

## FCC PART 15.249



## TEST REPORT

For

### Airsound Technologies Limited

Chapel House, West Mead Drive, Swindon, SN5 7UN, United Kingdom

**FCC ID: 2AA8C-S1-01**

<b>Report Type:</b> Original Report		<b>Product Type:</b> Compact Wireless Subwoofer	
<b>Test Engineer:</b>	Ares Liu		
<b>Report Number:</b>	R2DG140314008-00A		
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<b>Reviewed By:</b>	Ivan Cao RF Leader		
<b>Test Laboratory:</b>	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 <a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a>		

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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *Airsound Technologies Limited* 's product, model number: *S1 (FCC ID: 2AA8C-S1-01)* (the "EUT") in this report was a *Compact Wireless Subwoofer*, S1 was measured approximately: 23.0 cm (W) x 14.0 cm (H) x 34.7 cm (D), S2 was measured approximately: 22.0 cm (L) x 22.0 cm (W) x 34.13 cm (H), rated input voltage: AC 120V/50Hz.

*Note: The series product, model S1, S2 are electrically identical, the difference between them are the model name, enclosure shape and dimension, we selected S1 for fully testing, the details was explained in the attached declaration letter.*

*\* All measurement and test data in this report was gathered from production sample serial number: 140314008 (Assigned by BACL.Dongguan). The EUT was received on 2014-03-18.*

### Objective

This type approval report is prepared on behalf of *Airsound Technologies Limited* in accordance with Part 2-Subpart J, and Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules

### Related Submittal(s)/Grant(s)

No related grants.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, 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.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan).

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Dongguan) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 500069-0).



The current scope of accreditations can be found at <http://ts.nist.gov/standards/scopes/5000690.htm>

## SYSTEM TEST CONFIGURATION

### Justification

The system was configured for testing in Engineering Mode, which was provided by the manufacturer. The engineering mode was configured as maximum power and switched the channels by keys.

3 channels were provided by the manufacturer:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2404	2	2440	3	2478

EUT was tested with Channel 2404 MHz, 2440 MHz and 2478 MHz

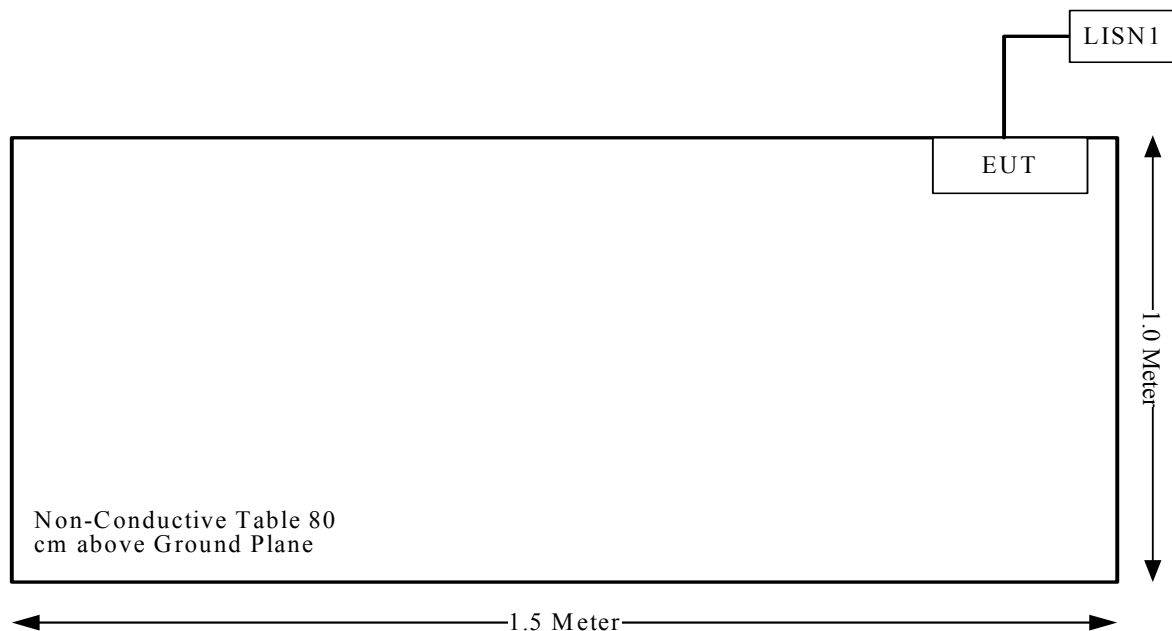
### EUT Exercise Software

The test software was built in the equipment, and the maximum power configured by the system.

### Equipment Modifications

No modifications were made to the unit tested.

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

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## **FCC§15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

### **Antenna Connector Construction**

The EUT has one integral antenna arrangement which was permanently attached and the antenna gain is 3.0 dBi, fulfill the requirement of this section. Please refer to the internal photos.

**Result:** Compliant.

## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207

### Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cisp}$  of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cisp}$  of Table 1, then:

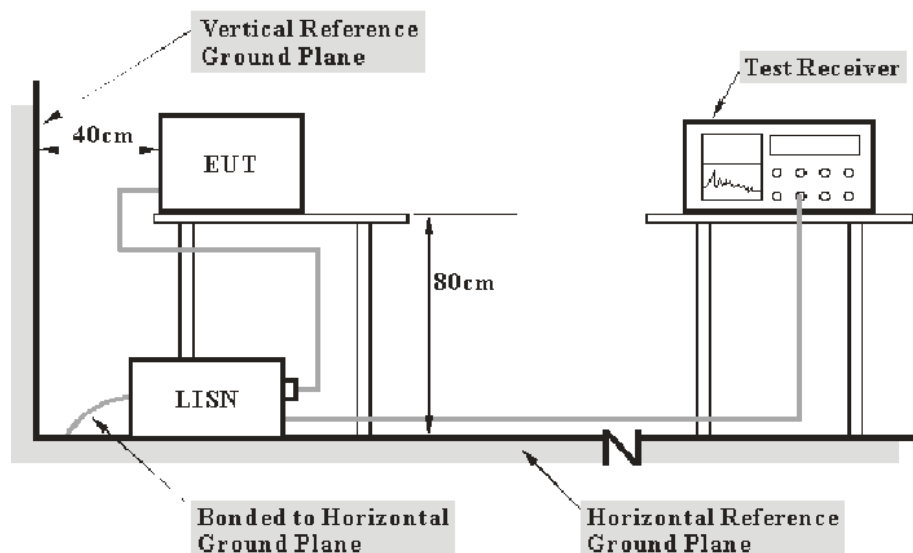
- compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.46 dB (150 kHz to 30 MHz).

Table 1 – Values of  $U_{cisp}$

Measurement	$U_{cisp}$
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

### EUT Setup



Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.



The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The EUT was connected to a 120 VAC/60 Hz power source

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

### Test Procedure

During the conducted emission test, the EUT was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

### Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

$V_C$  (cord. Reading): corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

VDF: voltage division factor of AMN

$C_f$ : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2013-11-20	2014-11-19
R&S	Two-line V-network	ENV216	3560.6550.12	2014-01-22	2015-01-21
R&S	L.I.S.N	ESH3-Z5	100113	N/A	N/A
BACL	Test Software	BACL-EMC	V1.0-2010	N/A	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

**Test Results Summary**

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

**10.12 dB at 0.385 MHz** in the **Line** conducted mode

**Test Data****Environmental Conditions**

Temperature:	21.5 °C
Relative Humidity:	40 %
ATM Pressure:	101.7 kPa

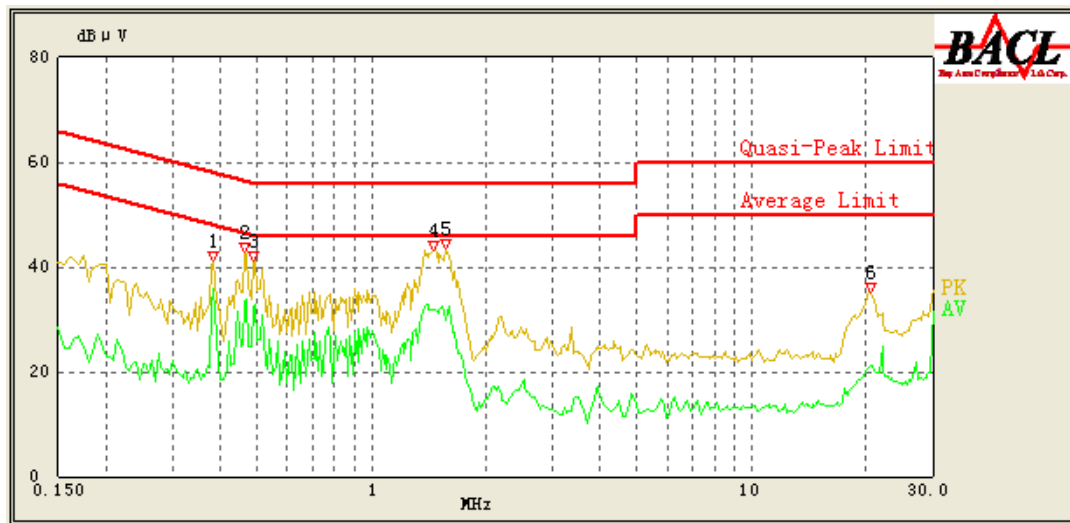
*The testing was performed by Ares Liu on 2014-03-21.*

Test Mode: Transmitting

AC120 V, 60 Hz, Line:



Frequency (MHz)	Cord. Reading (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.385	40.45	10.05	58.17	17.72	QP
0.385	38.05	10.05	48.17	10.12	AV
0.470	38.99	9.97	56.51	17.52	QP
0.470	34.38	9.97	46.51	12.13	AV
0.490	38.17	9.96	56.17	18.00	QP
0.490	33.44	9.96	46.17	12.73	AV
0.975	33.59	9.73	56.00	22.41	QP
0.975	28.03	9.73	46.00	17.97	AV
1.410	39.48	9.72	56.00	16.52	QP
1.410	30.78	9.72	46.00	15.22	AV
1.575	39.61	9.72	56.00	16.39	QP
1.575	31.82	9.72	46.00	14.18	AV

**AC120 V, 60 Hz, Neutral:**

Frequency (MHz)	Cord. Reading (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.385	39.61	10.28	58.17	18.56	QP
0.385	35.89	10.28	48.17	12.28	AV
0.465	38.34	10.05	56.60	18.26	QP
0.465	33.49	10.05	46.60	13.11	AV
0.490	38.55	9.98	56.17	17.62	QP
0.490	32.34	9.98	46.17	13.83	AV
1.455	39.50	9.77	56.00	16.50	QP
1.455	31.74	9.77	46.00	14.26	AV
1.575	38.73	9.76	56.00	17.27	QP
1.575	29.89	9.76	46.00	16.11	AV
20.570	28.02	10.06	60.00	31.98	QP
20.675	21.25	10.06	50.00	28.75	AV

## FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS

### Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cisp}$  of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cisp}$  of Table 1, then:

- compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:

30M~200MHz: 5.0 dB

200M~1GHz: 6.2 dB

1G~6GHz: 4.45 dB

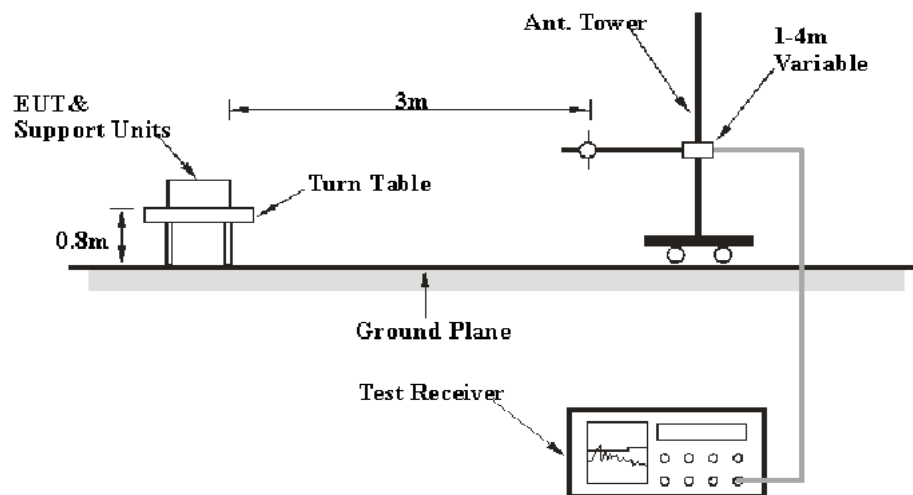
6G~18GHz: 5.23 dB

Table 1 – Values of  $U_{\text{cispr}}$ 

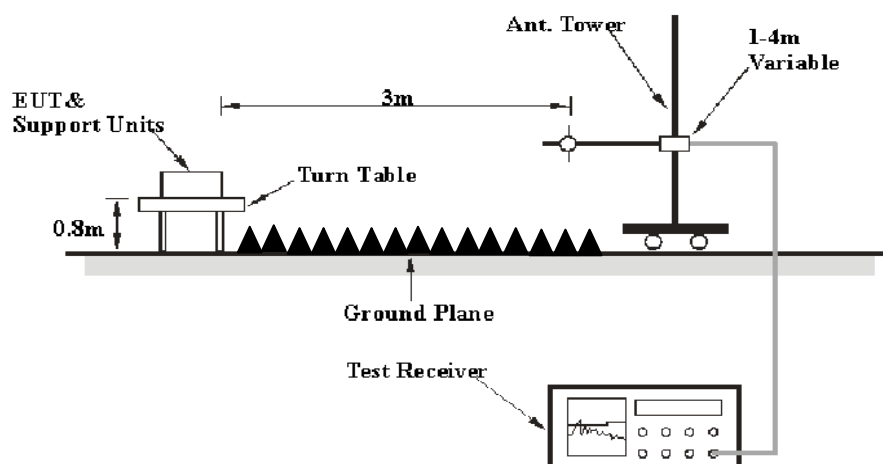
Measurement	$U_{\text{cispr}}$
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

## EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The EUT was connected to a 120 VAC/60 Hz power source.

### Test Equipment Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

### Test Procedure

For the radiated emissions test, the EUT was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

### Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Extrapolation result}$$

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2013-05-06	2014-05-05
Sunol Sciences	Antenna	JB3	A060611-1	2011-09-06	2014-09-05
HP	Amplifier	8447E	2434A02181	2013-09-06	2014-09-05
R&S	Spectrum Analyzer	FSEM	DE31388	2013-05-07	2014-05-06
ETS LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2014-02-19	2015-02-18
R&S	Spectrum Analyzer	FSP 38	100478	2013-06-16	2014-06-15
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2013-06-16	2014-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2013-09-06	2014-09-05

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

**Test Results Summary**

According to the data in the following table, the EUT complied with the FCC Part 15.209 & 15.205 & 15.249, with the worst margin reading of:

**4.22 dB at 2483.5MHz in the Horizontal polarization**

**Test Data****Environmental Conditions**

<b>Temperature:</b>	22.6 °C
<b>Relative Humidity:</b>	70 %
<b>ATM Pressure:</b>	100.8kPa

*The testing was performed by Ares Liu on 2014-03-19.*



Test Mode: Transmitting

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB(1/m))					
frequency: 2404 MHz									
2404	94.39	PK	H	25.65	4.42	27.32	97.14	114.00	16.86
2404	84.21	AV	H	25.65	4.42	27.32	86.96	94.00	7.04
2404	93.87	PK	V	25.65	4.42	27.32	96.62	114.00	17.38
2404	83.33	AV	V	25.65	4.42	27.32	86.08	94.00	7.92
2390	53.17	PK	H	25.61	4.39	27.32	55.85	74.00	18.15
2390	31.29	AV	H	25.61	4.39	27.32	33.97	54.00	20.03
2483.5	44.50	PK	H	25.86	4.49	27.36	47.49	74.00	26.51
2483.5	30.63	AV	H	25.86	4.49	27.36	33.62	54.00	20.38
4808	55.73	PK	V	30.60	5.99	27.41	64.91	74.00	9.09
4808	28.04	AV	V	30.60	5.99	27.41	37.22	54.00	16.78
7212	38.36	PK	V	34.11	7.45	25.91	54.01	74.00	19.99
7212	21.36	AV	V	34.11	7.45	25.91	37.01	54.00	16.99
2562	44.59	PK	H	26.06	4.64	27.40	47.89	74.00	26.11
2562	32.44	AV	H	26.06	4.64	27.40	35.74	54.00	18.26
34.6	36.3	QP	V	18.42	0.79	21.42	37.09	40.00	2.91
frequency: 2440 MHz									
2440	93.96	PK	V	25.74	4.40	27.34	96.76	114.00	17.24
2440	83.4	AV	V	25.74	4.40	27.34	86.20	94.00	7.80
2440	96.58	PK	H	25.74	4.40	27.34	99.38	114.00	14.62
2440	84.9	AV	H	25.74	4.40	27.34	87.70	94.00	6.30
2390	50.2	PK	H	25.61	4.39	27.32	52.88	74.00	21.12
2390	23.88	AV	H	25.61	4.39	27.32	26.56	54.00	27.44
2483.5	51.16	PK	H	25.86	4.49	27.36	54.15	74.00	19.85
2483.5	23.7	AV	H	25.86	4.49	27.36	26.69	54.00	27.31
4880	57.37	PK	H	30.79	6.08	27.42	66.82	74.00	7.18
4880	29.57	AV	H	30.79	6.08	27.42	39.02	54.00	14.98
2600	43.36	PK	H	26.16	4.63	27.42	46.73	74.00	27.27
2600	39.64	AV	H	26.16	4.63	27.42	43.01	54.00	10.99
7320	40.36	PK	V	34.37	7.51	25.88	56.36	74.00	17.64
7320	22.01	AV	V	34.37	7.51	25.88	38.01	54.00	15.99
34.6	36.7	QP	V	18.42	0.79	21.42	37.49	40.00	2.51
frequency: 2478MHz									
2478	92.96	PK	V	25.84	4.47	27.36	95.91	114.00	18.09
2478	81.73	AV	V	25.84	4.47	27.36	84.68	94.00	9.32
2478	94.13	PK	H	25.84	4.47	27.36	97.08	114.00	16.92
2478	83.73	AV	H	25.84	4.47	27.36	86.68	94.00	7.32
2483.5	66.79	PK	H	25.86	4.49	27.36	69.78	74.00	4.22*
2483.5	28.03	AV	H	25.86	4.49	27.36	31.02	54.00	22.98
2390	44.97	PK	H	25.61	4.39	27.32	47.65	74.00	26.35
2390	23.82	AV	H	25.61	4.39	27.32	26.50	54.00	27.50
4956	49.78	PK	V	30.99	5.89	27.43	59.23	74.00	14.77
4956	26.03	AV	V	30.99	5.89	27.43	35.48	54.00	18.52
2540	43.11	PK	H	26.00	4.62	27.39	46.34	74.00	27.66
2450	18.44	AV	H	25.77	4.40	27.35	21.26	54.00	32.74
7434	40.12	PK	V	34.64	7.57	25.95	56.38	74.00	17.62
7434	22.86	AV	V	34.64	7.57	25.95	39.12	54.00	14.88
34.6	36.5	QP	V	18.5	0.79	21.42	37.29	40.00	2.71

\*Within measurement uncertainty!

**FCC §15.215(c) – 20 dB BANDWIDTH TESTING****Applicable Standard**

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

**Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2013-06-16	2014-06-15

\* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

**Test Data****Environmental Conditions**

<b>Temperature:</b>	24.8 °C
<b>Relative Humidity:</b>	67 %
<b>ATM Pressure:</b>	100.8 kPa

\* The testing was performed by Ares Liu on 2014-03-20.

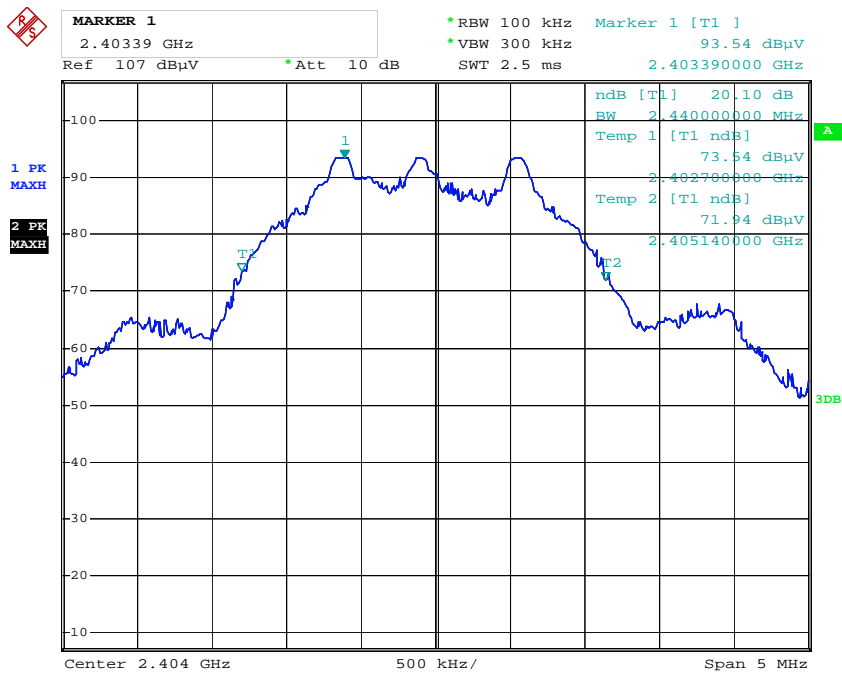
**Test Result:** Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

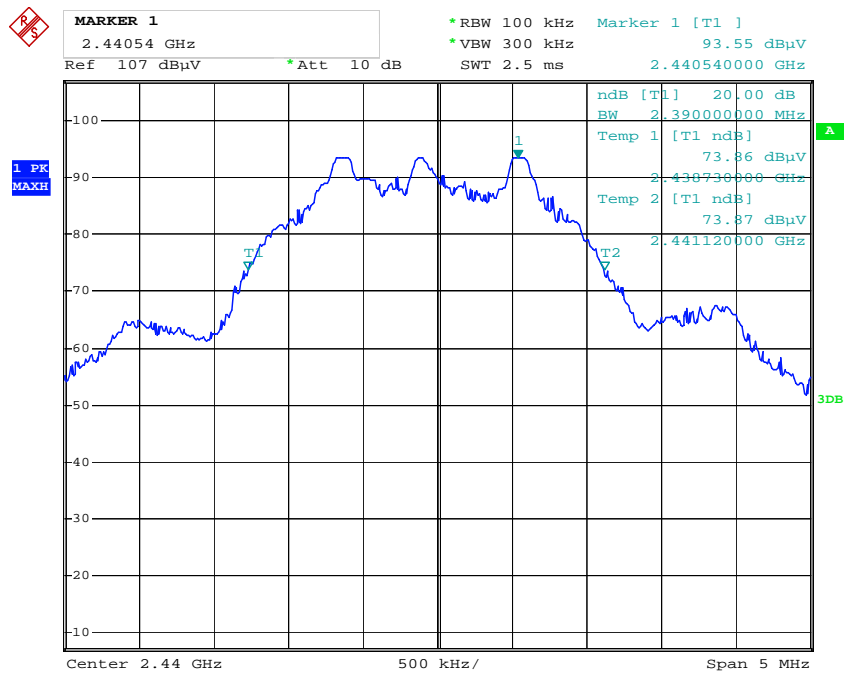
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2404	2.440
Middle	2440	2.390
High	2478	2.380

### Low Channel



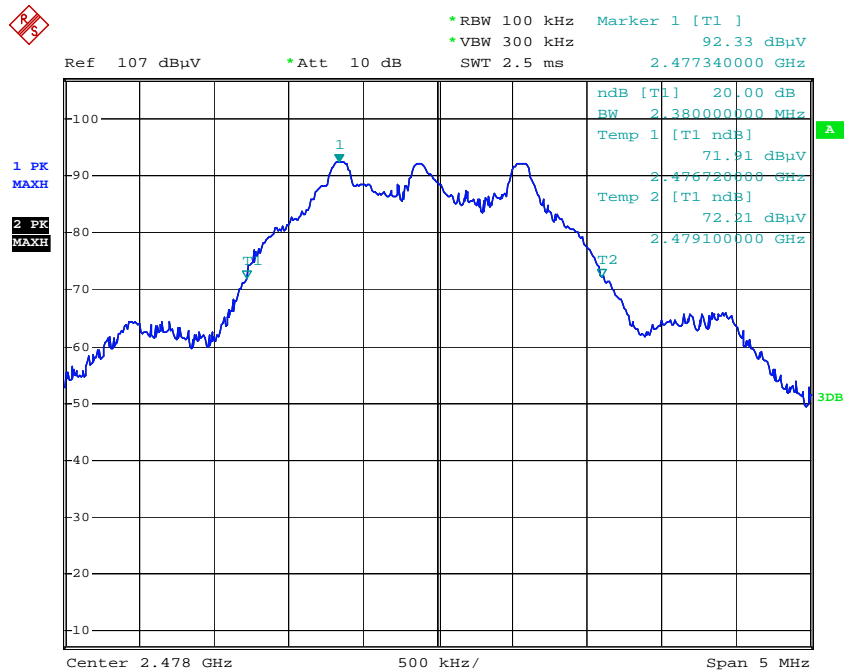
Date: 20.MAR.2014 17:05:42

### Middle Channel



Date: 20.MAR.2014 16:02:31

### High Channel



Date: 20.MAR.2014 17:20:46

## **DECLARATION OF SIMILARITY**

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### airSOUND™ Technologies Limited

Date: 7<sup>th</sup> April, 2014

To: Bay Area Compliance Laboratories Corp. (Dongguan)  
No.69 Pulong Village Puxinhu Industry Zone Tangxia,  
Dongguan,  
China

Dear Sir/Madam

#### DECLARATION OF SIMILARITY

We, airSOUND™ Technologies Limited, hereby declare that product: Wireless Subwoofer model S2 is electrically identical with the same electromagnetic emissions and electromagnetic compatibility characteristics as model name: S1 that was tested by BACL, the results of which are featured in BACL project: R2DG140314008.

A description of the differences between the tested model and those that are declared similar are as follows:

S1 and S2 are just different in model name, enclosure shape and dimension.

Yours sincerely,



Matthew Kitchen

Title: R&D Program Manager

Date: 7<sup>th</sup> April, 2014

airSOUND™ Technologies Limited

Chapel House, West Mead Drive, Swindon, SN5 7UN, United Kingdom

**\*\*\*\*\* END OF REPORT \*\*\*\*\***