

APPLICATION FOR CERTIFICATION

On Behalf of

SynerTech International Limited

Model Number: ST-2545

FCC ID: TYN-ST-2545

Prepared for : SynerTech International Limited

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EST Technology Co., Ltd.

Applicant:	SynerTech International Limited		
Address:	Rm1509, 15/F., Westley Square, 48 Hoi Yuen Road, Kwun Tong, Kowloon, Hong Kong		
Manufacturer:	SynerTech International Limited		
Address:	Rm1509, 15/F., Westley Square, 48 Hoi Yuen Road, Kwun Tong, Kowloon, Hong Kong		
E.U.T:	Double outlets remote control for indoor and outdoor lighting		
Model Number:	ST-2545		
Trade Name:	-----	Operating Frequency:	315MHz
Date of Receipt:	Apr.26, 2011	Date of Test:	May.4 ~Jun.27, 2011
Test Specification:	FCC Part 15 Subpart C: July. 10, 2008 ANSI C63.4:2009		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
	Issue Date: Jun. 27,2011		
Tested by:	Reviewed by:	Approved by:	
			
Ada / Assistant	Tony / Engineer	Iceman Hu / Manager	
Other Aspects:	None.		
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.			

1. GENERAL PRODUCT INFORMATION

1.1. Product Function

The EUT is used to transmit control command only. The operation frequency is 315MHz. Press the button on remote transmitter. Please refer to the user's manual for the details.

1.2. Description of Device (EUT)

E.U.T.	: Double outlets remote control for indoor and outdoor lighting
Model No.	: ST-2545
Operating Frequency	: 315MHz
Number of Channels	: 1 Channels
Type of Modulation	: FSK
Antenna and Gain	Integrated PCB loop antenna, 0 dBi Gain.
System Input Voltage	: Nominal Voltage: DC 12V(Battery)
Temperature Range(Operating)	: -0 ~+ 35℃

1.3. Difference between Model Numbers

None

1.4. Independent Operation Modes

The basic operation modes are: TX mode

2. TEST SITES

2.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below.

No.	Item	Specification	Results
1	Conducted emissions	FCC Part15.207	N/A
2	Radiated emissions	FCC Part 15.231(b)	PASS
3	20dB Occupied Bandwidth	FCC Part 15.231(c)	PASS
4	Deactivate time	FCC Part 15.231(a)	PASS

2.2. List of Test and Measurement Instruments

2.2.1. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESVS10	100004	Mar,19,11	1 Year
Spectrum Analyzer	Agilent	E4411B	MY50140697	Mar,19,11	1 Year
Bilog Antenna	Teseq	CBL 6111D	25872	June.08,10	1.5 Year
Signal Amplifier	Agilent	310N	187037	Sep,20,10	1 Year
Horn Antenna	EMCO	3115	00064654	May 02,11	1 Year
Amplifier	BURGEON	PEC-38-30M 18G-12-SEF	B001	May 02,11	1 Year

2.2.2. For 20dB Occupied Bandwidth test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4411B	MY50140697	Mar,19,11	1 Year
Bilog Antenna	Teseq	CBL 6111D	25872	June.08,10	1.5 Year

2.2.3. For Deactivate time test

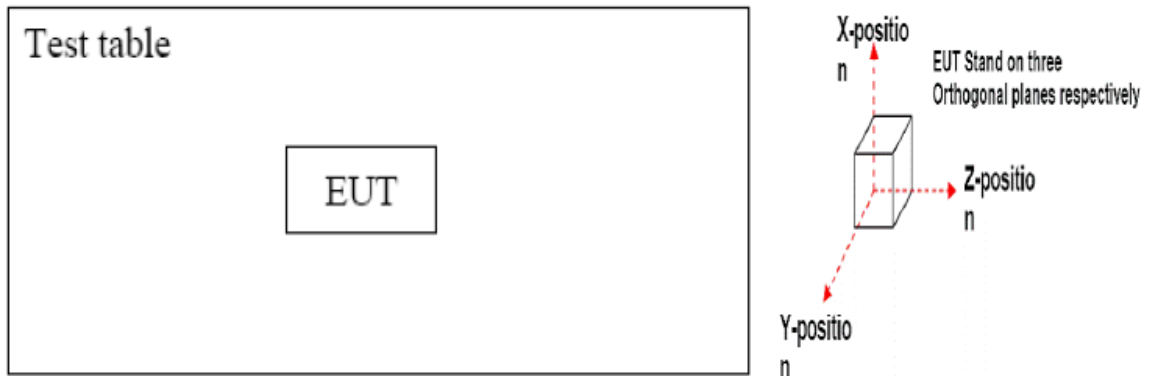
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4411B	MY50140697	Mar,19,11	1 Year
Bilog Antenna	Teseq	CBL 6111D	25872	June.08,10	1.5 Year

3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its highest possible radiated level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up



(EUT: Wireless Remote Control)

Note: We test X-axis, Y-axis, and Z-axis,. The Y-axis is the worst mode, so only the worst mode test data was included in the report.

3.3. Test Operation Mode and Test Software

Refer to clause 1.4

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

4. EMISSION TEST RESULTS

4.1. Conducted Emissions

According to paragraph(f) of FCC Part 15 Section 15.207, measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation, and which do not operate from the AC power lines or contain provision for operation while connected to the AC power.

4.2. Radiated emissions

4.2.1. Applied Standard

According to 15.231(b), the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequencies (MHz)	Field strength of Fundamental (uV/meter at 3m)	Unwanted emissions (uV/meter at 3m)
40.66-40.70	2250	225
70-130	1250(470nW)	125
130-174	1250 to 3750**	125 to 375**
174-260	3750(4.2uW)	375
260-470	3750 to 12500**	375 to 1250**
Above470	12500(47uW)	1250

**Linear interpolation with frequency F in MHz

For the band 130-174MHz: Field strength= $56.81818(F)-6136.3636$

For the band 260-470MHz: Field strength= $41.6667(F)-7083.3333$

The maximum permitted unwanted emissions level is 20dB below the maximum permitted fundamental level

The field strength of spurious emissions which appear outside of this band shall not exceed the general radiated emission limits in Section 15.209 as following:

Frequencies (MHz)	Field strength uV/meter	Measurement distance (meters)
0.009-0.490	$2400/F(\text{kHz})$	300
0.490-1.705	$24000/F(\text{kHz})$	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

According to 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.2.2. Test procedure

The EUT was placed on a turn table which was 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on a antenna tower. At the frequency band of 30MHz to 1GHz, The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 to 4 m for horizontal and vertical polarizations. The broadband antenna (calibrated by dipole antenna) was used as a receiving antenna. At the frequency band of 1GHz to 5GHz, The measuring antenna moved from 1 to 4 m for horizontal and vertical polarization. The horn antenna was used as a receiving antenna.

The resolution bandwidth and video bandwidth of the test receiver was 120 KHz and 300KHz for Quasi-peak detection at frequency below 1GHz.

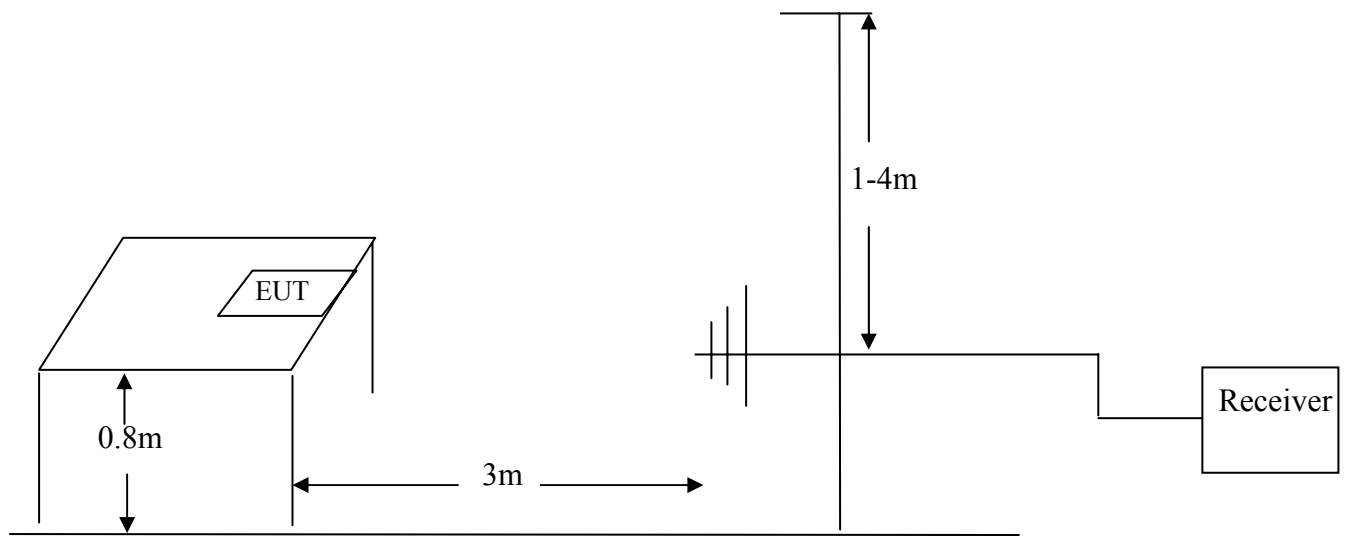
The resolution bandwidth and video bandwidth of the test receiver was 1MHz and 1MHz for Peak detection at frequency above 1GHz.

The EUT position(X.-axis, Y-axis, Z-axis) were checked and worse case was happened in Y-axis position. So Y-axis position was chose for find measurement.

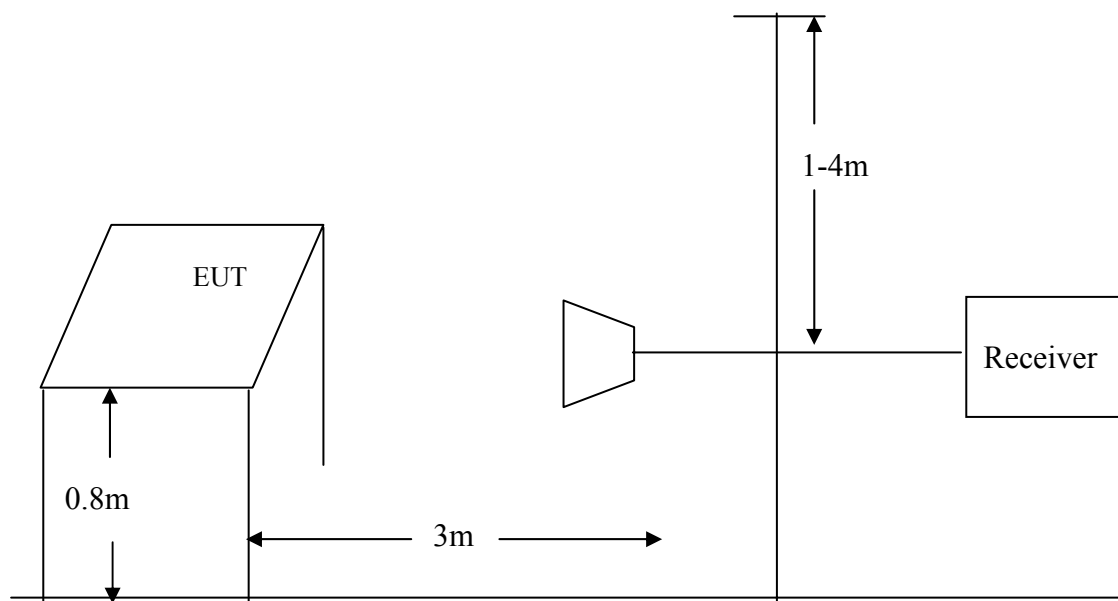
The EUT was tested in Chamber Site.

4.2.3. Test Setup Diagram

For frequency range: 30MHz-1000MHz



For frequency range: 1 GHz -5GHz



4.2.4. Test result

Pass.

Test Data (worst mode: Y-axis)

EUT	: Double outlets remote control for indoor and outdoor lighting	Temperature:	25.4°C
Model No.	: ST-2545	Humidity	: 55%
Test Mode	: TX mode	Test Engineer	: Tony

For Frequency range: 30MHz-1000MHz

Frequency MHz	Antenna Factor dB	Cable Loss dB	Meter Reading dBμV	Emission Level dBμV/m	Over Limits dB	Limits @3m dBμV/m	Polarity	Detector
30.47	18.29	1.61	2.15	22.05	-17.94	40.0	H	QP
215.98	8.79	4.18	10.69	23.68	-22.32	46.0	H	QP
368.41	14.81	5.60	10.31	30.72	-15.28	46.0	H	QP
315.00	13.39	5.10	58.14	77.14	-18.46	95.6	H	Peak
630.00	20.14	7.34	16.33	43.81	-31.79	75.6	H	Peak
945.00	24.64	9.51	12.57	46.72	-28.88	75.6	H	Peak
115.10	10.86	3.15	2.04	16.05	-27.45	43.5	V	QP
198.14	7.73	3.80	2.76	14.29	-29.21	43.5	V	QP
366.10	14.75	5.57	2.32	22.64	-23.36	46.0	V	QP
315.00	13.39	5.10	47.56	66.05	-29.55	95.6	V	Peak
630.00	20.14	7.34	17.81	45.29	-30.31	75.6	V	Peak
945.00	24.64	9.51	15.80	49.95	-25.65	75.6	V	Peak

Fundamental and Harmonics Average Result						
Frequency MHz	Peak Level (dBμV/m)	PDCF (dBμV/m) (see Section 5)	Average Level (dBμV/m)	Limit (dBμV/m) (average)	Over Limits dB	Polarity
315.00	77.14	-5.38	71.76	75.6	-3.84	H
630.00	43.81	-5.38	38.53	55.6	-17.07	H
945.00	46.72	-5.38	41.34	55.6	-14.26	H
315.00	66.05	-5.38	60.67	75.6	-14.93	V
630.00	45.29	-5.38	39.91	55.6	-15.69	V
945.00	49.95	-5.38	44.57	55.6	-11.03	V

Remark: The worst emission was detected at **315.00MHz** with corrected signal level of **71.76dBμV/m**(Limit is **75.6 dBμV/m**) when the antenna was at **Horizontal** polarization and at **1.15m** high and the turn table was at **250°**

Remark: The worst emission was detected at **315.00MHz** with corrected signal level of **60.67dBμV/m** (Limit is **75.6dBμV/m**) when the antenna was at **Vertical** polarization and at **2.0m** high and the turn table was at **255°**.

Remark:

1. Emission Level = Antenna Factor + Cable Loss + Meter Reading
2. Peak Limit=Average Limit+20dB
3. Test uncertainty: ±3.62dB at a level of confidence of 95%.

Test Data (worst mode: Y-axis)

EUT	: Double outlets remote control for indoor and outdoor lighting	Temperature:	25.4℃
Model No.	: ST-2545	Humidity	: 55%
Test Mode	: TX mode	Test Engineer	: Tony

For Frequency range: 1000MHz-5000MHz

Frequency MHz	Antenna Factor dB	Cable Loss dB	Meter Reading dBμV	Emission Level dBμV/m	Over Limits dB	Limits @3m dBμV/m	Polarity	Detector
1260.00	27.47	2.13	19.32	48. 92	-26.68	75.6	H	Peak
1575.00	28.20	2.16	15.37	45. 73	-28.27	74.0	H	Peak
2607.76	32.31	2.25	15.84	50. 40	-23.60	74.0	H	Peak
2607.76	32.31	2.25	9.31	43.87	-10.13	54.0	H	Average
3762.04	33.05	2.31	14.67	50. 03	-23.97	74.0	H	Peak
3762.04	33.05	2.31	7.54	42.90	-11.10	54.0	H	Average
1260.00	27.47	2.13	18.84	48. 44	-27.16	75.6	V	Peak
1575.00	28.20	2.16	15.42	45. 78	-28.22	74.0	V	Peak
3421.60	32.31	2.25	14.37	48. 93	-25.07	74.0	V	Peak
3421.60	32.31	2.25	7.91	42. 47	-11.53	54.0	V	Average
3762.04	33.05	2.31	15.33	50. 69	-23.31	74.0	V	Peak
3762.04	33.05	2.31	7.01	42. 37	-11.63	54.0	V	Average

Fundamental and Harmonics Average Result						
Frequency MHz	Peak Level (dBμV/m)	PDCF (dBμV/m) (see Section 5)	Average Level (dBμV/m)	Limit (dBμV/m) (average)	Over Limits dB	Polarity
1260.00	48. 92	-5.38	43.54	55.6	-12.06	H
1575.00	45. 73	-5.38	40.35	54.0	-13.65	H
1260.00	48. 44	-5.38	43.06	55.6	-12.54	V
1575.00	45. 78	-5.38	40.40	54.0	-13.6	V

Remark: The worst emission was detected at **2607.76MHz** with corrected signal level of **43.87μV/m**(Limit is **54.00 dBμV/m**) when the antenna was at **Horizontal** polarization and at **3.2m** high and the turn table was at **165°**

Remark: The worst emission was detected at **3421.60MHz** with corrected signal level of **42.47dBμV/m** (Limit is **54.00 dBμV/m**) when the antenna was at **Vertical** polarization and at **1.2m** high and the turn table was at **41°**.

Remark:

1. Emission Level = Antenna Factor + Cable Loss + Meter Reading
2. Peak Limit=Average Limit+20dB
3. Test uncertainty: ±4.76dB at a level of confidence of 95%.

4.3. 20dB Occupied Bandwidth

4.3.1. Applied Standard

According to 15.231(c), 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.

4.3.2. Test procedure

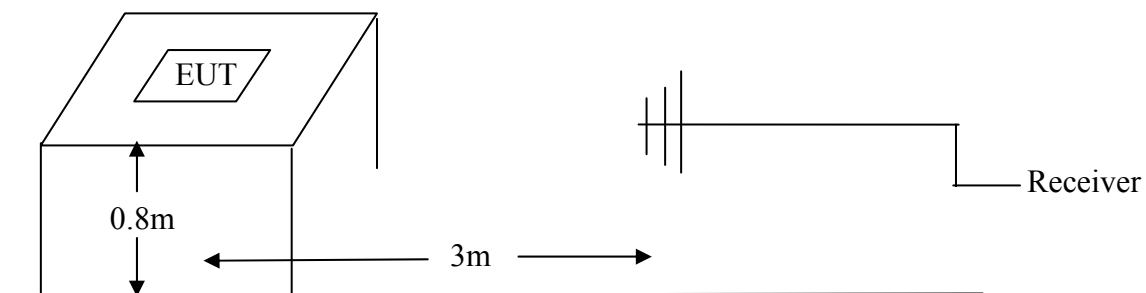
Step 1: The EUT was placed on a table which is 0.8m above ground plane.

Step 2: EUT was set to transmit continuously.

Step 3: Set SA Center Frequency = fundamental frequency , RBW=100kHz,VBW=300kHz

Step 4: Set SA trace max hold, then view.

4.3.3. Test Setup Diagram



4.3.4. Test Result

Pass.

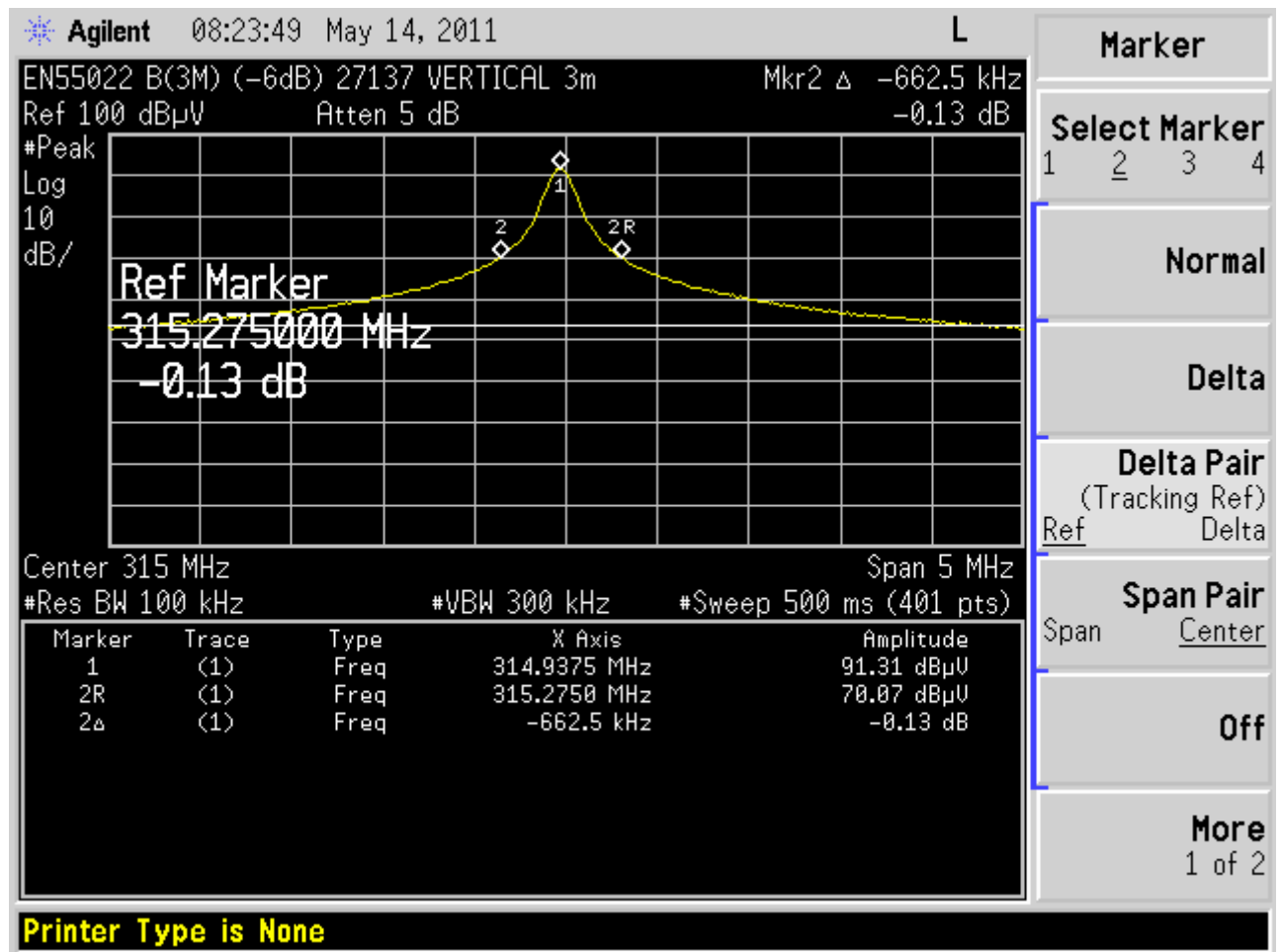
Test Data

EUT	: Double outlets remote control for indoor and outdoor lighting	Temperature:	25.4°C
Model No.	: ST-2545	Humidity	: 55%
Test Mode	: TX mode	Test Engineer	: Tony

Fundamental frequency (MHz)	Bandwidth Measurement (kHz)	Limit (kHz)	Result
315MHz	662.5kHz	787.5 kHz	PASS

Note: Limit= Fundamental frequency \times 0.25%=315 \times 0.25%=787.5kHz

The test plots as following:



4.4. Deactivation time

4.4.1. Applied Standard

According to 15.231(a), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released. A transmitter activated automatically shall cease transmission within 5 seconds after activation.

4.4.2. Test procedure

Step 1: The EUT was placed on a table which is 0.8m above ground plane.

Step 2: Set EUT as normal operation.

Step 3: Set SA Center Frequency = fundamental frequency , RBW=100kHz,VBW=300kHz

Step 4: Set SA trace max hold, then view.

4.4.3. Test Setup Diagram

Refer to clause 5.3.3

4.4.4. Test Result

Pass.

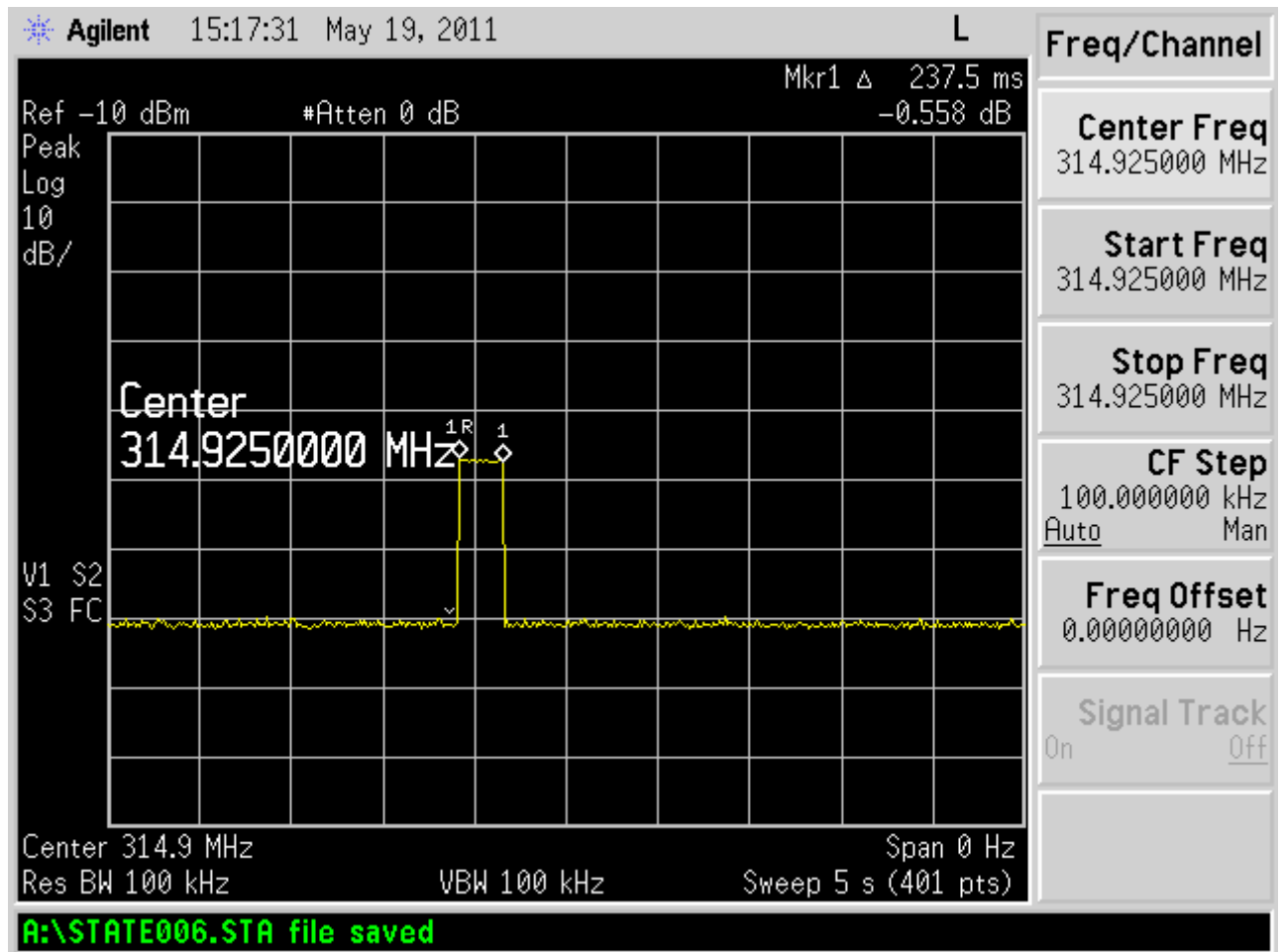
Test Data

EUT	:	Wireless Remote Control	Temperature:	25.4°C
Model No.	:	TH8	Humidity	: 55%
Test Mode	:	TX mode	Test Engineer	: Tony

Set the spectrum to zero span, activated the EUT by manually, And then, we could see the transmitting wave in the spectrum, when the time marker went to “1”, released the EUT, After 237.5ms, we could see the EUT stop transmitting.

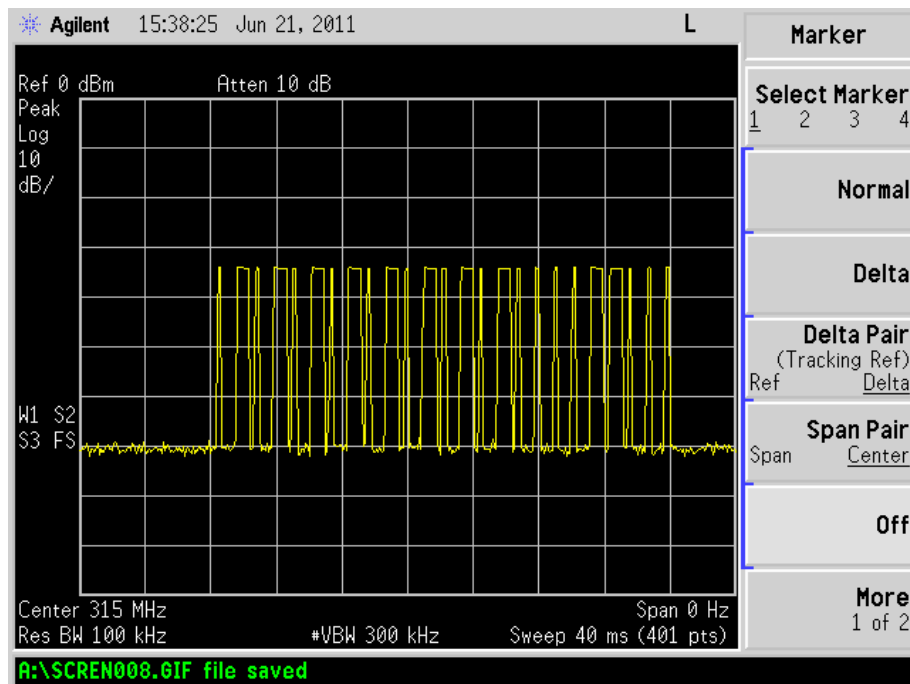
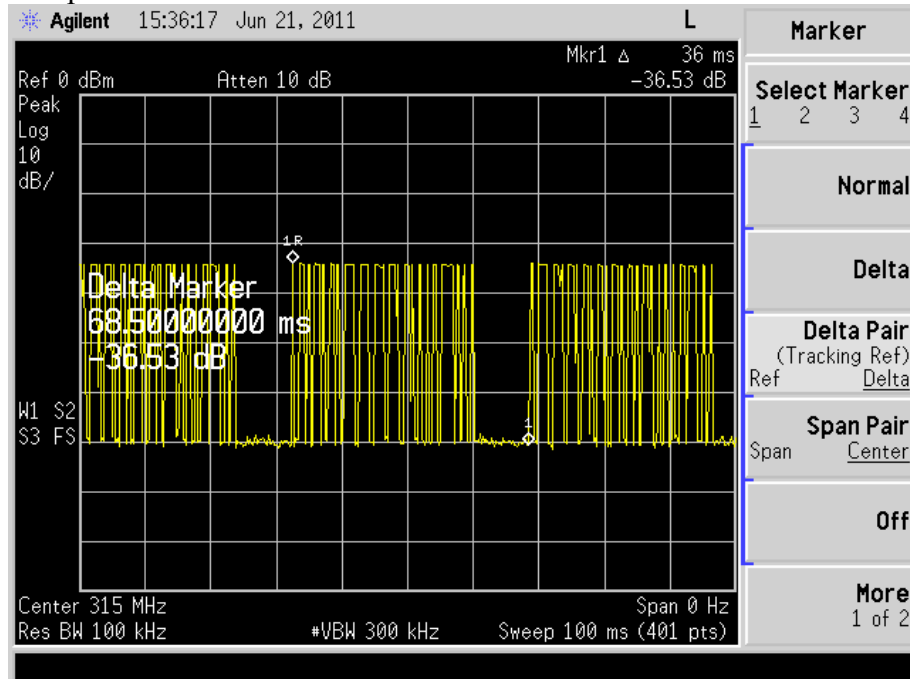
Fundamental frequency (MHz)	Transmission time (ms)	Limit (s)	Result
315MHz	237.5ms	5s	PASS

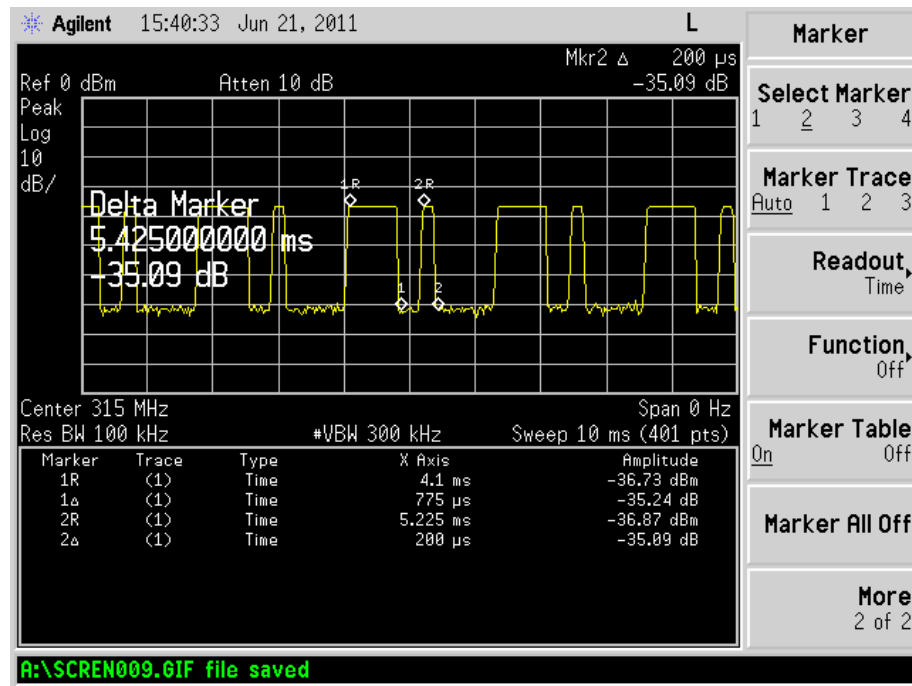
The test plots as following:



5. DUTY CYCLE CORRECTION FACTOR

T period = 36.00ms





$T_{\text{ontime}}(\text{assumed worse case}) = 25 \times 0.775 \text{ ms} = 19.375 \text{ ms}$

$\text{Duty cycle} = T_{\text{ontime}} / T_{\text{period}} = 19.375 \text{ ms} / 36.00 \text{ ms} = 0.538$

$\text{PDCF} = 20 \times \log(\text{Duty cycle}) = 20 \times \log(0.538) = -5.38$

6. PHOTOGRAPHS OF TEST SET-UP

Figure 1

Set-up for radiated measurements (30MHz to 1000MHz)

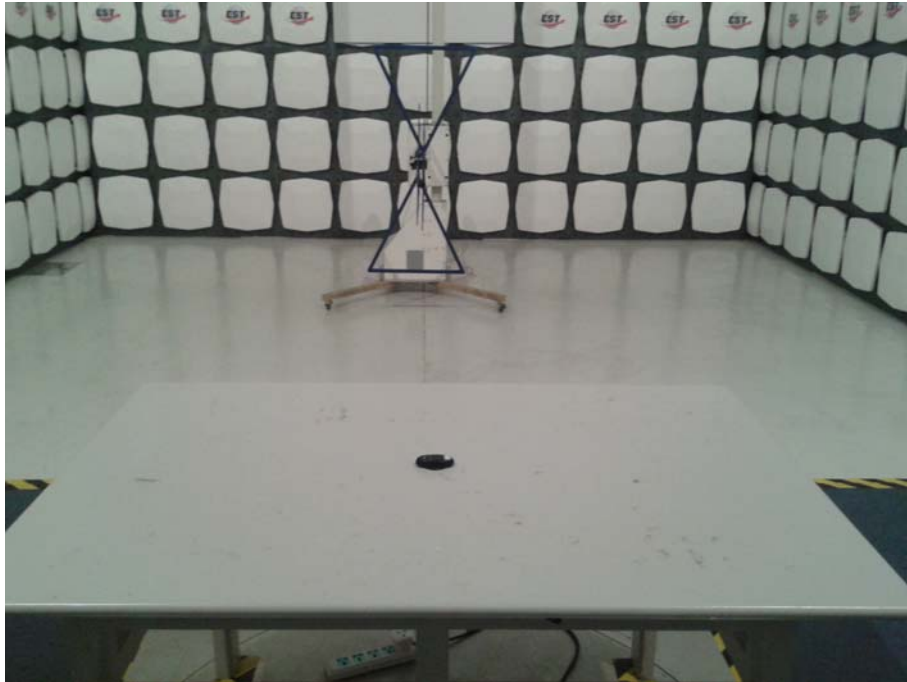
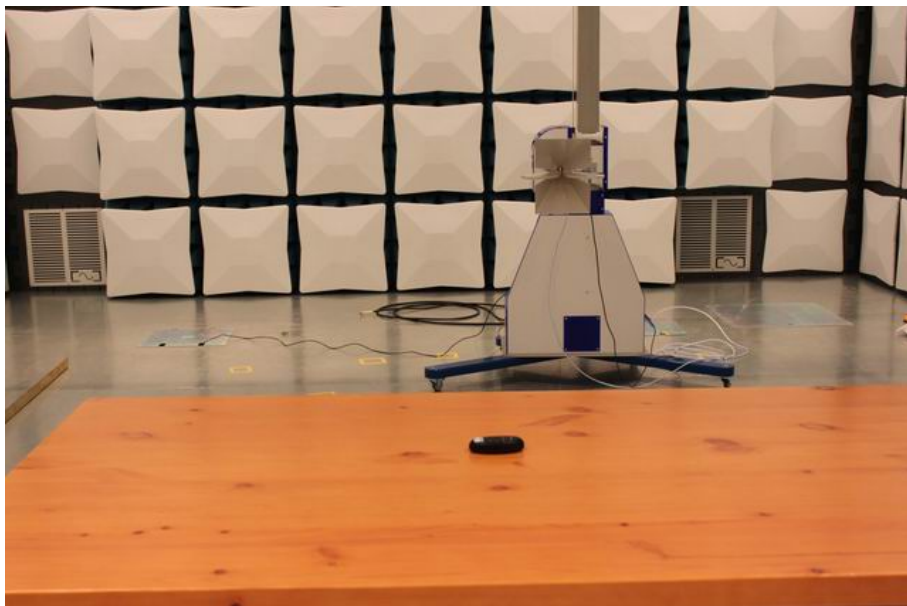


Figure 2

Set-up for radiated measurements (1000MHz to 5000MHz)



7. PHOTOGRAPHS OF THE EUT

Figure 1
General Appearance of the EUT



Figure 2
General Appearance of the EUT



Figure 3
General Appearance of the EUT



Figure 4
General Appearance of the PCB

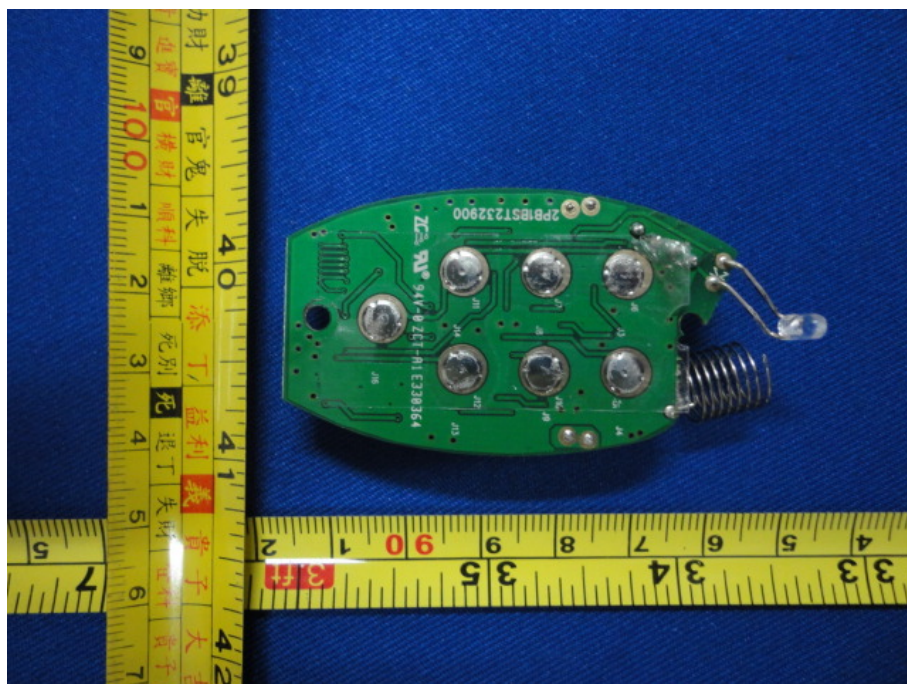


Figure 5
General Appearance of the PCB

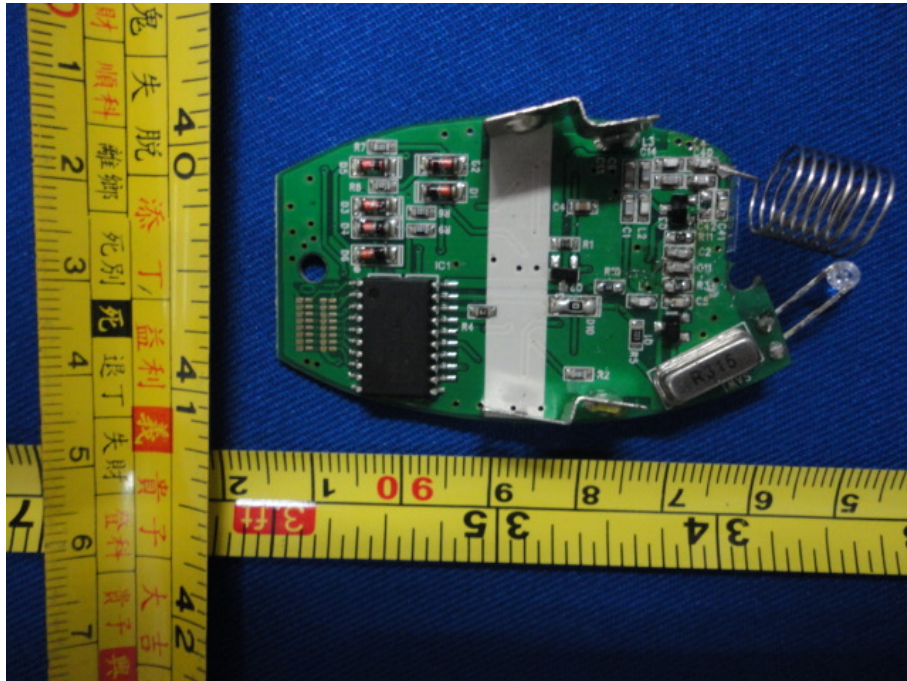


Figure 6
General Appearance of the PCB

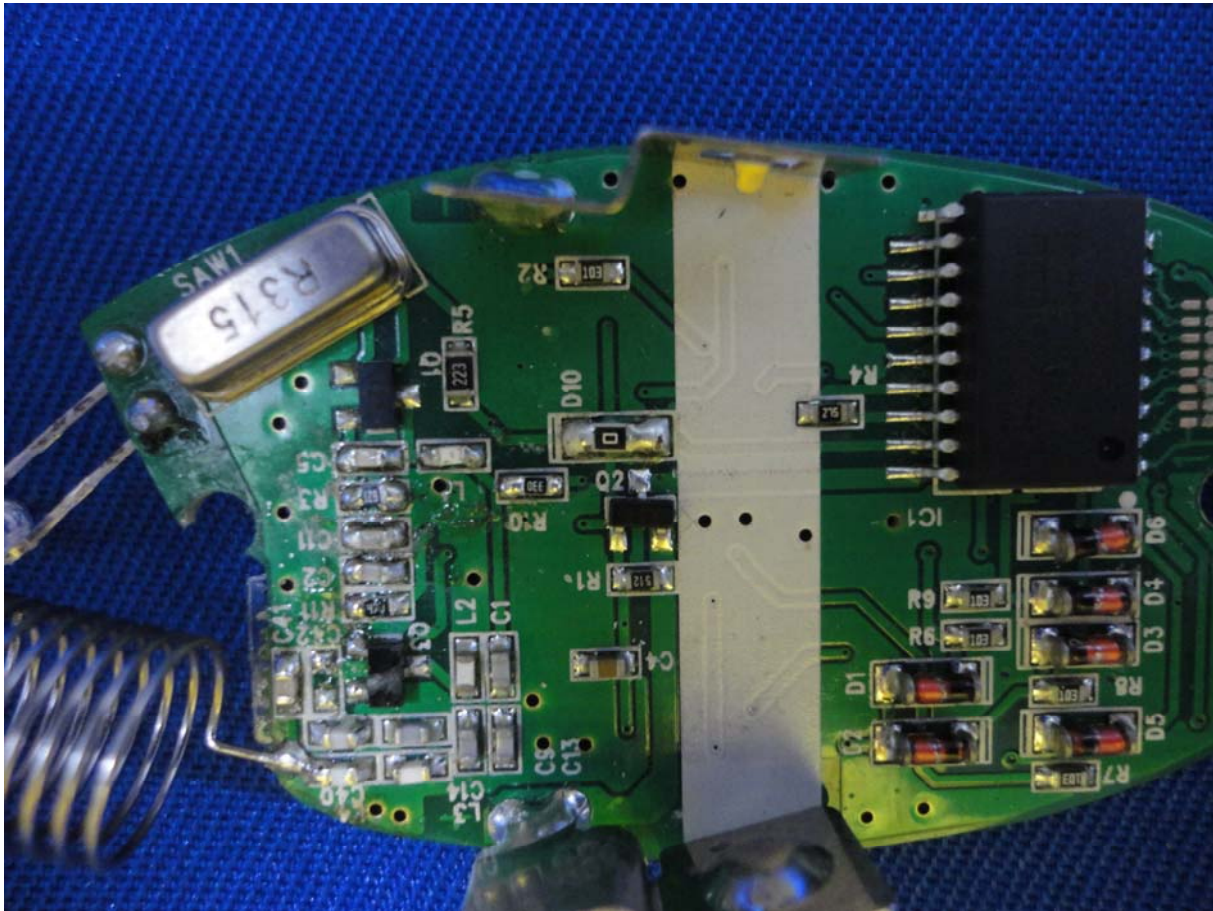


Figure 7
General Appearance of the PCB

