

FCC Test Report (TR-1103-009-01)

Applicant : MINAH INTERNATIONAL LTD.
Address : RM. 828, 8/F., TOPSAIL PLAZA, 11 ON SUM ST., SHATING, N.T. HONG KONG
Manufacturer : MINT HOME LIGHTING CO.
Address : HUANG SHARD RD., DONG YUAN COUNTY, HE YUAN CITY, GUANG DONG, CHINA,
Product Name : LIGHT SET REMOTE CONTROLLER
Trademark : None
Model(s) : RF801
Standard(s) : FCC Part 15 Subpart C
Test Result : Pass
Date of Test : Apr. 18, 2011 to May 23, 2011
Report issued Dated : May 23, 2011

The report shall not be reproduced except in full, without the written approval of the TDK EMC Center.

The results in this report apply only to the sample(s) tested. The production units are required to conform to the initial sample as received when the units are placed in the market.

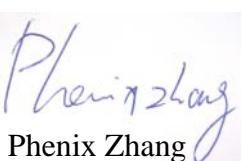
Responsible Engineer	:  Phenix Zhang	Approved by	:  CHAN king-chui	
Date	: 2011.05.23	Technical manager	Date	: 2011.05.23

Table of Contents

Description	Page
1. Description of the Test Site	3
1.1 Test Site Location:	3
1.2 Site Registration	3
1.3 Test Scope.....	3
2. Description of the Tested Samples	4
2.1 Customer Information.....	4
2.2 Identification of EUT	4
2.3 Spec of EUT	4
2.4 Test Standards List.....	4
3. Test Specifications	5
3.1 Standard(s) Used	5
3.2 Deviations from the Test Specification	5
4. Test Result.....	6
4.1 Antenna Requirement.....	6
4.2 Conducted Emission (mains).....	7
4.3 Radiated Emission Test.....	8
4.4 20dB Occupied Bandwidth.....	17
4.5 Release Time Measurement.....	19
5. FCC ID Label	22
6. Test Setup.....	23
6.1 Photographs of the Test Configuration	23
6.2 Photographs of the EUT	24
7. Equipment List.....	26
8. Test Uncertainty	27
9. Appendix	27
9.1 Confirmation of Compliance within the Limits	27

1. Description of the Test Site

1.1 Test Site Location:

Laboratory : TDK South China EMC Center
SAE Technologies Development (Dongguan) Co.,
Ltd. Changan Branch

Address : Zhenan Hi-tech Industrial Park, Dongguang City,
Guangdong Province, China

Phone no. : (86)-769-8564-4678

Fax no. : (86)-769-8564-4499

Email : emc@cn.tdk.com

1.2 Site Registration

VCCI (September, 2008) : Reg. No. R-2205, C-2392

FCC site registration (July, 2008) : Reg. No. 732901

IC registration : Reg. No. 7993

EMCC (September, 2008) : Reg. No. NAR/tl-060330

1.3 Test Scope

EMC and RF testing according to national / international standards

2. Description of the Tested Samples

2.1 Customer Information

Customer : MINAH INTERNATIONAL LTD.
Address : RM. 828, 8/F., TOPSAIL PLAZA, 11 ON SUM ST.,
SHATING, N.T. HONG KONG
Phone no. :
Fax no. :

2.2 Identification of EUT

Trademark : None
Model(s) No. : RF801
Serial No. : None

2.3 Spec of EUT

Description of EUT : This product is a remote controller with 433MHz.
Description of Antenna : fixed permanent antenna, 1.0dBi gain
Power Supply : Internal battery 4.5V DC (AAA*3)
Operation Frequency : 433.92MHz
Number of Channels : 1
Bandwidth : 800kHz
Type of Modulation : ASK

2.4 Test Standards List

FCC Part 15 (2009)

American national standard for methods of measurement of radio noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40GHz.

3. Test Specifications

3.1 Standard(s) Used

FCC Rules	Description Of Test	Result
15.203	Antenna Requirement	Pass
15.207	Conducted Emission	N/A
15.231(b)	Radiated Emission	Pass
15.231(c)	20dB Bandwidth	Pass
15.231(a)(1)	Release Time	Pass

3.2 Deviations from the Test Specification

N/A

4. Test Result

4.1 Antenna Requirement

4.1.1 Standard Applicable

Section 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 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 James or electrical connector is prohibited.

4.1.2 Antenna Connected Construction

The antenna connector is designed with permanent attachment and no consideration of replacement.

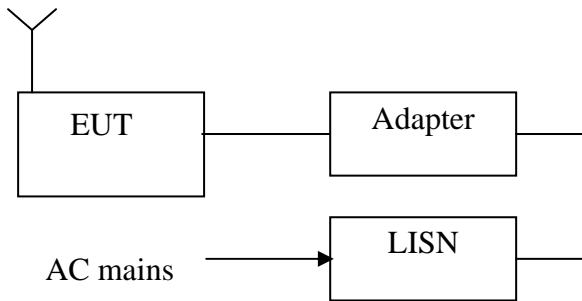
Transmitter antenna of directional gain is 1.0dBi.

4.2 Conducted Emission (mains)

4.2.1 Test Summary

Test Room	:	Shielded Room
Power Source	:	AC 120V / 60Hz
Standards:	:	FCC Part15 B : 2009
EUT Type	:	Table Top
EUT configuration	:	EUT's highest possible emission level

4.2.2 Block diagram of test setup



4.2.3 Measurement method

The EUT along with its peripherals were placed on a 1.0m (W) x 1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4m space from a vertical reference plane. The EUT was connected to power mains through a Artificial Mains Network(AMN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.

The excess power cable between the EUT and the AMN was bundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

4.2.4. Result

N/A

Because the power of EUT is with internal battery, this test item is not applicable.

4.3 Radiated Emission Test

4.3.1 Limit

a. Radiation emission measurement limits according to FCC Part 15 Section 15.231(b).

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750 **	125 to 375 **
174-260	3750	375
260-470	3750 or 12500 **	375 to 1250 **
Above 470	12500	1250

** 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.]

b. Restricted band radiation emission measurement limits according to FCC part 15 Section 15.205 and Section 15.209.

4.3.2 Block diagram of test setup

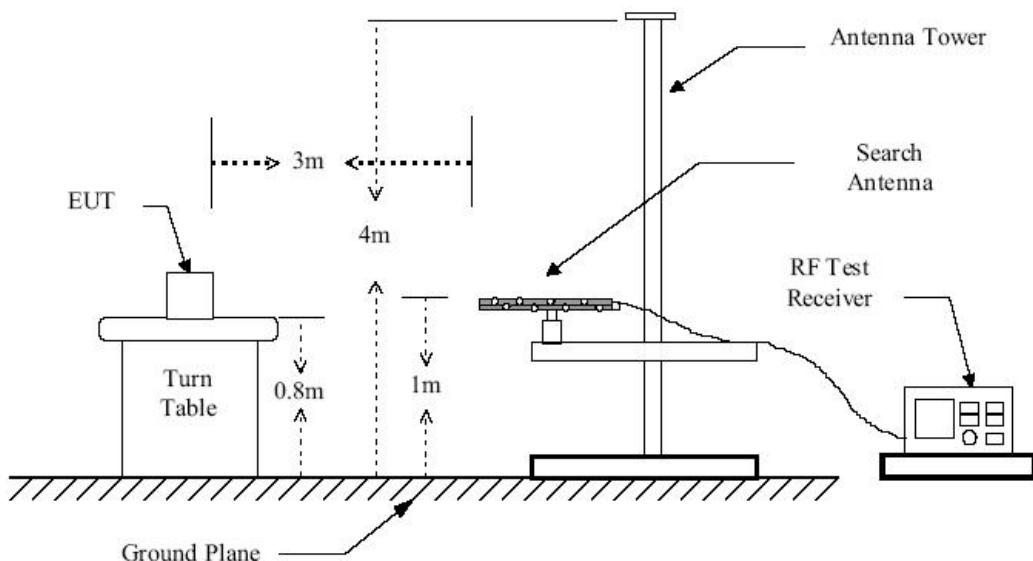


Figure 1 : Frequencies measured below 1 GHz configuration

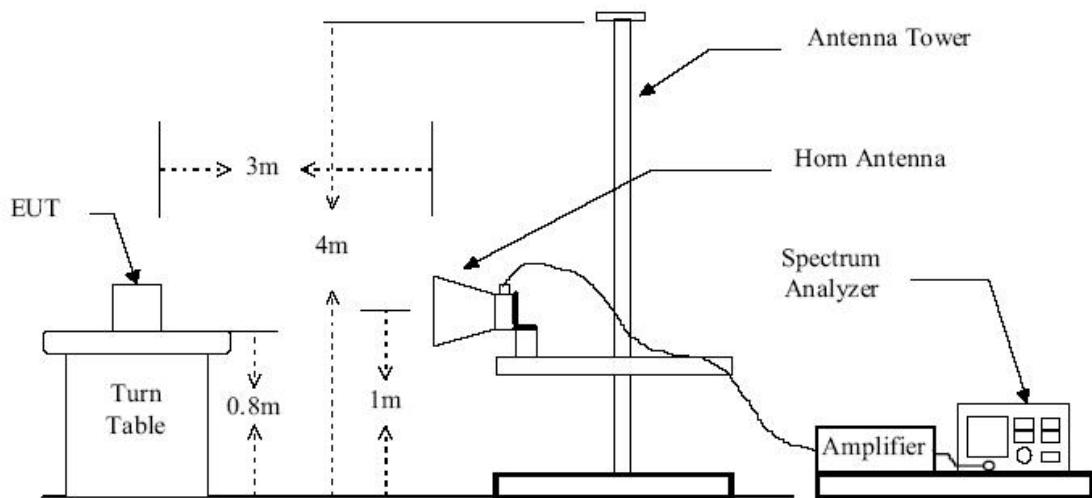


Figure 2 : Frequencies measured above 1 GHz configuration

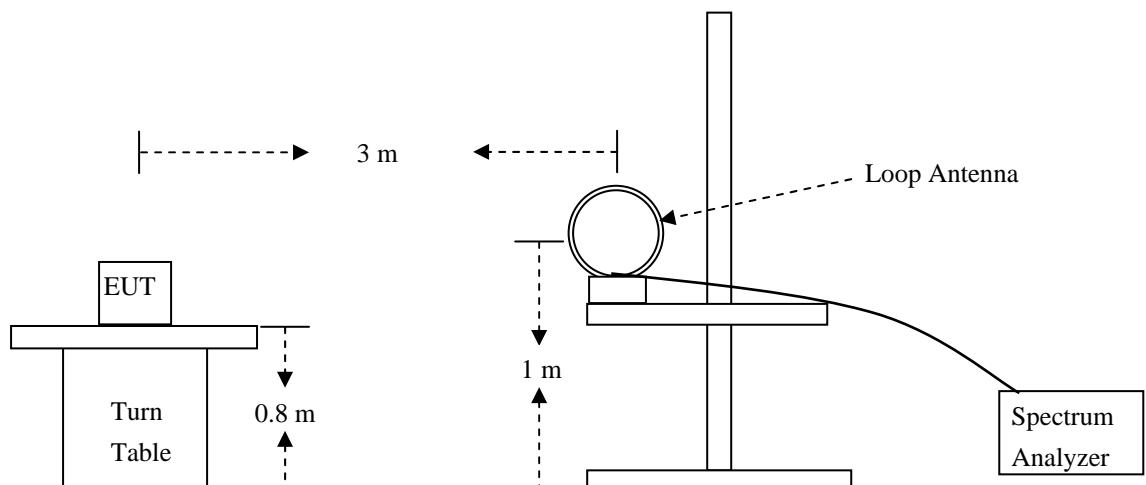


Figure 3: Frequencies measured below 30MHz configuration

4.3.3 Measurement method

1. Configure the EUT according to ANSI C63.4 (2003).
2. The EUT was placed on the top of the turntable 0.8 meter above ground.
3. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
4. Power on the EUT and all the supporting units.
5. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
6. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
7. For each suspected emission, the antenna tower was scanned (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
8. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.

4.3.4. Result

In pretesting, we found out the ON button generated higher power than other buttons. This test item was base on the setting.

Below 30MHz:

No further spurious emissions found between lowest internal used or generated frequency and 30 MHz.

30M- 1GHz:

2011/04/18 11:29:44

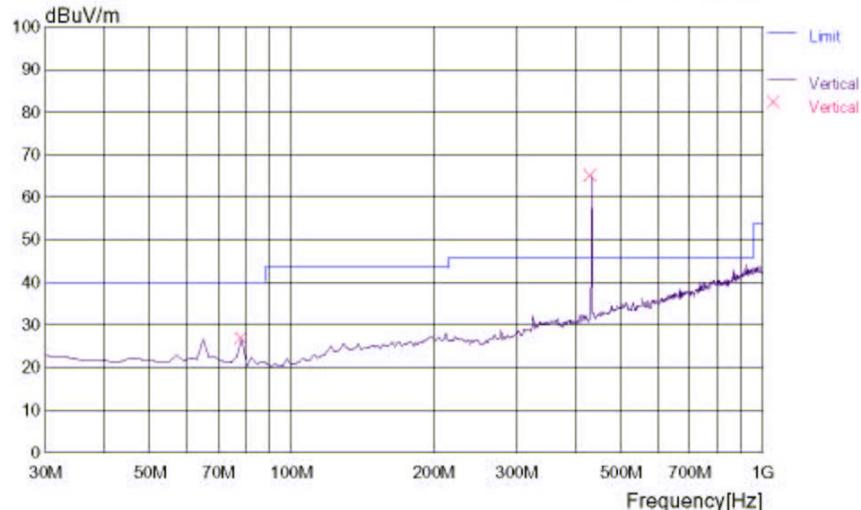
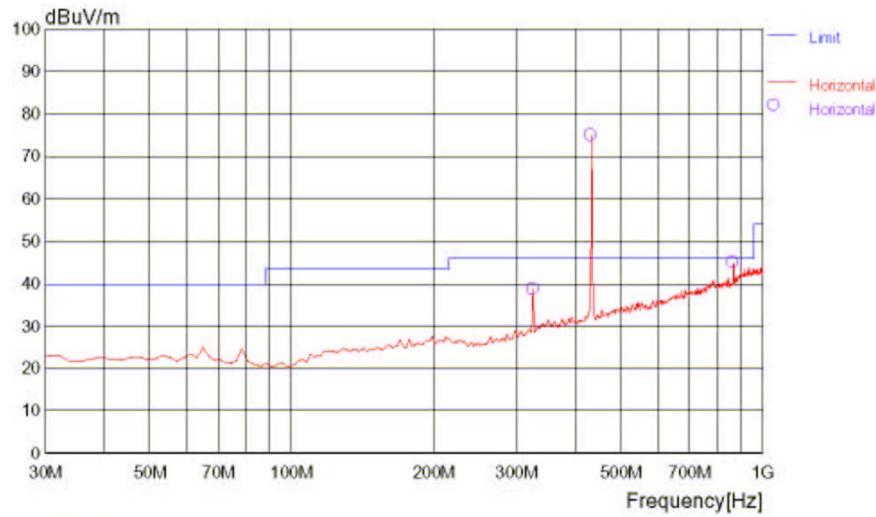
RADIATED EMISSION

Date : 2011/04/18 11:29:31

Trade Name	:	RF801	Document No.	:	DC 4.5V
Model Name	:	remote Controller	Power Supply	:	27/55RH%
Product Name	:		Temp/Humi	:	
Test Condition	:	TX ON	Operator	:	Phenix

Memo :

LIMIT : FCC Part15 Class B(3m)/USA



2011/04/18 11:29:44

RADIATED EMISSION

Date : 2011/04/18 11:29:31

Trade Name	RF 801	Document No.	
Model Name	remote Controller	Power Supply	DC 4.5V
Product Name		Temp/Humi	27/55RH%
Test Condition	TX ON	Operator	Phenix

Memo

LIMIT : FCC Part15 Class B(3m)/USA

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dB]	MARGIN [cm]	ANTENNA TABLE		COMMENT
									TABLE	COMMENT	
--- Horizontal ---											
1	325.471	46.5	14.9	8.7	31.3	38.8	46	7.2	100	286	
2	434.328	79.9	17.2	9.2	31.3	75.0	80.8	5.8	100	113	
3	867.819	42.6	22.8	10.7	31.1	45.0	60.8	15.8	100	171	
--- Vertical ---											
4	78.597	41.6	9.4	7.2	31.6	26.6	40	13.4	100	298	
5	434.328	70.1	17.2	9.2	31.3	65.2	80.8	15.6	300	194	

Above 1GHz:

2011/05/16 14:42:58

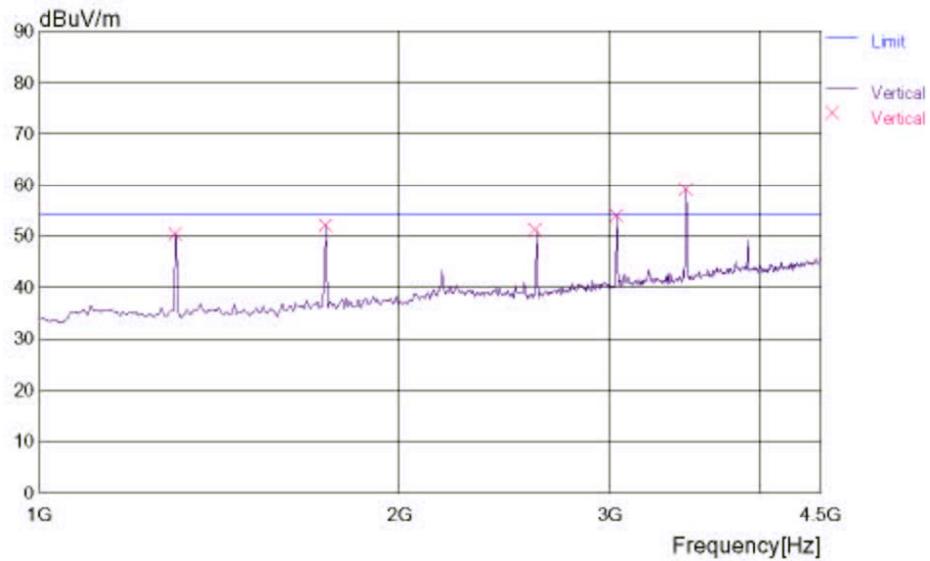
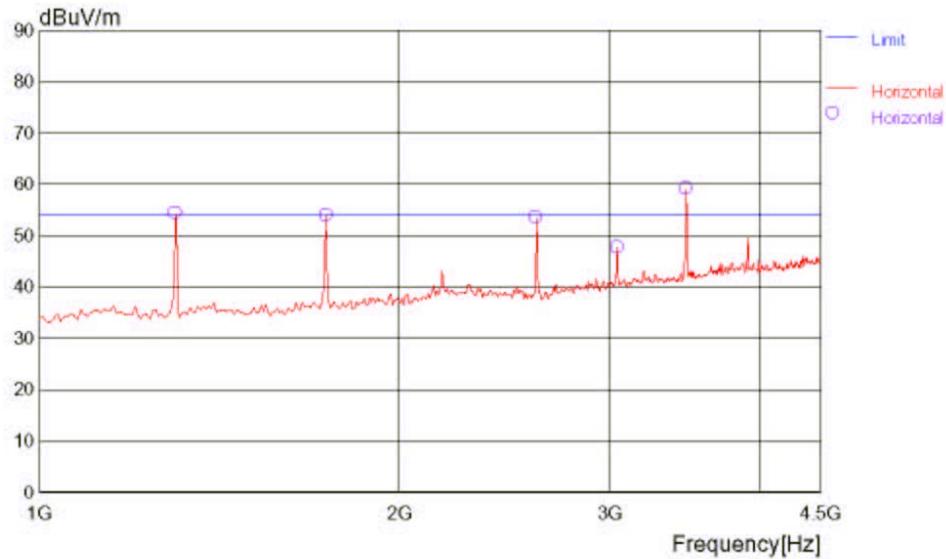
RADIATED EMISSION

Date : 2011/05/13 17:37:07

Trade Name	:	RF801	Document No.	:	Internal Battery
Model Name	:	remote controller	Power Supply	:	27/55RH%
Product Name	:		Temp/Humi	:	
Test Condition	:	TX mode	Operator	:	pang

Memo

LIMIT : FCC Part15 C transmitter spurious above1G(average)



2011/05/16 14:42:58

RADIATED EMISSION

Date : 2011/05/13 17:37:07

Trade Name : RF801 Document No.
Model Name : remote controller Power Supply : Internal Battery
Product Name : TX mode Temp/Humi : 27/55RH%
Test Condition : pang Operator : pang

Memo :

LIMIT : FCC Part15 C transmitter spurious above1G(average)

Frequency [MHz]	Meter (PK) [dBuV]	Ant. Type	Detector	Antenna Factor [dB/m]	Total Loss [dB]	Level (PK) [dBuV/m]	Angle [degree]	Height [m]	Pol.	Limit [dBuV/m]	Margin [dB]
*1301.604	62.0	HRN	PK	28.6	-36.4	54.2	72	1.00	Hori.	60.8	6.6
1301.604	58.0	HRN	PK	28.6	-36.4	50.2	38	1.99	Vert.	54	3.8
1736.474	59.4	HRN	PK	29.5	-35.2	53.7	138	2.00	Hori.	60.8	7.1
1736.474	57.5	HRN	PK	29.5	-35.2	51.8	195	1.99	Vert.	60.8	9.0
2606.205	55.9	HRN	PK	31.0	-33.5	53.4	114	1.00	Hori.	60.8	7.4
2606.205	53.5	HRN	PK	31.0	-33.5	51.0	142	1.99	Vert.	60.8	9.8
3041.068	48.2	HRN	PK	32.5	-33.0	47.7	118	1.00	Hori.	60.8	13.1
3041.068	54.2	HRN	PK	32.5	-33.0	53.7	106	1.00	Vert.	60.8	7.1
3475.931	57.5	HRN	PK	33.8	-32.4	58.9	18	2.00	Hori.	60.8	1.9
3475.931	57.6	HRN	PK	33.8	-32.4	59.0	357	1.00	Vert.	60.8	1.8

Note:

* 1301.604: Because 1301.604 MHz is inside restricted band (1300-1427 MHz) so that 15.209 limits (AV 54 dB μ V/m@3m) apply.

AV value = PK level * Duty Cycle

Duty Cycle = on time / period

$$= (N_1 L_1 + N_2 L_2) / 50\text{ms} = (22 * 1.751\text{ms} + 19 * 0.549\text{ms}) / 100\text{ms}$$

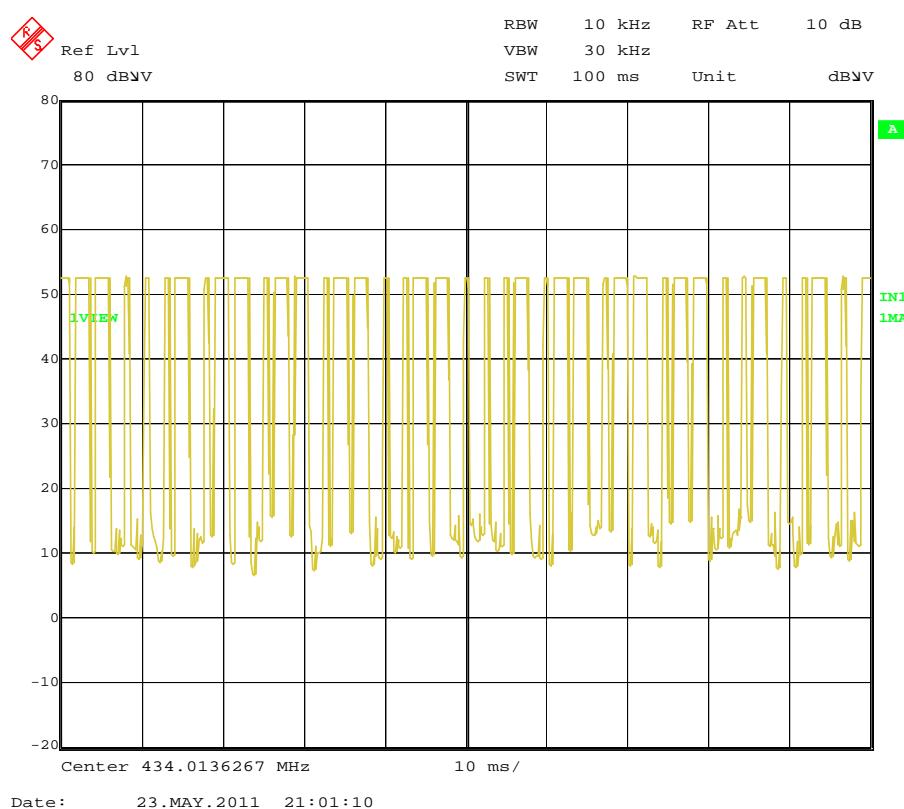
$$= 0.490$$

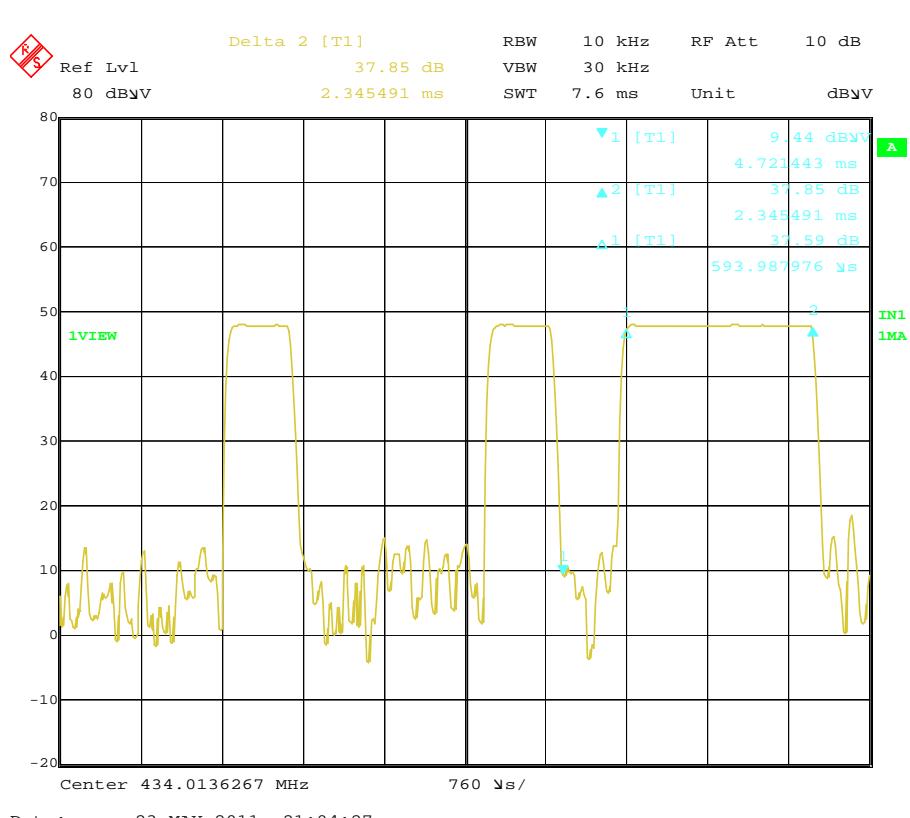
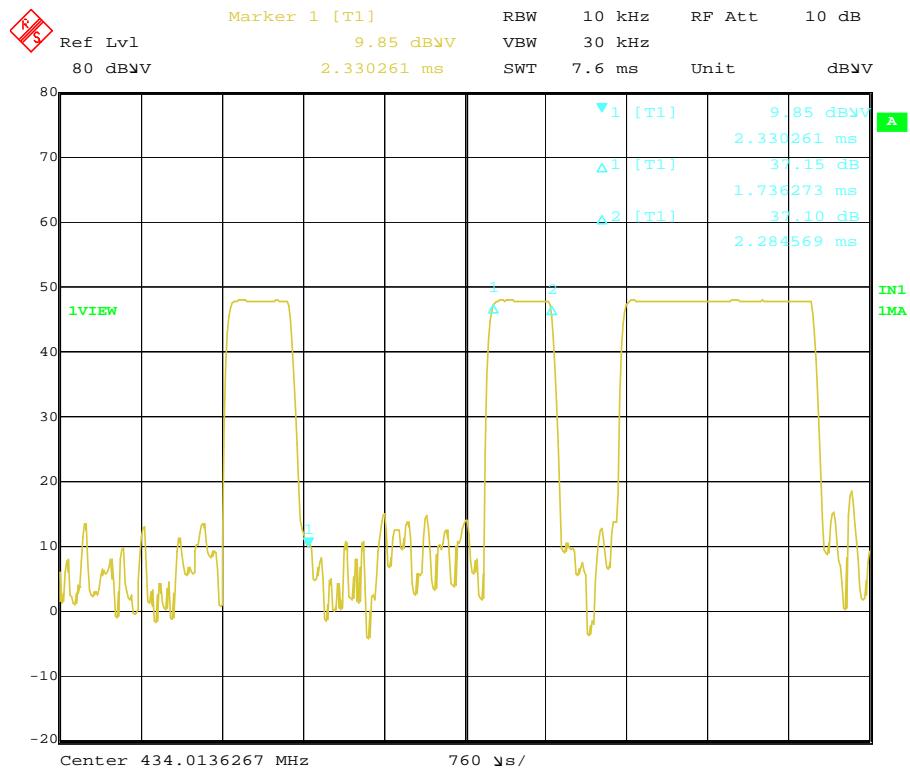
AV value = $54.2 + 20\log 0.490 = 48.0\text{dBuV}$

Margin = AV limit – AV value = $54 - 48 = 6\text{ dB}$

So the **AV value** passed the **AV limit**.

Test Plot of Duty Cycle:



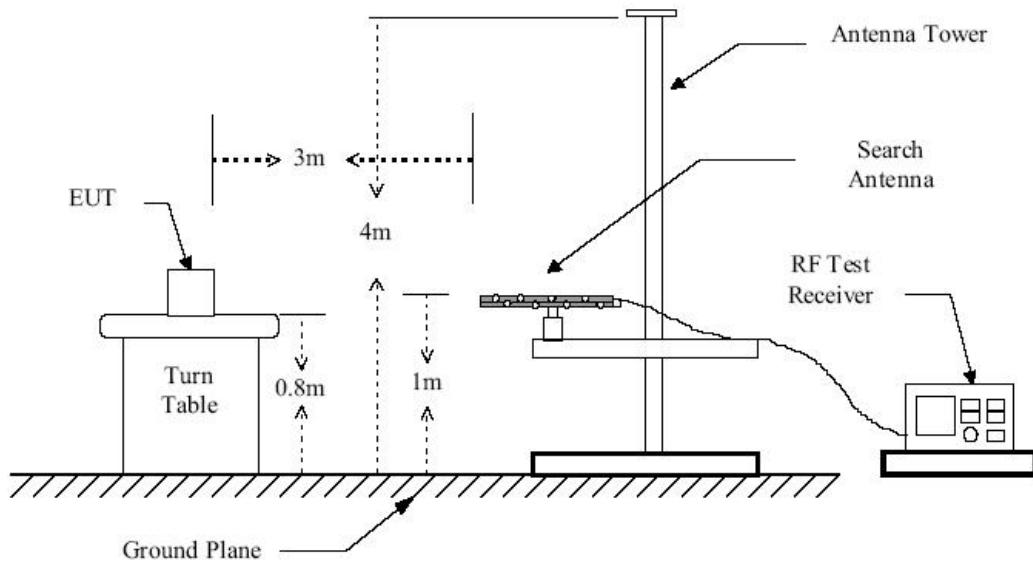


4.4 20dB Occupied Bandwidth

4.4.1 Applicable Standard

According to section 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.

4.4.2 Block diagram of test setup



4.4.3 Measurement method

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Span=2.5MHz, Sweep=auto.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is auto.
4. Mark the peak frequency and -20dB(upper and lower) frequency.

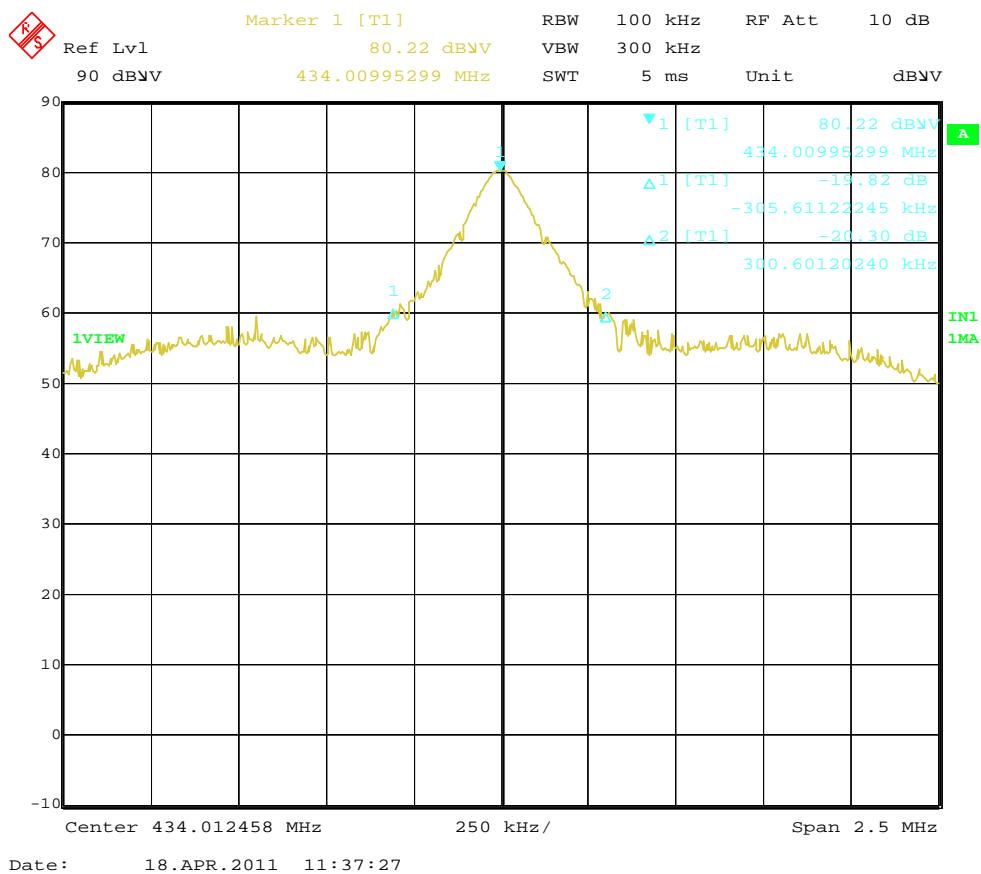
4.4.4. Result

In pretesting, we found out the ON button generated higher bandwidth than other buttons. This test item was base on the setting.

Temperature () : 22~23	EUT: LIGHT SET REMOTE CONTROLLER
Humidity (%RH): 50~54	M/N: RF801
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode
Test data: Apr. 18, 2010	Test engineer: Phenix

Frequency (MHz)	20dB Bandwidth (kHz)	Limits (kHz)
433	606.2	1084. 8

Test Plot:

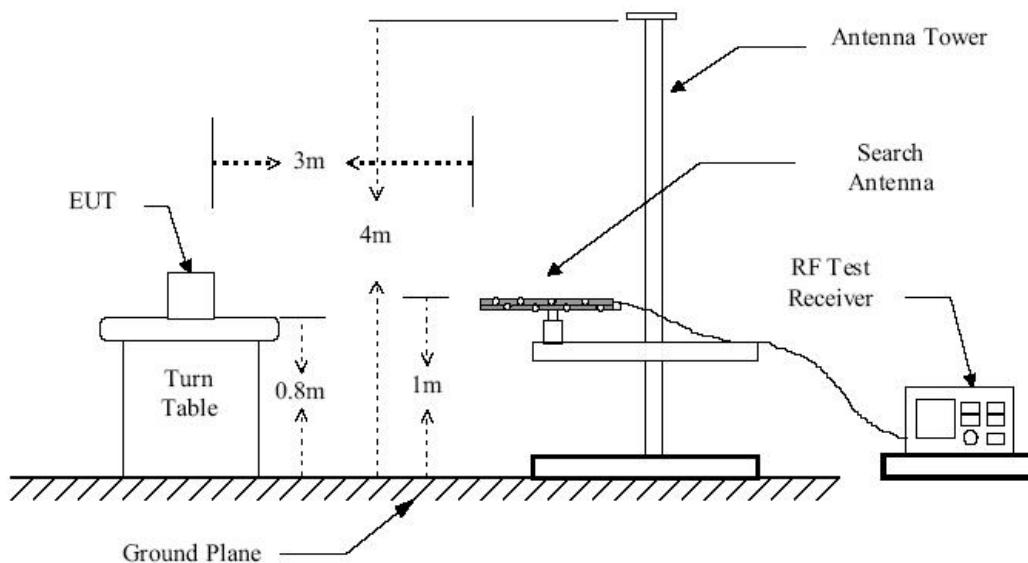


4.5 Release Time Measurement

4.5.1 Applicable Standard

According to section 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.

4.5.2 Block diagram of test setup



4.5.3 Measurement method

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set the spectrum analyzer Center Frequency = Fundamental Frequency, RBW=100kHz, VBW=300kHz, Span=0Hz, Sweep time=5 seconds.
3. set EUT as normal operation and press transmitter button.
4. set spectrum analyzer view, Delta Mark time.

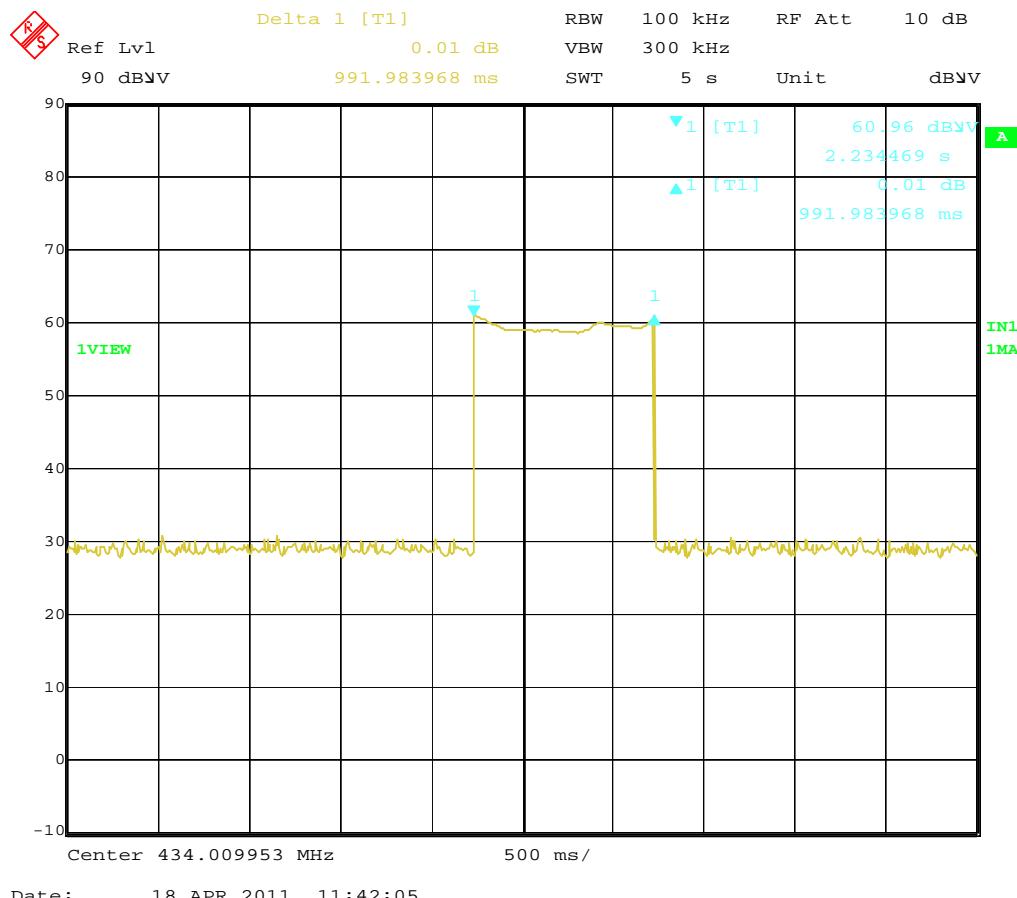
4.5.4. Result

In pretesting, we found out the ON button generated longer release time than other buttons. This test item was base on the setting.

Temperature () : 22~23	EUT: LIGHT CONTROLLER	SET	REMOTE
Humidity (%RH): 50~54	M/N: RF801		
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode		
Test data: Apr. 18, 2010 and May 20, 2010	Test engineer: Phenix		

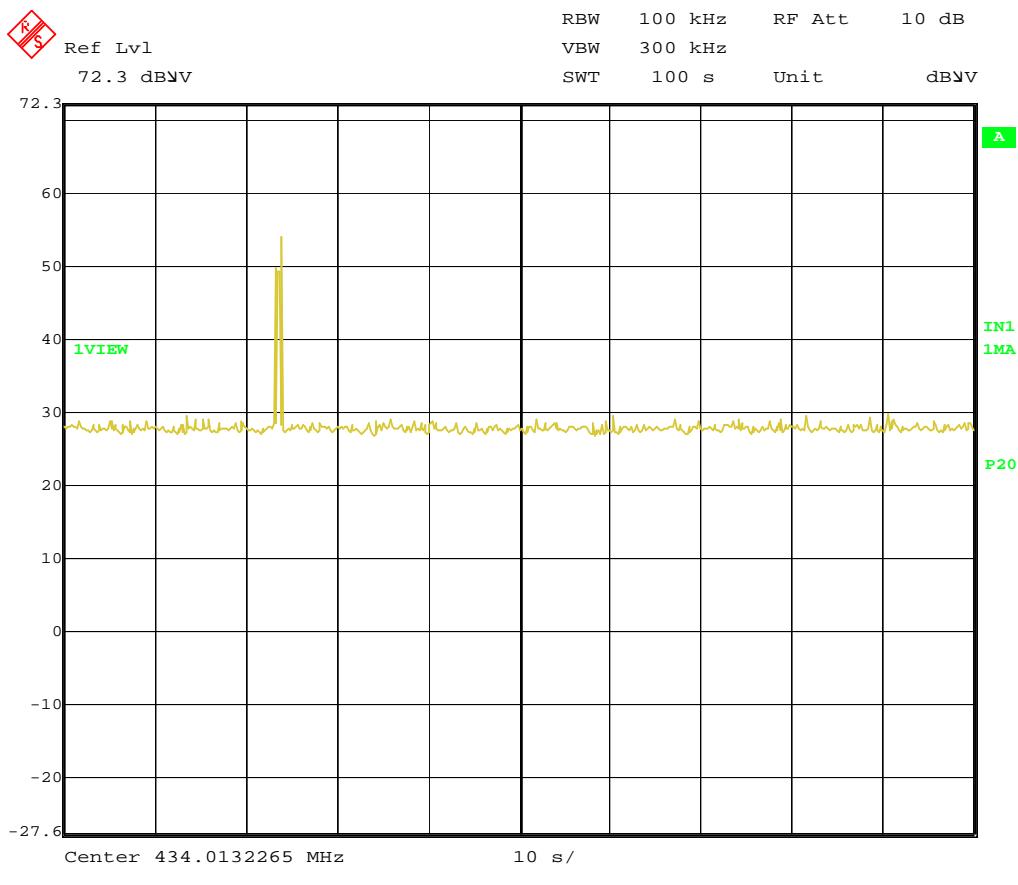
Frequency (MHz)	Release time (ms)	Limits (s)
433.92	991.98	5

Test Plot:



Date: 18.APR.2011 11:42:05

Note: Independent of the time any button is pressed, there is only one transmission with a duration of 991 ms.



Comment:

The method of calculation for release time:

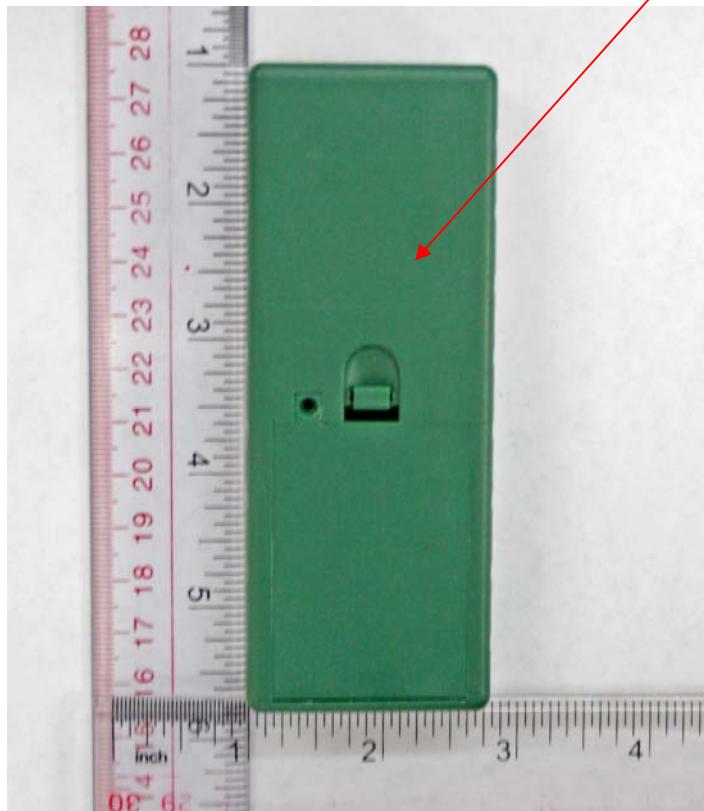
1. Start: the tester press the button of TX, then the TX is transmitting. We can snatch the rise edge of pulse.
2. Stop: The RX received the signal, then it's working. At the moment, the tester loosens the button of TX. We can snatch the down edge of pulse.

The time of deactivate:

The receiver recorded down edge of pulse when the tester loosened the TX button. It means the transmission is over. The time of down edge is deactivation time. It's very short and can not be measured.

5. FCC ID Label

Mark Location:



6. Test Setup

6.1 Photographs of the Test Configuration

Radiated emission:

Below 1GHz:



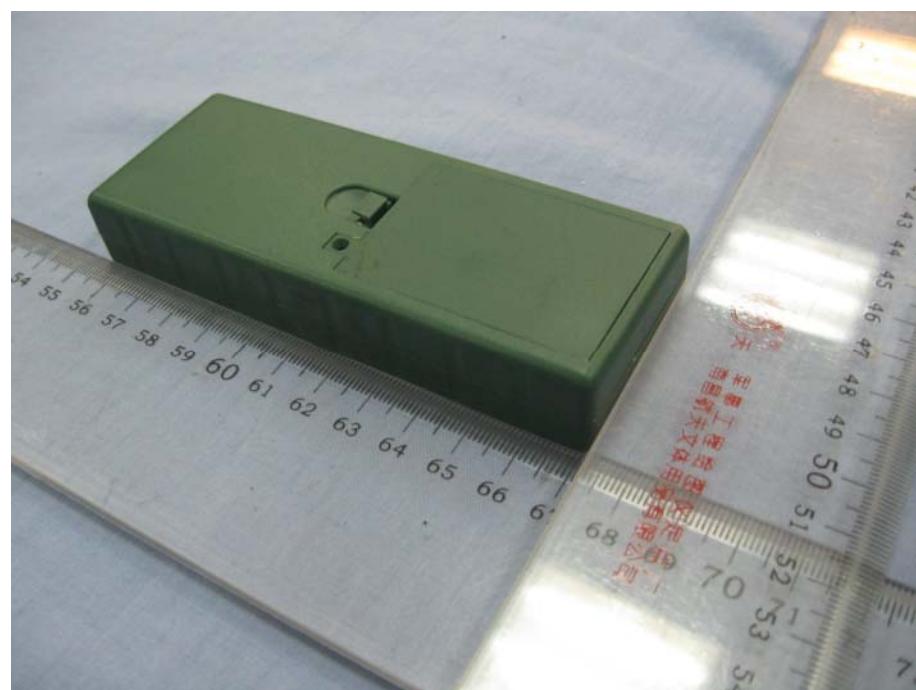
Above 1GHz:



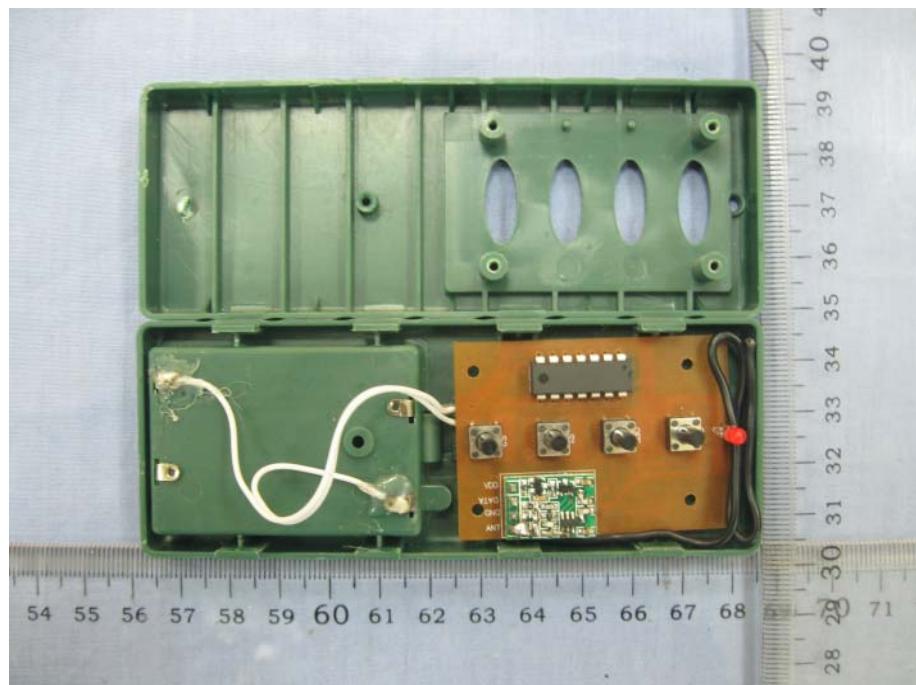
6.2 Photographs of the EUT



Enclosure of EUT



Enclosure of EUT



Internal Photo

7. Equipment List

No.	Equipment	Manufacturer	Model	Serial No.	Calibration Date
1	Precision Biconical Antenna	TDK Co.	PBA-2030	090500	2010-09-18
2	Precision Log Periodic Antenna	TDK Co.	PLP-3003	061001	2010-09-18
3	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130174	2010-09-18
4	Horn antenna	TDK	HRN-0118	130186	2010-09-18
5	Attenuator 6 dB	Agilent	8491B	MY39260147	2010-09-18
6	Preamplifier	TDK Sonoma	310	242803	2011-04-02
7	Preamplifier	ELENA	EAU-3718 GXA	A070701	2010-09-09
8	EMI Receiver	Rohde & Schwarz	ESIB26	100234	2011-04-02
9	EMI Receiver	Rohde & Schwarz	ESCS30	100350	2011-04-02
10	Spectrum Analyzer	Agilent	E4403B	MY44210199	2011-04-02
11	Art. Mains Network	EMCO	3816/2	00044921	2011-04-02
12	Transient Limiter(10 dB)	Agilent	11947A	3107A03736	2011-04-02
13	Personal Computer	HP	DX2000MT	MXD4250FZM	N/A
14	Personal Computer	HP	DX2000MT	MXD4130B2N	N/A
15	Semi-Anechoic Chamber	TDK Co.	N/A	N/A	2010-07-15
16	Shielded Room	TDK Co.	N/A	N/A	N/A
17	Loop Antenna	EMCO	6502	9107-2440	2011-04-02

8. Test Uncertainty

Test	Range	Confidence Level	Calculated Uncertainty
Radiated emission(3m)	30-1000MHz	95%	4.3dB
Conducted emission	0.15-30MHz	95%	3.3dB

9. Appendix

9.1 Confirmation of Compliance within the Limits

9.1.1 Method of calculating measurement result

Radiated Emission

For example the point of 78.597MHz, vertical, Page 12.

$$\begin{array}{ccccccccc} \text{Reading} & + & \text{Antenna} & + & \text{Cable} & - & \text{Gain} & = & \text{Result} \\ & & \text{factor} & & & & \text{loss} & & \end{array}$$

$$\text{Example} \quad 41.6 \quad + \quad 9.4 \quad + \quad 7.2 \quad - \quad 31.6 \quad = \quad 26.6$$