TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: LBWA1ZZPDZ-385

FCC ID: TTULBWA1ZZPD

Industry Canada 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-RP84552JD04A V5.0

Version 5.0 Supersedes All Previous Versions

This Test Report Is Issued Under The Authority Of John Newell, Group Quality Manager:	
Checked By:	Sarah Williams
Signature:	
Date of Issue:	15 November 2012

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RFI Global Services Ltd
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number:2117901

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Table of Contents

1. Customer Information

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

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.107 and 47CFR15.109
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart B (Unintentional Radiators) - Sections 15.107 and 15.109
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Specification Reference:	RSS-Gen Issue 3 December 2010
Specification Title:	General Requirements and Information for the Certification of Radio Apparatus
Specification Reference:	RSS-210 Issue 8 December 2010
Specification Title:	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
Site Registration:	FCC: 209735; Industry Canada: 3245B-2
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	31 January 2012 to 31 October 2012

2.2. Summary of Test Results

FCC Reference (47CFR)	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

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices
Reference:	FCC KDB 558074 D01 v01 1/18/2012
Title:	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) devices operating Under §15.247
Reference:	FCC KDB 558074 D01 v02 10/04/2012
Title:	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) devices operating Under §15.247
Reference:	FCC KDB 662911 D01 v01r01 10/25/2011
Title:	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)

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

Brand Name:	Bang & Olufsen
Model Name or Number:	Beo Play V1-32 32” TV containing a Murata LBWA1ZZPDZ-385 module
Serial Number:	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

Technology Tested:	IEEE 802.11		
Type of Unit:	Transceiver		
Modulation:	Barker, CCK, DBPSK, DQPSK, QPSK, 16QAM, 64QAM		
Data rates:	802.11 b	1, 2, 5.5 & 11 Mbps	
	802.11 g	6, 9, 12, 18, 24, 36 ,48 & 54 Mbps	
	802.11 n	6.5, 13, 19.5, 26, 39, 52, 58.5, 65, 78, 104, 117 & 130 Mbps	
TV Power Supply Requirement(s):	Nominal	120 VAC 60 Hz	
Murata LBWA1ZZPDZ-385 Power Supply Requirement:	Nominal	3.3 VDC	
Video Engine Power Supply Requirement(s):	Nominal	5.0 VDC & 12.0 VDC	
Maximum Conducted Output Power:	23.5 dBm		
Antenna Gain:	0 dBi		
Channel Spacing:	20 MHz		
Transmit & Receive Frequency Band:	2400 MHz to 2483.5 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462
Channel Spacing:	40 MHz		
Transmit & Receive Frequency Band:	2400 MHz to 2483.5 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	3	2422
	Middle	6	2437
	Top	9	2452

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:	D610
Serial Number:	RFI Asset No. PC401NT

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

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

Description:	Serial to Ethernet cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Ethernet cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

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

Description:	HDMI Player
Brand Name:	Sumvision
Model Name or Number:	Cyclone
Serial Number:	SUM0911

Support Equipment (continued)

Description:	USB Stick
Brand Name:	Integral
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

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

Description:	Wireless N router
Brand Name:	Cisco
Model Name or Number:	Linkseys E4200
Serial Number:	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.
- The EUT supports the following:
    - 802.11b – 1 TX chain
    - 802.11g – 1 TX chain
    - 802.11n – 2 TX chains / MIMO.

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 -0.8 dBi in the 2.4 GHz band. This figure is the antenna manufacturer's stated antenna gain (0 dBi) less the loss of the internal RF cables (0.8 dB). 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.
- Transmitter radiated spurious emissions pre-scans were performed with both transmit ports active, using the proprietary test software supplied by the Customer. Final measurements were then subsequently performed in both 802.11b and n modes, with the worst case emissions being recorded. 802.11b / 20 MHz / 11 Mbps was identified as worst case below 1 GHz and 802.11n / 40 MHz / 78 Mbps was identified as worst case above 1 GHz.
- 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 either 11 Mbps or 78 Mbps with a channel bandwidth of 20 MHz or 40 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 (dBµV)	Limit (dBµV)	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 (dBµV)	Limit (dBµV)	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)

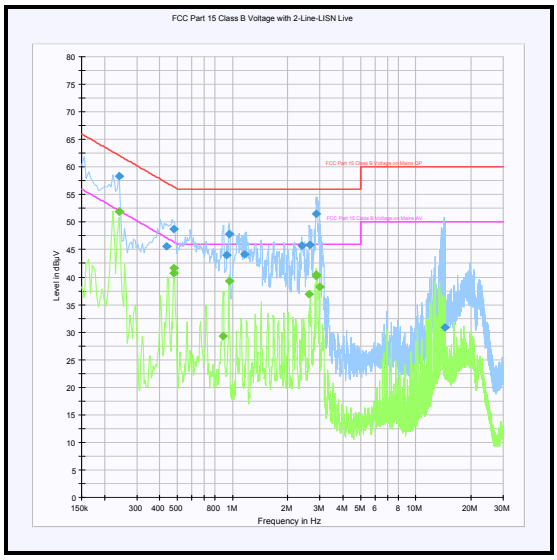
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	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

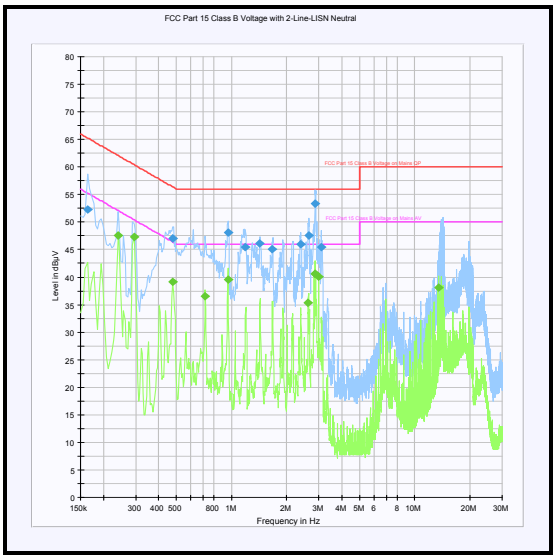
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	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)



Live



Neutral

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

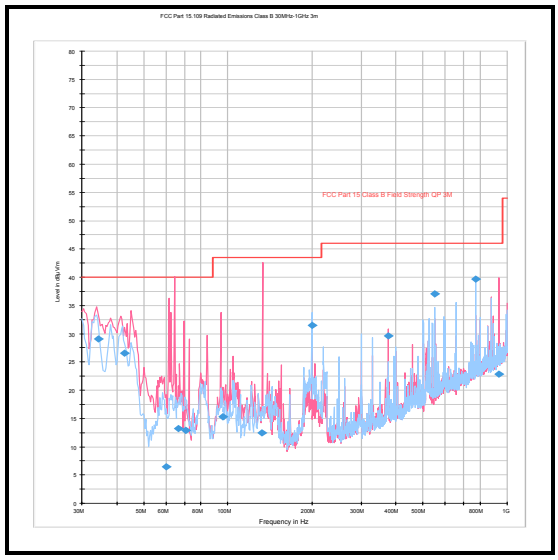
Results: Quasi Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/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:

Test Engineer:	Mark Percival	**Test Date:**	14 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 6.6 referencing ANSI C63.4
Frequency Range:	1 GHz to 12.5 GHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	21

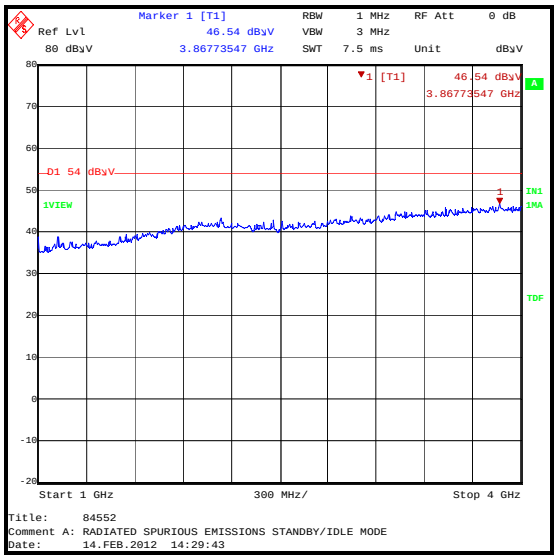
Results:

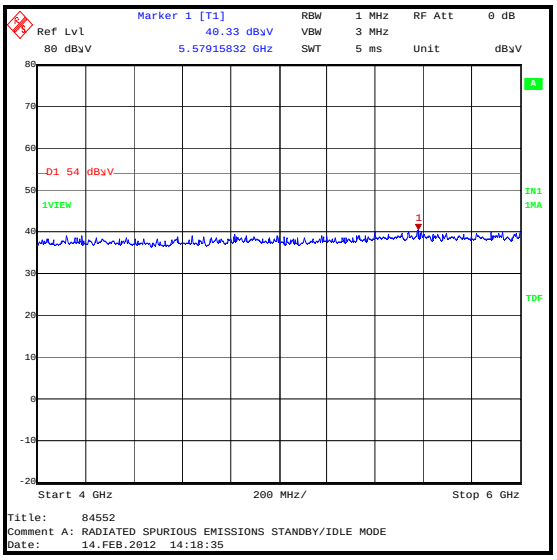
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
3867.735	Horizontal	46.5	54.0	7.5	Complied

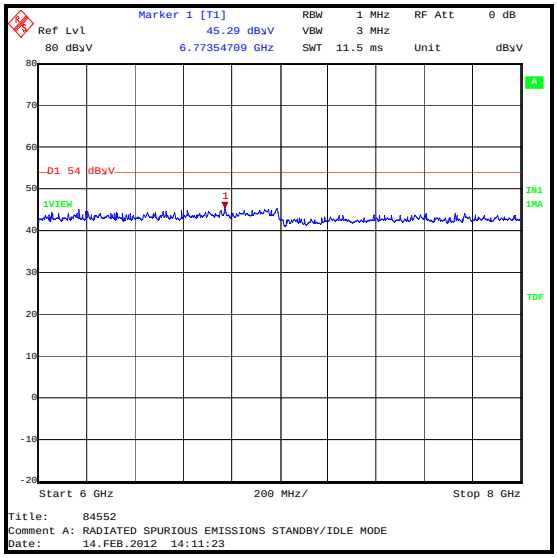
Note(s):

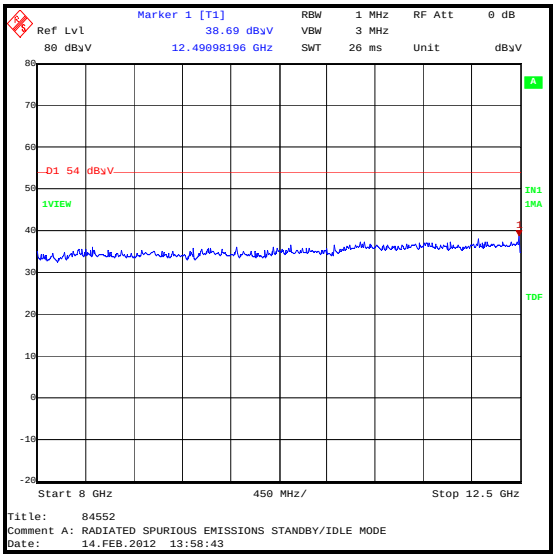
1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded 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)









5.2.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

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

FCC Reference:	Part 15.207
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

Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.240	Live	56.7	62.1	5.4	Complied
0.407	Live	46.2	57.7	11.5	Complied
0.474	Live	48.8	56.4	7.6	Complied
0.951	Live	48.4	56.0	7.6	Complied
1.158	Live	44.2	56.0	11.8	Complied
1.410	Live	43.2	56.0	12.8	Complied
2.616	Live	44.3	56.0	11.7	Complied
2.828	Live	49.2	56.0	6.8	Complied
2.994	Live	41.4	56.0	14.6	Complied
3.057	Live	42.9	56.0	13.1	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.164	Live	46.7	55.3	8.6	Complied
0.240	Live	50.6	52.1	1.5	Complied
0.402	Live	36.9	47.8	10.9	Complied
0.474	Live	40.3	46.4	6.1	Complied
0.947	Live	40.1	46.0	5.9	Complied
1.419	Live	34.2	46.0	11.8	Complied
2.612	Live	34.1	46.0	11.9	Complied
2.823	Live	40.4	46.0	5.6	Complied
2.985	Live	38.3	46.0	7.7	Complied
12.809	Live	40.0	50.0	10.0	Complied

Transmitter AC Conducted Spurious Emissions (continued)

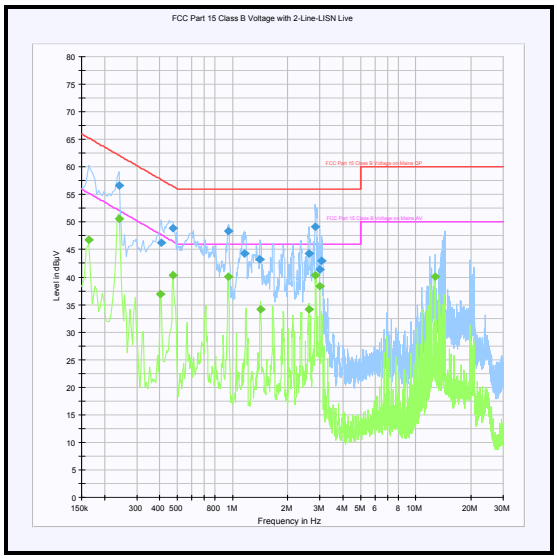
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.164	Neutral	54.4	65.3	10.9	Complied
0.474	Neutral	46.8	56.4	9.6	Complied
0.956	Neutral	48.4	56.0	7.6	Complied
1.149	Neutral	44.0	56.0	12.0	Complied
1.415	Neutral	45.2	56.0	10.8	Complied
2.364	Neutral	45.3	56.0	10.7	Complied
2.616	Neutral	46.3	56.0	9.7	Complied
2.828	Neutral	49.7	56.0	6.3	Complied
2.985	Neutral	43.0	56.0	13.0	Complied
3.071	Neutral	45.9	56.0	10.1	Complied

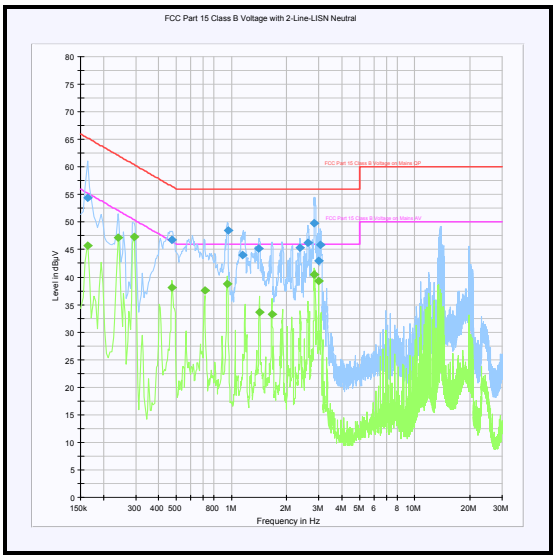
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.164	Neutral	45.7	55.3	9.6	Complied
0.240	Neutral	47.1	52.1	5.0	Complied
0.294	Neutral	47.3	50.4	3.1	Complied
0.474	Neutral	38.1	46.4	8.3	Complied
0.713	Neutral	37.6	46.0	8.4	Complied
0.951	Neutral	38.7	46.0	7.3	Complied
1.424	Neutral	33.6	46.0	12.4	Complied
1.662	Neutral	33.2	46.0	12.8	Complied
2.823	Neutral	40.4	46.0	5.6	Complied
2.985	Neutral	39.3	46.0	6.7	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)



Live



Neutral

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

5.2.4. Transmitter 6 dB Bandwidth

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	14 March 2012 & 16 March 2012
Test Sample Serial No:	Not marked or 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):	25
Relative Humidity (%):	21

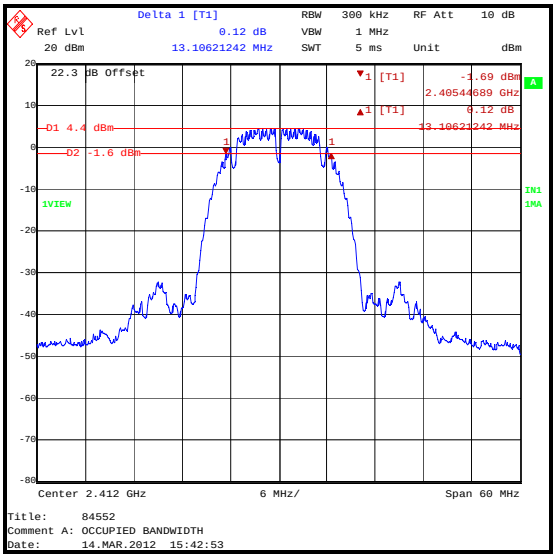
Note(s):

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.

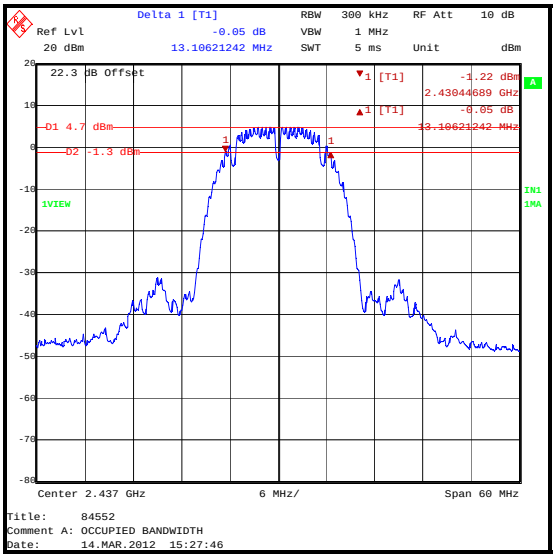
Transmitter 6 dB Emission Bandwidth (continued)

Results: 802.11b / 1 Mbps / 20 MHz

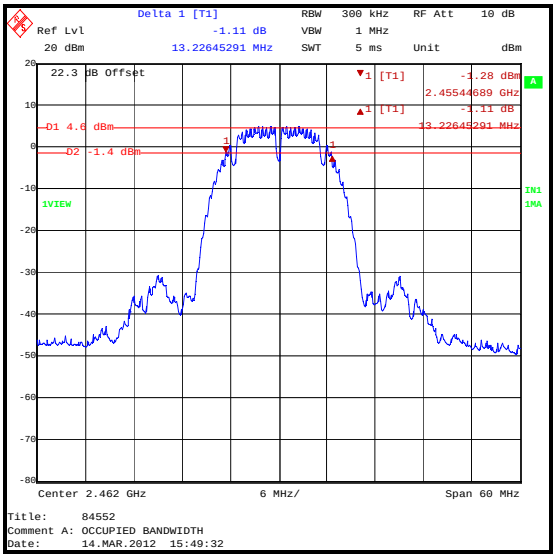
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	13.106	≥0.5	12.606	Complied
Middle	13.106	≥0.5	12.606	Complied
Top	13.226	≥0.5	12.726	Complied



Bottom Channel



Middle Channel

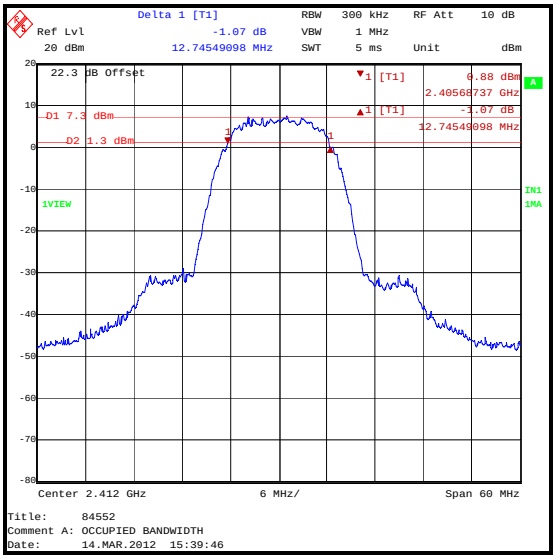


Top Channel

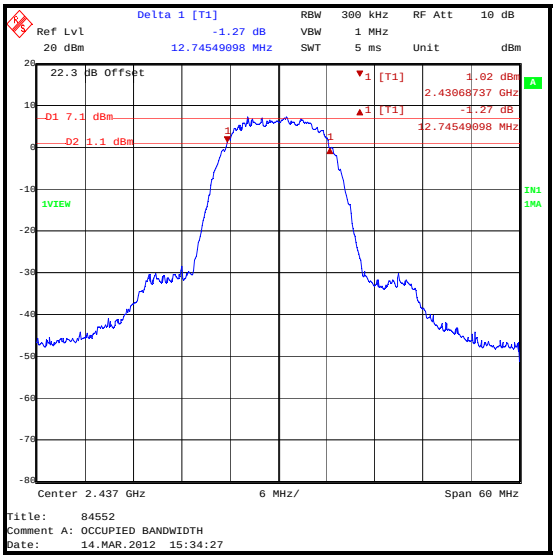
Transmitter 6 dB Emission Bandwidth (continued)

Results: 802.11b / 11 Mbps / 20 MHz

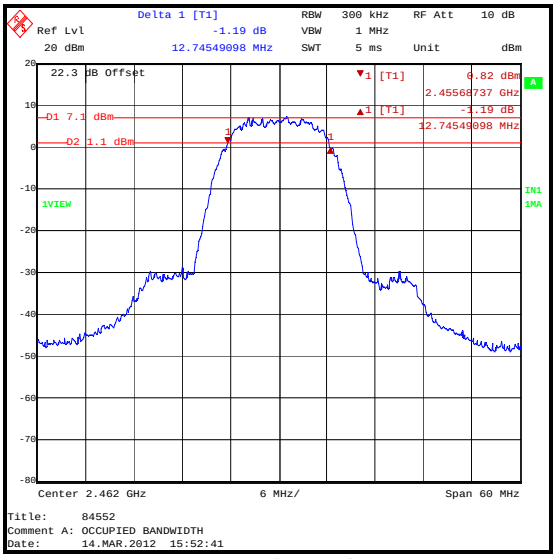
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	12.745	≥0.5	12.245	Complied
Middle	12.745	≥0.5	12.245	Complied
Top	12.745	≥0.5	12.245	Complied



Bottom Channel



Middle Channel

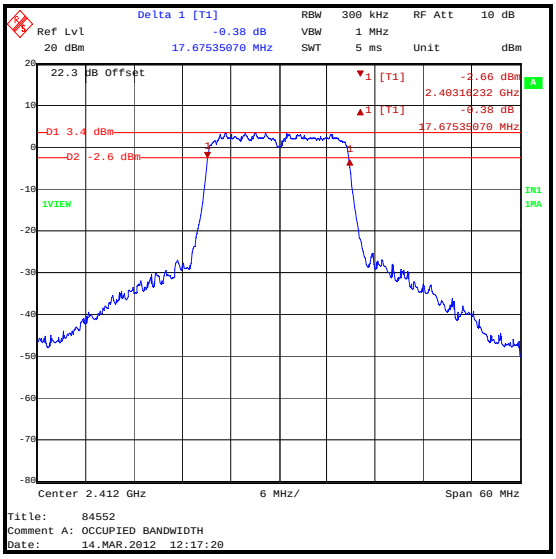


Top Channel

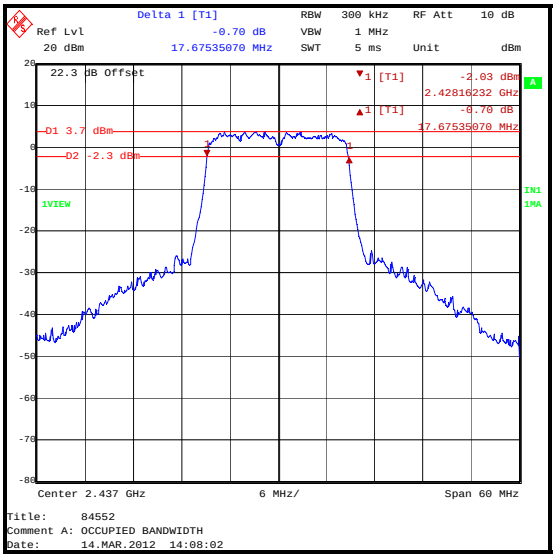
Transmitter 6 dB Emission Bandwidth (continued)

Results: 802.11n / 13 Mbps / 20 MHz

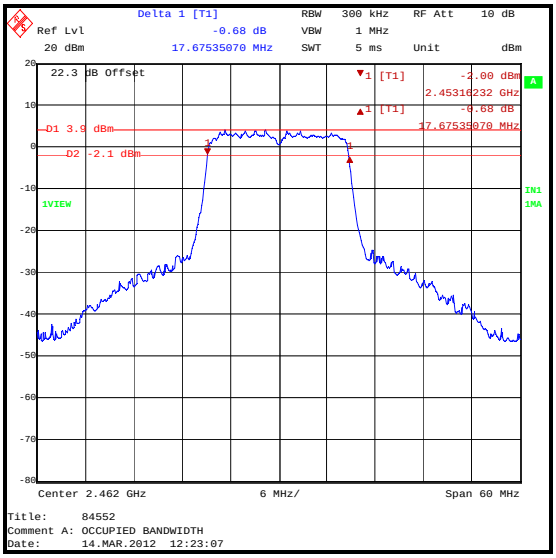
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.675	≥0.5	17.175	Complied
Middle	17.675	≥0.5	17.175	Complied
Top	17.675	≥0.5	17.175	Complied



Bottom Channel



Middle Channel

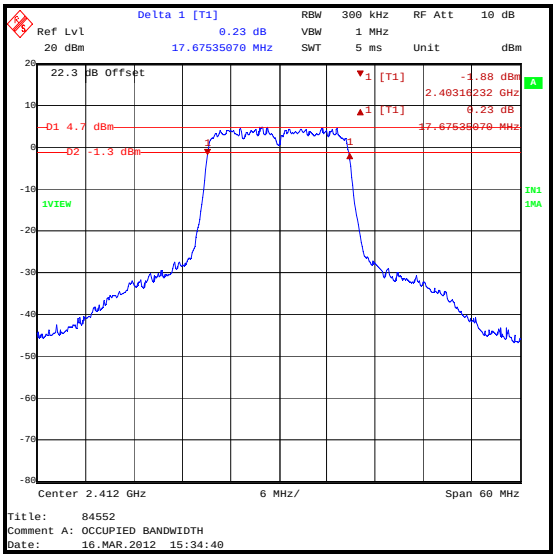


Top Channel

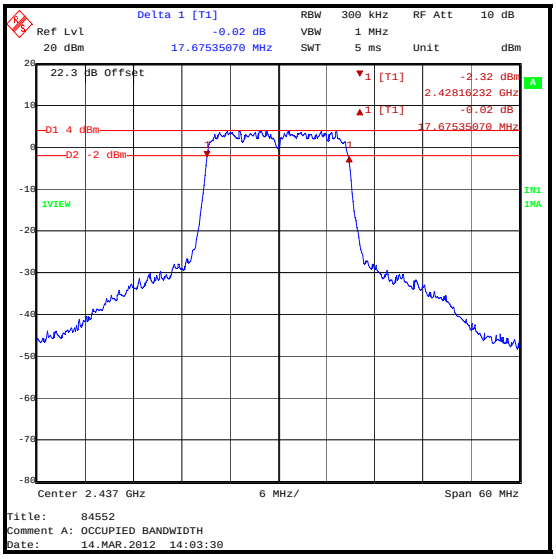
Transmitter 6 dB Bandwidth (continued)

Results: 802.11n / 39 Mbps / 20 MHz

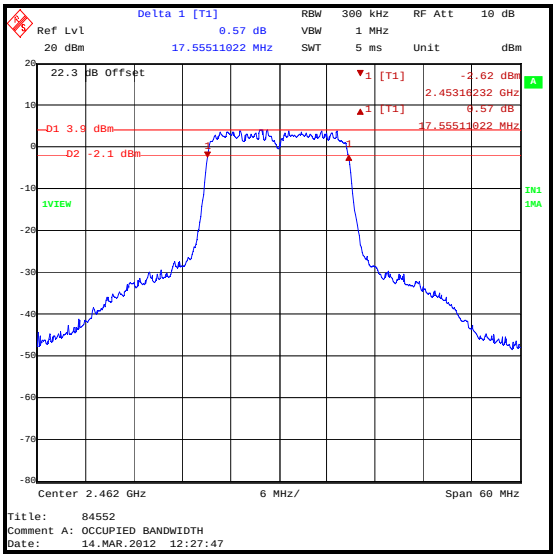
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.675	≥0.5	17.175	Complied
Middle	17.675	≥0.5	17.175	Complied
Top	17.555	≥0.5	17.055	Complied



Bottom Channel



Middle Channel

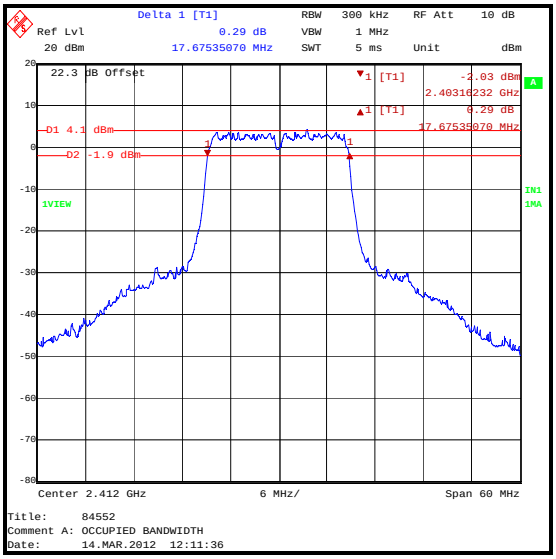


Top Channel

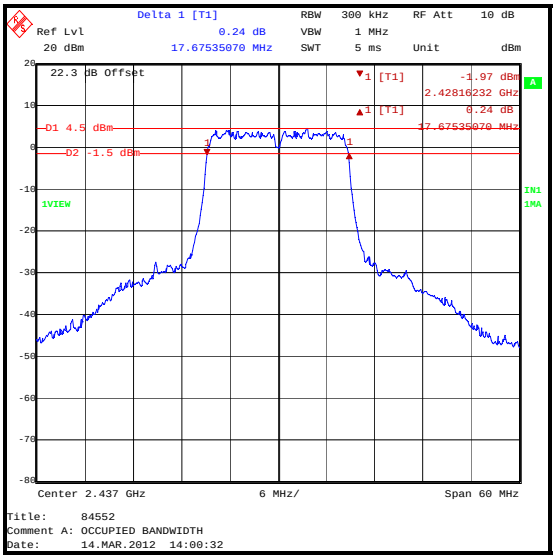
Transmitter 6 dB Bandwidth (continued)

Results: 802.11n / 78 Mbps / 20 MHz

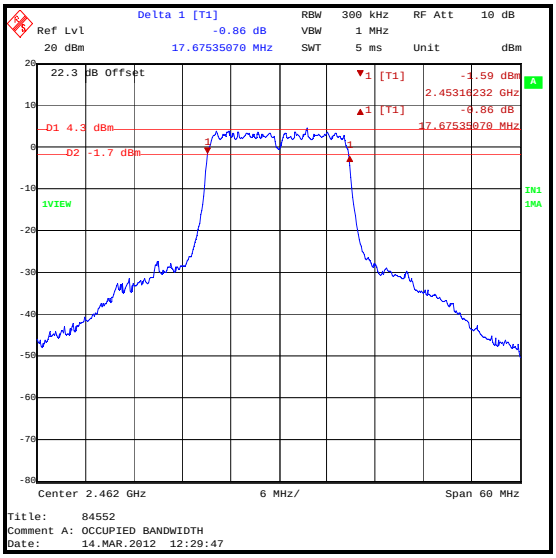
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.675	≥0.5	17.175	Complied
Middle	17.675	≥0.5	17.175	Complied
Top	17.675	≥0.5	17.175	Complied



Bottom Channel



Middle Channel

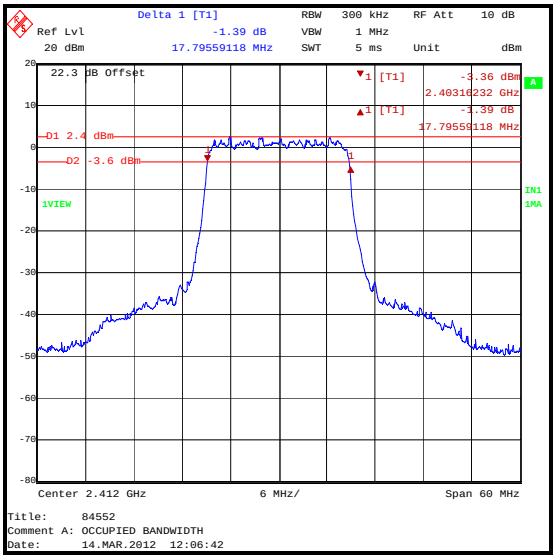


Top Channel

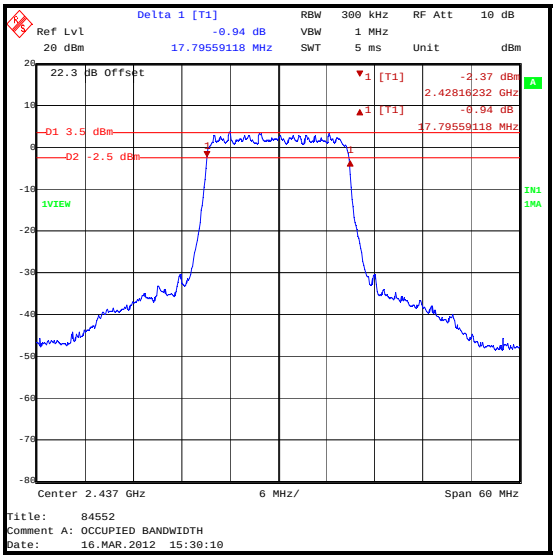
Transmitter 6 dB Bandwidth (continued)

Results: 802.11n / 130 Mbps / 20 MHz

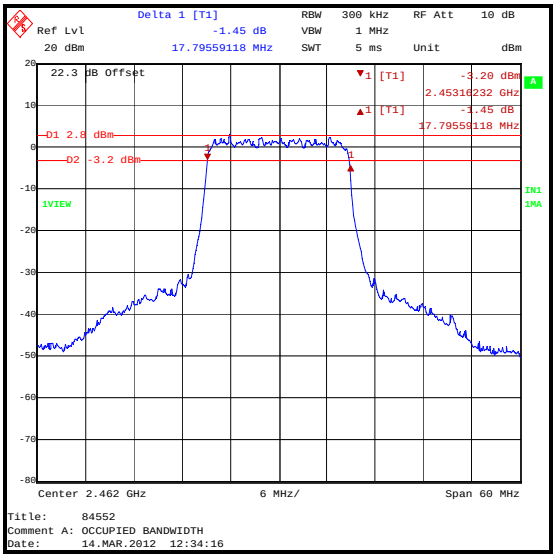
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	17.796	≥0.5	17.296	Complied
Middle	17.796	≥0.5	17.296	Complied
Top	17.796	≥0.5	17.296	Complied



Bottom Channel



Middle Channel

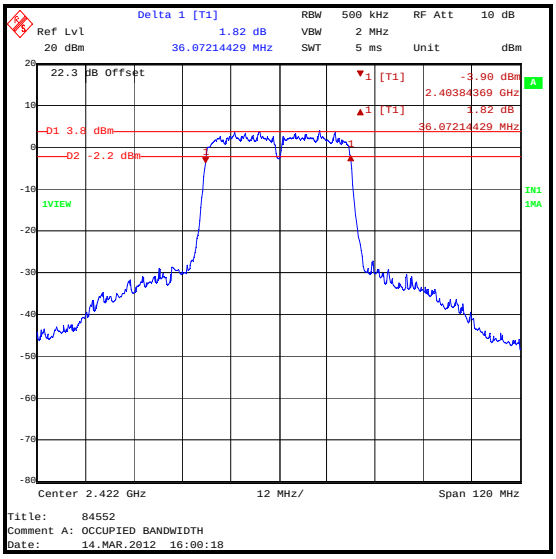


Top Channel

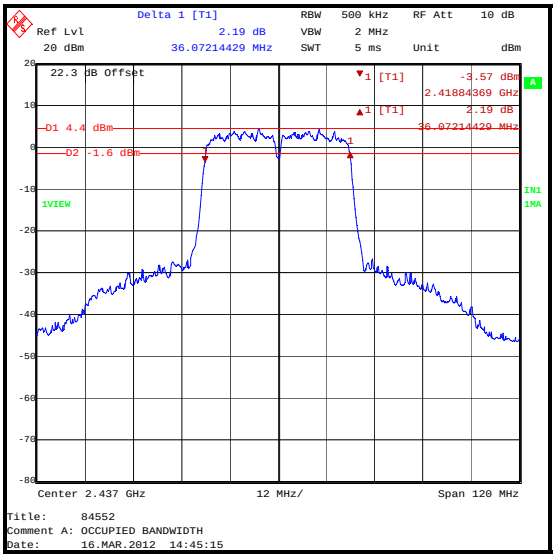
Transmitter 6 dB Bandwidth (continued)

Results: 802.11n / 13 Mbps / 40 MHz

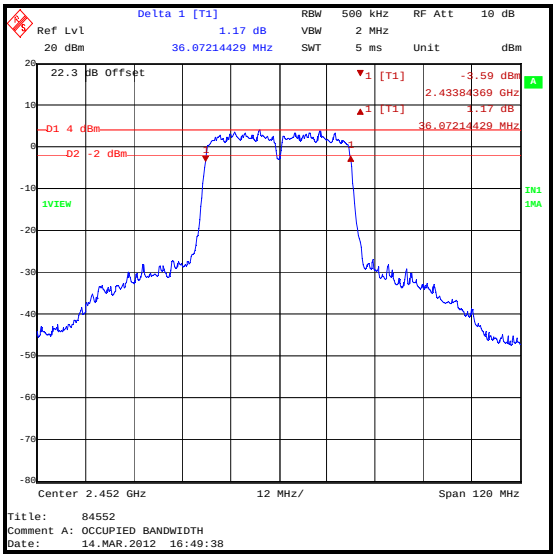
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	36.072	≥0.5	35.572	Complied
Middle	36.072	≥0.5	35.572	Complied
Top	36.072	≥0.5	35.572	Complied



Bottom Channel



Middle Channel

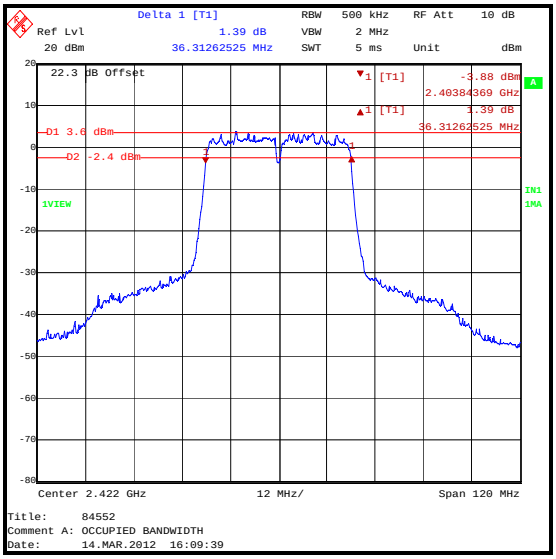


Top Channel

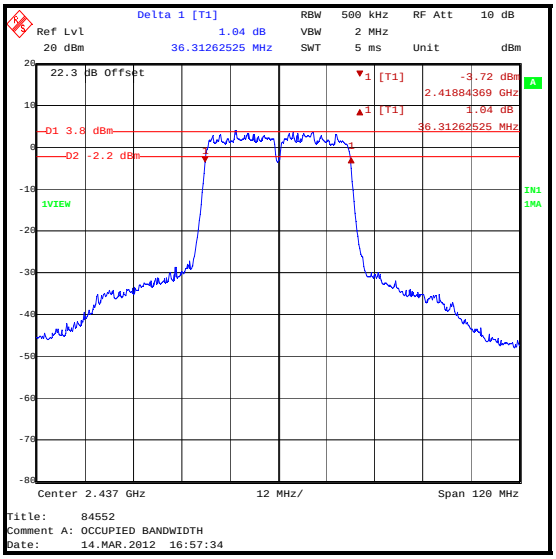
Transmitter 6 dB Bandwidth (continued)

Results: 802.11n / 39 Mbps / 40 MHz

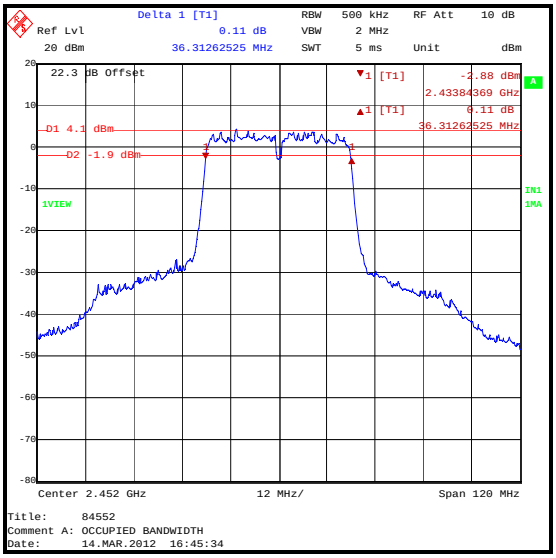
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	36.313	≥0.5	35.813	Complied
Middle	36.313	≥0.5	35.813	Complied
Top	36.313	≥0.5	35.813	Complied



Bottom Channel



Middle Channel

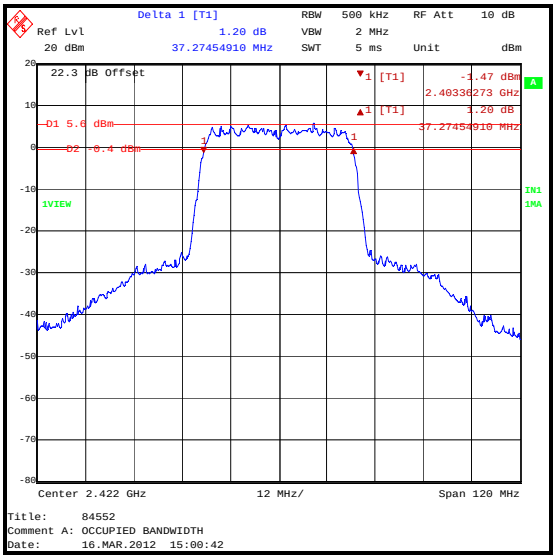


Top Channel

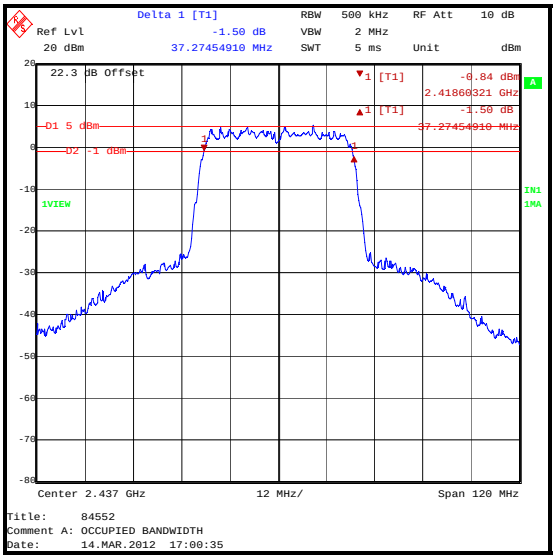
Transmitter 6 dB Bandwidth (continued)

Results: 802.11n / 78 Mbps / 40 MHz

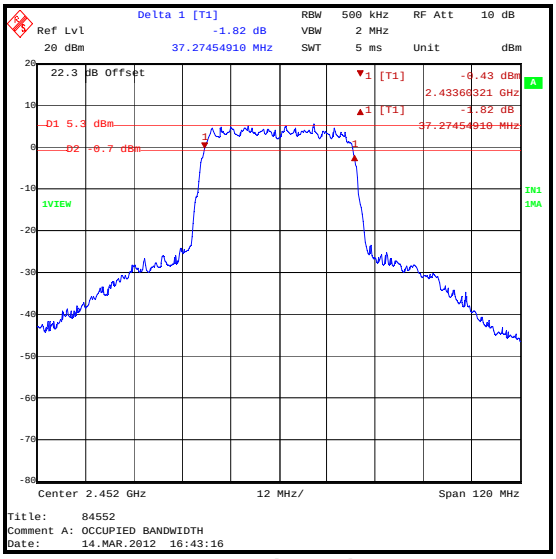
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	37.275	≥0.5	36.775	Complied
Middle	37.275	≥0.5	36.775	Complied
Top	37.275	≥0.5	36.775	Complied



Bottom Channel



Middle Channel

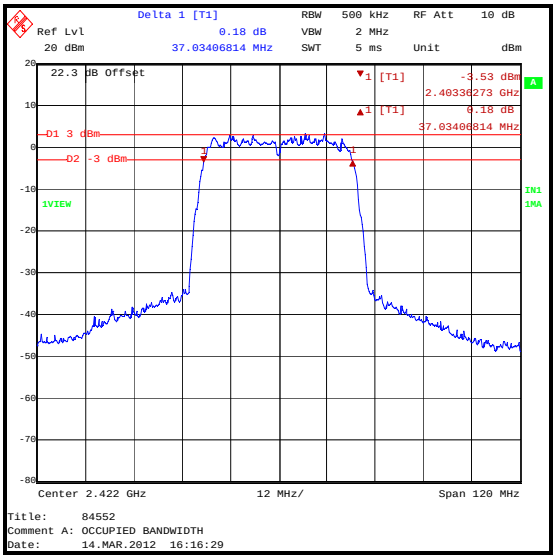


Top Channel

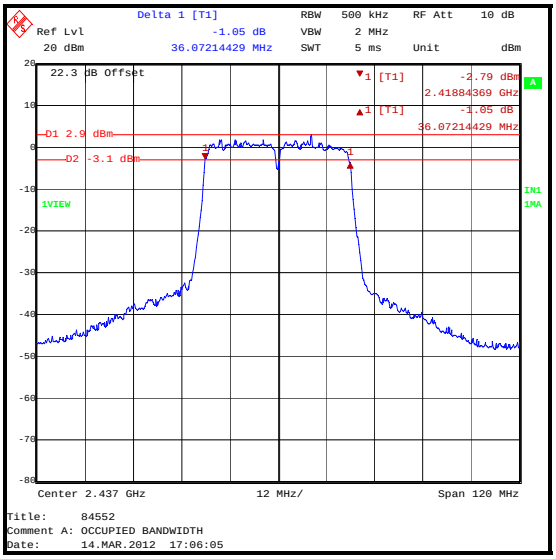
Transmitter 6 dB Bandwidth (continued)

Results: 802.11n / 130 Mbps / 40 MHz

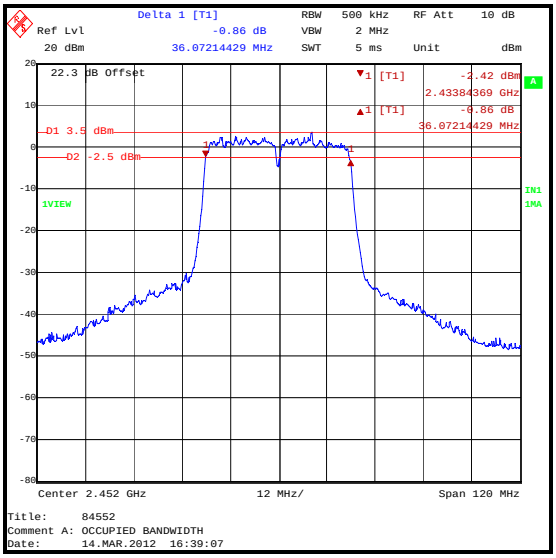
Channel	6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	37.034	≥0.5	36.534	Complied
Middle	36.072	≥0.5	35.572	Complied
Top	36.072	≥0.5	35.572	Complied



Bottom Channel



Middle Channel



Top Channel

5.2.5. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	14 March 2012 & 16 March 2012
Test Sample Serial No:	Not stated		

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

Environmental Conditions:

Temperature (°C):	20
Relative Humidity (%):	23

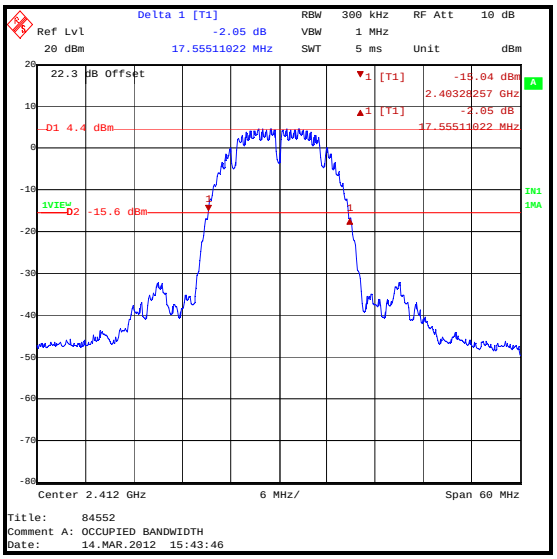
Note(s):

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.

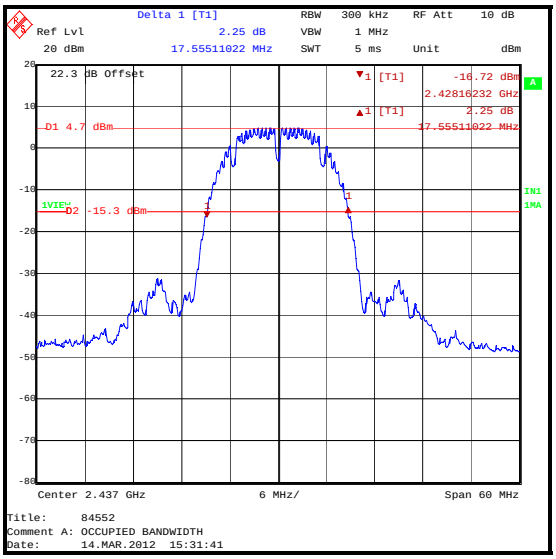
Transmitter 20 dB Bandwidth (continued)

Results: 802.11b / 1 Mbps / 20 MHz

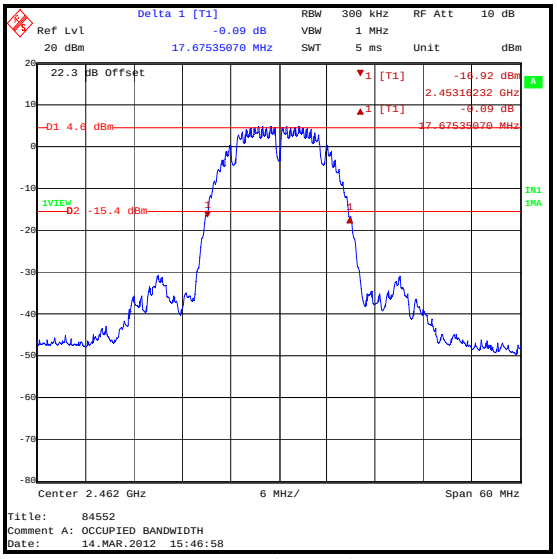
Channel	20 dB Bandwidth (MHz)
Bottom	17.555
Middle	17.555
Top	17.675



Bottom Channel



Middle Channel

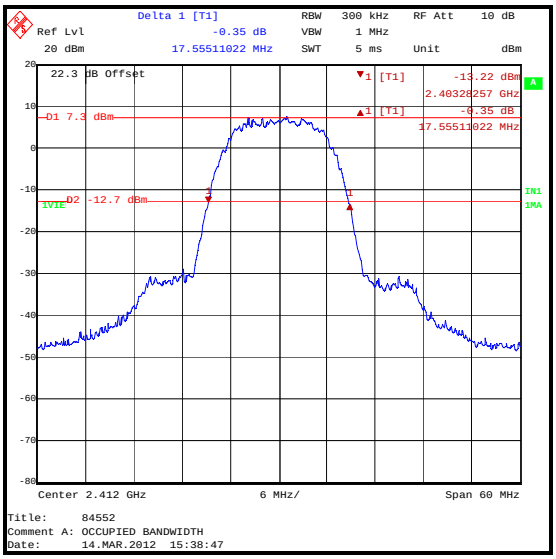


Top Channel

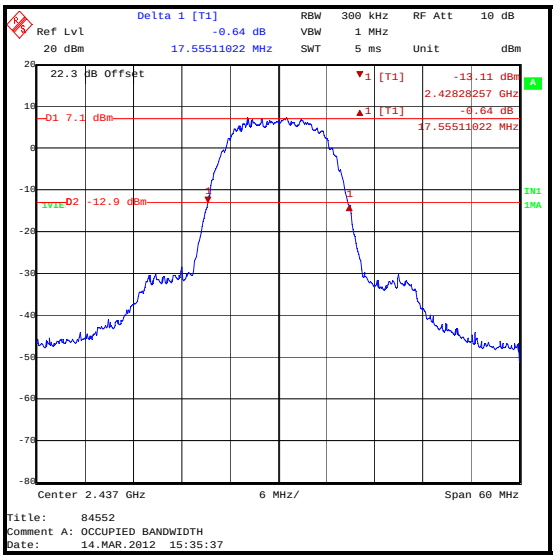
Transmitter 20 dB Bandwidth (continued)

Results: 802.11b / 11 Mbps / 20 MHz

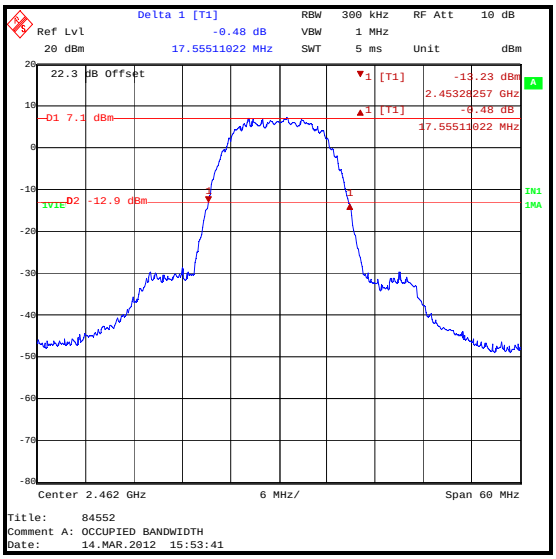
Channel	20 dB Bandwidth (MHz)
Bottom	17.555
Middle	17.555
Top	17.555



Bottom Channel



Middle Channel

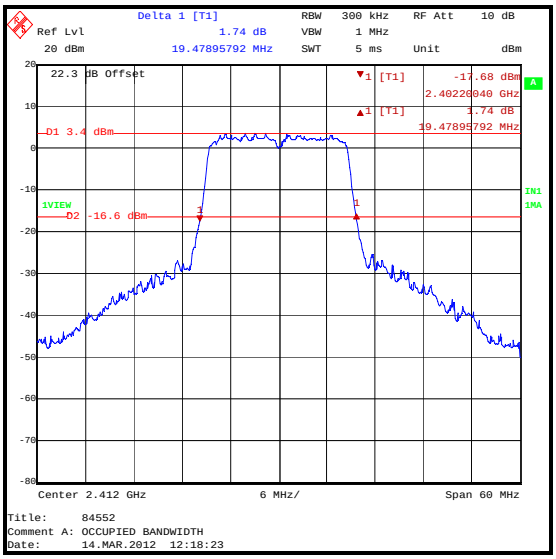


Top Channel

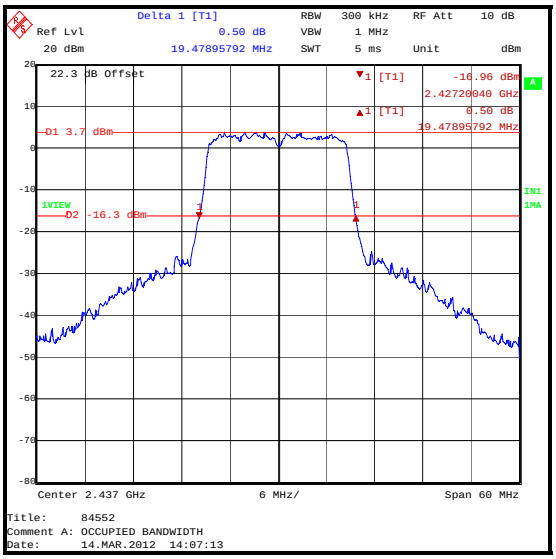
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 13 Mbps / 20 MHz

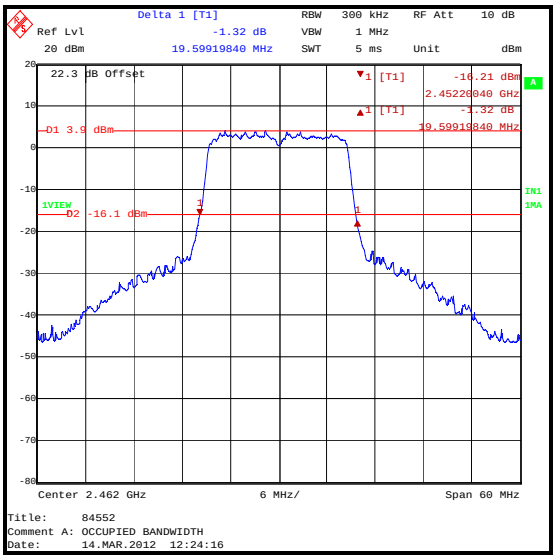
Channel	20 dB Bandwidth (MHz)
Bottom	19.479
Middle	19.479
Top	19.599



Bottom Channel



Middle Channel

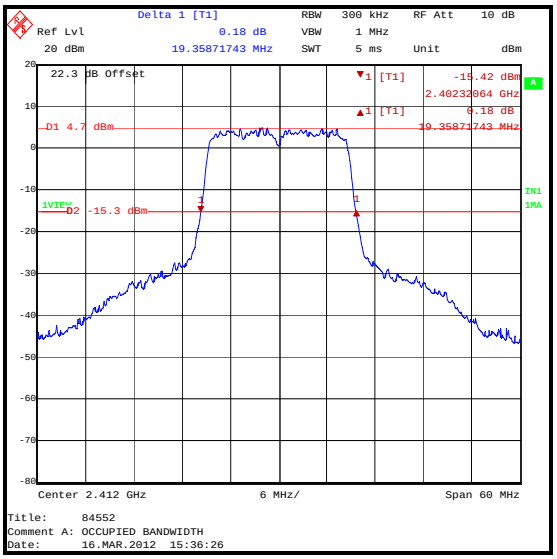


Top Channel

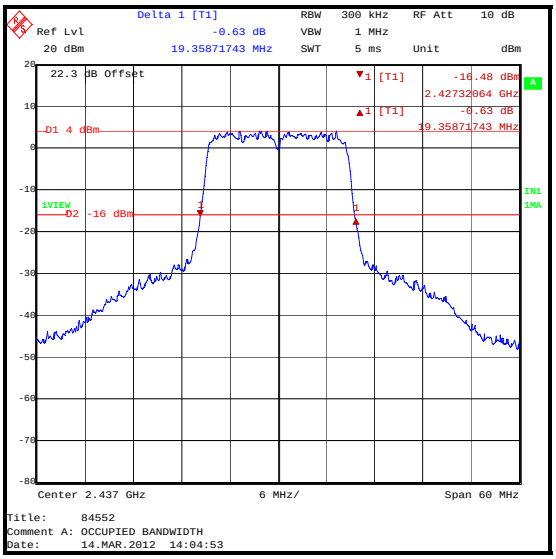
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 39 Mbps / 20 MHz

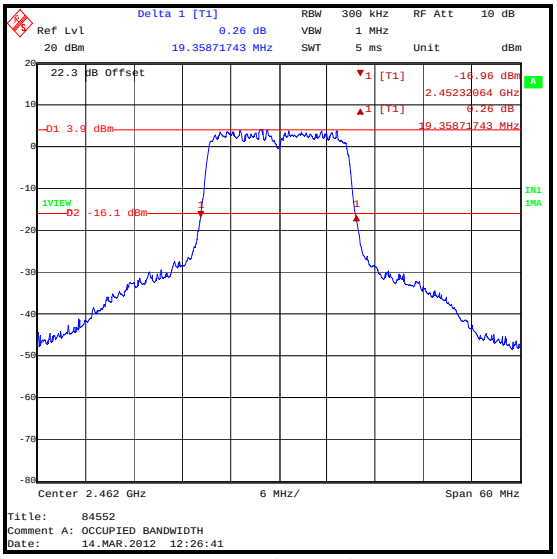
Channel	20 dB Bandwidth (MHz)
Bottom	19.359
Middle	19.359
Top	19.359



Bottom Channel



Middle Channel

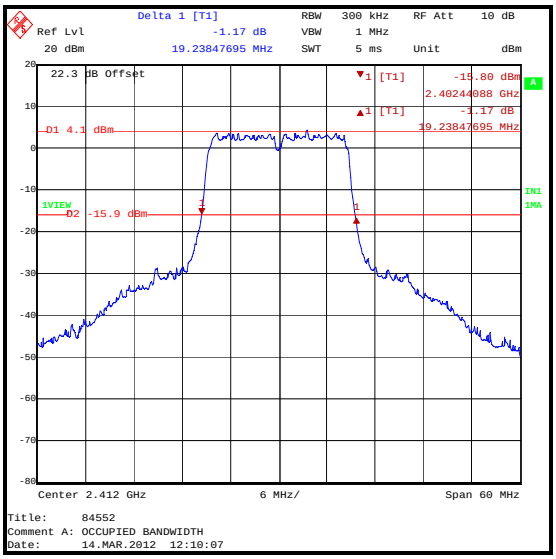


Top Channel

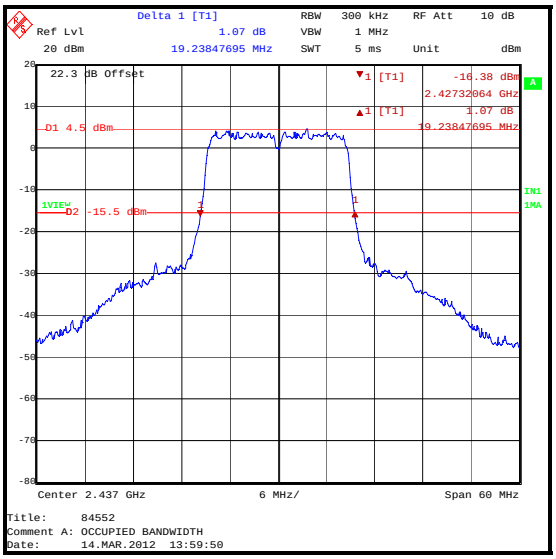
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 78 Mbps / 20 MHz

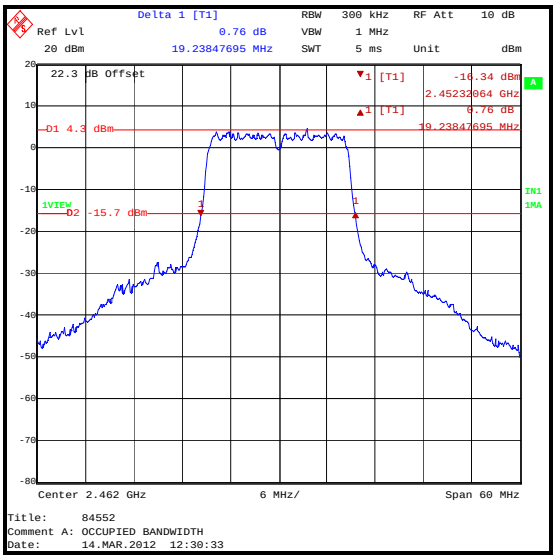
Channel	20 dB Bandwidth (MHz)
Bottom	19.238
Middle	19.238
Top	19.238



Bottom Channel



Middle Channel

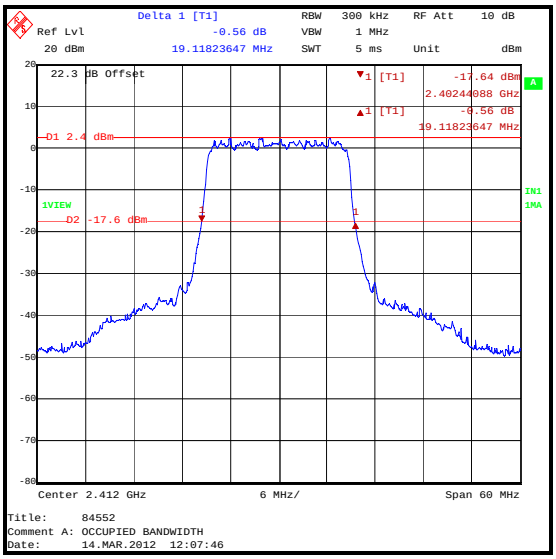


Top Channel

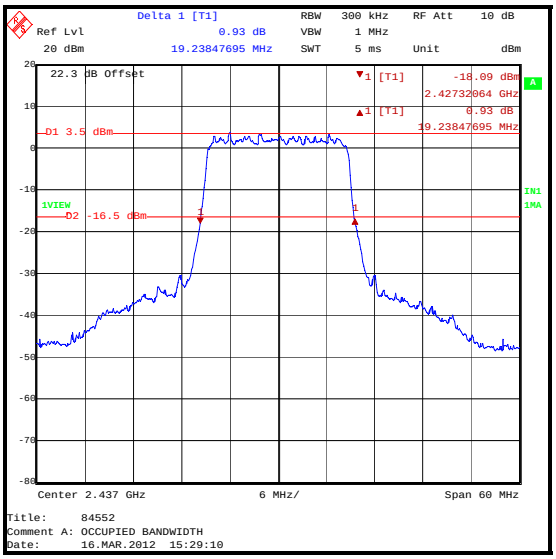
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 130 Mbps / 20 MHz

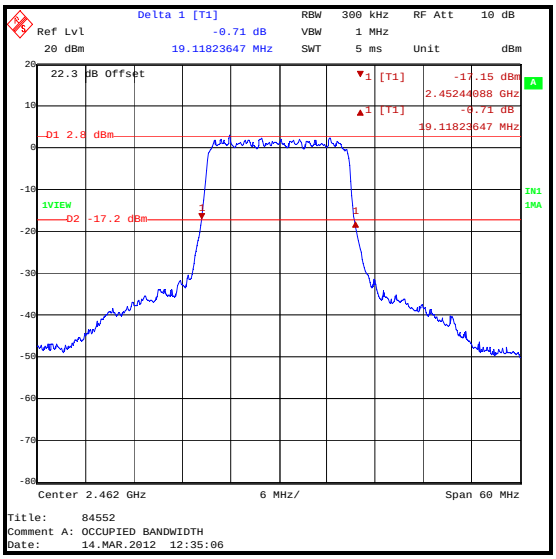
Channel	20 dB Bandwidth (MHz)
Bottom	19.118
Middle	19.238
Top	19.118



Bottom Channel



Middle Channel

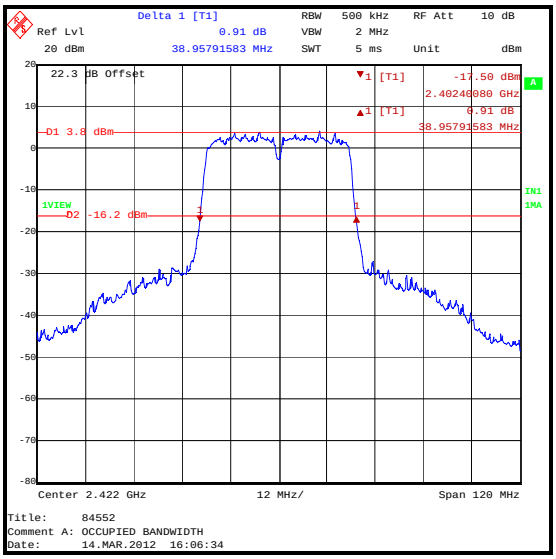


Top Channel

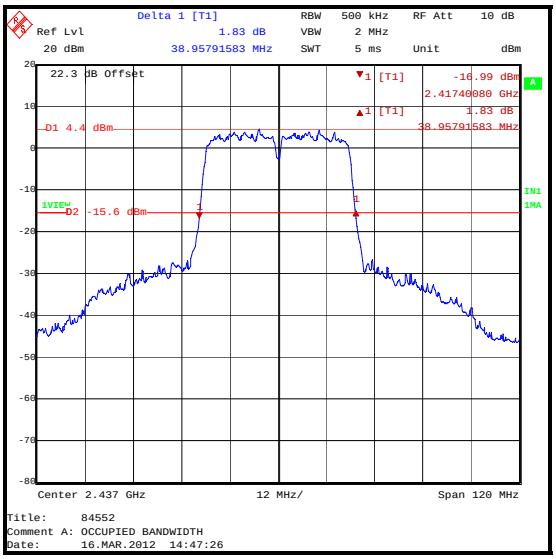
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 13 Mbps / 40 MHz

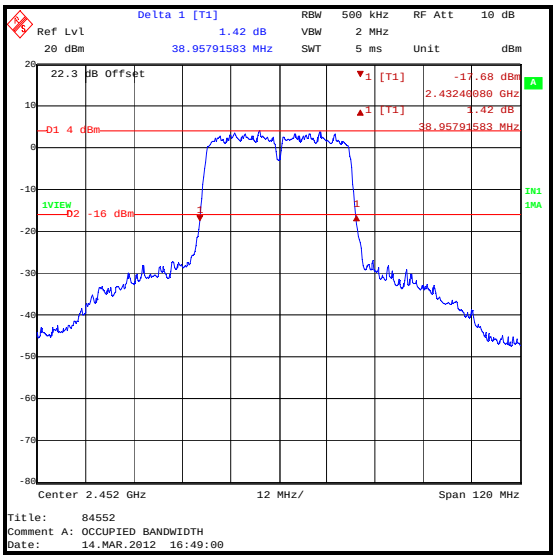
Channel	20 dB Bandwidth (MHz)
Bottom	38.958
Middle	38.958
Top	38.958



Bottom Channel



Middle Channel

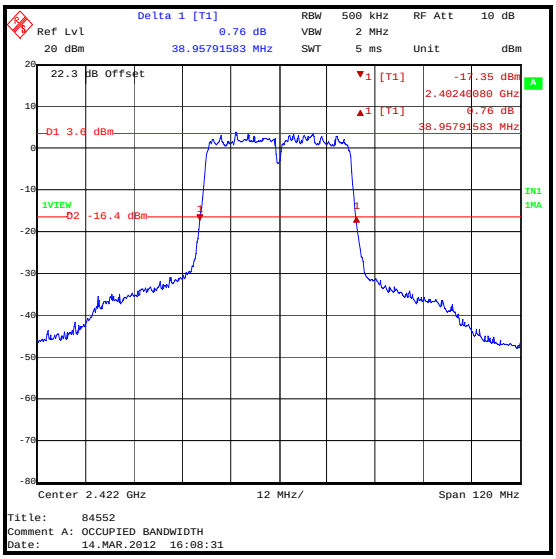


Top Channel

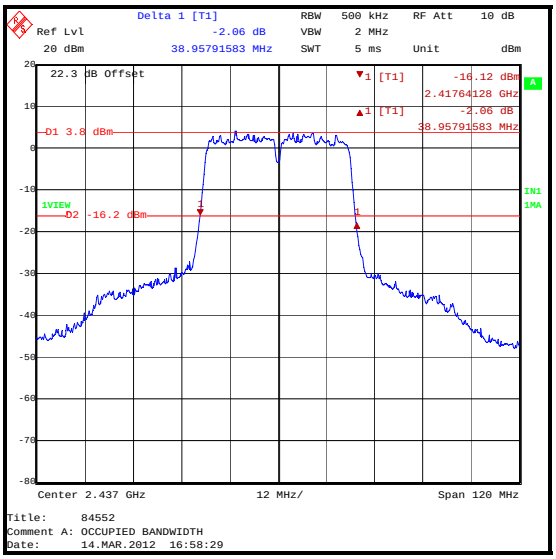
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 39 Mbps / 40 MHz

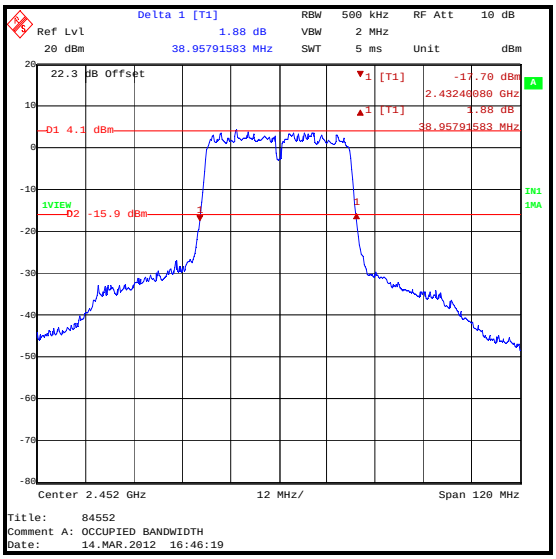
Channel	20 dB Bandwidth (MHz)
Bottom	38.958
Middle	38.958
Top	38.958



Bottom Channel



Middle Channel

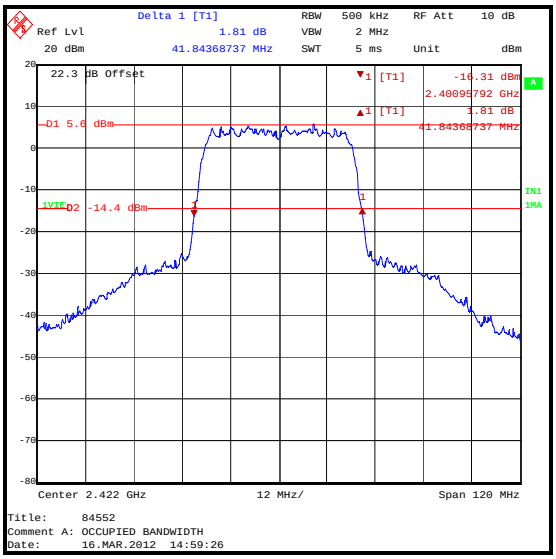


Top Channel

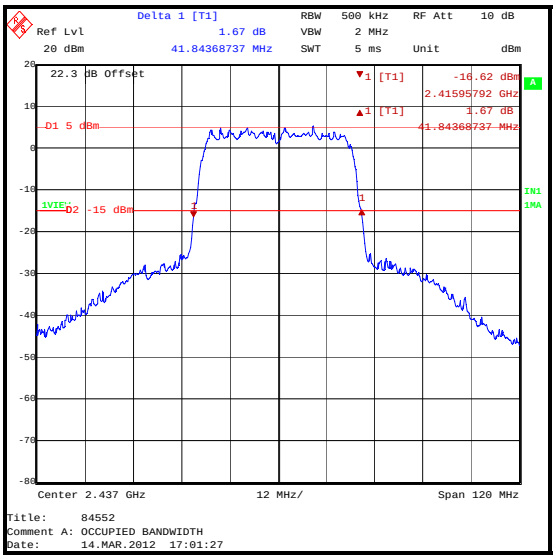
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 78 Mbps / 40 MHz

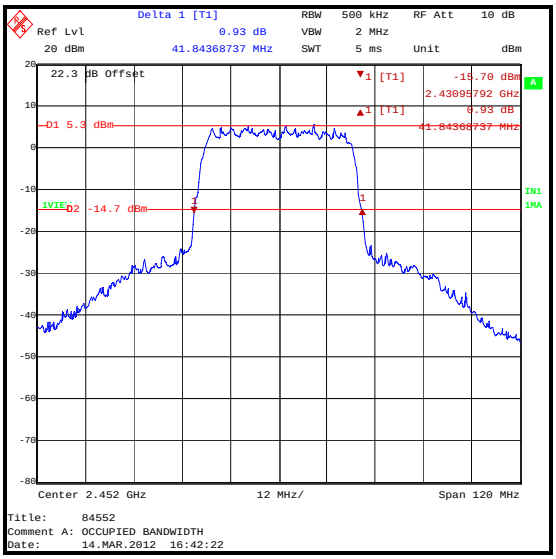
Channel	20 dB Bandwidth (MHz)
Bottom	41.844
Middle	41.844
Top	41.844



Bottom Channel



Middle Channel

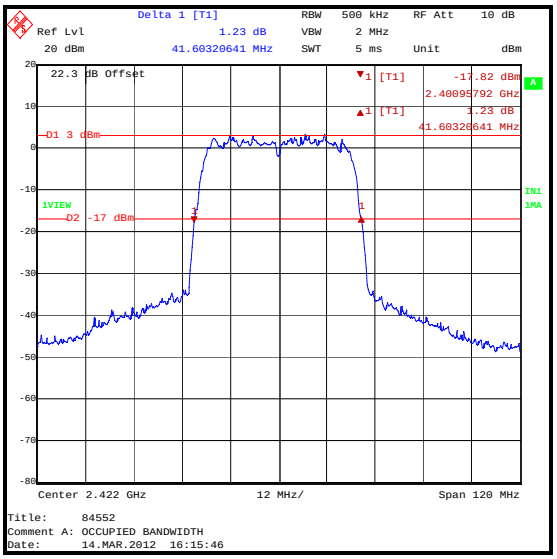


Top Channel

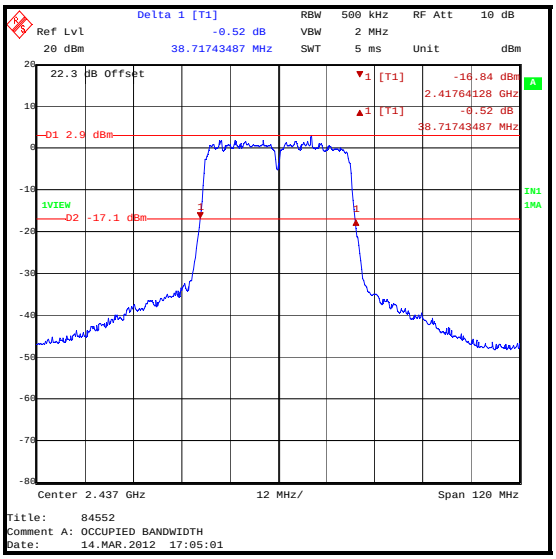
Transmitter 20 dB Bandwidth (continued)

Results: 802.11n / 130 Mbps / 40 MHz

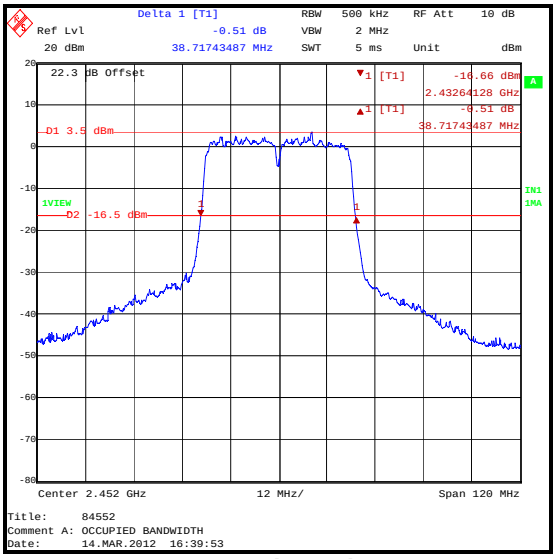
Channel	20 dB Bandwidth (MHz)
Bottom	41.603
Middle	38.717
Top	38.717



Bottom Channel



Middle Channel



Top Channel

5.2.6. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Sarah Williams	**Test Date:**	16 March 2012
Test Sample Serial No:	Not stated		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	21

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. For 802.11b the worst case result was compared to the limit. For 802.11n the two results were 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 e.g. closest to the limit, for 20 MHz channels (CCK / 5.5 Mbps) and 40 MHz channels (64QAM / 104 Mbps / MCS13) 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. All data rates were tested on the bottom, middle and top channels in 20 MHz and 40 MHz channel widths to determine the worst case configuration. The configurations that produced the highest PSD levels were recorded in the following tables.
7. *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 (BWCF) was calculated as shown below:

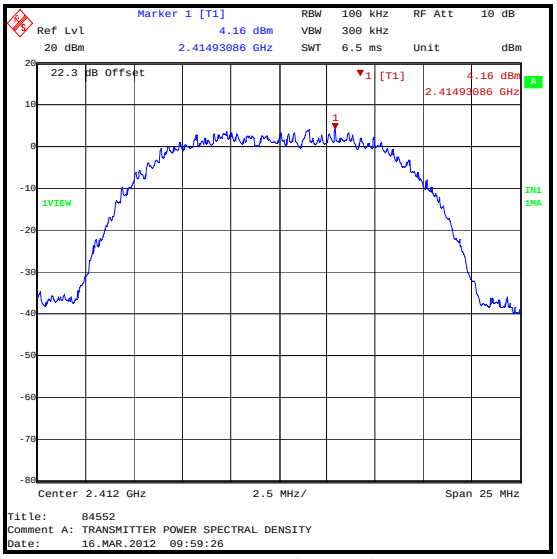
$$10 \log_{10} (3 \text{ kHz} / 100 \text{ kHz}) = -15.2 \text{ dB}$$

Transmitter Power Spectral Density (continued)

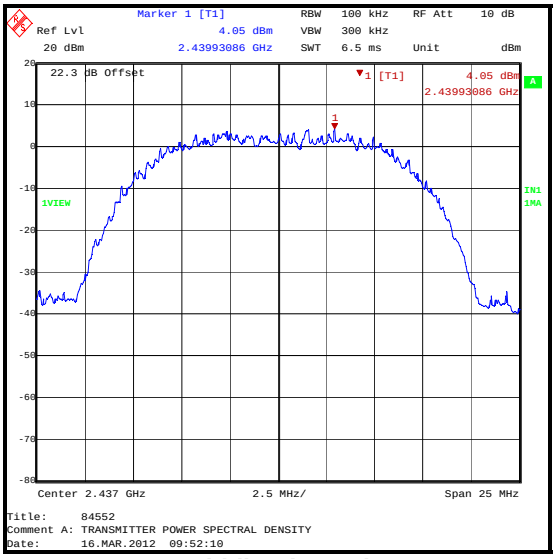
Results: 802.11b / 5.5 Mbps / 20 MHz

Channel	PSD at Port 0 (dBm / 100 kHz)	PSD at Port 1 (dBm / 100 kHz)	Highest PSD (dBm / 100 kHz)	*Highest PSD (dBm / 3 kHz)	PSD Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	4.2	1.8	4.2	-11.0	8.0	19.0	Complied
Middle	4.1	2.3	4.1	-11.1	8.0	19.1	Complied
Top	4.0	2.9	4.0	-11.2	8.0	19.2	Complied

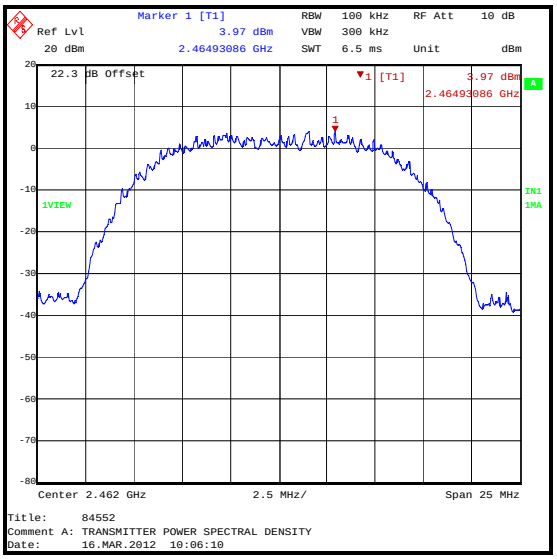
Results: 802.11b / 5.5 Mbps / 20 MHz / Port 0



Bottom Channel



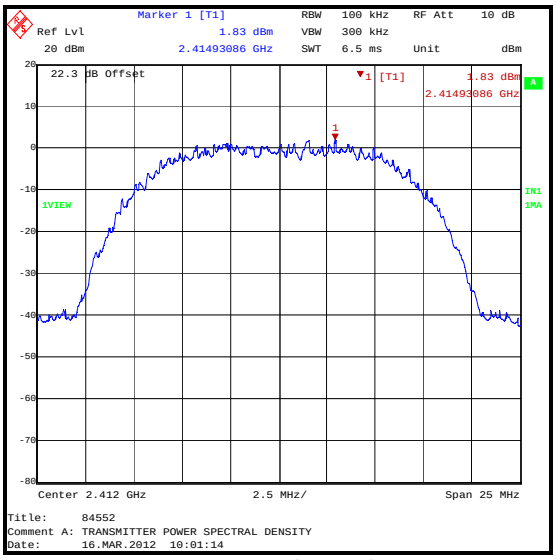
Middle Channel



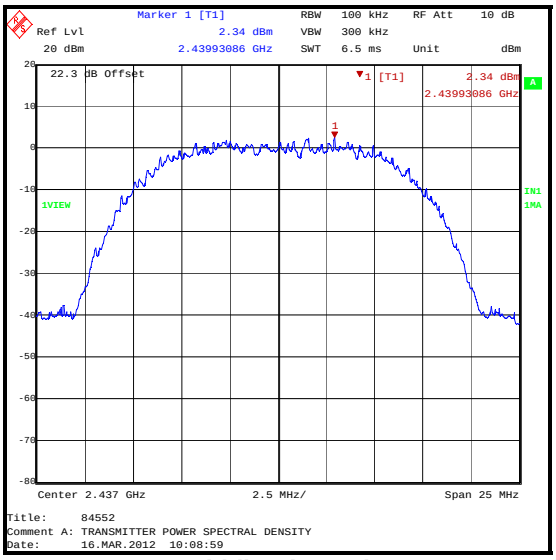
Top Channel

Transmitter Power Spectral Density (continued)

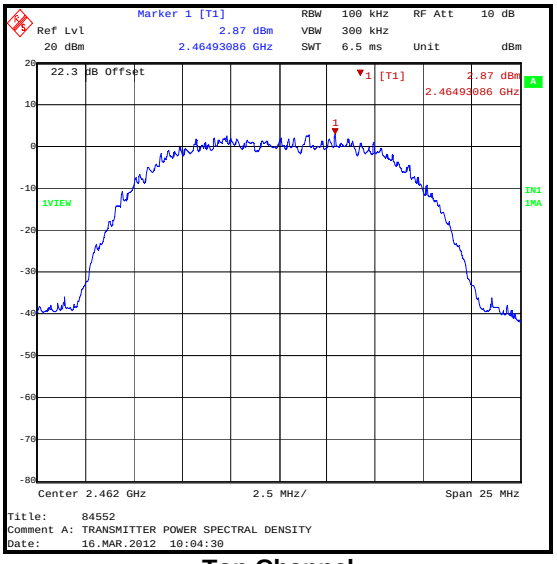
Results: 802.11b / 5.5 Mbps / 20 MHz / Port 1



Bottom Channel



Middle Channel



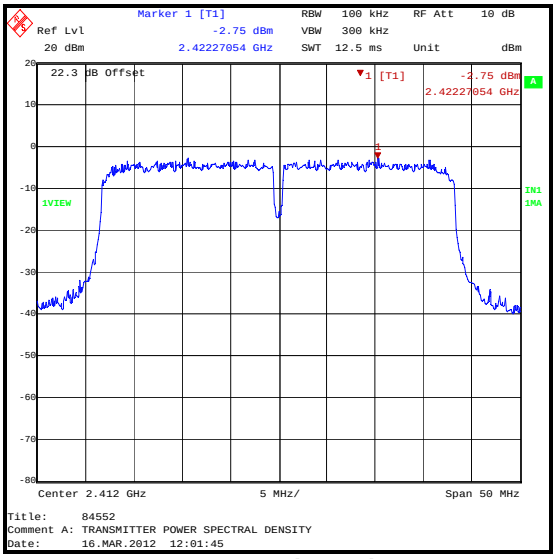
Top Channel

Transmitter Power Spectral Density (continued)

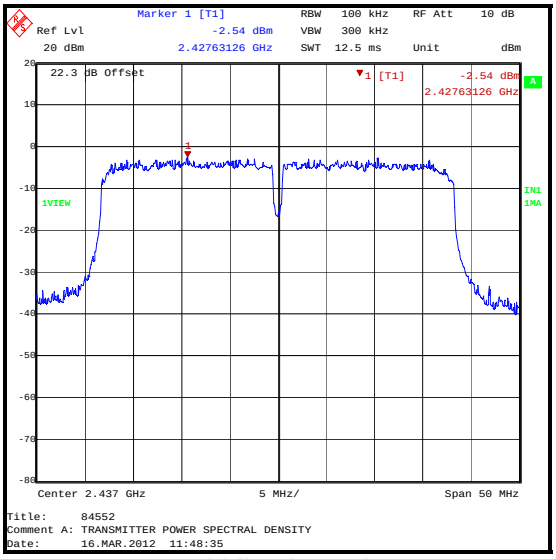
Results: 802.11n / 104 Mbps / 40 MHz

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	-2.8	-4.6	-0.6	-15.8	8.0	23.8	Complied
Middle	-2.5	-4.2	-0.3	-15.5	8.0	23.5	Complied
Top	-2.4	-4.2	-0.2	-15.4	8.0	23.4	Complied

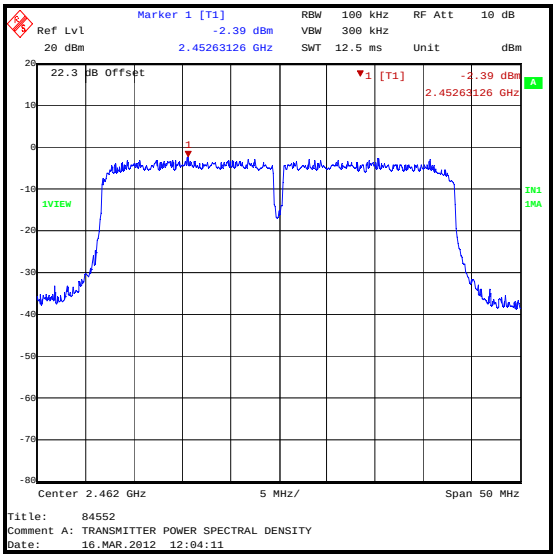
Results: 802.11n / 104 Mbps / 40 MHz / Port 0



Bottom Channel



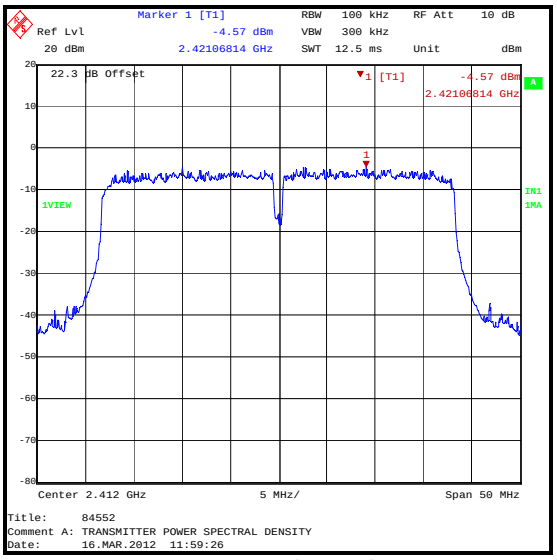
Middle Channel



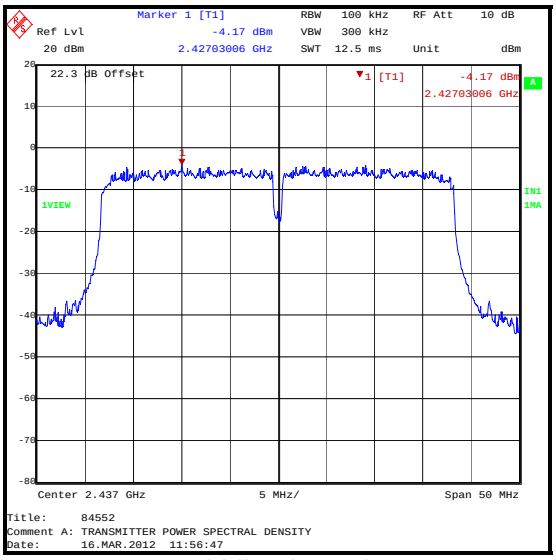
Top Channel

Transmitter Power Spectral Density (continued)

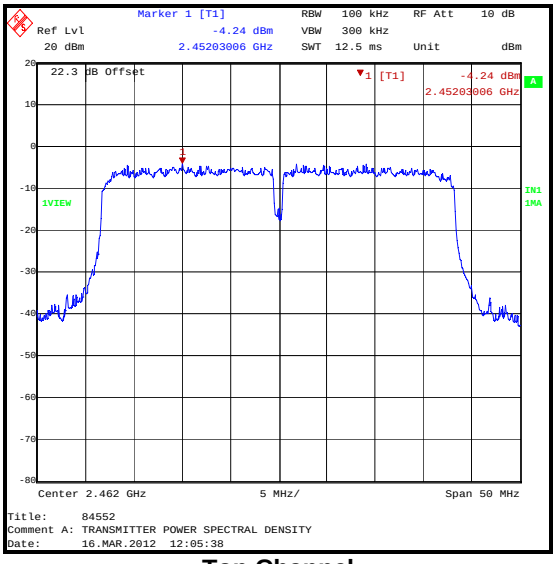
Results: 802.11n / 104 Mbps / 40 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

5.2.7. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	14 March 2012 & 15 March 2012
Test Sample Serial No:	Not stated		

FCC Reference:	Part 15.247(b)(3)
Industry Canada Reference:	RSS-Gen 4.8 & RSS-210 A8.4(4)
Test Method Used:	As detailed in FCC KDB 558074 Section 5.2.1.2

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	21

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. For 802.11b the worst case result was compared to the limit. For 802.11n the two results were 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 -0.8 dBi. For 802.11b the declared antenna gain was added to the port that exhibited the highest conducted power in order to calculate the EIRP. For 802.11n the declared antenna gain was added to the combined ports 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)

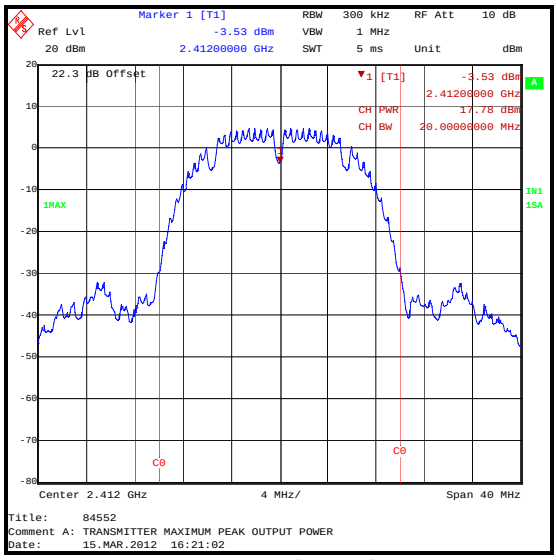
Results: 802.11b / 1 Mbps / 20 MHz

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Highest Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	17.8	15.6	17.8	30.0	12.2	Complied
Middle	17.8	16.3	17.8	30.0	12.2	Complied
Top	17.8	16.8	17.8	30.0	12.2	Complied

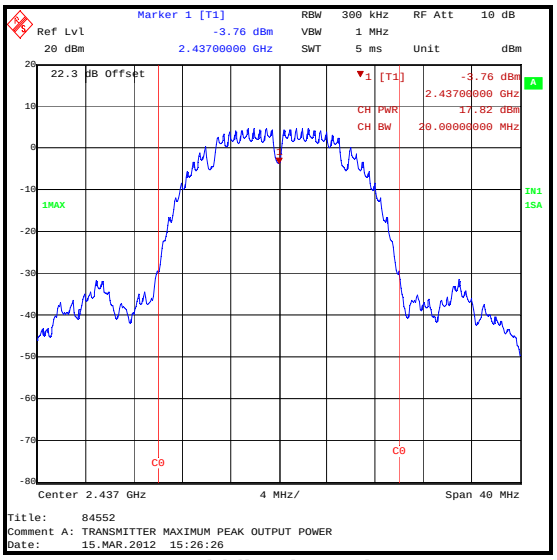
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	17.8	-0.8	17.0	36.0	19.0	Complied
Middle	17.8	-0.8	17.0	36.0	19.0	Complied
Top	17.8	-0.8	17.0	36.0	19.0	Complied

Transmitter Maximum Peak Output Power (continued)

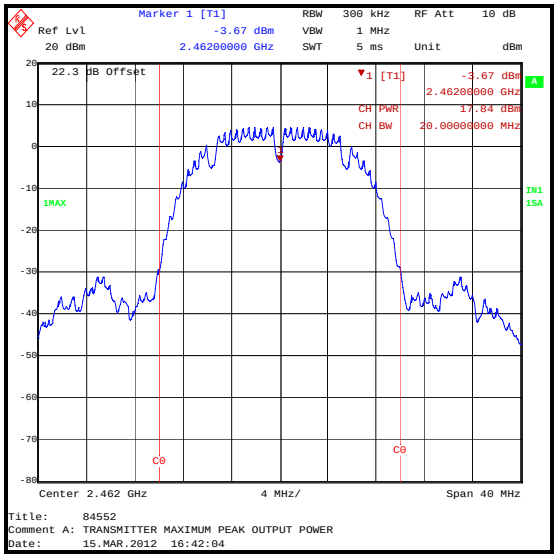
Results: 802.11b / 1 Mbps / 20 MHz / Port 0



Bottom Channel



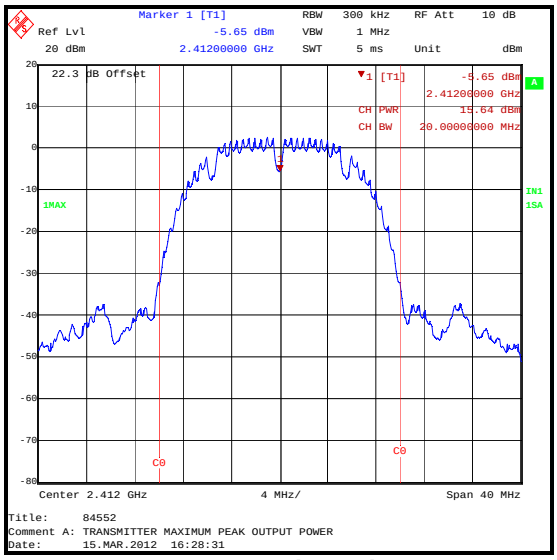
Middle Channel



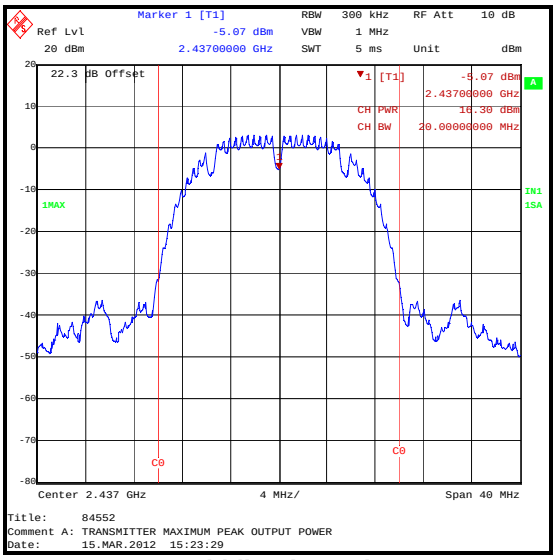
Top Channel

Transmitter Maximum Peak Output Power (continued)

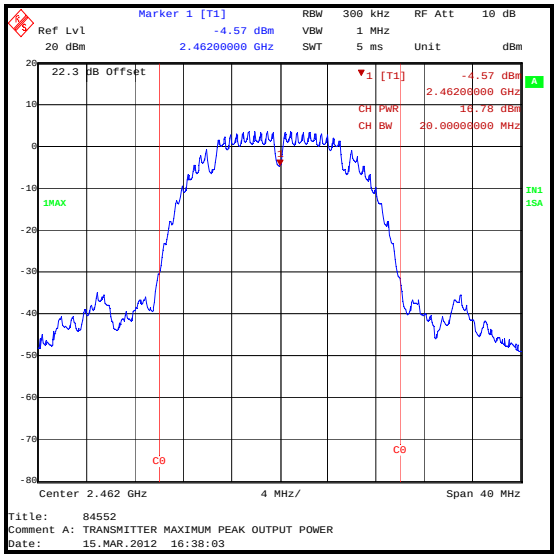
Results: 802.11b / 1 Mbps / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

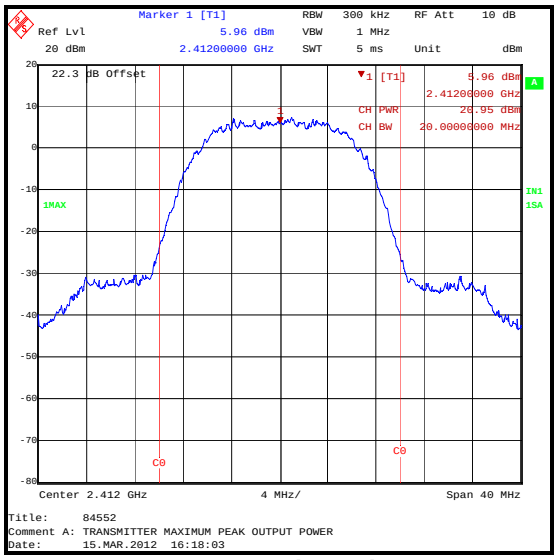
Results: 802.11b / 11 Mbps / 20 MHz

Channel	Conducted Peak Power Port 0 (dBm)	Conducted Peak Power Port 1 (dBm)	Highest Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	21.0	18.8	21.0	30.0	9.0	Complied
Middle	21.0	19.4	21.0	30.0	9.0	Complied
Top	21.1	19.7	21.1	30.0	8.9	Complied

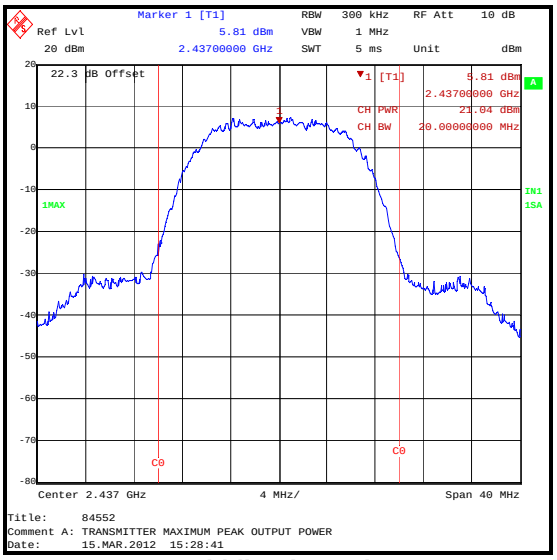
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.0	-0.8	20.2	36.0	15.8	Complied
Middle	21.0	-0.8	20.2	36.0	15.8	Complied
Top	21.1	-0.8	20.3	36.0	15.7	Complied

Transmitter Maximum Peak Output Power (continued)

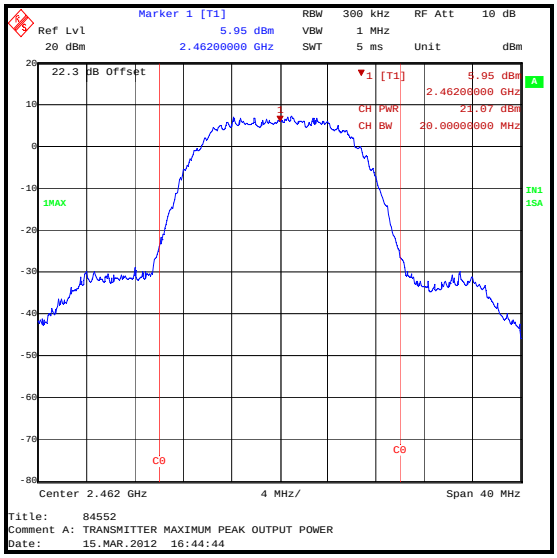
Results: 802.11b / 11 Mbps / 20 MHz / Port 0



Bottom Channel



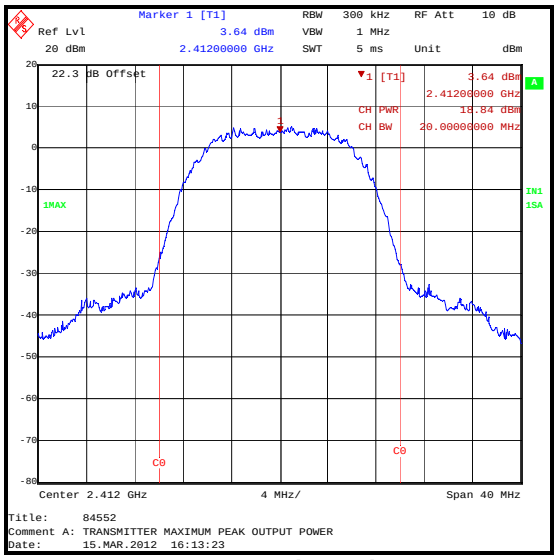
Middle Channel



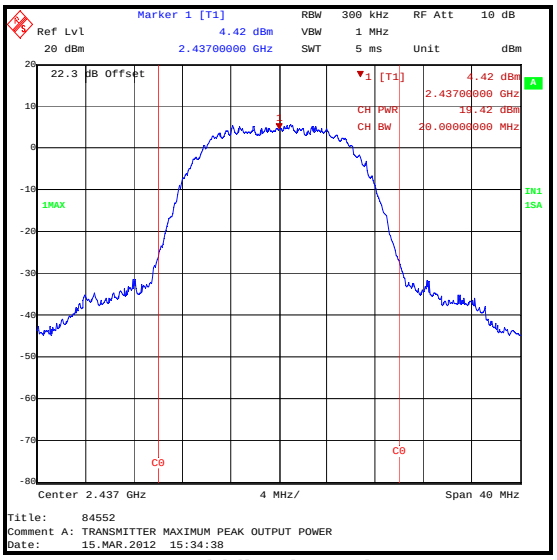
Top Channel

Transmitter Maximum Peak Output Power (continued)

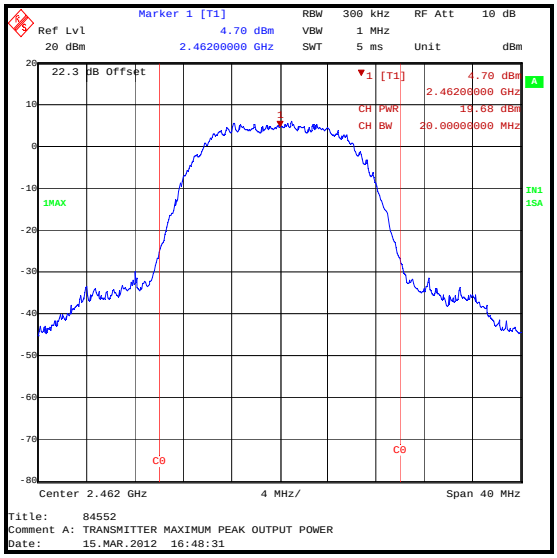
Results: 802.11b / 11 Mbps / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

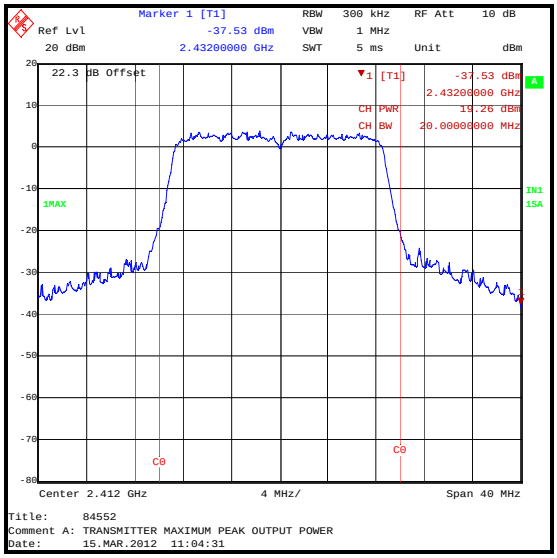
Results: 802.11n / 13 Mbps / 20 MHz

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	19.3	17.6	21.5	30.0	8.5	Complied
Middle	19.6	18.1	21.9	30.0	8.1	Complied
Top	19.4	18.4	21.9	30.0	8.1	Complied

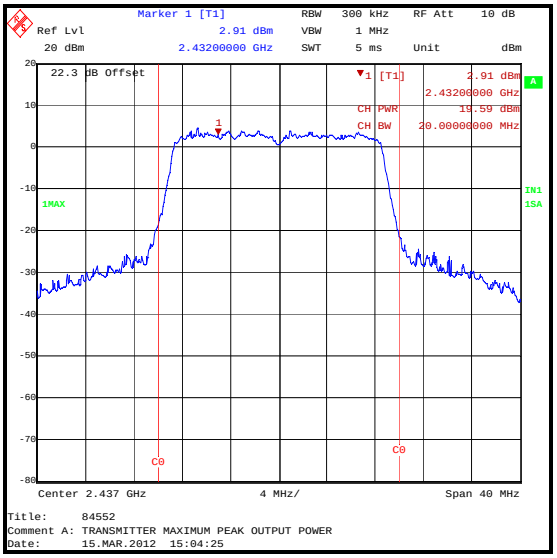
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.5	-0.8	20.7	36.0	15.3	Complied
Middle	21.9	-0.8	21.1	36.0	14.9	Complied
Top	21.9	-0.8	21.1	36.0	14.9	Complied

Transmitter Maximum Peak Output Power (continued)

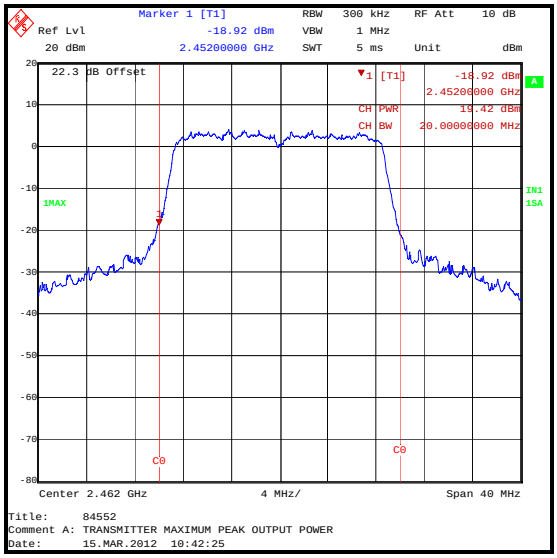
Results: 802.11n / 13 Mbps / 20 MHz / Port 0



Bottom Channel



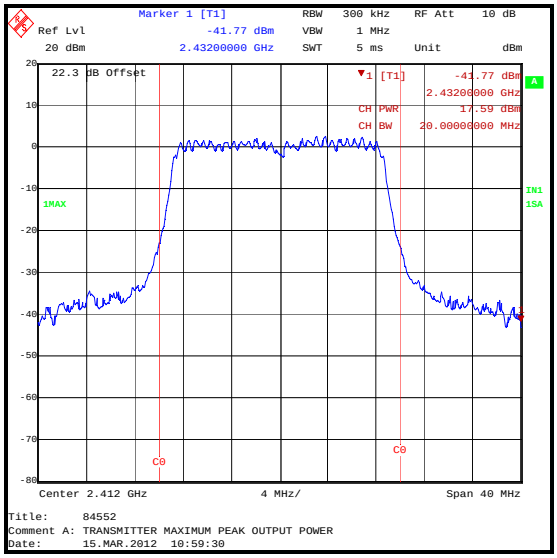
Middle Channel



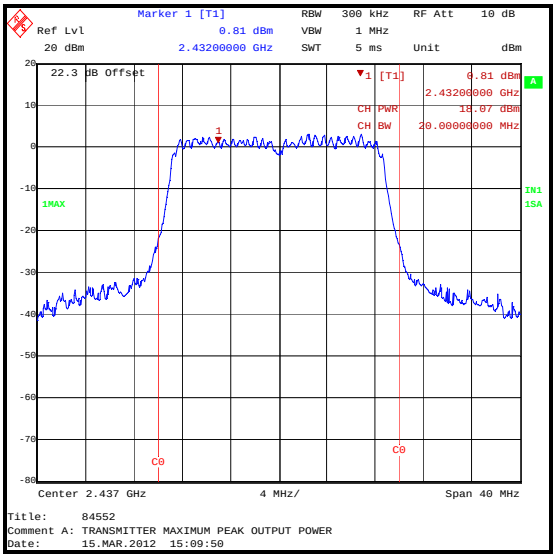
Top Channel

Transmitter Maximum Peak Output Power (continued)

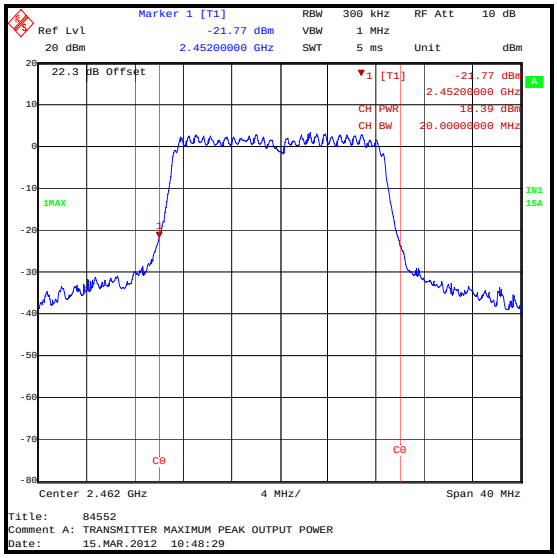
Results: 802.11n / 13 Mbps / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

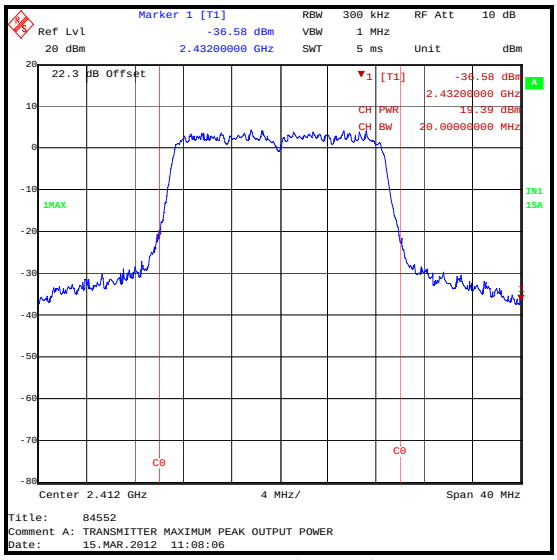
Results: 802.11n / 39 Mbps / 20 MHz

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	19.4	17.4	21.5	30.0	8.5	Complied
Middle	19.6	17.9	21.8	30.0	8.2	Complied
Top	19.5	18.1	21.9	30.0	8.1	Complied

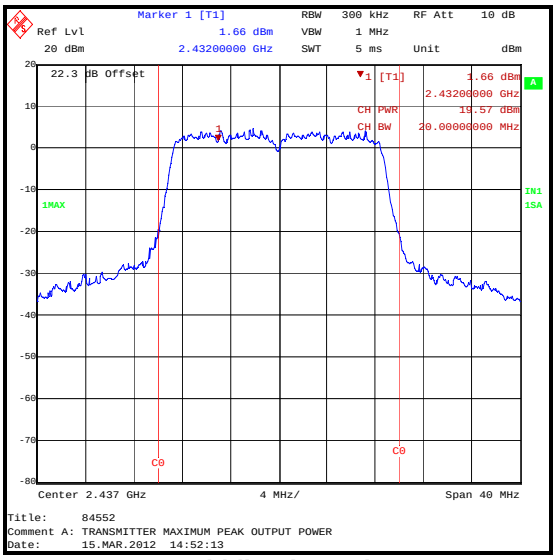
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.5	-0.8	20.7	36.0	15.3	Complied
Middle	21.8	-0.8	21.0	36.0	15.0	Complied
Top	21.9	-0.8	21.1	36.0	14.9	Complied

Transmitter Maximum Peak Output Power (continued)

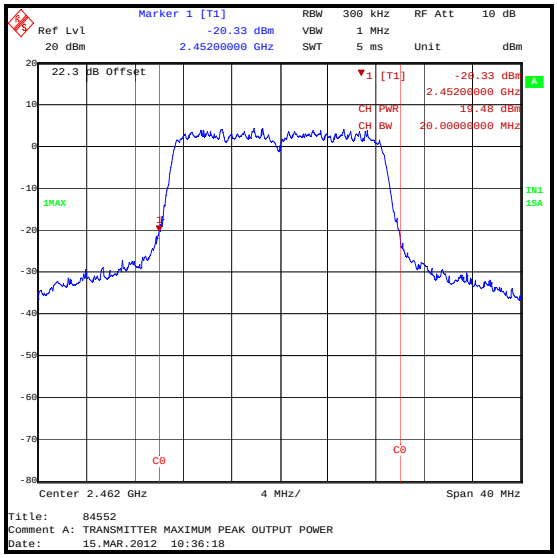
Results: 802.11n / 39 Mbps / 20 MHz / Port 0



Bottom Channel



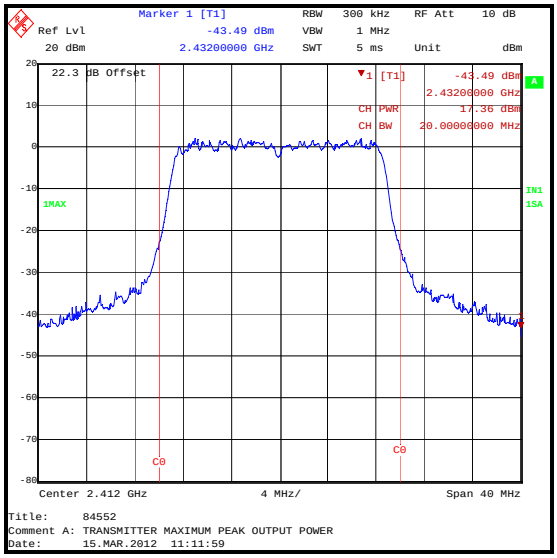
Middle Channel



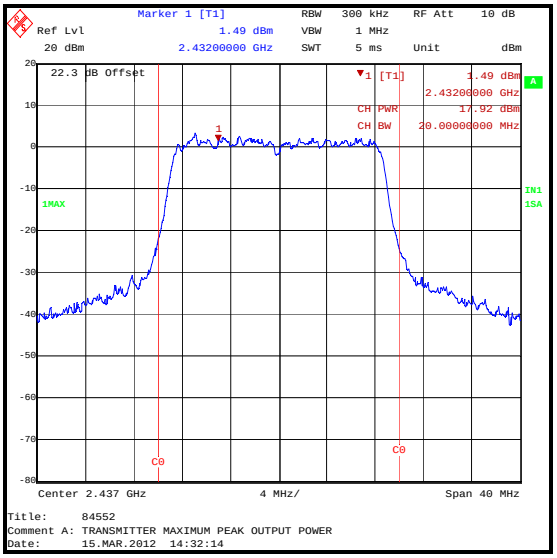
Top Channel

Transmitter Maximum Peak Output Power (continued)

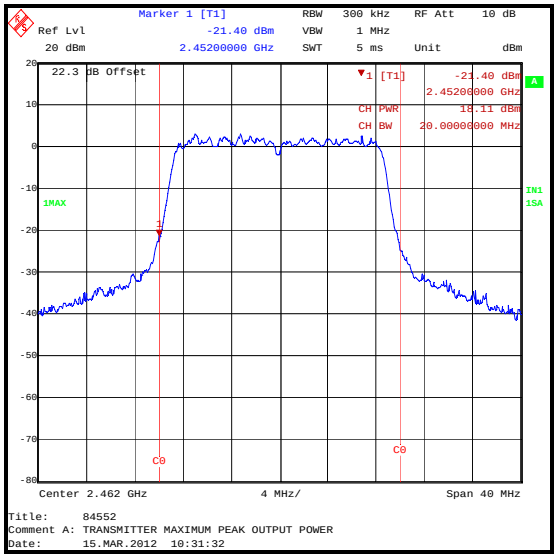
Results: 802.11n / 39 Mbps / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

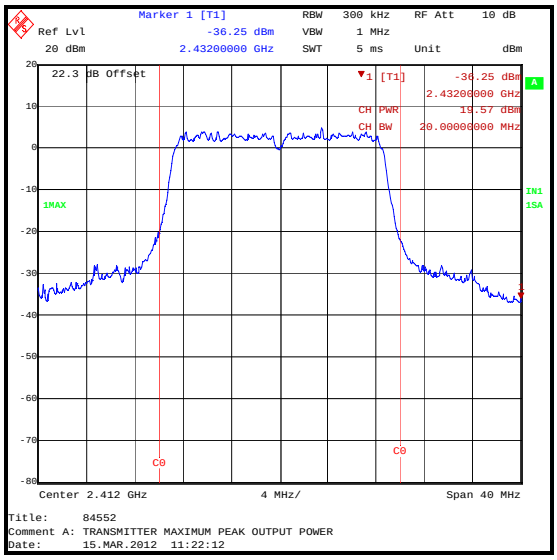
Results: 802.11n / 78 Mbps / 20 MHz

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	19.6	17.5	21.7	30.0	8.3	Complied
Middle	19.6	18.0	21.9	30.0	8.1	Complied
Top	19.6	18.3	22.0	30.0	8.0	Complied

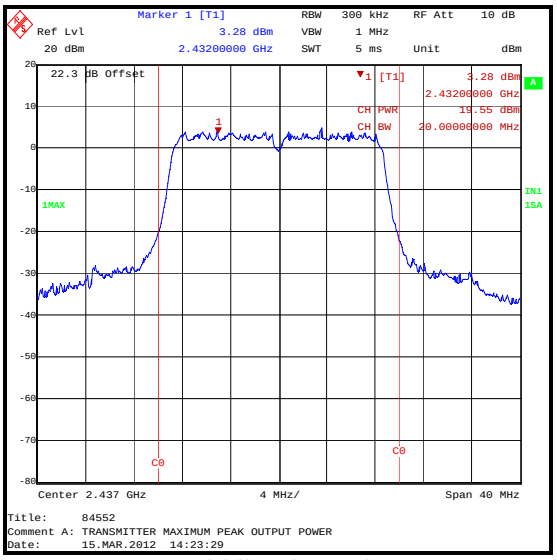
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.7	-0.8	20.9	36.0	15.1	Complied
Middle	21.9	-0.8	21.1	36.0	14.9	Complied
Top	22.0	-0.8	21.2	36.0	14.8	Complied

Transmitter Maximum Peak Output Power (continued)

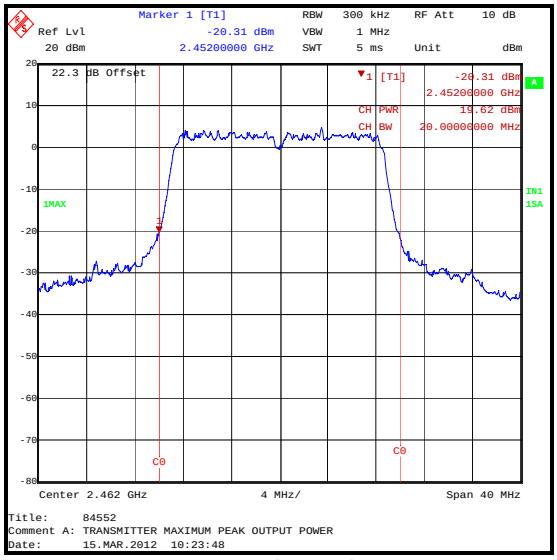
Results: 802.11n / 78 Mbps / 20 MHz / Port 0



Bottom Channel



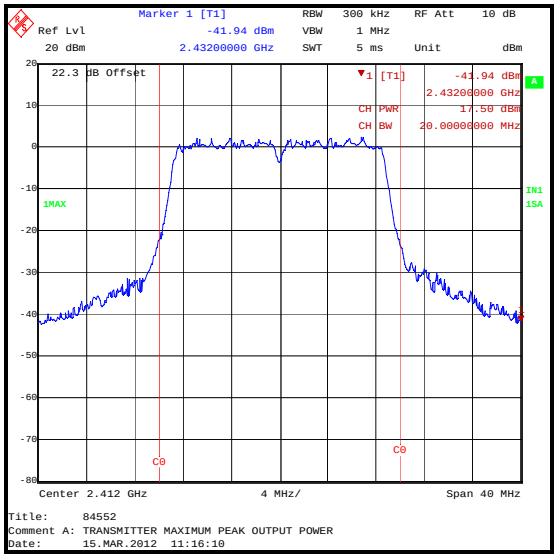
Middle Channel



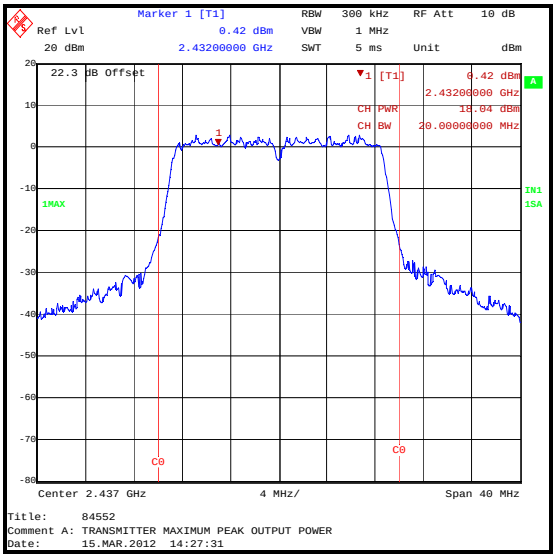
Top Channel

Transmitter Maximum Peak Output Power (continued)

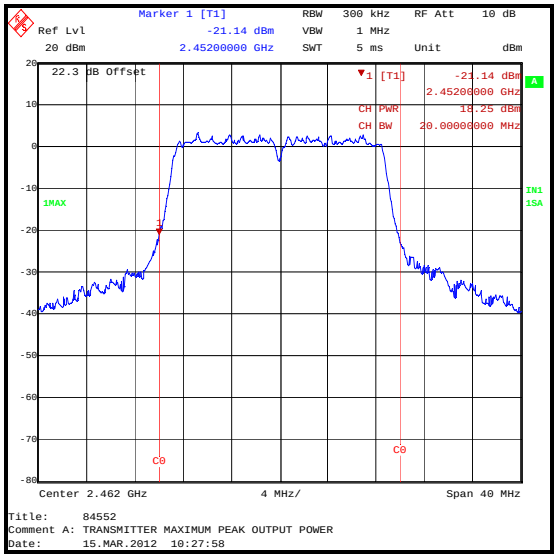
Results: 802.11n / 78 Mbps / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

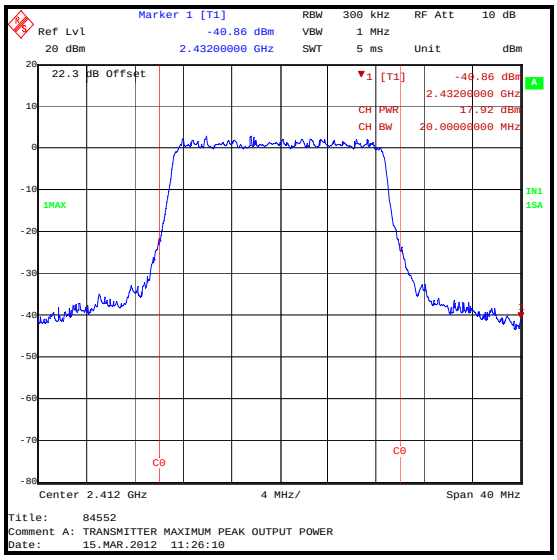
Results: 802.11n / 130 Mbps / 20 MHz

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	17.9	15.8	20.0	30.0	10.0	Complied
Middle	18.0	16.4	20.3	30.0	9.7	Complied
Top	18.1	16.7	20.5	30.0	9.5	Complied

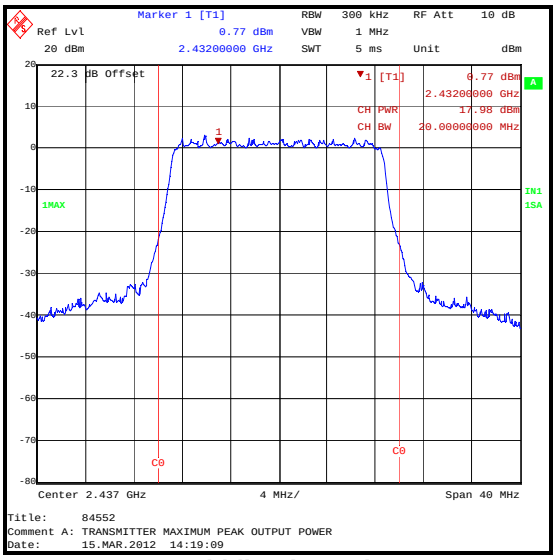
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	20.0	-0.8	19.2	36.0	16.8	Complied
Middle	20.3	-0.8	19.5	36.0	16.5	Complied
Top	20.5	-0.8	19.7	36.0	16.3	Complied

Transmitter Maximum Peak Output Power (continued)

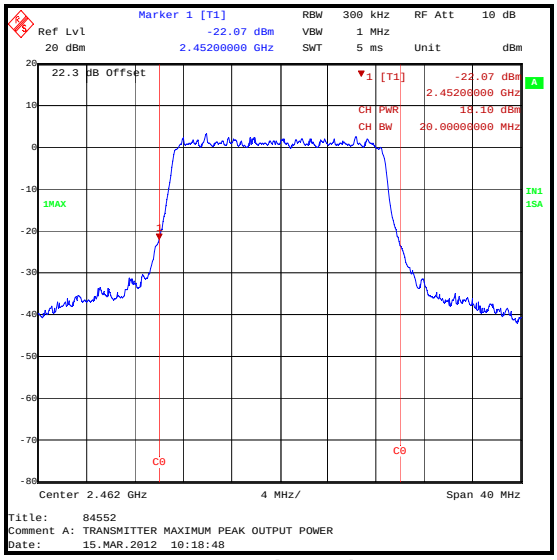
Results: 802.11n / 130 Mbps / 20 MHz / Port 1



Bottom Channel



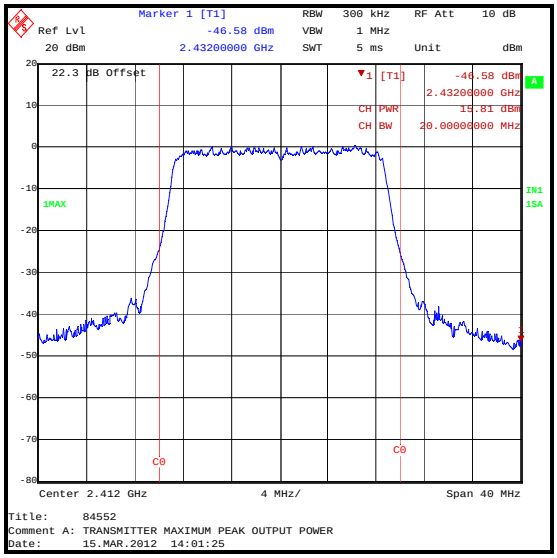
Middle Channel



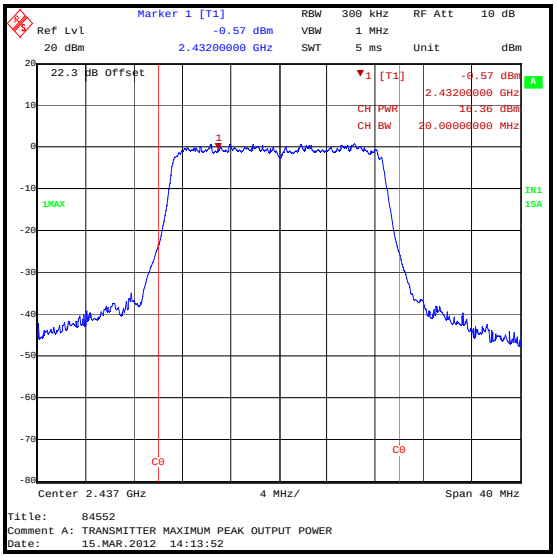
Top Channel

Transmitter Maximum Peak Output Power (continued)

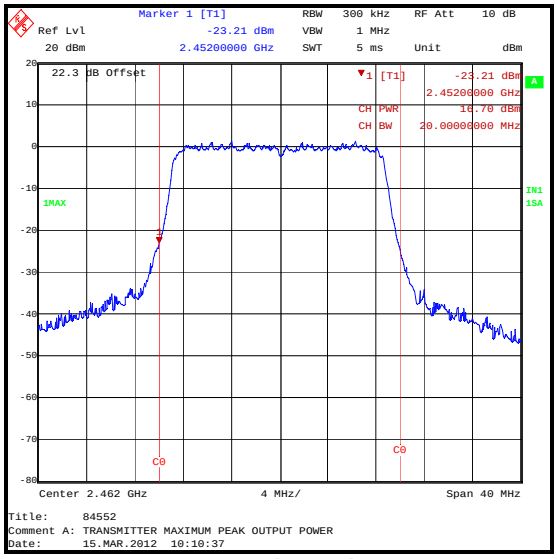
Results: 802.11n / 130 Mbps / 20 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

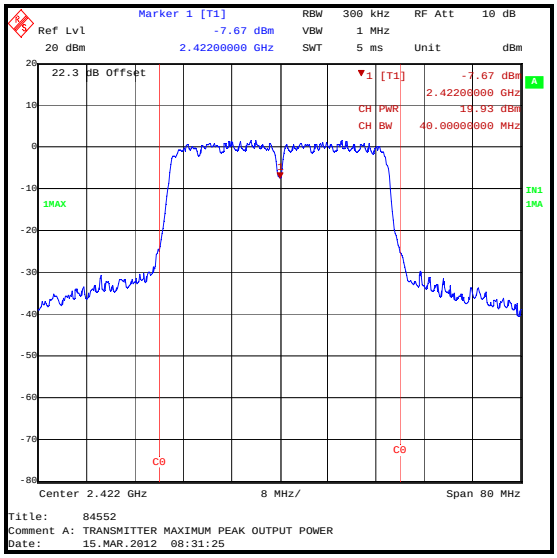
Results: 802.11n / 13 Mbps / 40 MHz

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	19.9	18.4	22.2	30.0	7.8	Complied
Middle	20.0	18.3	22.2	30.0	7.8	Complied
Top	20.1	18.7	22.5	30.0	7.5	Complied

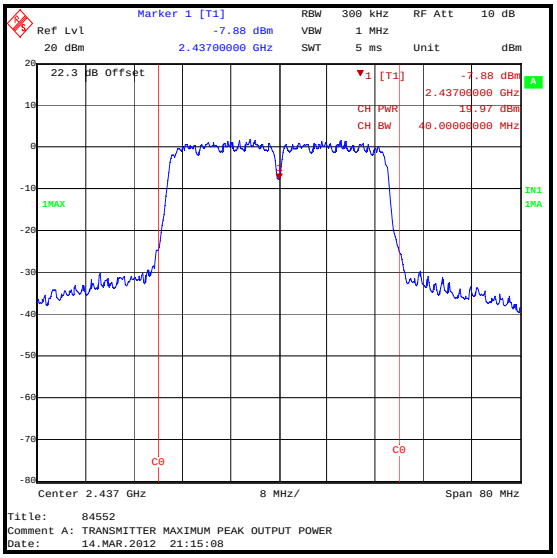
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	22.2	-0.8	21.4	36.0	14.6	Complied
Middle	22.2	-0.8	21.4	36.0	14.6	Complied
Top	22.5	-0.8	21.7	36.0	14.3	Complied

Transmitter Maximum Peak Output Power (continued)

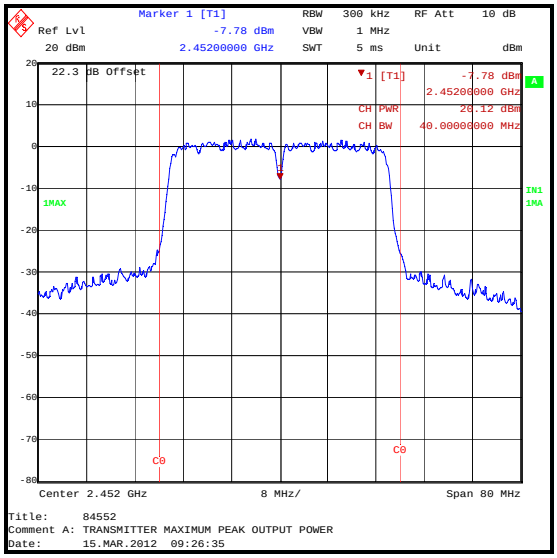
Results: 802.11n / 13 Mbps / 40 MHz / Port 0



Bottom Channel



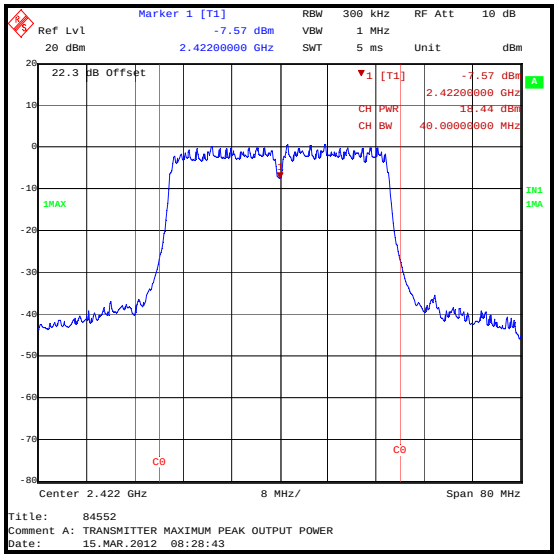
Middle Channel



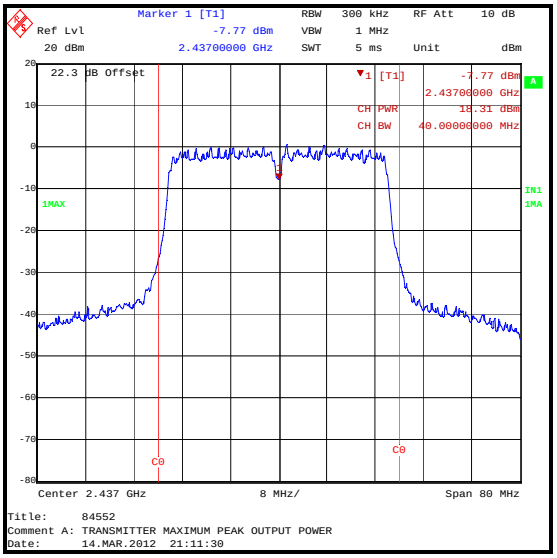
Top Channel

Transmitter Maximum Peak Output Power (continued)

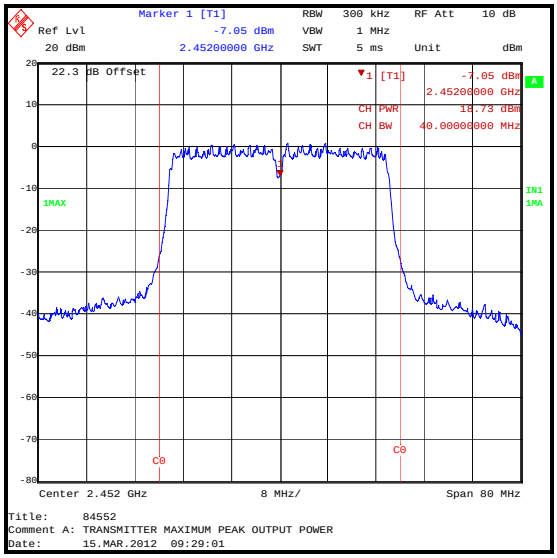
Results: 802.11n / 13 Mbps / 40 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

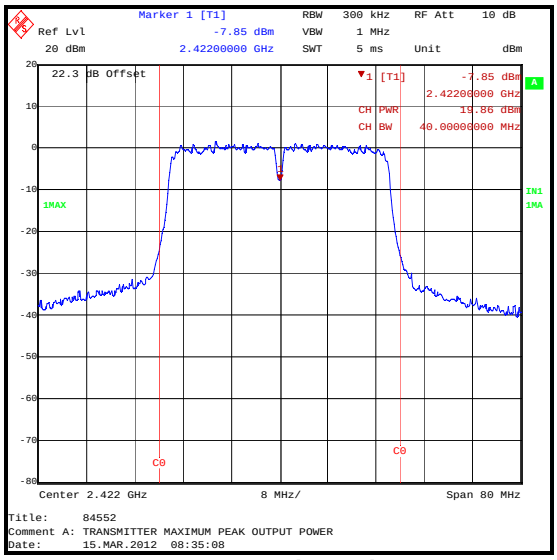
Results: 802.11n / 39 Mbps / 40 MHz

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	19.9	17.8	22.0	30.0	8.0	Complied
Middle	19.8	18.0	22.0	30.0	8.0	Complied
Top	20.0	17.0	21.8	30.0	8.2	Complied

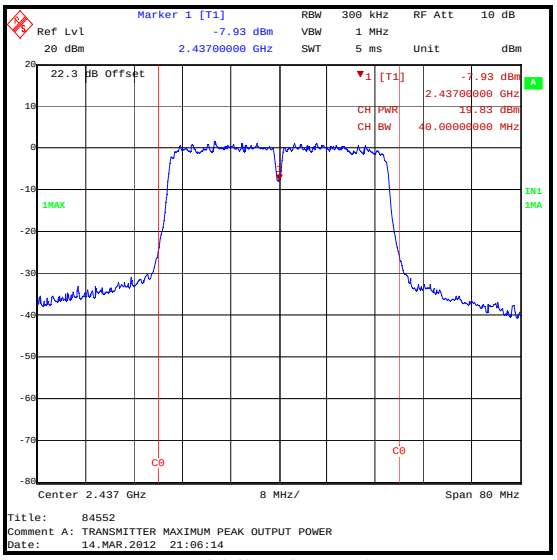
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	22.0	-0.8	21.2	36.0	14.8	Complied
Middle	22.0	-0.8	21.2	36.0	14.8	Complied
Top	21.8	-0.8	21.0	36.0	15.0	Complied

Transmitter Maximum Peak Output Power (continued)

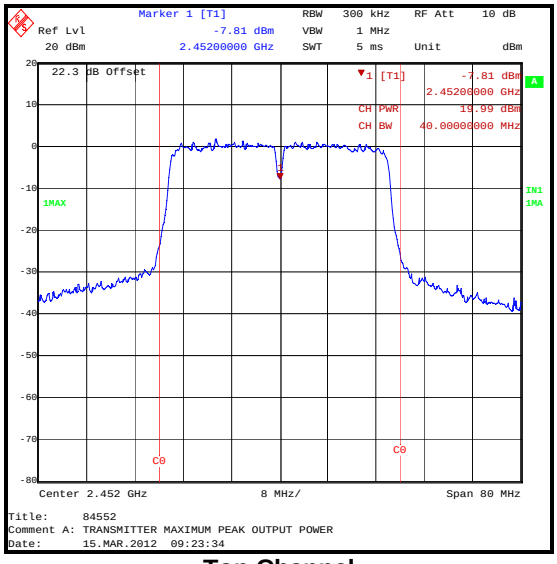
Results: 802.11n / 39 Mbps / 40 MHz / Port 0



Bottom Channel



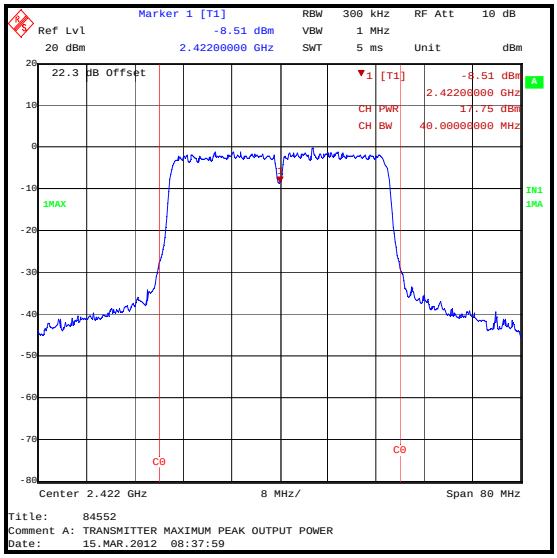
Middle Channel



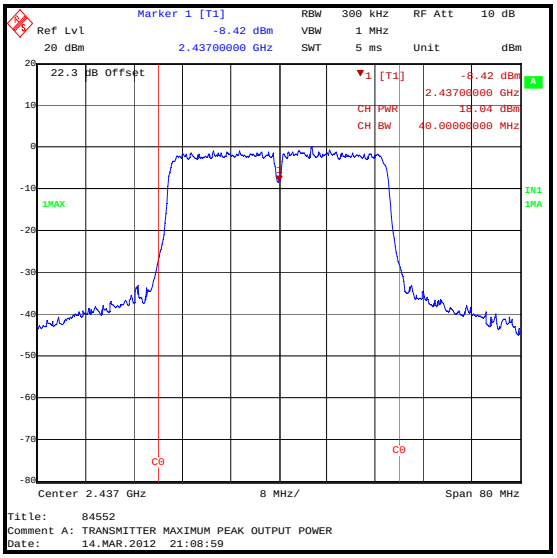
Top Channel

Transmitter Maximum Peak Output Power (continued)

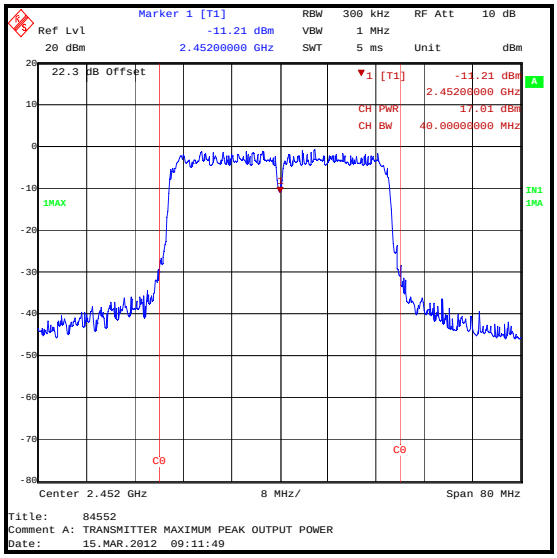
Results: 802.11n / 39 Mbps / 40 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

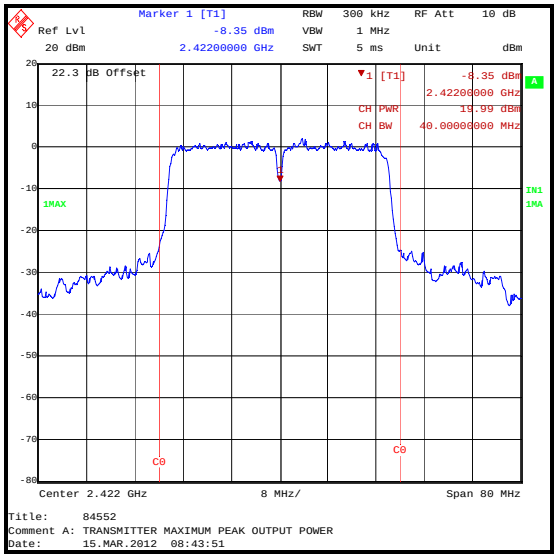
Results: 802.11n / 78 Mbps / 40 MHz

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	20.0	18.1	22.2	30.0	7.8	Complied
Middle	20.1	18.5	22.4	30.0	7.6	Complied
Top	20.4	18.8	22.7	30.0	7.3	Complied

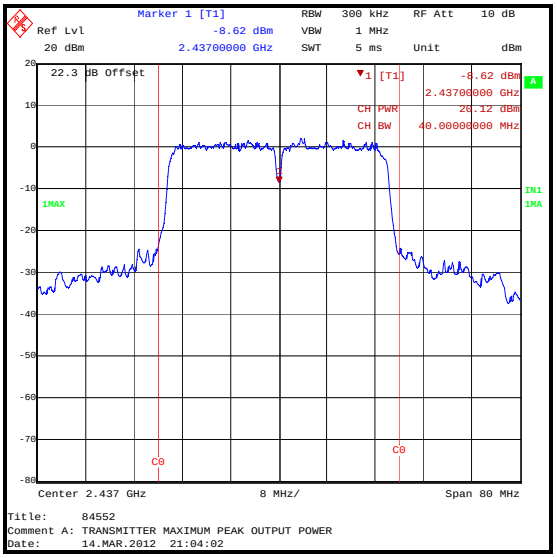
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	22.2	-0.8	21.4	36.0	14.6	Complied
Middle	22.4	-0.8	21.6	36.0	14.4	Complied
Top	22.7	-0.8	21.9	36.0	14.1	Complied

Transmitter Maximum Peak Output Power (continued)

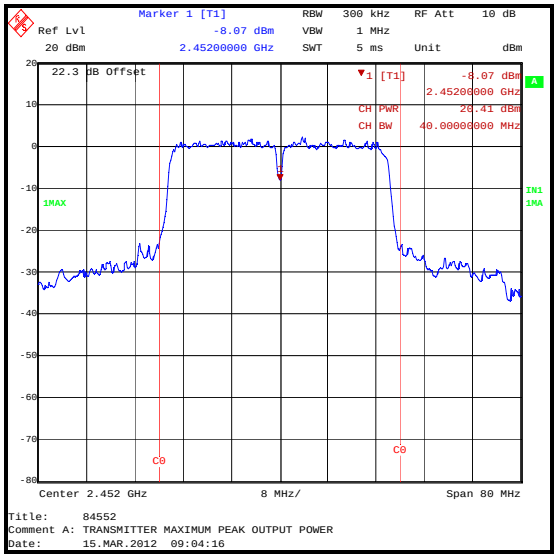
Results: 802.11n / 78 Mbps / 40 MHz / Port 0



Bottom Channel



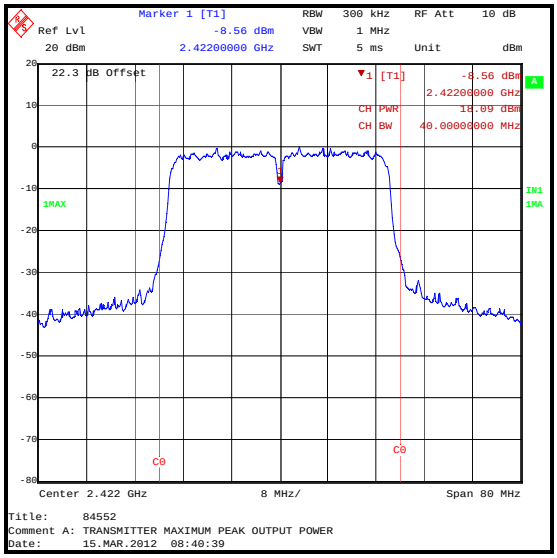
Middle Channel



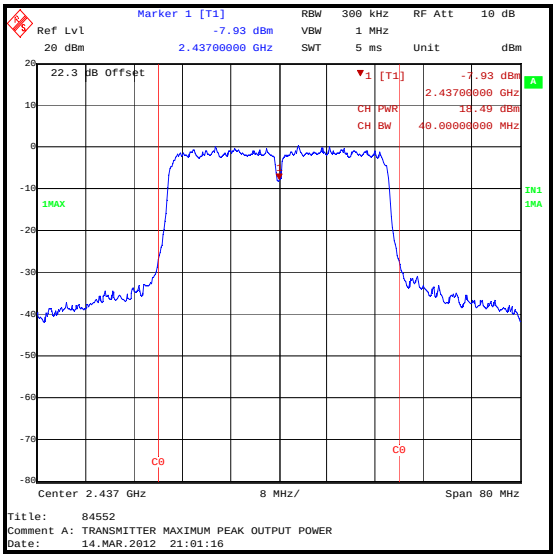
Top Channel

Transmitter Maximum Peak Output Power (continued)

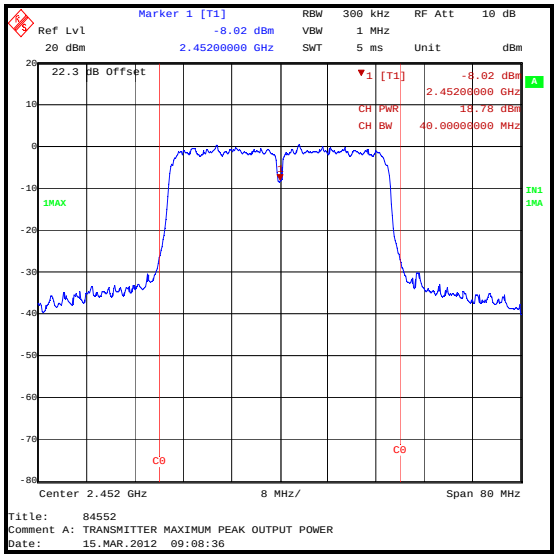
Results: 802.11n / 78 Mbps / 40 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

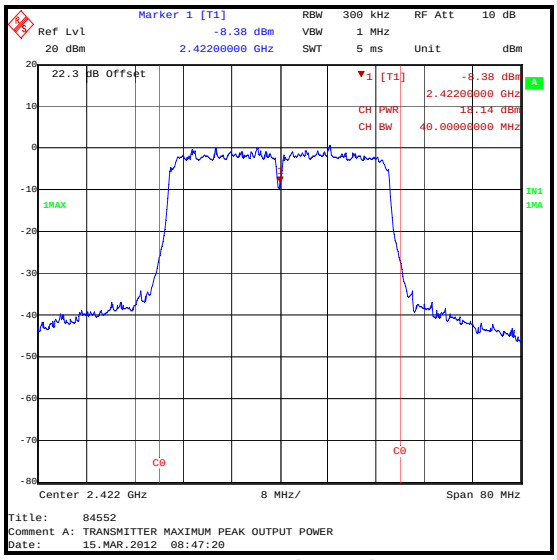
Results: 802.11n / 130 Mbps / 40 MHz

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	18.1	16.1	20.2	30.0	9.8	Complied
Middle	18.3	16.5	20.5	30.0	9.5	Complied
Top	18.5	17.1	20.9	30.0	9.1	Complied

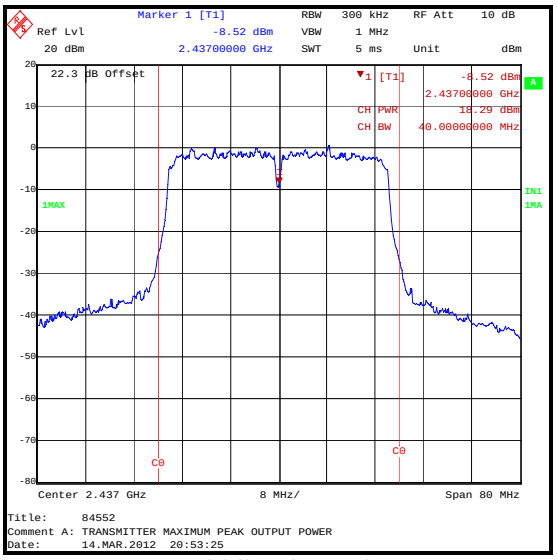
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	20.2	-0.8	19.4	36.0	16.6	Complied
Middle	20.5	-0.8	19.7	36.0	16.3	Complied
Top	20.9	-0.8	20.1	36.0	15.9	Complied

Transmitter Maximum Peak Output Power (continued)

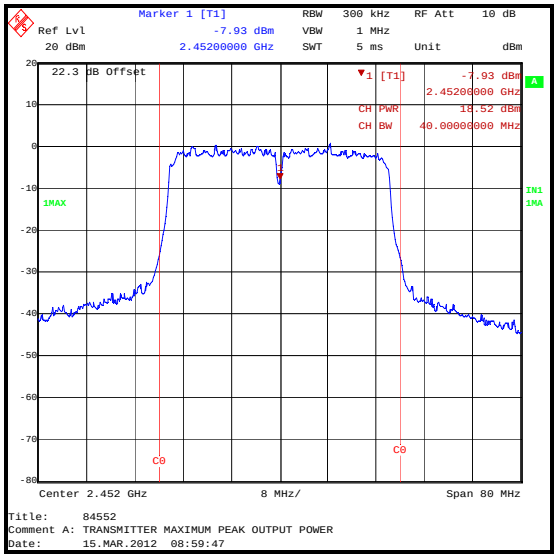
Results: 802.11n / 130 Mbps / 40 MHz / Port 0



Bottom Channel



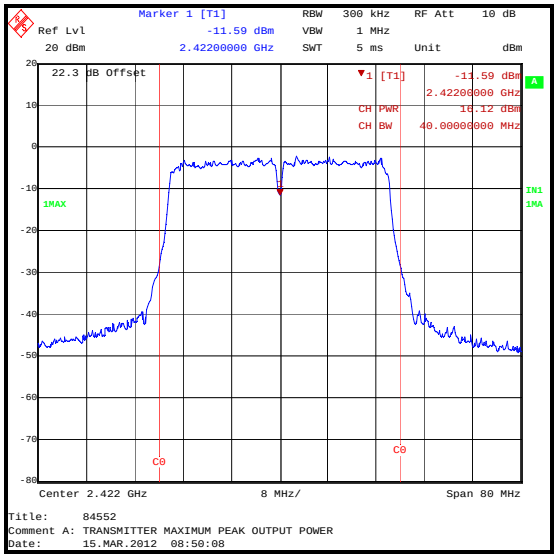
Middle Channel



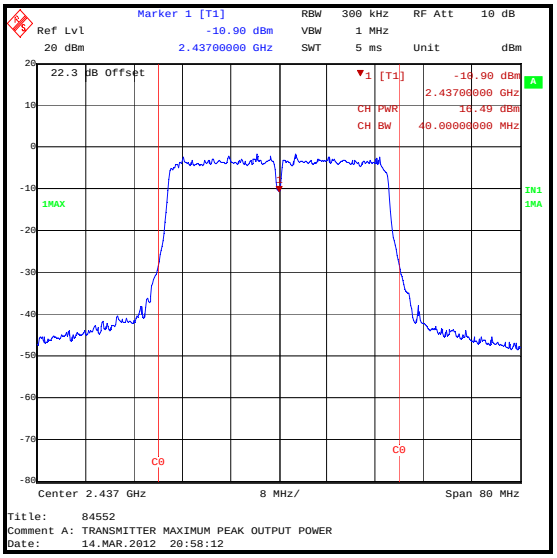
Top Channel

Transmitter Maximum Peak Output Power (continued)

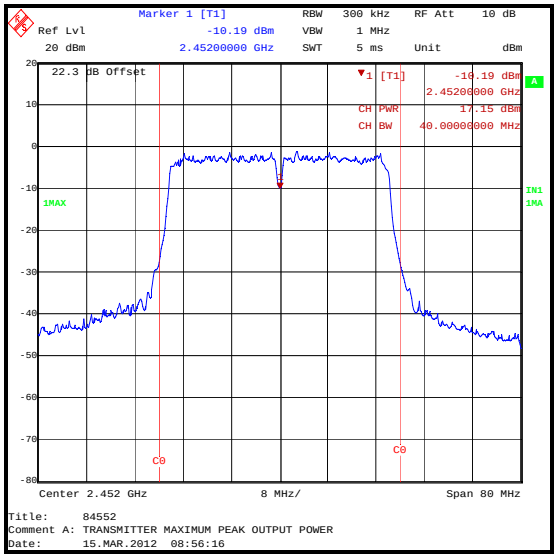
Results: 802.11n / 130 Mbps / 40 MHz / Port 1



Bottom Channel



Middle Channel



Top Channel

5.2.8. Transmitter Radiated Emissions

Test Summary:

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

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

Environmental Conditions:

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

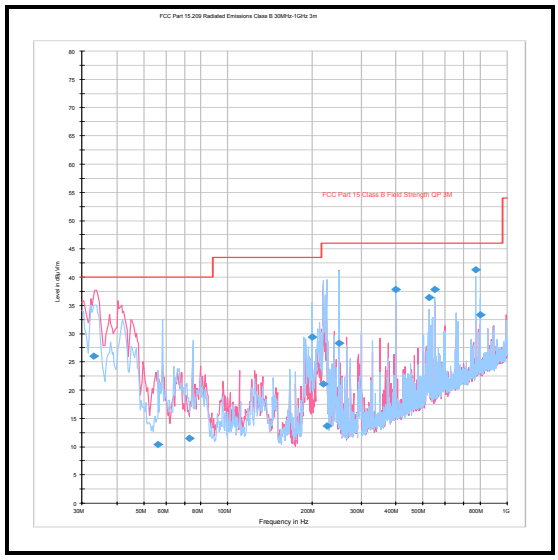
Note(s):

1. Final measurements were performed with the EUT transmitting with a data rate of 11 Mbps with a channel bandwidth of 20 MHz as this combination produced the highest emissions. Pre-scans were performed with the EUT transmitting on the top channel.
2. The final measured value for the given emissions in the result table, incorporates the calibrated antenna factor and cable loss.
3. 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.
4. All other emissions were at least 20 dB below the appropriate limit or below the noise floor of the measurement system.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Radiated Emissions (continued)

Results: 802.11b / 11 Mbps / 20 MHz

Frequency (MHz)	Antenna Polarity	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
249.999	Horizontal	28.3	46.0	17.7	Complied
399.998	Horizontal	37.8	46.0	8.2	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:

Test Engineers:	Andrew Edwards & Nick Steele	**Test Dates:**	14 February 2012 & 31 October 2012
Test Sample Serial No:	22582545		

FCC Reference:	Part 15.247(d) & 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9, RSS-210 A8.5
Test Method Used:	FCC KDB 558074 D01 V02 Section 10.0 & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	21 to 22

Note(s):

1. Final measurements were performed with the EUT transmitting with a data rate of 78 Mbps with a channel bandwidth of 40 MHz as all configurations were previously measured and this combination produced the highest output power. Pre-scans were performed with the EUT transmitting on the top channel.
2. The final measured value for the given emissions in the result tables, incorporates the calibrated antenna factor and cable loss.
3. The emission shown on the pre-scan plot at approximately 6565.681 MHz was investigated and found to be in a non-restricted band. Final measurements of this emission showed it was >20 dB below the -20 dBc limit (when the fundamental emission was measured in 100 kHz bandwidth), therefore the emission was not recorded. 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.
4. The emission shown at 2452 MHz on the 1 GHz to 4 GHz plot is the EUT fundamental.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Radiated Emissions (continued)

Results: Bottom Channel / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4856.128	Vertical	50.3	74.0	23.7	Complied

Results: Bottom Channel / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4846.393	Vertical	36.1	54.0	17.9	Complied

Results: Middle Channel / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4891.182	Vertical	50.7	74.0	23.3	Complied

Results: Middle Channel / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4875.100	Vertical	37.2	54.0	16.8	Complied

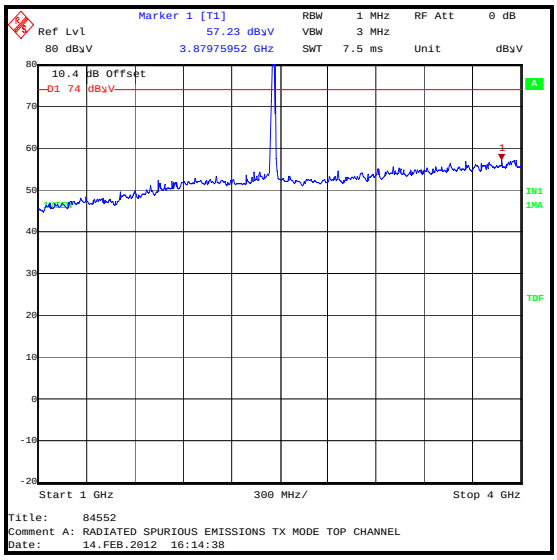
Results: Top Channel / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4903.166	Vertical	51.4	74.0	22.6	Complied

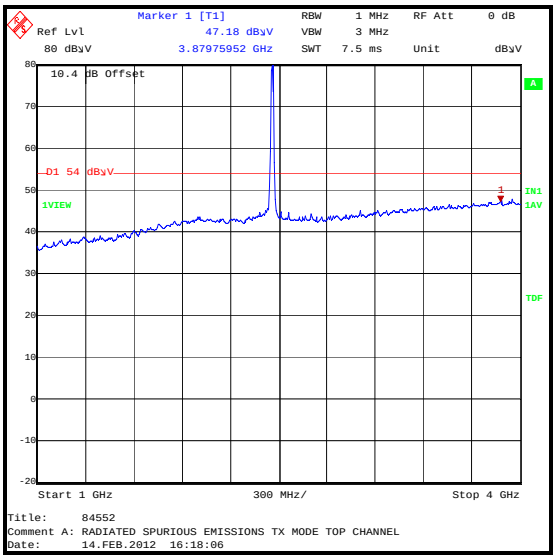
Results: Top Channel / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4904.449	Vertical	38.3	54.0	15.7	Complied

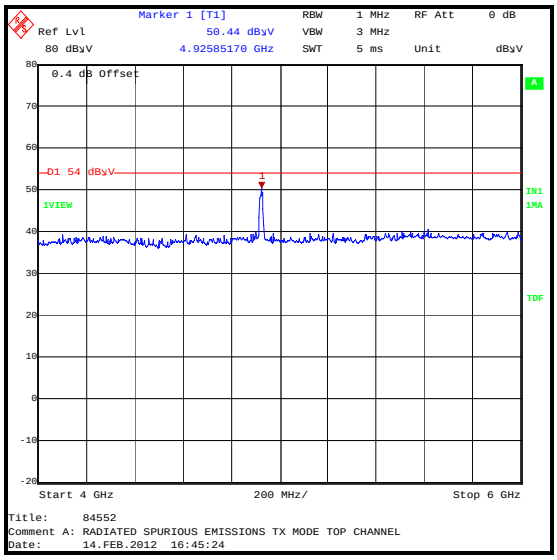
Transmitter Radiated Emissions (continued)

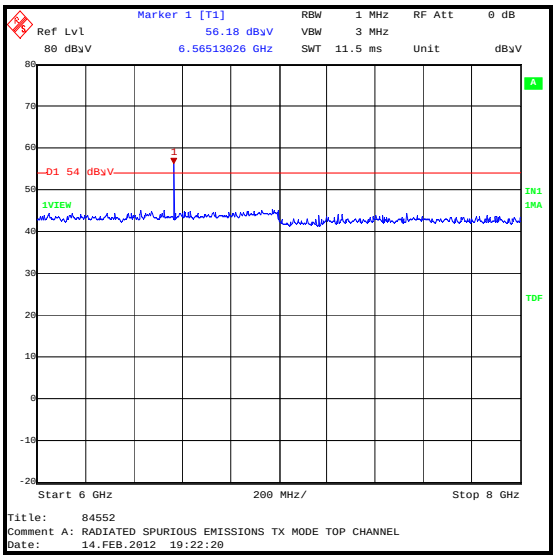


Peak detector

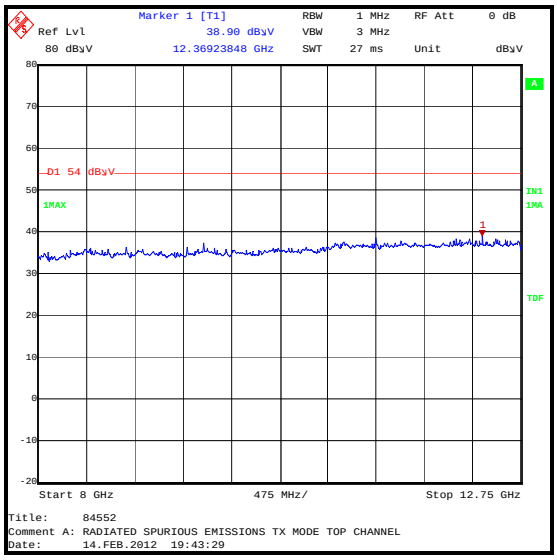


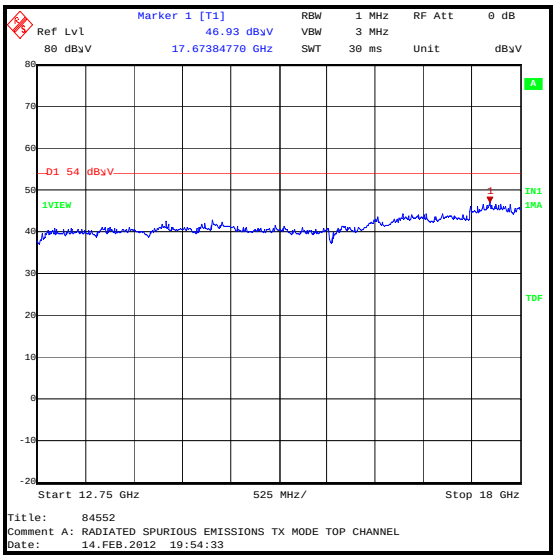
Average detector

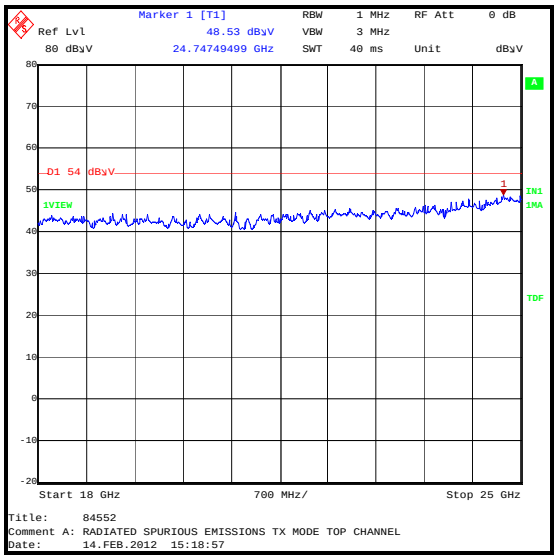




Transmitter Radiated Emissions (continued)







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:

Test Engineers:	Nick Steele & Andrew Edwards	**Test Dates:**	07 March 2012, 08 March 2012 & 31 October 2012
Test Sample Serial No:	22582545		

FCC Reference:	Part 15.247(d) & 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9, RSS-210 A8.5
Test Method Used:	FCC KDB 558074 D01 V02 Section 10.0 & ANSI C63.10 Section 6.9.2

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	22 to 38

Note(s):

1. FCC Response to Inquiry (Tracking Number 917954 / Date: 14th February 2012) confirmed band edge measurements need only be performed in the EUT modes that produce the highest power and the widest bandwidths. Occupied bandwidth in all modes was previously measured. 802.11n / 13 Mbps / 20 MHz channel and 802.11n / 78 Mbps / 40 MHz channel were found to have the widest bandwidths. Conducted power in all modes was previously measured. 802.11n / 78 Mbps / 20 MHz channel bandwidth and 802.11n / 78 Mbps / 40 MHz channel were found to have the highest power levels. 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. * -20 dBc limit.

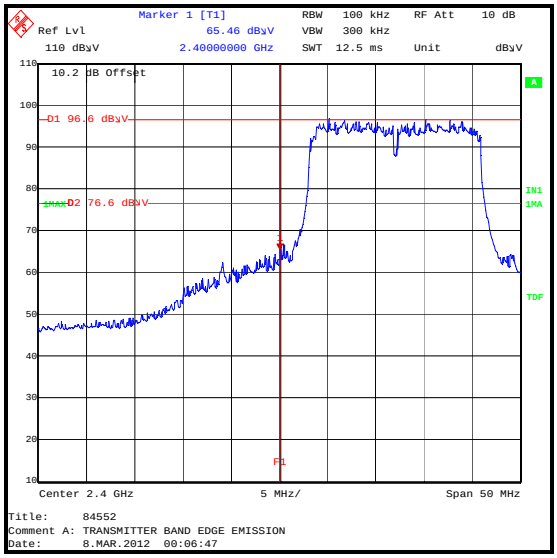
Transmitter Band Edge Radiated Emissions (continued)

Results: 20 MHz Channel / 802.11n / 13 Mbps / Peak

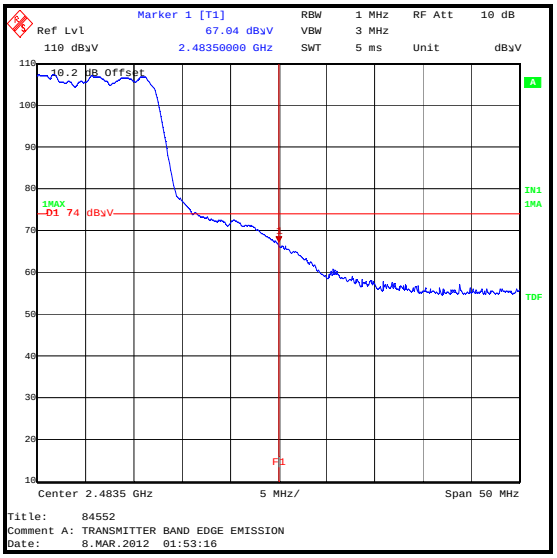
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	65.5	76.6*	11.1	Complied
2483.5	67.0	74.0	7.0	Complied

Results: 20 MHz Channel / 802.11n / 13 Mbps / Average

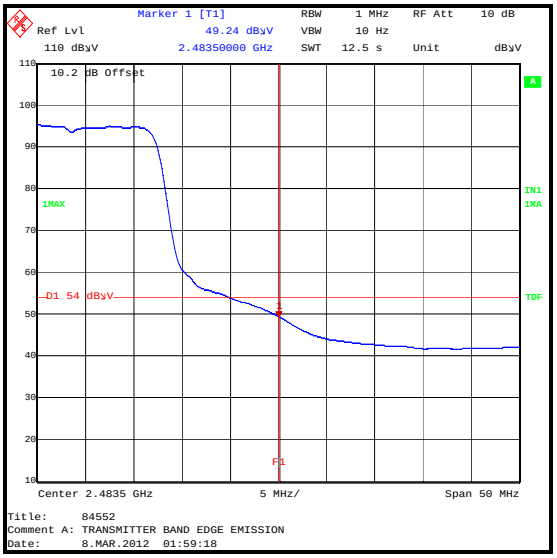
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	49.2	54.0	4.8	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

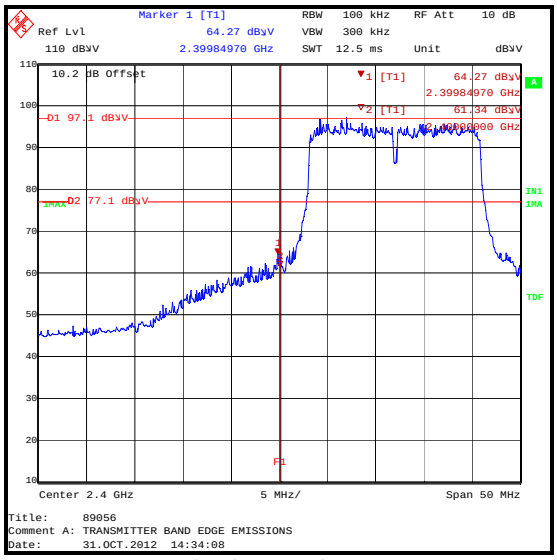
Transmitter Band Edge Radiated Emissions (continued)

Results: 20 MHz Channel / 802.11n / 78 Mbps / Peak

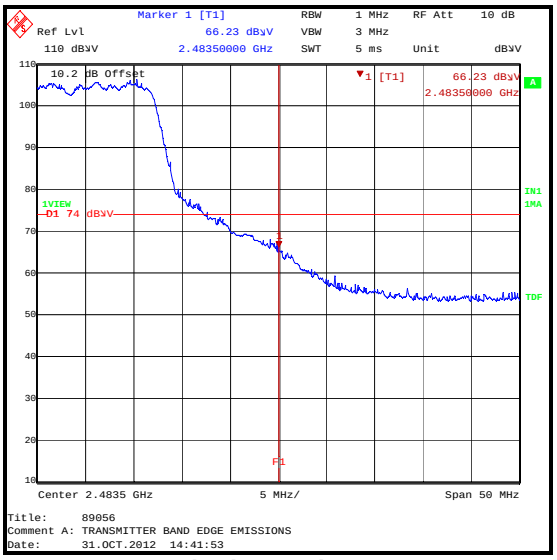
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.850	64.3	77.1*	12.8	Complied
2400	61.3	77.1*	15.8	Complied
2483.5	66.2	74.0	7.8	Complied

Results: 20 MHz Channel / 802.11n / 78 Mbps / Average

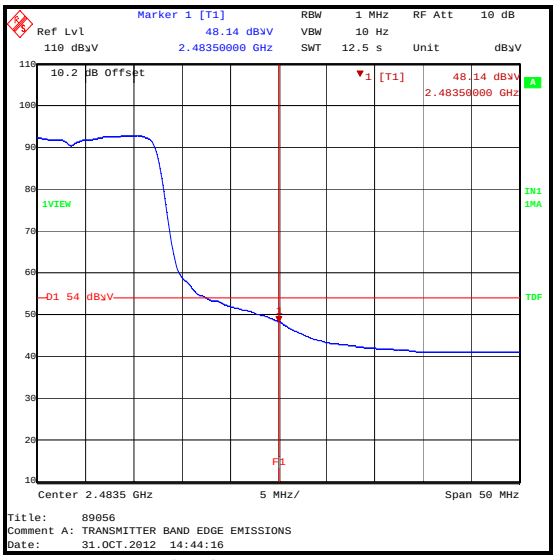
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	48.1	54.0	5.9	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

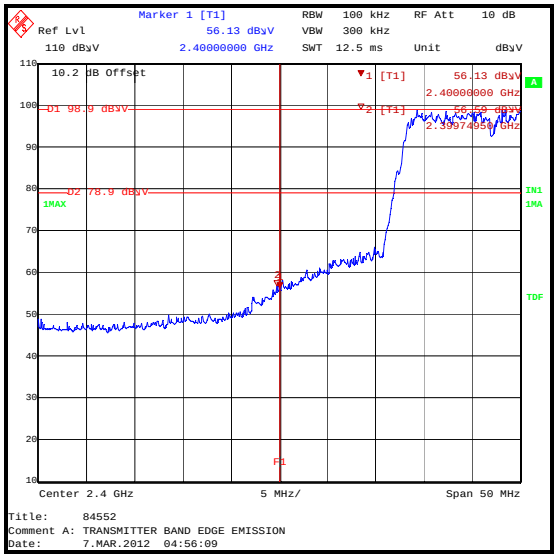
Transmitter Band Edge Radiated Emissions (continued)

Results: 40 MHz Channel / 802.11n / 78 Mbps / Peak

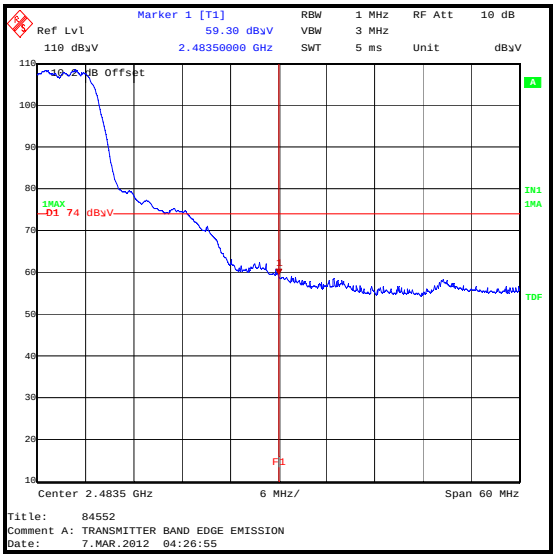
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	56.1	78.9*	22.8	Complied
2483.5	59.3	74.0	14.7	Complied

Results: 40 MHz Channel / 802.11n / 78 Mbps / Average

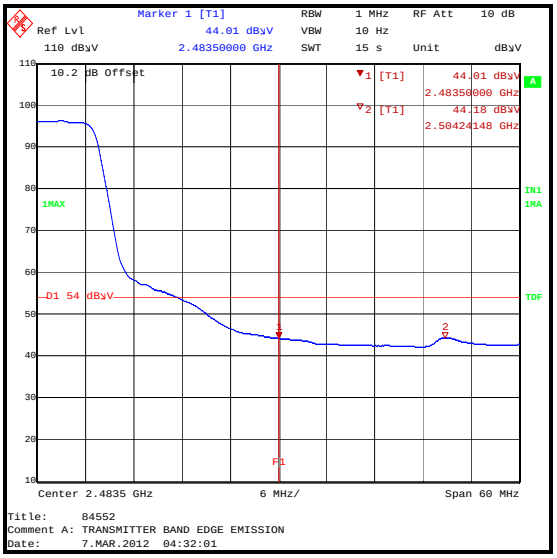
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	44.0	54.0	10.0	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average 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	2.4 GHz to 2.4835 GHz	95%	±0.27 dB
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±2.94 dB
6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±0.92 ppm
20 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±0.92 ppm
Radiated Spurious Emissions	30 MHz to 26.5 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
A1393	Attenuator	Huber & Suhner	757456	6820.17.B	08 Jul 2012	12
A1396	Attenuator	Huber & Suhner	757987	6810.17.B	08 Jul 2012	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	31 Oct 2012	12
A1818	Antenna	EMCO	3115	00075692	31 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
A1975	RF Filter	AtlanTec	AFH-03000	090424010	15 Mar 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
A253	Antenna	Flann Microwave	12240-20	128	31 Oct 2012	12
A254	Antenna	Flann Microwave	14240-20	139	31 Oct 2012	12
A255	Antenna	Flann Microwave	16240-20	519	31 Oct 2012	12
A256	Antenna	Flann Microwave	18240-20	400	31 Oct 2012	12
A259	Antenna	Chase	CBL6111	1513	01 Mar 2013	12
A436	Antenna	Flann	20240-20	330	31 Oct 2012	12
A490	Antenna	Chase	CBL6111A	1590	14 May 2013	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	29 May 2012	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	31 Oct 2012	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESI26	100046K	14 Aug 2013	12
M1251	Multimeter	Fluke	179	87640015	21 Jun 2012	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	13 Jul 2012	12
M1269	Multimeter	Fluke	179	90250210	20 Jul 2012	12
M1590	Test Receiver	Rohde & Schwarz	ESU26	100239	15 Jun 2012	12
S011	DC Power Supply Unit	INSTEK	PR-3010H	9401270	Calibrated Before Use	-
S0537	EL302D Dual Power Supply	TTI	EL302D	249928	Calibrated Before Use	-

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

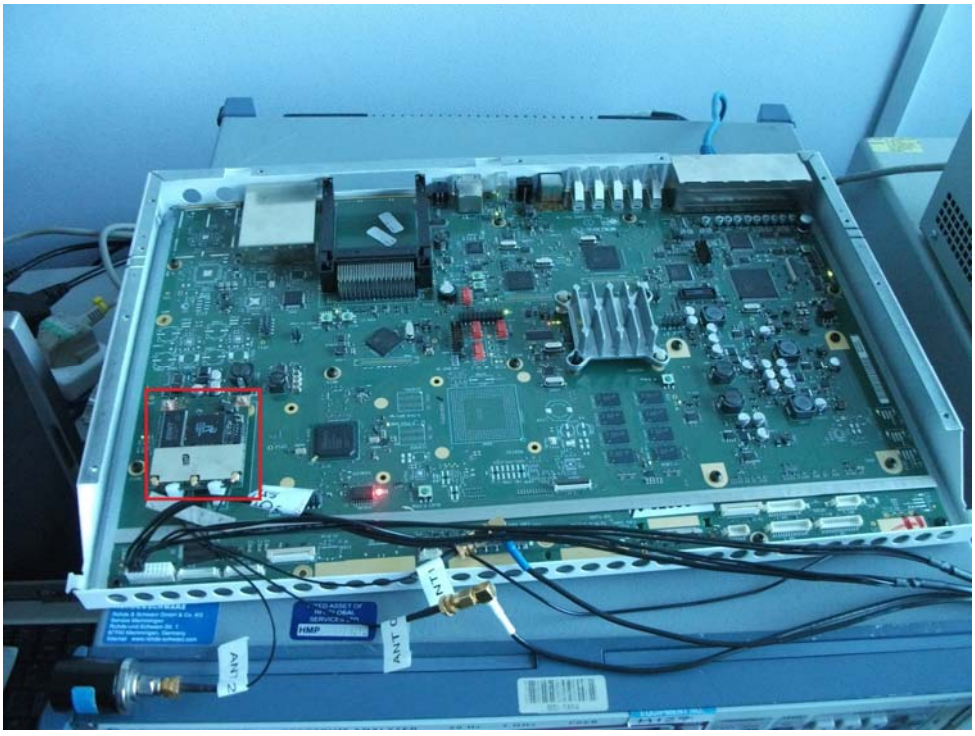


Photo #2. 802.11 module location within Video Engine shown in red. Antenna ports shown at bottom left.

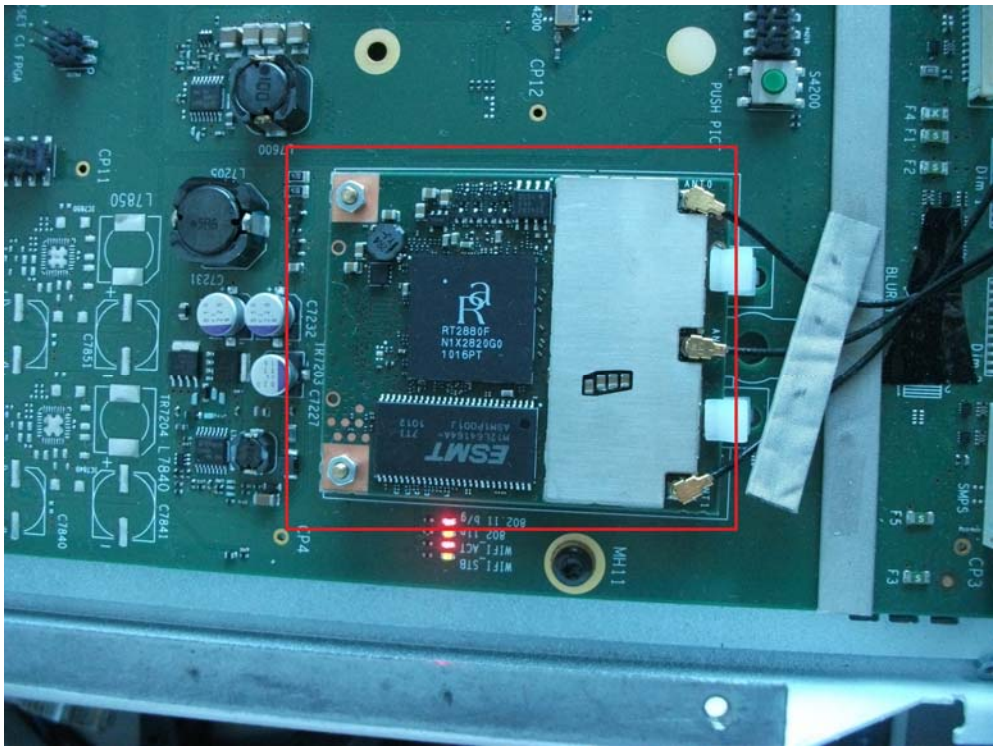


Photo #3. Close up photo of EUT module within Video Engine. The three antenna ports are shown on the right hand side of the 802.11 module.

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