# EMI Test Report

Tested in accordance with
Federal Communications Commission (FCC)
Personal Communications Services
CFR 47, Parts 2, 22, 24, 27
IC RSS 130, 132, 133, 139 and RSS GEN

This report supersedes the report RTS-6058-1408-12 dated August 11, 2014

**REPORT NO.:** RTS-6058-1408-12_Rev1

| | |
|---|---|
| **PRODUCT MODEL NO.**: | RHA111LW |
| **TYPE NAME**: | BlackBerry® smartphone |
| **FCC ID**: | L6ARHA110LW |
| **IC**: | 2503A-RHA110LW |
| **EMISSION DESIGNATOR (GSM):** | 246KGXW |
| **EMISSION DESIGNATOR (EDGE):** | 246KG7W |
| **EMISSION DESIGNATOR (WCDMA):** | 4M17F9W |
| **EMISSION DESIGNATOR (LTE QPSK)**: | See details in Appendix |
| **EMISSION DESIGNATOR (LTE 16QAM)**: | See details in Appendix |

**DATE**: August 26, 2014

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

592

## Report Revision History:

Rev1:

1. Addition of calibration intervals in section G.

## Statement of Performance:

The BlackBerry® smartphone, model RHA111LW, part number; CER-59878-001 - Rev2-x001-02 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, 2013.
- FCC CFR 47 Part 22, Subpart H, Cellular Radiotelephone Services, Oct., 2013.
- FCC CFR 47 Part 24 Subpart E, Broadband PCS, Oct., 2013.
- FCC CFR 47 Part 27, Subpart C, Technical Standards, Oct, 2013.
- Industry Canada, RSS-132 Issue 2, September 2005, Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz.
- Industry Canada, RSS-133 Issue 5, February 2009, 2 GHz Personal Communications Services.
- Industry Canada, RSS-GEN Issue 3, December 2010, General Requirements and Information for the Certification of Radio communication Equipment.
- Industry Canada, RSS-139 Issue 2, February 2009, Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz.
- Industry Canada, RSS-130 Issue 1, October 2013, Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz.

## B. Associated Documents

1)MultiSourceDeclaration_RHA111LW_10.3.0.890,
2)RHA111LW_ CER-59878-001 Rev 1- x001-00
3)RHA111LW_ CER-59878-001 Rev 2- x001-02

## C. Product Identification

Manufactured by BlackBerry Limited whose headquarters is located at:

2200 University Ave. E
Waterloo, Ontario
Canada, N2K 0A7
Phone: 519 888 7465
Fax: 519 888 7884

The equipment under test (EUT) was tested at the following locations:

BlackBerry RTS EMC test facilities

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

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

The testing was performed from June 24 to August 5, 2014.

BlackBerry® smartphone Samples Tested

| Sample | Model | CER NUMBER | PIN | Software Information |
|---|---|---|---|---|
| 1 | RHA111LW | CER-59878-001Rev1-x001-00 | 2FFEB284 | OS Version: 10.3.0.686<br>Bundle: 686 |
| 2 | RHA111LW | CER-59878-001Rev2-x001-02 | 2FFFC30D | OS Version: 10.3.0.890<br>Bundle: 890 |
| 3 | RHA111LW | CER-59878-001Rev1-x001-00 | 2FFEB2A5 | OS Version: 10.3.0.686<br>Bundle: 686 |
| 4 | RHA111LW | CER-59878-001Rev1-x001-00 | 2FFEB281 | OS Version: 10.3.0.686<br>Bundle: 686 |
| 5 | RHA111LW | CER-59878-001Rev2-x001-02 | 2FFFC30C | OS Version: 10.3.0.890<br>Bundle: 890 |
| 6 | RHA111LW | CER-59878-001Rev2-x001-02 | 2FFEC346 | OS Version: 10.3.0.890<br>Bundle: 890 |

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

Only the characteristics that may have been impacted by the changes from RHA111LW Rev1 to RHA111LW Rev2 were re-tested.
For more details, refer to RHA111LW_HW_Declaration_CER-59878-001_Rev1 - x001-00 and RHA111LW_HW_Declaration_CER-59878-001_Rev2 - x001-02

To view the differences between OS: 10.3.0.686 and OS: 10.3.0.890 see documents

MultiSourceDeclaration_RHA111LW_10.3.0.890.

## D. Support Equipment Used for the Testing of the EUT

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

## E. Test Results Chart

| SPECIFICATION | | TEST TYPE | RESULT | TEST DATA APPENDIX |
|---|---|---|---|---|
| FCC CFR 47 | IC | | | |
| Part 2.1051<br>Part 2.1057<br>Part 22.917<br>Part 24.238 | RSS-132, 4.5<br>RSS-133, 6.5 | GSM850 / PCS1900 Conducted Spurious Emissions | Pass | 1A |
| Part 2.202<br>Part 2.1049<br>Part 22.917<br>Part 24.238 | RSS-GEN, 4.6 | GSM 850 / PCS1900 Occupied Bandwidth and Channel Mask | Pass | 1A |
| Part 2.1055<br>Part 22.863<br>Part 24.235 | RSS-132, 4.3<br>RSS-133, 6.3 | GSM 850 /PCS 1900 Frequency Stability vs. Temperature and Voltage | Pass | 1B |
| Part 22.913(a)(2)<br>Part 24.232(b)(c) | RSS-132, 4.4<br>RSS-133, 6.4 | GSM850 ERP<br>PCS1900 EIRP | Pass | 1C |
| Part 2.1053<br>Part 22.917<br>Part 24.238 | RSS-132, 4.5<br>RSS-133, 6.5 | GSM850 / PCS1900 Radiated Spurious/Harmonic Emissions | Pass | 1C |
| Part 2.1051<br>Part 22.917<br>Part 24.238 | RSS-132, 4.5<br>RSS-133, 6.5 | WCDMA Band II/V Conducted Spurious Emissions | Pass | 2A |
| Part 2.1049<br>Part 22.917<br>Part 24.238 | RSS-GEN, 4.6 | WCDMA Band II/V Occupied Bandwidth and Channel Mask | Pass | 2A |
| Part 2.1055(a)(d)<br>Part 22.917<br>Part 24.235 | RSS-132, 4.3<br>RSS-133, 6.3 | WCDMA Band II/V Frequency Stability vs. Temperature and Voltage | Pass | 2B |
| Part 22.913(a)(2)<br>Part 24.232(c) | RSS-132, 4.4<br>RSS-133, 6.4 | WCDMA Band V ERP<br>WCDMA Band II EIRP | Pass | 2C |
| Part 22.917<br>Part 24.238 | RSS-132, 4.5<br>RSS-133, 6.5 | WCDMA Band II/V Radiated Spurious/Harmonic Emissions | Pass | 2C |
| Part 2.1051<br>Part 24.238(a)<br>Part 24.50 (d) | RSS-133, 6.5 | LTE Band 2 Conducted Spurious Emissions | Pass | 3A |
| Part 2.1049<br>Part 24.238 | RSS-GEN, 4.6 | LTE Band 2 Occupied Bandwidth and Channel Mask | Pass | 3A |
| Part 24.232 (d) | RSS-133, 6.4 | LTE Band 2 Peak to Average Ratio measurements | Pass | 3A |
| Part 2.1055(a)(d)<br>Part 24.235 | RSS-133, 6.3 | LTE Band 2 Frequency Stability vs. Temperature and Voltage | Pass | 3B |

| | | | | |
|---|---|---|---|---|
| Part 24.232(b)(c) | RSS-133, 6.4 | LTE Band 2 EIRP | Pass | 3C |
| Part 24.238 | RSS-133, 6.5 | LTE Band 2 Radiated Spurious/Harmonic Emissions | Pass | 3C |
| Part 2.1051<br>Part 22.917 | RSS-132, 4.5 | LTE Band 5 Conducted Spurious Emissions | Pass | 4A |
| Part 2.1049<br>Part 22.917 | RSS-GEN, 4.6 | LTE Band 5 Occupied Bandwidth and Channel Mask | Pass | 4A |
| Part 2.1055(a)(d)<br>Part 22.917 | RSS-132, 4.3 | LTE Band 5 Frequency Stability vs. Temperature and Voltage | Pass | 4B |
| Part 22.913(a)(2) | RSS-132, 4.4 | LTE Band 5 ERP | Pass | 4C |
| Part 22.917 | RSS-132, 4.5 | LTE Band 5 Radiated Spurious/Harmonic Emissions | Pass | 4C |
| Part 2.1051<br>Part 27.53(h) | RSS-139, 6.5 | LTE Band 4 Conducted Spurious Emissions | Pass | 5A |
| Part 2.1049<br>Part 27.53(h)(1) | RSS-GEN, 4.6 | LTE Band 4 Occupied Bandwidth and Channel Mask | Pass | 5A |
| Part 27.50 (d)(5) | RSS-139, 6.4 | LTE Band 4 Peak to Average Ratio measurements | Pass | 5A |
| Part 2.1055<br>Part 27.54 | RSS-139, 6.3 | LTE Band 4 Frequency Stability vs. Temperature and Voltage | Pass | 5B |
| Part 2.1053<br>Part 27.50(d)(4) | RSS-139, 6.4 | LTE Band 4 EIRP | Pass | 5C |
| Part 2.1053<br>Part 27.53(h) | RSS-139, 6.5 | LTE Band 4 Radiated Spurious/Harmonic Emissions | Pass | 5C |
| Part 2.1051<br>Part 27.53(g) | RSS-130, 4.6 | LTE Band 17 Conducted Spurious Emissions | Pass | 6A |
| Part 2.1049<br>Part 27.53(g) | RSS-GEN, 4.6 | LTE Band 17 Occupied Bandwidth and Channel Mask | Pass | 6A |
| Part 2.1055<br>Part 27.54 | RSS-130, 4.3 | LTE Band 17 Frequency Stability vs. Temperature and Voltage | Pass | 6B |
| Part 2.1053<br>Part 27.50(c)(9) | RSS-130, 4.4 | LTE Band 17 ERP | Pass | 6C |
| Part 2.1053<br>Part 27.53(g) | RSS-130, 4.6 | LTE Band 17 Radiated Spurious/Harmonic Emissions | Pass | 6C |

## F.Summary of Results

### 1) Conducted Emission Measurements

- 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) and RSS-GEN, 4.9.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) and RSS-GEN, 4.9. 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 RSS-GEN, 4.6. The EUT was measured in GSM and EDGE mode on the low, middle and high channels. The worst case occupied bandwidth was 245 kHz on the low and high channels in CALL mode, and 246 kHz on high 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 and RSS-GEN, 4.6. 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 high channel in CALL mode, and 243 kHz on all channels 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, CFR 22.917 and RSS-GEN, 4.3. 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 and RSS-GEN, 4.7. 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) and RSS-GEN, 4.9. 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) and RSS-GEN, 4.9. 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 and RSS-GEN, 4.6. The EUT was measured in Voice and HSUPA mode on the low, middle and high channels. The worst case occupied bandwidth was 4.167 MHz on the low and high channel in Loopback mode, and 4.167 MHz on all channels 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 and RSS-GEN, 4.6. The EUT was measured in Voice and HSUPA mode on the low, middle and high channels. The worst case occupied bandwidth was 4.167 MHz on high channel in Loopback mode, and 4.167 MHz on all 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 BlackBerry® smartphone met the requirements of the Tx Conducted Spurious Emissions in the LTE Band 2 as per 47 CFR 2.1051, CFR 24.238, CFR 24.50(d), RSS-133, 6.5 and RSS-GEN, 4.9. The EUT was measured on the low, middle and high channels in all bandwidths for LTE Band 2 with both QPSK and 16-QAM modulations. Different Resource Block allocations were investigated; a minimum

one RB case was also tested. The frequency range investigated was from 30 MHz to 20 GHz.
See APPENDIX 3A 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 in all bandwidth and both modulations. The worst case occupied bandwidth was 17.94 MHz on the middle channel in 20MHz BW, 100 RB and 16QAM 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 all bandwidths for LTE Band 2 with QPSK and 16-QAM modulations. Different RB allocations were also investigated, a minimum one RB case was also tested. The worst case Peak to Average Ratio was 11.20 dB on mid channel in 10MHz bandwidth with 50 RB.
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 RB 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 all bandwidths for LTE Band 5 with QPSK and 16-QAM modulations. Different RB allocations were investigated, a minimum one RB 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 RB allocations were investigated, a minimum one RB case was also tested. The worst case occupied bandwidth was 8.97 MHz on the high channel in 10MHz BW, 50 RB and 16QAM 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 all bandwidths for LTE Band 5 with QPSK and 16-QAM modulations. Different RB allocations were investigated, a minimum one RB 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 all bandwidths for LTE Band 4 with QPSK and 16-QAM modulations. Different RB allocations were investigated, a minimum one RB 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 in all bandwidths and both modulations. The worst case occupied bandwidth was 17.94 MHz on the high channel in 20MHz BW, 100 RBs and 16QAM 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 all bandwidths for LTE Band 4 with QPSK and 16-QAM modulations. Different RB allocations were also investigated, a minimum one RB case was also tested. The worst case Peak to Average Ratio was 10.90 dB on middle channel in 10MHz bandwidth with 50 RBs.
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 RBs 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 RB allocations were investigated, a minimum one RB 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 8.973MHz on the low channel in 10MHz BW, 50 RBs 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 RB allocations were also investigated, a minimum one RB case was also tested. The worst case Peak to Average Ratio was 10.48 dB on middle channel in 10MHz bandwidth with 50 RBs.
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 RBs 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.

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 30.56 dBm (1.14 W) at 848.80 MHz (channel 251).
- The highest ERP in the 850 band EDGE mode measured was 29.74 dBm (0.94 W) at 848.80 MHz (channel 251).
- The highest EIRP in the PCS band Call mode measured was 32.44 dBm (1.75 W) at 1850.20 MHz (channel 512).
- The highest EIRP in the PCS band EDGE mode measured was 31.85 dBm (1.53 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 10.2 dB below the limit at 2509.696 MHz in Call mode in band GSM850.
- -All margins in the GSM850 in EDGE mode for harmonic emissions were at least 25 dB below the limit for all test frequencies
- All margins in the PCS1900 for harmonic emissions were at least 25 dB below the limit for all test frequencies in CALL mode.
- 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/V.

- The highest ERP in the WCDMA band V, Call Service mode was 23.35 dBm (0.22 W) at 826.40 MHz (channel 4132).
- The highest ERP in the WCDMA band V, HSUPA mode was 21.78 dBm (0.15 W) at 826.40 MHz (channel 4132).
- The highest EIRP in the WCDMA band II, Call Service mode measured was 28.13 dBm (0.65 W) at 1907.60 MHz (channel 9538).
- The highest EIRP in the WCDMA band II, HSUPA mode measured was 27.71 dBm (0.59 W) at 1907.60 MHz (channel 9538).

The radiated carrier harmonics were measured up to the 10$^{th}$ harmonic for low, middle and high channels in the WCDMA Band V, 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.

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 20MHz bandwidths for LTE Band 2 with QPSK and 16-QAM modulations. Worst RB case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE Band 2 measured was 27.86 dBm (0.61 W) at 1907.40 MHz (channel 19174) in 5 MHz BW, 1 RB and QPSK modulation and
- The highest EIRP in the LTE Band 2 measured was 26.82 dBm (0.48 W) at 1907.40 MHz (channel 19174) in 5 MHz BW, 1 RB 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 15MHz bandwidth for LTE Band 2 with QPSK and 16-QAM modulations as per conducted power. Worst RB 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 10 MHz bandwidth for LTE Band 5 with QPSK and 16-QAM modulations. Worst RB case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE Band 5 measured was 22.24 dBm (0.17 W) at 836.50 MHz (channel 20525) in 5 MHz BW, 1 RB and QPSK modulation.

- The highest EIRP in the LTE Band 5 measured was 21.19 dBm (0.13 W) at 836.50 MHz (channel 20525) in 5 MHz BW, 1 RB 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 3MHz bandwidths for LTE Band 5 with QPSK and 16-QAM modulations as per conducted power. Worst RB 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 RB case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE Band 4 measured was 29.35 dBm (0.86 W) at 1749.90 MHz (channel 20349) in 15MHz BW, 1 RB and QPSK modulation.
- The highest EIRP in the LTE Band 4 measured was 28.06 dBm (0.64 W) at 1715.00 MHz (channel 20000) in 20MHz BW, 1 RB 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 RB 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 10 MHz bandwidths for LTE band 17 with QPSK and 16-QAM modulations. Worst RB case was tested. Both the horizontal and vertical polarizations were measured.

- The highest EIRP in the LTE band 17 measured was 22.72dBm (0.19 W) at 706.50 MHz (channel 23755) in 5MHz BW, 1 RB and QPSK modulation.
- The highest EIRP in the LTE band 17 measured was 21.69 dBm (0.15 W) at 706.50 MHz (channel 23755) in 5MHz BW, 1 RB 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 10

MHz bandwidth for LTE Band 17 with QPSK and 16-QAM modulations as per conducted power. Worst RB 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 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(DH5) + 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 ±4.3 dB**

## G. Compliance Test Equipment Used

| UNIT | MANUFACTURER | MODEL | SERIAL NUMBER | CAL DUE DATE (YY MM DD) | CAL INTERVAL (YEARS) | USE |
|---|---|---|---|---|---|---|
| Preamplifier | Sonoma | 310N/11909A | 185831 | 14-10-16 | 1 | Radiated Emissions |
| Preamplifier system | TDK RF Solutions | PA-02 | 080010 | 14-10-16 | 1 | Radiated Emissions |
| Preamplifier | Rohde & Schwarz | TS-ANA4-SP | 001 | 14-10-23 | 1 | Radiated Emissions |
| Preamplifier | Rohde & Schwarz | TS-ANA-SP | 001 | 14-10-23 | 1 | Radiated Emissions |
| Hybrid Log Antenna | EMC Automation | HLP-3003C | 017301 | 14-08-13 | 2 | Radiated Emissions |
| Horn Antenna | EMC Automation | HRN-0118 | 030101 | 14-08-07 | 2 | Radiated Emissions |
| Horn Antenna | EMC Automation | HRN-0118 | 030201 | 15-05-07 | 2 | Radiated Emissions |
| Horn Antenna | Emco | 3117 | 47563 | 15-08-07 | 2 | Radiated Emissions |
| Horn Antenna | ETS | 3116 | 2538 | 14-09-29 | 2 | Radiated Emissions |
| Dipole Antenna | Schwarzbeck | UHAP | 974 | 14-11-27 | 2 | Radiated Emissions |
| Universal Radio Communication Tester | Rohde & Schwarz | CMU 200 | 837493/073 | 14-11-24 | 1 | Radiated Emissions |
| Universal Radio Communication Tester | Rohde & Schwarz | CMU 200 | 112394 | 14-11-25 | 1 | Radiated Emissions |
| Universal Radio Communication Tester | Rohde & Schwarz | CMU 200 | 109747 | 14-11-25 | 1 | RF Conducted Emissions |
| EMI Receiver | Rohde & Schwarz | ESIB-40 | 100255 | 14-12-11 | 1 | Radiated Emissions |
| EMI Receiver | Rohde & Schwarz | ESU-40 | 100162 | 14-12-08 | 1 | Radiated Emissions |
| Environment Monitor | Omega | iTHX-SD | 0380561 | 16-11-15 | 3 | Radiated Emissions |
| Environment Monitor | Omega | iTHX-SD | 0340060 | 16-11-15 | 3 | RF Conducted Emissions |
| Environment Monitor | Omega | iTHX-SD | 0380567 | 16-11-15 | 3 | Radiated Emissions |

## Compliance Test Equipment Used cont'd

| UNIT | MANUFACTURER | MODEL | SERIAL NUMBER | CAL DUE DATE (YY MM DD) | CAL INTERVAL (YEARS) | USE |
|---|---|---|---|---|---|---|
| Universal Radio Communication Tester | Rohde & Schwarz | CMW500 | 101469 | 14-12-09 | 1 | Radiated /RF Conducted Emission |
| Universal Radio Communication Tester | Rohde & Schwarz | CMW500 | 109949 | 14-12-07 | 1 | Radiated /RF Conducted Emission |
| Signal Generator | Agilent | E8257D | MY45140527 | 14-12-10 | 1 | Radiated Emissions |
| Signal Generator | Agilent | 83630B | 3844A00927 | 14-11-23 | 1 | Radiated Emissions |
| Spectrum Analyzer | Rohde & Schwarz | FSV | 101820 | 14-11-21 | 1 | RF Conducted Emissions |
| Spectrum Analyzer | Rohde & Schwarz | FSP | 100884 | 14-11-21 | 1 | RF Conducted Emissions |

## H. Test Software used

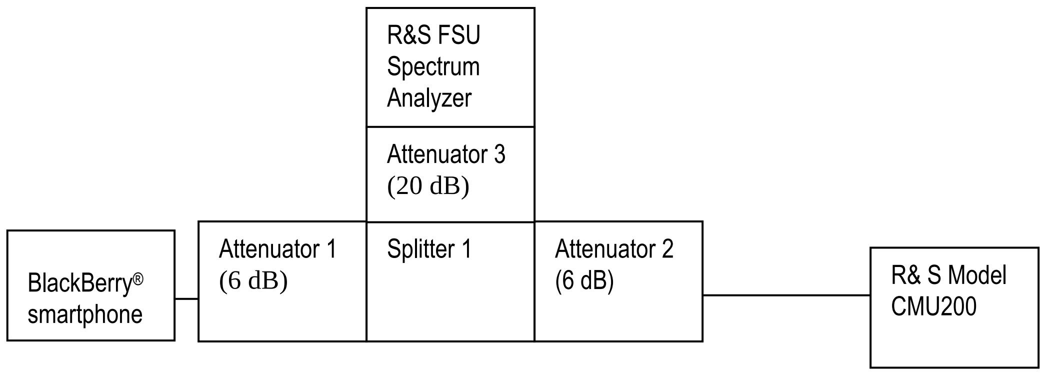
| SOFTWARE | COMPANY | VERSION | USE |
|---|---|---|---|
| EMC32 | Rohde & Schwarz | 8.53.0 | Radiated Emissions |
| TDK Standard Emission Test | TDK RF Solutions | 8.53.1.62 | Radiated Emissions |

# 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 32.4 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 Chuan Tran.

## GSM Conducted RF Emission Test Data cont'd

**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 274kHz, and for the PCS1900 band was measured to be 272kHz 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 | 267 | **245** |
| 837.6 | 274 | 243 |
| 848.8 | 272 | **245** |

| PCS1900 band Frequency (MHz) | -26dBc Bandwidth (kHz) | 99% Occupied Bandwidth (kHz) |
|---|---|---|
| 1850.2 | 272 | 242 |
| 1880.0 | 270 | 243 |
| 1909.8 | 272 | **246** |

***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 | 245 |
| 837.6 | 245 |
| 848.8 | **246** |

| PCS1900 band Frequency (MHz) | 99% Occupied Bandwidth (kHz) |
|---|---|
| 1850.2 | **243** |
| 1880.0 | **243** |
| 1909.8 | **243** |

### *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

<u>GSM Conducted RF Emission Test Data</u> cont'd

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

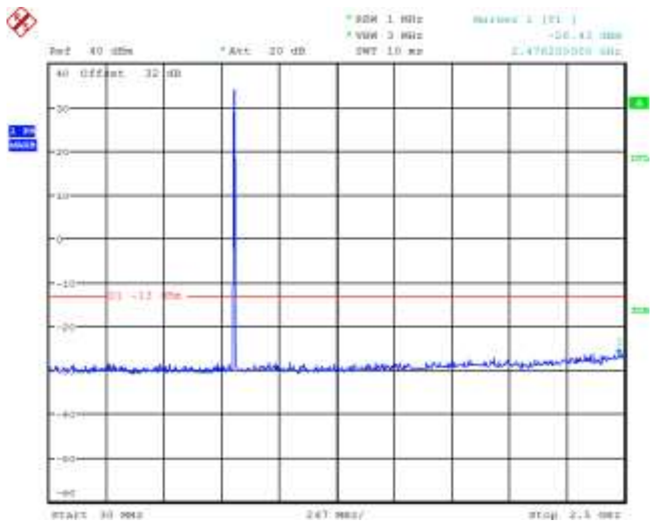



**Figure 1-1a: GSM850 band, Spurious Conducted Emissions, Low channel**

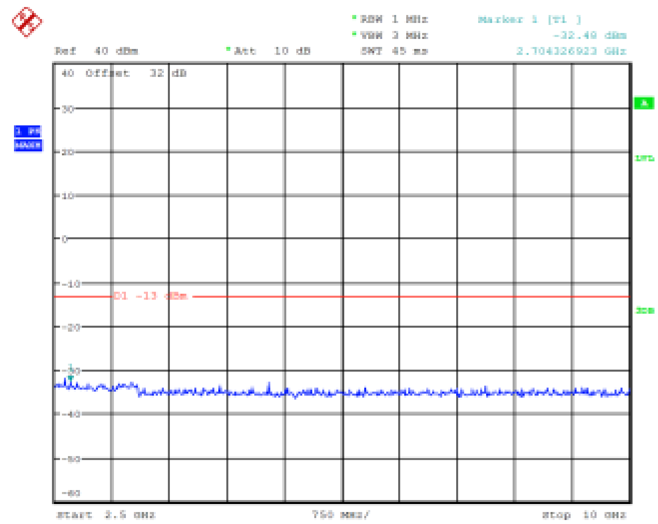



**Figure 1-2a: GSM850 band, Spurious Conducted Emissions, Middle Channel**

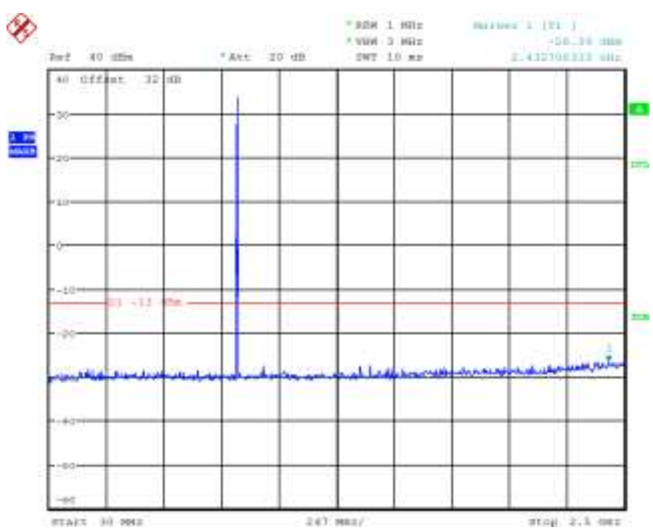
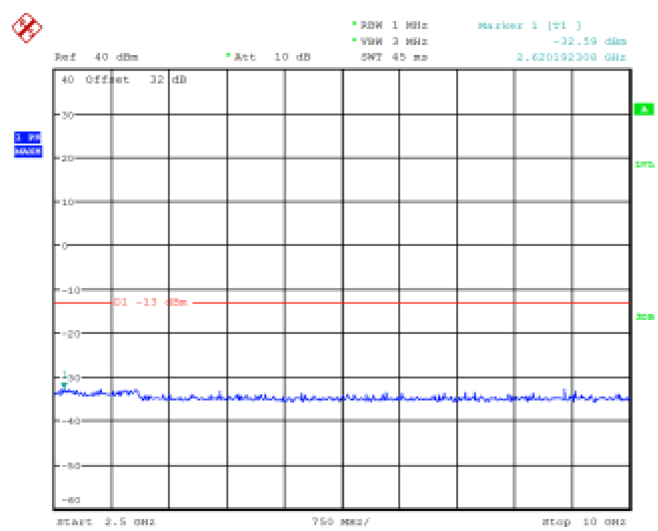



**Figure 1-3a: GSM850 band, Spurious Conducted Emissions, Middle Channel**



## GSM Conducted RF Emission Test Data cont'd

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

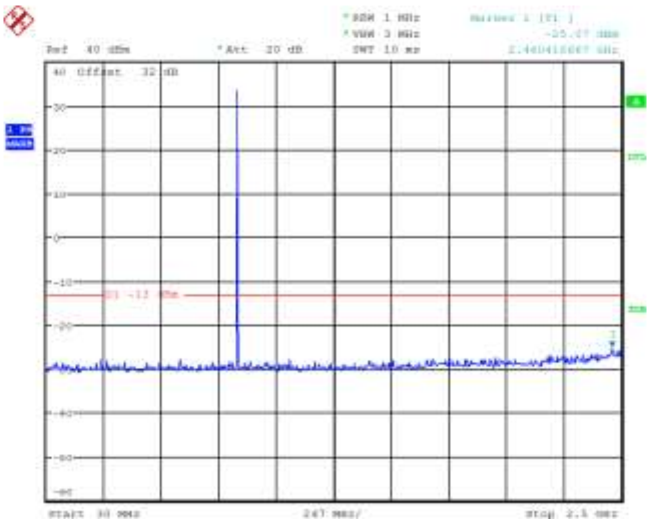



**Figure 1-5a: GSM850 band, Spurious Conducted Emissions, High Channel**

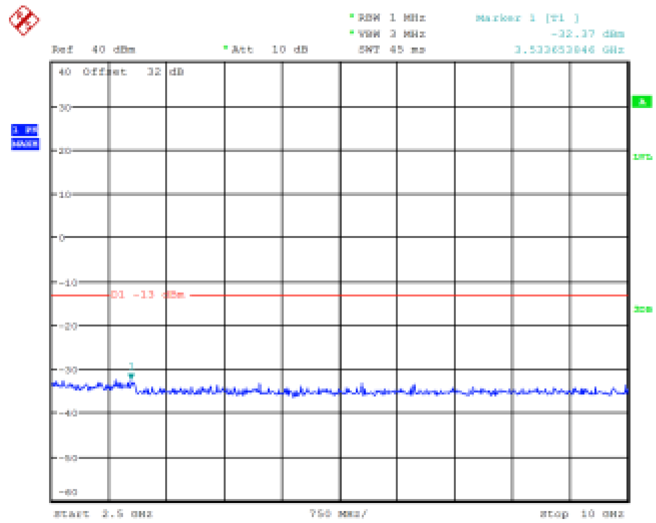



**Figure 1-7a: PCS1900 band, Spurious Conducted Emissions, Low Channel**

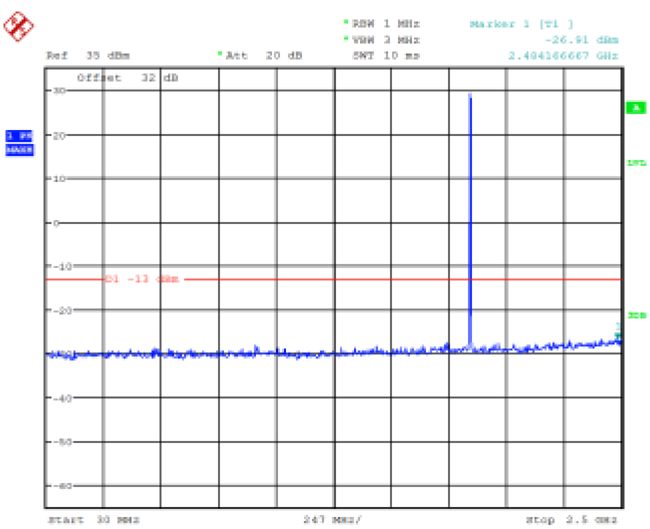
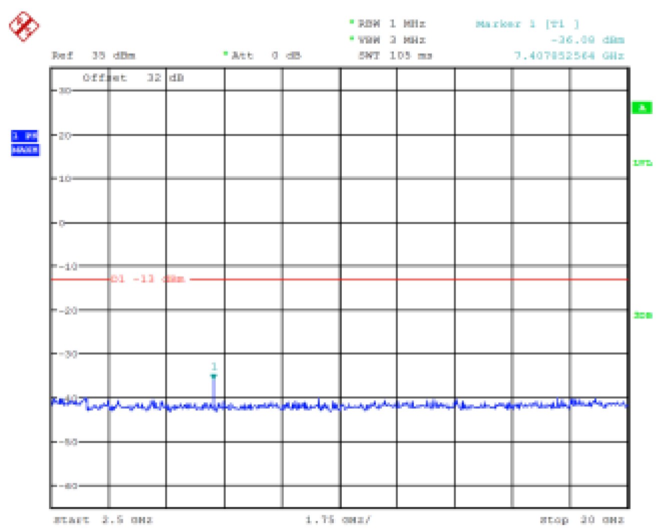



**Figure 1-8a: PCS1900 band, Spurious Conducted Emissions, Low Channel**



## GSM Conducted RF Emission Test Data cont'd

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

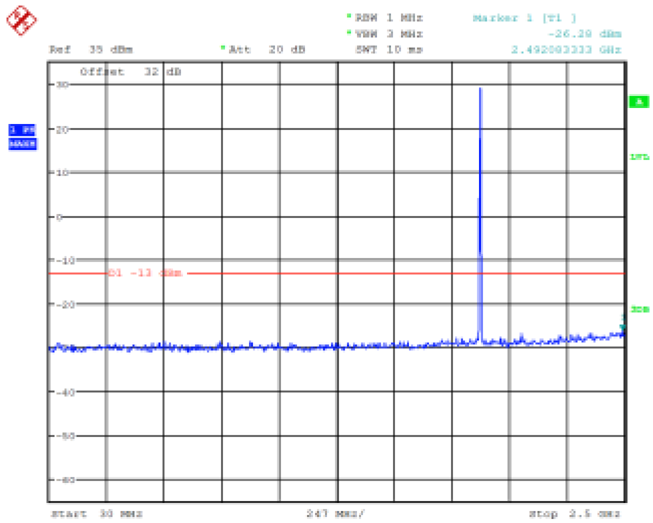


**Figure 1-10a: PCS1900 band, Spurious Conducted Emissions, Middle Channel**

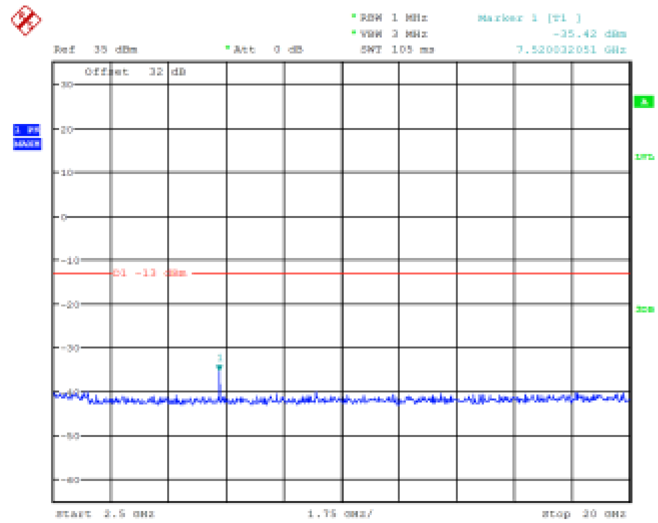


**Figure 1-11a: PCS1900 band, Spurious Conducted Emissions, High Channel**

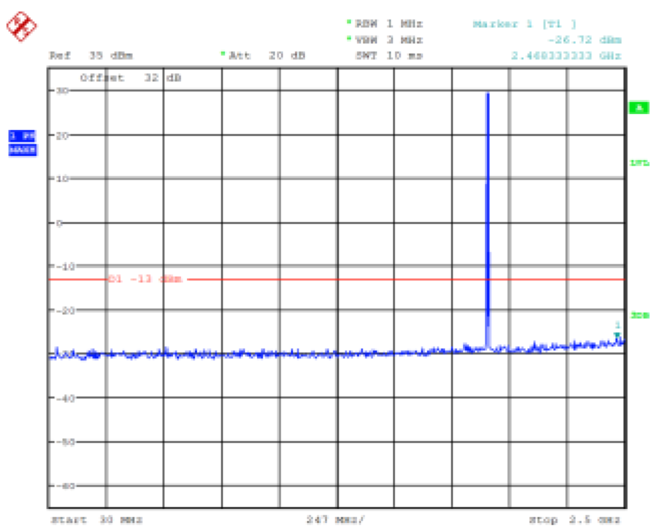
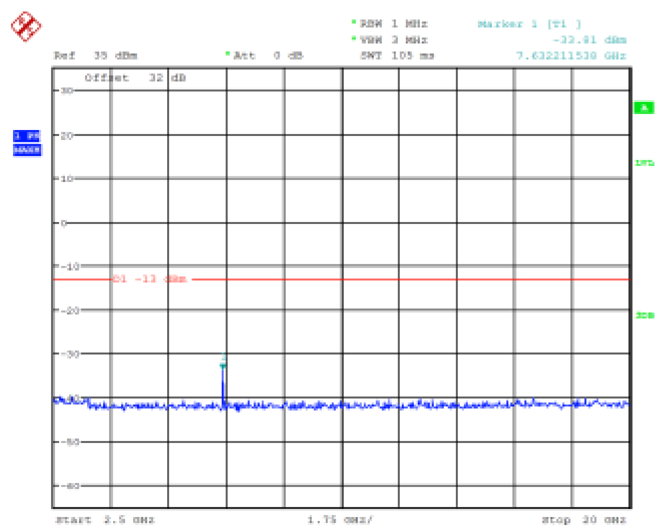


**Figure 1-12a: PCS1900 band, Spurious Conducted Emissions, High Channel**



## GSM Conducted RF Emission Test Data cont'd

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

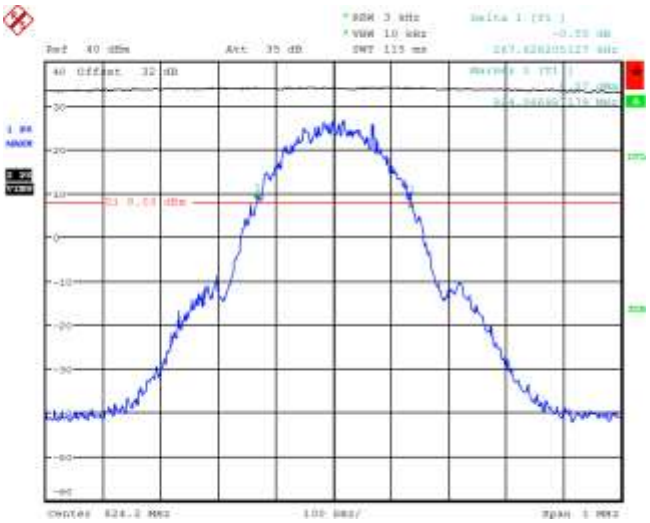


**Figure 1-14a: Occupied Bandwidth, GSM850 band Low Channel in GSM mode**

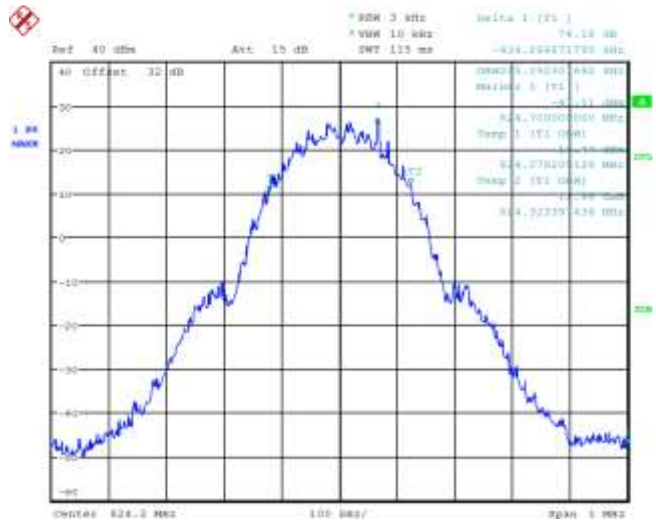


**Figure 1-15a: -26dBc bandwidth, GSM850 band Middle Channel in GSM mode**

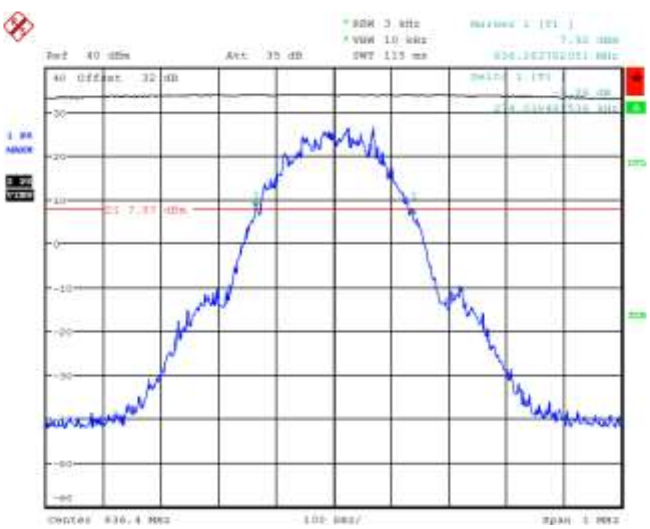
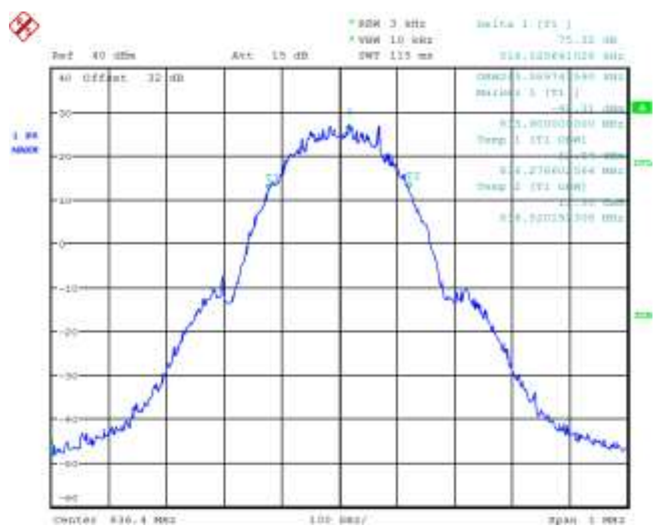


**Figure 1-16a: Occupied Bandwidth, GSM850 band Middle Channel in GSM mode**



## GSM Conducted RF Emission Test Data cont'd

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

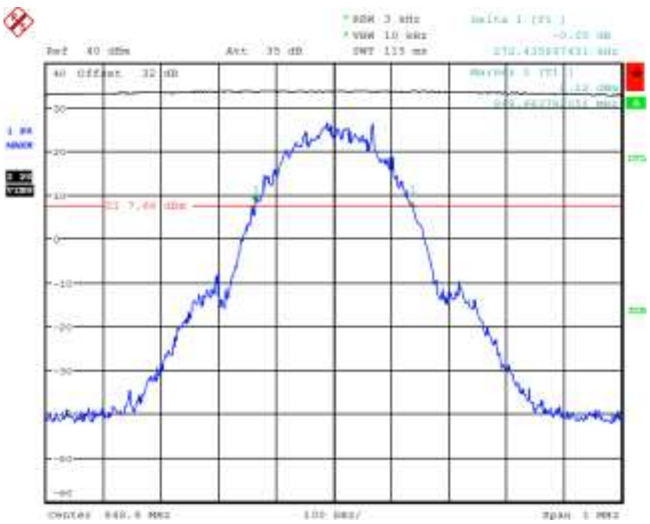


**Figure 1-18a: Occupied Bandwidth, GSM850 band High Channel in GSM mode**

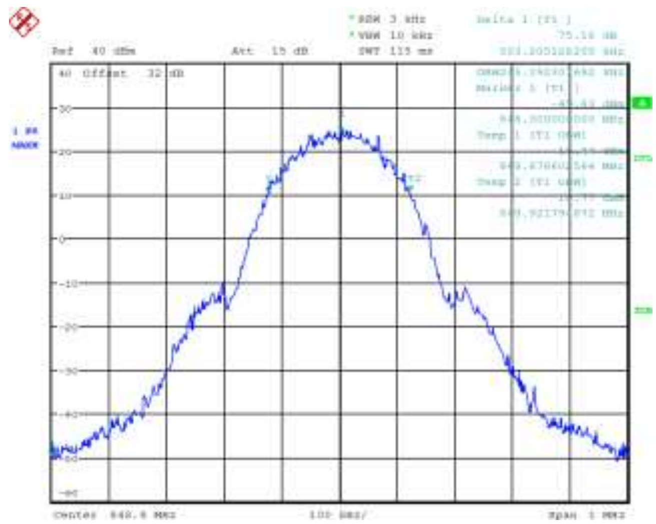


**Figure 1-19a: -26dBc bandwidth, PCS1900 Low Channel in GSM mode**

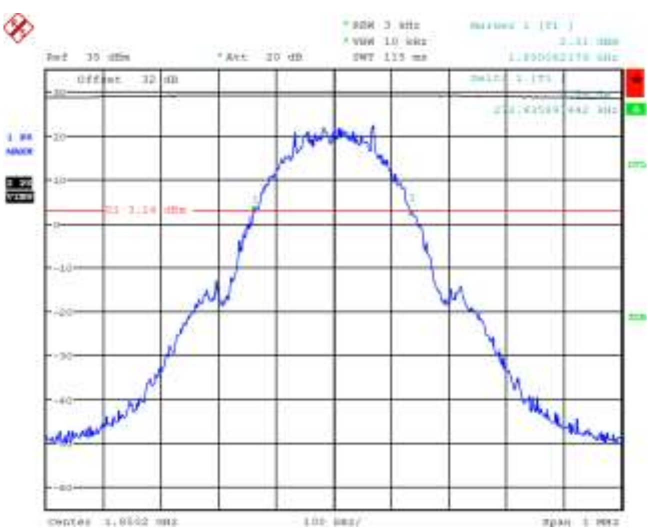
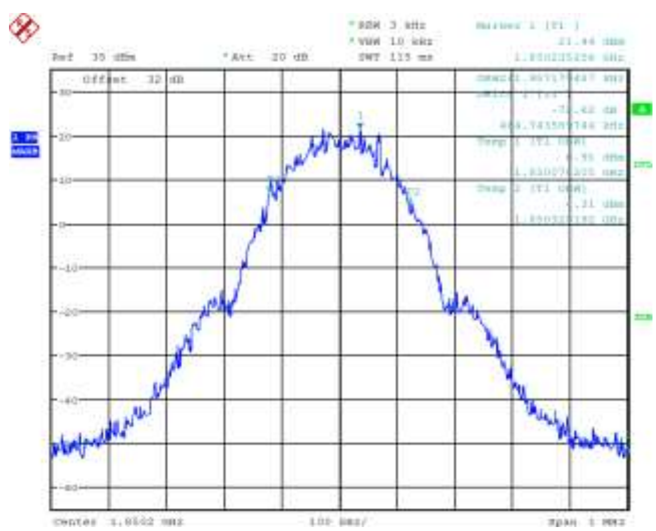


**Figure 1-20a: Occupied Bandwidth, PCS1900 Low Channel in GSM mode**



## GSM Conducted RF Emission Test Data cont'd

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

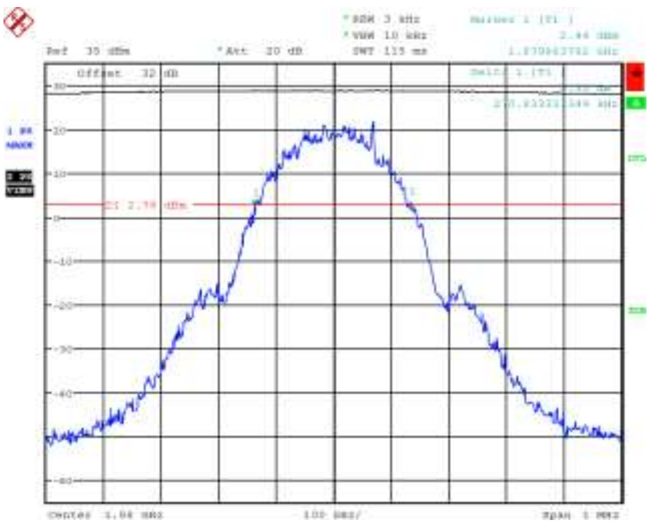



**Figure 1-22a: Occupied Bandwidth, PCS1900 Middle Channel in GSM mode**

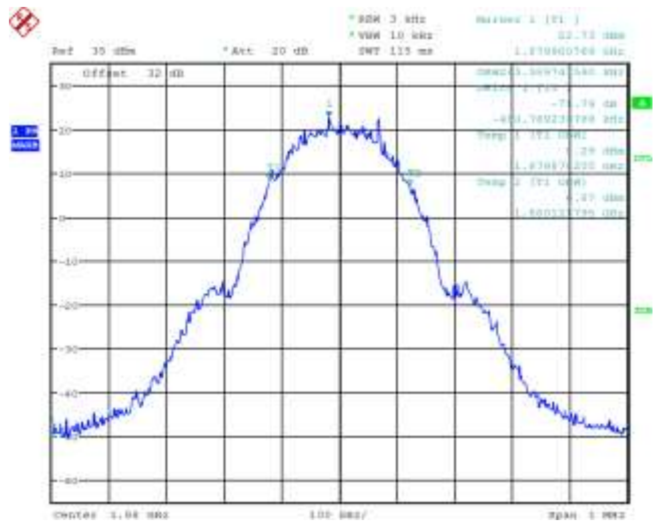



**Figure 1-23a: -26dBc bandwidth, PCS1900 High Channel in GSM mode**

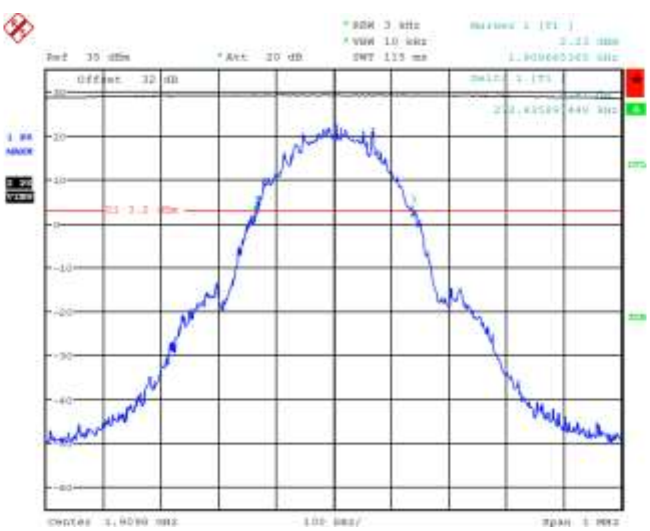
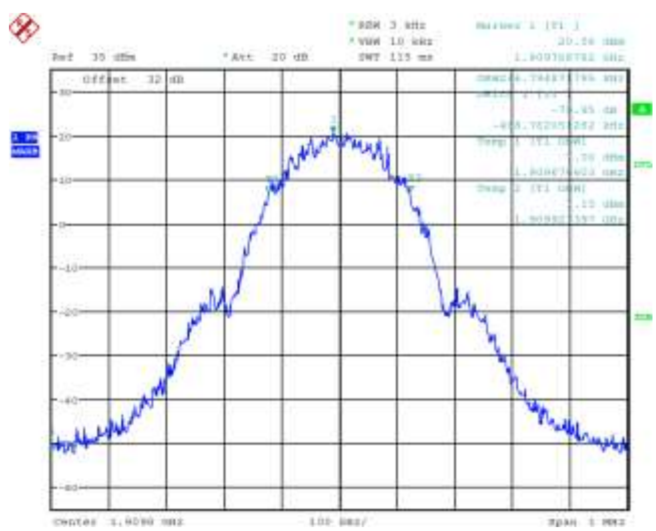



**Figure 1-24a: Occupied Bandwidth, PCS1900 High Channel in GSM mode**



## GSM Conducted RF Emission Test Data cont'd

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

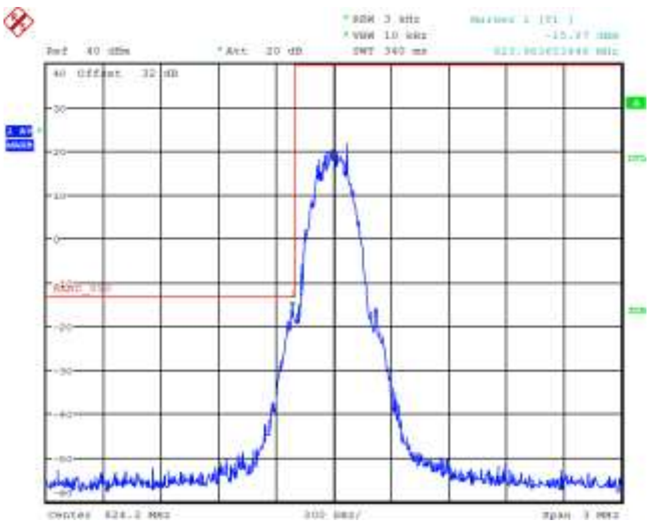


**Figure 1-26a: GSM850 band High Channel Mask in GSM mode**

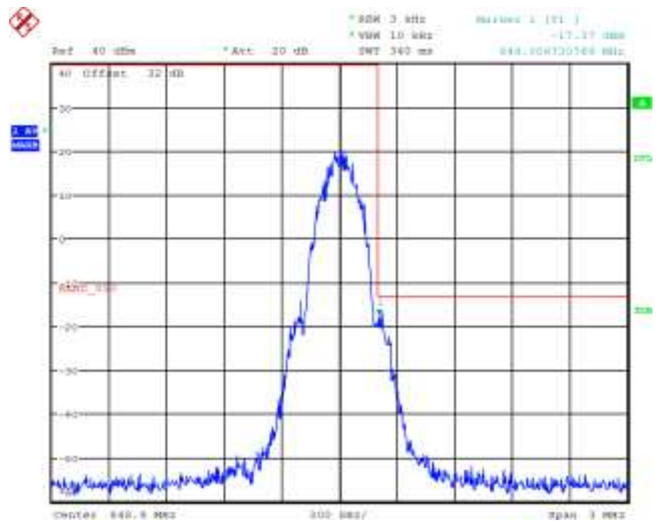


**Figure 1-27a: PCS1900, Low Channel Mask in GSM mode**

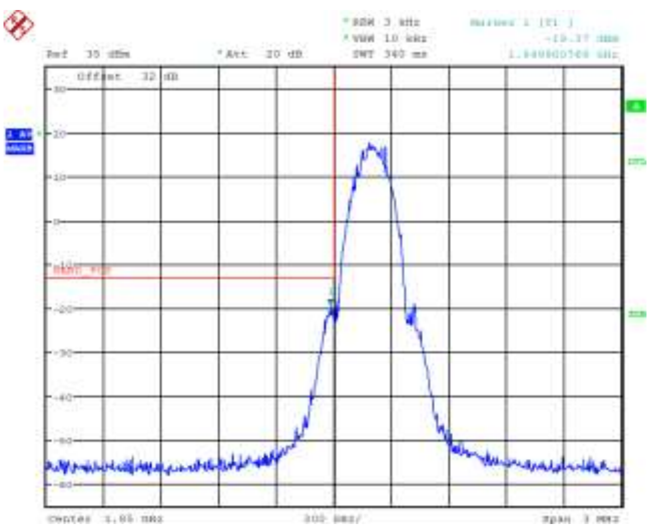
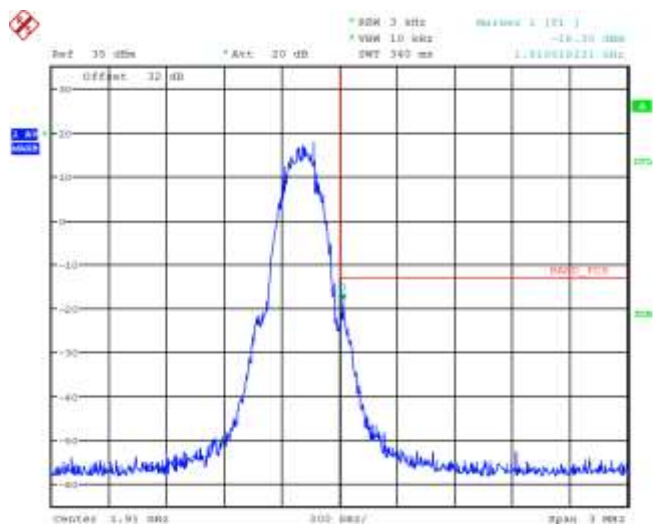


**Figure 1-28a: PCS1900, High Channel Mask in GSM mode**



## GSM Conducted RF Emission Test Data cont'd

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

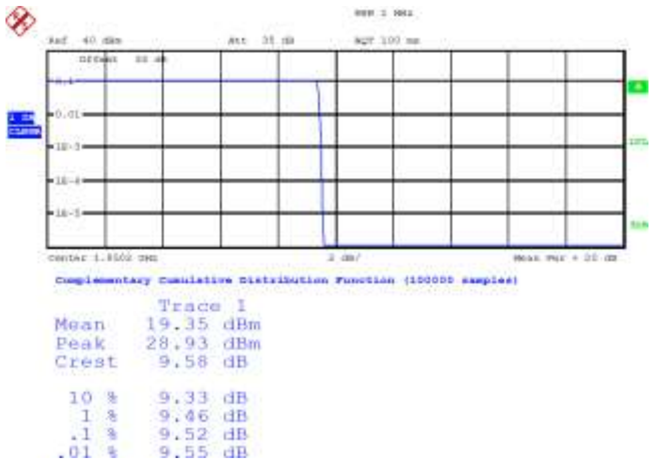



**Figure 1-52a: PCS1900 Band, PAR Mid Channel**

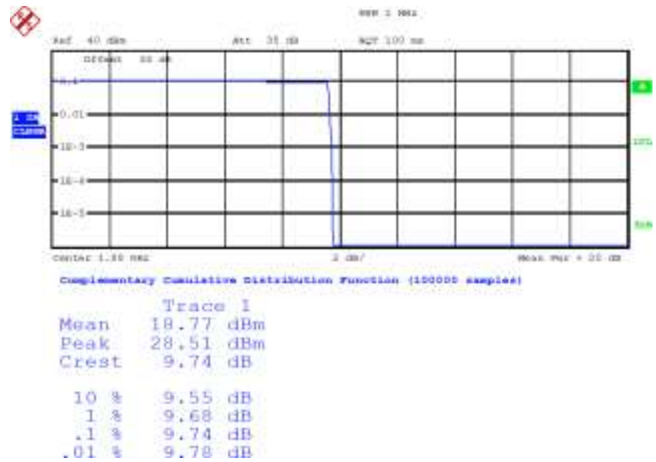
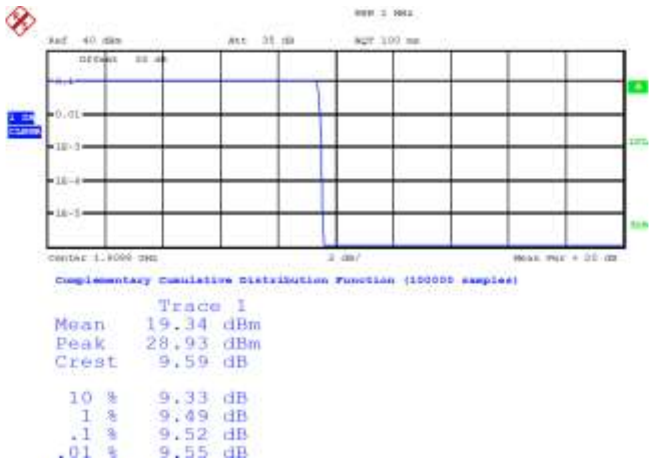



**Figure 1-53a: PCS1900 Band, PAR High Channel**



## GSM Conducted RF Emission Test Data cont'd

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

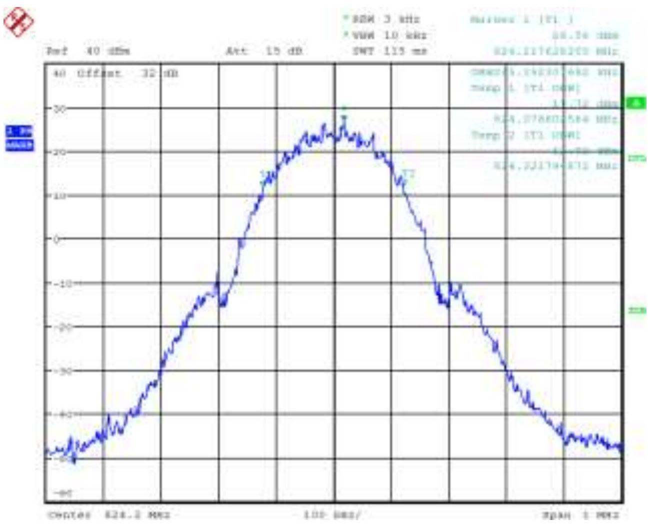


**Figure 1-30a: Occupied Bandwidth, GSM850 Band, Middle Channel in EDGE mode**

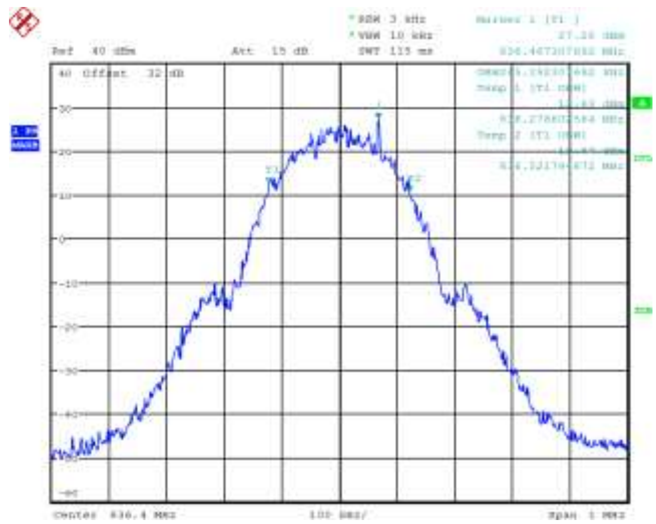


**Figure 1-31a: Occupied Bandwidth, GSM850 band, High Channel in EDGE mode**

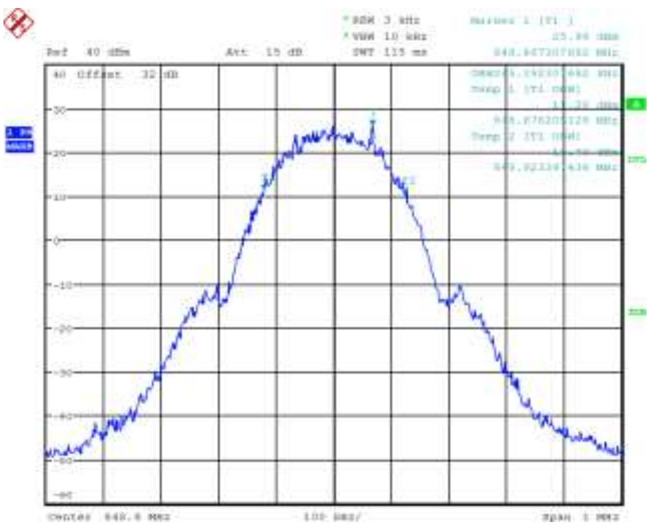
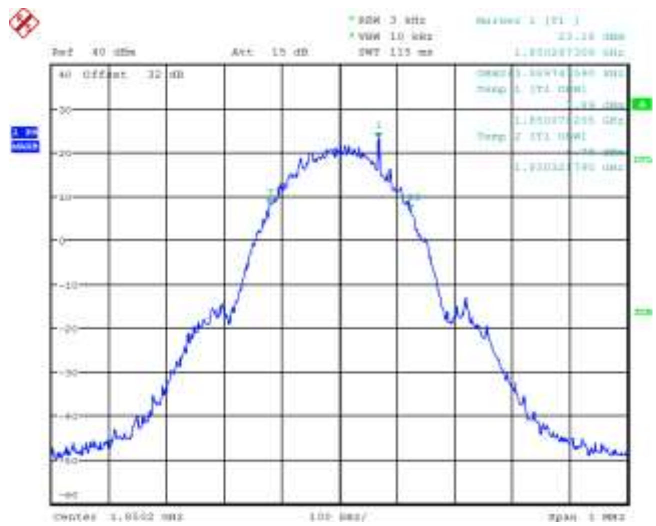


**Figure 1-32a: Occupied Bandwidth, PCS1900 Band, Low Channel in EDGE mode**



## GSM Conducted RF Emission Test Data cont'd

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

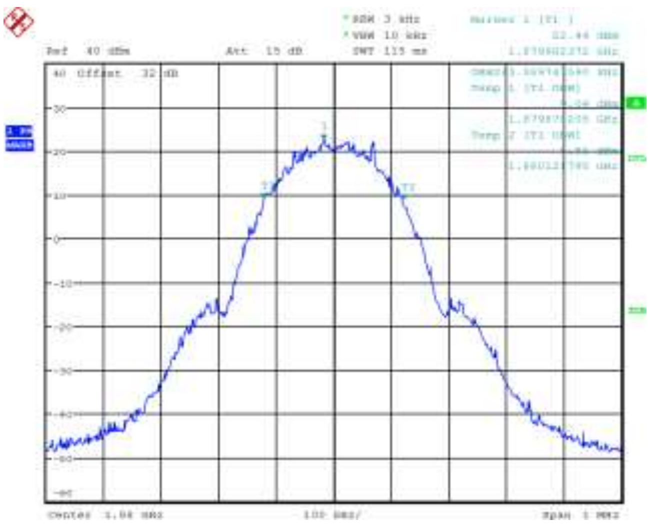


**Figure 1-34a: Occupied Bandwidth, PCS1900 Band, High Channel in EDGE mode**

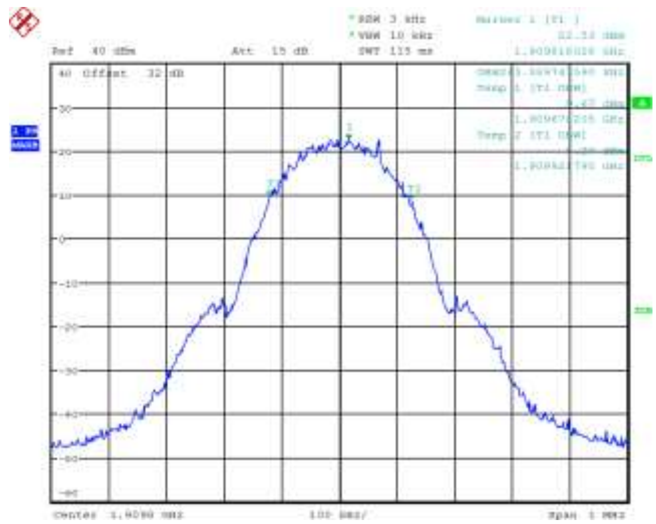


**Figure 1-35a: GSM850 Band, Low Channel Mask in EDGE mode**

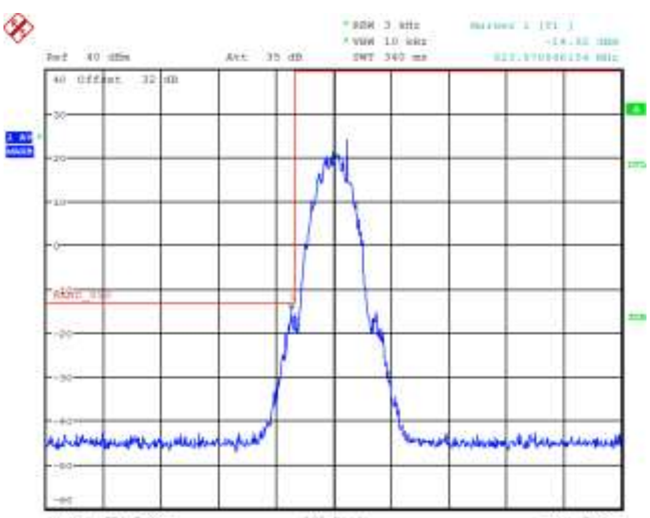
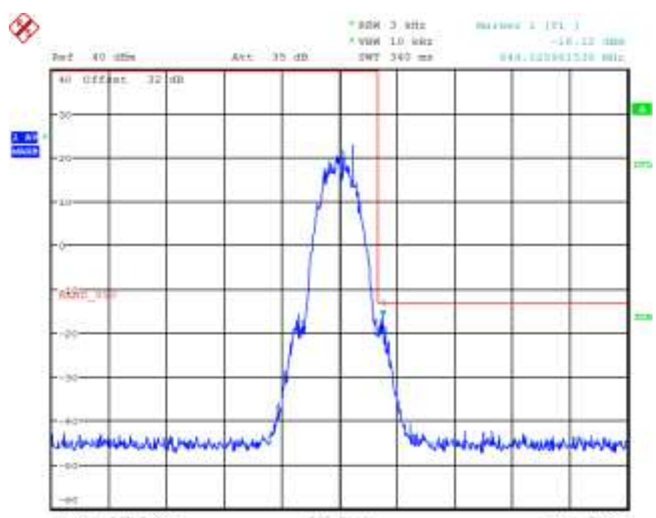


**Figure 1-36a: GSM850 Band, High Channel Mask in EDGE mode**



## GSM Conducted RF Emission Test Data cont'd

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

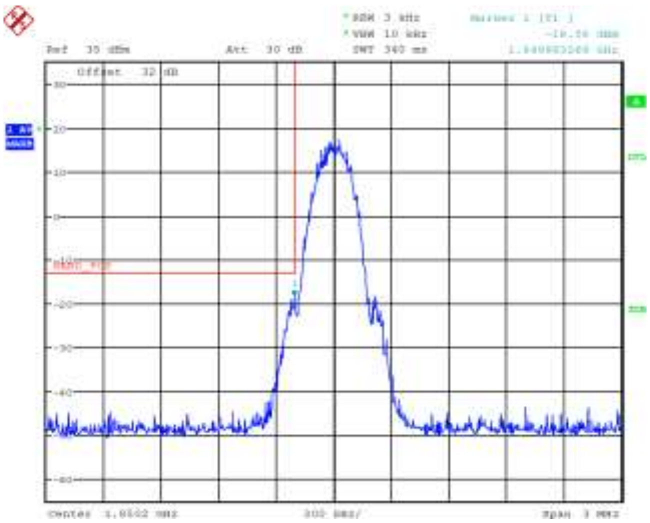
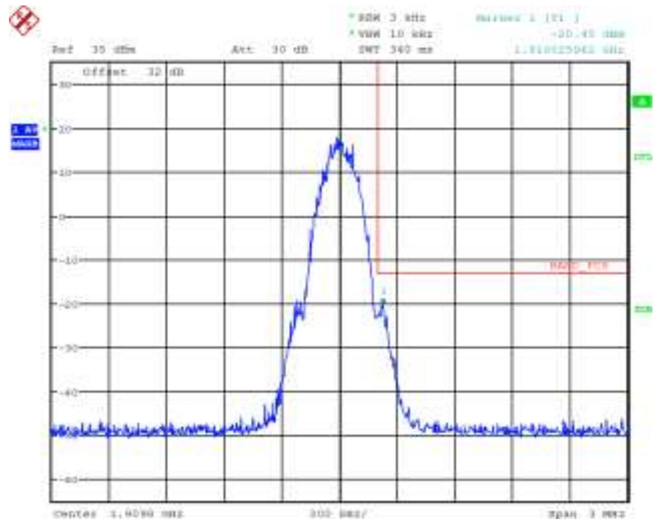



**Figure 1-38a: PCS1900 Band, High Channel Mask in EDGE mode**



## GSM Conducted RF Emission Test Data cont'd

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

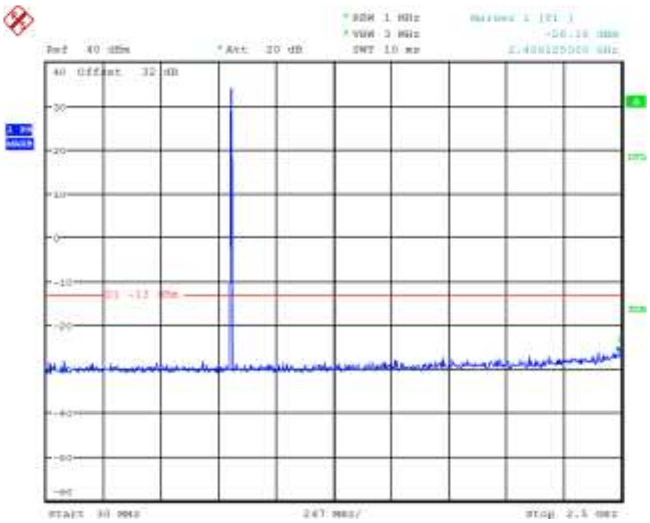



**Figure 1-40a: GSM850 band, Spurious Conducted Emissions, Low channel in Edge Mode**

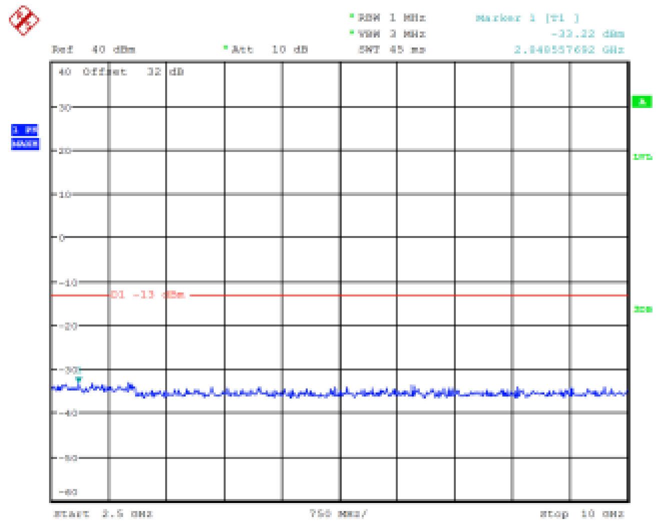



**Figure 1-41a: GSM850 band, Spurious Conducted Emissions, Middle channel in Edge Mode**

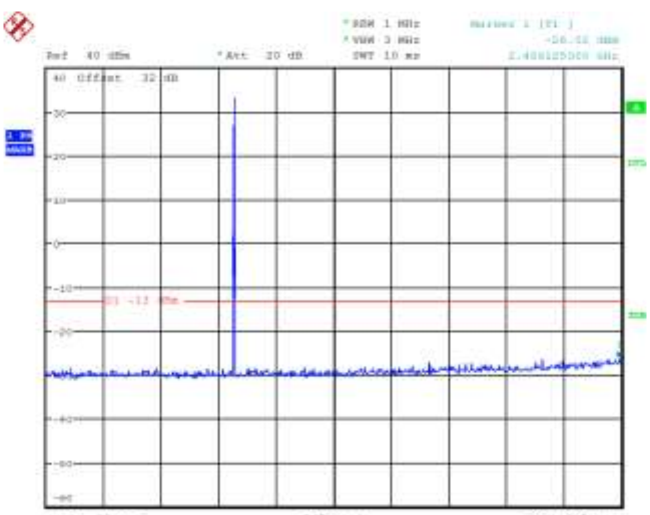
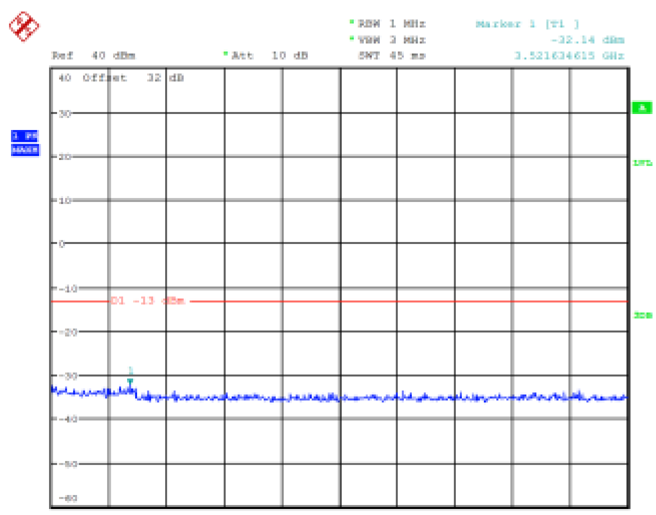



**Figure 1-42a: GSM850 band, Spurious Conducted Emissions, Middle channel in Edge Mode**



## GSM Conducted RF Emission Test Data cont'd

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

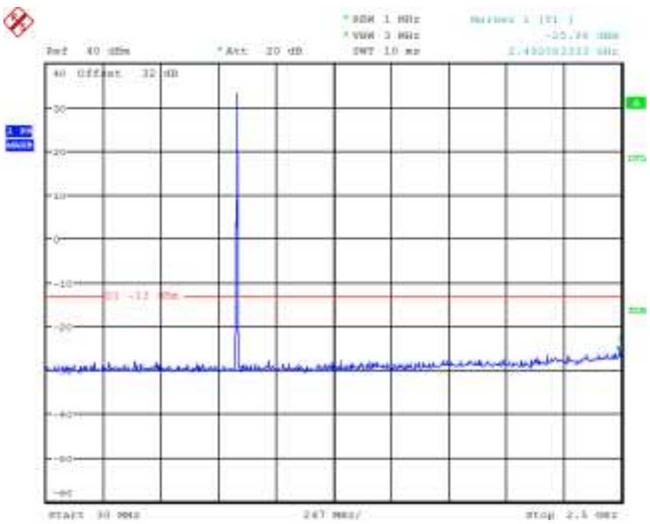



**Figure 1-44a: GSM850 band, Spurious Conducted Emissions, High channel in Edge Mode**

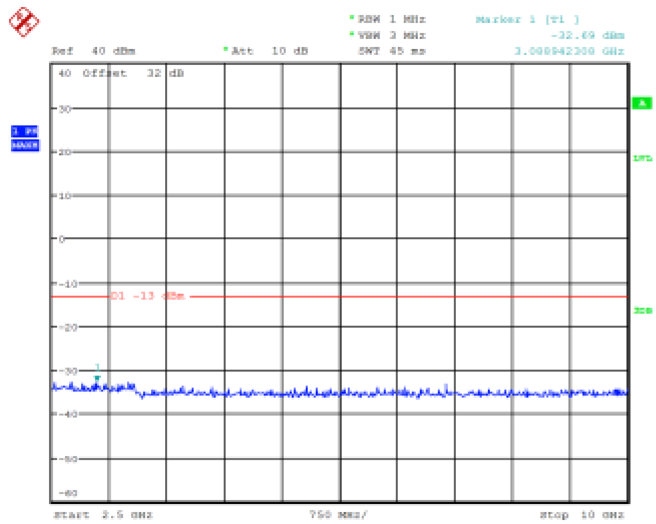



**Figure 1-45a: PCS1900 band, Spurious Conducted Emissions, Low channel in Edge Mode**

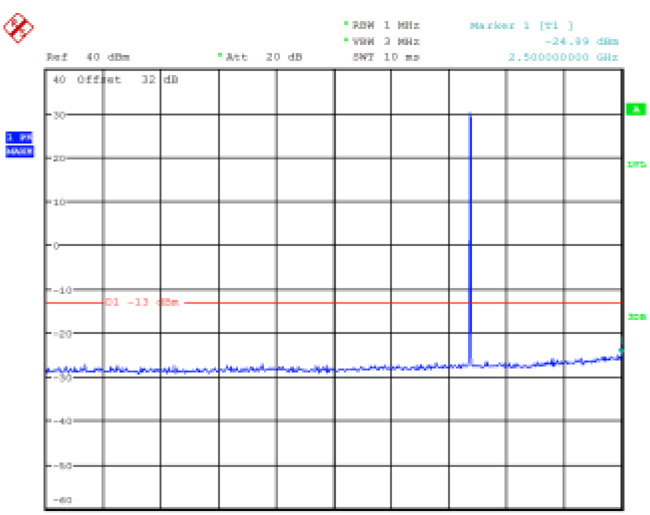
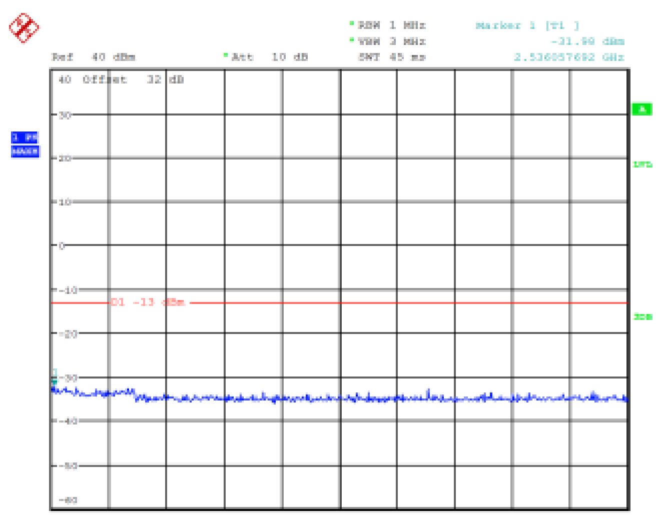



**Figure 1-46a: PCS1900 band, Spurious Conducted Emissions, Low channel in Edge Mode**



## GSM Conducted RF Emission Test Data cont'd

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

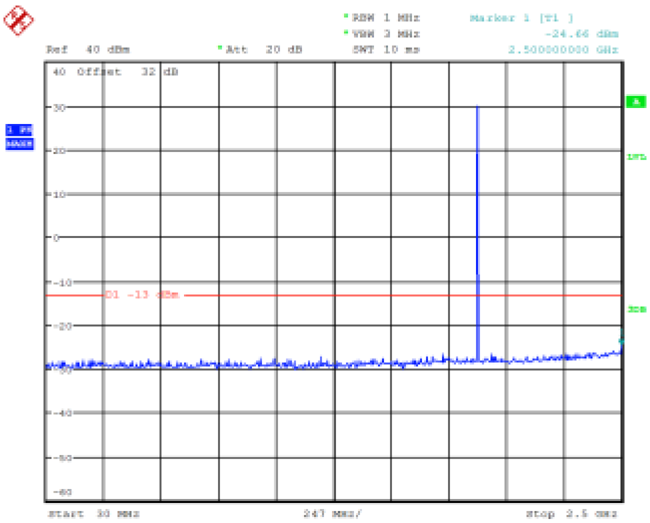



**Figure 1-48a: PCS1900 band, Spurious Conducted Emissions, middle channel in Edge Mode**

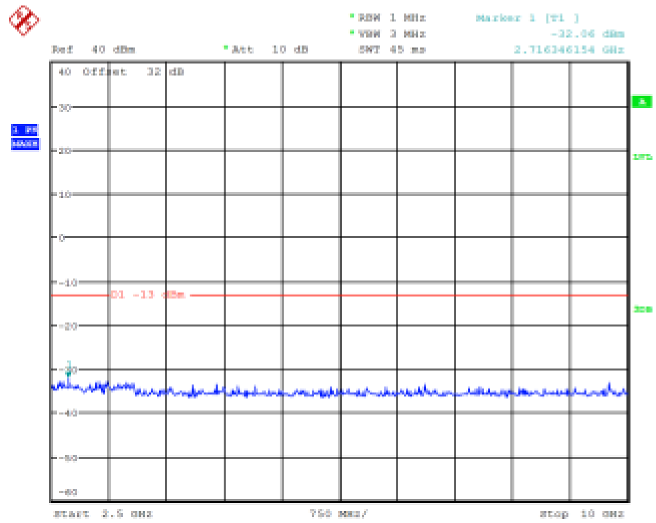



**Figure 1-49a: PCS1900 band, Spurious Conducted Emissions, High channel in Edge Mode**

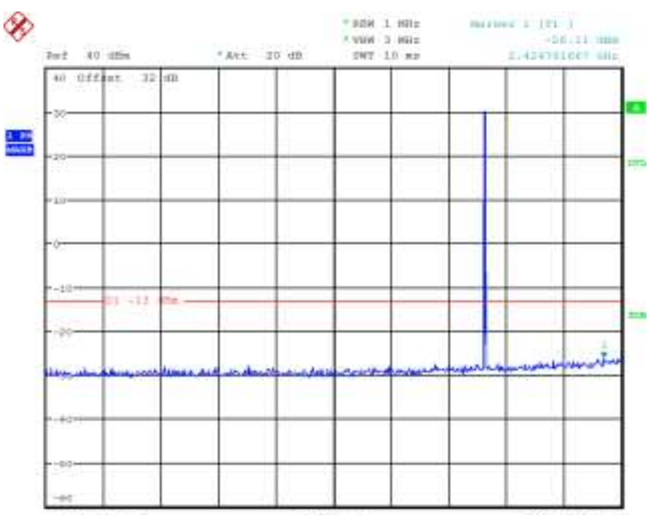
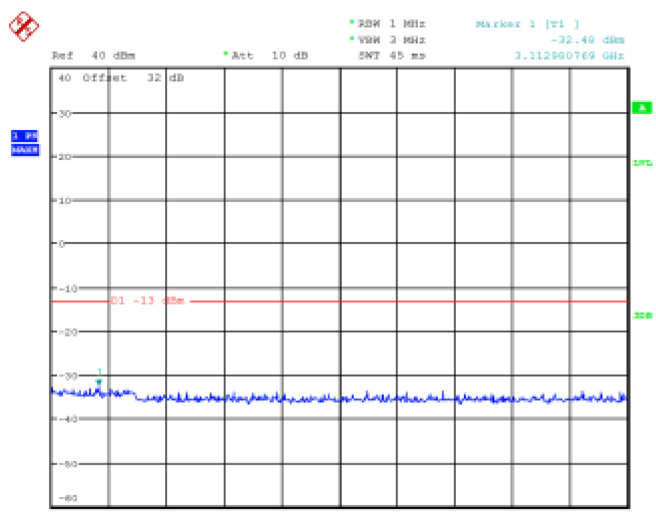
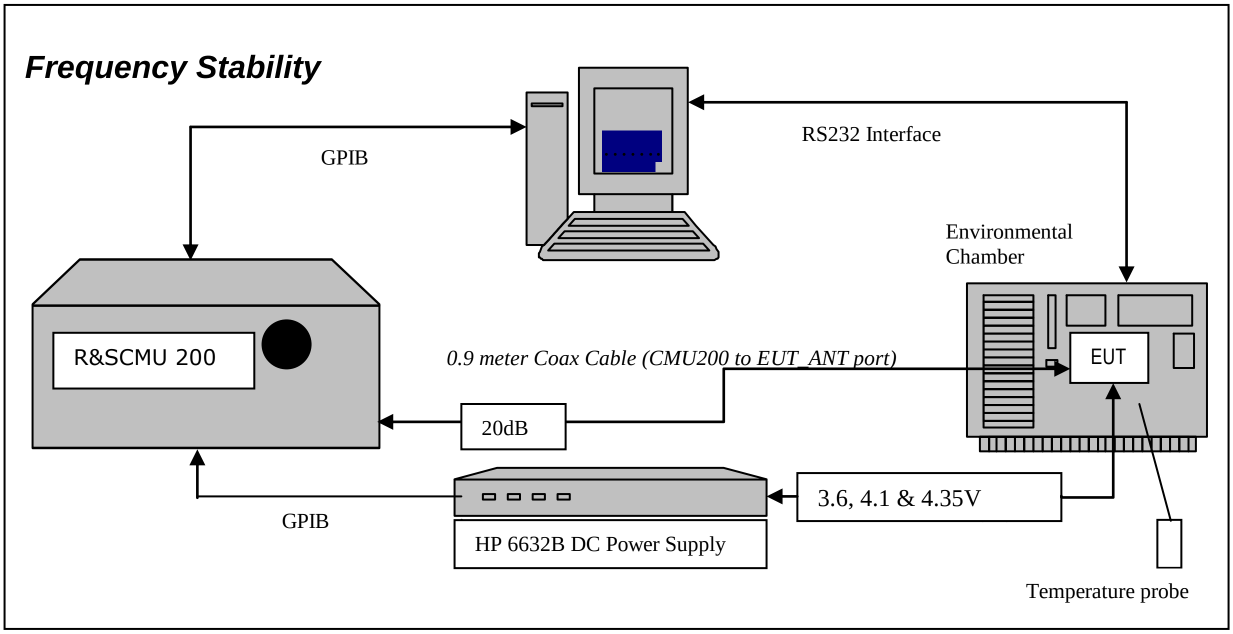



**Figure 1-50a: PCS1900 band, Spurious Conducted Emissions, High channel in Edge Mode**



# APPENDIX 1B – GSM FREQUENCY STABILITY TEST DATA

GSM Frequency Stability Test Data




The measurements were performed by Chuan Tran.

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.

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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 0.0402 PPM.
The maximum frequency error in the PCS1900 band measured was -0.0273 PPM.

Date of Test: June 30, 2014

### 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 | 13.69 | 0.0166 |
| 189 | 836.40 | 3.6 | 20 | 12.07 | 0.0144 |
| 251 | 848.60 | 3.6 | 20 | 10.01 | 0.0118 |

| Traffic Channel Number | GSM850 Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 128 | 824.20 | 4.1 | 20 | 8.07 | 0.0098 |
| 189 | 836.40 | 4.1 | 20 | 5.17 | 0.0062 |
| 251 | 848.60 | 4.1 | 20 | 7.94 | 0.0094 |

| Traffic Channel Number | GSM850 Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 128 | 824.20 | 4.35 | 20 | -3.55 | -0.0043 |
| 189 | 836.40 | 4.35 | 20 | 6.97 | 0.0083 |
| 251 | 848.60 | 4.35 | 20 | 6.97 | 0.0082 |

## 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 | -19.11 | -0.0232 |
| 128 | 824.20 | 3.6 | -20 | -8.85 | -0.0107 |
| 128 | 824.20 | 3.6 | -10 | -7.17 | -0.0087 |
| 128 | 824.20 | 3.6 | 0 | 5.55 | 0.0067 |
| 128 | 824.20 | 3.6 | 10 | 8.98 | 0.0109 |
| 128 | 824.20 | 3.6 | 20 | 13.69 | 0.0166 |
| 128 | 824.20 | 3.6 | 30 | 10.65 | 0.0129 |
| 128 | 824.20 | 3.6 | 40 | 6.07 | 0.0074 |
| 128 | 824.20 | 3.6 | 50 | 3.16 | 0.0038 |
| 128 | 824.20 | 3.6 | 60 | 6.84 | 0.0083 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 128 | 824.20 | 4.1 | -30 | 12.20 | 0.0148 |
| 128 | 824.20 | 4.1 | -20 | -13.11 | -0.0159 |
| 128 | 824.20 | 4.1 | -10 | 9.10 | 0.0110 |
| 128 | 824.20 | 4.1 | 0 | 7.88 | 0.0096 |
| 128 | 824.20 | 4.1 | 10 | -12.33 | -0.0150 |
| 128 | 824.20 | 4.1 | 20 | 8.07 | 0.0098 |
| 128 | 824.20 | 4.1 | 30 | -15.43 | -0.0187 |
| 128 | 824.20 | 4.1 | 40 | 5.75 | 0.0070 |
| 128 | 824.20 | 4.1 | 50 | -16.53 | -0.0201 |
| 128 | 824.20 | 4.1 | 60 | -4.84 | -0.0059 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 128 | 824.20 | 4.35 | -30 | 24.41 | 0.0296 |
| 128 | 824.20 | 4.35 | -20 | -20.92 | -0.0254 |
| 128 | 824.20 | 4.35 | -10 | 12.07 | 0.0146 |
| 128 | 824.20 | 4.35 | 0 | 7.23 | 0.0088 |
| 128 | 824.20 | 4.35 | 10 | -22.54 | -0.0273 |
| 128 | 824.20 | 4.35 | 20 | -3.55 | -0.0043 |
| 128 | 824.20 | 4.35 | 30 | -24.67 | -0.0299 |
| 128 | 824.20 | 4.35 | 40 | 3.94 | 0.0048 |
| 128 | 824.20 | 4.35 | 50 | -21.89 | -0.0266 |
| 128 | 824.20 | 4.35 | 60 | -9.75 | -0.0118 |

## 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 | -15.56 | -0.0186 |
| 189 | 836.40 | 3.6 | -20 | -9.56 | -0.0114 |
| 189 | 836.40 | 3.6 | -10 | -3.49 | -0.0042 |
| 189 | 836.40 | 3.6 | 0 | 8.01 | 0.0096 |
| 189 | 836.40 | 3.6 | 10 | 8.46 | 0.0101 |
| 189 | 836.40 | 3.6 | 20 | 12.07 | 0.0144 |
| 189 | 836.40 | 3.6 | 30 | 12.20 | 0.0146 |
| 189 | 836.40 | 3.6 | 40 | 10.27 | 0.0123 |
| 189 | 836.40 | 3.6 | 50 | -6.59 | -0.0079 |
| 189 | 836.40 | 3.6 | 60 | 7.30 | 0.0087 |
| Traffic Channel Number | Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
| 189 | 836.40 | 4.1 | -30 | 25.89 | 0.0310 |
| 189 | 836.40 | 4.1 | -20 | -11.17 | -0.0134 |
| 189 | 836.40 | 4.1 | -10 | 10.46 | 0.0125 |
| 189 | 836.40 | 4.1 | 0 | 7.68 | 0.0092 |
| 189 | 836.40 | 4.1 | 10 | -16.98 | -0.0203 |
| 189 | 836.40 | 4.1 | 20 | 5.17 | 0.0062 |
| 189 | 836.40 | 4.1 | 30 | -20.15 | -0.0241 |
| 189 | 836.40 | 4.1 | 40 | 10.98 | 0.0131 |
| 189 | 836.40 | 4.1 | 50 | -16.79 | -0.0201 |
| 189 | 836.40 | 4.1 | 60 | -4.65 | -0.0056 |
| Traffic Channel Number | Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
| 189 | 836.40 | 4.35 | -30 | 25.96 | 0.0310 |
| 189 | 836.40 | 4.35 | -20 | -23.89 | -0.0286 |
| 189 | 836.40 | 4.35 | -10 | 10.01 | 0.0120 |
| 189 | 836.40 | 4.35 | 0 | 7.49 | 0.0090 |
| 189 | 836.40 | 4.35 | 10 | -26.02 | -0.0311 |
| 189 | 836.40 | 4.35 | 20 | 6.97 | 0.0083 |
| 189 | 836.40 | 4.35 | 30 | -26.35 | -0.0315 |
| 189 | 836.40 | 4.35 | 40 | 9.94 | 0.0119 |
| 189 | 836.40 | 4.35 | 50 | -21.63 | -0.0259 |
| 189 | 836.40 | 4.35 | 60 | -9.94 | -0.0119 |

## 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 | -6.13 | -0.0072 |
| 251 | 848.8 | 3.6 | -20 | -7.75 | -0.0091 |
| 251 | 848.8 | 3.6 | -10 | -4.58 | -0.0054 |
| 251 | 848.8 | 3.6 | 0 | 10.53 | 0.0124 |
| 251 | 848.8 | 3.6 | 10 | 5.23 | 0.0062 |
| 251 | 848.8 | 3.6 | 20 | 10.01 | 0.0118 |
| 251 | 848.8 | 3.6 | 30 | -5.62 | -0.0066 |
| 251 | 848.8 | 3.6 | 40 | 12.98 | 0.0153 |
| 251 | 848.8 | 3.6 | 50 | -9.69 | -0.0114 |
| 251 | 848.8 | 3.6 | 60 | 5.29 | 0.0062 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 251 | 848.8 | 4.1 | -30 | **34.16** | **0.0402** |
| 251 | 848.8 | 4.1 | -20 | -14.40 | -0.0170 |
| 251 | 848.8 | 4.1 | -10 | 14.08 | 0.0166 |
| 251 | 848.8 | 4.1 | 0 | 9.17 | 0.0108 |
| 251 | 848.8 | 4.1 | 10 | -14.98 | -0.0176 |
| 251 | 848.8 | 4.1 | 20 | 7.94 | 0.0094 |
| 251 | 848.8 | 4.1 | 30 | -20.92 | -0.0246 |
| 251 | 848.8 | 4.1 | 40 | 11.04 | 0.0130 |
| 251 | 848.8 | 4.1 | 50 | -18.40 | -0.0217 |
| 251 | 848.8 | 4.1 | 60 | -5.42 | -0.0064 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 251 | 848.8 | 4.35 | -30 | 30.99 | 0.0365 |
| 251 | 848.8 | 4.35 | -20 | -26.02 | -0.0307 |
| 251 | 848.8 | 4.35 | -10 | 13.75 | 0.0162 |
| 251 | 848.8 | 4.35 | 0 | 4.91 | 0.0058 |
| 251 | 848.8 | 4.35 | 10 | -22.73 | -0.0268 |
| 251 | 848.8 | 4.35 | 20 | 6.97 | 0.0082 |
| 251 | 848.8 | 4.35 | 30 | -26.54 | -0.0313 |
| 251 | 848.8 | 4.35 | 40 | 14.98 | 0.0176 |
| 251 | 848.8 | 4.35 | 50 | -19.50 | -0.0230 |
| 251 | 848.8 | 4.35 | 60 | -12.40 | -0.0146 |

## 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 | 9.49 | 0.0051 |
| 661 | 1880.00 | 3.6 | 20 | 8.59 | 0.0046 |
| 810 | 1909.80 | 3.6 | 20 | 14.53 | 0.0076 |

| Traffic Channel Number | PCS Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 512 | 1850.20 | 4.1 | 20 | -8.07 | -0.0044 |
| 661 | 1880.00 | 4.1 | 20 | 9.04 | 0.0048 |
| 810 | 1909.80 | 4.1 | 20 | 13.75 | 0.0072 |

| Traffic Channel Number | PCS Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 512 | 1850.20 | 4.35 | 20 | 10.85 | 0.0059 |
| 661 | 1880.00 | 4.35 | 20 | 8.85 | 0.0047 |
| 810 | 1909.80 | 4.35 | 20 | 8.98 | 0.0047 |

## 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 | -32.09 | -0.0173 |
| 512 | 1850.20 | 3.6 | -20 | -25.12 | -0.0136 |
| 512 | 1850.20 | 3.6 | -10 | -15.24 | -0.0082 |
| 512 | 1850.20 | 3.6 | 0 | -7.75 | -0.0042 |
| 512 | 1850.20 | 3.6 | 10 | -6.84 | -0.0037 |
| 512 | 1850.20 | 3.6 | 20 | 9.49 | 0.0051 |
| 512 | 1850.20 | 3.6 | 30 | 10.14 | 0.0055 |
| 512 | 1850.20 | 3.6 | 40 | 15.43 | 0.0083 |
| 512 | 1850.20 | 3.6 | 50 | 9.23 | 0.0050 |
| 512 | 1850.20 | 3.6 | 60 | -10.07 | -0.0054 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 512 | 1850.20 | 4.1 | -30 | **-50.43** | **-0.0273** |
| 512 | 1850.20 | 4.1 | -20 | -32.35 | -0.0175 |
| 512 | 1850.20 | 4.1 | -10 | -17.56 | -0.0095 |
| 512 | 1850.20 | 4.1 | 0 | -16.21 | -0.0088 |
| 512 | 1850.20 | 4.1 | 10 | -7.55 | -0.0041 |
| 512 | 1850.20 | 4.1 | 20 | -8.07 | -0.0044 |
| 512 | 1850.20 | 4.1 | 30 | -6.59 | -0.0036 |
| 512 | 1850.20 | 4.1 | 40 | -10.20 | -0.0055 |
| 512 | 1850.20 | 4.1 | 50 | -14.46 | -0.0078 |
| 512 | 1850.20 | 4.1 | 60 | -19.05 | -0.0103 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 512 | 1850.20 | 4.35 | -30 | -45.72 | -0.0247 |
| 512 | 1850.20 | 4.35 | -20 | -28.54 | -0.0154 |
| 512 | 1850.20 | 4.35 | -10 | -21.95 | -0.0119 |
| 512 | 1850.20 | 4.35 | 0 | -10.46 | -0.0057 |
| 512 | 1850.20 | 4.35 | 10 | 15.95 | 0.0086 |
| 512 | 1850.20 | 4.35 | 20 | 10.85 | 0.0059 |
| 512 | 1850.20 | 4.35 | 30 | -18.92 | -0.0102 |
| 512 | 1850.20 | 4.35 | 40 | 7.75 | 0.0042 |
| 512 | 1850.20 | 4.35 | 50 | -10.46 | -0.0057 |
| 512 | 1850.20 | 4.35 | 60 | -30.99 | -0.0167 |

# 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 | -32.67 | -0.0174 |
| 661 | 1880.00 | 3.6 | -20 | -22.34 | -0.0119 |
| 661 | 1880.00 | 3.6 | -10 | -18.27 | -0.0097 |
| 661 | 1880.00 | 3.6 | 0 | 8.01 | 0.0043 |
| 661 | 1880.00 | 3.6 | 10 | 10.40 | 0.0055 |
| 661 | 1880.00 | 3.6 | 20 | 8.59 | 0.0046 |
| 661 | 1880.00 | 3.6 | 30 | 12.53 | 0.0067 |
| 661 | 1880.00 | 3.6 | 40 | 21.63 | 0.0115 |
| 661 | 1880.00 | 3.6 | 50 | 13.11 | 0.0070 |
| 661 | 1880.00 | 3.6 | 60 | -7.49 | -0.0040 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 661 | 1880.00 | 4.1 | -30 | -41.65 | -0.0222 |
| 661 | 1880.00 | 4.1 | -20 | -24.80 | -0.0132 |
| 661 | 1880.00 | 4.1 | -10 | -20.53 | -0.0109 |
| 661 | 1880.00 | 4.1 | 0 | -13.04 | -0.0069 |
| 661 | 1880.00 | 4.1 | 10 | 8.78 | 0.0047 |
| 661 | 1880.00 | 4.1 | 20 | 9.04 | 0.0048 |
| 661 | 1880.00 | 4.1 | 30 | -13.82 | -0.0074 |
| 661 | 1880.00 | 4.1 | 40 | -11.56 | -0.0061 |
| 661 | 1880.00 | 4.1 | 50 | -12.07 | -0.0064 |
| 661 | 1880.00 | 4.1 | 60 | -19.50 | -0.0104 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 661 | 1880.00 | 4.35 | -30 | -36.10 | -0.0192 |
| 661 | 1880.00 | 4.35 | -20 | -32.35 | -0.0172 |
| 661 | 1880.00 | 4.35 | -10 | -23.50 | -0.0125 |
| 661 | 1880.00 | 4.35 | 0 | -12.27 | -0.0065 |
| 661 | 1880.00 | 4.35 | 10 | 6.84 | 0.0036 |
| 661 | 1880.00 | 4.35 | 20 | 8.85 | 0.0047 |
| 661 | 1880.00 | 4.35 | 30 | -31.51 | -0.0168 |
| 661 | 1880.00 | 4.35 | 40 | 11.49 | 0.0061 |
| 661 | 1880.00 | 4.35 | 50 | -10.14 | -0.0054 |
| 661 | 1880.00 | 4.35 | 60 | -32.22 | -0.0171 |

## 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 | -39.65 | -0.0208 |
| 810 | 1909.80 | 3.6 | -20 | -26.41 | -0.0138 |
| 810 | 1909.80 | 3.6 | -10 | -11.75 | -0.0062 |
| 810 | 1909.80 | 3.6 | 0 | 7.36 | 0.0039 |
| 810 | 1909.80 | 3.6 | 10 | 19.24 | 0.0101 |
| 810 | 1909.80 | 3.6 | 20 | 14.53 | 0.0076 |
| 810 | 1909.80 | 3.6 | 30 | 18.53 | 0.0097 |
| 810 | 1909.80 | 3.6 | 40 | 17.24 | 0.0090 |
| 810 | 1909.80 | 3.6 | 50 | 17.50 | 0.0092 |
| 810 | 1909.80 | 3.6 | 60 | 10.53 | 0.0055 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 810 | 1909.80 | 4.1 | -30 | -49.20 | -0.0258 |
| 810 | 1909.80 | 4.1 | -20 | -26.86 | -0.0141 |
| 810 | 1909.80 | 4.1 | -10 | -22.99 | -0.0120 |
| 810 | 1909.80 | 4.1 | 0 | -7.94 | -0.0042 |
| 810 | 1909.80 | 4.1 | 10 | 16.59 | 0.0087 |
| 810 | 1909.80 | 4.1 | 20 | 13.75 | 0.0072 |
| 810 | 1909.80 | 4.1 | 30 | -18.27 | -0.0096 |
| 810 | 1909.80 | 4.1 | 40 | 7.55 | 0.0040 |
| 810 | 1909.80 | 4.1 | 50 | 6.20 | 0.0032 |
| 810 | 1909.80 | 4.1 | 60 | -22.54 | -0.0118 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 810 | 1909.80 | 4.35 | -30 | -42.88 | -0.0225 |
| 810 | 1909.80 | 4.35 | -20 | -33.90 | -0.0178 |
| 810 | 1909.80 | 4.35 | -10 | -21.31 | -0.0112 |
| 810 | 1909.80 | 4.35 | 0 | -11.04 | -0.0058 |
| 810 | 1909.80 | 4.35 | 10 | 14.21 | 0.0074 |
| 810 | 1909.80 | 4.35 | 20 | 8.98 | 0.0047 |
| 810 | 1909.80 | 4.35 | 30 | -32.61 | -0.0171 |
| 810 | 1909.80 | 4.35 | 40 | 12.85 | 0.0067 |
| 810 | 1909.80 | 4.35 | 50 | -10.27 | -0.0054 |
| 810 | 1909.80 | 4.35 | 60 | -29.06 | -0.0152 |

# APPENDIX 1C – GSM RADIATED EMISSIONS TEST DATA

## Radiated Power Test Data Results

Date of test: July 17, 2014

The following measurements were performed by Rex Zhang.
The environmental tests conditions were: Temperature: 24.8 °C
Relative Humidity: 36.2 %

The BlackBerry® smartphone was standalone, USB down and 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 | -36.76 | -22.55 | V-V | 12.26 | 29.73 | 0.94 | 38.50 | 8.77 |
| F0 | 128 | 824.20 | 850 | Dipole | H | -22.55 | | H-H | 11.81 | | | | |
| F0 | 190 | 836.60 | 850 | Dipole | V | -35.80 | -23.16 | V-V | 12.49 | 29.63 | 0.92 | 38.50 | 8.87 |
| F0 | 190 | 836.60 | 850 | Dipole | H | -23.16 | | H-H | 10.62 | | | | |
| F0 | 251 | 848.80 | 850 | Dipole | V | -36.57 | -23.67 | V-V | 13.47 | **30.56** | 1.14 | 38.50 | 7.94 |
| F0 | 251 | 848.80 | 850 | Dipole | H | -23.67 | | H-H | 10.74 | | | | |

### 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 | -37.60 | -23.40 | V-V | 11.42 | 28.89 | 0.77 | 38.50 | 9.61 |
| F0 | 128 | 824.20 | 850 | Dipole | H | -23.40 | | H-H | 10.96 | | | | |
| F0 | 190 | 836.60 | 850 | Dipole | V | -36.59 | -24.19 | V-V | 11.41 | 28.55 | 0.72 | 38.50 | 9.95 |
| F0 | 190 | 836.60 | 850 | Dipole | H | -24.19 | | H-H | 9.54 | | | | |
| F0 | 251 | 848.80 | 850 | Dipole | V | -37.34 | -24.51 | V-V | 12.65 | **29.74** | 0.94 | 38.50 | 8.76 |
| F0 | 251 | 848.80 | 850 | Dipole | H | -24.51 | | H-H | 9.86 | | | | |

## Radiated Power Test Data Results cont'd

Date of test: July 16, 2014
The following measurements were performed by Rex Zhang.

The environmental tests conditions were: Temperature: 24.4 °C
Relative Humidity: 39.9 %

The BlackBerry® smartphone was standalone, horizontal up and top 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 | | | | | |
| | | Frequency | | | | Reading | Max (V,H) | Pol. | Reading | Corrected Reading (relative to Isotropic Radiator) | | Limit | Diff to Limit |
| Type | Ch | (MHz) | Band | Type | Pol. | (dBm) | dBm | Tx-Rx | (dBm) | (dBm) | (W) | (dBm) | (dB) |
| F0 | 512 | 1850.20 | 1900 | Horn | V | -29.43 | -19.69 | V-V | -8.26 | **32.44** | 1.75 | 33 | 0.56 |
| F0 | 512 | 1850.20 | 1900 | Horn | H | -19.69 | | H-H | -7.27 | | | | |
| F0 | 661 | 1880.00 | 1900 | Horn | V | -29.56 | -20.70 | V-V | -8.37 | 31.81 | 1.52 | 33 | 1.19 |
| F0 | 661 | 1880.00 | 1900 | Horn | H | -20.70 | | H-H | -7.48 | | | | |
| F0 | 810 | 1909.80 | 1900 | Horn | V | -30.09 | -21.37 | V-V | -9.18 | 31.12 | 1.29 | 33 | 1.88 |
| F0 | 810 | 1909.80 | 1900 | Horn | H | -21.37 | | H-H | -8.41 | | | | |

### PCS1900 Band in EDGE Mode

| | | | | | | | | Substitution Method | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EUT | | | | Receive Antenna | | Spectrum Analyzer | | Tracking Generator | | | | | |
| | | Frequency | | | | Reading | Max (V,H) | Pol. | Reading | Corrected Reading (relative to Isotropic Radiator) | | Limit | Diff to Limit |
| Type | Ch | (MHz) | Band | Type | Pol. | (dBuV) | dBuV | Tx-Rx | (dBm) | (dBm) | (W) | (dBm) | (dB) |
| F0 | 512 | 1850.20 | 1900 | Horn | V | -29.85 | -20.23 | V-V | -8.84 | **31.85** | 1.53 | 33 | 1.15 |
| F0 | 512 | 1850.20 | 1900 | Horn | H | -20.23 | | H-H | -7.86 | | | | |
| F0 | 661 | 1880.00 | 1900 | Horn | V | -30.09 | -21.06 | V-V | -8.74 | 31.43 | 1.39 | 33 | 1.57 |
| F0 | 661 | 1880.00 | 1900 | Horn | H | -21.06 | | H-H | -7.86 | | | | |
| F0 | 810 | 1909.80 | 1900 | Horn | V | -30.51 | -21.78 | V-V | -9.58 | 30.70 | 1.17 | 33 | 2.30 |
| F0 | 810 | 1909.80 | 1900 | Horn | H | -21.78 | | H-H | -8.83 | | | | |

## Radiated Emissions Test Data Results cont'd

## GSM850 Call Mode

The following measurements were performed by Rex Zhang.

Date of Test: July 28, 2014
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.

The following measurements were performed by Kevin Guo.

Date of Test: July 25, 2014
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 9 GHz.

The BlackBerry® smartphone was standalone, with horizontal 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 | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pol. (V/H) | Height (meters) | | | | | | | |
| 1672.84 | 190 | H | 2.45 | 162 | PK | 48.84 | -85.89 | -28.737 | -13.00 | -15.7 |
| 2509.696 | 190 | H | 2.60 | 175 | PK | 47.25 | -90.75 | -23.158 | -13.00 | **-10.2** |

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 28, 2014
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 horizontal 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 25, 2014
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 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.

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

## Radiated Emissions Test Data Results cont'd

## PCS1900 CALL Mode

Date of Test: June 25, 2014

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 side button 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.
All emissions were at least 25.0 dB below the limit.

Date of Test: July 26-28, 2014

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 side button 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.

All emissions were at least 25.0 dB below the limit.

## Radiated Emissions Test Data Results cont'd

## PCS1900 EDGE Mode

Date of Test: June 25, 2014

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 side button 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.

Date of Test: July 26-28, 2014

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.

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

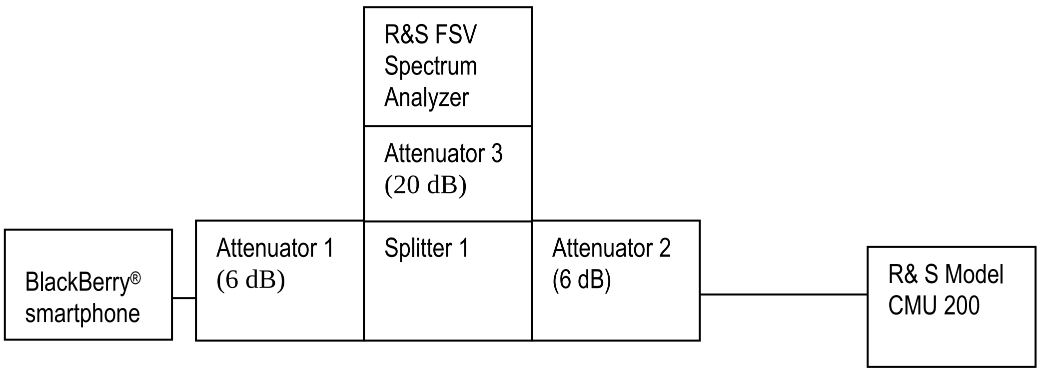
All emissions were at least 25.0 dB below the limit.

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

# WCDMA Band II/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 32.4 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 3-7, 2014

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, RSS – 133, 6.5, CFR 27.53 and RSS-139, 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 4.59 MHz, WCDMA Band II was measured to be 4.58 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 WCDMA Band II/IV/V selected Frequencies in Loopback mode

| WCDMA Band V Frequency (MHz) | 26dBc Occupied Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|---|
| 826.400 | 4.59 | **4.167** |
| 836.400 | 4.54 | 4.158 |
| 846.600 | 4.58 | **4.167** |

| WCDMA Band II Frequency (MHz) | 26dBc Occupied Bandwidth (MHz | 99% Occupied Bandwidth (MHz) |
|---|---|---|
| 1852.400 | 4.56 | 4.158 |
| 1880.000 | 4.58 | 4.158 |
| 1907.600 | 4.58 | **4.167** |

### 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 6.91 dB on the low channel of WCDMA Band II.

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

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).

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.

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

| WCDMA Band V Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|
| 826.400 | **4.167** |
| 836.400 | **4.167** |
| 846.600 | **4.167** |

| WCDMA Band II Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|
| 1852.400 | **4.167** |
| 1880.000 | **4.167** |
| 1907.600 | **4.167** |

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

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.

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**

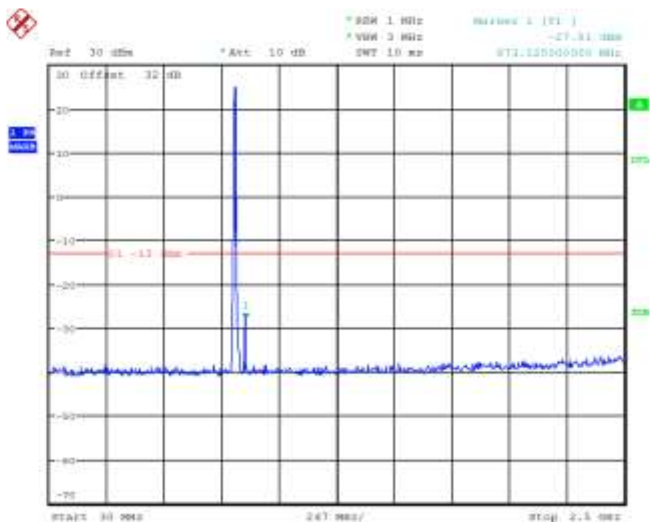



**Figure 2-2a: Band V, Spurious Conducted Emissions, Low channel**

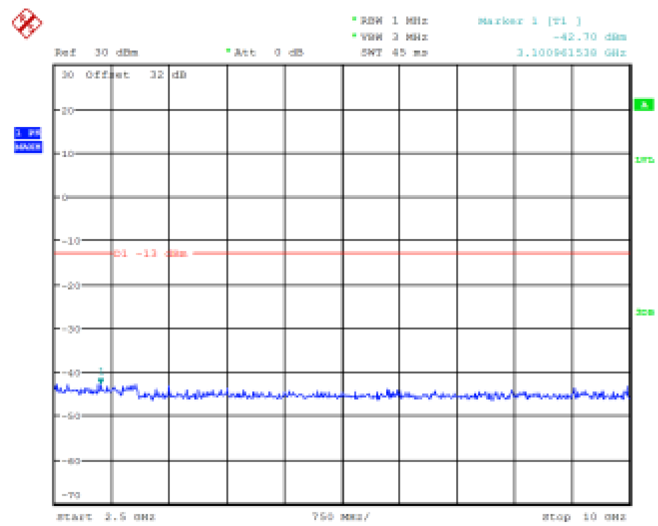



**Figure 2-3a: Band V, Spurious Conducted Emissions, Middle channel**

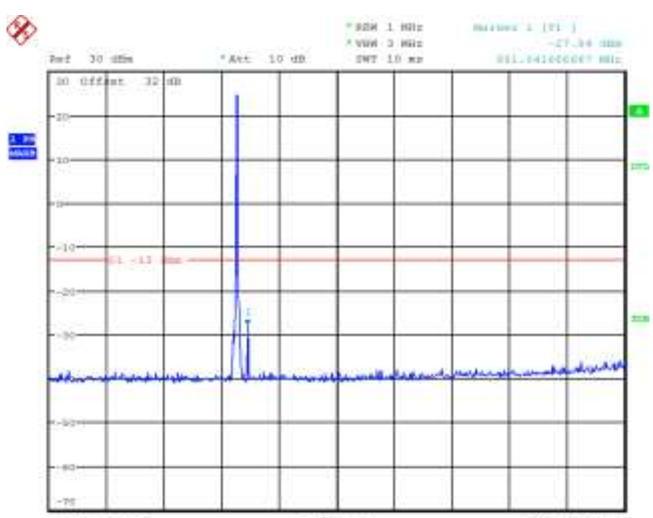
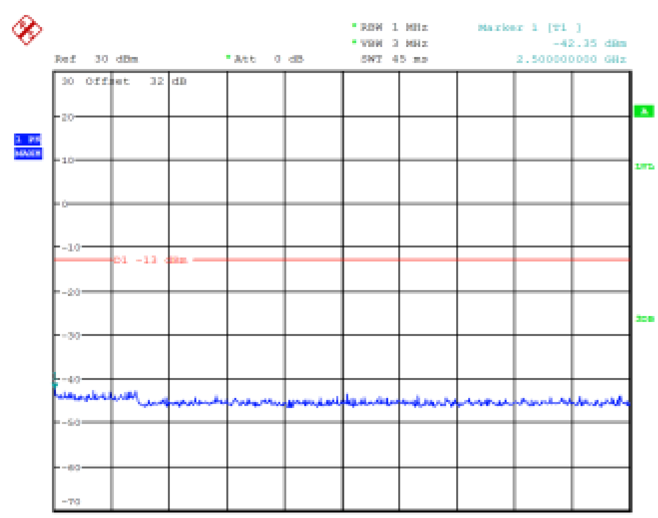



**Figure 2-4a: Band V, Spurious Conducted Emissions, Middle channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

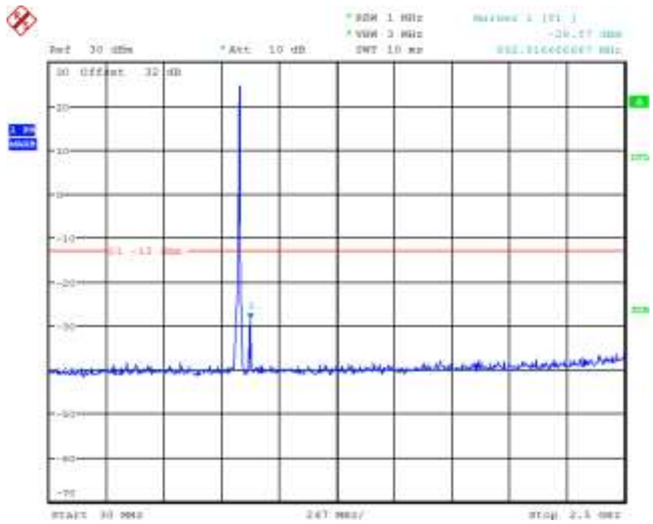


**Figure 2-6a: Band V, Spurious Conducted Emissions, High Channel**

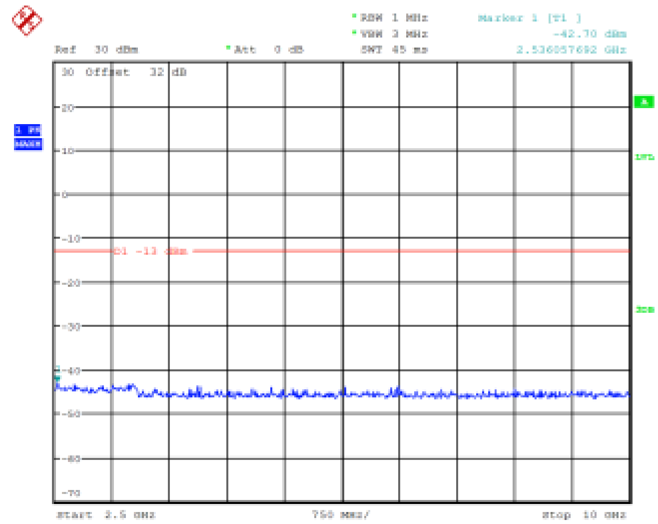


**Figure 2-2a:, BAND II Spurious Conducted Emissions, Low Channel**

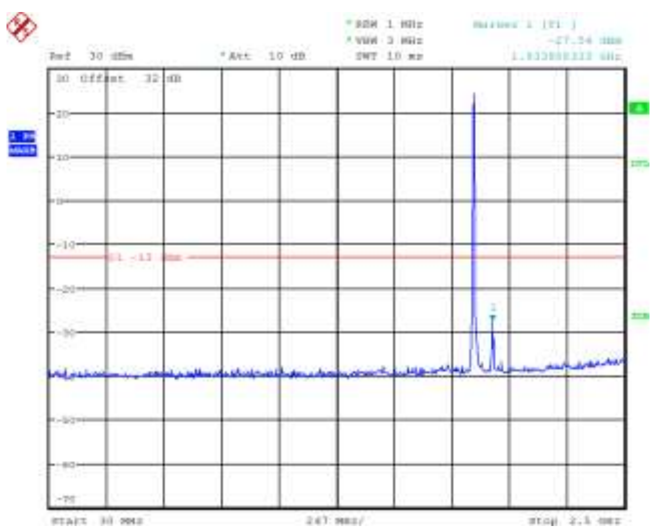
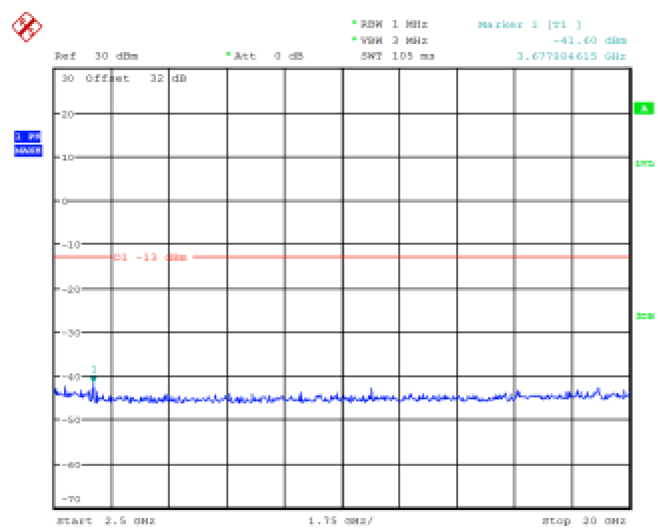


**Figure 2-8a: BAND II, Spurious Conducted Emissions, Low Channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

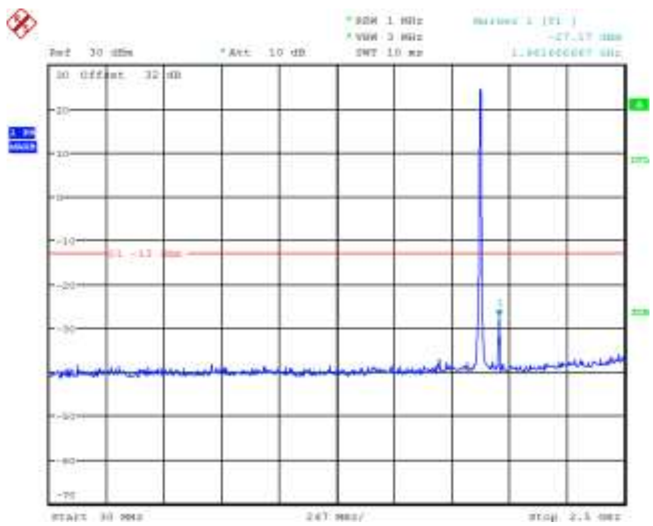



**Figure 2-10a: BAND II, Spurious Conducted Emissions, Middle Channel**

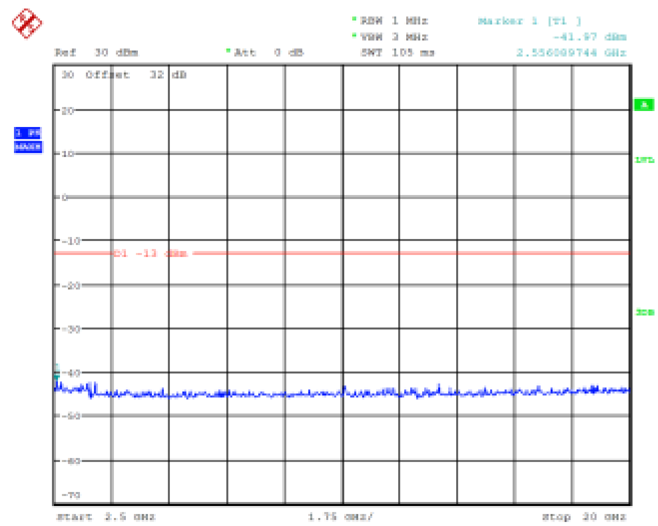



**Figure 2-11a: BAND II, Spurious Conducted Emissions, High Channel**

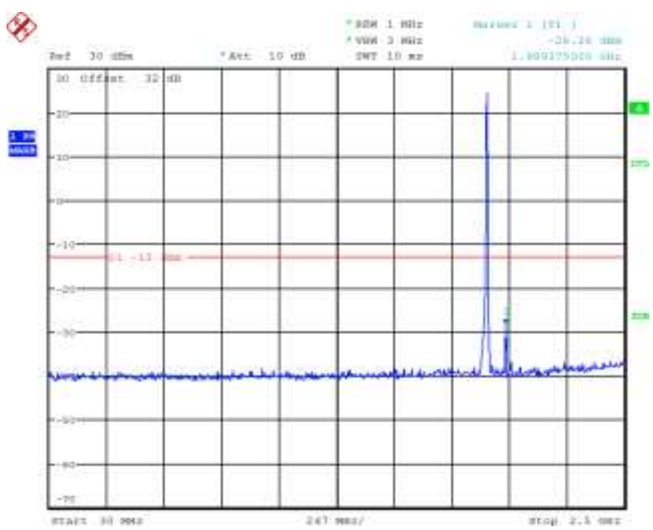
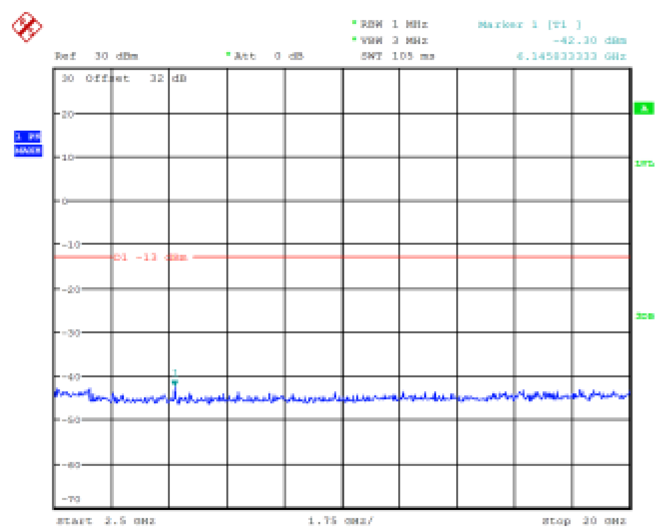



**Figure 2-12a: BAND II, Spurious Conducted Emissions, High Channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

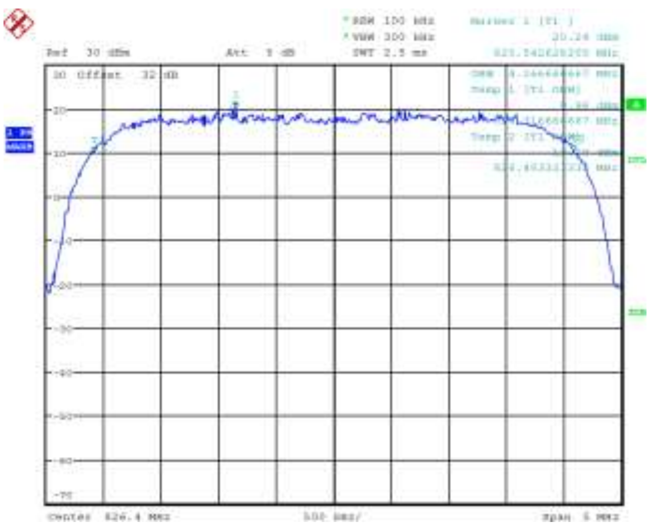


**Figure 2-14a: Occupied Bandwidth, Band V Middle Channel**

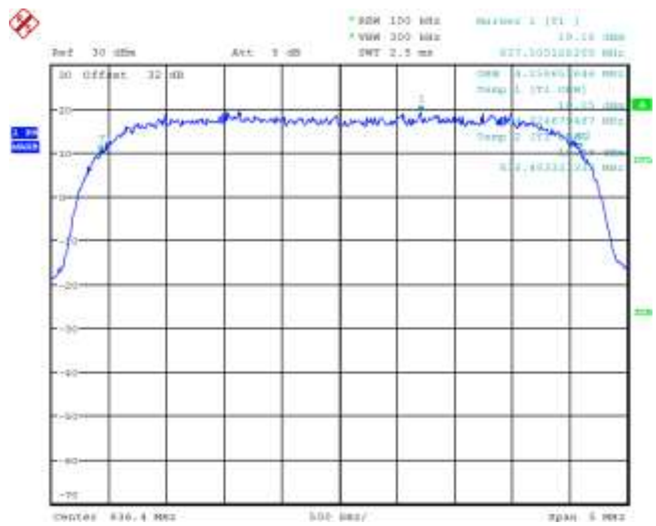


**Figure 2-15a: Occupied Bandwidth, Band V High Channel**

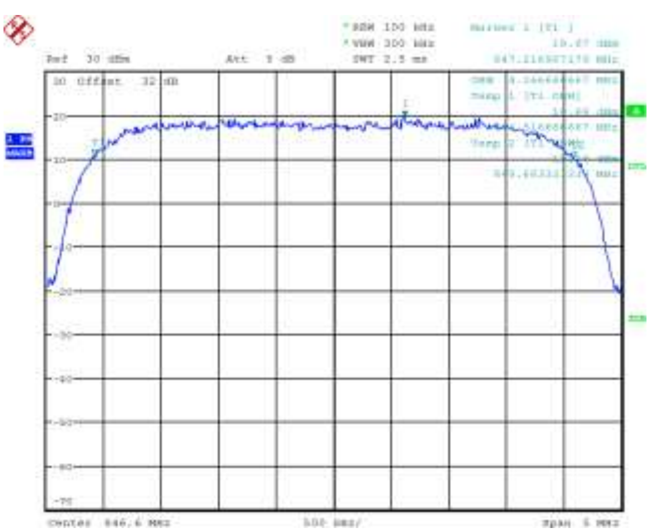
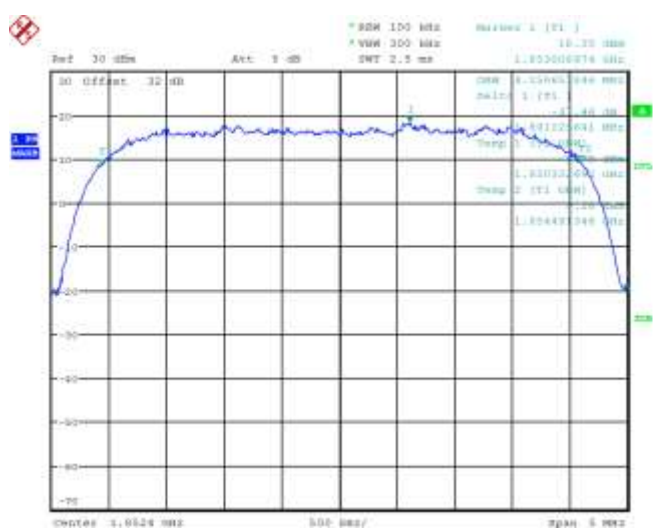


**Figure 2-16a: Occupied Bandwidth, Band II Low Channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

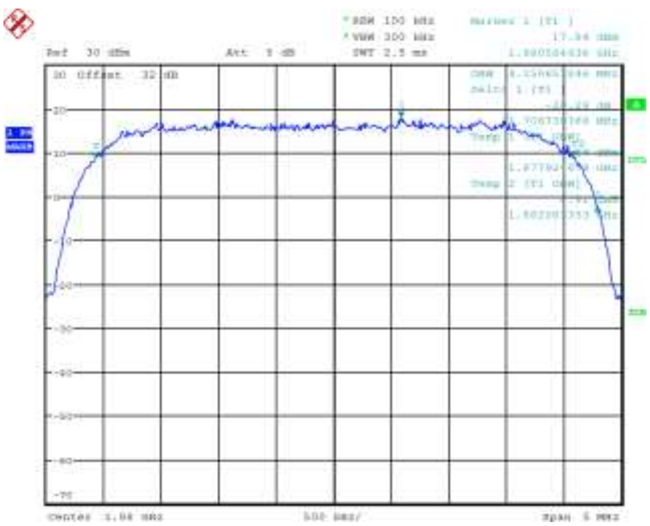


**Figure 2-18a: Occupied Bandwidth, Band II High Channel**

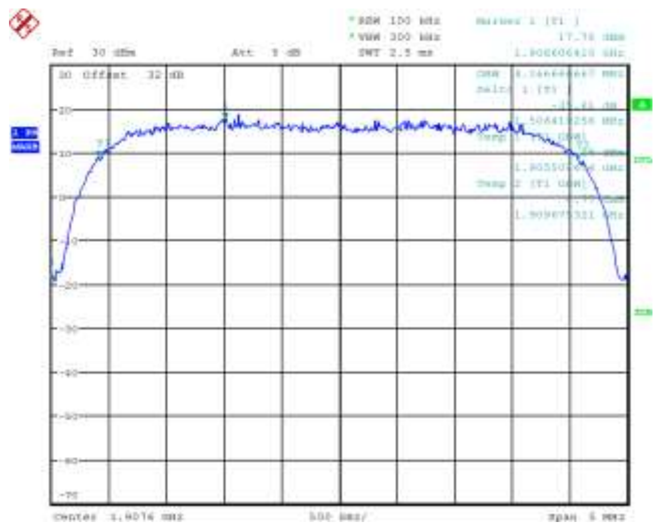


**Figure 2-19a: -26 dBc Bandwidth, Band V Low Channel**

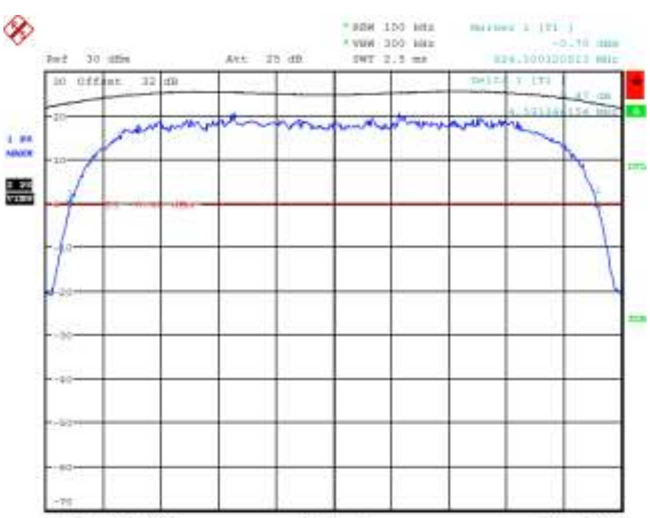
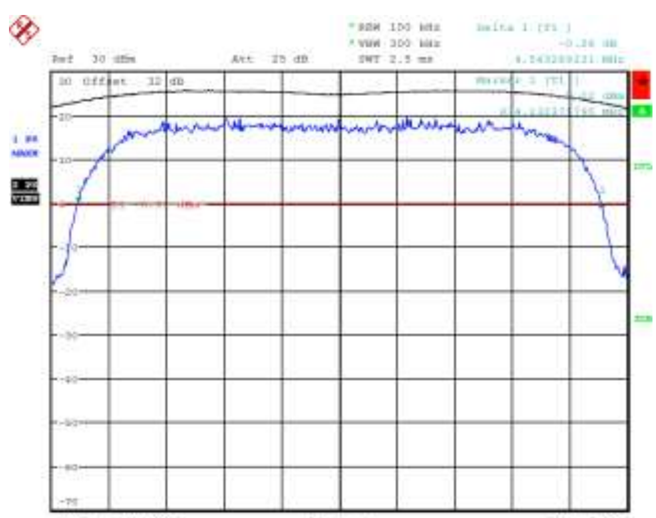


**Figure 2-20a: -26 dBc Bandwidth, Band V Middle Channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

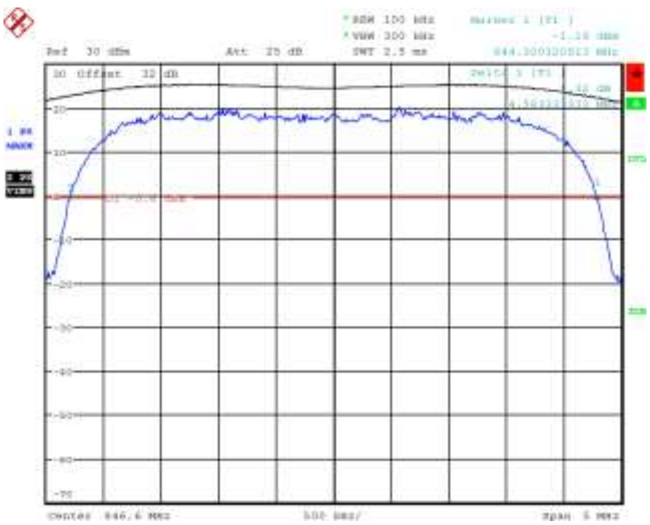


**Figure 2-22a: -26 dBc Bandwidth, Band II Low Channel**

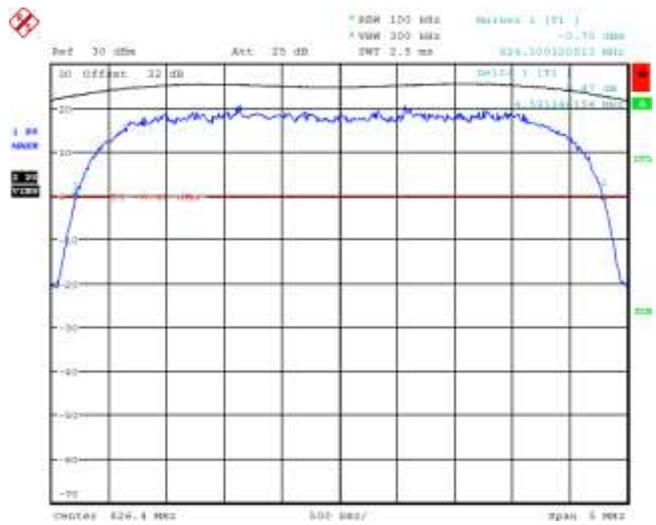


**Figure 2-23a: -26 dBc Bandwidth, Band II Middle Channel**

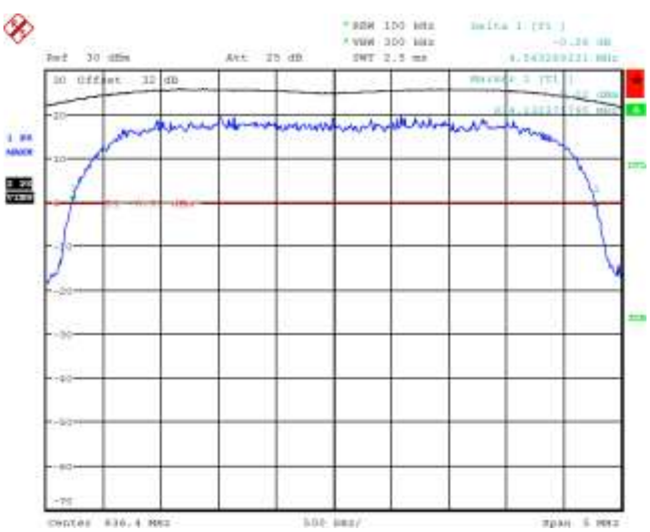
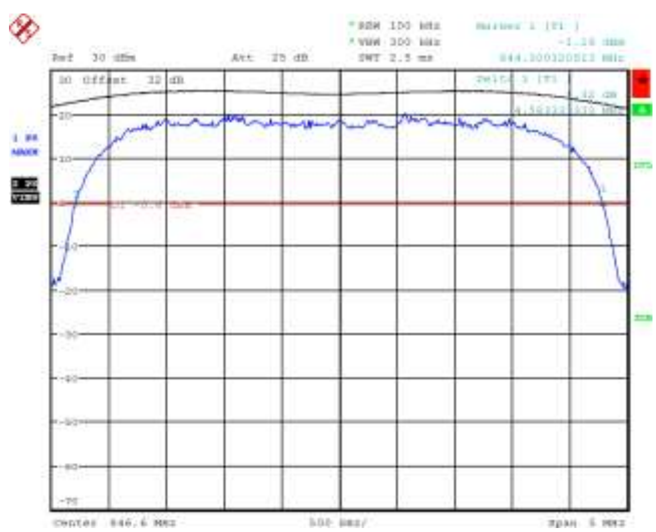


**Figure 2-24a: -26 dBc Bandwidth, Band II High Channel**



## WCDMA Conducted RF Emission Test Data cont'd

**Figure 2-25a: Band V Low Channel Mask**

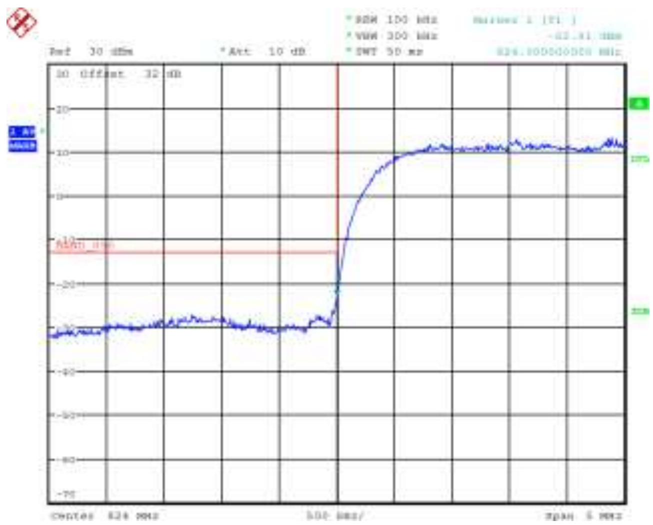


**Figure 2-26a: Band V High Channel Mask**

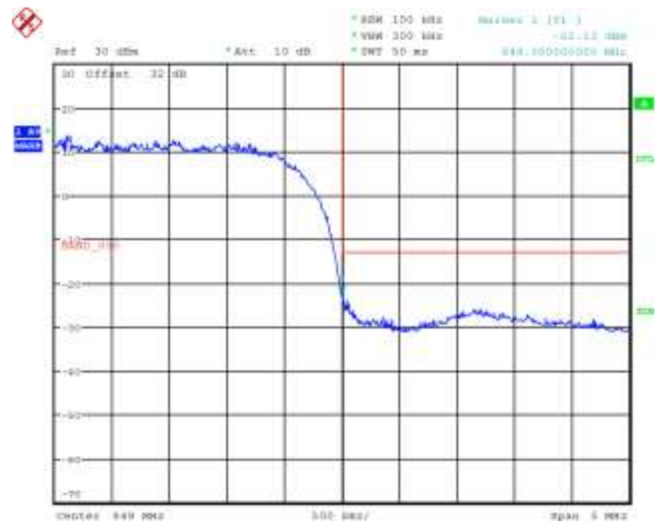


**Figure 2-27a: Band II Low Channel Mask**

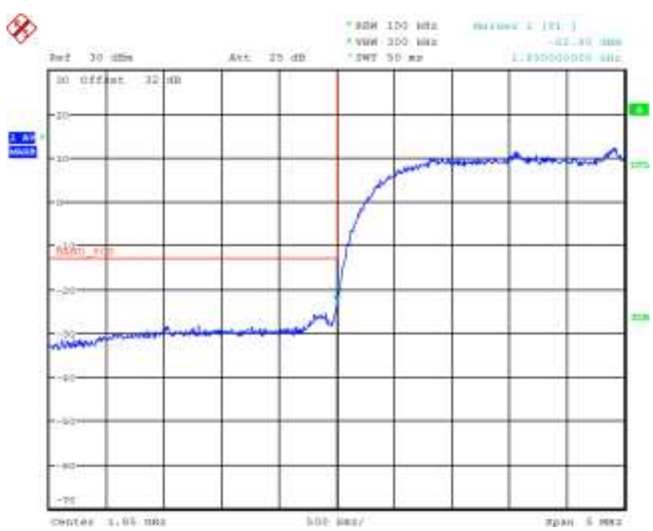
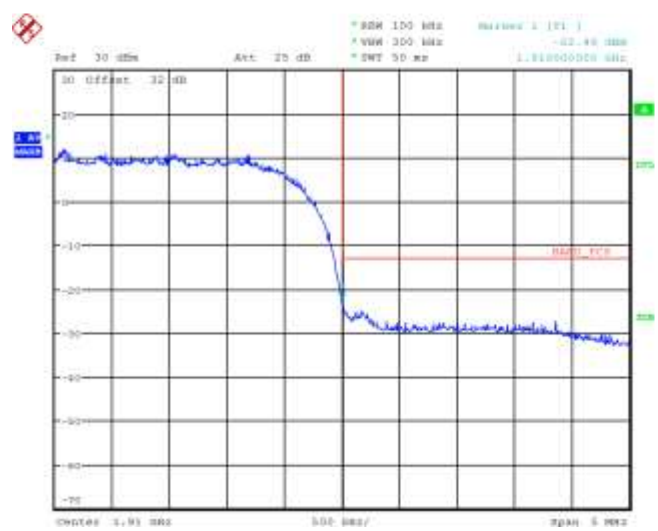


**Figure 2-28a: Band II High Channel Mask**



## WCDMA Conducted RF Emission Test Data cont'd

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

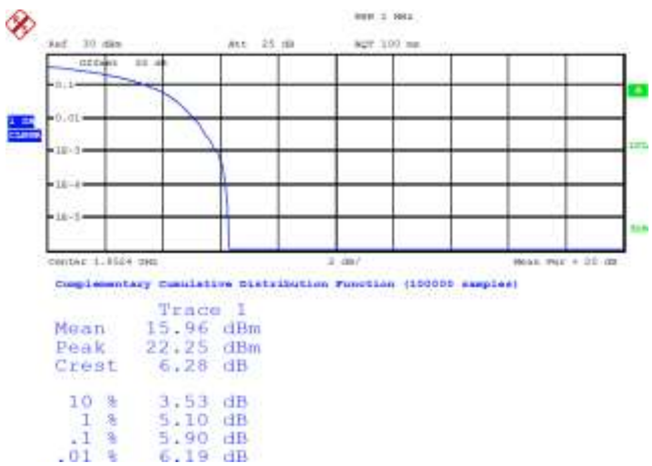



**Figure 2-30a: Band II, PAR Mid Channel**

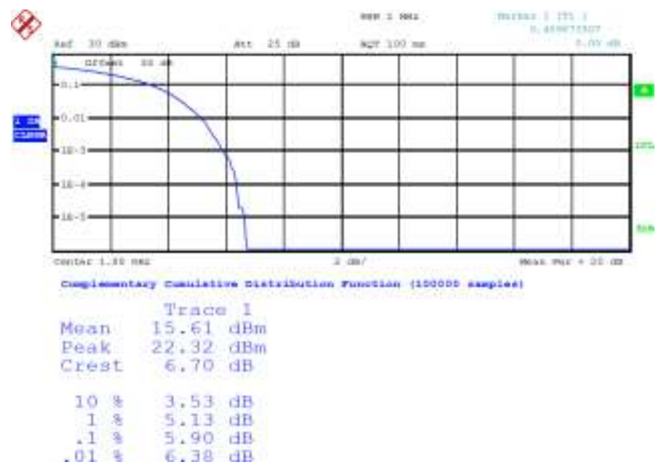
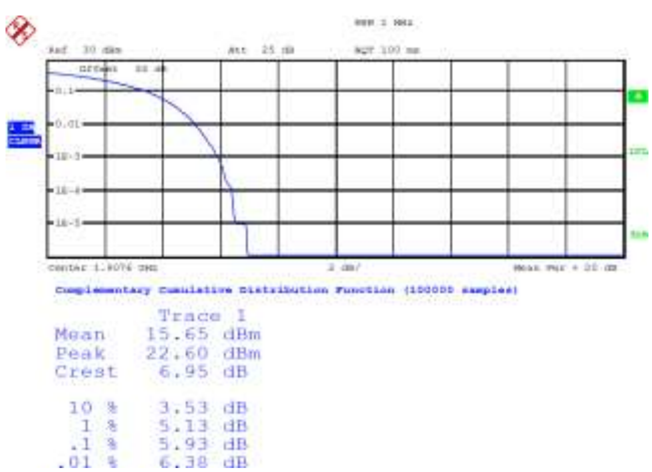



**Figure 2-31a: Band II, PAR High Channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

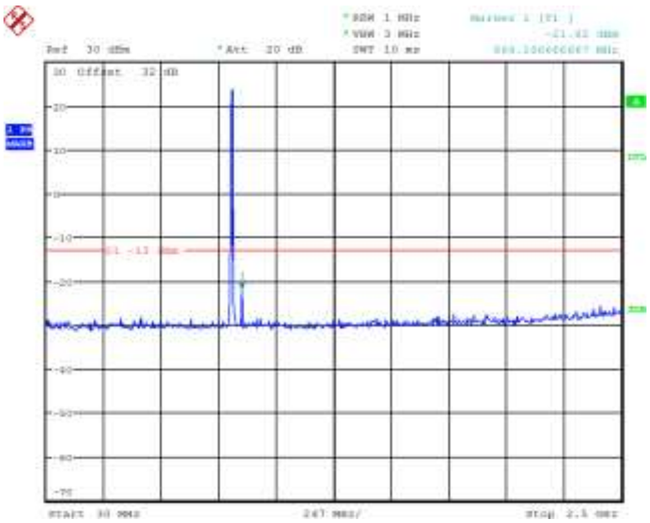


**Figure 2-33a: Band V HSUPA, Spurious Conducted Emissions, Low channel**

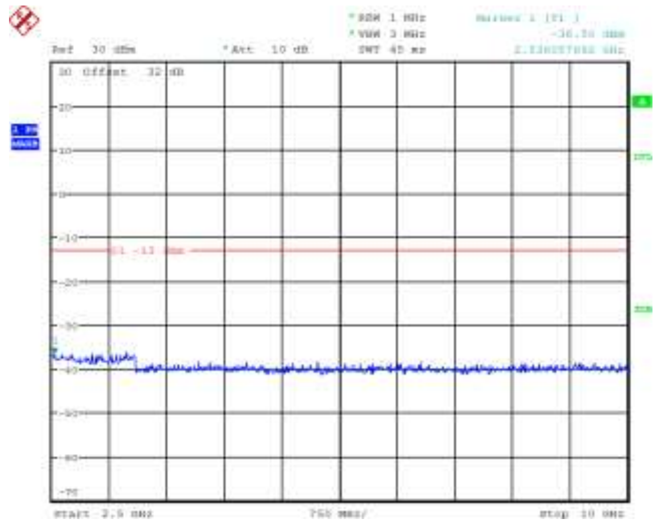


**Figure 2-34a: Band V HSUPA, Spurious Conducted Emissions, Middle channel**

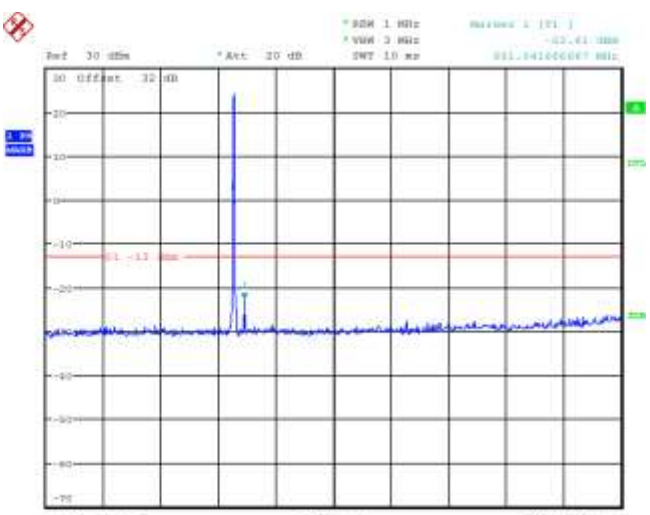
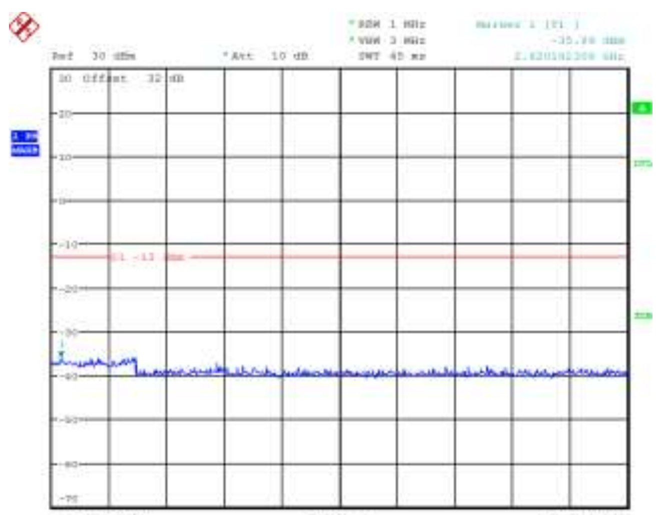


**Figure 2-35a: Band V HSUPA, Spurious Conducted Emissions, Middle channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

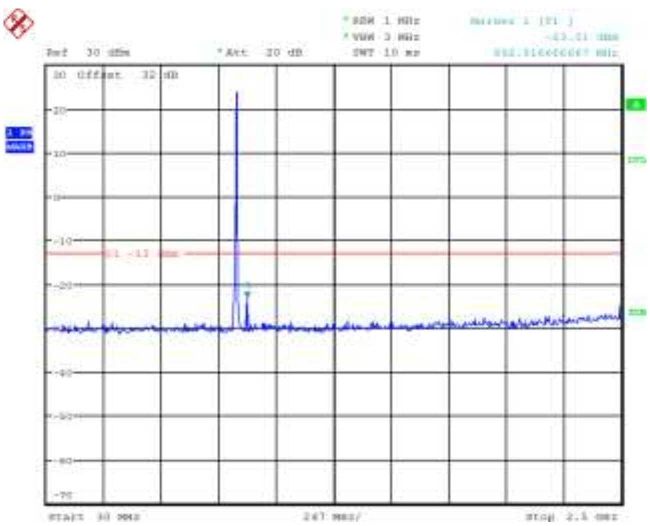


**Figure 2-37a: Band V HSUPA, Spurious Conducted Emissions, High Channel**

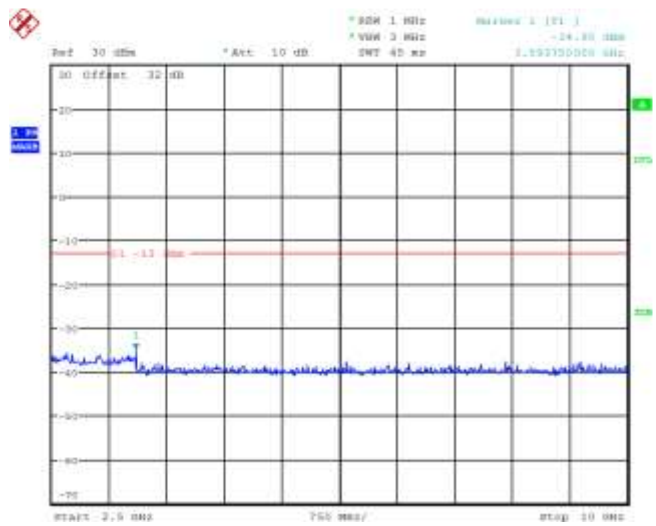


**Figure 2-38a: Band II HSUPA, Spurious Conducted Emissions, Low Channel**

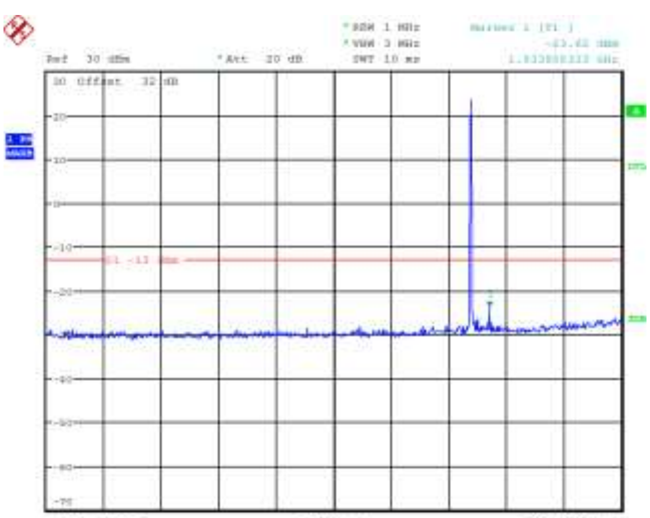
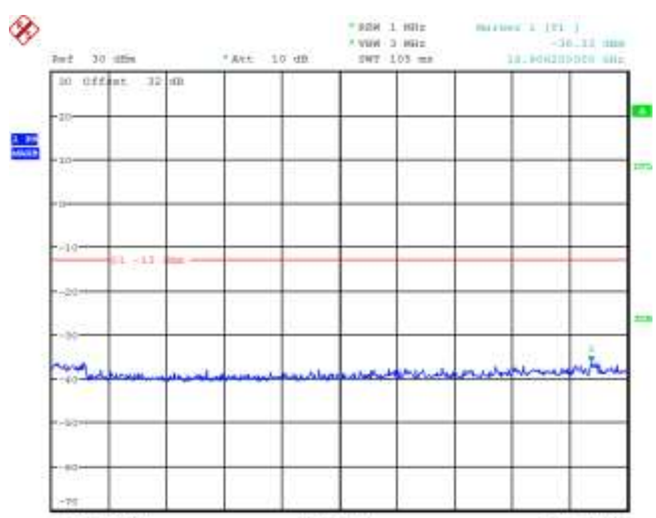


**Figure 2-39a: Band II HSUPA, Spurious Conducted Emissions, Low Channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

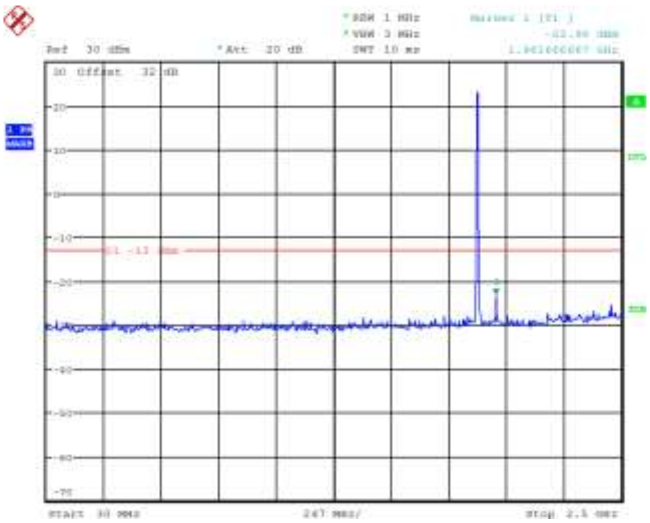


**Figure 2-41a: Band II HSUPA, Spurious Conducted Emissions, Middle Channel**

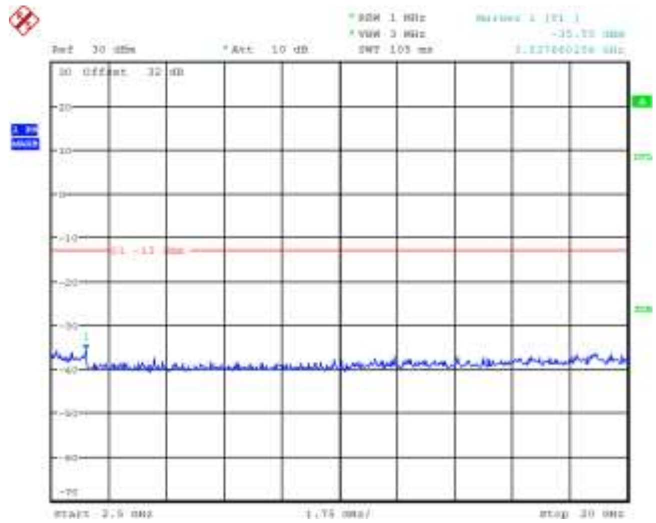


**Figure 2-42a: Band II HSUPA, Spurious Conducted Emissions, High Channel**

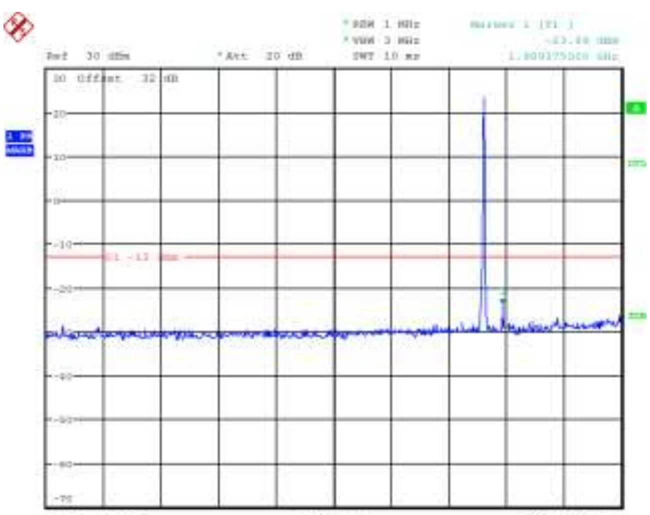
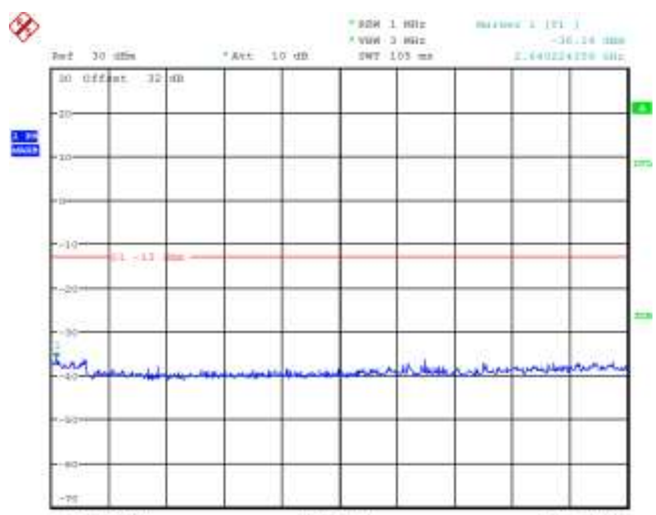


**Figure 2-43a: Band II HSUPA, Spurious Conducted Emissions, High Channel**



## WCDMA Conducted RF Emission Test Data cont'd

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

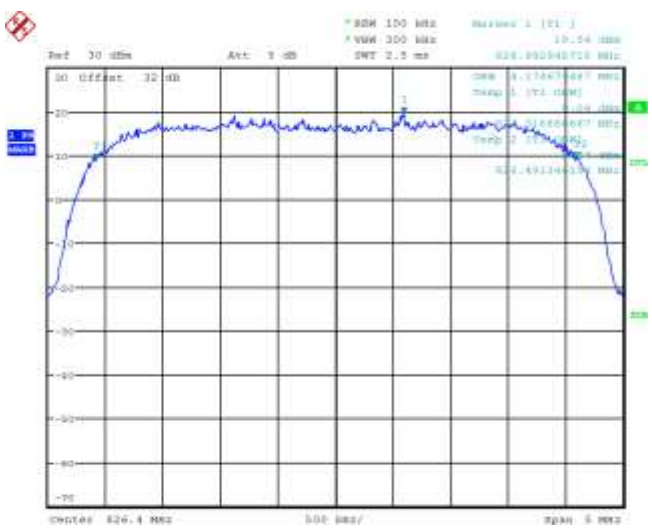


**Figure 2-45a: Occupied Bandwidth, Band V HSUPA Middle Channel**

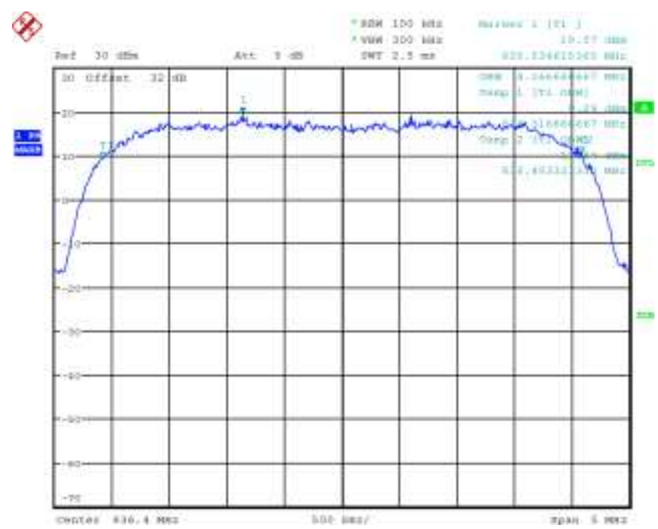


**Figure 2-46a: Occupied Bandwidth, Band V HSUPA High Channel**

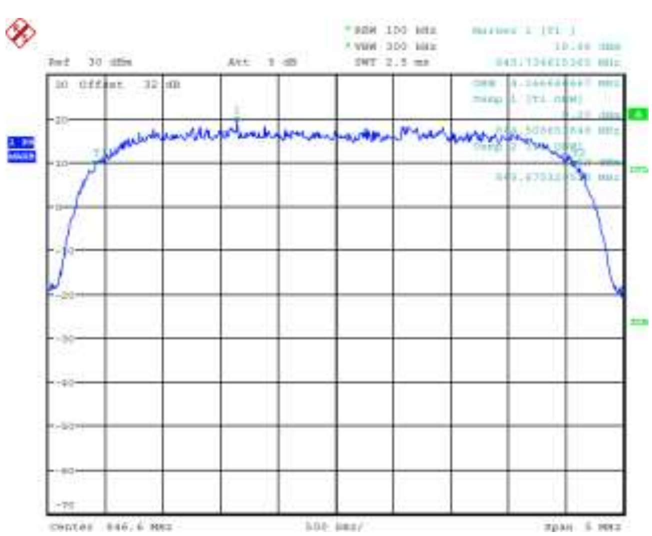
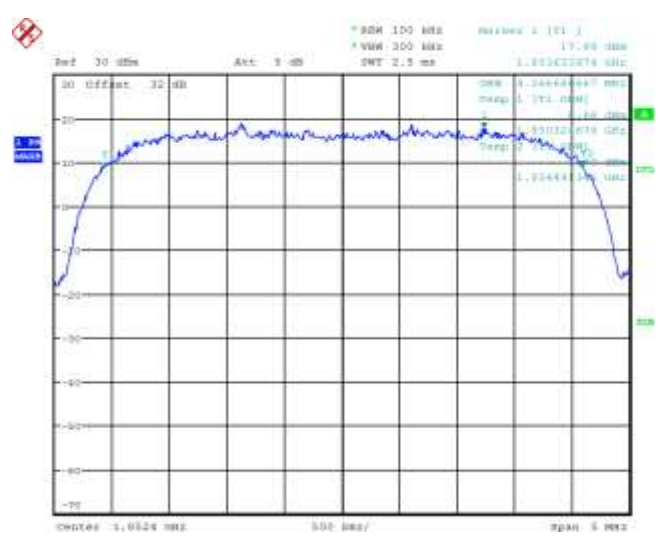


**Figure 2-47a: Occupied Bandwidth, Band II HSUPA Low Channel**



## <u>WCDMA Conducted RF Emission Test Data</u> cont'd

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

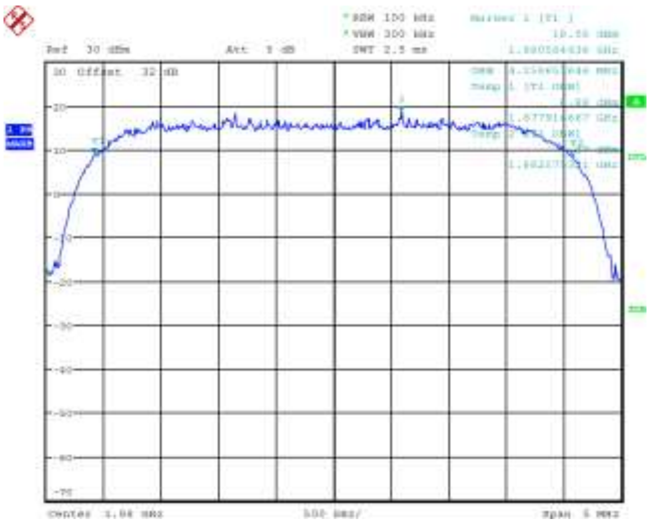


**Figure 2-49a: Occupied Bandwidth, Band II HSUPA High Channel**

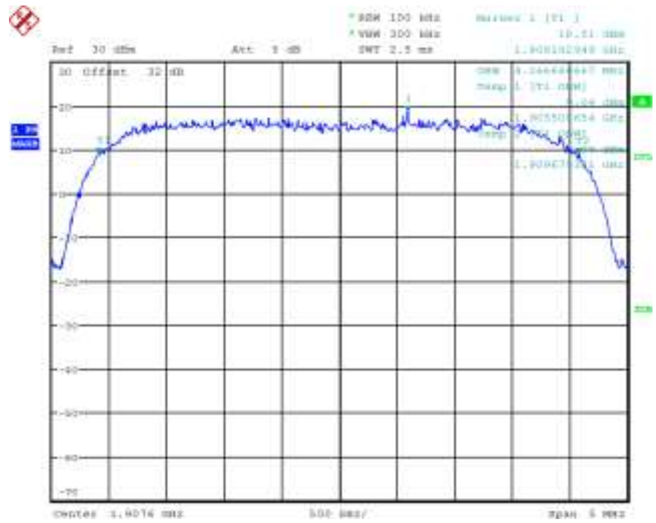


**Figure 2-50a: Band V , HSUPA Low Channel Mask**

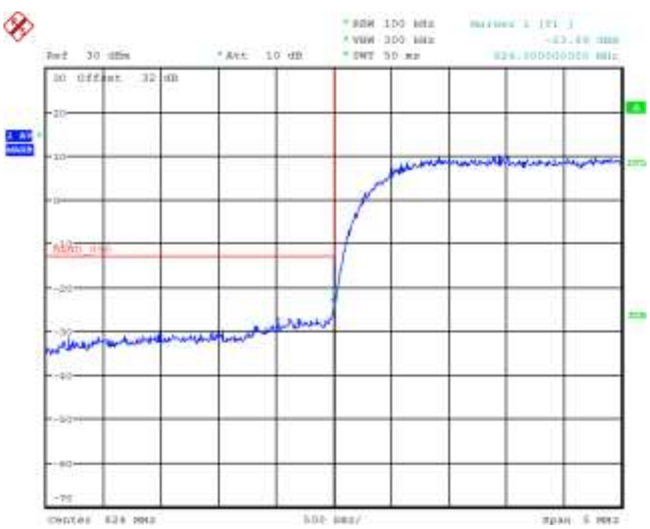
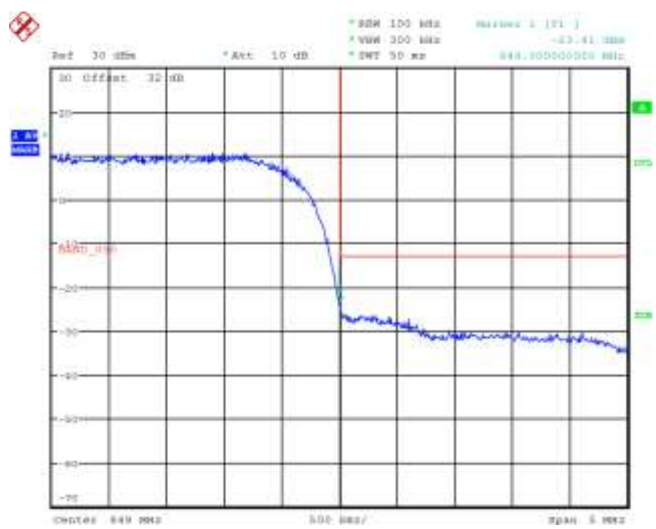


**Figure 2-51a: Band V , HSUPA High Channel Mask**



## WCDMA Conducted RF Emission Test Data cont'd

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

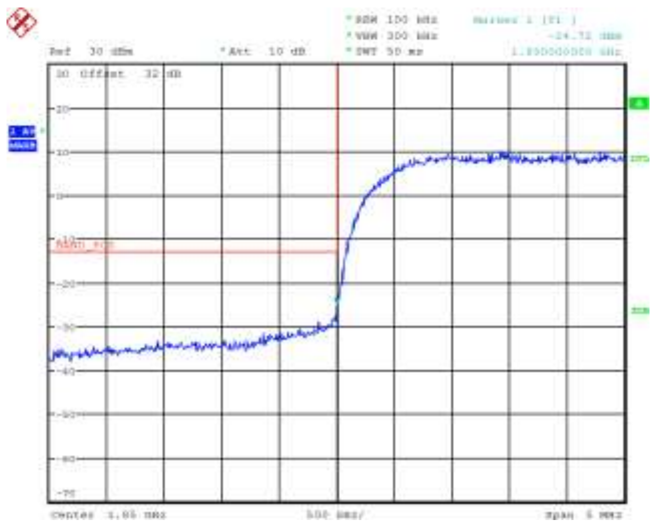
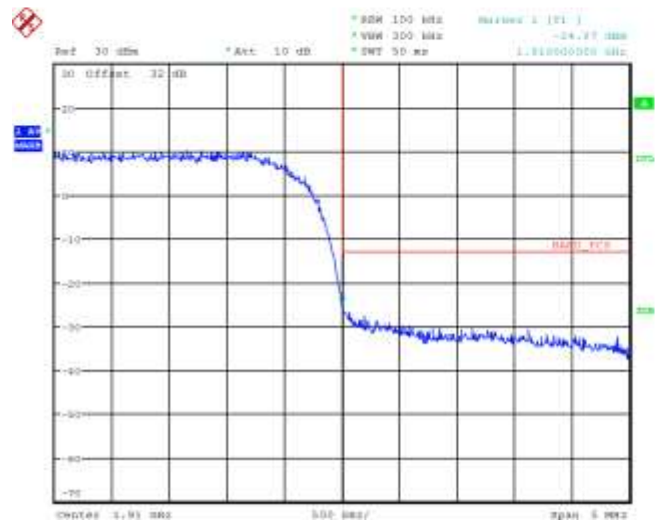
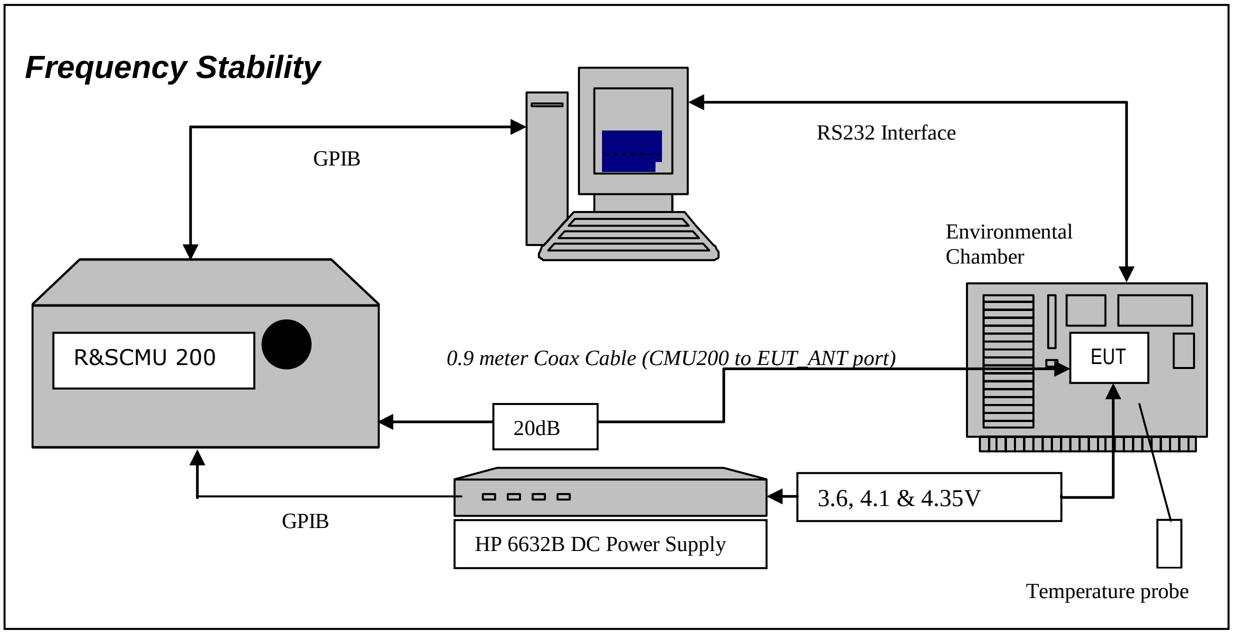



**Figure 2-53a: Band II, HSUPA High Channel Mask**



# APPENDIX 2B – WCDMA Band II/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 0.0088PPM.
The maximum frequency error in the WCDMA band II measured was 0.0157 PPM.

## 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 | 5.72 | 0.0069 |
| 4182 | 836.4 | 3.6 | 20 | 3.56 | 0.0043 |
| 4233 | 846.6 | 3.6 | 20 | 5.31 | 0.0063 |

| Traffic Channel Number | WCDMA Band V Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 4132 | 826.4 | 4.1 | 20 | -6.71 | -0.0081 |
| 4182 | 836.4 | 4.1 | 20 | -6.84 | -0.0082 |
| 4233 | 846.6 | 4.1 | 20 | 5.75 | 0.0068 |

| Traffic Channel Number | WCDMA Band V Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 4132 | 826.4 | 4.35 | 20 | -4.94 | -0.0060 |
| 4182 | 836.4 | 4.35 | 20 | 4.20 | 0.0050 |
| 4233 | 846.6 | 4.35 | 20 | 5.29 | 0.0063 |

## 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 | 4.55 | 0.0055 |
| 4132 | 826.4 | 3.6 | -20 | -4.36 | -0.0053 |
| 4132 | 826.4 | 3.6 | -10 | -6.29 | -0.0076 |
| 4132 | 826.4 | 3.6 | 0 | -5.40 | -0.0065 |
| 4132 | 826.4 | 3.6 | 10 | -4.97 | -0.0060 |
| 4132 | 826.4 | 3.6 | 20 | 5.72 | 0.0069 |
| 4132 | 826.4 | 3.6 | 30 | 7.19 | 0.0087 |
| 4132 | 826.4 | 3.6 | 40 | 7.35 | 0.0089 |
| 4132 | 826.4 | 3.6 | 50 | 6.52 | 0.0079 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 4132 | 826.4 | 4.1 | -30 | 5.66 | 0.0069 |
| 4132 | 826.4 | 4.1 | -20 | -6.97 | -0.0084 |
| 4132 | 826.4 | 4.1 | -10 | -6.59 | -0.0080 |
| 4132 | 826.4 | 4.1 | 0 | -6.30 | -0.0076 |
| 4132 | 826.4 | 4.1 | 10 | -7.08 | -0.0086 |
| 4132 | 826.4 | 4.1 | 20 | -6.71 | -0.0081 |
| 4132 | 826.4 | 4.1 | 30 | 5.84 | 0.0071 |
| 4132 | 826.4 | 4.1 | 40 | 6.18 | 0.0075 |
| 4132 | 826.4 | 4.1 | 50 | 6.41 | 0.0078 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 4132 | 826.4 | 4.35 | -30 | 5.26 | 0.0064 |
| 4132 | 826.4 | 4.35 | -20 | -5.80 | -0.0070 |
| 4132 | 826.4 | 4.35 | -10 | -6.85 | -0.0083 |
| 4132 | 826.4 | 4.35 | 0 | -5.46 | -0.0066 |
| 4132 | 826.4 | 4.35 | 10 | -6.01 | -0.0073 |
| 4132 | 826.4 | 4.35 | 20 | -4.94 | -0.0060 |
| 4132 | 826.4 | 4.35 | 30 | 5.83 | 0.0071 |
| 4132 | 826.4 | 4.35 | 40 | 7.19 | 0.0087 |
| 4132 | 826.4 | 4.35 | 50 | 7.49 | 0.0091 |

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 | -3.85 | -0.0046 |
| 4182 | 836.4 | 3.6 | -20 | -4.97 | -0.0059 |
| 4182 | 836.4 | 3.6 | -10 | 4.85 | 0.0058 |
| 4182 | 836.4 | 3.6 | 0 | 4.17 | 0.0050 |
| 4182 | 836.4 | 3.6 | 10 | 4.20 | 0.0050 |
| 4182 | 836.4 | 3.6 | 20 | 3.56 | 0.0043 |
| 4182 | 836.4 | 3.6 | 30 | -6.39 | -0.0076 |
| 4182 | 836.4 | 3.6 | 40 | 5.68 | 0.0068 |
| 4182 | 836.4 | 3.6 | 50 | -3.92 | -0.0047 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 4182 | 836.4 | 4.1 | -30 | -5.16 | -0.0062 |
| 4182 | 836.4 | 4.1 | -20 | -3.78 | -0.0045 |
| 4182 | 836.4 | 4.1 | -10 | 5.08 | 0.0061 |
| 4182 | 836.4 | 4.1 | 0 | 5.81 | 0.0070 |
| 4182 | 836.4 | 4.1 | 10 | -4.20 | -0.0050 |
| 4182 | 836.4 | 4.1 | 20 | -6.84 | -0.0082 |
| 4182 | 836.4 | 4.1 | 30 | 4.59 | 0.0055 |
| 4182 | 836.4 | 4.1 | 40 | 5.37 | 0.0064 |
| 4182 | 836.4 | 4.1 | 50 | 4.85 | 0.0058 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 4182 | 836.4 | 4.35 | -30 | 6.18 | 0.0074 |
| 4182 | 836.4 | 4.35 | -20 | 5.74 | 0.0069 |
| 4182 | 836.4 | 4.35 | -10 | 5.25 | 0.0063 |
| 4182 | 836.4 | 4.35 | 0 | -4.99 | -0.0060 |
| 4182 | 836.4 | 4.35 | 10 | -4.39 | -0.0053 |
| 4182 | 836.4 | 4.35 | 20 | 4.20 | 0.0050 |
| 4182 | 836.4 | 4.35 | 30 | -5.10 | -0.0061 |
| 4182 | 836.4 | 4.35 | 40 | 4.93 | 0.0059 |
| 4182 | 836.4 | 4.35 | 50 | -6.16 | -0.0074 |

## 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 | -10.31 | **-0.0122** |
| 4233 | 846.6 | 3.6 | -20 | -4.82 | -0.0057 |
| 4233 | 846.6 | 3.6 | -10 | 5.72 | 0.0068 |
| 4233 | 846.6 | 3.6 | 0 | 5.77 | 0.0068 |
| 4233 | 846.6 | 3.6 | 10 | 5.39 | 0.0064 |
| 4233 | 846.6 | 3.6 | 20 | 5.31 | 0.0063 |
| 4233 | 846.6 | 3.6 | 30 | -6.29 | -0.0074 |
| 4233 | 846.6 | 3.6 | 40 | -5.17 | -0.0061 |
| 4233 | 846.6 | 3.6 | 50 | -6.81 | -0.0080 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 4233 | 846.6 | 4.1 | -30 | -6.44 | -0.0076 |
| 4233 | 846.6 | 4.1 | -20 | 5.19 | 0.0061 |
| 4233 | 846.6 | 4.1 | -10 | 6.04 | 0.0071 |
| 4233 | 846.6 | 4.1 | 0 | 6.16 | 0.0073 |
| 4233 | 846.6 | 4.1 | 10 | 6.56 | 0.0078 |
| 4233 | 846.6 | 4.1 | 20 | 5.75 | 0.0068 |
| 4233 | 846.6 | 4.1 | 30 | -6.10 | -0.0072 |
| 4233 | 846.6 | 4.1 | 40 | -6.18 | -0.0073 |
| 4233 | 846.6 | 4.1 | 50 | -7.58 | -0.0090 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 4233 | 846.6 | 4.35 | -30 | -6.36 | -0.0075 |
| 4233 | 846.6 | 4.35 | -20 | -5.87 | -0.0069 |
| 4233 | 846.6 | 4.35 | -10 | 7.20 | 0.0085 |
| 4233 | 846.6 | 4.35 | 0 | 6.26 | 0.0074 |
| 4233 | 846.6 | 4.35 | 10 | 5.80 | 0.0068 |
| 4233 | 846.6 | 4.35 | 20 | 5.29 | 0.0063 |
| 4233 | 846.6 | 4.35 | 30 | -4.97 | -0.0059 |
| 4233 | 846.6 | 4.35 | 40 | -7.03 | -0.0083 |
| 4233 | 846.6 | 4.35 | 50 | -7.84 | -0.0093 |

### 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 | 9.41 | 0.0051 |
| 9400 | 1880.00 | 3.6 | 20 | 9.98 | 0.0053 |
| 9538 | 1907.60 | 3.6 | 20 | 10.03 | 0.0053 |

| Traffic Channel Number | WCDMA1900 Frequency (MHz | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 9262 | 1852.40 | 4.1 | 20 | 7.42 | 0.0040 |
| 9400 | 1880.00 | 4.1 | 20 | 8.27 | 0.0044 |
| 9538 | 1907.60 | 4.1 | 20 | 9.40 | 0.0049 |

| Traffic Channel Number | WCDMA1900 Frequency (MHz | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 9262 | 1852.40 | 4.35 | 20 | 7.32 | 0.0040 |
| 9400 | 1880.00 | 4.35 | 20 | 9.08 | 0.0048 |
| 9538 | 1907.60 | 4.35 | 20 | 10.85 | 0.0057 |

## 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 | 8.19 | 0.0044 |
| 9262 | 1852.40 | 3.6 | -20 | -4.82 | -0.0026 |
| 9262 | 1852.40 | 3.6 | -10 | -7.42 | -0.0040 |
| 9262 | 1852.40 | 3.6 | 0 | -8.21 | -0.0044 |
| 9262 | 1852.40 | 3.6 | 10 | 5.78 | 0.0031 |
| 9262 | 1852.40 | 3.6 | 20 | 9.41 | 0.0051 |
| 9262 | 1852.40 | 3.6 | 30 | 11.78 | 0.0064 |
| 9262 | 1852.40 | 3.6 | 40 | 13.37 | 0.0072 |
| 9262 | 1852.40 | 3.6 | 50 | 16.33 | **0.0088** |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 9262 | 1852.40 | 4.1 | -30 | 8.73 | 0.0047 |
| 9262 | 1852.40 | 4.1 | -20 | 5.29 | 0.0029 |
| 9262 | 1852.40 | 4.1 | -10 | -10.25 | -0.0055 |
| 9262 | 1852.40 | 4.1 | 0 | -10.39 | -0.0056 |
| 9262 | 1852.40 | 4.1 | 10 | 8.36 | 0.0045 |
| 9262 | 1852.40 | 4.1 | 20 | 7.42 | 0.0040 |
| 9262 | 1852.40 | 4.1 | 30 | 11.43 | 0.0062 |
| 9262 | 1852.40 | 4.1 | 40 | 12.97 | 0.0070 |
| 9262 | 1852.40 | 4.1 | 50 | 14.60 | 0.0079 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 9262 | 1852.40 | 4.35 | -30 | 10.86 | 0.0059 |
| 9262 | 1852.40 | 4.35 | -20 | -5.77 | -0.0031 |
| 9262 | 1852.40 | 4.35 | -10 | -11.14 | -0.0060 |
| 9262 | 1852.40 | 4.35 | 0 | -8.90 | -0.0048 |
| 9262 | 1852.40 | 4.35 | 10 | -7.63 | -0.0041 |
| 9262 | 1852.40 | 4.35 | 20 | 7.32 | 0.0040 |
| 9262 | 1852.40 | 4.35 | 30 | 11.35 | 0.0061 |
| 9262 | 1852.40 | 4.35 | 40 | 14.56 | 0.0079 |
| 9262 | 1852.40 | 4.35 | 50 | 14.66 | 0.0079 |

**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 | 7.68 | 0.0041 |
| 9400 | 1880.00 | 3.6 | -20 | 8.07 | 0.0043 |
| 9400 | 1880.00 | 3.6 | -10 | 6.81 | 0.0036 |
| 9400 | 1880.00 | 3.6 | 0 | 8.82 | 0.0047 |
| 9400 | 1880.00 | 3.6 | 10 | 9.28 | 0.0049 |
| 9400 | 1880.00 | 3.6 | 20 | 9.98 | 0.0053 |
| 9400 | 1880.00 | 3.6 | 30 | 9.11 | 0.0048 |
| 9400 | 1880.00 | 3.6 | 40 | 9.05 | 0.0048 |
| 9400 | 1880.00 | 3.6 | 50 | 7.42 | 0.0039 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 9400 | 1880.00 | 4.1 | -30 | 6.26 | 0.0033 |
| 9400 | 1880.00 | 4.1 | -20 | 7.75 | 0.0041 |
| 9400 | 1880.00 | 4.1 | -10 | 8.36 | 0.0044 |
| 9400 | 1880.00 | 4.1 | 0 | 8.00 | 0.0043 |
| 9400 | 1880.00 | 4.1 | 10 | 7.57 | 0.0040 |
| 9400 | 1880.00 | 4.1 | 20 | 8.27 | 0.0044 |
| 9400 | 1880.00 | 4.1 | 30 | 10.76 | 0.0057 |
| 9400 | 1880.00 | 4.1 | 40 | 8.76 | 0.0047 |
| 9400 | 1880.00 | 4.1 | 50 | 8.73 | 0.0046 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 9400 | 1880.00 | 4.35 | -30 | 7.60 | 0.0040 |
| 9400 | 1880.00 | 4.35 | -20 | 8.73 | 0.0046 |
| 9400 | 1880.00 | 4.35 | -10 | 6.82 | 0.0036 |
| 9400 | 1880.00 | 4.35 | 0 | 8.04 | 0.0043 |
| 9400 | 1880.00 | 4.35 | 10 | 9.38 | 0.0050 |
| 9400 | 1880.00 | 4.35 | 20 | 9.08 | 0.0048 |
| 9400 | 1880.00 | 4.35 | 30 | 9.31 | 0.0050 |
| 9400 | 1880.00 | 4.35 | 40 | 7.93 | 0.0042 |
| 9400 | 1880.00 | 4.35 | 50 | 8.19 | 0.0044 |

**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 | -8.48 | -0.0044 |
| 9538 | 1907.60 | 3.6 | -20 | 8.80 | 0.0046 |
| 9538 | 1907.60 | 3.6 | -10 | 13.18 | 0.0069 |
| 9538 | 1907.60 | 3.6 | 0 | 13.95 | 0.0073 |
| 9538 | 1907.60 | 3.6 | 10 | 10.54 | 0.0055 |
| 9538 | 1907.60 | 3.6 | 20 | 10.03 | 0.0053 |
| 9538 | 1907.60 | 3.6 | 30 | -9.40 | -0.0049 |
| 9538 | 1907.60 | 3.6 | 40 | -7.29 | -0.0038 |
| 9538 | 1907.60 | 3.6 | 50 | -9.96 | -0.0052 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 9538 | 1907.60 | 4.1 | -30 | -5.63 | -0.0030 |
| 9538 | 1907.60 | 4.1 | -20 | 10.97 | 0.0058 |
| 9538 | 1907.60 | 4.1 | -10 | 12.68 | 0.0066 |
| 9538 | 1907.60 | 4.1 | 0 | 13.12 | 0.0069 |
| 9538 | 1907.60 | 4.1 | 10 | 13.17 | 0.0069 |
| 9538 | 1907.60 | 4.1 | 20 | 9.40 | 0.0049 |
| 9538 | 1907.60 | 4.1 | 30 | 8.10 | 0.0042 |
| 9538 | 1907.60 | 4.1 | 40 | -6.15 | -0.0032 |
| 9538 | 1907.60 | 4.1 | 50 | -8.06 | -0.0042 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **21BPPM** |
| 9538 | 1907.60 | 4.35 | -30 | -7.40 | -0.0039 |
| 9538 | 1907.60 | 4.35 | -20 | 10.54 | 0.0055 |
| 9538 | 1907.60 | 4.35 | -10 | 12.54 | 0.0066 |
| 9538 | 1907.60 | 4.35 | 0 | 13.26 | 0.0070 |
| 9538 | 1907.60 | 4.35 | 10 | 13.03 | 0.0068 |
| 9538 | 1907.60 | 4.35 | 20 | 10.85 | 0.0057 |
| 9538 | 1907.60 | 4.35 | 30 | 7.98 | 0.0042 |
| 9538 | 1907.60 | 4.35 | 40 | -8.73 | -0.0046 |
| 9538 | 1907.60 | 4.35 | 50 | -10.35 | -0.0054 |

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

## Radiated Power Test Data Results

The following measurements were performed by Rex Zhang.

Date of Test: July 3, 2014

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 | -39.88 | -29.59 | V-V | 6.03 | **23.35** | 0.22 | 38.5 | 15.15 |
| F0 | 4132 | 826.40 | V | Dipole | H | -29.59 | | H-H | 5.19 | | | | |
| F0 | 4182 | 836.40 | V | Dipole | V | -39.38 | -29.97 | V-V | 5.83 | 22.95 | 0.20 | 38.5 | 15.55 |
| F0 | 4182 | 836.40 | V | Dipole | H | -29.97 | | H-H | 5.03 | | | | |
| F0 | 4233 | 846.60 | V | Dipole | V | -38.46 | -29.39 | V-V | 6.03 | 23.16 | 0.21 | 38.5 | 15.34 |
| F0 | 4233 | 846.60 | V | Dipole | H | -29.39 | | H-H | 4.84 | | | | |

### 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 | -41.15 | -31.15 | V-V | 4.46 | **21.78** | 0.15 | 38.50 | 16.72 |
| F0 | 4132 | 826.40 | V | Dipole | H | -31.15 | | H-H | 3.68 | | | | |
| F0 | 4182 | 836.40 | V | Dipole | V | -40.85 | -31.41 | V-V | 4.39 | 21.51 | 0.14 | 38.50 | 16.99 |
| F0 | 4182 | 836.40 | V | Dipole | H | -31.41 | | H-H | 3.45 | | | | |
| F0 | 4233 | 846.60 | V | Dipole | V | -39.90 | -30.80 | V-V | 4.64 | 21.77 | 0.15 | 38.50 | 16.73 |
| F0 | 4233 | 846.60 | V | Dipole | H | -30.80 | | H-H | 3.69 | | | | |

## Radiated Power Test Data Results cont'd

Date of Test: July 16, 2014

The environmental test conditions were: Temperature: 25.2 ºC
Relative Humidity: 36.8 %

The BlackBerry® smartphone was standalone, USB 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 | -25.36 | -25.36 | V-V | -13.57 | 27.10 | 0.51 | 33.0 | 5.90 |
| F0 | 9262 | 1852.40 | II | Horn | H | -32.43 | | H-H | -12.55 | | | | |
| F0 | 9400 | 1880.00 | II | Horn | V | -25.07 | -25.07 | V-V | -12.76 | 27.32 | 0.54 | 33.0 | 5.68 |
| F0 | 9400 | 1880.00 | II | Horn | H | -32.42 | | H-H | -11.97 | | | | |
| F0 | 9538 | 1907.60 | II | Horn | V | -24.21 | -24.21 | V-V | -12.01 | **28.13** | 0.65 | 33.0 | 4.87 |
| F0 | 9538 | 1907.60 | II | Horn | H | -32.07 | | H-H | -11.39 | | | | |

### 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 | -25.80 | -25.80 | V-V | -14.07 | 26.63 | 0.46 | 33.0 | 6.37 |
| F0 | 9262 | 1852.40 | II | Horn | H | -32.96 | | H-H | -13.02 | | | | |
| F0 | 9400 | 1880.00 | II | Horn | V | -25.48 | -25.48 | V-V | -13.16 | 26.91 | 0.49 | 33.0 | 6.09 |
| F0 | 9400 | 1880.00 | II | Horn | H | -32.90 | | H-H | -12.38 | | | | |
| F0 | 9538 | 1907.60 | II | Horn | V | -24.65 | -24.65 | V-V | -12.47 | **27.71** | 0.59 | 33.0 | 5.29 |
| F0 | 9538 | 1907.60 | II | Horn | H | -32.46 | | H-H | -11.81 | | | | |

Radiated Emissions Test Data Results cont'd

## WCDMA Band V Call Service Mode

The following measurements were performed by Savtej Sandhu.

Date of Test: June 26, 2014

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.

The following measurements were performed by Masud Attayi

Date of Test: June 30-July 11, 2014

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 up 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: June 26, 2014

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: June 30-July 11, 2014

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 up 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: June 25, 2014

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: June 30-July 11, 2014

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: June 25, 2014

| | | |
|---|---|---|
| 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: June 30-July 11, 2014

| | | |
|---|---|---|
| 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.

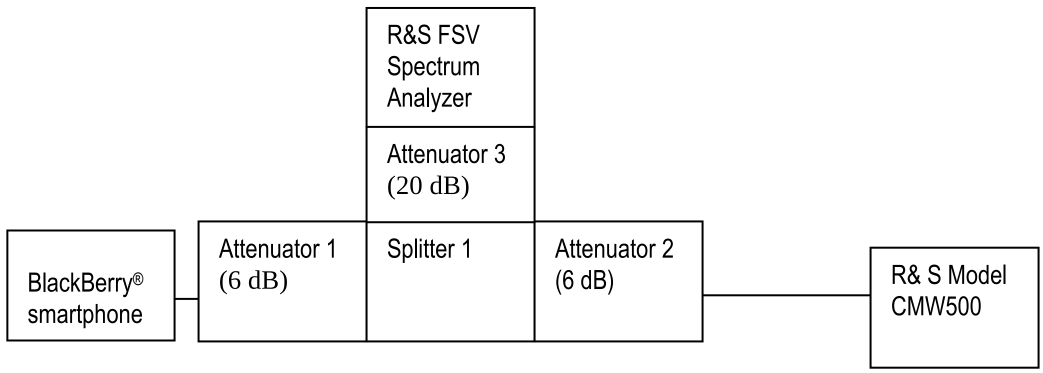
All emissions were at least 25.0 dB below the limit.

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

# LTE Band 2 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 32.4 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: June 26-27, 2014

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 RBs 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 RB 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 18.75 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 | 18.68 | 17.84 | 17.87 |
| 1880.000 | 18.75 | **17.90** | **17.94** |
| 1907.600 | 18.75 | 17.87 | 17.84 |

**Peak to Average Ratio (PAR)**

For each 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20 MHz with different number of RBs 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 Peak to Average Ratio was 11.20 dB on mid channel in 10MHz bandwidth with 50 RB.

***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)**

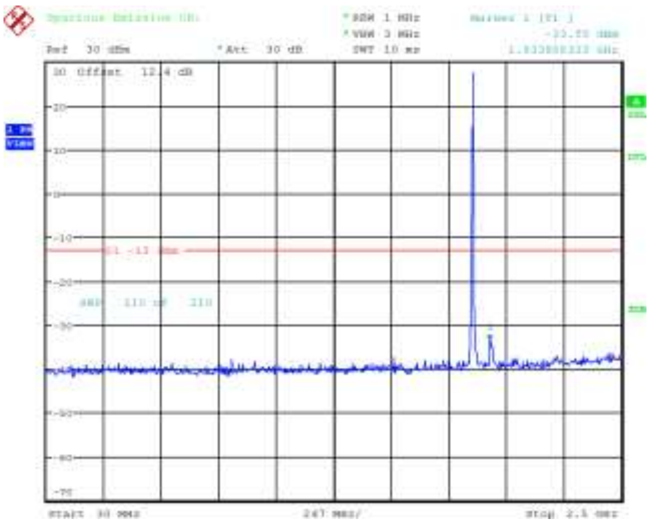


**Figure 3-2a: Band 2, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 100)**

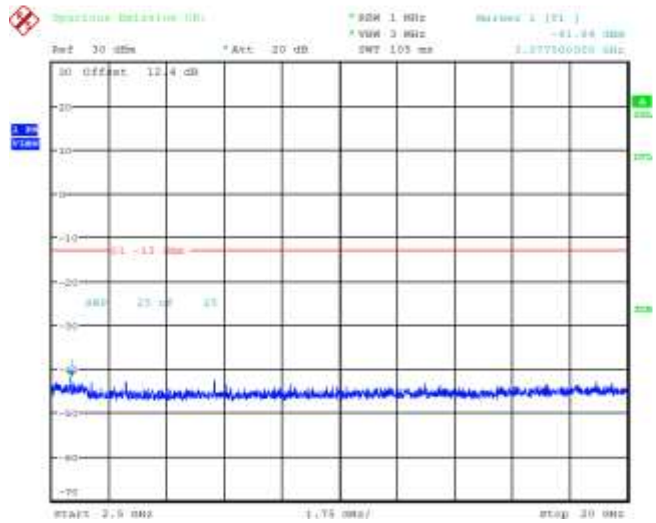


**Figure 3-3a: Band 2, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 100)**

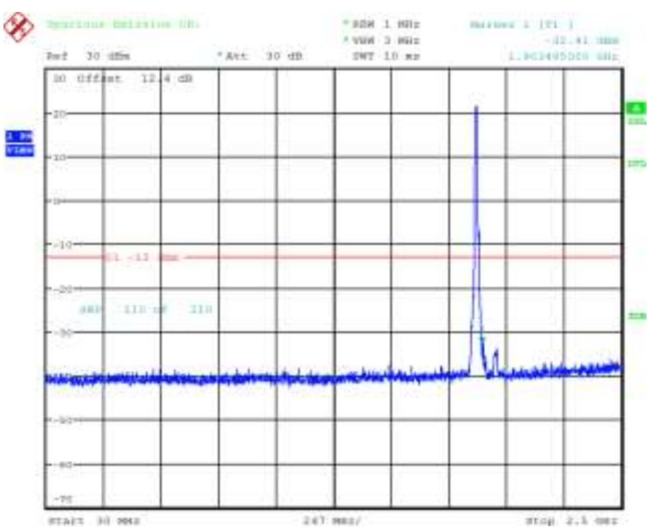
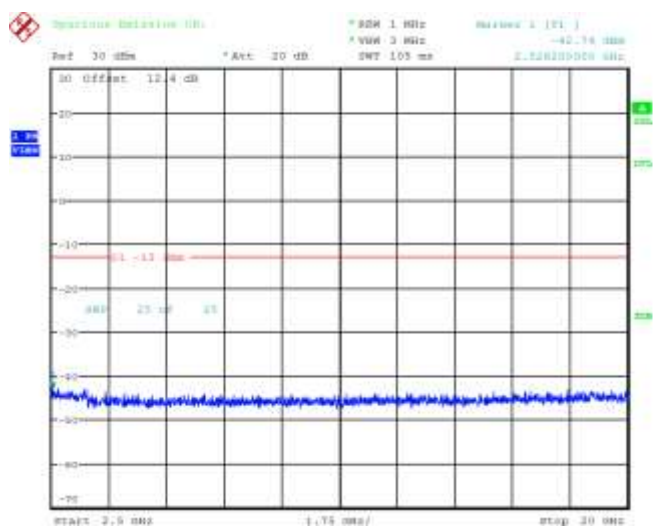


**Figure 3-4a: Band 2, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 100)**



## LTE Band 2 Conducted RF Emission Test Data cont'd

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

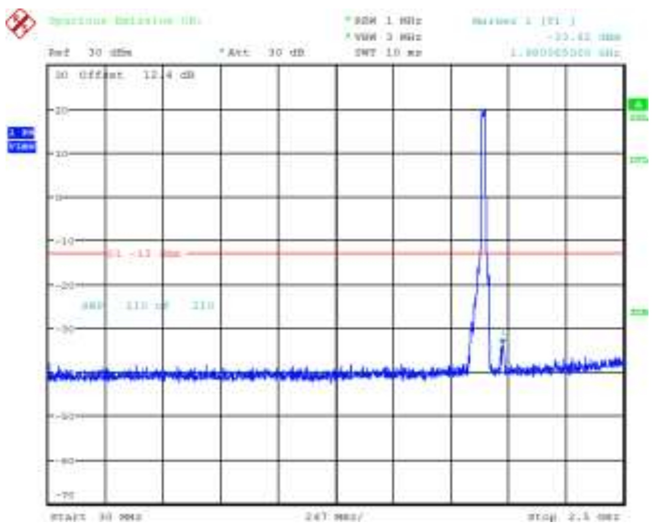


**Figure 3-6a: Band 2, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)**

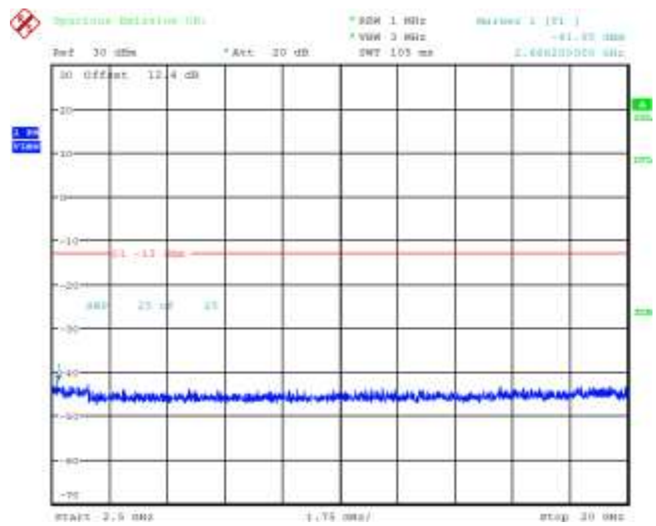


**Figure 3-7a: Band 2, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 50)**

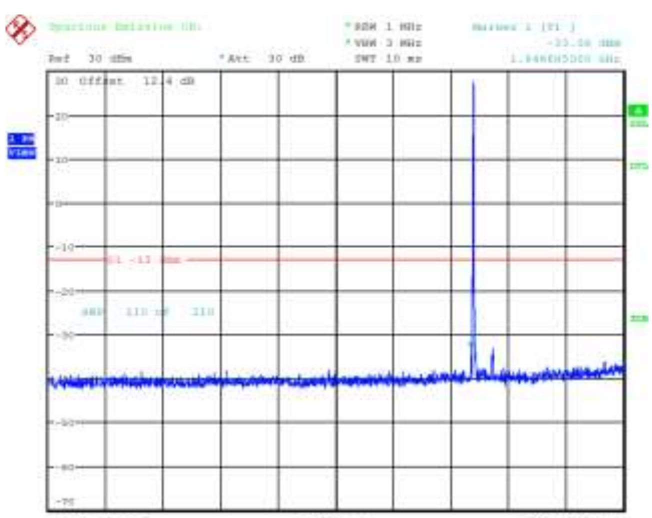
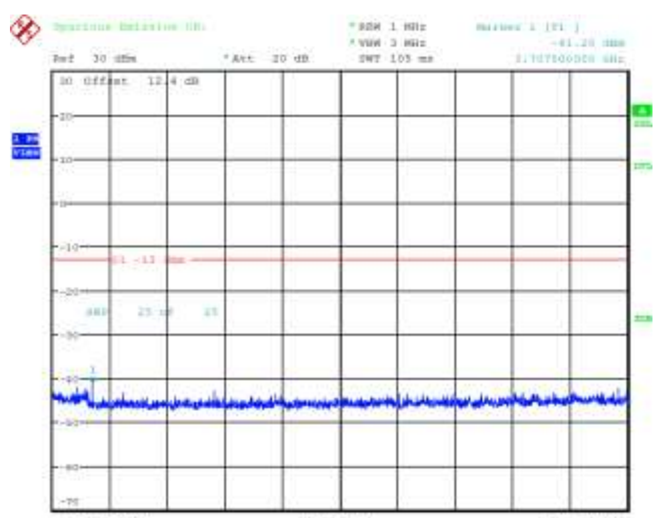


**Figure 3-8a: Band 2, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 50)**



## LTE Band 2 Conducted RF Emission Test Data cont'd

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

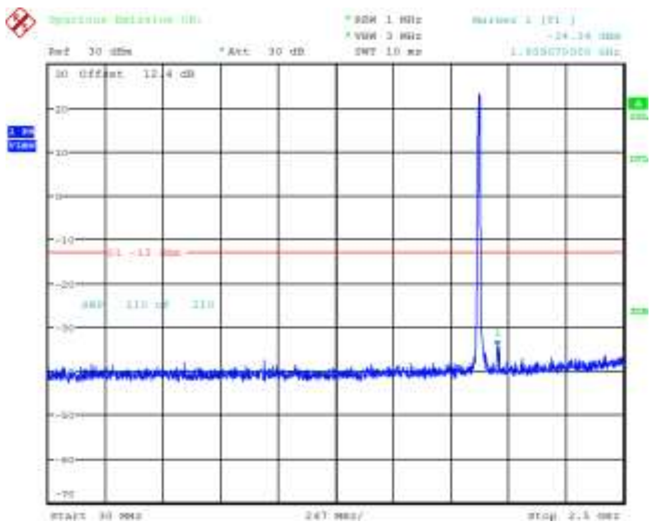


**Figure 3-10a: Band 2, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 50)**

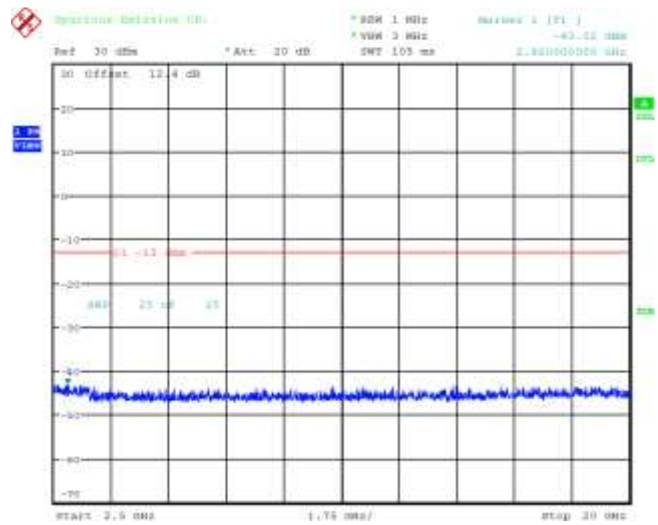


**Figure 3-11a: Band 2, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)**

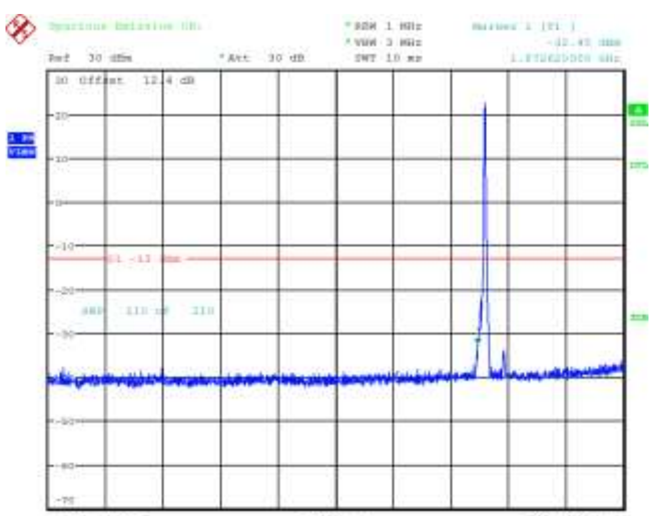
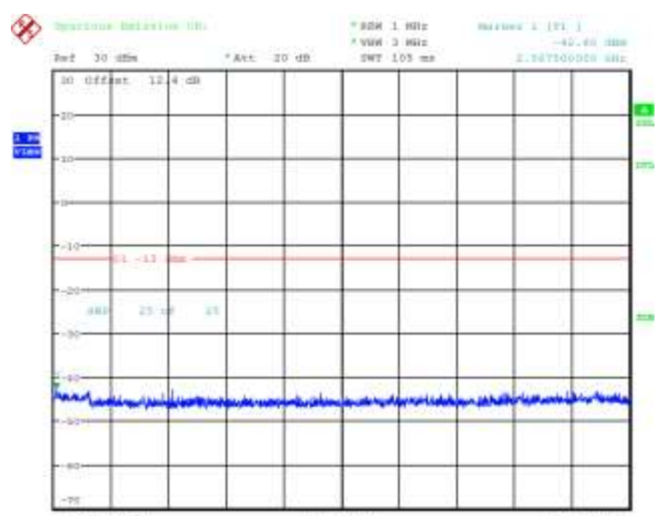


**Figure 3-12a: Band 2, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)**



## 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)**

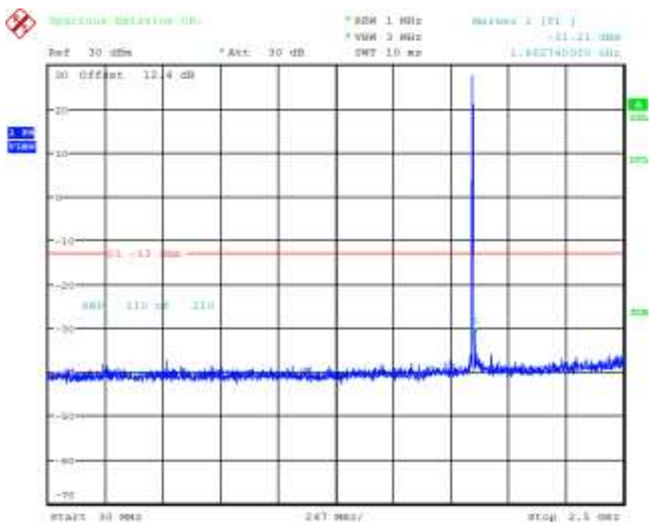


**Figure 3-14a: Band 2, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 6)**

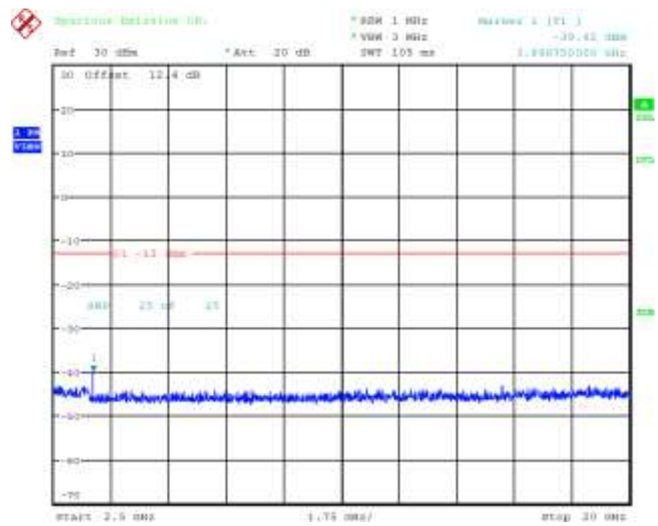


**Figure 3-15a: Band 2, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 6)**

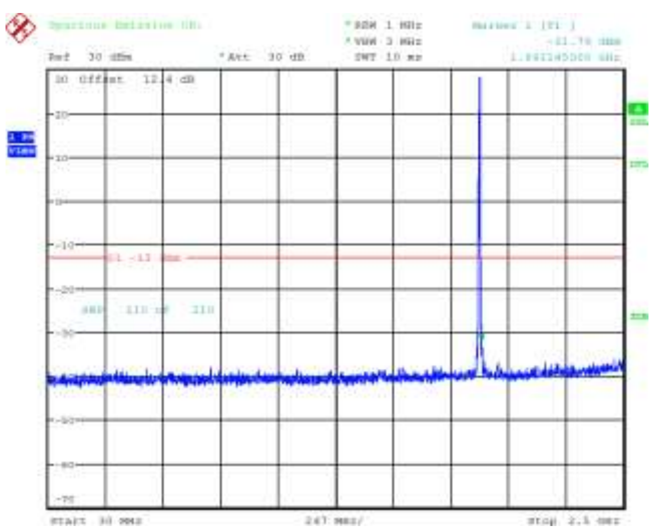
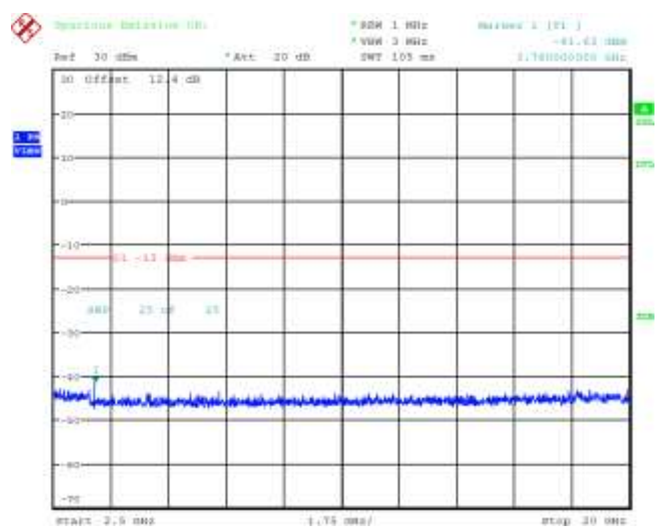


**Figure 3-16a: Band 2, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 6)**



## 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)**

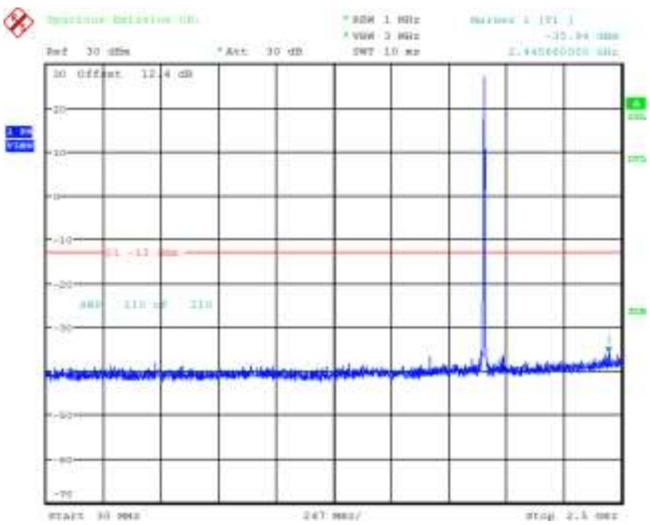


**Figure 3-18a: Band 2, Spurious Conducted Emissions, High Channel, 1.4MHz BW (RB= 6)**

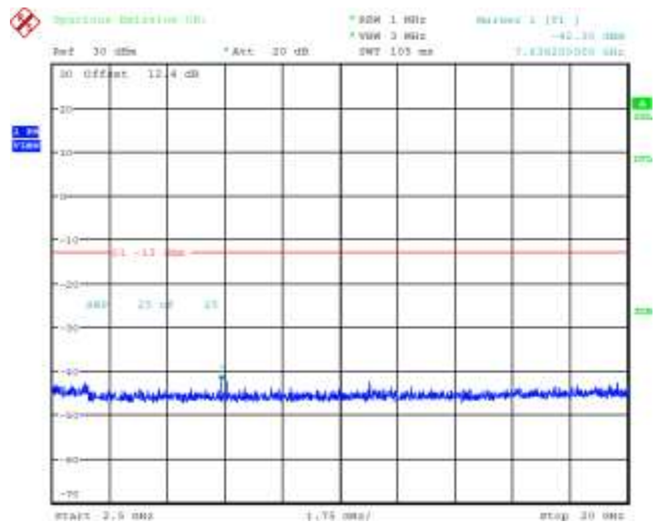


**Figure 3-19a: Occupied Bandwidth, Band 2 Low Channel, 20MHz BW (RB= 100)**

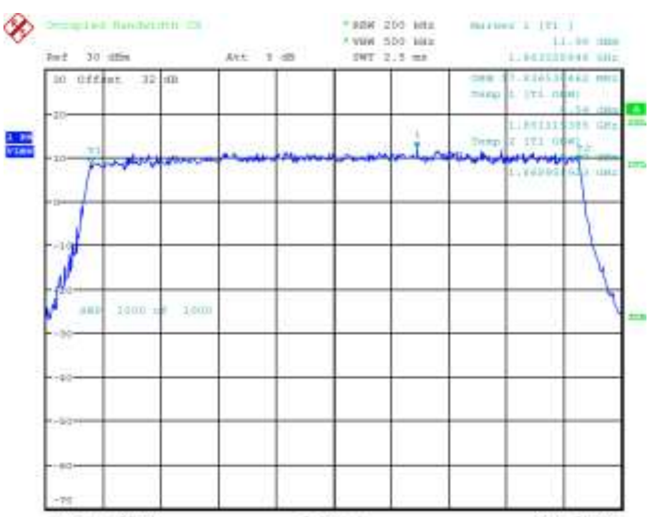
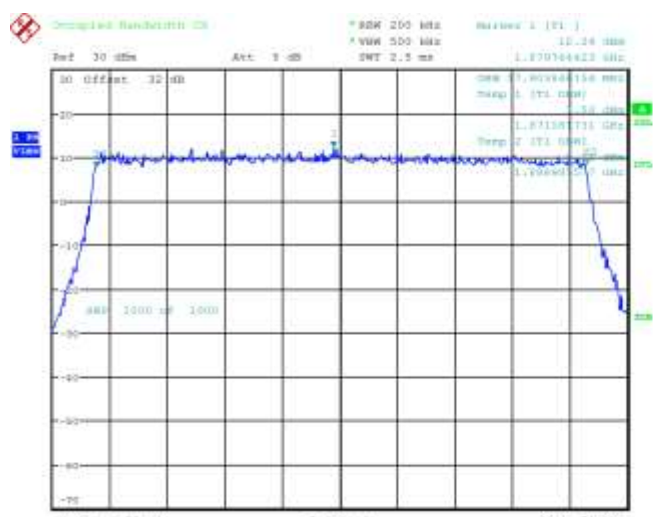


**Figure 3-20a: Occupied Bandwidth, Band 2 Middle Channel, 20MHz BW (RB= 100)**



## LTE Band 2 Conducted RF Emission Test Data cont'd

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

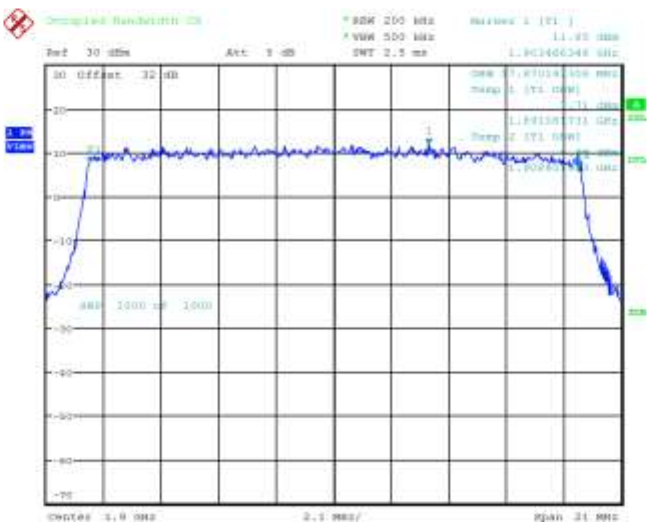


**Figure 3-22a: -26 dBc Bandwidth, Band 2 Low Channel, 20MHz BW (RB= 100)**

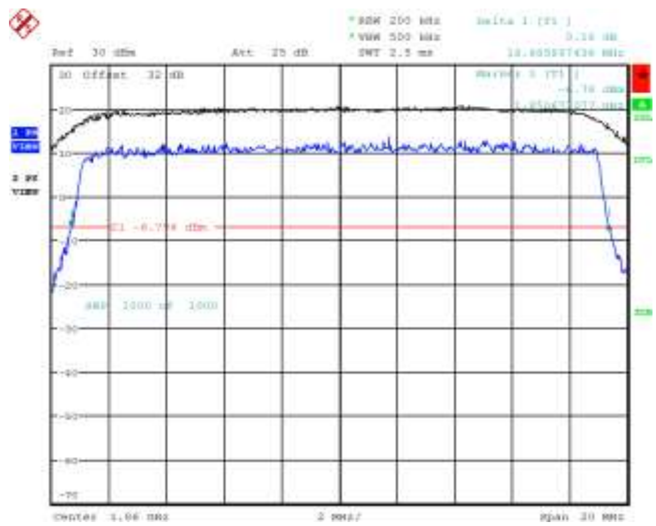


**Figure 3-23a: -26 dBc Bandwidth, Band 2 Middle Channel, 20MHz BW (RB= 100)**

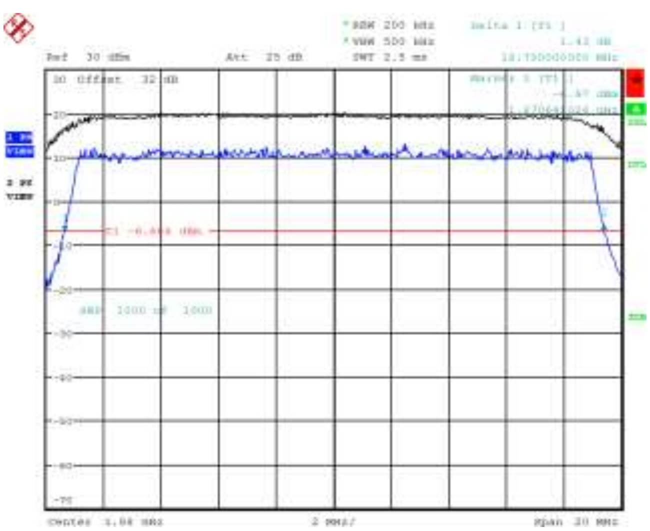
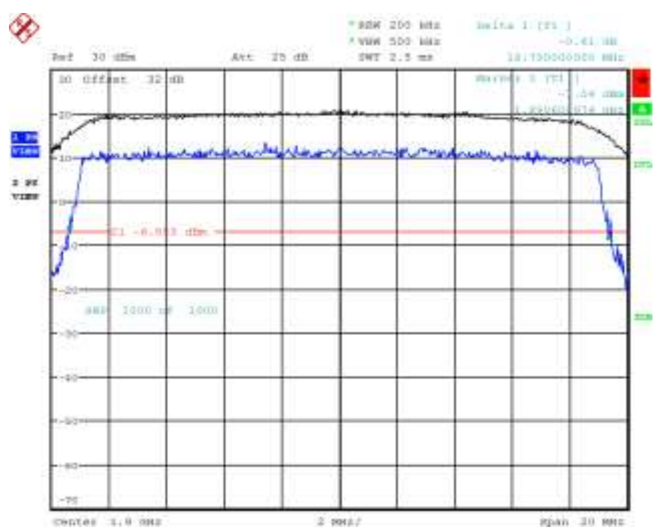


**Figure 3-24a: -26 dBc Bandwidth, Band 2 High Channel, 20MHz BW (RB= 100)**



## LTE Band 2 Conducted RF Emission Test Data cont'd

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

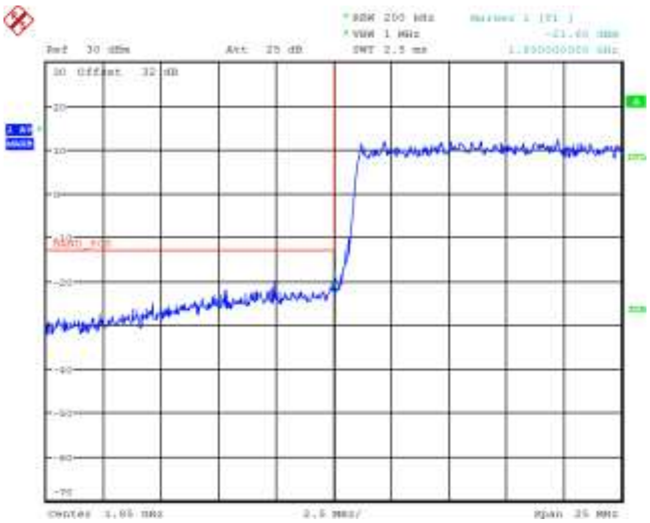


**Figure 3-26a: Band 2 High Channel Mask, 20MHz BW, RB = 100**

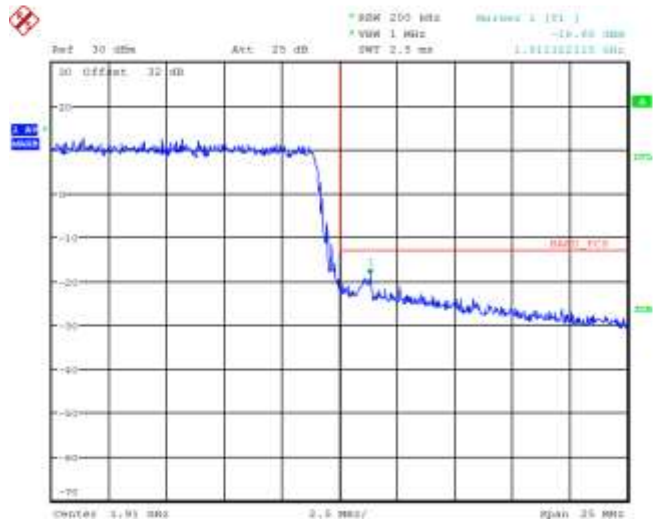


**Figure 3-27a: Band 2 Low Channel Mask, 10MHz BW, RB = 50**

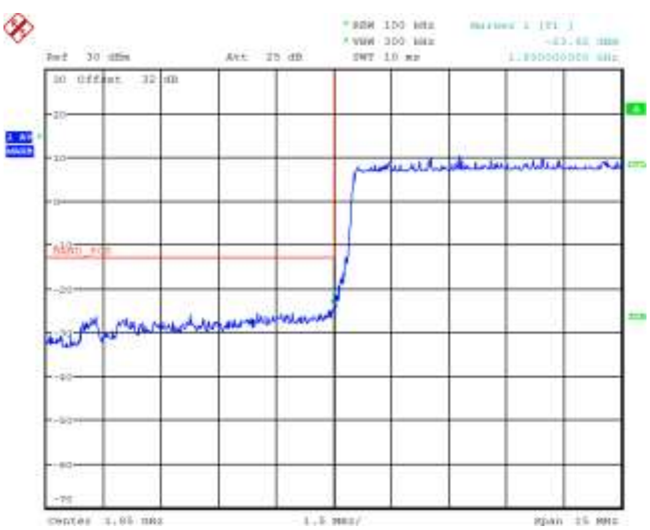
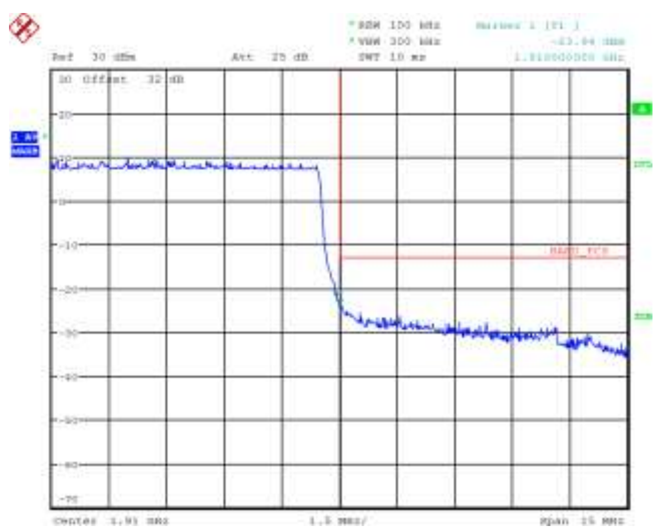


**Figure 3-28a: Band 2 High Channel Mask, 10MHz BW, RB = 50**



## LTE Band 2 Conducted RF Emission Test Data cont'd

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

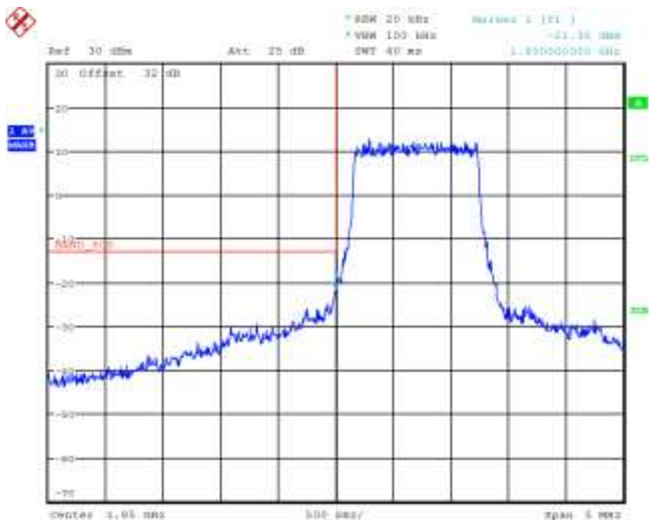


**Figure 3-30a: Band 2 High Channel Mask, 1.4MHz BW, RB = 6**

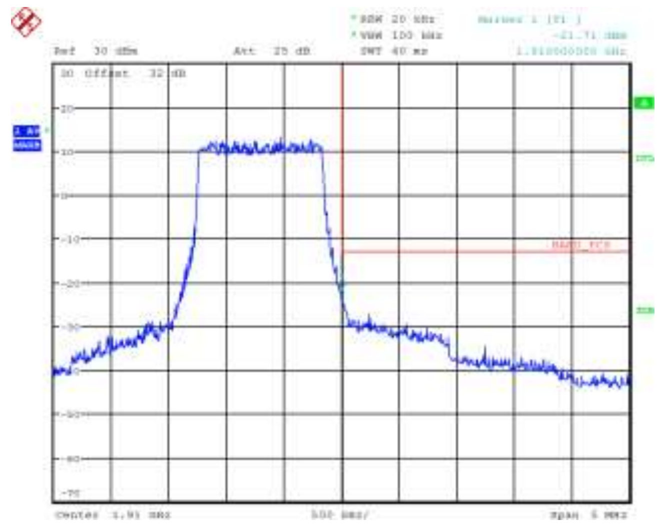


**Figure 3-31a: Band 2 Low Channel Mask, 20MHz BW, RB = 1**

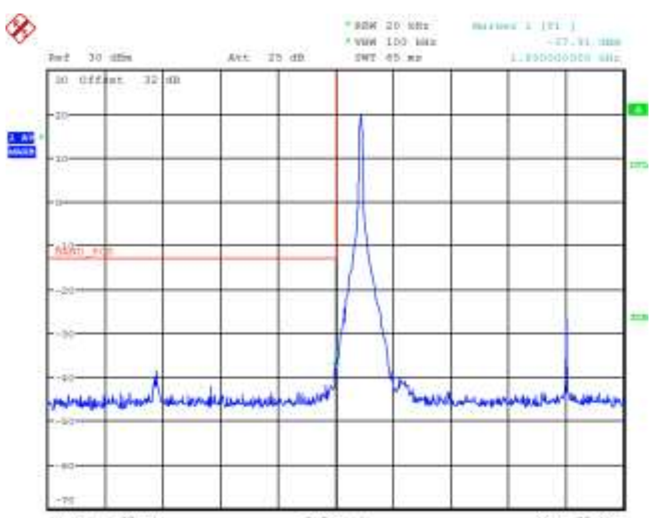
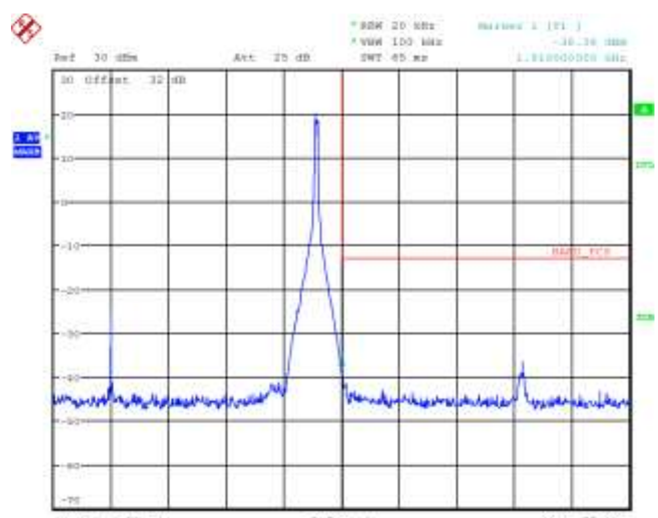


**Figure 3-32a: Band 2 High Channel Mask, 20MHz BW, RB = 1**



## LTE Band 2 Conducted RF Emission Test Data cont'd

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

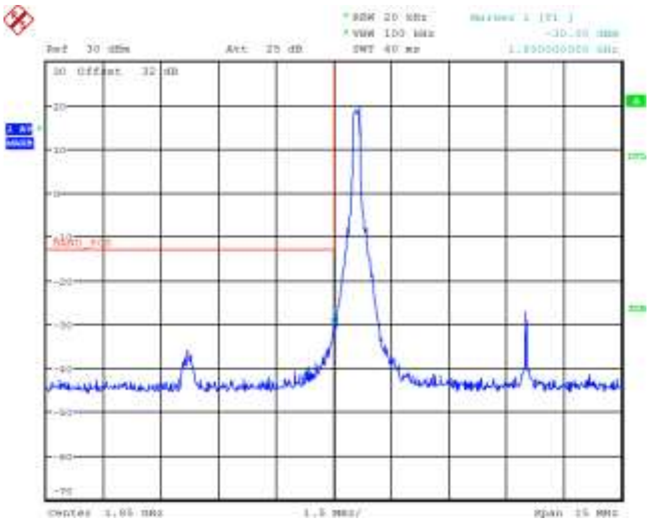


**Figure 3-34a: Band 2 High Channel Mask, 10MHz BW, RB = 1**

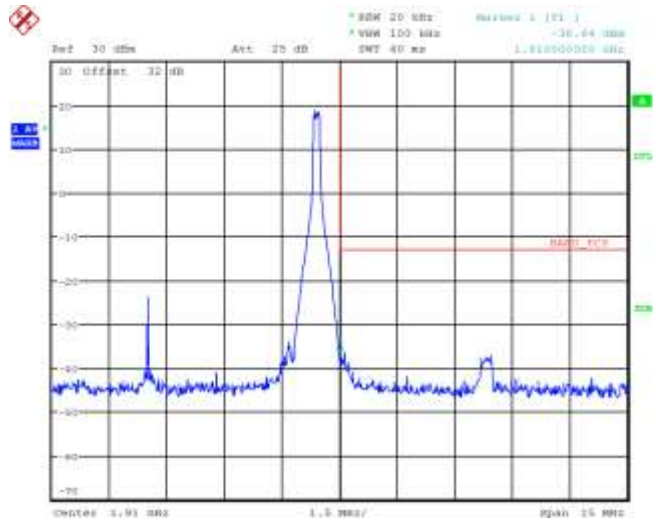


**Figure 3-35a: Band 2 Low Channel Mask, 1.4MHz BW, RB = 1**

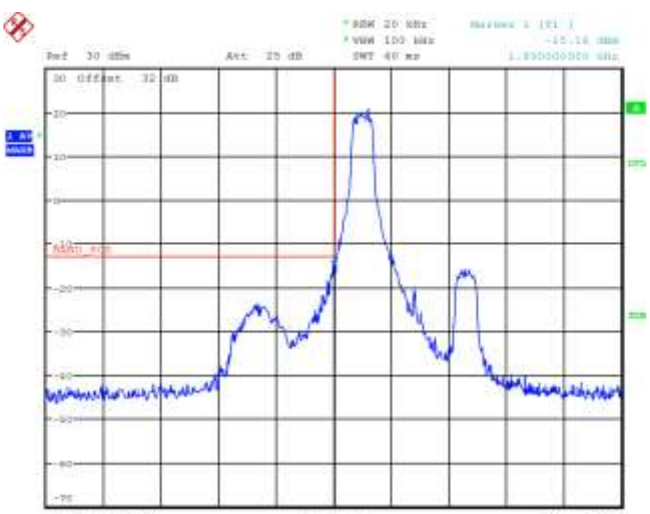
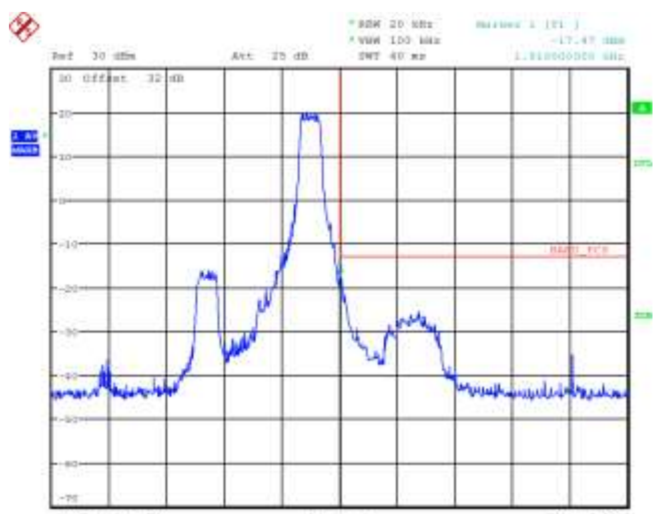


**Figure 3-36a: Band 2 High Channel Mask, 1.4MHz BW, RB = 1**



## 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**

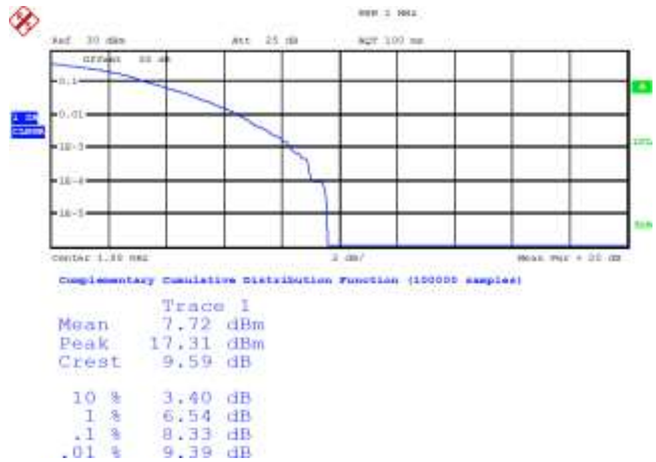



**Figure 3-39a: Band 2, Mid Channel PAR, 10 MHz BW, RB = 25 QPSK**

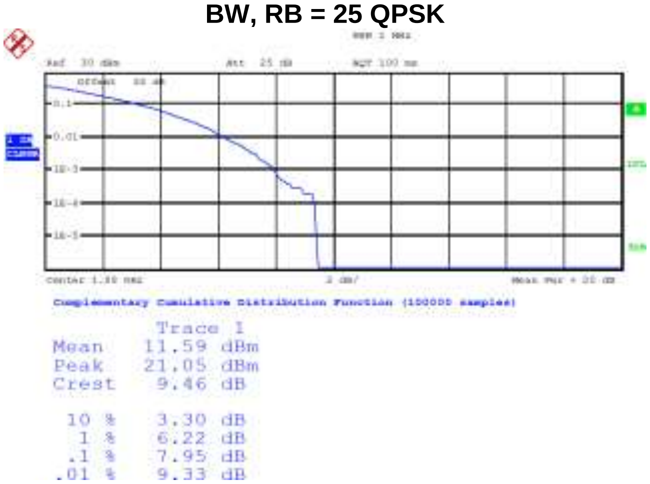
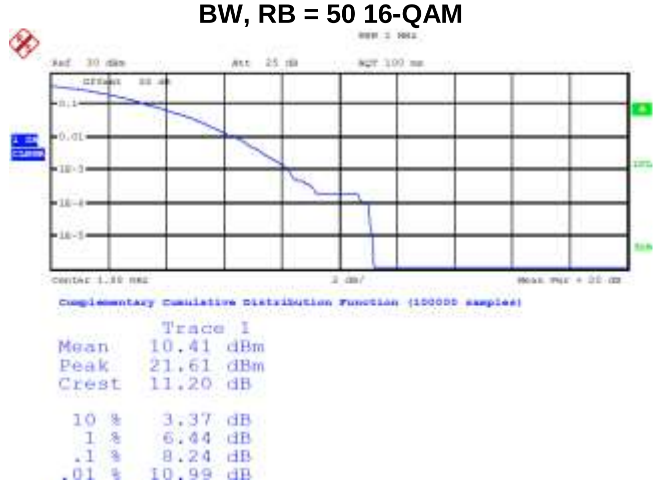



**Figure 3-40a: Band 2, Mid Channel PAR, 10 MHz BW, RB = 50 16-QAM**



## 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**

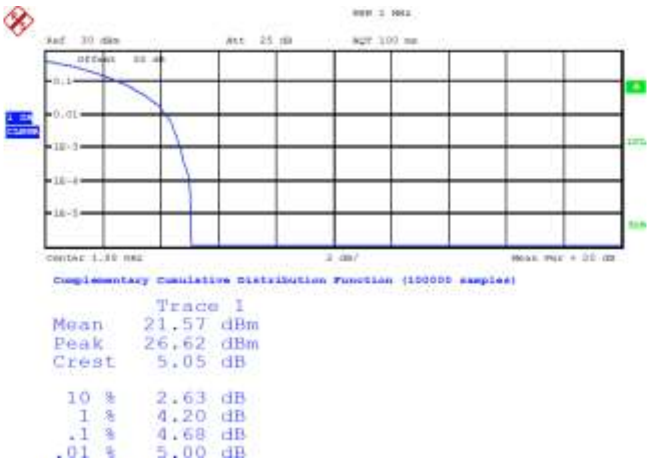
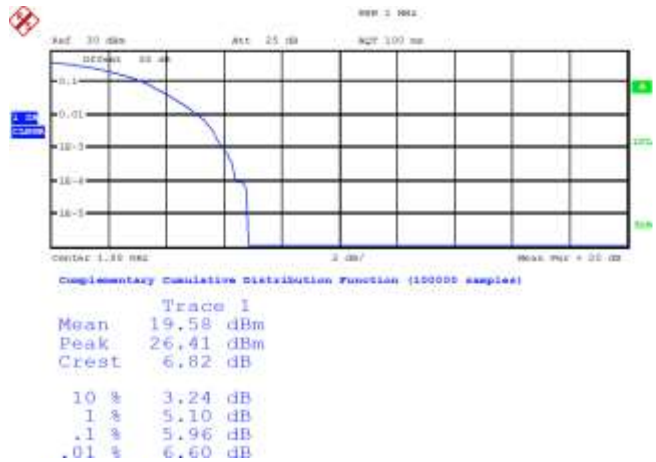



**Figure 3-42a: Band 2, Mid Channel PAR, 1.4 MHz BW, RB = 6 16-QAM**



## 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**

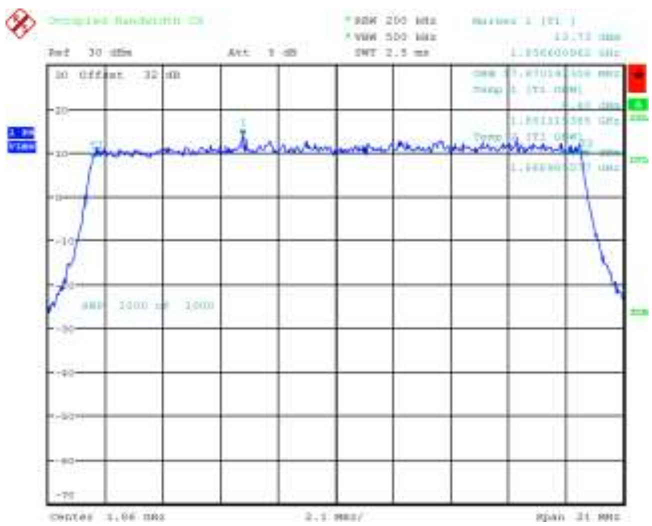


**Figure 3-44a: Occupied Bandwidth, Band 2 Mid Channel, 20MHz BW (RB= 100) 16-QAM**

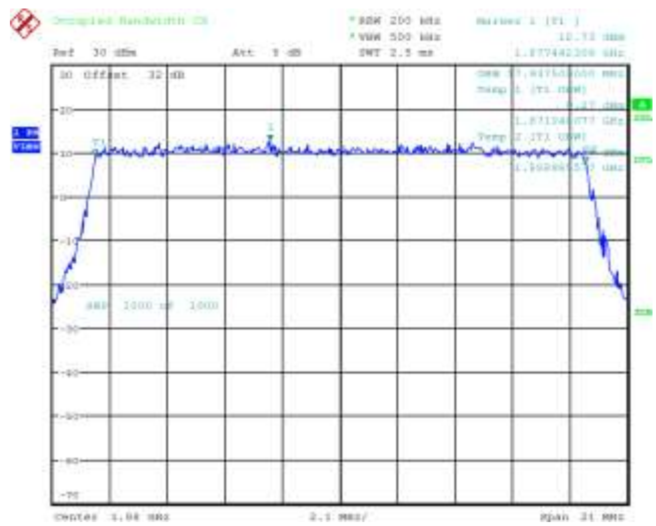
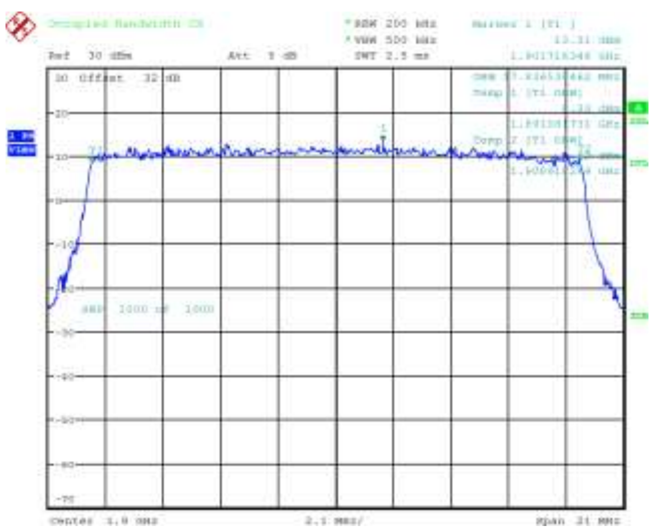
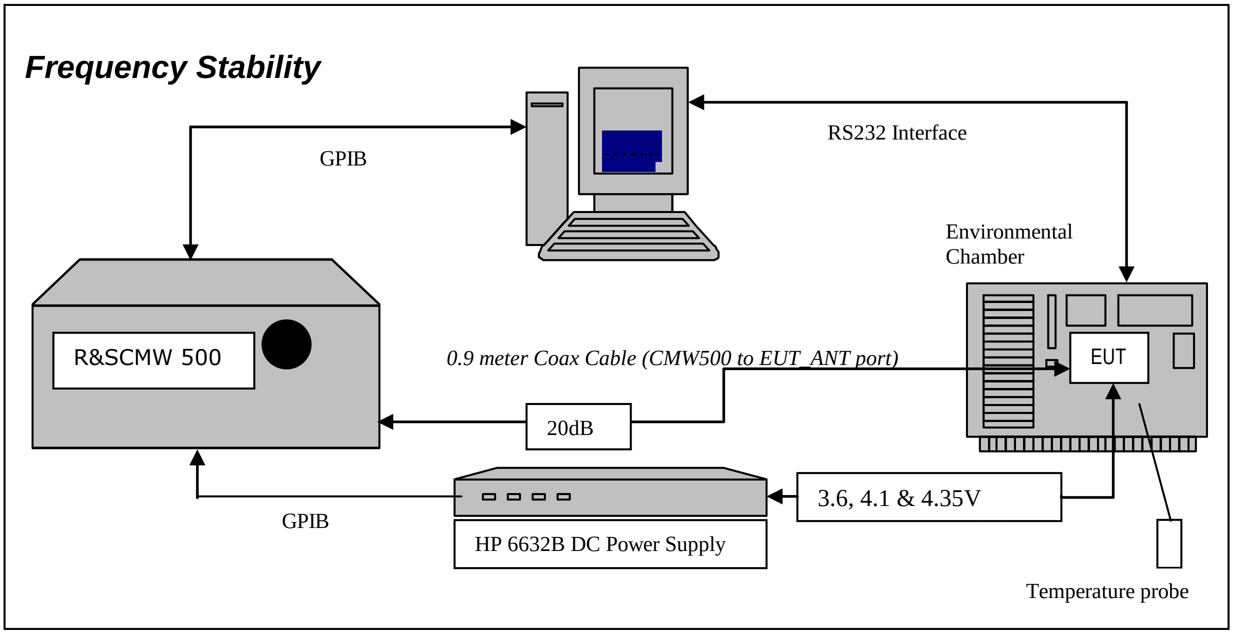


**Figure 3-45a: Occupied Bandwidth, Band 2 High Channel, 20MHz BW (RB= 100) 16-QAM**



# APPENDIX 3B – LTE Band 2 FREQUENCY STABILITY TEST DATA

## LTE Frequency Stability Test Data




The following 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) RBs. 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: June 27, 2014

**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 | 8.25 | 0.0044 |
| 18900 | 1880.0 | 3.6 | 20 | 11.53 | 0.0061 |
| 19199 | 1900.0 | 3.6 | 20 | 9.33 | 0.0049 |

| Traffic Channel Number | LTE Band 2 Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 18600 | 1860.0 | 4.1 | 20 | -7.52 | -0.0040 |
| 18900 | 1880.0 | 4.1 | 20 | 10.30 | 0.0055 |
| 19199 | 1900.0 | 4.1 | 20 | 9.51 | 0.0050 |

| Traffic Channel Number | LTE Band 2 Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 18600 | 1860.0 | 4.35 | 20 | -8.70 | -0.0047 |
| 18900 | 1880.0 | 4.35 | 20 | 11.03 | 0.0059 |
| 19199 | 1900.0 | 4.35 | 20 | -5.88 | -0.0031 |

## 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 | -9.48 | -0.0051 |
| 18600 | 1860.0 | 3.6 | -20 | -8.45 | -0.0045 |
| 18600 | 1860.0 | 3.6 | -10 | -8.17 | -0.0044 |
| 18600 | 1860.0 | 3.6 | 0 | -5.83 | -0.0031 |
| 18600 | 1860.0 | 3.6 | 10 | -8.83 | -0.0047 |
| 18600 | 1860.0 | 3.6 | 20 | 8.25 | 0.0044 |
| 18600 | 1860.0 | 3.6 | 30 | -9.06 | -0.0049 |
| 18600 | 1860.0 | 3.6 | 40 | -11.96 | -0.0064 |
| 18600 | 1860.0 | 3.6 | 50 | -11.12 | -0.0060 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 18600 | 1860.0 | 4.1 | -30 | -8.41 | -0.0045 |
| 18600 | 1860.0 | 4.1 | -20 | -9.36 | -0.0050 |
| 18600 | 1860.0 | 4.1 | -10 | -6.48 | -0.0035 |
| 18600 | 1860.0 | 4.1 | 0 | -6.24 | -0.0034 |
| 18600 | 1860.0 | 4.1 | 10 | 8.61 | 0.0046 |
| 18600 | 1860.0 | 4.1 | 20 | -7.52 | -0.0040 |
| 18600 | 1860.0 | 4.1 | 30 | -6.64 | -0.0036 |
| 18600 | 1860.0 | 4.1 | 40 | -6.19 | -0.0033 |
| 18600 | 1860.0 | 4.1 | 50 | -8.60 | -0.0046 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 18600 | 1860.0 | 4.35 | -30 | -7.40 | -0.0040 |
| 18600 | 1860.0 | 4.35 | -20 | 9.87 | 0.0053 |
| 18600 | 1860.0 | 4.35 | -10 | -8.18 | -0.0044 |
| 18600 | 1860.0 | 4.35 | 0 | -7.60 | -0.0041 |
| 18600 | 1860.0 | 4.35 | 10 | -7.27 | -0.0039 |
| 18600 | 1860.0 | 4.35 | 20 | -8.70 | -0.0047 |
| 18600 | 1860.0 | 4.35 | 30 | -7.62 | -0.0041 |
| 18600 | 1860.0 | 4.35 | 40 | -9.21 | -0.0050 |
| 18600 | 1860.0 | 4.35 | 50 | -8.98 | -0.0048 |

## 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 | 6.08 | 0.0032 |
| 18900 | 1880.00 | 3.6 | -20 | 8.74 | 0.0046 |
| 18900 | 1880.00 | 3.6 | -10 | 13.13 | 0.0070 |
| 18900 | 1880.00 | 3.6 | 0 | 8.91 | 0.0047 |
| 18900 | 1880.00 | 3.6 | 10 | 9.41 | 0.0050 |
| 18900 | 1880.00 | 3.6 | 20 | 11.53 | 0.0061 |
| 18900 | 1880.00 | 3.6 | 30 | 5.22 | 0.0028 |
| 18900 | 1880.00 | 3.6 | 40 | 7.88 | 0.0042 |
| 18900 | 1880.00 | 3.6 | 50 | 4.19 | 0.0022 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 18900 | 1880.00 | 4.1 | -30 | 8.20 | 0.0044 |
| 18900 | 1880.00 | 4.1 | -20 | 12.42 | 0.0066 |
| 18900 | 1880.00 | 4.1 | -10 | 8.25 | 0.0044 |
| 18900 | 1880.00 | 4.1 | 0 | 7.93 | 0.0042 |
| 18900 | 1880.00 | 4.1 | 10 | 8.23 | 0.0044 |
| 18900 | 1880.00 | 4.1 | 20 | 10.30 | 0.0055 |
| 18900 | 1880.00 | 4.1 | 30 | -7.87 | -0.0042 |
| 18900 | 1880.00 | 4.1 | 40 | -6.62 | -0.0035 |
| 18900 | 1880.00 | 4.1 | 50 | 10.27 | 0.0055 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 18900 | 1880.00 | 4.35 | -30 | -6.49 | -0.0035 |
| 18900 | 1880.00 | 4.35 | -20 | 9.03 | 0.0048 |
| 18900 | 1880.00 | 4.35 | -10 | 7.42 | 0.0039 |
| 18900 | 1880.00 | 4.35 | 0 | 5.18 | 0.0028 |
| 18900 | 1880.00 | 4.35 | 10 | 11.12 | 0.0059 |
| 18900 | 1880.00 | 4.35 | 20 | 11.03 | 0.0059 |
| 18900 | 1880.00 | 4.35 | 30 | 9.94 | 0.0053 |
| 18900 | 1880.00 | 4.35 | 40 | 6.12 | 0.0033 |
| 18900 | 1880.00 | 4.35 | 50 | 8.45 | 0.0045 |

## 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 | 9.84 | 0.0052 |
| 19199 | 1900.0 | 3.6 | -20 | 8.37 | 0.0044 |
| 19199 | 1900.0 | 3.6 | -10 | 6.90 | 0.0036 |
| 19199 | 1900.0 | 3.6 | 0 | -5.81 | -0.0031 |
| 19199 | 1900.0 | 3.6 | 10 | 6.71 | 0.0035 |
| 19199 | 1900.0 | 3.6 | 20 | 9.33 | 0.0049 |
| 19199 | 1900.0 | 3.6 | 30 | 5.72 | 0.0030 |
| 19199 | 1900.0 | 3.6 | 40 | -8.47 | -0.0045 |
| 19199 | 1900.0 | 3.6 | 50 | -7.42 | -0.0039 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 19199 | 1900.0 | 4.1 | -30 | -6.34 | -0.0033 |
| 19199 | 1900.0 | 4.1 | -20 | 10.04 | 0.0053 |
| 19199 | 1900.0 | 4.1 | -10 | 8.94 | 0.0047 |
| 19199 | 1900.0 | 4.1 | 0 | 7.68 | 0.0040 |
| 19199 | 1900.0 | 4.1 | 10 | 10.11 | 0.0053 |
| 19199 | 1900.0 | 4.1 | 20 | 9.51 | 0.0050 |
| 19199 | 1900.0 | 4.1 | 30 | 10.34 | 0.0054 |
| 19199 | 1900.0 | 4.1 | 40 | 5.02 | 0.0026 |
| 19199 | 1900.0 | 4.1 | 50 | -6.22 | -0.0033 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 19199 | 1900.0 | 4.35 | -30 | -6.75 | -0.0036 |
| 19199 | 1900.0 | 4.35 | -20 | 6.87 | 0.0036 |
| 19199 | 1900.0 | 4.35 | -10 | 8.04 | 0.0042 |
| 19199 | 1900.0 | 4.35 | 0 | 5.46 | 0.0029 |
| 19199 | 1900.0 | 4.35 | 10 | 6.59 | 0.0035 |
| 19199 | 1900.0 | 4.35 | 20 | -5.88 | -0.0031 |
| 19199 | 1900.0 | 4.35 | 30 | -6.64 | -0.0035 |
| 19199 | 1900.0 | 4.35 | 40 | 7.27 | 0.0038 |
| 19199 | 1900.0 | 4.35 | 50 | -5.62 | -0.0030 |

APPENDIX 3C – LTE Band 2 RADIATED EMISSIONS TEST DATA

## Radiated Power Test Data Results

The following measurements were performed by Rex Zhang.
Date of Test: May 7, 2014
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, 5MHz BW, RB=1, QPSK modulation**

| | | | | | | | | Substitution Method | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EUT | | | | Rx Antenna | | Spectrum Analyzer | | Tracking Generator | | | | | |
| | | Frequency | | | | Reading | Max (V,H) | Pol. | Reading | Corrected Reading | | Limit | Diff to Limit |
| Type | Ch | (MHz) | Band | Type | Pol. | (dBuV) | (dBuV) | Tx-Rx | (dBm) | (dBm) | (W) | (dBm) | (dB) |
| F0 | 18625 | 1852.50 | 2 | Horn | V | -25.86 | -25.86 | V-V | -14.11 | 26.37 | 0.43 | 33.00 | 6.63 |
| F0 | 18625 | 1852.50 | 2 | Horn | H | -33.13 | | H-H | -13.18 | | | | |
| F0 | 18900 | 1880.00 | 2 | Horn | V | -25.69 | -25.69 | V-V | -13.31 | 26.66 | 0.46 | 33.00 | 6.34 |
| F0 | 18900 | 1880.00 | 2 | Horn | H | -33.08 | | H-H | -12.63 | | | | |
| F0 | 19174 | 1907.40 | 2 | Horn | V | -24.52 | -24.52 | V-V | -12.18 | **27.86** | 0.61 | 33.00 | 5.14 |
| F0 | 19174 | 1907.40 | 2 | Horn | H | -32.44 | | H-H | -11.73 | | | | |

**LTE band 2, 5MHz BW, RB=1, 16-QAM modulation**

| | | | | | | | | Substitution Method | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EUT | | | | Rx Antenna | | Spectrum Analyzer | | Tracking Generator | | | | | |
| | | Frequency | | | | Reading | Max (V,H) | Pol. | Reading | Corrected Reading | | Limit | Diff to Limit |
| Type | Ch | (MHz) | Band | Type | Pol. | (dBuV) | (dBuV) | Tx-Rx | (dBm) | (dBm) | (W) | (dBm) | (dB) |
| F0 | 18625 | 1852.50 | 2 | Horn | V | -26.78 | -26.78 | V-V | -14.91 | 25.53 | 0.36 | 33.00 | 7.47 |
| F0 | 18625 | 1852.50 | 2 | Horn | H | -34.51 | | H-H | -14.02 | | | | |
| F0 | 18900 | 1880.00 | 2 | Horn | V | -26.81 | -26.81 | V-V | -14.43 | 25.59 | 0.36 | 33.00 | 7.41 |
| F0 | 18900 | 1880.00 | 2 | Horn | H | -34.06 | | H-H | -13.70 | | | | |
| F0 | 19174 | 1907.40 | 2 | Horn | V | -25.82 | -25.82 | V-V | -13.52 | **26.82** | 0.48 | 33.00 | 6.18 |
| F0 | 19174 | 1907.40 | 2 | Horn | H | -33.99 | | H-H | -12.77 | | | | |

## Radiated Emissions Test Data Results

The following measurements were performed by Rex Zhang.

Date of Test: June 26, 2014

| | | |
|---|---|---|
| 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.

The following measurements were performed by Kevin Guo.

Date of Test: July 2-9, 2014

| | | |
|---|---|---|
| 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 USB up LCD facing to 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)

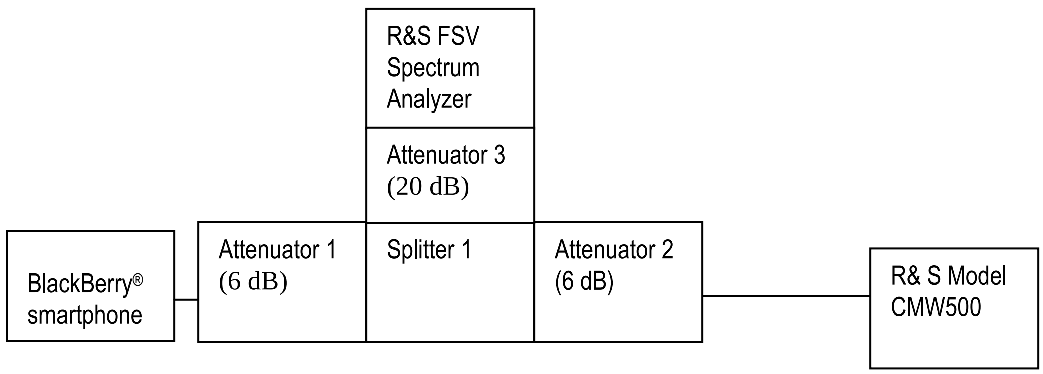
All emissions were at least 25 dB below the limit.

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

LTE Band 5 Conducted RF Emission Test Data

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: June 26-27, 2014

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 RBs 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 RB 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 9.34 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 | **8.96** | 8.96 |
| 836.5 | 9.34 | **8.96** | 8.96 |
| 843.9 | 9.31 | **8.96** | **8.97** |

***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)**

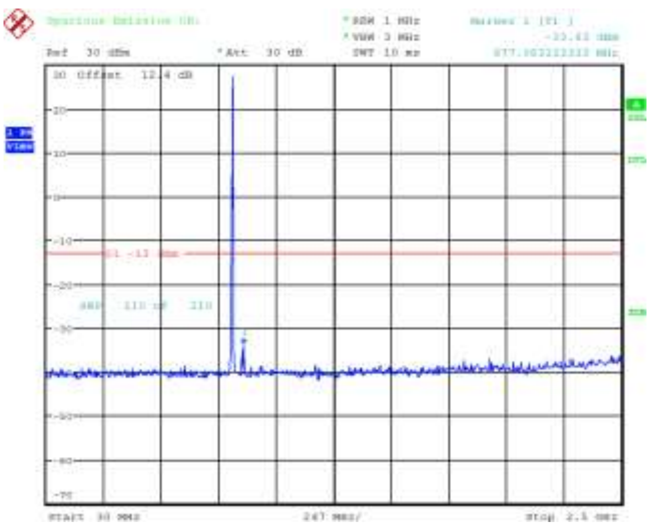



**Figure 4-2a: Band 5, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)**

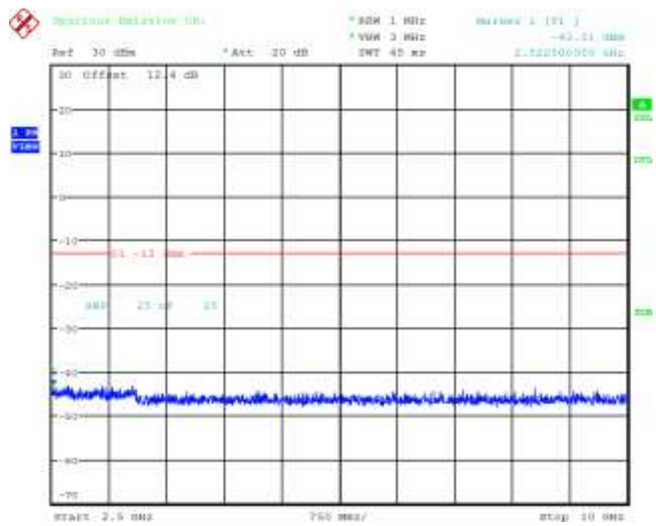



**Figure 4-3a: Band 5, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)**

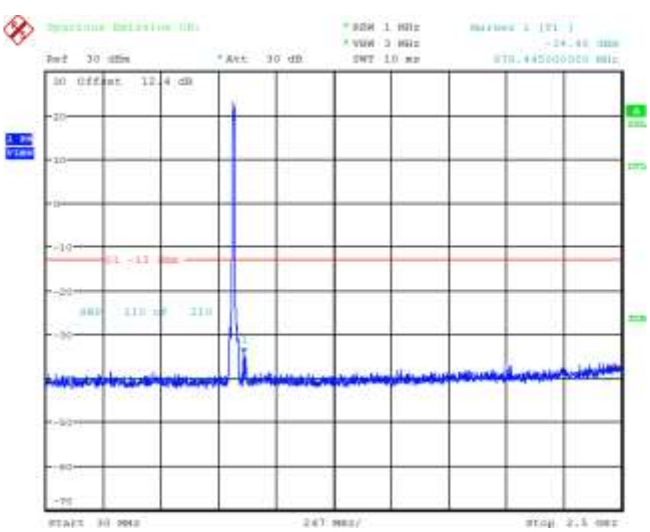
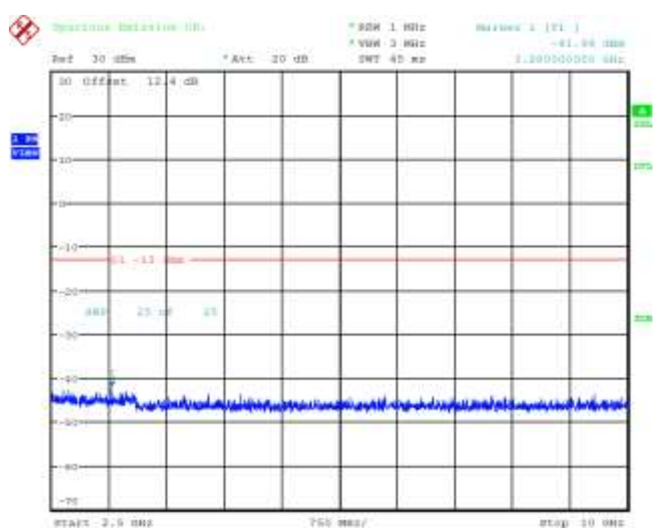



**Figure 4-4a: Band 5, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)**



## <u>LTE Band 5 Conducted RF Emission Test Data</u> cont'd

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

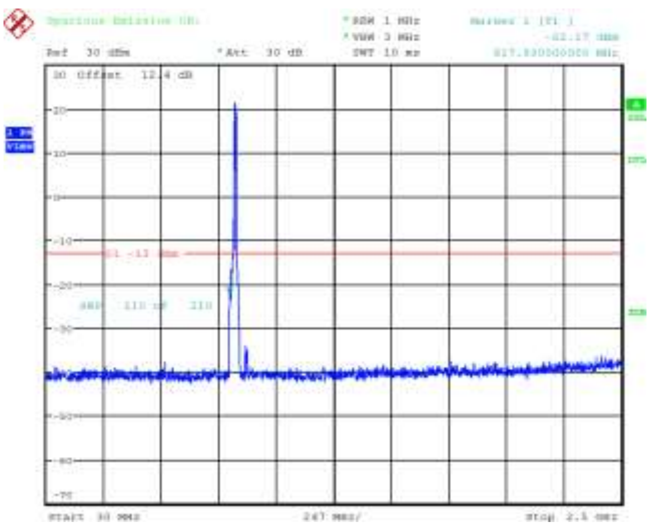


**Figure 4-6a: Band 5, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)**

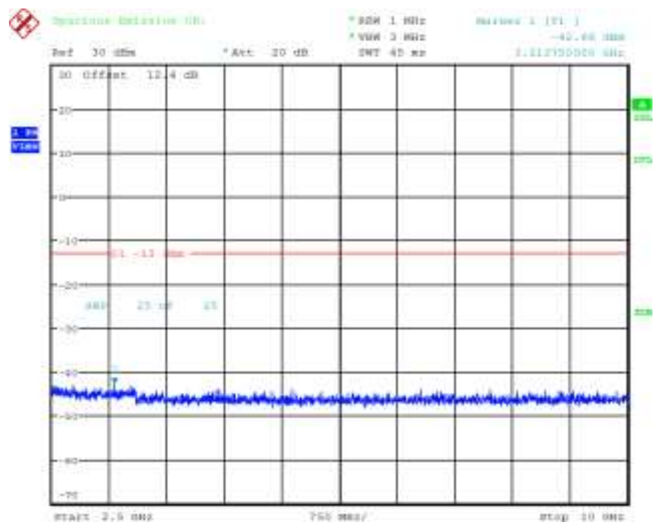


**Figure 4-7a: Band 5, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)**

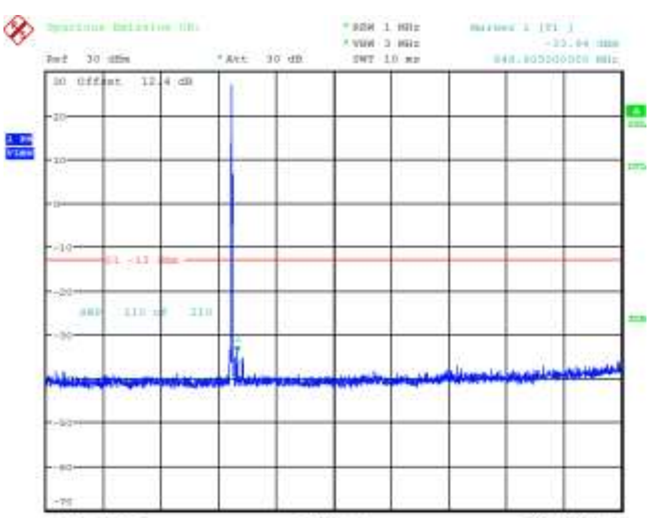
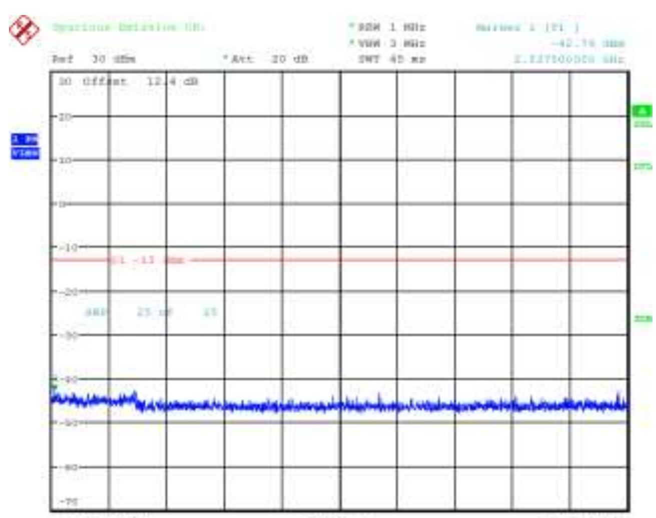


**Figure 4-8a: Band 5, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

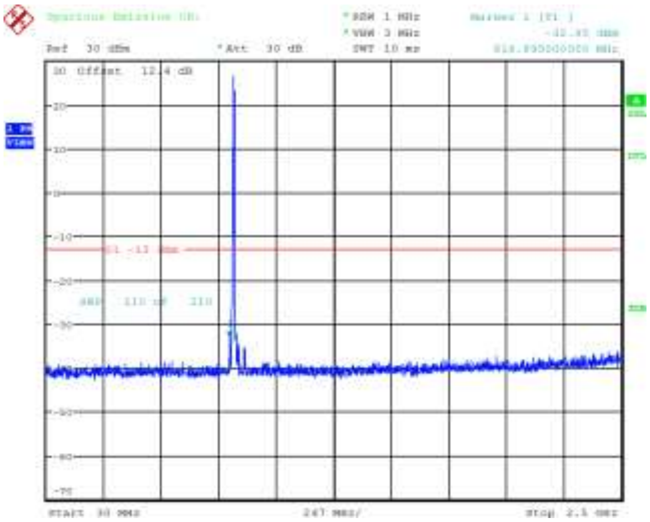


**Figure 4-10a: Band 5, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 15)**

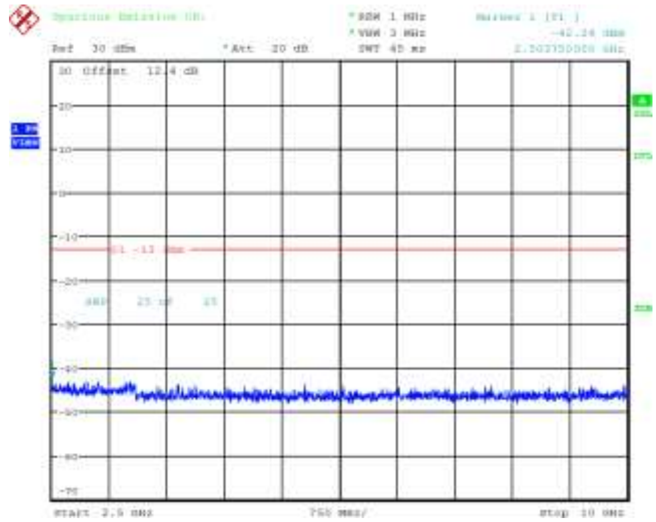


**Figure 4-11a: Band 5, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)**

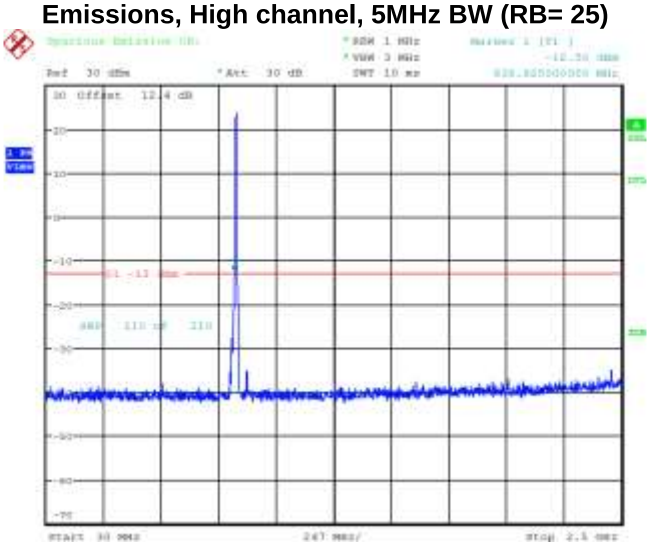
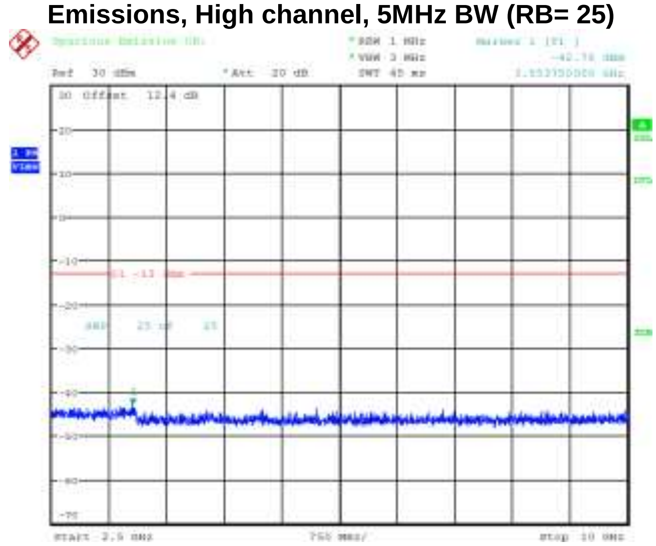


**Figure 4-12a: Band 5, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)**



## 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)**

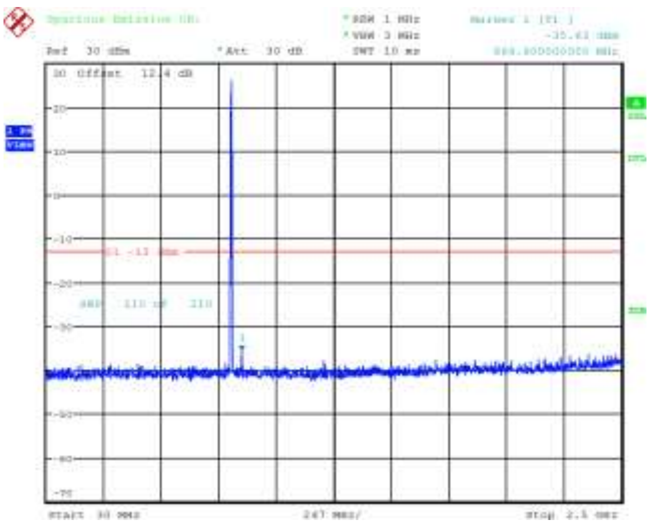


**Figure 4-14a: Band 5, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)**

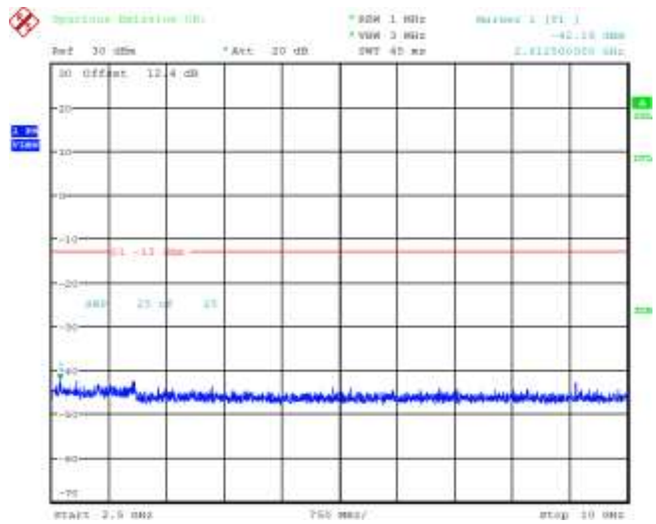


**Figure 4-15a: Band 5, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)**

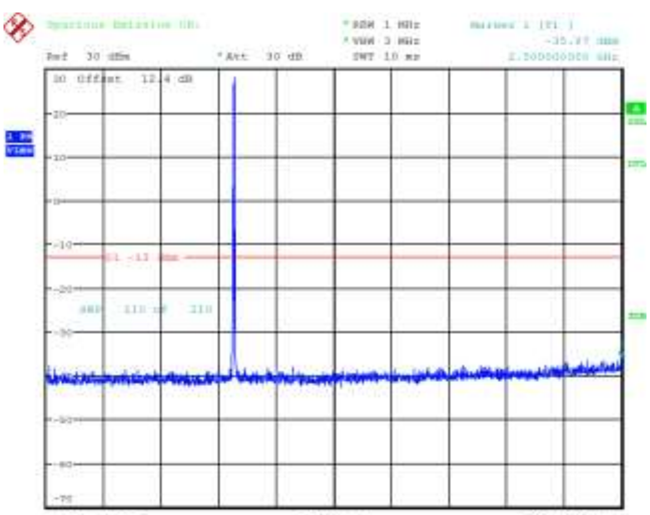
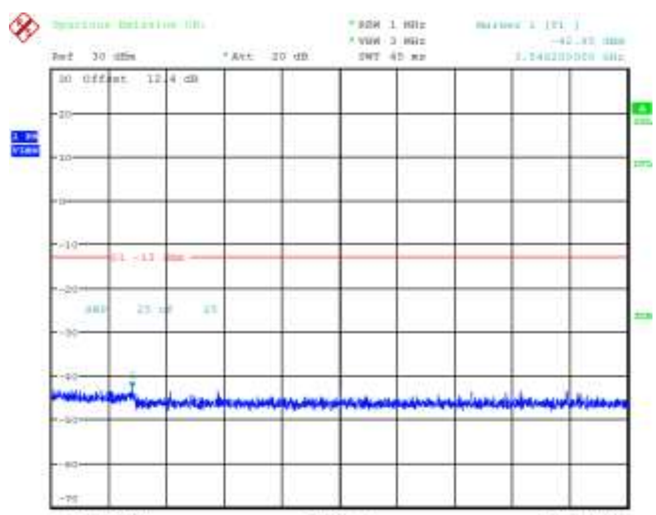


**Figure 4-16a: Band 5, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)**



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)**

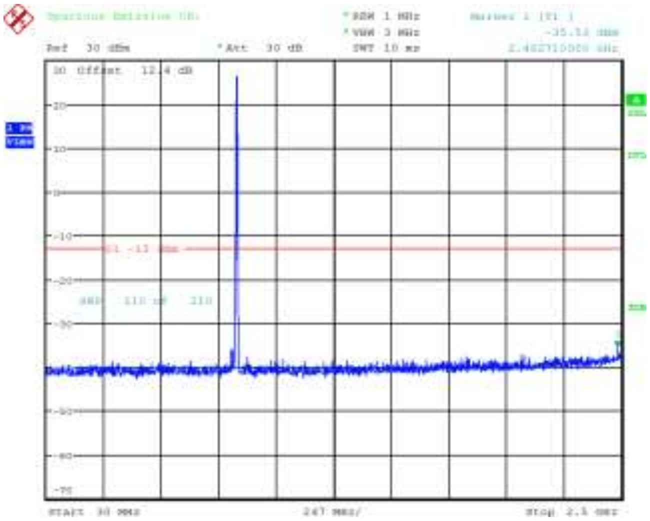
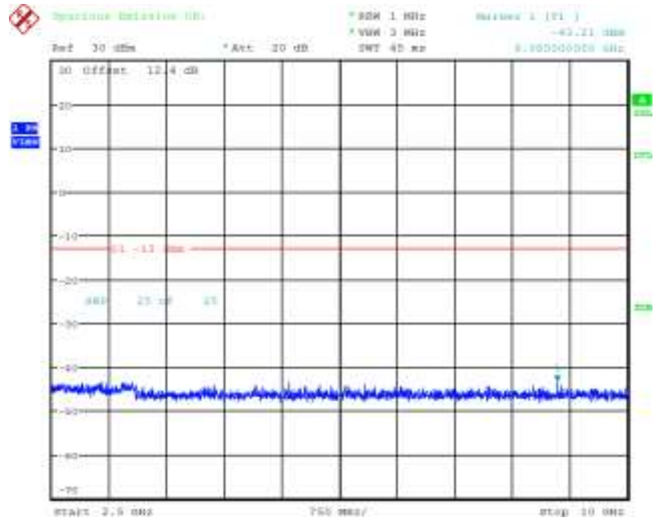



**Figure 4-18a: Band 5, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

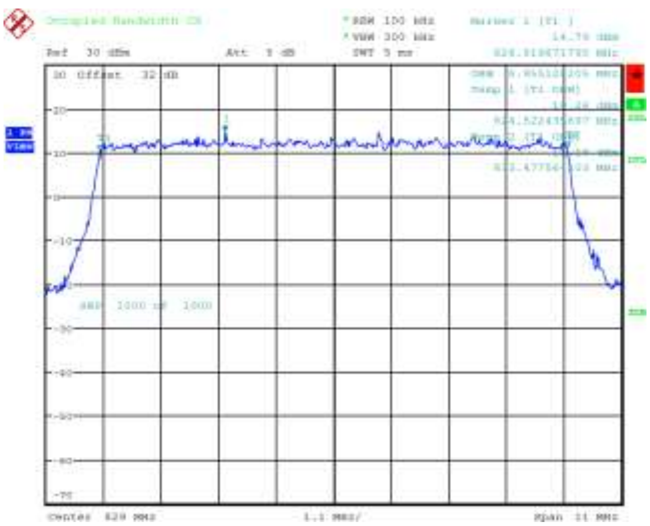



**Figure 4-20a: Occupied Bandwidth, Band 5 Middle Channel, 10MHz BW, RB=50**

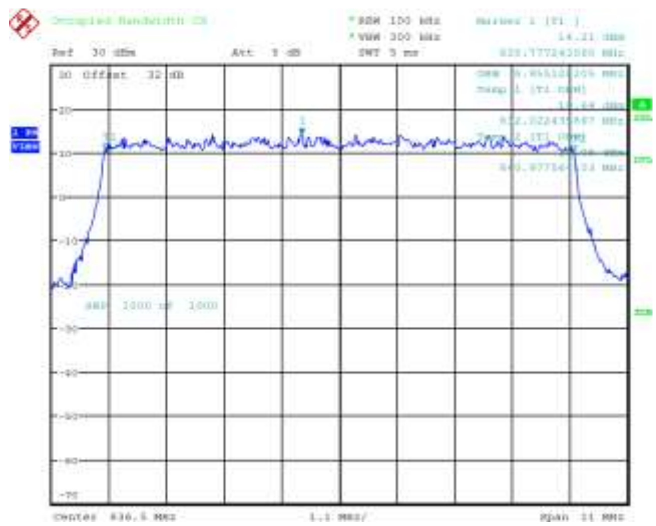
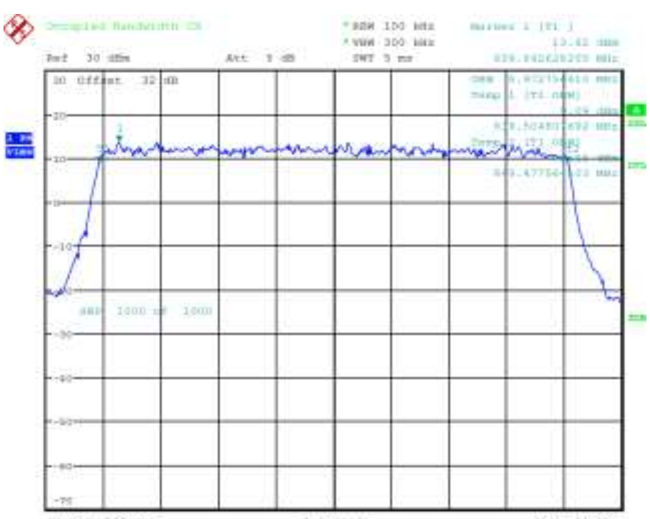



**Figure 4-21a: Occupied Bandwidth, Band 5 High Channel, 10MHz BW, RB=50**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

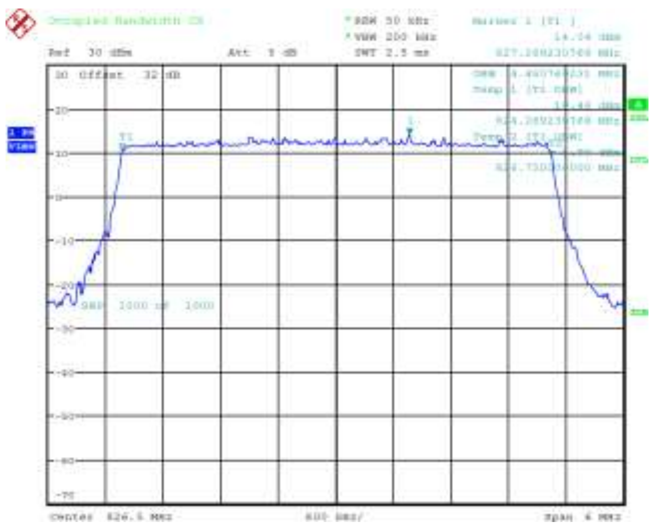


**Figure 4-23a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25**

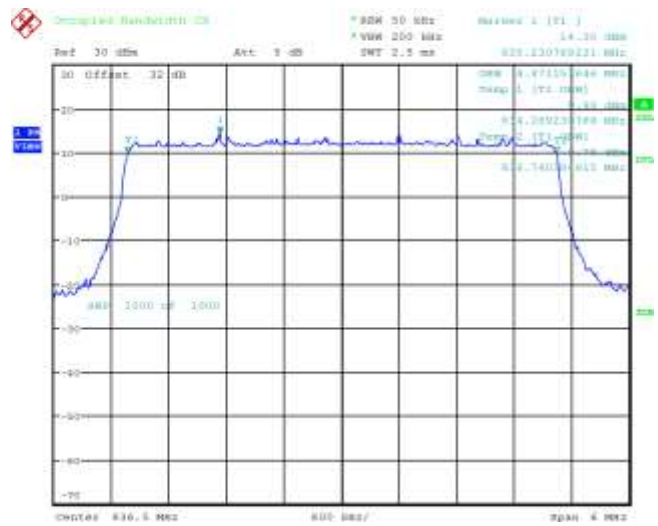
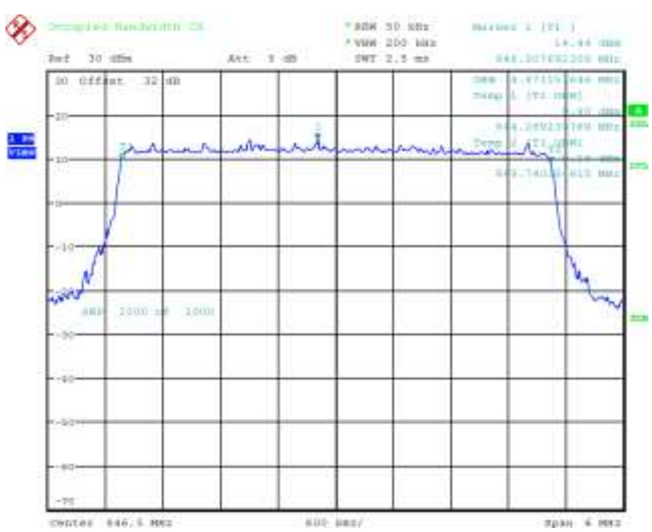


**Figure 4-24a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

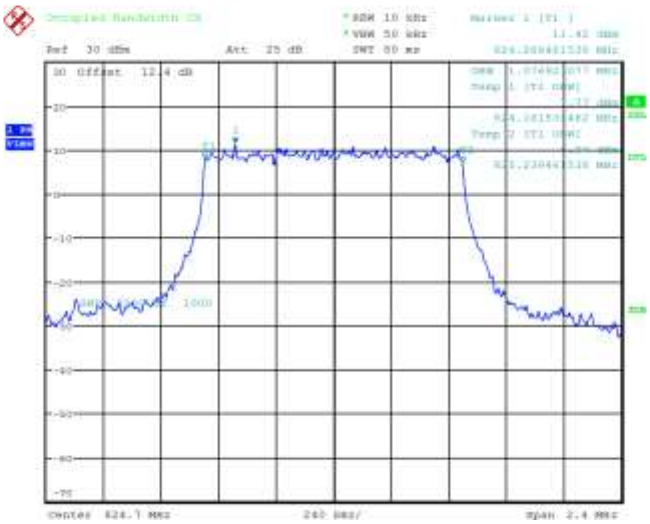


**Figure 4-26a: Occupied Bandwidth, Band 5 Middle Channel, 1.4MHz BW, RB=6**

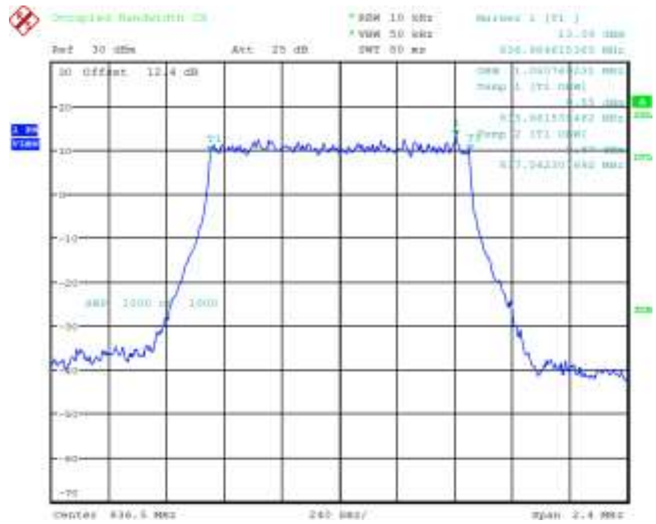
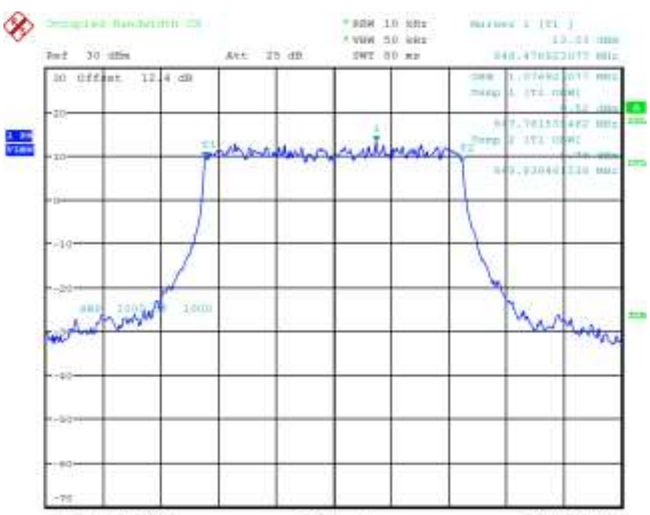


**Figure 4-27a: Occupied Bandwidth, Band 5 High Channel, 1.4MHz BW, RB=6**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

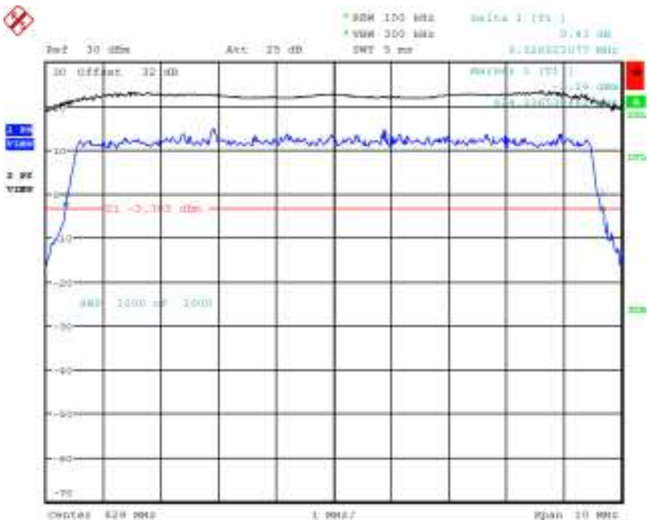


**Figure 4-29a: -26 dBc Bandwidth, Band 5 Middle Channel, 10MHz BW, RB=50**

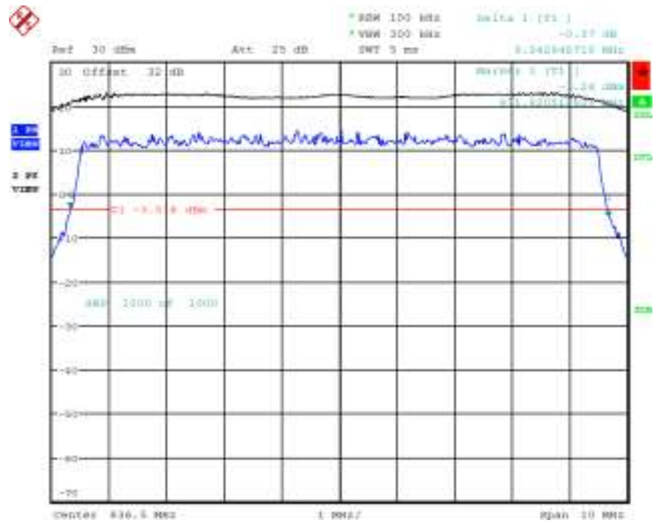


**Figure 4-30a: -26 dBc Bandwidth, Band 5 High Channel, 10MHz BW, RB=50**

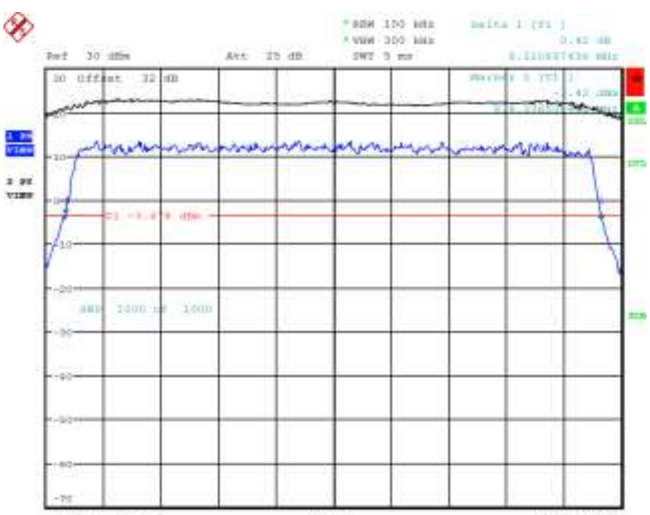
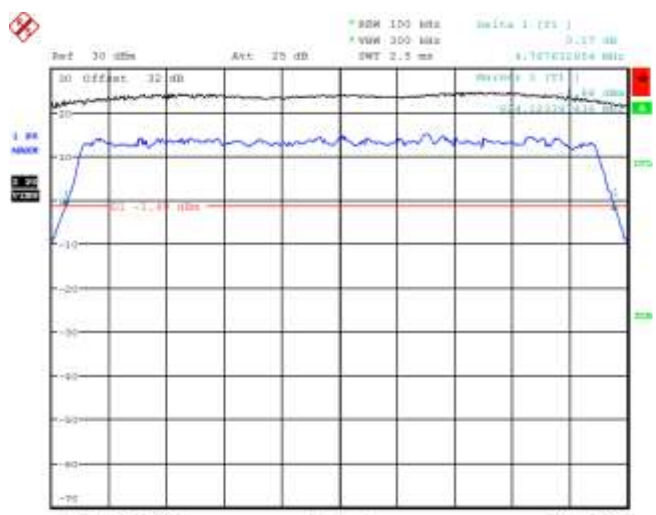


**Figure 4-31a: -26 dBc Bandwidth, Band 5 Low Channel, 5MHz BW, RB=25**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

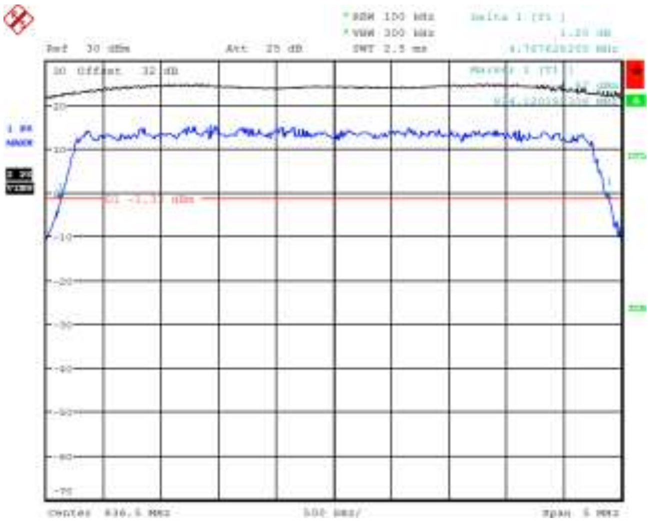


**Figure 4-33a: -26 dBc Bandwidth, Band 5 High Channel, 5MHz BW, RB=25**

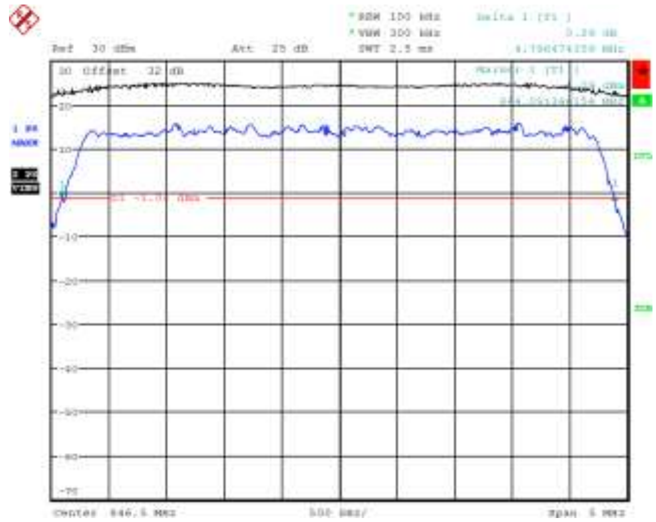


**Figure 4-34a: -26 dBc Bandwidth, Band 5 Low Channel, 1.4MHz BW, RB=6**

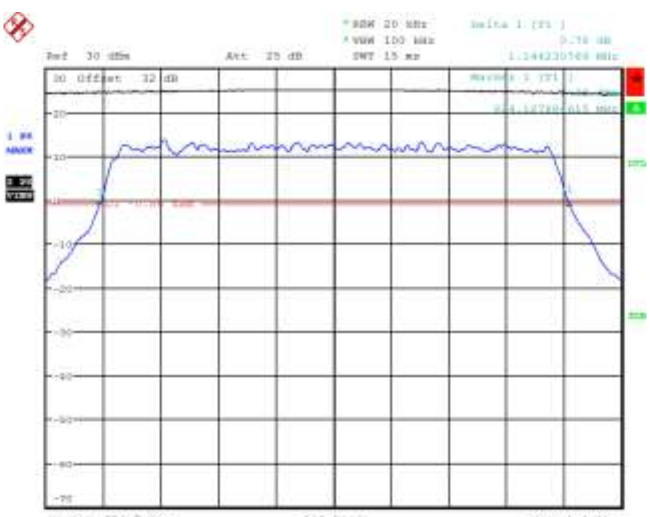
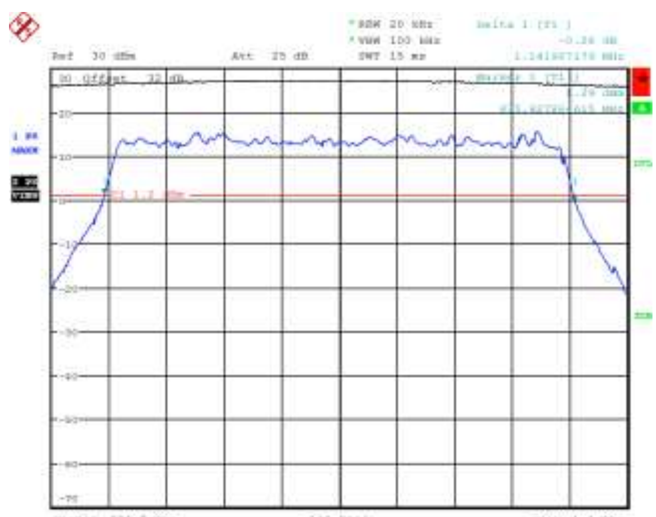


**Figure 4-35a: -26 dBc Bandwidth, Band 5 Middle Channel, 1.4MHz BW, RB=6**



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**

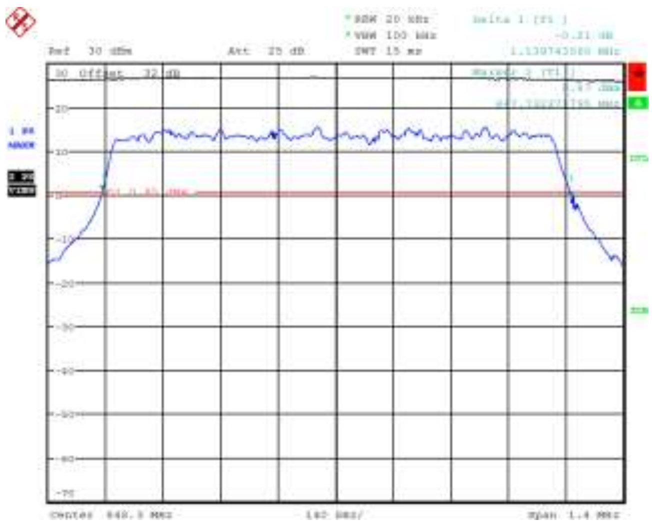


**Figure 4-37a: Band 5 Low Channel Mask, 10MHz BW, RB=50**

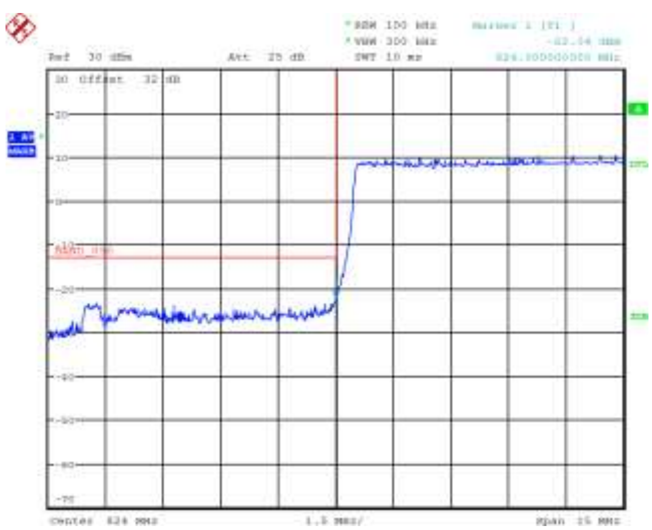
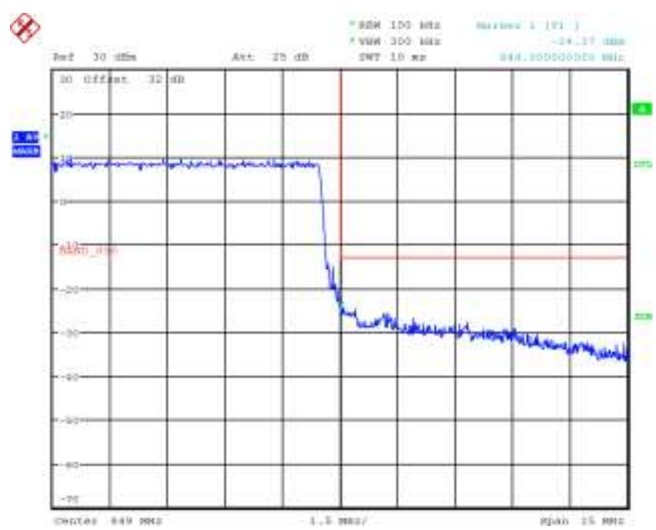


**Figure 4-38a: Band 5 High Channel Mask, 10MHz BW, RB=50**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

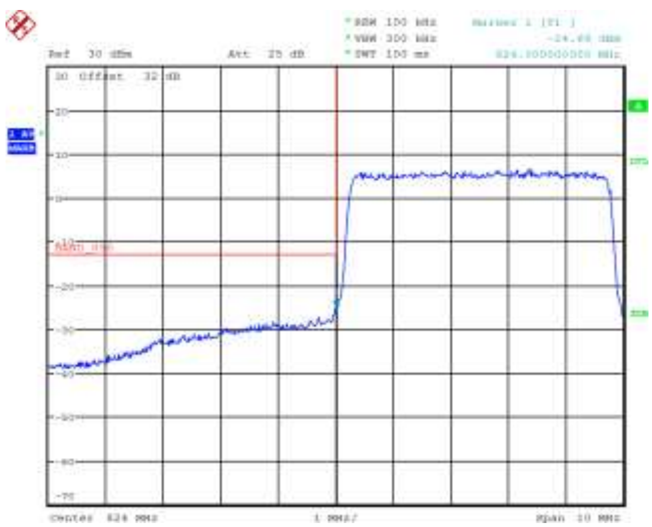


**Figure 4-40a: Band 5 High Channel Mask, 5MHz BW, RB=25**

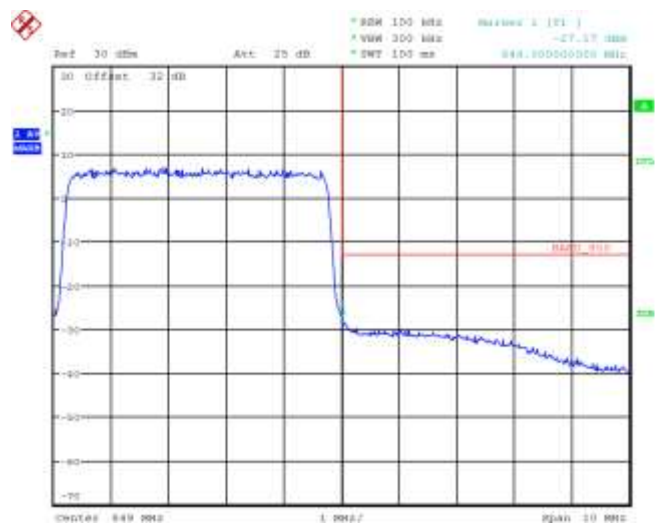


**Figure 4-41a: Band 5 Low Channel Mask, 1.4MHz BW, RB=6**

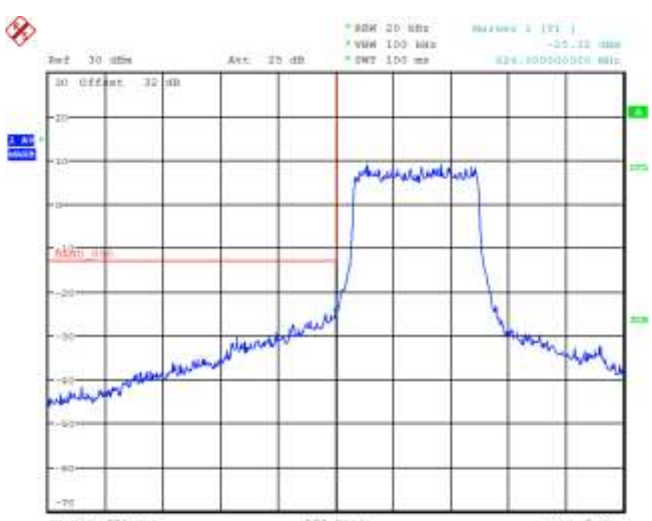
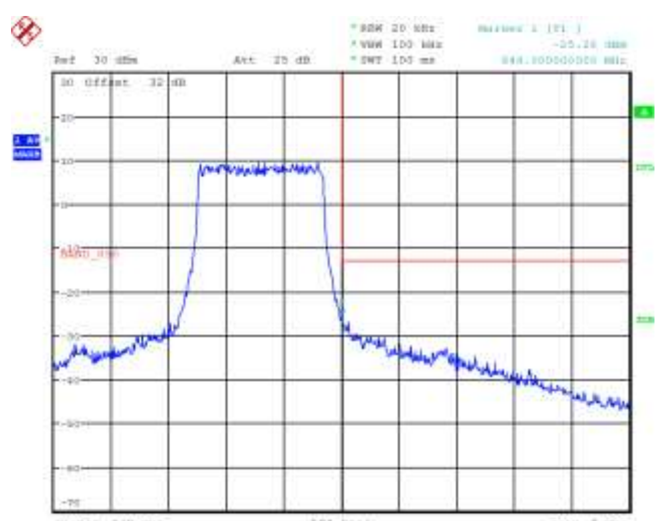


**Figure 4-42a: Band 5 High Channel Mask, 1.4MHz BW, RB=6**



## LTE Band 5 Conducted RF Emission Test Data cont'd

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

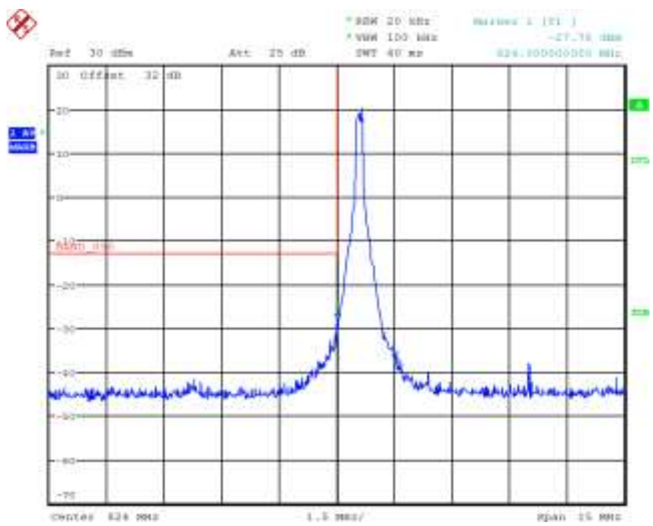
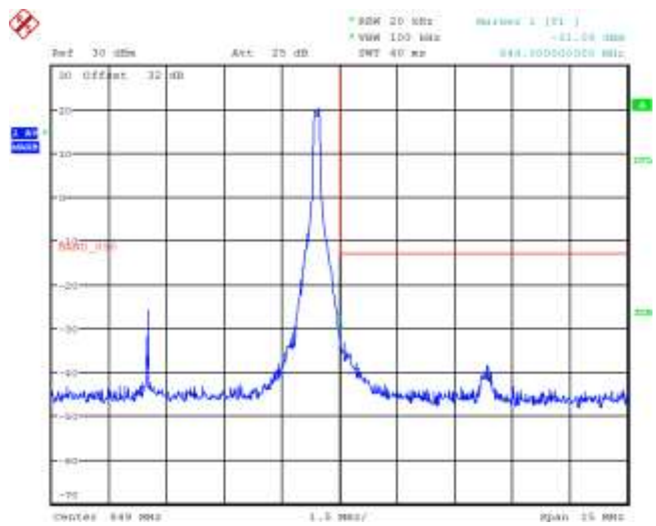


**Figure 4-44a: Band 5 High Channel Mask, 10MHz BW, RB=1**



## 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**

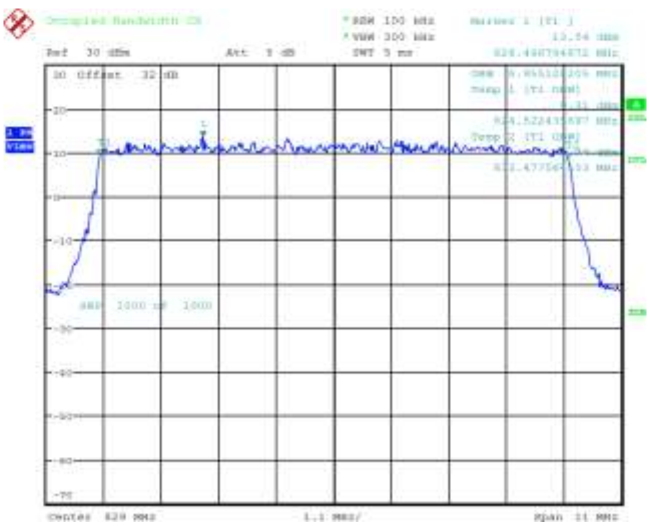


**Figure 3-46a: Occupied Bandwidth, Band 5 Mid Channel, 20MHz BW (RB= 50) 16-QAM**

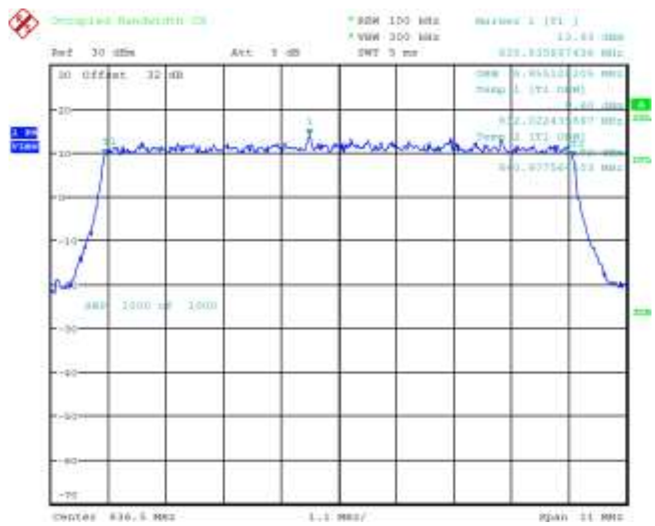
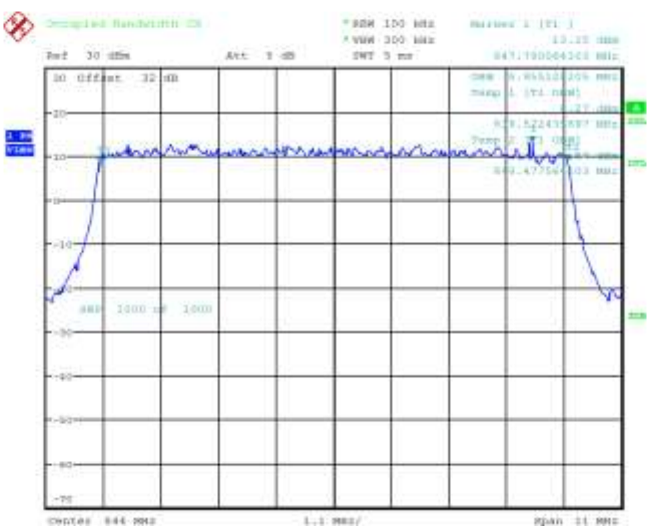
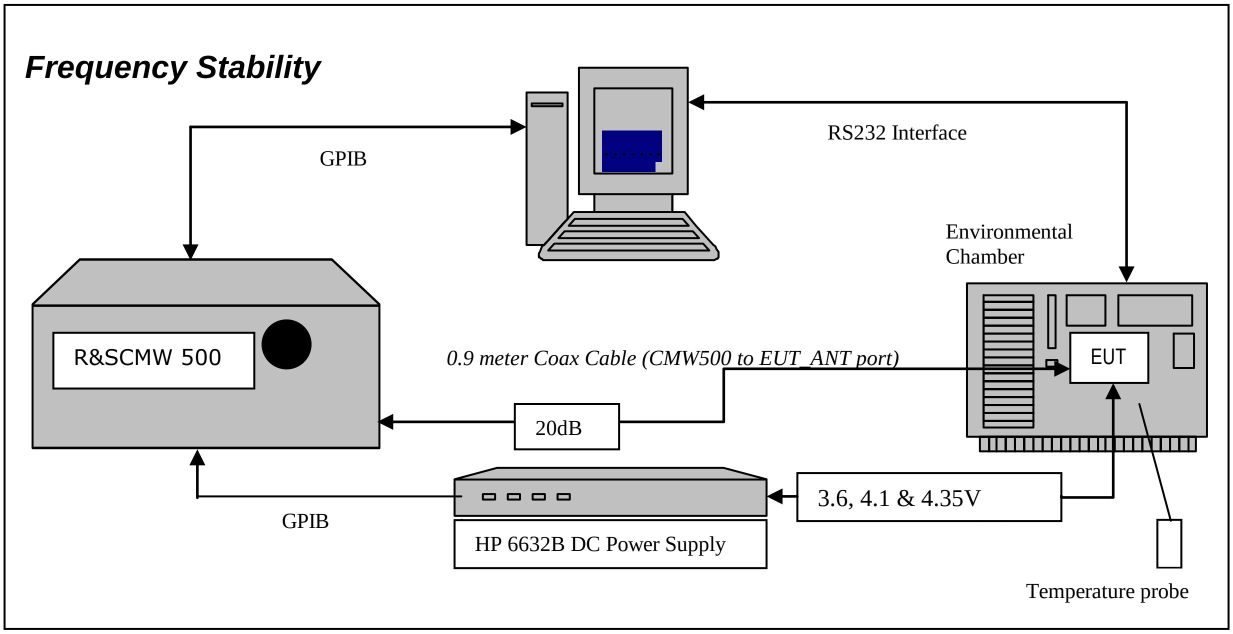


**Figure 3-47a: Occupied Bandwidth, Band 5 High Channel, 10MHz BW (RB= 50) 16-QAM**



APPENDIX 4B – LTE Band 5 FREQUENCY STABILITY TEST DATA

LTE Band 5 Frequency Stability Test Data




The following 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) RBs. 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 | -4.36 | -0.0053 |
| 20525 | 836.5 | 3.6 | 20 | -3.60 | -0.0043 |
| 20600 | 844.0 | 3.6 | 20 | 4.09 | 0.0048 |

| Traffic Channel Number | LTE Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 20450 | 829.0 | 4.1 | 20 | -4.43 | -0.0053 |
| 20525 | 836.5 | 4.1 | 20 | -3.56 | -0.0043 |
| 20600 | 844.0 | 4.1 | 20 | 4.09 | 0.0048 |

| Traffic Channel Number | LTE Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 20450 | 829.0 | 4.35 | 20 | -13.88 | -0.0167 |
| 20525 | 836.5 | 4.35 | 20 | -3.25 | -0.0039 |
| 20600 | 844.0 | 4.35 | 20 | -7.75 | -0.0092 |

## 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 | -5.61 | -0.0068 |
| 20450 | 829.0 | 3.6 | -20 | -3.75 | -0.0045 |
| 20450 | 829.0 | 3.6 | -10 | -3.20 | -0.0039 |
| 20450 | 829.0 | 3.6 | 0 | -4.85 | -0.0059 |
| 20450 | 829.0 | 3.6 | 10 | -5.09 | -0.0061 |
| 20450 | 829.0 | 3.6 | 20 | -4.36 | -0.0053 |
| 20450 | 829.0 | 3.6 | 30 | -4.18 | -0.0050 |
| 20450 | 829.0 | 3.6 | 40 | -4.09 | -0.0049 |
| 20450 | 829.0 | 3.6 | 50 | -3.76 | -0.0045 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20450 | 829.0 | 4.1 | -30 | 5.66 | 0.0068 |
| 20450 | 829.0 | 4.1 | -20 | 4.23 | 0.0051 |
| 20450 | 829.0 | 4.1 | -10 | 4.16 | 0.0050 |
| 20450 | 829.0 | 4.1 | 0 | -4.11 | -0.0050 |
| 20450 | 829.0 | 4.1 | 10 | -4.52 | -0.0055 |
| 20450 | 829.0 | 4.1 | 20 | -4.43 | -0.0053 |
| 20450 | 829.0 | 4.1 | 30 | -4.73 | -0.0057 |
| 20450 | 829.0 | 4.1 | 40 | -4.33 | -0.0052 |
| 20450 | 829.0 | 4.1 | 50 | -5.83 | -0.0070 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20450 | 829.0 | 4.35 | -30 | -4.18 | -0.0050 |
| 20450 | 829.0 | 4.35 | -20 | 8.97 | 0.0108 |
| 20450 | 829.0 | 4.35 | -10 | 3.73 | 0.0045 |
| 20450 | 829.0 | 4.35 | 0 | -18.98 | -0.0229 |
| 20450 | 829.0 | 4.35 | 10 | 3.55 | 0.0043 |
| 20450 | 829.0 | 4.35 | 20 | -13.88 | -0.0167 |
| 20450 | 829.0 | 4.35 | 30 | -4.85 | -0.0059 |
| 20450 | 829.0 | 4.35 | 40 | -19.25 | -0.0232 |
| 20450 | 829.0 | 4.35 | 50 | -3.79 | -0.0046 |

**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 | -3.45 | -0.0041 |
| 20525 | 836.5 | 3.6 | -20 | -3.36 | -0.0040 |
| 20525 | 836.5 | 3.6 | -10 | -4.26 | -0.0051 |
| 20525 | 836.5 | 3.6 | 0 | -3.52 | -0.0042 |
| 20525 | 836.5 | 3.6 | 10 | -4.89 | -0.0058 |
| 20525 | 836.5 | 3.6 | 20 | -3.60 | -0.0043 |
| 20525 | 836.5 | 3.6 | 30 | -6.15 | -0.0074 |
| 20525 | 836.5 | 3.6 | 40 | -4.94 | -0.0059 |
| 20525 | 836.5 | 3.6 | 50 | -6.52 | -0.0078 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20525 | 836.5 | 4.1 | -30 | -2.83 | -0.0034 |
| 20525 | 836.5 | 4.1 | -20 | -6.58 | -0.0079 |
| 20525 | 836.5 | 4.1 | -10 | -3.92 | -0.0047 |
| 20525 | 836.5 | 4.1 | 0 | -3.66 | -0.0044 |
| 20525 | 836.5 | 4.1 | 10 | -3.58 | -0.0043 |
| 20525 | 836.5 | 4.1 | 20 | -3.56 | -0.0043 |
| 20525 | 836.5 | 4.1 | 30 | -5.55 | -0.0066 |
| 20525 | 836.5 | 4.1 | 40 | -5.36 | -0.0064 |
| 20525 | 836.5 | 4.1 | 50 | -4.41 | -0.0053 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20525 | 836.5 | 4.35 | -30 | -3.38 | -0.0040 |
| 20525 | 836.5 | 4.35 | -20 | -4.05 | -0.0048 |
| 20525 | 836.5 | 4.35 | -10 | -3.45 | -0.0041 |
| 20525 | 836.5 | 4.35 | 0 | -4.32 | -0.0052 |
| 20525 | 836.5 | 4.35 | 10 | 17.75 | 0.0212 |
| 20525 | 836.5 | 4.35 | 20 | -3.25 | -0.0039 |
| 20525 | 836.5 | 4.35 | 30 | -5.35 | -0.0064 |
| 20525 | 836.5 | 4.35 | 40 | -4.32 | -0.0052 |
| 20525 | 836.5 | 4.35 | 50 | -5.46 | -0.0065 |

## 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 | -3.71 | -0.0044 |
| 20600 | 844.0 | 3.6 | -20 | 3.45 | 0.0041 |
| 20600 | 844.0 | 3.6 | -10 | -7.34 | -0.0087 |
| 20600 | 844.0 | 3.6 | 0 | 4.35 | 0.0052 |
| 20600 | 844.0 | 3.6 | 10 | -4.29 | -0.0051 |
| 20600 | 844.0 | 3.6 | 20 | 4.09 | 0.0048 |
| 20600 | 844.0 | 3.6 | 30 | -4.56 | -0.0054 |
| 20600 | 844.0 | 3.6 | 40 | -4.84 | -0.0057 |
| 20600 | 844.0 | 3.6 | 50 | 2.95 | 0.0035 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20600 | 844.0 | 4.1 | -30 | 3.62 | 0.0043 |
| 20600 | 844.0 | 4.1 | -20 | 2.95 | 0.0035 |
| 20600 | 844.0 | 4.1 | -10 | 3.46 | 0.0041 |
| 20600 | 844.0 | 4.1 | 0 | 4.19 | 0.0050 |
| 20600 | 844.0 | 4.1 | 10 | 4.66 | 0.0055 |
| 20600 | 844.0 | 4.1 | 20 | 4.09 | 0.0048 |
| 20600 | 844.0 | 4.1 | 30 | -5.11 | -0.0061 |
| 20600 | 844.0 | 4.1 | 40 | -4.23 | -0.0050 |
| 20600 | 844.0 | 4.1 | 50 | -4.95 | -0.0059 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20600 | 844.0 | 4.35 | -30 | 5.05 | 0.0060 |
| 20600 | 844.0 | 4.35 | -20 | 3.29 | 0.0039 |
| 20600 | 844.0 | 4.35 | -10 | -3.28 | -0.0039 |
| 20600 | 844.0 | 4.35 | 0 | -3.53 | -0.0042 |
| 20600 | 844.0 | 4.35 | 10 | -3.99 | -0.0047 |
| 20600 | 844.0 | 4.35 | 20 | -7.75 | -0.0092 |
| 20600 | 844.0 | 4.35 | 30 | -4.22 | -0.0050 |
| 20600 | 844.0 | 4.35 | 40 | -3.92 | -0.0046 |
| 20600 | 844.0 | 4.35 | 50 | -3.79 | -0.0045 |

# APPENDIX 4C – LTE Band 5 RADIATED EMISSIONS TEST DATA

## Radiated Power Test Data Results

The following measurements were performed by Rex Zhang.
Date of Test: July 17, 2014
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, 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 Dipole) (dBm) | Corrected Reading (relative to Dipole) (W) | Limit (dBm) | Diff to Limit (dB) |
| F0 | 20425 | 826.50 | 5 | Dipole | V | -38.77 | -31.33 | V-V | 4.40 | 21.82 | 0.15 | 38.50 | 16.68 |
| F0 | 20425 | 826.50 | 5 | Dipole | H | -31.33 | | H-H | 3.53 | | | | |
| F0 | 20525 | 836.50 | 5 | Dipole | V | -38.62 | -30.72 | V-V | 5.09 | **22.24** | 0.17 | 38.50 | 16.26 |
| F0 | 20525 | 836.50 | 5 | Dipole | H | -30.72 | | H-H | 4.07 | | | | |
| F0 | 20624 | 846.40 | 5 | Dipole | V | -38.97 | -30.51 | V-V | 4.96 | 22.16 | 0.16 | 38.50 | 16.34 |
| F0 | 20624 | 846.40 | 5 | Dipole | H | -30.51 | | H-H | 3.86 | | | | |

**LTE band 5, 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 Dipole) (dBm) | Corrected Reading (relative to Dipole) (W) | Limit (dBm) | Diff to Limit (dB) |
| F0 | 20425 | 826.50 | 5 | Dipole | V | -40.04 | -32.54 | V-V | 3.14 | 20.56 | 0.11 | 38.50 | 17.94 |
| F0 | 20425 | 826.50 | 5 | Dipole | H | -32.54 | | H-H | 2.29 | | | | |
| F0 | 20525 | 836.50 | 5 | Dipole | V | -39.51 | -31.76 | V-V | 4.04 | **21.19** | 0.13 | 38.50 | 17.31 |
| F0 | 20525 | 836.50 | 5 | Dipole | H | -31.76 | | H-H | 3.09 | | | | |
| F0 | 20624 | 846.40 | 5 | Dipole | V | -40.01 | -31.67 | V-V | 3.81 | 21.01 | 0.13 | 38.50 | 17.49 |
| F0 | 20624 | 846.40 | 5 | Dipole | H | -31.67 | | H-H | 2.71 | | | | |

## Radiated Emissions Test Data Results cont'd

The following measurements were performed by Savtej.

Date of Test: July 2, 2014

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

The BlackBerry® smartphone was standalone USB facing down and LCD 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 5MHz BW (channel 20415, 20525 and 20634 with RB = 6).

All emissions were at least 25 dB below the limit.

The following measurements were performed by Masud Attayi

Date of Test: July 3 to 11, 2014

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 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 5MHz BW (channel 20415, 20525 and 20634 with RB = 6).

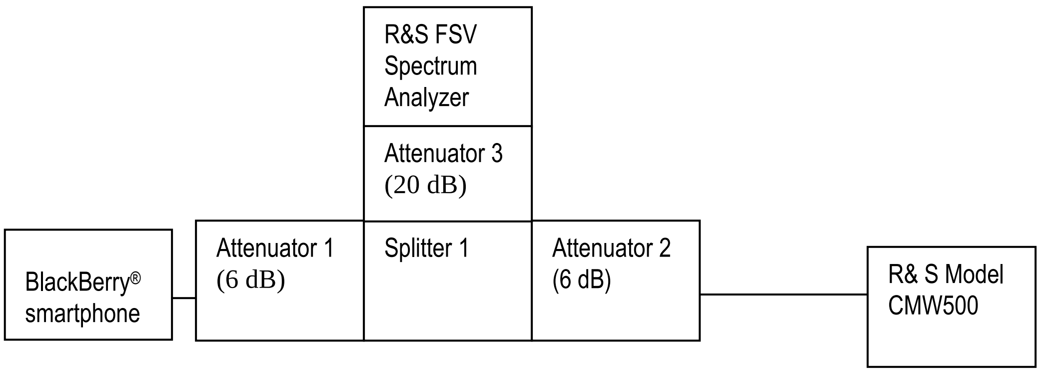
All emissions were at least 25 dB below the limit.

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

# LTE Band 4 Conducted RF Emission Test Data

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: June 26 - 27, 2014

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 RBs 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 RB 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 18.97 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<br>Frequency (MHz) | 26dBc Occupied Bandwidth<br>(MHz) | 99% Occupied Bandwidth<br>(MHz) | |
|---|---|---|---|
| | QPSK | QPSK | 16-QAM |
| 1720.0 | 18.71 | 17.87 | 17.87 |
| 1732.5 | 18.97 | **17.90** | 17.87 |
| 1745.0 | 18.71 | **17.90** | **17.94** |

**Peak to Average Ratio (PAR)**

For each 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz with different number of RBs 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 Peak to Average Ratio was 10.90 dB on middle channel in 10MHz bandwidth with 50 RBs.

***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)**

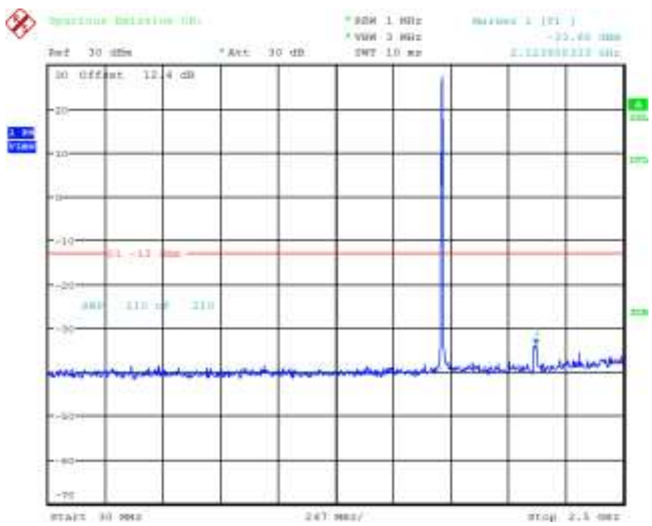


**Figure 5-2a: Band 4, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)**

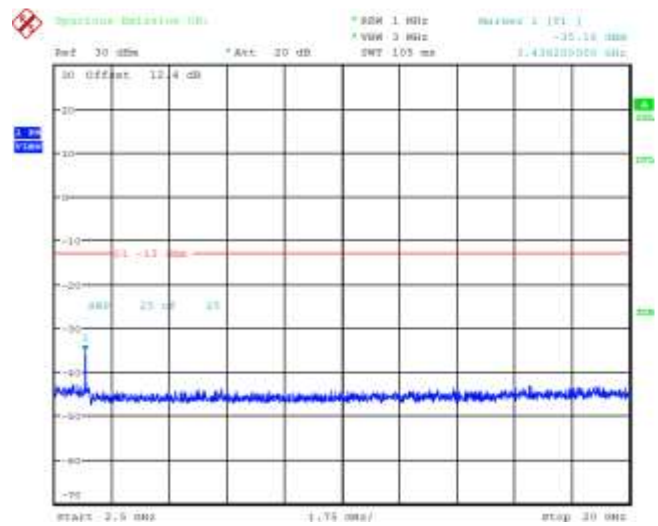


**Figure 5-3a: Band 4, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)**

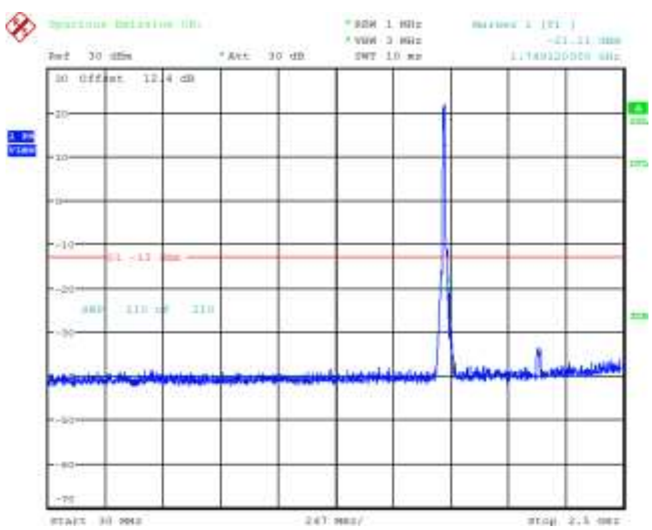
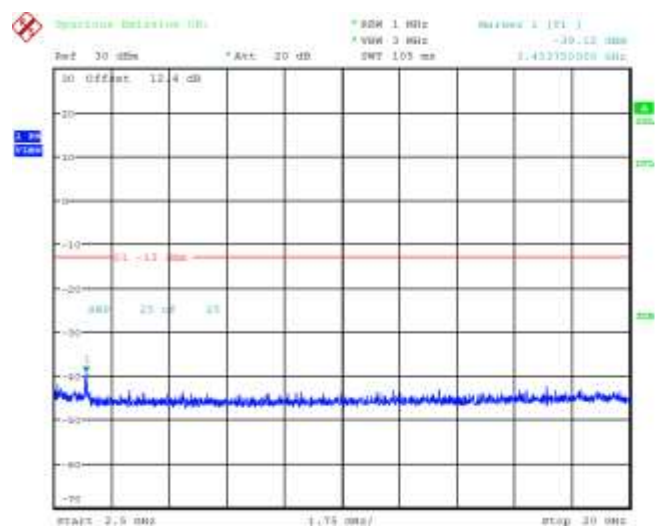


**Figure 5-4a: Band 4, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

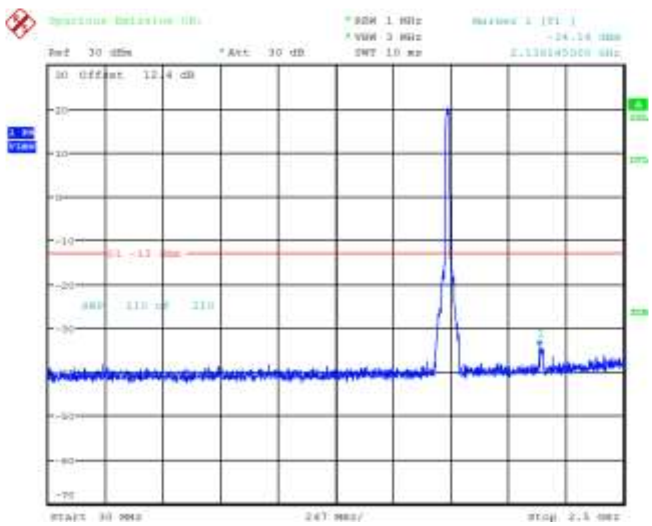


**Figure 5-6a: Band 4, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)**

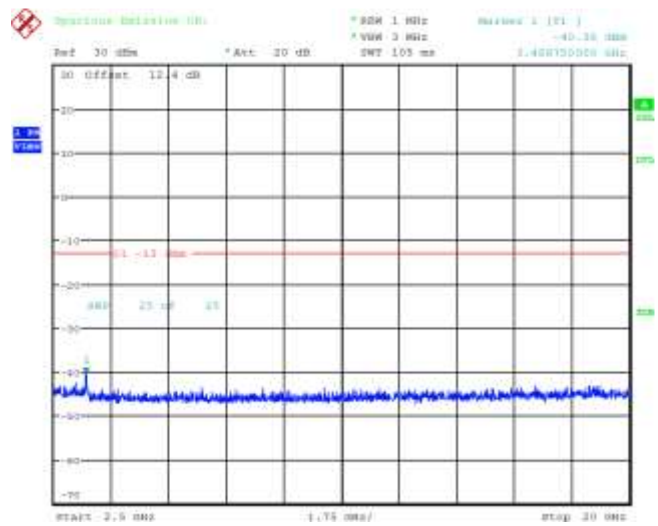


**Figure 5-7a: Band 4, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)**

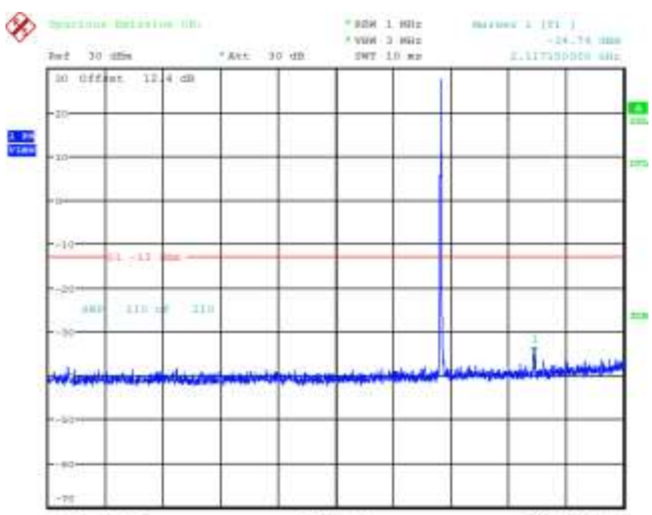
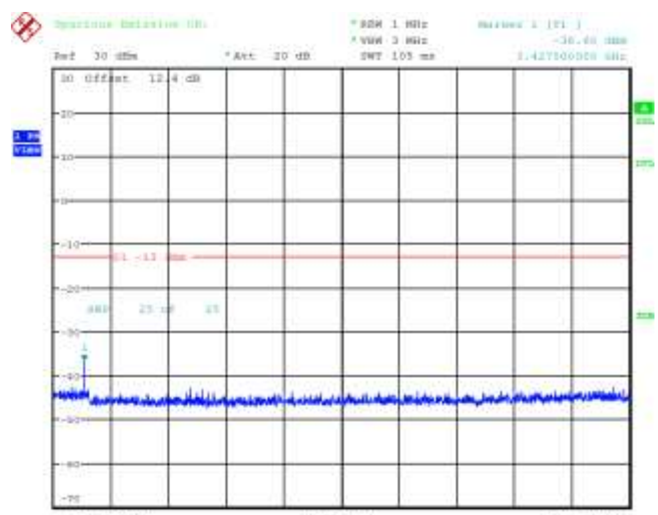


**Figure 5-8a: Band 4, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

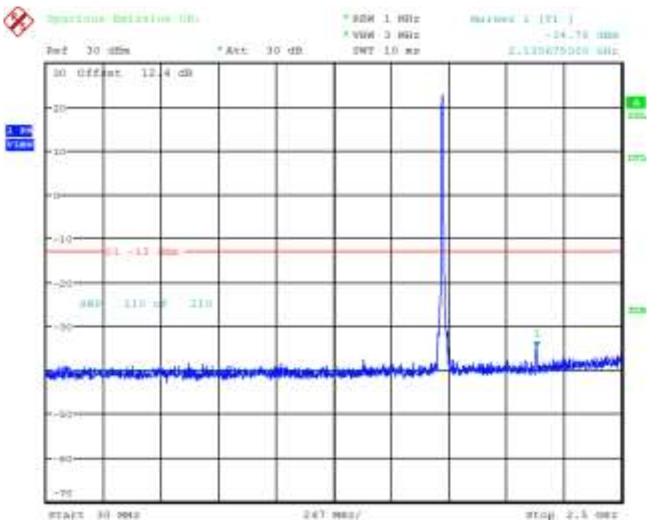


**Figure 5-10a: Band 4, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 25)**

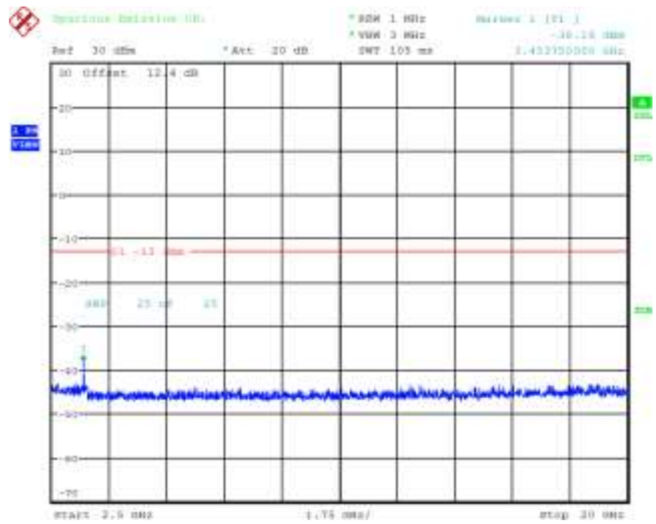


**Figure 5-11a: Band 4, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)**

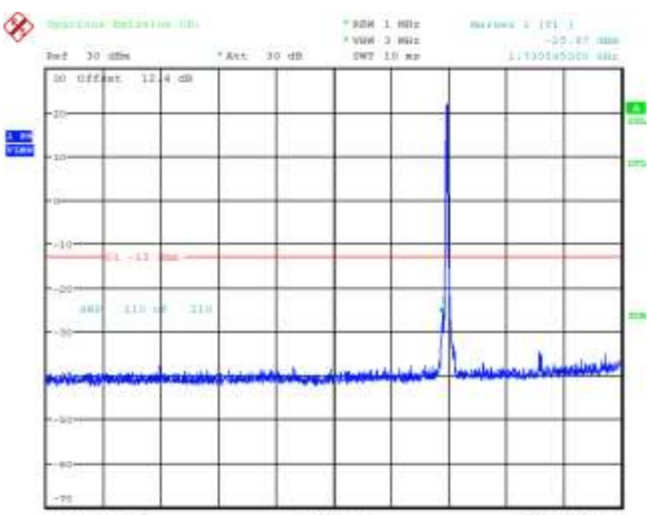
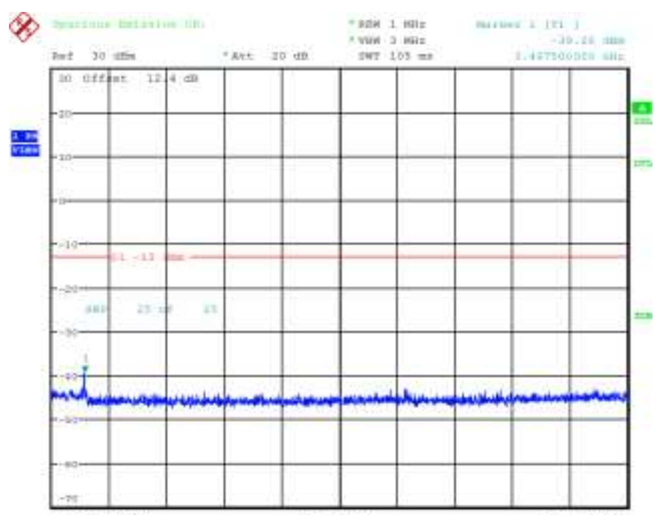


**Figure 5-12a: Band 4, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)**



## 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)**

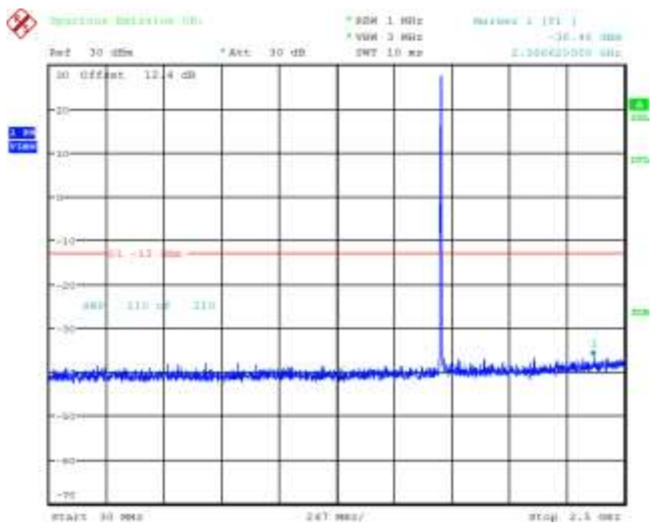


**Figure 5-14a: Band 4, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)**

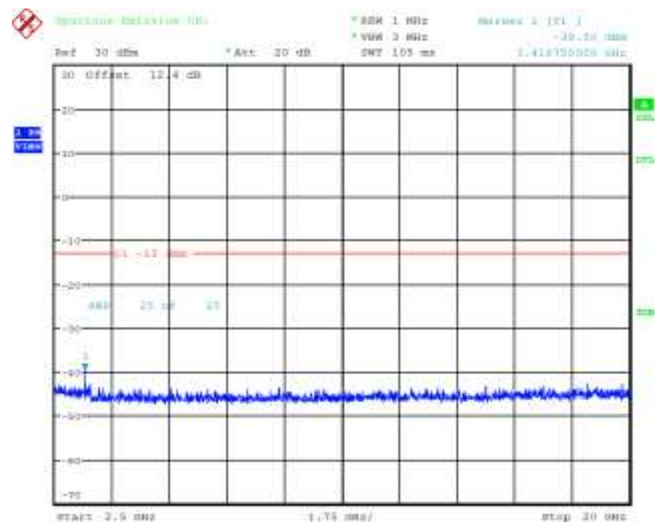


**Figure 5-15a: Band 4, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)**

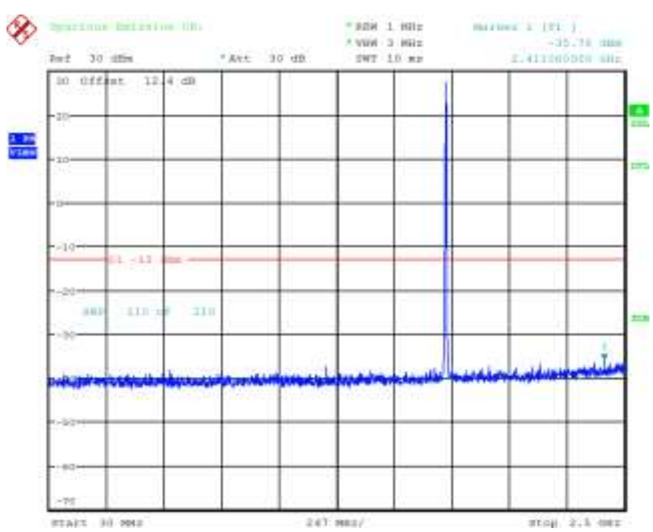
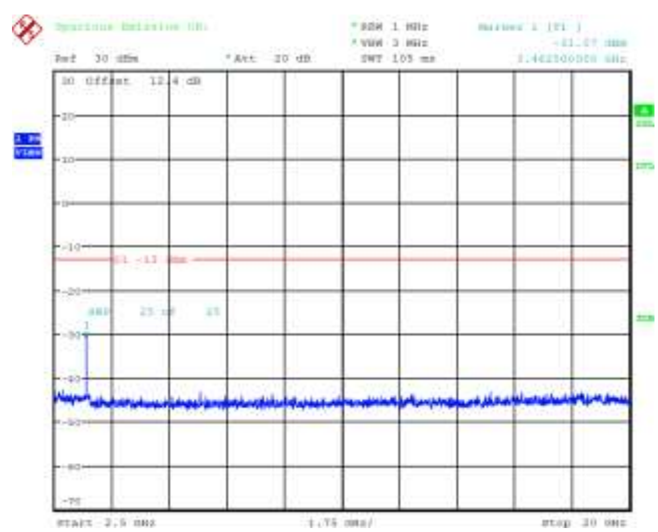


**Figure 5-16a: Band 4, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)**



## 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)**

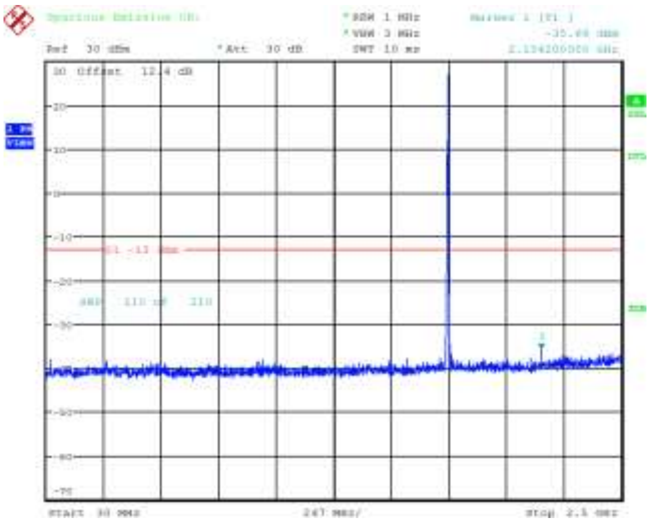
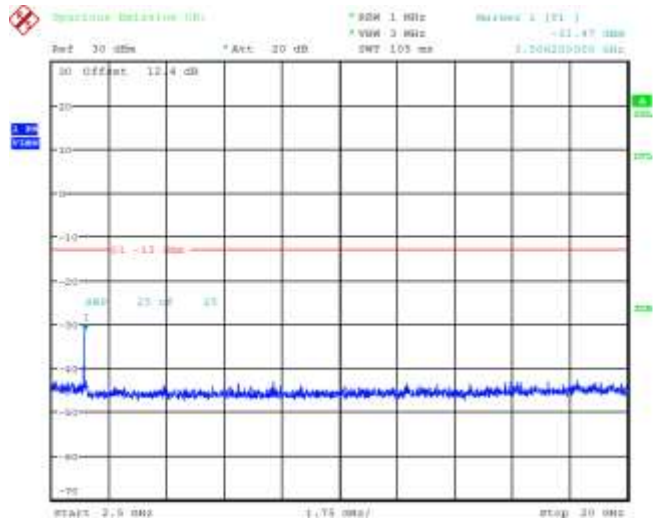


**Figure 5-18a: Band 4, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

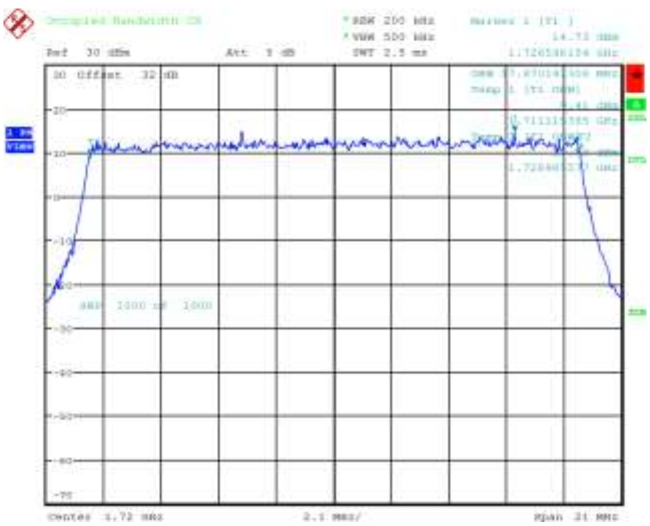



**Figure 5-20a: Occupied Bandwidth, Band 4 Middle Channel, 20MHz BW, RB=100**

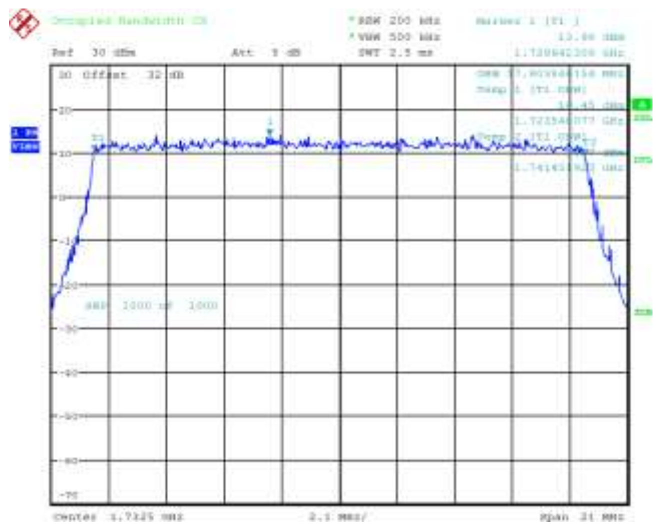
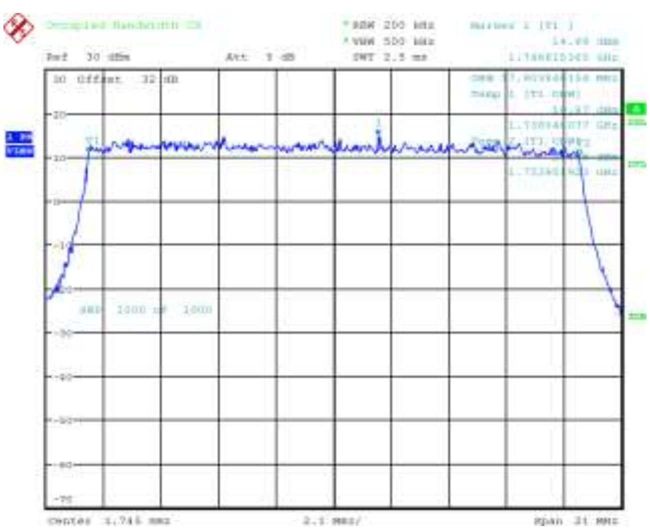



**Figure 5-21a: Occupied Bandwidth, Band 4 High Channel, 20MHz BW, RB=100**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

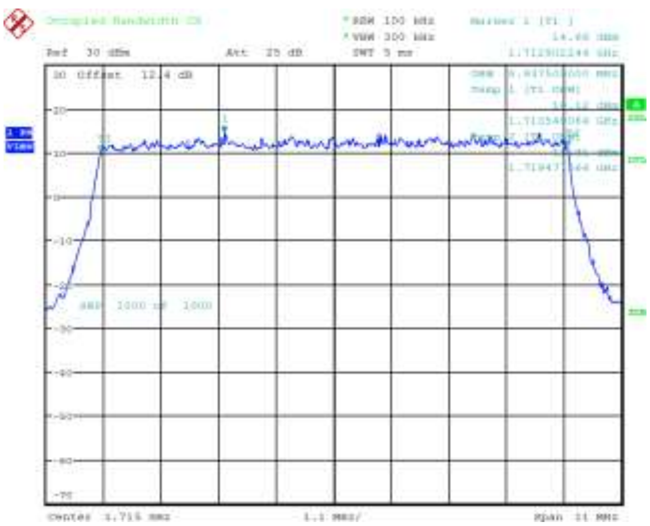


**Figure 5-23a: Occupied Bandwidth, Band Middle Channel, 10MHz BW, RB=50**

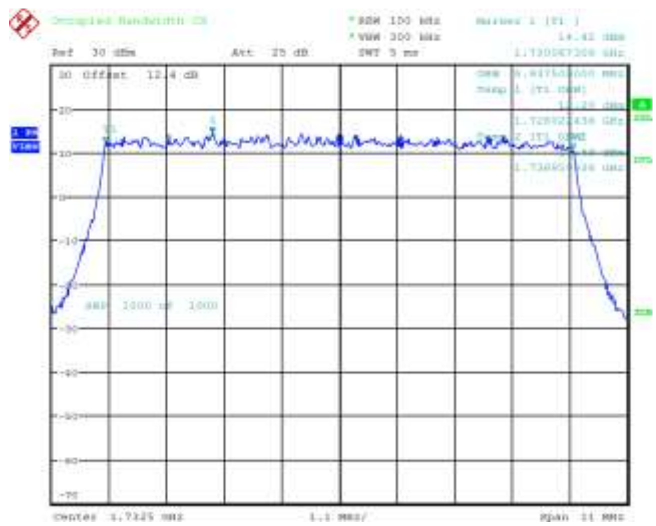
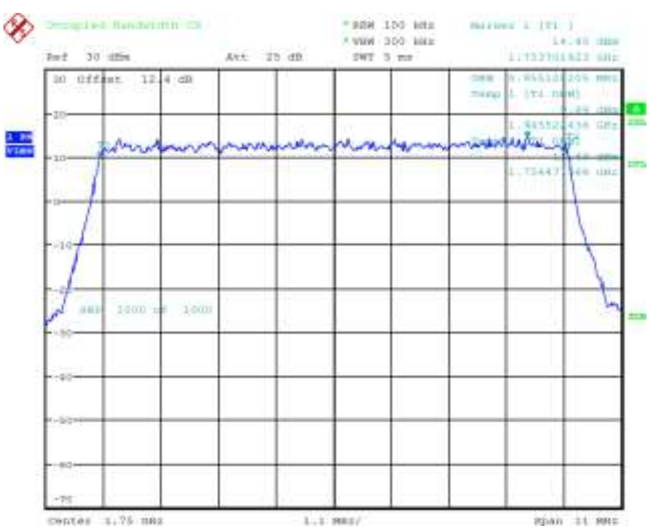


**Figure 5-24a: Occupied Bandwidth, Band 4 High Channel, 10MHz BW, RB=50**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

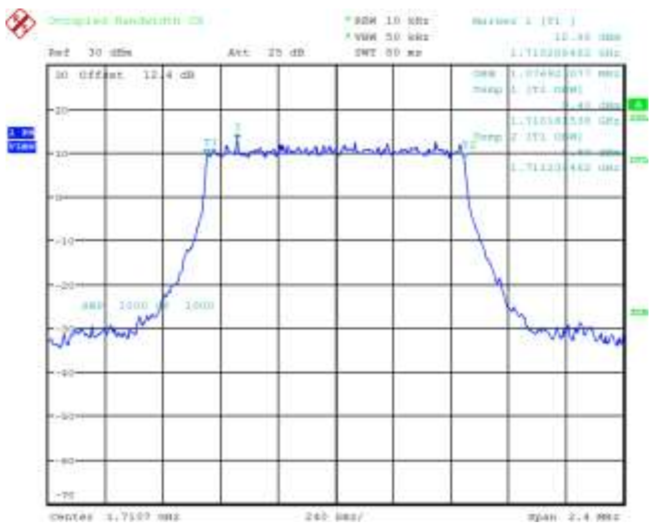


**Figure 5-26a: Occupied Bandwidth, Band 4 Middle Channel, 1.4MHz BW, RB=6**

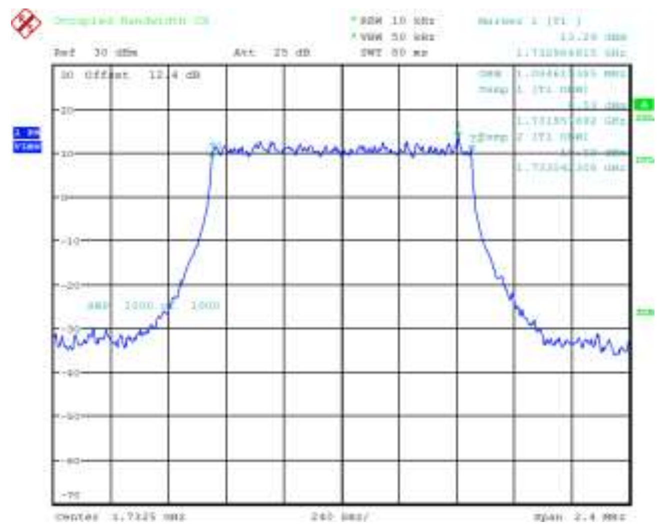
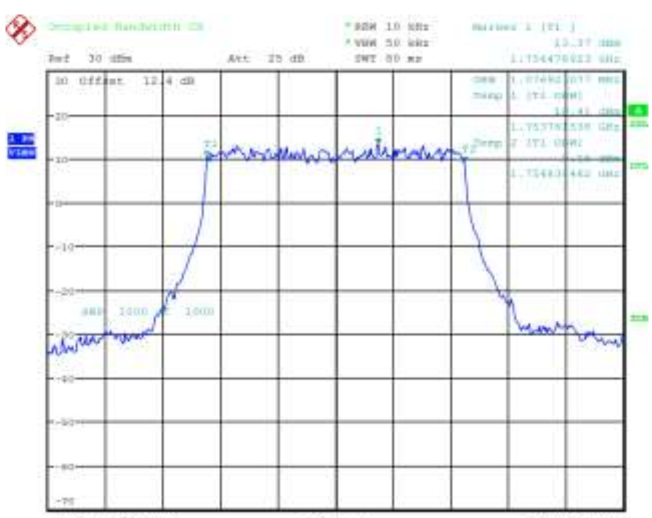


**Figure 5-27a: Occupied Bandwidth, Band 4 High Channel, 1.4MHz BW, RB=6**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

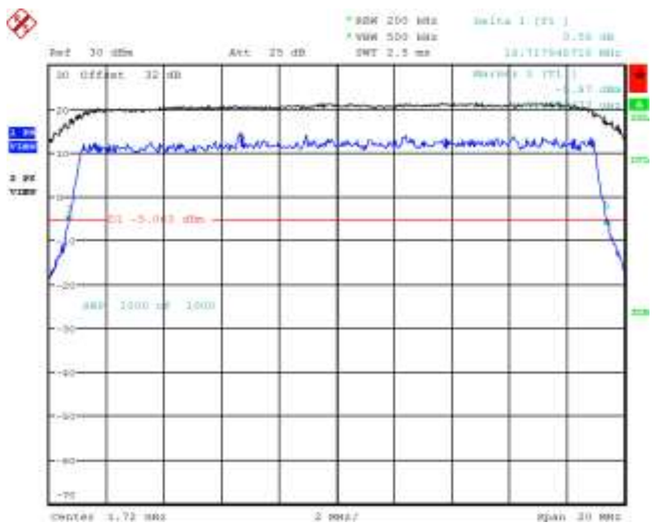


**Figure 5-29a: -26 dBc Bandwidth, Band 4 Middle Channel, 20MHz BW, RB=100**

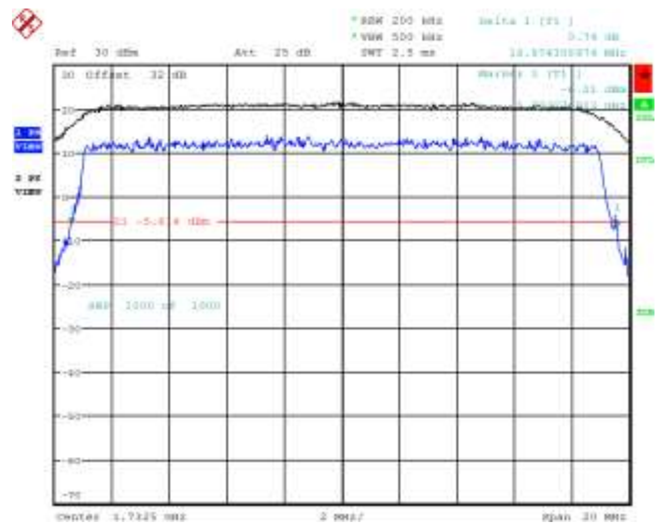


**Figure 5-30a: -26 dBc Bandwidth, Band 4 High Channel, 20MHz BW, RB=100**

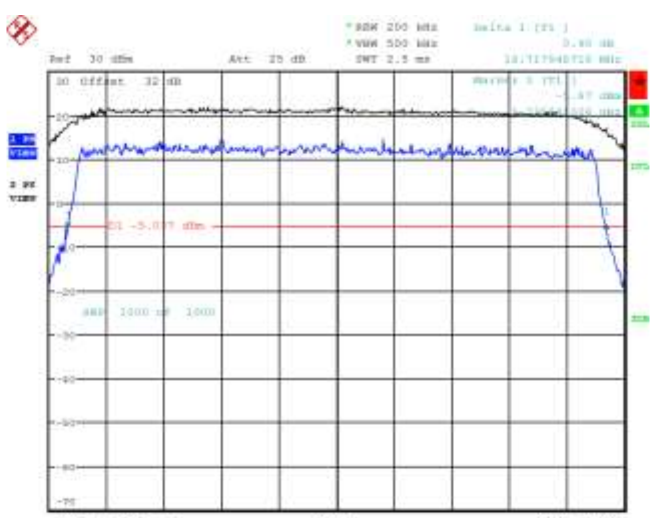
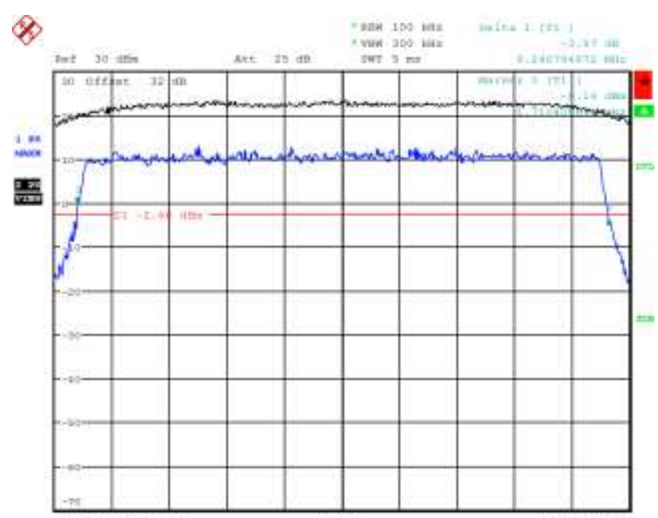


**Figure 5-31a: -26 dBc Bandwidth, Band 4 Low Channel, 10MHz BW, RB=50**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

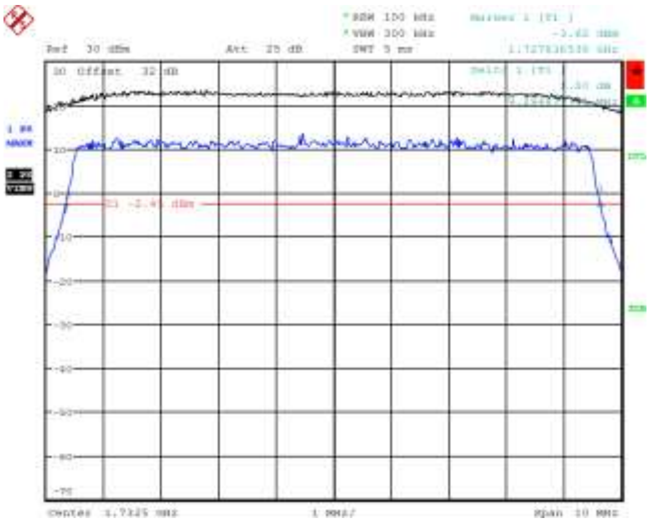


**Figure 5-33a: -26 dBc Bandwidth, Band 4 High Channel, 10MHz BW, RB=50**

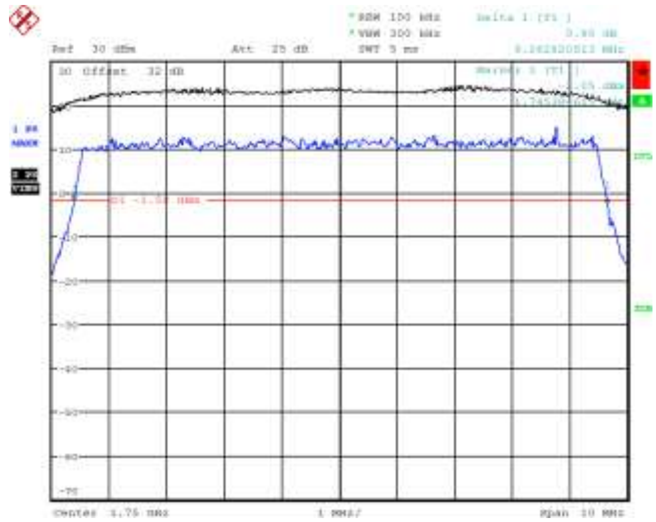


**Figure 5-34a: -26 dBc Bandwidth, Band 4 Low Channel, 1.4MHz BW, RB=6**

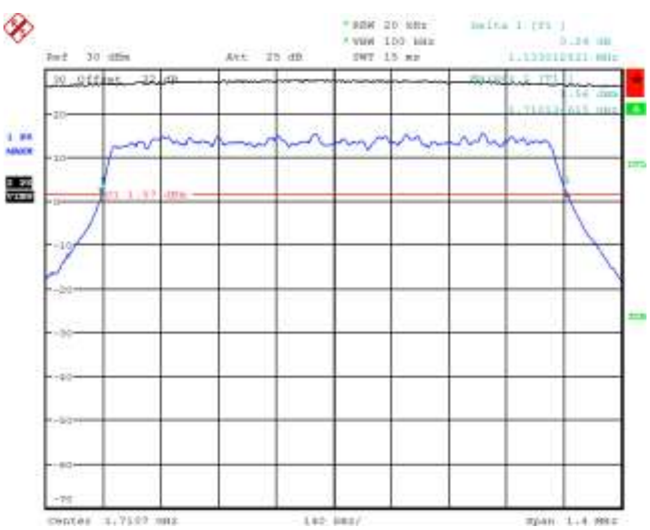
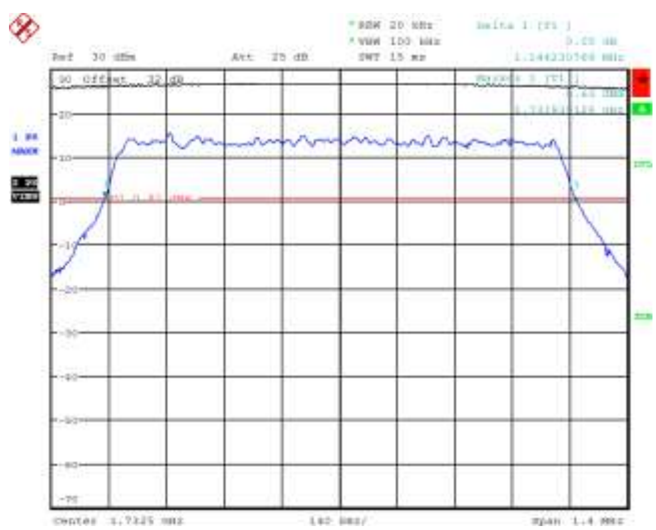


**Figure 5-35a: -26 dBc Bandwidth, Band 4 Middle Channel, 1.4MHz BW, RB=6**



## 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**

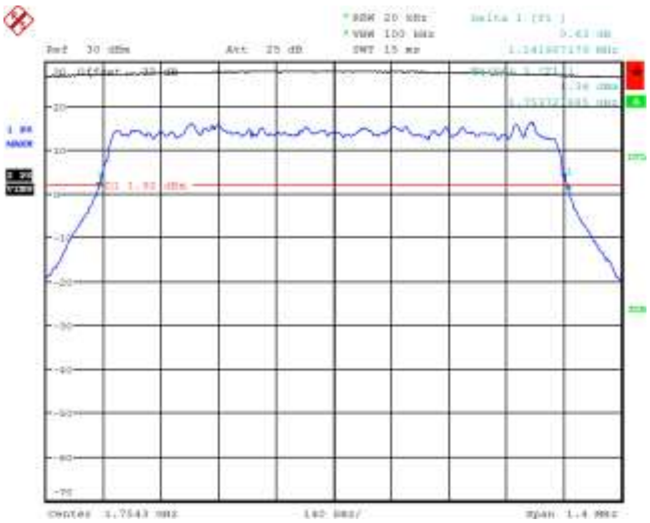


**Figure 5-37a: Band 4 Low Channel Mask, 20MHz BW, RB=100**

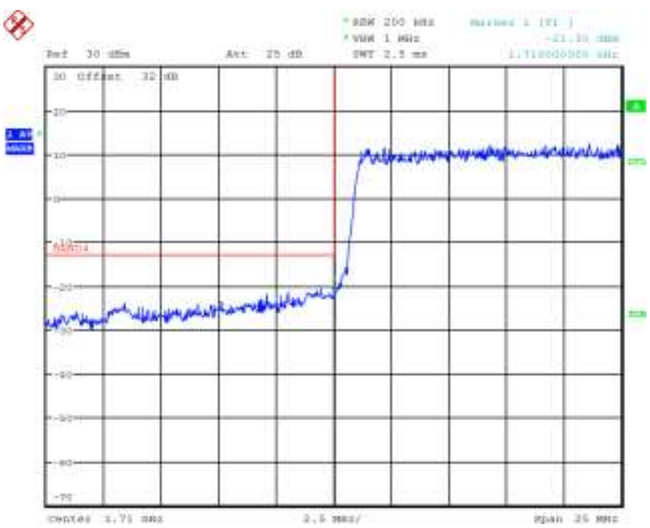
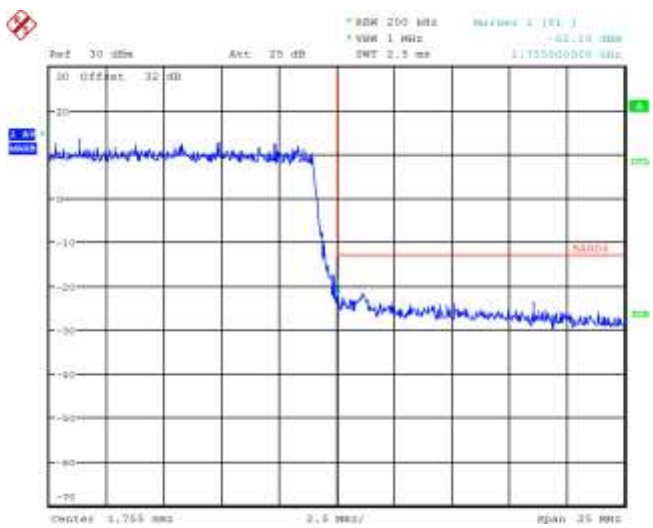


**Figure 5-38a: Band 4 High Channel Mask, 20MHz BW, RB=100**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

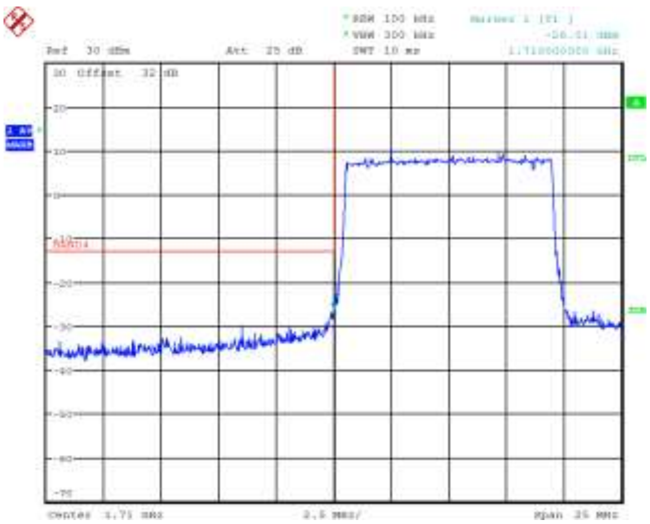


**Figure 5-40a: Band 4 High Channel Mask, 10MHz BW, RB=50**

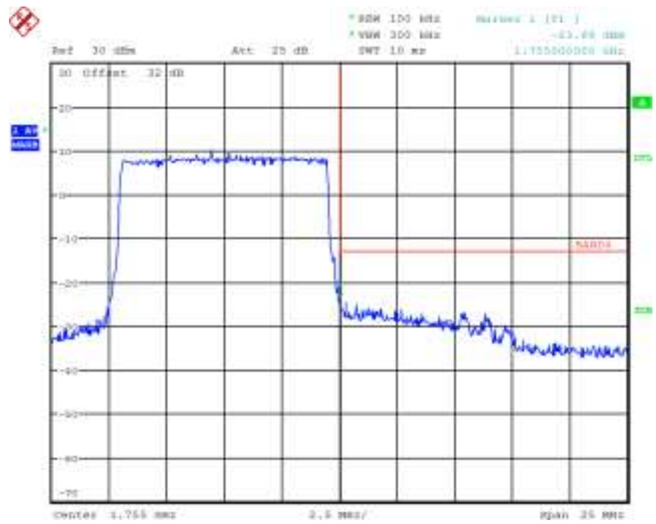


**Figure 5-41a: Band 4 Low Channel Mask, 1.4MHz BW, RB=6**

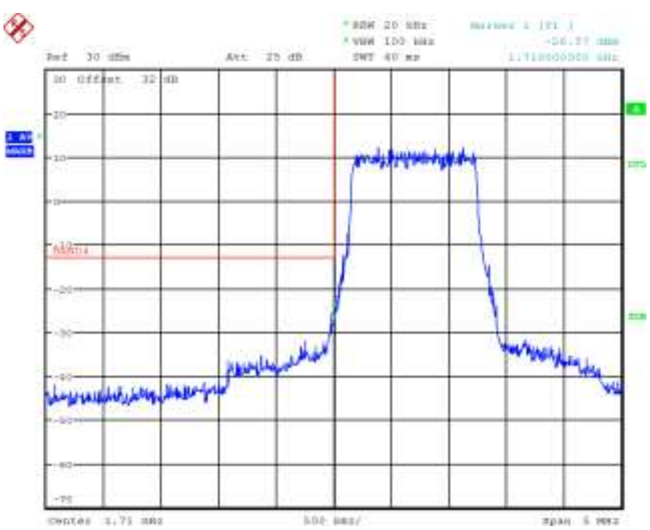
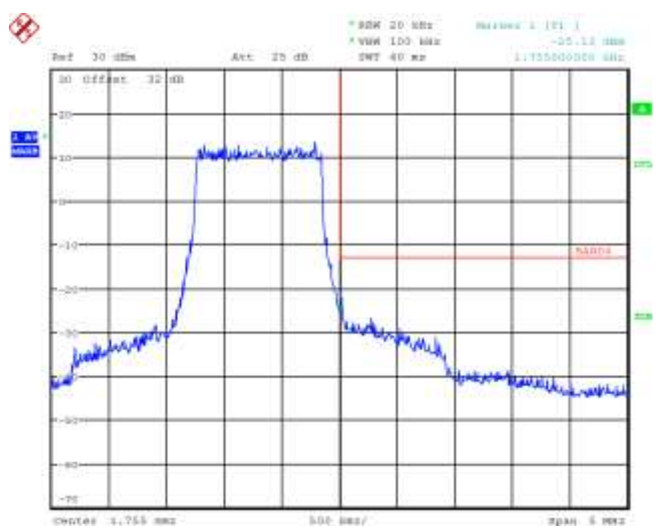


**Figure 5-42a: Band 4 High Channel Mask, 1.4MHz BW, RB=6**



## LTE Band 4 Conducted RF Emission Test Data cont'd

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

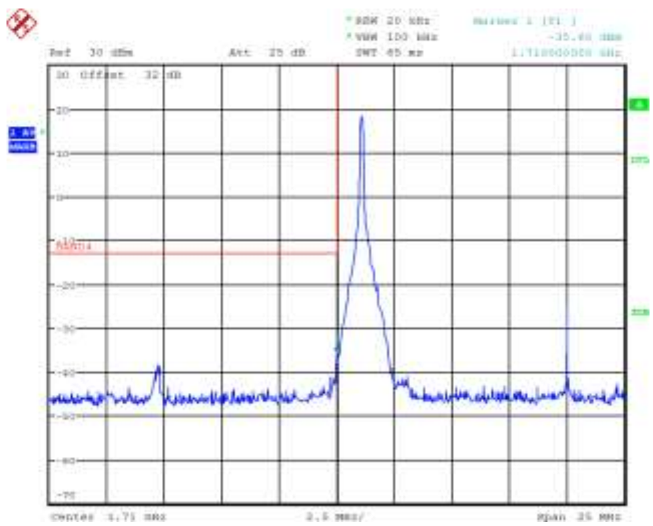


**Figure 5-44a: Band 4 High Channel Mask, 20MHz BW, RB=1**

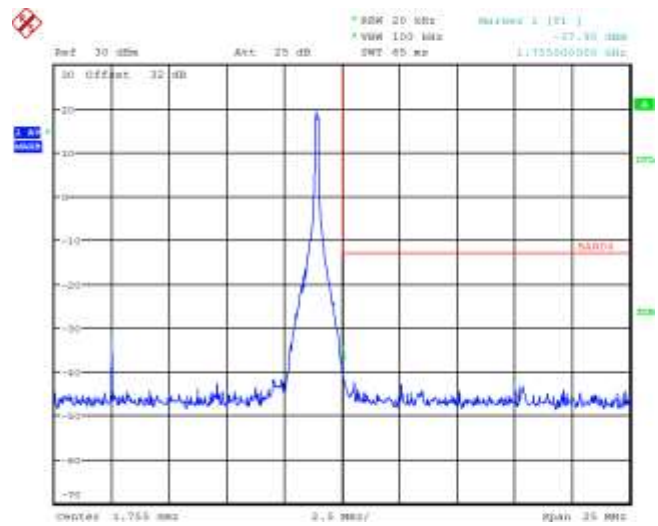
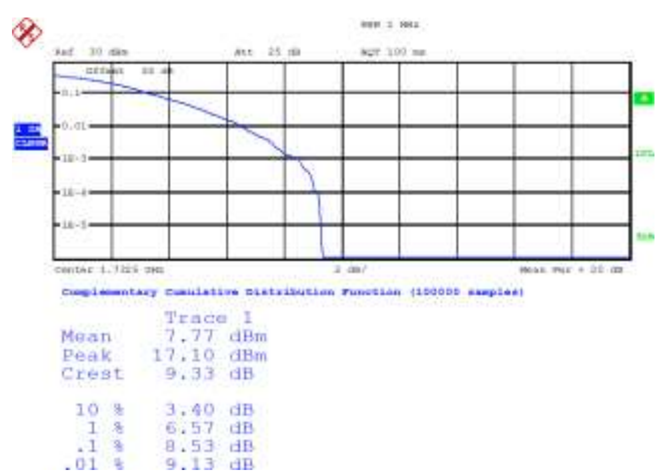


**Figure 5-45a: Band 4 Mid Channel PAR, 20MHz BW, RB=50, QPSK**


**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**

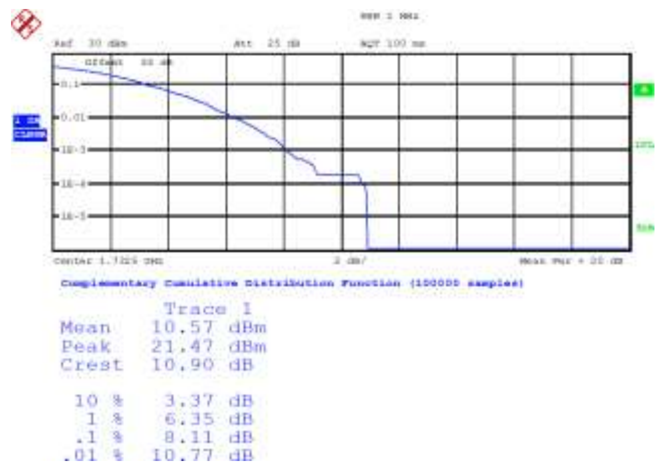



**Figure 5-49a: Band 4 Mid Channel PAR, 1.4MHz BW, RB=3, QPSK**

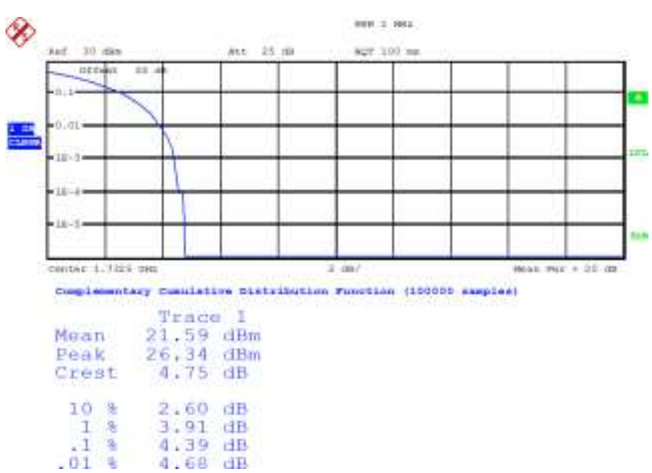
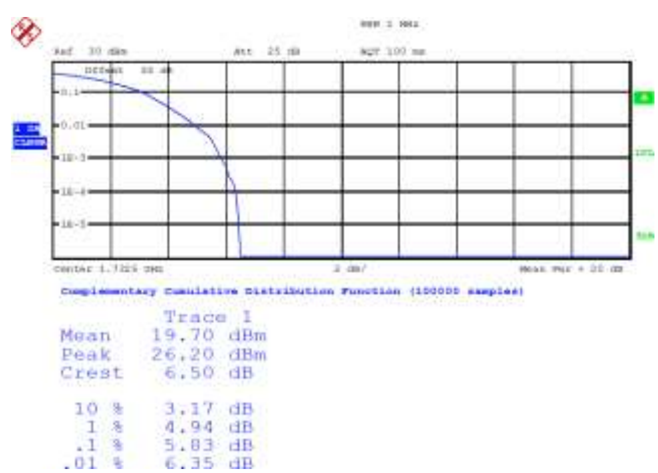



**Figure 5-50a: Band 4 Middle Channel Mask, 5MHz BW, RB=6, 16-QAM**



## 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**

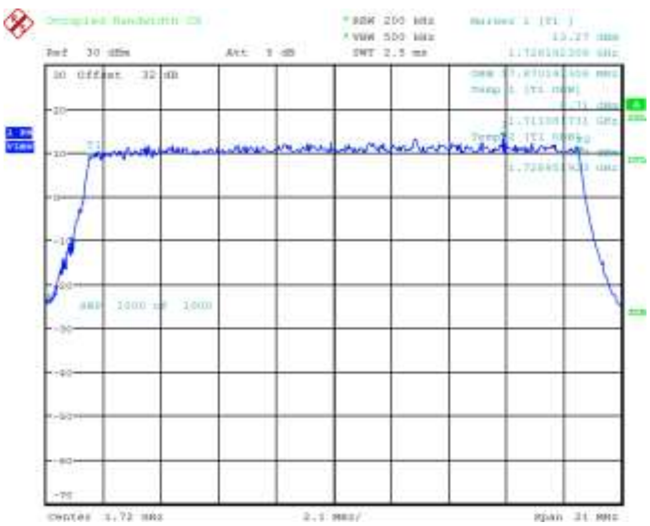


**Figure 5-52a: Occupied Bandwidth, Band 4 Mid Channel, 20MHz BW (RB= 100) 16-QAM**

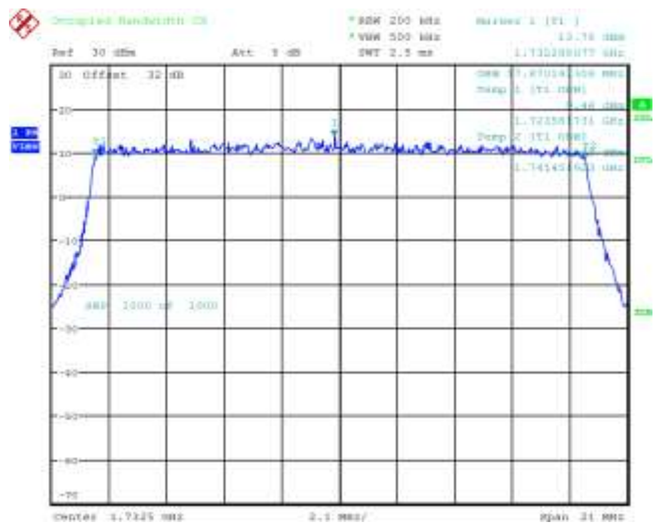
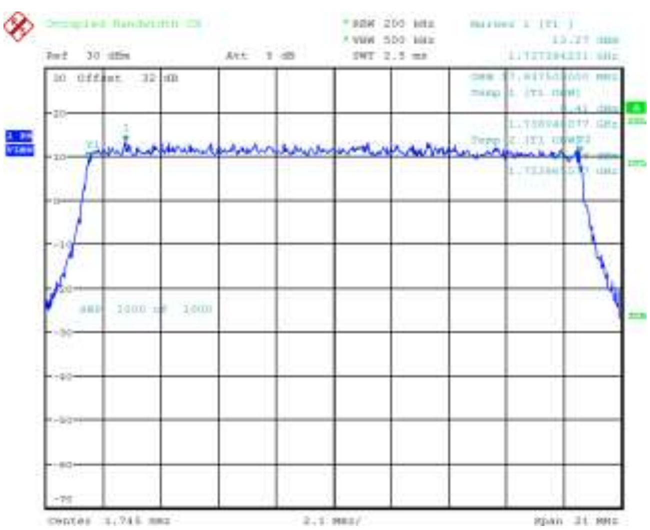
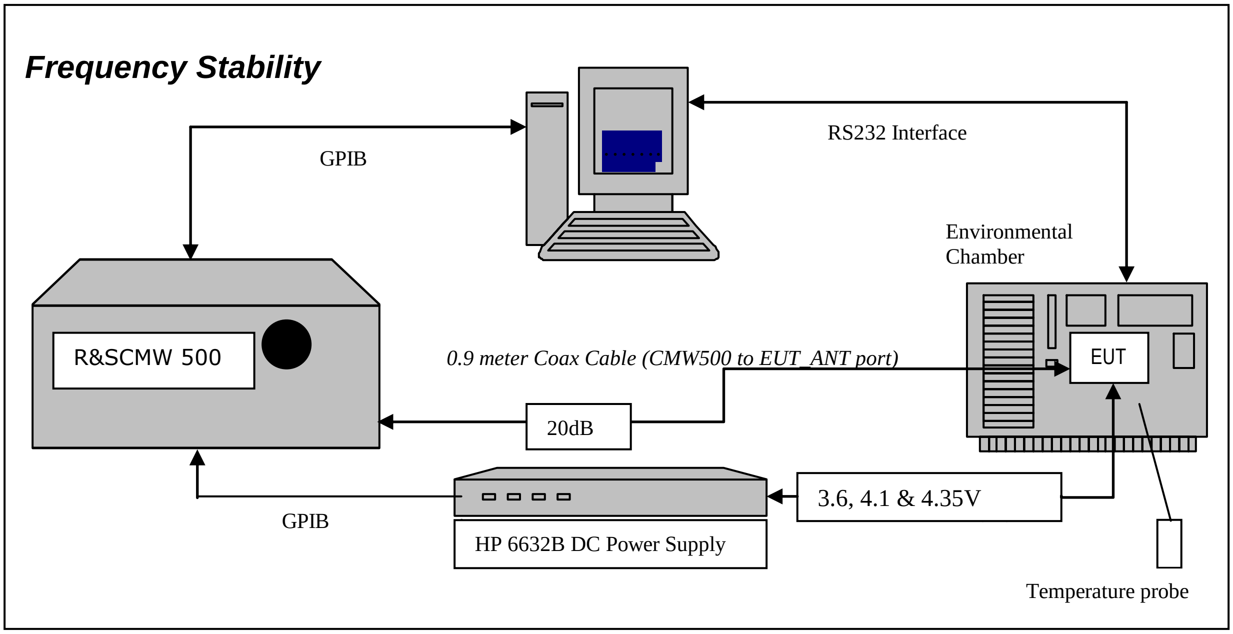


**Figure 5-53a: Occupied Bandwidth, Band 4 High Channel, 20MHz BW (RB= 100) 16-QAM**



APPENDIX 5B – LTE Band 4 FREQUENCY STABILITY TEST DATA

LTE Band 4 Frequency Stability Test Data




The following 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) RBs. 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**.

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 | -6.59 | -0.0038 |
| 20175 | 1732.5 | 3.6 | 20 | 10.17 | 0.0059 |
| 20300 | 1745.0 | 3.6 | 20 | 6.95 | 0.0040 |

| Traffic Channel Number | LTE Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 20050 | 1720.0 | 4.1 | 20 | 4.94 | 0.0029 |
| 20175 | 1732.5 | 4.1 | 20 | 8.74 | 0.0050 |
| 20300 | 1745.0 | 4.1 | 20 | 6.95 | 0.0040 |

| Traffic Channel Number | LTE Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 20050 | 1720.0 | 4.35 | 20 | 6.82 | 0.0040 |
| 20175 | 1732.5 | 4.35 | 20 | 9.64 | 0.0056 |
| 20300 | 1745.0 | 4.35 | 20 | 8.57 | 0.0049 |

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 | -7.30 | -0.0042 |
| 20050 | 1720.0 | 3.6 | -20 | -6.22 | -0.0036 |
| 20050 | 1720.0 | 3.6 | -10 | -6.35 | -0.0037 |
| 20050 | 1720.0 | 3.6 | 0 | 9.44 | 0.0055 |
| 20050 | 1720.0 | 3.6 | 10 | -5.71 | -0.0033 |
| 20050 | 1720.0 | 3.6 | 20 | -6.59 | -0.0038 |
| 20050 | 1720.0 | 3.6 | 30 | 7.34 | 0.0043 |
| 20050 | 1720.0 | 3.6 | 40 | -7.12 | -0.0041 |
| 20050 | 1720.0 | 3.6 | 50 | -6.55 | -0.0038 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20050 | 1720.0 | 4.1 | -30 | -5.74 | -0.0033 |
| 20050 | 1720.0 | 4.1 | -20 | 5.85 | 0.0034 |
| 20050 | 1720.0 | 4.1 | -10 | -7.97 | -0.0046 |
| 20050 | 1720.0 | 4.1 | 0 | 5.11 | 0.0030 |
| 20050 | 1720.0 | 4.1 | 10 | 4.36 | 0.0025 |
| 20050 | 1720.0 | 4.1 | 20 | 4.94 | 0.0029 |
| 20050 | 1720.0 | 4.1 | 30 | -7.70 | -0.0045 |
| 20050 | 1720.0 | 4.1 | 40 | -6.67 | -0.0039 |
| 20050 | 1720.0 | 4.1 | 50 | -7.78 | -0.0045 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20050 | 1720.0 | 4.35 | -30 | -8.96 | -0.0052 |
| 20050 | 1720.0 | 4.35 | -20 | -6.35 | -0.0037 |
| 20050 | 1720.0 | 4.35 | -10 | 6.85 | 0.0040 |
| 20050 | 1720.0 | 4.35 | 0 | -1.37 | -0.0008 |
| 20050 | 1720.0 | 4.35 | 10 | 1.11 | 0.0006 |
| 20050 | 1720.0 | 4.35 | 20 | 6.82 | 0.0040 |
| 20050 | 1720.0 | 4.35 | 30 | -6.49 | -0.0038 |
| 20050 | 1720.0 | 4.35 | 40 | -7.14 | -0.0042 |
| 20050 | 1720.0 | 4.35 | 50 | -6.39 | -0.0037 |

**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 | -4.88 | -0.0028 |
| 20175 | 1732.5 | 3.6 | -20 | 6.88 | 0.0040 |
| 20175 | 1732.5 | 3.6 | -10 | 9.17 | 0.0053 |
| 20175 | 1732.5 | 3.6 | 0 | 3.55 | 0.0020 |
| 20175 | 1732.5 | 3.6 | 10 | 3.69 | 0.0021 |
| 20175 | 1732.5 | 3.6 | 20 | 10.17 | 0.0059 |
| 20175 | 1732.5 | 3.6 | 30 | 7.04 | 0.0041 |
| 20175 | 1732.5 | 3.6 | 40 | 8.30 | 0.0048 |
| 20175 | 1732.5 | 3.6 | 50 | 12.13 | 0.0070 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20175 | 1732.5 | 4.1 | -30 | 8.77 | 0.0051 |
| 20175 | 1732.5 | 4.1 | -20 | 8.96 | 0.0052 |
| 20175 | 1732.5 | 4.1 | -10 | 9.00 | 0.0052 |
| 20175 | 1732.5 | 4.1 | 0 | -2.36 | -0.0014 |
| 20175 | 1732.5 | 4.1 | 10 | 6.45 | 0.0037 |
| 20175 | 1732.5 | 4.1 | 20 | 8.74 | 0.0050 |
| 20175 | 1732.5 | 4.1 | 30 | 8.00 | 0.0046 |
| 20175 | 1732.5 | 4.1 | 40 | 7.70 | 0.0044 |
| 20175 | 1732.5 | 4.1 | 50 | 7.37 | 0.0043 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20175 | 1732.5 | 4.35 | -30 | -5.55 | -0.0032 |
| 20175 | 1732.5 | 4.35 | -20 | -6.87 | -0.0040 |
| 20175 | 1732.5 | 4.35 | -10 | 7.17 | 0.0041 |
| 20175 | 1732.5 | 4.35 | 0 | 2.11 | 0.0012 |
| 20175 | 1732.5 | 4.35 | 10 | -2.26 | -0.0013 |
| 20175 | 1732.5 | 4.35 | 20 | 9.64 | 0.0056 |
| 20175 | 1732.5 | 4.35 | 30 | 5.41 | 0.0031 |
| 20175 | 1732.5 | 4.35 | 40 | 7.34 | 0.0042 |
| 20175 | 1732.5 | 4.35 | 50 | -7.14 | -0.0041 |

## 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 | -6.19 | -0.0035 |
| 20300 | 1745.0 | 3.6 | -20 | 8.61 | 0.0049 |
| 20300 | 1745.0 | 3.6 | -10 | 6.67 | 0.0038 |
| 20300 | 1745.0 | 3.6 | 0 | -5.95 | -0.0034 |
| 20300 | 1745.0 | 3.6 | 10 | 4.25 | 0.0024 |
| 20300 | 1745.0 | 3.6 | 20 | 6.95 | 0.0040 |
| 20300 | 1745.0 | 3.6 | 30 | -8.93 | -0.0051 |
| 20300 | 1745.0 | 3.6 | 40 | -4.85 | -0.0028 |
| 20300 | 1745.0 | 3.6 | 50 | -6.27 | -0.0036 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20300 | 1745.0 | 4.1 | -30 | 8.96 | 0.0051 |
| 20300 | 1745.0 | 4.1 | -20 | -6.42 | -0.0037 |
| 20300 | 1745.0 | 4.1 | -10 | 7.50 | 0.0043 |
| 20300 | 1745.0 | 4.1 | 0 | 6.55 | 0.0038 |
| 20300 | 1745.0 | 4.1 | 10 | -4.36 | -0.0025 |
| 20300 | 1745.0 | 4.1 | 20 | 6.95 | 0.0040 |
| 20300 | 1745.0 | 4.1 | 30 | -7.00 | -0.0040 |
| 20300 | 1745.0 | 4.1 | 40 | 6.25 | 0.0036 |
| 20300 | 1745.0 | 4.1 | 50 | -6.49 | -0.0037 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 20300 | 1745.0 | 4.35 | -30 | -7.82 | -0.0045 |
| 20300 | 1745.0 | 4.35 | -20 | 6.79 | 0.0039 |
| 20300 | 1745.0 | 4.35 | -10 | 7.67 | 0.0044 |
| 20300 | 1745.0 | 4.35 | 0 | 5.51 | 0.0032 |
| 20300 | 1745.0 | 4.35 | 10 | -3.68 | -0.0021 |
| 20300 | 1745.0 | 4.35 | 20 | 8.57 | 0.0049 |
| 20300 | 1745.0 | 4.35 | 30 | 8.27 | 0.0047 |
| 20300 | 1745.0 | 4.35 | 40 | -5.11 | -0.0029 |
| 20300 | 1745.0 | 4.35 | 50 | 4.66 | 0.0027 |

APPENDIX 5C – LTE Band 4 RADIATED EMISSIONS TEST DATA

## Radiated Power Test Data Results

The following measurements were performed by Rex Zhang.
Date of Test: July 16, 2014
The environmental tests conditions were: Temperature: 25.0 °C
Relative Humidity: 29.5 %
The BlackBerry® smartphone was standalone, USB 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, 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 (relative to Isotropic Radiator) (dBm) | Corrected Reading (relative to Isotropic Radiator) (W) | Limit (dBm) | Diff to Limit (dB) |
| F0 | 20000 | 1715.00 | 4 | Horn | V | -21.14 | -21.14 | V-V | -11.47 | 29.13 | 0.82 | 30.00 | 0.87 |
| F0 | 20000 | 1715.00 | 4 | Horn | H | -31.55 | | H-H | -11.08 | | | | |
| F0 | 20175 | 1732.50 | 4 | Horn | V | -21.92 | -21.92 | V-V | -11.87 | 28.94 | 0.78 | 30.00 | 1.06 |
| F0 | 20175 | 1732.50 | 4 | Horn | H | -30.92 | | H-H | -11.39 | | | | |
| F0 | 20349 | 1749.90 | 4 | Horn | V | -21.80 | -21.80 | V-V | -11.20 | **29.35** | 0.86 | 30.00 | 0.65 |
| F0 | 20349 | 1749.90 | 4 | Horn | H | -31.66 | | H-H | -10.68 | | | | |

### LTE band 4, 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 (relative to Isotropic Radiator) (dBm) | Corrected Reading (relative to Isotropic Radiator) (W) | Limit (dBm) | Diff to Limit (dB) |
| F0 | 20000 | 1715.00 | 4 | Horn | V | -22.17 | -22.17 | V-V | -12.51 | **28.06** | 0.64 | 30.00 | 1.94 |
| F0 | 20000 | 1715.00 | 4 | Horn | H | -32.91 | | H-H | -12.15 | | | | |
| F0 | 20175 | 1732.50 | 4 | Horn | V | -22.94 | -22.94 | V-V | -12.86 | 27.93 | 0.62 | 30.00 | 2.07 |
| F0 | 20175 | 1732.50 | 4 | Horn | H | -31.84 | | H-H | -12.40 | | | | |
| F0 | 20349 | 1749.90 | 4 | Horn | V | -23.22 | -23.22 | V-V | -12.66 | 27.92 | 0.62 | 30.00 | 2.08 |
| F0 | 20349 | 1749.90 | 4 | Horn | H | -32.68 | | H-H | -12.11 | | | | |

## Radiated Emissions Test Data Results cont'd

The following measurements were performed by Rex Zhang.

Date of Test: June 27, 2014

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

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, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in LTE band 4 with QPSK and 16-QAM modulations for 10MHz BW (channel 19975, 20175 and 20374 with RB = 1).

All emissions were at least 25.0 dB below the limit.

The following measurements were performed by Kevin Guo

Date of Test: July 3 - 11, 2014

| | | |
|---|---|---|
| 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 Down 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 10MHz BW (channel 19975, 20175 and 20374 with RB = 1).

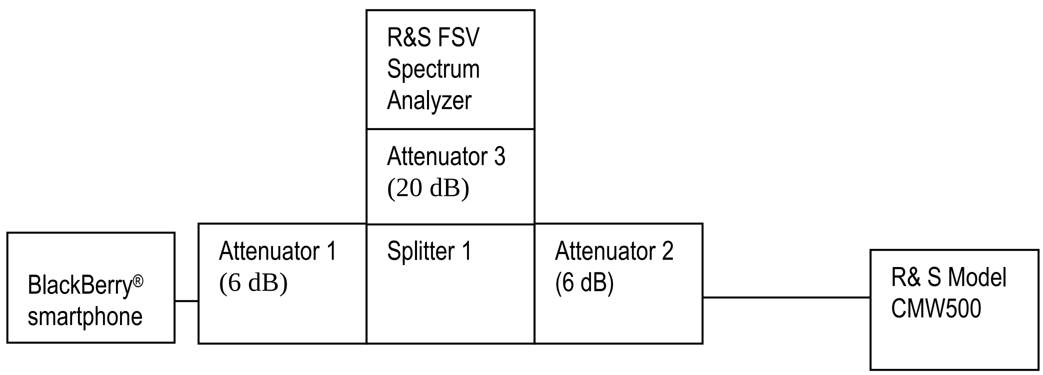
All emissions were at least 25.0 dB below the limit.

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

## LTE Band 17 Conducted RF Emission Test Data

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

### Test Setup Diagram




A reference offset of 32.4 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: June 26-27, 2014.

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 RBs 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 RB 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 9.359MHz. 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 | 8.955 | **8.973** |
| 710.0 | **9.359** | **8.973** | 8.955 |
| 711.0 | **9.359** | 8.955 | 8.955 |

**Peak to Average Ratio (PAR)**
For each 5MHz and 10MHz with different number of RBs 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 10.48 dB on in 10MHz bandwidth with 50 RBs.

***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)**

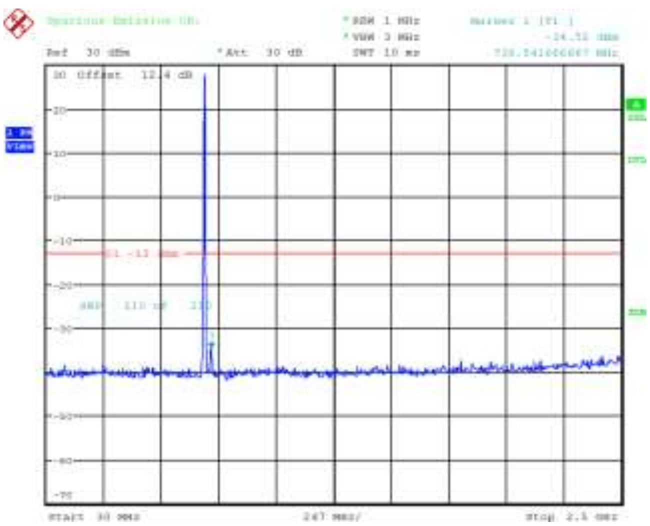


**Figure 6-2a: Band 17, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)**

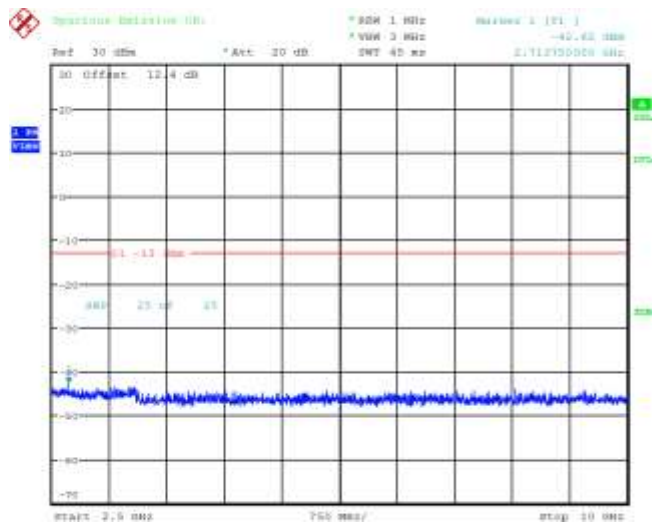


**Figure 6-3a: Band 17, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)**

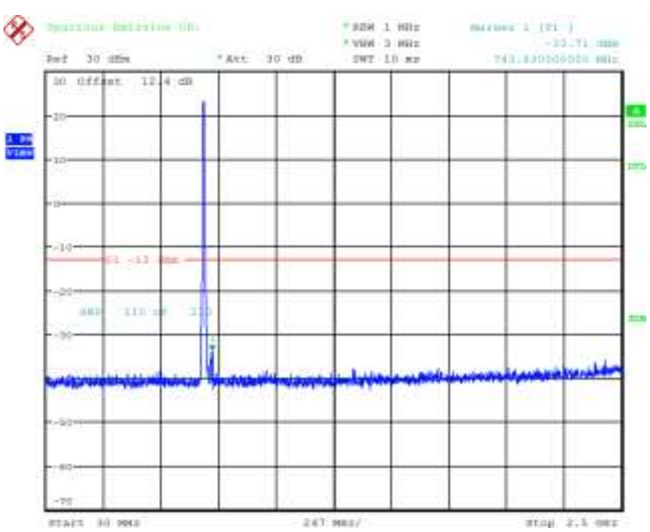
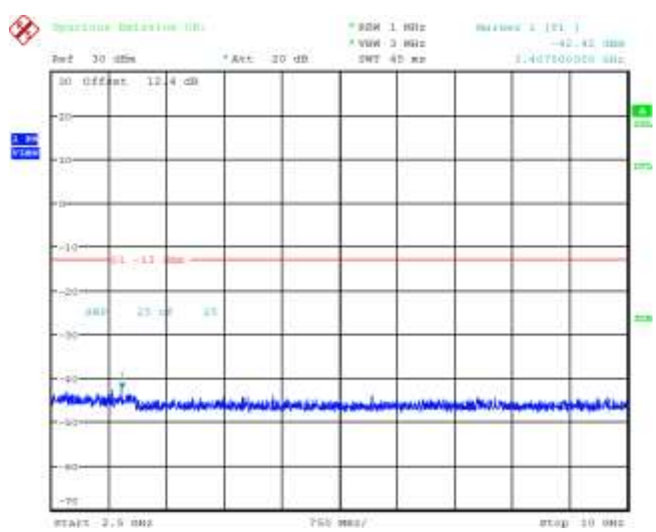


**Figure 6-4a: Band 17, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)**



## LTE Band 17 Conducted RF Emission Test Data cont'd

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

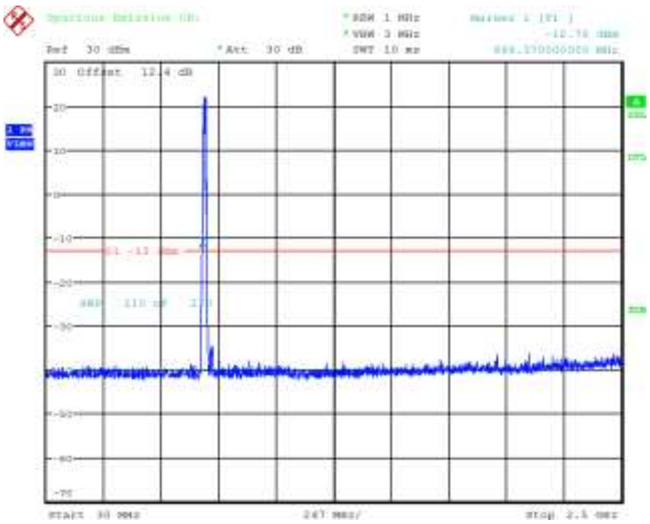


**Figure 6-6a: Band 17, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)**

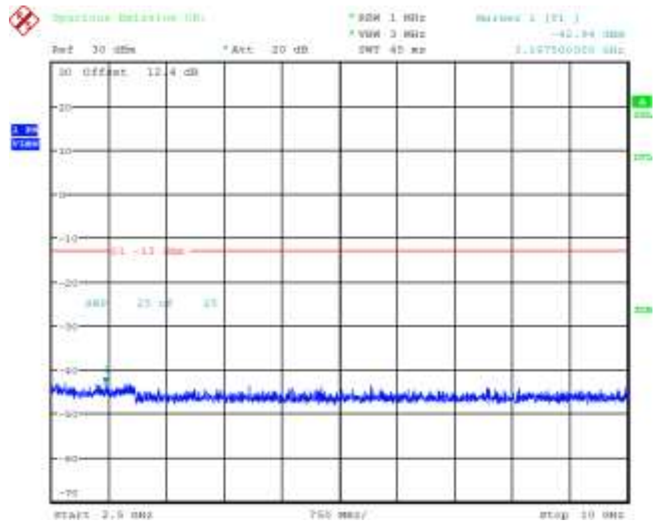


**Figure 6-7a: Band 17, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)**

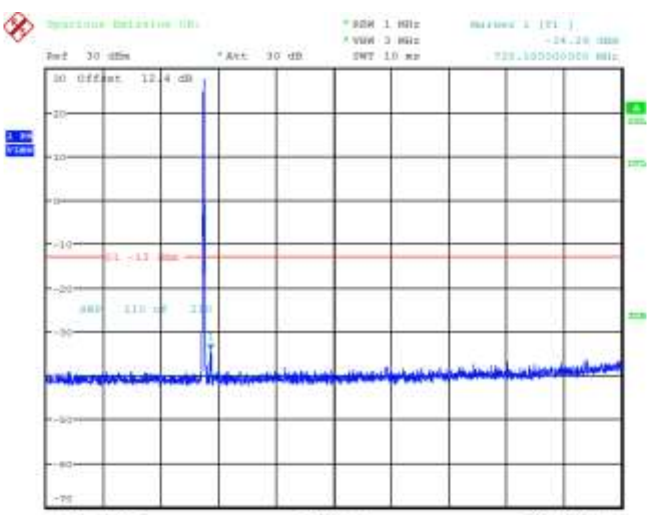
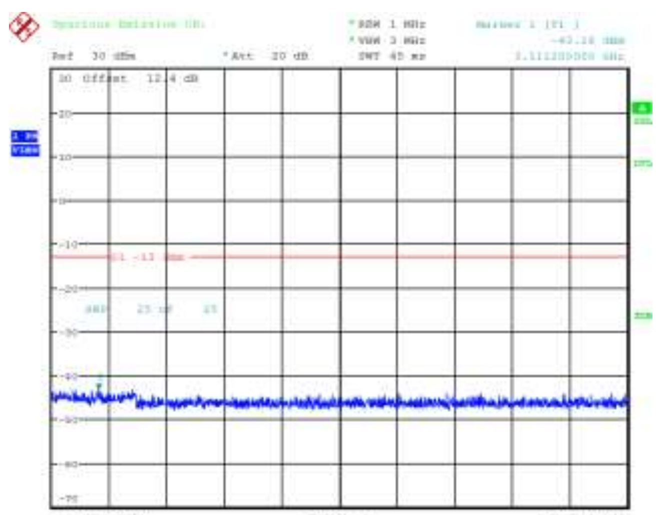


**Figure 6-8a: Band 17, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)**



## LTE Band 17 Conducted RF Emission Test Data cont'd

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

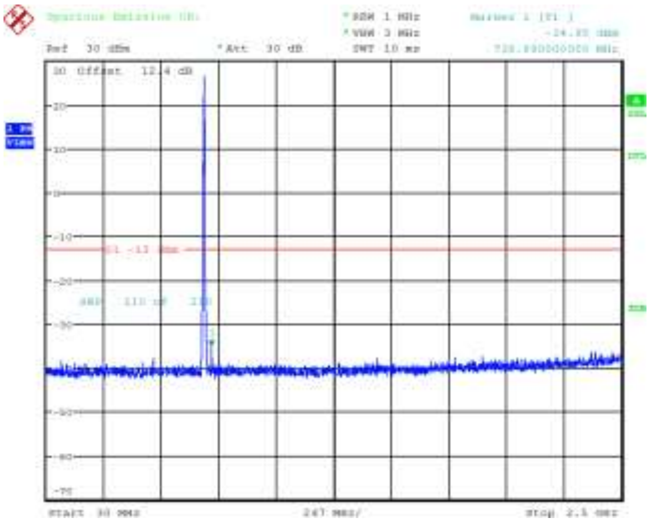


**Figure 6-10a: Band 17, Spurious Conducted Emissions, High Channel, 5MHz BW (RB= 15)**

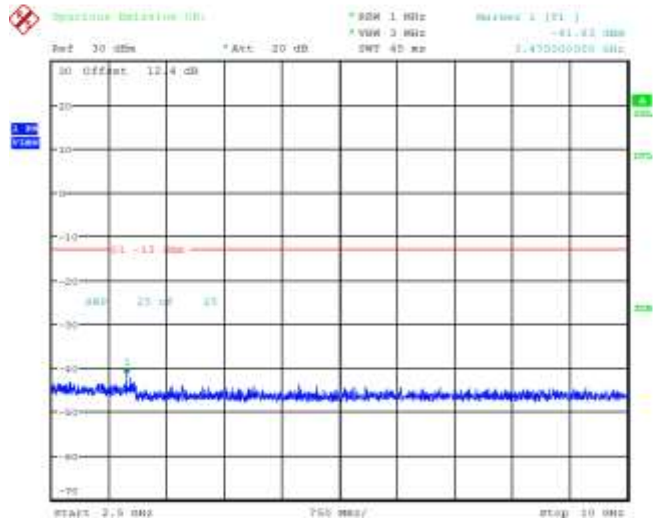


**Figure 6-11a: Band 17, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)**

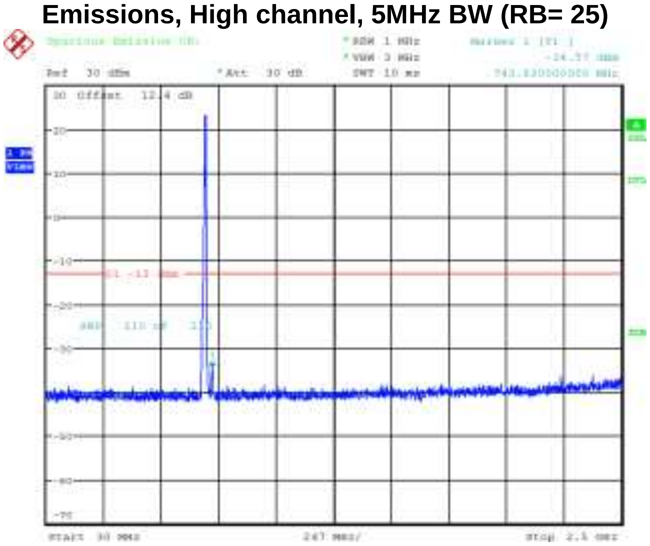
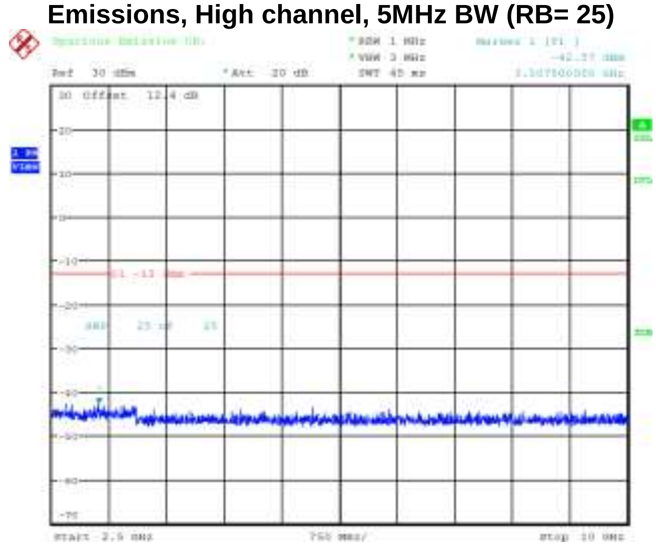


**Figure 6-12a: Band 17, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)**



## LTE Band 17 Conducted RF Emission Test Data cont'd

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

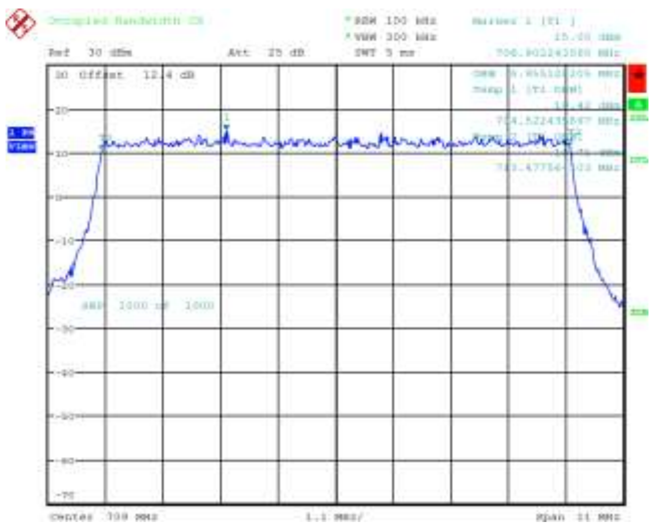


**Figure 6-14a: Occupied Bandwidth, Band 17 Middle Channel, 10MHz BW, RB=50**

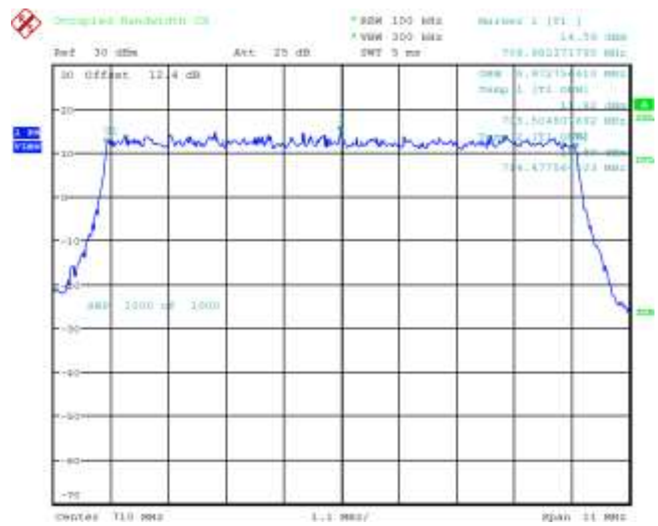
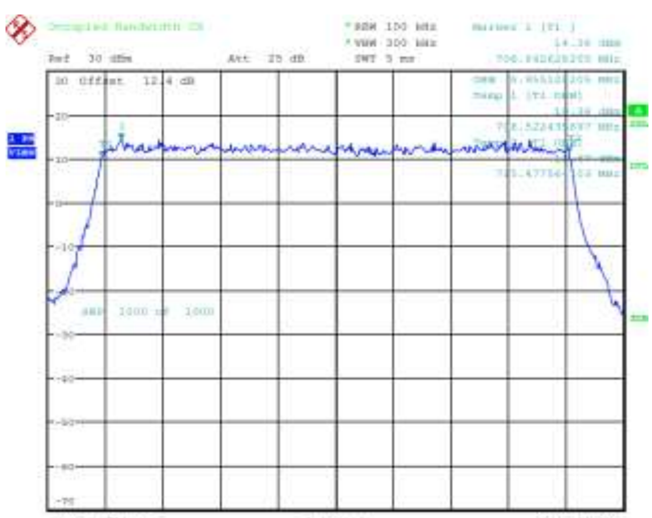


**Figure 6-15a: Occupied Bandwidth, Band 17 High Channel, 10MHz BW, RB=50**



## LTE Band 17 Conducted RF Emission Test Data cont'd

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

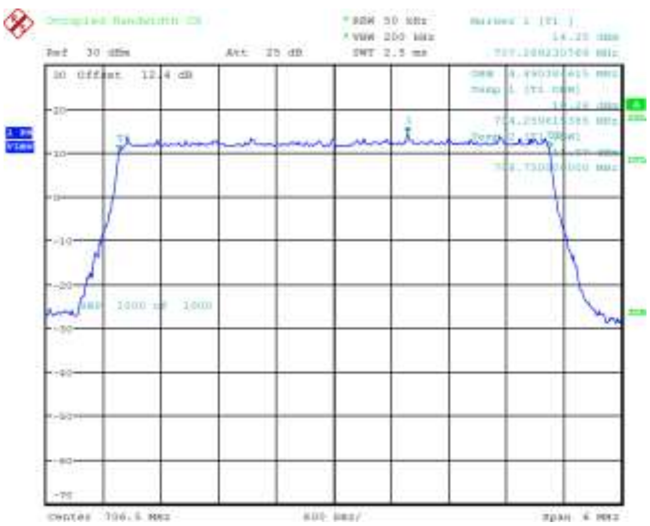


**Figure 6-17a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25**

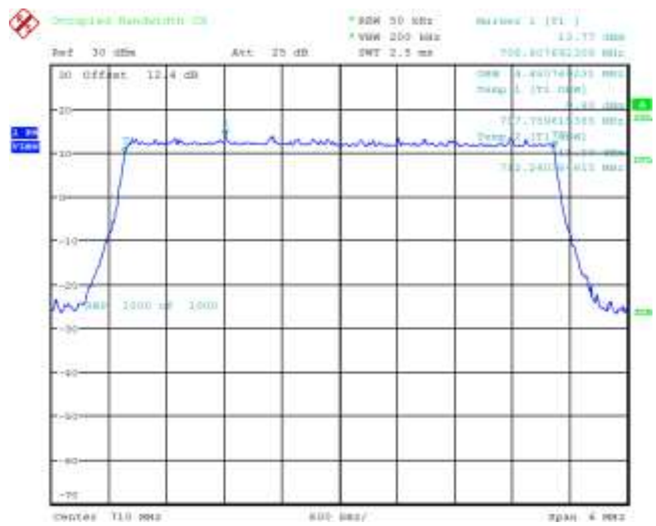
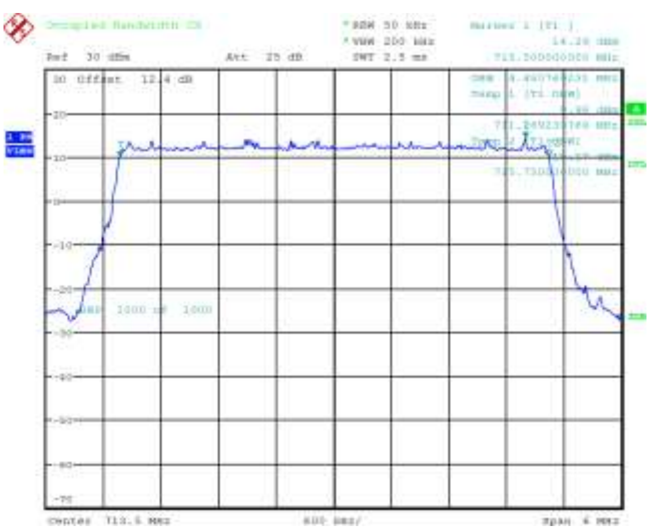


**Figure 6-18a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25**



## LTE Band 17 Conducted RF Emission Test Data cont'd

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

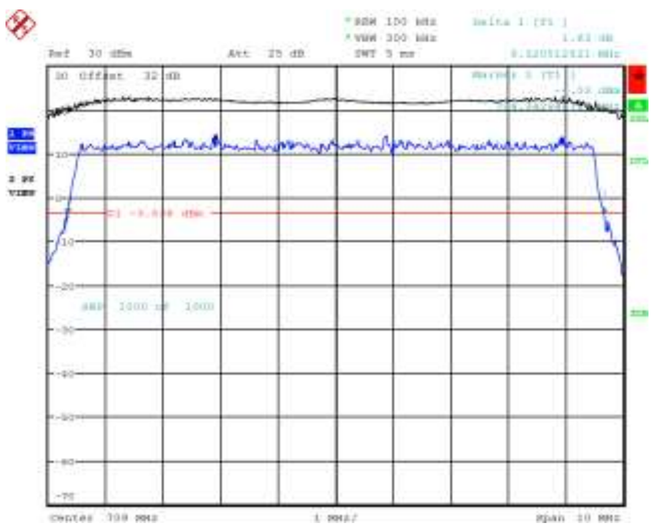


**Figure 6-20a: -26 dBc Bandwidth, Band 17 Middle Channel, 10MHz BW, RB=50**

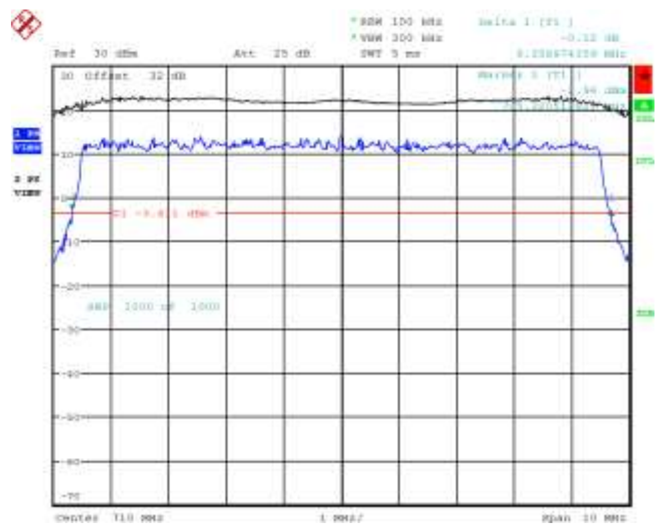


**Figure 6-21a: -26 dBc Bandwidth, Band 17 High Channel, 10MHz BW, RB=50**

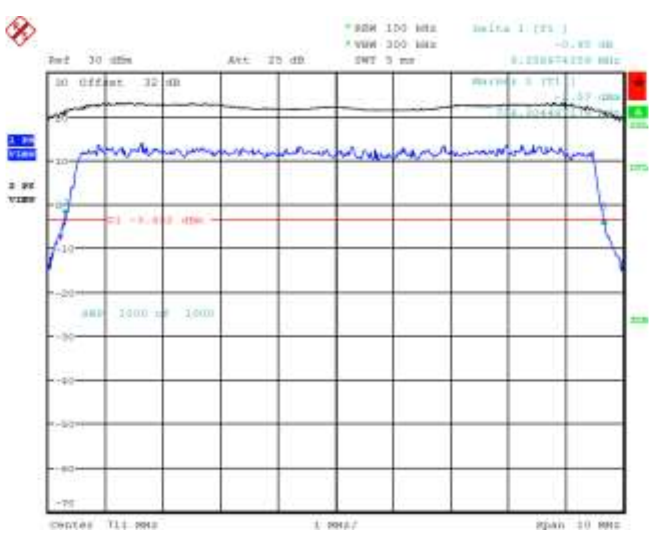
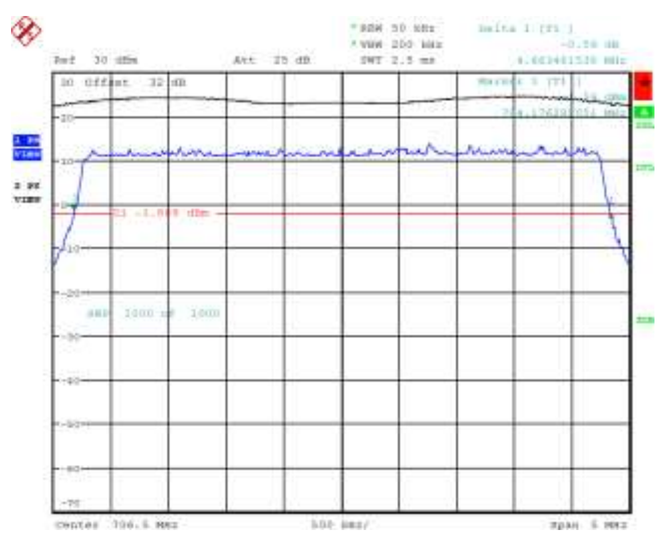


**Figure 6-22a: -26 dBc Bandwidth, Band 17 Low Channel, 5MHz BW, RB=25**



## LTE Band 17 Conducted RF Emission Test Data cont'd

**Figure 6-23a: -26 dBc Bandwidth, Band 17 Middle Channel, 5MHz BW, RB=25**

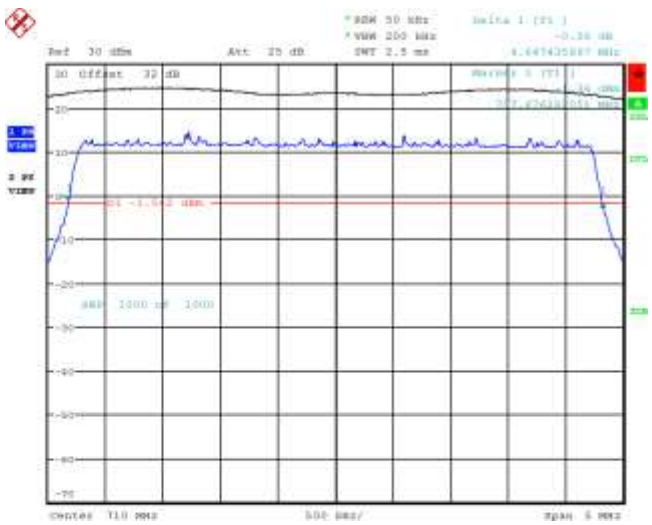


**Figure 6-24a: -26 dBc Bandwidth, Band 17 High Channel, 5MHz BW, RB=25**

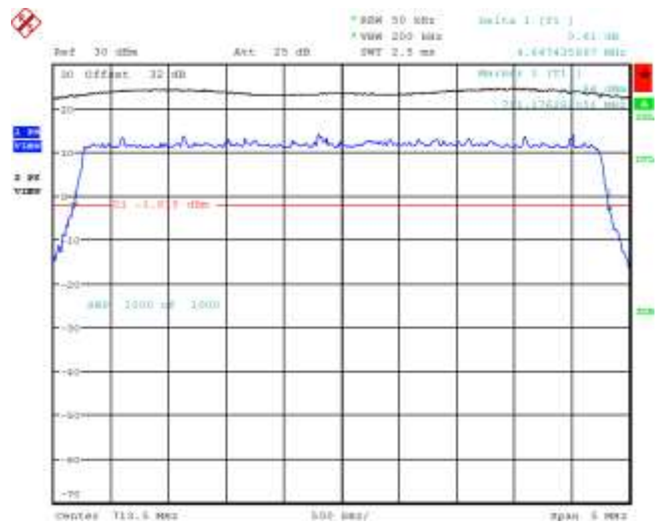


**Figure 6-25a: Band 17 Low Channel Mask, 10MHz BW, RB=50**

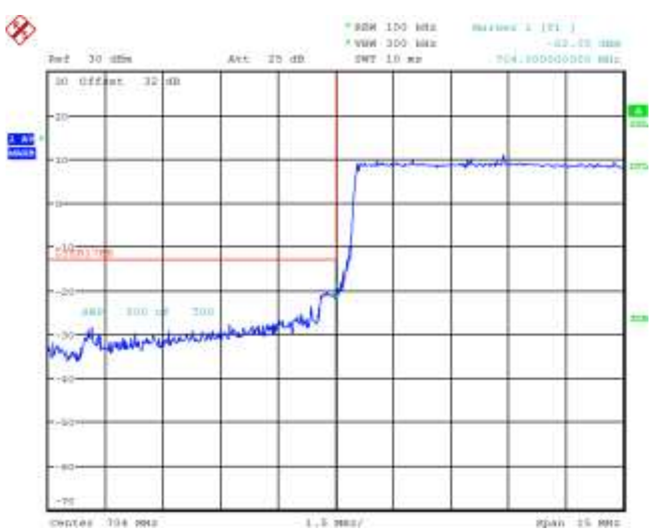
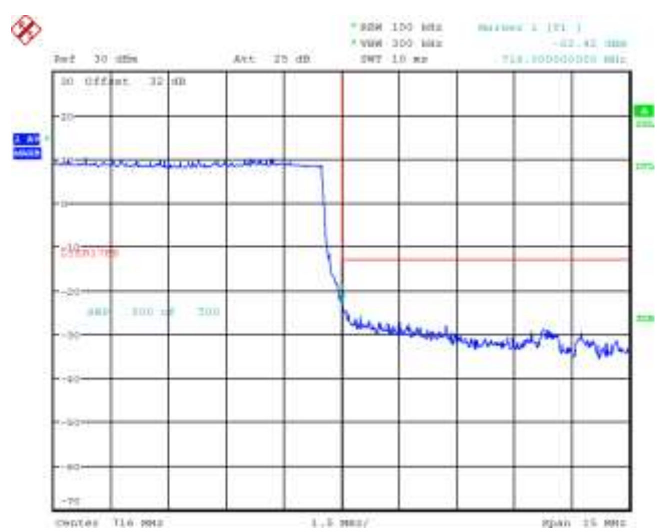


**Figure 6-26a: Band 17 High Channel Mask, 10MHz BW, RB=50**



## LTE Band 17 Conducted RF Emission Test Data cont'd

**Figure 6-27a: Band 17 Low Channel Mask, 10MHz BW, RB=1**

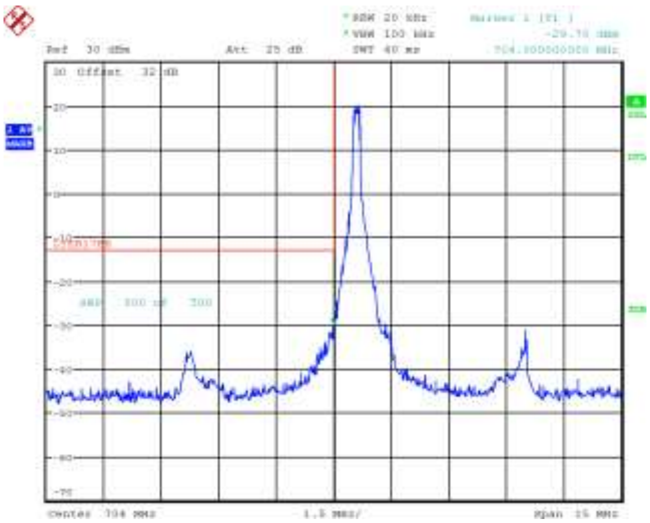


**Figure 6-28a: Band 17 High Channel Mask,10MHz BW, RB=1**

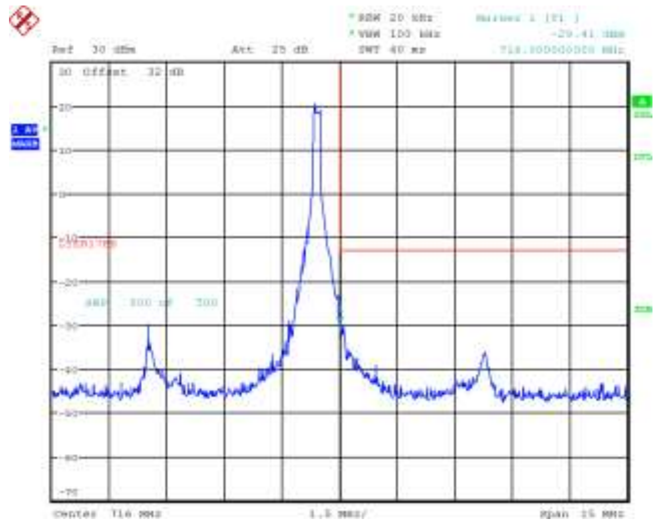


**Figure 6-29a: Band 17 Low Channel Mask, 5MHz BW, RB=25**

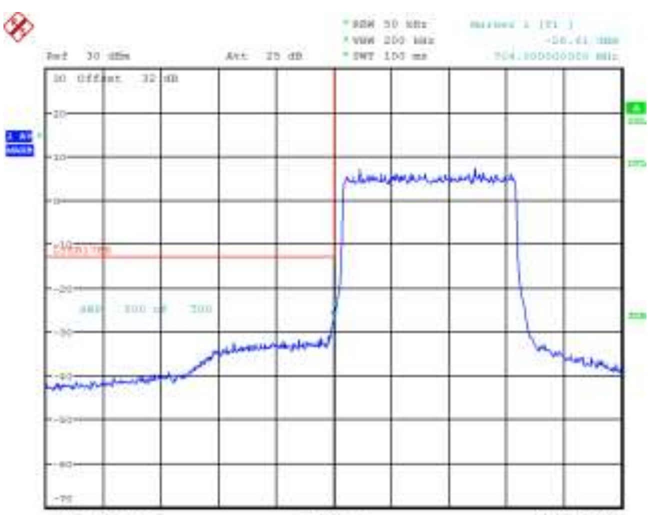
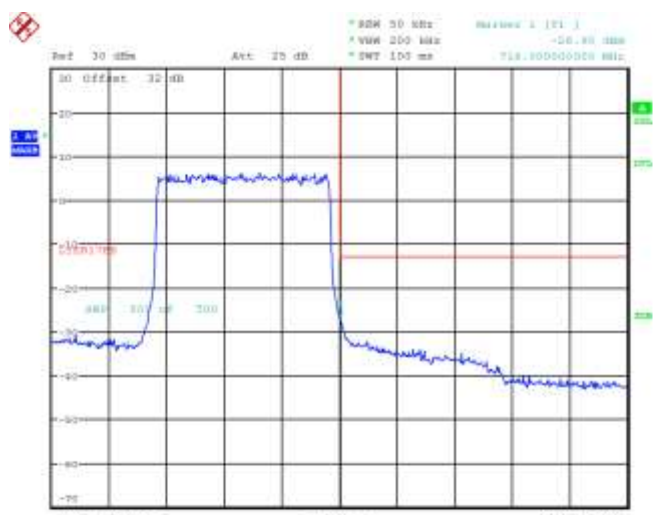


**Figure 6-30a: Band 17 High Channel Mask, 5MHz BW, RB=25**



## LTE Band 17 Conducted RF Emission Test Data cont'd

**Figure 6-31a: Band 17 Low Channel Mask, 5MHz BW, RB=1**

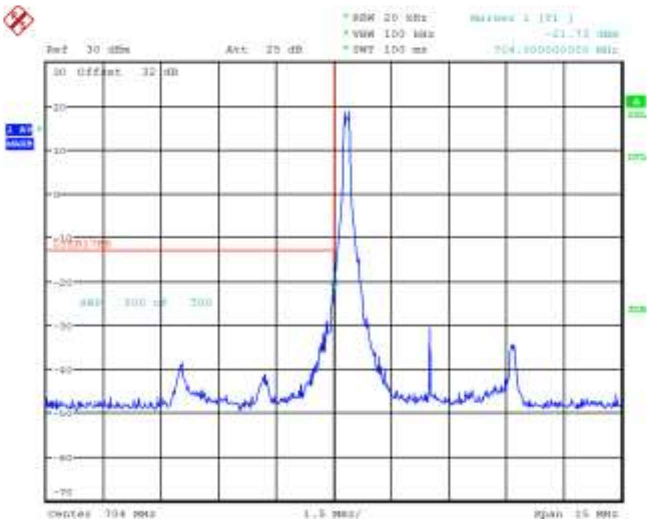


**Figure 6-32a: Band 17 High Channel Mask, 5MHz BW, RB=1**

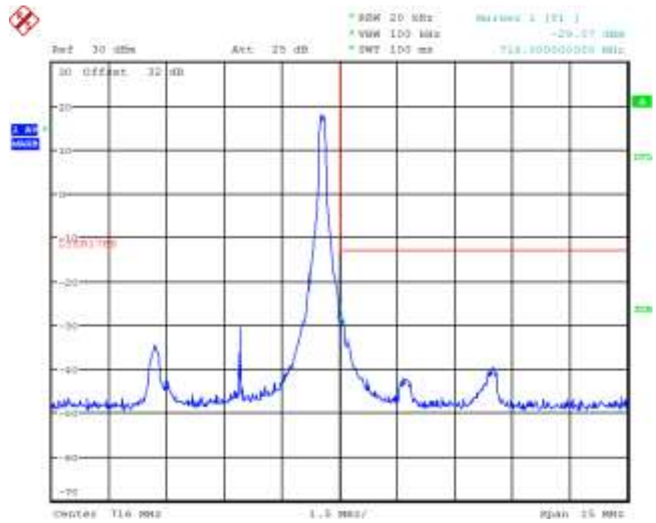


**Figure 6-33a: Band 17 Mid Channel PAR, 10MHz BW, RB=25**

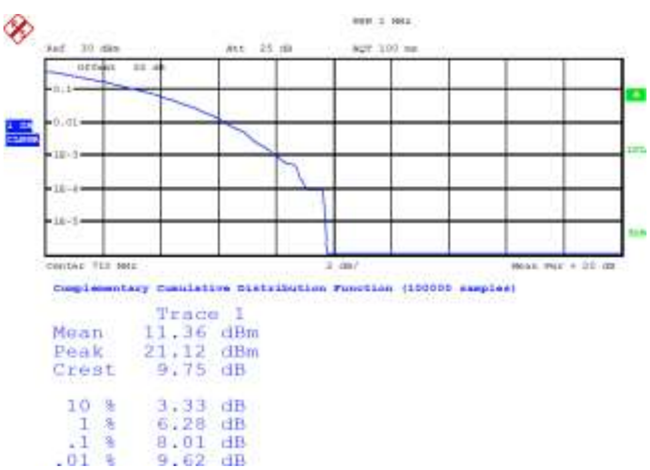
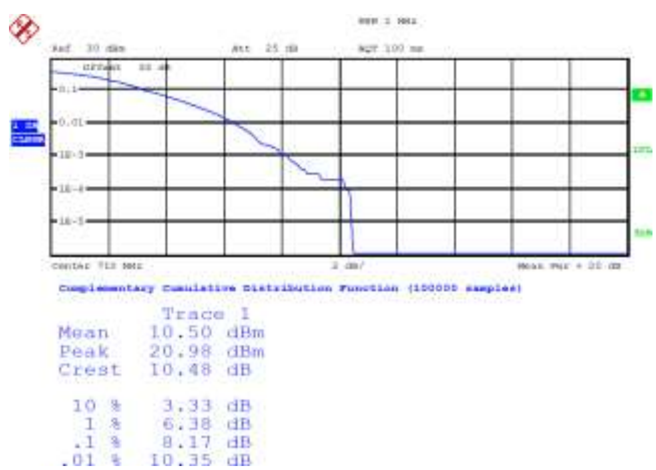



**Figure 6-34a: Band 17 Middle Channel PAR, 10MHz BW, RB=50**



## LTE Band 17 Conducted RF Emission Test Data cont'd

**Figure 6-35a: Band 17 Mid Channel PAR, 5MHz BW, RB=15**

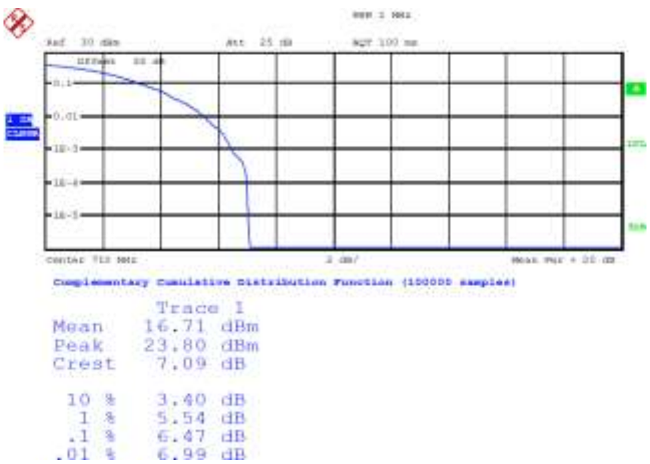
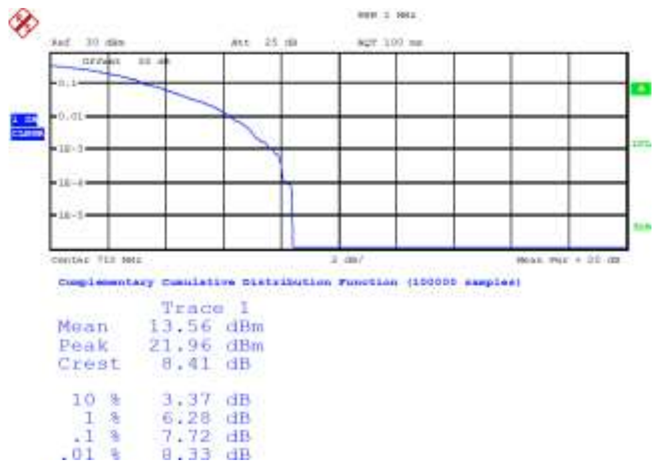



**Figure 6-36a: Band 17 Mid Channel PAR, 5MHz BW, RB=25**



## 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**

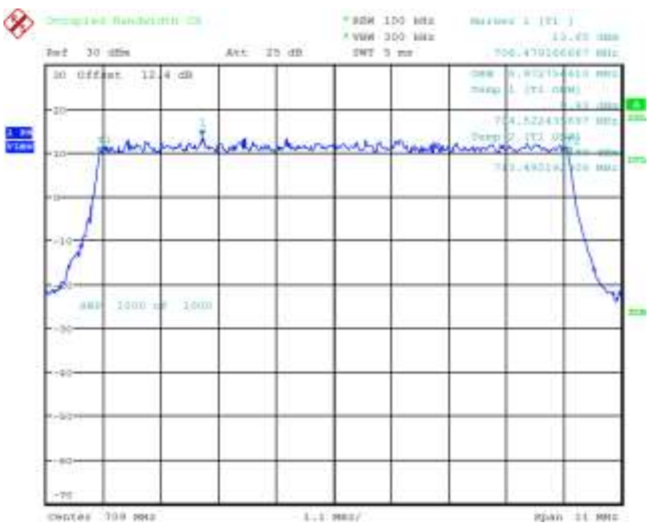



**Figure 6-38a: Occupied Bandwidth, Band 17 Mid Channel, 20MHz BW (RB= 100) 16-QAM**

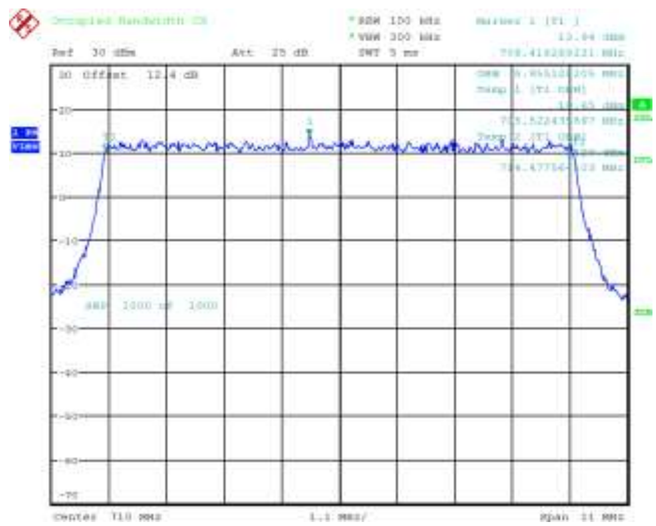
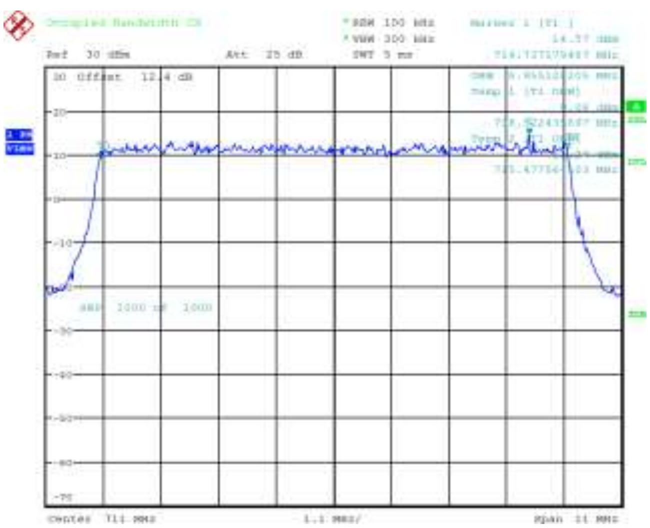
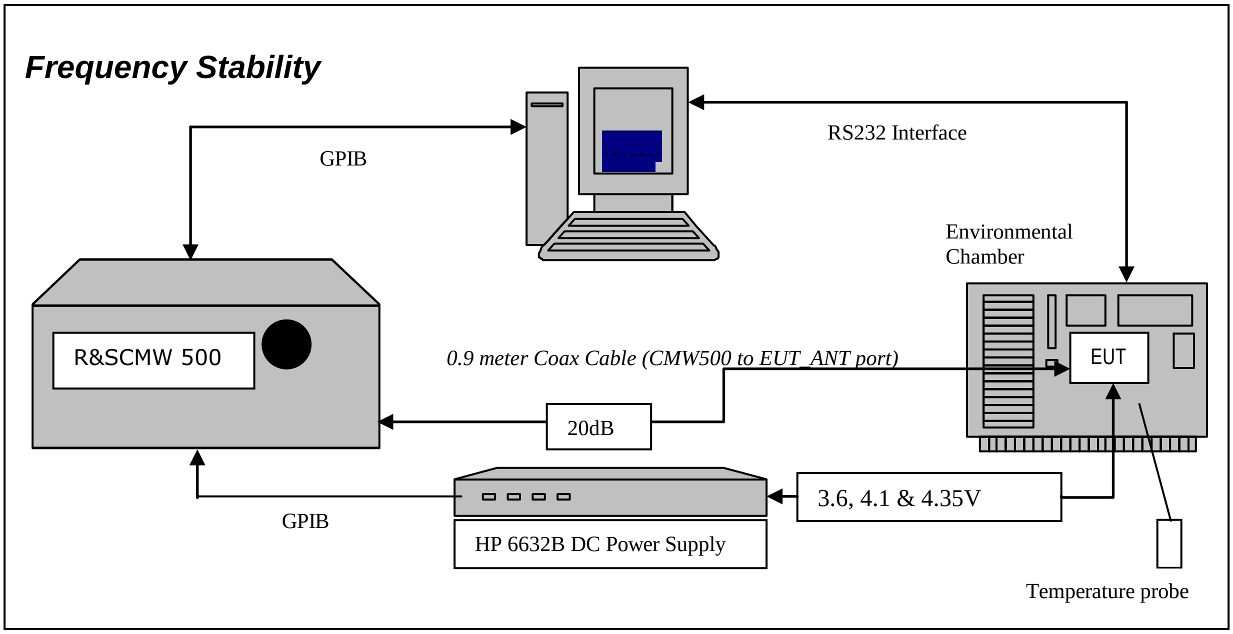



**Figure 6-39a: Occupied Bandwidth, Band 17 High Channel, 20MHz BW (RB= 100) 16-QAM**



APPENDIX 6B – LTE Band 17 FREQUENCY STABILITY TEST DATA

LTE Band 17 Frequency Stability Test Data




The following 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) RBs. 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**.

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 | -3.59 | -0.0051 |
| 23790 | 710.0 | 3.6 | 20 | 3.85 | 0.0054 |
| 23800 | 711.0 | 3.6 | 20 | 3.10 | 0.0044 |

| Traffic Channel Number | LTE Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 23780 | 709.0 | 4.1 | 20 | 3.89 | 0.0055 |
| 23790 | 710.0 | 4.1 | 20 | 4.86 | 0.0068 |
| 23800 | 711.0 | 4.1 | 20 | 2.70 | 0.0038 |

| Traffic Channel Number | LTE Frequency (MHz) | Voltage (Volts) | Temperature (Celsius) | Frequency Error (Hz) | PPM |
|---|---|---|---|---|---|
| 23780 | 709.0 | 4.35 | 20 | 2.98 | 0.0042 |
| 23790 | 710.0 | 4.35 | 20 | 3.25 | 0.0046 |
| 23800 | 711.0 | 4.35 | 20 | 2.65 | 0.0037 |

### 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 | -4.28 | -0.0060 |
| 23780 | 709.0 | 3.6 | -20 | -3.81 | -0.0054 |
| 23780 | 709.0 | 3.6 | -10 | -3.75 | -0.0053 |
| 23780 | 709.0 | 3.6 | 0 | -3.19 | -0.0045 |
| 23780 | 709.0 | 3.6 | 10 | -3.29 | -0.0046 |
| 23780 | 709.0 | 3.6 | 20 | -3.59 | -0.0051 |
| 23780 | 709.0 | 3.6 | 30 | -3.68 | -0.0052 |
| 23780 | 709.0 | 3.6 | 40 | -5.29 | -0.0075 |
| 23780 | 709.0 | 3.6 | 50 | -4.68 | -0.0066 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 23780 | 709.0 | 4.1 | -30 | -4.56 | -0.0064 |
| 23780 | 709.0 | 4.1 | -20 | -2.96 | -0.0042 |
| 23780 | 709.0 | 4.1 | -10 | 3.46 | 0.0049 |
| 23780 | 709.0 | 4.1 | 0 | -4.58 | -0.0065 |
| 23780 | 709.0 | 4.1 | 10 | -4.23 | -0.0060 |
| 23780 | 709.0 | 4.1 | 20 | 3.89 | 0.0055 |
| 23780 | 709.0 | 4.1 | 30 | -3.69 | -0.0052 |
| 23780 | 709.0 | 4.1 | 40 | -5.59 | -0.0079 |
| 23780 | 709.0 | 4.1 | 50 | -3.79 | -0.0053 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 23780 | 709.0 | 4.35 | -30 | -5.58 | -0.0079 |
| 23780 | 709.0 | 4.35 | -20 | -2.85 | -0.0040 |
| 23780 | 709.0 | 4.35 | -10 | -3.63 | -0.0051 |
| 23780 | 709.0 | 4.35 | 0 | -3.88 | -0.0055 |
| 23780 | 709.0 | 4.35 | 10 | -3.85 | -0.0054 |
| 23780 | 709.0 | 4.35 | 20 | 2.98 | 0.0042 |
| 23780 | 709.0 | 4.35 | 30 | -3.12 | -0.0044 |
| 23780 | 709.0 | 4.35 | 40 | -5.35 | -0.0075 |
| 23780 | 709.0 | 4.35 | 50 | -4.32 | -0.0061 |

### 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 | 5.48 | 0.0077 |
| 23790 | 710.0 | 3.6 | -20 | 4.12 | 0.0058 |
| 23790 | 710.0 | 3.6 | -10 | 4.95 | 0.0070 |
| 23790 | 710.0 | 3.6 | 0 | 3.26 | 0.0046 |
| 23790 | 710.0 | 3.6 | 10 | 3.75 | 0.0053 |
| 23790 | 710.0 | 3.6 | 20 | 3.85 | 0.0054 |
| 23790 | 710.0 | 3.6 | 30 | -5.02 | -0.0071 |
| 23790 | 710.0 | 3.6 | 40 | -6.21 | -0.0087 |
| 23790 | 710.0 | 3.6 | 50 | 5.35 | 0.0075 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 23790 | 710.0 | 4.1 | -30 | 5.06 | 0.0071 |
| 23790 | 710.0 | 4.1 | -20 | 5.15 | 0.0073 |
| 23790 | 710.0 | 4.1 | -10 | 6.08 | 0.0086 |
| 23790 | 710.0 | 4.1 | 0 | 4.86 | 0.0068 |
| 23790 | 710.0 | 4.1 | 10 | 3.83 | 0.0054 |
| 23790 | 710.0 | 4.1 | 20 | 4.86 | 0.0068 |
| 23790 | 710.0 | 4.1 | 30 | -4.08 | -0.0057 |
| 23790 | 710.0 | 4.1 | 40 | -3.33 | -0.0047 |
| 23790 | 710.0 | 4.1 | 50 | 4.22 | 0.0059 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 23790 | 710.0 | 4.35 | -30 | 5.87 | 0.0083 |
| 23790 | 710.0 | 4.35 | -20 | 6.35 | 0.0089 |
| 23790 | 710.0 | 4.35 | -10 | 7.54 | 0.0106 |
| 23790 | 710.0 | 4.35 | 0 | 2.40 | 0.0034 |
| 23790 | 710.0 | 4.35 | 10 | 4.26 | 0.0060 |
| 23790 | 710.0 | 4.35 | 20 | 3.25 | 0.0046 |
| 23790 | 710.0 | 4.35 | 30 | -5.26 | -0.0074 |
| 23790 | 710.0 | 4.35 | 40 | -5.08 | -0.0072 |
| 23790 | 710.0 | 4.35 | 50 | 2.43 | 0.0034 |

## 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 | 3.39 | 0.0048 |
| 23800 | 711.0 | 3.6 | -20 | 3.52 | 0.0050 |
| 23800 | 711.0 | 3.6 | -10 | 6.52 | 0.0092 |
| 23800 | 711.0 | 3.6 | 0 | 4.28 | 0.0060 |
| 23800 | 711.0 | 3.6 | 10 | 4.05 | 0.0057 |
| 23800 | 711.0 | 3.6 | 20 | 3.10 | 0.0044 |
| 23800 | 711.0 | 3.6 | 30 | -2.78 | -0.0039 |
| 23800 | 711.0 | 3.6 | 40 | -4.69 | -0.0066 |
| 23800 | 711.0 | 3.6 | 50 | -7.23 | -0.0102 |
| 23800 | 711.0 | 3.6 | 60 | 3.39 | 0.0048 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 23800 | 711.0 | 4.1 | -30 | -3.16 | -0.0044 |
| 23800 | 711.0 | 4.1 | -20 | 4.51 | 0.0063 |
| 23800 | 711.0 | 4.1 | -10 | 3.63 | 0.0051 |
| 23800 | 711.0 | 4.1 | 0 | -2.96 | -0.0042 |
| 23800 | 711.0 | 4.1 | 10 | 4.05 | 0.0057 |
| 23800 | 711.0 | 4.1 | 20 | 2.70 | 0.0038 |
| 23800 | 711.0 | 4.1 | 30 | -4.49 | -0.0063 |
| 23800 | 711.0 | 4.1 | 40 | -3.78 | -0.0053 |
| 23800 | 711.0 | 4.1 | 50 | -4.29 | -0.0060 |
| 23800 | 711.0 | 4.1 | 60 | -3.16 | -0.0044 |
| **Traffic Channel Number** | **Frequency (MHz)** | **Voltage (Volts)** | **Temperature (Celsius)** | **Frequency Error (Hz)** | **PPM** |
| 23800 | 711.0 | 4.35 | -30 | -2.82 | -0.0040 |
| 23800 | 711.0 | 4.35 | -20 | -3.55 | -0.0050 |
| 23800 | 711.0 | 4.35 | -10 | 2.59 | 0.0036 |
| 23800 | 711.0 | 4.35 | 0 | -3.23 | -0.0045 |
| 23800 | 711.0 | 4.35 | 10 | 3.73 | 0.0052 |
| 23800 | 711.0 | 4.35 | 20 | 2.65 | 0.0037 |
| 23800 | 711.0 | 4.35 | 30 | -4.01 | -0.0056 |
| 23800 | 711.0 | 4.35 | 40 | -4.08 | -0.0057 |
| 23800 | 711.0 | 4.35 | 50 | -2.68 | -0.0038 |
| 23800 | 711.0 | 4.35 | 60 | -2.82 | -0.0040 |

APPENDIX 6C – LTE Band 17 RADIATED EMISSIONS TEST DATA

## Radiated Power Test Data Results

Date of Test: July 17, 2014
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, 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, 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 | -42.97 | -31.26 | V-V | 4.31 | **22.72** | 0.19 | 35.00 | 12.28 |
| F0 | 23755 | 706.50 | 17 | Dipole | H | -31.26 | | H-H | 0.20 | | | | |
| F0 | 23790 | 710.00 | 17 | Dipole | V | -43.45 | -31.04 | V-V | 4.02 | 22.47 | 0.18 | 35.00 | 12.53 |
| F0 | 23790 | 710.00 | 17 | Dipole | H | -31.04 | | H-H | 0.24 | | | | |
| F0 | 23824 | 713.40 | 17 | Dipole | V | -43.07 | -31.28 | V-V | 3.30 | 21.73 | 0.15 | 35.00 | 13.27 |
| F0 | 23824 | 713.40 | 17 | Dipole | H | -31.28 | | H-H | -0.33 | | | | |

**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 | -43.74 | -32.34 | V-V | 3.28 | **21.69** | 0.15 | 35.0 | 13.31 |
| F0 | 23755 | 706.50 | 17 | Dipole | H | -32.34 | | H-H | -0.90 | | | | |
| F0 | 23790 | 710.00 | 17 | Dipole | V | -44.34 | -32.38 | V-V | 2.67 | 21.12 | 0.13 | 35.0 | 13.88 |
| F0 | 23790 | 710.00 | 17 | Dipole | H | -32.38 | | H-H | -1.18 | | | | |
| F0 | 23824 | 713.40 | 17 | Dipole | V | -44.20 | -31.98 | V-V | 2.62 | 21.05 | 0.13 | 35.0 | 13.95 |
| F0 | 23824 | 713.40 | 17 | Dipole | H | -31.98 | | H-H | -1.02 | | | | |

## Radiated Emissions Test Data Results cont'd

The following measurements were performed by Rex Zhang.

Date of Test: June 30, 2014

| | | |
|---|---|---|
| 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.

The following measurements were performed by Kevin Guo

Date of Test: July 8-11, 2014

| | | |
|---|---|---|
| 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 up 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.