TEST REPORT

Report No.	CISRR25011715106
Project No.	CISR25011715106
FCC ID	2BKK2-X6-A
Applicant	Shenzhen Keithy Innovation Technology Co., Ltd.
Address	15C(1588), Block C Electronic Technology Building, Huafa North Road,Futian Shenzhen,China
Manufacturer	Shenzhen Keithy Innovation Technology Co., Ltd.
Address	15C(1588), Block C Electronic Technology Building, Huafa North Road,Futian Shenzhen,China
Product Name	SMART DOORBELL
Trade Mark	N/A
Model/Type reference	X6-A
Listed Model(s)	X6-FA, X6-FD, X2, X2-A, X2-F, X3, X3-A, X3-F, X5, X5-A, X5-F
Standard	Part 15 Subpart C Section 15.231
Test date	January 17, 2025 to January 24, 2025
Issue date	January 23, 2025
Test result	**Complied**

Rory Huang

Prepared by: Rory Huang

Genry Long

Approved by: Genry Long

The test results relate only to the tested samples.

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Contents

1. REPORT VERSION

Version No.	Issue date	Description
00	January 23, 2025	Original

2. SUMMARY OF TEST RESULT

Report clause	Test Item	Standard Requirement	Result
5.1	Antenna Requirement	15.203	PASS
5.2	AC Conducted Emission	15.207	N/A
5.3	20 dB Bandwidth	15.231(c)	PASS
5.4	Radiated Spurious Emission	15.231 (a)/15.205/15.209	PASS
5.5	Transmitter Deactivation Time	15.231	PASS
5.6	Duty cycle Factor	15.231	PASS

Note:

– The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Product Description

Main unit information:	
Product Name:	SMART DOORBELL
Trade Mark:	N/A
Model No.:	X6-A
Listed Model(s):	X6-FA, X6-FD, X2, X2-A, X2-F, X3, X3-A, X3-F, X5, X5-A, X5-F
Model difference:	The difference between different models is that in this application, due to different sales channels and different model names
Power supply:	DC 5V
Hardware version:	X6-IP-TX-V02
Software version:	2.3.6

3.2. Radio Specification Description

Technology:	SRD
Modulation:	ASK
Operation frequency:	433.92MHz
Channel Number:	1
Antenna type:	Metal(Carbon steel) Antenna
Antenna gain:	1.2dBi

3.3. Modification of EUT

No modifications are made to the EUT during all test items.

3.4. Testing Site

Laboratory Name	Shenzhen Bangce Testing Technology Co., Ltd.
Laboratory Location	101, building 10, Yunli Intelligent Park, Shutianpu community, Matian Street, Guangming District, Shenzhen, Guangdong, China
FCC registration number	736346

3.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS (dBuV/m) = RA (dBuV) + AF (dB/m) + CL (dB) – AG (dB)

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

3.6. DISTURBANCE Calculation

The AC mains conducted disturbance is calculated by adding the 10dB Pulse Limiter and Cable Factor and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

CD (dBuV) = RA (dBuV) + PL (dB) + CL (dB)

Where CD = Conducted Disturbance	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	PL = 10 dB Pulse Limiter Factor

4. TEST CONFIGURATION

4.1. Test frequency list

Channel	Frequency (MHz)
CH1	433.92

4.2. Test mode

For RF test items:		
The engineering prototype is provided with key switching channel to realize EUT continuous transmission.Power setting Default.		
Test Item	Test Mode	Modulation
Conducted test item	TX-CH1	ASK
	Charging	--
Radiated test item	TX-CH1	ASK
	Normal link	--
Remark: – The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.		

4.3. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The following peripheral devices and interface cables were connected during the measurement:

Item	Equipment name	Trade Name	Model No.
1	--	--	--

4.4. Test sample information

Type	sample no.
Engineer sample	CISR25011715106-S01
Normal sample	CISR25011715106-S02

4.5. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.6. Statement of the measurement uncertainty

No.	Test Items	Measurement Uncertainty
1	AC Conducted Emission	1.63dB
2	Power Spectral Density	1.34dB
3	20dB Bandwidth	0.002%
4	Duty cycle	-
5	Conducted Band Edge and Spurious Emission	1.93dB
6	Radiated Band Edge Emission	3.76dB for 30MHz-1GHz 3.80dB for above 1GHz
7	Radiated Spurious Emission	3.76dB for 30MHz-1GHz 3.80dB for above 1GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.7. Equipment Used during the Test

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	SKET	9.3*6.3*6	N/A	2024.09.01	3Year
Spectrum analyzer	Agilent	N9020A	MY50530263	2025.01.08	1Year
Receiver	ROHDE&SCHWARZ	ESCI	100853	2025.01.08	1Year
Spectrum analyzer	R&S	FSV-40N	/	2025.01.08	1Year
Bilog Antenna	Schwarzbeck	VULB 9163	1463	2025.01.08	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2487	2025.01.08	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	/	2025.01.08	2Year
RF Cable	Tonscend	Cable 1	/	2025.01.08	1Year
RF Cable	Tonscend	Cable 2	/	2025.01.08	1Year
RF Cable	SKET	Cable 3	/	2025.01.08	1Year
Pre-amplifier	Tonscend	TAP9K3G32	AP21G806153	2025.01.08	1Year
Pre-amplifier	Tonscend	TAP01018050	AP22E806229	2025.01.08	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8127	/	2025.01.08	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	2025.01.08	1Year
Horn Antenna	SCHWARZBECK	BBHA9170	1130	2025.01.08	2 Year
Preamplifier	Tonscend	TAP18040048	AP21C806126	2025.01.08	1Year
variable-frequency power source	Pinhong	PH1110	/	2025.01.08	1Year
6dB Attenuator	SKET	DC-6G	/	N/A	N/A
Artificial power network	Schwarzbeck	NSLK8127	8127-01096	2025.01.08	1Year
EMI Test Receiver	Rohde&schwarz	ESCI7	100853	2025.01.08	1Year
8-wire Impedance Stabilization Network	Schwarzbeck	NTFM 8158	8158-00337	2025.01.08	1Year
Artificial power network	Schwarzbeck	ENV216	/	2025.01.08	1Year
Antenna tower	SKET	Bk-4AT-BS	AT2021040101-V1	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Standard Applicable	**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 response-ble 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.
Description	The EUT antenna is Metal(Carbon steel)Antenna (1.2dBi), the directional gain of the antenna less than 6dBi. It comply with the standard requirement. In case of replacement of broken antenna the same antenna type must be used.Antenna structure please refer to the EUT internal photographs antenna photo.

Remark: The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen Bangce Testing Technology Co., Ltd. does not assume any responsibility.

5.2. AC Conducted Emission

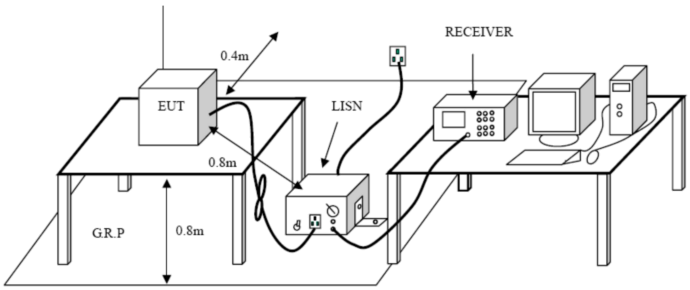
Limit:

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

* Decreases with the logarithm of the frequency.

Test configuration:



Test procedure:

1. The EUT was setup according to ANSI C63.10 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 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Refer to the block diagram of the test setup and photographs)
5. 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.
6. 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.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

Test mode:

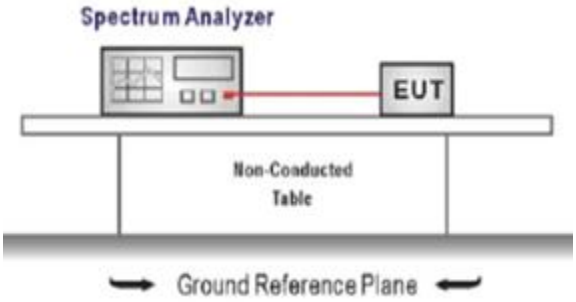
Refer to the clause 4.2

Result:

Not Applicable

Note:
1. Factor = LISN Factor + Cable Factor
2. Level= Reading + Factor
3. Margin= Level – Limit

5.3. 20 dB Bandwidth

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. Bandwidth is determined at the points 20 dB down from the modulated carrier.
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: Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a Test channel RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Result:	**Passed**

Center Frequency of operation(MHz)	Measured 20dB Bandwidth(kHz)	Limit(kHz)	Result
433.92	195.0	1084.75	PASS

5.4. Radiated Spurious Emission

Limit:

FCC CFR Title 47 Part 15 Subpart C Section 15.209

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)

Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

FCC CFR Title 47 Part 15 Subpart C Section 15.231

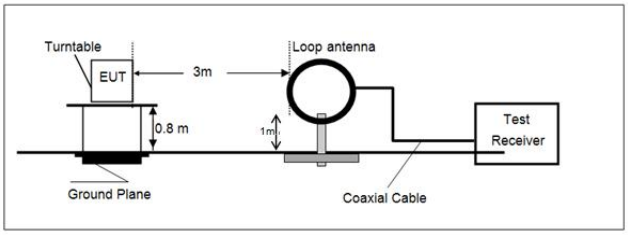
In addition to the provisions of § 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

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] 1,250 to 3,750	[1] 125 to 375
174-260	3,750	375
260-470	[1] 3,750 to 12,500	[1] 375 to 1,250
Above 470	12,500	1,250

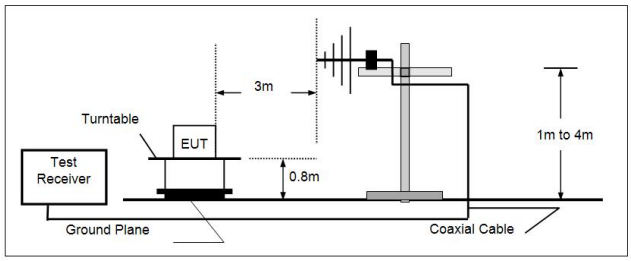
[1] *Linear interpolations.*

Test configuration:

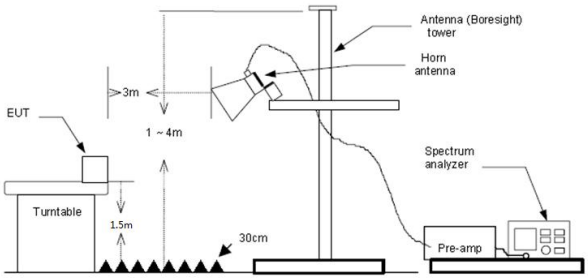
9kHz~30MHz



30 MHz ~ 1 GHz



Above 1 GHz



Test procedure:

1. The EUT was setup and tested according to ANSI C63.10.
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
   a) Span shall wide enough to fully capture the emission being measured;
   b) 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.
   c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement
   d) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement

Test mode: Refer to the clause 4.2

Result: **Passed**

Note:

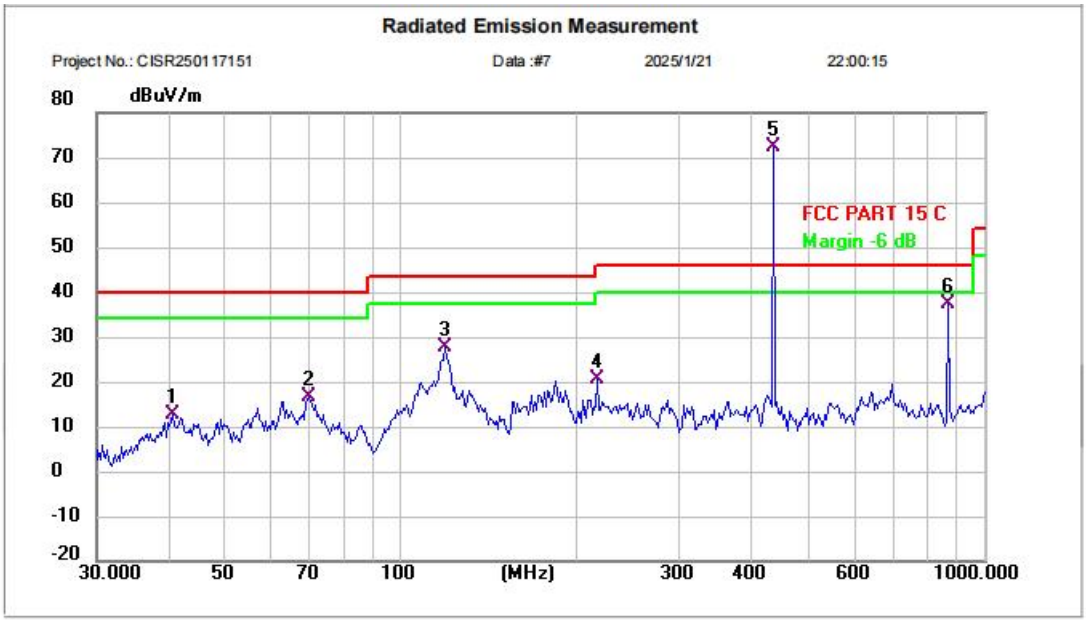
1) Level= Reading + Factor/Transd; Factor/Transd =Antenna Factor+ Cable Loss- Preamp Factor
2) Margin = Limit – Level
3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.
4) The other emission levels were very low against the limit.
5) This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.

For 9 kHz ~ 30 MHz

The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

For 30 MHz ~ 1000 MHz

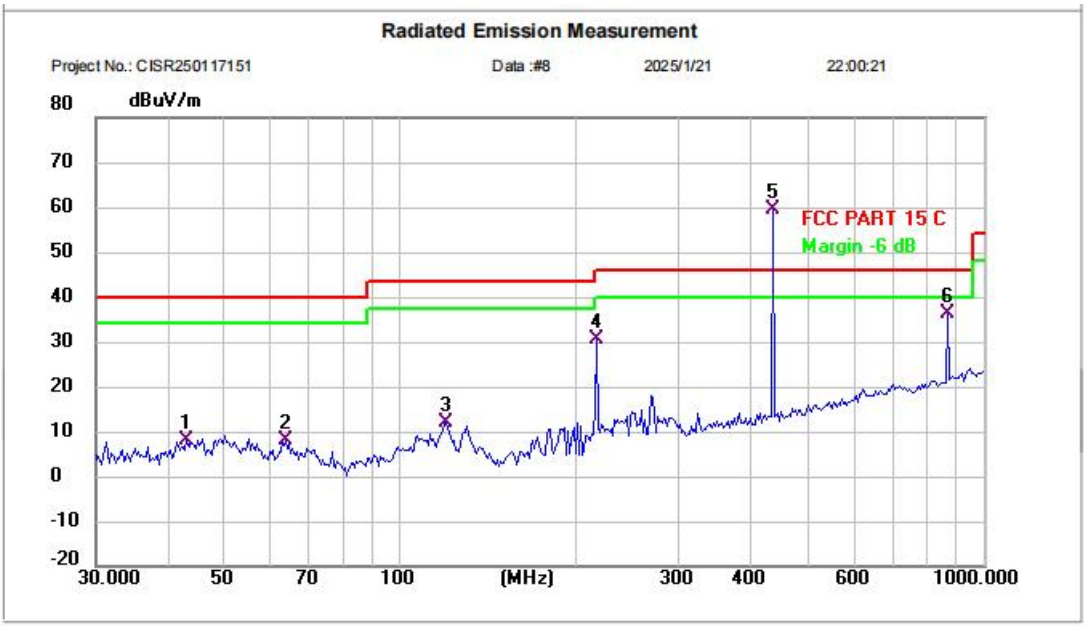
Polarization:	Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	40.559	43.36	-30.60	12.76	40.00	-27.24	QP
2	69.600	49.53	-32.97	16.56	40.00	-23.44	QP
3	118.601	59.50	-31.93	27.57	43.50	-15.93	QP
4	216.783	50.07	-29.58	20.49	46.00	-25.51	QP
5 *	433.921	96.21	-23.88	72.33	46.00	26.33	QP
6	869.130	52.69	-15.25	37.44	46.00	-8.56	QP

Fundamental and Harmonics Result						
Frequency (MHz)	Peak Level (dBμV/m)	AV Factor(dBμV/m) (see Section 5.4)	Average Level (dBμV/m)	Limit(dBμV/m) (average)	Limit(dBμV/m) (Peak)	Conclusion
433.92	72.93	-9.951	62.979	80.82	100.82	PASS
869.1	37.44	-9.951	27.489	60.82	80.82	PASS

Polarization:	Vertical



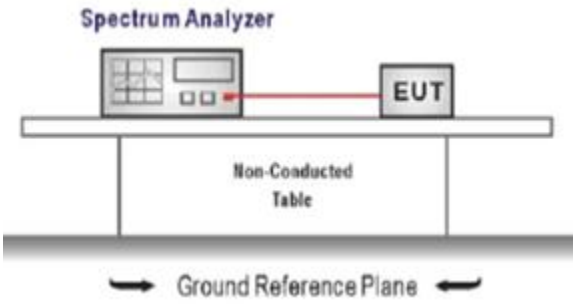
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	42.900	38.08	-29.93	8.15	40.00	-31.85	QP
2	63.536	39.63	-31.43	8.20	40.00	-31.80	QP
3	119.436	44.15	-32.03	12.12	43.50	-31.38	QP
4	216.783	59.98	-29.58	30.40	46.00	-15.60	QP
5 *	433.921	83.18	-23.88	59.30	46.00	13.30	QP
6	869.130	51.36	-15.25	36.11	46.00	-9.89	QP

Fundamental and Harmonics Result						
Frequency (MHz)	Peak Level (dBμV/m)	AV Factor(dBμV/m) (see Section 5.4)	Average Level (dBμV/m)	Limit(dBμV/m) (average)	Limit(dBμV/m) (Peak)	Conclusion
433.92	59.30	-9.951	49.349	80.82	100.82	PASS
866.1	36.11	-9.951	26.159	60.82	80.82	PASS

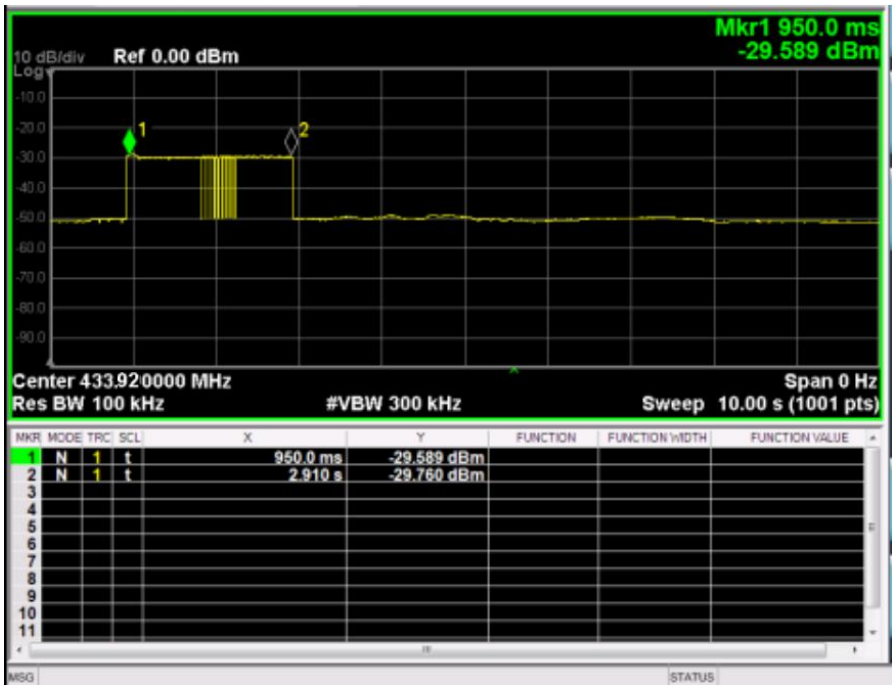
For 1 GHz ~ 4 GHz

Test channel: 433.92MHz										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
1204.00	70.56	28.62	4.08	38.62	-5.92	64.64	74	9.36	Peak	Horizontal
1204.00	51.69	28.62	4.08	38.62	-5.92	45.77	54	8.23	Average	Horizontal
1204.00	68.75	28.62	4.08	38.62	-5.	62.83	74	11.17	Peak	Vertical
1204.00	50.45	28.62	4.08	38.62	-5.92	44.53	54	9.47	Average	Vertical

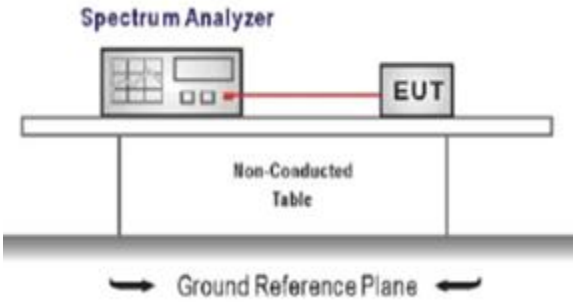
5.5. Transmitter Deactivation Time

Limit:	A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
Test configuration:	
Test procedure:	Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.
Test mode:	Refer to the clause 4.2
Result:	**Passed**

Test Results			
Frequency (MHz)	Activation Time(s)	Limit: not more than 5 seconds of being released (s)	Conclusion
433.92	2.91	5	PASS



5.6. Duty cycle Factor

Limit:	No dedicated limit specified in the Rules.
Test configuration:	
Test procedure:	1. Place the EUT on the table and set it in transmitting mode. 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. 3. Set centre frequency of spectrum analyzer=operating frequency. 4. Set the spectrum analyzer as RBW=100kHz, VBW=300kHz, Span=0Hz, Adjust Sweep=Auto. 5. Repeat above procedures until all frequency measured was complete.
Test mode:	Refer to the clause 4.2
Result:	**Passed**

Test Data

Ton = 0.5832*10+0.1728*9+0.216*5=8.4672(ms)

Tp = 26.65(ms)

The duty cycle=8.4672/26.65=31.8%

Average Correction Factory = 20log (Ton/Tp) =20log (0.318) =-9.951dB

Test plot of Duty cycle	

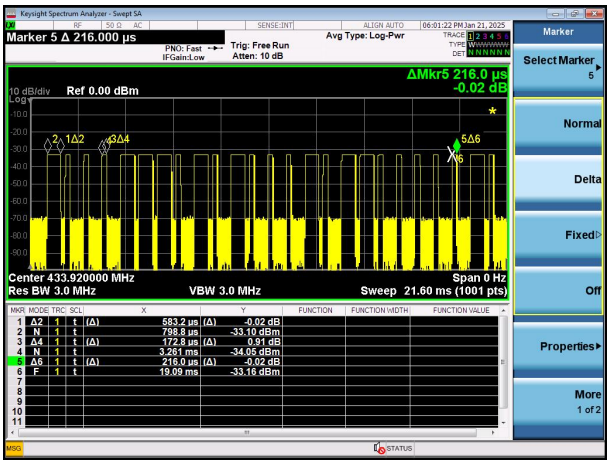
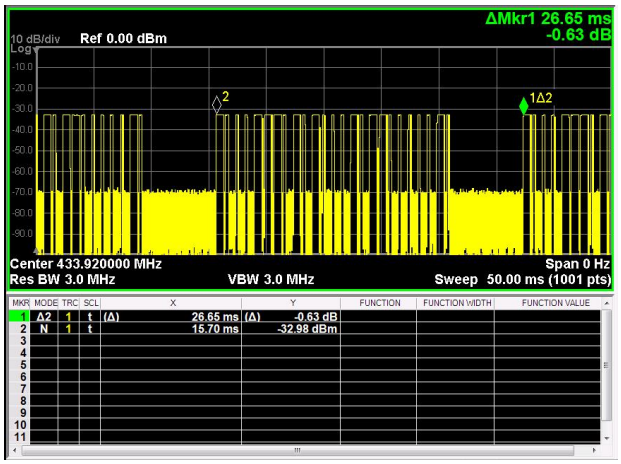

	

Fig.1	Fig.2

6. TEST SETUP PHOTOS

refer to the RF report：CISRR25011715105

7. EXTERNAL AND INTERNAL PHOTOS

7.1 External photos

refer to the RF report：CISRR25011715105

7.2 Internal photos

refer to the RF report：CISRR25011715105

------End of the report------