

FCC TEST REPORT  
for  
Shandong Welltek Petroleum Equipment CO., LTD.

Signal Transmitter  
Model No.: TG-XF

Prepared for : Shandong Welltek Petroleum Equipment CO., LTD.  
Address : Yulan Road, No. 618, High and New Technology Industry  
Development Zone, Qufu City, Shandong Province, China

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Report Number : R011412288E  
Date of Test : Dec. 16, 2014~ Mar. 26, 2015  
Date of Report : Mar. 27, 2015

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## TEST REPORT

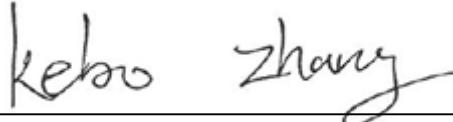
Applicant : Shandong Welltek Petroleum Equipment CO., LTD.  
Manufacturer : Shandong Welltek Petroleum Equipment CO., LTD.  
EUT : Signal Transmitter  
Model No. : TG-XF  
Serial No. : N.A.  
Trade Mark :   
Rating : DC 7.2V, 15mA

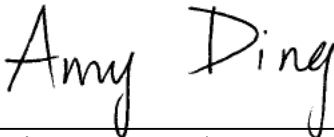
Measurement Procedure Used:  
FCC Part15 Subpart C, Paragraph 15.231e

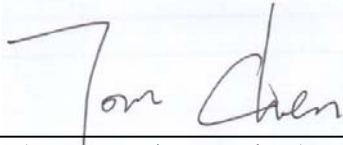
The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited

Date of Test : Dec. 16, 2014~ Mar. 26, 2015

Prepared by :   
(Tested Engineer / Kebo Zhang)

Reviewer :   
(Project Manager / Amy Ding)

Approved & Authorized Signer :   
(Manager / Tom Chen)

## 1. GENERAL INFORMATION

### 1.1. Description of Device (EUT)

EUT : Signal Transmitter

Model Number : TG-XF

Test Power Supply : DC 7.2V

Frequency : 315MHz

Antenna : 0dBi External Antenna

Applicant : Shandong Welltek Petroleum Equipment CO., LTD.  
Address : Yulan Road, No. 618, High and New Technology Industry  
Development Zone, Qufu City, Shandong Province, China

Manufacturer : Shandong Welltek Petroleum Equipment CO., LTD.  
Address : Yulan Road, No. 618, High and New Technology Industry  
Development Zone, Qufu City, Shandong Province, China

Factory : Shandong Welltek Petroleum Equipment CO., LTD.  
Address : Yulan Road, No. 618, High and New Technology Industry  
Development Zone, Qufu City, Shandong Province, China

Date of receiver : Dec. 08, 2014

Date of Test : Dec. 16, 2014~ Mar. 26, 2015

## 1.2. Auxiliary Equipment Used during Test

N/A

## 1.3. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

### **CNAS - LAB Code: L3503**

Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

### **FCC-Registration No.: 752021**

Shenzhen Anbotek Compliance Laboratory Limited, 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. Registration 752021, July 10, 2013.

### **IC-Registration No.: 8058A-1**

Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A-1, February 22, 2013.

### **Test Location**

All Emissions tests were performed at  
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

## 1.4. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 4.1 dB (Horizontal) Ur = 4.3 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4dB

## 1.5. Test Summary

For the EUT described above. The standards used were FCC Part 15 Subpart C Section 15.231 for Emissions

### Tests Carried Out Under FCC Part 15 Subpart C

Standard	Test Items	Status	Application
Part 15 Subpart C Section 15.231	Disturbance Voltage at The Mains Terminals	x	N/A, without AC power supply
	Radiation Emission	√	
	20dB Bandwidth	√	
	Duty Cycle	√	

- √ Indicates that the test is applicable.  
x Indicates that the test is not applicable.

## 2. MEASURING DEVICE AND TEST EQUIPMENT

The following test equipments were used during test:

Equipment	Manufacturer	Model #	Serial #	Date of Cal.	Cal. Interval
Spectrum Analyzer	Agilent	E4407B	US39390582	Aug. 08, 2014	1 Year
Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 22, 2014	1 Year
Test Receiver	Rohde & Schwarz	ESCI	100627	Apr. 22, 2014	1 Year
Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB9163-289	Apr. 24, 2014	1 Year
Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 04, 2014	1 Year
Preamplifier	Instruments corporation	EMC011830	980100	Aug. 08, 2014	1 Year
Pre-amplifier	SONOMA	310N	186860	Aug. 08, 2014	1 Year
AC Power Source	Sepcial power system	YF650	N/A	N/A	N/A
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	N/A	N/A	N/A
EMI Test Software EZ-EMC	SHURPLE	EZ-EMC	N/A	N/A	N/A
Coaxial Cable	N/A	N/A	N/A	N/A	N/A
Coaxial Cable	N/A	N/A	N/A	N/A	N/A
Coaxial Cable	N/A	N/A	N/A	N/A	N/A
3m Semi-Anechoic Chamber	Zhong Yu Electronic	N/A	N/A	N/A	N/A

### 3. Test Procedure

#### JUSTIFICATION

ANSI C63.4 section 12.1.4.1 requires that hand-held or body-worn devices shall include rotation of the EUT through three orthogonal axes to determine the attitude that maximizes the emissions. The EUT is a hand-held device. As such, preliminary tests were performed to determine the orientation that produced the highest level of emissions. This was with the DUT orientated vertically as shown in Section 7.1.

#### GENERAL:

This report shall NOT be reproduced except in full without the written approval of Anbotek Compliance Laboratory Limited. The EUT was transmitting a test signal during the testing.

**RADIATION INTERFERENCE:** The test procedure used was ANSI STANDARD C63.4-2009 using a spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100KHz and the video bandwidth was 300KHz up to 1.0GHz and 1.0MHz with a video BW of 3.0MHz above 1.0GHz. The ambient temperature of the EUT was 74.3oF with a humidity of 69%.

**FORMULA OF CONVERSION FACTORS:** The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the Spectrum Analyzer Meter Reading.

#### Example:

Freq (MHz) METER READING + ACF = FS  
33 20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

**ANSI STANDARD C63.4 MEASUREMENT PROCEDURES:** The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation. When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.



## 4. Radiation Interference

### 4.1. Requirements (15.231e):

According to 15.231(e), the field strength of emissions from Intentional Radiators operated under this section shall not exceed the following:

FCC Part 15 Subpart C Paragraph 15.231(e) Limits				
Fundamental Frequency MHz	Field Strength of Fundamental		Field Strength of Harmonics	
	uV/m	dBuV/m	uV/m	dBuV/m
40.66-40.70	1000	60	100	40
70-130	500	53.98	50	33.98
130-174	500-1500	53.98-63.52	50-150	33.98-43.52
174-260	1500	63.52	150	43.52
260-470	1500-5000	53.52-73.98	150-500	33.52-53.98
above 470	5000	73.98	500	53.98

Remarks:

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector.

**Spurious electric field strength limits**

<b>FCC Part 15 Subpart C Paragraph 15.209 Limits</b>			
Frequency MHz	uV/m	dBuV/m	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	See Remark <sup>1</sup>	300
0.490-1.705	24000/F(kHz)	See Remark <sup>1</sup>	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Remarks:

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

**4.2 Test Procedure**

The EUT is placed on a turn table which is 0.8 meter high above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

All readings from 30MHz to 1GHz are quasi-peak values with a resolution bandwidth of 120kHz. All reading are above 1GHz, peak & average values with a resolution bandwidth of 1MHz. The EUT is tested in 9\*6\*6 Chamber.

**4.3 Test Results**

PASS.

The test data Please refer the following pages.

**Data:**

Horizontal

Frequency (MHz)	Reading (dBuV/m)	Factor (dBuV/m)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
315.480	62.60	-15.80	46.80	67.66	-20.86
629.477	50.09	-10.42	39.67	47.66	-7.99
945.440	45.30	-4.03	41.27	47.66	-6.39
1250.00	---	---	---	---	---
**1574.01	---	---	---	---	---
1889.83	---	---	---	---	---
**2205.00	---	---	---	---	---
2520.00	---	---	---	---	---
**2835.00	---	---	---	---	---
3150.00	---	---	---	---	---

Vertical

Frequency (MHz)	Reading (dBuV/m)	Factor (dBuV/m)	Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
315.480	59.11	-14.35	44.76	67.66	-22.90
629.477	45.94	-9.01	36.93	47.66	-10.73
945.440	39.50	-3.03	36.47	47.66	-11.19
1250.00	---	---	---	---	---
**1574.01	---	---	---	---	---
1889.83	---	---	---	---	---
**2205.00	---	---	---	---	---
2520.00	---	---	---	---	---
**2835.00	---	---	---	---	---
3150.00	---	---	---	---	---

**NOTE: 1. All values measured above 1GHz are recorded as AV values.**

**2. “ --- ” 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.**

**3. “\*\*” in the table above means the restricted band.**

## 5. 20dB Bandwidth

### 5.1. Requirements (15.231):

In accordance with Part15.231(c), the fundamental frequency bandwidth was kept within 0.25% of the center frequency for devices operating >70MHz and <900MHz.

Fundamental Frequency (MHz)	Limit of 20dB Bandwidth (kHz)
315	$315000 \times 0.0025 = 787.50$

### 5.2. EUT Setup

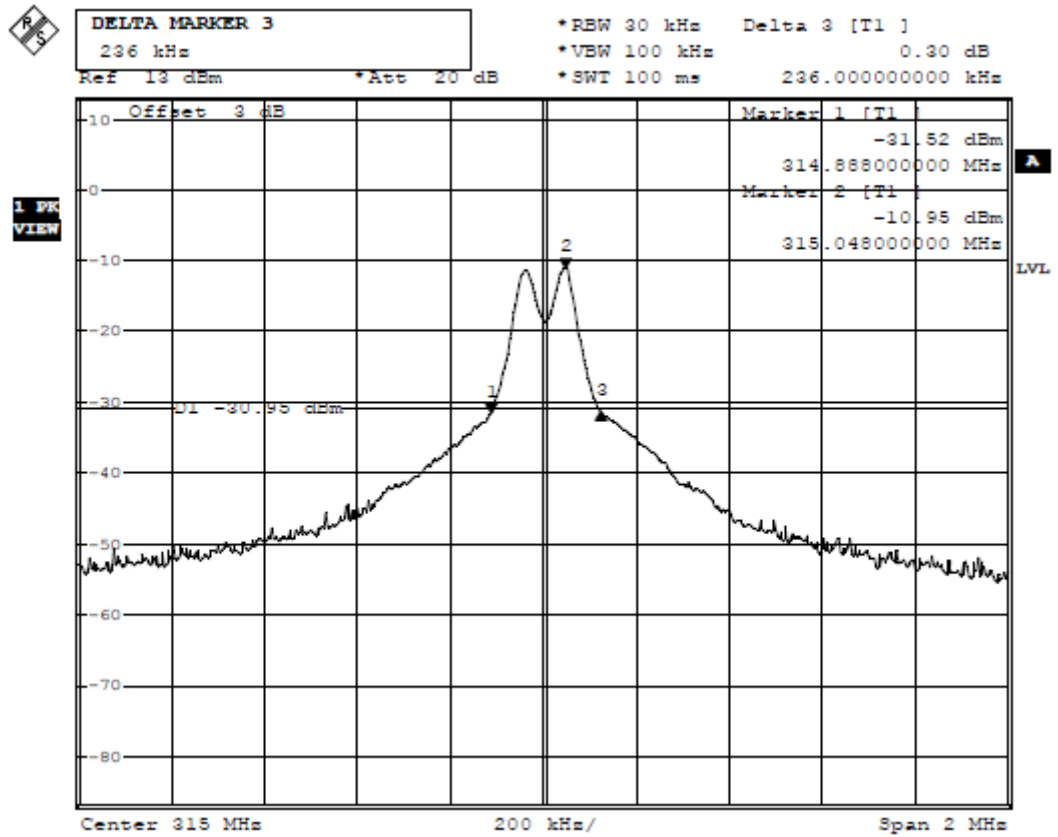
The radiated emission tests were performed in the in the 3m Semi-anechoic chamber, using the setup accordance with the ANSI C63.4.

The EUT was placed on the center of the nonmetal table which is 0.8 meter above a grounded turntable. The turntable can rotate 360 degrees to determine the azimuth of the maximum emission level.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

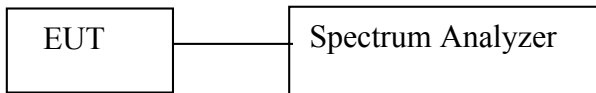
### 5.3. Test Results

Pass.  
Please refer the following plot.



## 6. DUTY CYCLE

### 6.1. EUT Setup



### 6.2. Test Procedure

Set EUT operating in continuous transmitting mode

Set Test Receiver into spectrum analyzer mode, Tune the spectrum analyzer to the transmitter carrier frequency, and set the spectrum analyzer resolution bandwidth(RBW) to 100kHz and video bandwidth(VBW) to 100kHz, Span was set to 0Hz.

The Duty Cycle was measured and recorded.

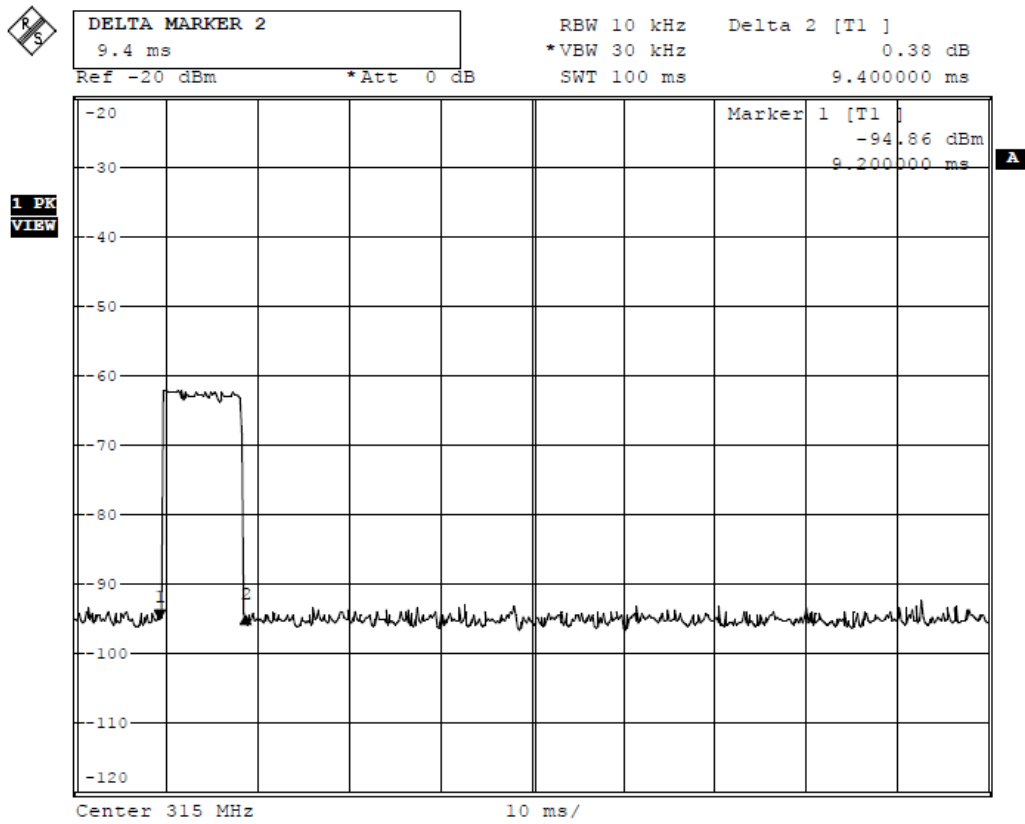
### 6.3. Requirements & Result

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

**Result:**

Test plots see following pages.

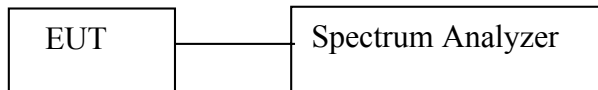
The EUT meets the requirements of this section.



**Note: “Marker 1” means the moment button was persistent pressed, and “Delta 1” means the actual ON time when the transmitter deactivated automatically.**

## 7. TRANSMITTER TIME

### 7.1. EUT Setup



### 7.2. Test Procedure

Set EUT operating in continuous transmitting mode

Set Test Receiver into spectrum analyzer mode, Tune the spectrum analyzer to the transmitter carrier frequency, and set the spectrum analyzer resolution bandwidth(RBW) to 100kHz and video bandwidth(VBW) to 100kHz, Span was set to 0Hz.

The Duty Cycle was measured and recorded.

### 7.3. Requirements & Result

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

**Result:**

PASS.

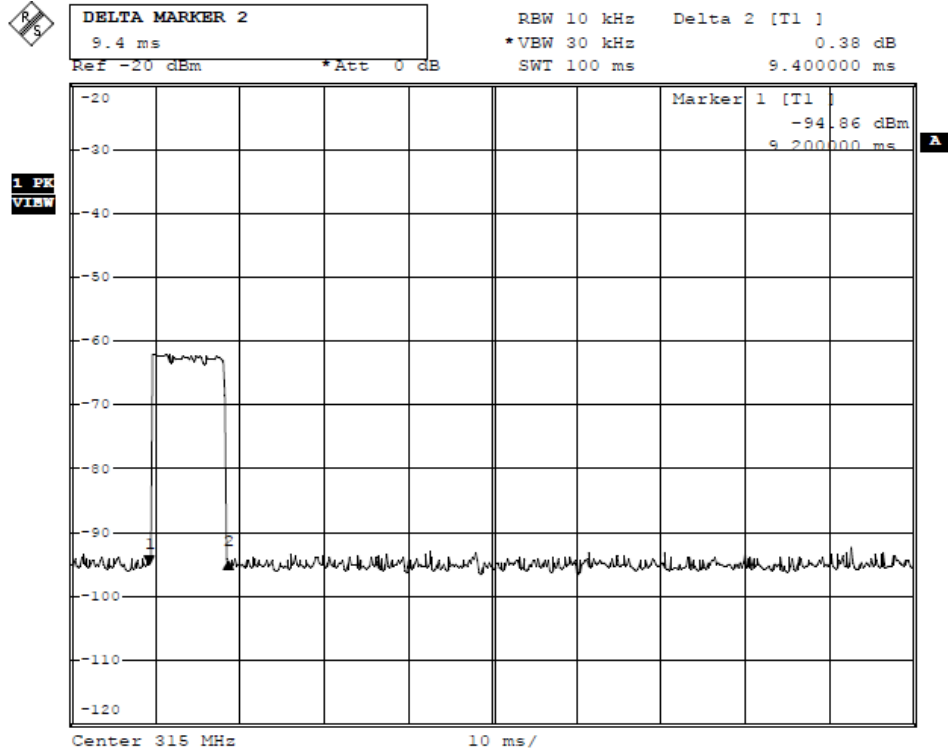
Test plots see following pages.

The EUT meets the requirements of this section.

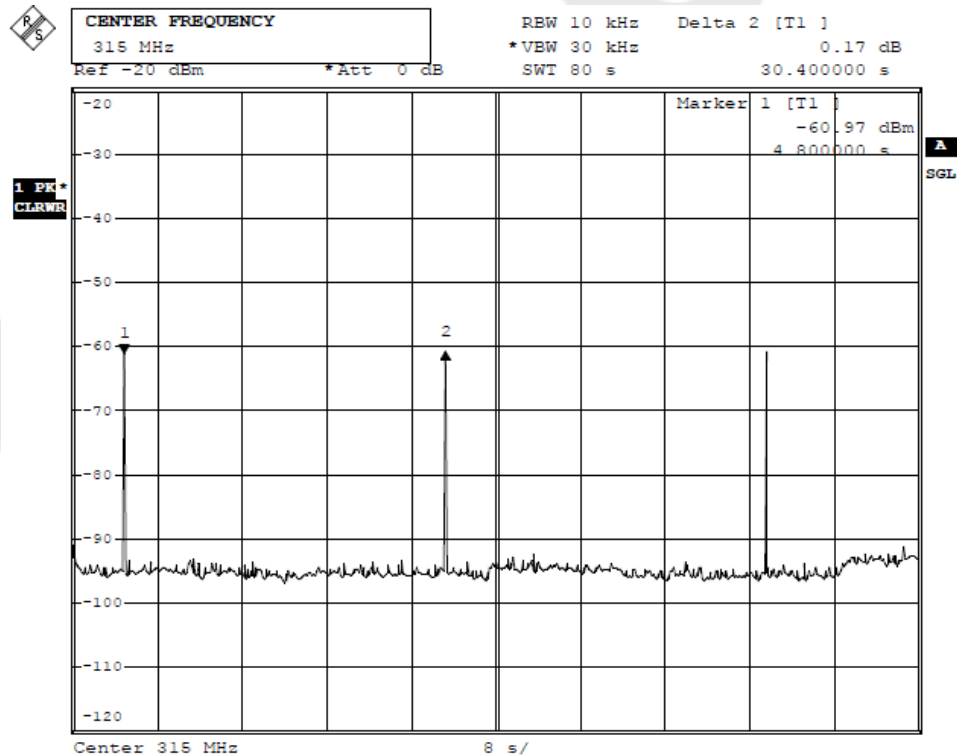
Frequency (MHz)	Transmitter Time (ms.)		Silent Period (Sec.)	
	Measure Value	Limit	Measure Value	Limit
315	9.40	1000.00	30.40	10.00



### Transmitter time in 100ms



### Transmitter time in 80sec



## 8. ANTENNA APPLICATION

### 8.1. Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203.

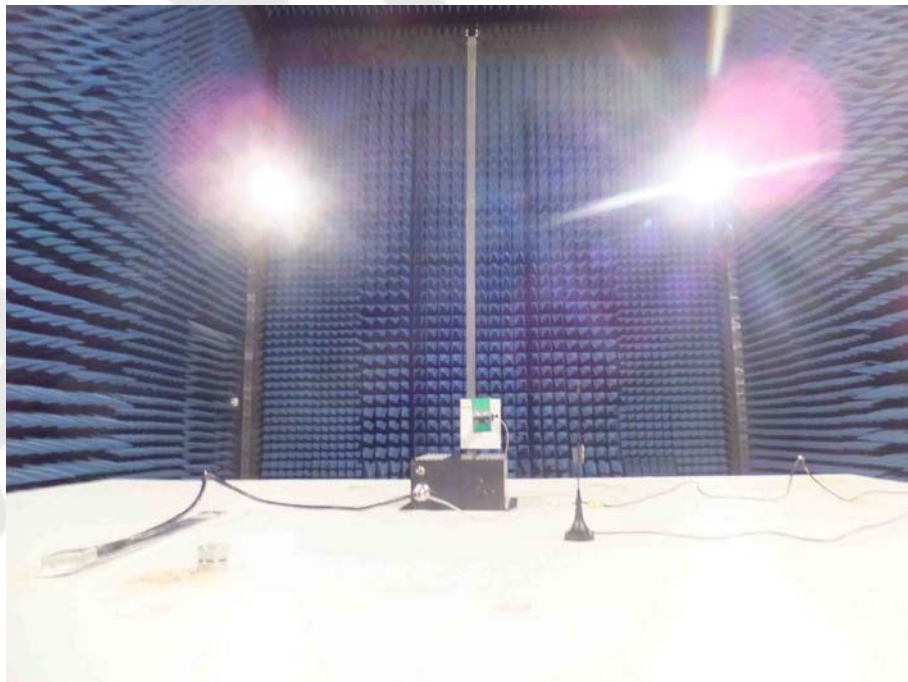
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### 8.2. Result

The EUT's antenna used a external antenna and integrated on PCB, The antenna's gain is 0dBi and meets the requirement.

## 9. TEST PHOTO

### 9.1. Photo of Radiation Emission Test



## APPENDIX I (EXTERNAL PHOTOS)

Figure 1  
The EUT-Overall View



Figure 2  
The EUT-Top View

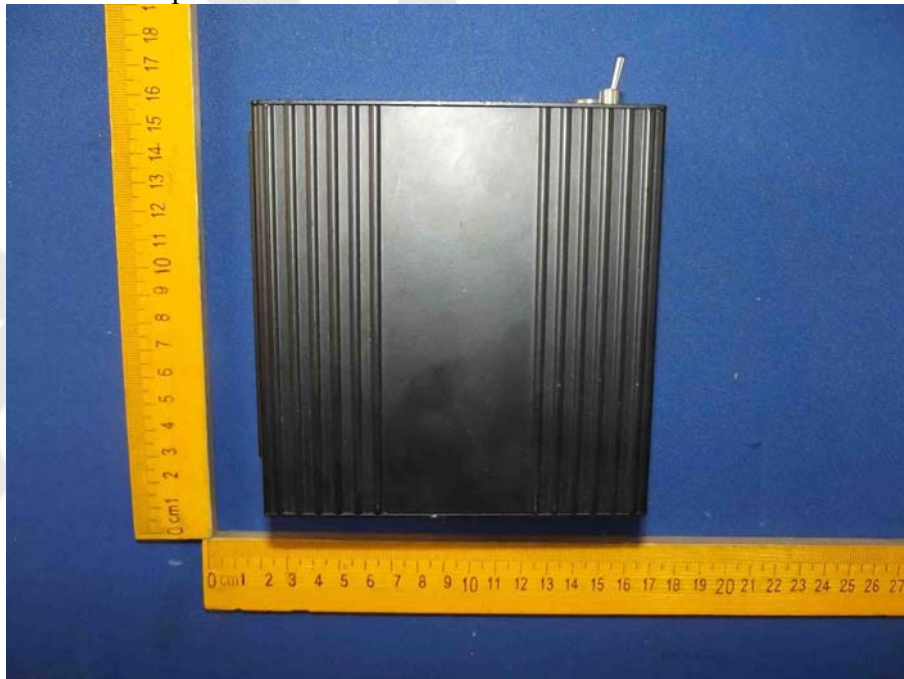




Figure 3  
The EUT- Bottom View



Figure 4  
The EUT-Front View



Figure 5  
The EUT-Back View

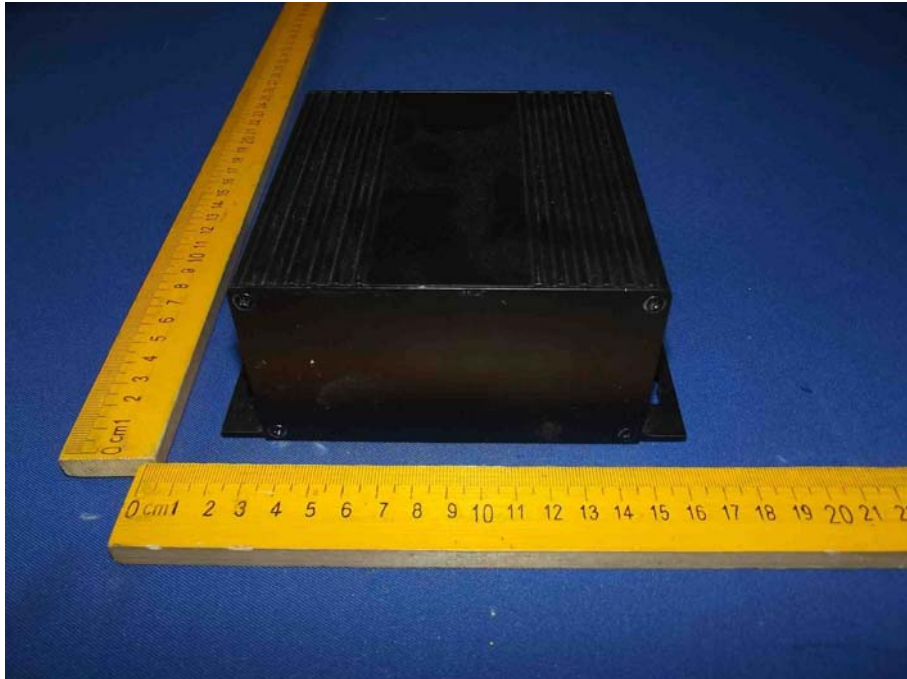


Figure 6  
The EUT-Left View

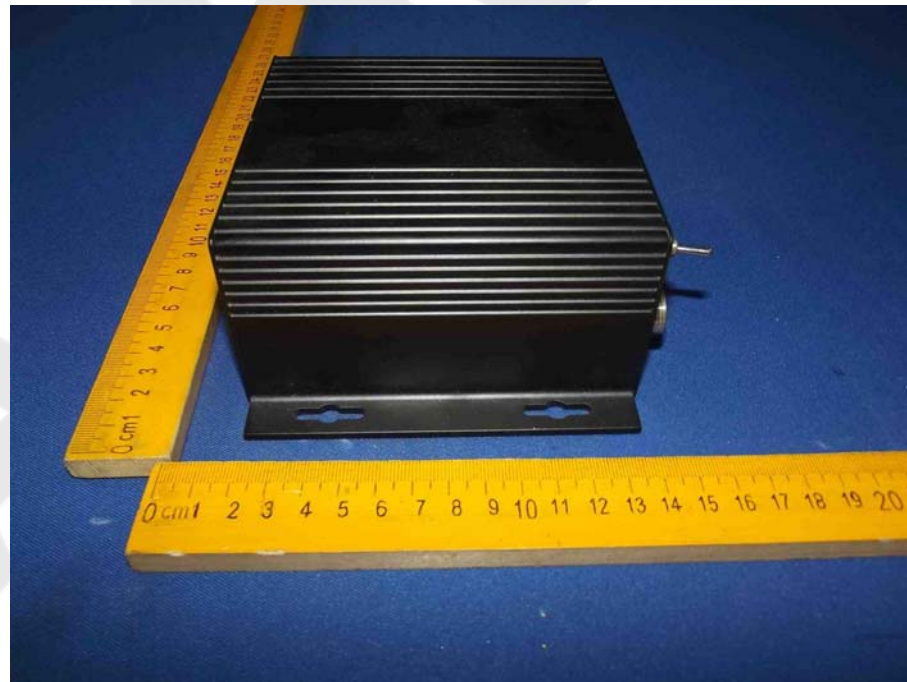
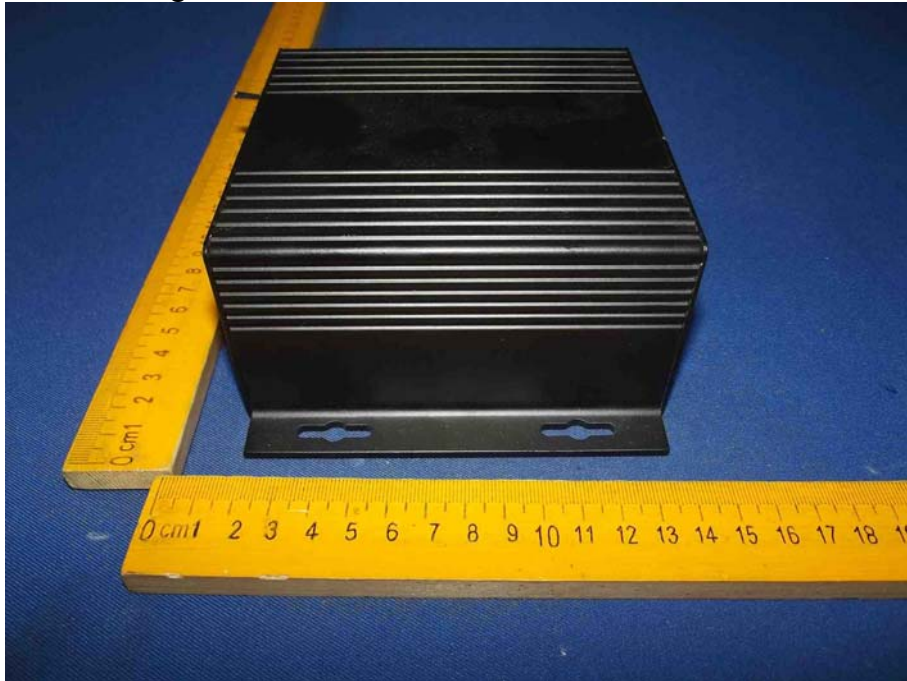


Figure 7  
The EUT-Right View





## APPENDIX II (INTERNAL PHOTOS)

Figure 8  
The EUT-Inside View

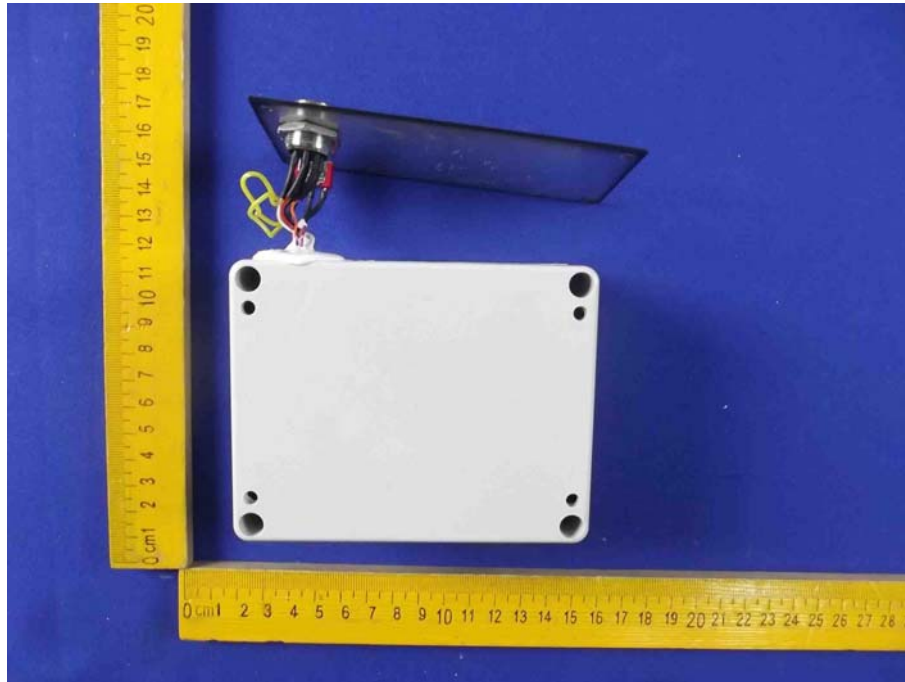


Figure 9  
The EUT-Inside View

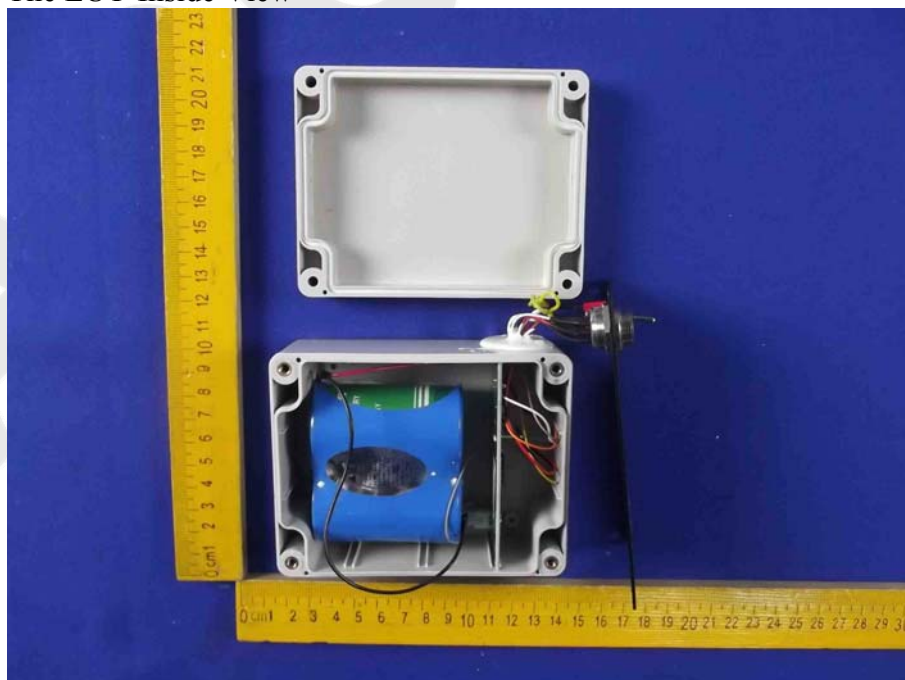




Figure 10  
PCB of the EUT-Front View

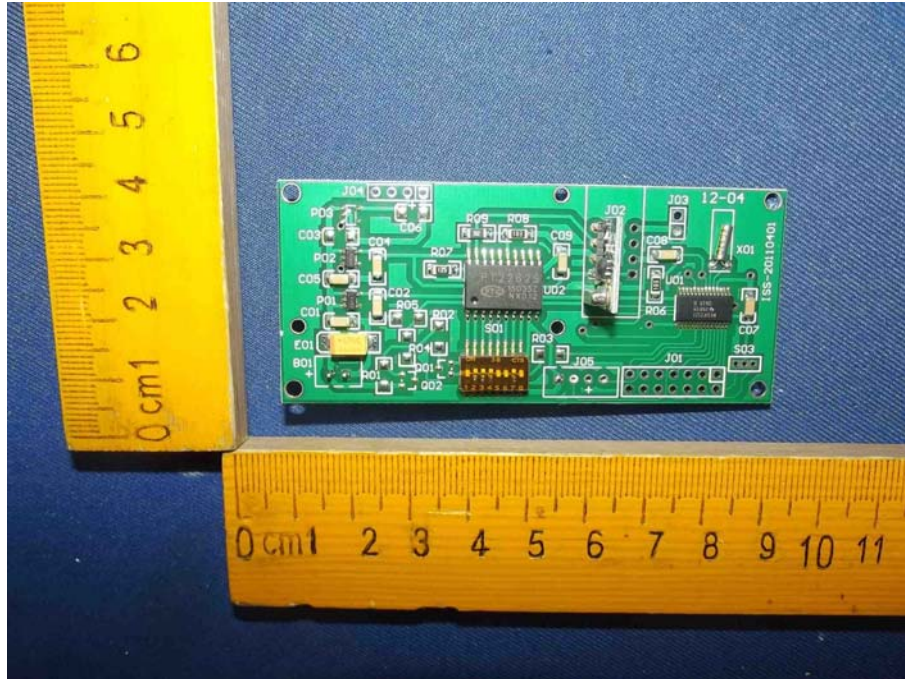


Figure 11  
PCB of the EUT-Back View

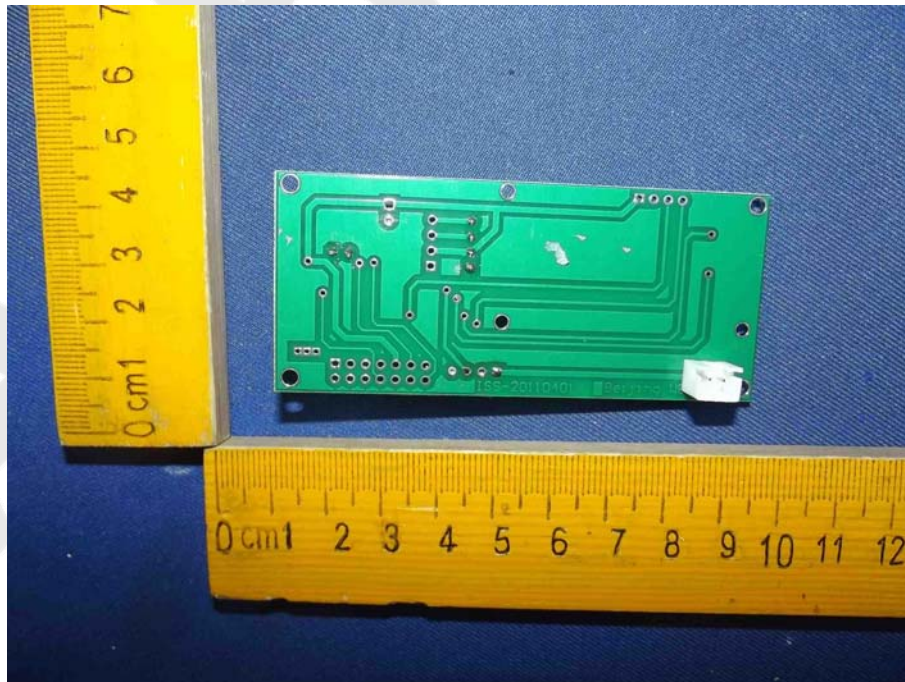




Figure 12  
PCB of the EUT-Front View

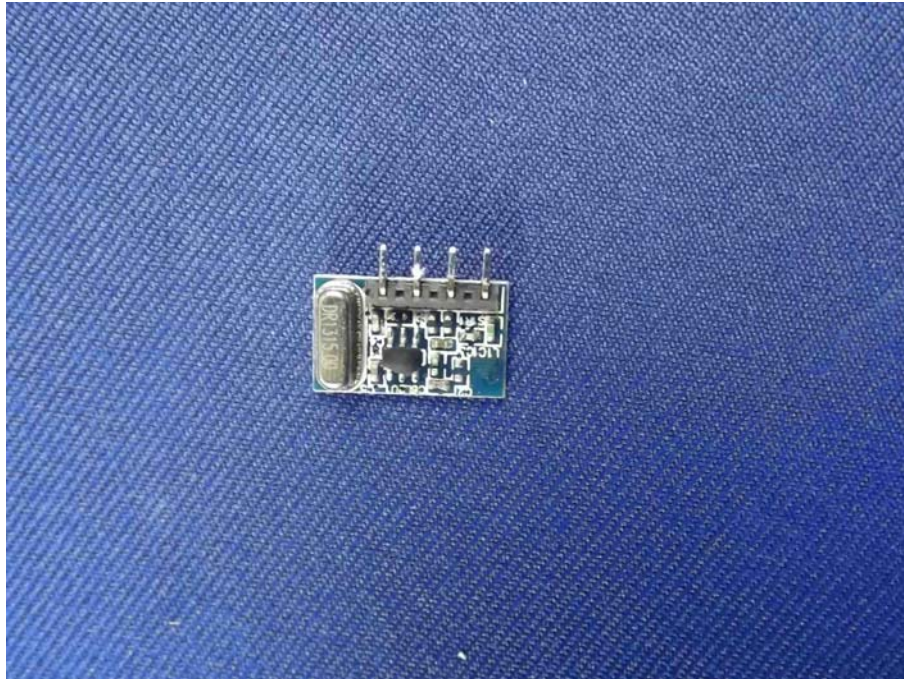


Figure 13  
PCB of the EUT-Back View

