

FCC RADIO TEST REPORT

FCC ID: 2AHSQ-CF7009

Applicant : CARFORM GROUP LIMITED
Address : RM307 Junfu Commercial center, No.5, Qifu Road, Baiyun district, Guangzhou China

Equipment Under Test (EUT):

Name : SMART KEY SYSTEM

Model : CF7009

Standards : FCC PART 15, SUBPART C : 2013 (Section 15.231)

Report No : CTB160118001Q

Date of Test : January 18- January 22, 2016

Date of Issue : March 09, 2015

Test Result : PASS

In the configuration tested, the EUT complied with the standards specified above

Authorized Signature



(Simon Lee)

General Manager

The manufacturer should ensure that all the products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of Shenzhen CTB Testing Technology Co., Ltd. Or test done by Shenzhen CTB Testing Technology Co., Ltd. Approvals in connection with, distribution or use of the product described in this report must be approved by Shenzhen CTB Testing Technology Co., Ltd Approvals in writing.

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1 General Information

1.1 Description of Device (EUT)

EUT : SMART KEY SYSTEM

Model No. : CF7009

Trade Name : N/A

Type of Antenna : Integral antenna, Max Gain 1.0dBi.

Operation Frequency : 433.92MHz

Channel number : 1

Modulation type : ASK

Power Supply : DC 3V From Battery

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Manufacturer : CARFORM GROUP LIMITED

Address : RM307 Junfu Commercial center, No.5, Qifu Road, Baiyun district, Guangzhou China

1.2 Description of Test Facility

Shenzhen CTB Testing Technology Co., Ltd.

10th floor, West Logistics Information Center Building, Fuyong Town, Bao'an District, Shenzhen City, P.R.C

FCC Registered No.: 671575

2 EMC Equipment List

Equipment	Manufacture	Model No.	Serial No.	Cal. Due day	Cal Interval
3m Semi-Anechoic Chamber	Frankonia	N/A	N/A	2016.04.09	1 Year
EMI Test receiver	Rohde&Schwarz	ESCS30	100085	2016.04.09	1 Year
Signal Analyzer	Agilent	N9010A	MY48030494	2016.08.15	1 Year
Spectrum Analyzer	Agilent	E4407B	MY49600138	2016.08.15	1 Year
Bilog Antenna	SCHAFFNER CHASE	CBL6143	N/A	2016.04.09	1 Year
Horn Antenna	SCHAFFNER CHASE	BBHA 9120D	BBHA 9120 D(1206)	2016.04.09	1 Year
Amplifier	EM	EM-30180	060568	2016.04.09	1 Year
Power Meter	Anritsu	ML2487A	6K00001491	2016.08.15	1 Year
Power sensor	Anritsu	ML2491A	32516	2016.08.15	1 Year
Coaxial Cable	SZHTW	N/A	C-01	2016.04.09	1 Year
Coaxial Cable	SZHTW	N/A	C-02	2016.04.09	1 Year
Coaxial Cable	SZHTW	N/A	C-03	2016.04.09	1 Year
Test Receiver	Rohde&Schwarz	ESCS30	100086	2016.04.09	1 Year
L.I.S.N.	Schwarzbeck	NSLK8126	8126466	2016.04.09	1 Year
50 Ω Coaxial Switch	Anritsu	MP59B	6200264326	2016.04.09	1 Year

3 Test Procedure

POWER LINE CONDUCTED INTERFERENCE: The test procedure used was ANSI Standard C63.4-2009 using a 50 μ H LISN. Both Lines were observed. The bandwidth of the receiver was 10kHz with an appropriate sweep speed. The ambient temperature of the EUT was 25°C with a humidity of 58%.

RADIATION INTERFERENCE: The test procedure used was ANSI Standard C63.4-2009 using a ANRITSU spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a micro volt at the output of the antenna. The resolution bandwidth was 100kHz and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3MHz above 1 GHz. The ambient temperature of the EUT was 25°C with a humidity of 58%.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer and cable loss. The antenna correction factors and cable loss are stated in terms of dB. The gain of the Pre-selector was accounted for in the Spectrum Analyzer Meter Reading.

Example:

$$\text{Freq (MHz) METER READING} + \text{ACF} + \text{CABLE} = \text{FS}$$
$$33.20 \text{ dBuV} + 10.36 \text{ dB} + 0.9 \text{ dB} = 44.46 \text{ dBuV/m @ 3m}$$

ANSI STANDARD C63.4-2009 10.1.7 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation. When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. The situation was similar for the conducted measurement except that the table did not rotate. The EUT was setup as described in ANSI Standard C63.4-2009 10.1.7 with the EUT 40 cm from the vertical ground wall.

4 Summary of Measurement

4.1 Summary of test result

Test Item	Test Requirement	Standard Paragraph	Result
Spurious Emission	FCC PART 15: 2013	Section 15.231 b&15.209	Compliance
Conduction Emission	FCC PART 15: 2013	Section 15.207	Compliance
Occupied bandwidth	FCC PART 15: 2013	Section 15.231 c	Compliance
Transmission time	FCC PART 15: 2013	Section 15.231 a(2)	Compliance
Band Edge	FCC PART 15: 2013	Section 15.231&15.205	Not applicable
Antenna Requirement	FCC PART 15 : 2013	Section 15.203	Compliance

Note: 1, EUT have been tested and only worst case reported. The EUT has been tested as an independent unit. And Continual Transmitting in maximum power.

2, All test are according to ANSI C63.10-2009 and ANSI C63.4-2009, A New battery is used during testing.

4.2 Block Diagram

Mode 1:



Note: New battery is used during all test.

4.3 Assistant equipment used for test

Description : N/A
Manufacturer : N/A
Model No. : N/A

4.4 Test Conditions

Temperature range	21-25 °C
Humidity range	40-75%
Pressure range	86-106kPa

4.5 Measurement Uncertainty (95% confidence levels, k=2)

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.40dB	
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.15 dB	Polarize: V
	2.56dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.2dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	2.12dB	Polarize: H
	2.52dB	Polarize: V
Uncertainty for radio frequency	1×10^{-9}	
Uncertainty for conducted RF Power	0.66dB	
Uncertainty for temperature	0.2 °C	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.05%	

5 Radiation Emission

5.1 Radiation Emission Limits(15.209&231b)

Frequency (MHz)	Field Strength Limits at 3 metres (watts, e.i.r.p.)		
	uV/m	dB uV/m	Measurement distance(m)
0.009-0.490	2400/F(kHz)	XX	300
0.490-1.705	24000/F(kHz)	XX	30
1.705-30	30	29.5	30
30~88	100(3nW)	40	3
88~216	150(6.8nW)	43.5	3
216~960	200(12nW)	46	3
Above960	500(75nW)	54	3
Carrier frequency		80.8(AV)	3
Carrier frequency		100.8(PK)	3

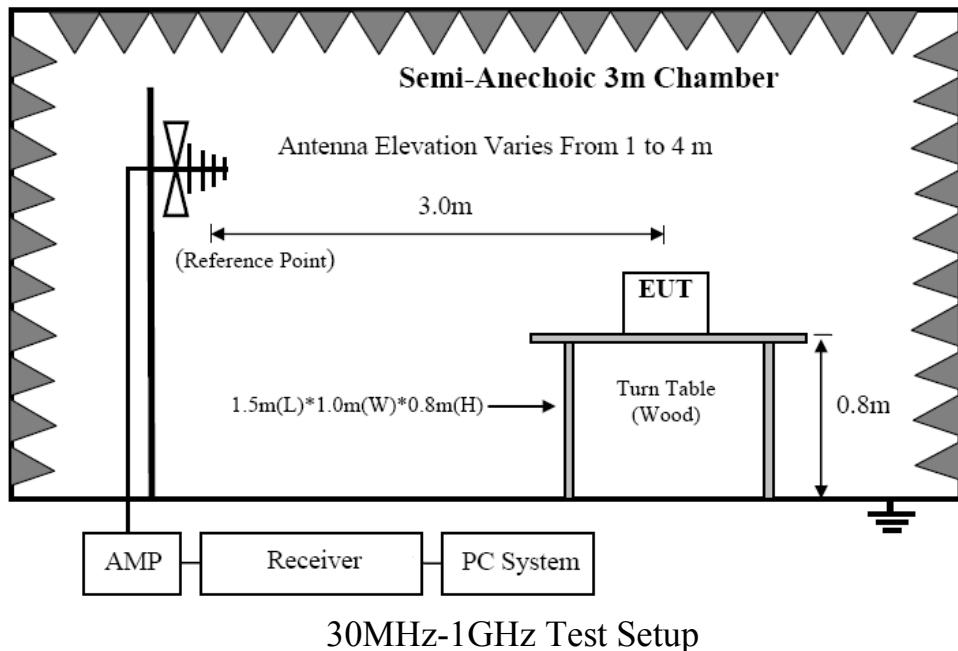
NOTE:

- a) The tighter limit applies at the band edges.
- b) Emission Level(dB uV/m)=20log Emission Level(Uv/m)

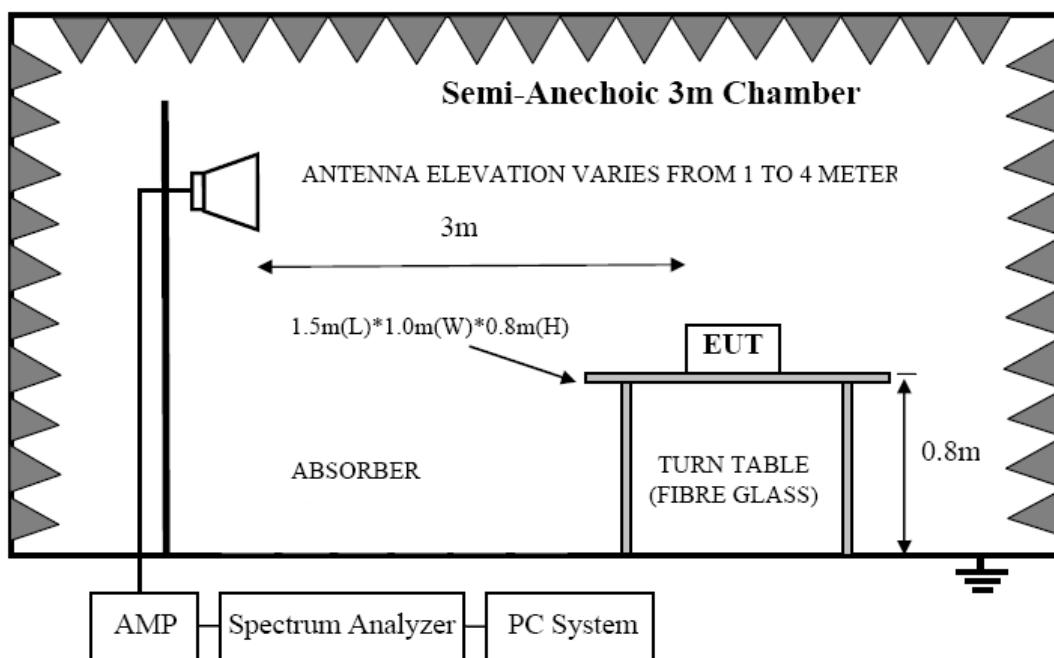
5.2 Test Setup

See the next page.

In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Above 1GHz Test Setup

5.3 Test Procedure

- a) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1GHz, The EUT was placed on a rotating 0.8 m high above ground, The table was rotated 360 degrees to determine the position of the highest radiation
- b) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- c) The initial step in collecting conducted emission data is a spectrum analyzer Peak detector mode pre-scanning the measurement frequency range. Significant Peaks are then marked, and then Qusia Peak Detector mode remeasured
- d) If Peak value comply with QP limit Below 1GHz. The EUT deemed to comply with QP limit. But the Peak value and average value both need to comply with applicable limit above 1GHz.
- e) For the actual test configuration, please see the test setup photo.
- f) The EUT are tested at X, Y and Z axis position, and only list the worse result (X axis) in the report.

5.4 Test Equipment Setting For emission test.

9KHz~150KHz	RBW 200Hz	VBW1KHz
150KHz~30MHz	RBW 9KHz	VBW 30KHz
30MHz~1GHz	RBW 120KHz	VBW 300KHz
Above 1GHz	RBW 1MHz	VBW 3MHz

5.5 Test Condition

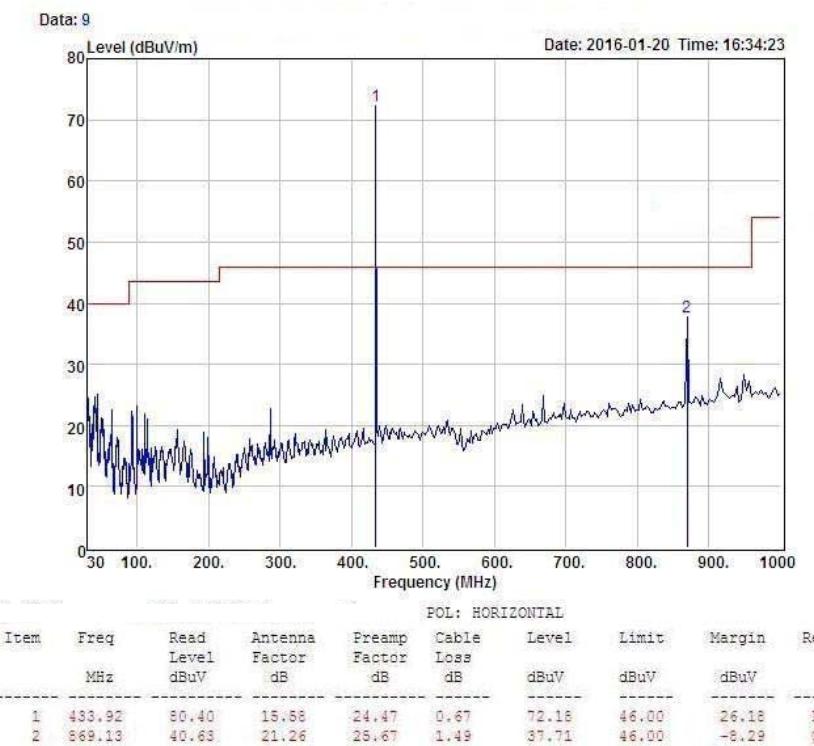
Continual Transmitting in maximum power

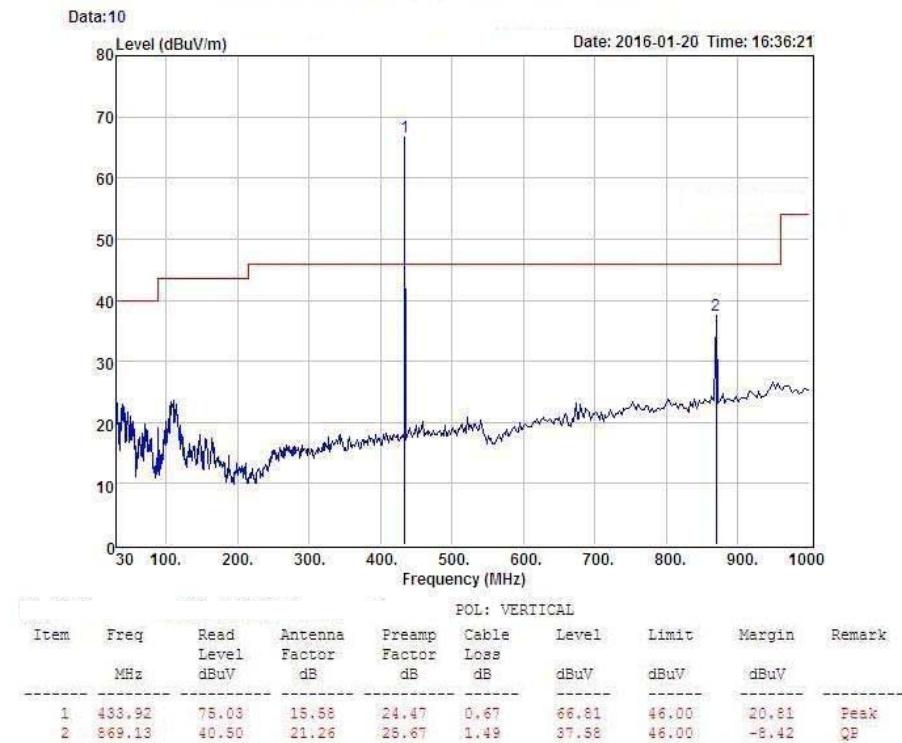
5.6 Test Result

We have scanned the 10th harmonic from 9KHz to the EUT.
Detailed information please see the following page.

From 9KHz to 30MHz: Conclusion: **PASS**

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

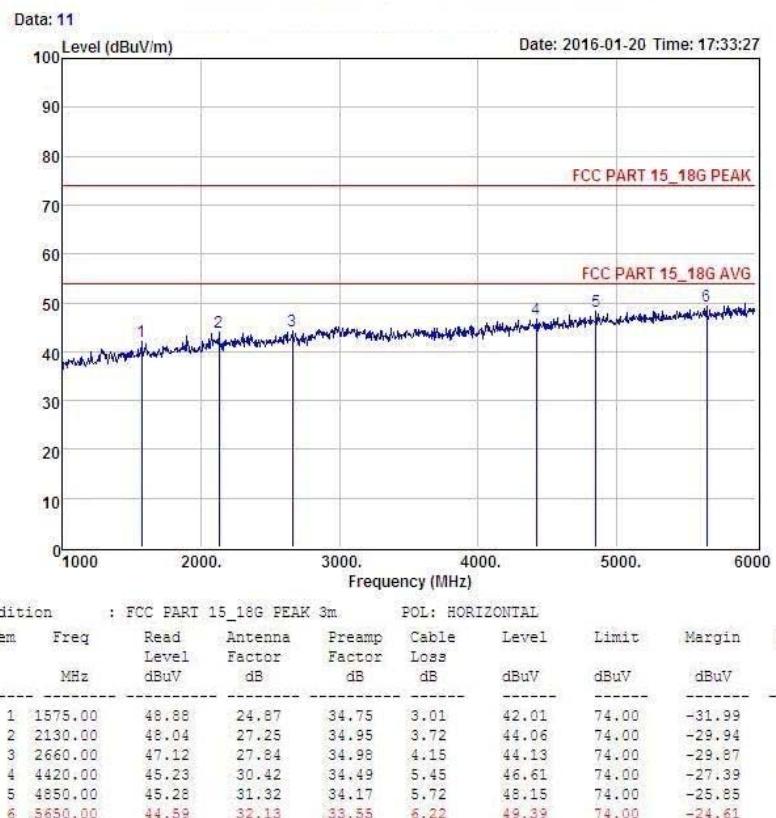


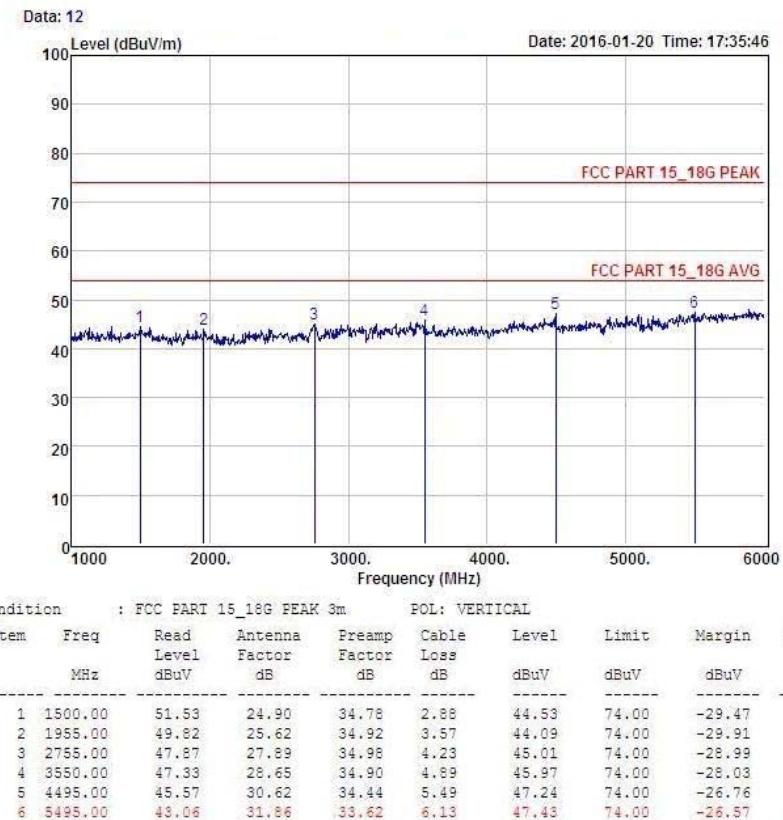


- 3 -

Notes: Above is Below 1GHz test data

Notes: Below is Above 1GHz test data





Emissions attenuated more than 20 dB below the permissible value are not reported.

Radiated Emissions Result of Inside band (433.92MHz)

EUT	SMART KEY SYSTEM	Model Name	CF7009
Temperature	25°C	Relative Humidity	56%
Pressure	960hPa	Test voltage	DC 3V From Battery
Test Mode	TX	Antenna polarization	Horizontal/Vertical

Channel (433.92MHz)									
Fre. MHz	Plority H/V	Reading dBuV	Antenna Factor dB	Cable Loss dB	Amplifier Gain dB	Correct Factor dB	Measure Result dBuV/m	Limit dBuV/m	Margin dB
433.92	H	80.40 (PK)	15.58	0.67	24.47	-8.22	72.18	100.8 (PK)	-28.62
433.92	H	80.40 (PK)	15.58	0.67	24.47	-8.22	72.18	80.8 (AV)	-8.62
--	H	--	--	--	--	--	--	--	--
433.92	V	75.03 (PK)	15.58	0.67	24.47	-8.22	66.81	100.8 (PK)	-33.99
433.92	V	75.03 (PK)	15.58	0.67	24.47	-8.22	66.81	80.8 (AV)	-13.99
--	V	--	--	--	--	--	--	--	--

Notes: 1 --Means other frequency and mode comply with standard requirements and at least have 20dB margin.

Correct Factor=Cable Loss+Antenna Factor-Amplifier Gain

Measurement Result=Reading + Correct Factor

Margin=Measurement Result-Limit

2 -Spectrum setting:

- a. Peak setting 30MHz-1GHz, RBW=100KHz, VBW=300KHz, Peak detector.

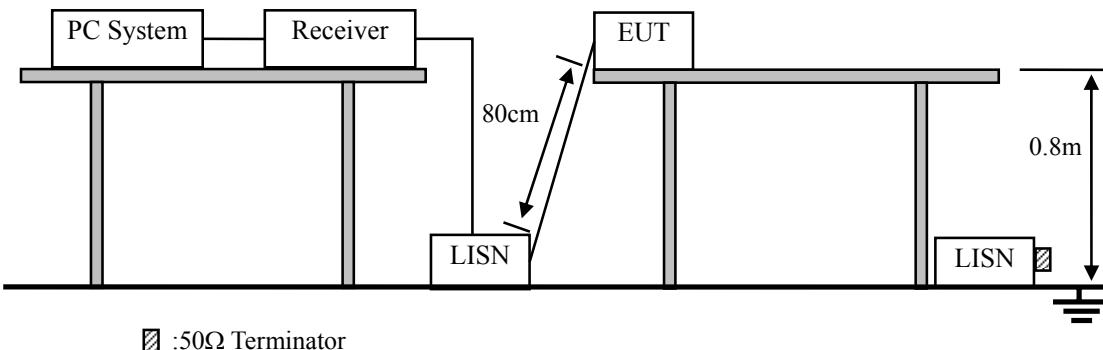
6 POWER LINE CONDUCTED EMISSION

6.1 Conducted Emission Limits(15.209)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 -0.50	66 -56*	56 - 46*
0.50 -5.00	56	46
5.00 -30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
 2. The lower limit shall apply at the transition frequencies.
 3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

6.2 Test Setup



6.3 Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50Ω coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.4-2009 on Conducted Emission Measurement.

The bandwidth of test receiver (R & S ESCS30) is set at 9 kHz.

6.4 Test Results

EUT power supply by battery, so the test not applicable.

7 Occupied bandwidth

7.1 Test limit

Please refer section 15.231

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 70MHz and below 900MHz.

7.2 Method of measurement

- a) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.
- b) The test receiver RBW set 30KHz, VBW set 30KHz, Sweep time set auto.

7.3 Test Setup

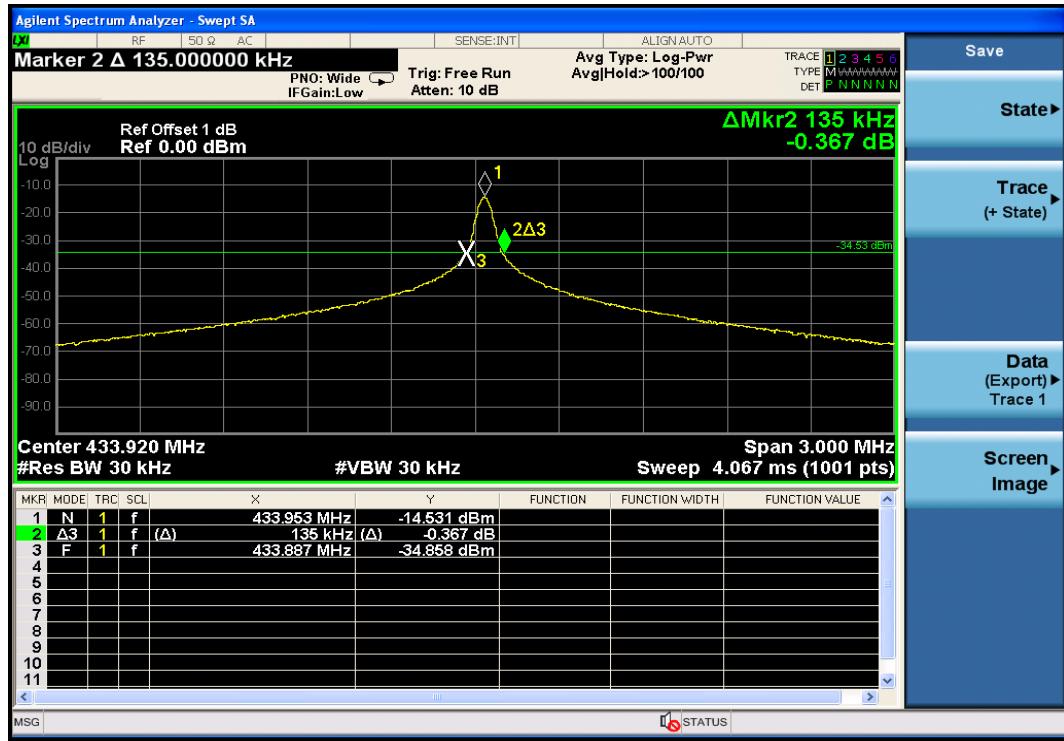


7.4 Test Results

PASS.

Detailed information please see the following page.

Frequency	Test Result	Limit	Result
433.92MHz	135KHz	<1.08MHz	Pass



8 Transmission time

8.1 Test limit

Please refer section 15.231

According to §15.231(a)(1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

8.2 Method of measurement

8.2.1. Place the EUT on the table and set it in transmitting mode.

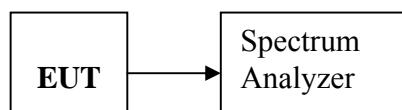
8.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

8.2.3. Set spectrum analyzer Center=433.92MHz, Span = 0MHz, Sweep = 10s.

8.2.4. Set the spectrum analyzer as RBW, VBW=1MHz,

8.2.5. Max hold, view and count how many channel in the band.

8.3 Test Setup



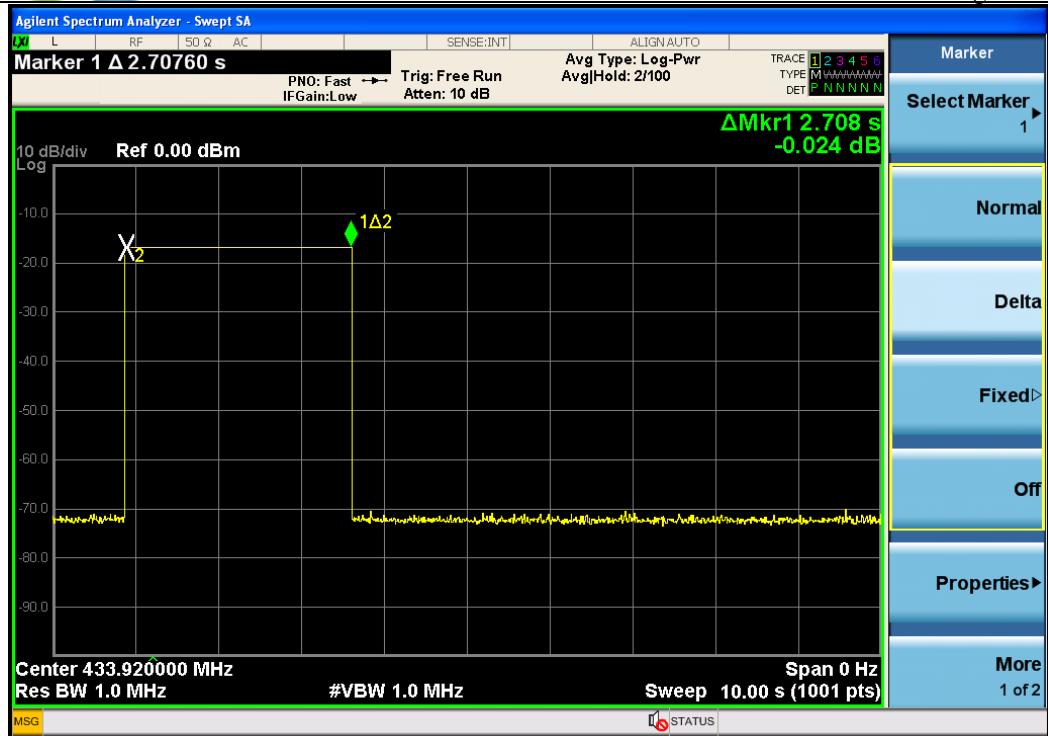
8.4 Test Results

PASS.

Detailed information please see the following page.

Frequency	Test Result	Limit	Result
433.92MHz	2.708s	< 5s	Pass

EUT emission Continue 2.708s



9 Antenna Requirement

9.1 Standard Requirement

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 or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

9.2 Antenna Connected Construction

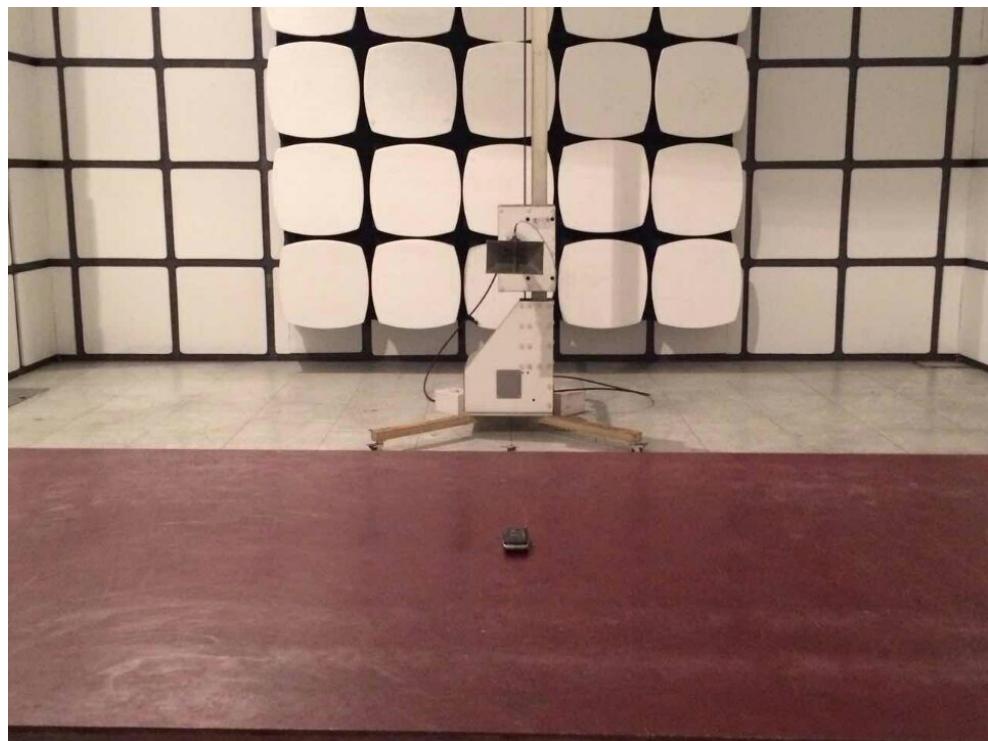
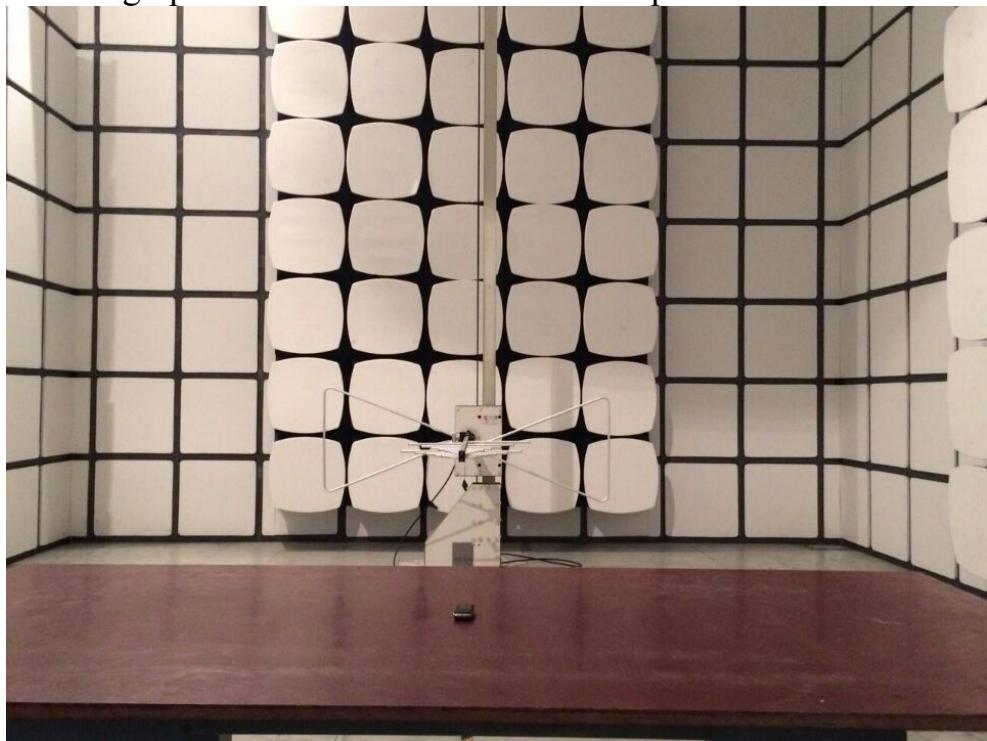
The directional gains of antenna used for transmitting is 1.0dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

9.3 Result

The EUT antenna is integrated antenna. It complies with the standard requirement.

10. Photographs of Test Setup

10.1 Photographs-Radiated Emission Test Setup in Chamber

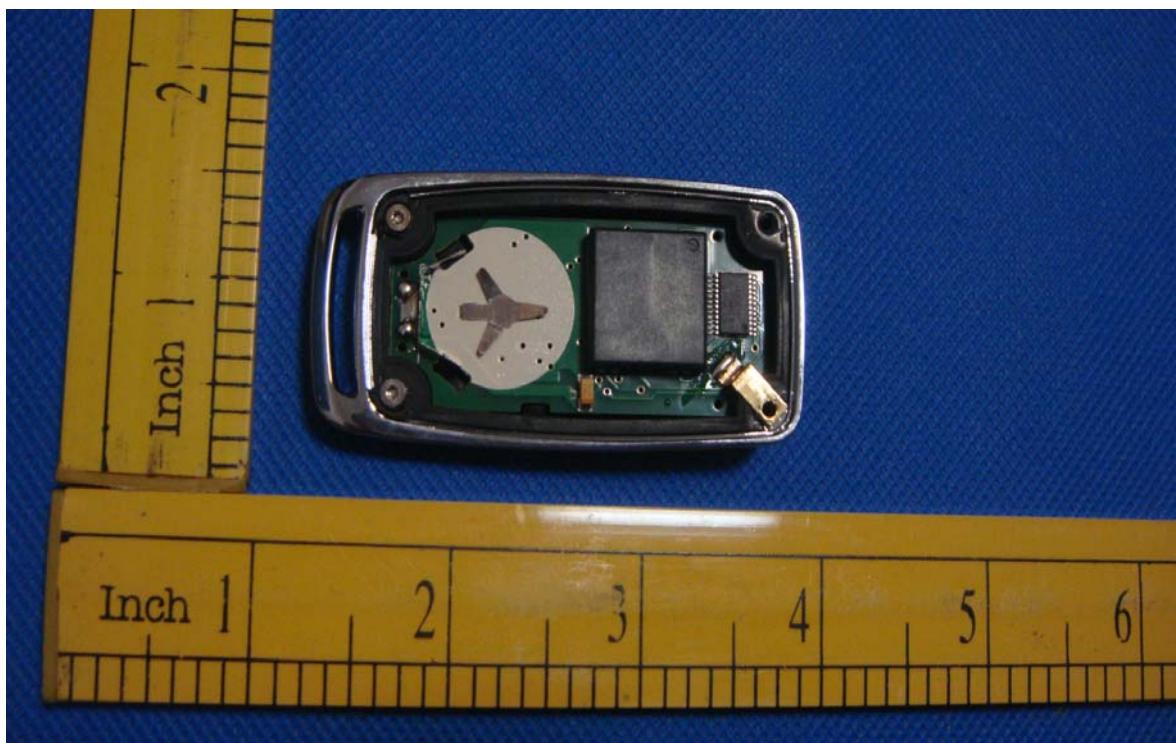


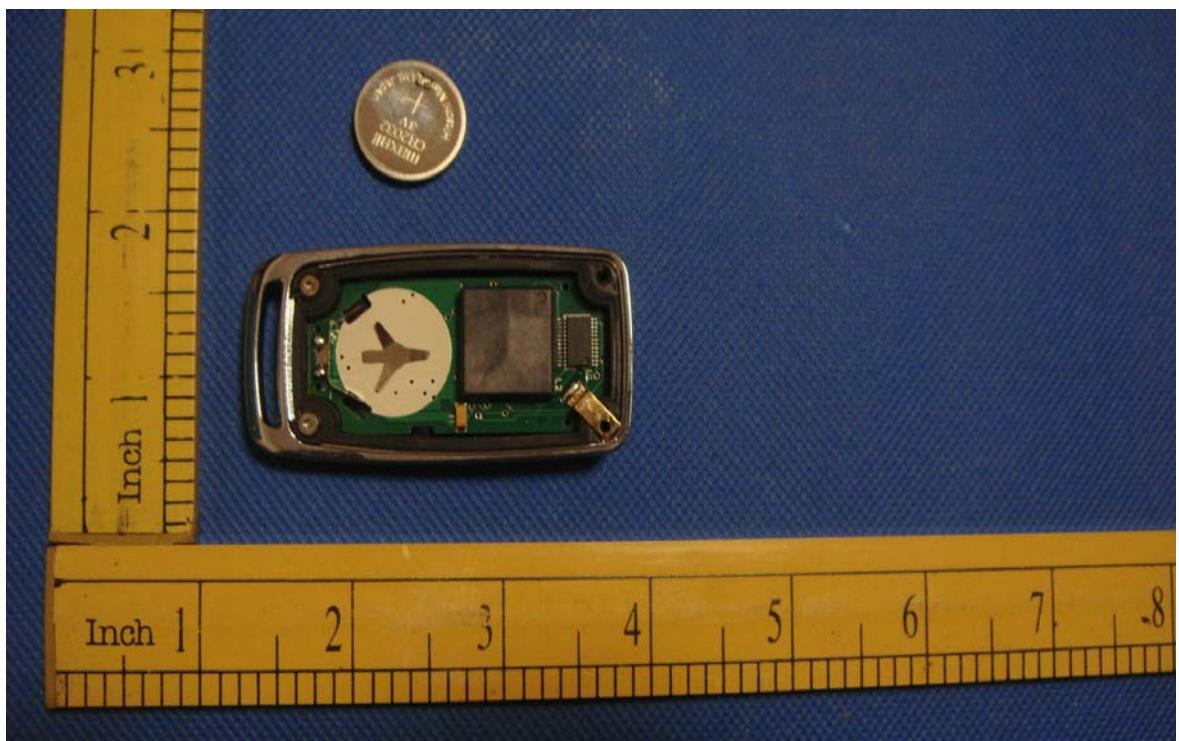
11 Photographs of EUT

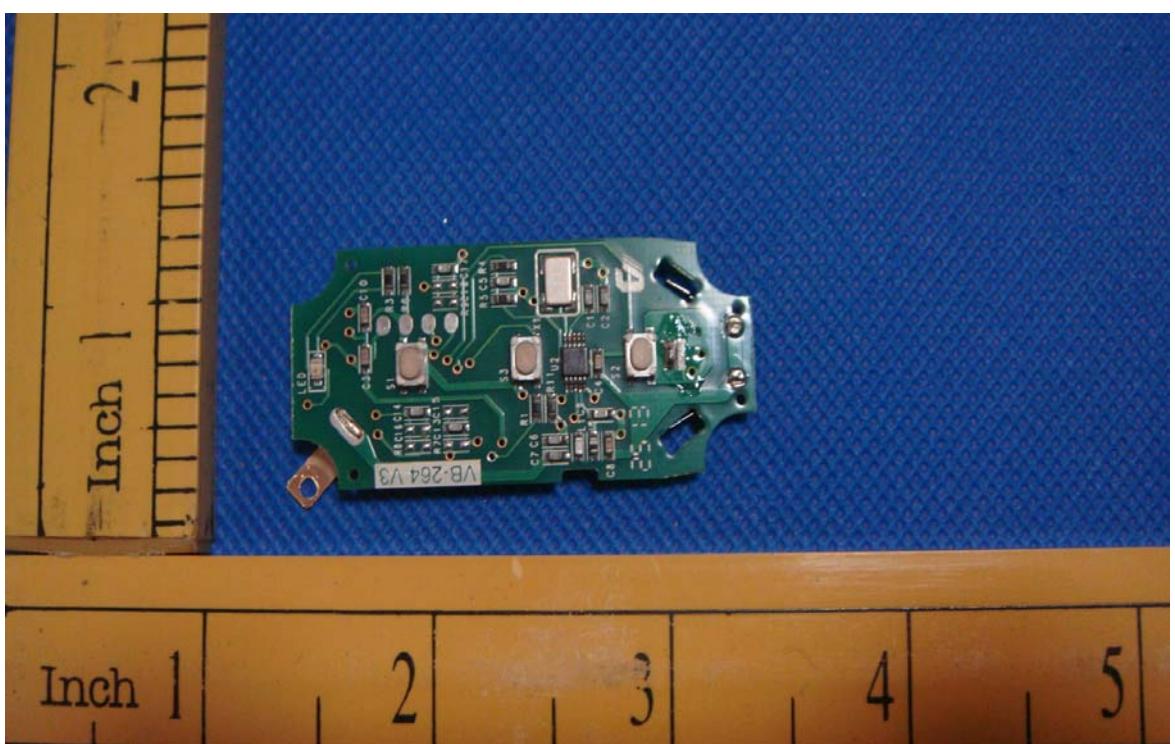
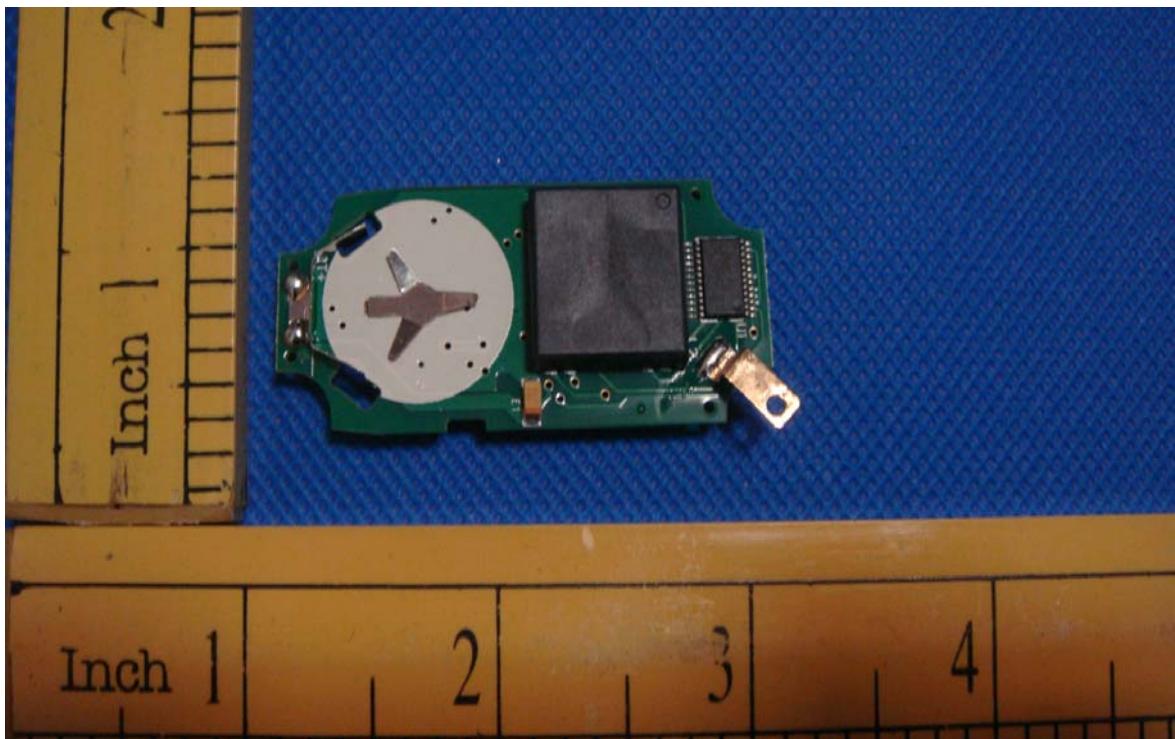












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