

APPLICATION FOR CERTIFICATION

On Behalf of

EGLO Hong Kong Lighting Ltd

Model Number: RF-21-A

FCC ID: 2AEBXRF-21-A

Prepared for : EGLO Hong Kong Lighting Ltd
Address : Rm 2101, 21/F Multifield Centre, 426 Shangha Street,
Mongkok ,Hong Kong, China

Prepared By : EST Technology Co., Ltd.
Address : Santun(guantai Road), Houjie Town, DongGuan City,GuangDong,
China


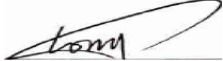

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Report Number : ESTE-R1503004
Date of Test : March 01~09, 2015
Date of Report : March 10, 2015

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EST Technology Co., Ltd.

Applicant: Address:	EGLO Hong Kong Lighting Ltd Rm 2101, 21/F Multifield Centre, 426 Shangha Street, Mongkok , Hong Kong ,China.		
Manufacturer: Address:	Dong Duan NewShengDa Lighting Co Ltd No.1 Shang Qiao Industrial Road. Dongcheng Town, DongGuan, GuangDong, China		
E.U.T:	Remote control		
Model Number:	RF-21-A		
Trade Name:	EGLO	Operating Frequency:	433.92 MHz
Date of Receipt:	March 01, 2015	Date of Test:	March 01~09, 2015
Test Specification:	FCC Rules and Regulations Part 15 Subpart C:2014 ANSI C63.10:2013		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
Issue Date: March 10, 2015			
Prepared by:	Tested 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. Description of Device (EUT)

E.U.T.	: Remote control
Model No.	: RF-21-A
Operating Frequency	: 433.92 MHz
Number of Channels	: 1 Channels
Type of Modulation	: ASK
Antenna Type	: Integral
System Input Voltage	: Nominal Voltage: DC 3V(Battery)

1.2. Difference between Model Numbers

None.

1.3. Independent Operation Modes

The basic operation modes are: TX mode

2. TEST SITES

2.1. Test Facilities

EMC Lab : Certificated by CNAL, CHINA
 Registration No.: L5288
 Date of registration: November 13, 2014

Certificated by FCC, USA
 Registration No.: 989591
 Date of registration: November 20, 2013

Certificated by Industry Canada
 Registration No.: 46405-9405
 Test Side Number: 9405A-1
 Date of registration: January 03, 2013

Certificated by VCCI, Japan
 Registration No.: R-3663 & C-4103
 Date of registration: July 25, 2011

Certificated by TUV Rheinland, Germany
 Registration No.: UA 50195514 0001
 Date of registration: January 07, 2011

Certificated by TUV/PS, Shenzhen
 Registration No.: SCN1017
 Date of registration: January 27, 2011

Certificated by Intertek ETL SEMKO
 Registration No.: 2011-RTL-L1-18
 Date of registration: April 28, 2011

Certificated by Siemic, Inc.
 Registration No.: SLCN021
 Date of registration: November 8, 2011

Certificated by Nemko, Hong Kong
 Registration No.: 175193
 Date of registration: May 4, 2011

Name of Firm : EST Technology Co., Ltd.

Site Location : San Tun Management Zone, Houjie Town, Dongguan, Guangdong, China

2.2. 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
5	Antenna requirement	FCC Part 15.203	PASS

2.3.Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.54dB
Uncertainty for Radiation Emission test (30MHz-1GHz)	3.62
Uncertainty for Radiation Emission test (1GHz to 18GHz)	4.86
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	0.20dB
Uncertainty for Power density test	0.26dB

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2.4. List of Test and Measurement Instruments

2.4.1. For conducted emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESHS30	832354	June,28,14	1 Year
Artificial Mains Networ	Rohde & Schwarz	ENV216	101260	June,28,14	1 Year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	101100	June,28,14	1 Year

2.4.2. For radiated emission test(30-1000MHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESVS10	100004	June,28,14	1 Year
Spectrum Analyzer	Agilent	E4411B	MY50140697	June,28,14	1 Year
Bilog Antenna	Teseq	CBL 6111D	27090	June,28,14	1 Year
Signal Amplifier	Agilent	310N	187037	June,28,14	1 Year

2.4.3. For radiated emission test(above 1GHz)

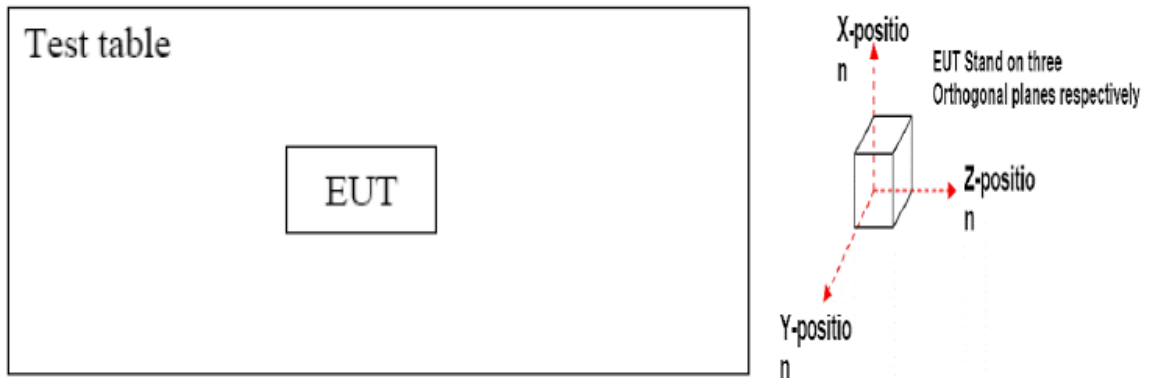
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	SCHWARZBEC K	BBHA 9120 D	BBHA9120D 1002	June,28,14	1 Year
Signal Amplifier	SCHWARZBEC K	BBV9718	9718-212	June,28,14	1 Year
Spectrum Analyzer	Agilent	E4408B	MY44211139	June,28,14	1 Year

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: 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 1.3

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. Antenna Requirements

4.2.1. Standard requirement

15.203 requirement: For intentional device, according to 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.

4.2.2. Result

The EUT antenna is permanent attached antenna. It comply with the standard requirement.

4.3. Radiated emissions

4.3.1. 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.

4.3.2. Test procedure

The EUT was placed on a turn table which was 0.8 meter above ground for 30-1000MHz, and was 1.5 meter above ground for above 1GHz . 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.

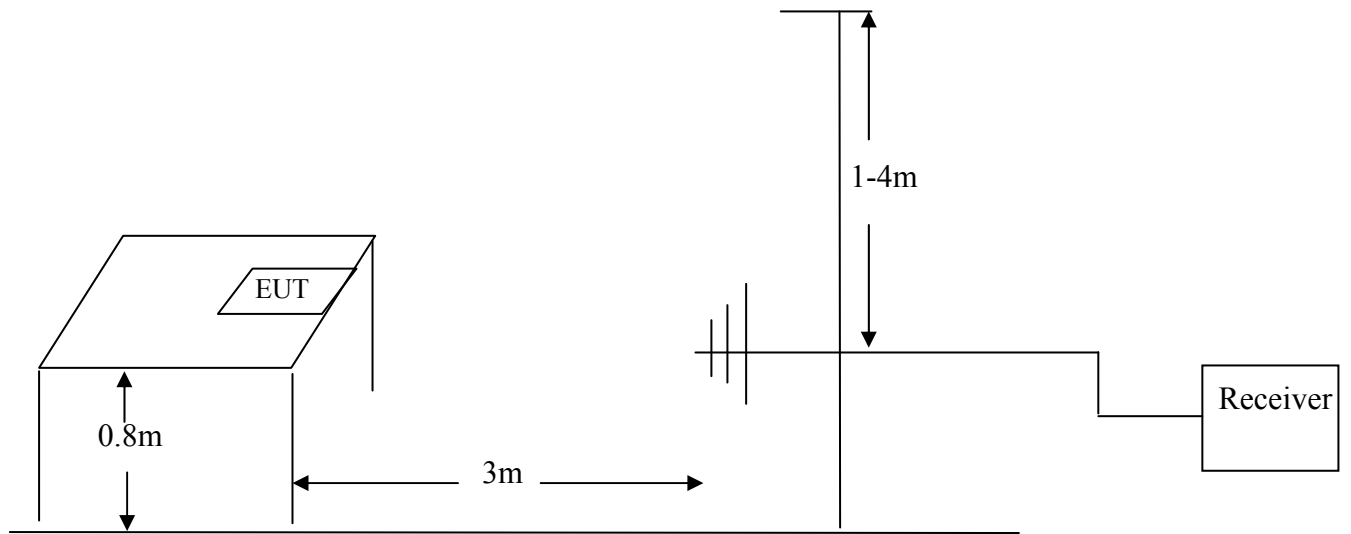
The resolution bandwidth and video bandwidth of the test receiver was 1MHz and 1MHz for Peak detection at frequency above 1GHz.

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.

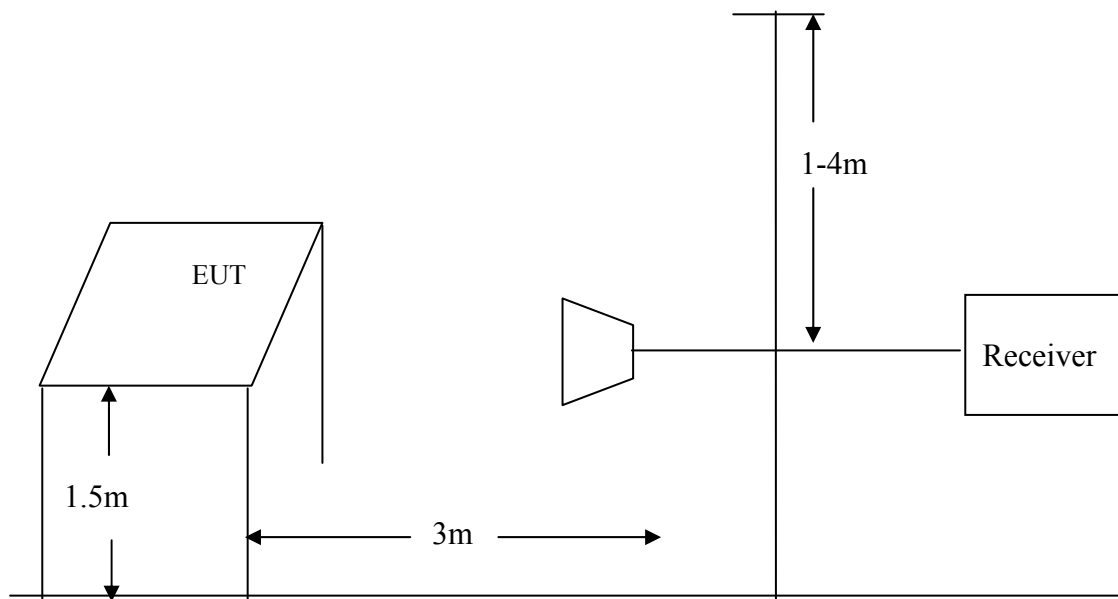
The EUT was tested in Chamber Site.

4.3.3. Test Setup Diagram

For frequency range: 30MHz-1000MHz



For frequency range: 1 GHz -5GHz



4.3.4. Test result

Pass.

Test Data (worst mode: Y-axis)

EUT	:	Remote control	Temperature:	25.4°C
Model No.	:	Rf-21-A	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
114.39	10.85	1.42	1.54	13.81	-29.69	43.50	H	QP
563.50	19.67	3.28	0.74	23.69	-22.31	46.00	H	QP
805.03	22.20	3.86	0.94	27.00	-19.00	46.00	H	QP
433.92	16.13	2.79	65.24	84.16	-16.64	100.825	H	Peak
867.84	22.85	3.83	38.42	65.10	-15.70	80.825	H	Peak
35.82	14.99	0.75	0.05	15.79	-24.21	40.00	V	QP
114.39	10.85	1.42	3.47	15.74	-27.76	43.50	V	QP
647.89	20.08	3.59	0.84	24.51	-21.49	46.00	V	QP
433.92	16.13	2.79	59.44	78.36	-22.44	100.825	V	Peak
867.84	22.85	3.83	32.20	58.88	-21.92	80.825	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
433.92	84.16	-6.99	77.17	80.825	-3.655	H
867.84	65.10	-6.99	58.11	60.825	-2.715	H
433.92	78.36	-6.99	71.37	80.825	-9.455	V
867.84	58.88	-6.99	51.89	60.825	-8.935	V

Remark: The worst emission was detected at **867.84MHz** with corrected signal level of **58.11dBμV/m**(Limit is **60.825 dBμV/m**) when the antenna was at **Horizontal** polarization and at **1.85m** high and the turn table was at **170°**

Remark: The worst emission was detected at **867.84MHz** with corrected signal level of **51.89dBμV/m** (Limit is **60.825dBμV/m**) when the antenna was at **Vertical** polarization and at **1.0m** high and the turn table was at **100°**.

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%.
4. Pulse Desensitization Correction Factor
Pulse Width(PW)=5.1ms 2/PW=2/5.1ms=0.39kHz
RBW(100kHz)>2/PW (0.39kHz),
Therefore PDCF is not needed.

Test Data (worst mode: Y-axis)

EUT	:	Remote control	Temperature:	25.4°C
Model No.	:	Rf-21-A	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
1301.76	25.02	3.96	25.36	54.34	-26.485	80.825	H	Peak
1735.68	24.77	5.19	21.98	51.94	-28.885	80.825	H	Peak
2169.60	25.88	6.19	26.77	58.84	-21.985	80.825	H	Peak
1301.76	25.02	3.96	21.66	50.64	-30.185	80.825	V	Peak
1735.68	24.77	5.19	14.32	44.28	-36.545	80.825	V	Peak
2169.60	25.88	6.19	23.28	55.35	-25.475	80.825	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	Polar- ity
1301.76	54.34	-6.99	47.35	60.825	-13.475	H
1735.68	51.94	-6.99	44.95	60.825	-15.875	H
2169.60	58.84	-6.99	51.85	60.825	-8.975	H
1301.76	50.64	-6.99	43.65	60.825	-17.175	V
1735.68	44.28	-6.99	37.29	60.825	-23.535	V
2169.60	55.35	-6.99	48.36	60.825	-12.465	V

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. Pulse Desensitization Correction Factor
Pulse Width(PW)=5.1ms 2/PW=2/5.1ms=0.39kHz
RBW(100kHz)> 2/PW (0.39kHz),
Therefore PDCF is not needed.

4.4. 20dB Occupied Bandwidth

4.4.1. 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.

4.4.2. Test procedure

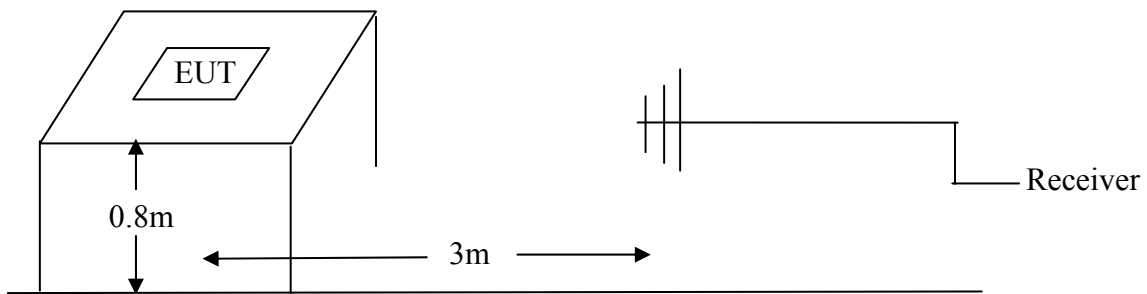
Step 1: The EUT was placed on a table which is 0.8m above ground plane.

Step 2: EUT was set to transmit continuously.

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

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

4.4.3. Test Setup Diagram



4.4.4. Test Result

Pass.

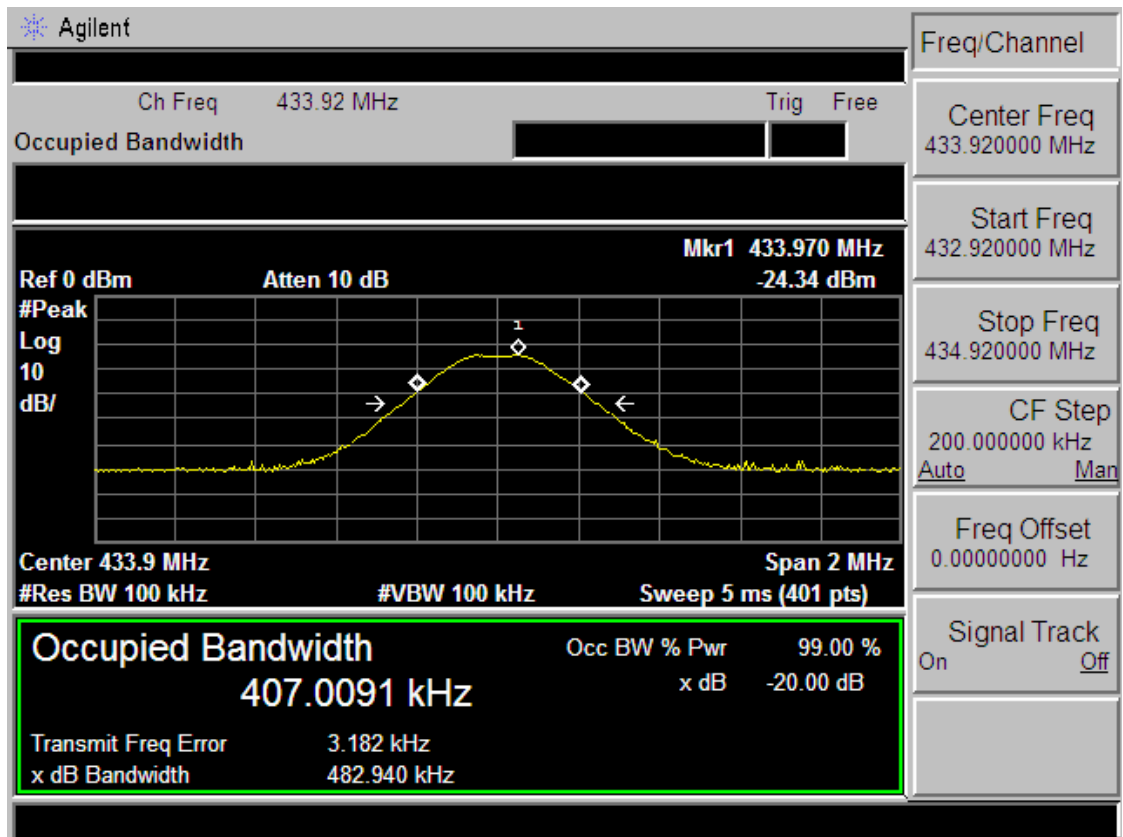
Test Data

EUT	:	Remote control	Temperature:	25.4°C
Model No.	:	RF-21-A	Humidity	: 55%
Test Mode	:	TX mode	Test Engineer	: Tony

Fundamental frequency (MHz)	Bandwidth Measurement (kHz)	Limit (kHz)	Result
433.92MHz	482.94kHz	1084.8 kHz	PASS

Note: Limit= Fundamental frequency \times 0.25%=433.92 \times 0.25%=787.5kHz

The test plots as following:



4.5. Deactivation time

4.5.1. 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.

4.5.2. 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=100kHz

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

4.5.3. Test Setup Diagram

Refer to clause 5.3.3

4.5.4. Test Result

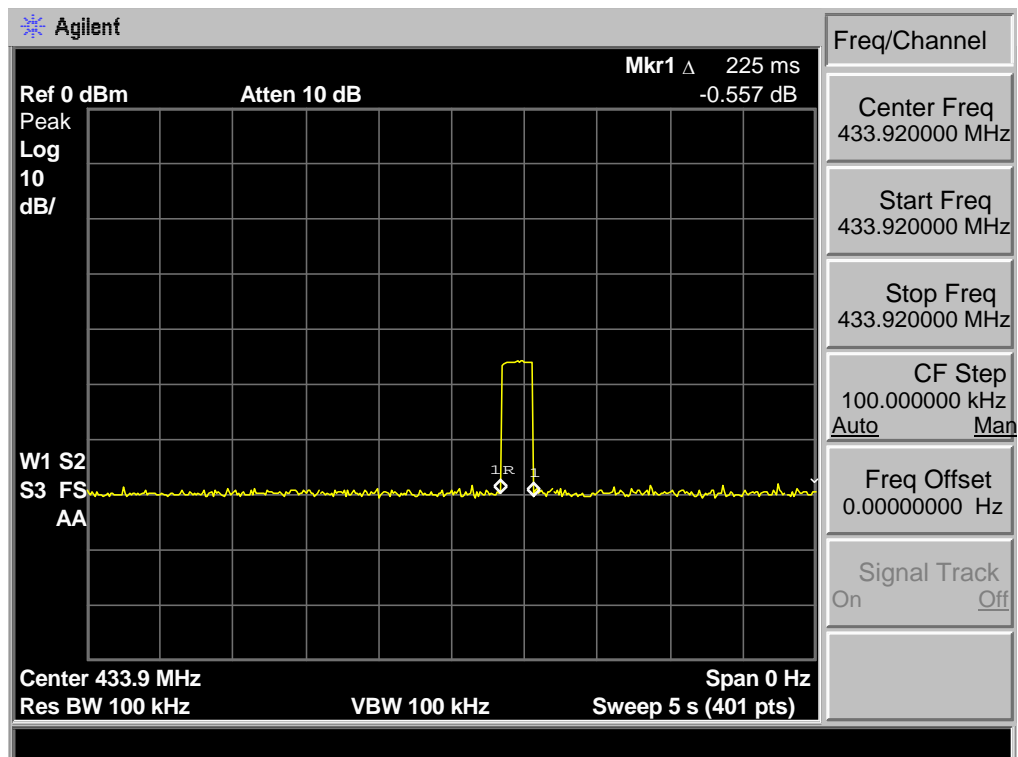
Pass.

Test Data

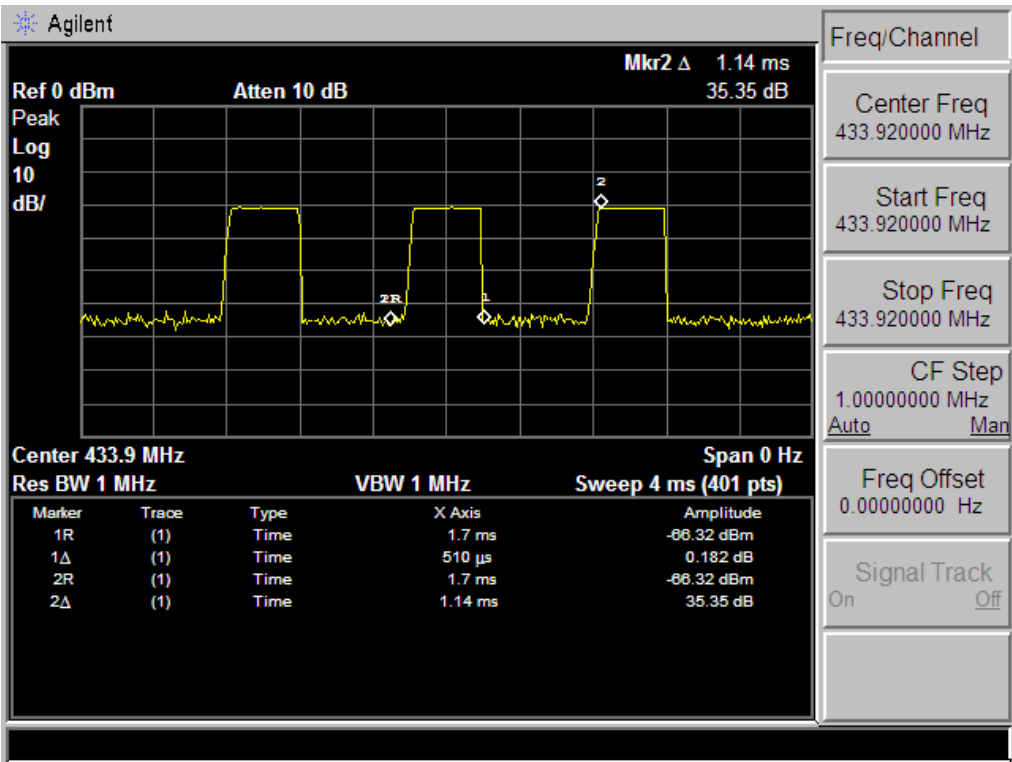
EUT	:	Remote control	Temperature:	25.4°C
Model No.	:	RF-21-A	Humidity	: 55%
Test Mode	:	TX mode	Test Engineer	: Tony

Fundamental frequency (MHz)	Transmission time (ms)	Limit (s)	Result
433.92MHz	225ms	5s	PASS

The test plots as following:



5. DUTY CYCLE CORRECTION FACTOR



Duty cycle= T ontime / T period=0.51ms / 1.14ms=0.447

PDCF=20*log(Duty cycle)=20*log(0.447)=-6.99

6. PHOTOGRAPHS OF TEST SET-UP

Figure 1

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

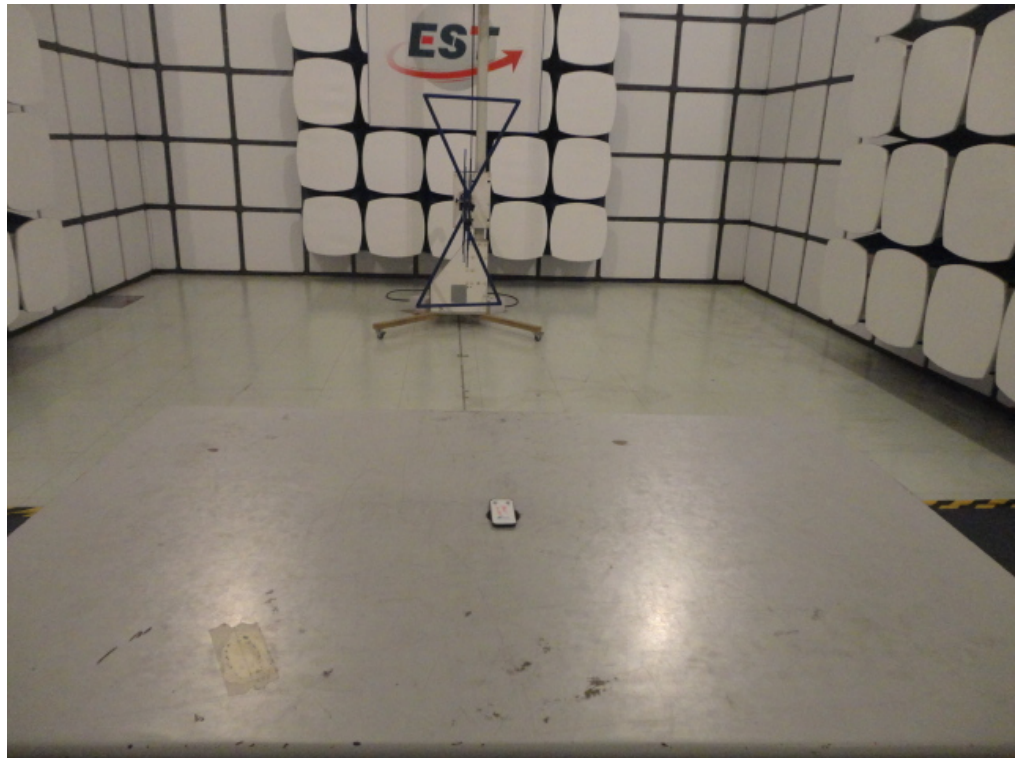


Figure 2

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



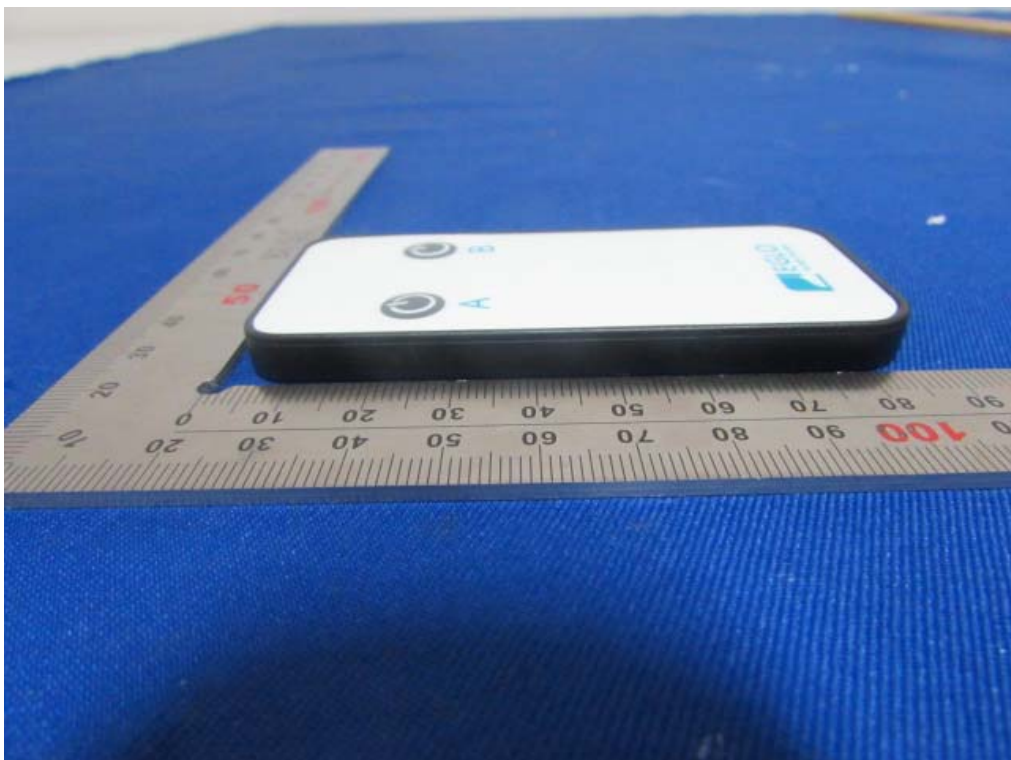
7. PHOTOGRAPHS OF THE EUT

External Photos

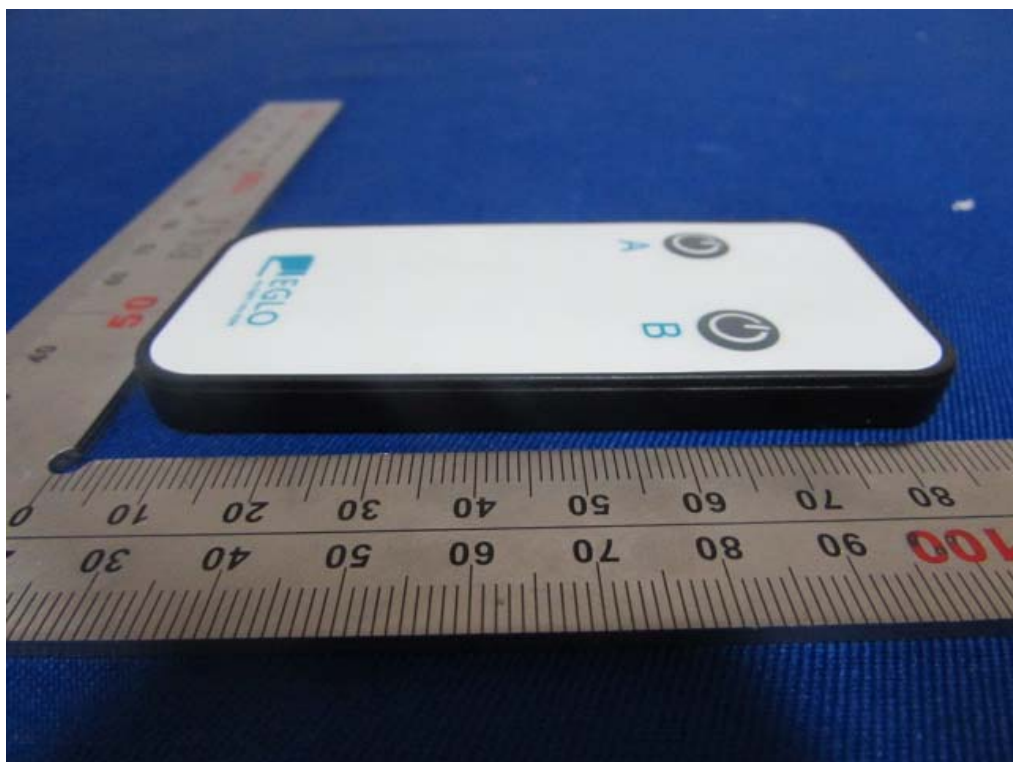
M/N: RF-21-A



External Photos
M/N: RF-21-A

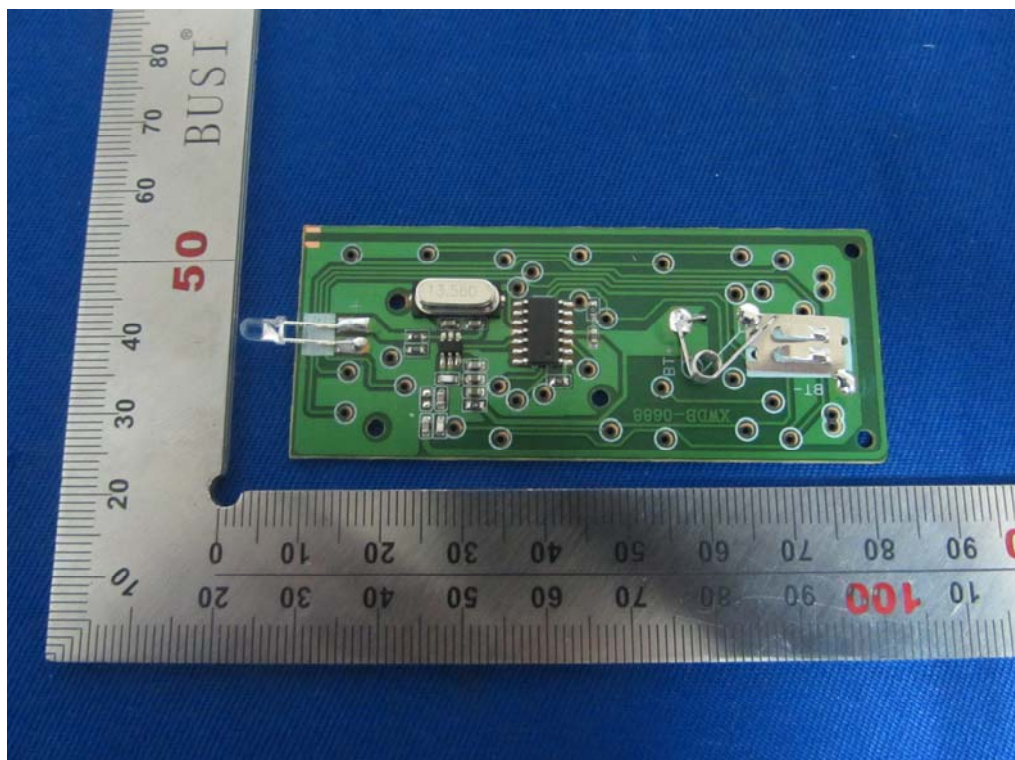
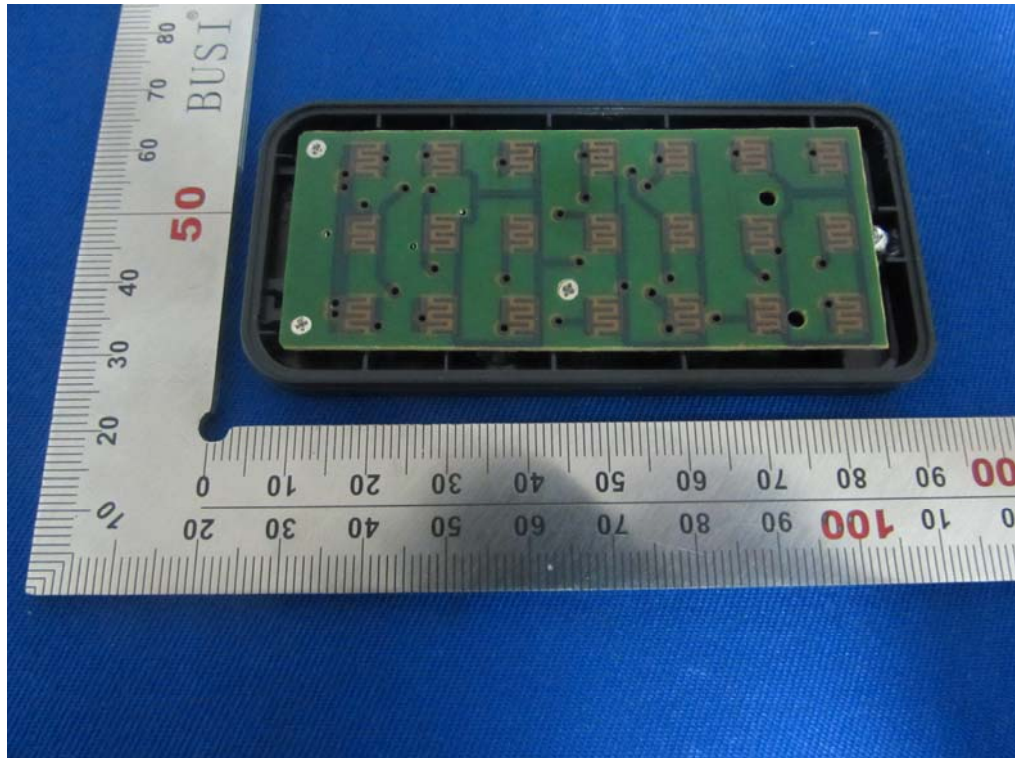


External Photos
M/N: RF-21-A



Internal Photos

M/N: RF-21-A



Internal Photos
M/N: RF-21-A

Antenna

