

FCC TEST REPORT

FCC ID : SUKRL-R25

Applicant : ZHUHAI ROULE ELECTRIC CO., LTD

Address of Applicant : NO. 12, Pingdong 3rd Road, Nanping Industry Community, Zhuhai,
Guangdong China.

Equipment Under Test (EUT) :

Product description : Magnetic code controller

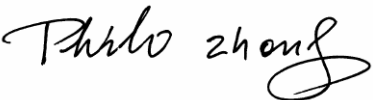
Model No. : RL-R25

Standards : FCC 15 Subpart C Paragraph 15.231

Date of Test : Sep,05~22,2009

Date of Issue : Sep.24,2009

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3 Test Summary

Test	Test Requirement	Test Method	Class / Severity	Result
Periodic operation	FCC PART 15: 2007	ANSI C63.4: 2003	Note	PASS
Band Edge	FCC PART 15: 2007	ANSI C63.4: 2003	Note	PASS
Radiated Emission (30MHz to 5GHz)	FCC PART 15: 2007	ANSI C63.4: 2003	FCC PART15.109	PASS
Conducted Emission (150KHz to 30MHz)	FCC PART 15: 2007	ANSI C63.4: 2003	FCC PART15.107	N/A

Note : denote that for more details of the EUT , please refer to the relating test items as below .

Remark : the methods of measurement in all the test items were according to ANSI C63.4: 2003.

4 General Information

4.1 Client Information

Applicant: ZHUHAI ROULE ELECTRIC CO., LTD
Address: NO. 12, Pingdong 3rd Road, Nanping Industry Community,
Zhuhai, Guangdong China.

Manufacturer: ZHUHAI ROULE ELECTRIC CO., LTD
Address: NO. 12, Pingdong 3rd Road, Nanping Industry Community,
Zhuhai, Guangdong China.

4.2 General Description of E.U.T.

Product description: Magnetic code controller
Model No.: RL-R25

4.3 Details of E.U.T.

Power Supply: Batteries 1.5V*3 “AAA”
Operation Frequency: 433.92MHz
Modulation : ASK

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Standards Applicable for Testing

The customer requested FCC tests for a Magnetic code controller . The standards used were FCC 15 Paragraph 15.231, Paragraph 15.205, Paragraph 15.31, Paragraph 15.33, Paragraph 15.35.

4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **IC – Registration No.:7760A**

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 No.:7760A, July 24, 2008.

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. 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, June 24, 2008. compliance

4.7 Test Location

All Emissions tests were performed at:-

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen 518105, China.

5 Equipment Used during Test

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
EMC Analyzer	Agilent/ E7405A	MY45114943	W2008001	9k-26.5GHz	Aug-09	Aug-10	Wws20081596	±1dB
Trilog Broadband Antenne 30-3000 MHz	SCHWARZB ECK MESS-ELEKTROM / VULB9163	336	W2008002	30-3000 MHz	Aug-09	Aug-10		±1dB
Broad-band Horn Antenna 1-18 GHz	SCHWARZB ECK MESS-ELEKTROM / VULB9163	667	W2008003	1-18GHz	Aug-09	Aug-10		f<10 GHz: ±1dB 10GHz<f<18 GHz: ±1.5dB
Broadband Preamplifier 0.5-18 GHz	SCHWARZB ECK MESS-ELEKTROM / BBV 9718	9718-148	W2008004	0.5-18GHz	Aug-09	Aug-10		±1.2dB
10m Coaxial Cable with N-male Connectors usable up to 18GHz,	SCHWARZB ECK MESS-ELEKTROM / AK 9515 H	-	-	-	Aug-09	Aug-10		-
10m 50 Ohm Coaxial Cable with N-plug, individual length, usable up to 3(5)GHz, Connector	SCHWARZB ECK MESS-ELEKTROM / AK 9513				Aug-09	Aug-10		
Positioning Controller	C&C LAB/ CC-C-IF				N/A	N/A		
Color Monitor	SUNSP0/ SP-14C				N/A	N/A		
Test Receiver	ROHDE&SC HWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug-09	Aug-10	Wws20080942	±1dB
EMI Receiver	Beijingkehua n	KH3931		9k-1GHz	Aug-09	Aug-10		
Two-Line V-Network	ROHDE&SC HWARZ/ ENV216	100115	W2005002	50Ω/50μH	Aug-09	Aug-10	Wws20080941	±10%

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
Absorbing Clamp	ROHDE&SC HWAZ/ MDS-21	100205	W2005003	impedance 50 Ω loss : 17 dB	Aug-09	Aug-10	Wws200 80943	± 1 dB
10m 50 Ohm Coaxial Cable with N-plug, individual length, usable up to 3(5)GHz, Connectors	SCHWARZB ECK MESS- ELEKTROM / AK 9514				Aug-09	Aug-10		
Digital Power Analyzer	Em Test AG/Switzerland/ DPA 500	V07451 03095	W2008012	Power: 2000VA Vol-range: 0-300V Freq_range: 10-80Hz	Aug-09	Aug-10	Wwd200 81185	Voltage distinguish: 0.025% Power_freq distinguish: 0.02Hz
Power Source	Em Test AG/Switzerland/ ACS 500	V07451 03096	W2008013	Vol-range: 0-300V Power_freq: 10-80Hz				
Electrostatic Discharge Simulator	Em Test AG/Switzerland/DITO	V07451 03094	W2008005	Contact discharge: 500V-10KV Air discharge: 500V-16.5KV	Aug-09	Aug-10	Wwc200 82400	7.5A current will be changed in $V_m=1.5V$
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Freq-range: 9K-1GHz RF voltage: -60 dBm-+10dBm	Aug-09	Aug-10	Wws200 81890	Power_freq distinguish: 0.1Hz RF electricity distinguish 0.1 B
CDN M-Type	TESEQ GmbH/ CDN M016	25112	W2008009	Voltage correct factor 9.5 dB	Aug-09	Aug-10	Wwc200 82396	150K-80MHz: ± 1 dB 80-230MHz: -2-+3dB
EM-Clamp	TESEQ GmbH/ KEMZ 801	25453	W2008010	Freq_range: 0.15-1000 MHz	Aug-09	Aug-10	Wwc200 82397	0.3-400 MHz: ± 4 dB Other freq: ± 5 dB
Attenuator 6dB	TESEQ GmbH/ ATN6050	25365			Aug-09	Aug-10	Wws200 81597	

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
All Modules Generator	SCHAFFNER/6150	34579	W2008006	voltage:200V-4.4KV Pulse current: 100A-2.2KA	Aug-09	Aug-10	Wwc20082401	voltage: $\pm 10\%$ Pulse current: $\pm 10\%$
Capacitive Coupling Clamp	SCHAFFNER/CDN 8014	25311			Aug-09	Aug-10	Wwc20082398	-
Signal and Data Line Coupling Network	SCHAFFNER/CDN 117	25627	W2008011	1.2/50 μ S	Aug-09	Aug-10	Wwc20082399	-
AC Power Supply	TONGYUN/DTDGC-4				Aug-09	Aug-10	Wws20080944	-
Exposure Level Tester ELT-400	Narda Safety TEST Solutions/2304/03	M-0155	w2008022	Test freq range: 1—400kHz	Aug-09	Aug-10	Wwd20081191	Test uncertainty : 1—120kHz: $\pm 1.83\%$, 120 kHz-400 kHz: $\pm 4.06\%$
Magnetic Field Probe 100cm ²	Narda Safety TEST Solutions/2300/90.10	M-1070	w2008021	Test freq range: 1—400kHz				Test uncertainty : 1Hz-10Hz: $\pm 16.2\%$, 10Hz - 120kHz: $\pm 2.2\%$, 120 kHz-400 kHz: $\pm 4.7\%$
Active Loop Antenna Charger 10kHz-30MHz	Beijing Dazhi / ZN30900A	-	-	10kHz-30MHz	Aug-09	Aug-10		$\pm 1\text{dB}$

6 Conducted Emission Test

Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	Based on FCC Part15 Paragraph 15.207
Test Date:	N/A
Frequency Range:	150kHz to 30MHz
Class:	Class B
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 Test Equipment

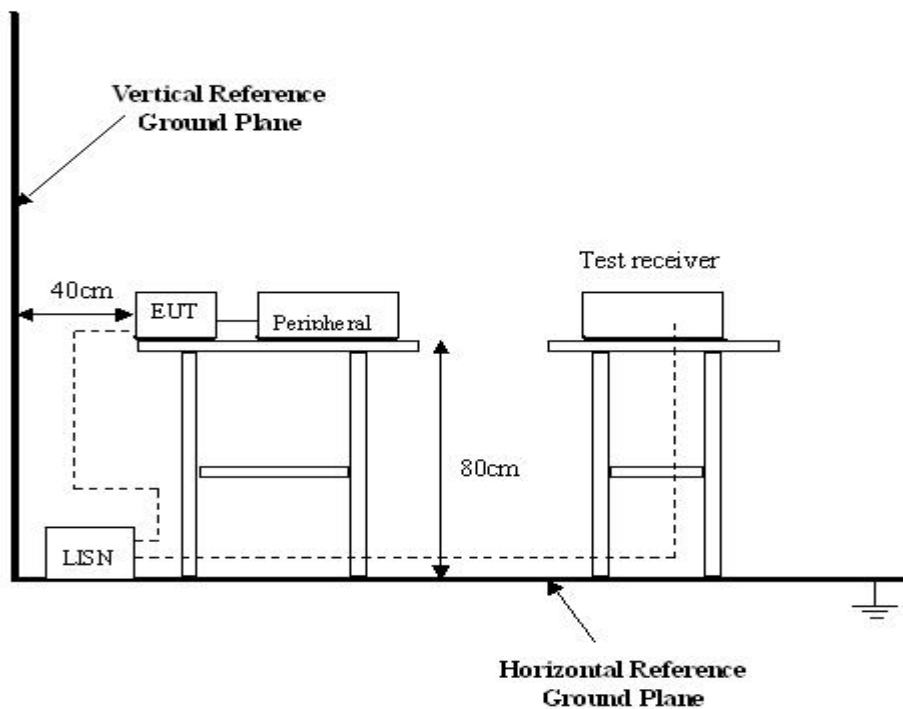
Please refer to Section 5 this report.

6.2 Test Procedure

1. The EUT was tested according to ANSI C63.4: 2003. The frequency spectrum from 150kHz to 30MHz was investigated.
2. The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.3 Conducted Test Setup

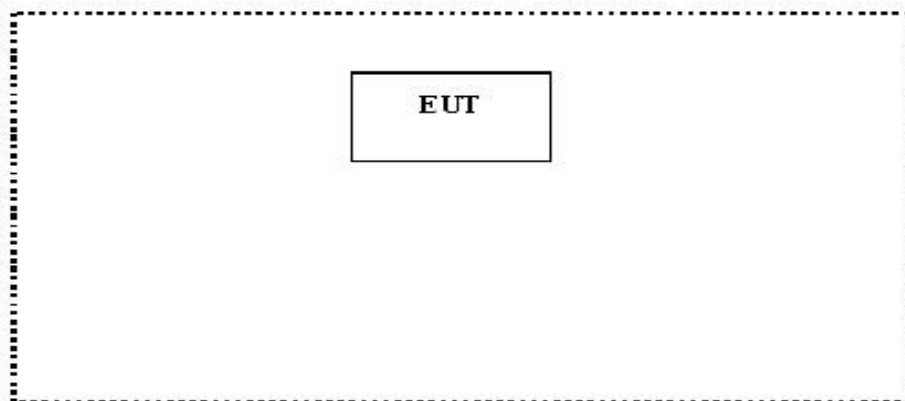
The conducted emission tests were performed using the setup accordance with the ANSI C63.4: 2003, The specification used in this report was the FCC Part15 Paragraph 15.207 limits.



6.4 EUT Operating Condition

Operating condition is according to ANSI C63.4: 2003.

- A. Setup the EUT and simulators as shown on follow.
- B. Enable RF signal and confirm EUT active.
- C. Modulate output capacity of EUT up to specification.



6.5 Conducted Emission Limits

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

Note: In the above limits, the tighter limit applies at the band edges.

6.6 Conducted Emission Test Data

Own to the EUT operation with battery, the test was not performed.

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7 Radiation Emission Test

Test Requirement:	FCC Part15 Paragraph 15.231
Test Method:	Based on FCC Part15 Paragraph 15.33
Test Result:	PASS
Frequency Range:	30MHz to 5GHz
Measurement Distance:	3m

7.1 Test Equipment

Please refer to Section 5 this report.

7.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

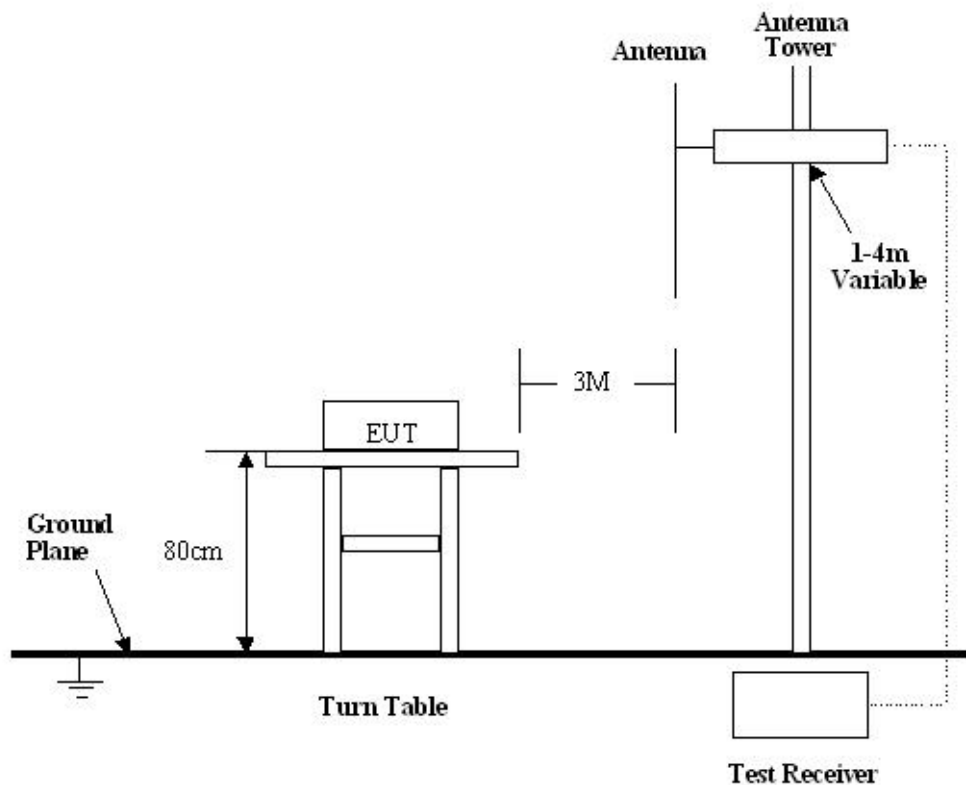
Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Waltek EMC Lab is ± 5.03 dB.

7.3 Test Procedure

1. New battery were installed in the equipment under test for radiated emissions test.
2. The radiation emission should be tested under 3-axes position(lying,side and stand),After pre-test,It was found that the worse radiation emission was get at the lying position.
3. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
4. All data was recorded in the peak and average detection mode.
5. The EUT was under working mode during the final qualification test and the configuration was used to represent the worst case results.

7.4 Radiated 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 specification used in this report was the FCC Part15 Paragraph 15.231, Paragraph 15.209 limits.



7.5 Spectrum Analyzer Setup

According to FCC Part15 Paragraph 15.231 Rules, the system was tested to 5000 MHz.

Below 1GHz

Start Frequency	30 MHz
Stop Frequency	1000 MHz
Sweep Speed	Auto
IF Bandwidth	120 kHz
Video Bandwidth	100 kHz
Quasi-Peak Adapter Bandwidth	120 kHz
Quasi-Peak Adapter Mode.....	Normal
Resolution Bandwidth	100 kHz

Above 1GHz

Start Frequency	1GHz
Stop Frequency	5GHz
Sweep Speed	Auto
Video Bandwidth	1 MHz
Resolution Bandwidth	1MHz

7.6 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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

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

7.7 Summary of Test Results

According to the data in section 7.10, the EUT complied with the FCC Part15 Paragraph 15.231 standards.

7.8 EUT Operating Condition

Same as section 6.4 of this report.

7.9 Radiated Emissions Limit

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\ 1, 250 to 3, 750	\1\ 125 to 375
174-260.	3, 750.	375
260-470.	\1\ 3, 750 to 12, 500.	\1\ 375 to 1, 250
Above 470.	12, 500.	1, 250

7.10 Radiated Emissions Test Result

Formula of conversion factors:the field strength at 3m was egtablished by adding
The meter reading of the spectrum analyer (which is set to read in units of dBuV)
To the antenna correction factor supplied by the antenna manufacturer. The antenna
Correction factors are stared in terms of dB.The gain of the pressletor was accounted
For in the spectrum analyser meter reading.

Example:

Freq(MHz) Meter Reading +ACF=FS
33 20dBuV+10.36dB=30.36dBuV/m @3m

7.10.1 Radiated Emission Test Data

Test Item:	Radiated Emission Test Data
Test Voltage:	DC 4.5V
Test Mode:	TX On
Temperature:	25.5 °C
Humidity:	51%RH
Test Result:	PASS

Note:

$AV = Peak + 20Log_{10}(duty\ cycle) = Peak - 5.39$
So the Radiated Emission Test Data as the table follow.For more details of the calculation ,
please refer the section 9 of the Periodic operation .

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	80.22	100.82	20.6	1.1	0
433.92	Peak	Horizontal	83.02	100.82	17.8	1.4	60
867.831	Peak	Vertical	56.77	80.82	24.05	1.5	0
1301.76	Peak	Vertical	37.96	74.00	36.04	2.0	120
1735.58	Peak	Vertical	32.75	74.00	41.25	1.6	0
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	50
4339.20	Peak	Vertical	31.08	74.00	42.92	1.6	110
867.831	Peak	Horizontal	51.95	74.00	22.05	1.3	120
1301.76	Peak	Horizontal	39.22	80.82	41.6	1.4	45
1735.58	Peak	Horizontal	34.80	74.00	39.2	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
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	10
4339.20	Peak	Horizontal	30.35	74.00	43.65	2.0	90
433.92	AV	Vertical	74.83	80.82	5.99	1.1	0
433.92	AV	Horizontal	77.63	80.82	3.19	1.1	0
867.831	AV	Vertical	51.38	60.82	9.44	1.5	60
1301.76	AV	Vertical	34.32	54.00	19.68	2.0	120
1735.58	AV	Vertical	29.11	54.00	24.89	1.6	60
2169.60	AV	Vertical	26.43	54.00	27.57	1.5	140
2603.52	AV	Vertical	27.36	54.00	26.64	1.3	60
3037.44	AV	Vertical	27.91	54.00	26.09	1.4	45
3471.36	AV	Vertical	29.07	54.00	24.93	1.5	60
3905.28	AV	Vertical	29.01	54.00	24.99	1.5	45
4339.20	AV	Vertical	27.44	54.00	26.56	1.6	110
867.831	AV	Horizontal	48.31	80.82	32.51	1.3	10

1301.76	AV	Horizontal	35.58	54.00	18.42	1.0	135
1735.58	AV	Horizontal	31.16	54.00	22.84	1.5	90
2169.60	AV	Horizontal	30.02	54.00	23.98	1.0	130
2603.52	AV	Horizontal	30.18	54.00	23.82	2.0	40
3037.44	AV	Horizontal	28.37	54.00	25.63	1.3	60
3471.36	AV	Horizontal	30.08	54.00	23.92	1.5	110
3905.28	AV	Horizontal	24.81	54.00	29.19	1.3	140
4339.20	AV	Horizontal	26.71	54.00	27.29	1.0	0

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

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

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

And

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

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

8 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 has a permanent antenna, fulfill the requirement of this section

9 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(%)=

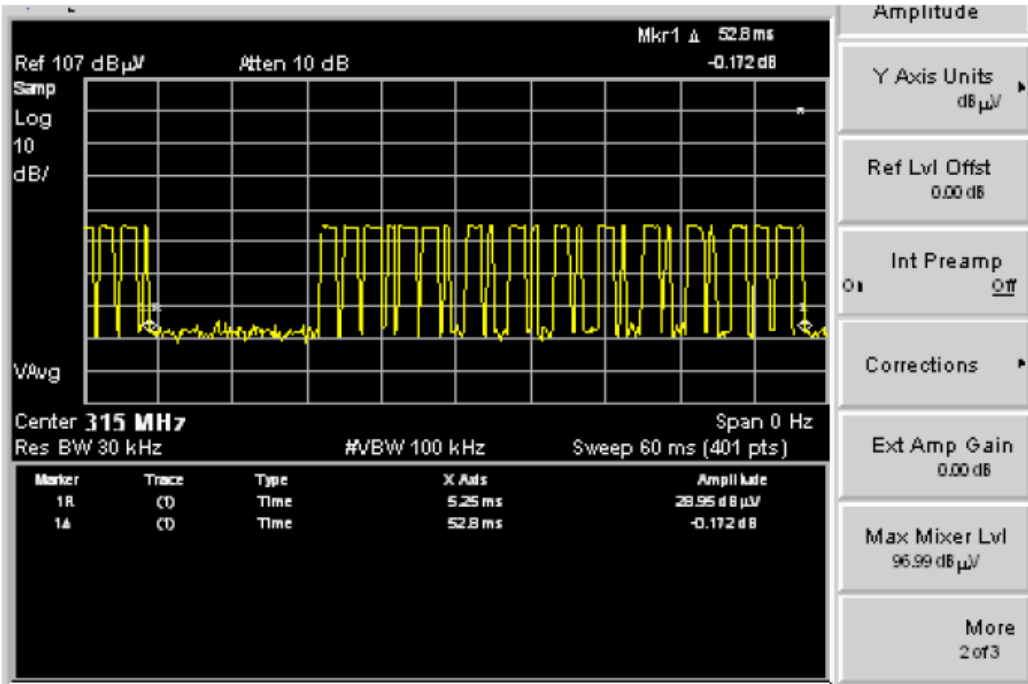
Total On interval in a complete pulse train/ Length of a complete pulse train * %

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

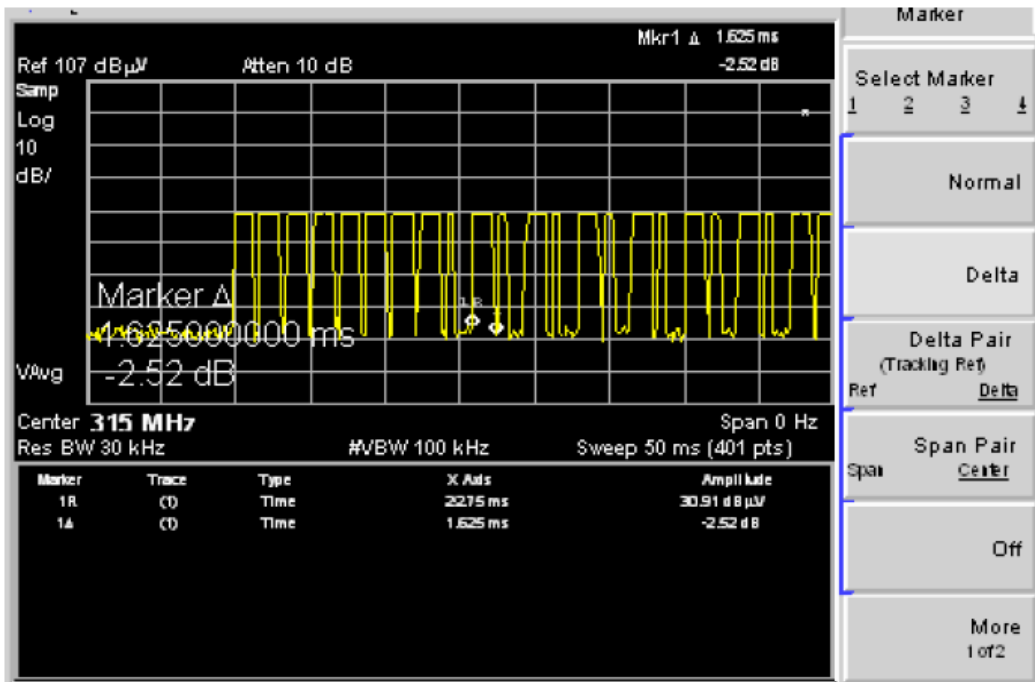
Pulse Train	Number of Pulse	T(ms)	Total Time(ms)
Long Pulse	14	1.625	22.75msec
Short Pulse	9	0.625	5.625msec

Total On interval in a complete pulse train	52.8msec
Length of a complete pulse train	28.375msec
Duty Cycle(%)	53.74%
Duty Cycle Correction Factor(dB)	5.39

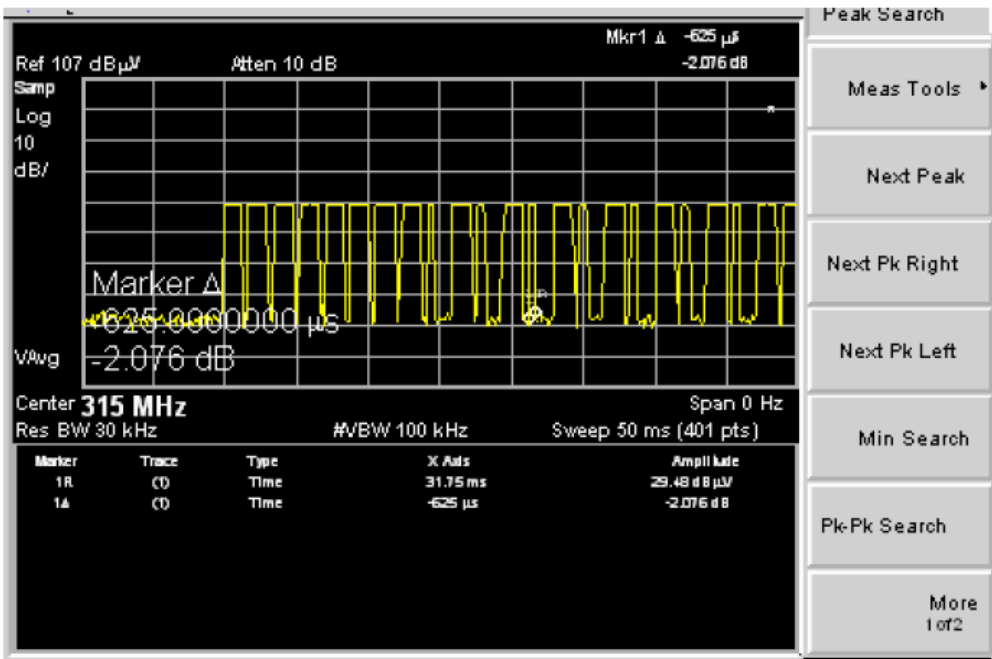
Refer to the duty cycle plot (as below),This device does meet the FCC requirement.
Length of a complete pulse train:



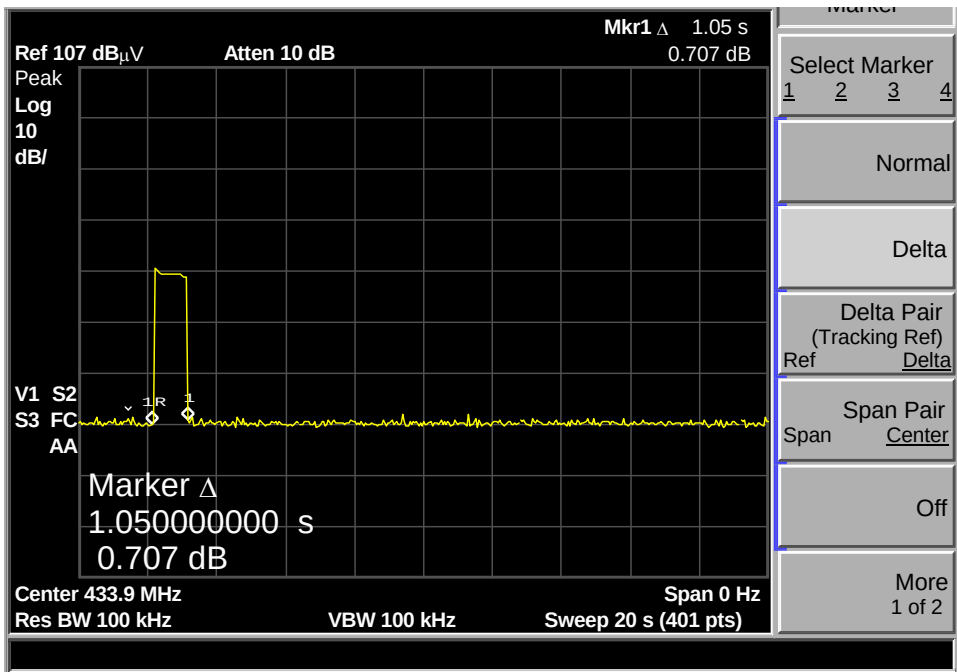
Long Pulse



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 1.05seconds, within not more than 5 seconds of being released.



10 Band Edge

Test Requirement:	FCC Part15 C
Test Method:	Based on FCC Part15 Paragraph 15.231
Test Date:	Sep.11,2009
Test mode:	TX On
Temperature:	25.5 °C
Humidity:	51%RH

10.1 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.

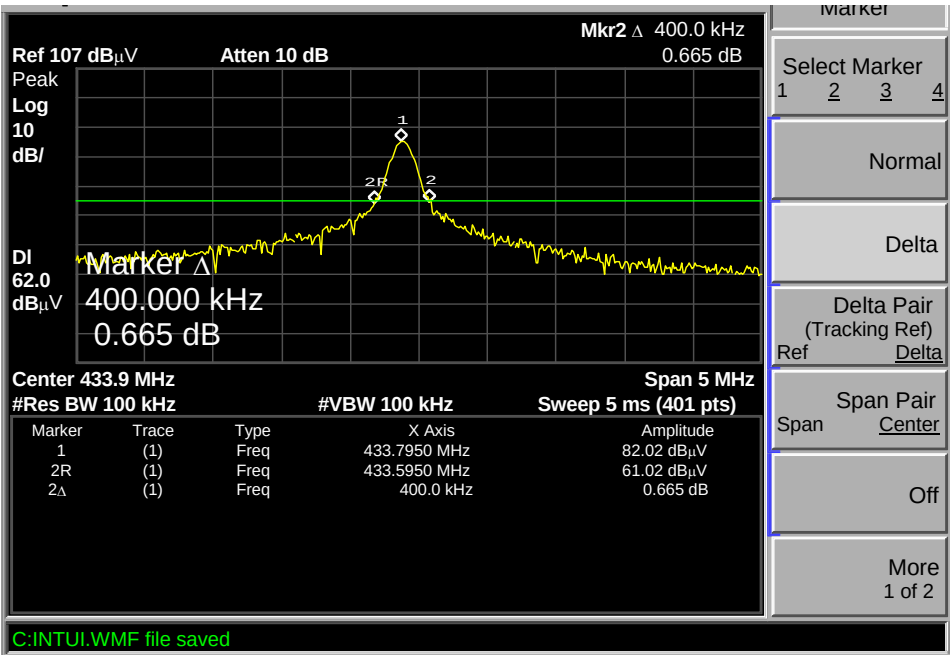
10.2 Band Edge

Requirements: 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Frequency (MHz)	Bandwidth Emission (KHz)	Limit (KHz)	Result
433.92	400	1084.8	Pass

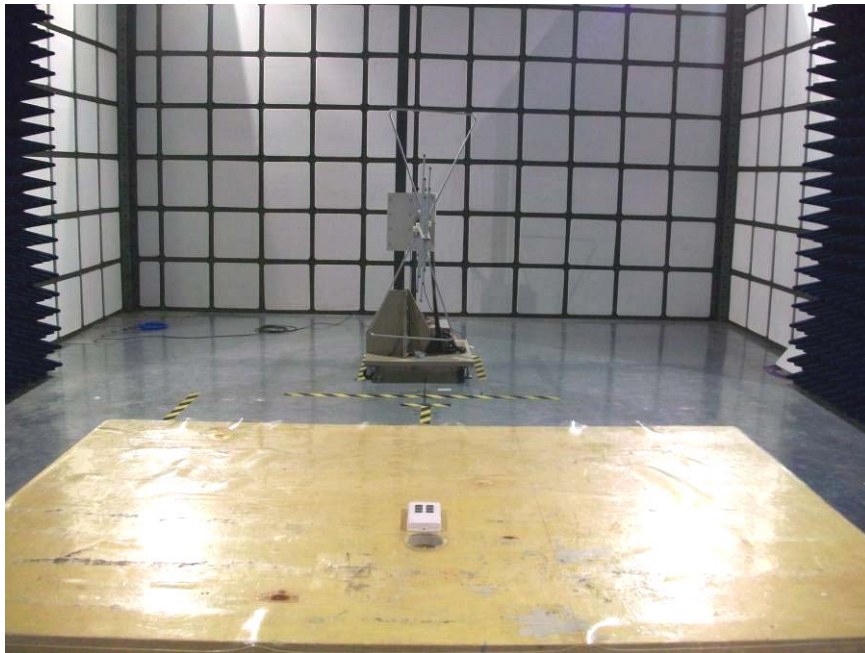
10.3 Band Edge Test Result

433.92MHz TX

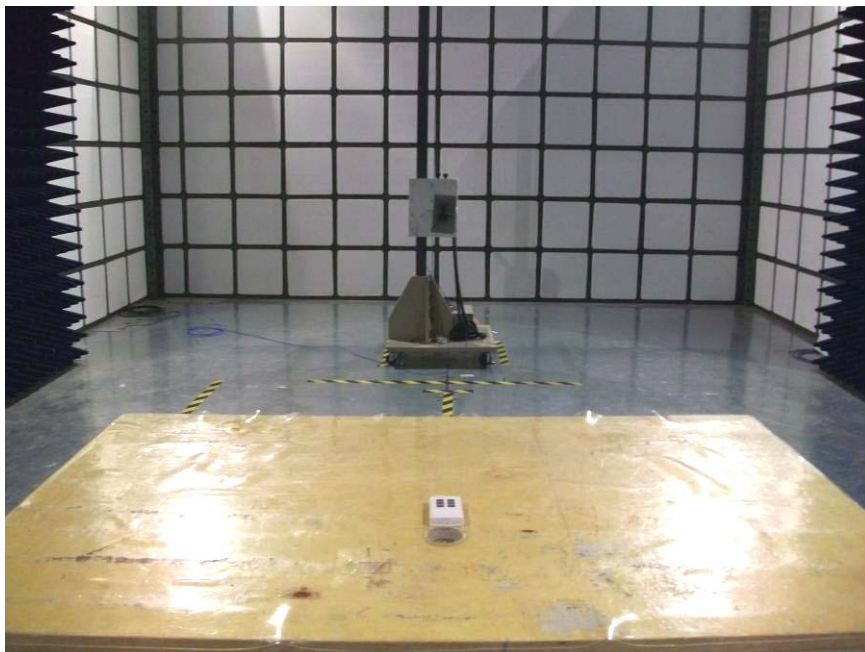


11 Photographs of Testing

11.1 Radiation Emission Test View For 30MHz-1000MHz

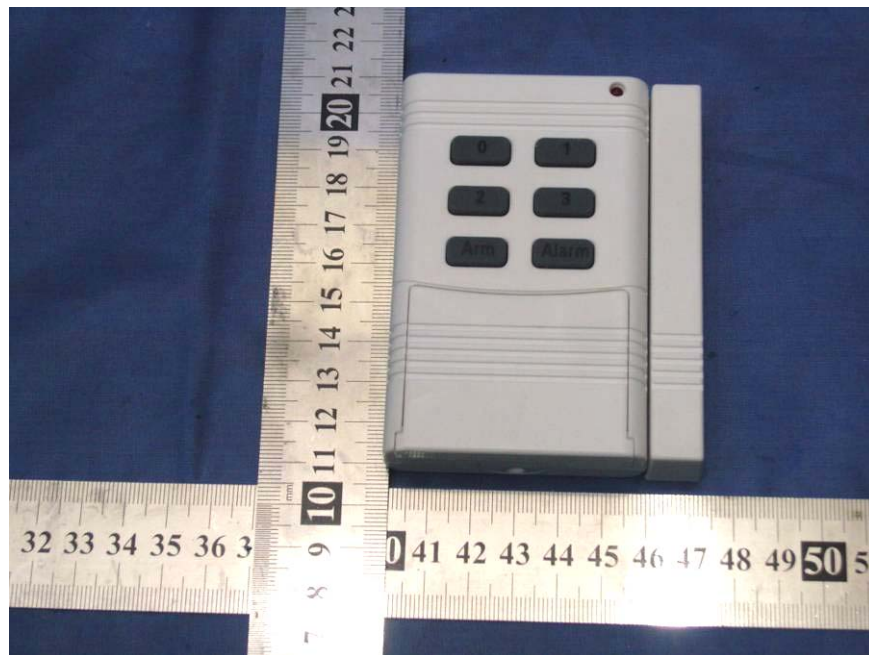


11.2 Radiation Emission Test View For 1GHz-5GHz



12 Photographs - Constructional Details

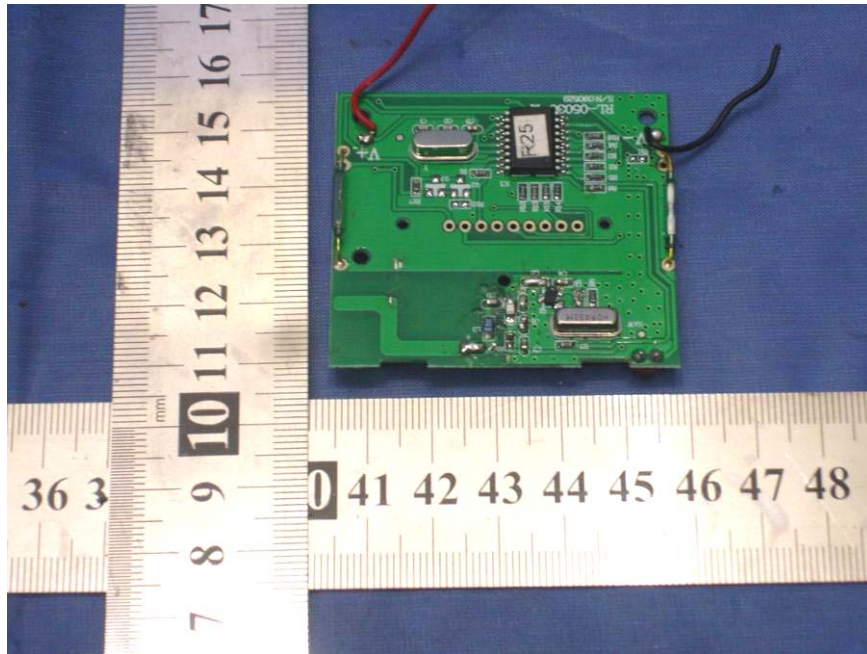
12.1 EUT - Front View



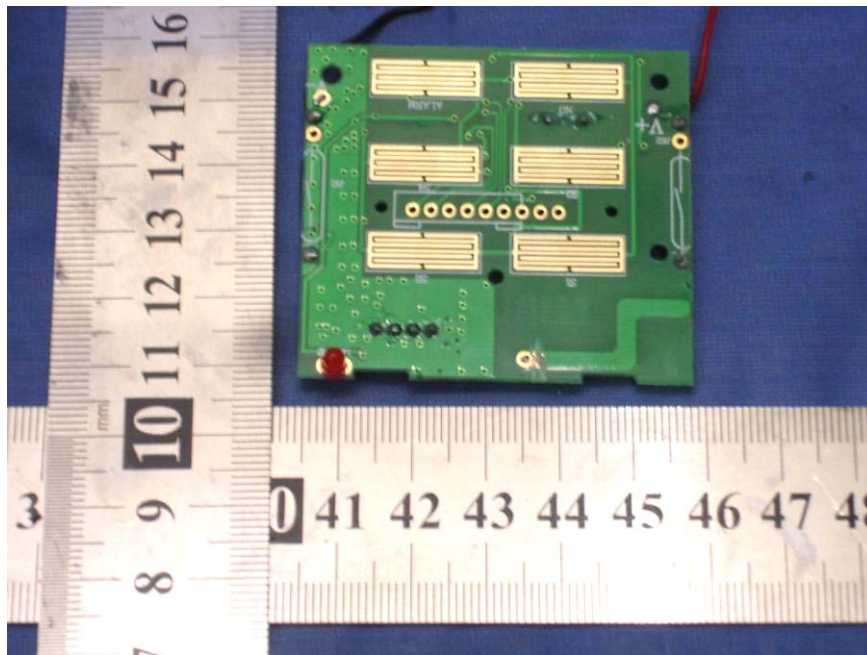
12.2 EUT - Back View



12.3 PCB-Front View



12.4 PCB-Back View



13 FCC ID Label

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

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

