

# TEST REPORT

**Applicant:** Unit Connection Technology Co., Ltd

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

**Manufacturer/Factory:** Unit Connection Technology Co., Ltd

**Address of Manufacturer/Factory:** 5/F., Block J, Shifeng Technology Park, Loucun, Guangming New District, Shenzhen, China

**Equipment Under Test (EUT)**

Product Name: Wireless Weather Station Transmitter

Model No.: WS029, WS029T, WS029TE, WS030, WS030T, WS030TE, MK-WS-104-UC

**FCC ID:** 2ALHJ-WS029T

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C Section 15.231

**Date of sample receipt:** June 26, 2023

**Date of Test:** June 27, 2023-July 20, 2023

**Date of report issued:** July 20, 2023

**Test Result :** PASS \*

\* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



**Robinson Luo**

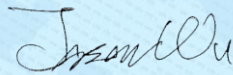
**Laboratory Manager**

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

## 2 Version

Version No.	Date	Description
00	July 20, 2023	Original

**Prepared By:**



**Date:**

July 20, 2023

**Project Engineer**

**Check By:**



**Reviewer**

**Date:**

July 20, 2023

## 3 Contents

	Page
1 COVER PAGE.....	1
2 VERSION .....	2
3 CONTENTS .....	3
4 TEST SUMMARY .....	4
4.1 MEASUREMENT UNCERTAINTY .....	4
5 GENERAL INFORMATION .....	5
5.1 GENERAL DESCRIPTION OF EUT .....	5
5.2 TEST MODE .....	6
5.3 TEST FACILITY.....	6
5.4 TEST LOCATION .....	6
5.5 DESCRIPTION OF SUPPORT UNITS .....	6
5.6 DEVIATION FROM STANDARDS.....	6
5.7 ABNORMALITIES FROM STANDARD CONDITIONS.....	6
5.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER .....	6
6 TEST INSTRUMENTS LIST .....	7
7 TEST RESULTS AND MEASUREMENT DATA.....	9
7.1 ANTENNA REQUIREMENT .....	9
7.2 RADIATED EMISSION METHOD .....	10
7.2.1 Field Strength of The Fundamental Signal .....	12
7.2.2 Spurious emissions.....	13
7.3 OCCUPY BANDWIDTH.....	17
7.4 DWELL TIME .....	18
7.5 SILENT PERIOD .....	19
8 TEST SETUP PHOTO .....	20
9 EUT CONSTRUCTIONAL DETAILS .....	20

## 4 Test Summary

Test Item	Section in	Result
Antenna requirement	CFR 47 15.203	Pass
Conduction Emission	CFR 47 15.207	N/A
Field strength of the fundamental signal	CFR 47 15.231(e)	Pass
Spurious emissions	CFR 47 15.231(e) & 15.209	Pass
Occupy Bandwidth	CFR 47 15.231(c)	Pass
Dwell time	CFR 47 15.231(e)	Pass

*Pass: The EUT complies with the essential requirements in the standard.*

### 4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.



## 5 General Information

### 5.1 General Description of EUT

Product Name:	Wireless Weather Station Transmitter
Model No.:	WS029, WS029T, WS029TE, WS030, WS030T, WS030TE, MK-WS-104-UC
Test Model No:	WS029T
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are appearance color and model name for commercial purpose.	
Serial No.:	N/A
Test sample(s) ID:	GTS2023060479-1
Sample(s) Status	Engineer sample
Operation Frequency:	433.92MHz
Modulation type:	ASK
Antenna Type:	Integral Antenna
Antenna gain:	-3.92dBi(Declared by applicant)
Power supply:	DC 4.5V(3*1.5V Size“AA” Battery)

Remark:

1. Antenna gain information provided by the customer
2. The relevant information of the sample is provided by the entrusting company, and the laboratory is not responsible for its authenticity.

## 5.2 Test mode

Transmitting mode	Keep the EUT in transmitting mode.
Remark: New battery is used during all test.	

### Per-test mode.

We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

433.92MHz	Axis	X	Y	Z
	Field Strength(dBuV/m)	72.56	73.47	71.24

### Final Test Mode:

According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup”:  
Y axis (see the test setup photo)

## 5.3 Test Facility

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

- **FCC—Registration No.: 381383**

Designation Number: CN5029

Global United Technology Services Co., Ltd., Shenzhen 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 files.

- **ISED—Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of ISED for radio equipment testing

- **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

## 5.4 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

No. 123- 128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

## 5.5 Description of Support Units

None.

## 5.6 Deviation from Standards

None.

## 5.7 Abnormalities from Standard Conditions

None.

## 5.8 Other Information Requested by the Customer

None.

## 6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	June 23, 2021	June 22, 2024
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	April 14, 2023	April 13, 2024
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9168	GTS640	March 19, 2023	March 18, 2025
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	April 17, 2023	April 16, 2025
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Coaxial Cable	GTS	N/A	GTS213	April 21, 2023	April 20, 2024
8	Coaxial Cable	GTS	N/A	GTS211	April 21, 2023	April 20, 2024
9	Coaxial cable	GTS	N/A	GTS210	April 21, 2023	April 20, 2024
10	Coaxial Cable	GTS	N/A	GTS212	April 21, 2023	April 20, 2024
11	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	April 14, 2023	April 13, 2024
12	Loop Antenna	ZHINAN	ZN30900A	GTS534	Nov. 29, 2022	Nov. 28, 2023
13	Broadband Preamplifier	SCHWARZBECK	BBV9718	GTS535	April 14, 2023	April 13, 2024
14	Amplifier(1GHz-26.5GHz)	HP	8449B	GTS601	April 14, 2023	April 13, 2024
15	Horn Antenna (18-26.5GHz)	/	UG-598A/U	GTS664	Oct. 30, 2022	Oct. 29, 2023
16	Horn Antenna (26.5-40GHz)	A.H Systems	SAS-573	GTS665	Oct. 30, 2022	Oct. 29, 2023
17	FSV·Signal Analyzer (10Hz-40GHz)	Keysight	FSV-40-N	GTS666	March 13, 2023	March 12, 2024
18	Amplifier	/	LNA-1000-30S	GTS650	April 14, 2023	April 13, 2024
19	CDNE M2+M3-16A	HCT	30MHz-300MHz	GTS668	Dec. 20, 2022	Dec.19, 2023
20	Thermo meter	JINCHUANG	GSP-8A	GTS643	April 19, 2023	April 18, 2024



RF Conducted Test:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	April 14, 2023	April 13, 2024
2	EMI Test Receiver	R&S	ESCI 7	GTS552	April 14, 2023	April 13, 2024
3	PSA Series Spectrum Analyzer	Agilent	E4440A	GTS536	April 14, 2023	April 13, 2024
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	April 14, 2023	April 13, 2024
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	April 14, 2023	April 13, 2024
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	April 14, 2023	April 13, 2024
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	April 14, 2023	April 13, 2024
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	April 14, 2023	April 13, 2024
9	Thermo meter	JINCHUANG	GSP-8A	GTS641	April 19, 2023	April 18, 2024

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	KUMAO	SF132	GTS647	April 19, 2023	April 18, 2024

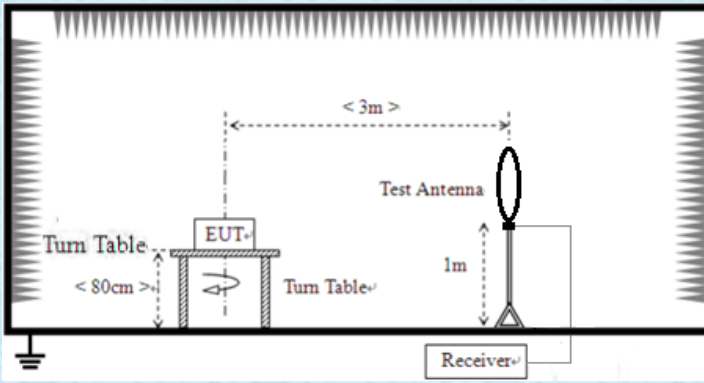


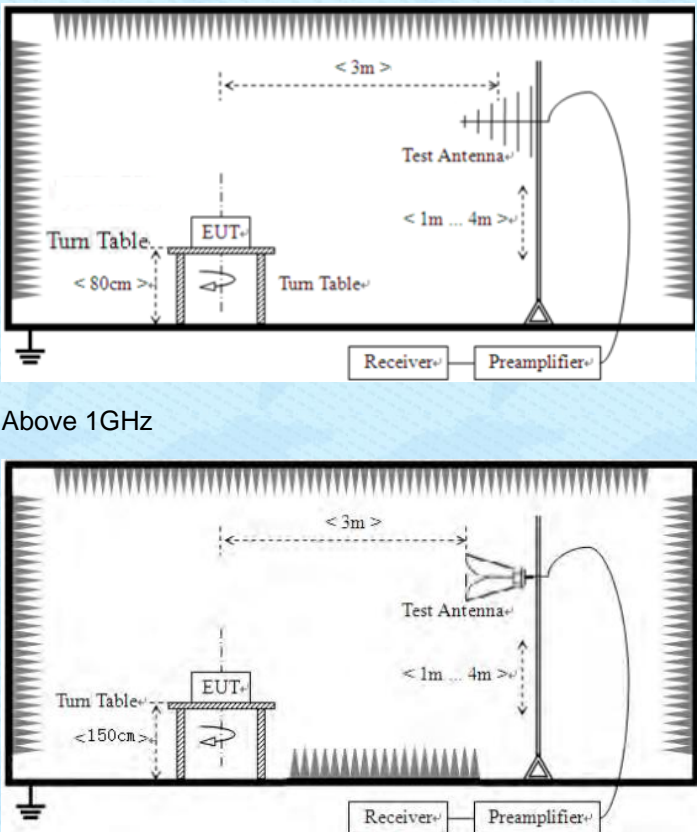
## 7 Test results and Measurement Data

### 7.1 Antenna requirement

<b>Standard requirement:</b>	FCC Part15 C Section 15.203
<b>15.203 requirement:</b> 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, 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.	
<b>EUT Antenna:</b>	
The antenna is integral antenna, reference to the appendix II for details.	

## 7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 6000MHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
Peak		1MHz	10Hz	Average	
Limit: (Field strength of the fundamental signal)	Frequency	Limit (dBuV/m @3m)		Remark	
	433.92MHz	72.87		Average Value	
		92.87		Peak Value	
Limit: (Spurious Emissions)	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz-0.490MHz	2400/F(KHz)	QP	300m	
	0.490MHz-1.705MHz	24000/F(KHz)	QP	30m	
	1.705MHz-30MHz	30	QP	30m	
	30MHz-88MHz	100	QP	3m	
	88MHz-216MHz	150	QP		
	216MHz-960MHz	200	QP		
	960MHz-1GHz	500	QP		
	Above 1GHz	500	Average		
		5000	Peak		
Or The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level whichever limit permits a higher field strength.					
Test setup:	<p>Below 30MHz</p>  <p>Below 1GHz</p>				

	 <p>Above 1GHz</p>						
<p>Test Procedure:</p>	<ol style="list-style-type: none"> <li>1. The EUT was placed on the top of a rotating table (0.8 meters for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>3. The antenna height 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.</li> <li>4. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li> </ol>						
<p>Test Instruments:</p>	<p>Refer to section 6.0 for details</p>						
<p>Test mode:</p>	<p>Refer to section 5.2 for details</p>						
<p>Test environment:</p>	<table border="1"> <tr> <td>Temp.:</td> <td>25 °C</td> <td>Humid.:</td> <td>50%</td> <td>Press.:</td> <td>1 010mbar</td> </tr> </table>	Temp.:	25 °C	Humid.:	50%	Press.:	1 010mbar
Temp.:	25 °C	Humid.:	50%	Press.:	1 010mbar		
<p>Test voltage:</p>	<p>DC 4.5V</p>						
<p>Test results:</p>	<p>Pass</p>						



**Measurement data:**

**7.2.1 Field Strength of The Fundamental Signal**

**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
433.92	80.06	16.40	3.02	30.00	69.48	92.87	-23.39	Vertical
433.92	84.05	16.40	3.02	30.00	73.47	92.87	-19.40	Horizontal

**Average value:**

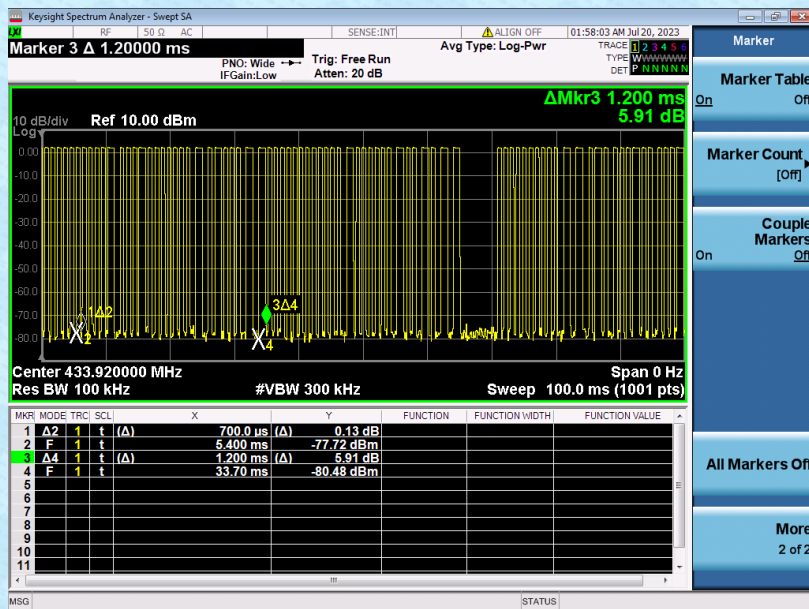
Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	69.48	-3.78	65.70	72.87	-7.17	Vertical
433.92	73.47	-3.78	69.69	72.87	-3.18	Horizontal

*Remarks:*

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. PK Value under PK limit more than 20db, then pass for AV value.

Average value:	
Calculate Formula:	Average value=Peak value + Duty Cycle Factor
	Duty cycle factor=20 log(Duty cycle)
	Duty cycle=on time/100 milliseconds or period, whichever is less
Test data:	T on time =64.70(ms)
	T period =100(ms)
	Duty cycle=0.647
	duty cycle factor=-3.78

Test plot as follows:



## 7.2.2 Spurious emissions

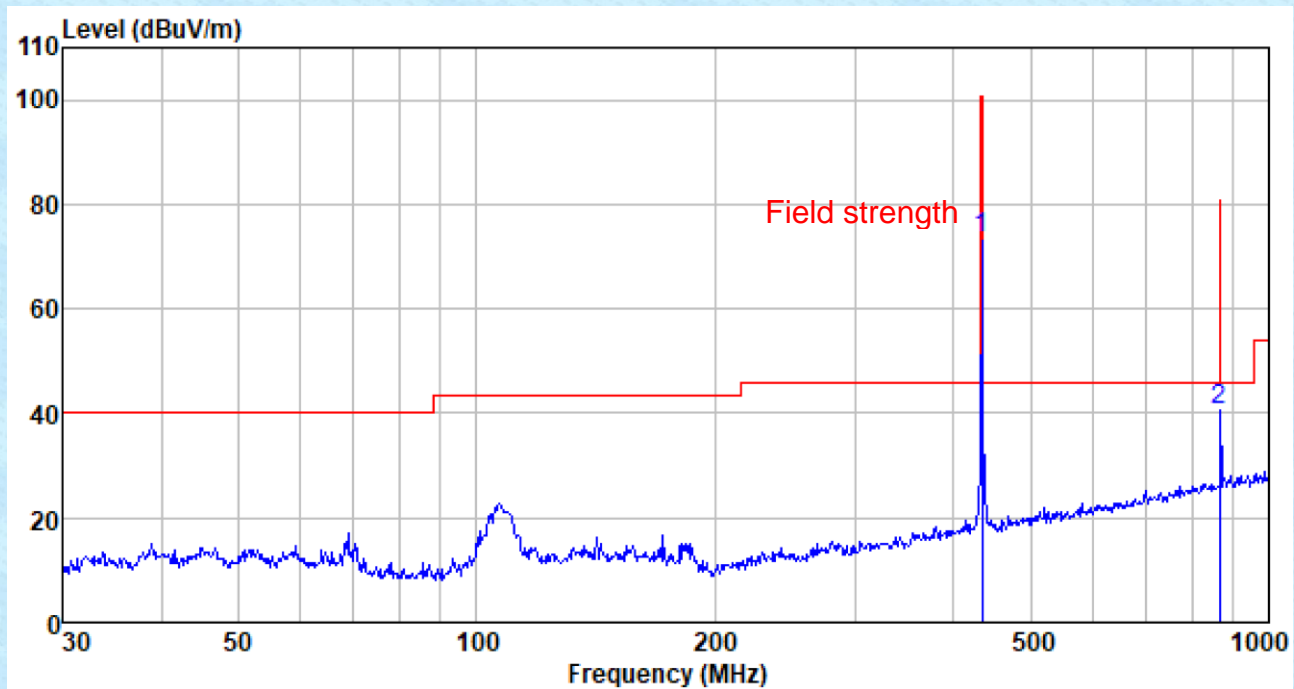
### Measurement data:

9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

### Below 1GHz:

Test channel:	433.92MHz	Polarization:	Horizontal
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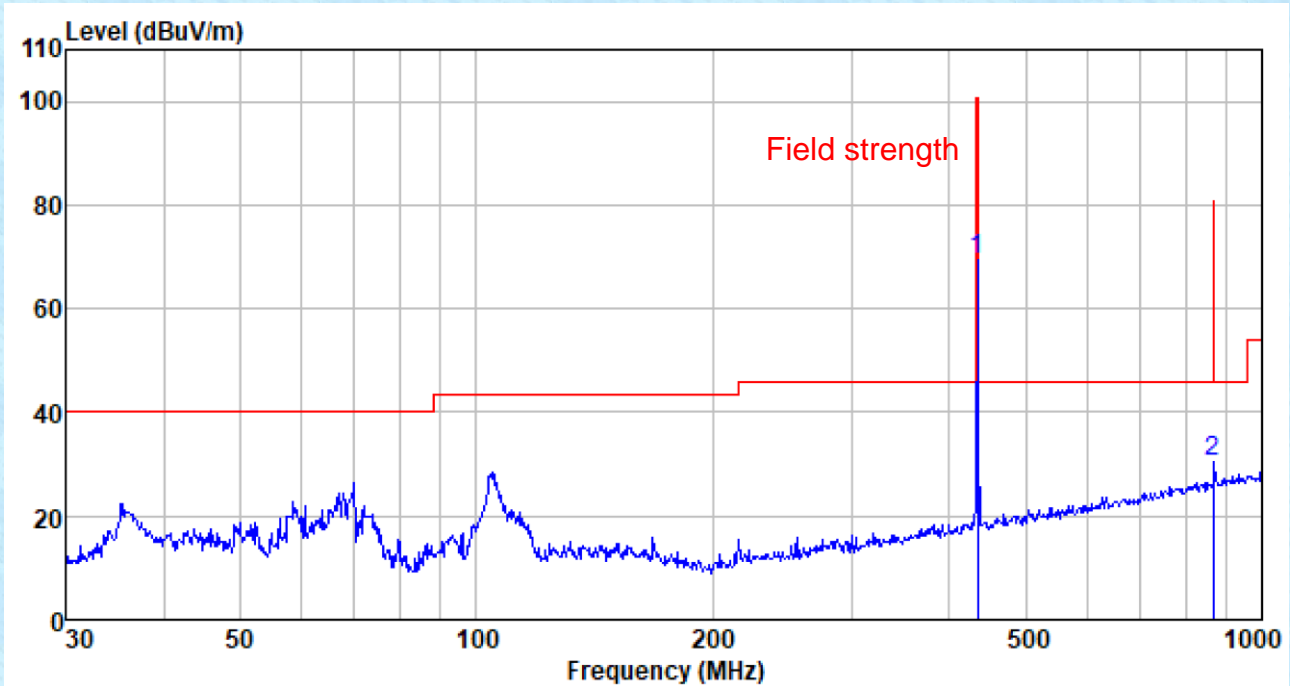
### Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
867.84	42.16	23.54	4.74	30.00	40.44	72.87	-32.43	Horizontal

### Average value:

Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
867.84	40.44	-3.78	36.66	52.87	-16.21	Horizontal

Test channel:	433.92MHz	Polarization:	Vertical
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**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
867.84	32.20	23.54	4.74	30.00	30.48	72.87	-42.39	Vertical

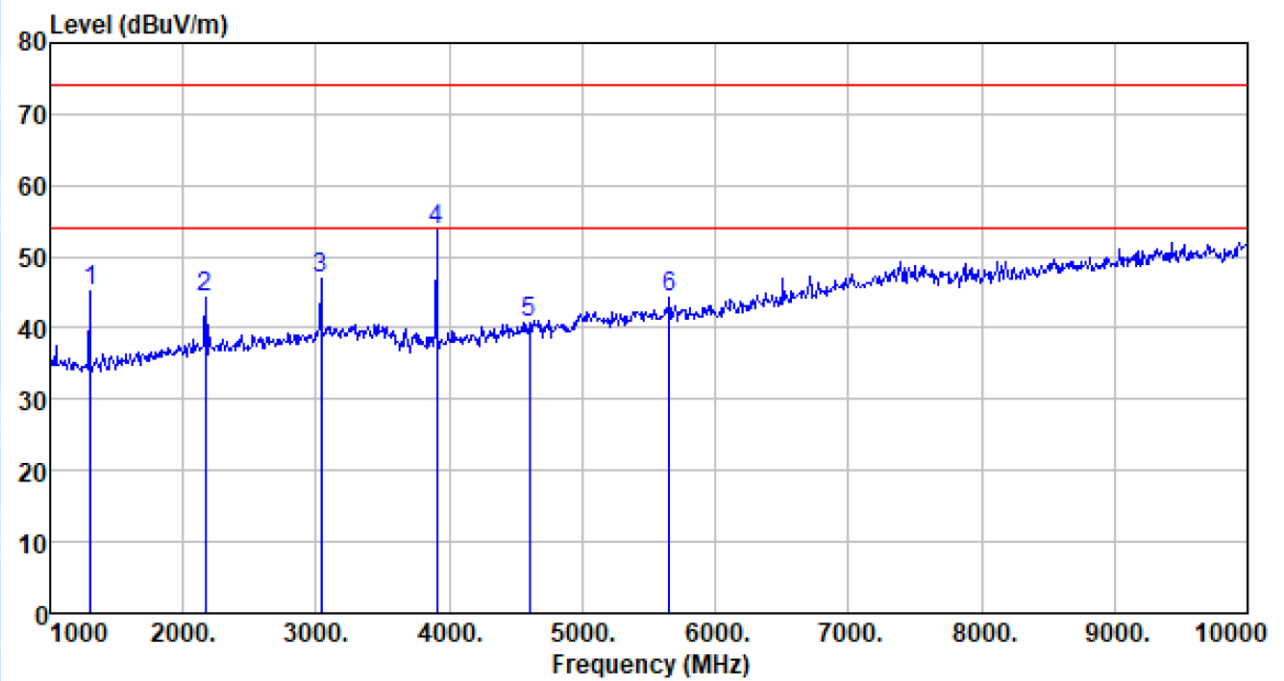
**Average value:**

Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
867.84	30.48	-3.78	26.70	52.87	-26.17	Vertical



**Above 1G:**

<b>Test channel:</b>	<b>433.92MHz</b>	<b>Polarization:</b>	<b>Horizontal</b>
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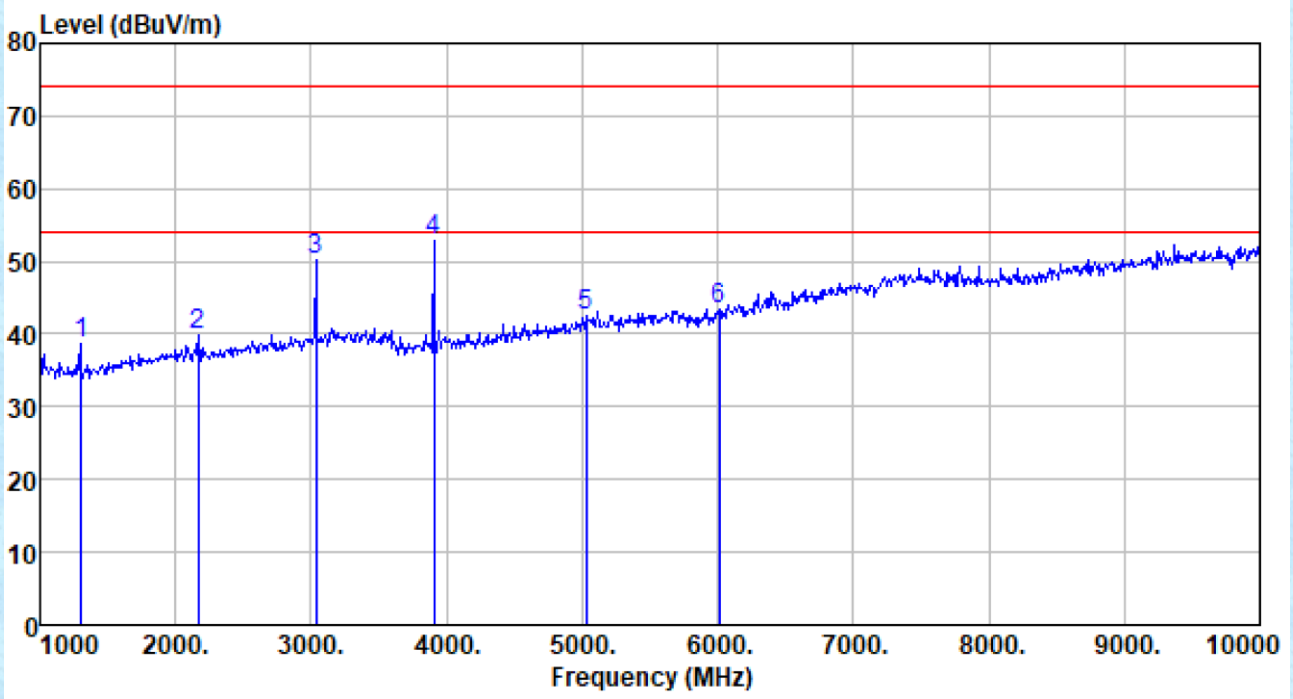
**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1301.76	57.83	24.35	2.20	39.24	45.14	74.00	-28.86	Horizontal
2169.60	53.08	27.00	2.66	38.47	44.27	74.00	-29.73	Horizontal
3037.44	53.58	28.60	3.45	38.59	47.04	74.00	-26.96	Horizontal
3905.28	58.99	29.17	3.91	38.26	53.81	74.00	-20.19	Horizontal
4600.00	44.15	30.48	4.51	38.32	40.82	74.00	-33.18	Horizontal
6013.00	45.12	32.36	5.35	38.63	44.20	74.00	-29.80	Horizontal

**Average value:**

Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1301.76	45.14	-3.78	41.36	54.00	-12.64	Horizontal
2169.60	44.27	-3.78	40.49	54.00	-13.51	Horizontal
3037.44	47.04	-3.78	43.26	54.00	-10.74	Horizontal
3905.28	53.81	-3.78	50.03	54.00	-3.97	Horizontal
4600.00	40.82	-3.78	37.04	54.00	-16.96	Horizontal
5653.00	44.20	-3.78	40.42	54.00	-13.58	Horizontal

<b>Test channel:</b>	<b>433.92MHz</b>	<b>Polarization:</b>	<b>Vertical</b>
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**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1301.76	51.39	24.35	2.20	39.24	38.70	74.00	-35.30	Vertical
2169.60	48.73	27.00	2.66	38.47	39.92	74.00	-34.08	Vertical
3037.44	56.85	28.60	3.45	38.59	50.31	74.00	-23.69	Vertical
3905.28	58.04	29.17	3.91	38.26	52.86	74.00	-21.14	Vertical
4600.00	44.52	30.48	4.51	38.32	41.19	74.00	-32.81	Vertical
6013.00	43.95	32.55	5.62	38.70	43.42	74.00	-30.58	Vertical

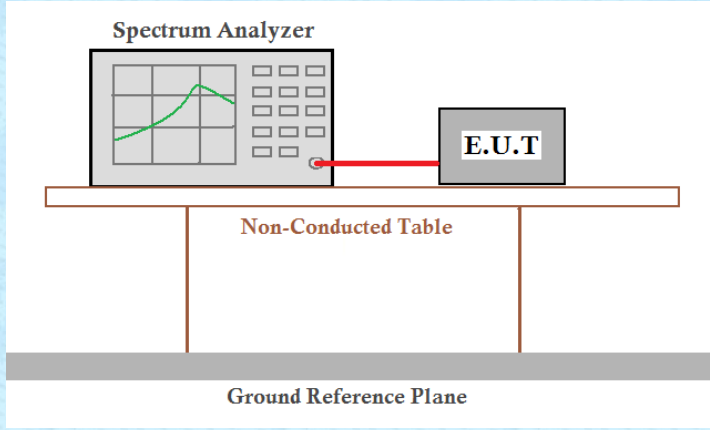
**Average value:**

Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1301.76	38.70	-3.78	34.92	54.00	-19.08	Vertical
2169.60	39.92	-3.78	36.14	54.00	-17.86	Vertical
3037.44	50.31	-3.78	46.53	54.00	-7.47	Vertical
3905.28	52.86	-3.78	49.08	54.00	-4.92	Vertical
4600.00	41.19	-3.78	37.41	54.00	-16.59	Vertical
5653.00	43.42	-3.78	39.64	54.00	-14.36	Vertical

**Remarks:**

*Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*

## 7.3 Occupy Bandwidth

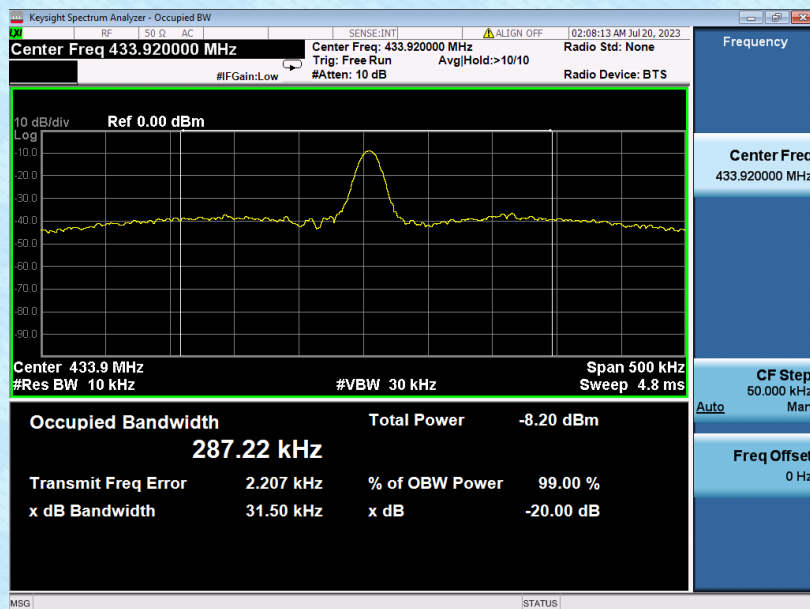
Test Requirement:	FCC Part15 C Section 15.231 (c)
Test Method:	ANSI C63.10:2013
Limit:	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

### Measurement Data

Test Frequency (MHz)	20dB bandwidth (kHz)	99% bandwidth(kHz)	Limit (MHz)	Result
433.92	31.50	287.22	1.0848	Pass

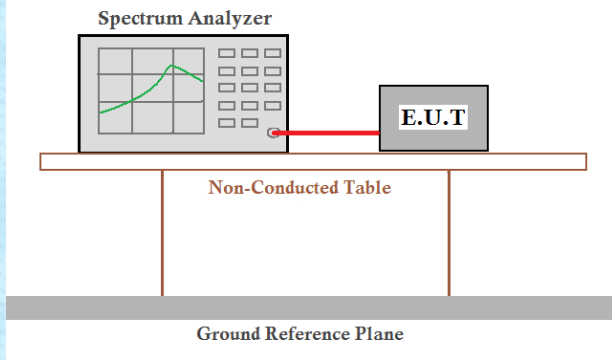
Note: Limit= Fundamental frequency $\times$ 0.25%

Test plot as follows:





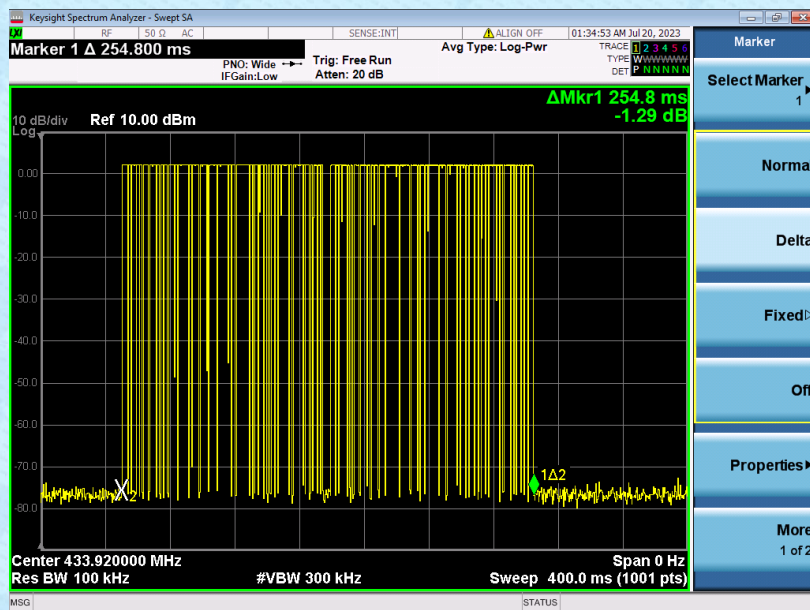
## 7.4 Dwell time

Test Requirement:	FCC Part15 C Section 15.231 (e)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, span=0Hz, detector: Peak
Limit:	Not more than 1 seconds
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

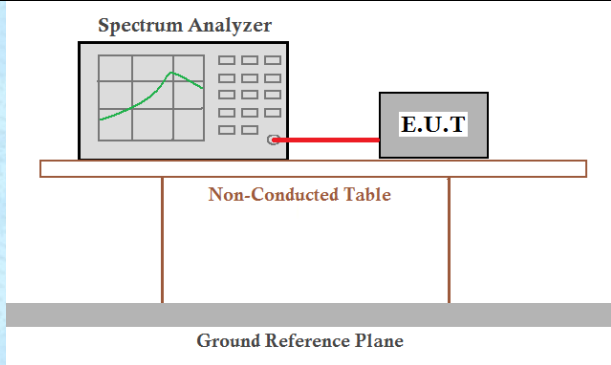
### Measurement data:

Test Frequency (MHz)	Duration of each TX (second)	Limit (second)	Result
433.92	0.255	<1.0	Pass

Test plot as follows:



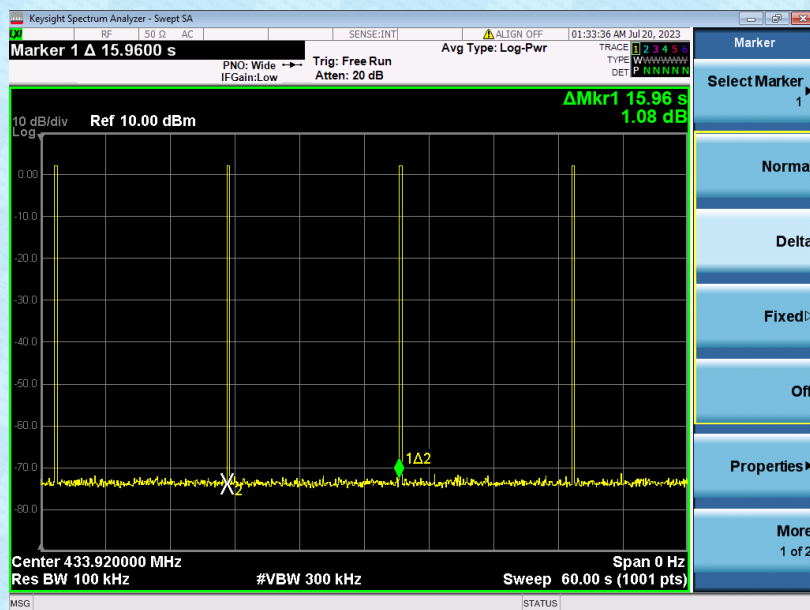
## 7.5 Silent period

Test Requirement:	FCC Part15 C Section 15.231 (e)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, span=0Hz, detector: Peak
Limit:	at least 30 times the duration of the transmission or more than 10 seconds
Test Procedure:	<ol style="list-style-type: none"> <li>1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.</li> <li>2. Set the EUT to proper test channel.</li> <li>3. Single scan the transmit, and read the transmission time.</li> </ol>
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

### Measurement data:

Test Frequency (MHz)	Silent period (second)	Limit (second)	Result
433.92	15.96	>10	Pass

Test plot as follows:



## **8 Test Setup Photo**

Reference to the **appendix I** for details.

## **9 EUT Constructional Details**

Reference to the **appendix II** for details.

-----End-----