LTE Band 30 Conducted RF Emission Test Data cont'd

Figure 8-9a: Occupied Bandwidth, Band 30 10MHz BW, RB=50

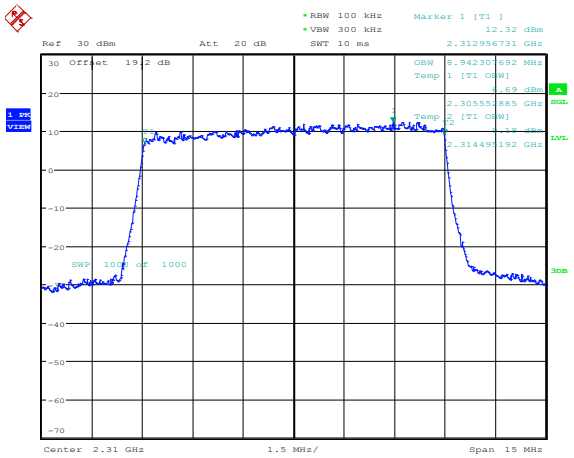


Figure 8-10a: Occupied Bandwidth, Band 5 Low Channel, 5MHz BW, RB=25

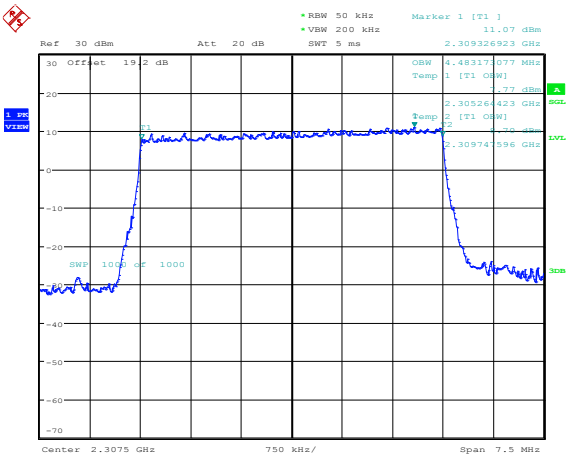


Figure 8-11a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=25

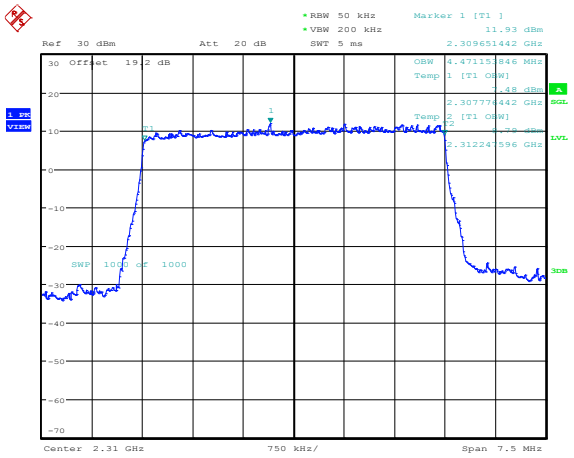
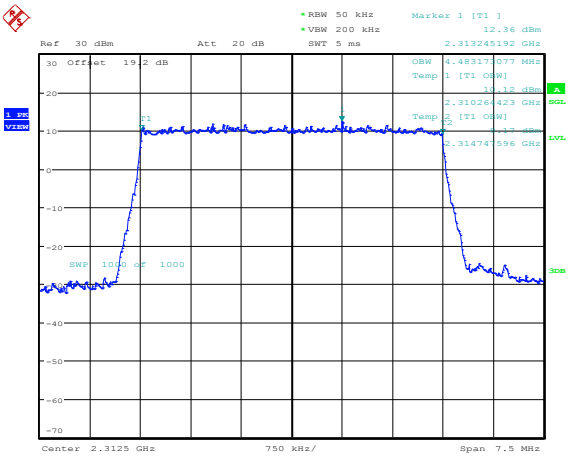


Figure 8-12a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=25



LTE Band 30 Conducted RF Emission Test Data cont'd

Figure 8-13a: -26 dBc Bandwidth, Band 30 Middle Channel, 10MHz BW, RB=50

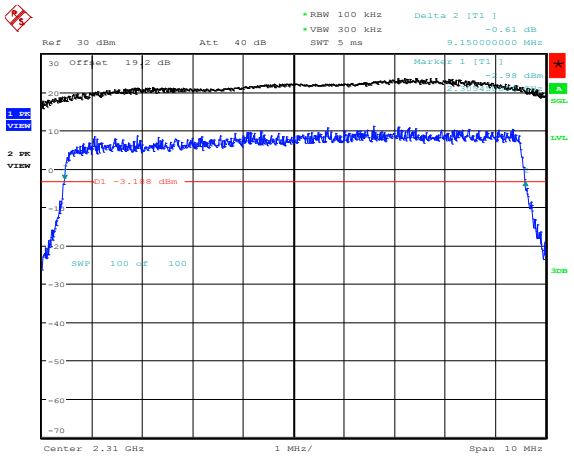


Figure 8-14a: -26 dBc Bandwidth, Band 30 Low Channel, 5MHz BW, RB=25

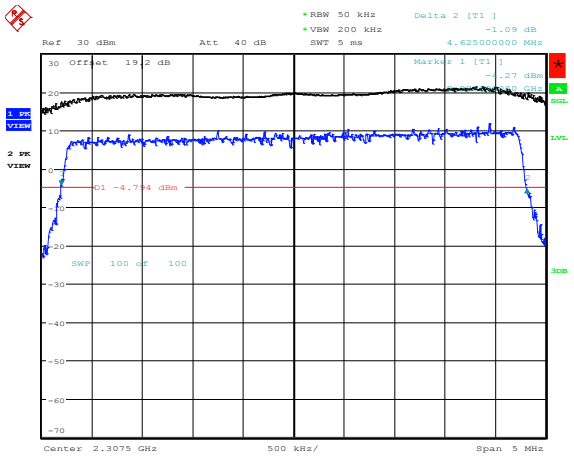


Figure 8-15a: -26 dBc Bandwidth, Band 30 Middle Channel, 5MHz BW, RB=25

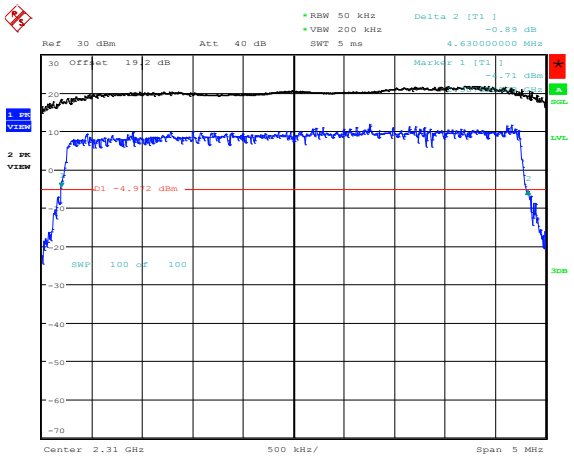
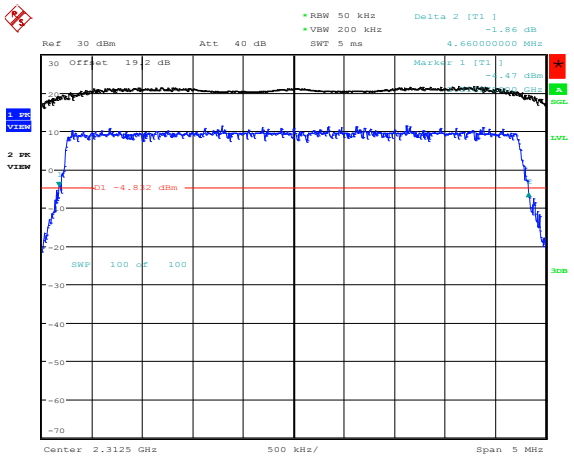


Figure 8-16a: -26 dBc Bandwidth, Band 30 High Channel, 5MHz BW, RB=25



LTE Band 30 Conducted RF Emission Test Data cont'd

Figure 8-17a: Band 30 Channel Mask, 10MHz BW, RB=50

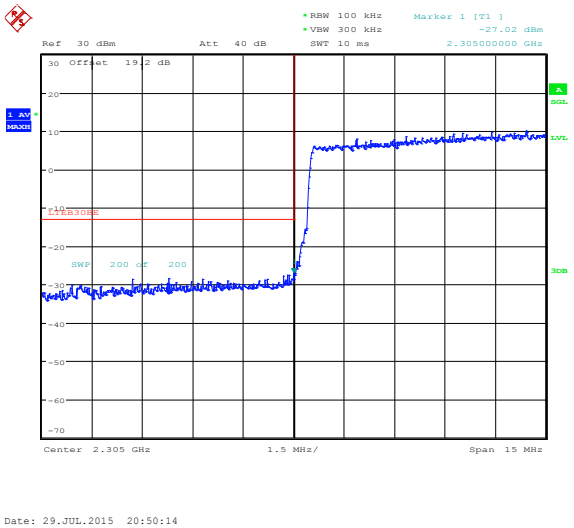


Figure 8-17a: Band 30 Channel Mask, 10MHz BW, RB=50

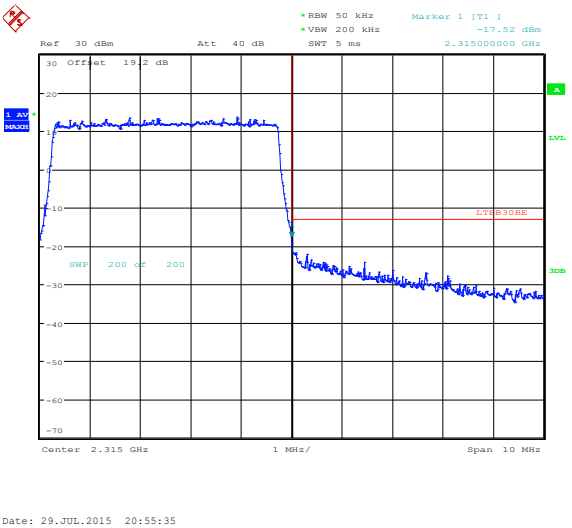


Figure 8-18a: Band 30 Low Channel Mask, 5MHz BW, RB=1

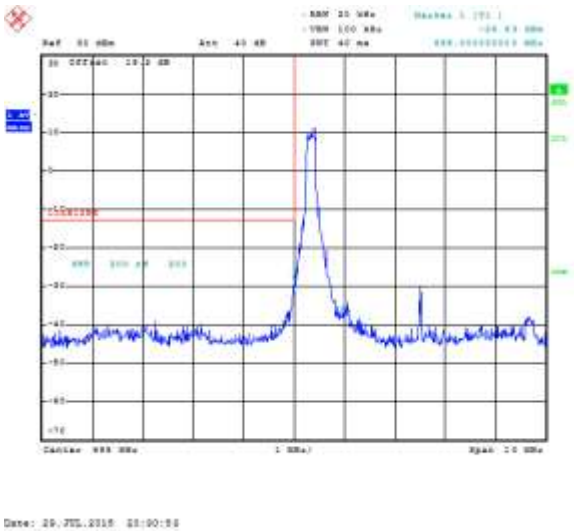
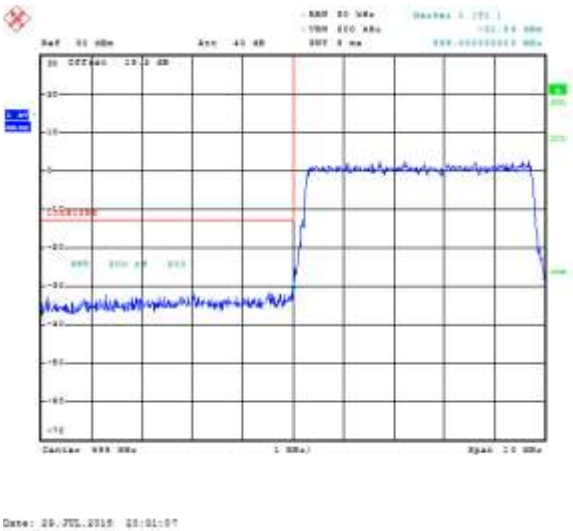


Figure 8-19a: Band 30 Low Channel Mask, 5MHz BW, RB=25



LTE Band 30 Conducted RF Emission Test Data cont'd

Figure 8-20a: Band 30 High Channel Mask, 5MHz BW, RB=1

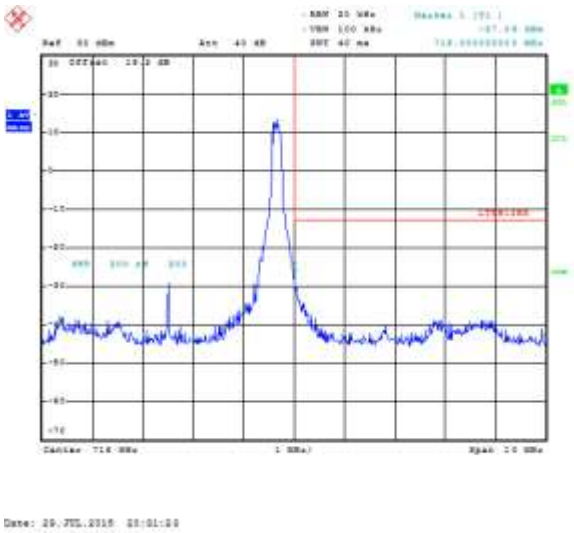


Figure 8-21a: Band 30 High Channel Mask, 5MHz BW, RB=25

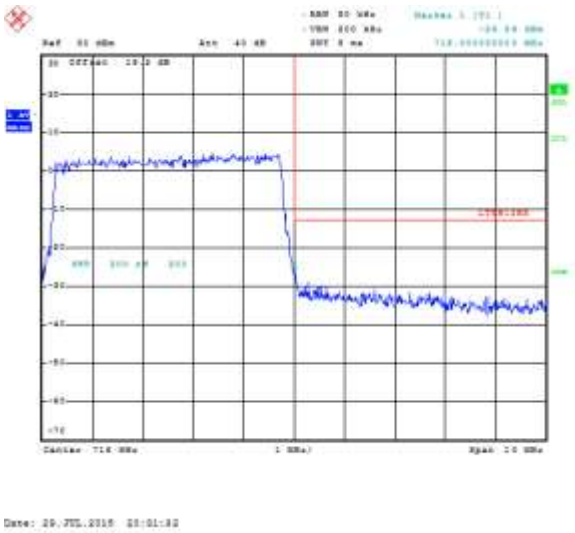
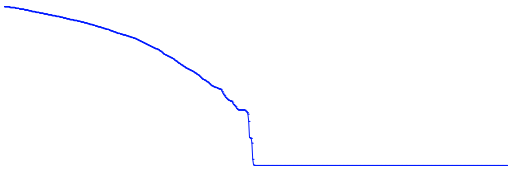


Figure 8-22a: Band 30 PAR, 10MHz BW, RB=25



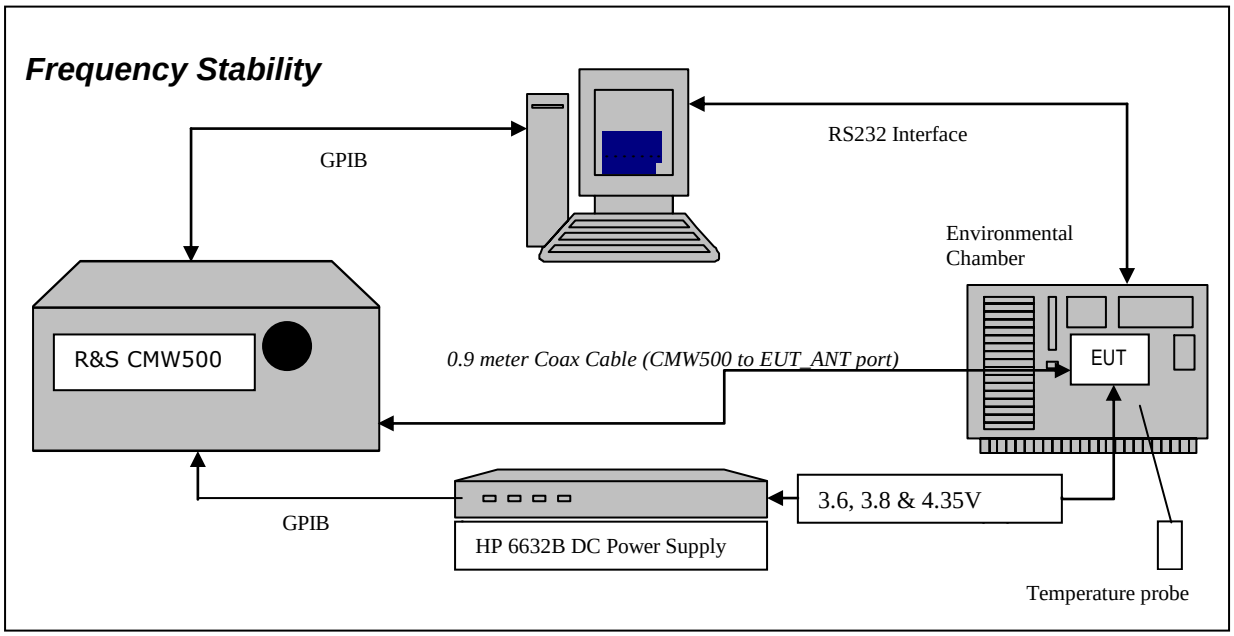
Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	13.32 dBm
Peak	23.22 dBm
Crest	9.90 dB
10 %	3.33 dB
1 %	6.25 dB
.1 %	8.01 dB
.01 %	9.55 dB

Date: 3.SEP.2015 03:17:20

APPENDIX 8B – LTE Band 30 FREQUENCY STABILITY TEST DATA

LTE Band 30 Frequency Stability Test Data



The following configurations were measured for model RHK211LW (STV100-1):

. 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, 3.8 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, 3.8 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:

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

85. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
86. Start test program
87. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
88. Set power supply voltage to 3.6 volts.
89. Set up CMW 500 Radio Communication Tester.
90. Command the CMW 500 to switch to the low channel.
91. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
92. EUT is commanded to Transmit 100 Bursts.
93. 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.
94. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
95. Repeat steps 5 to 10 changing the supply voltage to 3.8 Volts
96. Increase temperature by 10°C and soak for 1/2 hour.
97. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
98. 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, 3.8 and 4.35 volts

The maximum frequency error in the LTE Band 30 measured was **0.0093 PPM**.

Date of test: August 25, 2015

LTE Band 30 results (10MHz Bandwidth): channels 27710 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
27710	2310.00	3.6	20	-4.79	-0.0021
27710	2310.00	3.8	20	-5.75	-0.0025
27710	2310.00	4.35	20	-7.08	-0.0031

LTE Band 30 Results (10MHz Bandwidth): channel 27710 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
27710	704	3.6	-30	-8.23	-0.0036
27710	704	3.6	-20	-5.49	-0.0024
27710	704	3.6	-10	-6.04	-0.0026
27710	704	3.6	0	-7.52	-0.0033
27710	704	3.6	10	-5.89	-0.0026
27710	704	3.6	20	-4.79	-0.0021
27710	704	3.6	30	-6.34	-0.0027
27710	704	3.6	40	-8.45	-0.0037
27710	704	3.6	50	-8.51	-0.0037
27710	704	3.6	60	-7.28	-0.0032

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
27710	704	3.8	-30	21.59	**0.0093**
27710	704	3.8	-20	-6.28	-0.0027
27710	704	3.8	-10	-5.05	-0.0022
27710	704	3.8	0	-6.19	-0.0027
27710	704	3.8	10	-7.32	-0.0032
27710	704	3.8	20	-5.75	-0.0025
27710	704	3.8	30	-6.98	-0.0030
27710	704	3.8	40	-8.41	-0.0036
27710	704	3.8	50	-6.41	-0.0028
27710	704	3.8	60	-7.80	-0.0034

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
27710	704	4.35	-30	-5.85	-0.0025
27710	704	4.35	-20	-7.38	-0.0032
27710	704	4.35	-10	-4.98	-0.0022
27710	704	4.35	0	-5.75	-0.0025
27710	704	4.35	10	-5.19	-0.0022
27710	704	4.35	20	-7.08	-0.0031
27710	704	4.35	30	-7.77	-0.0034
27710	704	4.35	40	-6.98	-0.0030
27710	704	4.35	50	-7.65	-0.0033
27710	704	4.35	60	-7.67	-0.0033

APPENDIX 8C – LTE Band 30 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following configurations were measured for model RHK211LW (STV100-1):

The following measurements were performed by Shiva Kumbham.
Date of Test: August 7, 2015
The environmental tests conditions were: Temperature: 25.5 °C
Relative Humidity: 35.6 %

The BlackBerry® smartphone was standalone, with horizontal top pointing up 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 30, 5MHz BW, RB=1, QPSK modulation

EUT				Rx Antenna		Spectrum Analyzer		Substitution Method / Tracking Generator					
Type	Ch	Frequency (MHz)	Band	Type	Pol.	Reading (dBm)	Max (V, H) (dBm)	Pol. Tx-Rx	Reading (dBm)	Corrected Reading (relative to Dipole) (dBm)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	23035	2307.50	30	Horn	V	-31.97	-28.94	V-V	-10.99	23.46	0.22	24.00	0.54
F0	23035	2307.50	30	Horn	H	-28.94		H-H	-12.37				
F0	23095	2310.00	30	Horn	V	-31.65	-28.91	V-V	-10.95	23.36	0.22	24.00	0.64
F0	23095	2310.00	30	Horn	H	-28.91		H-H	-12.35				
F0	23154	2312.40	30	Horn	V	-31.47	-28.76	V-V	-10.70	**23.52**	0.22	24.00	0.48
F0	23154	2312.40	30	Horn	H	-28.76		H-H	-11.82				

LTE Band 30, 10MHz BW, RB=1, 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)	Corrected Reading (relative to Dipole) (W)	Limit (dBm)	Diff. To Limit (dB)
F0	27710	2310.00	30	Horn	V	-30.23	-29.28	V-V	-11.36	22.95	0.20	24.00	1.05
F0	27710	2310.00	30	Horn	H	-29.28		H-H	-12.72				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Savtej Sandhu.

Date of Test: August 10, 2015

The environmental test conditions were: Temperature: 26.8 ºC
Relative Humidity: 33.2 %

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 30 with 5MHz BW (channel 27710, 23095 and 23129 with RB = 1) with QPSK modulation. and 10MHz BW (channel 27710, 23095 and 23129 with RB = 1), with 16-QAM modulation.

All emissions had test margins greater than 25.0 dB.

The following measurements were performed by Xing Fang and Winston Vernon.

Date of Test: August 10-11, 2015

The environmental test conditions were: Temperature: 27.9 ºC
Relative Humidity: 39.7 %

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 with top facing to the RX antenna when the turntable is at 0 degree position

Measurements were performed in LTE Band 30 with 5MHz BW (channel 27710, 23095 and 23129 with RB = 1) with QPSK modulation. and 10MHz BW (channel 27710, 23095 and 23129 with RB = 1), with 16-QAM modulation.

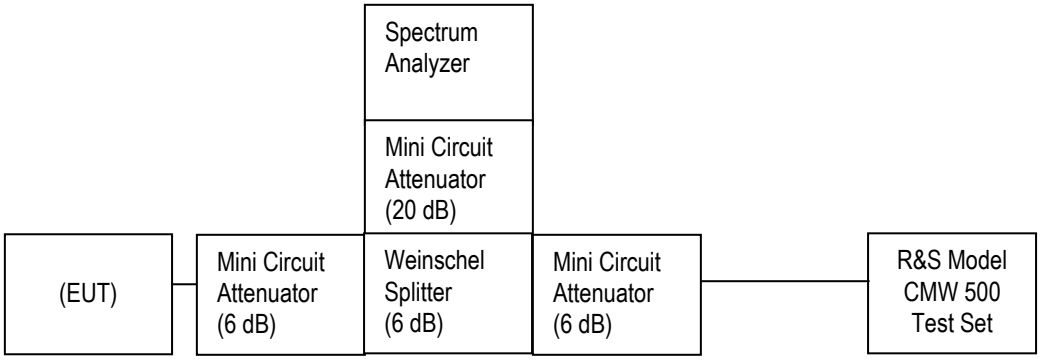
All emissions had test margins greater than 25.0 dB.

APPENDIX 9A– 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



The following configurations were measured for model RHL211LW (STV100-3):

Date of Test: April 25 – September 2, 2015

The environmental test conditions were: Temperature: 23.0 – 27.5 ºC
Relative Humidity: 40.5 – 48.3 %

The following measurements were performed by Sijia Li and Landon Martin.

LTE Band 13 Conducted RF Emission Test Data cont'd

Emission Designator Table

Frequency Range (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
779.5-784.4	**22.74**	4M50G7D	LTE B13	5	QPSK
779.5-784.4	22.45	4M50D7W	LTE B13	5	16QAM
782-782	22.72	8M96G7D	LTE B13	10	QPSK
782-782	22.55	8M94D7W	LTE B13	10	16QAM

The following test configurations were measured on RHL211LW (STV100-3):
The conducted spurious emissions – As per 47 CFR 2.1051, 27.53(c), RSS-130, 4.6 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 9.24 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	**9.24**	**8.96**

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)
777	4.585	4.471
782	4.6	4.483
787	4.63	4.495

Peak to Average Ratio (PAR)

For each 5MHz and 10MHz with Resource Block allocation 50,25 and 15 as per scalable bandwidths for LTE Band 13, the peak to average ratio was measured on the middle channel 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 10.22 dB on 10MHz bandwidth with Resource Block allocation 50 while transmitting at 782 MHz.

Measurement Plots for LTE Band 13

See Figures 9-1a to 9-12a for the plots of the conducted spurious emissions.

See Figures 9-13a to 9-24a and 9-37a to 9-39a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.

See Figures 9-25a to 9-32a for the plots of the Channel mask.

See Figures 9-33a to 9-36a for the plots of the Peak to Average Ratio.

LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-1a: Band 13, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

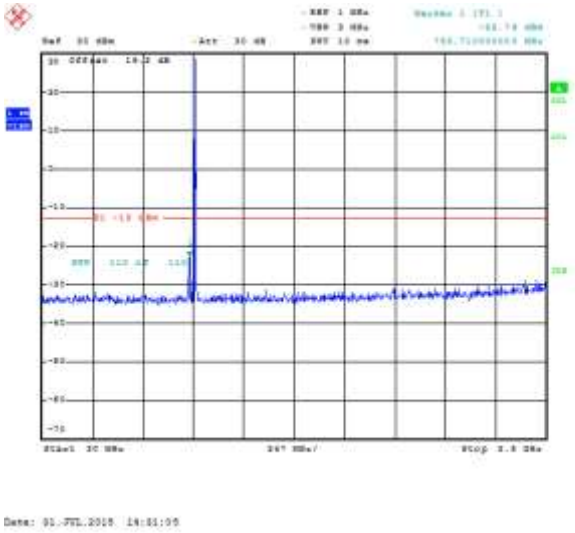


Figure 9-2a: Band 13, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

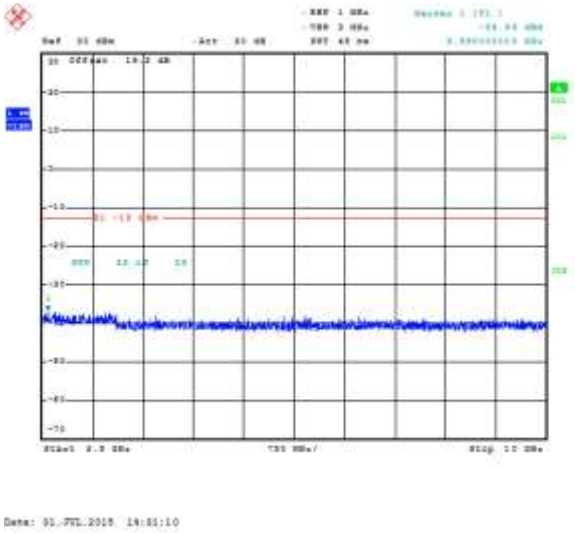


Figure 9-3a: Band 13, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)

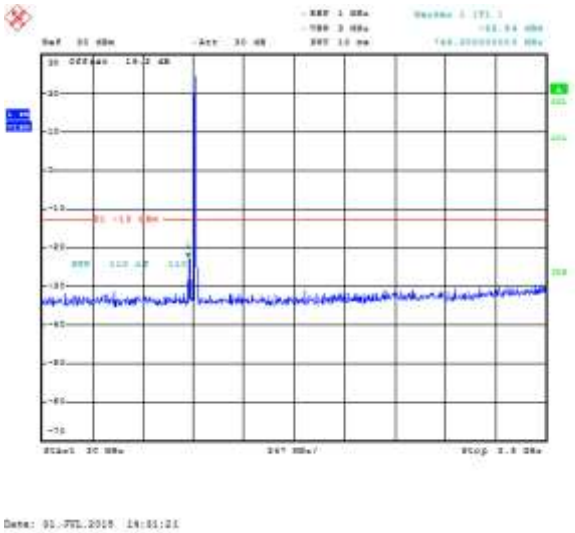
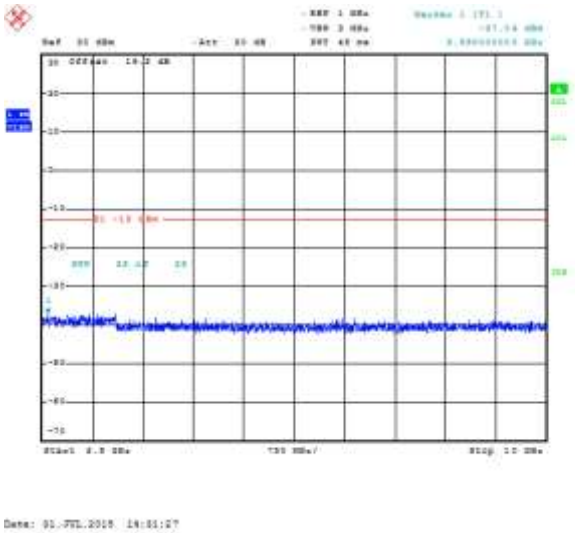


Figure 9-4a: Band 13, Spurious Conducted Emissions, Middle channel, 10MHz BW (RB= 25)



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-5a: Band 13, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

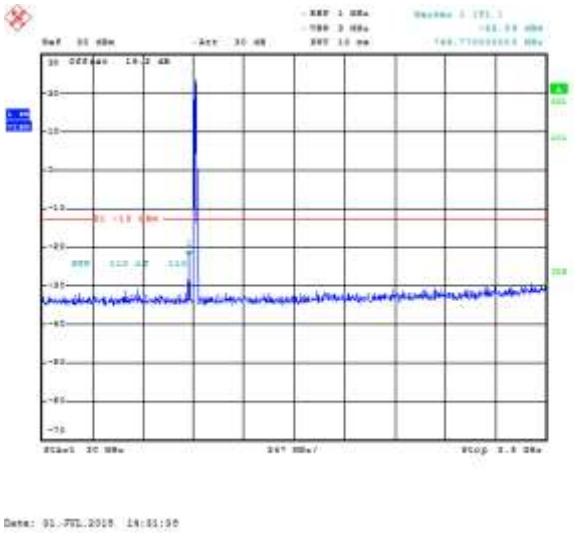


Figure 9-6a: Band 13, Spurious Conducted Emissions, High Channel, 10MHz BW (RB= 50)

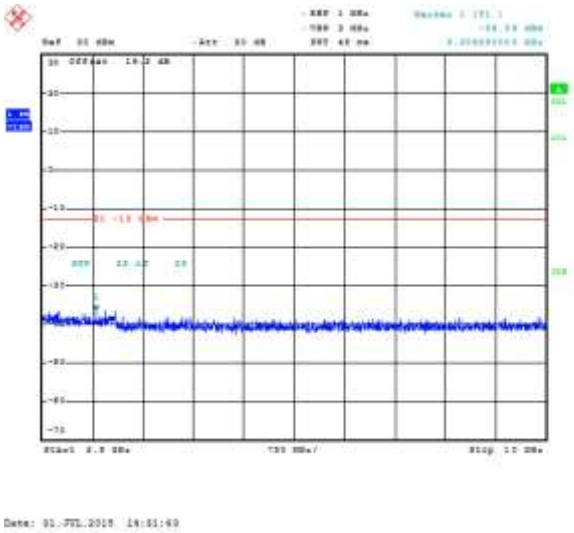


Figure 9-7a: Band 13, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)

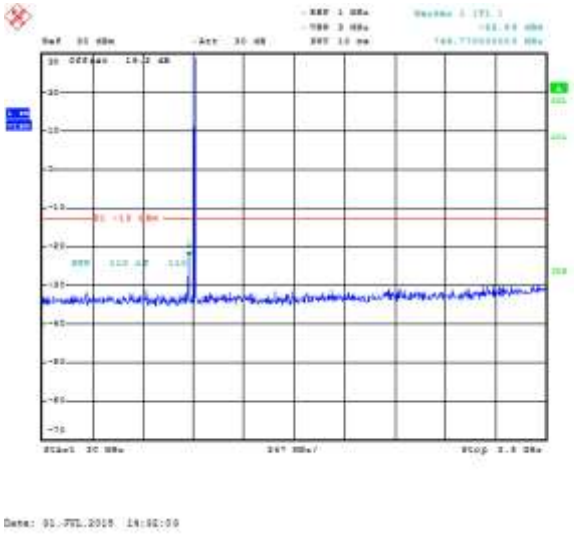
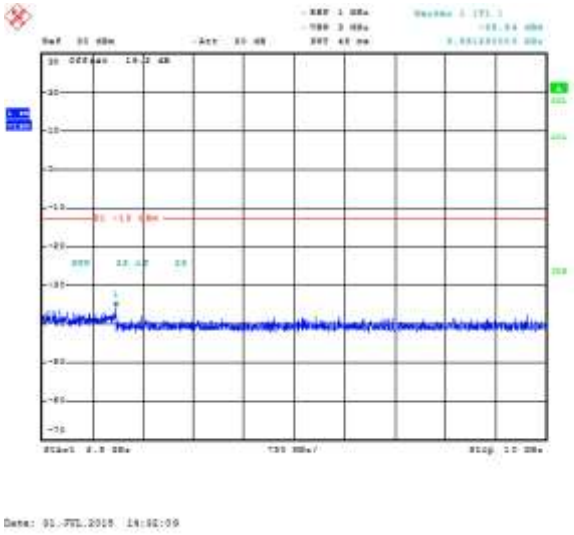


Figure 9-8a: Band 13, Spurious Conducted Emissions, Low channel, 5MHz BW (RB= 1)



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-9a: Band 13, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 15)

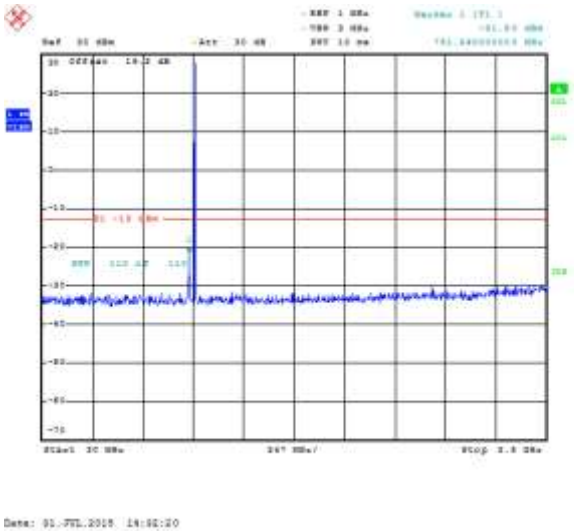


Figure 9-10a: Band 13, Spurious Conducted Emissions, Middle Channel, 5MHz BW (RB= 15)

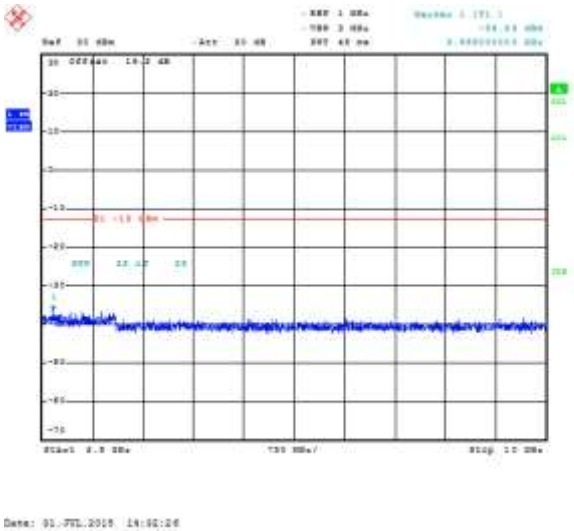


Figure 9-11a: Band 13, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)

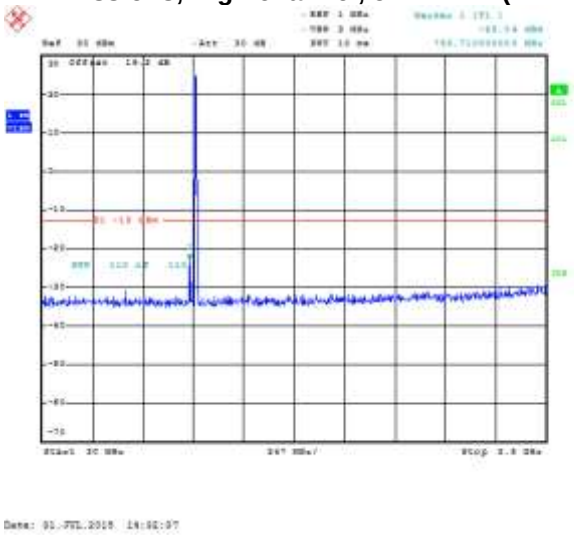
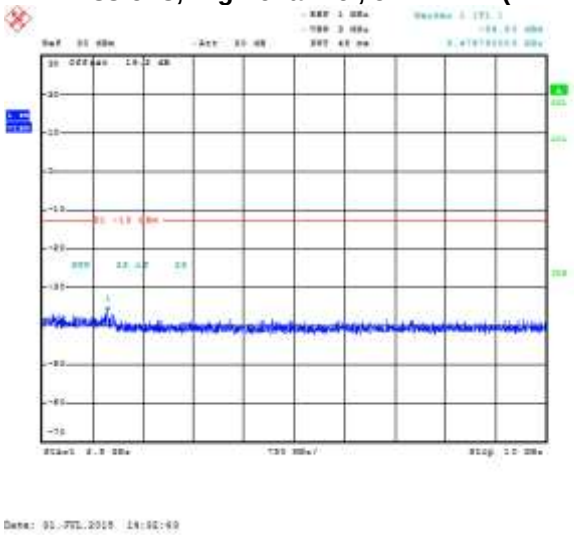


Figure 9-12a: Band 13, Spurious Conducted Emissions, High channel, 5MHz BW (RB= 25)



LTE Band 13 Conducted RF Emission Test Data cont'd

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

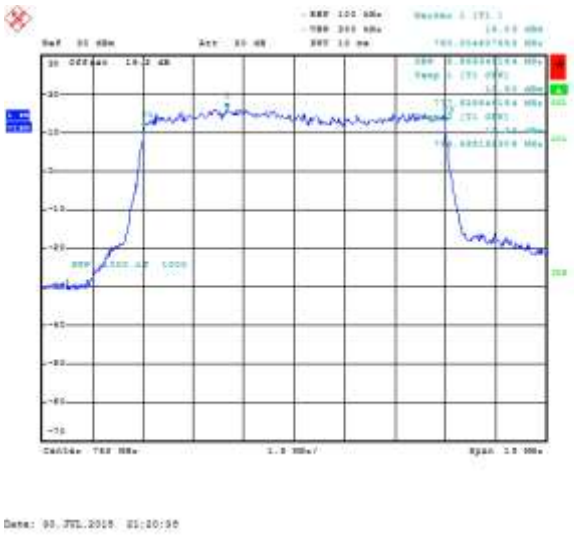


Figure 9-14a: Occupied Bandwidth, Band 13 Middle Channel, 10MHz BW, RB=50

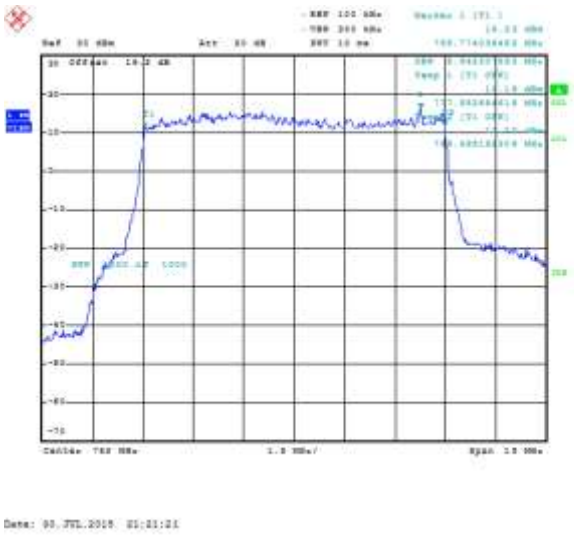
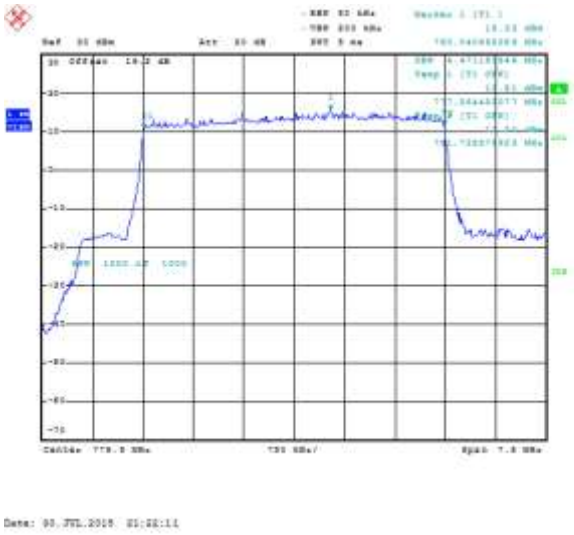


Figure 9-15a: Occupied Bandwidth, Band 13 Low Channel, 5MHz BW, RB=50



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-16a: Occupied Bandwidth, Band 5 Middle Channel, 5MHz BW, RB=50

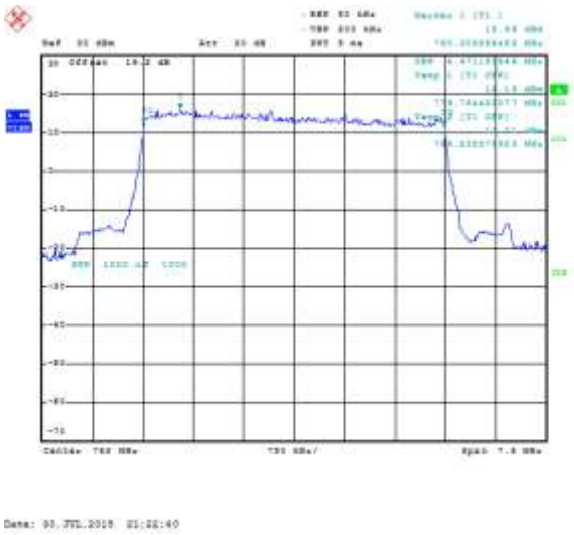
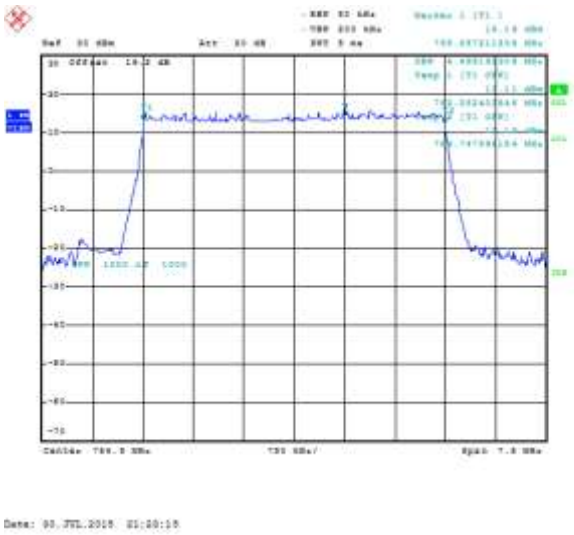


Figure 9-17a: Occupied Bandwidth, Band 5 High Channel, 5MHz BW, RB=50



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-19a: -26 dBc Bandwidth, Band 13 Low Channel, 10MHz BW, RB=50

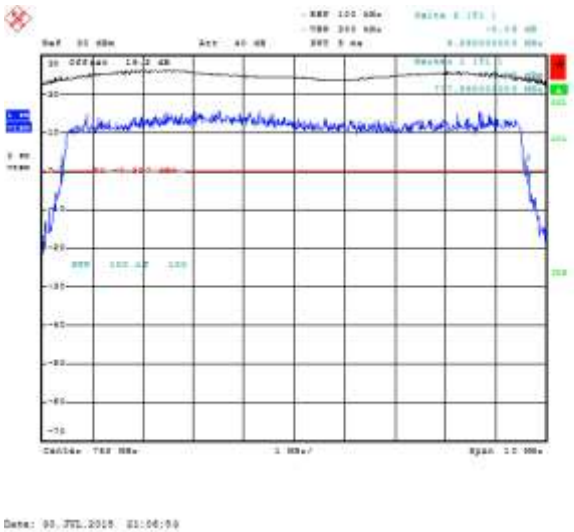


Figure 9-20a: -26 dBc Bandwidth, Band 13 Middle Channel, 10MHz BW, RB=50

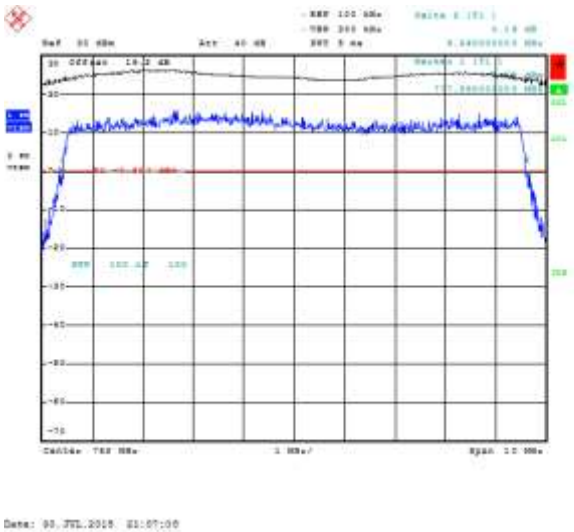


Figure 9-21a: -26 dBc Bandwidth, Band 13 High Channel, 10MHz BW, RB=50

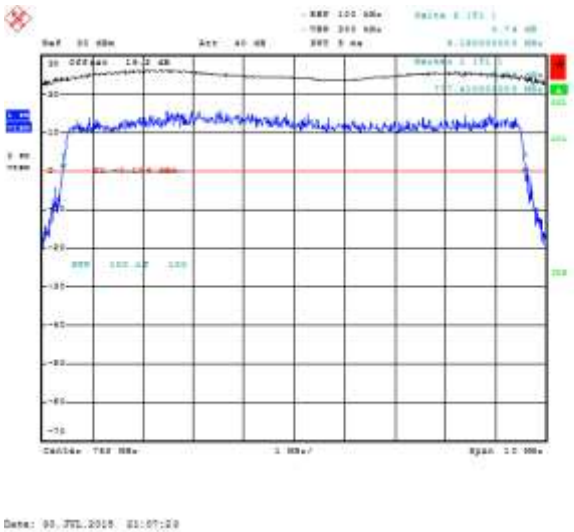
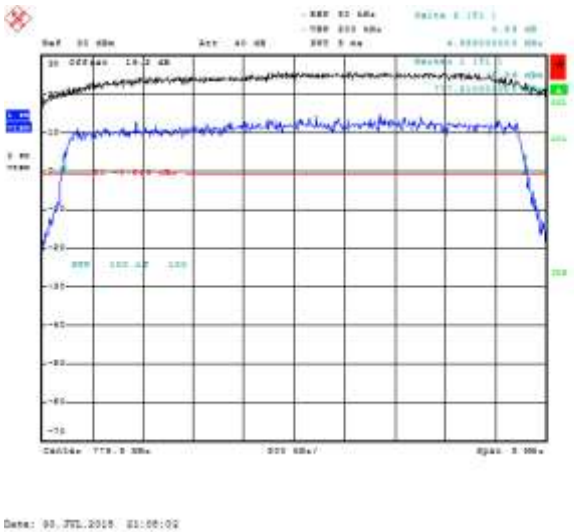


Figure 9-22a: -26 dBc Bandwidth, Band 13 Low Channel, 5MHz BW, RB=25



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-23a: -26 dBc Bandwidth, Band 13 Middle Channel, 5MHz BW, RB=25

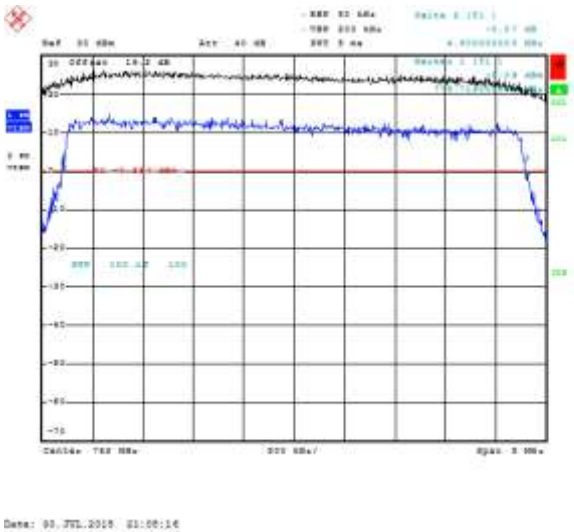


Figure 9-24a: -26 dBc Bandwidth, Band 13 High Channel, 5MHz BW, RB=25

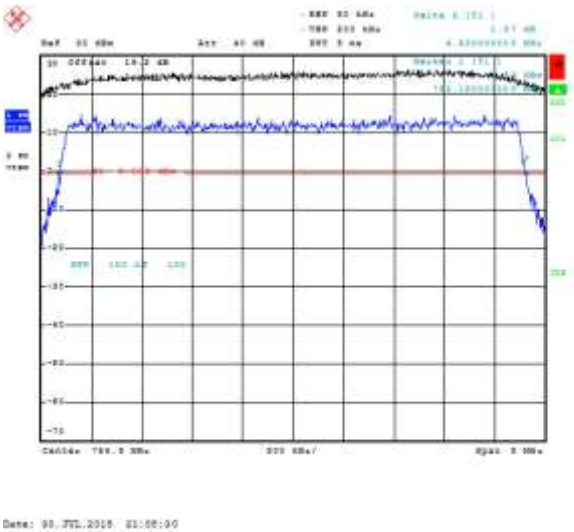


Figure 9-25a: Band 13 Middle Channel Mask, 10MHz BW, RB=50

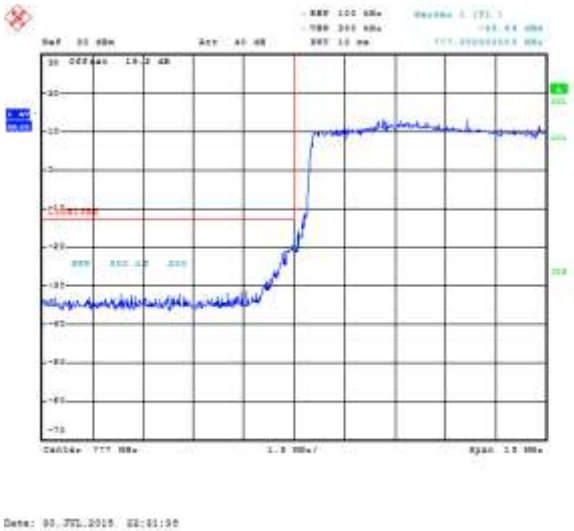
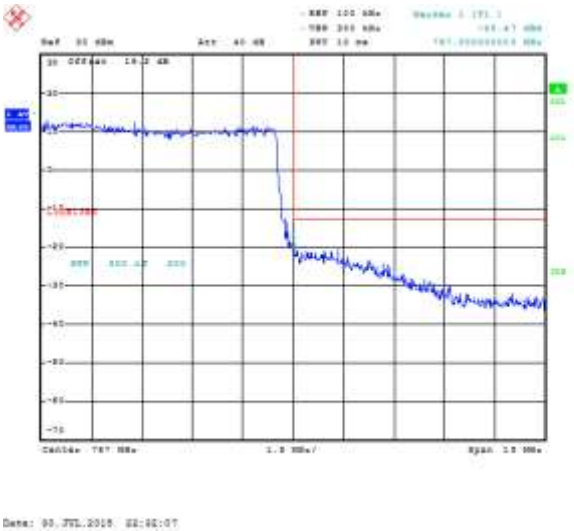


Figure 9-26a: Band 13 Middle Channel Mask, 10MHz BW, RB=50



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-27a: Band 13 Middle Channel Mask, 10MHz BW, RB=1

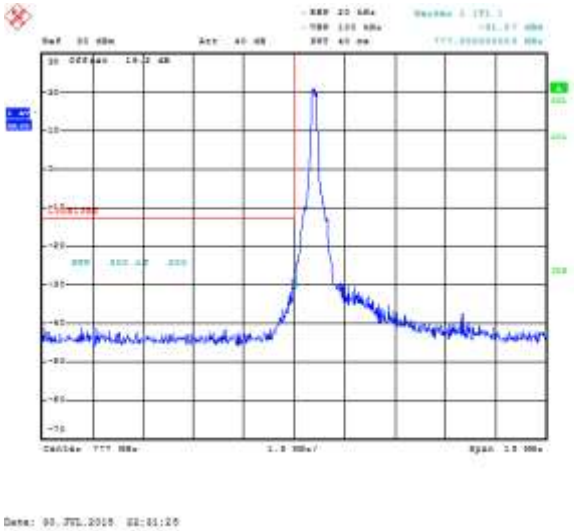


Figure 9-28a: Band 13 Middle Channel Mask,10MHz BW, RB=1

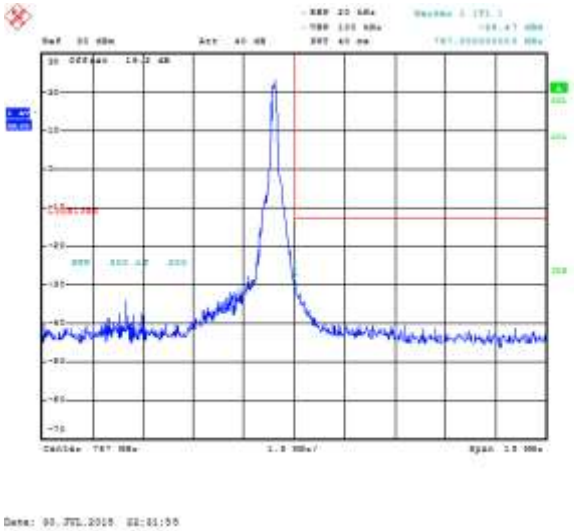


Figure 9-29a: Band 13 Low Channel Mask, 5MHz BW, RB=25

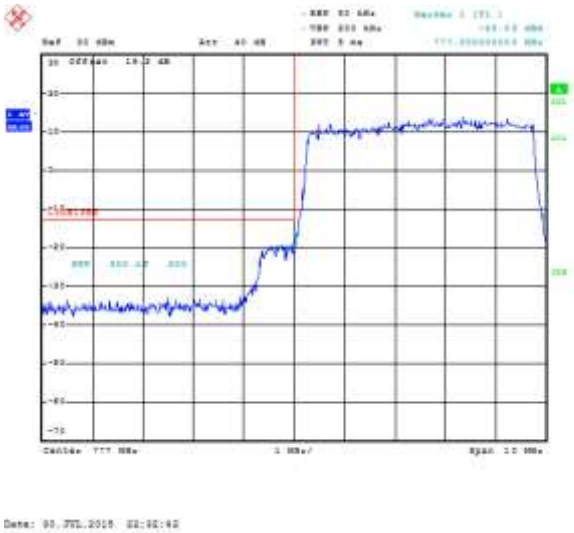
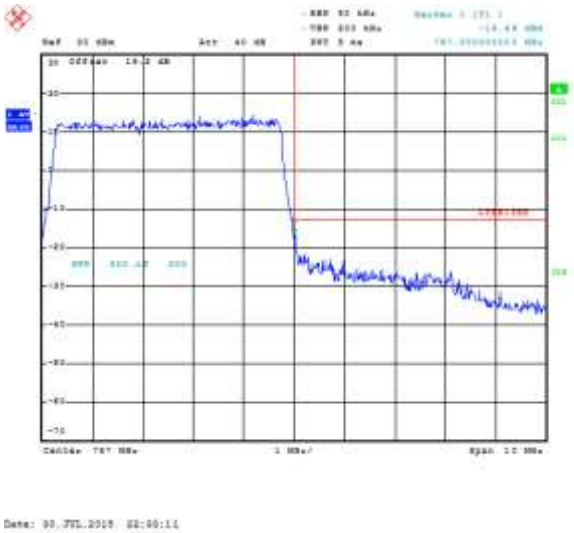


Figure 9-30a: Band 13 High Channel Mask, 5MHz BW, RB=25



LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-31a: Band 13 Low Channel Mask, 5MHz BW, RB=1

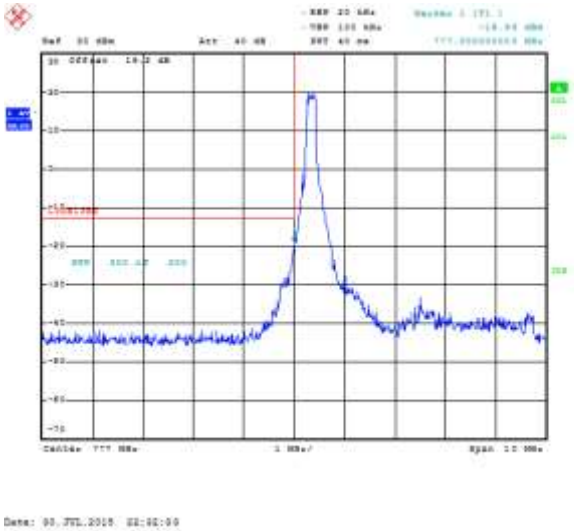


Figure 9-32a: Band 13 High Channel Mask, 5MHz BW, RB=1

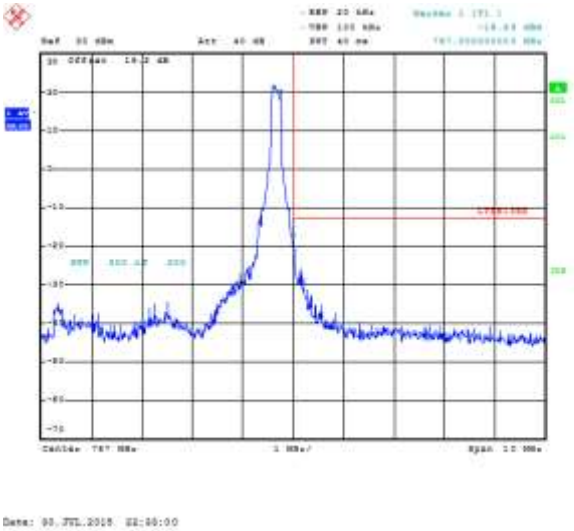


Figure 9-33a: Band 13 Mid Channel PAR, 10MHz BW, RB=25

Figure 9-34a: Band 13 Middle Channel PAR, 10MHz BW, RB=50

LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-35a: Band 13 Mid Channel PAR, 5MHz BW, RB=15

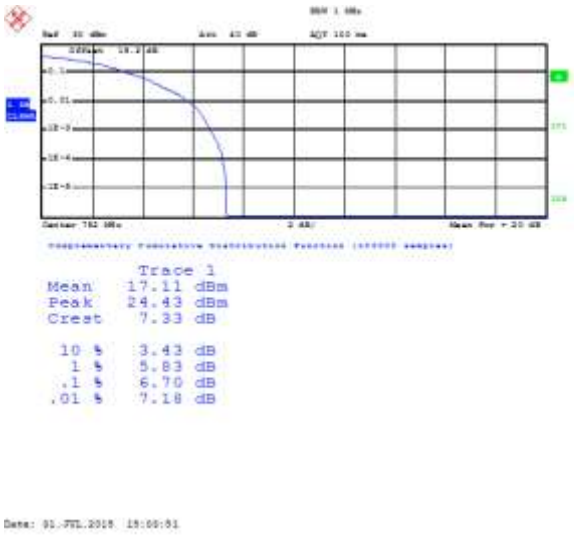


Figure 9-36a: Band 13 Mid Channel PAR, 5MHz BW, RB=25

LTE Band 13 Conducted RF Emission Test Data cont'd

Figure 9-37a: Occupied Bandwidth, Band 13 Low Channel, 5MHz BW (RB= 25) 16-QAM

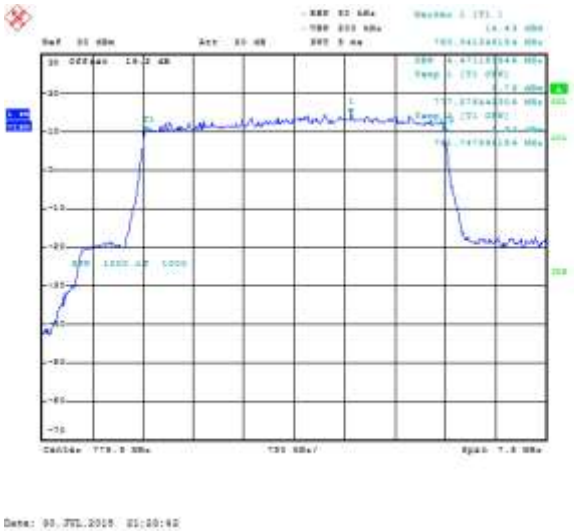


Figure 9-38a: Occupied Bandwidth, Band 13 Mid Channel, 5MHz BW (RB= 25) 16-QAM

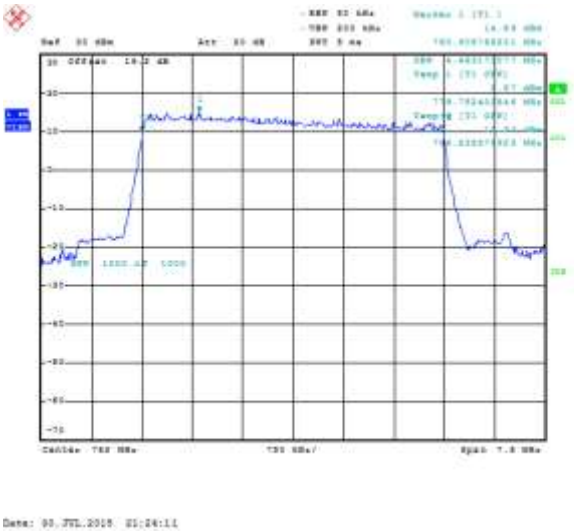
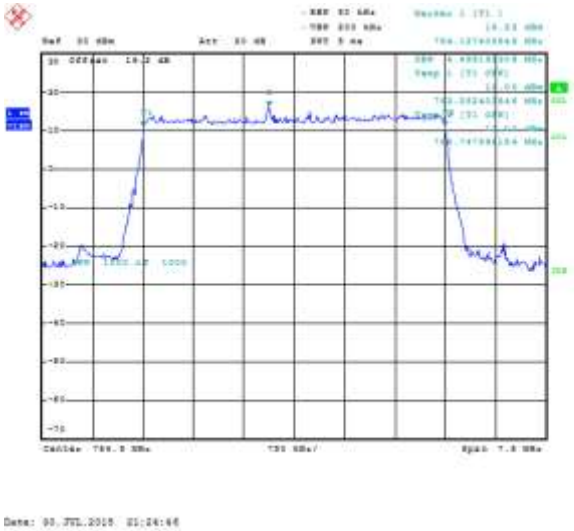
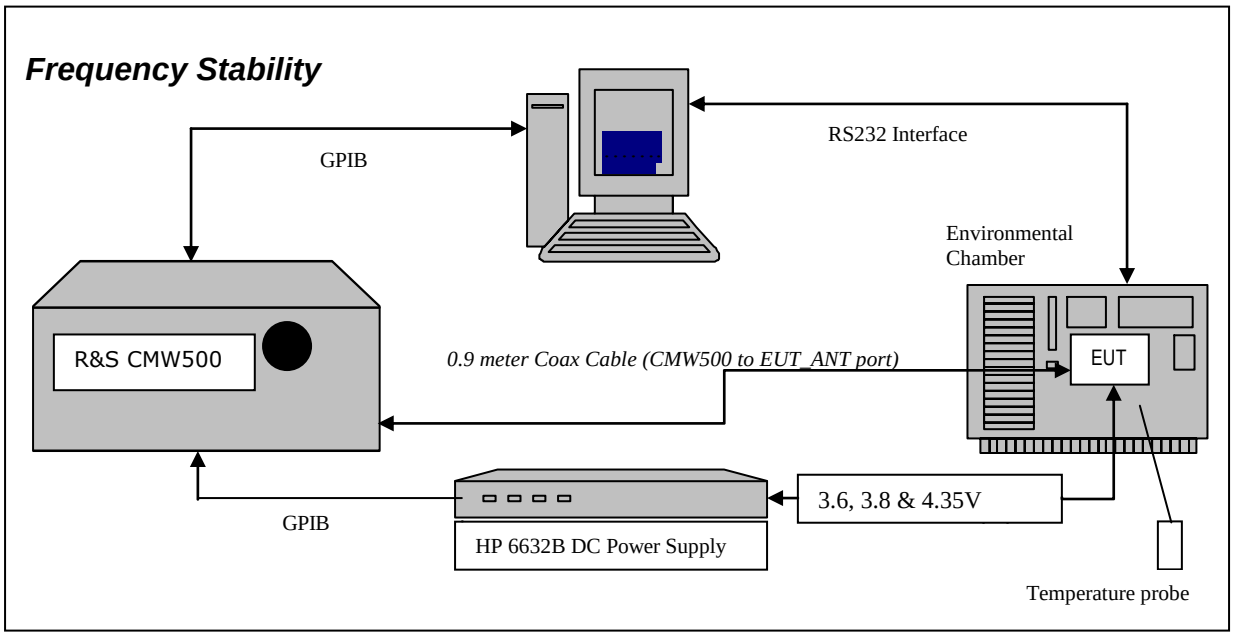


Figure 9-39a: Occupied Bandwidth, Band 13 High Channel, 5MHz BW (RB= 25) 16-QAM



APPENDIX 9B – LTE Band 13 FREQUENCY STABILITY TEST DATA

LTE Band 13 Frequency Stability Test Data



The following configurations were measured for model RHL211LW (STV100-3):

. The following measurements were performed by Landon Martin.

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, 3.8 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, 3.8 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:

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

99. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
100. Start test program
101. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
102. Set power supply voltage to 3.6 volts.
103. Set up CMW 500 Radio Communication Tester.
104. Command the CMW 500 to switch to the low channel.
105. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
106. EUT is commanded to Transmit 100 Bursts.
107. 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.
108. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
109. Repeat steps 5 to 10 changing the supply voltage to 3.8 Volts
110. Increase temperature by 10°C and soak for 1/2 hour.
111. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
112. 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, 3.8 and 4.35 volts

The maximum frequency error in the LTE Band 13 measured was **0.0099 PPM**.

Date of test: August 25, 2015

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

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	782.00	3.6	20	6.17	0.0079
23230	782.00	3.8	20	5.97	0.0076
23230	782.00	4.35	20	5.75	0.0074

LTE Band 13 Results (10MHz Bandwidth): channel 23230 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	782	3.6	-30	6.77	0.0087
23230	782	3.6	-20	5.28	0.0068
23230	782	3.6	-10	7.30	0.0093
23230	782	3.6	0	5.09	0.0065
23230	782	3.6	10	5.65	0.0072
23230	782	3.6	20	6.17	0.0079
23230	782	3.6	30	-2.65	-0.0034
23230	782	3.6	40	6.55	0.0084
23230	782	3.6	50	2.32	0.0030
23230	782	3.6	60	3.95	0.0050

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	782	3.8	-30	7.22	0.0092
23230	782	3.8	-20	5.06	0.0065
23230	782	3.8	-10	6.32	0.0081
23230	782	3.8	0	5.38	0.0069
23230	782	3.8	10	7.65	0.0098
23230	782	3.8	20	5.97	0.0076
23230	782	3.8	30	-2.90	-0.0037
23230	782	3.8	40	5.22	0.0067
23230	782	3.8	50	4.71	0.0060
23230	782	3.8	60	-3.02	-0.0039

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	782	4.35	-30	7.74	**0.0099**
23230	782	4.35	-20	6.01	0.0077
23230	782	4.35	-10	6.18	0.0079
23230	782	4.35	0	4.85	0.0062
23230	782	4.35	10	6.01	0.0077
23230	782	4.35	20	5.75	0.0074
23230	782	4.35	30	2.12	0.0027
23230	782	4.35	40	5.74	0.0073
23230	782	4.35	50	-3.30	-0.0042
23230	782	4.35	60	-2.06	-0.0026

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 –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. 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 43 + 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 3.8 Volts
14. Increase temperature to 20 and 50°C and soak for 1/2 hour.
15. Repeat steps 4 - 14 for temperatures –30°C to 60°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, 3.8 and 4.35 volts

Date of test: Sept 2, 2015.

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

LTE Band 13 10MHz Bandwidth results: channels 23230 @ 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)
23230	782	3.6	20	3.018	783.275	N/A	783.275	N/A
23230	782	3.6	20	3.018	N/A	781.235	N/A	781.235

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)
23230	782	3.8	20	-2.975	782.825	N/A	782.825	N/A
23230	782	3.8	20	-2.975	N/A	781.385	N/A	781.385

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)
23230	782	4.35	20	-3.948	782.915	N/A	782.915	N/A
23230	782	4.35	20	-3.948	N/A	781.445	N/A	781.445

LTE Band 13 10MHz Bandwidth results: channels 23230 @ -30 and +60°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)
23230	782	3.6	-30	-3.233	783.620	N/A	783.620	N/A
23230	782	3.6	-30	-3.233	N/A	781.250	N/A	781.250
23230	782	3.8	-30	-3.877	782.900	N/A	782.900	N/A
23230	782	3.8	-30	-3.877	N/A	781.445	N/A	781.445
23230	782	4.35	-30	-3.719	783.980	N/A	783.980	N/A
23230	782	4.35	-30	-3.719	N/A	781.235	N/A	781.235
23230	782	3.6	60	-4.206	783.050	N/A	783.050	N/A
23230	782	3.6	60	-4.206	N/A	781.400	N/A	781.400
23230	782	3.8	60	-4.520	782.675	N/A	782.675	N/A
23230	782	3.8	60	-4.520	N/A	780.890	N/A	780.890
23230	782	4.35	60	4.821	782.675	N/A	782.675	N/A
23230	782	4.35	60	4.821	N/A	781.250	N/A	781.250

APPENDIX 9C – LTE Band 13 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following configurations were measured for model RHL211LW (STV100-3):

The following measurements were performed by Shiva Kumbham.
Date of Test: August 14, 2015
The environmental tests conditions were: Temperature: 26.0 °C
Relative Humidity: 35.4 %

The BlackBerry® smartphone was standalone, with horizontal top pointing up 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	Horn	V	-43.72	-31.67	V-V	2.42	20.38	0.11	35.00	14.62
F0	23205	779.50	13	Horn	H	-31.67		H-H	-1.80				
F0	23230	782.00	13	Horn	V	-43.07	-30.95	V-V	3.18	**21.14**	0.13	35.00	13.86
F0	23230	782.00	13	Horn	H	-30.95		H-H	-0.74				
F0	23254	784.40	13	Horn	V	-43.05	-31.07	V-V	3.02	20.91	0.12	35.00	14.09
F0	23254	784.40	13	Horn	H	-31.07		H-H	-0.39				

LTE Band 13, 10MHz BW, RB=1, 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	23230	782.00	13	Horn	V	-43.46	-31.12	V-V	2.89	20.85	0.12	35.00	14.15
F0	23230	782.00	13	Horn	H	-31.12		H-H	-0.88				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Savtej Sandhu.

Date of Test: August 13, 2015

The environmental test conditions were: Temperature: 27.0 ºC
Relative Humidity: 32.7 %

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 5MHz BW (channel 23205, 23230 and 23254 with RB = 1) with QPSK modulation. and 10MHz BW (channel 23230 with RB = 1), with 16-QAM modulation.

All emissions had test margins greater than 25.0 dB.

The following measurements were performed by Xing Fang and Winston Vernon.

Date of Test: August 12-13, 2015

The environmental test conditions were: Temperature: 24.4 ºC
Relative Humidity: 37.0 %

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 with top facing to the RX antenna when the turntable is at 0 degree position

Measurements were performed in LTE Band 13 with 5MHz BW (channel 23205, 23230 and 23254 with RB = 1) with QPSK modulation. and 10MHz BW (channel 23230 with RB = 1), with 16-QAM modulation.

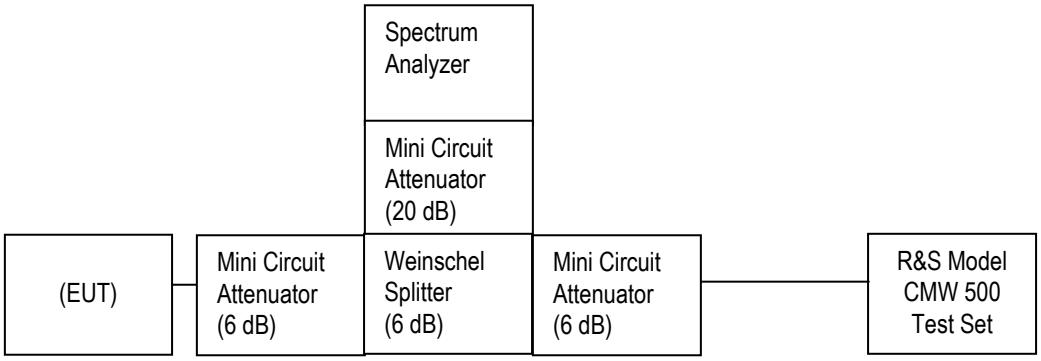
All emissions had test margins greater than 25.0 dB.

APPENDIX 10A– LTE Band 25 CONDUCTED RF EMISSIONS TEST DATA/PLOTS

LTE Band 25 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



The following configurations were measured for model RHL211LW (STV100-3):

Date of Test: July 31, 2015

The environmental test conditions were: Temperature: 24.0 ºC
Relative Humidity: 45.3 %

The following measurements were performed by Sijia Li.

LTE Band 25 Conducted RF Emission Test Data cont'd

Emission Designator Table

Frequency Rane (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
1850.7-1914.3	**25.70**	1M09G7D	LTE B25	1.4	QPSK
1850.7-1914.3	24.72	1M09D7W	LTE B25	1.4	16QAM
1851.5-1913.5	25.42	2M70G7D	LTE B25	3	QPSK
1851.5-1913.5	24.61	2M69D7W	LTE B25	3	16QAM
1852.5-1912.5	25.46	4M50G7D	LTE B25	5	QPSK
1852.5-1912.5	24.38	4M48D7W	LTE B25	5	16QAM
1855-1910	25.46	8M97G7D	LTE B25	10	QPSK
1855-1910	25.16	8M97D7W	LTE B25	10	16QAM
1857.5-1907.5	25.19	13M5G7D	LTE B25	15	QPSK
1857.5-1907.5	24.79	13M5D7W	LTE B25	15	16QAM
1860-1905.5	24.92	18M0G7D	LTE B25	20	QPSK
1860-1905.5	24.40	18M0D7W	LTE B25	20	16QAM

The following test configurations were measured on RHL211LW (STV100-3):
The conducted spurious emissions – As per 47 CFR 2.1051, 24.238(a), RSS – 133, 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, 10MHz and 20MHz with different number of RBs for LTE Band 25. 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 25 was measured to be 18.72 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 25 selected Frequencies in 20MHz BW (RB = 100)

LTE Band 25 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
1860	18.56	17.980
1882.5	18.68	17.980
1905	**18.72**	17.884

Test Data for LTE Band 25 selected Frequencies in 10MHz BW (RB = 50)

LTE Band 25 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
1860	9.15	8.966
1882.5	9.17	8.966
1905	9.18	8.966

Test Data for LTE Band 25 selected Frequencies in 1.4MHz BW (RB = 6)

LTE Band 25 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
1860	1.150	1.090
1882.5	1.141	1.097
1905	1.148	1.087

Peak to Average Ratio (PAR)

For each 1.4MHz, 10MHz and 20MHz with Resource Block allocation 100,50,25, 6 and 3 as per scalable bandwidths for LTE Band 25, the peak to average ratio was measured on the middle channel 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 10.42dB on 10MHz bandwidth with Resource Block allocation 50 while transmitting at 1882.5 MHz.

Measurement Plots for LTE Band 25

See Figures 10-1a to 10-12a and 10-40a to 10-45a for the plots of the conducted spurious emissions.

See Figures 10-13a to 10-24a and 10-37a to 10-39a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.

See Figures 10-25a to 10-32a for the plots of the Channel mask.

See Figures 10-33a to 10-36a for the plots of the Peak to Average Ratio.

LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-1a: Band 25, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

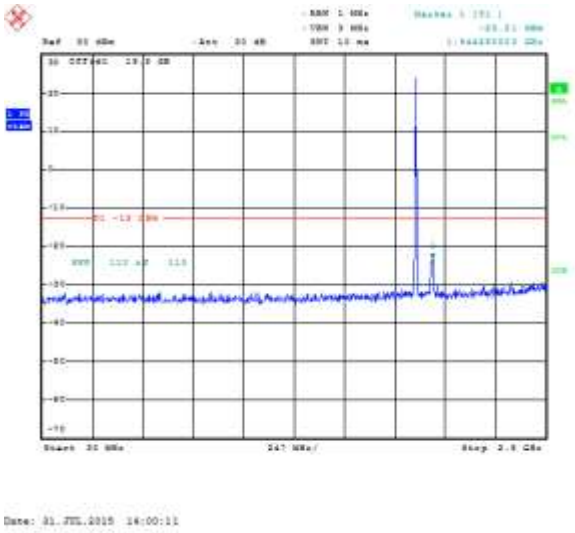


Figure 10-2a: Band 25, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

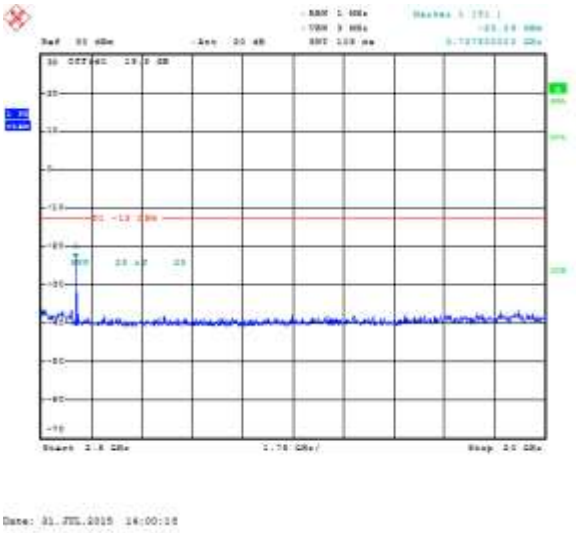


Figure 10-3a: Band 25, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)

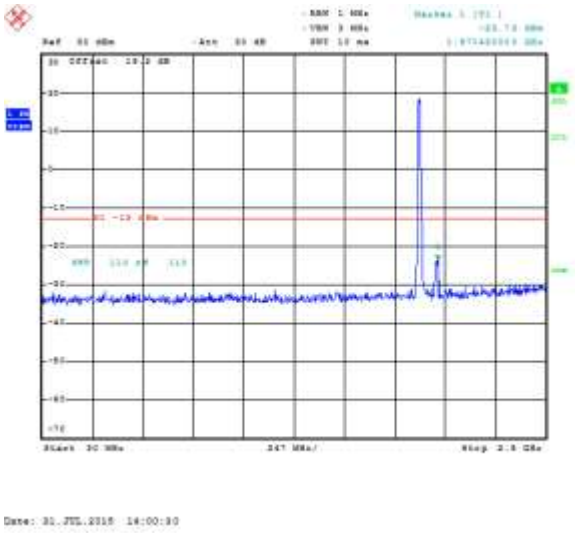
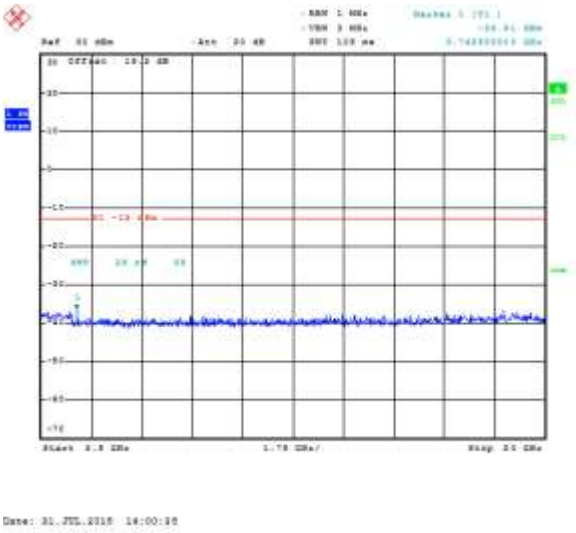


Figure 10-4a: Band 25, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-5a: Band 25, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

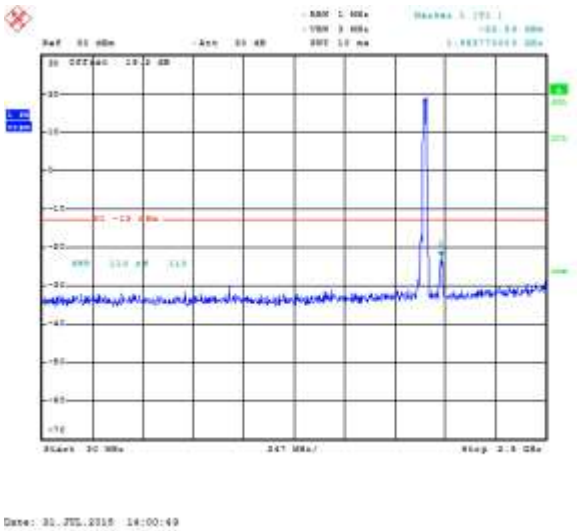


Figure 10-6a: Band 25, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

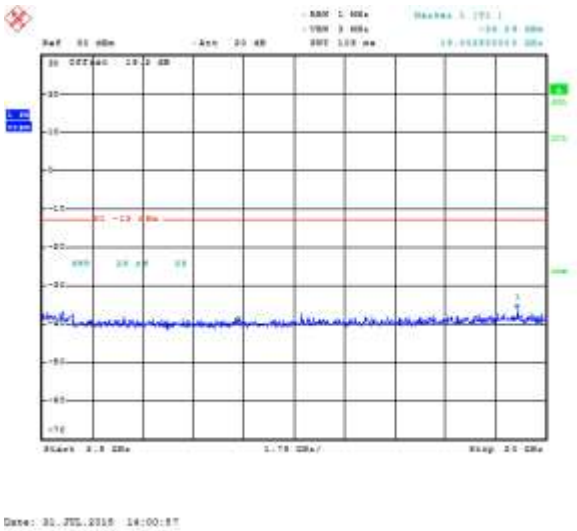


Figure 10-7a: Band 25, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

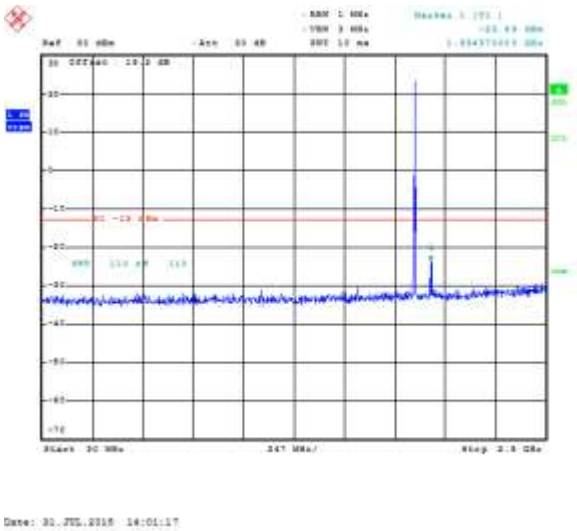
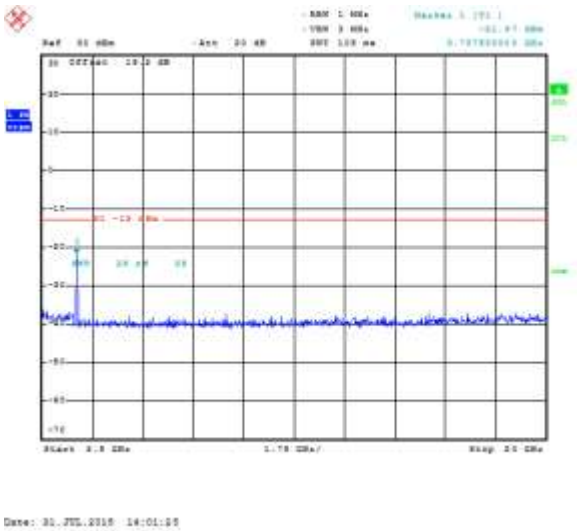


Figure 10-8a: Band 25, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)



LTE Band 25 Conducted RF Emission Test Data cont'd

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

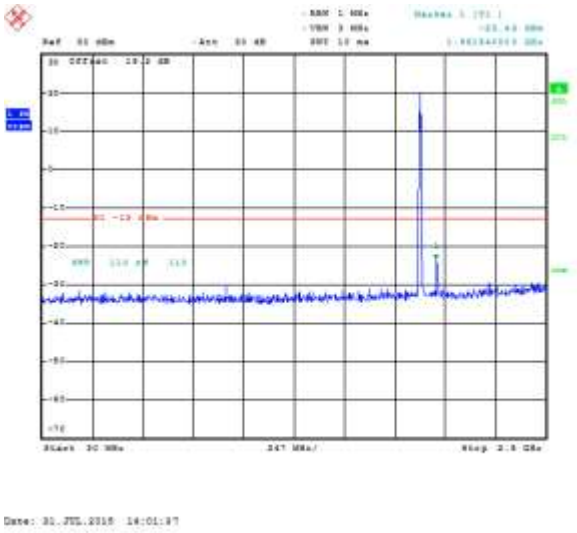


Figure 10-10a: Band 25, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 25)

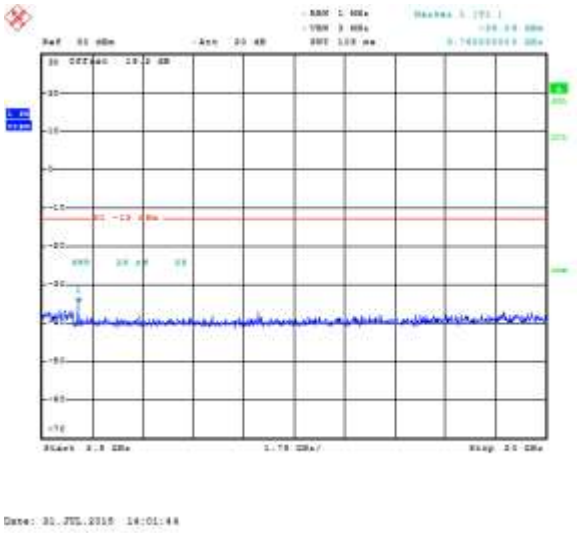


Figure 10-11a: Band 25, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)

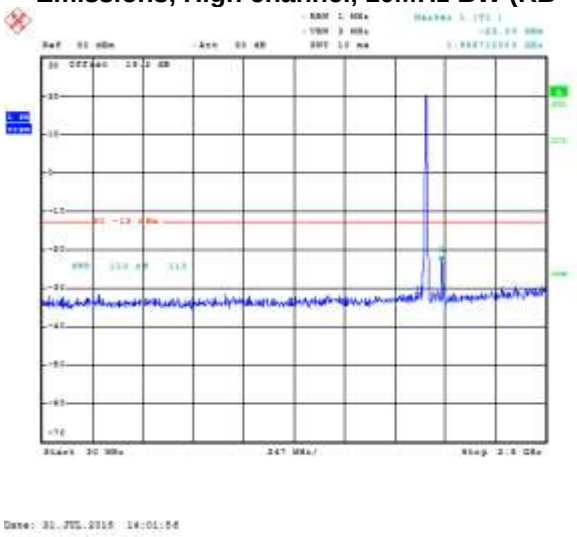
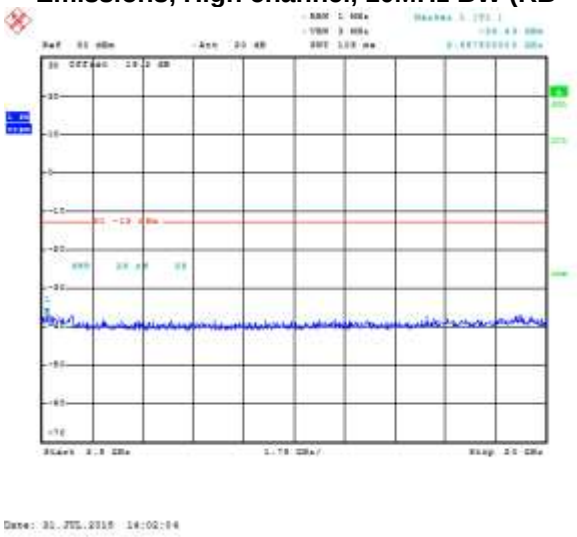


Figure 10-12a: Band 25, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-13a: Band 25, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 1)

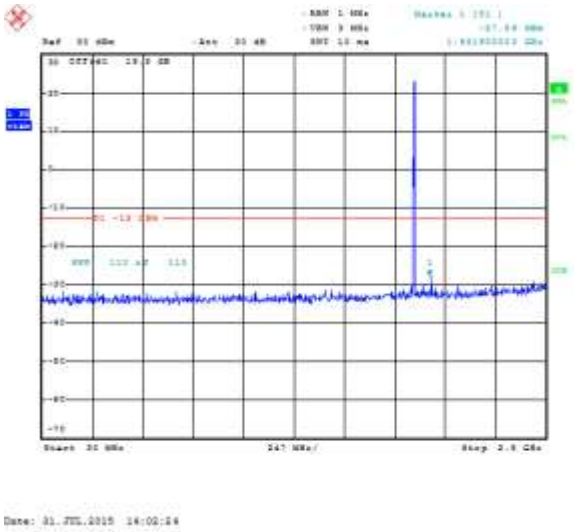
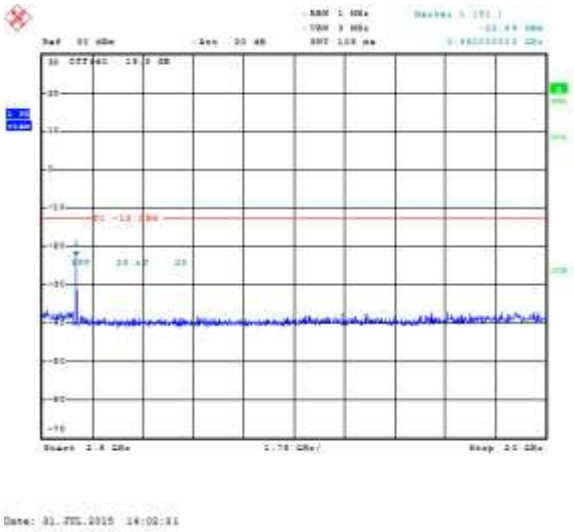


Figure 10-14a: Band 25, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 1)



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-15a: Band 25, Spurious Conducted Emissions, Middle Channel, 1.4MHz BW (RB= 3)

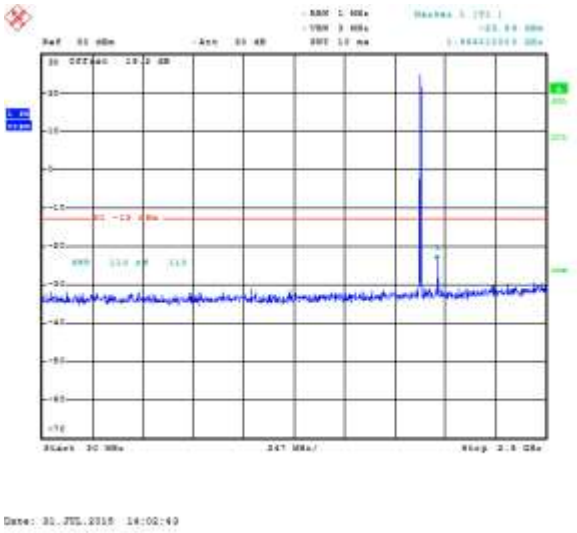


Figure 10-16a: Band 25, Spurious Conducted Emissions, Middle Channel, 1.4MHz BW (RB= 3)

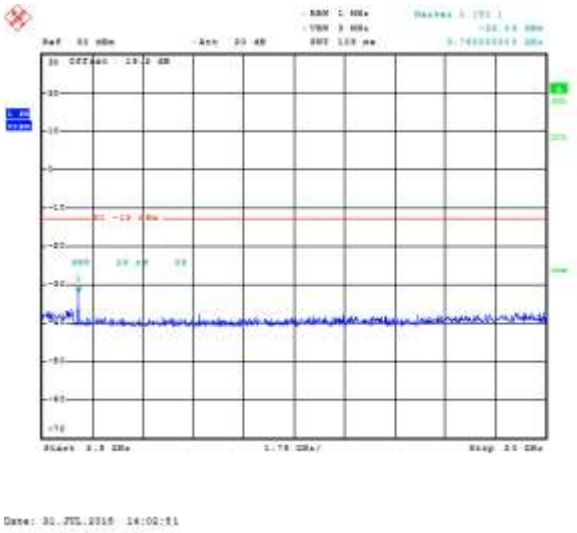


Figure 10-17a: Band 25, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)

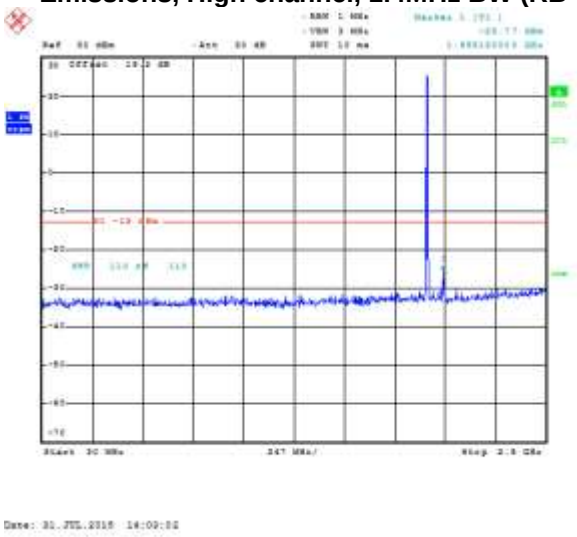
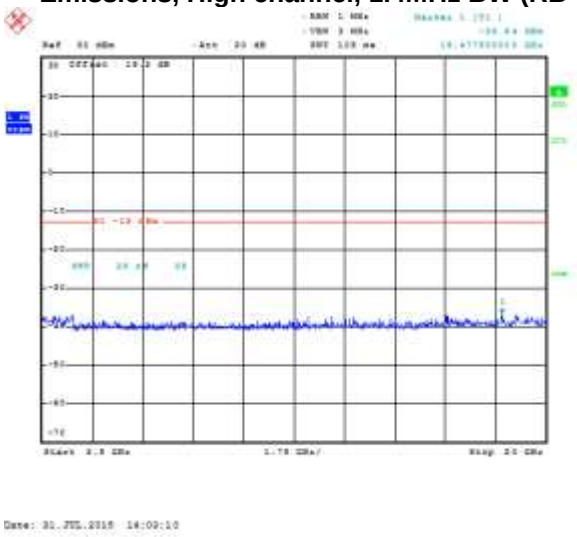


Figure 10-18a: Band 25, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 6)



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-19a: Occupied Bandwidth, Band 25

Low Channel, 20MHz BW, RB=100

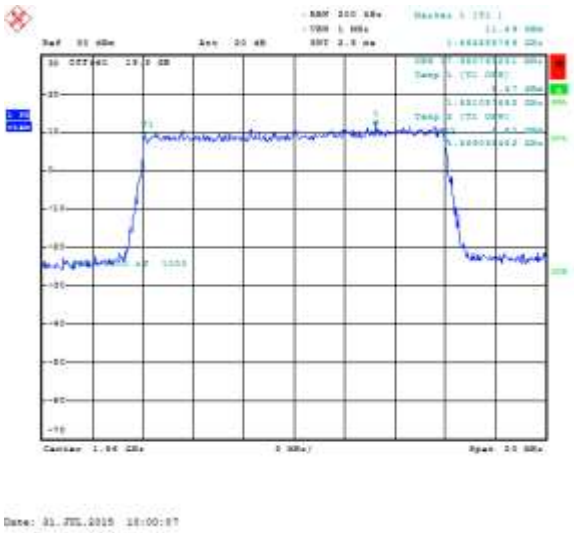


Figure 10-20a: Occupied Bandwidth, Band 25
Middle Channel, 20MHz BW, RB=100

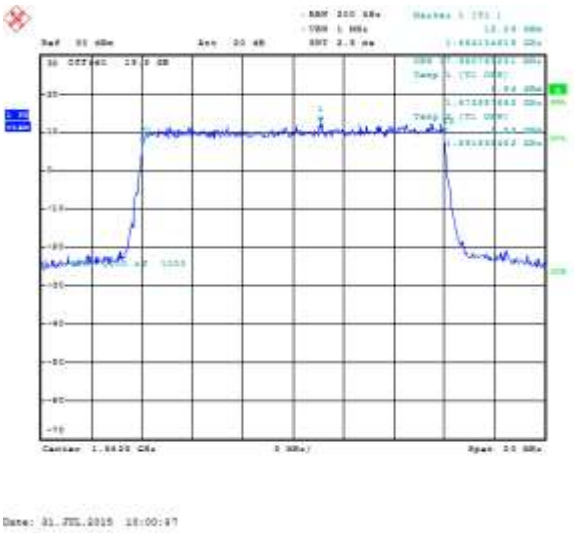
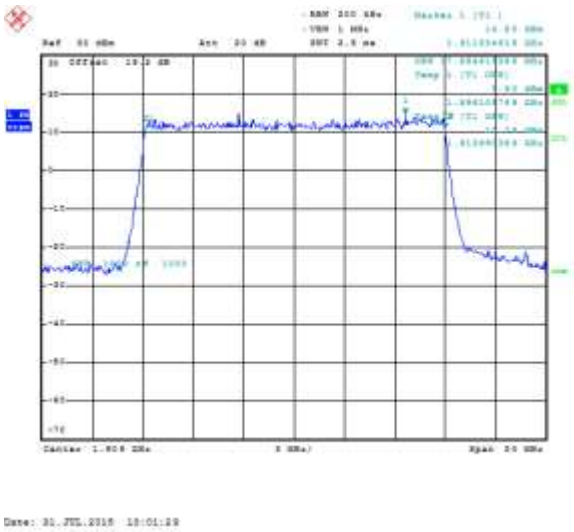


Figure 10-21a: Occupied Bandwidth, Band 25 High Channel, 20MHz BW, RB=100



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-22a: Occupied Bandwidth, Band 25

Low Channel, 20MHz BW, RB=100

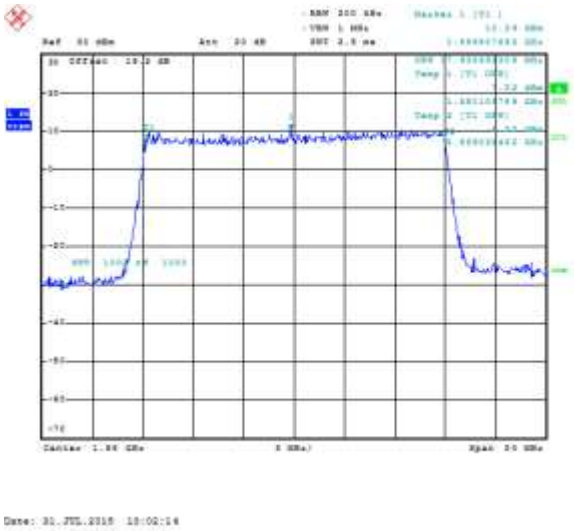


Figure 10-23a: Occupied Bandwidth, Band 25
Middle Channel, 20MHz BW, RB=100

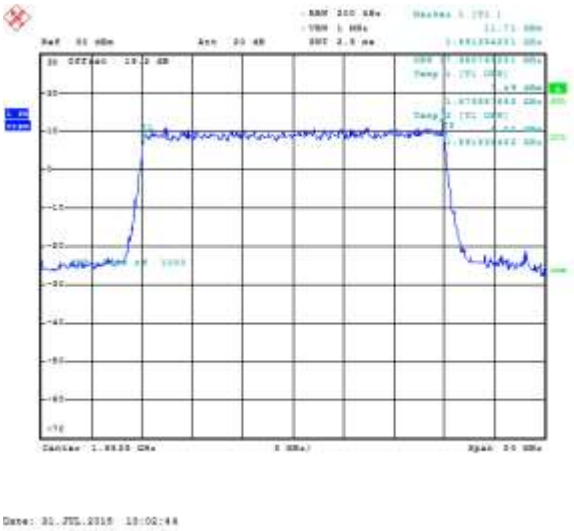
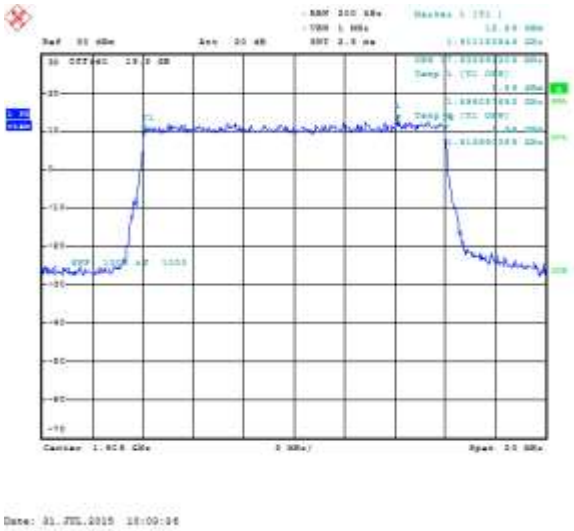


Figure 10-24a: Occupied Bandwidth, Band 25 High Channel, 20MHz BW, RB=100



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-25a: Occupied Bandwidth, Band 25

Low Channel, 15MHz BW, RB=75

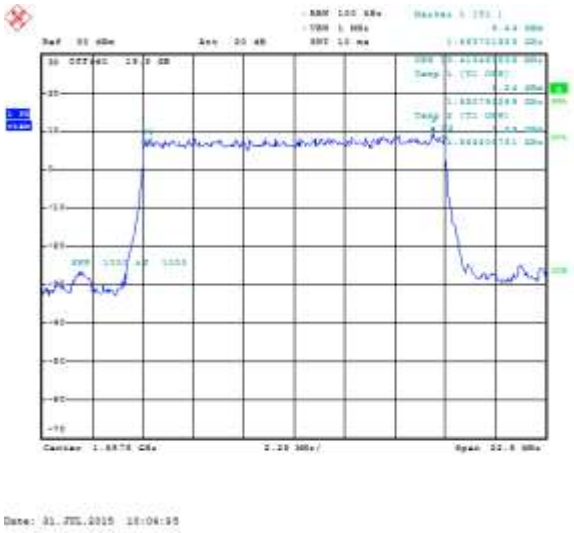


Figure 10-26a: Occupied Bandwidth, Band 25
Middle Channel, 15MHz BW, RB=75

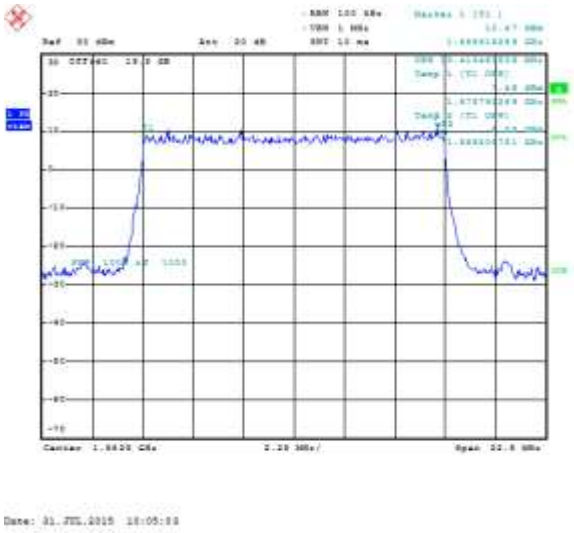
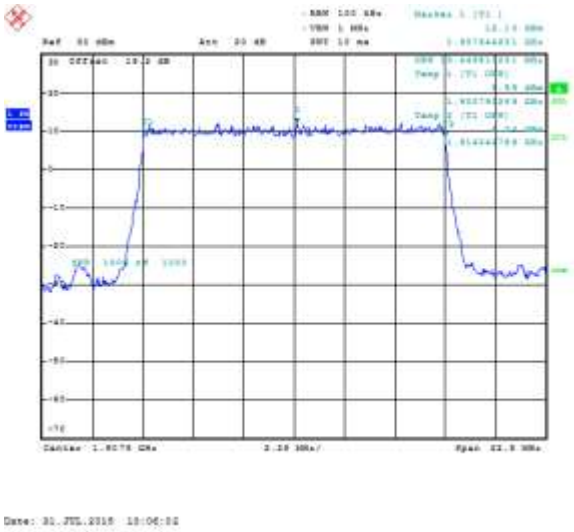


Figure 10-27a: Occupied Bandwidth, Band 25 High Channel, 15MHz BW, RB=75



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-28a: Occupied Bandwidth, Band 25

Low Channel, 15MHz BW, RB=75

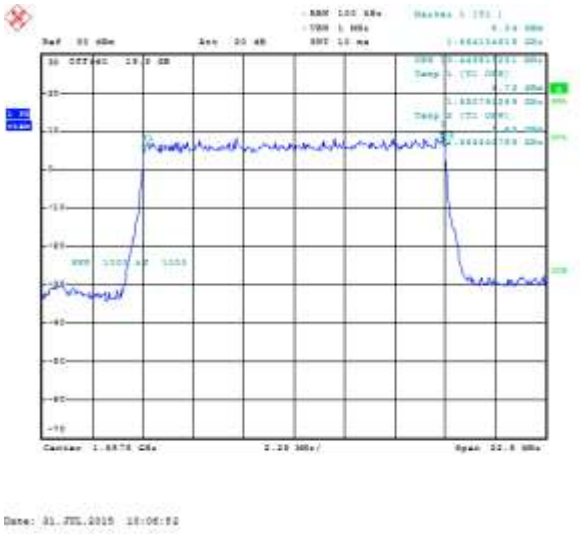


Figure 10-29a: Occupied Bandwidth, Band 25
Middle Channel, 15MHz BW, RB=75

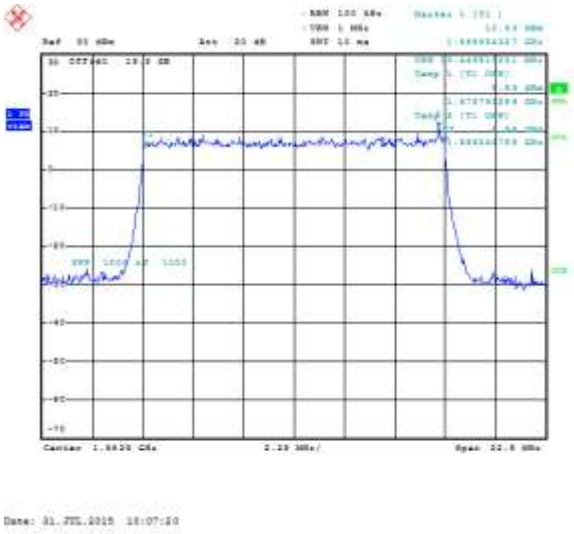
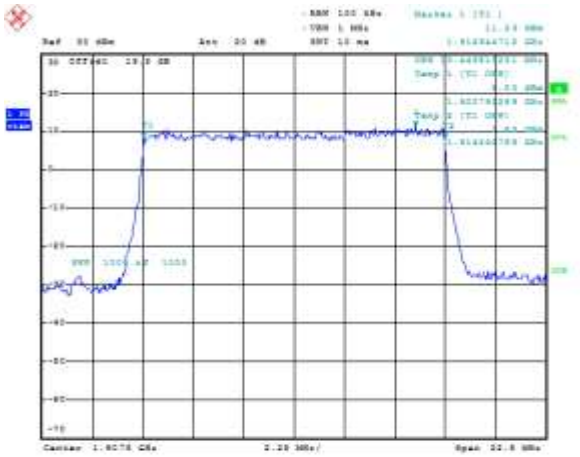


Figure 10-30a: Occupied Bandwidth, Band 25 High Channel, 15MHz BW, RB=75



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-31a: Occupied Bandwidth, Band 25

Low Channel, 10MHz BW, RB=50

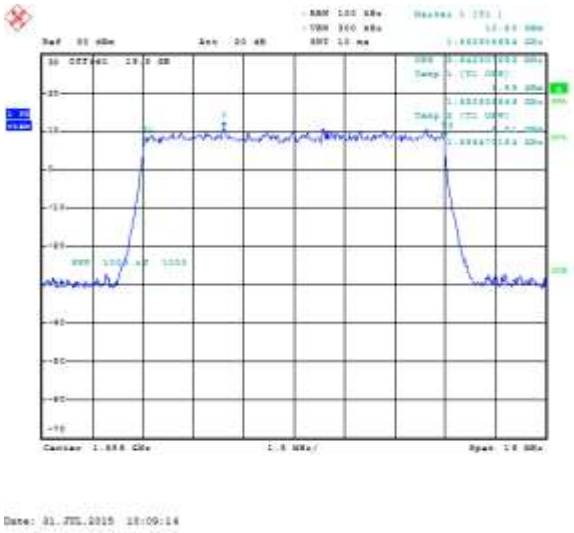


Figure 10-32a: Occupied Bandwidth, Band 25
Middle Channel, 10MHz BW, RB=50

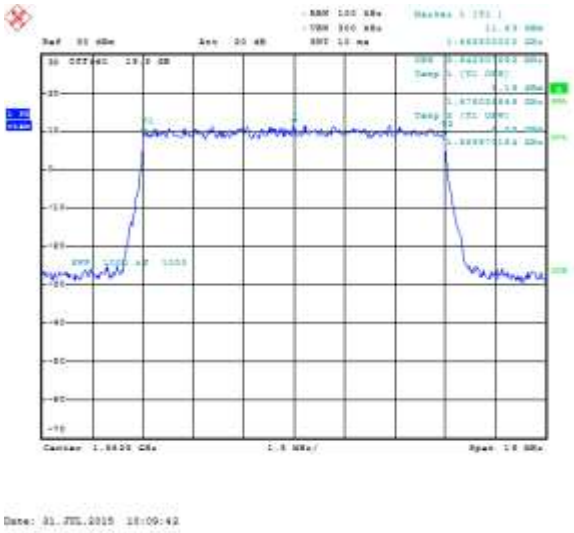
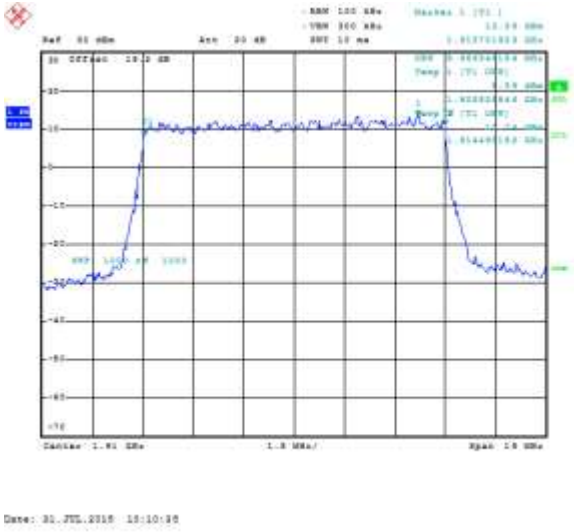


Figure 10-33a: Occupied Bandwidth, Band 25 High Channel, 10MHz BW, RB=50



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-34a: Occupied Bandwidth, Band 25

Low Channel, 10MHz BW, RB=50

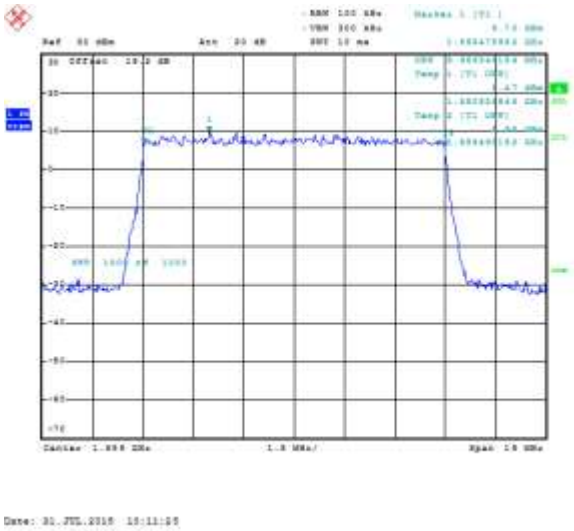


Figure 10-35a: Occupied Bandwidth, Band 25
Middle Channel, 10MHz BW, RB=50

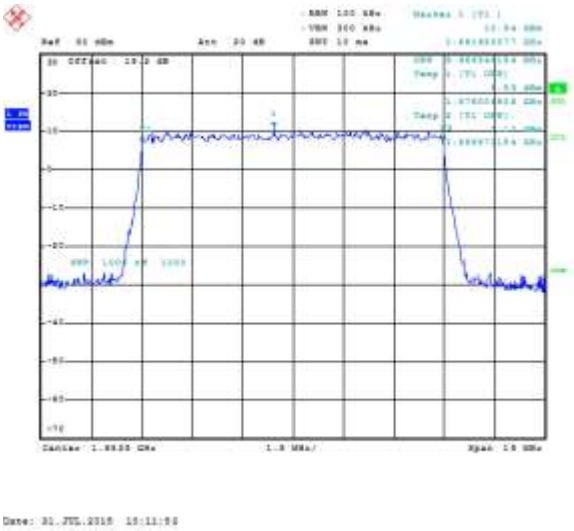
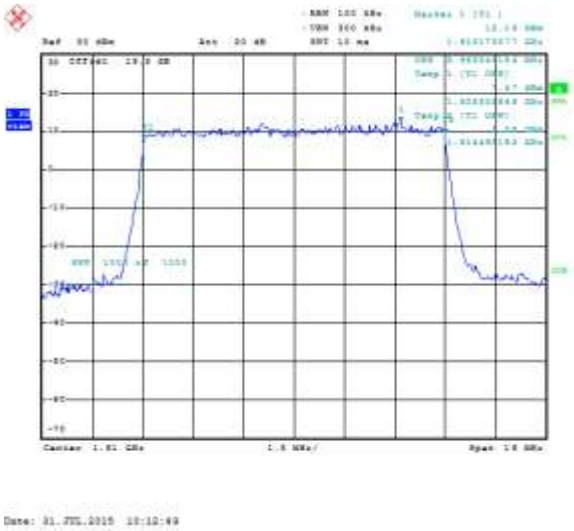


Figure 10-36a: Occupied Bandwidth, Band 25 High Channel, 10MHz BW, RB=50



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-37a: Occupied Bandwidth, Band 25

Low Channel, 5MHz BW, RB=25

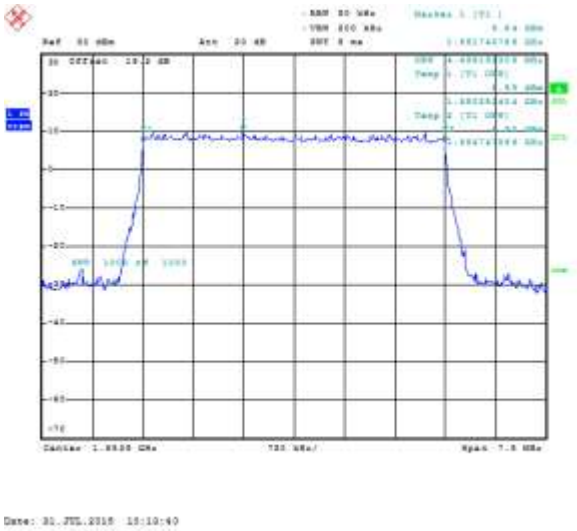


Figure 10-38a: Occupied Bandwidth, Band 25
Middle Channel, 5MHz BW, RB=25

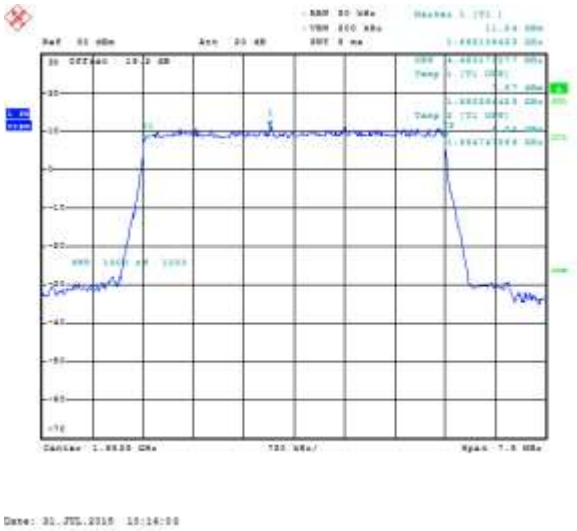
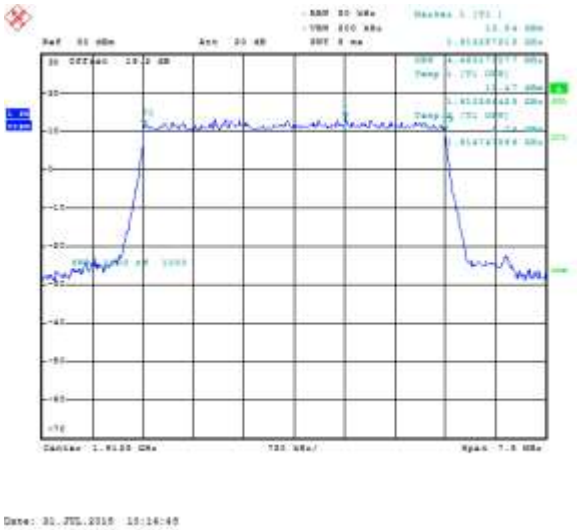


Figure 10-39a: Occupied Bandwidth, Band 25 High Channel, 5MHz BW, RB=25



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-40a: Occupied Bandwidth, Band 25

Low Channel, 5MHz BW, RB=25

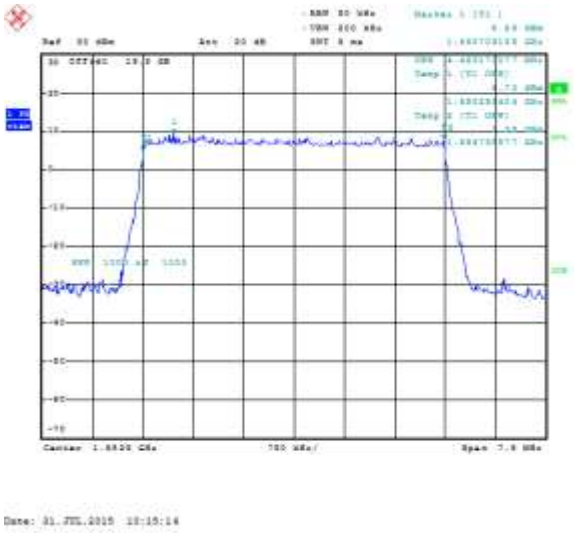


Figure 10-41a: Occupied Bandwidth, Band 25
Middle Channel, 5MHz BW, RB=25

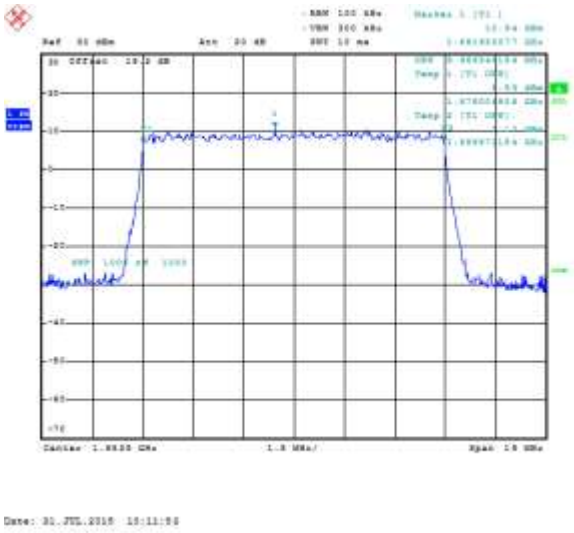
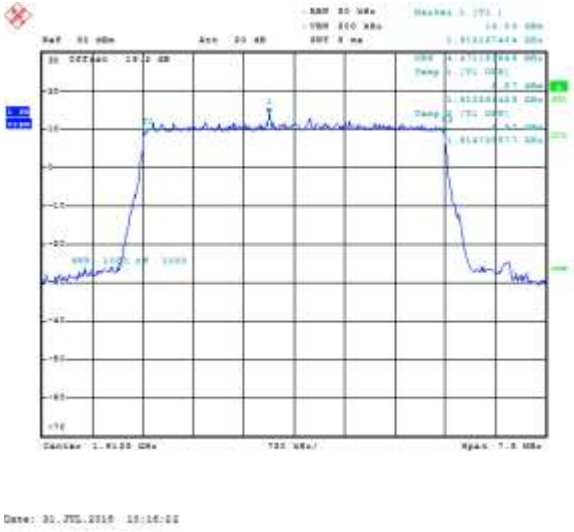


Figure 10-42a: Occupied Bandwidth, Band 25 High Channel, 5MHz BW, RB=25



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-43a: Occupied Bandwidth, Band 25

Low Channel, 3MHz BW, RB=15

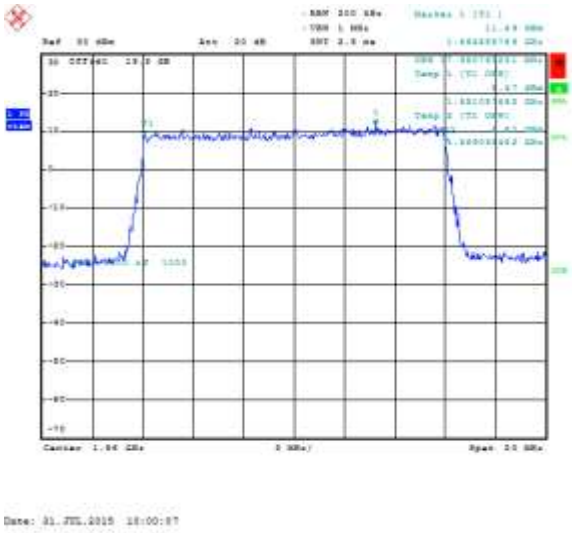


Figure 10-44a: Occupied Bandwidth, Band 25
Middle Channel, 3MHz BW, RB=15

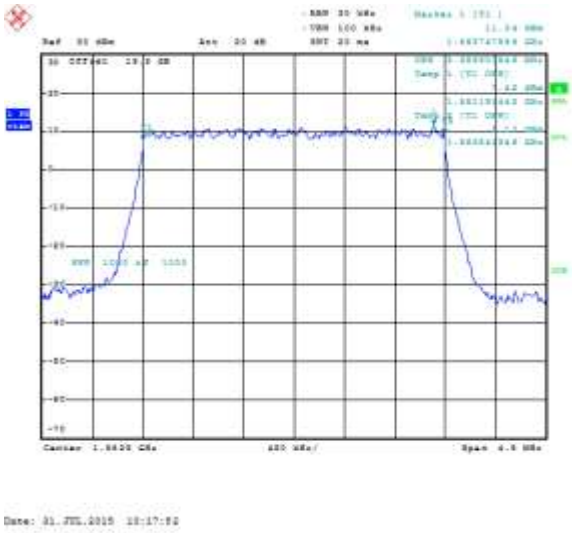
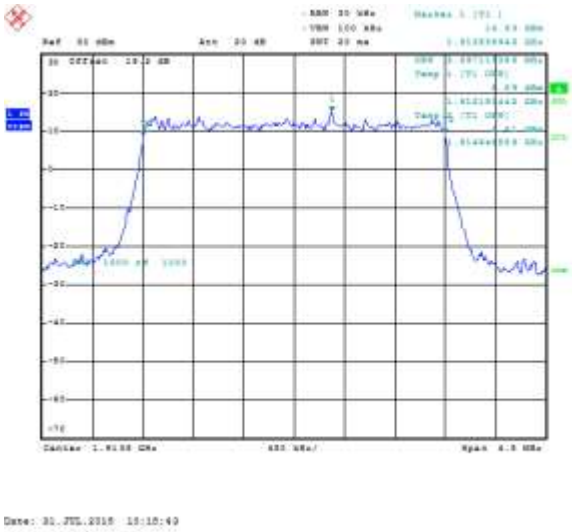


Figure 10-45a: Occupied Bandwidth, Band 25 High Channel, 3MHz BW, RB=15



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-46a: Occupied Bandwidth, Band 25

Low Channel, 3MHz BW, RB=15

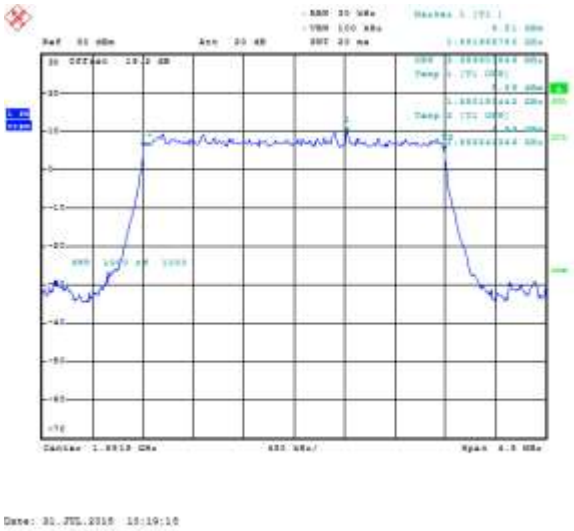


Figure 10-47a: Occupied Bandwidth, Band 25
Middle Channel, 3MHz BW, RB=15

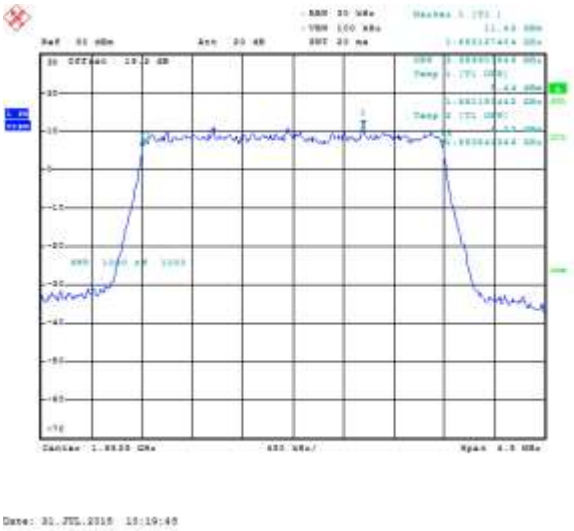
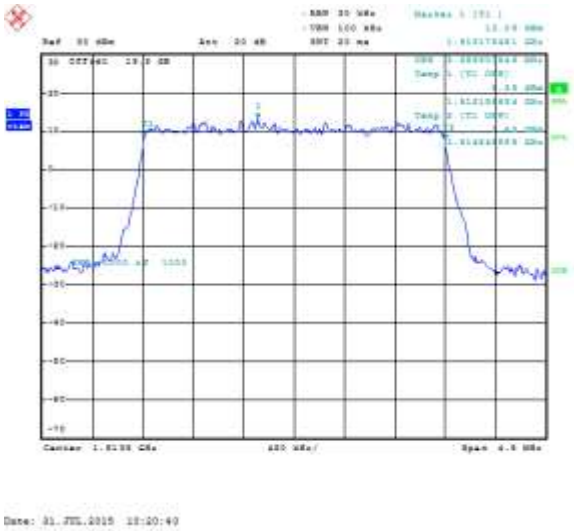


Figure 10-48a: Occupied Bandwidth, Band 25 High Channel, 3MHz BW, RB=15



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-49a: Occupied Bandwidth, Band 25

Low Channel, 1.4MHz BW, RB=6

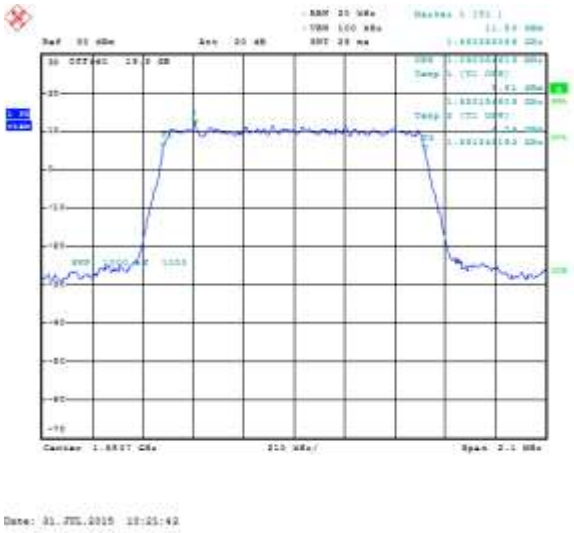


Figure 10-50a: Occupied Bandwidth, Band 25
Middle Channel, 1.4MHz BW, RB=6

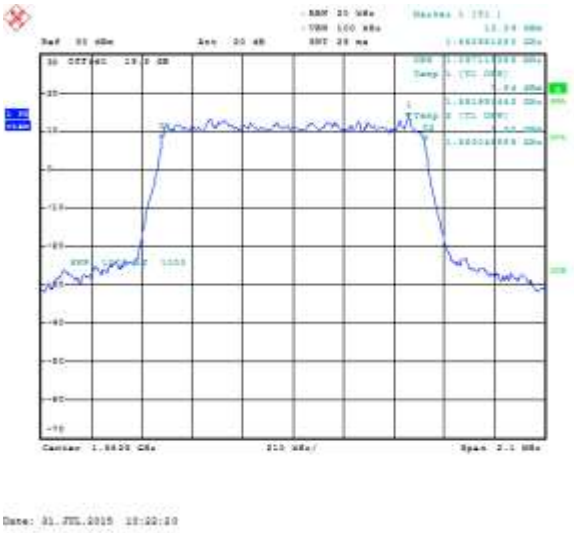


Figure 10-51a: Occupied Bandwidth, Band 25 High Channel, 1.4MHz BW, RB=60

LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-52a: Occupied Bandwidth, Band 25

Low Channel, 1.4MHz BW, RB=6

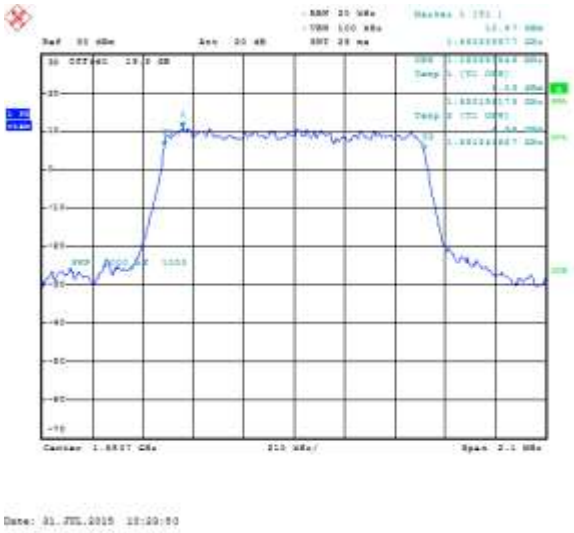


Figure 10-53a: Occupied Bandwidth, Band 25
Middle Channel, 1.4MHz BW, RB=6

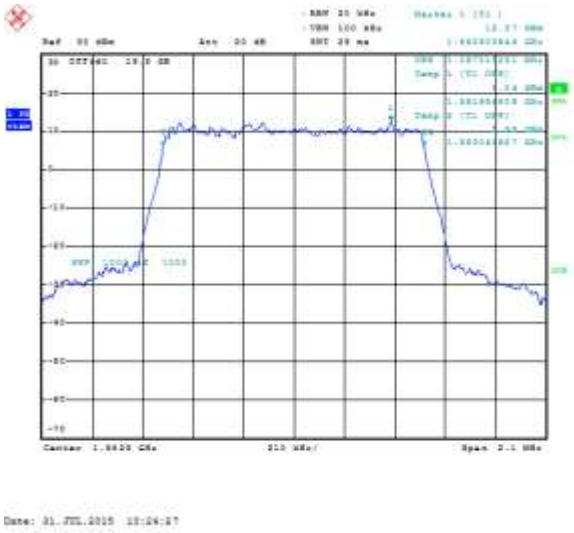
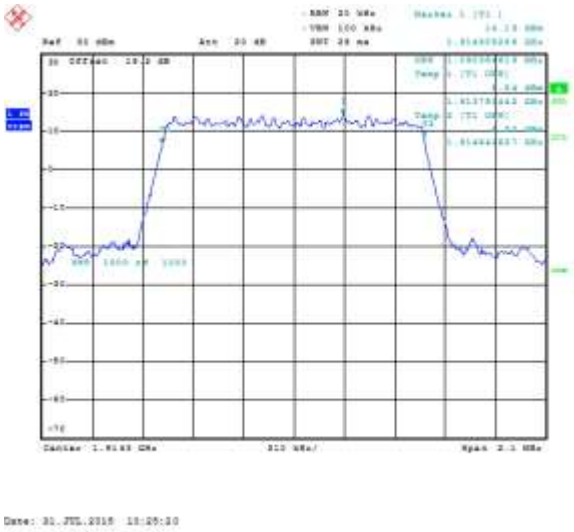


Figure 10-54a: Occupied Bandwidth, Band 25 High Channel, 1.4MHz BW, RB=6



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-55a: -26 dBc Bandwidth, Band 25 Low Channel, 20MHz BW, RB=100

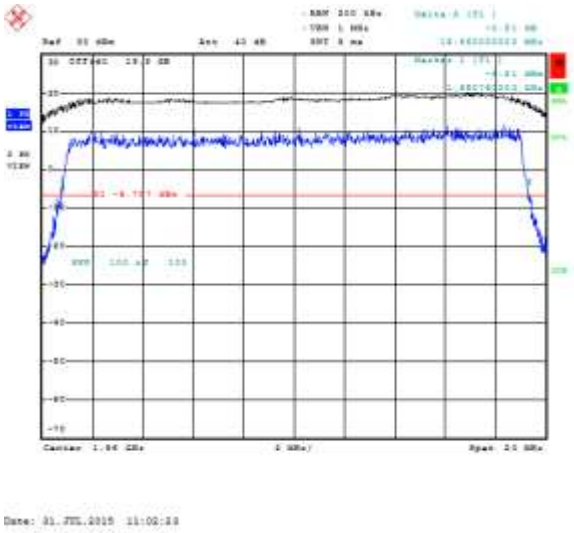


Figure 10-56a: -26 dBc Bandwidth, Band 25 Middle Channel, 20MHz BW, RB=100

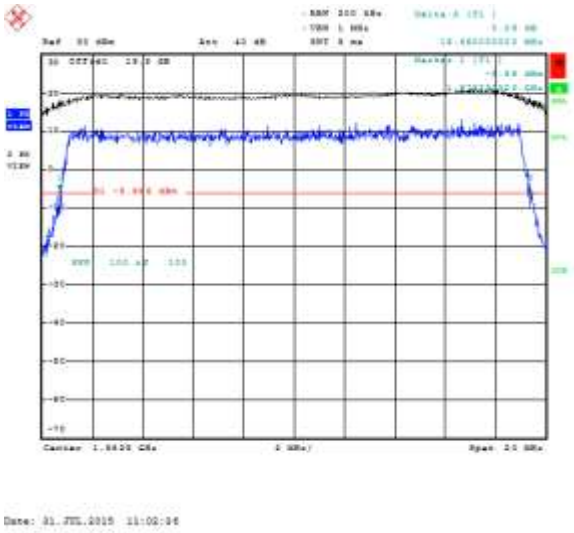


Figure 10-57a: -26 dBc Bandwidth, Band 25 High Channel, 20MHz BW, RB=100

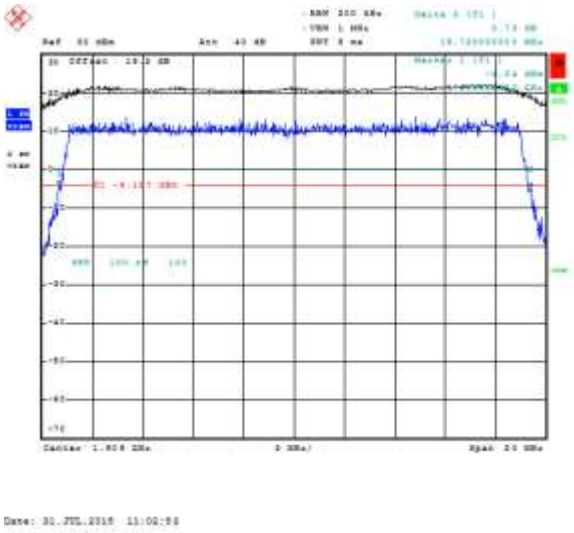
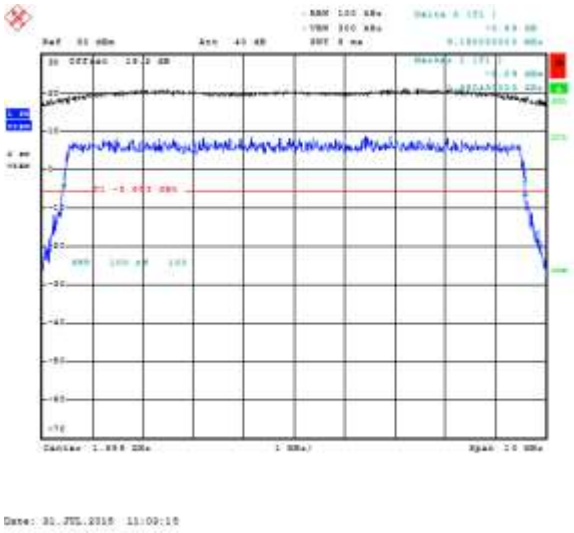


Figure 10-58a: -26 dBc Bandwidth, Band 25 Low Channel, 10MHz BW, RB=50



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-59a: -26 dBc Bandwidth, Band 25 Middle Channel, 10MHz BW, RB=50

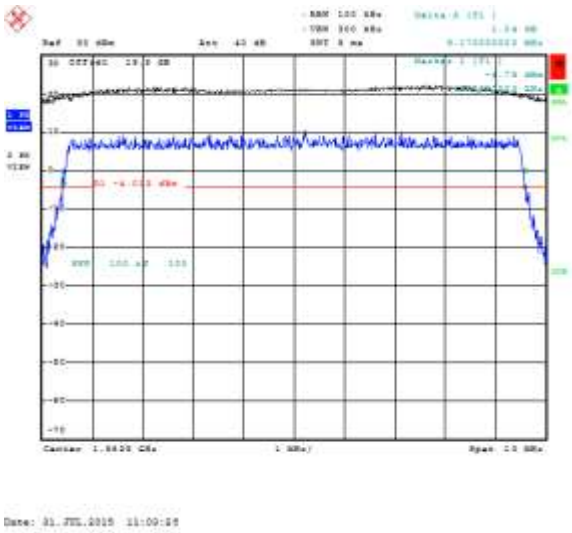


Figure 10-60a: -26 dBc Bandwidth, Band 25 High Channel, 10MHz BW, RB=50

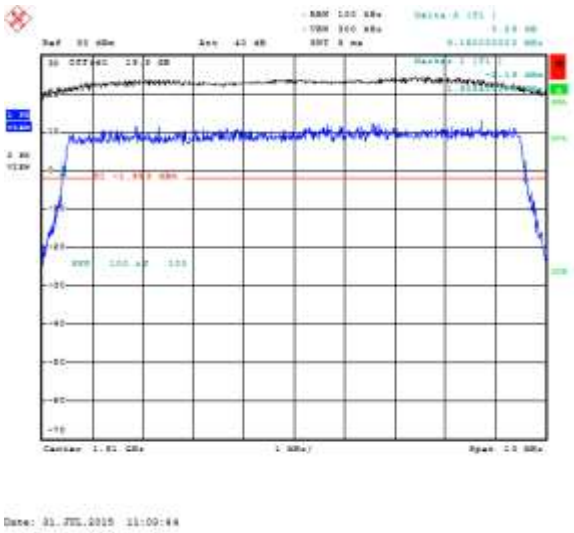


Figure 10-61a: -26 dBc Bandwidth, Band 25 Low Channel, 1.4MHz BW, RB=6

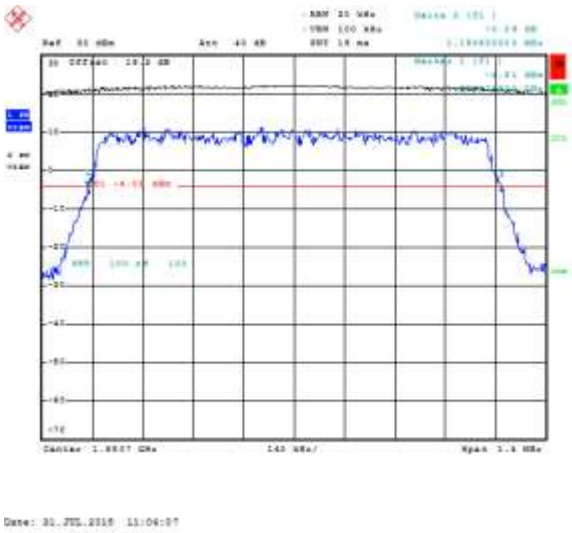


Figure 10-62a: -26 dBc Bandwidth, Band 25 Middle Channel, 1.4MHz BW, RB=6

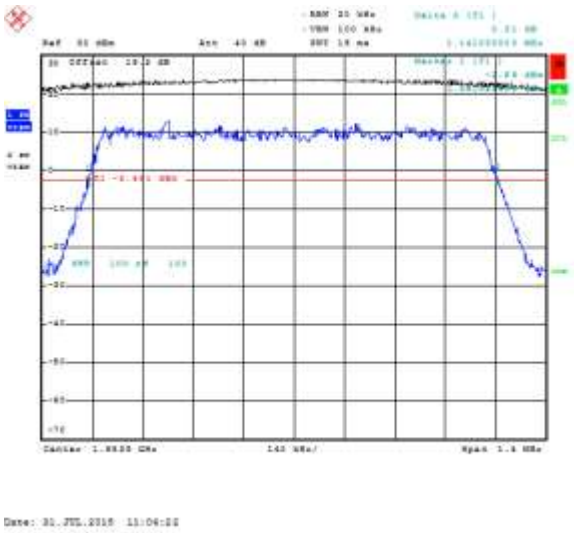


Figure 10-63a: -26 dBc Bandwidth, Band 25 High Channel, 1.4MHz BW, RB=6

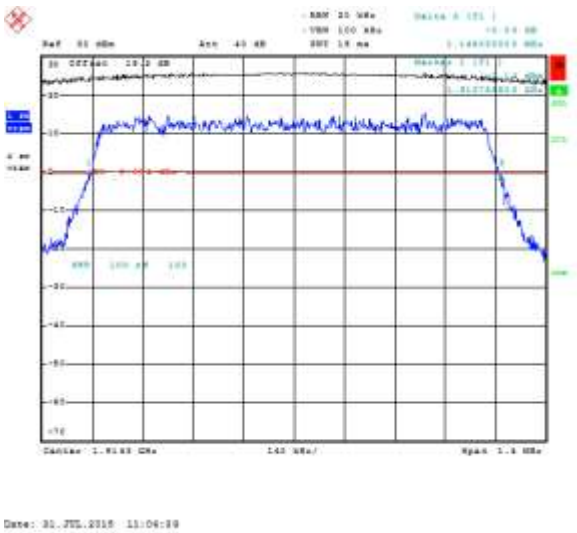


Figure 10-64a: Band 25 Low Channel Mask, 20MHz BW, RB=100

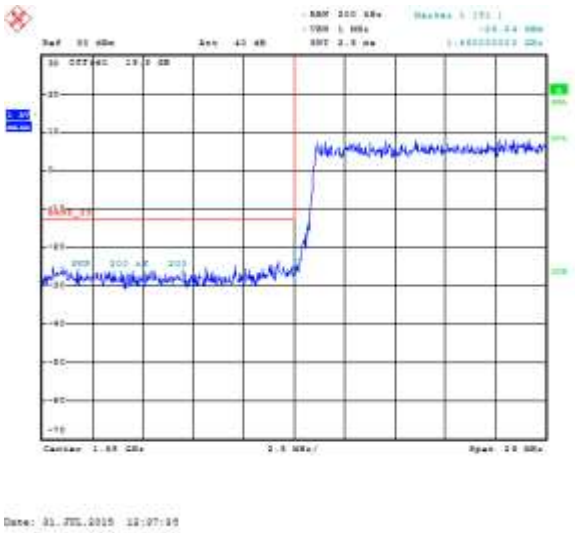


Figure 10-65a: Band 25 High Channel Mask, 20MHz BW, RB=100

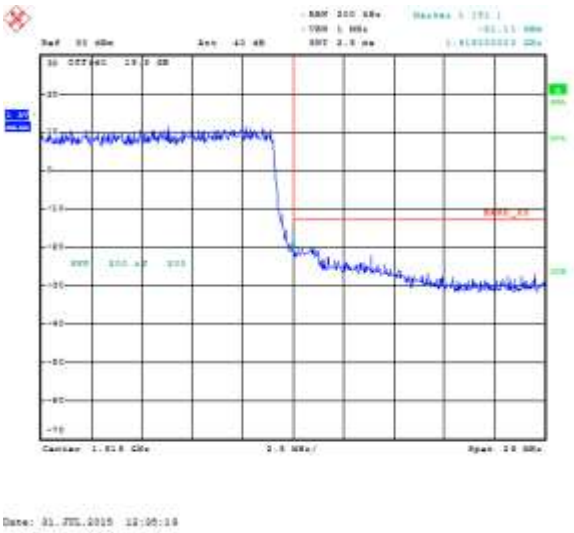


Figure 10-66a: Band 25 Low Channel Mask, 20MHz BW, RB=1

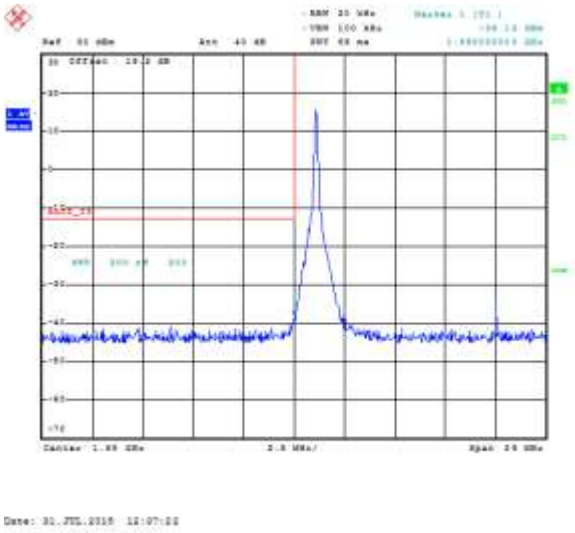


Figure 10-67a: Band 25 High Channel Mask,20MHz BW, RB=1

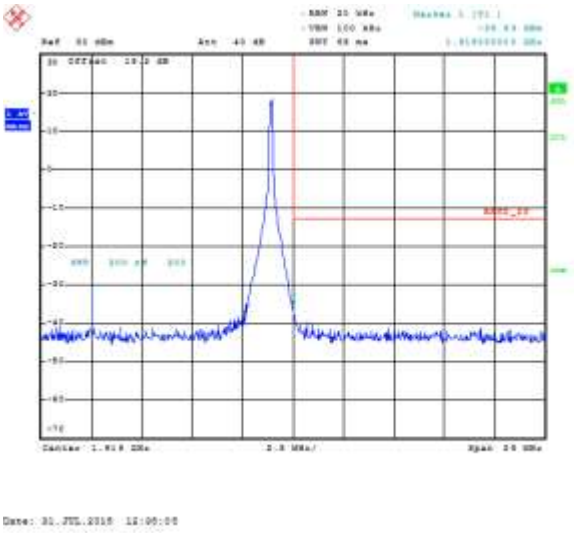


Figure 10-68a: Band 25 Low Channel Mask, 10MHz BW, RB=50

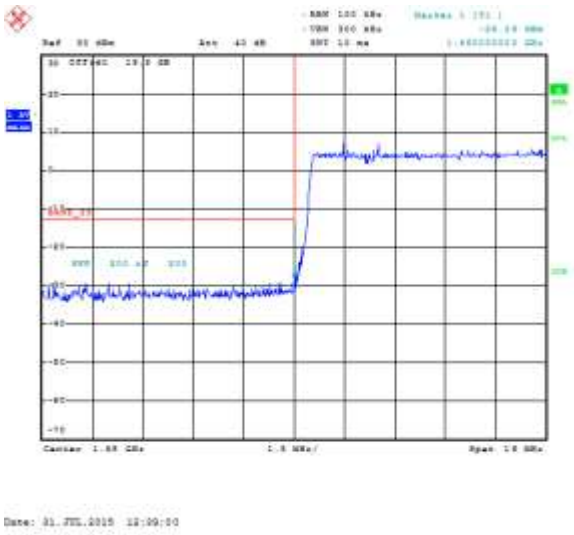
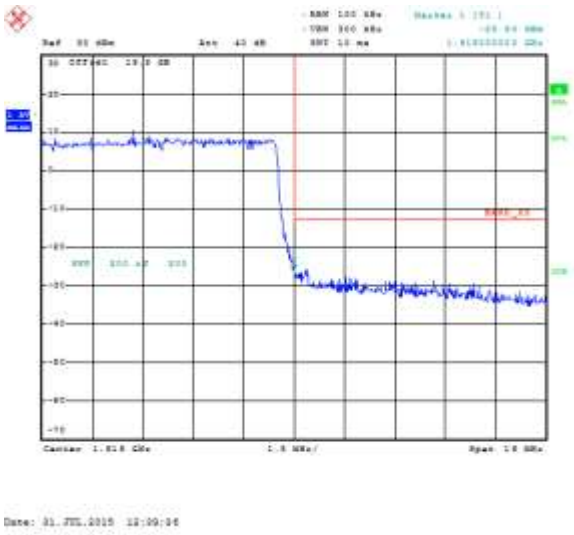


Figure 10-69a: Band 25 High Channel Mask, 10MHz BW, RB=50



LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-70a: Band 25 Low Channel Mask, 10MHz BW, RB=1

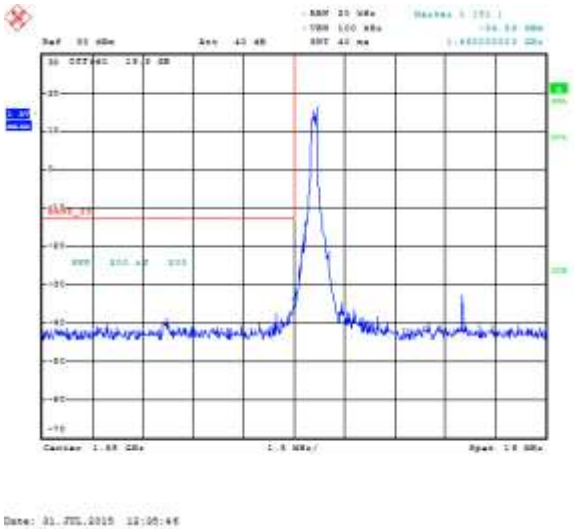


Figure 10-71a: Band 25 High Channel Mask, 10MHz BW, RB=1

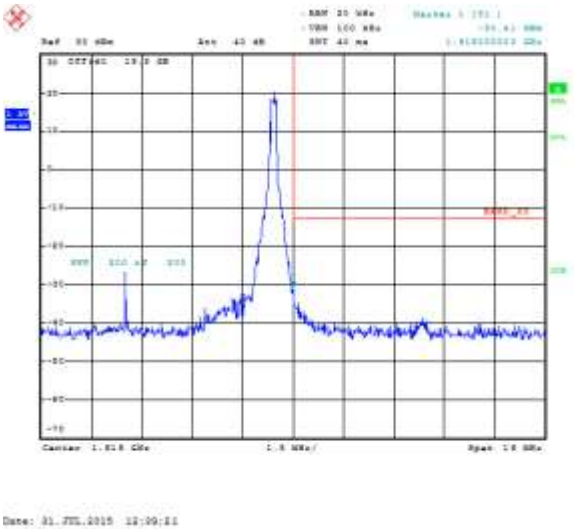


Figure 10-72a: Band 25 Low Channel Mask, 1.4MHz BW, RB=6

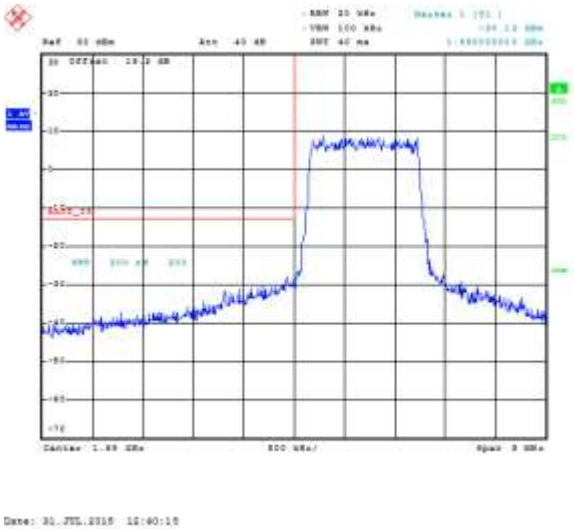


Figure 10-73a: Band 25 High Channel Mask, 1.4MHz BW, RB=6

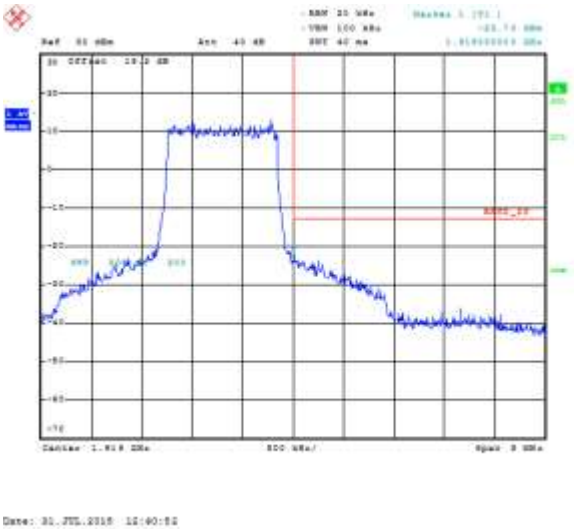


Figure 10-74a: Band 25 Low Channel Mask, 1.4MHz BW, RB=1

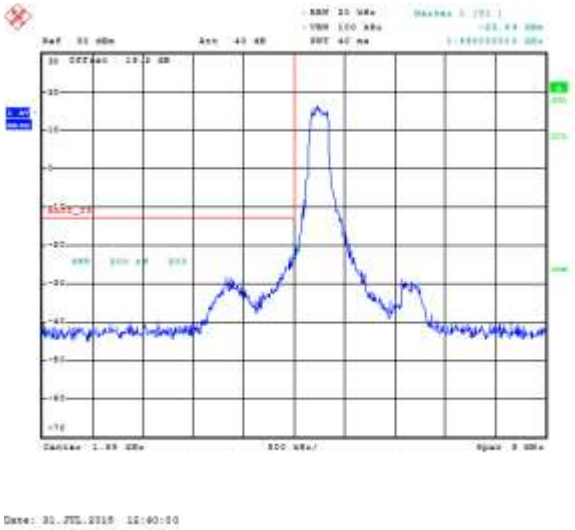


Figure 10-75a: Band 25 High Channel Mask, 1.4MHz BW, RB=1

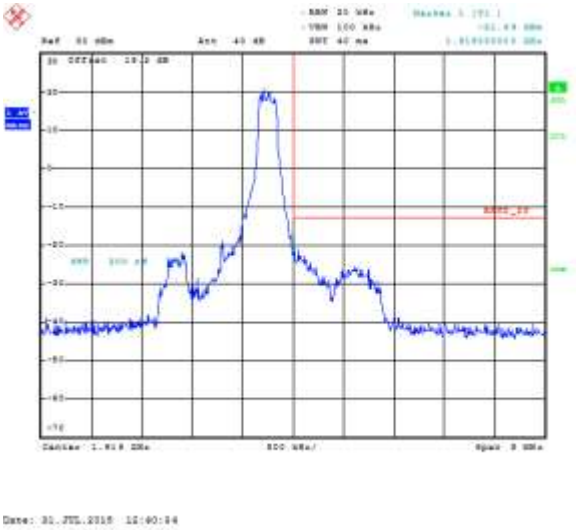
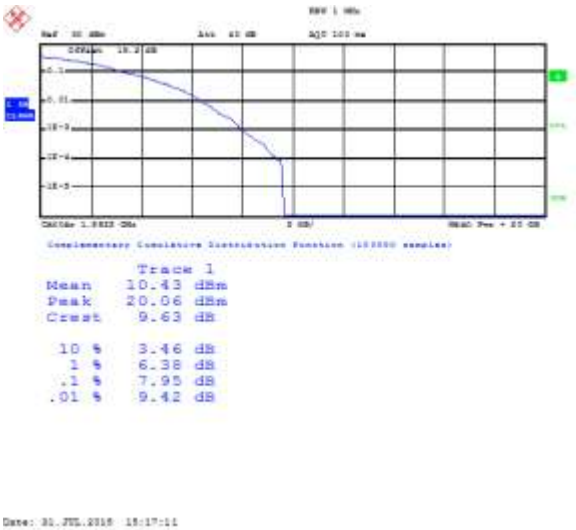


Figure 10-76a: Band 25 Mid Channel PAR, 20MHz BW, RB=50

Trace 1
Mean 11.17 dBm
Peak 21.47 dBm
Crest 10.30 dB

10 % 3.37 dB
1 % 6.31 dB
.1 % 7.85 dB
.01 % 10.10 dB

Figure 10-77a: Band 25 Middle Channel PAR, 20MHz BW, RB=100



Trace 1
Mean 10.43 dBm
Peak 20.06 dBm
Crest 9.63 dB

10 % 3.46 dB
1 % 6.38 dB
.1 % 7.95 dB
.01 % 9.42 dB

LTE Band 25 Conducted RF Emission Test Data cont'd

Figure 10-78a: Band 25 Mid Channel PAR, 10MHz BW, RB=25

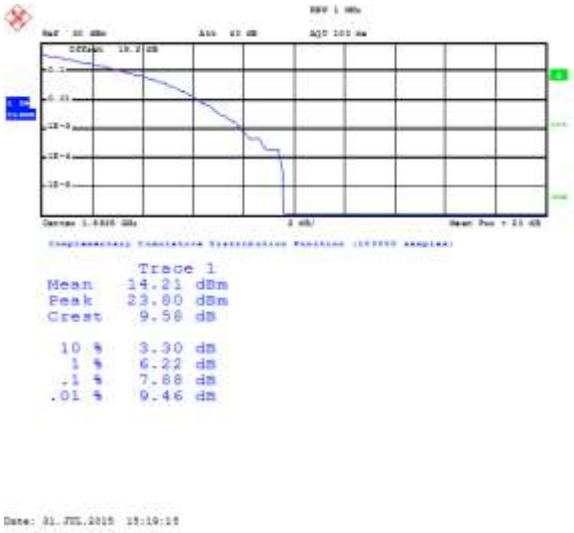


Figure 10-79a: Band 25 Mid Channel PAR, 10MHz BW, RB=50

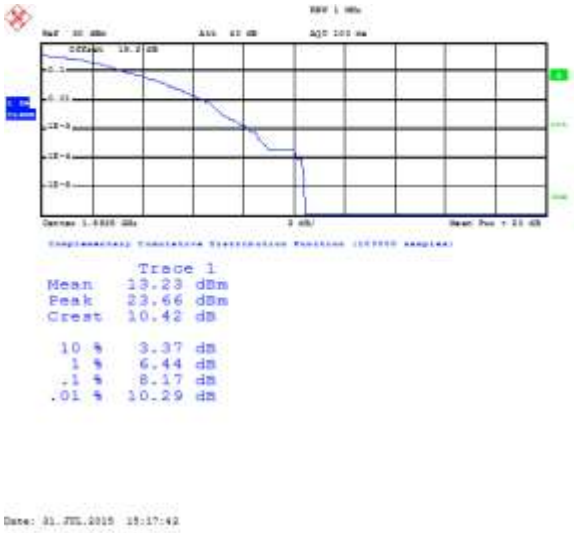


Figure 10-80a: Band 25 Mid Channel PAR, 1.4MHz BW, RB=3

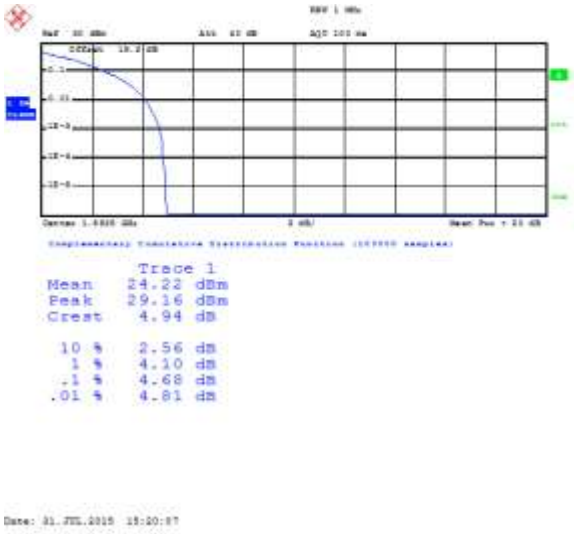
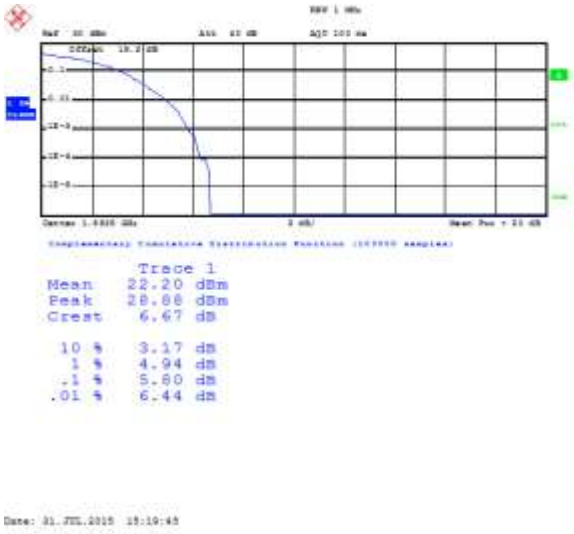
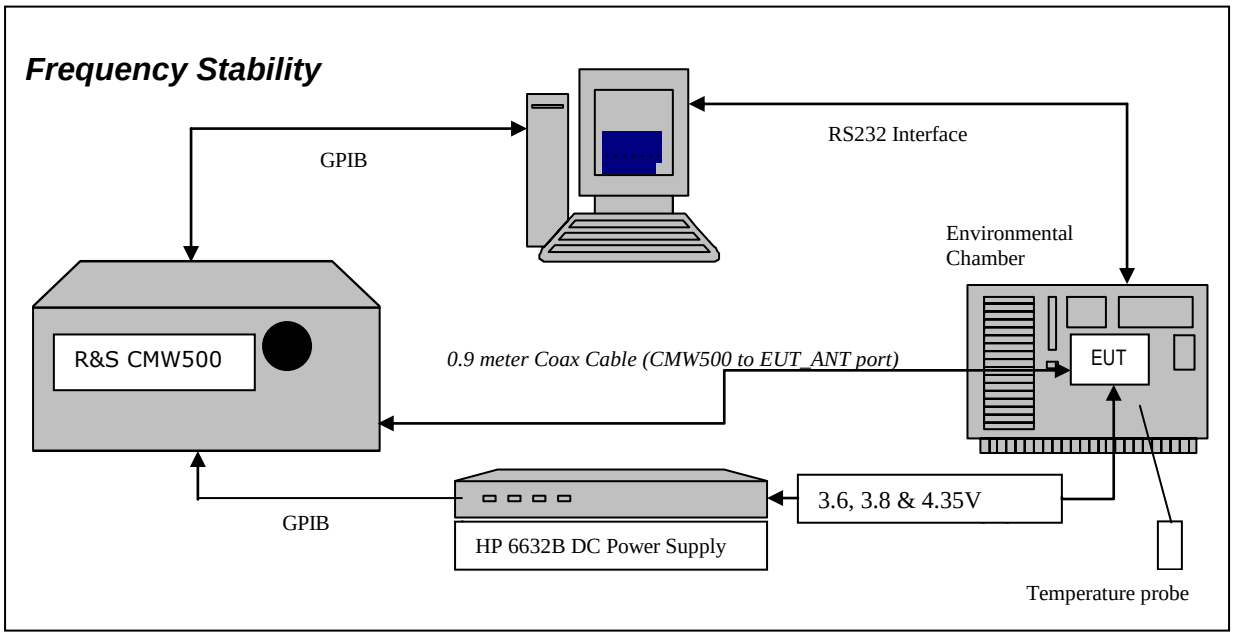


Figure 10-81a: Band 25 Mid Channel PAR, 1.4MHz BW, RB=6



APPENDIX 10B – LTE Band 25 FREQUENCY STABILITY TEST DATA

LTE Band 25 Frequency Stability Test Data



The following configurations were measured for model RHL211LW (STV100-3):

The following measurements were performed by Landon Martin.

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, 3.8 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, 3.8 volts and 4.35 volts. The transmit frequency was measured on 1882.5MHz for 10MHz bandwidth with maximum (50) RB. The transmit frequency was varied in 3 steps consisting of 779.5 MHz, 1882.5.0 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:

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

113. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
114. Start test program
115. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
116. Set power supply voltage to 3.6 volts.
117. Set up CMW 500 Radio Communication Tester.
118. Command the CMW 500 to switch to the low channel.
119. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
120. EUT is commanded to Transmit 100 Bursts.
121. 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.
122. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
123. Repeat steps 5 to 10 changing the supply voltage to 3.8 Volts
124. Increase temperature by 10°C and soak for 1/2 hour.
125. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
126. 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, 3.8 and 4.35 volts

The maximum frequency error in the LTE Band 25 measured was **0.0099 PPM**.

Date of test: August 25, 2015

LTE Band 25 results (10MHz Bandwidth): channels 23230 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	1882.5.00	3.6	20	6.17	0.0079
23230	1882.5.00	3.8	20	5.97	0.0076
23230	1882.5.00	4.35	20	5.75	0.0074

LTE Band 25 Results (10MHz Bandwidth): channel 23230 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	1882.5	3.6	-30	6.77	0.0087
23230	1882.5	3.6	-20	5.28	0.0068
23230	1882.5	3.6	-10	7.30	0.0093
23230	1882.5	3.6	0	5.09	0.0065
23230	1882.5	3.6	10	5.65	0.0072
23230	1882.5	3.6	20	6.17	0.0079
23230	1882.5	3.6	30	-2.65	-0.0034
23230	1882.5	3.6	40	6.55	0.0084
23230	1882.5	3.6	50	2.32	0.0030
23230	1882.5	3.6	60	3.95	0.0050

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	1882.5	3.8	-30	7.22	0.0092
23230	1882.5	3.8	-20	5.06	0.0065
23230	1882.5	3.8	-10	6.32	0.0081
23230	1882.5	3.8	0	5.38	0.0069
23230	1882.5	3.8	10	7.65	0.0098
23230	1882.5	3.8	20	5.97	0.0076
23230	1882.5	3.8	30	-2.90	-0.0037
23230	1882.5	3.8	40	5.22	0.0067
23230	1882.5	3.8	50	4.71	0.0060
23230	1882.5	3.8	60	-3.02	-0.0039

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
23230	1882.5	4.35	-30	7.74	**0.0099**
23230	1882.5	4.35	-20	6.01	0.0077
23230	1882.5	4.35	-10	6.18	0.0079
23230	1882.5	4.35	0	4.85	0.0062
23230	1882.5	4.35	10	6.01	0.0077
23230	1882.5	4.35	20	5.75	0.0074
23230	1882.5	4.35	30	2.12	0.0027
23230	1882.5	4.35	40	5.74	0.0073
23230	1882.5	4.35	50	-3.30	-0.0042
23230	1882.5	4.35	60	-2.06	-0.0026

APPENDIX 10C – LTE Band 25 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following configurations were measured for model RHL211LW (STV100-3):
The following measurements were performed by Shiva Kumbham.
Date of Test: August 14, 2015
The environmental tests conditions were: Temperature: 26.0 °C
Relative Humidity: 35.4 %

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

LTE Band 25, 1.4MHz 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	26047	1850.70	25	Horn	V	-25.81	-24.16	V-V	-12.49	**27.84**	0.61	33.00	5.16
F0	26047	1850.70	25	Horn	H	-24.16		H-H	-11.66				
F0	26365	1882.50	25	Horn	V	-25.97	-25.10	V-V	-13.36	27.13	0.52	33.00	5.87
F0	26365	1882.50	25	Horn	H	-25.10		H-H	-12.31				
F0	26683	1914.30	25	Horn	V	-27.24	-25.49	V-V	-12.42	27.32	0.54	33.00	5.68
F0	26683	1914.30	25	Horn	H	-25.49		H-H	-12.07				

LTE Band 25, 10MHz BW, RB=1, 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	26090	1855.00	25	Horn	V	-26.70	-25.81	V-V	-14.25	26.22	0.42	33.00	6.78
F0	26090	1855.00	25	Horn	H	-25.81		H-H	-13.28				
F0	26365	1882.50	25	Horn	V	-26.58	-25.95	V-V	-14.14	**26.31**	0.43	33.00	6.69
F0	26365	1882.50	25	Horn	H	-25.95		H-H	-13.13				
F0	26640	1910.00	25	Horn	V	-27.96	-26.55	V-V	-13.51	26.28	0.42	33.00	6.72
F0	26640	1910.00	25	Horn	H	-26.55		H-H	-13.11				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Savtej Sandhu.

Date of Test: August 13, 2015

The environmental test conditions were: Temperature: 27.0 ºC
Relative Humidity: 32.7 %

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 25 with 5MHz BW (channel 23205, 23230 and 23254 with RB = 1) with QPSK modulation. and 10MHz BW (channel 23230 with RB = 1), with 16-QAM modulation.

All emissions had test margins greater than 25.0 dB.

The following measurements were performed by Xing Fang and Winston Vernon.

Date of Test: August 12-13, 2015

The environmental test conditions were: Temperature: 24.4 ºC
Relative Humidity: 37.0 %

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 with top facing to the RX antenna when the turntable is at 0 degree position

Measurements were performed in LTE Band 25 with 5MHz BW (channel 23205, 23230 and 23254 with RB = 1) with QPSK modulation. and 10MHz BW (channel 23230 with RB = 1), with 16-QAM modulation.

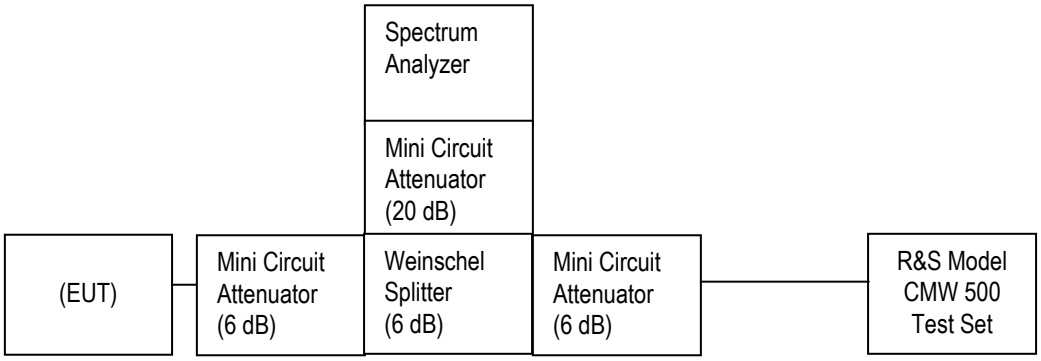
All emissions had test margins greater than 25.0 dB.

APPENDIX 11A – LTE Band 41 CONDUCTED RF EMISSIONS TEST DATA/PLOTS

LTE Band 41 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: July 31, 2015

The environmental test conditions were: Temperature: 25.7 ºC
Relative Humidity: 35.6 %

The following measurements were performed by Sijia Li.

LTE Band 41 Conducted RF Emission Test Data cont'd

Emission Designator Table

Frequency Rane (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
2498.5-2687.5	25.81	4M51G7D	LTE B41	5	QPSK
2498.5-2687.5	25.07	4M48D7W	LTE B41	5	16QAM
2501-2685	25.79	8M97G7D	LTE B41	10	QPSK
2501-2685	25.20	8M97D7W	LTE B41	10	16QAM
2503.5-2682.5	25.77	13M5G7D	LTE B41	15	QPSK
2503.5-2682.5	24.98	13M5D7W	LTE B41	15	16QAM
2506-2680	**25.92**	17M9G7D	LTE B41	20	QPSK
2506-2680	25.40	17M9D7W	LTE B41	20	16QAM

The following test configurations were measured on RHL211LW (STV100-3):
The conducted spurious emissions – As per 47 CFR 2.1051, 27.53(m), RSS-199, 4.6 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, 10MHz and 20MHz with different number of RBs for LTE Band 41. 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 41 was measured to be 18.54 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 41 selected Frequencies in 20MHz BW (RB = 100)

LTE Band 41 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2506	18.42	17.932
2593	**18.54**	17.932
2680	18.44	17.884

Test Data for LTE Band 41 selected Frequencies in 10MHz BW (RB = 50)

LTE Band 41 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2506	9.17	8.966
2593	9.18	8.966
2680	9.17	8.966

Test Data for LTE Band 41 selected Frequencies in 5MHz BW (RB = 25)

LTE Band 41 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2506	4.625	4.507
2593	4.68	4.483
2680	4.64	4.495

Peak to Average Ratio (PAR)

For each 1.4MHz, 10MHz and 20MHz with Resource Block allocation 100,50,25, 6 and 3 as per scalable bandwidths for LTE Band 41, the peak to average ratio was measured on the middle channel 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 12.67dB on 20MHz bandwidth with Resource Block allocation 100 while transmitting at 2535 MHz.

Measurement Plots for LTE Band 41

See Figures 11-1a to 11-18a for the plots of the conducted spurious emissions.

See Figures 11-19a to 11-51a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.

See Figures 11-52a to 11-63a for the plots of the Channel mask.

See Figures 11-64a to 11-69a for the plots of the Peak to Average Ratio.

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-1a: Band 41, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

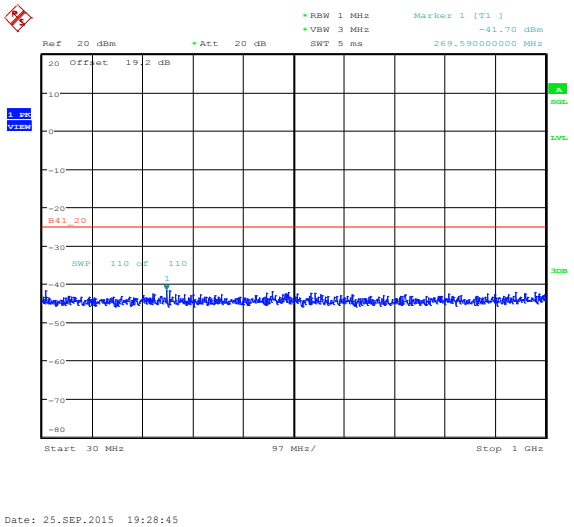


Figure 11-2a: Band 41, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

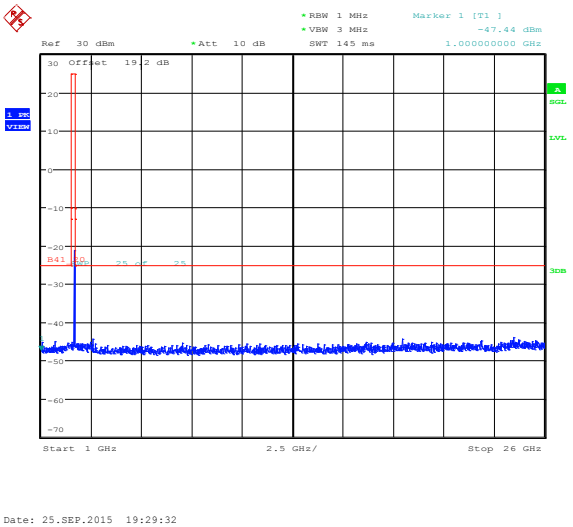


Figure 11-3a: Band 41, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)

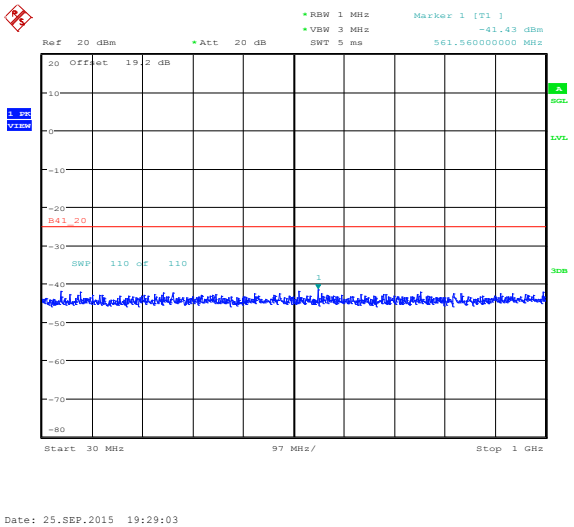
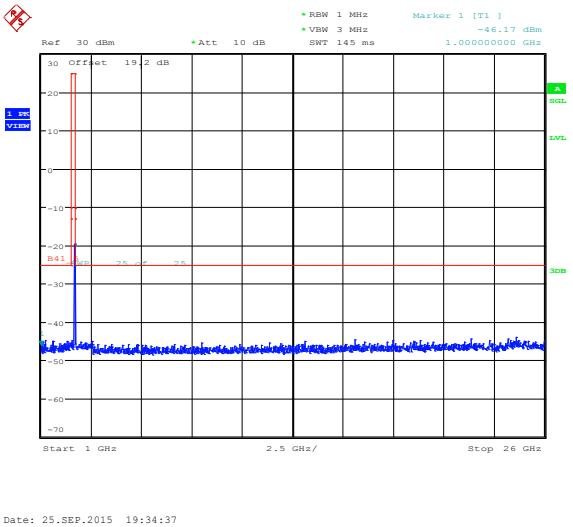


Figure 11-4a: Band 41, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-5a: Band 41, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

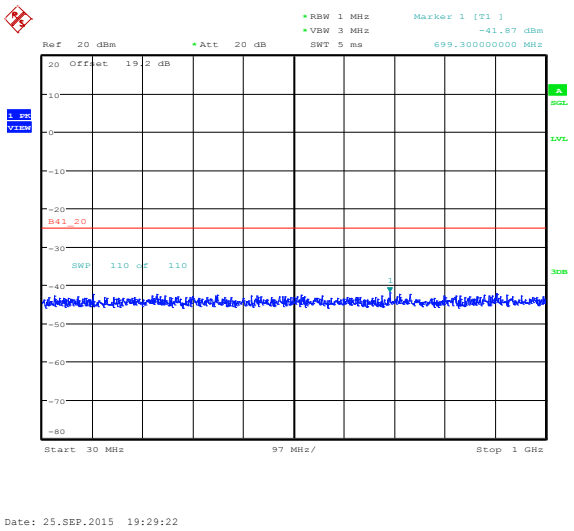


Figure 11-6a: Band 41, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

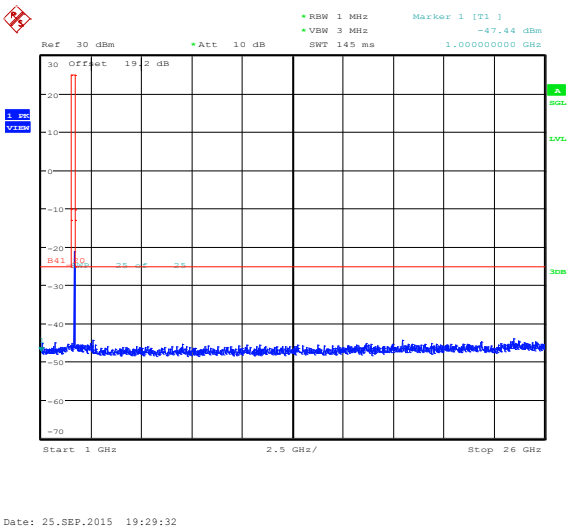


Figure 11-7a: Band 41, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

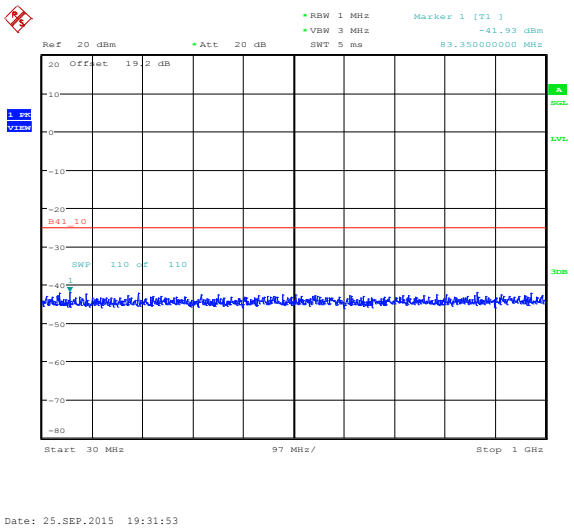
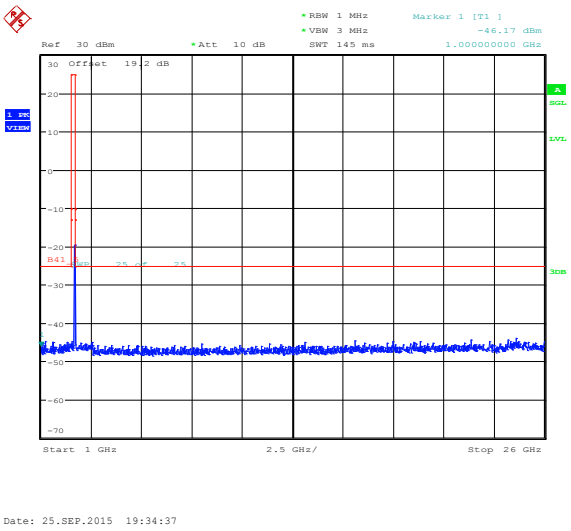
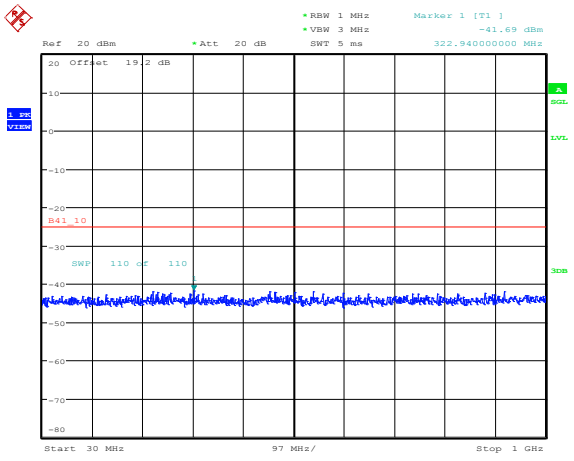


Figure 11-8a: Band 41, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)



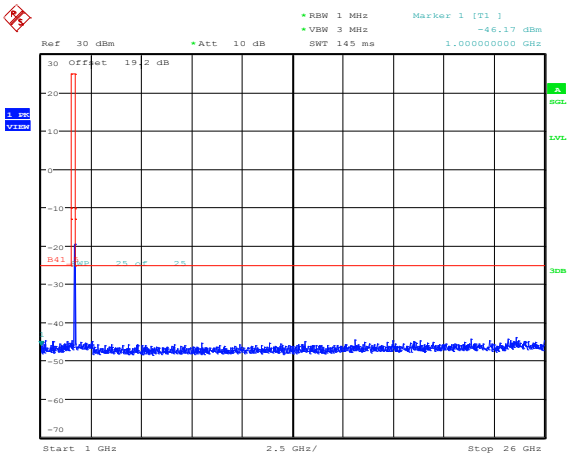
LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-9a: Band 41, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 30)



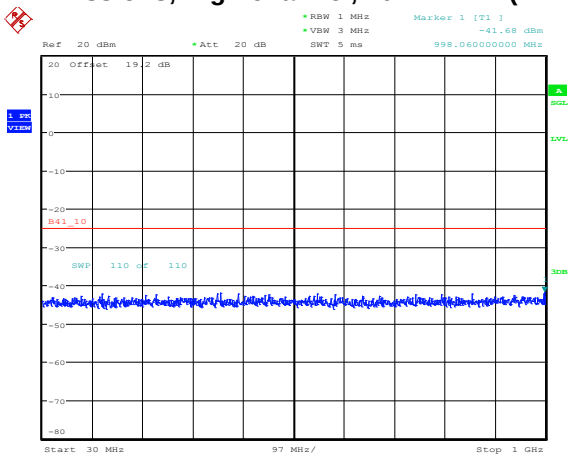
Date: 25.SEP.2015 19:32:11

Figure 11-10a: Band 41, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 30)



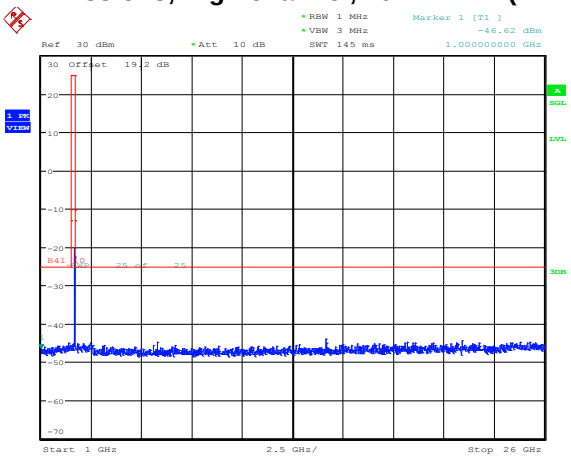
Date: 25.SEP.2015 19:34:37

Figure 11-11a: Band 41, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)



Date: 25.SEP.2015 19:32:29

Figure 11-12a: Band 41, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)



Date: 25.SEP.2015 19:32:40

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-13a: Band 41, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 1)

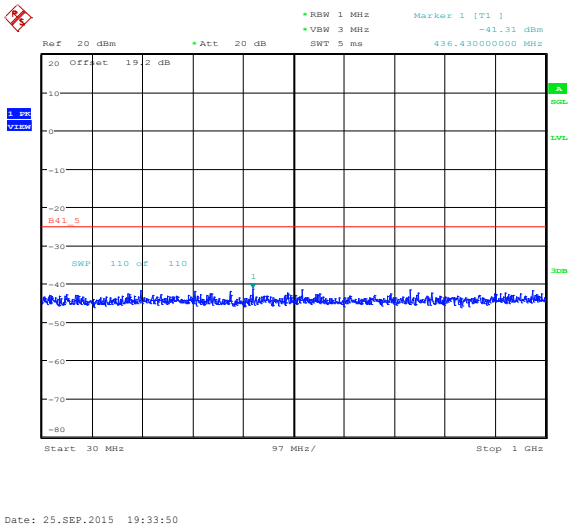
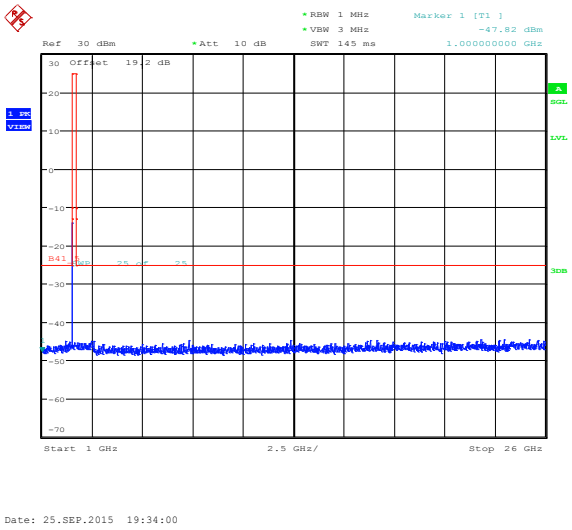
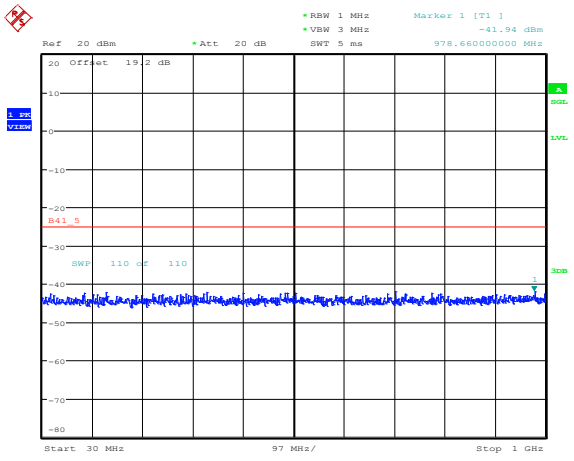


Figure 11-14a: Band 41, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 1)



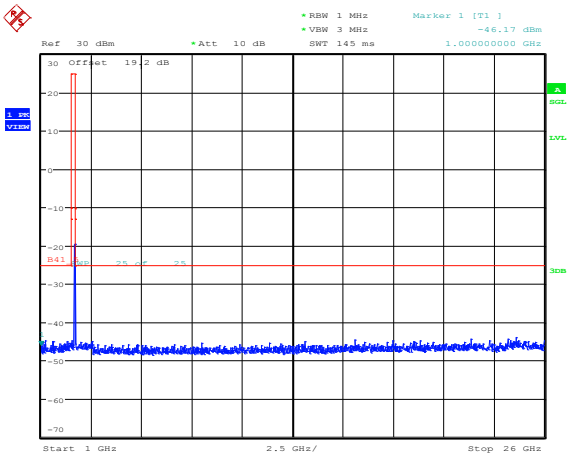
LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-15a: Band 41, Spurious Conducted Emissions, Middle Channel, 1.4MHz BW (RB= 15)



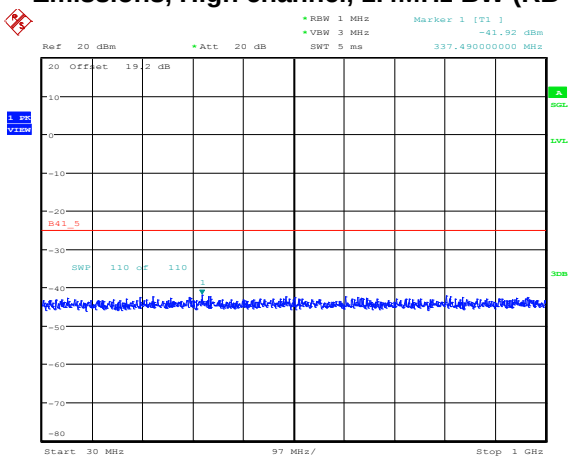
Date: 25.SEP.2015 19:34:08

Figure 11-16a: Band 41, Spurious Conducted Emissions, Middle Channel, 1.4MHz BW (RB= 15)



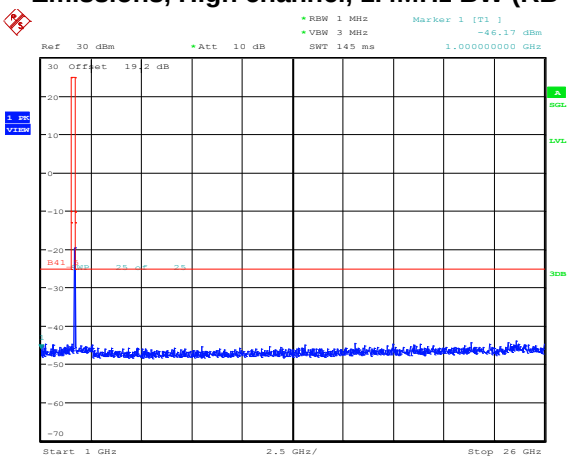
Date: 25.SEP.2015 19:34:37

Figure 11-17a: Band 41, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 25)



Date: 25.SEP.2015 19:34:27

Figure 11-18a: Band 41, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 25)



Date: 25.SEP.2015 19:34:37

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-19a: Occupied Bandwidth, Band 41

Low Channel, 20MHz BW, RB=100

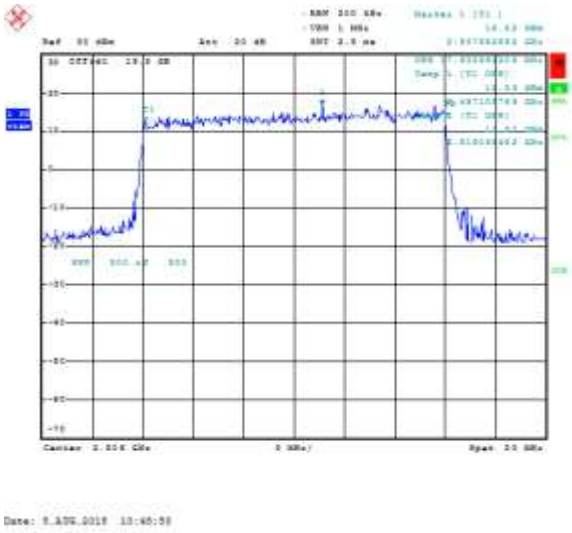


Figure 11-20a: Occupied Bandwidth, Band 41
Middle Channel, 20MHz BW, RB=100

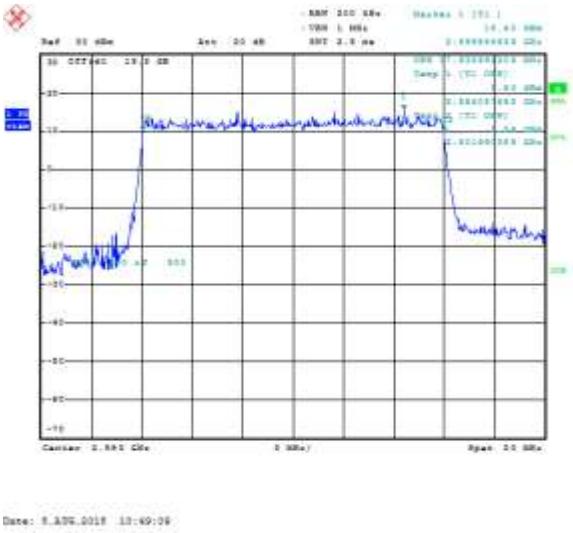
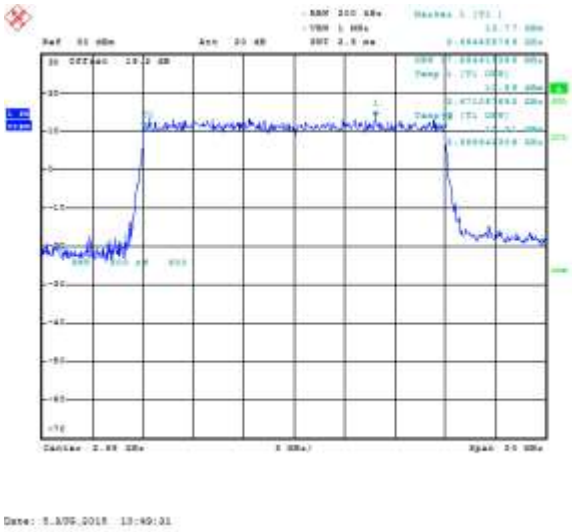


Figure 11-21a: Occupied Bandwidth, Band 41 High Channel, 20MHz BW, RB=100



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-22a: Occupied Bandwidth, Band 41

Low Channel, 20MHz BW, RB=100

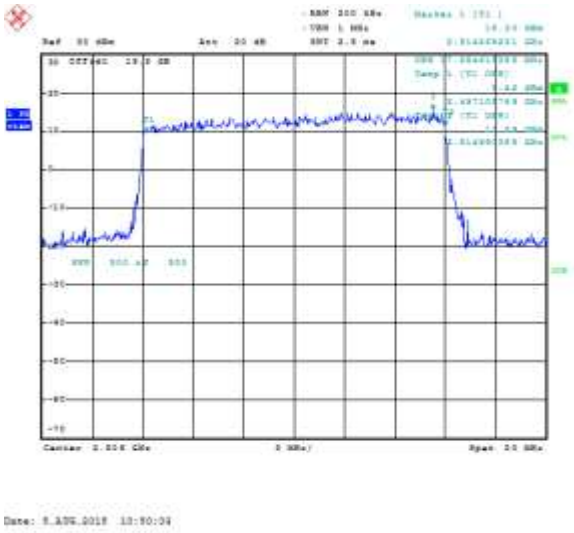


Figure 11-23a: Occupied Bandwidth, Band 41
Middle Channel, 20MHz BW, RB=100

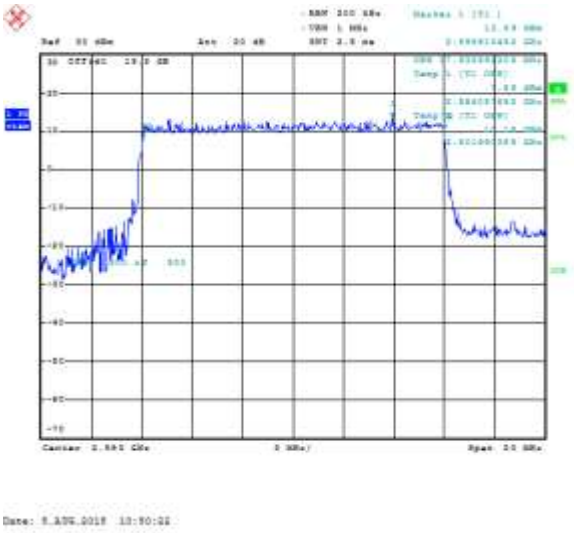
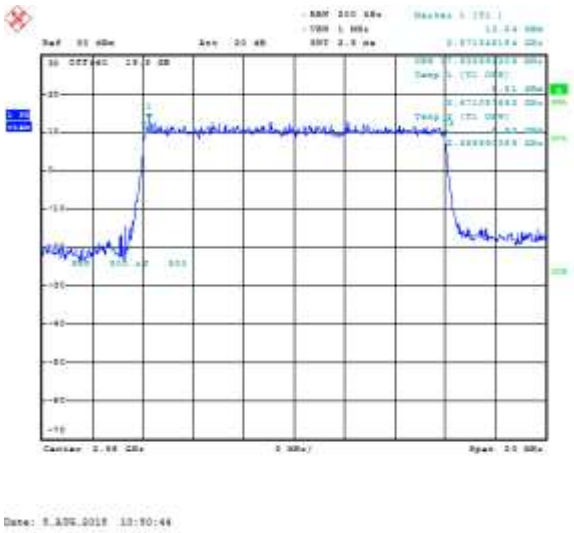


Figure 11-24a: Occupied Bandwidth, Band 41 High Channel, 20MHz BW, RB=100



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-25a: Occupied Bandwidth, Band 41

Low Channel, 15MHz BW, RB=75

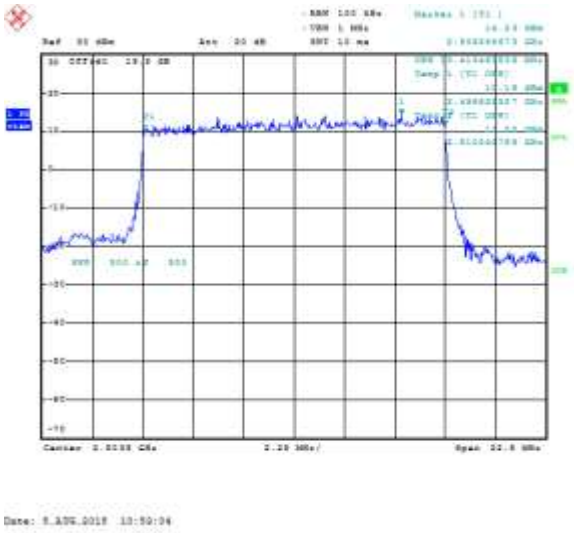


Figure 11-26a: Occupied Bandwidth, Band 41
Middle Channel, 15MHz BW, RB=75

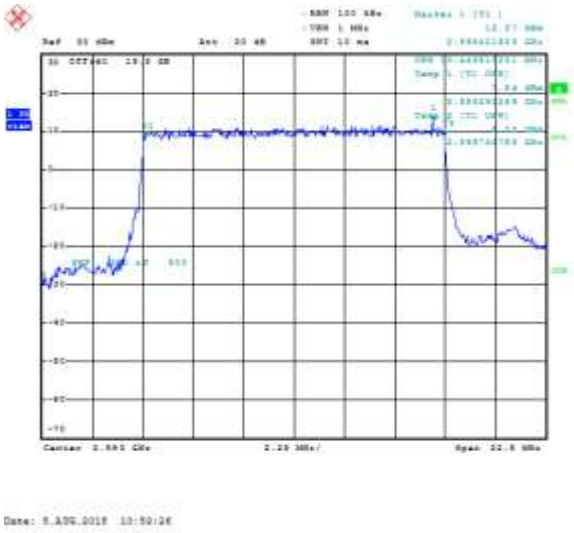
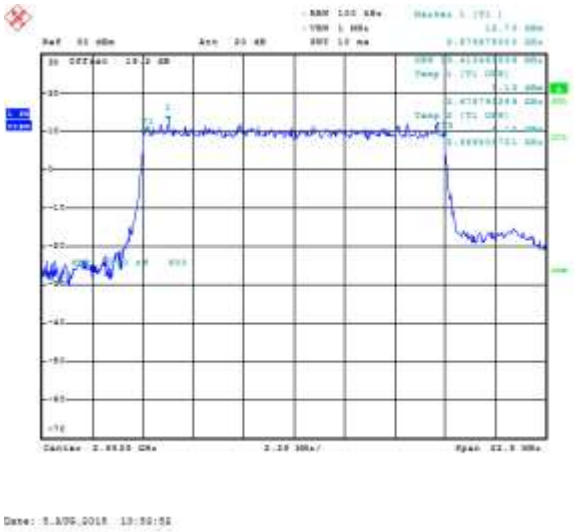


Figure 11-27a: Occupied Bandwidth, Band 41 High Channel, 15MHz BW, RB=75



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-28a: Occupied Bandwidth, Band 41

Low Channel, 15MHz BW, RB=75

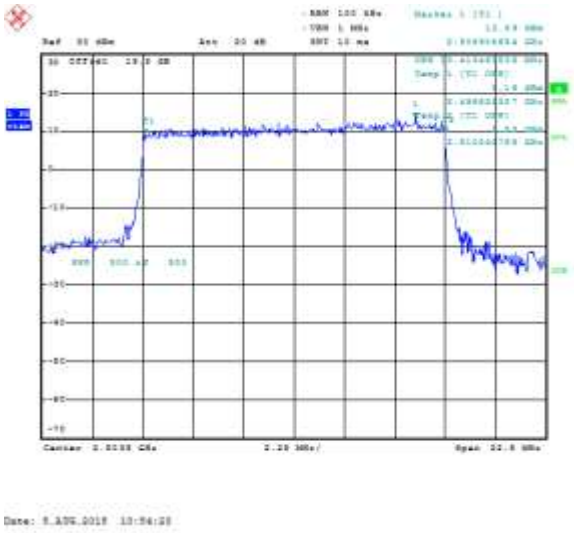


Figure 11-29a: Occupied Bandwidth, Band 41
Middle Channel, 15MHz BW, RB=75

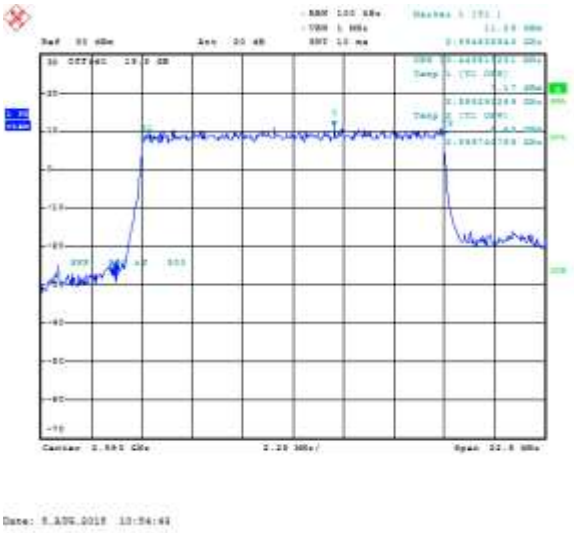
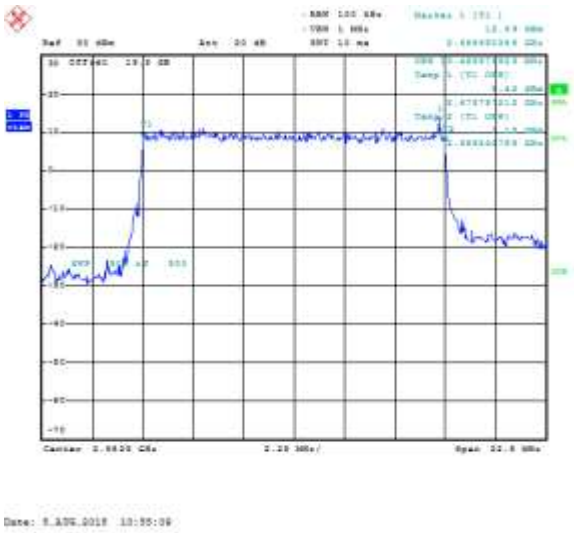


Figure 11-30a: Occupied Bandwidth, Band 41 High Channel, 15MHz BW, RB=75



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-31a: Occupied Bandwidth, Band 41

Low Channel, 10MHz BW, RB=50

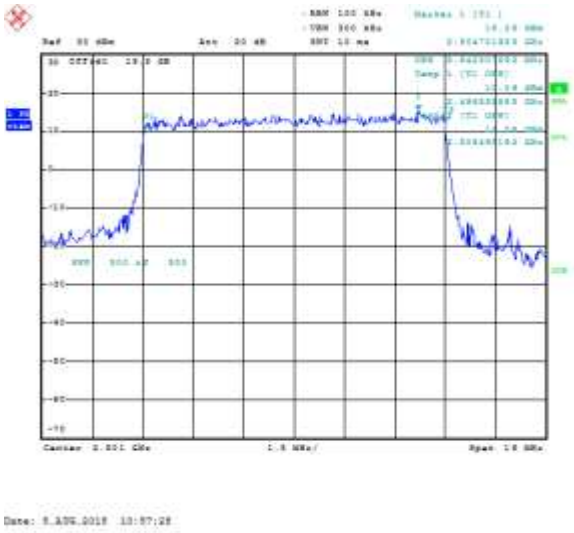


Figure 11-32a: Occupied Bandwidth, Band 41
Middle Channel, 10MHz BW, RB=50

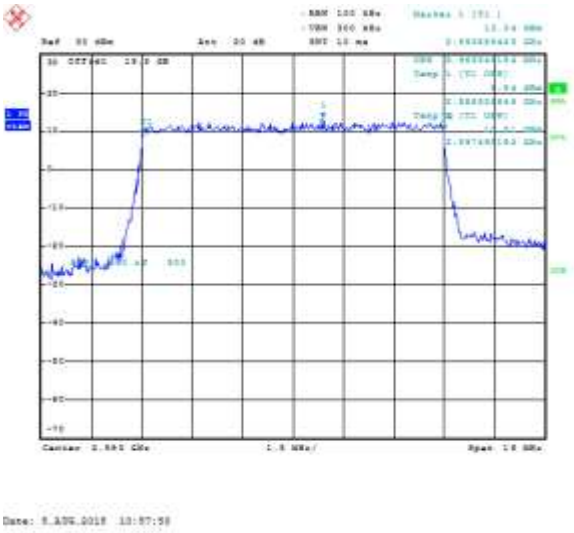
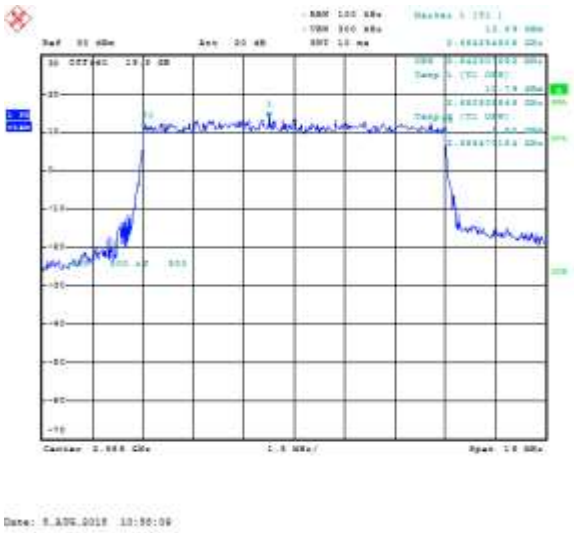


Figure 11-33a: Occupied Bandwidth, Band 41 High Channel, 10MHz BW, RB=50



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-34a: Occupied Bandwidth, Band 41

Low Channel, 10MHz BW, RB=50

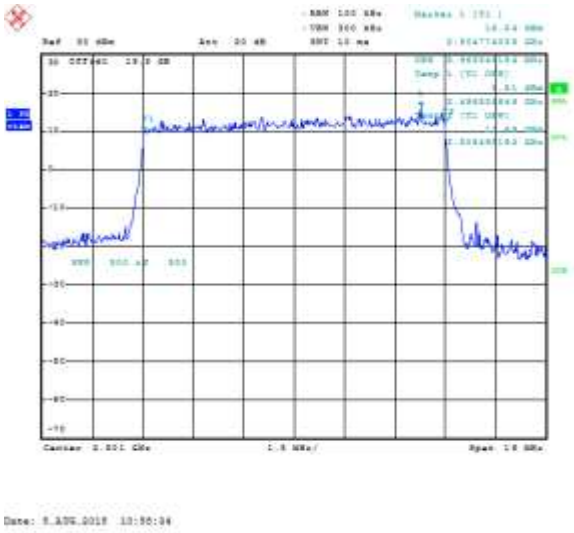


Figure 11-35a: Occupied Bandwidth, Band 41
Middle Channel, 10MHz BW, RB=50

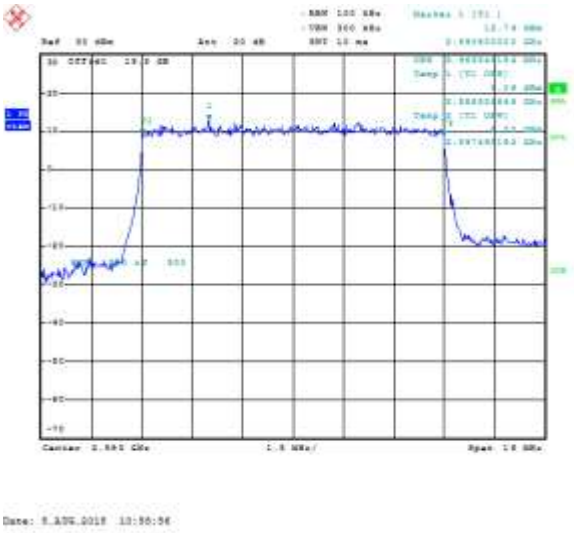
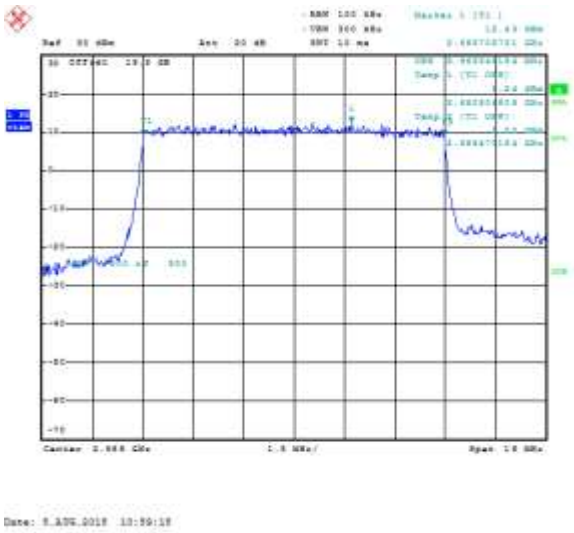


Figure 11-36a: Occupied Bandwidth, Band 41 High Channel, 10MHz BW, RB=50



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-37a: Occupied Bandwidth, Band 41

Low Channel, 5MHz BW, RB=25

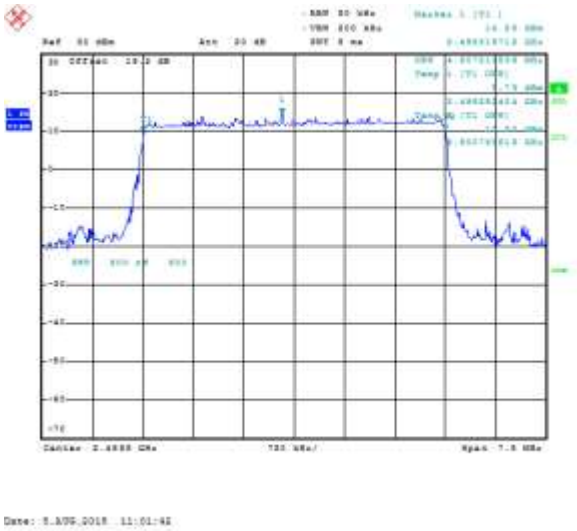


Figure 11-38a: Occupied Bandwidth, Band 41
Middle Channel, 5MHz BW, RB=25

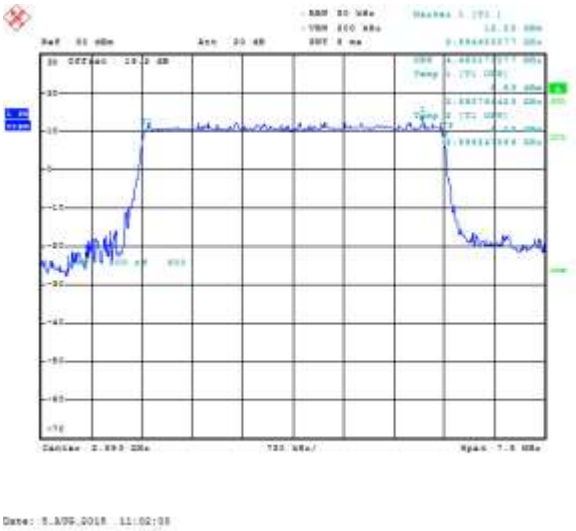
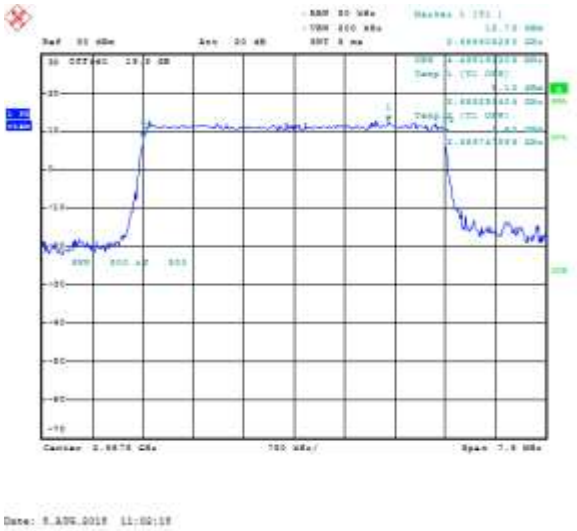


Figure 11-39a: Occupied Bandwidth, Band 41 High Channel, 5MHz BW, RB=25



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-40a: Occupied Bandwidth, Band 41

Low Channel, 5MHz BW, RB=25

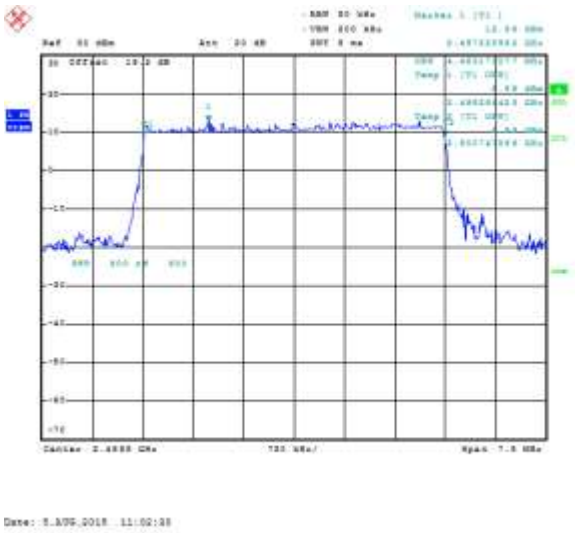


Figure 11-41a: Occupied Bandwidth, Band 41
Middle Channel, 5MHz BW, RB=25

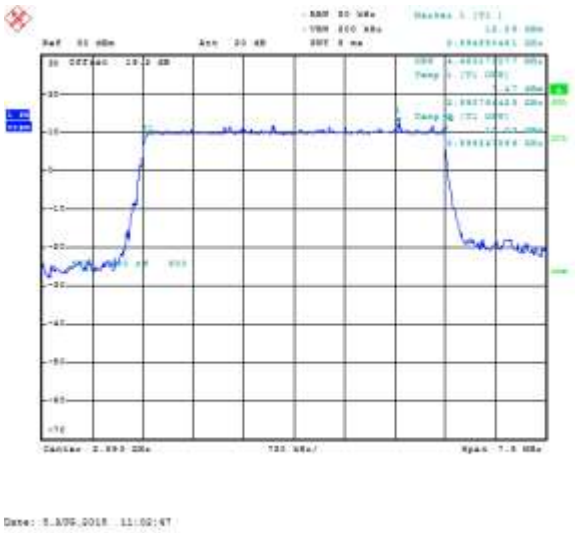
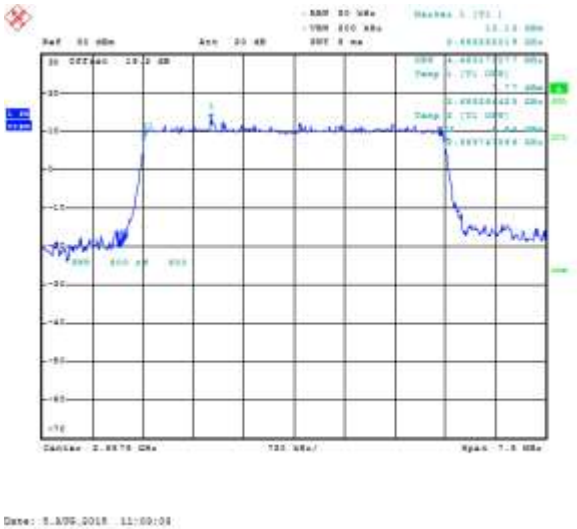


Figure 11-42a: Occupied Bandwidth, Band 41 High Channel, 5MHz BW, RB=25



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-43a: -26 dBc Bandwidth, Band 41 Low Channel, 20MHz BW, RB=100

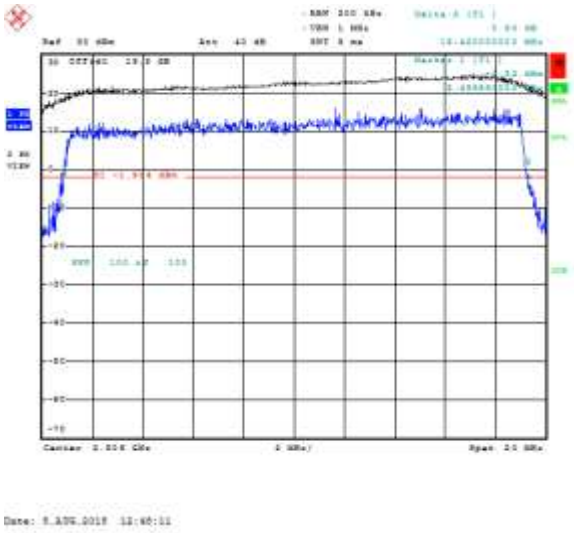


Figure 11-44a: -26 dBc Bandwidth, Band 41 Middle Channel, 20MHz BW, RB=100

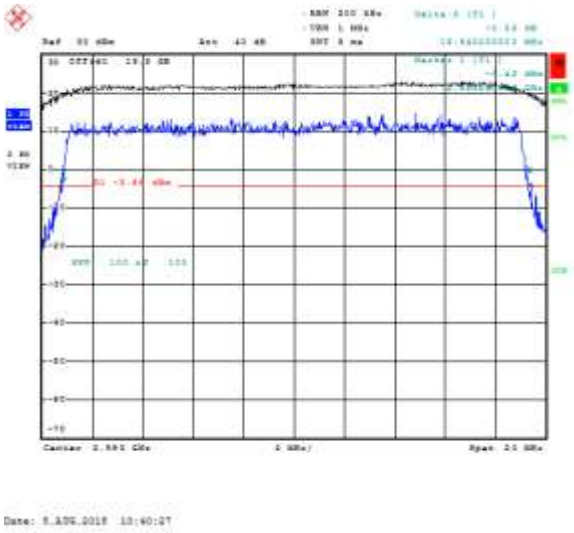


Figure 11-45a: -26 dBc Bandwidth, Band 41 High Channel, 20MHz BW, RB=100

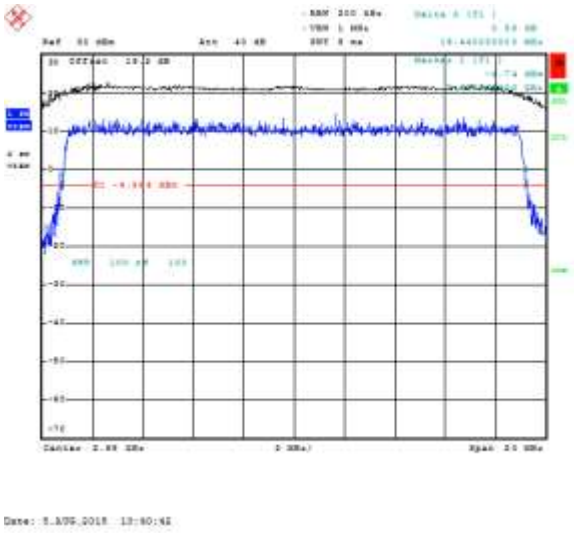
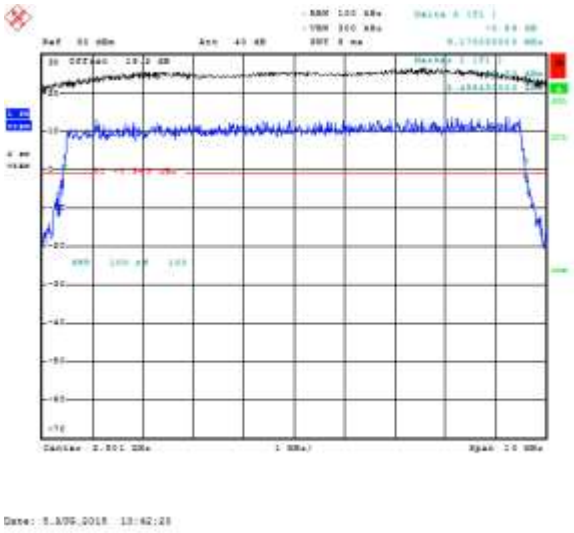


Figure 11-46a: -26 dBc Bandwidth, Band 41 Low Channel, 10MHz BW, RB=50



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-47a: -26 dBc Bandwidth, Band 41 Middle Channel, 10MHz BW, RB=50

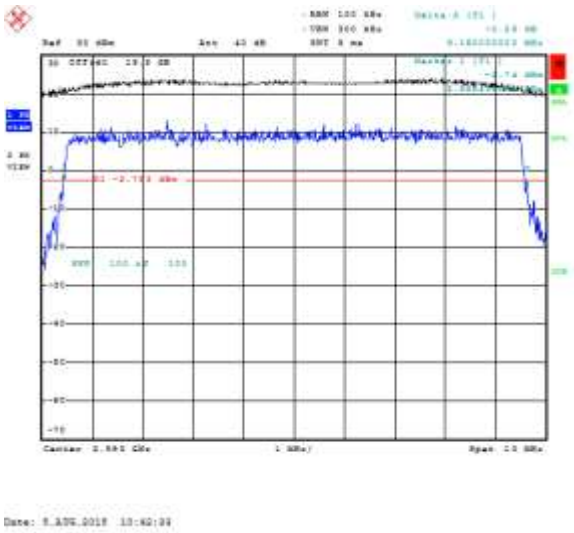


Figure 11-48a: -26 dBc Bandwidth, Band 41 High Channel, 10MHz BW, RB=50

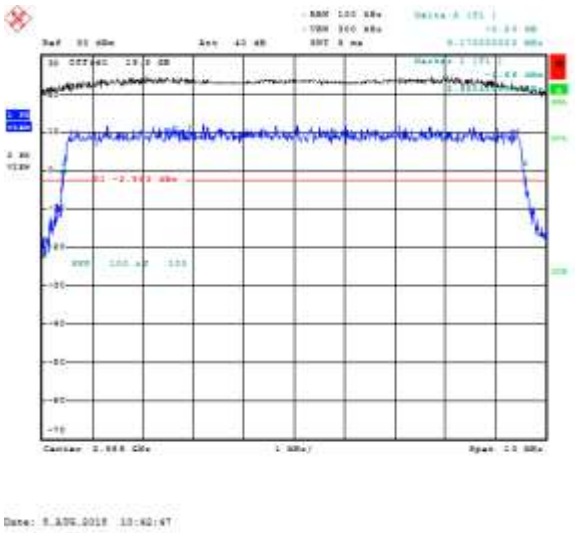


Figure 11-49a: -26 dBc Bandwidth, Band 41 Low Channel, 5MHz BW, RB=6

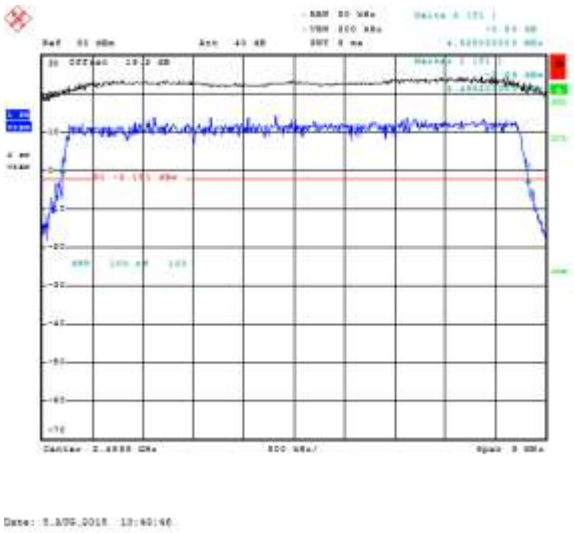


Figure 11-50a: -26 dBc Bandwidth, Band 41 Middle Channel, 5MHz BW, RB=6

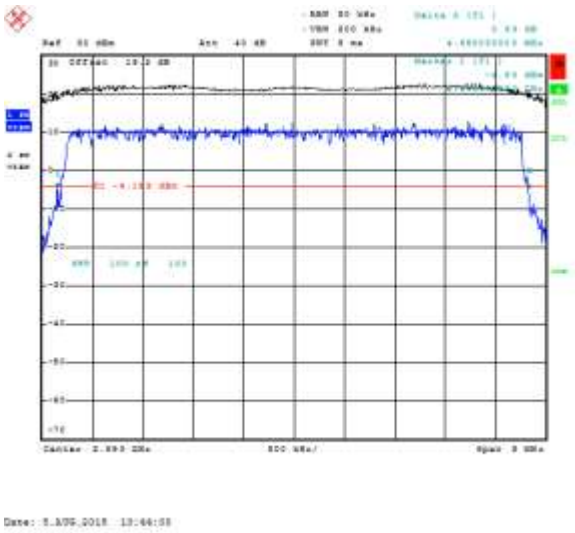


Figure 11-51a: -26 dBc Bandwidth, Band 41 High Channel, 5MHz BW, RB=6

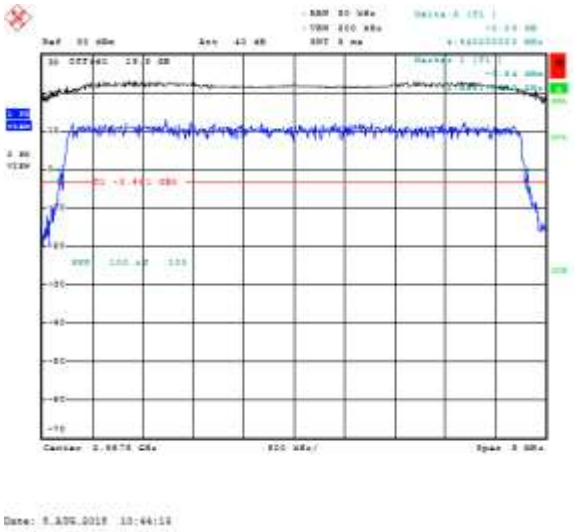


Figure 11-52a: Band 41 Low Channel Mask, 20MHz BW, RB=100

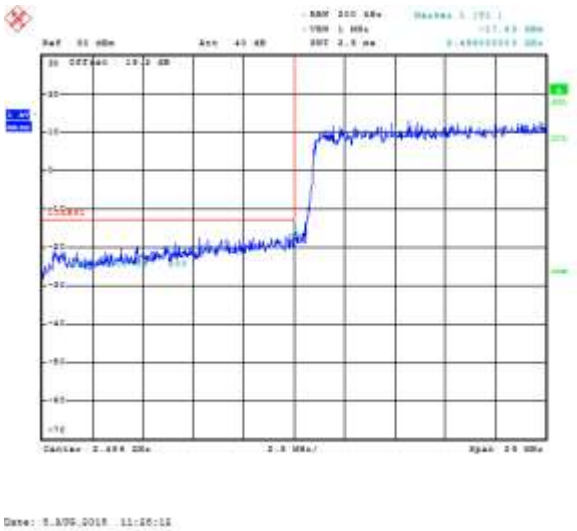


Figure 11-53a: Band 41 High Channel Mask, 20MHz BW, RB=100

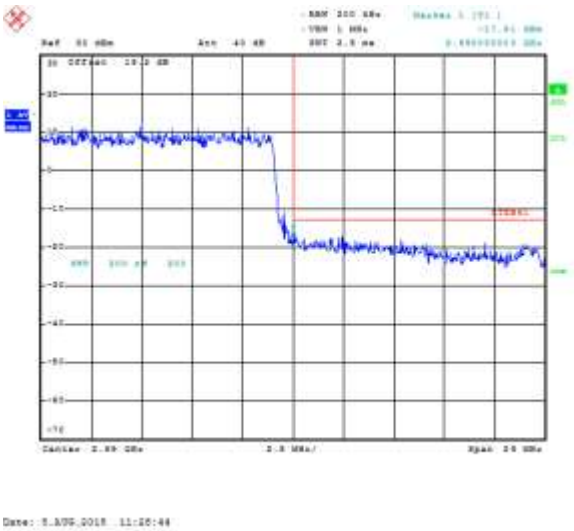


Figure 11-54a: Band 41 Low Channel Mask, 20MHz BW, RB=1

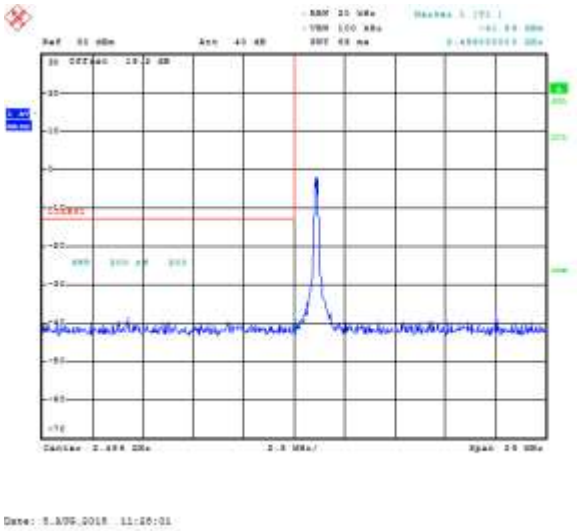


Figure 11-55a: Band 41 High Channel Mask,20MHz BW, RB=1

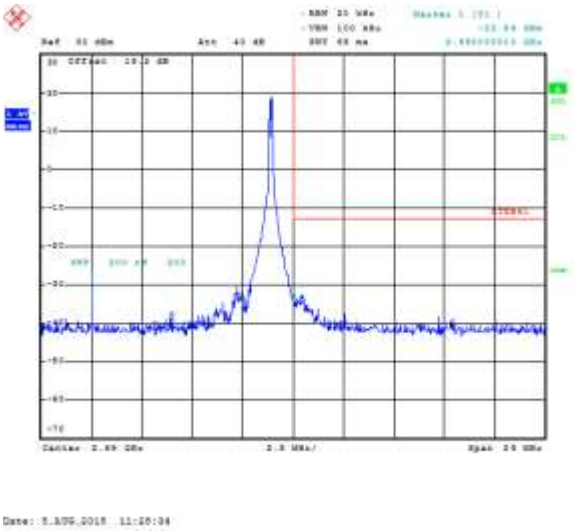


Figure 11-56a: Band 41 Low Channel Mask, 10MHz BW, RB=50

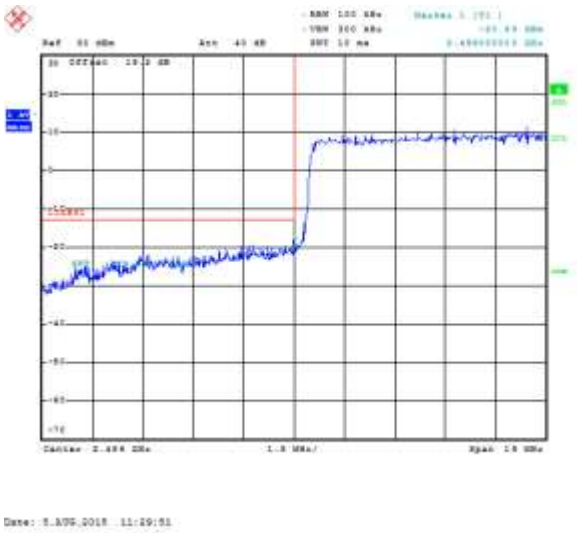
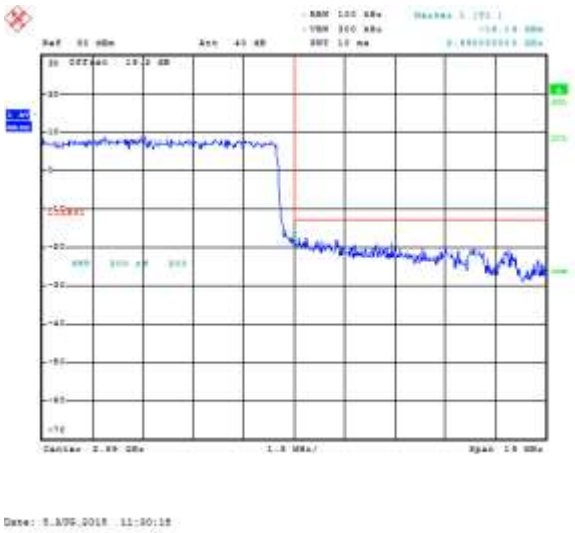


Figure 11-57a: Band 41 High Channel Mask, 10MHz BW, RB=50



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-58a: Band 41 Low Channel Mask, 10MHz BW, RB=1

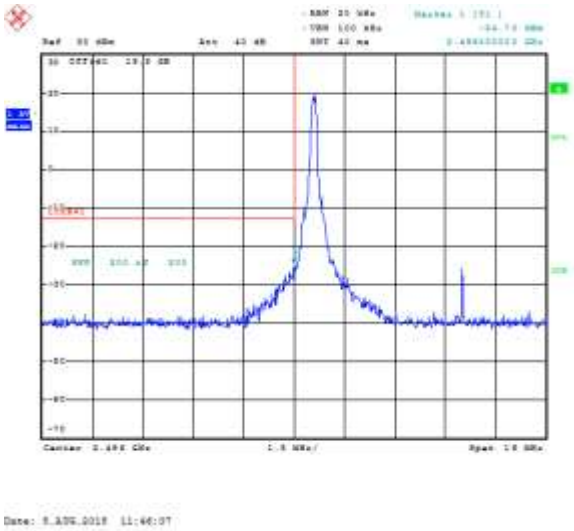


Figure 11-59a: Band 41 High Channel Mask, 10MHz BW, RB=1

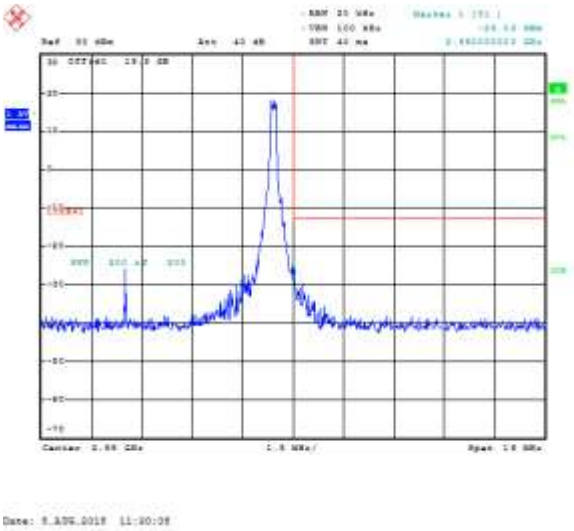


Figure 11-60a: Band 41 Low Channel Mask, 5MHz BW, RB=25

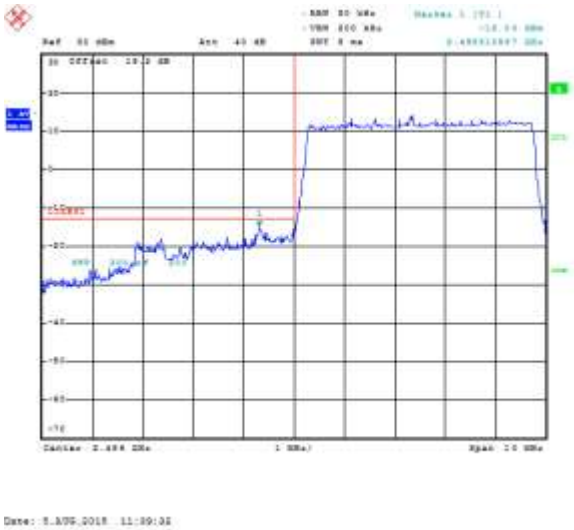


Figure 11-61a: Band 41 High Channel Mask, 5MHz BW, RB=25

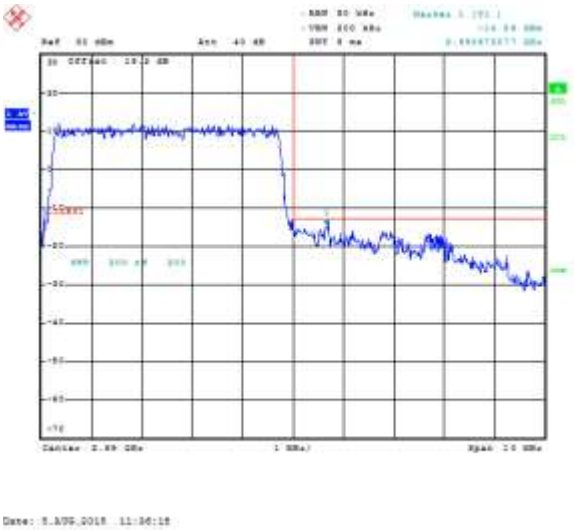


Figure 11-62a: Band 41 Low Channel Mask, 5MHz BW, RB=1

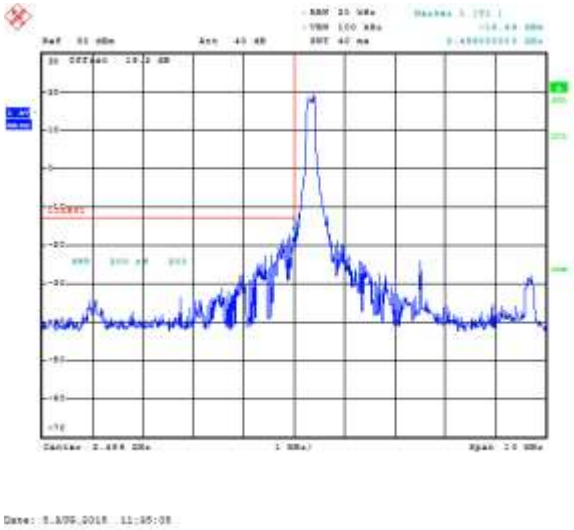


Figure 11-63a: Band 41 High Channel Mask, 5MHz BW, RB=1

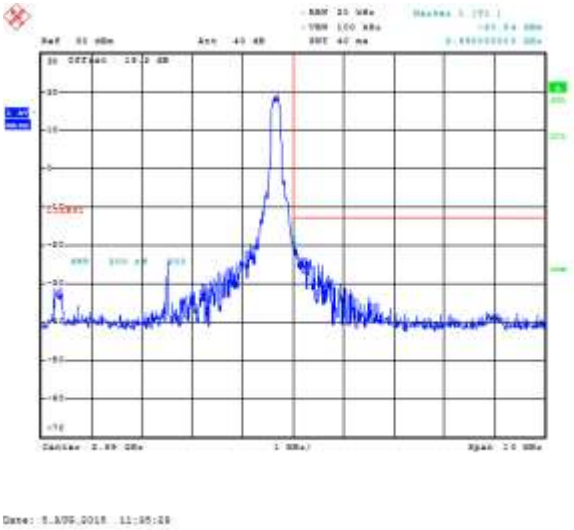
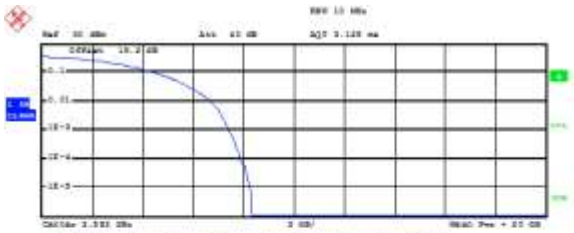


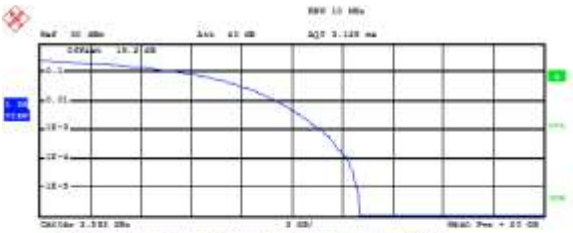
Figure 11-64a: Band 41 Mid Channel PAR, 20MHz BW, RB=50



```
          Trace 1
Mean    16.79 dBm
Peak    25.14 dBm
Crest    8.34 dB

 10 %    4.52 dB
  1 %    6.70 dB
 .1 %    7.44 dB
.01 %    7.85 dB
```

Figure 11-65a: Band 41 Middle Channel PAR, 20MHz BW, RB=100



```
          Trace 1
Mean    13.88 dBm
Peak    26.55 dBm
Crest   12.67 dB

 10 %    5.74 dB
  1 %    9.42 dB
 .1 %   11.15 dB
.01 %   12.21 dB
```

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-66a: Band 41 Mid Channel PAR, 10MHz BW, RB=25

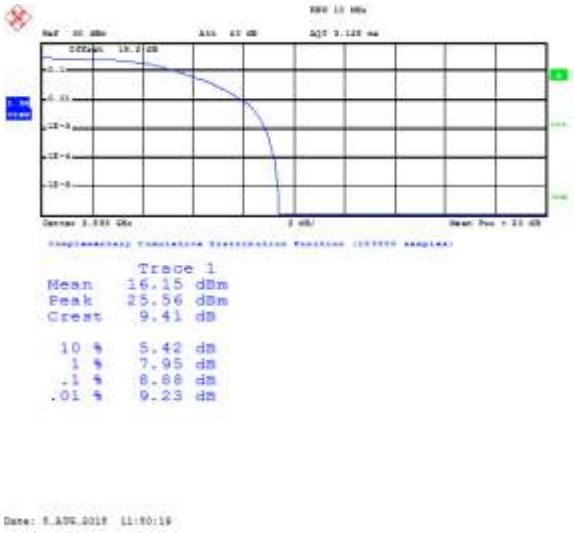


Figure 11-67a: Band 41 Mid Channel PAR, 10MHz BW, RB=50

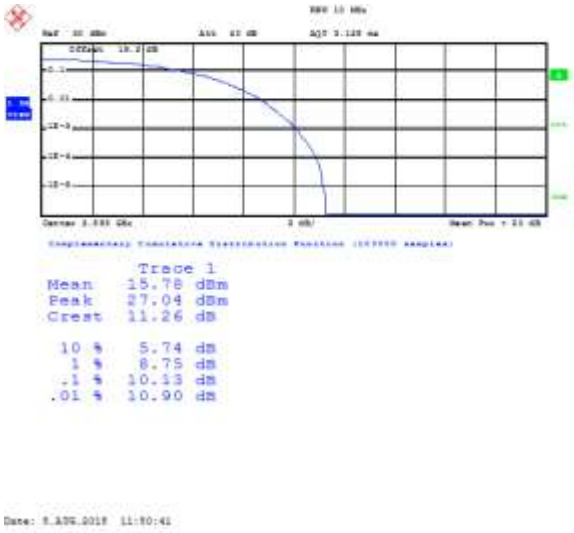


Figure 11-68a: Band 41 Mid Channel PAR, 5MHz BW, RB=10

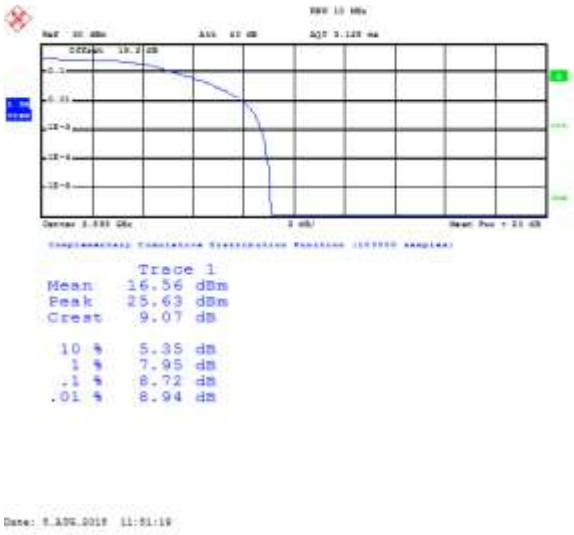
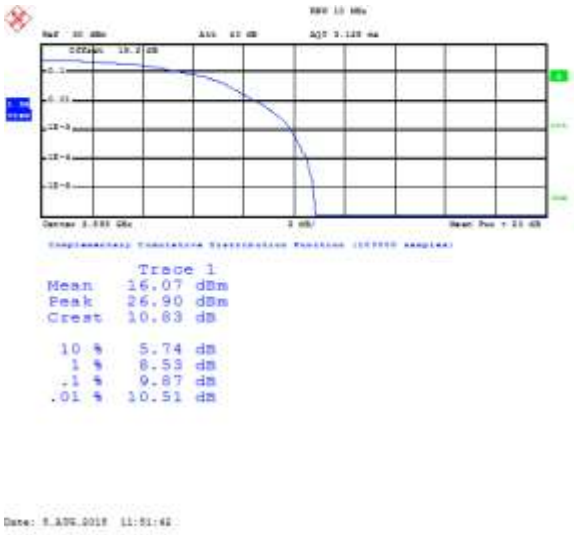


Figure 11-69a: Band 41 Mid Channel PAR, 5MHz BW, RB=25



LTE Band 41 Conducted RF Emission Test Data cont'd

The following test configurations were measured on RHM181LW (STV100-4):
The conducted spurious emissions – As per 47 CFR 2.1051, 27.53(m), RSS-199, 4.6 were measured from 30 MHz to 20 GHz.

Emission Designator Table

Frequency Rane (MHz)	Conducted Output Power (dBm)	Emission Designator	Band	Bandwidth (MHz)	Modulation
2498.5-2687.5	22.49	4M50G7D	LTE B41	5	QPSK
2498.5-2687.5	20.46	4M50D7W	LTE B41	5	16QAM
2501-2685	22.71	8M97G7D	LTE B41	10	QPSK
2501-2685	21.23	8M97D7W	LTE B41	10	16QAM
2503.5-2682.5	22.68	13M5G7D	LTE B41	15	QPSK
2503.5-2682.5	22.79	13M5D7W	LTE B41	15	16QAM
2506-2680	**23.53**	17M9G7D	LTE B41	20	QPSK
2506-2680	22.56	17M9D7W	LTE B41	20	16QAM

–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, 10MHz and 20MHz with different number of RBs for LTE Band 41.

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 41 was measured to be 18.6 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 41 selected Frequencies in 20MHz BW (RB = 100)

LTE Band 41 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2506	18.42	**17.932**
2593	18.6	17.884
2680	18.54	17.932

Test Data for LTE Band 41 selected Frequencies in 10MHz BW (RB = 50)

LTE Band 41 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2506	9.16	**8.966**
2593	9.16	**8.966**
2680	9.19	8.942

Test Data for LTE Band 41 selected Frequencies in 5MHz BW (RB = 25)

LTE Band 41 Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2506	4.625	4.495
2593	4.655	4.495
2680	4.62	4.495

Measurement Plots for LTE Band 41

See Figures 11-1a to 11-18a for the plots of the conducted spurious emissions.

See Figures 11-19a to 11-51a for the plots of 99% Occupied Bandwidth and -26 dBc Bandwidth.

See Figures 11-52a to 11-63a for the plots of the Channel mask.

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-1a: Band 41, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

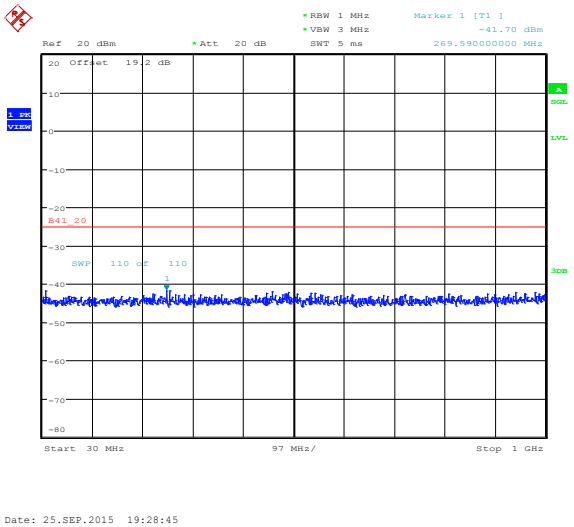


Figure 11-2a: Band 41, Spurious Conducted Emissions, Low channel, 20MHz BW (RB= 1)

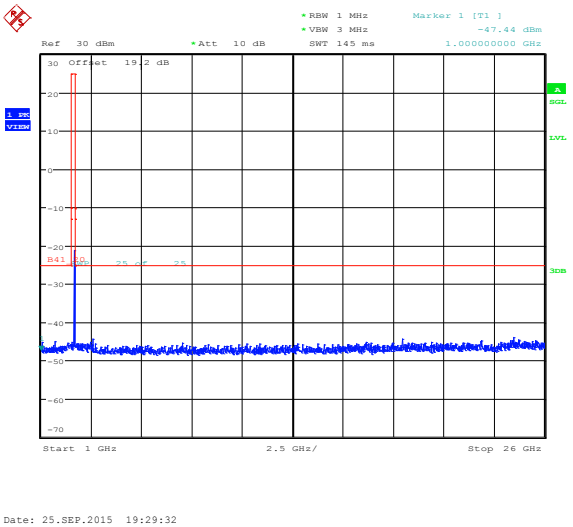


Figure 11-3a: Band 41, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)

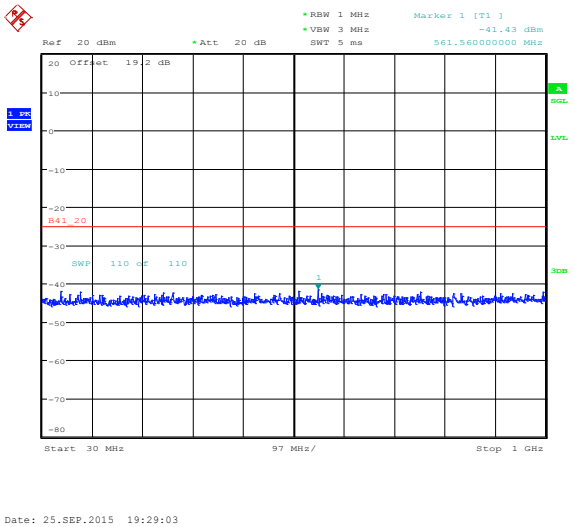
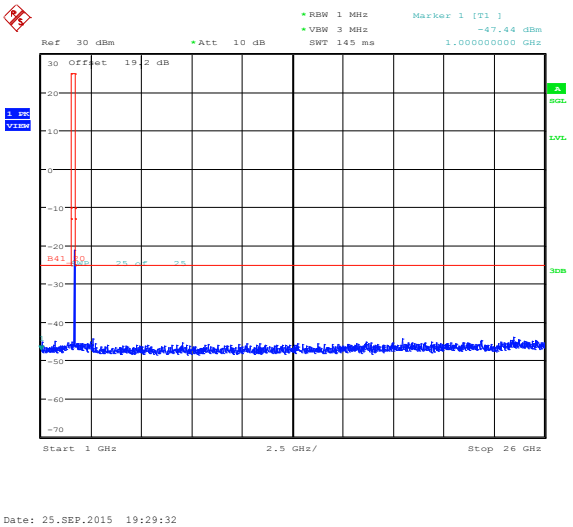


Figure 11-4a: Band 41, Spurious Conducted Emissions, Middle channel, 20MHz BW (RB= 50)



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-5a: Band 41, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

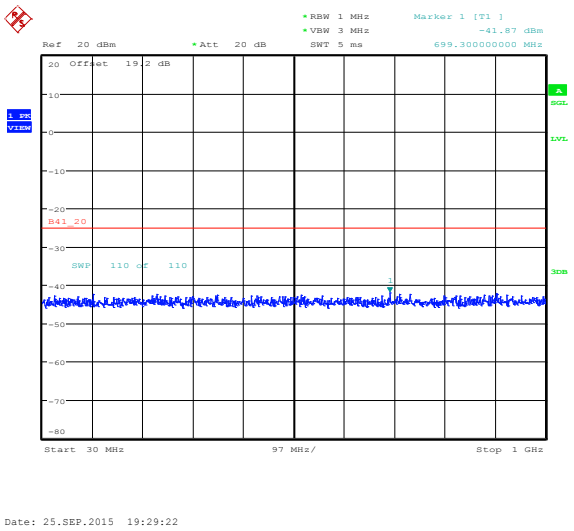


Figure 11-6a: Band 41, Spurious Conducted Emissions, High Channel, 20MHz BW (RB= 100)

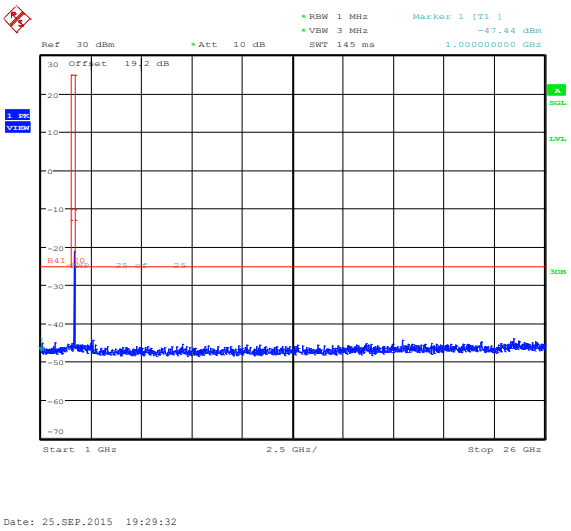


Figure 11-7a: Band 41, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)

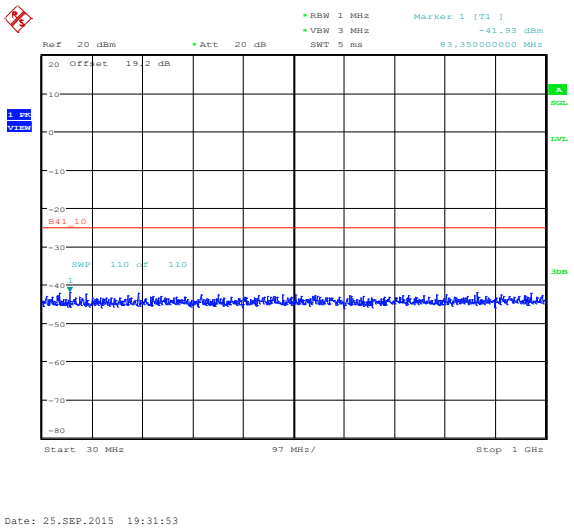
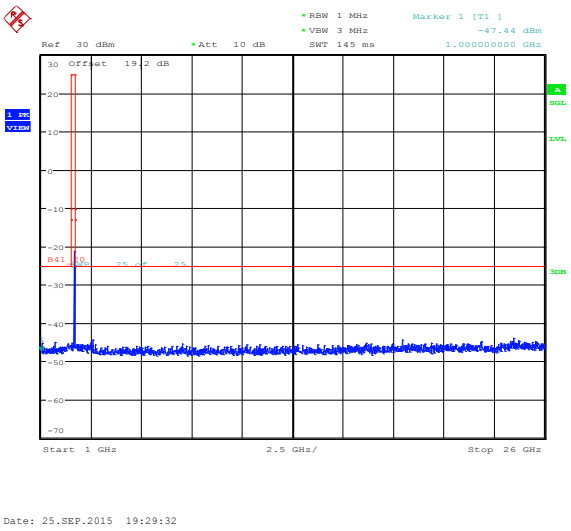


Figure 11-8a: Band 41, Spurious Conducted Emissions, Low channel, 10MHz BW (RB= 1)



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-9a: Band 41, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 30)

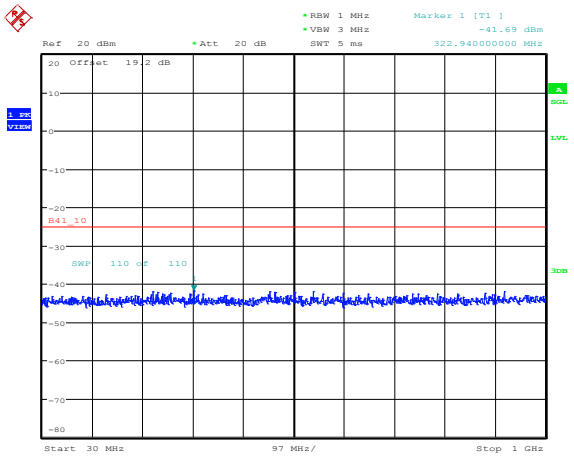


Figure 11-10a: Band 41, Spurious Conducted Emissions, Middle Channel, 10MHz BW (RB= 30)

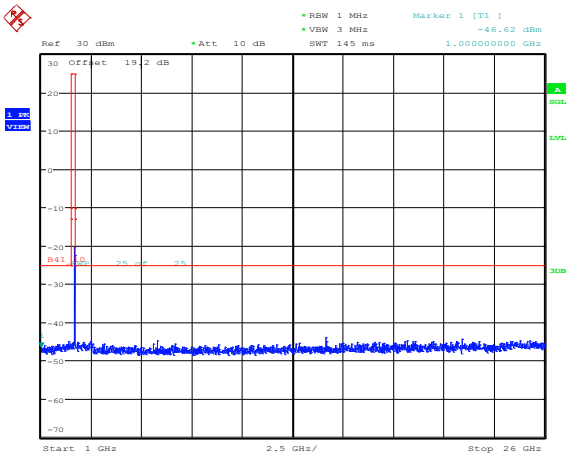


Figure 11-11a: Band 41, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)

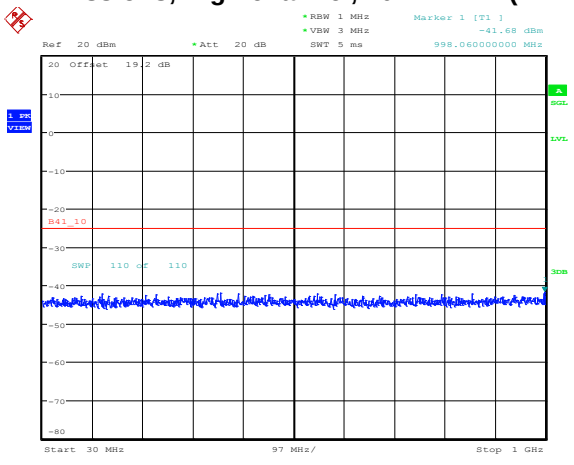
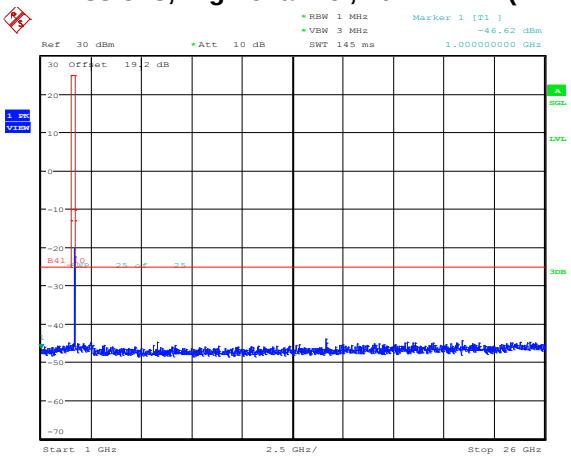


Figure 11-12a: Band 41, Spurious Conducted Emissions, High channel, 10MHz BW (RB= 50)



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-13a: Band 41, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 1)

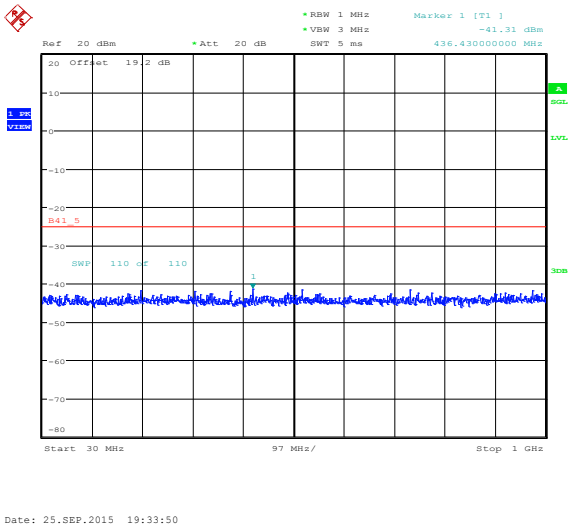
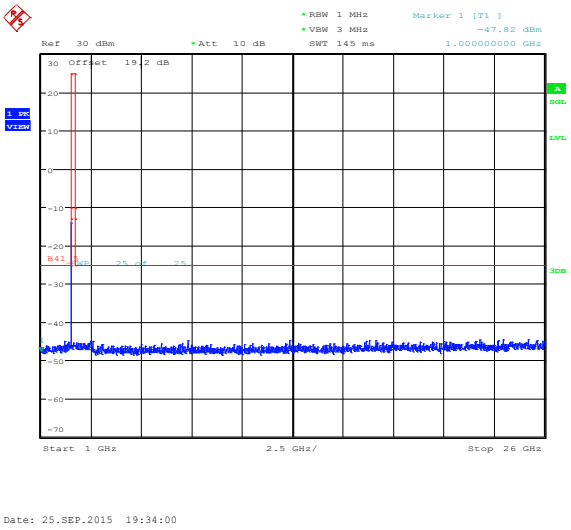
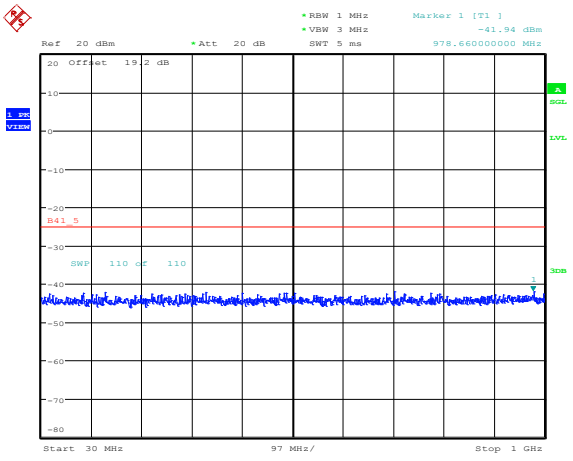


Figure 11-14a: Band 41, Spurious Conducted Emissions, Low channel, 1.4MHz BW (RB= 1)



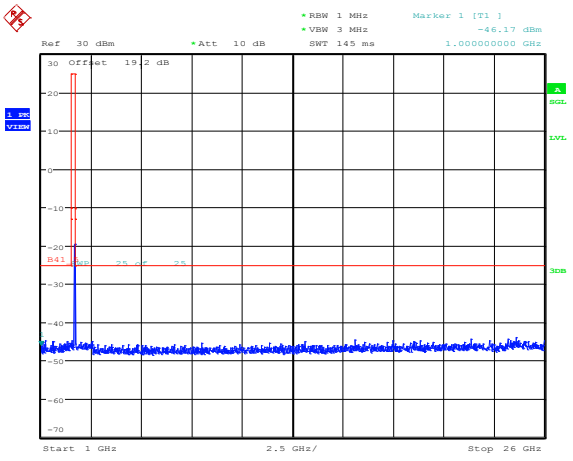
LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-15a: Band 41, Spurious Conducted Emissions, Middle Channel, 1.4MHz BW (RB= 15)



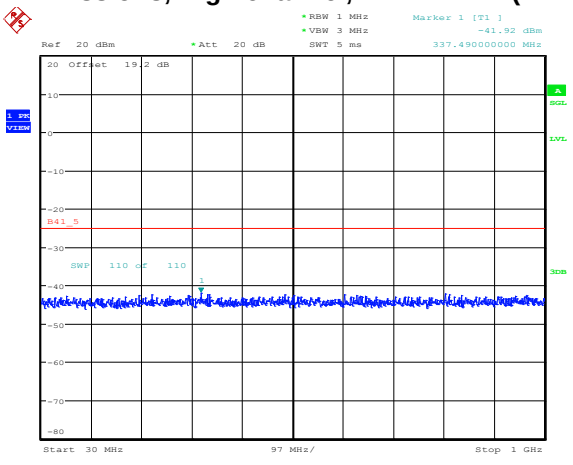
Date: 25.SEP.2015 19:34:08

Figure 11-16a: Band 41, Spurious Conducted Emissions, Middle Channel, 1.4MHz BW (RB= 15)



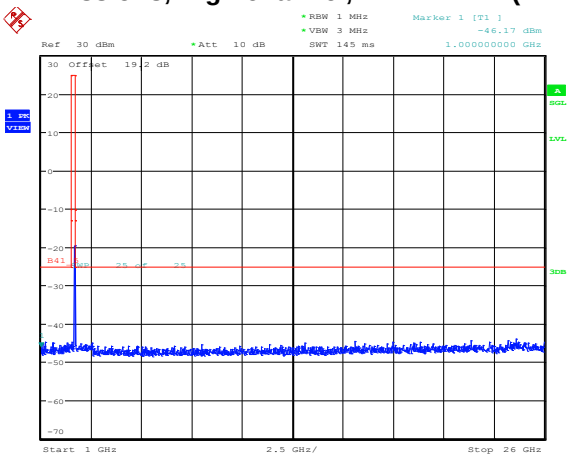
Date: 25.SEP.2015 19:34:37

Figure 11-17a: Band 41, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 25)



Date: 25.SEP.2015 19:34:27

Figure 11-18a: Band 41, Spurious Conducted Emissions, High channel, 1.4MHz BW (RB= 25)

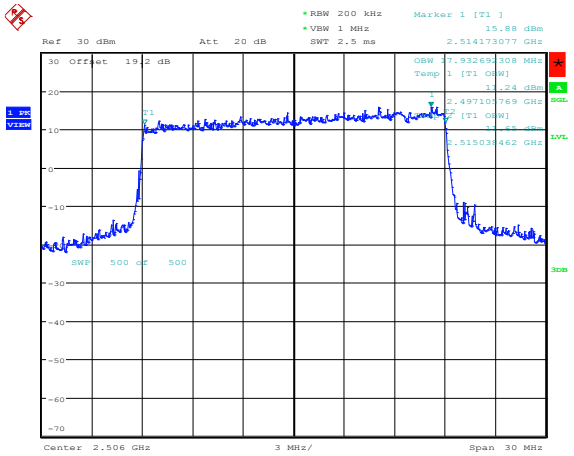


Date: 25.SEP.2015 19:34:37

LTE Band 41 Conducted RF Emission Test Data cont'd

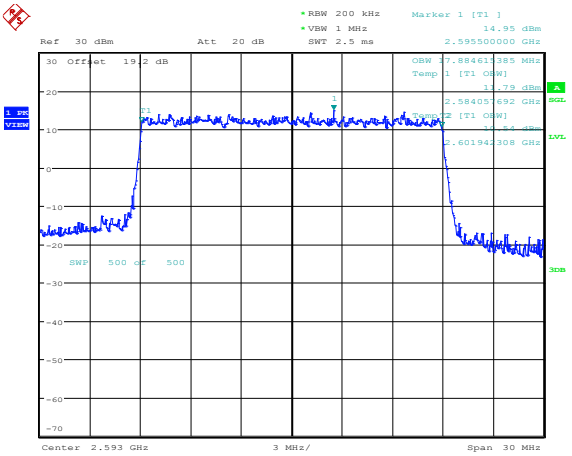
Figure 11-19a: Occupied Bandwidth, Band 41

Low Channel, 20MHz BW, RB=100



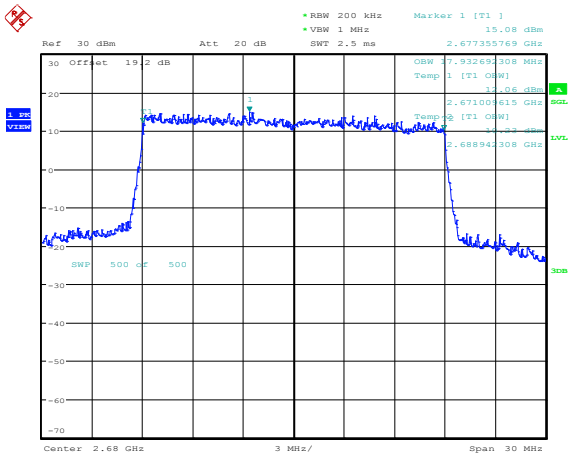
Date: 5.AUG.2015 12:53:09

Figure 11-20a: Occupied Bandwidth, Band 41
Middle Channel, 20MHz BW, RB=100



Date: 5.AUG.2015 12:53:28

Figure 11-21a: Occupied Bandwidth, Band 41 High Channel, 20MHz BW, RB=100



Date: 5.AUG.2015 12:53:51

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-22a: Occupied Bandwidth, Band 41

Low Channel, 20MHz BW, RB=100

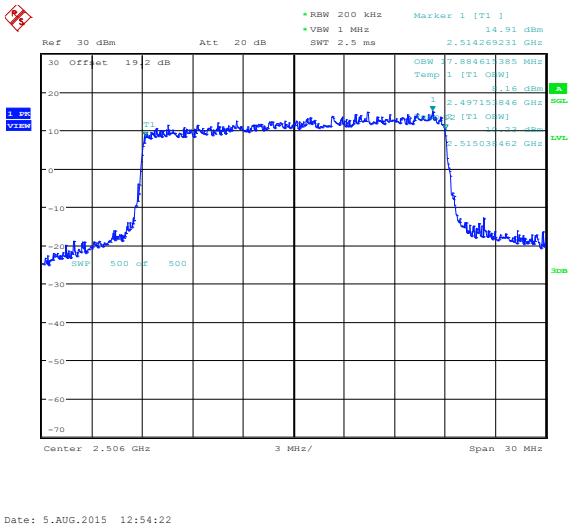


Figure 11-23a: Occupied Bandwidth, Band 41
Middle Channel, 20MHz BW, RB=100

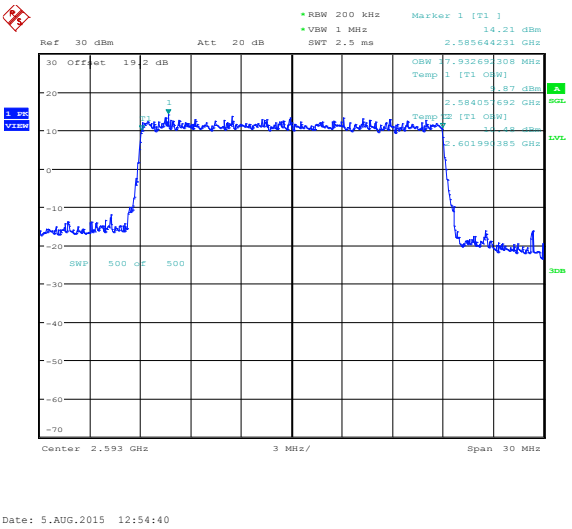
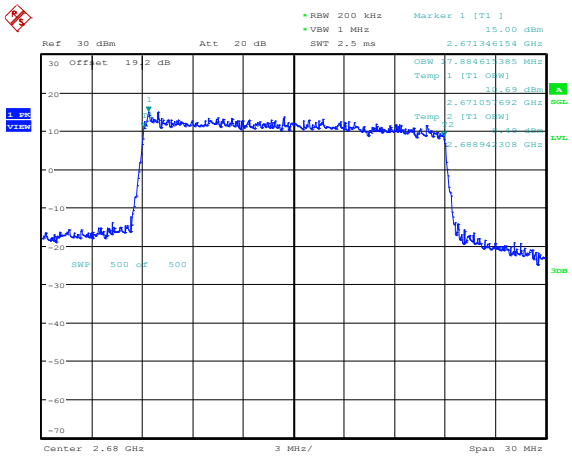


Figure 11-24a: Occupied Bandwidth, Band 41 High Channel, 20MHz BW, RB=100



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-25a: Occupied Bandwidth, Band 41

Low Channel, 15MHz BW, RB=75

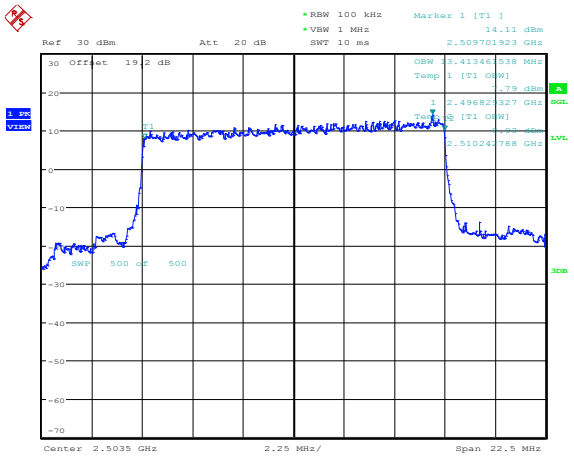


Figure 11-26a: Occupied Bandwidth, Band 41
Middle Channel, 15MHz BW, RB=75

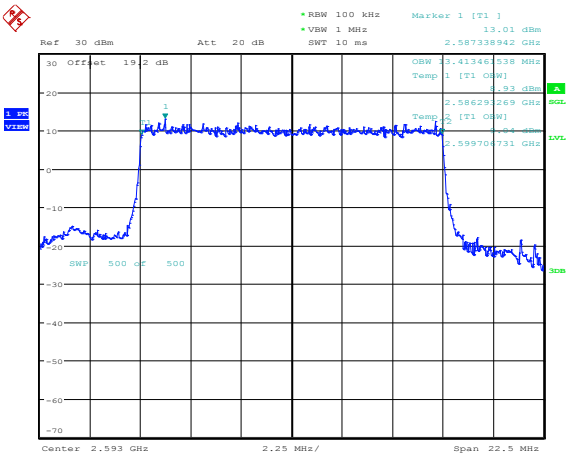
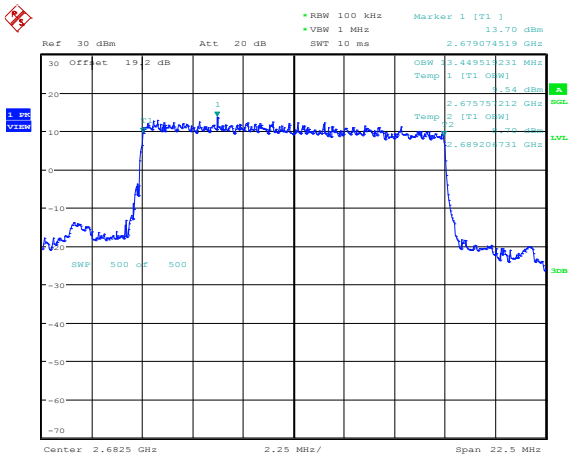


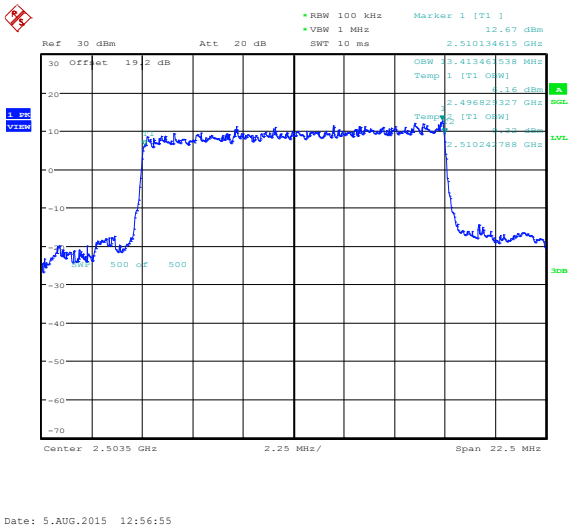
Figure 11-27a: Occupied Bandwidth, Band 41 High Channel, 15MHz BW, RB=75



LTE Band 41 Conducted RF Emission Test Data cont'd

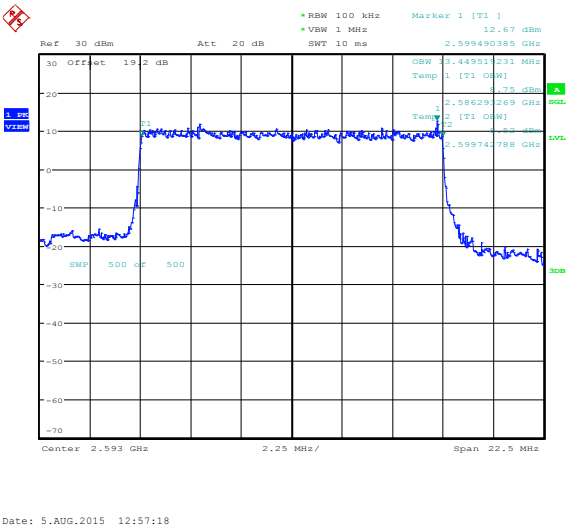
Figure 11-28a: Occupied Bandwidth, Band 41

Low Channel, 15MHz BW, RB=75



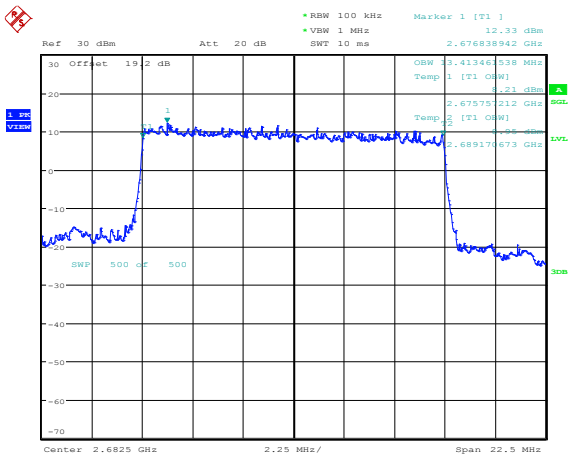
Date: 5.AUG.2015 12:56:55

Figure 11-29a: Occupied Bandwidth, Band 41
Middle Channel, 15MHz BW, RB=75



Date: 5.AUG.2015 12:57:18

Figure 11-30a: Occupied Bandwidth, Band 41 High Channel, 15MHz BW, RB=75



Date: 5.AUG.2015 12:57:44

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-31a: Occupied Bandwidth, Band 41

Low Channel, 10MHz BW, RB=50

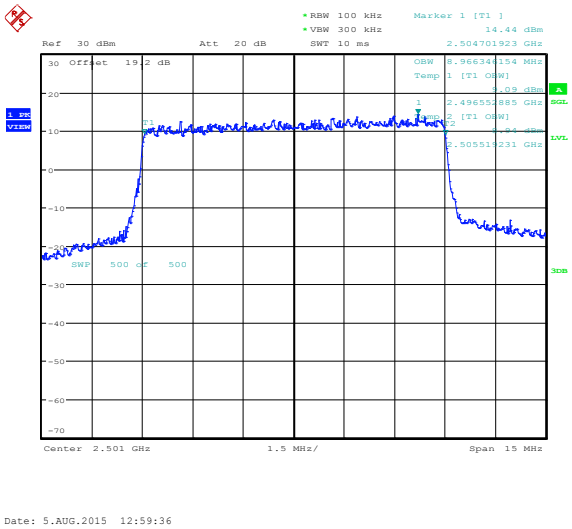


Figure 11-32a: Occupied Bandwidth, Band 41
Middle Channel, 10MHz BW, RB=50

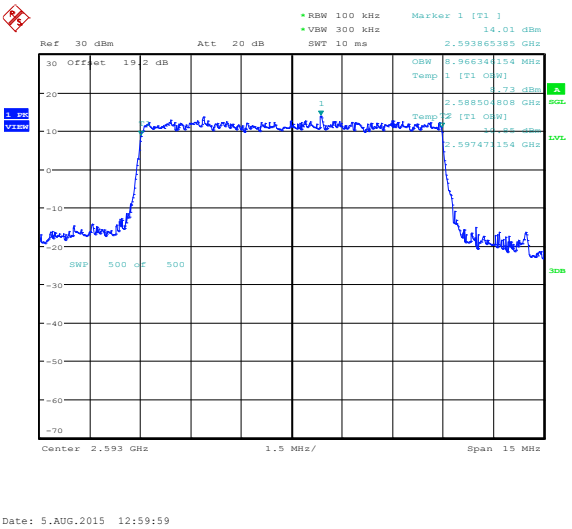
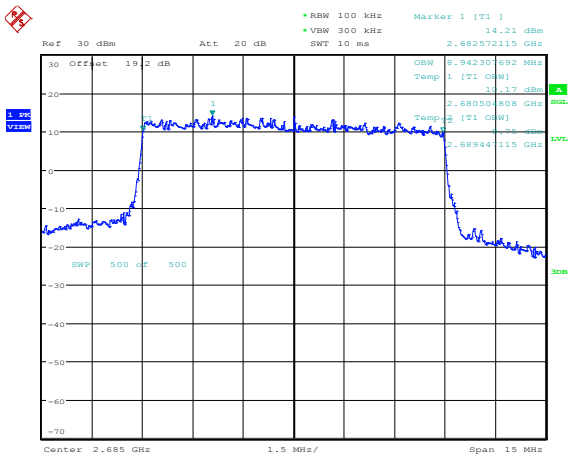


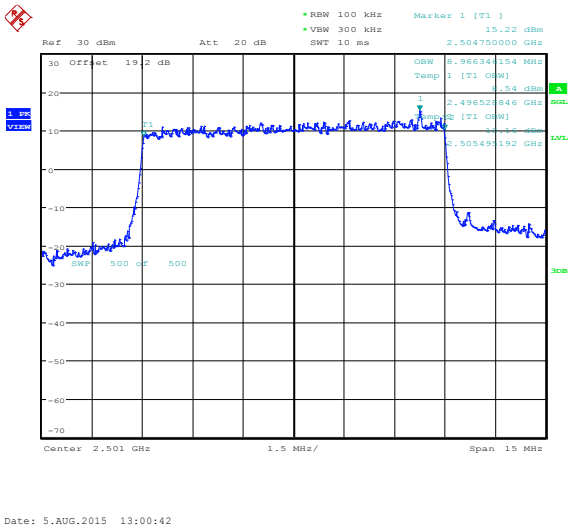
Figure 11-33a: Occupied Bandwidth, Band 41 High Channel, 10MHz BW, RB=50



LTE Band 41 Conducted RF Emission Test Data cont'd

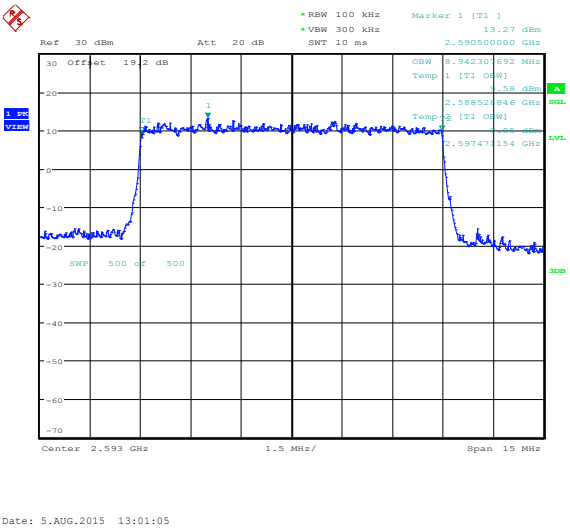
Figure 11-34a: Occupied Bandwidth, Band 41

Low Channel, 10MHz BW, RB=50



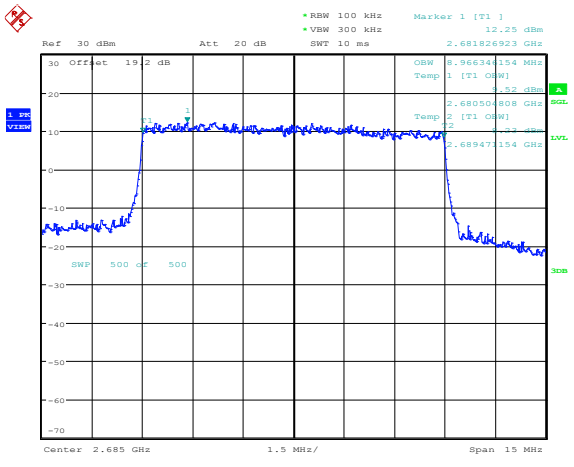
Date: 5.AUG.2015 13:00:42

Figure 11-35a: Occupied Bandwidth, Band 41
Middle Channel, 10MHz BW, RB=50



Date: 5.AUG.2015 13:01:05

Figure 11-36a: Occupied Bandwidth, Band 41 High Channel, 10MHz BW, RB=50



Date: 5.AUG.2015 13:01:23

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-37a: Occupied Bandwidth, Band 41

Low Channel, 5MHz BW, RB=25

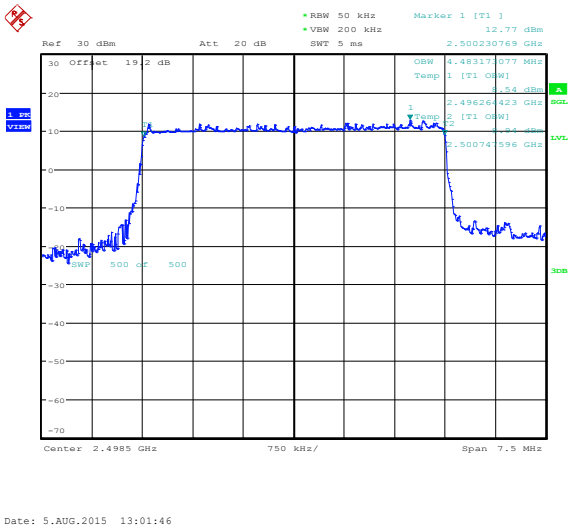


Figure 11-38a: Occupied Bandwidth, Band 41
Middle Channel, 5MHz BW, RB=25

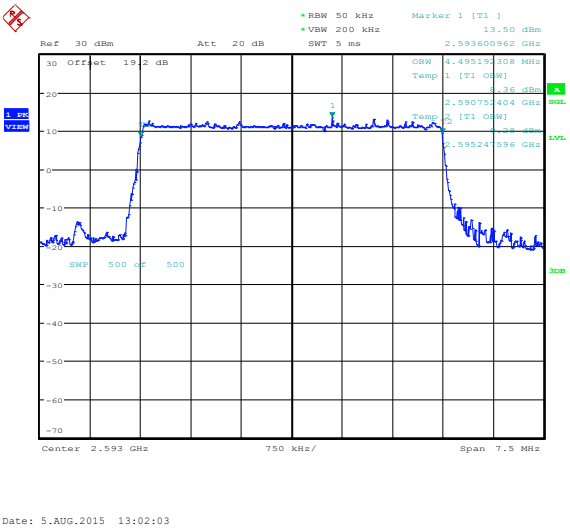
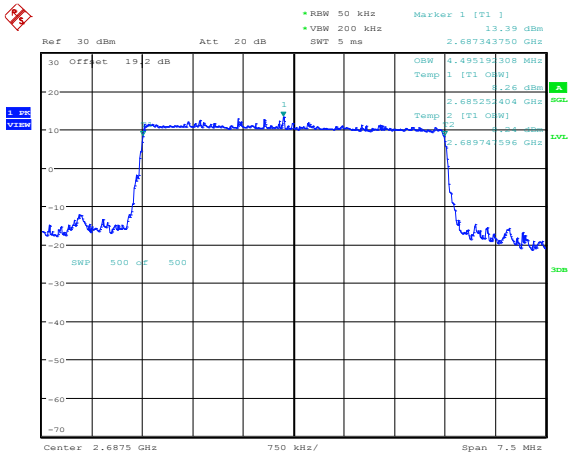


Figure 11-39a: Occupied Bandwidth, Band 41 High Channel, 5MHz BW, RB=25



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-40a: Occupied Bandwidth, Band 41

Low Channel, 5MHz BW, RB=25

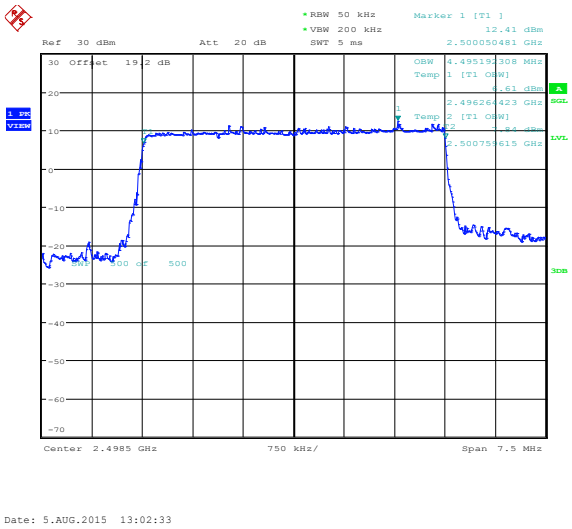


Figure 11-41a: Occupied Bandwidth, Band 41
Middle Channel, 5MHz BW, RB=25

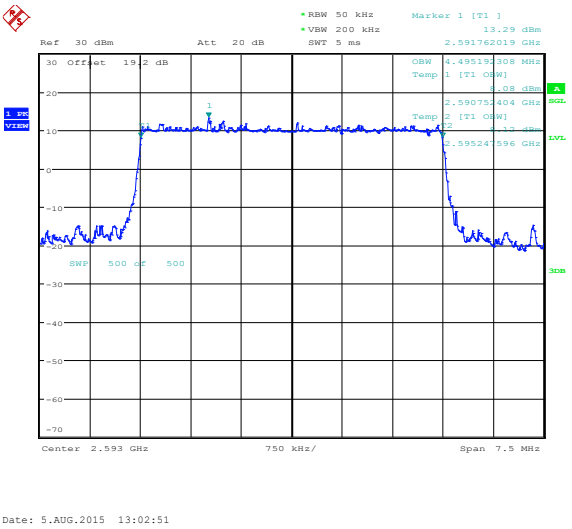
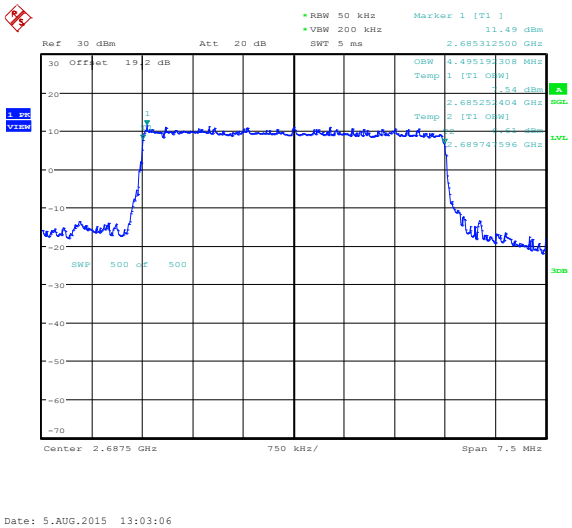
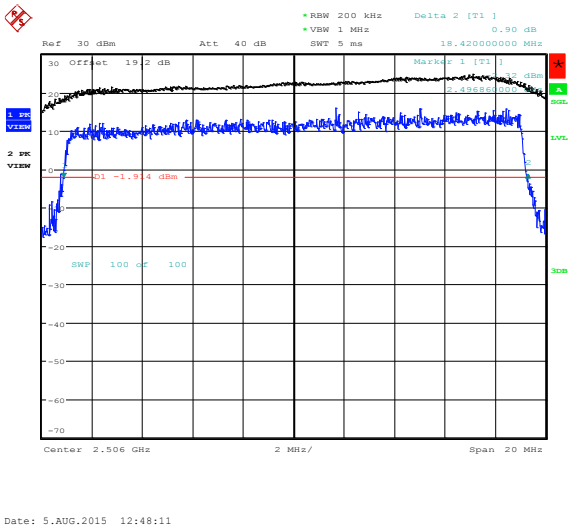


Figure 11-42a: Occupied Bandwidth, Band 41 High Channel, 5MHz BW, RB=25



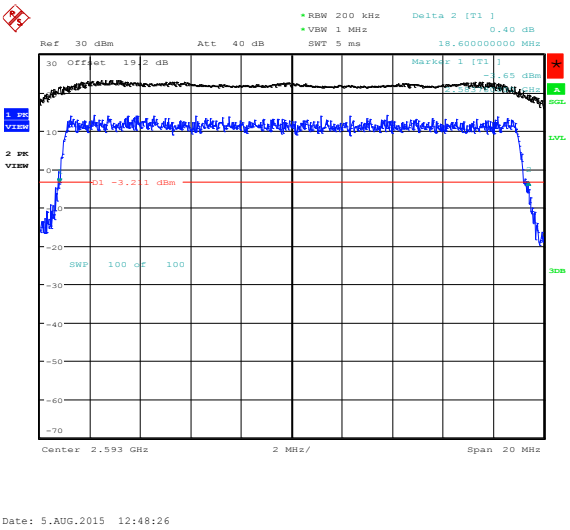
LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-43a: -26 dBc Bandwidth, Band 41 Low Channel, 20MHz BW, RB=100



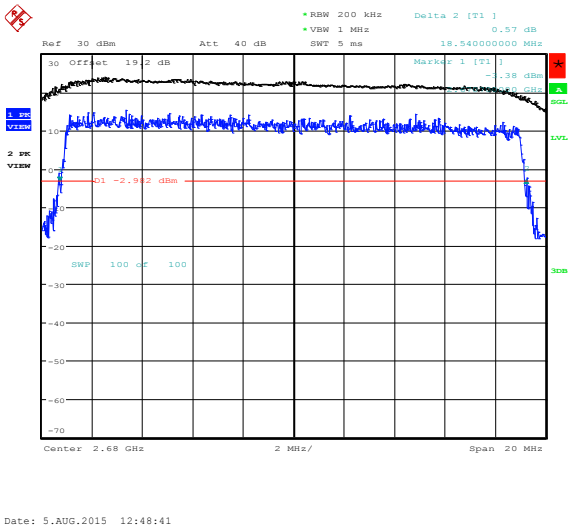
Date: 5.AUG.2015 12:48:11

Figure 11-44a: -26 dBc Bandwidth, Band 41 Middle Channel, 20MHz BW, RB=100



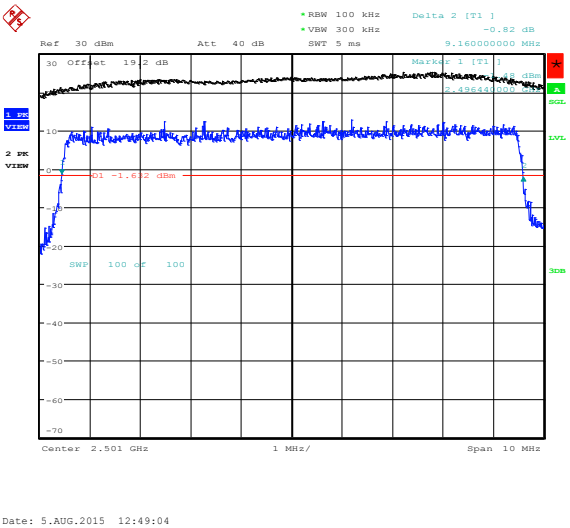
Date: 5.AUG.2015 12:48:26

Figure 11-45a: -26 dBc Bandwidth, Band 41 High Channel, 20MHz BW, RB=100



Date: 5.AUG.2015 12:48:41

Figure 11-46a: -26 dBc Bandwidth, Band 41 Low Channel, 10MHz BW, RB=50



Date: 5.AUG.2015 12:49:04

LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-47a: -26 dBc Bandwidth, Band 41 Middle Channel, 10MHz BW, RB=50

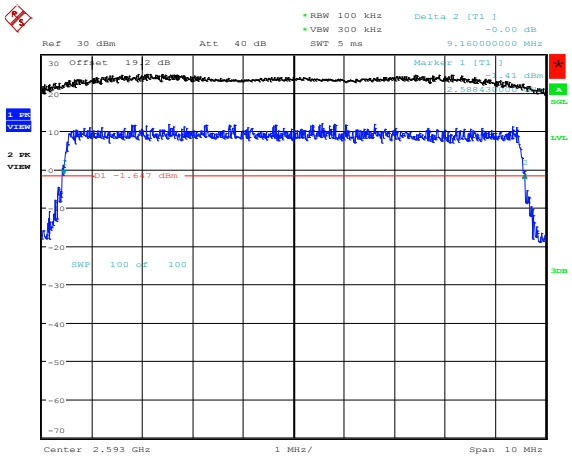


Figure 11-48a: -26 dBc Bandwidth, Band 41 High Channel, 10MHz BW, RB=50

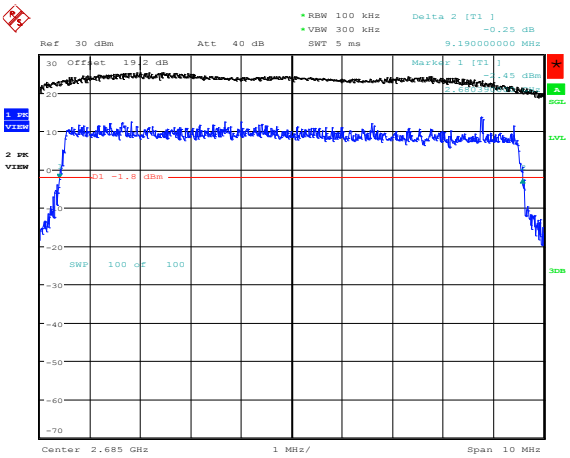


Figure 11-49a: -26 dBc Bandwidth, Band 41 Low Channel, 5MHz BW, RB=6

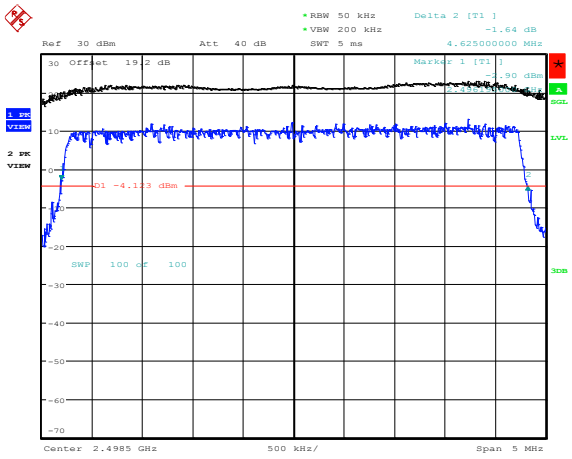


Figure 11-50a: -26 dBc Bandwidth, Band 41 Middle Channel, 5MHz BW, RB=6

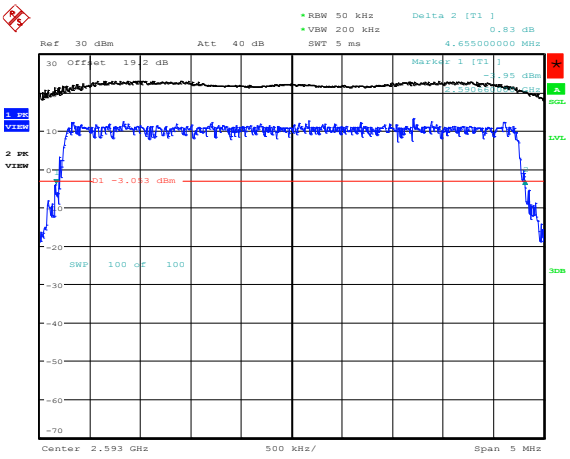


Figure 11-51a: -26 dBc Bandwidth, Band 41 High Channel, 5MHz BW, RB=6

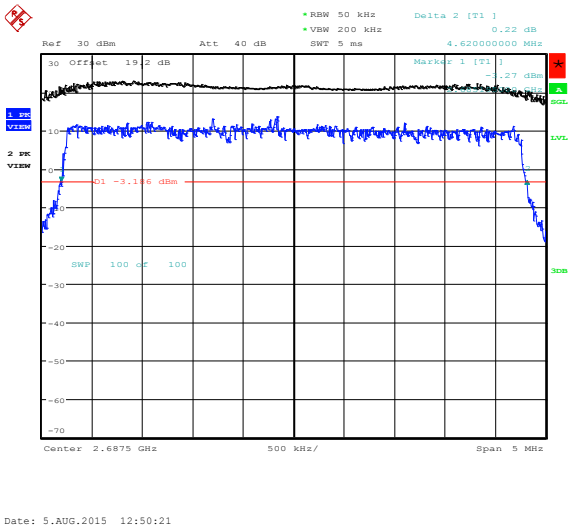


Figure 11-52a: Band 41 Low Channel Mask, 20MHz BW, RB=100

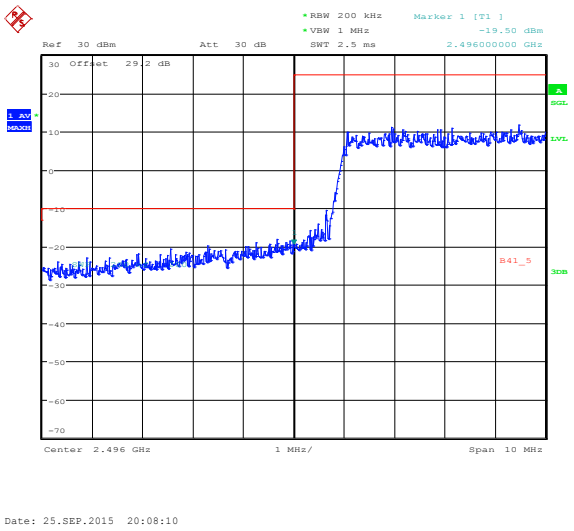


Figure 11-53a: Band 41 High Channel Mask, 20MHz BW, RB=100

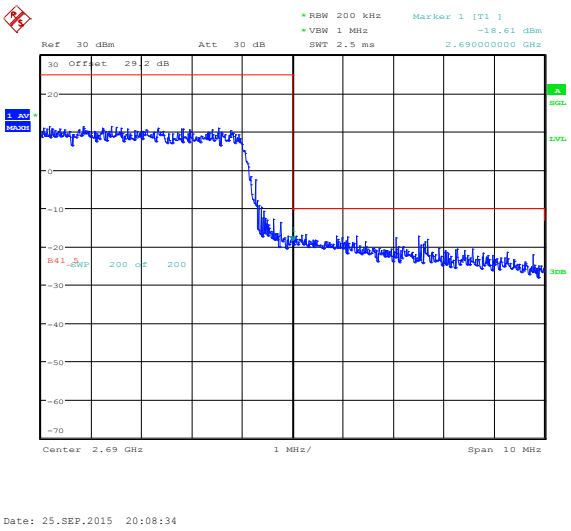


Figure 11-54a: Band 41 Low Channel Mask, 20MHz BW, RB=1

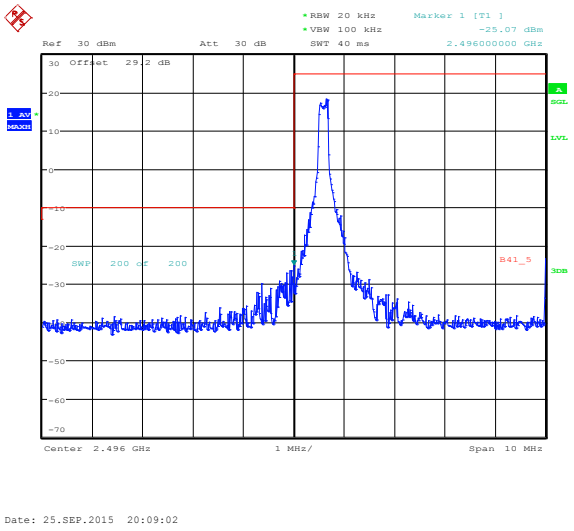


Figure 11-55a: Band 41 High Channel Mask,20MHz BW, RB=1

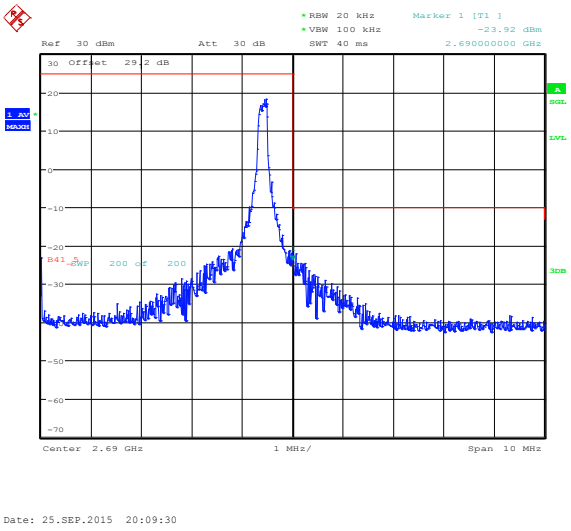


Figure 11-56a: Band 41 Low Channel Mask, 10MHz BW, RB=50

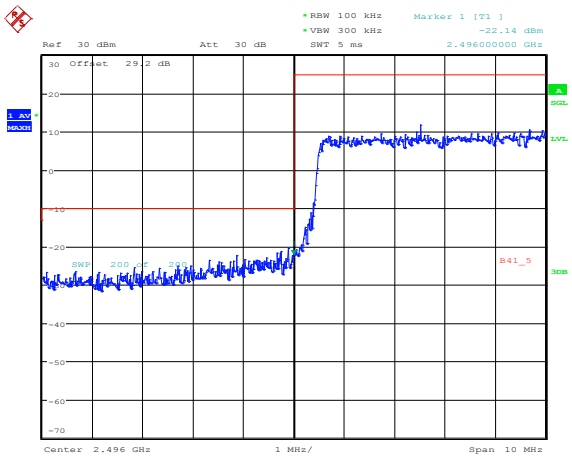
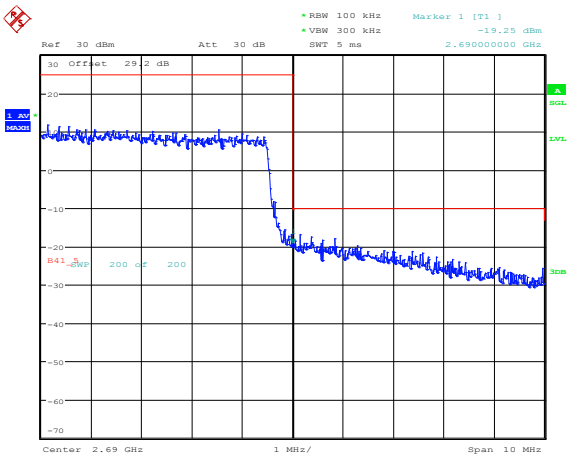


Figure 11-57a: Band 41 High Channel Mask, 10MHz BW, RB=50



LTE Band 41 Conducted RF Emission Test Data cont'd

Figure 11-58a: Band 41 Low Channel Mask, 10MHz BW, RB=1

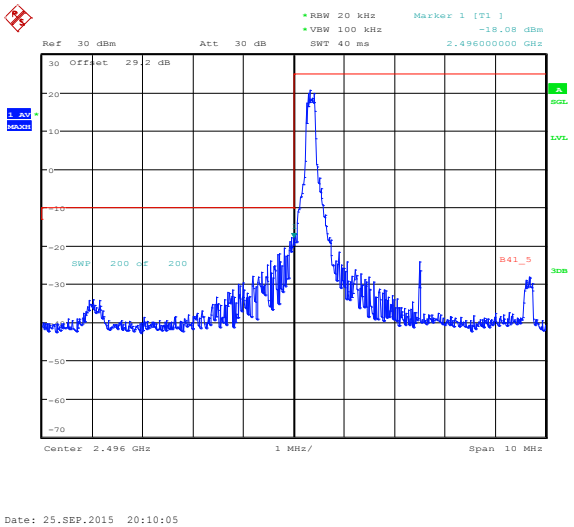


Figure 11-59a: Band 41 High Channel Mask, 10MHz BW, RB=1

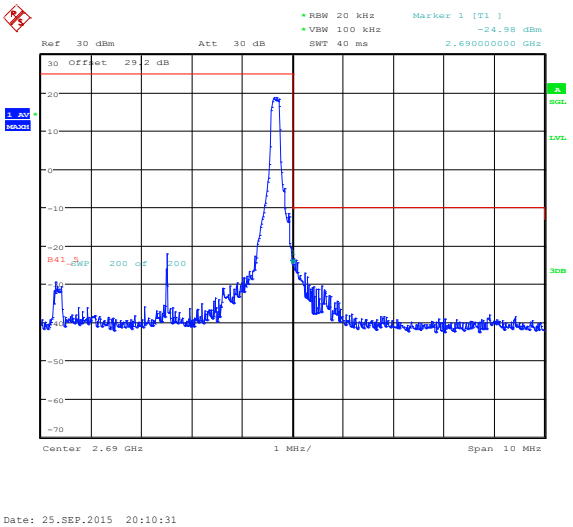


Figure 11-60a: Band 41 Low Channel Mask, 5MHz BW, RB=25

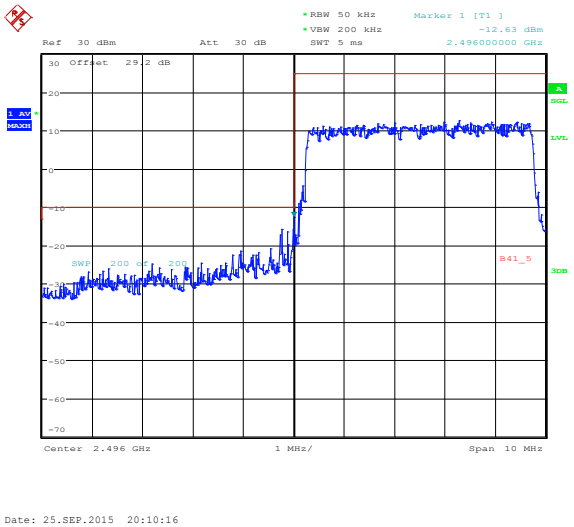


Figure 11-61a: Band 41 High Channel Mask, 5MHz BW, RB=25

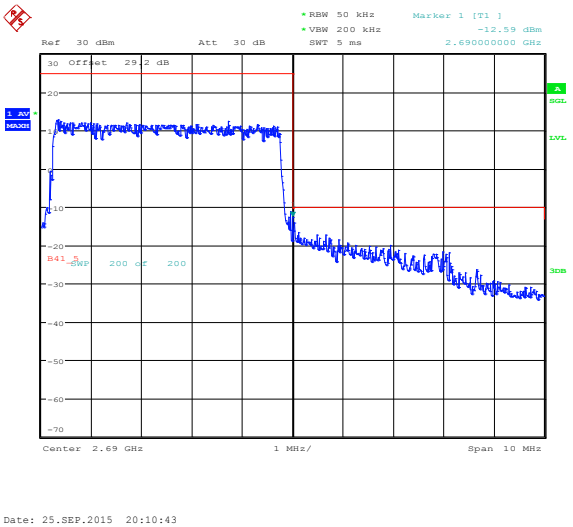


Figure 11-62a: Band 41 Low Channel Mask, 5MHz BW, RB=1

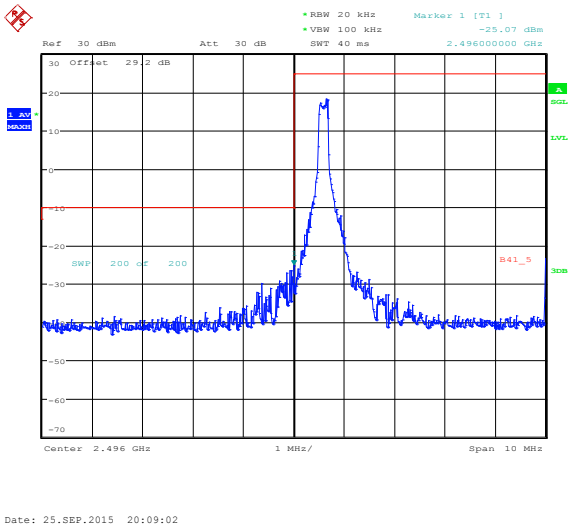
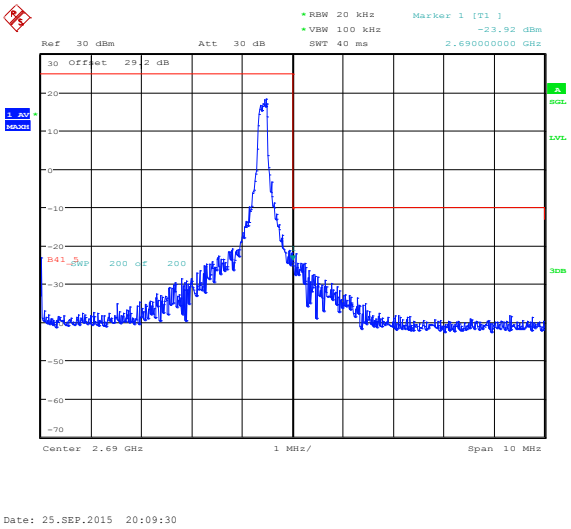
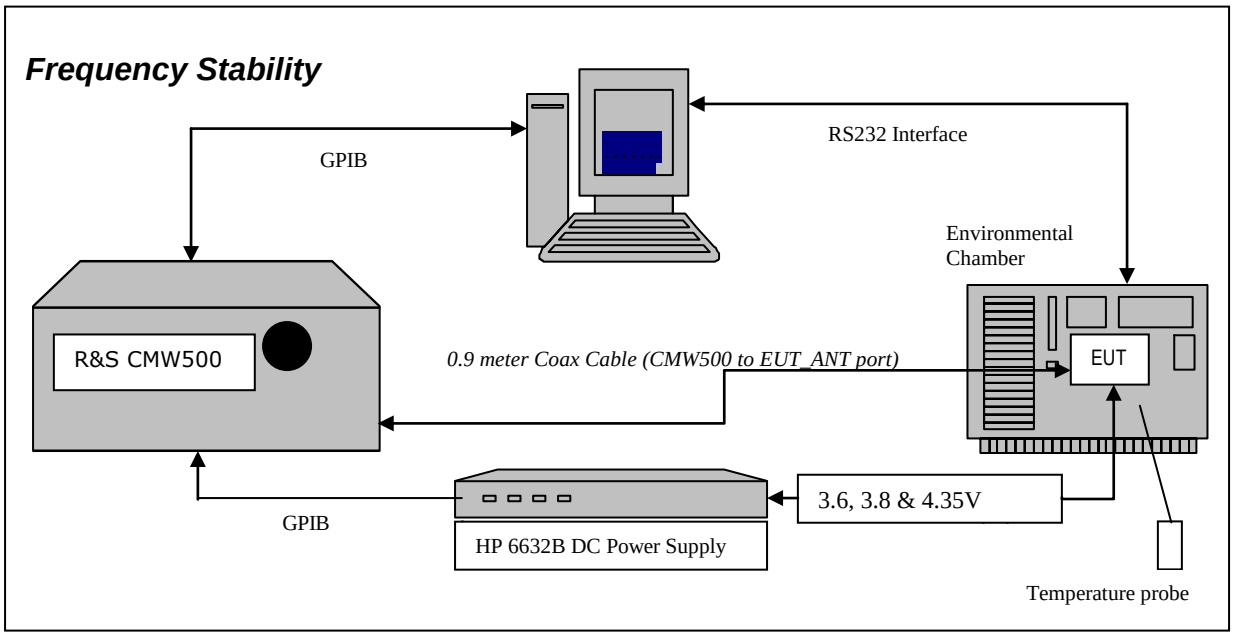


Figure 11-63a: Band 41 High Channel Mask, 5MHz BW, RB=1



APPENDIX 11B – LTE Band 41 FREQUENCY STABILITY TEST DATA

LTE Band 41 Frequency Stability Test Data



The following configurations were measured for model RHL211LW (STV100-3):

. The following measurements were performed by Landon Martin.

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, 3.8 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, 3.8 volts and 4.35 volts. The transmit frequency was measured on 2593MHz for 10MHz bandwidth with maximum (50) RB. The transmit frequency was varied in 3 steps consisting of 779.5 MHz, 2593.0 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:

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

127. Switch on the HP 6632B power supply; CMW 500 Communications test Set, and Environmental Chamber.
128. Start test program
129. Set the Temperature to –30°C and maintain a period of one- hour soak time, with the EUT supply voltage disabled.
130. Set power supply voltage to 3.6 volts.
131. Set up CMW 500 Radio Communication Tester.
132. Command the CMW 500 to switch to the low channel.
133. Enable the voltage to the EUT, and connect a link to the CMW 500 test set.
134. EUT is commanded to Transmit 100 Bursts.
135. 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.
136. The CMW 500 commands the EUT to change frequency to the middle channel and high channel and repeats steps 7 to 9.
137. Repeat steps 5 to 10 changing the supply voltage to 3.8 Volts
138. Increase temperature by 10°C and soak for 1/2 hour.
139. Repeat steps 4 - 12 for temperatures –30°C to 60°C.
140. 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, 3.8 and 4.35 volts

The following configurations were measured for model RHL211LW (STV100-3):

The maximum frequency error in the LTE Band 41 measured was **-2.5891PPM**.

The following configurations were measured for model RHM181LW (STV100-4):

The maximum frequency error in the LTE Band 41 measured was **-2.9073PPM**.

Date of test: August 28, 2015

LTE Band 41 results (20MHz Bandwidth): channels 40620 @ 20°C maximum transmitted power

Traffic Channel Number	LTE Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
40620	2593.00	3.6	20	845.06	0.3367
40620	2593.00	3.8	20	1053.16	0.4154
40620	2593.00	4.35	20	793.16	0.3098

LTE Band 41 Results (20MHz Bandwidth): channel 40620 @ maximum transmitted power

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
40620	2593.00	3.6	-30	964.95	0.3807
40620	2593.00	3.6	-20	-850.10	-0.3353
40620	2593.00	3.6	-10	742.71	0.2930
40620	2593.00	3.6	0	967.87	0.3818
40620	2593.00	3.6	10	929.00	0.3665
40620	2593.00	3.6	20	1053.16	0.4154
40620	2593.00	3.6	30	942.11	0.3716
40620	2593.00	3.6	40	-1274.14	-0.5026
40620	2593.00	3.6	50	991.80	0.3912
40620	2593.00	3.6	60	-11.23	-0.0044

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
40620	2593.00	3.8	-30	996.95	0.3933
40620	2593.00	3.8	-20	1463.63	0.5774
40620	2593.00	3.8	-10	-7370.00	**-2.9073**
40620	2593.00	3.8	0	-1010.77	-0.3987
40620	2593.00	3.8	10	-817.87	-0.3226
40620	2593.00	3.8	20	-990.20	-0.3906
40620	2593.00	3.8	30	-996.34	-0.3930
40620	2593.00	3.8	40	752.81	0.2970
40620	2593.00	3.8	50	-581.22	-0.2293
40620	2593.00	3.8	60	-12.26	-0.0048

Traffic Channel Number	Frequency (MHz)	Voltage (Volts)	Temperature (Celsius)	Frequency Error (Hz)	PPM
40620	2593.00	4.35	-30	919.73	0.3628
40620	2593.00	4.35	-20	-859.71	-0.3391
40620	2593.00	4.35	-10	-883.87	-0.3487
40620	2593.00	4.35	0	-598.93	-0.2363
40620	2593.00	4.35	10	-937.11	-0.3697
40620	2593.00	4.35	20	960.02	0.3787
40620	2593.00	4.35	30	-971.20	-0.3831
40620	2593.00	4.35	40	-924.24	-0.3646
40620	2593.00	4.35	50	-683.76	-0.2697
40620	2593.00	4.35	60	12.55	0.0049

APPENDIX 11C – LTE Band 41 RADIATED EMISSIONS TEST DATA

Radiated Power Test Data Results

The following configurations were measured for model RHL211LW (STV100-3):
The following measurements were performed by Savtej Sandhu.
Date of Test: August 26, 2015
The environmental tests conditions were: Temperature: 26.1 °C
Relative Humidity: 31.0 %
The BlackBerry® smartphone was standalone, with horizontal top pointing up 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 41, 15MHz 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	39725	2503.50	41	Horn	V	-42.27	-35.06	V-V	-17.42	18.94	0.08	33.00	14.06
F0	39725	2503.50	41	Horn	H	-35.06		H-H	-17.54				
F0	40620	2593.00	41	Horn	V	-41.86	-34.07	V-V	-16.28	19.87	0.10	33.00	13.13
F0	40620	2593.00	41	Horn	H	-34.07		H-H	-17.19				
F0	41515	2682.50	41	Horn	V	-40.67	-33.50	V-V	-14.81	**21.14**	0.13	33.00	11.86
F0	41515	2682.50	41	Horn	H	-33.50		H-H	-15.86				

LTE Band 41, 20MHz BW, RB=1, 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	39750	2506.00	41	Horn	V	-42.72	-35.78	V-V	-17.94	18.42	0.07	33.00	14.58
F0	39750	2506.00	41	Horn	H	-35.78		H-H	-18.14				
F0	40620	2593.00	41	Horn	V	-42.34	-34.96	V-V	-17.21	18.94	0.08	33.00	14.06
F0	40620	2593.00	41	Horn	H	-34.96		H-H	-18.08				
F0	41490	2680.00	41	Horn	V	-41.83	-34.03	V-V	-15.25	20.70	0.12	33.00	12.30
F0	41490	2680.00	41	Horn	H	-34.03		H-H	-16.34				

Radiated Emissions Test Data Results cont'd

The following measurements were performed by Shiva Kumbham.

Date of Test: August 20, 2015

The environmental test conditions were: Temperature: 26.1 ºC
Relative Humidity: 29.0 %

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 41 with 15MHz BW (channel 39725, 40620 and 41515 with RB = 1) with QPSK modulation and 20MHz BW (channel 39750, 40620, 41490 with RB = 1), with 16-QAM modulation.

All emissions had test margins greater than 25.0 dB.

The following measurements were performed by Xing Fang, Kevin Guo and Winston Vernon.

Date of Test: July 28 to August 18, 2015

The environmental test conditions were: Temperature: 28.3 ºC
Relative Humidity: 43.6 %

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 26 GHz.

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

Measurements were performed in LTE Band 41 with 15MHz BW (channel 39725, 40620 and 41515 with RB = 1) with QPSK modulation and 20MHz BW (channel 39750, 40620, 41490 with RB = 1), with 16-QAM modulation.

All emissions had test margins greater than 25.0 dB.