



TEST REPORT

Product Name: Outdoor Sensor FCC ID: 2A99K-TX001

Trademark: N/A

Model Number: TX001, MK8007A, MK8007B, FJ8007A, FJ8007B, FJ3351A, FJ3385

Prepared For: FUJIAN EMAX INTELLIGENT CO.LTD

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Manufacturer: FUJIAN EMAX INTELLIGENT CO., LTD

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Prepared By: Shenzhen CTB Testing Technology Co., Ltd.

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Shenzhen, Guangdong, China

Sample Received Date: Oct. 28, 2024

Sample tested Date: Oct. 28, 2024 to Nov. 26, 2024

Issue Date: Nov. 26, 2024

Report No.: CTB24102807403RF01

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

ANSI C63.10:2013

Test Results PASS

Remark: This is 433MHz radio test report.

Compiled by: Reviewed by: Approved by:

Zhou kui Arron Ziu

Zhou Kui Arron Liu Bin Mei / Director

Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

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(Note: N/A means not applicable)



1. VERSION

Report No.	Issue Date	Description	Approved
CTB24102807403RF01	Nov. 26, 2024	Original	Valid

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2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result	
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	N/A	
Radiated Emission	47 CFR Part 15 Subpart C Section 15.209; 15.231(e)	ANSI C63.10-2013	PASS	
Dwell Time	47 CFR Part 15 Subpart C Section 15.231 (e)	ANSI C63.10-2013	PASS	
Occupied Bandwidth	47 CFR Part 15 Subpart C Section 15.231(c)	ANSI C63.10-2013	PASS	
Antenna requirement	47 CFR Part 15 Subpart C Section 15.203	ANSI C63.10-2013	PASS	

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3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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Item	Uncertainty
Occupancy bandwidth	U=±54.3Hz
Conducted output power Above 1G	U=±1.0dB
Conducted output power below 1G	U=±0.9dB
Power Spectral Density , Conduction	U=±1.0dB
Conduction spurious emissions	U=±2.8dB
Out of band emission	U=±54Hz
3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
humidity uncertainty	U=±5.3%
Temperature uncertainty	U=±0.59°C
Supply voltages	U=±3%
Time C C C C	U=±5%

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4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s): TX001, MK8007A, MK8007B, FJ8007A, FJ8007B, FJ3351A, FJ3385

Model Description:

All the model are the same circuit and RF module, only the model names are

different. Test sample model: TX001

Hardware Version: TX001_REV.1

Software Version: V1.0

Operation Frequency: 433.9011MHz

Type of Modulation: ASK

Antenna installation: Spring antenna

Antenna Gain: 1.0dBi

Ratings: DC 3V 10mA

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Data Cable	Power Cord
1.	· · · · · · · · · · · · · · · · · · ·	Ф		b . 0 .0	\$ - \$	♦ , ♦ , ♦

Notes:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode
Keep the EUT in transmitting mode with modulation.

4.5 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(DC):	3V
Normal Temperature(°C)	23

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5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

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5.2 Test Instrument Used

No.	Equipment	Manufacturer	Type No.	Serial No.	Firmware Version	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	A.14.16	2025/6/28
2	Power Sensor	Agilent	U2021XA	MY56120032	616	2025/6/28
3	Power Sensor	Agilent	U2021XA	MY56120034	\$ A	2025/6/28
4	Communication test set	R&S	CMW500	108058	V3.5.80	2025/6/28
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	A.14.16	2025/6/28
6	Signal Generator	Agilent	N5181A	MY50140365	A.01.60	2025/6/28
7	Vector signal generator	Agilent	N5182A	MY47420195	A.01.87	2025/6/28
8	Communication test set	Agilent	E5515C	MY50102567	B.19.07 (E1962B)	2025/6/28
9	2.4 GHz Filter	Shenxiang	MSF2400-24 83.5MS-1154	20181015001	010	2025/6/30
10	5 GHz Filter	Shenxiang	MSF5150-58 50MS-1155	20181015001		2025/6/30
11	Filter	Xingbo	XBLBQ-DZA 120	190821-1-1		2025/6/30
12	BT&WI-FI Automatic test software	Micowave	MTS8310	Ver. 2.0.0.0	\$ 5P 5	59 59
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	\$ 15 X	2025/6/28
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	*	2025/6/28
15	234G Automatic test software	Micowave	MTS8200	Ver. 2.0.0.0		67/67
16	966 chamber	C.R.T.	966	1	51	2027/6/21
17	Receiver	R&S	ESPI	100362	RF_ATTEN_7 (104489/003)	2025/6/28
18	Amplifier	HP	8447E	2945A02747		2025/6/28
19	Amplifier	Agilent	8449B	3008A01838	\$ 1 5	2025/6/28
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869		2025/6/28
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911		2025/6/28

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22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	\$ \b	, 4
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	010	2025/6/28
24	loop antenna	ZHINAN	ZN30900A	GTS534		7 67 69
25	40G Horn antenna	A/H/System	SAS-574	588	0,0	2025/6/28
26	Amplifier	AEROFLEX	Aeroflex	097	N AP A	2025/6/28
27	Power Metter	KEYSIGHT	N1912AP	N/A	A.05.00	2025/6/28

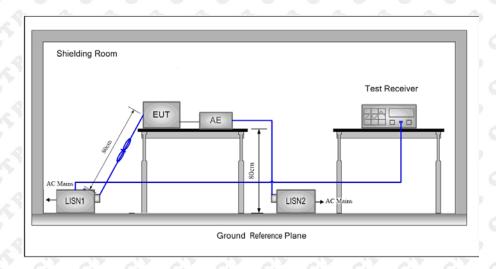
		Radiated	d emission(No.	2 Chamber)		
No.	Equipment	Manufacturer	Model No.	Serial No.	Firmware version	Calibrated until
1	966 Chamber	C/ R/ T	966			2026/11/14
2	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	01911	0 4 0	2026/7/07
3	Broadband Antenna	Schwarzbeck	VULB 9168	1471		2025/7/06
4	Amplifier	Agilent	8449B	3008A01838	\$ P \$	2025/6/30
5	Preamplifier	Schwarzbeck	BBV 9743 B	00500	0,0	2025/5/23
6	EMI TEST RECEIVER	R&S	ESCI7	100861	· · · · · · · · · · · · · · · · · · ·	2024/11/27
7	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	A.14.16	2025/6/28
8	EMI test software	Farad	EZ-EMC	67 6	Ver. FARAD-3A1+	0 10
9	Coaxial cable	Rosenberg	8m	\$ 18 6	\$ \$ P \$	2024/11/27
10	Coaxial cable	Times	2m	0,0	0,0	2024/11/27
11	Coaxial cable	Times	2m		, 51	2024/11/27
12	Coaxial cable	Times	1m	8 4	4 4 4	2024/11/27
13	loop antenna	Schwarzbeck	FMZB 1519B	1519B-224	67/67	2025/6/29
14	Communication test set	R&S	CMW500	108058	B.19.07 (E1962B)	2025/6/28
15	Communication test set	Agilent	E5515C	MY50102567	V3.5.80	2025/6/28

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6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

I	Eraguanav	Maximum RF Line Voltage (dBμV)					
	Frequency (MHz)	CLASS A		C	CLASS B		
ı	(111112)	Q.P.	Ave.	Q.P.	Ave.		
2	0.15 - 0.50	79	66	66-56*	56-46*		
1	0.50 - 5.00	73	60	56	46		
	5.00 - 30.0	73	60	60	50		

^{*} Decreasing linearly with the logarithm of the frequency

6.3 Test procedure

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.
- 5) 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.

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6.4 Test Result

N/A

NOTE: This EUT is powered by the battery only, this test item is not applicable.

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7. RADIATED EMISSION

7.1 Block Diagram Of Test Setup

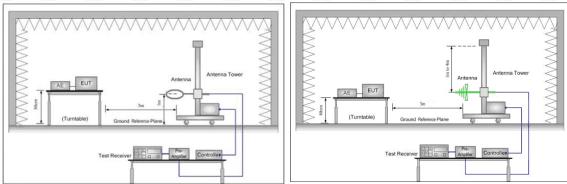


Figure 1. Below 30MHz

Figure 2. 30MHz to 1GHz

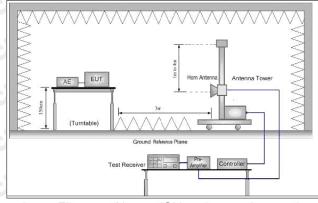


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBµV/m)	Remark	Measurement distance (m)	
0.009MHz-0.490MHz	20log 2400/F (kHz) + 80	' c' c	3	
0.490MHz-1.705MHz	20log 24000/F (kHz) + 40	0 -0	♦ 3♦	
1.705MHz-30MHz	20log 30 + 40	' C C	3	
30MHz-88MHz	40.0	Quasi-peak	3	
88MHz-216MHz	43.5	Quasi-peak	3	
216MHz-960MHz	46.0	Quasi-peak	3.5	
960MHz-1GHz	54.0	Quasi-peak	3	
Above 1GHz	54.0	Average	45 345	

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

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Field Strength of Fundamental Limit:

Fundamental and	Field strength of	Field strength of spurious
harmonics emission	Fundamental((microvolts/meter)	emissions(microvolts/meter)
limits Frequency(MHz)	0'0'0'0'	0'0'0'
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500**	50 to 150**
174-260	1500	150
260-470	1500 to 5000**	150 to 500**
Above 470	5000	500

^{**} linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, μ V/m at 3 meters = 22.72727(F)+500; for the band 260-470 MHz, μ V/m at 3 meters = 16.66667(F) -2833.33 The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

Frequency	Limit (dBµV/m @3m)	Remark
433.9011MHz	72.87	Average Value
433.9011WIDZ	92.87	Peak Value

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7.3 Test procedure

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

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- 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 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.
- 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table 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.
- f.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.

Above 1GHz test procedure as below:

- g.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter (Above 18GHz the distance is 1 meter and table is 1.5 meter).
- h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- j.Repeat above procedures until all frequencies measured was complete.

Receiver set:

Frequency Detector		RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak
Above 4CH=	Peak	1MHz	3MHz	Peak
Above 1GHz	Peak	1MHz	10Hz	Average

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7.4 Test Result

7.4.1 Calculation of average factor

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

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The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.



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Average factor:	
7 7 7	Average value=Peak value + PDCF
Calculate Formula:	PDCF=20 log(Duty cycle)
O O O	Duty cycle = T on time / T period
Calculated average	Ton time = 0.450×17+0.105×22=9.96(ms); T period =80.40(ms)
factor:	PDCF = 20 log(9.96/80.40)= -18.14dB

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7.4.2 Radiated Spurious Emission

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBµV/m)	Limit@3m (dBµV/m)
	0, 0, 0,	
4 4 ·· 4 ·	0 0 0 0	& & & &
2 2 -2 2		
	0 0 0	0 0 0

Note: 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

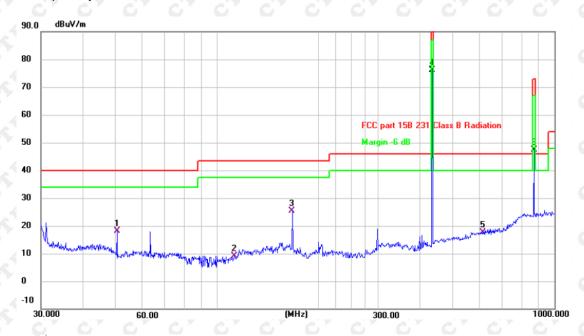
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About 30MHz-1GHz Test Results:

Antenna polarity: H

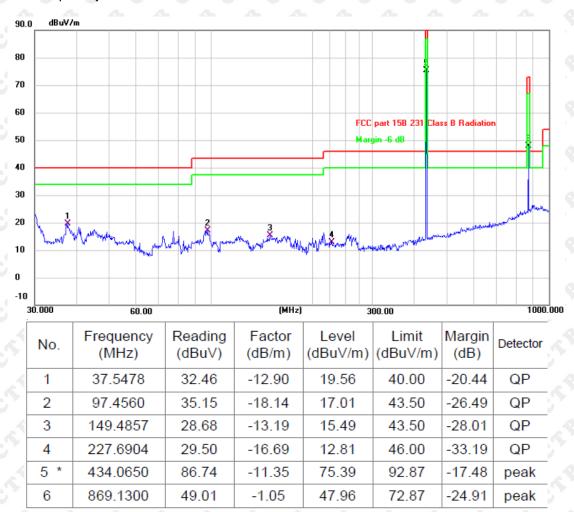


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	50.4090	32.74	-14.59	18.15	40.00	-21.85	QP
2	112.1303	26.07	-16.84	9.23	43.50	-34.27	QP
3	167.2366	39.56	-14.07	25.49	43.50	-18.01	QP
4 *	434.0650	87.46	-11.35	76.11	92.87	-16.76	peak
5	612.0641	24.09	-6.34	17.75	46.00	-28.25	QP
6	869.1300	48.33	-1.05	47.28	72.87	-25.59	peak

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Antenna polarity: V



Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit - Level

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For average Emission

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	AverageLev el dBuV/m	Limit AV	Margin	Polarization
434.0650	87.46	-18.14	69.32	72.87	-3.55	Horizontal
869.1300	48.33	-18.14	30.19	52.87	-22.68	Horizontal
434.0650	86.74	-18.14	68.60	72.87	-4.27	Vertical
869.1300	49.01	-18.14	30.87	52.87	-22.00	Vertical

Notes: Average emission Level = Peak Level + Duty cycle factor

Above 1GHz Test Results

Frequency	Peak	Duty	Average	Li	mit	Margi	n dB	
MHz	Level dBuV/m	cycle factor	Level dBuV/m	PK	AV	PK	AV	Polarization
1302.195	51.05	-9.02	42.03	72.87	52.87	-21.82	-10.84	Vertical
1736.26	46.97	-9.02	37.95	72.87	52.87	-25.90	-14.92	Vertical
2170.325	43.77	-9.02	34.75	72.87	52.87	-29.10	-18.12	Vertical
2604.39	39.73	-9.02	30.71	72.87	52.87	-33.14	-22.16	Vertical
3038.455	40.29	-9.02	31.27	72.87	52.87	-32.58	-21.60	Vertical
3472.52	41.86	-9.02	32.84	72.87	52.87	-31.01	-20.03	Vertical
1302.195	50.89	-9.02	41.87	72.87	52.87	-21.98	-11.00	Horizontal
1736.26	46.05	-9.02	37.03	72.87	52.87	-26.82	-15.84	Horizontal
2170.325	43.71	-9.02	34.69	72.87	52.87	-29.16	-18.18	Horizontal
2604.39	40.93	-9.02	31.91	72.87	52.87	-31.94	-20.96	Horizontal
3038.455	41.16	-9.02	32.14	72.87	52.87	-31.71	-20.73	Horizontal
3472.52	40.67	-9.02	31.65	72.87	52.87	-32.20	-21.22	Horizontal

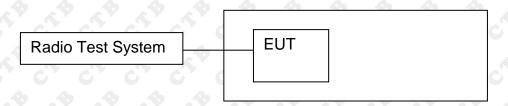
Notes: Average emission Level = Peak Level + Duty cycle factor

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8. DWELL TIME

8.1 Block Diagram Of Test Setup



8.2 Limit

According to FCC 15.231(e):

In addition, 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.

8.3 Test procedure

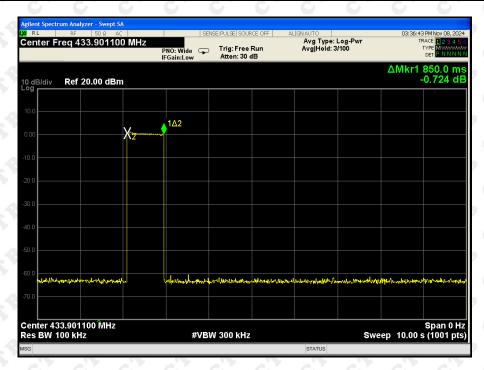
With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the transmission duration was measured and recorded.

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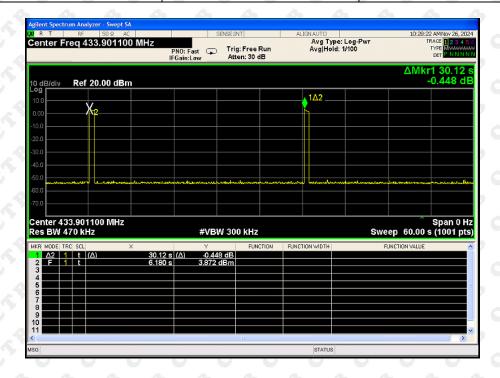


8.4 Test Result

Duration (ms)	Limit (S)	Results
850.0	<1	Pass



the silent period between transmissions (s)	Limit (S)	Results
30.12	>10S	Pass

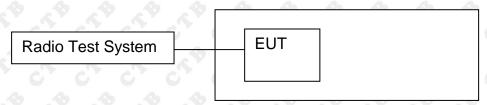


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9. OCCUPIED BANDWIDTH

9.1 Block Diagram Of Test Setup



9.2 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 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. B.W (20dBc) Limit = 0.25% * f(MHz) = 0.25% * 433.92MHz = 1.0848MHz

9.3 Test procedure

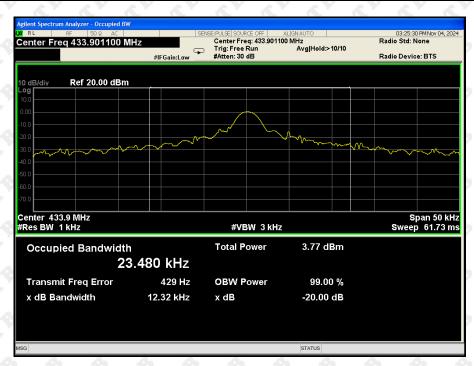
- 1. Set RBW = 10 kHz.
- 2. Set the video bandwidth (VBW) ≥RBW.
- 3. Detector = Peak.
- 4. Trace mode = max hold.
- 5. Sweep = auto couple.
- 6. Allow the trace to stabilize.
- 7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

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9.4 Test Result

20dB bandwidth (kHz)	Limit (MHz)	Results
12.32	1.0848	Pass



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10. ANTENNA REQUIREMENT

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.

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EUT Antenna:

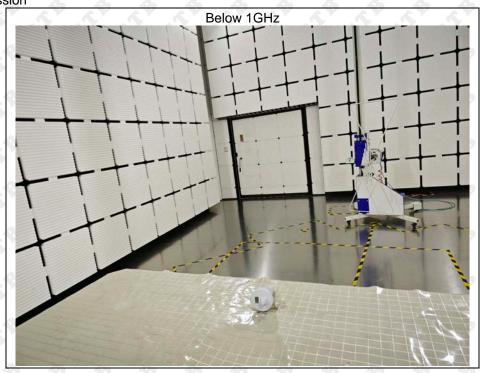
The antenna is Spring antenna and no consideration of replacement. The best case gain of the antenna is 1.0dBi.

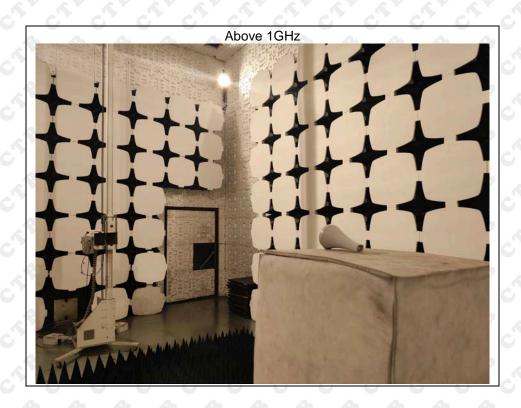
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11. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission





*** END OF REPORT ***

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