



Test Report No.: RF130705N033



# TEST REPORT

Applicant	Axesstel, Inc.
Address	6815 Flanders Drive, Suite 210, San Diego, CA92121, USA

Manufacturer or Supplier	Shenzhen Youngcheer Science & Technology Co., Ltd.
Address	2/F, No.2 Factory building, 40 zone, Bao'an distr., Shenzhen city, Guangdong Province, P.R. China
Product	433MHz W/D Sensor
Brand Name	Axesstel
Model	AI113
Additional Model & Model Difference	N/A
Date of tests	Jul. 05, 2013 ~ Aug. 16, 2013

the tests have been carried out according to the requirements of the following standards:

FCC Part 15, Subpart C, Section 15.231a (2012-10)

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

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Approved by Sam Tung  
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Date: Aug. 16, 2013

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**Test Lab  
Cert 2951.01**

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF130705N033	Original release	Aug. 16, 2013



# 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.231)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
§15.203	Antenna Requirement	PASS	Compliant
§15.207 (a)	AC Power Conducted Emission	N/A	EUT is powered by battery
§15.209 §15.231(b)	Radiated Emission	PASS	Compliant
§15.231 (a)	Deactivation Testing	PASS	Compliant
§15.231(c)	Emission Bandwidth Measurement	PASS	Compliant

# 2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.67dB
Radiated emissions	9KHz ~ 30MHz	2.74dB
	30MHz ~ 1000MHz	4.81dB
	1GHz ~ 18GHz	4.3dB
	18GHz ~ 40GHz	1.94dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	433MHz W/D Sensor
<b>MODEL NO.</b>	AI113
<b>FCC ID</b>	PH7AI113
<b>NOMINAL VOLTAGE</b>	DC 12V from Battery
<b>MODULATION TYPE</b>	ASK
<b>OPERATING FREQUENCY</b>	433.92MHz
<b>NUMBER OF CHANNEL</b>	1
<b>ANTENNA TYPE</b>	Integral PCB Antenna
<b>I/O PORTS</b>	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.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

#### 3.2 DESCRIPTION OF TEST MODES

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X plane for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

<b>FREQUENCY</b>	<b>TEST MODES</b>
433.92MHz	Transmitting

### 3.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	RE ≥ 1G	RE < 1G	PLC	EB	DT	
-	√	√	-	√	√	-

Where **RE ≥ 1G**: Radiated Emission above 1GHz      **RE < 1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission      **EB**: 20dB Bandwidth measurement  
**DT**: Deactivation Time measurement

#### POWER LINE CONDUCTED EMISSION TEST:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

#### RADIATED EMISSION TEST (ABOVE 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

#### RADIATED EMISSION TEST (BELOW 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

**EMISSION BANDWIDTH MEASUREMENT:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

**DEACTIVATION TIME MEASUREMENT:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
PLC	N/A	N/A	N/A
RE $\geq$ 1G	25deg. C, 62%RH	DC 12V from Battery	Glyn He
RE<1G	25deg. C, 62%RH	DC 12V from Battery	Glyn He
EB	24deg. C, 60%RH	DC 12V from Battery	Glyn He
DT	24deg. C, 60%RH	DC 12V from Battery	Glyn He



### 3.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.231)**

**ANSI C63.4-2003**

All test items have been performed and recorded as per the above standards.

### 3.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	N/A	N/A	N/A	N/A	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A

## 4. TEST TYPES AND RESULTS

### 4.1 RADIATED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/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

According to §15.231(b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	<sup>1</sup> 1,250 to 3,750	<sup>1</sup> 125 to 375
174–260	3,750	375
260–470	<sup>1</sup> 3,750 to 12,500	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250

**NOTE:**

- <sup>1</sup> Linear interpolations.
- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

#### 4.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4446A	MY46180622	April 24, 13	April 23, 14
EMI Test Receiver	Rohde&Schwarz	ESVD	847398/003	May 14, 13	May 13, 14
Loop antenna (9kHz~30MHz)	Daze	ZN30900A	0708	Nov. 28, 12	Nov. 27, 13
Bilog Antenna (20M-2GHz)	Teseq	CBL 6111D	25757	Nov. 22, 12	Nov. 21, 13
Horn Antenna (1GHz -18GHz)	EMCO	3117	00062558	Oct. 18, 12	Oct. 17, 13
Pre-Amplifier (9kHz~1GHz)	SONOMA	310D	186955	Mar. 06, 13	Mar. 05, 14
Pre-Amplifier (20MHz-3GHz)	EMCI	EMC 330	980095	Nov. 02, 12	Nov. 01, 13
Pre-Amplifier (100MHz-26.5GHz)	Agilent	8449B	3008A00409	May 14, 13	May 13, 14
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8 .8m	NSEMC006	Mar. 24, 13	Mar. 23, 14
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 31, 12	Oct. 30, 13
Test Software	ADT	ADT_Radiated _V7.6.15	N/A	N/A	N/A
Spectrum Analyzer	Agilent	E4446A	MY46180622	April 24, 13	April 23, 14

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
  2. The test was performed in Chamber
  3. The FCC Site Registration No. is 502831

#### 4.1.3 TEST PROCEDURES

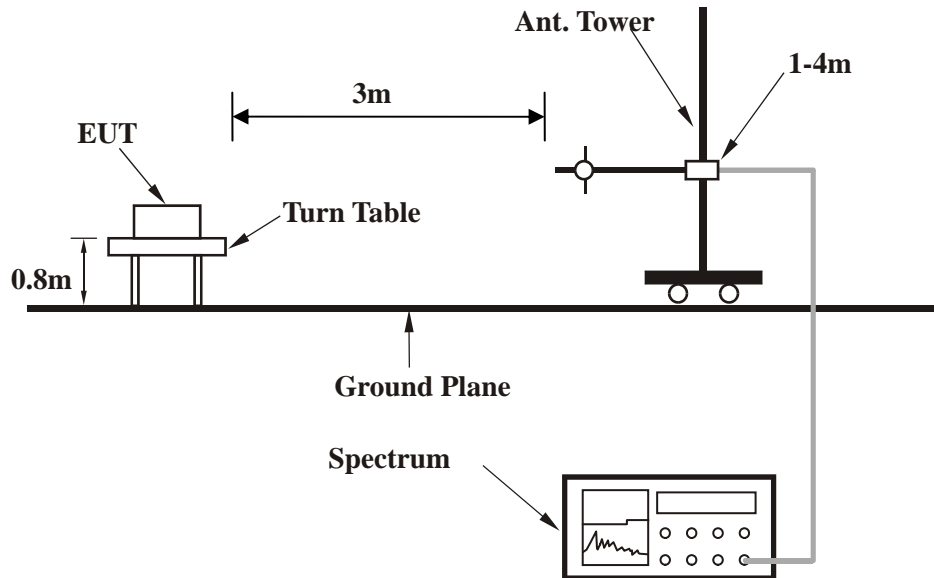
The basic test procedure was in accordance with ANSI C63.4 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters Semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.1.5 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT OPERATING CONDITIONS

- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 TEST RESULTS

##### BELOW 1GHz WORST-CASE DATA: Transmitting

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	31.52 PK	18.95	-5.99	12.96	40	-27.04	120	257
2	170.58 PK	11.21	-1.68	9.53	43.5	-33.97	145	285
3	433.92 PK	19.77	43.42	63.19	100.82	-37.63	203	247
4	433.92 AV	-	-	54.13	80.82	-26.69	-	-
5	474.57 PK	20.76	1.41	22.17	46	-23.83	192	339
6	830.32 PK	26.84	2.06	28.9	46	-17.1	202	357
7	867.84 PK	27.41	6.71	34.12	80.82	-46.7	203	346
8	867.84 AV	-	-	25.06	60.82	-35.76	-	-
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	299.94 PK	15.89	-0.6	15.29	46	-30.71	100	152
2	433.92 PK	19.77	47.62	67.39	100.82	-33.43	100	327
3	433.92 AV	-	-	58.33	80.82	-22.49	-	-
4	474.57 PK	20.76	2.13	22.89	46	-23.11	108	0
5	524.7 PK	21.3	-1.48	19.82	46	-26.18	124	155
6	600.7 PK	23.09	0.18	23.27	46	-22.73	130	210
7	867.84 PK	27.41	7.68	35.09	80.82	-45.73	114	85
8	867.84 AV	-	-	26.03	60.82	-34.79	-	-

#### NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. For the test results, the EUT had been tested from 9KHz ~5GHz. But only the worst case was shown in test report.
6. Fundamental AV value =PK Emission +20\*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20 log (20.3 ms / 57.6 ms) = -9.06 dB  
Please see page 16~18 for plotted duty.

**ABOVE 1GHz WORST-CASE DATA: Transmitting**

<b>CHANNEL</b>	TX Channel 1	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 5GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	2055 PK	36.67	9.56	46.23	74	-27.77	100	205
	2055 AV	36.67	-	37.17	54	-16.83	-	-
2	2335 PK	37.15	10.05	47.2	74	-26.8	100	227
	2335 AV	37.15	-	38.14	54	-15.86	-	-
3	3125 PK	38.78	9.74	48.52	74	-25.48	100	244
	3125 AV	38.78	-	39.46	54	-14.54	-	-
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	2190 PK	36.9	9.6	46.5	74	-27.5	100	286
	2190 AV	36.9	-	37.44	54	-16.56	-	-
2	2645 PK	37.78	10.74	48.52	74	-25.48	100	237
	2645 AV	37.78	-	39.46	54	-14.54	-	-
3	3345 PK	39.06	9.53	48.59	74	-25.41	100	262
	3345 AV	39.06	-	39.53	54	-14.47	-	-

**NOTE:**

- 1 The resolution bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection (PK) at frequency above 1GHz.
- 2 Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- 3 Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 4 Margin value = Emission level – Limit value.
- 5 Fundamental AV value =PK Emission +20\*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20 log (20.3ms / 57.6ms) = -9.06 dB Please see page 16~18 for plotted duty.

**Duty Cycle:**

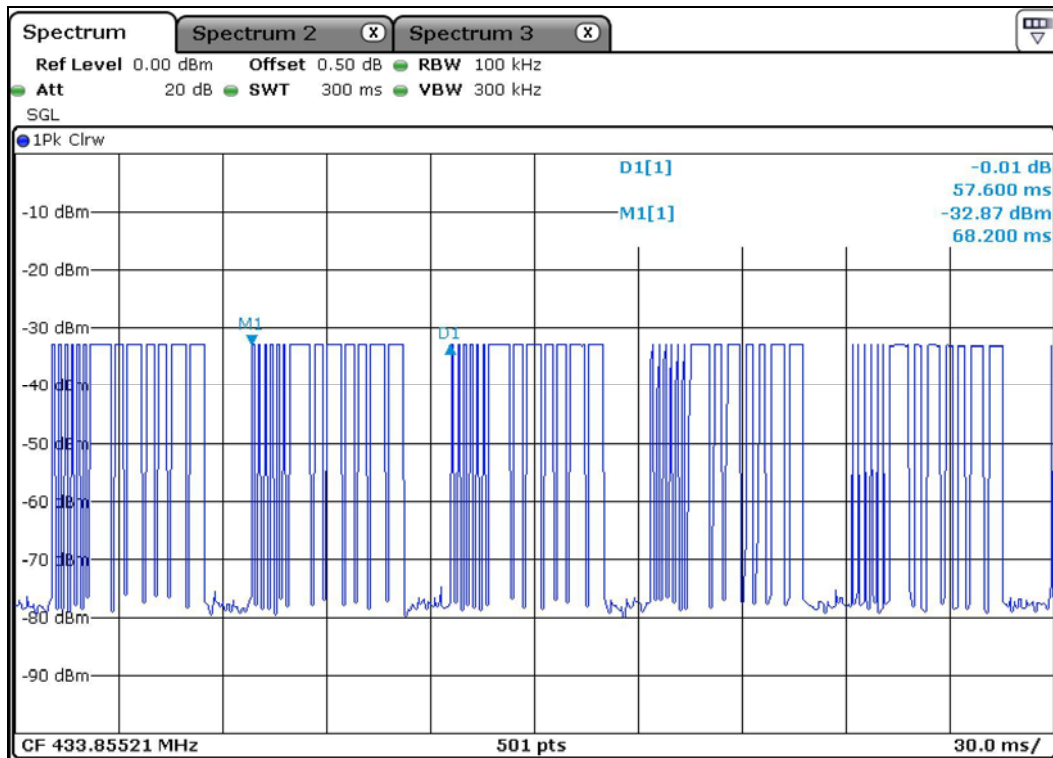
$T_p = 57.6\text{ms}$

$T_{on} = 12 \times 1.28\text{ms} + 13 \times 0.38\text{ms} = 20.3\text{ms}$

Duty Cycle =  $T_{on} / T_p \times 100\% = 20.3 / 57.6 \times 100\% = 35.24\%$

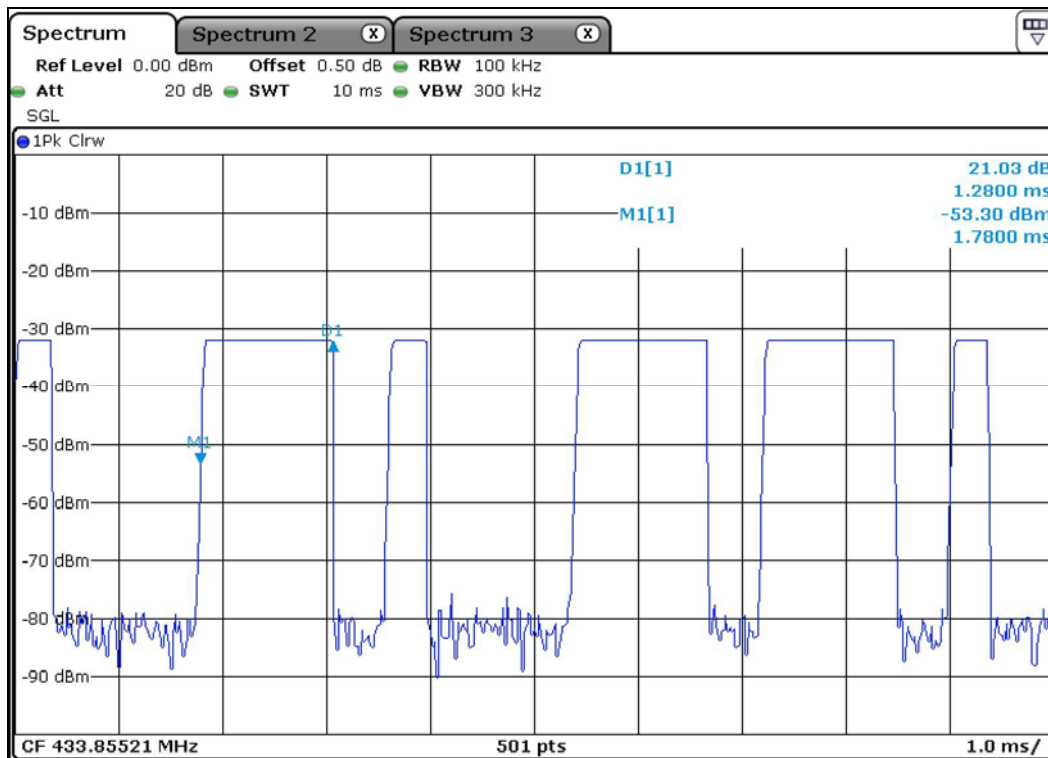
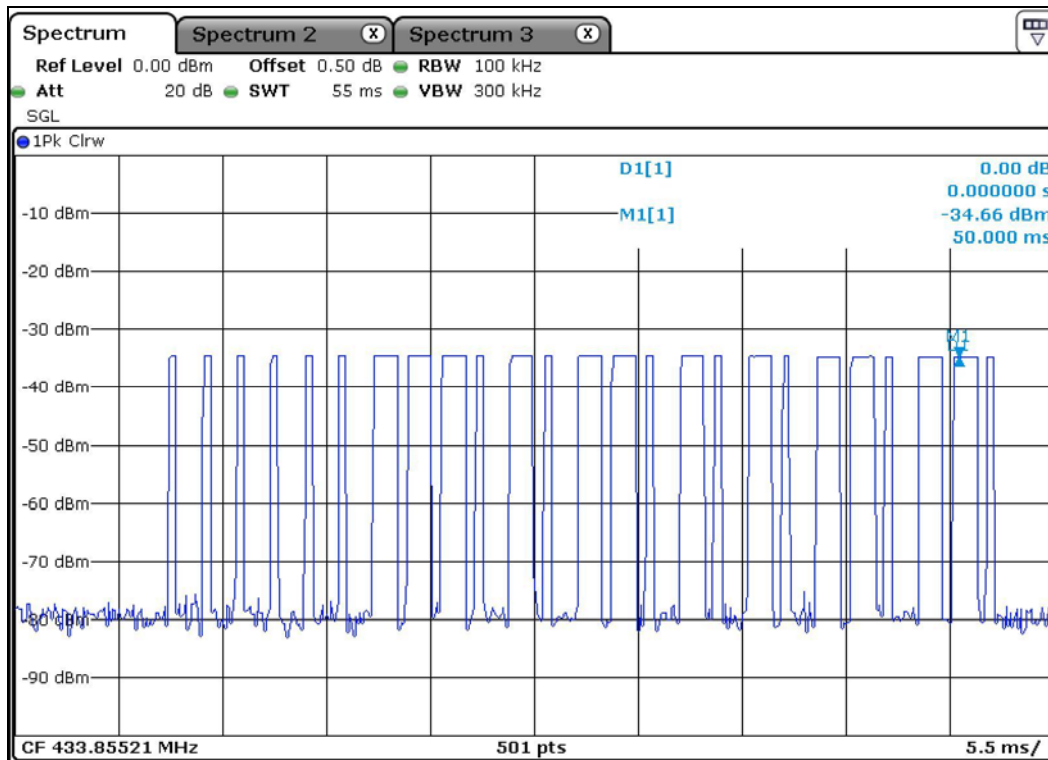
Factor =  $20 \times \text{Log}(T_{on} / T_p) = -9.06\text{ dB}$

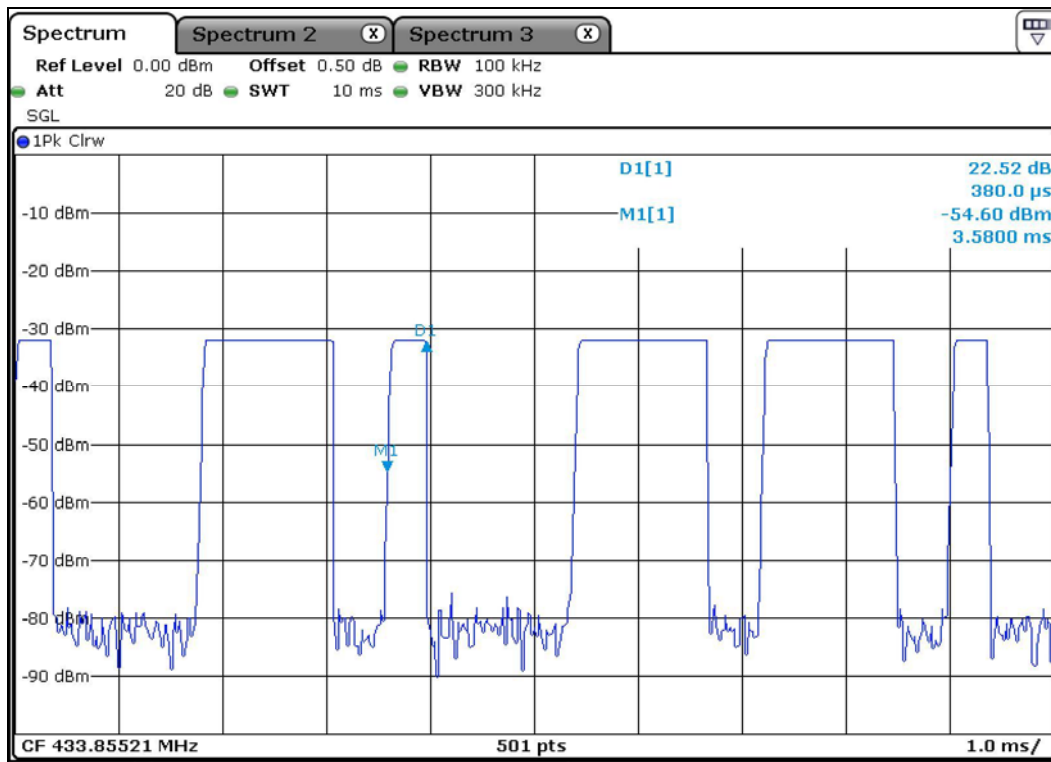
***T<sub>p</sub>***





$Ton = 12 \times 1.28ms + 13 \times 0.38ms = 20.3ms$





## 4.2 20dB BANDWIDTH MEASUREMENT

### 4.2.1 LIMITS OF 20dB BANDWIDTH MEASUREMENT

According to FCC 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

$$\text{Limit} = \text{Fundamental Frequency} \times 0.25\% = 433.92 \text{ MHz} \times 0.25\% = 1084.8 \text{ kHz}$$

### 4.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4446A	MY46180622	Apr. 24,13	Apr. 23,14
EMI Test Receiver	Rohde&Schwarz	ESVD	847398/003	May 14,13	May 13,14
Bilog Antenna	Teseq	CBL 6111D	25757	Nov. 22,12	Nov. 21,13
Horn Antenna (1GHz -18GHz)	EMCO	3117	00062558	Oct.18,12	Oct.17,13
Pre-Amplifier (20MHz-3GHz)	EMCI	EMC 330	980095	Nov. 02,12	Nov.01,13
Pre-Amplifier (100MHz-26.5GHz)	Agilent	8449B	3008A00409	May 14,13	May 13,14
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8 .8m	NSEMC006	Mar. 24,13	Mar. 23,14
Digital Multimeter	FLUKE	15B	A1220010D G	Oct. 31,12	Oct. 30,13
Test Software	ADT	ADT_Radiated _V7.6.15	N/A	N/A	N/A

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in Chamber 10m

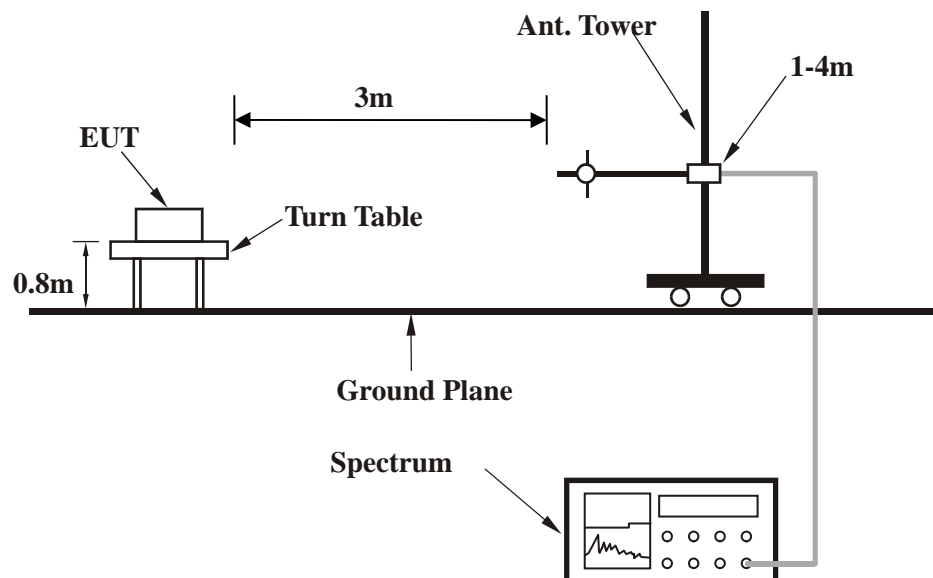
#### 4.2.3 TEST PROCEDURE

The spectrum analyzer was receiving the maximum emission level. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.2.5 TEST SETUP



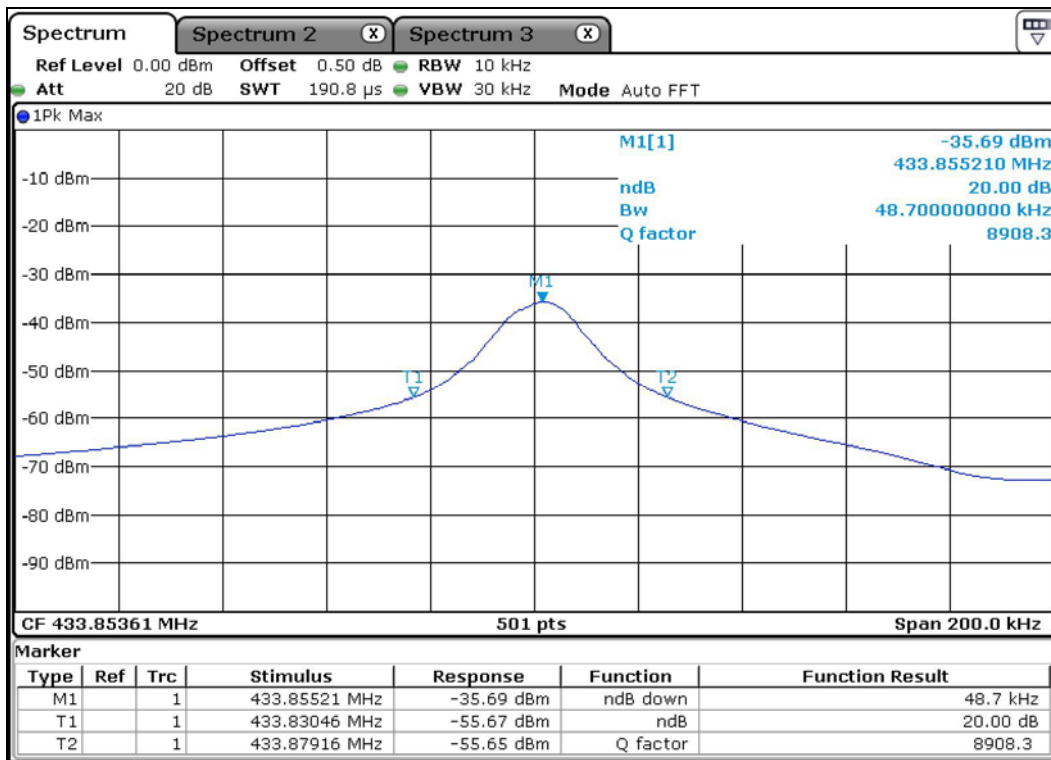
#### 4.2.6 EUT OPERATING CONDITIONS

- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.

### 4.2.7 TEST RESULTS

FREQUENCY (MHz)	20dB BANDWIDTH (kHz)	MAXIMUM LIMIT (kHz)	PASS/FAIL
433.92	48.7	1084.8	PASS

**Test Data:**



### 4.3 DEACTIVATION TEST

#### 4.3.1 LIMITS OF DEACTIVATION TEST

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.

15.231 (a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

#### 4.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4446A	MY46180622	Apr. 24, 13	Apr. 23, 14
EMI Test Receiver	Rohde&Schwarz	ESVD	847398/003	May 14, 13	May 13, 14
Bilog Antenna	Teseq	CBL 6111D	25757	Nov. 22, 12	Nov. 21, 13
Horn Antenna (1GHz -18GHz)	EMCO	3117	00062558	Oct.18,12	Oct.17,13
Pre-Amplifier (20MHz-3GHz)	EMCI	EMC 330	980095	Nov. 02,12	Nov.01,13
Pre-Amplifier (100MHz-26.5GHz)	Agilent	8449B	3008A00409	May 14,13	May 13,14
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8 .8m	NSEMC006	Mar. 24,13	Mar. 23,14
Digital Multimeter	FLUKE	15B	A1220010D G	Oct. 31,12	Oct. 30,13
Test Software	ADT	ADT_Radiated _V7.6.15	N/A	N/A	N/A

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA

2. The test was performed in Chamber 10m

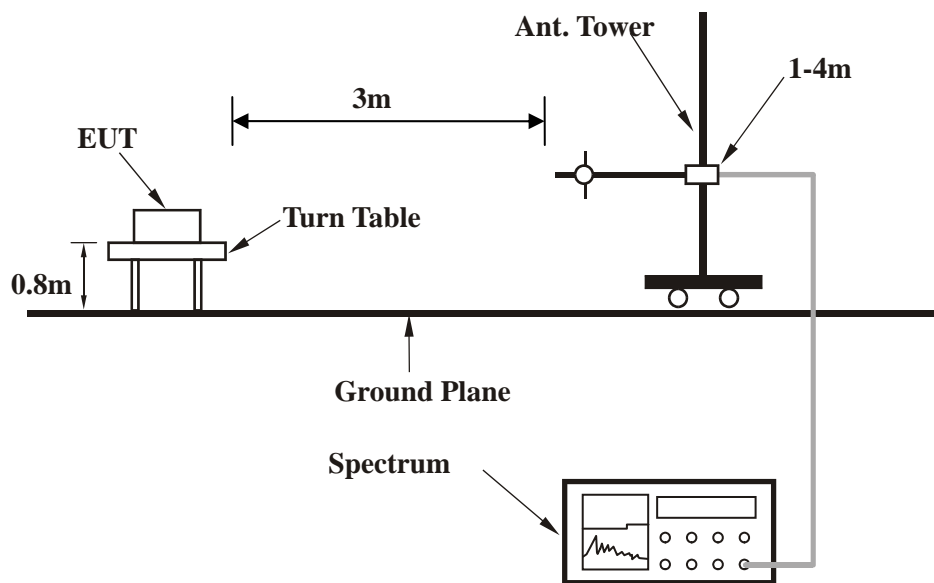
#### 4.3.3 TEST PROCEDURE

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the transmission duration was measured and recorded.

#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.5 TEST SETUP



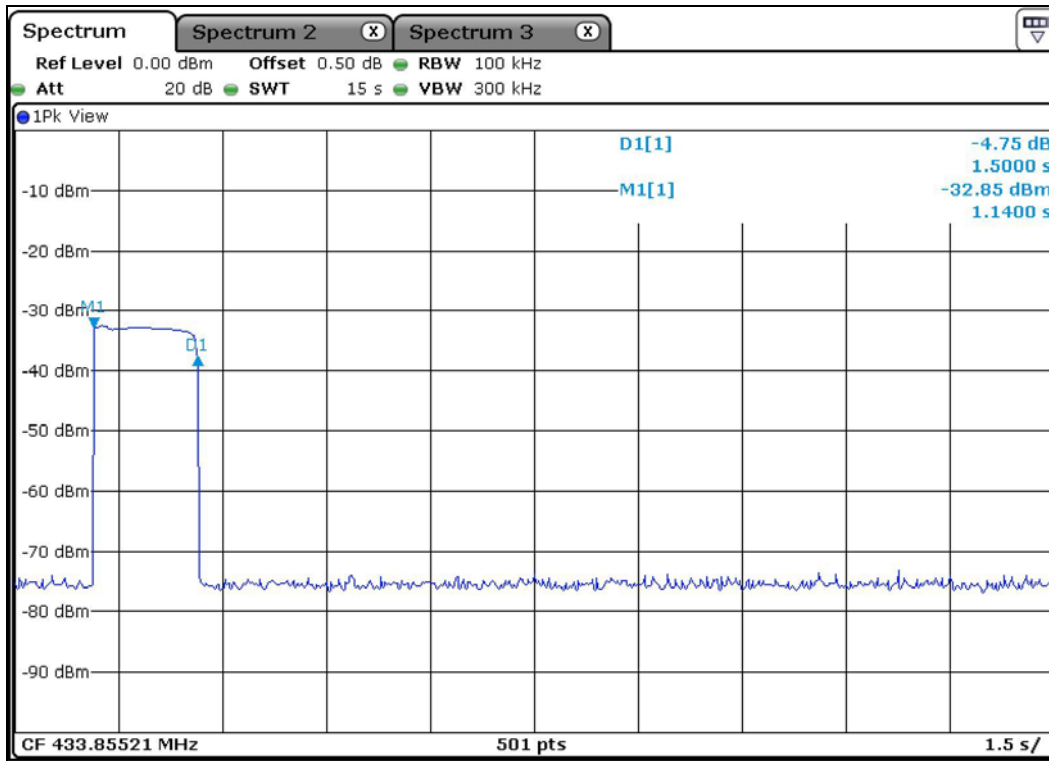
#### 4.3.6 EUT OPERATING CONDITIONS

- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.

### 4.3.7 TEST RESULTS

MODE/SENSE	FREQUENCY (MHz)	MAXIMUM LIMIT (sec)	PASS/FAIL
1	433.92	5	PASS

The plots of test results are attached as below.







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## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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## 6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---