

FCC Part 15C Measurement and Test Report

For

Hangzhou Gubei Electronics Technology Co., Ltd.

Room106, No.1 Building, No.611 Jianghong Road, Binjiang, Hangzhou,

Zhejiang, China

FCC ID: 2ACDZ-RMPRO

FCC Rule(s):	<u>FCC Part 15.231</u>	
Product Description:	<u>Universal Remote</u>	
Tested Model:	<u>RM pro</u>	
Report No.:	<u>STR17048111I-2</u>	
Tested Date:	<u>2017-06-12 to 2017-07-04</u>	
Issued Date:	<u>2017-07-05</u>	
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Hangzhou Gubei Electronics Technology Co., Ltd.
Address of applicant: Room106, No.1 Building, No.611 Jianghong Road,
Binjiang, Hangzhou, Zhejiang, China

Manufacturer: Hangzhou Gubei Electronics Technology Co., Ltd.
Address of manufacturer: Room106, No.1 Building, No.611 Jianghong Road,
Binjiang, Hangzhou, Zhejiang, China

General Description of EUT	
Product Name:	Universal Remote
Trade Name:	BroadLink
Model No.:	RM pro
Adding Model(s):	RM 3, RM 3+, RM pro+, RM home, RM home+, RM pro B
Rated Voltage:	DC 5V
Power Adaptor :	Model: KA25-0501000US
	Input: 100-240V 50/60Hz 0.25A, Output: 5V, 1000mA
Software Version:	42
Hardware Version:	RM3_MW300 V3.3
<i>Note: The test data is gathered from a production sample provided by the manufacturer. The appearance of others models listed in the report is different from main-test model RM pro, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	315.00MHz, 433.92 MHz
Max. Field Strength:	433.92MHz: 86.35dBuV/m(3m)
	315.00MHz: 81.64dBuV/m(3m)
Data Rate:	/
Modulation: ASK	
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi
Lowest Internal Frequency:	30MHz

1.2 Test Standards

The following report is prepared on behalf of the Hangzhou Gubei Electronics Technology Co., Ltd. in accordance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, 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 40 GHz.

1.4 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

1.5 EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	With modulation(433.92MHz, 315.00MHz)

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB Cable	1.0	Shielded	Without Ferrite

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Transmission Time	Conducted	$\pm 5\%$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-12	2018-06-11
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-12	2018-06-11
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-12	2018-06-11
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-12	2018-06-11
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.209	Radiated Spurious Emissions	Compliant
§15.231(a)	Deactivation Testing	Compliant
§15.231(b)	Radiated Emissions	Compliant
§15.231(c)	20dB Bandwidth Testing	Compliant

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 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.

3.2 Test Result

This product has a permanent antenna, fulfill the requirement of this section.

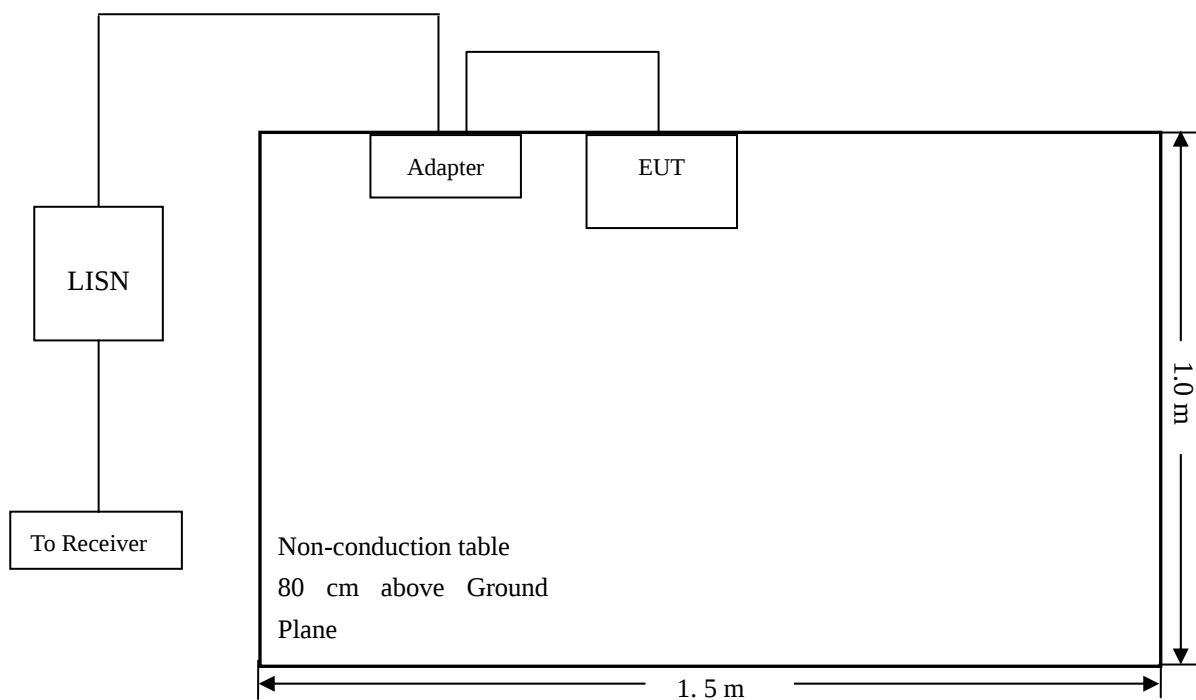
4. Conducted Emissions

4.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

4.2 Basic Test Setup Block Diagram



4.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

4.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth 9 kHz

Quasi-Peak Adapter Mode Normal

4.5 Summary of Test Results/Plots

According to the data in section 4.7, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

-10.82 dB at **0.1780 MHz** in the **Line** mode, **QP** detector, 0.15-30MHz

4.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

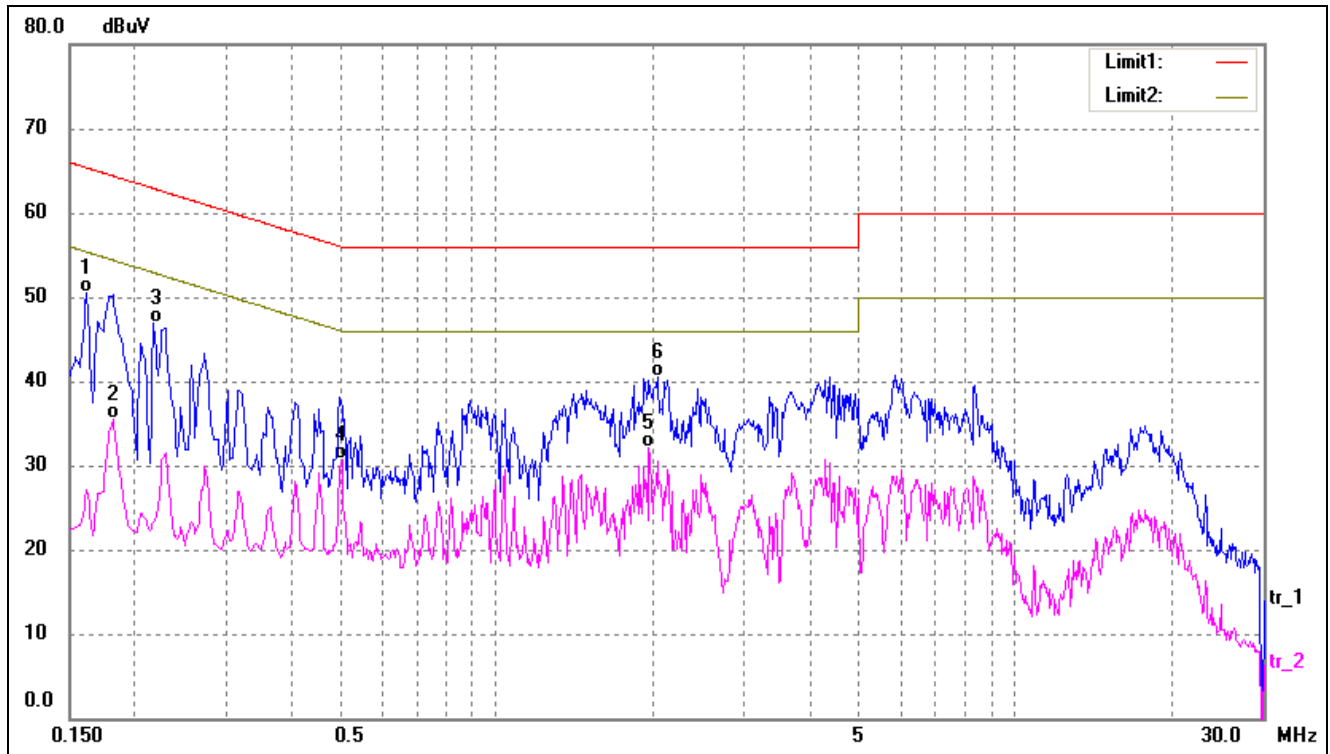
EUT: Universal Remote

Tested Model: RM pro

Operating Condition: SRD Transmitting

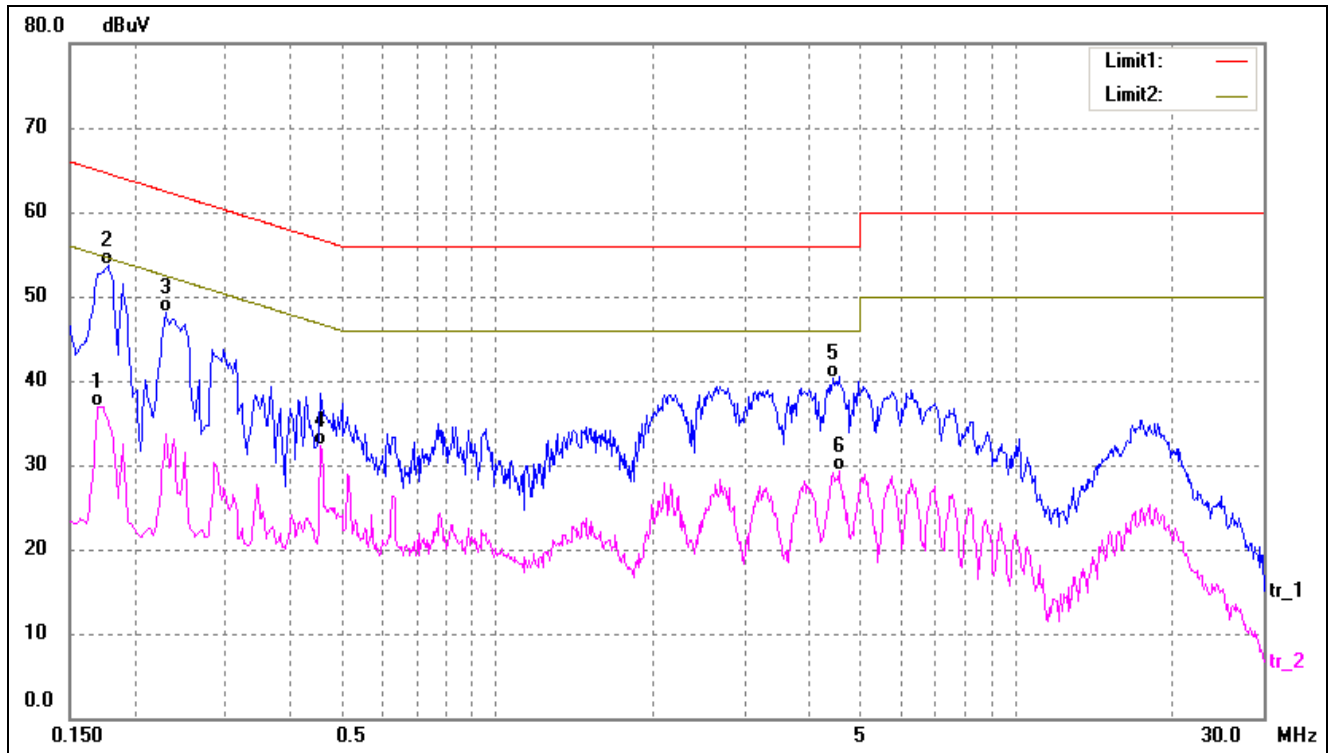
Comment: AC 120V/60Hz, USB 5V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1620	40.76	9.84	50.60	65.36	-14.76	QP
2	0.1820	25.65	9.82	35.47	54.39	-18.92	AVG
3	0.2180	37.05	9.80	46.85	62.89	-16.04	QP
4	0.5020	20.93	9.80	30.73	46.00	-15.27	AVG
5*	1.9660	22.42	9.74	32.16	46.00	-13.84	AVG
6	2.0420	30.76	9.73	40.49	56.00	-15.51	QP

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1700	27.05	9.83	36.88	54.96	-18.08	AVG
2*	0.1780	43.94	9.82	53.76	64.58	-10.82	QP
3	0.2300	38.22	9.80	48.02	62.45	-14.43	QP
4	0.4580	22.53	9.80	32.33	46.73	-14.40	AVG
5	4.4420	30.59	9.67	40.26	56.00	-15.74	QP
6	4.5620	19.66	9.67	29.33	46.00	-16.67	AVG

5. Radiated Emissions

5.1 Standard Applicable

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

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

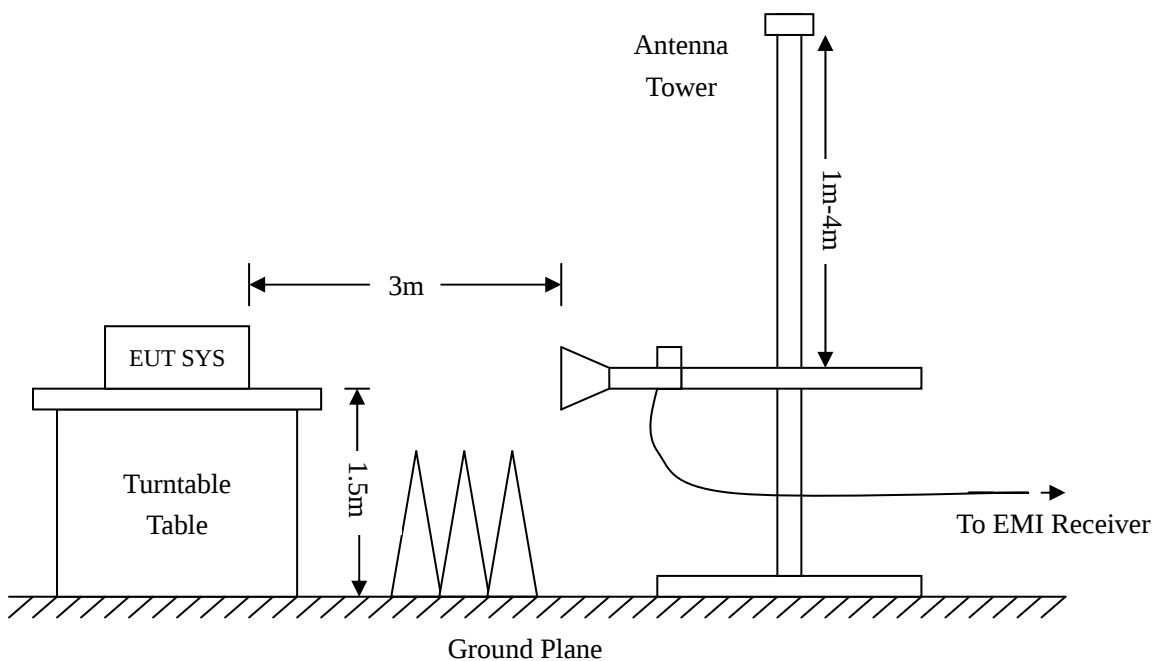
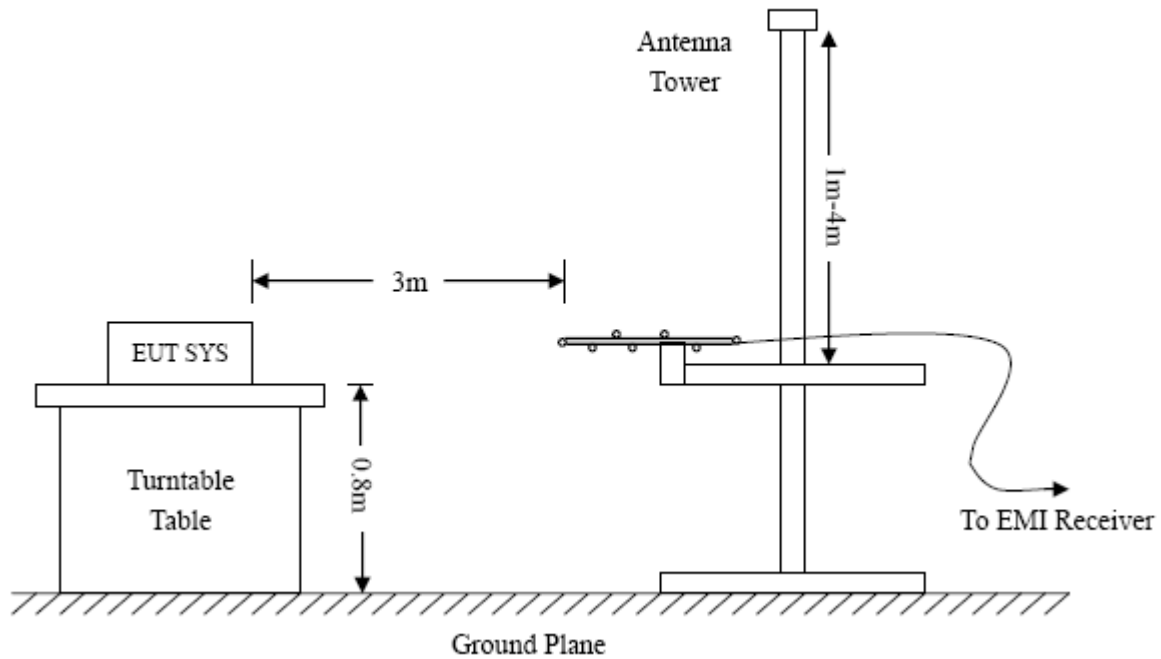
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

5.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.231(b) and FCC Part 15.209 Limit.



5.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Loss} + \text{Cab. Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

5.4 Environmental Conditions

Temperature:	21° C
Relative Humidity:	50%
ATM Pressure:	1011 mbar

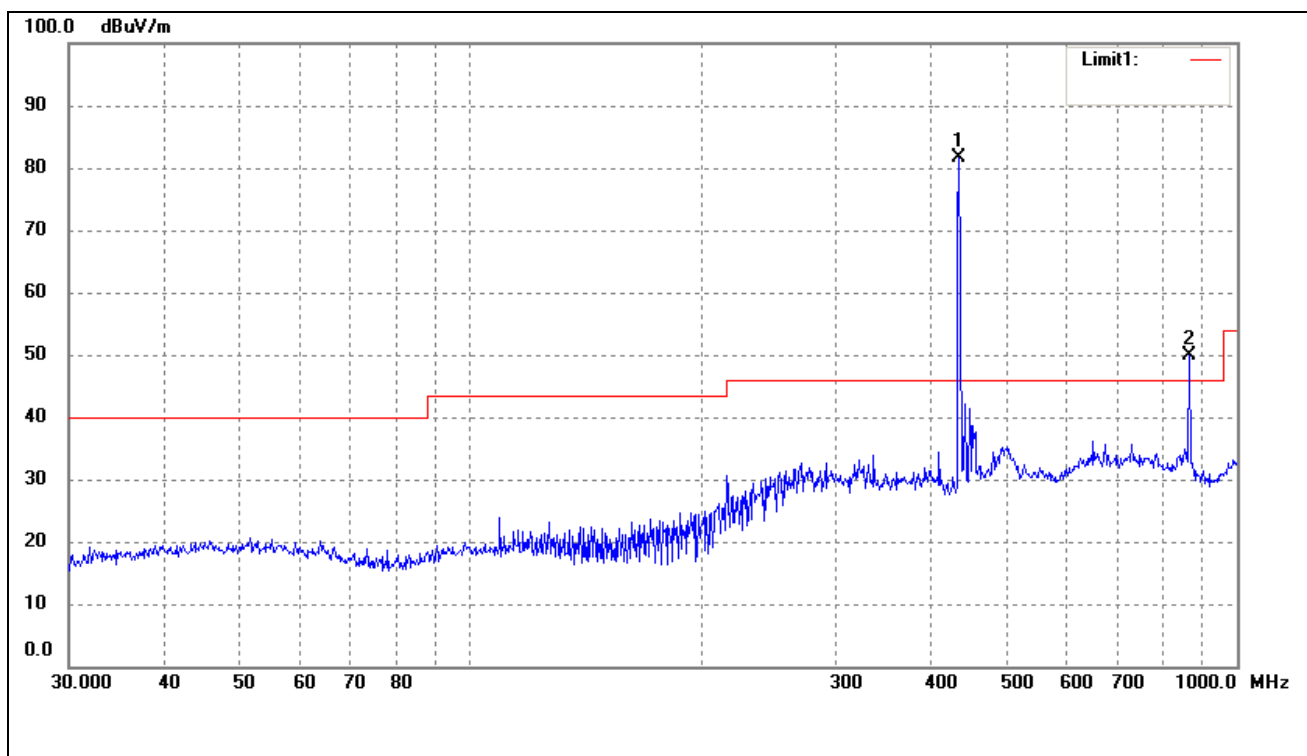
5.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.231 standards, and had the worst margin of:

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Plot of Radiated Emissions Test Data

EUT: Universal Remote
Tested Model: RM pro
Operating Condition: SRD Transmitting(433.92MHz)
Comment: AC 120V/60Hz, USB 5V
Test Specification: Horizontal

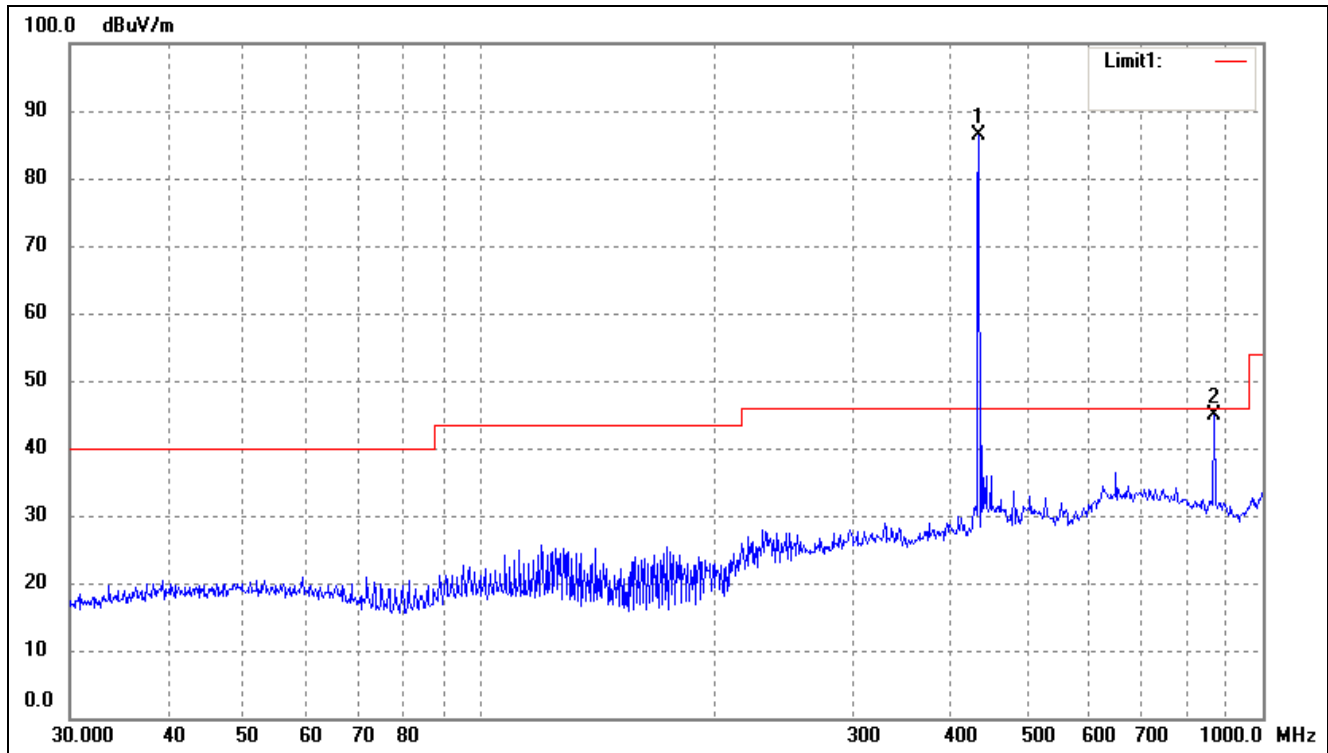


No.	Frequency MHz	Reading dBuV/m	Corr. Factor(dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. (°)	Height (cm)	Remark
2	434.0650	79.28	12.31	N/A	81.59	100.82	-19.23	33	100	peak
	434.0650	/	/	-10.33	71.26	80.82	-9.56	33	100	Ave
2	866.0878	34.14	15.86	N/A	50.00	80.82	-30.82	162	100	peak
	867.8401	/	/	-10.33	39.67	60.82	-21.15	162	100	Ave

Above 1GHz

No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. (°)	Height (cm)	Remark
1	1302.30	27.31	26.95	N/A	53.84	74.00	-20.16	45	100	Peak
	1302.30	/	/	-10.33	43.51	54.00	-10.49	321	100	Ave
2	1736.40	27.64	27.77	N/A	50.07	74.00	-23.93	231	100	Peak
	1736.40	/	/	-10.33	39.74	54.00	-14.26	32	100	Ave

Test Specification: Vertical



No.	Frequency MHz	Reading dBuV/m	Corr. Factor(dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. (°)	Height (cm)	Remark
2	434.0650	79.28	12.31	N/A	86.35	100.82	-14.47	71	100	peak
	434.0650	/	/	-10.33	76.02	80.82	-4.80	12	100	Ave
2	866.0878	34.14	15.86	N/A	44.80	80.82	-36.02	32	100	peak
	866.0878	/	/	-10.33	34.47	60.82	-26.35	114	100	Ave

Above 1GHz

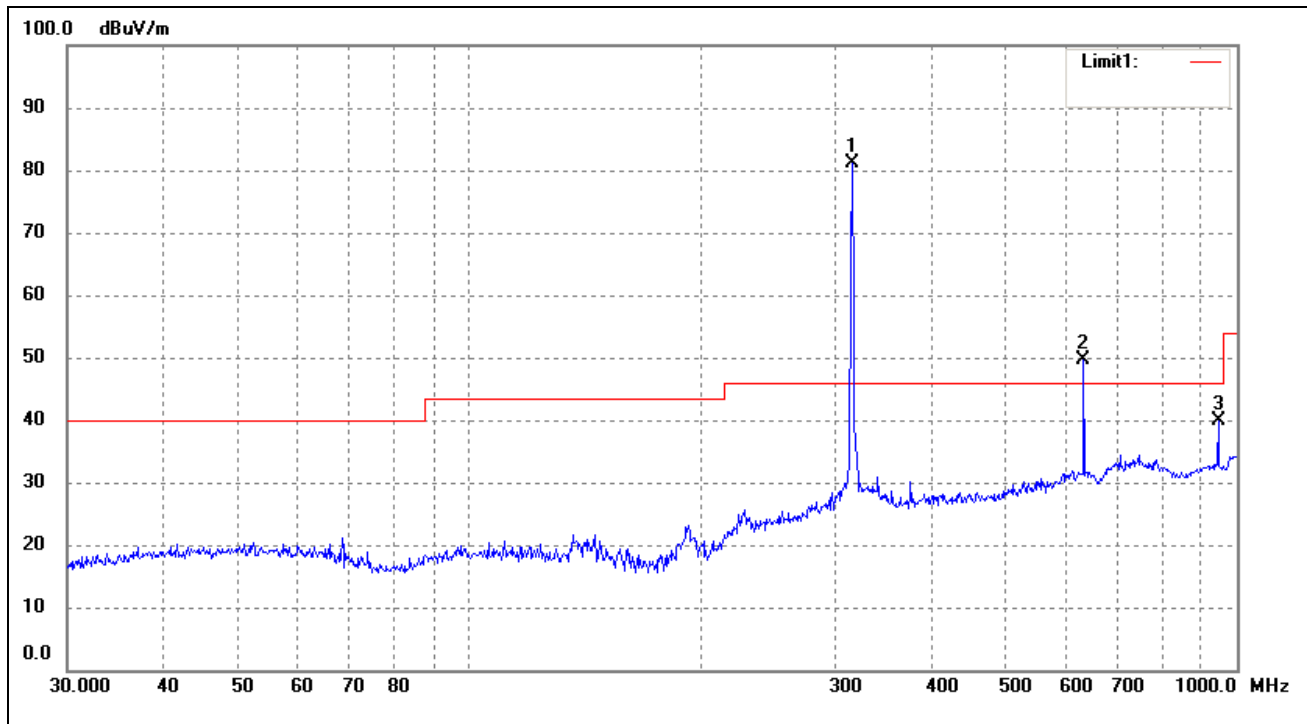
No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. (°)	Height (cm)	Remark
1	1302.30	27.31	26.95	N/A	52.77	74.00	-21.23	114	100	Peak
	1302.30	/	/	-10.33	42.44	54.00	-11.56	21	100	Ave
2	1736.40	27.64	27.77	N/A	48.12	74.00	-25.88	31	100	Peak
	1736.40	/	/	-10.33	37.79	54.00	-16.21	51	100	Ave

Note: Testing is carried out with frequency rang 30MHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the the operating frequency 433.92MHz.

Plot of Radiated Emissions Test Data

EUT: Universal Remote
 Tested Model: RM pro
 Operating Condition: SRD Transmitting(315.00MHz)
 Comment: AC 120V/60Hz, USB 5V
 Test Specification: Horizontal

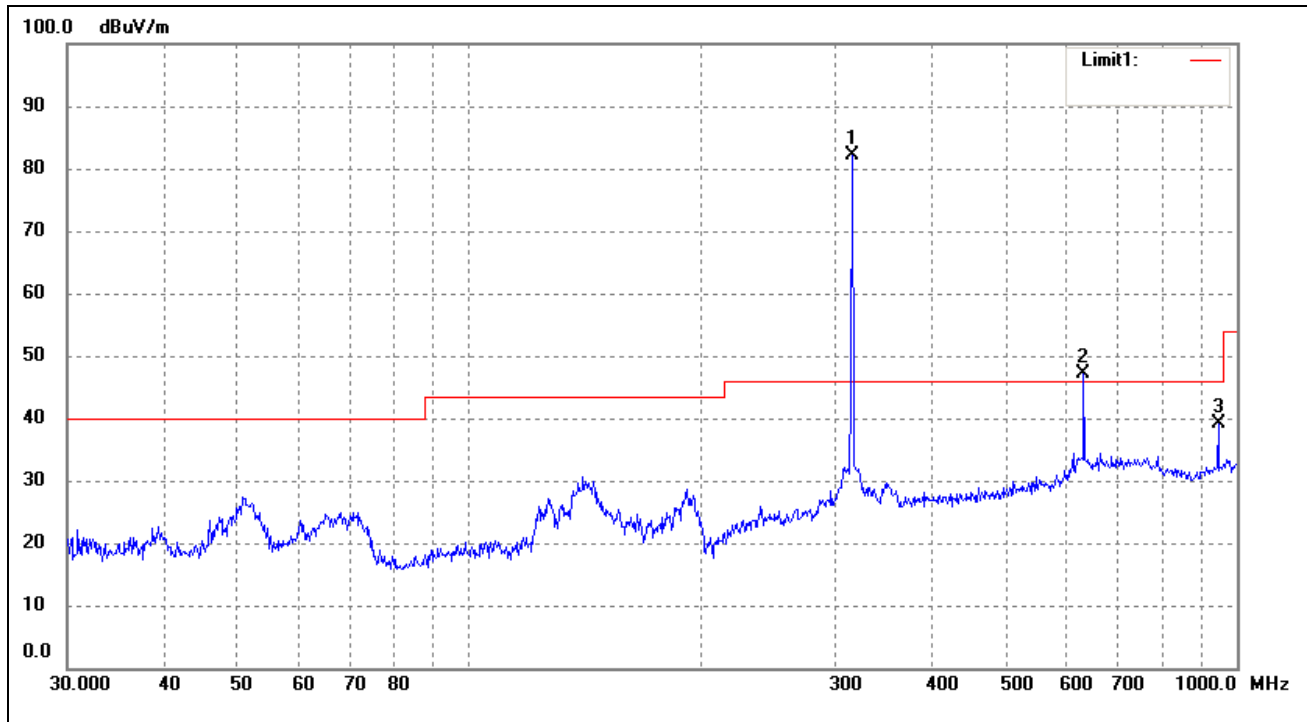


No.	Frequency MHz	Reading dBuV/m	Corr. Factor(dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. (°)	Height (cm)	Remark
1	315.4807	79.19	11.95	N/A	81.14	95.67	-14.53	261	100	peak
	315.4807	/	/	-8.60	72.54	75.67	-3.13	71	100	Ave
2	631.6884	31.88	17.78	N/A	49.66	75.65	-25.99	183	100	peak
	631.6884	/	/	-8.60	41.06	55.65	-14.59	217	100	Ave
3	945.4398	25.35	14.58	N/A	39.93	75.65	-35.72	231	100	peak
	945.4398	25.35	14.58	-8.60	31.33	55.65	-24.32	103	100	Ave

Above 1GHz

No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. (°)	Height (cm)	Remark
1	1259.65	50.92	-8.43	N/A	46.23	74.00	-27.77	12	100	Peak
	1259.65	/	/	-8.60	37.73	54.00	-16.37	12	100	Ave

Test Specification: Vertical



No.	Frequency	Reading	Corr.	Dutycycle	Result	Limit	Margin	Deg.	Height	Remark
	MHz	dBuV/m	Factor(dB)	Factor (dB)	dBuV/m	dBuV/m	(dB)	(°)	(cm)	
1	315.4808	72.69	11.95	N/A	81.64	95.67	-14.03	261	100	peak
	315.4808	/	/	-8.60	73.04	75.67	-2.63	71	100	Ave
2	631.6884	29.23	17.78	N/A	47.01	75.65	-28.64	183	100	peak
	631.6884	/	/	-8.60	38.41	55.65	-17.24	217	100	Ave
3	945.4399	24.59	14.58	N/A	39.17	75.65	-36.48	231	100	peak
	945.4399	25.35	14.58	-8.60	30.57	55.65	-25.08	103	100	Ave

Above 1GHz

No.	Frequency	Reading	Corr.	Dutycycle	Result	Limit	Margin	Deg.	Height	Remark
	MHz	dBuV/m	Factor (dB)	Factor (dB)	dBuV/m	dBuV/m	dB	(°)	(cm)	
1	1259.65	50.92	-8.43	N/A	45.32	74.00	-28.68	12	100	Peak
	1259.65	/	/	-8.60	36.72	54.00	-17.28	12	100	Ave

Note: Testing is carried out with frequency rang 30MHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The fundamental frequency is 315.00MHz, so the fundamental and spurious emissions radiated limit base on the the operating frequency 315.00MHz.

6. 20dB Bandwidth

6.1 Standard Applicable

According to FCC Part 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

6.1 Test Procedure

With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

6.2 Environmental Conditions

Temperature:	21° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

6.3 Summary of Test Results/Plots

Test Frequency MHz	20dB Bandwidth kHz	Limit kHz	Result
433.92	337.389	1084.8	Pass
315.00	331.690	787.5	Pass

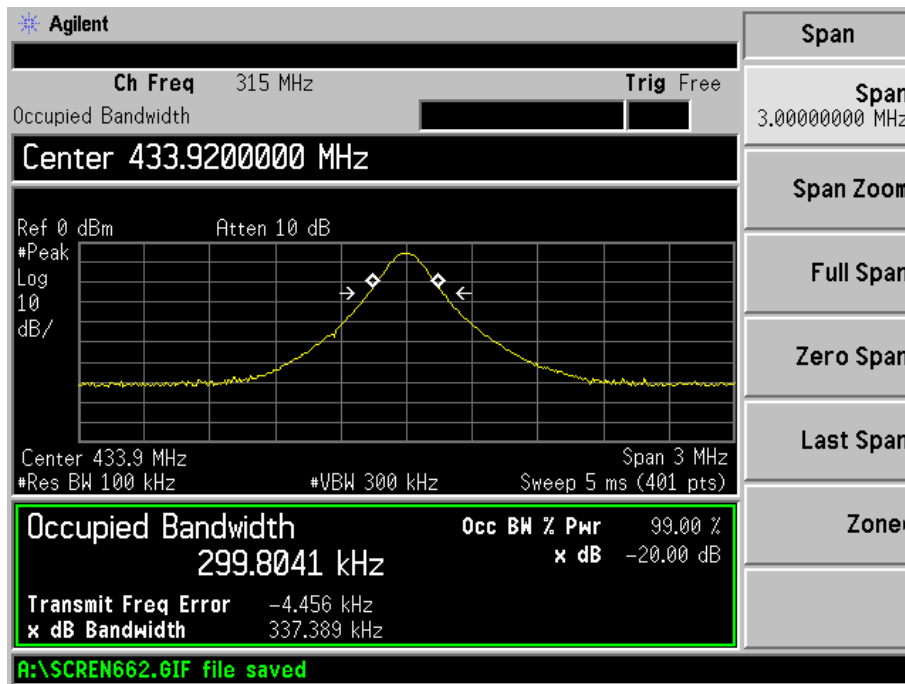
Limit = Fundamental Frequency X 0.25% = 433.92 MHz X 0.25% = 1084 kHz

Limit = Fundamental Frequency X 0.25% = 315.00 MHz X 0.25% = 787.5 kHz

Please refer to the attached plots.

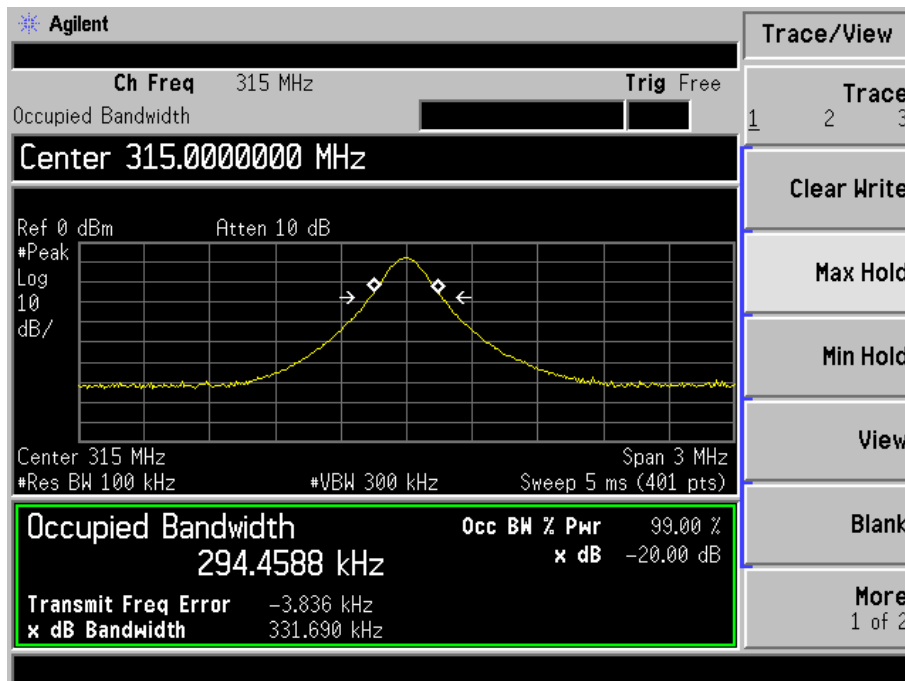
433.92MHz:

20dB Bandwidth Test Plot



315.00MHz:

20dB Bandwidth Test Plot



7. Transmission Time

7.1 Standard Applicable

According to FCC Part 15.231 (a), the transmitter shall be complied the following requirements:

- 1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

7.2 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

7.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

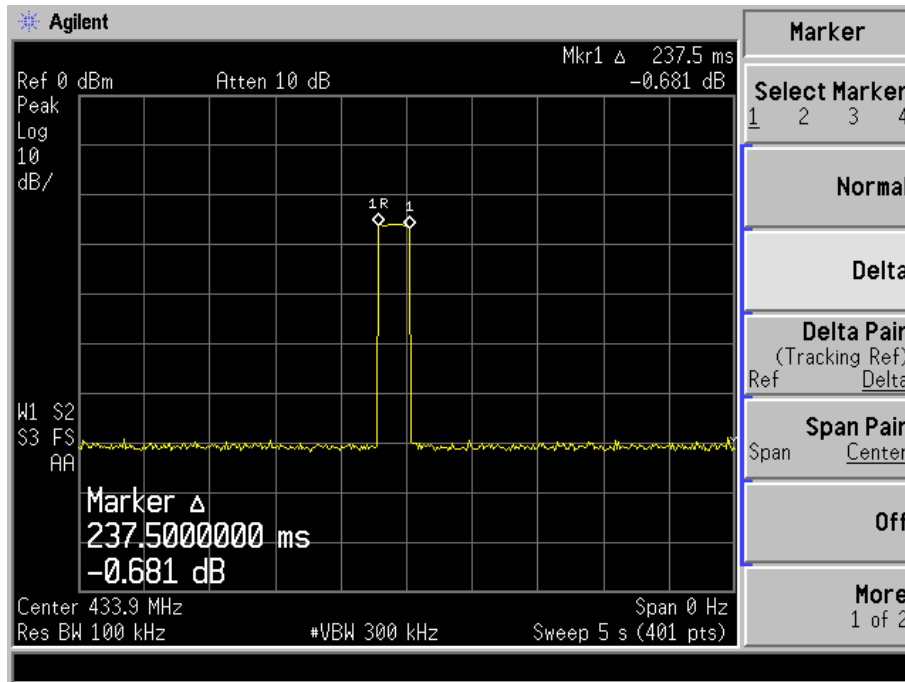
7.4 Summary of Test Results/Plots

Transmission Type	Test Frequency MHz	Transmission Time seconds	Limit s	Result
Manually	433.92	0.2375	5	Pass
Manually	315.00	0.100	5	Pass

Please refer to the attached plots.

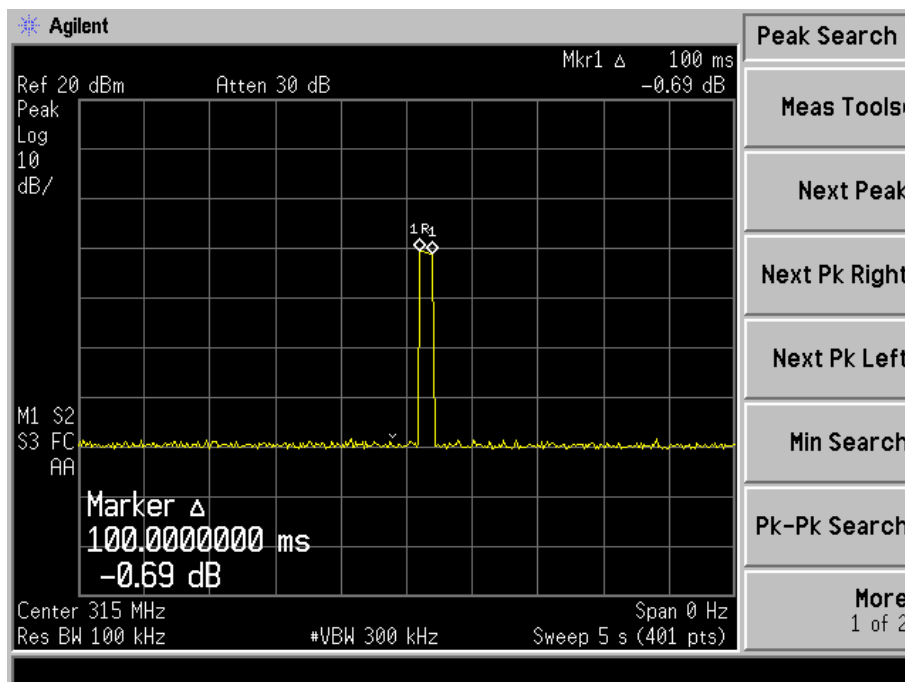
433.92MHz:

Transmission Time



315.00MHz:

Transmission Time



8. Duty Cycle

8.1 Standard Applicable

According to FCC Part 15.231 (b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

8.2 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

8.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

8.4 Summary of Test Results/Plots

433.93MHz:

Type of Pulse	Width of Pulse ms	Quantity of Pulse	Transmission Time ms	Total Time (T _{on}) ms
Pulse 1 (Wide)	0.775	12	9.3	12.55
Pulse 2 (Narrow)	0.250	13	3.25	

Test Period (T _p) ms	Total Time (T _{on}) ms	Duty Cycle %	Duty Cycle Factor dB
41.25	12.55	30.42	-10.33

Remark: Duty Cycle Factor=20*log(Duty Cycle)

315.00MHz:

Type of Pulse	Width of Pulse ms	Quantity of Pulse	Transmission Time ms	Total Time (T _{on}) ms
Pulse 1(Wide)	0.81	11	8.91	12.55
Pulse 2(Narrow)	0.26	14	3.64	

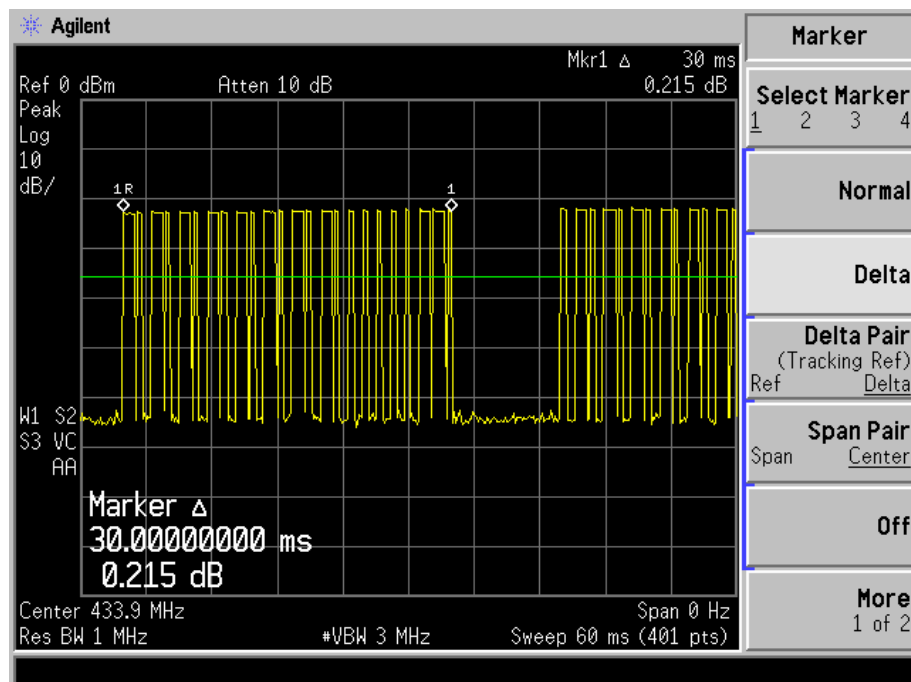
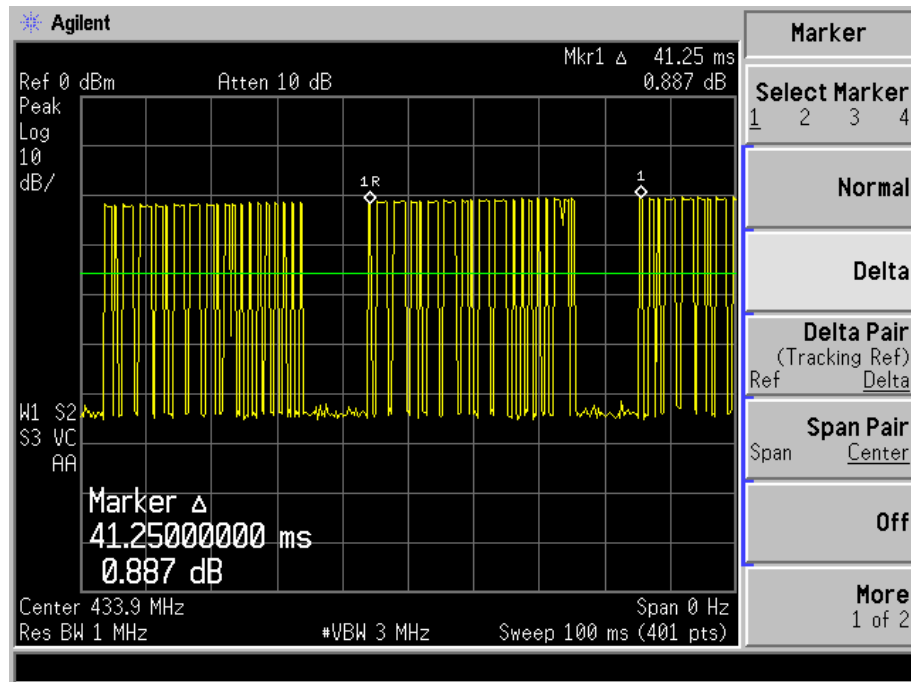
Test Period (T _p) ms	Total Time (T _{on}) ms	Duty Cycle %	Duty Cycle Factor dB
33.78	12.55	37.15	-8.60

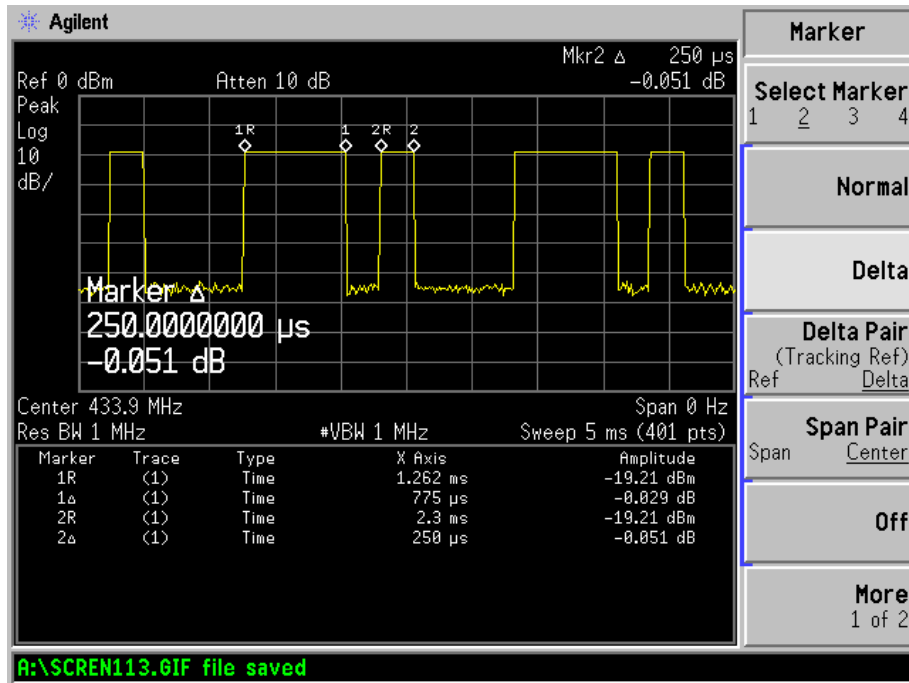
Remark: Duty Cycle Factor=20*log(Duty Cycle)

Please refer to the attached test plots

433.92MHz:

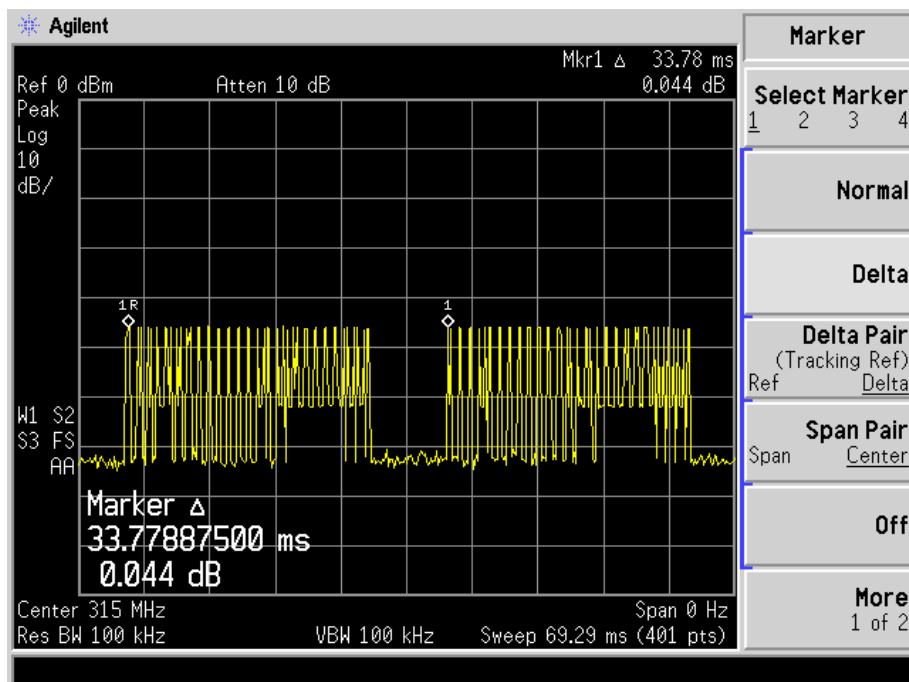
Width of Pulse

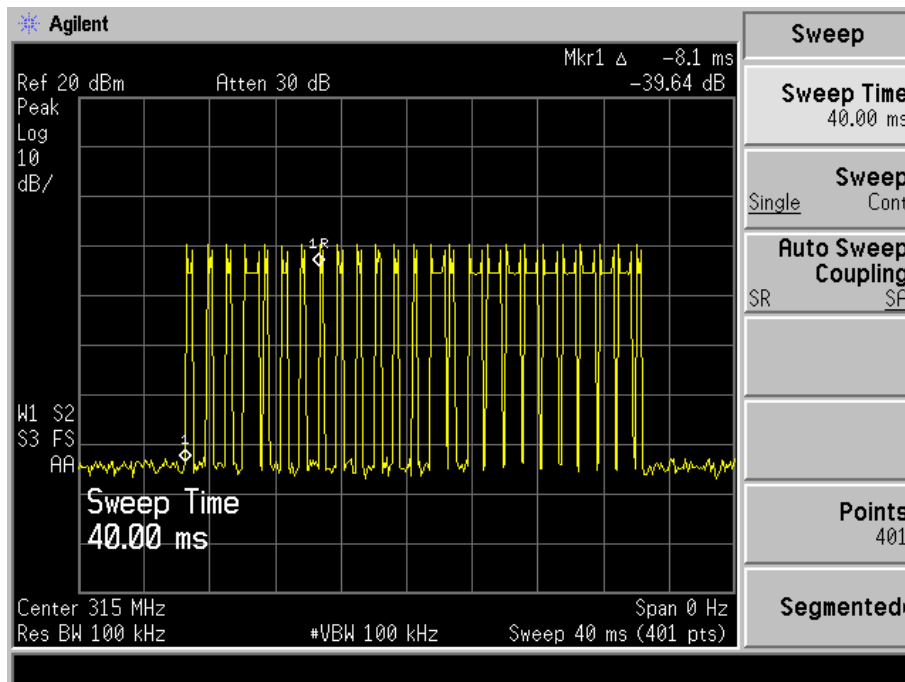




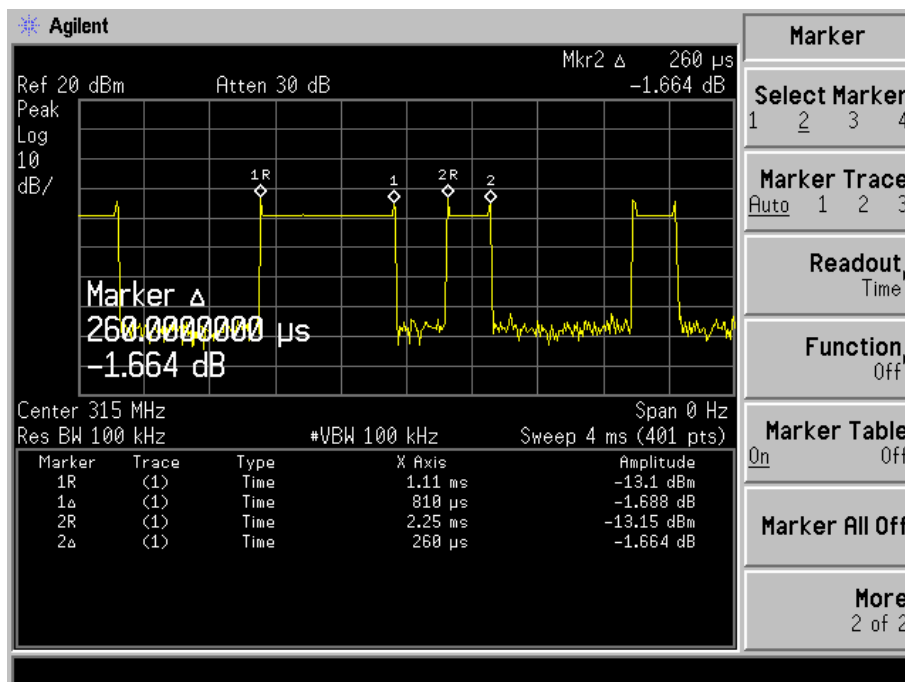
315.00MHz:

Quantity of Pulse





Width of Pulse 1 and Pulse 2



***** END OF REPORT *****