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)

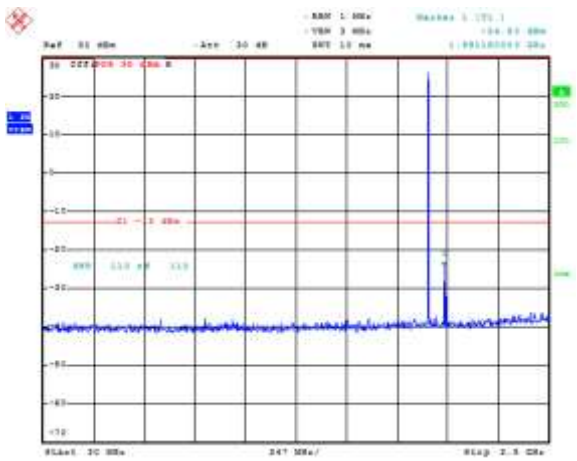


Figure 3-18a: Band 2, Spurious Conducted Emissions, High Channel, 1.4MHz BW (RB= 6)

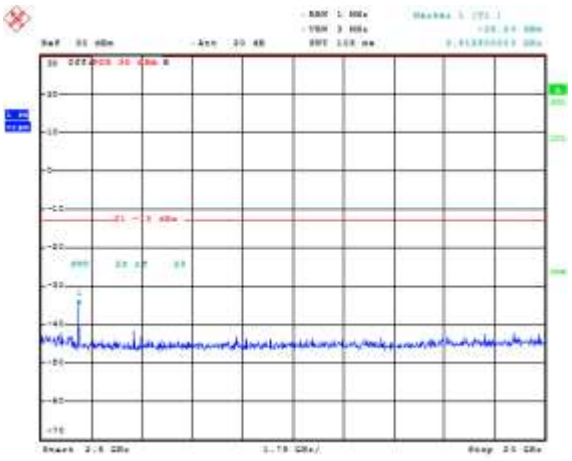


Figure 3-19a: Occupied Bandwidth, Band 2 Low Channel, 20MHz BW (RB= 100)

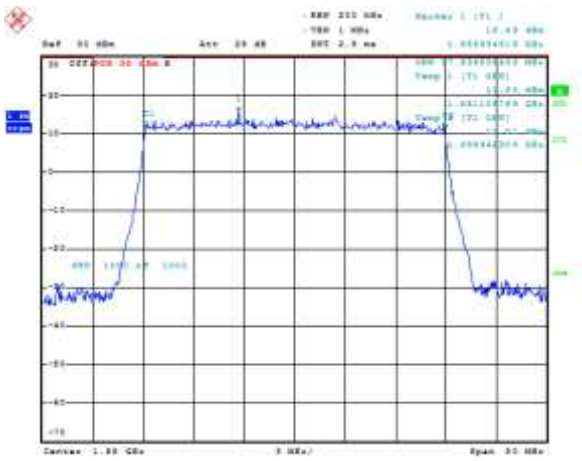
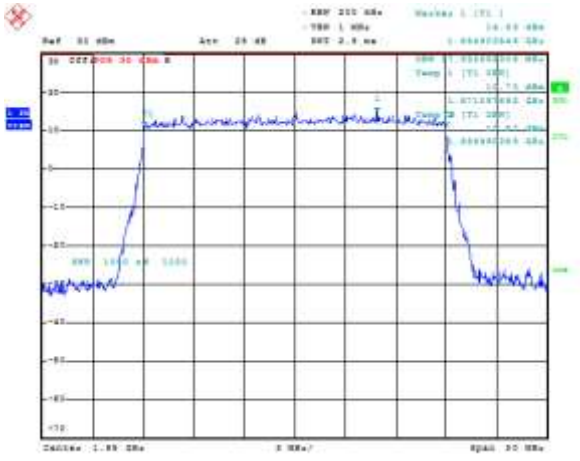


Figure 3-20a: Occupied Bandwidth, Band 2 Middle Channel, 20MHz BW (RB= 100)



LTE Band 2 Conducted RF Emission Test Data cont'd

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

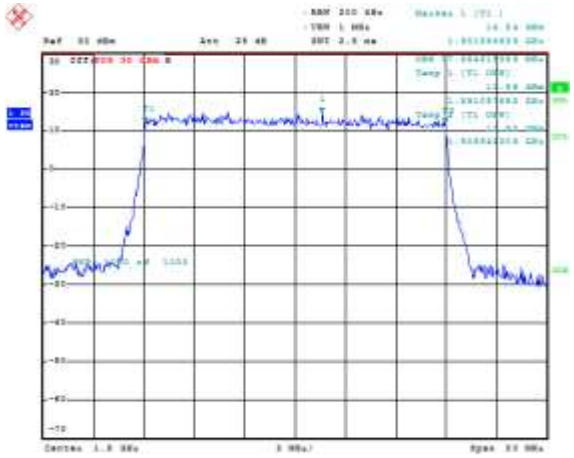


Figure 3-22a: -26 dBc Bandwidth, Band 2 Low Channel, 20MHz BW (RB= 100)

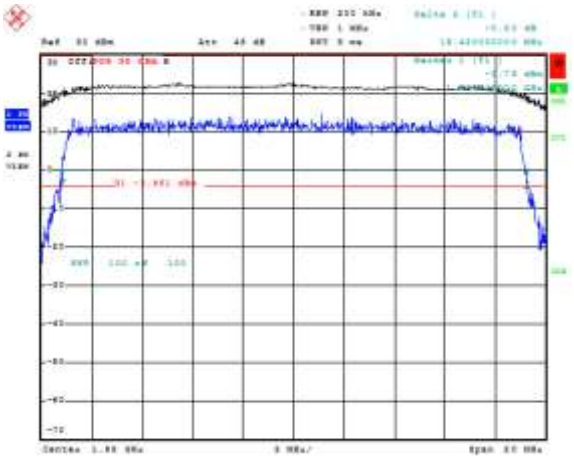


Figure 3-23a: -26 dBc Bandwidth, Band 2 Middle Channel, 20MHz BW (RB= 100)

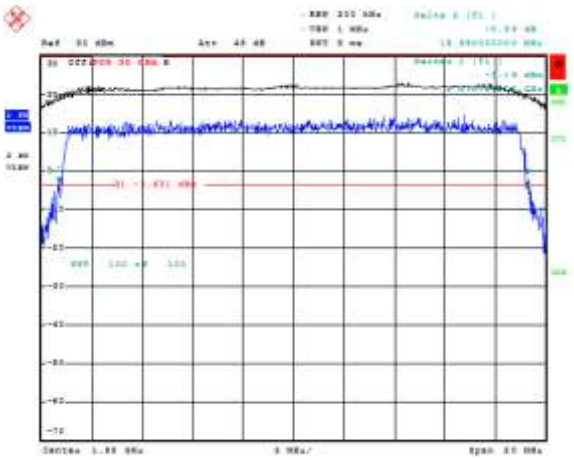
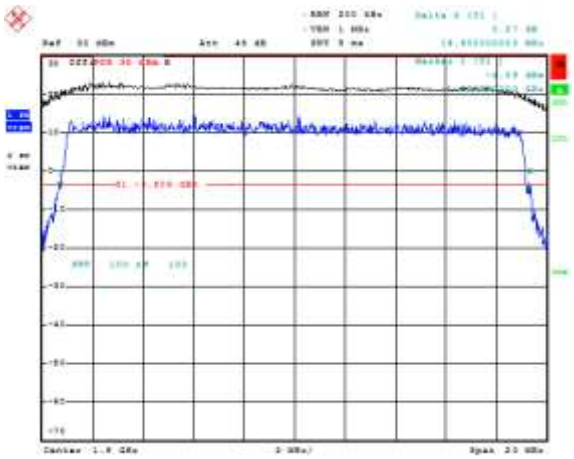


Figure 3-24a: -26 dBc Bandwidth, Band 2 High Channel, 20MHz BW (RB= 100)



LTE Band 2 Conducted RF Emission Test Data cont'd

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

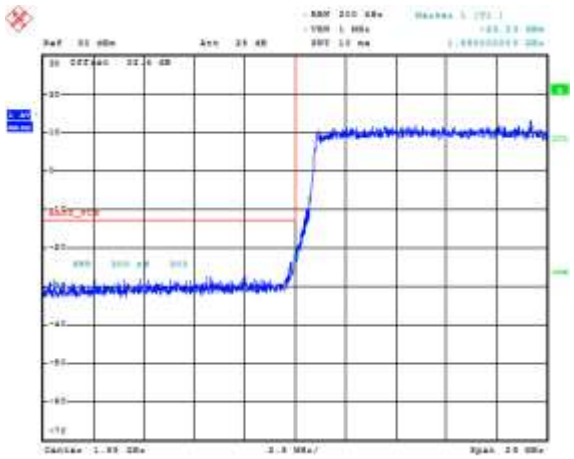


Figure 3-26a: Band 2 High Channel Mask, 20MHz BW, RB = 100

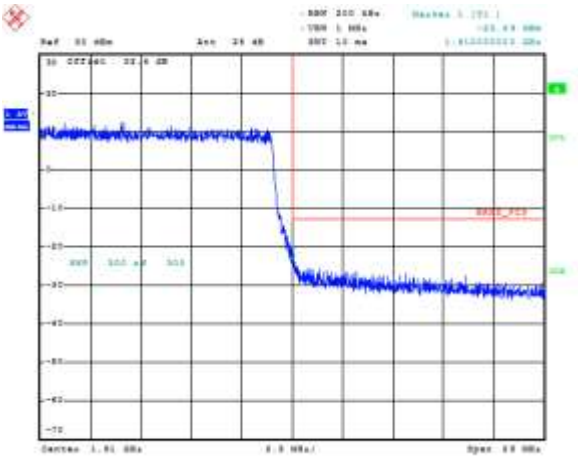


Figure 3-27a: Band 2 Low Channel Mask, 10MHz BW, RB = 50

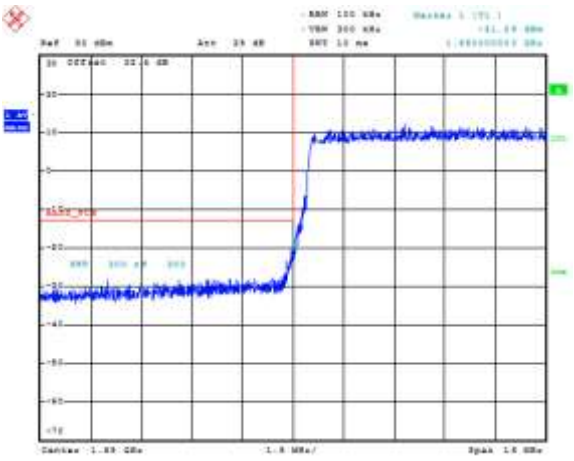
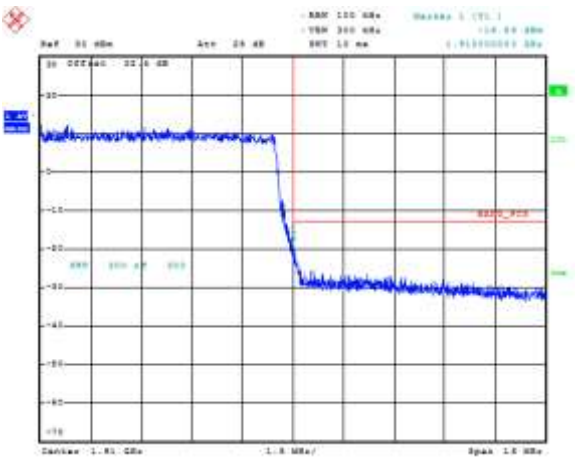


Figure 3-28a: Band 2 High Channel Mask, 10MHz BW, RB = 50



LTE Band 2 Conducted RF Emission Test Data cont'd

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

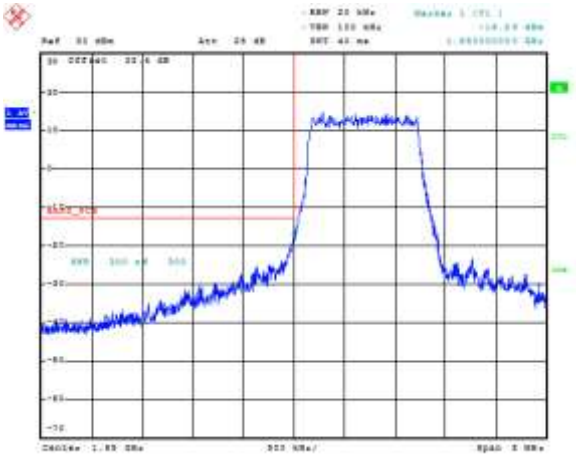


Figure 3-30a: Band 2 High Channel Mask, 1.4MHz BW, RB = 6

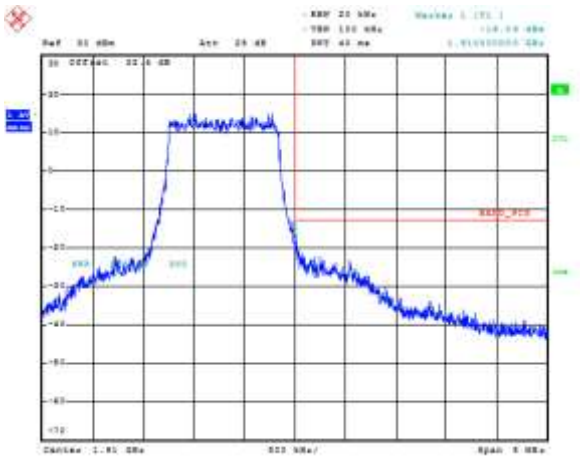


Figure 3-31a: Band 2 Low Channel Mask, 20MHz BW, RB = 1

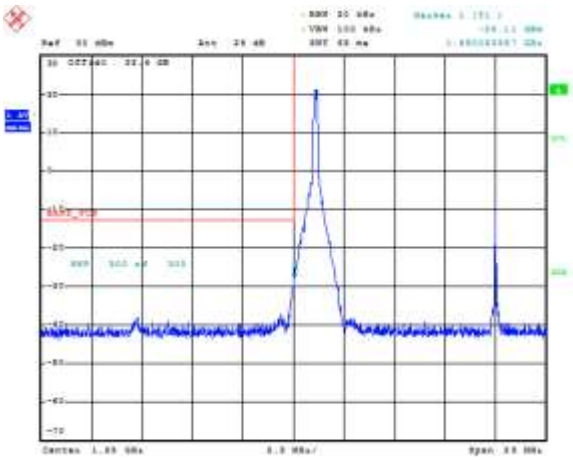
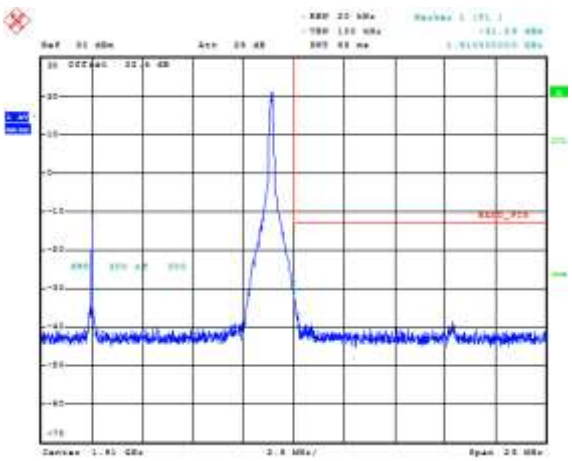


Figure 3-32a: Band 2 High Channel Mask, 20MHz BW, RB = 1



LTE Band 2 Conducted RF Emission Test Data cont'd

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

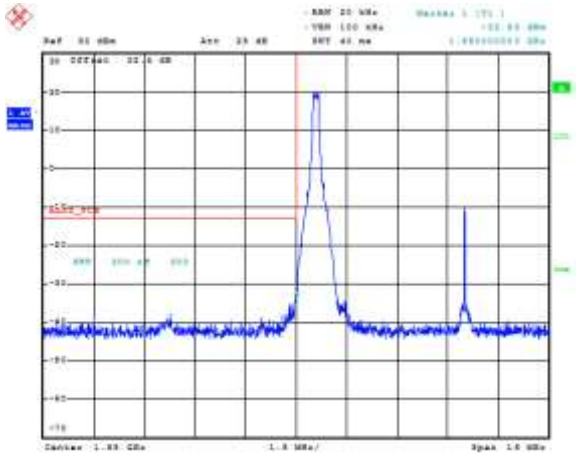


Figure 3-34a: Band 2 High Channel Mask, 10MHz BW, RB = 1

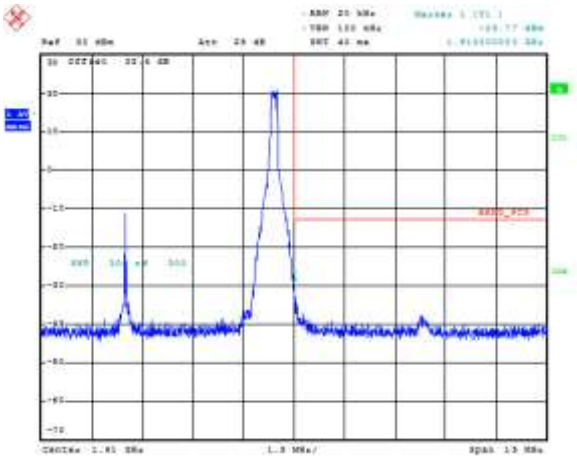


Figure 3-35a: Band 2 Low Channel Mask, 1.4MHz BW, RB = 1

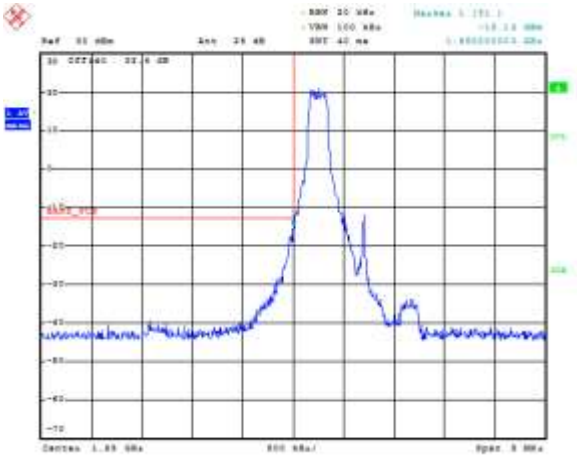
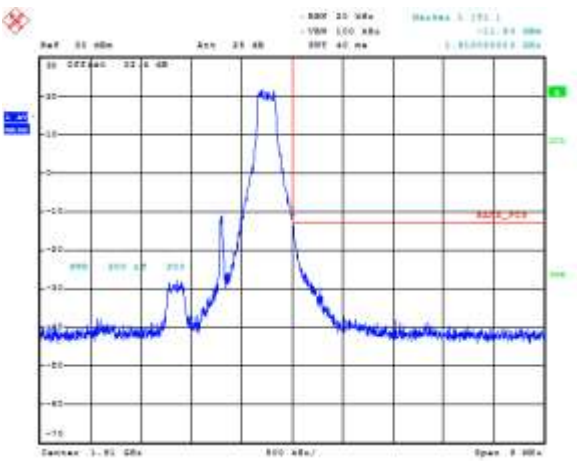


Figure 3-36a: Band 2 High Channel Mask, 1.4MHz BW, RB = 1



LTE Band 2 Conducted RF Emission Test Data cont'd

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

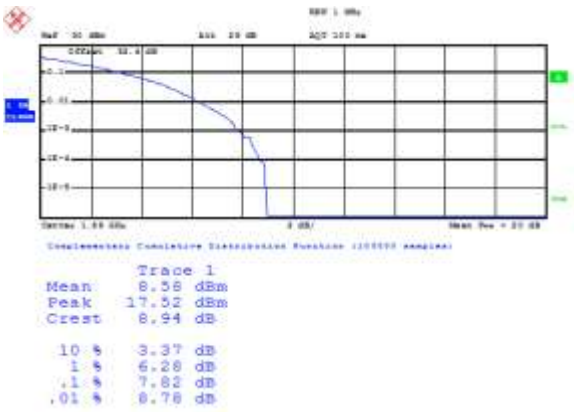


Figure 3-38a: Band 2, Mid Channel PAR, 20 MHz BW, RB = 100 16-QAM

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

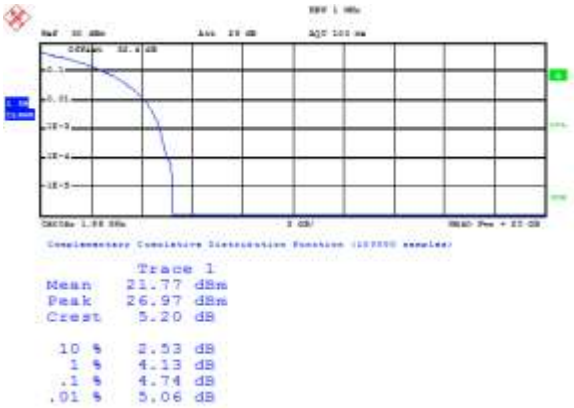
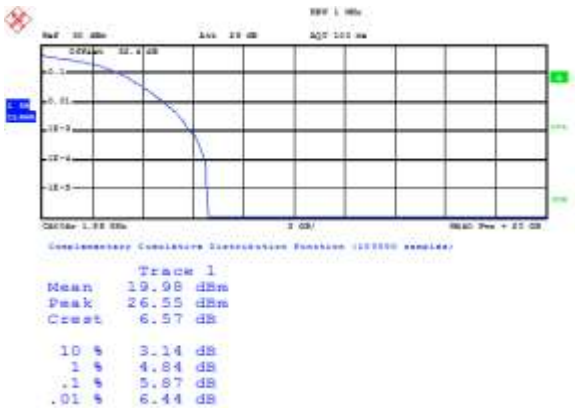


Figure 3-42a: Band 2, Mid Channel PAR, 1.4 MHz BW, RB = 6 16-QAM



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

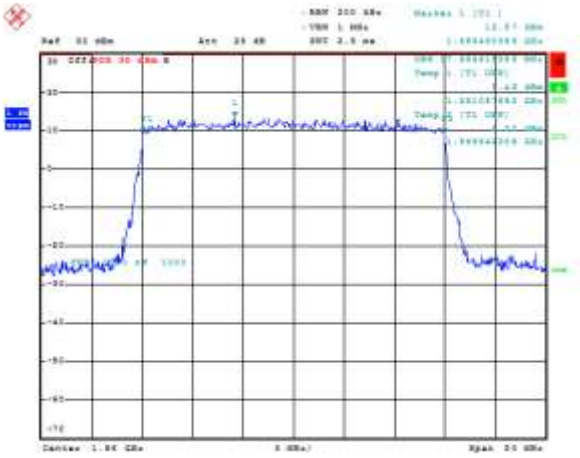


Figure 3-44a: Occupied Bandwidth, Band 2 Mid Channel, 20MHz BW (RB= 100) 16-QAM

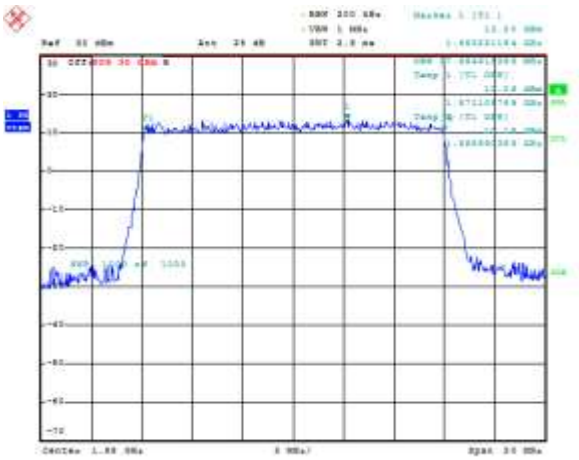
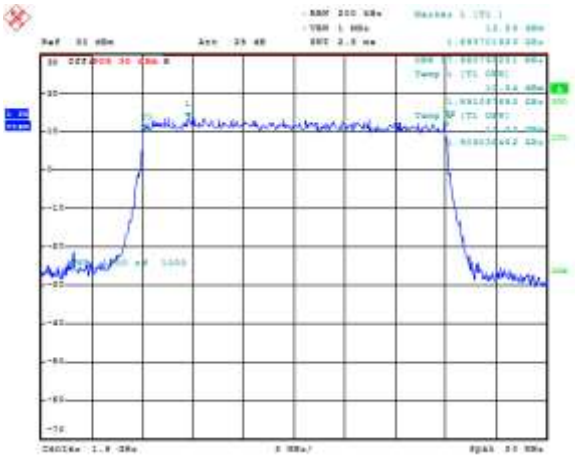
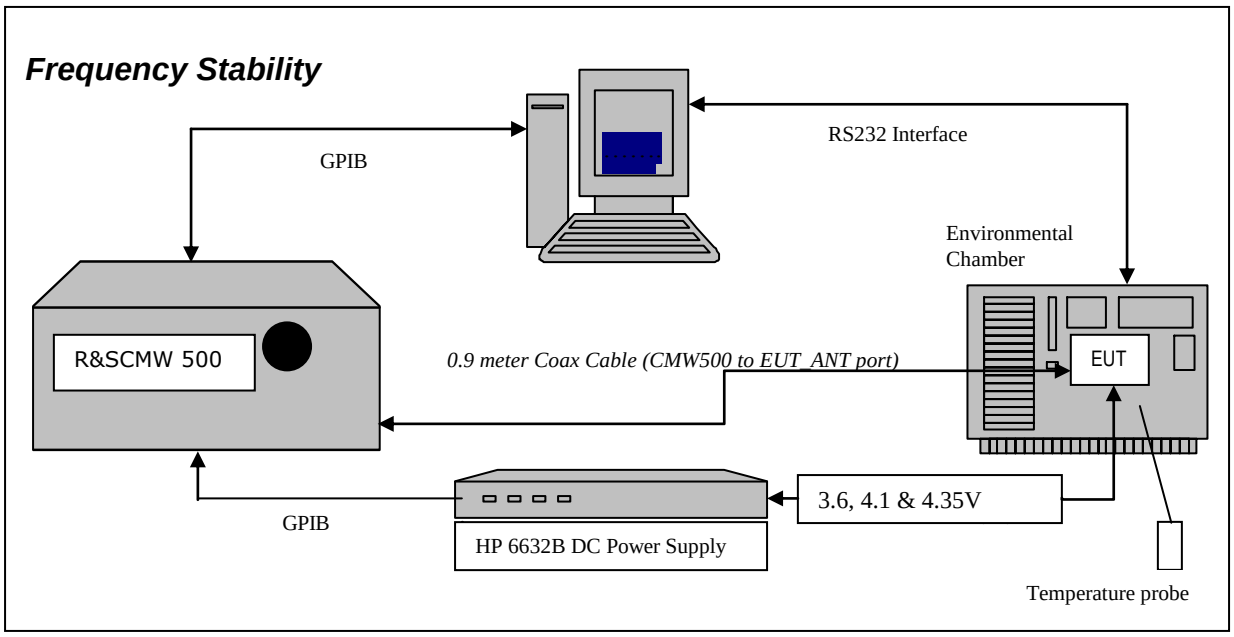


Figure 3-45a: Occupied Bandwidth, Band 2 High Channel, 20MHz BW (RB= 100) 16-QAM



APPENDIX 3B – LTE Band 2 FREQUENCY STABILITY TEST DATA

LTE Frequency Stability Test Data



The following measurements were performed by Sijia Li.

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 **-0.0126 PPM.**

Date of test: Feb 3, 2015

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	8.05	0.0043
18900	1880.0	3.6	20	-20.13	-0.0107
19199	1900.0	3.6	20	-13.05	-0.0069

Traffic Channel Number	LTE Band 2 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
18600	1860.0	4.1	20	10.40	0.0056
18900	1880.0	4.1	20	5.79	0.0031
19199	1900.0	4.1	20	-5.18	-0.0027

Traffic Channel Number	LTE Band 2 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
18600	1860.0	4.35	20	15.52	0.0083
18900	1880.0	4.35	20	9.67	0.0051
19199	1900.0	4.35	20	3.65	0.0019

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	-14.13	-0.0076
18600	1860.0	3.6	-20	-14.62	-0.0079
18600	1860.0	3.6	-10	-9.33	-0.0050
18600	1860.0	3.6	0	5.01	0.0027
18600	1860.0	3.6	10	9.33	0.0050
18600	1860.0	3.6	20	8.05	0.0043
18600	1860.0	3.6	30	13.30	0.0072
18600	1860.0	3.6	40	14.08	0.0076
18600	1860.0	3.6	50	-6.92	-0.0037
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18600	1860.0	4.1	-30	11.36	0.0061
18600	1860.0	4.1	-20	9.11	0.0049
18600	1860.0	4.1	-10	11.83	0.0064
18600	1860.0	4.1	0	-6.64	-0.0036
18600	1860.0	4.1	10	-12.82	-0.0069
18600	1860.0	4.1	20	10.40	0.0056
18600	1860.0	4.1	30	13.22	0.0071
18600	1860.0	4.1	40	11.52	0.0062
18600	1860.0	4.1	50	-12.73	-0.0068
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18600	1860.0	4.35	-30	14.92	0.0080
18600	1860.0	4.35	-20	-13.65	-0.0073
18600	1860.0	4.35	-10	-15.01	-0.0081
18600	1860.0	4.35	0	-12.60	-0.0068
18600	1860.0	4.35	10	-6.47	-0.0035
18600	1860.0	4.35	20	15.52	0.0083
18600	1860.0	4.35	30	-16.35	-0.0088
18600	1860.0	4.35	40	-15.16	-0.0082
18600	1860.0	4.35	50	12.83	0.0069

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	-20.66	-0.0110
18900	1880.00	3.6	-20	-22.19	-0.0118
18900	1880.00	3.6	-10	-15.64	-0.0083
18900	1880.00	3.6	0	9.60	0.0051
18900	1880.00	3.6	10	-20.16	-0.0107
18900	1880.00	3.6	20	-20.13	-0.0107
18900	1880.00	3.6	30	4.62	0.0025
18900	1880.00	3.6	40	-12.57	-0.0067
18900	1880.00	3.6	50	-23.07	-0.0123
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18900	1880.00	4.1	-30	-17.50	-0.0093
18900	1880.00	4.1	-20	-18.32	-0.0097
18900	1880.00	4.1	-10	-21.86	-0.0116
18900	1880.00	4.1	0	-3.86	-0.0021
18900	1880.00	4.1	10	8.61	0.0046
18900	1880.00	4.1	20	5.79	0.0031
18900	1880.00	4.1	30	-15.32	-0.0081
18900	1880.00	4.1	40	-23.65	**-0.0126**
18900	1880.00	4.1	50	-7.17	-0.0038
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
18900	1880.00	4.35	-30	-21.17	-0.0113
18900	1880.00	4.35	-20	6.84	0.0036
18900	1880.00	4.35	-10	-13.23	-0.0070
18900	1880.00	4.35	0	-10.37	-0.0055
18900	1880.00	4.35	10	-21.89	-0.0116
18900	1880.00	4.35	20	9.67	0.0051
18900	1880.00	4.35	30	-14.09	-0.0075
18900	1880.00	4.35	40	-20.61	-0.0110
18900	1880.00	4.35	50	-18.48	-0.0098

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	-15.44	-0.0081
19199	1900.0	4.1	-20	5.97	0.0031
19199	1900.0	4.1	-10	12.93	0.0068
19199	1900.0	4.1	0	-19.78	-0.0104
19199	1900.0	4.1	10	12.25	0.0064
19199	1900.0	4.1	20	-13.05	-0.0069
19199	1900.0	4.1	30	-12.95	-0.0068
19199	1900.0	4.1	40	-6.85	-0.0036
19199	1900.0	4.1	50	-13.49	-0.0071
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
19199	1900.0	4.35	-30	-15.91	-0.0084
19199	1900.0	4.35	-20	-5.66	-0.0030
19199	1900.0	4.35	-10	11.07	0.0058
19199	1900.0	4.35	0	5.48	0.0029
19199	1900.0	4.35	10	-12.16	-0.0064
19199	1900.0	4.35	20	-5.18	-0.0027
19199	1900.0	4.35	30	-7.67	-0.0040
19199	1900.0	4.35	40	8.44	0.0044
19199	1900.0	4.35	50	5.16	0.0027

APPENDIX 3C – LTE Band 2 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following measurements were performed by Shiva Kumbham.
Date of Test: February 23, 2015
The environmental tests conditions were: Temperature: 26.4 °C
Relative Humidity: 2.5 %
The BlackBerry® smartphone was standalone, horizontal down with top of device facing the RX antenna when the turntable is at 0 degree position.
Measurements were performed with QPSK and 16QAM modulations. The smallest test margins are reported below.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

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

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18700	1860.00	2	Horn	V	-27.77	-26.83	V-V	-15.59	24.69	0.29	33.00	8.31
F0	18700	1860.00	2	Horn	H	-26.83		H-H	-14.81				
F0	18900	1880.00	2	Horn	V	-27.03	-26.63	V-V	-14.96	**25.52**	0.36	33.00	7.48
F0	18900	1880.00	2	Horn	H	-26.63		H-H	-13.88				
F0	19099	1899.90	2	Horn	V	-28.10	-27.36	V-V	-15.34	24.66	0.29	33.00	8.34
F0	19099	1899.90	2	Horn	H	-27.36		H-H	-14.88				

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

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (dBm)	Corrected Reading (W)	Limit (dBm)	Diff to Limit (dB)
F0	18700	1860.00	2	Horn	V	-28.65	-27.64	V-V	-16.38	23.85	0.24	33.00	9.15
F0	18700	1860.00	2	Horn	H	-27.64		H-H	-15.65				
F0	18900	1880.00	2	Horn	V	-28.11	-27.12	V-V	-15.44	**25.01**	0.32	33.00	7.99
F0	18900	1880.00	2	Horn	H	-27.12		H-H	-14.39				
F0	19099	1899.90	2	Horn	V	-29.11	-28.33	V-V	-16.33	23.65	0.23	33.00	9.35
F0	19099	1899.90	2	Horn	H	-28.33		H-H	-15.89				

Radiated Emissions Test Data Results

The following measurements were performed by Savtej Sandhu.

Date of Test: February 11, 2015

The environmental test conditions were: Temperature: 25.0 ºC
Relative Humidity: 8.8 %

The BlackBerry® smartphone was standalone, horizontal down with top of device 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 20MHz BW (channel18700, 18900, 19099 with RB = 1)

All emissions were at least 25 dB below the limit.

The following measurements were performed by Winston Vernon.

Date of Test: February 11 and 20, 2015

The environmental test conditions were: Temperature: 24.7 - 24.9 ºC
Relative Humidity: 14.3 – 18.6 %

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 20 GHz.

The BlackBerry® smartphone was standalone, with side button 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 20MHz BW (channel18700, 18900, 19099 with RB = 1)

Frequency (MHz)	Channel Of Occurrence	Antenna Pol. (V/H)	Antenna Height (meters)	Test Angle (Deg.)	Detector (PK or QP)	Measured Level (dBµV)	Correction Factor for preamp/antenna/ cables/ filter (dB)	Field Strength Level (reading+corr) (dBm)	Limit @ 3.0 m (dBm)	Test Margin (dB)
3799.764	19099	H	2.26	174	PK	47.745	-82.6232	-34.878	-13.00	**21.9**

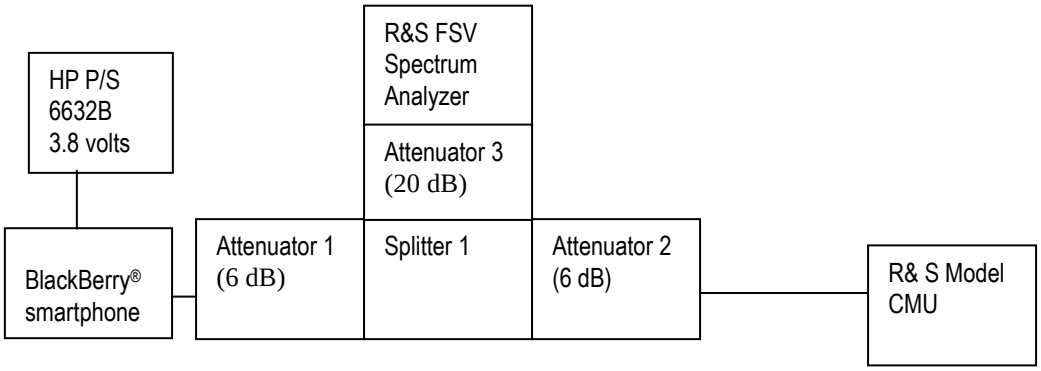
All other emissions were at least 25 dB below the limit.

APPENDIX 4A– 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: Feb 17, 2015

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

The following measurements were performed by Sijia Li.

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 18.70 MHz. Results were derived in a 200 kHz resolution bandwidth.

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

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

LTE Band 4 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	
	QPSK	QPSK	16-QAM
1720.0	18.60	17.88	17.88
1732.5	18.70	**17.93**	**17.93**
1745.0	18.52	17.84	17.88

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 measured was 11.32 dB in 10MHz bandwidth with 50 RBs.

Measurement Plots for LTE Band 4

See Figures 4-1a to 4-18a for the plots of the conducted spurious emissions.
See Figures 4-19a to 4-34a and 4-51a to 4-53a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.
See Figures 4-35a to 4-44a for the plots of the Channel mask.
See Figures 4-45a to 4-50a for the plots of the Peak to Average Ratios.

LTE Band 4 Conducted RF Emission Test Data cont'd

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

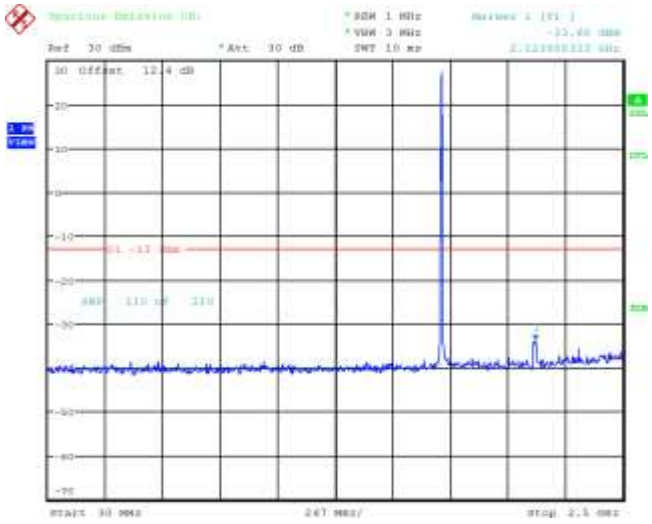


Figure 4-2a: Band 4, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

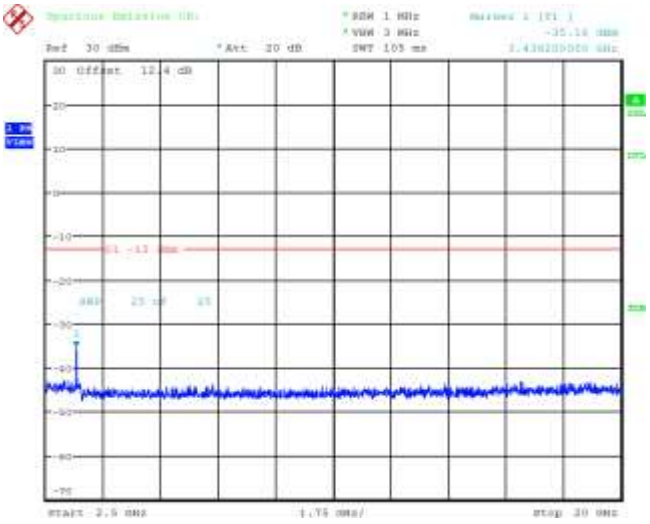


Figure 4-3a: Band 4, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)

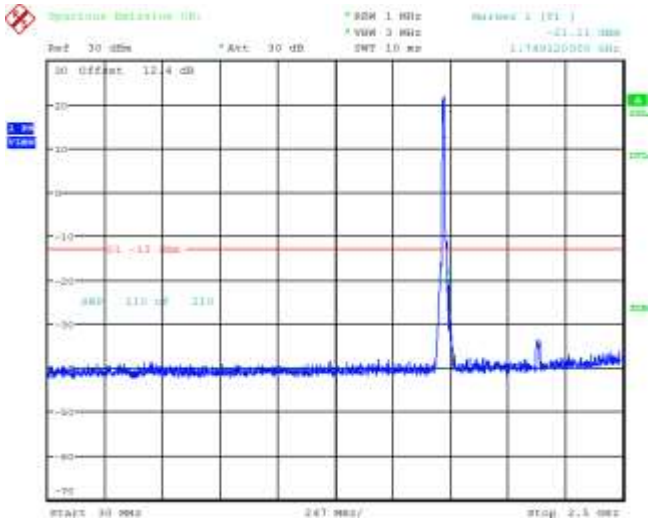
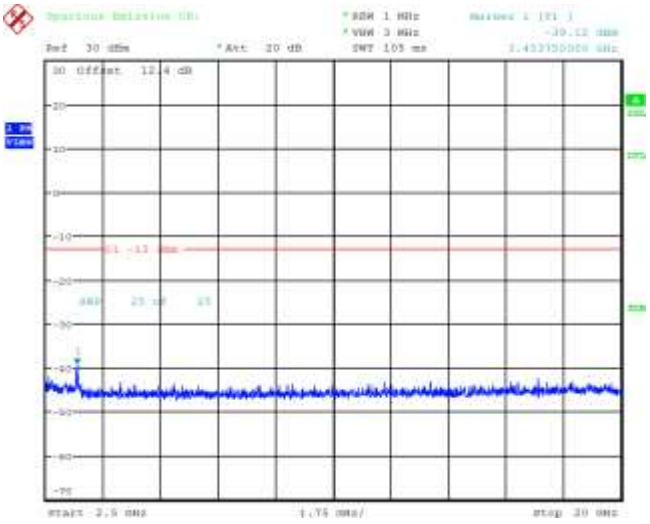


Figure 4-4a: Band 4, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)



LTE Band 4 Conducted RF Emission Test Data cont'd

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

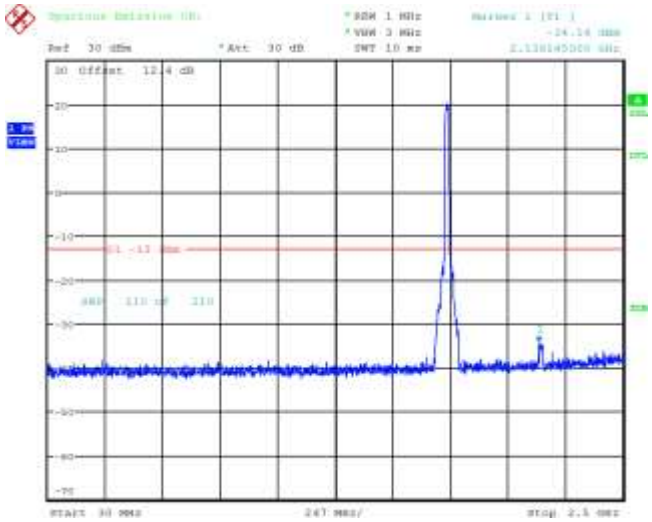


Figure 4-6a: Band 4, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

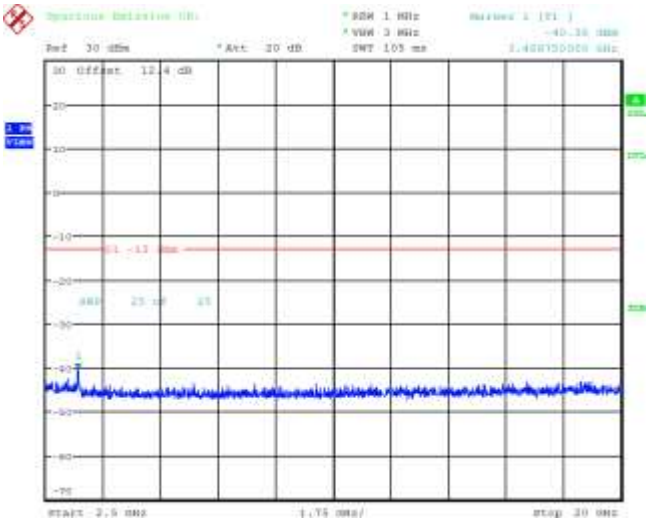


Figure 4-7a: Band 4, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

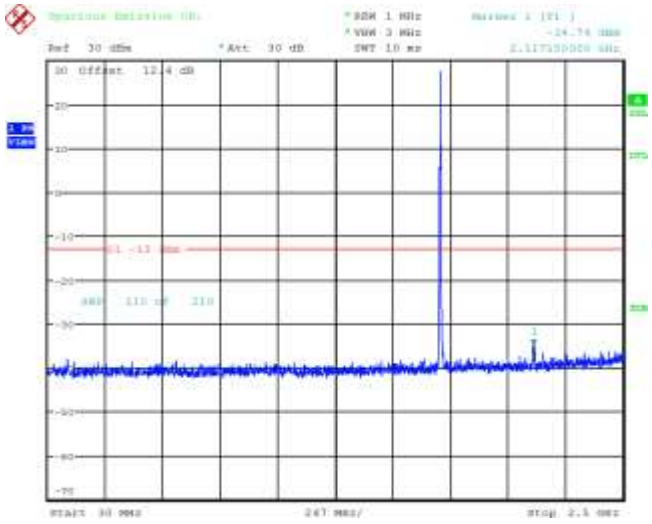
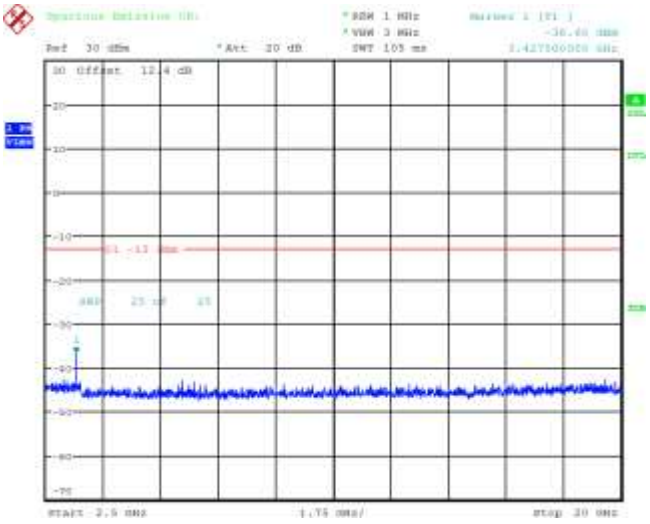


Figure 4-8a: Band 4, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)



LTE Band 4 Conducted RF Emission Test Data cont'd

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

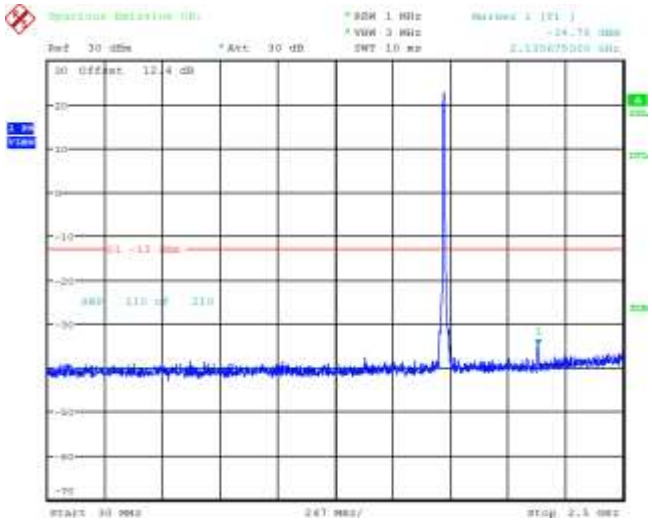


Figure 4-10a: Band 4, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 25)

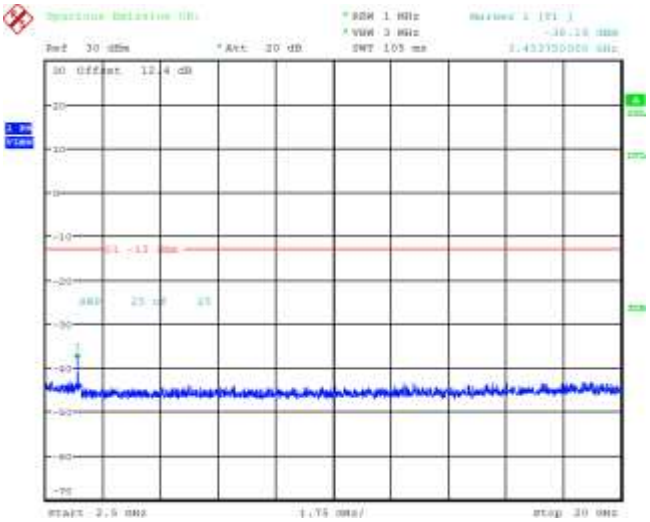


Figure 4-11a: Band 4, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)

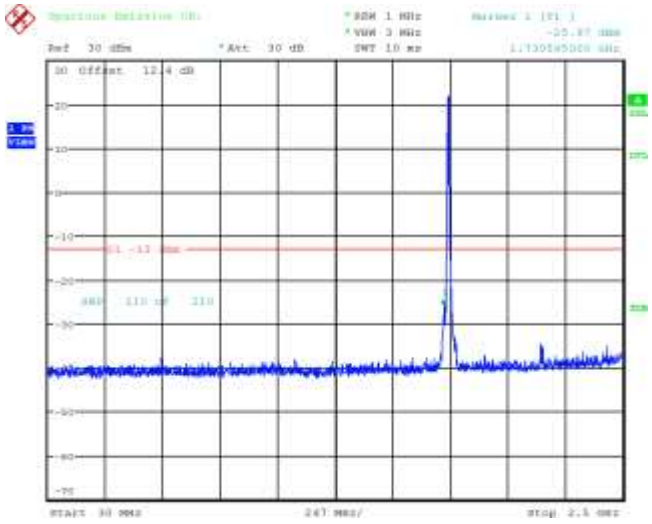
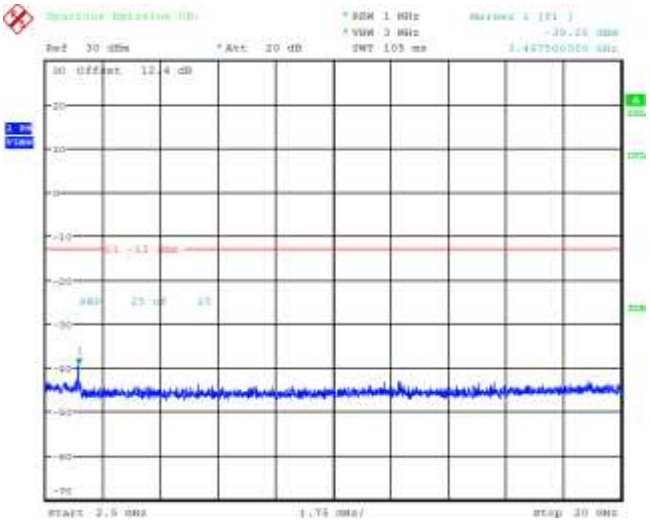


Figure 4-12a: Band 4, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)



LTE Band 4 Conducted RF Emission Test Data cont'd

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

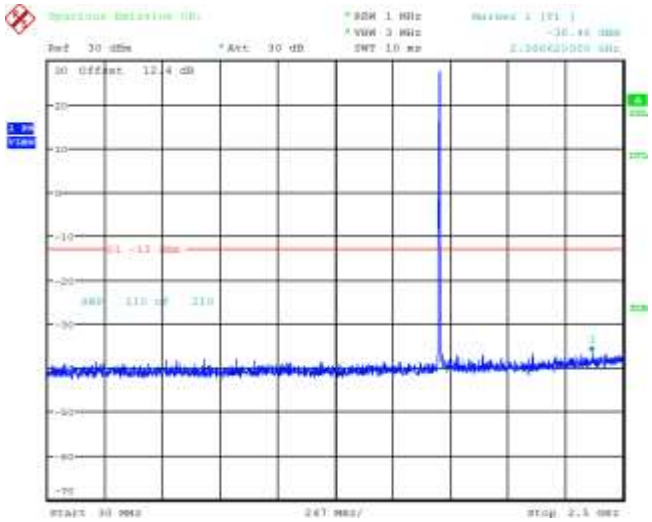


Figure 4-14a: Band 4, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)

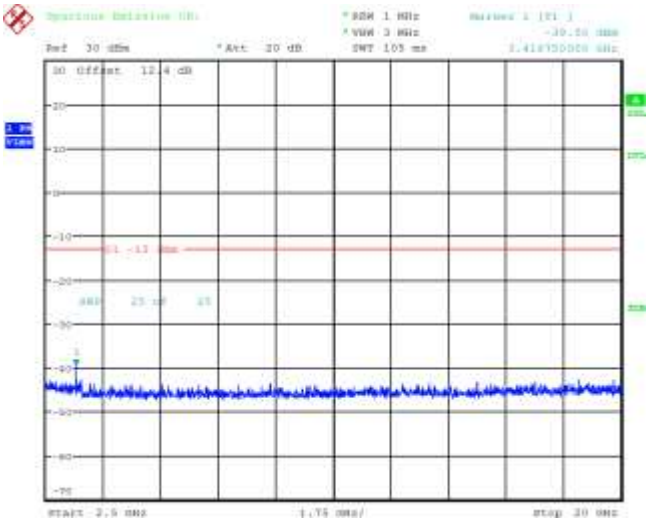


Figure 4-15a: Band 4, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)

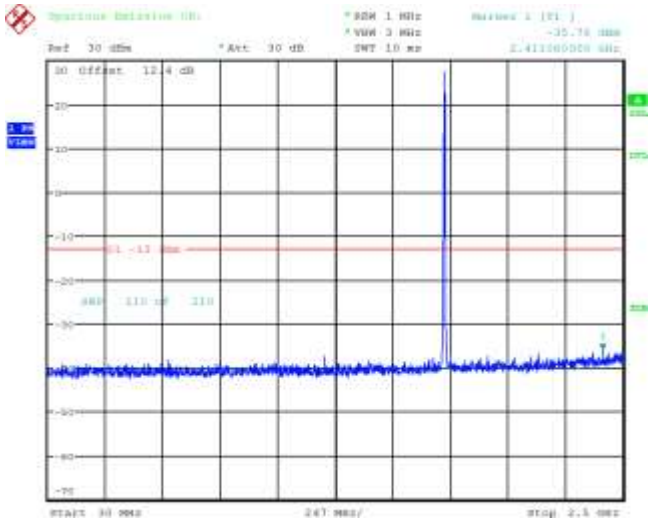
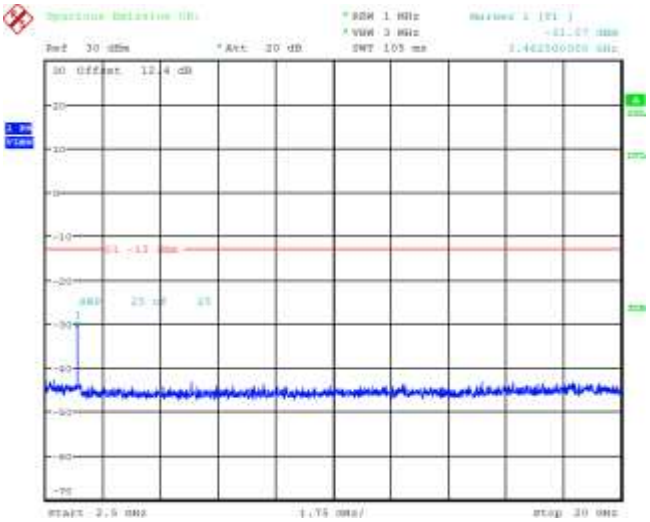


Figure 4-16a: Band 4, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)



LTE Band 4 Conducted RF Emission Test Data cont'd

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

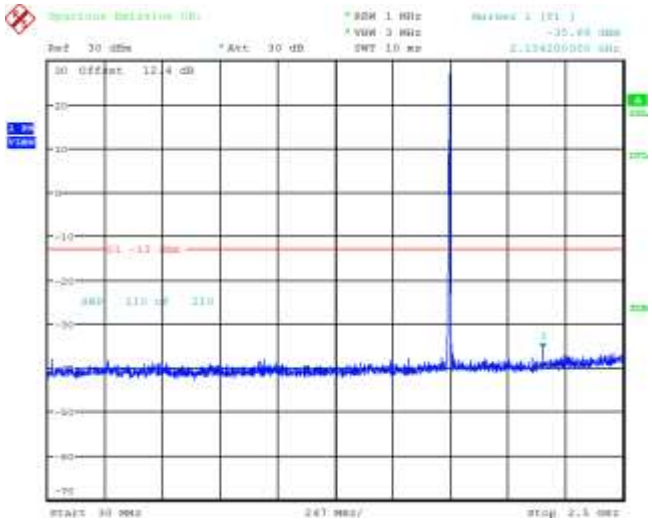
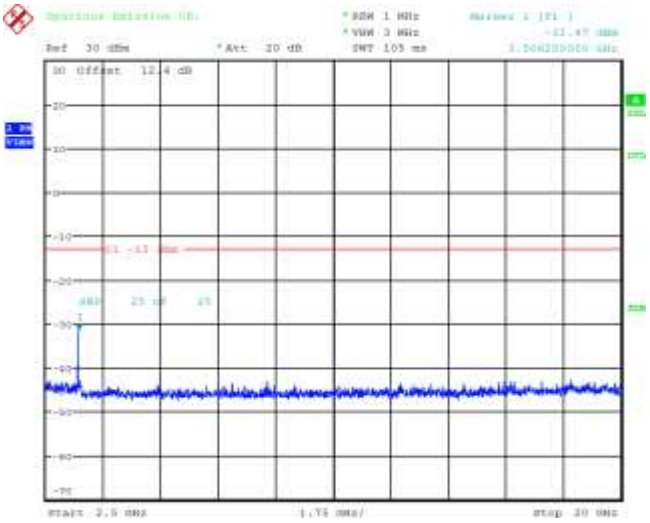


Figure 4-18a: Band 4, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)



LTE Band 4 Conducted RF Emission Test Data cont'd

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

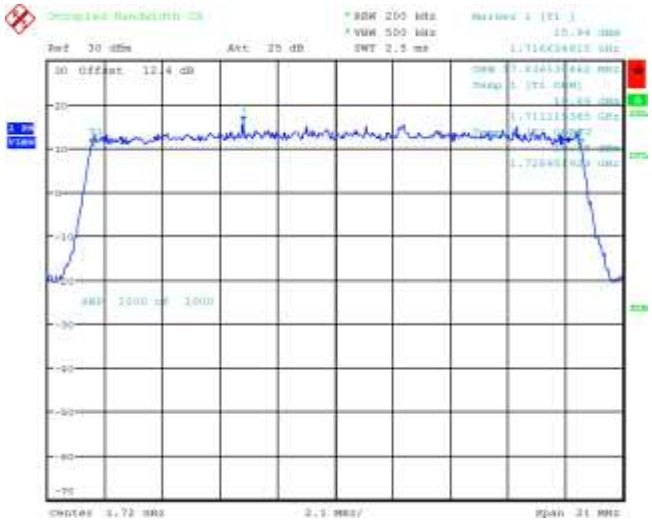


Figure 4-20a: Occupied Bandwidth, Band 4 Middle Channel, 20MHz BW, RB=100

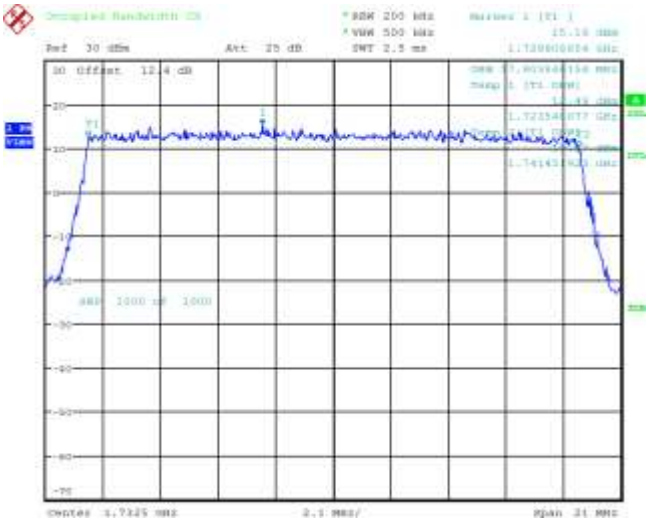
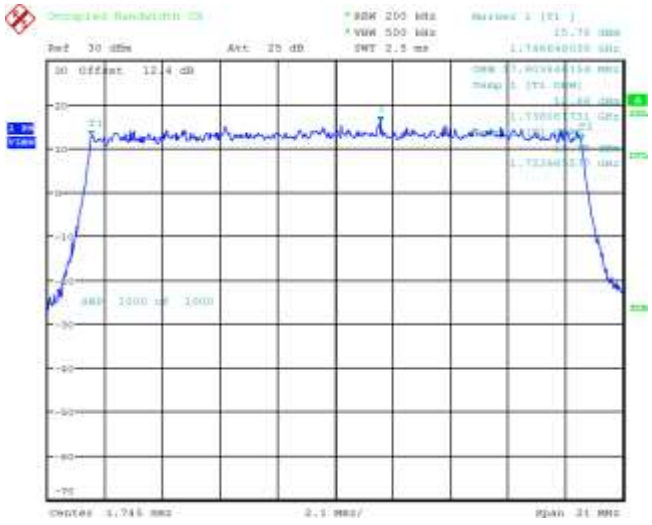


Figure 4-21a: Occupied Bandwidth, Band 4 High Channel, 20MHz BW, RB=100



LTE Band 4 Conducted RF Emission Test Data cont'd

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

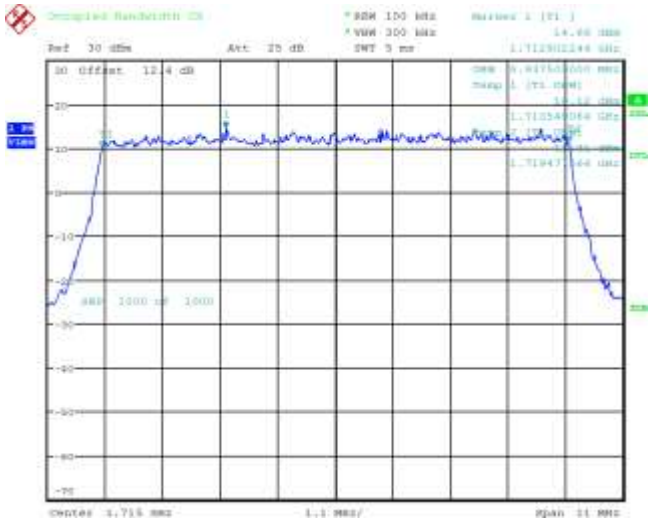


Figure 4-23a: Occupied Bandwidth, Band Middle Channel, 10MHz BW, RB=50

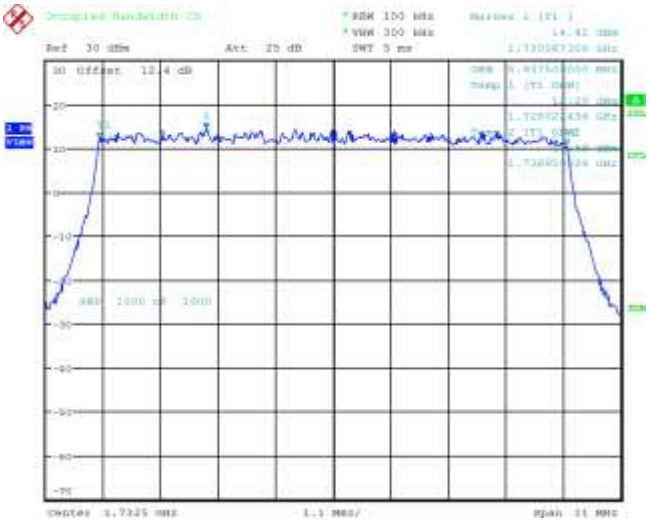
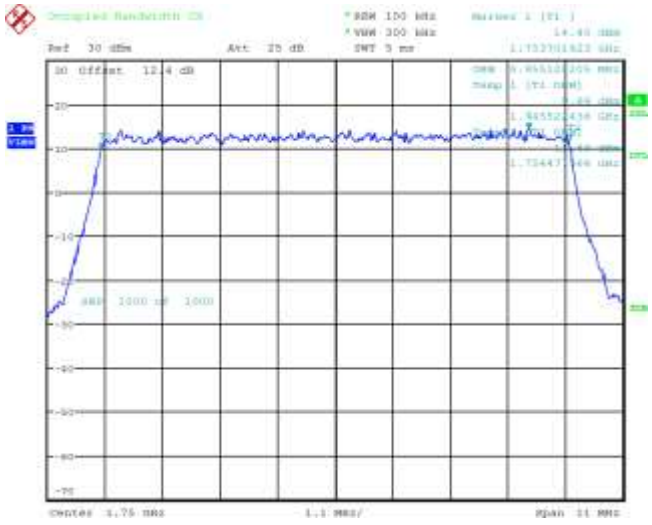


Figure 4-24a: Occupied Bandwidth, Band 4 High Channel, 10MHz BW, RB=50



LTE Band 4 Conducted RF Emission Test Data cont'd

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

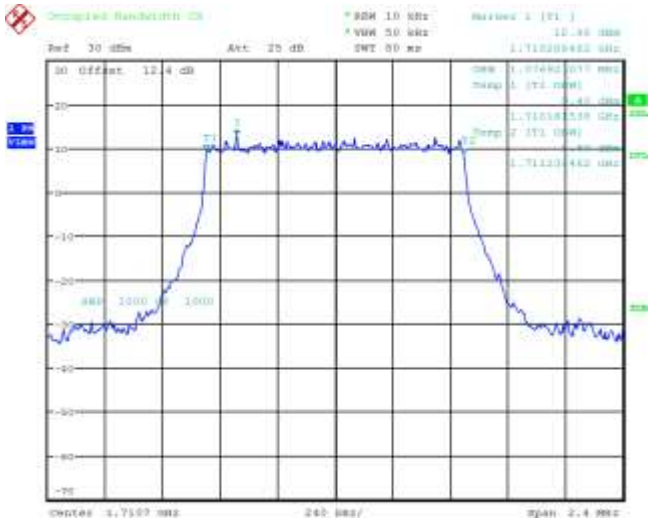


Figure 4-26a: Occupied Bandwidth, Band 4 Middle Channel, 1.4MHz BW, RB=6

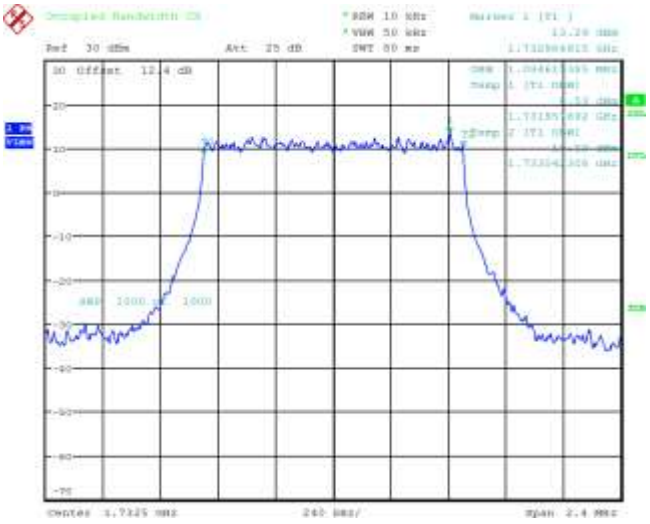
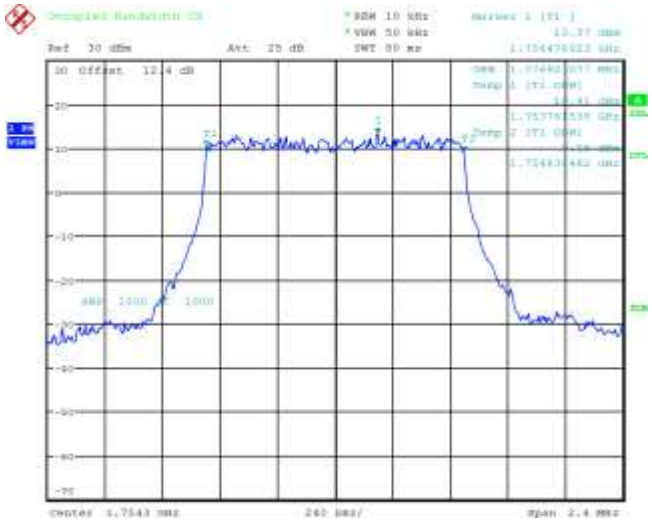


Figure 4-27a: Occupied Bandwidth, Band 4 High Channel, 1.4MHz BW, RB=6



LTE Band 4 Conducted RF Emission Test Data cont'd

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

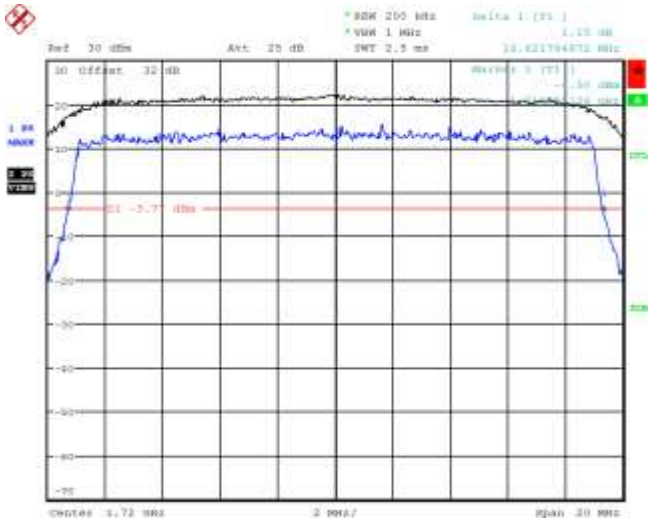


Figure 4-29a: -26 dBc Bandwidth, Band 4 Middle Channel, 20MHz BW, RB=100

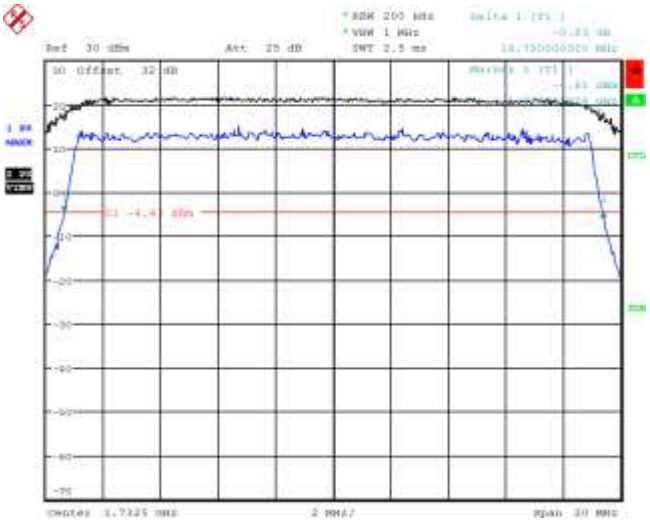


Figure 4-30a: -26 dBc Bandwidth, Band 4 High Channel, 20MHz BW, RB=100

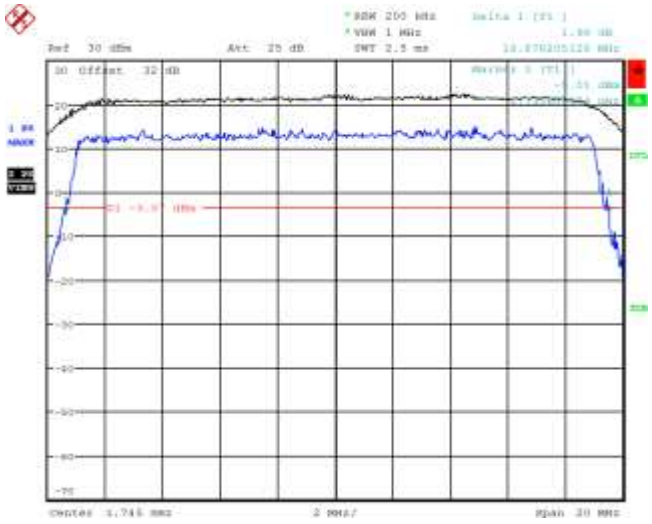
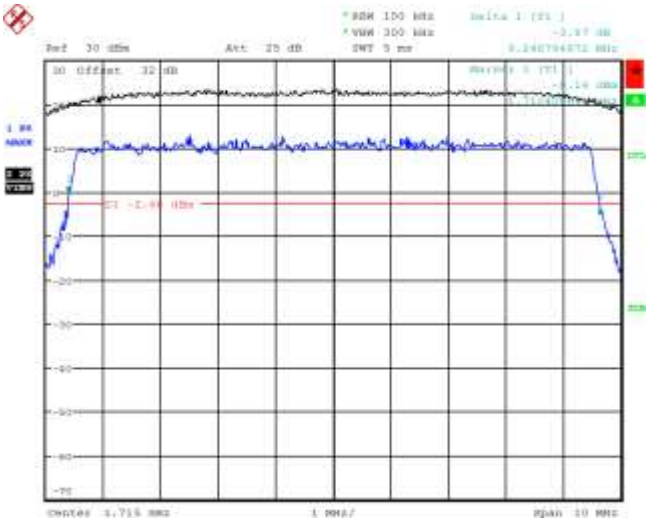


Figure 4-31a: -26 dBc Bandwidth, Band 4 Low Channel, 10MHz BW, RB=50



LTE Band 4 Conducted RF Emission Test Data cont'd

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

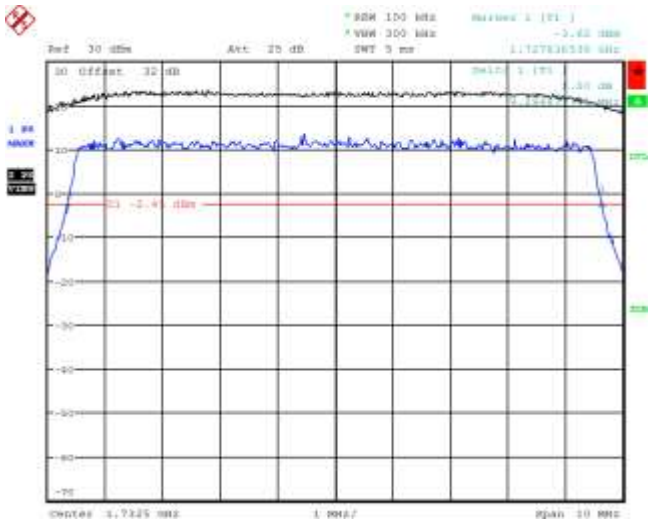


Figure 4-33a: -26 dBc Bandwidth, Band 4 High Channel, 10MHz BW, RB=50

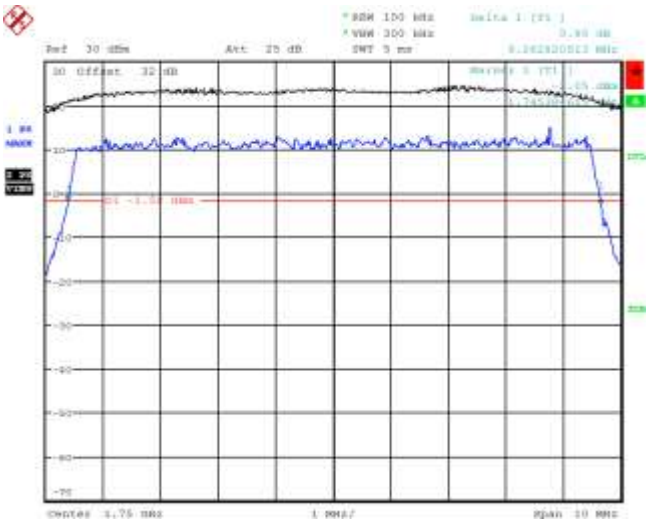


Figure 4-34a: -26 dBc Bandwidth, Band 4 Low Channel, 1.4MHz BW, RB=6

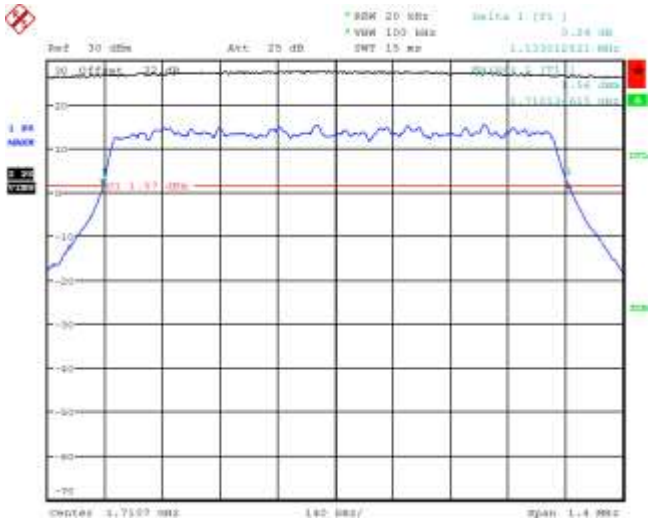
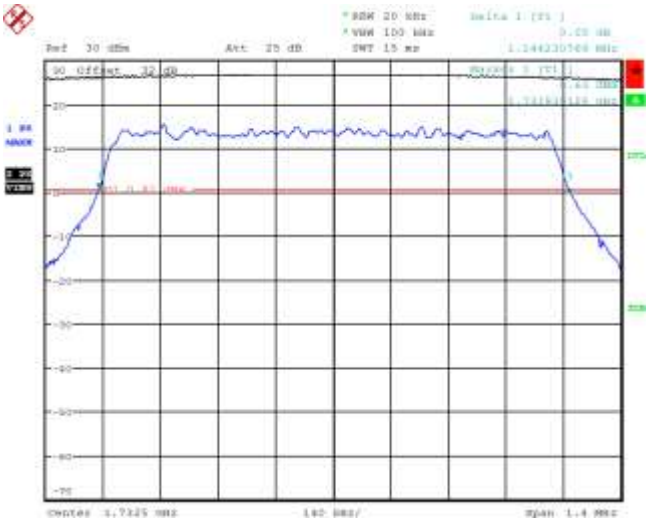


Figure 4-35a: -26 dBc Bandwidth, Band 4 Middle Channel, 1.4MHz BW, RB=6



LTE Band 4 Conducted RF Emission Test Data cont'd

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

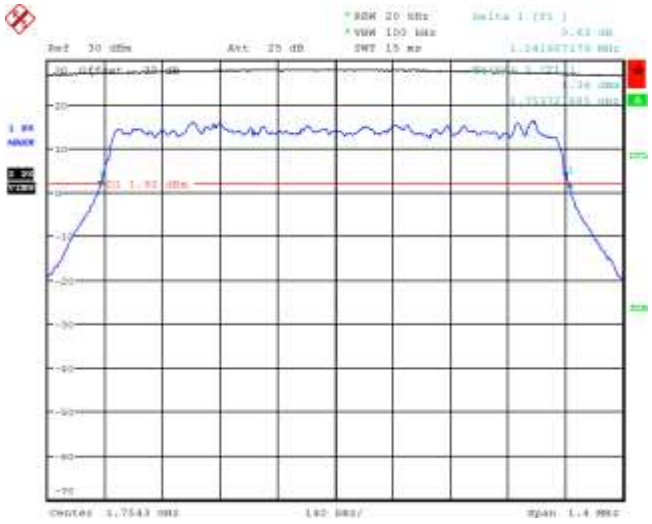


Figure 4-37a: Band 4 Low Channel Mask, 20MHz BW, RB=100

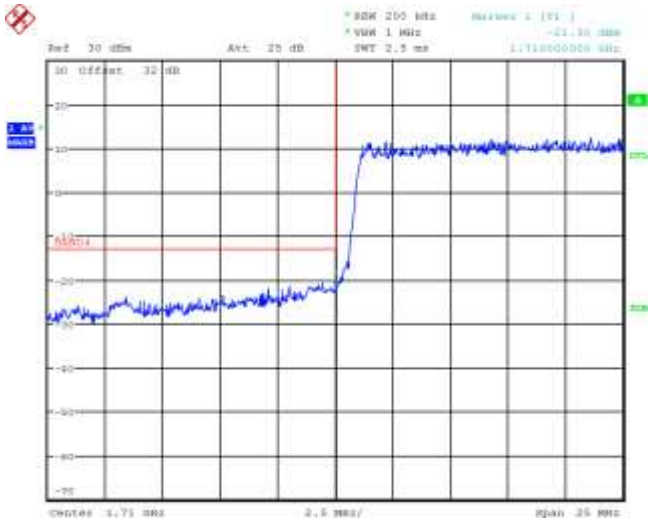
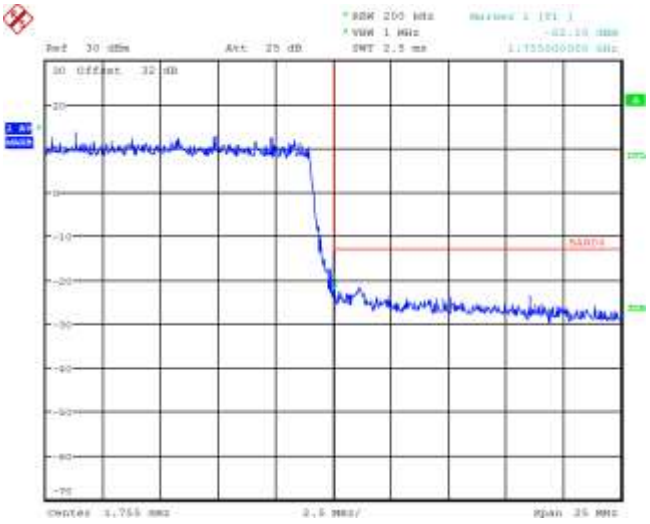


Figure 4-38a: Band 4 High Channel Mask, 20MHz BW, RB=100



LTE Band 4 Conducted RF Emission Test Data cont'd

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

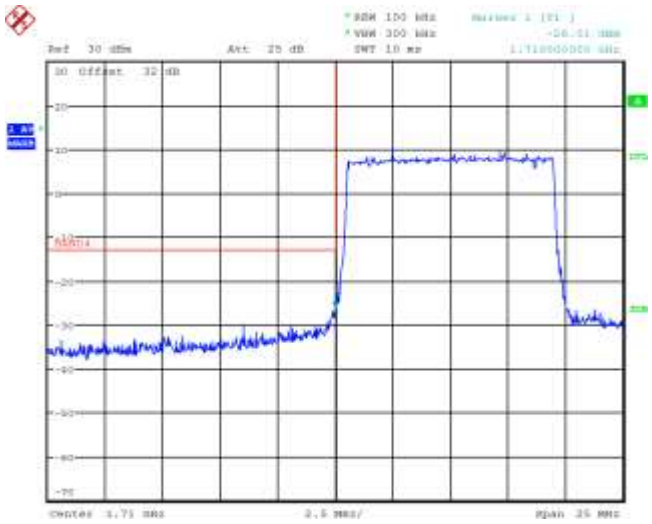


Figure 4-40a: Band 4 High Channel Mask, 10MHz BW, RB=50

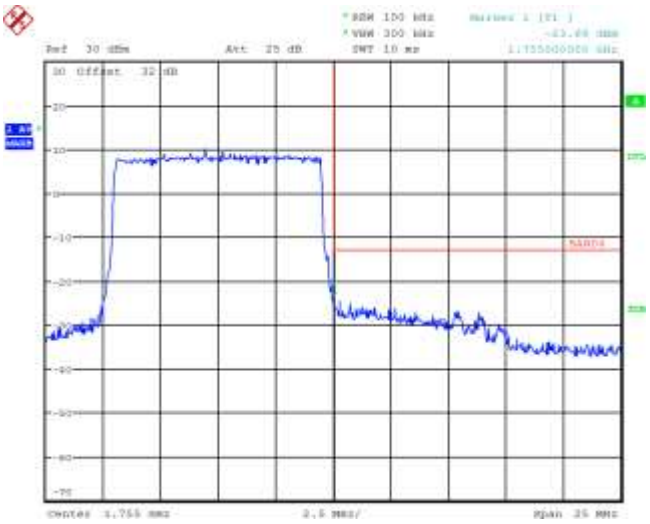


Figure 4-41a: Band 4 Low Channel Mask, 1.4MHz BW, RB=6

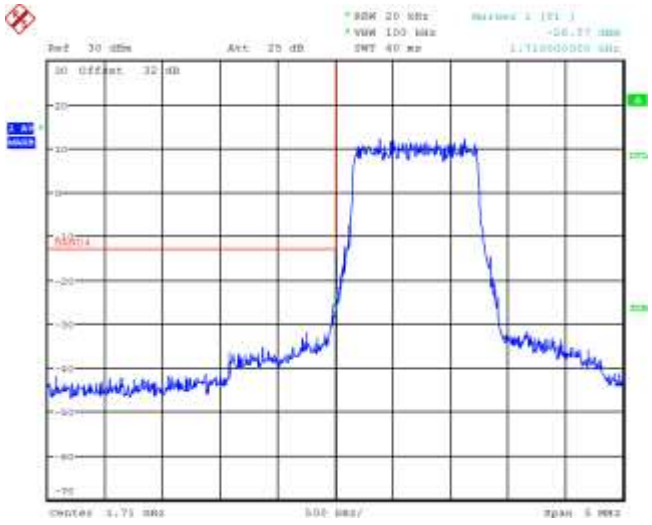
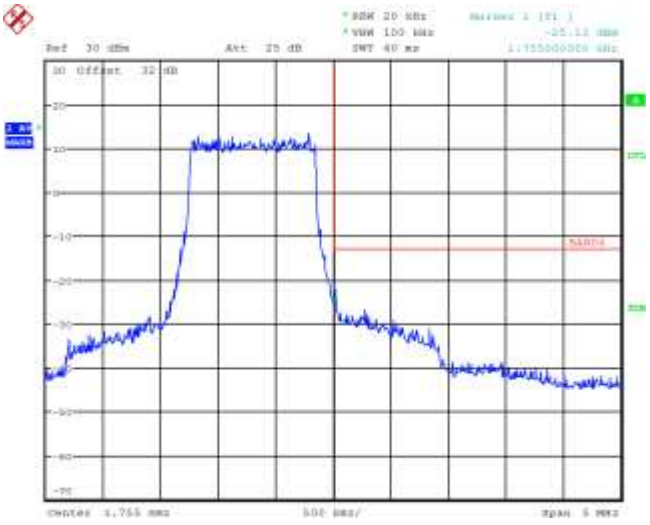


Figure 4-42a: Band 4 High Channel Mask, 1.4MHz BW, RB=6



LTE Band 4 Conducted RF Emission Test Data cont'd

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

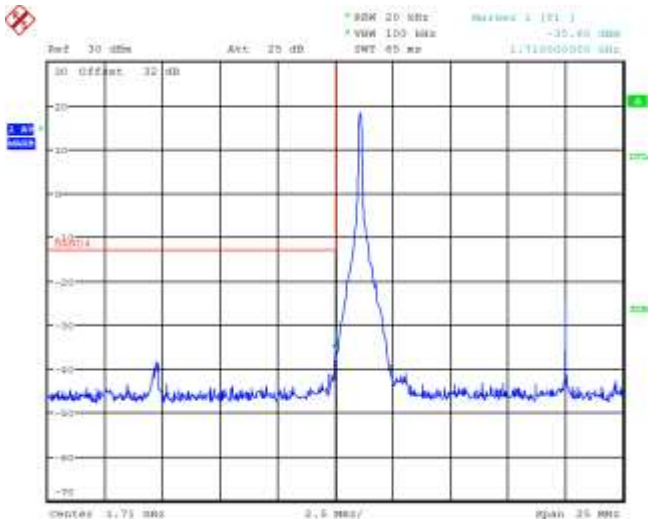


Figure 4-44a: Band 4 High Channel Mask, 20MHz BW, RB=1

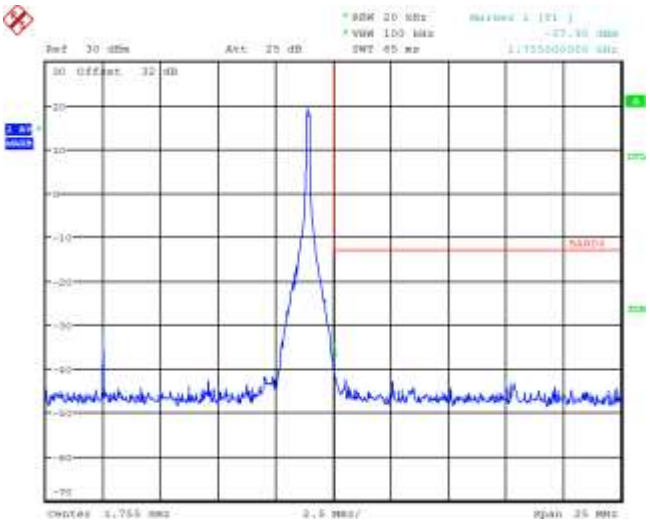


Figure 4-45a: Band 4 Mid Channel PAR, 20MHz BW, RB=50, QPSK

Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	8.36 dBm
Peak	18.08 dBm
Crest	9.72 dB
10 %	3.33 dB
1 %	6.31 dB
.1 %	7.85 dB
.01 %	9.52 dB

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

Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	7.77 dBm
Peak	17.10 dBm
Crest	9.33 dB
10 %	3.40 dB
1 %	6.57 dB
.1 %	8.53 dB
.01 %	9.13 dB

LTE Band 4 Conducted RF Emission Test Data cont'd

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

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

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

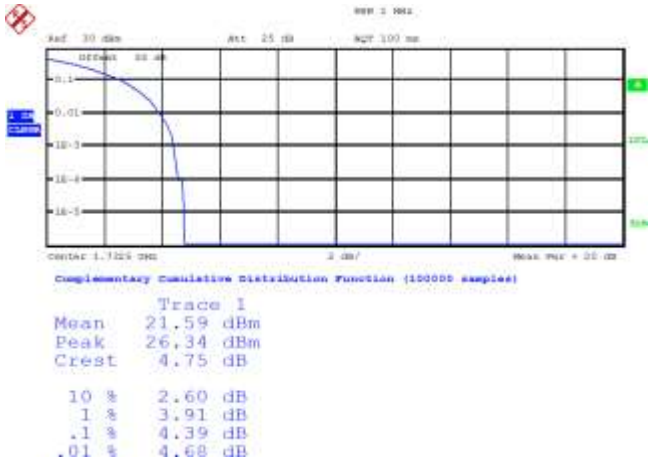
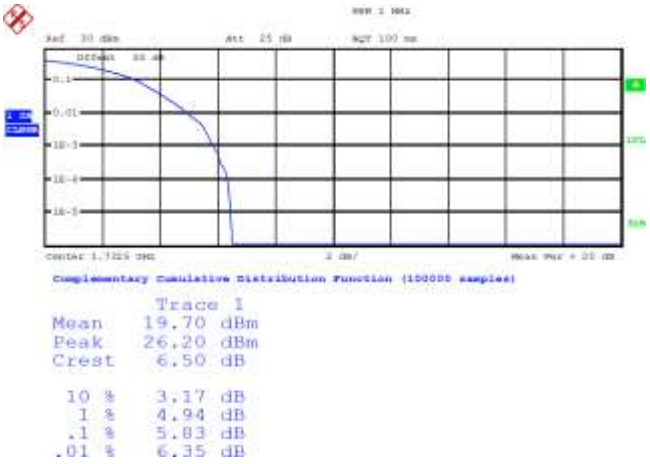


Figure 4-50a: Band 4 Middle Channel Mask, 5MHz BW, RB=6, 16-QAM



LTE Band 4 Conducted RF Emission Test Data cont'd

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

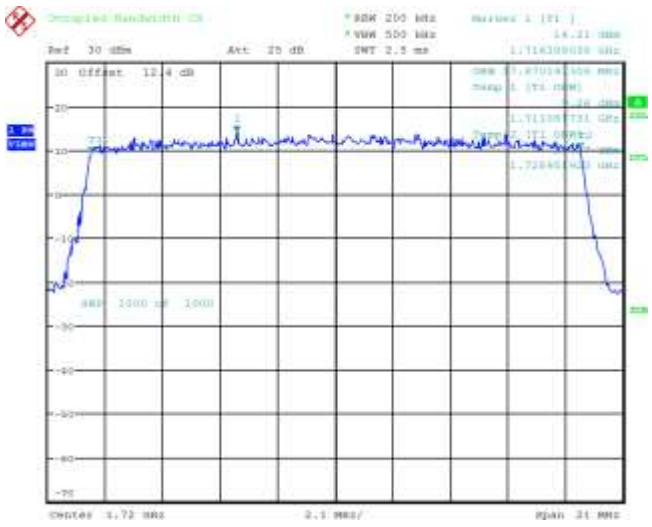


Figure 4-52a: Occupied Bandwidth, Band 4 Mid Channel, 20MHz BW (RB= 100) 16-QAM

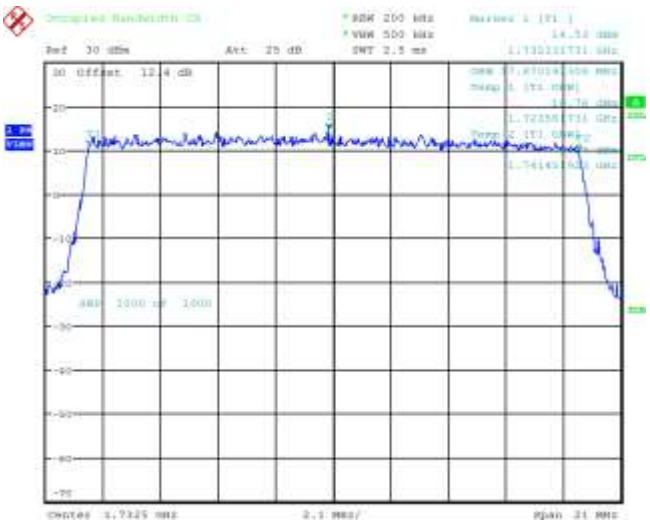
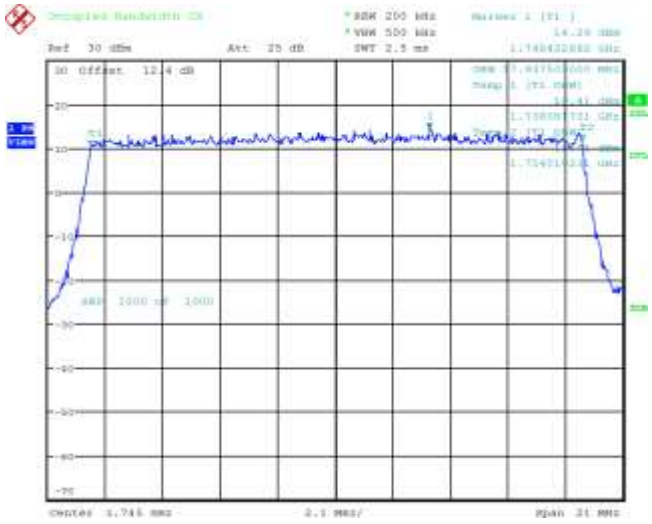
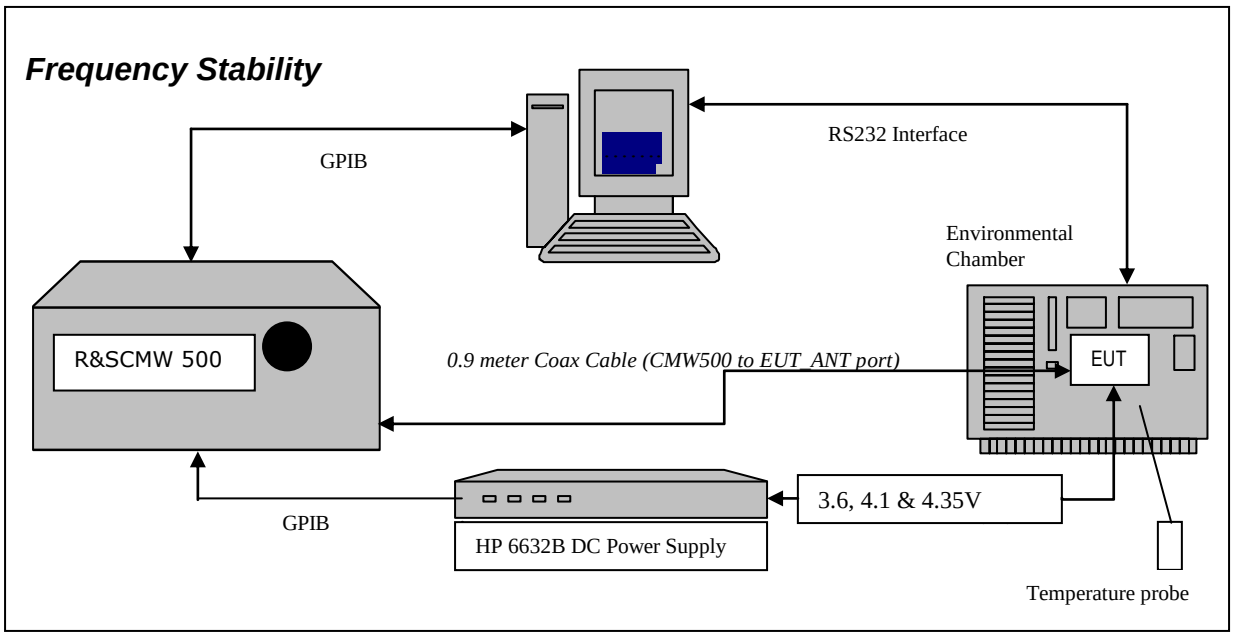


Figure 4-53a: Occupied Bandwidth, Band 4 High Channel, 20MHz BW (RB= 100) 16-QAM



APPENDIX 4B – LTE Band 4 FREQUENCY STABILITY TEST DATA

LTE Band 4 Frequency Stability Test Data



The following measurements were performed by Sijia Li.

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.

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 4 measured was **0.0070PPM**.

Date of Test: Feb 17, 2015

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 4C – LTE Band 4 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following measurements were performed by Shiva Kumbham.
Date of Test: February 23, 2015
The environmental tests conditions were: Temperature: 26.4 °C
Relative Humidity: 2.5 %
The BlackBerry® smartphone was standalone, volume keys pointing up with the LCD facing to the RX antenna when the turntable is at 0 degree position.
Measurements were performed with QPSK and 16QAM modulations. The smallest test margins are reported below.
Test Distance was 3.0 meters with the RX antenna height scans between 1-4 meters height.

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

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	19975	1712.50	4	Horn	V	-21.07	-21.07	V-V	-11.38	**28.13**	0.65	30.00	1.87
F0	19975	1712.50	4	Horn	H	-24.71		H-H	-10.51				
F0	20175	1732.50	4	Horn	V	-22.72	-22.72	V-V	-12.66	26.72	0.47	30.00	3.28
F0	20175	1732.50	4	Horn	H	-26.07		H-H	-12.07				
F0	20374	1752.40	4	Horn	V	-21.73	-21.73	V-V	-11.55	27.94	0.62	30.00	2.06
F0	20374	1752.40	4	Horn	H	-25.18		H-H	-10.66				

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

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Isotropic Radiator) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20050	1720.00	4	Horn	V	-22.07	-22.07	V-V	-12.19	26.77	0.48	30.00	3.23
F0	20050	1720.00	4	Horn	H	-25.64		H-H	-11.87				
F0	20175	1732.50	4	Horn	V	-23.73	-23.73	V-V	-13.73	25.68	0.37	30.00	4.32
F0	20175	1732.50	4	Horn	H	-26.99		H-H	-13.11				
F0	20299	1744.90	4	Horn	V	-23.17	-23.17	V-V	-12.44	**27.20**	0.52	30.00	2.80
F0	20299	1744.90	4	Horn	H	-26.65		H-H	-11.40				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Shiva Kumbham.

Date of Test: February 12, 2015

The environmental test conditions were: Temperature: 27.3 ºC
Relative Humidity: 4.6 %

The BlackBerry® smartphone was standalone, volume keys pointing 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 modulations for 5MHz BW (channel 19975, 20175 and 20374 with RB = 1).

Measurements were performed in LTE band 4 with 16-QAM modulations for 20MHz BW (channel 20050, 20175 and 20299 with RB = 1).

All emissions were at least 25.0 dB below the limit.

The following measurements were performed by Winston Vernon

Date of Test: February 11, and 20, 2015

The environmental test conditions were: Temperature: 24.7 - 24.9 ºC
Relative Humidity: 14.0 – 18.6%

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 20 GHz.

The BlackBerry® smartphone was standalone, volume key pointing 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 modulations for 5MHz BW (channel 19975, 20175 and 20374 with RB = 1).

Measurements were performed in LTE band 4 with 16-QAM modulations for 20MHz BW (channel 20050, 20175 and 20299 with RB = 1).

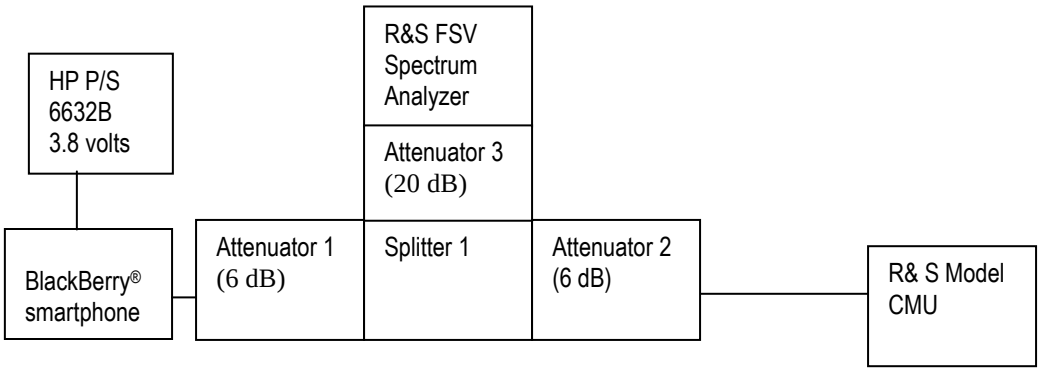
All emissions were at least 25.0 dB below the limit.

APPENDIX 5A– 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: Feb 2-3, 2015

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

The following measurements were performed by Sijia Li.

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, 5.5 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 9.22 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	9.22	**8.94**	**8.94**
836.5	9.22	**8.94**	**8.94**
843.9	9.21	**8.94**	**8.94**

Measurement Plots for LTE Band 5

See Figures 5-1a to 5-18a for the plots of the conducted spurious emissions.
See Figures 5-19a to 5-36a and 5-45a to 5-47a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.
See Figures 5-37a to 5-44a for the plots of the Channel mask.

LTE Band 5 Conducted RF Emission Test Data cont'd

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

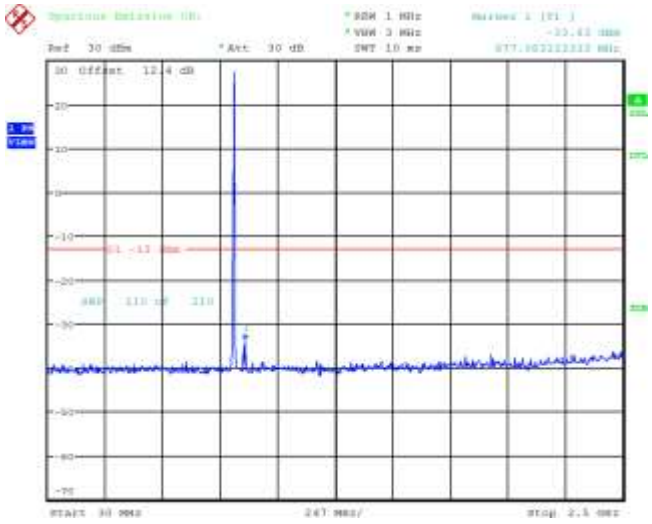


Figure 5-2a: Band 5, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

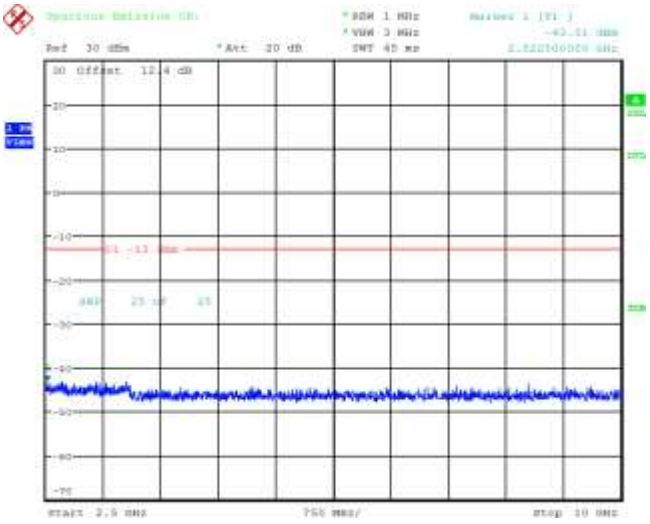


Figure 5-3a: Band 5, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)

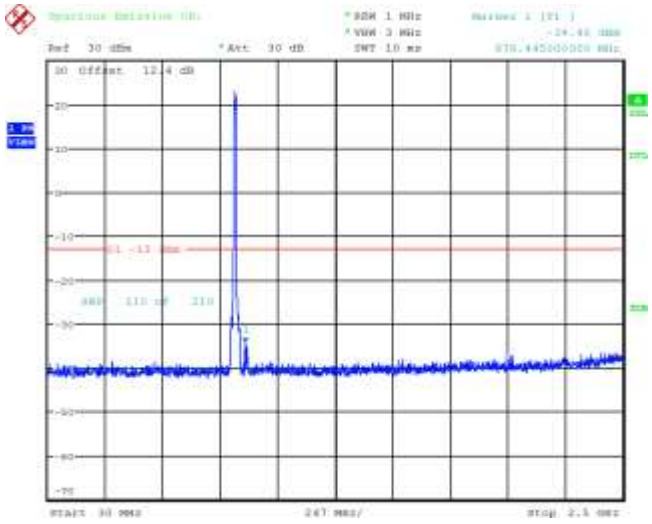
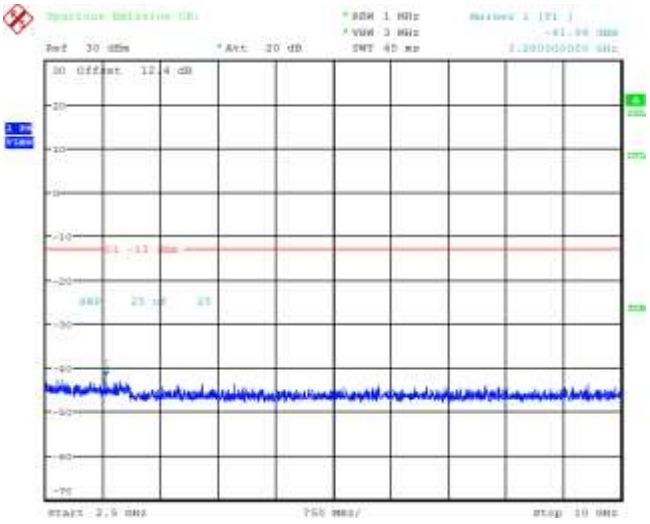


Figure 5-4a: Band 5, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)



LTE Band 5 Conducted RF Emission Test Data cont'd

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

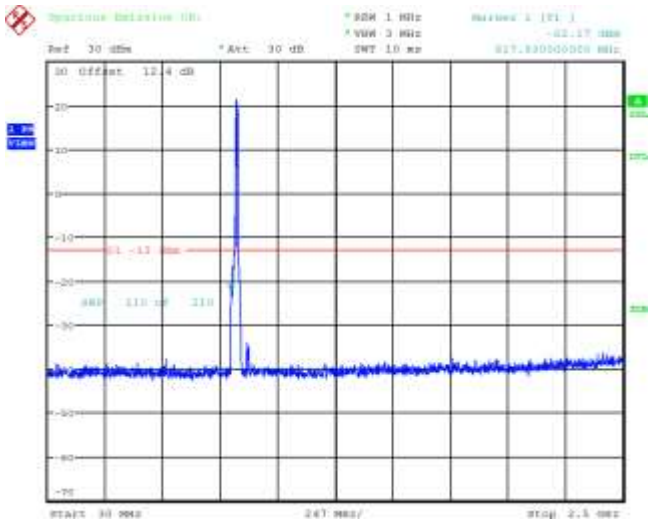


Figure 5-6a: Band 5, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

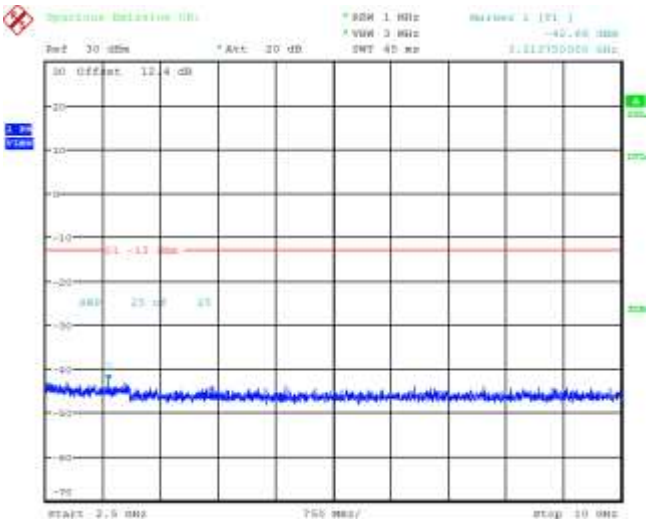


Figure 5-7a: Band 5, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)

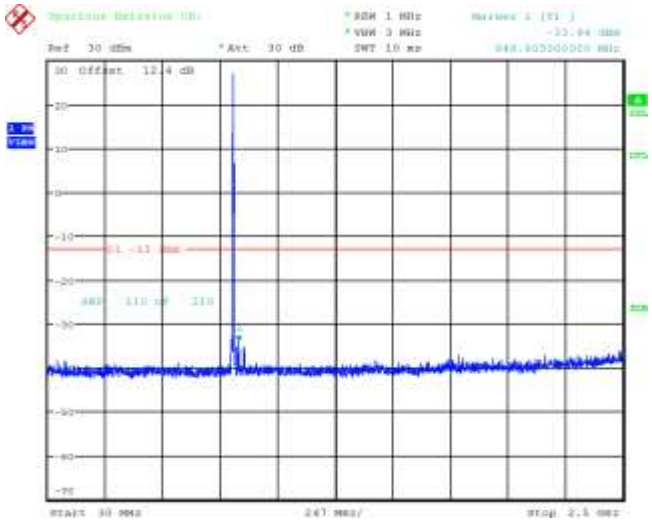
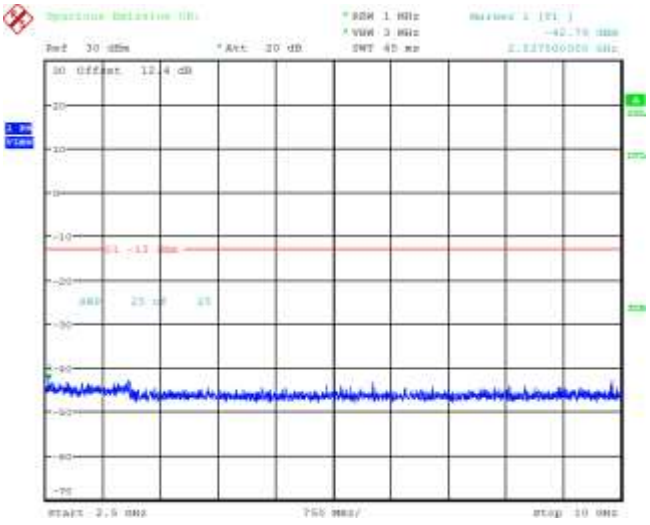


Figure 5-8a: Band 5, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)



LTE Band 5 Conducted RF Emission Test Data cont'd

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

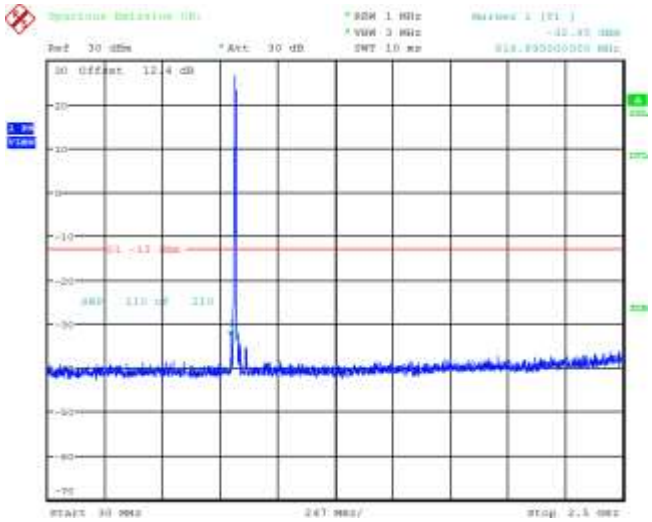


Figure 5-10a: Band 5, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 15)

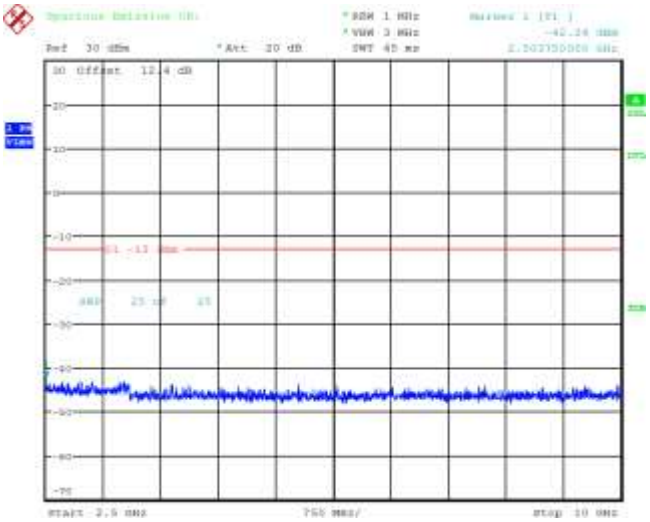


Figure 5-11a: Band 5, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)

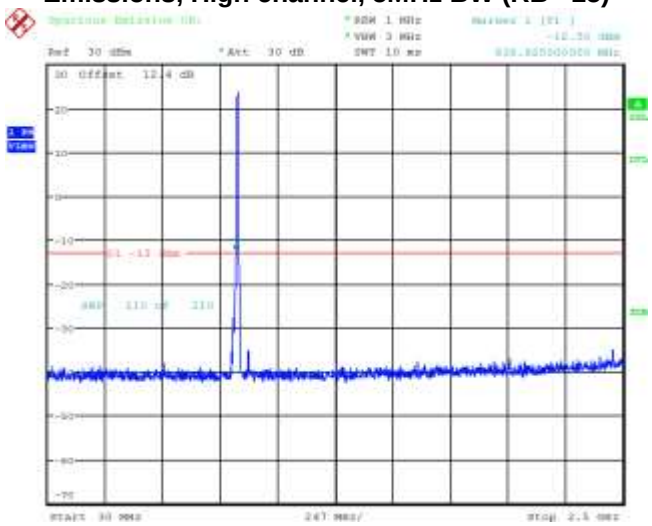
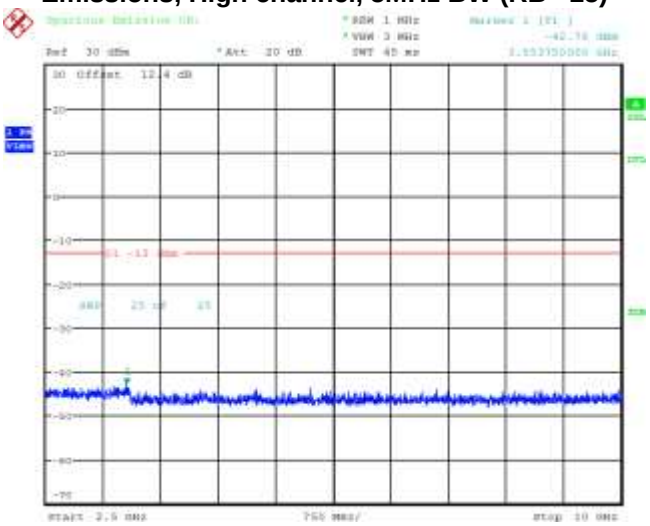


Figure 5-12a: Band 5, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)



LTE Band 5 Conducted RF Emission Test Data cont'd

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

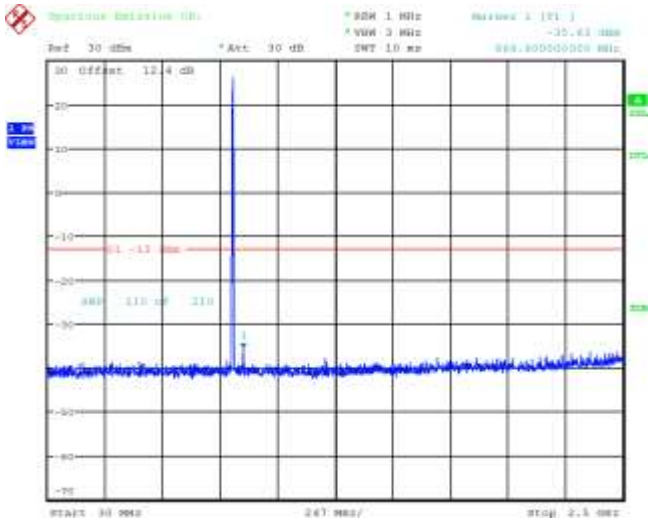


Figure 5-14a: Band 5, Spurious Conducted Emissions, Low Channel, 1.4MHz BW (RB= 1)

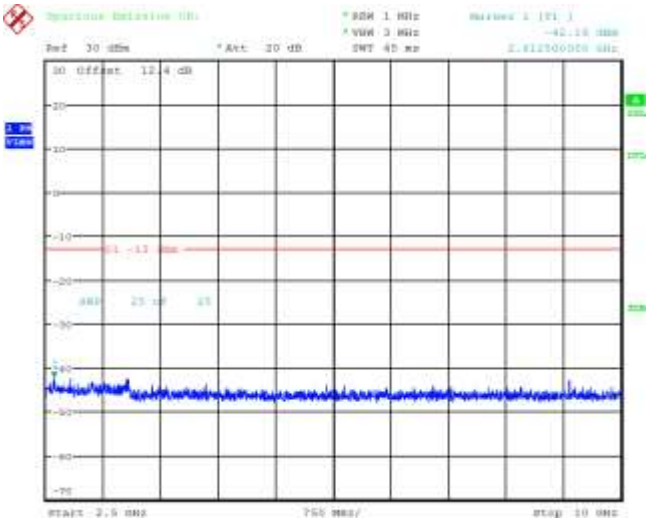


Figure 5-15a: Band 5, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)

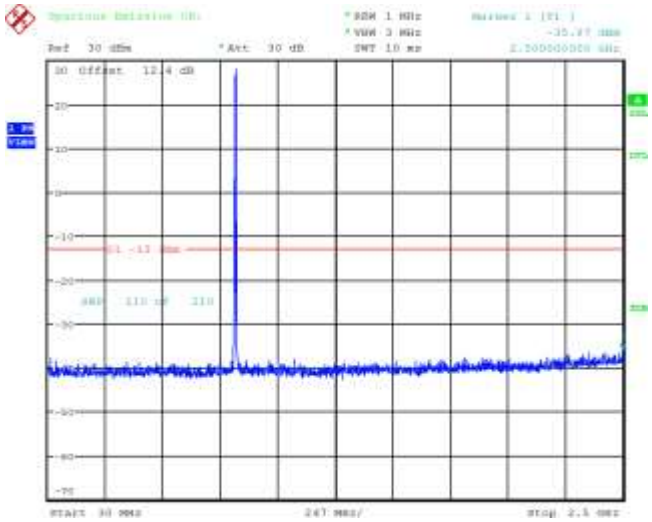
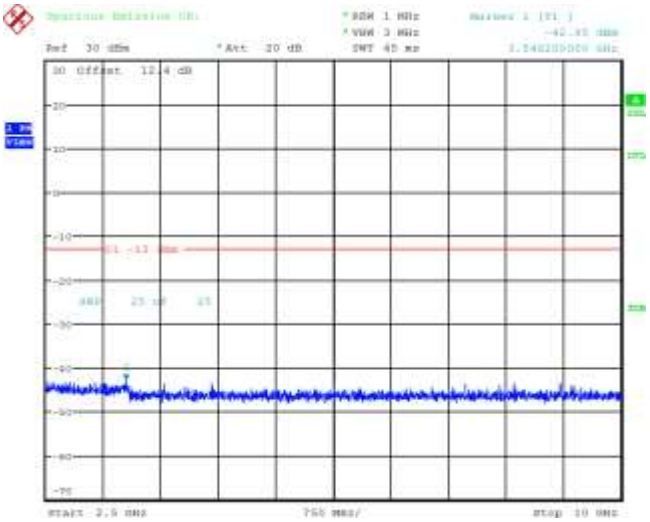


Figure 5-16a: Band 5, Spurious Conducted Emissions, Middle channel, 1.4MHz BW (RB= 3)



LTE Band 5 Conducted RF Emission Test Data cont'd

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

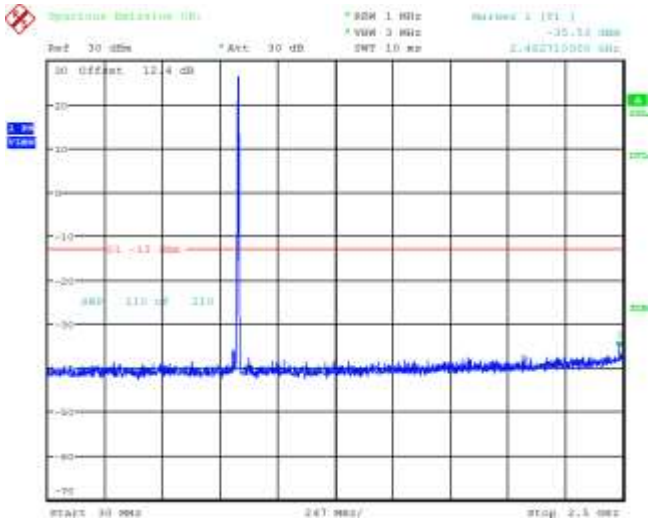
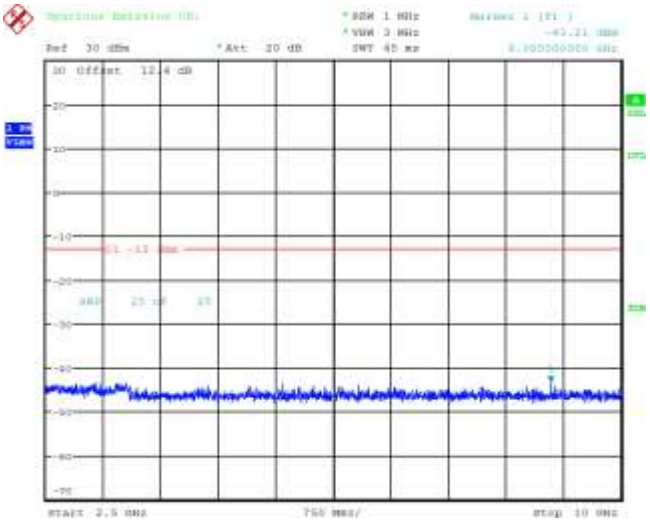


Figure 5-18a: Band 5, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)



LTE Band 5 Conducted RF Emission Test Data cont'd

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

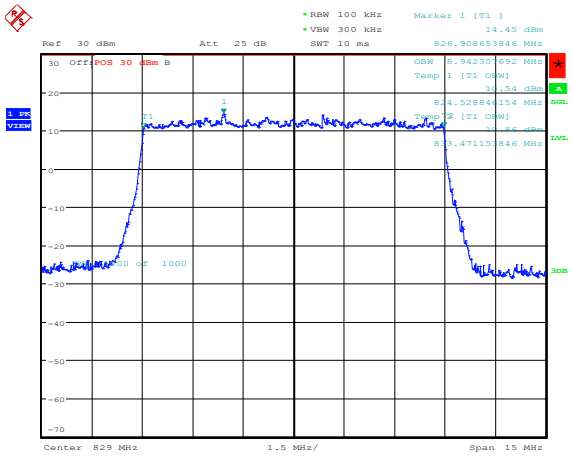


Figure 5-20a: Occupied Bandwidth, Band 5 Middle Channel, 10MHz BW, RB=50

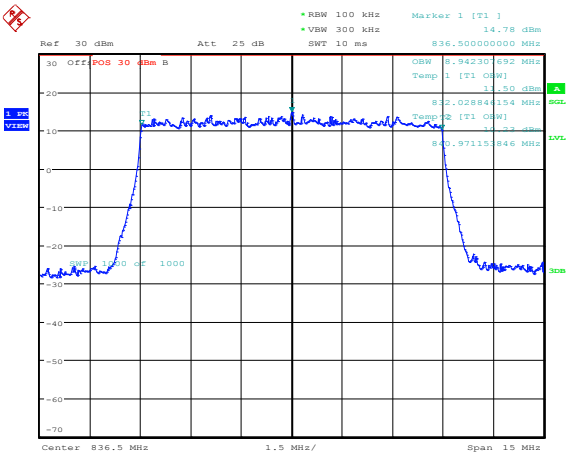
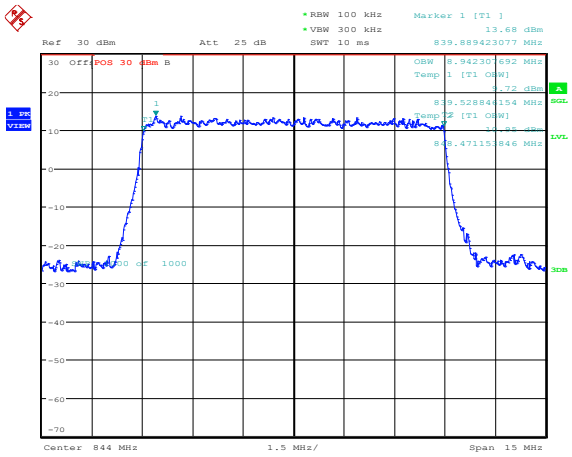
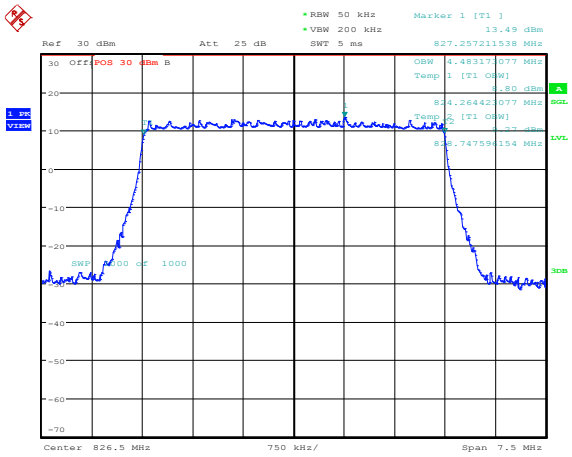


Figure 5-21a: Occupied Bandwidth, Band 5 High Channel, 10MHz BW, RB=50



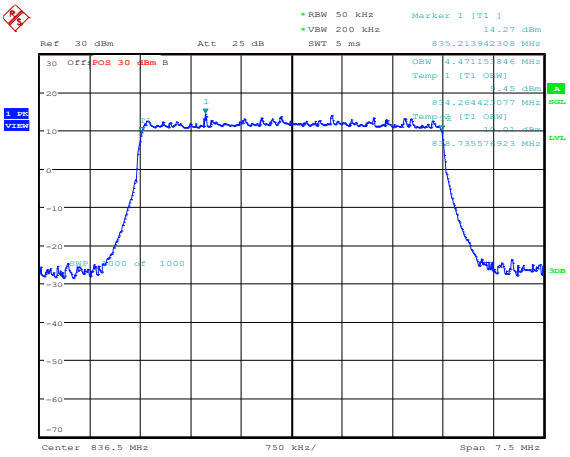
LTE Band 5 Conducted RF Emission Test Data cont'd

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



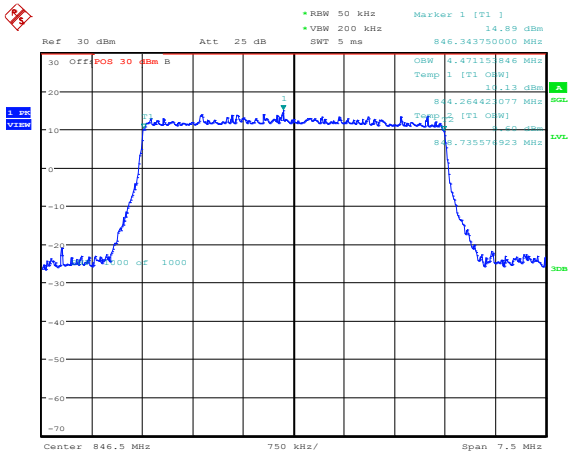
Date: 30.JAN.2015 10:53:39

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



Date: 30.JAN.2015 10:54:41

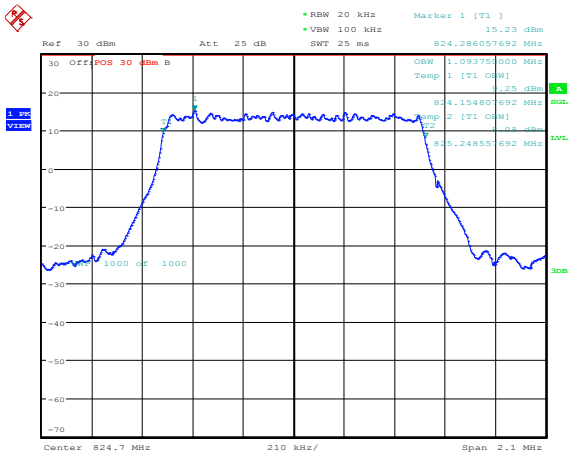
Figure 5-24a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25



Date: 30.JAN.2015 10:55:07

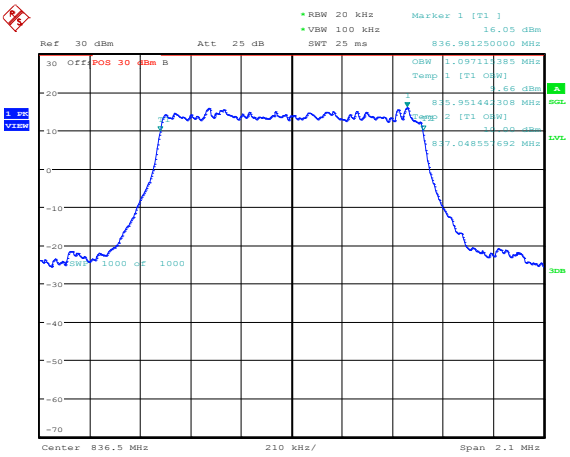
LTE Band 5 Conducted RF Emission Test Data cont'd

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



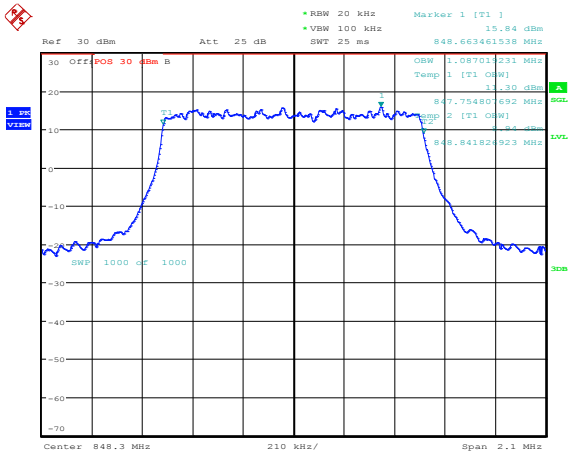
Date: 30.JAN.2015 11:02:01

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



Date: 30.JAN.2015 11:02:57

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



Date: 30.JAN.2015 11:03:35

LTE Band 5 Conducted RF Emission Test Data cont'd

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

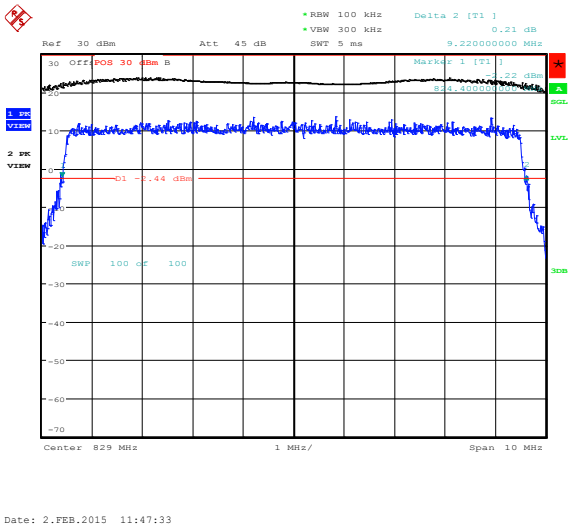


Figure 5-29a: -26 dBc Bandwidth, Band 5 Middle Channel, 10MHz BW, RB=50

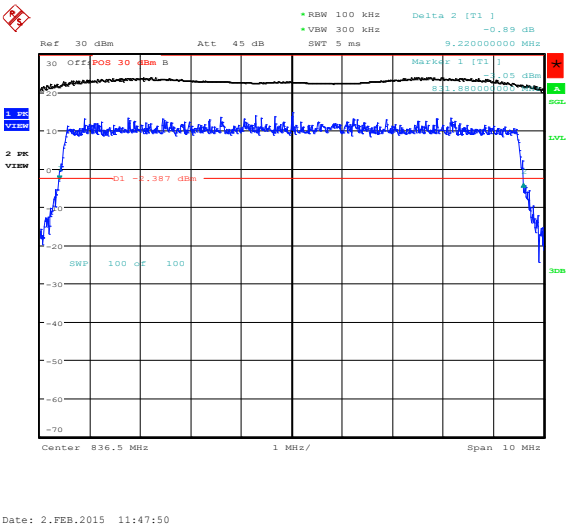


Figure 5-30a: -26 dBc Bandwidth, Band 5 High Channel, 10MHz BW, RB=50

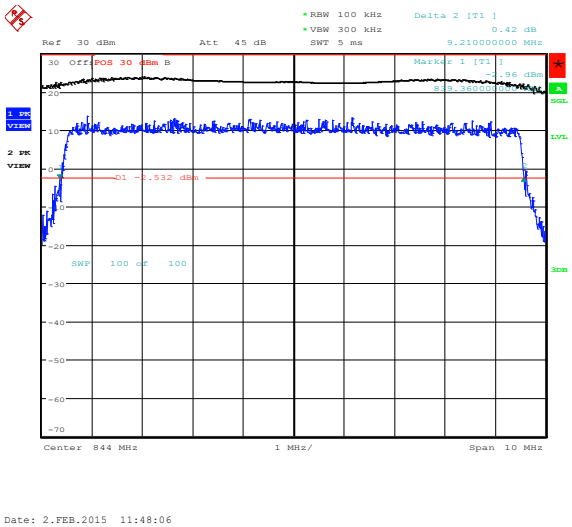
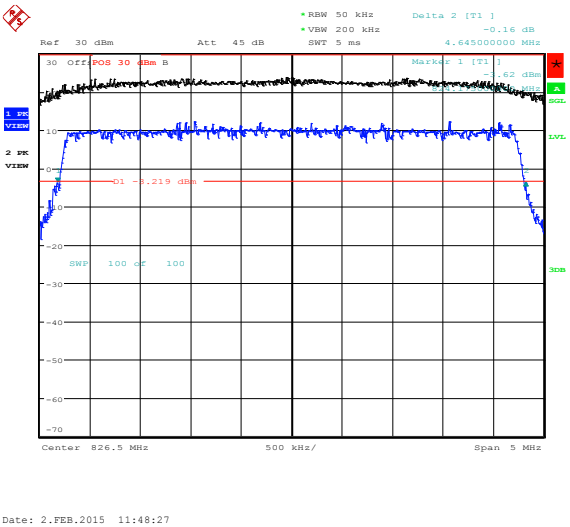


Figure 5-31a: -26 dBc Bandwidth, Band 5 Low Channel, 5MHz BW, RB=25



LTE Band 5 Conducted RF Emission Test Data cont'd

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

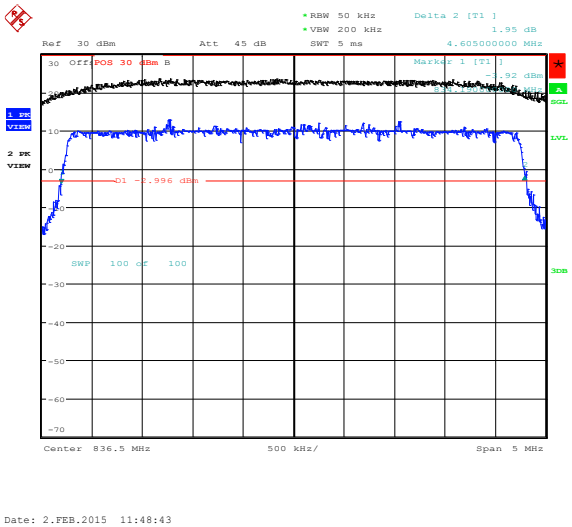


Figure 5-33a: -26 dBc Bandwidth, Band 5 High Channel, 5MHz BW, RB=25

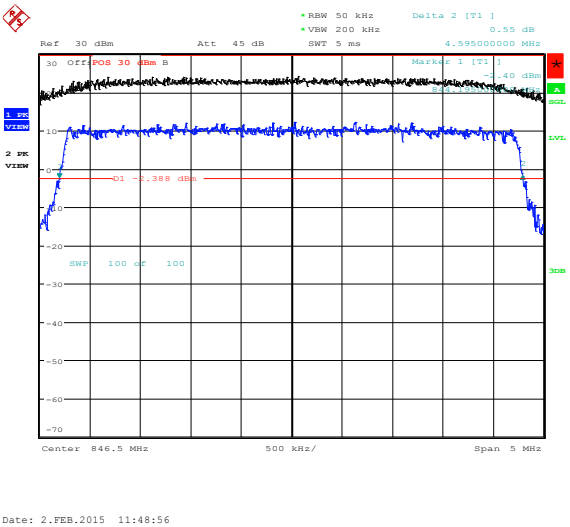


Figure 5-34a: -26 dBc Bandwidth, Band 5 Low Channel, 1.4MHz BW, RB=6

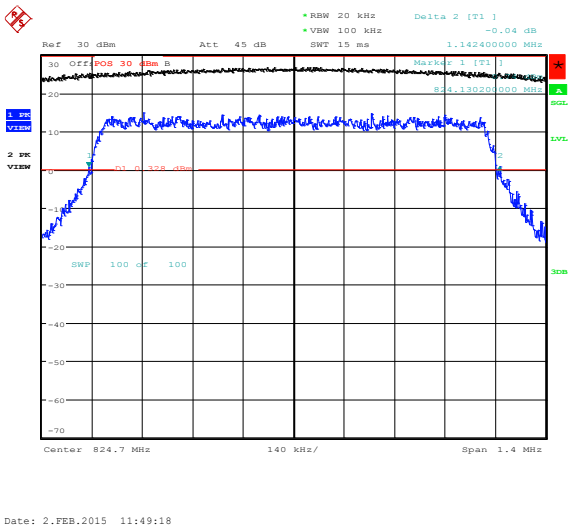
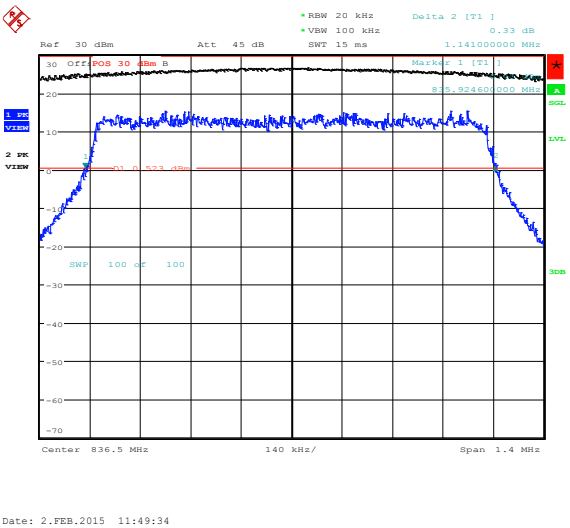
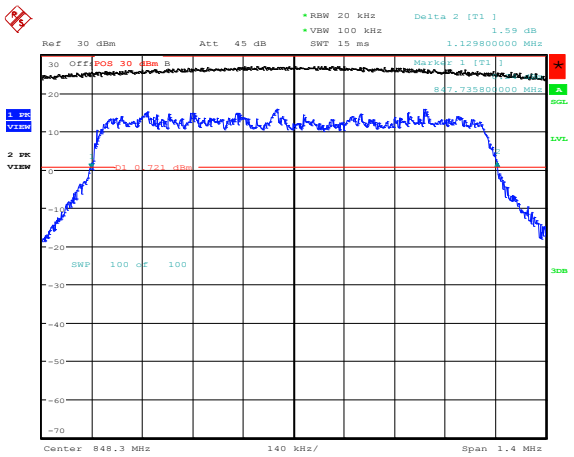


Figure 5-35a: -26 dBc Bandwidth, Band 5 Middle Channel, 1.4MHz BW, RB=6



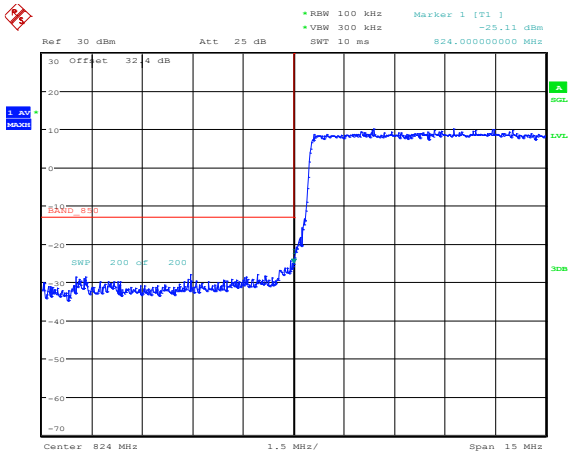
LTE Band 5 Conducted RF Emission Test Data cont'd

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



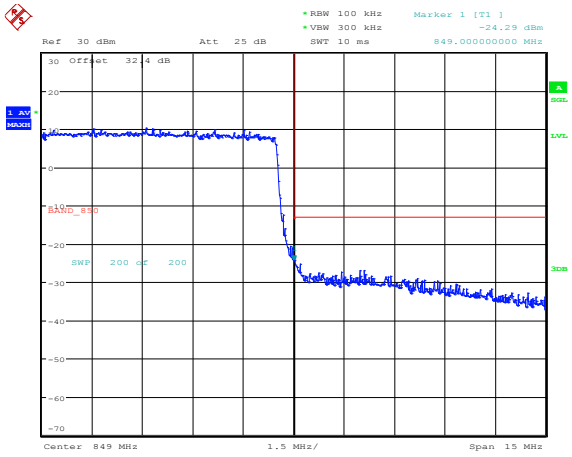
Date: 2.FEB.2015 11:49:48

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



Date: 3.FEB.2015 13:10:49

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



Date: 3.FEB.2015 13:13:36

LTE Band 5 Conducted RF Emission Test Data cont'd

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

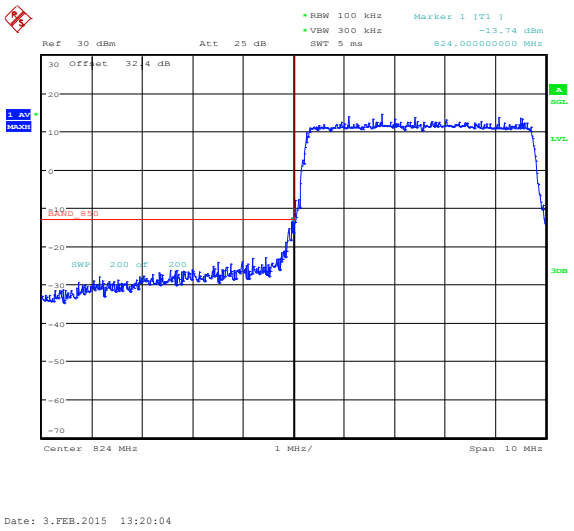


Figure 5-40a: Band 5 High Channel Mask, 5MHz BW, RB=25

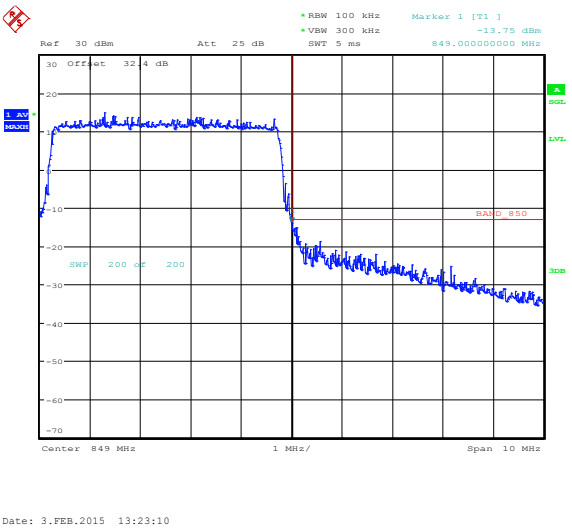


Figure 5-41a: Band 5 Low Channel Mask, 1.4MHz BW, RB=6

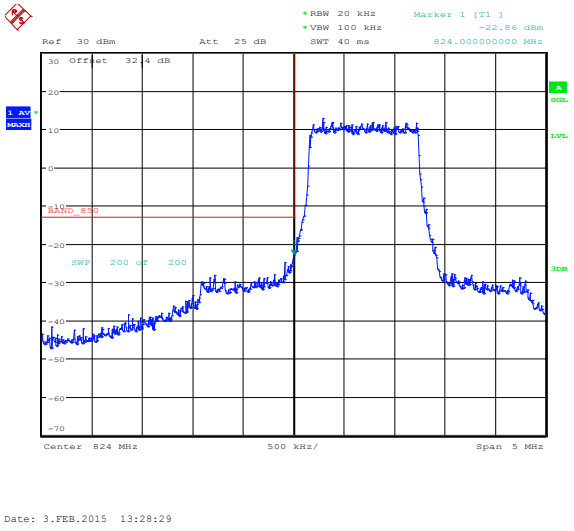
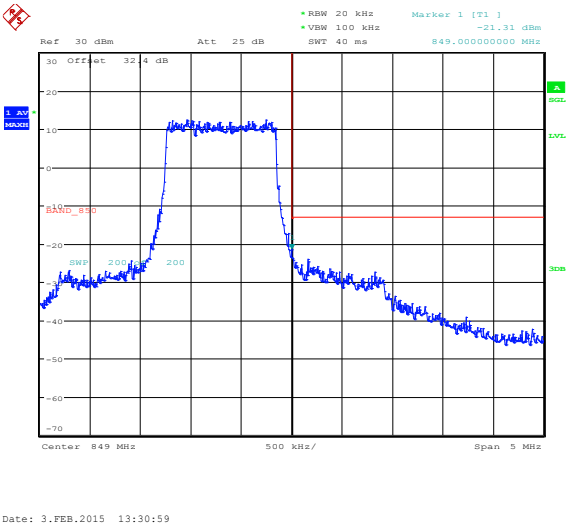


Figure 5-42a: Band 5 High Channel Mask, 1.4MHz BW, RB=6



LTE Band 5 Conducted RF Emission Test Data cont'd

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

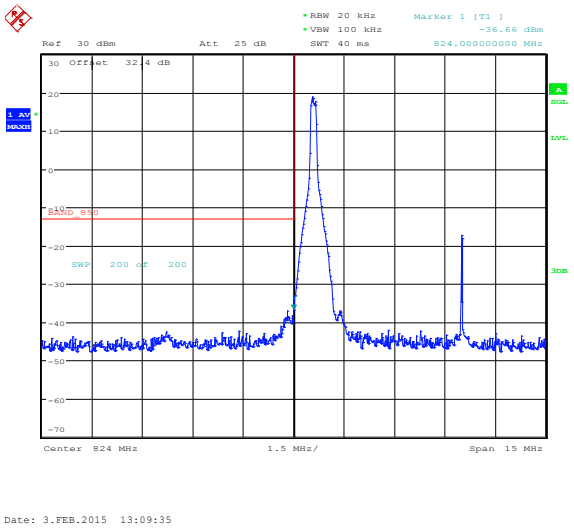
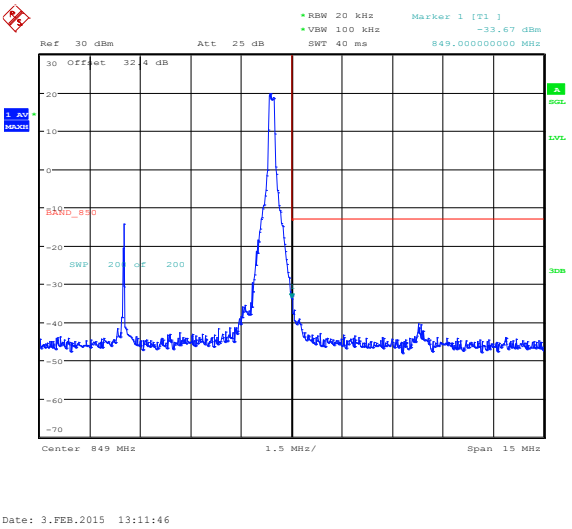
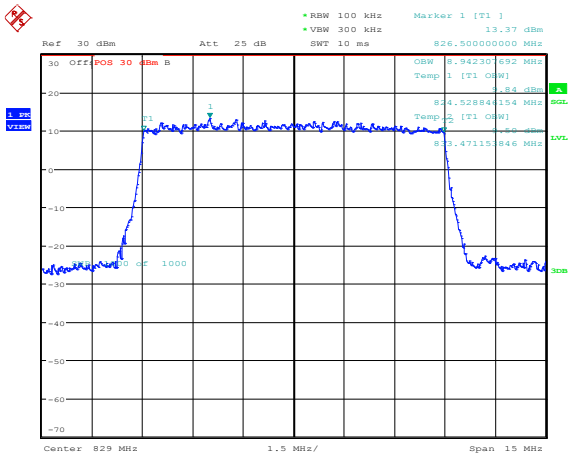


Figure 5-44a: Band 5 High Channel Mask, 10MHz BW, RB=1



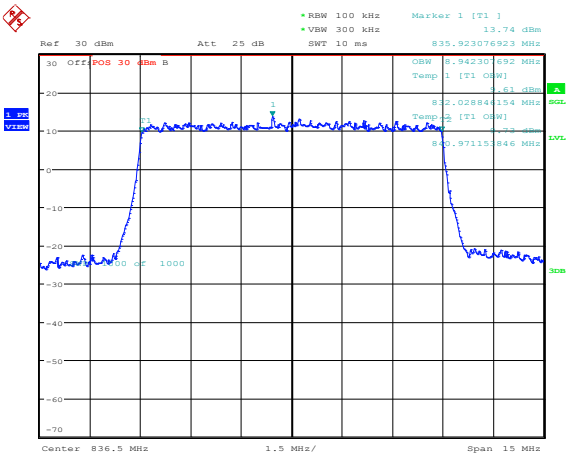
LTE Band 5 Conducted RF Emission Test Data cont'd

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



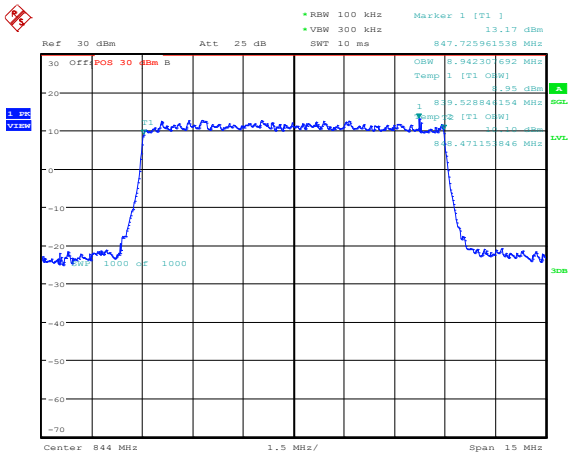
Date: 30.JAN.2015 10:50:49

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



Date: 30.JAN.2015 10:52:04

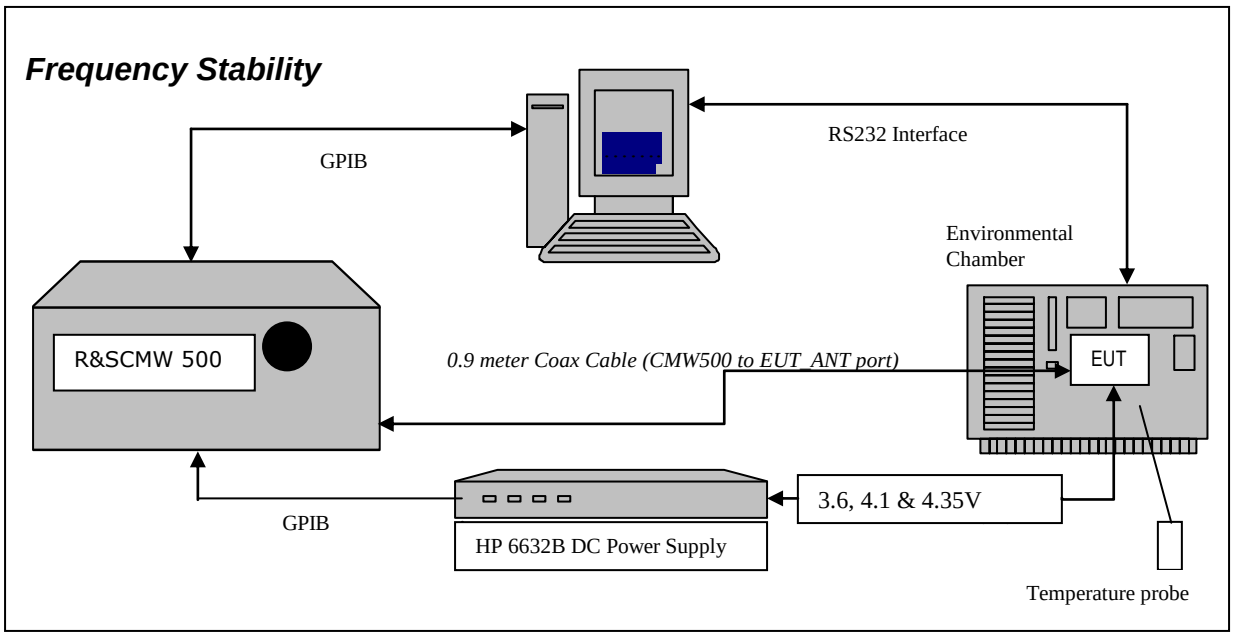
Figure 5-47a: Occupied Bandwidth, Band 5 High Channel, 10MHz BW (RB= 50) 16-QAM



Date: 30.JAN.2015 10:53:06

APPENDIX 5B – LTE Band 5 FREQUENCY STABILITY TEST DATA

LTE Band 5 Frequency Stability Test Data



The following measurements were performed by Sijia Li.

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.

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 5 measured was **0.0075 PPM**.

Date of Test: Feb 17, 2015

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	5.51	0.0066
20525	836.5	3.6	20	4.86	0.0058
20600	844.0	3.6	20	3.43	0.0041

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20450	829.0	4.1	20	5.01	0.0060
20525	836.5	4.1	20	2.42	0.0029
20600	844.0	4.1	20	3.38	0.0040

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20450	829.0	4.35	20	2.56	0.0031
20525	836.5	4.35	20	4.86	0.0058
20600	844.0	4.35	20	4.91	0.0058

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	2.98	0.0036
20450	829.0	3.6	-20	3.86	0.0047
20450	829.0	3.6	-10	4.48	0.0054
20450	829.0	3.6	0	3.18	0.0038
20450	829.0	3.6	10	4.35	0.0052
20450	829.0	3.6	20	5.51	0.0066
20450	829.0	3.6	30	-2.88	-0.0035
20450	829.0	3.6	40	3.12	0.0038
20450	829.0	3.6	50	4.84	0.0058
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20450	829.0	4.1	-30	4.31	0.0052
20450	829.0	4.1	-20	2.78	0.0033
20450	829.0	4.1	-10	4.21	0.0051
20450	829.0	4.1	0	-1.44	-0.0017
20450	829.0	4.1	10	-1.63	-0.0020
20450	829.0	4.1	20	5.01	0.0060
20450	829.0	4.1	30	4.52	0.0055
20450	829.0	4.1	40	2.06	0.0025
20450	829.0	4.1	50	2.49	0.0030
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20450	829.0	4.35	-30	2.72	0.0033
20450	829.0	4.35	-20	2.36	0.0028
20450	829.0	4.35	-10	5.34	0.0064
20450	829.0	4.35	0	3.78	0.0046
20450	829.0	4.35	10	3.15	0.0038
20450	829.0	4.35	20	2.56	0.0031
20450	829.0	4.35	30	3.59	0.0043
20450	829.0	4.35	40	-2.33	-0.0028
20450	829.0	4.35	50	3.26	0.0039

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	6.15	0.0074
20525	836.5	3.6	-20	5.26	0.0063
20525	836.5	3.6	-10	2.99	0.0036
20525	836.5	3.6	0	2.83	0.0034
20525	836.5	3.6	10	3.43	0.0041
20525	836.5	3.6	20	4.86	0.0058
20525	836.5	3.6	30	1.92	0.0023
20525	836.5	3.6	40	4.03	0.0048
20525	836.5	3.6	50	-2.23	-0.0027
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20525	836.5	4.1	-30	5.84	0.0070
20525	836.5	4.1	-20	2.49	0.0030
20525	836.5	4.1	-10	3.60	0.0043
20525	836.5	4.1	0	4.79	0.0057
20525	836.5	4.1	10	2.76	0.0033
20525	836.5	4.1	20	2.42	0.0029
20525	836.5	4.1	30	3.45	0.0041
20525	836.5	4.1	40	5.16	0.0062
20525	836.5	4.1	50	3.42	0.0041
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20525	836.5	4.35	-30	2.70	0.0032
20525	836.5	4.35	-20	3.91	0.0047
20525	836.5	4.35	-10	1.96	0.0023
20525	836.5	4.35	0	3.39	0.0041
20525	836.5	4.35	10	3.66	0.0044
20525	836.5	4.35	20	4.86	0.0058
20525	836.5	4.35	30	6.25	**0.0075**
20525	836.5	4.35	40	4.06	0.0049
20525	836.5	4.35	50	-2.40	-0.0029

LTE band 5 Results: channel 20649 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
20600	844.0	3.6	-30	-4.11	-0.0049
20600	844.0	3.6	-20	2.62	0.0031
20600	844.0	3.6	-10	2.56	0.0030
20600	844.0	3.6	0	4.22	0.0050
20600	844.0	3.6	10	4.21	0.0050
20600	844.0	3.6	20	3.43	0.0041
20600	844.0	3.6	30	-2.96	-0.0035
20600	844.0	3.6	40	-2.06	-0.0024
20600	844.0	3.6	50	2.78	0.0033
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20600	844.0	4.1	-30	4.09	0.0048
20600	844.0	4.1	-20	5.15	0.0061
20600	844.0	4.1	-10	4.45	0.0053
20600	844.0	4.1	0	-2.85	-0.0034
20600	844.0	4.1	10	2.30	0.0027
20600	844.0	4.1	20	3.38	0.0040
20600	844.0	4.1	30	3.28	0.0039
20600	844.0	4.1	40	-2.89	-0.0034
20600	844.0	4.1	50	-2.76	-0.0033
Traffic Channel Number	**Frequency (MHz)**	**Voltage (Volts)**	**Temperature (Celsius)**	**Frequency Error (Hz)**	**PPM**
20600	844.0	4.35	-30	-2.45	-0.0029
20600	844.0	4.35	-20	2.79	0.0033
20600	844.0	4.35	-10	4.42	0.0052
20600	844.0	4.35	0	3.38	0.0040
20600	844.0	4.35	10	-2.60	-0.0031
20600	844.0	4.35	20	4.91	0.0058
20600	844.0	4.35	30	4.41	0.0052
20600	844.0	4.35	40	-5.32	-0.0063
20600	844.0	4.35	50	-2.39	-0.0028

APPENDIX 5C – LTE Band 5 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following measurements were performed by Shiva Kumbham.
Date of Test: February 23, 2015
The environmental tests conditions were: Temperature: 26.4 °C
Relative Humidity: 2.5 %
The BlackBerry® smartphone was standalone horizontal up and top of the device 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)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20425	826.50	5	Dipole	V	-40.80	-30.76	V-V	4.33	22.14	0.16	38.50	16.36
F0	20425	826.50	5	Dipole	H	-30.76		H-H	2.73				
F0	20525	836.50	5	Dipole	V	-39.50	-29.53	V-V	6.23	**23.92**	0.25	38.50	14.58
F0	20525	836.50	5	Dipole	H	-29.53		H-H	4.16				
F0	20624	846.40	5	Dipole	V	-41.47	-31.06	V-V	5.96	23.71	0.23	38.50	14.79
F0	20624	846.40	5	Dipole	H	-31.06		H-H	2.70				

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

								Substitution Method					
EUT				Rx Antenna		Spectrum Analyzer		Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBuV)	Max (V,H) (dBuV)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff to Limit (dB)
F0	20500	834.00	5	Dipole	V	-41.46	-31.57	V-V	4.76	**22.57**	0.18	38.50	15.93
F0	20500	834.00	5	Dipole	H	-31.57		H-H	2.22				
F0	20525	836.50	5	Dipole	V	-40.73	-31.00	V-V	4.71	22.40	0.17	38.50	16.10
F0	20525	836.50	5	Dipole	H	-31.00		H-H	2.59				
F0	20549	838.90	5	Dipole	V	-41.04	-31.28	V-V	4.57	22.32	0.17	38.50	16.18
F0	20549	838.90	5	Dipole	H	-31.28		H-H	2.16				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Shiva Kumbham.

Date of Test: February 20, 2015

The environmental test conditions were: Temperature: 27.2 ºC
Relative Humidity: 6.5 %

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

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

Measurements were performed in LTE band 5 with QPSK modulation for 5MHz BW (channel 20425, 20525 and 20624 with RB = 1).

Measurements were performed in LTE band 5 with 16-QAM modulation for 10MHz BW (channel 20500, 20525 and 20549 with RB = 1).

All emissions were at least 25 dB below the limit.

The following measurements were performed by Kevin Guo

Date of Test: February 12, and 20

The environmental test conditions were: Temperature: 24.0 - 24.7 ºC
Relative Humidity: 14.2 - 18.6 %

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 9 GHz.

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

Measurements were performed in LTE band 5 with QPSK modulation for 5MHz BW (channel 20425, 20525 and 20624 with RB = 1).
Measurements were performed in LTE band 5 with 16-QAM modulation for 10MHz BW (channel 20500, 20525 and 20549 with RB = 1).

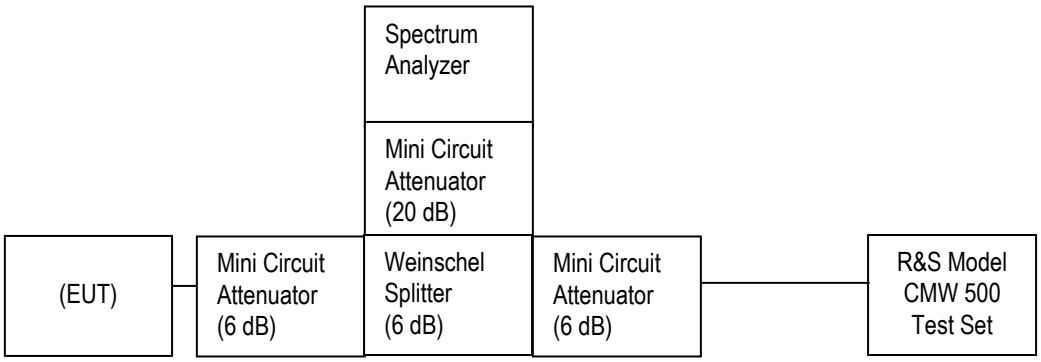
All emissions were at least 25 dB below the limit.

APPENDIX 6A– LTE Band 13 CONDUCTED RF EMISSIONS TEST DATA/PLOTS

LTE Band 13 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



Date of Test: Feb 2, 2015

The environmental test conditions were: Temperature: 21.2 – 23.2 ºC
Relative Humidity: 20.3 – 23.3 %

The following measurements were performed by Sijia Li.

LTE Band 13 Conducted RF Emission Test Data cont'd

The conducted spurious emissions – As per 47 CFR 2.202, CFR 2.1046, CFR 27.53 CFR 27.54, CFR 27.50 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 13.

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 13 was measured to be 9.25 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 13 selected Frequencies in 10MHz BW (RB = 50)

LTE Band 13 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
782.0	**9.25**	**8.942**

Test Data for LTE Band 13 selected Frequencies in 5MHz BW (RB = 25)

LTE Band 13 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
779.5	**4.66**	**4.495**
782.0	4.62	**4.495**
784.5	4.625	**4.495**

Peak to Average Ratio (PAR)

For each 5MHz and 10MHz with different number of RBs as per scalable bandwidths for LTE band 13, the peak to average ratio was measured on the low, middle and high channels with QPSK modulation.

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

The worst case measured was 9.51 dB on 10MHz bandwidth with 25 RBs while transmitting at 782MHz.

Measurement Plots for LTE Band 13

See Figures 3-1a to 3-8a for the plots of the conducted spurious emissions.

See Figures 3-9a to 3-16a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.

See Figures 3-17a to 3-21a for the plots of the Channel mask.

See Figures 3-22a for the plots of the Peak to Average Ratio.

LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 3-1a: Band 13, Spurious Conducted Emissions, 10MHz BW (RB= 50)

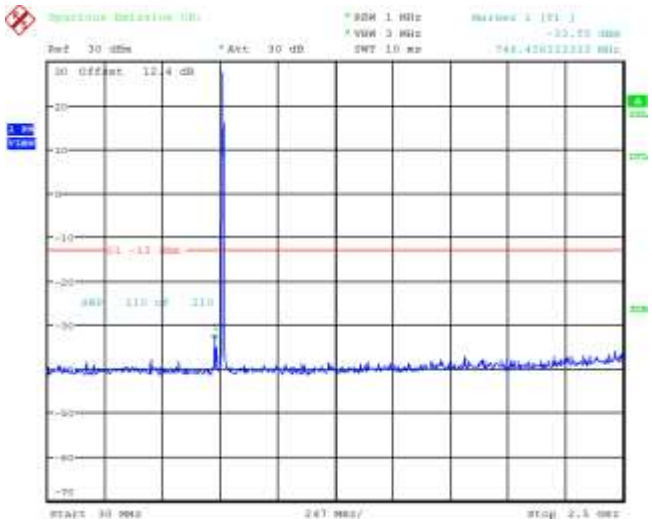


Figure 3-2a: Band 13, Spurious Conducted Emissions, 10MHz BW (RB= 50)

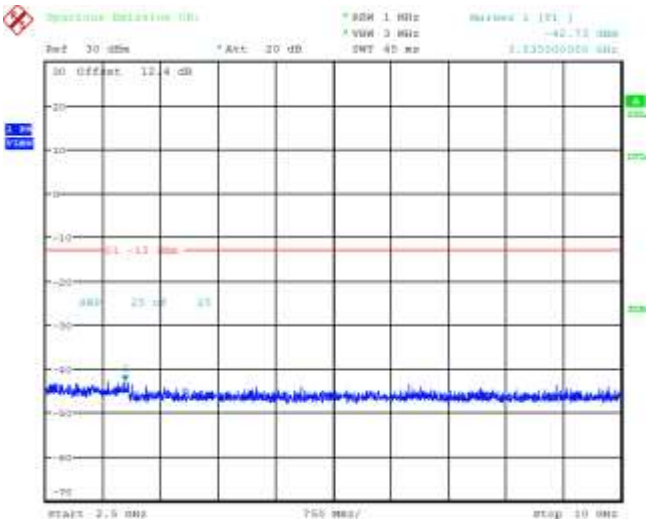


Figure 3-3a: Band 13, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 25)

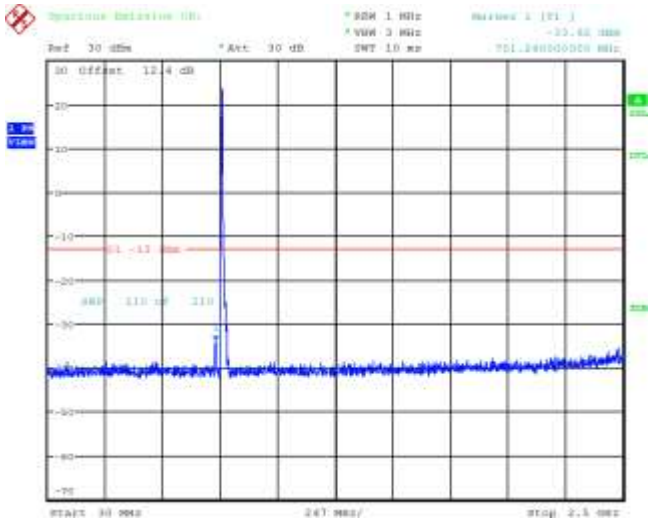
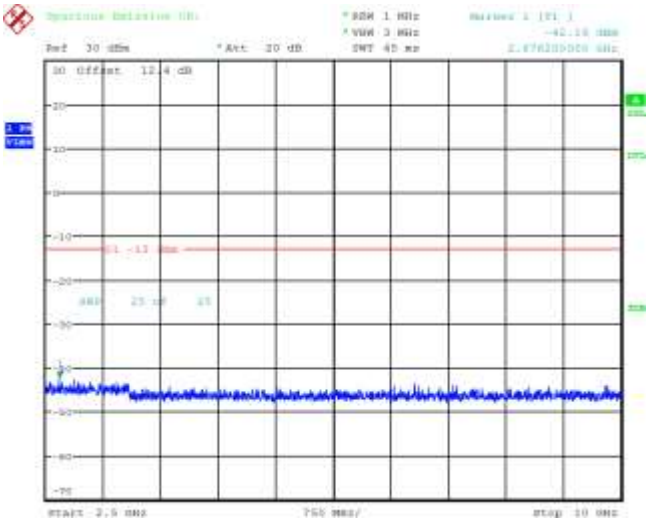


Figure 3-4a: Band 13, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 25)



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 3-5a: Band 13, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 25)

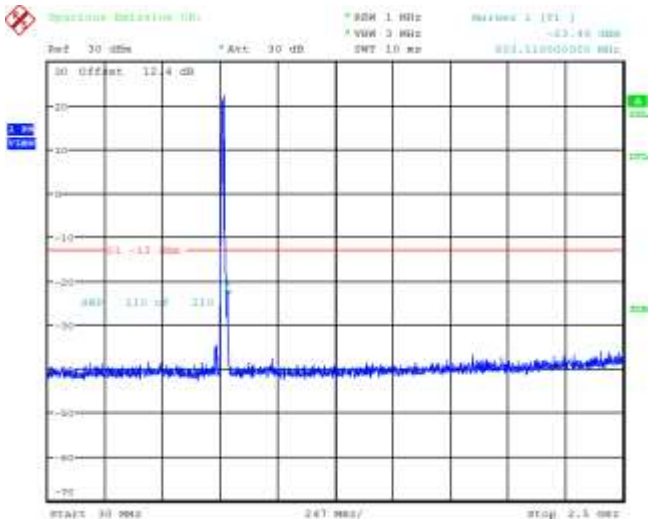


Figure 3-6a: Band 13, Spurious Conducted Emissions, High Channel, 5MHz BW (RB= 25)

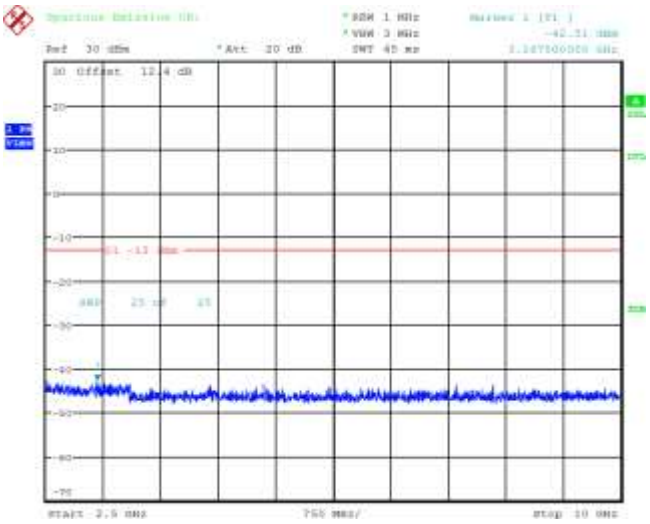


Figure 3-7a: Band 13, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)

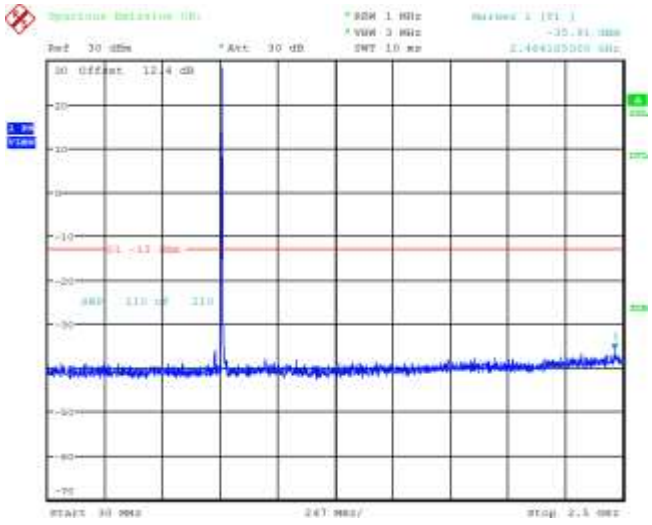
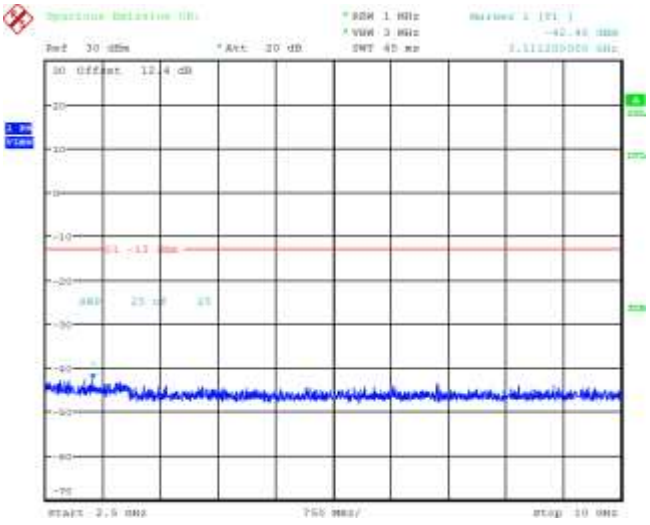


Figure 3-8a: Band 13, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 3-9a: Occupied Bandwidth, Band 13 10MHz BW, RB=50

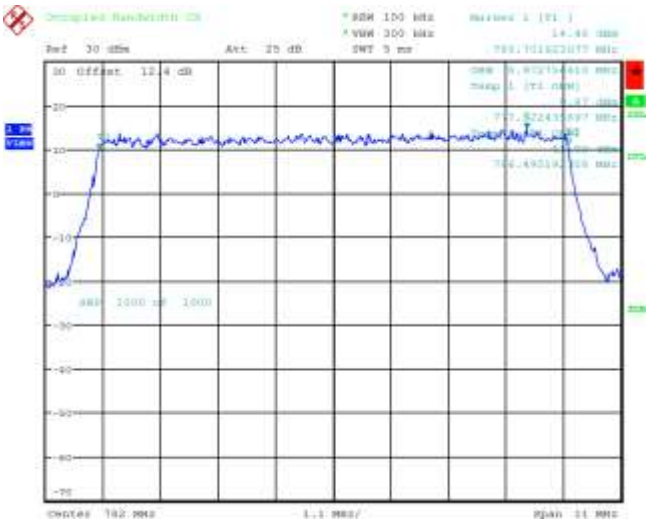


Figure 3-10a: Occupied Bandwidth, Band 5 Low Channel, 5MHz BW, RB=25

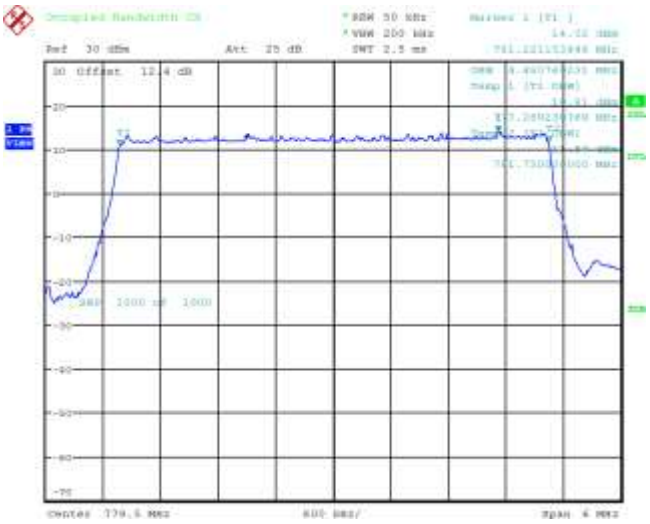


Figure 3-11a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25

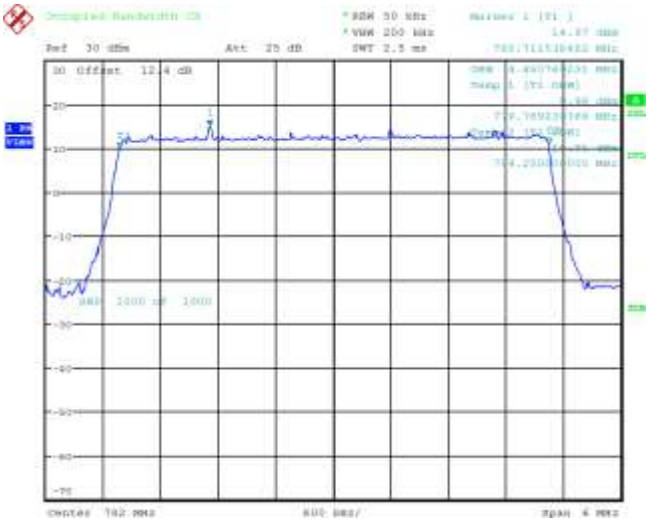
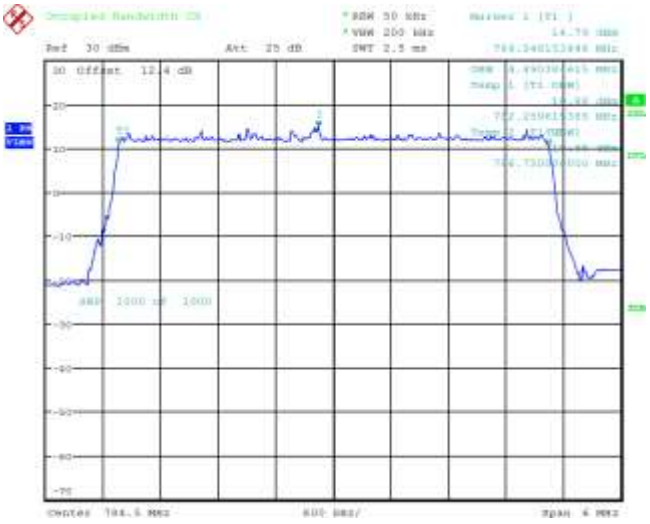


Figure 3-12a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 3-13a: -26 dBc Bandwidth, Band 13 Middle Channel, 10MHz BW, RB=50

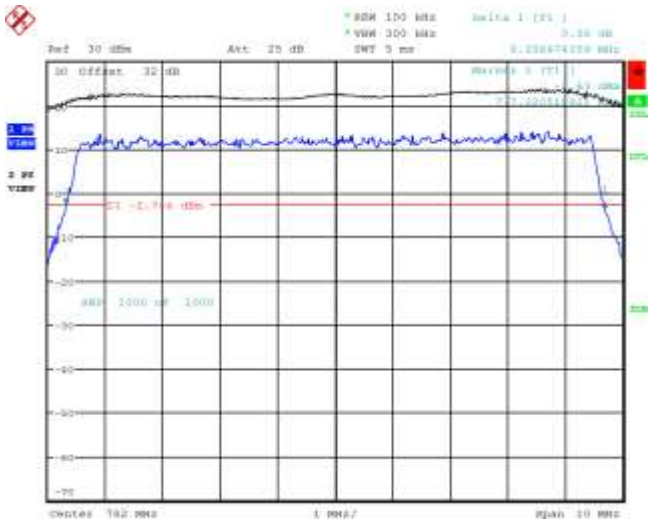


Figure 3-14a: -26 dBc Bandwidth, Band 13 Low Channel, 5MHz BW, RB=25

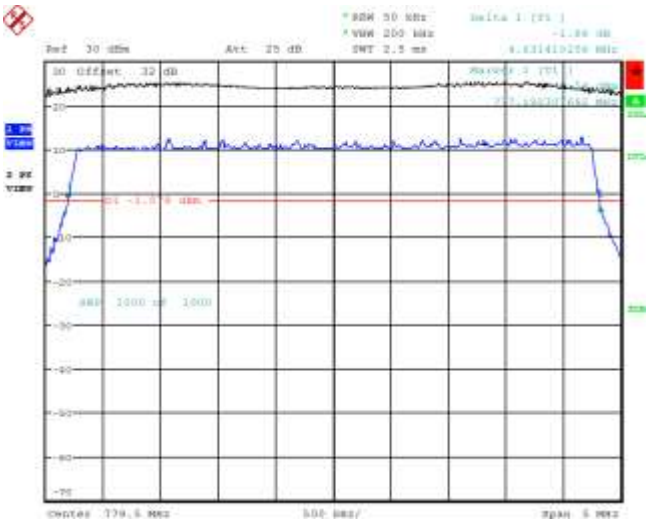


Figure 3-15a: -26 dBc Bandwidth, Band 13 Middle Channel, 5MHz BW, RB=25

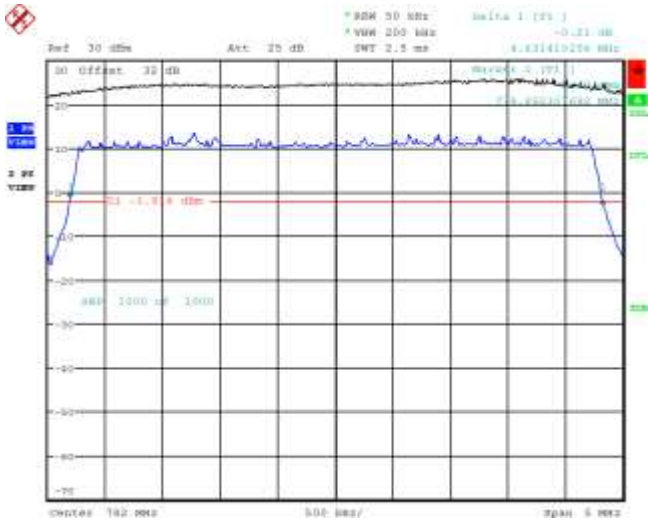
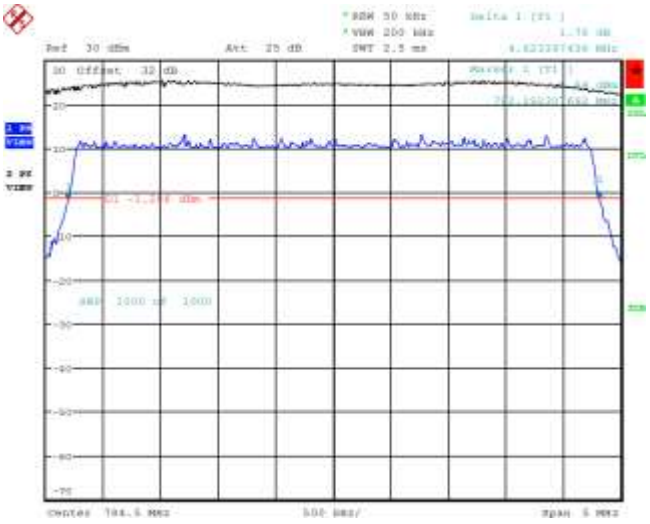


Figure 3-16a: -26 dBc Bandwidth, Band 13 High Channel, 5MHz BW, RB=25



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 3-17a: Band 13 Channel Mask, 10MHz BW, RB=50

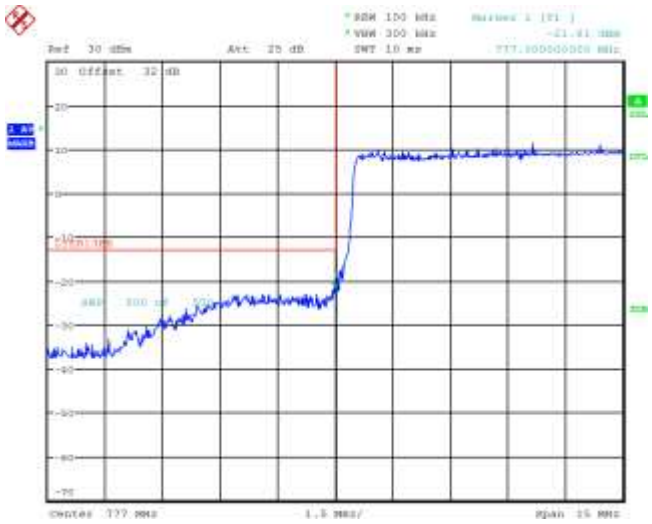


Figure 3-17a: Band 13 Channel Mask, 10MHz BW, RB=50

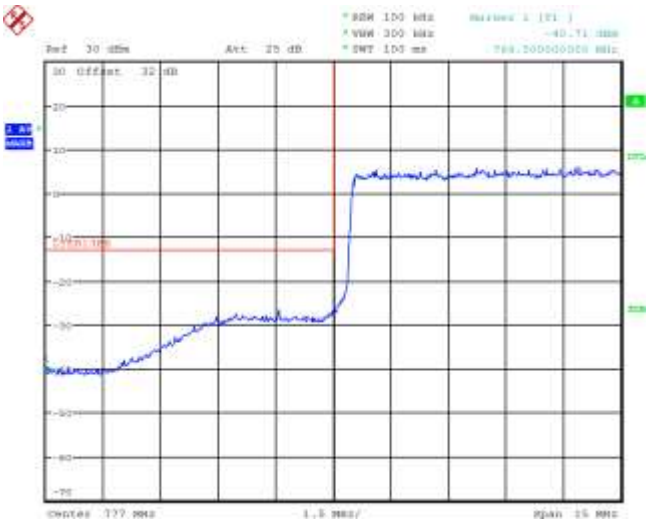


Figure 3-18a: Band 13 Low Channel Mask, 5MHz BW, RB=1

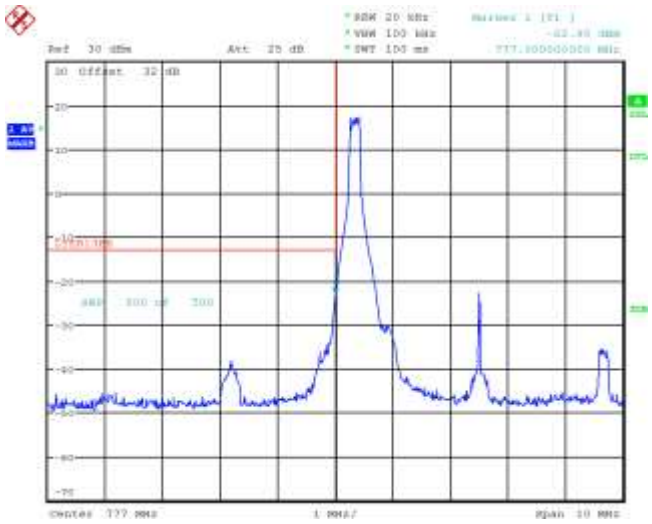
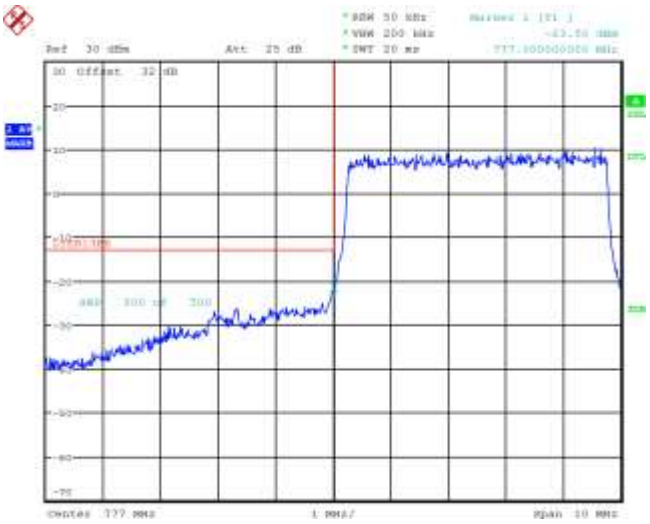


Figure 3-19a: Band 13 Low Channel Mask, 5MHz BW, RB=25



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 3-20a: Band 13 High Channel Mask, 5MHz BW, RB=1

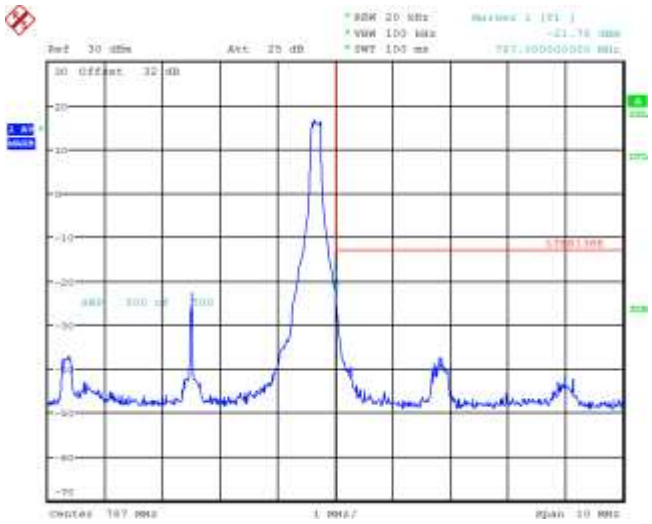


Figure 3-21a: Band 13 High Channel Mask, 5MHz BW, RB=25

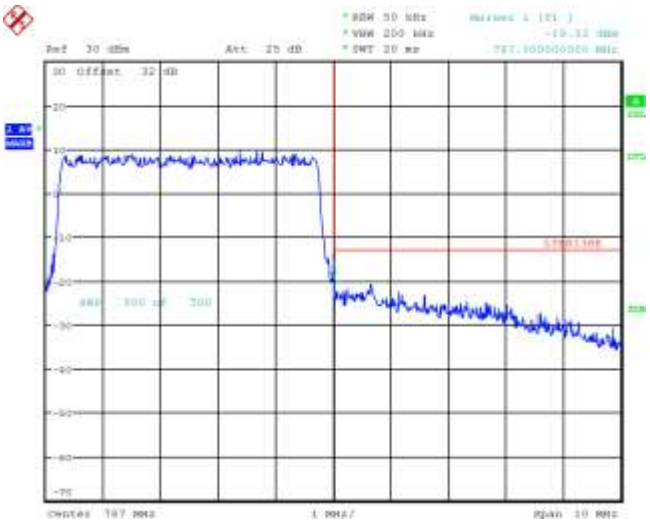


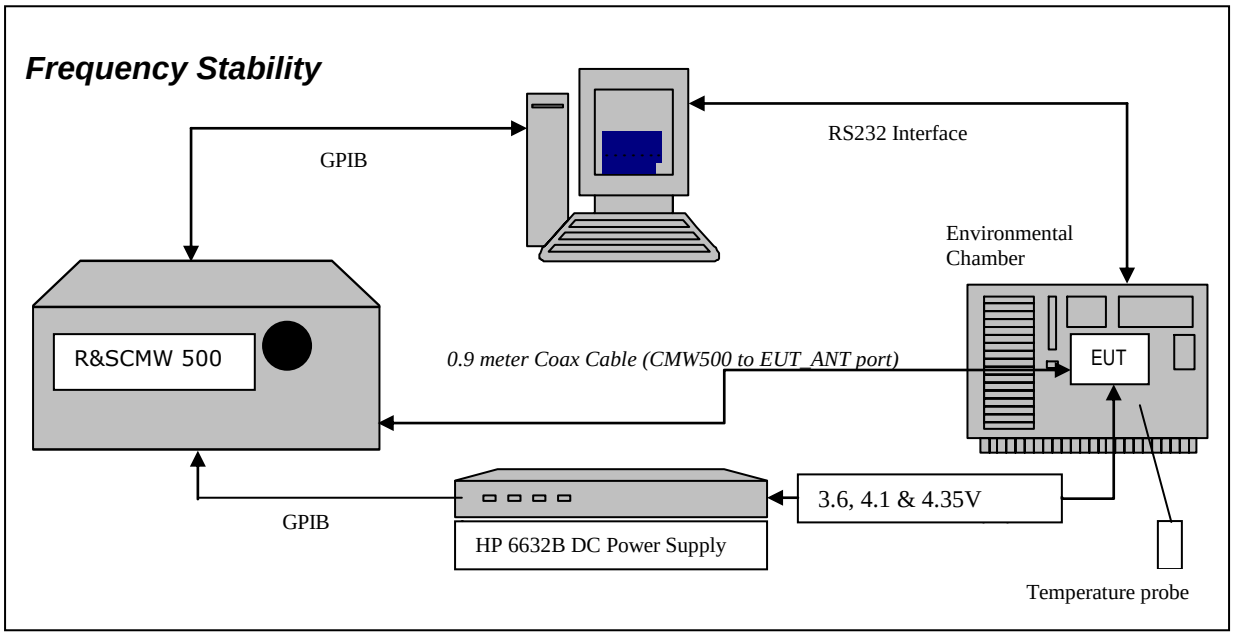
Figure 3-22a: Band 13 PAR, 10MHz BW, RB=25

Complementary Cumulative Distribution Function (150000 samples)

	Trace 1
Mean	12.10 dBm
Peak	21.61 dBm
Crest	9.51 dB
10 %	3.27 dB
1 %	6.22 dB
.1 %	7.92 dB
.01 %	9.42 dB

APPENDIX 6B – LTE Band 13 FREQUENCY STABILITY TEST DATA

LTE Band 13 Frequency Stability Test Data



The following measurements were performed by Sijia Li.

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, 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 measured on 782MHz for 10MHz bandwidth with maximum (50) RB. The transmit frequency was varied in 3 steps consisting of 779.5 MHz, 782.0 MHz and 784.5 MHz each was measured under 5 MHz bandwidth with maximum (25) 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 for FCC:

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 13 measured was **0.0093 PPM**.

Date of test: Feb 17, 2015

LTE Band 13 results (10MHz Bandwidth): channels 23205, 23230 and 23255 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23205	779.50	3.6	20	4.75	0.0061
23230	782.00	3.6	20	-3.33	-0.0043
23255	784.50	3.6	20	5.55	0.0071

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23205	779.50	4.1	20	3.88	0.0050
23230	782.00	4.1	20	4.52	0.0058
23255	784.50	4.1	20	3.69	0.0047

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23205	779.50	4.35	20	4.39	0.0056
23230	782.00	4.35	20	4.39	0.0056
23255	784.50	4.35	20	5.38	0.0069

LTE Band 13 Results (10MHz Bandwidth): channel 23205 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23205	779.50	3.6	-30	-3.65	-0.0047
23205	779.50	3.6	-20	4.73	0.0061
23205	779.50	3.6	-10	4.84	0.0062
23205	779.50	3.6	0	3.26	0.0042
23205	779.50	3.6	10	4.48	0.0057
23205	779.50	3.6	20	4.75	0.0061
23205	779.50	3.6	30	4.51	0.0058
23205	779.50	3.6	40	-5.55	-0.0071
23205	779.50	3.6	50	4.88	0.0063
23205	779.50	3.6	60	-4.53	-0.0058

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23205	779.50	4.1	-30	5.08	0.0065
23205	779.50	4.1	-20	4.59	0.0059
23205	779.50	4.1	-10	4.55	0.0058
23205	779.50	4.1	0	3.66	0.0047
23205	779.50	4.1	10	5.36	0.0069
23205	779.50	4.1	20	3.88	0.0050
23205	779.50	4.1	30	4.51	0.0058
23205	779.50	4.1	40	-5.64	-0.0072
23205	779.50	4.1	50	-4.95	-0.0064
23205	779.50	4.1	60	-3.65	-0.0047

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23205	779.50	4.35	-30	4.11	0.0053
23205	779.50	4.35	-20	-4.06	-0.0052
23205	779.50	4.35	-10	5.72	0.0073
23205	779.50	4.35	0	4.99	0.0064
23205	779.50	4.35	10	3.60	0.0046
23205	779.50	4.35	20	4.39	0.0056
23205	779.50	4.35	30	4.65	0.0060
23205	779.50	4.35	40	-5.34	-0.0069
23205	779.50	4.35	50	-3.56	-0.0046
23205	779.50	4.35	60	-4.11	-0.0053

LTE Band 13 Results(5MHz Bandwidth): channel 23230 @ maximum transmitted power (cont'd)

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	782.00	3.6	-30	-5.09	-0.0065
23230	782.00	3.6	-20	-3.92	-0.0050
23230	782.00	3.6	-10	4.29	0.0055
23230	782.00	3.6	0	3.76	0.0048
23230	782.00	3.6	10	-4.41	-0.0056
23230	782.00	3.6	20	-3.33	-0.0043
23230	782.00	3.6	30	3.93	0.0050
23230	782.00	3.6	40	-4.42	-0.0057
23230	782.00	3.6	50	-5.99	-0.0077
23230	782.00	3.6	60	-3.16	-0.0040

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	782.00	4.1	-30	-4.84	-0.0062
23230	782.00	4.1	-20	-5.78	-0.0074
23230	782.00	4.1	-10	-5.35	-0.0068
23230	782.00	4.1	0	3.33	0.0043
23230	782.00	4.1	10	5.71	0.0073
23230	782.00	4.1	20	4.52	0.0058
23230	782.00	4.1	30	-4.51	-0.0058
23230	782.00	4.1	40	-4.66	-0.0060
23230	782.00	4.1	50	5.69	0.0073
23230	782.00	4.1	60	-3.30	-0.0042

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	782.00	4.35	-30	-4.33	-0.0055
23230	782.00	4.35	-20	-3.92	-0.0050
23230	782.00	4.35	-10	-4.22	-0.0054
23230	782.00	4.35	0	-3.53	-0.0045
23230	782.00	4.35	10	-3.62	-0.0046
23230	782.00	4.35	20	4.39	0.0056
23230	782.00	4.35	30	5.92	0.0076
23230	782.00	4.35	40	-3.69	-0.0047
23230	782.00	4.35	50	5.19	0.0066
23230	782.00	4.35	60	-3.29	-0.0042

LTE Band 13 Results(5MHz Bandwidth): channel 23255 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23255	784.50	3.6	-30	-3.82	-0.0049
23255	784.50	3.6	-20	3.68	0.0047
23255	784.50	3.6	-10	5.38	0.0069
23255	784.50	3.6	0	3.96	0.0050
23255	784.50	3.6	10	4.99	0.0064
23255	784.50	3.6	20	5.55	0.0071
23255	784.50	3.6	30	4.42	0.0056
23255	784.50	3.6	40	-4.63	-0.0059
23255	784.50	3.6	50	-4.28	-0.0055
23255	784.50	3.6	60	4.12	0.0053

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23255	784.50	4.1	-30	4.94	0.0063
23255	784.50	4.1	-20	-4.91	-0.0063
23255	784.50	4.1	-10	4.72	0.0060
23255	784.50	4.1	0	7.28	**0.0093**
23255	784.50	4.1	10	4.01	0.0051
23255	784.50	4.1	20	3.69	0.0047
23255	784.50	4.1	30	5.35	0.0068
23255	784.50	4.1	40	3.95	0.0050
23255	784.50	4.1	50	4.26	0.0054
23255	784.50	4.1	60	-2.92	-0.0037

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23255	784.50	4.35	-30	3.91	0.0050
23255	784.50	4.35	-20	6.79	0.0087
23255	784.50	4.35	-10	6.64	0.0085
23255	784.50	4.35	0	3.85	0.0049
23255	784.50	4.35	10	3.93	0.0050
23255	784.50	4.35	20	5.38	0.0069
23255	784.50	4.35	30	3.48	0.0044
23255	784.50	4.35	40	-2.99	-0.0038
23255	784.50	4.35	50	3.85	0.0049
23255	784.50	4.35	60	-4.01	-0.0051

Procedure for IC:

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 –20°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. Using a resolution bandwidth equal to that permitted within the 1MHz band immediately outside the channel edge, reference points will be selected at the unwanted emission levels which comply with the attenuation 40 + 10 log10 p, for the type of device under test, on the emission mask of the lowest and highest channels, and the frequency at these points shall be recorded as fL and fH respectively.
11. The frequency stability is calculated by fL minus the frequency offset (frequency error measured in step 9) and fH plus the frequency offset shall be within the frequency range that the equipment is designed to operate (2.5 to 2.57 GHz).
12. The CMW 500 commands the EUT to change frequency to the high channel and repeats steps 7 to 11.
13. Repeat steps 5 to 12 changing the supply voltage to 4.1 Volts
14. Increase temperature to 20 and 50°C and soak for 1/2 hour.
15. Repeat steps 4 - 14 for temperatures –20°C to 50°C.
16. Repeat steps 5 to 15 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

Date of test: March 18, 2015.

IC RSS – 130, 4.3 LTE Band 13 Frequency Stability.

LTE Band 13 10MHz Bandwidth results: channels 23205, & 23255 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Band 13 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23205	779.5	3.6	20	-3.104	777.264	N/A	777.264	N/A
23255	784.50	3.6	20	2.761	N/A	786.688	N/A	786.688

Traffic Channel Number	LTE Band 13 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23205	779.5	4.1	20	-3.033	777.264	N/A	777.264	N/A
23255	784.50	4.1	20	3.777	N/A	786.688	N/A	786.688

Traffic Channel Number	LTE Band 13 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23205	779.5	4.35	20	-2.460	777.264	N/A	777.264	N/A
23255	784.50	4.35	20	3.247	N/A	786.688	N/A	786.688

LTE Band 13 10MHz Bandwidth results: channels 20850, & 21350 @ -20 and +50°C maximum transmitted power

Traffic Channel Number	LTE Band 13 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23205	779.5	3.6	-20	-3.848	777.264	N/A	777.264	N/A
23255	784.50	3.6	-20	-4.320	N/A	786.688	N/A	786.687
23205	779.5	4.1	-20	4.148	777.264	N/A	777.264	N/A
23255	784.50	4.1	-20	-2.890	N/A	786.688	N/A	786.687
23205	779.5	4.35	-20	-3.705	777.264	N/A	777.264	N/A
23255	784.50	4.35	-20	3.619	N/A	786.688	N/A	786.688
23205	779.5	3.6	50	-2.847	777.264	N/A	777.264	N/A
23255	784.50	3.6	50	2.160	N/A	786.688	N/A	786.688
23205	779.5	4.1	50	2.561	777.264	N/A	777.264	N/A
23255	784.50	4.1	50	-4.563	N/A	786.688	N/A	786.687
23205	779.5	4.35	50	-3.333	777.264	N/A	777.264	N/A
23255	784.50	4.35	50	-3.448	N/A	786.688	N/A	786.687

APPENDIX 6C – LTE Band 13 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following measurements were performed by Shiva Kumbham.
Date of Test: February 23, 2015
The environmental tests conditions were: Temperature: 26.4 °C
Relative Humidity: 2.5 %

The BlackBerry® smartphone was standalone, positioned horizontal up, top of device 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 3-4 meters height.

LTE Band 13, 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)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	23205	779.50	13	Dipole	V	-39.32	-27.67	V-V	6.40	**24.36**	0.27	35.00	10.64
F0	23205	779.50	13	Dipole	H	-27.67		H-H	3.04				
F0	23230	782.00	13	Dipole	V	-39.78	-27.85	V-V	5.86	23.82	0.24	35.00	11.18
F0	23230	782.00	13	Dipole	H	-27.85		H-H	2.80				
F0	23254	784.40	13	Dipole	V	-39.35	-27.76	V-V	5.83	23.72	0.24	35.00	11.28
F0	23254	784.40	13	Dipole	H	-27.76		H-H	3.16				

LTE Band 13, 5MHz BW, RB=25, 16QAM 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)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	23205	779.50	13	Dipole	V	-40.52	-28.94	V-V	5.12	**23.08**	0.20	35.00	11.92
F0	23205	779.50	13	Dipole	H	-28.94		H-H	1.70				
F0	23230	782.00	13	Dipole	V	-40.48	-28.97	V-V	4.75	22.71	0.19	35.00	12.29
F0	23230	782.00	13	Dipole	H	-28.97		H-H	1.69				
F0	23254	784.40	13	Dipole	V	-40.26	-28.73	V-V	4.85	22.74	0.19	35.00	12.26
F0	23254	784.40	13	Dipole	H	-28.73		H-H	2.16				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Shiva Kumbham.

Date of Test: February 20, 2015

The environmental test conditions were: Temperature: 25.6 ºC
Relative Humidity: 2.8 %

The BlackBerry® smartphone was standalone, with horizontal pointing up and top 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 3-4 meters height, and the frequency range scanned was 30MHz – 1GHz.

Measurements were performed in LTE band 13 with QPSK modulations for 5MHz BW (channel 23205, 23230 and 23254 with RB = 1).

Measurements were performed in LTE band 13 with QPSK modulations for 5MHz BW (channel 23205, 23230 and 23254 with RB = 25).

All emissions had test margins greater than 25.0 dB.

The following measurements were performed by Winston Vernon

Date of Test: February 12 and 20, 2015

The environmental test conditions were: Temperature: 24.3 - 24.7 ºC
Relative Humidity: 13.7 - 14.5 %

Test Distance was 3.0 meters with the RX antenna height scans between 3-4 meters height, and a frequency range of 1 GHz to 10 GHz.

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

Measurements were performed in LTE band 13 with QPSK modulations for 5MHz BW (channel 23205, 23230 and 23254 with RB = 1).

Measurements were performed in LTE band 13 with QPSK modulations for 5MHz BW (channel 23205, 23230 and 23254 with RB = 25).

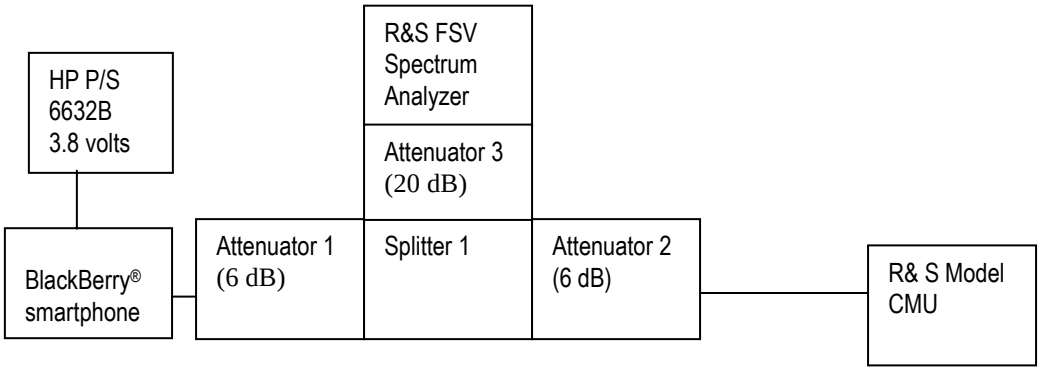
All emissions had test margins greater than 25.0 dB.

APPENDIX 7A– 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 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: Feb 18, 2015.

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

The following measurements were performed by Sijia Li.

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 9.28MHz. 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	9.21	**8.966**	8.942
710.0	9.20	8.942	8.942
711.0	**9.28**	**8.966**	**8.966**

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)

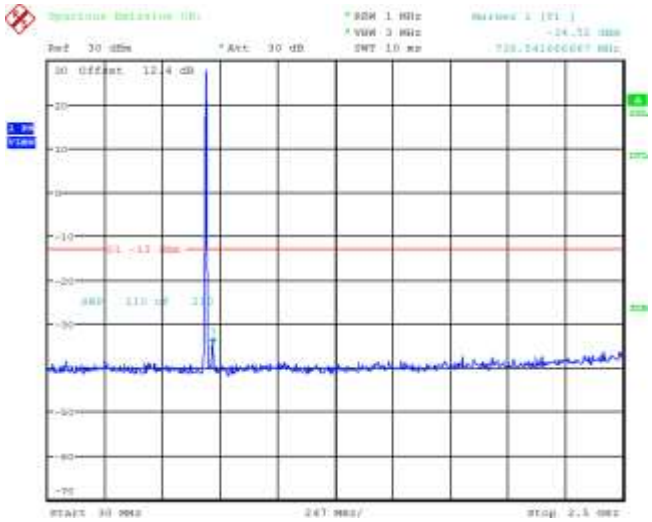


Figure 6-2a: Band 17, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

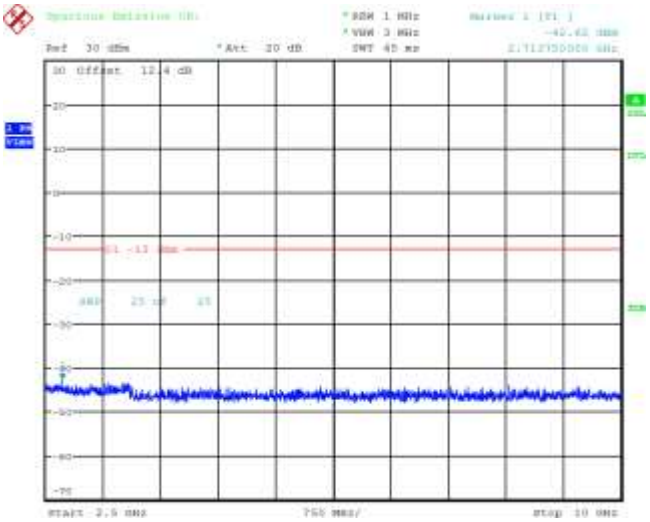


Figure 6-3a: Band 17, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)

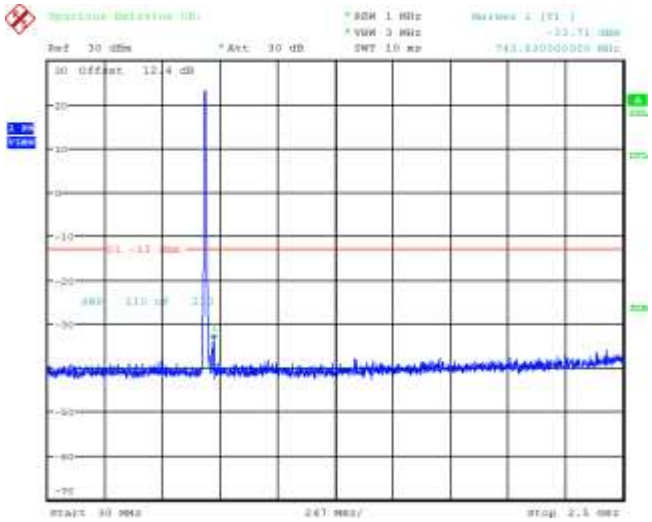
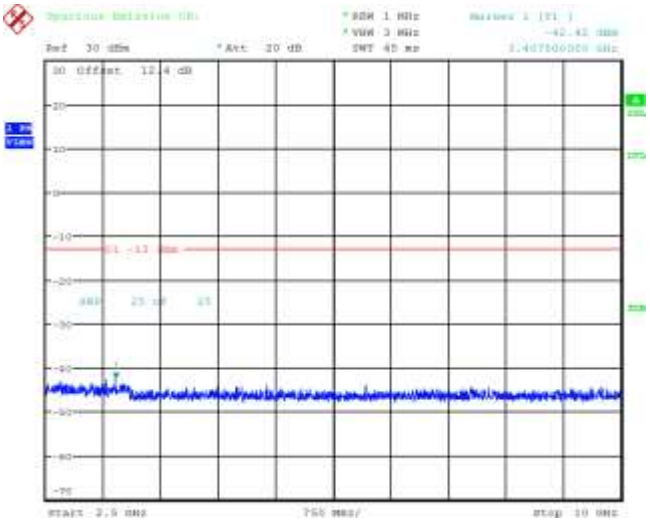


Figure 6-4a: Band 17, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)



LTE Band 17 Conducted RF Emission Test Data cont'd

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

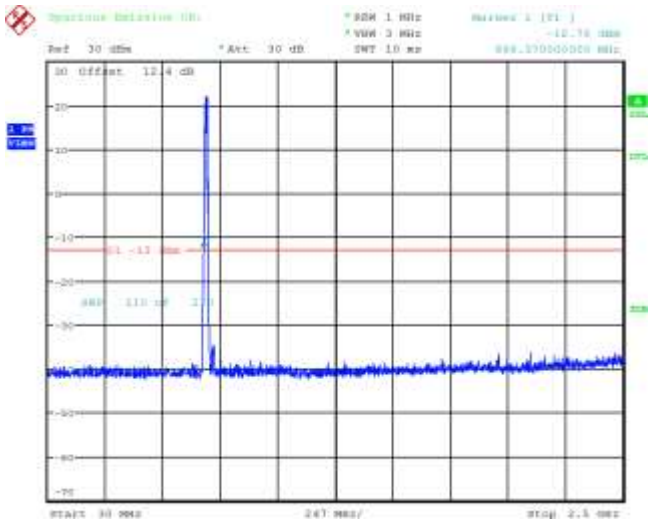


Figure 6-6a: Band 17, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

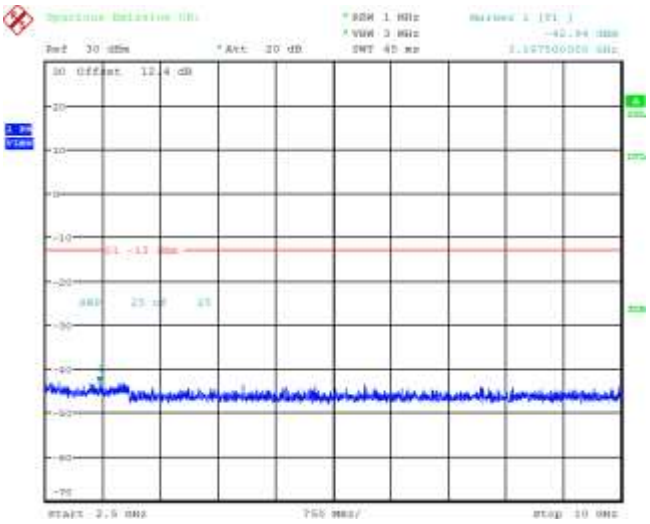


Figure 6-7a: Band 17, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)

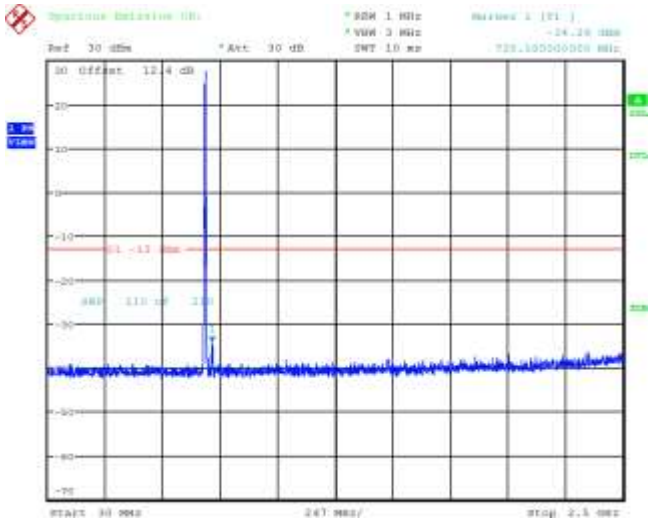
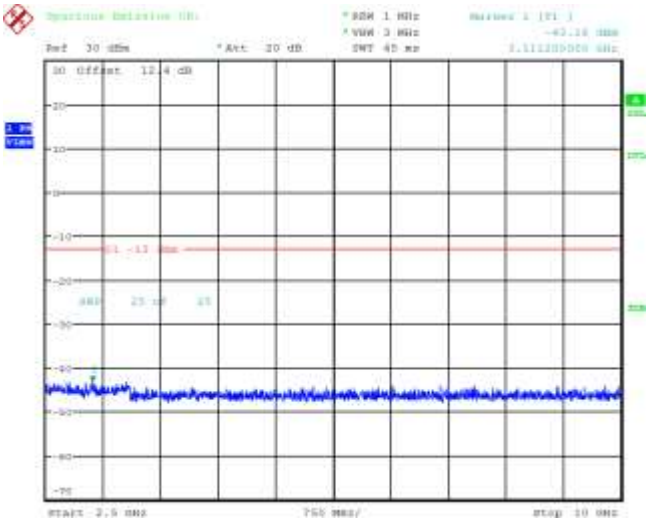


Figure 6-8a: Band 17, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)



LTE Band 17 Conducted RF Emission Test Data cont'd

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

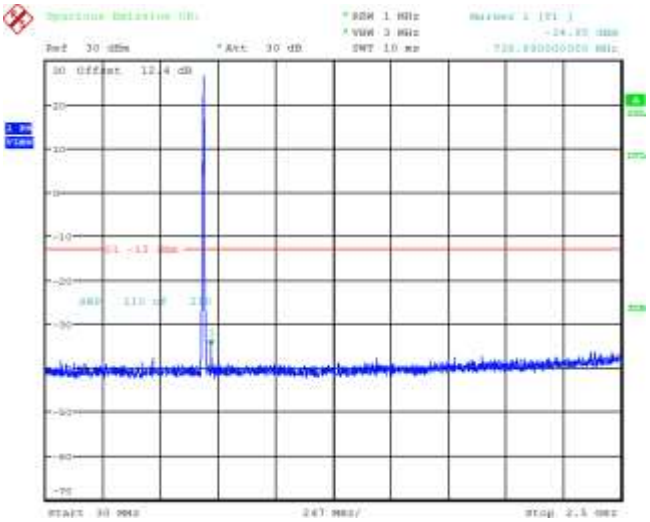


Figure 6-10a: Band 17, Spurious Conducted Emissions, High Channel, 5MHz BW (RB= 15)

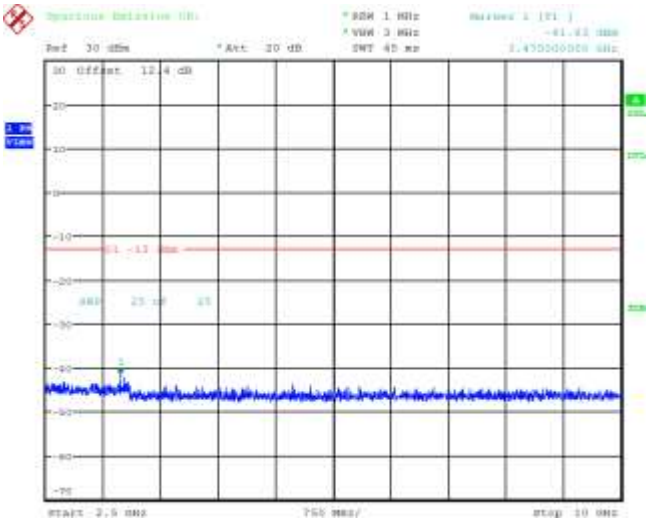


Figure 6-11a: Band 17, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)

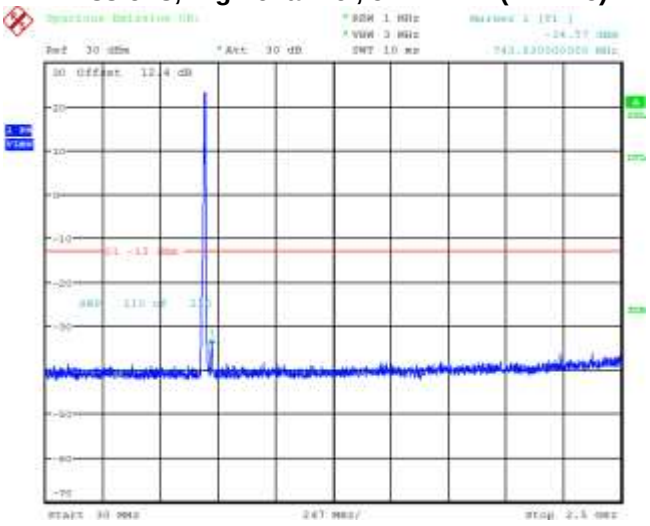
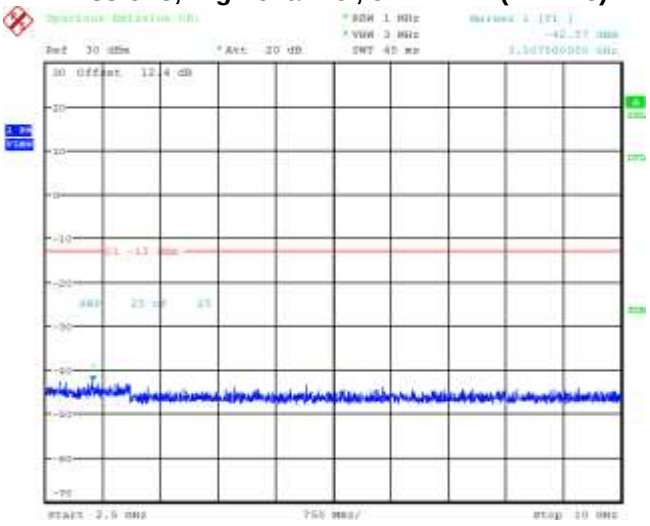


Figure 6-12a: Band 17, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)



LTE Band 17 Conducted RF Emission Test Data cont'd

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

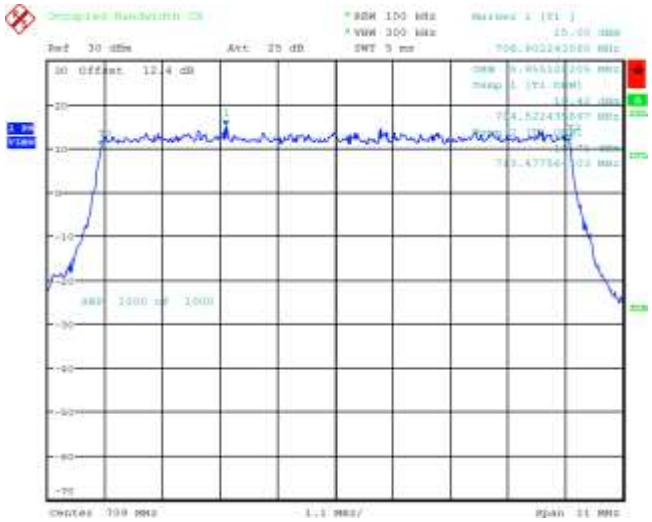


Figure 6-14a: Occupied Bandwidth, Band 17 Middle Channel, 10MHz BW, RB=50

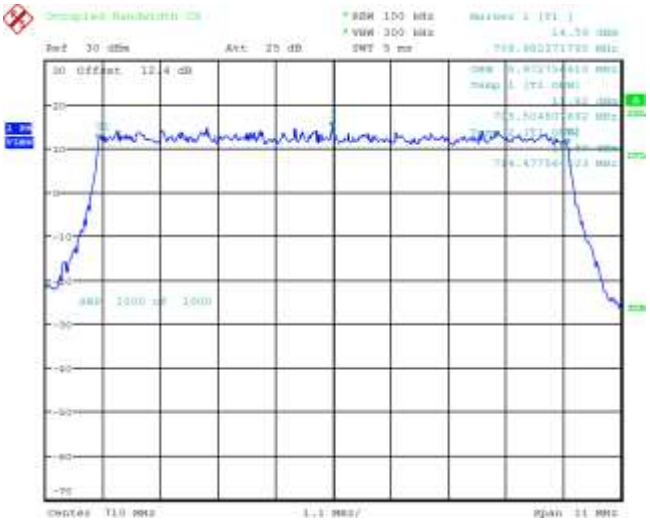
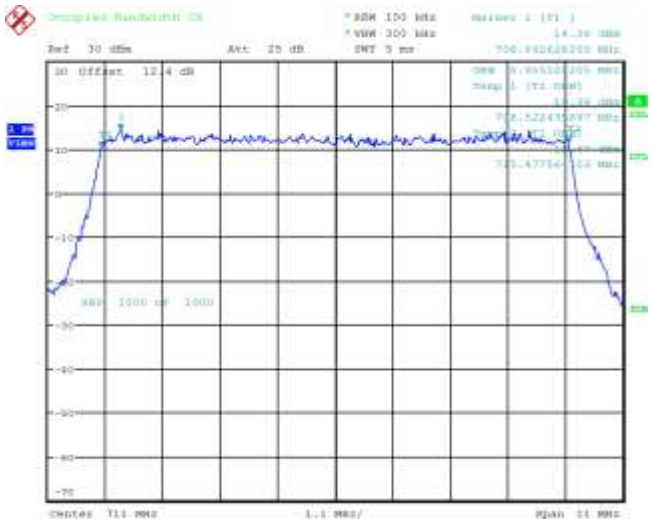


Figure 6-15a: Occupied Bandwidth, Band 17 High Channel, 10MHz BW, RB=50



LTE Band 17 Conducted RF Emission Test Data cont'd

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

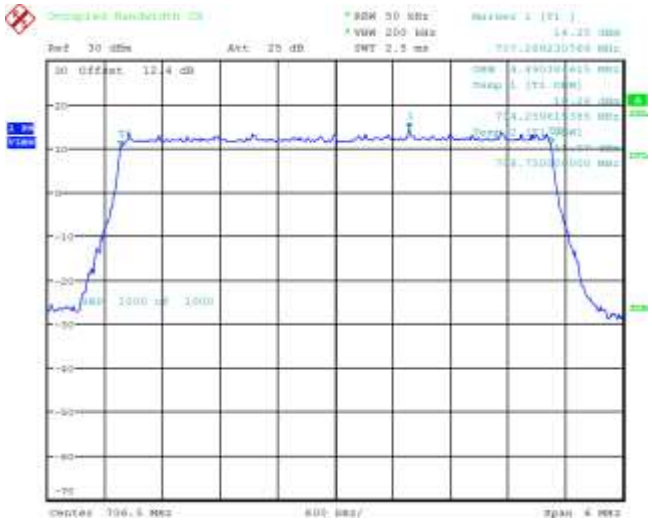


Figure 6-17a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25

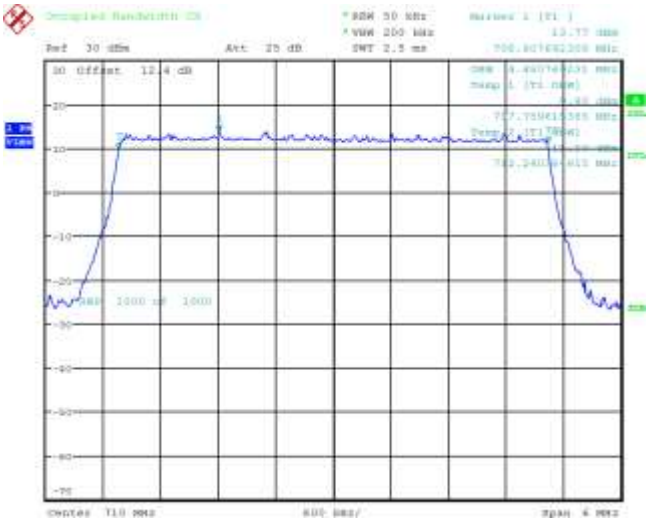
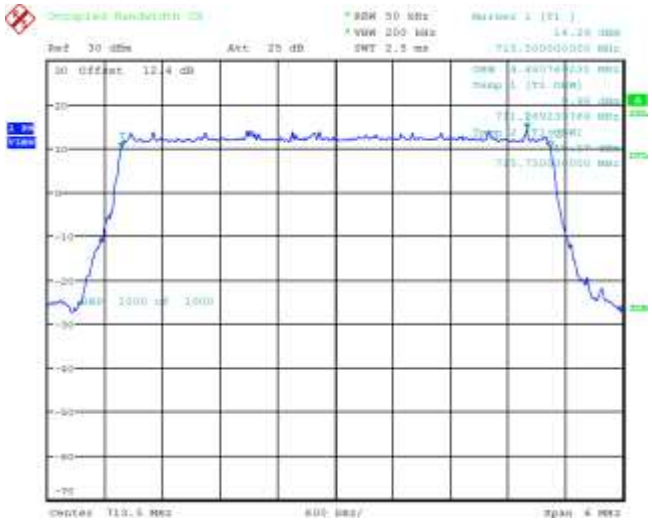


Figure 6-18a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25



LTE Band 17 Conducted RF Emission Test Data cont'd

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

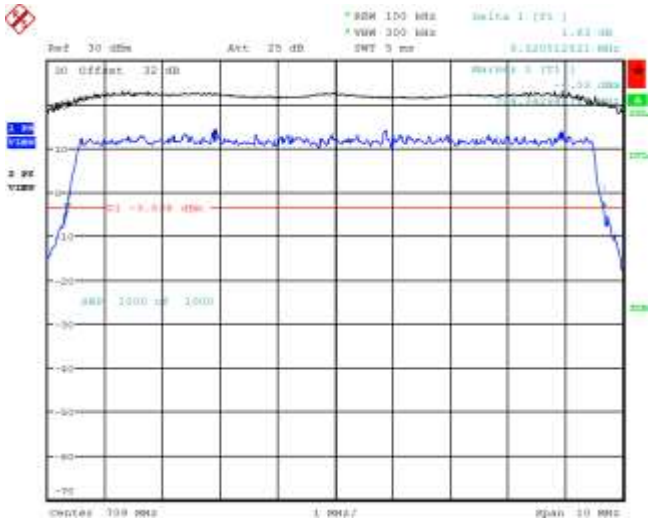


Figure 6-20a: -26 dBc Bandwidth, Band 17 Middle Channel, 10MHz BW, RB=50

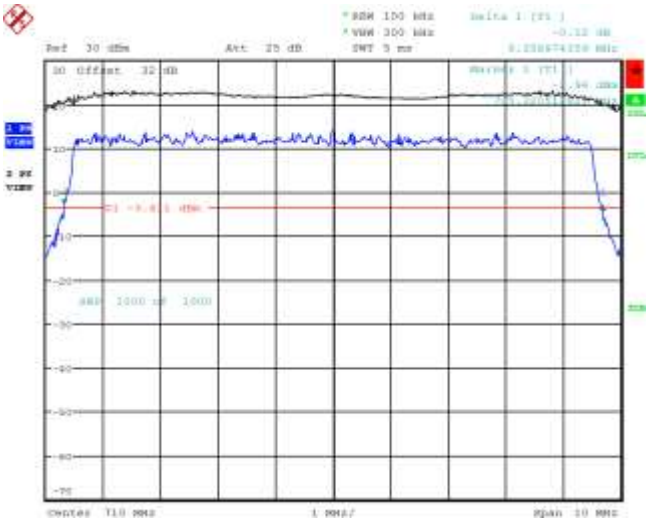


Figure 6-21a: -26 dBc Bandwidth, Band 17 High Channel, 10MHz BW, RB=50

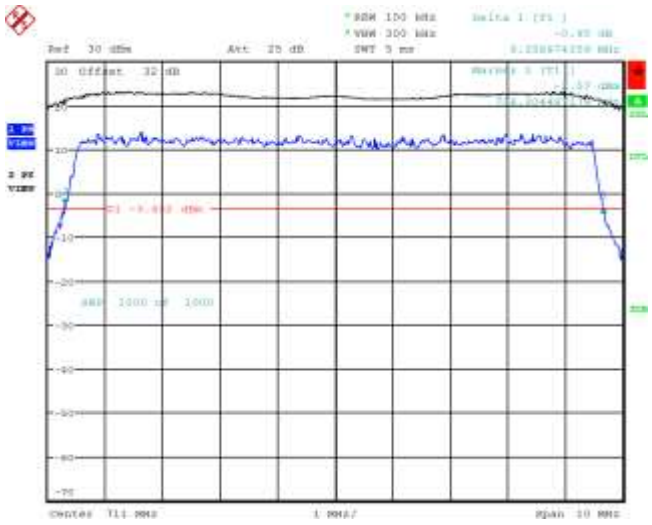
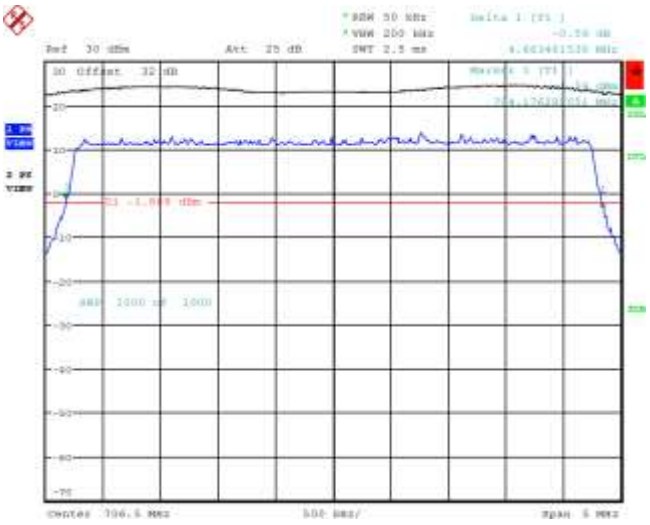


Figure 6-22a: -26 dBc Bandwidth, Band 17 Low Channel, 5MHz BW, RB=25



LTE Band 17 Conducted RF Emission Test Data cont'd

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

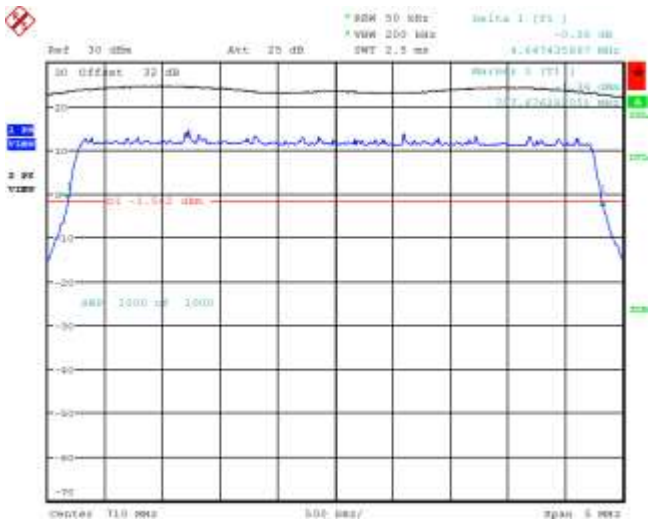


Figure 6-24a: -26 dBc Bandwidth, Band 17 High Channel, 5MHz BW, RB=25

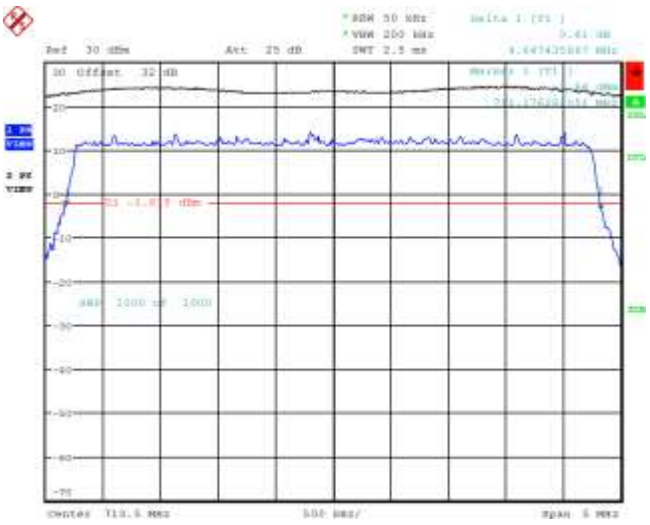


Figure 6-25a: Band 17 Low Channel Mask, 10MHz BW, RB=50

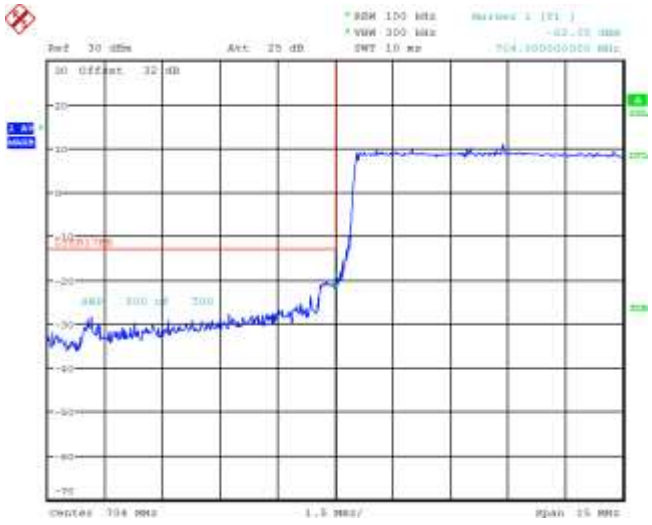
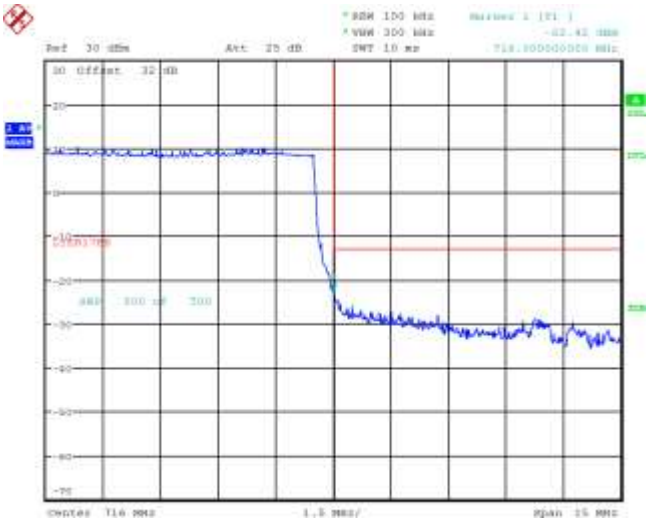


Figure 6-26a: Band 17 High Channel Mask, 10MHz BW, RB=50



LTE Band 17 Conducted RF Emission Test Data cont'd

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

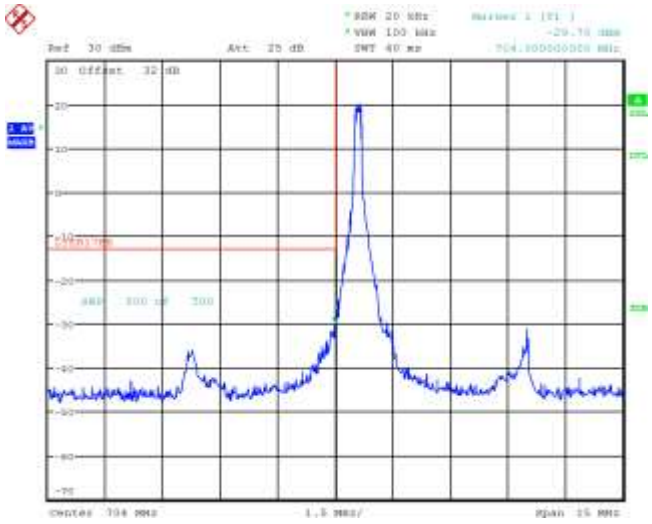


Figure 6-28a: Band 17 High Channel Mask,10MHz BW, RB=1

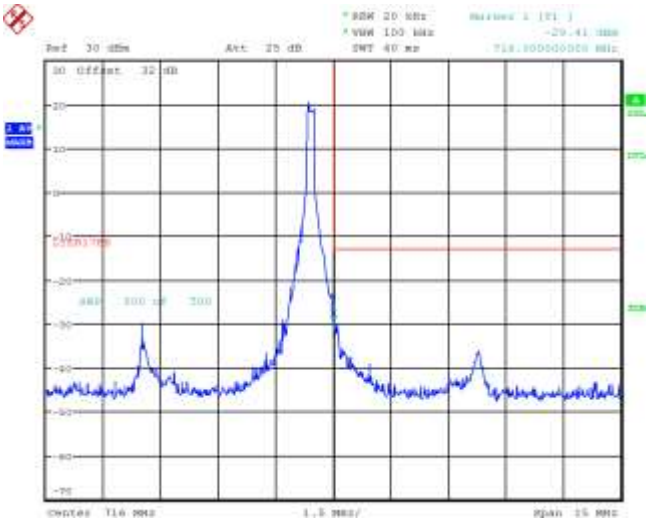


Figure 6-29a: Band 17 Low Channel Mask, 5MHz BW, RB=25

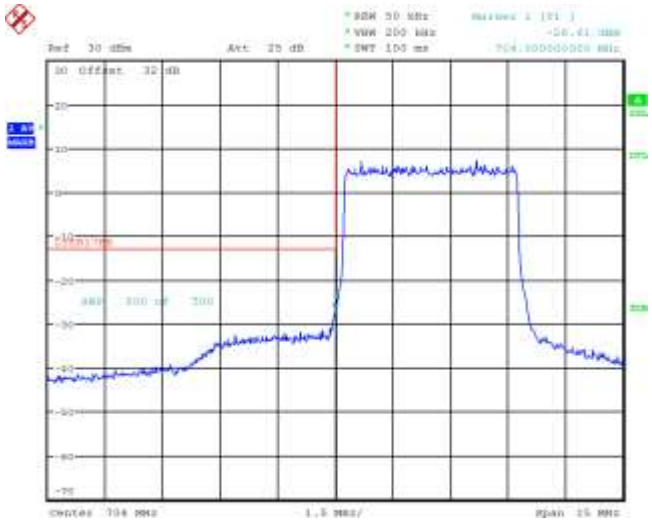
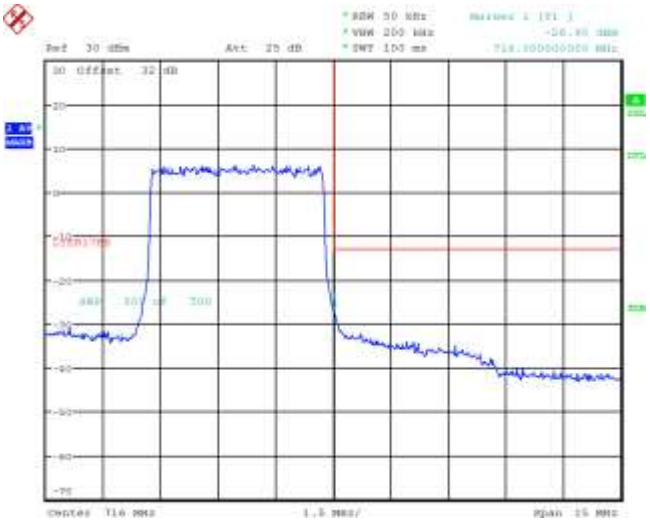


Figure 6-30a: Band 17 High Channel Mask, 5MHz BW, RB=25



LTE Band 17 Conducted RF Emission Test Data cont'd

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

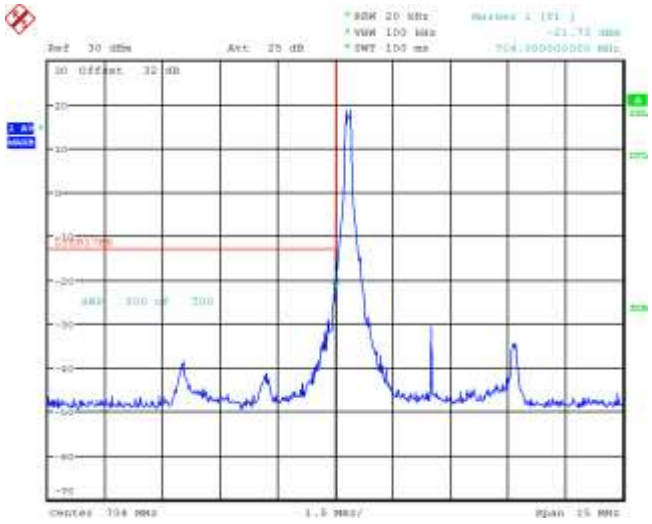


Figure 6-32a: Band 17 High Channel Mask, 5MHz BW, RB=1

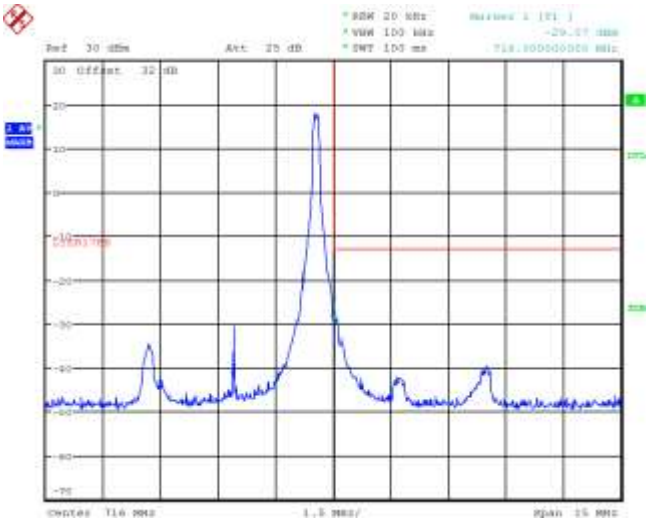


Figure 6-33a: Band 17 Mid Channel PAR, 10MHz BW, RB=25

Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	11.36 dBm
Peak	21.12 dBm
Crest	9.75 dB
10 %	3.33 dB
1 %	6.28 dB
.1 %	8.01 dB
.01 %	9.62 dB

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

Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	10.50 dBm
Peak	20.98 dBm
Crest	10.48 dB
10 %	3.33 dB
1 %	6.38 dB
.1 %	8.17 dB
.01 %	10.35 dB

LTE Band 17 Conducted RF Emission Test Data cont'd

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

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

LTE Band 17 Conducted RF Emission Test Data cont'd

Figure 6-37a: Occupied Bandwidth, Band 17 Low Channel, 20MHz BW (RB= 100) 16-QAM

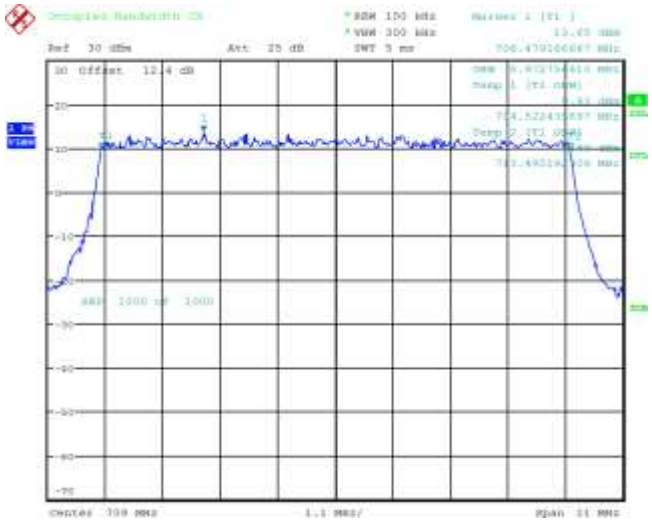


Figure 6-38a: Occupied Bandwidth, Band 17 Mid Channel, 20MHz BW (RB= 100) 16-QAM

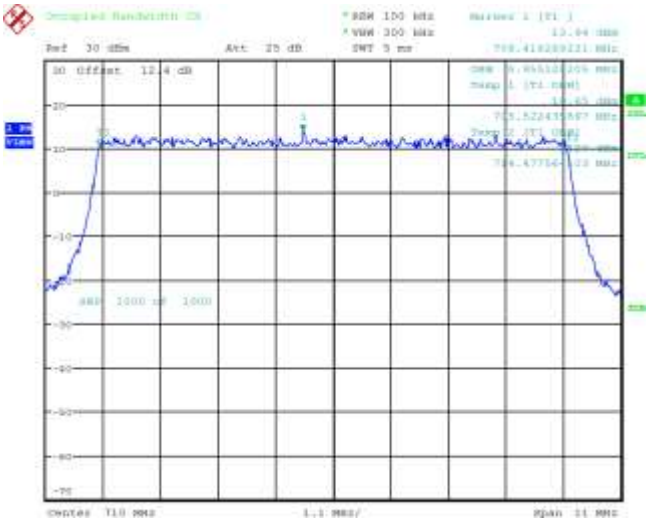
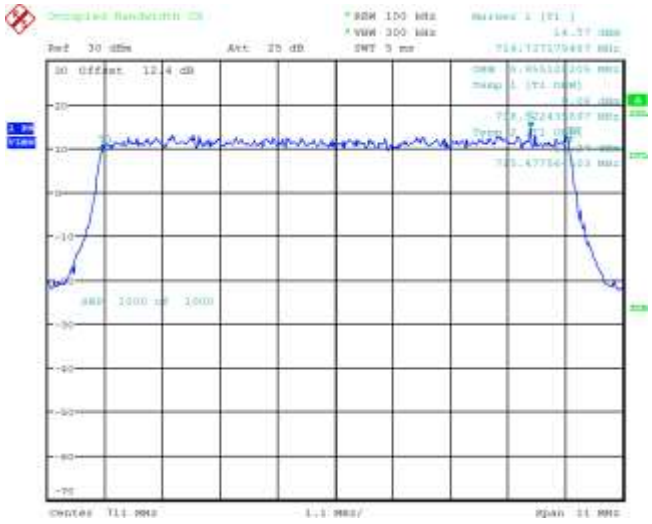
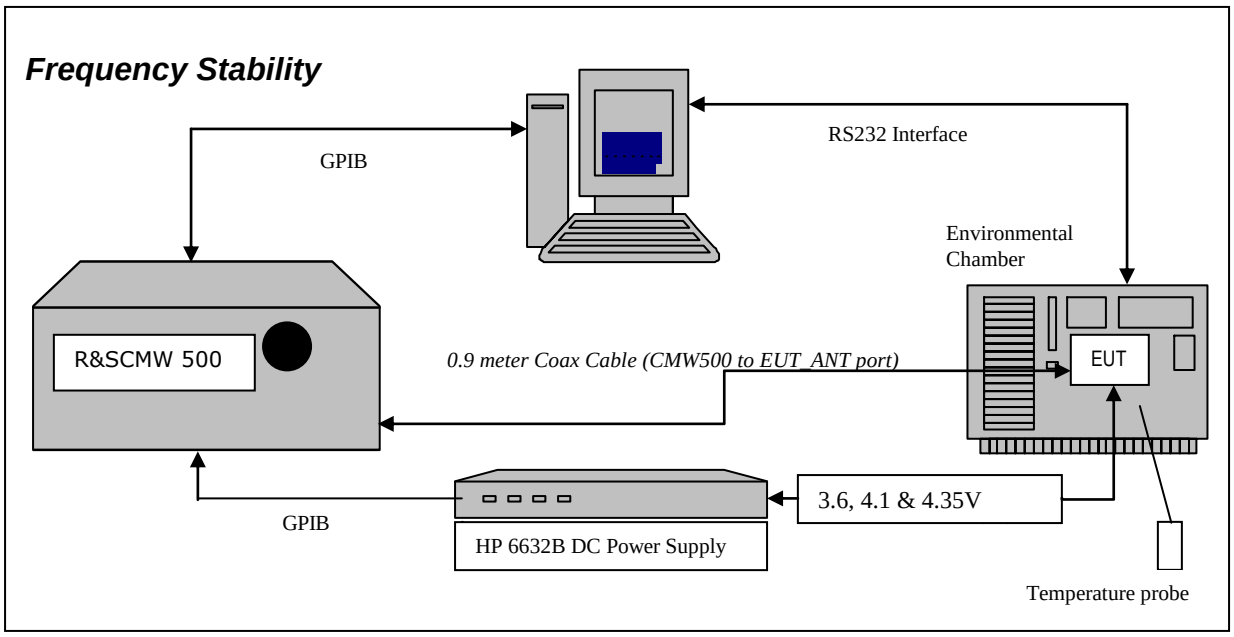


Figure 6-39a: Occupied Bandwidth, Band 17 High Channel, 20MHz BW (RB= 100) 16-QAM



APPENDIX 7B – LTE Band 17 FREQUENCY STABILITY TEST DATA

LTE Band 17 Frequency Stability Test Data



The following measurements were performed by Sijia Li.

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 for FCC:

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 17 measured was **0.0106 PPM.**

Date of Test: Feb 17, 2015

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

Procedure for IC:

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 –20°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. Using a resolution bandwidth equal to that permitted within the 1MHz band immediately outside the channel edge, reference points will be selected at the unwanted emission levels which comply with the attenuation 40 + 10 log10 p, for the type of device under test, on the emission mask of the lowest and highest channels, and the frequency at these points shall be recorded as fL and fH respectively.
11. The frequency stability is calculated by fL minus the frequency offset (frequency error measured in step 9) and fH plus the frequency offset shall be within the frequency range that the equipment is designed to operate (2.5 to 2.57 GHz).
12. The CMW 500 commands the EUT to change frequency to the high channel and repeats steps 7 to 11.
13. Repeat steps 5 to 12 changing the supply voltage to 4.1 Volts
14. Increase temperature to 20 and 50°C and soak for 1/2 hour.
15. Repeat steps 4 - 14 for temperatures –20°C to 50°C.
16. Repeat steps 5 to 15 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

Date of test: March 18, 2015.

IC RSS – 130, 4.3 LTE Band 17 Frequency Stability.

LTE Band 17 20MHz Bandwidth results: channels 23780, & 23800 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Band 17 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23780	709.0	3.6	20	-4.01	704.285	N/A	704.285	N/A
23800	711.0	3.6	20	-2.49	N/A	715.7	N/A	715.7

Traffic Channel Number	LTE Band 17 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23780	709.0	4.1	20	3.42	704.345	N/A	704.345	N/A
23800	711.0	4.1	20	-3.20	N/A	715.64	N/A	715.64

Traffic Channel Number	LTE Band 17 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23780	709.0	4.35	20	-2.57	704.33	N/A	704.33	N/A
23800	711.0	4.35	20	4.58	N/A	715.715	N/A	715.715

LTE Band 17 20MHz Bandwidth results: channels 23780, & 23800 @ -20 and +50°C maximum transmitted power

Traffic Channel Number	LTE Band 17 Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	fL (MHz)	fH (MHz)	fL-Freq Offset (MHz)	fH+Freq Offset (MHz)
23780	709.0	3.6	-20	-1.67	704.36	N/A	704.36	N/A
23800	711.0	3.6	-20	-2.49	N/A	715.64	N/A	715.64
23780	709.0	4.1	-20	-2.37	704.36	N/A	704.36	N/A
23800	711.0	4.1	-20	4.08	N/A	715.73	N/A	715.73
23780	709.0	4.35	-20	-1.90	704.315	N/A	704.315	N/A
23800	711.0	4.35	-20	4.01	N/A	715.64	N/A	715.64
23780	709.0	3.6	50	-3.19	704.27	N/A	704.27	N/A
23800	711.0	3.6	50	1.46	N/A	715.64	N/A	715.64
23780	709.0	4.1	50	1.83	704.36	N/A	704.36	N/A
23800	711.0	4.1	50	-4.46	N/A	715.655	N/A	715.655
23780	709.0	4.35	50	-2.30	704.375	N/A	704.375	N/A
23800	711.0	4.35	50	2.26	N/A	715.655	N/A	715.655

APPENDIX 7C – LTE Band 17 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

Date of Test: February 23, 2015
The following measurements were performed by Shiva Kumbham.
The environmental tests conditions were: Temperature: 26.4 °C
Relative Humidity: 2.4 %

The BlackBerry® smartphone was standalone, volume keys up with the screen 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)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	23755	706.50	17	Dipole	V	-43.57	-32.26	V-V	-0.29	18.00	0.06	35.00	17.00
F0	23755	706.50	17	Dipole	H	-32.26		H-H	-2.50				
F0	23790	710.00	17	Dipole	V	-42.70	-30.99	V-V	1.31	**19.63**	0.09	35.00	15.37
F0	23790	710.00	17	Dipole	H	-30.99		H-H	-1.08				
F0	23824	713.40	17	Dipole	V	-42.45	-30.86	V-V	1.25	19.51	0.09	35.00	15.49
F0	23824	713.40	17	Dipole	H	-30.86		H-H	-1.24				

LTE band 17, 10MHz BW, RB=1, 16-QAM modulation

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method / Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V,H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	(W)	Limit (dBm)	Diff. To Limit (dB)
F0	23780	709.00	17	Dipole	V	-44.15	-32.18	V-V	-0.09	18.20	0.07	35.00	16.80
F0	23780	709.00	17	Dipole	H	-32.18		H-H	-2.35				
F0	23790	710.00	17	Dipole	V	-44.16	-32.25	V-V	-0.02	18.30	0.07	35.00	16.70
F0	23790	710.00	17	Dipole	H	-32.25		H-H	-2.41				
F0	23799	710.90	17	Dipole	V	-43.74	-31.93	V-V	0.39	**18.65**	0.07	35.00	16.35
F0	23799	710.90	17	Dipole	H	-31.93		H-H	-2.08				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Shiva Kumbham.

Date of Test: February 20, 2015

The environmental test conditions were: Temperature: 25.6 ºC
Relative Humidity: 2.8 %

The BlackBerry® smartphone was standalone, volume keys up with the screen 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 modulations for 5MHz BW (channel 23755, 23790, 23824 with RB = 1).

Measurements were performed in LTE band 17 with QPSK modulations for 10MHz BW (channel 23755, 23790, 23824 with RB = 1).

All emissions were at least 25.0 dB below the limit.

The following measurements were performed by Winston Vernon

Date of Test: February 20, 2015

The environmental test conditions were: Temperature: 24.3 – 24.6 ºC
Relative Humidity: 13.8 – 14.5 %

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, vertical upside down with the screen 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 modulations for 5MHz BW (channel 23755, 23790, 23824 with RB = 1).

Measurements were performed in LTE band 17 with QPSK modulations for 10MHz BW (channel 23755, 23790, 23824 with RB = 1).

All emissions were at least 25.0 dB below the limit.