

# RF TEST REPORT



Report No.: 17071240-FCC-R

Supersede Report No.: N/A

Applicant	Unit Connection Technology Co., Ltd	
Product Name	Outdoor Transmitter	
Model No.	WS015T	
Serial Model No.	WS015TP, WS015TH, WS005T, WS005TP, WS005TH	
Test Standard	FCC 15.231:2016, ANSI C63.4:2009	
Test Date	November 10 to 28, 2017	
Issue Date	November 29, 2017	
Test Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
Equipment complied with the specification <input checked="" type="checkbox"/>		
Equipment did not comply with the specification <input type="checkbox"/>		
		
Aaron Liang Test Engineer	David Huang Checked By	
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only		

Issued by:

**SIEMIC (SHENZHEN-CHINA) LABORATORIES**

Zone A, Floor 1, Building 2 Wan Ye Long Technology Park

South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108

Phone: +86 0755 2601 4629801 Email: [China@siemic.com.cn](mailto:China@siemic.com.cn)

## Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

### Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

Test Report No.	17071240-FCC-R
Page	3 of 27

This page has been left blank intentionally.

## CONTENTS

1. REPORT REVISION HISTORY .....	5
2. CUSTOMER INFORMATION .....	5
3. TEST SITE INFORMATION .....	5
4. EQUIPMENT UNDER TEST (EUT) INFORMATION .....	6
5. TEST SUMMARY .....	7
6. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS .....	8
6.1 ANTENNA REQUIREMENT .....	8
6.2 CONDUCTED EMISSIONS VOLTAGE .....	9
6.3 20DB OCCUPIED BANDWIDTH .....	10
6.4 RADIATED FUNDAMENTAL AND SPURIOUS EMISSION .....	11
6.5 DEACTIVATION .....	14
ANNEX A. TEST INSTRUMENT .....	16
ANNEX B. EUT AND TEST SETUP PHOTOGRAPHS .....	17
ANNEX C. TEST SETUP AND SUPPORTING EQUIPMENT .....	24
ANNEX D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PARTLIST .....	26
ANNEX E. DECLARATION OF SIMILARITY .....	27

## 1. Report Revision History

Report No.	Report Version	Description	Issue Date
17071240-FCC-R	NONE	Original	November 29, 2017

## 2. Customer information

Applicant Name	Unit Connection Technology Co., Ltd
Applicant Add	5/F., Block J, Shifeng Technology Park, Loucun, Guangming New District, Shenzhen ,China
Manufacturer	Unit Connection Technology Co., Ltd
Manufacturer Add	5/F., Block J, Shifeng Technology Park, Loucun, Guangming New District, Shenzhen ,China

## 3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	535293
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

## 4. Equipment under Test (EUT) Information

Description of EUT:	Outdoor Transmitter
Main Model:	WS015T
Serial Model:	WS015TP, WS015TH, WS005T, WS005TP, WS005TH
Date EUT received:	November 09, 2017
Test Date(s):	November 10 to 28, 2017
RF Operating Frequency (ies):	433.92MHz
Number of Channels :	1 CH
Equipment Category:	DSC
Antenna Gain:	-10Bi
Input Power:	Spec: DC 2.4-3.3V
Trade Name :	N/A
FCC ID:	2ALHJ-WS015T
Port:	N/A
Type of Modulation:	ASK

## 5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

### Test Results Summary

Test Standard	Description	Pass / Fail
CFR 47 Part 15.231: 2014		
15.203	Antenna Requirement	Pass
15.207	Conducted Emissions Voltage	N/A
15.231(e)	Fundamental & Radiated Spurious Emission	Pass
15.231(c)	20dB Bandwidth	Pass
15.231(e)	Deactivation	Pass
ANSI C63.4: 2009		
PS: All measurement uncertainties are not taken into consideration for all presented test result.		

## 6. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

### 6.1 Antenna Requirement

**Requirement(s):** 47 CFR §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.

Antenna requirement must meet at least one of the following:

- a) Antenna must be permanently attached to the device.
- b) Antenna must use a unique type of connector to attach to the device.
- c) Device must be professionally installed. Installer shall be responsible for ensuring that the correct antenna is employed with the device.

Test result: Pass

The antenna is permanently attached to the device which meets the requirement.



## 6.2 Conducted Emissions Voltage

Temperature	24°C
Relative Humidity	62%
Atmospheric Pressure	1012mbar
Test date :	-----
Tested By :	Aaron Liang

### Requirement:

Frequency of emission (MHz)	Conducted limit (dBμ V)	
	Quasi-peak	Average
0.15– 0.5	66 to 56*	56 to 46*
0.5– 5	56	46
5– 30	60	50

\*Decreases with the logarithm of the frequency.

### Procedures:

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.

Test result: N/A (Batteries operated)

### 6.3 20dB Occupied Bandwidth

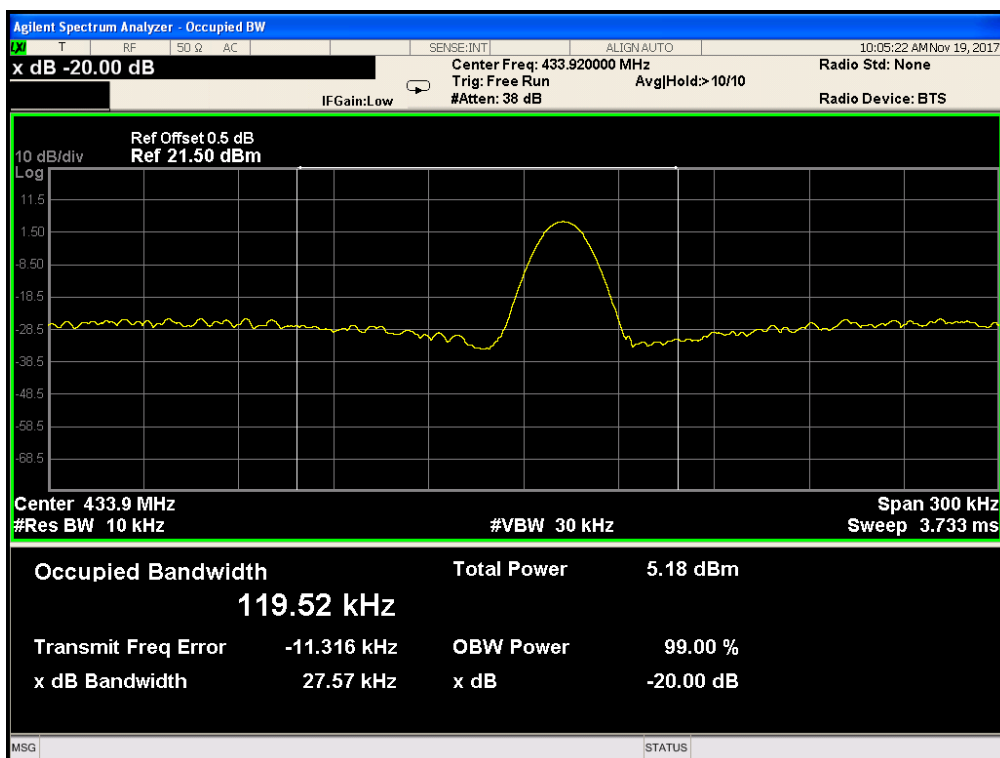
Temperature	25°C
Relative Humidity	57%
Atmospheric Pressure	1018mbar
Test date :	November 19, 2017
Tested By :	Aaron Liang

20dB bandwidth was measured by conducted method using a spectrum analyzer.

#### Test Result:

Fundamental Frequency (MHz)	Measured 20dB Bandwidth (kHz)	FCC 15.231 Limit (kHz)	Result
433.92	27.57	1084.80	Pass

433.9MHz



## 6.4 Radiated Fundamental and Spurious Emission

Temperature	25°C
Relative Humidity	57%
Atmospheric Pressure	1018mbar
Test date :	November 19, 2017
Tested By :	Aaron Liang

1. Radiated emissions were measured according to ANSI C63.4. The EUT was set 3 meter away from the measuring antenna. The loop antenna was positioned 1meter above the ground from the center of the loop. The measuring bandwidth was set to 10kHz. All possible modes of operation were investigated. Only the worst case emissions measured, All other emissions were relatively insignificant.

2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.

3. Sample Calculation: Corrected Amplitude=Raw Amplitude(dBuV/m)+ACF(dB)+Cable Loss(dB)-Distance Correction Factor.

Sample Calculation:

1) Corrected Amplitude= Raw Amplitude(dBuV/m)+ACF(dB)+Cable Loss(dB)-Distance Correction Factor

2) Average = peak reading + 20log(duty cycle)

4. Radiated Emissions Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz( QP only3m & 10m) is +5.6/-4.5dB(for EUTs<0.5m×0.5m×0.5m).In range of 1-40GHz) is ±3.6dB.

### Standard Requirement:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1,500	50 to 150
174-260	1,500	150
260-470	1,500-5,000	150-500
Above 470	5,000	500

**Test Result: Pass**

433.9MHz

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
434.06	-8.59	H	74.21	65.62	92.87	72.87	-18.66	-7.25
868.12	-8.59	H	42.18	33.59	72.87	52.87	-30.69	-19.28
1302.18	-8.59	H	51.41	42.82	72.87	52.87	-21.46	-10.05
1736.24	-8.59	H	45.34	36.75	72.87	52.87	-27.53	-16.12
2170.3	-8.59	H	37.12	28.53	72.87	52.87	-35.75	-24.34
2604.36	-8.59	H	48.95	40.36	72.87	52.87	-23.92	-12.51
3038.42	-8.59	H	41.85	33.26	72.87	52.87	-31.02	-19.61
4215.12	-8.59	H	52.28	43.69	74	54	-21.72	-10.31
434.06	-8.59	V	65.76	57.17	92.87	72.87	-27.11	-15.7
868.12	-8.59	V	43.86	35.27	72.87	52.87	-29.01	-17.6
1302.18	-8.59	V	42.96	34.37	72.87	52.87	-29.91	-18.5
1736.24	-8.59	V	42.1	33.51	72.87	52.87	-30.77	-19.36
2170.3	-8.59	V	38.19	29.6	72.87	52.87	-34.68	-23.27
2604.36	-8.59	V	50.39	41.8	72.87	52.87	-22.48	-11.07
3038.42	-8.59	V	45.03	36.44	72.87	52.87	-27.84	-16.43
4315.15	-8.59	V	49.24	40.65	74	54	-24.76	-13.35

Notes:

- Duty cycle is 37.2%,  $20\log(\text{duty cycle}) = -8.59\text{dB}$  correction was used to determine the average level from the peak.
- Reading. Average = peak reading +  $20\log(\text{duty cycle})$ , Final Average= peak reading -8.59
- All the data measurement of peak values.
- FCC Limit for Average Measurement= $1,500+(5,000-1,500)/(470-260)*(433.92-260) \mu \text{ V/m}$   
= $4398.67 \mu \text{ V/m}=72.87\text{dB} \mu \text{ V/m}$
- Average pulsed signal over one complete pulse train or 100 ms time frame if pulse train exceeds 100 ms
- Maximum average in 100 ms
- Calculate duty cycle for pulse train or 100 ms
- Duty cycle =  $(t_1 + t_2 + t_3 + \dots t_n)/T$  where  $t_n$  = pulse width,  $T$  = pulse train length or 100 ms
- Pulse width (PW) = 37.2ms  
 $2/PW = 2/37.2\text{ms} = 0.054 \text{ kHz}$   
 $RBW > 2/PW (37.2 \text{ kHz})$   
Therefore PDCF is not needed.

Test Report No.	17071240-FCC-R
Page	13 of 27

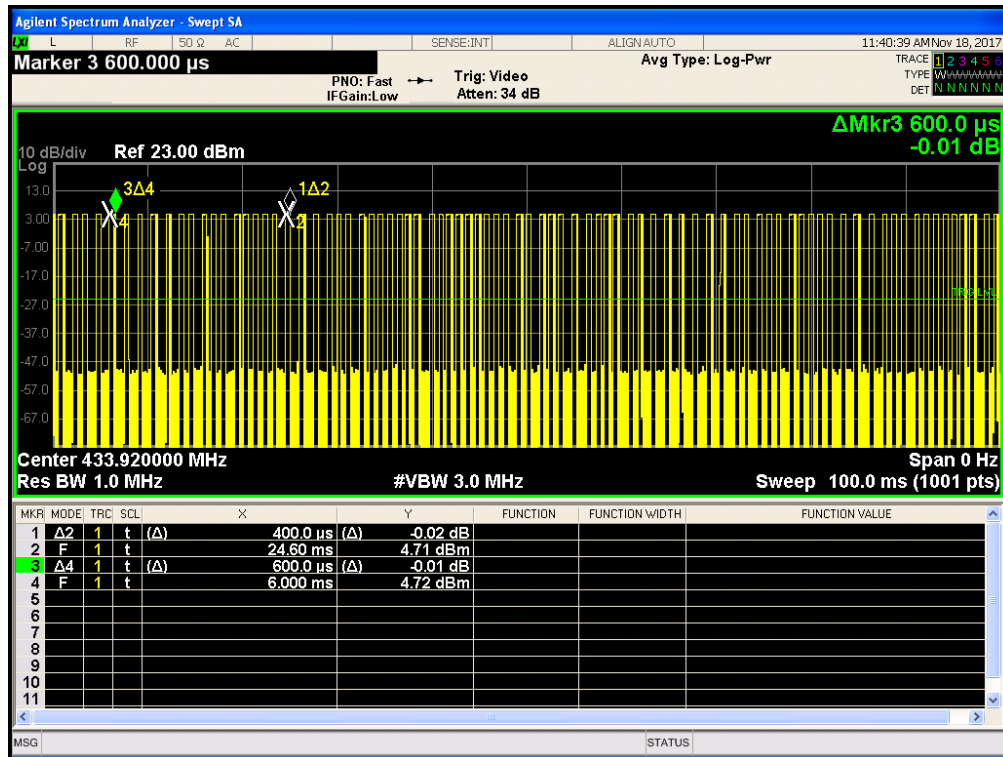
Pulse Duty Cycle:

The pulse train is nonperiodic, so the period of the pulse train=100ms

$$\text{Duty cycle} = 0.6 \times 28 + 51 \times 0.4 = 37.2\%$$

Average Duty Factor:  $20 \cdot \log(\text{Duty Cycle}) = -8.3\text{dB}$

## Duty Cycle



## 6.5 Deactivation

Temperature	25°C
Relative Humidity	57%
Atmospheric Pressure	1019mbar
Test date :	November 17, 2017
Tested By :	Aaron Liang

Deactivation was measured by conducted method using a spectrum analyzer.

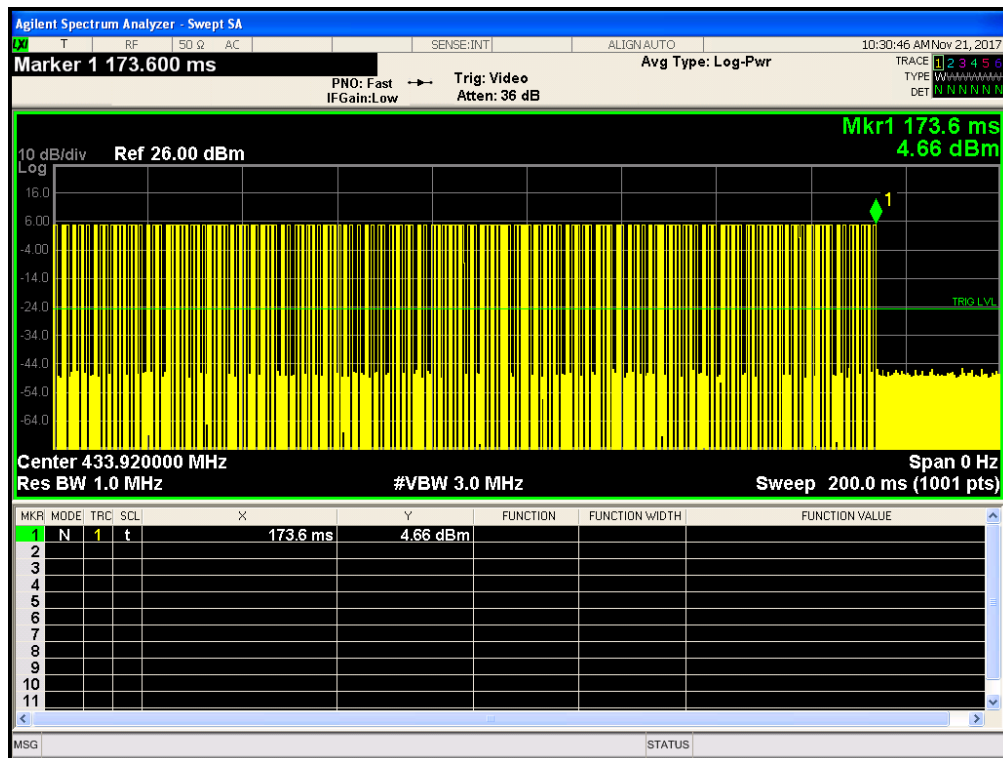
Standard requirement: 47 CFR §15.231 (e)

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

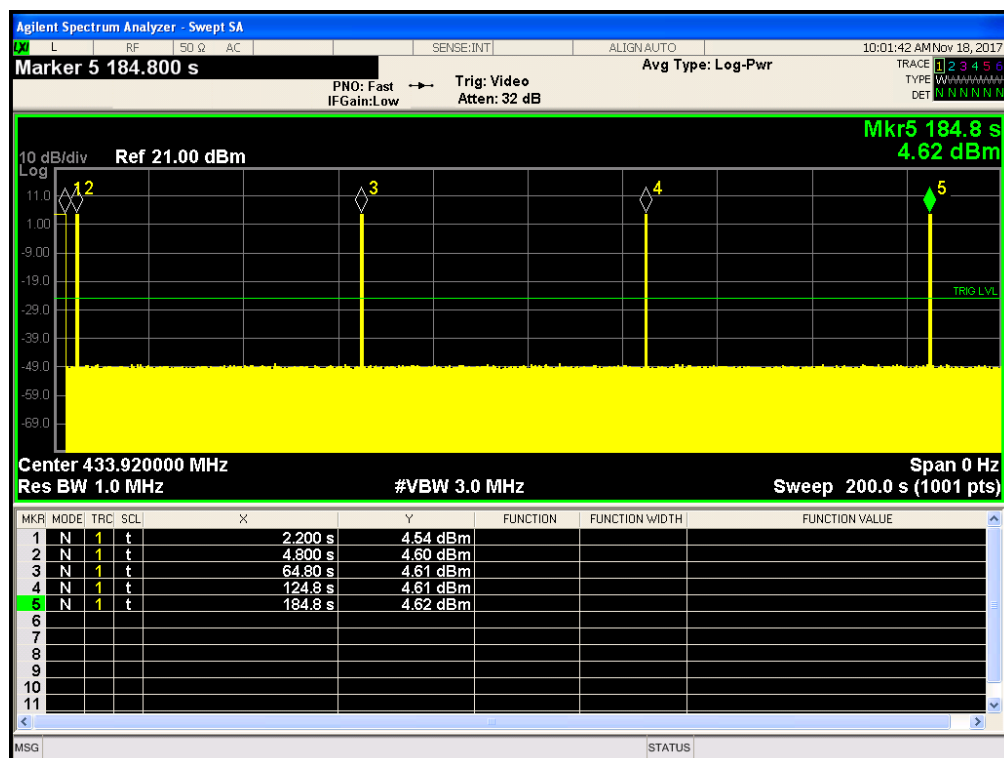
**Test Result: Pass**

Frequency (MHz)	The duration of transmission(s)	the silent period between transmissions(s)	Limit(The duration of transmission) (s)	Limit (the silent period between transmissions)	Verdict (Pass)
433.92	0.174	59.826	$\leq 1s$	$\geq 30 \times$ the duration of transmission but in no case less than 10s	Pass

Note: The silent period between transmissions = The periodic time - The duration of transmission.



The duration of transmission



The periodic time

## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191106	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191107	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
ISN	ISN T800	34373	09/23/2017	09/22/2018	<input type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	<input checked="" type="checkbox"/>
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/17/2017	11/16/2018	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>



## Annex B. EUT And Test Setup Photographs

### Annex B.i. Photograph: EUT External Photo

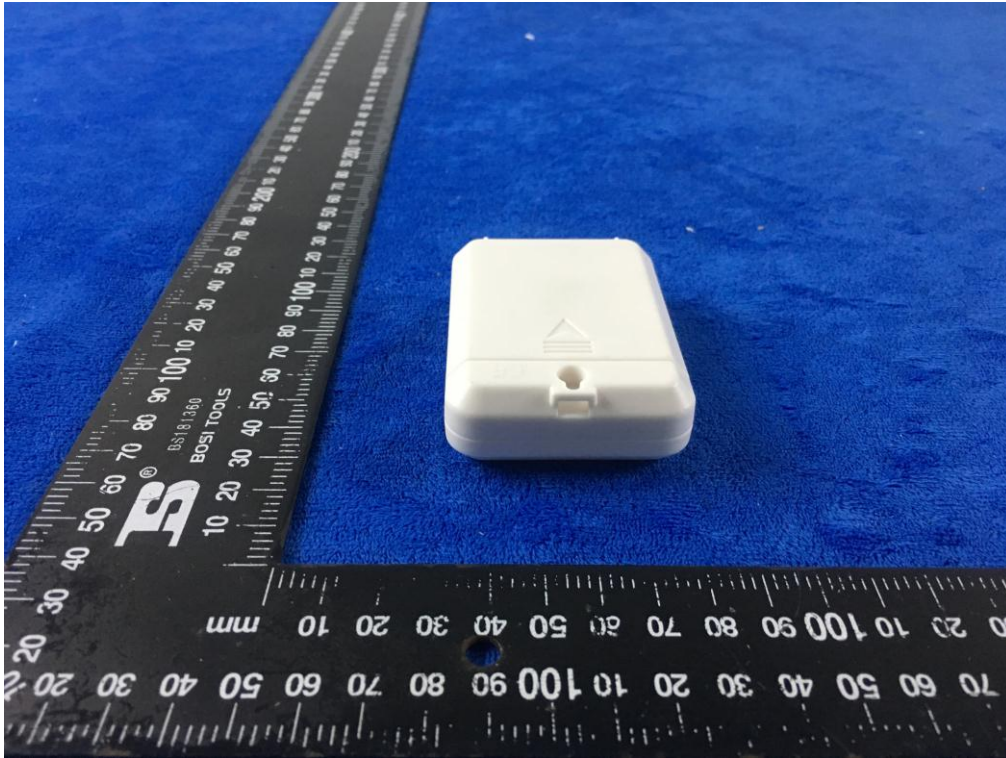
EUT - Front View



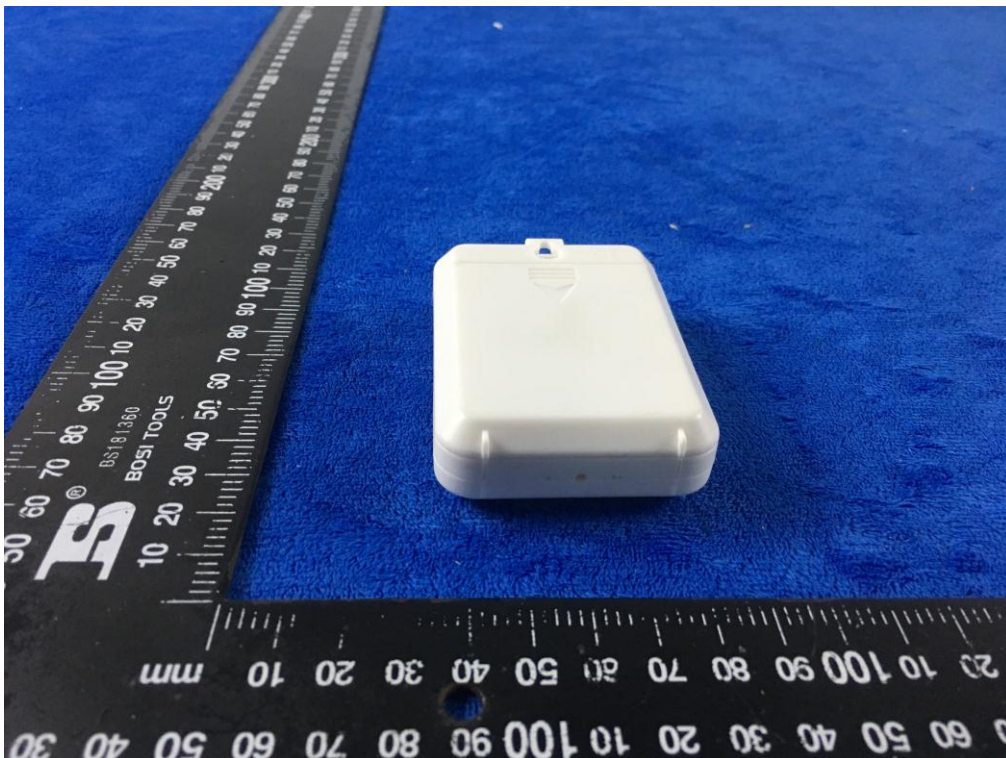
EUT - Rear View



EUT - Top View



EUT - Bottom View





EUT - Left View



EUT - Right View



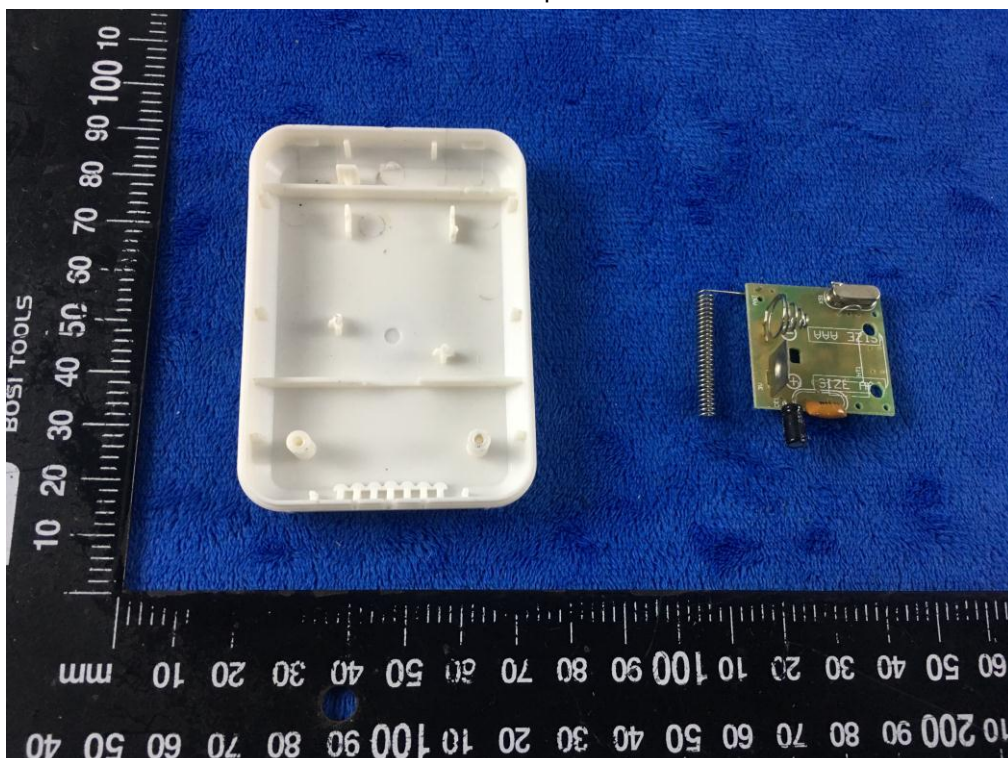


**Annex B.ii. Photograph: EUT Internal Photo**

Cover Off - Top View 1

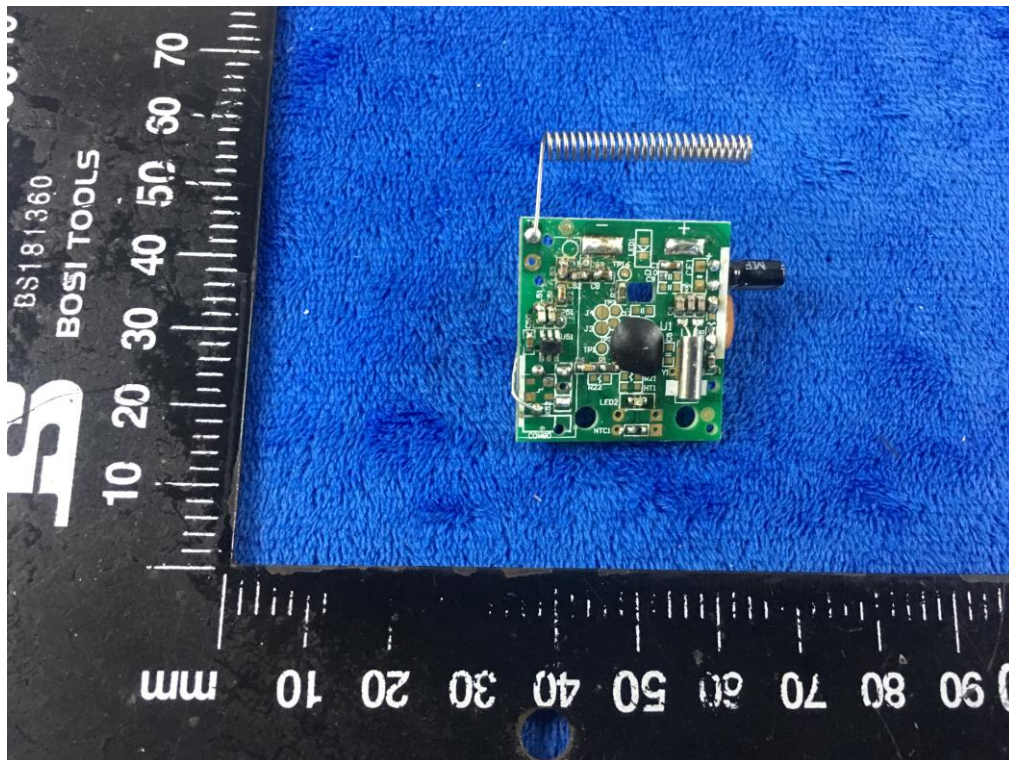


Cover Off - Top View 2

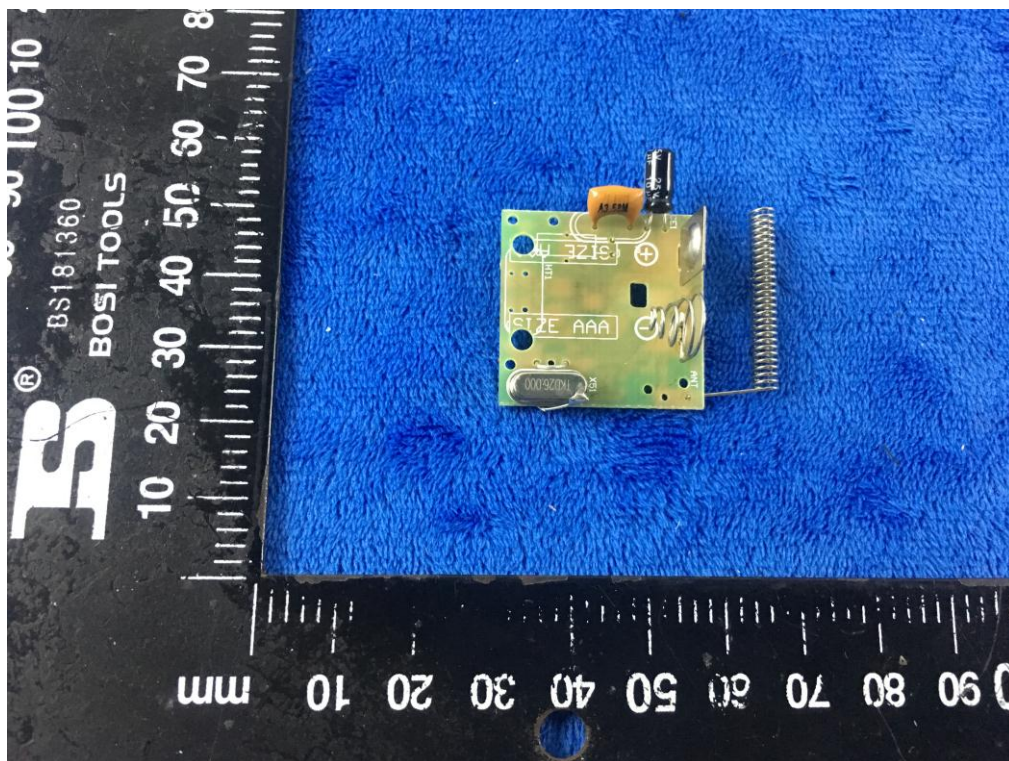




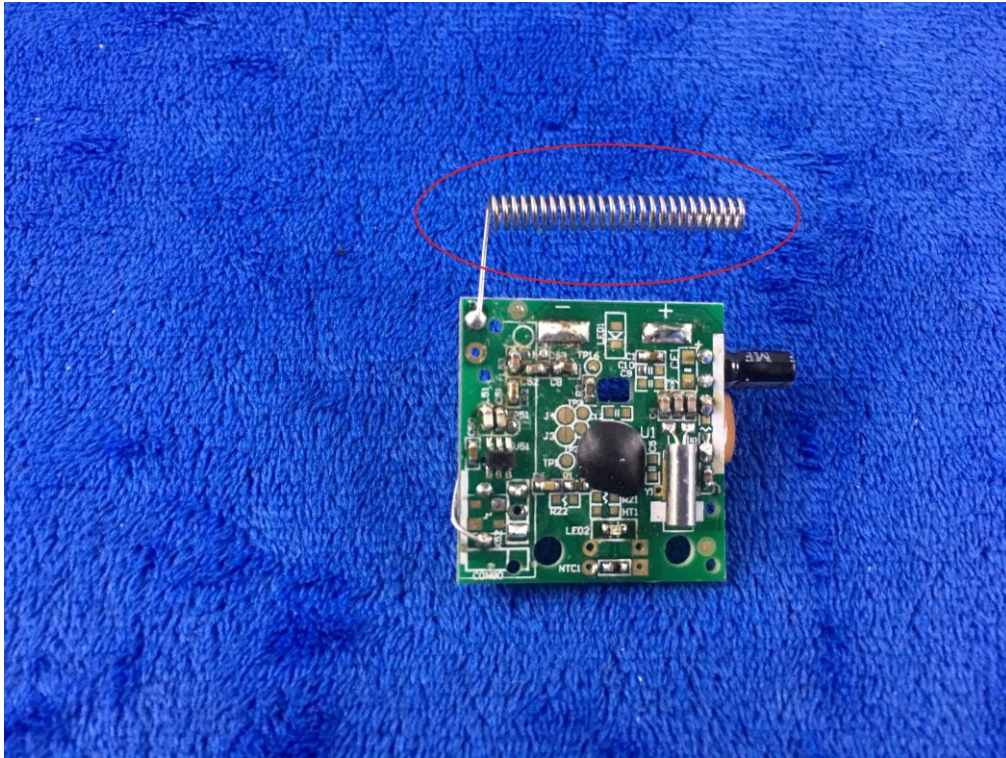
Mainboard - Front View



Mainboard - Rear View



Antenna View

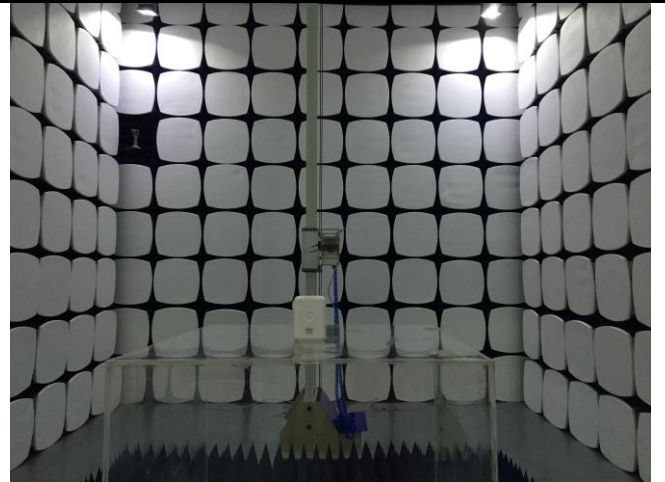




**Annex B.iii. Photograph: Test Setup Photo**



Radiated Spurious Emissions Test Setup Below 1GHz

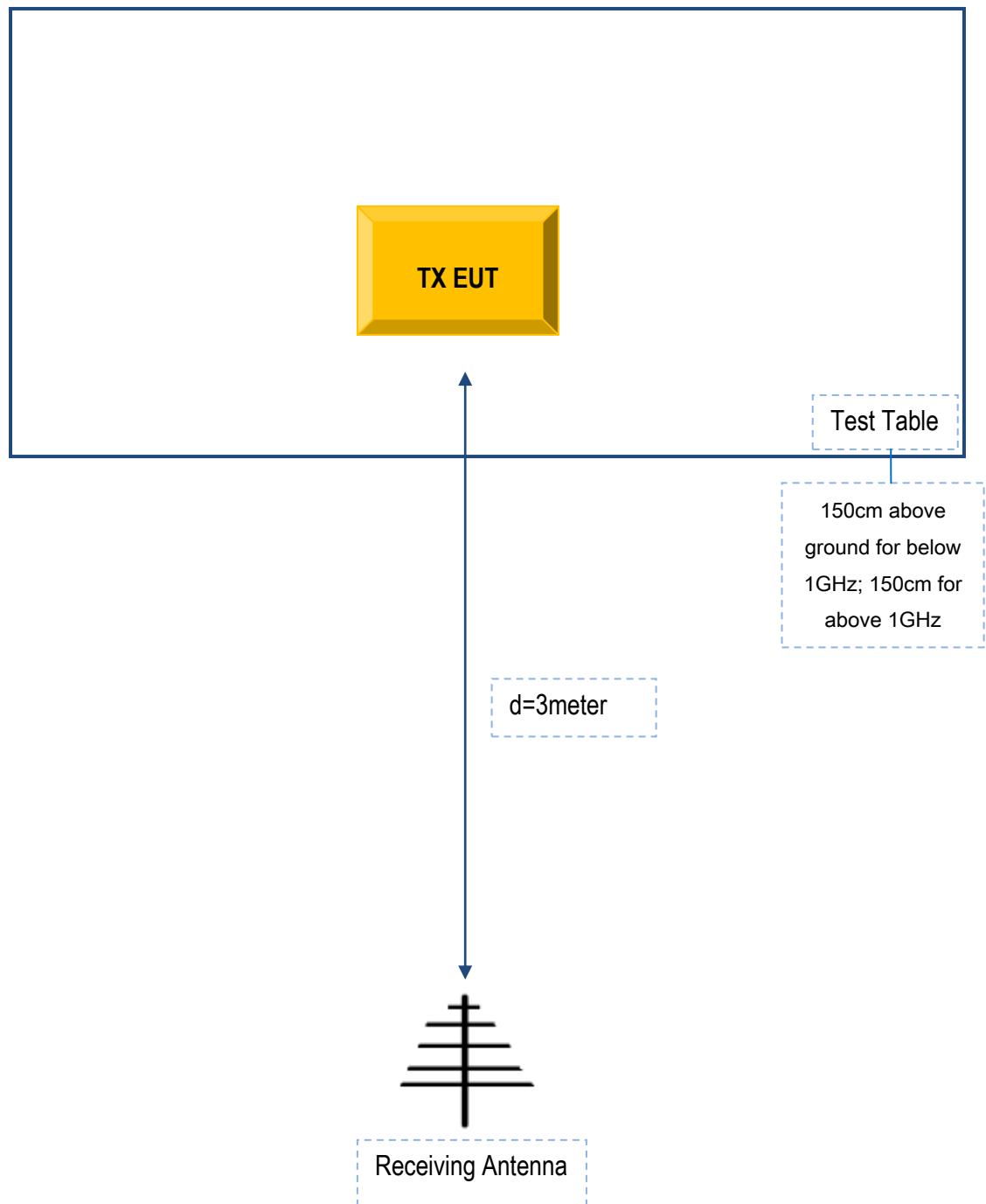


Radiated Spurious Emissions Test Setup Above  
1GHz

## Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

### Annex C.ii. TEST SET UP BLOCK

#### Block Configuration Diagram for Radiated Emissions





## **Annex C. ii. SUPPORTING EQUIPMENT DESCRIPTION**

The following is a description of supporting equipment and details of cables used with the EUT.

### **Supporting Equipment:**

Manufacturer	Equipment Description	Model	Serial No
N/A	N/A	N/A	N/A

### **Supporting Cable:**

Cable type	Shield Type	Ferrite Core	Length	Serial No
N/A	N/A	N/A	N/A	N/A

## Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see attachment

## Annex E. DECLARATION OF SIMILARITY

### Unit Connection Technology Co., Ltd

To: SIEMIC, 775 Montague Expressway, Milpitas, CA 95035, USA

## Declaration Letter

Dear Sir,

For our business issue and marketing requirement, we would like to list 6 model numbers on the FCC certificates and reports, as following:

Model No.: WS015T, WS015TP, WS015TH, WS005T, WS005TP, WS005TH

We declare that, all the model PCB, Antenna and Appearance shape, accessories are the same. The difference of these is listed as below:

Main Model No	Serial Model No	Difference
WS015T	WS015TP, WS015TH, WS005T, WS005TP, WS005TH	Different model name

Thank you!

Signature:



Printed name/title: Pei Ming Wang/ President

Address: Address :5/F., Block J, Shifeng Technology Park, Loucun, Guangming New District, Shenzhen, China 6