipole	H	-22.99		H-H	10.73				
F0	190	836.60	850	Dipole	V	-30.98	-21.98	V-V	13.69	**30.49**	**1.12**	38.50	8.01
F0	190	836.60	850	Dipole	H	-21.98		H-H	11.99				
F0	251	848.80	850	Dipole	V	-32.02	-23.01	V-V	13.01	29.79	0.95	38.50	8.71
F0	251	848.80	850	Dipole	H	-23.01		H-H	10.85				

GSM850 Band in EDGE Mode

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method / Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	128	824.20	850	Dipole	V	-32.61	-24.58	V-V	9.92	27.05	0.51	38.50	11.45
F0	128	824.20	850	Dipole	H	-24.58		H-H	9.08				
F0	190	836.60	850	Dipole	V	-34.28	-24.17	V-V	11.45	**28.25**	**0.67**	38.50	10.25
F0	190	836.60	850	Dipole	H	-24.17		H-H	9.78				
F0	251	848.80	850	Dipole	V	-34.76	-24.79	V-V	11.17	27.95	0.62	38.50	10.55
F0	251	848.80	850	Dipole	H	-24.79		H-H	9.09				

Radiated Power Test Data Results cont'd

Date of test: July 5, 2013
The following measurements were performed by Mahmood Ahmed.

The environmental tests conditions were: Temperature: 27.6 °C
Relative Humidity: 41.7 %

The BlackBerry® smartphone was standalone, USB up and LCD Screen pointing to RX antenna when the turntable is at 0 degree position.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

PCS1900 Band in Call Mode

								Substitution Method					
EUT				Receive Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) dBuV	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	512	1850.20	1900	Horn	V	89.05	89.05	V-V	-3.92	**30.89**	**1.23**	33	2.11
F0	512	1850.20	1900	Horn	H	86.48		H-H	-3.96				
F0	661	1880.00	1900	Horn	V	88.6	88.6	V-V	-4.42	30.48	1.12	33	2.52
F0	661	1880.00	1900	Horn	H	85.90		H-H	-4.56				
F0	810	1909.80	1900	Horn	V	88	88	V-V	-3.30	30.65	1.16	33	2.35
F0	810	1909.80	1900	Horn	H	86.1		H-H	-3.66				

PCS1900 Band in EDGE Mode

								Substitution Method					
EUT				Receive Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) dBuV	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	512	1850.20	1900	Horn	V	86.37	86.37	V-V	-6.58	**28.33**	**0.68**	33	4.67
F0	512	1850.20	1900	Horn	H	83.53		H-H	-6.48				
F0	661	1880.00	1900	Horn	V	85.5	85.50	V-V	-7.60	27.46	0.56	33	5.54
F0	661	1880.00	1900	Horn	H	82.60		H-H	-7.44				
F0	810	1909.80	1900	Horn	V	84.6	84.6	V-V	-6.78	27.17	0.52	33	5.83
F0	810	1909.80	1900	Horn	H	82.4		H-H	-6.98				

Radiated Emissions Test Data Results cont'd

GSM850 Call Mode

Date of Test: July 3-4, 2013

The following measurements were performed by Rex Zhang.
The environmental test conditions were: Temperature: 25.7 ºC
Relative Humidity: 36.4 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 30 MHz to 1000 MHz.

The BlackBerry® smartphone was standalone, with USB facing down and top pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in GSM850 Call Tx mode, channels 128, 190, 251.

All emissions were at least 25.0 dB below the limit.

Date of Test: July 3 - 4, 2013

The following measurements were performed by Mahmood Ahmed.
The environmental test conditions were: Temperature: 24.5 - 25.4 ºC
Relative Humidity: 23.6 - 41.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 9 GHz.

The BlackBerry® smartphone was standalone, with horizontal down and the top pointing to the RX antenna when the turntable is at 0 degree position.

The measurements were performed in GSM850 Call Tx mode, channels 128, 190, 251.

Frequency (MHz)	Channel Of Occurrence	Antenna Pol. (V/H)	Antenna Height (meters)	Test Angle (Deg.)	Detector (PK or QP)	Measured Level (dBµV)	Correction Factor for preamp/antenna/ cables/ filter (dB)	Field Strength Level (reading+corr) (dBm)	Limit @ 3.0 m (dBm)	Test Margin (dB)
2472.800	25	H	1.26	193.00	PK	48.84	-85.89	-37.05	-13.00	**-24.05**

All other emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

GSM850 EDGE Mode

Date of Test: July 3-4, 2013

The following measurements were performed by Rex Zhang.
The environmental test conditions were: Temperature: 25.7 ºC
Relative Humidity: 36.4 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 30 MHz to 1000 MHz.

The BlackBerry® smartphone was standalone, with USB facing down and top pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in GSM850 EDGE Tx mode, channels 128, 190, 251.
All emissions were at least 25.0 dB below the limit.

Date of Test: July 3 - 4, 2013

The following measurements were performed by Mahmood Ahmed.
The environmental test conditions were: Temperature: 24.5 - 25.4 ºC
Relative Humidity: 23.6 - 41.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 9 GHz.

The BlackBerry® smartphone was standalone, with horizontal down and the top pointing to the RX antenna when the turntable is at 0 degree position.

The measurements were performed in GSM850 EDGE Tx mode, channels 128, 190, 251.

All emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

PCS1900 CALL Mode

Date of Test: July 3-4, 2013

The following measurements were performed by Feras Obeid.
The environmental test conditions were: Temperature: 25.7 ºC
Relative Humidity: 17.5 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 30 MHz to 1000 MHz.

The BlackBerry® smartphone was standalone, with USB jack pointing down and the LCD facing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in PCS1900 Call Tx mode, channels 512, 661, 810.
All emissions were at least 25.0 dB below the limit.

Date of Test: July 4 - 12, 2013

The following measurements were performed by Mahmood Ahmed.
The environmental test conditions were: Temperature: 24.3 – 27 ºC
Relative Humidity: 23.6 – 36.2 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 20 GHz.

The BlackBerry® smartphone was standalone, with USB jack pointing up and the LCD facing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in PCS1900 Call Tx mode, channels 512, 661, 810.

Frequency (MHz)	Channel Of Occurrence	Antenna Pol. (V/H)	Antenna Height (meters)	Test Angle (Deg.)	Detector (PK or QP)	Measured Level (dBµV)	Correction Factor for preamp/antenna/ cables/ filter (dB)	Field Strength Level (reading+corr) (dBm)	Limit @ 3.0 m (dBm)	Test Margin (dB)
3819.508	25	V	2.55	86.00	PK	46.37	-80.21	-33.84	-13.00	**-20.84**
3700.260	600	V	1.03	72.00	PK	43.94	-80.32	-36.39	-13.00	-23.39
3760.064	1175	V	3.29	175.00	PK	44.04	-80.49	-36.45	-13.00	-23.45

All other emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

PCS1900 EDGE Mode

Date of Test: July 3-4, 2013

The environmental test conditions were: Temperature: 25.7 ºC
Relative Humidity: 17.5 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 30 MHz to 1000 MHz.

The BlackBerry® smartphone was standalone, with USB jack pointing down and the LCD facing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in PCS1900 EDGE Tx mode, channels 512, 661, 810.
All emissions were at least 25.0 dB below the limit.

Date of Test: July 4 - 12, 2013

The following measurements were performed by Mahmood Ahmed.
The environmental test conditions were: Temperature: 24.3 – 27 ºC
Relative Humidity: 23.6 – 36.2 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 20 GHz.

The BlackBerry® smartphone was standalone, with USB jack pointing up and the LCD facing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in PCS1900 EDGE Tx mode, channels 512, 661, 810.

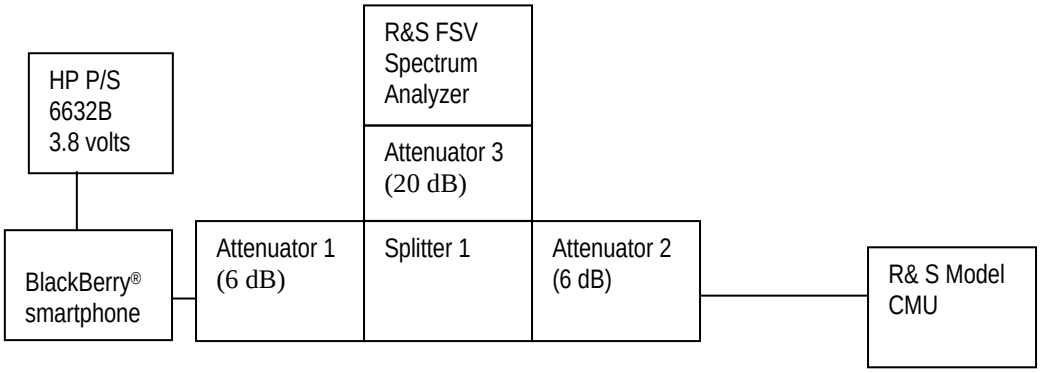
All emissions were at least 25.0 dB below the limit.

APPENDIX 2A– WCDMA Band II/IV/V CONDUCTED RF EMISSIONS TEST DATA/PLOTS

WCDMA Band II/IV/V Conducted RF Emission Test Data

This appendix contains measurement data pertaining to conducted spurious emissions, 99% power bandwidth and the channel mask.

Test Setup Diagram



A reference offset of 31.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

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

Date of Test: July 9, 2013

The environmental test conditions were: Temperature: 25.1ºC
Relative Humidity: 29%

The following measurements were performed by Chuan Tran.

WCDMA Conducted RF Emission Test Data cont'd

The conducted spurious emissions – As per 47 CFR 2.1051, CFR 22.917, CFR 24.238(a), RSS-132, 5.5 and RSS – 133, 6.5 were measured from 30 MHz to 20 GHz.

–26 dBc Bandwidth and Occupied Bandwidth (99%)

For each carrier frequency of low, middle and high, the modulation spectrum was measured by both methods of 99% power bandwidth and –26 dBc bandwidth.
The resolution bandwidth required for out-of-band emissions in the 1 MHz bands immediately outside and adjacent to the frequency block, was determined to be at least 1% of the emission bandwidth.
The worst case –26dBc bandwidth for WCDMA Band V was measured to be 4.573 MHz, WCDMA Band II was measured to be 4.580 MHz and for the WCDMA Band IV was measured to be 4.580 MHz as shown below. Results were derived in a 100 kHz resolution bandwidth.
On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.

Test Data for WCDMA Band II/IV/V selected Frequencies in Voice mode

The following tests were performed on model RFW121LW.

WCDMA Band V Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
826.400	4.573	**4.168**
836.400	4.566	4.161
846.600	4.573	4.161

WCDMA Band II Frequency (MHz)	26dBc Occupied Bandwidth (MHz	99% Occupied Bandwidth (MHz)
1852.400	4.580	4.153
1880.000	4.580	**4.161**
1907.600	4.559	**4.161**

The following tests were performed on model RFV121LW.

WCDMA Band IV Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
1712.4	4.550	4.150
1732.6	4.560	**4.155**

1752.6	4.580	**4.155**

Peak to Average Ratio (PAR)
The peak to average ratio was measured on the low, middle and high channels.
On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.
The worst case measured was 6.71 dB on the low channel of WCDMA Band II.
The worst case measured was 6.81 dB on low and high channels of WCDMA Band IV.

Measurement Plots for WCDMA Band II/IV/V Voice mode

The measurement plots on product RFW121LW:
See Figures 2-1a to 2-12a for the plots of the conducted spurious emissions.
See Figures 2-13a to 2-24a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.
See Figures 2-25a to 2-28a for the plots of the Channel mask.
See Figures 2-29a to 2-31a for the plots of the Peak to Average Ratio (WCDMA Band II).

The measurement plots on product RFV121LW:
See Figures 2-1b to 2-6b for the plots of the conducted spurious emissions.
See Figures 2-7b to 2-12b for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.
See Figures 2-13b to 2-14b for the plots of the Channel mask.
See Figures 2-15b to 2-17b for the plots of the Peak to Average Ratio (WCDMA Band IV).

Test Data for WCDMA Band II/IV/V selected Frequencies in HSUPA mode

The following tests were performed on model RFW121LW.

WCDMA Band V Frequency (MHz)	99% Occupied Bandwidth (MHz)
826.400	**4.160**
836.400	4.155
846.600	4.150

WCDMA Band II Frequency (MHz)	99% Occupied Bandwidth (MHz)
1852.400	4.155
1880.000	**4.160**
1907.600	**4.160**

The following tests were performed on model RFW121LW.

WCDMA Band IV Frequency (MHz)	99% Occupied Bandwidth (MHz)
1712.4	4.150
1732.6	**4.155**
1752.6	4.150

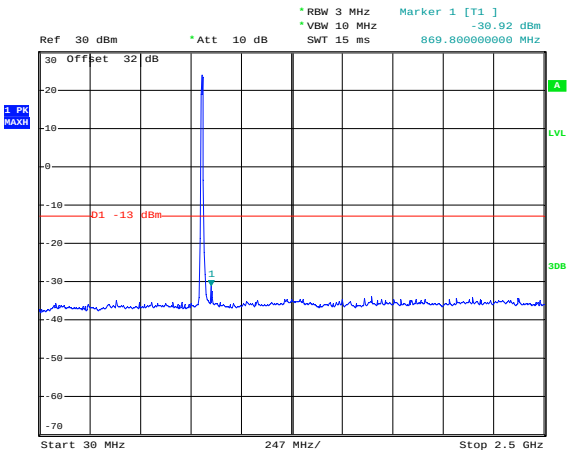
Measurement Plots for WCDMA Band V/II/IV in HSUPA mode
Refer to the following measurement plots for more detail:

The measurement plots for product RFW121LW:
See Figures 2-32a to 2-43a for the plots of the conducted spurious emissions.
See Figures 2-44a to 2-49a for the plots of 99% Occupied Bandwidth.
See Figures 2-50a to 2-53a for the plots of the Channel mask.

The measurement plots for product RFV121LW:
See Figures 2-18b to 2-23b for the plots of the conducted spurious emissions.
See Figures 2-24b to 2-26b for the plots of 99% Occupied Bandwidth.
See Figures 2-27b to 2-28b for the plots of the Channel mask.

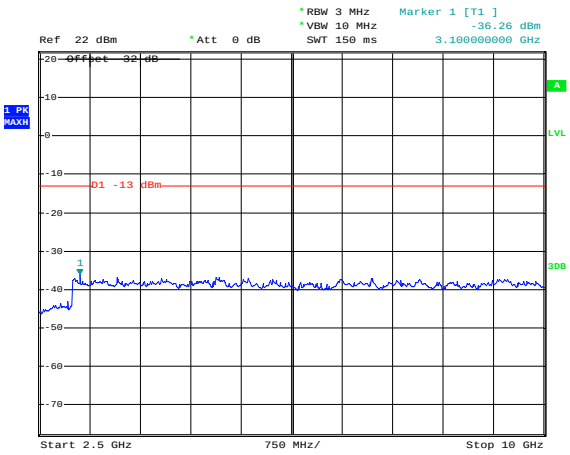
WCDMA Conducted RF Emission Test Data cont'd

Figure 2-1a: Band V, Spurious Conducted Emissions, Low channel



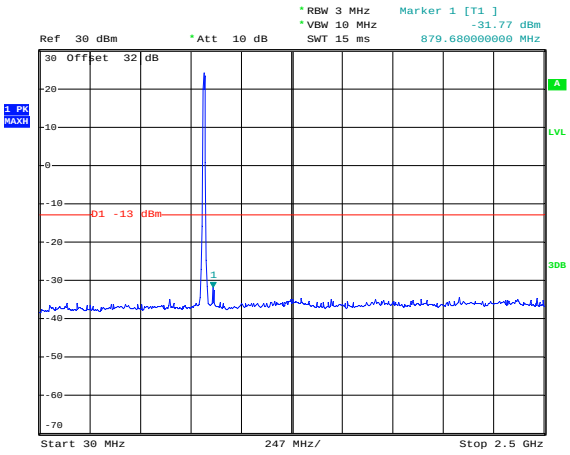
Date: 4.JUL.2013 11:24:10

Figure 2-2a: Band V, Spurious Conducted Emissions, Low channel



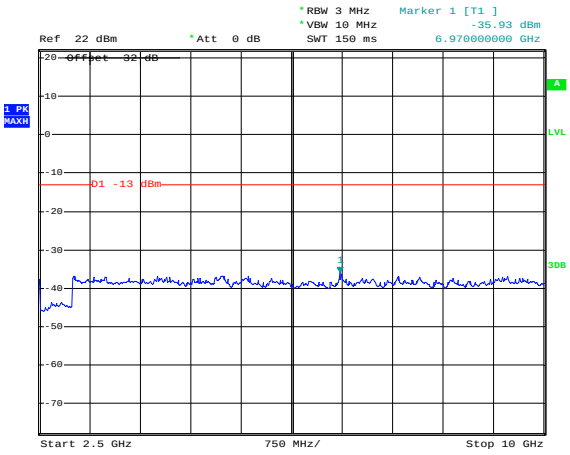
Date: 4.JUL.2013 11:28:05

Figure 2-3a: Band V, Spurious Conducted Emissions, Middle channel



Date: 4.JUL.2013 11:24:50

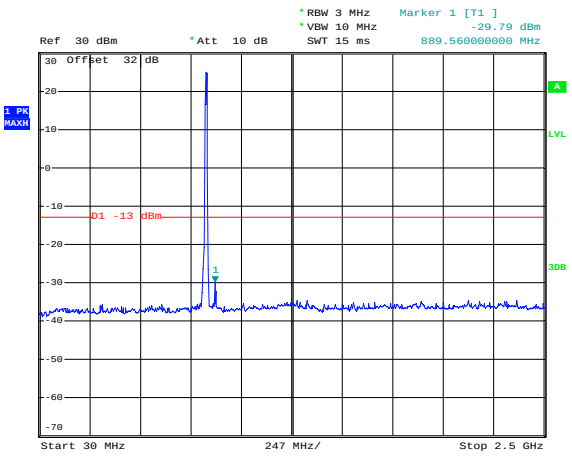
Figure 2-4a: Band V, Spurious Conducted Emissions, Middle channel



Date: 4.JUL.2013 11:27:37

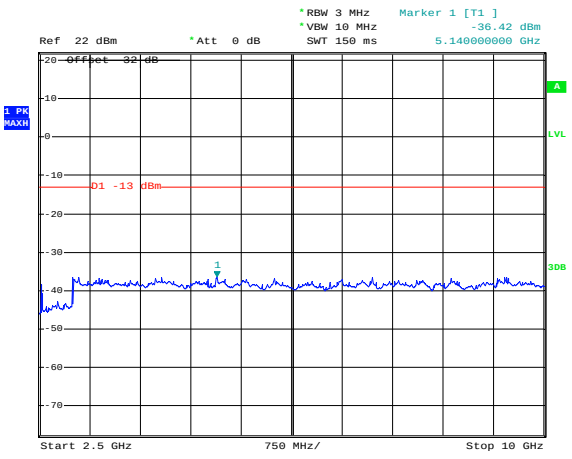
WCDMA Conducted RF Emission Test Data cont'd

Figure 2-5a: Band V, Spurious Conducted Emissions, High Channel



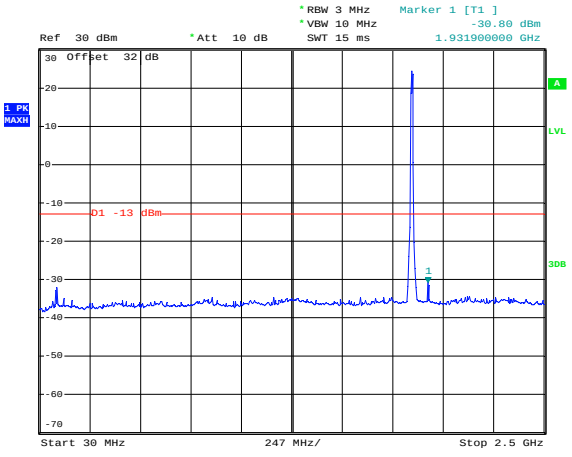
Date: 4.JUL.2013 11:25:20

Figure 2-6a: Band V, Spurious Conducted Emissions, High Channel



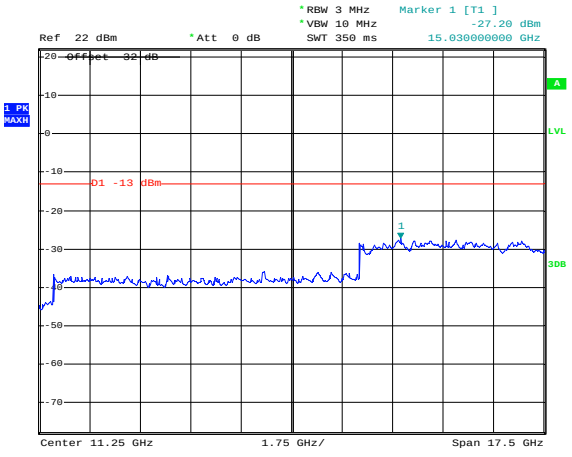
Date: 4.JUL.2013 11:26:56

Figure 2-2a:, BAND II Spurious Conducted Emissions, Low Channel



Date: 4.JUL.2013 11:31:31

Figure 2-8a: BAND II, Spurious Conducted Emissions, Low Channel



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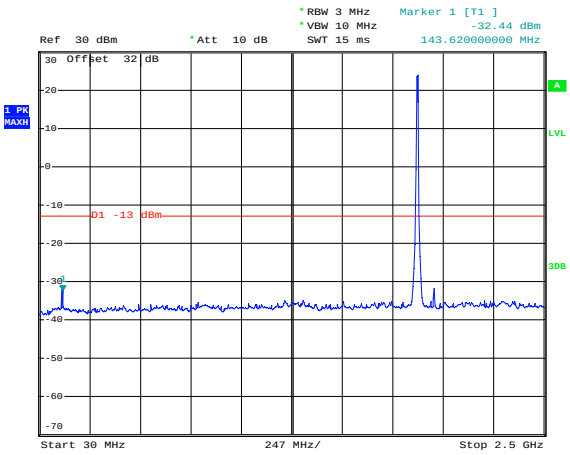
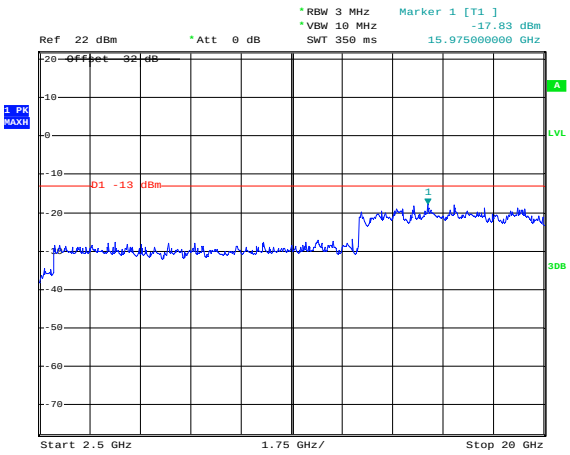
WCDMA Conducted RF Emission Test Data cont'd

Figure 2-9a: BAND II, Spurious Conducted Emissions, Middle Channel



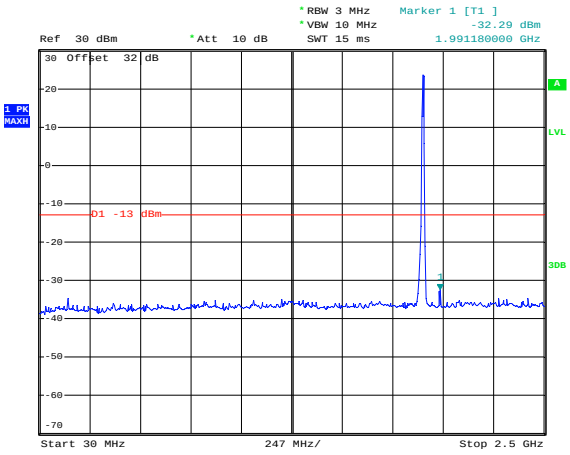
Date: 4.JUL.2013 11:32:04

Figure 2-10a: BAND II, Spurious Conducted Emissions, Middle Channel



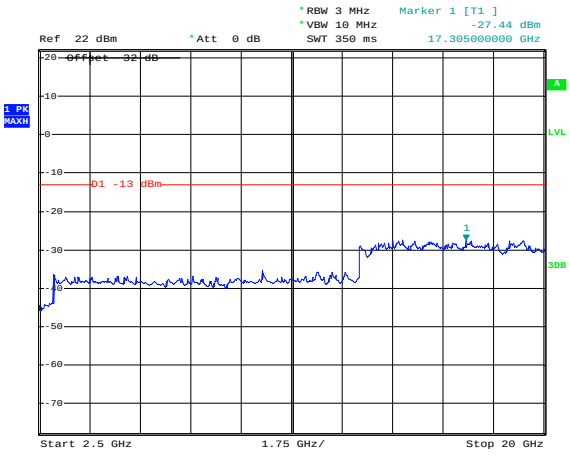
Date: 4.JUL.2013 11:38:15

Figure 2-11a: BAND II, Spurious Conducted Emissions, High Channel



Date: 4.JUL.2013 11:37:34

Figure 2-12a: BAND II, Spurious Conducted Emissions, High Channel



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WCDMA Conducted RF Emission Test Data cont'd

Figure 2-13a: Occupied Bandwidth, Band V Low Channel

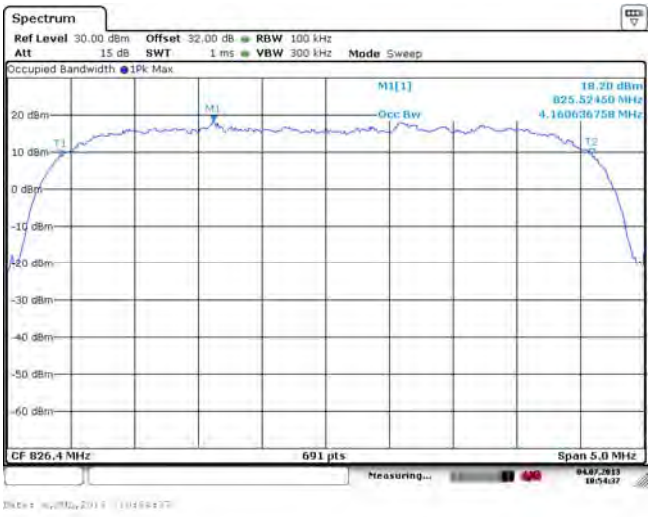


Figure 2-14a: Occupied Bandwidth, Band V Middle Channel

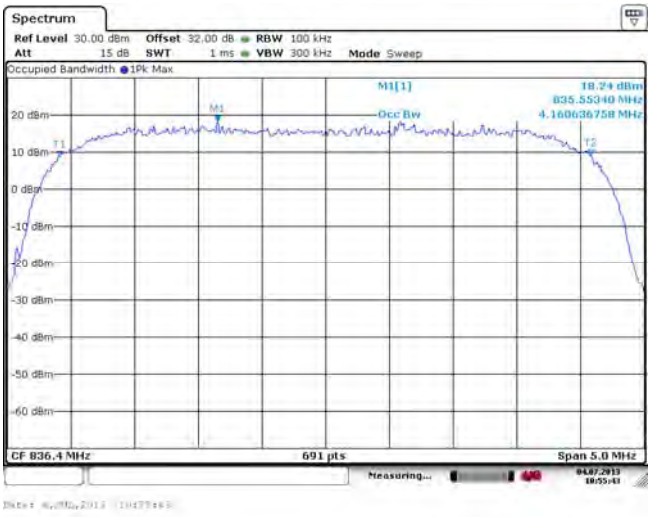


Figure 2-15a: Occupied Bandwidth, Band V High Channel

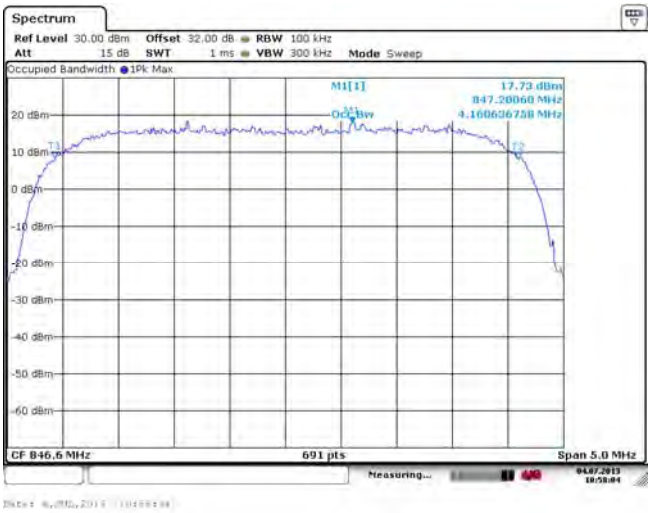
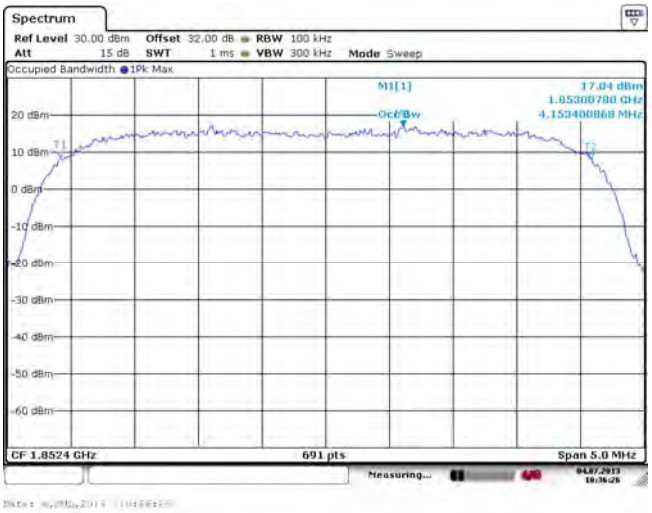


Figure 2-16a: Occupied Bandwidth, Band II Low Channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-17a: Occupied Bandwidth, Band II Middle Channel

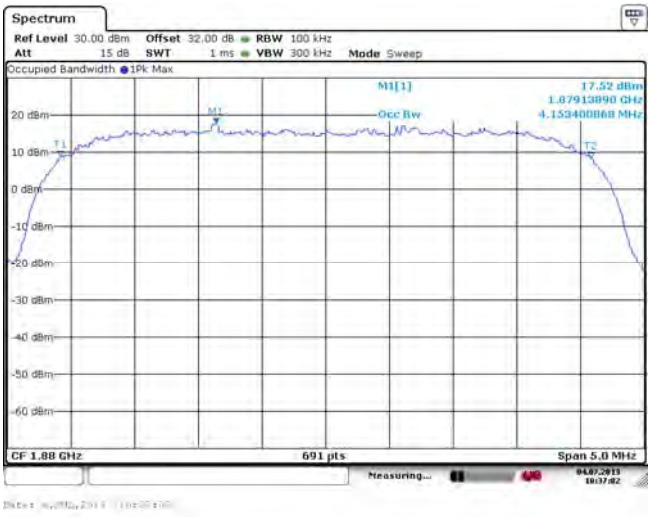


Figure 2-18a: Occupied Bandwidth, Band II High Channel

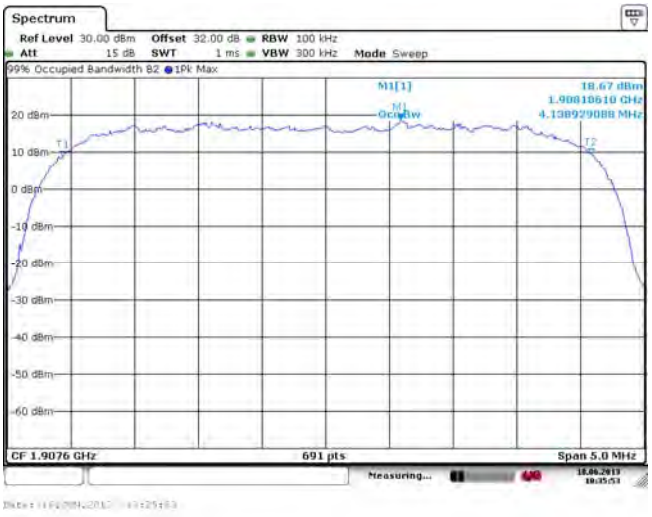


Figure 2-19a: -26 dBc Bandwidth, Band V Low Channel

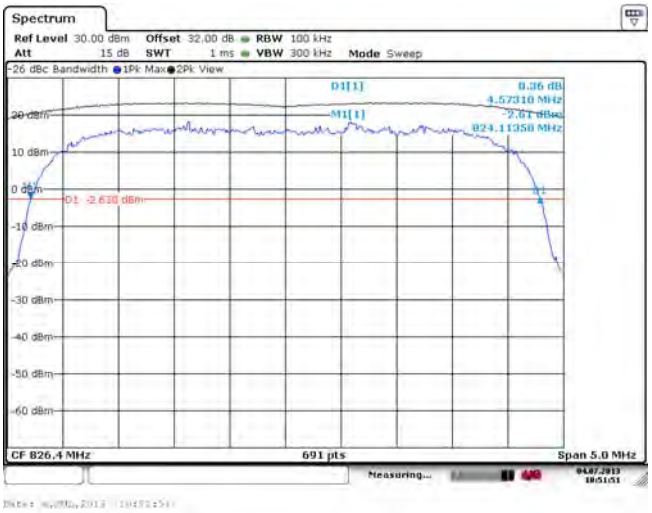
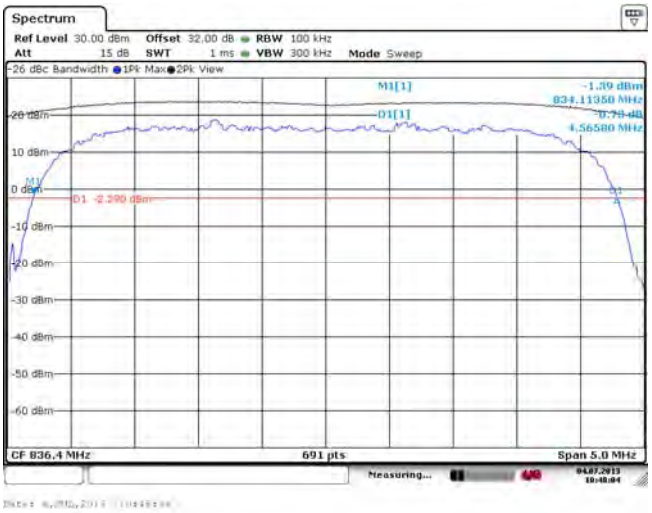


Figure 2-20a: -26 dBc Bandwidth, Band V Middle Channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-21a: -26 dBc Bandwidth, Band V High Channel

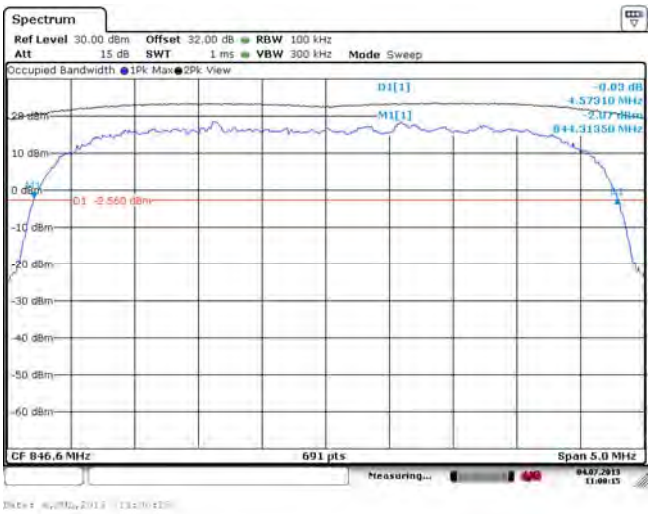


Figure 2-22a: -26 dBc Bandwidth, Band II Low Channel

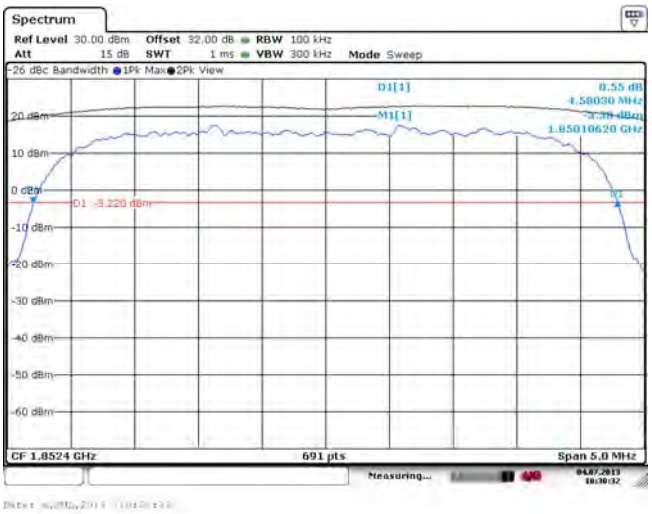


Figure 2-23a: -26 dBc Bandwidth, Band II Middle Channel

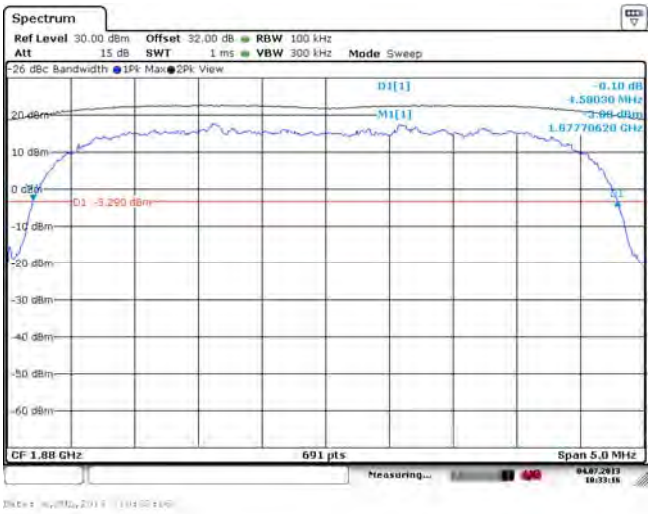
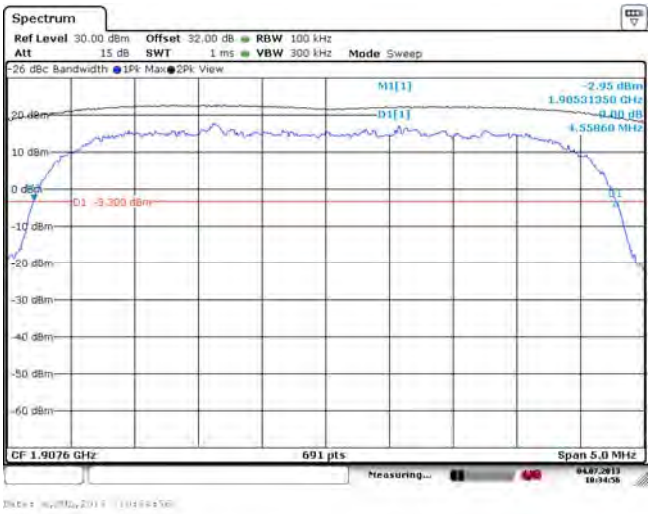


Figure 2-24a: -26 dBc Bandwidth, Band II High Channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-25a: Band V Low Channel Mask

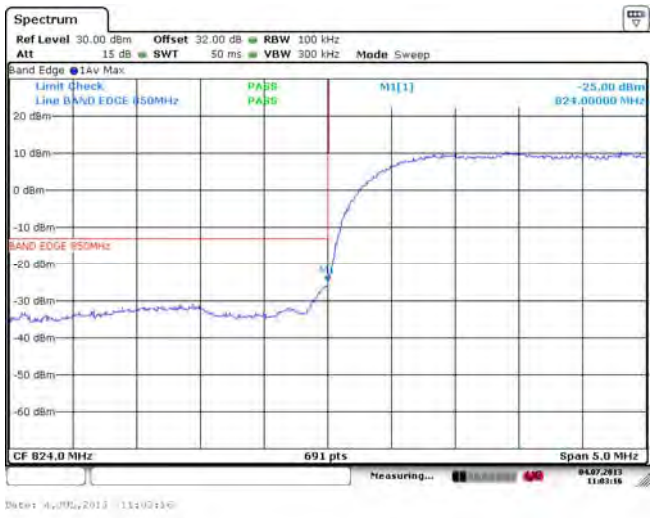


Figure 2-26a: Band V High Channel Mask

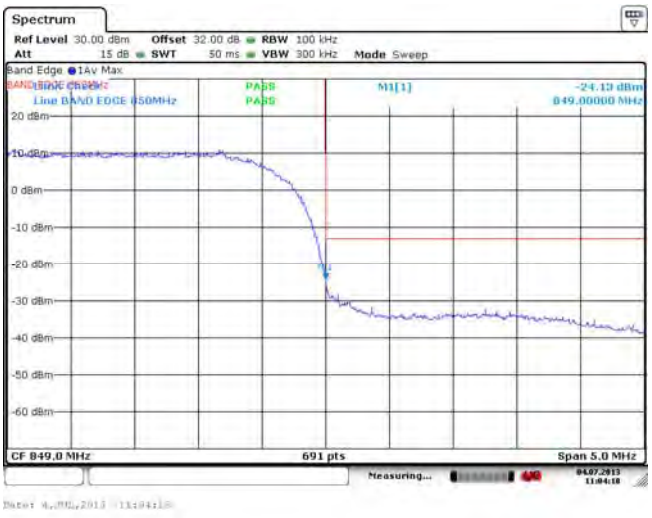


Figure 2-27a: Band II Low Channel Mask

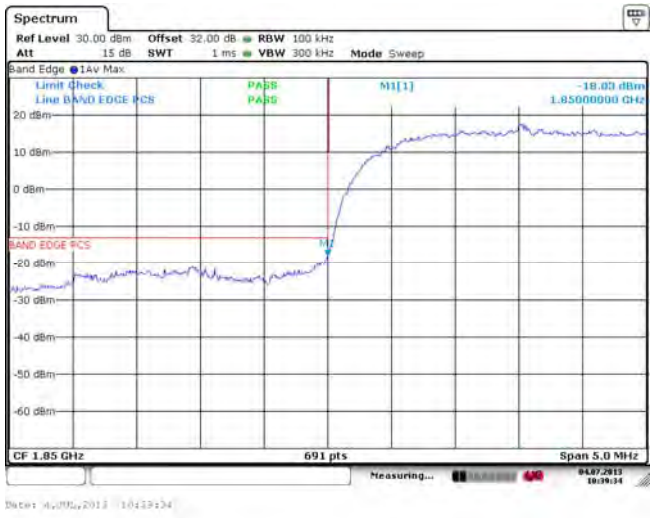
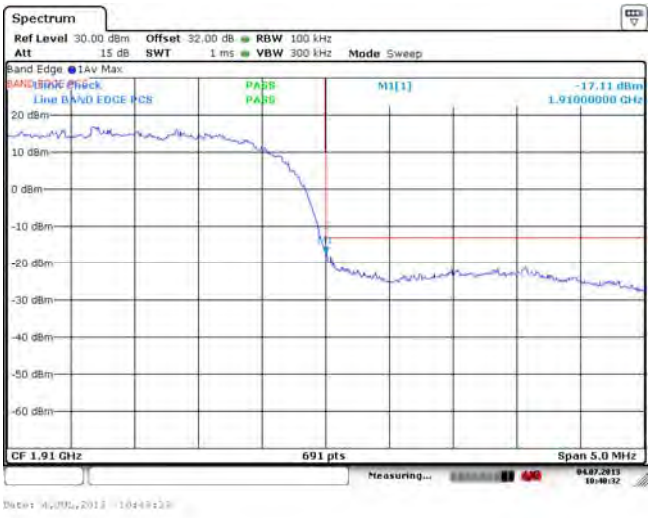


Figure 2-28a: Band II High Channel Mask



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-29a: Band II, PAR Low Channel

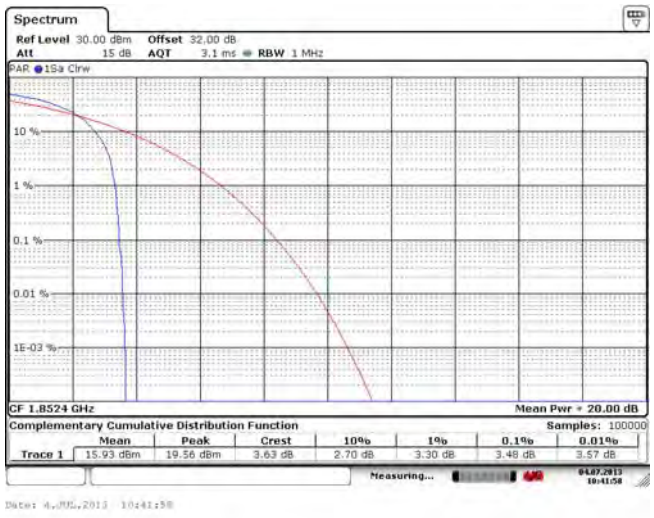


Figure 2-30a: Band II, PAR Mid Channel

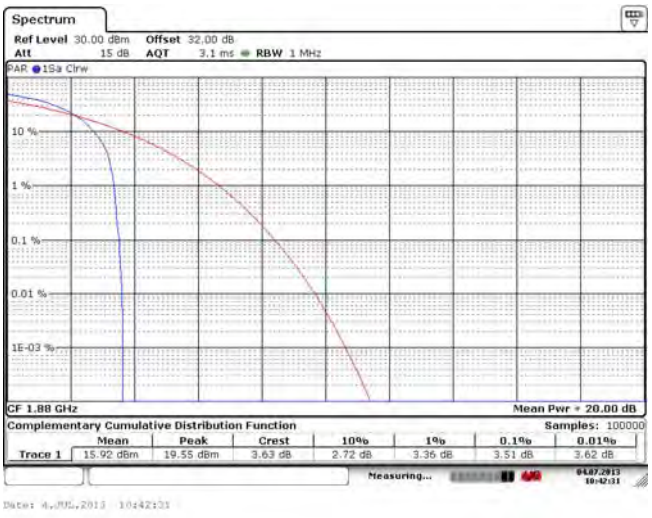
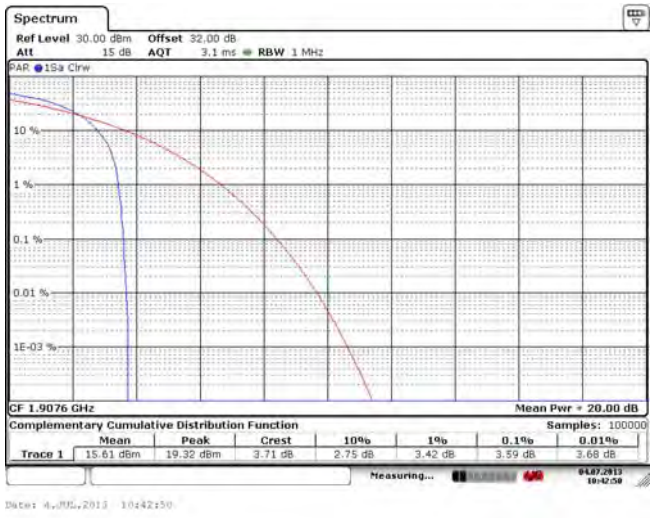


Figure 2-31a: Band II, PAR High Channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-32a: Band V HSUPA, Spurious Conducted Emissions, Low channel

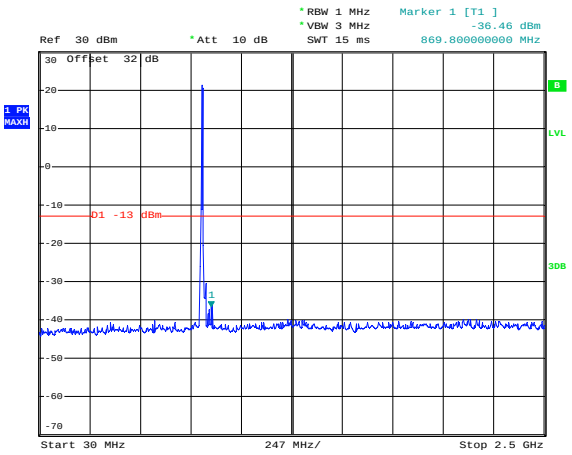


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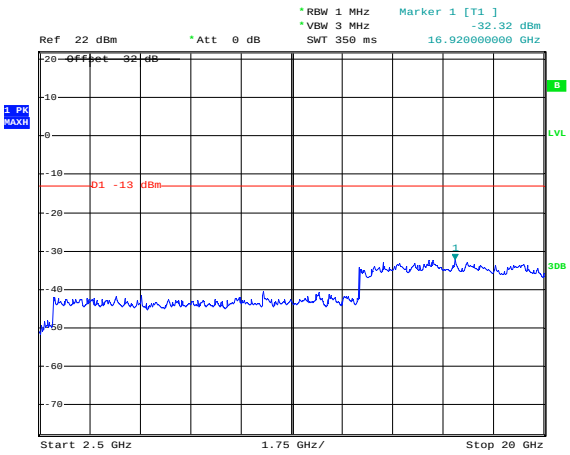
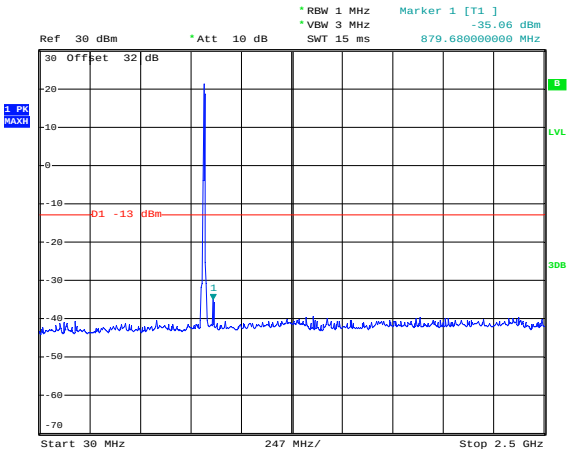
Figure 2-33a: Band V HSUPA, Spurious Conducted Emissions, Low channel



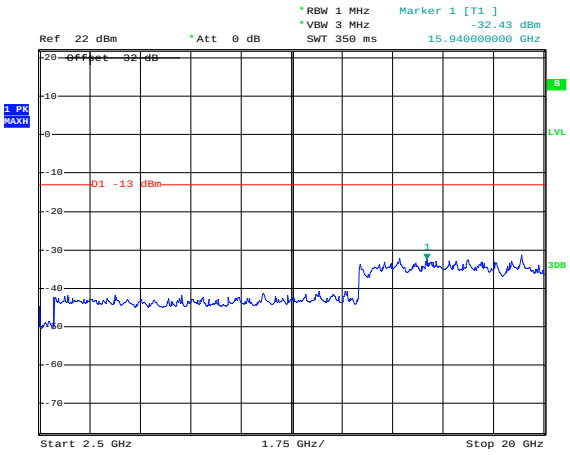
Date: 4.JUL.2013 12:37:15

Figure 2-34a: Band V HSUPA, Spurious Conducted Emissions, Middle channel



Date: 4.JUL.2013 12:35:50

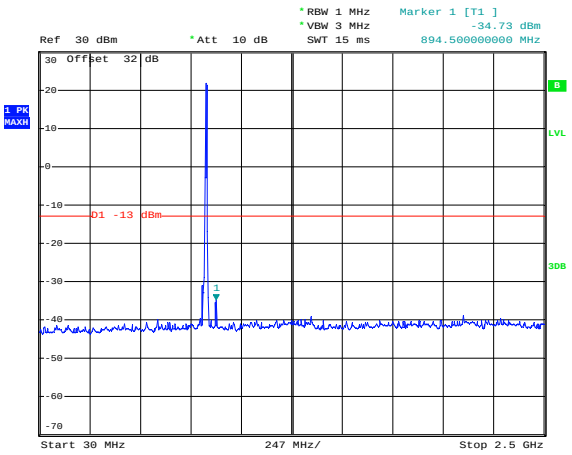
Figure 2-35a: Band V HSUPA, Spurious Conducted Emissions, Middle channel



Date: 4.JUL.2013 12:37:59

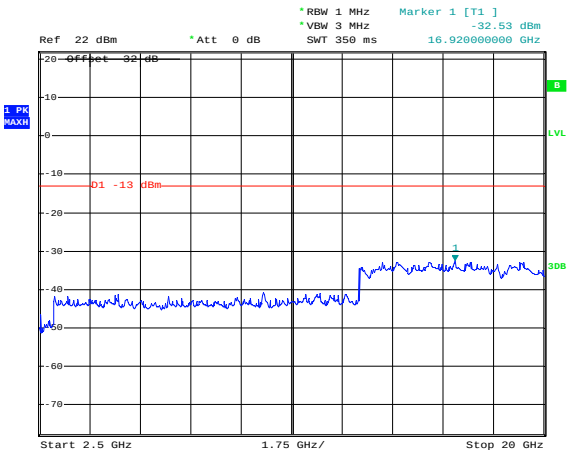
WCDMA Conducted RF Emission Test Data cont'd

Figure 2-36a: Band V HSUPA, Spurious Conducted Emissions, High Channel



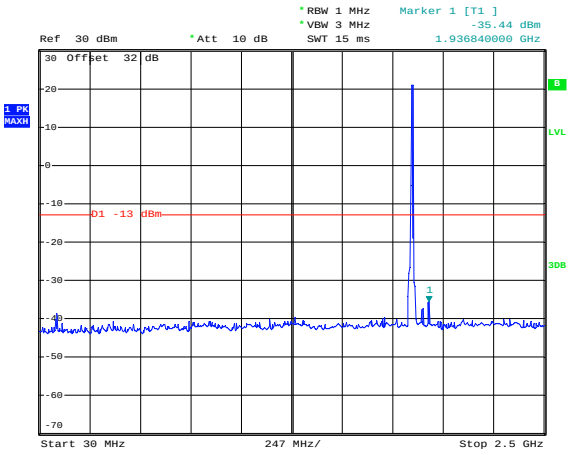
Date: 4.JUL.2013 12:34:06

Figure 2-37a: Band V HSUPA, Spurious Conducted Emissions, High Channel



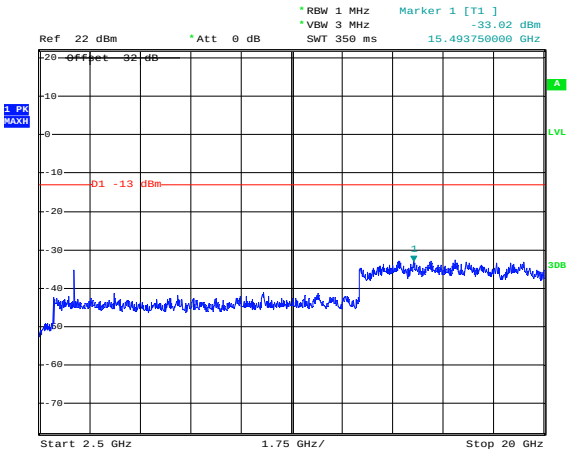
Date: 4.JUL.2013 12:38:28

Figure 2-38a: Band II HSUPA, Spurious Conducted Emissions, Low Channel



Date: 4.JUL.2013 12:26:58

Figure 2-39a: Band II HSUPA, Spurious Conducted Emissions, Low Channel



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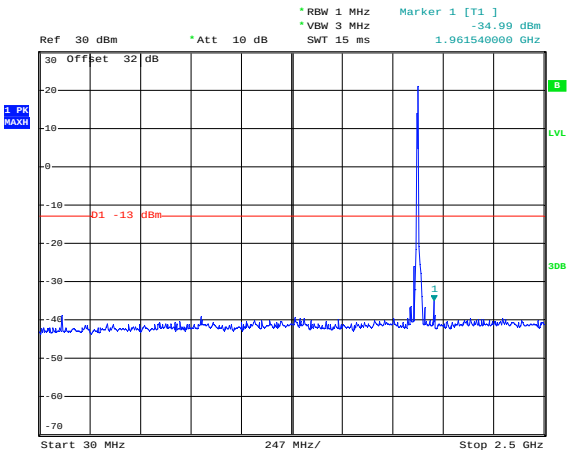
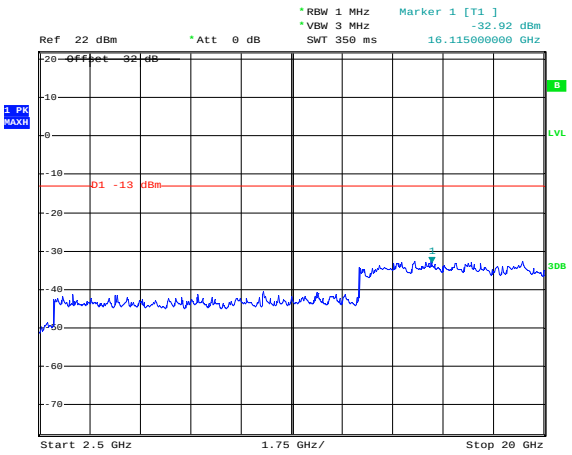
WCDMA Conducted RF Emission Test Data cont'd

Figure 2-40a: Band II HSUPA, Spurious Conducted Emissions, Middle Channel



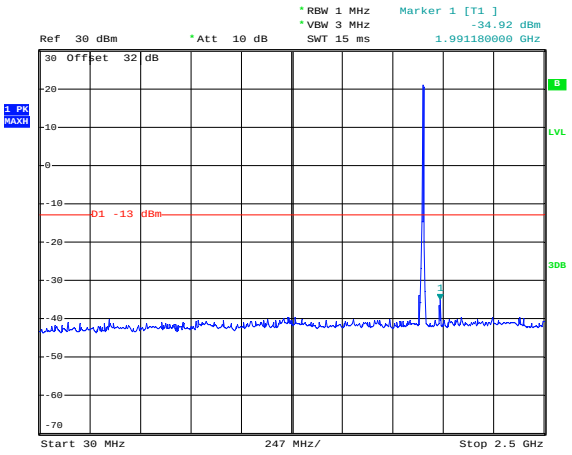
Date: 4.JUL.2013 12:27:29

Figure 2-41a: Band II HSUPA, Spurious Conducted Emissions, Middle Channel



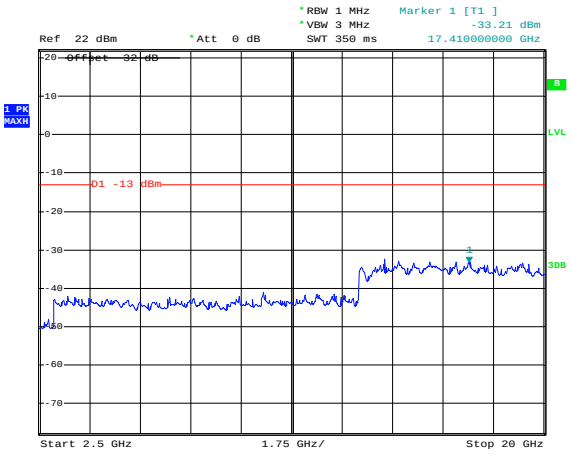
Date: 4.JUL.2013 12:28:59

Figure 2-42a: Band II HSUPA, Spurious Conducted Emissions, High Channel



Date: 4.JUL.2013 12:27:55

Figure 2-43a: Band II HSUPA, Spurious Conducted Emissions, High Channel



Date: 4.JUL.2013 12:28:31

WCDMA Conducted RF Emission Test Data cont'd

Figure 2-44a: Occupied Bandwidth, Band V HSUPA Low Channel

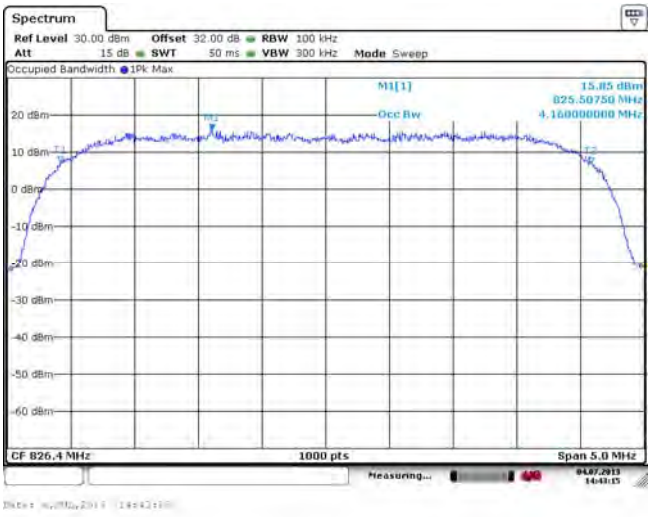


Figure 2-45a: Occupied Bandwidth, Band V HSUPA Middle Channel

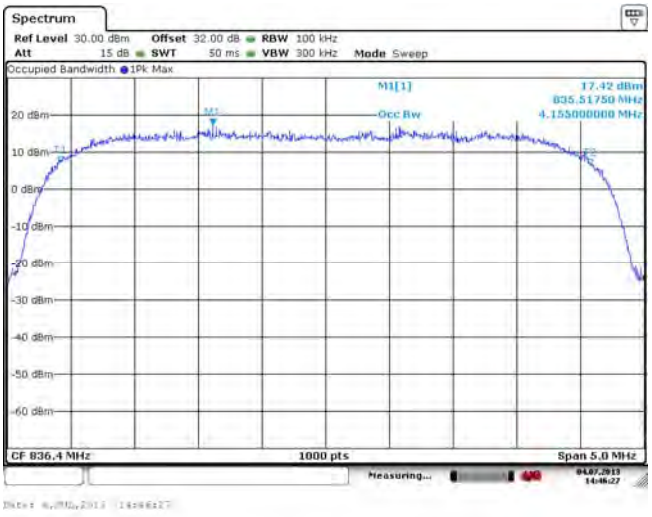


Figure 2-46a: Occupied Bandwidth, Band V HSUPA High Channel

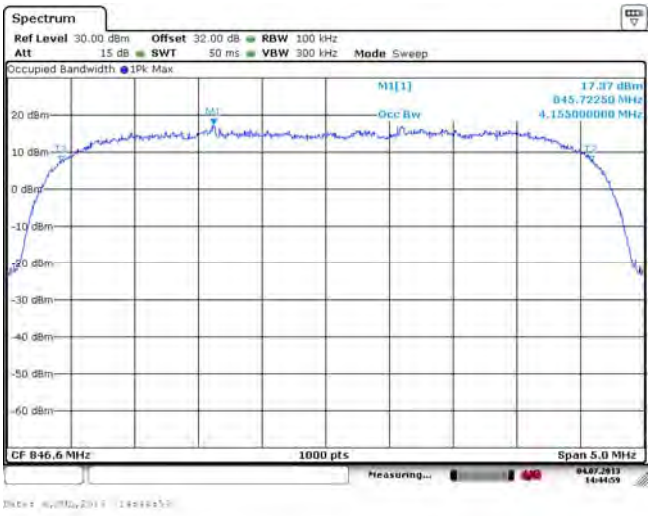
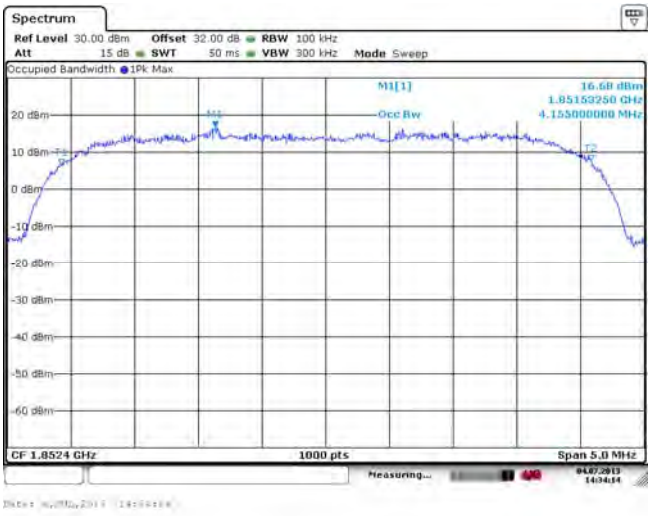


Figure 2-47a: Occupied Bandwidth, Band II HSUPA Low Channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-48a: Occupied Bandwidth, Band II HSUPA Middle Channel

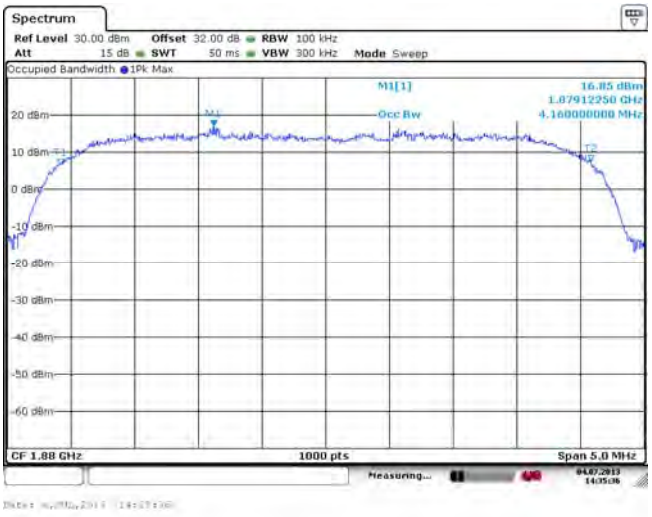


Figure 2-49a: Occupied Bandwidth, Band II HSUPA High Channel

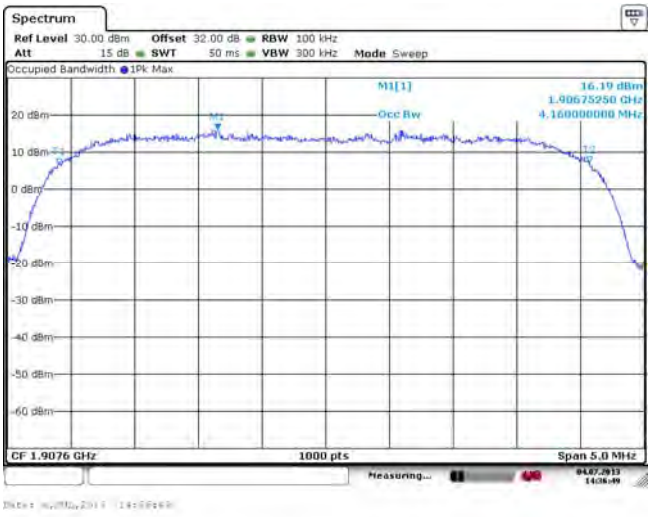


Figure 2-50a: Band V , HSUPA Low Channel Mask

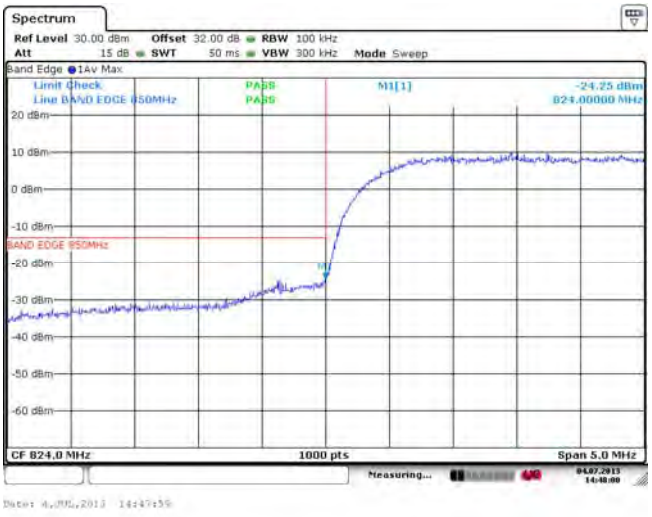
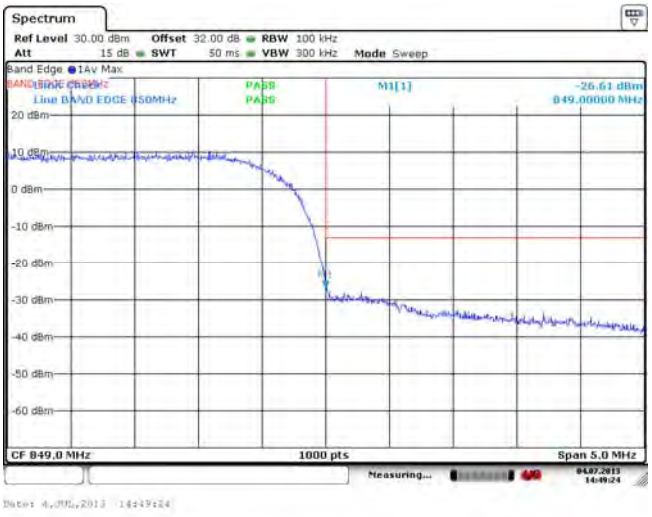


Figure 2-51a: Band V , HSUPA High Channel Mask



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-52a: Band II, HSUPA Low Channel Mask

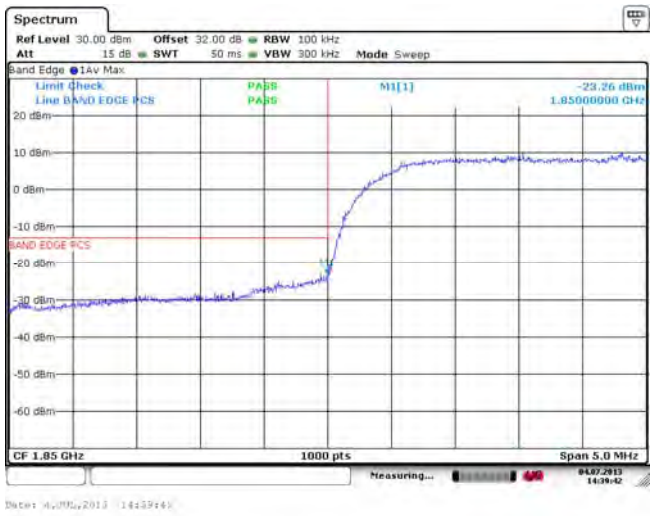
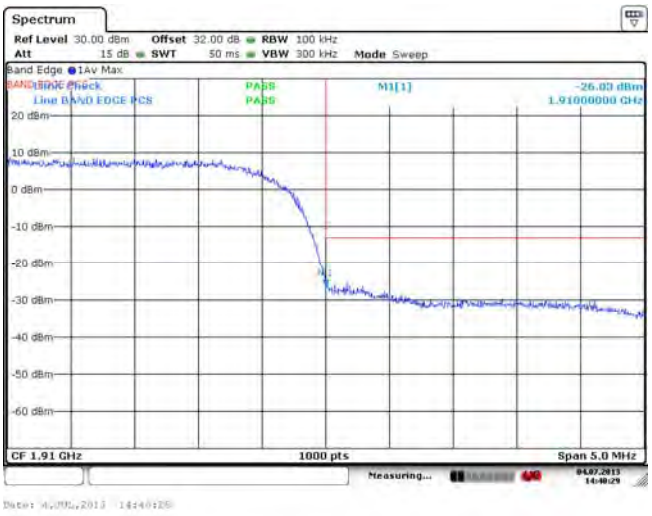


Figure 2-53a: Band II, HSUPA High Channel Mask



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-1b: Band IV, Spurious Conducted Emissions, Low channel

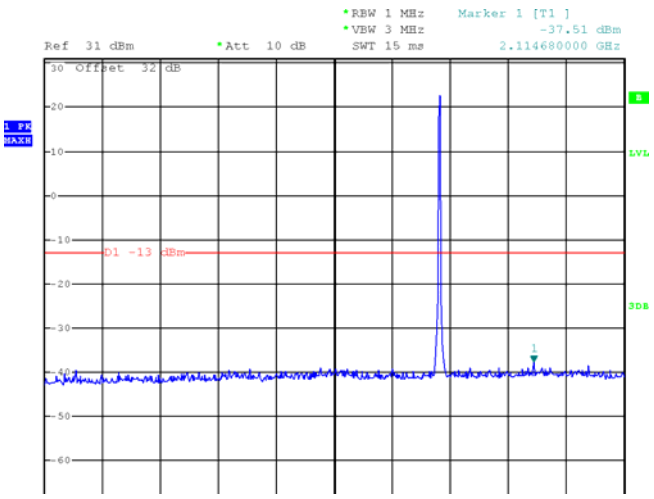


Figure 2-2b: Band IV, Spurious Conducted Emissions, Low channel

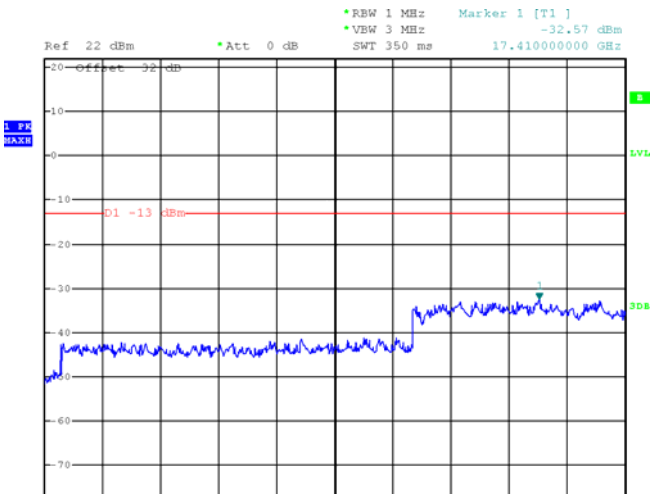


Figure 2-3b: Band IV, Spurious Conducted Emissions, Middle channel

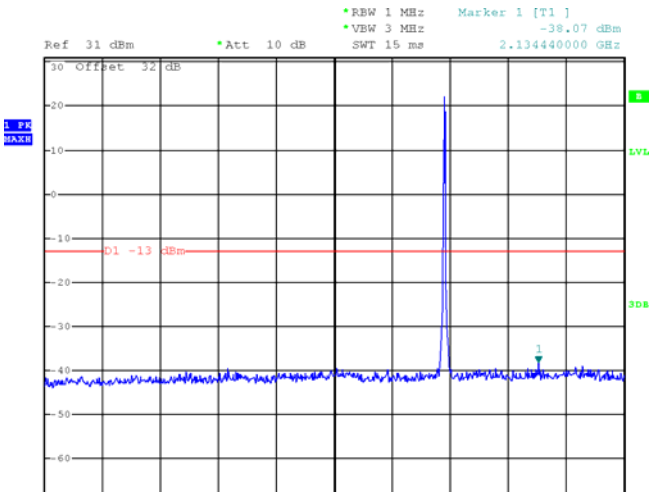
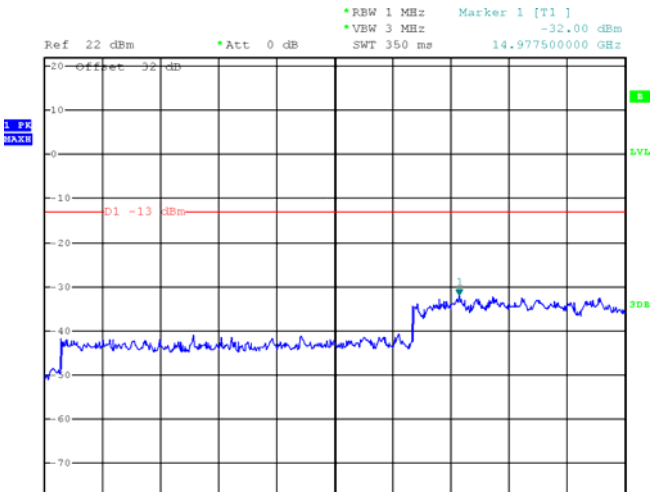


Figure 2-4b: Band IV, Spurious Conducted Emissions, Middle channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-5b: Band IV, Spurious Conducted Emissions, High Channel

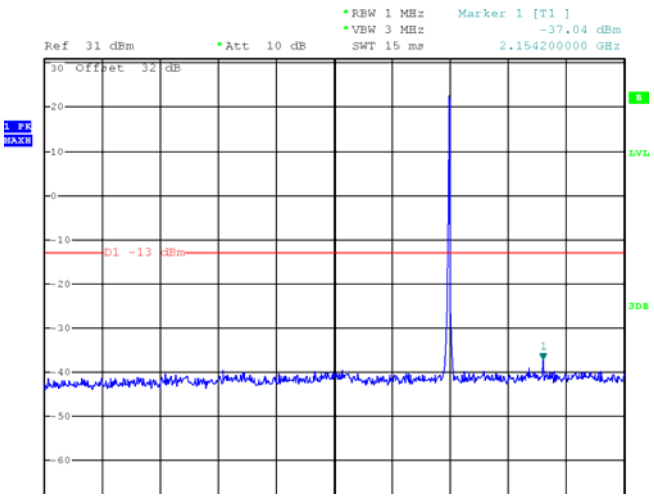
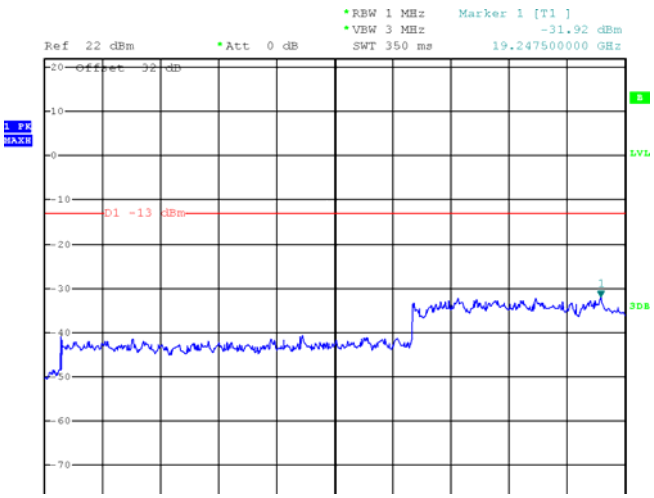


Figure 2-6b: Band IV, Spurious Conducted Emissions, High Channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-7b: Occupied Bandwidth, Band IV Low Channel

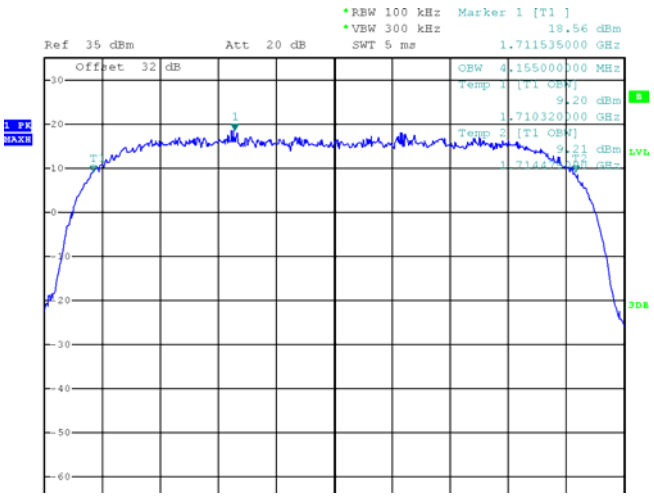


Figure 2-8b: Occupied Bandwidth, Band IV Middle Channel

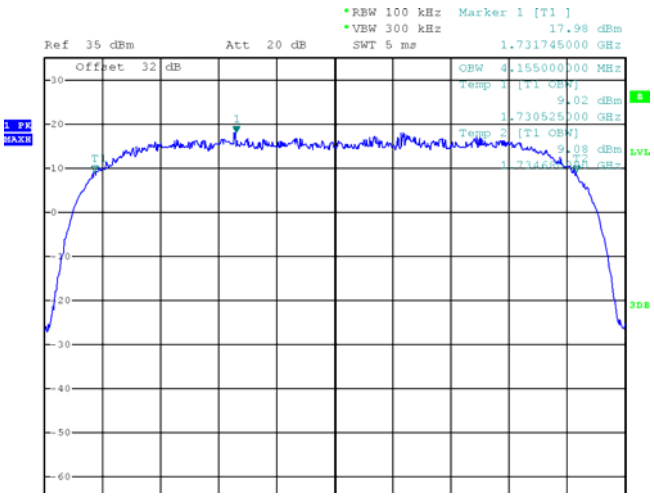


Figure 2-9b: Occupied Bandwidth, Band IV High Channel

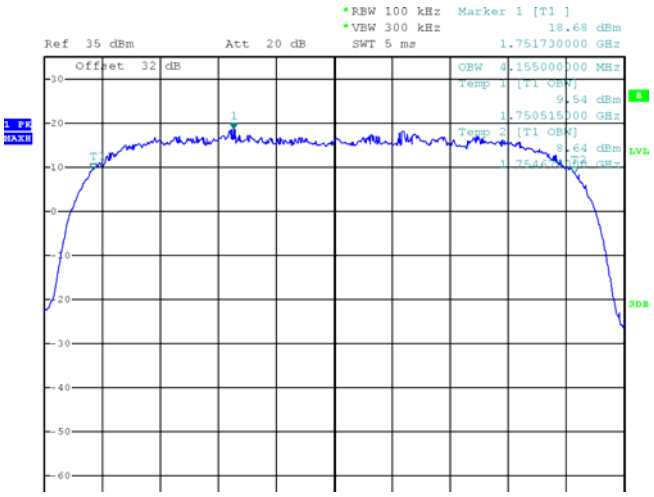


Figure 2-10b: -26 dBc Bandwidth, Band IV Low Channel

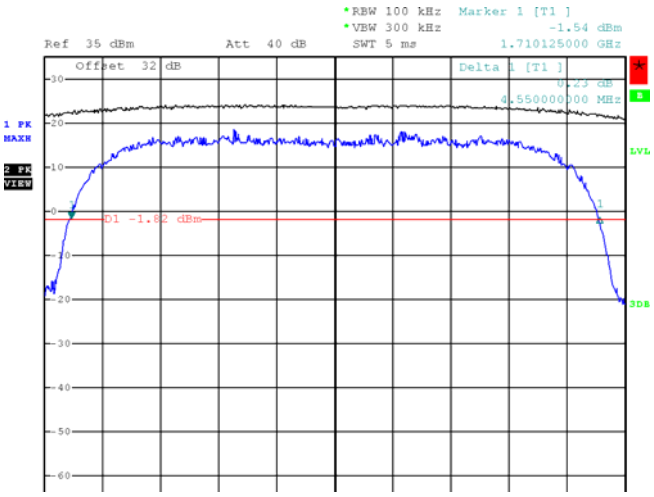


Figure 2-11b: -26 dBc Bandwidth, Band IV Middle Channel

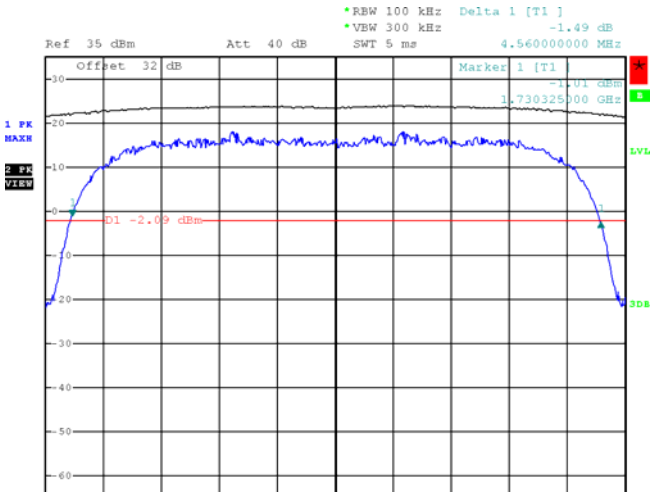


Figure 2-12b: -26 dBc Bandwidth, Band IV High Channel

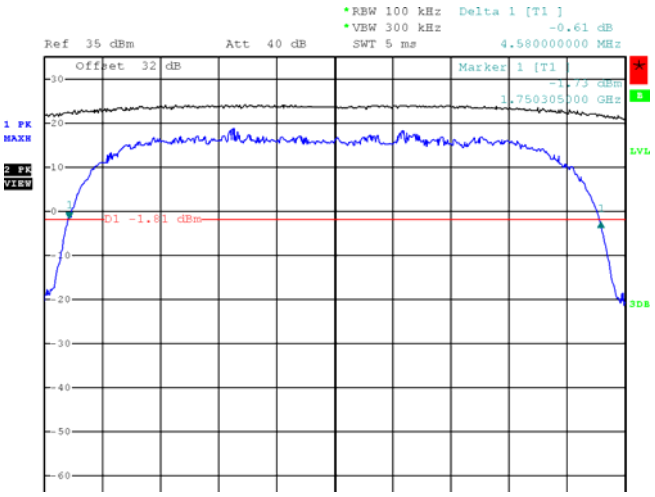


Figure 2-13b: Band IV Low Channel Mask

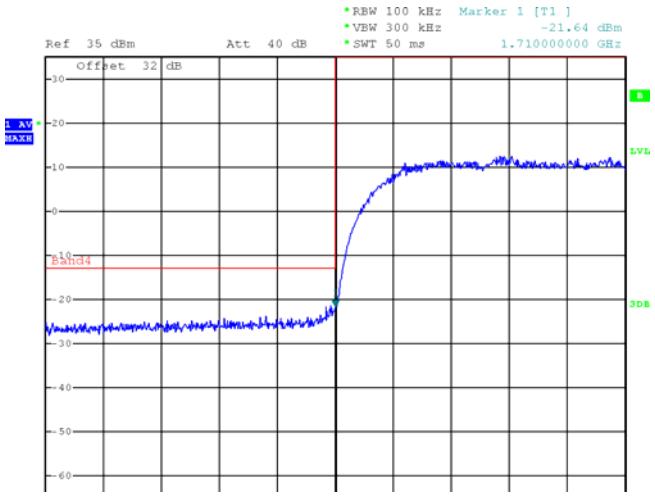
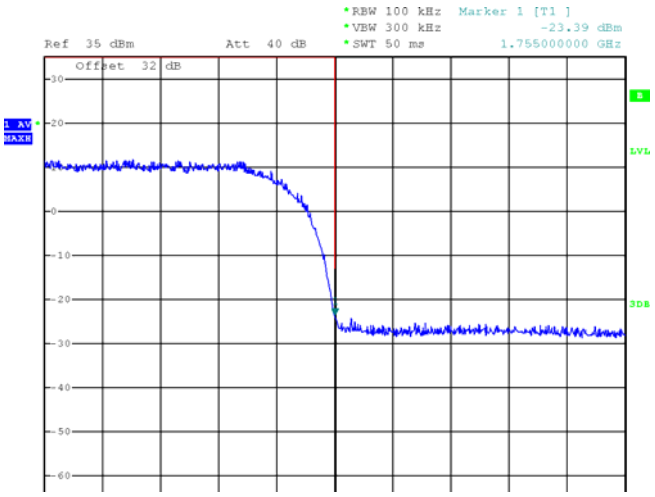
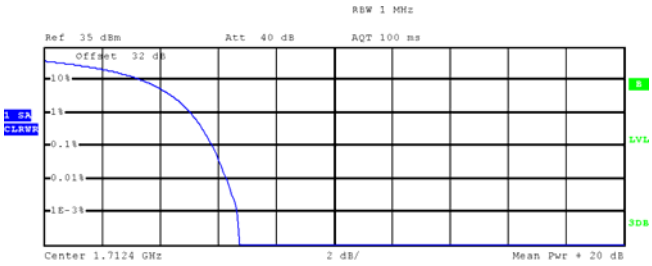


Figure 2-14b: Band IV High Channel Mask



WCDMA Conducted RF Emission Test Data cont'd

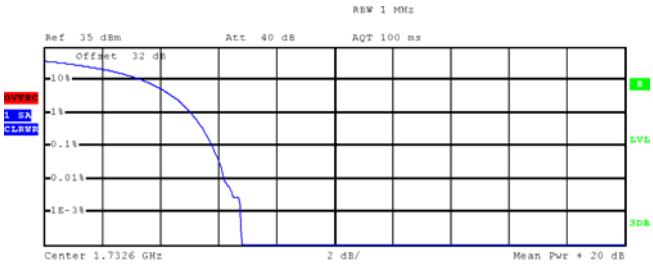
Figure 2-15b: Band IV, PAR Low Channel



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	15.49 dBm
Peak	22.22 dBm
Crest	6.73 dB
10 %	3.48 dB
1 %	5.08 dB
.1 %	5.84 dB
.01 %	6.32 dB

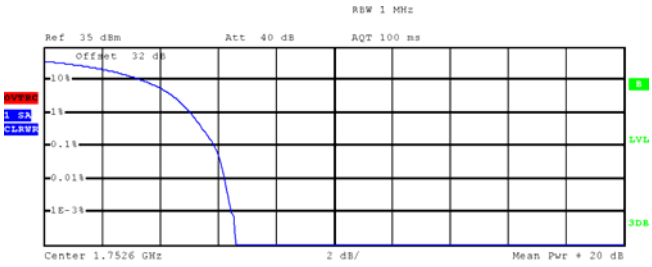
Figure 2-16b: Band IV, PAR Mid Channel



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	15.36 dBm
Peak	22.15 dBm
Crest	6.79 dB
10 %	3.48 dB
1 %	5.08 dB
.1 %	5.84 dB
.01 %	6.24 dB

Figure 2-17b: Band IV, PAR High Channel



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	15.62 dBm
Peak	22.22 dBm
Crest	6.60 dB
10 %	3.48 dB
1 %	5.08 dB
.1 %	5.92 dB
.01 %	6.24 dB

WCDMA Conducted RF Emission Test Data cont'd

Figure 2-18b: Band IV HSUPA, Spurious Conducted Emissions, Low channel

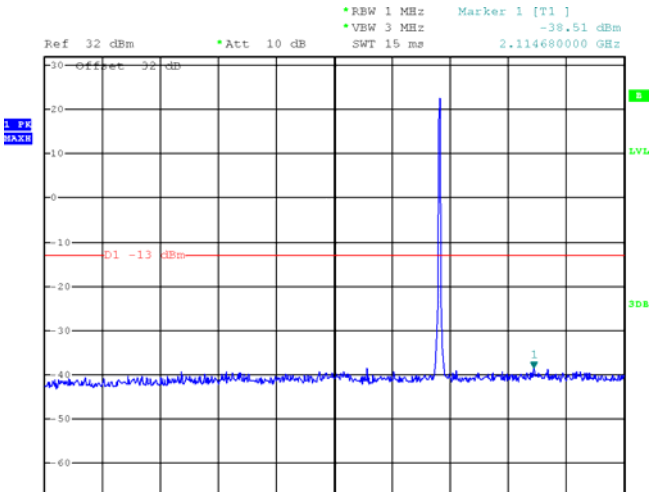


Figure 2-19b: Band IV HSUPA, Spurious Conducted Emissions, Low channel

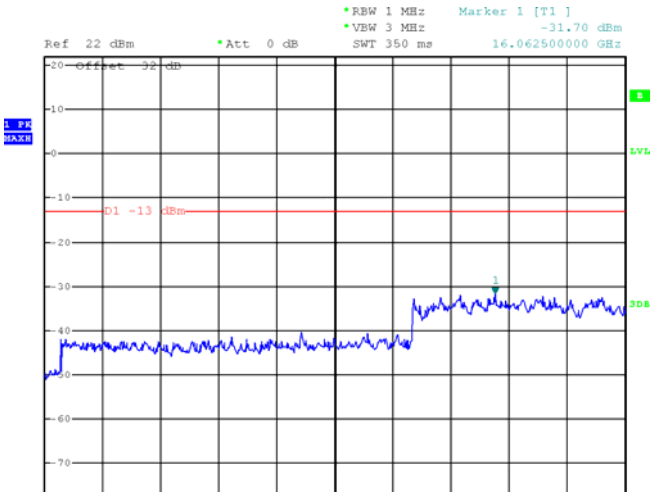


Figure 2-20b: Band IV HSUPA, Spurious Conducted Emissions, Middle channel

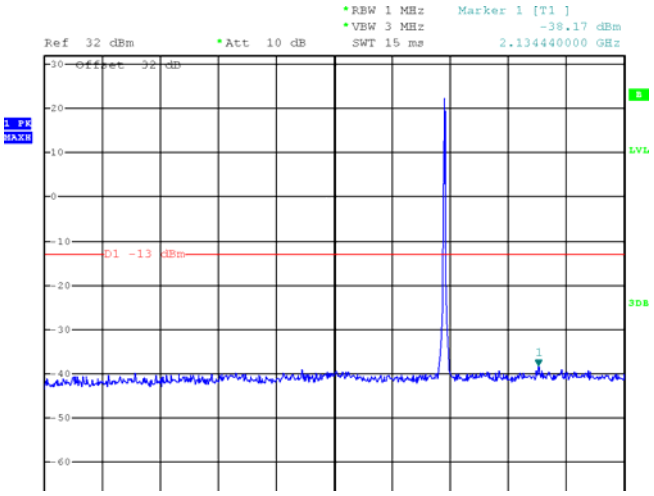
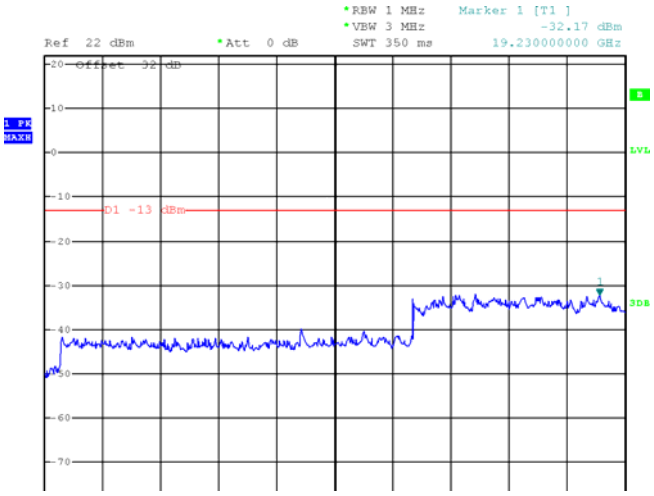


Figure 2-21b: Band IV HSUPA, Spurious Conducted Emissions, Middle channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-22b: Band IV HSUPA, Spurious Conducted Emissions, High Channel

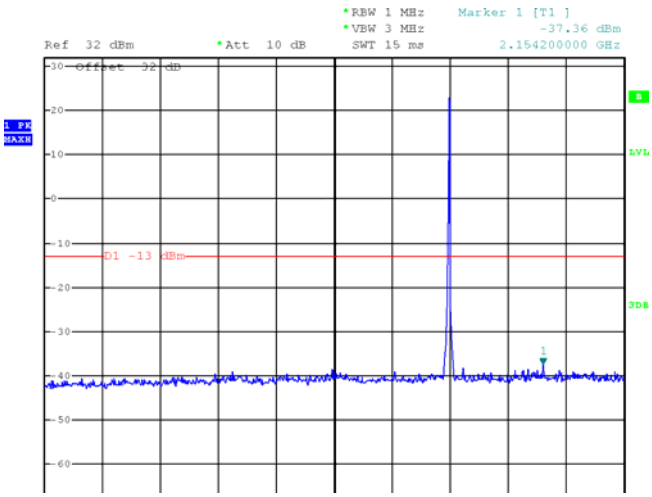


Figure 2-23b: Band IV HSUPA, Spurious Conducted Emissions, High Channel

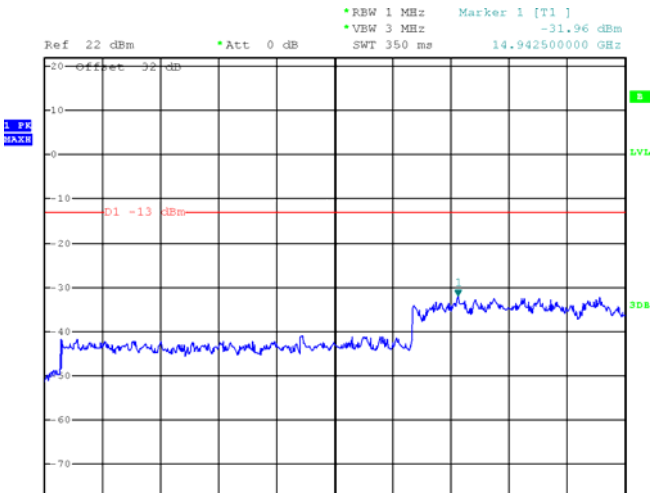


Figure 2-24b: Occupied Bandwidth, Band IV HSUPA Low Channel

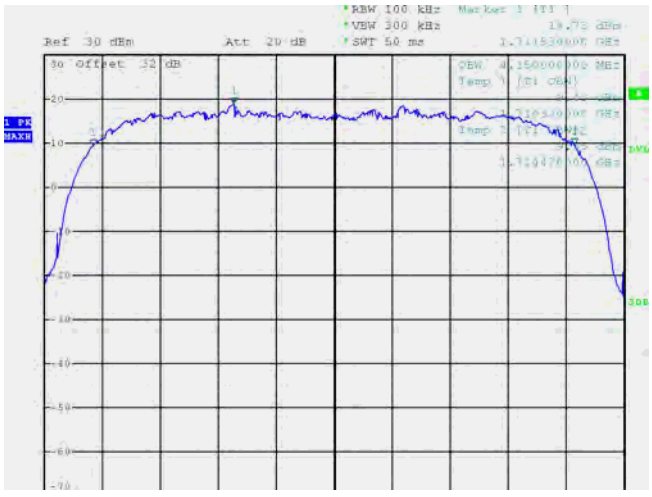
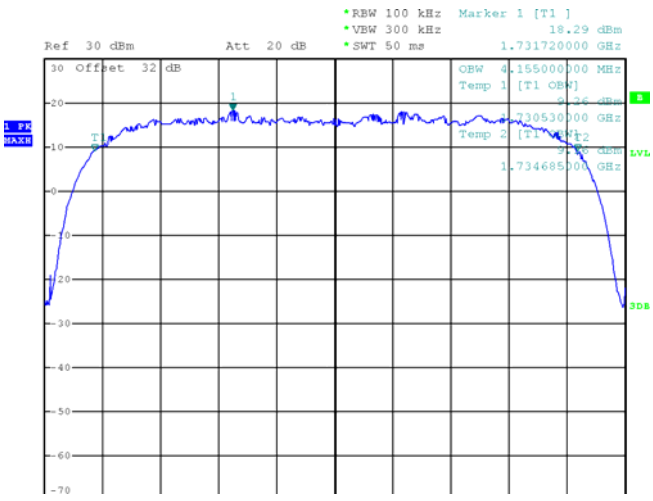


Figure 2-25b: Occupied Bandwidth, Band IV HSUPA Middle Channel



WCDMA Conducted RF Emission Test Data cont'd

Figure 2-26b: Occupied Bandwidth, Band IV
HSUPA High Channel

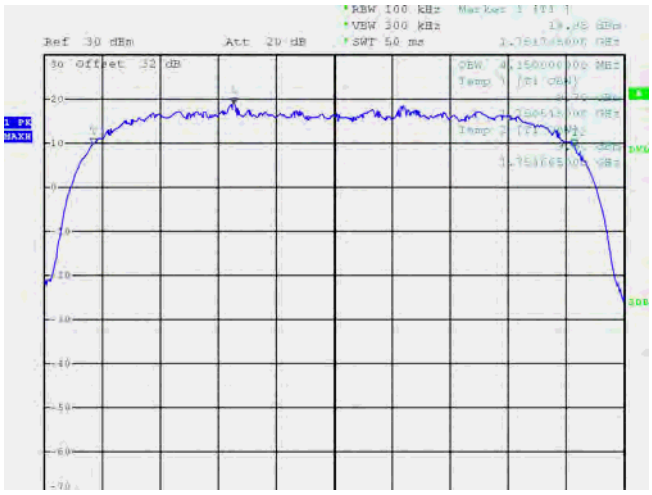


Figure 2-27b: Band IV , HSUPA Low Channel Mask

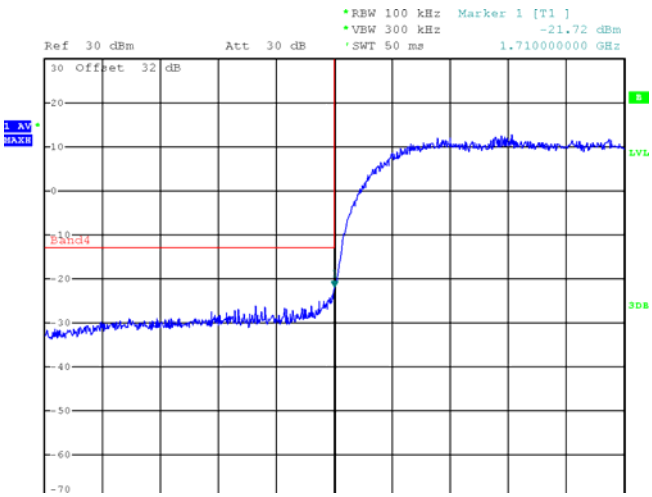
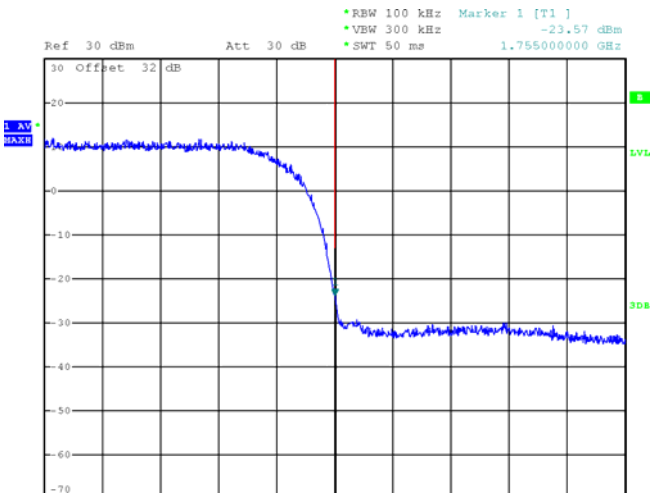
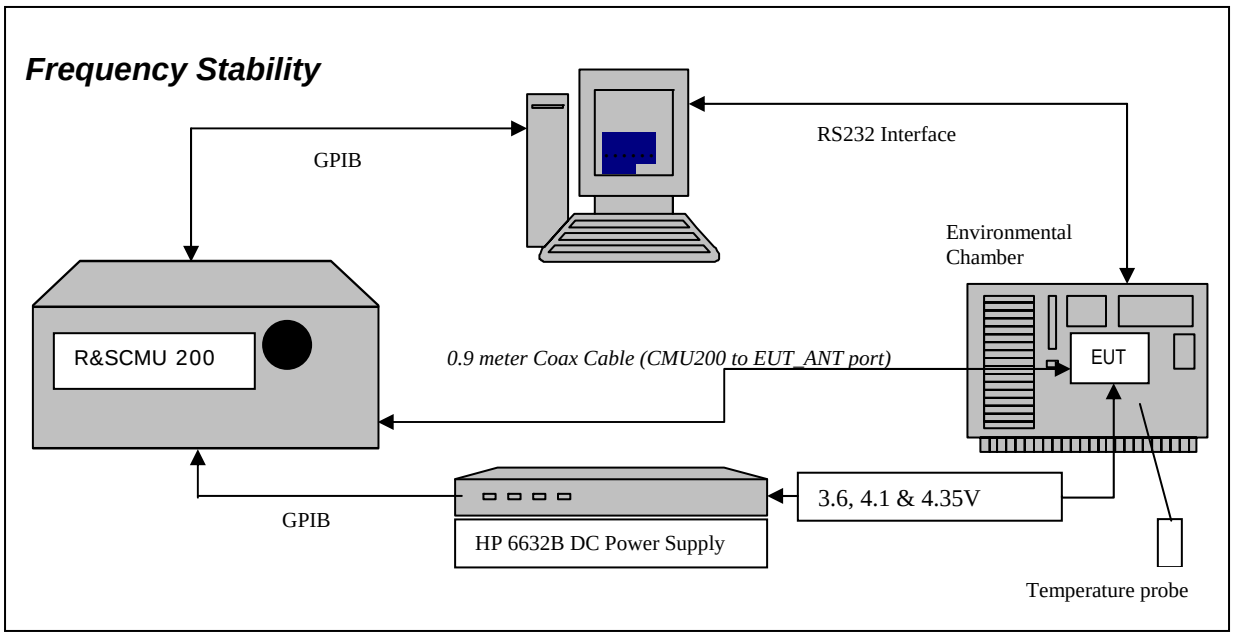


Figure 2-28b: Band IV , HSUPA High Channel Mask



APPENDIX 2B – WCDMA Band II/IV/V FREQUENCY STABILITY TEST DATA

WCDMA Frequency Stability Test Data



The following measurements were performed by Chuan Tran.

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurements
2.1055 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

24.235 *Frequency Stability*.
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The EUT meets the requirements as stated in CFR 47 chapter 1, Section 24.235, CFR 47 chapter 1, Section 22.917 RSS-132, 4.3 Frequency Stability, and RSS-133, 6.3 Frequency Stability.

Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, power, data, temperatures, and stepped voltages controlled via a GPIB interface linked to the Environmental chamber, a DC power supply, and the Communications Test Set. A 0.9-metre coax cable was calibrated to characterize the insertion loss for the transmitted frequencies between the RF input/output of the CMU 200 and the EUT antenna port.

Test Setup:

The EUT was placed in the Temperature chamber and connected to CMU 200 outside as shown in the figure above. Dry air was pumped inside the temperature chamber to maintain a backpressure during the test. The EUT was kept in the off condition at all times except when the following measurements were to be made.

The chamber was switched on and the temperature was set to -30°C.
After the chamber stabilized at -30 °C there was a soak period of one hour to alleviate moisture in the chamber, the EUT voltage was enabled.
The system software recorded the frequency, power, and associated measurements.

A Computer system controlled the automated software. This application was given the command of activating all machines intrinsic to the temperature and voltage tests controlling the CMU 200 via the GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The EUT dialogue was passed through a serial connection.

The EUT repetitively transmitted 100 bursts for each set of programmed parameters recording temperature, voltage settings, and systematically selected frequencies. The power supply was cycled from minimum voltage 3.6 volts, 4.1 volts and to 4.35 volts maximum voltage. The frequency error was measured at a maximum output power and recorded by the automated system test software.

The EUT output power and frequency was measured at 3.6 volts, 4.1 volts and 4.35 volts. The transmit frequency was varied in 3 steps consisting of 826.4, 836.4 and 846.6 MHz for the WCDMA band V. This frequency was recorded in MHz and deviation from nominal, in Parts Per Million.
After the initial one-hour soak at the beginning of the tests, a period of thirty minutes soak was initialized between each ascending temperature step, before proceeding to the next measurement test cycle.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

1. Switch on the HP 6632B power supply; CMU 200 Communications test Set, and Environmental Chamber.
2. Start test program
3. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
4. Set power supply voltage to 3.6 volts.
5. Set up CMU 200 Radio Communication Tester.
6. Command the CMU 200 to switch to the low channel.
7. Enable the voltage to the EUT, and connect a link to the CMU 200 test set.
8. EUT is commanded to Transmit 100 Bursts.
9. Software logs the following data from the CMU 200, power supply and temperature chamber: Traffic Channel Number, Traffic Channel Frequency, Power Level, Chamber Temperature, Supply Voltage, Power and Frequency Error.
10. The CMU 200 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
11. Repeat steps 5 to 10 changing the supply voltage to 4.1 Volts
12. Increase temperature by 10°C and soak for 1/2 hour.
13. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
14. Repeat steps 5 to 10 changing the supply voltage to 4.35 volts

Procedure 5 to 10 was repeated at room temperature (20°C) with the power supply voltage set to 3.6, 4.1 and 4.35 volts

The maximum frequency error in the WCDMA band V measured was **0.0392 PPM**.
The maximum frequency error in the WCDMA band II measured was **0.0157 PPM.**
The maximum frequency error in the WCDMA Band IV measured was **-0.0217 PPM**.

The following tests were performed on model RFW121LW.

WCDMA Band V results: channels 4132, 4182 and 4233 @ 20°C maximum transmitted power

Traffic Channel Number	WCDMA Band V Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
4132	826.4	3.6	20	20.16	0.0244
4182	836.4	3.6	20	-5.65	-0.0068
4233	846.6	3.6	20	-6.47	-0.0076

Traffic Channel Number	WCDMA Band V Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
4132	826.4	4.1	20	-8.31	-0.0101
4182	836.4	4.1	20	21.81	0.0261
4233	846.6	4.1	20	-13.93	-0.0165

Traffic Channel Number	WCDMA Band V Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
4132	826.4	4.35	20	-6.62	-0.0080
4182	836.4	4.35	20	-9.97	-0.0119
4233	846.6	4.35	20	-6.86	-0.0081

WCDMA Band V Results: channel 4132 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
4132	826.4	3.6	-30	-10.75	-0.0130
4132	826.4	3.6	-20	-2.98	-0.0036
4132	826.4	3.6	-10	11.93	0.0144
4132	826.4	3.6	0	-4.84	-0.0059
4132	826.4	3.6	10	-6.11	-0.0074
4132	826.4	3.6	20	20.16	0.0244
4132	826.4	3.6	30	-13.84	-0.0167
4132	826.4	3.6	40	17.64	0.0213
4132	826.4	3.6	50	17.76	0.0215
4132	826.4	3.6	60	-3.36	-0.0041
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
4132	826.4	4.1	-30	18.24	0.0221
4132	826.4	4.1	-20	-4.79	-0.0058
4132	826.4	4.1	-10	-4.13	-0.0050
4132	826.4	4.1	0	-3.89	-0.0047
4132	826.4	4.1	10	18.06	0.0219
4132	826.4	4.1	20	-8.31	-0.0101
4132	826.4	4.1	30	-2.97	-0.0036
4132	826.4	4.1	40	-2.08	-0.0025
4132	826.4	4.1	50	-2.76	-0.0033
4132	826.4	4.1	60	26.45	0.0320
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
4132	826.4	4.35	-30	-14.51	-0.0176
4132	826.4	4.35	-20	-6.67	-0.0081
4132	826.4	4.35	-10	-3.95	-0.0048
4132	826.4	4.35	0	-6.23	-0.0075
4132	826.4	4.35	10	19.33	0.0234
4132	826.4	4.35	20	-6.62	-0.0080
4132	826.4	4.35	30	-2.25	-0.0027
4132	826.4	4.35	40	17.02	0.0206
4132	826.4	4.35	50	20.87	0.0253
4132	826.4	4.35	60	-5.63	-0.0068

WCDMA Band V Results: channel 4182 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
4182	836.4	3.6	-30	13.43	0.0161
4182	836.4	3.6	-20	18.05	0.0216
4182	836.4	3.6	-10	-7.46	-0.0089
4182	836.4	3.6	0	21.37	0.0255
4182	836.4	3.6	10	14.62	0.0175
4182	836.4	3.6	20	-5.65	-0.0068
4182	836.4	3.6	30	19.95	0.0239
4182	836.4	3.6	40	1.38	0.0016
4182	836.4	3.6	50	0.44	0.0005
4182	836.4	3.6	60	**32.76**	**0.0392**
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
4182	836.4	4.1	-30	10.75	0.0129
4182	836.4	4.1	-20	-7.14	-0.0085
4182	836.4	4.1	-10	-7.29	-0.0087
4182	836.4	4.1	0	17.46	0.0209
4182	836.4	4.1	10	-6.96	-0.0083
4182	836.4	4.1	20	21.81	0.0261
4182	836.4	4.1	30	14.14	0.0169
4182	836.4	4.1	40	18.85	0.0225
4182	836.4	4.1	50	18.91	0.0226
4182	836.4	4.1	60	-8.62	-0.0103
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
4182	836.4	4.35	-30	11.41	0.0136
4182	836.4	4.35	-20	13.13	0.0157
4182	836.4	4.35	-10	13.17	0.0157
4182	836.4	4.35	0	15.86	0.0190
4182	836.4	4.35	10	-7.86	-0.0094
4182	836.4	4.35	20	-9.97	-0.0119
4182	836.4	4.35	30	19.98	0.0239
4182	836.4	4.35	40	-3.43	-0.0041
4182	836.4	4.35	50	-5.85	-0.0070
4182	836.4	4.35	60	31.91	0.0382

WCDMA Band V Results: channel 4233 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
4233	846.6	3.6	-30	14.75	0.0174
4233	846.6	3.6	-20	-5.12	-0.0060
4233	846.6	3.6	-10	-13.52	-0.0160
4233	846.6	3.6	0	17.40	0.0206
4233	846.6	3.6	10	-6.75	-0.0080
4233	846.6	3.6	20	-6.47	-0.0076
4233	846.6	3.6	30	13.24	0.0156
4233	846.6	3.6	40	17.07	0.0202
4233	846.6	3.6	50	22.26	0.0263
4233	846.6	3.6	60	-7.01	-0.0083
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
4233	846.6	4.1	-30	16.03	0.0189
4233	846.6	4.1	-20	16.83	0.0199
4233	846.6	4.1	-10	19.66	0.0232
4233	846.6	4.1	0	20.64	0.0244
4233	846.6	4.1	10	16.41	0.0194
4233	846.6	4.1	20	-13.93	-0.0165
4233	846.6	4.1	30	-5.87	-0.0069
4233	846.6	4.1	40	-1.47	-0.0017
4233	846.6	4.1	50	-2.05	-0.0024
4233	846.6	4.1	60	-9.71	-0.0115
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
4233	846.6	4.35	-30	-6.56	-0.0077
4233	846.6	4.35	-20	-6.40	-0.0076
4233	846.6	4.35	-10	15.25	0.0180
4233	846.6	4.35	0	17.97	0.0212
4233	846.6	4.35	10	18.59	0.0220
4233	846.6	4.35	20	-6.86	-0.0081
4233	846.6	4.35	30	16.41	0.0194
4233	846.6	4.35	40	-6.82	-0.0081
4233	846.6	4.35	50	-4.70	-0.0056
4233	846.6	4.35	60	-2.81	-0.0033

The following tests were performed on model RFW121LW.

WCDMA Band II results: channels 9262, 9400, & 9538 @ 20°C maximum transmitted power

Traffic Channel Number	WCDMA1900 Frequency (MHz	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
9262	1852.40	3.6	20	16.46	0.0089
9400	1880.00	3.6	20	-8.89	-0.0047
9538	1907.60	3.6	20	-12.62	-0.0066

Traffic Channel Number	WCDMA1900 Frequency (MHz	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
9262	1852.40	4.1	20	-7.94	-0.0043
9400	1880.00	4.1	20	14.81	0.0079
9538	1907.60	4.1	20	-12.91	-0.0068

Traffic Channel Number	WCDMA1900 Frequency (MHz	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
9262	1852.40	4.35	20	-8.78	-0.0047
9400	1880.00	4.35	20	-10.23	-0.0054
9538	1907.60	4.35	20	-13.90	-0.0073

WCDMA Band II Results: channel 9262 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
9262	1852.40	3.6	-30	-11.61	-0.0063
9262	1852.40	3.6	-20	-3.34	-0.0018
9262	1852.40	3.6	-10	14.80	0.0080
9262	1852.40	3.6	0	-8.29	-0.0045
9262	1852.40	3.6	10	-9.24	-0.0050
9262	1852.40	3.6	20	16.46	0.0089
9262	1852.40	3.6	30	-15.26	-0.0082
9262	1852.40	3.6	40	12.53	0.0068
9262	1852.40	3.6	50	11.40	0.0062
9262	1852.40	3.6	60	-7.67	-0.0041
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
9262	1852.40	4.1	-30	18.08	0.0098
9262	1852.40	4.1	-20	-7.56	-0.0041
9262	1852.40	4.1	-10	-10.99	-0.0059
9262	1852.40	4.1	0	-7.73	-0.0042
9262	1852.40	4.1	10	15.18	0.0082
9262	1852.40	4.1	20	-7.94	-0.0043
9262	1852.40	4.1	30	-4.47	-0.0024
9262	1852.40	4.1	40	-9.08	-0.0049
9262	1852.40	4.1	50	-10.63	-0.0057
9262	1852.40	4.1	60	27.75	0.0150
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
9262	1852.40	4.35	-30	-14.07	-0.0076
9262	1852.40	4.35	-20	-7.63	-0.0041
9262	1852.40	4.35	-10	-12.58	-0.0068
9262	1852.40	4.35	0	-8.63	-0.0047
9262	1852.40	4.35	10	18.53	0.0100
9262	1852.40	4.35	20	-8.78	-0.0047
9262	1852.40	4.35	30	-4.12	-0.0022
9262	1852.40	4.35	40	17.62	0.0095
9262	1852.40	4.35	50	18.07	0.0098
9262	1852.40	4.35	60	-10.68	-0.0058

WCDMA Band II Results: channel 9400 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
9400	1880.00	3.6	-30	13.02	0.0069
9400	1880.00	3.6	-20	14.69	0.0078
9400	1880.00	3.6	-10	-12.06	-0.0064
9400	1880.00	3.6	0	18.43	0.0098
9400	1880.00	3.6	10	12.57	0.0067
9400	1880.00	3.6	20	-8.89	-0.0047
9400	1880.00	3.6	30	15.07	0.0080
9400	1880.00	3.6	40	-6.11	-0.0033
9400	1880.00	3.6	50	-4.15	-0.0022
9400	1880.00	3.6	60	**29.44**	**0.0157**
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
9400	1880.00	4.1	-30	12.10	0.0064
9400	1880.00	4.1	-20	-7.51	-0.0040
9400	1880.00	4.1	-10	-7.99	-0.0043
9400	1880.00	4.1	0	13.73	0.0073
9400	1880.00	4.1	10	-8.67	-0.0046
9400	1880.00	4.1	20	14.81	0.0079
9400	1880.00	4.1	30	15.24	0.0081
9400	1880.00	4.1	40	17.29	0.0092
9400	1880.00	4.1	50	15.28	0.0081
9400	1880.00	4.1	60	-10.20	-0.0054
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
9400	1880.00	4.35	-30	9.46	0.0050
9400	1880.00	4.35	-20	11.29	0.0060
9400	1880.00	4.35	-10	10.03	0.0053
9400	1880.00	4.35	0	10.45	0.0056
9400	1880.00	4.35	10	-8.04	-0.0043
9400	1880.00	4.35	20	-10.23	-0.0054
9400	1880.00	4.35	30	12.56	0.0067
9400	1880.00	4.35	40	-5.93	-0.0032
9400	1880.00	4.35	50	-10.60	-0.0056
9400	1880.00	4.35	60	29.22	0.0155

WCDMA Band II Results: channel 9538 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
9538	1907.60	3.6	-30	15.69	0.0082
9538	1907.60	3.6	-20	-6.65	-0.0035
9538	1907.60	3.6	-10	-10.40	-0.0055
9538	1907.60	3.6	0	17.34	0.0091
9538	1907.60	3.6	10	-9.71	-0.0051
9538	1907.60	3.6	20	-12.62	-0.0066
9538	1907.60	3.6	30	15.67	0.0082
9538	1907.60	3.6	40	15.97	0.0084
9538	1907.60	3.6	50	15.26	0.0080
9538	1907.60	3.6	60	-9.04	-0.0047
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
9538	1907.60	4.1	-30	11.48	0.0060
9538	1907.60	4.1	-20	12.50	0.0066
9538	1907.60	4.1	-10	14.05	0.0074
9538	1907.60	4.1	0	15.27	0.0080
9538	1907.60	4.1	10	14.17	0.0074
9538	1907.60	4.1	20	-12.91	-0.0068
9538	1907.60	4.1	30	-9.37	-0.0049
9538	1907.60	4.1	40	-3.40	-0.0018
9538	1907.60	4.1	50	-5.16	-0.0027
9538	1907.60	4.1	60	-13.74	-0.0072
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**21BPPM**
9538	1907.60	4.35	-30	-11.06	-0.0058
9538	1907.60	4.35	-20	-8.32	-0.0044
9538	1907.60	4.35	-10	11.93	0.0063
9538	1907.60	4.35	0	12.01	0.0063
9538	1907.60	4.35	10	17.92	0.0094
9538	1907.60	4.35	20	-13.90	-0.0073
9538	1907.60	4.35	30	12.21	0.0064
9538	1907.60	4.35	40	-8.28	-0.0043
9538	1907.60	4.35	50	-12.56	-0.0066
9538	1907.60	4.35	60	-9.16	-0.0048

The following tests were performed on model RFV121LW.

WCDMA Band IV results: channels 1312, 1413 and 1513 @ 20°C maximum transmitted power

Traffic Channel Number	WCDMA Band IV Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
1312	1712.4	3.6	20	-20.43	-0.0119
1413	1732.6	3.6	20	11.40	0.0066
1513	1752.6	3.6	20	16.56	0.0109

Traffic Channel Number	WCDMA Band IV Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
1312	1712.4	4.1	20	-22.06	-0.0129
1413	1732.6	4.1	20	11.09	0.0064
1513	1752.6	4.1	20	19.44	0.0128

Traffic Channel Number	WCDMA Band IV Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
1312	1712.4	4.35	20	-21.50	-0.0126
1413	1732.6	4.35	20	10.33	0.0060
1513	1752.6	4.35	20	17.15	0.0113

WCDMA Band IV Results: channel 1312 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
1312.00	1712.40	3.6	-30	-12.99	-0.0076
1312.00	1712.40	3.6	-20	-29.30	-0.0171
1312.00	1712.40	3.6	-10	-36.56	-0.0214
1312.00	1712.40	3.6	0	-36.04	-0.0210
1312.00	1712.40	3.6	10	-6.35	-0.0037
1312.00	1712.40	3.6	20	-20.43	-0.0119
1312.00	1712.40	3.6	30	-6.85	-0.0040
1312.00	1712.40	3.6	40	9.80	0.0057
1312.00	1712.40	3.6	50	13.38	0.0078
1312.00	1712.40	3.6	60	13.73	0.0080
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
1312.00	1712.40	4.1	-30	-12.57	-0.0073
1312.00	1712.40	4.1	-20	-28.88	-0.0169
1312.00	1712.40	4.1	-10	**-37.09**	**-0.0217**
1312.00	1712.40	4.1	0	-36.25	-0.0212
1312.00	1712.40	4.1	10	15.75	0.0092
1312.00	1712.40	4.1	20	-22.06	-0.0129
1312.00	1712.40	4.1	30	-10.19	-0.0060
1312.00	1712.40	4.1	40	10.53	0.0061
1312.00	1712.40	4.1	50	14.82	0.0087
1312.00	1712.40	4.1	60	13.43	0.0078
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
1312.00	1712.40	4.35	-30	-11.83	-0.0069
1312.00	1712.40	4.35	-20	-28.37	-0.0166
1312.00	1712.40	4.35	-10	-36.07	-0.0211
1312.00	1712.40	4.35	0	-36.38	-0.0212
1312.00	1712.40	4.35	10	17.65	0.0103
1312.00	1712.40	4.35	20	-21.50	-0.0126
1312.00	1712.40	4.35	30	-9.22	-0.0054
1312.00	1712.40	4.35	40	8.16	0.0048
1312.00	1712.40	4.35	50	13.78	0.0080
1312.00	1712.40	4.35	60	13.82	0.0081

WCDMA Band IV Results: channel 1413 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
1413.00	1732.60	3.6	-30	10.24	0.0059
1413.00	1732.60	3.6	-20	8.91	0.0051
1413.00	1732.60	3.6	-10	10.59	0.0061
1413.00	1732.60	3.6	0	10.01	0.0058
1413.00	1732.60	3.6	10	4.21	0.0024
1413.00	1732.60	3.6	20	11.40	0.0066
1413.00	1732.60	3.6	30	10.24	0.0059
1413.00	1732.60	3.6	40	9.38	0.0054
1413.00	1732.60	3.6	50	10.54	0.0061
1413.00	1732.60	3.6	60	8.77	0.0051
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
1413.00	1732.60	4.1	-30	9.84	0.0057
1413.00	1732.60	4.1	-20	10.60	0.0061
1413.00	1732.60	4.1	-10	10.77	0.0062
1413.00	1732.60	4.1	0	11.00	0.0063
1413.00	1732.60	4.1	10	11.06	0.0064
1413.00	1732.60	4.1	20	11.09	0.0064
1413.00	1732.60	4.1	30	8.93	0.0052
1413.00	1732.60	4.1	40	8.73	0.0050
1413.00	1732.60	4.1	50	8.83	0.0051
1413.00	1732.60	4.1	60	10.86	0.0063
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
1413.00	1732.60	4.35	-30	11.72	0.0068
1413.00	1732.60	4.35	-20	9.77	0.0056
1413.00	1732.60	4.35	-10	11.98	0.0069
1413.00	1732.60	4.35	0	11.06	0.0064
1413.00	1732.60	4.35	10	-18.65	-0.0108
1413.00	1732.60	4.35	20	10.33	0.0060
1413.00	1732.60	4.35	30	8.48	0.0049
1413.00	1732.60	4.35	40	8.76	0.0051
1413.00	1732.60	4.35	50	9.70	0.0056
1413.00	1732.60	4.35	60	10.28	0.0059

WCDMA Band IV Results: channel 1513 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
1513.00	1752.6	3.6	-30	-7.86	-0.0052
1513.00	1752.6	3.6	-20	22.06	0.0146
1513.00	1752.6	3.6	-10	32.59	0.0215
1513.00	1752.6	3.6	0	31.23	0.0206
1513.00	1752.6	3.6	10	12.02	0.0079
1513.00	1752.6	3.6	20	16.56	0.0109
1513.00	1752.6	3.6	30	-6.20	-0.0041
1513.00	1752.6	3.6	40	-15.98	-0.0106
1513.00	1752.6	3.6	50	-19.15	-0.0127
1513.00	1752.6	3.6	60	-19.36	-0.0128
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
1513.00	1752.6	4.1	-30	-5.45	-0.0036
1513.00	1752.6	4.1	-20	23.88	0.0158
1513.00	1752.6	4.1	-10	30.17	0.0199
1513.00	1752.6	4.1	0	30.76	0.0203
1513.00	1752.6	4.1	10	-3.12	-0.0021
1513.00	1752.6	4.1	20	19.44	0.0128
1513.00	1752.6	4.1	30	-5.45	-0.0036
1513.00	1752.6	4.1	40	-14.33	-0.0095
1513.00	1752.6	4.1	50	-19.64	-0.0130
1513.00	1752.6	4.1	60	-18.72	-0.0124
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
1513.00	1752.6	4.35	-30	-5.97	-0.0039
1513.00	1752.6	4.35	-20	23.90	0.0158
1513.00	1752.6	4.35	-10	30.67	0.0203
1513.00	1752.6	4.35	0	30.76	0.0203
1513.00	1752.6	4.35	10	-4.61	-0.0030
1513.00	1752.6	4.35	20	17.15	0.0113
1513.00	1752.6	4.35	30	-9.08	-0.0060
1513.00	1752.6	4.35	40	-15.50	-0.0102
1513.00	1752.6	4.35	50	-20.32	-0.0134
1513.00	1752.6	4.35	60	-20.46	-0.0135

APPENDIX 2C – WCDMA Band II/IV/V RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following tests were performed on model RFV121LW.

Date of Test: July 9, 2013

The following measurements were performed by Feras Obeid.
The environmental tests conditions were: Temperature: 25.8 °C
Relative Humidity: 37.1 %

The BlackBerry® smartphone was standalone, horizontally with LCD facing down and top pointing to the RX antenna when the turntable is at 0 degree position.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

WCDMA Band V Call Service Mode

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	4132	826.40	V	Dipole	V	-42.28	-30.72	V-V	4.81	**21.92**	**0.16**	38.5	16.58
F0	4132	826.40	V	Dipole	H	-30.72		H-H	3.28				
F0	4182	836.40	V	Dipole	V	-40.27	-31.72	V-V	4.04	20.85	0.12	38.5	17.65
F0	4182	836.40	V	Dipole	H	-31.72		H-H	2.68				
F0	4233	846.60	V	Dipole	V	-39.75	-31.77	V-V	4.22	21.04	0.13	38.5	17.46
F0	4233	846.60	V	Dipole	H	-31.77		H-H	3.19				

WCDMA Band V HSUPA Mode

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	4132	826.40	V	Dipole	V	-42.39	-32.76	V-V	2.90	20.01	0.10	38.50	18.49
F0	4132	826.40	V	Dipole	H	-32.76		H-H	1.16				
F0	4182	836.40	V	Dipole	V	-42.42	-32.51	V-V	3.23	**20.04**	**0.10**	38.50	18.46
F0	4182	836.40	V	Dipole	H	-32.51		H-H	1.87				
F0	4233	846.60	V	Dipole	V	-41.99	-33.76	V-V	2.41	19.23	0.08	38.50	19.27
F0	4233	846.60	V	Dipole	H	-33.76		H-H	1.16				

Radiated Power Test Data Results

Date of Test: July 7, 2013

The following measurements were performed by Rex Zhang.
The environmental tests conditions were: Temperature: 25.8 °C
Relative Humidity: 37.1 %

The BlackBerry® smartphone was standalone, USB up with LCD facing to the RX antenna when the turntable is at 0 degree position.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

WCDMA Band IV Call Service Mode

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	1312	1712.4	IV	Dipole	V	-21.82	-21.82	V-V	-13.83	25.72	0.37	38.5	4.28
F0	1312	1712.4	IV	Dipole	H	-26.25		H-H	-13.83				
F0	1413	1732.6	IV	Dipole	V	-21.28	-21.28	V-V	-13.60	**26.48**	**0.44**	38.5	3.52
F0	1413	1732.6	IV	Dipole	H	-27.14		H-H	-13.19				
F0	1513	1752.6	IV	Dipole	V	-22.28	-22.28	V-V	-14.46	25.55	0.36	38.5	4.45
F0	1513	1752.6	IV	Dipole	H	-27.32		H-H	-13.86				

WCDMA Band IV HSUPA Mode

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	1312	1712.4	IV	Dipole	V	-23.00	-23.00	V-V	-15.03	24.54	0.28	38.50	5.46
F0	1312	1712.4	IV	Dipole	H	-27.94		H-H	-15.01				
F0	1413	1732.6	IV	Dipole	V	-22.83	-22.83	V-V	-15.18	**24.89**	**0.31**	38.50	5.11
F0	1413	1732.6	IV	Dipole	H	-28.58		H-H	-14.78				
F0	1513	1752.6	IV	Dipole	V	-24.37	-24.37	V-V	-16.55	23.42	0.22	38.50	6.58
F0	1513	1752.6	IV	Dipole	H	-29.02		H-H	-15.99				

Radiated Power Test Data Results cont'd

Date of Test: July 4, 2013

The following measurements were performed by Feras Obeid.
The environmental test conditions were: Temperature: 25.2 ºC
Relative Humidity: 36.8 %

The BlackBerry® smartphone was standalone, vertically down with LCD facing to the RX antenna when the turntable is at 0 degree position.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

WCDMA Band II Call Service Mode

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	9262	1852.40	II	Horn	V	-29.16	-25.50	V-V	-15.57	**24.49**	**0.28**	33.0	8.51
F0	9262	1852.40	II	Horn	H	-25.50		H-H	-14.85				
F0	9400	1880.00	II	Horn	V	-30.81	-26.14	V-V	-15.98	23.42	0.22	33.0	9.58
F0	9400	1880.00	II	Horn	H	-26.14		H-H	-15.57				
F0	9538	1907.60	II	Horn	V	-31.46	-26.73	V-V	-16.57	22.86	0.19	33.0	10.14
F0	9538	1907.60	II	Horn	H	-26.73		H-H	-16.02				

WCDMA Band II HSUPA Mode

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	9262	1852.40	II	Horn	V	-31.19	-27.74	V-V	-17.77	**22.30**	**0.17**	33.0	10.70
F0	9262	1852.40	II	Horn	H	-27.74		H-H	-17.04				
F0	9400	1880.00	II	Horn	V	-32.90	-28.51	V-V	-18.36	21.07	0.13	33.0	11.93
F0	9400	1880.00	II	Horn	H	-28.51		H-H	-17.92				
F0	9538	1907.60	II	Horn	V	-33.36	-29.52	V-V	-19.32	20.09	0.10	33.0	12.91
F0	9538	1907.60	II	Horn	H	-29.52		H-H	-18.79				

Radiated Emissions Test Data Results cont'd

WCDMA Band V Call Service Mode

Date of Test: July 4, 2013

The following measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 23.9 ºC
Relative Humidity: 36.9 %

The BlackBerry® smartphone was standalone, with horizontal down and top pointing to the RX antenna when the turntable is at 0 degree position.

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in WCDMA Band V Call mode on channels 4132, 4182, and 4233.

All emissions were at least 25.0 dB below the limit.

Date of Test: July 5, 2013

The following measurements were performed by Mahmood Ahmed
The environmental test conditions were: Temperature: 23.2 - 25.6 ºC
Relative Humidity: 17.7 - 31.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 9 GHz.

The BlackBerry® smartphone was standalone, horizontal with LCD facing down and top pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band V Call mode on channels 4132, 4182, and 4233.

All emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

WCDMA V HSUPA Mode

Date of Test: July 4, 2013

The following measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 23.9 ºC
Relative Humidity: 36.9 %

The BlackBerry® smartphone was standalone, with horizontal down and top pointing to the RX antenna when the turntable is at 0 degree position.

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in WCDMA Band V HSUPA mode on channels 4132, 4182, and 4233.

All emissions were at least 25.0 dB below the limit.

Date of Test: July 5, 2013

The following measurements were performed by Mahmood Ahmed
The environmental test conditions were: Temperature: 23.2 - 25.6 ºC
Relative Humidity: 17.7 - 31.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 9 GHz.

The BlackBerry® smartphone was standalone, horizontal with LCD facing down and top pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band V HSUPA mode on channels 4132, 4182, and 4233.

All emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

WCDMA Band II Call Service mode

Date of Test: July 4, 2013

The following measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 23.9 ºC
Relative Humidity: 36.9 %

The BlackBerry® smartphone was standalone, with vertically down and LCD screen pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band II Call mode on channels 9262, 9400 and 9538.

All emissions were at least 25.0 dB below the limit.

Date of Test: July 9 - 12, 2013

The following measurements were performed by Mahmood Ahmed
The environmental test conditions were: Temperature: 23.2 - 25.6 ºC
Relative Humidity: 17.7 - 31.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1GHz to 20 GHz.

The BlackBerry® smartphone was standalone, USB up with LCD facing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band II Call mode on channels 9262, 9400, 9538.

All emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

WCDMA Band II HSUPA Mode

Date of Test: July 4, 2013

The following measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 23.9 ºC
Relative Humidity: 36.9 %

The BlackBerry® smartphone was standalone, with vertically down and LCD screen pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band II HSUPA mode on channels 9262, 9400, and 9538.

All emissions were at least 25.0 dB below the limit.

Date of Test: July 9 - 12, 2013

The following measurements were performed by Mahmood Ahmed
The environmental test conditions were: Temperature: 23.2 - 25.6 ºC
Relative Humidity: 17.7 - 31.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1GHz to 20 GHz.

The BlackBerry® smartphone was standalone, USB up with LCD facing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band II HSUPA mode on channels 9262, 9400, 9538.

All emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

WCDMA Band IV Call Service mode

Date of Test: July 4, 2013

The following measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 23.9 ºC
Relative Humidity: 36.9 %

The BlackBerry® smartphone was standalone, with USB up and LCD screen pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band IV Call mode on channels 1312, 1413 and 1513.

All emissions were at least 25.0 dB below the limit.

Date of Test: July 4 - 8, 2013

The following measurements were performed by Mahmood Ahmed
The environmental test conditions were: Temperature: 23.2 - 25.6 ºC
Relative Humidity: 17.7 - 31.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1GHz to 20 GHz.

The BlackBerry® smartphone was standalone, USB up with LCD facing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band IV HSUPA mode on channels 1312, 1413 and 1513.

All emissions were at least 25.0 dB below the limit.

Radiated Emissions Test Data Results cont'd

WCDMA Band IV HSUPA Mode

Date of Test: July 4, 2013

The following measurements were performed by Savtej Sandhu.

The environmental test conditions were: Temperature: 23.9 ºC
Relative Humidity: 36.9 %

The BlackBerry® smartphone was standalone, with USB up and LCD screen pointing to the RX antenna when the turntable is at 0 degree position.

Measurements were performed in WCDMA Band IV Call mode on channels 1312, 1413 and 1513.

All emissions were at least 25.0 dB below the limit.

Date of Test: July 4 - 8, 2013

The following measurements were performed by Mahmood Ahmed
The environmental test conditions were: Temperature: 23.2 - 25.6 ºC
Relative Humidity: 17.7 - 31.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1GHz to 20 GHz.

Measurements were performed in WCDMA Band IV HSUPA mode on channels 1312, 1413 and 1513.

All emissions were at least 25.0 dB below the limit.

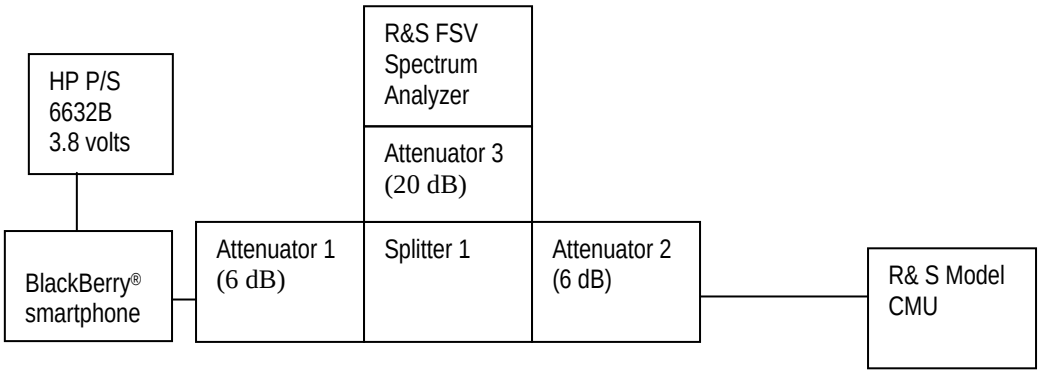
APPENDIX 3A– LTE Band 2 CONDUCTED RF EMISSIONS TEST DATA/PLOTS

LTE Band 2 Conducted RF Emission Test Data

The following tests were performed on model RFV121LW.

This appendix contains measurement data pertaining to conducted spurious emissions, 99% power bandwidth and the channel mask.

Test Setup Diagram



A reference offset of 31.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

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

Date of Test: July 10 to 15, 2013

The environmental test conditions were: Temperature: 23.9ºC
Relative Humidity: 34.4 %

The following measurements were performed by Chuan Tran.

LTE Band 2 Conducted RF Emission Test Data cont'd

Emission Designator Table

Frequency Rane (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
1850.7-1909.3	21.87	1M07G7D	LTE B2	1.4	QPSK
1850.7-1909.3	20.82	1M07D7W	LTE B2	1.4	16QAM
1851.5-1908.5	21.80	2M69G7D	LTE B2	3	QPSK
1851.5-1908.5	21.08	2M69D7W	LTE B2	3	16QAM
1852.5-1907.5	21.89	4M47G7D	LTE B2	5	QPSK
1852.5-1907.5	20.68	4M49D7W	LTE B2	5	16QAM
1855-1905	21.94	8M95G7D	LTE B2	10	QPSK
1855-1905	21.37	8M93D7W	LTE B2	10	16QAM
1857.5-1902.5	22.00	13M4G7D	LTE B2	15	QPSK
1857.5-1902.5	21.42	13M4D7W	LTE B2	15	16QAM
1860-1900	21.93	17M8G7D	LTE B2	20	QPSK
1860-1900	21.55	17M9D7W	LTE B2	20	16QAM

The conducted spurious emissions – As per 47 CFR 2.1051, CFR 24.232(d), CFR 2.202, RSS - 133 were measured from 30 MHz to 20 GHz.

–26 dBc Bandwidth and Occupied Bandwidth (99%)

For each 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz with different number of resource blocks as per scalable bandwidths for LTE Band 2, the modulation spectrum was measured by both methods of 99% power bandwidth and –26 dBc bandwidth.
QPSK and 16-QAM modulations were applied to each of the bandwidths. Only the worst case measurements are documented in this report.
A minimum resource block condition was also measured (RB = 1).
The resolution bandwidth required for out-of-band emissions in the 1 MHz bands immediately outside and adjacent to the frequency block, was determined to be at least 1% of the emission bandwidth.
The worst case –26dBc bandwidth for LTE Band 2 was measured to be 19.44 MHz as shown below. Results were derived in a 200 kHz resolution bandwidth.
On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.

Test Data for LTE Band 2 selected Frequencies in 20MHz bandwidth (RB = 100)

LTE Band 2 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	
	QPSK	QPSK	16QAM
1852.400	19.18	17.96	17.92
1880.000	19.44	**18.00**	**17.96**
1907.600	18.98	17.88	17.92

Peak to Average Ratio (PAR)

For each 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20 MHz with different number of resource blocks as per scalable bandwidths for LTE Band 2, the peak to average ratio was measured on the low, middle and high channels with QPSK and 16-QAM modulation.
On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.
The worst case measured was 9.10 dB on middle channel in 20MHz bandwidth with 100 resource blocks.

Measurement Plots for LTE Band 2

Refer to the following measurement plots for more detail:
See Figures 3-1a to 3-18a for the plots of the conducted spurious emissions.
See Figures 3-19a to 3-24a and 3-43a to 3-45a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.
See Figures 3-25a to 3-36a for the plots of the Channel mask.
See Figures 3-37a to 3-42a for the plots of the Peak to Average Ratio.

LTE Band 2 Conducted RF Emission Test Data (cont'd)

Figure 3-1a: Band 2, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 100)

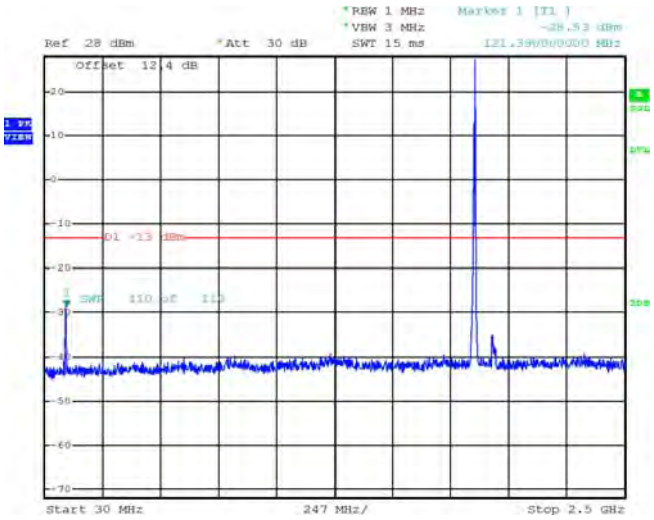


Figure 3-2a: Band 2, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 100)

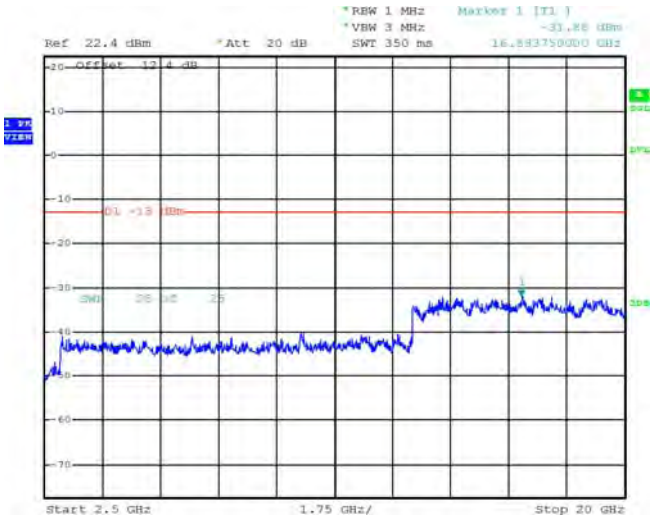


Figure 3-3a: Band 2, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 100)

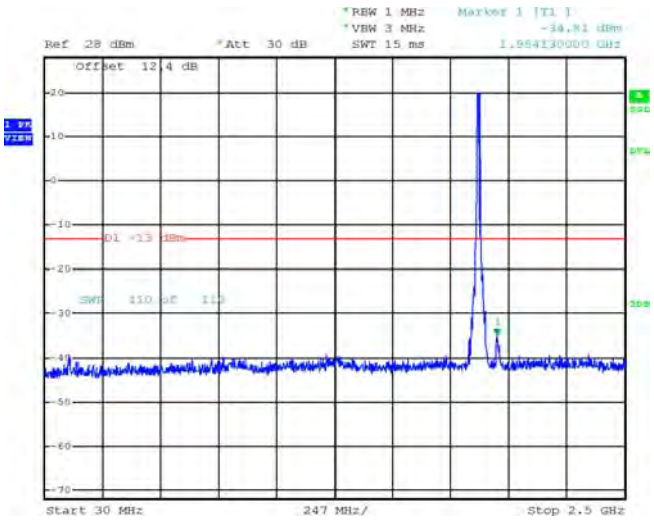
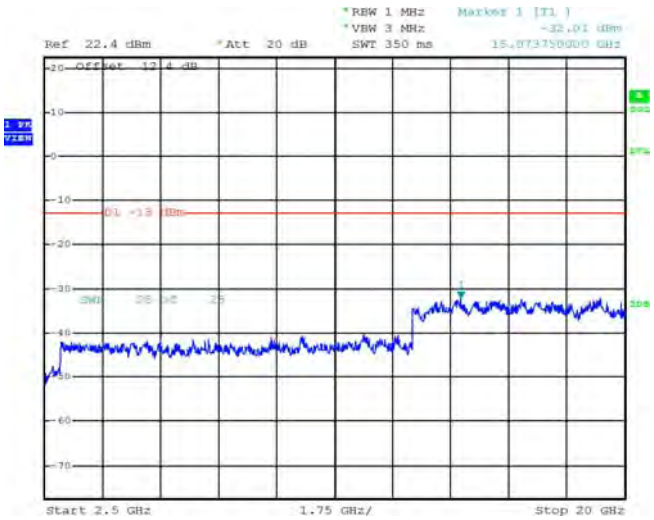


Figure 3-4a: Band 2, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 100)



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-5a: Band 2, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

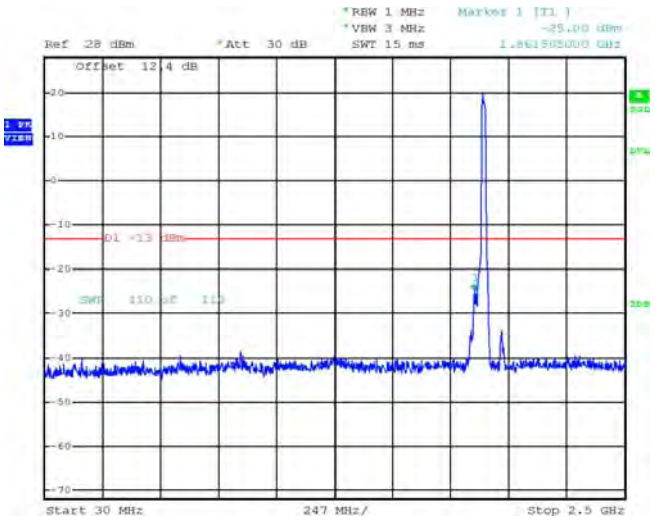


Figure 3-6a: Band 2, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

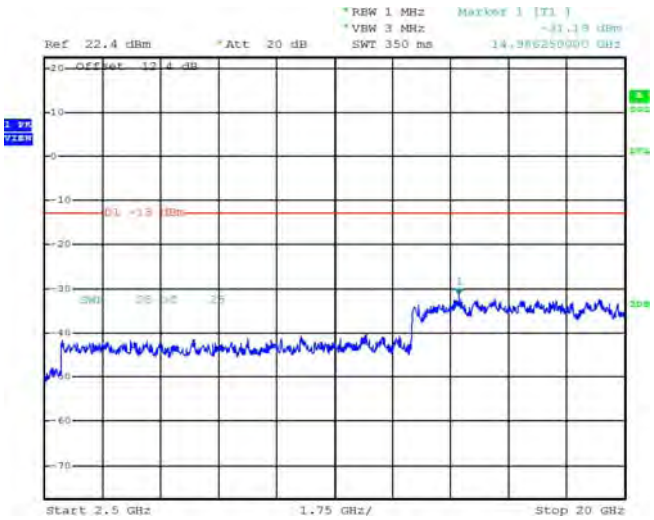


Figure 3-7a: Band 2, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 50)

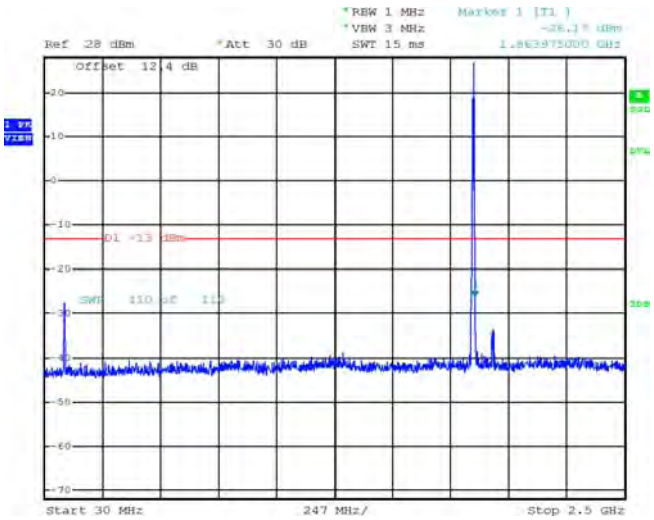
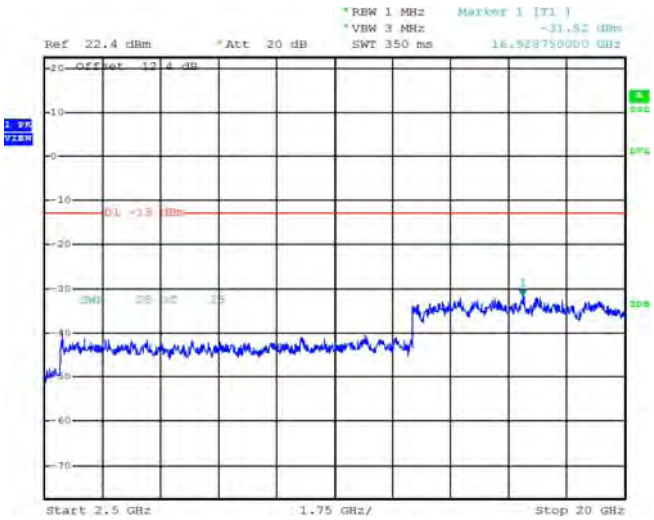


Figure 3-8a: Band 2, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 50)



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-9a: Band 2, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 50)

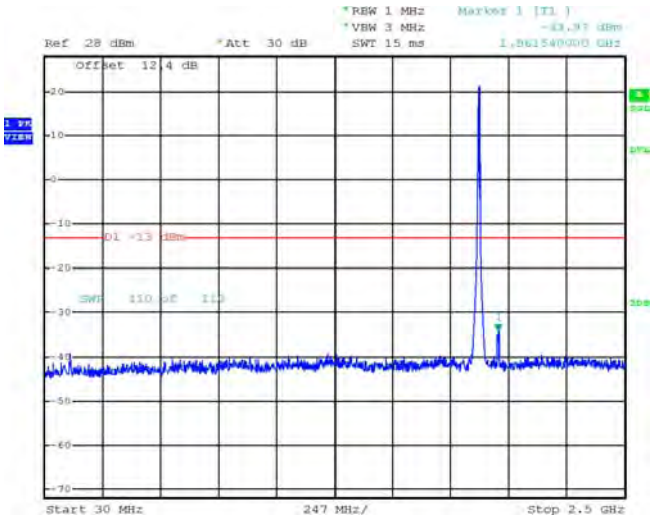


Figure 3-10a: Band 2, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 50)

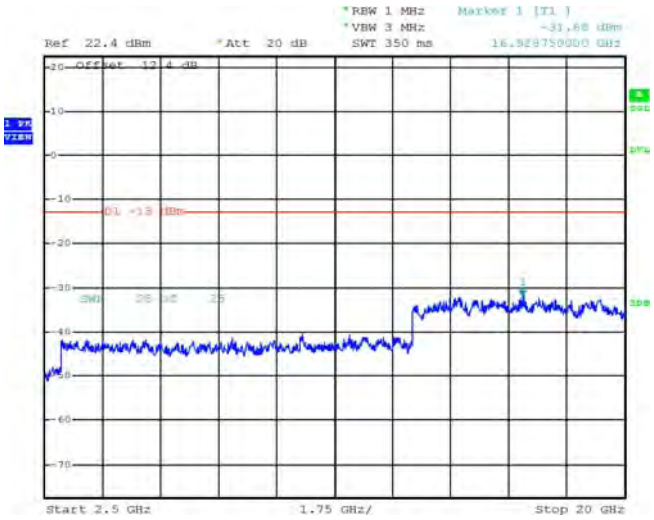


Figure 3-11a: Band 2, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

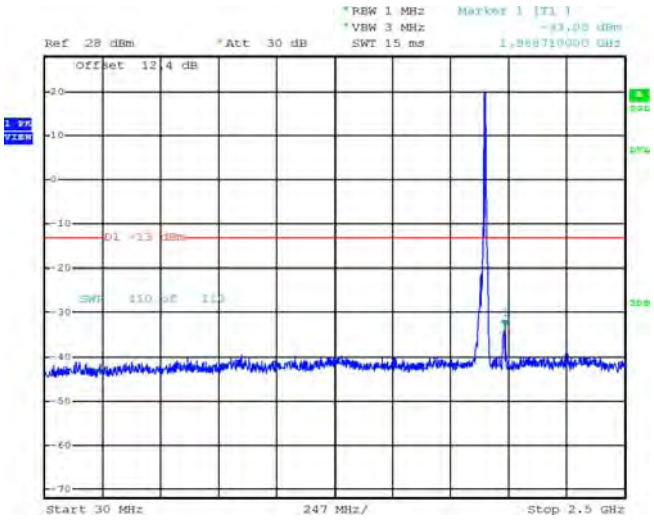
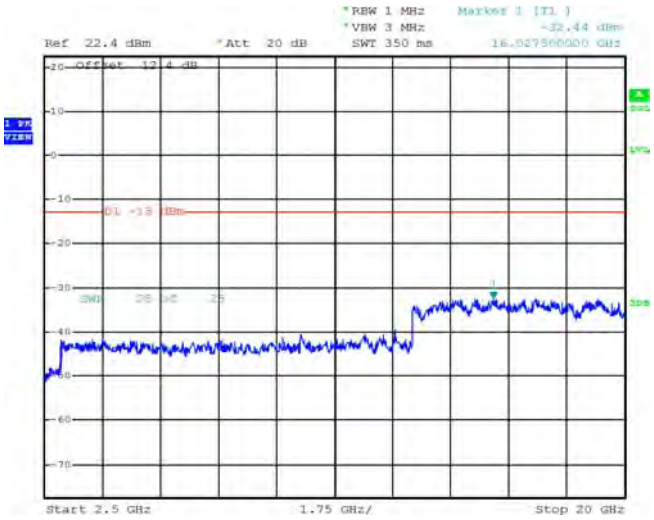


Figure 3-12a: Band 2, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-13a: Band 2, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 6)

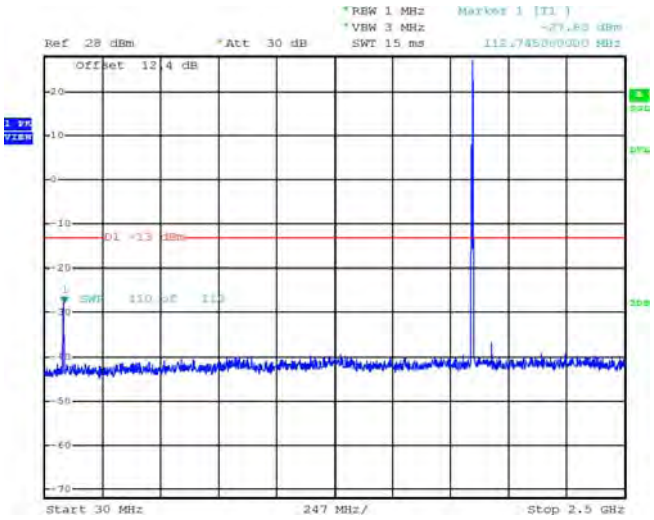


Figure 3-14a: Band 2, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 6)

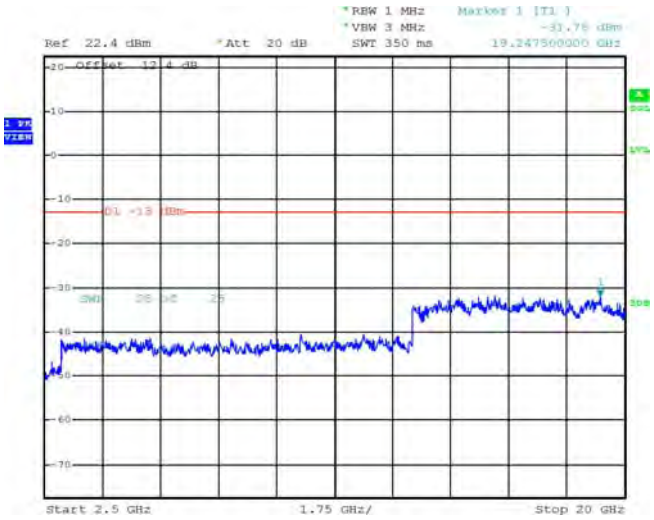


Figure 3-15a: Band 2, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 6)

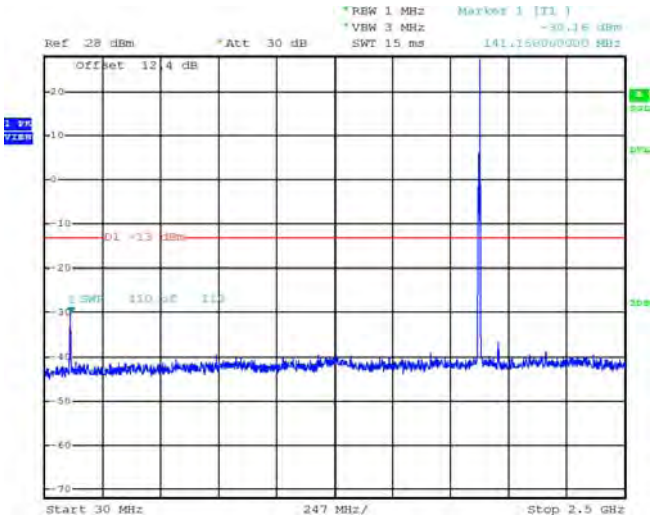
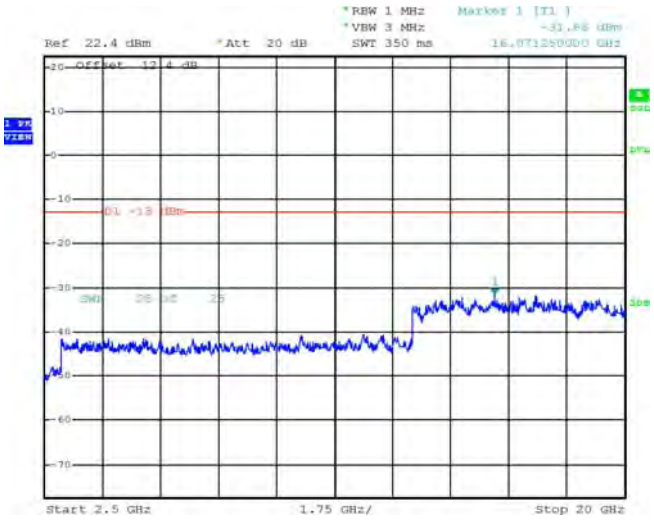


Figure 3-16a: Band 2, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 6)



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-17a: Band 2, Spurious Conducted Emissions, High Channel, 1.4MHz BW (RB= 6)

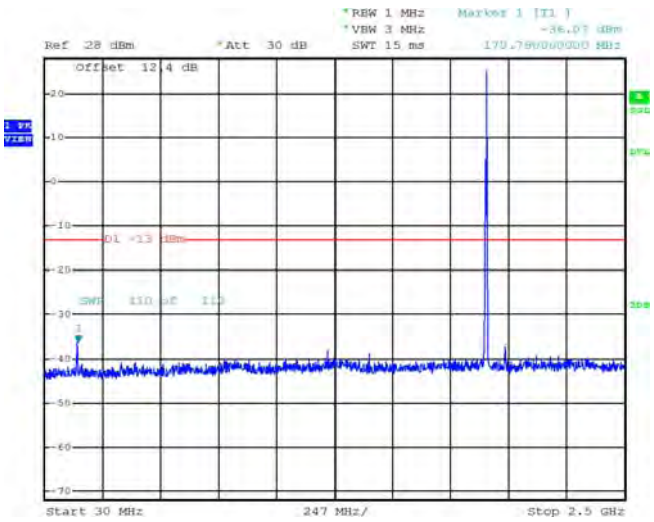


Figure 3-18a: Band 2, Spurious Conducted Emissions, High Channel, 1.4MHz BW (RB= 6)

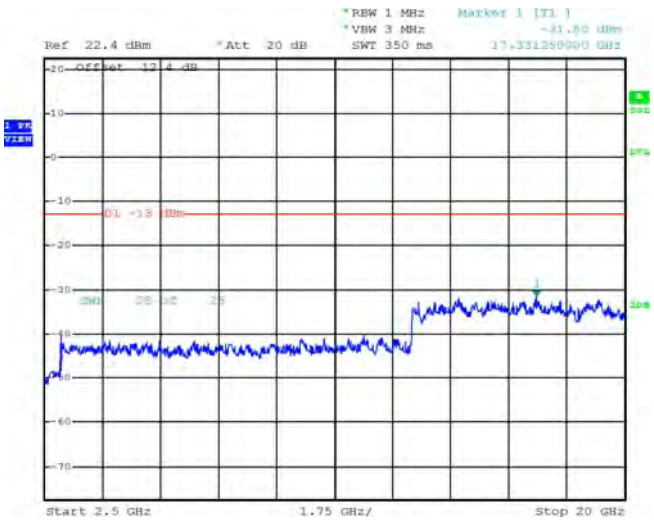


Figure 3-19a: Occupied Bandwidth, Band 2 Low Channel, 20MHz BW (RB= 100)

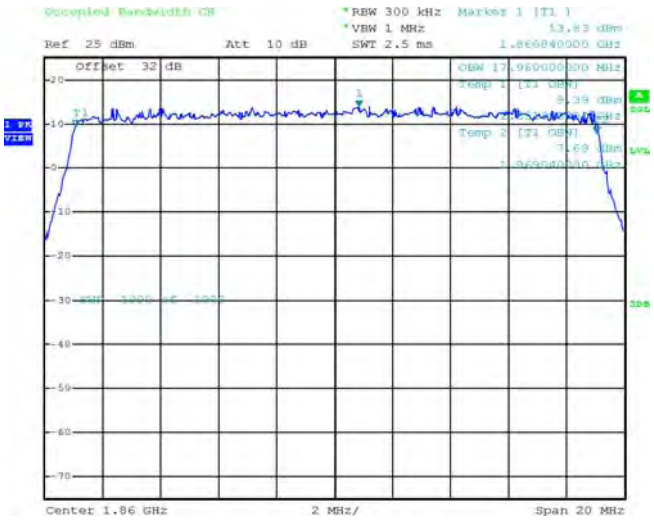
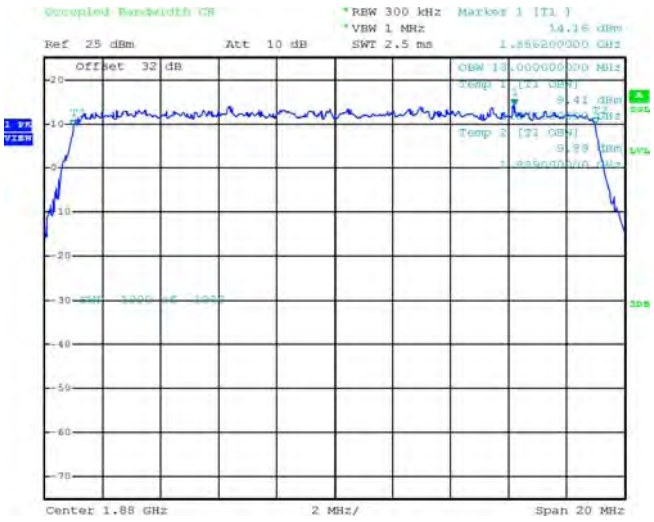


Figure 3-20a: Occupied Bandwidth, Band 2 Middle Channel, 20MHz BW (RB= 100)



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-21a: Occupied Bandwidth, Band 2 High Channel, 20MHz BW (RB= 100)

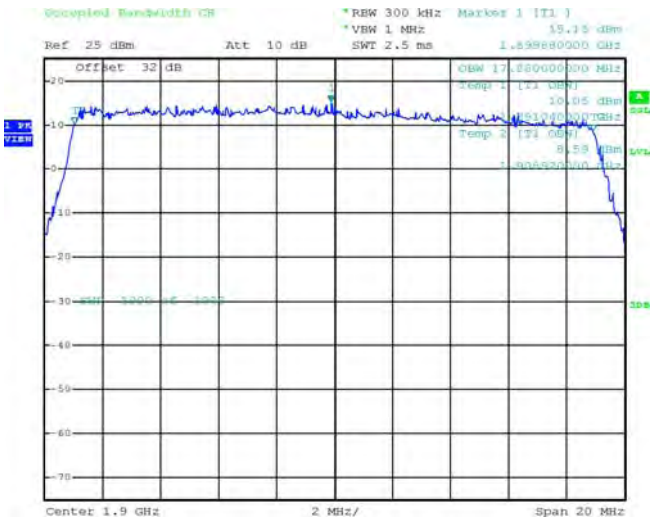


Figure 3-22a: -26 dBc Bandwidth, Band 2 Low Channel, 20MHz BW (RB= 100)

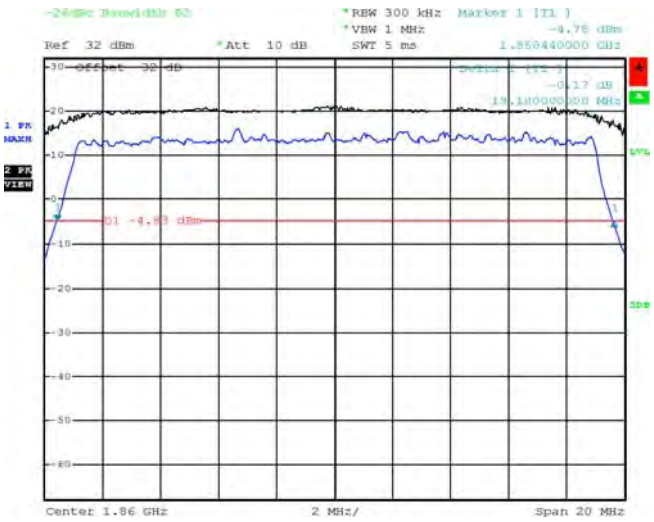


Figure 3-23a: -26 dBc Bandwidth, Band 2 Middle Channel, 20MHz BW (RB= 100)

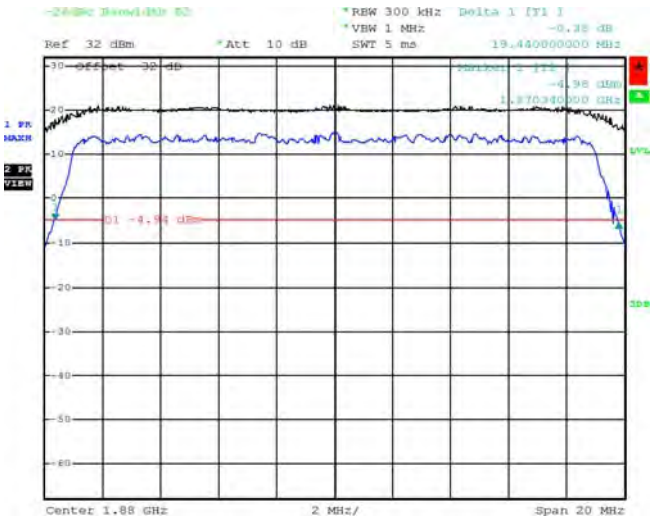
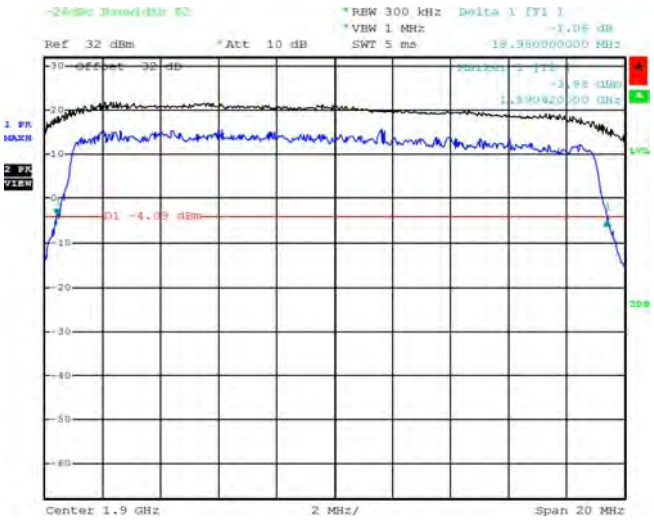


Figure 3-24a: -26 dBc Bandwidth, Band 2 High Channel, 20MHz BW (RB= 100)



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-25a: Band 2 Low Channel Mask, 20MHz BW, RB = 100

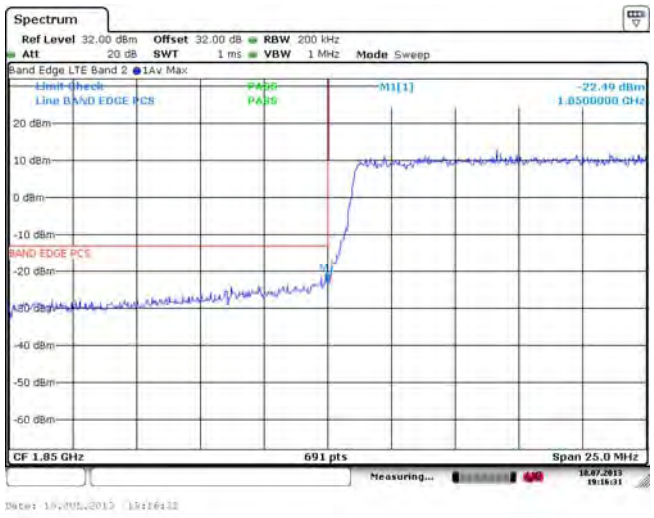


Figure 3-26a: Band 2 High Channel Mask, 20MHz BW, RB = 100

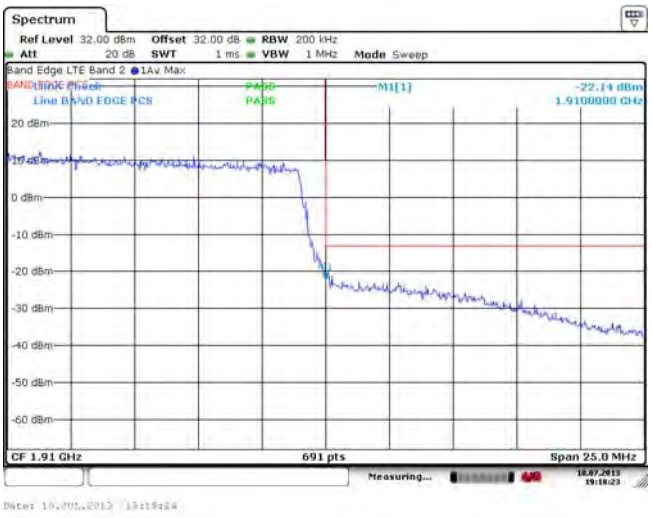


Figure 3-27a: Band 2 Low Channel Mask, 10MHz BW, RB = 50

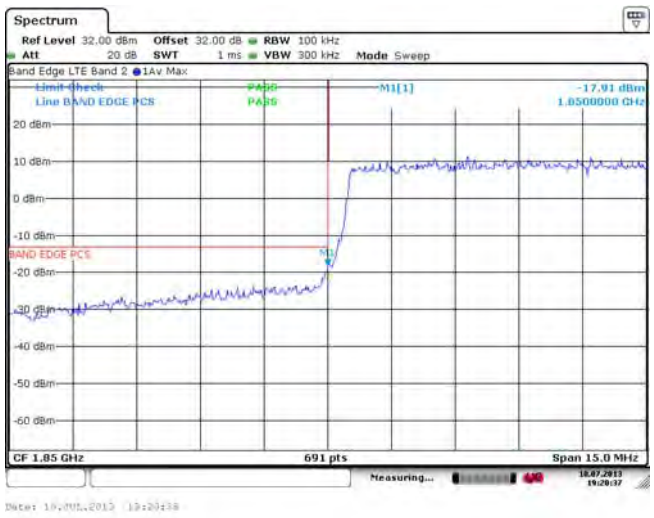
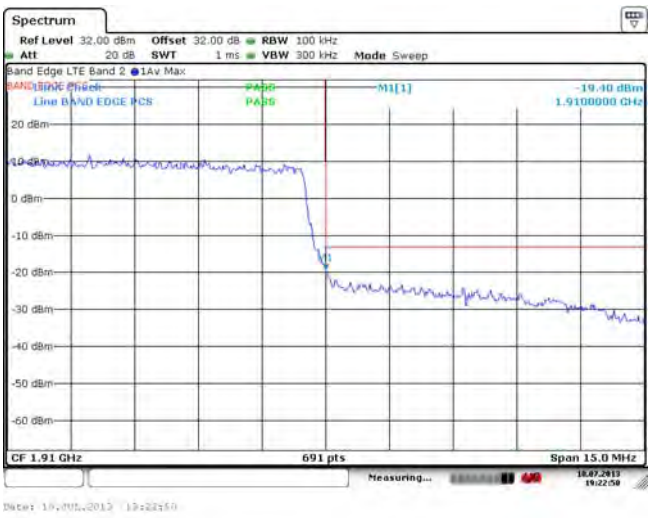


Figure 3-28a: Band 2 High Channel Mask, 10MHz BW, RB = 50



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-29a: Band 2 Low Channel Mask, 1.4MHz BW, RB = 6

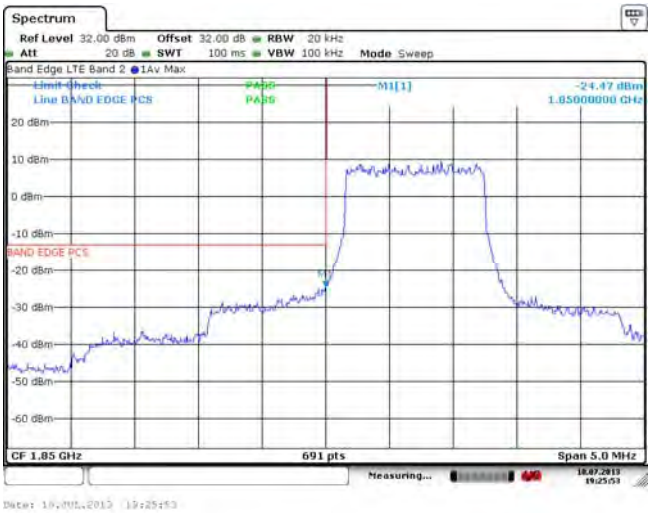


Figure 3-30a: Band 2 High Channel Mask, 1.4MHz BW, RB = 6

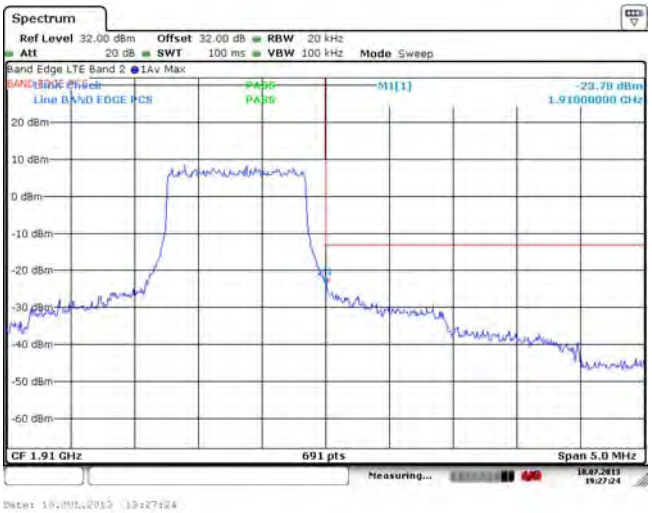


Figure 3-31a: Band 2 Low Channel Mask, 20MHz BW, RB = 1

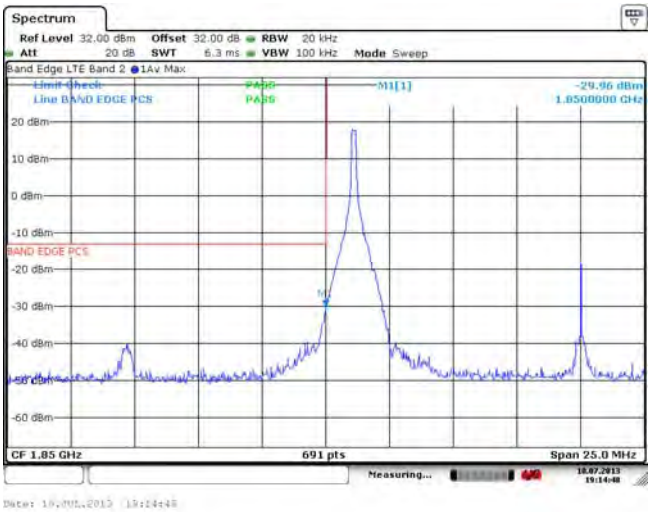
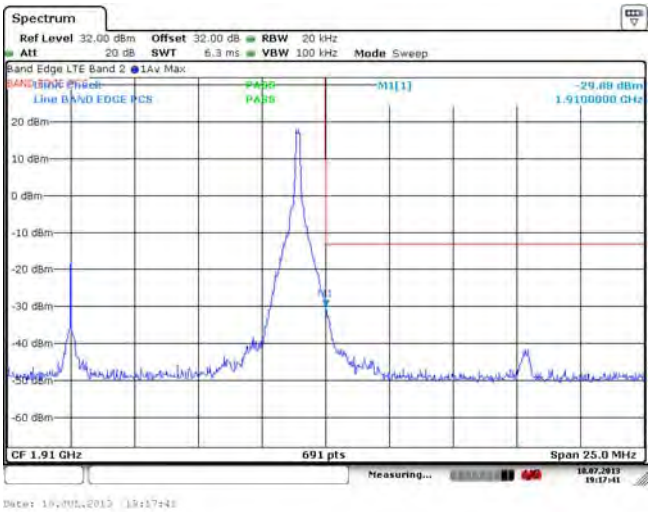


Figure 3-32a: Band 2 High Channel Mask, 20MHz BW, RB = 1



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-33a: Band 2 Low Channel Mask, 10MHz BW, RB = 1

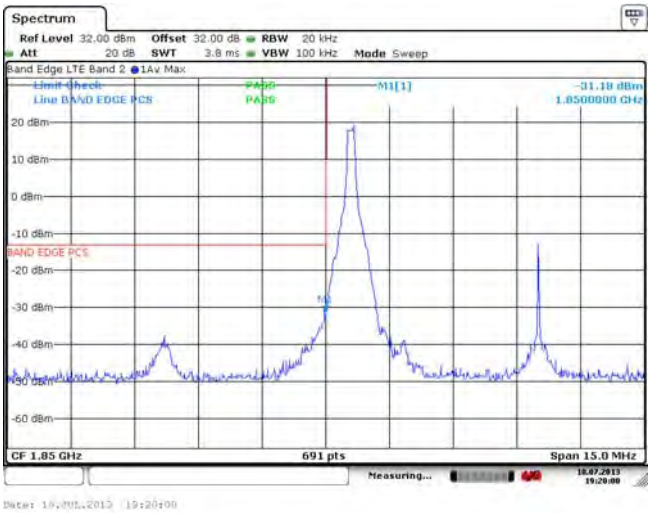


Figure 3-34a: Band 2 High Channel Mask, 10MHz BW, RB = 1

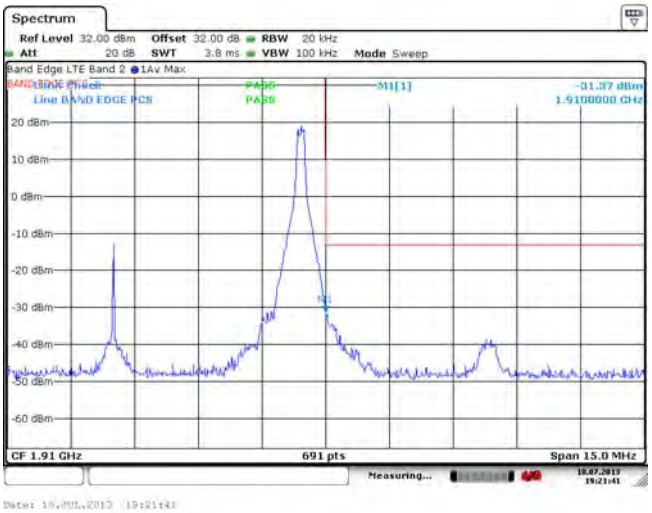


Figure 3-35a: Band 2 Low Channel Mask, 1.4MHz BW, RB = 1

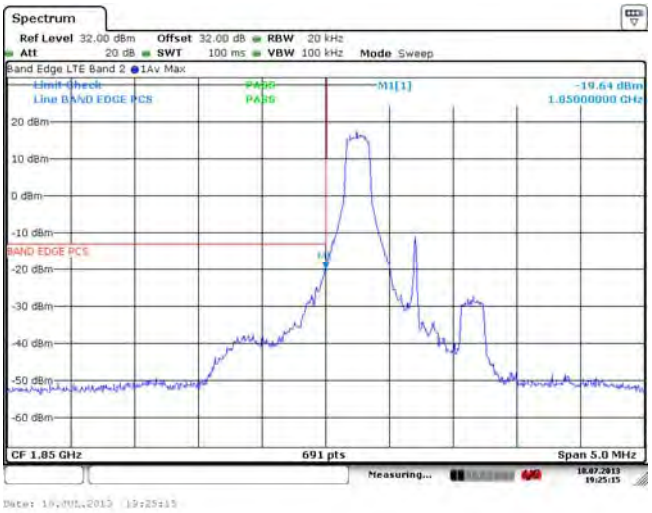
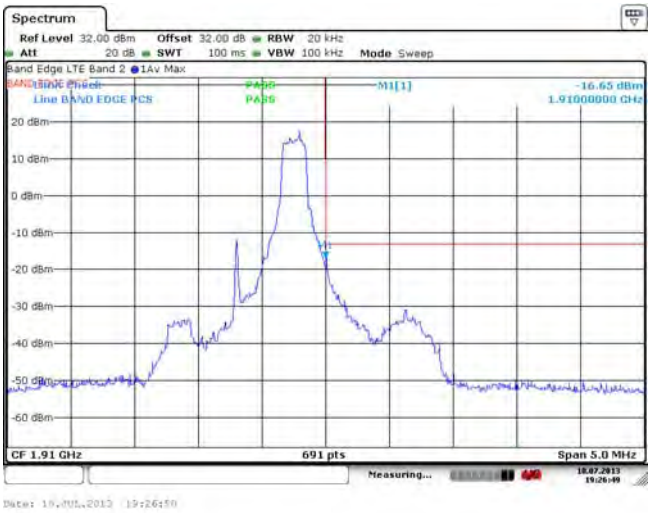


Figure 3-36a: Band 2 High Channel Mask, 1.4MHz BW, RB = 1



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-37a: Band 2, Mid Channel PAR, 20 MHz BW, RB = 50 QPSK

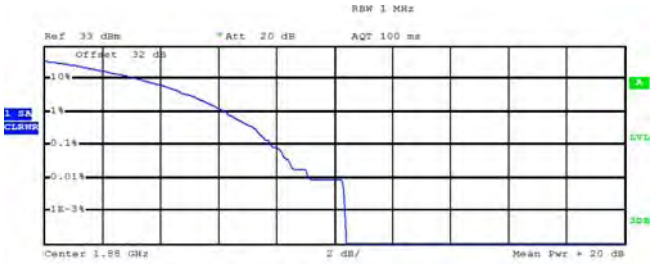


Figure 3-38a: Band 2, Mid Channel PAR, 20 MHz BW, RB = 100 16-QAM

Figure 3-39a: Band 2, Mid Channel PAR, 10 MHz BW, RB = 25 QPSK

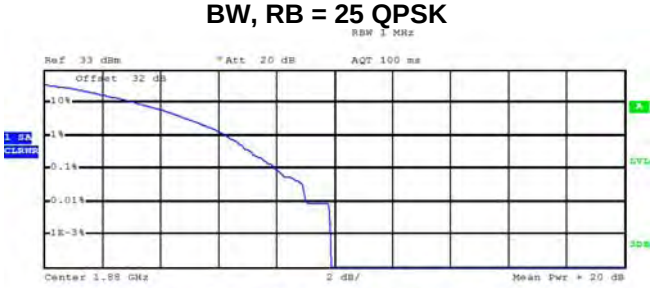
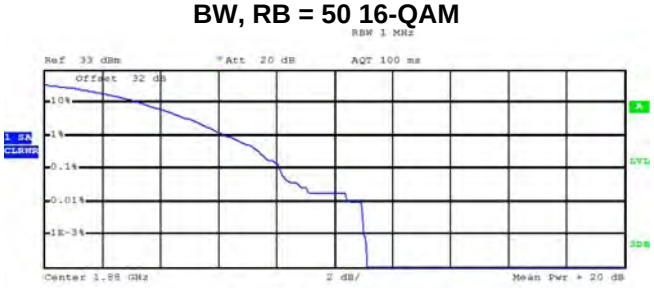


Figure 3-40a: Band 2, Mid Channel PAR, 10 MHz BW, RB = 50 16-QAM



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-41a: Band 2, Mid Channel PAR, 1.4 MHz BW, RB = 3 QPSK

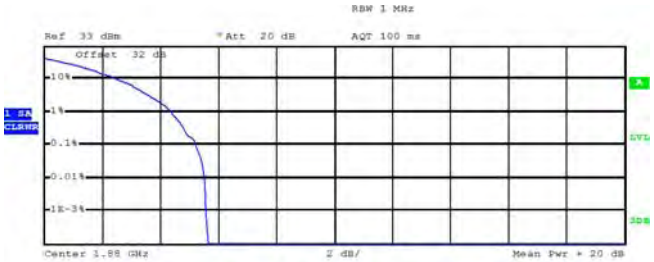
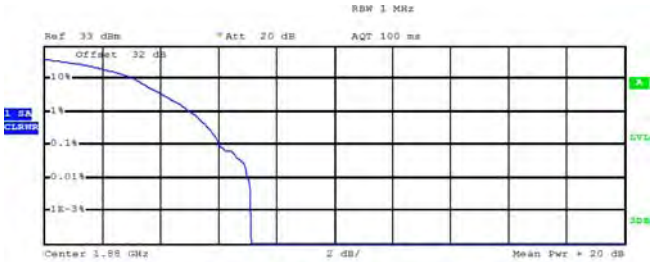


Figure 3-42a: Band 2, Mid Channel PAR, 1.4 MHz BW, RB = 6 16-QAM



LTE Band 2 Conducted RF Emission Test Data cont'd

Figure 3-43a: Occupied Bandwidth, Band 2 Low Channel, 20MHz BW (RB= 100) 16-QAM

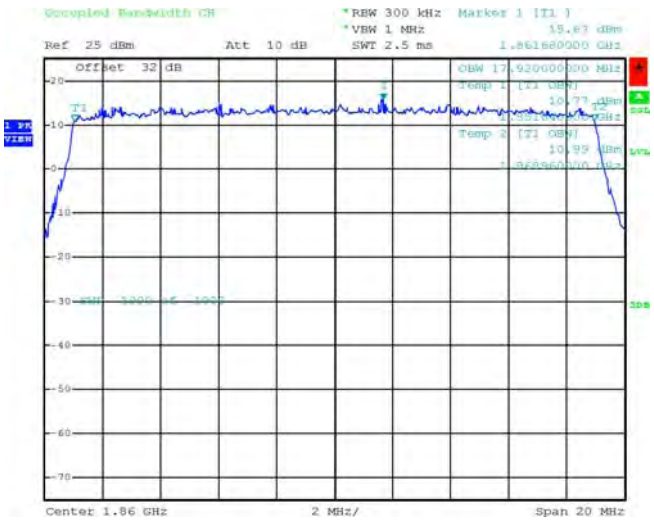


Figure 3-44a: Occupied Bandwidth, Band 2 Mid Channel, 20MHz BW (RB= 100) 16-QAM

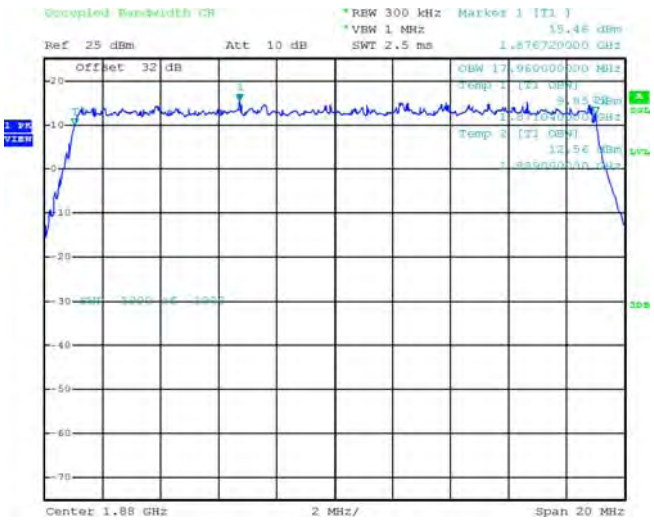
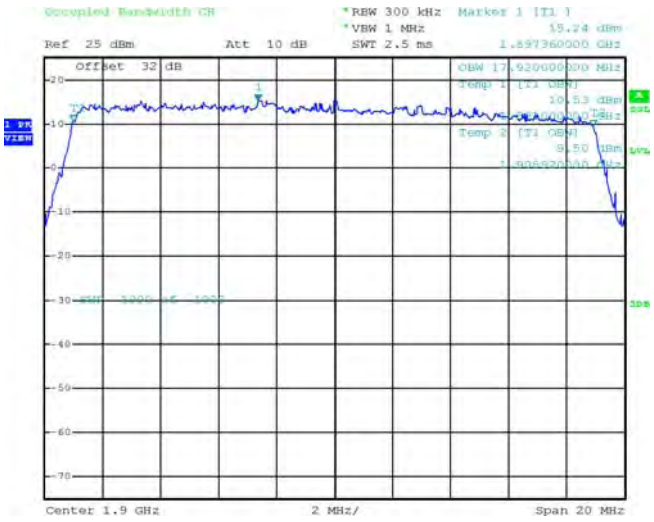
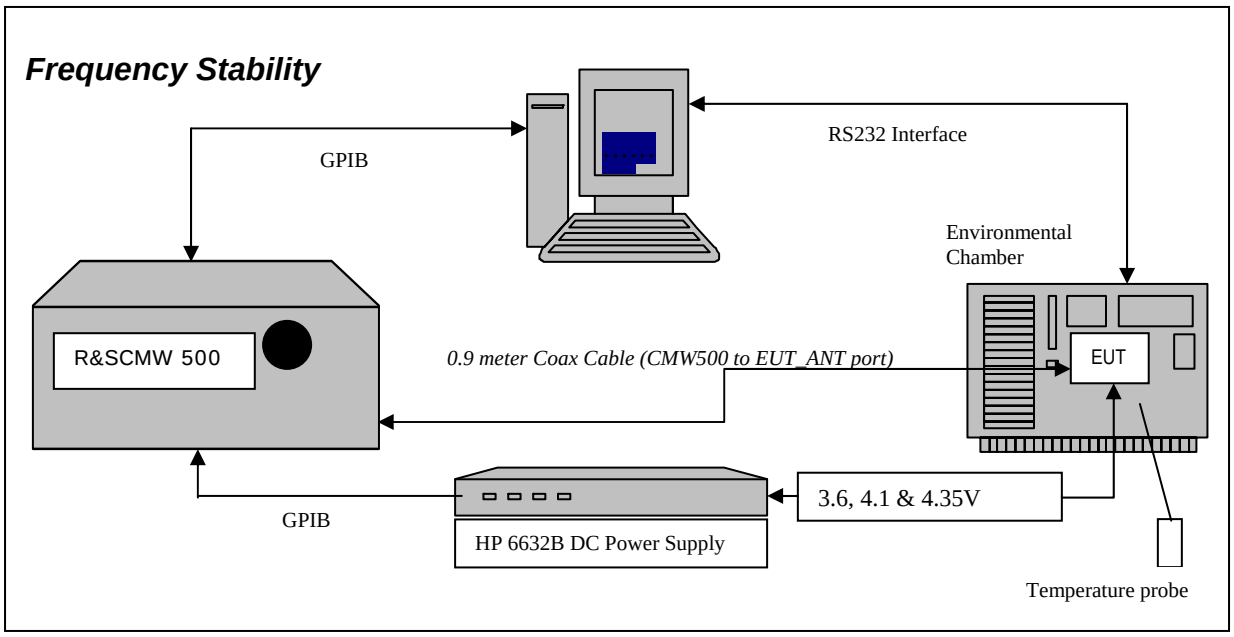


Figure 3-45a: Occupied Bandwidth, Band 2 High Channel, 20MHz BW (RB= 100) 16-QAM



APPENDIX 3B – LTE Band 2 FREQUENCY STABILITY TEST DATA

LTE Frequency Stability Test Data



The following tests were performed on model RFV121LW.

The following measurements were performed by Chuan Tran.

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurements
2.1055 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

24.235 *Frequency Stability*.
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The EUT meets the requirements as stated in CFR 47 chapter 1, Section 24.235, CFR 47 and RSS-133, 6.3 Frequency Stability.
Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, power, data, temperatures, and stepped voltages controlled via a GPIB interface linked to the Environmental chamber, a DC power supply, and the Communications Test Set. A 0.9-metre coax cable was calibrated to characterize the insertion loss for the transmitted frequencies between the RF input/output of the CMW 500 and the EUT antenna port.

Test Setup:

The EUT was placed in the Temperature chamber and connected to CMW 500 outside as shown in the figure above. Dry air was pumped inside the temperature chamber to maintain a backpressure during the test. The EUT was kept in the off condition at all times except when the following measurements were to be made.

The chamber was switched on and the temperature was set to -30°C.
After the chamber stabilized at -30 °C there was a soak period of one hour to alleviate moisture in the chamber, the EUT voltage was enabled.
The system software recorded the frequency, power, and associated measurements.

A Computer system controlled the automated software. This application was given the command of activating all machines intrinsic to the temperature and voltage tests controlling the CMW 500 via the GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The EUT dialogue was passed through a serial connection.

The EUT repetitively transmitted 100 bursts for each set of programmed parameters recording temperature, voltage settings, and systematically selected frequencies. The power supply was cycled from minimum voltage 3.6 volts, to 4.1 volts and to 4.35 volts maximum voltage. The frequency error was measured at a maximum output power and recorded by the automated system test software.

The EUT output power and frequency was measured at 3.6 volts, 4.1 volts and 4.35 volts. The transmit frequency was varied in 3 steps consisting of 1860.0, 1880.0 and 1900.0 MHz each was measured under bandwidth of 20 MHz with maximum (100) resource blocks. This frequency was recorded in MHz and deviation from nominal, in Parts Per Million.

After the initial one-hour soak at the beginning of the tests, a period of thirty minutes soak was initialized between each ascending temperature step, before proceeding to the next measurement test cycle.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

1. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
2. Start test program
3. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
4. Set power supply voltage to 3.6 volts.
5. Set up CMW 500 Radio Communication Tester.
6. Command the CMW 500 to switch to the low channel.
7. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
8. EUT is commanded to Transmit 100 Bursts.
9. Software logs the following data from the CMW 500, power supply and temperature chamber: Traffic Channel Number, Traffic Channel Frequency, Power Level, Chamber Temperature, Supply Voltage, Power and Frequency Error.
10. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
11. Repeat steps 5 to 10 changing the supply voltage to 4.1 Volts
12. Increase temperature by 10°C and soak for 1/2 hour.
13. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
14. Repeat steps 5 to 10 changing the supply voltage to 4.35 volts

Procedure 5 to 10 was repeated at room temperature (20°C) with the power supply voltage set to 3.6, 4.1 and 4.35 volts

The maximum frequency error in the LTE band 2 measured was **0.0093 PPM.**

Date of test: August 19, 2013

LTE band 2 results: channels 18600, 18900, & 19199 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Band 2 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
18600	1860.0	3.6	20	-9.56	-0.0051
18900	1880.0	3.6	20	12.36	0.0066
19199	1900.0	3.6	20	14.56	0.0077

Traffic Channel Number	LTE Band 2 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
18600	1860.0	4.1	20	8.69	0.0047
18900	1880.0	4.1	20	-6.40	-0.0034
19199	1900.0	4.1	20	-3.14	-0.0017

Traffic Channel Number	LTE Band 2 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
18600	1860.0	4.35	20	10.23	0.0055
18900	1880.0	4.35	20	11.32	0.0060
19199	1900.0	4.35	20	-6.35	-0.0033

LTE band 2 Results: channel 18600 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
18600	1860.0	3.6	-30	13.23	0.0071
18600	1860.0	3.6	-20	9.43	0.0051
18600	1860.0	3.6	-10	-4.56	-0.0025
18600	1860.0	3.6	0	-7.65	-0.0041
18600	1860.0	3.6	10	-6.35	-0.0034
18600	1860.0	3.6	20	-9.56	-0.0051
18600	1860.0	3.6	30	9.65	0.0052
18600	1860.0	3.6	40	5.64	0.0030
18600	1860.0	3.6	50	14.56	0.0078
18600	1860.0	3.6	60	-6.35	-0.0034
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18600	1860.0	4.1	-30	-5.65	-0.0030
18600	1860.0	4.1	-20	11.32	0.0061
18600	1860.0	4.1	-10	**17.32**	**0.0093**
18600	1860.0	4.1	0	11.32	0.0061
18600	1860.0	4.1	10	13.23	0.0071
18600	1860.0	4.1	20	8.69	0.0047
18600	1860.0	4.1	30	9.65	0.0052
18600	1860.0	4.1	40	12.32	0.0066
18600	1860.0	4.1	50	-4.78	-0.0026
18600	1860.0	4.1	60	9.65	0.0052
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18600	1860.0	4.35	-30	12.30	0.0066
18600	1860.0	4.35	-20	7.65	0.0041
18600	1860.0	4.35	-10	15.64	0.0084
18600	1860.0	4.35	0	10.32	0.0055
18600	1860.0	4.35	10	-6.35	-0.0034
18600	1860.0	4.35	20	10.23	0.0055
18600	1860.0	4.35	30	11.45	0.0062
18600	1860.0	4.35	40	-6.45	-0.0035
18600	1860.0	4.35	50	14.65	0.0079
18600	1860.0	4.35	60	-6.45	-0.0035

LTE band 2 Results: channel 18900 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
18900	1880.00	3.6	-30	11.32	0.0060
18900	1880.00	3.6	-20	10.32	0.0055
18900	1880.00	3.6	-10	12.35	0.0066
18900	1880.00	3.6	0	-6.35	-0.0034
18900	1880.00	3.6	10	3.20	0.0017
18900	1880.00	3.6	20	12.36	0.0066
18900	1880.00	3.6	30	12.36	0.0066
18900	1880.00	3.6	40	-4.66	-0.0025
18900	1880.00	3.6	50	12.35	0.0066
18900	1880.00	3.6	60	8.36	0.0044
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18900	1880.00	4.1	-30	9.65	0.0051
18900	1880.00	4.1	-20	9.64	0.0051
18900	1880.00	4.1	-10	-2.30	-0.0012
18900	1880.00	4.1	0	12.65	0.0067
18900	1880.00	4.1	10	9.65	0.0051
18900	1880.00	4.1	20	-6.40	-0.0034
18900	1880.00	4.1	30	10.65	0.0057
18900	1880.00	4.1	40	11.01	0.0059
18900	1880.00	4.1	50	-11.32	-0.0060
18900	1880.00	4.1	60	11.32	0.0060
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18900	1880.00	4.35	-30	-11.65	-0.0062
18900	1880.00	4.35	-20	5.64	0.0030
18900	1880.00	4.35	-10	14.35	0.0076
18900	1880.00	4.35	0	10.65	0.0057
18900	1880.00	4.35	10	12.35	0.0066
18900	1880.00	4.35	20	11.32	0.0060
18900	1880.00	4.35	30	4.56	0.0024
18900	1880.00	4.35	40	12.32	0.0066
18900	1880.00	4.35	50	13.32	0.0071
18900	1880.00	4.35	60	15.23	0.0081

LTE band 2 Results: channel 19199 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
19199	1900.0	3.6	-30	-9.65	-0.0051
19199	1900.0	3.6	-20	6.32	0.0033
19199	1900.0	3.6	-10	8.65	0.0046
19199	1900.0	3.6	0	12.05	0.0063
19199	1900.0	3.6	10	-2.23	-0.0012
19199	1900.0	3.6	20	14.56	0.0077
19199	1900.0	3.6	30	-4.56	-0.0024
19199	1900.0	3.6	40	6.35	0.0033
19199	1900.0	3.6	50	-4.65	-0.0024
19199	1900.0	3.6	60	-4.65	-0.0024
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
19199	1900.0	4.1	-30	-5.60	-0.0029
19199	1900.0	4.1	-20	-6.33	-0.0033
19199	1900.0	4.1	-10	9.65	0.0051
19199	1900.0	4.1	0	-6.35	-0.0033
19199	1900.0	4.1	10	-5.64	-0.0030
19199	1900.0	4.1	20	-3.14	-0.0017
19199	1900.0	4.1	30	12.35	0.0065
19199	1900.0	4.1	40	10.99	0.0058
19199	1900.0	4.1	50	12.35	0.0065
19199	1900.0	4.1	60	10.35	0.0054
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
19199	1900.0	4.35	-30	-2.60	-0.0014
19199	1900.0	4.35	-20	-2.30	-0.0012
19199	1900.0	4.35	-10	9.64	0.0051
19199	1900.0	4.35	0	-9.65	-0.0051
19199	1900.0	4.35	10	11.32	0.0060
19199	1900.0	4.35	20	-6.35	-0.0033
19199	1900.0	4.35	30	-6.31	-0.0033
19199	1900.0	4.35	40	-9.65	-0.0051
19199	1900.0	4.35	50	12.35	0.0065
19199	1900.0	4.35	60	-1.46	-0.0008

APPENDIX 3C – LTE Band 2 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following tests were performed on model RFV121LW.

Date of Test: October 18, 2013
The following measurements were performed by Savtej Sandhu.
The environmental tests conditions were: Temperature: 25.8 °C
Relative Humidity: 37.1 %
The BlackBerry® smartphone was standalone, USB Down and LCD facing the RX antenna when the turntable is at 0 degree position.
Measurements were performed with QPSK and 16QAM modulations. The smallest test margins are reported below.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

LTE band 2, 20MHz BW, RB=1, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18700	1860.00	2	Horn	V	-27.18	-27.18	V-V	-17.73	22.82	0.19	33.00	10.18
F0	18700	1860.00	2	Horn	H	-31.26		H-H	-16.29				
F0	18900	1880.00	2	Horn	V	-30.18	-30.18	V-V	-20.12	19.71	0.09	33.00	13.29
F0	18900	1880.00	2	Horn	H	-31.38		H-H	-19.23				
F0	19099	1899.90	2	Horn	V	-29.96	-29.96	V-V	-19.71	19.70	0.09	33.00	13.30
F0	19099	1899.90	2	Horn	H	-31.94		H-H	-19.45				

LTE band 2, 20MHz BW, RB=1, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18700	1860.00	2	Horn	V	-28.06	-28.06	V-V	-18.22	21.95	0.16	33.00	11.05
F0	18700	1860.00	2	Horn	H	-32.24		H-H	-17.16				
F0	18900	1880.00	2	Horn	V	-31.56	-31.56	V-V	-21.57	18.21	0.07	33.00	14.79
F0	18900	1880.00	2	Horn	H	-32.69		H-H	-20.73				
F0	19099	1899.90	2	Horn	V	-31.26	-31.26	V-V	-21.17	18.77	0.08	33.00	14.23
F0	19099	1899.90	2	Horn	H	-33.19		H-H	-20.38				

Radiated Emissions Test Data Results

LTE band 2, 15MHz BW, RB=1, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18675	1857.50	2	Horn	V	-26.64	-26.64	V-V	-16.72	**23.46**	**0.22**	33.00	9.54
F0	18675	1857.50	2	Horn	H	-30.33		H-H	-15.65				
F0	18900	1880.00	2	Horn	V	-30.31	-30.31	V-V	-20.27	19.17	0.08	33.00	13.83
F0	18900	1880.00	2	Horn	H	-31.69		H-H	-19.77				
F0	19124	1902.40	2	Horn	V	-31.12	-31.12	V-V	-20.84	18.80	0.08	33.00	14.20
F0	19124	1902.40	2	Horn	H	-31.56		H-H	-20.35				

LTE band 2, 15MHz BW, RB=1, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18675	1857.50	2	Horn	V	-27.73	-27.73	V-V	-17.84	22.45	0.18	33.00	10.55
F0	18675	1857.50	2	Horn	H	-31.34		H-H	-16.66				
F0	18900	1880.00	2	Horn	V	-31.60	-31.60	V-V	-21.55	17.89	0.06	33.00	15.11
F0	18900	1880.00	2	Horn	H	-32.54		H-H	-21.05				
F0	19124	1902.40	2	Horn	V	-32.18	-32.18	V-V	-21.56	17.74	0.06	33.00	15.26
F0	19124	1902.40	2	Horn	H	-32.67		H-H	-21.41				

Radiated Emissions Test Data Results

LTE band 2, 1.4MHz BW, RB=1, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18607	1850.70	2	Horn	V	-26.46	-26.46	V-V	-16.60	23.23	0.21	33.00	9.77
F0	18607	1850.70	2	Horn	H	-30.88		H-H	-15.88				
F0	18900	1880.00	2	Horn	V	-30.29	-30.29	V-V	-20.24	19.61	0.09	33.00	13.39
F0	18900	1880.00	2	Horn	H	-31.41		H-H	-19.33				
F0	19192	1909.20	2	Horn	V	-30.98	-30.98	V-V	-20.77	21.10	0.13	33.00	11.90
F0	19192	1909.20	2	Horn	H	-31.72		H-H	-18.05				

LTE band 2, 1.4MHz BW, RB=1, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18607	1850.70	2	Horn	V	-27.74	-27.74	V-V	-17.88	22.42	0.17	33.00	10.58
F0	18607	1850.70	2	Horn	H	-32.14		H-H	-16.69				
F0	18900	1880.00	2	Horn	V	-31.56	-31.56	V-V	-21.57	18.21	0.07	33.00	14.79
F0	18900	1880.00	2	Horn	H	-32.68		H-H	-20.73				
F0	19192	1909.20	2	Horn	V	-32.15	-32.15	V-V	-21.90	19.95	0.10	33.00	13.05
F0	19192	1909.20	2	Horn	H	-32.96		H-H	-19.20				

Radiated Emissions Test Data Results

Date of Test: July 4, 2013

The following measurements were performed by Feras Obeid.

The environmental test conditions were: Temperature: 25.1 ºC
Relative Humidity: 15.3 %

The BlackBerry® smartphone was standalone, USB down and LCD facing the RX antenna when the turntable is at 0 degree position.

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in LTE band 2 with QPSK and 16-QAM modulations for 15MHz BW (channel18675, 18900, 19124 with RB = 1)

All emissions were at least 25 dB below the limit.

Date of Test: July 5 - 12, 2013

The following measurements were performed by Mahmood Ahmed.

The environmental test conditions were: Temperature: 25.4 ºC
Relative Humidity: 41.7 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 20 GHz.

The BlackBerry® smartphone was standalone, with horizontally LCD facing down and top pointing the RX antenna when the turntable is at 0 degree position

Measurements were performed in LTE band 2 with QPSK and 16-QAM modulations for 15MHz BW (channel18675, 18900, 19124 with RB = 1)

All emissions were at least 25 dB below the limit.

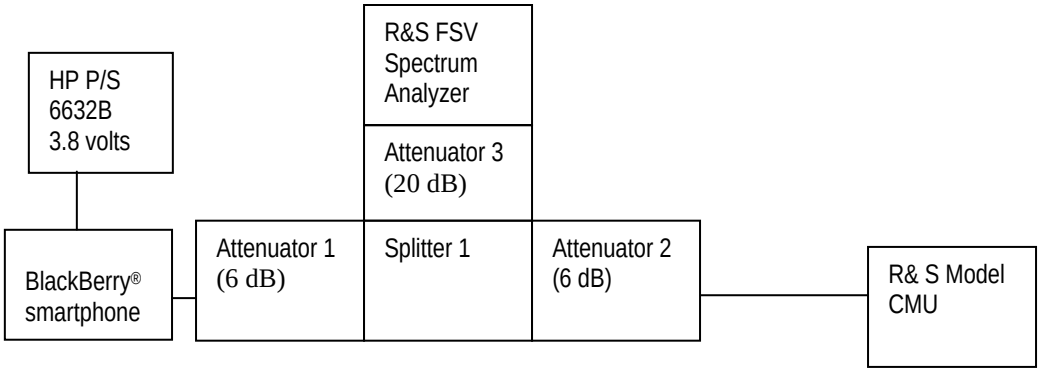
APPENDIX 4A– LTE Band 5 CONDUCTED RF EMISSIONS TEST DATA/PLOTS

LTE Band 5 Conducted RF Emission Test Data

The following tests were performed on model RFV121LW.

This appendix contains measurement data pertaining to conducted spurious emissions, 99% power bandwidth and the channel mask.

Test Setup Diagram



A reference offset of 31.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

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

Date of Test: July 10, 2013

The environmental test conditions were: Temperature: 22.5 ºC
Relative Humidity: 19.2 %

The following measurements were performed by Chuan Tran.

LTE Band 5 Conducted RF Emission Test Data cont'd

Emission Designator Table

Frequency Range (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
824.7-848.2	23.00	1M08G7D	LTE B5	1.4	QPSK
824.7-848.2	21.92	1M08D7W	LTE B5	1.4	16QAM
825.5-847.5	23.88	2M69G7D	LTE B5	3	QPSK
825.5-847.5	22.59	2M68D7W	LTE B5	3	16QAM
826.5-846.4	23.14	4M47G7D	LTE B5	5	QPSK
826.5-846.4	22.47	4M47D7W	LTE B5	5	16QAM
829-844	23.10	8M93G7D	LTE B5	10	QPSK
829-844	22.74	8M92D7W	LTE B5	10	16QAM

The conducted spurious emissions – As per 47 CFR 2.1051, CFR 22.917 and RSS-132, 4.5 were measured from 30 MHz to 20 GHz.

–26 dBc Bandwidth and Occupied Bandwidth (99%)

For each 1.4MHz, 3MHz, 5MHz, 10MHz with different number of resource blocks as per scalable bandwidths for LTE band 5, the modulation spectrum was measured by both methods of 99% power bandwidth and –26 dBc bandwidth.

QPSK and 16-QAM modulations were applied to each of the bandwidths. Only the worst case measurements are documented in this report.

A minimum resource block condition was also measured (RB = 1).

The resolution bandwidth required for out-of-band emissions in the 1 MHz bands immediately outside and adjacent to the frequency block, was determined to be at least 1% of the emission bandwidth.

The worst case –26dBc bandwidth for LTE band 5 was measured to be 9.32 MHz. Results were derived in a 100 kHz resolution bandwidth.

On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.

Test Data for LTE Band 5 selected Frequencies in 10MHz BW (RB = 50)

LTE Band 5 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	
	QPSK	QPSK	16-QAM
829.0	9.32	9.060	9.080
836.5	9.25	**9.100**	9.060
843.9	9.23	**9.100**	**9.100**

Measurement Plots for LTE Band 5

See Figures 4-1a to 4-18a for the plots of the conducted spurious emissions.
See Figures 4-19a to 4-36a and 4-45a to 4-47a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.
See Figures 4-37a to 4-44a for the plots of the Channel mask.

LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-1a: Band 5, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

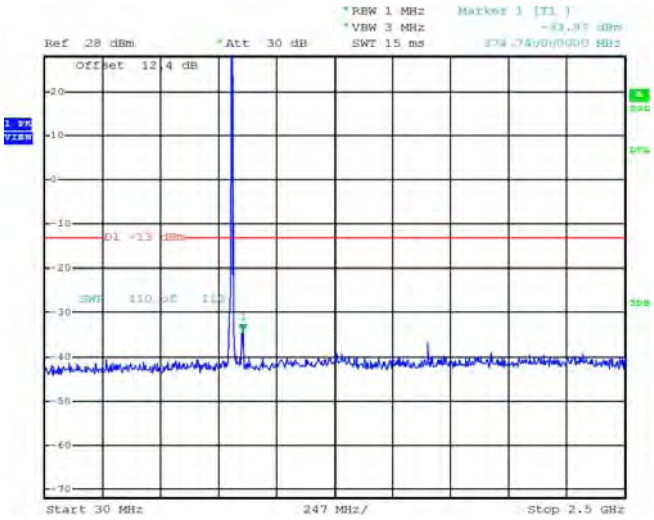


Figure 4-2a: Band 5, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

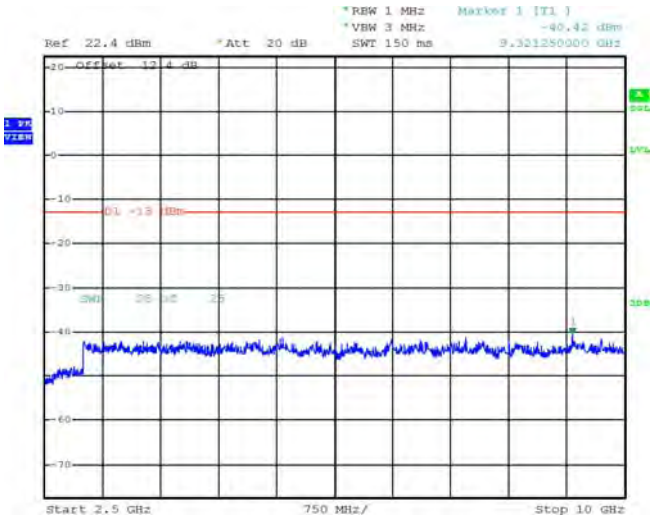


Figure 4-3a: Band 5, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)

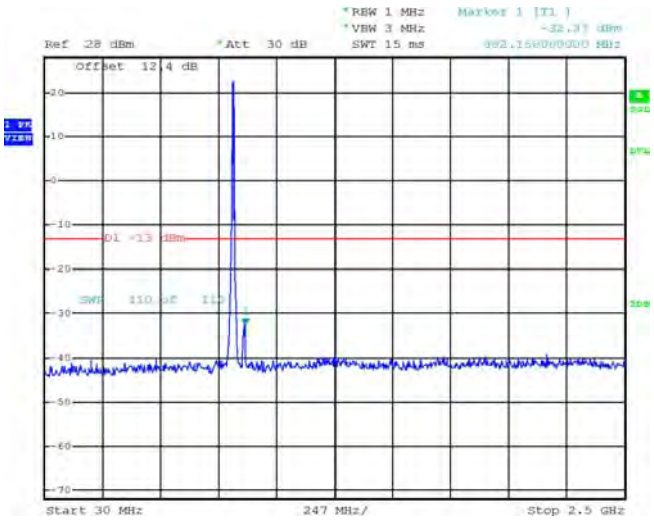
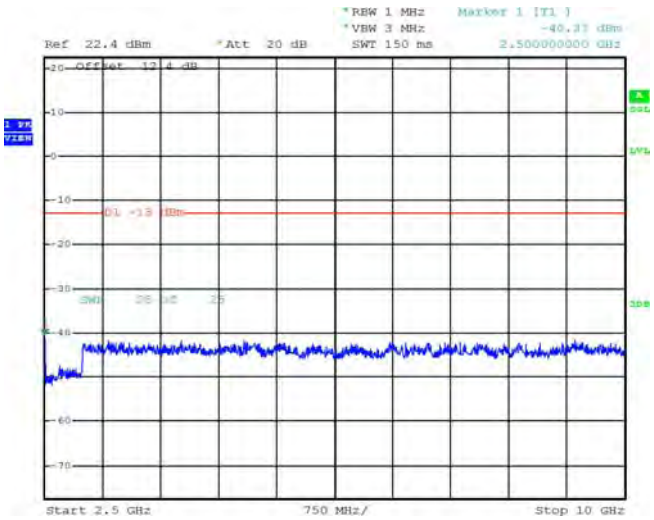


Figure 4-4a: Band 5, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-5a: Band 5, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

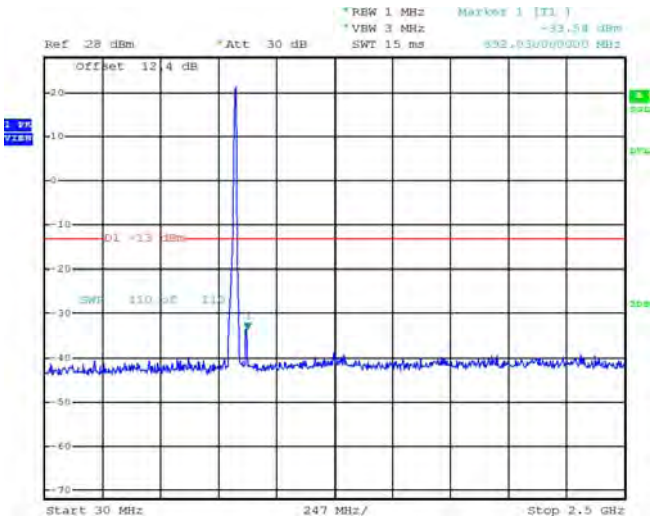


Figure 4-6a: Band 5, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

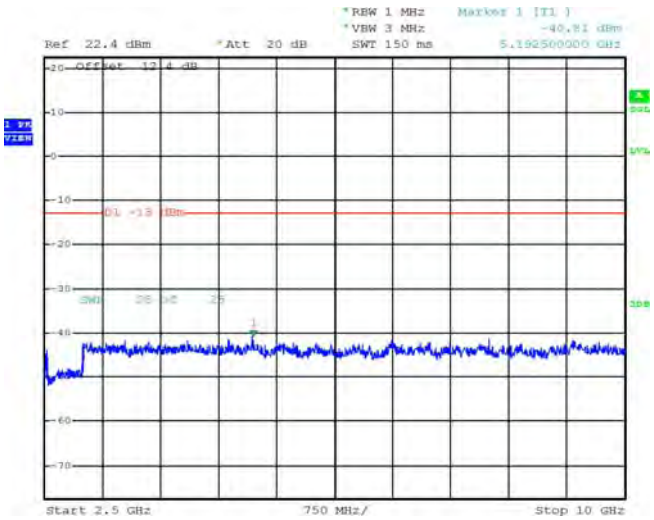


Figure 4-7a: Band 5, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)

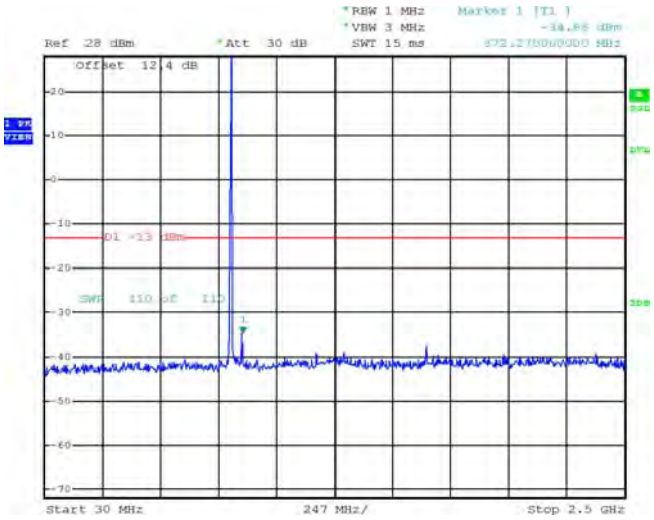
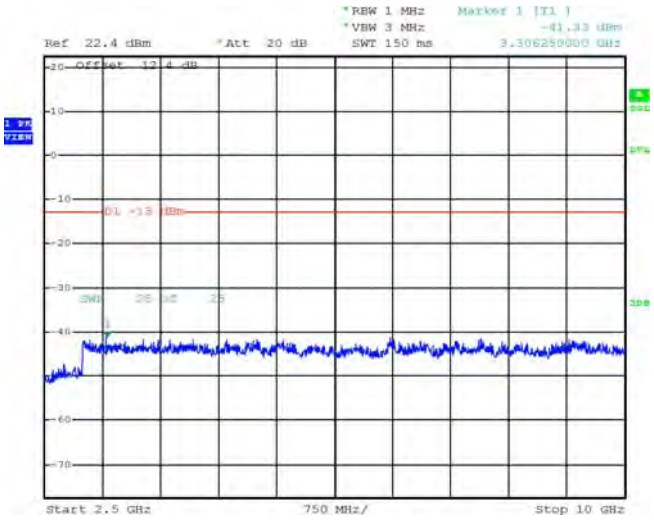


Figure 4-8a: Band 5, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-9a: Band 5, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 15)

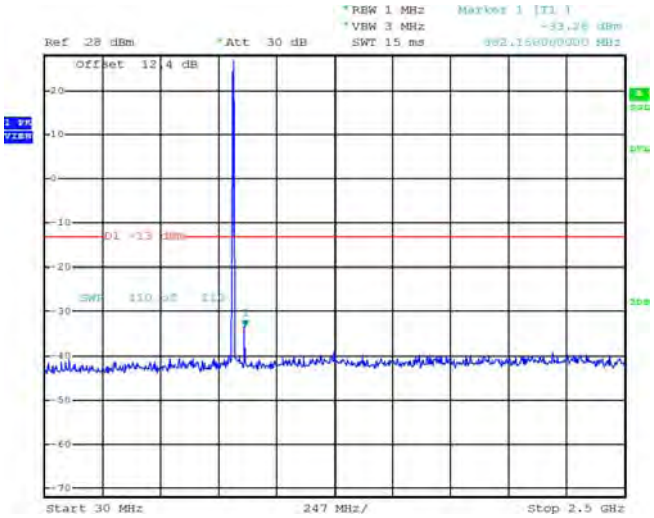


Figure 4-10a: Band 5, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 15)

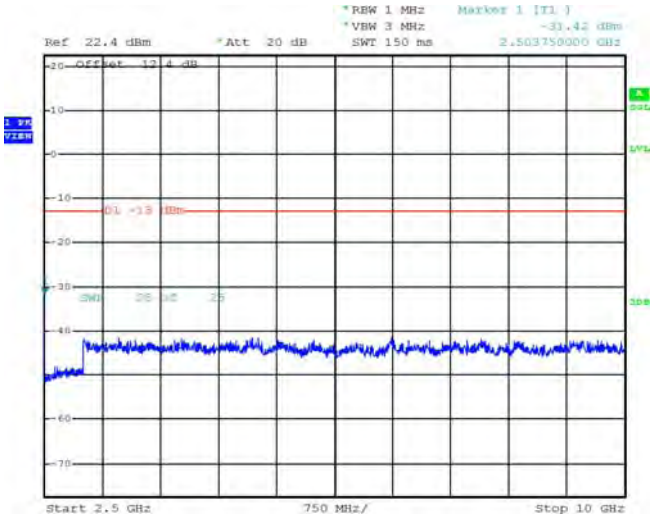


Figure 4-11a: Band 5, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)

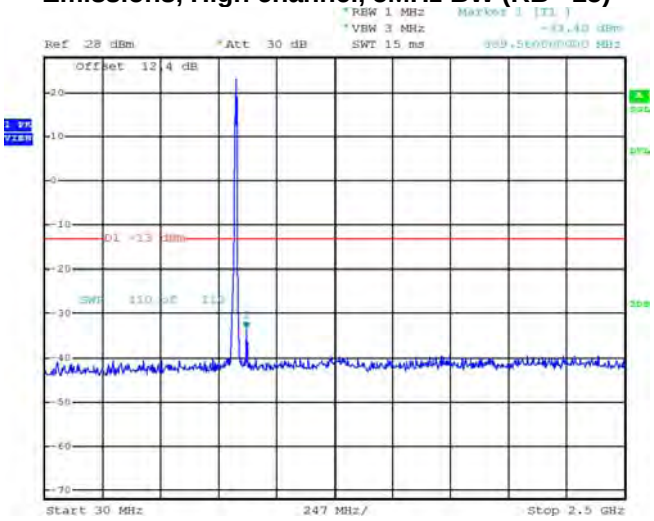
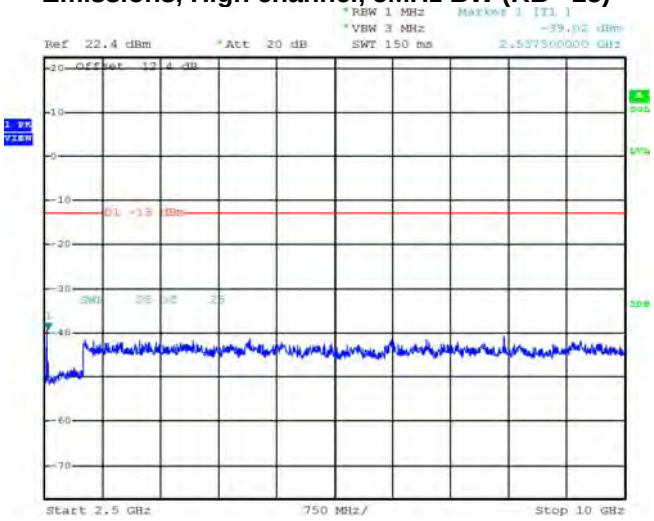


Figure 4-12a: Band 5, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-13a: Band 5, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)

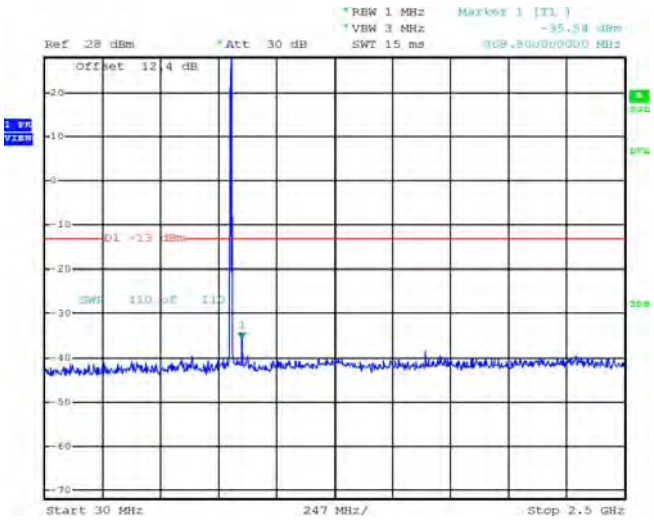


Figure 4-14a: Band 5, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)

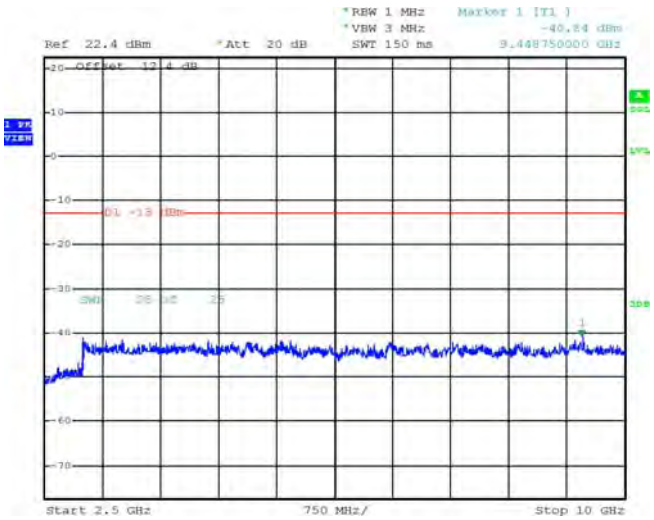


Figure 4-15a: Band 5, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)

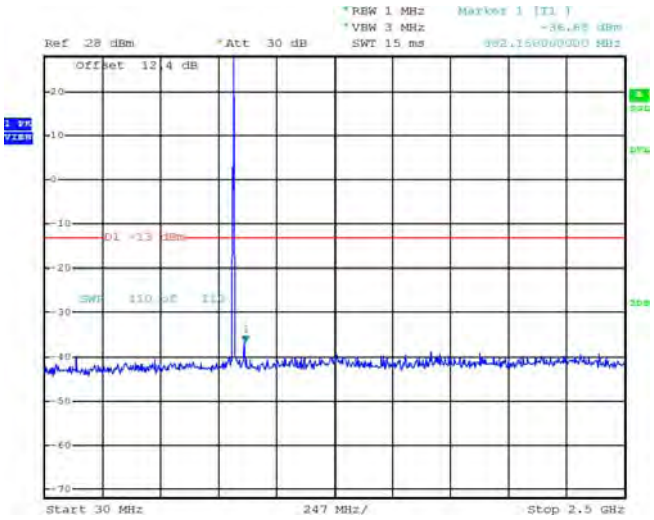
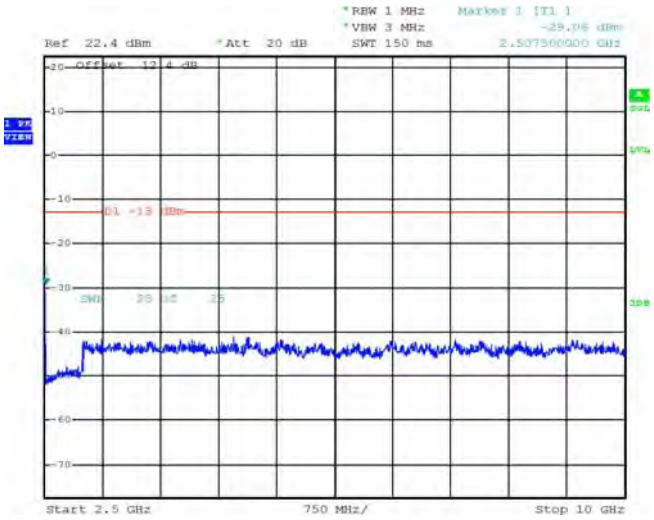


Figure 4-16a: Band 5, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-17a: Band 5, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)

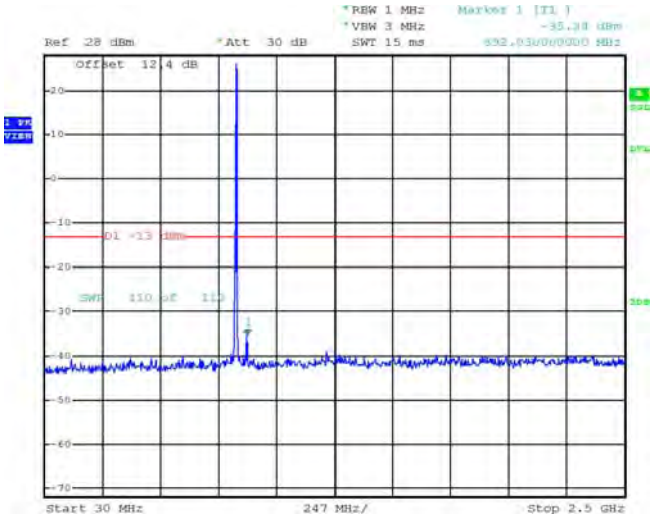
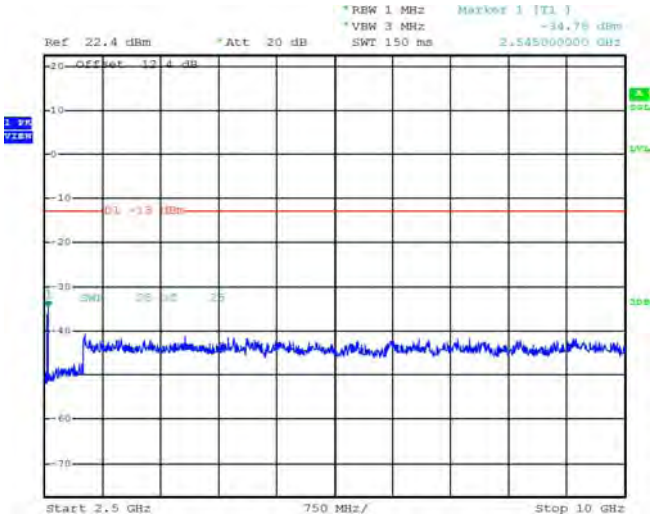


Figure 4-18a: Band 5, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-19a: Occupied Bandwidth, Band 5 Low Channel, 10MHz BW, RB=50

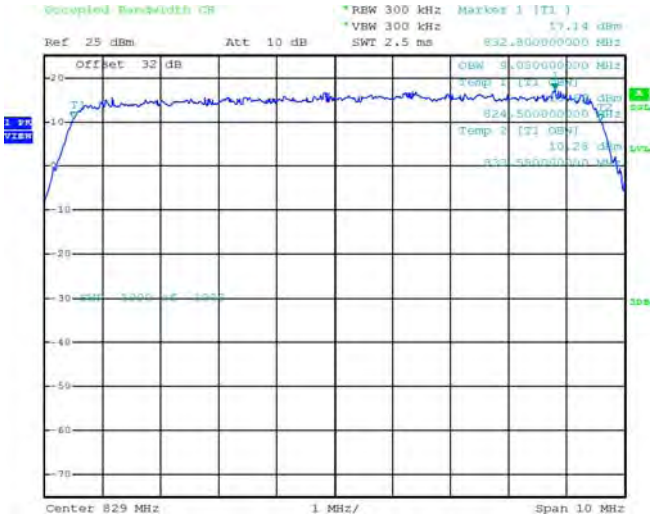


Figure 4-20a: Occupied Bandwidth, Band 5 Middle Channel, 10MHz BW, RB=50

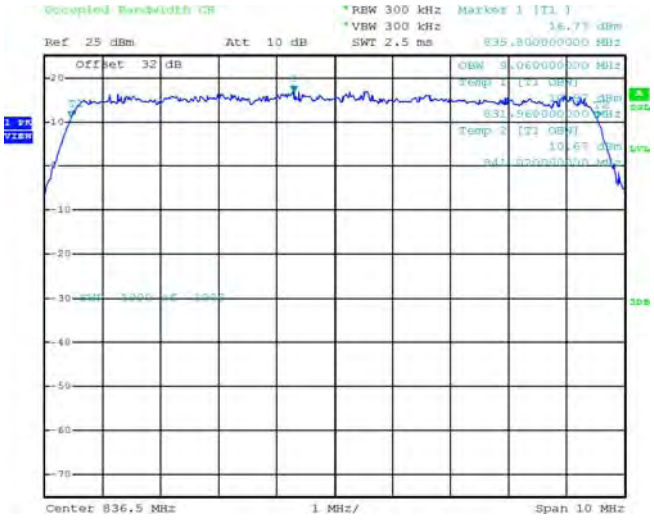
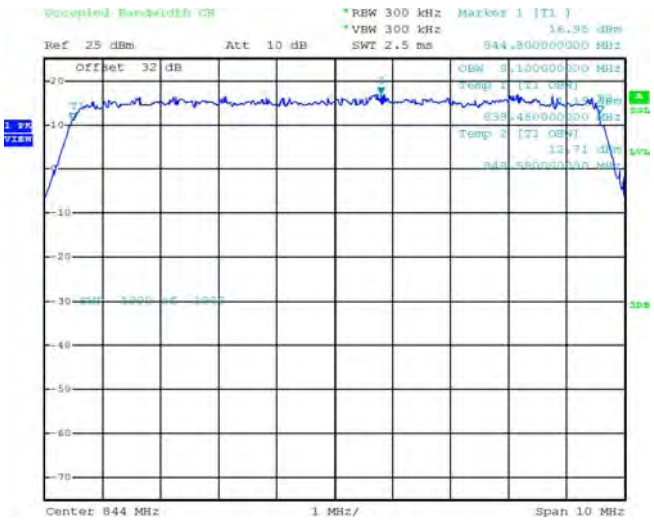


Figure 4-21a: Occupied Bandwidth, Band 5 High Channel, 10MHz BW, RB=50



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-22a: Occupied Bandwidth, Band 5 Low Channel, 5MHz BW, RB=25

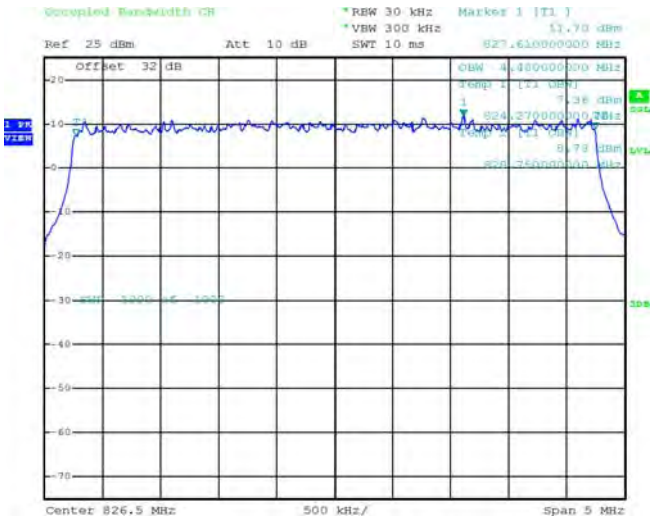


Figure 4-23a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25

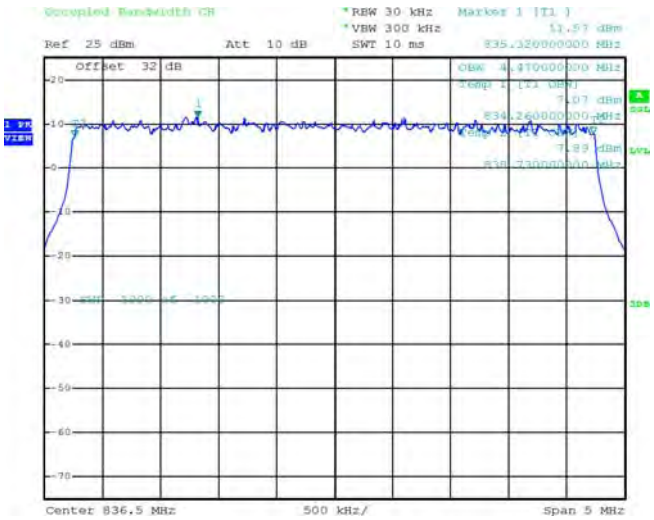
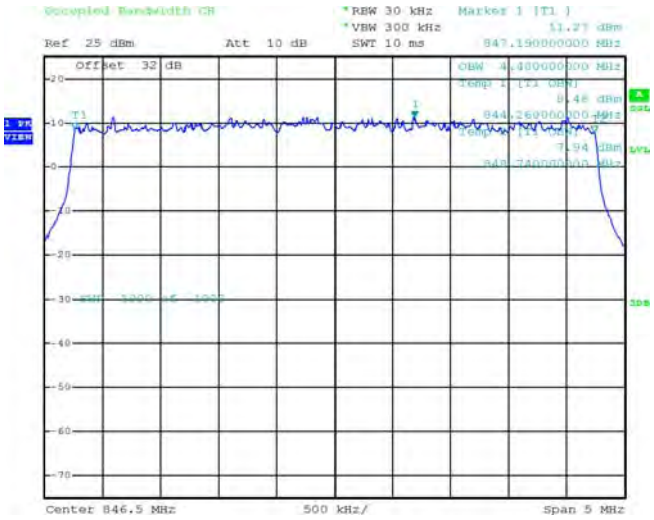


Figure 4-24a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-25a: Occupied Bandwidth, Band 5 Low Channel, 1.4MHz BW, RB=6

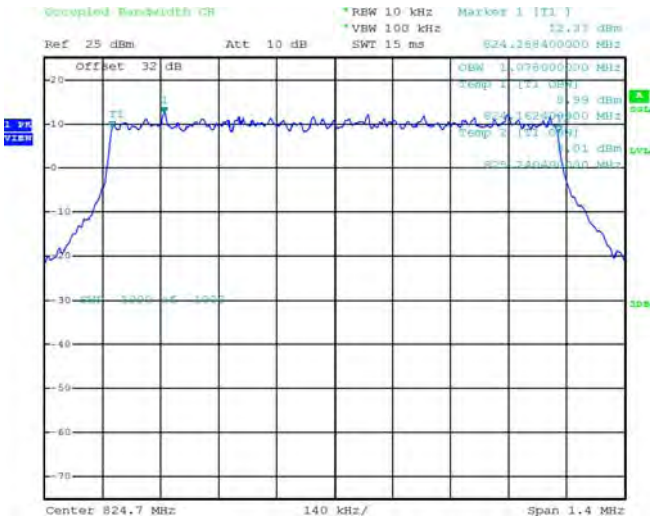


Figure 4-26a: Occupied Bandwidth, Band 5 Middle Channel, 1.4MHz BW, RB=6

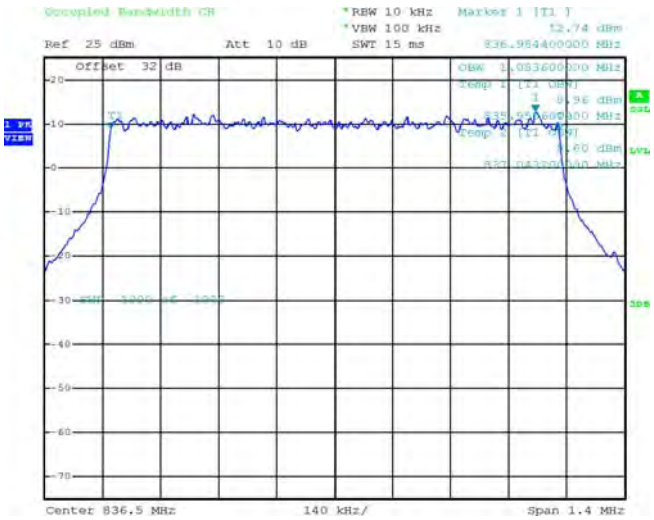
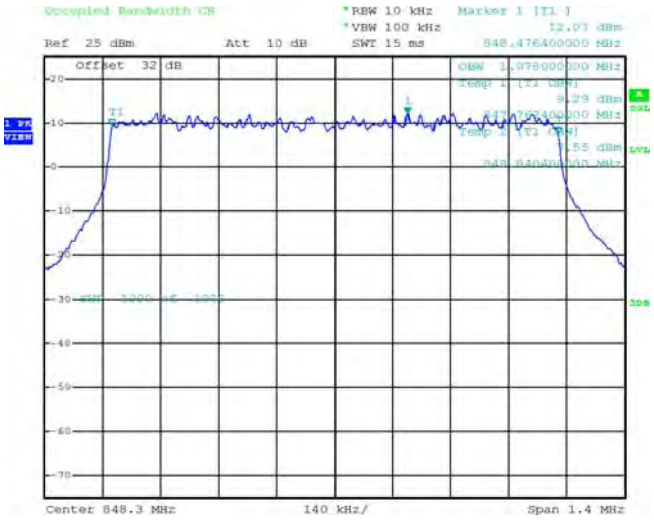


Figure 4-27a: Occupied Bandwidth, Band 5 High Channel, 1.4MHz BW, RB=6



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-28a: -26 dBc Bandwidth, Band 5 Low Channel, 10MHz BW, RB=50

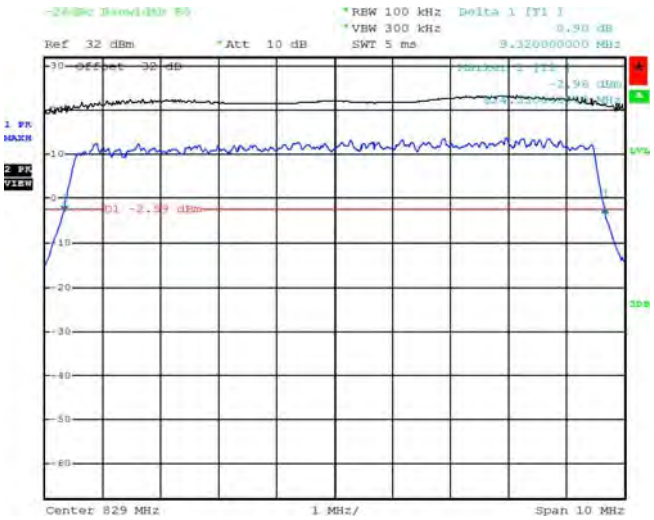


Figure 4-29a: -26 dBc Bandwidth, Band 5 Middle Channel, 10MHz BW, RB=50

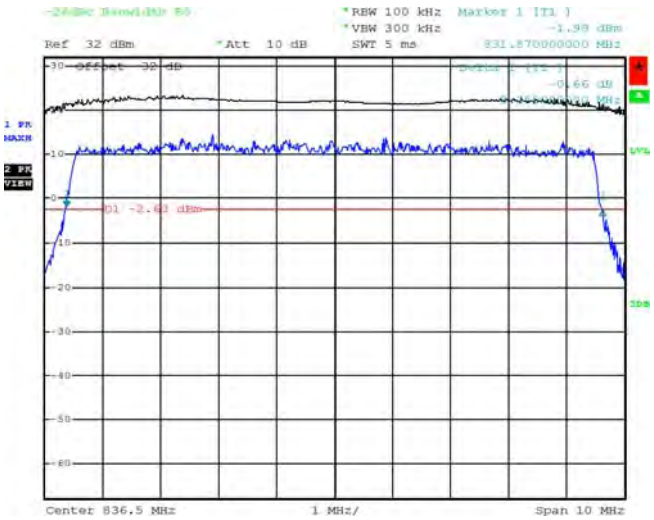


Figure 4-30a: -26 dBc Bandwidth, Band 5 High Channel, 10MHz BW, RB=50

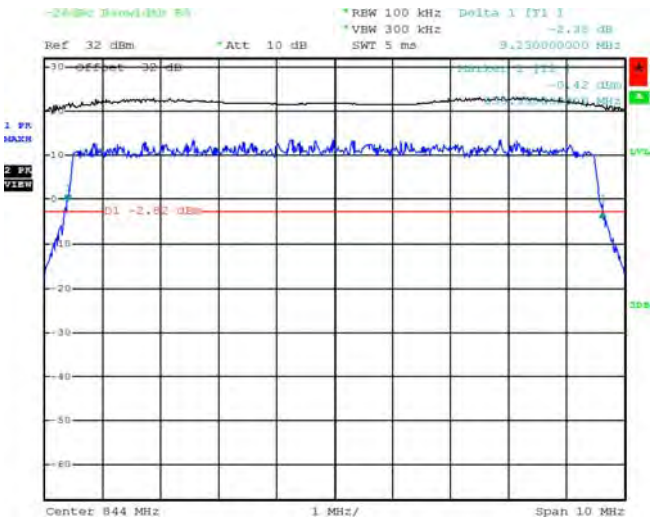
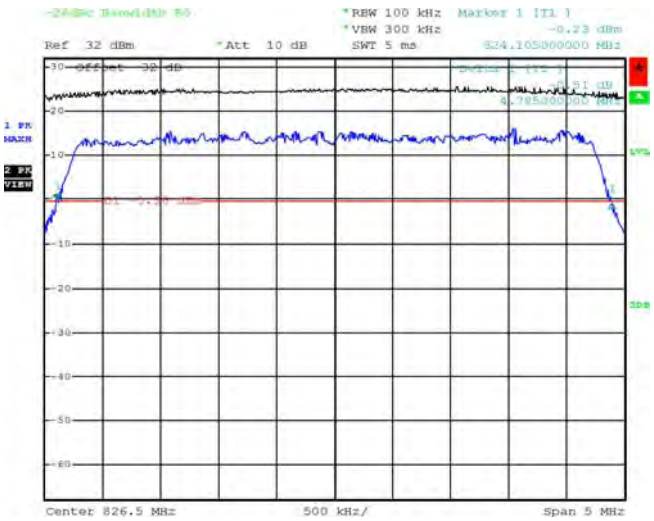


Figure 4-31a: -26 dBc Bandwidth, Band 5 Low Channel, 5MHz BW, RB=25



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-32a: -26 dBc Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25

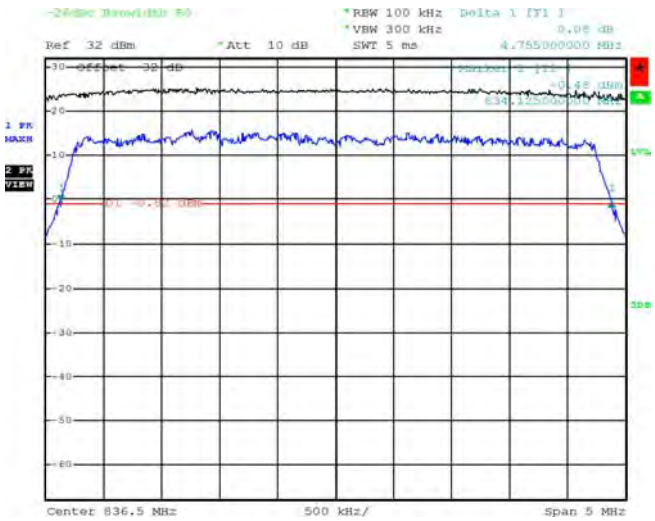


Figure 4-33a: -26 dBc Bandwidth, Band 5 High Channel, 5MHz BW, RB=25

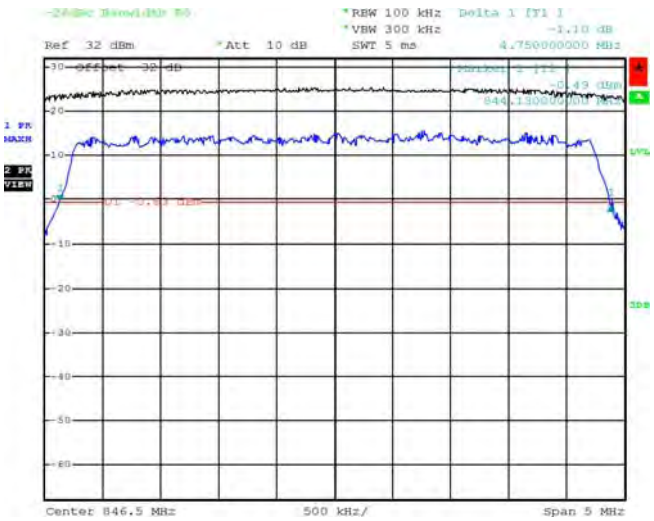


Figure 4-34a: -26 dBc Bandwidth, Band 5 Low Channel, 1.4MHz BW, RB=6

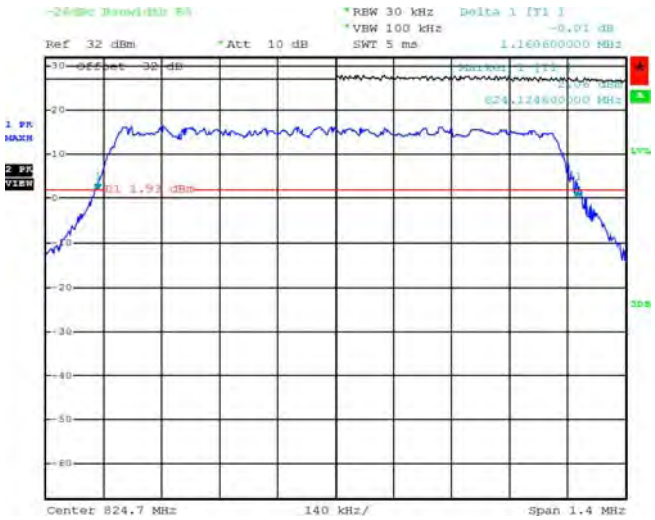
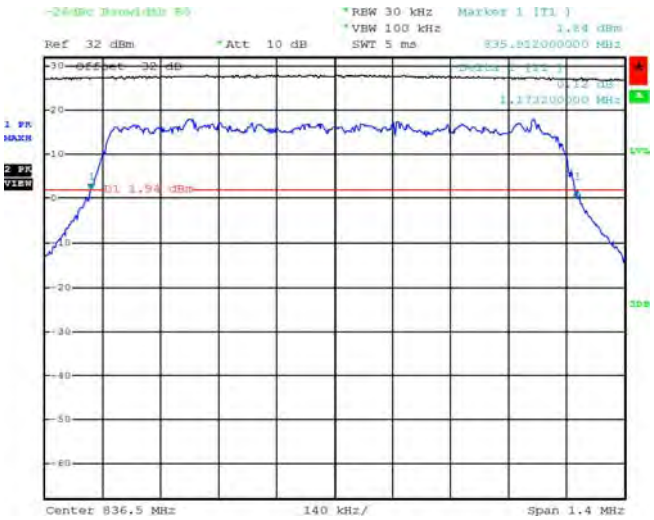


Figure 4-35a: -26 dBc Bandwidth, Band 5 Middle Channel, 1.4MHz BW, RB=6



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-36a: -26 dBc Bandwidth, Band 5 High Channel, 1.4MHz BW, RB=6

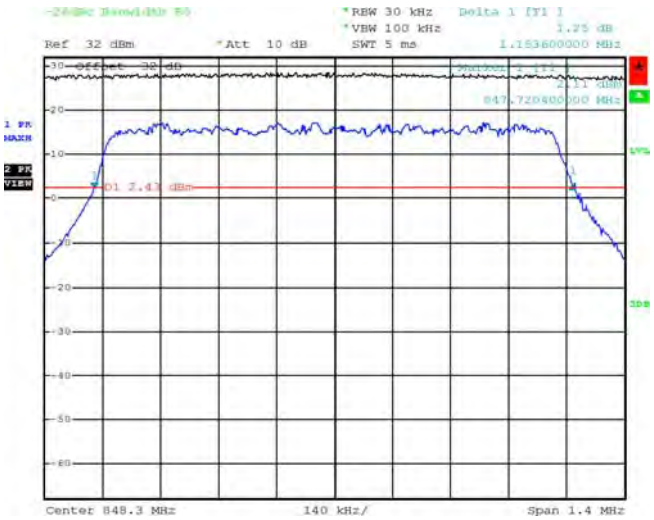


Figure 4-37a: Band 5 Low Channel Mask, 10MHz BW, RB=50

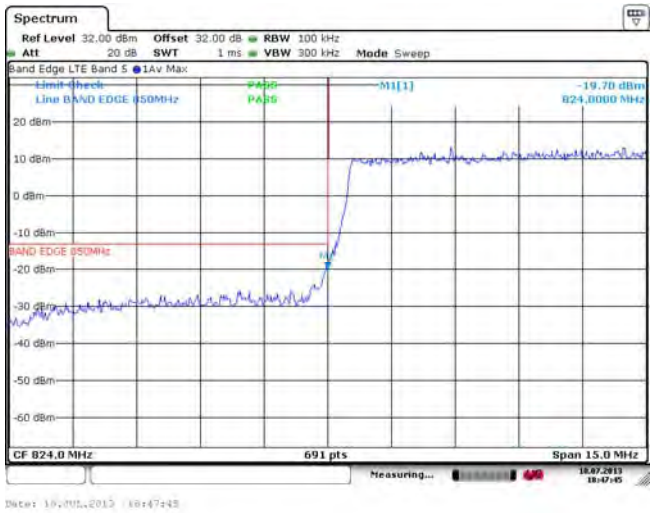
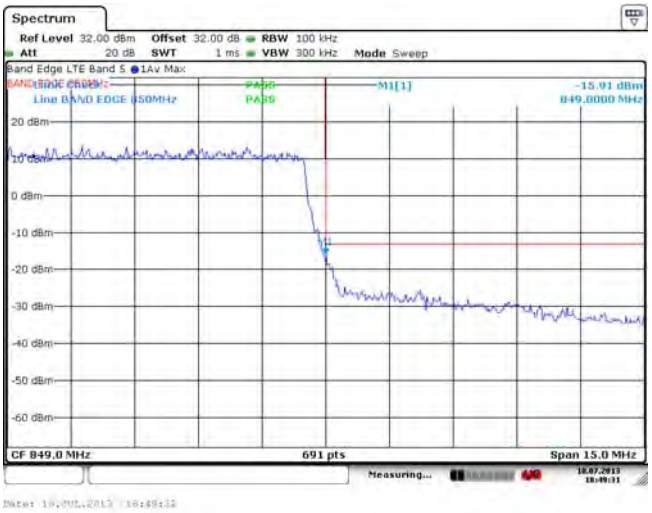


Figure 4-38a: Band 5 High Channel Mask, 10MHz BW, RB=50



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-39a: Band 5 Low Channel Mask, 5MHz BW, RB=25

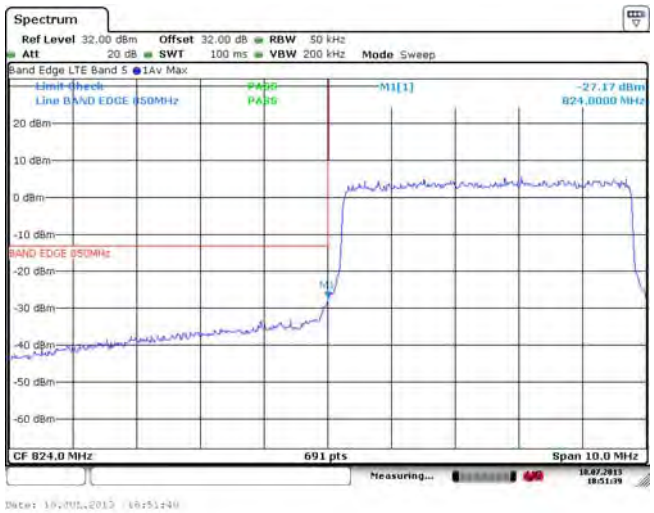


Figure 4-40a: Band 5 High Channel Mask, 5MHz BW, RB=25

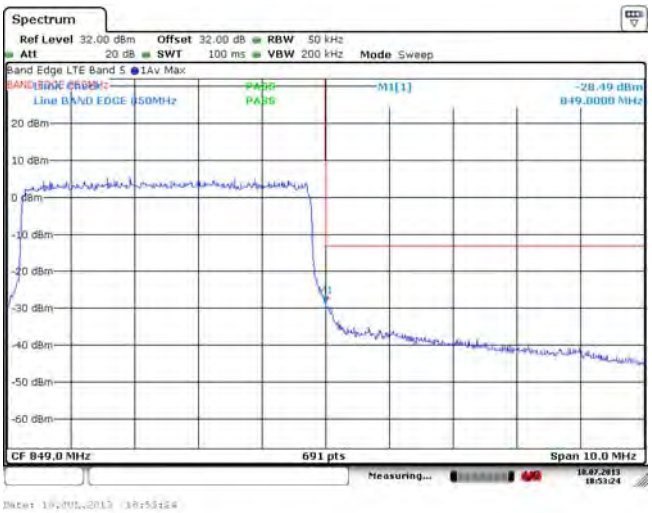


Figure 4-41a: Band 5 Low Channel Mask, 1.4MHz BW, RB=6

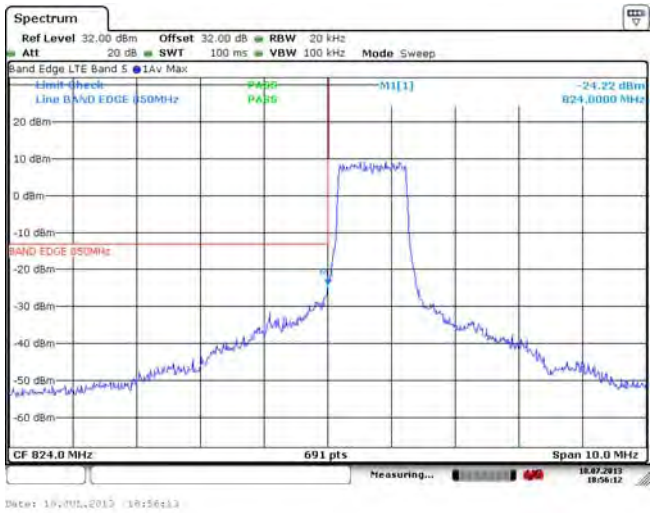
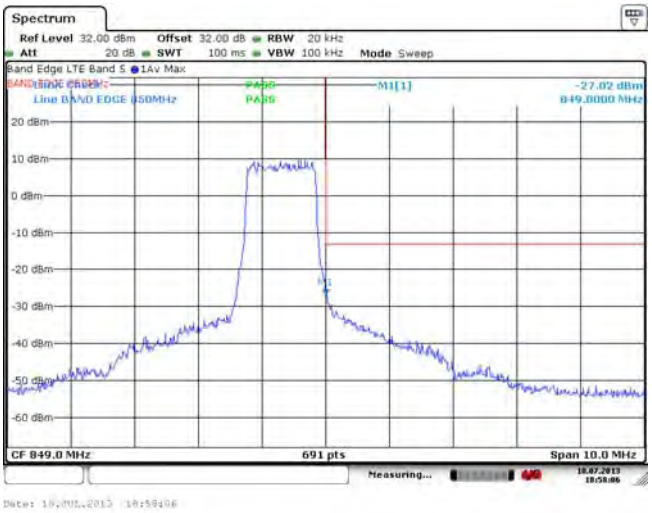


Figure 4-42a: Band 5 High Channel Mask, 1.4MHz BW, RB=6



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 4-43d: Band 5 Low Channel Mask, 10MHz BW, RB=1

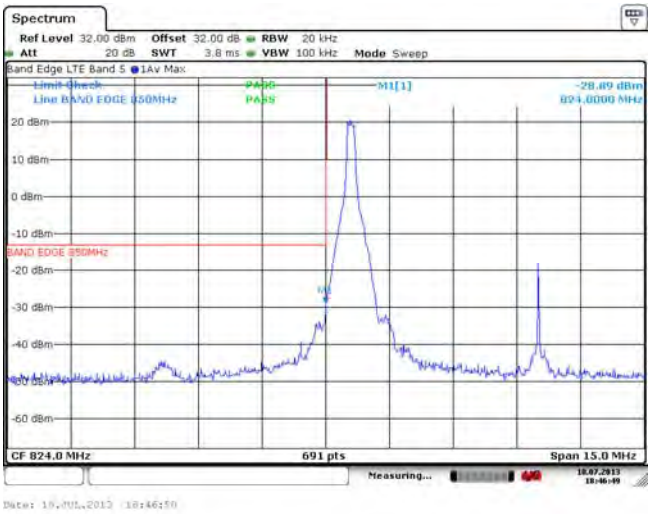
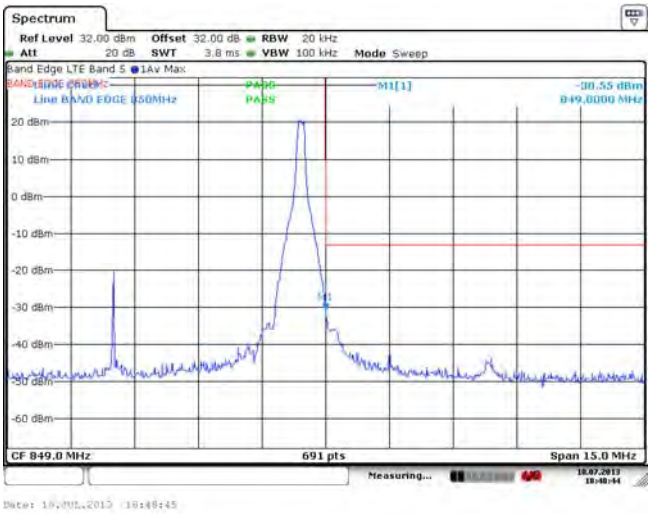


Figure 4-44a: Band 5 High Channel Mask, 10MHz BW, RB=1



LTE Band 5 Conducted RF Emission Test Data cont'd

Figure 3-45a: Occupied Bandwidth, Band 5 Low Channel, 10MHz BW (RB= 50) 16-QAM

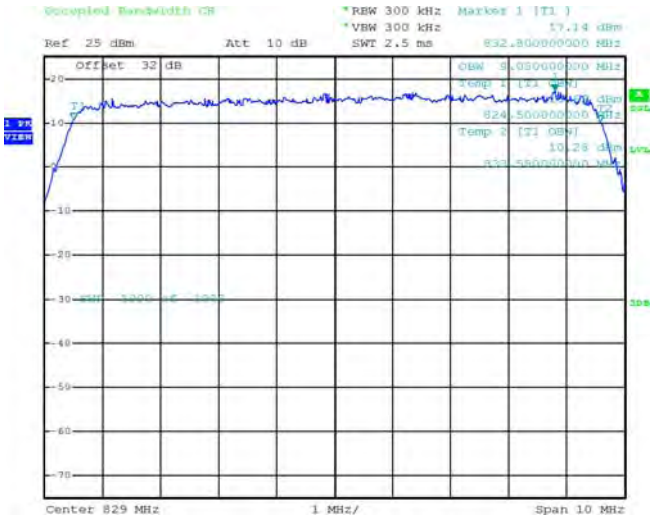


Figure 3-46a: Occupied Bandwidth, Band 5 Mid Channel, 20MHz BW (RB= 50) 16-QAM

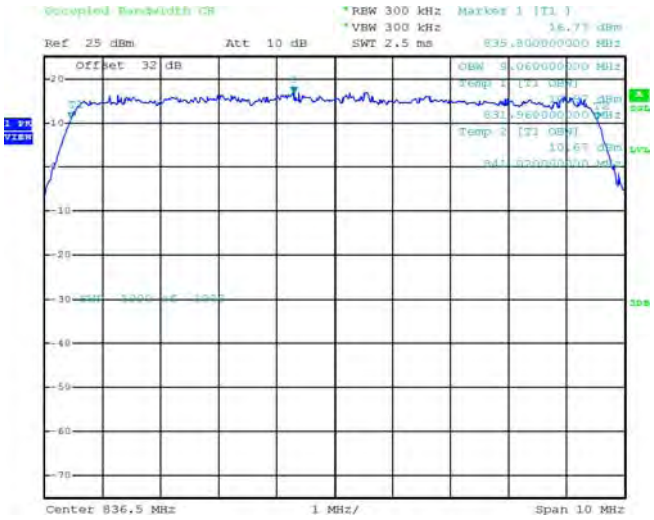
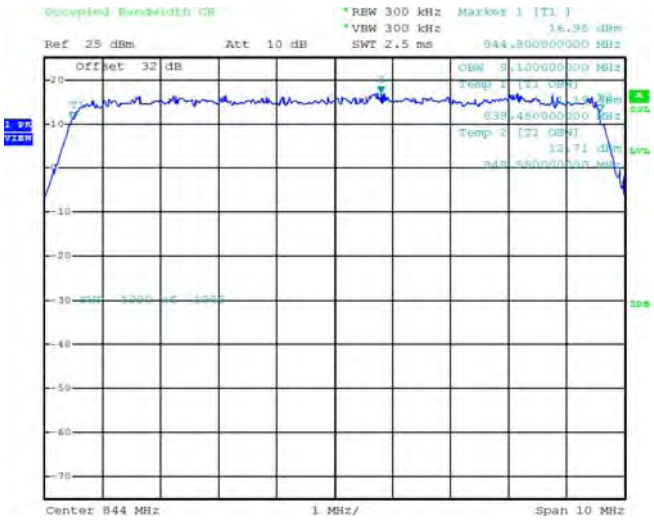
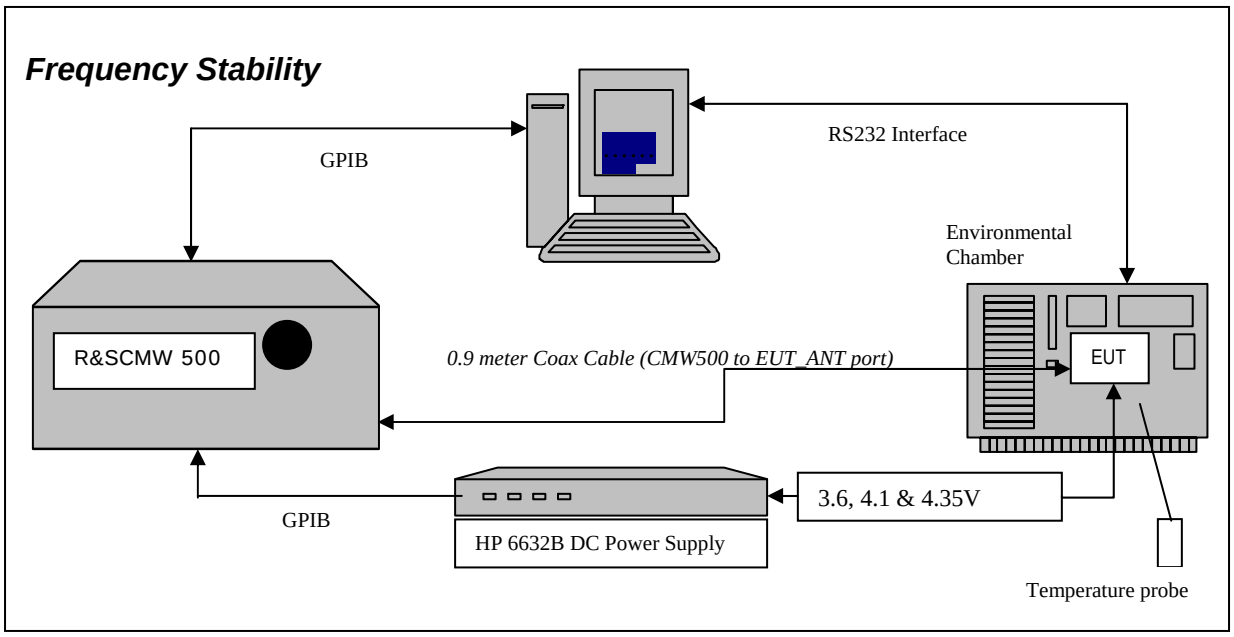


Figure 3-47a: Occupied Bandwidth, Band 5 High Channel, 10MHz BW (RB= 50) 16-QAM



APPENDIX 4B – LTE Band 5 FREQUENCY STABILITY TEST DATA

LTE Band 5 Frequency Stability Test Data



The following tests were performed on model RFV121LW.

The following measurements were performed by Chuan Tran.

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurements
2.1055 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

24.236 *Frequency Stability*.
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The EUT meets the requirements as stated in CFR 47 chapter 1, Section 27.54, CFR 47 and RSS-139, 6.3 Frequency Stability.
Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, power, data, temperatures, and stepped voltages controlled via a GPIB interface linked to the Environmental chamber, a DC power supply, and the Communications Test Set. A 0.9-metre coax cable was calibrated to characterize the insertion loss for the transmitted frequencies between the RF input/output of the CMW 500 and the EUT antenna port.

Test Setup:

The EUT was placed in the Temperature chamber and connected to CMW 500 outside as shown in the figure above. Dry air was pumped inside the temperature chamber to maintain a backpressure during the test. The EUT was kept in the off condition at all times except when the following measurements were to be made.

The chamber was switched on and the temperature was set to -30°C.
After the chamber stabilized at -30 °C there was a soak period of one hour to alleviate moisture in the chamber, the EUT voltage was enabled.
The system software recorded the frequency, power, and associated measurements.

A Computer system controlled the automated software. This application was given the command of activating all machines intrinsic to the temperature and voltage tests controlling the CMW 500 via the GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The EUT dialogue was passed through a serial connection.

The EUT repetitively transmitted 100 bursts for each set of programmed parameters recording temperature, voltage settings, and systematically selected frequencies. The power supply was cycled from minimum voltage 3.6 volts, 4.1 volts and to 4.35 volts maximum voltage. The frequency error was measured at a maximum output power and recorded by the automated system test software.

The EUT output power and frequency was measured at 3.6 volts, 4.1 volts and 4.35 volts. The transmit frequency was varied in 3 steps consisting of 829.0 MHz, 836.5 MHz and 844.0 MHz each was measured under 10 MHz bandwidth with maximum (50) resource blocks. This frequency was recorded in MHz and deviation from nominal, in Parts Per Million.

After the initial one-hour soak at the beginning of the tests, a period of thirty minutes soak was initialized between each ascending temperature step, before proceeding to the next measurement test cycle.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

15. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
16. Start test program
17. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
18. Set power supply voltage to 3.6 volts.
19. Set up CMW 500 Radio Communication Tester.
20. Command the CMW 500 to switch to the low channel.
21. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
22. EUT is commanded to Transmit 100 Bursts.
23. Software logs the following data from the CMW 500, power supply and temperature chamber: Traffic Channel Number, Traffic Channel Frequency, Power Level, Chamber Temperature, Supply Voltage, Power and Frequency Error.
24. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
25. Repeat steps 5 to 10 changing the supply voltage to 4.1 Volts
26. Increase temperature by 10°C and soak for 1/2 hour.
27. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
28. Repeat steps 5 to 10 changing the supply voltage to 4.35 volts

Procedure 5 to 10 was repeated at room temperature (20°C) with the power supply voltage set to 3.6, 4.1 and 4.35 volts

The maximum frequency error in the LTE Band 5 measured was **0.0180PPM**.

LTE Band 5 results: channels 20400, 20525 and 20649 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20450	829.0	3.6	20	-3.71	-0.0045
20525	836.5	3.6	20	-3.10	-0.0037
20600	844.0	3.6	20	2.95	0.0035

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20450	829.0	4.1	20	-3.29	-0.0040
20525	836.5	4.1	20	4.45	0.0053
20600	844.0	4.1	20	-3.79	-0.0045

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20450	829.0	4.35	20	-4.11	-0.0050
20525	836.5	4.35	20	5.11	0.0061
20600	844.0	4.35	20	-4.23	-0.0050

LTE band 5 Results: channel 20400 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20450	829.0	3.6	-30	-4.41	-0.0053
20450	829.0	3.6	-20	-3.85	-0.0046
20450	829.0	3.6	-10	4.18	0.0050
20450	829.0	3.6	0	-4.52	-0.0055
20450	829.0	3.6	10	-3.42	-0.0041
20450	829.0	3.6	20	-3.71	-0.0045
20450	829.0	3.6	30	-4.73	-0.0057
20450	829.0	3.6	40	-3.52	-0.0042
20450	829.0	3.6	50	-3.93	-0.0047
20450	829.0	3.6	60	6.90	0.0083
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20450	829.0	4.1	-30	-4.73	-0.0057
20450	829.0	4.1	-20	-3.96	-0.0048
20450	829.0	4.1	-10	-4.15	-0.0050
20450	829.0	4.1	0	-2.89	-0.0035
20450	829.0	4.1	10	3.36	0.0041
20450	829.0	4.1	20	-3.29	-0.0040
20450	829.0	4.1	30	-3.20	-0.0039
20450	829.0	4.1	40	-3.53	-0.0043
20450	829.0	4.1	50	3.06	0.0037
20450	829.0	4.1	60	-12.10	-0.0146
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20450	829.0	4.35	-30	-3.00	-0.0036
20450	829.0	4.35	-20	-4.12	-0.0050
20450	829.0	4.35	-10	-5.11	-0.0062
20450	829.0	4.35	0	2.63	0.0032
20450	829.0	4.35	10	-2.95	-0.0036
20450	829.0	4.35	20	-4.11	-0.0050
20450	829.0	4.35	30	-7.37	-0.0089
20450	829.0	4.35	40	-8.78	-0.0106
20450	829.0	4.35	50	-3.83	-0.0046
20450	829.0	4.35	60	-7.38	-0.0089

LTE band 5 Results: channel 20525 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20525	836.5	3.6	-30	2.76	0.0033
20525	836.5	3.6	-20	4.23	0.0051
20525	836.5	3.6	-10	5.58	0.0067
20525	836.5	3.6	0	-2.40	-0.0029
20525	836.5	3.6	10	-2.27	-0.0027
20525	836.5	3.6	20	-3.10	-0.0037
20525	836.5	3.6	30	3.72	0.0044
20525	836.5	3.6	40	**15.06**	**0.0180**
20525	836.5	3.6	50	1.89	0.0023
20525	836.5	3.6	60	1.96	0.0023
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20525	836.5	4.1	-30	5.26	0.0063
20525	836.5	4.1	-20	5.66	0.0068
20525	836.5	4.1	-10	5.49	0.0066
20525	836.5	4.1	0	7.31	0.0087
20525	836.5	4.1	10	3.78	0.0045
20525	836.5	4.1	20	4.45	0.0053
20525	836.5	4.1	30	4.25	0.0051
20525	836.5	4.1	40	5.31	0.0063
20525	836.5	4.1	50	4.08	0.0049
20525	836.5	4.1	60	4.03	0.0048
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20525	836.5	4.35	-30	4.42	0.0053
20525	836.5	4.35	-20	3.85	0.0046
20525	836.5	4.35	-10	4.12	0.0049
20525	836.5	4.35	0	-3.02	-0.0036
20525	836.5	4.35	10	3.88	0.0046
20525	836.5	4.35	20	5.11	0.0061
20525	836.5	4.35	30	2.89	0.0035
20525	836.5	4.35	40	3.20	0.0038
20525	836.5	4.35	50	4.81	0.0058
20525	836.5	4.35	60	3.66	0.0044

LTE band 5 Results: channel 20649 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20600	844.0	3.6	-30	4.71	0.0056
20600	844.0	3.6	-20	-2.72	-0.0032
20600	844.0	3.6	-10	-4.82	-0.0057
20600	844.0	3.6	0	-3.35	-0.0040
20600	844.0	3.6	10	3.45	0.0041
20600	844.0	3.6	20	2.95	0.0035
20600	844.0	3.6	30	-3.96	-0.0047
20600	844.0	3.6	40	-3.81	-0.0045
20600	844.0	3.6	50	-3.18	-0.0038
20600	844.0	3.6	60	-3.30	-0.0039
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20600	844.0	4.1	-30	3.39	0.0040
20600	844.0	4.1	-20	4.52	0.0054
20600	844.0	4.1	-10	-3.45	-0.0041
20600	844.0	4.1	0	3.82	0.0045
20600	844.0	4.1	10	-3.50	-0.0041
20600	844.0	4.1	20	-3.79	-0.0045
20600	844.0	4.1	30	-4.18	-0.0050
20600	844.0	4.1	40	-3.47	-0.0041
20600	844.0	4.1	50	-3.68	-0.0044
20600	844.0	4.1	60	-3.23	-0.0038
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20600	844.0	4.35	-30	-4.62	-0.0055
20600	844.0	4.35	-20	-3.72	-0.0044
20600	844.0	4.35	-10	-3.52	-0.0042
20600	844.0	4.35	0	5.21	0.0062
20600	844.0	4.35	10	-3.60	-0.0043
20600	844.0	4.35	20	-4.23	-0.0050
20600	844.0	4.35	30	4.56	0.0054
20600	844.0	4.35	40	-3.60	-0.0043
20600	844.0	4.35	50	2.92	0.0035
20600	844.0	4.35	60	-7.55	-0.0089

APPENDIX 4C – LTE Band 5 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following tests were performed on model RFV121LW.

Date of Test: August 16, 2013
The following measurements were performed by Feras Obeid.
The environmental tests conditions were: Temperature: 25.0 °C
Relative Humidity: 29.5 %
The BlackBerry® smartphone was standalone USB Down and LCD Screen pointing to the RX antenna when the turntable is at 0 degree position.
Measurements were performed with QPSK and 16QAM modulations. The smallest test margins are reported below.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

LTE band 5, 10MHz BW, RB=1, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20500	834.00	5	Dipole	V	-37.88	-30.10	V-V	3.88	20.91	0.12	38.50	17.59
F0	20500	834.00	5	Dipole	H	-30.10		H-H	3.89				
F0	20525	836.50	5	Dipole	V	-38.12	-30.01	V-V	3.68	20.62	0.12	38.50	17.88
F0	20525	836.50	5	Dipole	H	-30.01		H-H	3.73				
F0	20549	838.90	5	Dipole	V	-38.21	-29.75	V-V	3.63	20.58	0.11	38.50	17.92
F0	20549	838.90	5	Dipole	H	-29.75		H-H	3.69				

LTE band 5, 10MHz BW, RB=1, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20500	834.00	5	Dipole	V	-39.01	-31.13	V-V	2.76	19.88	0.10	38.50	18.62
F0	20500	834.00	5	Dipole	H	-31.13		H-H	2.86				
F0	20525	836.50	5	Dipole	V	-39.33	-31.20	V-V	2.38	19.37	0.09	38.50	19.13
F0	20525	836.50	5	Dipole	H	-31.20		H-H	2.48				
F0	20549	838.90	5	Dipole	V	-39.03	-30.90	V-V	2.44	19.34	0.09	38.50	19.16
F0	20549	838.90	5	Dipole	H	-30.90		H-H	2.45				

Radiated Emissions Test Data Results cont'd

LTE band 5, 3MHz BW, RB=6, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20500	834.00	5	Dipole	V	-39.76	-31.07	V-V	4.50	**21.52**	**0.14**	38.50	16.98
F0	20500	834.00	5	Dipole	H	-31.07		H-H	2.95				
F0	20525	836.50	5	Dipole	V	-41.28	-32.66	V-V	3.05	19.94	0.10	38.50	18.56
F0	20525	836.50	5	Dipole	H	-32.66		H-H	1.72				
F0	20549	838.90	5	Dipole	V	-40.09	-32.19	V-V	4.02	20.91	0.12	38.50	17.59
F0	20549	838.90	5	Dipole	H	-32.19		H-H	2.85				

LTE band 5, 3MHz BW, RB=6, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20500	834.00	5	Dipole	V	-40.82	-32.06	V-V	3.54	20.56	0.11	38.50	17.94
F0	20500	834.00	5	Dipole	H	-32.06		H-H	1.97				
F0	20525	836.50	5	Dipole	V	-42.31	-33.63	V-V	2.04	18.93	0.08	38.50	19.57
F0	20525	836.50	5	Dipole	H	-33.63		H-H	0.86				
F0	20549	838.90	5	Dipole	V	-41.03	-33.06	V-V	3.11	20.00	0.10	38.50	18.50
F0	20549	838.90	5	Dipole	H	-33.06		H-H	1.98				

Radiated Emissions Test Data Results cont'd

Date of Test: July 6, 2013

The following measurements were performed by Feras Obeid.

The environmental test conditions were: Temperature: 25.3 ºC
Relative Humidity: 18.3 %

The BlackBerry® smartphone was standalone horizontally with LCD facing down and top pointing to the RX antenna when the turntable is at 0 degree position

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in LTE band 5 with QPSK and 16-QAM modulation for 3MHz BW (channel 20415, 20525 and 20634 with RB = 6).

All emissions were at least 25 dB below the limit.

Date of Test: July 8, 2013

The following measurements were performed by Kevin Guo
The environmental test conditions were: Temperature: 25.5 ºC
Relative Humidity: 21.6 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 10 GHz.

The BlackBerry® smartphone was standalone, with horizontally down and top pointing to the RX antenna when the turntable is at 0 degree position

Measurements were performed in LTE band 5 with QPSK and 16-QAM modulation for 3MHz BW (channel 20415, 20525 and 20634 with RB = 6).

All emissions were at least 25 dB below the limit.

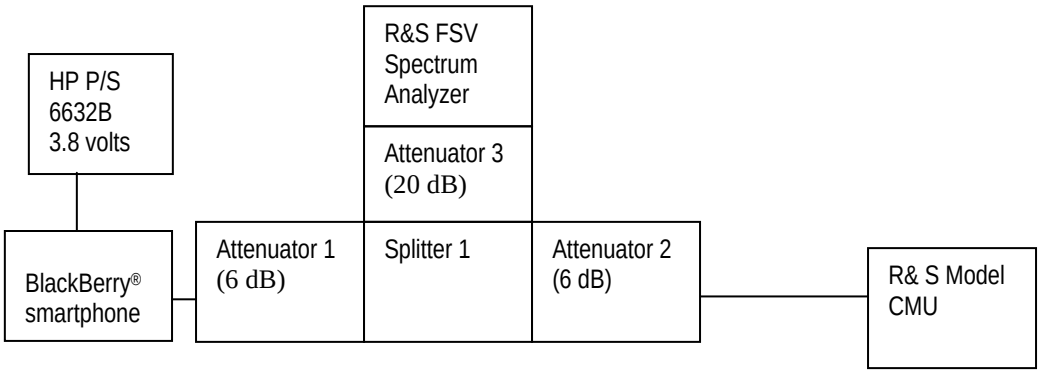
APPENDIX 5A– LTE Band 4 CONDUCTED RF EMISSIONS TEST DATA/PLOTS

LTE Band 4 Conducted RF Emission Test Data

The following tests were performed on model RFV121LW.

This appendix contains measurement data pertaining to conducted spurious emissions, 99% power bandwidth and the channel mask.

Test Setup Diagram



A reference offset of 31.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

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

Date of Test: July 10 - 15, 2013

The environmental test conditions were: Temperature: 23.2ºC
Relative Humidity: 21.1 %

The following measurements were performed by Chuan Tran.

LTE Band 4 Conducted RF Emission Test Data cont'd

Emission Designator Table

Frequency Range (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
1710.7-1754.3	21.80	1M08G7D	LTE B4	1.4	QPSK
1710.7-1754.3	20.50	1M08D7W	LTE B4	1.4	16QAM
1711.5-1753.5	21.70	2M69G7D	LTE B4	3	QPSK
1711.5-1753.5	21.30	2M69D7W	LTE B4	3	16QAM
1712.5-1752.5	21.90	4M48G7D	LTE B4	5	QPSK
1712.5-1752.5	21.40	4M47D7W	LTE B4	5	16QAM
1715-1750	21.70	8M95G7D	LTE B4	10	QPSK
1715-1750	21.30	8M95D7W	LTE B4	10	16QAM
1717.5-1747.5	21.70	13M4G7D	LTE B4	15	QPSK
1717.5-1747.5	21.40	13M4D7W	LTE B4	15	16QAM
1720-1745	21.90	17M9G7D	LTE B4	20	QPSK
1720-1745	21.50	17M9D7W	LTE B4	20	16QAM

The conducted spurious emissions – As per 47 CFR 2.1051, CFR 27.53, RSS-139, 6.5 were measured from 30 MHz to 20 GHz.

–26 dBc Bandwidth and Occupied Bandwidth (99%)

The modulation spectrum was measured by both methods of 99% power bandwidth and –26 dBc bandwidth For each 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz with different number of resource blocks for LTE band 4,.

QPSK and 16-QAM modulations were applied to each of the bandwidths. Only the worst case measurements are documented in this report.

A minimum resource block condition was also measured (RB = 1).

The resolution bandwidth required for out-of-band emissions in the 1 MHz bands immediately outside and adjacent to the frequency block, was determined to be at least 1% of the emission bandwidth.

The worst case –26dBc bandwidth for LTE band 4 was measured to be 19.32 MHz. Results were derived in a 200 kHz resolution bandwidth.

On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.

Test Data for LTE Band 4 selected Frequencies in 20MHz BW (RB = 100)

LTE Band 4 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	
	QPSK	QPSK	16-QAM
1720.0	19.16	17.96	17.96
1732.5	19.32	**18.04**	**18.00**
1745.0	18.98	17.88	17.88

Peak to Average Ratio (PAR)

For each 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz with different number of resource blocks as per scalable bandwidths for LTE band 4, the peak to average ratio was measured on the low, middle and high channels with QPSK modulation.
On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.
The worst case measured was 9.24 dB in 10MHz bandwidth with 50 resource blocks.

Measurement Plots for LTE Band 4

See Figures 5-1a to 5-18a for the plots of the conducted spurious emissions.
See Figures 5-19a to 5-34a and 5-51a to 5-53a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.
See Figures 5-35a to 5-44a for the plots of the Channel mask.
See Figures 5-45a to 5-50a for the plots of the Peak to Average Ratios.

LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-1a: Band 4, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

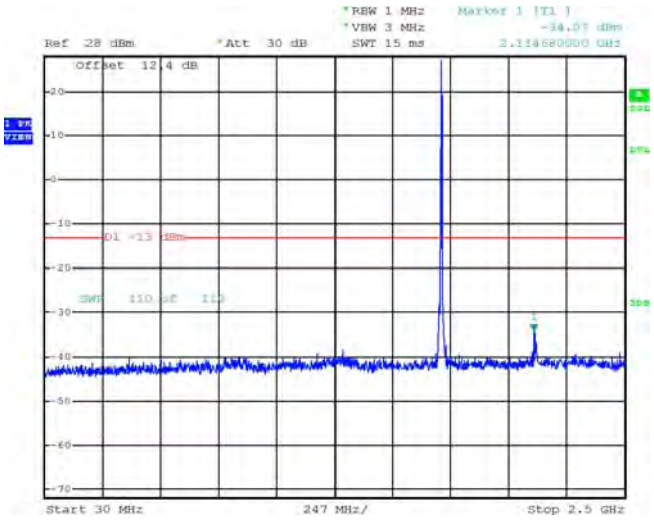


Figure 5-2a: Band 4, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

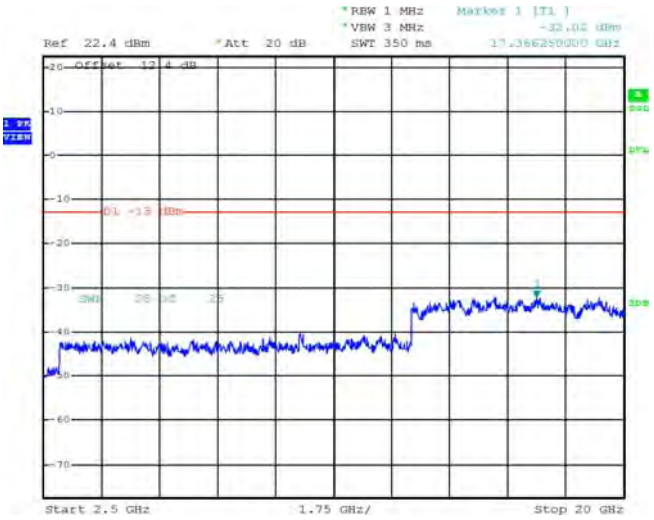


Figure 5-3a: Band 4, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)

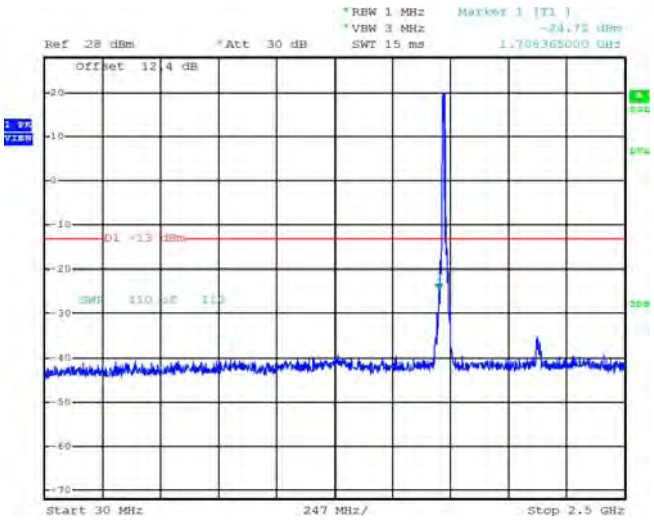
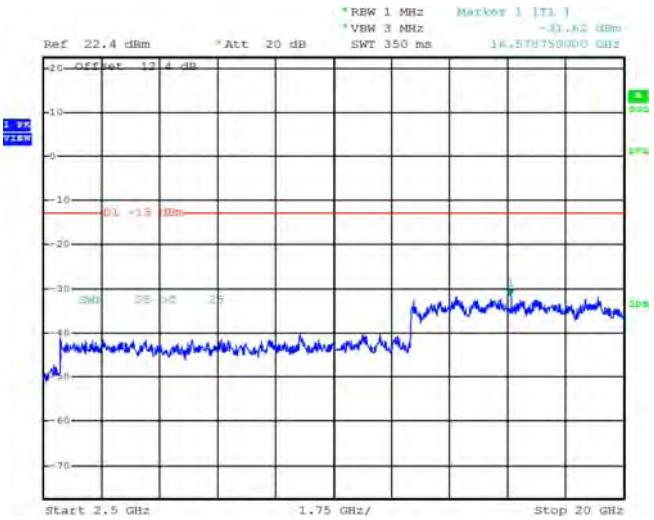


Figure 5-4a: Band 4, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-5a: Band 4, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

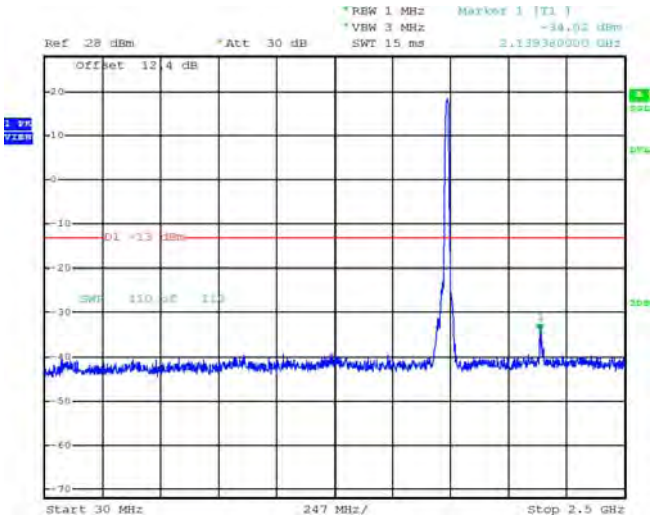


Figure 5-6a: Band 4, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

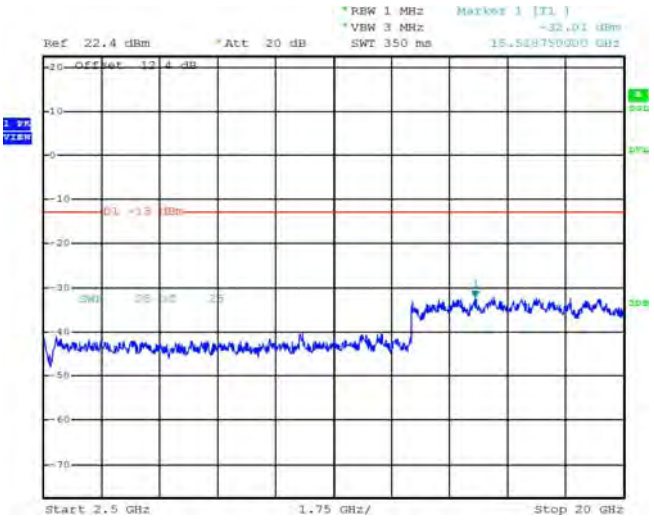


Figure 5-7a: Band 4, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

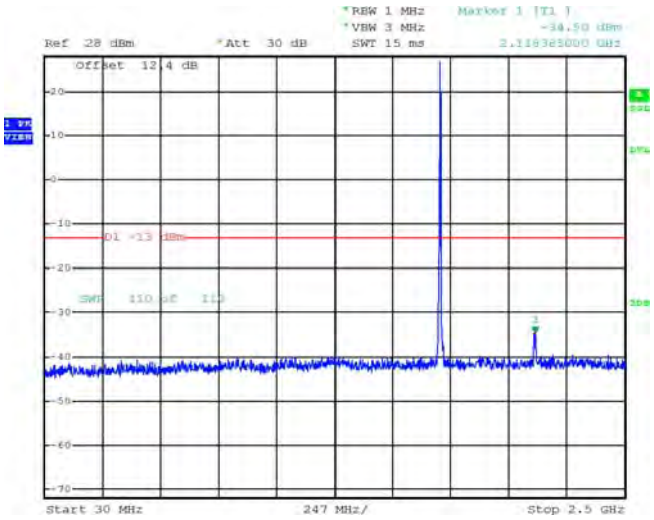
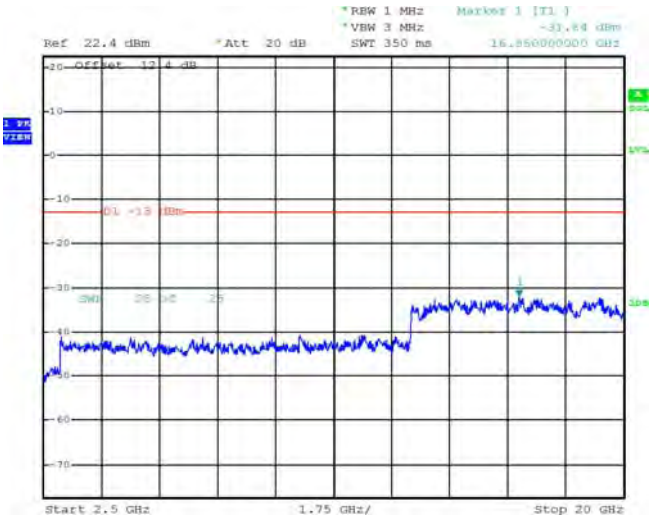


Figure 5-8a: Band 4, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-9a: Band 4, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 25)

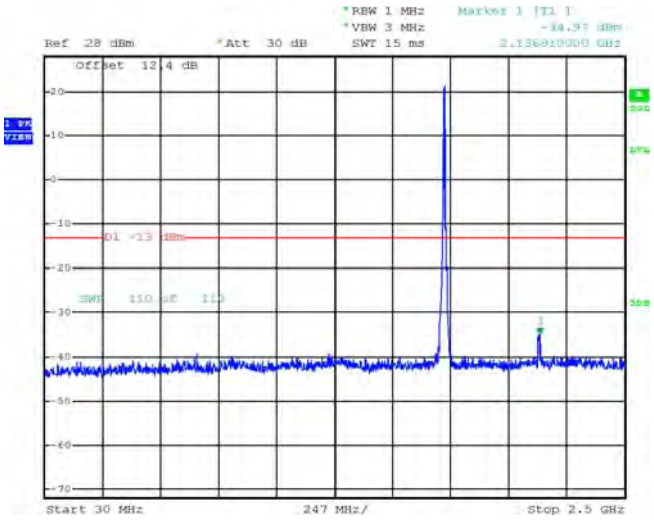


Figure 5-10a: Band 4, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 25)

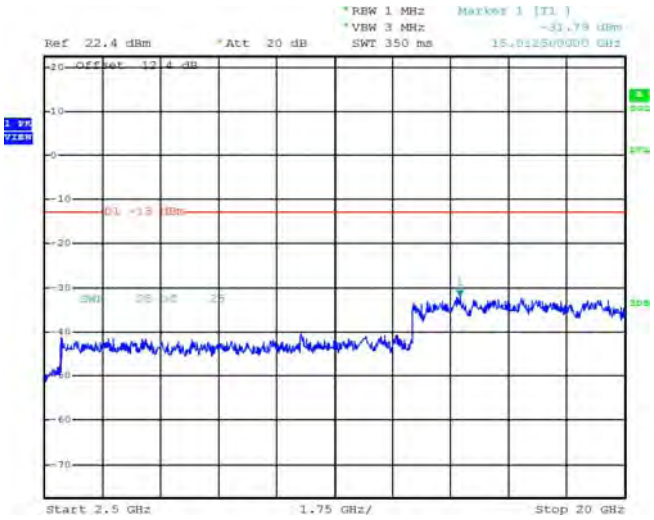


Figure 5-11a: Band 4, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)

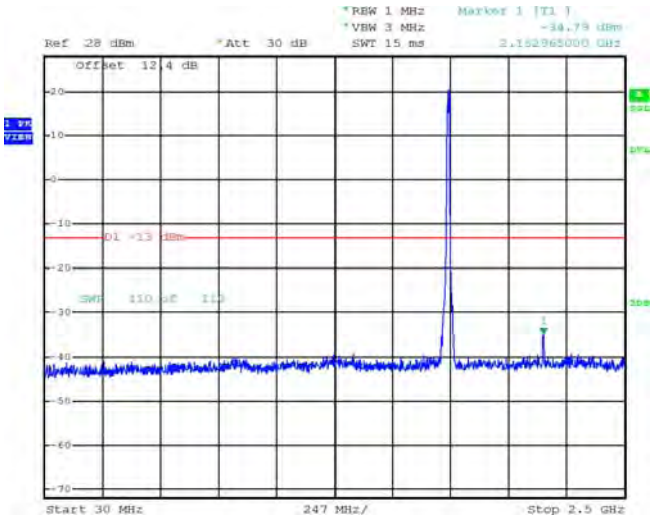
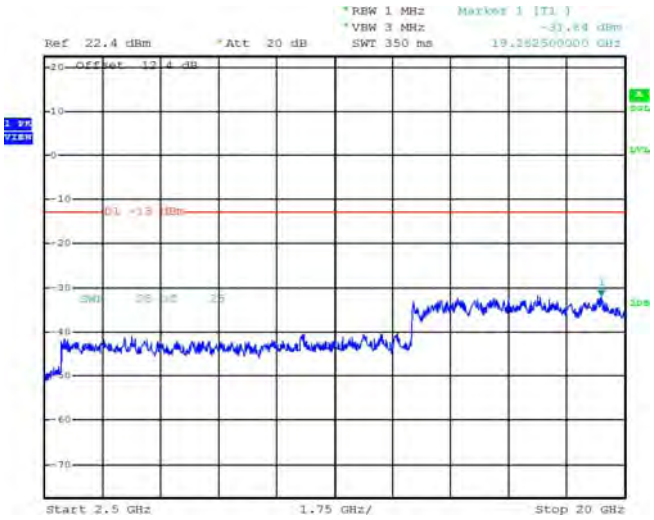


Figure 5-12a: Band 4, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-13a: Band 4, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)

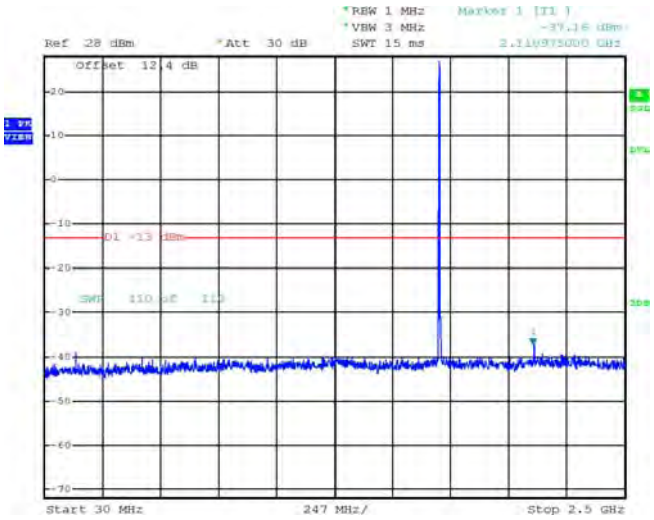


Figure 5-14a: Band 4, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)

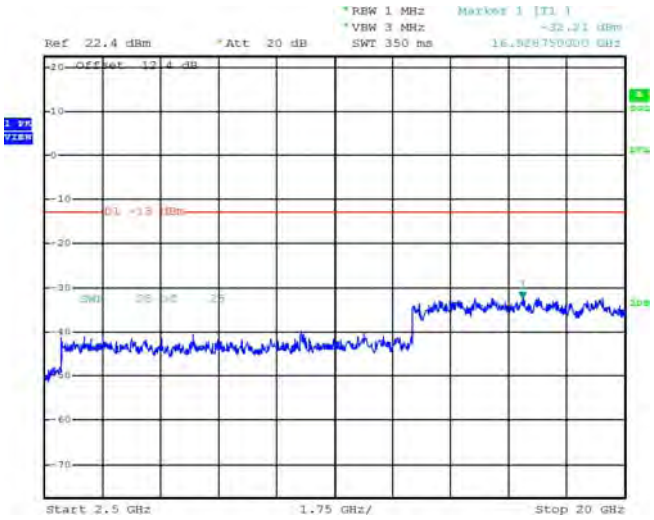


Figure 5-15a: Band 4, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)

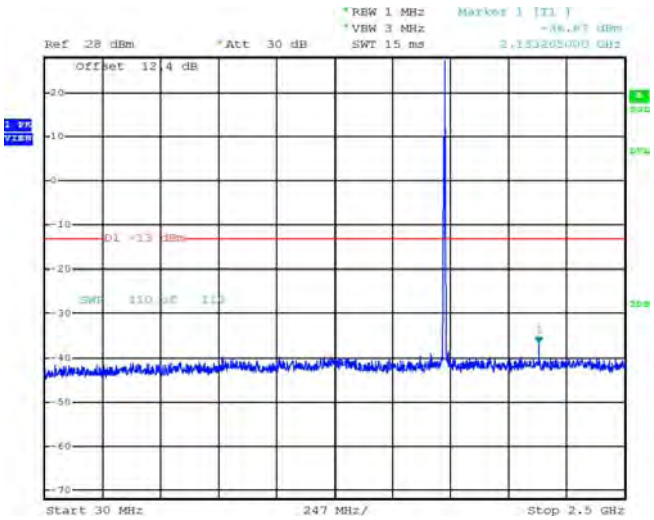
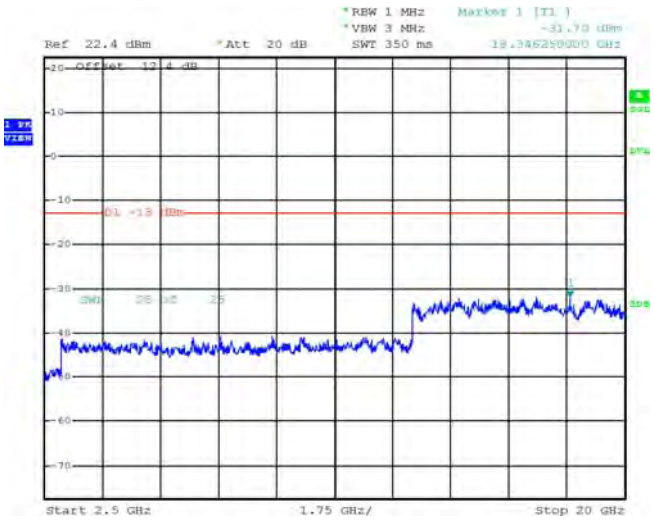


Figure 5-16a: Band 4, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-17a: Band 4, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)

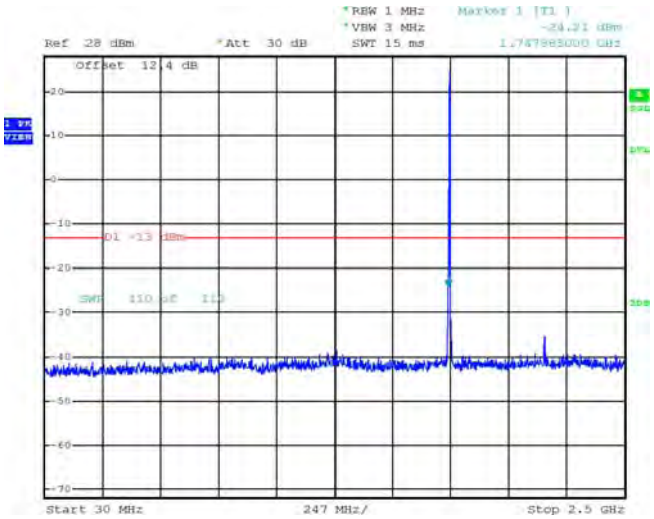
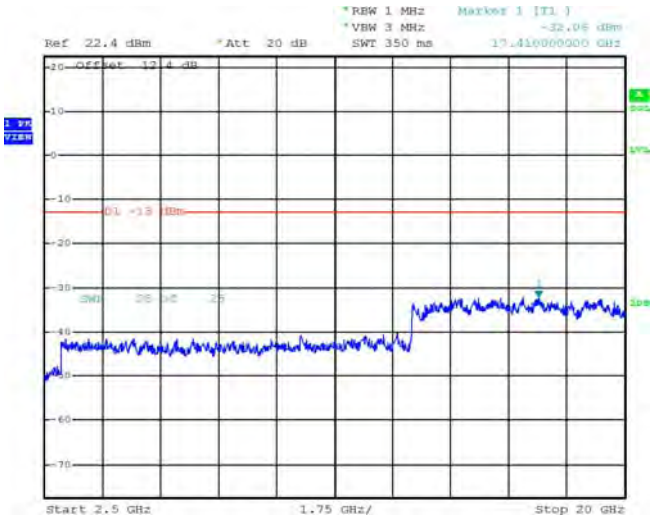


Figure 5-18a: Band 4, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-19a: Occupied Bandwidth, Band 4 Low Channel, 20MHz BW, RB=100

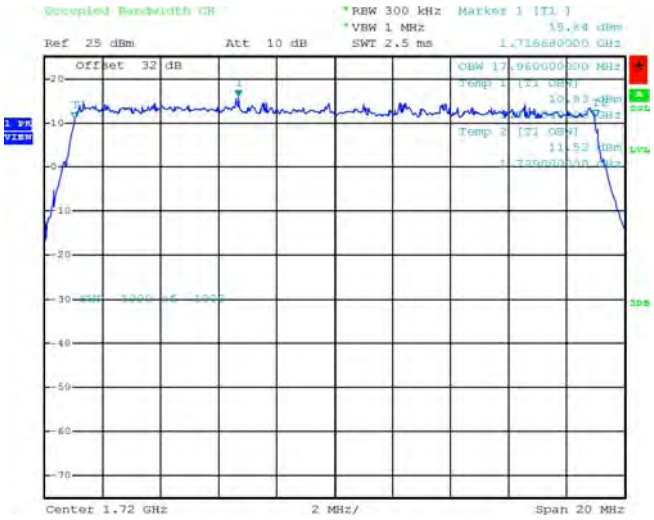


Figure 5-20a: Occupied Bandwidth, Band 4 Middle Channel, 20MHz BW, RB=100

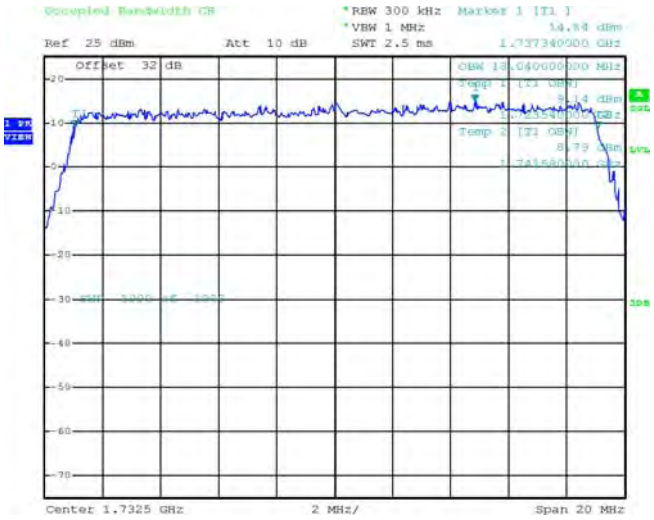
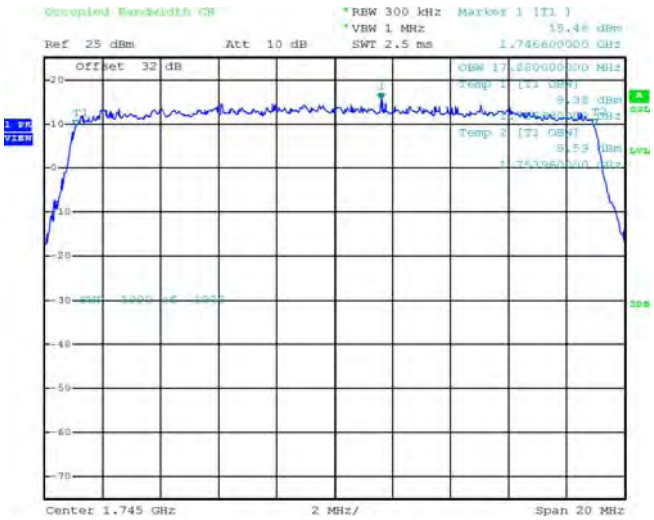


Figure 5-21a: Occupied Bandwidth, Band 4 High Channel, 20MHz BW, RB=100



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-22a: Occupied Bandwidth, Band 4 Low Channel, 10MHz BW, RB=50

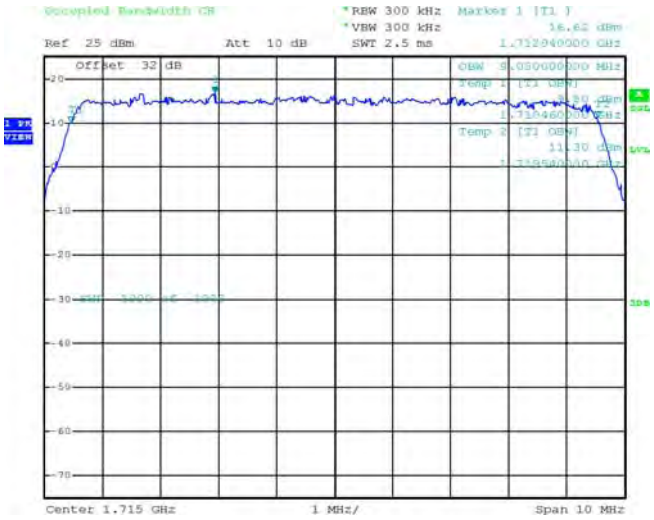


Figure 5-23a: Occupied Bandwidth, Band Middle Channel, 10MHz BW, RB=50

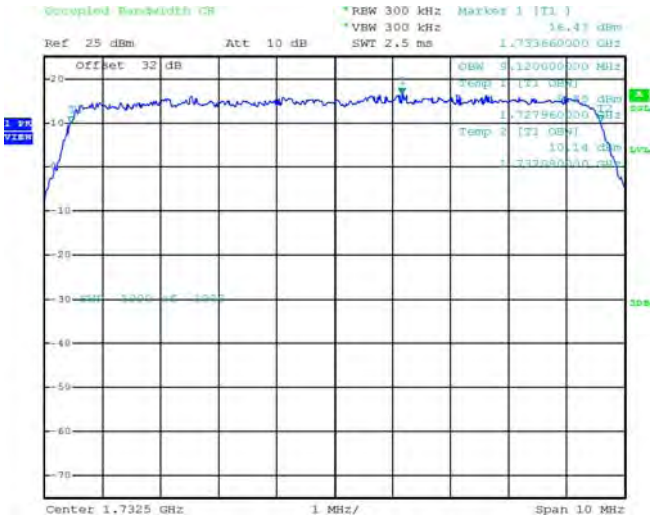
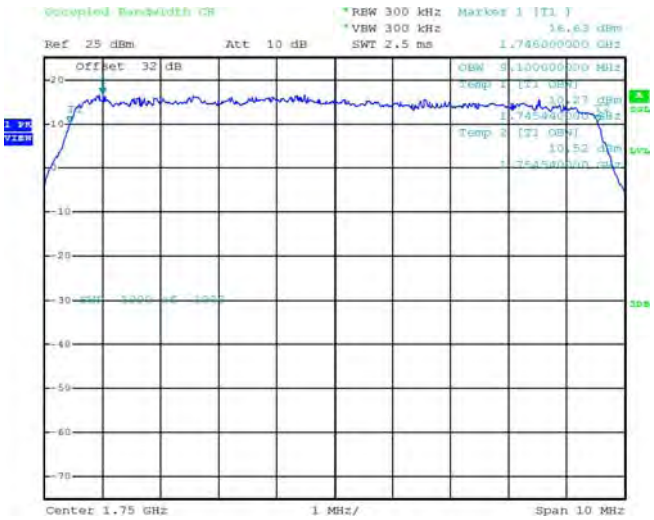


Figure 5-24a: Occupied Bandwidth, Band 4 High Channel, 10MHz BW, RB=50



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-25a: Occupied Bandwidth, Band 4 Low Channel, 1.4MHz BW, RB=6

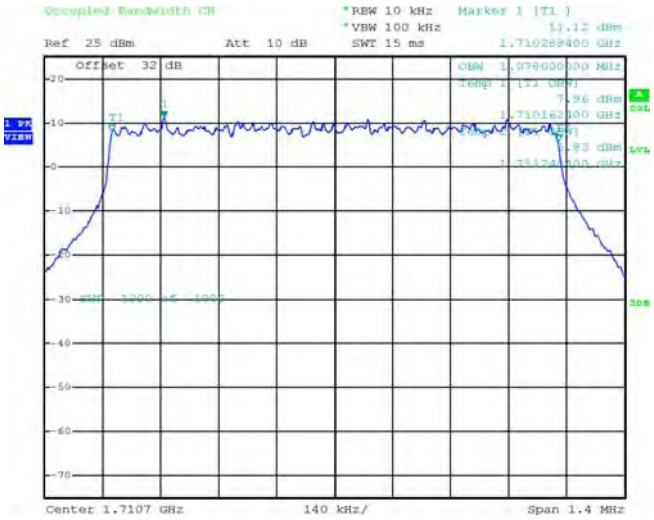


Figure 5-26a: Occupied Bandwidth, Band 4 Middle Channel, 1.4MHz BW, RB=6

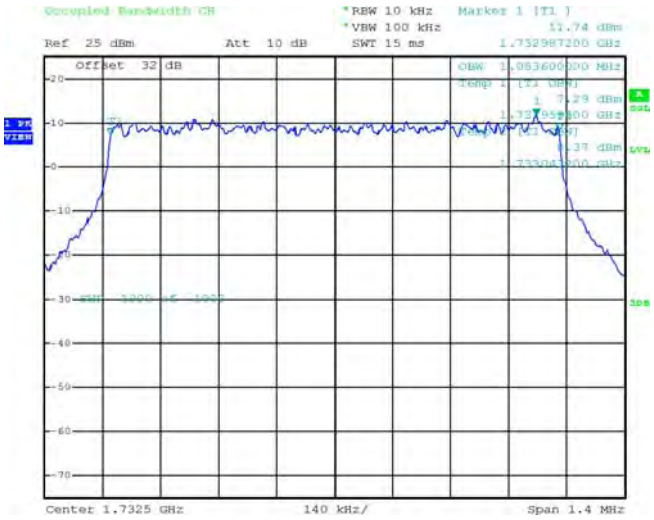
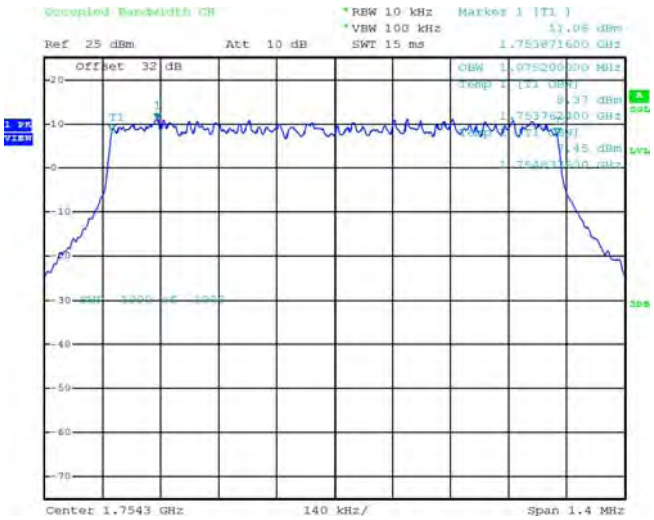


Figure 5-27a: Occupied Bandwidth, Band 4 High Channel, 1.4MHz BW, RB=6



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-28a: -26 dBc Bandwidth, Band 4 Low Channel, 20MHz BW, RB=100

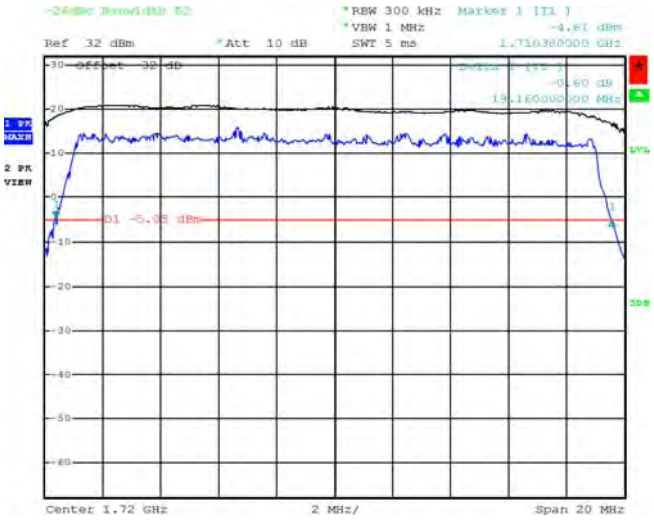


Figure 5-29a: -26 dBc Bandwidth, Band 4 Middle Channel, 20MHz BW, RB=100

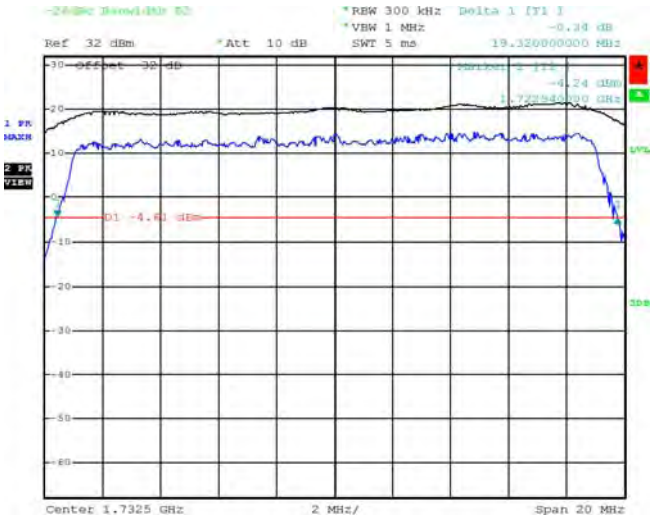


Figure 5-30a: -26 dBc Bandwidth, Band 4 High Channel, 20MHz BW, RB=100

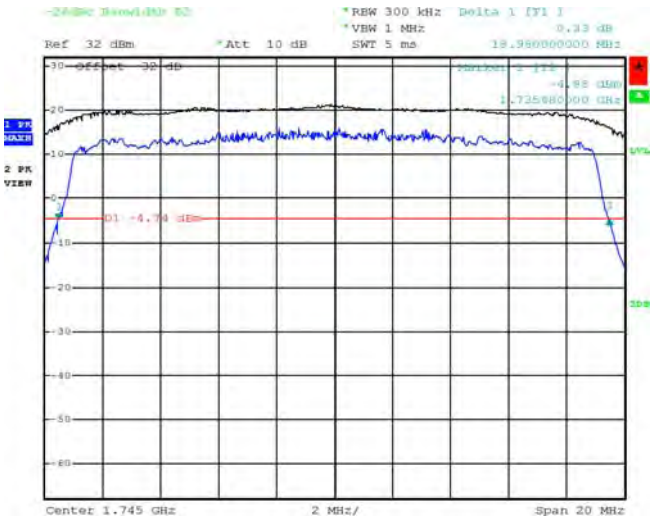
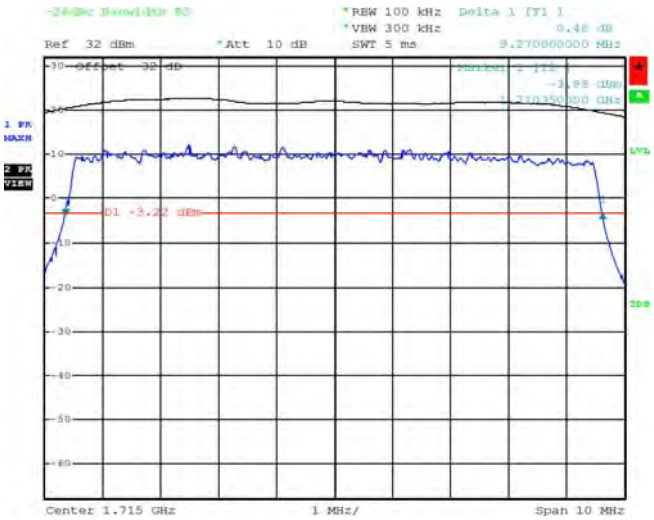


Figure 5-31a: -26 dBc Bandwidth, Band 4 Low Channel, 10MHz BW, RB=50



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-32a: -26 dBc Bandwidth, Band 4 Middle Channel, 10MHz BW, RB=50

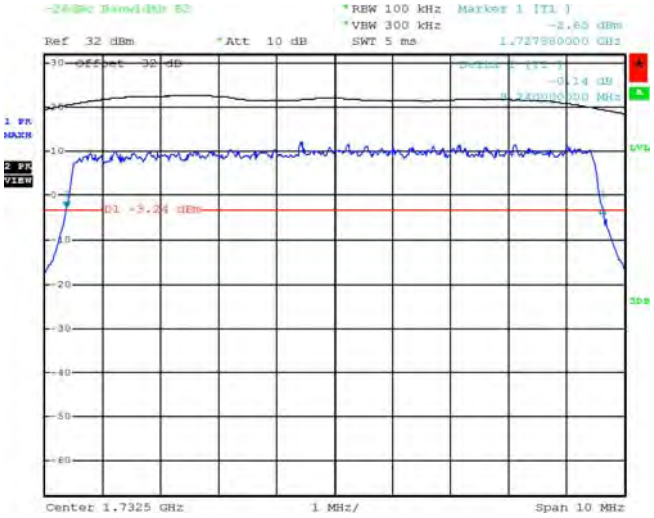


Figure 5-33a: -26 dBc Bandwidth, Band 4 High Channel, 10MHz BW, RB=50

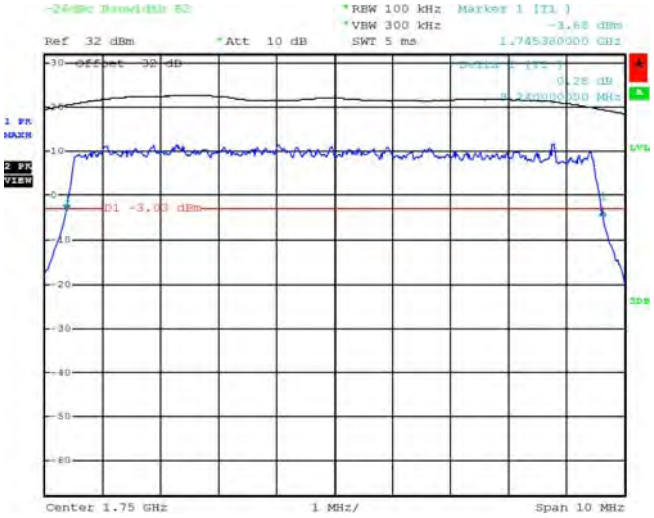


Figure 5-34a: -26 dBc Bandwidth, Band 4 Low Channel, 1.4MHz BW, RB=6

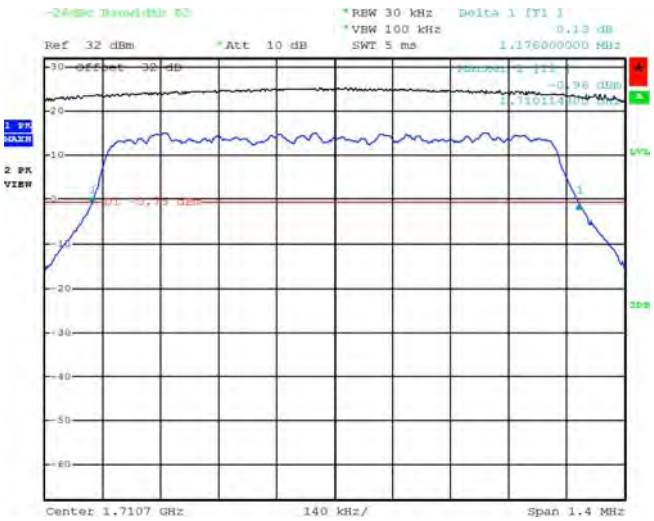
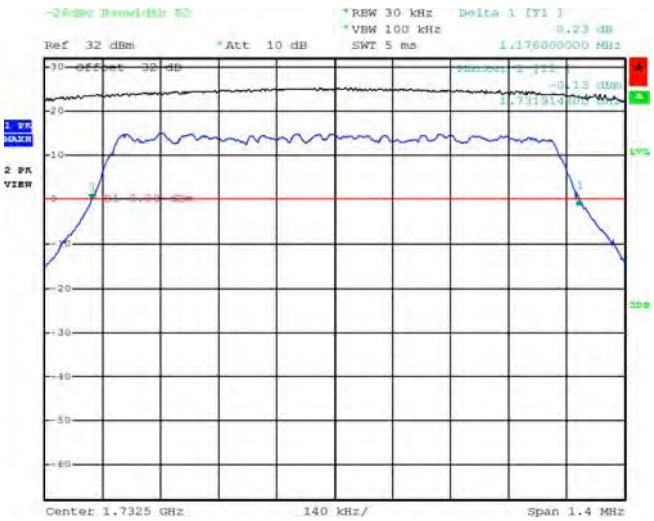


Figure 5-35a: -26 dBc Bandwidth, Band 4 Middle Channel, 1.4MHz BW, RB=6



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-36a: -26 dBc Bandwidth, Band 4 High Channel, 1.4MHz BW, RB=6

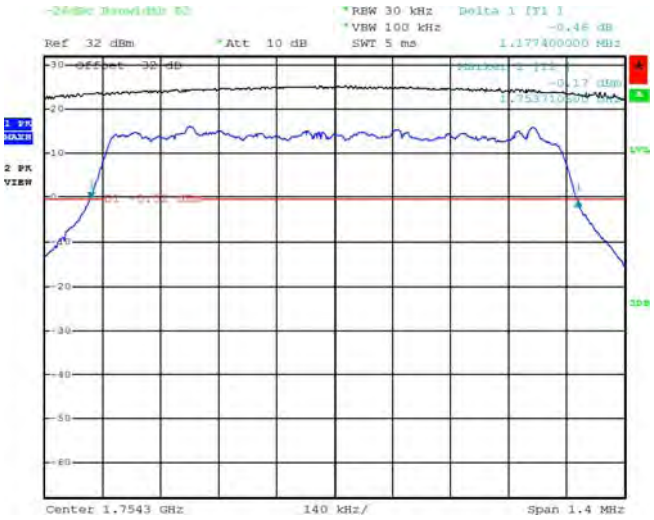


Figure 5-37a: Band 4 Low Channel Mask, 20MHz BW, RB=100

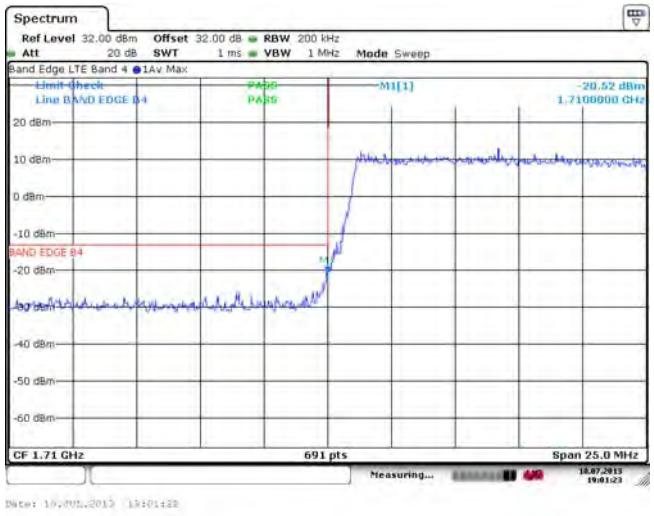
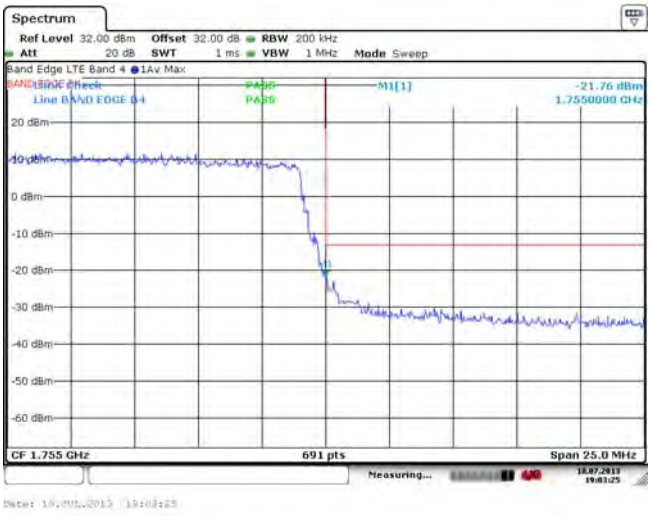


Figure 5-38a: Band 4 High Channel Mask, 20MHz BW, RB=100



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-39a: Band 4 Low Channel Mask, 10MHz BW, RB=50

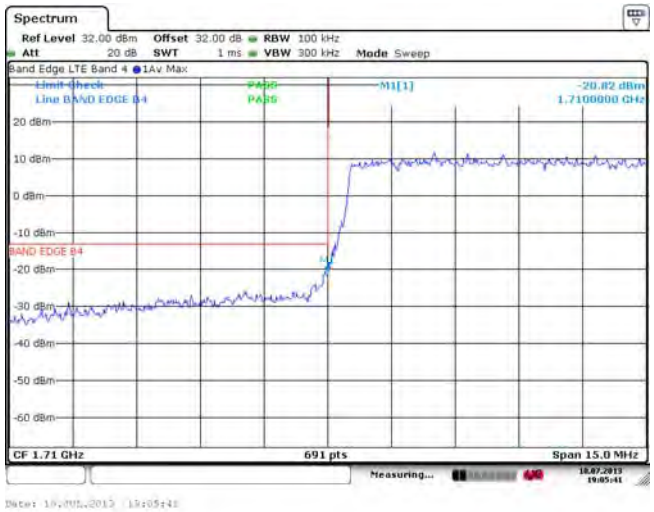


Figure 5-40a: Band 4 High Channel Mask, 10MHz BW, RB=50

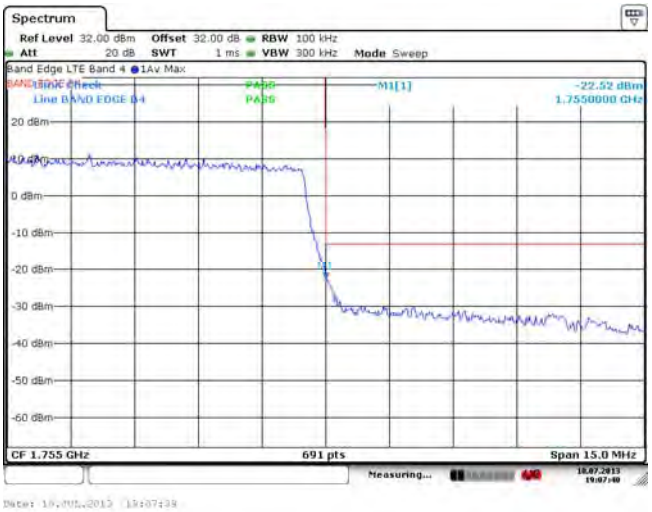


Figure 5-41a: Band 4 Low Channel Mask, 1.4MHz BW, RB=6

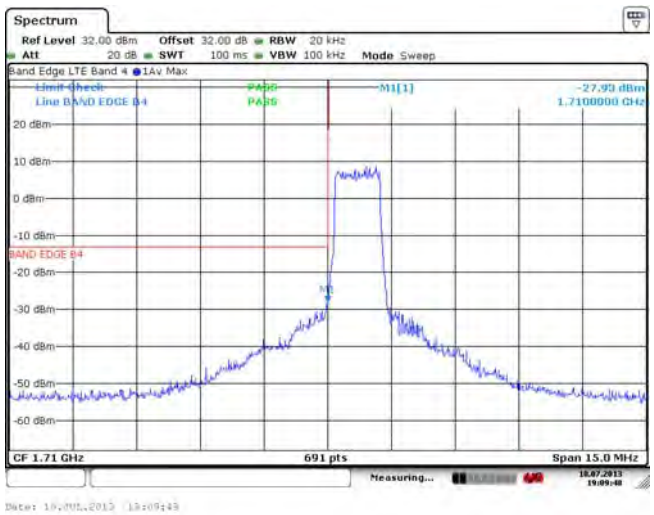
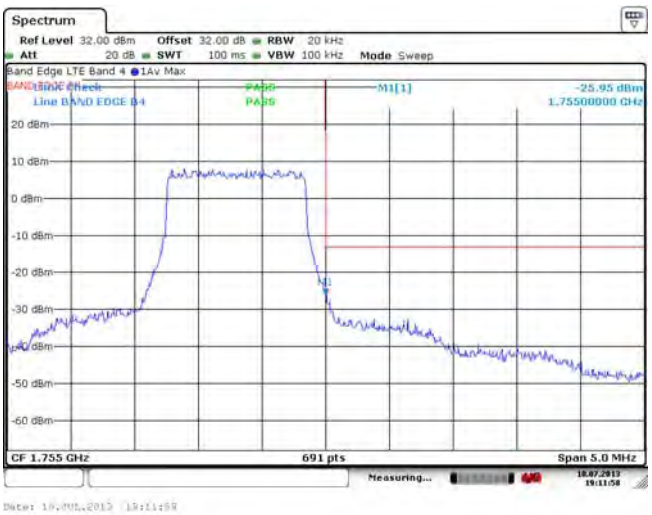


Figure 5-42a: Band 4 High Channel Mask, 1.4MHz BW, RB=6



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-43a: Band 4 Low Channel Mask, 20MHz BW, RB=1

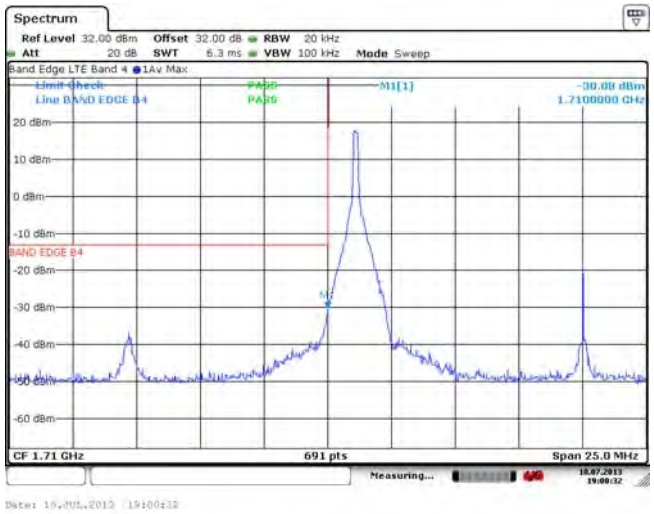


Figure 5-44a: Band 4 High Channel Mask, 20MHz BW, RB=1

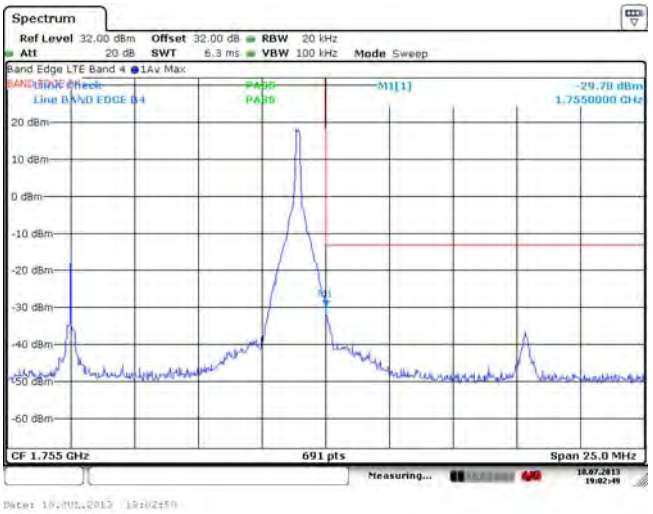


Figure 5-45a: Band 4 Mid Channel PAR, 20MHz BW, RB=50, QPSK

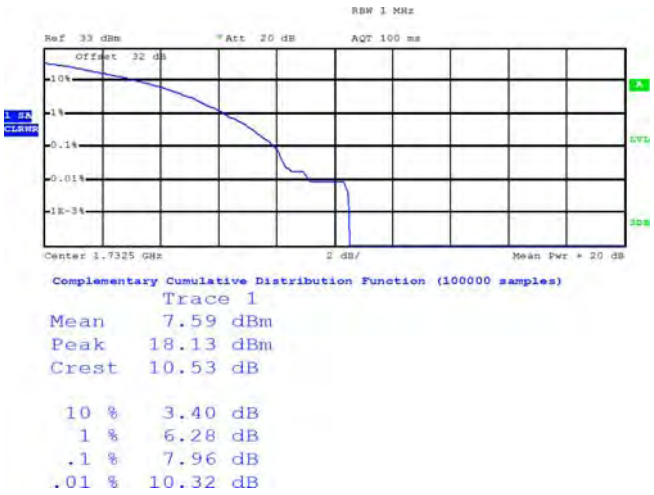
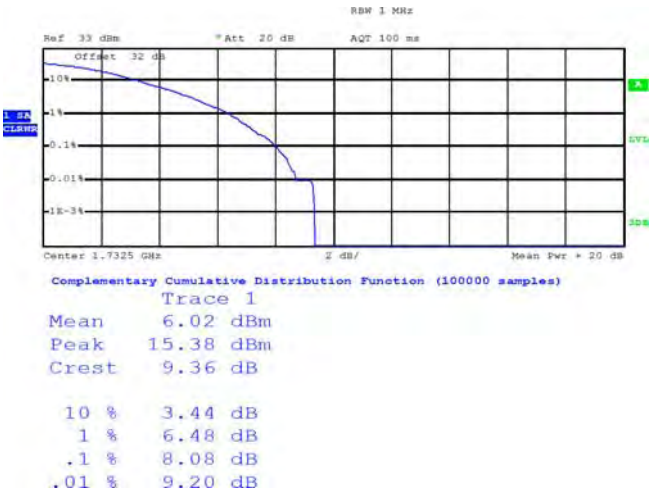


Figure 5-46a: Band 4 Middle Channel Mask, 20MHz BW, RB=100, 16-QAM



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-47a: Band 4 Mid Channel PAR, 10MHz BW, RB=25, QPSK

Figure 5-48a: Band 4 Mid Channel PAR, 10MHz BW, RB=50, 16-QAM

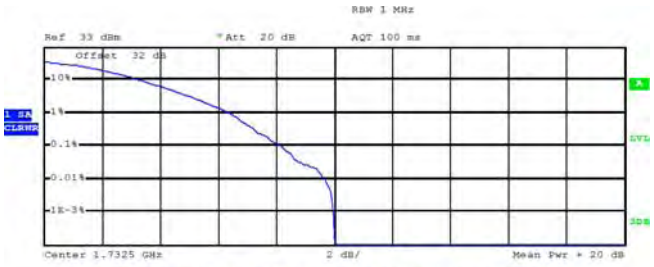


Figure 5-49a: Band 4 Mid Channel PAR, 1.4MHz BW, RB=3, QPSK

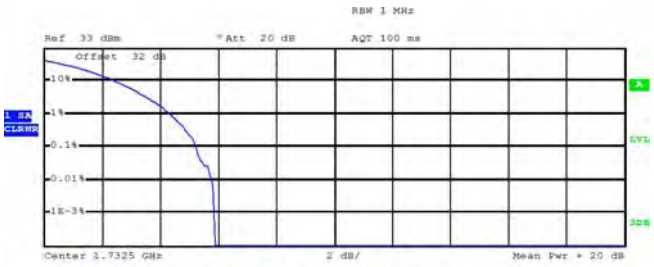
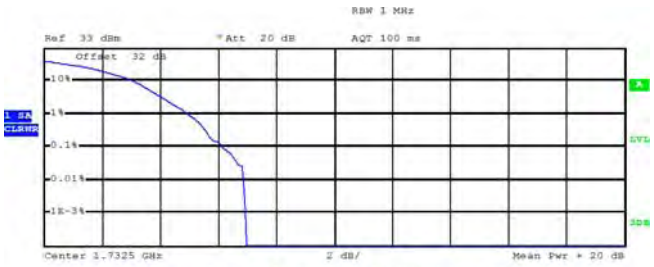


Figure 5-50a: Band 4 Middle Channel Mask, 5MHz BW, RB=6, 16-QAM



LTE Band 4 Conducted RF Emission Test Data cont'd

Figure 5-51a: Occupied Bandwidth, Band 4 Low Channel, 20MHz BW (RB= 100) 16-QAM

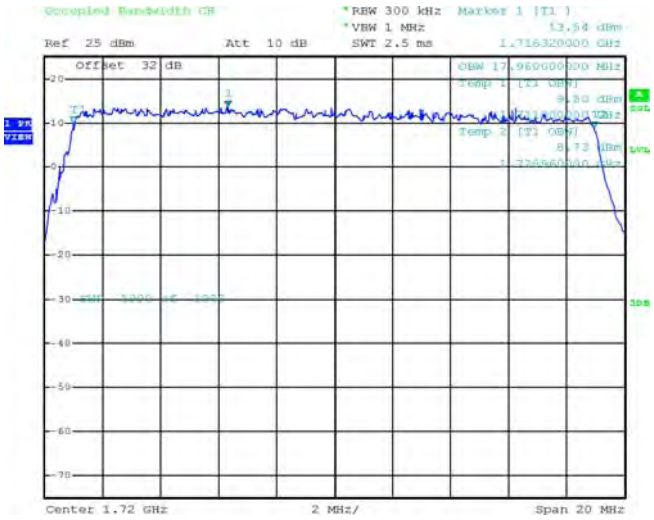


Figure 5-52a: Occupied Bandwidth, Band 4 Mid Channel, 20MHz BW (RB= 100) 16-QAM

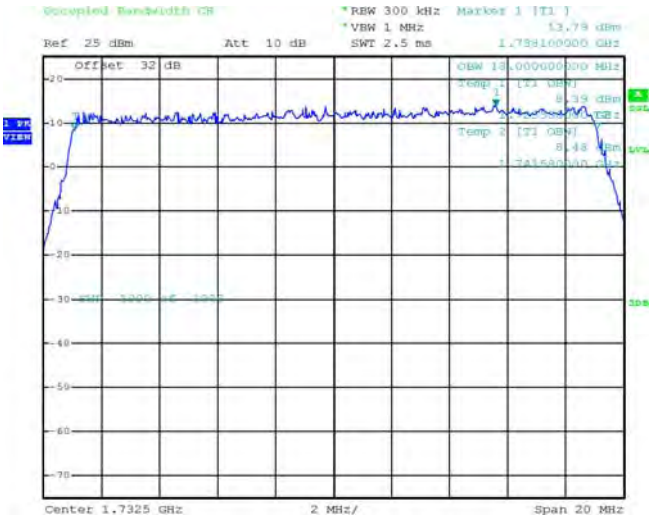
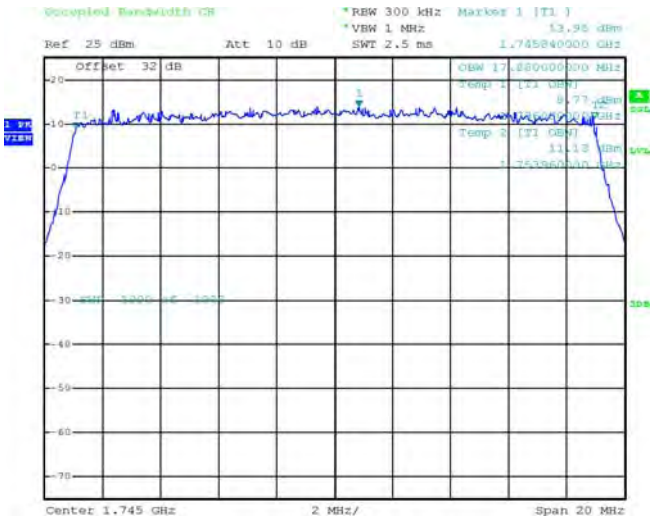
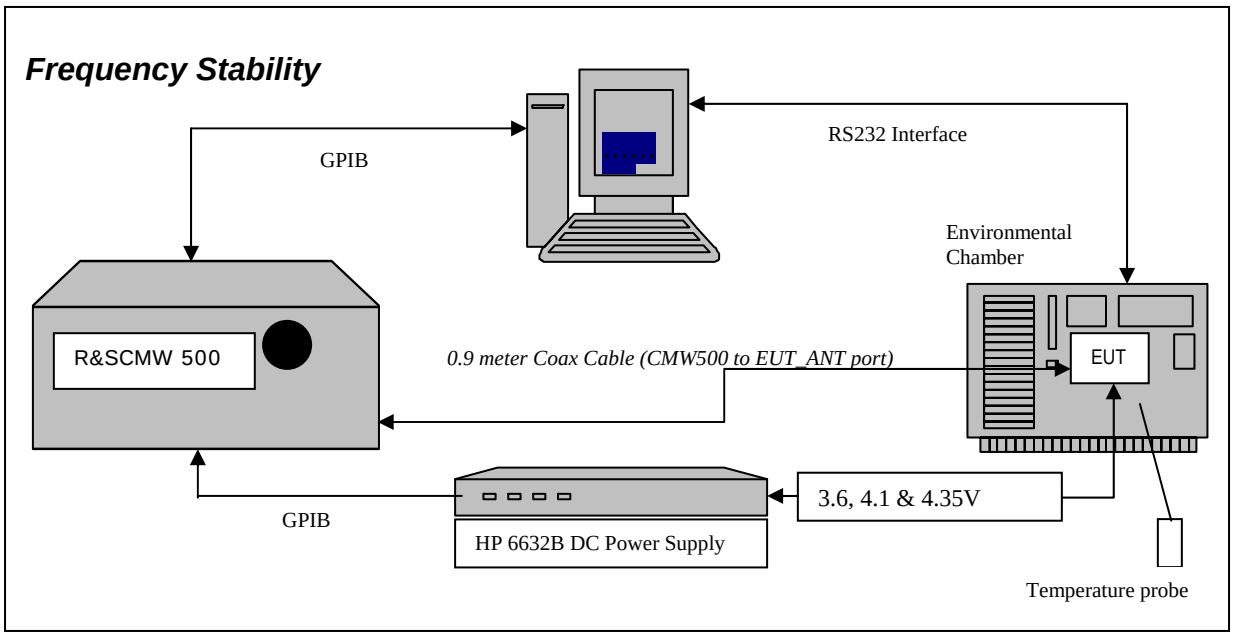


Figure 5-53a: Occupied Bandwidth, Band 4 High Channel, 20MHz BW (RB= 100) 16-QAM



APPENDIX 5B – LTE Band 4 FREQUENCY STABILITY TEST DATA

LTE Band 4 Frequency Stability Test Data



The following tests were performed on model RFV121LW.

The following measurements were performed by Chuan Tran.

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurements
2.1055 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

The EUT meets the requirements as stated in CFR 47 chapter 1, Section 27.54, CFR 47 and RSS-139, 6.3 Frequency Stability.
Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, power, data, temperatures, and stepped voltages controlled via a GPIB interface linked to the Environmental chamber, a DC power supply, and the Communications Test Set. A 0.9-metre coax cable was calibrated to characterize the insertion loss for the transmitted frequencies between the RF input/output of the CMW 500 and the EUT antenna port.

Test Setup:

The EUT was placed in the Temperature chamber and connected to CMW 500 outside as shown in the figure above. Dry air was pumped inside the temperature chamber to maintain a backpressure during the test. The EUT was kept in the off condition at all times except when the following measurements were to be made.

The chamber was switched on and the temperature was set to -30°C.
After the chamber stabilized at -30 °C there was a soak period of one hour to alleviate moisture in the chamber, the EUT voltage was enabled.
The system software recorded the frequency, power, and associated measurements.

A Computer system controlled the automated software. This application was given the command of activating all machines intrinsic to the temperature and voltage tests controlling the CMW 500 via the GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The EUT dialogue was passed through a serial connection.

The EUT repetitively transmitted 100 bursts for each set of programmed parameters recording temperature, voltage settings, and systematically selected frequencies. The power supply was cycled from minimum voltage 3.6 volts, to 4.1 volts and to 4.35 volts maximum voltage. The frequency error was measured at a maximum output power and recorded by the automated system test software.

The EUT output power and frequency was measured at 3.6 volts, 4.1 volts and 4.35 volts. The transmit frequency was varied in 3 steps consisting of 1720.0 MHz, 1732.5 MHz and 1745.0 MHz each was measured under 20 MHz bandwidth with maximum (100) resource blocks. This frequency was recorded in MHz and deviation from nominal, in Parts Per Million.

After the initial one-hour soak at the beginning of the tests, a period of thirty minutes soak was initialized between each ascending temperature step, before proceeding to the next measurement test cycle.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

29. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
30. Start test program
31. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
32. Set power supply voltage to 3.6 volts.
33. Set up CMW 500 Radio Communication Tester.
34. Command the CMW 500 to switch to the low channel.
35. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
36. EUT is commanded to Transmit 100 Bursts.
37. Software logs the following data from the CMW 500, power supply and temperature chamber: Traffic Channel Number, Traffic Channel Frequency, Power Level, Chamber Temperature, Supply Voltage, Power and Frequency Error.
38. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
39. Repeat steps 5 to 10 changing the supply voltage to 4.1 Volts
40. Increase temperature by 10°C and soak for 1/2 hour.
41. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
42. Repeat steps 5 to 10 changing the supply voltage to 4.35 volts

Procedure 5 to 10 was repeated at room temperature (20°C) with the power supply voltage set to 3.6, 4.1 and 4.35 volts

The maximum frequency error in the LTE band 4 measured was **-0.0118PPM**.

The following tests were performed on product RFV121LW.

Date of test: August 19, 2012

LTE Band 4 results: channels 20050, 20175 and 20300 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20050	1720.0	3.6	20	9.94	0.0058
20175	1732.5	3.6	20	-6.17	-0.0036
20300	1745.0	3.6	20	-4.81	-0.0028

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20050	1720.0	4.1	20	6.18	0.0036
20175	1732.5	4.1	20	-5.24	-0.0030
20300	1745.0	4.1	20	-5.89	-0.0034

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20050	1720.0	4.35	20	7.21	0.0042
20175	1732.5	4.35	20	6.84	0.0039
20300	1745.0	4.35	20	-6.90	-0.0040

LTE band 4 Results: channel 20050 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20050	1720.0	3.6	-30	7.27	0.0042
20050	1720.0	3.6	-20	6.38	0.0037
20050	1720.0	3.6	-10	15.99	0.0093
20050	1720.0	3.6	0	10.09	0.0059
20050	1720.0	3.6	10	**-20.21**	**-0.0118**
20050	1720.0	3.6	20	9.94	0.0058
20050	1720.0	3.6	30	7.51	0.0044
20050	1720.0	3.6	40	8.75	0.0051
20050	1720.0	3.6	50	8.07	0.0047
20050	1720.0	3.6	60	6.54	0.0038
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20050	1720.0	4.1	-30	8.14	0.0047
20050	1720.0	4.1	-20	6.59	0.0038
20050	1720.0	4.1	-10	7.67	0.0045
20050	1720.0	4.1	0	7.85	0.0046
20050	1720.0	4.1	10	7.88	0.0046
20050	1720.0	4.1	20	6.18	0.0036
20050	1720.0	4.1	30	6.58	0.0038
20050	1720.0	4.1	40	7.54	0.0044
20050	1720.0	4.1	50	6.49	0.0038
20050	1720.0	4.1	60	6.81	0.0040
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20050	1720.0	4.35	-30	-6.69	-0.0039
20050	1720.0	4.35	-20	7.55	0.0044
20050	1720.0	4.35	-10	6.18	0.0036
20050	1720.0	4.35	0	-9.63	-0.0056
20050	1720.0	4.35	10	7.21	0.0042
20050	1720.0	4.35	20	7.21	0.0042
20050	1720.0	4.35	30	6.11	0.0036
20050	1720.0	4.35	40	7.28	0.0042
20050	1720.0	4.35	50	9.73	0.0057
20050	1720.0	4.35	60	8.80	0.0051

LTE band 4 Results: channel 20175 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20175	1732.5	3.6	-30	-5.59	-0.0032
20175	1732.5	3.6	-20	4.81	0.0028
20175	1732.5	3.6	-10	4.53	0.0026
20175	1732.5	3.6	0	8.80	0.0051
20175	1732.5	3.6	10	16.67	0.0096
20175	1732.5	3.6	20	-6.17	-0.0036
20175	1732.5	3.6	30	-4.42	-0.0026
20175	1732.5	3.6	40	5.14	0.0030
20175	1732.5	3.6	50	5.85	0.0034
20175	1732.5	3.6	60	5.31	0.0031
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20175	1732.5	4.1	-30	6.21	0.0036
20175	1732.5	4.1	-20	-16.02	-0.0092
20175	1732.5	4.1	-10	6.28	0.0036
20175	1732.5	4.1	0	6.24	0.0036
20175	1732.5	4.1	10	7.38	0.0043
20175	1732.5	4.1	20	-5.24	-0.0030
20175	1732.5	4.1	30	5.89	0.0034
20175	1732.5	4.1	40	6.87	0.0040
20175	1732.5	4.1	50	5.31	0.0031
20175	1732.5	4.1	60	-9.61	-0.0055
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20175	1732.5	4.35	-30	9.33	0.0054
20175	1732.5	4.35	-20	7.87	0.0045
20175	1732.5	4.35	-10	5.72	0.0033
20175	1732.5	4.35	0	-3.56	-0.0021
20175	1732.5	4.35	10	7.82	0.0045
20175	1732.5	4.35	20	6.84	0.0039
20175	1732.5	4.35	30	-3.08	-0.0018
20175	1732.5	4.35	40	14.28	0.0082
20175	1732.5	4.35	50	-5.64	-0.0033
20175	1732.5	4.35	60	8.41	0.0049

LTE band 4 Results: channel 20300 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20300	1745.0	3.6	-30	-5.97	-0.0034
20300	1745.0	3.6	-20	-6.61	-0.0038
20300	1745.0	3.6	-10	-7.48	-0.0043
20300	1745.0	3.6	0	6.34	0.0036
20300	1745.0	3.6	10	-5.79	-0.0033
20300	1745.0	3.6	20	-4.81	-0.0028
20300	1745.0	3.6	30	3.36	0.0019
20300	1745.0	3.6	40	-2.29	-0.0013
20300	1745.0	3.6	50	5.99	0.0034
20300	1745.0	3.6	60	-8.07	-0.0046
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20300	1745.0	4.1	-30	-9.57	-0.0055
20300	1745.0	4.1	-20	-7.75	-0.0044
20300	1745.0	4.1	-10	-6.75	-0.0039
20300	1745.0	4.1	0	-4.53	-0.0026
20300	1745.0	4.1	10	20.08	0.0115
20300	1745.0	4.1	20	-5.89	-0.0034
20300	1745.0	4.1	30	-4.02	-0.0023
20300	1745.0	4.1	40	-5.19	-0.0030
20300	1745.0	4.1	50	-9.11	-0.0052
20300	1745.0	4.1	60	6.22	0.0036
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20300	1745.0	4.35	-30	-8.60	-0.0049
20300	1745.0	4.35	-20	-8.07	-0.0046
20300	1745.0	4.35	-10	6.71	0.0038
20300	1745.0	4.35	0	4.21	0.0024
20300	1745.0	4.35	10	-6.45	-0.0037
20300	1745.0	4.35	20	-6.90	-0.0040
20300	1745.0	4.35	30	-4.63	-0.0027
20300	1745.0	4.35	40	5.89	0.0034
20300	1745.0	4.35	50	-6.14	-0.0035
20300	1745.0	4.35	60	5.64	0.0032

APPENDIX 5C – LTE Band 4 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following tests were performed on model RFV121LW.

Date of Test: October 22, 2013
The following measurements were performed by Rex Zhang.
The environmental tests conditions were: Temperature: 25.0 °C
Relative Humidity: 29.5 %
The BlackBerry® smartphone was standalone, USB port pointing up with the LCD facing to the RX antenna when the turntable is at 0 degree position.
Measurements were performed with QPSK and 16QAM modulations. The smallest test margins are reported below.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

LTE band 4, 20MHz BW, RB=1, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20050	1720.00	4	Horn	V	-23.38	-23.38	V-V	-15.35	24.60	0.29	30.00	5.40
F0	20050	1720.00	4	Horn	H	-27.18		H-H	-14.82				
F0	20175	1732.50	4	Horn	V	-23.24	-23.24	V-V	-14.55	25.38	0.35	30.00	4.62
F0	20175	1732.50	4	Horn	H	-28.25		H-H	-14.25				
F0	20299	1744.90	4	Horn	V	-23.71	-23.71	V-V	-15.38	24.29	0.27	30.00	5.71
F0	20299	1744.90	4	Horn	H	-28.21		H-H	-15.05				

LTE band 4, 20MHz BW, RB=1, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20050	1720.00	4	Horn	V	-24.62	-24.62	V-V	-16.52	23.48	0.22	30.00	6.52
F0	20050	1720.00	4	Horn	H	-28.31		H-H	-15.94				
F0	20175	1732.50	4	Horn	V	-24.47	-24.47	V-V	-15.75	24.18	0.26	30.00	5.82
F0	20175	1732.50	4	Horn	H	-29.55		H-H	-15.45				
F0	20299	1744.90	4	Horn	V	-24.67	-24.67	V-V	-16.05	23.56	0.23	30.00	6.44
F0	20299	1744.90	4	Horn	H	-29.44		H-H	-15.78				

Radiated Power Test Data Results

LTE band 4, 1.4 MHz BW, RB=1, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	19957	1710.70	4	Horn	V	-23.59	-23.59	V-V	-15.21	24.94	0.31	30.00	5.06
F0	19957	1710.70	4	Horn	H	-27.37		H-H	-14.48				
F0	20175	1732.50	4	Horn	V	-23.14	-23.14	V-V	-14.42	**25.51**	**0.36**	30.00	4.49
F0	20175	1732.50	4	Horn	H	-28.33		H-H	-14.12				
F0	20392	1754.20	4	Horn	V	-24.60	-24.60	V-V	-15.47	24.14	0.26	30.00	5.86
F0	20392	1754.20	4	Horn	H	-28.89		H-H	-15.20				

LTE band 4, 1.4 MHz BW, RB=1, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	19957	1710.70	4	Horn	V	-24.73	-24.73	V-V	-16.37	23.80	0.24	30.00	6.20
F0	19957	1710.70	4	Horn	H	-28.60		H-H	-15.62				
F0	20175	1732.50	4	Horn	V	-24.39	-24.39	V-V	-15.70	24.24	0.27	30.00	5.76
F0	20175	1732.50	4	Horn	H	-29.58		H-H	-15.39				
F0	20392	1754.20	4	Horn	V	-25.69	-25.69	V-V	-16.56	23.04	0.20	30.00	6.96
F0	20392	1754.20	4	Horn	H	-30.09		H-H	-16.30				

Radiated Power Test Data Results

LTE band 4, 5MHz BW, RB=1, QPSK modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	19975	1712.50	4	Horn	V	-23.17	-23.17	V-V	-15.49	24.51	0.28	30.00	5.49
F0	19975	1712.50	4	Horn	H	-27.47		H-H	-14.91				
F0	20175	1732.50	4	Horn	V	-22.87	-22.87	V-V	-15.24	25.11	0.32	30.00	4.89
F0	20175	1732.50	4	Horn	H	-28.14		H-H	-14.52				
F0	20374	1752.40	4	Horn	V	-24.11	-24.11	V-V	-16.12	23.80	0.24	30.00	6.20
F0	20374	1752.40	4	Horn	H	-28.68		H-H	-15.54				

LTE band 4, 5MHz BW, RB=1, 16-QAM modulation

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	19975	1712.50	4	Horn	V	-23.67	-23.67	V-V	-15.98	24.04	0.25	30.00	5.96
F0	19975	1712.50	4	Horn	H	-27.82		H-H	-15.38				
F0	20175	1732.50	4	Horn	V	-23.62	-23.62	V-V	-16.00	24.38	0.27	30.00	5.62
F0	20175	1732.50	4	Horn	H	-28.89		H-H	-15.25				
F0	20374	1752.40	4	Horn	V	-24.92	-24.92	V-V	-16.90	23.00	0.20	30.00	7.00
F0	20374	1752.40	4	Horn	H	-29.21		H-H	-16.34				

Radiated Emissions Test Data Results cont'd

Date of Test: July 6, 2013

The following measurements were performed by Feras Obeid.

The environmental test conditions were: Temperature: 26.4 ºC
Relative Humidity: 17.3 %

The BlackBerry® smartphone was standalone, USB port point up with LCD facing to the RX antenna when the turntable is at 0 degree position

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in LTE band 4 with QPSK and 16-QAM modulations for 5MHz BW (channel 19975, 20175 and 20374 with RB = 1).

All emissions were at least 25.0 dB below the limit.

Date of Test: July 9, 2013

The following measurements were performed by Mahmood Ahmed
The environmental test conditions were: Temperature: 29.5 ºC
Relative Humidity: 30.4 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 20 GHz.

The BlackBerry® smartphone was standalone, USB port point up with LCD facing to the RX antenna when the turntable is at 0 degree position

Measurements were performed in LTE band 4 with QPSK and 16-QAM modulations for 5MHz BW (channel 19975, 20175 and 20374 with RB = 1).

All emissions were at least 25.0 dB below the limit.

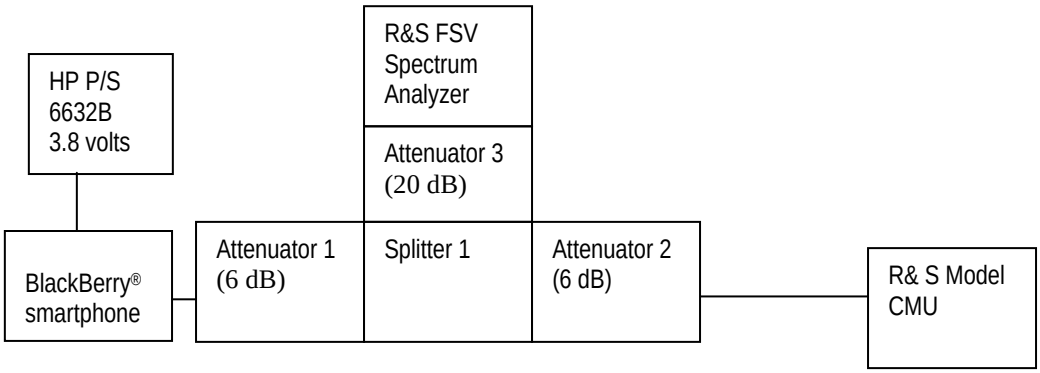
APPENDIX 6A– LTE Band 17 CONDUCTED RF EMISSIONS TEST DATA/PLOTS

LTE Band 17 Conducted RF Emission Test Data

The following tests were performed on model RFV121LW.

This appendix contains measurement data pertaining to conducted spurious emissions, 99% power bandwidth and the channel mask.

Test Setup Diagram



A reference offset of 31.4 dB was applied to the spectrum analyzer reference level for the attenuators and coaxial cable loss in the test circuit.

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

Date of Test: July 10 - 15, 2013.

The environmental test conditions were: Temperature: 21.8 – 22.5ºC
Relative Humidity: 19 – 19.2 %

The following measurements were performed by Chuan Tran.

LTE Band 17 Conducted RF Emission Test Data cont'd

Emission Designator Table

Frequency Range (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
706.5-713.5	23.22	4M48G7D	LTE B17	5	QPSK
706.5-713.5	22.47	4M47D7W	LTE B17	5	16QAM
709-711	23.34	8M95G7D	LTE B17	10	QPSK
709-711	22.80	8M93D7W	LTE B17	10	16QAM

The conducted spurious emissions – As per 47 CFR 2.202, CFR 2.1046, CFR 27.53 CFR 27.54, CFR 27.50, RSS-139 were measured from 30 MHz to 20 GHz.

–26 dBc Bandwidth and Occupied Bandwidth (99%)

the modulation spectrum was measured by both methods of 99% power bandwidth and –26 dBc bandwidth for each 5MHz and 10MHz with different number of resource blocks for LTE band 17.

QPSK and 16-QAM modulations were applied to each of the bandwidths. Only the worst case measurements are documented in this report.

A minimum resource block condition was also measured (RB = 1).

The resolution bandwidth required for out-of-band emissions in the 1 MHz bands immediately outside and adjacent to the frequency block, was determined to be at least 1% of the emission bandwidth.

The worst case –26dBc bandwidth for LTE band 17 was measured to be 9.320MHz. Results were derived in a 100 kHz resolution bandwidth.

On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.

Test Data for LTE Band 17 selected Frequencies in 10MHz BW (RB = 50)

LTE Band 17 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	
	QPSK	QPSK	16-QAM
709.0	9.32	**9.100**	**9.120**
710.0	9.26	9.080	9.080
711.0	9.28	9.080	9.080

Peak to Average Ratio (PAR)

For each 5MHz and 10MHz with different number of resource blocks as per scalable bandwidths for LTE band 17, the peak to average ratio was measured on the low, middle and high channels with QPSK modulation.

On any frequency outside the frequency block and outside the adjacent 1 MHz bands, a resolution bandwidth of at least 1 MHz was applied.

The worst case measured was 9.94 dB on in 10MHz bandwidth with 50 resource blocks.

Measurement Plots for LTE Band 17

See Figures 6-1a to 6-12a for the plots of the conducted spurious emissions.

See Figures 6-19a to 6-24a and 6-37a to 6-39a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.

See Figures 6-25a to 6-32a for the plots of the Channel mask.

See Figures 6-33a to 6-36a for the plots of the Peak to Average Ratio.

LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-1a: Band 17, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

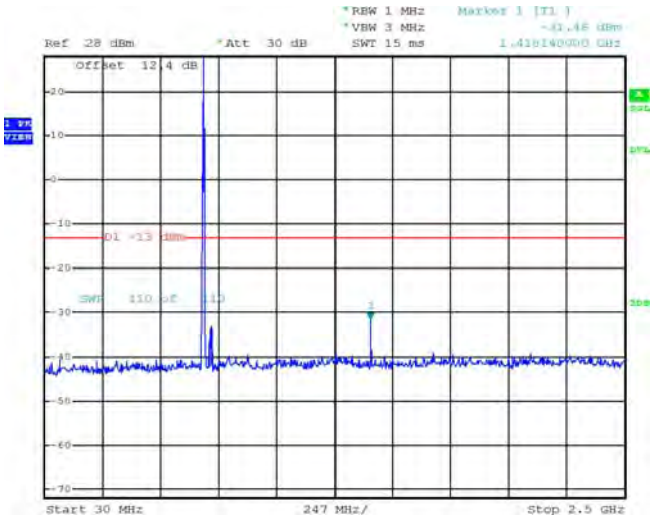


Figure 6-2a: Band 17, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

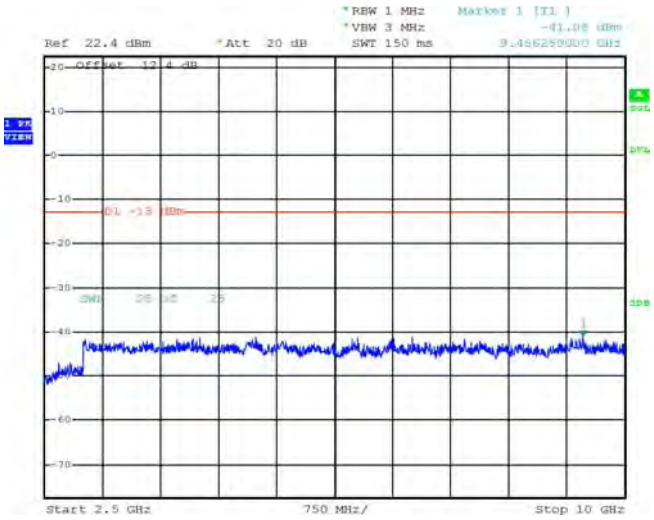


Figure 6-3a: Band 17, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)

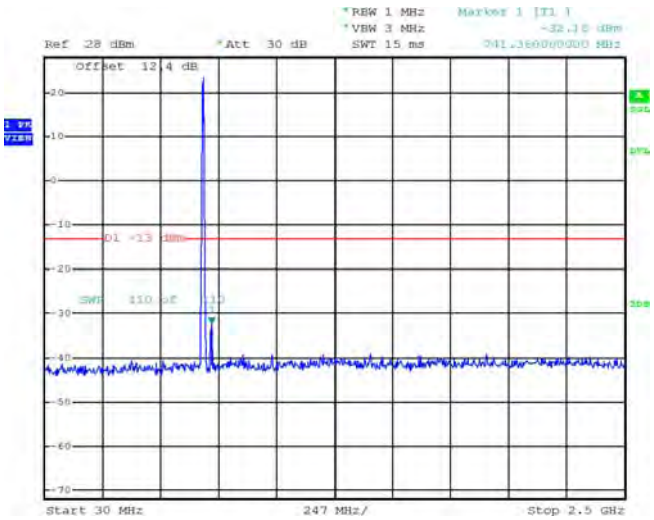
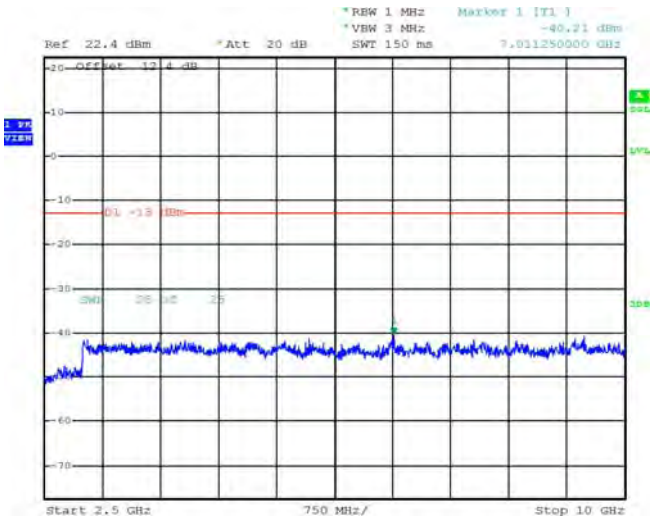


Figure 6-4a: Band 17, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-5a: Band 17, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

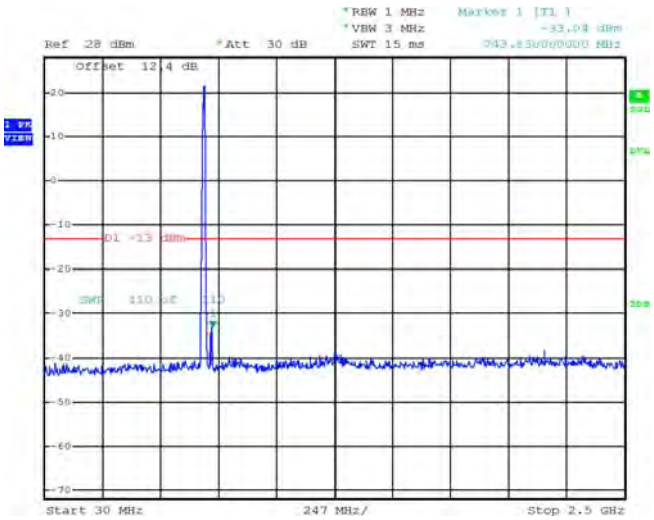


Figure 6-6a: Band 17, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

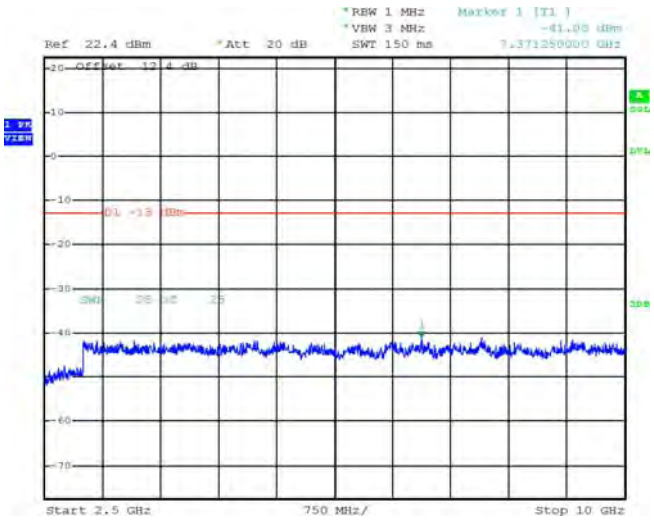


Figure 6-7a: Band 17, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)

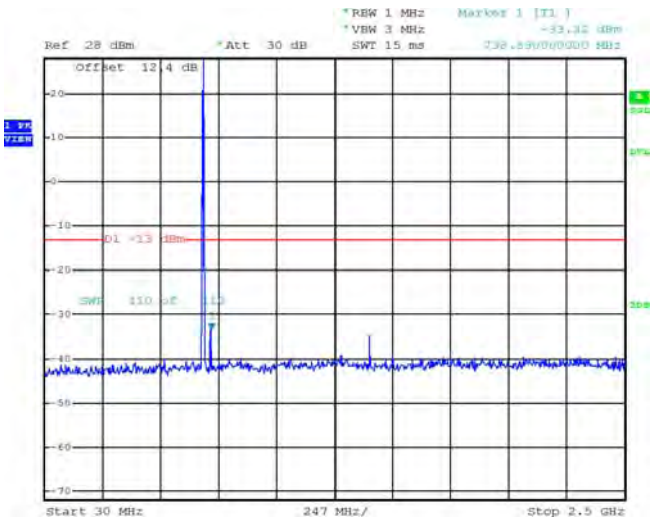
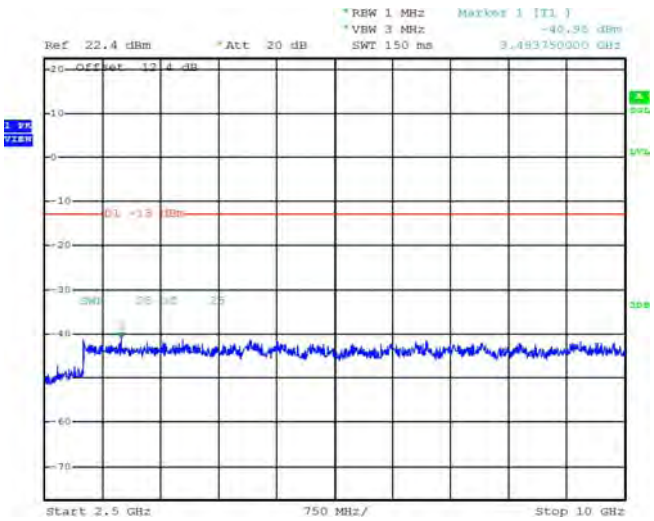


Figure 6-8a: Band 17, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-9a: Band 17, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 15)

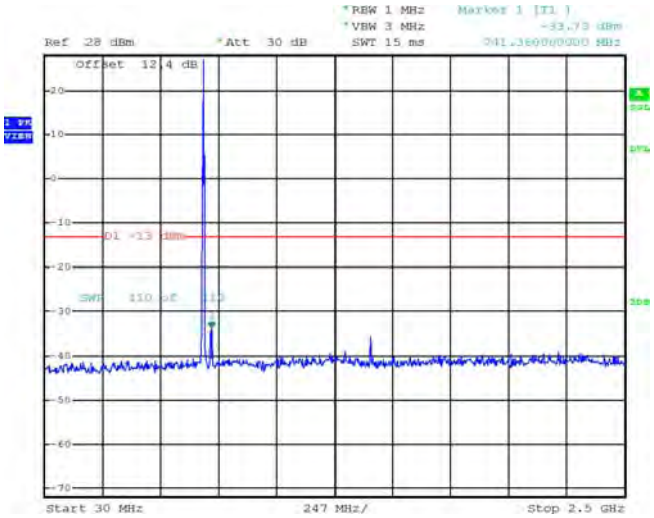


Figure 6-10a: Band 17, Spurious Conducted Emissions, High Channel, 5MHz BW (RB= 15)

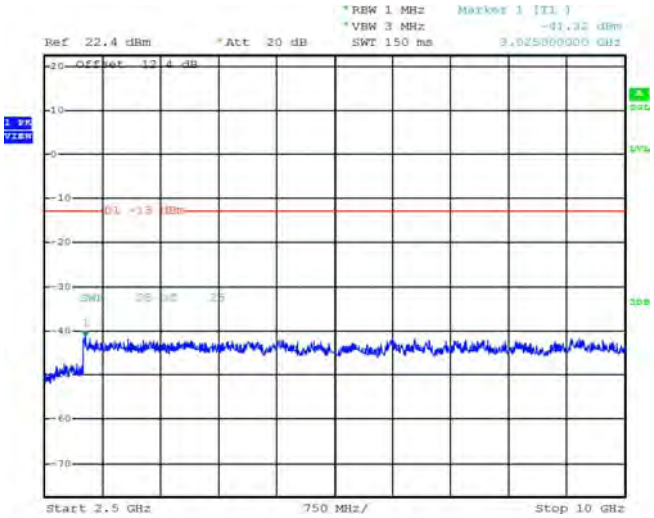


Figure 6-11a: Band 17, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)

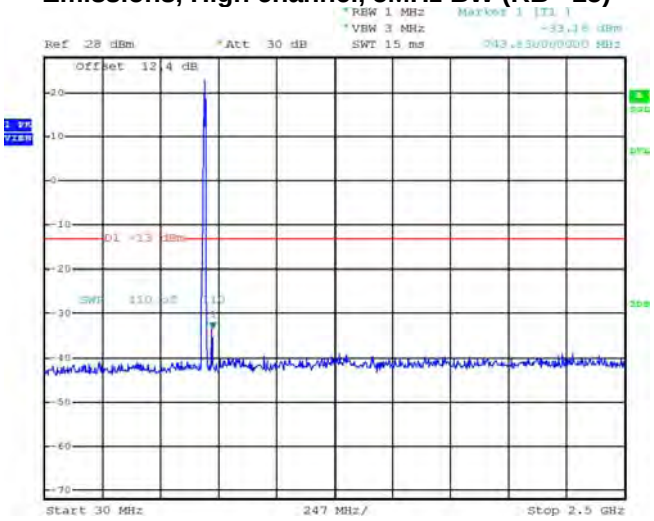
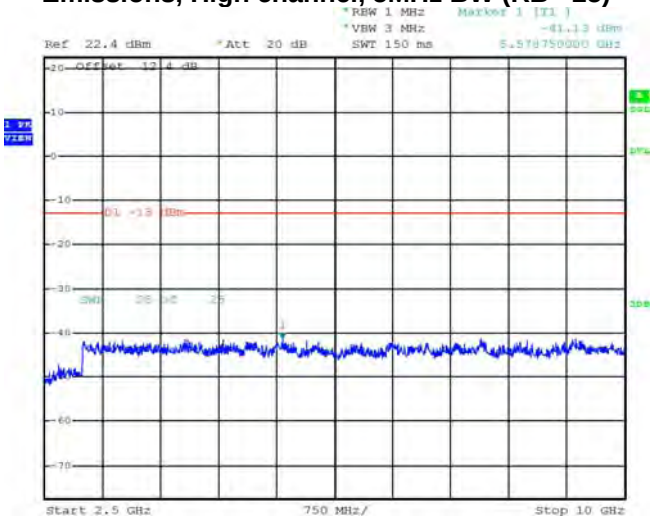


Figure 6-12a: Band 17, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-13a: Occupied Bandwidth, Band 17 Low Channel, 10MHz BW, RB=50

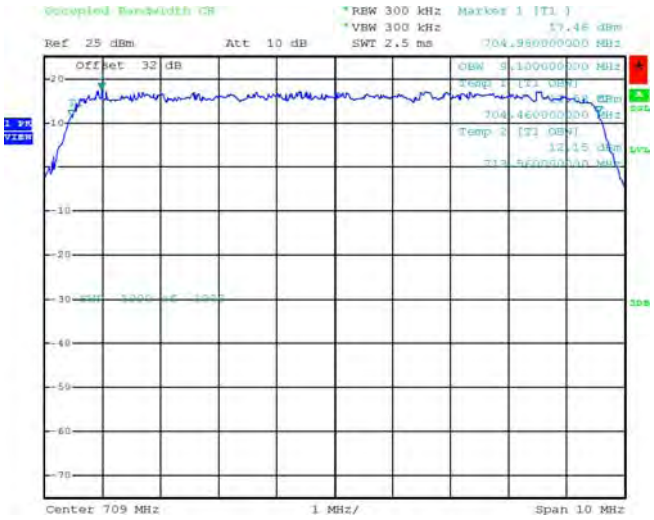


Figure 6-14a: Occupied Bandwidth, Band 17 Middle Channel, 10MHz BW, RB=50

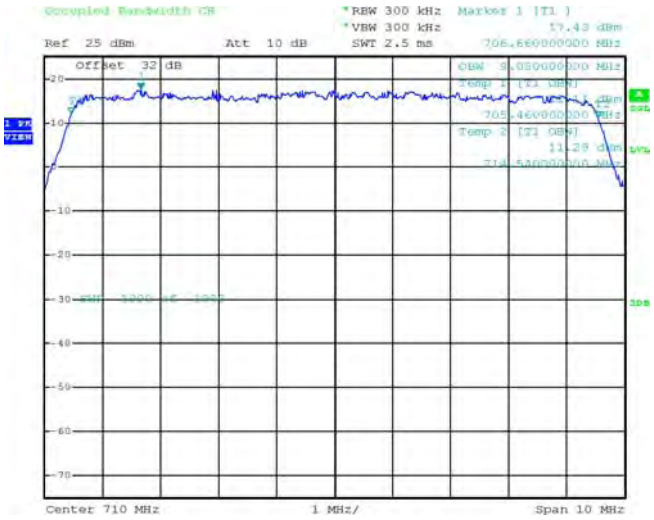
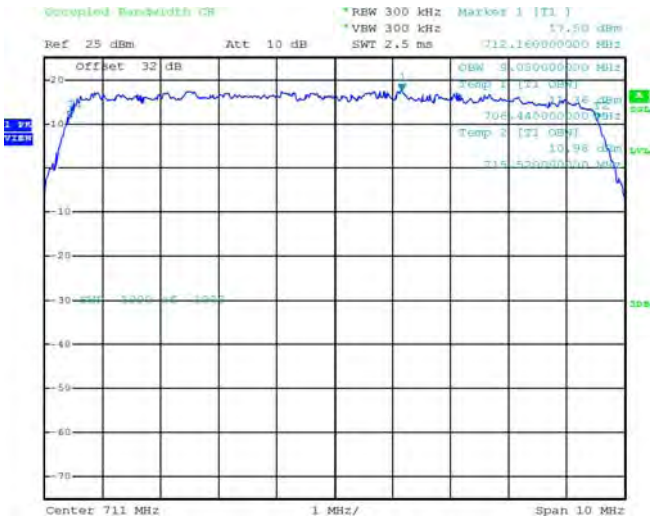


Figure 6-15a: Occupied Bandwidth, Band 17 High Channel, 10MHz BW, RB=50



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-16a: Occupied Bandwidth, Band 5 Low Channel, 5MHz BW, RB=25

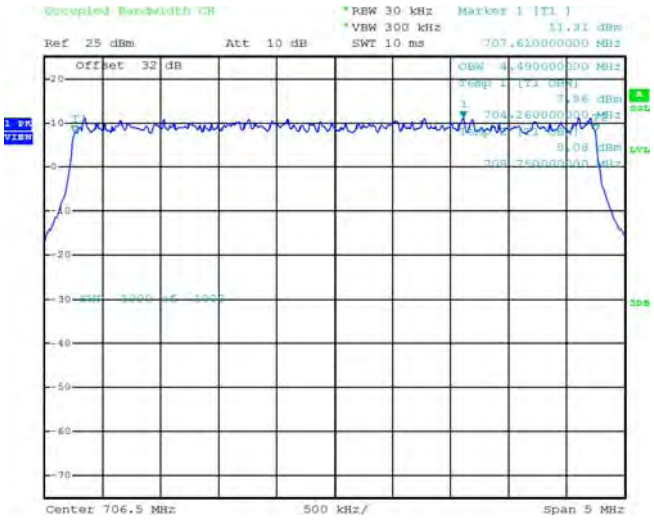


Figure 6-17a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25

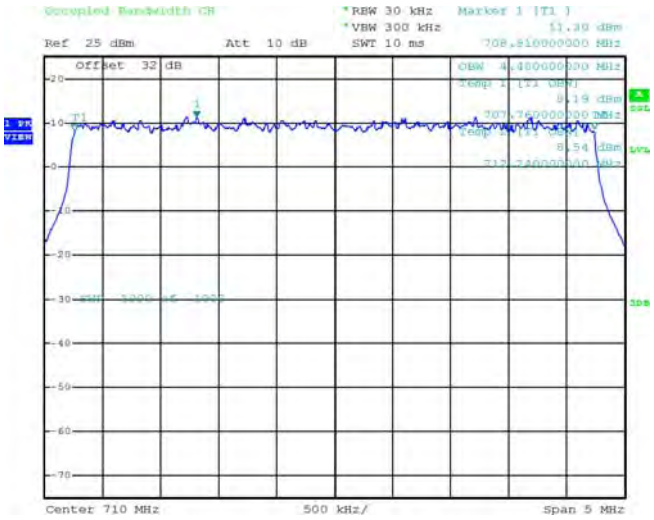
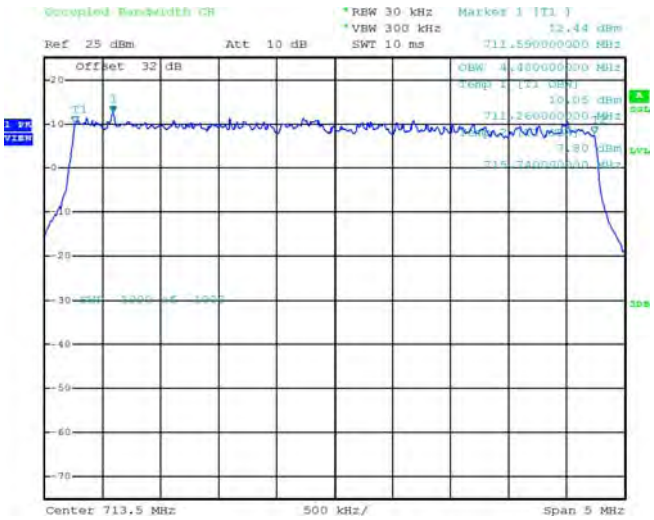


Figure 6-18a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-19a: -26 dBc Bandwidth, Band 17 Low Channel, 10MHz BW, RB=50

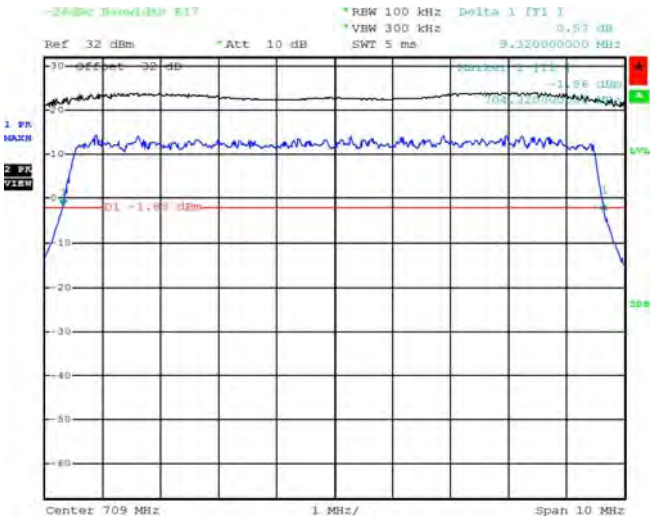


Figure 6-20a: -26 dBc Bandwidth, Band 17 Middle Channel, 10MHz BW, RB=50

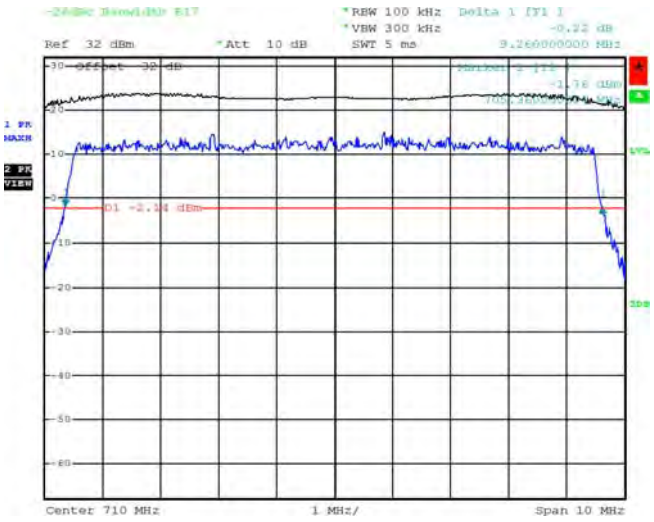


Figure 6-21a: -26 dBc Bandwidth, Band 17 High Channel, 10MHz BW, RB=50

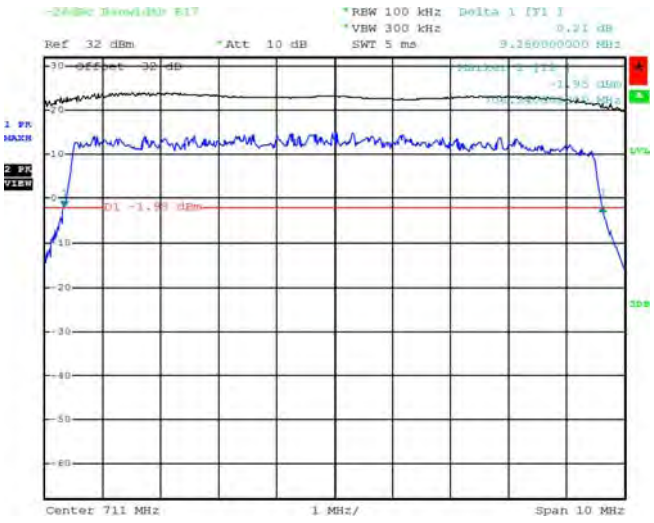
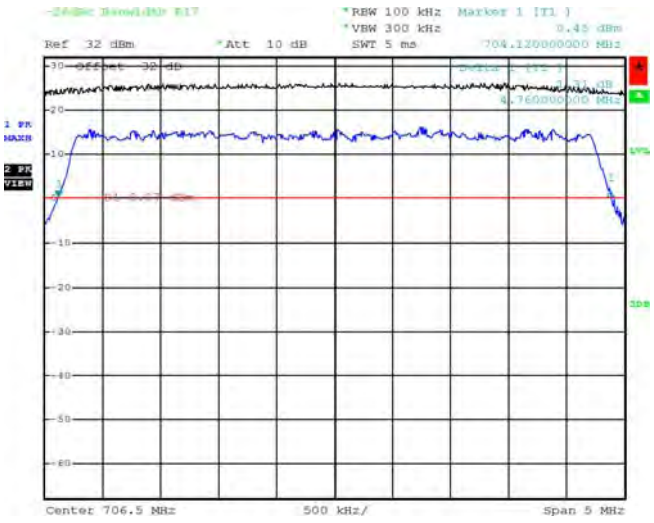


Figure 6-22a: -26 dBc Bandwidth, Band 17 Low Channel, 5MHz BW, RB=25



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-23a: -26 dBc Bandwidth, Band 17 Middle Channel, 5MHz BW, RB=25

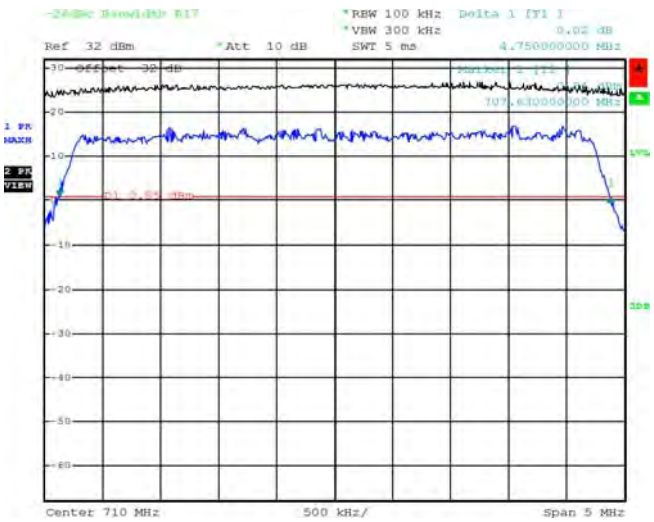


Figure 6-24a: -26 dBc Bandwidth, Band 17 High Channel, 5MHz BW, RB=25

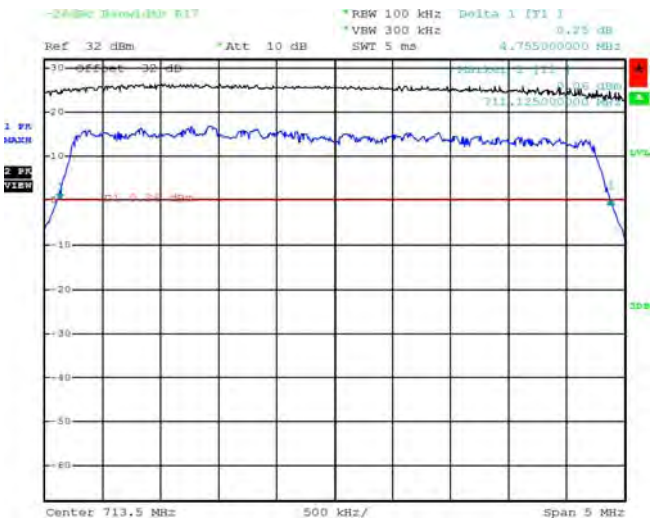


Figure 6-25a: Band 17 Low Channel Mask, 10MHz BW, RB=50

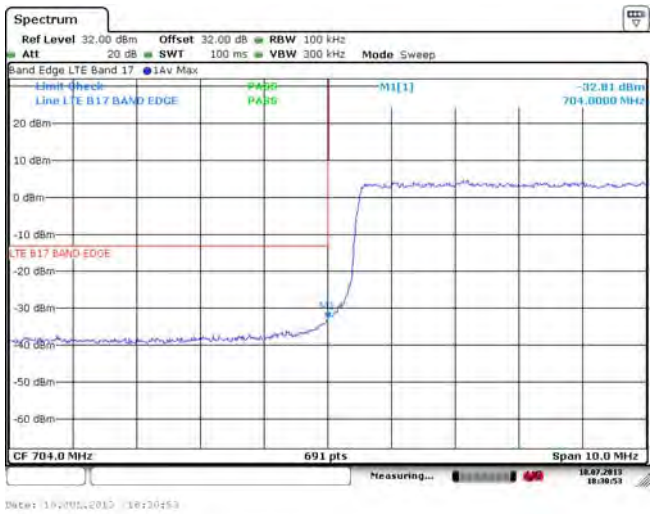
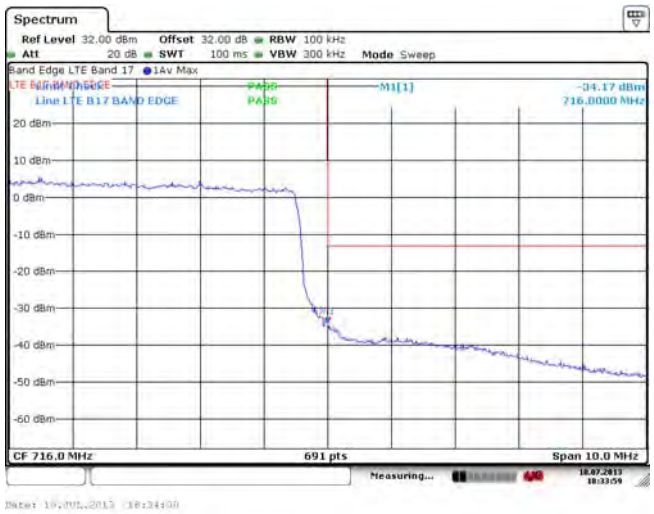


Figure 6-26a: Band 17 High Channel Mask, 10MHz BW, RB=50



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-27a: Band 17 Low Channel Mask, 10MHz BW, RB=1

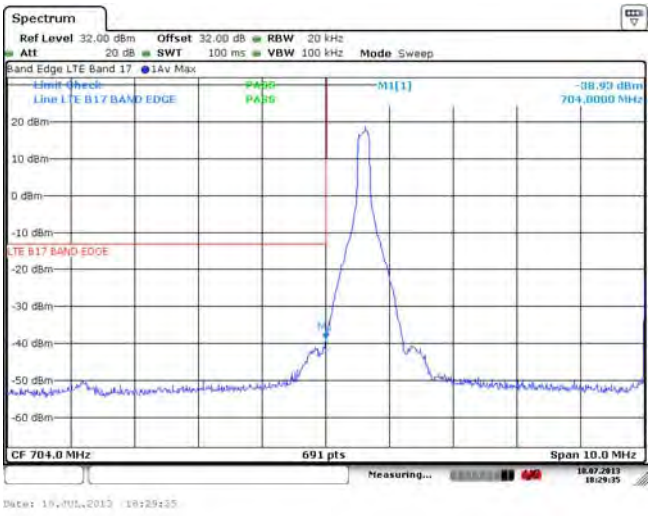


Figure 6-28a: Band 17 High Channel Mask,10MHz BW, RB=1

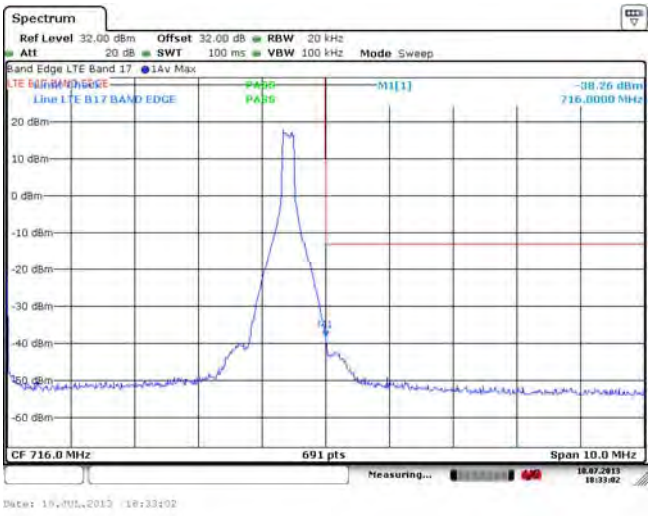


Figure 6-29a: Band 17 Low Channel Mask, 5MHz BW, RB=25

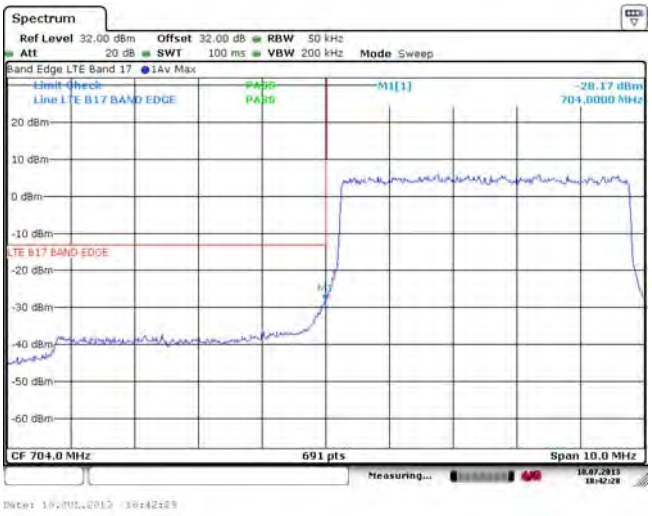
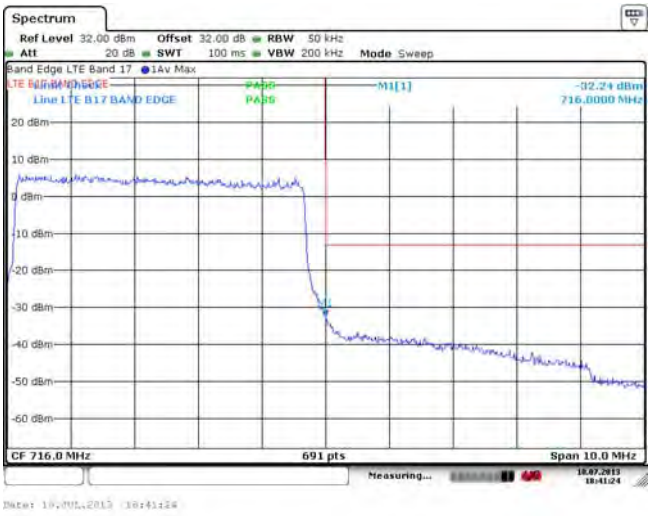


Figure 6-30a: Band 17 High Channel Mask, 5MHz BW, RB=25



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-31a: Band 17 Low Channel Mask, 5MHz BW, RB=1

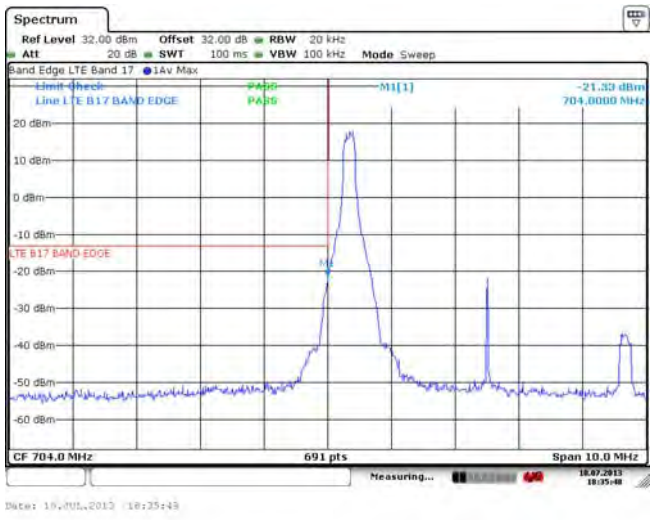


Figure 6-32a: Band 17 High Channel Mask, 5MHz BW, RB=1

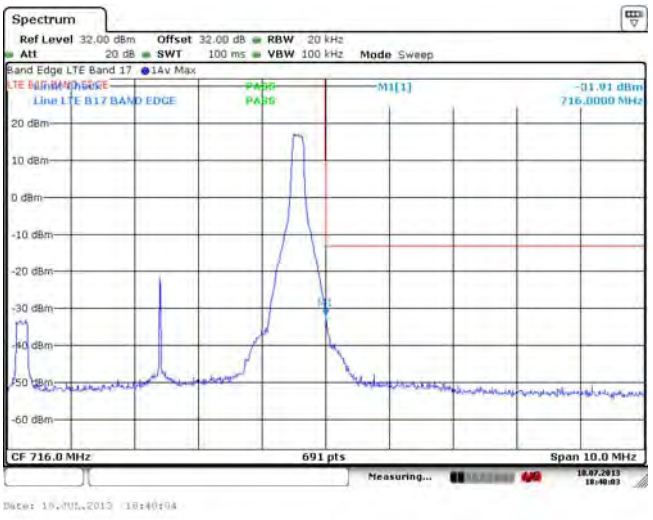


Figure 6-33a: Band 17 Mid Channel PAR, 10MHz BW, RB=25

Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	11.58 dBm
Peak	21.09 dBm
Crest	9.51 dB
10 %	3.32 dB
1 %	6.24 dB
.1 %	7.92 dB
.01 %	9.40 dB

Figure 6-34a: Band 17 Middle Channel PAR, 10MHz BW, RB=50

Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	10.57 dBm
Peak	20.95 dBm
Crest	10.38 dB
10 %	3.36 dB
1 %	6.40 dB
.1 %	8.20 dB
.01 %	10.24 dB

LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-35a: Band 17 Mid Channel PAR, 5MHz BW, RB=15

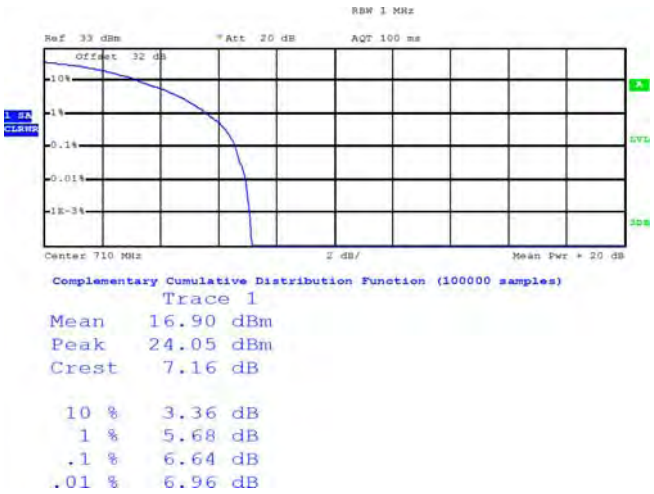
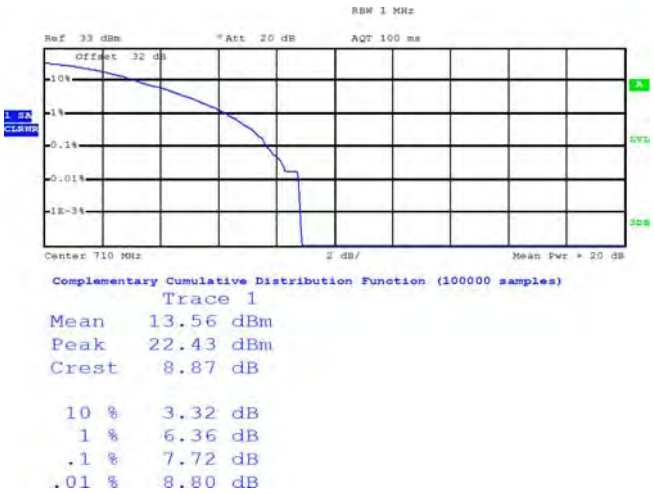


Figure 6-36a: Band 17 Mid Channel PAR, 5MHz BW, RB=25



LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-37a: Occupied Bandwidth, Band 17 Low Channel, 20MHz BW (RB= 100) 16-QAM

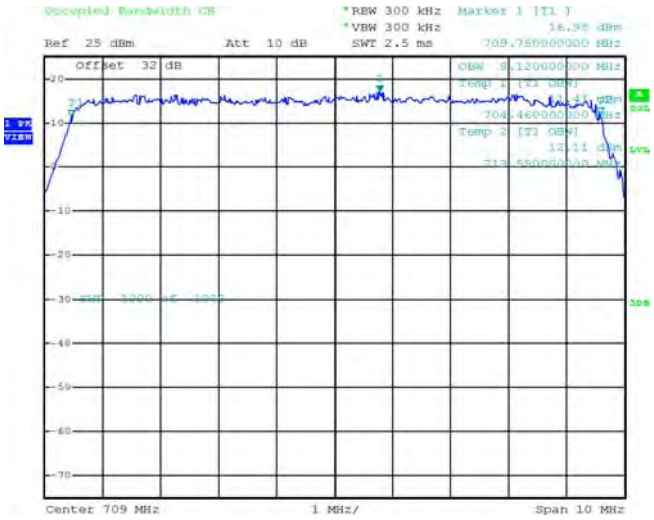


Figure 6-38a: Occupied Bandwidth, Band 17 Mid Channel, 20MHz BW (RB= 100) 16-QAM

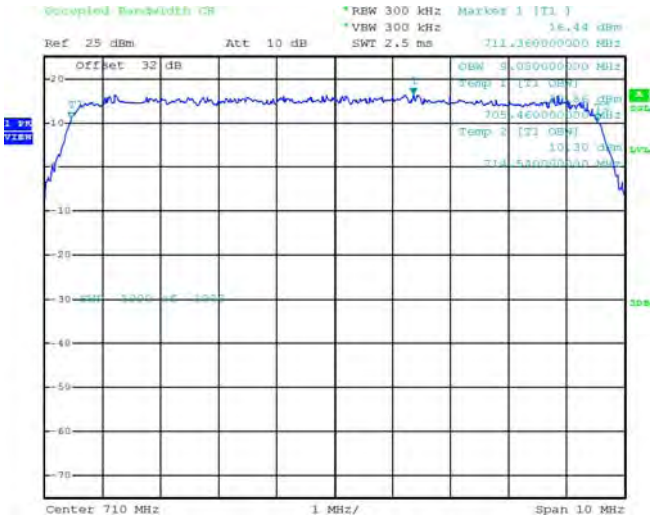
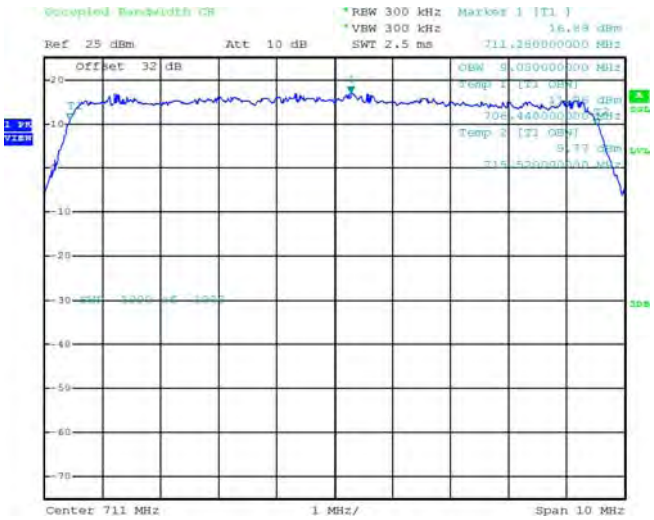
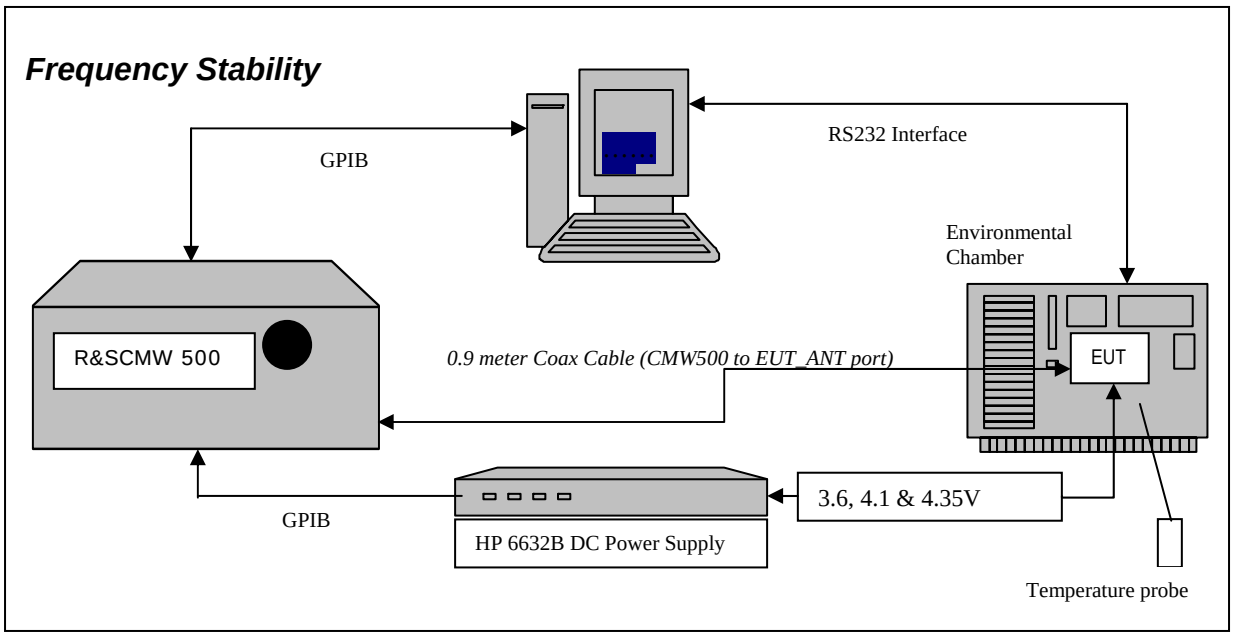


Figure 6-39a: Occupied Bandwidth, Band 17 High Channel, 20MHz BW (RB= 100) 16-QAM



APPENDIX 6B – LTE Band 17 FREQUENCY STABILITY TEST DATA

LTE Band 17 Frequency Stability Test Data



The following tests were performed on model RFV121LW.

The following measurements were performed by Chuan Tran.

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurements
2.1055 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

The EUT meets the requirements as stated in CFR 47 chapter 1, Section 27.54, CFR 47 and RSS-139, 6.3 Frequency Stability.
Frequency Stability measurement devices were configured as presented in the block diagram recording frequency, power, data, temperatures, and stepped voltages controlled via a GPIB interface linked to the Environmental chamber, a DC power supply, and the Communications Test Set. A 0.9-metre coax cable was calibrated to characterize the insertion loss for the transmitted frequencies between the RF input/output of the CMW 500 and the EUT antenna port.

Test Setup:

The EUT was placed in the Temperature chamber and connected to CMW 500 outside as shown in the figure above. Dry air was pumped inside the temperature chamber to maintain a backpressure during the test. The EUT was kept in the off condition at all times except when the following measurements were to be made.

The chamber was switched on and the temperature was set to -30°C.
After the chamber stabilized at -30 °C there was a soak period of one hour to alleviate moisture in the chamber, the EUT voltage was enabled.
The system software recorded the frequency, power, and associated measurements.

A Computer system controlled the automated software. This application was given the command of activating all machines intrinsic to the temperature and voltage tests controlling the CMW 500 via the GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The EUT dialogue was passed through a serial connection.

The EUT repetitively transmitted 100 bursts for each set of programmed parameters recording temperature, voltage settings, and systematically selected frequencies. The power supply was cycled from minimum voltage 3.6 volts, to 4.1 volts and to 4.35 volts maximum voltage. The frequency error was measured at a maximum output power and recorded by the automated system test software.

The EUT output power and frequency was measured at 3.6 volts, 4.1 volts and 4.35 volts. The transmit frequency was varied in 3 steps consisting of 709.0 MHz, 710.0 MHz and 711.0 MHz each was measured under 10 MHz bandwidth with maximum (50) resource blocks. This frequency was recorded in MHz and deviation from nominal, in Parts Per Million.

After the initial one-hour soak at the beginning of the tests, a period of thirty minutes soak was initialized between each ascending temperature step, before proceeding to the next measurement test cycle.

Procedure:

The test system software for commencing the Frequency Stability Tests carried through the following cycle.

43. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
44. Start test program
45. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
46. Set power supply voltage to 3.6 volts.
47. Set up CMW 500 Radio Communication Tester.
48. Command the CMW 500 to switch to the low channel.
49. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
50. EUT is commanded to Transmit 100 Bursts.
51. Software logs the following data from the CMW 500, power supply and temperature chamber: Traffic Channel Number, Traffic Channel Frequency, Power Level, Chamber Temperature, Supply Voltage, Power and Frequency Error.
52. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
53. Repeat steps 5 to 10 changing the supply voltage to 4.1 Volts
54. Increase temperature by 10°C and soak for 1/2 hour.
55. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
56. Repeat steps 5 to 10 changing the supply voltage to 4.35 volts

Procedure 5 to 10 was repeated at room temperature (20°C) with the power supply voltage set to 3.6, 4.1 and 4.35 volts

The maximum frequency error in the LTE band 17 measured was **-0.0176PPM**.

Date of test: August 20, 2013

LTE Band 17 results: channels 23780, 23790 and 23800 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23780	709.0	3.6	20	-2.55	-0.0036
23790	710.0	3.6	20	3.66	0.0052
23800	711.0	3.6	20	-3.28	-0.0046

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23780	709.0	4.1	20	-3.29	-0.0046
23790	710.0	4.1	20	1.99	0.0028
23800	711.0	4.1	20	-2.30	-0.0032

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23780	709.0	4.35	20	-2.45	-0.0035
23790	710.0	4.35	20	-2.12	-0.0030
23800	711.0	4.35	20	-2.50	-0.0035

LTE band 17 Results: channel 23780 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23780	709.0	3.6	-30	3.85	0.0054
23780	709.0	3.6	-20	2.90	0.0041
23780	709.0	3.6	-10	3.22	0.0045
23780	709.0	3.6	0	-3.95	-0.0056
23780	709.0	3.6	10	2.79	0.0039
23780	709.0	3.6	20	-2.55	-0.0036
23780	709.0	3.6	30	-2.92	-0.0041
23780	709.0	3.6	40	3.78	0.0053
23780	709.0	3.6	50	-3.25	-0.0046
23780	709.0	3.6	60	-4.66	-0.0066
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
23780	709.0	4.1	-30	-4.28	-0.0060
23780	709.0	4.1	-20	3.02	0.0043
23780	709.0	4.1	-10	11.50	0.0162
23780	709.0	4.1	0	2.65	0.0037
23780	709.0	4.1	10	8.33	0.0117
23780	709.0	4.1	20	-3.29	-0.0046
23780	709.0	4.1	30	-3.02	-0.0043
23780	709.0	4.1	40	2.65	0.0037
23780	709.0	4.1	50	-3.78	-0.0053
23780	709.0	4.1	60	-3.26	-0.0046
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
23780	709.0	4.35	-30	-3.33	-0.0047
23780	709.0	4.35	-20	-3.56	-0.0050
23780	709.0	4.35	-10	-3.19	-0.0045
23780	709.0	4.35	0	3.25	0.0046
23780	709.0	4.35	10	2.82	0.0040
23780	709.0	4.35	20	-2.45	-0.0035
23780	709.0	4.35	30	-3.40	-0.0048
23780	709.0	4.35	40	-3.56	-0.0050
23780	709.0	4.35	50	-4.16	-0.0059
23780	709.0	4.35	60	-3.60	-0.0051

LTE band 5 Results: channel 23790 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23790	710.0	3.6	-30	2.88	0.0041
23790	710.0	3.6	-20	0.99	0.0014
23790	710.0	3.6	-10	-2.36	-0.0033
23790	710.0	3.6	0	2.88	0.0041
23790	710.0	3.6	10	-1.75	-0.0025
23790	710.0	3.6	20	3.66	0.0052
23790	710.0	3.6	30	1.73	0.0024
23790	710.0	3.6	40	3.50	0.0049
23790	710.0	3.6	50	1.62	0.0023
23790	710.0	3.6	60	**-12.49**	**-0.0176**
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
23790	710.0	4.1	-30	3.62	0.0051
23790	710.0	4.1	-20	3.99	0.0056
23790	710.0	4.1	-10	3.22	0.0045
23790	710.0	4.1	0	3.69	0.0052
23790	710.0	4.1	10	-5.72	-0.0081
23790	710.0	4.1	20	1.99	0.0028
23790	710.0	4.1	30	3.85	0.0054
23790	710.0	4.1	40	-6.48	-0.0091
23790	710.0	4.1	50	3.32	0.0047
23790	710.0	4.1	60	2.55	0.0036
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
23790	710.0	4.35	-30	3.78	0.0053
23790	710.0	4.35	-20	2.98	0.0042
23790	710.0	4.35	-10	3.20	0.0045
23790	710.0	4.35	0	3.43	0.0048
23790	710.0	4.35	10	3.28	0.0046
23790	710.0	4.35	20	-2.12	-0.0030
23790	710.0	4.35	30	3.25	0.0046
23790	710.0	4.35	40	3.12	0.0044
23790	710.0	4.35	50	2.63	0.0037
23790	710.0	4.35	60	3.50	0.0049

LTE band 17 Results: channel 23800 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23800	711.0	3.6	-30	5.79	0.0081
23800	711.0	3.6	-20	5.69	0.0080
23800	711.0	3.6	-10	7.07	0.0099
23800	711.0	3.6	0	-3.19	-0.0045
23800	711.0	3.6	10	-7.12	-0.0100
23800	711.0	3.6	20	-3.28	-0.0046
23800	711.0	3.6	30	6.69	0.0094
23800	711.0	3.6	40	-3.33	-0.0047
23800	711.0	3.6	50	-3.75	-0.0053
23800	711.0	3.6	60	-3.03	-0.0043
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
23800	711.0	4.1	-30	-2.95	-0.0041
23800	711.0	4.1	-20	-3.32	-0.0047
23800	711.0	4.1	-10	-4.08	-0.0057
23800	711.0	4.1	0	-3.33	-0.0047
23800	711.0	4.1	10	-3.22	-0.0045
23800	711.0	4.1	20	-2.30	-0.0032
23800	711.0	4.1	30	-3.43	-0.0048
23800	711.0	4.1	40	-2.90	-0.0041
23800	711.0	4.1	50	-4.16	-0.0059
23800	711.0	4.1	60	-4.09	-0.0058
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
23800	711.0	4.35	-30	-2.85	-0.0040
23800	711.0	4.35	-20	-3.49	-0.0049
23800	711.0	4.35	-10	-3.63	-0.0051
23800	711.0	4.35	0	2.89	0.0041
23800	711.0	4.35	10	-2.63	-0.0037
23800	711.0	4.35	20	-2.50	-0.0035
23800	711.0	4.35	30	-3.35	-0.0047
23800	711.0	4.35	40	-3.33	-0.0047
23800	711.0	4.35	50	-2.95	-0.0041
23800	711.0	4.35	60	-3.42	-0.0048

APPENDIX 6C – LTE Band 17 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

Date of Test: August 15, 2013
The following measurements were performed by Feras Obeid.
The environmental tests conditions were: Temperature: 25.0 °C
Relative Humidity: 29.5 %

The BlackBerry® smartphone was standalone, vertically with LCD facing the RX antenna when the turntable is at 0 degree position.
Measurements were performed with QPSK and 16QAM modulations. The smallest test margins are reported below.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

LTE band 17, 10MHz BW, RB=1, QPSK modulation

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	23780	709.00	17	Dipole	V	-32.59	-32.59	V-V	2.69	21.30	0.13	35.00	13.70
F0	23780	709.00	17	Dipole	H	-43.92		H-H	-1.14				
F0	23790	710.00	17	Dipole	V	-32.70	-32.70	V-V	2.27	20.88	0.12	35.00	14.12
F0	23790	710.00	17	Dipole	H	-43.83		H-H	-1.28				
F0	23799	710.90	17	Dipole	V	-32.80	-32.80	V-V	1.76	20.37	0.11	35.00	14.63
F0	23799	710.90	17	Dipole	H	-44.21		H-H	-1.40				

LTE band 17, 10MHz BW, RB=1, 16-QAM modulation

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	23780	709.00	17	Dipole	V	-33.77	-33.77	V-V	1.53	20.14	0.10	35.0	14.86
F0	23780	709.00	17	Dipole	H	-45.08		H-H	-2.27				
F0	23790	710.00	17	Dipole	V	-33.49	-33.49	V-V	1.49	20.10	0.10	35.0	14.90
F0	23790	710.00	17	Dipole	H	-44.96		H-H	-2.07				
F0	23799	710.90	17	Dipole	V	-34.16	-34.16	V-V	0.50	19.11	0.08	35.0	15.89
F0	23799	710.90	17	Dipole	H	-45.48		H-H	-2.82				

Radiated Power Test Data Results

LTE band 17, 5MHz BW, RB=1, QPSK modulation

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	23755	706.50	17	Dipole	V	-31.19	-31.19	V-V	4.44	**23.05**	**0.20**	35.00	11.95
F0	23755	706.50	17	Dipole	H	-43.20		H-H	0.81				
F0	23790	710.00	17	Dipole	V	-31.17	-31.17	V-V	3.81	22.42	0.17	35.00	12.58
F0	23790	710.00	17	Dipole	H	-43.37		H-H	0.32				
F0	23824	713.40	17	Dipole	V	-31.13	-31.13	V-V	2.74	21.35	0.14	35.00	13.65
F0	23824	713.40	17	Dipole	H	-43.35		H-H	0.17				

LTE band 17, 5MHz BW, RB=1, 16-QAM modulation

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	23755	706.50	17	Dipole	V	-32.36	-32.36	V-V	3.45	22.06	0.16	35.0	12.94
F0	23755	706.50	17	Dipole	H	-44.06		H-H	-0.42				
F0	23790	710.00	17	Dipole	V	-32.40	-32.40	V-V	2.61	21.22	0.13	35.0	13.78
F0	23790	710.00	17	Dipole	H	-44.61		H-H	-0.95				
F0	23824	713.40	17	Dipole	V	-32.46	-32.46	V-V	1.41	20.02	0.10	35.0	14.98
F0	23824	713.40	17	Dipole	H	-44.64		H-H	-1.15				

Radiated Emissions Test Data Results cont'd

Date of Test: July 9, 2012

The following measurements were performed by Feras Obeid.

The environmental test conditions were: Temperature: 25.7 ºC
Relative Humidity: 17.9 %

The BlackBerry® smartphone was standalone, vertically with LCD facing the RX antenna when the turntable is at 0 degree position.

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in LTE band 17 with QPSK and 16-QAM modulations for 10MHz BW (channel 23780, 23790, 23800 with RB = 1).

All emissions were at least 25.0 dB below the limit.

Date of Test: July 10 - 12, 2013

The following measurements were performed by Kevin Guo
The environmental test conditions were: Temperature: 23.6 – 25.7 ºC
Relative Humidity: 17.2 – 19.8 %

Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height, and a frequency range of 1 GHz to 10 GHz.

The BlackBerry® smartphone was standalone, horizontally with LCD facing down and the top pointing to the RX antenna when the turntable is at 0 degree position

Measurements were performed in LTE band 17 with QPSK and 16-QAM modulations for 10MHz BW (channel 23780, 23790, 23800 with RB = 1).

All emissions were at least 25.0 dB below the limit.