CMA Testing and Certification Laboratories
廠商會檢定中心

TEST REPORT

Report No.	:	AR0017092(8)	Date :	12 Apr 2013
Application No.	:	LR006229(8)		
Applicant	:	Winsonic Electric Limited 17/F, Flat K, Universal Ind. Center, 19-25 Shan Mei St., Fo Tan, Shatin, N.T., Hong Kong		
Sample Description	:	One(1) item of submitted sample stated to be Boombox of Model No. SPK90A Sample registration No. : RR006771-001 Radio Frequency : 2402MHz ~ 2480MHz Transceiver Rating : 4 x 1.5V AA size batteries AC 100-240V to DC 5V adaptor No. of submitted sample : One (1) set (s)		
Date Received	:	12 Mar 2013		
Test Period	:	13 Mar 2013 to 12 Apr 2013		
Test Requested	:	FCC Part 15 Certification.		
Test Method	:	47 CFR Part 15 (10-1-09 Edition) ANSI C63.4 – 2009 FCC Public Notice DA 00-705		
Test Engineer	:	Mr. LEUNG Shu-kan, Ken		
Test Result	:	See attached sheet(s) from page 2 to 48.		
Conclusion	:	The submitted sample was found to comply with requirement of FCC Part 15 Subpart B and C.		

For and on behalf of
CMA Industrial Development Foundation Limited

Authorized Signature : _____

Mr. WONG Lap-pong, Andrew
Assistant Manager
Electrical Division

FCC ID: 2AAFH-SPK90A

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Report No. : AR0017092(8) Date : 12 Apr 2013

Table of Contents

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1 General Information

1.1 General Description

The equipment under test (EUT) is a SPK90A Bluetooth Speaker. The EUT is powered by AC 100-240V to DC 5V adaptor or 4 x 1.5V AA size batteries.

The EUT has two operating models. The first operating mode is Bluetooth mode. It receives digital audio signal from other wireless device and play back the audio signal.

The second mode is AUX mode. An AUX input terminal supports audio input by 3.5mm terminal.

For the Bluetooth mode, it supports standard Bluetooth V3.0+EDR or below revision protocol for data synchronization. After paring with other standard Bluetooth device, it can play the music and control the operation in Play, Stop, Volume Up/Down, Forward and Backward.

The Bluetooth module used in the speaker has been test and approved by official Bluetooth Special Interest Group (SIG) member. All technical requirements including hopping rate, Frequency channels, Pseudo randomly order list and Bandwidth has been tested and complied with Spread Spectrum System requirements. The compliance information was listed at Bluetooth SIG with ID code is B020161 for model No F-3086.

A non standardized Bluetooth protocol or other Gaussian frequency-shift keying (GFSK) digital modulation signal was unable to synchronize the Bluetooth speaker.

A Bluetooth trademark was printed on the speaker enclosure to indicate it communicate with Bluetooth protocol only.

Pseudorandom frequency hopping sequence
The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF Channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1600 hops/s.
Example of a 79 hopping sequence in data mode: 40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54…

Equal Hopping Frequency Use
All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

System Receiver Input Bandwidth

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The input bandwidth of the receiver is 1 MHz. In every connection one Bluetooth device is the master and the other one is slave. The aster determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single multisport (packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence.. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

Equipment Description

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply With all of The regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

The brief circuit description is listed as follows:

- IC7 and its associated circuit act as bluetooth module
- IC6 and its associated circuit act as amplifier
- Q2 and its associated circuit act as DC-DC power supply

Antenna type : Chip Antenna
Antenna gain : 0dBi
Modulation technique : GFSK
Number of channel : 79 channels

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1.2 Location of the test site

FCC Registered Test Site Number: 552221

Radiated emissions measurements are investigated and taken pursuant to the procedures of ANSI C63.4 – 2009. A Semi-Anechoic Chamber Testing Site is set up for investigation and located at:

Ground Floor, Yan Hing Centre,
9 – 13 Wong Chuk Yeung Street,
Fo Tan, Shatin,
New Territories,
Hong Kong.

Conducted emissions measurements are investigated and also taken pursuant to the procedures of ANSI C63.4 – 2009. A shielded room is located at :

Ground Floor, Yan Hing Centre,
9 – 13 Wong Chuk Yeung Street,
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1.3 List of measuring equipment

Equipment	Manufacturer	Model No.	Serial No.	Calibration Due Date
EMI Test Receiver	R&S	ESCI	100152	28 May 2013
Spectrum Analyzer	R&S	FSP30	100628	15 Aug 2013
Broadband Antenna	Schaffner	CBL6112B	2692	16 Jan 2014
Loop Antenna	EMCO	6502	00056620	15 Sep 2013
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-531	09 Oct 2014
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170442	16 May 2015
Broadband Pre-Amplifier	Schwarzbeck	BBV 9718	9718-119	09 Oct 2014
Broadband Pre-Amplifier	Schwarzbeck	BBV 9719	9719-010	16 May 2015
LISN	R&S	ENV216	101232	25 Oct 2013
Coaxial Cable	Schaffner	RG 213/U	N/A	28 May 2013
Coaxial Cable	Suhner	RG 214/U	N/A	28 May 2013
Coaxial Cable	Suhner	Sucoflex_102	N/A	09 Oct 2014

1.4 List of supporting equipment

Support Equipment (Supplied by Client):

1. Adaptor
   Model: YN6W-0500100UZ

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1.5 Measurement Uncertainty

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Radiated emissions

Frequency	Uncertainty (U_{lab})
30MHz ~ 200MHz (Horizontal)	4.83dB
30MHz ~ 200MHz (Vertical)	4.84dB
200MHz ~1000MHz (Horizontal)	4.66dB
200MHz ~1000MHz (Vertical)	4.65dB

Conducted emissions

Frequency	Uncertainty (U_{lab})
150kHz~30MHz	3.02dB

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2 Description of the radiated emission test

2.1 Test Procedure

Radiated emissions measurements are investigated and taken pursuant to the procedures of ANSI C63.4 – 2009 and DA 00-705.

The equipment under test (EUT) was placed on a non-conductive turntable with dimensions of 1.5m x 1m and 0.8m high above the ground. 3m from the EUT, a broadband antenna mounting on the mast received the signal strength. The turntable was rotated to maximize the emission level. The antenna was then moving along the mast from 1m up to 4m until no more higher value was found. Both horizontal and vertical polarization of the antenna were placed and investigated.

For below 30MHz, a loop antenna with its vertical plane is placed 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1 m above the ground.

For 30MHz to 2GHz, broadband antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. And the reference point of antenna shall be 1 m above the ground.

For above 2GHz, horn antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. Preamplifier and High Pass filter was used for measurements. The reference point of antenna shall be 1 m above the ground.

The device was rotated through three orthogonal axes to determine which attitude and configuration produce the highest emission during measurement for Radiated Emission measurement.

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2.2 Test Result

Summary

Section in FCC part 15	Description	Result
15.205(a), 15.209, 15.247(d)	Transmitter radiated spurious field strength and other emissions	Page 11-12
15.209	Receiver emissions	Page 13
15.209	Voltage disturblance	Page 14, 28, 29
15.247 (a)(1), Part 2.1 and DA-00705	Hopping sequence	Page 30, 31
15.247 (a)(1)	20dB bandwidth and 99% bandwidth	Page 32, 33, 34
15.247 (a)(1)	Channel Spacing (Frequency separation)	Page 35, 36
15.247 (a)(1)(iii)	Number of hopping frequency	Page 37
15.247 (d)	Band Edge	Page 38
15.247 (a)(1)(iii)	Dwell Time (Bluetooth Average On Time)	Page 39-47
15.247 (b)(1)	Maximum Peak output power	Page 10, 47, 48

Subpart C:
Peak Detector and Average Detector data were measured unless otherwise stated.

"#" means emissions appear within the restricted bands shall follow the requirement of section 15.205.

The harmonic emissions meet the requirement of section 15.209 are based on measurements employing the CISPR quasi-peak detector below 1000MHz and average detector for frequencies above 1000MHz.

Subpart B:
The emissions meet the requirement of section 15.109 are based on measurements employing the CISPR quasi-peak detector below 1000MHz and average detector for frequencies above 1000MHz.

The frequencies from 30MHz to 1000MHz were investigated, and emissions more 20dB below limit were not reported. Thus, those highest emissions were presented in next page (section 2.3).

It was found that the EUT meet the FCC requirement.

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2.3 Maximum peak output power

Conductive measurements

pursuant to

the requirement of FCC Part 15 subpart C

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	24	° C
Relative humidity:	71	%

Operation Mode: Transmission

Channel	Frequency (MHz)	Field Strength at 3m (dBm)	Limit at 3m (dBm)
00	2402	-6.24	29.6

Channel	Frequency (MHz)	Field Strength at 3m (dBm)	Limit at 3m (dBm)
39	2441	-7.19	29.6

Channel	Frequency (MHz)	Field Strength at 3m (dBm)	Limit at 3m (dBm)
78	2480	-8.08	29.6

The plot saved in TestRpt9.pdf shows the transmission power was less than 1watt.

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2.4 Radiated Emission Measurement Data

Radiated emission

pursuant to

the requirement of FCC Part 15 subpart C

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	24	° C
Relative humidity:	71	%

Operation Mode: 1st Channel

Detector: Peak

Channel	Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBµV)	Transducer Factor (dB/m)	Field Strength at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
00	2402.026	H	85.8	- 6.3	79.5	114.0	- 34.5
	# 4803.971	H	39.9	2.4	42.3	74.0	- 31.7
	# 4803.993	V	40.3	2.4	42.7	74.0	- 31.3
	7205.899	H	31.4	10.8	42.2	74.0	- 31.8
39	2441.014	V	86.2	- 6.3	79.9	114.0	- 34.1
	# 4881.985	H	40.8	2.4	43.2	74.0	- 30.8
	# 4881.978	V	41.0	2.4	43.4	74.0	- 30.6
	# 7322.985	H	33.5	10.8	44.3	74.0	- 29.7
78	2480.012	V	91.6	- 6.3	85.3	114.0	- 28.7
	# 4959.978	H	39.8	2.4	42.2	74.0	- 31.8
	# 4960.021	V	41.2	2.4	43.6	74.0	- 30.4
	# 7440.057	H	32.1	10.8	42.9	74.0	- 31.1

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2.4 Radiated Emission Measurement Data

Radiated emission

pursuant to

the requirement of FCC Part 15 subpart C

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	24	° C
Relative humidity:	71	%

Operation Mode: 1st Channel

Detector: Average

Channel	Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBµV)	Transducer Factor (dB/m)	Field Strength at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
00	2402.026	H	85.7	- 6.3	79.4	94.0	- 14.6
	# 4803.971	H	33.1	2.4	35.5	54.0	- 18.5
	# 4803.993	V	34.3	2.4	36.7	54.0	- 17.3
	7205.899	H	19.4	10.8	30.2	54.0	- 23.8
39	2441.014	V	86.3	- 6.3	80.0	94.0	- 14.0
	# 4881.985	H	35.1	2.4	37.5	54.0	- 16.5
	# 4881.978	V	36.0	2.4	38.4	54.0	- 15.6
	# 7322.985	H	19.6	10.8	30.4	54.0	- 23.6
78	2480.012	V	91.6	- 6.3	85.3	94.0	- 8.7
	# 4959.978	H	32.6	2.4	35.0	54.0	- 19.0
	# 4960.021	V	35.1	2.4	37.5	54.0	- 16.5
	# 7440.057	H	18.8	10.8	29.6	54.0	- 24.4

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Report No. : AR0017092(8) Date : 12 Apr 2013

2.4 Radiated Emission Measurement Data (Con't)

Radiated emission

pursuant to

the requirement of FCC Part 15 subpart B

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	24	° C
Relative humidity:	71	%

Operation Mode: Receiver mode

Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBμV)	Antenna Factor and Cable Loss (dB/m)	Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
30.535	V	17.1	21.1	38.2	40.0	- 1.8
37.366	V	18.3	18.4	36.7	40.0	- 3.3
42.836	V	20.1	15.3	35.4	40.0	- 4.6
45.586	V	24.2	12.5	36.7	40.0	- 3.3
352.002	H	16.9	15.9	32.8	46.0	-13.2
383.948	H	217.6	15.9	33.5	46.0	-12.5
400.012	H	14.5	20.3	34.8	46.0	-11.2
415.991	H	13.2	20.3	33.5	46.0	- 12.5
447.979	H	15.8	20.3	36.1	46.0	- 9.9
463.986	H	15.8	20.3	36.1	46.0	- 9.9

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3 Description of the Line-conducted Test

3.1 Test Procedure

Conducted emissions measurements are investigated and also taken pursuant to the procedures of ANSI C63.4 – 2009. The EUT was setup as described in the procedures, and both lines were measured.

3.2 Test Result

The EUT was receiving date through bluetooth.

It was found that the EUT met the FCC requirement.

3.3 Graph and Table of Conducted Emission Measurement Data

For electronic filling, the document is saved with filename TestRpt2.pdf.

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4 Photograph

4.1 Photographs of the Test Setup for Radiated Emission and Conducted Emission

For electronic filing, the photos are saved with filename TSup1.jpg to TSup5.jpg.

4.2 Photographs of the External and Internal Configurations of the EUT

For electronic filing, the photos are saved with filename ExPho1.jpg to ExPho2.jpg and InPho1.jpg to InPho5.jpg.

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5 Supplementary document

The following document were submitted by applicant, and for electronic filing, the document are saved with the following filenames:

Document	Filename
ID Label/Location	LabelSmp.jpg
Block Diagram	BlkDia.pdf
Schematic Diagram	Schem.pdf
Users Manual	UserMan.pdf
Operational Description	OpDes.pdf

5.1 Bandwidth

Bluetooth:

The plot saved in TestRpt4.pdf shows the 20dB bandwidth and 99% bandwidth:

Frequency Channel (MHz)	20dB bandwidth (kHz)	99% bandwidth (kHz)
2402	26.050	22.141
2441	26.050	22.141
2480	26.050	22.141

The plot saved in TestRpt5.pdf shows the channel spacing has minimum 25 kHz or two-third of 20dB bandwidth of hopping channel.

Frequency (MHz)	Channel spacing (kHz)	Two-third of 20dB bandwidth (kHz)	Minimum bandwidth (kHz)
2402	1001	17.367	25
2441	1003	17.367	25
2480	1001	17.367	25

The plot saved in TestRpt6.pdf shows the frequency hopping channel over 75 hopping frequency.

The plot saved in TestRpt7.pdf shows the fundamental emission is confined in the specified band. It shows the 20dB bandwidth and band edge meet the 15.247(d) and 15.205 requirement.

5.2 Duty cycle

Not Applicable

5.3 Transmission time

Not Applicable

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5.4 Power Spectral Density

Not Applicable

5.5 Hopping sequence

The plot saved in TestRpt3.pdf shows the hopping sequence is pseudorandom randomly distributed. Four example of continuous fundamental frequency hopping pattern was as below:

The 1st example of fundamental frequency = 2.421090GHz
The 2nd example of fundamental frequency = 2.469910GHz
The 3rd example of fundamental frequency = 2.427010GHz
The 4th example of fundamental frequency = 2.456850GHz

Result:
Fc 1 – Fc 2 = -4.8820MHz
Fc 2 – Fc 3 = +3.9981MHz
Fc 3 – Fc 4 = -2.9840MHz

It was found the hopping pattern is pseudorandom random.

5.6 Average on time

The plot saved in TestRpt8.pdf shows the average on time for frequency hopping channel is within 0.4 seconds.

The calculation for average on time as below:

Average hopping channel = Number of transmitted carrier / Sweep time

Average on time = Packet on time x Average hopping channel

Dwell time = Average on time x Total frequency hopping channel x 0.4

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Report No. : AR0017092(8) Date : 12 Apr 2013

Test result:

Frequency Channel (MHz)	Packet	Dwell Time (Seconds)	Limit (Seconds)	Margin (Seconds)
2402	DH1	0.123	0.4	- 0.277
2441	DH1	0.126	0.4	- 0.274
2480	DH1	0.123	0.4	- 0.277
2402	DH3	0.247	0.4	- 0.153
2441	DH3	0.268	0.4	- 0.132
2480	DH3	0.227	0.4	- 0.173
2402	DH5	0.272	0.4	- 0.128
2441	DH5	0.182	0.4	- 0.218
2480	DH5	0.383	0.4	- 0.017

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6 Appendices

A1	Photos of the set-up of Radiated Emissions	1	page
A2	Photos of the set-up of Conducted Emissions	2	pages
A3	Photos of External Configurations	1	page
A4	Photos of Internal Configurations	2	pages
A5	ID Label/Location	2	page
A6	Conducted Emission Measurement Data	2	pages
A7	Hopping sequence	2	pages
A8	20 dB bandwidth and 99% bandwidth	3	pages
A9	Bluetooth Channel Spacing	2	pages
A10	Bluetooth Hopping Channel	1	page
A11	Bluetooth Band Edge	1	page
A12	Bluetooth Average on time	9	pages
A13	Block Diagram	1	page
A14	Schematics	1	page
A15	User Manual	6	pages
A16	Operation Description	1	page

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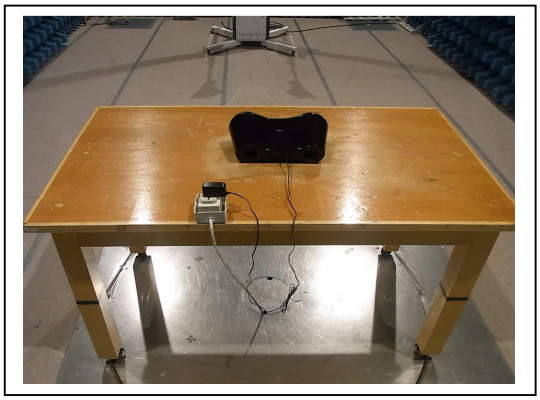
A1. Photos of the set-up of Radiated Emissions



(Front view)

(Back view)

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A2 Photos of the set-up of Conducted Emission

(front view)

(rear view)

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Report No. : AR0017092(8) Date : 12 Apr 2013

Photos of the set-up of Conducted Emission

(side view)

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A3. Photos of External Configurations

External Configuration 1

External Configuration 2

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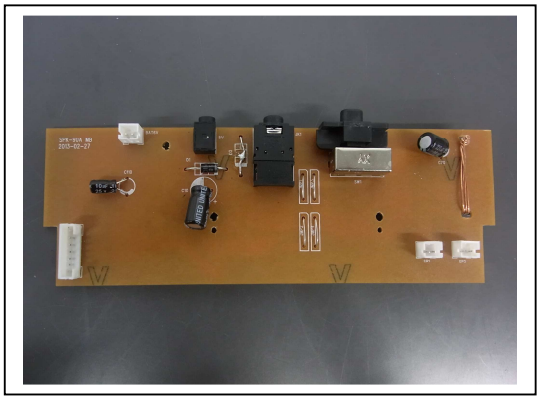
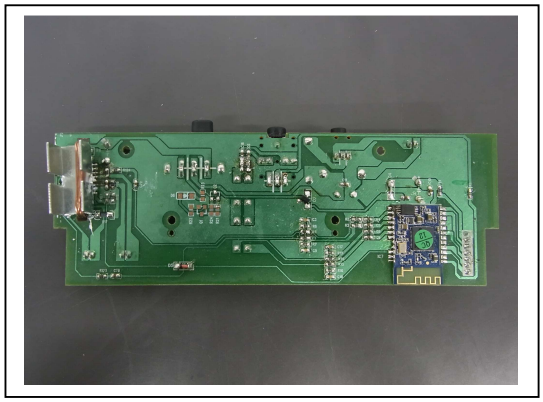
A4. Photos of Internal Configurations



Internal Configuration 1



Internal Configuration 2

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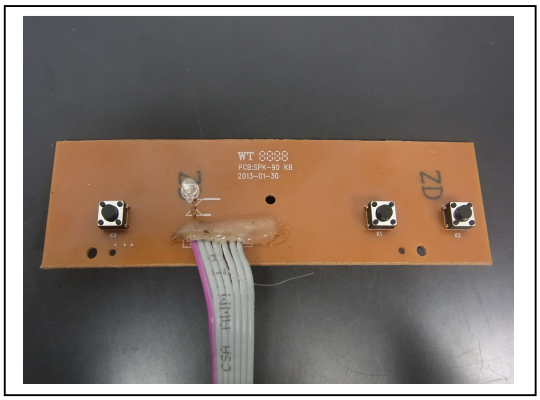
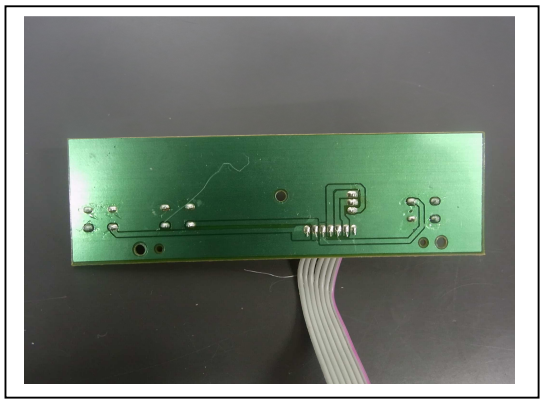
A4. Photos of Internal Configurations



Internal Configuration 3



Internal Configuration 4

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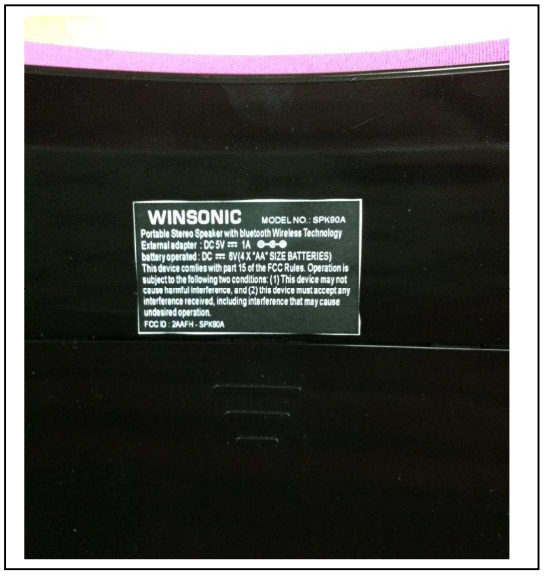
A5. ID Label / Location

ID Label 1



ID Label 2

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