

TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Beo Play V1-40" TV containing an LBWA1ZZPDZ-385 Module

FCC ID: TTULBWA1ZZPD

IC Certification Number: 3775B-LBWA1ZZPD

To: FCC Parts 15.247(d), 15.209(a) & Industry Canada RSS-210 A8.5
and RSS-Gen 4.9

Test Report Serial No.:
RFI-RPT-RP84552JD02E V2.0

Version 2.0 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:

06 July 2012

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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) 2011: Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2011: 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, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	24 February 2012 to 26 February 2012

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	
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 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 Name or Number:	Beo Play V1-40 40" TV containing a Murata LBWA1ZZPDZ-385 module
Serial Number:	22586321
Software Version Number:	0.0.0.23327
FCC ID:	TTULBWA1ZZPD
IC 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. The EUT has three external antenna ports, two transmit and one receive, 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.

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		
Data Rate:	13 Mbps		
Power Supply Requirement(s):	Nominal	120 VAC 60 Hz	
Transmit & Receive Frequency Band:	5745 MHz to 5825 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	149	5745
	Middle	157	5785
	Top	165	5825

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:	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

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

Support Equipment (continued)

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

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 at maximum power on the bottom, centre and top channels as required using the supported data rates.

4.2. Configuration and Peripherals

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

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 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.
- A Tyco Electronics TE Connectivity 1513711-1 antenna (supporting MIMO) was connected to the 3-way antenna port. The antenna was placed on the highest point of the television using a temporary bracket. The following accessories were representative of typical accessories that are normally used in conjunction with the television incorporating the EUT: HDMI player, USB memory stick, Digital Terrestrial Receiver and Wireless N Router. These were connected using suitable cables in order to terminate all ports during radiated testing. The television was powered from a 120 VAC 60 Hz single phase mains supply.
- For transmitter radiated spurious emissions tests, the TV was configured to be transmitting on both ports which were then connected to the Tyco antenna. The EUT was transmitting with a data rate of 13 Mbps / MCS8 with a channel bandwidth of 20 MHz. Initial measurements were carried out on one channel and this was found to have the highest power level and therefore deemed to be worst case. Pre-scans were performed on the top channel and if any emissions seen, final measurements were carried out on bottom, middle and top channels.

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. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	Test Date:	24 February 2012
Test Sample Serial No:	22586321		

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 Section 5.4 & ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

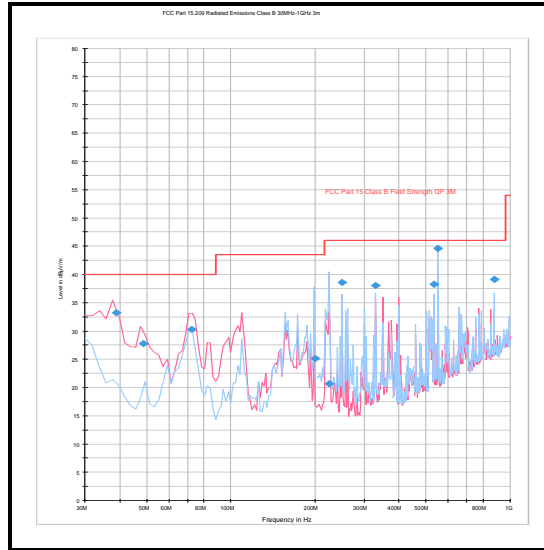
Temperature (°C):	24
Relative Humidity (%):	26

Note(s):

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

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
250.001	Horizontal	38.6	46.0	7.4	Complied
330.008	Horizontal	38.0	46.0	8.0	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 Engineer:	Andrew Edwards & Nick Steele	Test Date:	25 February 2012 & 26 February 2012
Test Sample Serial No:	22586321		

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 Section 5.4 & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	24

Note(s):

1. The final measured value for the given emissions in the result tables incorporates the calibrated antenna factor and cable loss.
2. The emission shown at approximately 5825 MHz on the 4 GHz to 6 GHz plot is the EUT fundamental.
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. 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
4595.807	Vertical	46.7	74.0	27.3	Complied
11496.507	Horizontal	43.1	74.0	30.9	Complied

Results: Average Bottom Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4595.951	Vertical	44.4	54.0	9.6	Complied
11496.507	Horizontal	29.7	54.0	24.3	Complied

Results: Peak Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4627.989	Vertical	48.5	74.0	25.5	Complied
11571.524	Horizontal	42.8	74.0	31.2	Complied

Results: Average Middle Channel

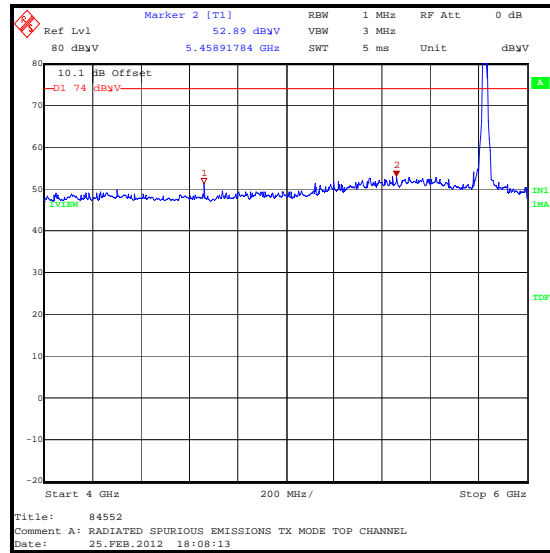
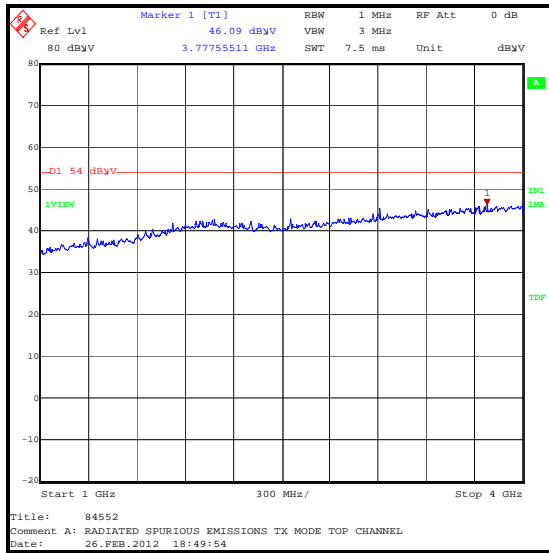
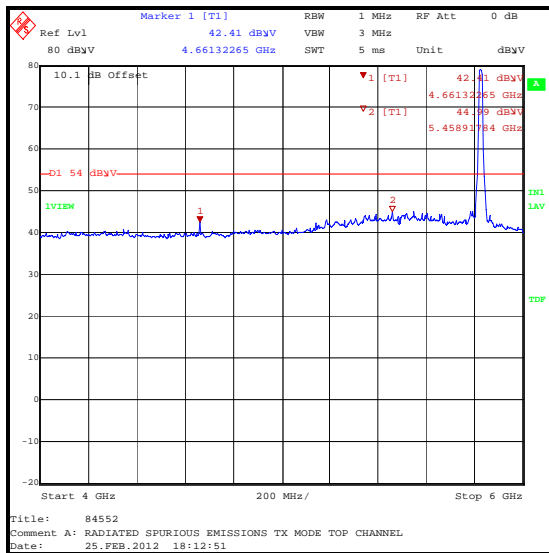
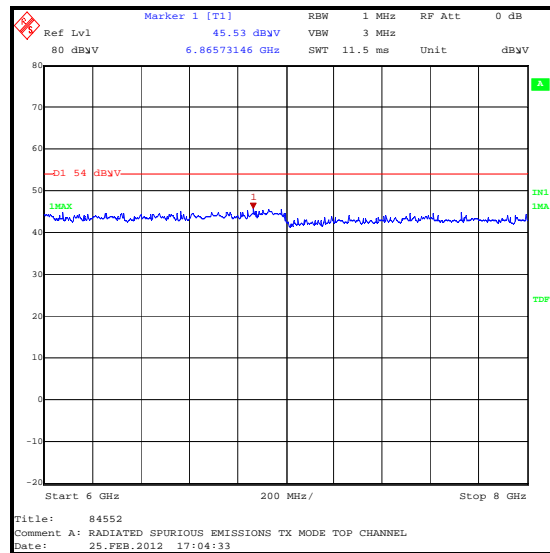
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4627.917	Vertical	46.1	54.0	7.9	Complied
11571.524	Horizontal	29.3	54.0	24.7	Complied

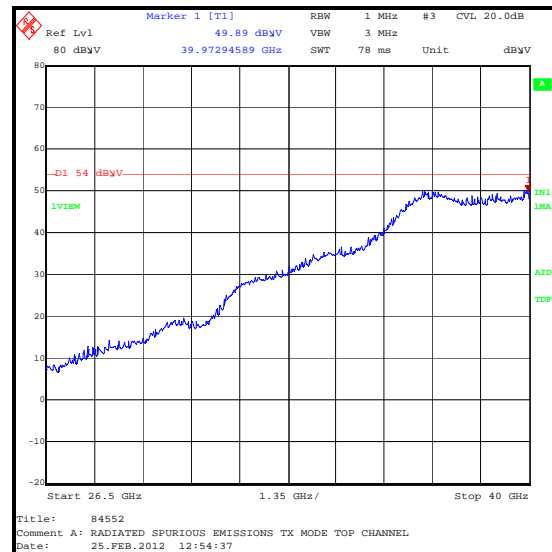
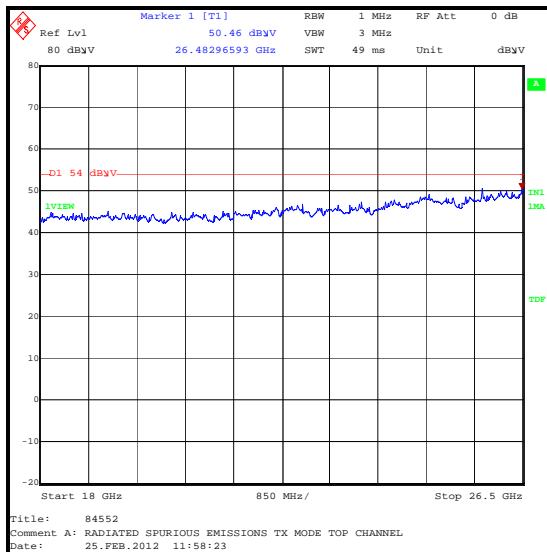
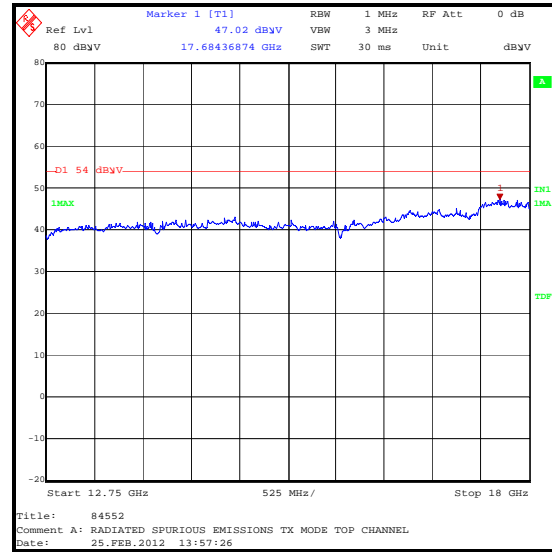
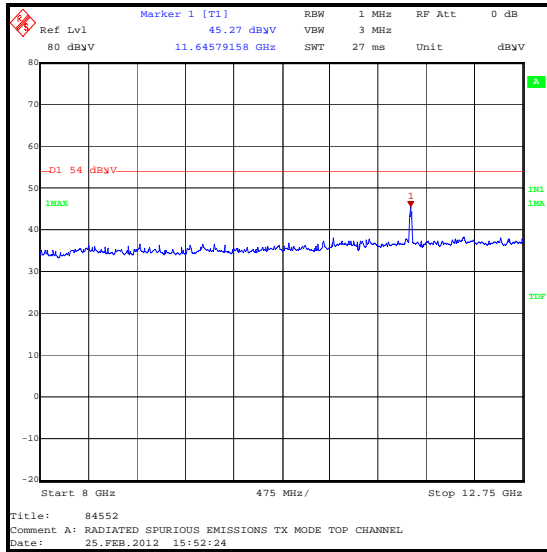
Results: Peak Top Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4660.033	Vertical	46.3	74.0	27.7	Complied
11648.910	Horizontal	46.3	74.0	27.7	Complied

Results: Average Top Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4659.895	Vertical	48.3	54.0	5.7	Complied
11648.910	Horizontal	33.7	54.0	20.3	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.

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.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (months)
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	09 Oct 2012	12
A1818	Antenna	EMCO	3115	00075692	09 Oct 2012	12
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A202	Antenna	Flann Microwave	24240-20	116	11 May 2013	36
A203	Antenna	Flann Microwave	22240-20	343	11 May 2013	36
A253	Antenna	Flann Microwave	12240-20	128	09 Oct 2012	12
A254	Antenna	Flann Microwave	14240-20	139	09 Oct 2012	12
A255	Antenna	Flann Microwave	16240-20	519	09 Oct 2012	12
A256	Antenna	Flann Microwave	18240-20	400	09 Oct 2012	12
A436	Antenna	Flann	20240-20	330	09 Oct 2012	12
A553	Antenna	Chase	CBL6111A	1593	15 Feb 2013	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	09 Nov 2012	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	09 Oct 2012	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESI26	100046K	29 Jun 2012	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	03 Feb 2013	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated Before Use	-

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