



TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: AWB RG211-3.8

To: FCC Part 90: 2009 Subpart Z, in accordance with FCC test plan
AWB 3650-3675 MHz CPE FCC Test Plan Document Reference
SC_AIR_TP02_A Dated 14 July 2010

Test Report Serial No:
RFI-RPT-RP78529JD01A V2.0

Version 2.0 Supersedes All Previous Versions

This Test Report Is Issued Under The Authority Of Scott D'Adamo, Operations Manager Global Approvals:		
Checked By:	Ian Watch	
Signature:		
Date of Issue:	09 August 2010	

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1. Customer Information










Company Name:	Accton Wireless Broadband Corp
Address:	No.1 Creation Rd. III Science-based Industrial Park Hsinchu 30077 Taiwan R.O.C.

2. Summary of Testing

2.1. General Information

Specification Reference:	FCC Part 90: 2009
Specification Title:	Code of Federal Regulations, Part 90 (47CFR290) Private Land Mobile Radio Services.
Specification Reference:	FCC Test Plan Document Reference: SC_AIR_TP02_A
Specification Title:	AWB 3650-3675 MHz CPE Test Plan – 14 July 2010
Site Registration:	FCC: 209735
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	14 July 2010 to 10 August 2010

2.2. Summary of Test Results

FCC Part Reference (47CFR)	Measurement	Result
90.1321 / 2.1046	Transmitter Carrier Output Power (EIRP)	
90.1321 / 2.1046	Transmitter Power Output Density	
90.209 / 2.1049	Transmitter Occupied Bandwidth	
90.210(b) / 90.210(n) / 2.1051	Transmitter Conducted Emissions Mask	
90.1323 / 2.1051	Transmitter Conducted Emissions	
90.1323 / 2.1053	Transmitter Radiated Emissions	
90.213 / 2.1055	Transmitter Frequency Stability (Temperature & Voltage Extremes)	
Key to Results		
 = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI/TIA-603-C-2004
Title:	Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards.

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)

Description:	WiMAX 802.16e indoor CPE
Brand Name:	AWB
Model Name or Number:	RG211-3.8
Serial Number(s):	W023000022 (5MHz channel) W023000015 (5MHz channel) W023000028 (10MHz channel)
Hardware Version Number:	02
FCC ID Number:	V8YFW181RG38002W

3.2. Description of EUT

The equipment under test was a WiMAX 802.16e indoor Customer Premises Equipment (CPE).

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	WiMAX		
Type of Equipment	Transceiver		
Highest Internally Generated Clock or Oscillator Frequency:	3700 MHz		
Duty Cycle	38%		
Declared Antenna Type:	Omni-directional		
Declared Antenna Gain:	6dBi		
Power Supply Requirement:	Nominal	120V	
	Minimum	108V	
	Maximum	132V	
Tested Temperature Range:	Minimum	-30°C	
	Maximum	50°C	
Transmit Frequency Range:	3650 to 3700 MHz		
Transmit Channels Tested:	Channel ID	5MHz Channel	10MHz Channel
	Bottom	3652.5	3655.0
	Top	3672.5	3670.0
Receive Frequency Range:	3650 to 3700 MHz		

3.5. Support Equipment

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

Description:	Laptop
Brand Name:	Dell
Model Name or Number:	Vostro 1000
Serial Number:	User 17

Description:	Mains-dc PSU
Brand Name:	Asian Power Deivces Inc
Model Name or Number:	WA1212FG
Serial Number:	Y550209D17007281600

Description:	Analogue Telephone
Brand Name:	Binatone
Model Name or Number:	0119
Serial Number:	Not stated

Description:	Router
Brand Name:	Linksys
Model Name or Number:	WRT54G2 V1
Serial Number:	CSV00H447523

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- The EUT was set to transmit with maximum output power on the bottom and top channel, using a 5MHz or 10MHz channel bandwidth, as detailed in the test plan.
- The EUT was in an engineering mode and controlled from a laptop PC supplied by the client.

4.2. Configuration and Peripherals

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

- The EUT was connected to the 120V / 60 Hz AC mains via a DC power supply adapter.
- Radiated emissions were performed with the antenna port terminated into a 50 ohm load.

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 Carrier Output Power (Conducted)

Test Summary:

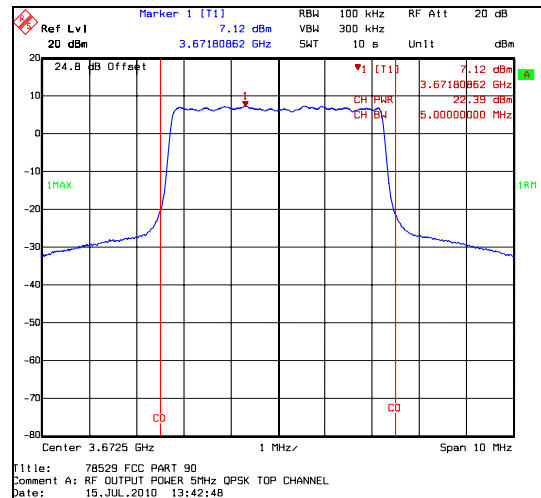
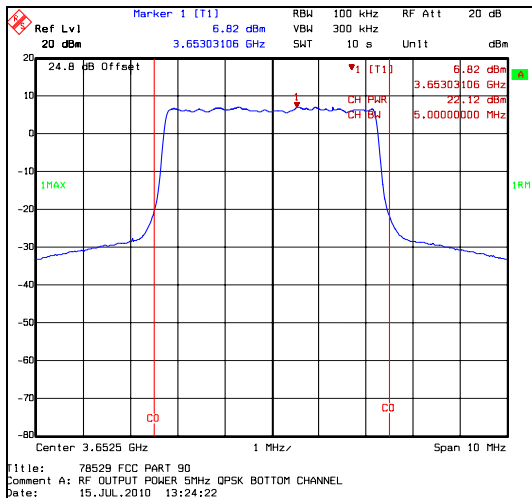
FCC Part:	90.1321 / 2.1046
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

Temperature Range (°C):	28 to 30
Relative Humidity Range (%):	34 to 35

Results: 5 MHz Channel Bandwidth – QPSK 3/4

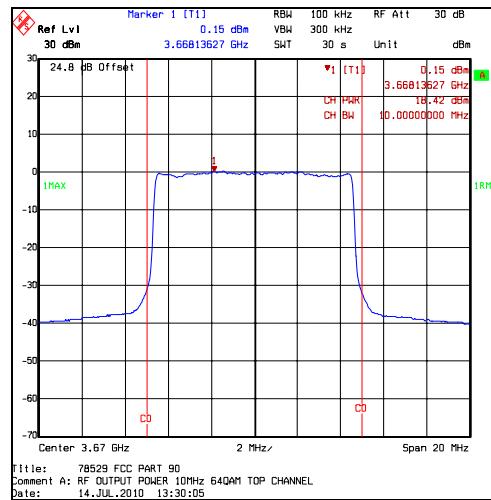
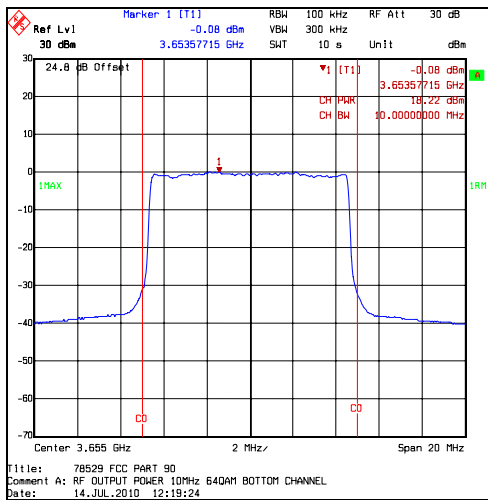
Channel	Frequency (MHz)	Conducted RF O/P Power (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3652.5	22.1	28.1	44.0	15.9	Complied
Top	3672.5	22.4	28.4	44.0	15.6	Complied



Transmitter Carrier Output Power (Conducted) (continued)

Results: 10MHz Channel Bandwidth – 64 QAM 3/4

Channel	Frequency (MHz)	Conducted RF O/P Power (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3655.0	18.2	24.2	44.0	19.8	Complied
Top	3670.0	18.4	24.4	44.0	19.6	Complied



Note(s):

1. The client stated that the system is designed to use an omni-directional antenna with 6 dBi gain. The limit is 25W / 25 MHz (44 dBm / 25 MHz). The antenna gain was added to the conducted output power to calculate the EIRP.
2. Measurements were performed on bottom channel and top channels, 5 MHz and 10 MHz channel bandwidth, as specified within the test plan using the spectrum analyser channel power function.
3. The spectrum analyser offset incorporated a 4.4dB offset for the 36% duty cycle of the EUT. This was calculated using the equation $10 \cdot \log_{10}(T_{on}/T)$, whereby T_{on} was measured as being 1.8 ms and T measured as being 5 ms.

5.2.2. Transmitter Peak Power Spectral Density (Conducted)

Test Summary:

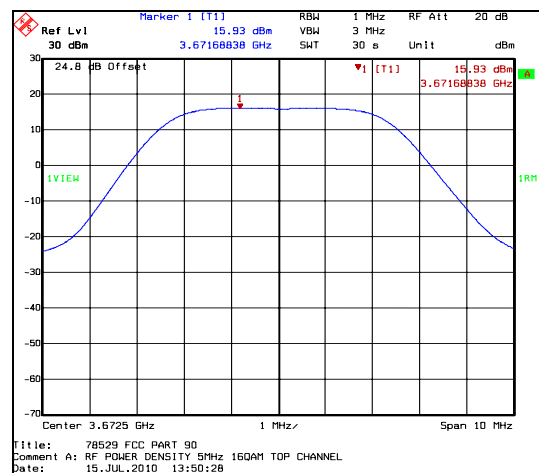
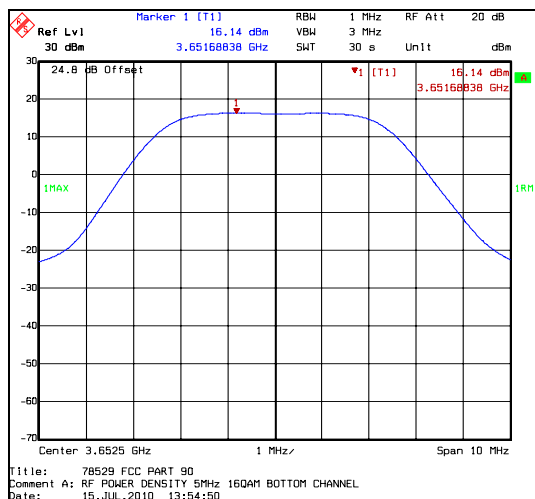
FCC Part:	90.1321 / 2.1046
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

Temperature Range (°C):	28 to 30
Relative Humidity Range (%):	34 to 35

Results: 5 MHz Channel Bandwidth – 16 QAM ¾

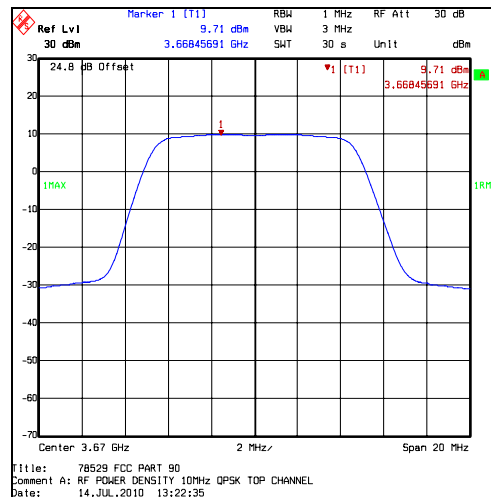
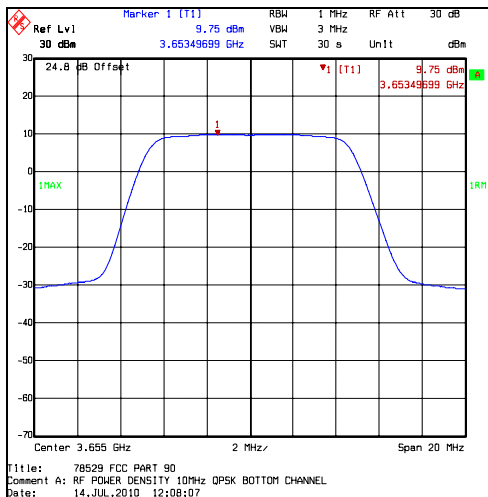
Channel	Frequency (MHz)	Conducted RF O/P Power (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3652.5	16.1	22.1	30.0	7.9	Complied
Top	3672.5	15.9	21.9	30.0	8.1	Complied



Transmitter Peak Power Spectral Density (Conducted) (continued)

Results: 10 MHz Channel Bandwidth – QPSK 3/4

Channel	Frequency (MHz)	Conducted RF O/P Power (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3655.0	9.8	15.8	30.0	14.2	Complied
Top	3670.0	9.7	15.7	30.0	14.3	Complied



Note(s):

1. The client stated that the system is designed to use an omni-directional antenna with 6 dBi gain. The antenna gain was added to the conducted output power to calculate the EIRP.
2. Measurements were performed on bottom and top channel, 5 MHz and 10 MHz channel bandwidth, as specified within the test plan.
3. The spectrum analyser offset used incorporated a 4.4dB offset for the 36% duty cycle of the EUT. This was calculated using the equation $10 \cdot \log_{10}(T_{on}/T)$, whereby T_{on} was measured as being 1.8 ms and T measured as being 5 ms.

5.2.3. Transmitter Occupied Bandwidth (Bandwidth Limitations)

Test Summary:

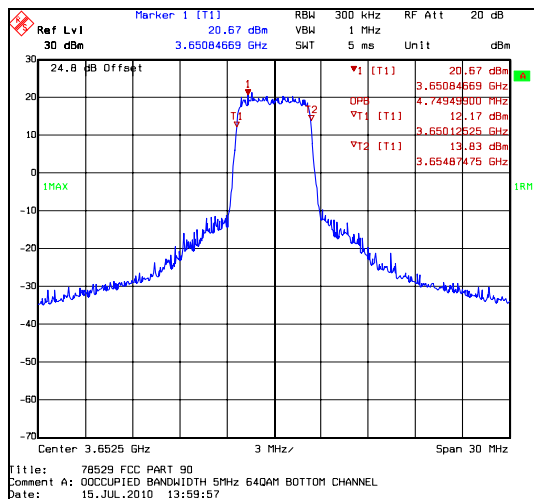
FCC Part:	90.209 / 2.1049
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

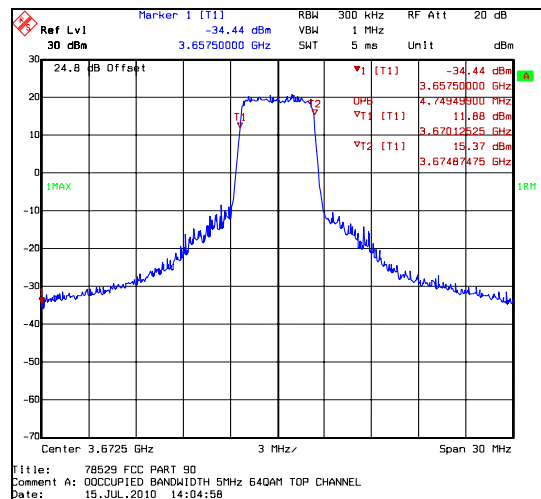
Temperature Range (°C):	28 to 30
Relative Humidity Range (%):	34 to 35

Results: 5MHz Channel Bandwidth – 64 QAM ³/₄

Channel	Frequency (MHz)	RBW (kHz)	VBW (kHz)	Occupied Bandwidth (kHz)
Bottom	3652.5	300	1000	4749.499
Top	3672.5	300	1000	4749.499



Title: 78529 FCC PART 90
 Comment A: OCCUPIED BANDWIDTH 5MHz 64QAM BOTTOM CHANNEL
 Date: 15.JUL.2010 13:59:57

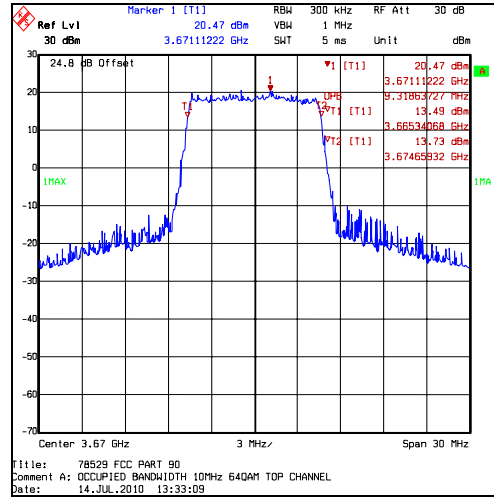
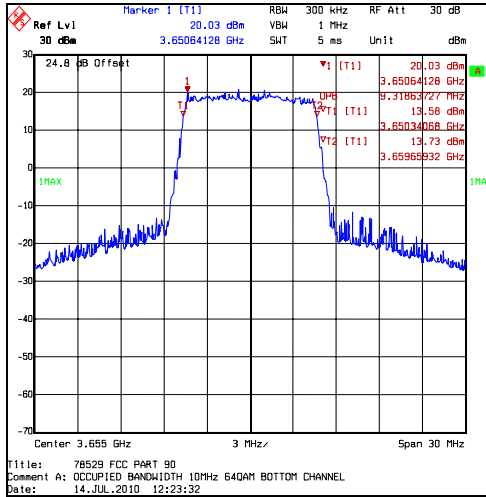


Title: 78529 FCC PART 90
 Comment A: OCCUPIED BANDWIDTH 5MHz 64QAM TOP CHANNEL
 Date: 15.JUL.2010 14:04:58

Transmitter Occupied Bandwidth (Bandwidth Limitations) (continued)

Results: 10MHz Channel Bandwidth – 64 QAM 3/4

Channel	Frequency (MHz)	RBW (kHz)	VBW (kHz)	Occupied Bandwidth (kHz)
Bottom	3655.0	300	1000	9318.637
Top	3670.0	300	1000	9318.637



Note(s):

1. The spectrum analyser offset used incorporated a 4.4dB offset for the 36% duty cycle of the EUT. This was calculated using the equation $10 \cdot \log_{10}(T_{on}/T)$, whereby T_{on} was measured as being 1.8 ms and T measured as being 5 ms.
2. The spectrum analyser Occupied Bandwidth function was used to measure the Occupied Bandwidth. Measurement bandwidths were automatically set by the spectrum analyser.

5.2.4. Transmitter Conducted Emission Mask

Test Summary:

FCC Part:	90.210(n) / 2.1051
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

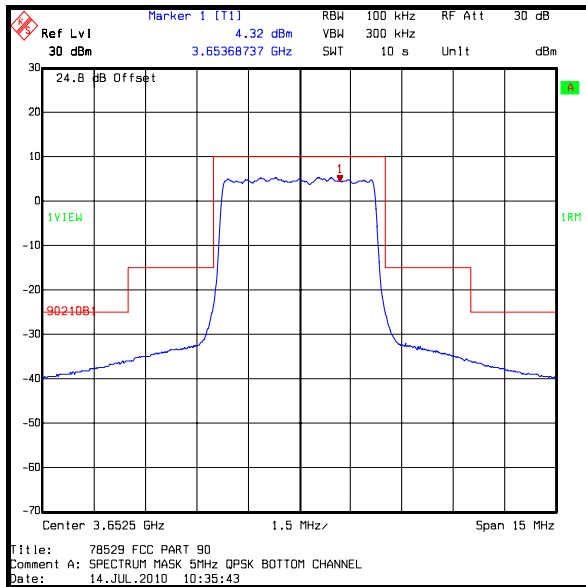
Temperature (°C):	28
Relative Humidity (%):	34

Note(s):

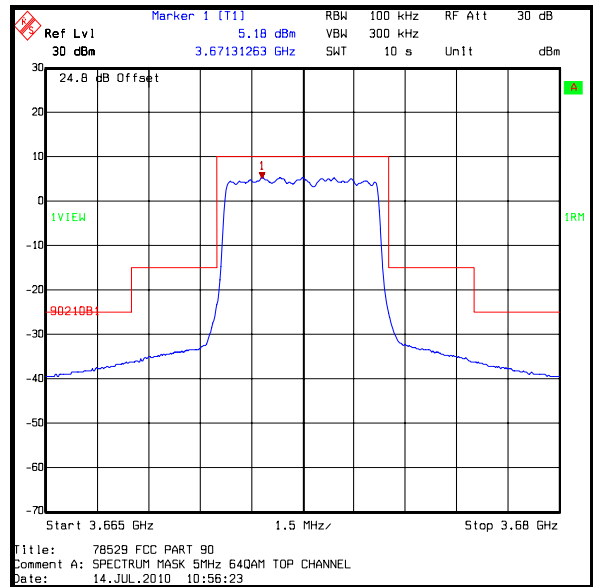
1. The measurement was performed with the EUT antenna port coupled to a spectrum analyser via suitable attenuation and cable. The power of the modulated signal was measured on a spectrum analyser using an RMS detector and 10 second sweep time, to give the full output power in the whole channel band. The spectrum analyser power measurements were verified using a calibrated power meter. The limit mask was referenced to the previously measured conducted power. The measurement was then performed in a 1 MHz bandwidth.
To eliminate the effects of measuring with a relatively wide resolution bandwidth, which caused the signal to cross the mask limit, the final measurements were performed with a 100 kHz resolution bandwidth and the mask limit was reduced by 10 dB to compensate.
2. Measurements were performed on bottom and top channel, 5 MHz and 10 MHz channel bandwidth, as specified within the test plan.
3. The spectrum analyser offset used incorporated a 4.4dB offset for the 36% duty cycle of the EUT. This was calculated using the equation $10 \cdot \log_{10}(T_{on}/T)$, whereby T_{on} was measured as being 1.8 ms and T measured as being 5 ms.

Transmitter Conducted Emission Mask (continued)

Results:



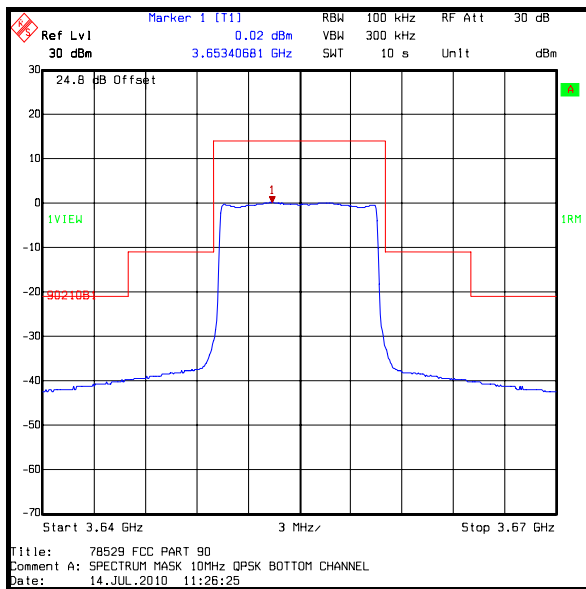
5 MHz channel QPSK3/4 / Bottom channel



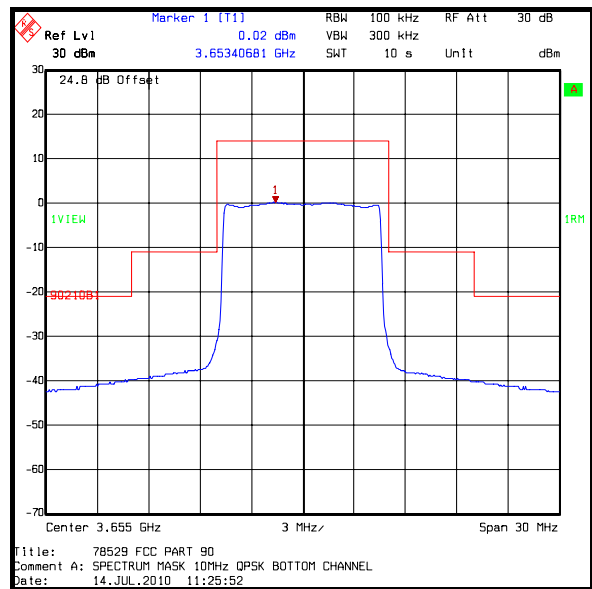
5 MHz channel 64QAM3/4 / Top channel

Transmitter Conducted Emission Mask (continued)

Results:



10 MHz channel QPSK3/4 / Bottom channel



10 MHz channel 64QAM3/4 / Top channel

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

FCC Part:	90.1323 / 2.1051
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

Temperature (°C):	27 to 31
Relative Humidity (%):	33 to 37

Results: 5 MHz Channel Bandwidth – Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3613.717	-32.3	-13.0	19.3	Complied

Results: 10 MHz Channel Bandwidth – Top Channel

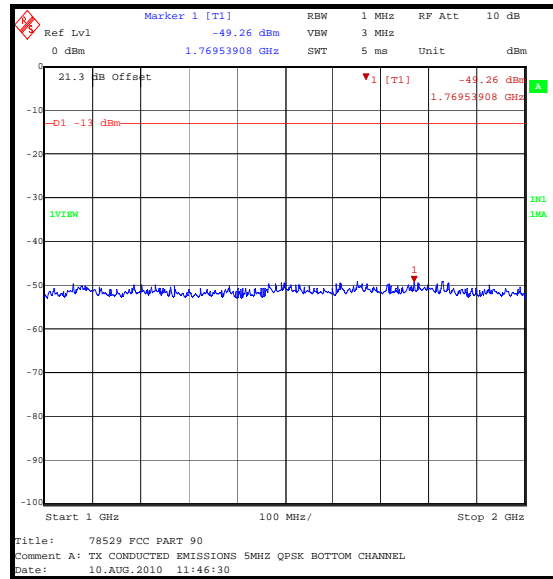
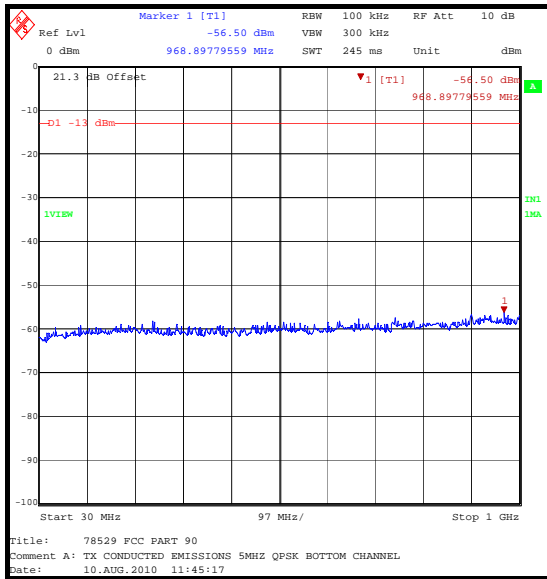
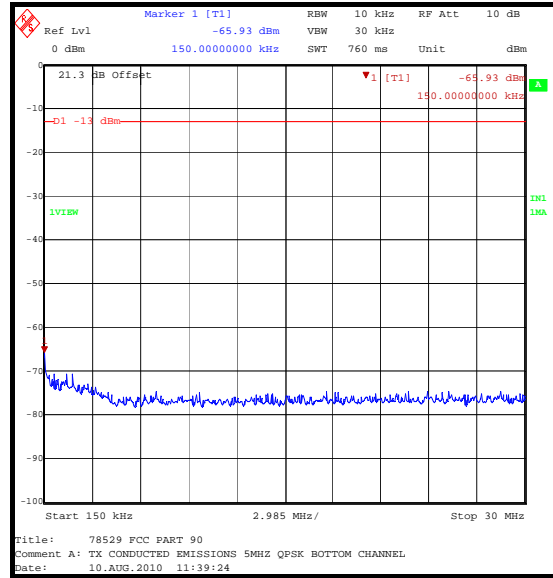
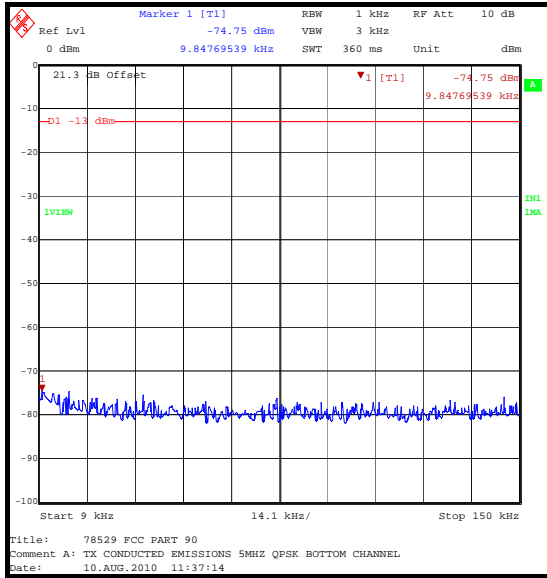
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
Note 1				

Note(s):

1. Except where recorded above, no spurious emissions were detected above the noise floor of the measuring receiver.
2. Measurements were performed on the bottom channel of the 5 MHz channel bandwidth and the top channel of the 10 MHz channel bandwidth in accordance with the test plan.
3. The EUT carrier signal is shown on the 2 to 4 GHz plots for both the 5 MHz and 10 MHz channel bandwidths.

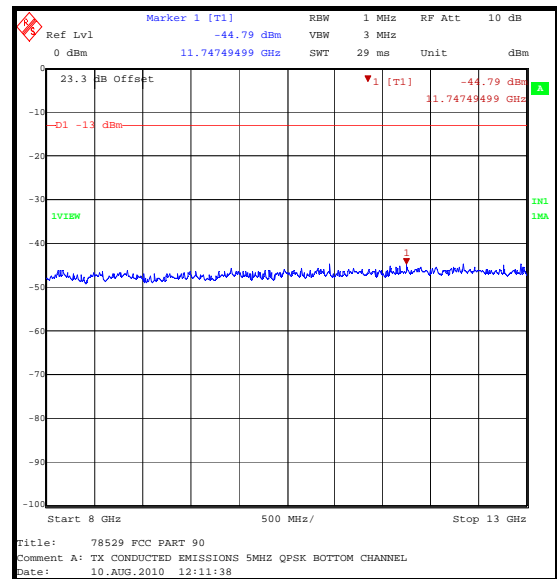
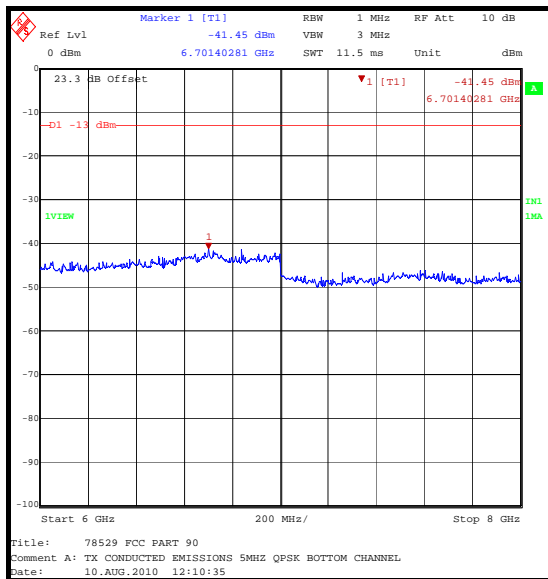
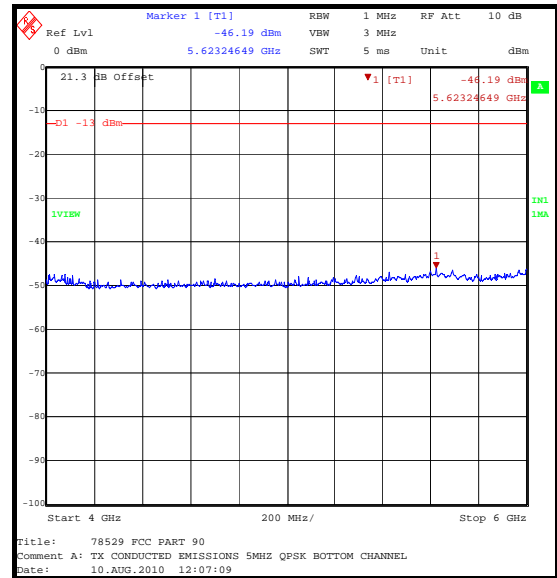
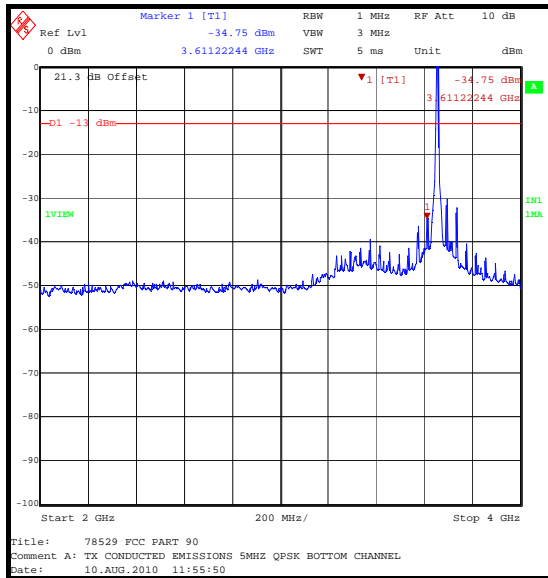
Transmitter Conducted Emissions (continued)

Bottom Channel – 5MHz Channel Bandwidth – QPSK 3/4



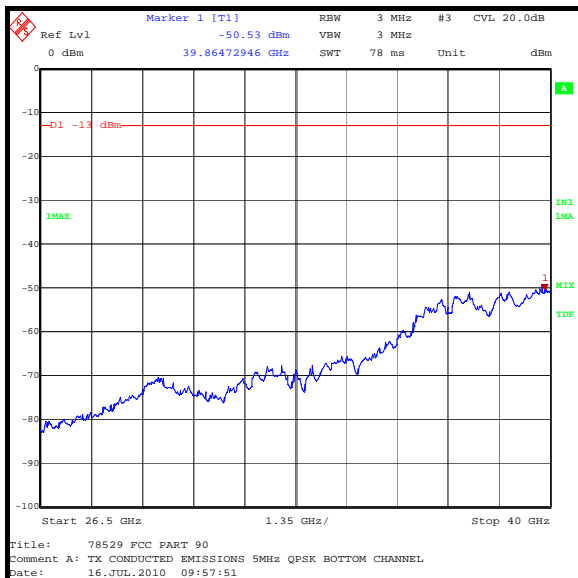
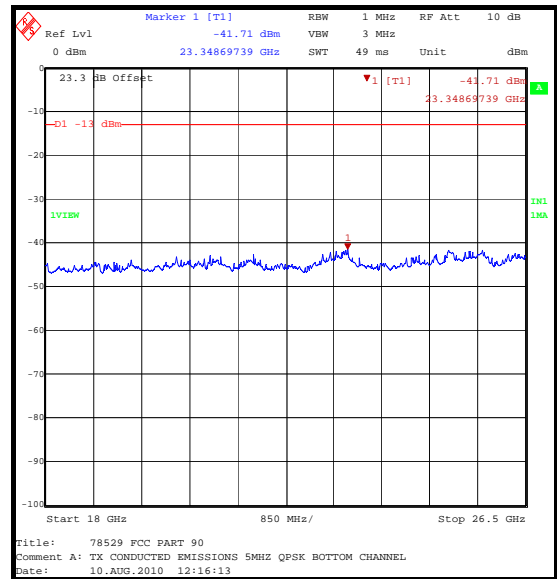
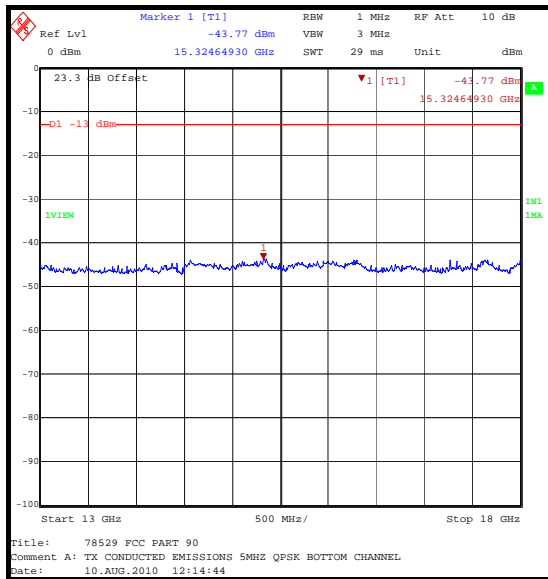
Transmitter Conducted Emissions (continued)

Bottom Channel – 5MHz Channel Bandwidth – QPSK 3/4



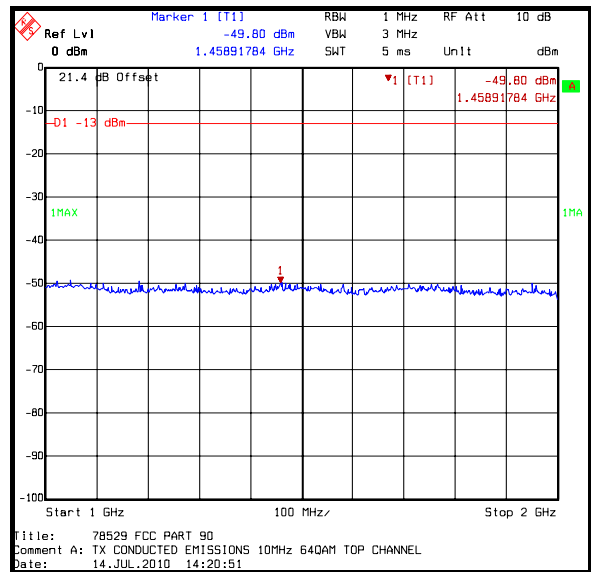
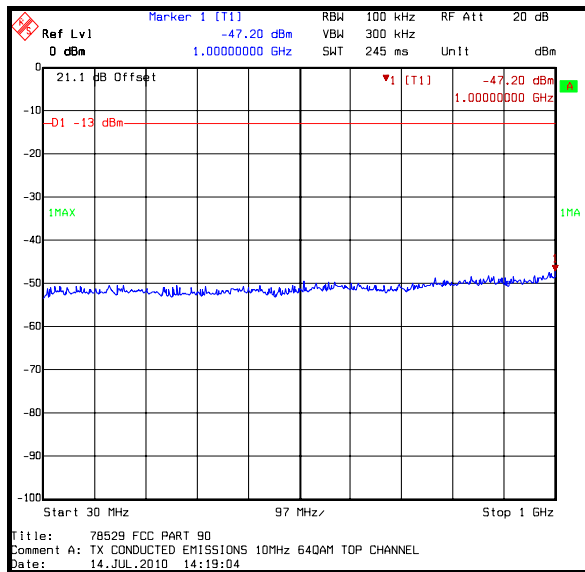
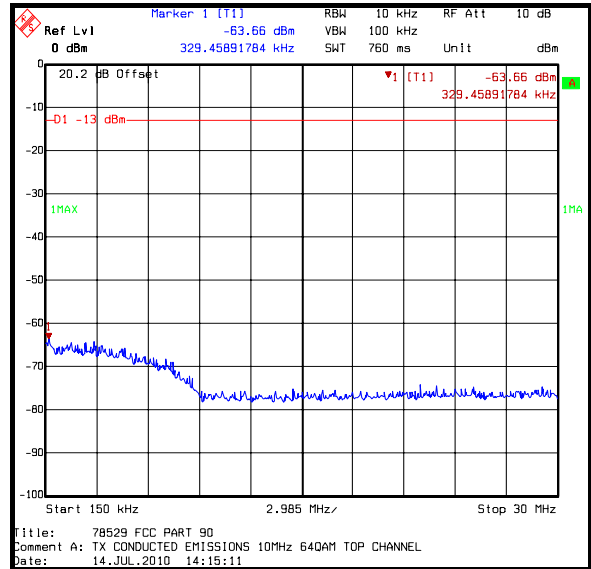
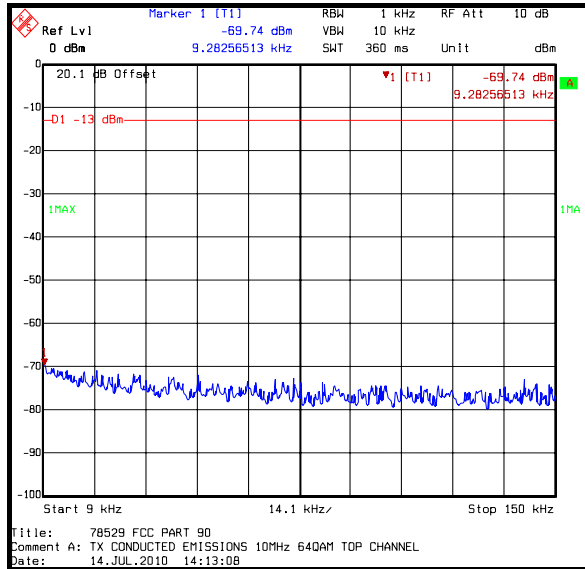
Transmitter Conducted Emissions (continued)

Bottom Channel – 5MHz Channel Bandwidth – QPSK 3/4



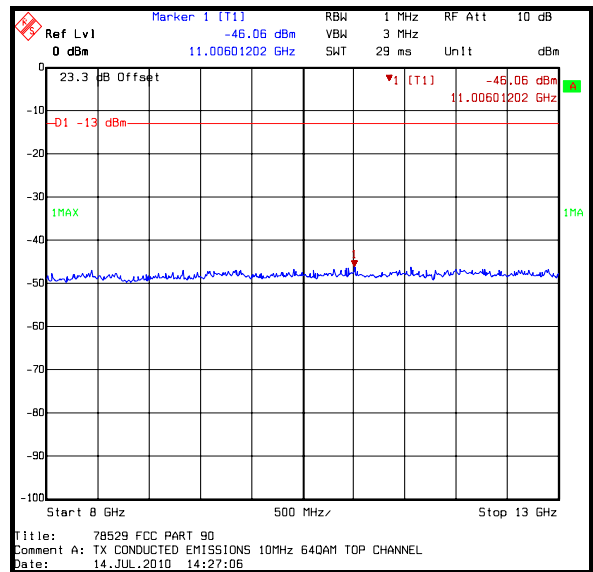
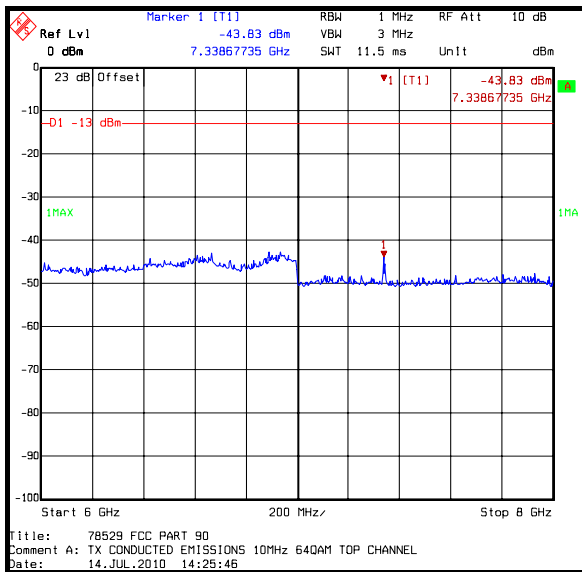
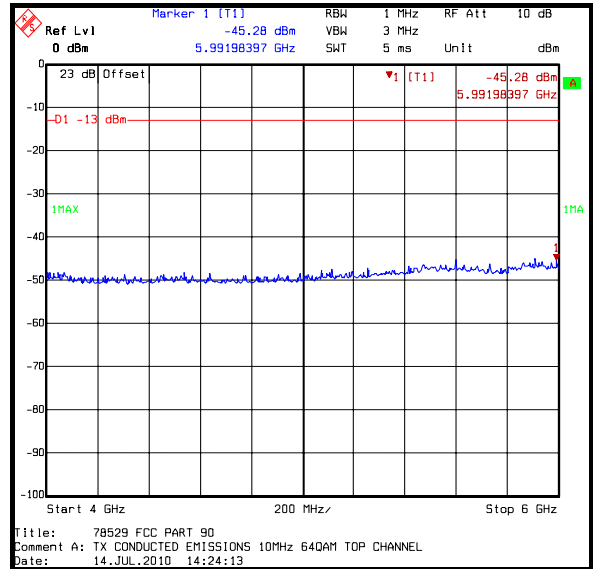
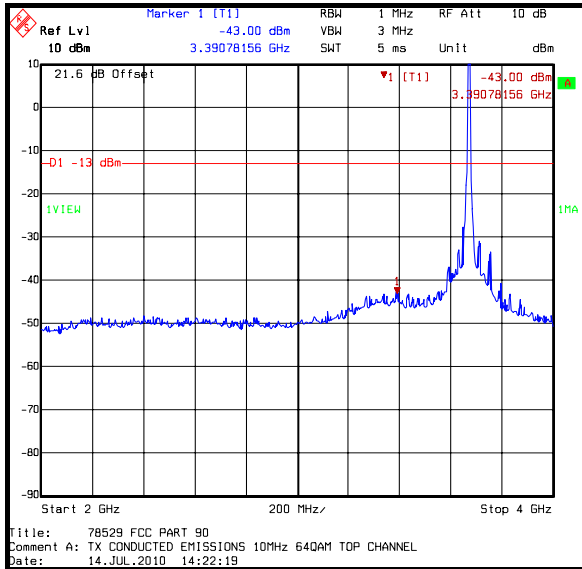
Transmitter Conducted Emissions (continued)

Top Channel – 10MHz Channel Bandwidth – 64 QAM ³/₄



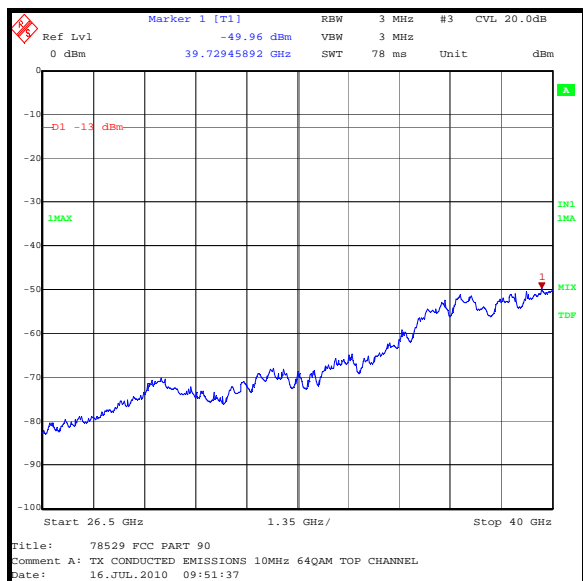
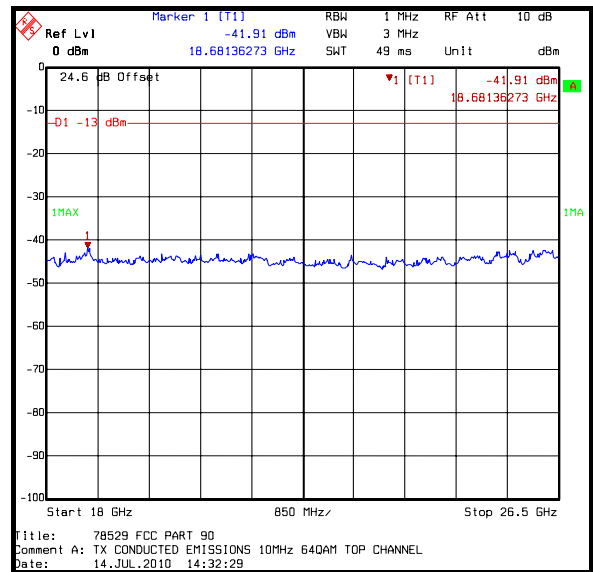
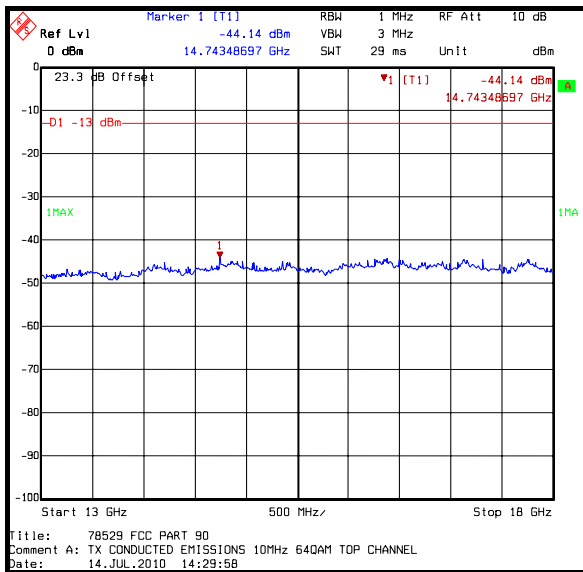
Transmitter Conducted Emissions (continued)

Top Channel – 10MHz Channel Bandwidth – 64 QAM 3/4



Transmitter Conducted Emissions (continued)

Top Channel – 10MHz Channel Bandwidth – 64 QAM ³/₄



5.2.6. Transmitter Conducted Emissions at Band Edges**Test Summary:**

FCC Part:	90.1323 / 2.1051
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

Temperature (°C):	28 to 31
Relative Humidity (%):	34 to 37

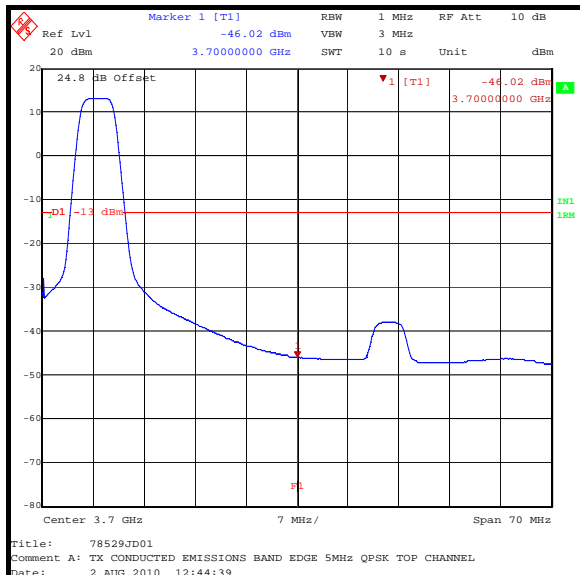
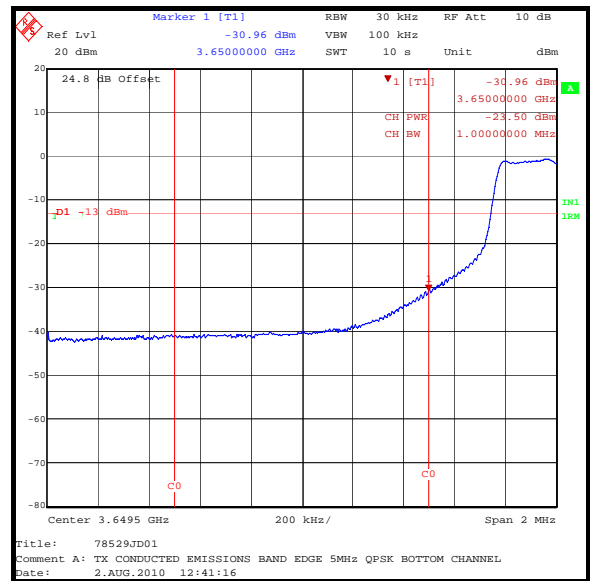
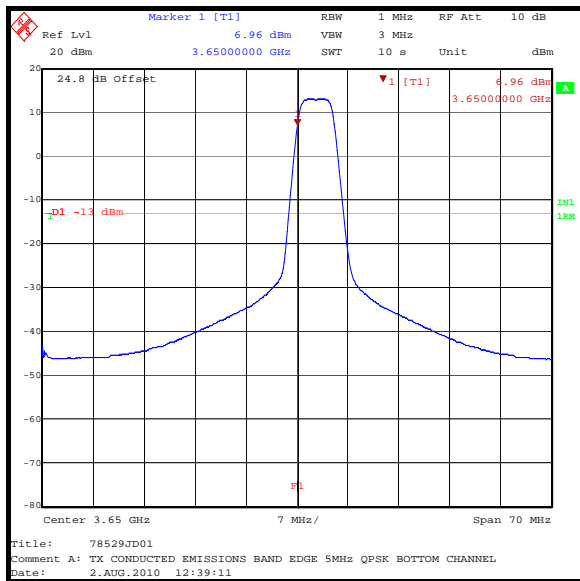
Note(s):

1. Tests were initially performed with a 1 MHz resolution bandwidth (RBW). 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 the spectrum analyser centred on the 1 MHz block immediately below and adjacent to the lower band edge. The measurement bandwidths were set automatically by the spectrum analyser.

Transmitter Conducted Emissions at Band Edges (continued)

Results: 5MHz Channel Bandwidth – QPSK 3/4

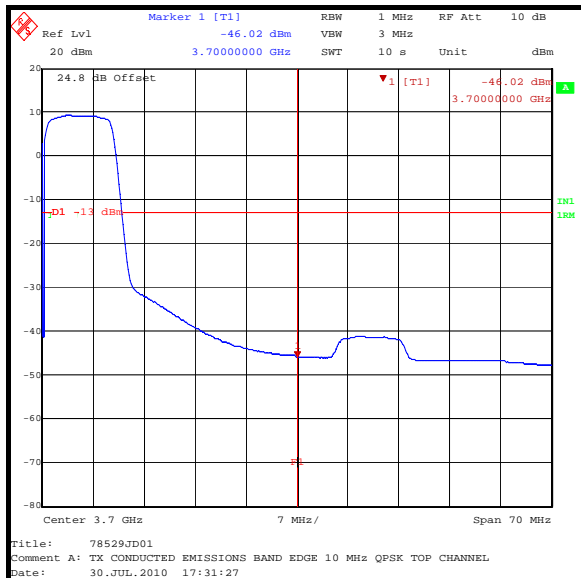
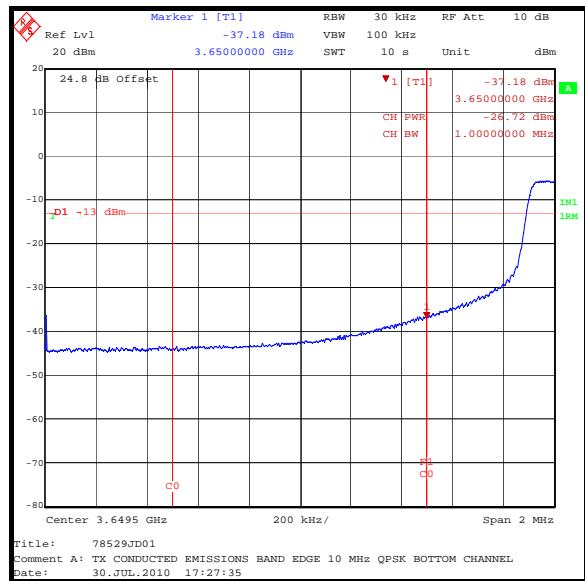
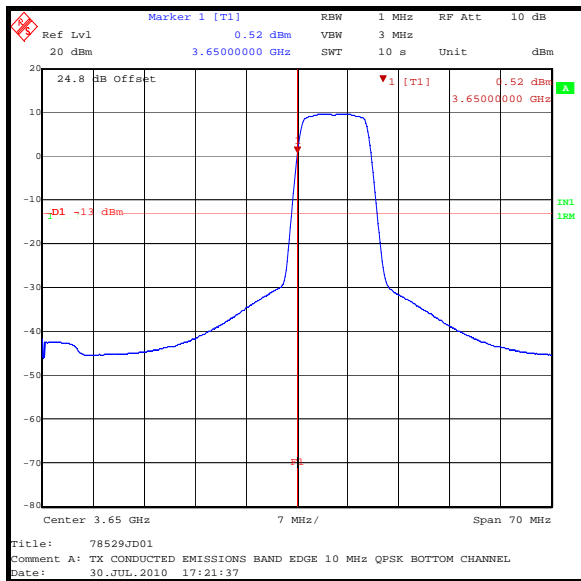
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3650.0	-23.5	-13.0	10.5	Complied
3700.0	-46.0	-13.0	33.0	Complied



Transmitter Conducted Emissions at Band Edges (continued)

Results: 10MHz Channel Bandwidth – 64 QAM 3/4

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3650.0	-26.7	-13.0	13.7	Complied
3700.0	-46.0	-13.0	33.0	Complied



5.2.7. Transmitter Radiated Emissions

Test Summary:

FCC Part:	90.1323 / 2.1053
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

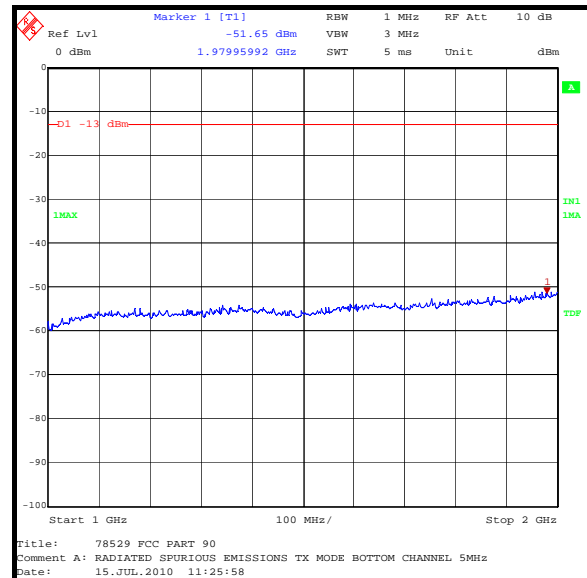
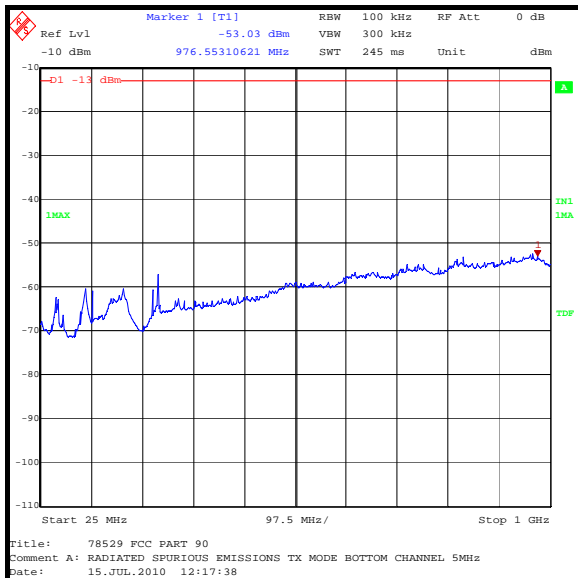
Temperature (°C):	28 to 31
Relative Humidity (%):	34 to 37

Results: 5 MHz Channel Bandwidth / Bottom Channel

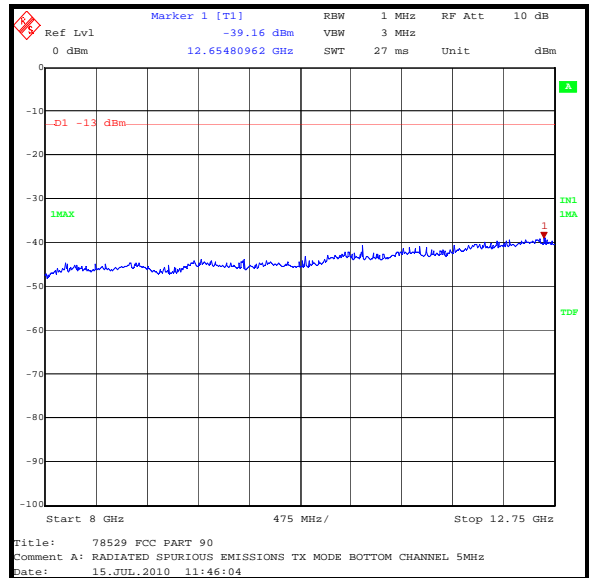
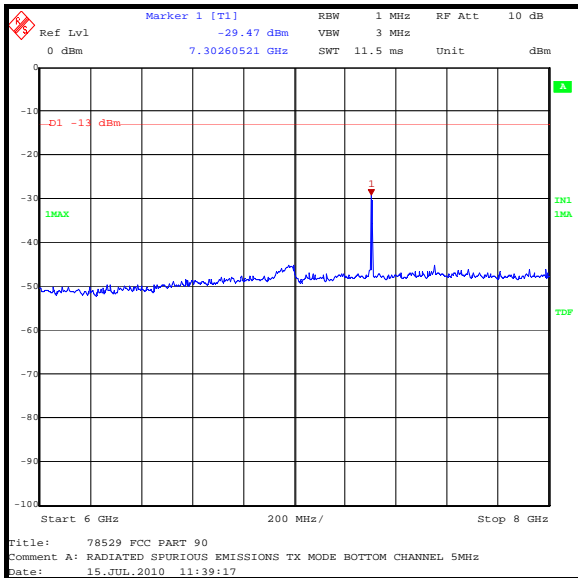
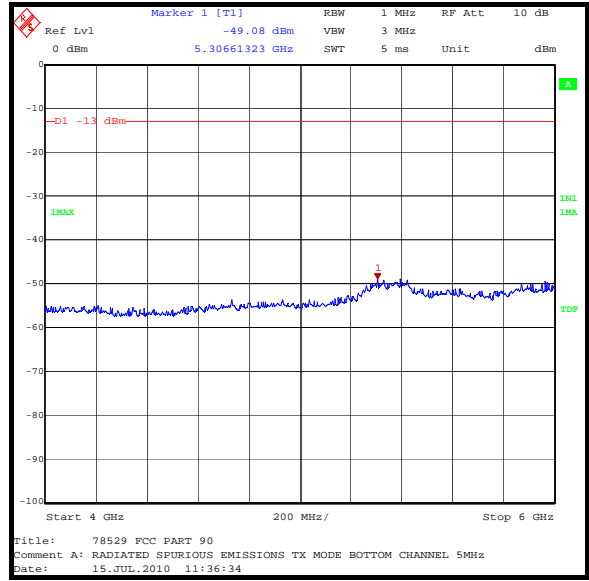
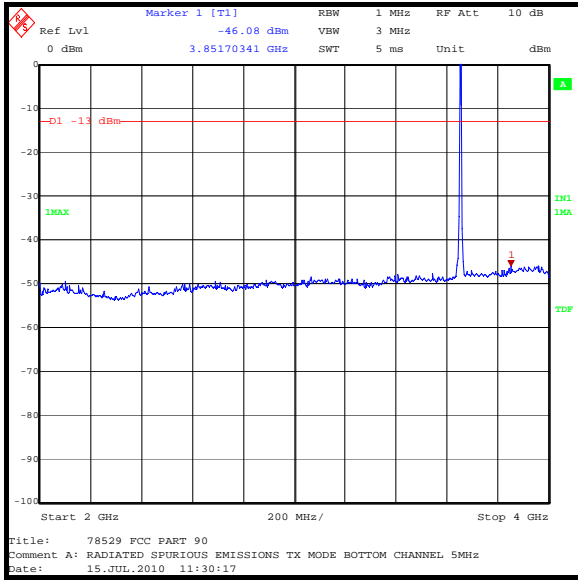
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
7305.392	-27.4	-13.0	14.4	Complied

Note(s):

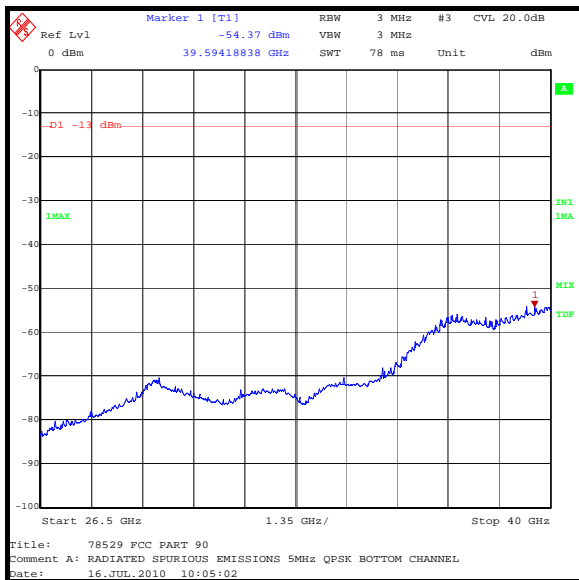
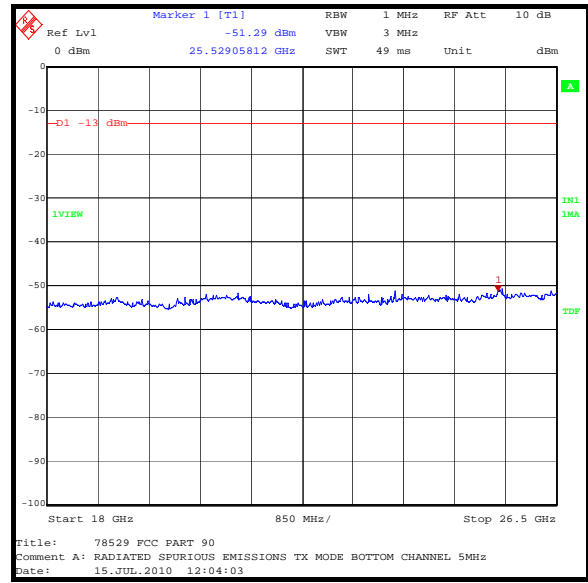
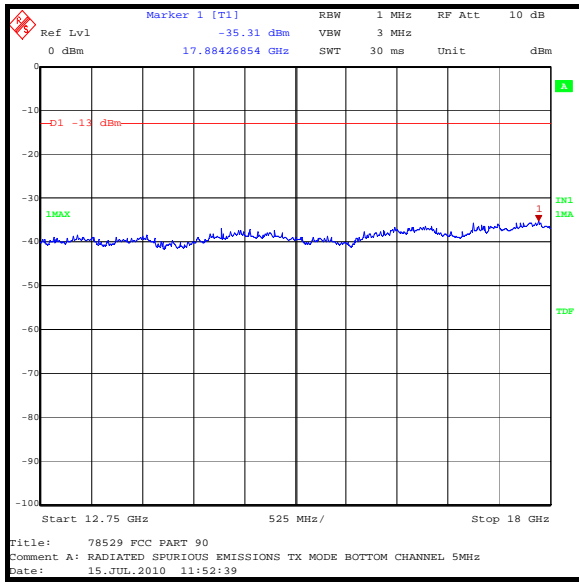
1. The emission seen on the 2 GHz to 4 GHz plot is the EUT carrier frequency.



Transmitter Radiated Emissions (continued) – 5 MHz Channel Bandwidth / Bottom Channel



Transmitter Radiated Emissions (continued) – 5 MHz Channel Bandwidth / Bottom Channel



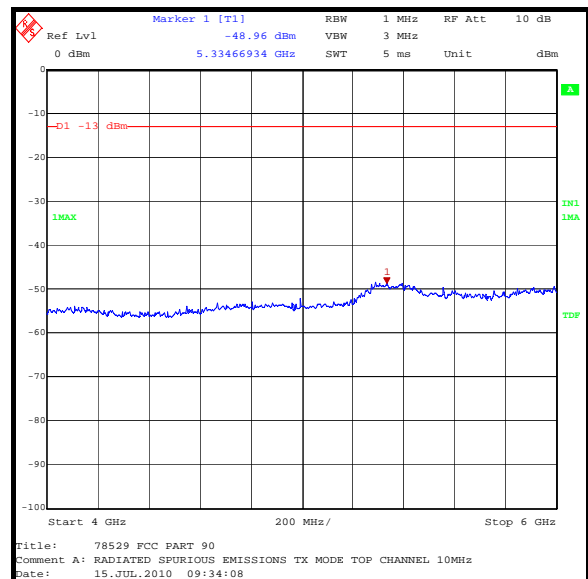
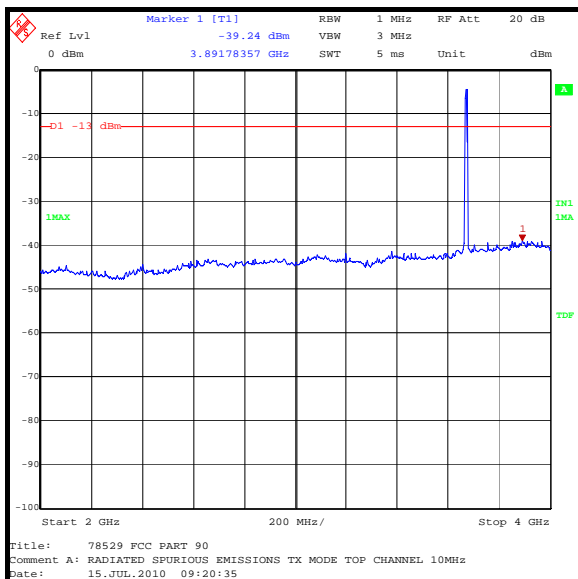
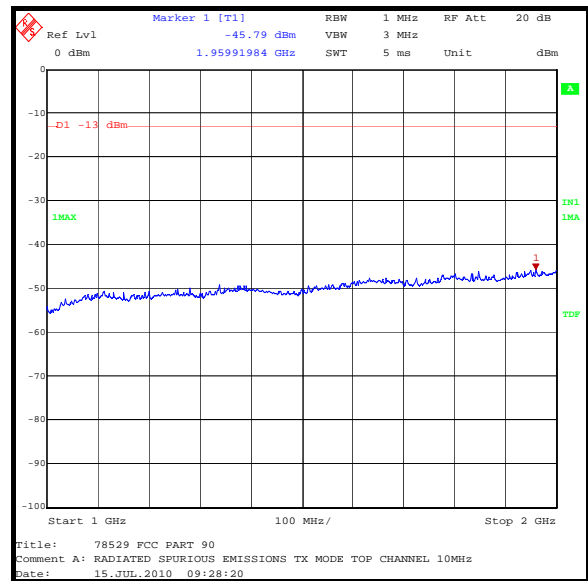
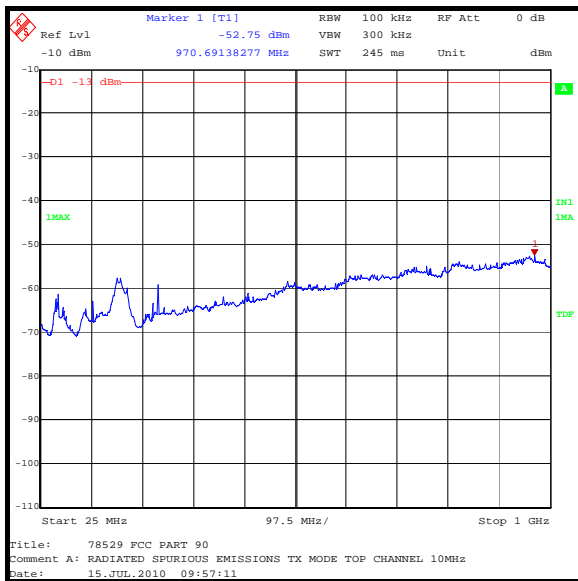
Transmitter Radiated Emissions (continued)

Results:- 10 MHz Channel Bandwidth / Top Channel

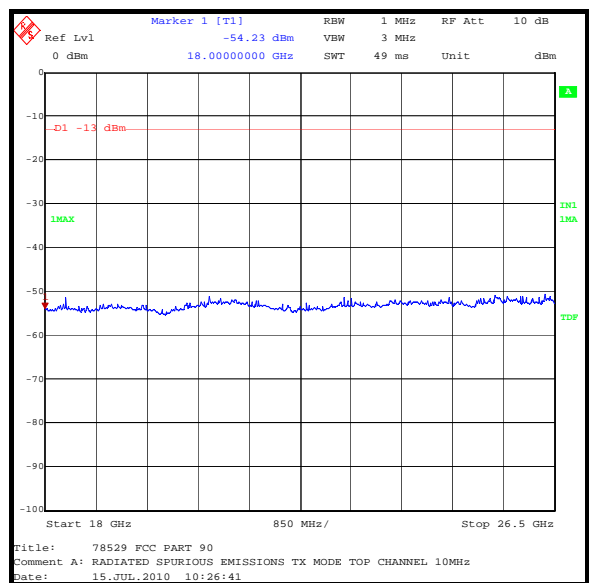
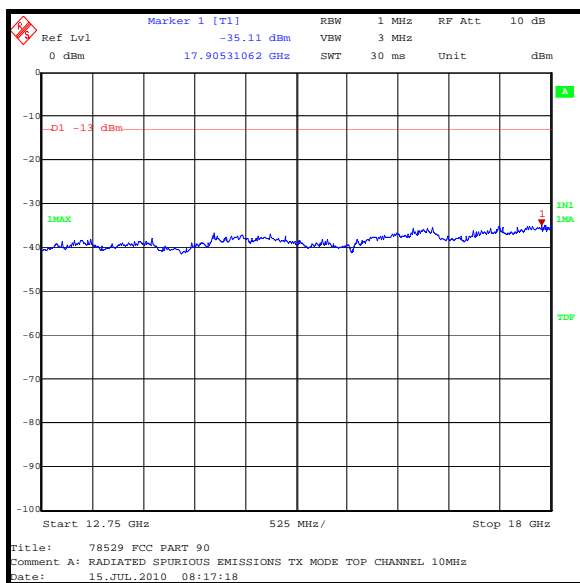
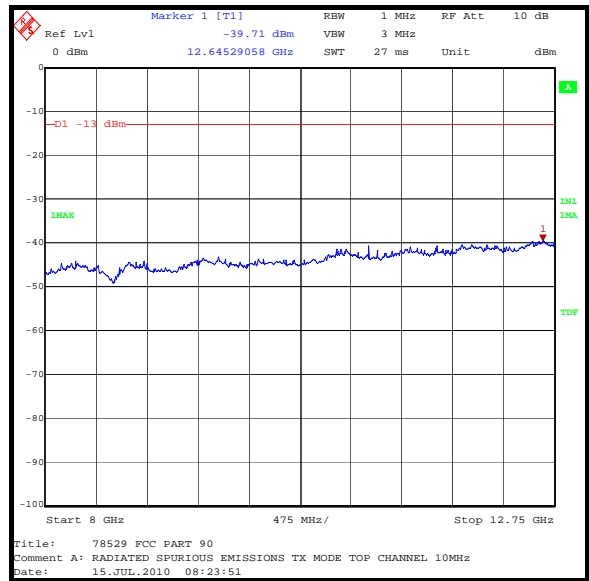
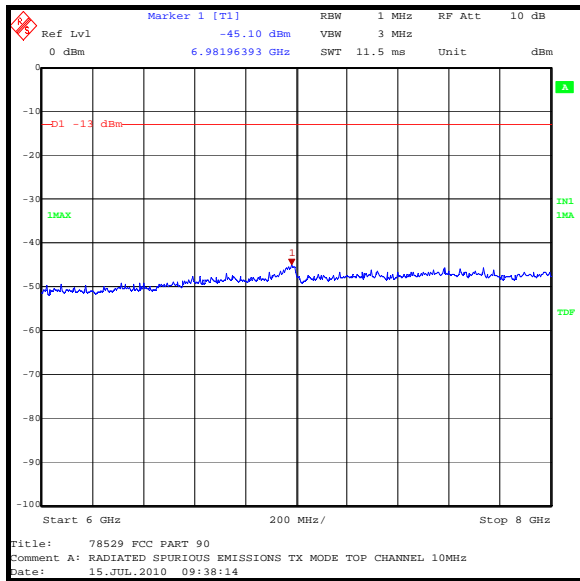
Frequency (GHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
17905.311	-35.1	-13.0	22.1	Complied

Note(s):

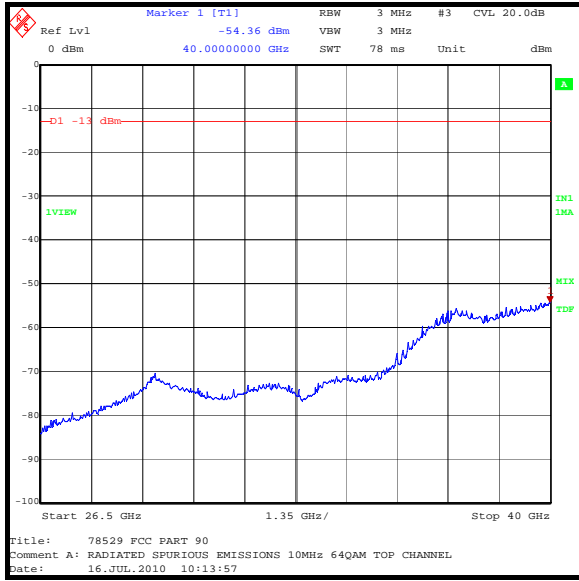
1. The emission seen on the 2 GHz to 4 GHz plot is the EUT carrier frequency.
2. All emissions were at least 20 dB below the analyser noise floor; therefore the highest level of noise floor was recorded in the table above.



Transmitter Radiated Emissions (continued) – 10 MHz Channel Bandwidth / Top Channel



Transmitter Radiated Emissions (continued) – 10 MHz Channel Bandwidth / Top Channel



5.2.7.1. Transmitter Band Edge Radiated Emissions

Test Summary:

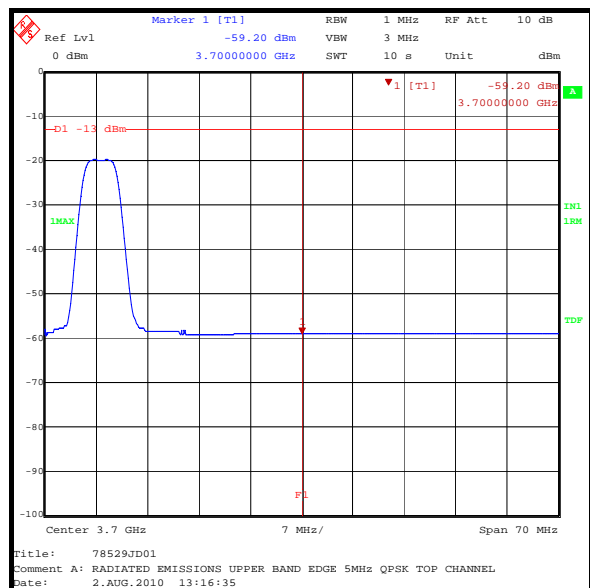
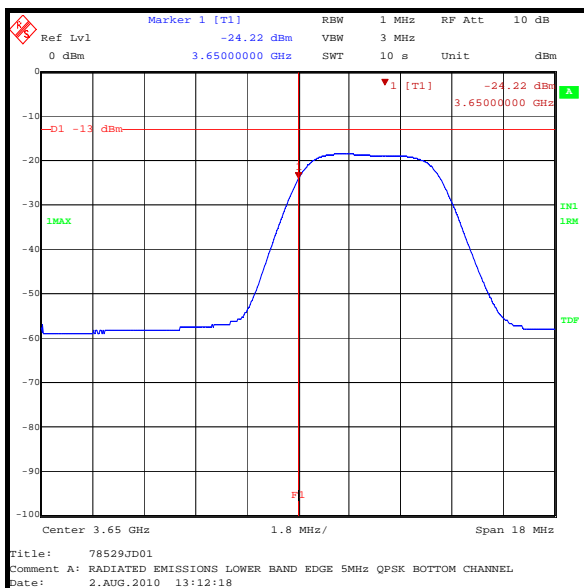
FCC Part:	90.1323/2.1053
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

Temperature (°C):	30
Relative Humidity (%):	35

Results: 5MHz Channel Bandwidth

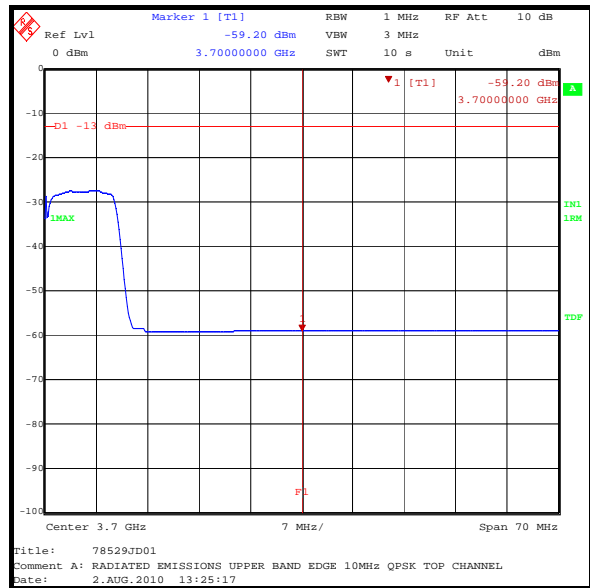
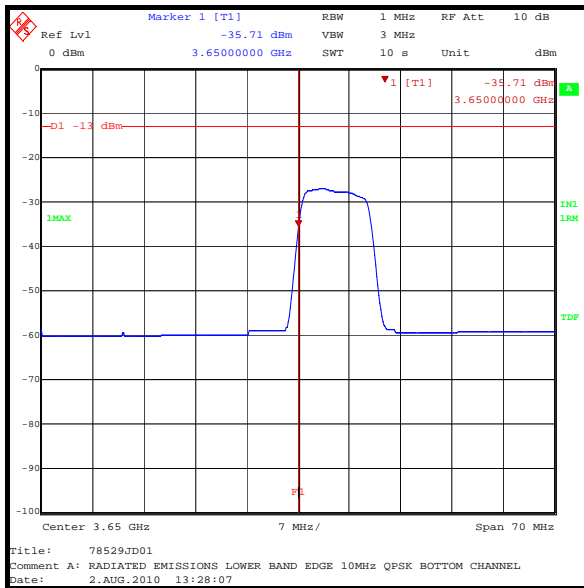
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3650.0	-24.2	-13.0	11.2	Complied
3700.0	-59.2	-13.0	46.2	Complied



Transmitter Band Edge Radiated Emissions (continued)

Results: 10MHz Channel Bandwidth

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3650.0	-35.7	-13.0	22.7	Complied
3700.0	-59.2	-13.0	46.2	Complied



5.2.8. Transmitter Frequency Stability (Temperature Variation)**Test Summary:**

FCC Part:	90.213 / 2.1055(a)(1)
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	40

Results: 5MHz Channel Bandwidth

Temp (°C)	Measured Frequency (MHz)	Frequency Error (kHz)
-30	3652.499701	0.299
-20	3652.499711	0.289
-10	3652.499983	0.017
0	3652.500746	0.746
10	3652.500678	0.678
20	3652.500475	0.475
30	3652.500130	0.130
40	3652.499545	0.455
50	3652.500098	0.098

5.2.9. Transmitter Frequency Stability (Voltage Variation)**Test Summary:**

FCC Part:	90.213 / 2.1055(a)(1)
Test Method Used:	As detailed in ANSI TIA-603-C-2004 and relevant annexes

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	40

Results: 5 MHz Channel Bandwidth, Bottom Channel (3652.5 MHz)

AC Voltage	Measured Frequency (MHz)	Frequency Error (kHz)
102	3652.500120	0.120
120	3652.500130	0.130
138	3562.500130	0.130

Note(s):

1. No limit has been specified for equipment operating in this frequency range. These results are provided for information purpose only.
2. Measurements were only performed on the bottom channel with 5 MHz channel bandwidth, as specified within AWB test plan SC_AIR_TP02_A.
3. When using a suitably small resolution bandwidth, the CPE transmitter centre frequency local oscillator fundamental frequency can be seen on a spectrum analyser amongst the WiMAX waveform and hence frequency stability can be measured using a spectrum analyser without WiMAX signal decoding capability.

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
Transmitter Carrier Output Power (EIRP)	Not Applicable	95%	±2.94 dB
Transmitter Power Output Density	Not Applicable	95%	±2.94 dB
Transmitter Occupied Bandwidth	Not Applicable	95%	±0.92 ppm
Transmitter Conducted Emissions Mask	Not Applicable	95%	±2.62 dB
Transmitter Conducted Emissions	9 kHz to 40 GHz	95%	±2.62 dB
Transmitter Radiated Emissions	9 kHz to 1 GHz	95%	±3.53 dB
Transmitter Radiated Emissions	1 GHz to 40 GHz	95%	±2.94 dB
Transmitter Frequency Stability (Temperature & Voltage Extreme)	Not Applicable	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)
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	Calibrated before use	-
A1818	Horn Antenna	EMCO	3115	00075692	27 Nov 2010	12
A1999	20 dB Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
A203	Horn Antenna	Flann Microwave Ltd	22240-20	343	11 May 2013	36
A436	Horn Antenna	Flann Microwave Ltd	20240-20	330	05 Jun 2013	36
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 Sep 2010	12
M1223	Votsch VT4002	Votsch	VT4002	58566072720010	Calibrated before use	-
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986/022	08 Mar 2011	12
M1249	Thermometer	Fluke	52II	88800049	05 Jul 2011	12
S0539	Power Supply Unit	Kikusui	PCR 1000L	13010170	Calibration not required	-

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