



# TEST REPORT

**Test Report No. : UL-RPT-RP89056JD21A V2.0**

**Manufacturer** : Bang & Olufsen a/s  
**Model No.** : BeoVision 11-46  
**FCC ID** : TTULBWA1ZZPD  
**IC Certification No.** : 3775B-LBWA1ZZPD  
**Test Standard(s)** : FCC Parts 15.247(d), 15.209(a), 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  
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This laboratory is accredited by UKAS.  
The tests reported herein have been  
performed in accordance with its' terms  
of accreditation.

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**1. Customer Information**




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

## **2. Summary of Testing**

### **2.1. General Information**

<b>Specification Reference:</b>	47CFR15.247
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Section 15.247
<b>Specification Reference:</b>	47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Section 15.209
<b>Specification Reference:</b>	RSS-Gen Issue 3 December 2010
<b>Specification Title:</b>	General Requirements and Information for the Certification of Radio Apparatus
<b>Specification Reference:</b>	RSS-210 Issue 8 December 2010
<b>Specification Title:</b>	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
<b>Site Registration:</b>	FCC: 209735; Industry Canada: 3245B-2
<b>Location of Testing:</b>	RFI Global Services Ltd trading as UL, Wade Road, Basingstoke, Hampshire, RG24 8AH.
<b>Test Dates:</b>	31 October 2012 to 01 November 2012

### **2.2. Summary of Test Results**

<b>FCC Reference (47CFR)</b>	<b>IC Reference</b>	<b>Measurement</b>	<b>Result</b>
Part 15.247(d) / 15.209(a)	RSS-Gen 4.9 / RSS-210 A8.5	Transmitter Radiated Emissions	
<b>Key to Results</b>  = Complied  = Did not comply			

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

<b>Reference:</b>	ANSI C63.4 (2009)
<b>Title:</b>	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>Reference:</b>	ANSI C63.10 (2009)
<b>Title:</b>	American National Standard for Testing Unlicensed Wireless Devices
<b>Reference:</b>	FCC KDB 558074 D01 v02 10/04/2012
<b>Title:</b>	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) devices operating under §15.247
<b>Reference:</b>	FCC KDB 662911 D01 v01r02 9/26/2012
<b>Title:</b>	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

### **2.4. Deviations from the Test Specification**

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

<b>Brand Name:</b>	Bang & Olufsen
<b>Model Name or Number:</b>	BeoVision 11-46
<b>Serial Number:</b>	22971876
<b>Software Version Number:</b>	1.0.1.25692
<b>FCC ID:</b>	TTULBWA1ZZPD
<b>Industry Canada Certification Number:</b>	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 46" 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 Rate:	78 Mbps		
Power Supply Requirement(s):	Nominal	120 VAC 60 Hz	
Channel Spacing:	20 MHz		
Transmit Frequency Range:	2400 MHz to 2483.5 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462
Channel Spacing:	40 MHz		
Transmit Frequency Range:	2400 MHz to 2483.5 MHz		
Transmit 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:

<b>Description:</b>	Laptop
<b>Brand Name:</b>	Dell
<b>Model Name or Number:</b>	D610
<b>Serial Number:</b>	RFI Asset No. PC343NT

<b>Description:</b>	Internal Antenna
<b>Brand Name:</b>	TE Connectivity Ltd
<b>Model Name or Number:</b>	PUCK

<b>Description:</b>	Internal Antenna
<b>Brand Name:</b>	TE Connectivity Ltd
<b>Model Name or Number:</b>	UAM

<b>Description:</b>	Ethernet hub
<b>Brand Name:</b>	Netgear
<b>Model Name or Number:</b>	GS605
<b>Serial Number:</b>	1YG194390218E

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

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

<b>Description:</b>	HDMI Monitor
<b>Brand Name:</b>	Philips
<b>Model Name or Number:</b>	MUT1121T
<b>Serial Number:</b>	AU1A1017002190



**Support Equipment (continued)**

<b>Description:</b>	Scart cable
<b>Brand Name:</b>	Not Stated
<b>Model Name or Number:</b>	Not Stated
<b>Serial Number:</b>	Not Stated

<b>Description:</b>	USB dongle
<b>Brand Name:</b>	Integral
<b>Model Name or Number:</b>	8 GB
<b>Serial Number:</b>	Not Stated

**3.6. Antenna**

The table below lists the antennas used with this product:

<b>Type</b>	<b>Stated Gain (dBi)</b>	<b>Model</b>	<b>Part No.</b>
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:	22971876		

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:

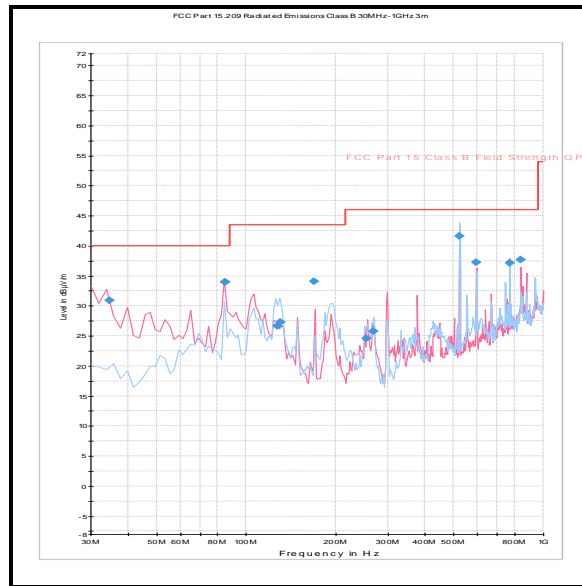
Temperature (°C):	28
Relative Humidity (%):	28

#### Note(s):

1. The final measured value, for the given emission, in the table below 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 >20 dB below the applicable 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
127.285	Horizontal	26.7	43.5	16.8	Complied
130.509	Horizontal	27.3	43.5	16.2	Complied
169.705	Vertical	34.1	43.5	9.4	Complied
254.707	Vertical	24.6	46.0	21.4	Complied
268.583	Horizontal	25.8	46.0	20.2	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:**

<b>Test Engineers:</b>	Nick Steele & Andrew Edwards	<b>Test Dates:</b>	31 October 2012 & 01 November 2012
<b>Test Sample Serial Number:</b>	22971876		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Industry Canada Reference:</b>	RSS-Gen 4.9 & RSS-210 A8.5
<b>Test Method Used:</b>	FCC KDB 558074 D01 v02 Section 10.0 & ANSI C63.10 Sections 6.3 and 6.6
<b>Frequency Range</b>	1 GHz to 25 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 24
<b>Relative Humidity (%):</b>	34 to 37

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The emissions shown on the pre-scan plots at approximately 1240.5, 1998.0 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 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 (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1664.854	Vertical	60.6	74.0	13.4	Complied
4847.335	Horizontal	53.6	74.0	20.4	Complied

**Results: Average / Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1664.854	Vertical	38.8	54.0	15.2	Complied
4847.335	Horizontal	39.9	54.0	14.1	Complied

**Results: Peak / Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1664.974	Vertical	60.1	74.0	13.9	Complied
4888.230	Horizontal	53.9	74.0	20.1	Complied

**Results: Average / Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1664.974	Vertical	38.1	54.0	15.9	Complied
4888.230	Horizontal	40.4	54.0	13.6	Complied

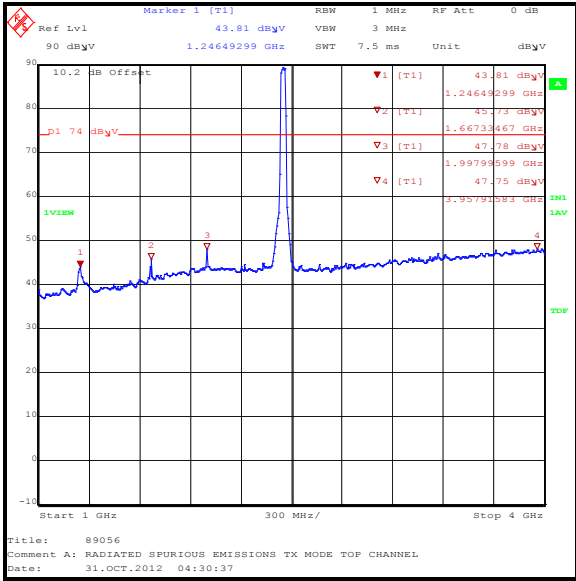
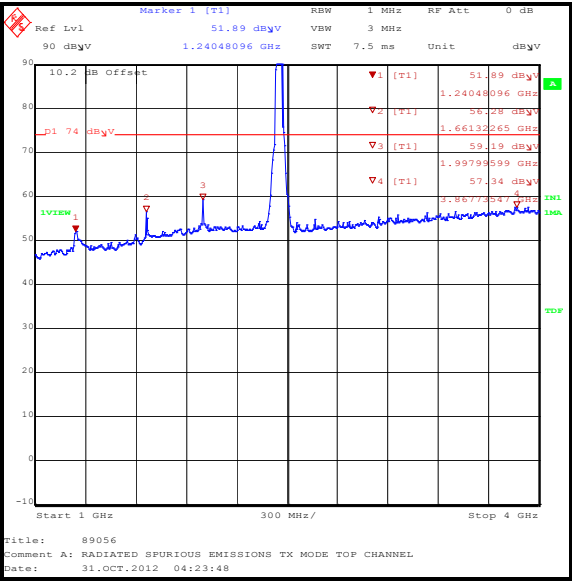
**Results: Peak / Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1665.101	Vertical	61.0	74.0	13.0	Complied
4906.579	Horizontal	54.6	74.0	19.4	Complied

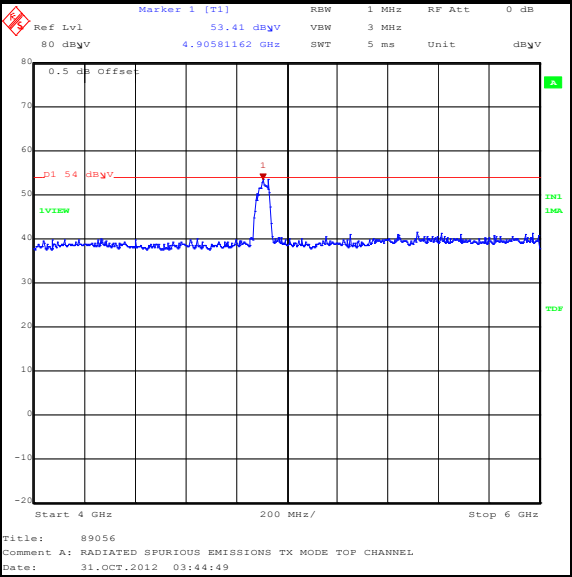
**Results: Average / Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1665.101	Vertical	38.8	54.0	15.2	Complied
4906.579	Horizontal	41.0	54.0	13.0	Complied

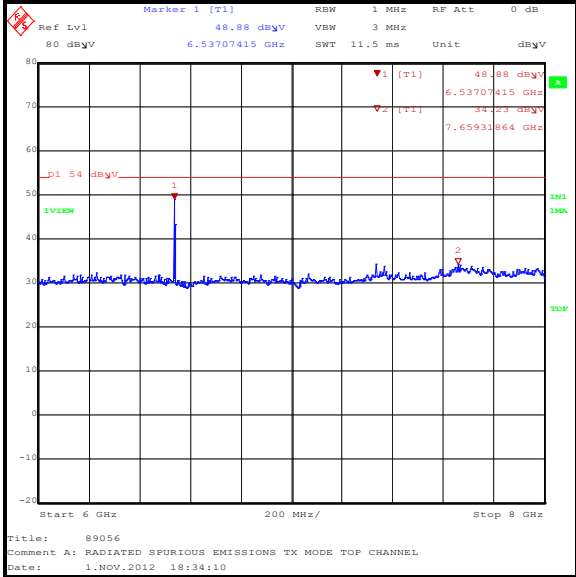
Transmitter Radiated Emissions (continued)



Peak Detector

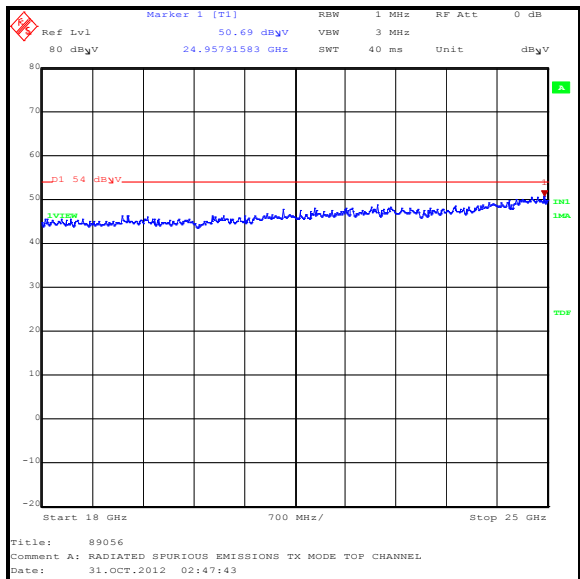
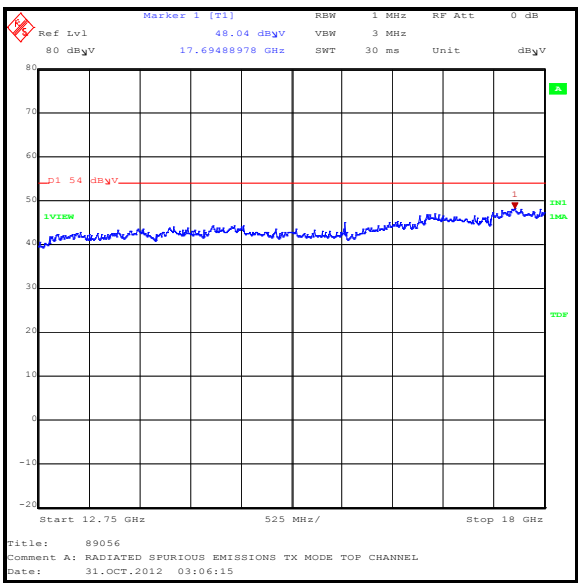
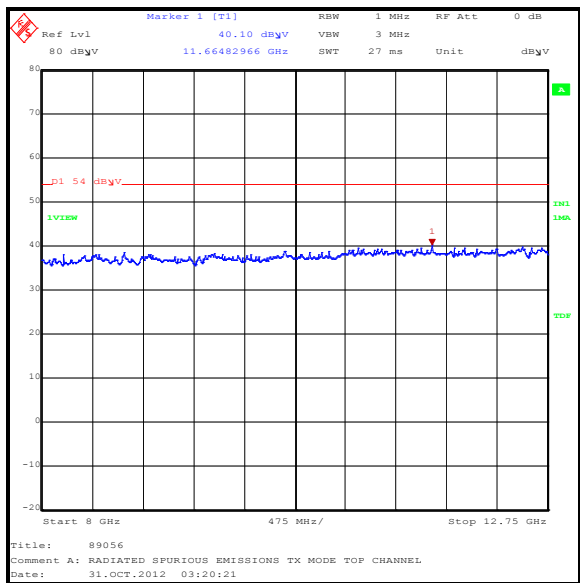


Average Detector





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:**

<b>RFI No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
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
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

## **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	-	-	Antenna information added