

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

Wireless Combo Sensor Model No.: TG-GWC

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

Prepared By : Shenzhen Anbotek Compliance Laboratory Limited

Address : 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road,

Nanshan District, Shenzhen, Guangdong, China

Tel: (86) 755-26066544 Fax: (86) 755-26014772

Report Number : R011412287E

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 : Wireless Combo Sensor

Model No. : TG-GWC

Serial No. : N.A.

Trade Mark :

WELLTEK

Rating : DC 7.2V, 100mA

Measurement Procedure Used:

FCC Part15 Subpart C, Paragraph 15.247

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 :	keloo zhang				
	(Tested Engineer / Kebo Zhang)				
Reviewer:	Amy Ding				
	(Project Manager / Amy Ding)				
Approved & Authorized Signer :	Ton Chen				
	(Manager / Tom Chen)				



1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT : Wireless Combo Sensor

Model Number : TG-GWC

Test Power Supply: DC 7.2V

RF Transmission

: Zigbee: 2405-2480MHz

Frequency

No. of Channels : 16

Channel Space : 5MHz

Modulation : DSSS

Antenna Gain: : 0 dBi

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 receipt : 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 registed 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, 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



2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2009 and FCC Part 15, Paragraph 15.247.

2.1. Summary of Test Results

The EUT has been tested according to the following specifications:

	. 61		
Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.107, 15.207	Conducted Emission Test	- - 7	N/A
FCC Part 15, Paragraph 15.247(b)(1)	Peak Output Power	PASS	Complies
FCC Part 15, Paragraph 15.247(a)(2)	6dB Bandwidth	PASS	Complies
FCC Part 15, Paragraph 15.247(c)	100kHz Bandwidth of Frequency Band Edges	PASS	Complies
FCC Part 15, Paragraph 15.209(a)(f)	Spurious Emission	PASS	Complies
FCC Part 15, Paragraph 15.247(a)(1)	Frequency Separation	<i>//</i>	N/A
FCC Part 15, Paragraph 15.247(a)(1)(iii)	Number of Hopping Frequency	-	N/A
FCC Part 15, Paragraph 15.247(a)(1)(iii)	Time of Occupancy	-	N/A
FCC Part 15, Paragraph 15.247(c)	Peak Power Density	PASS	Complies

2.2. Description of Test Modes

The EUT has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

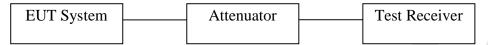
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	7	2435	13	2465
2	2410	8	2440	14	2470
3	2415	9	2445	15	2475
4	2420	10	2450	16	2480
5	2425	11	2455		
6	2430	12	2460		

Channel 1(2405 MHz), Channel 8(2440 MHz) and Channel 16(2480 MHz) are chosen for the final testing.



3. FCC Part 15.247 Requirements for DSSS & OFDM Modulation

3.1 Test Setup



3.2 6dB Bandwidth

a. Limit

For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

b.Test Procedure

- 1. Place the EUT on the table and set it in the 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 the spectrum analyzer as:

RBW = 100kHz, VBW $\geq 3*RBW = 300kHz$,

Detector= Peak

Trace mode= Max hold.

Sweep- auto couple.

- 4. Mark the peak frequency and –6dB (upper and lower) frequency.
- 5. Repeat until all the rest channels are investigated.

c. Test Setup See 3.1

d. Test Equipment

Item	em Equipment Manufactur		Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 08, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC01183 0	980100	Aug. 08, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 22, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 04, 2014	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 24, 2014	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Aug. 08, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

e. Test Results

Pass.



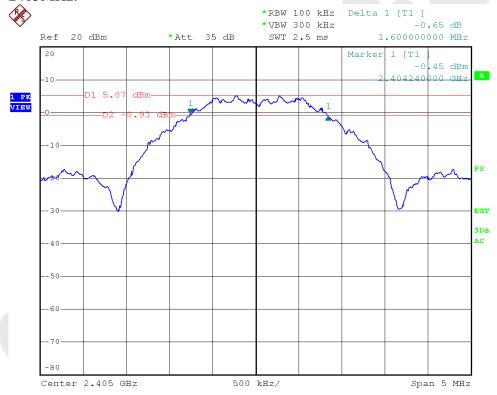
f. Test Data

Test mode: IEEE 802.15.4

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Results
Low	2405	1600.00	,	Pass
Mid	2440	1600.00	>500	Pass
High	2480	1600.00		Pass

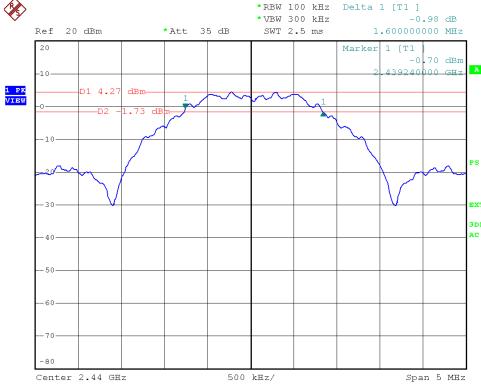
Test Plots See the following page.

2405MHz:

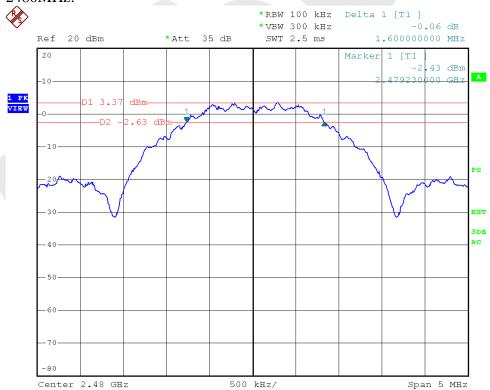








2480MHz:





3.3. Maximum Peak output power test

a. Limit

The maximum peak output power of the intentional radiator shall not exceed the following:

- 1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt (30dBm).
- 2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antenna of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

b. Configuration of Measurement

EUT	DC block	ATT.		Test receiver
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c. Test Procedure

This test was according the kDB 558074 9.2.2:

- 1. This procedure may be used when the maximum available RBW of the measurement instrument is great than the DTS bandwidth.
- 2. Set the RBW = 3 MHz.
- 3. Set the VBW \geq 3*RBW = 10 MHz.
- 4. Set the span $\geq 3*RBW$.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

d. Test Equipment

Same as the equipment listed in 3.2.

e. Test Results

Pass.

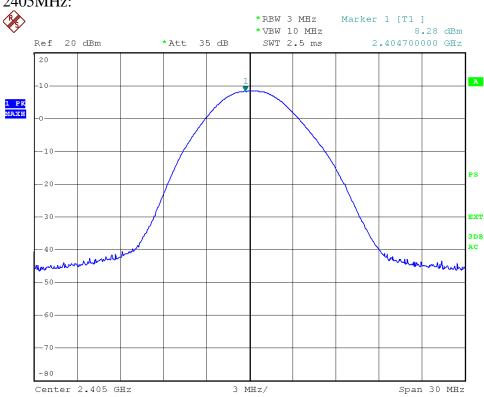


f. Test Data

Test mode: IEEE 802.15.4

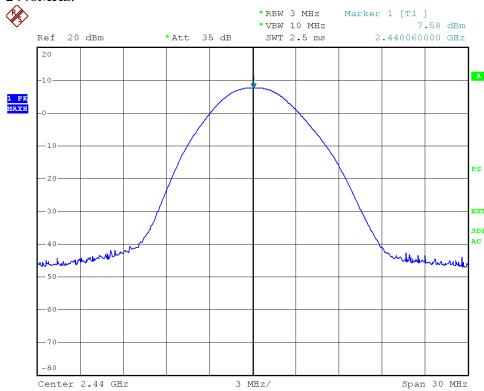
Channel	Frequency	Maximum transmit power	Li	mit	Result
Chamiei	(MHz)	(dBm)	(dBm)	(watts)	Result
Low	2405	8.28			Pass
Mid	2440	7.58	30	1	Pass
High	2480	6.63			Pass

2405MHz:

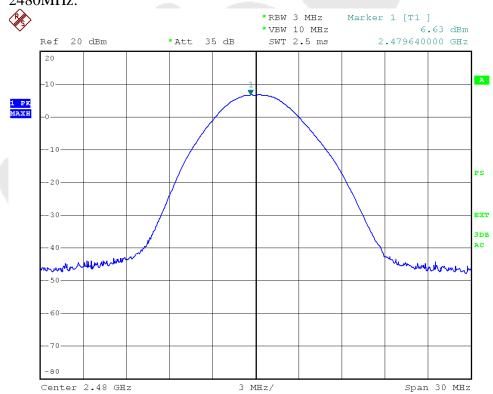








2480MHz:





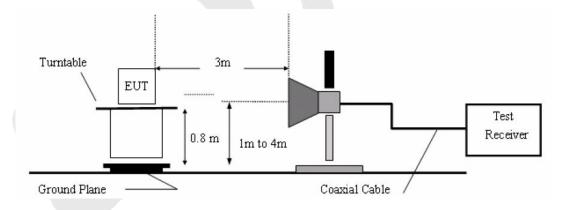
3.4. Band Edges Measurement

a. Limit

According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

b. Test Procedure

- 1. Conducted Method:
- 1) Set RBW=100KHz, VBW=300KHz
- 2) Detector=peak
- 3) Sweep time= auto
- 4) Trace mode=max hold.
- 2. Radiated Method:
- 1) The EUT is placed on a turntable, which is 0.8m above the ground plane.
- 2) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3) EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
- 4) Peak detector: RBW=1MHz, VBW=3MHz, SWT=AUTO Average detector: RBW=1MHz, VBW=10Hz, SWT=AUTO The EUT is tested in 9*6*6 Chamber.
- 5) Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.



c. Test Equipment

Same as the equipment listed in 3.2.

d. Test Results

Pass.

e. Test Plots

See the following page.



Test Item : Band eadge : CH Low ~ CH High

Test Voltage : DC 7.2V Temperature : 24° C Test Result : PASS Humidity : 55%RH

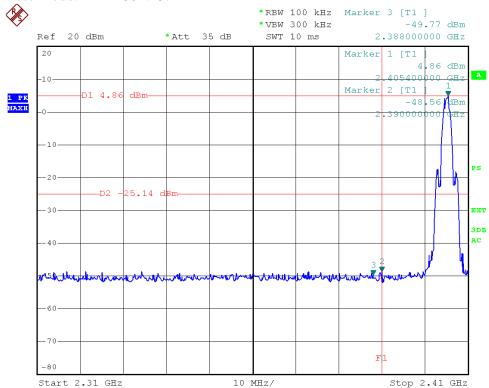
1. Conducted Test

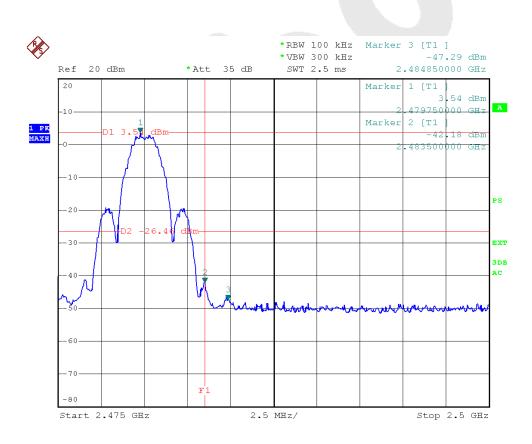
Frequency	Peak Power	Emission read	Result of Band	Band edge
(MHz)	Output(dBm)	Value(dBm)	edge(dBc)	Limit(dBc)
<2400	4.86	-48.56	53.42	>30dBc
>2483.5	3.54	-42.18	45.72	>30dBc

2. Radiated emission Test

Frequency (MHz)	Antenna polarization	Emis (dBuV		Band edge Limit (dBuV/m)		
	(H/V)	PK	AV	PK	AV	
<2400	V	55.89	36.69	74.00	54.00	
	Н	54.32	37.57	74.00	54.00	
>2483.5	V	56.87	39.31	74.00	54.00	
	Н	54.05	36.11	74.00	54.00	









3.5. Peak Power Spectral Density

a. Limit

- 1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
- 2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

b. Test Procedure

- 1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 1.5 times the DTS Bandwidth, Sweep=500s
- 3. Record the max. reading.
- 4. Repeat the above procedure until the measurements for all frequencies are completed.

c. Test Equipment

Same as the equipment listed in 3.2.

d. Test Setup

See 3.1

e. Test Results

Pass

f. Test Data

Please refer to the following data.

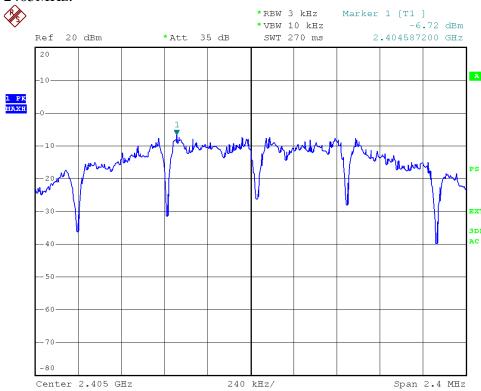
g. Test Plot See the following pages

Test mode: IEEE 802.15.4

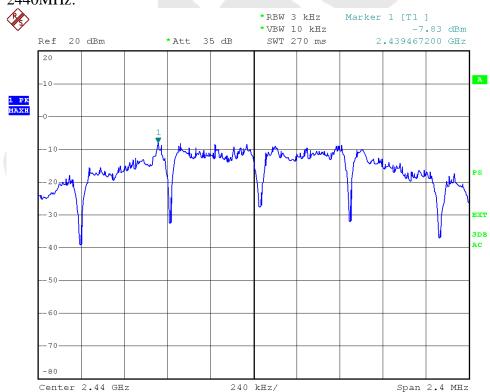
Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Σ PPSD (dBm/3KHz)	Limit (dBm)	Result
Low	2405	-6.72	-		Pass
Mid	2440	-7.83	-	8.00	Pass
High	2480	-9.09	-		Pass





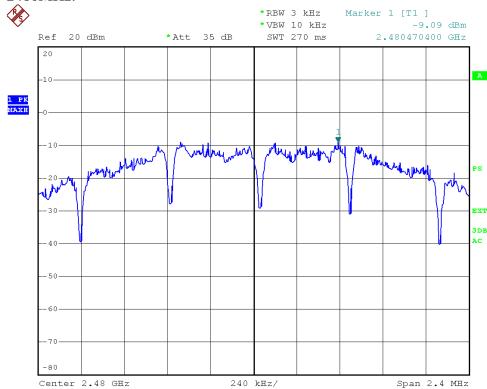








2480MHz:





3.6. Radiated Emissions

3.6.1.1. Test Limits (< 30 MHZ)

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

3.6.1.2. Test Limits (≥ 30 MHZ)

FIELD STRENGTH	S15.209	
of Harmonics	30 - 88 MHz	40 dBuV/m
	88 - 216 MHz	43.5
	216 - 960 MHz	46
54 dBµV/m @3m	ABOVE 960 MHz	54dBuV/m
	of Harmonics	of Harmonics 30 - 88 MHz 88 - 216 MHz 216 - 960 MHz

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

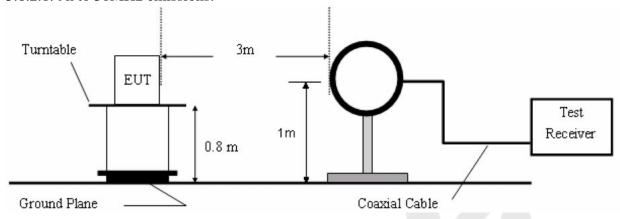
Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 08, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC01183 0	980100	Aug. 08, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 22, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 04, 2014	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 24, 2014	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Aug. 08, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

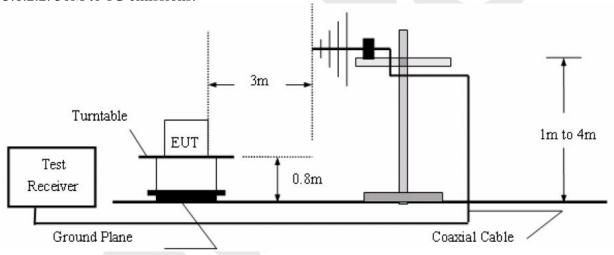


3.6.2. Test Configuration:

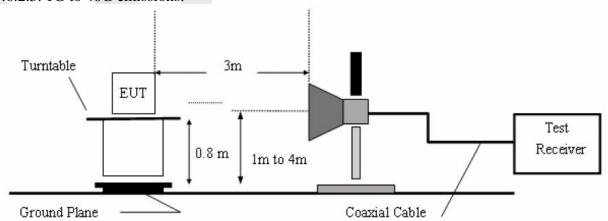
3.6.2.1. 9k to 30MHz emissions:



3.6.2.2. 30M to 1G emissions:



3.6.2.3. 1G to 40G emissions:





3.6.3. 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.

Measurements are made on 9KHz to 30MHz and 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

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.

The test results are listed in Section 3.6.4.

3.6.4. Test Results

PASS.

Please refer to the following pages.

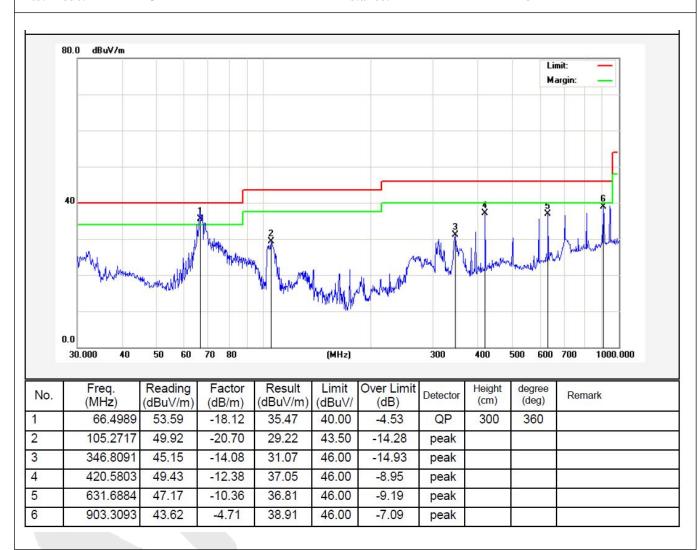


Job No.: 011412287E Polarization: Horizontal

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

Test Mode: On Distance: 3m



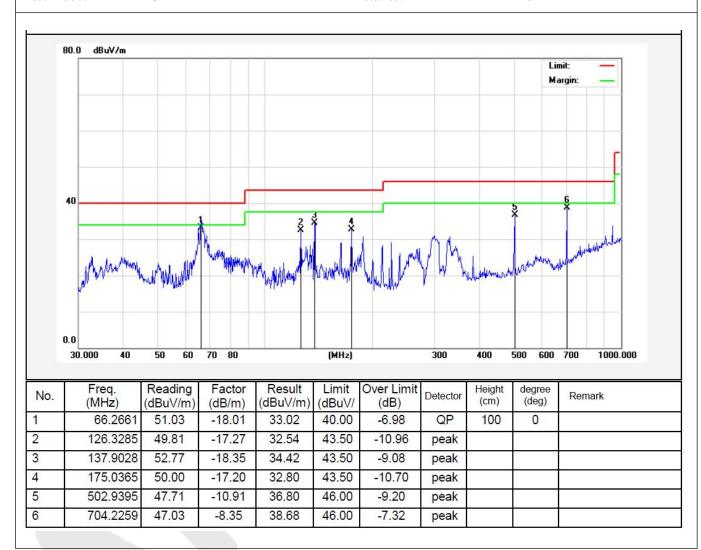


Job No.: 011412287E Polarization: Vertical

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

Test Mode: On Distance: 3m



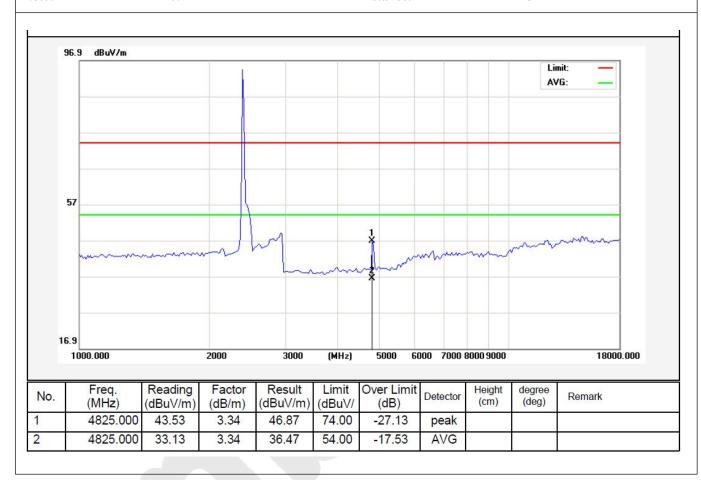


Job No.: 011412287E Polarization: Horizontal

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

Note: 2405MHz Distance: 3m



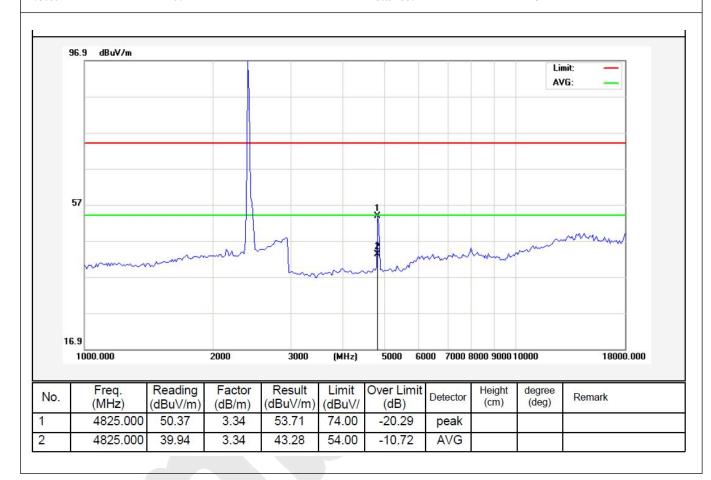


Job No.: 011412287E Polarization: Vertical

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

Note: 2405MHz Distance: 3m



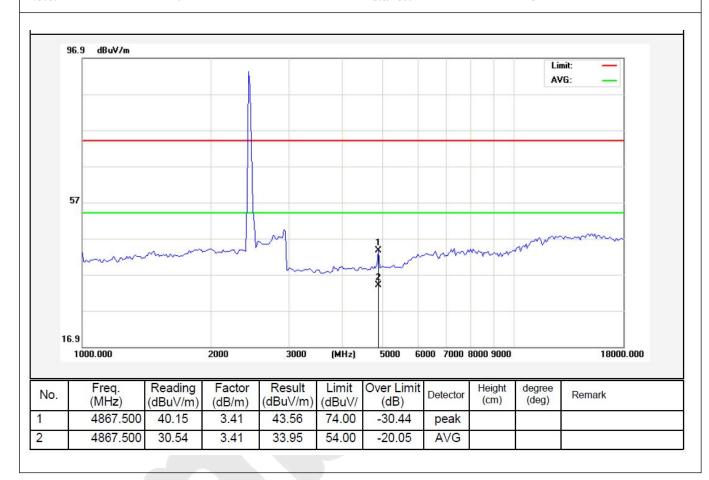


Job No.: 011412287E Polarization: Horizontal

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

Note: 2440MHz Distance: 3m



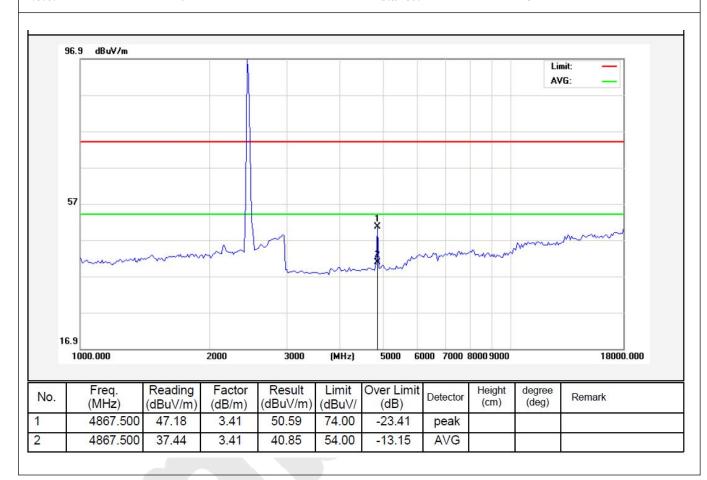


Job No.: 011412287E Polarization: Vertical

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

Note: 2440MHz Distance: 3m



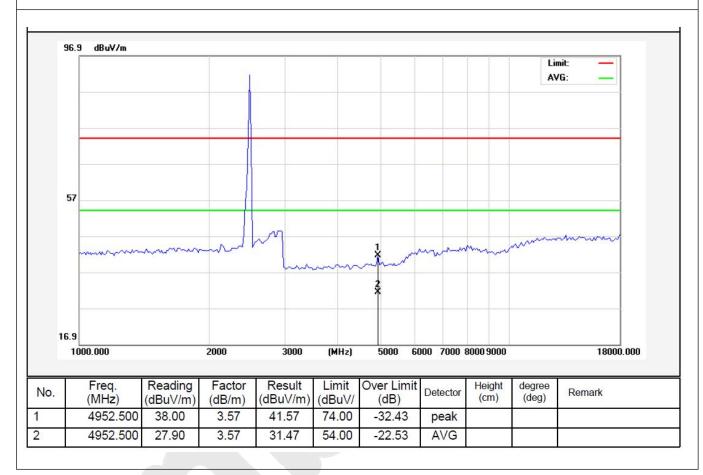


Job No.: 011412287E Polarization: Horizontal

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

Note: 2480MHz Distance: 3m



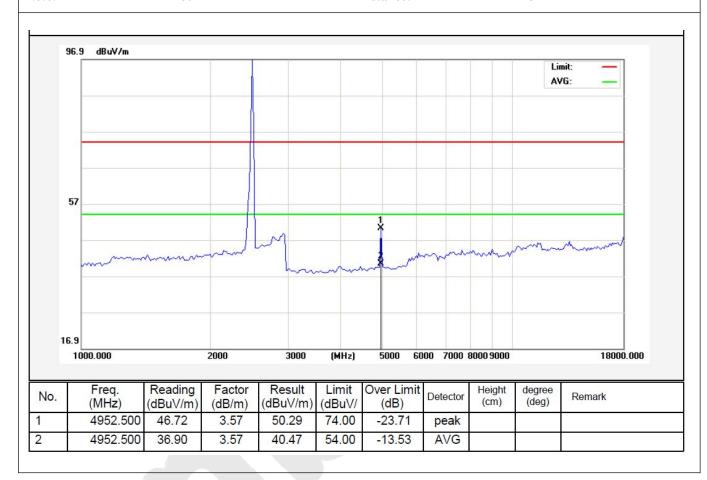


Job No.: 011412287E Polarization: Vertical

Standard: (RE)FCC PART15 C _3m Power Source: DC 7.2V

Test item: Radiation Test Temp.(C)/Hum.(%RH): 24.3(C)/55%RH

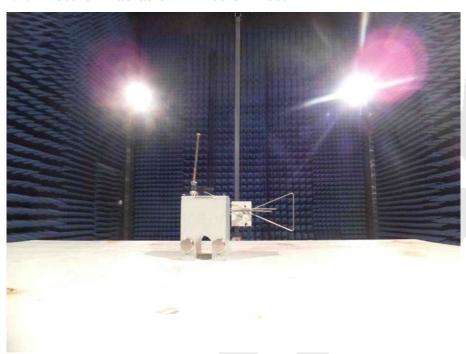
Note: 2480MHz Distance: 3m

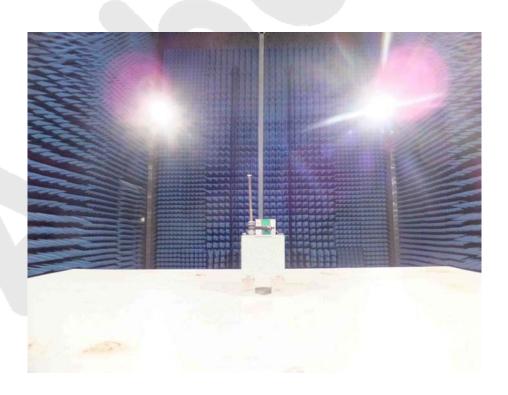




4. PHOTOGRAPH

4.1. Photo of Radiation Emission Test







APPENDIX I (EXTERNAL PHOTOS)

Figure 1 The EUT-Overall View

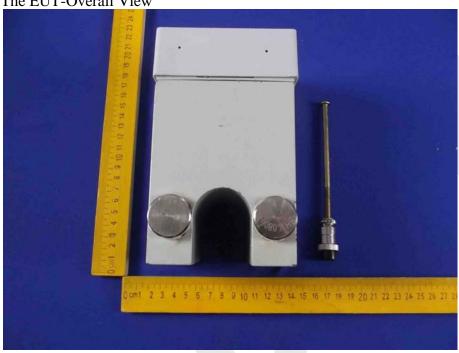


Figure 2
The EUT-Overall View





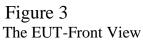
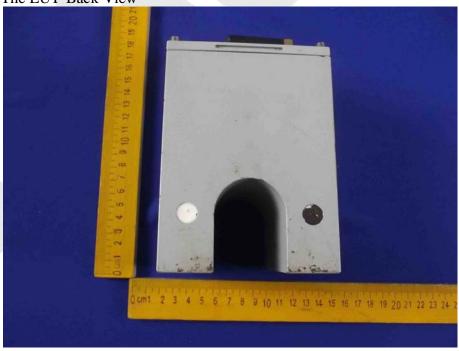




Figure 4
The EUT-Back View







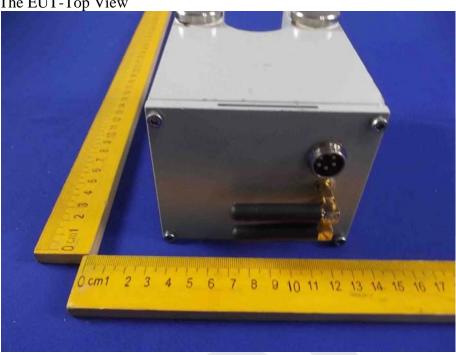
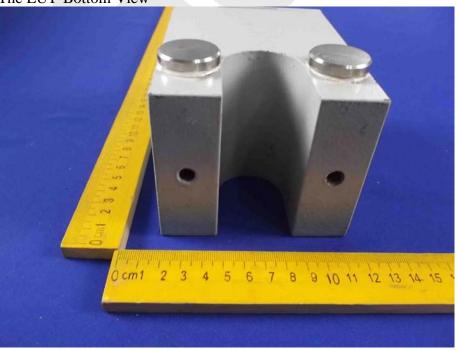


Figure 6
The EUT-Bottom View







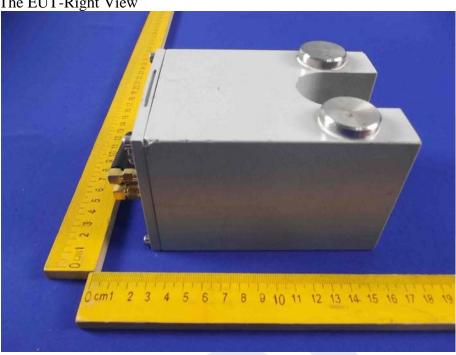


Figure 8
The EUT-Left View





APPENDIX III (INTERNAL PHOTOS)

Figure 9
The EUT-Inside View

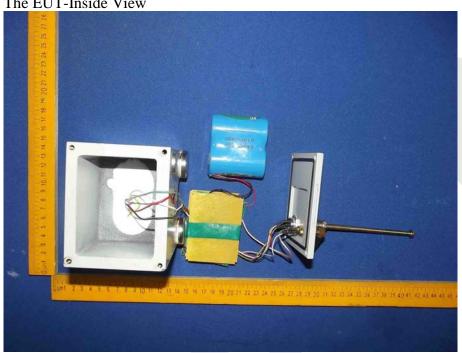


Figure 10
The EUT-Inside View







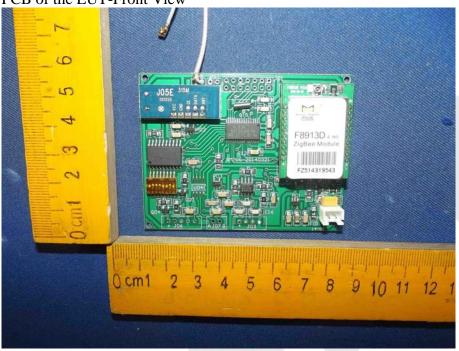


Figure 12 PCB of the EUT-Front View







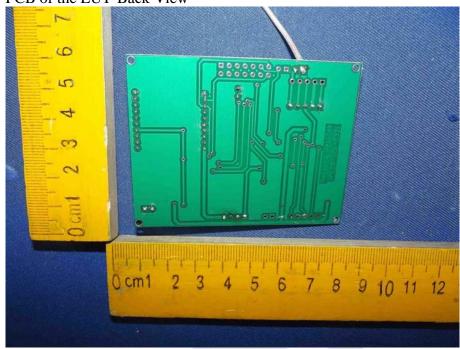


Figure 14 PCB of the EUT-Front View







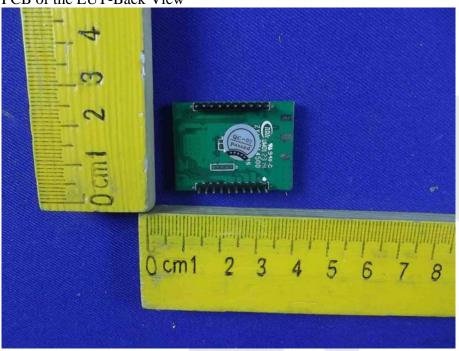


Figure 16 PCB of the EUT-Front View







