



# TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Airsynergy SYN2-CN-00-A36-000

FCC ID: O2J-365AS

To: FCC Parts 15.207; 90.209; 90.210; 90.1321 & 90.1323

**Test Report Serial No:**  
RFI-RPT-RP82269JD01A

<b>This Test Report Is Issued Under The Authority Of Chris Guy, Head of Global Approvals:</b>		
<b>Checked By:</b>	Ian Watch	
<b>Signature:</b>		
<b>Date of Issue:</b>	17 August 2011	

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## **Table of Contents**

<b>1. Customer Information .....</b>	<b>4</b>
<b>2. Summary of Testing .....</b>	<b>5</b>
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
<b>3. Equipment Under Test (EUT) .....</b>	<b>6</b>
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	8
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>9</b>
4.1. Operating Modes	9
4.2. Configuration and Peripherals	9
<b>5. Measurements, Examinations and Derived Results .....</b>	<b>10</b>
5.1. General Comments	10
5.2. Test Results	11
5.2.1. Transmitter AC Conducted Spurious Emissions	11
5.2.2. Transmitter Carrier Output Power (EIRP)	15
5.2.3. Transmitter Peak EIRP Power Density	20
5.2.4. Transmitter Occupied Bandwidth	25
5.2.5. Transmitter Conducted Emissions Mask	34
5.2.6. Transmitter Conducted Emissions (Out of Band)	39
5.2.7. Transmitter Band Edge Conducted Emissions	46
5.2.8. Transmitter Radiated Emissions (Out of Band)	58
5.2.9. Transmitter Band Edge Radiated Emissions	62
<b>6. Measurement Uncertainty .....</b>	<b>66</b>
<b>Appendix 1. Test Equipment Used .....</b>	<b>67</b>

## **1. Customer Information**










<b>Company Name:</b>	Airspan Communications Ltd.
<b>Address:</b>	Capital Point 33 Bath Road Slough Berkshire SL1 3UF United Kingdom

## 2. Summary of Testing

### 2.1. General Information

<b>Specification Reference:</b>	47CFR15.207
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 15 Subpart C (Intentional Radiators) – Section 15.207
<b>Specification Reference:</b>	47CFR90
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 90 Subpart Z (Wireless Broadband Services in the 3650-3700 MHz Band)
<b>Specification Reference:</b>	Customer Test Plan
<b>Specification Title:</b>	SC_AIR_TP03_A Date: 04 July 2011
<b>Site Registration:</b>	209735
<b>Location of Testing:</b>	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
<b>Test Dates:</b>	01 July 2011 to 10 August 2011

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	
Part 90.1321(a) / 2.1046	Transmitter Carrier Output Power (EIRP)	
Part 90.1321(a) / 2.1046	Transmitter Peak EIRP Power Density	
Part 90.209 / 2.1049	Transmitter Occupied Bandwidth	
Part 90.210(b)(n) / 2.1051	Transmitter Conducted Emissions Mask	
Part 90.1323 / 2.1051	Transmitter Conducted Emissions (Out of Band)	
Part 90.1323 / 2.1053	Transmitter Radiated Emissions (Out of Band)	
<b>Key to Results</b>		
 = Complied  = Did not comply		

### 2.3. Methods and Procedures

<b>Reference:</b>	ANSI/TIA-603-C-2004
<b>Title:</b>	Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards
<b>Reference:</b>	ANSI C63.4 (2009)
<b>Title:</b>	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

### 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)**

<b>Brand Name:</b>	Airspan
<b>Model Name or Number:</b>	Airsynergy SYN2-CN-00-A36-000
<b>Serial Number:</b>	9B23B3FFFF28 - baseband board
<b>Hardware Version Number:</b>	Synergy2 revA
<b>FCC ID:</b>	O2J-365AS

#### **3.2. Description of EUT**

The equipment under test was a Airsynergy P2P WiMax Base Station operating in the 3.6 GHz frequency band.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

<b>Tested Technology:</b>	WiMAX	
<b>Type of Equipment</b>	Base Station	
<b>Modulation Type:</b>	QPSK3/4 and 64QAM3/4	
<b>Duty Cycle</b>	5MHz: 59% 10MHz: 60%	
<b>Channel Spacing:</b>	5 MHz and 10 MHz	
<b>Antenna Gain:</b>	+6.5 dBi for 5 MHz channels +9.5 dBi for 10 MHz channels	
<b>Power Supply Requirement:</b>	Nominal	120 VAC 60 Hz
<b>5 MHz Channels Transmit Frequency Range:</b>	3650 MHz to 3700 MHz	
<b>5 MHz Channels Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Frequency (MHz)</b>
	Bottom	3652.5
	Top of lower 25 MHz band	3672.5
	Top of whole 50 MHz band	3697.5
<b>10 MHz Channels Transmit Frequency Range:</b>	3650 MHz to 3700 MHz	
<b>10 MHz Channels Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Frequency (MHz)</b>
	Bottom	3655.0
	Top of lower 25 MHz band	3670.0
	Top of whole 50 MHz band	3695.0

### **3.5. Support Equipment**

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

<b>Description:</b>	Laptop
<b>Brand Name:</b>	Dell
<b>Model Name or Number:</b>	Latitude
<b>Serial Number:</b>	Airspan 005853

<b>Description:</b>	120 VAC 60 Hz to 48 VDC PSU
<b>Brand Name:</b>	Powerbox
<b>Model Name or Number:</b>	PBUS-LUV-54V/100W-SN-QNA
<b>Serial Number:</b>	S1125CV000566

<b>Description:</b>	POE Connection box
<b>Brand Name:</b>	Airspan
<b>Model Name or Number:</b>	Not Stated
<b>Serial Number:</b>	Not Stated

<b>Description:</b>	Ethernet Router
<b>Brand Name:</b>	Dlink
<b>Model Name or Number:</b>	DGS-1005D
<b>Serial Number:</b>	DRSB92000451



## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

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

- Transmit Mode - The EUT was set to transmit with maximum output power on the bottom and top channels using a 5 MHz or 10 MHz channel bandwidth as detailed in the Customer's Test Plan.
- Operating on the bottom or lower top channel, as detailed in the Customer's Test Plan.

### **4.2. Configuration and Peripherals**

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

- The EUT was controlled from a laptop PC using software supplied by the Customer.
- The EUT supports MIMO on two RF ports. Measurements were performed on each port as required.
- A 50 Ohm load was fitted to both RF ports on the EUT during radiated spurious emission testing.
- AC conducted emissions testing was performed with the 120 VAC 60 Hz to 48 VDC PSU plugged into a LISN. The LISN was connected to a 120 VAC 60 Hz mains supply. The EUT was connected to the 48 VDC output of the PSU. The EUT was configured to transmit at full power during the test.

## **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****5.2.1. Transmitter AC Conducted Spurious Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	06 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	15.207
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

**Environmental Conditions:**

<b>Temperature (°C):</b>	29
<b>Relative Humidity (%):</b>	27

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.384000	Live	52.1	58.2	6.1	Complied
0.573000	Live	53.5	56.0	2.5	Complied
0.739500	Live	52.6	56.0	3.4	Complied
0.879000	Live	48.9	56.0	7.2	Complied
1.023000	Live	49.6	56.0	6.4	Complied
1.180500	Live	48.5	56.0	7.5	Complied
1.626000	Live	45.2	56.0	10.8	Complied
1.837500	Live	45.9	56.0	10.1	Complied
2.152500	Live	42.6	56.0	13.4	Complied
2.625000	Live	43.3	56.0	12.7	Complied

**Results: Live / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.294000	Live	43.4	50.4	7.0	Complied
0.366000	Live	43.0	48.6	5.6	Complied
0.442500	Live	37.7	47.0	9.3	Complied
0.568500	Live	41.0	46.0	5.0	Complied
0.739500	Live	39.3	46.0	6.7	Complied
0.852000	Live	36.9	46.0	9.1	Complied
0.991500	Live	34.6	46.0	11.4	Complied
1.774500	Live	31.1	46.0	14.9	Complied
1.828500	Live	29.0	46.0	17.0	Complied
2.049000	Live	30.7	46.0	15.3	Complied

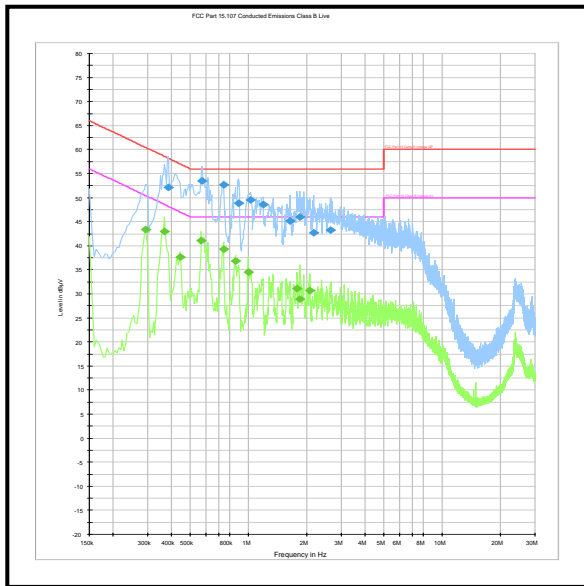
**Transmitter AC Conducted Spurious Emissions (continued)****Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.375000	Neutral	52.5	58.4	5.9	Complied
0.577500	Neutral	53.2	56.0	2.8	Complied
0.744000	Neutral	52.4	56.0	3.6	Complied
0.892500	Neutral	51.3	56.0	4.7	Complied
1.018500	Neutral	49.1	56.0	6.9	Complied
1.189500	Neutral	48.3	56.0	7.7	Complied
1.284000	Neutral	47.5	56.0	8.5	Complied
1.864500	Neutral	45.2	56.0	10.8	Complied
1.990500	Neutral	45.3	56.0	10.7	Complied
2.274000	Neutral	45.2	56.0	10.8	Complied

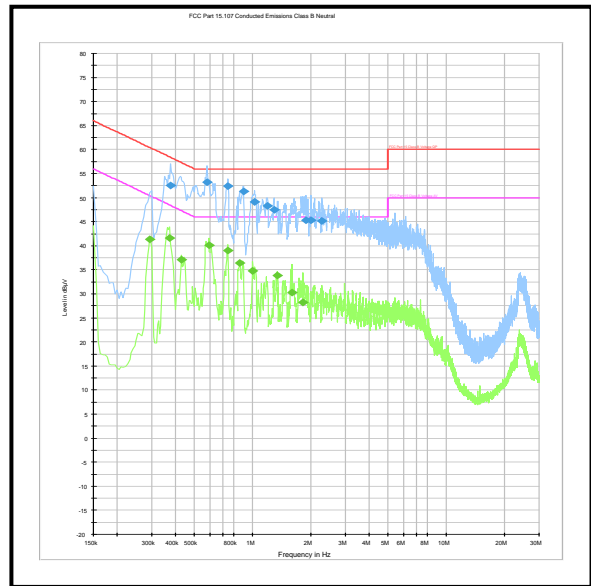
**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.294000	Neutral	41.3	50.4	9.1	Complied
0.370500	Neutral	41.6	48.5	6.9	Complied
0.429000	Neutral	37.2	47.3	10.1	Complied
0.591000	Neutral	40.1	46.0	5.9	Complied
0.739500	Neutral	39.1	46.0	6.9	Complied
0.856500	Neutral	36.4	46.0	9.6	Complied
0.996000	Neutral	34.8	46.0	11.2	Complied
1.338000	Neutral	33.9	46.0	12.1	Complied
1.594500	Neutral	30.3	46.0	15.7	Complied
1.815000	Neutral	28.2	46.0	17.8	Complied

**Transmitter 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 Carrier Output Power (EIRP)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	04 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	90.1321(a) / 2.1046
<b>Test Method:</b>	As detailed in FCC KDB 965270 dated 15 April 2010

**Environmental Conditions:**

<b>Temperature (°C):</b>	28
<b>Relative Humidity (%):</b>	24

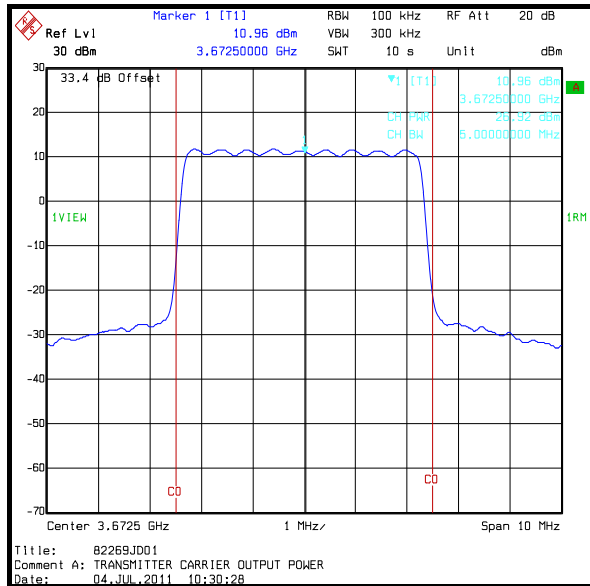
**Note(s):**

1. Measurements were performed with the EUT transmitting on the top channel of the lower 25 MHz frequency band using 5 MHz and 10 MHz channel bandwidths in accordance with the Customer's Test Plan.
2. Part 90.1321(a) limits of 25 Watts / 25 MHz were scaled to 5 MHz and 10 MHz channel widths supported by the EUT.
3. The Customer declared that the EUT supports MIMO using two outputs and the antenna is a dual port, dual slant +/- 45° polarised. Therefore, in accordance with FCC KDB 662911 the antenna definition is cross polarised with N = 2 and the directional gain is the gain of an individual antenna (+6.5 dBi for 5 MHz channels and +9.5 dBi for 10 MHz channels).
4. The conducted maximum output power from each port was measured using a spectrum analyser channel power function in conjunction with an RMS detector for each supported bandwidth. The results for each port were linearly summed in accordance with FCC KDB 662911(1). The applicable antenna gain was added to the summed conducted output power to calculate the EIRP.
5. An additional spectrum analyser offset of 2.3 dB was used to compensate for the 59% duty cycle of the EUT when transmitting a 5 MHz channel. This was calculated using the equation  $10 \cdot \log_{10}(\text{Ton}/\text{Period})$ . Ton was measured as being 2.97 ms and Period measured was 5.01 ms.
6. An additional spectrum analyser offset of 2.2 dB was used to compensate for the 60% duty cycle of the EUT when transmitting a 10 MHz channel. This was calculated using the equation  $10 \cdot \log_{10}(\text{Ton}/\text{Period})$ . Ton was measured as being 2.98 ms and period measured was 4.99 ms.

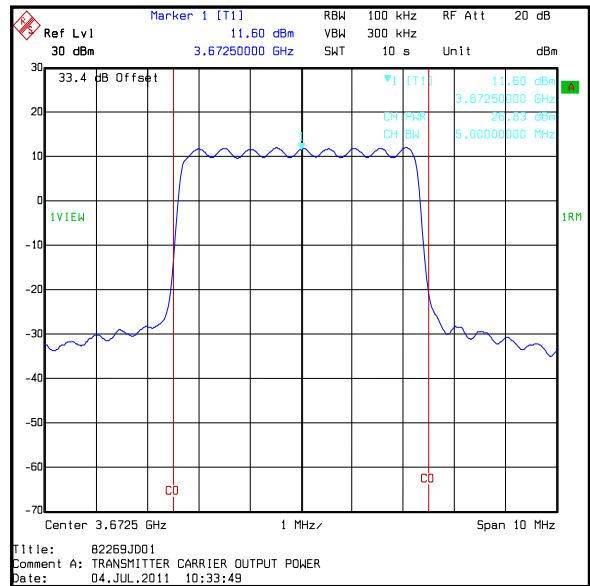
**Transmitter Carrier Output Power (EIRP) (continued)**

**Results: Top Channel / 3672.5 MHz / Lower 25 MHz Band / 5 MHz Channel / QPSK3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
26.9	26.8	29.9	6.5	36.4	37.0	0.6	Complied



**QPSK3/4 / Port 1**



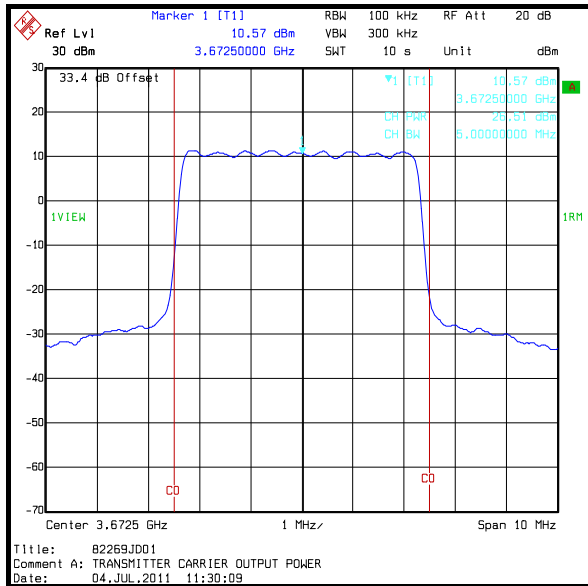
**QPSK3/4 / Port 2**



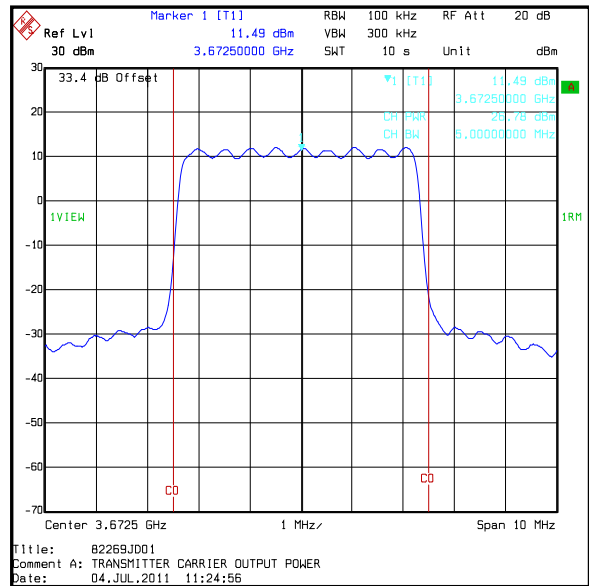
**Transmitter Carrier Output Power (EIRP) (continued)**

**Results: Top Channel / 3672.5 MHz / Lower 25 MHz Band / 5 MHz Channel / 64QAM3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
26.5	26.8	29.7	6.5	36.2	37.0	0.8	Complied



**64QAM3/4 / Port 1**

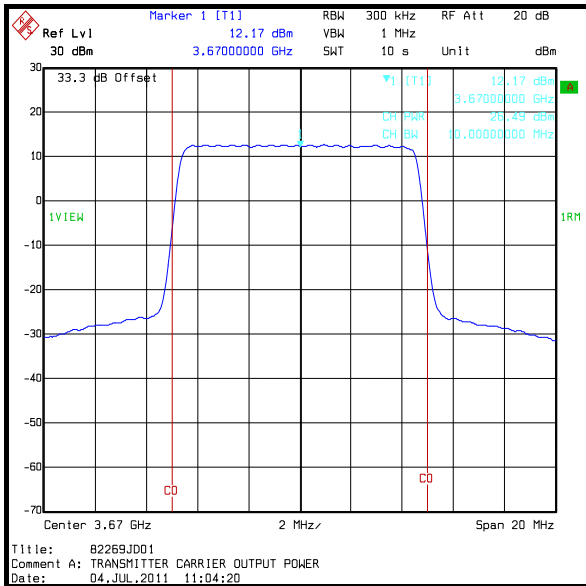


**64QAM3/4 / Port 2**

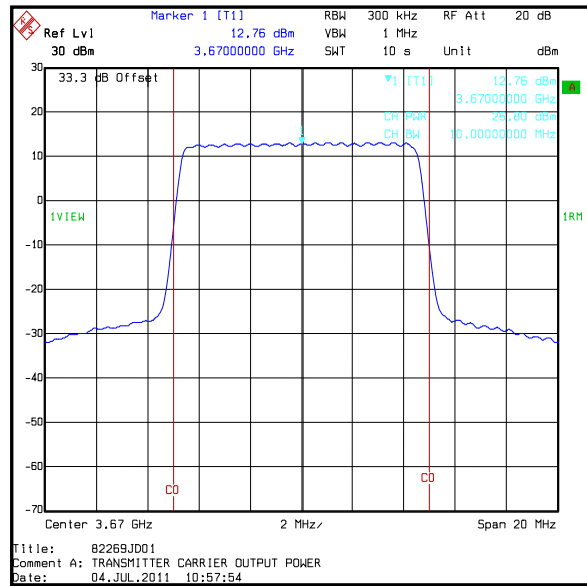
**Transmitter Carrier Output Power (EIRP) (continued)**

**Results: Top Channel / 3670.0 MHz / Lower 25 MHz Band / 10 MHz Channel / QPSK3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
26.5	26.8	29.7	9.5	39.2	40.0	0.8	Complied



**QPSK3/4 / Port 1**

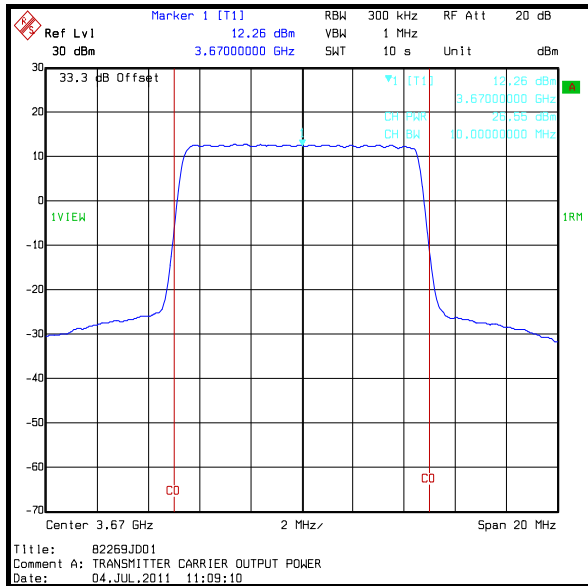


**QPSK3/4 / Port 2**

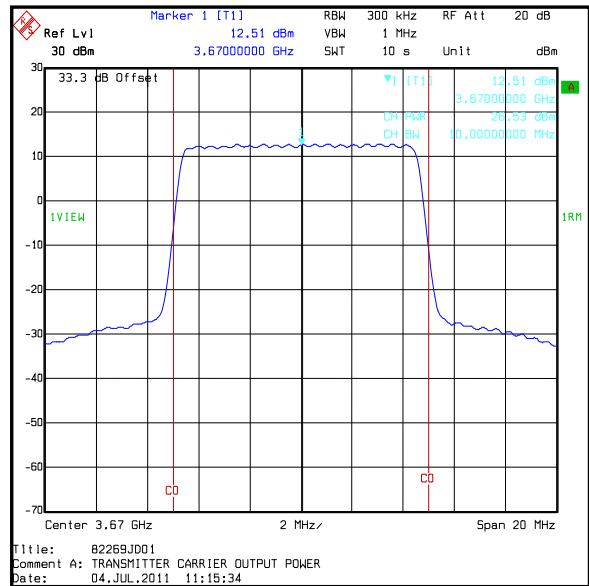
**Transmitter Carrier Output Power (EIRP) (continued)**

**Results: Top Channel / 3670.0 MHz / Lower 25 MHz Band / 10 MHz Channel / 64QAM3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
26.6	26.5	29.6	9.5	39.1	40.0	0.9	Complied



**64QAM3/4 / Port 1**



**64QAM3/4 / Port 2**

**5.2.3. Transmitter Peak EIRP Power Density****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	04 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	90.1321(a) / 2.1046
<b>Test Method:</b>	As detailed in FCC KDB 965270 dated 15 April 2010, referencing KDB 662911 dated 04 April 2011

**Environmental Conditions:**

<b>Temperature (°C):</b>	30
<b>Relative Humidity (%):</b>	23

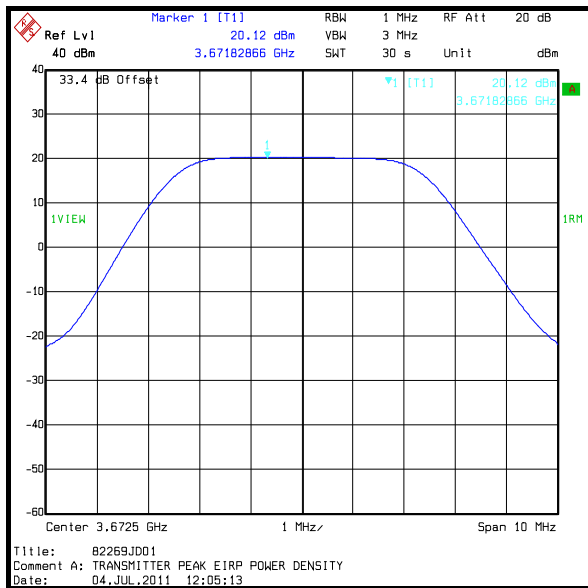
**Note(s):**

- Measurements were performed on the top channel of the lower 25 MHz frequency band using 5 MHz and 10 MHz channel bandwidths in accordance with the Customer's Test Plan.
- The Customer declared that the EUT supports MIMO using two outputs and the antenna is a dual port, dual slant +/- 45° polarised. Therefore, in accordance with FCC KDB 662911 the antenna definition is cross polarised with N = 2 and the directional gain is the gain of an individual antenna (+6.5 dBi for 5 MHz channels and +9.5 dBi for 10 MHz channels).
- The conducted maximum output power from each port was measured using a 1 MHz measurement bandwidth in conjunction with an RMS detector for each supported bandwidth. The results for each port were linearly summed in accordance with FCC KDB 662911(1). The applicable antenna gain was added to the summed conducted output power to calculate the EIRP.
- An additional spectrum analyser offset of 2.3 dB was used to compensate for the 59% duty cycle of the EUT when transmitting a 5 MHz channel. This was calculated using the equation  $10 \cdot \log_{10}(\text{Ton}/\text{Period})$ . Ton was measured as being 2.97 ms and Period measured was 5.01 ms.
- An additional spectrum analyser offset of 2.2 dB was used to compensate for the 60% duty cycle of the EUT when transmitting a 10 MHz channel. This was calculated using the equation  $10 \cdot \log_{10}(\text{Ton}/\text{Period})$ . Ton was measured as being 2.98 ms and period measured was 4.99 ms.

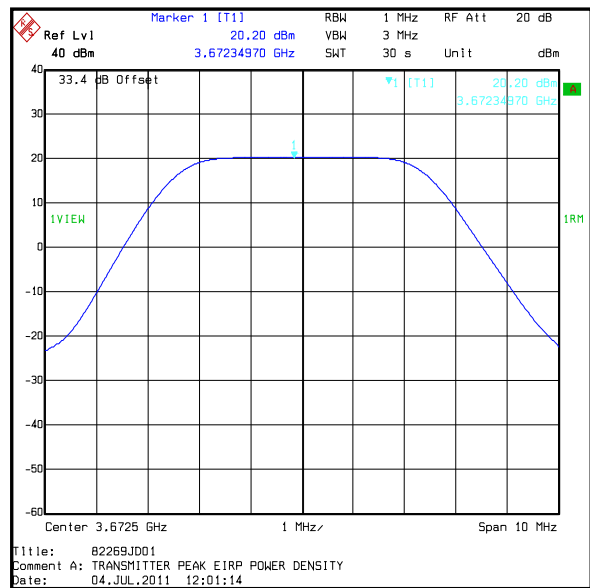
**Transmitter Peak EIRP Power Density (continued)**

**Results: Top Channel / 3672.5 MHz / Lower 25 MHz Band / 5 MHz Channel / QPSK3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP PSD Limit (dBm/MHz)	Margin (dB)	Result
20.1	20.2	23.2	6.5	29.7	30.0	0.3	Complied



**QPSK3/4 / Port 1**

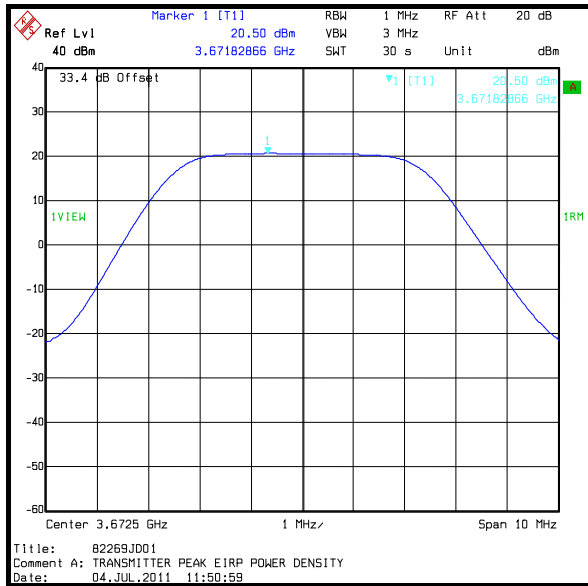


**QPSK3/4 / Port 2**

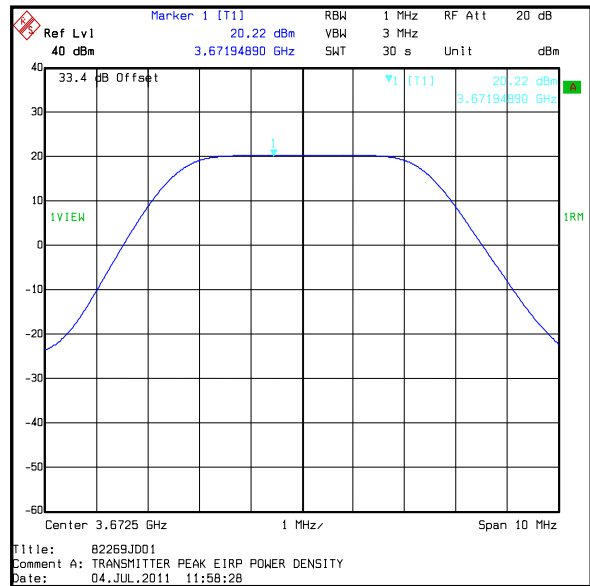
**Transmitter Peak EIRP Power Density (continued)**

**Results: Top Channel / 3672.5 MHz / Lower 25 MHz Band / 5 MHz Channel / 64QAM3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP PSD Limit (dBm/MHz)	Margin (dB)	Result
20.5	20.2	23.4	6.5	29.9	30.0	0.1	Complied



**64QAM3/4 / Port 1**

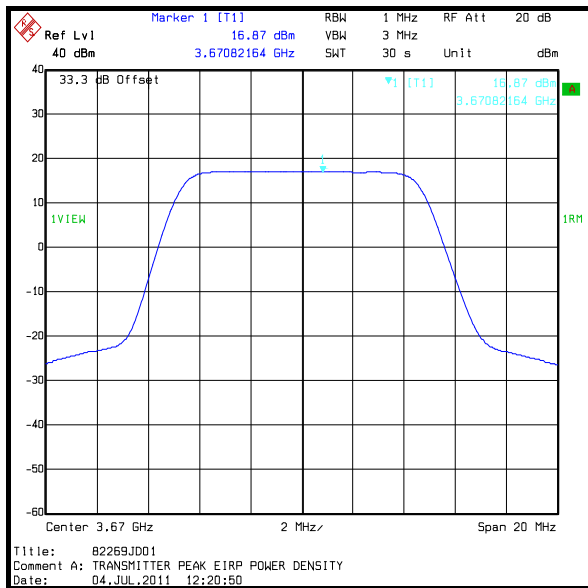


**64QAM3/4 / Port 2**

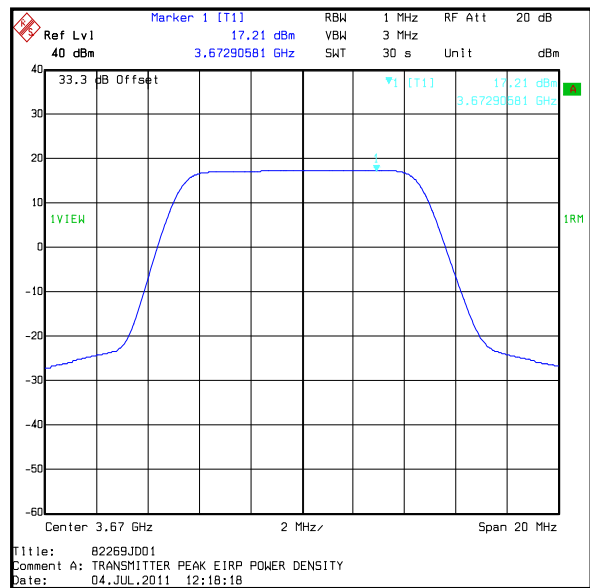
**Transmitter Peak EIRP Power Density (continued)**

**Results: Top Channel / 3670.0 MHz / Lower 25 MHz Band / 10 MHz Channel / QPSK3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP PSD Limit (dBm/MHz)	Margin (dB)	Result
16.9	17.2	20.1	9.5	29.6	30.0	0.4	Complied



**QPSK3/4 / Port 1**

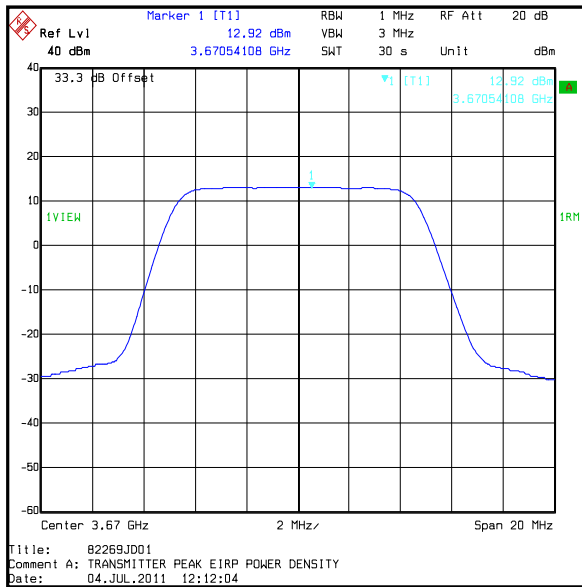


**QPSK3/4 / Port 2**

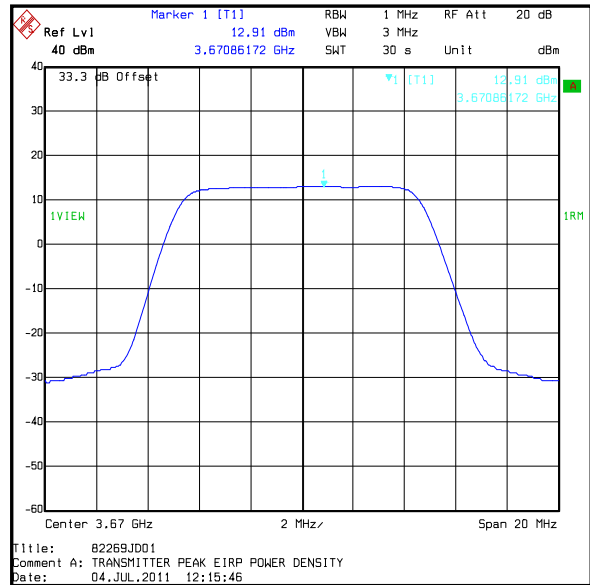
**Transmitter Peak EIRP Power Density (continued)**

**Results: Top Channel / 3670.0 MHz / Lower 25 MHz Band / 10 MHz Channel / 64QAM3/4**

Port 1 Conducted Power (dBm)	Port 2 Conducted Power (dBm)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Antenna Gain + Summed Power (dBm)	EIRP PSD Limit (dBm/MHz)	Margin (dB)	Result
12.9	12.9	15.9	9.5	25.4	30.0	4.6	Complied



**64QAM3/4 / Port 1**



**64QAM3/4 / Port 2**



**5.2.4. Transmitter Occupied Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	04 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	90.209 / 2.1049
<b>Test Method Used</b>	Occupied Bandwidth Function of a Spectrum Analyser in accordance with FCC KDB 971168

**Environmental Conditions:**

<b>Temperature (°C):</b>	31
<b>Relative Humidity (%):</b>	22

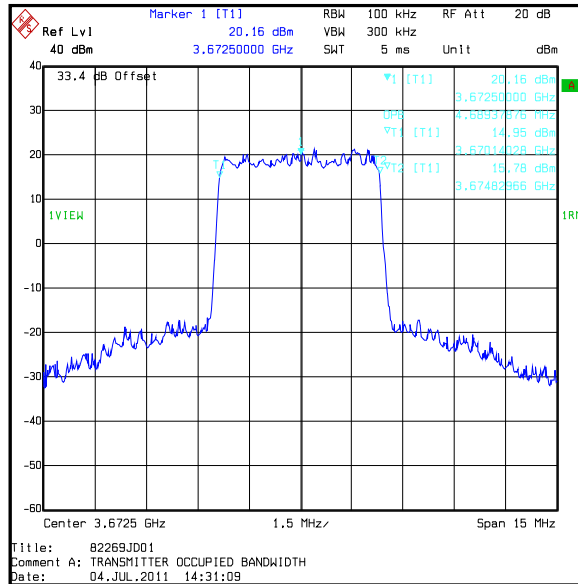
**Note(s):**

1. Measurements were performed on the top channel of the lower 25 MHz frequency band using 5 MHz and 10 MHz channel bandwidths in accordance with the Customer's Test Plan.
2. The spectrum analyser was left to sweep repeatedly on Max hold for a long enough period in order to maximise the measurement.

**Transmitter Occupied Bandwidth (continued)**

**Results: Port 1 / Lower 25 MHz Band / 5 MHz Channel / QPSK3/4**

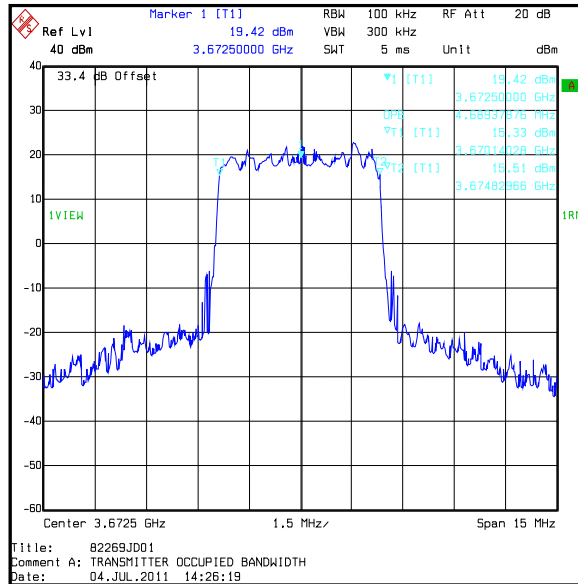
Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3672.5	4689.379



**Transmitter Occupied Bandwidth (continued)**

**Results: Port 2 / Lower 25 MHz Band / 5 MHz Channel / QPSK3/4**

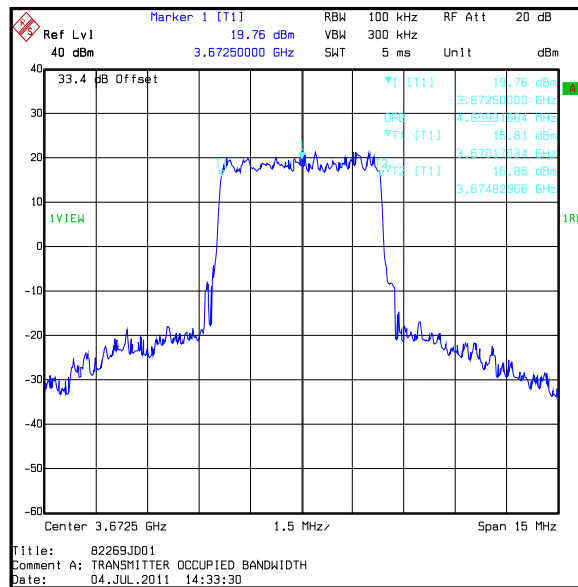
Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3672.5	4689.379



**Transmitter Occupied Bandwidth (continued)**

**Results: Port 1 / Lower 25 MHz Band / 5 MHz Channel / 64QAM3/4**

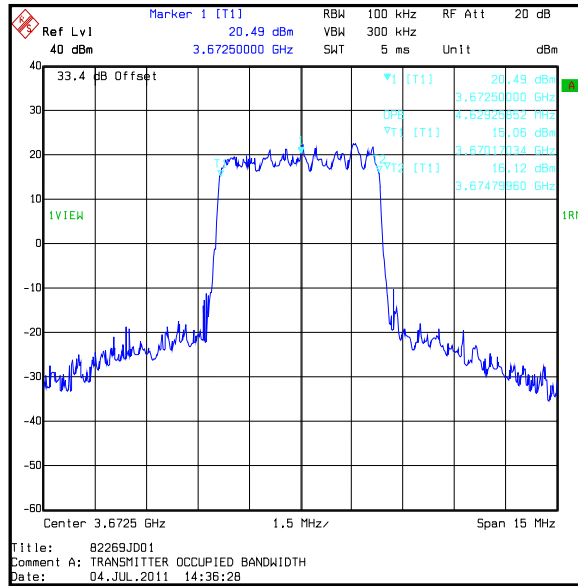
Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3672.5	4659.319



**Transmitter Occupied Bandwidth (continued)**

**Results: Port 2 / Lower 25 MHz Band / 5 MHz Channel / 64QAM3/4**

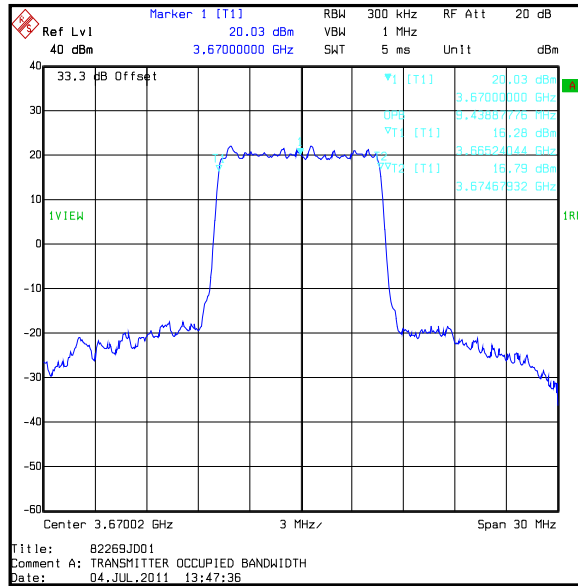
Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3672.5	4629.259



**Transmitter Occupied Bandwidth (continued)**

**Results: Port 1 / Lower 25 MHz Band / 10 MHz Channel / QPSK3/4**

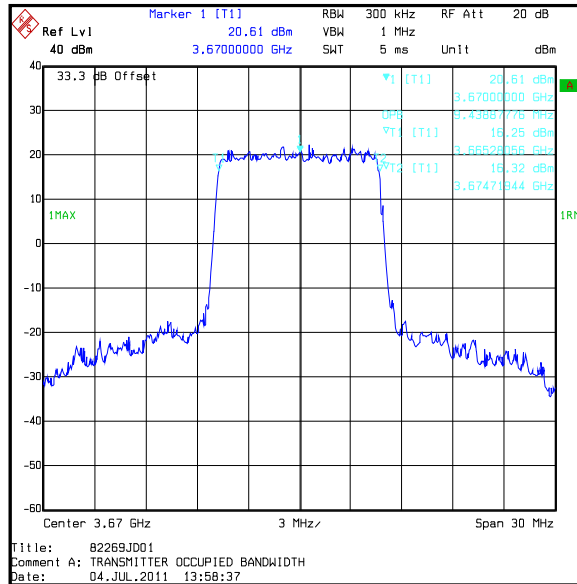
Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3670.0	9438.878



**Transmitter Occupied Bandwidth (continued)**

**Results: Port 2 / Lower 25 MHz Band / 10 MHz Channel / QPSK3/4**

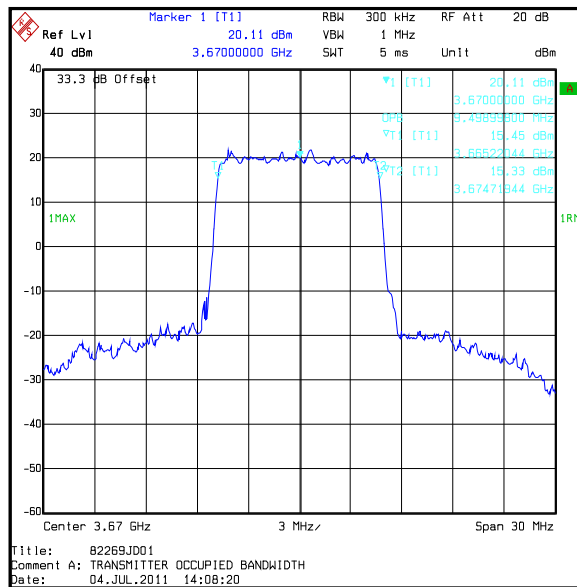
Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3670.0	9438.878



**Transmitter Occupied Bandwidth (continued)**

**Results: Port 1 / Lower 25 MHz Band / 10 MHz Channel / 64QAM3/4**

Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3670.0	9498.998

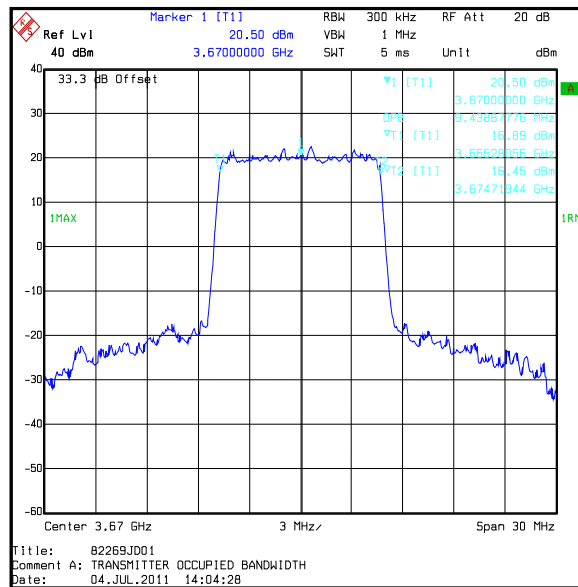




**Transmitter Occupied Bandwidth (continued)**

**Results: Port 2 / Lower 25 MHz Band / 10 MHz Channel / 64QAM3/4**

Channel	Frequency (MHz)	Occupied Bandwidth (kHz)
Top	3670.0	9438.878



**5.2.5. Transmitter Conducted Emissions Mask****Test Summary:**

<b>Test Engineer:</b>	Nick Steele	<b>Test Date:</b>	10 August 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

**Test Summary:**

<b>FCC Part:</b>	Part 90.210(b)(n) / 2.1051
<b>Test Method Used</b>	As detailed in ANSI TIA-603-C-2004 Section 2.2.13 referencing FCC Part 2.1051

**Environmental Conditions:**

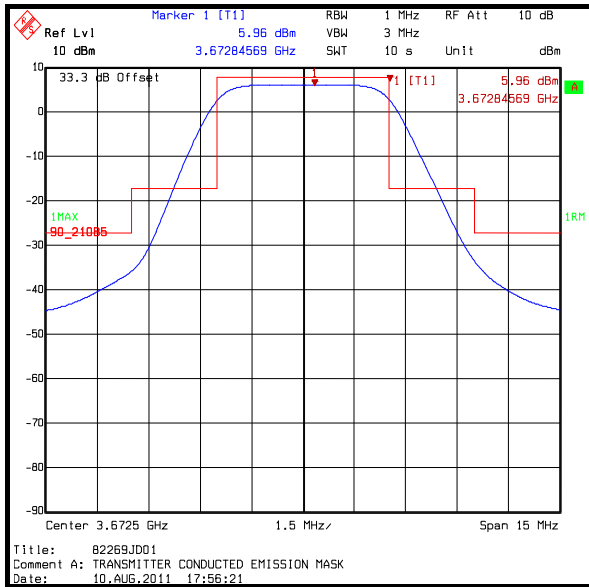
<b>Temperature (°C):</b>	30
<b>Relative Humidity (%):</b>	24

**Note(s):**

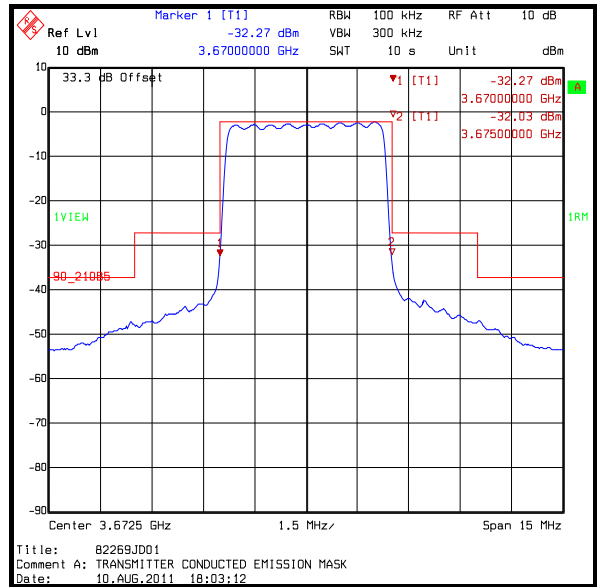
1. FCC Part 90.210 Emission Mask B was used at the request of the Customer.
2. The power of the modulated signal was measured on a spectrum analyser using an RMS detector and 10 second sweep time to give the full output power in the whole channel band. The limit mask on the spectrum analyser was placed at the level of the peak of the carrier when measured with an unmodulated carrier in a 10 MHz bandwidth. The modulation was turned on once the mask reference level had been established. The analyser resolution bandwidth was then changed to 1 MHz, to carry out the measurement in accordance with Part 90.210. To eliminate the effects of measuring with a relatively wide resolution bandwidth, which caused the signal to cross the mask limit, final measurements were performed with a 100 kHz resolution bandwidth and the mask amplitude was reduced by 10 dB to compensate for the reduced measurement bandwidth.
3. The spectrum analyser was left to sweep for 10 seconds during each test to ensure that all emissions were captured..
4. An additional spectrum analyser offset of 2.3 dB was used to compensate for the 59% duty cycle of the EUT when transmitting a 5 MHz channel. This was calculated using the equation  $10 \cdot \log_{10}(\text{Ton}/\text{Period})$ . Ton was measured as being 2.97 ms and Period measured was 5.01 ms.
5. An additional spectrum analyser offset of 2.2 dB was used to compensate for the 60% duty cycle of the EUT when transmitting a 10 MHz channel. This was calculated using the equation  $10 \cdot \log_{10}(\text{Ton}/\text{Period})$ . Ton was measured as being 2.98 ms and period measured was 4.99 ms.

**Transmitter Conducted Emissions Mask (continued)**

**Results: Port 1 / Lower 25 MHz Band / 5 MHz Channel / QPSK3/4**

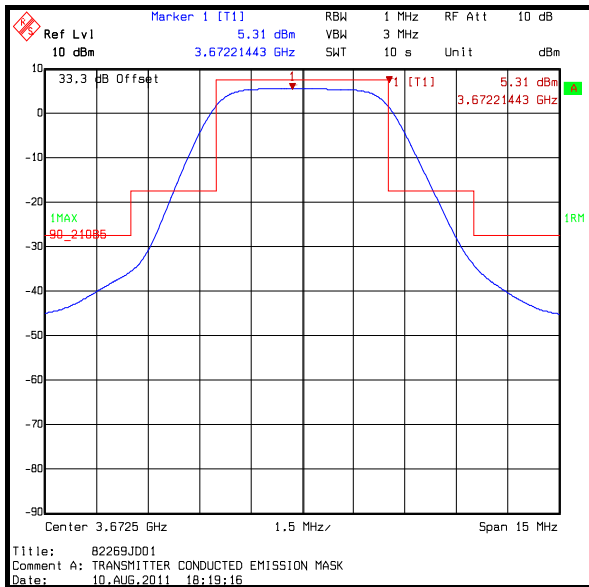


1 MHz Measurement Bandwidth

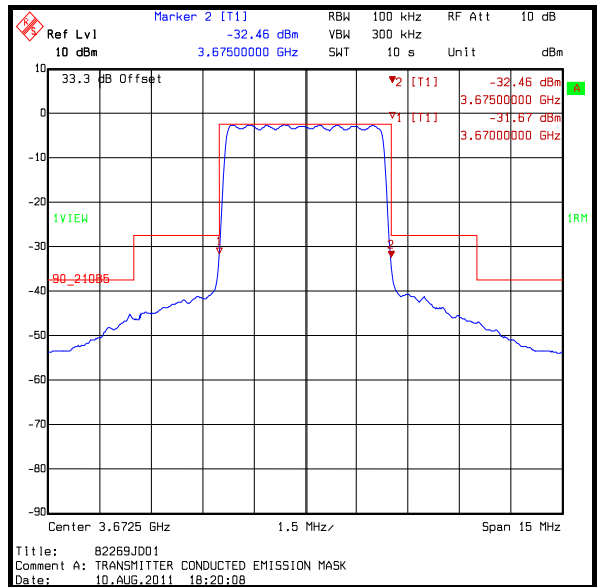


100 kHz Measurement Bandwidth

**Results: Port 2 / Lower 25 MHz Band / 5 MHz Channel / QPSK3/4**



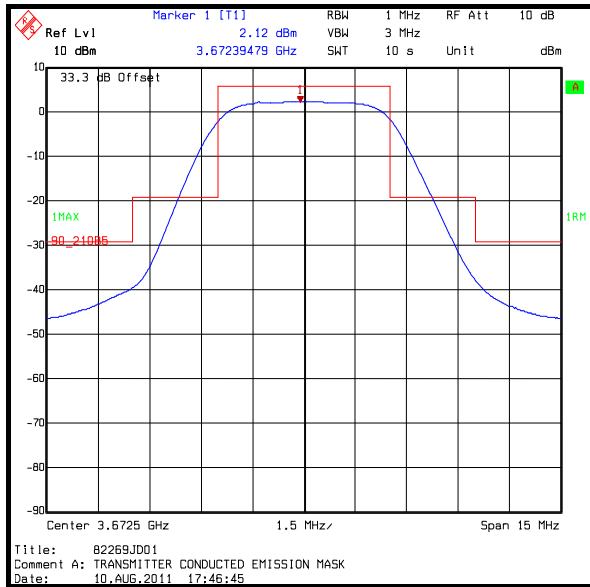
1 MHz Measurement Bandwidth



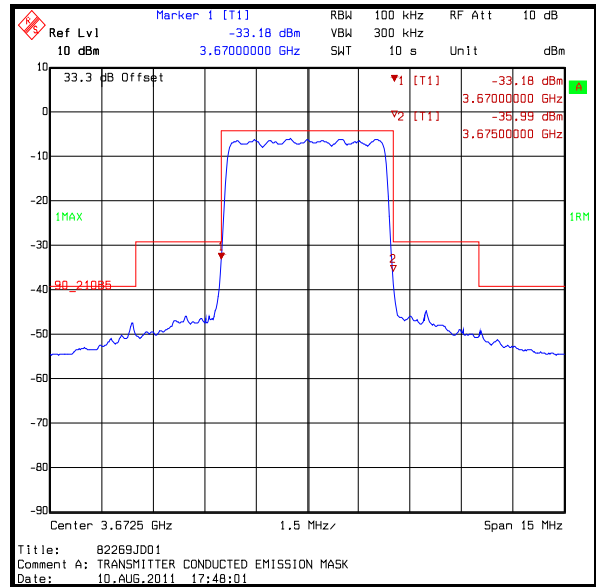
100 kHz Measurement Bandwidth

### Transmitter Conducted Emissions Mask (continued)

#### Results: Port 1 / Lower 25 MHz Band / 5 MHz Channel / 64QAM3/4

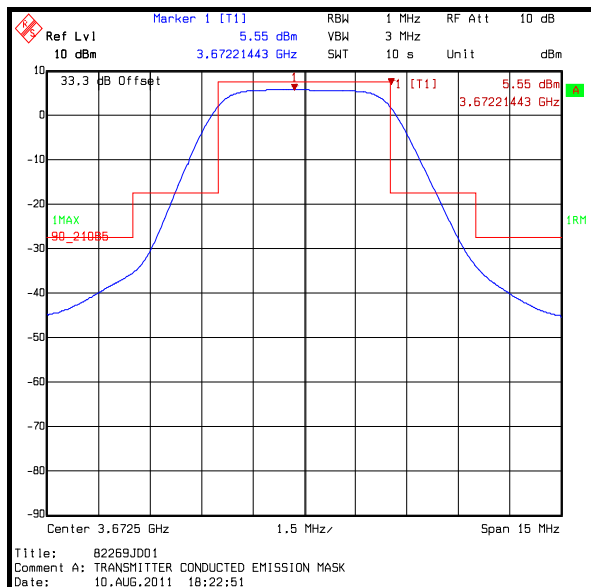


1 MHz Measurement Bandwidth

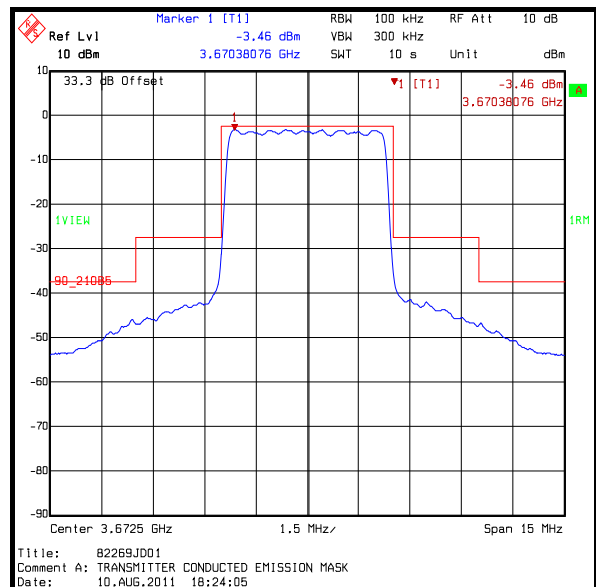


100 kHz Measurement Bandwidth

#### Results: Port 2 / Lower 25 MHz Band / 5 MHz Channel / 64QAM3/4



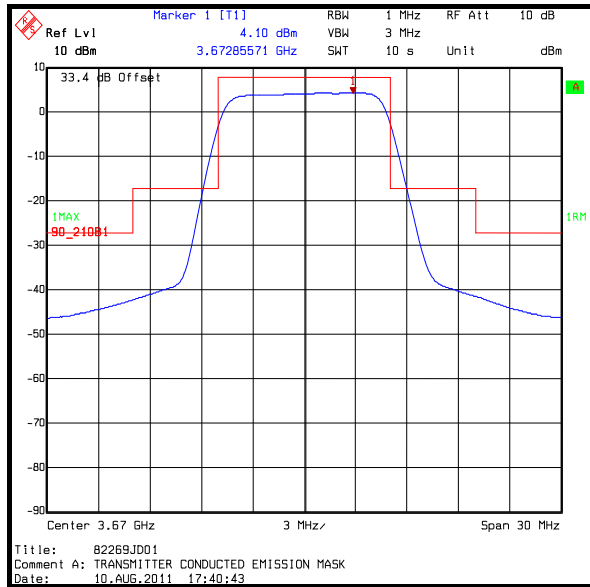
1 MHz Measurement Bandwidth



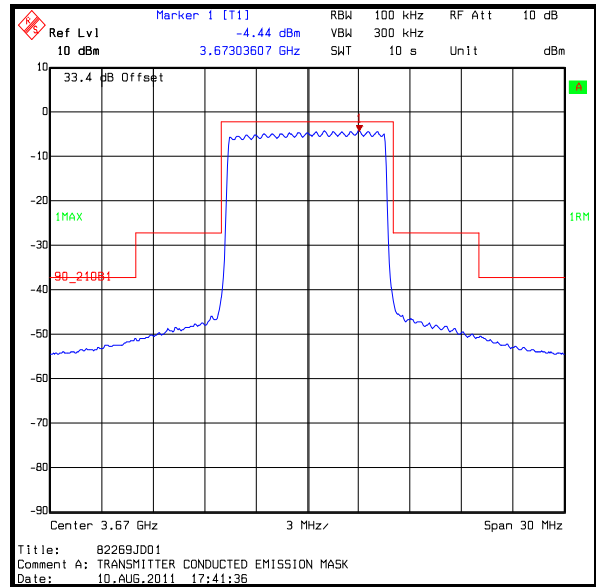
100 kHz Measurement Bandwidth

### Transmitter Conducted Emissions Mask (continued)

#### Results: Port 1 / Lower 25 MHz Band / 10 MHz Channel / QPSK3/4

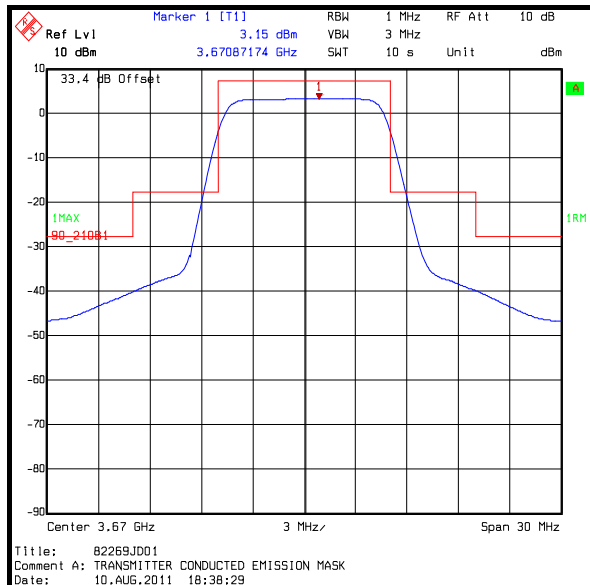


1 MHz Measurement Bandwidth

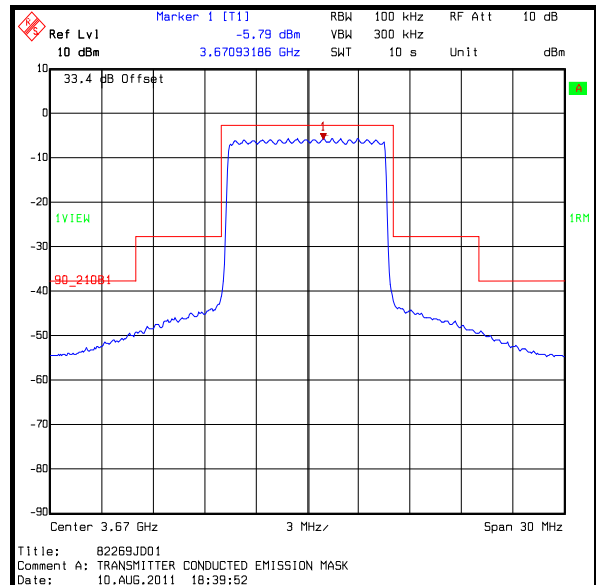


100 kHz Measurement Bandwidth

#### Results: Port 2 / Lower 25 MHz Band / 10 MHz Channel / QPSK3/4



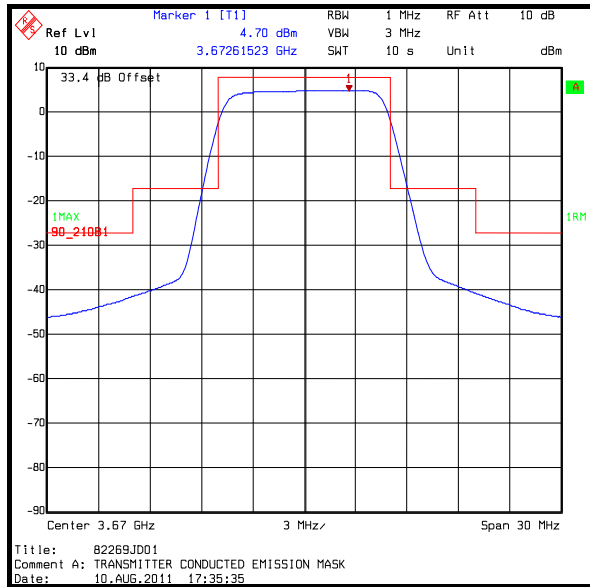
1 MHz Measurement Bandwidth



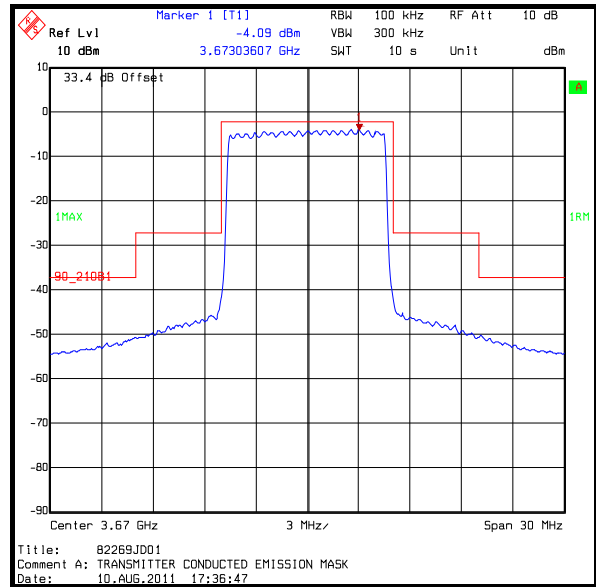
100 kHz Measurement Bandwidth

**Transmitter Conducted Emissions Mask (continued)**

**Results: Port 1 / Lower 25 MHz Band / 10 MHz Channel / 64QAM3/4**

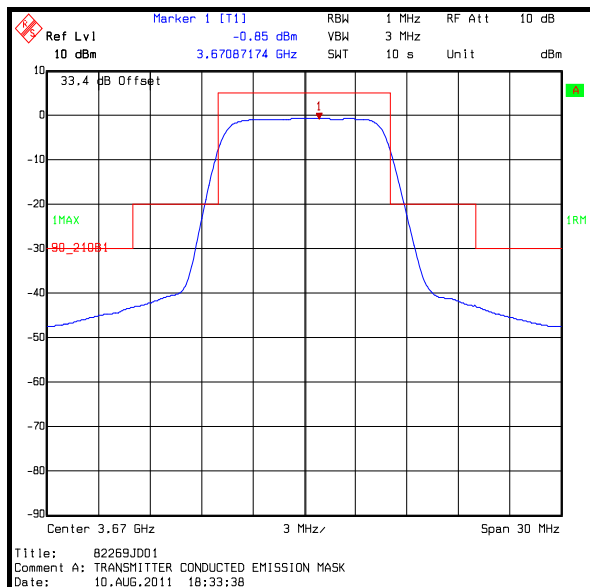


1 MHz Measurement Bandwidth

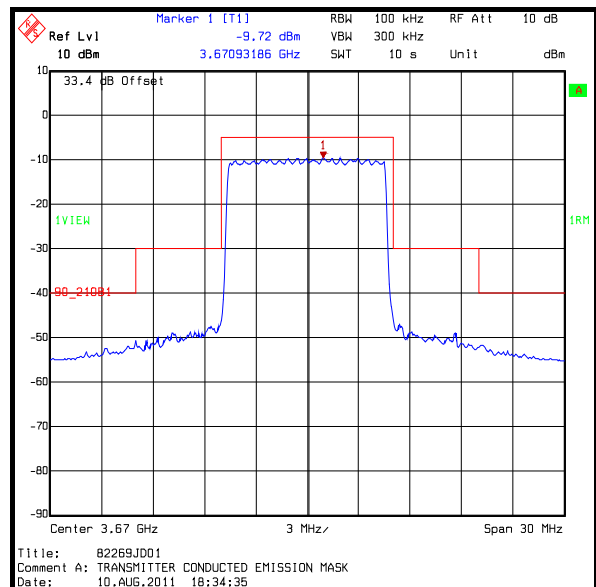


100 kHz Measurement Bandwidth

**Results: Port 2 / Lower 25 MHz Band / 10 MHz Channel / 64QAM3/4**



1 MHz Measurement Bandwidth



100 kHz Measurement Bandwidth

**5.2.6. Transmitter Conducted Emissions (Out of Band)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	05 July 2011 & 06 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	90.1323(a) & 90.210(b)(3) / 2.1051
<b>Test Method:</b>	As detailed in ANSI TIA-603-C-2004 Section 2.2.13 referencing FCC Part 2.1051
<b>Frequency Range:</b>	9 kHz to 37 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	30
<b>Relative Humidity (%):</b>	22

**Results: 5 MHz Channel Bandwidth – Top Channel 64 QAM3/4**

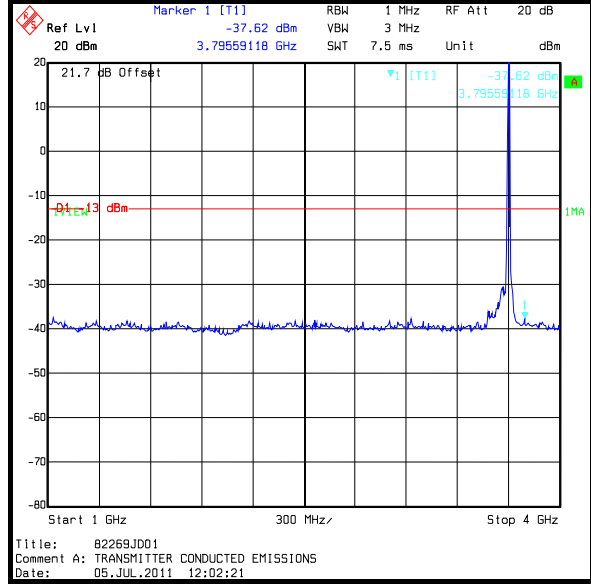
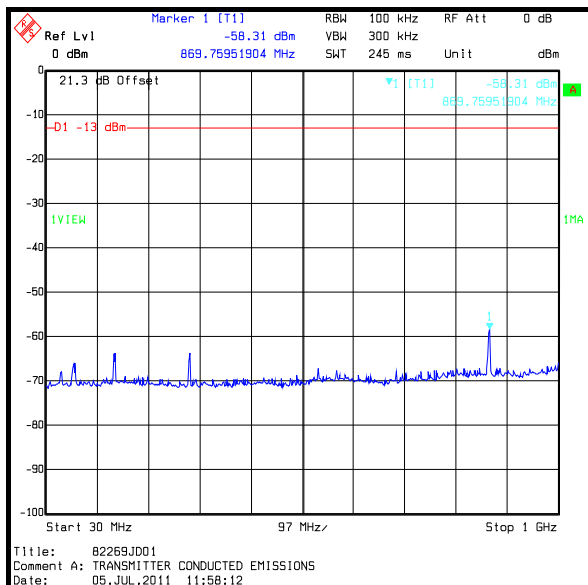
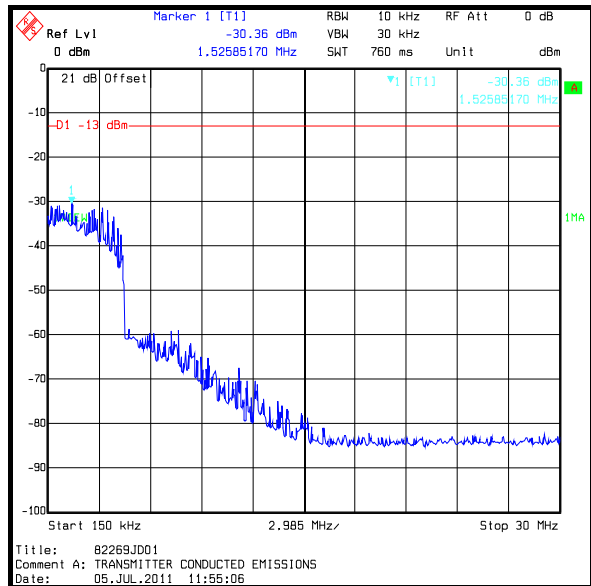
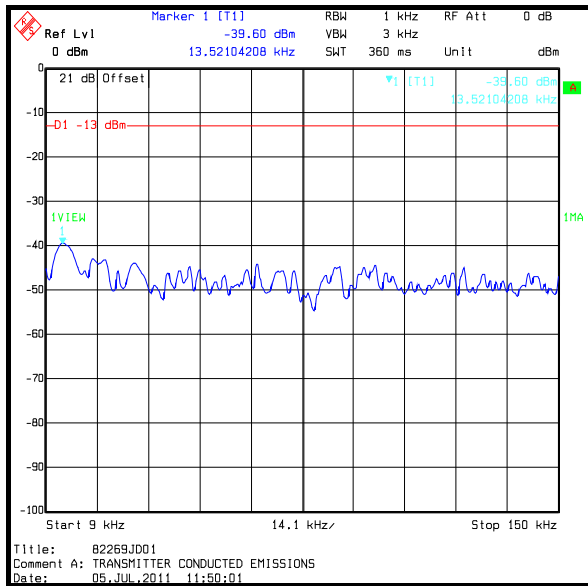
Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1.525852	-30.4	-13.0	17.4	Complied

**Note(s):**

1. The EUT was set to transmit on both the 5 MHz and 10 MHz bandwidths with 64QAM3/4 modulation applied as this was found to have the highest output power.
2. All tests were performed on RF Port 1 of the EUT, as it was previously found to emit the highest power.
3. The emission seen on the 1 GHz to 4 GHz plot at approximately 3.6 GHz is the EUT carrier.
4. All other emissions were at least 20 dB below the specification limit or below the measurement system noise floor.

**Transmitter Conducted Emissions (continued)**

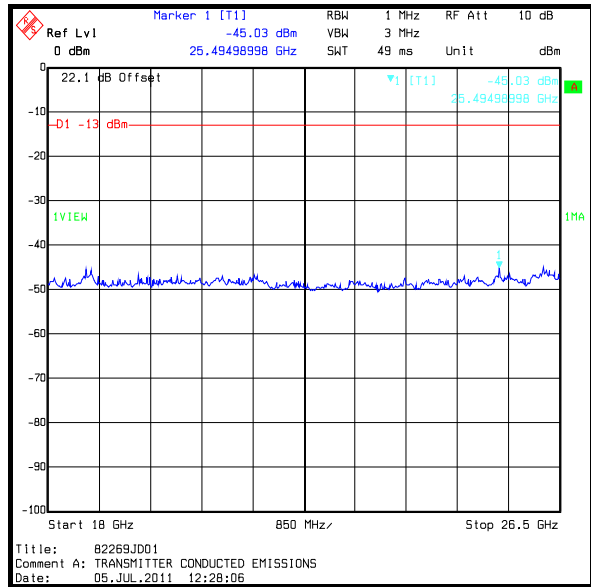
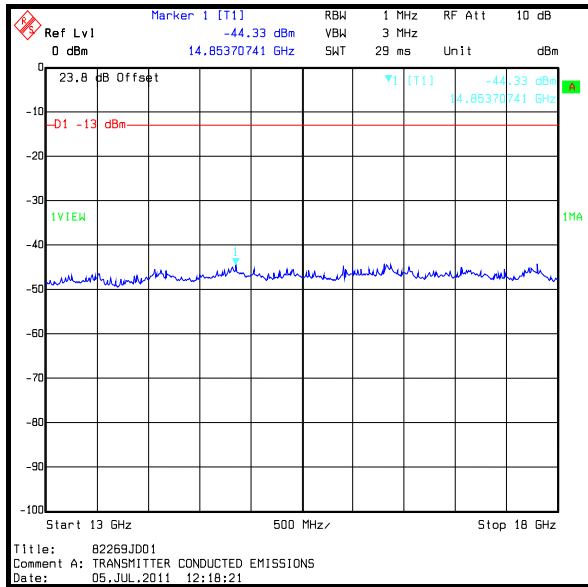
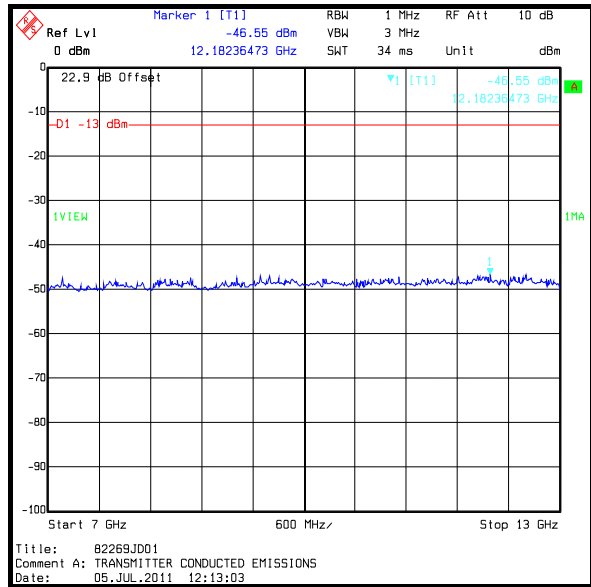
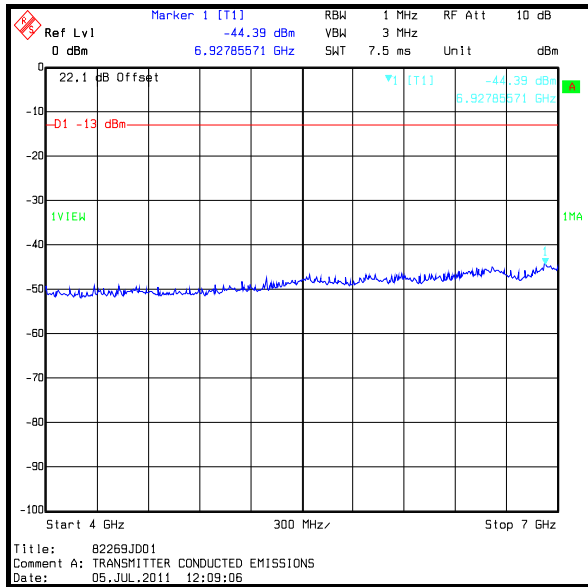
**Results: 5 MHz Channel Bandwidth – Top Channel 64QAM3/4**





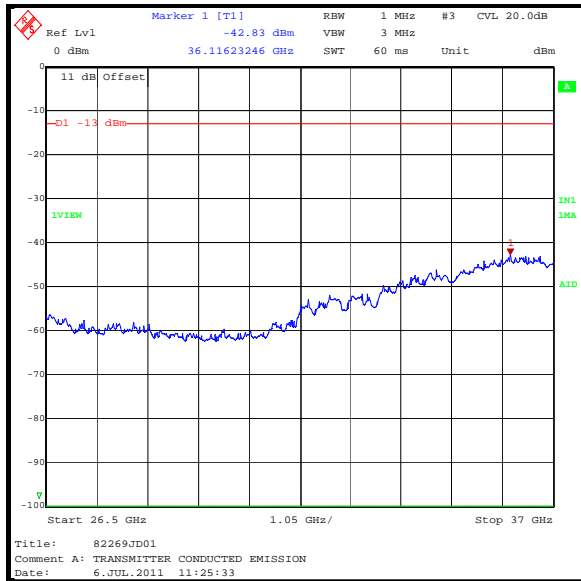
**Transmitter Conducted Emissions (continued)**

**Results: 5 MHz Channel Bandwidth – Top Channel 64QAM3/4**



**Transmitter Conducted Emissions (continued)**

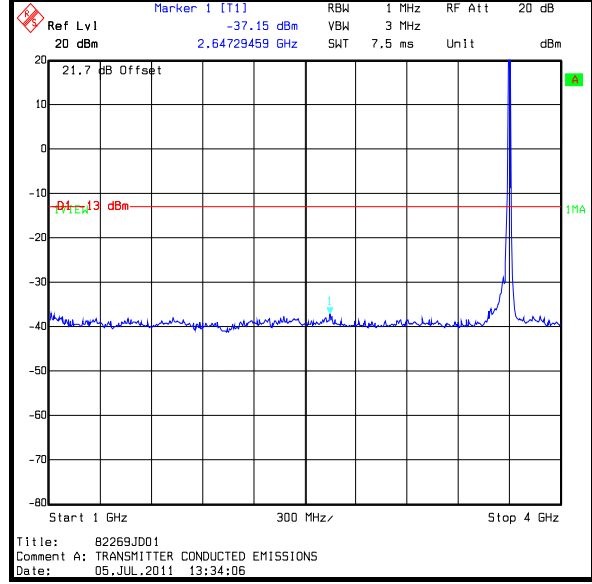
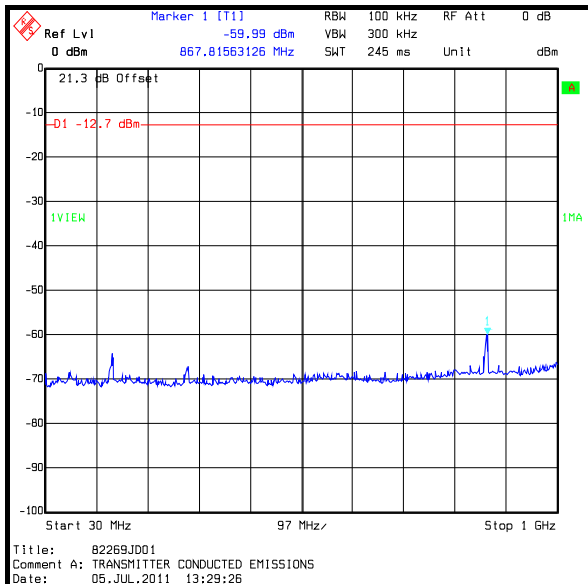
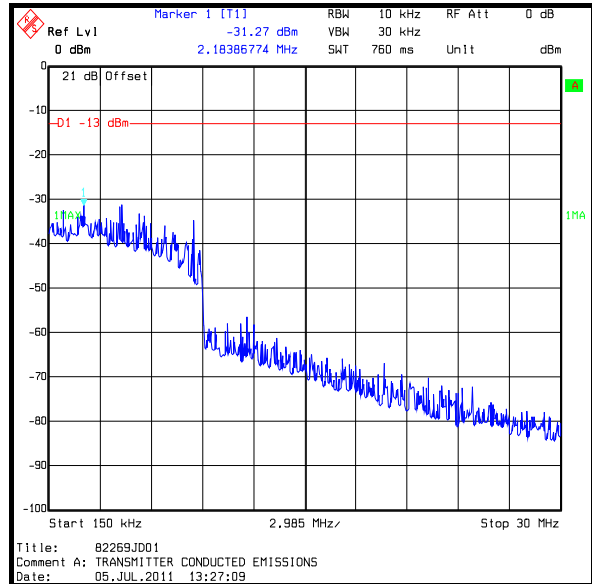
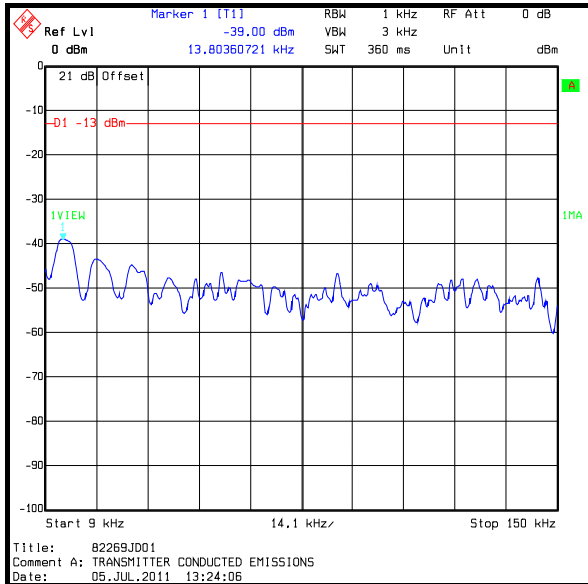
**Results: 5 MHz Channel Bandwidth – Top Channel 64QAM3/4**



**Transmitter Conducted Emissions (continued)**

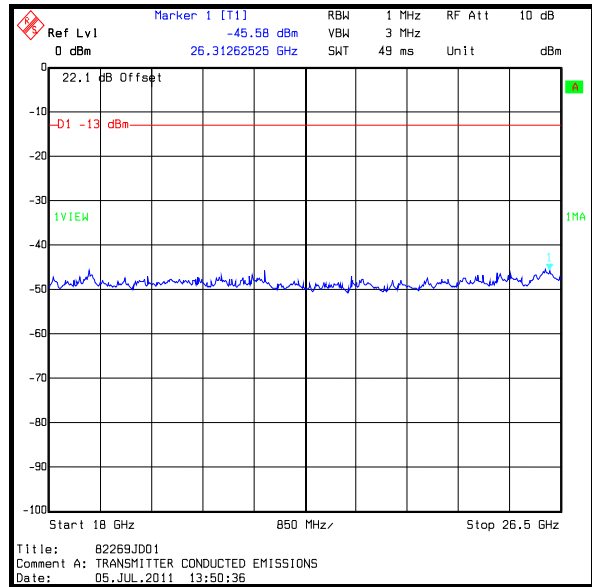
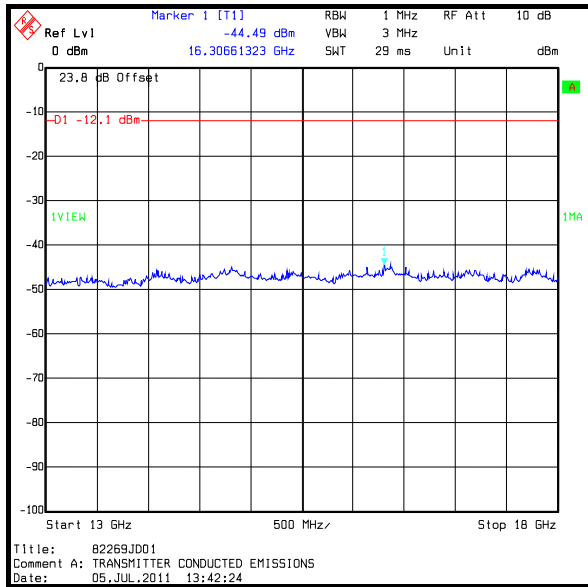
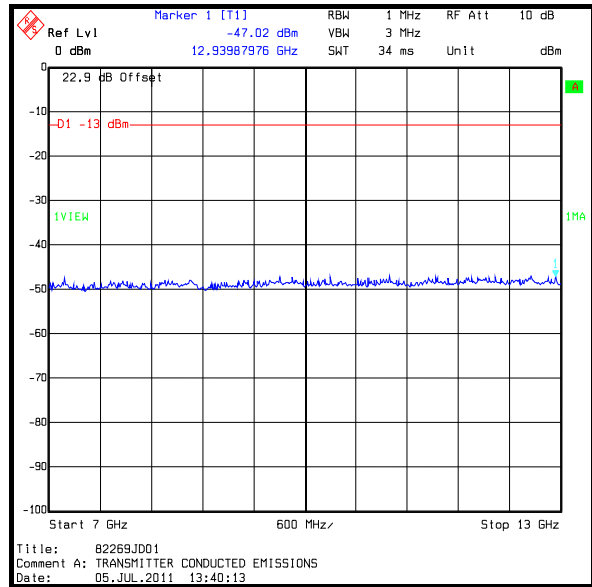
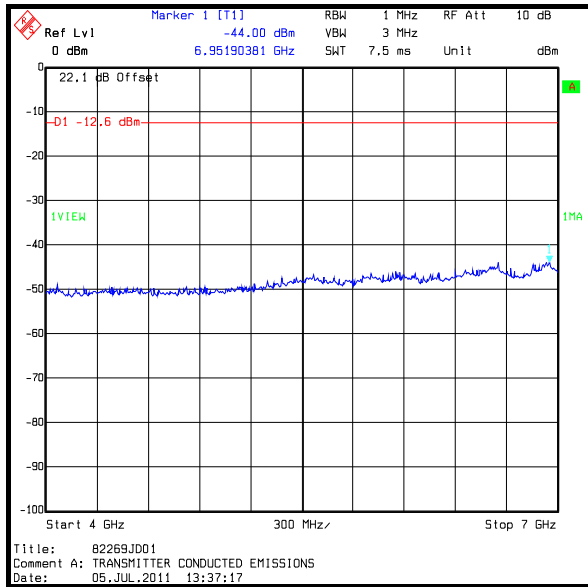
**Results: 10 MHz Channel Bandwidth – Top Channel 64QAM3/4**

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2.183868	-31.3	-13.0	18.3	Complied



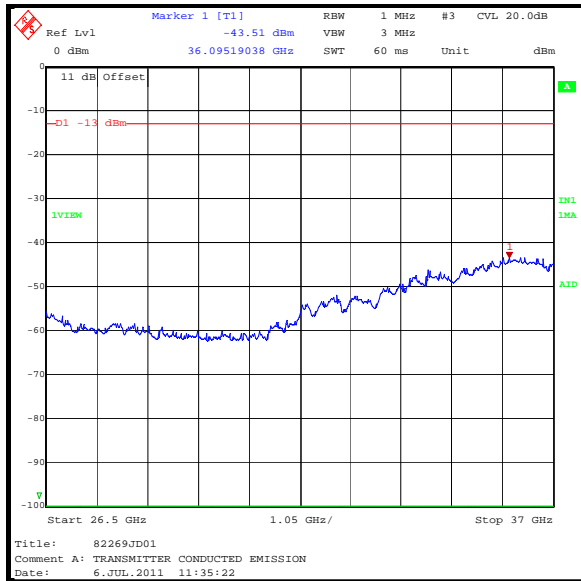
**Transmitter Conducted Emissions (continued)**

**Results: 10 MHz Channel Bandwidth – Top Channel 64QAM3/4**



**Transmitter Conducted Emissions (continued)**

**Results: 10 MHz Channel Bandwidth – Top Channel 64QAM3/4**



**5.2.7. Transmitter Band Edge Conducted Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	04 July 2011 & 05 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	90.1323 / 2.1051
<b>Test Method:</b>	As detailed in ANSI TIA-603-C-2004 Section 2.2.13 referencing FCC Part 2.1051

**Environmental Conditions:**

<b>Temperature (°C):</b>	31
<b>Relative Humidity (%):</b>	26

**Note(s):**

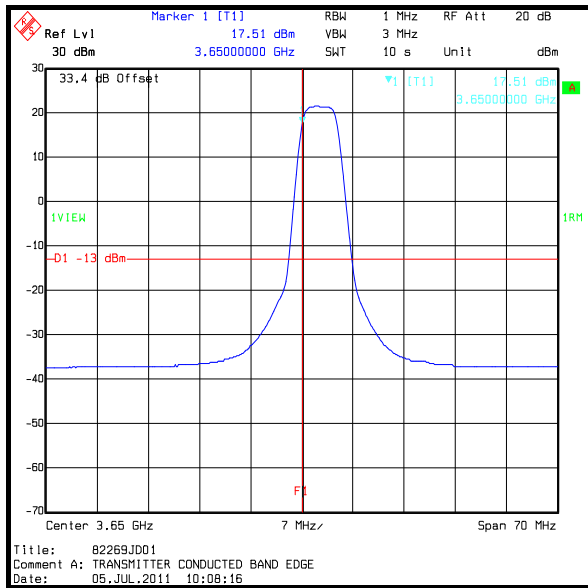
1. Tests were initially performed with a 1 MHz measurement bandwidth. Where the band edge limit was exceeded on the bottom channels using a 1 MHz measurement bandwidth, the EUT was retested using the channel power function of a spectrum analyser centred on the 1 MHz block adjacent to and immediately outside the band edges. The measurement bandwidths were set automatically by the spectrum analyser.
2. Measurements were performed at the lower band edge (3650 MHz) with the EUT transmitting on the bottom channel, the upper band edge (3675 MHz) of the lower 25 MHz band with the EUT transmitting on the top channel for this band and the upper band edge (3700 MHz) of the 50 MHz band with the EUT transmitting on the top channel for this band.
3. The EUT was set to transmit on both the 5 MHz and 10 MHz bandwidths with 64QAM3/4 modulation applied as this was previously found to have the highest output power.
4. The Customer requested that this test was performed with the EUT using 64QAM3/4 modulation scheme only.

**Results: Port 1 / 5 MHz Channel Bandwidth 64QAM3/4**

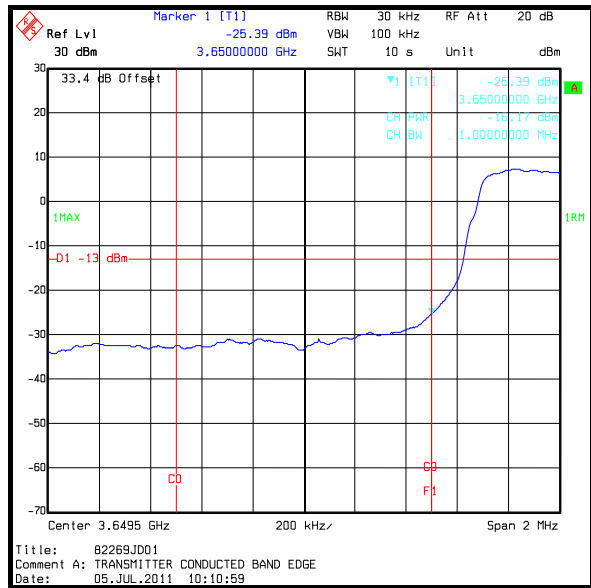
Frequency (MHz)	Level in 1 MHz strip adjacent to band edge (dBm)	Limit (dBm)	Margin (dB)	Result
3650	-16.2	-13.0	3.2	Complied
3675	-18.3	-13.0	5.3	Complied
3700	-17.3	-13.0	4.3	Complied

### Transmitter Band Edge Conducted Emissions (continued)

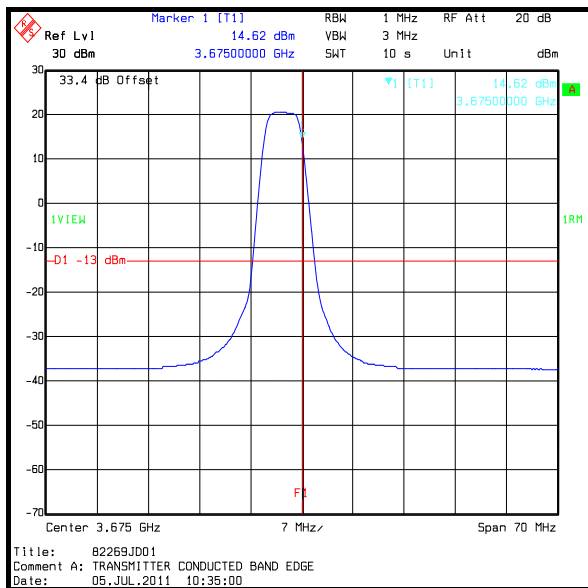
#### Port 1 / 5 MHz Channel Bandwidth / 64QAM3/4



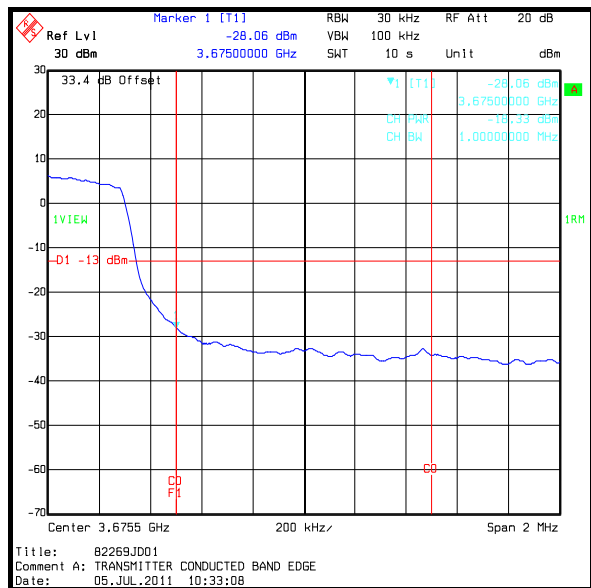
Lower edge / bottom channel



Lower edge / bottom channel



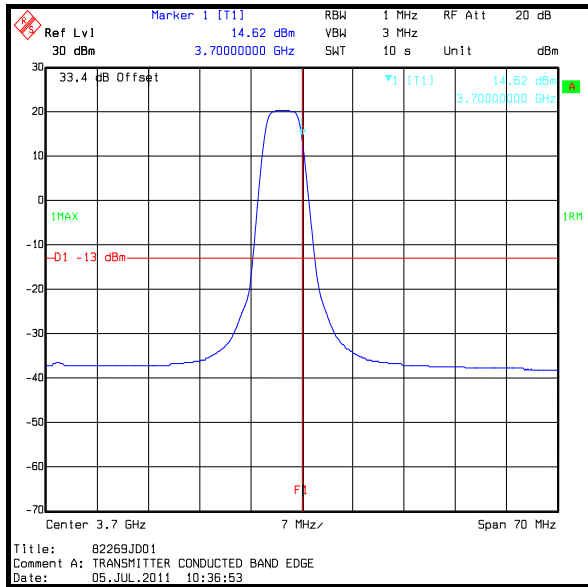
Lower 25 MHz band / Upper edge / top channel



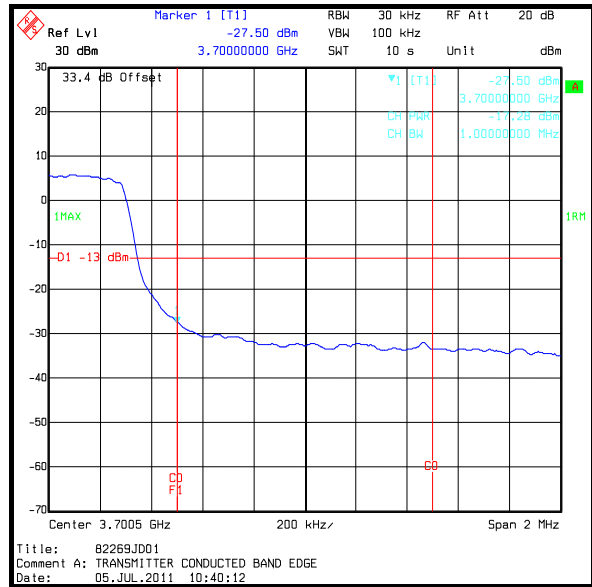
Lower 25 MHz band / Upper edge / top channel

**Transmitter Band Edge Conducted Emissions (continued)**

**Port 1 / 5 MHz Channel Bandwidth / 64QAM3/4**



**Upper edge / Top channel**



**Upper edge / Top channel**

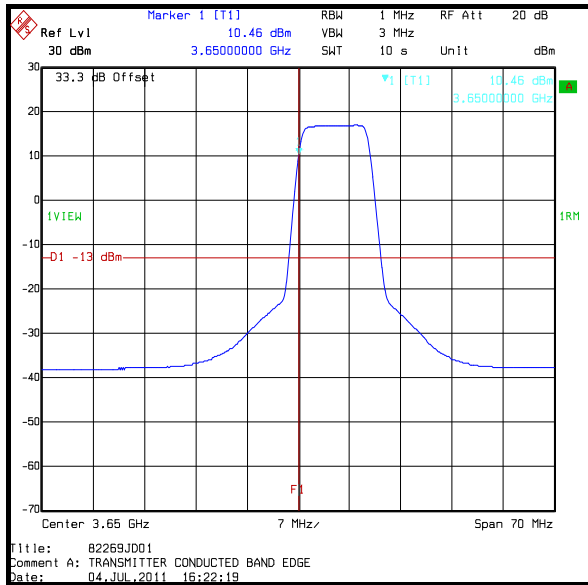


**Transmitter Band Edge Conducted Emissions (continued)****Port 1 / 10 MHz Channel Bandwidth / 64QAM3/4**

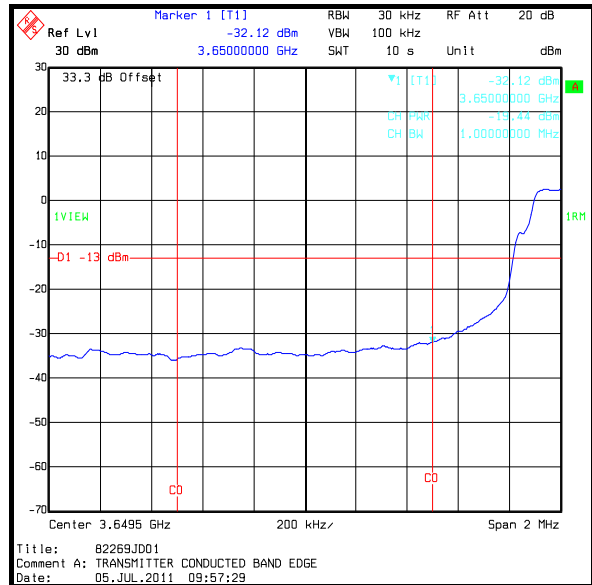
<b>Frequency (MHz)</b>	<b>Level in 1 MHz strip adjacent to band edge (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>	<b>Result</b>
3650	-19.4	-13.0	6.4	Complied
3675	-20.9	-13.0	7.9	Complied
3700	-19.5	-13.0	6.5	Complied

**Transmitter Band Edge Conducted Emissions (continued)**

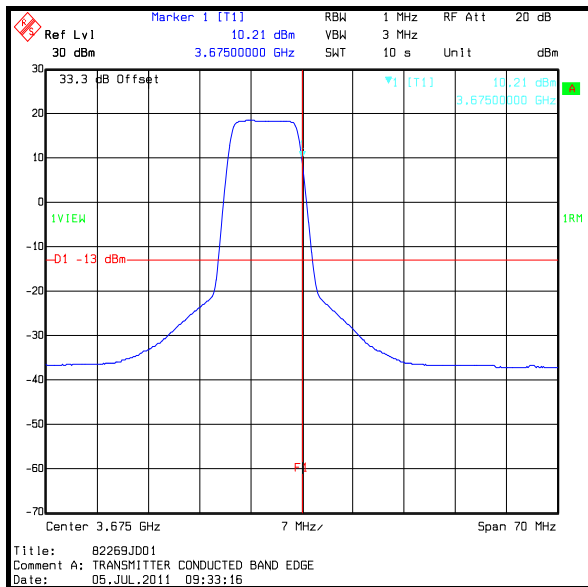
**Port 1 / 10 MHz Channel Bandwidth / 64QAM3/4**



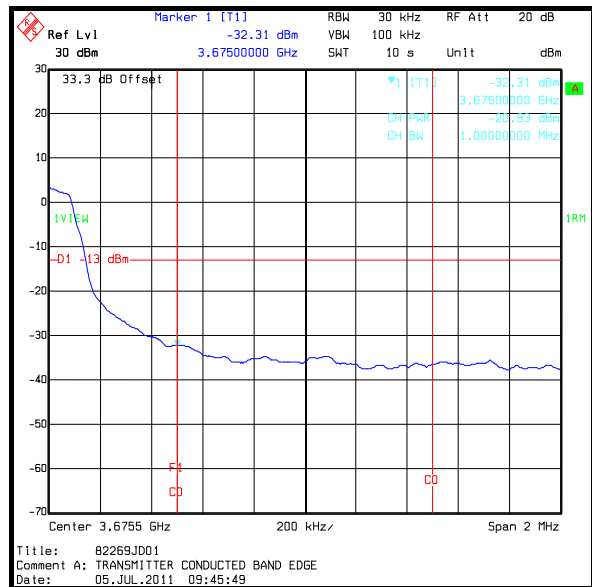
Lower edge / bottom channel



Lower edge / bottom channel



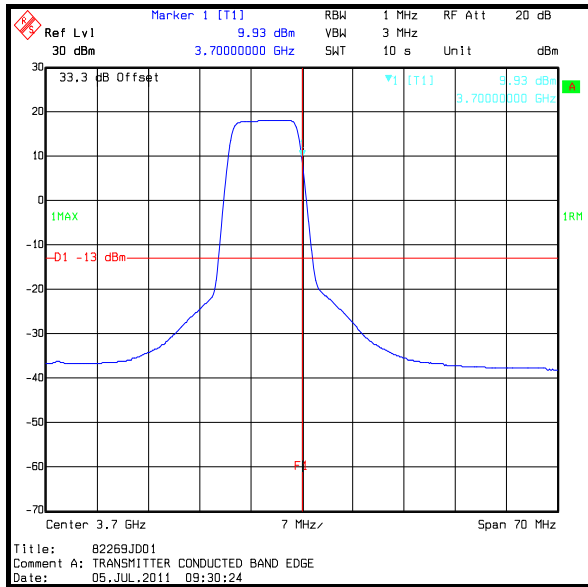
Lower 25 MHz band / Upper edge / top channel



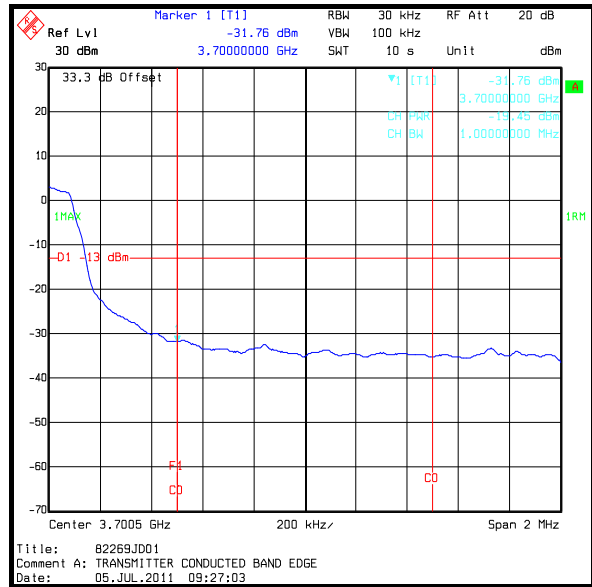
Lower 25 MHz band / Upper edge / top channel

**Transmitter Band Edge Conducted Emissions (continued)**

**Port 1 / 10 MHz Channel Bandwidth / 64QAM3/4**



Upper edge / Top channel



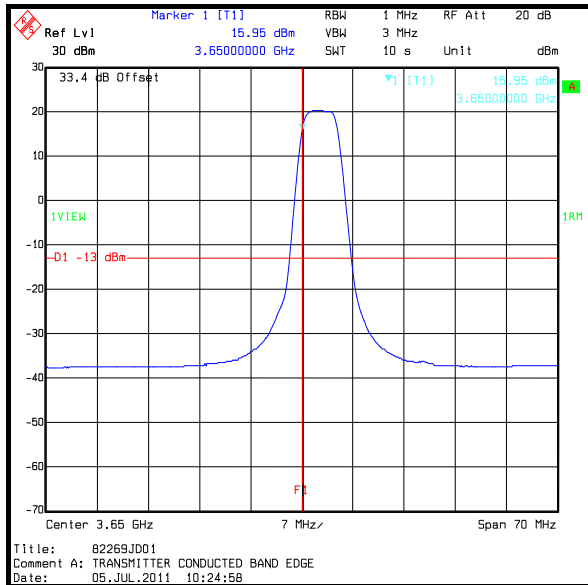
Upper edge / Top channel

**Transmitter Band Edge Conducted Emissions (continued)****Port 2 / 5 MHz Channel Bandwidth / 64QAM3/4**

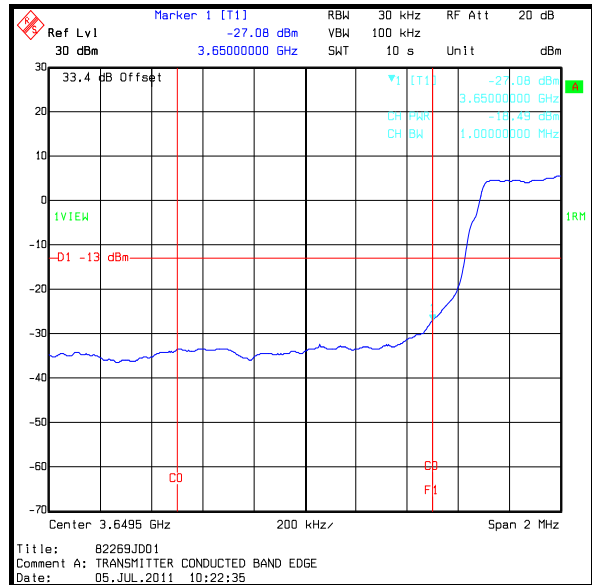
<b>Frequency (MHz)</b>	<b>Level in 1 MHz strip adjacent to band edge (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>	<b>Result</b>
3650	-18.5	-13.0	5.5	Complied
3675	-18.7	-13.0	5.7	Complied
3700	-17.6	-13.0	4.6	Complied

**Transmitter Band Edge Conducted Emissions (continued)**

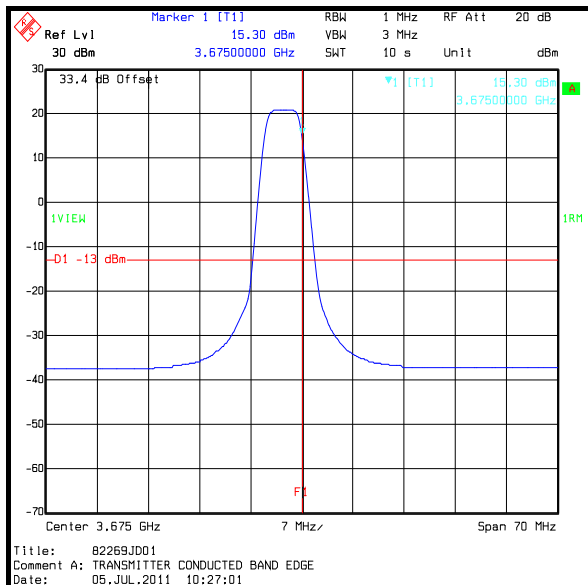
**Port 2 / 5 MHz Channel Bandwidth / 64QAM3/4**



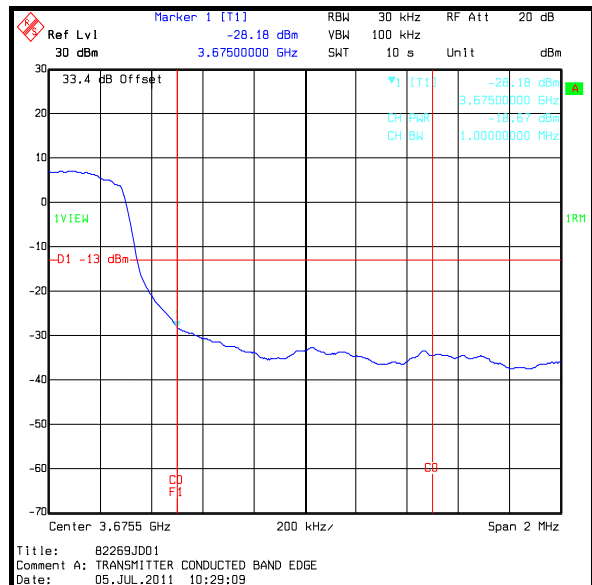
**Lower edge / bottom channel**



**Lower edge / bottom channel**



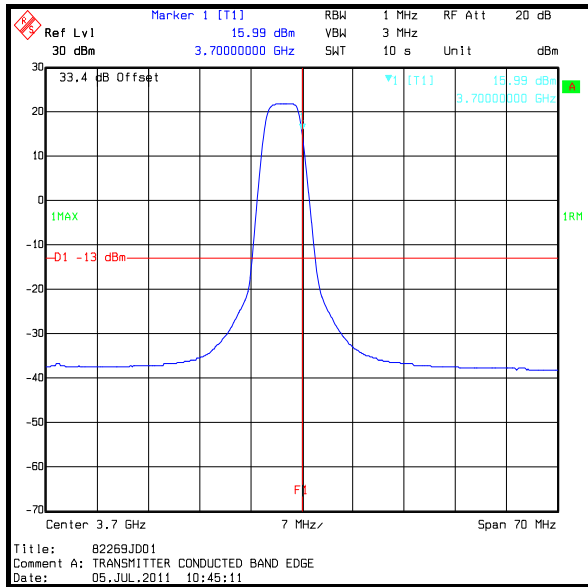
**Lower 25 MHz band / Upper edge / top channel**



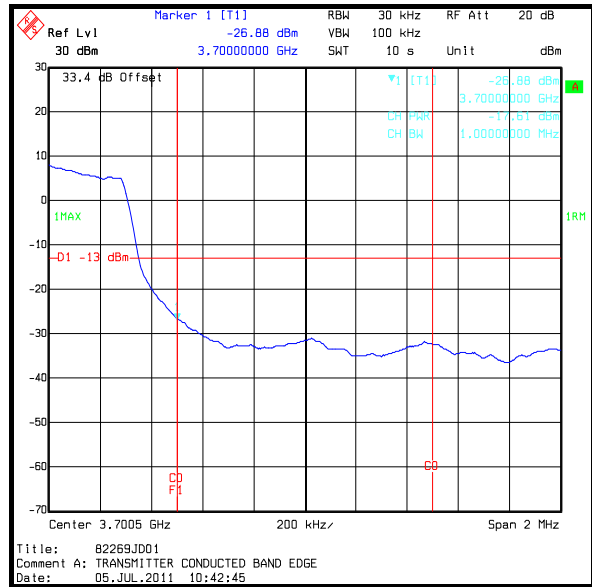
**Lower 25 MHz band / Upper edge / top channel**

**Transmitter Band Edge Conducted Emissions (continued)**

**Port 2 / 5 MHz Channel Bandwidth / 64QAM3/4**



**Upper edge / Top channel**



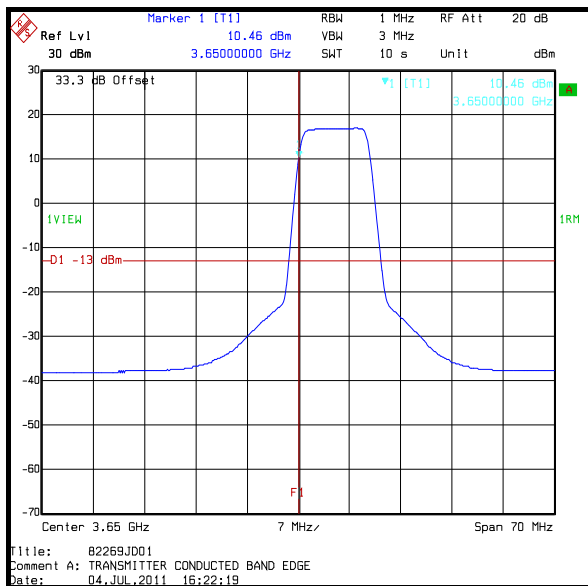
**Upper edge / Top channel**

**Transmitter Band Edge Conducted Emissions (continued)****Port 2 / 10 MHz Channel Bandwidth / 64QAM3/4**

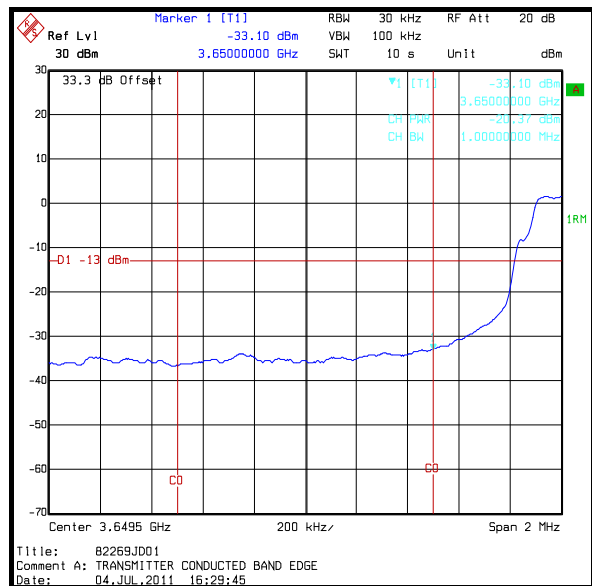
<b>Frequency (MHz)</b>	<b>Level in 1 MHz strip adjacent to band edge (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>	<b>Result</b>
3650	-20.4	-13.0	7.4	Complied
3675	-21.4	-13.0	8.4	Complied
3700	-19.0	-13.0	6.0	Complied

### Transmitter Band Edge Conducted Emissions (continued)

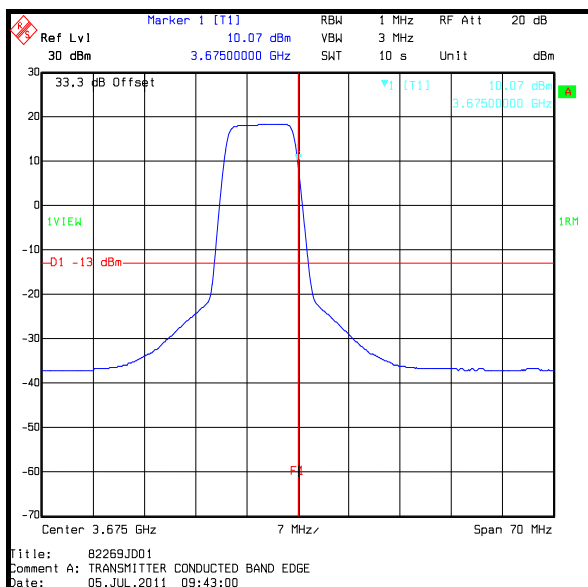
#### Port 2 / 10 MHz Channel Bandwidth / 64QAM3/4



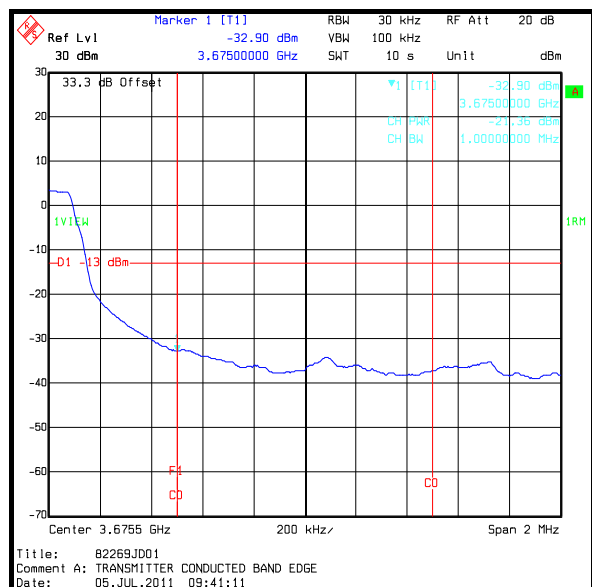
Lower edge / bottom channel



Lower edge / bottom channel



Lower 25 MHz band / Upper edge / top channel

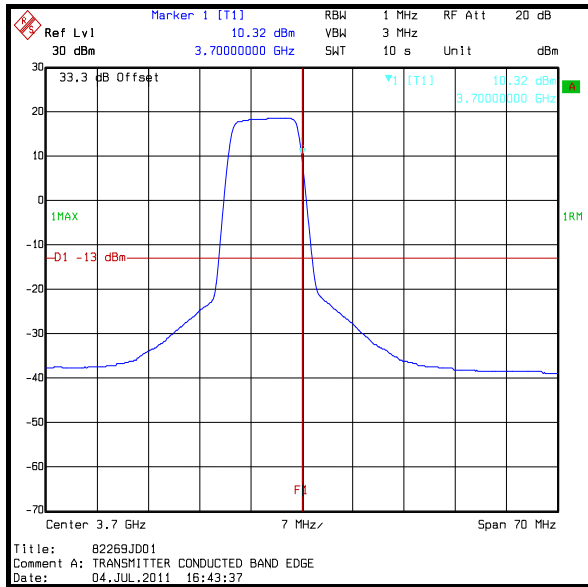


Lower 25 MHz band / Upper edge / top channel

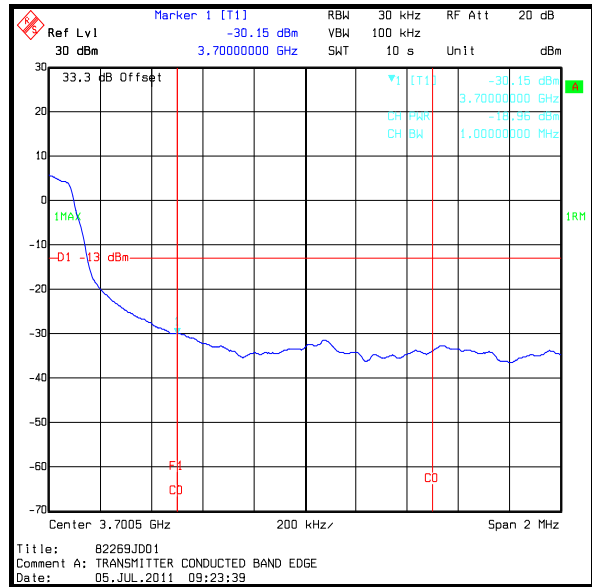


**Transmitter Band Edge Conducted Emissions (continued)**

**Port 2 / 10 MHz Channel Bandwidth / 64QAM3/4**



**Upper edge / Top channel**



**Upper edge / Top channel**

**5.2.8. Transmitter Radiated Emissions (Out of Band)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	01 July 2011 & 06 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	90.1323
<b>Test Method:</b>	As detailed in ANSI TIA-603-C-2004 Section 2.2.12 referencing FCC Part 2.1053
<b>Frequency Range:</b>	30 MHz to 37 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	31
<b>Relative Humidity (%):</b>	28

**Results: 5 MHz Channel Bandwidth 64QAM3/4**

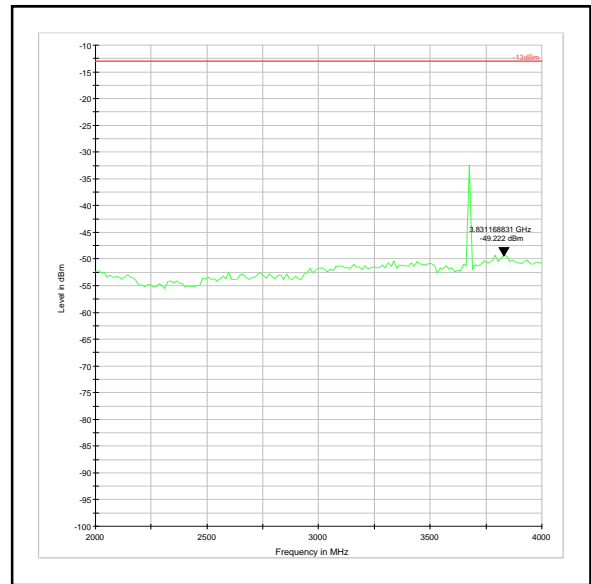
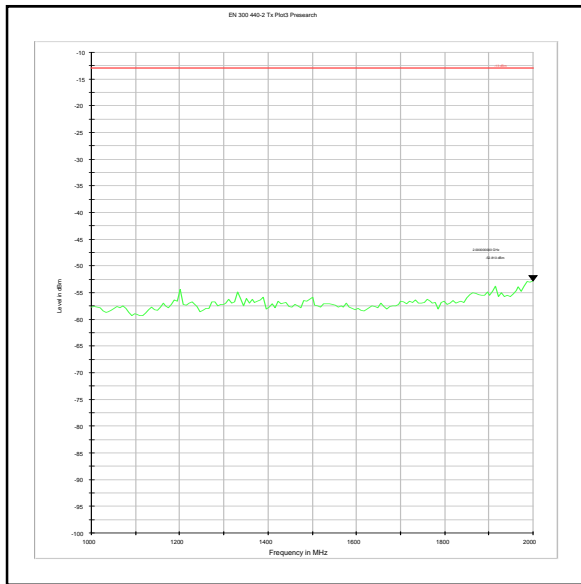
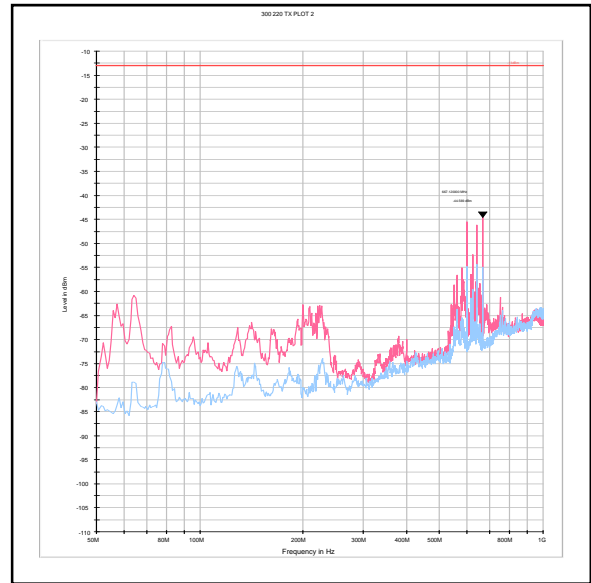
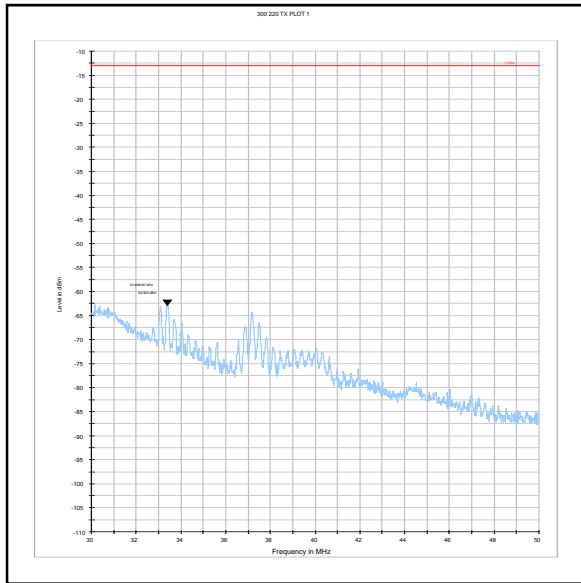
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
12551.948	-43.3	-13.0	30.0	Complied

**Note(s):**

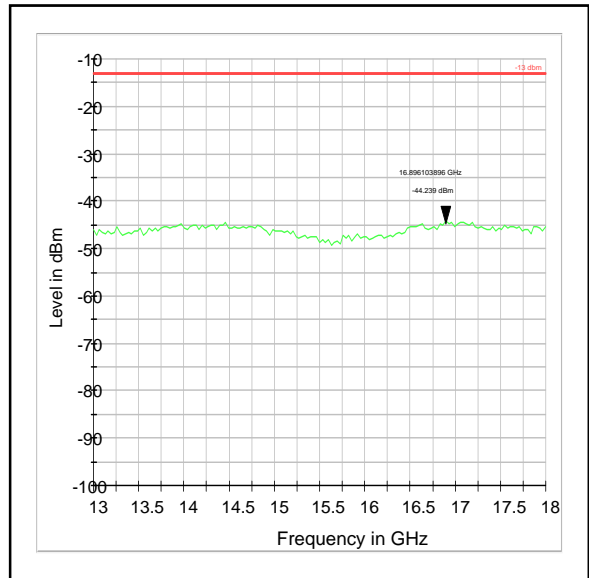
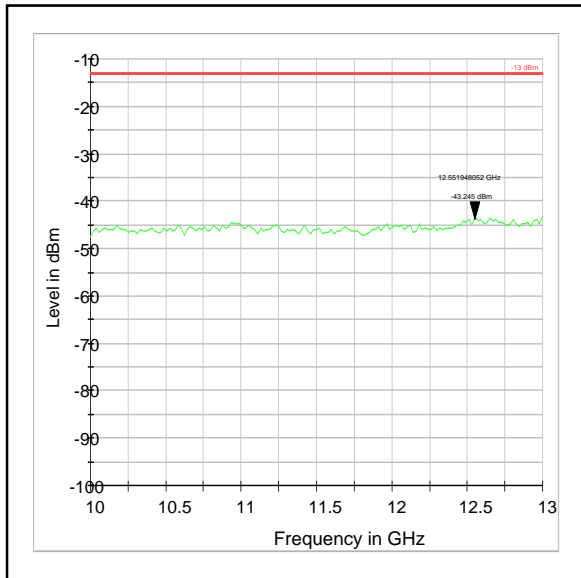
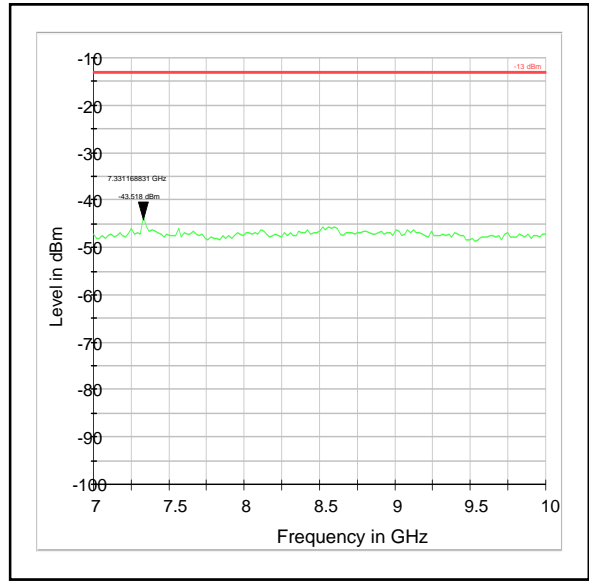
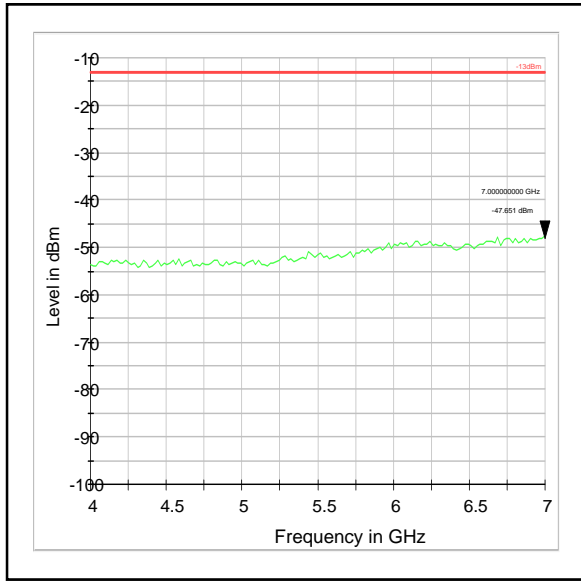
1. The EUT was set to transmit on the 5 MHz bandwidth with 64QAM3/4 modulation applied as this was found to have the highest output power.
2. Both RF ports were terminated into 50 Ohm loads during the test.
3. The emission seen on the 1 GHz to 4 GHz plot at approximately 3.6 GHz is the EUT carrier.
4. All other emissions were at least 20 dB below the specification limit or below the measurement system noise floor.
5. 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.
6. 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 Radiated Emissions (continued)**

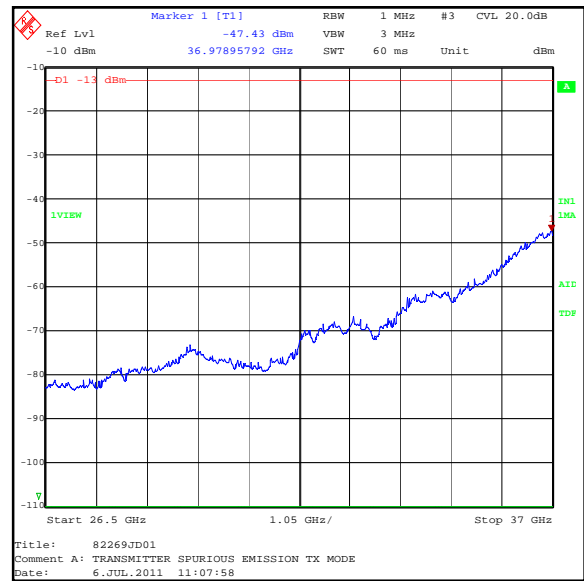
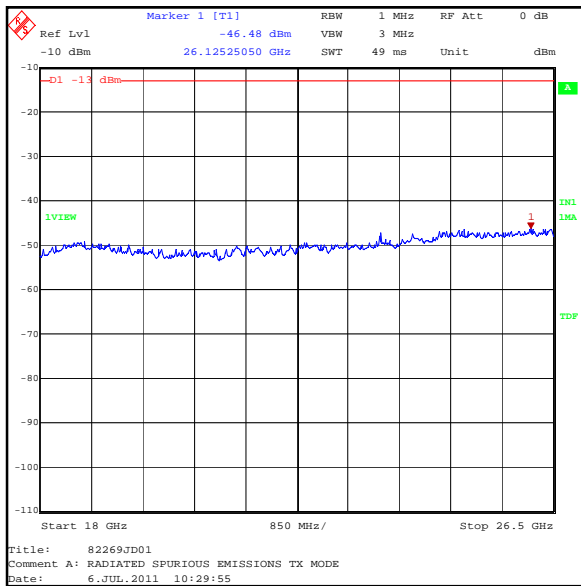
**5 MHz Channel Bandwidth / 64QAM3/4**



**Transmitter Radiated Emissions (continued)**



**Transmitter Radiated Emissions (continued)**



**5.2.9. Transmitter Band Edge Radiated Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	06 July 2011
<b>Test Sample Serial No:</b>	9B23B3FFFF28		

<b>FCC Part:</b>	90.1323
<b>Test Method:</b>	As detailed in ANSI TIA-603-C-2004 Section 2.2.12 referencing FCC Part 2.1053

**Environmental Conditions:**

<b>Temperature (°C):</b>	26
<b>Relative Humidity (%):</b>	23

**Note(s):**

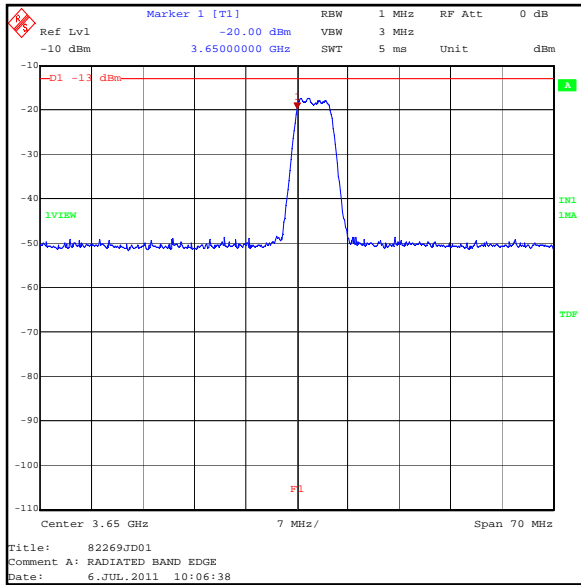
1. Measurements were performed at the lower band edge (3650 MHz) with the EUT transmitting on the bottom channel, the upper band edge (3675 MHz) of the lower 25 MHz band with the EUT transmitting on the top channel for this band and the upper band edge (3700 MHz) of the 50 MHz band with the EUT transmitting on the top channel for this band.
2. The EUT was set to transmit on both the 5 MHz and 10 MHz bandwidths with 64QAM3/4 modulation applied as this was previously found to have the highest output power.
3. The Customer requested that this test was performed with the EUT using 64QAM3/4 modulation scheme only.

**Results: 5 MHz Channel Bandwidth**

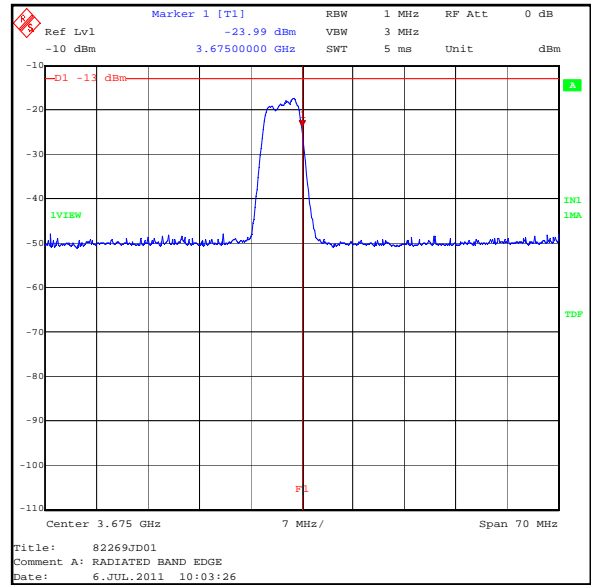
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3650	-20.0	-13.0	7.0	Complied
3675	-24.0	-13.0	11.0	Complied
3700	-23.4	-13.0	10.4	Complied

**Transmitter Band Edge Radiated Emissions (continued)**

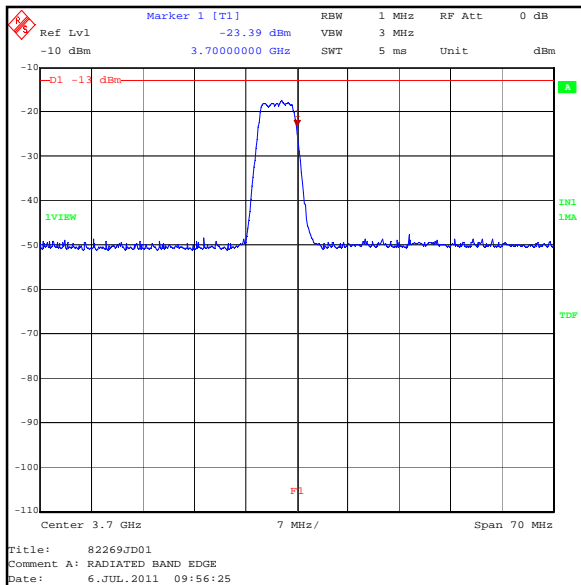
**Results: 5 MHz Channel Bandwidth**



**Lower edge / bottom channel**



**Lower 25 MHz band / Upper edge / top channel**



**Upper edge / Top channel**

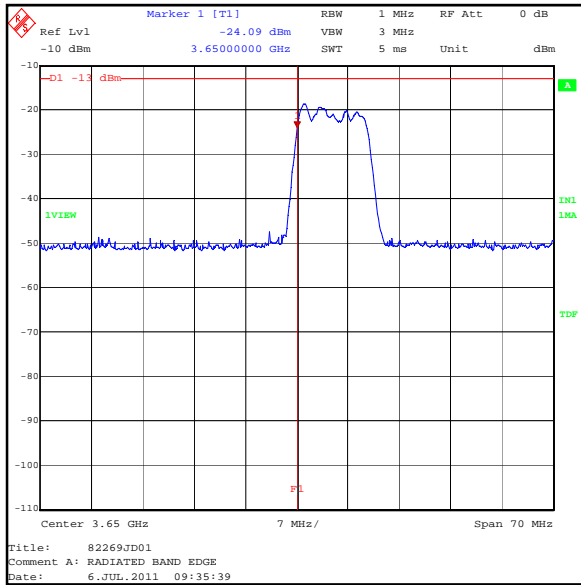
**Transmitter Band Edge Radiated Emissions (continued)****Results: 10 MHz Channel Bandwidth**

<b>Frequency (MHz)</b>	<b>Peak Emission Level (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>	<b>Result</b>
3650	-24.1	-13.0	11.1	Complied
3675	-28.6	-13.0	15.6	Complied
3700	-28.0	-13.0	15.0	Complied

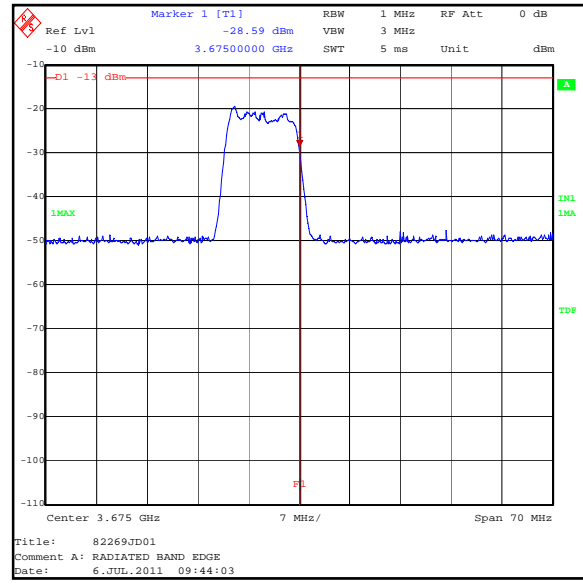


**Transmitter Band Edge Radiated Emissions (continued)**

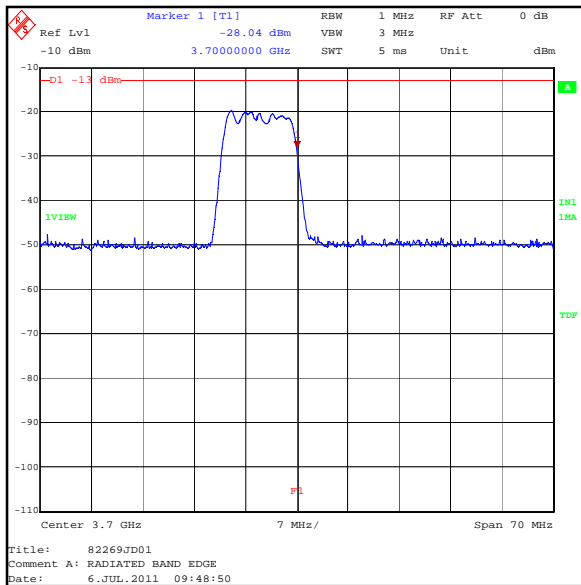
**Results: 10 MHz Channel Bandwidth**



**Lower edge / bottom channel**



**Lower 25 MHz band / Upper edge / top channel**



**Upper edge / Top channel**

## **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".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
Conducted Spurious Emissions	9 kHz to 37 GHz	95%	±2.64 dB
Radiated Spurious Emissions	30 GHz to 37 GHz	95%	±2.94 dB
Conducted Carrier Output Power	3650 MHz to 3700 MHz	95%	±0.27 dB
Occupied Bandwidth	3650 MHz to 3700 MHz	95%	±0.92 ppm

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.

## Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval Months
A1399	Attenuator	Weinschel	WA46-10	A126	09 Feb 2012	12
A1400	Attenuator	Weinschel	WA46-10	A127	18 Mar 2012	12
A1534	PreAmplifier	Hewlett Packard	8449B	3008A00405	20 Jun 2012	12
A1785	Low Noise Amplifier	Farran Technology	FLNA-28-30	FTL 6483	Calibrated before use	-
A1817	Antenna	EMCO	3115	00075694	03 Feb 2012	12
A1818	Antenna	EMCO	3115	00075692	05 Sep 2011	12
A1829	Pulse Limiter	Rhode & Schwarz	ESH3-Z2	100671	05 Mar 2012	12
A2001	Attenuator	Huber & Suhner	6830.17.B	07031	09 Feb 2012	12
A2055	Attenuator	Atlantic Microwave	WA-54-10-12	A2055	15 Jun 2012	12
A2056	Attenuator	Atlantic Microwave	WA-54-10-12	A2056	15 Jun 2012	12
A366	Isolator	MRI	FRR-400	169	Calibrated before use	-
A436	Antenna	Flann	20240-20	330	05 Sep 2011	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	05 Apr 2012	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	29 May 2012	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	05 Sep 2011	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESI26	100046K	29 Jun 2012	12
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986/022	03 Dec 2011	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated before use	-
M1590	Test Receiver	Rohde and Schwarz	ESU26	100239	15 Jun 2012	12

**NB** In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.