



TEST REPORT

Test Report No. : UL-RPT-RP89056JD13B V2.0

Manufacturer : Bang & Olufsen a/s
Model No. : BeoVision 11-40
FCC ID : TTULBWA1ZZPD
IC Certification No. : 3775B-LBWA1ZZPD
Test Standard(s) : FCC Parts 15.209(a), 15.247(d), Industry Canada Parts RSS-210
Issue 8 December 2010 A8.5 & RSS-Gen Issue 3 December 2010
4.9

1. This test report shall not be reproduced in full or partial, without the written approval of RFI Global Services Ltd trading as UL.
2. The results in this report apply only to the sample(s) tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 25 January 2013

Checked by:

Sarah Williams
WiSE Laboratory Engineer

Issued by :

pp

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



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

RFI Global Services Ltd trading as UL

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
3. Equipment Under Test (EUT)	7
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	7
3.3. Modifications Incorporated in the EUT	7
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	8
3.6. Antenna	9
4. Operation and Monitoring of the EUT during Testing	10
4.1. Operating Modes	10
4.2. Configuration and Peripherals	10
5. Measurements, Examinations and Derived Results	11
5.1. General Comments	11
5.2. Test Results	12
5.2.1. Transmitter Radiated Emissions	12
5.2.2. Transmitter Band Edge Radiated Emissions	20
6. Measurement Uncertainty	24
7. Report Revision History	25

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:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Section 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 trading as UL, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	30 October 2012 to 21 January 2013

2.2. Summary of Test Results

FCC Reference (47CFR)	IC Reference	Measurement	Result
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 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 v01r02 9/26/2012
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 Name or Number:	BeoVision 11-40
Serial Number:	22975498
Software Version Number:	1.0.1.27488
FCC ID:	TTULBWA1ZZPD
Industry Canada Certification Number:	3775B-LBWA1ZZPD

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 incorporated into a 40" television.

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 / Unlicensed National Information Infrastructure Devices (U-NII)		
Type of Unit:	Transceiver		
Data rates:	802.11 n	13 Mbps	
TV Power Supply Requirement(s):	Nominal	120 VAC 60 Hz	
Channel Spacing:	20 MHz		
Transmit & Receive Frequency Band:	5725 MHz to 5850 MHz		
Transmit & Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	149	5745
	Middle	157	5785
	Top	165	5825
Channel Spacing:	40 MHz		
Transmit & Receive Frequency Band:	5725 MHz to 5850 MHz		
Transmit & Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	151	5755
	Top	159	5795

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. PC343NT

Description:	Internal Antenna
Brand Name:	TE Connectivity Ltd
Model Name or Number:	PUCK

Description:	Internal Antenna
Brand Name:	TE Connectivity Ltd
Model Name or Number:	UAM

Description:	Ethernet hub
Brand Name:	Netgear
Model Name or Number:	GS605
Serial Number:	1YG194390218E

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

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

Description:	HDMI Monitor
Brand Name:	Philips
Model Name or Number:	MUT1121T
Serial Number:	AU1A1017002190

Support Equipment (continued)

Description:	Scart cable
Brand Name:	Not Stated
Model Name or Number:	Not Stated
Serial Number:	Not Stated

Description:	USB dongle
Brand Name:	Integral
Model Name or Number:	8 GB
Serial Number:	Not Stated

3.6. Antenna

The table below lists the antennas used with this product:

Type	Stated Gain (dBi)	Model	Part No.
Dual-band	4.0	PUCK	1551868-1
Dual-band	3.0	UAM	1513472-7

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Continuously transmitting with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.

4.2. Configuration and Peripherals

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

- Transmitting in test mode with 100% duty cycle and controlled using a bespoke application on a laptop PC. The application was used to enable continuous transmission 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.
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 13 Mbps / MCS8 with a channel bandwidth of 20 MHz as this was found to have the highest power level and therefore deemed worst case.

Please refer to UL-RPT-RP89056JD13E for details of these measurements.

- Radiated emissions tests were performed with all unused ports terminated.
- The 3 internal antennas are connected to the WLAN module ports within the television as follows:

Module Port	Antenna Type	TX	RX
ANT0	PUCK	Yes	Yes
ANT1	UAM	Yes	Yes
ANT2	PUCK	No	Yes

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.

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.

5.2. Test Results

5.2.1. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	Test Date:	02 November 2012
Test Sample Serial Number:	22975498		

FCC 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 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

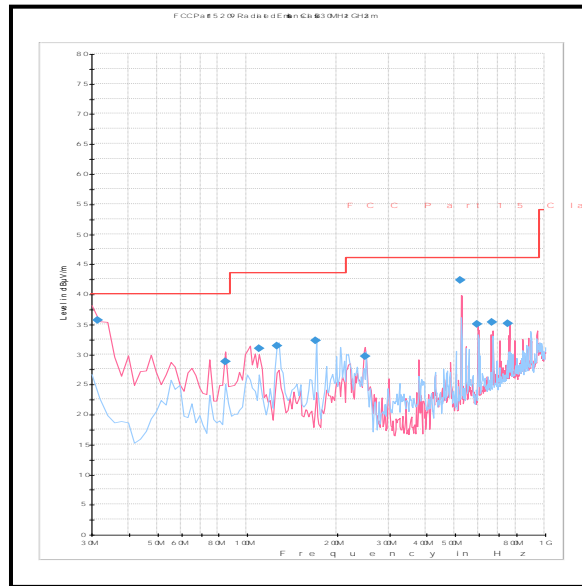
Temperature (°C):	28
Relative Humidity (%):	28

Note(s):

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

Results: 13 Mbps / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
110.589	Vertical	31.0	43.5	12.5	Complied
126.911	Horizontal	31.4	43.5	12.1	Complied
170.494	Horizontal	32.3	43.5	11.2	Complied
250.000	Vertical	29.6	46.0	16.4	Complied

Transmitter Radiated Emissions (continued)

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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A553	Antenna	Chase	CBL6111A	1593	15 Feb 2013	12
G0543	Amplifier	Sonoma	310N	230801	02 Jan 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	03 Feb 2013	12

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

Test Engineer:	Nick Steele	Test Dates:	30 October 2012 & 01 November 2012
Test Sample Serial Number:	22975498		

FCC 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 40 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	36

Note(s):

1. The final measured value for the given emissions in the result tables incorporates the calibrated antenna factor and cable loss.
2. The emissions shown on the pre-scan plots at approximately 1998.0 and 2665.3 MHz were investigated and found to be in a non-restricted band. Final measurements of these emissions showed they were >20 dB below the -20 dBc limit (when the fundamental emission was measured in 100 kHz bandwidth), therefore the emissions were 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.
3. The emission shown at 5825 MHz on the 4 GHz to 6 GHz plot is the EUT fundamental.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1665.317	Vertical	62.8	74.0	11.2	Complied
2331.951	Vertical	59.5	74.0	14.5	Complied
4595.953	Horizontal	56.9	74.0	17.1	Complied
11487.686	Horizontal	53.2	74.0	20.8	Complied

Results: Average Bottom Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1665.317	Vertical	38.0	54.0	16.0	Complied
2331.951	Vertical	35.2	54.0	18.8	Complied
4596.062	Horizontal	53.4	54.0	0.6	Complied
11487.686	Horizontal	37.7	54.0	16.3	Complied

Results: Peak Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1664.542	Vertical	61.5	74.0	12.5	Complied
2330.807	Vertical	60.7	74.0	13.3	Complied
4627.949	Horizontal	56.1	74.0	17.9	Complied
11571.982	Horizontal	51.1	74.0	22.9	Complied

Results: Average Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1664.542	Vertical	37.9	54.0	16.1	Complied
2330.807	Vertical	35.1	54.0	18.9	Complied
4627.949	Horizontal	52.5	54.0	1.5	Complied
11571.982	Horizontal	33.1	54.0	20.9	Complied

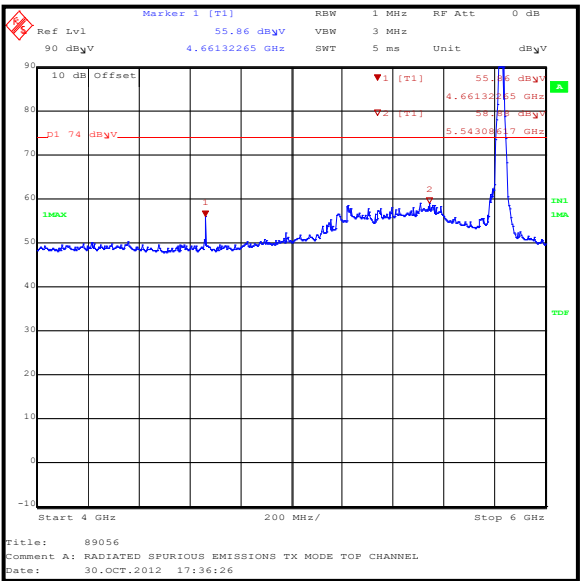
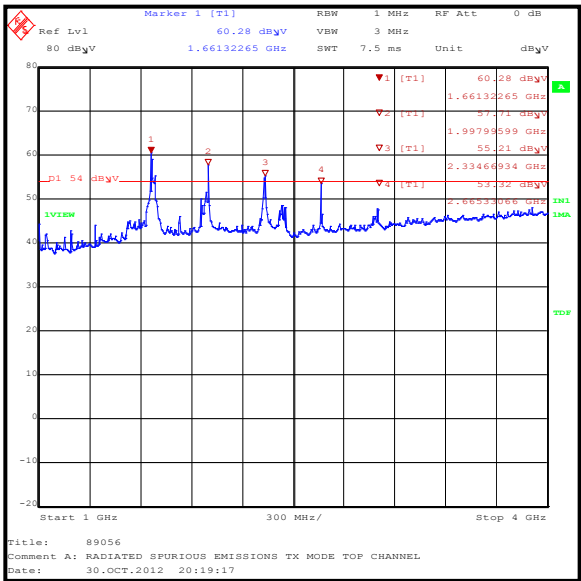
Transmitter Radiated Emissions (continued)**Results: Peak Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1665.027	Vertical	62.6	74.0	11.4	Complied
2331.004	Vertical	59.0	74.0	15.0	Complied
4660.058	Horizontal	56.2	74.0	17.8	Complied
11649.138	Horizontal	50.6	74.0	23.4	Complied

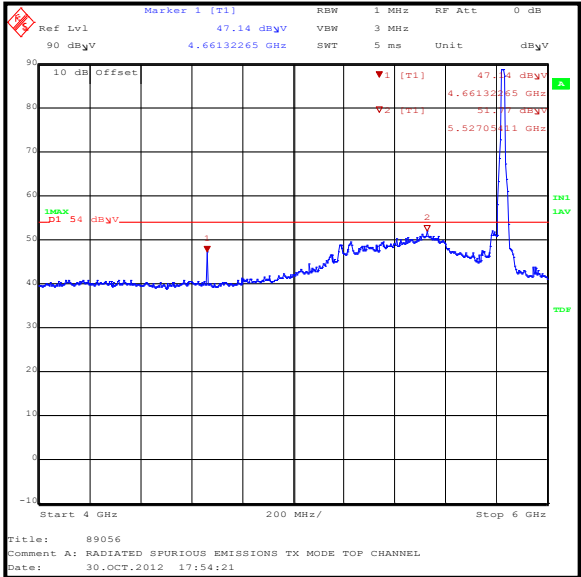
Results: Average Top Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1665.027	Vertical	38.2	54.0	15.8	Complied
2331.004	Vertical	35.2	54.0	18.8	Complied
4660.058	Vertical	53.3	54.0	0.7	Complied
11649.138	Horizontal	34.3	54.0	19.7	Complied

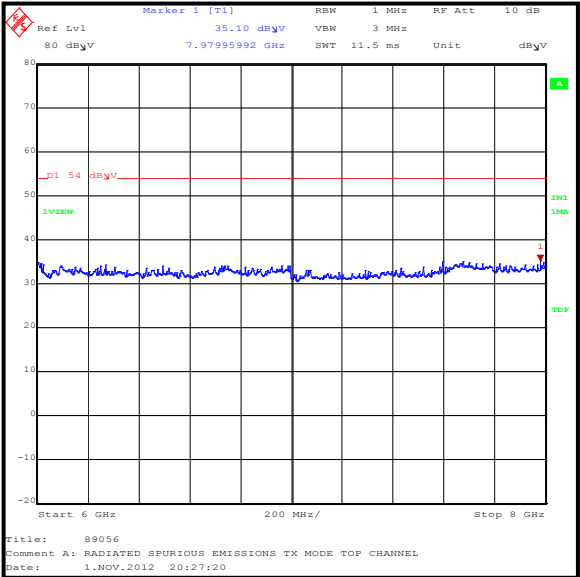
Transmitter Radiated Emissions (continued)

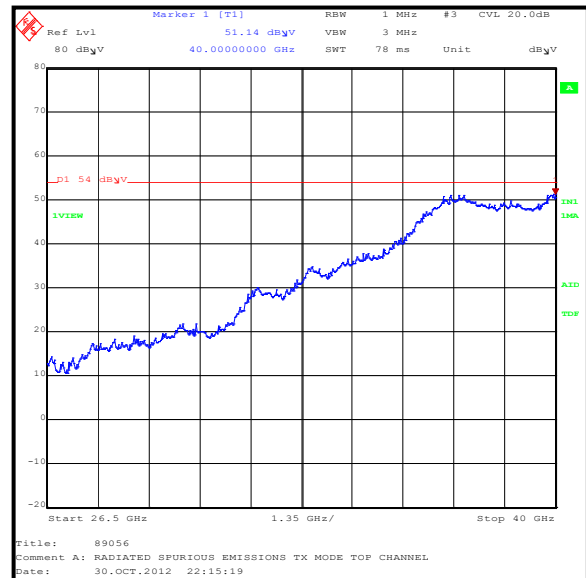
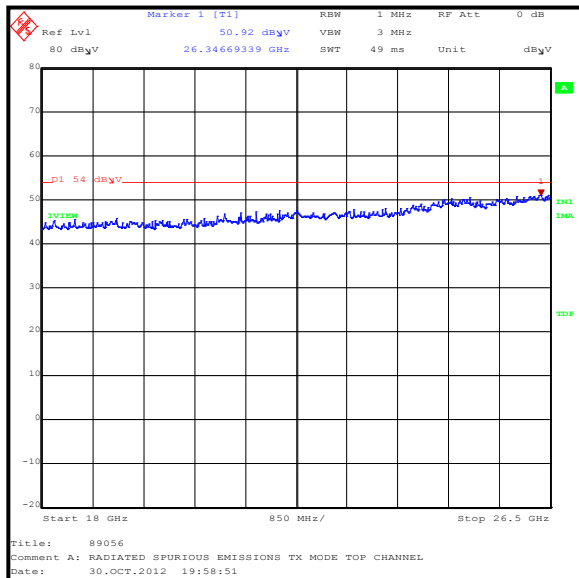
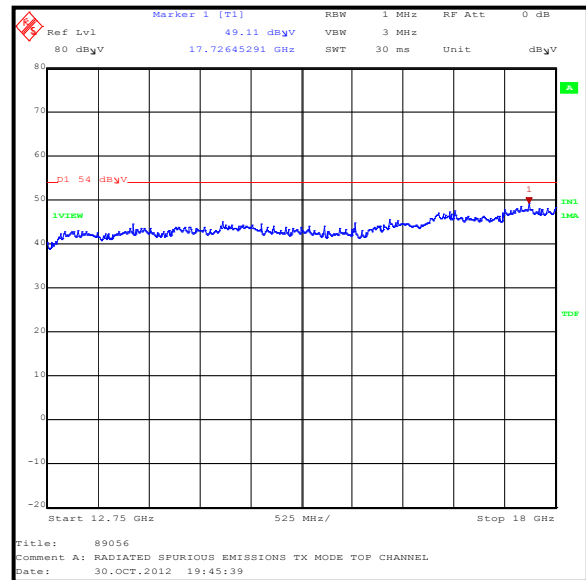
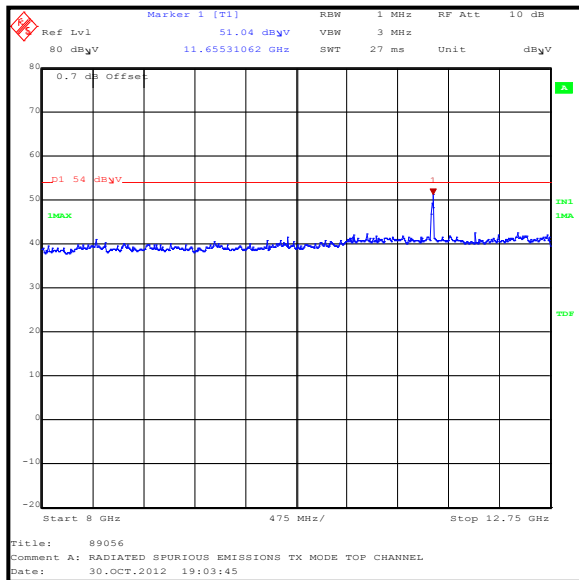


Peak Detector



Average Detector



Transmitter Radiated Emissions (continued)

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

Transmitter Radiated Emissions (continued)**Test Equipment Used:**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	06 Jul 2013	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1785	Low Noise Amplifier	Farran Technology	FLNA-28-30	FTL 6483	Calibrated Before Use	-
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A1980	High Pass Filter	Atlan TecRF	AFH-06000	09110900303	15 Mar 2013	12
A203	Antenna	Flann Microwave	22240-20	343	11 May 2013	12
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann	20240-20	330	04 Nov 2013	12
G088	Power Supply Unit	Thurlby Thandar	CPX200	100700	Calibrated Before Use	-
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated Before Use	-

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

Test Engineer:	Nick Steele	Test Date:	21 January 2013
Test Sample Serial Number:	22975498		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9, RSS-210 A8.5
Test Method Used:	FCC KDB 917954, FCC KDB 558074 D01 ANSI C63.10 Sections 6.3 and 6.6

Environmental Conditions:

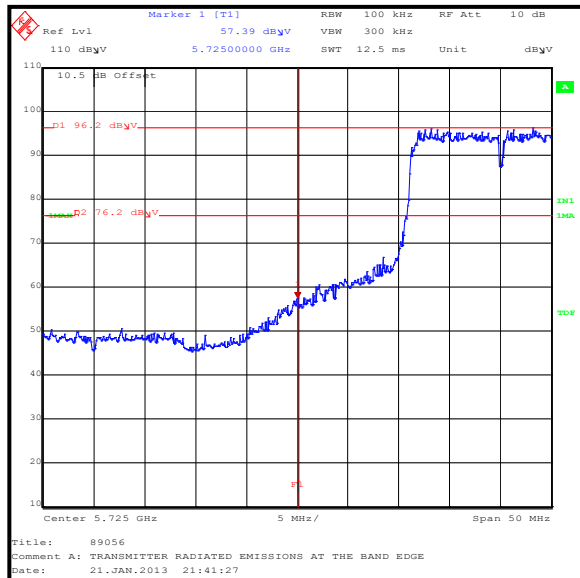
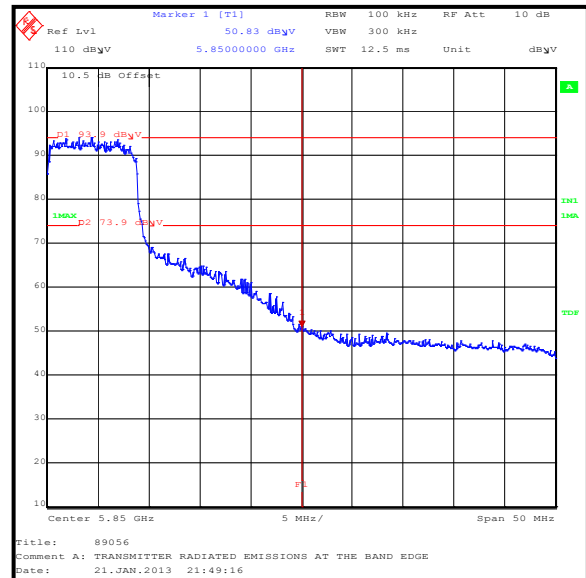
Temperature (°C):	22
Relative Humidity (%):	30

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. Band edge testing was performed in these modes on both supported channel widths.
2. Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
3. The final measured value for the given emission in the result tables incorporates the calibrated antenna factor and cable loss.
4. A -20 dBc limit applies at upper and lower band edges as the adjacent spectrum is in the non-restricted bands.

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

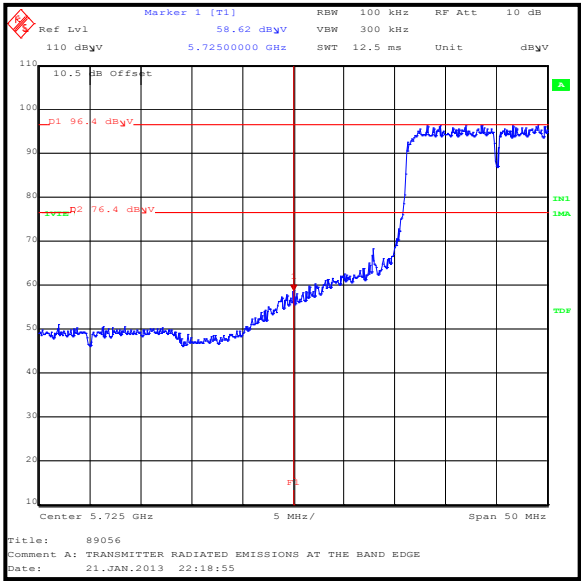
Frequency (MHz)	Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
5725	57.4	76.2	18.8	Complied
5850	50.8	73.9	23.1	Complied

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

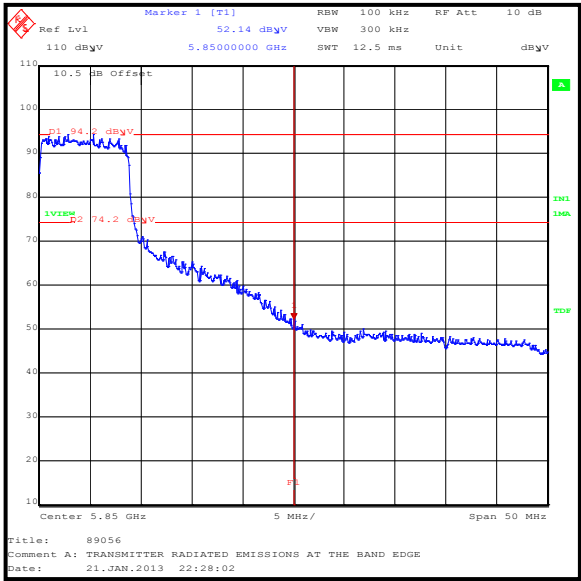
Transmitter Band Edge Radiated Emissions (continued)

Results: 802.11n / 78 Mbps / 16QAM / 20 MHz / Peak

Frequency (MHz)	Level (dBμV/m)	-20 dBc Limit (dBμV/m)	Margin (dB)	Result
5725	58.6	76.4	17.8	Complied
5850	52.1	74.2	22.1	Complied



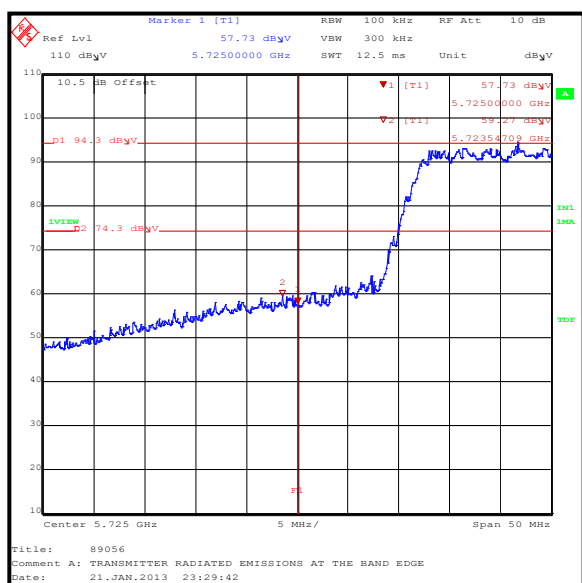
Lower Band Edge Peak Measurement



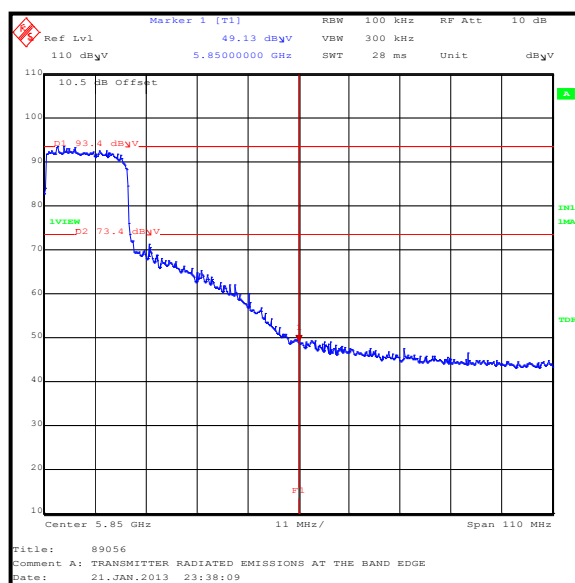
Upper Band Edge Peak Measurement

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

Frequency (MHz)	Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
5723.547	59.3	74.3	15.0	Complied
5725	57.7	74.3	16.6	Complied
5850	49.1	73.4	24.3	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	06 Jul 2013	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12

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
Radiated Spurious Emissions	30 MHz to 40 GHz	95%	±2.94 dB

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

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
2.0	-	-	Radiated Band Edge Measurements and Antenna information added