



# TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: LBWA1ZZPDZ-385

FCC ID: TTULBWA1ZZPD

IC Certification Number: 3775B-LBWA1ZZPD

To: FCC Part 15.247: 2011 & Industry Canada RSS-210 Issue 8  
December 2010, RSS-Gen Issue 3 December 2010

**Test Report Serial No.:**  
RFI-RPT-RP84552JD02D V2.0

**Version 2.0 Supersedes All Previous Versions**

<b>This Test Report Is Issued Under The Authority Of John Newell, Group Quality Manager:</b>	
<b>Checked By:</b>	Sarah Williams
<b>Signature:</b>	
<b>Date of Issue:</b>	06 July 2012

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## **1. Customer Information**

<b>Company Name:</b>	Bang & Olufsen a/s
<b>Address:</b>	Peter Bangs Vej 15 7600 Struer Denmark

## 2. Summary of Testing

### 2.1. General Information

<b>Specification Reference:</b>	47CFR15.247
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2011: Part 15 Subpart C (Intentional Radiators) - Section 15.247
<b>Specification Reference:</b>	47CFR15.107 and 47CFR15.109
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2011: Part 15 Subpart B (Unintentional Radiators) - Sections 15.107 and 15.109
<b>Specification Reference:</b>	47CFR15.207 and 47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2011: Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
<b>Specification Reference:</b>	RSS-Gen Issue 3 December 2010
<b>Specification Title:</b>	General Requirements and Information for the Certification of Radio Apparatus
<b>Specification Reference:</b>	RSS-210 Issue 8 December 2010
<b>Specification Title:</b>	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
<b>Site Registration:</b>	FCC: 209735; Industry Canada: 3245B-2
<b>Location of Testing:</b>	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
<b>Test Dates:</b>	07 January 2012 to 09 March 2012

### 2.2. Summary of Test Results

	IC Reference	Measurement	Result
Part 15.107(a)	RSS-Gen 7.2.4	Receiver/Idle Mode AC Conducted Emissions	✓
Part 15.109	RSS-Gen 4.10	Receiver/Idle Mode Radiated Spurious Emissions	✓
Part 15.207	RSS-Gen 7.2.4	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(2)	RSS-Gen 4.6.2 RSS-210 A8.2(a)	Transmitter 6 dB Bandwidth	✓
Part 2.1049	RSS-Gen 4.6.1/4.6.3	Transmitter 20 dB Bandwidth	✓
Part 15.247(e)	RSS-210 A8.2(b)	Transmitter Power Spectral Density	✓
Part 15.247(b)(3)	RSS-Gen 4.8 RSS-210 A8.4(4)	Transmitter Maximum Peak Output Power	✓
Part 15.247(d)/ 15.209(a)	RSS-Gen 4.9 RSS-210 A8.5	Transmitter Radiated Emissions	✓
Part 15.247(d)/ 15.209(a)	RSS-Gen 4.9 RSS-210 A8.5	Transmitter Band Edge Radiated Emissions	✓

**Key to Results**

✓ = Complied    ✗ = Did not comply

### **2.3. Methods and Procedures**

<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
<b>Reference:</b>	ANSI C63.10 (2009)
<b>Title:</b>	American National Standard for Testing Unlicensed Wireless Devices
<b>Reference:</b>	FCC KDB 558074 D01 v01 1/18/2012
<b>Title:</b>	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) devices operating Under §15.247
<b>Reference:</b>	FCC KDB 662911 D01 v01r01 10/25/2011
<b>Title:</b>	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

### **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>	Bang & Olufsen
<b>Model Number:</b>	Murata LBWA1ZZPDZ-385
<b>Specification Number:</b>	JEBMM0-0505
<b>Firmware Version:</b>	2.4.0.0 ,Size: 371412 bytes, date: 20110223
<b>Serial Number:</b>	Not marked or stated
<b>FCC ID:</b>	TTULBWA1ZZPD
<b>IC Certification Number:</b>	3775B-LBWA1ZZPD

<b>Brand Name:</b>	Bang & Olufsen
<b>Model Name or Number:</b>	Beo Play V1-32 32" TV containing a Murata LBWA1ZZPDZ-385 module
<b>Serial Number:</b>	22582545

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

The equipment under test was an IEEE 802.11a,b,g,n WLAN module operating in the 2.4 GHz and 5 GHz bands. The module is normally incorporated into a 32" television. The EUT has three external antenna ports, two transmit chains and three receive chains, MIMO is supported. For 802.11n operation the device uses MIMO (2 transmitters and 3 receivers). Depending on the 802.11 MCS, the device transmits 1 or 2 spatial stream. The device uses spatial multiplexing and from an RF point of view the streams are uncorrelated.

The Customer supplied a Video Engine which contains the WLAN Module and is part of the television. The Video Engine contained input and output ports (serial, Ethernet, HDMI, USB and RF ports). The Video Engine was powered from 5 V and 12 VDC supplies. The Video Engine allowed conducted measurements to be performed.

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

No modifications were applied to the EUT during testing.

### **3.4. Additional Information Related to Testing**

<b>Technology Tested:</b>	IEEE 802.11 / Unlicensed National Information Infrastructure Devices (U-NII)				
<b>Type of Unit:</b>	Transceiver				
<b>Data rates:</b>	802.11 a	6, 9, 12, 18, 24, 36 ,48 and 54 Mbps			
	802.11 n	13, 19.5, 26, 39, 52, 58.5, 65, 13.5, 26, 39, 52, 78, 104, 117, 130 Mbps			
<b>TV Power Supply Requirement(s):</b>	Nominal	120 VAC 60 Hz			
<b>Maximum Conducted Output Power:</b>	21.4 dBm				
<b>Channel Spacing:</b>	20 MHz				
<b>Transmit &amp; Receive Frequency Band:</b>	5725 MHz to 5850 MHz				
<b>Transmit &amp; Receive Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>		
	Bottom	149	5745		
	Middle	157	5785		
	Top	165	5825		
<b>Channel Spacing:</b>	40 MHz				
<b>Transmit &amp; Receive Frequency Band:</b>	5725 MHz to 5850 MHz				
<b>Transmit &amp; Receive Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>		
	Bottom	151	5755		
	Top	159	5795		

### **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>	D610
<b>Serial Number:</b>	RFI Asset No. PC343NT

<b>Description:</b>	Laptop
<b>Brand Name:</b>	IBM
<b>Model Name or Number:</b>	Thinkpad
<b>Serial Number:</b>	Bang & Olufsen Asset No. 00000 51736

<b>Description:</b>	External Antenna
<b>Brand Name:</b>	Tyco
<b>Model Name or Number:</b>	1513711-1
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Serial to Ethernet cable
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Ethernet cable
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	HDMI Cables / 2 metres length
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	HDMI Player
<b>Brand Name:</b>	Sumvision
<b>Model Name or Number:</b>	Cyclone
<b>Serial Number:</b>	SUM0911

**Support Equipment (continued)**

<b>Description:</b>	USB Stick
<b>Brand Name:</b>	Integral
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Digital Terrestrial Receiver
<b>Brand Name:</b>	Samsung
<b>Model Name or Number:</b>	DTB-B260V
<b>Serial Number:</b>	6RDLCOO101E

<b>Description:</b>	Wireless N router
<b>Brand Name:</b>	Cisco
<b>Model Name or Number:</b>	Linkseys E4200
<b>Serial Number:</b>	Not marked or stated

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

### **4.1. Operating Modes**

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

- Receiver/Idle mode. The 802.11 mode was active but not transmitting.
- Continuously transmitting with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.

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

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

- Transmitting in test mode with 100% duty cycle and controlled using a bespoke application on a laptop PC using Hyperterminal PC application. The application was used to enable continuous transmit mode or receive mode and to select the test channels, data rates and modulation schemes as required. The Customer supplied instructions on how to configure the EUT for test purposes.
- Conducted measurements were performed with the EUT fitted to the Video Engine and tests made with the measurement equipment connected to antenna ports (Port 0 & Port 1). Short internal RF cables were fitted between the Video Engine and the SMA antenna ports. The Customer declared the antenna gain was 1.0 dBi in the 5725-5850 GHz band. This figure is the antenna manufacturer's stated antenna gain less the loss of the internal RF cables. DC voltage to the Video Engine (5.0 VDC and 12.0 VDC) was supplied by two bench power supplies. Voltage was monitored using two calibrated voltmeters.
- The EUT has three RF ports, two transmit/receive RF ports (labelled as Port 0 and Port 1) and an additional receive RF port (labelled as Port 2). Conducted measurements were performed on Port 0 and Port 1. RF cables and attenuators connecting the test equipment to the EUT ports were calibrated before use and the calibration data incorporated into the conducted measurement results.
- AC conducted emissions tests were performed with the television powered from a 120 VAC 60 Hz single phase mains supply via a LISN.
- Radiated measurements and AC conducted measurements were made with the EUT fitted to the 32" television. A Tyco Electronics TE Connectivity 1513711-1 antenna (supporting MIMO) was connected to the 3-way antenna port. The antenna was placed on the highest point of the television using a temporary bracket. The following accessories were representative of typical accessories that are normally used in conjunction with the television incorporating the EUT: HDMI player, USB memory stick, Digital Terrestrial Receiver and Wireless N Router. These were connected using suitable cables in order to terminate all ports during radiated testing. The television was powered from a 120 VAC 60 Hz single phase mains supply.
- For transmitter radiated spurious emissions tests, the TV was configured to be transmitting on both ports which were then connected to the Tyco antenna. The EUT was transmitting with a data rate of 13 Mbps / MCS8 with a channel bandwidth of 20 MHz. Initial measurements were carried out on one channel and this was found to have the highest power level and therefore deemed to be worst case. Pre-scans were performed on the top channel and if any emissions seen, final measurements were carried out on bottom, middle and top channels.
- Photographs of the test setup using the Video Engine can be found in Appendix 2.

## **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. Receiver/Idle Mode AC Conducted Spurious Emissions**

#### **Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	07 March 2012
Test Sample Serial No:	22582545		

FCC Reference:	Part 15.107(a)
Industry Canada Reference:	RSS-Gen 7.2.4
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

#### **Environmental Conditions:**

Temperature (°C):	25
Relative Humidity (%):	29

#### **Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.240	Live	58.3	62.1	3.8	Complied
0.438	Live	45.6	57.1	11.5	Complied
0.479	Live	48.8	56.4	7.6	Complied
0.933	Live	44.1	56.0	11.9	Complied
0.965	Live	47.8	56.0	8.2	Complied
1.163	Live	44.1	56.0	11.9	Complied
2.382	Live	45.8	56.0	10.2	Complied
2.652	Live	45.9	56.0	10.1	Complied
2.868	Live	51.5	56.0	4.5	Complied
14.361	Live	30.9	60.0	29.1	Complied

#### **Results: Live / Average**

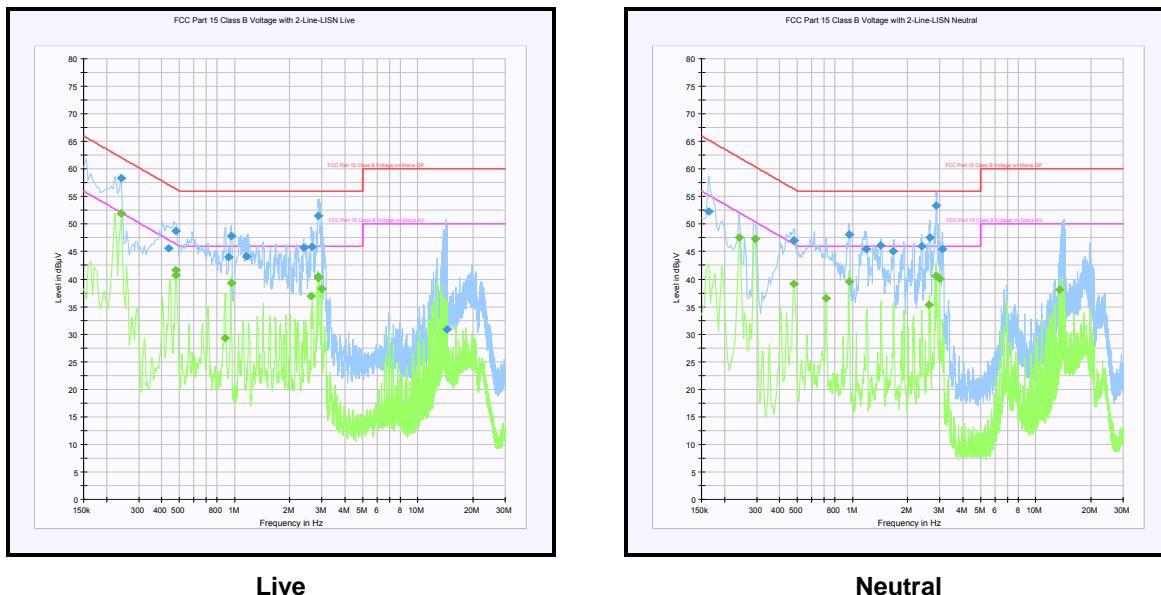
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.240	Live	51.9	52.1	0.2	Complied
0.479	Live	41.7	46.4	4.7	Complied
0.888	Live	29.3	46.0	16.7	Complied
0.956	Live	39.3	46.0	6.7	Complied
2.621	Live	36.9	46.0	9.1	Complied
2.864	Live	40.5	46.0	5.5	Complied
2.985	Live	38.2	46.0	7.8	Complied

**Receiver/Idle Mode AC Conducted Spurious Emissions (continued)****Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.164	Neutral	52.3	65.3	13.0	Complied
0.479	Neutral	47.0	56.4	9.4	Complied
0.965	Neutral	48.1	56.0	7.9	Complied
1.190	Neutral	45.4	56.0	10.6	Complied
1.428	Neutral	46.1	56.0	9.9	Complied
1.671	Neutral	45.0	56.0	11.0	Complied
2.382	Neutral	46.0	56.0	10.0	Complied
2.630	Neutral	47.6	56.0	8.4	Complied
2.864	Neutral	53.3	56.0	2.7	Complied
3.098	Neutral	45.4	56.0	10.6	Complied

**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.240	Neutral	47.5	52.1	4.6	Complied
0.294	Neutral	47.3	50.4	3.1	Complied
0.479	Neutral	39.1	46.4	7.3	Complied
0.717	Neutral	36.6	46.0	9.4	Complied
0.956	Neutral	39.6	46.0	6.4	Complied
2.625	Neutral	35.4	46.0	10.6	Complied
2.864	Neutral	40.6	46.0	5.4	Complied
2.985	Neutral	40.1	46.0	5.9	Complied
13.479	Neutral	38.1	50.0	11.9	Complied

**Receiver/Idle Mode AC Conducted Spurious Emissions (continued)**

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

**5.2.2. Receiver/Idle Mode Radiated Spurious Emissions****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	17 February 2012
Test Sample Serial No:	22582545		

FCC Reference:	Part 15.109
Industry Canada Reference:	RSS-Gen 4.10
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range:	30 MHz to 1000 MHz

**Environmental Conditions:**

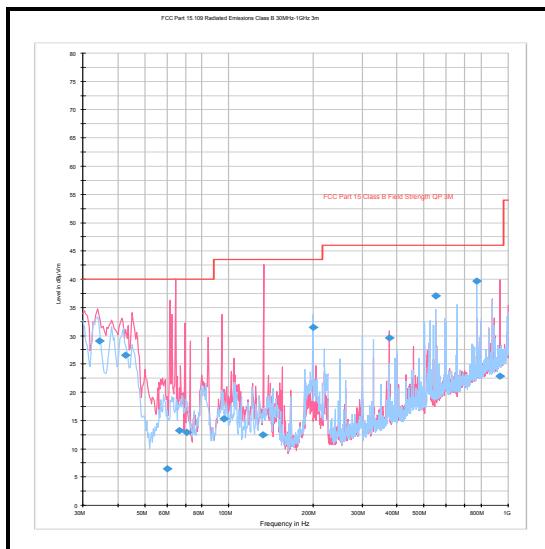
Temperature (°C):	25
Relative Humidity (%):	23

**Results: Quasi Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
34.306	Vertical	29.1	40.0	10.9	Complied
42.782	Vertical	26.6	40.0	13.4	Complied
66.759	Vertical	13.2	40.0	26.8	Complied
70.789	Vertical	12.9	40.0	27.1	Complied
96.040	Vertical	15.3	43.5	28.2	Complied
199.990	Horizontal	31.5	43.5	12.0	Complied
375.005	Vertical	29.7	46.0	16.3	Complied
550.001	Horizontal	37.1	46.0	8.9	Complied
770.008	Horizontal	39.7	46.0	6.3	Complied
936.080	Vertical	22.8	46.0	23.2	Complied

**Note(s):**

1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

**Receiver/Idle Mode Radiated Spurious Emissions (continued)**

*Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.*

**Receiver/Idle Mode Radiated Spurious Emissions (continued)****Test Summary:**

<b>Test Engineers:</b>	Andrew Edwards & Nick Steele	<b>Test Dates:</b>	14 February 2012 & 15 February 2012
<b>Test Sample Serial No:</b>	22582545		

<b>FCC Reference:</b>	Part 15.109
<b>Industry Canada Reference:</b>	RSS-Gen 4.10
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
<b>Frequency Range:</b>	1 GHz to 30 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	21

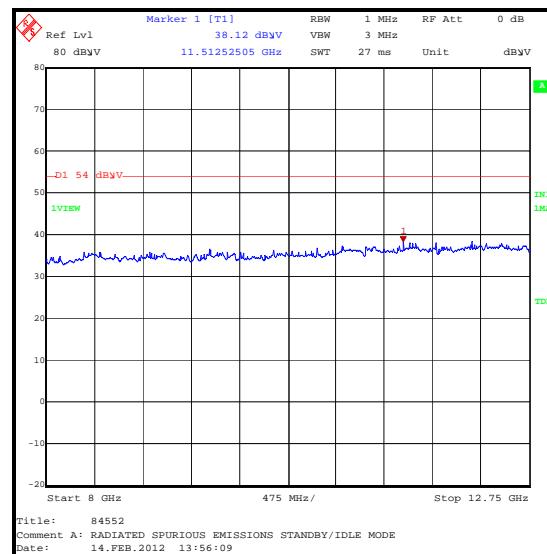
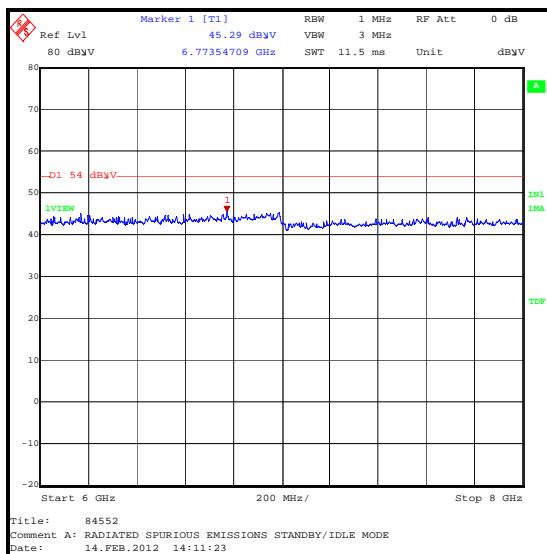
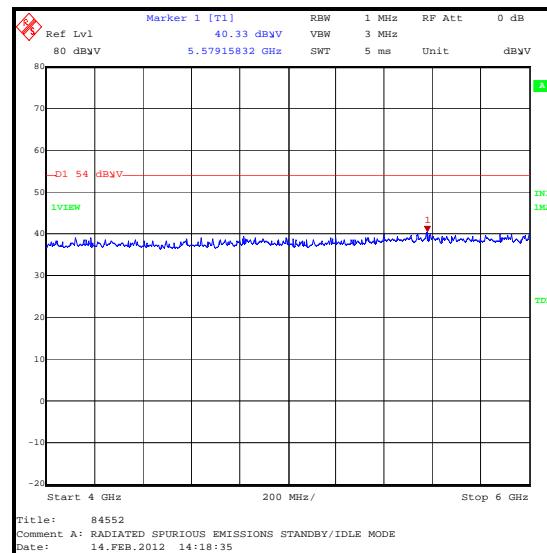
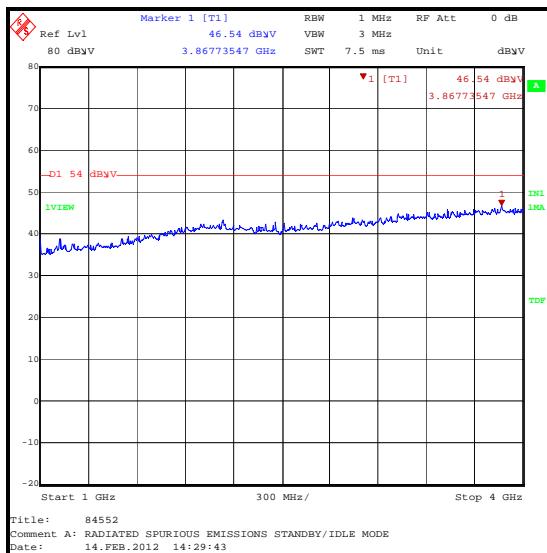
**Results:**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
26244.488	Vertical	50.0	54.0	4.0	Complied

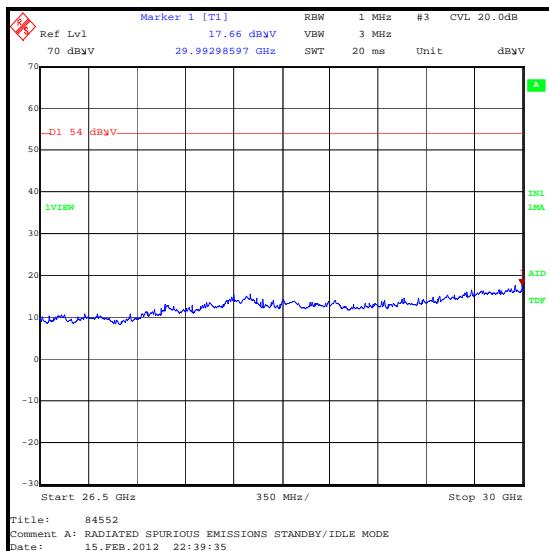
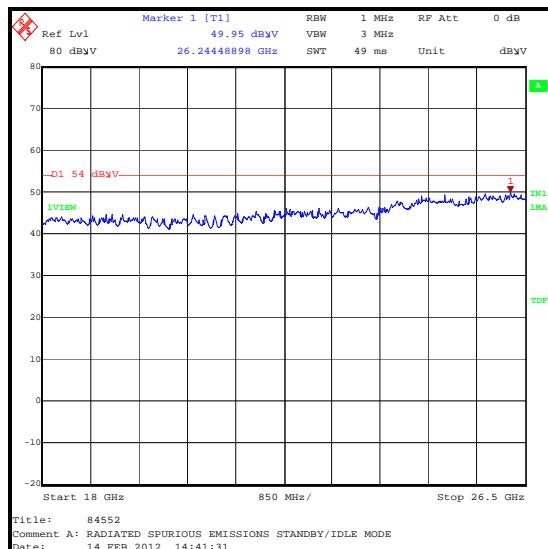
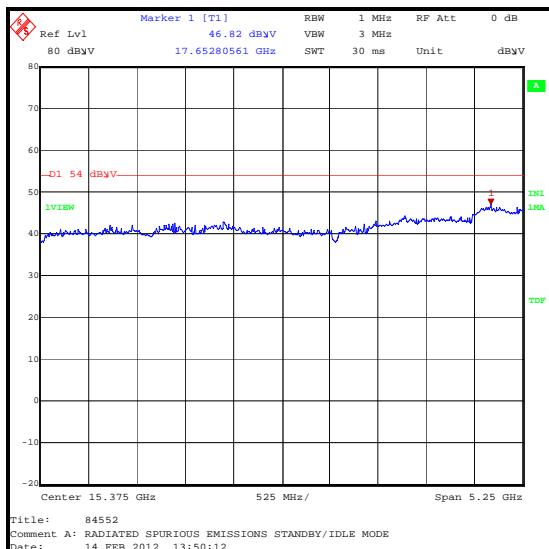
**Note(s):**

1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
3. 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.

## Receiver/Idle Mode Radiated Spurious Emissions (continued)



## Receiver/Idle Mode Radiated Spurious Emissions (continued)



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

**5.2.3. Transmitter AC Conducted Spurious Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	07 March 2012
<b>Test Sample Serial No:</b>	22582545		

<b>FCC Reference:</b>	Part 15.207
<b>Industry Canada Reference:</b>	RSS-Gen 7.2.4
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

**Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	29

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

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.236	Live	56.8	62.3	5.5	Complied
0.407	Live	46.3	57.7	11.4	Complied
0.452	Live	47.7	56.8	9.1	Complied
0.947	Live	48.7	56.0	7.3	Complied
1.131	Live	43.6	56.0	12.4	Complied
2.342	Live	45.0	56.0	11.0	Complied
2.594	Live	45.5	56.0	10.5	Complied
2.819	Live	49.1	56.0	6.9	Complied
2.985	Live	43.3	56.0	12.7	Complied
3.039	Live	46.4	56.0	9.6	Complied

**Results: Live / Average**

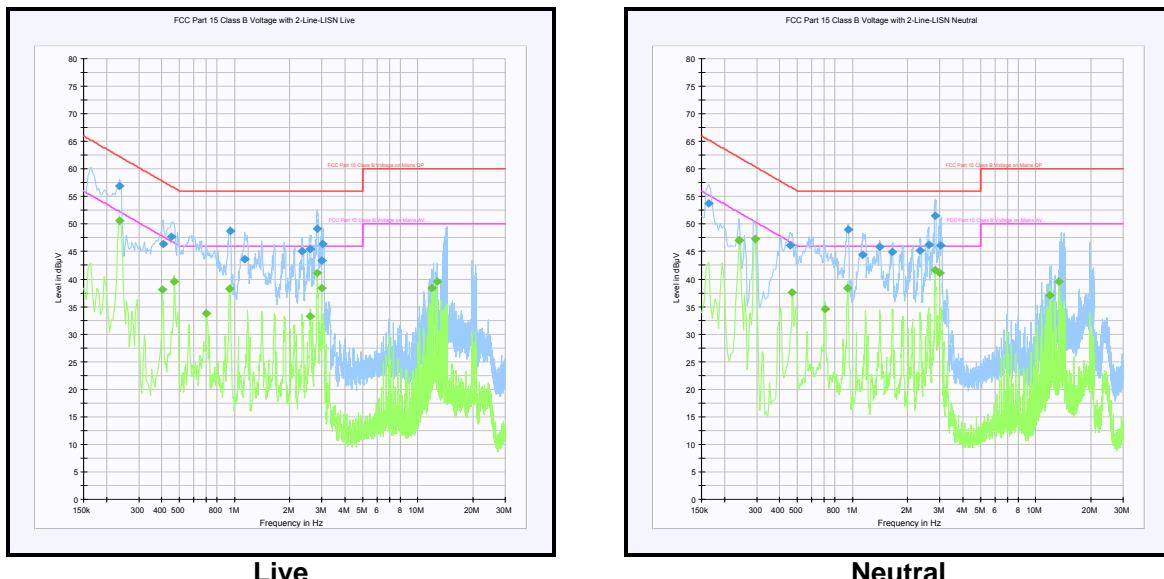
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.236	Live	50.6	52.3	1.7	Complied
0.402	Live	38.0	47.8	9.8	Complied
0.470	Live	39.5	46.5	7.0	Complied
0.704	Live	33.8	46.0	12.2	Complied
0.942	Live	38.3	46.0	7.7	Complied
2.594	Live	33.3	46.0	12.7	Complied
2.823	Live	41.1	46.0	4.9	Complied
2.985	Live	38.4	46.0	7.6	Complied
11.891	Live	38.3	50.0	11.7	Complied
12.809	Live	39.5	50.0	10.5	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
0.155	Neutral	53.4	65.3	11.6	Complied
0.609	Neutral	44.3	56.8	10.7	Complied
0.947	Neutral	48.9	56.0	7.0	Complied
1.136	Neutral	43.9	56.0	11.6	Complied
1.410	Neutral	46.0	56.0	10.1	Complied
2.346	Neutral	45.2	56.0	11.0	Complied
2.612	Neutral	47.1	56.0	10.8	Complied
2.828	Neutral	51.3	56.0	9.8	Complied
3.003	Neutral	43.6	56.0	4.5	Complied
3.048	Neutral	46.7	56.0	9.9	Complied

**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.240	Neutral	47.0	52.1	5.1	Complied
0.290	Neutral	46.0	50.5	4.5	Complied
0.474	Neutral	37.8	46.4	8.6	Complied
0.708	Neutral	35.0	46.0	11.0	Complied
0.947	Neutral	38.7	46.0	7.3	Complied
2.823	Neutral	41.9	46.0	4.1	Complied
2.985	Neutral	41.4	46.0	4.6	Complied
11.954	Neutral	36.7	50.0	13.3	Complied
12.197	Neutral	35.9	50.0	14.1	Complied
12.809	Neutral	34.8	50.0	15.2	Complied

**Transmitter AC Conducted Spurious Emissions (continued)**

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

**5.2.4. Transmitter 6 dB Bandwidth****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	12 January 2012
Test Sample Serial No:	Not Stated		

FCC Reference:	Part 15.247(a)(2)
Industry Canada Reference:	RSS-Gen 4.6.2, RSS-210 A8.2(a)
Test Method Used:	FCC KDB 558074 Section 5.1.1

**Environmental Conditions:**

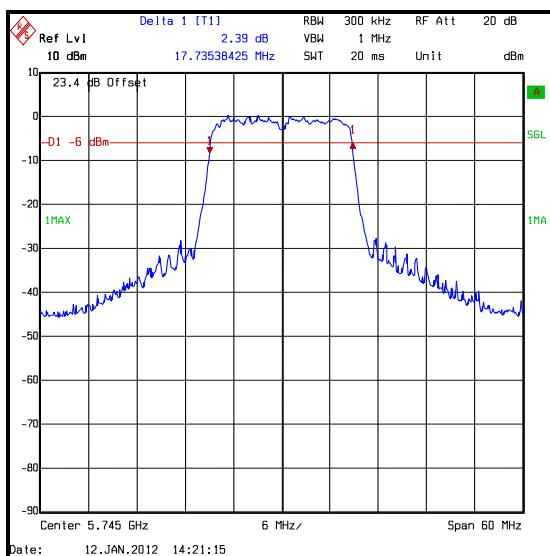
Temperature (°C):	22 to 23
Relative Humidity (%):	31 to 32

**Note(s):**

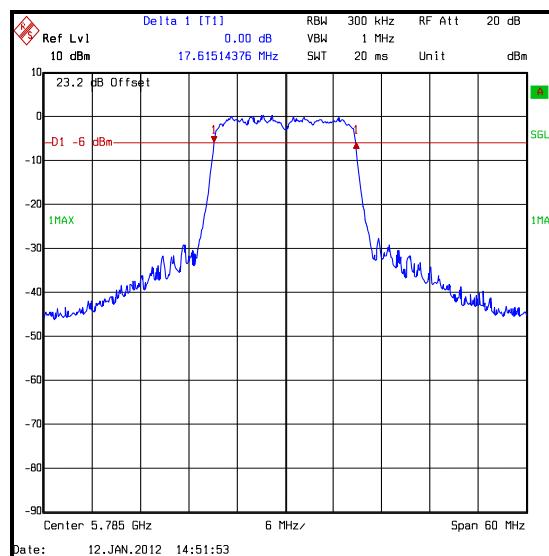
1. All bandwidth measurements were performed on the highest data rates within each modulation scheme for bottom, middle and top channels on port 0 and for both 20 MHz and 40 MHz channel bandwidths. Initial tests were performed on both ports and port 0 was found to have the highest RF output power.

**Transmitter 6 dB Emission Bandwidth (continued)****Results: 802.11n / 13 Mbps / 20 MHz**

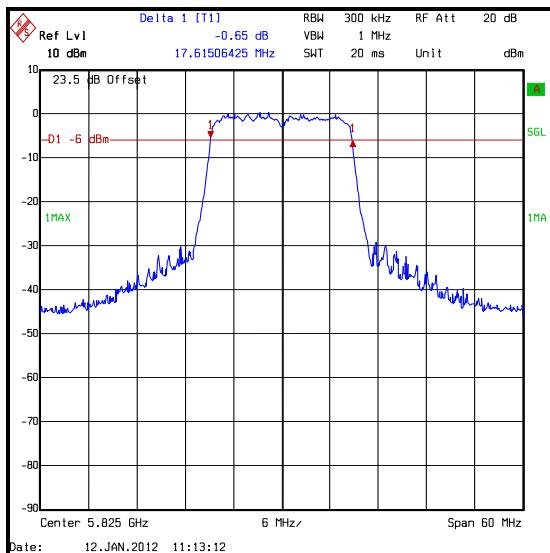
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.735	≥0.5	17.235	Complied
Middle	17.615	≥0.5	17.115	Complied
Top	17.615	≥0.5	17.115	Complied



Bottom Channel



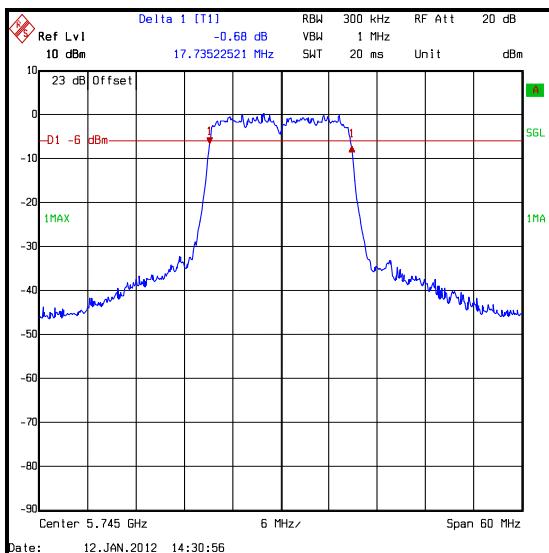
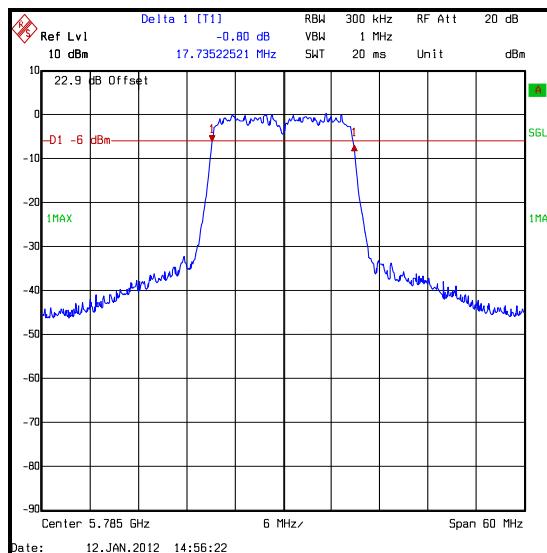
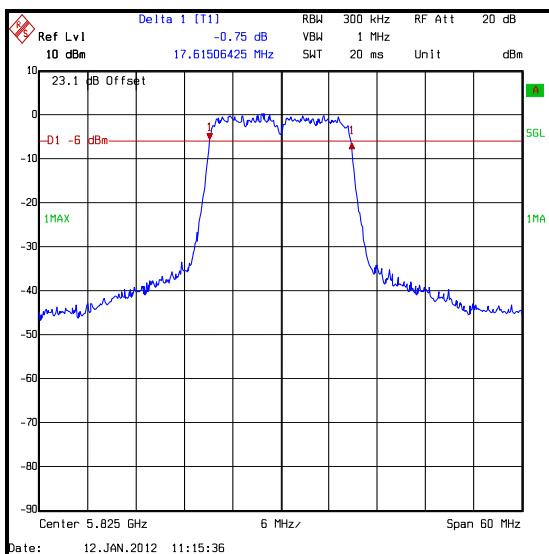
Middle Channel



Top Channel

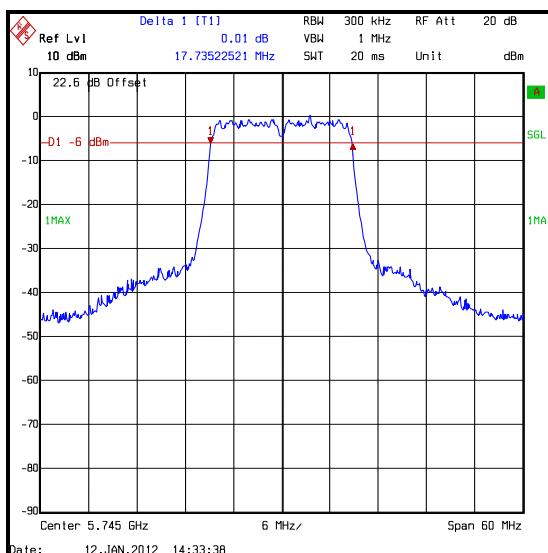
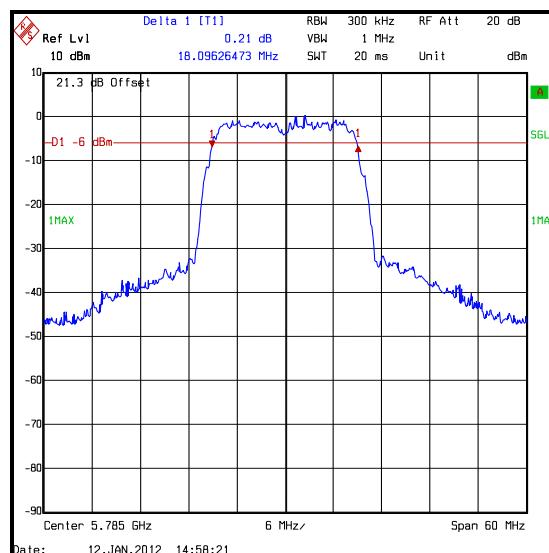
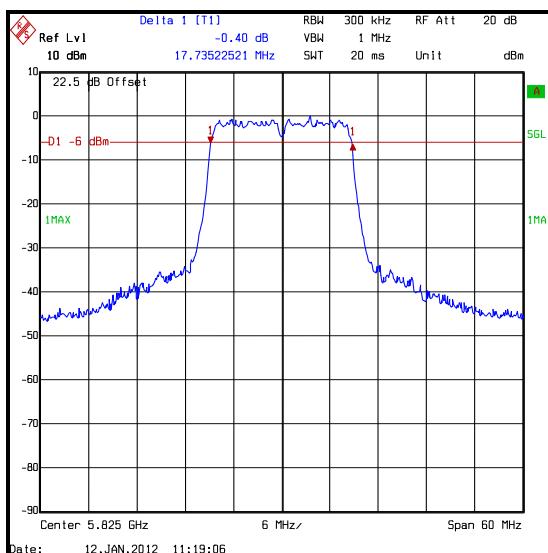
**Transmitter 6 dB Emission Bandwidth (continued)****Results: 802.11n / 39 Mbps / 20 MHz**

Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.735	≥0.5	17.235	Complied
Middle	17.735	≥0.5	17.235	Complied
Top	17.615	≥0.5	17.115	Complied

**Bottom Channel****Middle Channel****Top Channel**

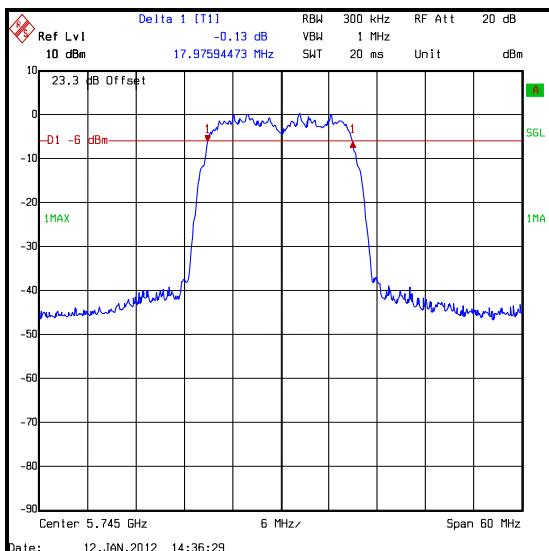
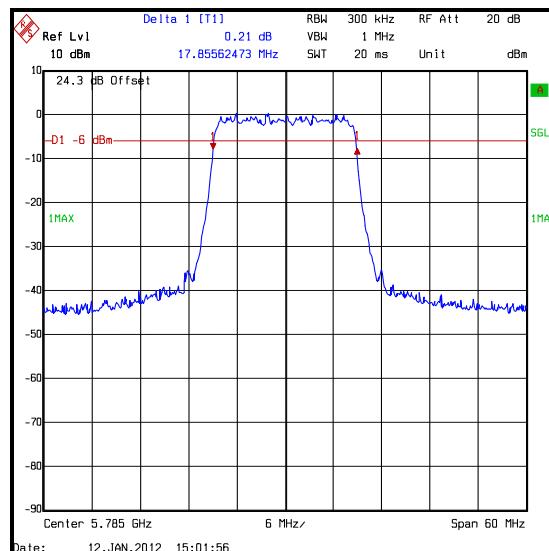
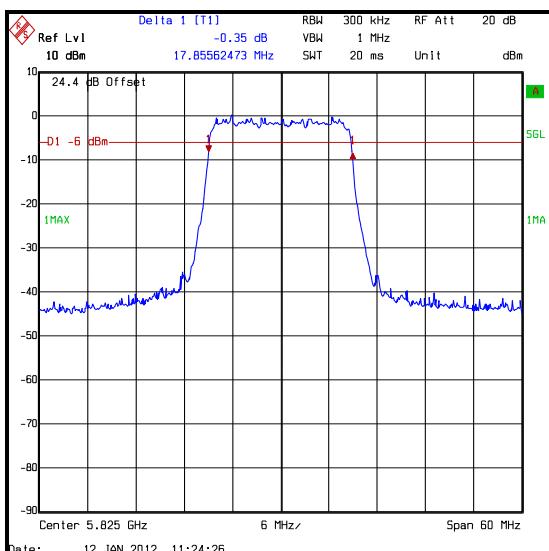
**Transmitter 6 dB Emission Bandwidth (continued)****Results: 802.11n / 78 Mbps / 20 MHz**

Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.735	$\geq 0.5$	17.235	Complied
Middle	18.096	$\geq 0.5$	17.596	Complied
Top	17.735	$\geq 0.5$	17.235	Complied

**Bottom Channel****Middle Channel****Top Channel**

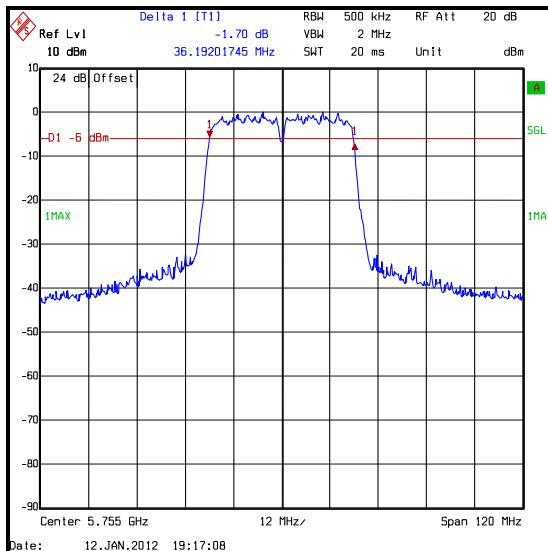
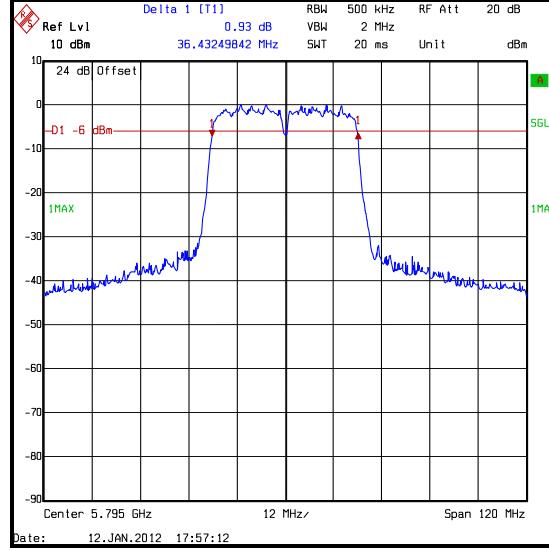
**Transmitter 6 dB Emission Bandwidth (continued)****Results: 802.11n / 130 Mbps / 20 MHz**

Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.976	≥0.5	17.476	Complied
Middle	17.856	≥0.5	17.356	Complied
Top	17.856	≥0.5	17.356	Complied

**Bottom Channel****Middle Channel****Top Channel**

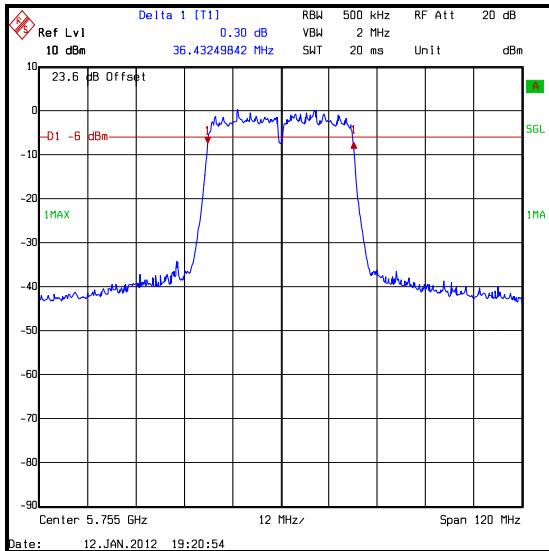
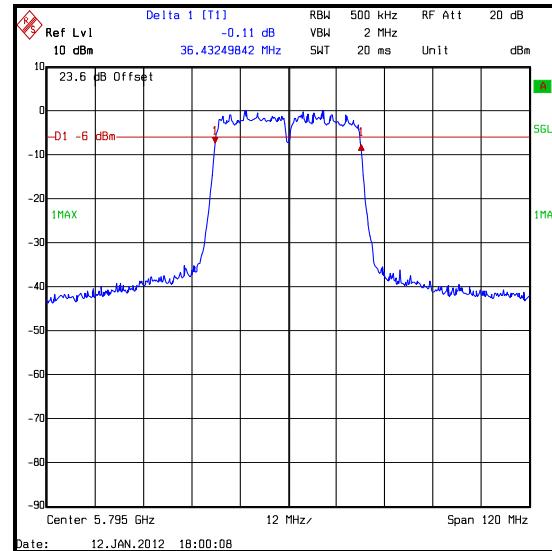
**Transmitter 6 dB Bandwidth (continued)****Results: 802.11n / 13 Mbps / 40 MHz**

Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	36.192	$\geq 0.5$	35.692	Complied
Top	36.432	$\geq 0.5$	35.932	Complied

**Bottom Channel****Top Channel**

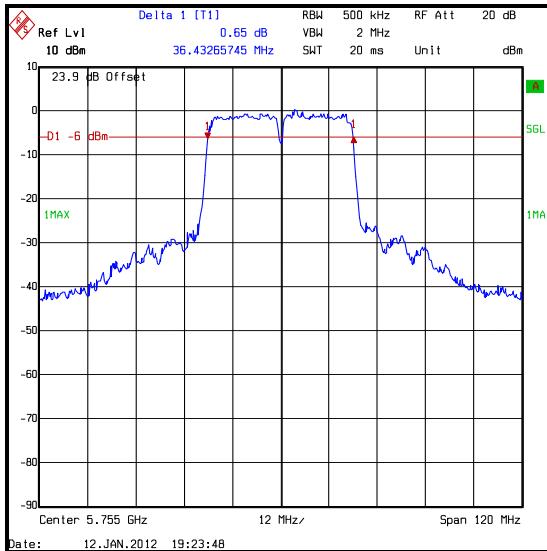
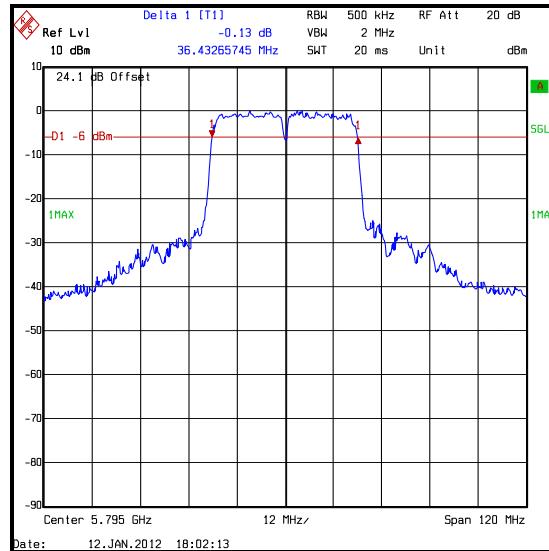
**Transmitter 6 dB Emission Bandwidth (continued)****Results: 802.11n / 39 Mbps / 40 MHz**

Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	36.432	$\geq 0.5$	35.932	Complied
Top	36.432	$\geq 0.5$	35.932	Complied

**Bottom Channel****Top Channel**

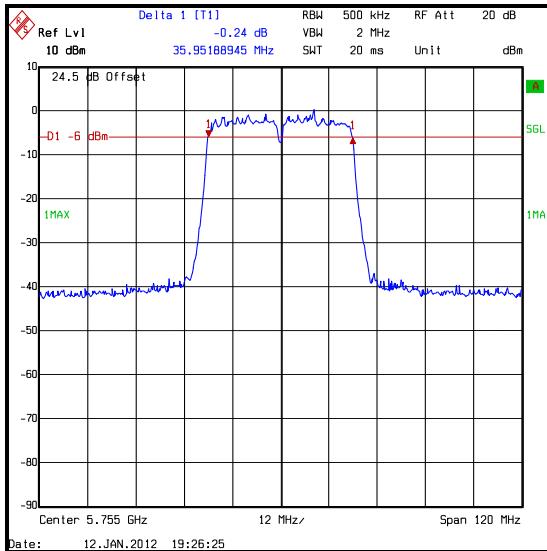
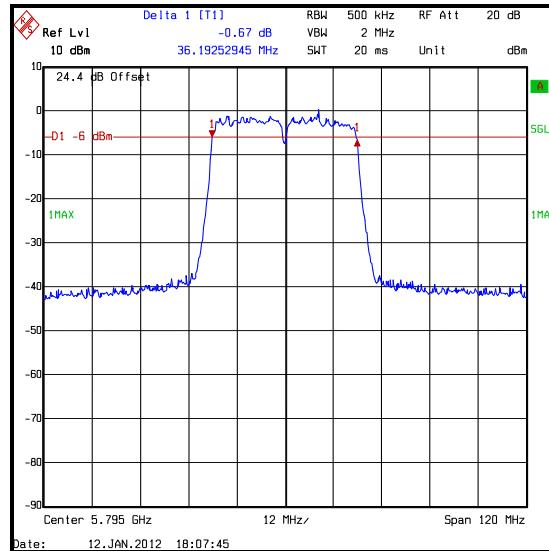
**Transmitter 6 dB Emission Bandwidth (continued)****Results: 802.11n / 78 Mbps / 40 MHz**

Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	36.433	$\geq 0.5$	35.933	Complied
Top	36.433	$\geq 0.5$	35.933	Complied

**Bottom Channel****Top Channel**

**Transmitter 6 dB Emission Bandwidth (continued)****Results: 802.11n / 130 Mbps / 40 MHz**

Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	35.952	$\geq 0.5$	35.452	Complied
Top	36.193	$\geq 0.5$	35.693	Complied

**Bottom Channel****Top Channel**

**5.2.5. Transmitter 20 dB Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	10 January 2012
<b>Test Sample Serial No:</b>	Not stated		

<b>FCC Reference:</b>	Part 2.1049
<b>Industry Canada Reference:</b>	RSS-Gen 4.6.1/4.6.3
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.9.1

**Environmental Conditions:**

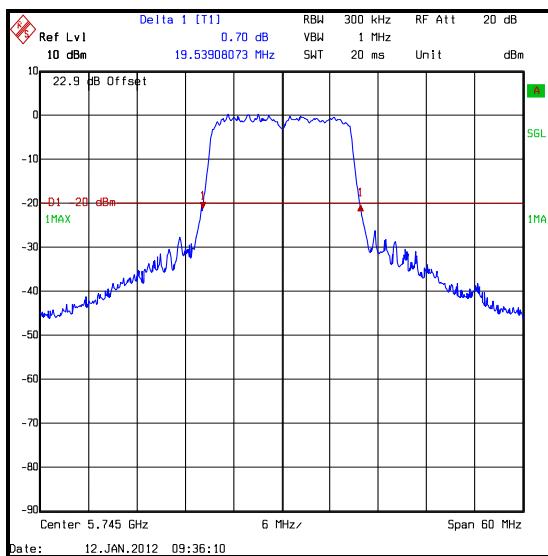
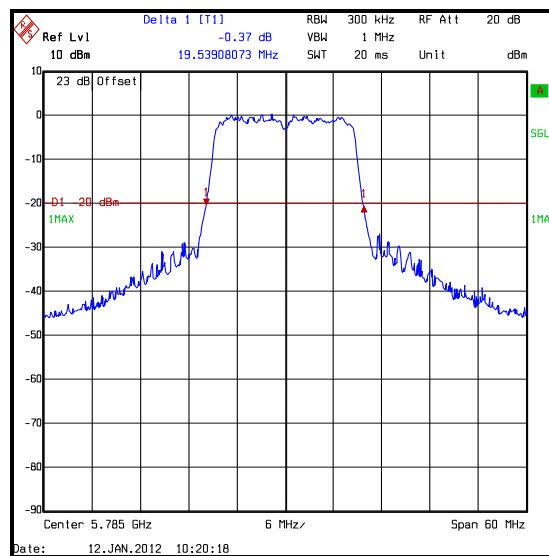
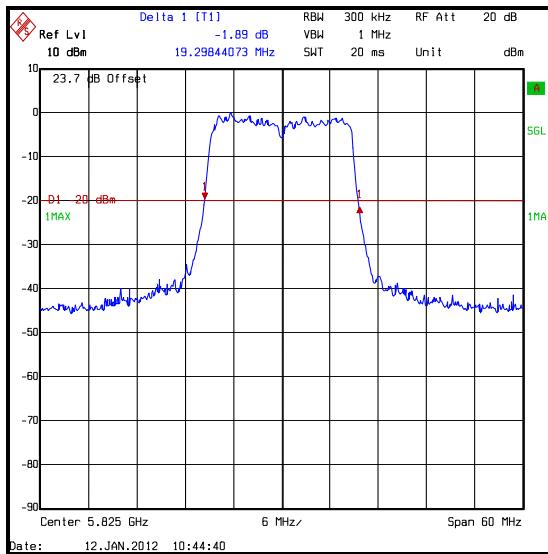
<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	32

**Note(s):**

1. All bandwidth measurements were performed on the highest data rates within each modulation scheme for bottom, middle and top channels on port 0 and for both 20 MHz and 40 MHz channel bandwidths. Initial tests were performed on both ports and port 0 was found to have the highest RF output power.

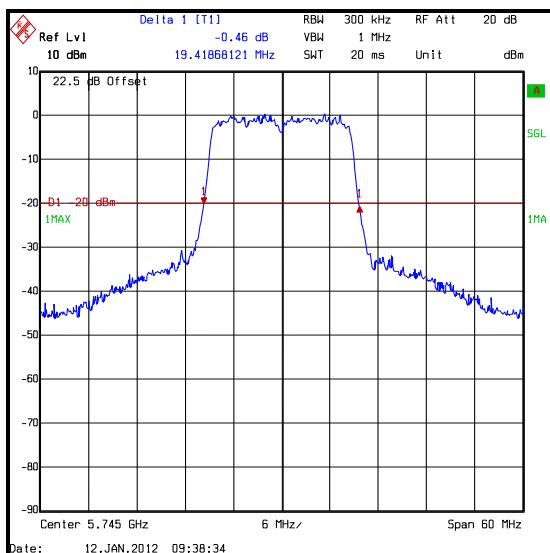
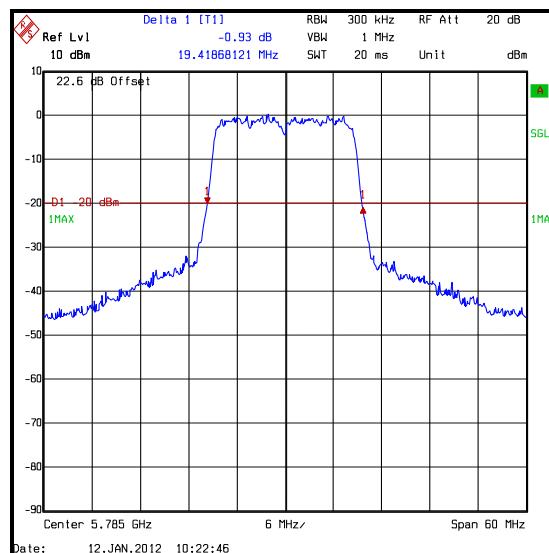
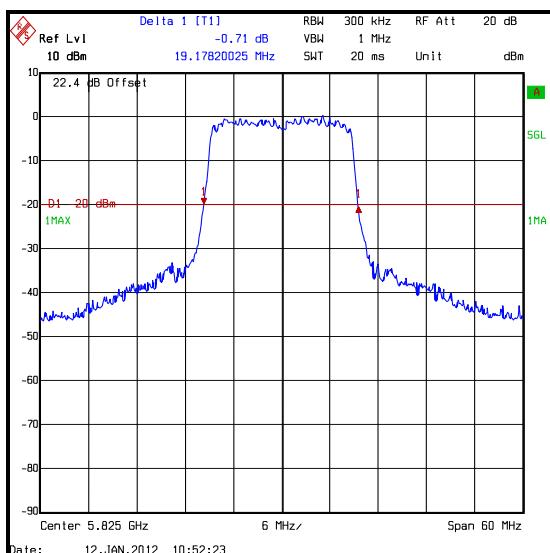
**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 13 Mbps / 20 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	19.539
Middle	19.539
Top	19.298

**Bottom Channel****Middle Channel****Top Channel**

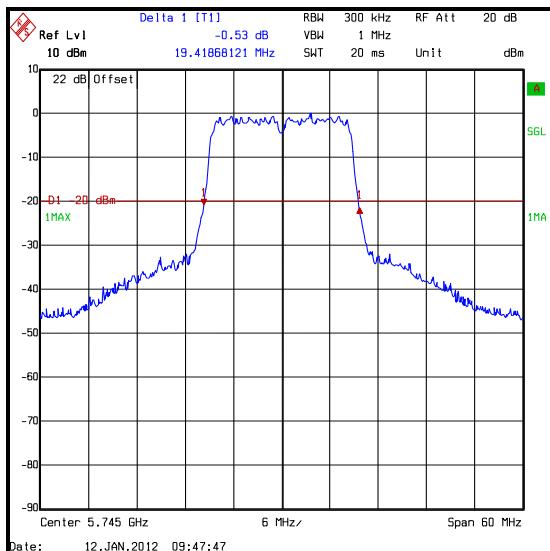
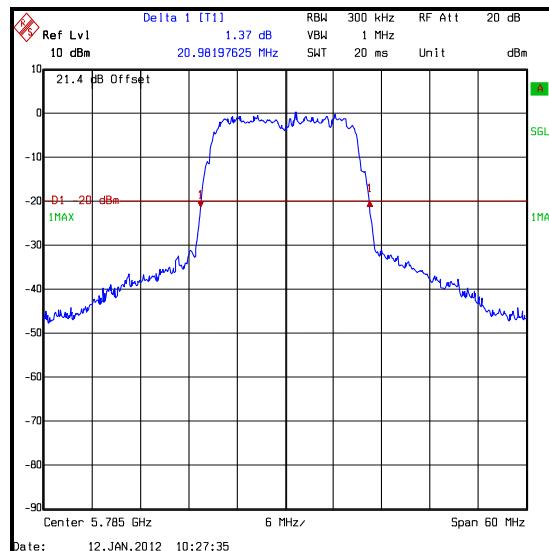
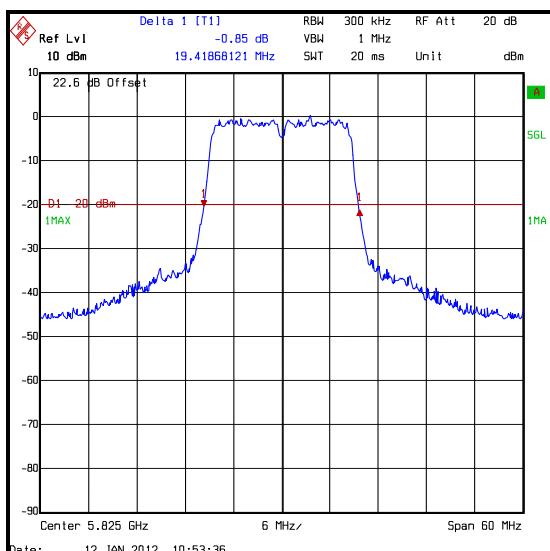
**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 39 Mbps / 20 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	19.419
Middle	19.419
Top	19.419

**Bottom Channel****Middle Channel****Top Channel**

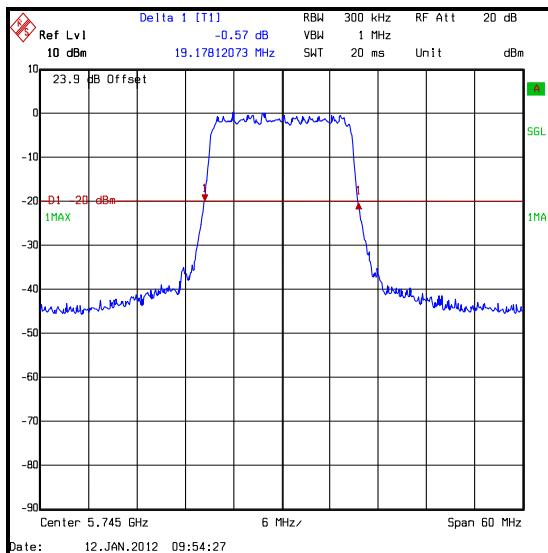
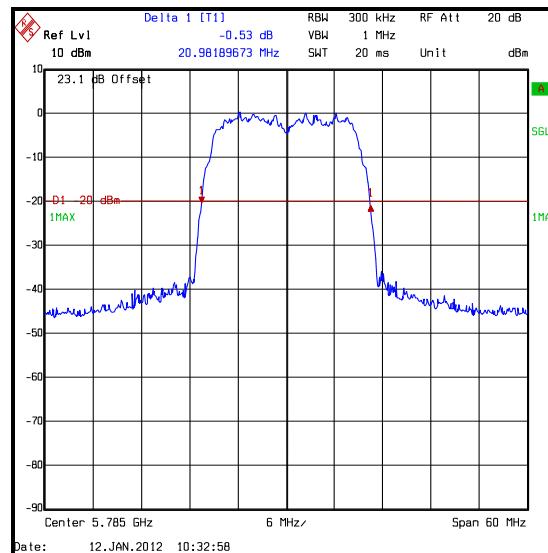
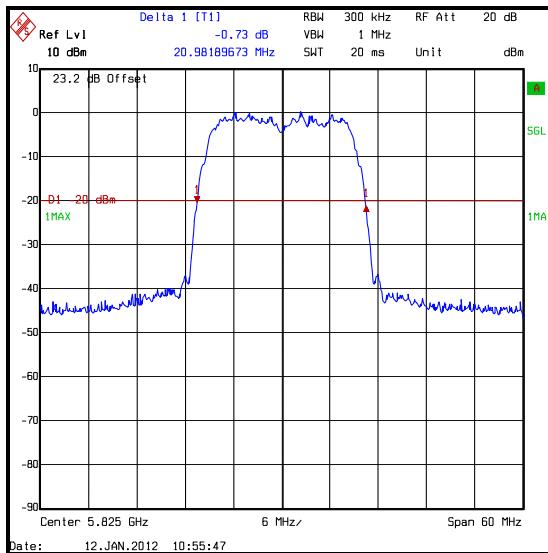
**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 78 Mbps / 20 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	19.419
Middle	20.982
Top	19.419

**Bottom Channel****Middle Channel****Top Channel**

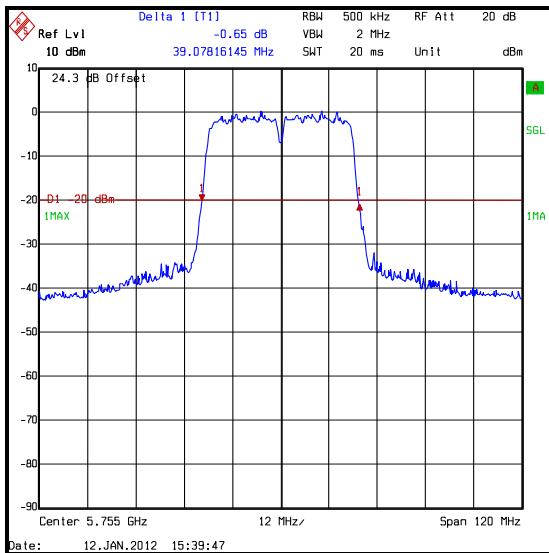
**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 130 Mbps / 20 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	19.178
Middle	20.982
Top	20.982

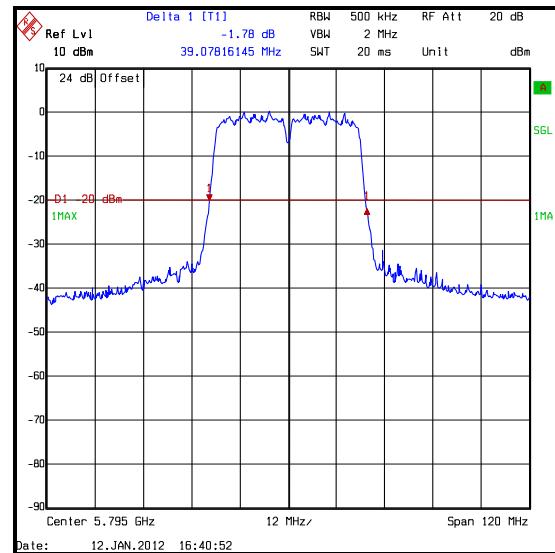
**Bottom Channel****Middle Channel****Top Channel**

**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 13 Mbps / 40 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	39.078
Top	39.078



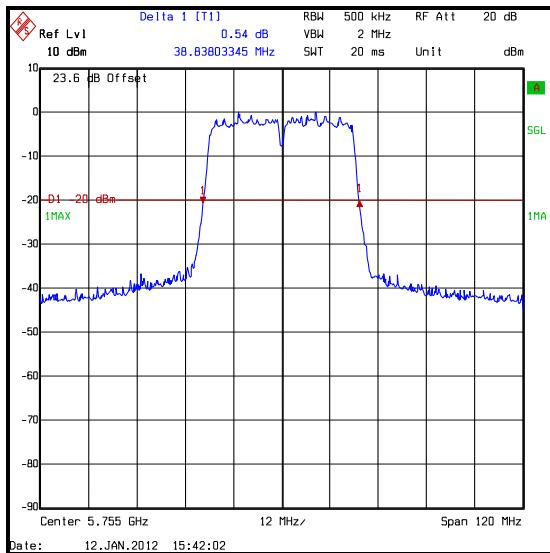
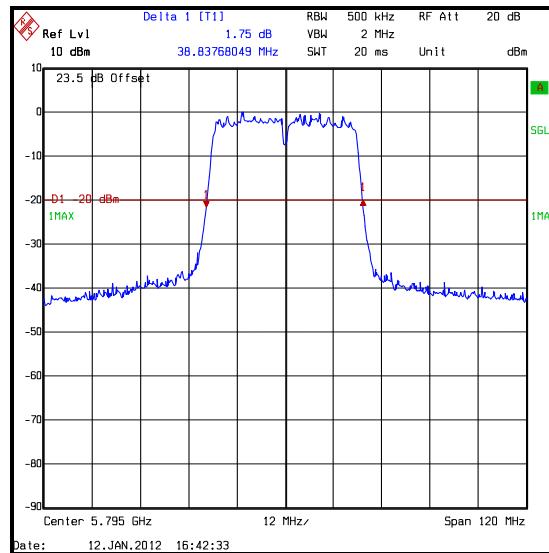
Top Channel



Top Channel

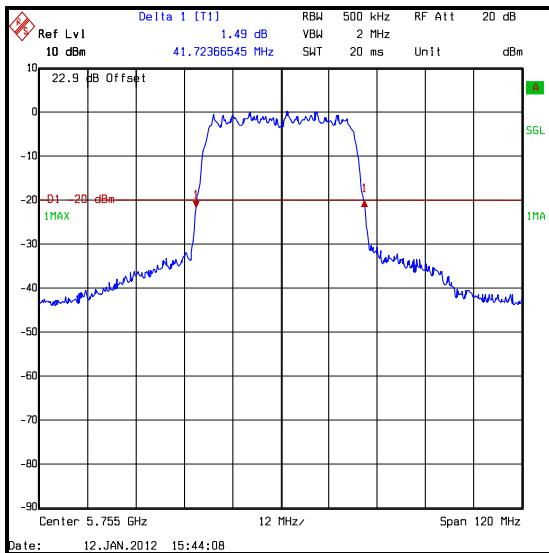
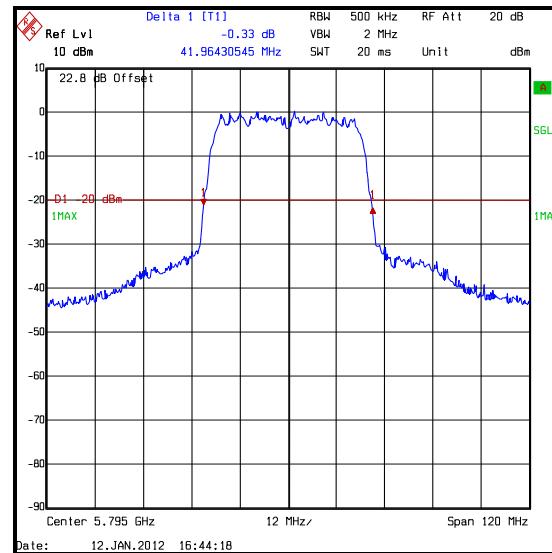
**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 39 Mbps / 40 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	38.838
Top	38.838

**Bottom Channel****Top Channel**

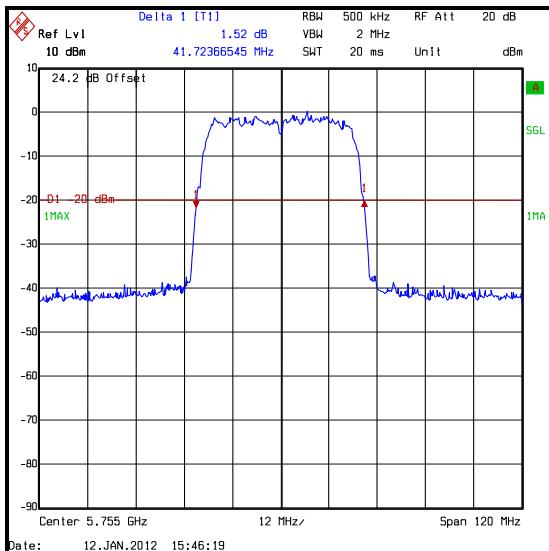
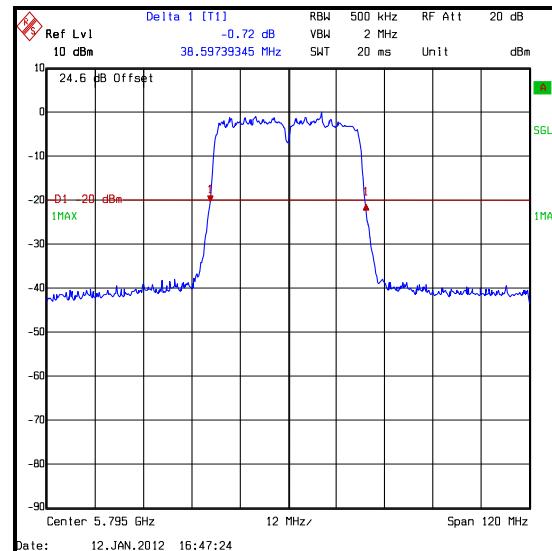
**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 78 Mbps / 40 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	41.724
Top	41.964

**Bottom Channel****Top Channel**

**Transmitter 20 dB Bandwidth (continued)****Results: 802.11n / 130 Mbps / 40 MHz**

Channel	20 dB Bandwidth (MHz)
Bottom	41.724
Top	38.597

**Bottom Channel****Top Channel**

**5.2.6. Transmitter Power Spectral Density****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	07 January 2012, 09 January 2012 & 09 March 2012
<b>Test Sample Serial No:</b>	Not Stated		

<b>FCC Reference:</b>	Part 15.247(e)
<b>Industry Canada Reference:</b>	RSS-210 A8.2(b)
<b>Test Method Used:</b>	FCC KDB 558074 Section 5.3.1

**Environmental Conditions:**

<b>Temperature (°C):</b>	21 to 23
<b>Relative Humidity (%):</b>	24 to 27

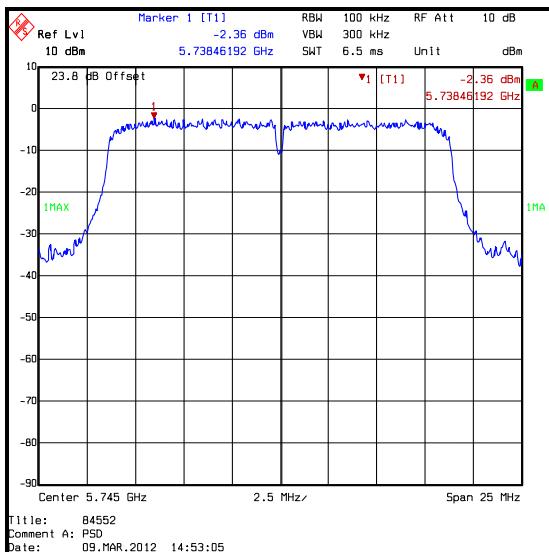
**Note(s):**

1. Transmitter Power Spectral Density tests in all bands were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 5.3.1
2. The EUT has two RF ports, Port 0 and Port 1. PSD from both ports were measured and combined using the measure-and-sum method stated in FCC KDB 662911 D01.
3. The EUT was transmitting at 100% duty cycle.
4. The EUT antenna has a gain of <6 dBi.
5. All supported modes and channel widths were initially investigated on one channel. The mode that produced the highest PSD i.e. closest to the limit, for 20 MHz channels (BPSK / 13 Mbps / MCS8) and 40 MHz channels (16QAM / 78 Mbps / MCS12) were found to be worst case. Measurements were then performed in these modes on bottom, middle (where applicable) and top channels on both ports, both channel widths in all operating bands. For all modes/channel widths initially investigated, results are available upon request.
6. \*In accordance with FCC KDB 558074 Section 5.3.1, the measurements were performed using a 100 kHz resolution bandwidth. A Band Width Correction Factor of 15.2 dB was then subtracted from the combined results as the limit is specified in a 3 kHz bandwidth. The correction factor (BWC) was calculated as shown below:

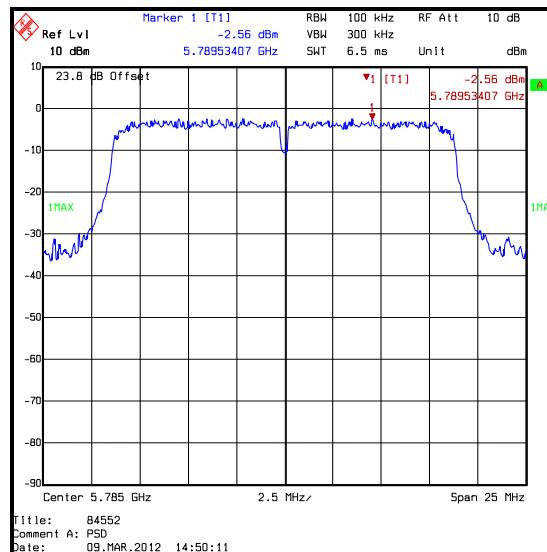
$$10 \log_{10} (3 \text{ kHz} / 100 \text{ kHz}) = -15.2 \text{ dB}$$

**Transmitter Power Spectral Density (continued)****Results: 802.11n / 13 Mbps / BPSK / 20 MHz**

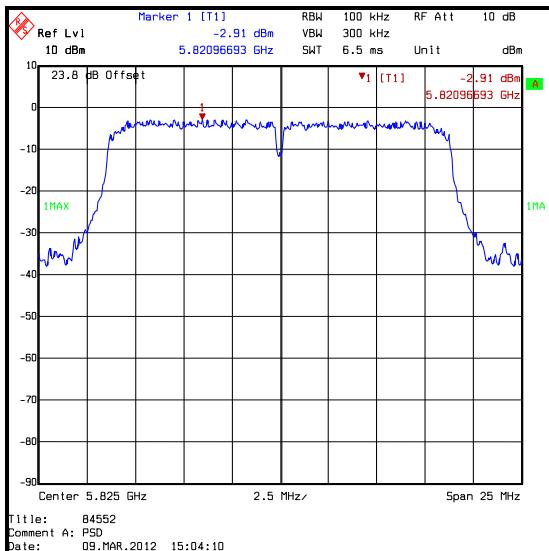
Channel	PSD at Port 0 (dBm / 100 kHz)	PSD at Port 1 (dBm / 100 kHz)	Combined PSD (dBm / 100 kHz)	*Combined PSD (dBm / 3 kHz)	PSD Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-2.4	-4.0	-0.1	-15.3	8.0	23.3	Complied
Middle	-2.6	-4.3	-0.4	-15.6	8.0	23.6	Complied
Top	-2.9	-4.8	-0.7	-15.9	8.0	23.9	Complied

**Results: 802.11n / 13 Mbps / BPSK / 20 MHz / Port 0**

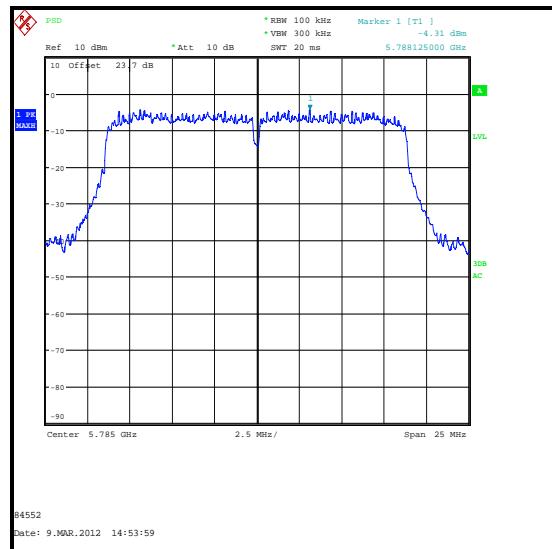
Bottom Channel



Middle Channel

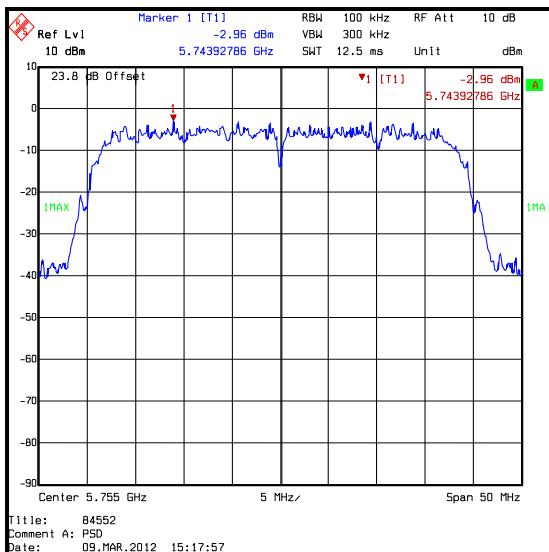


Top Channel

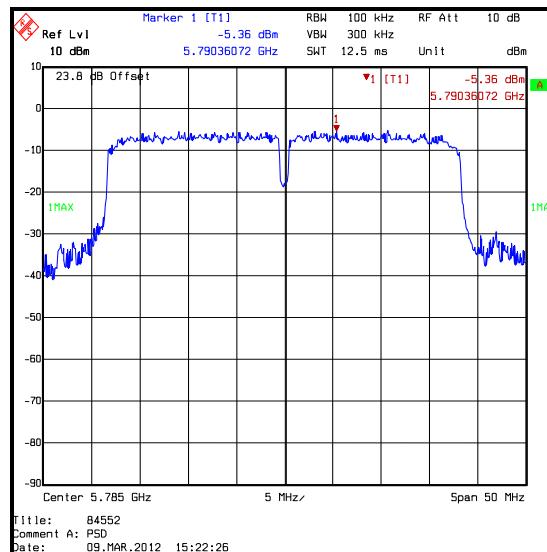
**Transmitter Power Spectral Density (continued)****Results: 802.11n / 13 Mbps / BPSK / 20 MHz / Port 1****Bottom Channel****Middle Channel****Top Channel**

**Transmitter Power Spectral Density (continued)****Results: 802.11n / 78 Mbps / 16QAM / 40 MHz**

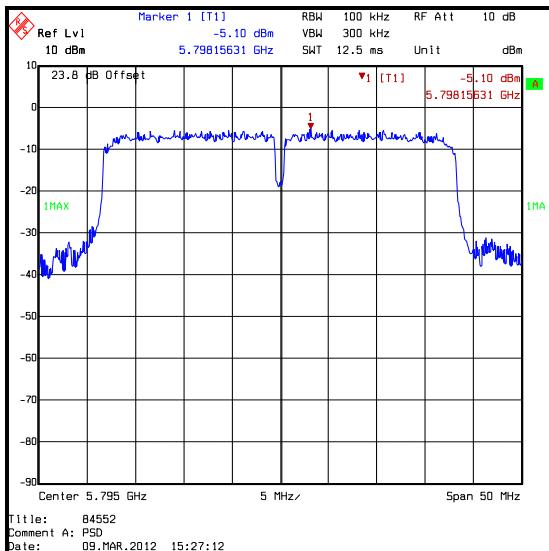
Channel	PSD at Port 0 (dBm / 100 kHz)	PSD at Port 1 (dBm / 100 kHz)	Combined PSD (dBm / 100 kHz)	*Combined PSD (dBm / 3 kHz)	PSD Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-3.0	-9.3	-2.0	-17.2	8.0	25.2	Complied
Middle	-5.4	-7.7	-3.4	-18.6	8.0	26.6	Complied
Top	-5.1	-7.8	-3.2	-18.4	8.0	26.4	Complied

**Results: 802.11n / 78 Mbps / 16QAM / 40 MHz / Port 0**

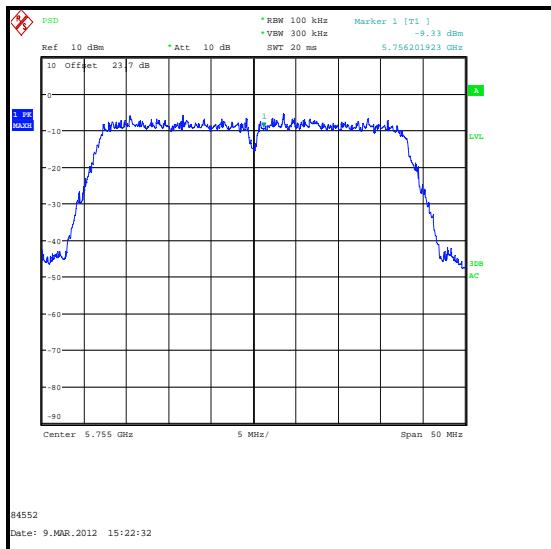
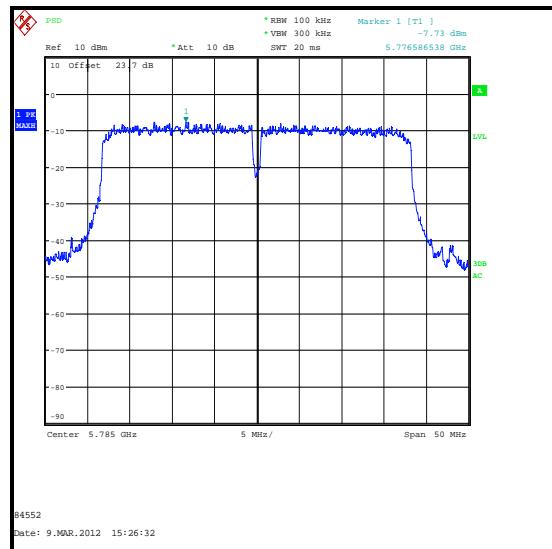
Bottom Channel



Middle Channel



Top Channel

**Transmitter Power Spectral Density (continued)****Results: 802.11n / 78 Mbps / 16QAM / 40 MHz / Port 1****Bottom Channel****Middle Channel****Top Channel**

**5.2.7. Transmitter Maximum Peak Output Power****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	07 January 2012
<b>Test Sample Serial No:</b>	Not stated		

<b>FCC Reference:</b>	Part 15.247(b)(3)
<b>Industry Canada Reference:</b>	RSS-Gen 4.8, RSS-210 A8.4(4)
<b>Test Method Used:</b>	KDB 558074 Section 5.2.1.2

**Environmental Conditions:**

<b>Temperature (°C):</b>	19
<b>Relative Humidity (%):</b>	27

**Note(s):**

1. Conducted power tests in all bands were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 5.2.1.2 Measurement Procedure PK2.
2. The EUT has two RF ports, Port 0 and Port 1. Conducted power from both ports was measured and combined using the measure-and-sum method stated in FCC KDB 662911 D01.
3. The EUT was transmitting at 100% duty cycle.
4. The EUT antenna has a declared gain of 1.0 dBi. The declared antenna gain was added to the combined conducted power in order to calculate the EIRP.
5. Measurements were performed on the highest data rates within each modulation scheme for bottom, middle and top channels on both ports and for both 20 MHz and 40 MHz channel bandwidths.

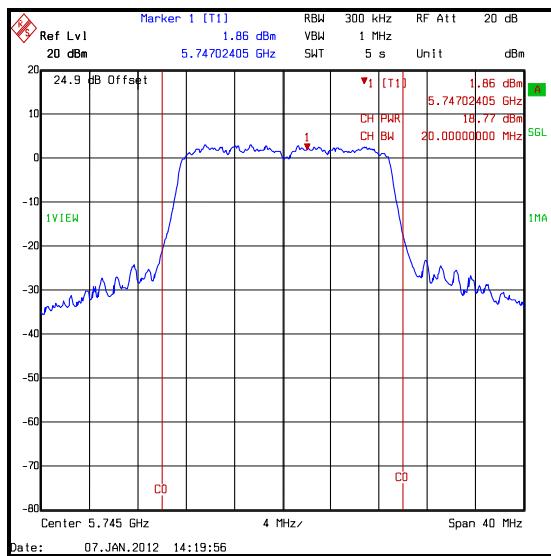
**Transmitter Maximum Peak Output Power (continued)****Results: 13 Mbps / BPSK / 20 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	18.8	17.9	21.4	30.0	8.6	Complied
Middle	18.3	17.9	21.1	30.0	8.9	Complied
Top	18.7	17.4	21.1	30.0	8.9	Complied

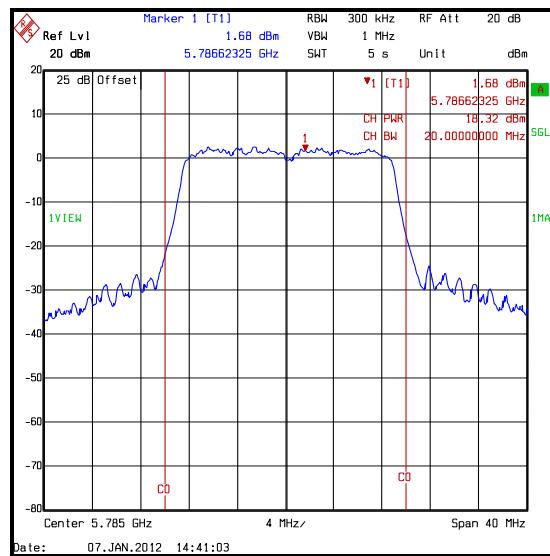
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.4	1.0	22.4	36.0	13.6	Complied
Middle	21.1	1.0	22.1	36.0	13.9	Complied
Top	21.1	1.0	22.1	36.0	13.9	Complied

## Transmitter Maximum Peak Output Power (continued)

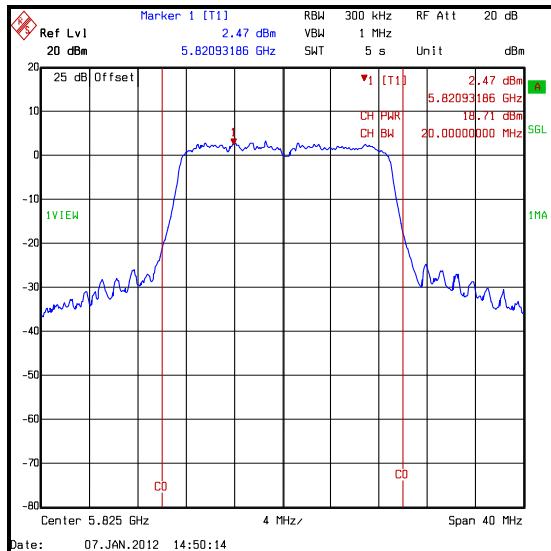
### Results: 13 Mbps / BPSK / 20 MHz / Port 0



Bottom Channel



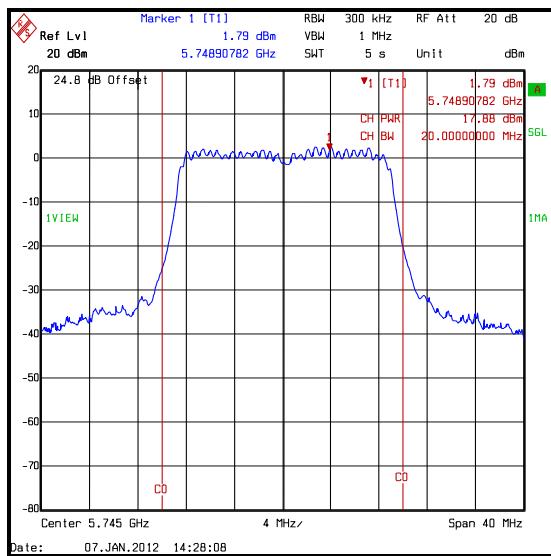
Middle Channel



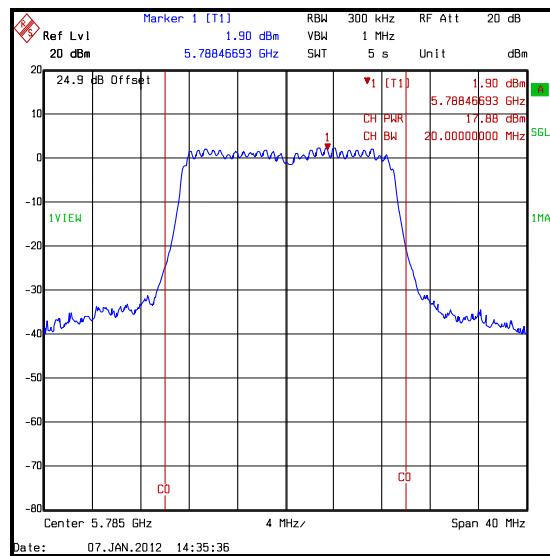
Top Channel

## Transmitter Maximum Peak Output Power (continued)

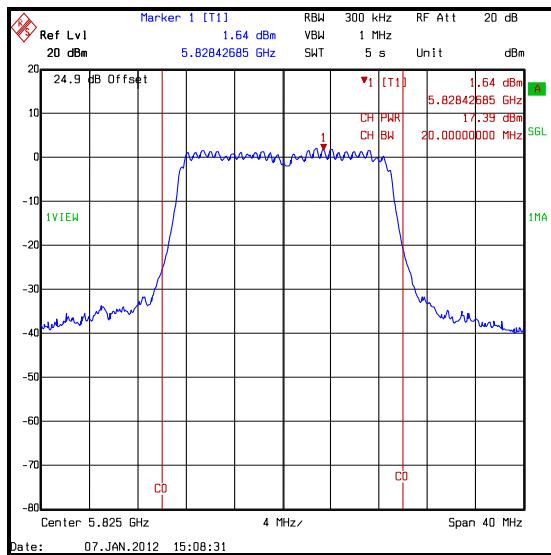
### Results: 13 Mbps / BPSK / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

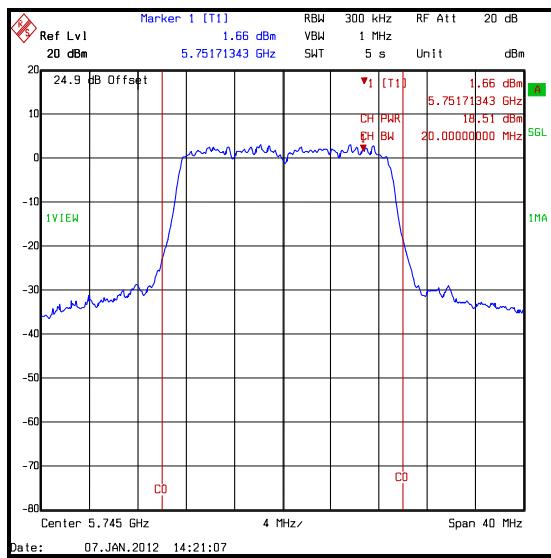
**Transmitter Maximum Peak Output Power (continued)****Results: 39 Mbps / QPSK / 20 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	18.5	17.6	21.1	30.0	8.9	Complied
Middle	18.5	17.4	21.0	30.0	9.0	Complied
Top	18.5	17.0	20.8	30.0	9.2	Complied

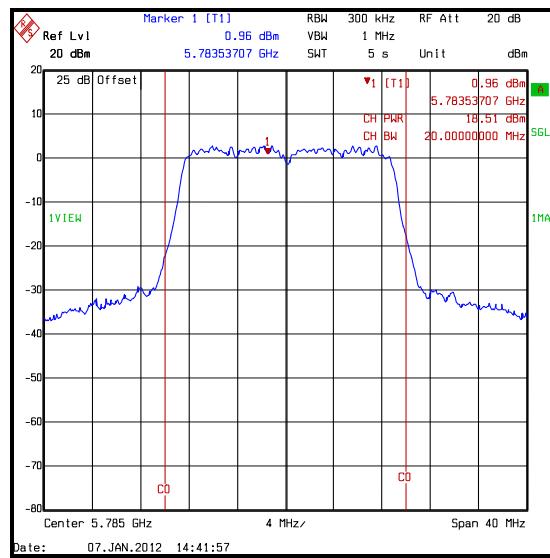
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.1	1.0	22.1	36.0	13.9	Complied
Middle	21.0	1.0	22.0	36.0	14.0	Complied
Top	20.8	1.0	21.8	36.0	14.2	Complied

## Transmitter Maximum Peak Output Power (continued)

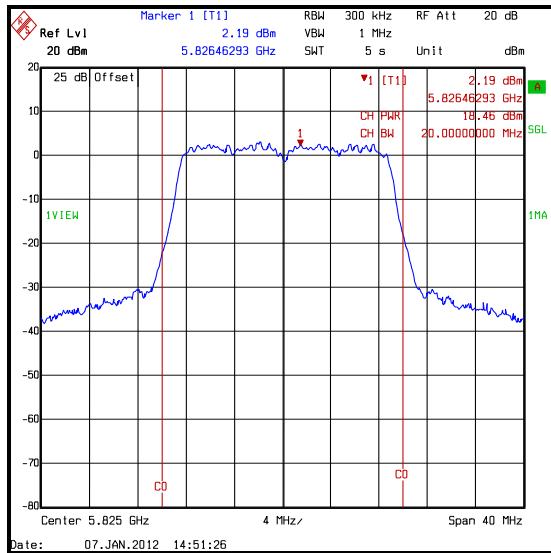
### Results: 39 Mbps / QPSK / 20 MHz / Port 0



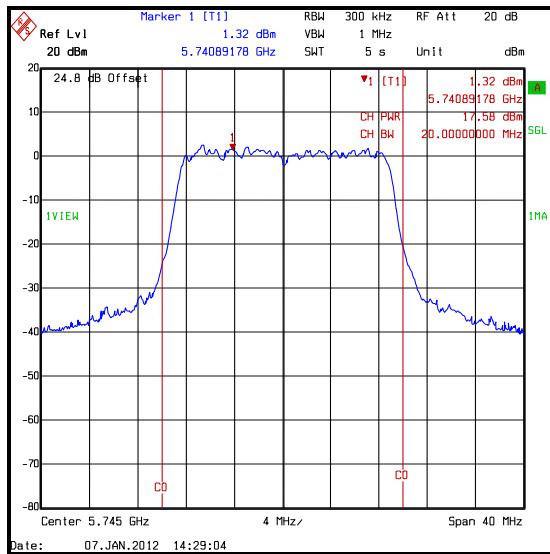
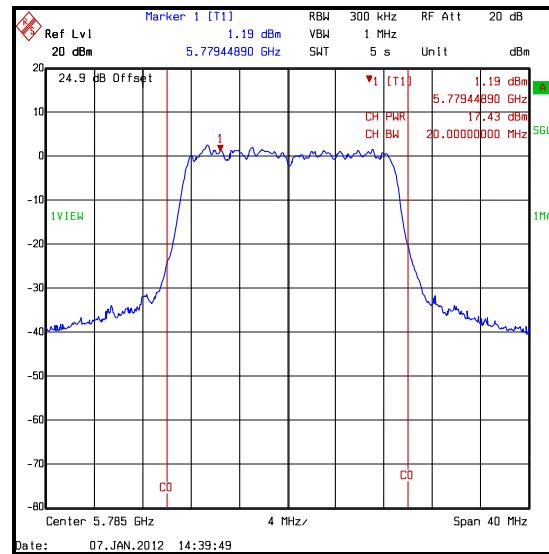
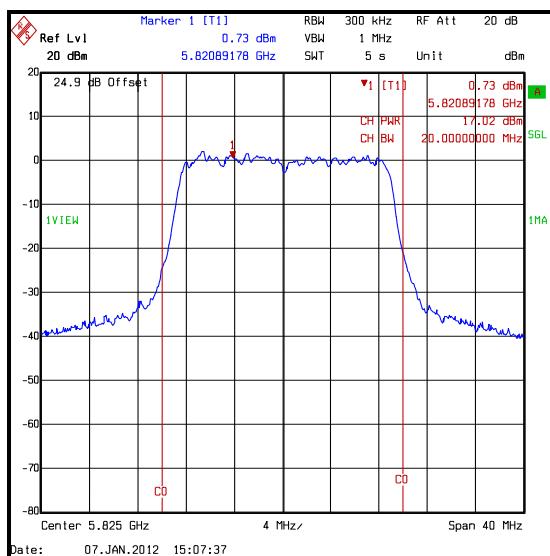
Bottom Channel



Middle Channel



Top Channel

**Transmitter Maximum Peak Output Power (continued)****Results: 39 Mbps / QPSK / 20 MHz / Port 1****Bottom Channel****Middle Channel****Top Channel**

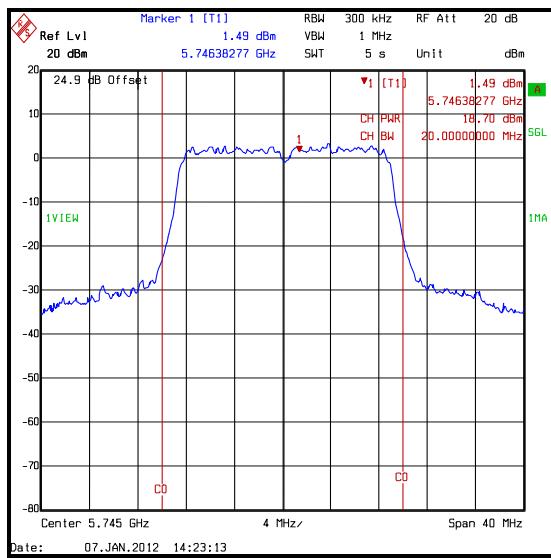
**Transmitter Maximum Peak Output Power (continued)****Results: 78 Mbps / 16QAM / 20 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	18.7	17.6	21.2	30.0	8.8	Complied
Middle	18.6	17.5	21.1	30.0	8.9	Complied
Top	18.5	17.2	20.9	30.0	9.1	Complied

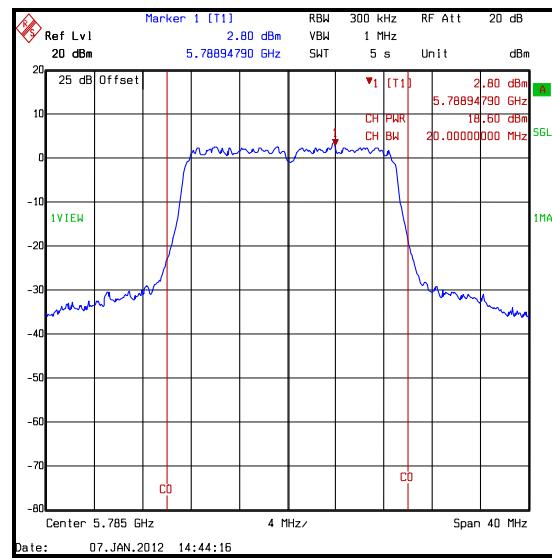
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.2	1.0	22.2	36.0	13.8	Complied
Middle	21.1	1.0	22.1	36.0	13.9	Complied
Top	20.9	1.0	21.9	36.0	14.1	Complied

## Transmitter Maximum Peak Output Power (continued)

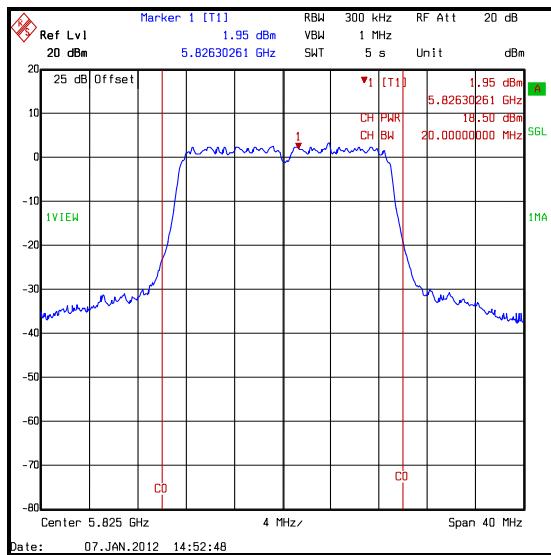
### Results: 78 Mbps / 16QAM / 20 MHz / Port 0



Bottom Channel



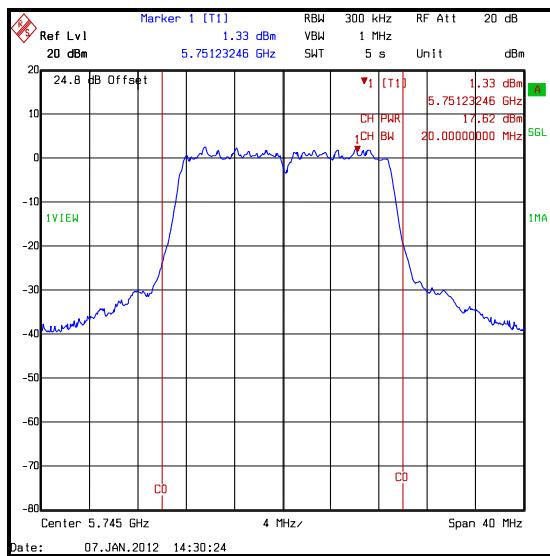
Middle Channel



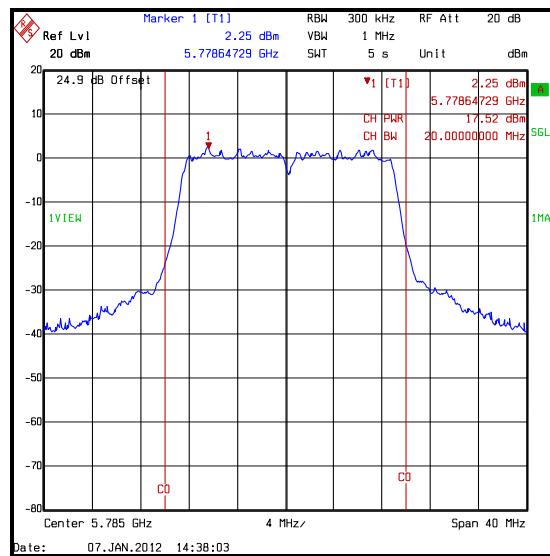
Top Channel

## Transmitter Maximum Peak Output Power (continued)

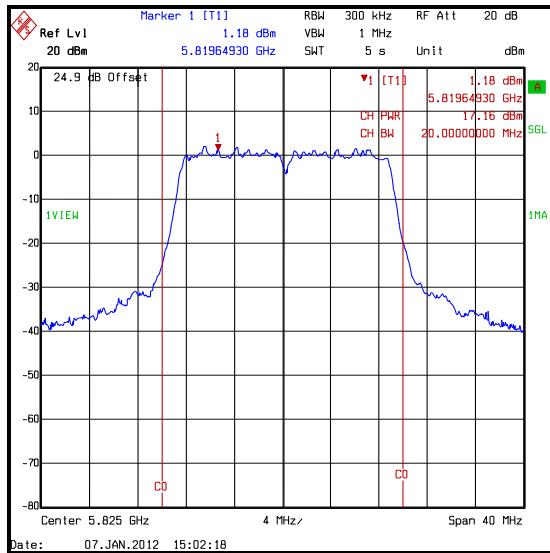
### Results: 78 Mbps / 16QAM / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

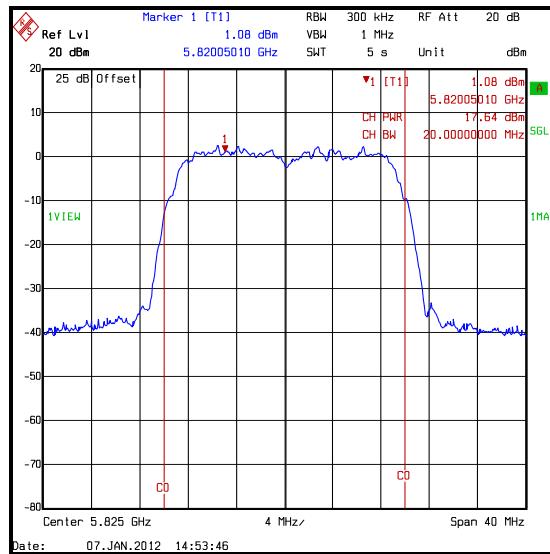
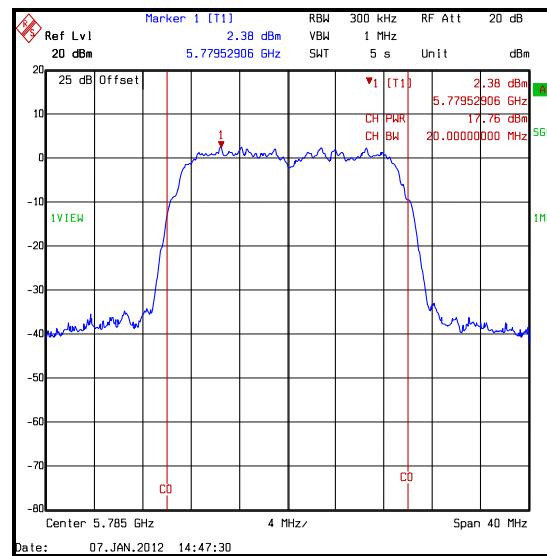
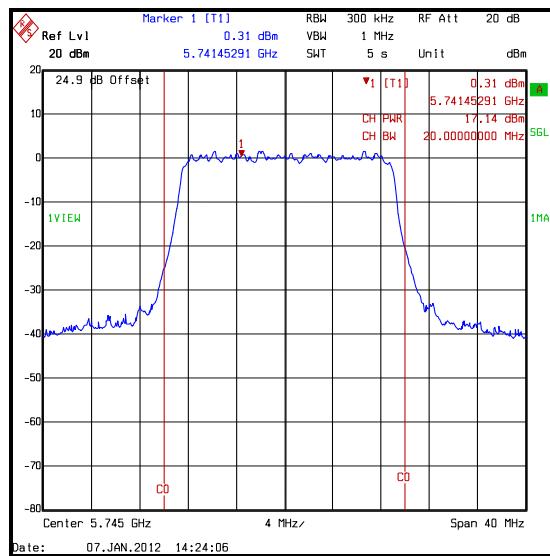
**Transmitter Maximum Peak Output Power (continued)****Results: 130 Mbps / 64QAM / 20 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	17.1	16.5	19.8	30.0	10.2	Complied
Middle	17.8	16.4	20.2	30.0	9.8	Complied
Top	17.6	15.9	19.8	30.0	10.2	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	19.8	1.0	20.8	36.0	15.2	Complied
Middle	20.2	1.0	21.2	36.0	14.8	Complied
Top	19.8	1.0	20.8	36.0	15.2	Complied

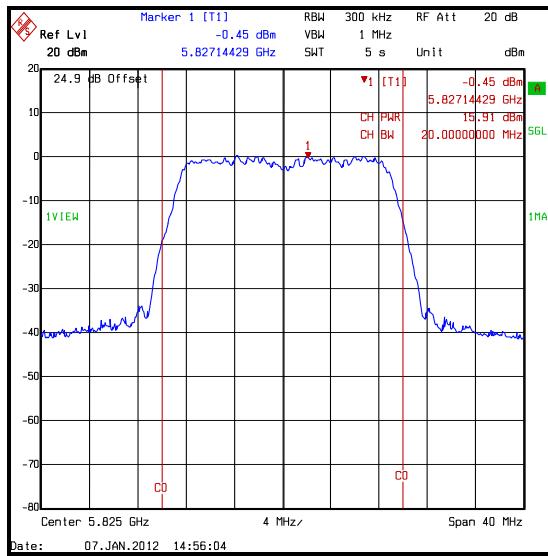
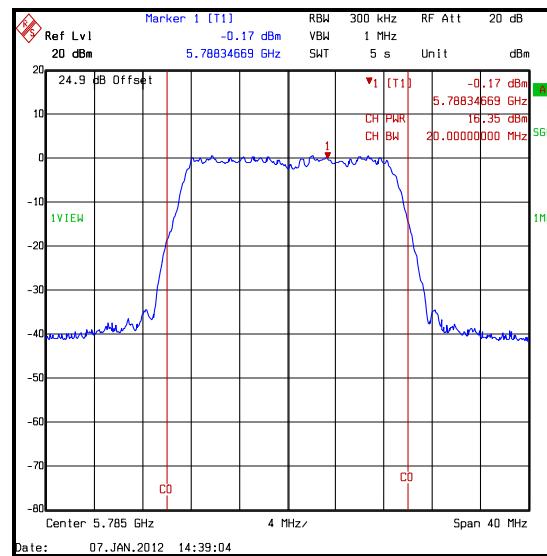
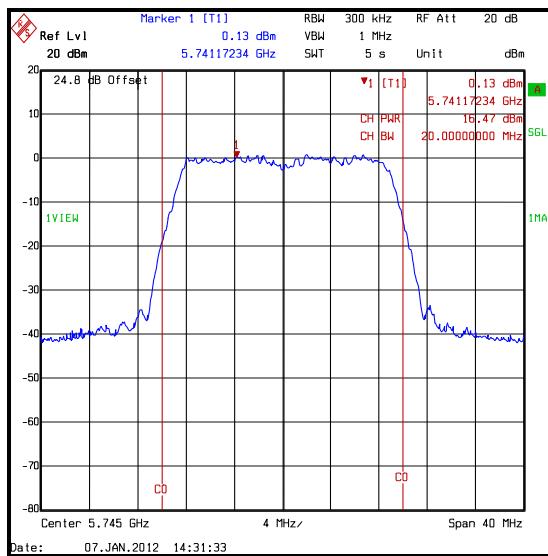
## Transmitter Maximum Peak Output Power (continued)

### Results: 130 Mbps / 64QAM / 20 MHz / Port 0



### Transmitter Maximum Peak Output Power (continued)

#### Results: 130 Mbps / 64QAM / 20 MHz / Port 1



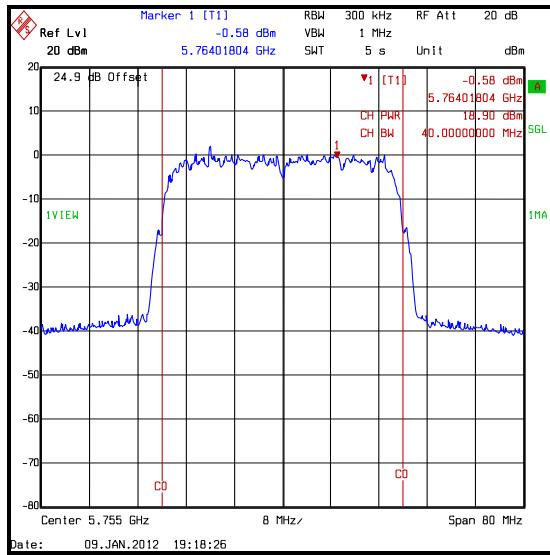
**Transmitter Maximum Peak Output Power (continued)****Results: 13 Mbps / BPSK / 40 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	18.9	16.9	21.0	30.0	9.0	Complied
Top	17.7	16.8	20.3	30.0	9.7	Complied

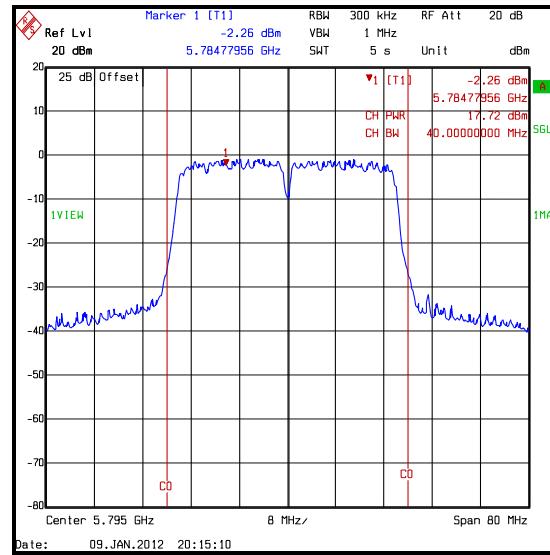
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.0	1.0	22.0	36.0	14.0	Complied
Top	20.3	1.0	21.3	36.0	14.7	Complied

## Transmitter Maximum Peak Output Power (continued)

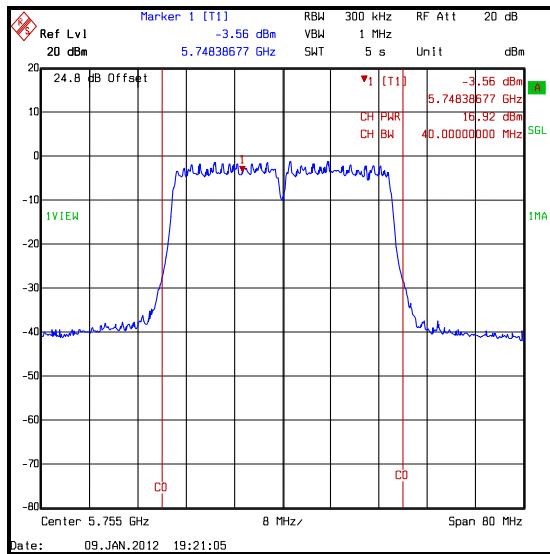
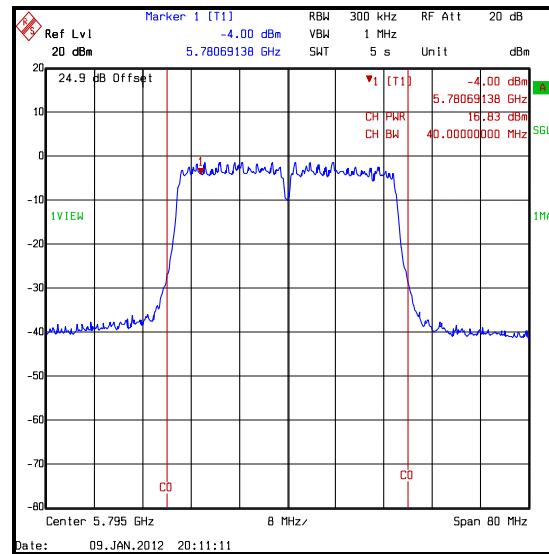
### Results: 13 Mbps / BPSK / 40 MHz / Port 0



Bottom Channel



Top Channel

**Transmitter Maximum Peak Output Power (continued)****Results: 13 Mbps / BPSK / 40 MHz / Port 1****Bottom Channel****Top Channel**

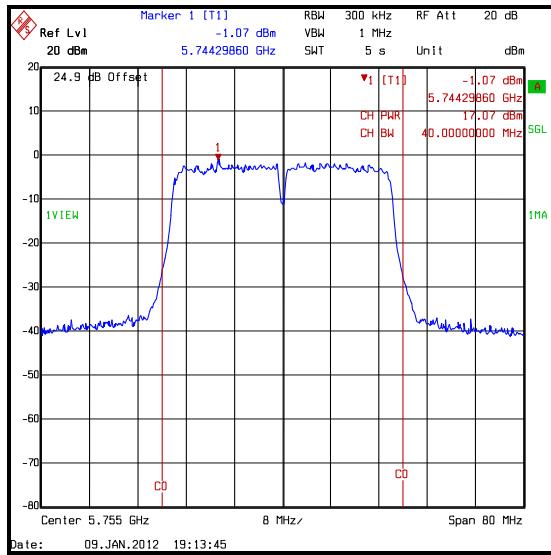
**Transmitter Maximum Peak Output Power (continued)****Results: 39 Mbps / QPSK / 40 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	17.1	16.6	19.8	30.0	10.2	Complied
Top	17.5	16.4	20.0	30.0	10.0	Complied

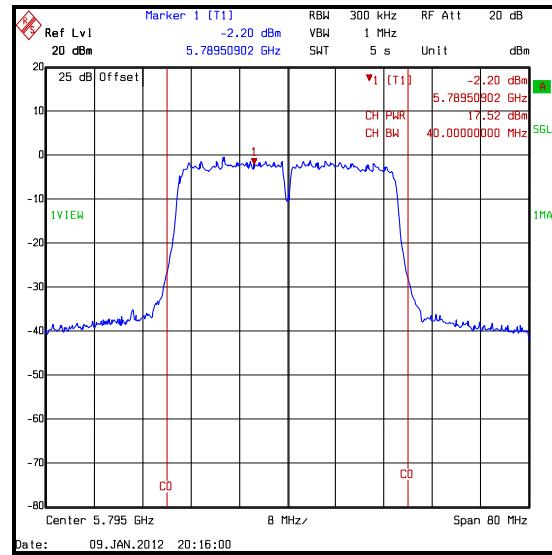
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	19.8	1.0	20.8	36.0	15.2	Complied
Top	20.0	1.0	21.0	36.0	15.0	Complied

## Transmitter Maximum Peak Output Power (continued)

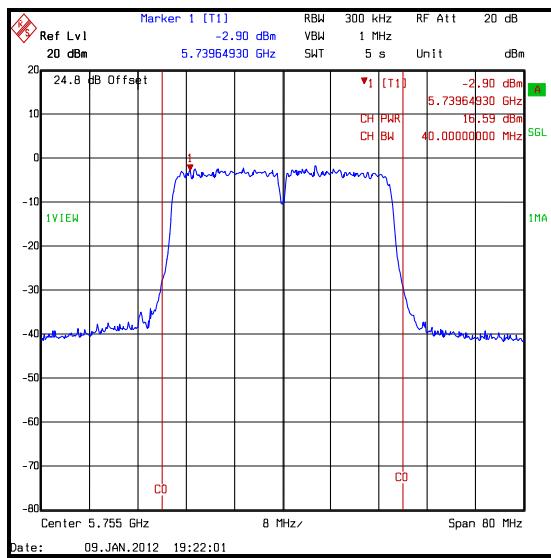
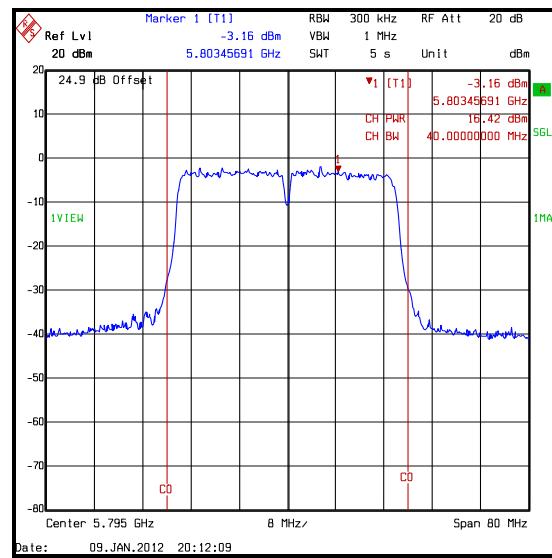
### Results: 39 Mbps / QPSK / 40 MHz / Port 0



Bottom Channel



Top Channel

**Transmitter Maximum Peak Output Power (continued)****Results: 39 Mbps / QPSK / 40 MHz / Port 1****Bottom Channel****Top Channel**

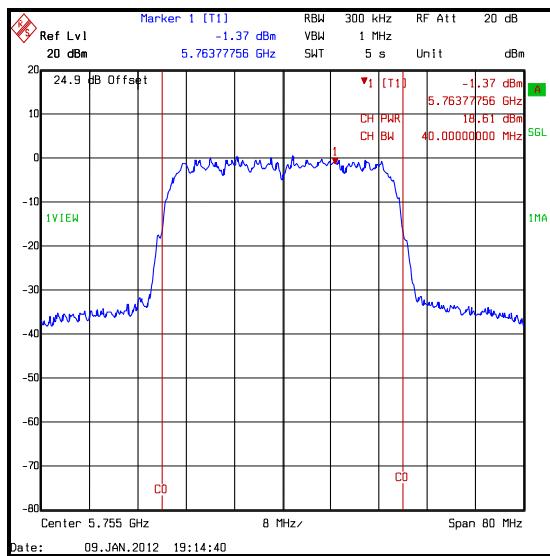
**Transmitter Maximum Peak Output Power (continued)****Results: 78 Mbps / 16QAM / 40 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	18.6	17.8	21.2	30.0	8.8	Complied
Top	17.8	17.6	20.7	30.0	9.3	Complied

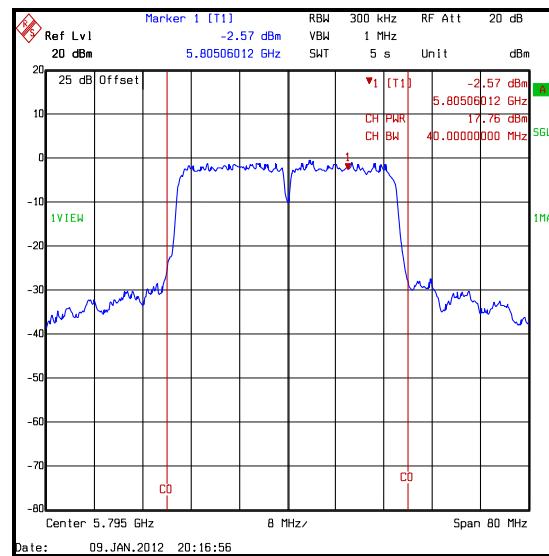
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.2	1.0	22.2	36.0	13.8	Complied
Top	20.7	1.0	21.7	36.0	14.3	Complied

## Transmitter Maximum Peak Output Power (continued)

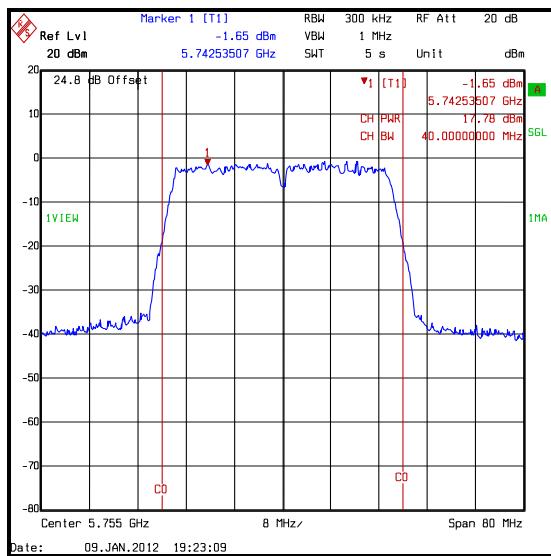
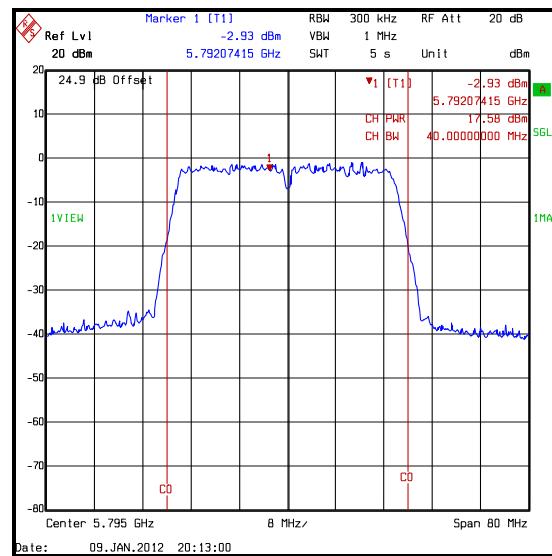
### Results: 78 Mbps / 16QAM / 40 MHz / Port 0



Bottom Channel



Top Channel

**Transmitter Maximum Peak Output Power (continued)****Results: 78 Mbps / 16QAM / 40 MHz / Port 1****Bottom Channel****Top Channel**

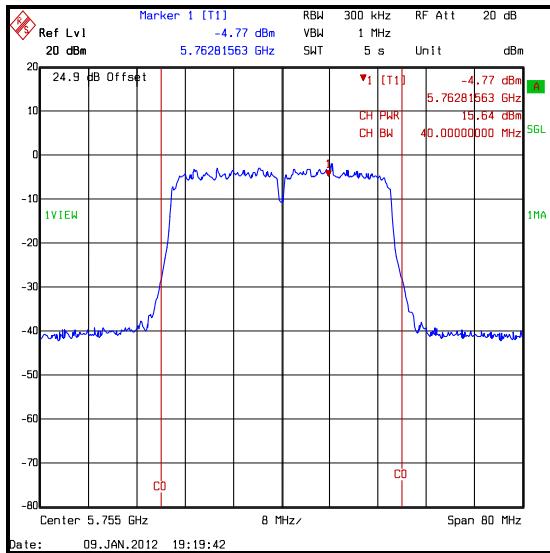
**Transmitter Maximum Peak Output Power (continued)****Results: 130 Mbps / 64QAM / 40 MHz**

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Combined Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	15.6	16.1	18.9	30.0	11.1	Complied
Top	17.3	15.0	19.3	30.0	10.7	Complied

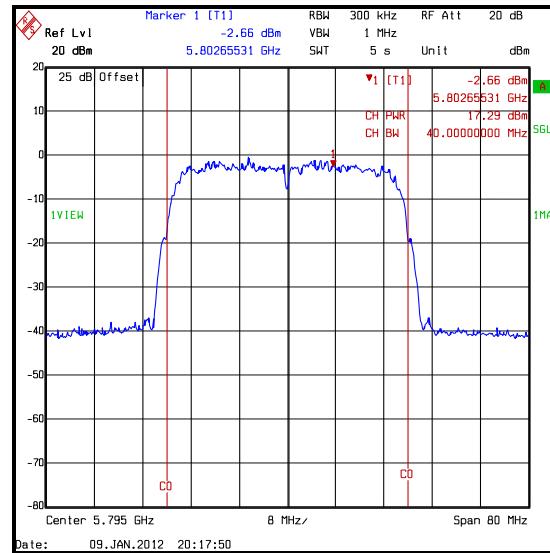
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	18.9	1.0	19.9	36.0	16.1	Complied
Top	19.3	1.0	20.3	36.0	15.7	Complied

### **Transmitter Maximum Peak Output Power (continued)**

## Results: 130 Mbps / 64QAM / 40 MHz / Port 0



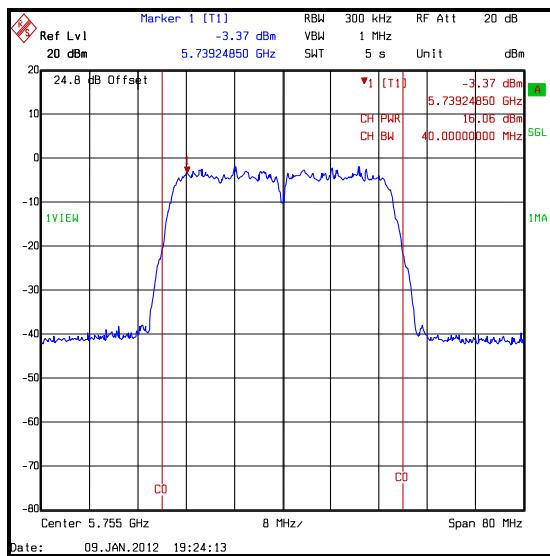
## Bottom Channel



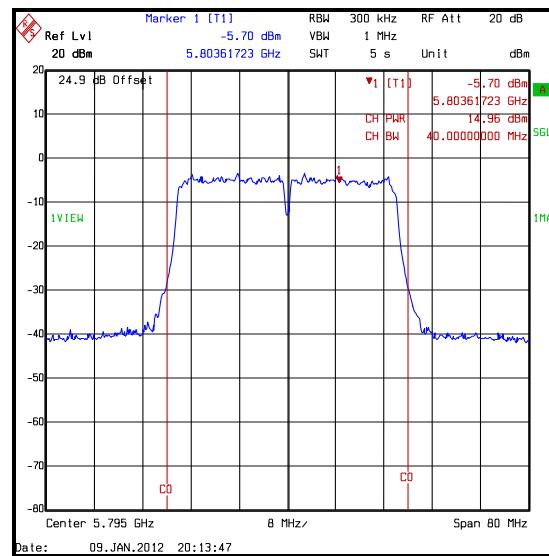
## Top Channel

### Transmitter Maximum Peak Output Power (continued)

#### Results: 130 Mbps / 64QAM / 40 MHz / Port 1



Bottom Channel



Top Channel

**5.2.8. Transmitter Radiated Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	17 February 2012
<b>Test Sample Serial No:</b>	22582545		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Industry Canada Reference:</b>	RSS-Gen 4.9, RSS-210 A8.5
<b>Test Method Used:</b>	FCC KDB 558074 D01 Section 5.4 & ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range</b>	30 MHz to 1000 MHz

**Environmental Conditions:**

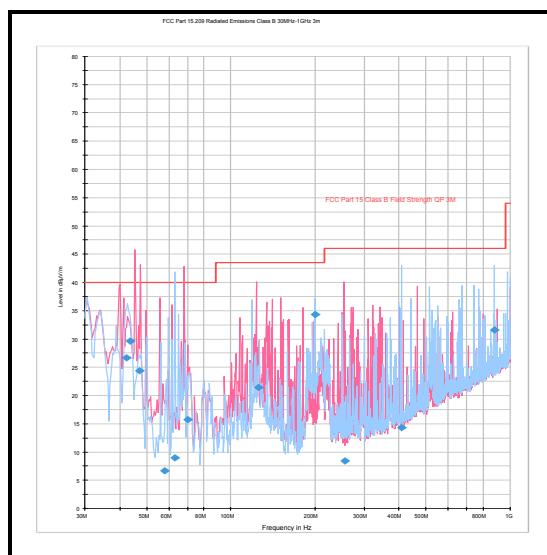
<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	23

**Note(s):**

1. The final measured value for the given emissions in the result table, incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the top channel only.
3. All other emissions were at least 20 dB below the appropriate limit or below the noise floor of the measurement system.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

**Transmitter Radiated Emissions (continued)****Results: 802.11n / 13 Mbps / 20 MHz**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
125.777	Vertical	21.5	43.5	22.0	Complied
408.016	Horizontal	14.4	46.0	31.6	Complied



*Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.*

**Transmitter Radiated Emissions (continued)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	15 February 2012
<b>Test Sample Serial No:</b>	22582545		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Industry Canada Reference:</b>	RSS-Gen 4.9, RSS-210 A8.5
<b>Test Method Used:</b>	FCC KDB 558074 D01 Section 5.4 & ANSI C63.10 Sections 6.3 and 6.6
<b>Frequency Range</b>	1 GHz to 40 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	21

**Note(s):**

1. The final measured value for the given emissions in the result tables, incorporates the calibrated antenna factor and cable loss.
2. The emission shown at approximately 5795 MHz on the 4 GHz to 6 GHz plot is the EUT fundamental.
3. All other emissions shown on the pre-scan plots were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

**Transmitter Radiated Emissions (continued)****Results: Bottom Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4595.897	Vertical	54.9	74.0	19.1	Complied
11488.927	Horizontal	46.9	74.0	27.1	Complied

**Results: Bottom Channel / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4595.897	Vertical	52.3	54.0	1.7	Complied
11488.927	Horizontal	31.8	54.0	22.2	Complied

**Results: Middle Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4627.941	Vertical	54.7	74.0	19.3	Complied
11570.717	Horizontal	46.7	74.0	27.3	Complied

**Results: Middle Channel / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4627.941	Vertical	51.9	54.0	2.1	Complied
11570.717	Horizontal	32.9	54.0	21.1	Complied

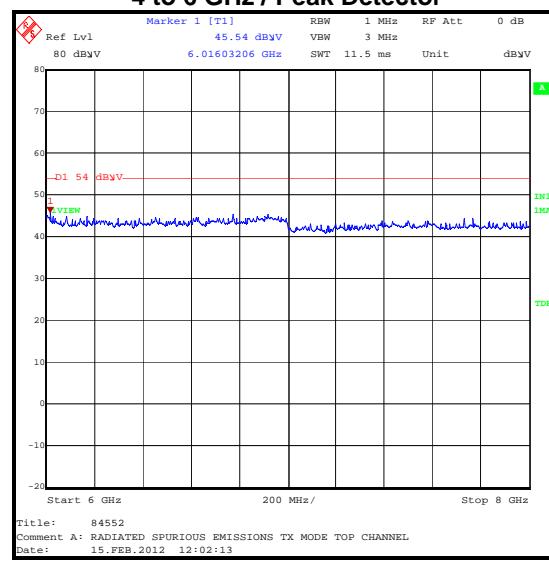
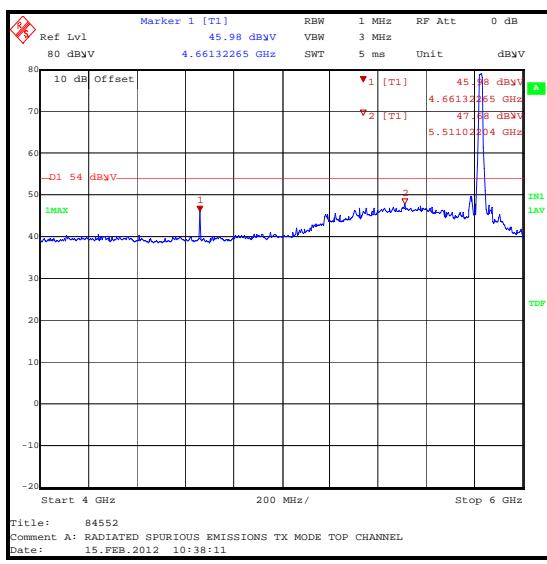
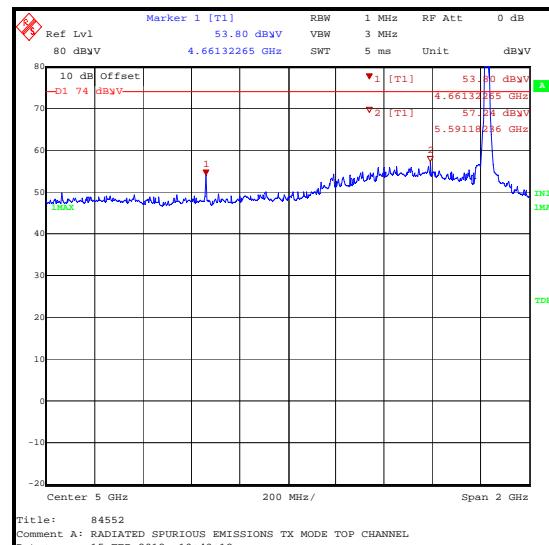
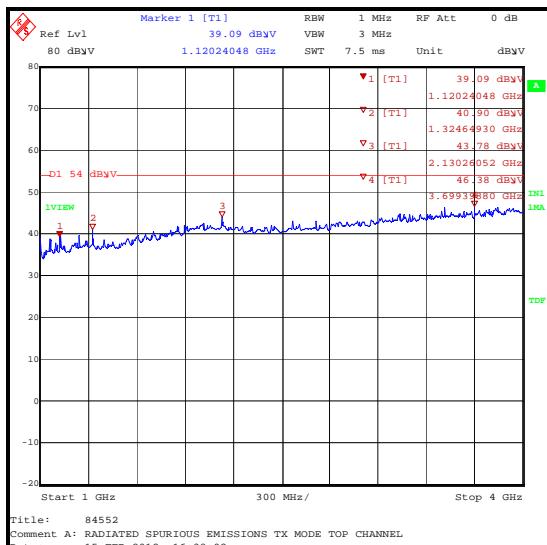
**Results: Top Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1124.950	Vertical	40.2	74.0	33.8	Complied
4659.953	Vertical	56.1	74.0	17.9	Complied
11647.721	Horizontal	52.2	74.0	21.8	Complied

**Results: Top Channel / Average**

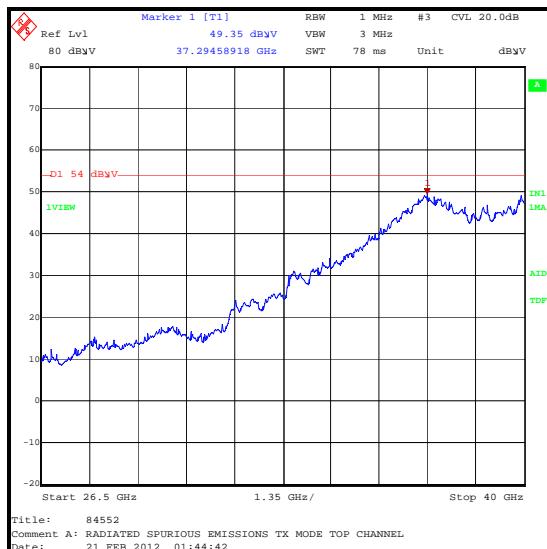
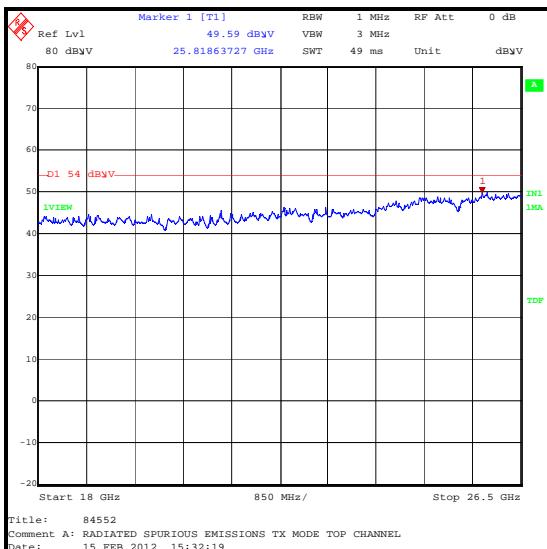
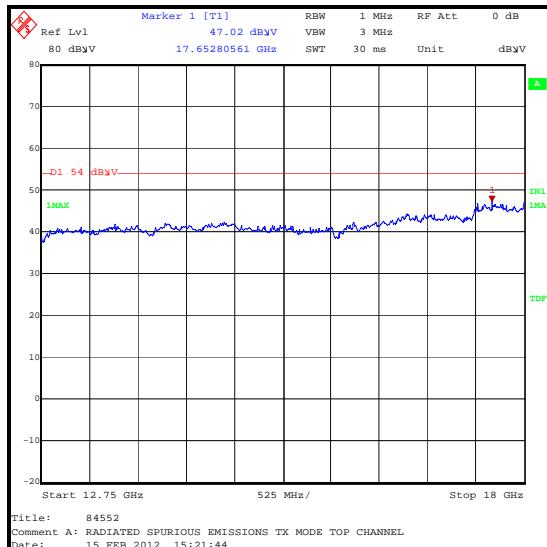
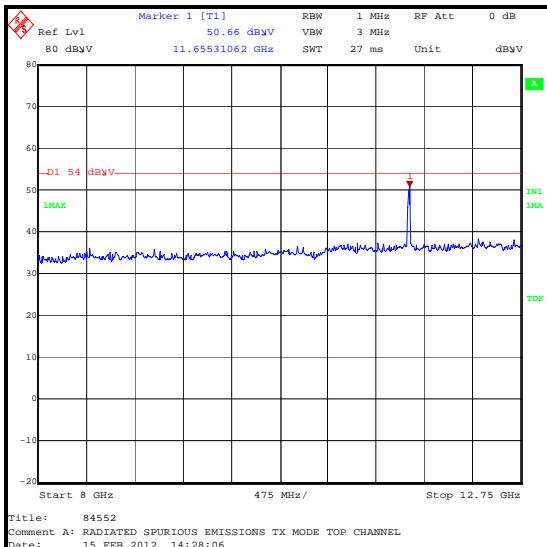
Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1124.950	Vertical	35.6	54.0	18.2	Complied
4659.953	Vertical	53.3	54.0	0.7	Complied
11647.721	Horizontal	35.2	54.0	18.8	Complied

## Transmitter Radiated Emissions (continued)



## 4 to 6 GHz / Average Detector

## Transmitter Radiated Emissions (continued)



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

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

<b>Test Engineer:</b>	Nick Steele	<b>Test Date:</b>	08 March 2012
<b>Test Sample Serial No:</b>	22582545		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Industry Canada Reference:</b>	RSS-Gen 4.9, RSS-210 A8.5
<b>Test Method Used:</b>	FCC KDB 558074 Section 5.4 & ANSI C63.10 Section 6.9.2

**Environmental Conditions:**

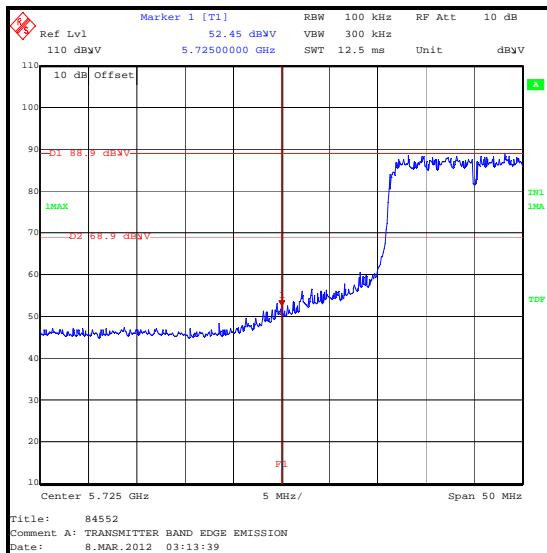
<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	21

**Note(s):**

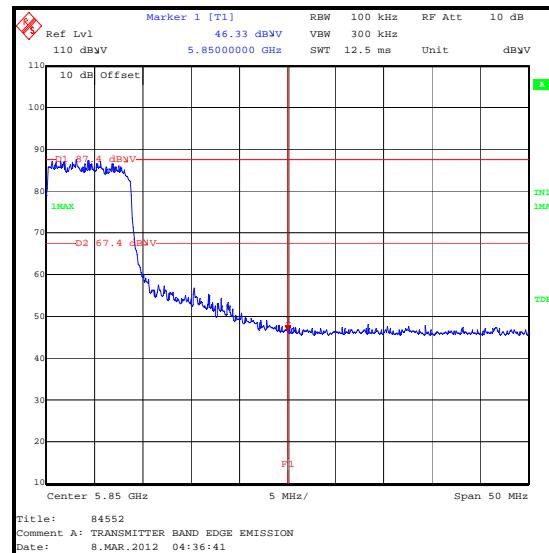
1. FCC Response to Inquiry (Tracking Number 917954 / Date: 14<sup>th</sup> February 2012) confirmed band edge measurements need only be performed in the EUT modes that produce the highest power and the widest bandwidths. Band edge testing was performed in these modes on both supported channel widths.
2. Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
3. The final measured value for the given emission in the result tables incorporates the calibrated antenna factor and cable loss.
4. A -20 dBc limit applies at upper and lower band edges as the adjacent spectrum is in the non-restricted bands.

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / 13 Mbps / BPSK / 20 MHz / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5725	52.5	68.9	16.4	Complied
5850	46.3	67.4	21.1	Complied



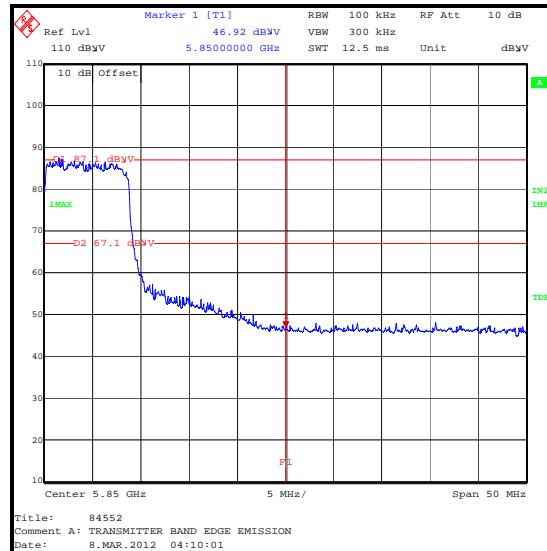
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement

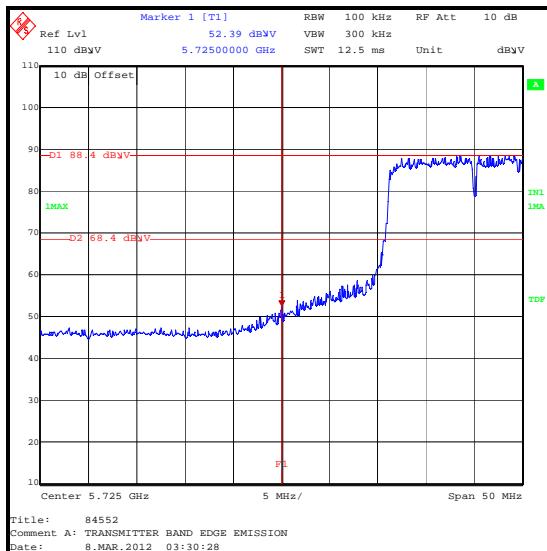
**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / 39 Mbps / QPSK / 20 MHz / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5725	50.8	68.3	17.5	Complied
5850	46.9	67.1	20.2	Complied

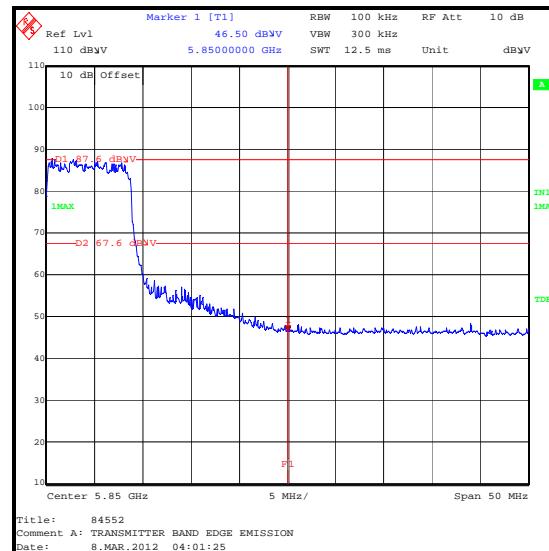
**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement**

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / 78 Mbps / 16QAM / 20 MHz / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5725	52.4	68.4	16.0	Complied
5850	46.5	67.6	21.1	Complied



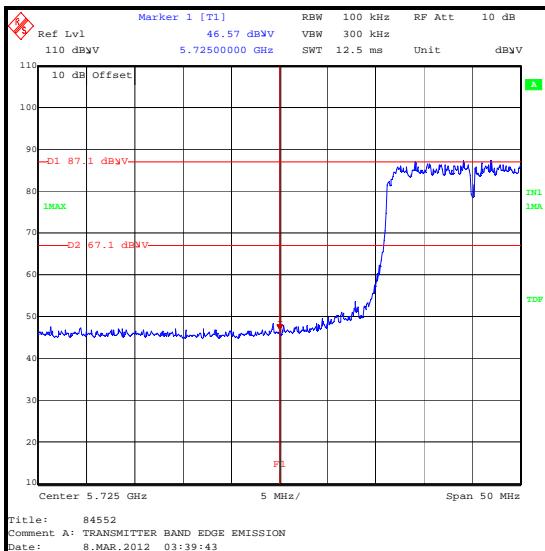
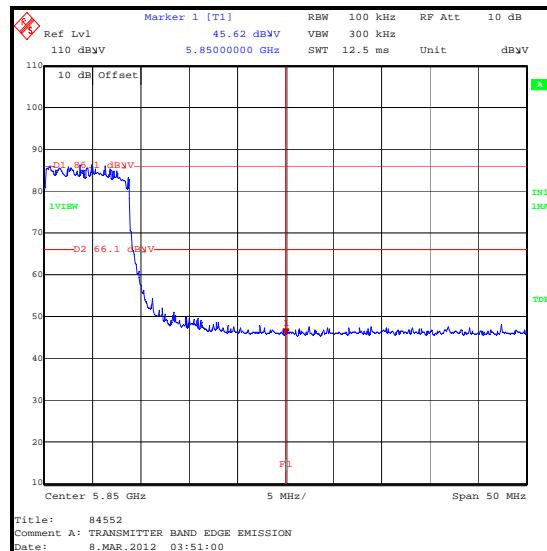
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement

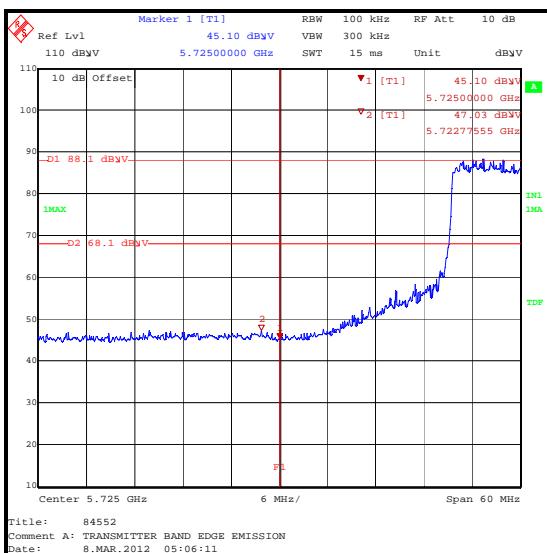
**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / 130 Mbps / 64QAM / 20 MHz / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5725	46.6	67.1	20.5	Complied
5850	45.1	66.1	21.0	Complied

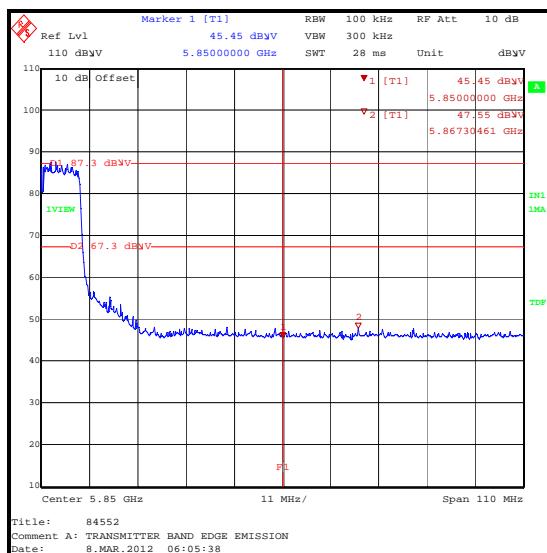
**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement**

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / 13 Mbps / BPSK / 40 MHz / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5722.776	47.0	68.1	21.1	Complied
5725	45.1	68.1	23.0	Complied
5850	45.5	67.3	21.8	Complied
5867.305	47.6	67.3	19.7	Complied



Lower Band Edge Peak Measurement

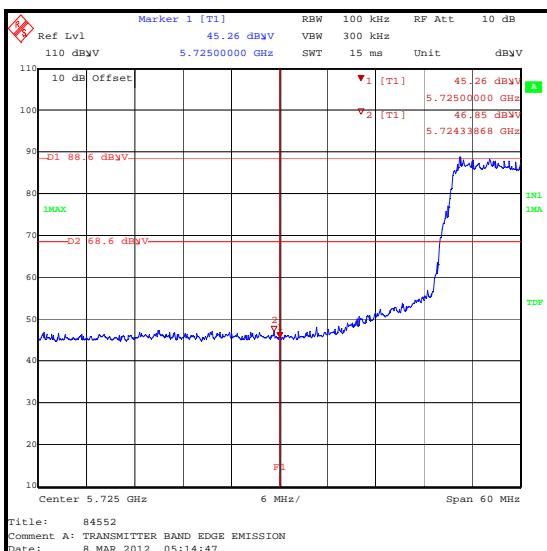


Upper Band Edge Peak Measurement

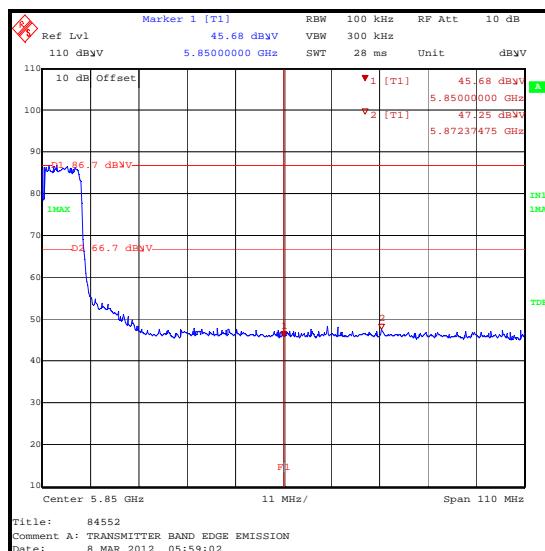
### Transmitter Band Edge Radiated Emissions (continued)

## Results: 802.11n / 39 Mbps / QPSK / 40 MHz / Peak

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5724.339	46.9	68.6	21.7	Complied
5725	45.3	68.6	23.3	Complied
5850	45.7	66.7	21.0	Complied
5872.375	47.3	66.7	19.4	Complied



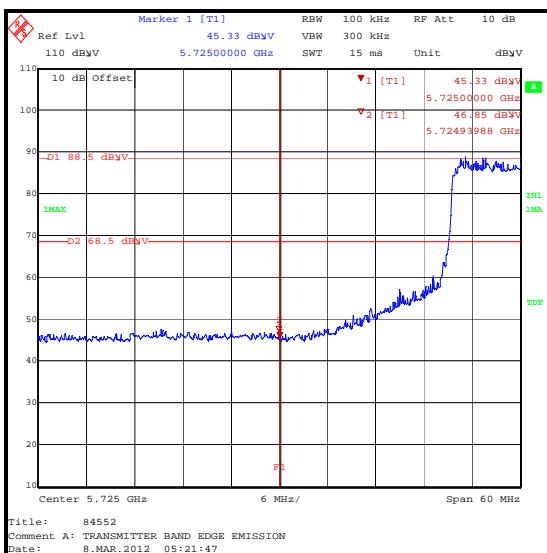
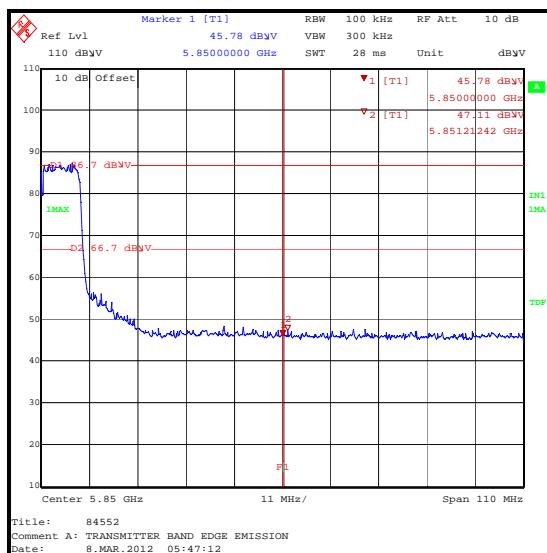
## Lower Band Edge Peak Measurement



## Upper Band Edge Peak Measurement

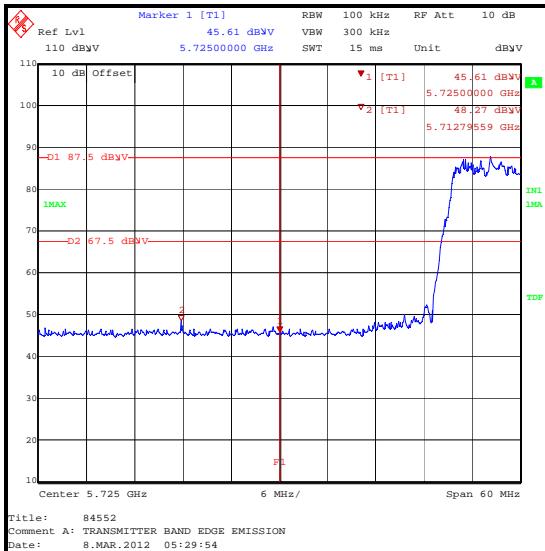
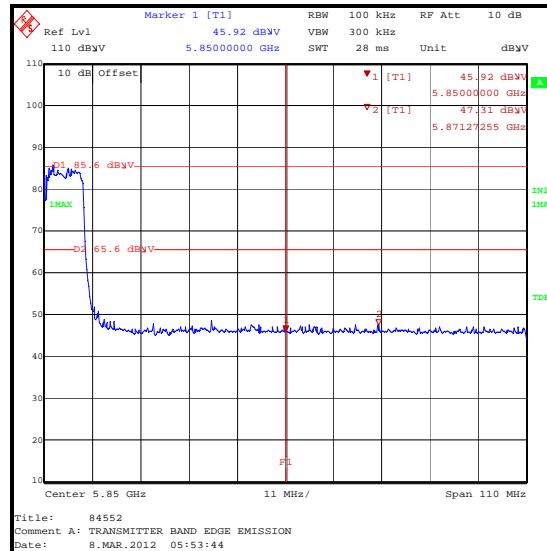
**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / 78 Mbps / 16QAM / 40 MHz / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5724.940	46.9	68.5	21.6	Complied
5725	45.3	68.5	23.2	Complied
5850	46.0	66.7	20.7	Complied
5851.212	47.1	66.7	19.6	Complied

**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement**

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / 130 Mbps / 64QAM / 40 MHz / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
5725	45.6	67.5	21.9	Complied
5850	45.9	65.6	19.7	Complied

**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement**

## **6. Measurement Uncertainty**

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

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

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

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

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.25 dB
Conducted Maximum Peak Output Power	5725 MHz to 5850 MHz	95%	±0.27 dB
Spectral Power Density	5725 MHz to 5850 MHz	95%	±2.94 dB
6 dB Bandwidth	5725 MHz to 5850 MHz	95%	±0.92 ppm
20 dB Bandwidth	5725 MHz to 5850 MHz	95%	±0.92 ppm
Radiated Spurious Emissions	30 MHz to 40 GHz	95%	±2.94 dB

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

## Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (months)
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	02 Jun 2012	12
A1396	Attenuator	Huber & Suhner	757987	6810.17.B	08 Jul 2012	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	09 Oct 2012	12
A1785	Low Noise Amplifier	Farran Technology	FLNA-28-30	FTL 6483	Calibrated Before Use	-
A1818	Antenna	EMCO	3115	00075692	09 Oct 2012	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	25 Feb 2013	12
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	09 Feb 2012	12
A1999	Attenuator	Huber & Suhner	6820.17.B	07101	18 Mar 2012	12
A203	Antenna	Flann Microwave	22240-20	343	11 May 2013	36
A253	Antenna	Flann Microwave	12240-20	128	09 Oct 2012	12
A254	Antenna	Flann Microwave	14240-20	139	09 Oct 2012	12
A255	Antenna	Flann Microwave	16240-20	519	09 Oct 2012	12
A256	Antenna	Flann Microwave	18240-20	400	09 Oct 2012	12
A259	Antenna	Chase	CBL6111	1513	26 Mar 2012	12
A366	Isolator	MRI	FRR-400	169	Calibrated Before Use	-
A436	Antenna	Flann	20240-20	330	09 Oct 2012	12
A490	Antenna	Chase	CBL6111A	1590	11 Apr 2012	12
G085	Signal Generator	HP	83650L	3614A00104	09 Nov 2012	12
G088	PSU	Thurlby Thandar	CPX200	100700	Calibrated Before Use	-
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	29 May 2012	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	09 Oct 2012	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESI26	100046K	29 Jun 2012	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	13 Jul 2012	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842 659/016	08 Nov 2012	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated Before Use	-
M1269	Multimeter	Fluke	179	90250210	20 Jul 2012	12
M1251	Multimeter	Fluke	179	87640015	21 Jun 2012	12
M1590	Test Receiver	Rohde & Schwarz	ESU26	100239	15 Jun 2012	12

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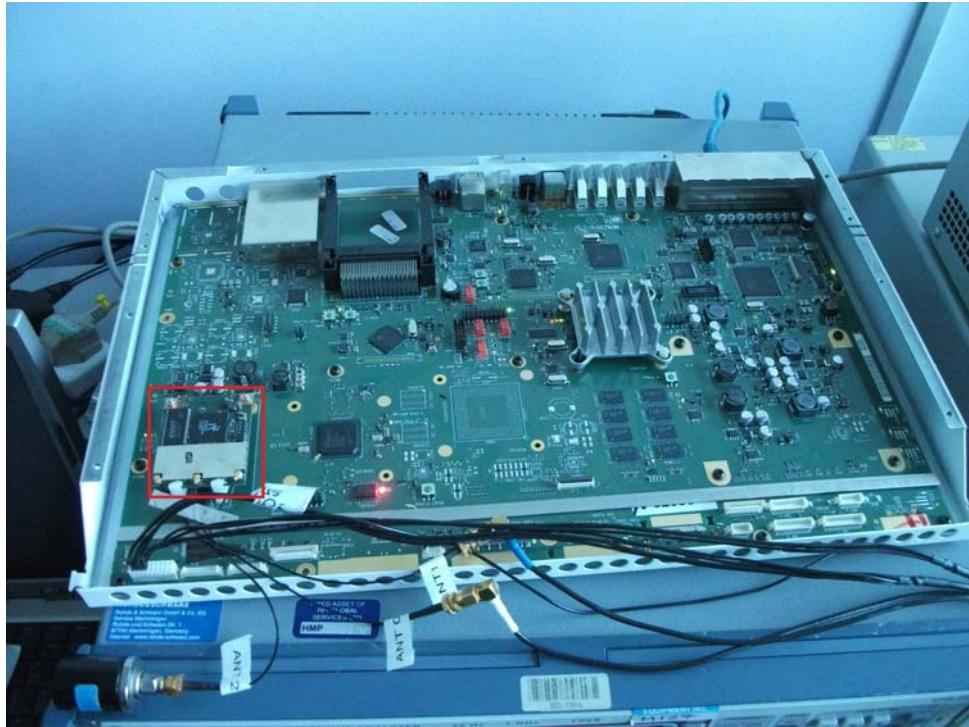
RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (months)
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	06 Feb 2013	12

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

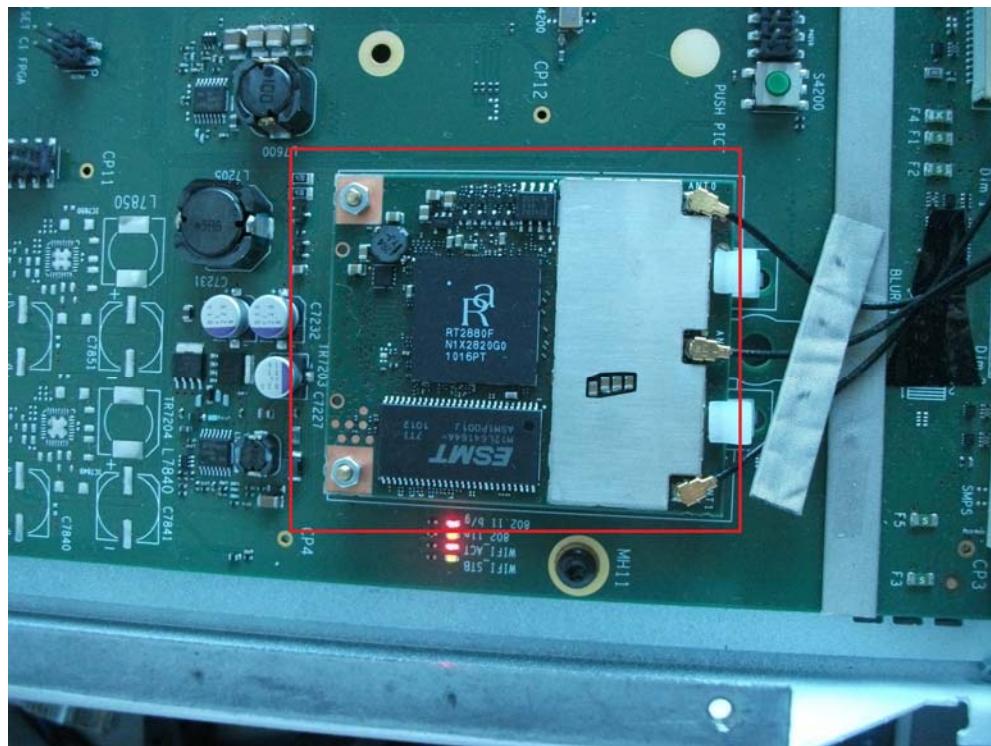
## Appendix 2. Test Setup Photographs



**Photo #1.** Test setup for conducted measurements on Video Engine. Video Engine is the black box on top of the spectrum analyser.



**Photo #2.** 802.11 module location within Video Engine shown in red. Antenna ports shown at bottom left.



**Photo #3. Close up photo of EUT module within Video Engine. The three antenna ports are shown on the right hand side of the 802.11 module.**



**Photo #4. Rear of TV showing location of EUT module.**