



## CTC Laboratories, Inc.

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# TEST REPORT

**Report No.** ..... CTC20220891E01  
**FCC ID** ..... 2A4VACZ-TYJC  
**Applicant** ..... Shenzhen Qiluoxiang Technology Co., Ltd.  
**Address** ..... Room 1811, Block A, Xintianxia Bairuida Building, Vanke City Community, Bantian Street, Longgang District, Shenzhen  
**Manufacturer** ..... Shenzhen Qiluoxiang Technology Co., Ltd.  
**Address** ..... Room 1811, Block A, Xintianxia Bairuida Building, Vanke City Community, Bantian Street, Longgang District, Shenzhen  
**Product Name** ..... Tire Pressure Monitoring System  
**Trade Mark** ..... /  
**Model/Type reference** ..... CZ-TYJC-4Tires  
Listed Model(s) ..... CZ-TYJC-6Tires, CZ-TYJC-8Tires, CZ-TYJC-10Tires, CZ-TYJC-12Tires, CZ-TYJC-14Tires, CZ-TYJC-16Tires, CZ-TYJC-18Tires, CZ-TYJC-20Tires, CZ-TYJC-22Tires, CZ-TYJC-24Tires, CZ-TYJC-26Tires, CZ-TYJC-28Tires, CZ-TYJC-30Tires, CZ-TYJC-32Tires, CZ-TYJC-2Tires  
**Standard** ..... FCC CFR Title 47 Part 15 Subpart C Section 15.231(e)  
**Date of receipt of test sample** ..... June 25, 2022  
**Date of testing** ..... June 25 to July 2, 2022  
**Date of issue** ..... July 2, 2022  
**Result** ..... PASS

Compiled by:  
(Printed name+signature) ..... Zoe Xie   
Supervised by:  
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Approved by:  
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**Testing Laboratory Name** ..... CTC Laboratories, Inc.

**Address** ..... 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

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## 1. TEST SUMMARY

### 1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.231(e): Periodic operation in the band 40.66–40.70 MHz and above 70MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

### 1.2. Report version

Revised No.	Date of issue	Description
01	July 2, 2022	Original

### 1.3. Test Description

FCC Part 15 Subpart C 15.231(e)/ RSS-210 Issue 10			
Test Item	Standard Section	Result	Test Engineer
	FCC		
Antenna Requirement	15.203	Pass	Zoe Xie
Conducted Emission	15.207	N/A	N/A
Radiated Emissions	15.205&15.231(e)	Pass	Zoe Xie
Field Strength of the Fundamental	15.231(e)	Pass	Zoe Xie
20dB Bandwidth	15.231(c)	Pass	Zoe Xie
Release Time	15.231(e)	Pass	Zoe Xie

Note: "N/A" Not applicable.

The measurement uncertainty is not included in the test result.



## 1.4. Test Facility

### Address of the test laboratory

**CTC Laboratories, Inc.**

Add: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

### Laboratory accreditation

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

#### **A2LA-Lab Cert. No.: 4340.01**

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### **FCC (Registration No.: 951311, Designation Number CN1208)**

CTC Laboratories, Inc. 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 951311, Aug 26, 2017.

## 1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.



Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	-----	(1)

**Note (1):** This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=1.96$ .

## 1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101kPa



## 2. GENERAL INFORMATION

### 2.1. Client Information

Applicant:	Shenzhen Qiluoxiang Technology Co., Ltd.
Address:	Room 1811, Block A, Xintianxia Bairuida Building, Vanke City Community, Bantian Street, Longgang District, Shenzhen
Manufacturer:	Shenzhen Qiluoxiang Technology Co., Ltd.
Address:	Room 1811, Block A, Xintianxia Bairuida Building, Vanke City Community, Bantian Street, Longgang District, Shenzhen

### 2.2. General Description of EUT

Product Name:	tire pressure monitoring system
Model/Type reference:	CZ-TYJC-4Tires
Listed Model(s):	CZ-TYJC-6Tires, CZ-TYJC-8Tires, CZ-TYJC-10Tires, CZ-TYJC-12Tires, CZ-TYJC-14Tires, CZ-TYJC-16Tires, CZ-TYJC-18Tires, CZ-TYJC-20Tires, CZ-TYJC-22Tires, CZ-TYJC-24Tires, CZ-TYJC-26Tires, CZ-TYJC-28Tires, CZ-TYJC-30Tires, CZ-TYJC-32Tires, CZ-TYJC-2Tires
Power supply:	DC 3V from battery
Hardware version:	N/A
Software version:	N/A
Serial Number:	28cy7
<b>RF parameter</b>	
Modulation:	FSK
Operation frequency:	433.92MHz
Channel number:	1
Antenna type:	Integral Antenna
Antenna gain:	0dBi

### 2.3. EUT Operation state

The EUT has been tested under typical operating condition. The Applicant provides software to control the EUT for staying in continuous transmitting mode for testing.



## 2.4. Measurement Instruments List

3. Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Spectrum Analyzer	KEYSIGHT	N9020A	100231	Dec. 25, 2022
2	Spectrum Analyzer	Rohde & Schwarz	FUV40-N	101331	Mar. 15, 2023
3	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec. 25, 2022
4	Signal Generator	Agilent	E8257D	MY46521908	Dec. 25, 2022
5	Power Sensor	Agilent	U2021XA	MY5365004	Mar. 15, 2023
6	Power Sensor	Agilent	U2021XA	MY5365006	Mar. 15, 2023
7	High and low temperature box	ESPEC	MT3035	N/A	Mar. 24, 2023
8	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	102414	Dec. 25, 2022
9	300328 v2.2.2 test system	TONSCEND	v2.6	/	/

Radiated emission(3m chamber 2)					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-1013	Jan. 12, 2023
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-647	Dec. 24, 2022
3	Spectrum Analyzer	R&S	FSU26	100105	Dec. 25, 2022
4	Spectrum Analyzer	R&S	FSV40-N	101331	Mar. 15, 2023
5	Pre-Amplifier	SONOMA	310	186194	Dec. 25, 2022
6	Low Noise Pre-Amplifier	EMCI	EMC051835	980075	Dec. 25, 2022
7	Test Receiver	R&S	ESCI7	100967	Dec. 25, 2022

Radiated emission(3m chamber 3)					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-759	Nov. 09, 2023
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-647	Dec. 24, 2022
3	Test Receiver	Keysight	N9038A	MY56400071	Dec. 25, 2022
4	Broadband Premplifier	SCHWARZBECK	BBV9743B	259	Dec. 25, 2022
5	Mirowave Broadband Amplifier	SCHWARZBECK	BBV9718C	111	Dec. 25, 2022
6	Loop Antenna	ZHINAN	ZN30900A	/	Dec. 25, 2022

Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	R&S	ENV216	101112	Dec. 25, 2022
2	LISN	R&S	ENV216	101113	Dec. 25, 2022
3	EMI Test Receiver	R&S	ESCS30	100353	Dec. 25, 2022



Test software				
Item	Test Description	Manufacturer	Model No.	Version
1	Radiated emission/ Conducted Emission	Farad	EZ-EMC	RA-03A1

Note:1. The Cal. Interval was one year.

2. The cable loss has calculated in test result which connection between each test instruments.

## 4. TEST ITEM AND RESULTS

### 4.1. Conducted Emission

#### Limit

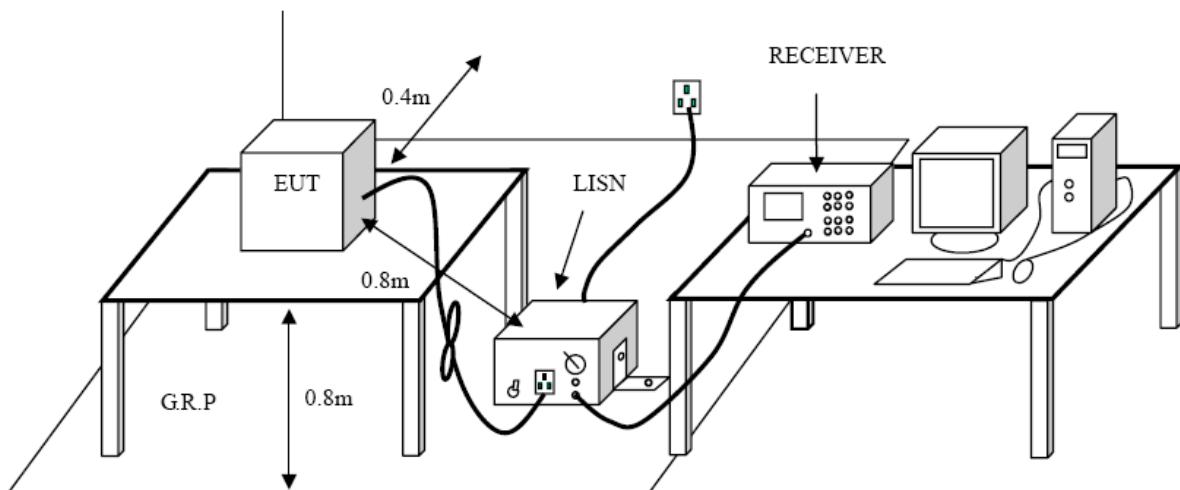
FCC CFR Title 47 Part 15 Subpart C Section 15.207:

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Notes:

- (1) \*Decreasing linearly with logarithm of the frequency.
- (2) The lower limit shall apply at the transition frequencies.
- (3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

#### Test Configuration



#### Test Procedure

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

**Test Mode:**

Please refer to the clause 2.3.

**Test Results**

Not applicable.

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## 4.2. Radiated Emission

### Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.231(e).

The field strength of emissions from intentional radiators operated **average value** under this section shall not exceed the following

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Unwanted emissions (millivolts/meter)
260 - 470 MHz	1500 to 5000(**)	150 to 500(**)

\*\* linear interpolation with frequency, f, in MHz:

F is **433.92MHz**

Field strength of fundamental: Limit at 3 meters =  $16.6667(F)-2833.3333$ .

So the field strength of emission limits have been calculated in below table.

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolt/meter) at 3m
433.92MHz	92.87 (Peak)
433.92MHz	72.87 (Average)

### Radiated Emission Limits (9 kHz~1000 MHz)

Frequency (MHz)	Field Strength (microvolt/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

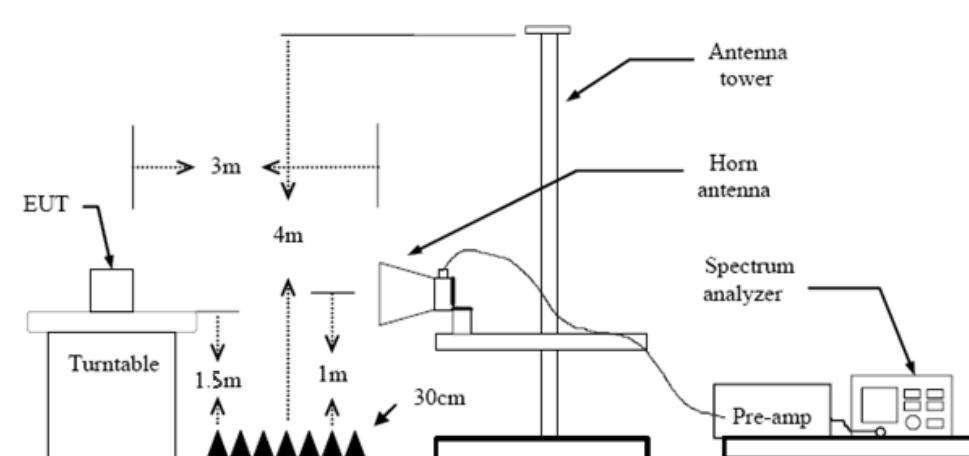
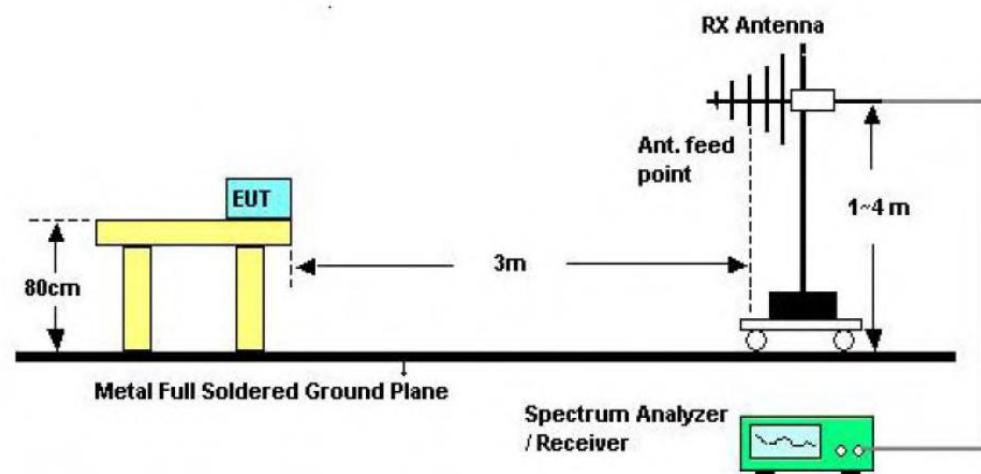
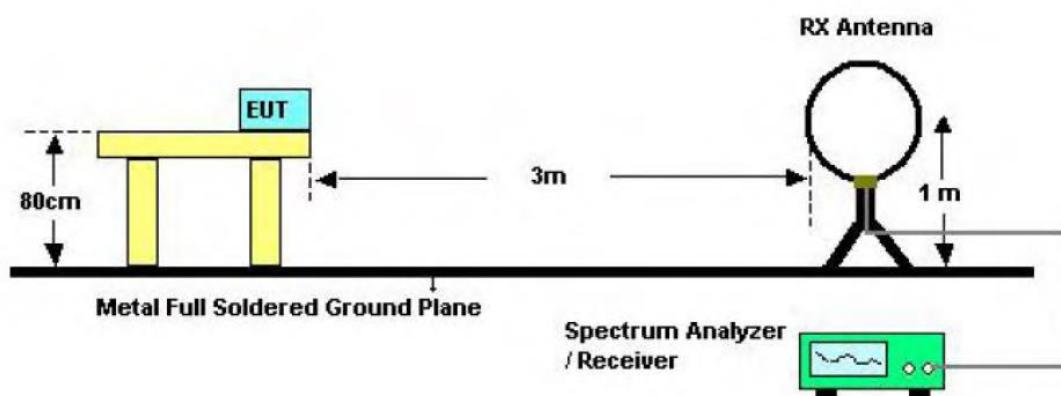
### Radiated Emission Limit (Above 1000MHz)

Frequency (MHz)	Distance Meters(at 3m)	
	Peak	Average
Above 1000	74	54

#### **Note:**

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)= $20\log$  Emission Level (uV/m).

### Test Configuration





## Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Below 1 GHz:  
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;  
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
  - (3) From 1 GHz to 10<sup>th</sup> harmonic:  
RBW=1MHz, VBW=3MHz Peak detector for Peak value.  
RBW=1MHz, VBW=3MHz RMS detector for Average value.

## Test Mode

Please refer to the clause 2.3.

## Test Result

### **9 KHz-30 MHz**

From 9 KHz to 30 MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



## 30MHz-1GHz

Frequency	Reading	Duty cycle Factor	Factor	Level	Limit	Margin	Det.	Polar H/V
(MHz)	(dBuV)	/	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
433.92	74.29	/	-12.33	61.96	92.87	-30.91	peak	H
433.92	/	-12.61	/	49.35	72.87	-23.52	AVG	H
867.84	36.14	/	-15.82	20.32	72.87	-52.55	peak	H
867.84	/	-12.61	0	7.71	52.87	-45.16	AVG	H
433.92	74.08	/	-12.33	61.75	92.87	-31.12	peak	V
433.92	/	-12.61	/	49.14	72.87	-23.73	AVG	V
867.84	35.33	/	-15.82	19.51	72.87	-53.36	peak	V
867.84	/	-12.61	0	6.9	52.87	-45.97	AVG	V

Remarks:

1. Correct (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2. Measure Level= Read Level+ Correct Factor
3. Margin = Measure Level-Limit
4. Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 4th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. AVG=Peak+Duty Cycle Factor



## Adobe 1GHz

Frequency	Reading	Duty cycle Factor	Factor	Level	Limit	Margin	Det.	Polar H/V
(MHz)	(dBuV)	/	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
1301.76	44.58	/	-14.57	30.01	74	-43.99	peak	H
1301.76	/	-12.61	/	17.4	54	-36.6	AVG	H
1735.68	35.14	/	-13.27	21.87	74	-52.13	peak	H
1735.68	/	-12.61	/	9.26	54	-44.74	AVG	H
1301.76	45.05	/	-14.57	30.48	74	-43.52	peak	V
1301.76	/	-12.61	/	17.87	54	-36.13	AVG	V
1735.68	35.26	/	-13.27	21.99	74	-52.01	peak	V
1735.68	/	-12.61	/	9.38	54	-44.62	AVG	V

Remarks:

1. Correct (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2. Measure Level= Read Level+ Correct Factor
3. Margin = Measure Level-Limit
4. Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 4th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5.AVG=Peak+Duty Cycle Factor

## 4.3. 20 dB Bandwidth

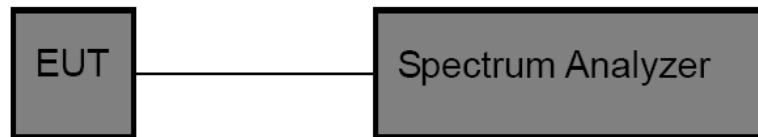
### Limit

FCC CFR Title 47 Part 15 Subpart C Section 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. 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.

$$433.92\text{MHz} \times 0.25\% = 1.085\text{MHz}$$

### Test Configuration



### Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
  - (1) Set RBW = 1% ~ 5% OCB.
  - (2) Set the video bandwidth (VBW)  $\geq 3$  RBW.
  - (3) Detector = Peak.
  - (4) Trace mode = Max hold.
  - (5) Sweep = Auto couple.

### Test Mode

Please refer to the clause 2.3.

### Test Results

Channel Frequency(MHz)	20dB Bandwidth(kHz)	Limit (MHz)	Result
433.92	102.1	1.085	PASS
 <p>The screenshot shows a spectrum analysis result. The main plot displays a single peak at 433.920000 MHz with a power of 20.00 dBm. The x-axis is labeled 'Center Freq 433.920000 MHz' and the y-axis is labeled 'Ref 20.00 dBm'. The plot area shows a noisy baseline with a central peak. Below the plot, the text 'Occupied Bandwidth 560.99 kHz' is displayed. On the right side, there is a vertical stack of status indicators: 'Center Freq 433.920000 MHz', 'CF Step 150.000 kHz Man', and 'Freq Offset 0 Hz'. The bottom of the screen shows a menu bar with 'MSG' and 'STATUS' buttons.</p>			

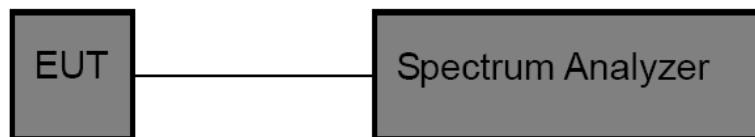
## 4.4. Release Time Measurement

### Limit

FCC CFR Title 47 Part 15 Subpart C Section 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 Configuration



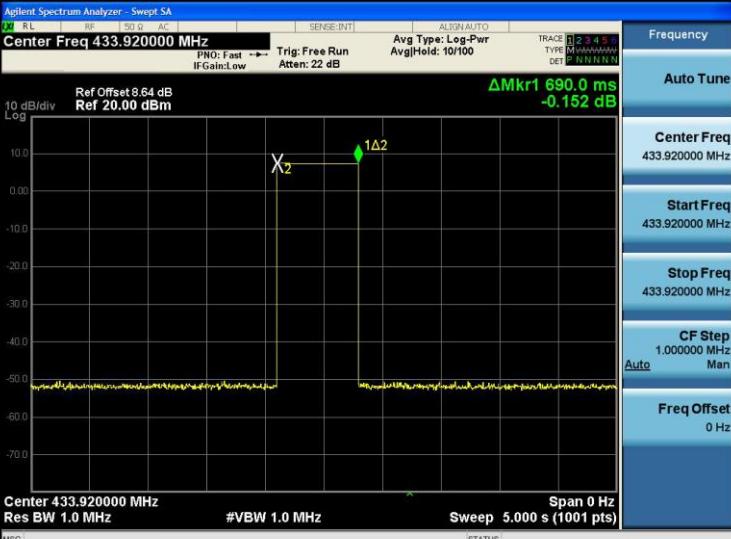
### Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:  
Frequency=Center carrier frequency  
RBW=100KHz, VBW=300KHz, Span= 0,  
Detector function = peak
4. Measure and record the results in the test report.

### Test Mode

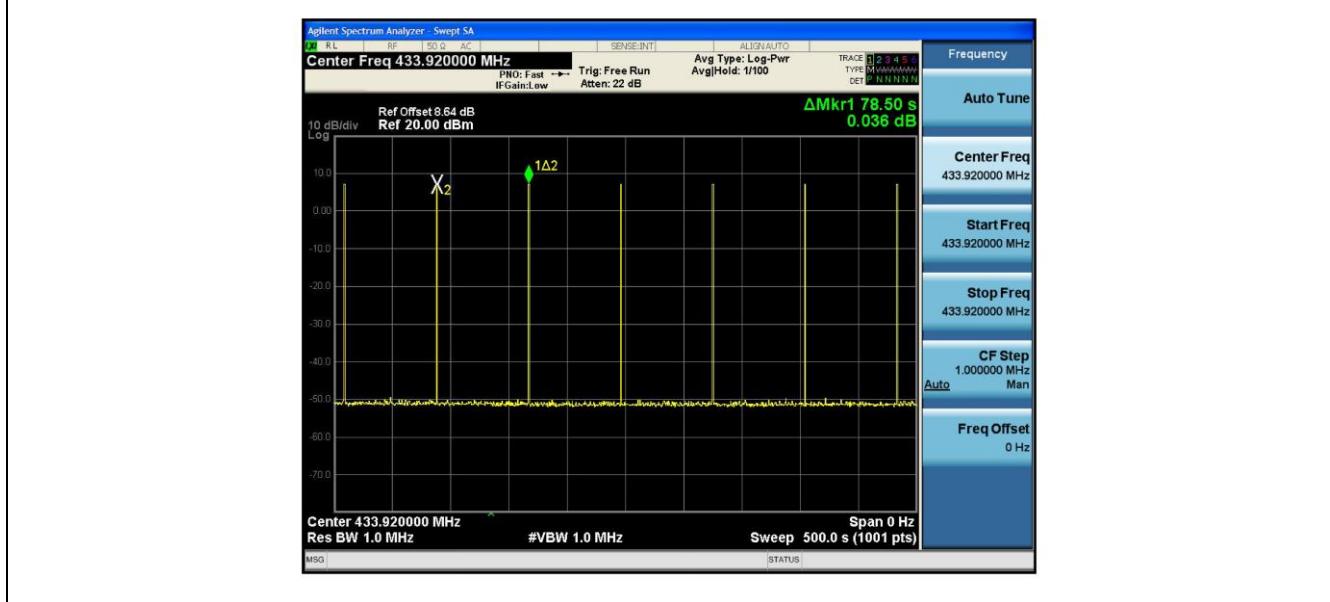
Please refer to the clause 2.3.

### Test Result

Frequency (MHz)	Release Time (s)	Limit (s)	Result
433.92	0.69	<1	Pass
			

Frequency (MHz)	Silent period(s)	Limit (s)	Result
433.92	78.5	>10s >30* Release Time	Pass

Note: 30\* Release Time=20.7s



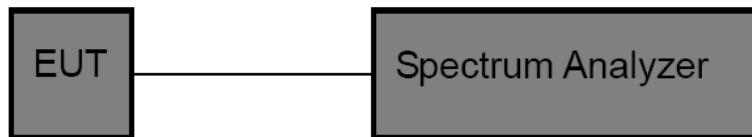


## 4.5. Duty Cycle

### Limit

According to FCC Part 15.231(b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

### Test Configuration



### Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:  
Frequency=Center carrier frequency  
RBW=1MHz, VBW>= RBW, Span= 0,  
Detector function = peak, Trace = single
4. Measure and record the results in the test report.

### Test Mode

Please refer to the clause 2.3.

### Test Result

Please refer the following pages:

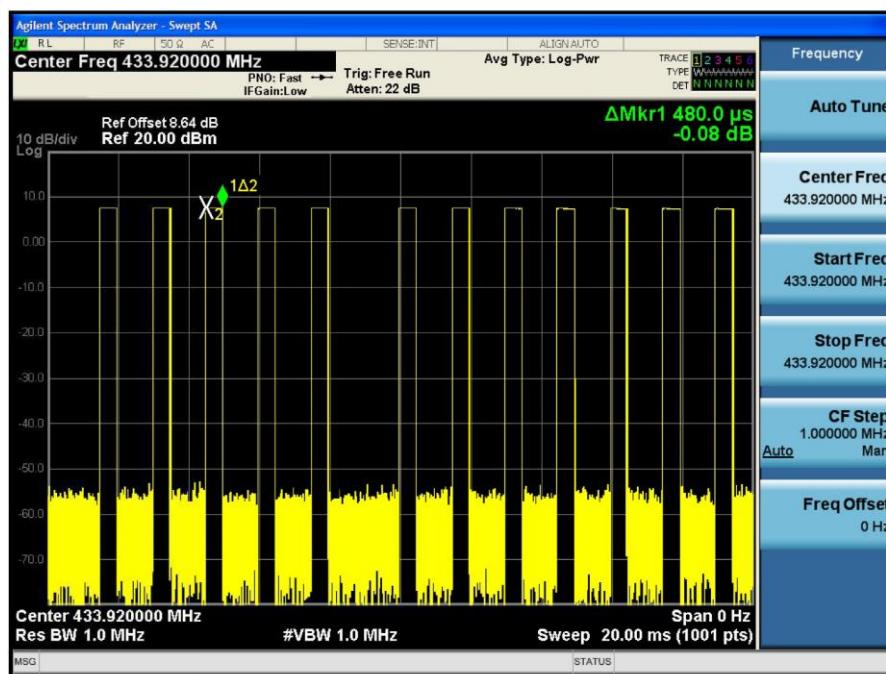
**Plot 1:** Because the transmit period(75.84ms) of the EUT is not exceed 100ms, So 75.84ms was used for calculated, The pulses number total 37.

**Plot 2:** One pulse in a time period of 0.48ms.

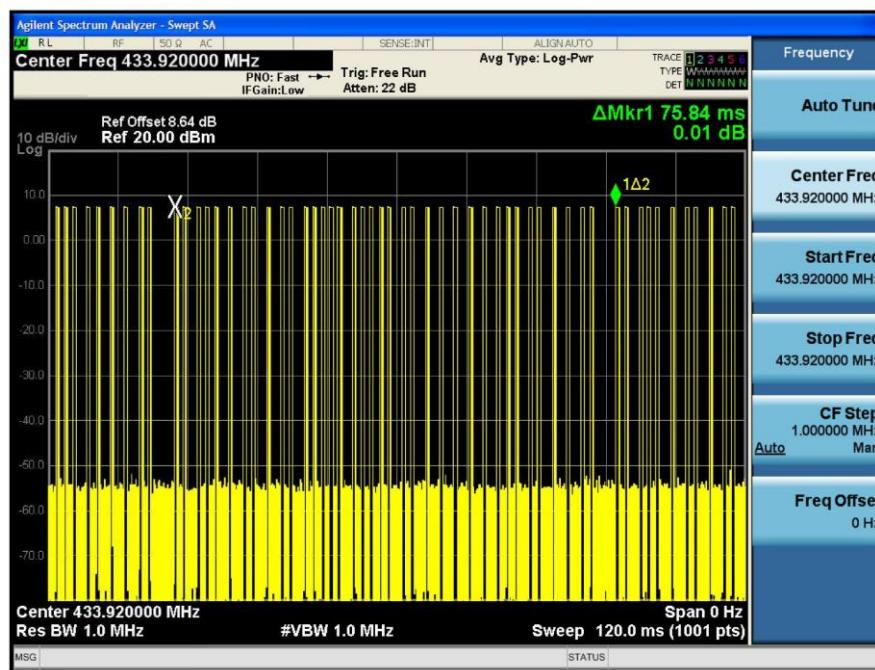
**Duty Cycle=ON/transmit period=0.48\*37/ 75.84=23.43%**

**Duty Cycle Factor=20 log(Duty Cycle)=-12.61**

## Plot 1



## Plot 2





## 4.6. Antenna requirement

### Requirement

#### FCC CFR Title 47 Part 15 Subpart C 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, 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.

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

### Test Result

This product has an Integral antenna, fulfill the requirement of this section.

\*\*\*\*\*THE END\*\*\*\*\*