

TEST REPORT

FCC ID : Q92BHOP
Applicant : NINGBO BAIHUANG ELECTRIC APPLIANCES CO., LTD.
Address : NO. 180, YANSHAN RD, HUXIMEN, HENGHE TOWN, CIXI, NINGBO 315318 CHINA
Manufacturer : NINGBO BAIHUANG ELECTRIC APPLIANCES CO., LTD.
Address : NO. 180, YANSHAN RD, HUXIMEN, HENGHE TOWN, CIXI, NINGBO 315318 CHINA

Equipment Under Test (EUT) :

Product Name : Remote Control Transmitter for Switches
Model No. : BH-O, BH-P
Rules : FCC CFR47 Part 15.231: 2010

Date of Test : September 18~24,2012
Date of Issue : September 24,2012

Test Result

: PASS*

Remark:

* The sample described above has been tested to be in compliance with the requirements of ANSI C63.4:2003. The test results have been reviewed and comply with the rules listed above and found to meet their essential requirements.

PERPARED BY:

Waltek Services (Shenzhen) Co., Ltd.

1/F, Fukangtai Building, West of Baima Road., Songgang Street, Bao'an District,
Shenzhen, China

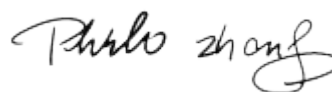
Tel: +86-755-83551033 Fax: +86-755-83552400

Compiled by:

Approved by:



Zero Zhou / Project Engineer



Philo Zhong / Manager

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2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.231(b)	PASS
Periodic Operation	15.231(a)	PASS
20dB Bandwidth	15.231(c)	PASS
Antenna Requirement	15.203	PASS

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4 General Information

4.1 General Description of E.U.T.

Product Name	: Remote Control Transmitter for Switches
Model No.	: BH-O, BH-P
Model Description	: The circuit of both models are identical except keyboard.BH-O consists of three pair buttons,and BH-P consists of five pair buttons.
Type of Modulation	: FM
Note	: N/A
Frequency Range	:433.92 MHz, 1Channel in total
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: Battery 12V DC
Adapter manufacturer	: N/A
M/N	: N/A

4.3 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: IC7760A**

Waltek Services (Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A, July 10, 2012.

- **FCC – Registration No.: 880581**

Waltek Services (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011.

4.4 Test Location

All Emissions testswere performed at:-

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building,West Baima Rd., Songgang Street, Baoan District, Shenzhen518105, China.

4.5 General condition

Ambient Condition: 25.5 °C 58 %RH

4.5.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Waltek Services (Shenzhen) Co.,Ltd.

<http://www.waltek.com.cn>

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The follow condition is not applicable

Test Voltage	Input voltage
Rated voltage-15%	
normal	
Rated voltage+15%	

The follow condition is applicable.

Test voltage	Test Voltage
Rated voltage	New Battery 12V DC

4.5.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	MHz	433.92MHz	MHz
Receiving	MHz	MHz	MHz

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5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101178	Aug. 13,2012	Aug. 13,2013
2.	LISN	R&S	ENV216	101215	Aug. 13,2012	Aug. 13,2013
3.	Cable	HUBER+SUHNER	CBL2-NN-3M	2230300	Aug. 13,2012	Aug. 13,2013
4.	Switch	---	RSU/M2	---	Aug. 13,2012	Aug. 13,2013
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 13,2013
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 13,2013
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Aug. 13,2012	Aug. 13,2013
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2012	Aug. 13,2013
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 13,2013
6.	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-254	Aug. 13,2012	Aug. 13,2013
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 13,2013
8.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug. 13,2012	Aug. 13,2013
9.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug. 13,2012	Aug. 13,2013
10.	Positioning Controller	C&C LAB	CC-C-IF	-	Aug. 13,2012	Aug. 13,2013
11.	Color Monitor	SUNSP0	SP-14C	-	Aug. 13,2012	Aug. 13,2013

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 2.46 dB (AC mains 150KHz~30MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

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6 Conducted Emission Test

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit
Test Result:	N/A
Remark:	This test is not applicable for a battery operation device.

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7 Radiation Emission Test

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: ANSI C63.4:2003
 Frequency Range: 30 MHz to 5 GHz
 Measurement Distance: 3m
 Test Result: PASS

15.209 The spurious radiated emissions limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 -0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

15.231 (b) Limit: The field strength of emissions

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750**	125 to 375**
174-260	3,750	375
260-470	3,750 to 12,500**	375 to 1,250**
Above 470	12,500	1,250

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average

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(or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

7.1 EUT Operation:

Operating Environment:

Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	1012 mbar

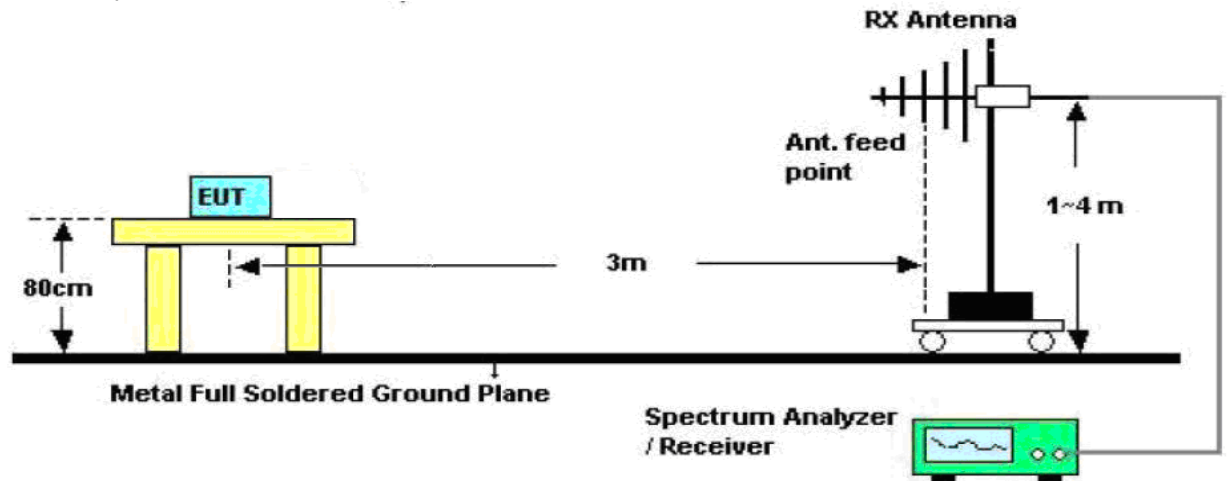
Operation Mode:

The EUT was tested in transmitting mode. The worst data were shown as follow.

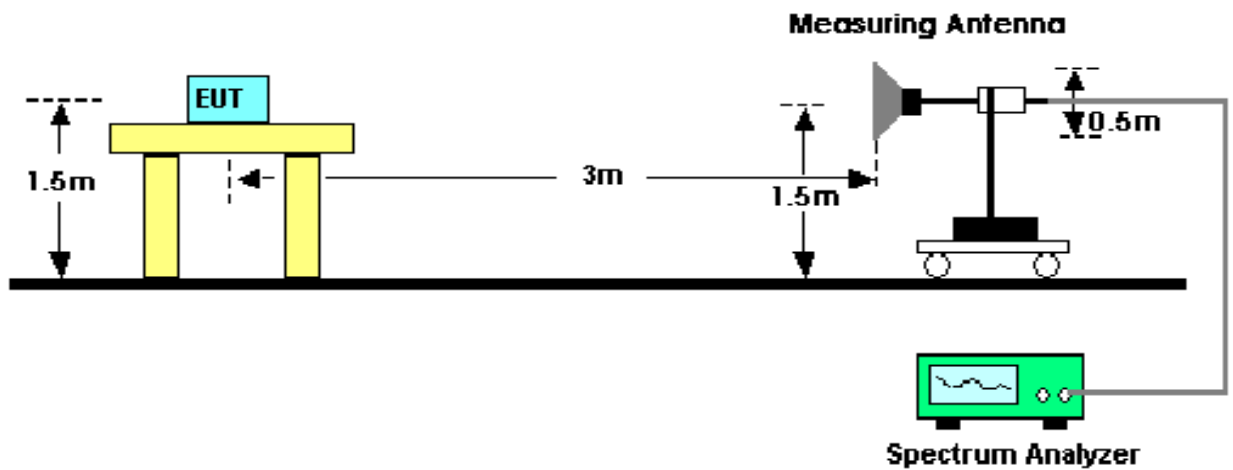
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



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7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 30MHz to 5GHz.

30MHz ~ 1GHz

Sweep SpeedAuto
IF Bandwidth 120 KHz
Video Bandwidth100KHz
Quasi-Peak Adapter Bandwidth120 KHz
Quasi-Peak Adapter ModeNormal
Resolution Bandwidth100KHz

Above 1GHz

Sweep SpeedAuto
IF Bandwidth 120 KHz
Video Bandwidth3MHz
Quasi-Peak Adapter Bandwidth120 KHz
Quasi-Peak Adapter ModeNormal
Resolution Bandwidth1MHz

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7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X, Y, Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand). After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.5 Corrected Amplitude & Margin Calculation

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

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - 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 maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

7.6 Summary of Test Results

Test Result for fundamental and harmonics

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	FCC 15 Subpart C Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
433.92	Peak	Vertical	73.85	100.82	26.97	1.6	90
433.92	Peak	Horizontal	75.94	100.82	24.88	1.4	60
867.831	Peak	Vertical	52.00	80.82	28.82	1.5	60
1301.76	Peak	Vertical	37.96	74.00	36.01	2.0	120
1735.58	Peak	Vertical	32.75	74.00	41.25	1.6	60
2169.60	Peak	Vertical	30.07	74.00	43.93	1.5	140
2603.52	Peak	Vertical	31.00	74.00	43.00	1.3	60
3037.44	Peak	Vertical	31.55	74.00	42.45	1.4	45
3471.36	Peak	Vertical	32.71	74.00	41.29	1.5	60
3905.28	Peak	Vertical	32.65	74.00	41.35	1.5	45
4339.20	Peak	Vertical	31.08	74.00	43.92	1.6	110
867.831	Peak	Horizontal	51.95	74.00	29.77	1.3	120
1301.76	Peak	Horizontal	39.22	80.82	24.78	1.4	45
1735.58	Peak	Horizontal	34.80	74.00	39.20	1.5	90
2169.60	Peak	Horizontal	33.66	74.00	40.34	1.0	130
2603.52	Peak	Horizontal	33.82	74.00	40.18	2.0	40

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3037.44	Peak	Horizontal	32.01	74.00	41.99	1.3	60
3471.36	Peak	Horizontal	33.72	74.00	40.28	1.5	110
3905.28	Peak	Horizontal	28.45	74.00	45.55	1.3	140
4339.20	Peak	Horizontal	30.35	74.00	43.65	2.0	90
433.92	Average	Vertical	65.45	80.82	27.81	1.5	90
433.92	Average	Horizontal	67.54	80.82	25.29	1.7	60
867.831	Average	Vertical	43.6	60.82	27.63	1.3	60
1301.76	Average	Vertical	29.56	54.00	35.77	2.1	120
1735.58	Average	Vertical	24.35	54.00	42.62	1.5	60
2169.60	Average	Vertical	21.67	54.00	42.16	1.4	140
2603.52	Average	Vertical	22.6	54.00	43.72	1.2	60
3037.44	Average	Vertical	23.15	54.00	42.69	1.5	45
3471.36	Average	Vertical	24.31	54.00	41.21	1.6	60
3905.28	Average	Vertical	24.25	54.00	41.36	1.6	45
4339.20	Average	Vertical	22.68	54.00	43.98	1.7	110
867.831	Average	Horizontal	43.55	54.00	29.31	1.4	120
1301.76	Average	Horizontal	30.82	60.82	24.26	1.5	45
1735.58	Average	Horizontal	26.4	54.00	39.18	1.6	90
2169.60	Average	Horizontal	25.26	54.00	40.55	1.1	130
2603.52	Average	Horizontal	25.42	54.00	40.03	2.1	40
3037.44	Average	Horizontal	23.61	54.00	41.27	1.4	60
3471.36	Average	Horizontal	25.32	54.00	40.12	1.6	110
3905.28	Average	Horizontal	20.05	54.00	45.36	1.4	140
4339.20	Average	Horizontal	21.95	54.00	43.99	2.1	90

Where F is the frequency in MHz, The formulas for calculating the maximum permitted fundamental field strengths are as follows:

- (1). For the band 130-174MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$;
- (2). For the band 260-470MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$.

Sample calculation of limit @ 433.92MHz

$$41.6667 (433.92) - 7083.3333 = 10996.681 \mu\text{V/m}$$

$$20\log(10996.681) = 80.82 \text{ dBuV/m(AV) limit @ 433.92MHz}$$

$$\text{AV} = \text{Peak} + 20\log_{10}(\text{duty cycle}) = \text{Peak} - 8.4$$

See section 8 for duty cycle factor.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

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8 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity, The duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

Duty Cycle(%)=38%

Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor(dB)=20 * Log₁₀(Duty Cycle)

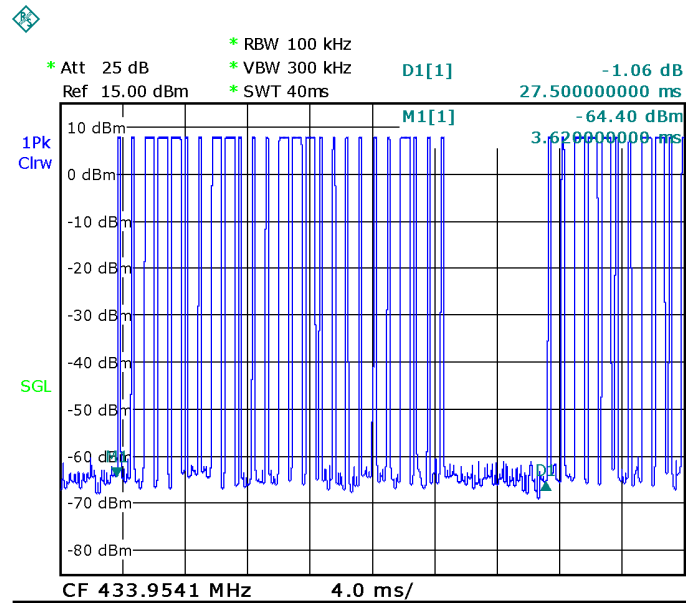
Pulse Train	Number of Pulse	T(ms)	Total Time(ms)
Long Pulse	9	0.692	6.228
Short Pulse	16	0.260	4.160

Total On interval in a complete pulse train(ms)	27.5
Length of a complete pulse train(ms)	10.388
Duty Cycle(%)	38
Duty Cycle Correction Factor(dB)	-8.4

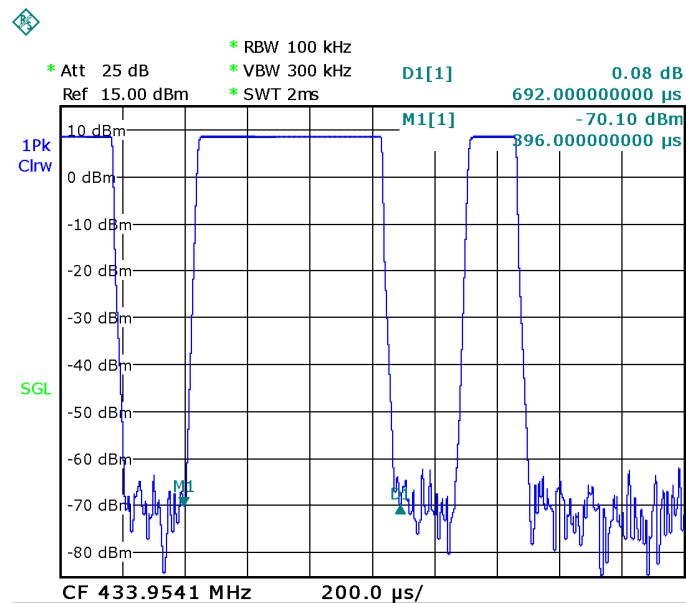
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Refer to the duty cycle plot (as below), This device meets the FCC requirement.

Length of a complete pulse train:

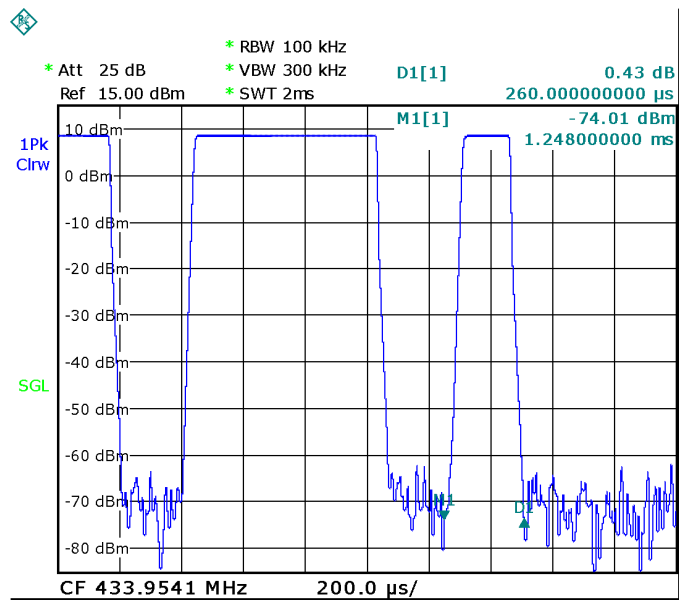


Long Pulse

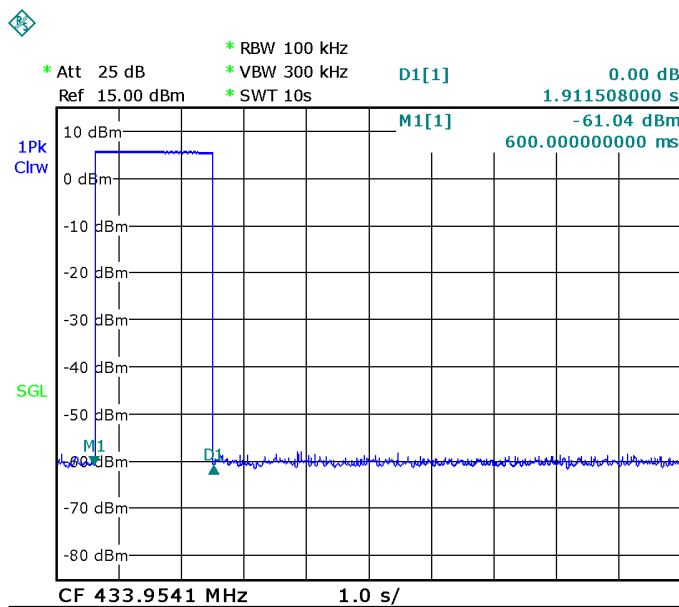


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Short Pulse:



Refer to the plot (as below), We find a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter is 1.92 seconds, within not more than 5 seconds of being released.



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9 Bandwidth

Test Requirement: FCC Part15 C

Test Method: FCC Part15 Paragraph 15.231(c)

Limit The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

9.1 Test Procedure

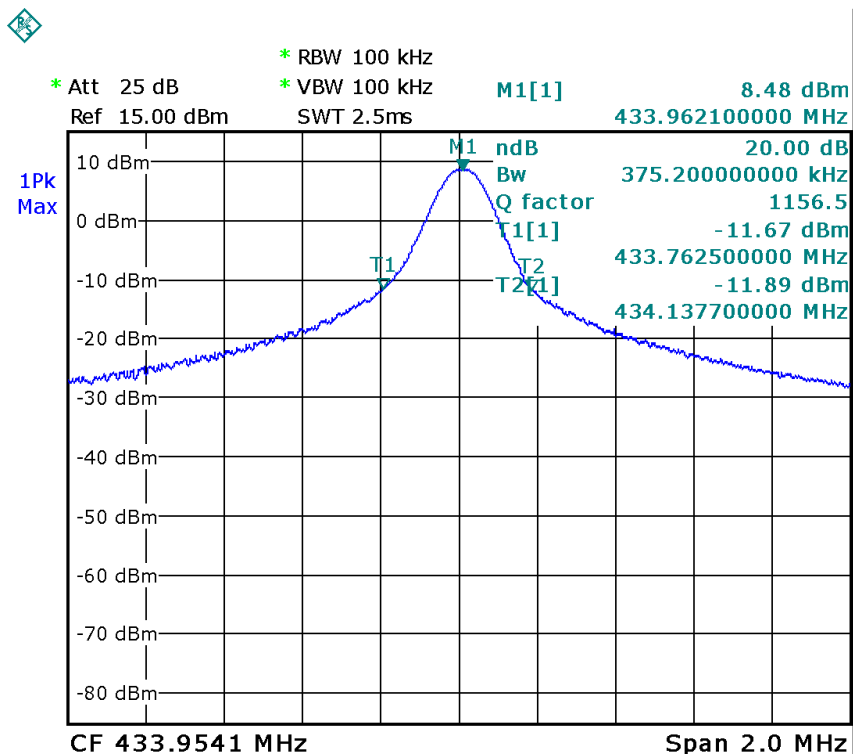
1. The transmitter output (antenna port) was connected to the spectrum analyzer. EUT and its simulators are placed on a table, let EUT working in test mode, then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 100KHz RBW and 100KHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

9.2 Test Result

Frequency (MHz)	Bandwidth Emission (KHz)	Limit (KHz)	Result
433.92	375.2	1084.8	Pass

Limit=Center Frequency*0.25%

Test Plot



10 Antenna Requirement

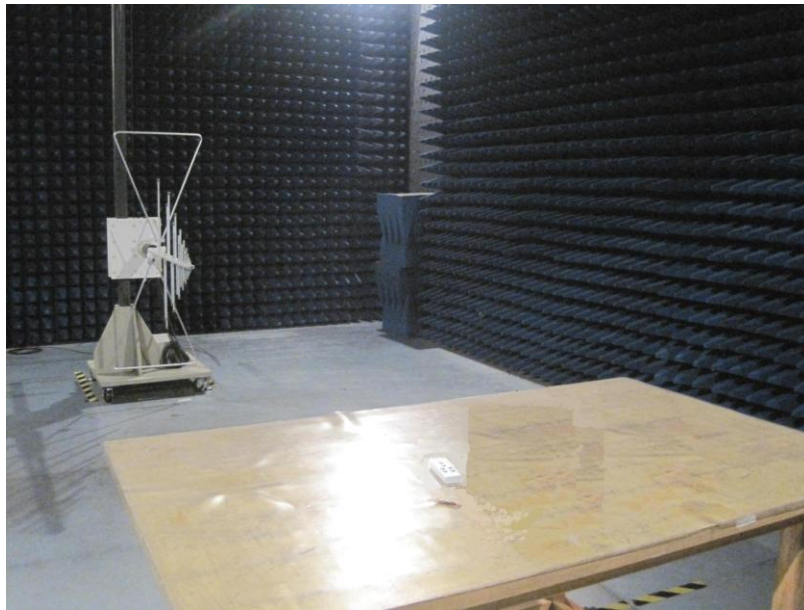
According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product use a permanent PCB printed antenna, fulfill the requirement of this section

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11 Photographs of Testing

11.1 Radiation Emission Test View

From 30MHz to 1GHz



Above 1GHz



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12 Photographs - Constructional Details

12.1 EUT - Appearance View

Model for BH-P



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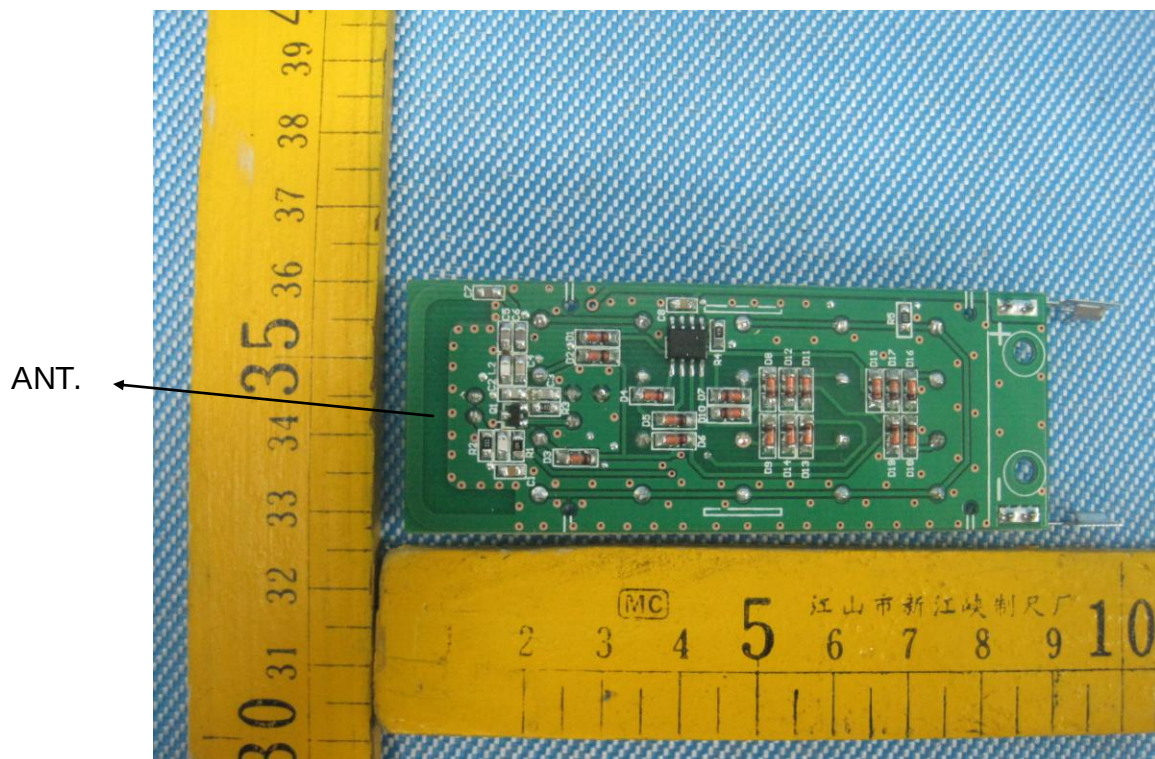
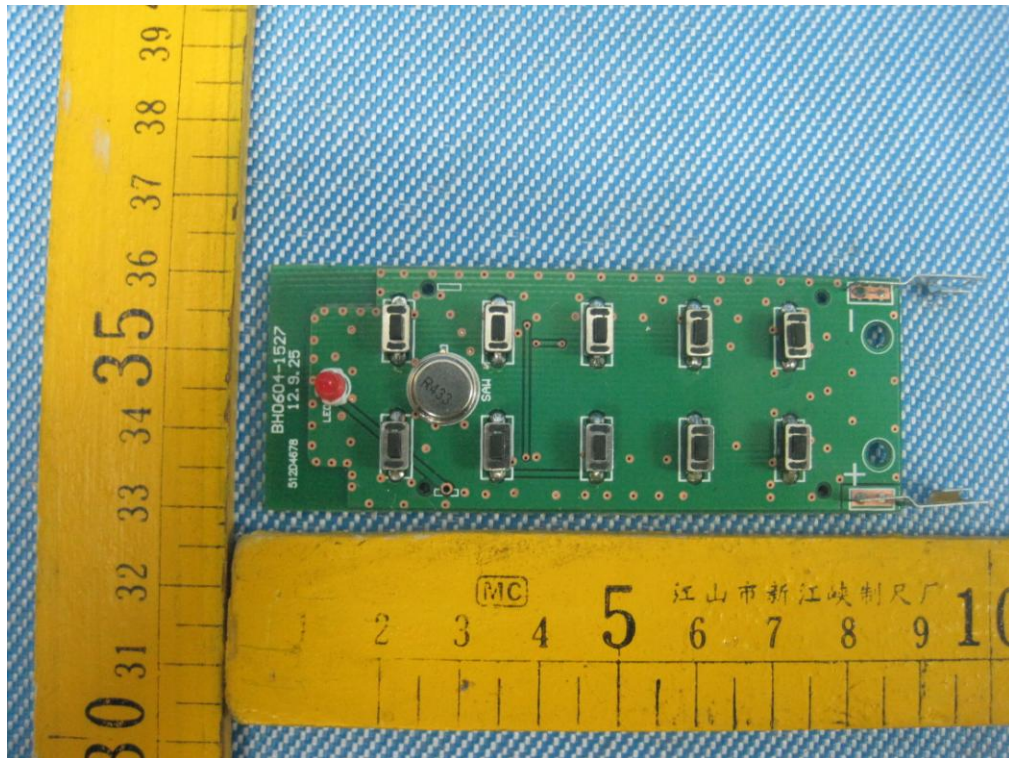
Model for BH-O



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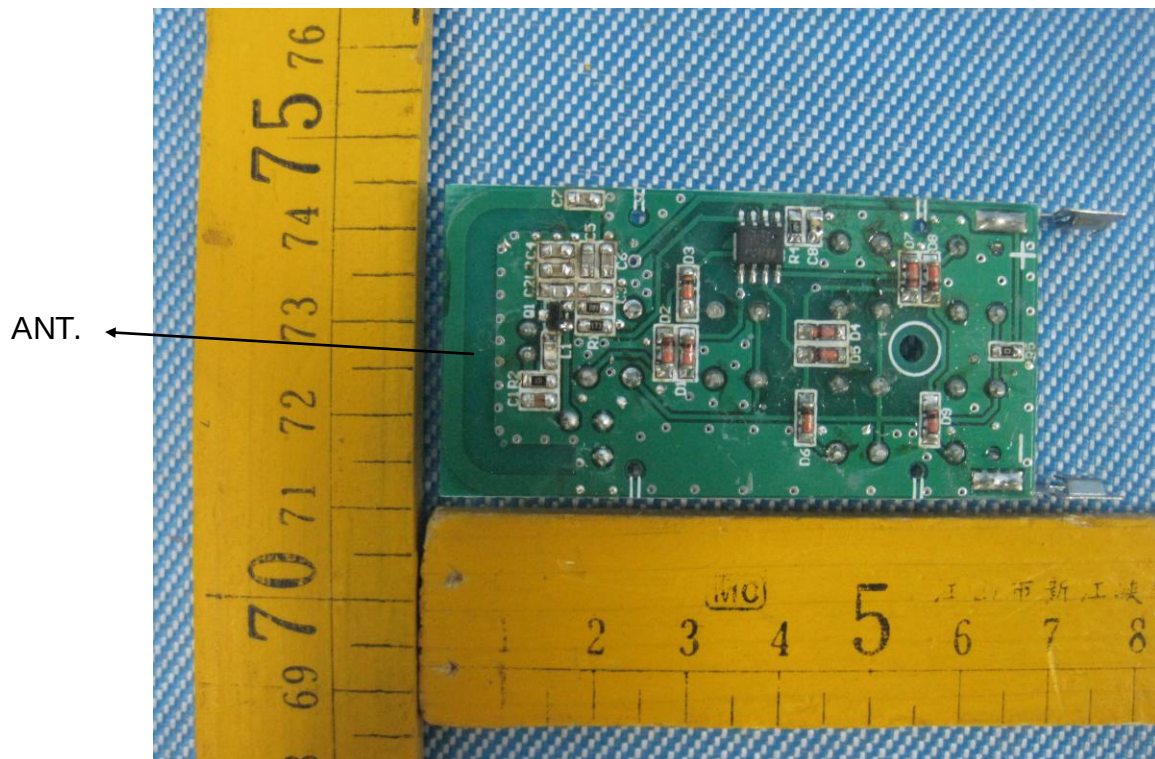
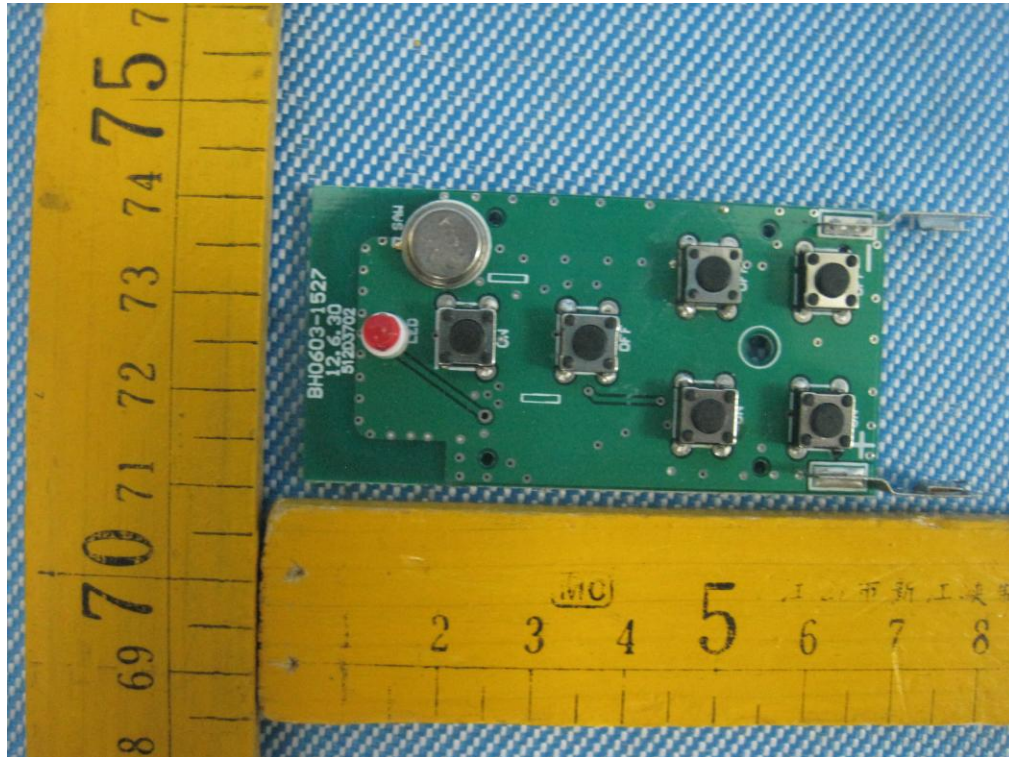
12.2 PCB- View

Model for BH-P



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Model for BH-O



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13 FCC ID Label

FCC Label Sample for model:BH-P,BH-O

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:(1)this device may not cause harmful interference,and (2) this device must accept any interference received, including interference that may cause undesired operation

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FCC Label Location for model:BH-P,BH-O

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT

EUT Bottom View/proposed FCC Label Location

