



NVLAP LAB CODE 200707-0



# FCC PART 15.231 MEASUREMENT AND TEST REPORT

For

**Fuzhou Emax Electronic Co., Ltd.**

Building #12-#16, Cangshan Industrial Area, Juyuanzhou Jinshan District,

Fuzhou, Fujian, China

**FCC ID: WEC-1216**

<b>Report Type:</b> Original Report	<b>Product Type:</b> RF 433.90 MHz Remote Sensor
<b>Test Engineer:</b> Chris Peng	<i>Chris Peng</i>
<b>Report Number:</b> RXM09011651	
<b>Report Date:</b> 2009-03-04	
<b>Reviewed By:</b> EMC Manager	<i>Green Xu</i>
<b>Prepared By:</b>	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008

**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP\*, NIST, or any agency of the Federal Government.

\* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "\*" (Rev 1.0)

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION.....</b>	<b>3</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	3
EUT PHOTOGRAPH .....	3
OBJECTIVE .....	3
RELATED SUBMITTAL(S)/GRANT(S) .....	3
TEST METHODOLOGY .....	4
TEST FACILITY .....	4
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>5</b>
JUSTIFICATION .....	5
SPECIAL ACCESSORIES.....	5
EQUIPMENT MODIFICATIONS .....	5
CONFIGURATION OF TEST SETUP .....	5
BLOCK DIAGRAM OF TEST SETUP .....	5
<b>SUMMARY OF TEST RESULTS .....</b>	<b>6</b>
<b>CFR47 §15.203 - ANTENNA REQUIREMENT.....</b>	<b>7</b>
STANDARD APPLICABLE .....	7
<b>CFR47 §15.205, §15.209, §15.231 (B) (E) - RADIATED EMISSIONS .....</b>	<b>8</b>
MEASUREMENT UNCERTAINTY .....	8
EUT SETUP .....	8
EMI TEST RECEIVER SETUP.....	8
TEST EQUIPMENT LIST AND DETAILS.....	9
TEST PROCEDURE .....	9
STANDARD APPLICABLE .....	9
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	10
TEST DATA .....	10
<b>CFR47 §15.231(C) - 20DB BANDWIDTH TESTING.....</b>	<b>13</b>
REQUIREMENT .....	13
TEST EQUIPMENT LIST AND DETAILS.....	13
TEST PROCEDURE .....	13
TEST DATA .....	13
<b>CFR47 §15.231(A) - DEACTIVATION TESTING .....</b>	<b>16</b>
REQUIREMENT .....	16
EUT SETUP .....	16
TEST EQUIPMENT LIST AND DETAILS.....	16
TEST DATA .....	17
<b>CFR47 §15.231 (A) (E) - DUTY CYCLE, ACTIVE TIME, SILENT PERIOD.....</b>	<b>18</b>
LIMIT .....	18
TEST EQUIPMENT LIST AND DETAILS.....	18
TEST PROCEDURE .....	18
TEST DATA .....	18

## GENERAL INFORMATION

---

### Product Description for Equipment Under Test (EUT)

The Fuzhou Emax Electronic Co., Ltd.'s product, model: EM3332 or the "EUT" as referred to in this report is a RF 433.92 MHz Remote sensor of the Multifunction Weather Station which measures approximately: 7.0 cm L x 3.0 cm W x 10.0 cm H, rated input voltage: DC 3V Battery. The EUT is designed to operate at 433.92 MHz.

\* All measurement and test data in this report was gathered from production sample serial number: 0901011 (Assigned by BACL, Shenzhen). The EUT was received on 2009-01-16.

### EUT Photograph



### Objective

This document is a test report based on the Electromagnetic Interference (EMI) tests performed on the EUT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4-2003.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.231 rules.

### Related Submittal(s)/Grant(s)

No Related Submittals

## Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 - 2003, 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. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located in the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 04, 2004. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



NVLAP LAB CODE 200707-0

The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2007070.htm>

## SYSTEM TEST CONFIGURATION

---

### Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

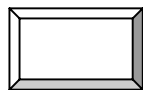
### Special Accessories

The special accessories were provided by Bay Area Compliance Laboratories Corp. (Shenzhen).

### Equipment Modifications

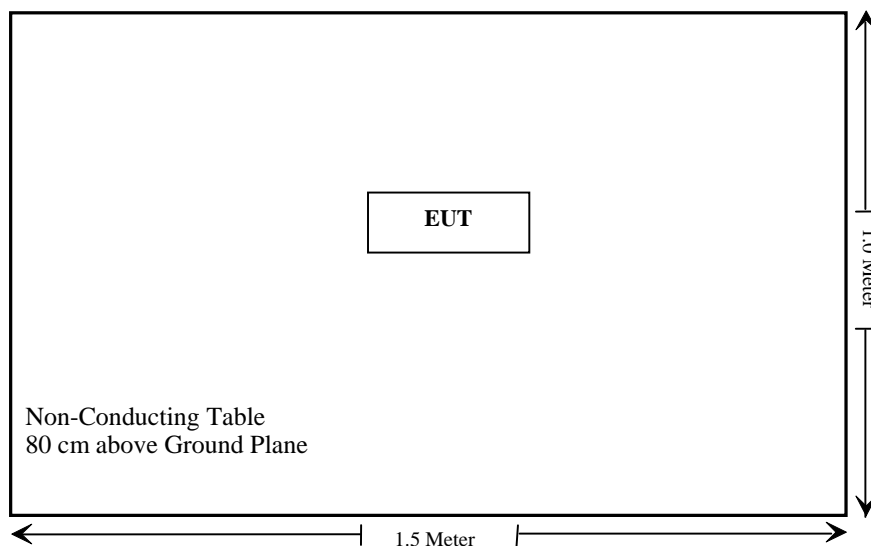
No modifications were made to the unit tested.

### Configuration of Test Setup



EUT

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band	Compliant
§15.209	General Requirement	Compliant
§15.207 (a)	Conducted Emissions	N/A*
§15.231 (b), (e)	Radiated Emissions	Compliant
§15.231 (c)	20dB Band Width Testing	Compliant
§15.231 (a) (1), (2)	Deactivation Testing	Compliant
§15.231 (a) (e)	Duty Cycle, Active time, Silent period	Compliant

**Note:** N/A, EUT is powered in battery only.

---

## **CFR47 §15.203 - ANTENNA REQUIREMENT**

---

### **Standard Applicable**

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 antenna of the EUT was printed antenna on the circuit board. The maximum gain is 1.5 dBi. The end user cannot access.

**Result:** Compliant.

Please refer to the EUT Internal photos.

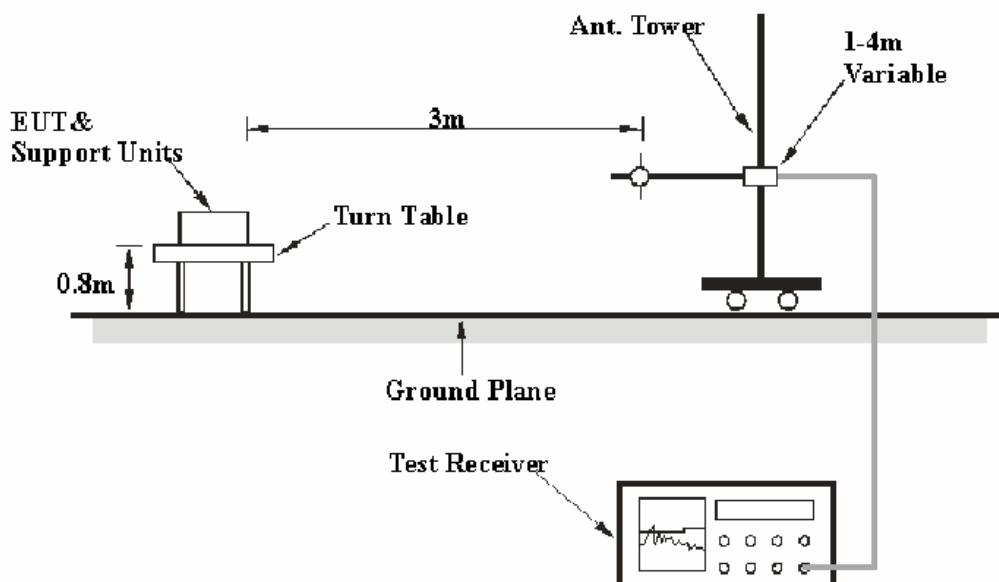
## CFR47 §15.205, §15.209, §15.231 (b) (e) - RADIATED EMISSIONS

### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emission measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is  $\pm 4.0$  dB.

### EUT Setup



The radiated emission tests were performed in the 3 meters chamber B test site, using the setup accordance with the ANSI C63.4 - 2003. The specification used was the FCC 15 § 15.209 and 15.231.

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

### EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

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

<i><b>Frequency Range</b></i>	<i><b>RBW</b></i>	<i><b>VBW</b></i>
30 – 1000 MHz	100 kHz	300 kHz
1000 MHz – 5 GHz	1 MHz	3 MHz



## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2008-08-02	2009-08-02
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-11-07	2009-11-06
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2008-03-11	2009-03-11
HP	Amplifier	8449B	3008A00277	2008-09-12	2009-09-11
Sunol Sciences	Horn Antenna	DRH-118	A052604	2008-09-25	2009-09-25

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Peak and Average detection mode.

## 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 3,370 *	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

According to §15.231(e), 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	1,000	100
70-130	500	50
130-174	500 to 1,500 *	50 to 150 *
174-260	1,500	150
260-470	1,500 to 5,000*	150 to 500*
Above 470	5,000	500

Note: \* Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

### Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 5.8dB means the emission is 5.8dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Chris Peng on 2009-03-04.*

Test Mode: Transmitting

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Direction (Degree)	Test Antenna			Cable Loss (dB)	Amp Gain (dB)	Duty Cycle Factor (dB)	Cord. Amp. (dBμV/m)	Part 15.231(b)/15.209	
				Height (m)	Polar (H/V)	Factor (dB)					Limit (dBμV/m)	Margin (dB)
1301.76	55.65	PK	97	1.0	V	26.30	5.52	34.50	-16.72	36.25	54	17.75
1301.76	53.16	PK	185	1.0	H	27.20	5.52	34.50	-16.72	34.66	54	19.34
1301.76	55.65	PK	97	1.0	V	26.30	5.52	34.50	/	52.97	74	21.03
1735.68	56.17	PK	100	1.0	V	28.40	5.82	34.30	-16.72	39.37	60.8	21.43
867.84	66.66	PK	108	1.0	V	19.80	1.73	32.77	-16.72	38.70	60.8	22.10
1301.76	53.16	PK	185	1.0	H	27.20	5.52	34.50	/	51.38	74	22.62
867.84	65.56	PK	187	1.0	H	19.80	1.73	32.77	-16.72	37.60	60.8	23.20
1735.68	56.17	PK	100	1.0	V	28.40	5.82	34.30	/	56.09	80.8	24.71
867.84	66.66	PK	108	1.0	V	19.80	1.73	32.77	/	55.42	80.8	25.38
1735.68	52.01	PK	33	1.9	H	28.10	5.82	34.30	-16.72	34.91	60.8	25.89
867.84	65.56	PK	187	1.0	H	19.80	1.73	32.77	/	54.32	80.8	26.48
2169.6	47.29	PK	260	1.5	V	30.00	6.51	33.90	-16.72	33.18	60.8	27.62
2169.6	46.17	PK	164	1.0	H	30.30	6.51	33.90	-16.72	32.36	60.8	28.44
1735.68	52.01	PK	33	1.9	H	28.10	5.82	34.30	/	51.63	80.8	29.17
2169.6	47.29	PK	260	1.5	V	30.00	6.51	33.90	/	49.90	80.8	30.90
2169.6	46.17	PK	164	1.0	H	30.30	6.51	33.90	/	49.08	80.8	31.72
433.92	84.81	PK	254	2.0	H	12.50	1.07	37.80	-16.72	46.02	80.8	34.78
433.92	82.94	PK	226	1.3	V	12.50	1.07	37.80	-16.72	44.15	80.8	36.65
433.92	84.81	PK	254	2.0	H	14.60	1.27	37.94	/	62.74	100.8	38.06
433.92	82.94	PK	226	1.3	V	14.60	1.27	37.94	/	60.87	100.8	39.93

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Direction (Degree)	Test Antenna			Cable Loss (dB)	Amp Gain (dB)	Duty Cycle Factor (dB)	Cord. Amp. (dBμV/m)	Part 15.231(e)/15.209	
				Height (m)	Polar (H/V)	Factor (dB)					Limit (dBμV/m)	Margin (dB)
1735.68	56.17	PK	100	1.0	V	28.40	5.82	34.30	-16.41	39.68	52.87	13.19
867.84	66.66	PK	108	1.0	V	19.80	1.73	32.77	-16.41	39.01	52.87	13.86
867.84	65.56	PK	187	1.0	H	19.80	1.73	32.77	-16.41	37.91	52.87	14.96
1301.76	55.65	PK	97	1.0	V	26.30	5.52	34.50	-16.41	36.56	52.87	16.31
1735.68	56.17	PK	100	1.0	V	28.40	5.82	34.30	/	56.09	72.87	16.78
867.84	66.66	PK	108	1.0	V	19.80	1.73	32.77	/	55.42	72.87	17.45
1735.68	52.01	PK	33	1.9	H	28.10	5.82	34.30	-16.41	35.22	52.87	17.65
1301.76	53.6	PK	185	1.0	H	27.20	5.52	34.50	-16.41	34.97	52.87	17.90
867.84	65.56	PK	187	1.0	H	19.80	1.73	32.77	/	54.32	72.87	18.55
2169.6	47.29	PK	260	1.5	V	30.00	6.51	33.90	-16.41	33.49	52.87	19.38
1301.76	55.65	PK	97	1.0	V	26.30	5.52	34.50	/	52.97	72.87	19.90
2169.6	46.17	PK	164	1.0	H	30.30	6.51	33.90	-16.41	32.67	52.87	20.20
1735.68	52.01	PK	33	1.9	H	28.10	5.82	34.30	/	51.63	72.87	21.24
1301.76	53.16	PK	185	1.0	H	27.20	5.52	34.50	/	51.38	72.87	21.49
2169.6	47.29	PK	260	1.5	V	30.00	6.51	33.90	/	49.90	72.87	22.97
2169.6	46.17	PK	164	1.0	H	30.30	6.51	33.90	/	49.08	72.87	23.79
433.92	84.81	PK	254	2.0	H	12.50	1.07	37.80	-16.41	46.33	72.87	26.54
433.92	82.94	PK	226	1.3	V	12.50	1.07	37.80	-16.41	44.46	72.87	28.41
433.92	84.81	PK	254	2.0	H	14.60	1.27	37.94	/	62.74	92.87	30.13
433.92	82.94	PK	226	1.3	V	14.60	1.27	37.94	/	60.87	92.87	32.00

**CFR47 §15.231(c) - 20dB BANDWIDTH TESTING****Requirement**

Per 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.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-11-07	2009-11-06
HP	Amplifier	8447E	1937A01046	2008-11-15	2009-11-15
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2008-04-12	2009-04-12

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

**Test Procedure**

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

**Test Data****Environmental Conditions**

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

*The testing was performed by Chris Peng on 2009-03-04.*

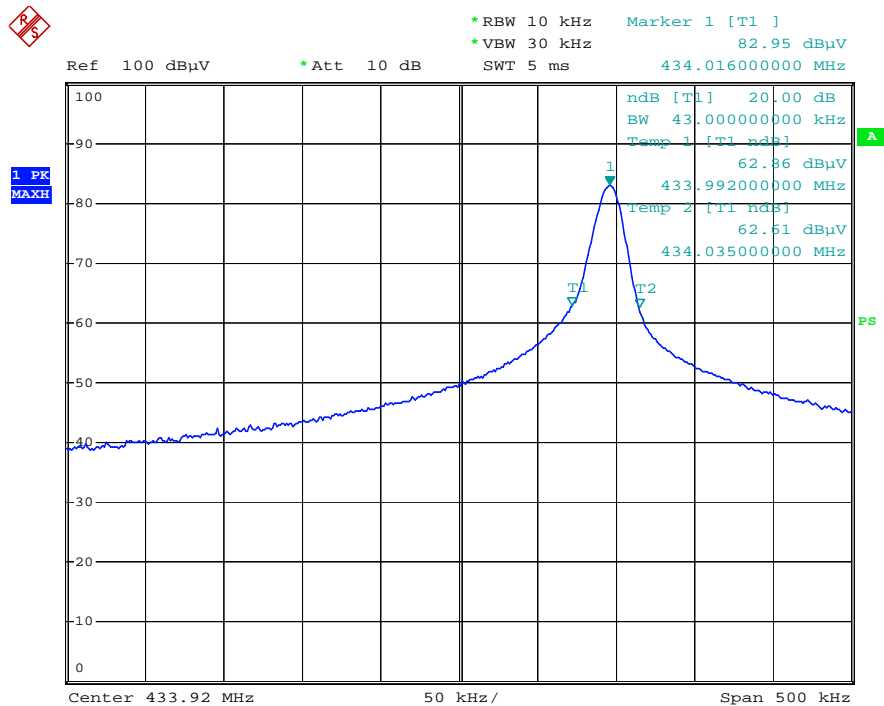
Please refer to following tables and plots.

Test Mode: Transmitting

Channel Frequency (MHz)	20 dB Occupied Bandwidth (kHz)	Limit (kHz)	Result
433.92	43.0	1084.8	Pass

**Note:** 20 dB Bandwidth Limit = 0.25% \* center frequency = 0.25% \* 433.92 MHz = 1084.8 kHz

## 20 dB Occupied Bandwidth



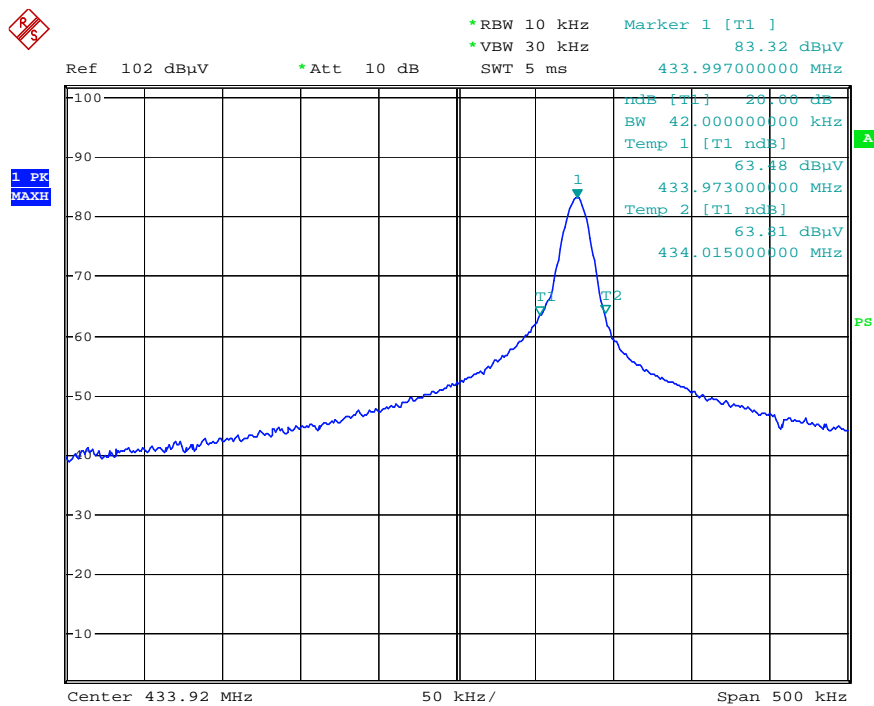
20dB bandwidth

Date: 6.FEB.2009 17:41:39

Channel Frequency (MHz)	20 dB Occupied Bandwidth (kHz)	Limit (kHz)	Result
433.92	42.0	1084.8	Pass

**Note:** 20 dB Bandwidth Limit = 0.25% \* center frequency = 0.25% \* 433.92 MHz = 1084.8 kHz

### 20 dB Occupied Bandwidth



20dB bandwidth

Date: 4.MAR.2009 19:40:19

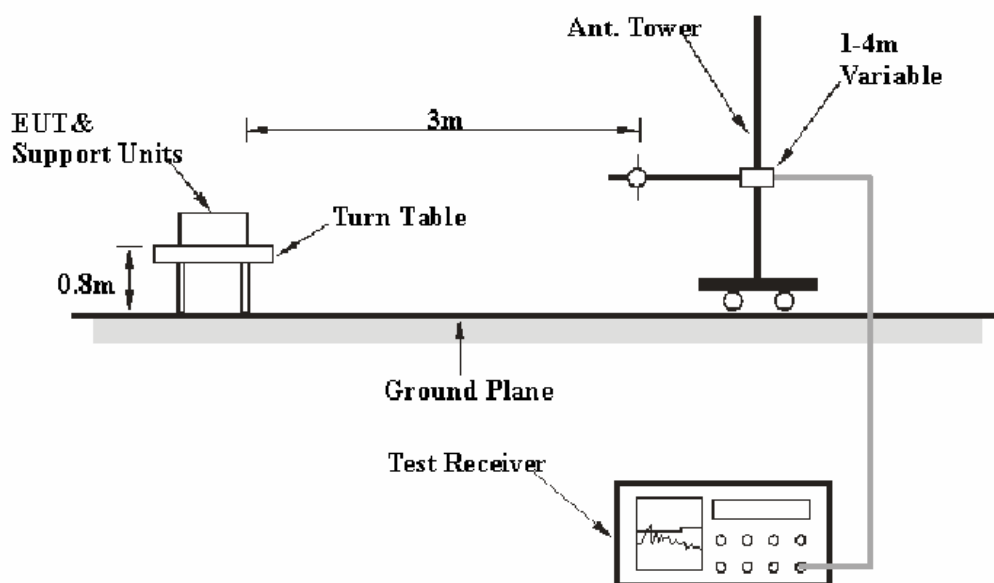
## CFR47 §15.231(a) - DEACTIVATION TESTING

### Requirement

Per Part 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.

Per Part 15.231(a)(2), a transmitter activated automatically shall cease transmission within 5 seconds after activation.

### EUT Setup



The deactivation test was performed in the 3 meters chamber B test site, using the setup accordance with the ANSI C63.4 - 2003. The specification used was the FCC 15.231(a) limits.

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

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-11-07	2009-11-06
HP	Amplifier	8447E	1937A01046	2008-11-15	2009-11-15
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2008-04-12	2009-04-12

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.



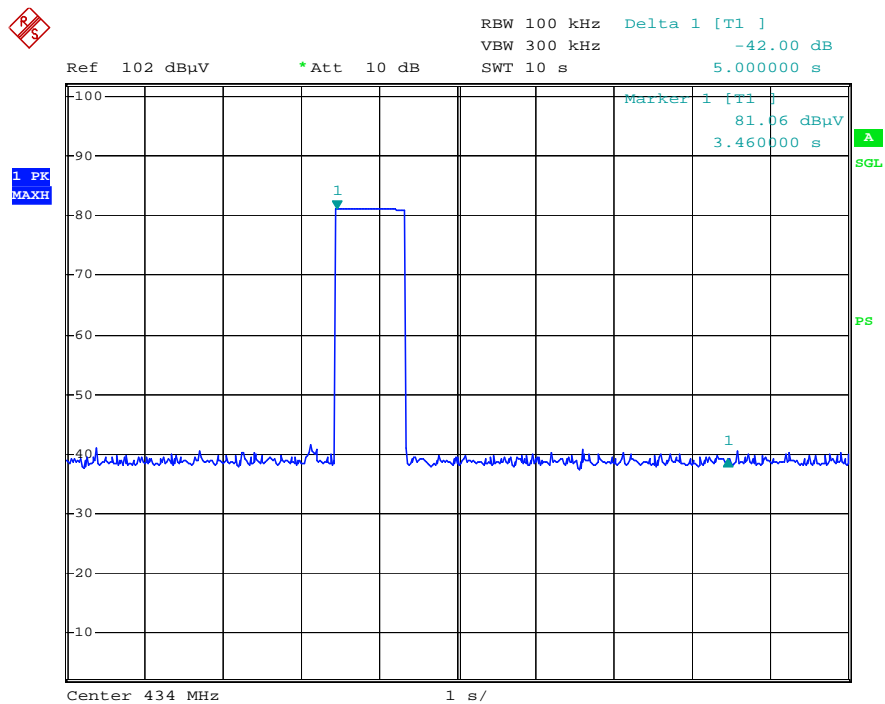
**Test Data****Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Chris Peng on 2009-03-04.

Test Mode: Transmitting

**Test Result:** Compliant.



deactivation time

Date: 4.MAR.2009 17:16:54

**CFR47 §15.231 (a) (e) - DUTY CYCLE, ACTIVE TIME, SILENT PERIOD****Limit**

(No dedicated limit specified in the Rules).

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2008-11-07	2009-11-06

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

**Test Procedure**

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer=operating frequency.
4. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Span=0Hz.
5. Repeat above procedures until all frequency measured was complete.

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Chris Peng on 2009-03-02 and 2009-03-04.*

*Test Mode: Transmitting*

**Test Result:**

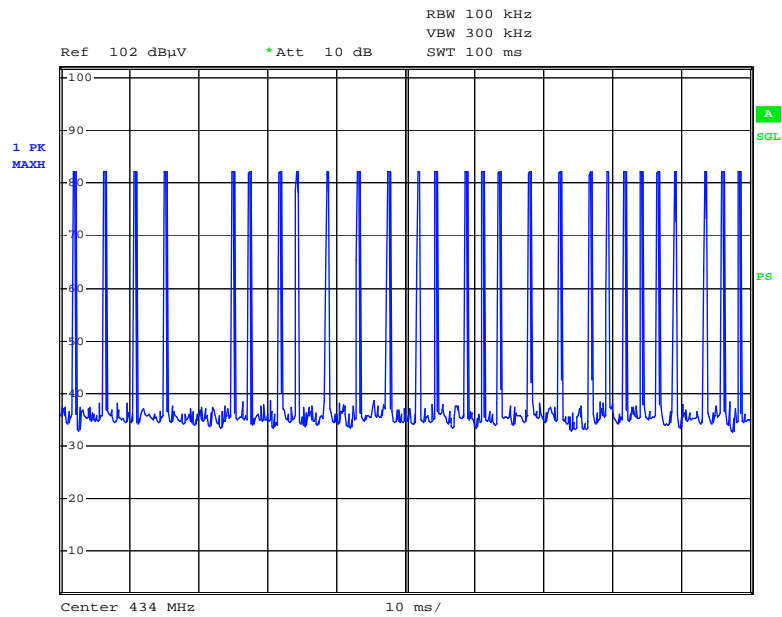
Please refer to following plots

Part §15.231 (a)

$T_p = 100 \text{ ms}$

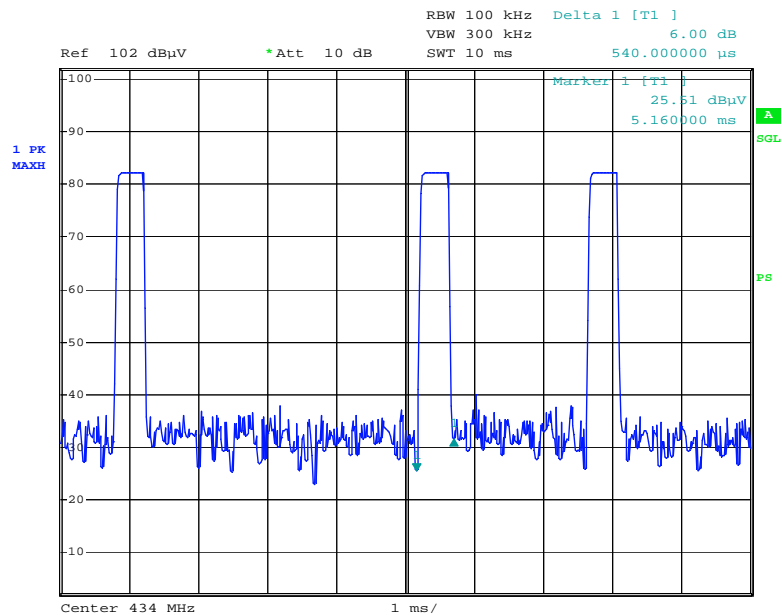
$T_{on} = 0.54 * 27 = 14.58 \text{ (ms)}$

$\text{Factor} = 20 * \log (T_{on} / T_p) = 20 * \log (14.58/100) = -16.72 \text{ dB}$



duty cycle-1

Date: 2.MAR.2009 22:47:13



duty cycle-2

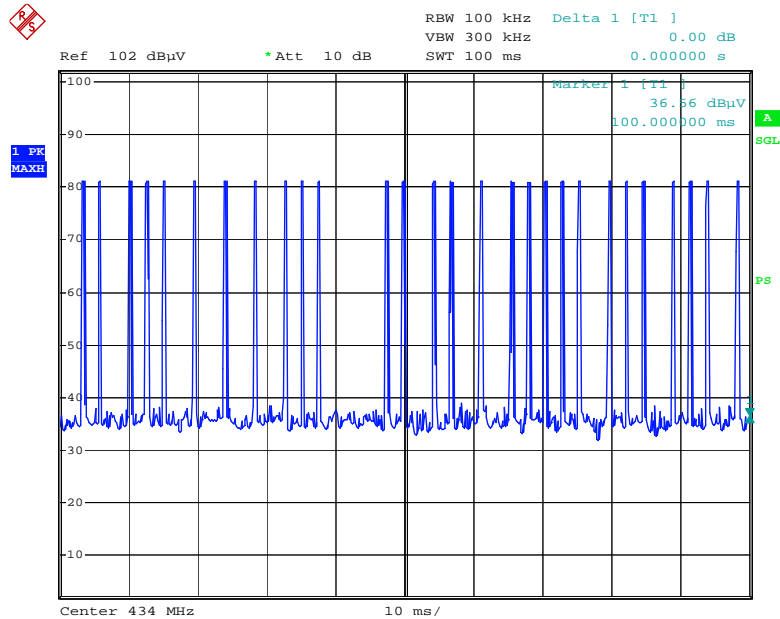
Date: 2.MAR.2009 22:49:38

## Part §15.231 (e)

$$T_p = 100 \text{ ms}$$

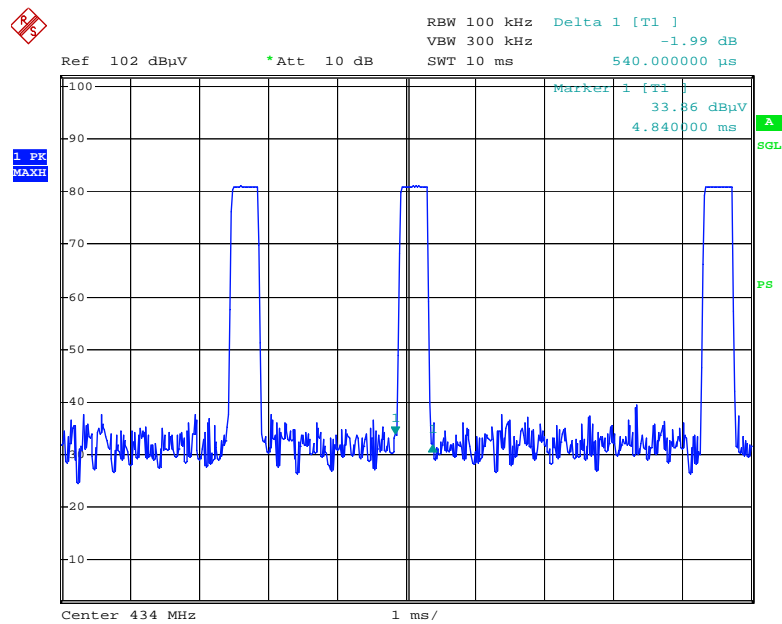
$$T_{on} = 0.54 \times 28 = 15.12 \text{ (ms)}$$

$$\text{Factor} = 20 * \log (T_{on} / T_p) = 20 * \log (15.12/100) = -16.41 \text{ dB}$$



duty cycle-1

Date: 4.MAR.2009 17:30:42



duty cycle-2

Date: 4.MAR.2009 17:33:00

### FCC §15.231(e): Deactivate time and silent period

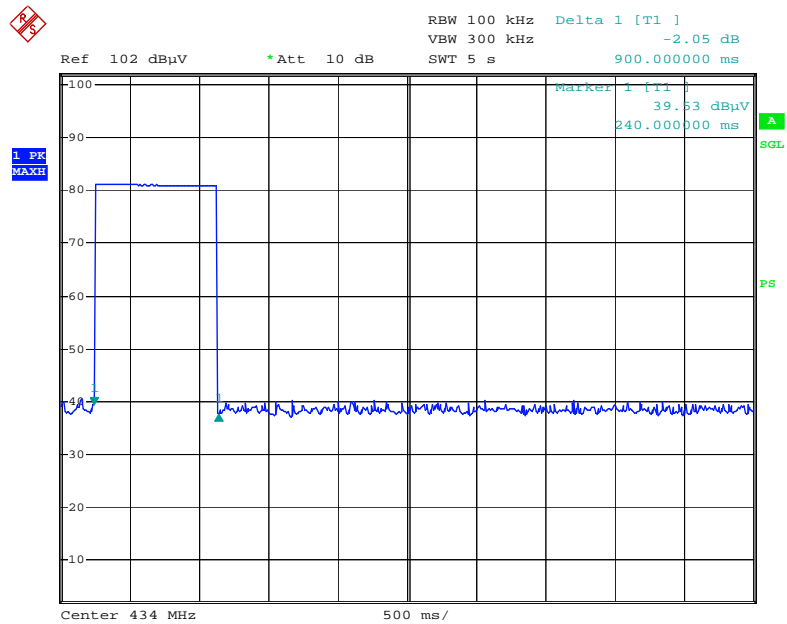
Deactivate Time:

Deactivate Time (Second)	Limit (Second)	Result
0.9	1	Pass

Silent Period:

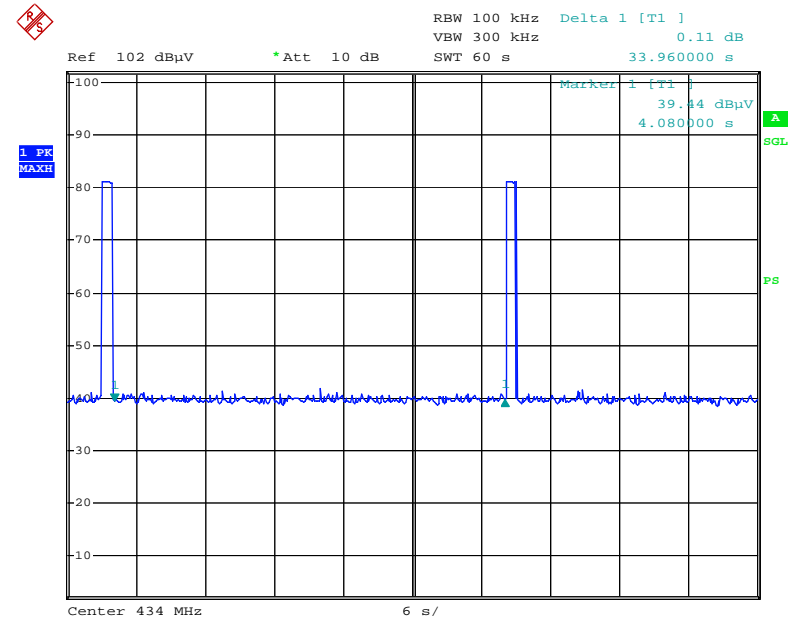
Silent Period (Second)	Limit (Second)	Result
33.96	27	Pass

Note: The silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.  
The duration time is 0.9 second,  $30 \times 0.9 = 27$  seconds.



Transmitting time

Date: 4.MAR.2009 17:20:27



Silent period

Date: 4.MAR.2009 17:13:40

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