



FCC TEST REPORT

REPORT NO.: GLU-15SE0087VNTY-1

MODEL NO.: RC30x, RC20x

Where x in the model can be any number from 1 to 9.

RECEIVED: Oct. 14, 2015

ISSUED: Nov. 11, 2015

APPLICANT: GoldenSun Lighting Technology Co., Ltd.

ADDRESS: 3F, #2 Building, GoldenSun Park, 1303 Nanhuan Road, Quanzhou , China

MANUFACTURER: Quanzhou GoldenSun Solar Technic Co., Ltd.

ADDRESS: 1303 Nanhuan Road, Jiangnan Electronics High-Tech Park, Quanzhou 362000, China

ISSUED BY: BUREAU VERITAS ADT (Shanghai) Corporation

ADDRESS: 2F, Building C, No.1618, Yishan rd., 201103, Shanghai, China

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Table of Contents

1	CERTIFICATION	3
2	SUMMARY OF TEST RESULTS	4
2.1	MEASUREMENT UNCERTAINTY	4
3	GENERAL INFORMATION	5
3.1	GENERAL DESCRIPTION OF EUT	5
3.2	DESCRIPTION OF TEST MODES	6
3.3	GENERAL DESCRIPTION OF APPLIED STANDARDS	7
3.4	DESCRIPTION OF SUPPORT UNITS	7
4	EMISSION TEST	8
4.1	CONDUCTED EMISSION MEASUREMENT	8
4.1.1	LIMITS OF CONDUCTED EMISSION MEASUREMENT	8
4.1.2	TEST RESULTS	8
4.2	DEACTIVATION TIME	9
4.2.1	LIMITS OF DEACTIVATION TIME MEASUREMENT	9
4.2.2	TEST INSTRUMENTS	9
4.2.3	TEST PROCEDURES	9
4.2.4	DEVIATION FROM TEST STANDARD	9
4.2.5	TEST SETUP	9
4.2.6	TEST RESULTS	10
4.3	RADIATED EMISSION MEASUREMENT	11
4.3.1	LIMITS OF RADIATED EMISSION MEASUREMENT	11
4.3.2	TEST INSTRUMENTS	13
4.3.3	TEST PROCEDURE	14
4.3.4	DEVIATION FROM TEST STANDARD	14
4.3.5	TEST SETUP	15
4.3.6	EUT OPERATING CONDITIONS	16
4.3.7	TEST RESULTS	17
4.4	20DB OCCUPIED BANDWIDTH MEASUREMENT	22
4.4.1	LIMITS OF BAND EDGES MEASUREMENT	22
4.4.2	TEST INSTRUMENTS	22
4.4.3	TEST PROCEDURES	23
4.4.4	DEVIATION FROM TEST STANDARD	23
4.4.5	TEST SETUP	23
4.4.6	TEST RESULTS	24
5	PHOTOGRAPHS OF THE TEST CONFIGURATION	25
6	PHOTOGRAPHS OF THE EUT	27
7	APPENDIX - INFORMATION ON THE TESTING LABORATORY	29



1 CERTIFICATION

PRODUCT: Smart Remote Controller
MODEL NO.: RC30x, RC20x
Where x in the model can be any number from 1 to 9.
APPLICANT: GoldenSun Lighting Technology Co., Ltd.
MANUFACTURER: Quanzhou GoldenSun Solar Technic Co., Ltd.
TESTED: Oct. 14, 2015~ Nov. 11, 2015
STANDARDS: FCC Part 15: 2015,
Subpart C (Section 15.209 and 15.231),
ANSI C63.10-2013

We, BUREAU VERITAS ADT (Shanghai) Corporation, declare that the equipment above has been tested in our facility and found compliance with the requirement limits of applicable standards. The test record, data evaluation and Equipment Under Test (EUT) configurations represented herein are true and accurate under the standards herein specified.

PREPARED BY : Alex Du, **DATE:** Nov. 11, 2015
Alex DU
Testing Engineer

TECHNICAL ACCEPTANCE : Joy zhu, **DATE:** Nov. 11, 2015
Joy Zhu
Testing Manager

APPROVED BY : Y Zhao, **DATE:** Nov. 11, 2015
Zhaoqian YU
Lab Manager



2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
Standard Paragraph	Test Type	Result	Remarks
15.207	Conducted Emission Test	N/A	Please refer to 4.1.2.
15.231(a)	De-activation Time	PASS	Meet the requirement of limit
15.209 15.231(b)	Radiated Emission Test	PASS	Minimum passing margin is -10.928dB/AV at 433.974 MHz
15.231(c)	20dB Occupied Bandwidth Measurement	PASS	Meet the requirement of limit

2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4:

Measurement		Value
Conducted emissions		2.55 dB
Conducted emissions at telecom port		2.60 dB
Radiated emissions	30 MHz ~ 1GHz	3.22 dB
	Above 1GHz	2.89 dB



3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Smart Remote Controller
MODEL NO.	RC30x, RC20x Where x in the model can be any number from 1 to 9.
POWER SUPPLY	3.0V~3.4Vdc by battery
MODULATION TYPE	ASK
CARRIER FREQUENCY OF EACH CHANNEL	433.974MHz
NUMBER OF CHANNEL	1
ANTENNA TYPE	Soldered on PCB
DATA CABLE SUPPLIED	N/A
I/O PORTS	N/A

NOTE: 1.The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2. Where x in the model can be any number from 1 to 9. All models have the same PCB and electric constructions except different model names, control program and appearance(details see below). We choose the model RC301 as the representative model which has all functions to cover the other models.

Difference of models:

Model		Shell			Touch Panel
	x	Shape	Color	Material	Printing Color
RC20x RC30X	1	Arc-shaped	White	Plastic	Gray Scale
	2		White		16-bit Color
	3		White		256-bit Color
	4		White		Full Color
	5		Gray		16-bit Color
	6		Gray		256-bit Color
	7		Gray		Full Color
	8		Blue-Black		256-bit Color
	9		Blue-Black		Full Color



3.2 DESCRIPTION OF TEST MODES

Test Mode	Description
1	Make sure EUT work in the operation mode.

One channel is provided to this EUT:

Channel	Frequency
1	433.974MHz

TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

EUT configure mode	Applicable to				Description
	PLC	De-a T	RE	20dB OBM	
1	-	√	√	√	Continuously transmitting

Where PLC: Power Line Conducted Emission
RE: Radiated Emission

De-a T: De-activation Time
20dB OBM: 20dB Occupied Bandwidth Measurement

Radiated Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, and X.Y.Z. axis.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type	Axis
1	1	ASK	X



3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a remote switching. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

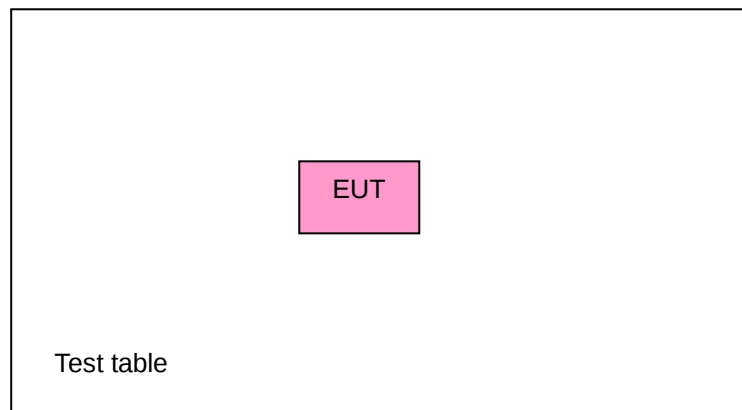
FCC Part 15, Subpart C. (15.231)

ANSI C63.10- 2013

All test items have been performed and recorded as per the above standards.

3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.



Note: When doing the test, fresh batteries were used.



4 EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY (MHz)	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

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

4.1.2 TEST RESULTS

Since the EUT is powered by battery, the report doesn't require for conduct emission test.



4.2 DEACTIVATION TIME

4.2.1 LIMITS OF DEACTIVATION TIME MEASUREMENT

TEST STANDARD:

FCC Part 15: 2015, Subpart C (Section: 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.

4.2.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Last Calibrated	Calibrated Until
Spectrum Analyzer ROHDE & SCHWARZ	FSP30	E1S1002	Aug. 16, 2015	Aug. 15, 2016
BILOG Antenna SCHWARZBECK	VULB9168	E1A1001	Mar. 27, 2015	Mar. 26, 2017

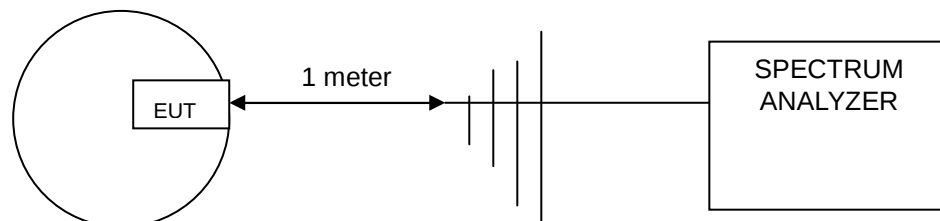
4.2.3 TEST PROCEDURES

- 1 The EUT was placed on the turning table.
- 2 The signal was coupled to the spectrum analyzer through an antenna.
- 3 The transmission duration was measured and recorded.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

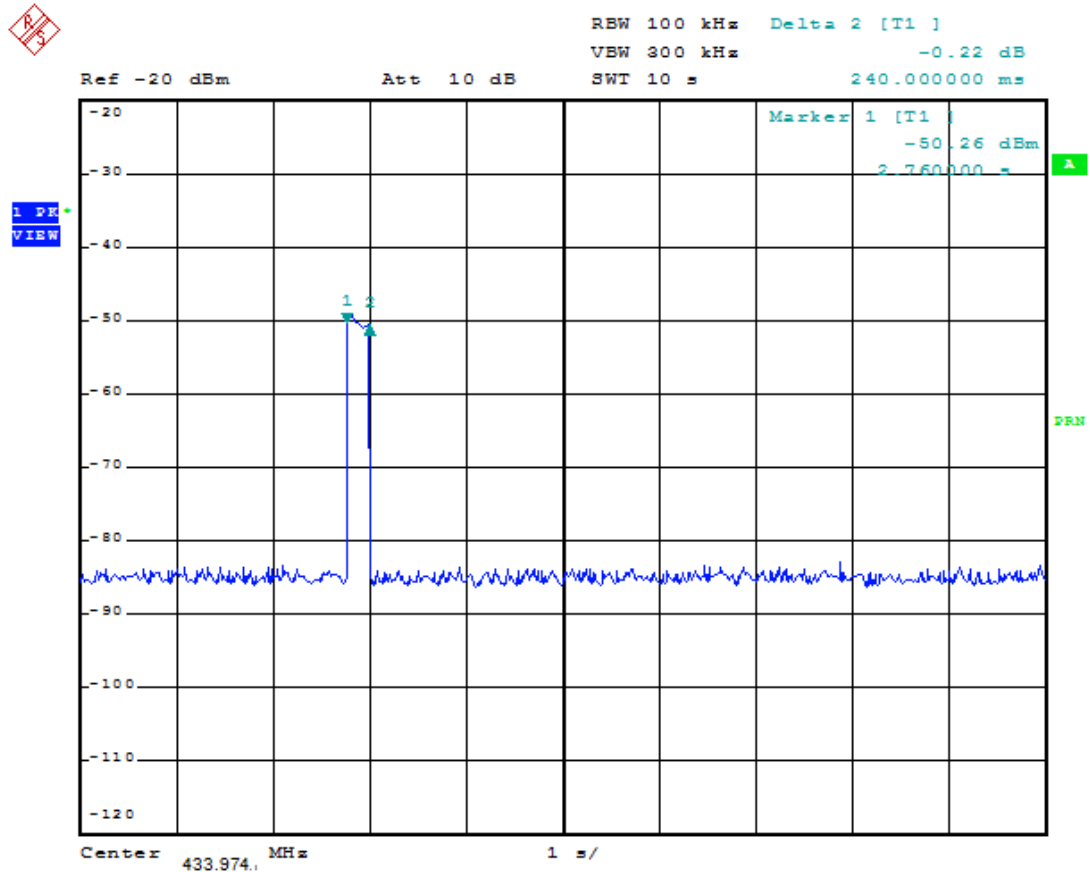
4.2.5 TEST SETUP





4.2.6 TEST RESULTS

Frequency (MHz)	Transmission duration	Maximum limit (sec)	Pass / Fail
433.974	240ms	5	Pass





4.3 RADIATED EMISSION MEASUREMENT

4.3.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD:

FCC Part 15: 2015, Subpart C (Section: 15.205)

FCC Part 15: 2015, Subpart C (Section: 15.209)

FCC Part 15: 2015, Subpart C (Section: 15.231(b))

According to 15.231 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	uV/meter	dBuV/meter	uV/meter	dBuV/meter
40.66 – 40.70	2250	67.04	225	48.04
70 – 130	1250	61.94	125	41.94
130 – 174	1250 to 3750	61.94 to 71.48	125 to 375	41.94 to 51.48
174 – 260	3750	71.48	75	37.50
260 – 470	3750 to 12500	71.48 to 81.94	375 to 1250	51.48 to 61.94
Above 470	12500	81.94	1250	61.94

NOTE:

- (1) Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, uV/m at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
- (2) The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.



Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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

As shown in 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.

FREQUENCY RANGE OF RADIATED MEASUREMENT

(For intentional radiators)

If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.



4.3.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Last Calibrated	Calibrated Until
Test Receiver ROHDE & SCHWARZ	ESCS30	E1R1001	Apr. 10, 2015	Apr. 09, 2016
BILOG Antenna SCHWARZBECK	VULB9168	E1A1001	Mar. 27, 2015	Mar. 26, 2017
Preamplifier Agilent	8447D	E1A2001	Apr. 10, 2015	Apr. 09, 2016
Preamplifier Agilent	8449B	E1A2002	Apr. 10, 2015	Apr. 09, 2016
Double Ridged Broadband Horn Antenna Schwarzbeck	BBHA 9120D	E1A1002	Sep. 09, 2015	Sep. 08, 2016
*Spectrum Analyzer Agilent	E4403B	E1S1001	Aug. 15, 2015	Aug. 14, 2016
*Spectrum Analyzer ROHDE & SCHWARZ	FSP30	E1S1002	Aug. 10, 2015	Aug. 09, 2016
Software ADT	ADT_Radiated_ V7.5	N/A	N/A	N/A

- NOTE:**
1. "*" = These equipment are used for the final measurement.
 2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 3. The Spectrum Analyzer (model: FSP30) is used only for the measurement of emission frequency above 1GHz if tested.



4.3.3 TEST PROCEDURE

- a. When tested from 30MHz to 1000MHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. When tested above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection (PK) at frequency above 1GHz.

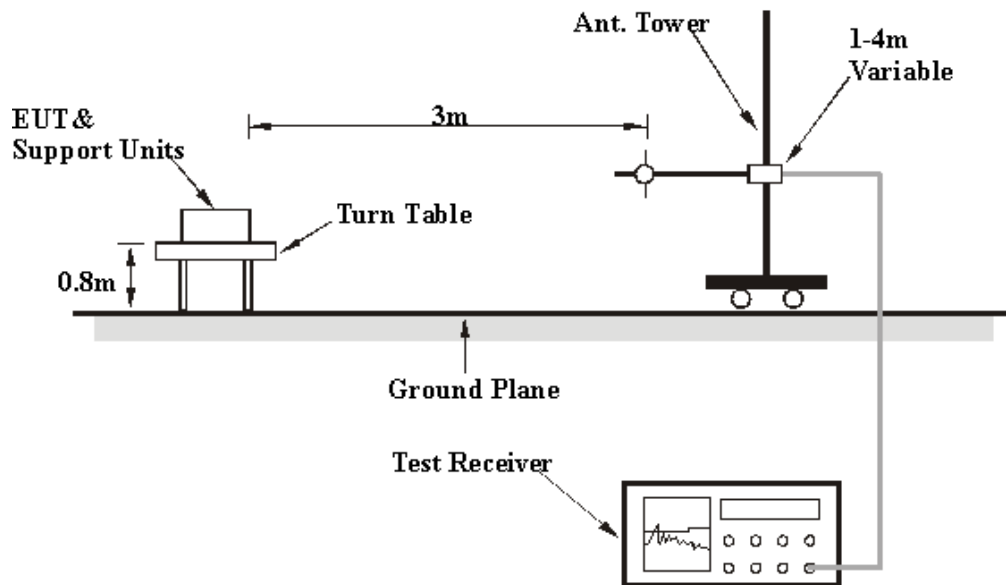
4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

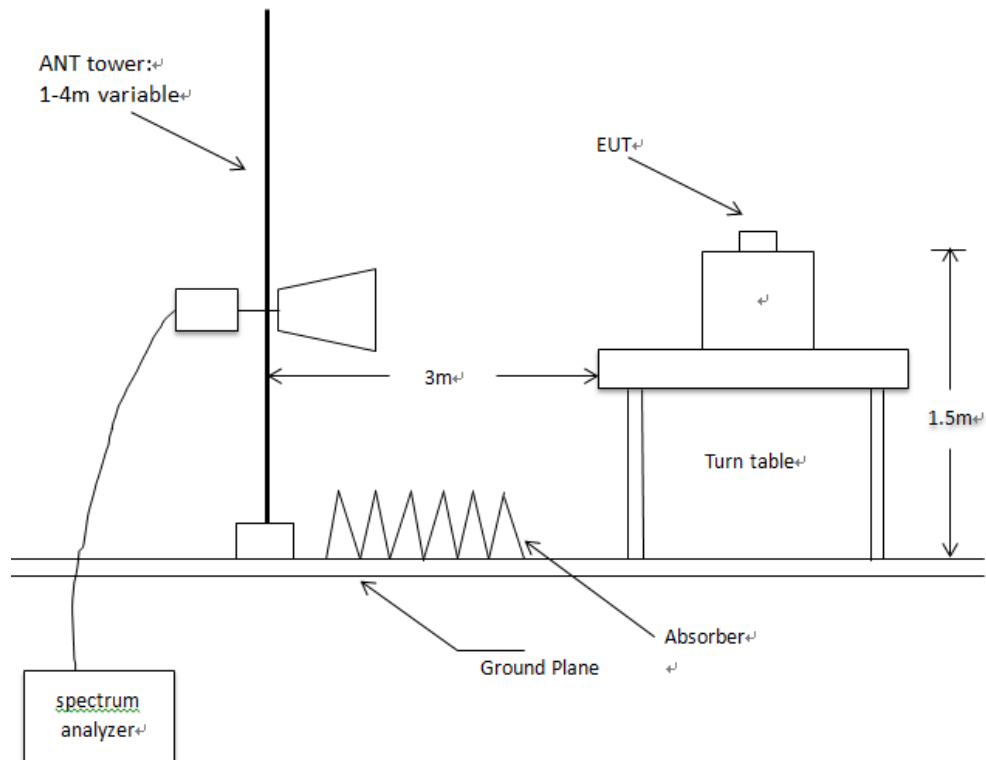


4.3.5 TEST SETUP

Test from 80MHz to 1000MHz



Test from 1GHz above



For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.



4.3.6 EUT OPERATING CONDITIONS

Settic channel frequency. the transmitter part of EUT under transmission condition continuously at specific channel frequency.



4.3.7 TEST RESULTS

Below 1GHz Worst-Case Data

EUT	Smart Remote Controller	MODEL NO.	RC301
CHANNEL	Channel 1	FREQUENCY RANGE	30 ~ 1000 MHz
MODULATION TYPE	ASK	INPUT POWER (SYSTEM)	3Vdc by battery
ENVIRONMENTAL CONDITIONS	23 deg. C, 53% RH, 101kPa	DETECTOR FUNCTION	Quasi-Peak/Peak/Average
TESTED BY	Alex DU		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Factor (dB/M)	Reading (dBuV/M)	Emission (dBuV/M)	Limit (dBuV/M)	Margin (dB)	Ant. Height (cm)	Table Angle (Deg.)
1	350.10 QP	15.78	7.7	23.48	46	-22.52	100	257
2*	433.974 PK	18.29	61.97	80.26	100.8	-20.54	--	--
2*	433.974 AV	--	--	69.872	80.8	-10.928	--	--
3	556.23 QP	21.24	5.71	26.95	46	-19.05	100	126
4	641.1 QP	23.08	5.79	28.87	46	-17.13	100	256
5	768.62 QP	25.54	6.03	31.57	46	-14.43	100	48
6	867.948 PK	26.6	10.96	37.56	80.8	-43.24	--	--
6	867.948 AV	--	--	27.172	60.8	-33.628	--	--



ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Factor (dB/M)	Reading (dBuV/M)	Emission (dBuV/M)	Limit (dBuV/M)	Margin (dB)	Ant. Height (cm)	Table Angle (Deg.)
1	291.90 QP	14.23	6.92	21.15	46	-24.85	199	34
2*	433.974 PK	18.29	54.72	73.01	100.8	-27.79	--	--
2*	433.974 AV	--	--	62.642	80.8	-18.158	--	--
3	556.23 QP	21.24	5.73	26.97	46	-19.03	199	45
4	679.90 QP	23.67	5.59	29.26	46	-16.74	156	56
5	786.60 QP	25.89	6.28	32.17	46	-13.83	204	36
6	867.948 PK	26.6	10.48	37.08	80.8	-43.72	--	--
6	867.948 AV	--	--	26.692	60.8	-34.108	--	--

NOTE:

1. Emission level (dBuV/m) = Reading (dBuV/m) + Factor (dB/m)
2. Correction Factor (dB) = Antenna Factor (dB) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. "*" = Fundamental frequency
6. The average value of fundamental frequency and spurious emission is:

Average = Peak value + 20log(Duty cycle)

Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log \frac{(0.36 \times 24 + 0.9 \times 24)\text{ms}}{100\text{ms}} = -10.388\text{dB}$$

please see page 19,20 for plotted duty



Above 1GHz Worst-Case Data

EUT	Smart Remote Controller	MODEL NO.	RC301
CHANNEL	Channel 1	FREQUENCY RANGE	1 GHz~5 GHz
MODULATION TYPE	ASK	INPUT POWER (SYSTEM)	3Vdc by battery
ENVIRONMENTAL CONDITIONS	23 deg. C, 53% RH, 1000 hPa	DETECTOR FUNCTION	Peak/Average
TESTED BY	Alex DU		

Frequency(MHz)		PK Emission (dBuV/m)	PK limit (dBuV/m)	PK margin (dBuV/m)	AV EMISSION	AV LIMIT	AV MARGIN
1301.92	H	40.29	74	-33.71	29.902	54	-24.098
	V	39.94	74	-34.06	29.552	54	-24.448
1735.87	H	39.67	74	-34.33	29.282	54	-24.718
	V	39.85	74	-34.15	29.462	54	-24.538
2169.87	H	44.13	74	-29.87	33.742	54	-20.258
	V	43.5	74	-30.5	33.112	54	-20.888
2603.84	H	42.49	74	-31.51	32.102	54	-21.898
	V	43.62	74	-30.38	33.232	54	-20.768
3037.18	H	42.94	74	-31.06	32.552	54	-21.448
	V	43.43	74	-30.57	33.042	54	-20.958
3471.79	H	43.98	74	-30.02	33.592	54	-20.408
	V	44.72	74	-29.28	34.332	54	-19.668
3905.77	H	45	74	-29	34.612	54	-19.388
	V	45	74	-29	34.612	54	-19.388
4339.74	H	45.16	74	-28.84	34.772	54	-19.228
	V	46.56	74	-27.44	36.172	54	-17.828

NOTE:

1. Emission level (dBuV/m) = Reading (dBuV/m) + Factor (dB/m)
2. Correction Factor (dB) = Antenna Factor (dB) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “*” = Fundamental frequency
6. The average value of fundamental frequency and spurious emission is:

Average = Peak value + 20log(Duty cycle)

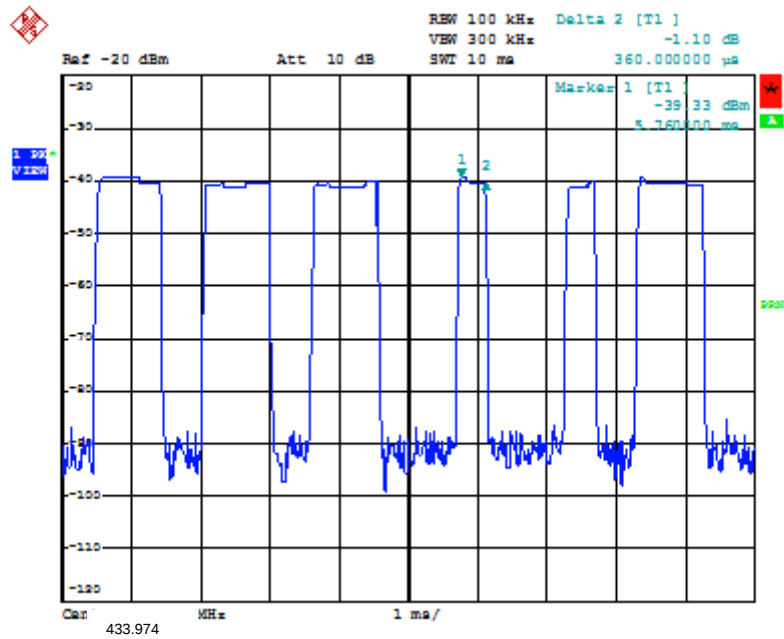
Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log \frac{(0.36 \times 24 + 0.9 \times 24)\text{ms}}{100\text{ms}} = -10.388\text{dB}$$

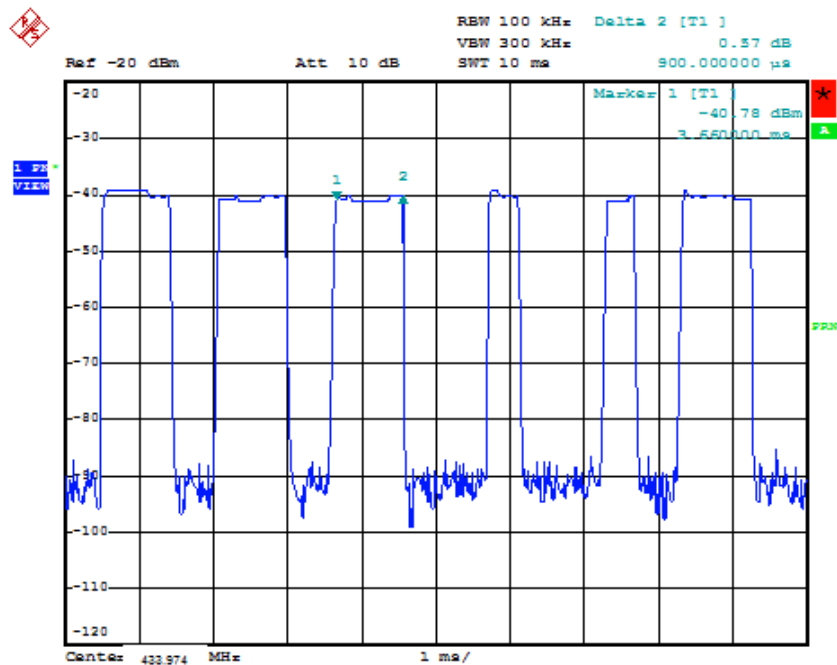
please see page 19,20 for plotted duty



10ms-1

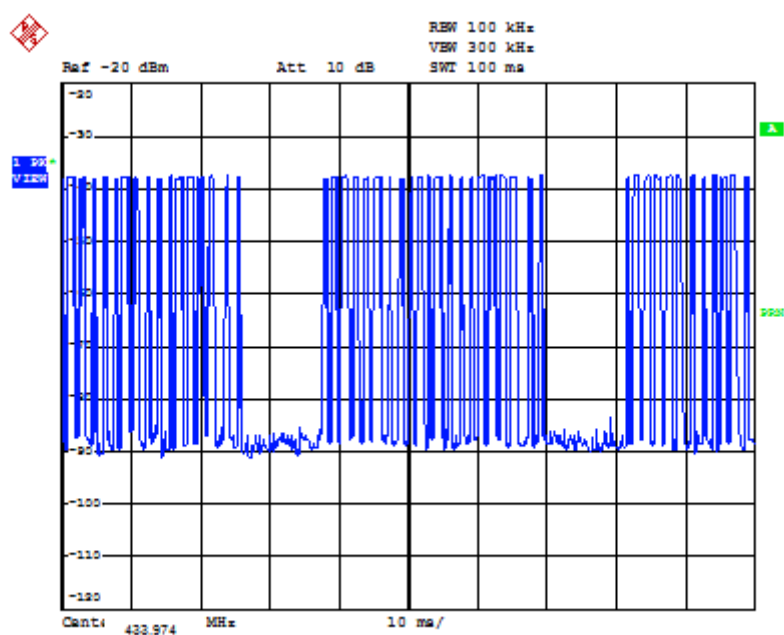


10ms-2





100ms





4.4 20DB OCCUPIED BANDWIDTH MEASUREMENT

4.4.1 LIMITS OF BAND EDGES MEASUREMENT

TEST STANDARD:

FCC Part 15: 2011, Subpart C (Section: 15.231(C))

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and below 900 MHz.

Fundamental Frequency (MHz)	Limit of 20 dB Bandwidth(kHz)
433.974	1084.8

4.4.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Last Calibrated	Calibrated Until
Spectrum Analyzer ROHDE & SCHWARZ	FSP30	E1S1002	Aug. 16, 2015	Aug. 15, 2016
BILOG Antenna SCHWARZBECK	VULB9168	E1A1001	Mar. 27, 2015	Mar. 26, 2017

NOTE: The calibration interval of the above test instruments is 12 months.



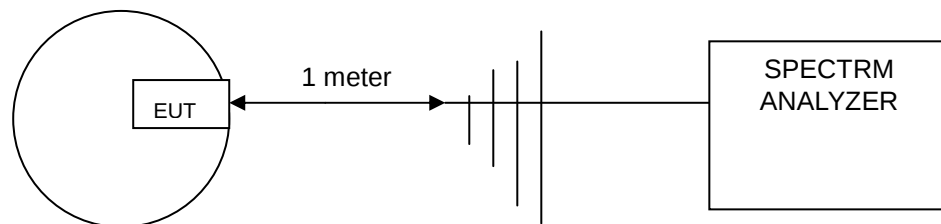
4.4.3 TEST PROCEDURES

1. The EUT was placed on the turning table.
2. The signal was coupled to the spectrum analyzer through an antenna.
3. Set the resolution bandwidth to 100 kHz and video bandwidth to 300 kHz then select Peak function to scan the channel frequency.
4. The 20dB bandwidth was measured and recorded.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

4.4.5 TEST SETUP

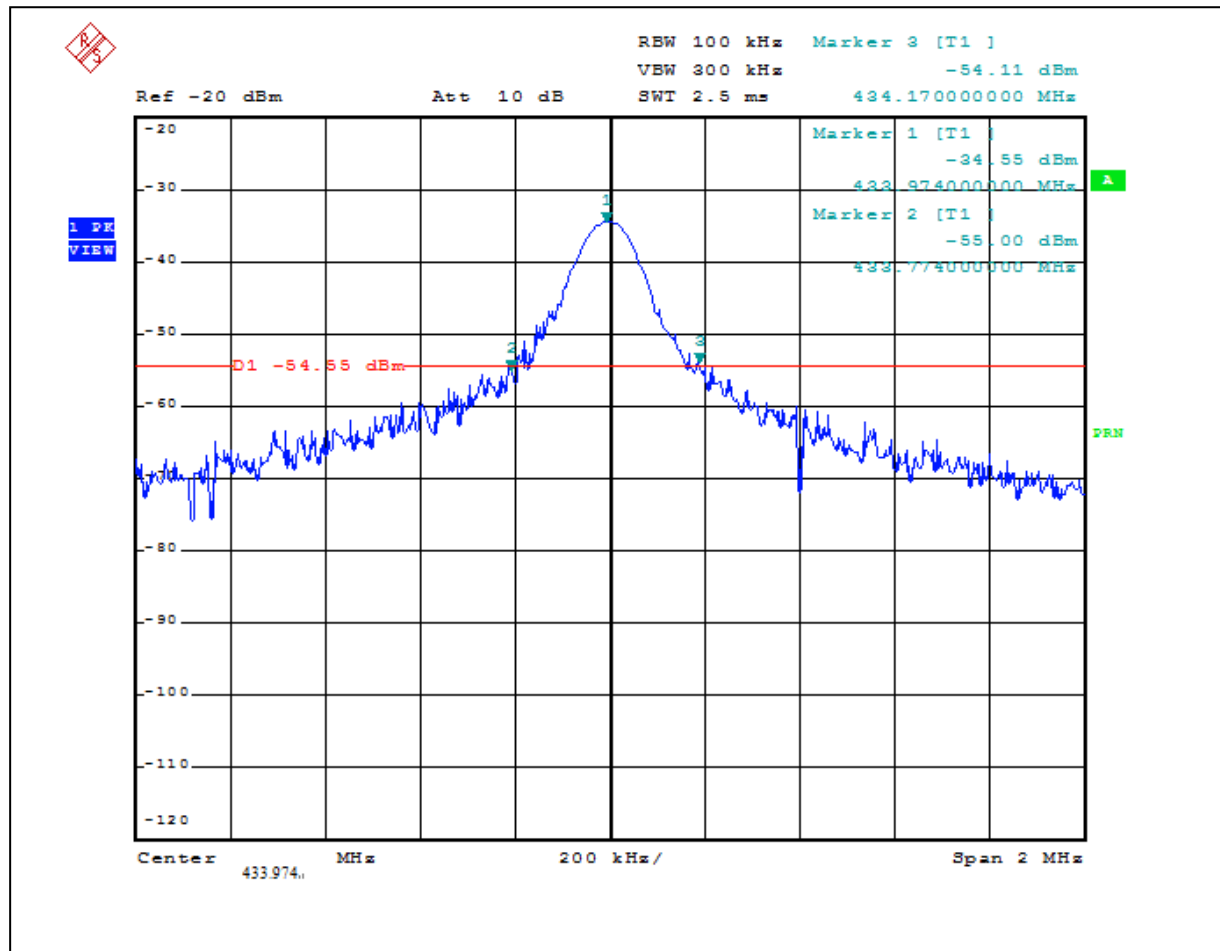




4.4.6 TEST RESULTS

Frequency (MHz)	20 dB bandwidth (kHz)	Maximum limit (kHz)	Pass / Fail
433.974	395.6	1084.8	Pass

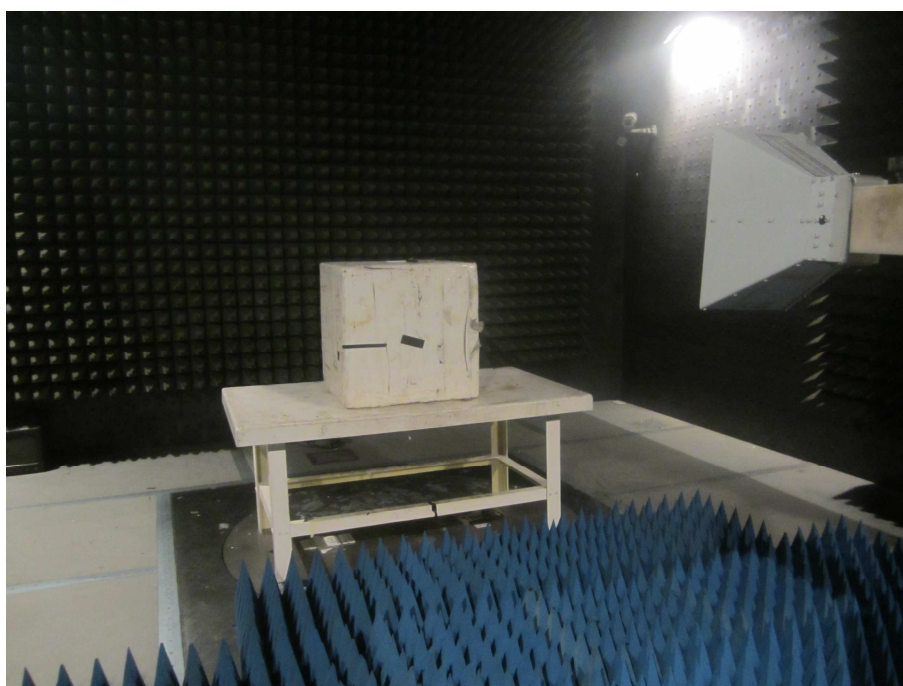
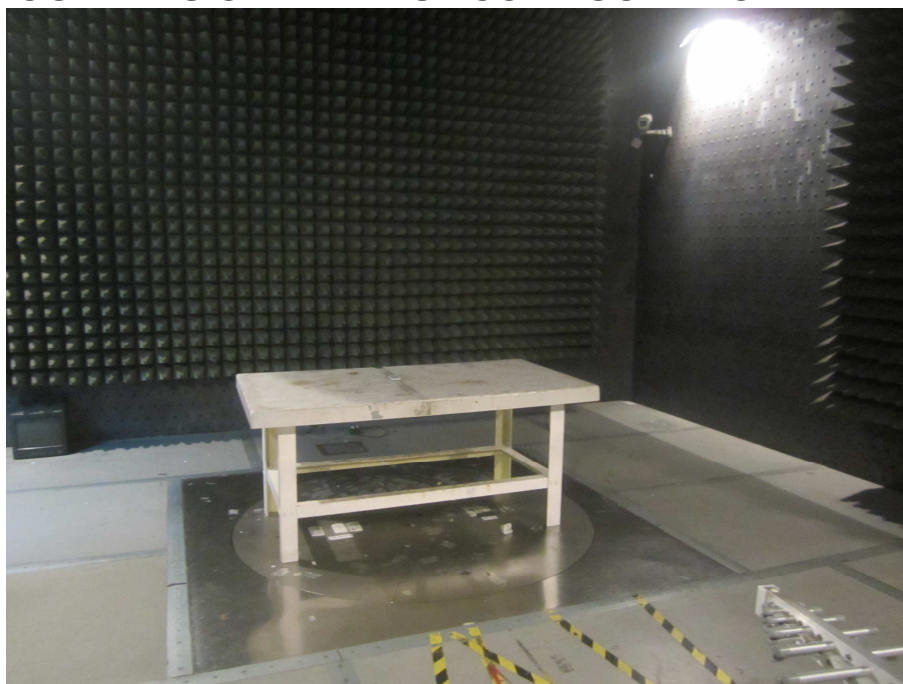
The plot of test result is attached as below.



Note:

20 dB bandwidth=(Marker 3 - Marker 2)= 434.170MHz-433.774MHz=395.6kHz

5 PHOTOGRAPHS OF THE TEST CONFIGURATION





6 PHOTOGRAPHS OF THE EUT

For appearance of Model RC301



For appearance of Model RC201





NOTE: The red line is antenna position.



7 APPENDIX - INFORMATION ON THE TESTING LABORATORY

We, BUREAU VERITAS ADT (Shanghai) Corporation, were founded in 2004 to provide our best service in EMC, Radio and Vehicle consultation. Our laboratories are accredited by the following accreditation bodies according to ISO/IEC 17025 (2005) .

USA	A2LA Certificate No.: 2343.01
China	CNAS Certificate No.: L2810

Copies of accreditation certificates could be inquired from our office. If you have any comments, please feel free to contact us at the following:

EMC / RF / Vehicle Lab:

Tel: +86 21 6465 9091

Fax: +86 21 6465 9092

Email: [bvadtshmail@cn.bureauveritas.com](mailto:bvadts@mail@cn.bureauveritas.com)

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