FCC RADIO TEST REPORT

FCC ID: Q6WTX5100LR

Sample： Smart Control

Trade Name： Light Wave

Main Model： TX-5100-LR

Additional Model： N/A

Report No.： UNIA22031035ER-61

Prepared for

STEELMATE CO., LTD.

Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan, China

Prepared by

Shenzhen United Testing Technology Co., Ltd.

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TEST RESULT CERTIFICATION

Applicant	:	STEELMATE CO., LTD.
Address	:	Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan, China
Manufacturer	:	STEELMATE CO., LTD.
Address	:	Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan, China

Product description

Product	:	Smart Control
Trade Name	:	Light Wave
Model Name	:	TX-5100-LR
Test Methods	:	FCC Rules and Regulations Part 15 Subpart C Section 15.249, ANSI C63.10: 2013

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

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Date of Test	:	
Date (s) of performance of tests	:	Mar. 10, 2022 ~ Apr. 06, 2022
Date of Issue	:	Apr. 21, 2022
Test Result	:	Pass

Prepared by: Jackson Fang

Jackson Fang/Editor

Reviewer: kahn.yang

Kahn yang/Supervisor

Approved & Authorized Signer: liuze

Liuze/Manager

Table of Contents Page

1 TEST SUMMARY 4
2 GENERAL INFORMATION 7
2.1 GENERAL DESCRIPTION OF EUT 7
2.2 CARRIER FREQUENCY OF CHANNELS 8
2.3 TEST MODE 8
2.4 TEST SETUP 8
2.5 DESCRIPTION TEST PERIPHERAL AND EUT PERIPHERAL 9
2.6 MEASUREMENT INSTRUMENTS LIST 10
3 CONDUCTED EMISSION 11
3.1 TEST LIMIT 11
3.2 TEST SETUP 11
3.3 TEST PROCEDURE 12
3.4 TEST RESULT 12
4 RADIATED EMISSION 13
4.1 TEST LIMIT 13
4.2 TEST SETUP 14
4.3 TEST PROCEDURE 15
4.4 TEST RESULT 15
5 OCCUPIED BANDWIDTH 20
5.1 TEST SETUP 20
5.2 TEST PROCEDURE 20
5.3 TEST RESULT 20
6 ANTENNA REQUIREMENT 22
7 PHOTO OF TEST 23
7.1 RADIATED EMISSION 23
7.2 CONDUCTED EMISSION 24

1 TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

ITEM	STANGARD	RESULT
CONDUCTED EMISSION	FCC Part 15.207	N/A
RADIATED EMISSION	FCC Part 15.209/15.249	COMPLIANT
BAND EDGE	FCC Part 15.205/15.249	COMPLIANT
OCCUPIED BANDWIDTH	FCC Part 15.215	COMPLIANT
ANTENNA REQUIREMENT	FCC Part 15.203	COMPLIANT

1.2 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements. This approval result is accepted by MRA of APLAC.

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

A2LA Certificate Number: 4747.01
The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 674885
The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 21947
The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

1.3 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 %.

A. Conducted Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 150kHz	2.96	
		150kHz ~ 30MHz	2.44	

B. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 30MHz	2.50	
		30MHz ~ 1000MHz	4.80	
		Above 1000MHz	4.13	

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product:	Smart Control
Trade Name:	Light Wave
Main Model:	TX-5100-LR
Additional Model:	N/A
Model Difference:	N/A
FCC ID:	Q6WTX5100LR
Operation Frequency:	911.85MHz
Number of Channels:	1CH
Modulation Type:	ASK
Antenna Type:	Internal Antenna
Antenna Gain:	0dBi
Battery:	CR2450
Adapter:	N/A
Power Source:	DC 3V from battery

2.2 CARRIER FREQUENCY OF CHANNELS

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	911.85						

2.3 TEST MODE

The EUT was programmed to be in continuously transmitting mode.

Channel List		
Test Channel	EUT Channel	Test Frequency (MHz)
Only one channel	CH01	911.85

2.4 TEST SETUP

Operation of EUT during Radiation testing:

2.5 DESCRIPTION TEST PERIPHERAL AND EUT PERIPHERAL

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	Mfr/Brand	Model/Type No.	Note
E-1	Smart Control	Light Wave	TX-5100-LR	EUT

Item	Shielded Type	Ferrite Core	Length	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.
3. “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.6 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
Conduction Emissions Measurement					
1	Conducted Emission Test Software	EZ-EMC	Ver.CCS-3A1-CE	N/A	N/A
2	AMN	Schwarzbeck	NNLK8121	8121370	2022.09.22
3	AAN	TESEQ	T8-Cat6	38888	2022.09.22
4	Pulse Limiter	CYBRTEK	EM5010	E115010056	2022.05.17
5	EMI Test Receiver	Rohde&Schwarz	ESCI	101210	2022.09.22
Radiated Emissions Measurement					
1	Radiated Emission Test Software	EZ-EMC	Ver.CCS-03A1	N/A	N/A
2	Horn Antenna	Sunol	DRH-118	A101415	2022.09.27
3	Broadband Hybrid Antenna	Sunol	JB1	A090215	2024.02.26
4	PREAMP	HP	8449B	3008A00160	2022.09.22
5	PREAMP	HP	8447D	2944A07999	2022.05.17
6	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2022.09.22
7	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2022.09.22
8	Signal Generator	Agilent	E4421B	MY4335105	2022.09.22
9	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2022.09.22
10	MXA Signal Analyzer	Keysight	N9020A	MY51110104	2022.09.22
11	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2022.05.17
12	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2022.05.17
13	RF power divider	Anritsu	K241B	992289	2022.09.22
14	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2022.09.22
15	Active Loop Antenna	Com-Power	AL-130R	10160009	2022.07.25
16	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2022.09.22
17	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2022.05.23
18	Horn Antenna	A-INFOMW	LB-180400-KF	J211060660	2022.09.27
19	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2022.09.22
20	Signal Generator	Agilent	N5183A	MY47420153	2022.09.22
21	Spctrum Analyzer	Rohde&Schwarz	FSP 40	100501	2022.09.22
22	Power Meter	KEYSIGHT	N1911A	MY50520168	2022.09.22
23	Frequency Meter	VICTOR	VC2000	997406086	2022.09.22
24	DC Power Source	HYELEC	HY5020E	055161818	2022.09.22

3 CONDUCTED EMISSION

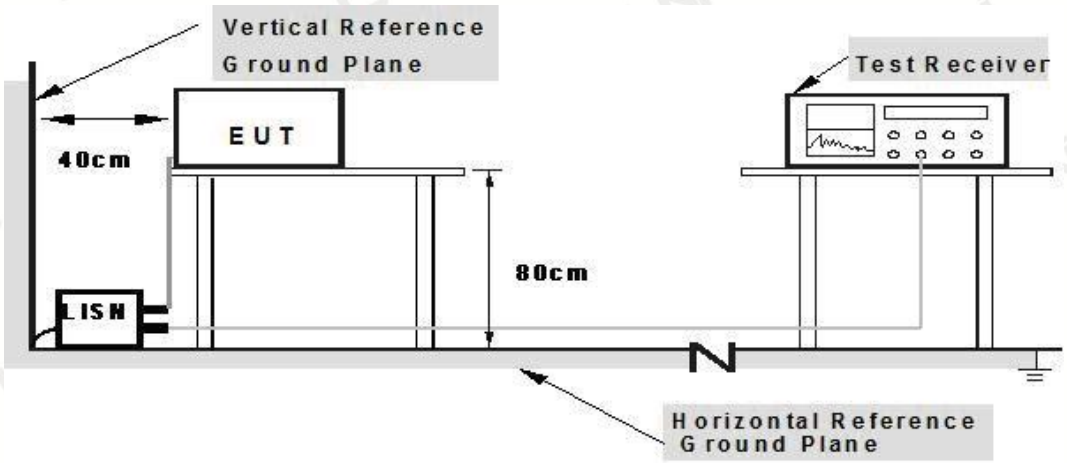
3.1 TEST LIMIT

For unintentional device, according to § 15.207(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency.
For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.3 TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is placed on a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

3.4 TEST RESULT

N/A

Remark: EUT is powered by DC 3V of a CR2450 battery.

4 RADIATED EMISSION

4.1 TEST LIMIT

1. Limit (Field strength of the fundamental signal):

Frequency	Limit(dBuV/m@3m)	Remark
902MHz-928MHz	94.00	Average Value
	114.00	Peak Value

2. Limit (Spurious Emissions):

Frequency	Limit(dBuV/m@3m)	Remark
0.009-0.490	2400/F(KHz)	Quasi-peak Value
0.490-1.705	24000/F(KHz)	Quasi-peak Value
1.705-30	30	Quasi-peak Value
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

3. Limit (Band edge):

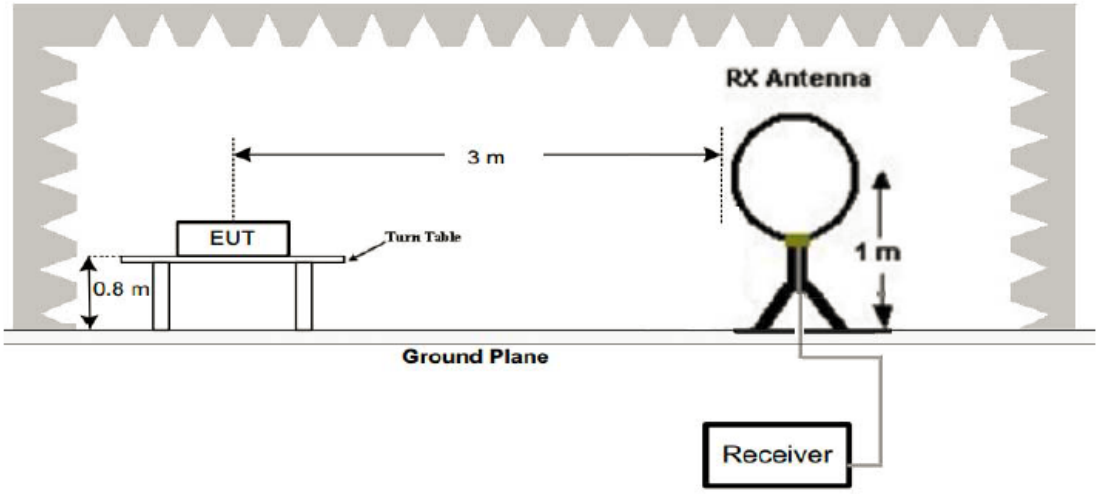
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

4. Receiver Setup:

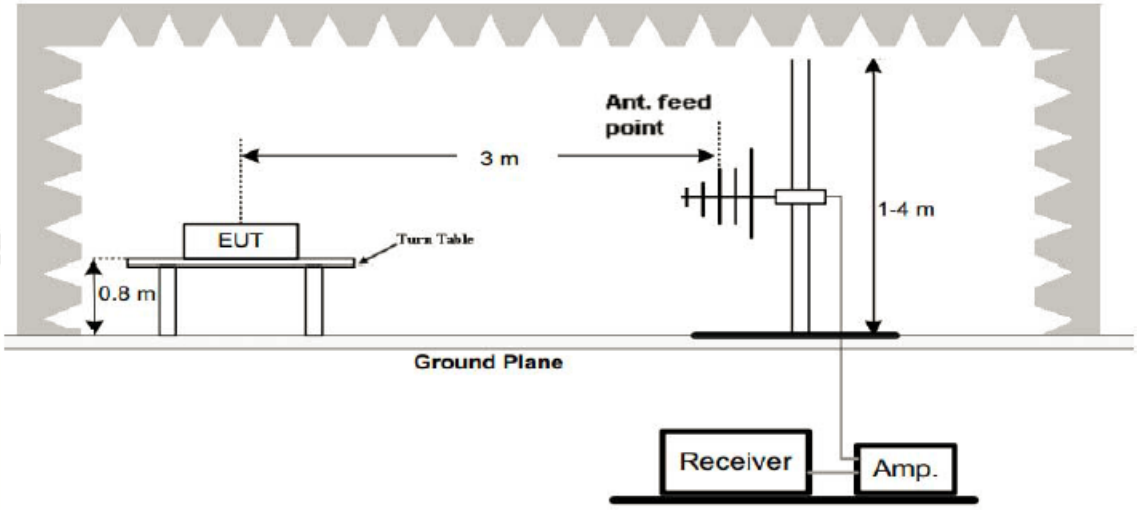
Frequency	Detector	RBW	VBW	Remark
9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

4.2 TEST SETUP

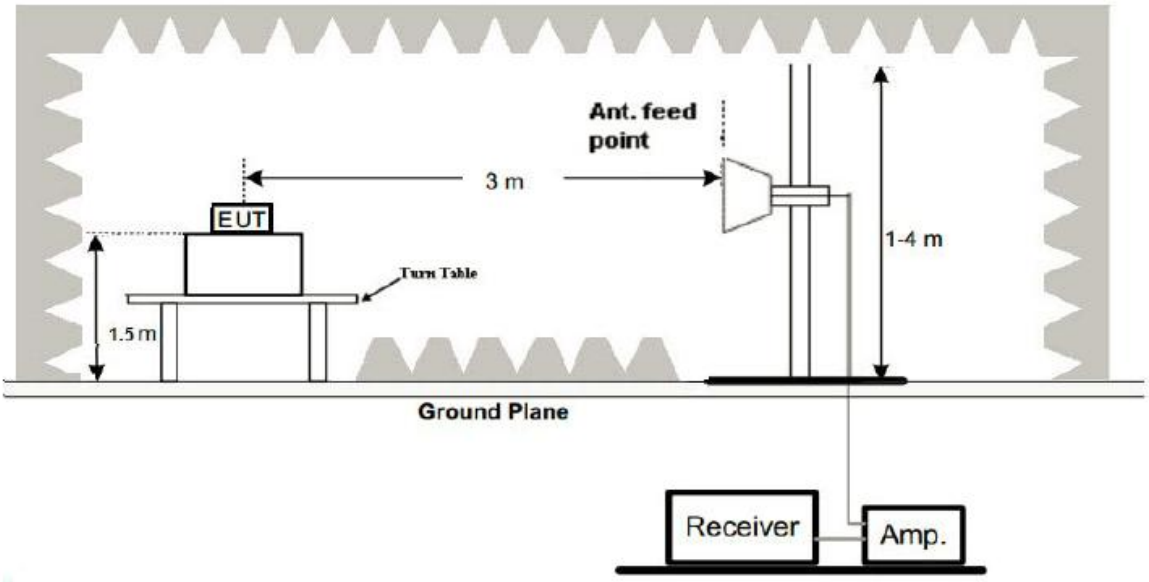
1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz



4.3 TEST PROCEDURE

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber in below 1GHz, 1.5m above the ground in above 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. 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.
4. 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. 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.

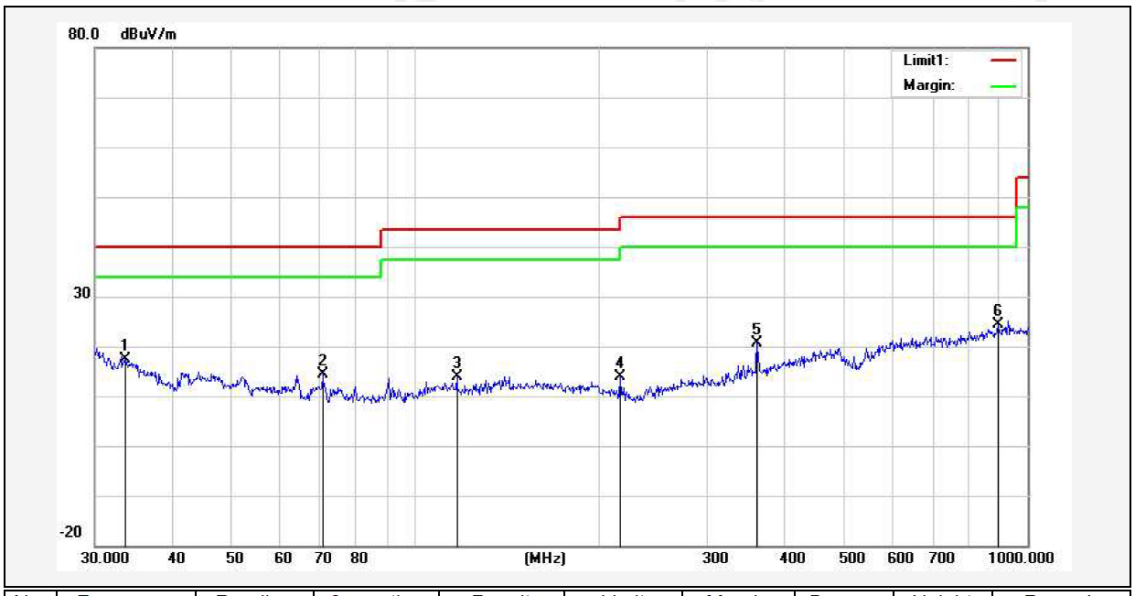
4.4 TEST RESULT

PASS

Remark:
1. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “X axis” position was the worst, and test data recorded in this report.
2. Radiated emission test from 9kHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9kHz to 30MHz and not recorded in this report.

Below 1GHz Test Results:

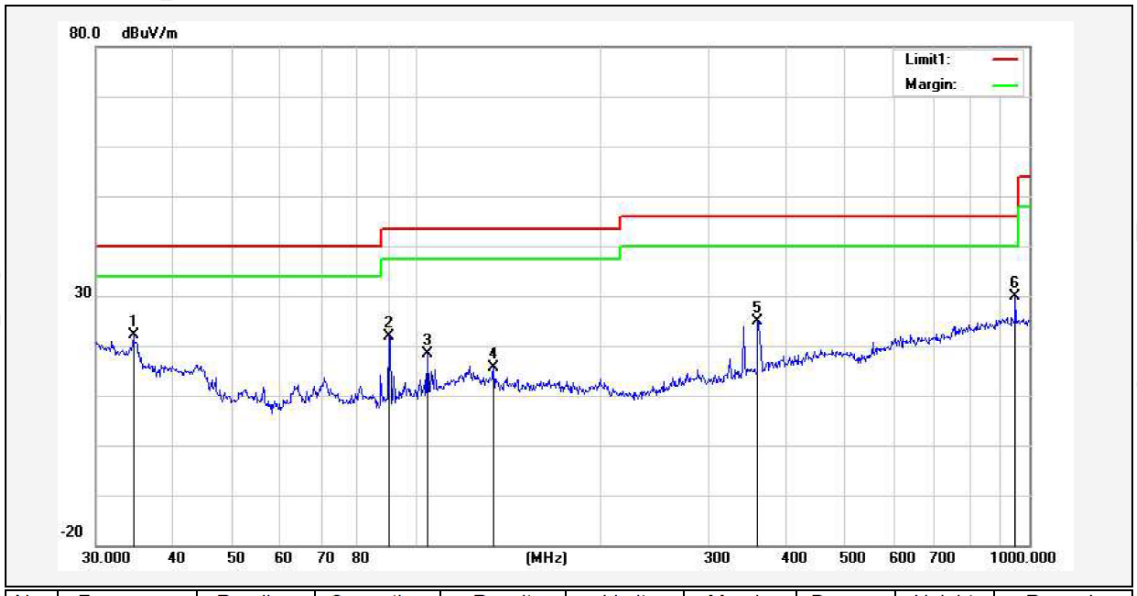
Temperature:	24℃	Relative Humidity:	48%
Test Date:	Mar. 24, 2022	Pressure:	1010hPa
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	Transmitting mode of 911.85MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	33.5623	27.07	-9.79	17.28	40.00	-22.72	60	100	peak
2	70.5836	35.00	-20.67	14.33	40.00	-25.67	80	100	peak
3	116.9495	30.58	-16.64	13.94	43.50	-29.56	100	100	peak
4	216.0240	31.12	-17.28	13.84	46.00	-32.16	120	100	peak
5	361.7140	34.46	-13.91	20.55	46.00	-25.45	180	100	peak
6*	893.8567	29.65	-5.32	24.33	46.00	-21.67	200	100	peak

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Mar. 24, 2022	Pressure:	1010hPa
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	Transmitting mode of 911.85MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	34.5172	32.74	-10.50	22.24	40.00	-17.76	90	100	peak
2	90.2205	42.51	-20.71	21.80	43.50	-21.70	100	100	peak
3	104.1701	36.79	-18.37	18.42	43.50	-25.08	120	100	peak
4	133.6186	31.55	-16.01	15.54	43.50	-27.96	180	100	peak
5	360.4476	38.81	-13.92	24.89	46.00	-21.11	200	100	peak
6*	948.7610	35.07	-5.20	29.87	46.00	-16.13	220	100	peak

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Remark：

1. Measuring frequencies from 9 kHz to the 1 GHz, Radiated emission test from 9kHz to 30MHzwas verified, and no any emission was found except system noise floor.
2. * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
3. The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120kHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10kHz.

Above 1 GHz Test Results:

CH01 (911.85MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
911.85	103.60	-7.68	95.92	114	-18.08	PK
911.85	89.44	-7.68	81.76	94	-12.24	AV
1823.7	70.30	-6.55	63.75	74	-10.25	PK
1823.7	54.11	-6.55	47.56	54	-6.44	AV
2735.55	70.10	-5.72	64.38	74	-9.62	PK
2735.55	53.87	-5.72	48.15	54	-5.85	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
911.85	103.46	-7.68	95.78	114	-18.22	PK
911.85	89.20	-7.68	81.52	94	-12.48	AV
1823.7	70.35	-6.55	63.80	74	-10.20	PK
1823.7	54.15	-6.55	47.60	54	-6.40	AV
2735.55	69.95	-5.72	64.23	74	-9.77	PK
2735.55	53.92	-5.72	48.20	54	-5.80	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Remark:
1. Measuring frequencies from 1 GHz to the 10 GHz.
2. “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
3. * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
4. Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120kHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10kHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
6. When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
7. For fundamental frequency, RBW>20dB Bandwidth, VBW>=3*RBW, Peak detector for PK value, RMS detector for AV value.

Band Edge:

Operation Mode: TX CH01 (911.85MHz)

Horizontal:

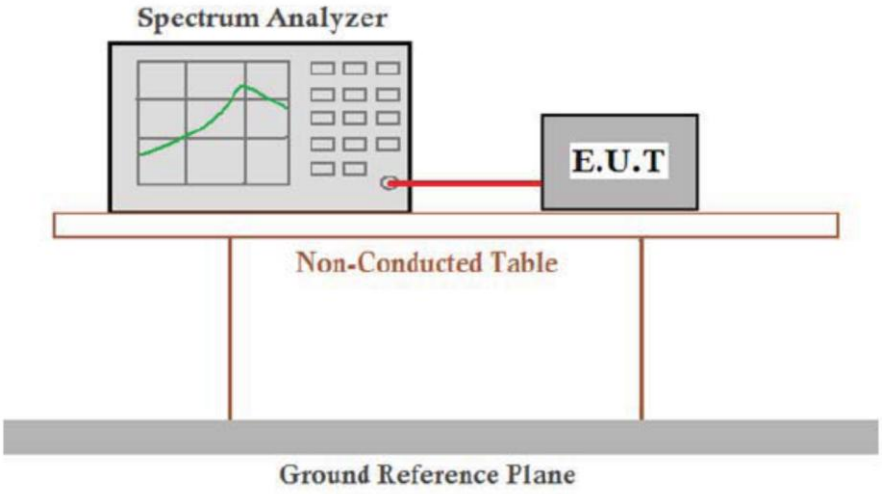
Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
902	42.48	-7.68	34.80	46	-11.20	PK
928	37.52	-7.68	29.84	46	-16.16	PK
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
902	42.02	-7.68	34.34	46	-11.66	PK
928	36.90	-7.68	29.22	46	-16.78	PK
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

5 OCCUPIED BANDWIDTH

5.1 TEST SETUP



5.2 TEST PROCEDURE

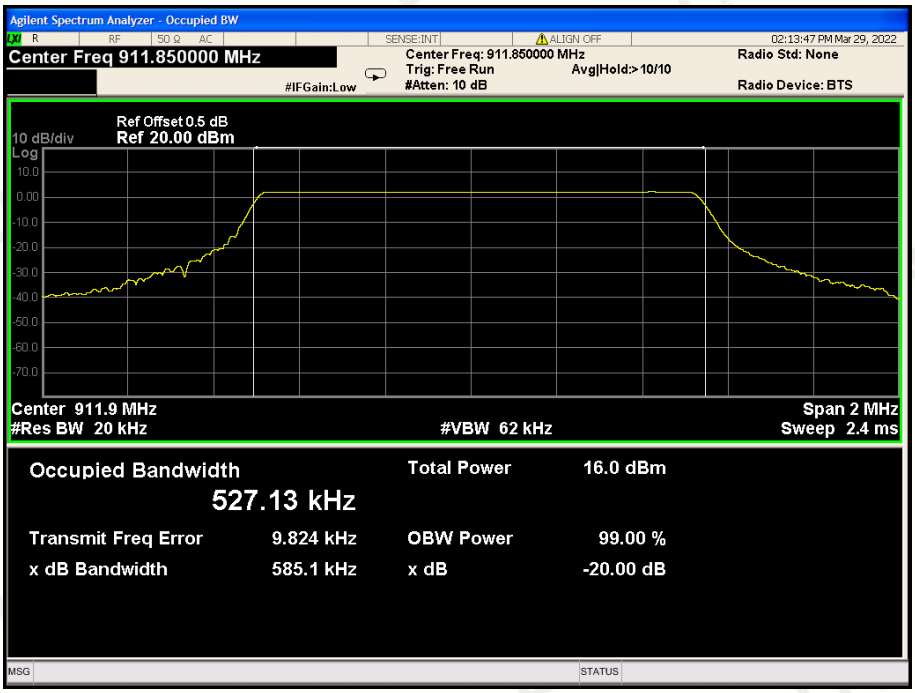
1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW≥1% of the 20dB bandwidth; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.
4. Measure and record the results in the test report.

5.3 TEST RESULT

PASS

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Result
CH01	911.85	585.10	PASS

CH01: 911.85MHz

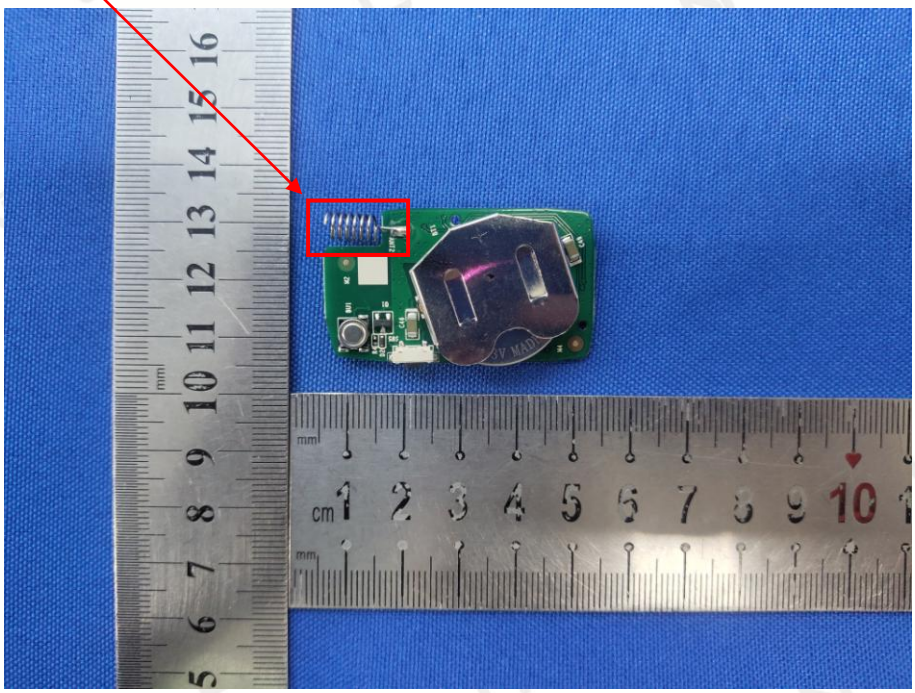


6 ANTENNA REQUIREMENT

Standard Applicable:
For intentional device, according to FCC 47 CFR 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.

Antenna Connected Construction
The antenna used in this product is an Internal Antenna, The directional gains of antenna used for transmitting is 0dBi.

ANTENNA:



7 PHOTO OF TEST

7.1 RADIATED EMISSION

7.2 CONDUCTED EMISSION

N/A

End of Report