

# ***FCC TEST REPORT***

**FCC ID** : U5DRB741RB742

**Applicant** : **Linear Electronics Manufactory**  
Hourui Second Industrial Zone Hourui Village, Xixiang, Bao An County,

**Equipment Under Test (EUT) :**

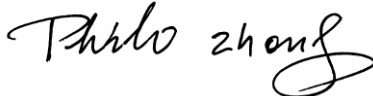
Product description :GTO Transmitter

Model No. : RB741 & RB742

**Standards** : FCC 15 Subpart C Paragraph 15.231

**Date of Test** : Feb.28, 2008

**Test Engineer** : **Tiger Su**

**Reviewed By** : 

PERPARED BY:

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### 3 Test Summary

Test	Test Requirement	Test Method	Class / Severity	Result
Radiated Emission (30MHz to 5GHz)	FCC PART 15: 2003	ANSI C63.4: 2003	Class B	PASS
Conducted Emission (150KHz to 30MHz)	FCC PART 15: 2003	ANSI C63.4: 2003	Class B	N/A

## 4 General Information

### 4.1 Client Information

Applicant:	<b>Linear Electronics Manufactory</b>
Address:	Hourui Second Industrial Zone Hourui Village, Xixiang, Bao An County
Manufacturer:	<b>Linear Electronics Manufactory</b>
Address:	Hourui Second Industrial Zone Hourui Village, Xixiang, Bao An County

### 4.2 General Description of E.U.T.

Product description:	GTO Transmitter
Model No.:	RB741 & RB742

### 4.3 Details of E.U.T.

Power Supply:	DC 12V Battery
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### 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 GTO Transmitter. 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:

- **FCC – Registration No.: 759397**  
Solid Industrial (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 759397, December 28, 2006.

#### **4.7 Test Location**

All Emissions tests were performed at:-

Solid Industrial (Shenzhen) Co., Ltd. at 333 Bulong Highway Buji Longgang, Shenzhen, Guangdong, China.

## 5 Equipment Used during Test

Equipment	Brand Name	Model	Cal. Int Months	Last Cal. Date
<b>3m Anechoic chamber</b>				
EMC Analyzer	Agilent	E7402A	12	2007-08
EMI Test Receiver	R&S	ESS	12	2007-08
Pre Amplifier	Anritsu	MH648A	12	2007-08
Bilog Antenna	SCHAFFNER	CBL6111C	12	2007-08
Loop Antenna	R&S	6108	12	2007-08
Horn Antenna	ETS.LINDGERN	GH14-H052	12	2007-08
AM/FM Stereo Signal Generator	Panasonic	VP-8122A	12	2007-08
Signal Generator	R&S	SMG	12	2007-08
RF Selector	TOYO	NS4901A	-	-
Turn Disc	HD	DS4150S	-	-
Antenna Mast	HD	MA2400	-	-
<b>EMI Shielded Room</b>				
Spectrum analyzer	ADVANTEST	R3261C	12	2007-08
EMI Test Receiver	R&S	ESS	12	2007-08
Pre Amplifier	Anritsu	MH648A	12	2007-08
LISN	Kyoritsu	KNW-403D	12	2007-08
Absorbing Clamp	R&S	MDS-21	12	2007-08
Distortion Meter	MEGURO	MAK-6578A	12	2007-08
AM/FM Stereo Signal Generator	Panasonic	VP-8122A	12	2007-08
Oscilloscope	LEADER	LS1020	12	2007-08
Function Generator	National	VP-7422A	12	2007-08
Signal Generator	R&S	SMG	12	2007-08
RF Selector	TOYO	NS4000	-	-
Remote Controller	TOYO	MAC	-	-

## 6 Conducted Emission Test

Product Name:	GTO Transmitter
Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	Based on FCC Part15 Paragraph 15.207
Test Date:	.....
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.

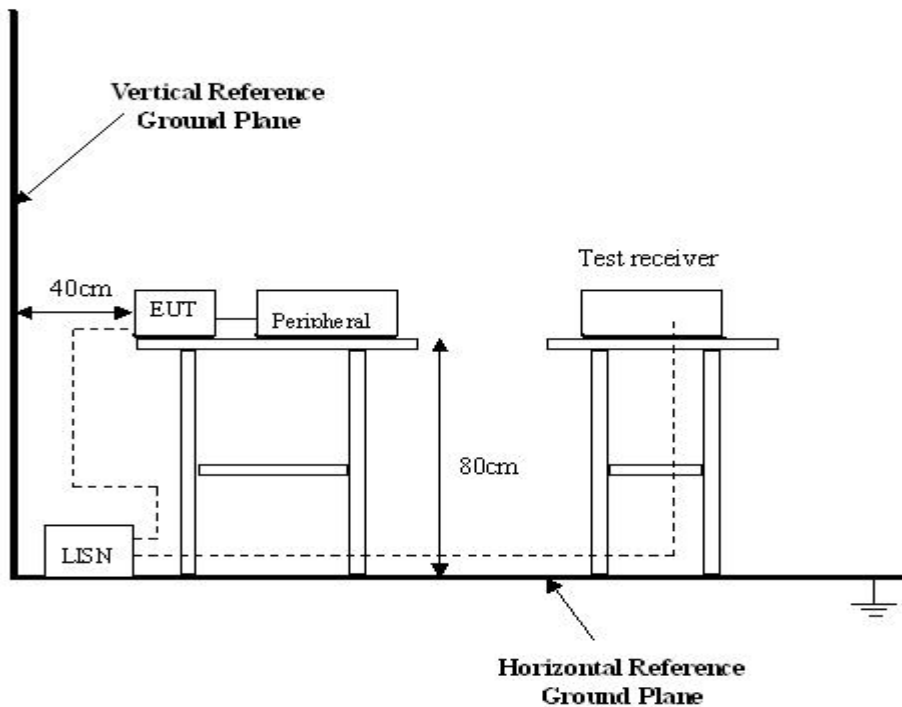
### 6.2 Test Procedure

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

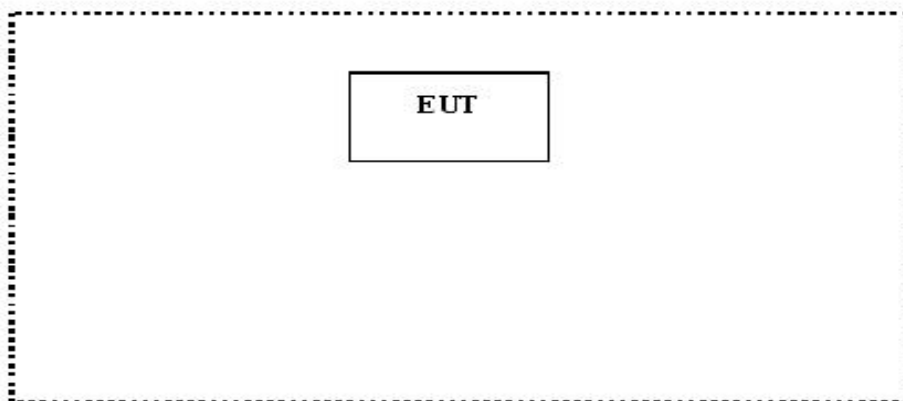
The conducted emission tests were performed using the setup accordance with the ANSI C63.4: 2003, The specification used in this report was the FCC Part15 Paragraph 15.207 limits.



### 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 $\mu$ V/m between 0.15MHz & 0.5MHz

56 dB $\mu$ V/m between 0.5MHz & 5MHz

60 dB $\mu$ V/m between 5MHz & 30MHz

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

## **6.6 Conducted Emission Test Result**

Owing to the DC operation of EUT, this test is not performed.

## 7 Radiation Emission Test

Product Name:	GTO Transmitter
Test Requirement:	FCC Part15 Paragraph 15.231
Test Method:	Based on FCC Part15 Paragraph 15.33
Test Date:	Feb.28, 2008
Frequency Range:	30MHz to 5GHz
Measurement Distance:	3m
Detector:	Peak for pre-scan (120kHz resolution bandwidth) Quasi-Peak if maximised peak within 6dB of limit

### 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.

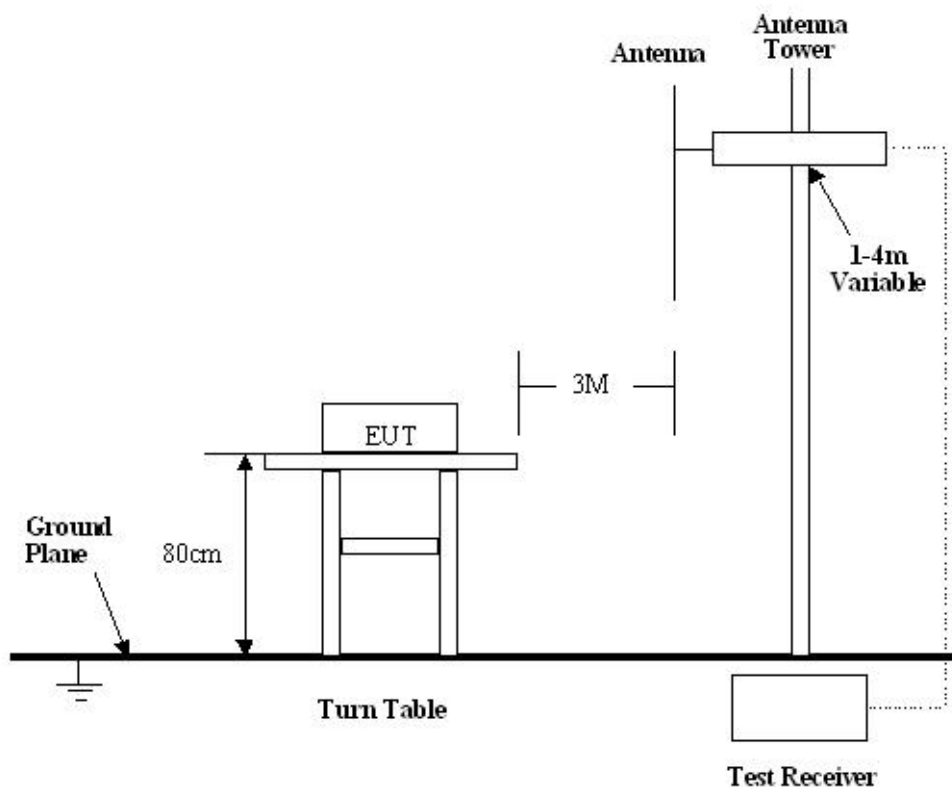
Based on ANSI C63.4: 2003, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Solid EMC Lab is +4.0 dB.

### 7.3 Test Procedure

1. For the radiated emissions test, since the EUT does not have a power source, there was no connection to AC outlets.
2. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
3. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB $\mu$ V of specification limits), and are distinguished with a "Qp" in the data table.
4. The EUT was under normal 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.

Start Frequency .....30 MHz  
Stop Frequency .....5000 MHz  
Sweep Speed Auto  
IF Bandwidth .....100 kHz  
Video Bandwidth .....1 MHz  
Quasi-Peak Adapter Bandwidth .....120 kHz  
Quasi-Peak Adapter Mode.....Normal  
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 -7dB $\mu$ V means the emission is 7dB $\mu$ V 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 12V
Test Mode:	TX On
Temperature:	24 °C
Humidity:	52%RH
Test Result:	PASS

Frequency (MHz)	Antenna Polarization	Emission Level (dBuV/m)	FCC 15 Subpart C Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
318.0	Vertical	65.4	75.8	10.4	1.5	90
318.0	Horizontal	64.2	75.8	11.6	1.5	90
636.0	Vertical	39.9	46.0	6.1	1.2	90
954.0	Vertical	36.7	46.0	9.3	2.0	180
1272.0	Vertical	35.5	54.0	18.5	1.8	60
1590.0	Vertical	34.9	54.0	19.1	2.0	45
1908.0	Vertical	34.3	54.0	19.7	1.5	45
2226.0	Vertical	34.1	54.0	19.9	1.6	60
2544.0	Vertical	33.6	54.0	20.4	2.0	180
2862.0	Vertical	33.2	54.0	20.8	2.0	90
3180.0	Vertical	32.9	54.0	21.1	1.0	180
636.0	Horizontal	36.6	46.0	9.4	1.5	120
954.0	Horizontal	36.1	46.0	9.9	1.2	180
1272.0	Horizontal	34.9	54.0	19.1	1.0	100
1590.0	Horizontal	34.2	54.0	19.8	1.0	90
1908.0	Horizontal	34.0	54.0	20.0	1.5	45
2226.0	Horizontal	39.8	54.0	14.2	2.0	100
2544.0	Horizontal	32.7	54.0	21.3	1.2	90
2862.0	Horizontal	32.3	54.0	21.7	1.5	180
3180.0	Horizontal	32.6	54.0	21.4	1.0	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 @ 318MHz

$$41.6667(315) - 7083.3333 = 6166.6773 \mu\text{V/m}$$

$$20\log(6166.6773) = 75.80 \text{ dBuV/m limit @ 318MHz}$$



## 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(%)=**

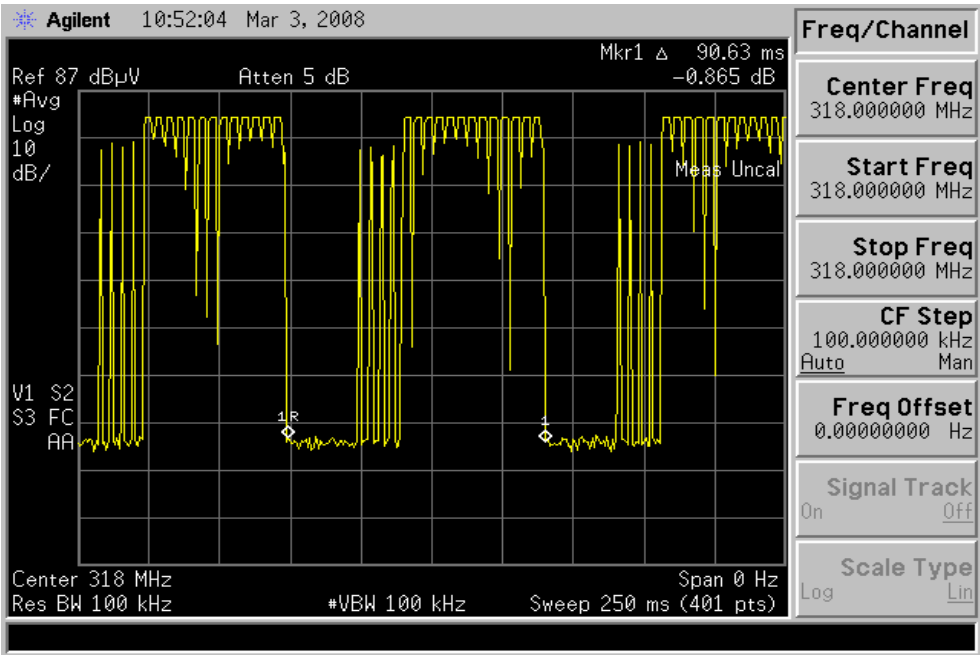
**Total On interval in a complete pulse train/ Length of a complete pulse train \* %**

**Duty Cycle Correction Factor(dB)=20 \* Logo10(Duty Cycle(%))**

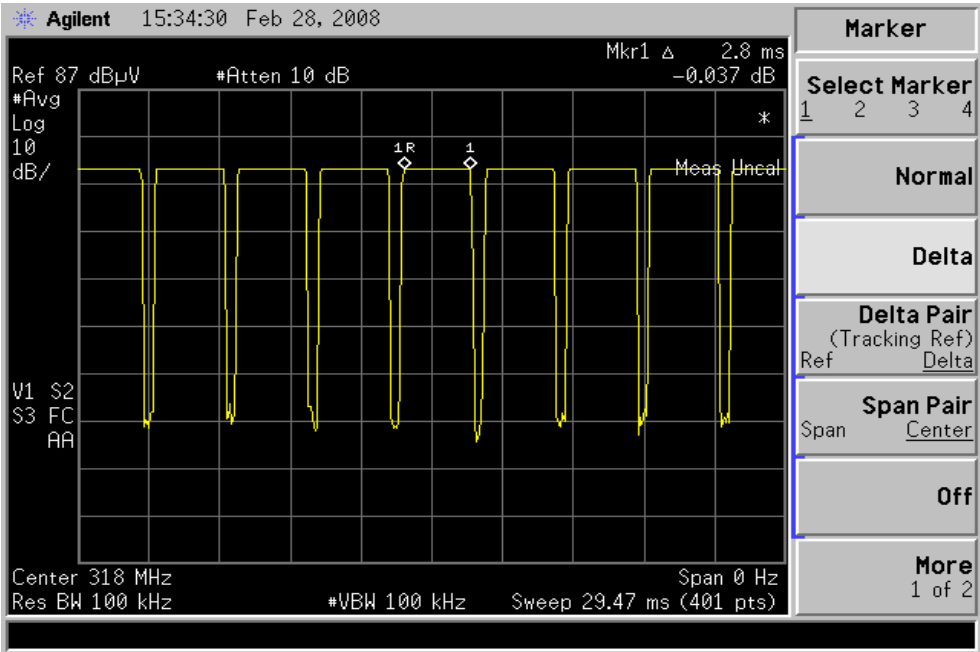
Pulse Train	Number of Pulse	T(ms)	Total Time(ms)
Long Pulse	13	2.8	36.4 msec
Short Pulse	4	0.28	1.12 msec

Total On interval in a complete pulse train	37.52 msec
Length of a complete pulse train	90.63 msec
Duty Cycle(%)	41.39%
Duty Cycle Correction Factor(dB)	7.66

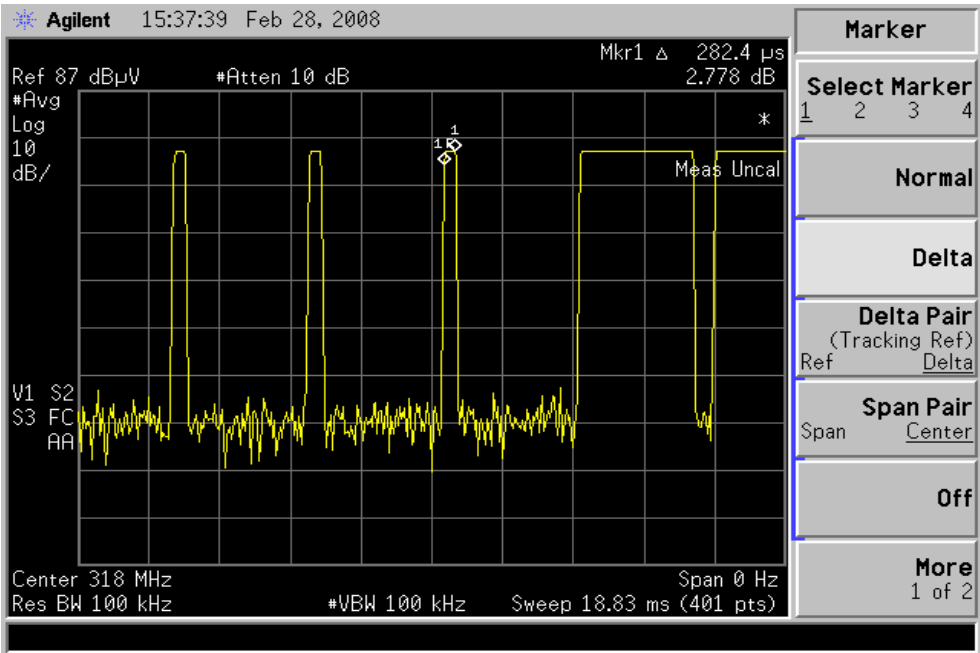
Refer to the duty cycle plot (as below), This device does meet the FCC requirement.  
Length of a complete pulse train:



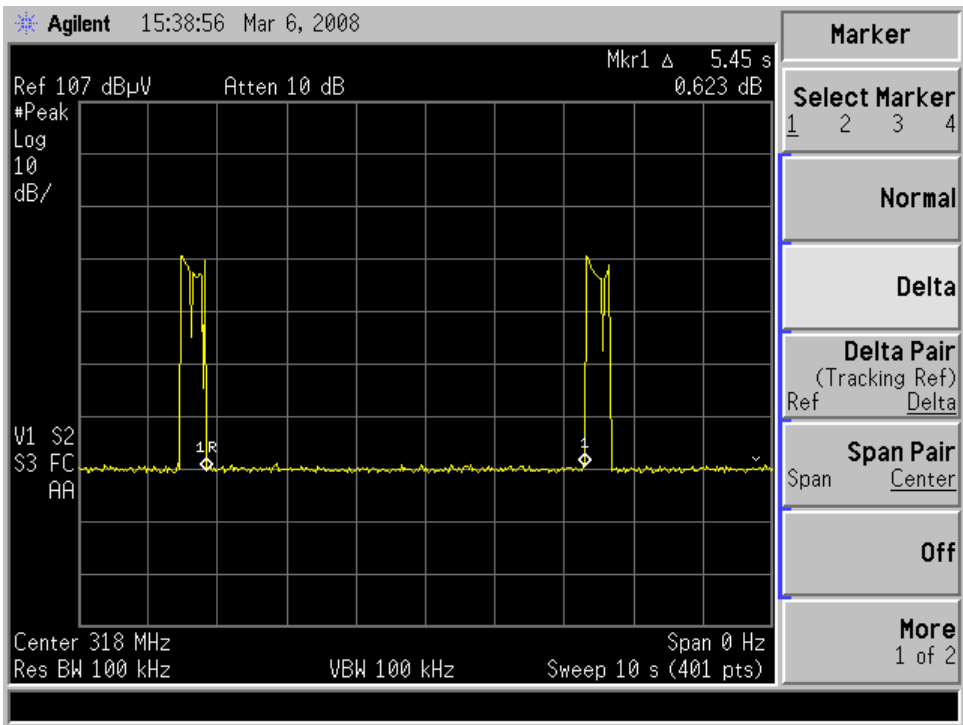
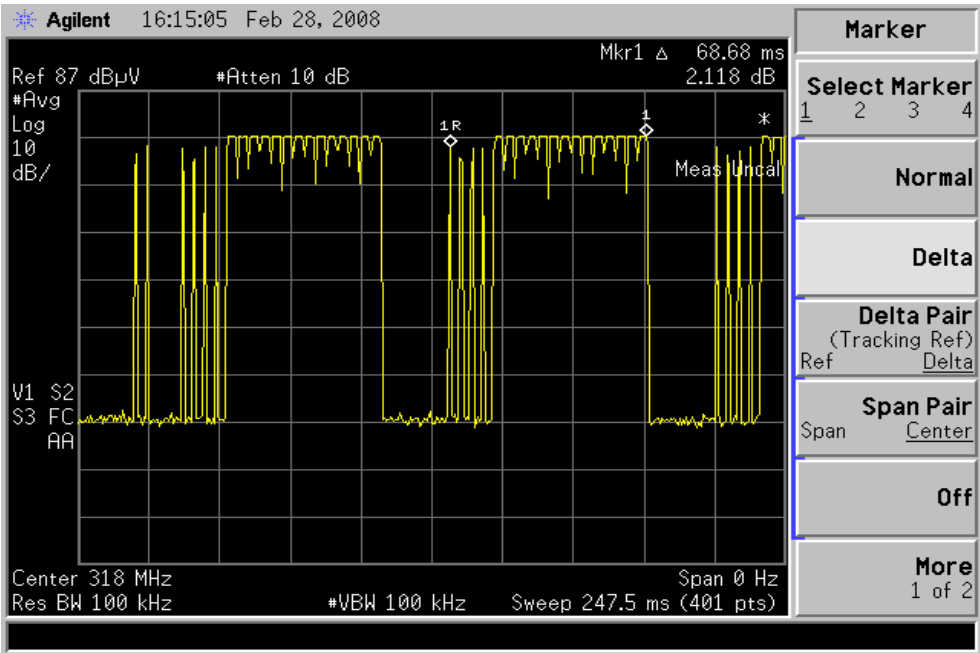
Long Pulse:



Short Pulse:



Refer to the duty cycle plot (as below),We find each the duration transmission for the device is about 68.68ms.and silent period between transmissions is about 5.45 seconds,This device does meet the FCC requirement



## 9 Band Edge

Test Requirement:	FCC Part15 C
Test Method:	Based on FCC Part15 Paragraph 15.231
Test Date:	Feb.28, 2008
Test mode:	TX On
Temperature:	24 °C
Humidity:	52%RH

### 9.1 Test Procedure

1. The EUT, peripherals were put on the turntable which table size is 1mX1.5m, table high 0.8m. All set up is according to ANSI C63.4: 2003.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 10KHz RBW and 10KHz VBW.The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

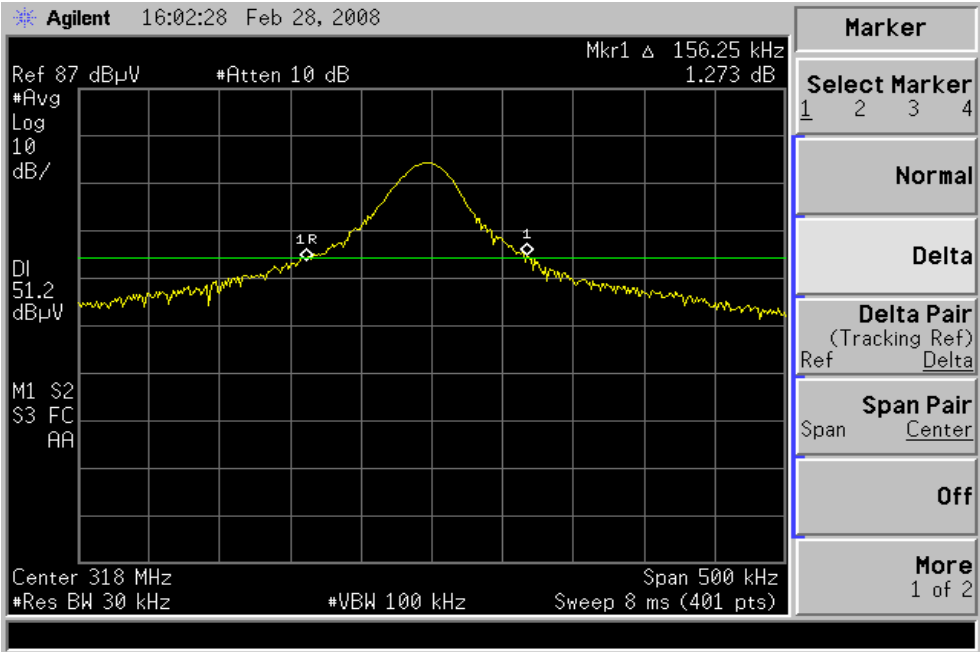
### 9.2 Band Edge

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
318.00	156	795	Pass

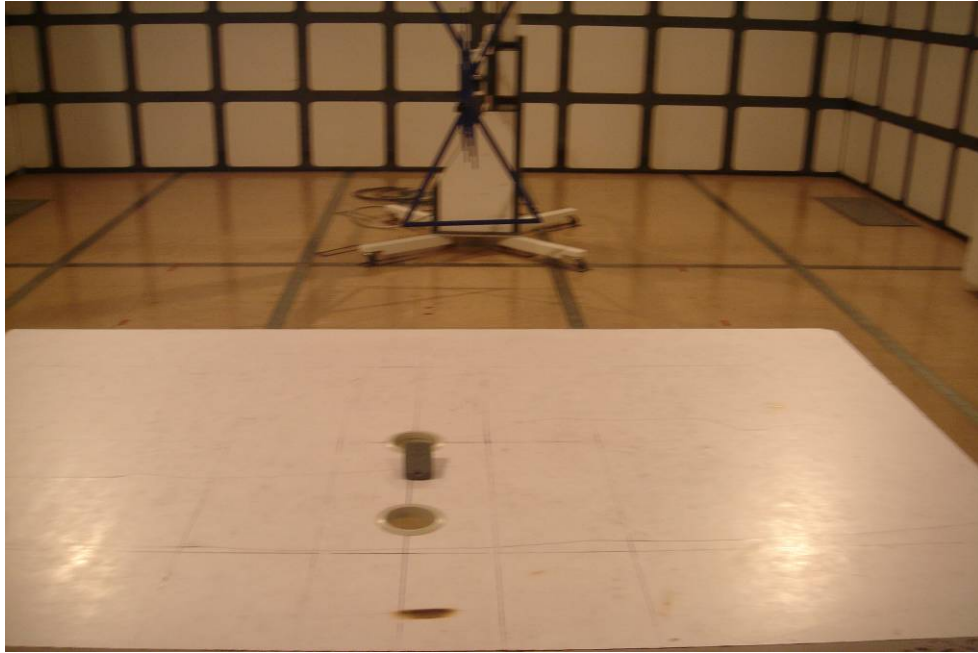
9.3 Band Edge Test Result

318MHz TX

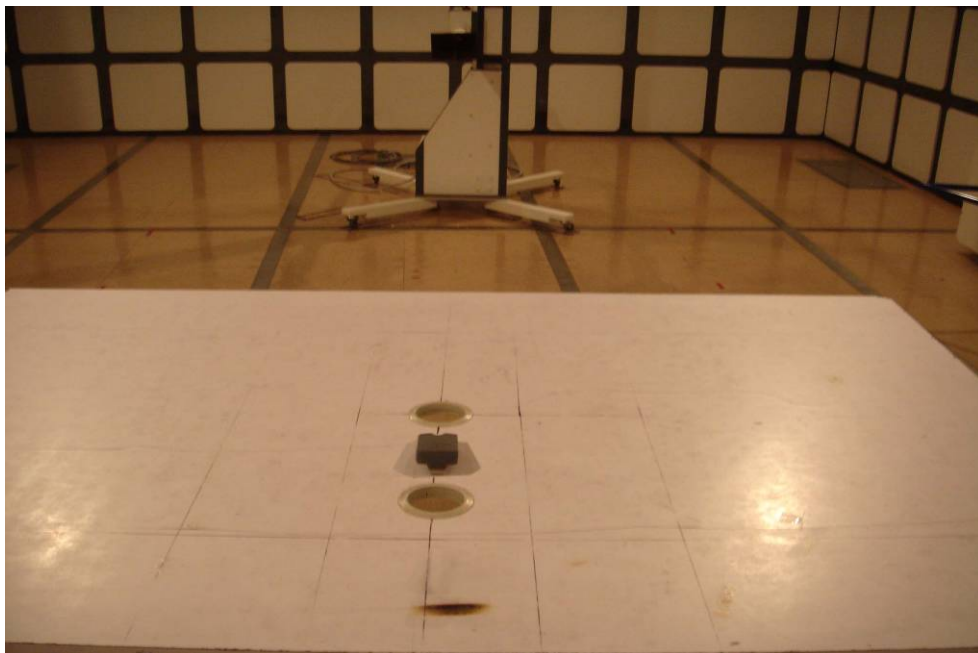


## **10 Photographs of Testing**

### **10.1 Radiation Emission Test View For 30MHz-1000MHz**



### **10.2 Radiation Emission Test View For 1GHz-5GHz**



## 11 Photographs - Constructional Details

### 11.1 EUT (RB741, 1 botton) - Front View



### 11.2 EUT (RB741, 1 botton) - Back View





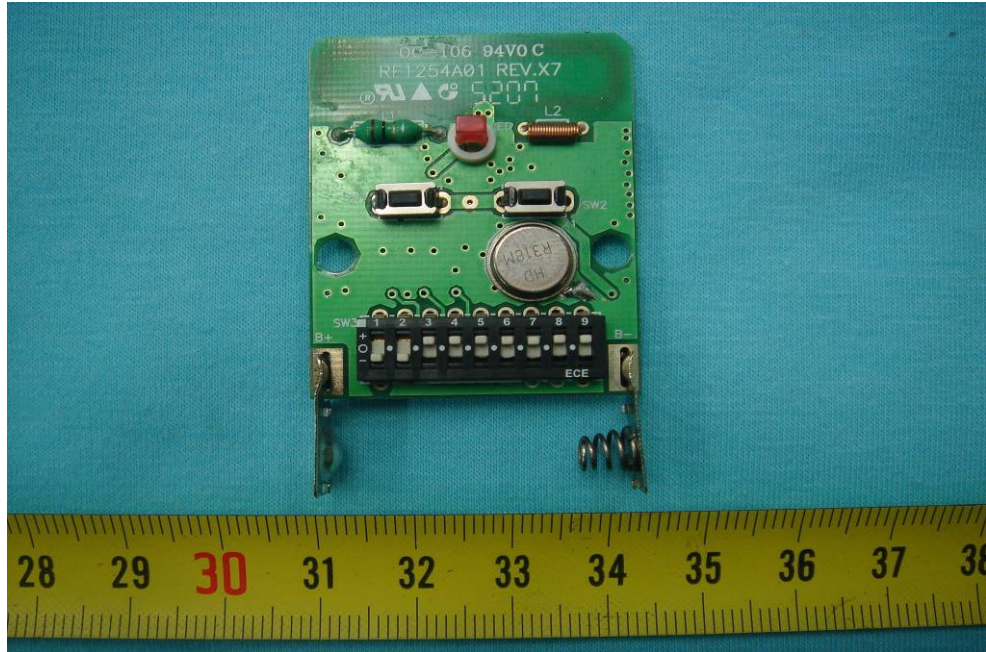
### 11.3 EUT (RB742, 2 button) - Front View



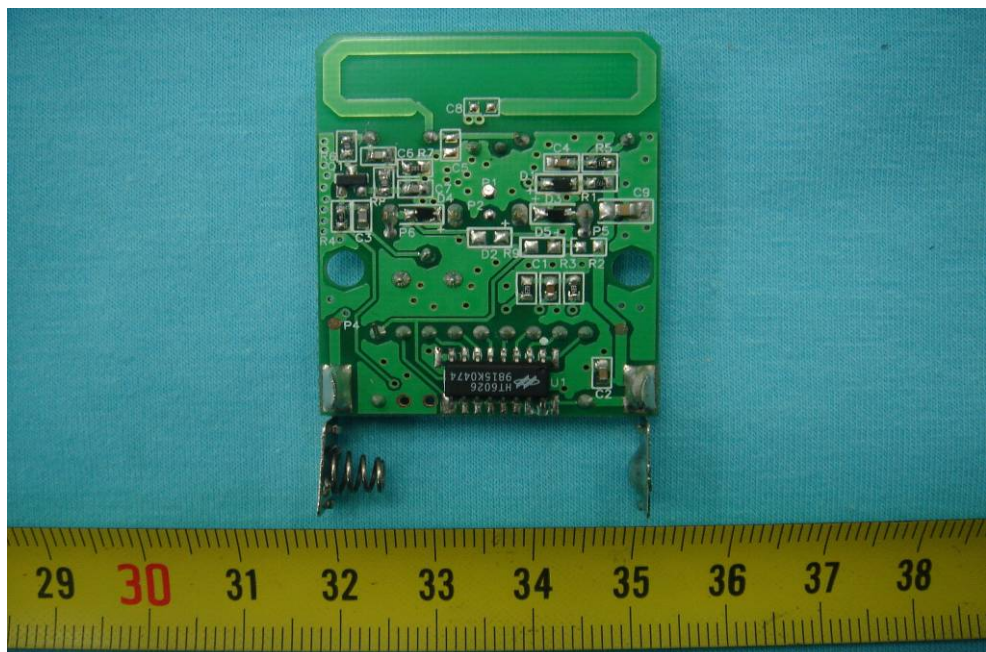
### 11.4 EUT (RB742, 2 button) - Back View



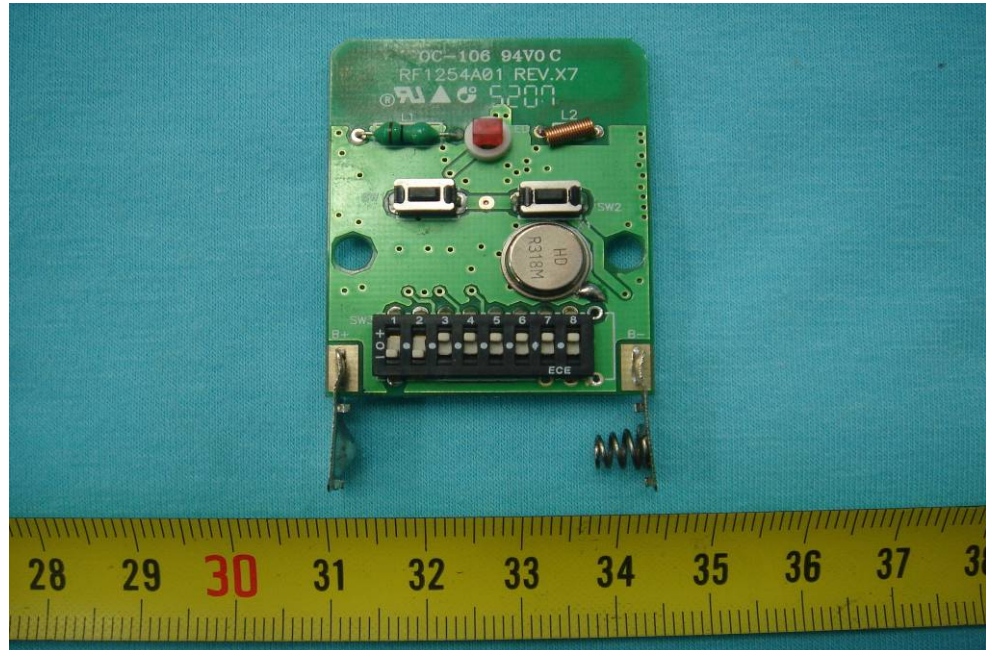
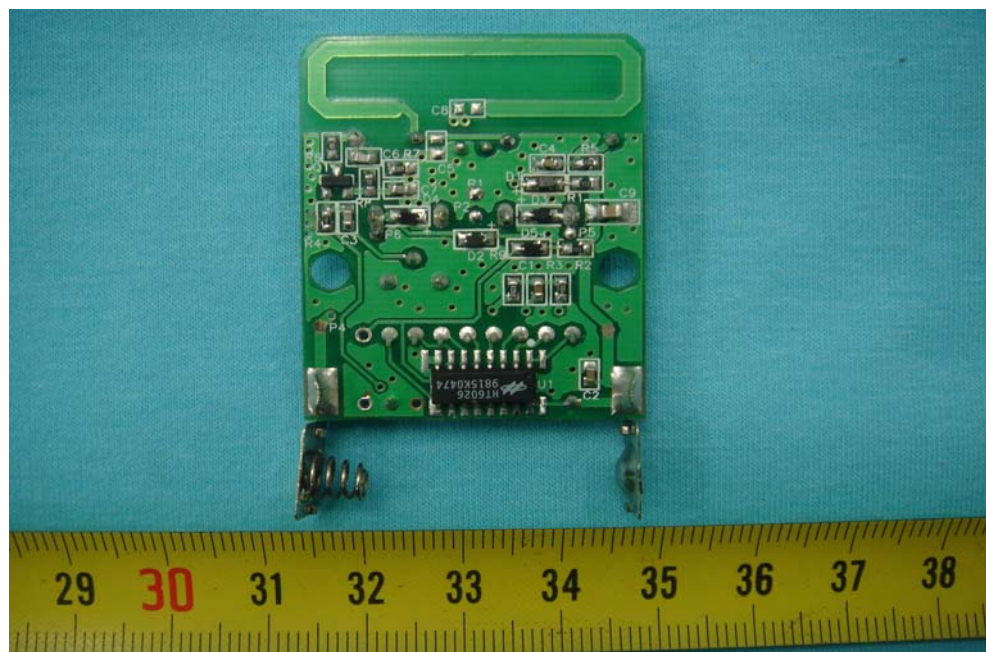
### 11.5 PCB (RB741, 1 button)-Front View



### 11.6 PCB (RB741, 1 button)-Back View





**11.7 PCB (RB742, 2 button)-Front View****11.8 PCB (RB742, 2 button)-Back View**

## 12 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 Mark Location

