Microtest
微测检测

Test Report

FCC ID: 2AB22ZAP-5LX-S

Date of issue: Aug. 07, 2019

Report Number:	MTi19071009-1E1
Sample Description:	ZAP remote
Model(s):	ZAP 1L-Tx
Applicant:	Etekcity Corporation
Address:	1202 N Miller St. Suite A, Anaheim, CA 92806, USA
Date of Test:	July 11, 2019 to Aug. 07, 2019

Shenzhen Microtest Co., Ltd.
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Table of Contents

Test Result Certification

Applicant's name:	Etekcity Corporation
Address:	1202 N Miller St. Suite A, Anaheim, CA 92806, USA
Manufacture's Name:	Dongguan Raiwee Electronic Technology Co., Ltd
Address:	Building 11, Antouling, Industry Avenue, Qinghu Village, Qishi Town, Dongguan, Guangdong 523000, China
Product name:	ZAP remote
Trademark:	ETEKCITY
Model name:	ZAP 1L-Tx
Standards:	FCC Part 15.231
Test Procedure:	ANSI C63.10-2013 DA 00-705

This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by:	Jone Lee	Aug. 07, 2019
Reviewed by:	Blue Zheng	Aug. 07, 2019
Approved by:	Smith Chen	Aug. 07, 2019

1 General description

1.1 Descriptions of EUT

Product name:	ZAP remote
Model name:	ZAP 1L-Tx
Series model:	N/A
Difference of series model:	N/A
Tx/Rx frequency range:	Tx:433.92MHz
Modulation type:	ASK
Power source:	DC 12V from battery
Adapter information:	N/A
Antenna designation:	PCB Antenna(Antenna Gain:1dBi)
Hardware version:	V1.0.1
Software version:	V1.0

1.2 Operation channel list

Channel	Frequency
1	433.92MHz

1.3 Frequency Channel Under Test

Channel	Frequency
1	433.92MHz

1.4 Ancillary equipment list

Equipment	Model	S/N	Manufacturer
/	/	/	/

1.5 Description of Support Units

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

Item	Equipment	Brand	Model/Type No.	Series No.	Note
/	/	/	/	/	
/	/	/	/	/	

Note:

(1)The support equipment was authorized by Declaration of Confirmation.

(2)For detachable type I/O cable should be specified the length in cm in『Length』column.

2 Summary of Test Results

Test procedures according to the technical standards:

Item	FCC Part No.	Description of Test	Result	Remark
1	15.203	Antenna requirement	Pass	
2	15.207	AC power line conducted emission	N/A	
3	15.231(b)	Field strength of fundamental and harmonic emissions	Pass	
4	15.205 and 15.209	Radiated emission and bandedge	Pass	
5	15.215	Occupied Bandwidth	Pass	
6	15.231(a)(2)	Release time	Pass	
The meaning of symbols: “ZAP 1L-Tx ” – Not Applicable				

3 Test Facilities and Accreditations

3.1 Test laboratory

Test Laboratory	Shenzhen Microtest Co., Ltd
Location	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
FCC Registration No.:	448573

3.2 Environmental conditions

Temperature:	15ºC~35ºC
Humidity	20%~75%
Atmospheric pressure	98kPa~101kPa

3.3 Measurement uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %

RF frequency	1×10^{-7}
RF power, conducted	±1.38dB
Conducted emission(150kHz~30MHz)	±0.21dB
Radiated emission(30MHz~1GHz)	±4.68dB
Radiated emission (above 1GHz)	±4.89dB
Temperature	±0.5°C
Humidity	± 2 %

3.4 Test software

Software Name	Manufacturer	Model	Version
RF Test System	Shenzhen JS tonscend co., ltd	JS1120-3	2.5.77.0418

4 Equipment list

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI7	100314	2018/10/09	2019/10/08
MTI-E006	TRILOG Broadband Antenna	schwarabeck	VULB 9163	9163-872	2018/10/15	2020/10/14
MTI-E014	amplifier	Hewlett-Packard	8447D	3113A06150	2018/10/09	2019/10/08
MTI-E036	Single path vehicle AMN(LISN)	Schwarzbeck	NNBM 8124	01175	2018/10/09	2019/10/08
MTI-E038	Low noise active vertical monopole antenna	Schwarzbeck	VAMP 9243	#565	2018/10/16	2019/10/15
MTI-E039	Biconical antenna	Schwarzbeck	BBA 9106	#164	2018/10/15	2019/10/14
MTI-E041	MXG Vector Signal Generator	Agilent	N5182A	MY49060455	2019/04/16	2020/04/15
MTI-E042	ESG Series Analog signal generator	Agilent	E4421B	GB40051240	2019/05/21	2020/05/20
MTI-E044	Thermometer clock humidity monitor	-	HTC-1	/	2019/04/17	2020/04/16
MTI-E062	Log Periodic Antenna	Schwarzbeck	VUSLP 9111B	#312	2018/04/11	2020/04/10
MTI-E063	Log Periodic Dipole Array Antenna	ETS-LINDGREN	3148B	00224524	2018/04/11	2020/04/10
MTI-E065	Amplifier	EMtrace	RP06A	00117	2019/04/29	2020/04/28
MTI-E066	Comprehensive test instrument	Rohde&schwarz	CMW500	149155	2019/04/16	2020/04/15
MTI-E071	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2018/10/25	2019/10/24
MTI-E076	EMI Test Receiver	Rohde&schwarz	ESIB26	100273	2019/04/16	2020/04/15
MTI-E078	Synthesized Sweeper	Agilent	83752A	3610A01957	2019/04/16	2020/04/15
MTI-E079	DC Power Supply	Agilent	E3632A	MY40027695	2019/04/16	2020/04/15
MTI-E093	Artificial mains network	3ctest	LISN J50	ES3911805	2019/04/16	2020/04/15
MTI-E096	Power amplifier	Space-Dtronics	EWLNA0118G-P40	1852001	2019/04/29	2020/04/28
MTI-E097	Current Probe	SOLAR ELECTRONICS CO.	9207-1	220095-1	2019/04/17	2020/04/16
MTI-E098	Loop Sensor	SOLAR ELECTRONICS CO.	7334-1	220095-2	2019/04/21	2020/04/20
Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).						

5 Test Result

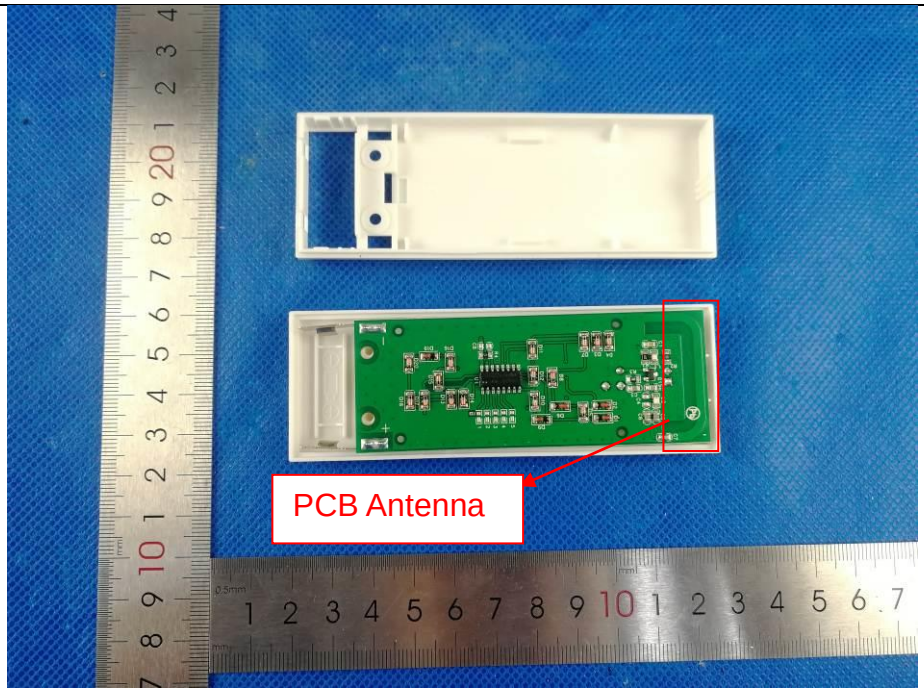
5.1 Antenna requirement

5.1.1 Requirement defined in FCC 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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

5.1.2 EUT antenna description

The radio antenna of EUT is a PCB antenna, the maximum gain is 1dBi. So the antenna meets the requirement of this part.



5.2 AC power line conducted emission

5.2.1 Limit

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

Note: Decreases with the logarithm of the frequency from 0.15MHz to 0.5MHz.

5.2.2 Test method

1. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/50uH of coupling impedance for the measuring instrument.

2. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

3. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

4. LISN is at least 80 cm from nearest part of EUT chassis.

5. The resolution bandwidth of EMI test receiver is set at 9kHz.

5.2.3 Test Result

Note: The device is a DC power supply and does not apply to conducted emissions.

5.3 Field strength of fundamental and harmonic emissions

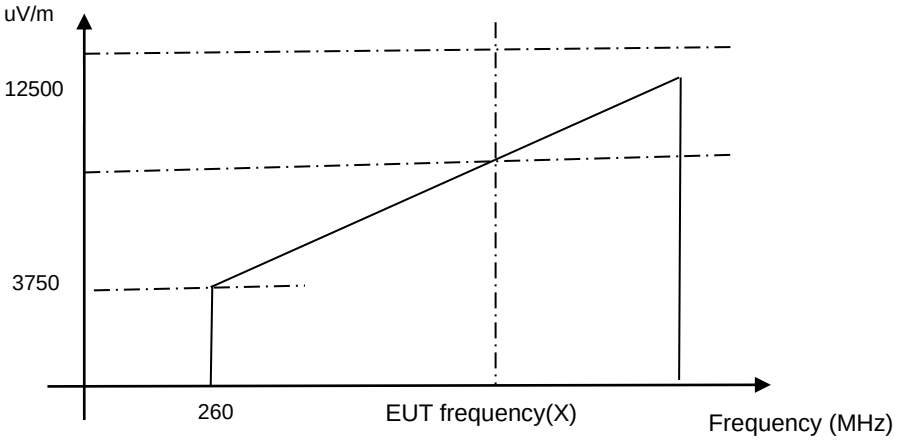
5.3.1 Limits

Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2.250	225
70-130	1.250	125
130-174	[1]1250 to 3750	[1]125 to 375
174-260	3.750	375
260-470	[1]3750 to 12500	[1]375 to 1250
Above 470	12500	1250

[1]Linear interpolations.

For example for 433.925MHz



The Field Strength of Fundamental Emissions (Operating Frequency) is:

3750 uV/m = 20*log (3750) dBuV/m = 71.48 dBuV/m

12500 uV/m = 20*log (12500) dBuV/m = 81.94 dBuV/m

For example the Fundamental emission is 433.925MHz, the limit is X.

(433.92-260)/(470-260)=(X-3750)/(12500-3750)

173.925/210 =(X-3750)/8750

X = 10996.875uV/m

AV Limit = 20*log (10996.875) dBuV/m = 80.83 dBuV/m

PK Limit = 100.83 dBuV/m

5.3.2 Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range blew 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.

2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.

3. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1GHz
RBW = 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = Auto
Detector function = Peak
Trace = max hold

4. Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

5. The peak level, once corrected, must comply with the limit specified in Section 15.209. Set the spectrum to

RBW = 1MHz
VBW = 10Hz
Detector = PK for AV value, while maintaining all of the other instrument settings

5.3.3 Test Result

Field Strength of Fundamental Emissions and Field strength of spurious emissions Value					
Operating Frequency (MHz)	Field Strength (dBuV/m)	Detector	Limit @3m (dBuV/m)	Margin (dB)	Antenna
433.920	78.26	Peak	100.83	22.57	Vertical
	67.8	Average	80.83	13.03	Vertical
	79.52	Peak	100.83	21.31	Horizontal
	69.06	Average	80.83	11.77	Horizontal
869.1301	54.34	Peak	80.83	26.49	Vertical
	43.88	Average	60.83	16.95	Vertical
	53.45	Peak	80.83	27.38	Horizontal
	42.99	Average	60.83	17.84	Horizontal

Note: If the PK measured values lower than average mode limit, the EUT shall be deemed to meet average limits and then no additional average mode measurement performed.

Note: 1. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report(Y orientation).

2. *Calculate Average value based on Duty Cycle correction factor:

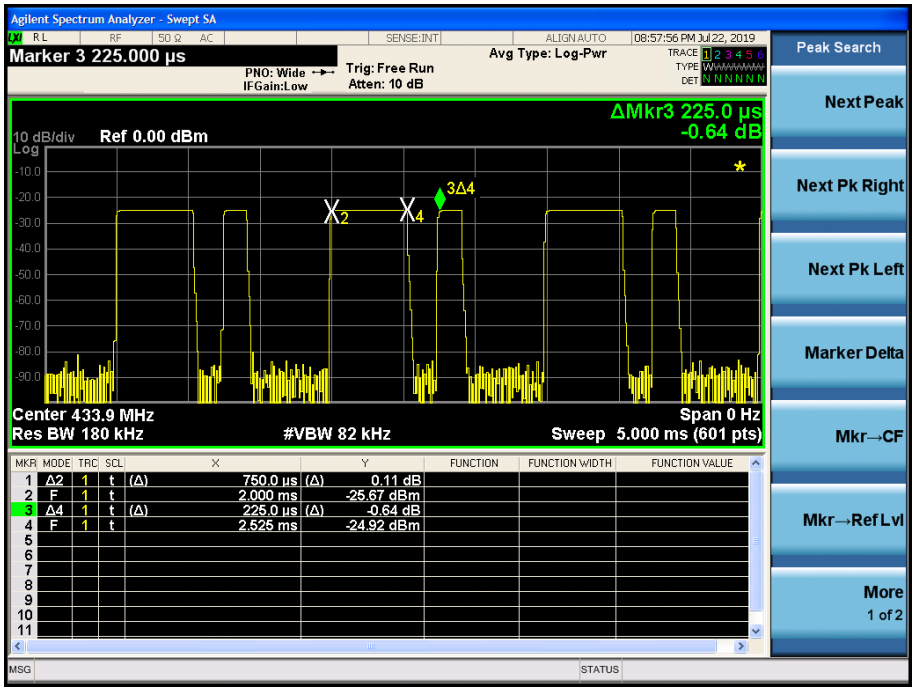
Duty Cycle=Ton/(Ton+Toff)= 225ms/750ms = 0.3=30%

Duty Cycle factor= 20lg (Duty Cycle) =20lg (0.3) = -10.46dB

Average=Peak+ Duty Cycle factor

3. Margin: Limit- Field Strength

433.92MHz



5.4 Occupied Bandwidth

5.4.1 Test method

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥1% of the 20 dB bandwidth
VBW ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth and 99% occupied bandwidth of the emission.

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

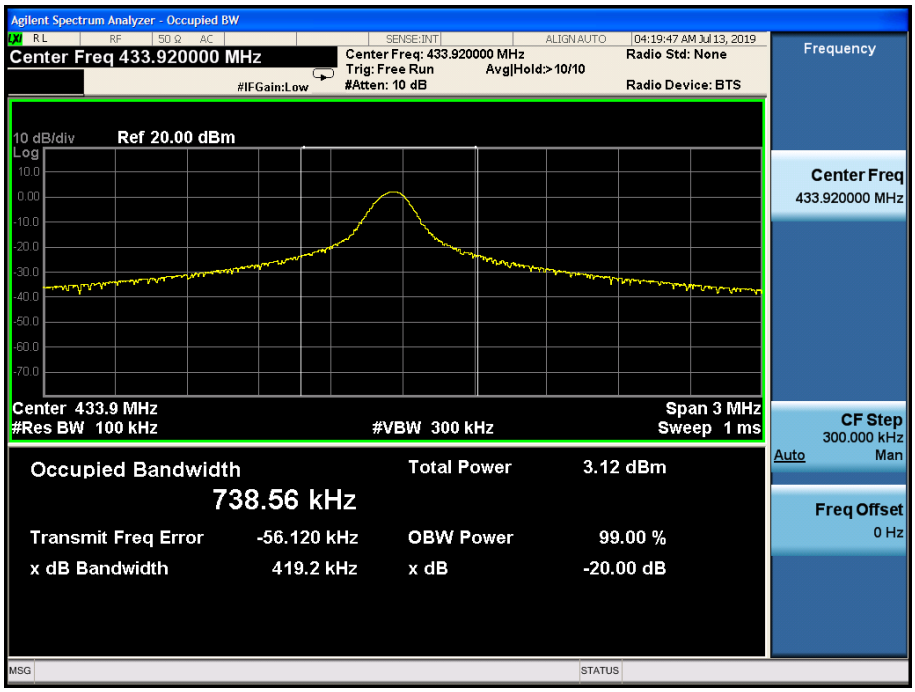
5.4.2 Test result

Test modulation: ASK

Frequency (MHz)	20dB emission bandwidth (MHz)	99% occupied bandwidth (MHz)	Limits(MHz)
433.92	0.4192	0.73856	1.08

Test plots as below

433.92MHz



5.5 Radiated emission and Band edge spurious emission

5.5.1 Limit

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, (b)shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Frequency (MHz)	Field strength μV/m	Field strength dBμV/m	Detector	Measurement distance
30-88	100	40	QP	3m
88-216	150	43.5	QP	
216-960	200	46	QP	
960-1000	500	54	QP	
Above 1000	500	54	AV	
Above 1000	5000	74	PK	

5.5.2 Test method

1. The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range blew 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.

2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.

3. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1GHz
100 kHz for f < 1 GHz, VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

4. Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

5. The peak level, once corrected, must comply with the limit specified in Section 15.209. Set the RBW = 1MHz, VBW = 10Hz, Detector = PK for AV value, while maintaining all of the other instrument settings.

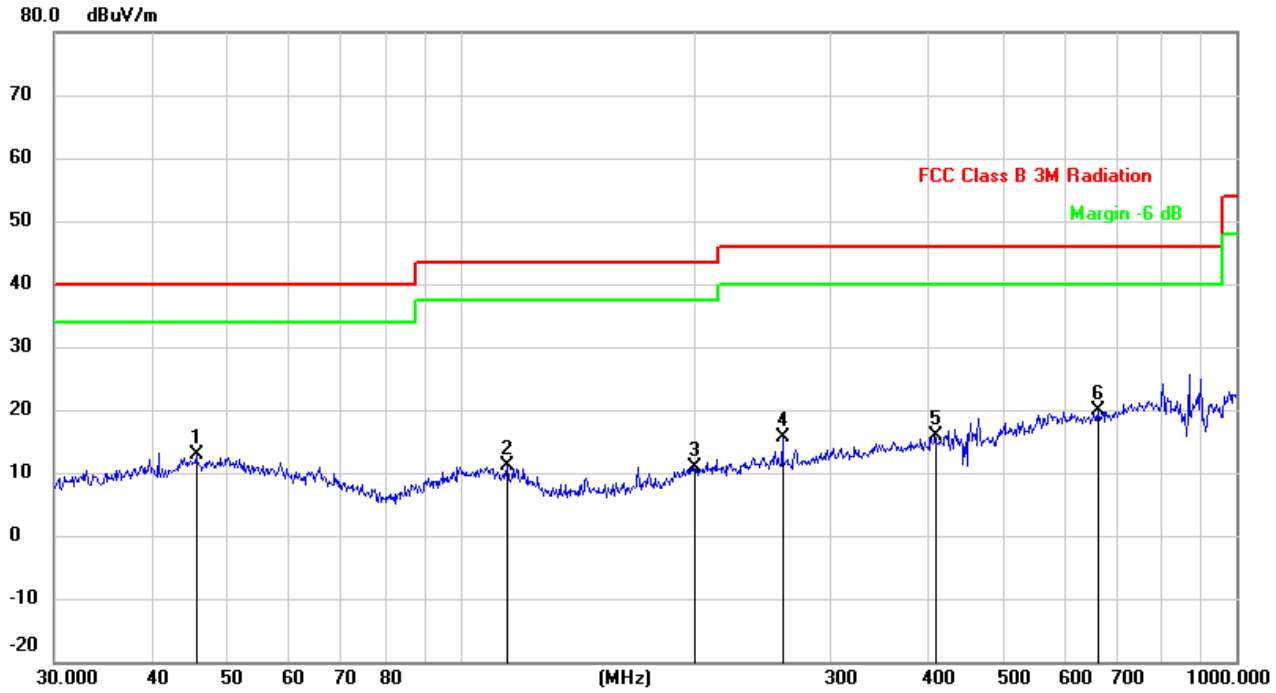
5.5.3 Test Result

Remark:
If the PK measured values lower than average mode limit, the EUT shall be deemed to meet average limits and then no additional average mode measurement performed.

Radiated emission

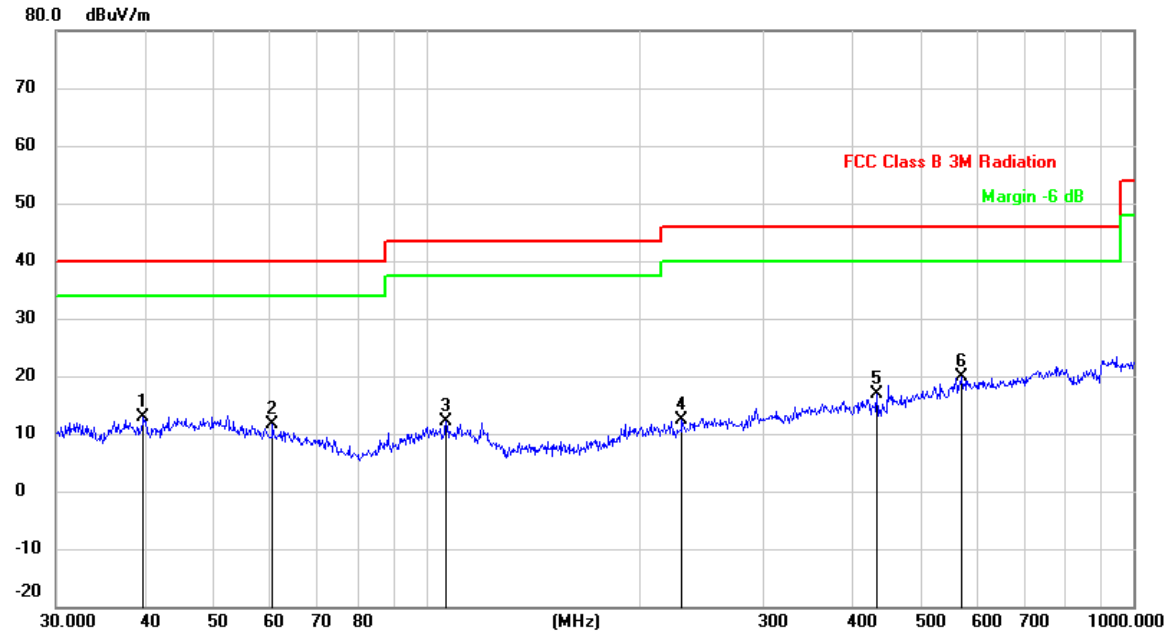
Between 30MHz – 1GHz

EUT：	ZAP remote	Model Name ：	ZAP 1L-Tx
Relative Humidity:	52%	Phase:	H
Pressure：	1010 hPa	Test Voltage ：	DC 12V from battery
Test Mode ：	TX		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector
1		45.6948	25.35	-12.58	12.77	40.00	-27.23	QP
2		114.9167	25.22	-14.19	11.03	43.50	-32.47	QP
3		199.9856	23.94	-13.04	10.90	43.50	-32.60	QP
4		260.1444	27.44	-11.77	15.67	46.00	-30.33	QP
5		408.9460	25.34	-9.55	15.79	46.00	-30.21	QP
6	*	663.4728	26.17	-6.39	19.78	46.00	-26.22	QP

EUT：	ZAP remote	Model Name ：	ZAP 1L-Tx
Relative Humidity:	52%	Phase:	V
Pressure：	1010 hPa	Test Voltage ：	DC 12V from battery
Test Mode ：	TX		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector
1		39.8541	26.38	-13.58	12.80	40.00	-27.20	QP
2		60.7043	25.95	-14.30	11.65	40.00	-28.35	QP
3		106.7587	26.00	-13.81	12.19	43.50	-31.31	QP
4		230.0985	24.94	-12.65	12.29	46.00	-33.71	QP
5		434.0649	25.81	-8.91	16.90	46.00	-29.10	QP
6	*	572.6144	26.36	-6.49	19.87	46.00	-26.13	QP

1G-6GHz

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	1355.738	43.29	-9.96	33.33	74	-40.67	Horizontal
2	2070.131	44.93	-9.17	35.76	74	-38.24	Horizontal
3	3157.061	44.72	-9.25	35.47	74	-38.53	Horizontal
4	3852.211	42.99	-9.04	33.95	74	-40.05	Horizontal
5	4902.902	47.67	-9.96	37.71	74	-36.29	Horizontal
6	5613.507	43.62	-9.65	33.97	74	-40.03	Horizontal
1	1526.384	47.79	-9.77	38.02	74	-35.98	Vertical
2	2202.488	48.04	-9.93	38.11	74	-35.89	Vertical
3	3053.802	47.59	-9.10	38.49	74	-35.51	Vertical
4	3928.957	46.41	-9.90	36.51	74	-37.49	Vertical
5	5199.723	52.55	-9.11	43.44	74	-30.56	Vertical
6	5680.524	49.41	-9.87	39.54	74	-34.46	Vertical

Note1 : Absolute Level = Reading Level+ Factor, Margin= Absolute Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Note2 :The peak value is less than the AV value, AV value is not required Factor added by measurement software automatically.

5.6 Transmitter timeout

5.6.1 Limit

15.231 (a)(1)A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

5.6.2 Test method

Setup the EUT as show in the block diagram above.

Set Spectrum Analyzer

Centre Frequency = Fundamental Frequency

RBW=100 kHz, VBW= 300 kHz

Span= 0 Hz

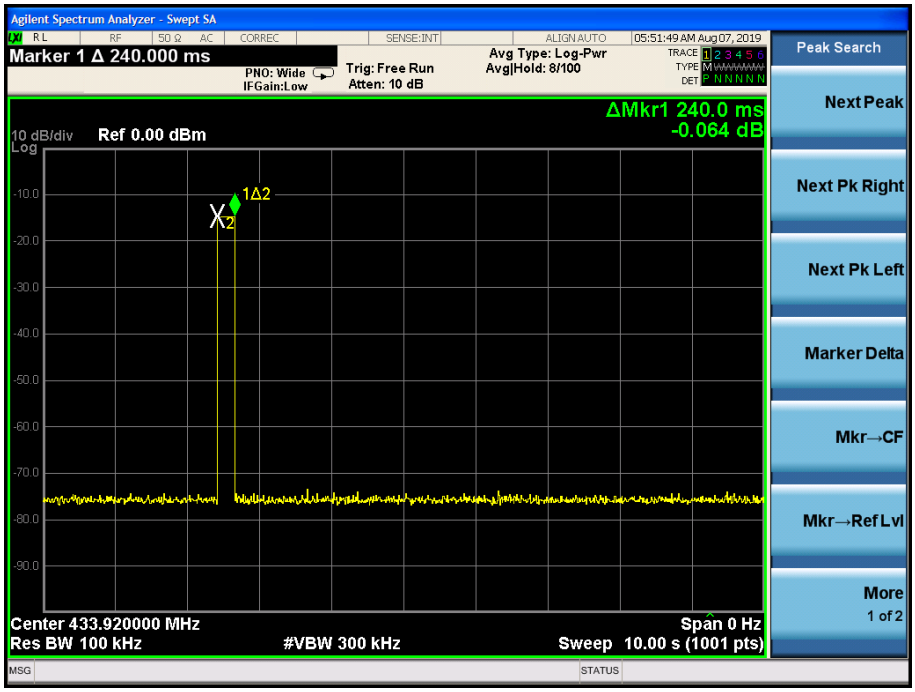
Sweep Time= 10 Seconds.

Setup the EUT as normal operation and press Transmitter button

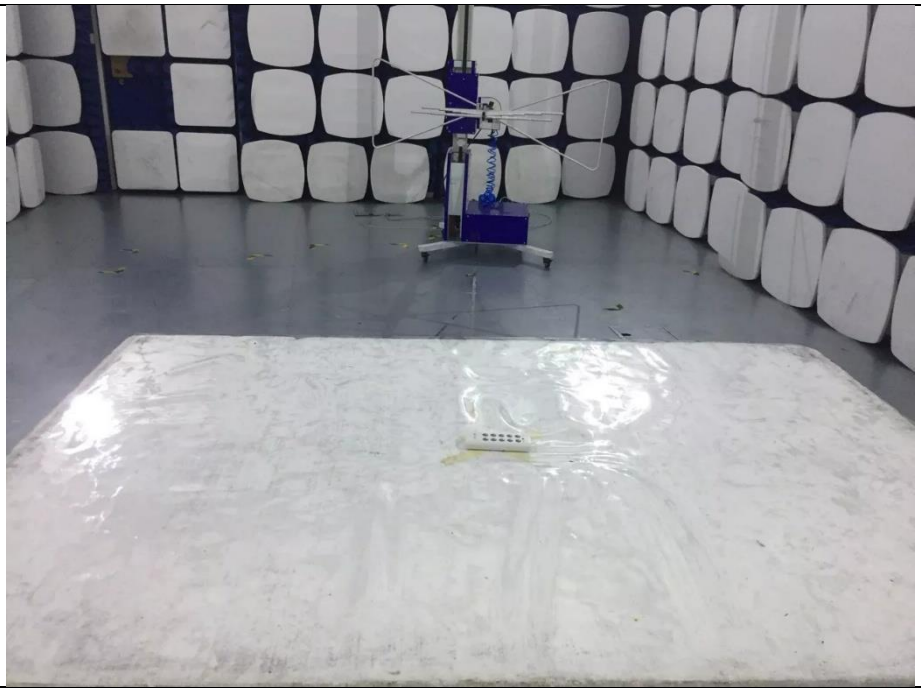
Release the button, use Delta Mark function to test the time.

5.6.3 Test Result

Periodic operation time (s)	Limit(s)	Result
0.24	5	Pass



Photographs of the Test Setup

Radiated emission – below 1GHz

Radiated emission – above 1GHz


Photographs of the EUT

See the APPENDIX 1: EUT PHOTO in the report No.: MTi19071009-1E1-1

----End of Report----