RADIO TEST REPORT

Test Report No. : 10012646H-R4

Applicant	:	**Bang & Olufsen a/s**
Type of Equipment	:	**IEEE 802.11a/b/g/n 2 x 2 MIMO WLAN and Bluetooth module**
Model No.	:	**AW-AU397**
FCC ID	:	**TTUAW-AU397**
IC Number	:	**3775B-AWAU397**
Test regulation	:	**FCC Part 15 Subpart C: 2015** **RSS-Gen Issue 4: 2014** **RSS-210 Issue 8: 2010 +Amendment 1: 2015** **(Average Output Power test only)**
Test Result	:	**Complied**

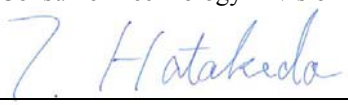
1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. This report is a revised version of 10012646H-R3. 10012646H-R3 is replaced with this report.

Date of test: November 19, 2014

Representative test engineer:

Hiroshi Kukita
Engineer
Consumer Technology Division

Approved by:



Takahiro Hatakeda
Leader
Consumer Technology Division

REVISION HISTORY

Original Test Report No.: 10012646H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10012646H	November 20, 2014	-	-
1	10012646H-R1	March 31, 2015	All pages (header)	Added IC Number
1	10012646H-R1	March 31, 2015	1	Deleted NVLAP logo and its related note
1	10012646H-R1	March 31, 2015	1, 5	Updated FCC15 standard version and added RSS standard information
1	10012646H-R1	March 31, 2015	5	Updated RSS standard in table in clause 3.2
1	10012646H-R1	March 31, 2015	7	Deleted a note for Operating mode
1	10012646H-R1	March 31, 2015	11, 12	Corrected test data
2	10012646H-R2	April 3, 2015	5	Corrected ANSI C63.4 version
3	10012646H-R3	April 22, 2015	7	Added explanatory note for worst mode
4	10012646H-R4	April 23, 2015	7	Added explanatory note for worst mode

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SECTION 1: Customer information

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

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	IEEE 802.11a/b/g/n 2 x 2 MIMO WLAN and Bluetooth module
Model No.	:	AW-AU397
Serial No.	:	Refer to Section 4, Clause 4.2
Receipt Date of Sample	:	August 8, 2014
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2412-2462MHz (11b/g/n-20) 2422-2452 (11n-40)
Modulation	:	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM
Power Supply (radio part input)	:	DC 3.3V
Antenna Gain	:	3.0dBi (UAM Antenna) 0.3dBi (V100 Antenna)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on January 21, 2015
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

* The revision on January 21, 2015 does not affect the test specification applied to the EUT.

Test Specification/Title	:	RSS-Gen Issue 4: 2014 General Requirements for Compliance of Radio Apparatus
	:	RSS-210 Issue 8: 2010 + Amendment 1: 2015 Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

* The amendment issued on February 5, 2015 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Average Output Power	**FCC:** KDB 558074D01 V03 r02 section 9.2.3	**FCC:** Section 15.247(b)(3)	See data	Complied	Conducted
	IC: RSS-Gen 6.12	**IC:** RSS-210 A8.4(4)			
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.					

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

FCC Part 15.31 (e)
This EUT provides stable voltage (DC3.3V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI
The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Power meter (±dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (±dB)			Antenna terminal conducted emission (±dB)		Channel power (±dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

3.5 Test Location

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	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Data of EMI and Test instruments

Refer to APPENDIX.

SECTION 4: Operation of E.U.T. during testing

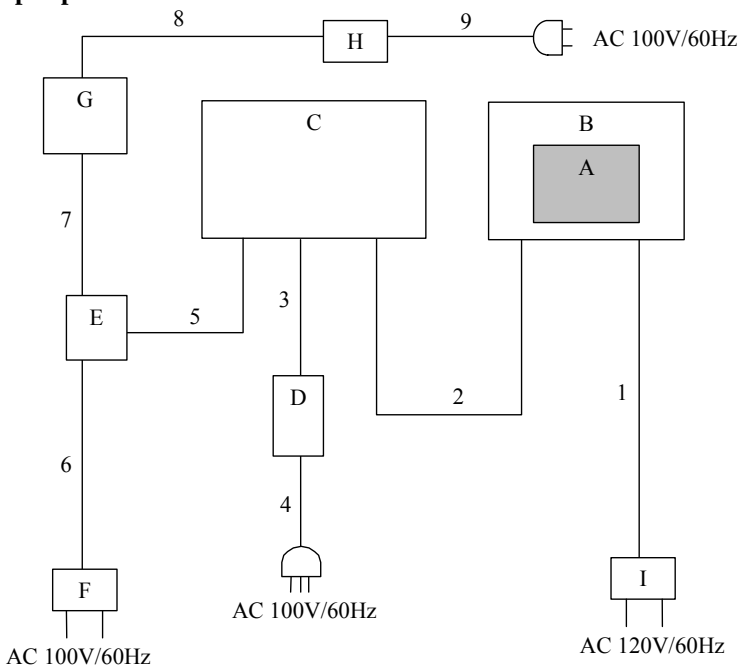
4.1 Operating Mode(s)

Mode	Remarks*
802.11b - DQPSK	11 Mbp/s
802.11g - QPSK	12 Mbp/s
802.11n HT20 - QPSK	29 Mbp/s / MCS 10
802.11n HT40 - QPSK	81 Mbp/s / MCS 10
*Transmitting duty was 100% on all tests.	
*All modes and channel widths were initially investigated on one channel, on both ports. The above modes produced the highest output power. *Power of the EUT was set by the software as follows; Power settings: 20 Software: Certification Tool 0.8 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product. *Pre-scans were performed to determine the worst case mode. Pre-scans are available if required.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested Antenna port	Tested frequency
Average Output Power	11b Tx 11g Tx	0, 1	2412MHz 2437MHz 2462MHz
	11n-20 Tx	0, 1, 0+1	2412MHz 2437MHz 2462MHz
	11n-40 Tx	0, 1, 0+1	2422MHz 2437MHz 2452MHz

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	IEEE 802.11a/b/g/n 2 x 2 MIMO WLAN and Bluetooth module	AW-AU397	3	Bang & Olufsen a/s	EUT
B	Jig board	S-PP002002	1213	Azure Wave	-
C	Laptop PC	7674	L3-A089907/08	Lenovo	-
D	AC Adapter	42T4424	11S42T4424Z1ZF3E18257P	Lenovo	-
E	Wireless LAN access point	CG-WLBARAG2	1072210051202516	Corega	-
F	AC Adapter	MT18-3053280-A1	-	Corega	-
G	Laptop PC	2373-L32	L3-NHT3H	IBM	-
H	AC Adapter	08K8208	11S08K8208Z1Z6MF43Y1BD	IBM	-
I	Travel Charger	44004	514-38	goobay	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	4.8	Shielded	Shielded	-
2	USB Cable	1.8	Shielded	Shielded	-
3	DC Cable	1.8	Unshielded	Unshielded	-
4	AC Cable	1.6	Unshielded	Unshielded	-
5	LAN Cable	0.9	Unshielded	Unshielded	-
6	DC Cable	1.8	Unshielded	Unshielded	-
7	LAN Cable	0.9	Unshielded	Unshielded	-
8	DC Cable	1.8	Unshielded	Unshielded	-
9	AC Cable	1.0	Unshielded	Unshielded	-

SECTION 5: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
Average Output Power	-	-	-	Auto	Average	-	Power Meter (Sensor: 50MHz BW)

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Data of EMI test

Average Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10012646H
Date	11/18/2014
Temperature/ Humidity	23 deg. C / 42% RH
Engineer	Hiroshi Kukita
Mode	11b/g Tx

Antenna 0

11b **11Mbps**

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	5.50	1.50	10.00	17.00	50.12	30.00	1000	13.00
2437	5.72	1.50	10.00	17.22	52.72	30.00	1000	12.78
2462	6.21	1.50	10.00	17.71	59.02	30.00	1000	12.29

11g **12Mbps**

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	5.60	1.50	10.00	17.10	51.29	30.00	1000	12.90
2437	5.92	1.50	10.00	17.42	55.21	30.00	1000	12.58
2462	5.86	1.50	10.00	17.36	54.45	30.00	1000	12.64

Antenna 1

11b **11Mbps**

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	5.62	1.50	10.00	17.12	51.52	30.00	1000	12.88
2437	5.00	1.50	10.00	16.50	44.67	30.00	1000	13.50
2462	5.03	1.50	10.00	16.53	44.98	30.00	1000	13.47

11g **12Mbps**

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	5.82	1.50	10.00	17.32	53.95	30.00	1000	12.68
2437	5.68	1.50	10.00	17.18	52.24	30.00	1000	12.82
2462	5.83	1.50	10.00	17.33	54.08	30.00	1000	12.67

Average Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10012646H
Date	11/18/2014
Temperature/ Humidity	23 deg. C / 42% RH
Engineer	Hiroshi Kukita
Mode	11n-20 MIMO Tx

11n-20 **MCS10**
Antenna 0 + 1

Freq.	Antenna 0 Result	Antenna 1 Result	Result		Limit Directional Gain < 6dBi		Margin
[MHz]	[mW]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	23.07	26.12	16.92	49.19	30.00	1000	13.08
2437	27.23	26.85	17.33	54.08	30.00	1000	12.67
2462	23.44	25.12	16.86	48.56	30.00	1000	13.14

Sample Calculation:
Result = Antenna 0 + 1

Antenna 0

Freq.	Reading	Cable Loss	Atten.	Result		Limit Directional Gain < 6dBi		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	2.13	1.50	10.00	13.63	23.07	30.00	1000	16.37
2437	2.85	1.50	10.00	14.35	27.23	30.00	1000	15.65
2462	2.20	1.50	10.00	13.70	23.44	30.00	1000	16.30

Antenna 1

Freq.	Reading	Cable Loss	Atten.	Result		Limit Directional Gain < 6dBi		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	2.67	1.50	10.00	14.17	26.12	30.00	1000	15.83
2437	2.79	1.50	10.00	14.29	26.85	30.00	1000	15.71
2462	2.50	1.50	10.00	14.00	25.12	30.00	1000	16.00

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

Average Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10012646H
Date	11/18/2014
Temperature/ Humidity	23 deg. C / 42% RH
Engineer	Hiroshi Kukita
Mode	11n-40 MIMO Tx

11n-40 **MCS10**
Antenna 0 + 1

Freq.	Antenna 0 Result	Antenna 1 Result	Result		Limit Directional Gain < 6dBi		Margin
[MHz]	[mW]	[mW]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2422	22.49	25.41	16.80	47.90	30.00	1000	13.20
2437	24.10	24.38	16.86	48.48	30.00	1000	13.14
2452	22.54	22.96	16.58	45.50	30.00	1000	13.42

Sample Calculation:
Result = Antenna 0 + 1

Antenna 0

Freq.	Reading	Cable Loss	Atten.	Result		Limit Directional Gain < 6dBi		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2422	2.02	1.50	10.00	13.52	22.49	30.00	1000	16.48
2437	2.32	1.50	10.00	13.82	24.10	30.00	1000	16.18
2452	2.03	1.50	10.00	13.53	22.54	30.00	1000	16.47

Antenna 1

Freq.	Reading	Cable Loss	Atten.	Result		Limit Directional Gain < 6dBi		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2422	2.55	1.50	10.00	14.05	25.41	30.00	1000	15.95
2437	2.37	1.50	10.00	13.87	24.38	30.00	1000	16.13
2452	2.11	1.50	10.00	13.61	22.96	30.00	1000	16.39

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2014/11/11 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2014/11/11 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2014/03/13 * 12
MBM-12	Barometer	Sunoh	SBR121	873	AT	2012/02/20 * 36
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2013/12/17 * 12

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: AT: Antenna Terminal Conducted test

End of Report