

FCC PART 15.231
EMI MEASUREMENT AND TEST REPORT
For
Robstep Robot Co.,Ltd. DongGuan
Tech-Road.9-1, High-tech industrial park, Songshan Lake, DongGuan, China

FCC ID: ZO4M1S-RC

November 7, 2012

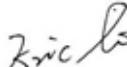
This Report Concerns: Original Report	Equipment Type: Remote Control
Test Engineer: Eric Li	
Test Engineer of performing the tests: Adam Yang	
Report No.: BST12091013Y-1ER-3	
Receive EUT Date/Test Date: October 30, 2012 / November 1-6, 2012	
Reviewed By: Christina Deng	
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1. GENERAL INFORMATION

1.1. Test Facility

The test site used to collect the data is located on the address of Shenzhen Certification Technology Service Co., Ltd (FCC Registered Test Site Number: 197647) on 2F, Building B, East Area of Nanchang Second Industrial Zone, Gushu 2nd Road, Bao'an District, shenzhen 518126, China
The Test Site is constructed and calibrated to meet the FCC requirements.

1.2. Measurement Uncertainty

(95% confidence levels, k=2)

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.50dB
Uncertainty for Radiation Emission test (30MHz to 1GHz)	3.04 dB (Polarize: V)
	3.02 dB (Polarize: H)
Uncertainty for Radiation Emission test (1GHz to 25GHz)	3.84dB (Polarize: H)
	3.56dB (Polarize: V)
Uncertainty for radio frequency	1×10^{-9}
Uncertainty for test site temperature and humidity	0.6 °C
	3%

2. PRODUCT DESCRIPTION

2.1. EUT Description

Description : Remote Control

Trade Name : N/A

Applicant : Robstep Robot Co.,Ltd. DongGuan
Tech-Road.9-1, High-tech industrial park, Songshan Lake,
DongGuan, China

Manufacture : Robstep Robot Co.,Ltd. DongGuan
Tech-Road.9-1, High-tech industrial park, Songshan Lake,
DongGuan, China

Model Number : M1S

Frequency : 433.92MHz

Power Supply : DC 12V

2.2. Block Diagram of EUT Configuration



2.3. Support Equipment List

Name	Model No	S/N	Manufacturer	Used “Yes/No”
N/A				

Remark: “N/A” means “Not applicable.”

2.4. Test Conditions

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-25
Humidity (%RH)	25-75	50-63
Barometric pressure (mbar)	860-1060	950-1000

3. FCC ID LABEL

FCC ID: ZO4M1S-RC

Label Location on EUT

EUT View/ FCC ID Label Location



4. TEST RESULTS SUMMARY

FCC 15 Subpart C, Paragraph 15.231

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

Remark: "N/A" means "Not applicable."

Statement: All testing was performed using the test procedures found in ANSI C63.4-2003.

Modifications

No modification was made.

5. TEST EQUIPMENT USED

EQUIPMENT/FACILITIES	MANUFACTURER	MODEL	SERIAL NO.	DATE OF CAL.	CAL. INTERVAL
3m Semi-Anechoic Chamber	Changzhou Chengyu	EC3048	N/A	May 5, 2012	1 Year
Broadband antenna	SCHWARZBECK	VULB 9168	VULB916 8-438	Aug. 14, 2012	1 Year
Horn Antenna	Schwarzbeck	BBHA9120D	1201	Sept. 28, 2012	1 Year
Horn antenna	R&S	HF906	10027	Aug. 14, 2012	1 Year
ETS Horn Antenna	ETS	3160	SEL0076	May 8, 2012	1 Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	Apr. 6, 2012	1 Year
Spectrum analyzer	Agilent	E4443A	MY461856 49	Apr. 6, 2012	1 Year
Spectrum analyzer	Agilent	E4440A	MY461873 35	Apr. 6, 2012	1 Year
Spectrum analyzer	Agilent	E4446A	MY453001 03	Apr. 6, 2012	1 Year
Test receiver	R&S	ESCI	100492	Apr. 6, 2012	1 Year
Test receiver	R&S	ESCI	101202	Apr. 6, 2012	1 Year
L.I.S.N.	SCHWARZBECK	NSLK8126	8126466	Apr. 6, 2012	1 Year
L.I.S.N.	SCHWARZBECK	NSLK8126	8126487	Apr. 6, 2012	1 Year
Cable	Resenberger	N/A	NO.1	Apr. 6, 2012	1 Year
Cable	SCHWARZBECK	N/A	NO.2	Apr. 6, 2012	1 Year
Cable	SCHWARZBECK	N/A	NO.3	Apr. 6, 2012	1 Year
Pre-amplifier	SCHWARZBECK	BBV9743	9743-019	Apr. 6, 2012	1 Year
Pre-amplifier	R&S	AFS33-18002 650-30-8P-44	SEL0080	Apr. 6, 2012	1 Year

6. CONDUCTED POWER LINE TEST

6.1. Test Equipment

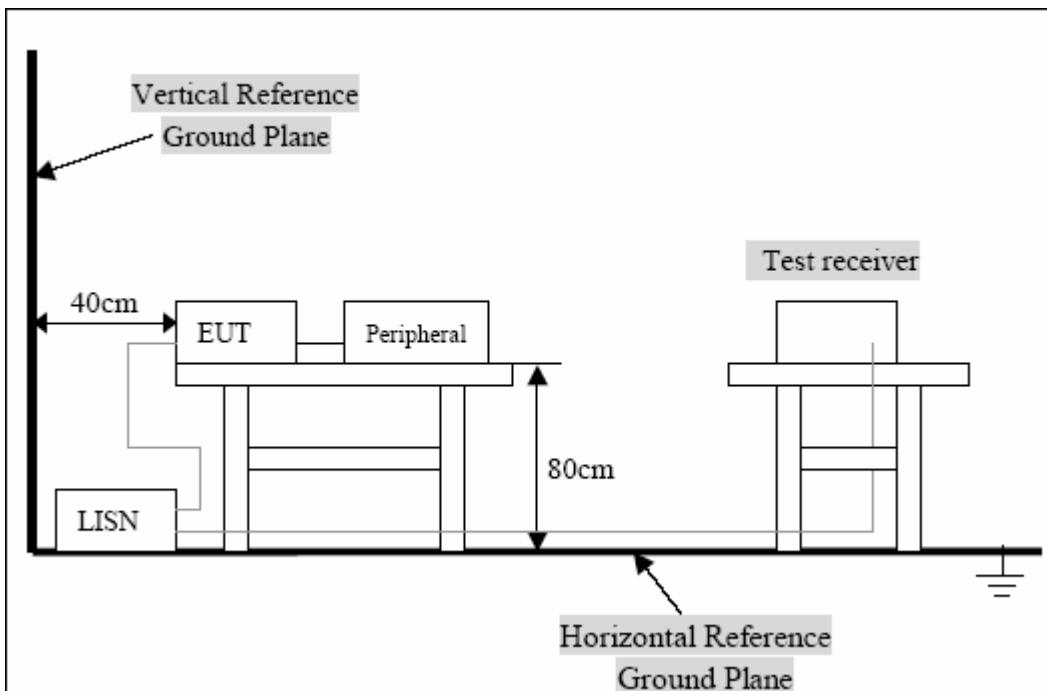
Please refer to section 5 this report.

6.2. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uh coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uh coupling impedance with 50ohm termination.

Both sides of A.C. Line are check for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ASIN C63.4:2003 on conducted measurement. Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

6.3. Test Setup



For the actual test configuration, Please refer to the related items-Photos of testing

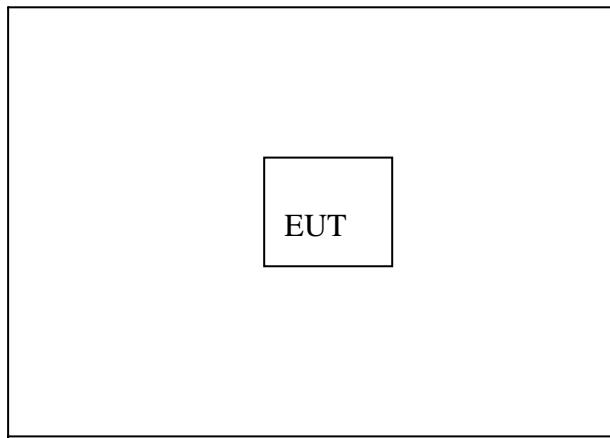
6.4. EUT Operating Condition

Operating condition is according to ANSI C63.4-2003.

Setup the EUT and simulators as shown on follow.

Enable RF signal and confirm EUT active.

Modulate output capacity of EUT up to specification.



6.5. Conducted Power line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuv)		
Frequency Range (MHZ)	Class A QP/AV	Class B QP/AV
0.15-0.5	79/66	65-56/56-46
0.5-5.0	73/60	56/46
5.0-30	73/60	60/50

Note: In the above table, the tighter limit applies at the band edges.

6.6. Conducted Power Line Test Result

N/A.

This EUT is only powered by the battery, therefore this test item is not applicable.

7. RADIATION EMISSIONS

7.1. Test Equipment

Please refer to section 5 this report.

7.2. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Calibrated Loop antenna is used as receiving antenna for frequencies below 30MHz, Calibrated Bilog antenna is used as receiving antenna for frequencies between 30 MHz and 1 GHz, Calibrated Horn antenna is used as receiving antenna for frequencies above 1000MHz. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4: 2003 on radiated emission measurement.

Through three orthogonal axes to determine which attitude and equipment arrangement produces the highest emission relative to the limit. Pretest x, y, z position of EUT, final, select the worst case Y position test and record the test results in the report.

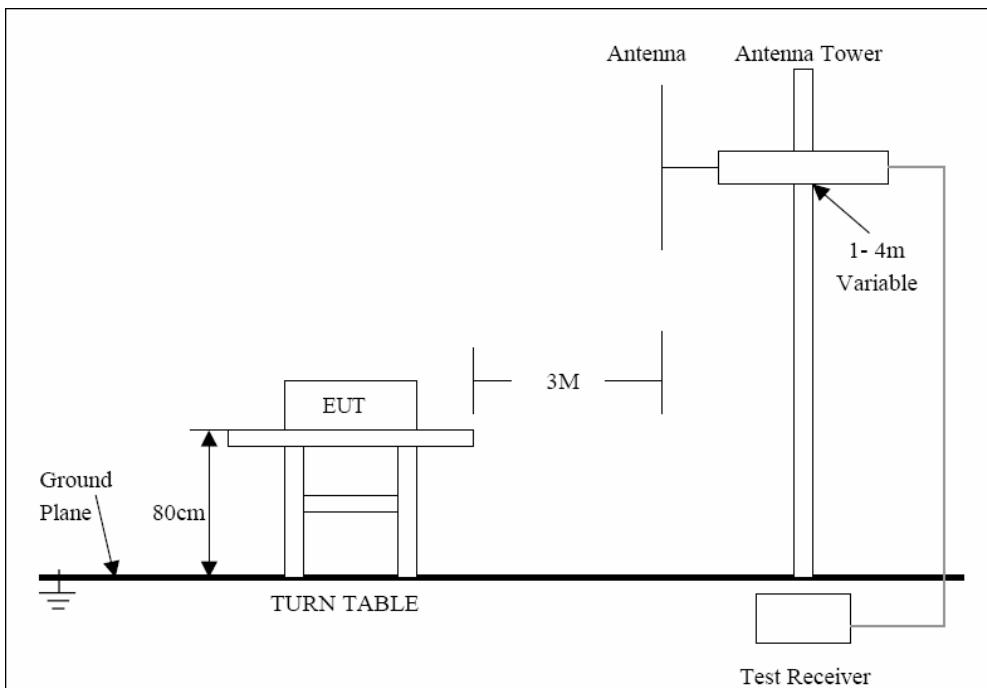
The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.

In accordance with Section 15.33(a)(1), the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator. So the frequency range from 9kHz to 5000MHz is checked.

The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Peak detector and Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

Let the EUT work in TX mode measure it.

7.3. Radiated Test Setup



For the accrual test configuration, please refer to the related items-photos of Testing.

7.4. Radiated Emission Limit

7.4.1. Radiation Emission Measurement Limits According to FCC Part 15 Section 15.231(b)

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [Average] [μ V/m]	Field Strength of Spurious Emission [Average] [μ V/m]
40.66-40.70	2250	225
70-130	1250	125
130-174	1250-3750	125-375
174-260	3750	375
260-470	3750-12500	375-1250
Above 470	12500	1250

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, μ V/m at 3 meters = $56.81818(F)-6136.3636$; for the band 260-470 MHz, μ 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.

7.4.2. Restricted Band Radiation Emission Measurement Limits According to FCC part 15 Section 15.205 and Section 15.209.

7.5. Radiated Emission Test Result

Date of Test:	November 2, 2012	Temperature:	25°C
EUT:	Remote Control	Humidity:	55%
Model No.:	M1S	Power Supply:	12V DC
Test Mode:	TX	Test Engineer:	Adam Yang

Frequency (MHz)	Average Factor (dB)	Result (dB μ V/m)		Limit (dB μ V/m)		Margin(dB)		Polarization
		AV	PEAK	AV	PEAK	AV	PEAK	
433.905	-1.3	77.07	78.37	80.8	100.8	-3.73	-22.43	Vertical
867.810	-1.3	55.38	56.68	60.8	80.8	-5.42	-24.12	
*1301.715	-1.3	50.29	51.59	54.0	74.0	-3.71	-22.41	
1735.620	-1.3	46.13	47.43	60.8	80.8	-14.67	-33.37	
2169.525	-1.3	48.57	49.87	60.8	80.8	-12.23	-30.93	
433.905	-1.3	73.36	74.66	80.8	100.8	-7.44	-26.14	
867.810	-1.3	53.13	54.43	60.8	80.8	-7.67	-26.37	Horizontal
*1301.715	-1.3	45.56	46.86	54.0	74.0	-8.44	-27.14	
1735.620	-1.3	47.41	48.71	60.8	80.8	-13.39	-32.09	
2169.525	-1.3	43.21	44.51	60.8	80.8	-17.59	-36.29	

Note:

1. Emissions attenuated more than 20 dB below the permissible value are not reported.

2. *: Denotes restricted band of operation.

Measurements were made using a peak detector and average detector. Any emission falling within the restricted bands of FCC Part 15 Section 15.205 were compliance with the emission limit of FCC Part 15 Section 15.209.

3. FCC Limit for Average Measurement = $41.6667(433.9)-7083.3333 = 10995.85\mu$ V/m = 80.8dB μ V/m

4. Average Factor = -1.3dB, Refer to section 10.

8. 20DB OCCUPIED BANDWIDTH

8.1. Test Equipment

Please refer to Section 5 this report.

8.2. Test Procedure

1. The EUT was tested according C63.4-2003. The radiated test was performed at FCC Registration laboratory.
2. 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.

8.3. FCC 15.231(c) 20dB Bandwidth Limit

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. Therefore, the bandwidth of the emission limit is $433.9\text{MHz} \times 0.25\% = 1.08\text{MHz}$. Bandwidth is determined at the points 20 dB down from the modulated carrier.

8.4. Test Result

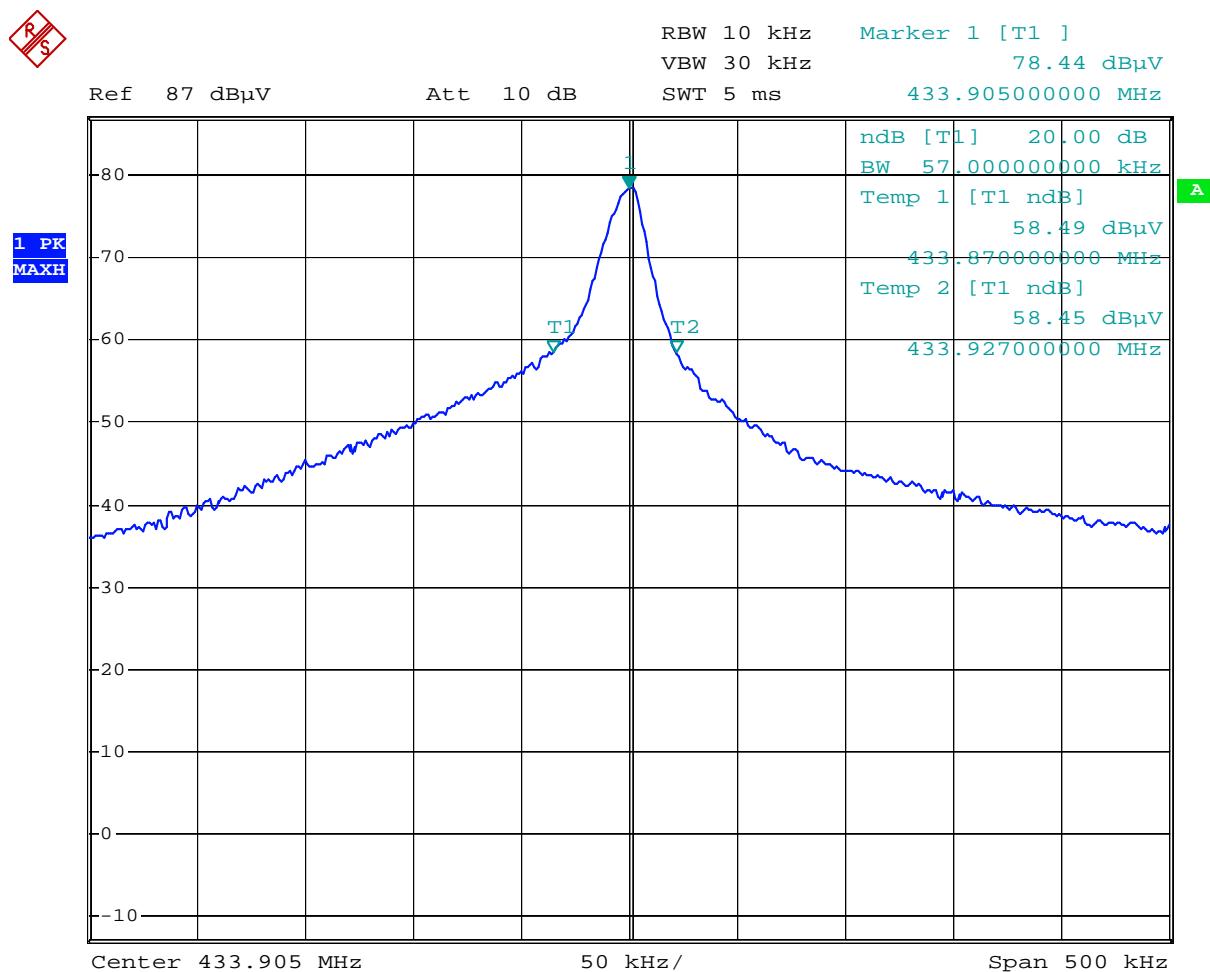
Temperature: 25°C

Humidity: 55%RH

Limit = 433.9MHz*0.25% = 1.08MHz

Test data: 57 kHz

Test Result: PASS



Date: 1.NOV.2012 17:48:52

9. RELEASE TIME MEASUREMENT

9.1. Test Equipment

Please refer to Section 5 this report.

9.2. Test Procedure

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

Set center frequency=433.905MHz

Set SPAN=0Hz

Set RBW=100kHz

Set VBW=300kHz

Set SWEET TIME=5s

9.3. Release time Requirement

Per 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.

9.4. Test Result

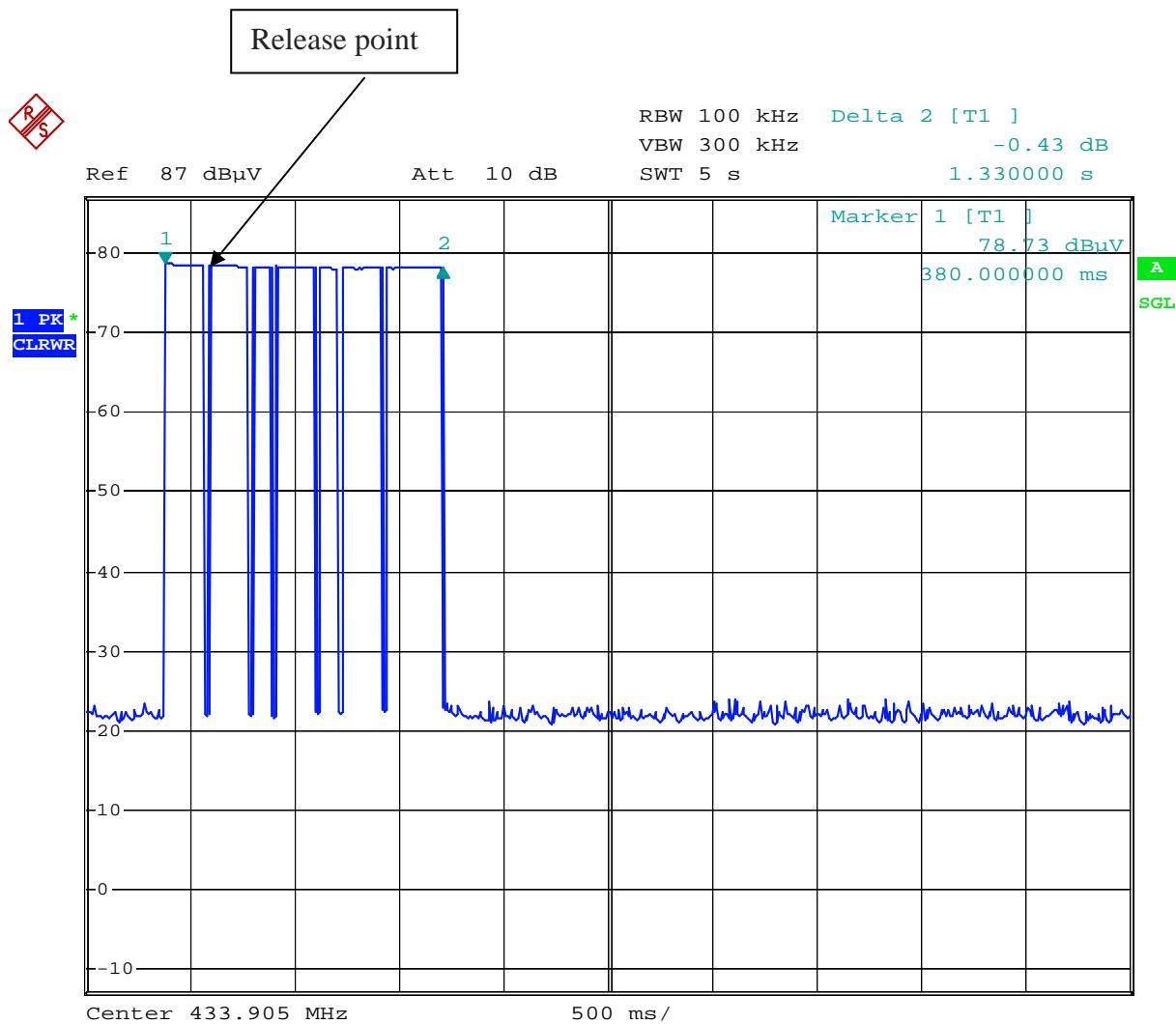
Temperature: 25°C

Humidity: 55%RH

The transmitter transmitting time not more than 5 seconds

Test time: 1.33 s

Test Result: PASS



Date: 1.NOV.2012 17:59:43

10. AVERAGE FACTOR MEASUREMENT

10.1. Average factor Measurement according to ANSI 63.4: 2003

ANSI 63.4: 2003 Section 13.1.4.2 Devices transmitting pulsed emissions and subject to a limit requiring an average detector function for radiated emissions shall initially be measured with an instrument that uses a peak detector. A radiated emission measured with a peak detector may then be corrected to a true average using the appropriate factor for emission duty cycle. This correction factor relates the measured peak level to the average limit and is derived by averaging absolute field strength over one complete pulse train that is 0.1 s, or less, in length. If the pulse train is longer than 0.1 s, the average shall be determined from the average absolute field strength during the 0.1 s interval in which the field strength is at a maximum. Instructions on calculating the duty cycle of a transmitter with pulsed emissions are provided in ANSI 63.4 H.4, step j.

Average factor in dB = $20 \log (\text{duty cycle})$

10.2. Test Procedure

1. The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation.
2. Set SPA Center Frequency = Fundamental frequency, RBW = 100kHz, VBW = 300kHz, Span = 0Hz.
3. Set EUT as normal operation.
4. Set SPA View. Delta Mark time.

10.3. Measurement Result

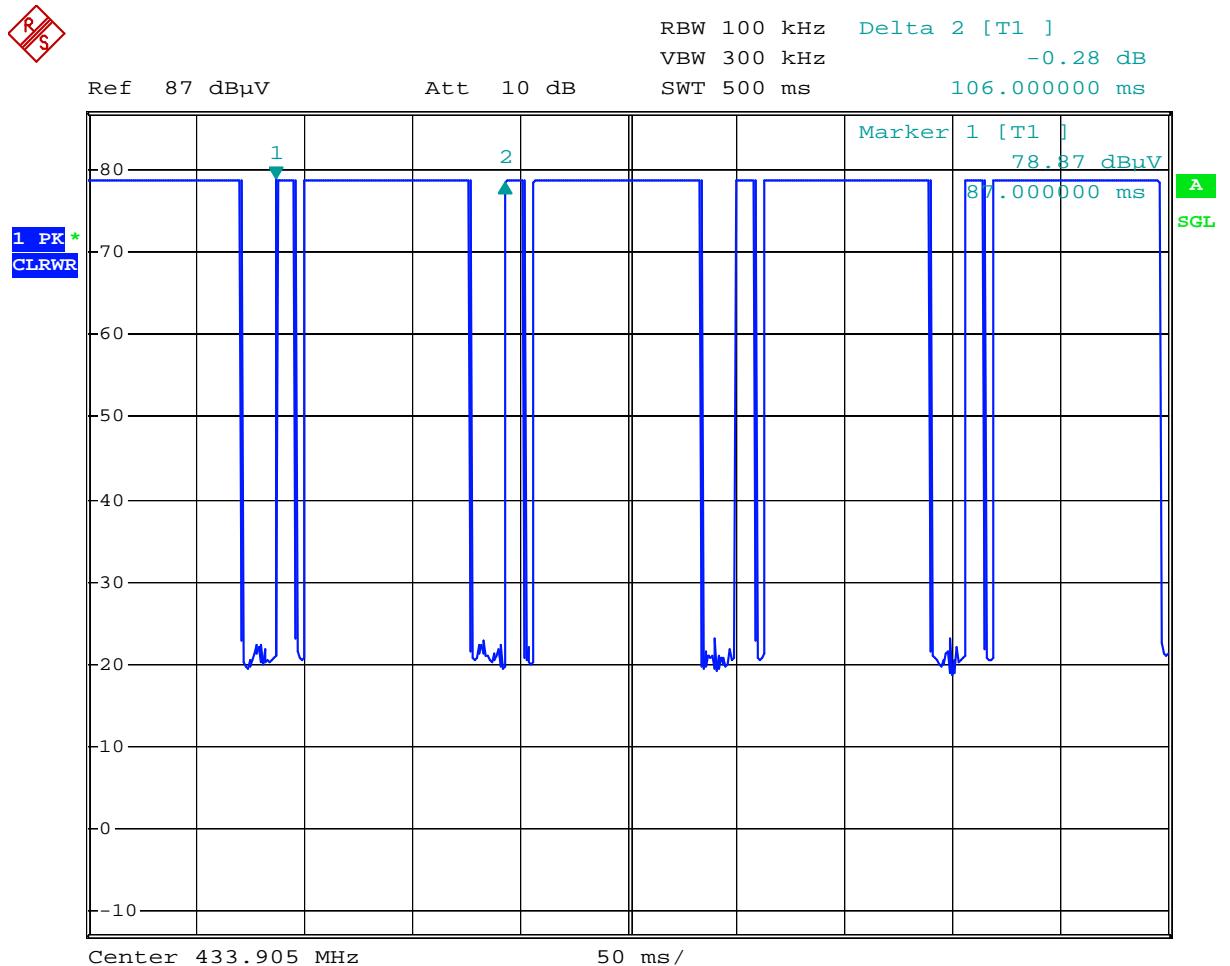
The duty cycle is simply the on time divided by the period:

The duration of one cycle = 106ms > 100ms

Effective period of the cycle = 77 + 9 ms = 86ms

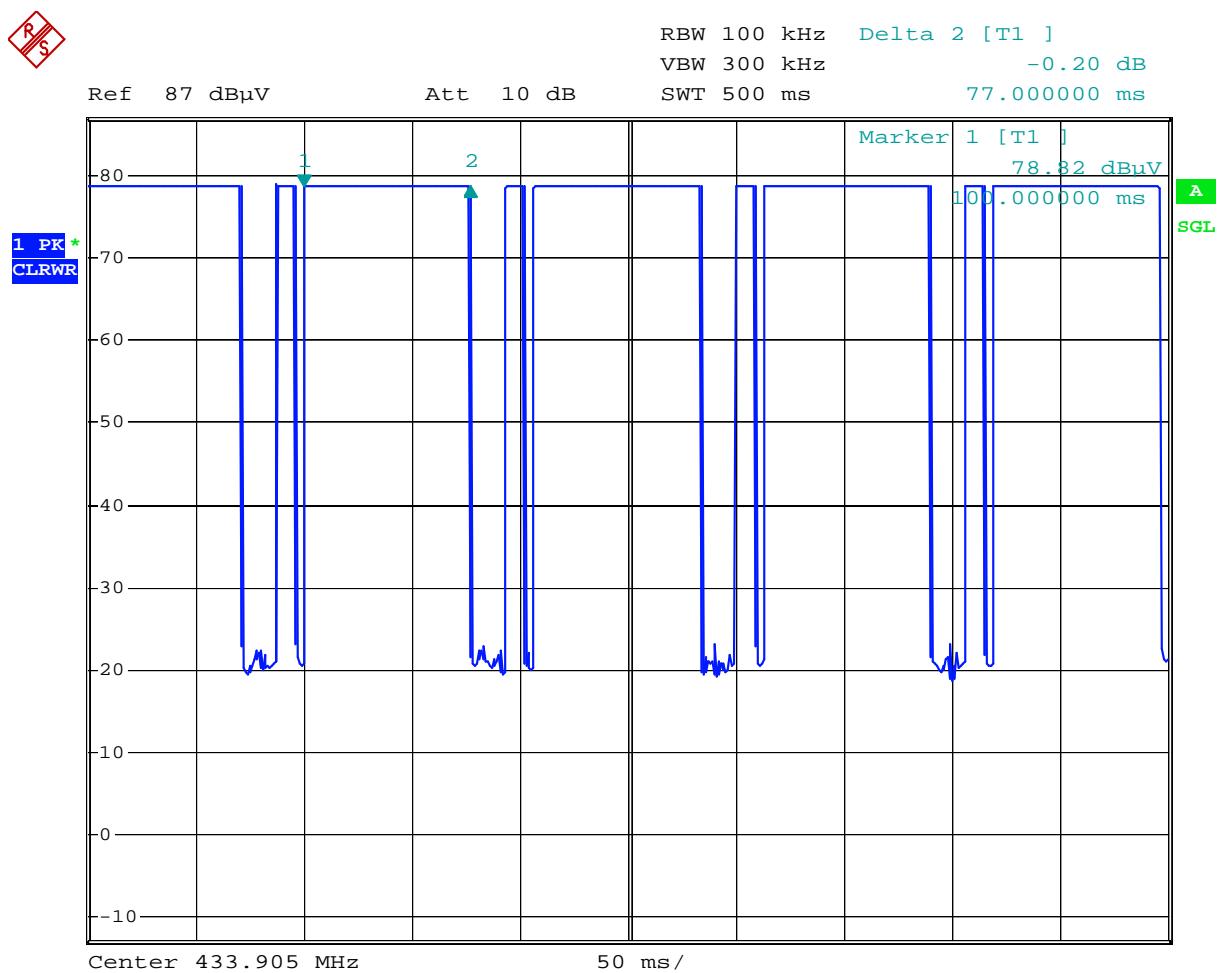
DC = 86ms/100ms = 0.86

Therefore, the average factor is found by $20\log 0.86 = -1.3\text{dB}$



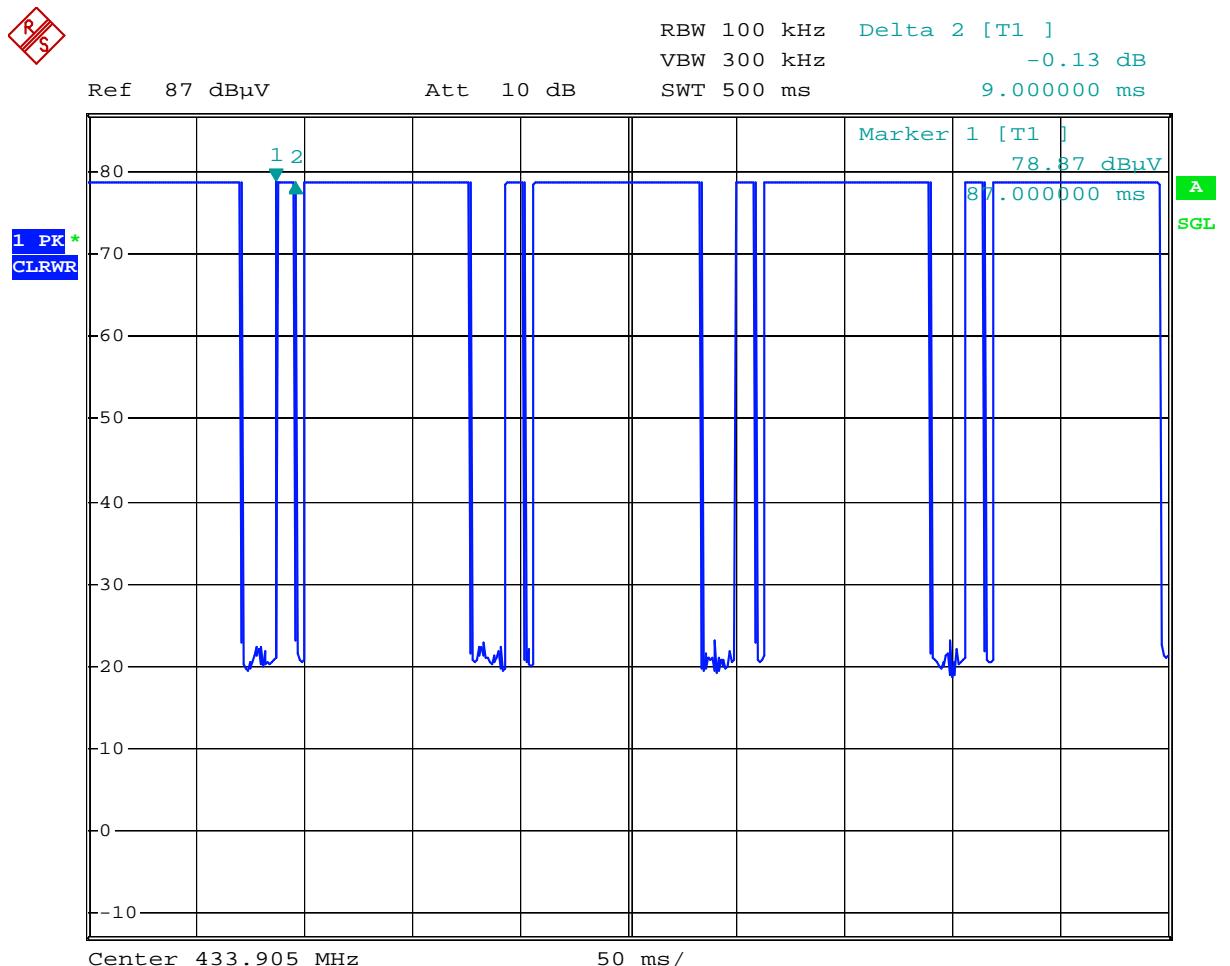
Date: 1.NOV.2012 18:56:49

The graph shows the pattern of coding during the signal transmission.



Date: 1.NOV.2012 18:57:58

The graph shows the duration of long 'on' signal. From marker 1 to marker 2, duration is 77ms.



Date: 1.NOV.2012 18:57:33

The graph shows the duration of short 'on' signal. From marker 1 to marker 2, duration is 9ms.

11. ANTENNA REQUIREMENT

11.1. Standard Applicable

For intentional device, according to FCC 47 CFR 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.

11.2. Antenna Connected Construction

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. 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 jack or electrical connector is prohibited.

The antenna used for this product is a PCB antenna. The antenna is permanently attached. Refer to the product photo.

11.3. Result

Compliance