TEST REPORT

Test Report No. : RFI-RPT-RP88031JD01A V2.0

Manufacturer	:	Axell Wireless
Model No.	:	D-MINI-2107L-2017
FCC ID	:	NEODMINI2107L2017
Test Standard(s)	:	FCC Parts 15.107, 27.50(d)(4), 27.50(d)(2)(B), 27.50(d)(5), 27.50(c)(3), 27.50(c)(10), 27.53(g), 27.53(h), 27.54 & 3GPP TS 36.143 V10.3.0 NOTE: 3GPP TS 36.143 V10.3.0 is not listed on the current UKAS Schedule of Accreditation

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 12 December 2012

Checked by:

Ian Watch
WiSE Senior Engineer

Issued by :

pp

John Newell
Group Quality Manager, WiSE
Basingstoke,
UL Verification Services

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This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its' terms of accreditation.

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1. Customer Information

Company Name:	Axell Wireless
Address:	Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR27
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 27.50(d), Part 27.50(c), Part 27.53(g), Part 27.53(h), Part 27.54 Subpart C (Public Mobile Services)
Specification Reference:	47CFR15.107
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart B (Unintentional Radiators) - Sections 15.107
Specification Reference:	3GPP TS 36.143 V10.3.0 (2012-03)
Specification Title:	3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater conformance testing (Release 10)
Site Registration:	FCC: 209735
Location of Testing:	RFI Global Services Ltd trading as UL, Wade Road, Basingstoke, Hampshire, RG24 8AH
Test Dates:	04 July 2012 to 30 October 2012

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 27- Band 12		
15.107(a)	AC Conducted Spurious Emissions	✓
Part 2.1046(a)/27.50(c)(3)/ 27.50(c)(10)	Transmitter Conducted Output Power	✓
Part 27.54	Frequency Stability (Temperature & Voltage variation)	✓
Part 2.1049	Transmitter Occupied Bandwidth	✓
Part 2.1051/27.53(g)	Transmitter Conducted Emissions	✓
Part 2.1053/27.53(g)	Transmitter Out of Band Radiated Emissions	✓
Part 2.1051/27.53(g)	Transmitter Band Edge Conducted Emissions	✓
Part 27- Band 4		
15.107(a)	AC Conducted Spurious Emissions	✓
Part 2.1046(a)/27.50(d)(4)/ 27.50(d)(2)(B)	Transmitter Conducted Output Power	✓
Part 27.50(d)(5)	Transmitter Peak-To-Average Ratio	✓
Part 27.54	Frequency Stability (Temperature & Voltage variation)	✓
Part 2.1049	Transmitter Occupied Bandwidth	✓
Part 2.1051/27.53(h)	Transmitter Conducted Emissions	✓
Part 2.1053/27.53(h)	Transmitter Out of Band Radiated Emissions	✓
Part 2.1051/27.53(h)	Transmitter Band Edge Conducted Emissions	✓
3GPP Reference (TS 36.143 V10.3.0)	**Measurement**	**Result**
Clause 11	Input Intermodulation	✓
Key to Results ✓ = Complied ✗ = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI/TIA-603-C-2004
Title:	Land Mobile Communications Equipment, Measurements and performance Standards
Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Reference:	3GPP TS 36.143 V10.3.0 (2012-03)
Title:	3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater conformance testing (Release 10)
Reference:	FCC KDB 971168
Title:	Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems
Reference:	FCC KDB 935210
Title:	Amplifier, Booster, and Repeater – Basic Items
Reference Date:	18 July 2012
Title:	FCC Response to Enquiry 486454
Reference Date:	11 October 2012
Title:	FCC Response to Enquiry 792557

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	D-MINI-2107L-2017
Model Name or Number:	400AD60000
Serial Number:	11120003
Hardware Version Number:	3.4.4.4.A
Software Version Number:	B010007.AAEE0009.4020000.0
FCC ID:	NEODMINI2107L2017

3.2. Description of EUT

The equipment under test was a dual-band DIGI mini repeater that provides additional cellular coverage for WCDMA and LTE. It supports LTE Band 12 in the 699-716 MHz/729-746 MHz frequency ranges, WCDMA Band 4 and LTE Band 4 in the 1710-1755 MHz/2110-2155 MHz frequency ranges. It has 73 dB of gain for both uplink and downlink.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Type of Radio Device:	Cellular Base Station Repeater			
Power Supply Requirement(s):	Nominal	120 VAC 60 Hz		
Technology Tested:	LTE Band 12			
Channel Spacing:	1.4, 3.0, 5.0, 10.0 MHz			
Uplink Frequency Range:	699 to 716 MHz			
Uplink Channels Tested:	**Channel Bandwidth (MHz)**	**Channel Frequency (MHz)**		
		Bottom	**Middle**	**Top**
	1.4	699.7	707.5	715.3
	3.0	700.5	707.5	714.5
	5.0	701.5	707.5	713.5
	10.0	704.0	707.5	711.0
Downlink Frequency Range:	729 to 746 MHz			
Downlink Channels Tested:	**Channel Bandwidth (MHz)**	**Channel Frequency (MHz)**		
		Bottom	**Middle**	**Top**
	1.4	729.7	737.5	745.3
	3.0	730.5	737.5	744.5
	5.0	731.5	737.5	743.5
	10.0	734.0	737.5	741.0

Additional Information Related to Testing (continued)

Technology Tested:	WCDMA Band 4			
Channel Spacing:	5 MHz			
Uplink Frequency Range:	1710 to 1755 MHz			
Uplink Channels Tested:	**Channel ID**	**Channel Frequency (MHz)**		
	Bottom	1712.5		
	Middle	1732.6		
	Top	1752.5		
Downlink Frequency Range:	2110 to 2155 MHz			
Downlink Channels Tested:	**Channel ID**	**Channel Frequency (MHz)**		
	Bottom	2112.5		
	Middle	2132.6		
	Top	2152.5		
Technology Tested:	LTE Band 4			
Channel Spacing:	1.4, 3.0, 5.0, 10.0, 15.0, 20.0 MHz			
Uplink Frequency Range:	1710 to 1755 MHz			
Uplink Channels Tested:	**Channel Bandwidth (MHz)**	**Channel Frequency (MHz)**		
		Bottom	**Middle**	**Top**
	1.4	1710.7	1732.5	1754.3
	3.0	1711.5	1732.5	1753.5
	5.0	1712.5	1732.5	1752.5
	10.0	1715.0	1732.5	1750.0
	15.0	1717.5	1732.5	1747.5
	20.0	1720.0	1732.5	1745.0
Downlink Frequency Range:	2110 to 2155 MHz			
Downlink Channels Tested:	**Channel Bandwidth (MHz)**	**Channel Frequency (MHz)**		
		Bottom	**Middle**	**Top**
	1.4	2110.7	2132.5	2154.3
	3.0	2111.5	2132.5	2153.5
	5.0	2112.5	2132.5	2152.5
	10.0	2115.0	2132.5	2150.0
	15.0	2117.5	2132.5	2147.5
	20.0	2120.0	2132.5	2145.0

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Switch Mode Power Supply
Brand Name:	MEAN WELL
Model Name or Number:	GS90A12
Serial Number:	EB17223691

Description:	Laptop PC
Brand Name:	Dell Latitude D610
Model Name or Number:	RFI Asset No. PC480NT

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- The Customer declared that the EUT would be constantly transmitting in its' normal operational environment and therefore there is no receive/idle mode.
- Downlink and Uplink transmitting at power levels as specified in each test case.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT was powered throughout testing via a 120 VAC 60 Hz single phase switched mode power supply.
- A laptop PC was connected through Ethernet to the EUT for monitoring purposes and to set the correct filter configuration as per each test case.
- The EUT was operating at maximum gain throughout testing.
- When testing different channels, the corresponding filter was activated using the laptop PC.
- For Uplink tests, the input signal was fed into the mobile port on the repeater and the base port connected to a spectrum analyser.
- For Downlink tests, the input signal was fed into the base port on the repeater and the mobile port connected to a spectrum analyser.
- Radiated spurious emissions and AC conducted emissions tests: the output port (either mobile or base depending on the direction) was terminated with a 50 Ω load.
- Radiated spurious emissions and AC conducted emissions tests: all unused ports were terminated with loads or were connected to a suitable peripheral device, e.g. a laptop PC.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

5.2. Test Results Part 27- LTE Band 12

5.2.1. AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	09 July 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 15.107(a)
Test Method Used:	As detailed in ANSI C63.4 Section 7

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	56

Note(s):

1. For the duration of this test all ports on the EUT were terminated with suitable 50 Ω loads or connected to a laptop computer providing suitable termination e.g. Ethernet port.
2. No RF signal was input into the EUT for this test.

AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.263	Live	42.5	61.4	18.9	Complied
0.438	Live	42.1	57.1	15.0	Complied
0.524	Live	40.9	56.0	15.1	Complied
0.960	Live	37.1	56.0	18.9	Complied
1.217	Live	38.4	56.0	17.6	Complied
1.311	Live	39.7	56.0	16.3	Complied
1.563	Live	39.7	56.0	16.3	Complied
2.009	Live	39.7	56.0	16.3	Complied
2.360	Live	38.4	56.0	17.6	Complied
2.607	Live	37.7	56.0	18.3	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.177	Live	43.2	54.6	11.4	Complied
0.348	Live	33.2	49.0	15.8	Complied
0.434	Live	40.1	47.2	7.1	Complied
0.524	Live	37.6	46.0	8.4	Complied
0.695	Live	32.3	46.0	13.7	Complied
1.221	Live	32.8	46.0	13.2	Complied
1.572	Live	33.1	46.0	12.9	Complied
1.923	Live	33.1	46.0	12.9	Complied
2.247	Live	32.5	46.0	13.5	Complied

AC Conducted Spurious Emissions (continued)

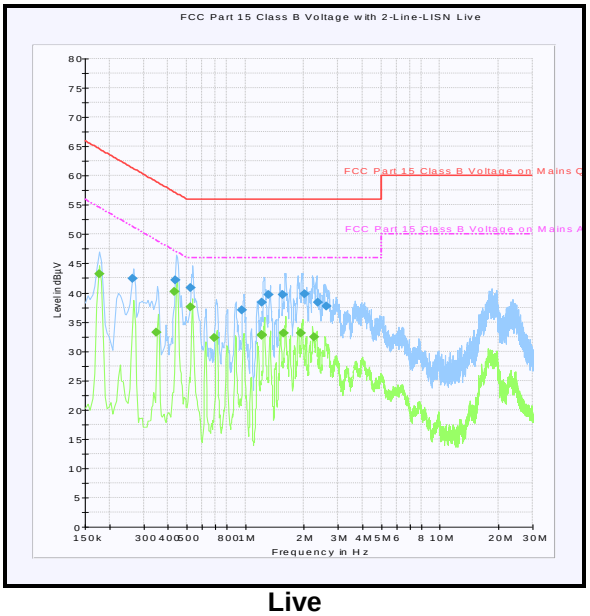
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.434	Neutral	47.1	57.2	10.1	Complied
0.524	Neutral	46.2	56.0	9.8	Complied
0.690	Neutral	44.0	56.0	12.0	Complied
0.780	Neutral	45.3	56.0	10.7	Complied
0.875	Neutral	45.8	56.0	10.2	Complied
0.960	Neutral	45.7	56.0	10.3	Complied
1.221	Neutral	45.7	56.0	10.3	Complied
1.307	Neutral	44.2	56.0	11.8	Complied
1.572	Neutral	44.0	56.0	12.0	Complied

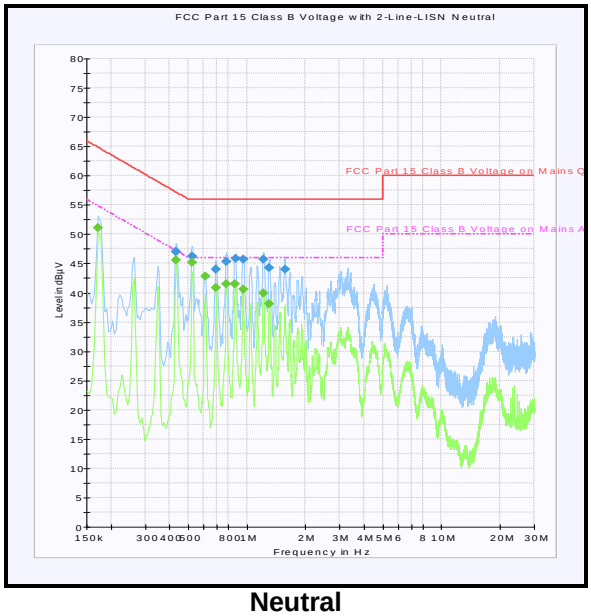
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.173	Neutral	51.1	54.8	3.7	Complied
0.434	Neutral	45.6	47.2	1.6	Complied
0.524	Neutral	45.2	46.0	0.8	Complied
0.609	Neutral	42.8	46.0	3.2	Complied
0.695	Neutral	40.9	46.0	5.1	Complied
0.780	Neutral	41.4	46.0	4.6	Complied
0.870	Neutral	41.5	46.0	4.5	Complied
0.960	Neutral	40.7	46.0	5.3	Complied
1.221	Neutral	39.9	46.0	6.1	Complied
1.307	Neutral	38.2	46.0	7.8	Complied

AC Conducted Spurious Emissions (continued)



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.2. Transmitter Conducted Output Power

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	08 August 2012, 09 August 2012 & 10 August 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1046(a), 27.50(c)(3) & 27.50(c)(10)
Test Method Used:	FCC Part 2.1046(a) and channel power function of a spectrum analyser and referencing FCC Response to Enquiry 486454

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	55

Note(s):

1. The output port of the EUT was connected directly to a spectrum analyser via suitable attenuation. The cable and attenuator were calibrated prior to use and the loss incorporated into the measurement as an RF level offset.
2. The channel power function of the spectrum analyser was used in conjunction with an average detector. The spectrum analyser measurement bandwidth was set accordingly for each emission bandwidth supported by the EUT.
3. For each channel tested, a corresponding filter was activated using the EUT's graphical user interface on a laptop PC.
4. In order to measure the maximum gain, the input signal from a signal generator was increased in steps of 1 dB from -60 dBm to find the minimum input level at which maximum output power is achieved for each modulation scheme. For each case the input level was recorded.
5. For each channel and modulation scheme, the input signal was increased by 10 dB and the power was re-measured. In each case, this did not increase the output power; therefore, the highest power was recorded.
6. The uplink ERP limit is stated in Part 27.50(c)(10) as 3 Watts (34.8 dBm). The highest conducted power measured in the uplink was 21.3 dBm. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBd with no cable loss, the margin between the highest measured conducted power and ERP limit is 13.5 dB.
7. The downlink ERP limit is stated in Part 27.50(c)(3) as 1000 Watts/MHz (60 dBm/MHz). The EUT operates with various emission bandwidths therefore the limit has been recalculated according to the bandwidth under test. The limit for a downlink 1.4 MHz emission bandwidth has been recalculated as $10\log_{10}(1.4\text{ MHz}/1\text{ MHz}) = 1.46$ dB. 1.46 dB was then added to 60 dBm/MHz ERP. The recalculated limit for a 1.4 MHz channel is 61.46 dBm/1.4 MHz (1399.587 Watts/1.4 MHz). The highest conducted power measured with a 1.4 MHz channel bandwidth was 20.6 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBd with no cable loss, the margin between the highest measured conducted power and ERP limit is 40.9 dB.
8. The limit for a downlink 3 MHz emission bandwidth has been recalculated as $10\log_{10}(3\text{ MHz}/1\text{ MHz}) = 4.77$ dB. 4.77 dB was then added to 60 dBm/MHz. The recalculated limit for a downlink 3 MHz channel is 64.77 dBm/3 MHz (2999.163 Watts/3 MHz ERP). The highest conducted power measured with a 3 MHz channel bandwidth was 20.9 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBd with no cable loss, the margin between the highest measured conducted power and ERP limit is 43.9 dB.

Transmitter Conducted Output Power (continued)

9. The limit for a downlink 5 MHz emission bandwidth has been recalculated as $10\log_{10}$(5 MHz/1 MHz) = 6.99 dB. 6.99 dB was then added to 60 dBm/MHz ERP. The recalculated limit for a 5 MHz channel is 66.99 dBm/5 MHz (5000.345 Watts/5 MHz). The highest conducted power measured with a 5 MHz channel bandwidth was 20.9 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBd with no cable loss, the margin between the highest measured conducted power and ERP limit is 46.1 dB.

10. The limit for a 10 MHz emission bandwidth has been recalculated as $10\log_{10}$(1 MHz/10 MHz) = 10.0 dB. 10 dB was then added to 60 dBm/MHz ERP. The recalculated limit for a 10 MHz channel is 70 dBm/10 MHz (10000 Watts/10 MHz). The highest conducted power measured with a 10 MHz channel bandwidth was 20.0 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBd with no cable loss, the margin between the highest measured conducted power and ERP limit is 50.0 dB.

Transmitter Conducted Output Power (continued)

Results: LTE / Uplink

Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
QPSK	1.4	Bottom	699.7	-51.0	20.5	71.5
		Middle	707.5	-51.0	21.0	72.0
		Top	715.3	-51.0	20.3	71.3
	3.0	Bottom	700.5	-51.0	21.0	72.0
		Middle	707.0	-51.0	21.3	72.3
		Top	714.5	-51.0	20.2	71.2
	5.0	Bottom	701.5	-51.0	21.0	72.0
		Middle	707.0	-51.0	20.5	71.5
		Top	713.5	-51.0	20.6	71.6
	10.0	Bottom	704.0	-51.0	21.1	72.1
		Middle	707.0	-51.0	21.1	72.1
		Top	711.0	-51.0	21.1	72.1
16QAM	1.4	Bottom	699.7	-51.0	20.5	71.5
		Middle	707.5	-51.0	20.9	71.9
		Top	715.3	-51.0	20.3	71.3
	3.0	Bottom	700.5	-51.0	21.0	72.0
		Middle	707.0	-51.0	21.3	72.3
		Top	714.5	-51.0	20.2	71.2
	5.0	Bottom	701.5	-51.0	21.0	72.0
		Middle	707.0	-51.0	20.5	71.5
		Top	713.5	-51.0	20.6	71.6
	10.0	Bottom	704.0	-51.0	21.1	72.1
		Middle	707.0	-51.0	21.1	72.1
		Top	711.0	-51.0	21.1	72.1
64QAM	1.4	Bottom	699.7	-51.0	20.5	71.5
		Middle	707.5	-51.0	21.0	72.0
		Top	715.3	-51.0	20.3	71.3
	3.0	Bottom	700.5	-51.0	21.0	72.0
		Middle	707.0	-51.0	21.3	72.3
		Top	714.5	-51.0	20.2	71.2
	5.0	Bottom	701.5	-51.0	20.9	71.9
		Middle	707.0	-51.0	20.4	71.4
		Top	713.5	-51.0	20.5	71.5
	10.0	Bottom	704.0	-51.0	21.1	72.1
		Middle	707.0	-51.0	21.0	72.0
		Top	711.0	-51.0	21.1	72.1

Transmitter Conducted Output Power (continued)

Results: LTE / Downlink

Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
QPSK	1.4	Bottom	729.7	-51.0	20.5	71.5
		Middle	737.5	-51.0	20.6	71.6
		Top	745.3	-51.0	20.5	71.5
	3.0	Bottom	730.5	-51.0	20.8	71.8
		Middle	737.5	-51.0	20.8	71.8
		Top	744.5	-51.0	20.5	71.5
	5.0	Bottom	731.5	-51.0	20.2	71.2
		Middle	737.5	-51.0	20.8	71.8
		Top	743.5	-51.0	20.6	71.6
	10.0	Bottom	734.0	-51.0	20.0	71.0
		Middle	737.5	-51.0	19.9	70.9
		Top	741.0	-51.0	20.0	71.0
16QAM	1.4	Bottom	729.7	-51.0	20.6	71.6
		Middle	737.5	-51.0	20.6	71.6
		Top	745.3	-51.0	20.5	71.5
	3.0	Bottom	730.5	-51.0	20.9	71.9
		Middle	737.5	-51.0	20.8	71.8
		Top	744.5	-51.0	20.4	71.4
	5.0	Bottom	731.5	-51.0	20.4	71.4
		Middle	737.5	-51.0	20.9	71.9
		Top	743.5	-51.0	20.7	71.7
	10.0	Bottom	734.0	-51.0	20.0	71.0
		Middle	737.5	-51.0	20.0	71.0
		Top	741.0	-51.0	20.0	71.0
64QAM	1.4	Bottom	729.7	-51.0	20.5	71.5
		Middle	737.5	-51.0	20.6	71.6
		Top	745.3	-51.0	20.5	71.5
	3.0	Bottom	730.5	-51.0	20.8	71.8
		Middle	737.5	-51.0	20.7	71.7
		Top	744.5	-51.0	20.4	71.4
	5.0	Bottom	731.5	-51.0	20.3	71.3
		Middle	737.5	-51.0	20.7	71.7
		Top	743.5	-51.0	20.5	71.5
	10.0	Bottom	734.0	-51.0	20.0	71.0
		Middle	737.5	-51.0	20.0	71.0
		Top	741.0	-51.0	19.9	70.9

5.2.3. Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineers:	Nick Steele & Andrew Edwards	**Test Date:**	06 August 2012
Test Sample Serial Number:	11120003		

FCC Part:	2.1055 & 27.54
Test Method Used:	ANSI TIA-603-C-2004 Section 2.2.2 referencing FCC CFR Part 2.1055

Environmental Conditions:

Ambient Temperature (°C):	27
Relative Humidity (%):	42

Note(s):

1. A signal generator was set to produce a CW signal at EUT maximum input level on the lowest channel of the downlink operating band (729.700000 MHz) and the highest channel of the downlink operating band (745.300000 MHz). The accuracy of the signal generator was verified prior to testing by using the frequency count function of a calibrated spectrum analyser. A calibrated test receiver with the same measurement settings as the spectrum analyser was used to monitor the CW output of the EUT. To ensure the accuracy and stability of all measurements, the reference 10 MHz clock from the test receiver was utilized to provide a reference clock for the other test equipment. The signal generator, spectrum analyser and EUT RF connectors were connected using suitable RF cables and an RF power divider. The measured frequency of the signal generator at the EUT input was then compared to the measured frequency of the output of the EUT and recorded in the result tables. Tests were performed from the point where the EUT became operational after power on and repeated at one minute intervals up to 10 minutes after initialisation. The output frequency was compared to the lower and upper band edge frequencies to obtain the margin.
2. Temperature was monitored throughout the test with a calibrated digital thermometer.
3. The EUT output frequency was monitored and remained within the frequency limits of Band 12, 729 MHz to 746 MHz.

Transmitter Frequency Stability (Temperature Variation)(continued)

Results: Bottom Channel (Input Frequency 729.700000 MHz)

Temperature (°C)	Time after Start-up					
	0 minutes (Output Frequency MHz)	1 minute (Output Frequency MHz)	2 minutes (Output Frequency MHz)	3 minutes (Output Frequency MHz)	4 minutes (Output Frequency MHz)	5 minutes (Output Frequency MHz)
-30	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
-20	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
-10	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
0	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
10	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
20	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
30	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
40	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000
50	729.700000	729.700000	729.700000	729.700000	729.700000	729.700000

Temperature (°C)	Time after Start-up				
	6 minutes (Output Frequency MHz)	7 minutes (Output Frequency MHz)	8 minutes (Output Frequency MHz)	9 minutes (Output Frequency MHz)	10 minutes (Output Frequency MHz)
-30	729.700000	729.700000	729.700000	729.700000	729.700000
-20	729.700000	729.700000	729.700000	729.700000	729.700000
-10	729.700000	729.700000	729.700000	729.700000	729.700000
0	729.700000	729.700000	729.700000	729.700000	729.700000
10	729.700000	729.700000	729.700000	729.700000	729.700000
20	729.700000	729.700000	729.700000	729.700000	729.700000
30	729.700000	729.700000	729.700000	729.700000	729.700000
40	729.700000	729.700000	729.700000	729.700000	729.700000
50	729.700000	729.700000	729.700000	729.700000	729.700000

Frequency closest to Lower Band 12 Edge (Output Frequency MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
729.700000	729.0	0.7	Complied

Transmitter Frequency Stability (Temperature Variation)(continued)

Results: Top Channel (Input Frequency 745.300000 MHz)

Temperature (°C)	Time after Start-up					
	0 minutes (Output Frequency MHz)	1 minute (Output Frequency MHz)	2 minutes (Output Frequency MHz)	3 minutes (Output Frequency MHz)	4 minutes (Output Frequency MHz)	5 minutes (Output Frequency MHz)
-30	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
-20	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
-10	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
0	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
10	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
20	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
30	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
40	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000
50	745.300000	745.300000	745.300000	745.300000	745.300000	745.300000

Temperature (°C)	Time after Start-up				
	6 minutes (Output Frequency MHz)	7 minutes (Output Frequency MHz)	8 minutes (Output Frequency MHz)	9 minutes (Output Frequency MHz)	10 minutes (Output Frequency MHz)
-30	745.300000	745.300000	745.300000	745.300000	745.300000
-20	745.300000	745.300000	745.300000	745.300000	745.300000
-10	745.300000	745.300000	745.300000	745.300000	745.300000
0	745.300000	745.300000	745.300000	745.300000	745.300000
10	745.300000	745.300000	745.300000	745.300000	745.300000
20	745.300000	745.300000	745.300000	745.300000	745.300000
30	745.300000	745.300000	745.300000	745.300000	745.300000
40	745.300000	745.300000	745.300000	745.300000	745.300000
50	745.300000	745.300000	745.300000	745.300000	745.300000

Frequency closest to Upper Band 12 Edge (Output Frequency MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
745.300000	746.0	0.7	Complied

5.2.4. Transmitter Frequency Stability (Voltage Variation)

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	06 August 2012
Test Sample Serial Number:	11120003		

FCC Part:	2.1055 & 27.54
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.2 referencing FCC CFR Part 2.1055

Environmental Conditions:

Temperature (°C):	27
Relative Humidity (%):	42

Note(s):

1. A signal generator was set to produce a CW signal at maximum input level on the lowest channel of the downlink operating band (729.700000 MHz) and the highest channel of the downlink operating band (745.300000 MHz). The accuracy of the signal generator was verified prior to testing by using the frequency count function of a calibrated spectrum analyser. A calibrated test receiver with the same measurement settings as the spectrum analyser was used to monitor the CW output of the EUT. To ensure the accuracy and stability of all measurements, the reference 10 MHz clock from the test receiver was utilized to provide a reference clock for the other test equipment. The signal generator, spectrum analyser and EUT RF connectors were connected using suitable RF cables and an RF power divider. The measured frequency of the signal generator at the EUT input was then compared to the measured frequency of the output of the EUT and recorded in the result tables. Tests were performed from the point where the EUT became operational after power on and repeated at one minute intervals up to 10 minutes after initialisation. The output frequency was compared to the lower and upper band edge frequencies to obtain the margin.
2. Voltage was monitored throughout the test with a calibrated digital voltmeter.
3. The EUT output frequency was monitored and remained within the frequency limits of Band 12, 729 MHz to 746 MHz.

Results: Bottom Channel (Input Frequency 729.700000 MHz)

Supply Voltage (VAC)	Output Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
102	729.700000	729.0	0.7	Complied
138	729.700000	729.0	0.7	Complied

Results: Top Channel (Input Frequency 745.300000 MHz)

Supply Voltage (VAC)	Output Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
102	745.300000	746.0	0.7	Complied
138	745.300000	746.0	0.7	Complied

5.2.5. Transmitter Occupied Bandwidth

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	08 August 2012 & 15 August 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1049
Test Method Used:	Spectrum Analyser Occupied Bandwidth function

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	59

Note(s):

1. The 99% occupied bandwidth was measured using the Occupied Bandwidth function of a spectrum analyser. Measurement bandwidths were set automatically by the spectrum analyser.
2. A signal generator was connected to the EUT input and the EUT output signal was measured using a spectrum analyser connected to the EUT via suitable RF cables and attenuators. Plots of various input and output signals are shown at the beginning of the plots section to prove that the signal is not being degraded or altered in any way. There was no distortion of either output signal compared with the respective input signal. The input signal is from the signal generator. The output signal is the output from the EUT (input signal after it has been amplified).
3. For the duration of this test, the input signal to the EUT was set at a level which resulted in maximum rated output power. In all cases, the input signal was increased by 10 dB and re-measured. For each channel and modulation scheme tested, the occupied bandwidth was not altered.

Transmitter Occupied Bandwidth (continued)

Results: Uplink

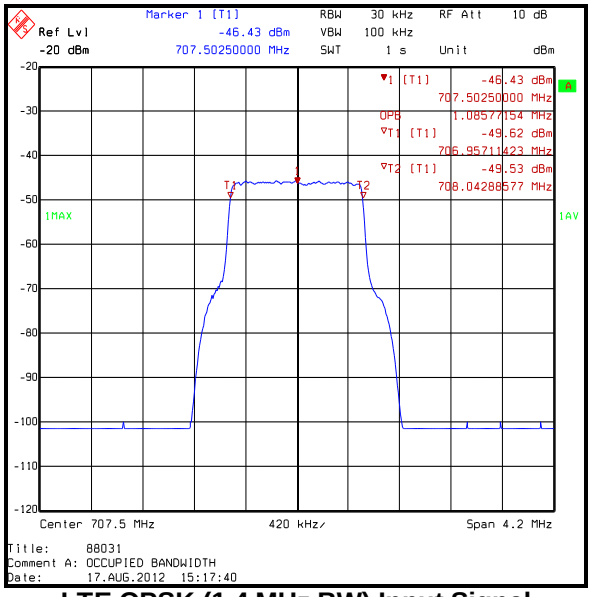
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
LTE QPSK	1.4	Middle	707.5	1085.772
	3.0	Middle	707.5	2705.411
	5.0	Middle	707.5	4509.018
	10.0	Middle	707.5	9078.156
LTE 16QAM	1.4	Middle	707.5	1094.188
	3.0	Middle	707.5	2705.411
	5.0	Middle	707.5	4509.018
	10.0	Middle	707.5	9078.156
LTE 64QAM	1.4	Middle	707.5	1085.772
	3.0	Middle	707.5	2705.411
	5.0	Middle	707.5	4478.958
	10.0	Middle	707.5	9078.156

Results: Downlink

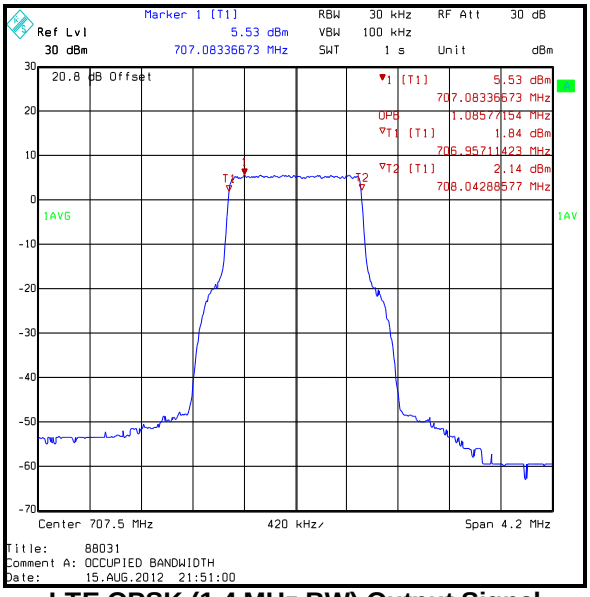
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
LTE QPSK	1.4	Middle	737.5	1085.772
	3.0	Middle	737.5	2741.483
	5.0	Middle	737.5	4478.958
	10.0	Middle	737.5	9078.156
LTE 16QAM	1.4	Middle	737.5	1085.772
	3.0	Middle	737.5	2741.483
	5.0	Middle	737.5	4478.958
	10.0	Middle	737.5	9078.156
LTE 64QAM	1.4	Middle	737.5	1085.772
	3.0	Middle	737.5	2741.483
	5.0	Middle	737.5	4509.018
	10.0	Middle	737.5	9018.036

Transmitter Occupied Bandwidth (continued)

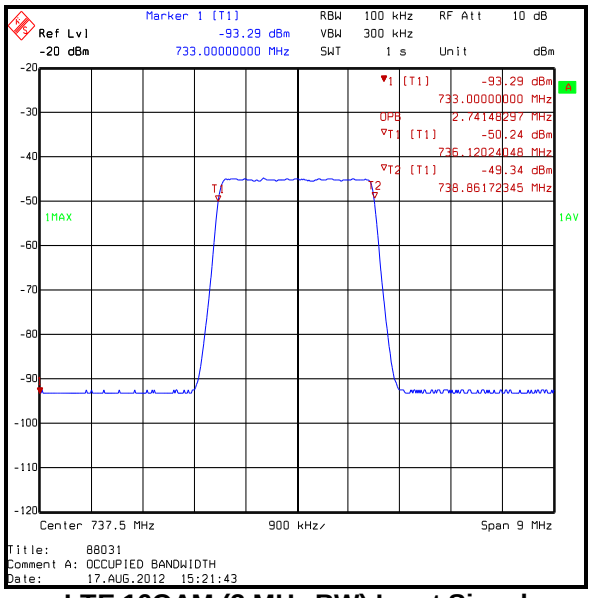
Results: Comparison of Input Signal versus Output Signal



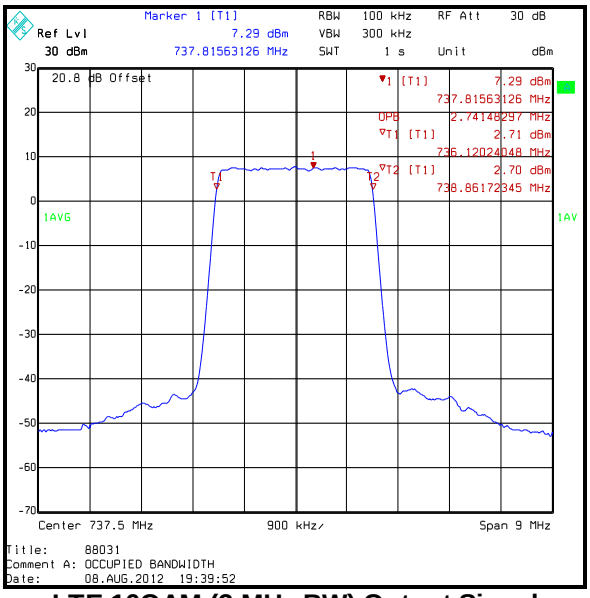
LTE QPSK (1.4 MHz BW) Input Signal



LTE QPSK (1.4 MHz BW) Output Signal



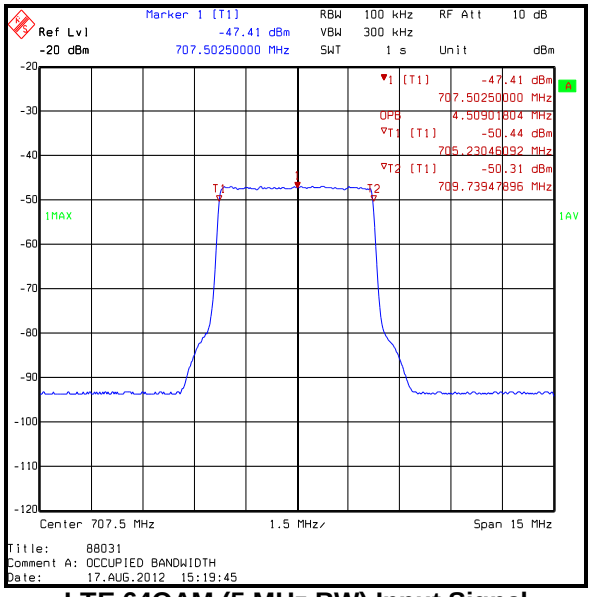
LTE 16QAM (3 MHz BW) Input Signal



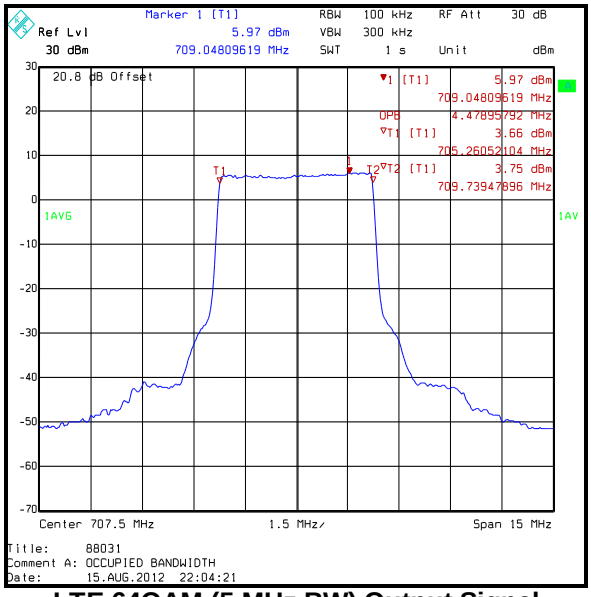
LTE 16QAM (3 MHz BW) Output Signal

Transmitter Occupied Bandwidth (continued)

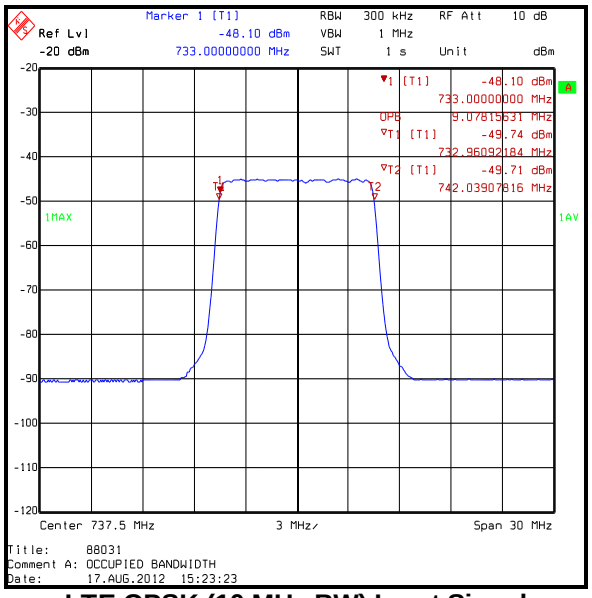
Results: Comparison of Input Signal versus Output Signal



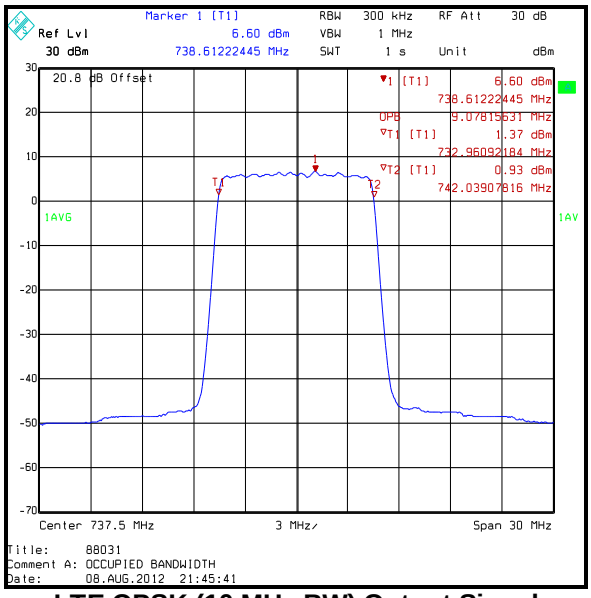
LTE 64QAM (5 MHz BW) Input Signal



LTE 64QAM (5 MHz BW) Output Signal



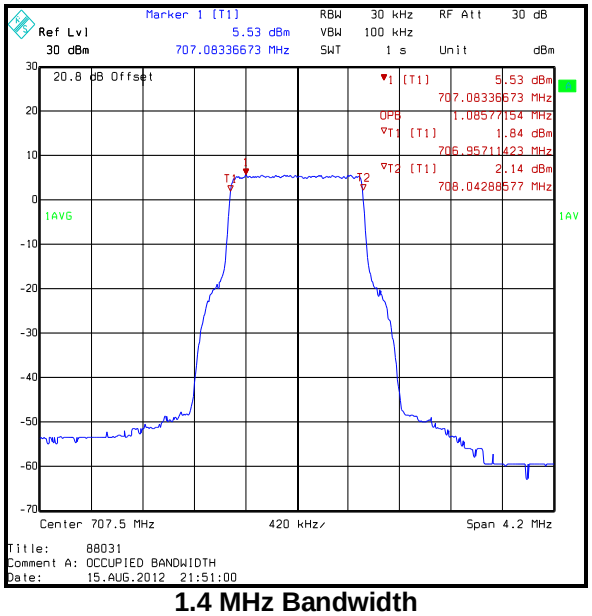
LTE QPSK (10 MHz BW) Input Signal



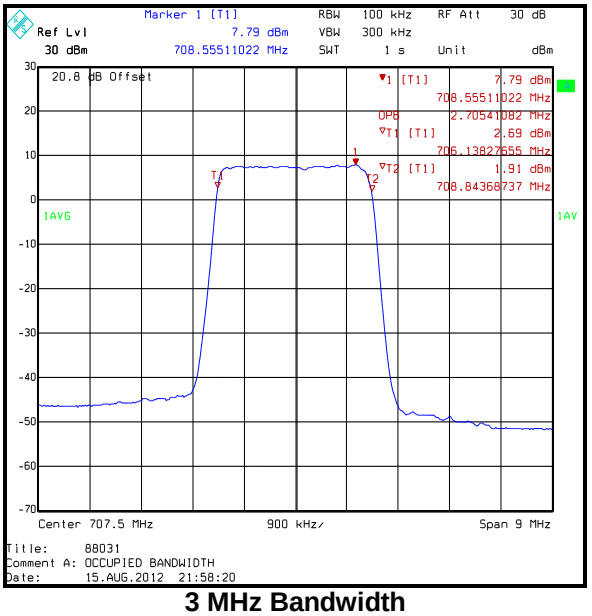
LTE QPSK (10 MHz BW) Output Signal

Transmitter Occupied Bandwidth (continued)

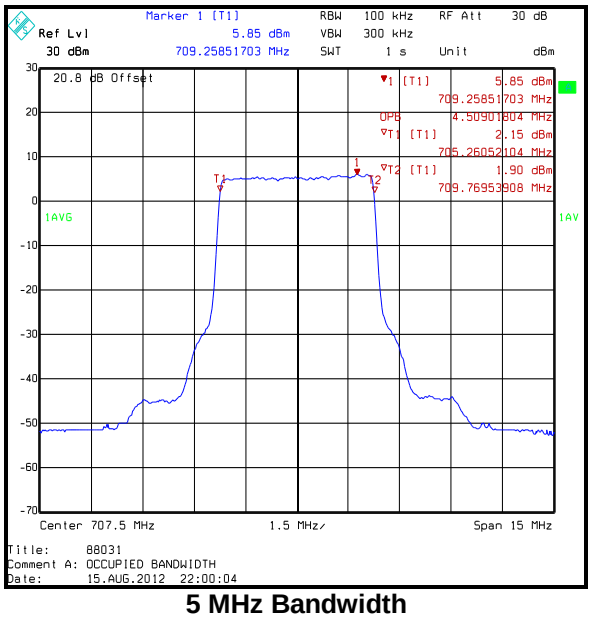
Results: LTE QPSK / Uplink



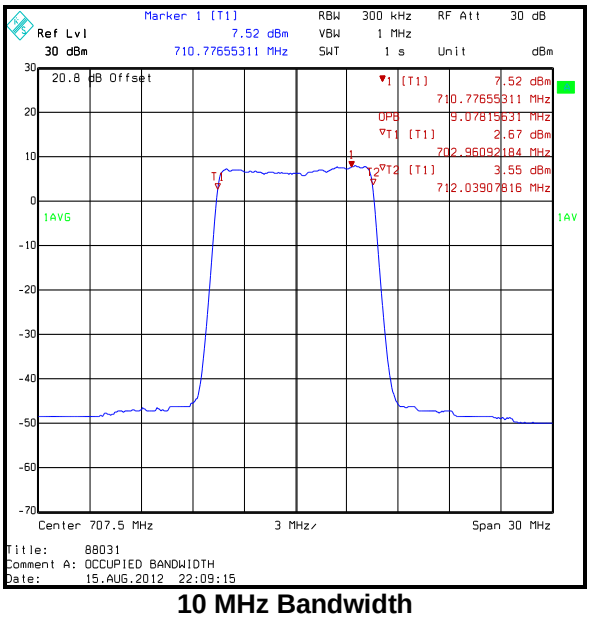
1.4 MHz Bandwidth



3 MHz Bandwidth



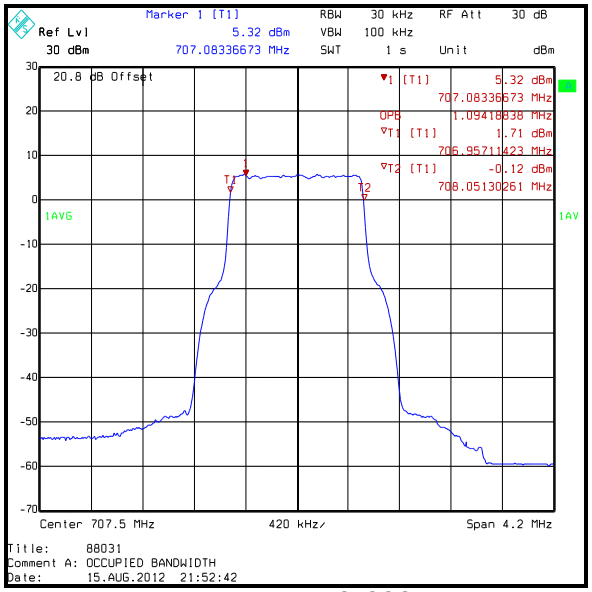
5 MHz Bandwidth



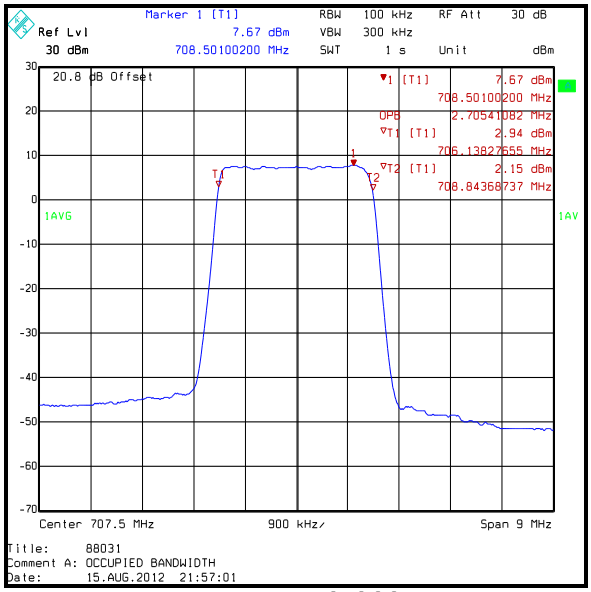
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

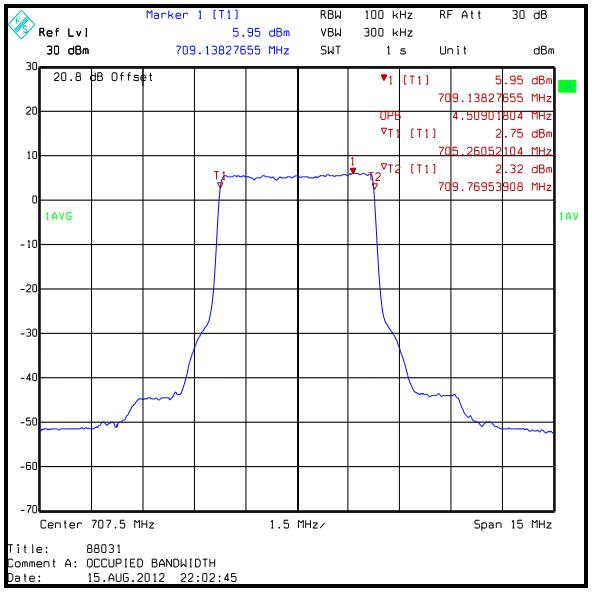
Results: LTE 16QAM / Uplink



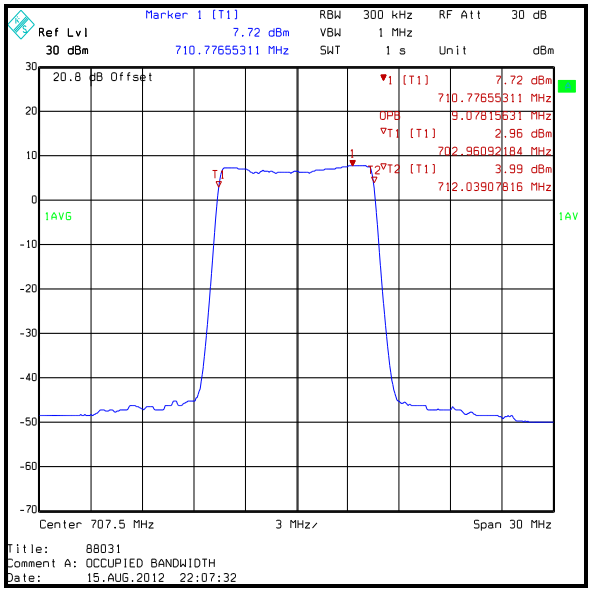
1.4 MHz Bandwidth



3 MHz Bandwidth



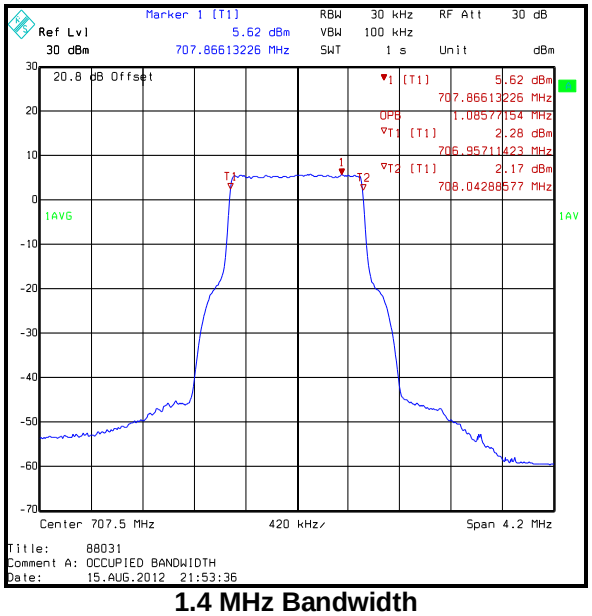
5 MHz Bandwidth



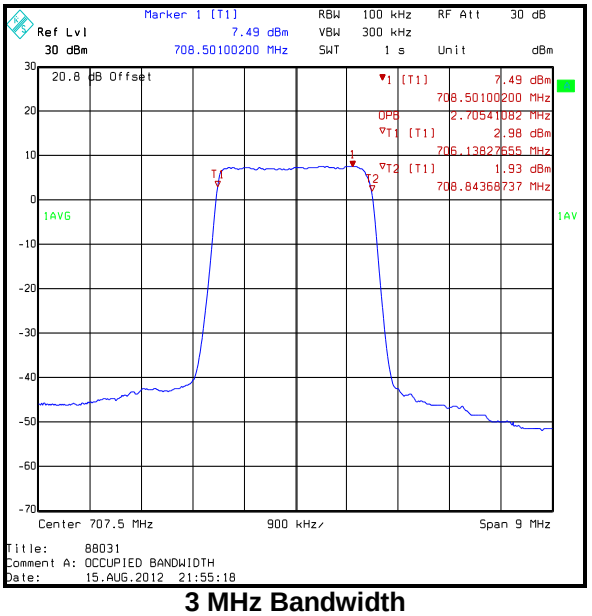
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

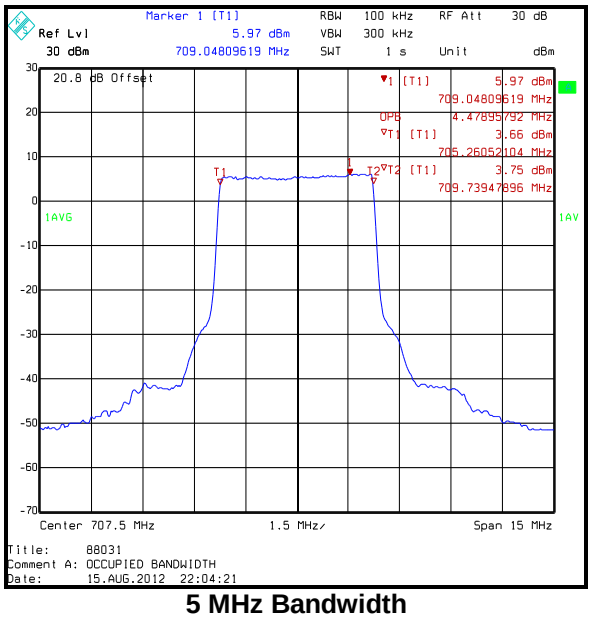
Results: LTE 64QAM / Uplink



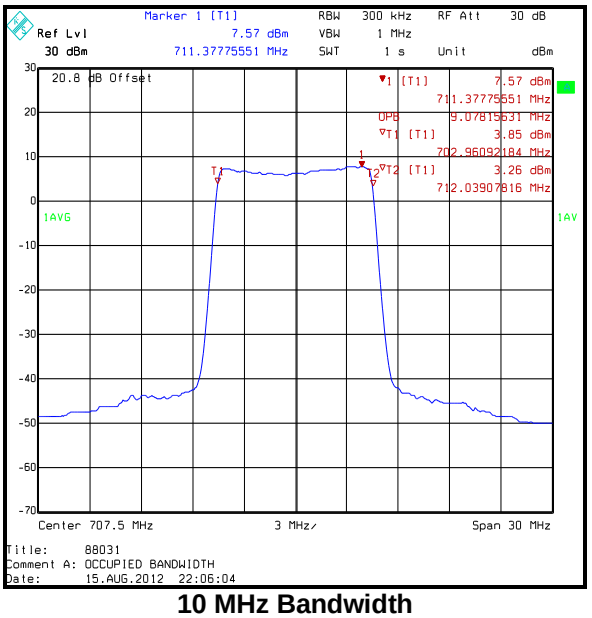
1.4 MHz Bandwidth



3 MHz Bandwidth



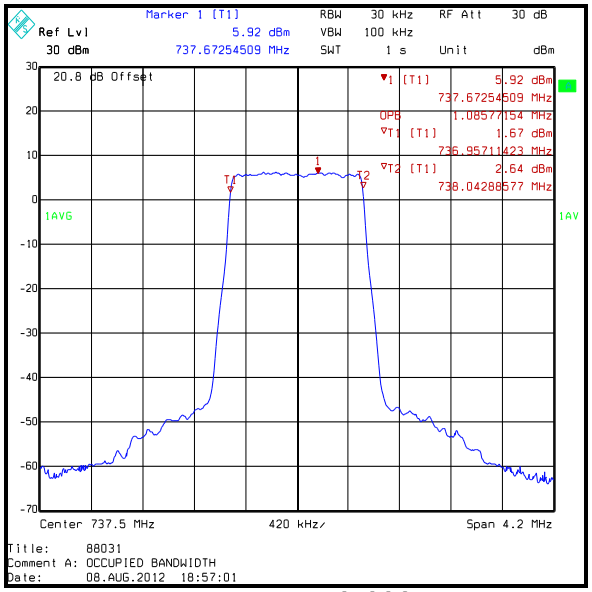
5 MHz Bandwidth



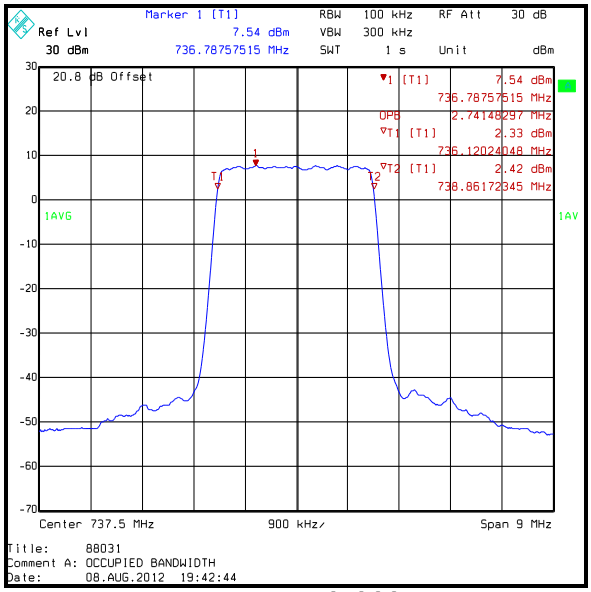
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

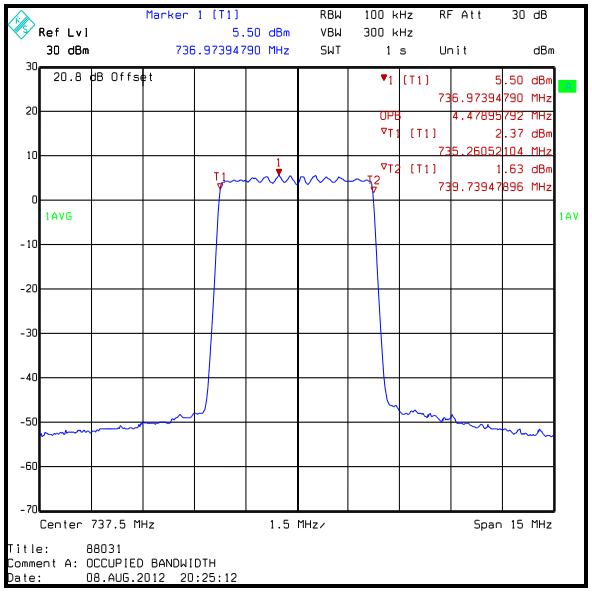
Results: LTE QPSK / Downlink



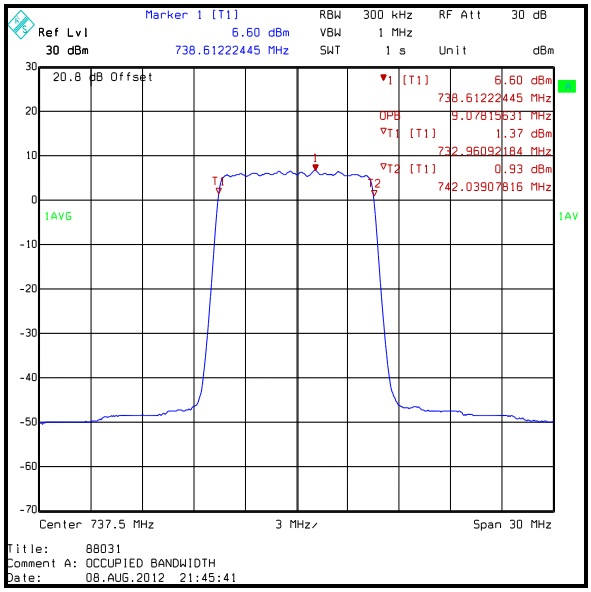
1.4 MHz Bandwidth



3 MHz Bandwidth



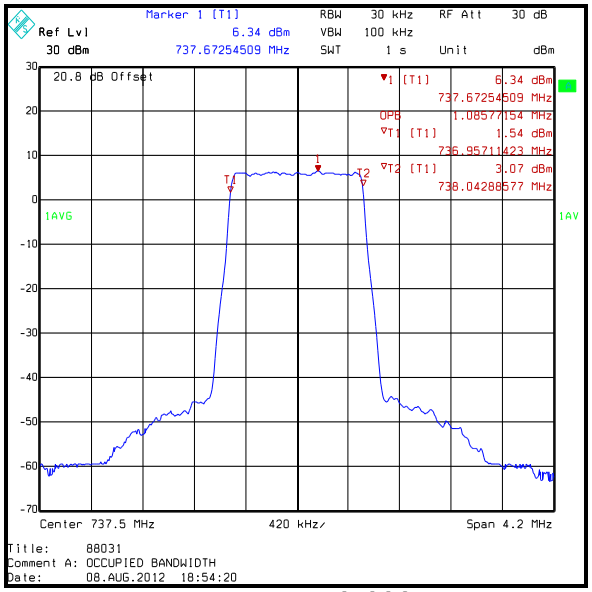
5 MHz Bandwidth



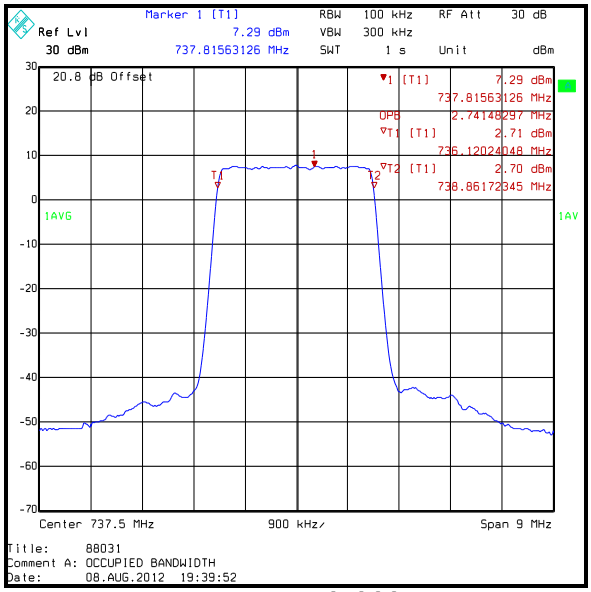
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

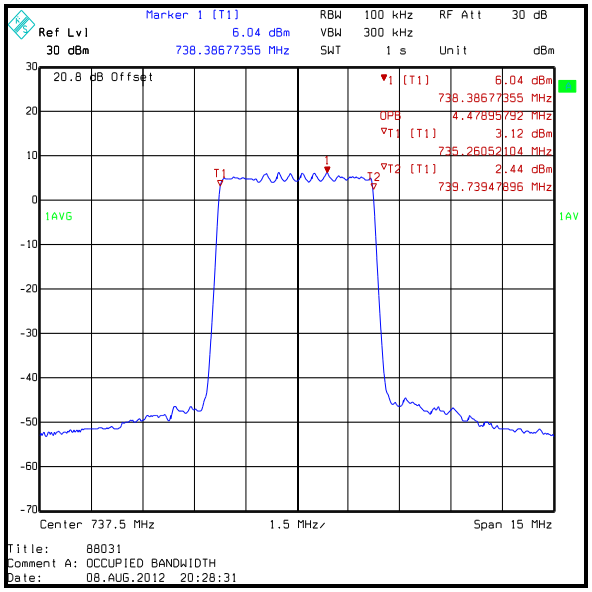
Results: LTE 16QAM / Downlink



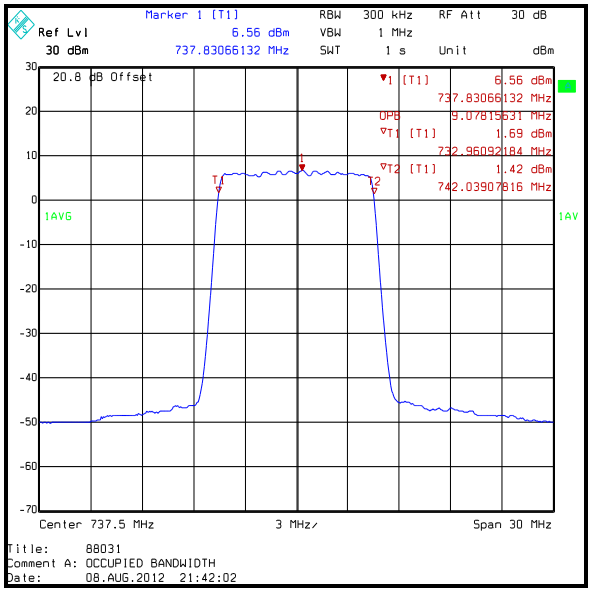
1.4 MHz Bandwidth



3 MHz Bandwidth



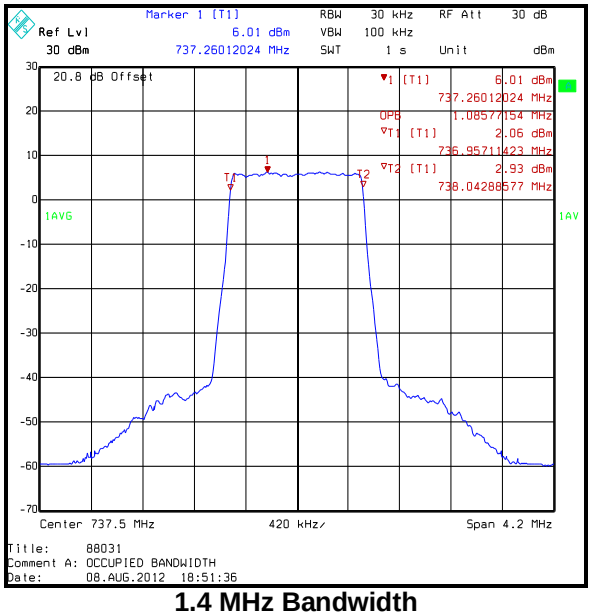
5 MHz Bandwidth



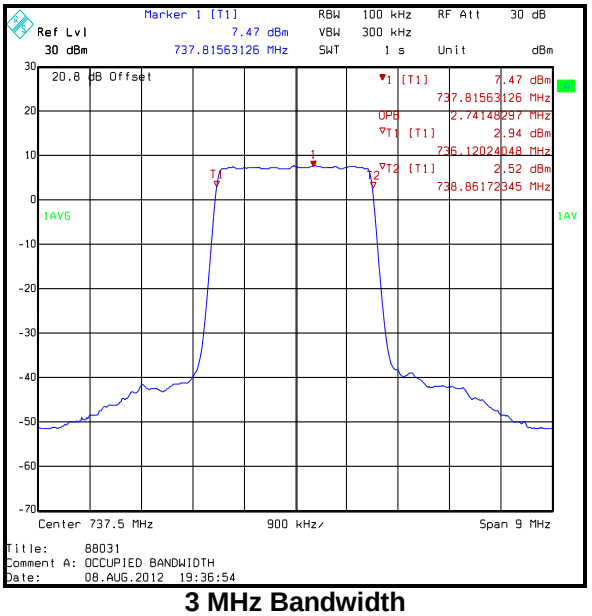
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

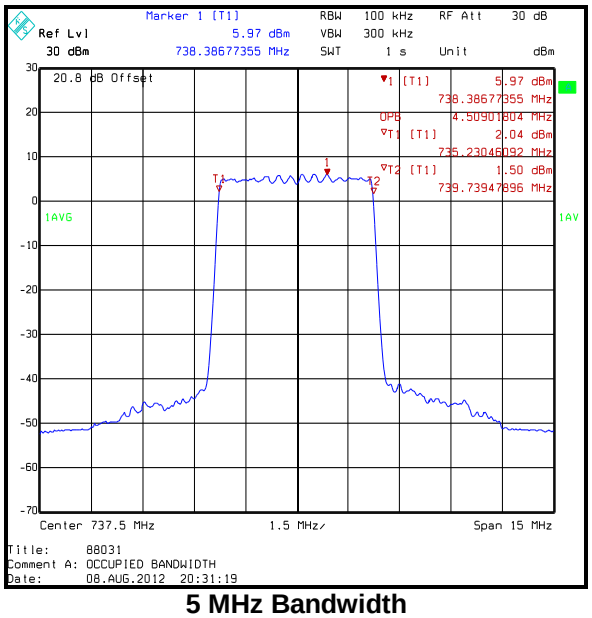
Results: LTE 64QAM / Downlink



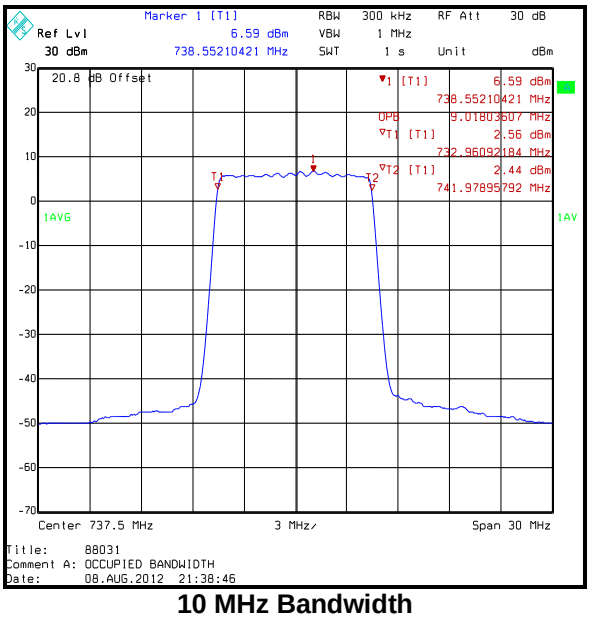
1.4 MHz Bandwidth



3 MHz Bandwidth



5 MHz Bandwidth



10 MHz Bandwidth

5.2.6. Transmitter Conducted Emissions

Test Summary:

Test Engineer:	Patrick Jones	**Test Dates:**	29 October 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1051 & 27.53(g)
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.13 referencing FCC CFR Part 2.1051 and FCC Response to Enquiry 792557
Frequency Range:	9 kHz to 8 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	34

Note(s):

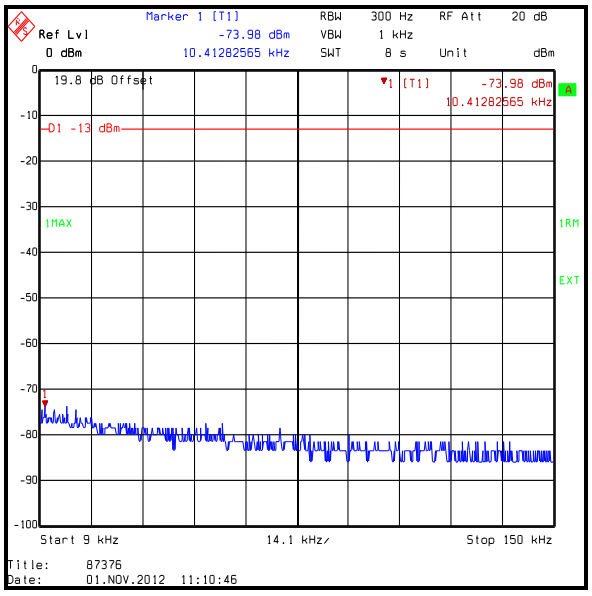
1. Three signal generators with appropriate modulation applied were connected to the input port of the EUT using suitable RF cables, circulators and a RF combiner. The RF output of the repeater was connected to a spectrum analyser via suitable cables and attenuators. The cables and attenuators were calibrated before use and the RF level offset was incorporated into the measurements. The signal generator was set to output a suitably modulated signal at the maximum input level for the EUT in accordance with FCC Response to Enquiry 792557.
2. Pre-scans for this test were carried out from 9 kHz to 8 GHz for all supported modulation types. The plots and results shown in the section below were deemed to have the worst case spurious emissions profile. All test results are archived on the company server and available for inspection if required. There were no spurious emissions recorded so the worst case is shown as the highest noise floor measured.
3. For LTE testing, two modulated carriers were used in two different configurations: one test with the carriers at the bottom of the band, at least one channel width apart; one test with the carriers at the top of the band, at least one channel width apart. The carrier bandwidth used for all LTE tests was 1.4 MHz as this represents the highest dBm/MHz ratio for all applicable bandwidths as shown in the Conducted Output Power section of this test report.
4. The combined signal generator outputs were checked on a spectrum analyser prior to the test in order to determine that there were no intermodulation products coming from the combining network itself and to verify the correct amplitude and frequencies were present at the input to the EUT prior to performing the tests.
5. For any emissions found, the input signal was increased by a further 10 dB and the emissions re-measured. In all cases the emission level was not increased.
6. All emissions were found to be ambient, in-band or >20 dB below the applicable limit and therefore not included in this report.

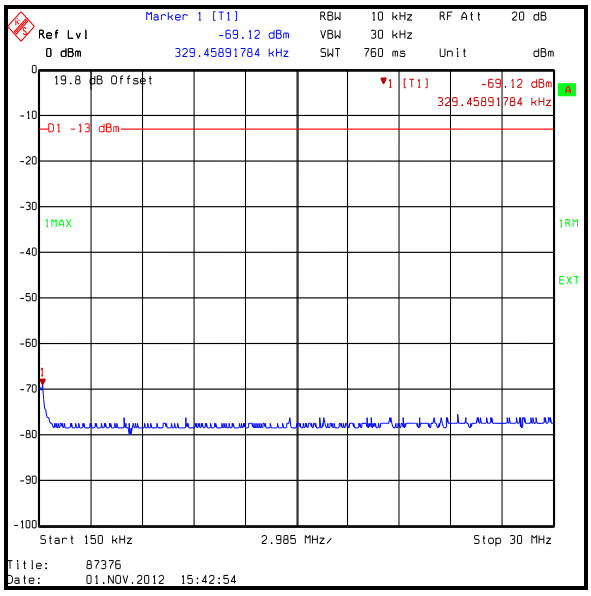
Transmitter Conducted Emissions (Continued)

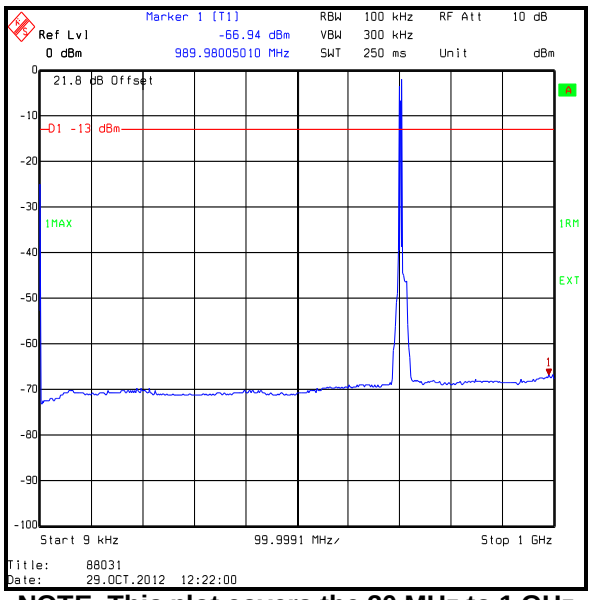
Results: Uplink / 16QAM Bottom Channels

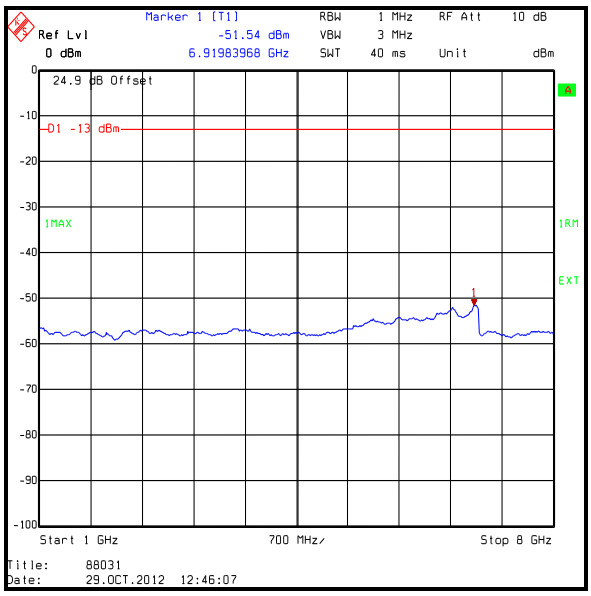
Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
6919.840	-51.5	-13.0	38.5	Complied

Results: Uplink / 16QAM Bottom Channels









NOTE: This plot covers the 30 MHz to 1 GHz frequency range

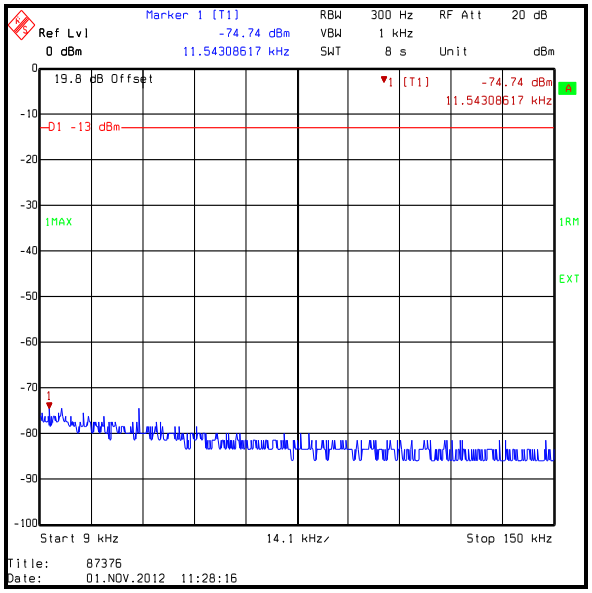
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

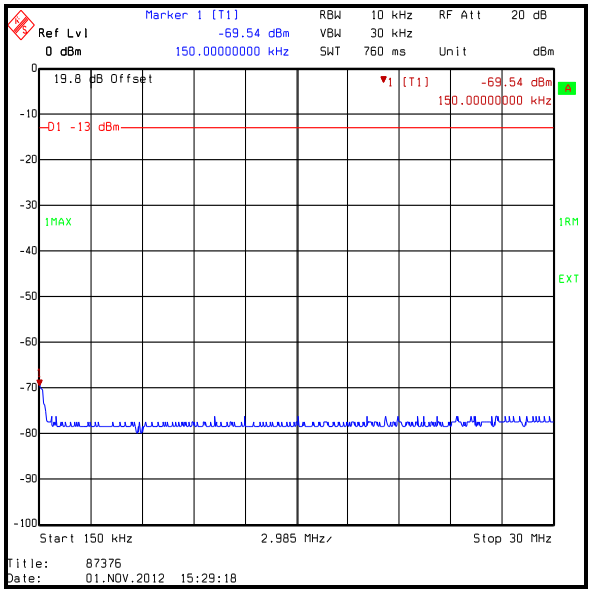
Transmitter Conducted Emissions (Continued)

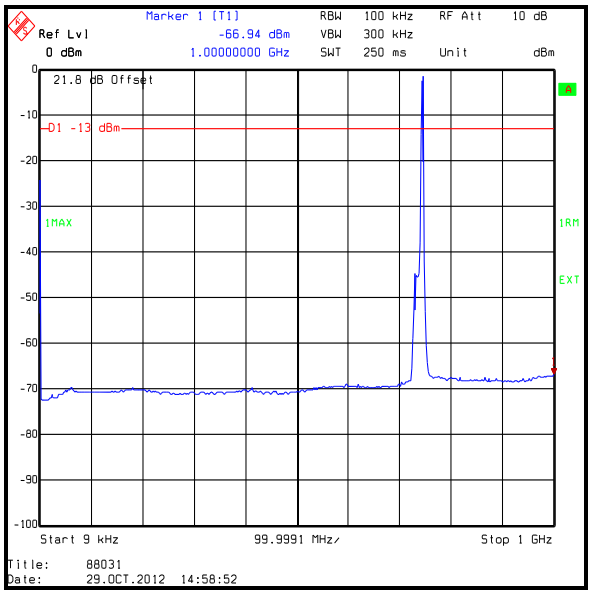
Results: Downlink/ 16QAM Top Channels

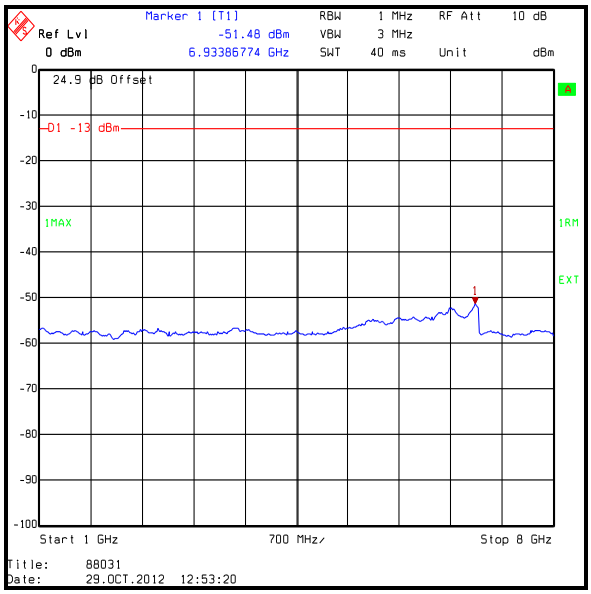
Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
6933.868	-51.5	-13.0	38.5	Complied

Results: Downlink/ 16QAM Top Channels









NOTE: This plot covers the 30 MHz to 1 GHz frequency range

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.7. Transmitter Out of Band Radiated Emissions

Test Summary:

Test Engineers:	David Doyle & Andrew Edwards	**Test Date:**	04 July 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1053 & Part 27.53(g)
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.12 referencing FCC CFR Part 2.1053
Frequency Range:	30 MHz to 8 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	61

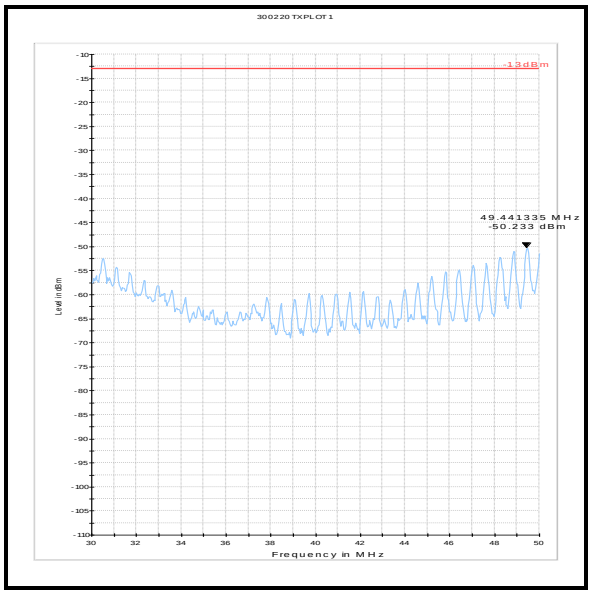
Note(s):

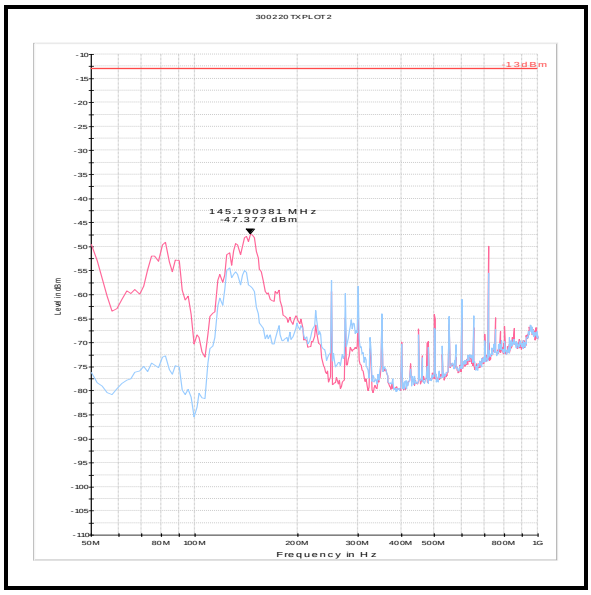
1. A signal generator was connected to the input port of the EUT using a suitable RF cable. The signal generator was located outside the anechoic chamber. The RF output of the repeater was terminated into a suitable 50 Ohm load. The signal generator was set to output a CW signal at the maximum input level for the EUT. Pre-scans were performed with the signal generator frequency set to the top channel of the 700 Band uplink (715.3 MHz) and downlink (745.3 MHz) bands.
2. All emissions shown on the pre-scan plots were investigated. The input signal was increased by 10 dB and the emissions re-measured. The emission levels did not increase when the input signal was increased. The highest emission levels were recorded. All emissions were found to be ambient, in-band or >20 dB below the applicable limit.
3. The uplink and downlink amplifier pass-bands are shown on the 30 MHz to 1 GHz and 1 GHz to 4 GHz plots.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

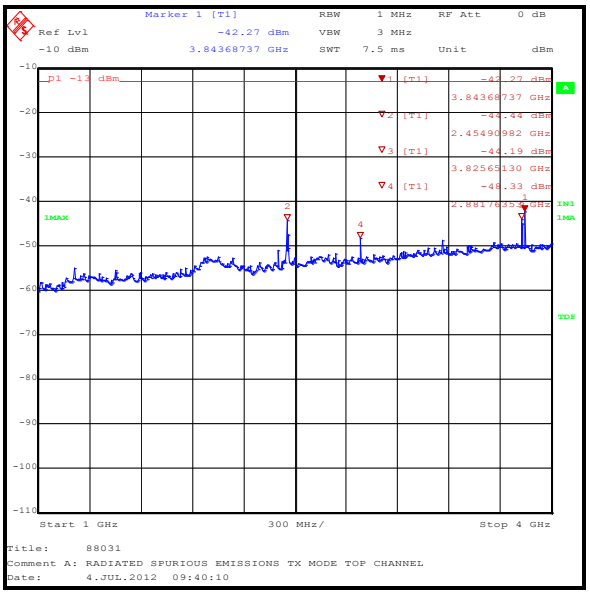
Transmitter Out of Band Radiated Emissions (continued)

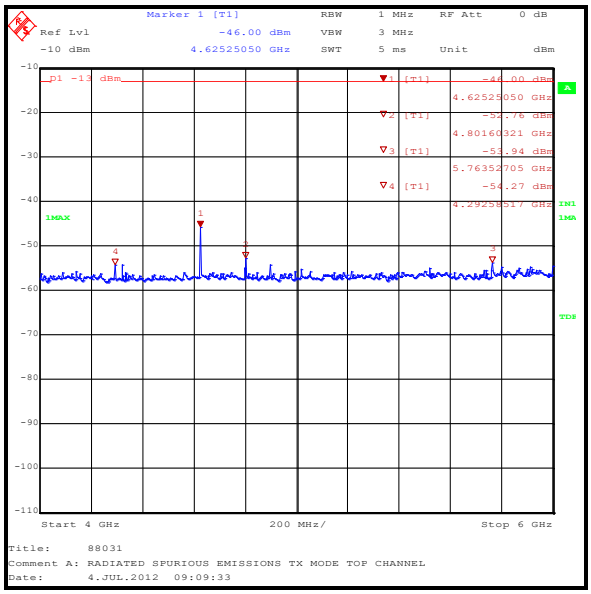
Results: Uplink / Input/Output signal 715.3 MHz

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
3843.687	-42.3	-13.0	29.3	Complied



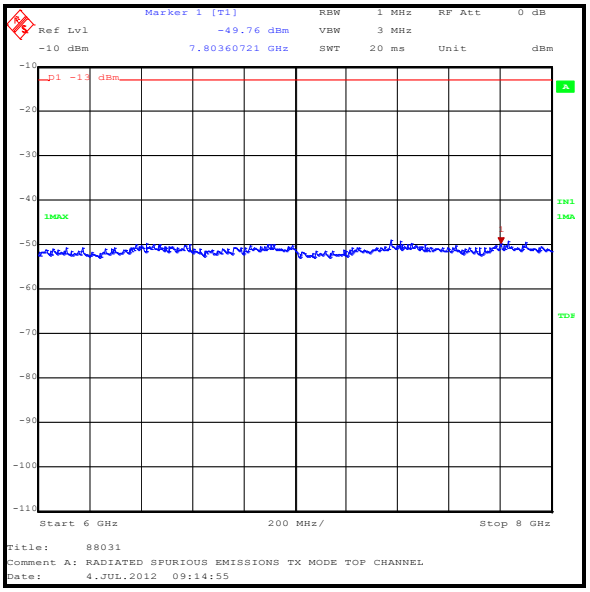






Transmitter Out of Band Radiated Emissions (continued)

Results: Uplink / Input/Output signal 715.3 MHz

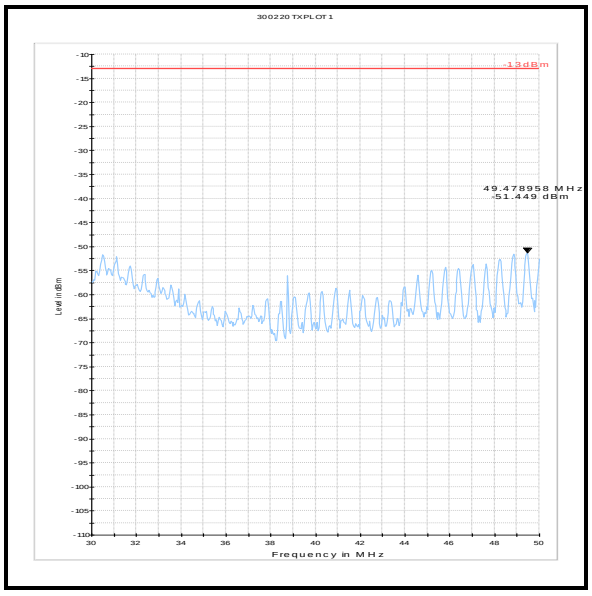


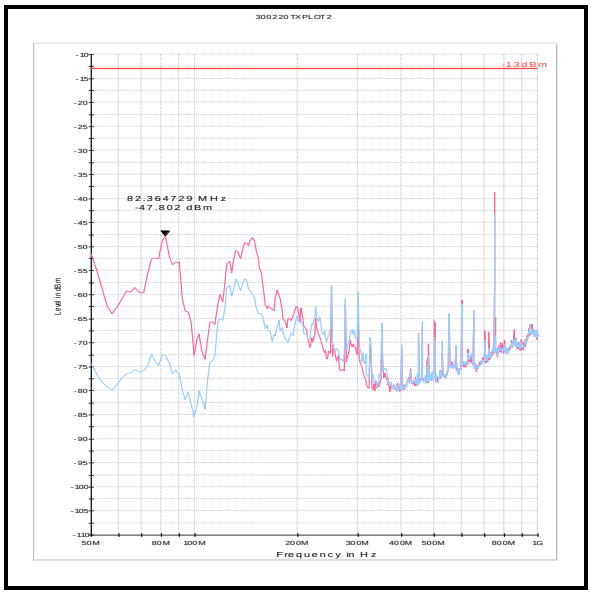
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

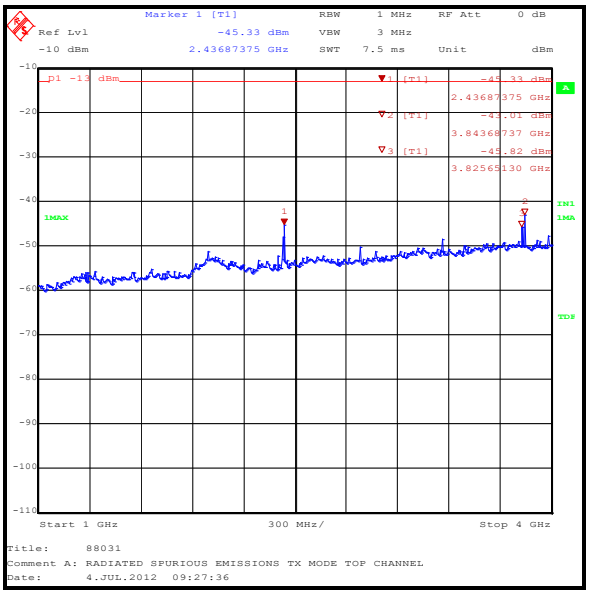
Transmitter Out of Band Radiated Emissions (continued)

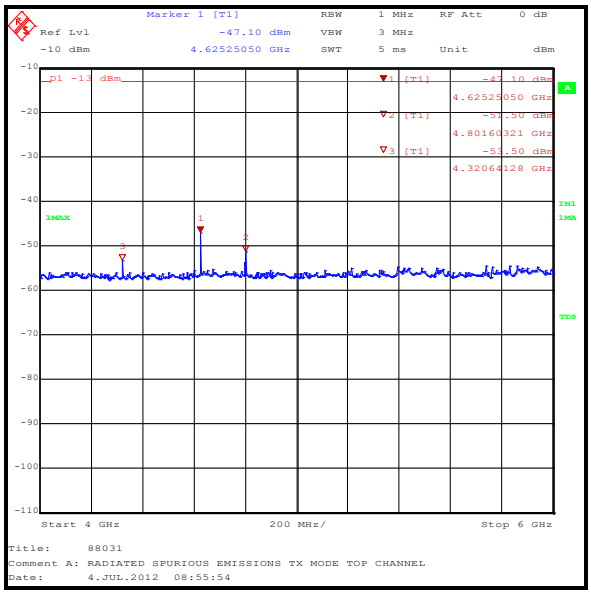
Results: Downlink Input/Output signal 745.3 MHz

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
3843.687	-43.0	-13.0	30.0	Complied



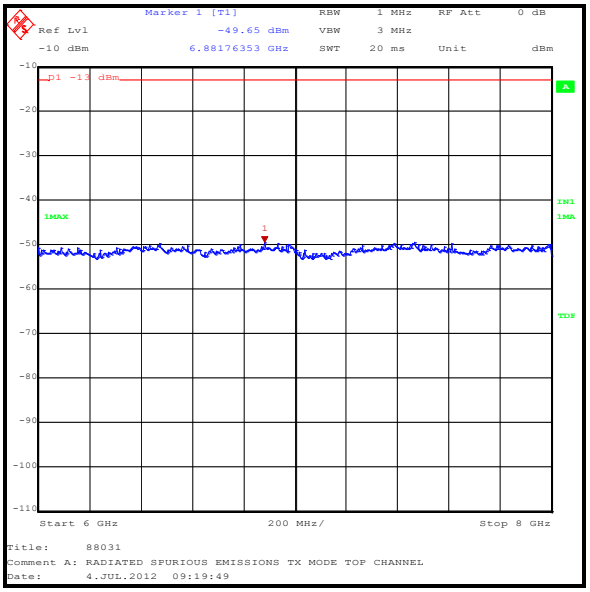






Transmitter Out of Band Radiated Emissions (continued)

Results: Downlink Input/Output signal 745.3 MHz



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.8. Transmitter Band Edge Conducted Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	14 August 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1051 & Part 27.53(g)
Test Method Used:	ANSI TIA-603-C-2004 Section 2.2.13 & FCC Part 27.53(g)

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	54

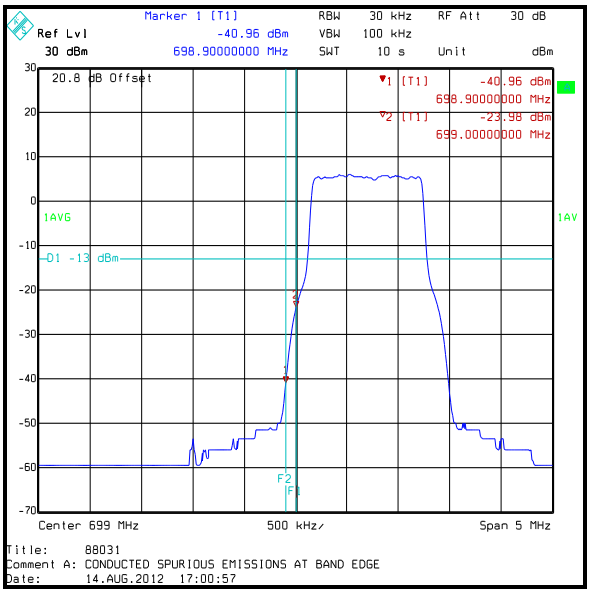
Note(s):

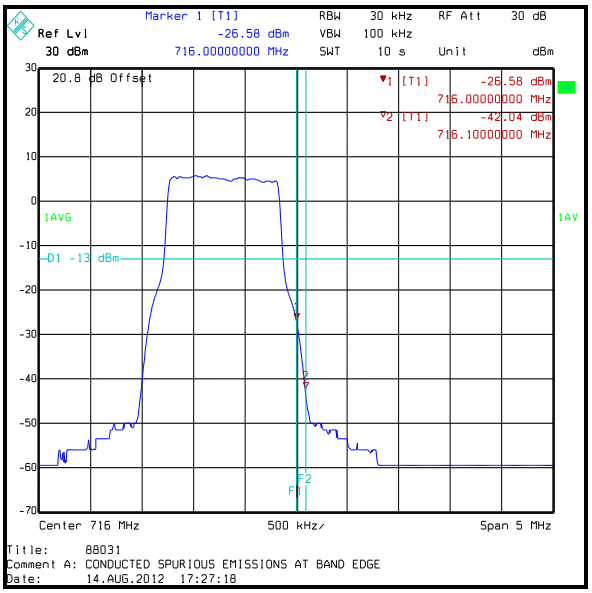
1. A signal generator was connected to the input port of the EUT using a suitable RF cable. The RF output of the EUT was connected to a spectrum analyser via suitable cables and attenuators. The cables and attenuators were calibrated before use and the RF level offset was incorporated into the measurements. The signal generator was set to output a modulated signal according to the technology under test on the bottom or top channel at a level corresponding to maximum output level for the EUT.
2. The EUT filters corresponding to the top and bottom of the operating band were activated for this test.
3. In accordance with FCC Part 27.53(g), measurements in the 100 kHz bands immediately outside and adjacent to the frequency blocks in the 698-746 MHz band were performed using a resolution bandwidth of at least 30 kHz.

Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth QPSK / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
699.000	-24.0	-13.0	11.0	Complied
716.000	-26.6	-13.0	13.6	Complied

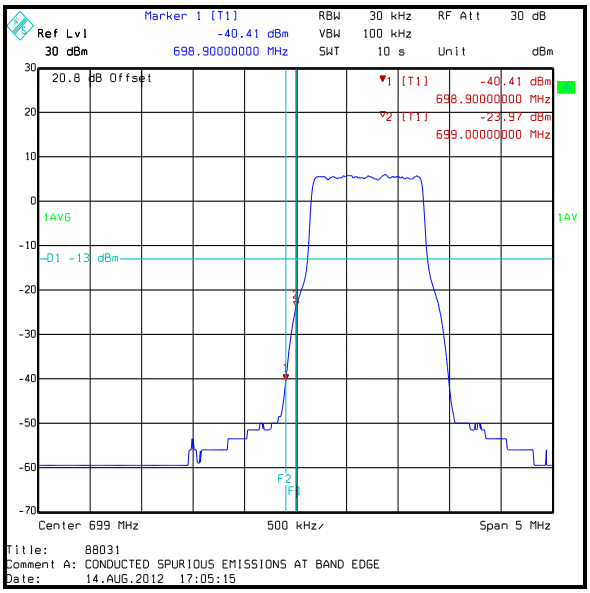


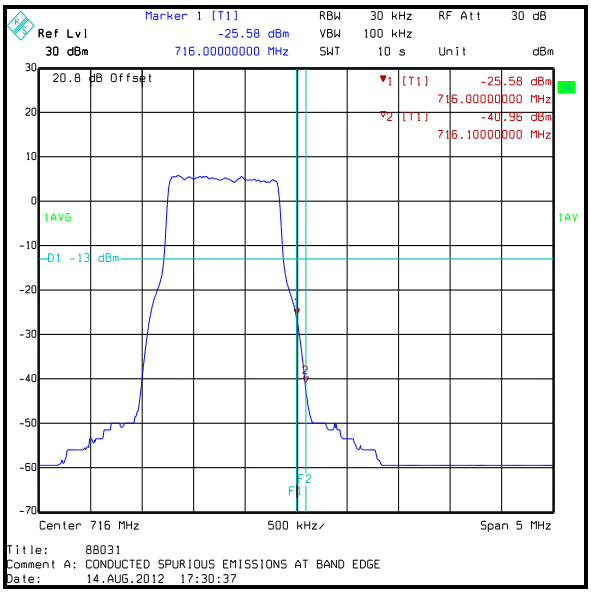


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth 16QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
699.000	-24.0	-13.0	11.0	Complied
716.000	-25.6	-13.0	12.6	Complied

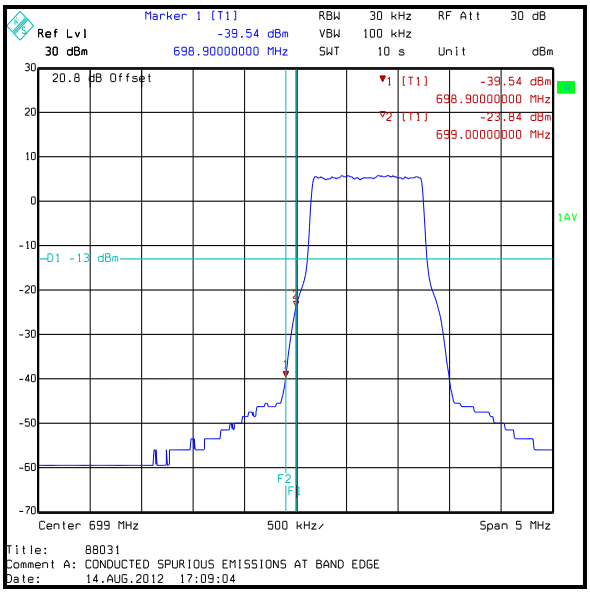


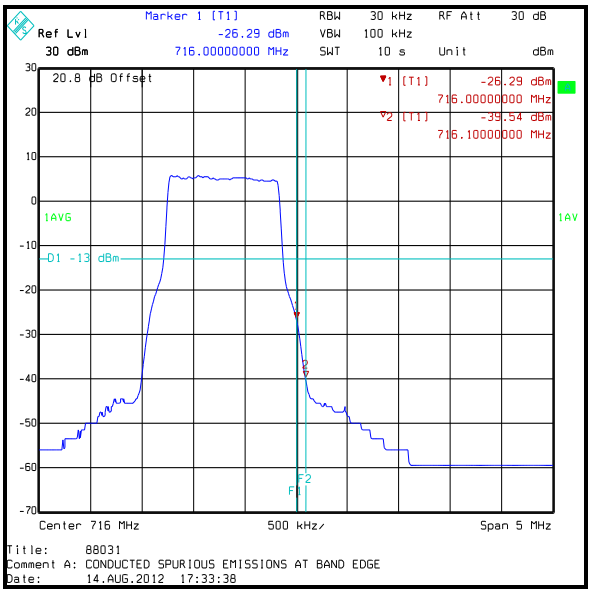


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth 64QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
699.000	-23.8	-13.0	10.8	Complied
716.000	-26.3	-13.0	13.3	Complied

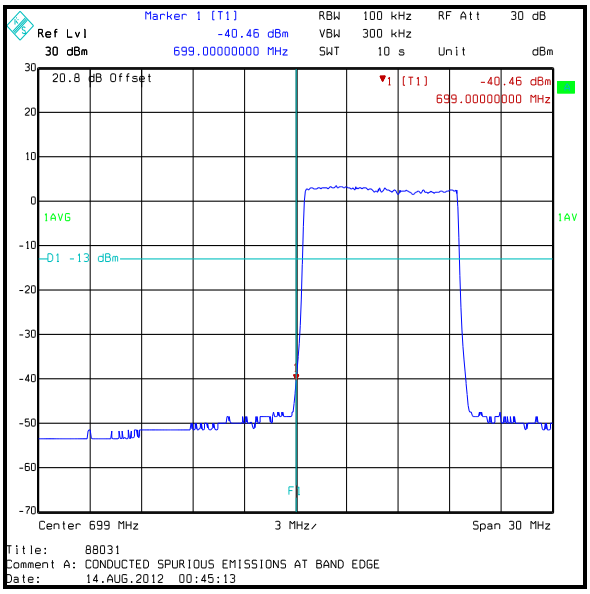


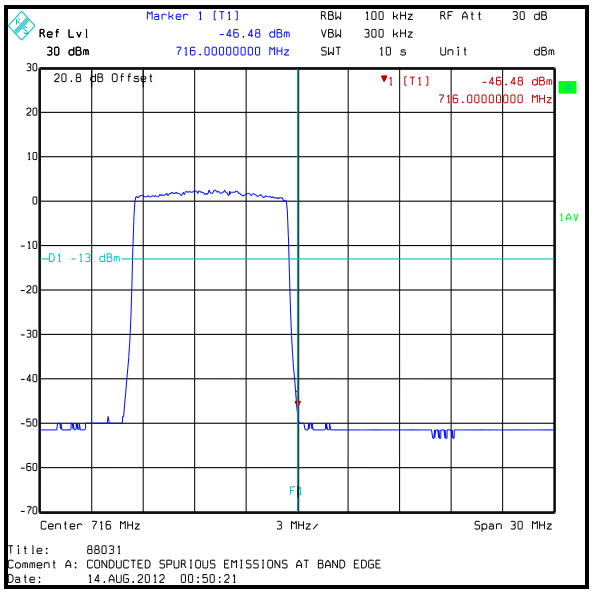


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth QPSK / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
699.000	-40.5	-13.0	27.5	Complied
716.000	-46.5	-13.0	33.5	Complied

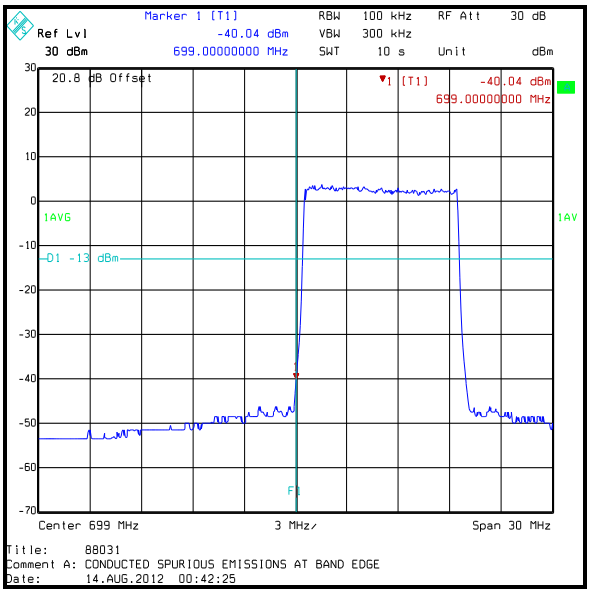


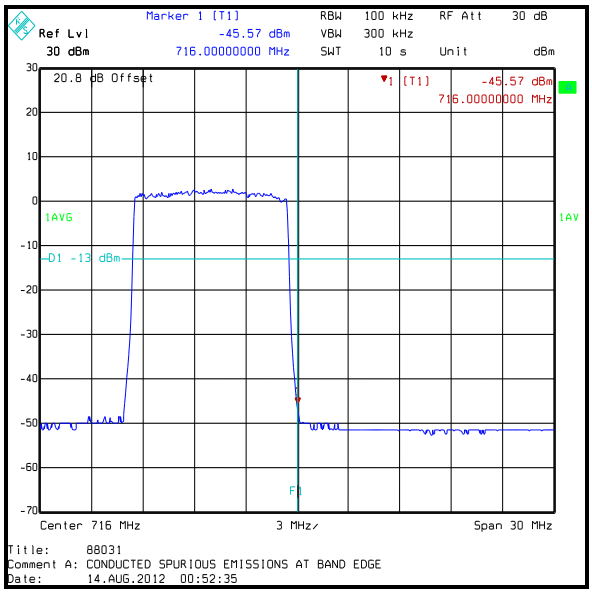


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth 16QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
699.000	-40.0	-13.0	27.0	Complied
716.000	-45.6	-13.0	32.6	Complied

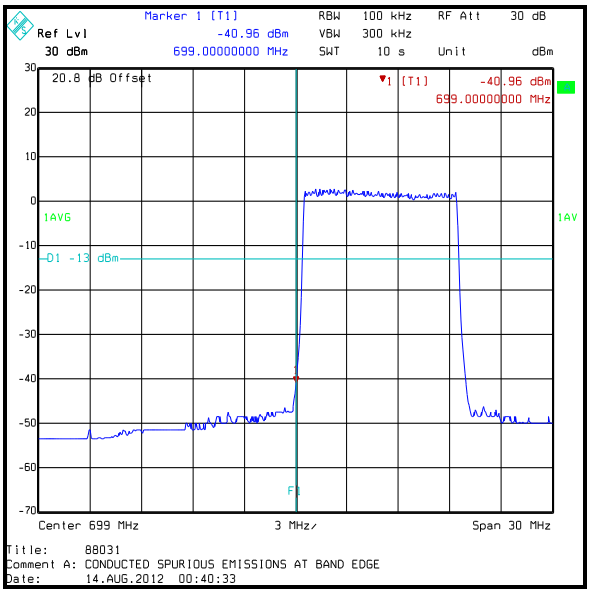


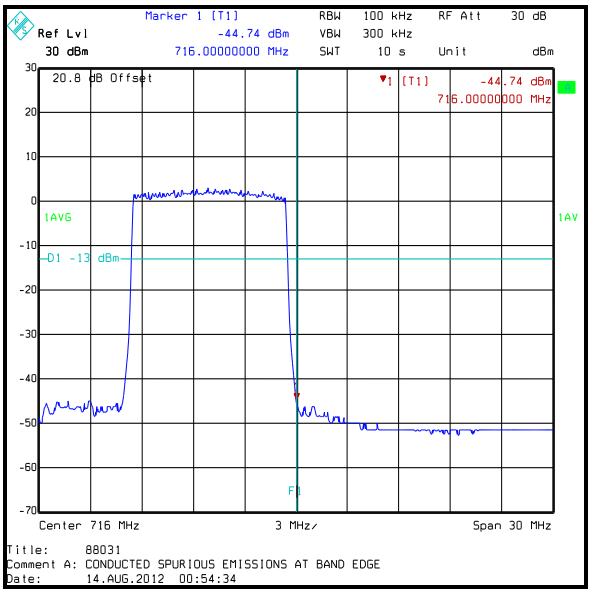


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth 64QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
699.000	-41.0	-13.0	28.0	Complied
716.000	-44.7	-13.0	31.7	Complied

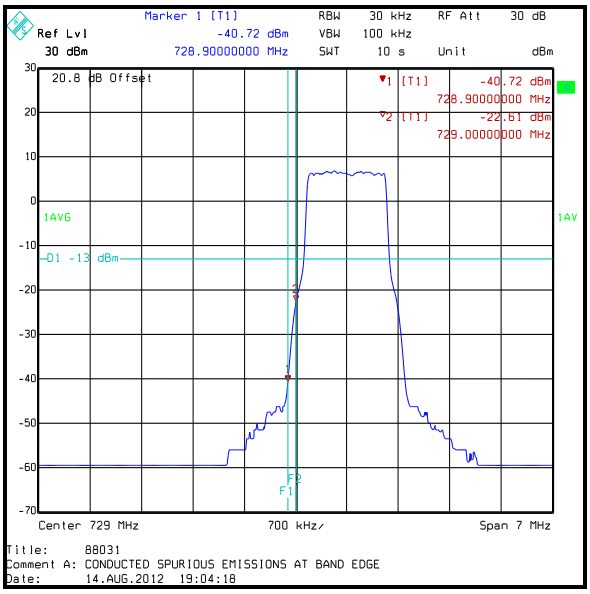


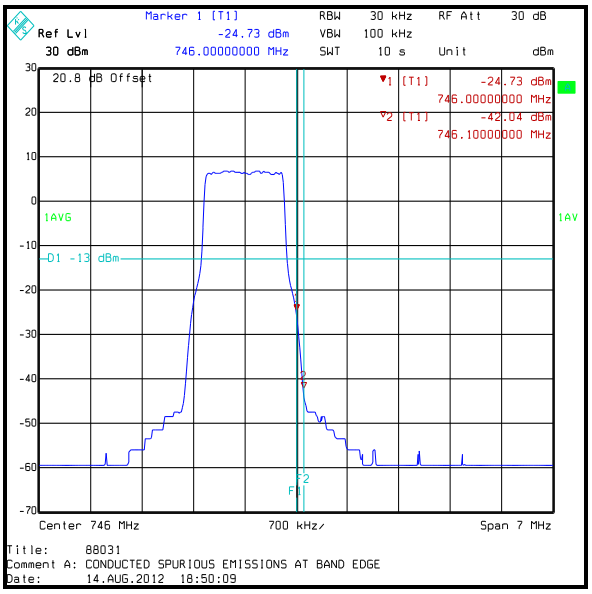


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth QPSK / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
729.000	-22.6	-13.0	9.6	Complied
746.000	-24.7	-13.0	11.7	Complied

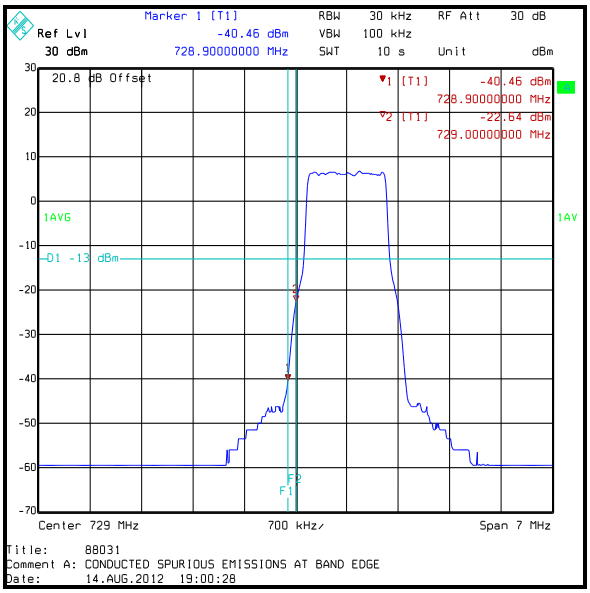


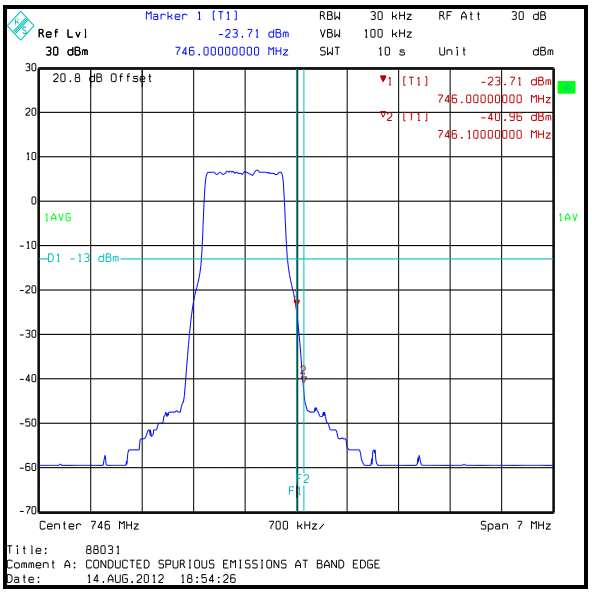


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth 16QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
729.000	-22.6	-13.0	9.6	Complied
746.000	-23.7	-13.0	10.7	Complied

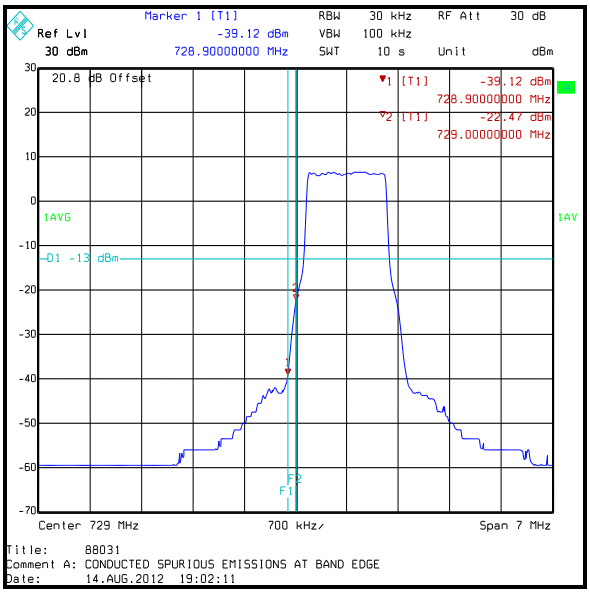


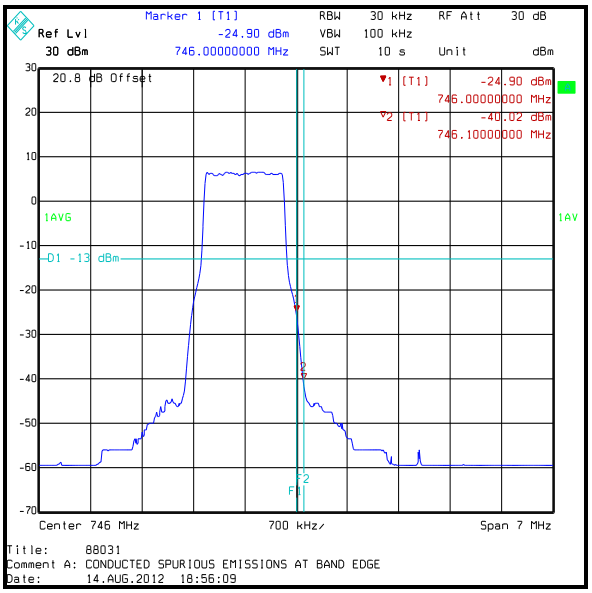


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth 64QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
729.000	-22.5	-13.0	9.5	Complied
746.000	-24.9	-13.0	11.9	Complied

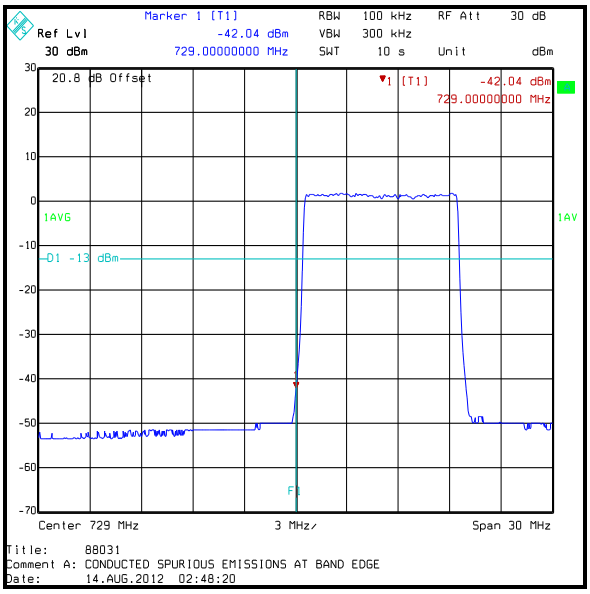


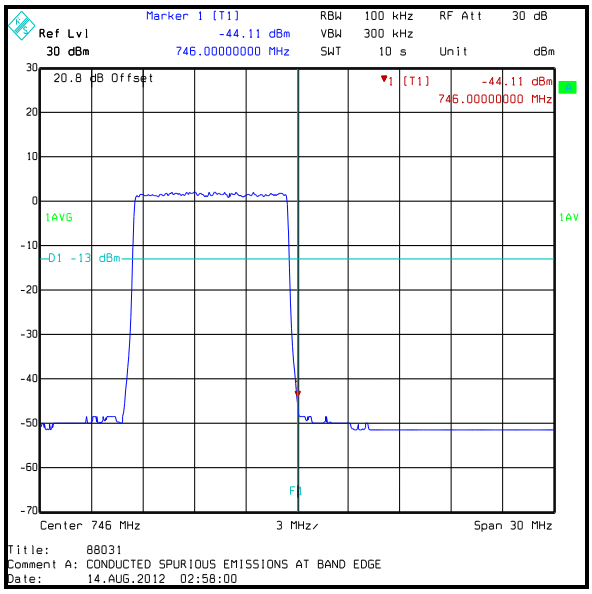


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth QPSK / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
729.000	-42.0	-13.0	29.0	Complied
746.000	-44.1	-13.0	31.1	Complied

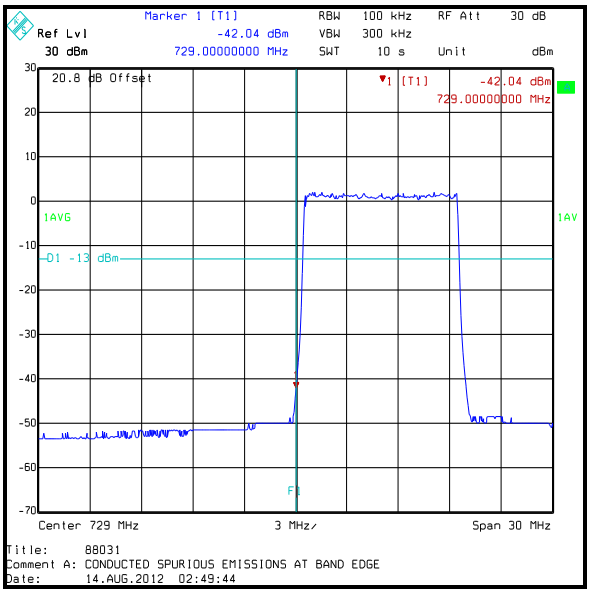


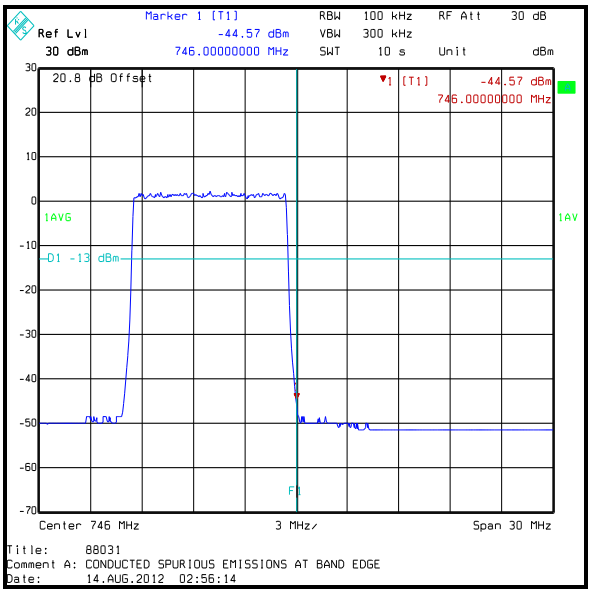


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth 16QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
729.000	-42.0	-13.0	29.0	Complied
746.000	-44.6	-13.0	31.6	Complied

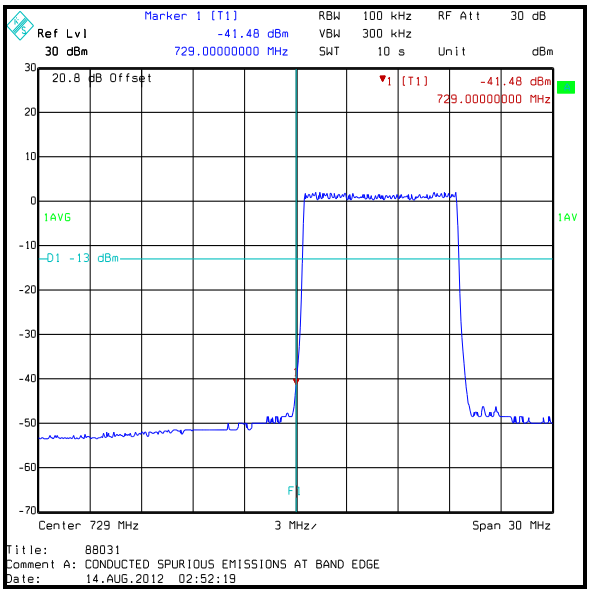


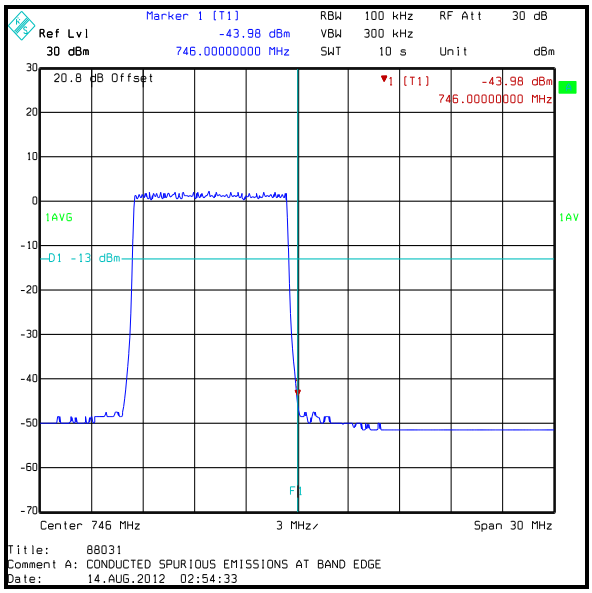


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth 64QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
729.000	-41.5	-13.0	28.5	Complied
746.000	-44.0	-13.0	31.0	Complied





5.3. Test Results Part 27- Band 4

5.3.1. AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	09 July 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 15.107(a)
Test Method Used:	As detailed in ANSI C63.4 Section 7

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	56

Note(s):

1. For the duration of this test all ports on the EUT were terminated with suitable 50 Ω loads or connected to a laptop computer providing suitable termination e.g. Ethernet port.
2. No RF signal was input into the EUT for this test.

AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.263	Live	42.5	61.4	18.9	Complied
0.438	Live	42.1	57.1	15.0	Complied
0.524	Live	40.9	56.0	15.1	Complied
0.960	Live	37.1	56.0	18.9	Complied
1.217	Live	38.4	56.0	17.6	Complied
1.311	Live	39.7	56.0	16.3	Complied
1.563	Live	39.7	56.0	16.3	Complied
2.009	Live	39.7	56.0	16.3	Complied
2.360	Live	38.4	56.0	17.6	Complied
2.607	Live	37.7	56.0	18.3	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.177	Live	43.2	54.6	11.4	Complied
0.348	Live	33.2	49.0	15.8	Complied
0.434	Live	40.1	47.2	7.1	Complied
0.524	Live	37.6	46.0	8.4	Complied
0.695	Live	32.3	46.0	13.7	Complied
1.221	Live	32.8	46.0	13.2	Complied
1.572	Live	33.1	46.0	12.9	Complied
1.923	Live	33.1	46.0	12.9	Complied
2.247	Live	32.5	46.0	13.5	Complied

AC Conducted Spurious Emissions (continued)

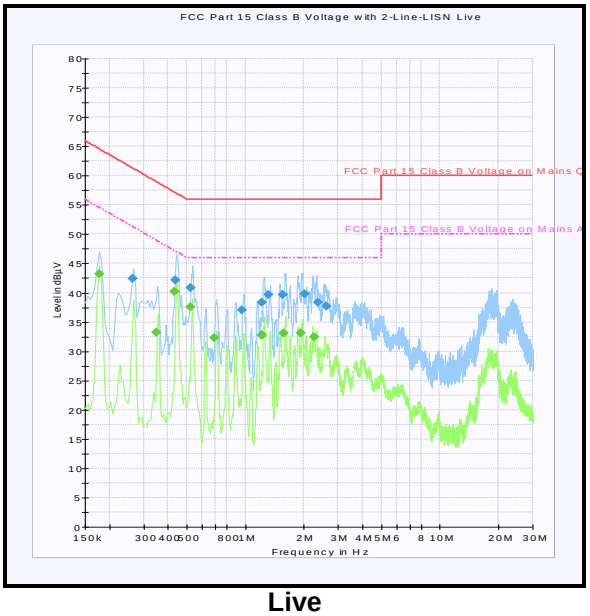
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.434	Neutral	47.1	57.2	10.1	Complied
0.524	Neutral	46.2	56.0	9.8	Complied
0.690	Neutral	44.0	56.0	12.0	Complied
0.780	Neutral	45.3	56.0	10.7	Complied
0.875	Neutral	45.8	56.0	10.2	Complied
0.960	Neutral	45.7	56.0	10.3	Complied
1.221	Neutral	45.7	56.0	10.3	Complied
1.307	Neutral	44.2	56.0	11.8	Complied
1.572	Neutral	44.0	56.0	12.0	Complied

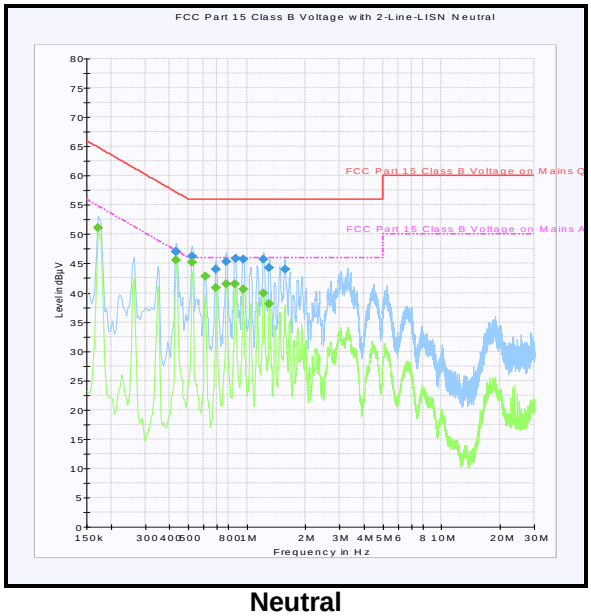
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.173	Neutral	51.1	54.8	3.7	Complied
0.434	Neutral	45.6	47.2	1.6	Complied
0.524	Neutral	45.2	46.0	0.8	Complied
0.609	Neutral	42.8	46.0	3.2	Complied
0.695	Neutral	40.9	46.0	5.1	Complied
0.780	Neutral	41.4	46.0	4.6	Complied
0.870	Neutral	41.5	46.0	4.5	Complied
0.960	Neutral	40.7	46.0	5.3	Complied
1.221	Neutral	39.9	46.0	6.1	Complied
1.307	Neutral	38.2	46.0	7.8	Complied

AC Conducted Spurious Emissions (continued)



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.3.2. Transmitter Conducted Output Power

Test Summary:

Test Engineers:	Mark Percival, David Doyle & Nick Steele	**Test Dates:**	09 July 2012 to 13 August 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1046(a), 27.50(d)(4) & 27.50(d)(2)(B)
Test Method Used:	FCC Part 2.1046(a) and channel power function of a spectrum analyser

Environmental Conditions:

Temperature (°C):	26 to 23
Relative Humidity (%):	37 to 50

Note(s):

1. The output port of the EUT was connected directly to a spectrum analyser via suitable attenuation. The cable and attenuator was calibrated prior to use and the loss incorporated into the measurement as an RF level offset.
2. The channel power function of the spectrum analyser was used in conjunction with an average detector. The channel bandwidth was set accordingly for each technology or modulation scheme under test.
3. For each channel tested, a corresponding filter was activated using the EUT's graphical user interface on a laptop PC.
4. In order to measure the maximum gain, the input signal from a signal generator was increased in steps of 1 dB from -60 dBm to find the minimum input level at which maximum output power is achieved for each technology and modulation scheme. For each case the input level was recorded
5. For each channel, technology and modulation scheme, the input signal was increased by 10 dB and the power was re-measured. In each case, this did not increase the output power; therefore, the worst case was recorded.
6. The uplink EIRP limit is stated in Part 27.50(d)(4) as 1 Watt (30 dBm). The highest power measured in the uplink was 20.5 dBm. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBi with no cable loss, the margin between the highest measured conducted power and EIRP limit is 9.5 dB.
7. The downlink EIRP limit stated in Part 27.50(d)(2)(B) for any device transmitting with an emission bandwidth greater than 1 MHz is 1640 Watts/MHz (62.1 dBm/MHz). The EUT operates with various emission bandwidths greater than 1 MHz therefore the limit has been recalculated according to the bandwidth under test. The limit for a 1.4 MHz bandwidth has been recalculated as $10\log_{10}$(1.4 MHz/1 MHz) = 1.46 dB. 1.46 dB was then added to 62.1 dBm/MHz. The recalculated limit for a 1.4 MHz channel is 63.56 dBm/1.4 MHz (2269.852 Watts/1.4 MHz). The highest conducted power measured with a 1.4 MHz channel bandwidth was 19.3 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBi with no cable loss, the margin between the highest measured conducted power and EIRP limit is 44.3 dB.

Transmitter Conducted Output Power (continued)

8. The downlink EIRP limit for a 3 MHz bandwidth has been recalculated as $10\log_{10}$(3 MHz/1 MHz) = 4.77 dB. 4.77 dB was then added to 62.1 dBm/MHz. The limit for a 3 MHz channel is 66.87 dBm/3 MHz (4864.072 Watts/3 MHz). The highest conducted power measured with a 3 MHz channel bandwidth was 19.6 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBi with no cable loss, the margin between the highest measured conducted power and EIRP limit is 47.3 dB.
9. The downlink EIRP limit for a 5 MHz bandwidth has been recalculated as $10\log_{10}$(5 MHz/1 MHz) = 6.99 dB. 6.99 dB was then added to 62 dBm/MHz. The limit for a 5 MHz channel is 68.99 dBm/5 MHz (7925.013 Watts/5 MHz). The highest power measured with a 5 MHz channel bandwidth was 19.9 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBi with no cable loss, the margin between the highest measured conducted power and EIRP limit is 49.1 dB.
10. The downlink EIRP limit for a 10 MHz bandwidth has been recalculated as $10\log_{10}$(10 MHz/1MHz) = 10.0 dB. 10.0 dB was then added to 62 dBm/MHz. The limit for a 10 MHz channel is 72 dBm/10 MHz (15848.932 Watts/10 MHz). The highest power measured with a 10 MHz channel bandwidth was 20.0 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBi with no cable loss, the margin between the highest measured conducted power and EIRP limit is 52.0 dB.
11. The downlink EIRP limit for a 15 MHz bandwidth has been recalculated as $10\log_{10}$(15 MHz/1 MHz) = 11.76 dB. 11.76 dB was then added to 62 dBm/MHz. The limit for a 15 MHz channel is 73.76 dBm/15 MHz (23768.403 Watts/15 MHz). The highest power measured with a 15 MHz channel bandwidth was 20.3 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBi with no cable loss, the margin between the highest measured conducted power and EIRP limit is 53.5 dB.
12. The downlink EIRP limit for a 20 MHz bandwidth has been recalculated as $10\log_{10}$(20 MHz /1 MHz) = 13.01 dB. 13.01 dB was then added to 62 dBm/MHz. The limit for a 20 MHz channel is 75.01 dBm/20 MHz (31695.675 Watts/20 MHz). The highest power measured with a 20 MHz channel bandwidth was 20.3 dBm in the downlink. The antenna gain and cable losses are unknown. Assuming an antenna gain of 0 dBi with no cable loss, the margin between the highest measured conducted power and EIRP limit is 54.7 dB.

Transmitter Conducted Output Power (continued)

Results: WCDMA / Uplink

Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
Bottom	1712.5	-51.0	20.5	71.5
Middle	1732.6	-51.0	19.8	70.8
Top	1752.5	-51.0	20.3	71.3

Results: LTE / Uplink

Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
QPSK	1.4	Bottom	1710.7	-51.0	19.2	70.2
		Middle	1732.5	-51.0	19.3	70.3
		Top	1754.3	-51.0	19.7	70.7
	3.0	Bottom	1711.5	-51.0	19.4	70.4
		Middle	1732.5	-51.0	19.5	70.5
		Top	1753.5	-51.0	19.2	70.2
	5.0	Bottom	1712.5	-51.0	19.2	70.2
		Middle	1732.5	-51.0	19.4	70.4
		Top	1752.5	-51.0	19.1	70.1
	10.0	Bottom	1715.0	-51.0	19.3	70.3
		Middle	1732.5	-51.0	19.7	70.7
		Top	1750.0	-51.0	19.3	70.3
	15.0	Bottom	1717.5	-51.0	19.4	70.4
		Middle	1732.5	-51.0	19.7	70.7
		Top	1747.5	-51.0	20.3	71.3
	20.0	Bottom	1720.0	-51.0	20.0	71.0
		Middle	1732.5	-51.0	20.2	71.2
		Top	1745.0	-51.0	20.3	71.3
16QAM	1.4	Bottom	1710.7	-51.0	19.1	70.1
		Middle	1732.5	-51.0	19.3	70.3
		Top	1754.3	-51.0	19.8	70.8
	3.0	Bottom	1711.5	-51.0	19.4	70.4
		Middle	1732.5	-51.0	19.5	70.5
		Top	1753.5	-51.0	19.2	70.2
	5.0	Bottom	1712.5	-51.0	19.3	70.3
		Middle	1732.5	-51.0	19.5	70.5
		Top	1752.5	-51.0	19.1	70.1
	10.0	Bottom	1715.0	-51.0	19.3	70.3
		Middle	1732.5	-51.0	19.7	70.7
		Top	1750.0	-51.0	19.4	70.4
	15.0	Bottom	1717.5	-51.0	19.5	70.5
		Middle	1732.5	-51.0	19.6	70.6
		Top	1747.5	-51.0	19.3	70.3
	20.0	Bottom	1720.0	-51.0	20.0	71.0
		Middle	1732.5	-51.0	20.2	71.2
		Top	1745.0	-51.0	20.4	71.4

Transmitter Conducted Output Power (continued)

Results: LTE / Uplink

Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
64QAM	1.4	Bottom	1710.7	-51.0	19.2	70.2
		Middle	1732.5	-51.0	19.4	70.4
		Top	1754.3	-51.0	19.8	70.8
	3.0	Bottom	1711.5	-51.0	19.4	70.4
		Middle	1732.5	-51.0	19.5	70.5
		Top	1753.5	-51.0	19.1	70.1
	5.0	Bottom	1712.5	-51.0	19.2	70.2
		Middle	1732.5	-51.0	19.4	70.4
		Top	1752.5	-51.0	19.0	70.0
	10.0	Bottom	1715.0	-51.0	19.3	70.3
		Middle	1732.5	-51.0	19.6	70.6
		Top	1750.0	-51.0	19.3	70.3
	15.0	Bottom	1717.5	-51.0	19.4	70.4
		Middle	1732.5	-51.0	19.6	70.6
		Top	1747.5	-51.0	19.3	70.3
	20.0	Bottom	1720.0	-51.0	20.0	71.0
		Middle	1732.5	-51.0	20.2	71.2
		Top	1745.0	-51.0	20.3	71.3

Transmitter Conducted Output Power (continued)

Results: WCDMA / Downlink

Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
Bottom	2152.5	-51.0	19.4	70.4
Middle	2132.6	-51.0	19.9	70.9
Top	2112.5	-51.0	18.8	69.8

Results: LTE / Downlink

Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
QPSK	1.4	Bottom	2110.7	-51.0	19.1	70.1
		Middle	2132.5	-51.0	19.3	70.3
		Top	2154.3	-51.0	18.8	69.8
	3.0	Bottom	2111.5	-51.0	19.6	70.6
		Middle	2132.5	-51.0	19.2	70.2
		Top	2153.5	-51.0	19.2	70.2
	5.0	Bottom	2112.5	-51.0	19.6	70.6
		Middle	2132.5	-51.0	19.2	70.2
		Top	2152.5	-51.0	19.2	70.2
	10.0	Bottom	2115.0	-51.0	19.9	70.9
		Middle	2132.5	-51.0	19.4	70.4
		Top	2150.0	-51.0	19.2	70.2
	15.0	Bottom	2117.5	-51.0	20.2	71.2
		Middle	2132.5	-51.0	19.8	70.8
		Top	2147.5	-51.0	19.6	70.6
	20.0	Bottom	2120.0	-51.0	20.3	71.3
		Middle	2132.5	-51.0	20.1	71.1
		Top	2145.0	-51.0	19.9	70.9
16QAM	1.4	Bottom	2110.7	-51.0	19.0	70.0
		Middle	2132.5	-51.0	19.3	70.3
		Top	2154.3	-51.0	18.8	69.8
	3.0	Bottom	2111.5	-51.0	19.5	70.5
		Middle	2132.5	-51.0	19.1	70.1
		Top	2153.5	-51.0	19.1	70.1
	5.0	Bottom	2112.5	-51.0	19.6	70.6
		Middle	2132.5	-51.0	19.4	70.4
		Top	2152.5	-51.0	19.2	70.2
	10.0	Bottom	2115.0	-51.0	20.0	71.0
		Middle	2132.5	-51.0	19.5	70.5
		Top	2150.0	-51.0	19.2	70.2
	15.0	Bottom	2117.5	-51.0	20.3	71.3
		Middle	2132.5	-51.0	19.8	70.8
		Top	2147.5	-51.0	19.7	70.7
	20.0	Bottom	2120.0	-51.0	20.3	71.3
		Middle	2132.5	-51.0	20.0	71.0
		Top	2145.0	-51.0	19.8	70.8

Transmitter Conducted Output Power (continued)

Results: LTE / Downlink

Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Input Power (dBm)	Conducted Output Power (dBm)	Amplifier Gain (dB)
64QAM	1.4	Bottom	2110.7	-51.0	19.1	70.1
		Middle	2132.5	-51.0	19.3	70.3
		Top	2154.3	-51.0	18.8	69.8
	3.0	Bottom	2111.5	-51.0	19.4	70.4
		Middle	2132.5	-51.0	19.0	70.0
		Top	2153.5	-51.0	19.0	70.0
	5.0	Bottom	2112.5	-51.0	19.5	70.5
		Middle	2132.5	-51.0	19.3	70.3
		Top	2152.5	-51.0	19.2	70.2
	10.0	Bottom	2115.0	-51.0	19.9	70.9
		Middle	2132.5	-51.0	19.5	70.5
		Top	2150.0	-51.0	19.1	70.1
	15.0	Bottom	2117.5	-51.0	20.2	71.2
		Middle	2132.5	-51.0	19.8	70.8
		Top	2147.5	-51.0	19.6	70.6
	20.0	Bottom	2120.0	-51.0	20.3	71.3
		Middle	2132.5	-51.0	20.0	71.0
		Top	2145.0	-51.0	19.8	70.8

5.3.3. Transmitter Peak to Average Power Ratio

Test Summary:

Test Engineer:	Patrick Jones	**Test Date:**	16 August 2012
Test Sample Serial Number:	11120003		

FCC Part:	27.50(d)(5)
Test Method Used:	FCC KDB 971168

Environmental Conditions:

Temperature (°C):	26
Relative Humidity (%):	42

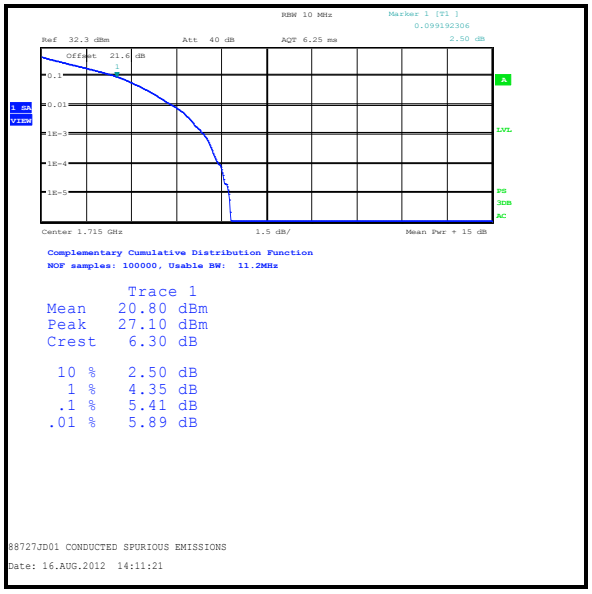
Note(s):

1. PAPR measurements were performed using the CCDF function of a calibrated test receiver in accordance with Section 6.0 of FCC KDB 971168 D01.

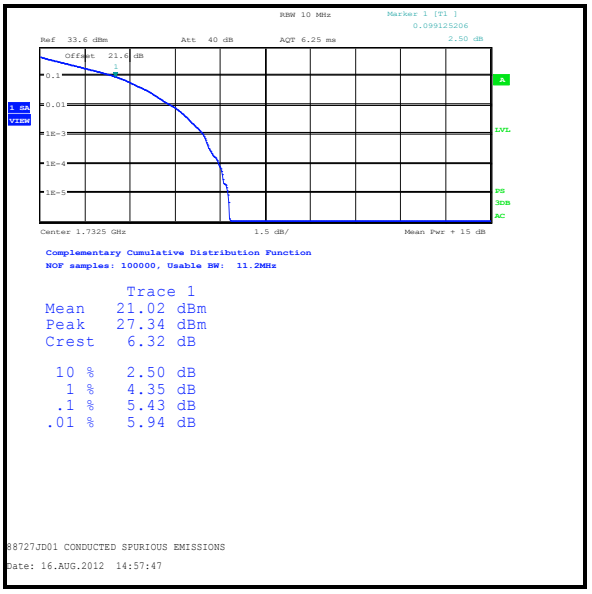
Transmitter Peak to Average Power Ratio (continued)

Results: QPSK / Uplink

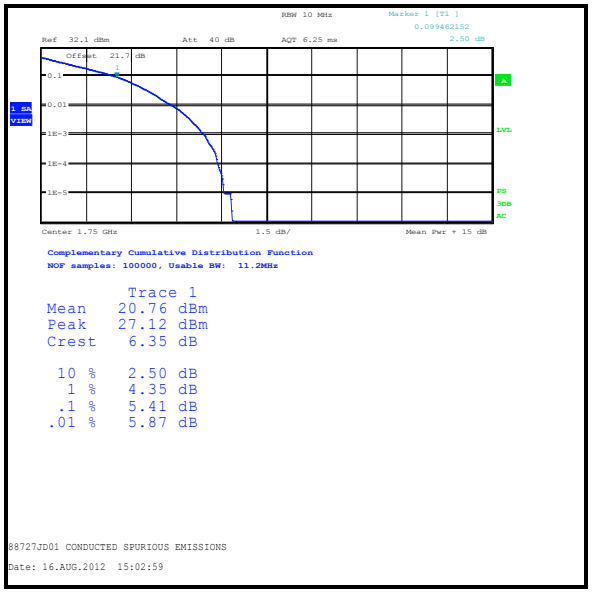
Channel	0.1% PAPR (dB)	PAPR Limit (dB)	Margin (dB)	Result
Bottom	5.41	13.0	7.59	Complied
Middle	5.43	13.0	7.57	Complied
Top	5.41	13.0	7.59	Complied



Bottom Channel



Middle Channel

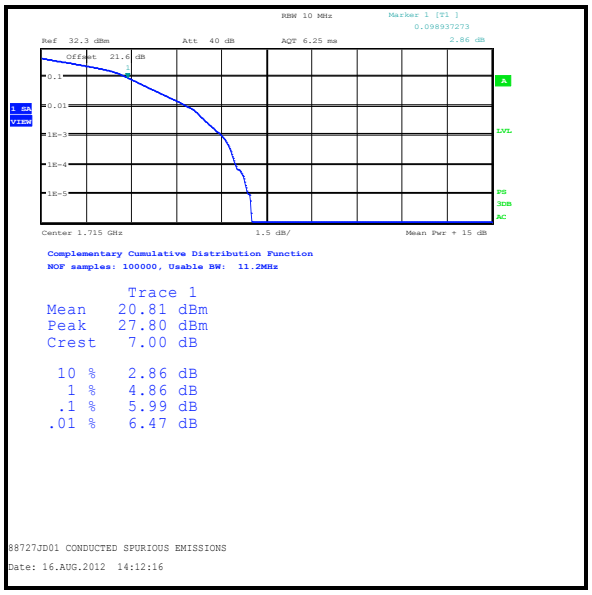


Top Channel

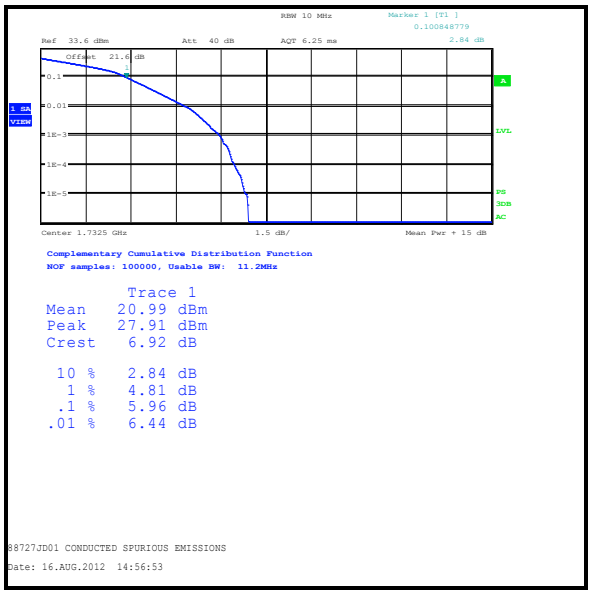
Transmitter Peak to Average Power Ratio (continued)

Results: 16QAM / Uplink

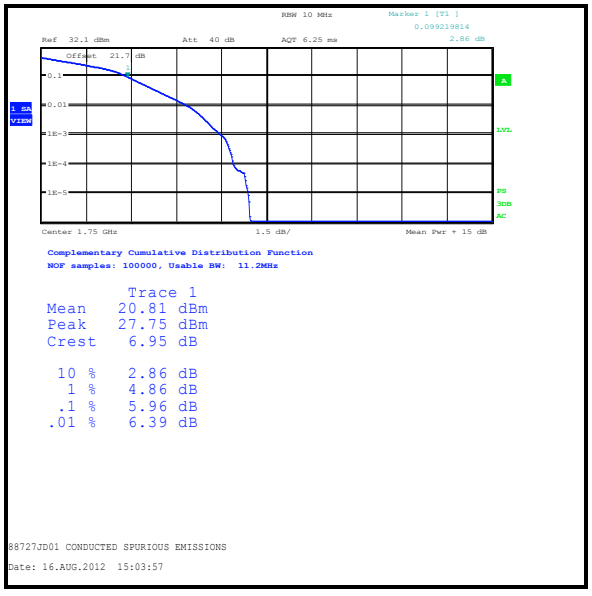
Channel	0.1% PAPR (dB)	PAPR Limit (dB)	Margin (dB)	Result
Bottom	5.99	13.0	7.01	Complied
Middle	5.96	13.0	7.04	Complied
Top	5.96	13.0	7.04	Complied



Bottom Channel



Middle Channel

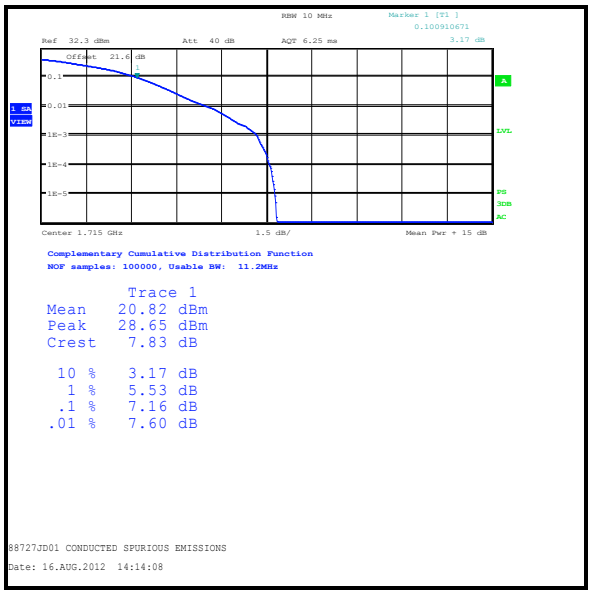


Top Channel

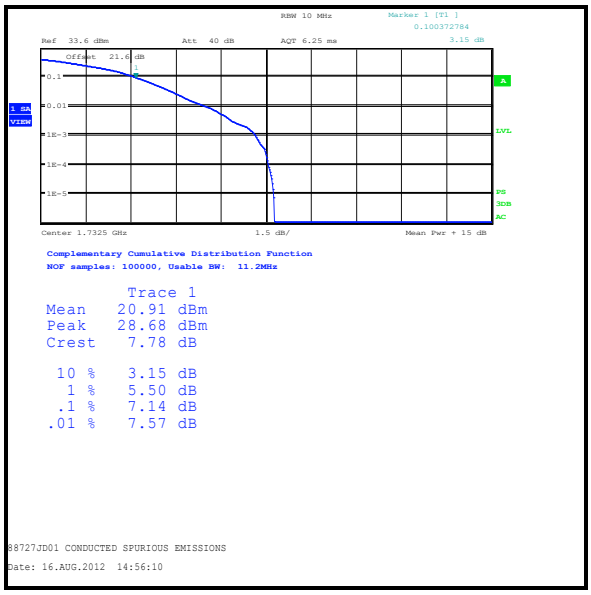
Transmitter Peak to Average Power Ratio (continued)

Results: 64QAM / Uplink

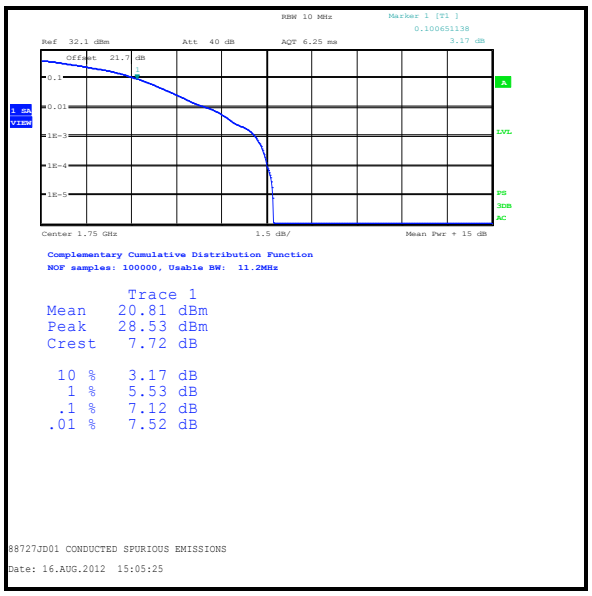
Channel	0.1% PAPR (dB)	PAPR Limit (dB)	Margin (dB)	Result
Bottom	7.16	13.0	5.84	Complied
Middle	7.14	13.0	5.86	Complied
Top	7.12	13.0	5.88	Complied



Bottom Channel



Middle Channel

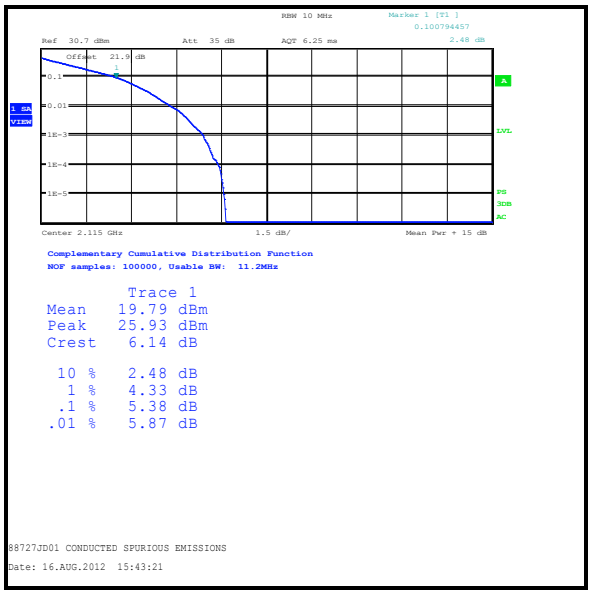


Top Channel

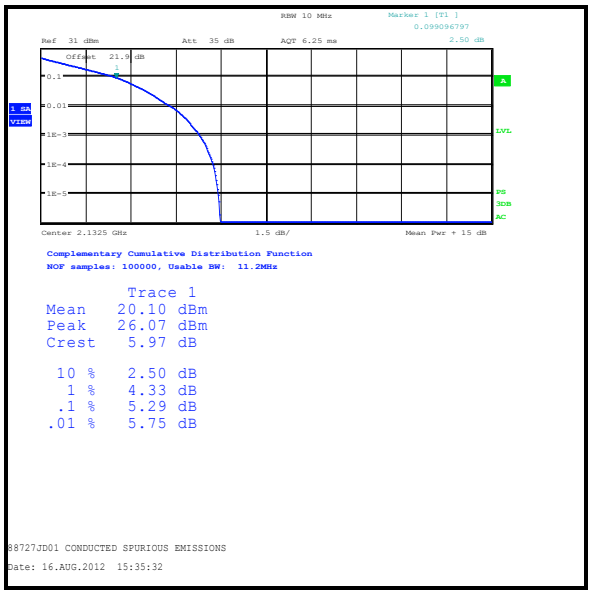
Transmitter Peak to Average Power Ratio (continued)

Results: QPSK / Downlink

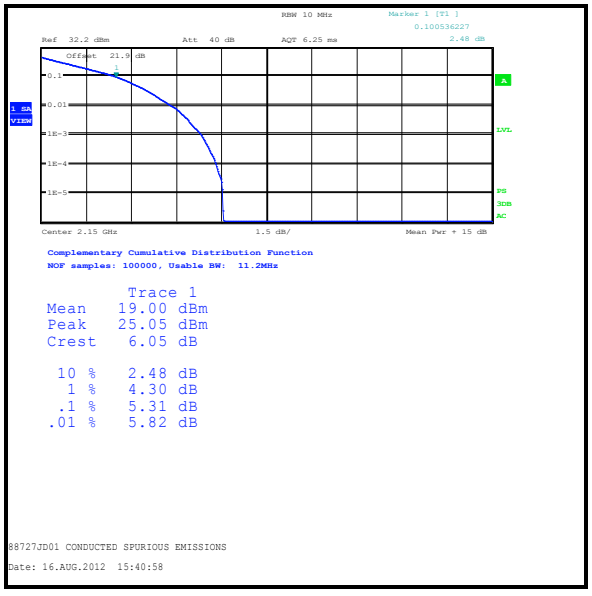
Channel	0.1% PAPR (dB)	PAPR Limit (dB)	Margin (dB)	Result
Bottom	5.38	13.0	7.62	Complied
Middle	5.29	13.0	7.71	Complied
Top	5.31	13.0	7.69	Complied



Bottom Channel



Middle Channel

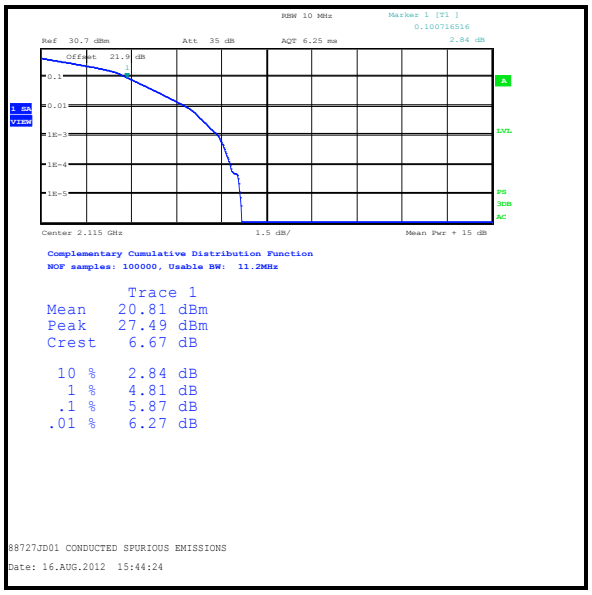


Top Channel

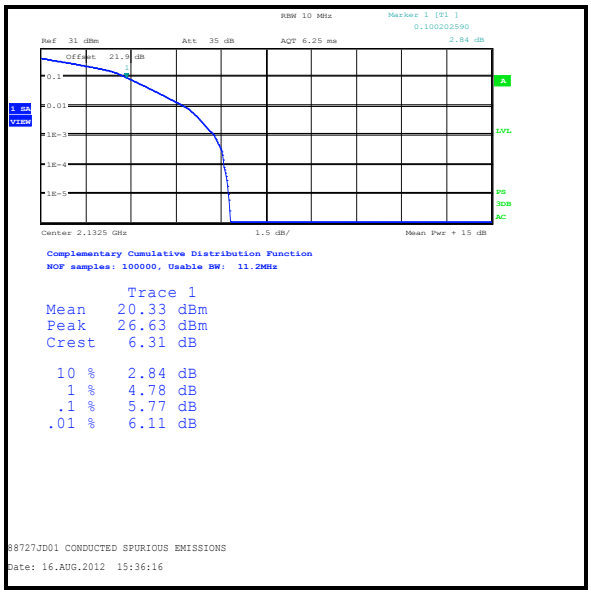
Transmitter Peak to Average Power Ratio (continued)

Results: 16QAM / Downlink

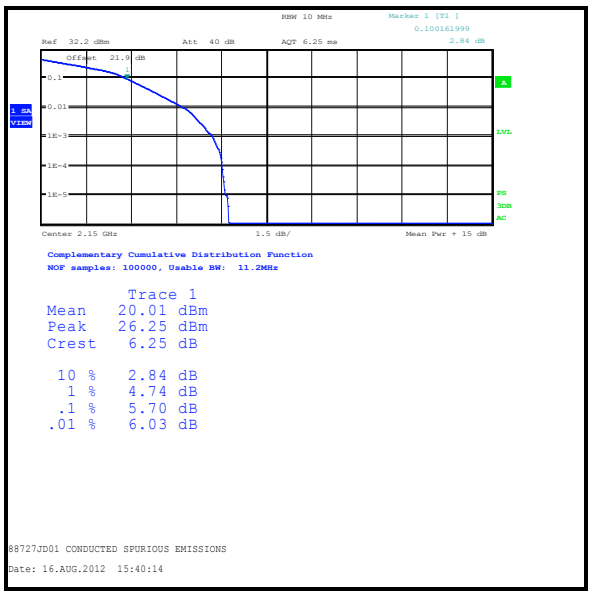
Channel	0.1% PAPR (dB)	PAPR Limit (dB)	Margin (dB)	Result
Bottom	5.87	13.0	7.13	Complied
Middle	5.77	13.0	7.23	Complied
Top	5.70	13.0	7.30	Complied



Bottom Channel



Middle Channel

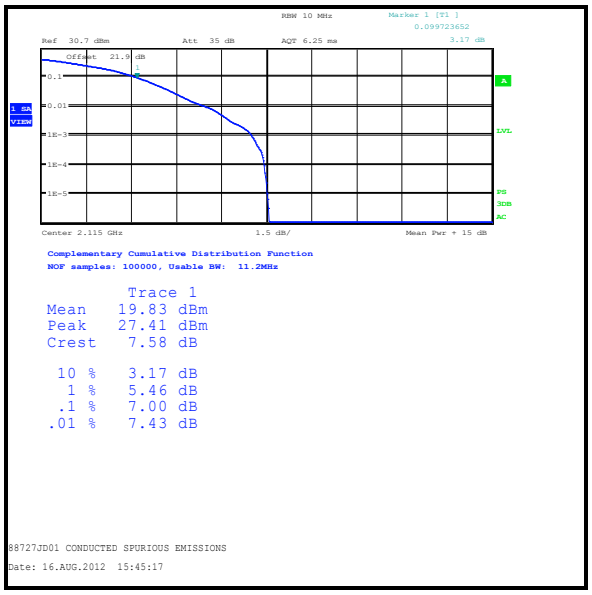


Top Channel

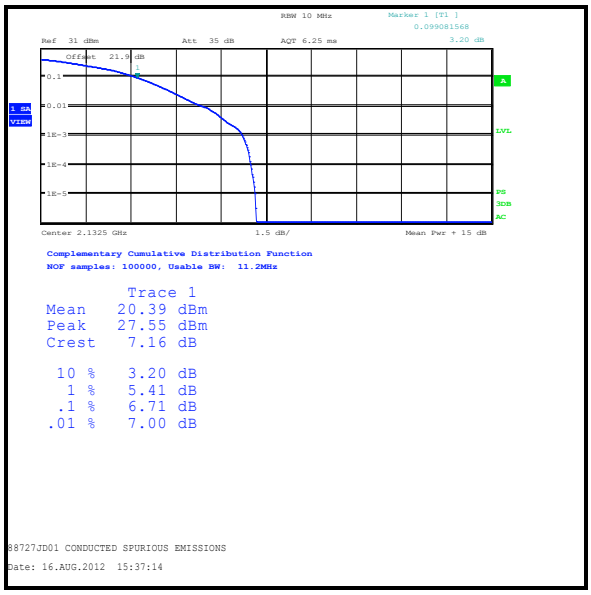
Transmitter Peak to Average Power Ratio (continued)

Results: 64QAM / Downlink

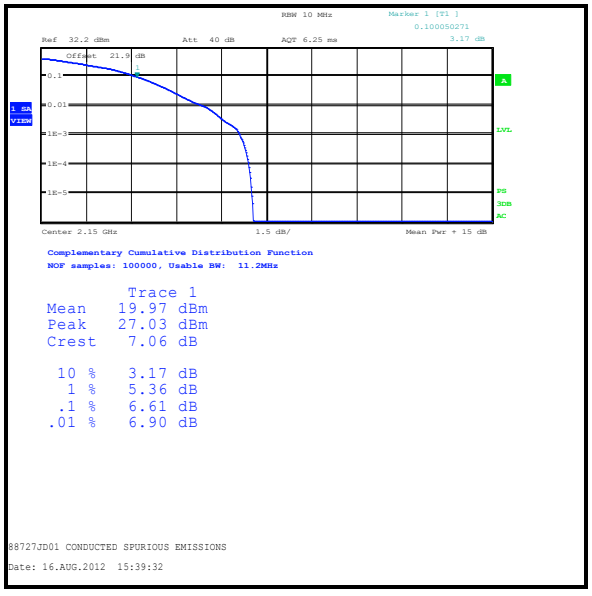
Channel	0.1% PAPR (dB)	PAPR Limit (dB)	Margin (dB)	Result
Bottom	7.00	13.0	6.00	Complied
Middle	6.71	13.0	6.29	Complied
Top	6.61	13.0	6.39	Complied



Bottom Channel



Middle Channel



Top Channel

5.3.4. Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineers:	Nick Steele & Andrew Edwards	**Test Date:**	06 August 2012
Test Sample Serial Number:	11120003		

FCC Part:	2.1055 & 27.54
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.2 referencing FCC CFR Part 2.1055

Environmental Conditions:

Ambient Temperature (°C):	27
Relative Humidity (%):	42

Note(s):

1. A signal generator was set to produce a CW signal at EUT maximum input level on the lowest channel of the downlink operating band (2110.700000 MHz) and the highest channel of the downlink operating band (2154.300000 MHz). The accuracy of the signal generator was verified prior to testing by using the frequency count function of a calibrated spectrum analyser. A calibrated test receiver with the same measurement settings as the spectrum analyser was used to monitor the CW output of the EUT. To ensure the accuracy and stability of all measurements, the reference 10 MHz clock from the test receiver was utilized to provide a reference clock for the other test equipment. The signal generator, spectrum analyser and EUT RF connectors were connected using suitable RF cables and an RF power divider. The measured frequency of the signal generator at the EUT input was then compared to the measured frequency of the output of the EUT and recorded in the result tables. Tests were performed from the point where the EUT became operational after power on and repeated at one minute intervals up to 10 minutes after initialisation. The output frequency was compared to the lower and upper band edge frequencies to obtain the margin.
2. Temperature was monitored throughout the test with a calibrated digital thermometer.
3. The EUT output frequency was monitored and remained within the frequency limits of Band 4, 2110 MHz to 2155 MHz.

Transmitter Frequency Stability (Temperature Variation)(continued)

Results: Bottom Channel (Input Frequency 2110.700000 MHz)

Temperature (°C)	Time after Start-up					
	0 minutes (Output Frequency MHz)	1 minute (Output Frequency MHz)	2 minutes (Output Frequency MHz)	3 minutes (Output Frequency MHz)	4 minutes (Output Frequency MHz)	5 minutes (Output Frequency MHz)
-30	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
-20	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
-10	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
0	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
10	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
20	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
30	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
40	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
50	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000

Temperature (°C)	Time after Start-up				
	6 minutes (Output Frequency MHz)	7 minutes (Output Frequency MHz)	8 minutes (Output Frequency MHz)	9 minutes (Output Frequency MHz)	10 minutes (Output Frequency MHz)
-30	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
-20	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
-10	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
0	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
10	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
20	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
30	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
40	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000
50	2110.700000	2110.700000	2110.700000	2110.700000	2110.700000

Frequency closest to Lower Band 12 Edge (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
2110.700000	2110.0	0.7	Complied

Transmitter Frequency Stability (Temperature Variation)(continued)

Results: Top Channel (2154.300000 MHz)

Temperature (°C)	Time after Start-up					
	0 minutes (Output Frequency MHz)	1 minute (Output Frequency MHz)	2 minutes (Output Frequency MHz)	3 minutes (Output Frequency MHz)	4 minutes (Output Frequency MHz)	5 minutes (Output Frequency MHz)
-30	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
-20	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
-10	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
0	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
10	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
20	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
30	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
40	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
50	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000

Temperature (°C)	Time after Start-up				
	6 minutes (Output Frequency MHz)	7 minutes (Output Frequency MHz)	8 minutes (Output Frequency MHz)	9 minutes (Output Frequency MHz)	10 minutes (Output Frequency MHz)
-30	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
-20	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
-10	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
0	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
10	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
20	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
30	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
40	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000
50	2154.300000	2154.300000	2154.300000	2154.300000	2154.300000

Frequency closest to Upper Band 12 Edge (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
2154.300000	2155.0	0.7	Complied

5.3.5. Transmitter Frequency Stability (Voltage Variation)

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	06 August 2012
Test Sample Serial Number:	11120003		

FCC Part:	2.1055 & 27.54
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.2 referencing FCC CFR Part 2.1055

Environmental Conditions:

Temperature (°C):	27
Relative Humidity (%):	42

Note(s):

1. A signal generator was set to produce a CW signal at EUT maximum input level on the lowest channel of the downlink operating band (2110.700000 MHz) and the highest channel of the downlink operating band (2154.300000 MHz). The accuracy of the signal generator was verified prior to testing by using the frequency count function of a calibrated spectrum analyser. A calibrated test receiver with the same measurement settings as the spectrum analyser was used to monitor the CW output of the EUT. To ensure the accuracy and stability of all measurements, the reference 10 MHz clock from the test receiver was utilized to provide a reference clock for the other test equipment. The signal generator, spectrum analyser and EUT RF connectors were connected using suitable RF cables and an RF power divider. The measured frequency of the signal generator at the EUT input was then compared to the measured frequency of the output of the EUT and recorded in the result tables. Tests were performed from the point where the EUT became operational after power on and repeated at one minute intervals up to 10 minutes after initialisation. The output frequency was compared to the lower and upper band edge frequencies to obtain the margin.
2. Voltage was monitored throughout the test with a calibrated digital voltmeter.
3. The EUT output frequency was monitored and remained within the frequency limits of Band 4, 2110 MHz to 2155 MHz.

Results: Bottom Channel (Input Frequency 2110.700000 MHz)

Supply Voltage (VDC)	Output Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
102	2110.700000	2110.0	0.7	Complied
138	2110.700000	2110.0	0.7	Complied

Results: Top Channel (Output Frequency 745.300000 MHz)

Supply Voltage (VDC)	Output Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
102	2154.300000	2155.0	0.7	Complied
138	2154.300000	2155.0	0.7	Complied

5.3.6. Transmitter Occupied Bandwidth

Test Summary:

Test Engineers:	Mark Percival, David Doyle & Nick Steele	**Test Dates:**	09 July 2012 to 20 August 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1049
Test Method Used:	Spectrum Analyser Occupied Bandwidth function

Environmental Conditions:

Temperature (°C):	24 to 26
Relative Humidity (%):	37 to 50

Note(s):

1. The 99% occupied bandwidth was measured using the Occupied Bandwidth function of a spectrum analyser. Measurement bandwidths were set automatically by the spectrum analyser.
2. A signal generator was connected to the EUT input and the EUT output signal was measured using a spectrum analyser connected to the EUT via suitable RF cables and attenuators. Plots of LTE input and output signals are shown at the beginning of the plots section to prove that the signal is not being degraded or altered in any way. There was no distortion of either output signal compared with the respective input signal. The input signal is from the signal generator. The output signal is the output from the EUT (input signal after it has been amplified).
3. For the duration of this test, the input signal to the EUT was set at a level which resulted in maximum rated output power. In all cases, the input signal was increased by 10 dB and re-measured. For each channel and modulation scheme tested, the occupied bandwidth was not altered.

Transmitter Occupied Bandwidth (continued)

Results: Uplink

Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
WCDMA	5.0	Middle	1732.6	4014.423
LTE QPSK	1.4	Middle	1732.5	1094.188
	3.0	Middle	1732.5	2723.447
	5.0	Middle	1732.5	4478.958
	10.0	Middle	1732.5	9078.156
	15.0	Middle	1732.5	13256.513
	20.0	Middle	1732.5	17434.870
LTE 16QAM	1.4	Middle	1732.5	1094.188
	3.0	Middle	1732.5	2741.483
	5.0	Middle	1732.5	4509.018
	10.0	Middle	1732.5	9078.156
	15.0	Middle	1732.5	13256.513
	20.0	Middle	1732.5	17555.110
LTE 64QAM	1.4	Middle	1732.5	1094.188
	3.0	Middle	1732.5	2741.483
	5.0	Middle	1732.5	4509.018
	10.0	Middle	1732.5	9018.036
	15.0	Middle	1732.5	13256.513
	20.0	Middle	1732.5	17434.870

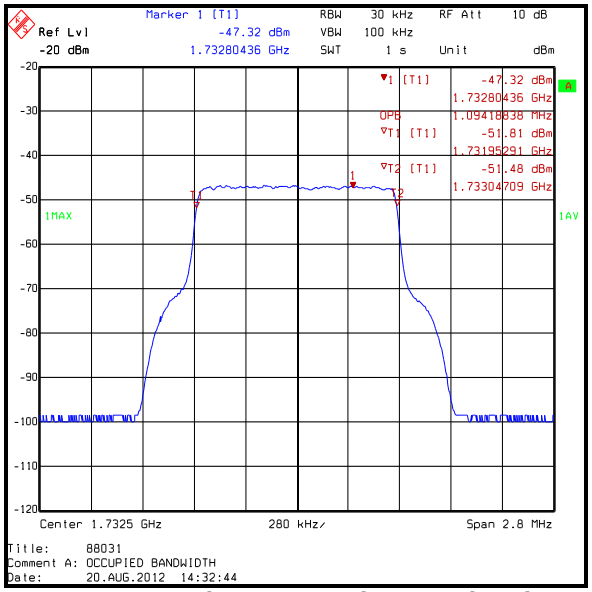
Transmitter Occupied Bandwidth (continued)

Results: Downlink

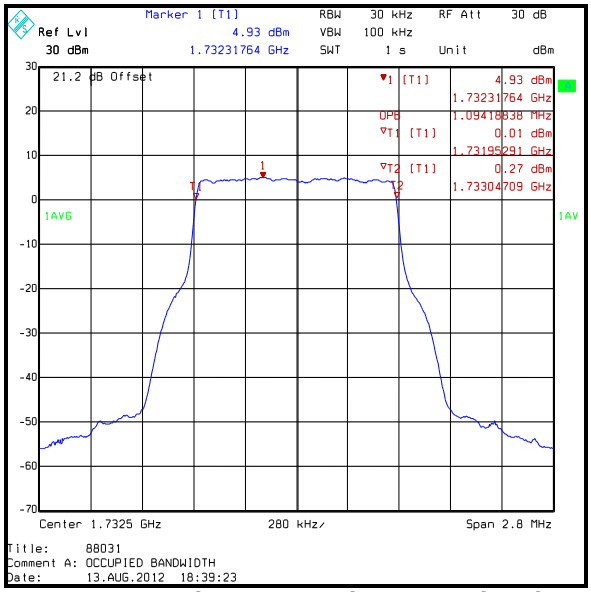
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
WCDMA	5.0	Middle	2132.6	4014.423
LTE QPSK	1.4	Middle	2132.5	1085.772
	3.0	Middle	2132.5	2723.447
	5.0	Middle	2132.5	4509.018
	10.0	Middle	2132.5	9078.156
	15.0	Middle	2132.5	13256.513
	20.0	Middle	2132.5	17434.870
LTE 16QAM	1.4	Middle	2132.5	1085.772
	3.0	Middle	2132.5	2723.447
	5.0	Middle	2132.5	4509.018
	10.0	Middle	2132.5	9078.156
	15.0	Middle	2132.5	13256.513
	20.0	Middle	2132.5	17555.110
LTE 64QAM	1.4	Middle	2132.5	1085.772
	3.0	Middle	2132.5	2723.447
	5.0	Middle	2132.5	4478.958
	10.0	Middle	2132.5	9018.036
	15.0	Middle	2132.5	13256.513
	20.0	Middle	2132.5	17434.870

Transmitter Occupied Bandwidth (continued)

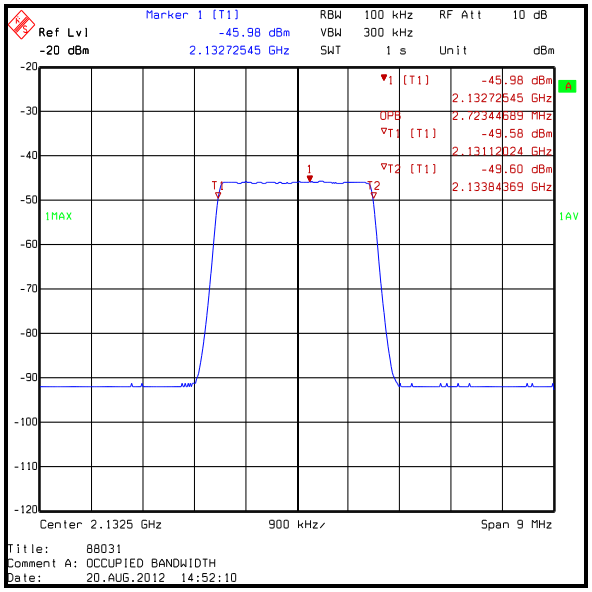
Results: Comparison of Input Signal versus Output Signal



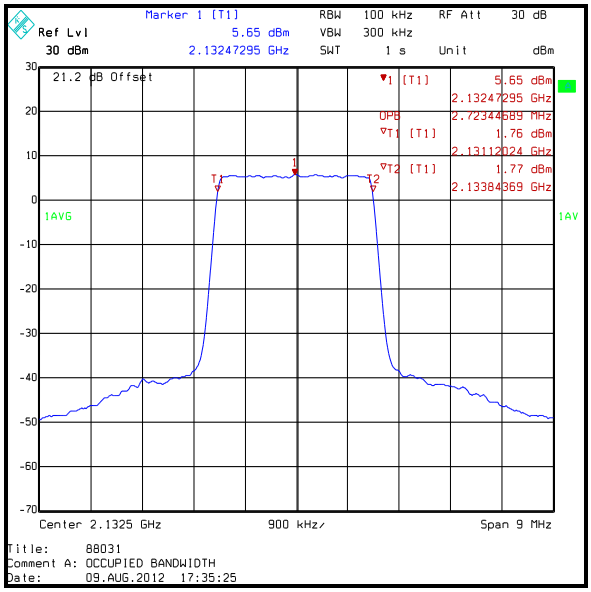
LTE QPSK (1.4 MHz BW) Input Signal



LTE QPSK (1.4 MHz BW) Output Signal



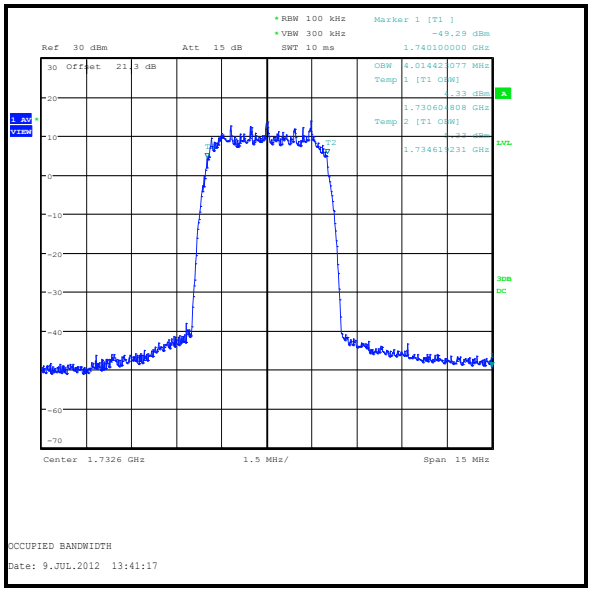
LTE 64QAM (3 MHz BW) Input Signal



LTE 64QAM (3 MHz BW) Output Signal

Transmitter Occupied Bandwidth (continued)

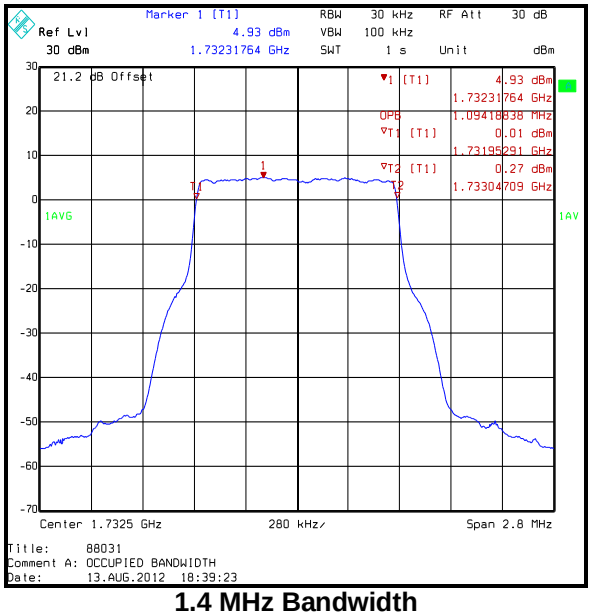
Results: Uplink



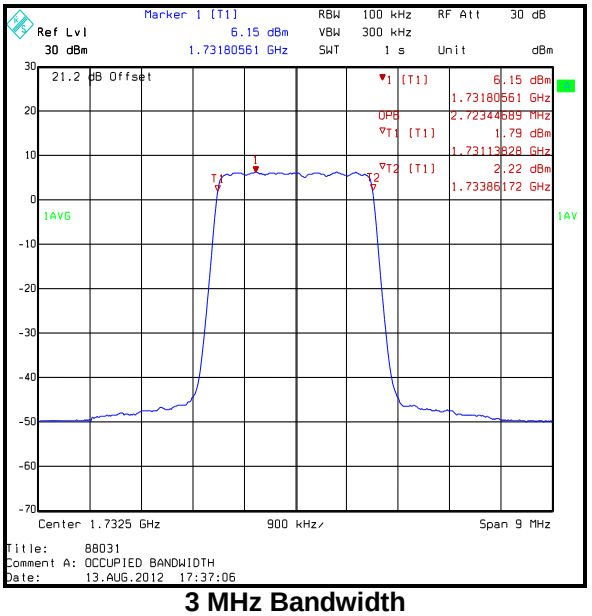
WCDMA

Transmitter Occupied Bandwidth (continued)

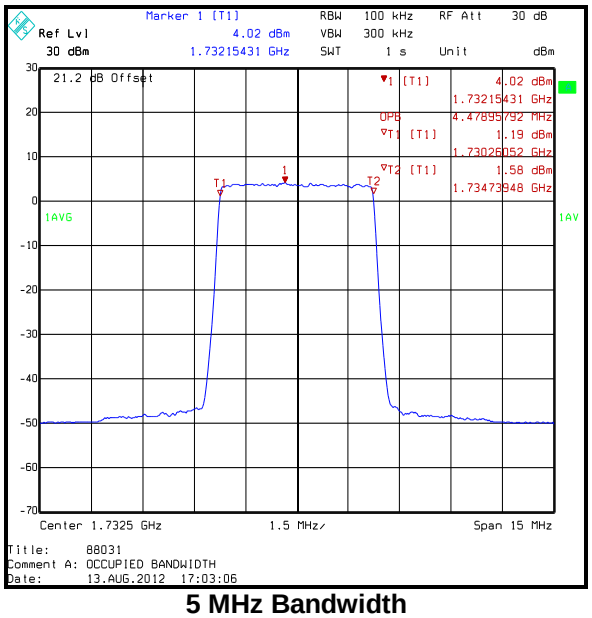
Results: LTE QPSK / Uplink



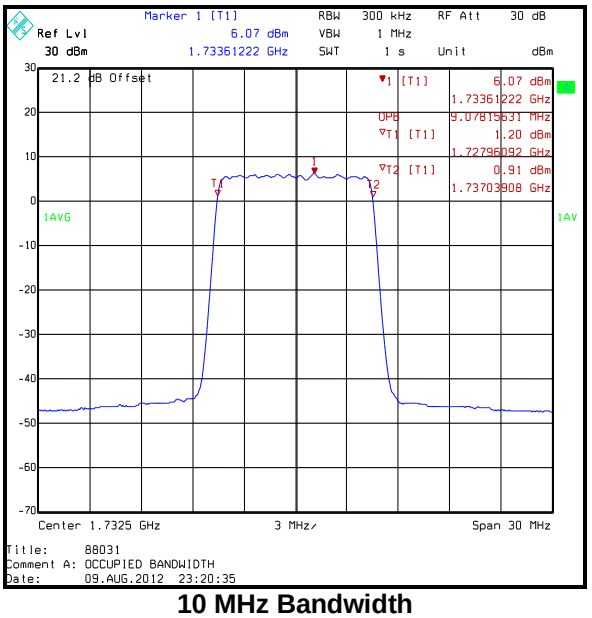
1.4 MHz Bandwidth



3 MHz Bandwidth



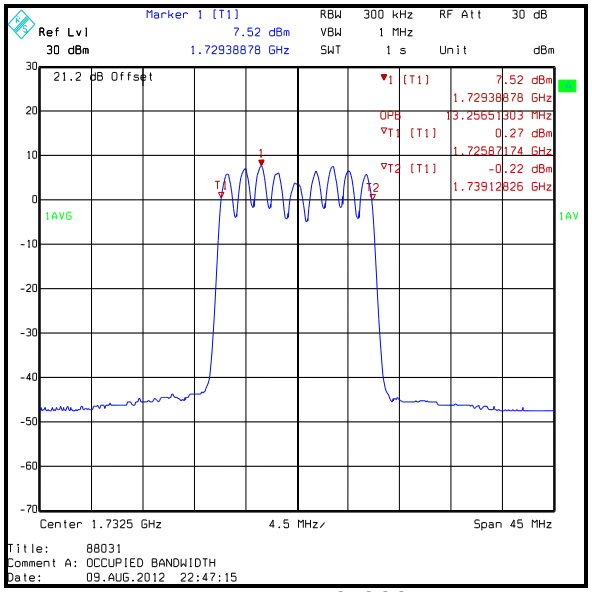
5 MHz Bandwidth



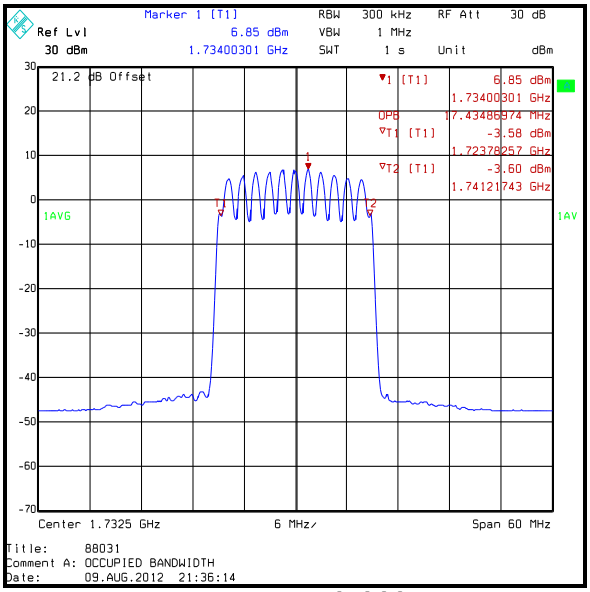
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

Results: LTE QPSK / Uplink



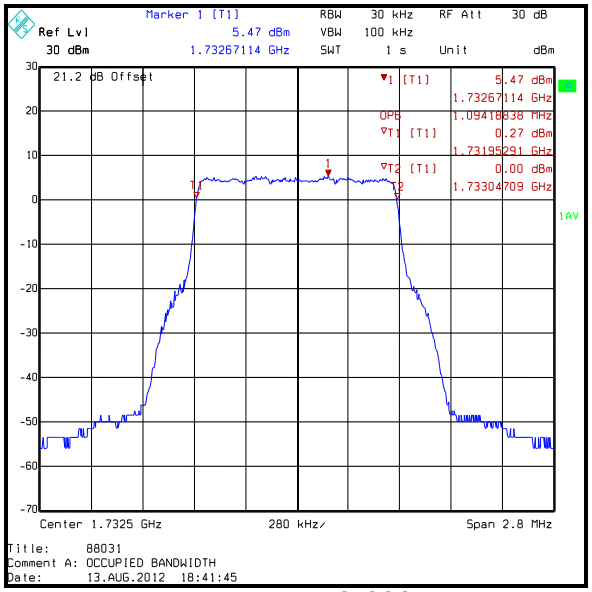
15 MHz Bandwidth



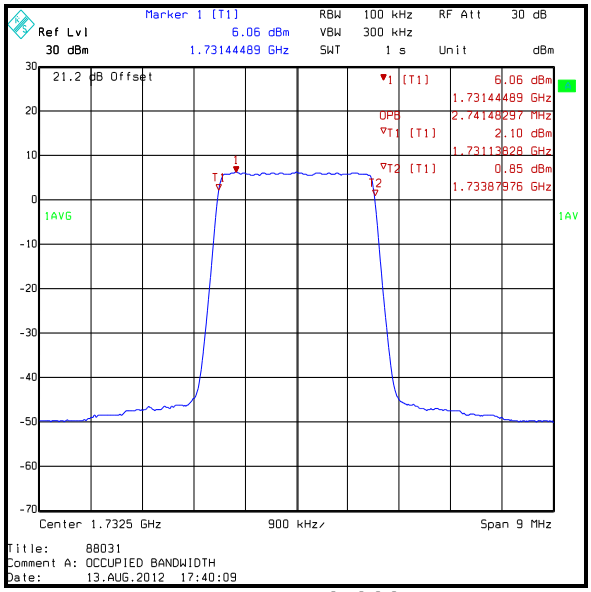
20 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

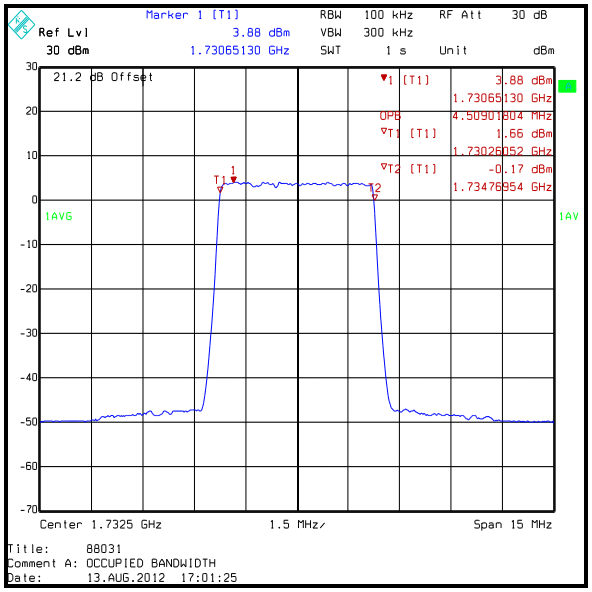
Results: LTE 16QAM / Uplink



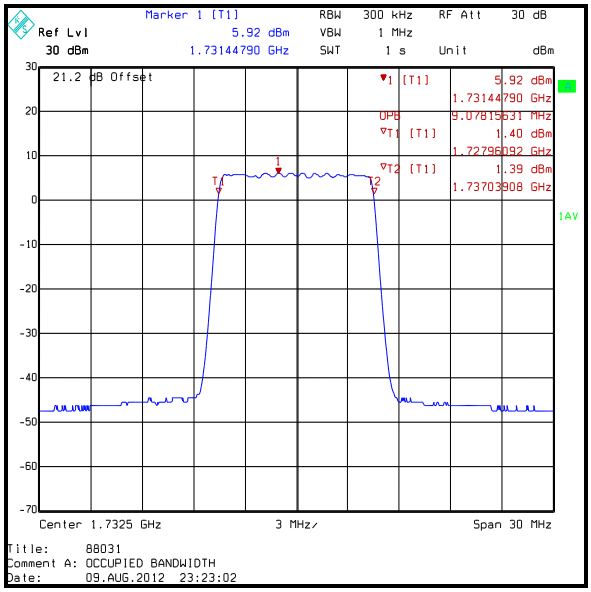
1.4 MHz Bandwidth



3 MHz Bandwidth



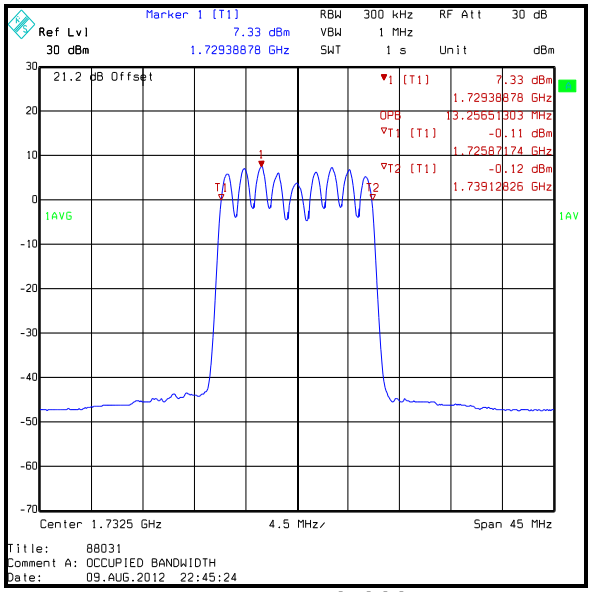
5 MHz Bandwidth



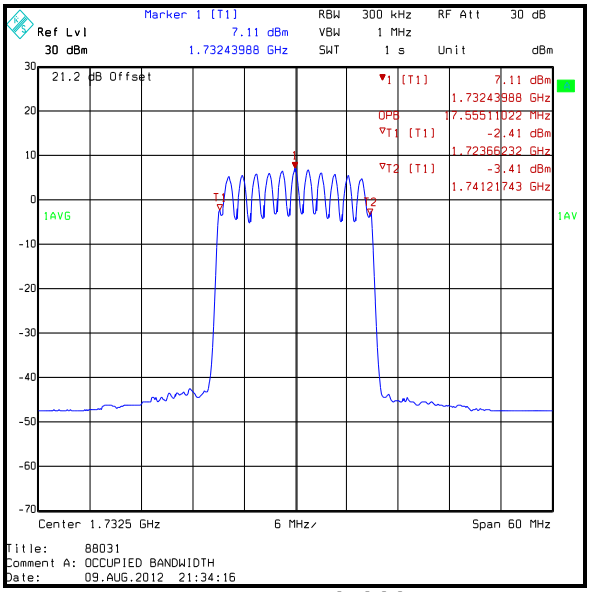
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

Results: LTE 16QAM / Uplink



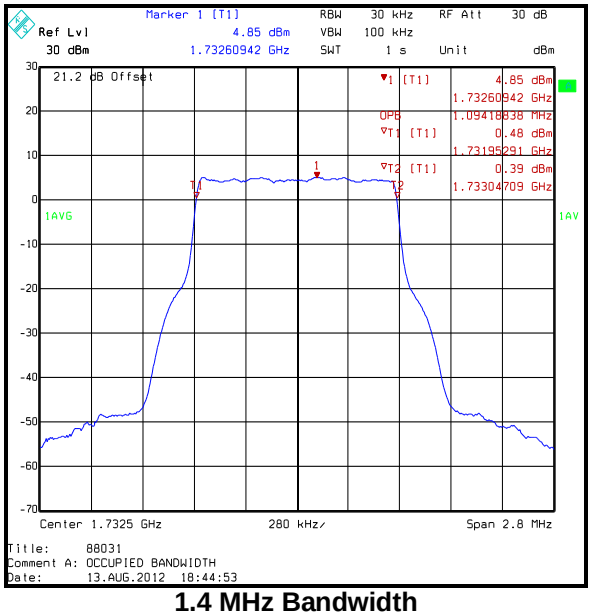
15 MHz Bandwidth



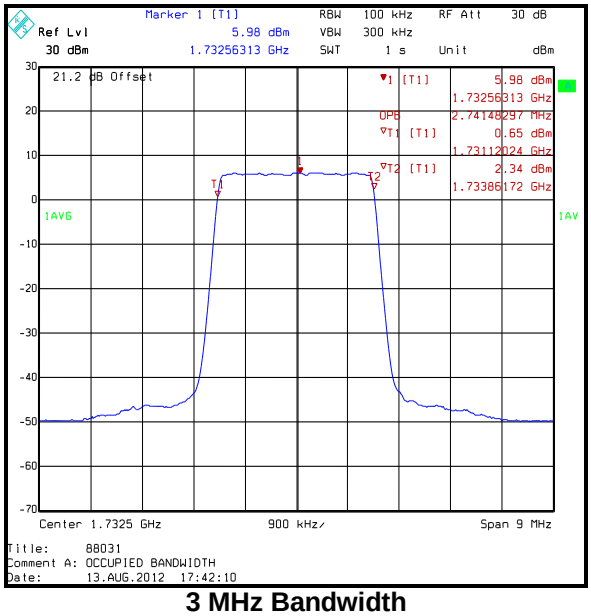
20 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

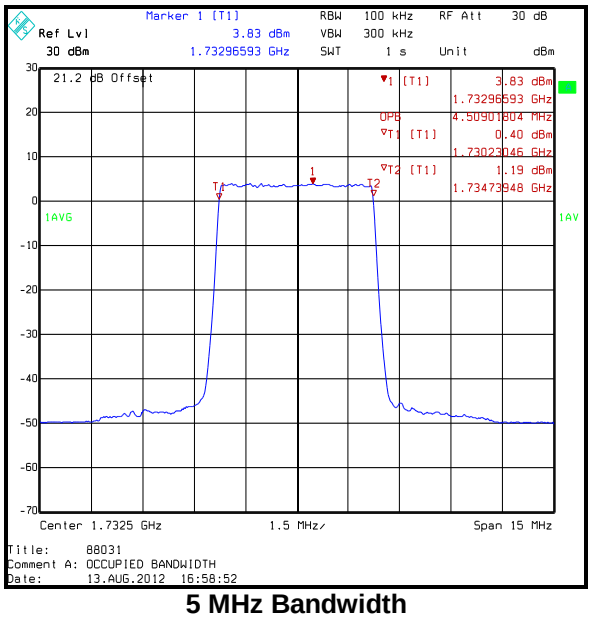
Results: LTE 64QAM / Uplink



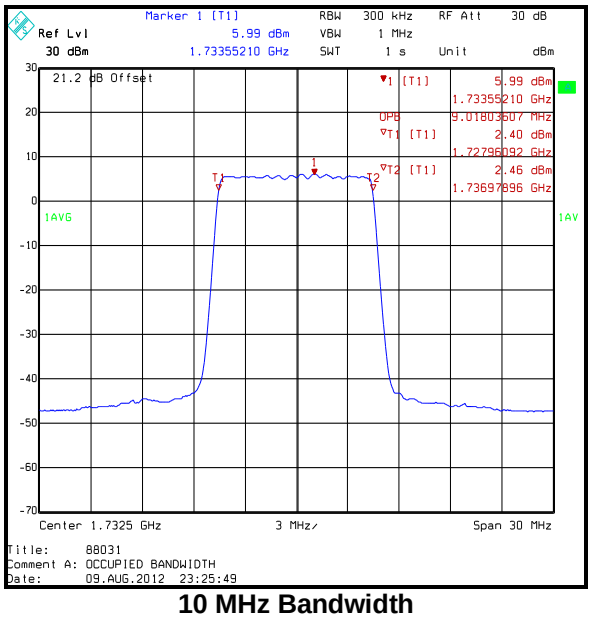
1.4 MHz Bandwidth



3 MHz Bandwidth



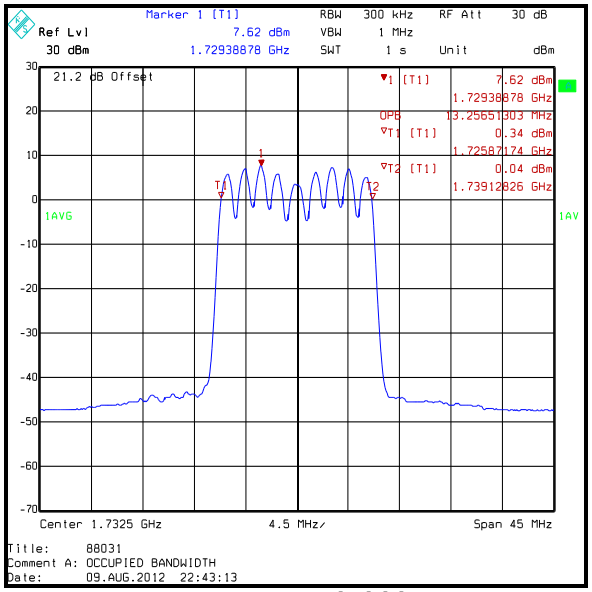
5 MHz Bandwidth



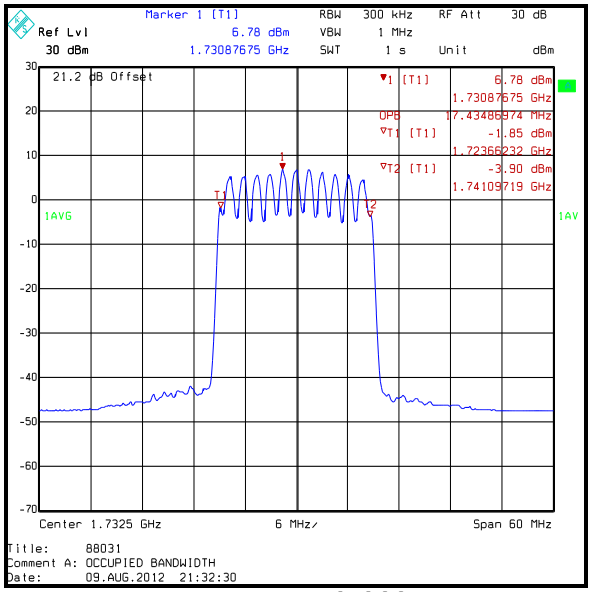
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

Results: LTE 64QAM / Uplink



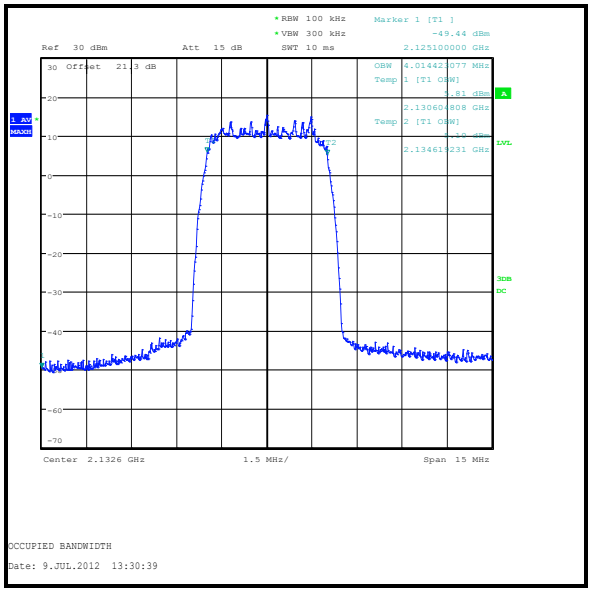
15 MHz Bandwidth



20 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

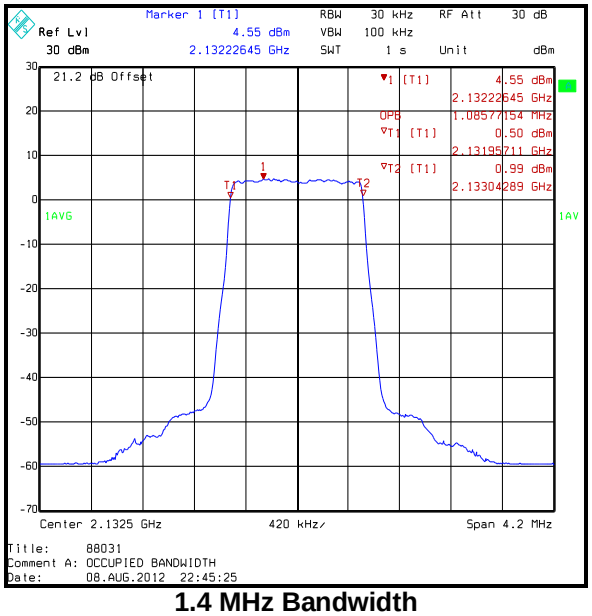
Results: Downlink



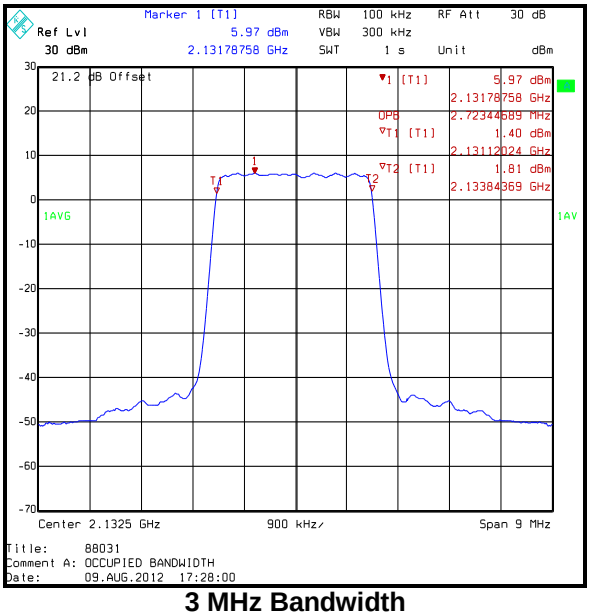
WCDMA

Transmitter Occupied Bandwidth (continued)

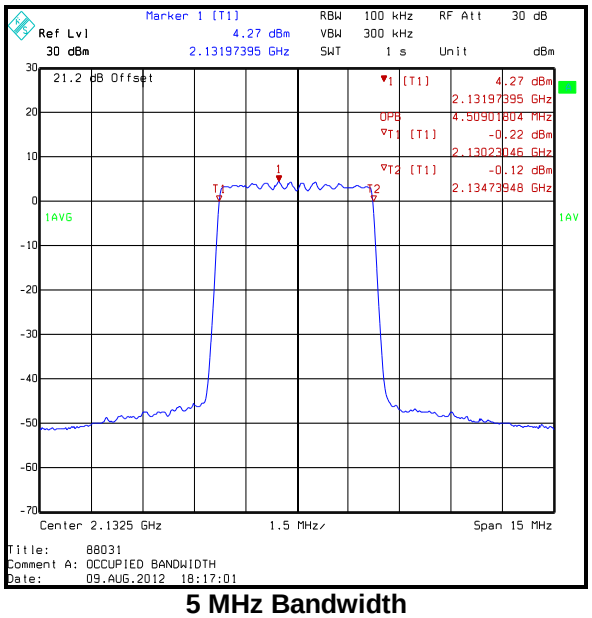
Results: LTE QPSK / Downlink



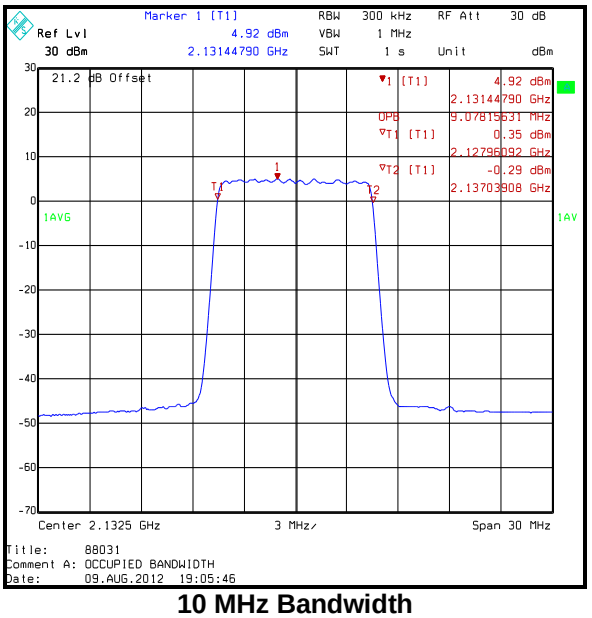
1.4 MHz Bandwidth



3 MHz Bandwidth



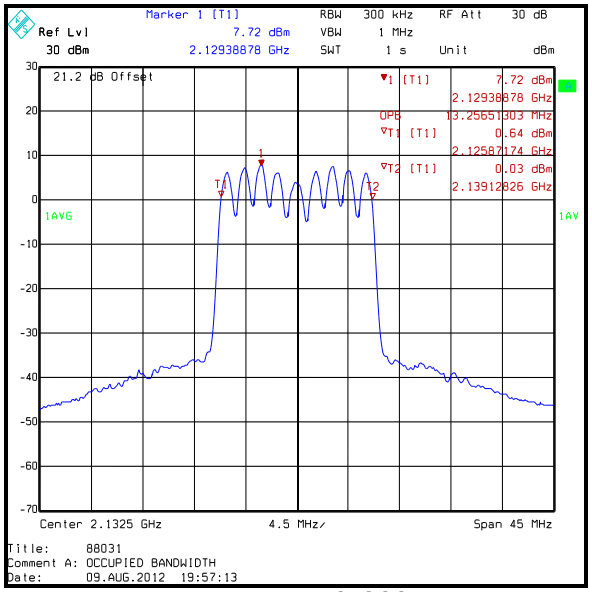
5 MHz Bandwidth



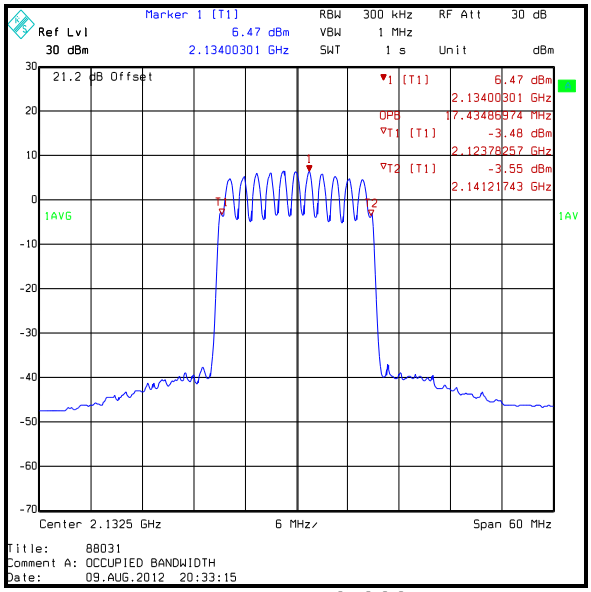
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

Results: LTE QPSK / Downlink



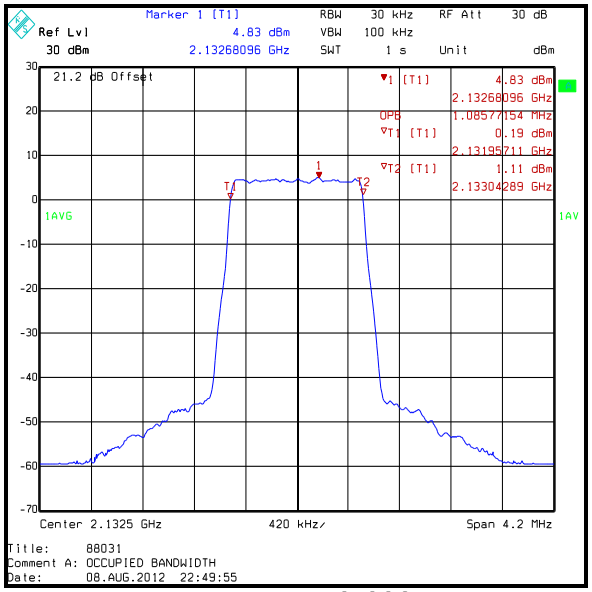
15 MHz Bandwidth



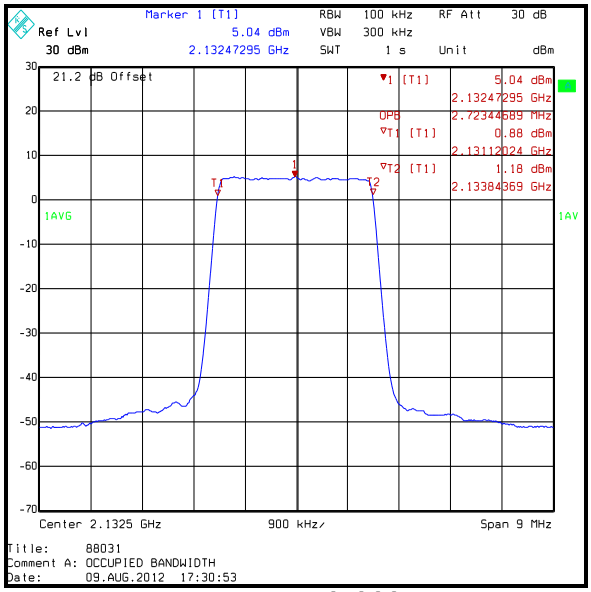
20 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

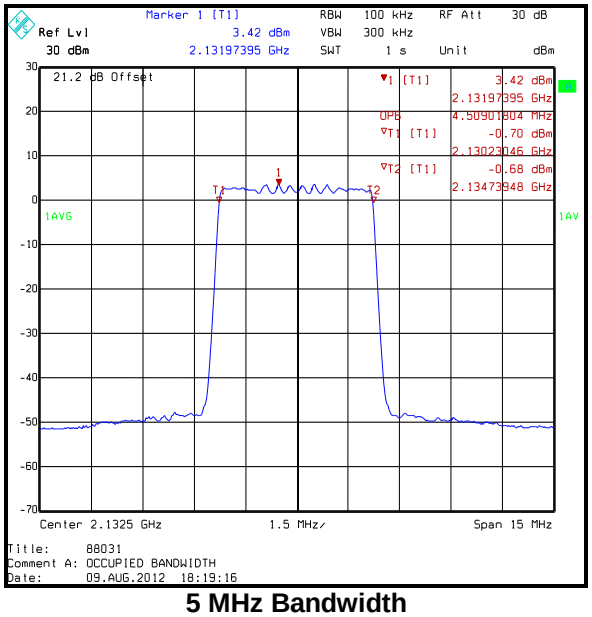
Results: LTE 16QAM / Downlink



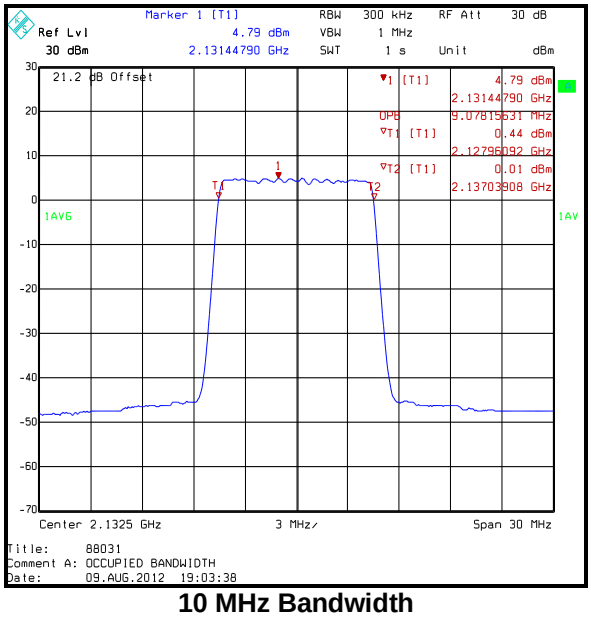
1.4 MHz Bandwidth



3 MHz Bandwidth



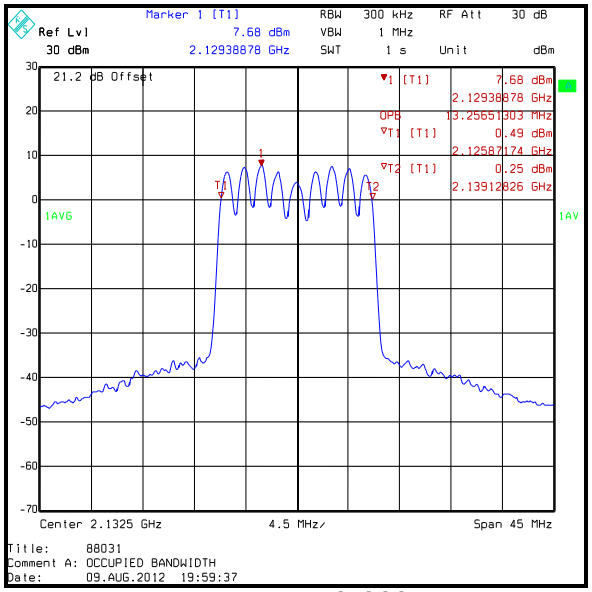
5 MHz Bandwidth



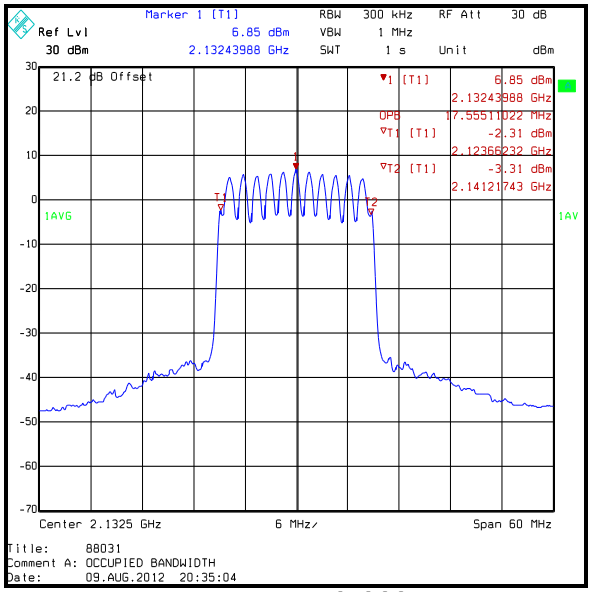
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

Results: LTE 16QAM / Downlink



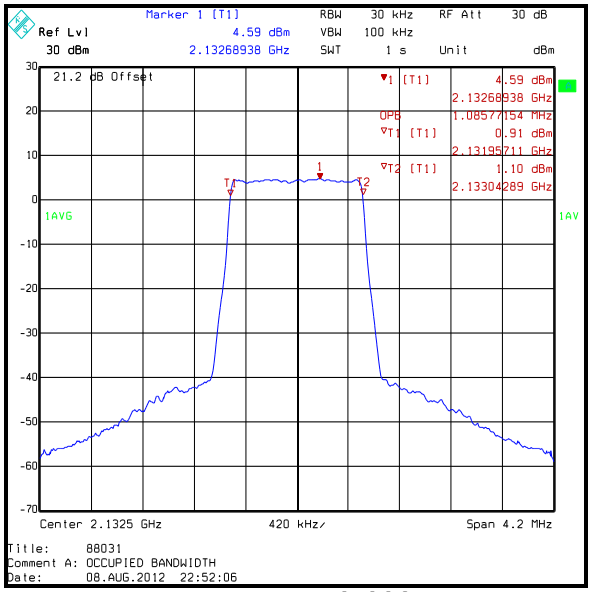
15 MHz Bandwidth



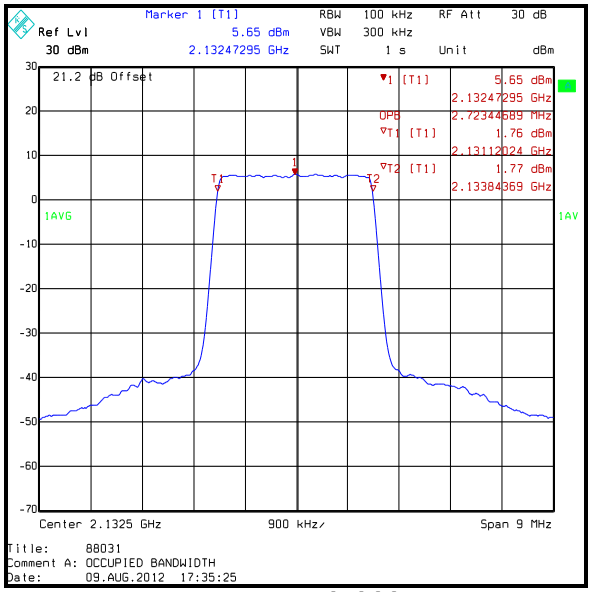
20 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

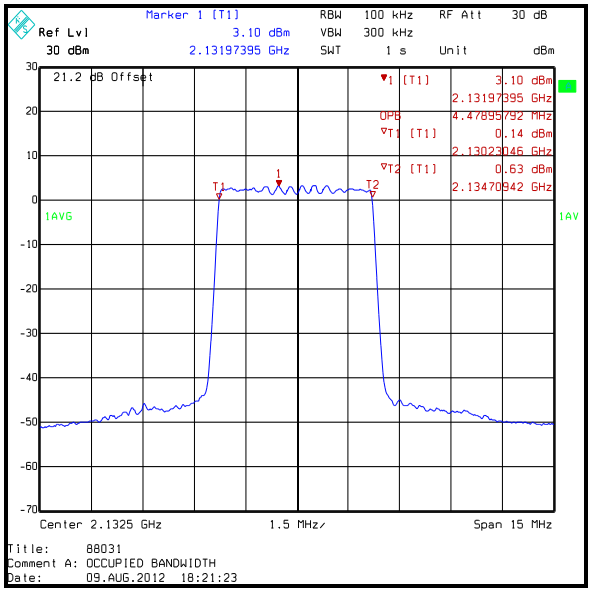
Results: LTE 64QAM / Downlink



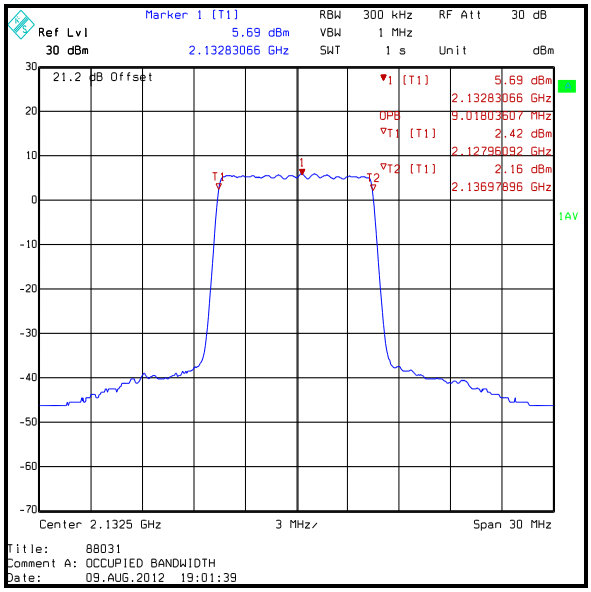
1.4 MHz Bandwidth



3 MHz Bandwidth



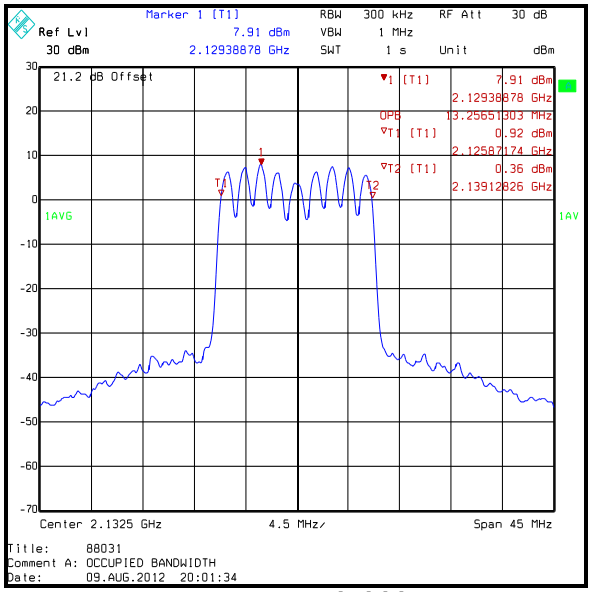
5 MHz Bandwidth



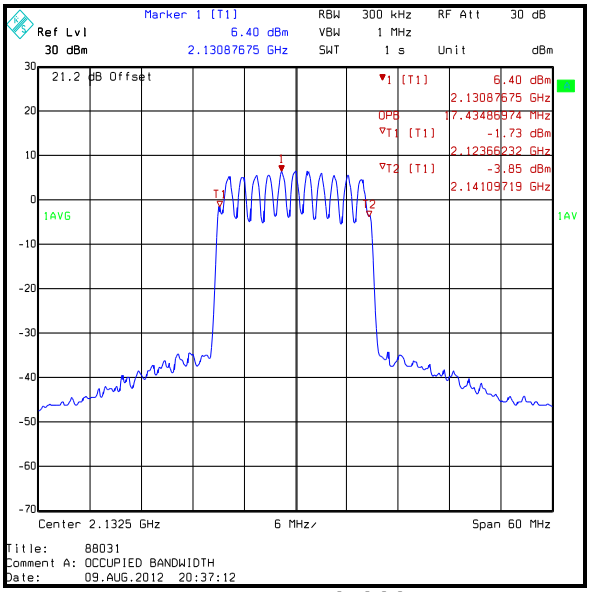
10 MHz Bandwidth

Transmitter Occupied Bandwidth (continued)

Results: LTE 64QAM / Downlink



15 MHz Bandwidth



20 MHz Bandwidth

5.3.7. Transmitter Conducted Emissions

Test Summary:

Test Engineer:	Patrick Jones	**Test Date:**	04 June 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1051 & 27.53(h)
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.13 referencing FCC CFR Parts 2.1051 and FCC Response to Enquiry 792557
Frequency Range:	9 kHz to 22 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	34

Note(s):

1. Three signal generators with appropriate modulation applied were connected to the input port of the EUT using suitable RF cables, circulators and a RF combiner. The RF output of the repeater was connected to a spectrum analyser via suitable cables and attenuators. The cables and attenuators were calibrated before use and the RF level offset was incorporated into the measurements. The signal generator was set to output a suitably modulated signal at the maximum input level for the EUT in accordance with FCC Response to Enquiry 792557.
2. Pre-scans for this test were carried out from 9 kHz to 22 GHz for all supported modulation types. The plots and results shown in the section below were deemed to have the worst case spurious emissions profile. All test results are archived on the company server and available for inspection if required. The worst case results were LTE with 64QAM modulation with the carriers on the bottom channels for Uplink. For Downlink, there were no emissions >20 dB below the limit or above the system noise floor, therefore, the highest noise floor was recorded using LTE with 64QAM modulation with the carriers on the bottom channels.
3. For WCDMA testing, three modulated carriers were used, one on the bottom channel and two at the top of the pass-band, at least one channel width apart.
4. For LTE testing, two modulated carriers were used in two different configurations: one test with the carriers at the bottom of the band, at least one channel width apart; one test with the carriers at the top of the band, at least one channel width apart. The carrier bandwidth used for all LTE tests was 1.4 MHz as this represents the highest dBm/MHz ratio for all applicable bandwidths as shown in the Conducted Output Power section.
5. The combined signal generator output was checked on a spectrum analyser prior to the test in order to determine that there were no intermodulation products coming from the combining network itself and to verify the correct amplitude and frequencies were present at the input to the EUT prior to performing the tests.
6. For any emissions found, the input signal was increased by a further 10 dB and the emissions re-measured.

Transmitter Conducted Emissions (continued)

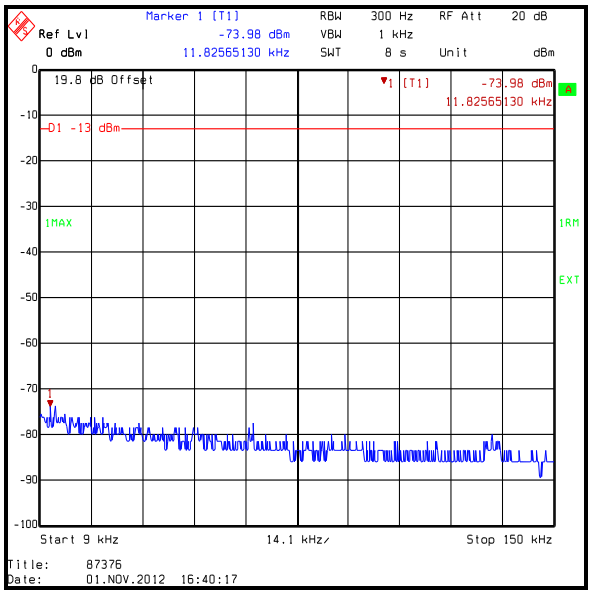
Results: Uplink / LTE 64QAM Bottom Channels / Nominal Input Power

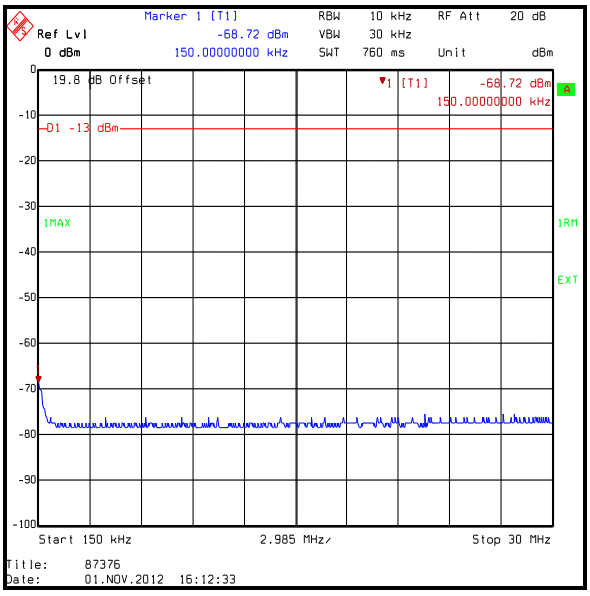
Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
3424.351	--23.4	-13.0	10.4	Complied

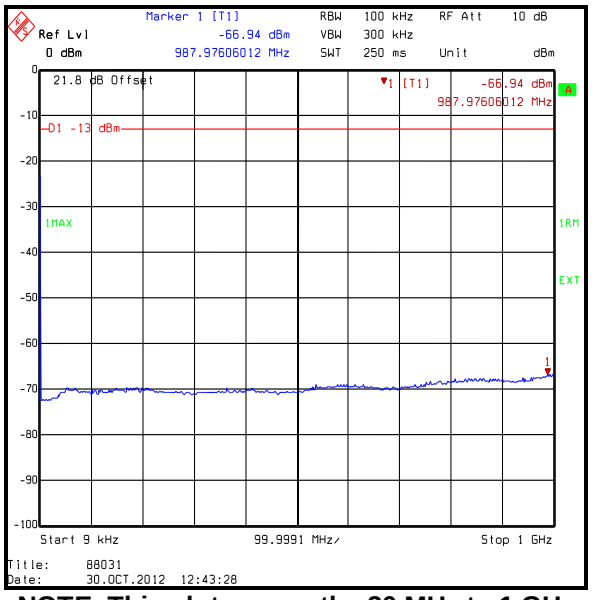
Results: Uplink / LTE 64QAM Bottom Channels / Nominal +10dB Input Power

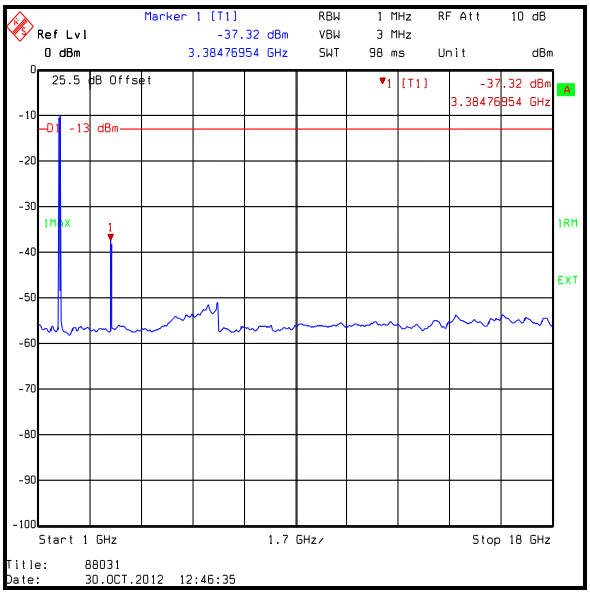
Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
3424.230	-20.6	-13.0	7.6	Complied

Results: Uplink / LTE 64QAM Bottom Channels









NOTE: This plot covers the 30 MHz to 1 GHz frequency range

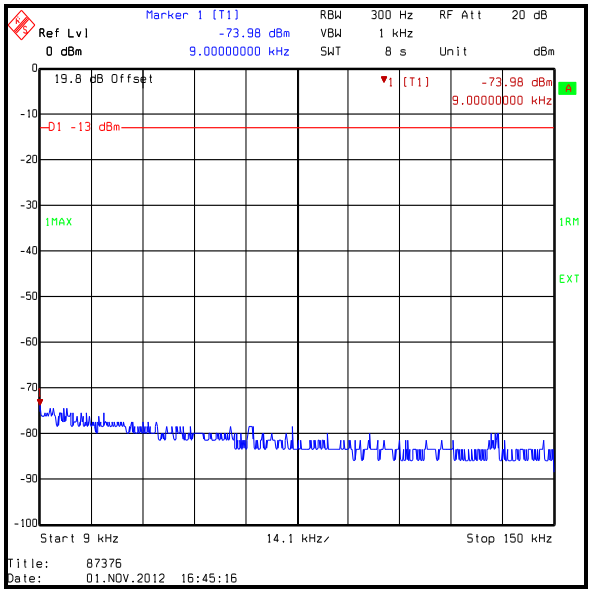
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

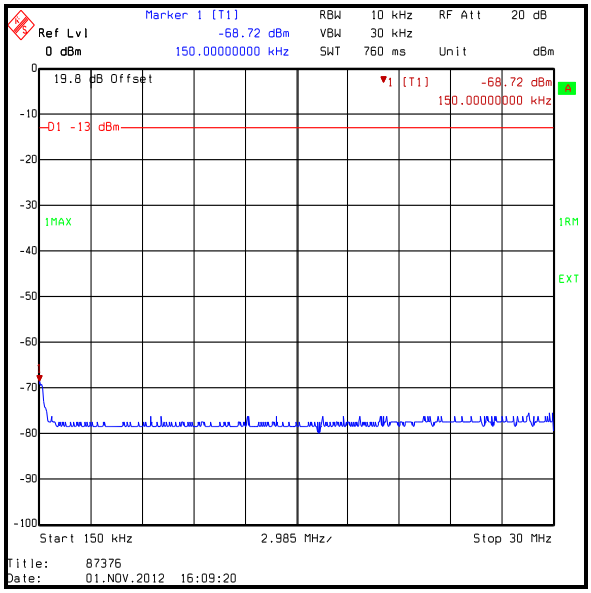
Transmitter Conducted Emissions (Continued)

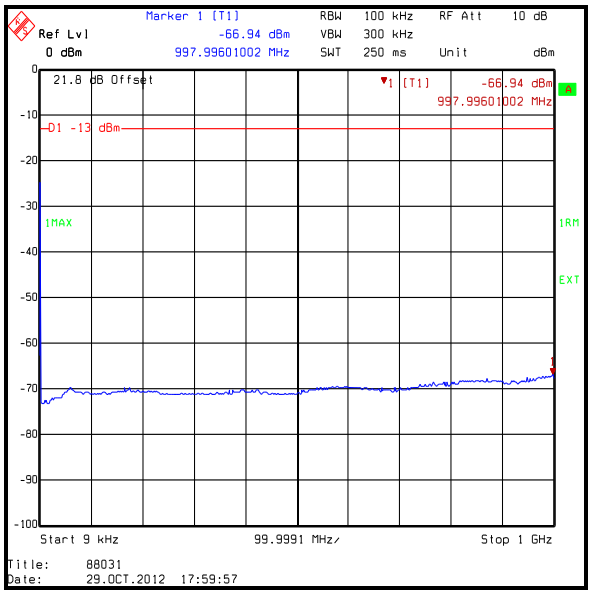
Results: Downlink / LTE 64QAM Bottom Channels

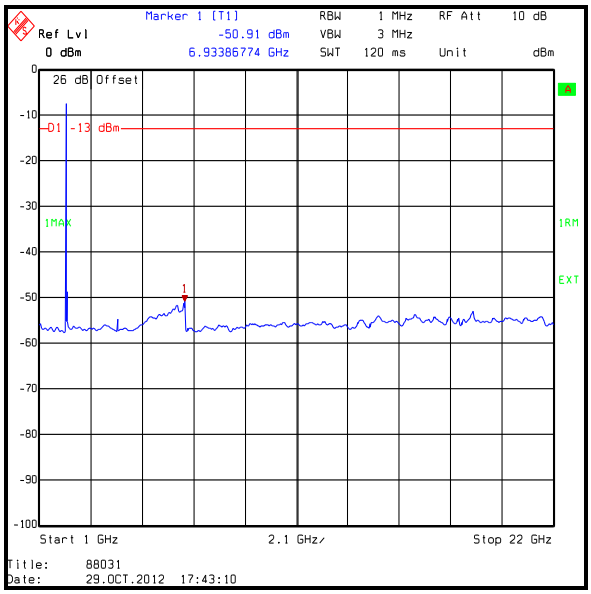
Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
6933.868	-50.9	-13.0	37.9	Complied

Results: Downlink / LTE 64QAM Bottom Channels









NOTE: This plot covers the 30 MHz to 1 GHz frequency range

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.3.8. Transmitter Out of Band Radiated Emissions

Test Summary:

Test Engineers:	David Doyle & Andrew Edwards	**Test Date:**	04 July 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1053 & 27.53(h)
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.12 referencing FCC CFR Parts 2.1053 and 24.238
Frequency Range:	30 MHz to 22 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	61

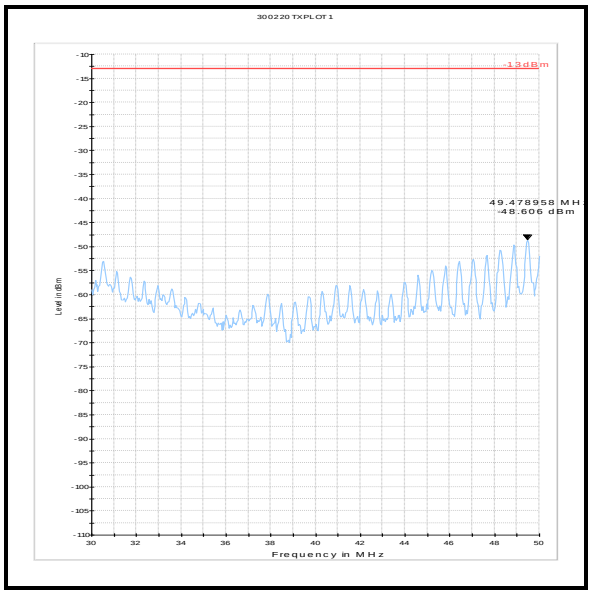
Note(s):

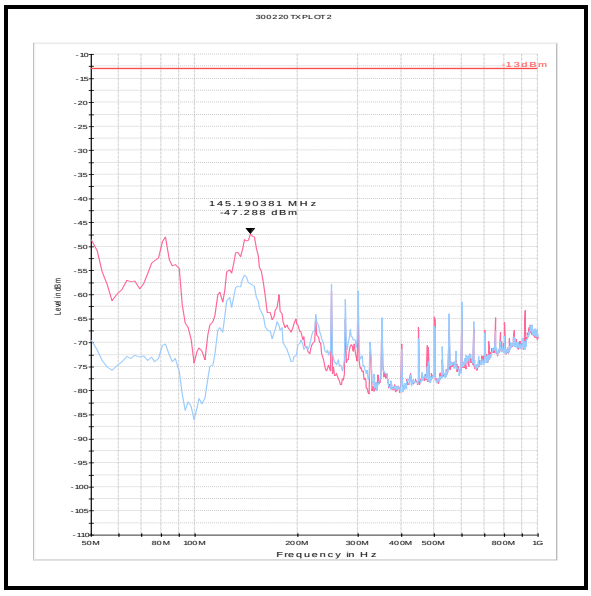
1. A signal generator was connected to the input port of the EUT using a suitable RF cable. The signal generator was located outside the anechoic chamber. The RF output of the repeater was terminated into a suitable 50 Ohm load. The signal generator was set to output a CW signal at the maximum input level for the EUT. Pre-scans were performed with the signal generator frequency set to the top channel of the 1700 Band uplink (1754.3 MHz) and downlink (2154.3 MHz) bands.
2. All emissions shown on the pre-scan plots were investigated. The input signal was increased by 10 dB and the emissions re-measured. The emission levels did not increase when the input signal was increased. The highest emission levels were recorded. All emissions were found to be ambient, in-band or >20 dB below the applicable limit.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

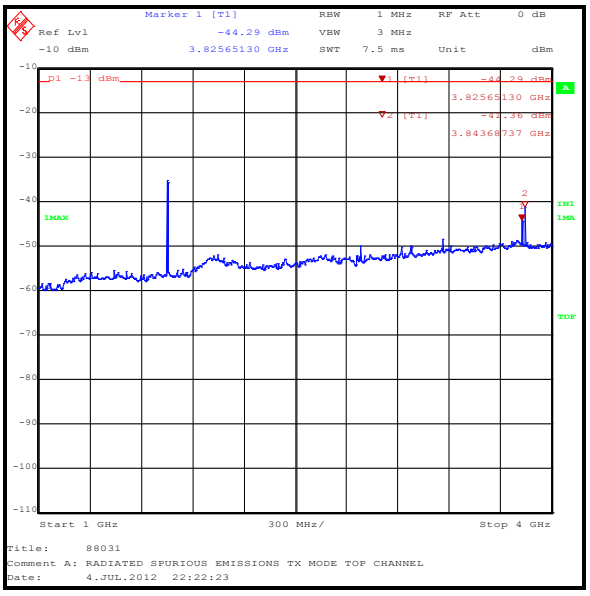
Transmitter Out of Band Radiated Emissions (continued)

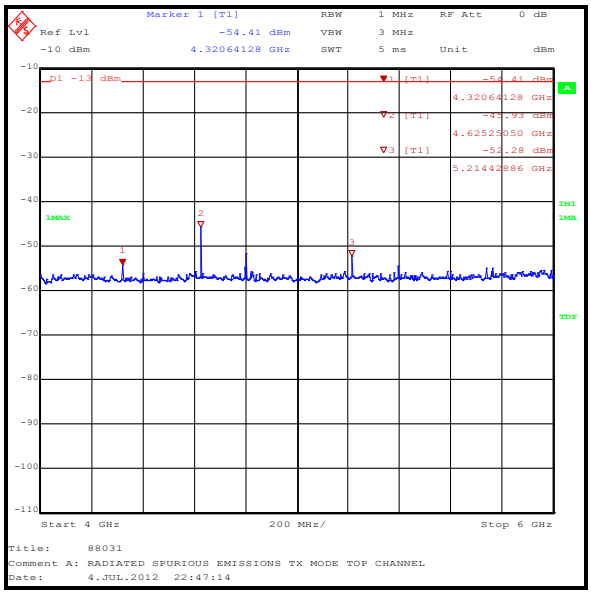
Results: Uplink / Input/Output signal 1754.3 MHz

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
3843.687	-41.4	-13.0	28.4	Complied



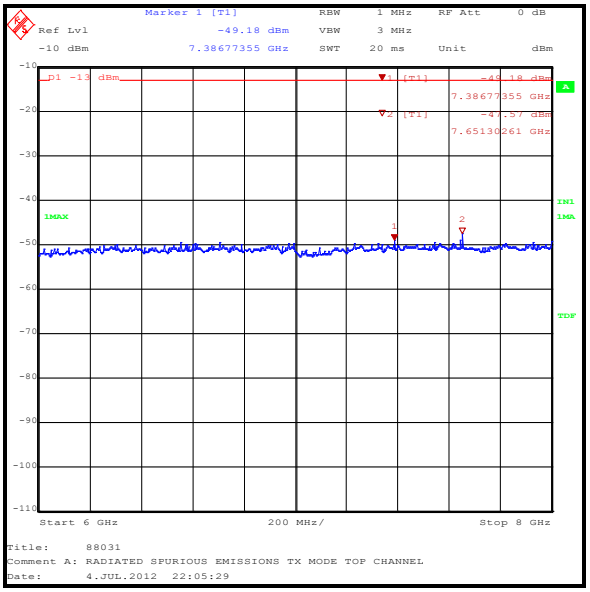


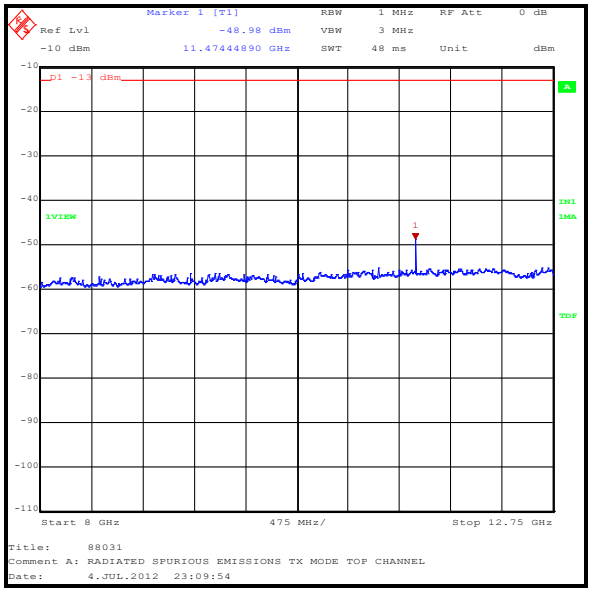


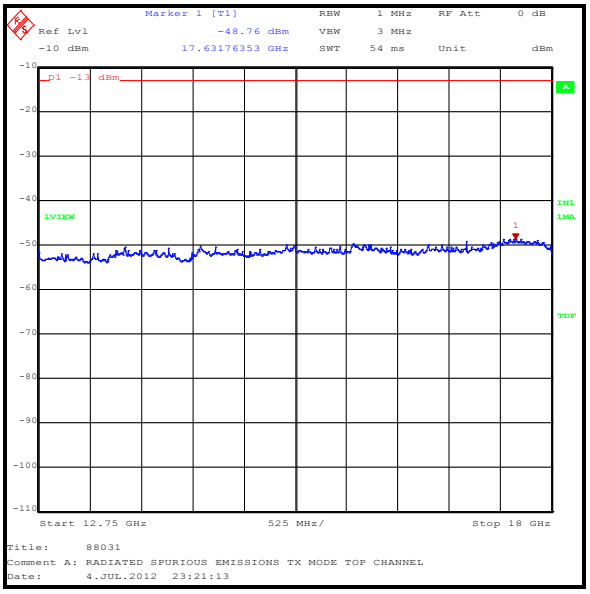


Transmitter Out of Band Radiated Emissions (continued)

Results: Uplink / Input/Output signal 1754.3 MHz





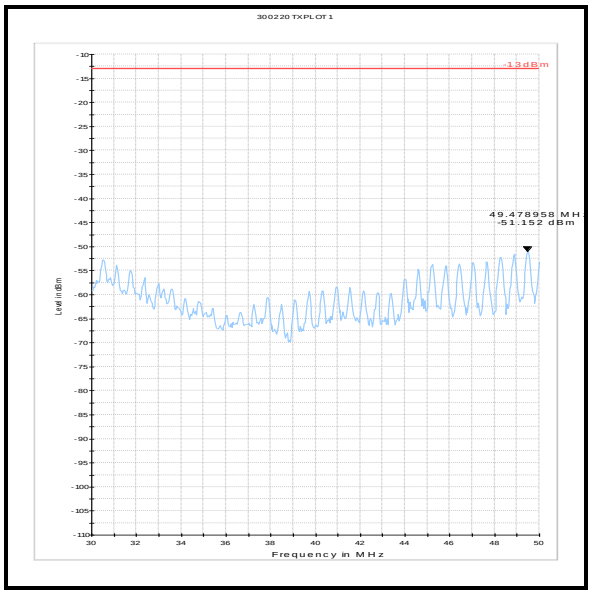


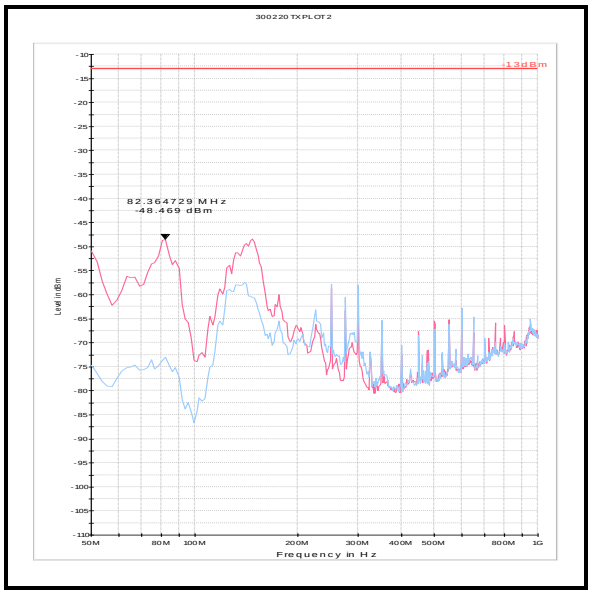
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

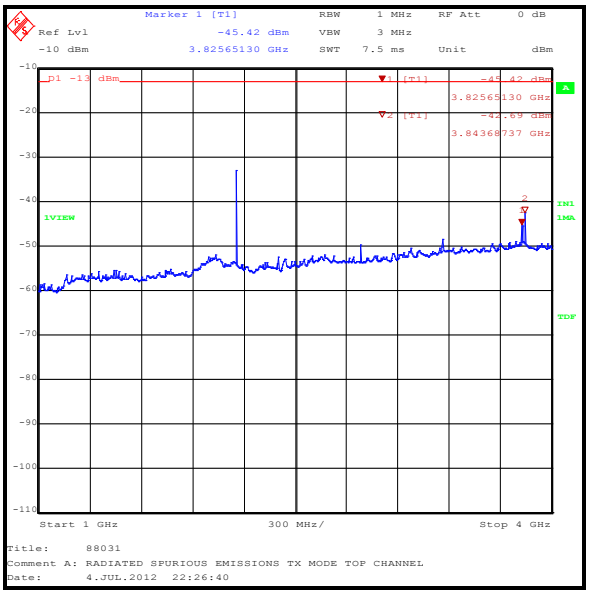
Transmitter Out of Band Radiated Emissions (continued)

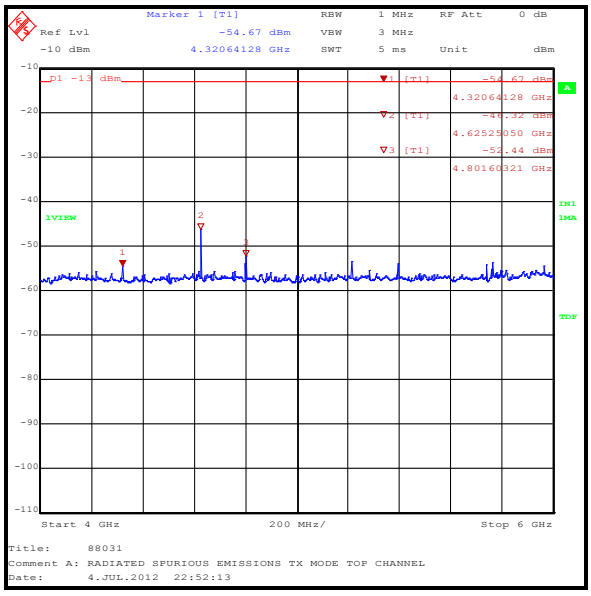
Results: Downlink / Input/Output signal 2154.3 MHz

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
3843.687	-42.7	-13.0	29.7	Complied



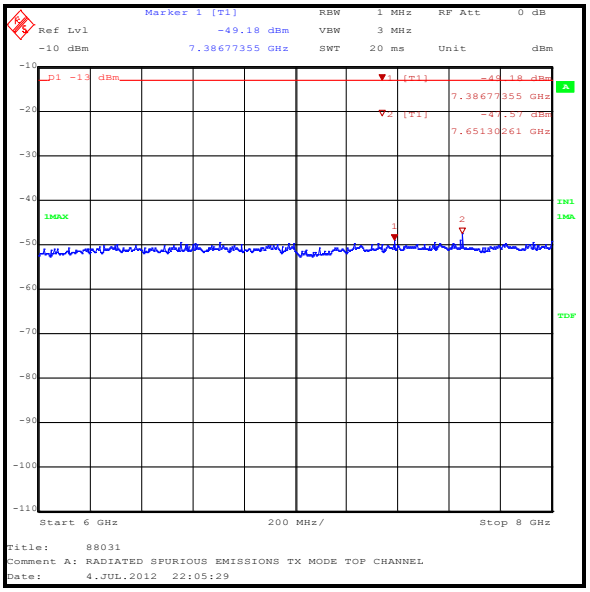


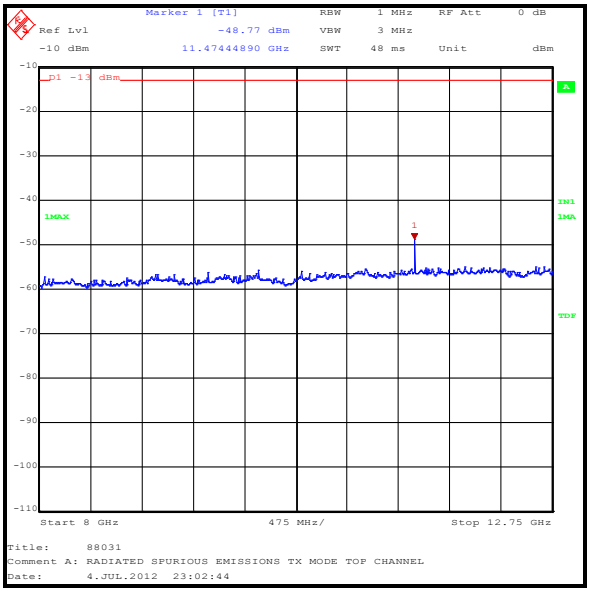


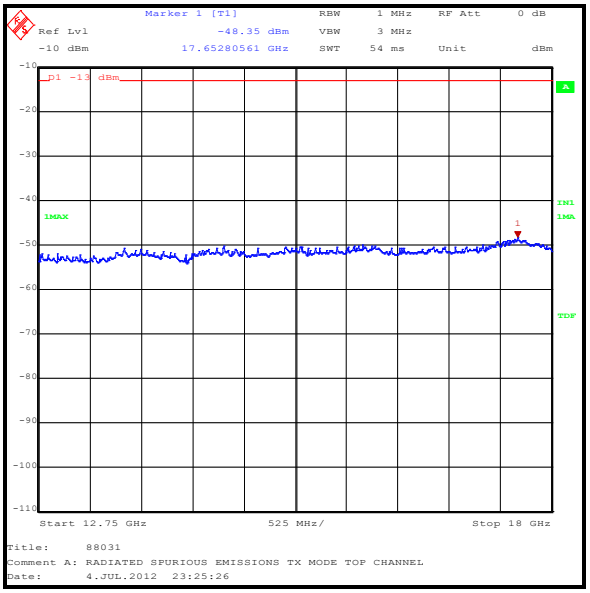


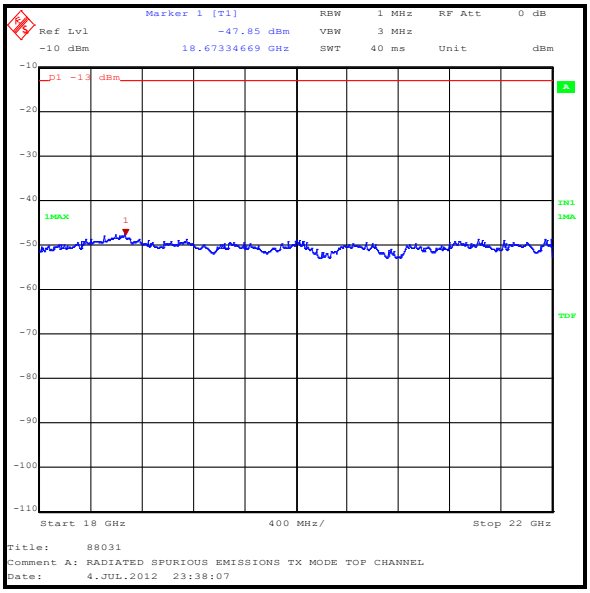
Transmitter Out of Band Radiated Emissions (continued)

Results: Downlink / Input/Output signal 2154.3 MHz









Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.3.9. Transmitter Band Edge Conducted Emissions

Test Summary:

Test Engineers:	Mark Percival & Patrick Jones	**Test Dates:**	06 July 2012 to 31 August 2012
Test Sample Serial Number:	11120003		

FCC Reference:	Part 2.1051 & 27.53(h)
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.13 referencing FCC CFR Parts 2.1051 and 27.53(h)

Environmental Conditions:

Temperature (°C):	24 to 26
Relative Humidity (%):	37 to 44

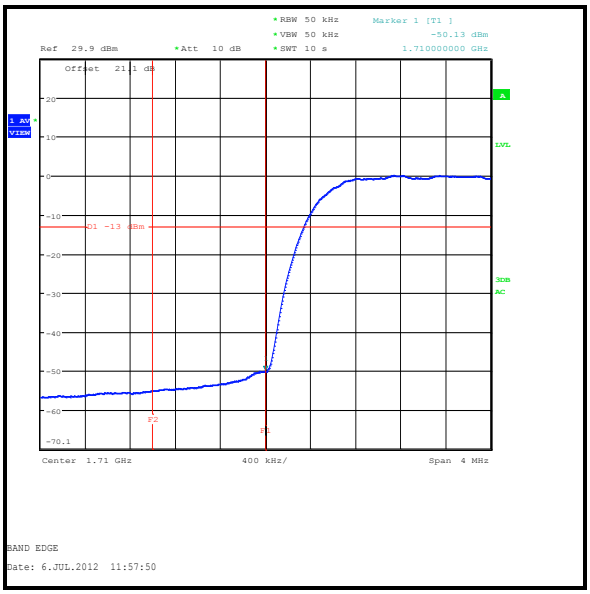
Note(s):

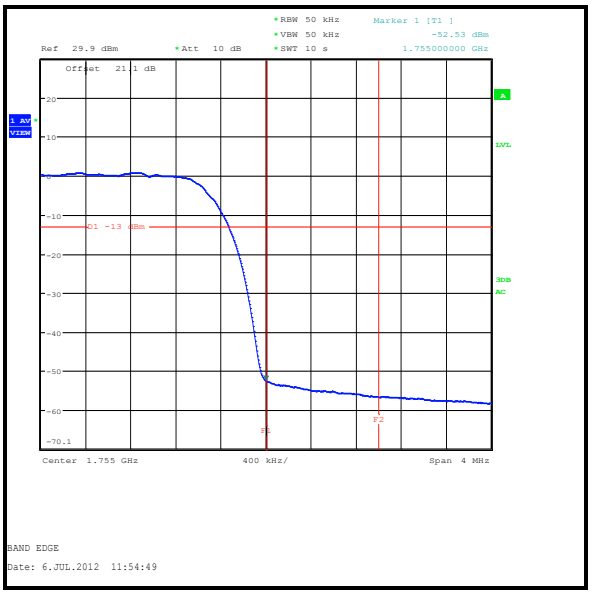
1. A signal generator was connected to the input port of the EUT using a suitable RF cable. The RF output of the EUT was connected to a spectrum analyser via suitable cables and attenuators. The cables and attenuators were calibrated before use and the RF level offset was incorporated into the measurements. The signal generator was set to output a modulated signal according to the technology under test on the bottom or top channel at the maximum input level for the EUT.
2. The filters corresponding to the top and bottom of the operating band were activated for this test.
3. In accordance with FCC part 27.53(h)(1), measurements in the 1 MHz bands immediately outside and adjacent to the frequency blocks in the 1710–1755 MHz and 2110–2155 MHz bands were performed using a resolution bandwidth of at least 1% of the emission bandwidth.
4. Each LTE modulation type was tested on each supported channel width. Only the worst case modulation type (smallest margin to limit) has been reported for each supported channel width in this test report. Full test results are archived on the RFI server and are available for inspection on request.

Transmitter Band Edge Conducted Emissions (continued)

Results: WCDMA / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710.000	-50.1	-13.0	37.1	Complied
1755.000	-52.5	-13.0	39.5	Complied

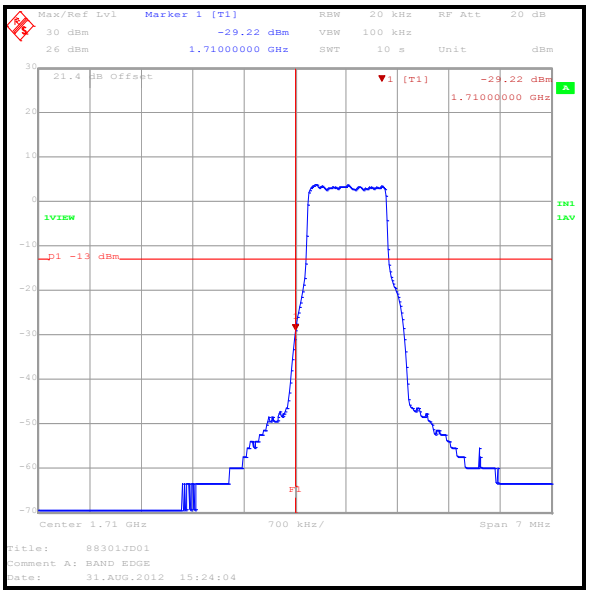


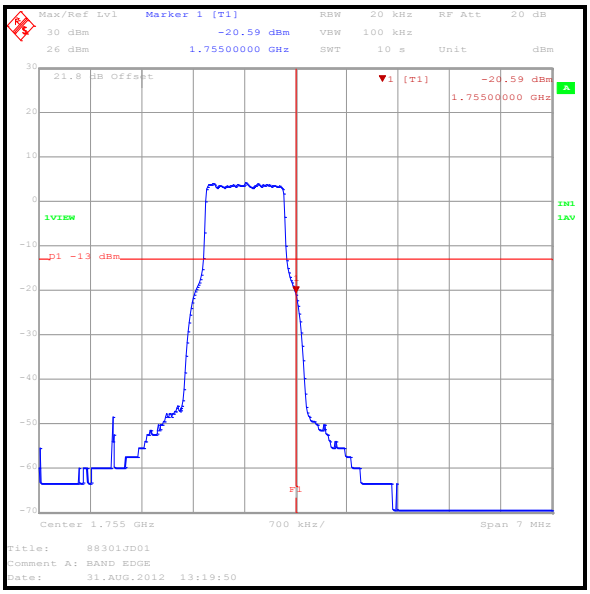


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth 16QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710.000	-29.2	-13.0	16.2	Complied
1755.000	-20.6	-13.0	7.6	Complied

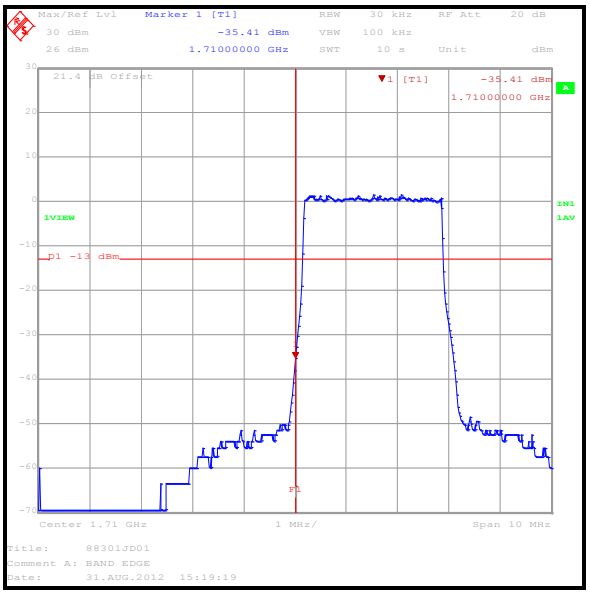


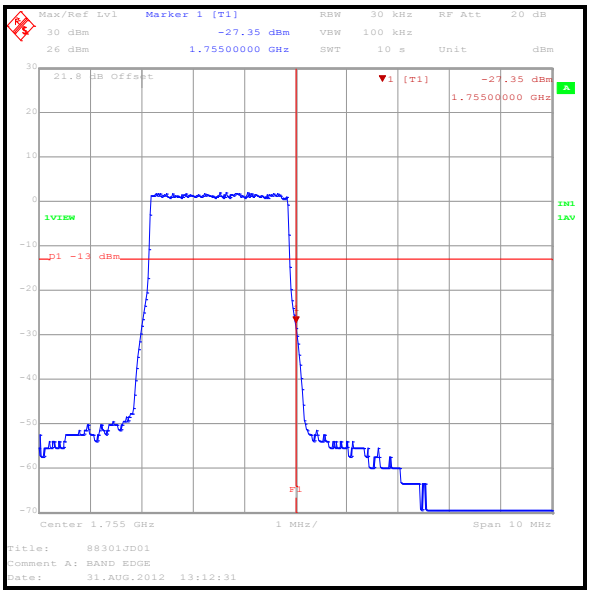


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 3 MHz Bandwidth 16QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710.000	-35.4	-13.0	22.4	Complied
1755.000	-27.4	-13.0	14.4	Complied

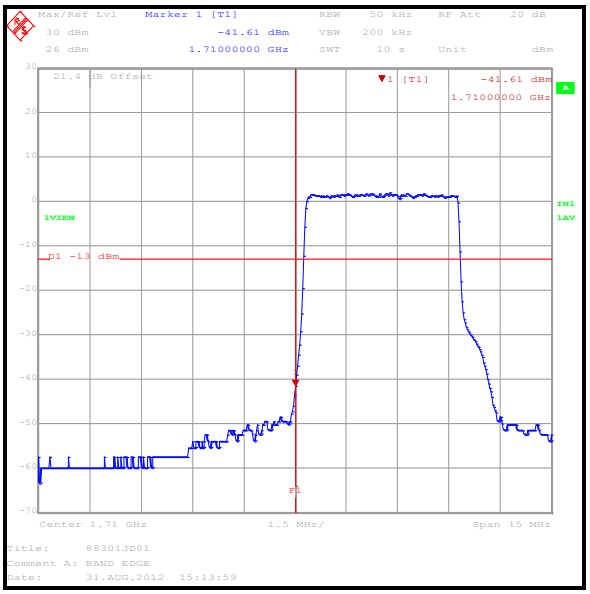


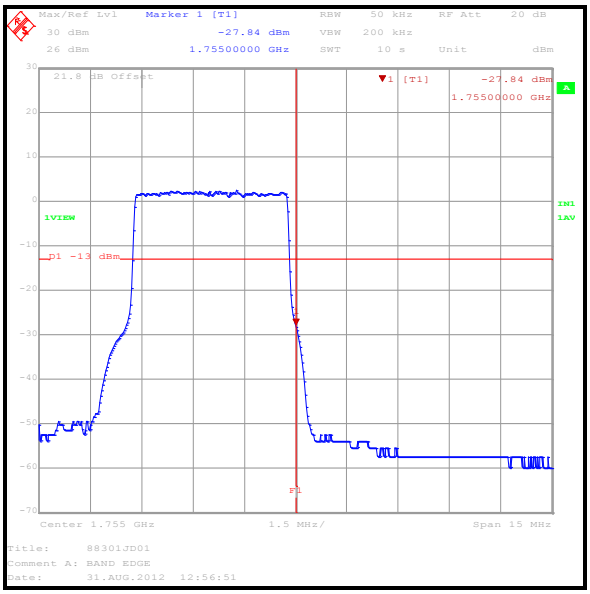


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 5 MHz Bandwidth QPSK / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710.000	-41.6	-13.0	28.6	Complied
1755.000	-27.8	-13.0	14.8	Complied

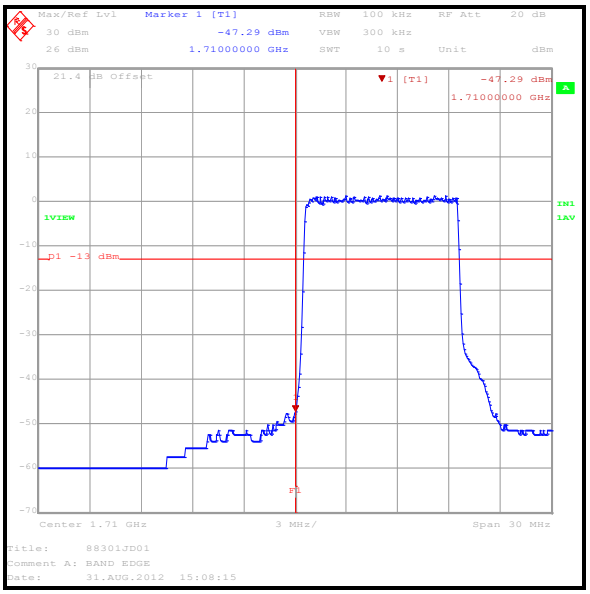


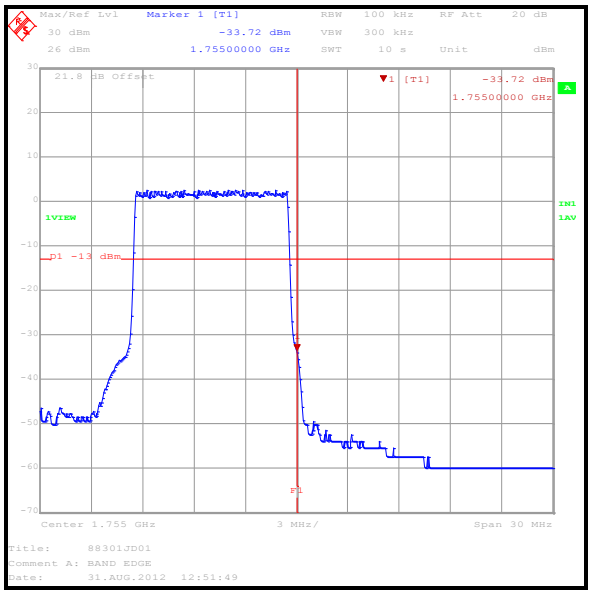


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth 64QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710.000	-47.3	-13.0	34.3	Complied
1755.000	-33.7	-13.0	20.7	Complied

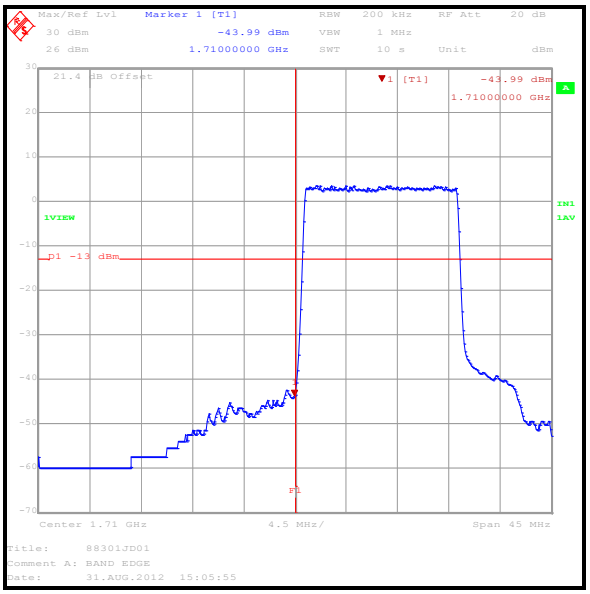


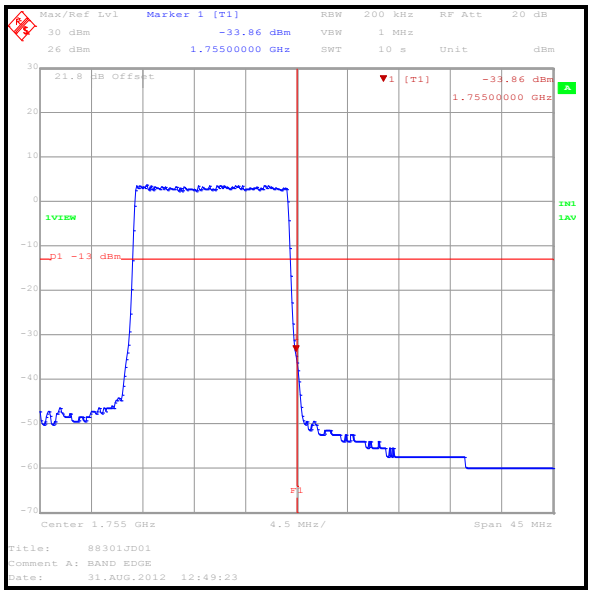


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 15 MHz Bandwidth 64QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710.000	-44.0	-13.0	31.0	Complied
1755.000	-33.9	-13.0	20.9	Complied

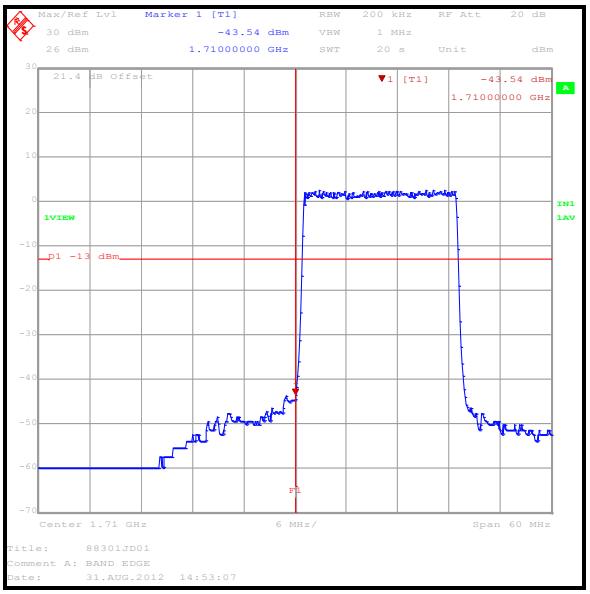


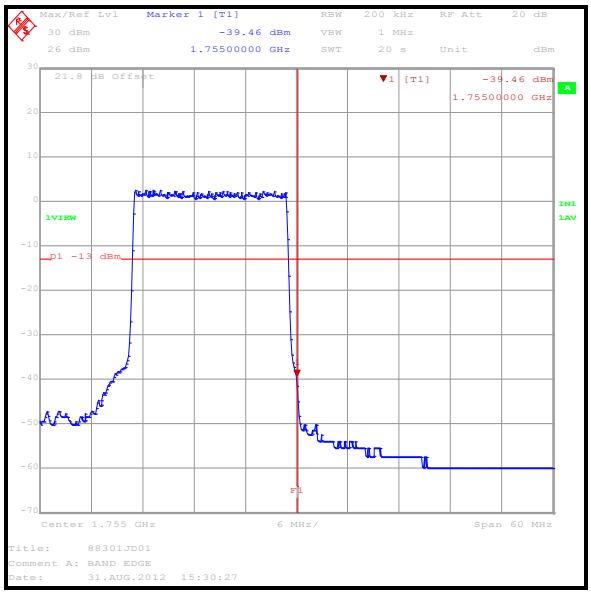


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 20 MHz Bandwidth 64QAM / Uplink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710.000	-43.5	-13.0	30.5	Complied
1755.000	-39.5	-13.0	26.6	Complied

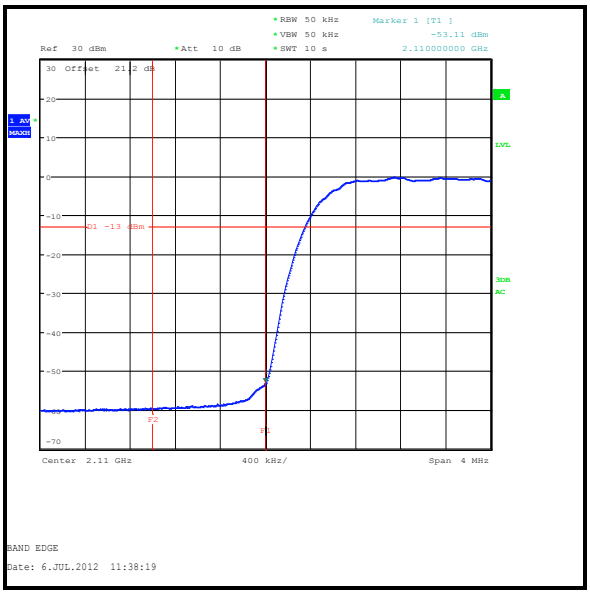


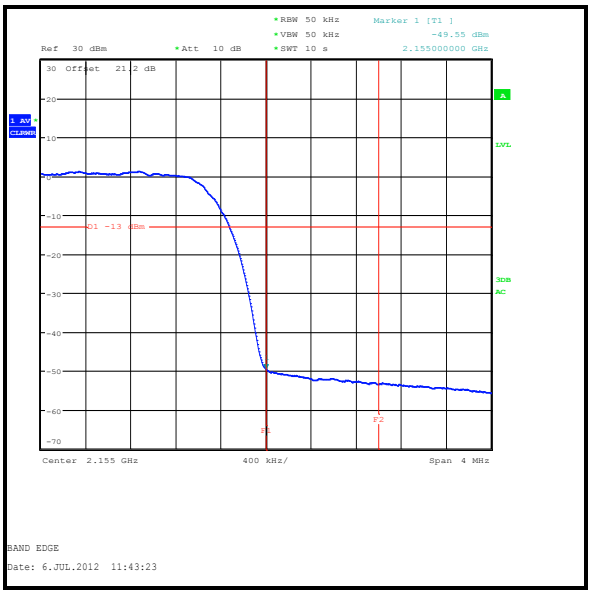


Transmitter Band Edge Conducted Emissions (continued)

Results: WCDMA / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
2110	-53.1	-13.0	40.1	Complied
2155	-49.6	-13.0	36.6	Complied

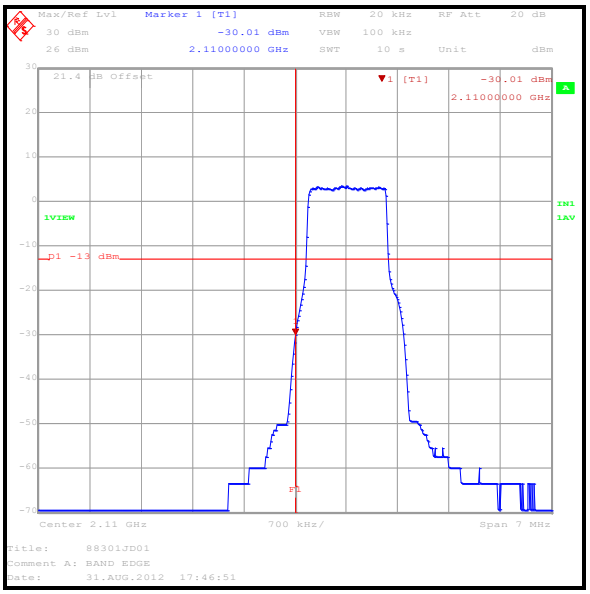


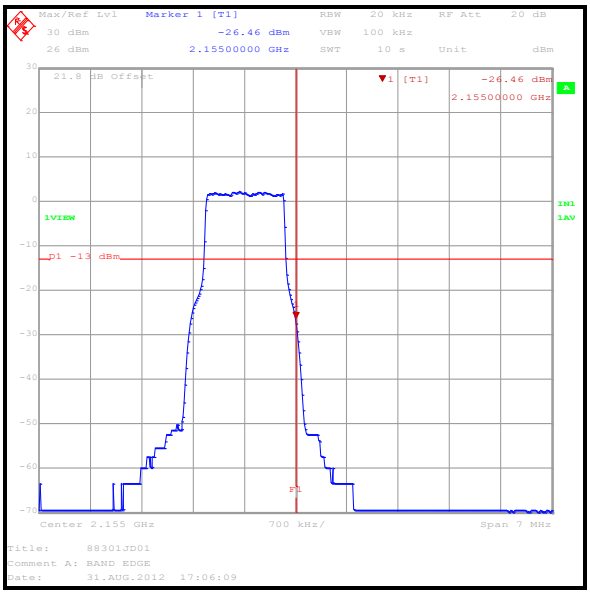


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 1.4 MHz Bandwidth QPSK / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
2110	-30.0	-13.0	17.0	Complied
2155	-26.5	-13.0	13.5	Complied

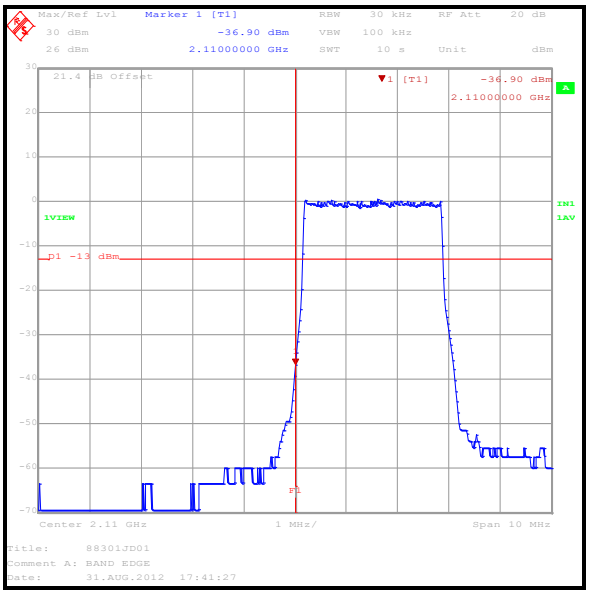


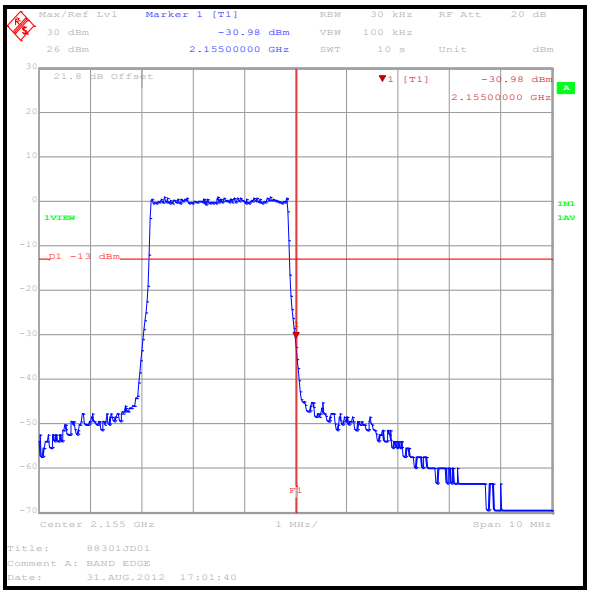


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 3.0 MHz Bandwidth 64QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
2110	-36.9	-13.0	23.9	Complied
2155	-31.0	-13.0	18.0	Complied

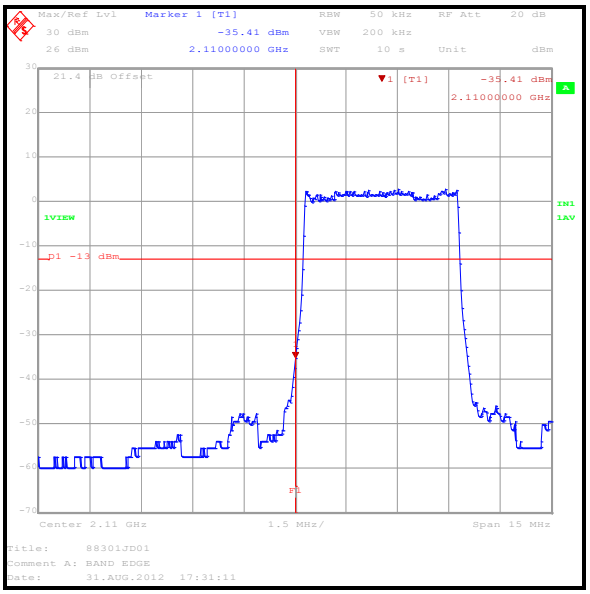


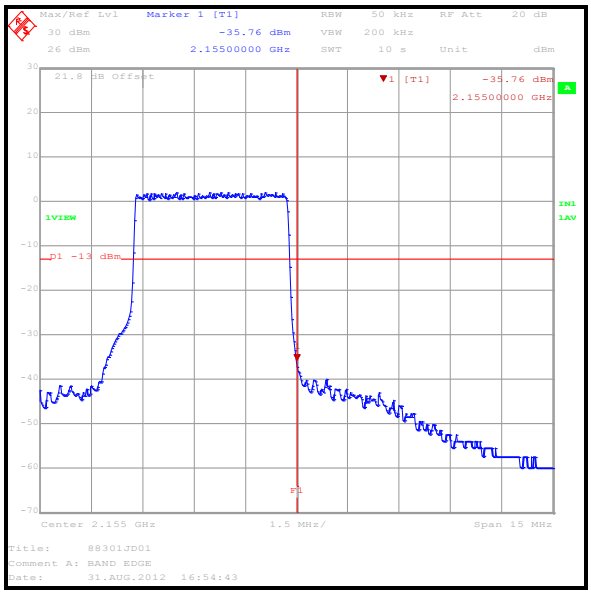


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 5.0 MHz Bandwidth 64QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
2110	-35.4	-13.0	23.4	Complied
2155	-35.8	-13.0	23.8	Complied

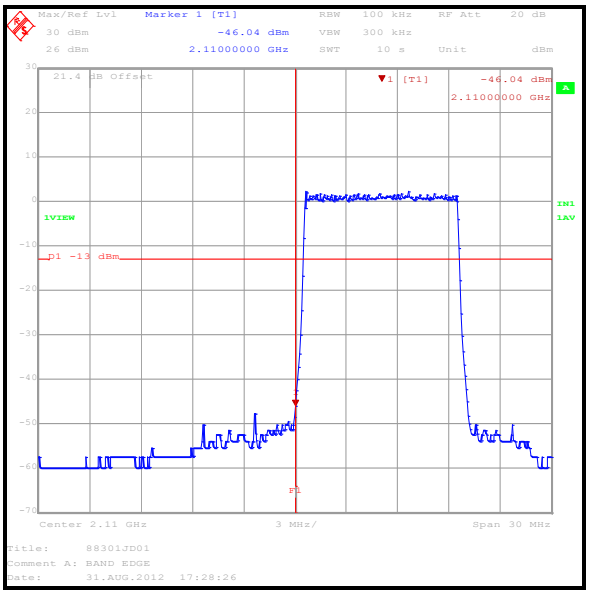


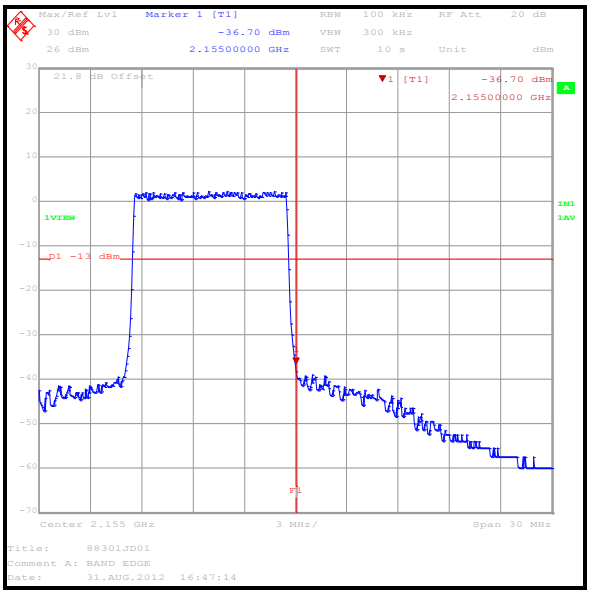


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 10 MHz Bandwidth 64QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
2110	-46.0	-13.0	33.0	Complied
2155	-36.7	-13.0	23.7	Complied

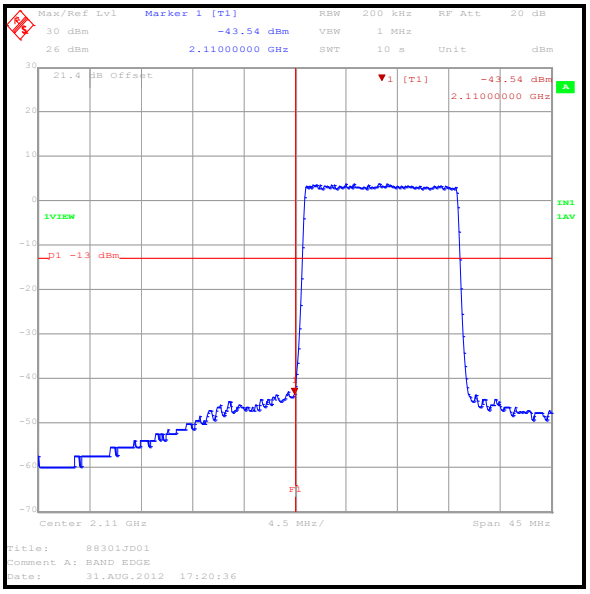


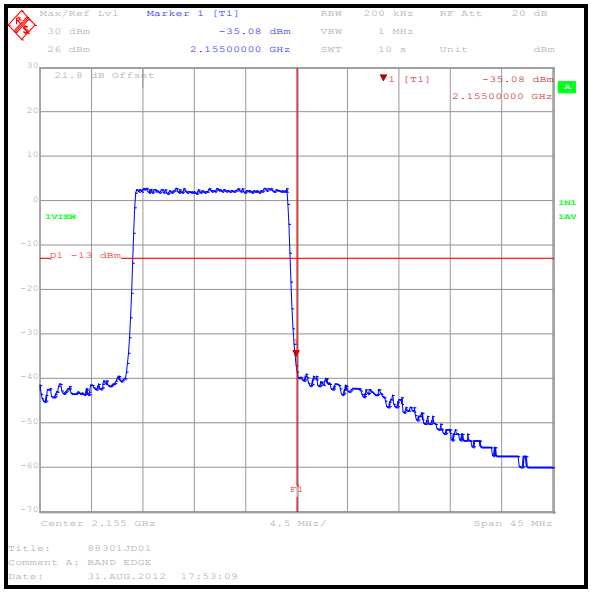


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 15 MHz Bandwidth 64QAM / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
2110	-43.5	-13.0	30.5	Complied
2155	-35.1	-13.0	22.1	Complied

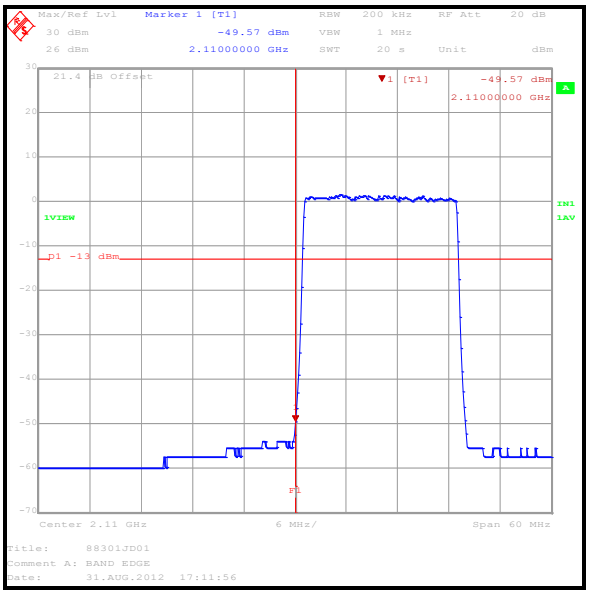


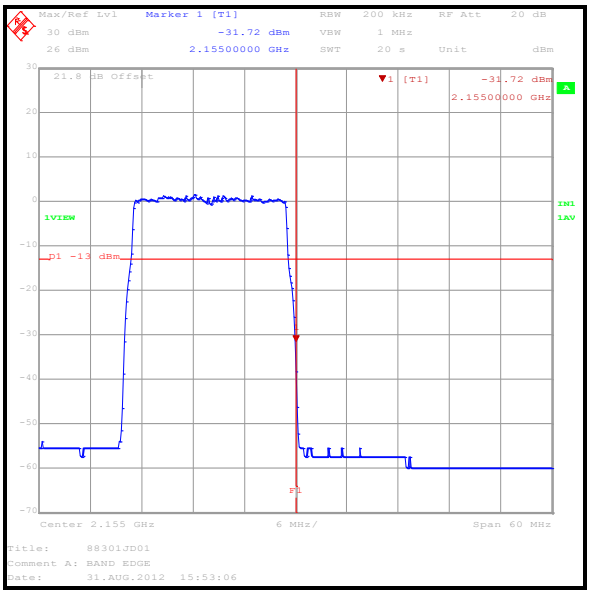


Transmitter Band Edge Conducted Emissions (continued)

Results: LTE 20 MHz Bandwidth QPSK / Downlink

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
2110	-49.6	-13.0	36.6	Complied
2155	-31.7	-13.0	18.7	Complied





5.4. Test Results: 3GPP TS 36.143 V10.3.0 Clause 11

5.4.1. Input Intermodulation

Test Summary:

Test Engineer:	Patrick Jones	**Test Date:**	30 October 2012
Test Sample Serial Number:	11120003		

3GPP Reference:	TS 36.143 V10.3.0, Clause 11.
Test Method Used:	As detailed in 3 GPP TS 36.143 V10.3.0, Clause 11, also referencing FCC Response to Enquiry 792557

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	36

Note(s):

1. Downlink tests: Two CW signals, one of which was at a varying offset from the first channel in the pass band depending on the technology being tested, were mixed through a suitable combining circuit. The 3rd order intermodulation product (F2-(2xF1)) = 737.5 MHz or (F2-(2xF1)) = 2132.5 MHz, which is the centre of the respective pass bands. The signal generator levels were adjusted to be -40.0 dBm at the repeater input.
2. Uplink tests: Two CW signals, one of which was at a varying offset from the first channel in the pass band depending on the technology being tested, were mixed through a suitable combining circuit. The 3rd order intermodulation product (F2-(2xF1)) = 707.5 MHz or (F2-(2xF1)) = 1732.5 MHz, which is the centre of the respective pass bands. The signal generator levels were adjusted to be -40.0 dBm at the repeater input.
3. TS 36.143 V10.3.0, Clause 11 states that the power in the centre of the pass band shall not increase by more than 11.2 dB. The highest power increase shown in the results tables below is 7.3 dB resulting in a worst case margin of 3.9 dB therefore the EUT was fully compliant.

Results: 700L Band / Downlink / LTE (offset 1.0 MHz)

Increase of Power in the Operating Band (dBm)				
Frequency 1 (MHz)	**Frequency 2 (MHz)**	**Measurement Bandwidth (MHz)**	**Interferer Signal Levels (dBm)**	**Observed Increase in Power (dB)**
728.7	2194.9	1.0	-40.0	1.5

Results: 700L Band / Uplink / LTE (offset 1.0 MHz)

Increase of Power in the Operating Band (dBm)				
Frequency 1 (MHz)	**Frequency 2 (MHz)**	**Measurement Bandwidth (MHz)**	**Interferer Signal Levels (dBm)**	**Observed Increase in Power (dB)**
698.7	2104.9	1.0	-40.0	2.2

Input Intermodulation (continued)

Results: 1700 Band / Downlink / WCDMA (offset 3.5 MHz)

Increase of Power in the Operating Band (dBm)				
Frequency 1 (MHz)	**Frequency 2 (MHz)**	**Measurement Bandwidth (MHz)**	**Interferer Signal Levels (dBm)**	**Observed Increase in Power (dB)**
2109.0	6350.6	1.0	-40.0	5.5

Results: 1700 Band / Downlink / LTE (offset 1.0 MHz)

Increase of Power in the Operating Band (dBm)				
Frequency 1 (MHz)	**Frequency 2 (MHz)**	**Measurement Bandwidth (MHz)**	**Interferer Signal Levels (dBm)**	**Observed Increase in Power (dB)**
2109.7	6351.9	1.0	-40.0	1.5

Results: 1700 Band / Uplink / WCDMA (offset 3.5 MHz)

Increase of Power in the Operating Band (dBm)				
Frequency 1 (MHz)	**Frequency 2 (MHz)**	**Measurement Bandwidth (MHz)**	**Interferer Signal Levels (dBm)**	**Observed Increase in Power (dB)**
1709.0	5150.6	1.0	-40.0	7.3

Results: 1700 Band / Uplink / LTE (offset 1.0 MHz)

Increase of Power in the Operating Band (dBm)				
Frequency 1 (MHz)	**Frequency 2 (MHz)**	**Measurement Bandwidth (MHz)**	**Interferer Signal Levels (dBm)**	**Observed Increase in Power (dB)**
1709.7	5151.9	1.0	-40.0	2.3

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.25 dB
Conducted Output Power	699 to 746 MHz / 1710 to 2155 MHz	95%	±0.27 dB
Frequency Stability	699 to 746 MHz / 1710 to 2155 MHz	95%	±0.92 ppm
Peak to Average Power Ratio	699 to 746 MHz / 1710 to 2155 MHz	95%	±0.27 dB
Occupied Bandwidth	699 to 746 MHz / 1710 to 2155 MHz	95%	±0.92 ppm
Conducted Spurious Emissions	9 kHz to 22 GHz	95%	±2.64 dB
Radiated Spurious Emissions	30 MHz to 22 GHz	95%	±2.94 dB
Input Intermodulation	9 kHz to 22 GHz	95%	±2.64 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version.
2.0	129 & 130	-	Added input intermodulation results.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (months)
A1532	RF Splitter	AtlanTec	A8204-2	23445	Calibrated before use	-
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	09 Oct 2012	12
A1818	Antenna	EMCO	3115	00075692	09 Oct 2012	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	25 Feb 2013	12
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A1932	RF Filter	AtlanTec	AFH-02000	20r-JFBD04-002	15 Mar 2013	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	03 Apr 2013	12
A1999	Attenuator	Huber & Suhner	6820.17.B	07101	04 Apr 2013	12
A2064	Coaxial Circulator	Atlantic	ACC-20010-SF-SF-SF	110714728	Calibrated before use	-
A2065	Coaxial Circulator	Atlantic	ACC-20010-SF-SF-SF	110714729	Calibrated before use	-
A2066	Coaxial Circulator	Atlantic	ACC-20070-SF-SF-SF	110733768	Calibrated before use	-
A2068	Coaxial Circulator	Atlantic	ACC-20040-SF-SF-SF	110714732	Calibrated before use	-
A2069	Coaxial Circulator	Atlantic	ACC-20040-SF-SF-SF	80701482	Calibrated before use	-
A2071	Coaxial Circulator	Atlantic	ACC-20070-SF-SF-SF	100512542	Calibrated before use	-
A253	Antenna	Flann Microwave	12240-20	128	09 Oct 2012	12
A254	Antenna	Flann Microwave	14240-20	139	09 Oct 2012	12
A255	Antenna	Flann Microwave	16240-20	519	09 Oct 2012	12
A256	Antenna	Flann Microwave	18240-20	400	09 Oct 2012	12
A553	Antenna	Chase	CBL6111A	1593	15 Feb 2013	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	19 Feb 2013	12
E013	Environmental Chamber	Sanyo	MTH-4200PR	None	10 Aug 2012	12
G0543	Amplifier	Sonoma	310N	230801	15 Oct 2012	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	31 Aug 2012	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	09 Oct 2012	12
L1017	Test Receiver	Rohde & Schwarz	ESIB 40	100109	09 Nov 2012	12
L1050	Test Receiver	Rohde & Schwarz	SMU200A	100943	09 Oct 2013	36
L1067	Test Receiver	Rohde & Schwarz	ESIB 40	100262	29 May 2013	12

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (months)
L1070	Signal Generator	Rohde & Schwarz	SMBV100A	257568	27 Jan 2013	12
M1068	Thermometer	Iso-Tech	RS55	93102884	08 Mar 2013	12
M1229	Multimeter	Fluke	179	87640015	18 Jun 2013	12
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986/022	24 Nov 2012	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	03 Feb 2013	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	20 Oct 2012	12
M1449	Signal Generator	Rohde & Schwarz	SMIQ03B	100176	01 Mar 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	13 Jan 2013	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	14 Jun 2013	12
S0539	Power Supply Unit	Kikusui	PCR 1000L	13010170	Calibrated Before Use	-

Notes:

1. All test equipment was within the previous or current calibration period on the date of testing
2. In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.