TEST REPORT

Test Report No. : UL-RPT-RP89056JD13A 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
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ilac-MRA UKAS TESTING 0644

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

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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:	47CFR15.209
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:	29 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:	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		
Type of Unit:	Transceiver		
Modulation:	CCK, BPSK, QPSK, 16QAM, 64QAM		
Data rates:	78 Mbps		
TV Power Supply Requirement(s):	Nominal	120 VAC 60 Hz	
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. 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 cables
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 rate/modulation type.

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 rate and modulation scheme 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 78 Mbps / MCS12 with a channel bandwidth of 40 MHz as this was found to have the highest power level and therefore deemed worst case.

  Please refer to UL-RPT-RP89056JD13D 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:**	01 November 2012
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 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 (%):	27

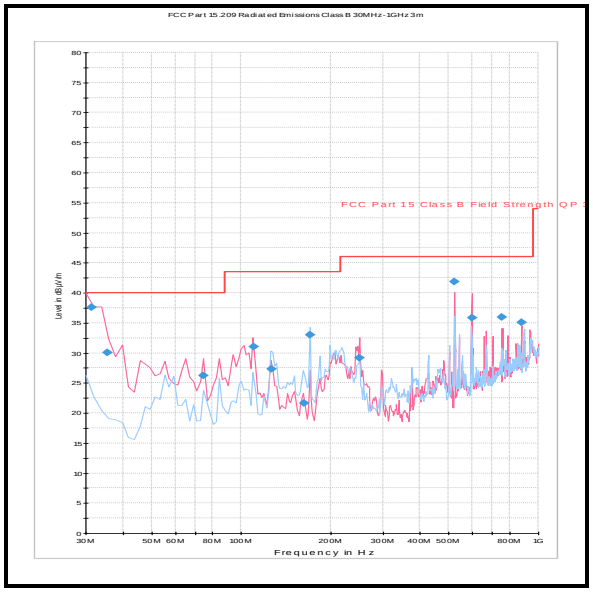
Note(s):

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: 78 Mbps / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
74.580	Vertical	26.2	40.0	13.8	Complied
110.608	Vertical	31.0	43.5	12.5	Complied
126.698	Horizontal	27.3	43.5	16.2	Complied
162.439	Horizontal	21.6	43.5	21.9	Complied
170.523	Horizontal	33.0	43.5	10.5	Complied
249.982	Vertical	29.2	46.0	16.8	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 Date:**	29 October 2012
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 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
Relative Humidity (%):	39

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 2665.3, 5947.9 and 6537.1 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 approximately 2452 MHz on the 1 GHz to 4 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 (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1665.032	Vertical	61.5	74.0	12.5	Complied
2331.264	Vertical	59.6	74.0	14.4	Complied
4861.347	Horizontal	53.4	74.0	20.6	Complied

Results: Average / Bottom Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1665.032	Vertical	45.8	54.0	8.2	Complied
2331.264	Vertical	44.3	54.0	9.7	Complied
4826.203	Horizontal	45.3	54.0	8.7	Complied

Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1664.944	Vertical	63.2	74.0	10.8	Complied
2331.287	Vertical	58.6	74.0	15.4	Complied
4875.276	Horizontal	54.3	74.0	19.7	Complied

Results: Average / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1664.944	Vertical	47.3	54.0	6.7	Complied
2331.287	Vertical	44.0	54.0	10.0	Complied
4875.276	Horizontal	46.2	54.0	17.8	Complied

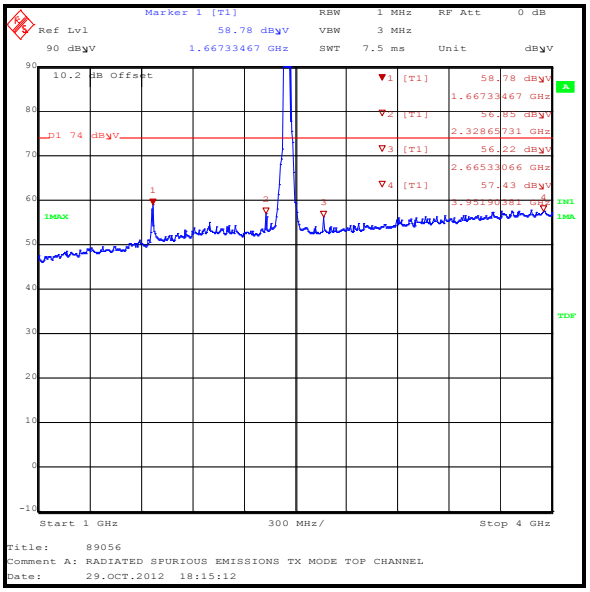
Results: Peak / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1664.734	Vertical	61.7	74.0	12.3	Complied
2330.860	Vertical	58.4	74.0	15.6	Complied
4901.428	Vertical	55.4	74.0	18.6	Complied

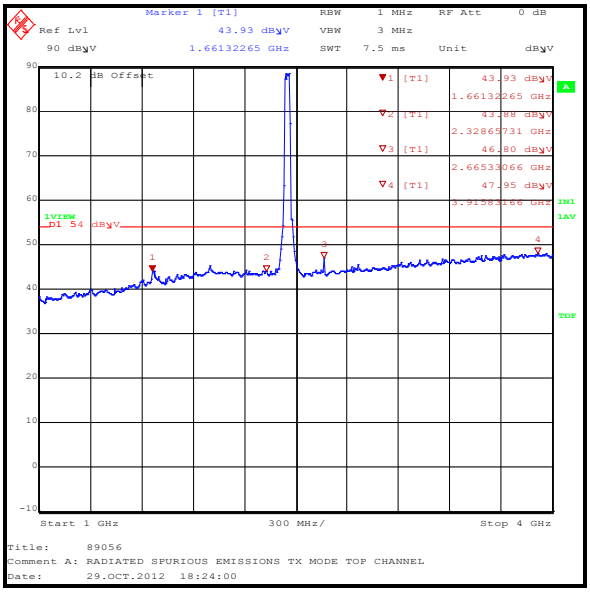
Results: Average / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1664.734	Vertical	45.9	54.0	8.1	Complied
2330.860	Vertical	43.8	54.0	10.2	Complied
4901.428	Vertical	47.4	54.0	6.6	Complied

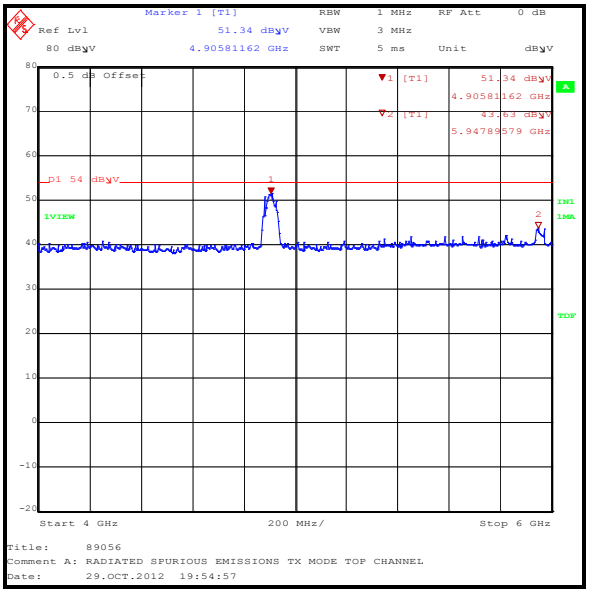
Transmitter Radiated Emissions (continued)

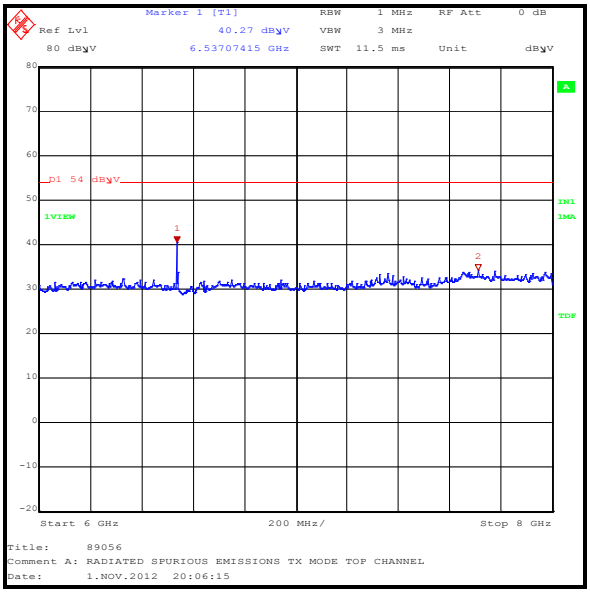


Peak Detector

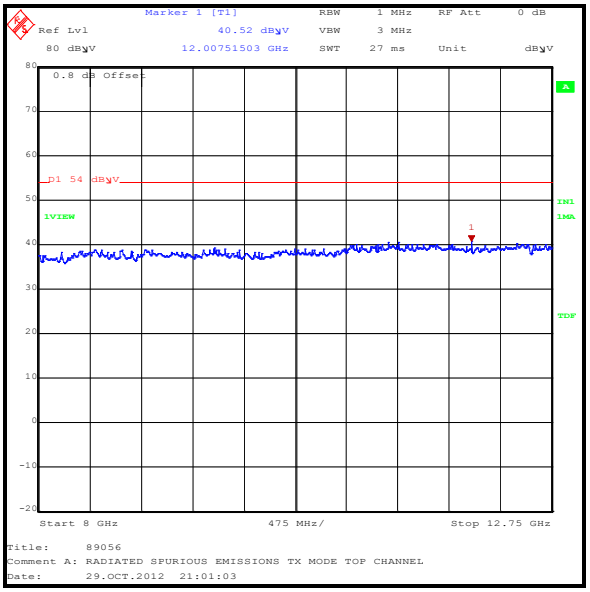


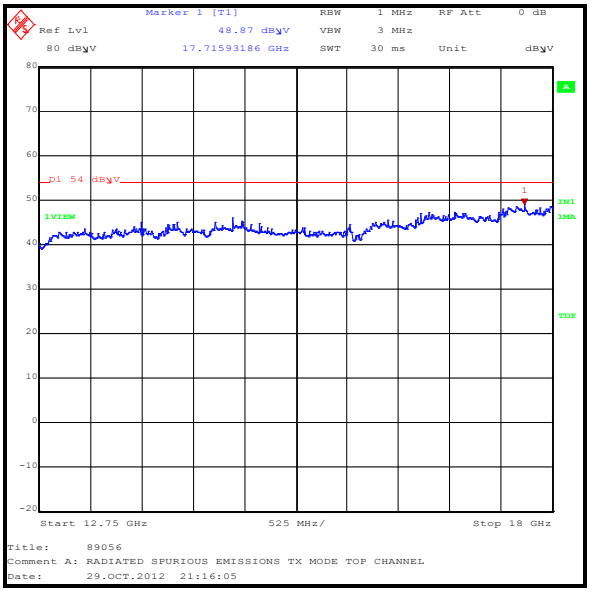
Average Detector

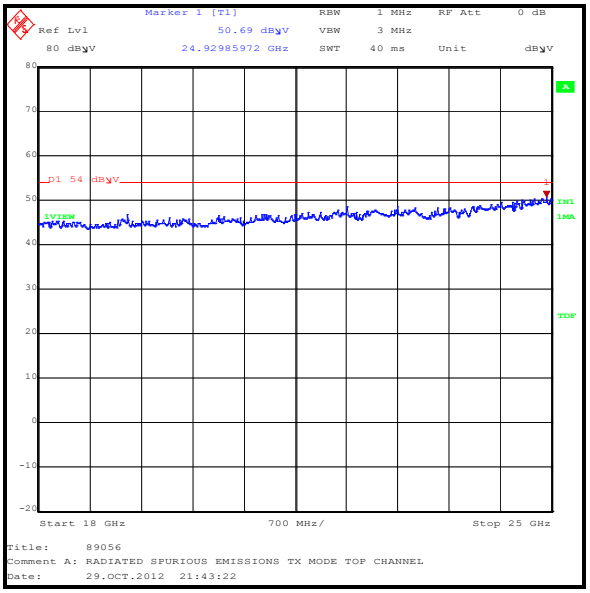




Transmitter Radiated Emissions (continued)







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
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	15 Mar 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
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

5.2.2. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	14 January 2013 & 21 January 2013
Test Sample Serial Number:	22975498		

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 917954, FCC KDB 558074 D01 v02 Section 10.0 & ANSI C63.10 Section 6.9.2

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	30 to 33

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. A -20 dBc limit applies at upper and lower band edges as the adjacent spectrum is in the non-restricted bands.
5. In accordance with FCC KDB 558074 D01 v02 Section 10.0, peak EIRP measurements within the first 1 MHz beyond the upper band edge were performed with the band power function of a spectrum analyser. Measurement bandwidths shown on the plots were set automatically by the spectrum analyser. The measured EIRP at a distance of 3 metres was converted to field strength by adding 95.2 dB. Average measurements at the upper band edges and peak EIRP measurements of the lower band edge were performed following ANSI C63.10 Section 6.9.2 procedures.

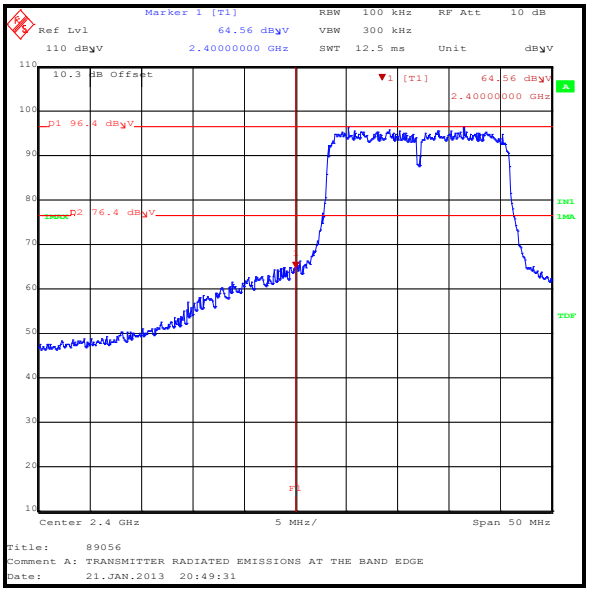
Transmitter Band Edge Radiated Emissions (continued)

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

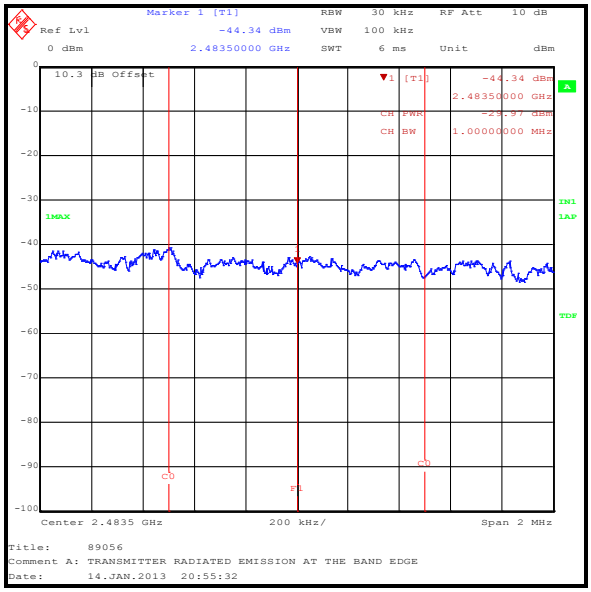
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	64.6	76.4*	11.8	Complied
2483.5	65.2	74.0	8.8	Complied

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

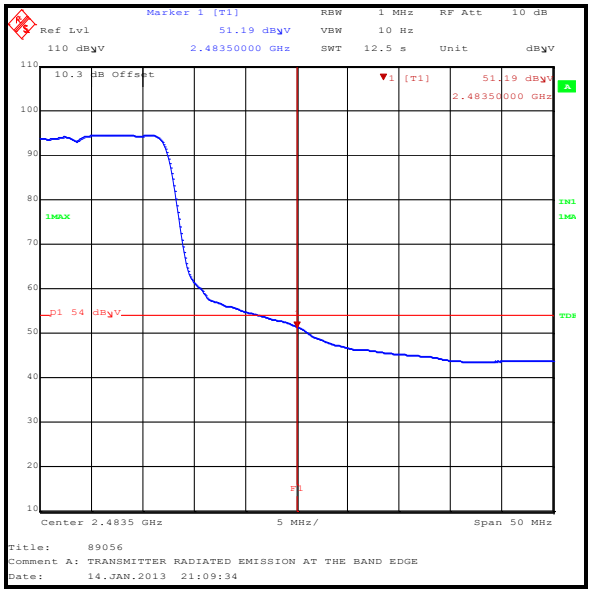
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	51.2	54.0	2.8	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

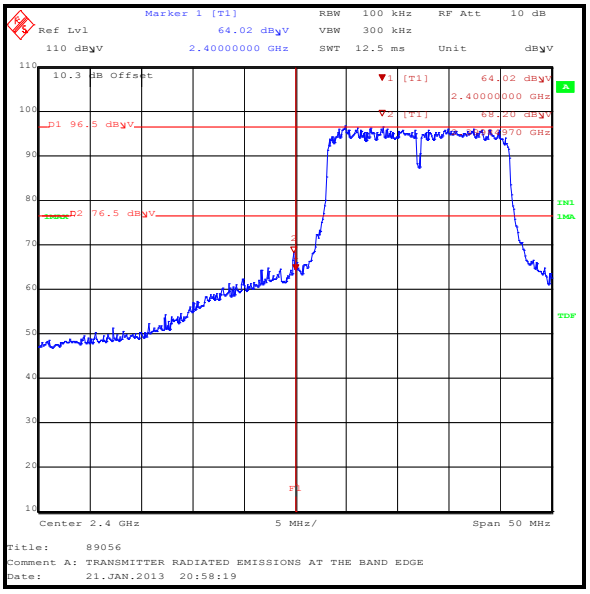
Transmitter Band Edge Radiated Emissions (continued)

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

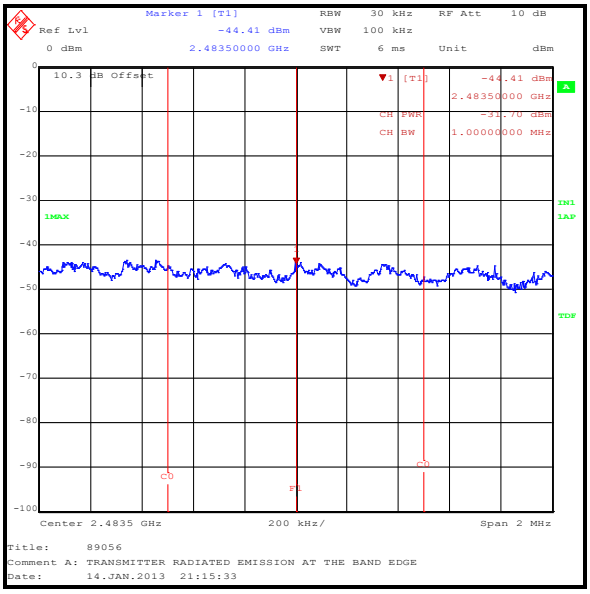
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.850	68.2	76.5*	8.3	Complied
2400	64.0	76.5*	12.5	Complied
2483.5	63.5	74.0	10.5	Complied

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

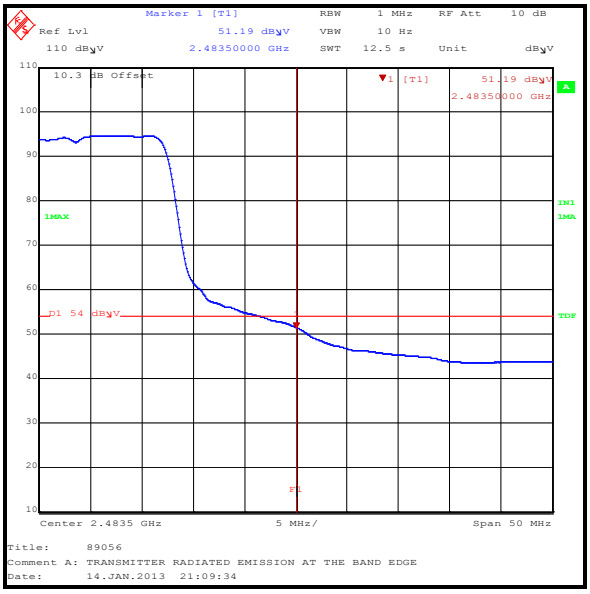
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	51.2	54.0	2.8	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

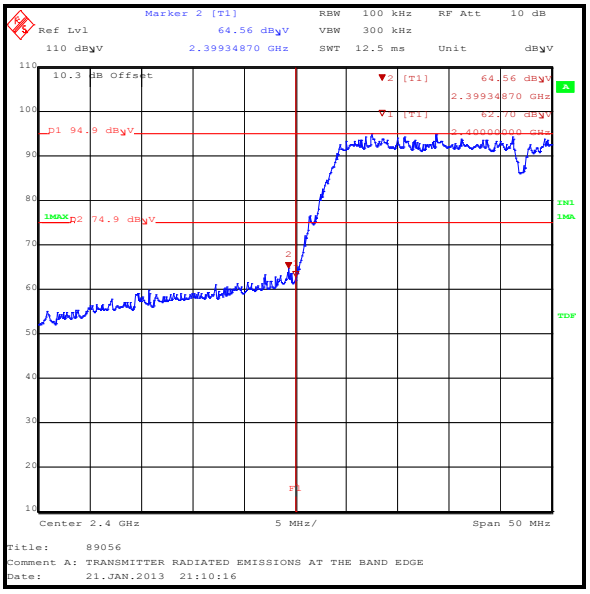
Transmitter Band Edge Radiated Emissions (continued)

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

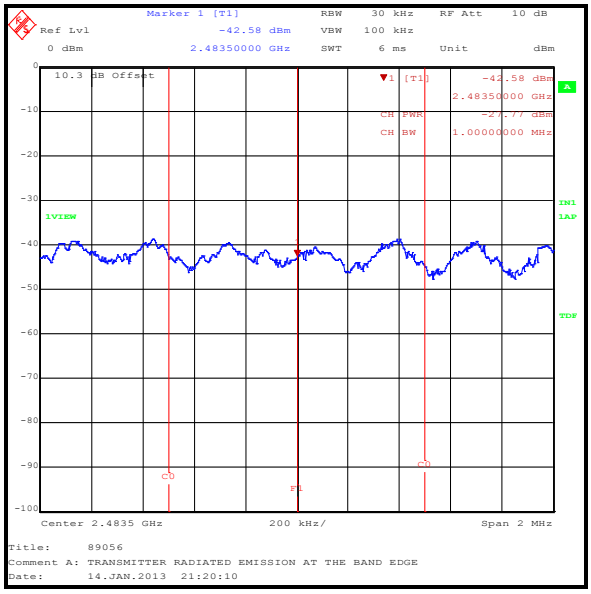
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.349	64.6	74.9*	10.3	Complied
2400	62.7	74.9*	12.2	Complied
2483.5	67.4	74.0	6.6	Complied

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

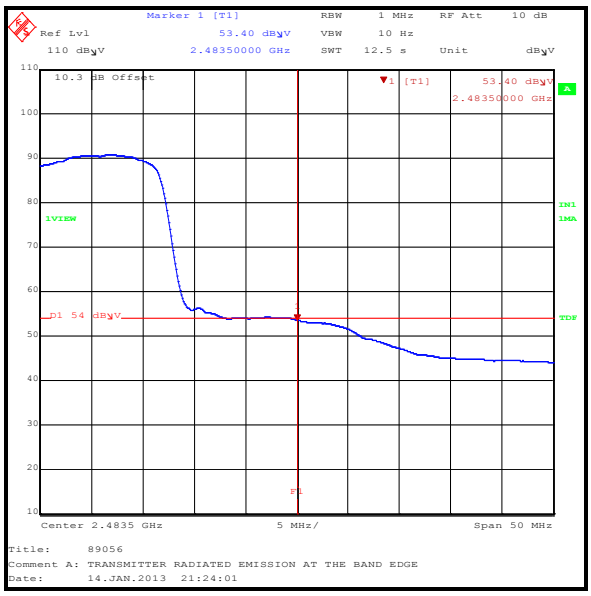
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	53.4	54.0	0.6	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge 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
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
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

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 25 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