

**Powerbeauty (Dongguan) Industrial Co., Ltd.**

Application  
For  
Certification

**FCC ID: 2AC37PBCLS-15011****Candle Lantern Speaker****Model: CLS-15011****Brand name: Powerbeauty, Alpan****2.4GHz Transceiver****Report No.: 141014008SZN-001**

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-13]

Prepared and Checked by:

Approved by:

Sign on file

*Jenner Liu*  
Assistant Engineer

---

*Andy Yan*  
Senior Project Engineer  
Date: October 30, 2014

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
- This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results referenced from this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
- For Terms And Conditions of the services, it can be provided upon request.
- The evaluation data of the report will be kept for 3 years from the date of issuance.

TRF No.: FCC 15C\_TX\_b

**Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch**  
6F, D Block, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China

Tel: (86 755) 8601 6288 Fax: (86 755) 8601 6751 Website: [www.china.intertek-etlsemko.com](http://www.china.intertek-etlsemko.com)

# INTERTEK TESTING SERVICES

---

---

## LIST OF EXHIBITS

### *INTRODUCTION*

<i>EXHIBIT 1:</i>	General Description
<i>EXHIBIT 2:</i>	System Test Configuration
<i>EXHIBIT 3:</i>	Emission Results
<i>EXHIBIT 4:</i>	Equipment Photographs
<i>EXHIBIT 5:</i>	Product Labelling
<i>EXHIBIT 6:</i>	Technical Specifications
<i>EXHIBIT 7:</i>	Instruction Manual
<i>EXHIBIT 8:</i>	Miscellaneous Information
<i>EXHIBIT 9:</i>	Confidentiality Request
<i>EXHIBIT 10:</i>	Test Equipment List

# INTERTEK TESTING SERVICES

---

## MEASUREMENT/TECHNICAL REPORT

**Powerbeauty (Dongguan) Industrial Co., Ltd. - MODEL:  
CLS-15011**

**Brand name: Powerbeauty, Alpan**

**FCC ID: 2AC37PBCLS-15011**

This report concerns (check one):      Original Grant       Class II Change

Equipment Type: DXX - Part 15 Low Power Communication Device Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?      Yes       No

If yes, defer until: \_\_\_\_\_  
date

Company Name agrees to notify the Commission by: \_\_\_\_\_  
date  
of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37?      Yes       No

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-13 Edition] provision.

Report prepared by:

Jenner Liu  
Intertek Testing Services Shenzhen Ltd.  
Kejiyuan Branch  
6F, Block D, Huahan Building, Langshan Road,  
Nanshan District, Shenzhen, P. R. China  
Phone: (86 755) 8601 0639  
Fax: (86 755) 8601 6751

# INTERTEK TESTING SERVICES

---

---

## Table of Contents

<b>1.0 General Description</b> .....	2
1.1 Product Description .....	2
1.2 Related Submittal(s) Grants .....	2
1.3 Test Methodology .....	2
1.4 Test Facility .....	2
<b>2.0 System Test Configuration</b> .....	4
2.1 Justification .....	4
2.2 EUT Exercising Software .....	4
2.3 Special Accessories .....	4
2.4 Equipment Modification .....	4
2.5 Measurement Uncertainty .....	5
2.6 Support Equipment List and Description .....	5
<b>3.0 Emission Results</b> .....	7
3.1 Radiated Test Results .....	8
3.1.1 Field Strength Calculation .....	8
3.1.2 Radiated Emission Configuration Photograph .....	9
3.1.3 Radiated Emissions .....	9
3.1.4 Transmitter Spurious Emissions .....	11
3.2 Conducted Emission at Mains Termination .....	15
3.2.1 Conducted Emissions Configuration Photograph .....	15
3.2.2 Conducted Emissions .....	15
<b>4.0 Equipment Photographs</b> .....	19
<b>5.0 Product Labelling</b> .....	21
<b>6.0 Technical Specifications</b> .....	23
<b>7.0 Instruction Manual</b> .....	25
<b>8.0 Miscellaneous Information</b> .....	27
8.1 Bandedge Plot .....	28
8.2 Discussion of Pulse Desensitization .....	30
8.3 Transmitter Duty Cycle Calculation .....	31
8.4 Emissions Test Procedures .....	32
<b>9.0 Confidentiality Request</b> .....	35
<b>10.0 Technical Specifications</b> .....	37

## INTERTEK TESTING SERVICES

---

---

### List of attached file

Exhibit type	File Description	Filename
Test Report	Test Report	report.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
Test Setup Photo	Conducted Emission	conducted photos.pdf
Test Report	Bandedge Plot	bandedge.pdf
Test Report	20dB BW Plot	bw.pdf
External Photo	External Photo	external photos.pdf
Internal Photo	Internal Photo	internal photos.pdf
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
Operation Description	Technical Description	descri.pdf
ID Label/Location	Label Artwork and Location	label.pdf
User Manual	User Manual	manual.pdf
Cover Letter	Confidentiality Letter	request.pdf
Cover Letter	Letter of Agency	agency.pdf

---

---

**INTERTEK TESTING SERVICES**

---

**EXHIBIT 1**

**GENERAL DESCRIPTION**

# INTERTEK TESTING SERVICES

---

## 1.0 General Description

### 1.1 Product Description

The equipment under test (EUT) is a Candle Lantern Speaker. The EUT was powered by the fully-charged DC 3.7V, 2000mAh new rechargeable battery which was charged by USB port (DC5V). For more detail information pls. refer to the user manual.

Bluetooth Version: 3.0+ EDR

Antenna Type: Integral antenna

Modulation Type: GFSK,  $\pi/4$ DQPSK, 8DPSK

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

### 1.2 Related Submittal(s) Grants

This is an application for certification of a transceiver for the Candle Lantern Speaker, and there is no corresponding unit for certification.

### 1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2009). Radiated emission measurement was performed in Semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

### 1.4 Test Facility

The Semi-anechoic chamber and shielding room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch** and located at 6F, D Block, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China. This test facility and site measurement data have been fully placed on file with the FCC(Registration Number: 242492).

**EXHIBIT 2**

**SYSTEM TEST CONFIGURATION**

## INTERTEK TESTING SERVICES

---

### 2.0 **System Test Configuration**

#### 2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.4 (2009).

The EUT was powered by the fully-charged DC 3.7V rechargeable battery which was charged by an AC/DC adaptor or PC with input of AC 120V, 60Hz during the test.

All packets DH1, DH3 & DH5 mode in modulation type GFSK,  $\pi/4$ DQPSK, 8DPSK were tested, and only the worst data was reported in this report.

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emission at and above 30 MHz, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data report in Exhibit 3.0.

The rear of unit shall be flushed with the rear of the table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on a turn table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

#### 2.2 EUT Exercising Software

The EUT exercise program (provided by client) used during testing was designed to exercise the various system components in a manner similar to a typical use.

#### 2.3 Special Accessories

No special accessories used.

#### 2.4 Equipment Modification

Any modifications installed previous to testing by Powerbeauty (Dongguan) Industrial Co., Ltd. will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd Kejiyuan Branch.

## INTERTEK TESTING SERVICES

---

### 2.5 Measurement Uncertainty

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

### 2.6 Support Equipment List and Description

Description	Manufacturer	Model No.
iPod	Apple	A1367
USB Cable	N/A	Detachable, un-shielded, 102cm
AC/DC adaptor (Provide by Intertek)	TP-Link	T050100-2A3 (Input: AC 100-240V, 50/60Hz, 0.3A, Output: DC 5V, 1A)
Notebook	Lenovo	T420

**EXHIBIT 3**  
**EMISSION RESULTS**

## INTERTEK TESTING SERVICES

---

---

### 3.0 Emission Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

## INTERTEK TESTING SERVICES

---

### 3.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

#### 3.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG$$

Where

FS = Field Strength in dB $\mu$ V/m

RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG$$

Assume a receiver reading of 62.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The net field strength for comparison to the appropriate emission limit is 42 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 = 42 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32 \text{ dB}\mu\text{V/m})/20] = 125.9 \mu\text{V/m}$$

## INTERTEK TESTING SERVICES

---

### 3.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

### 3.1.3 Radiated Emissions

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission  
at  
38.090 MHz

Judgement: Passed by 5.1 dB

### ***TEST PERSONNEL:***

*Sign on file*

Jenner Liu Assistant Engineer  
*Typed/Printed Name*

October 30, 2014

*Date*

# INTERTEK TESTING SERVICES

---

Applicant: Powerbeauty (Dongguan) Industrial Co., Ltd.

Date of Test: October 30, 2014

Model: CLS-15011

Sample: 1/1

Worst Case Operating Mode: BT Link and with Adapter Charging

Table 1

## Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	37.260	25.7	20.0	17.5	23.2	40.0	-16.8
Horizontal	89.640	28.5	20.0	10.6	19.1	43.5	-24.4
Horizontal	835.080	41.4	20.0	14.6	36.0	46.0	-10.0
Vertical	30.485	48.1	20.0	6.5	34.6	40.0	-5.4
Vertical	38.090	47.5	20.0	7.4	34.9	40.0	-5.1
Vertical	87.715	43.7	20.0	10.7	34.4	40.0	-5.6

NOTES:

1. Quasi-Peak detector is used except for others stated.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. All emissions are below the QP limit.

## INTERTEK TESTING SERVICES

---

### 3.1.4 Transmitter Spurious Emissions (Radiated)

Worst Case Radiated Emission  
at  
9608.000 MHz

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 13.6 dB

### ***TEST PERSONNEL:***

*Sign on file*

Jenner Liu Assistant Engineer  
*Typed/Printed Name*

October 30, 2014  
*Date*

# INTERTEK TESTING SERVICES

---

Applicant: Powerbeauty (Dongguan) Industrial Co., Ltd.

Date of Test: October 30, 2014

Model: CLS-15011

Sample: 1/1

Worst Case Operating Mode: Transmitting and with Adapter Charging

Table 2

## Radiated Emissions

(2402MHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2402.000	95.5	36.7	28.1	86.9	114.0	-27.1
Horizontal	4804.000	60.6	36.7	35.5	59.4	74.0	-14.6
Horizontal	7206.000	57.1	36.1	36.5	57.5	74.0	-16.5
Horizontal	9608.000	59.6	36.2	37.0	60.4	74.0	-13.6

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2402.000	95.5	36.7	28.1	22.5	64.4	94.0	-29.6
Horizontal	4804.000	60.6	36.7	35.5	22.5	36.9	54.0	-17.1
Horizontal	7206.000	57.1	36.1	36.5	22.5	35.0	54.0	-19.0
Horizontal	9608.000	59.6	36.2	37.0	22.5	37.9	54.0	-16.1

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Jenner Liu

# INTERTEK TESTING SERVICES

---

Applicant: Powerbeauty (Dongguan) Industrial Co., Ltd.

Date of Test: October 30, 2014

Model: CLS-15011

Sample: 1/1

Worst Case Operating Mode: Transmitting and with Adapter Charging

Table 3

## Radiated Emissions

(2441MHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2441.000	95.7	36.7	28.1	87.1	114.0	-26.9
Horizontal	4882.000	59.7	36.7	35.5	58.5	74.0	-15.5
Horizontal	7323.000	56.8	36.1	37.2	57.9	74.0	-16.1
Horizontal	9764.000	59.3	36.2	37.0	60.1	74.0	-13.9

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2441.000	95.7	36.7	28.1	22.5	64.6	94.0	-29.4
Horizontal	4882.000	59.7	36.7	35.5	22.5	36.0	54.0	-18.0
Horizontal	7323.000	56.8	36.1	37.2	22.5	35.4	54.0	-18.6
Horizontal	9764.000	59.3	36.2	37.0	22.5	37.6	54.0	-16.4

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Jenner Liu

---

TRF No.: FCC 15C\_TX\_b  
FCC ID: 2AC37PBCLS-15011

---

## INTERTEK TESTING SERVICES

---

Applicant: Powerbeauty (Dongguan) Industrial Co., Ltd.

Date of Test: October 30, 2014

Model: CLS-15011

Sample: 1/1

Worst Case Operating Mode: Transmitting and with Adapter Charging

Table 4

### Radiated Emissions

(2480MHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2480.000	96.2	36.7	28.1	87.6	114.0	-26.4
Horizontal	4960.000	61.4	36.7	35.5	60.2	74.0	-13.8
Horizontal	7440.000	57.4	36.1	37.2	58.5	74.0	-15.5
Horizontal	9920.000	57.2	36.3	38.9	59.8	74.0	-14.2

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2480.000	96.2	36.7	28.1	22.5	65.1	94.0	-28.9
Horizontal	4960.000	61.4	36.7	35.5	22.5	37.7	54.0	-16.3
Horizontal	7440.000	57.4	36.1	37.2	22.5	36.0	54.0	-18.0
Horizontal	9920.000	57.2	36.3	38.9	22.5	37.3	54.0	-16.7

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Jenner Liu

## INTERTEK TESTING SERVICES

---

### 3.2 Conducted Emission at Mains Terminal

#### 3.2.1 Conducted Emissions Configuration Photograph

For electronic filing, the worst case conducted emission configuration photograph is saved with filename: conducted photos.pdf.

#### 3.2.2 Conducted Emissions

Worst Case Live-Conducted Configuration  
At

0.190 MHz

Judgement: Passed by 9.9 dB margin

### ***TEST PERSONNEL:***

*Sign on file*

Jenner Liu Assistant Engineer  
*Typed/Printed Name*

October 30, 2014  
*Date*

# INTERTEK TESTING SERVICES

Applicant: Powerbeauty (Dongguan) Industrial Co., Ltd.

Date of Test: October 30, 2014

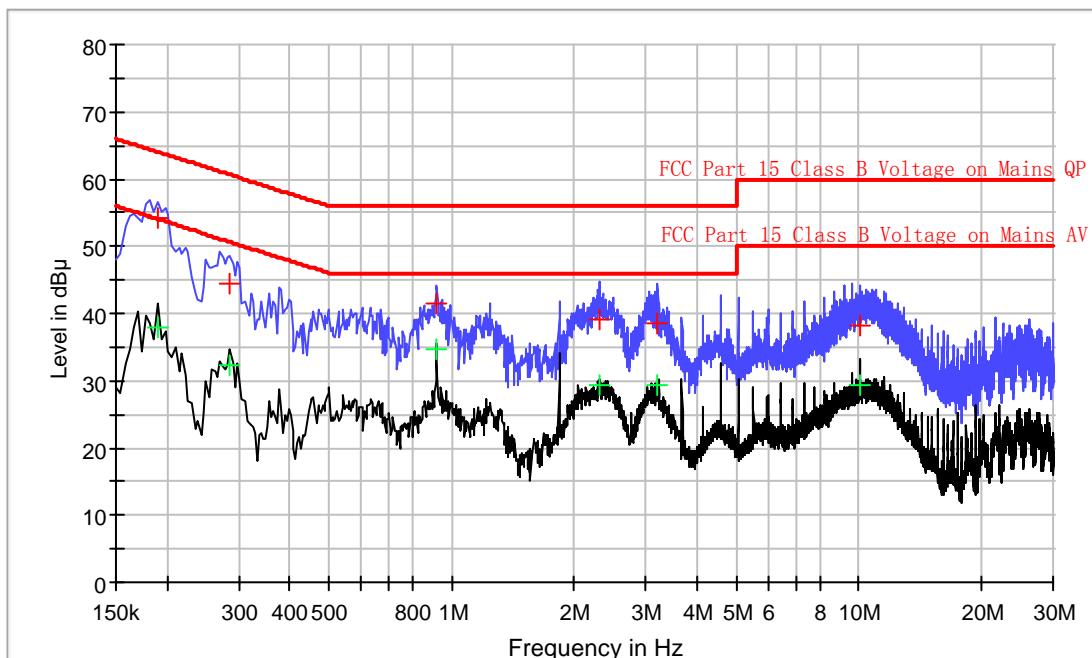
Model: CLS-15011

Sample: 1/1

Worst Case Operating Mode: BT Link and with Adapter Charging

Phase: Live

## Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.190	54.1	L1	9.8	9.9	64.0
0.286	44.6	L1	9.8	16.0	60.6
0.918	41.6	L1	9.9	14.4	56.0
2.302	39.0	L1	9.9	17.0	56.0
3.214	38.4	L1	9.9	17.6	56.0
10.114	38.1	L1	10.2	21.9	60.0

Result Table AV

Frequency (MHz)	Average (dB $\mu$ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.190	38.0	L1	9.8	16.0	54.0
0.286	32.2	L1	9.8	18.4	50.6
0.918	34.5	L1	9.9	11.5	46.0
2.302	29.3	L1	9.9	16.7	46.0
3.214	29.2	L1	9.9	16.8	46.0
10.114	29.4	L1	10.2	20.6	50.0

TRF No.: FCC 15C\_TX\_b  
FCC ID: 2AC37PBCLS-15011

# INTERTEK TESTING SERVICES

---

Applicant: Powerbeauty (Dongguan) Industrial Co., Ltd.

Date of Test: October 30, 2014

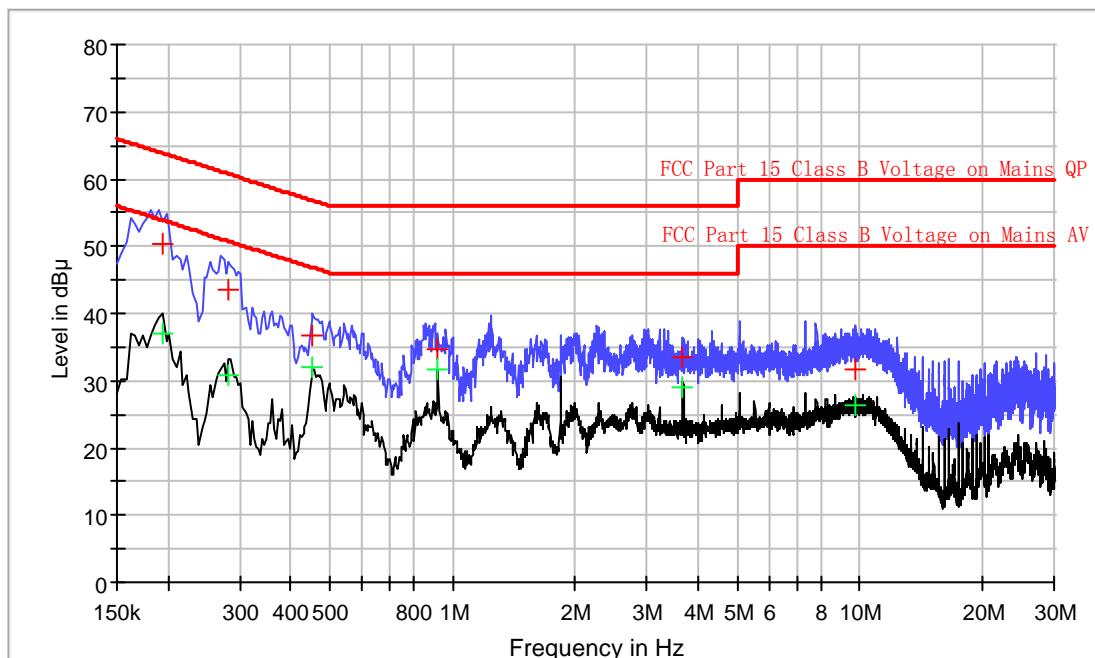
Model: CLS-15011

Sample: 1/1

Worst Case Operating Mode: BT Link and with Adapter Charging

Phase: Neutral

## Conducted Emission Test - FCC



**Result Table QP**

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.194	50.3	N	10.0	13.6	63.9
0.282	43.5	N	10.1	17.3	60.8
0.454	36.8	N	10.1	20.0	56.8
0.922	34.8	N	10.2	21.2	56.0
3.678	33.6	N	10.3	22.4	56.0
9.722	31.8	N	10.4	28.2	60.0

**Result Table AV**

Frequency (MHz)	Average (dB $\mu$ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.194	37.1	N	10.0	16.8	53.9
0.282	30.7	N	10.1	20.1	50.8
0.454	32.1	N	10.1	14.7	46.8
0.922	31.7	N	10.2	14.3	46.0
3.678	28.9	N	10.3	17.1	46.0
9.722	26.5	N	10.4	23.5	50.0

---

TRF No.: FCC 15C\_TX\_b  
FCC ID: 2AC37PBCLS-15011

**INTERTEK TESTING SERVICES**

---

---

**EXHIBIT 4**

**EQUIPMENT PHOTOGRAPHS**

## INTERTEK TESTING SERVICES

---

---

### 4.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

---

---

**INTERTEK TESTING SERVICES**

---

**EXHIBIT 5**

**PRODUCT LABELLING**

## INTERTEK TESTING SERVICES

---

---

### 5.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

---

---

**INTERTEK TESTING SERVICES**

---

**EXHIBIT 6**

**TECHNICAL SPECIFICATIONS**

## INTERTEK TESTING SERVICES

---

---

### 6.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

---

---

**INTERTEK TESTING SERVICES**

---

**EXHIBIT 7**

**INSTRUCTION MANUAL**

## INTERTEK TESTING SERVICES

---

---

### 7.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

---

---

**INTERTEK TESTING SERVICES**

---

**EXHIBIT 8**

**MISCELLANEOUS INFORMATION**

## INTERTEK TESTING SERVICES

---

---

### 8.0 **Miscellaneous Information**

This miscellaneous information includes details of the measured bandedge, the test procedure and calculation of factor such as pulse desensitization.

## INTERTEK TESTING SERVICES

---

### 8.1 Bandedge Plot

For electronic filing, the plot shows the fundamental emission when modulated is saved with filename: bandedge.pdf. From the plot, the field strength of any emissions outside of the specified frequency band are attenuated to the general radiated emission limits in section 15.209. It fulfils the requirement of 15.249(d).

#### Peak Measurement

Bandedge compliance is determined by applying marker-delta method, i.e (Bandedge Plot).

##### **(i) Lower channel 2402MHz:**

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

$$\begin{aligned} &= 86.9 \text{ dB}\mu\text{v/m} - 25.5 \text{ dB} \\ &= 61.4 \text{ dB}\mu\text{v/m} \end{aligned}$$

Average Resultant field strength = Fundamental emissions (Average value) – delta from the bandedge plot

$$\begin{aligned} &= 64.4 \text{ dB}\mu\text{v/m} - 25.5 \text{ dB} \\ &= 38.9 \text{ dB}\mu\text{v/m} \end{aligned}$$

##### **(ii) Upper channel 2480MHz:**

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

$$\begin{aligned} &= 87.6 \text{ dB}\mu\text{v/m} - 26.3 \text{ dB} \\ &= 61.3 \text{ dB}\mu\text{v/m} \end{aligned}$$

Average Resultant field strength = Fundamental emissions (Average value) – delta from the bandedge plot

$$\begin{aligned} &= 65.1 \text{ dB}\mu\text{v/m} - 26.3 \text{ dB} \\ &= 38.8 \text{ dB}\mu\text{v/m} \end{aligned}$$

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dB $\mu$ v/m (Peak Limit) and 54dB $\mu$ v/m (Average Limit).

## INTERTEK TESTING SERVICES

---

---

### 8.1 Bandedge Plot (cont'd)

Pursuant to FCC part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

Figure 8.1 Bandwidth

## INTERTEK TESTING SERVICES

---

---

### 8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period ( $T_{eff}$ ) is approximately 625 $\mu$ s for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

## INTERTEK TESTING SERVICES

---

---

### 8.3 Transmitter Duty Cycle Calculation, FCC Rule 15.35(b, c)

Based on the Bluetooth Specification Version 3.0+EDR, and worst case AFH mode, transmitter ON time is independent of packet type (DH5) and packet length, the AFH mode Duty cycle connection factor as below:

Channel hop rate = 800 hops/second (AFH Mode)

Adjusted channel hop rate for DH5 mode = 133.33 hops/second

Time per channel hop = 1 / 133.33 hops/second = 7.5 ms

Time to cycle through all channels = 7.5 x 20 channels = 150 ms

Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)

Worst case dwell time = 7.5 ms

Duty cycle connection factor =  $20\log_{10}(7.5\text{ms} / 100\text{ms}) = -22.5 \text{ dB}$

## INTERTEK TESTING SERVICES

---

### 8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 2009.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

Detector function for conducted emissions is in QP & AV mode and IFBW setting is 9 kHz from the frequency band 150 kHz to 30MHz.

## INTERTEK TESTING SERVICES

---

### 8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.4 - 2009.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz (RBW 3MHz for fundamental emission) is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

---

---

**INTERTEK TESTING SERVICES**

---

**EXHIBIT 9**

**CONFIDENTIALITY REQUEST**

## INTERTEK TESTING SERVICES

---

---

### 9.0 Confidentiality Request

For electronic filing, the confidentiality request of the tested EUT is saved with filename: request.pdf.

---

---

**INTERTEK TESTING SERVICES**

---

**EXHIBIT10**  
**TEST EQUIPMENT LIST**

## INTERTEK TESTING SERVICES

---

### 10.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-03	BiConiLog Antenna	ETS	3142C	00066460	28-Jun-14	28-Jun-15
SZ185-01	EMI Receiver	R&S	ESCI	100547	10-Mar-14	10-Mar-15
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	03-Sep-14	03-Sep-15
SZ061-08	Horn Antenna	ETS	3115	00092346	19-Oct-14	19-Oct-15
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	29-Apr-14	29-Apr-15
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	10-Mar-14	10-Mar-15
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	10-Mar-14	10-Mar-15
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	19-Apr-14	19-Apr-15
SZ062-02	RF Cable	RADIALL	RG 213U	--	03-Jul-14	03-Jan-15
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	09-Oct-14	09-Apr-15
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	09-Oct-14	09-Apr-15
SZ067-04	Notch Filter	Micro-Tronics	BRM5070 2-02	--	21-May-14	21-May-15
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	09-Nov-13	09-Nov-14
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	09-Nov-13	09-Nov-14
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	16-Jun-14	16-Jun-15
SZ188-03	Shielding Room	ETS	RFD-100	4100	23-Aug-14	23-Aug-15