FCC Radio Test Report
FCC ID: Z2F-RDB12

Report No.	:	TB-FCC111329
Applicant	:	Liuyang Happiness Firing System Factory
Equipment Under Test (EUT)		
EUT Name	:	Remote Controller For Fireworks
Model No.	:	RDB12
Serial No.	:	RDB12-1
Brand Name	:	Smile Face Fireworks
Receipt Date	:	2011-09-08
Test Date	:	2011-09-09 to 2011-09-16
Issue Date	:	2011-09-20
Tested By:	:	Bontek Compliance Testing Laboratory Ltd.
Standards	:	FCC Part 15, Subpart C(15.231)/ANSI C63.4:2003
Test/Witness Engineer	:	Roy Lai
Approved& Authorized	:	Laofy Wang

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Contents

Test Report Declaration

Applicant	:	Liuyang Happiness Firing System Factory.
Address	:	Room 501, NO.148, Laodong Zhong Road, Liuyang City, Hunan, China
Manufacturer	:	Liuyang Happiness Firing System Factory.
Address	:	Room 501, NO.148, Laodong Zhong Road, Liuyang City, Hunan, China
EUT Description	:	Remote Controller For Fireworks
Models No.	:	RDB12, RDB12-1

The device described above is tested by Bontek Compliance Testing Laboratory Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits for both radiation and conduction emissions.

The measurement results are contained in this test report and Shenzhen Meihua Electronic Technology Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliant with the FCC official limits.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of Shenzhen Meihua Electronic Technology Co., Ltd.

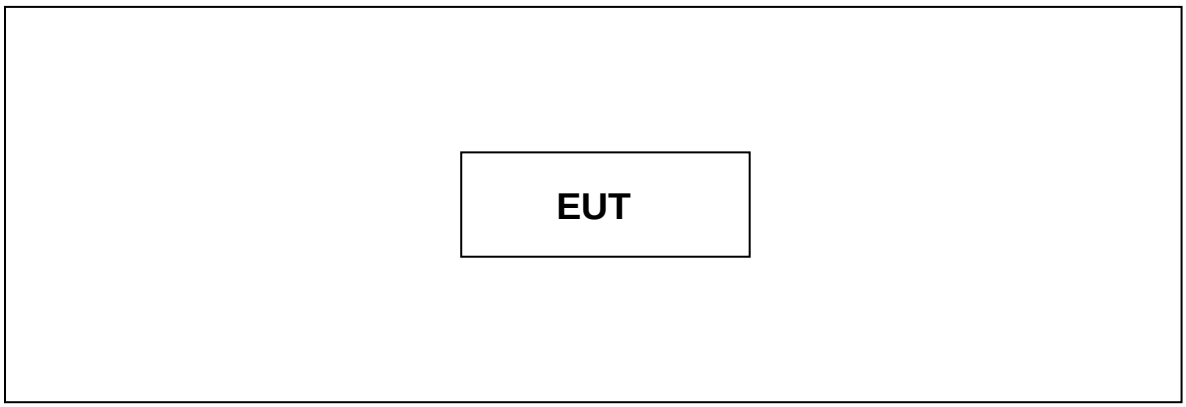
1. General Information about EUT

1.1 General Description of EUT (Equipment Under Test)

EUT Name	:	Remote Controller For Fireworks	
Models No.	:	RDB12, RDB12-1	
Model Difference	:	The different models are identical in schematic, structure and critical components, the only different is the color of the control panel.	
Product Description	:	Operation Frequency:	433.98 MHz
		Out Power:	79.82 dBuV/m (PK Max.) 71.87 dBuV/m (AV Max.)
		Antenna Gain:	External Antenna(2 dBi)
		Modulation Type:	ASK
Power Supply	:	DC Voltage supplied from battery.	
Power Rating	:	DC 12V from Ni-mh battery	
Connecting I/O Port(S)	:	Please refer to the User's Manual	

Note:
(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

1.2 Block Diagram Showing The Configuration of System Tested



1.3 Description of Support Units

The EUT has been tested as an independent unit.

1.4 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

Test Items	Note
Radiated Emission	Continuously transmitting
Bandwidth	Continuously transmitting
Duty Cycle	Continuously transmitting
Release Time	Normal Mode

Note:

(1) During the testing procedure, the continuously transmitting mode was programmed by the customer.

(2) The EUT is considered a portable unit, and it was pre-tested on the positioned of each 3 axis: X axis, Y axis and Z axis. The worst case was found positioned on Z-plane. There for only the test data of this Z-plane were used for radiated emission measurement test.

1.5 Test Facility

The tests were performed at:
Bontek Compliance Testing Laboratory Ltd.
1/F., Block East H-3, OCT Eastern Ind. Zone, Shenzhen China
Tel: 86-755-86337020 Fax: 86-755-86337028

At the time of testing, the Laboratory is accredited. It is listed in the United States of American Federal Communications Commission (FCC), and the registration number is 338263.

The test report was fulfilled by Shenzhen Meihua Electronic Co., Ltd. Shenzhen Meihua Electronic Technology Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements results.

2. Test Summary

FCC Part 15 Subpart (15.231)			
Standard Section	**Test Item**	**Judgment**	**Remark**
15.203	Antenna Requirement	PASS	
15.231	Conducted Emission	N/A	
	Release Time	PASS	
	Radiation Emission	PASS	
	20 dB Bandwidth	PASS	
	Duty Cycle	PASS	
Note: N/A is an abbreviation for Not Applicable.			

3. Conducted Emission Test

3.1 Test Standard and Limit

3.1.1Test Standard

FCC Part 15.207

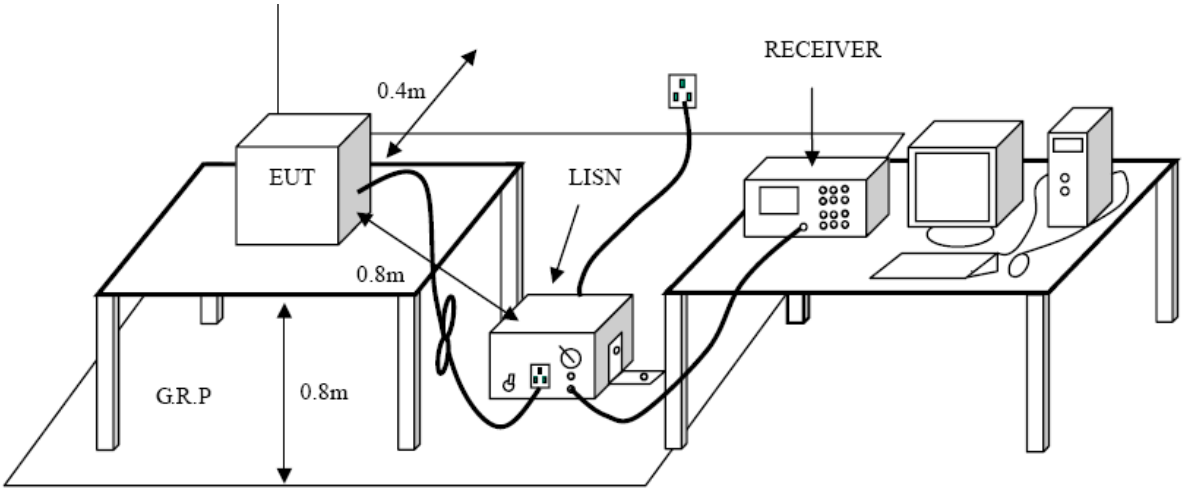
3.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Notes:
(1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequencies.
(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

3.2 Test Setup



3.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis.

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

3.4 Test Equipment Used

Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Date
EMI Test Receiver	ROHDE& SCHWARZ	ESC30	DE25181	2011-08-11	2012-08-11
50ΩCoaxial Switch	Anritsu	MP59B	X10321	2011-08-11	2012-08-11
L.I.S.N	EMCO	3624/1	00063417	2011-08-11	2012-08-11
L.I.S.N	EMCO	3624/1	00063417	2011-08-11	2012-08-11

3.5 Test Data

The test is not applicable.

4. Radiated Emission Test

4.1 Test Standard and Limit

4.1.1 Test Standard

FCC Part 15.231(b)

4.1.2 Test Limit

According to FCC 15.231(b) requirement:

In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolt/meter) at 3m	Field Strength of Spurious Emissions (microvolt/meter) at 3m
40.66~40.70	2250	225
70~130	1250	125
130~174	1250 to 3750(**)	125 to 375(**)
174~260	3750	375
260~470	3750 to 12500(**)	375 to 1250(**)
Above 470	12500	1250

** Linear interpolations, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

(1) for the band 130~174 MHz, uV/m at 3 meters= 56.81818(F)-6136.3636;

(2) for the band 260~470 MHz, uV/m at 3 meter= 41.6667(F)-7083.3333.

(3) The maximum permitted unwanted emissions level is 20 dB below the maximum permitted fundamental level. In addition field strength of any emissions which appear inside of the restriction band shall not exceed the general radiated emissions limits in Section 15.209(a).

Frequency (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	2400/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3

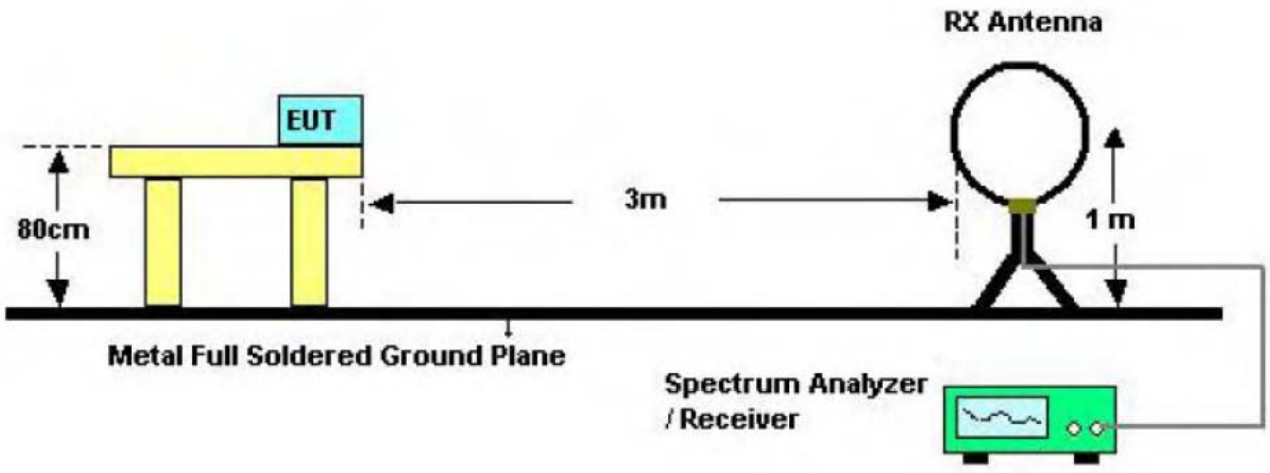
216~960	200	3
Above 960	500	3

Note:
(1) The tighter limit applies at the band edges.
(2) Emission Level(dBuV/m)=20log Emission Level(uV/m)

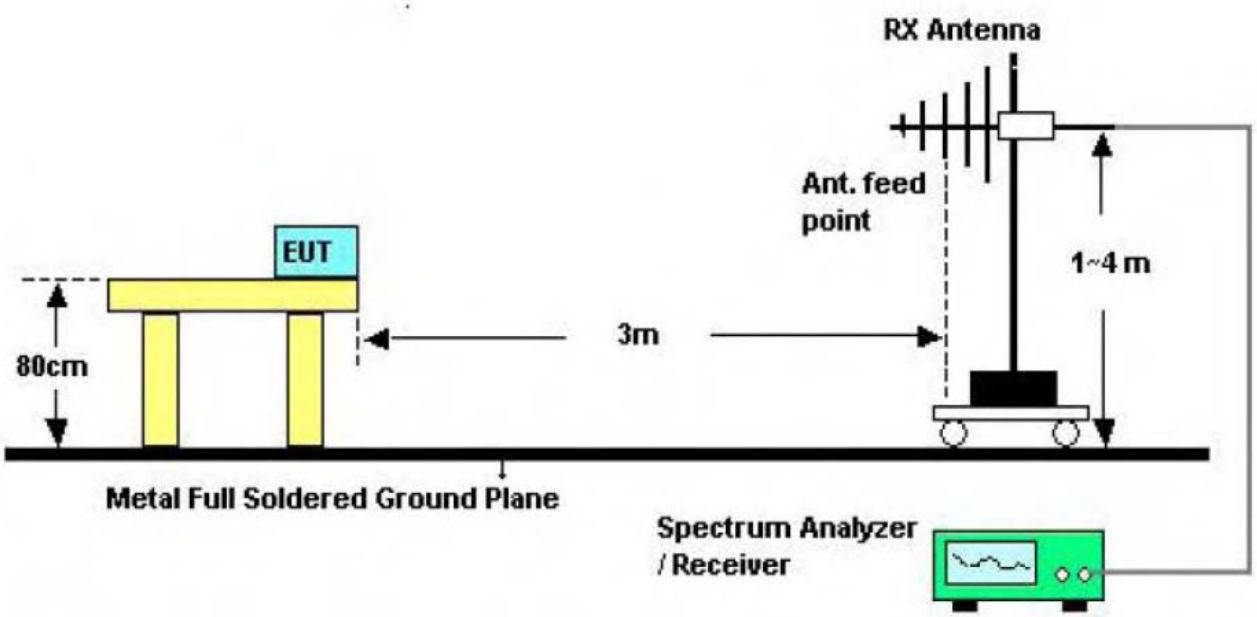
So the field strength of emission limits have been calculated in below table.

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolt/meter) at 3m
433.98 MHz	80.83 (Average)
433.98 MHz	100.83 (Peak)

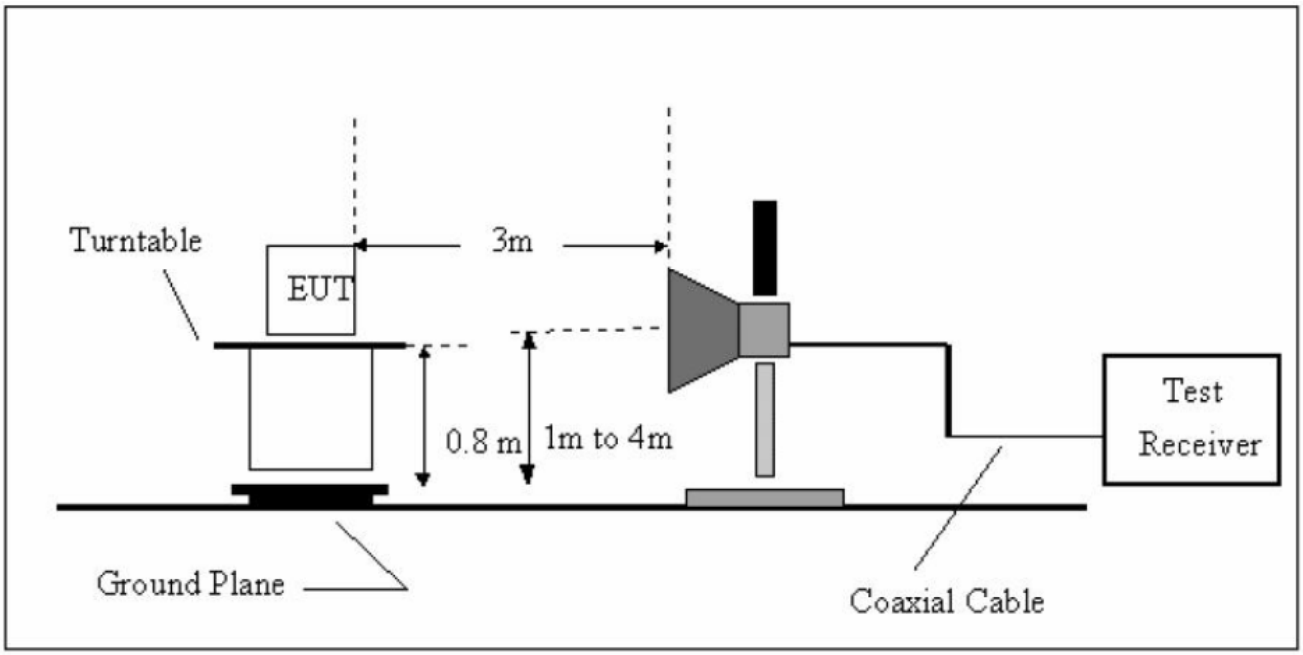
4.2 Test Setup



Bellow 30MHz Test Setup



Bellow 1000MHz Test Setup



Above 1GHz Test Setup

4.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.

(2) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are

set to make measurement.

(3) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(4) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(5) For the actual test configuration, please see the test setup photo.

4.4 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

4.5 Test Equipment

Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Date
Spectrum Analyzer	ROHDE& SCHWARZ	FSEA20	DE25181	2011-08-12	2012-08-11
Positioning Controller	C&C	CC-C-1F	N/A	2011-08-12	2012-08-11
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2011-07-21	2012-07-20
Horn Antenna	SCHWARZBECK	BBHX 9120	9120-426	2011-07-21	2012-07-20
RF Switch	EM	EMSW18	SW060023	2011-08-12	2012-08-11
Amplifier	Agilent	8447F	3113A06717	2011-08-12	2012-08-11
Coaxial Cable	SCHWARZBECK	AK9513	9513-10	2011-08-12	2012-08-11
EMI Test Receiver	ROHDE& SCHWARZ	ESPI	25498514	2011-08-12	2012-08-11
EMI Test Receiver	ROHDE& SCHWARZ	ESI26	838786/103	2011-08-12	2012-08-11
Receiver Horn Antenna	ROHDE& SCHWARZ	HF906	100013	2011-08-12	2012-08-11

4.6 Test Condition

Temperature	:	25 ℃
Relative Humidity	:	65 %
Pressure	:	1010 hPa
Test Power	:	DC 12V

4.7 Test Data

Radiated Emission Bellow 1 GHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Margin (dB)	Note
35.820	H	23.40	40.00	16.60	PK
55.220	H	22.10	40.00	17.90	PK
284.140	H	28.60	46.00	17.40	PK
311.300	H	31.20	46.00	14.80	PK
472.720	H	33.70	46.00	12.30	PK
660.800	H	33.20	46.00	12.80	PK
47.46	V	27.20	40.00	12.80	PK
59.10	V	24.70	40.00	15.30	PK
103.720	V	23.60	43.50	19.90	PK
291.900	V	25.60	46.00	20.40	PK
378.420	V	30.42	46.00	15.58	PK
657.840	V	32.04	46.00	13.96	PK

Note: (1) All Readings are Peak Value.
(2) Emission Level= Reading Level+ Probe Factor +Cable Loss
(3) The QP measurement was not performed when the peak measured data under the limit of QP detection.

Fundamental and Harmonics emissions

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV) PK	AV	Limit 3m(dBuV/m) PK	AV	Margin(dB) PK	AV
433.980	V	70.65	62.70	100.83	80.83	30.18	18.13
867.960	V	48.73	40.78	80.83	60.83	32.10	20.05
1301.960	V	45.09	37.14	74.00	54.00	28.91	16.86
1735.930	V	42.93	34.98	74.00	54.00	31.07	19.02
2169.980	V	41.75	33.80	74.00	54.00	32.25	20.20
2603.880	V	38.21	30.26	74.00	54.00	35.79	23.74
---	V	---	---	74.00	54.00	---	---
---	V	---	---	74.00	54.00	---	---
---	V	---	---	74.00	54.00	---	---
---	V	---	---	74.00	54.00	---	---
433.980	H	79.82	71.87	100.83	80.83	21.01	8.96
867.960	H	53.05	45.10	80.83	60.83	27.78	15.73
1301.950	H	50.47	42.52	74.00	54.00	23.53	11.48
1735.940	H	46.02	38.07	74.00	54.00	27.98	15.93
2170.010	H	47.54	39.59	74.00	54.00	26.46	14.41
2603.900	H	43.38	35.43	74.00	54.00	30.62	18.57
---	H	---	---	74.00	54.00	---	---
---	H	---	---	74.00	54.00	---	---
---	H	---	---	74.00	54.00	---	---
---	H	---	---	74.00	54.00	---	---

Other harmonics emissions are lower than 20dB below the allowable limit.

Note: (1) All Readings are Peak Value and AV. And AV is calculated by the following: Average =Peak Value + 20log(Duty Cycle), Final AV=PK-7.95

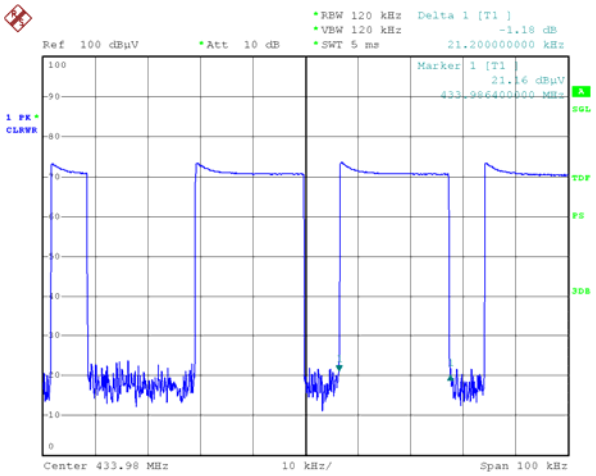
(2) Emission Level= Reading Level + Probe Factor +Cable Loss

(3) Data of measurement within this frequency range shown " -- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

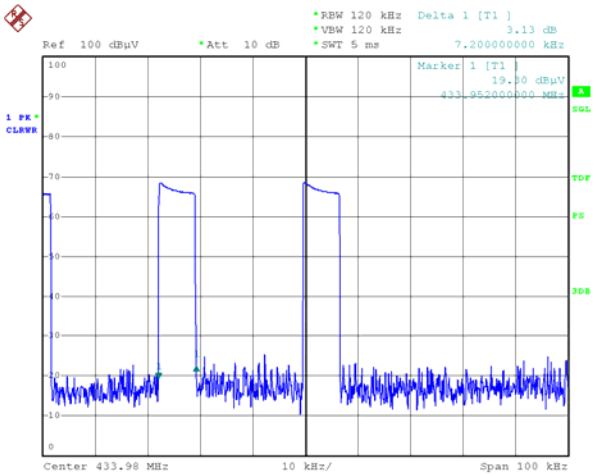
Pulse Desensitization Correction Factor

Note:

(1) For the Large Pulse train, Pulse Width=21.2 KHz, and Pulse Emission Bandwidth= 1/PW= 0.047 KHz< RBW=120 KHz.



(2) For the Small Pulse train, Pulse Width=7.2 KHz, and Pulse Emission Bandwidth= 1/PW= 0.139 KHz< RBW=120 KHz.



Because the two Pulses of the Emission Bandwidth are less than measuring Bandwidth, so the PDCF is not needed.

5. Bandwidth

5.1 Test Standard and Limit

5.1.1 Test Standard

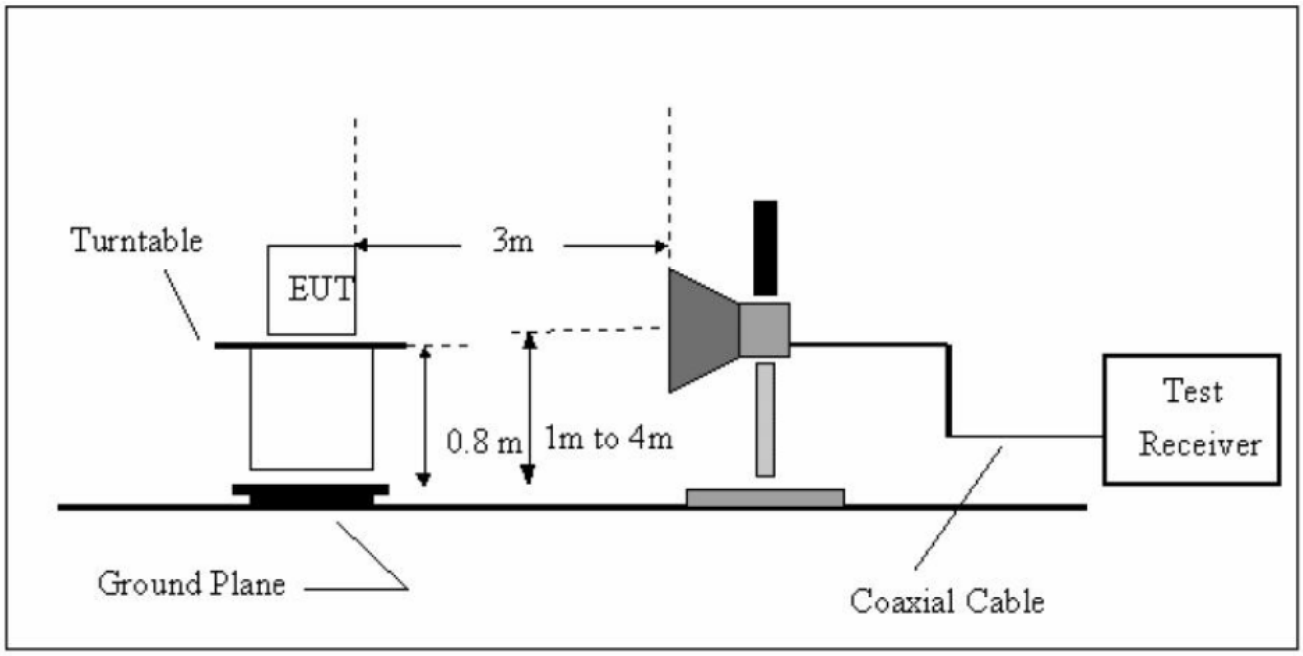
FCC Part 15.231

5.1.2 Test Limit

The bandwidth of the emissions shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. So the emission bandwidth limits have been calculated in below table.

Fundamental Frequency	20 dB Bandwidth Limits (MHz)
433.98 MHz	1.085

5.2 Test Setup



5.3 Test Procedure

(1) Set Spectrum Analyzer Center Frequency= Fundamental Frequency, RBW=10 kHz, VBW= 30 kHz, Span= 1 MHz.
(2) Measured the spectrum width with power higher than 20 dB below carrier.

5.4 EUT Operating Condition

The Equipment Under Test was Programmed to be in continuously transmitting mode.

5.5 Test Equipment

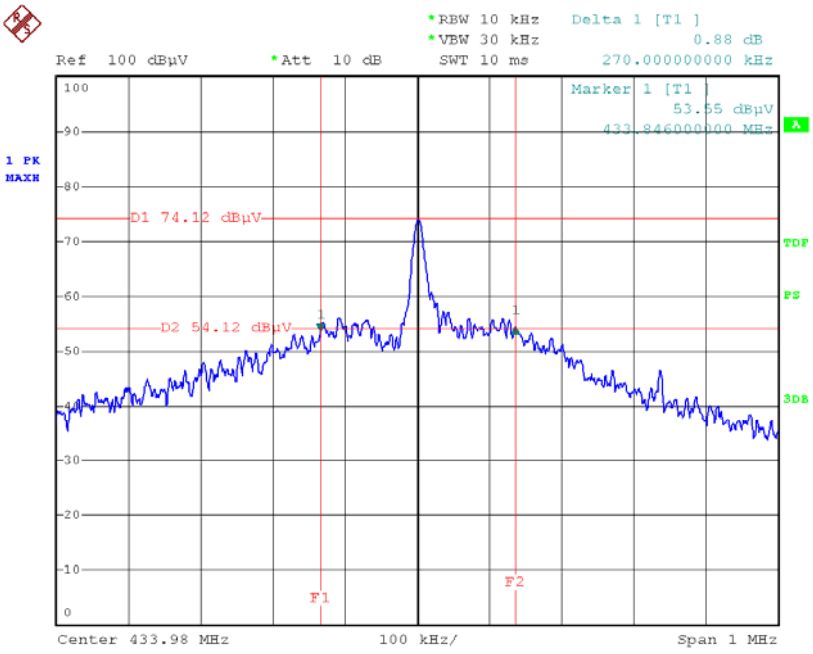
Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Date
Spectrum Analyzer	ROHDE& SCHWARZ	FSEA20	DE25181	2011-08-12	2012-08-11
Positioning Controller	C&C	CC-C-1F	N/A	2011-08-12	2012-08-11
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2011-07-21	2012-07-20
Horn Antenna	SCHWARZBECK	BBHX 9120	9120-426	2011-07-21	2012-07-20
RF Switch	EM	EMSW18	SW060023	2011-08-12	2012-08-11
Amplifier	Agilent	8447F	3113A06717	2011-08-12	2012-08-11
Coaxial Cable	SCHWARZBECK	AK9513	9513-10	2011-08-12	2012-08-11
EMI Test Receiver	ROHDE& SCHWARZ	ESPI	25498514	2011-08-12	2012-08-11
EMI Test Receiver	ROHDE& SCHWARZ	ESI26	838786/103	2011-08-12	2012-08-11
Receiver Horn Antenna	ROHDE& SCHWARZ	HF906	100013	2011-08-12	2012-08-11

5.6 Test Condition

Temperature	:	25 ℃
Relative Humidity	:	65 %
Pressure	:	1010 hPa
Test Power	:	DC 12V

5.7 Test Data

Frequency (MHz)	20 dBc Bandwidth (kHz)	Result
433.98	270	PASS



6. Release Time Measurement

6.1 Test Standard and Limit

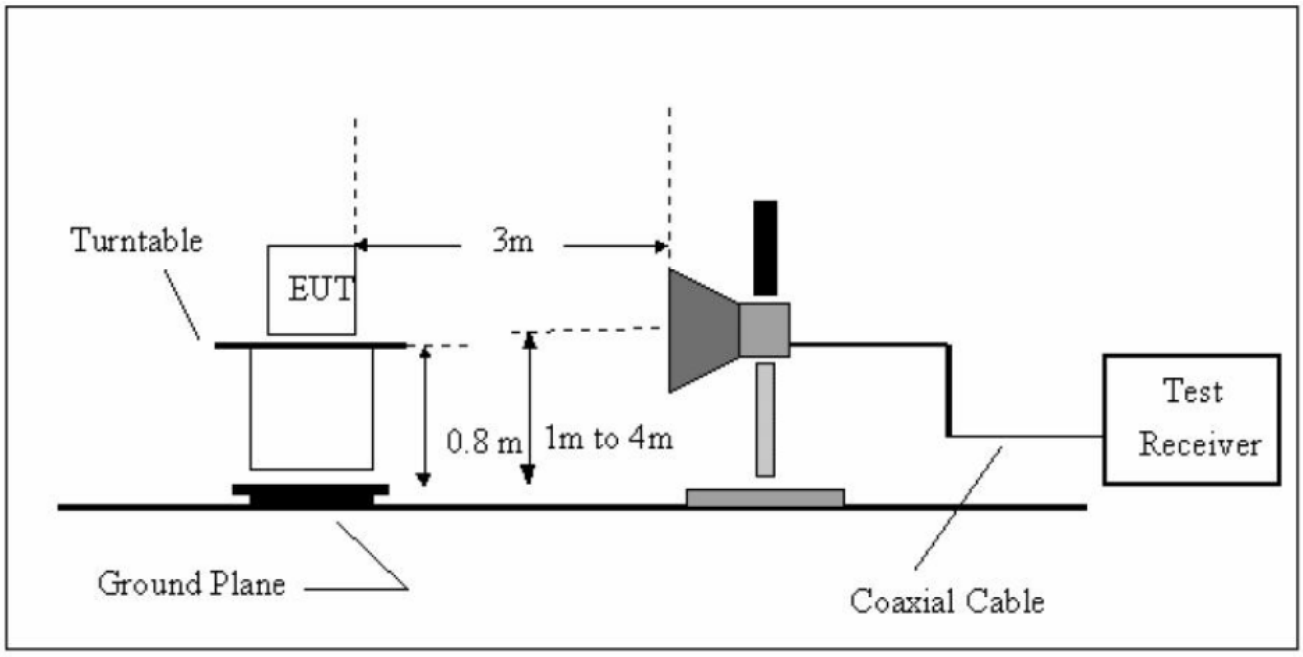
5.1.1 Test Standard

FCC Part 15.231 (a)(1)

5.1.2 Test Limit

According to FCC 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.

6.2 Test Setup



6.3 Test Procedure

(1) Setup the EUT as show in the block diagram above.
(2) Set Spectrum Analyzer Centre Frequency= Fundamental Frequency, RBW=100 kHz, VBW= 100 kHz, Span= 0 Hz. Sweep Time= 5 Seconds.
(3) Setup the EUT as normal operation and press Transmitter button.
(4) Set Spectrum Analyzer View, Delta Mark time.

6.4 EUT Operating Condition

The EUT was set to work in transmitting mode.

6.5 Test Equipment

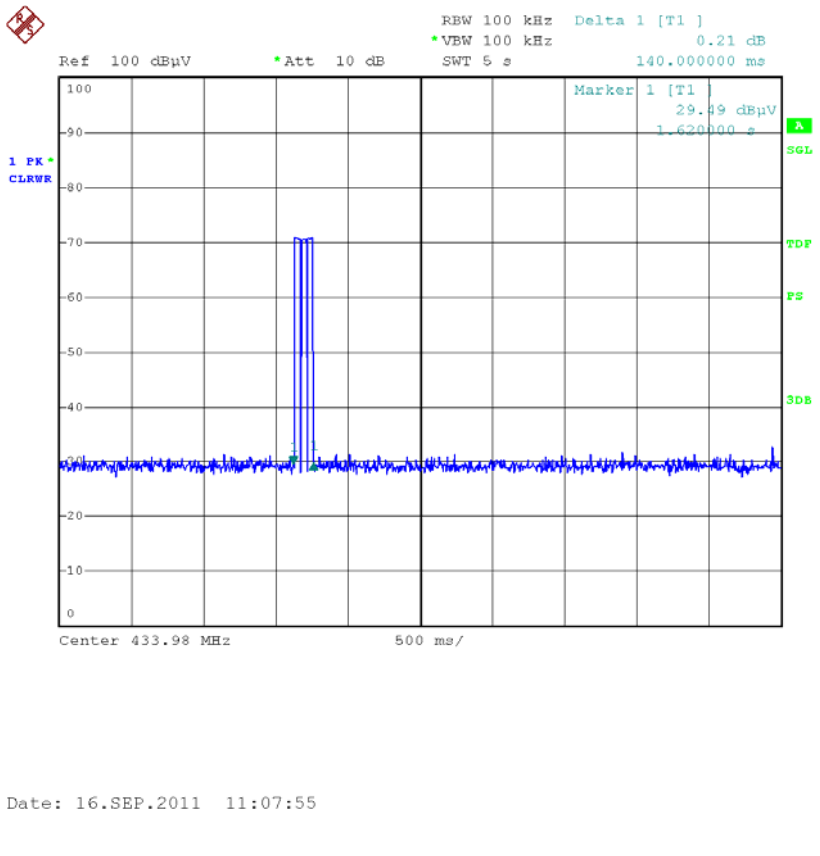
Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Date
Spectrum Analyzer	ROHDE& SCHWARZ	FSEA20	DE25181	2011-08-12	2012-08-11
Positioning Controller	C&C	CC-C-1F	N/A	2011-08-12	2012-08-11
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2011-07-21	2012-07-20
Horn Antenna	SCHWARZBECK	BBHX 9120	9120-426	2011-07-21	2012-07-20
RF Switch	EM	EMSW18	SW060023	2011-08-12	2012-08-11
Amplifier	Agilent	8447F	3113A06717	2011-08-12	2012-08-11
Coaxial Cable	SCHWARZBECK	AK9513	9513-10	2011-08-12	2012-08-11
EMI Test Receiver	ROHDE& SCHWARZ	ESPI	25498514	2011-08-12	2012-08-11
EMI Test Receiver	ROHDE& SCHWARZ	ESI26	838786/103	2011-08-12	2012-08-11
Receiver Horn Antenna	ROHDE& SCHWARZ	HF906	100013	2011-08-12	2012-08-11

6.6 Test Condition

Temperature	:	25 ℃
Relative Humidity	:	65 %
Pressure	:	1010 hPa
Test Power	:	DC 12V

6.7 Test Data

Release Time (s)	Limit (s)	Result
0.14	5	PASS

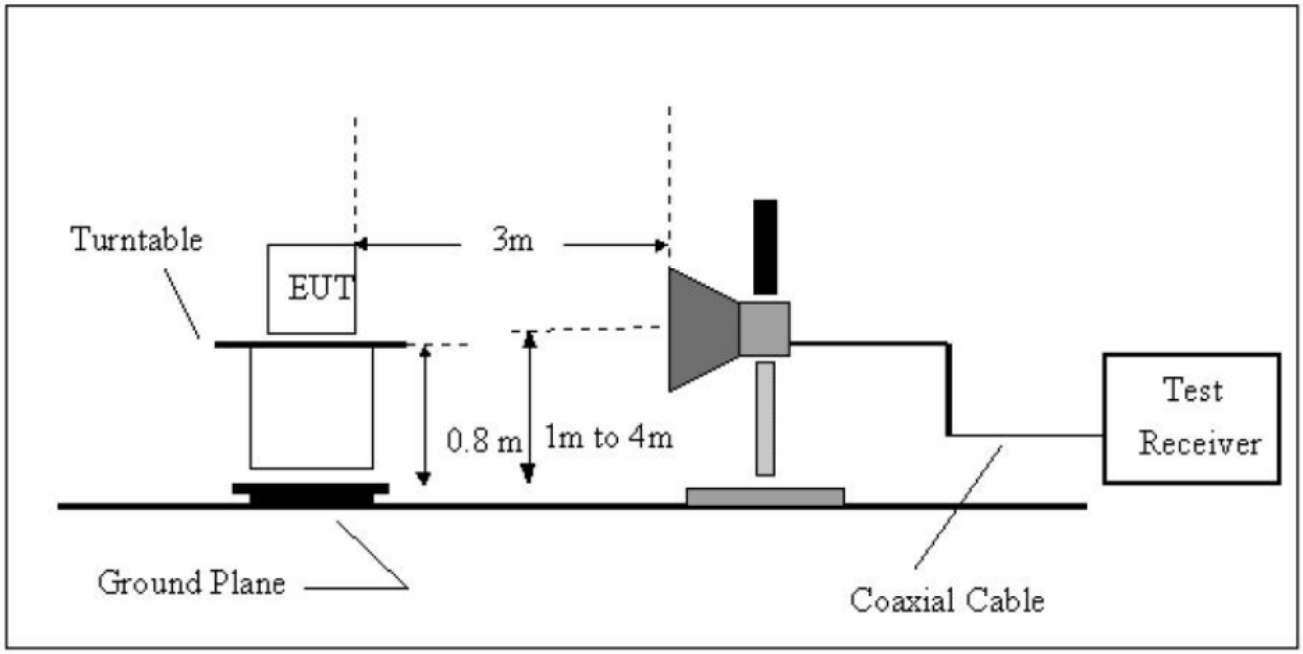


7. Duty Cycle

7.1 Test Standard and Limit

5.1.1 Test Standard
FCC Part 15.231

7.2 Test Setup



7.3 Test Procedure

(1) The EUT was placed on a turntable which is 0.8m above ground plane.
(2) Set EUT operating in continuous transmitting mode.
(3) Set the Spectrum Analyzer to the transmitter carrier frequency, and set the spectrum analyzer resolution bandwidth (RBW) to 100 kHz and video bandwidth (VBW) to 300 kHz, Span was set to 0 Hz.
(4) The Duty Cycle was measured and recorded.

7.4 EUT Operating Condition

The EUT was programmed to be in transmitting mode.

7.5 Test Equipment

Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Date
Spectrum Analyzer	ROHDE& SCHWARZ	FSEA20	DE25181	2011-08-12	2012-08-11

Positioning Controller	C&C	CC-C-1F	N/A	2011-08-12	2012-08-11
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2011-07-21	2012-07-20
Horn Antenna	SCHWARZBECK	BBHX 9120	9120-426	2011-07-21	2012-07-20
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EMI Test Receiver	ROHDE& SCHWARZ	ESI26	838786/103	2011-08-12	2012-08-11
Receiver Horn Antenna	ROHDE& SCHWARZ	HF906	100013	2011-08-12	2012-08-11

7.6 Test Condition

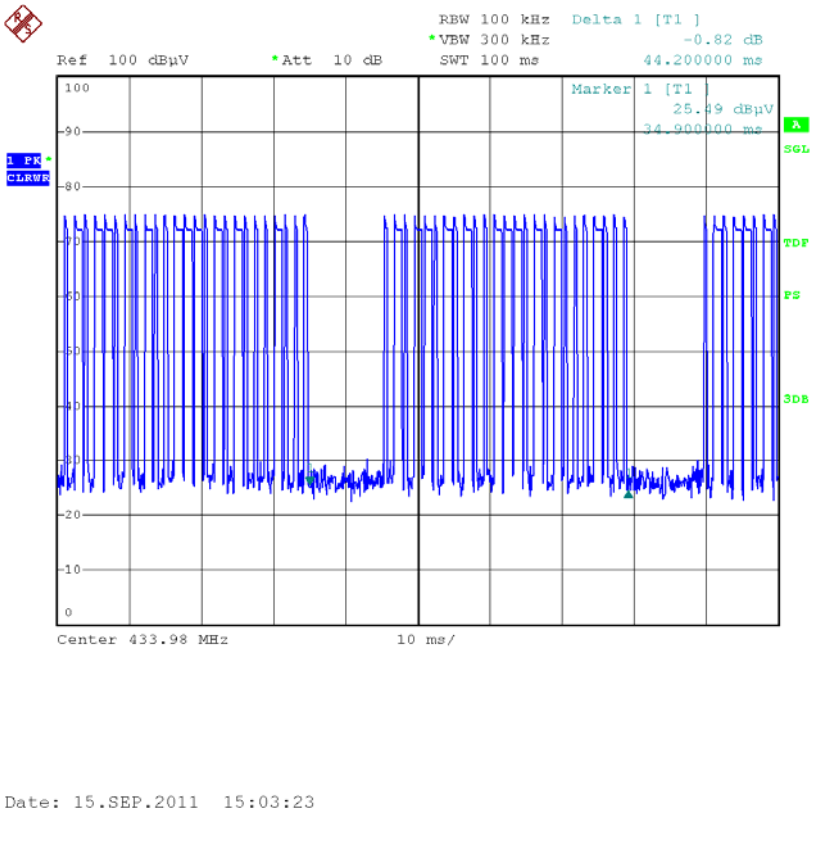
Temperature	:	25 ℃
Relative Humidity	:	65 %
Pressure	:	1010 hPa
Test Power	:	DC 12V

7.7 Test Data

Please refer the following pages:
Plot 1: transmit once in 100ms, and each cycle is 44.20 ms
Plot 2: there are two kinds of pulse in each cycle, the large pulses total 11, the small pulses total 14
Plot 3: one large pulse in a time period of 1.10 ms
Plot 4: one small pulse in a time period of 0.40 ms.

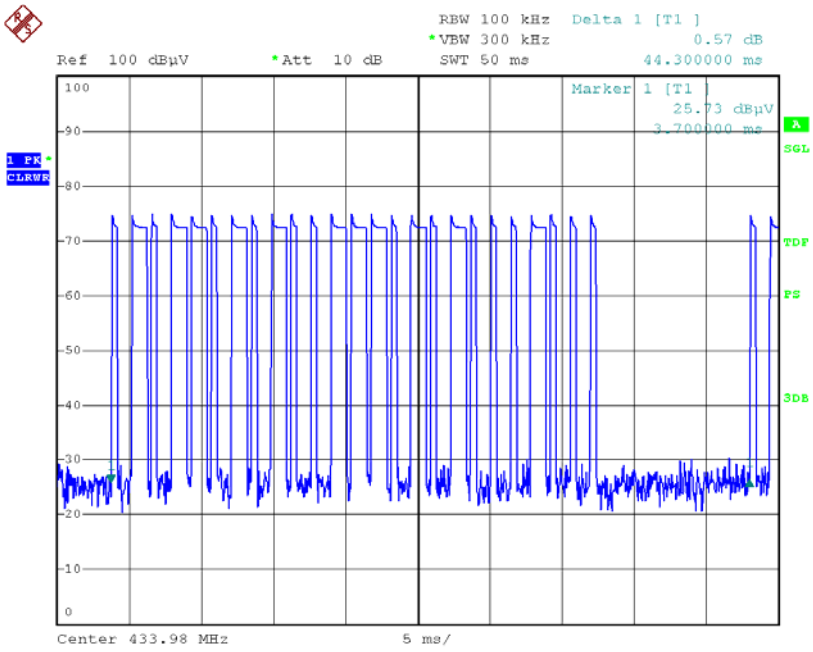
Duty Cycle=ON/Total=(11*1.10+14*0.40)/44.2=17.70/44.20=40.05%
20 log(Duty Cycle)=-7.95
Average=Peak value+ 20log(Duty Cycle), AV=PK-7.95

Plot 1



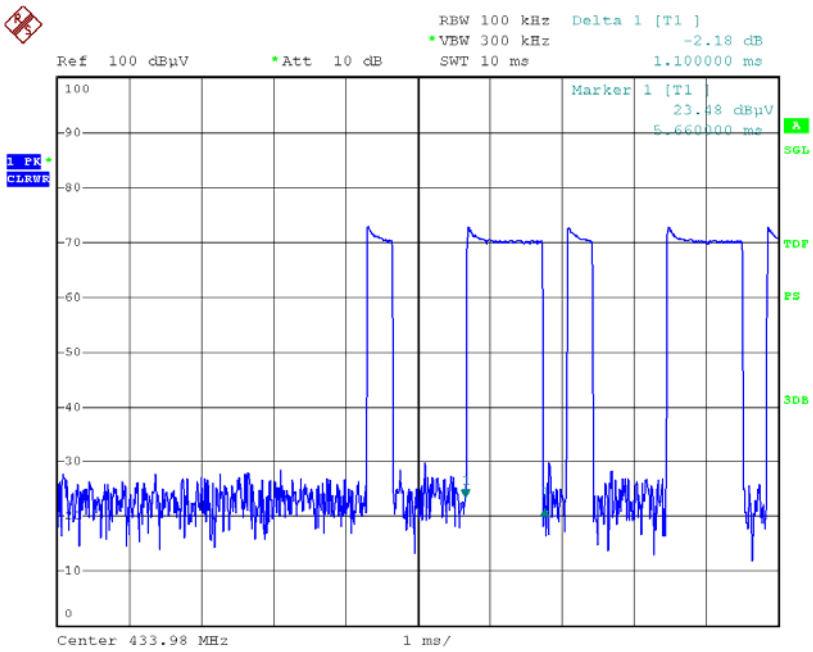
Date: 15.SEP.2011 15:03:23

Plot 2



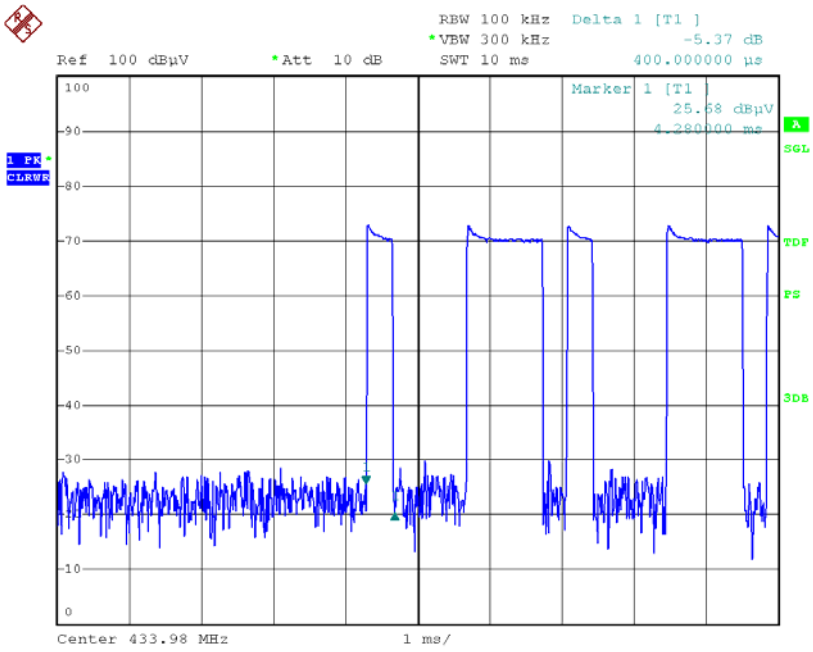
Date: 15.SEP.2011 15:05:01

Plot 3



Date: 15.SEP.2011 15:08:11

Plot 4



Date: 15.SEP.2011 15:07:14

8. Antenna Requirement

8.1 Standard Requirement

11.1.1 Standard

FCC Part 15.203

11.1.2 Requirement

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.

8.2 Antenna Connected Construction

The directional gains of the antenna used for transmitting is 2 dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

8.3 Result

The EUT antenna is a External Antenna. It complies with the standard requirement.