FCC Test Report

Report No.: RWAZ202300076A

Applicant: Shenzhenshi Zhixinliankong Keji Youxian Gongsi

Address: Shenzhenshi Longgangqu Pinghujiedao HehuashequPingxin Beilu 164hao1hao lou 411 Shenzhen Guangdong China

Product Name: F5-433R

Product Model: F5

Multiple Models: N/A

Trade Mark: CoralBoxer

FCC ID: 2BEYE-F5

Standards: FCC CFR Title 47 Part 15C (§15.231)

Test Date: 2024-01-3 to 2024-01-22

Test Result: Complied

Report Date: 2024-01-30

Reviewed by:

Abel Chen

Abel Chen
Project Engineer

Approved by:

Jacob Kong

Jacob Kong
Manager

Prepared by:

World Alliance Testing and Certification (Shenzhen) Co., Ltd

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NVLAP LAB CODE 600335-0

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Revision History

Version No.	Issued Date	Description
00	*2024-01-30*	*Original*

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1 General Information

1.1 Client Information

Applicant:	Shenzhenshi Zhixinliankong Keji Youxian Gongsi
Address:	GuangdongShenzhensh Longgangqu Pinghujiedao HehuashequPingxin Beilu 164hao1
Manufacturer:	Shenzhenshi Zhixinliankong Keji Youxian Gongsi
Address:	GuangdongShenzhensh Longgangqu Pinghujiedao HehuashequPingxin Beilu 164hao1

1.2 Product Description of EUT

The EUT is a F5-433R that contains a 433.95MHz transmitter, this report covers the full testing of the 433.95MHz transmitter.

Sample Serial Number	1F-2 & 25-1 for RE Test (assigned by WATC)
Sample Received Date	2023-12-15
Sample Status	Good Condition
Frequency Range	433.95MHz
Maximum E-field Strength:	78.93dBuV/m@3m
Modulation Technology	OOK
Power Supply	DC 3V from battery
Operating temperature#	-10 deg.C to +40 deg.C
Adapter Information	N/A
Modification	Sample No Modification by the test lab

1.3 Antenna information

15.203 requirement:

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.

Device Antenna information:	

The antenna is an internal antenna which cannot replace by end-user. Please see product internal photos for details.

1.4 Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s)

1.5 Measurement Uncertainty

Parameter		Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
AC Power Lines Conducted Emissions		±3.14dB
Emissions, Radiated	Below 30MHz	±2.78dB
	Below 1GHz	±4.84dB
	Above 1GHz	±5.44dB
Bandwidth		0.34%

Note 1: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Note 2: The Decision Rule is based on simple acceptance with ISO Guide 98-4:2012 Clause 8.2 (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

1.6 Laboratory Location

World Alliance Testing and Certification (Shenzhen) Co., Ltd

No. 1002, East Block, Laobing Building, Xingye Road 3012, Xixiang street, Bao'an District, Shenzhen, Guangdong, People's Republic of China

Tel: +86-755-29691511, Email: qa@watc.com.cn

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 463912, the FCC Designation No. : CN5040.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0160.

1.7 Test Methodology

FCC CFR 47 Part 2

FCC CFR 47 Part 15

ANSI C63.10-2020

2 Description of Measurement

2.1 Test Configuration

Operating channels:					
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	433.95	/	/	/	/
According to ANSI C63.10-2020 chapter 5.6.1 Table 11 requirement, select lowest channel, middle channel, and highest channel in the frequency range in which device operates for testing. The detailed frequency points are as follows:					
Lowest channel		Middle channel		Highest channel	
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
/	/	1	433.95	/	/

Test Mode:			
Transmitting mode:	Keep the EUT in continuous transmitting with modulation		
Exercise software#:	The EUT was configured to continuous transmitting mode by applicant		
Mode	**Powel Level Setting#**		
	Low Channel	**Middle Channel**	**High Channel**
SRD		Default	
The exercise software and the maximum power setting that provided by manufacturer.			

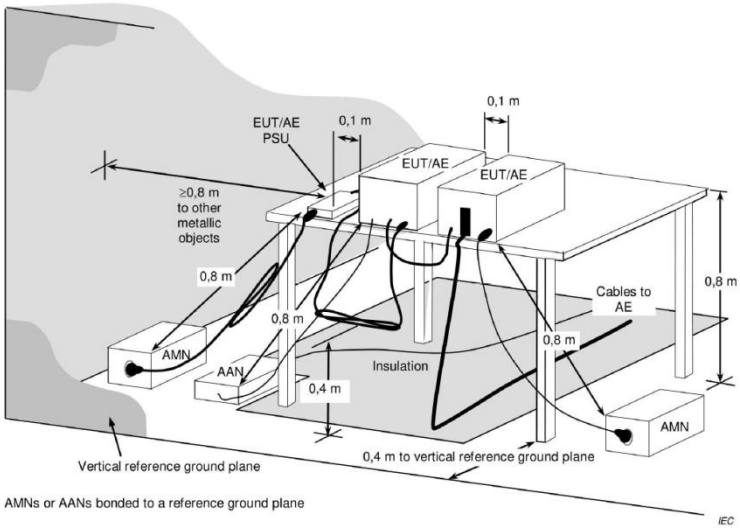
Worst-Case Configuration:
For radiated emissions, EUT was investigated in three orthogonal orientation, the worst-case orientation was recorded in report All the keys with same power setting, the maximum duty cycle was tested and recorded.

2.2 Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number
/	/	/	/

2.3 Test Setup

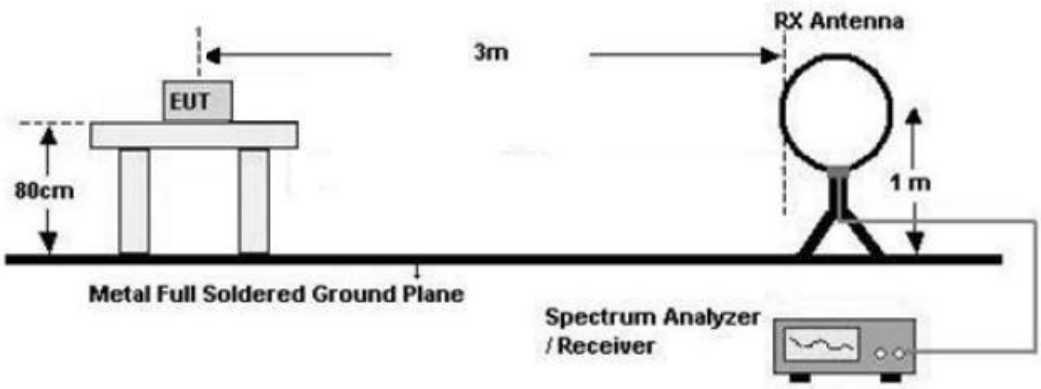
1) Conducted emission measurement:



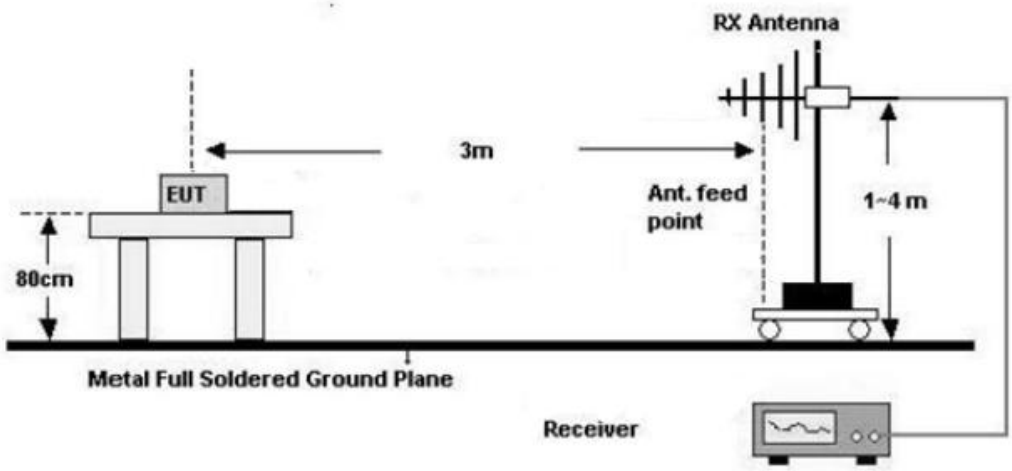
Note: The 0.8 m distance specified between EUT/AE/PSU and AMN/AAN, is applicable only to the EUT being measured. If the device is AE then it shall be >0.8 m.

2) Radiated emission measurement:

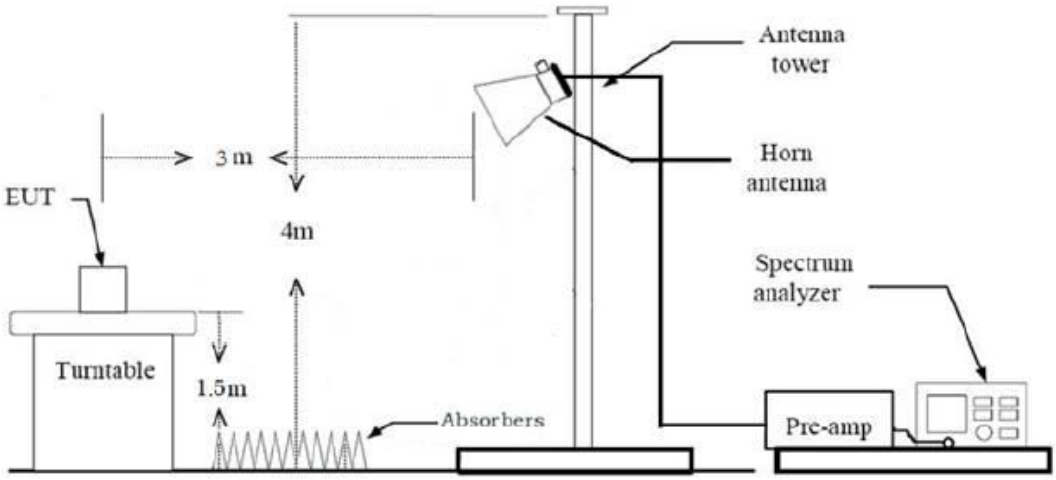
Below 30MHz (3m SAC)



30MHz-1GHz (3m SAC)



Above 1GHz (3m FAC)



2.4 Test Procedure

Conducted emission:

1. The E.U.T is placed on a non-conducting table 40cm from the vertical ground plane and 80cm above the horizontal ground plane (Please refer to the block diagram of the test setup and photographs).
2. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.
3. Line conducted data is recorded for both Line and Neutral

Radiated Emission Procedure:

a) For below 30MHz

1. All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz- 30

MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).

2. Loop antenna use, investigation was done on the three antenna orientations (parallel, perpendicular, gound-parallel)

b) For 30MHz-1GHz:

1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m.
2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.

c) For above 1GHz:

1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m (1-18GHz) and 1.5 m (above 18GHz).
2. EUT works in each mode of operation that needs to be tested， and having the EUT continuously working. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.
3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
4. Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

Bandwidth Test:

1. Use the same setup for radiated above 1GHz, found the maximum fundamental level.
2. Change the spectrum analyzer setting for bandwidth testing
3. Test the bandwidth and record the result

Deactivation Test:

1. Use the same setup for radiated below 1GHz, found the maximum fundamental level.
2. Change the spectrum analyzer setting to time domain, the sweep time greater than the specified time for periodic operation

Manually activate and deactivate the EUT and confirm that it ceases transmission within the specified time of deactivation, record the result

2.5 Measurement Method

Description of Test	Measurement Method
AC Line Conducted Emissions	ANSI C63.10-2020 Section 6.2
20dB Emission Bandwidth	ANSI C63.10-2020 Section 6.9.2
Field strength of fundamental and Radiated emission	ANSI C63.10-2020 Section 6.3&6.4&6.5&6.6
Deactivation Test	ANSI C63.10-2013 Section 7.4

2.6 Measurement Equipment

Manufacturer	Description	Model	Management No.	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI test receiver	ESR3	102758	2023/7/3	2024/7/2
ROHDE& SCHWARZ	SPECTRUM ANALYZER	FSV40-N	101608	2023/7/3	2024/7/2
SONOMA INSTRUMENT	Low frequency amplifier	310	186014	2023/7/12	2024/7/11
COM-POWER	preamplifier	PAM-118A	18040152	2023/8/21	2024/8/20
COM-POWER	Amplifier	PAM-840A	461306	2023/8/8	2024/8/7
ETS	Passive Loop Antenna	6512	29604	2023/7/7	2024/7/6
SCHWARZBECK	Log - periodic wideband antenna	VULB 9163	9163-872	2023/7/7	2024/7/6
Astro Antenna Ltd	Horn antenna	AHA-118S	3015	2023/7/6	2024/7/5
N/A	Coaxial Cable	N/A	NO.9	2023/8/8	2024/8/7
N/A	Coaxial Cable	N/A	NO.10	2023/8/8	2024/8/7
N/A	Coaxial Cable	N/A	NO.11	2023/8/8	2024/8/7
Audix	Test Software	E3	191218 V9	/	/

Note: All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or International standards.

3 Test Results

3.1 Test Summary

FCC/ISEDC Rules	Description of Test	Result
FCC §15.203	Antenna Requirement	Compliance
FCC §15.207(a)	AC Line Conducted Emissions	N/A
FCC §15.231(c)	20dB Emission Bandwidth	Compliance
FCC §15.231(a)	Deactivation Testing	Compliance
FCC §15.205, §15.209, §15.231(b)	Field strength of fundamental and Radiated emission	Compliance

3.2 Limit

<table>
<tr><th>Test items</th><th>Limit</th></tr>
<tr><td>AC Line Conducted Emissions</td><td>See details §15.207 (a)</td></tr>
<tr><td>20dB Emission Bandwidth</td><td>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.</td></tr>
<tr><td>Deactivation Testing</td><td>A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.</td></tr>
<tr><td>Field strength of fundamental and Radiated emission</td><td>In addition to the provisions of § 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:
<table>
<tr><th>Fundamental frequency (MHz)</th><th>Field strength of fundamental (microvolts/meter)</th><th>Field strength of spurious emissions (microvolts/meter)</th></tr>
<tr><td>40.66–40.70</td><td>2,250</td><td>225</td></tr>
<tr><td>70–130</td><td>1,250</td><td>125</td></tr>
<tr><td>130–174</td><td>[1] 1,250 to 3,750</td><td>[1] 125 to 375</td></tr>
<tr><td>174–260</td><td>3,750</td><td>375</td></tr>
<tr><td>260–470</td><td>[1] 3,750 to 12,500</td><td>[1] 375 to 1,250</td></tr>
<tr><td>Above 470</td><td>12,500</td><td>1,250</td></tr>
</table>
[1] Linear interpolations.
The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in § 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of § 15.205 shall be demonstrated using the measurement instrumentation specified in that section.
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.</td></tr>
</table>

3.3 AC Line Conducted Emissions Test Data

Not Applicable, the device only powered by battery

3.4 Radiated emission Test Data

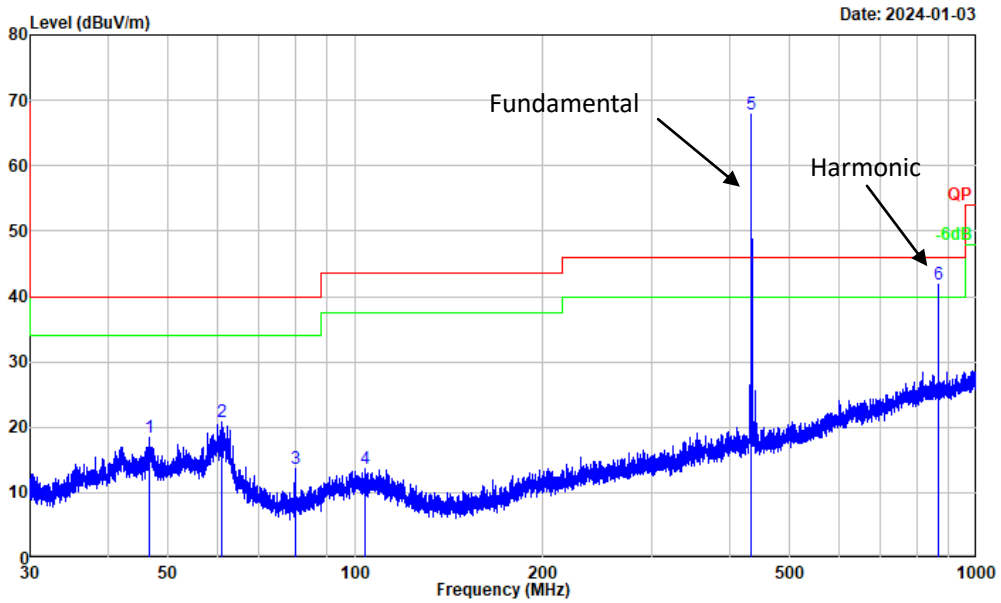
9 kHz-30MHz:

Test Date:	20234-01-03	**Test By:**	Bard Huang
Environment condition:	Temperature: 24.5°C; Relative Humidity:49%; ATM Pressure: 101.4kPa		

For radiated emissions below 30MHz, there were no emissions found within 20dB of limit.

30MHz-1GHz:

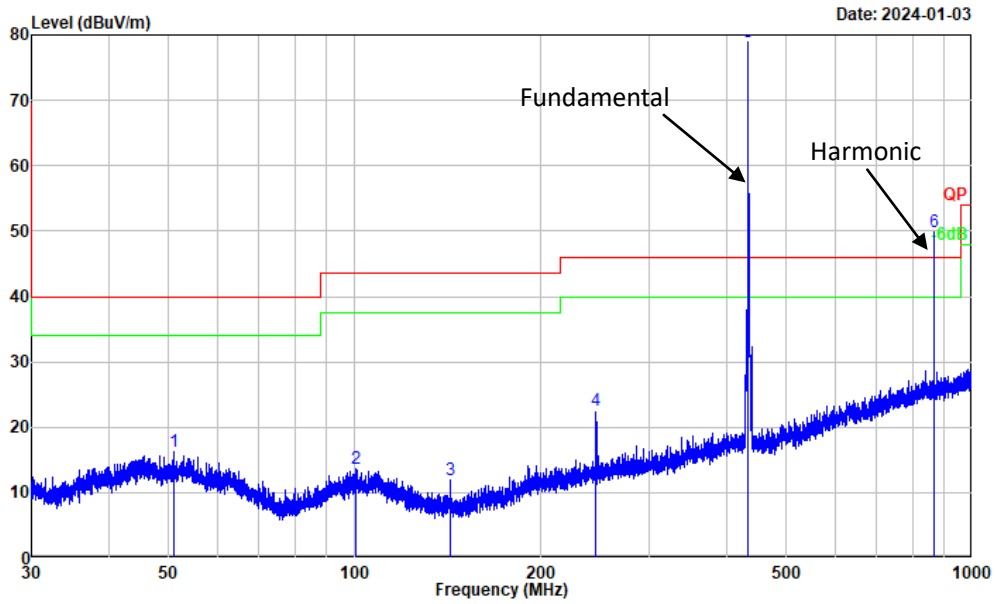
Test Date:	2024-01-03	**Test By:**	Bard Huang
Environment condition:	Temperature: 24。5°C; Relative Humidity:49%; ATM Pressure: 101.4kPa		



Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 24.5℃/49%R.H./101.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : /

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	46.646	30.68	-12.18	18.50	40.00	-21.50	Peak
2	61.105	34.74	-13.85	20.89	40.00	-19.11	Peak
3	80.010	31.83	-18.08	13.75	40.00	-26.25	Peak
4	103.760	27.68	-13.99	13.69	43.50	-29.81	Peak
5	433.950	76.09	-8.24	67.85	100.83	-32.98	Peak
6	867.900	42.94	-1.09	41.85	80.83	-38.98	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain



Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 24.5℃/49%R.H./101.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : /

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	50.920	28.49	-12.16	16.33	40.00	-23.67	Peak
2	100.361	27.85	-14.19	13.66	43.50	-29.84	Peak
3	142.824	29.50	-17.60	11.90	43.50	-31.60	Peak
4	245.628	34.94	-12.50	22.44	46.00	-23.56	Peak
5	433.950	87.17	-8.24	78.93	100.83	-21.90	Peak
6	867.900	51.05	-1.09	49.96	80.83	-30.87	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain

Remark:

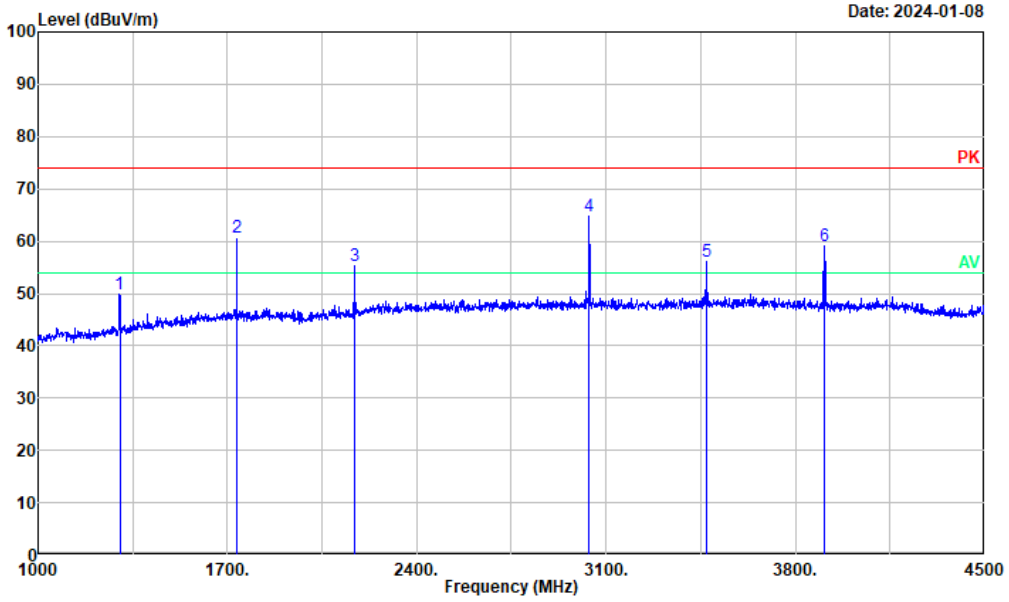
Result = Reading + Factor

Factor = Antenna factor + Cable loss – Amplifier gain

Over Limit = Result – Limit

Above 1GHz:

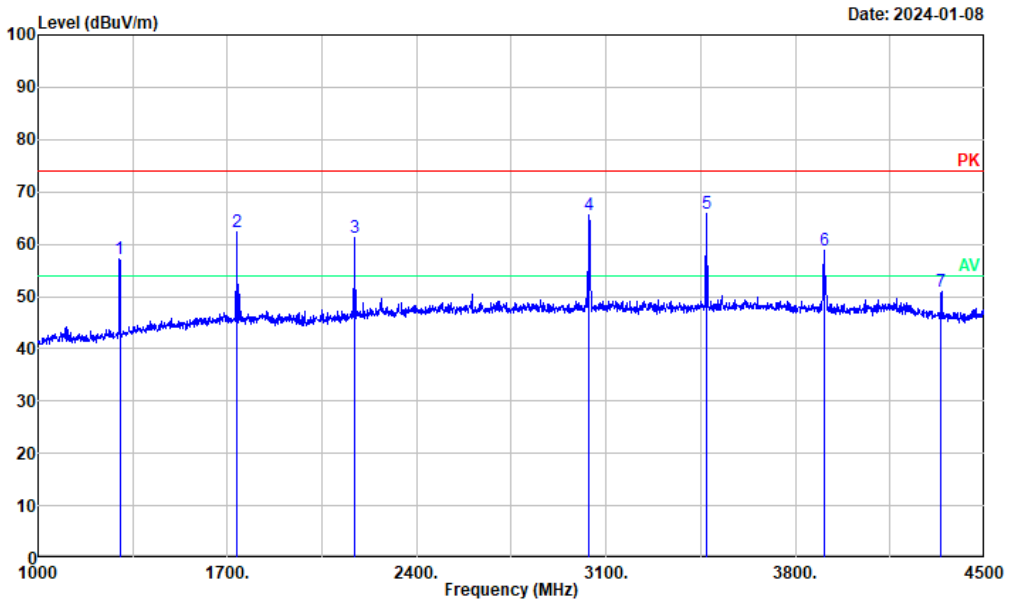
Test Date:	2024-01-08	Test By:	Bard Huang
Environment condition:	Temperature: 25.7°C; Relative Humidity:51%; ATM Pressure: 101kPa		



Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 25.7℃/51%R.H./101.0kPa
Tested by : Bard Huang
Polarization : vertical
Remark : /

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	1301.850	54.52	-4.74	49.78	74.00	-24.22	Peak
2	1735.800	63.07	-2.33	60.74	80.83	-20.09	Peak
3	2169.750	57.60	-2.42	55.18	80.83	-25.65	Peak
4	3037.650	66.84	-1.94	64.90	80.83	-15.93	Peak
5	3471.600	57.77	-1.60	56.17	80.83	-24.66	Peak
6	3905.550	60.98	-2.03	58.95	74.00	-15.05	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain



Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 25.7℃/51%R.H./101.0kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : /

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	1301.850	61.90	-4.74	57.16	74.00	-16.84	Peak
2	1735.800	64.55	-2.33	62.22	80.83	-18.61	Peak
3	2169.750	63.62	-2.42	61.20	80.83	-19.63	Peak
4	3037.650	67.59	-1.94	65.65	80.83	-15.18	Peak
5	3471.600	67.56	-1.60	65.96	80.83	-14.87	Peak
6	3905.550	60.82	-2.03	58.79	74.00	-15.21	Peak
7	4339.500	53.53	-2.71	50.82	74.00	-23.18	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain

Remark:

Result = Reading + Factor

Factor = Antenna factor + Cable loss – Amplifier gain

Over Limit = Result – Limit

The emission levels of other frequencies that were lower than the limit 20dB not show in test report.

Field strength of average:

Frequency (MHz)	Peak level (dBμV)	Polar (H/V)	Duty Cycle Factor (dB/m)	Average Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark
433.95	78.93	H	-5.48	73.45	80.83	-7.38	Fundamental
433.95	67.85	V	-5.48	62.37	80.83	-18.46	Fundamental
867.9	49.96	H	-5.48	44.48	60.83	-16.35	Harmonic
867.9	41.85	V	-5.48	36.37	60.83	-24.46	Harmonic
1301.85	57.16	H	-5.48	51.68	54	-2.32	Harmonic
1735.8	62.22	H	-5.48	56.74	60.83	-4.09	Harmonic
2169.75	61.2	H	-5.48	55.72	60.83	-5.11	Harmonic
3037.65	65.65	H	-5.48	60.17	60.83	-0.66	Harmonic
3471.6	65.96	H	-5.48	60.48	60.83	-0.35	Harmonic
3905.55	58.79	H	-5.48	53.31	54	-0.69	Harmonic
4339.5	50.82	H	-5.48	45.34	54	-8.66	Harmonic
1301.85	49.78	V	-5.48	44.3	54	-9.7	Harmonic
1735.8	60.74	V	-5.48	55.26	60.83	-5.57	Harmonic
2169.75	55.18	V	-5.48	49.7	60.83	-11.13	Harmonic
3037.65	64.9	V	-5.48	59.42	60.83	-1.41	Harmonic
3471.6	56.17	V	-5.48	50.69	60.83	-10.14	Harmonic
3905.55	58.95	V	-5.48	53.47	54	-0.53	Harmonic

Remark:

Average Amplitude= Peak level + Duty Cycle Factor

Margin = Average Amplitude - Limit

3.5 Duty Cycle

Test Date:	2024-01-04	Test By:	Bard Huang
Environment condition:	Temperature: 24.2°C; Relative Humidity:37%; ATM Pressure: 101.6kPa		

Subpulse	Ton Duration [ms]	Number of pulse	Total On time [ms]	Period of the pulse train [ms]	Duty Cycle [%]
1	0.7246	4	9.2754	17.426	53.23
2	1.2754	5			
Duty cycle Factor[dB]:		-5.48			

Remark:

Total On time= Ton1*N1+Ton2*N2

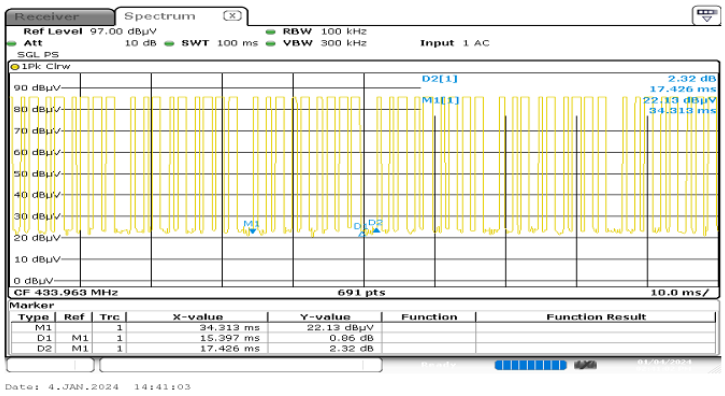
Duty Cycle=(Total On time)/Tp

Duty Cycle Factor=20*log(Duty Cycle)

Duty Cycle

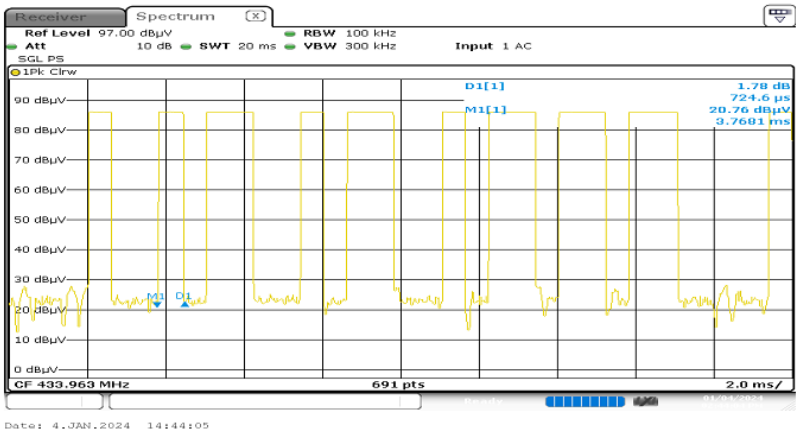
Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 24.2℃/37%R.H./101.6kPa
Tested by : Bard Huang
Polarization : vertical
Remark : Duty Cycle

Date: 2024-01-04



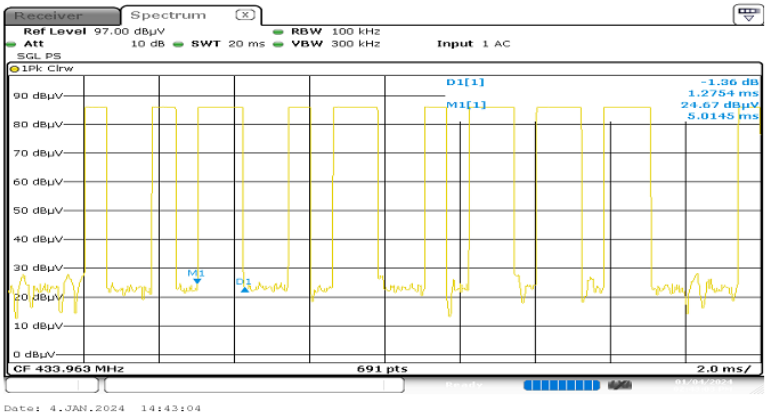
Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 24.2℃/37%R.H./101.6kPa
Tested by : Bard Huang
Polarization : vertical
Remark : Duty Cycle

Date: 2024-01-04



Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 24.2℃/37%R.H./101.6kPa
Tested by : Bard Huang
Polarization : vertical
Remark : Duty Cycle

Date: 2024-01-04



3.6 Deactivation Testing

Test Date:	2024-01-22	Test By:	Bard Huang
Environment condition:	Temperature: 23.5°C; Relative Humidity:55%; ATM Pressure: 103.1kPa		

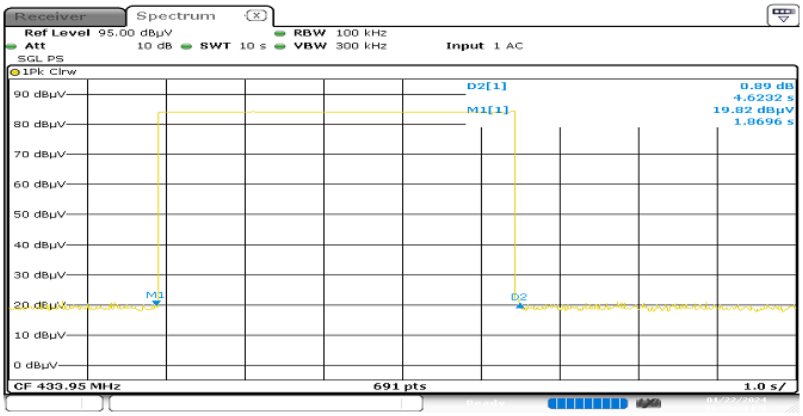
Channel Frequency [MHz]	Deactivation time[s]	Limit[s]	Verdict
433.95	4.62	≤5	Pass

Test Plots:

Deactivation time

Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 23.9℃/48%R.H./101.6kPa
Tested by : Bard Huang
Polarization : vertical
Remark : /

Date: 2024-01-22



Date: 22.JAN.2024 18:25:54

3.7 Bandwidth Test Data

Test Date:	2024-01-22	Test By:	Bard Huang
Environment condition:	Temperature: 23.5°C; Relative Humidity:55%; ATM Pressure: 101.6kPa		

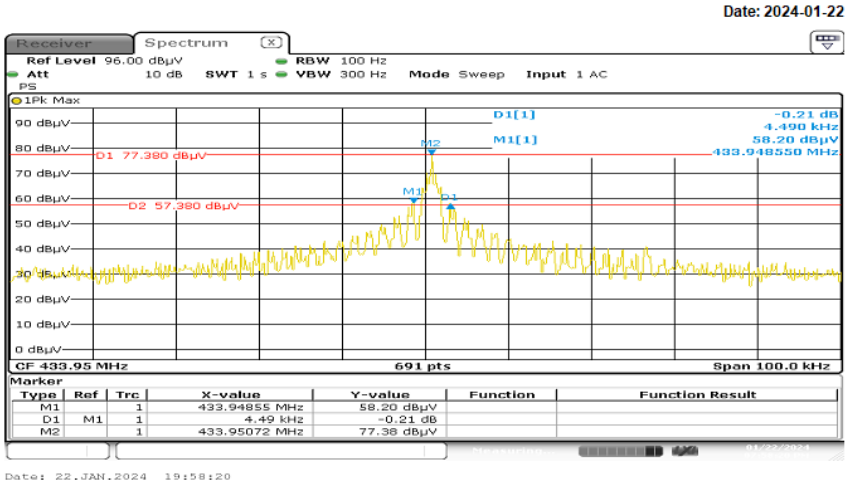
Channel Frequency [MHz]	20dB BW [kHz]	Limit[kHz]	Verdict
433.95	4.49	1084.88	Pass

Note: Limit≤Center frequency*0.25%

Test Plots:

20dB BW

Project No. : RWAZ202300076
Test Mode : Transmitting
Test Voltage : DC 3V
Environment : 23.9℃/48%R.H./101.6kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : /



4 Test Setup Photo

Please refer to the attachment RWAZ202300076 Test Setup photo.

5 E.U.T Photo

Please refer to the attachment RWAZ202300076 External photo and RWAZ202300076 Internal photo.

---End of Report---