中认信通
CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)

ACCREDITED
TESTING LABORATORY
CERTIFICATE # 6356.01

TEST REPORT

Applicant: **Wenzhou Morning Electronics Co.,LTD**

Address: NO.238,Wei 11 Road, Yueging Economic Development Zone, Yueqing, China

FCC ID: **2AT8P-ZSS-S01-GWM-C**

Product Name: **Smart Sensor**

Standard(s): **47 CFR Part 15, Subpart C(15.247)**
ANSI C63.10-2013
KDB 558074 D01 15.247 Meas Guidance v05r02

The above device has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

Report Number: **CR231058663-00B**

Date Of Issue: **2023/10/25**

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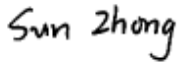
Title: RF Engineer

Approved By: **Sun Zhong**



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Test Facility

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

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. : 442868, the FCC Designation No. : CN1314.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0123.

Declarations

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CONTENTS

DOCUMENT REVISION HISTORY 5

1. GENERAL INFORMATION 6

1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 6

1.2 DESCRIPTION OF TEST CONFIGURATION 7

1.2.1 EUT Operation Condition: 7
1.2.2 Support Equipment List and Details 7
1.2.3 Support Cable List and Details 7
1.2.4 Block Diagram of Test Setup 7

1.3 MEASUREMENT UNCERTAINTY 8

2. SUMMARY OF TEST RESULTS 9

3. REQUIREMENTS AND TEST PROCEDURES 10

3.1 AC LINE CONDUCTED EMISSIONS 10

3.1.1 Applicable Standard 10
3.1.2 EUT Setup 11
3.1.3 EMI Test Receiver Setup 11
3.1.4 Test Procedure 12
3.1.5 Corrected Amplitude & Margin Calculation 12

3.2 RADIATION SPURIOUS EMISSIONS 13

3.2.1 Applicable Standard 13
3.2.2 EUT Setup 13
3.2.3 EMI Test Receiver & Spectrum Analyzer Setup 14
3.2.4 Test Procedure 15
3.2.5 Corrected Amplitude & Margin Calculation 15

3.3 MINIMUM 6 DB BANDWIDTH 16

3.3.1 Applicable Standard 16
3.3.2 EUT Setup 16
3.3.3 Test Procedure 16

3.4 MAXIMUM CONDUCTED OUTPUT POWER 17

3.4.1 Applicable Standard 17
3.4.2 EUT Setup 17
3.4.3 Test Procedure 17

3.5 MAXIMUM POWER SPECTRAL DENSITY 18

3.5.1 Applicable Standard 18
3.5.2 EUT Setup 18
3.5.3 Test Procedure 18

3.6 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE 19

3.6.1 Applicable Standard 19
3.6.2 EUT Setup 19
3.6.3 Test Procedure 19

3.7 DUTY CYCLE 20

3.7.1 EUT Setup 20
3.7.2 Test Procedure 20

3.8 ANTENNA REQUIREMENT 21
3.8.1 Applicable Standard 21
3.8.2 Judgment 21
4. Test DATA AND RESULTS 22
4.1 AC LINE CONDUCTED EMISSIONS 22
4.2 RADIATION SPURIOUS EMISSIONS 23
4.3 6 DB EMISSION BANDWIDTH 38
4.4 MAXIMUM CONDUCTED OUTPUT POWER 40
4.5 MAXIMUM POWER SPECTRAL DENSITY 42
4.6 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE 44
4.7 DUTY CYCLE 46
5. RF EXPOSURE EVALUATION 48
5.1 APPLICABLE STANDARD 48
5.2 PROCEDURE 48
5.3 MEASUREMENT RESULT 48
6. EUT PHOTOGRAPHS 49
7. TEST SETUP PHOTOGRAPHS 50

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	CR231058663-00B	Original Report	2023/10/25

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Name:	Smart Sensor
EUT Model:	ZSS-S01-GWM-C
Multiple Models:	ZSS-X-PIR-C, ZSS-X-PIRL-C, ZSS-S01-GWM-C, ZSS-S01-TH, ZSS-S01-HP, ZSS-S01-VBR, ZSS-S01-PIR, ZSS-S01-GL, ZSS-S01-SOS, ZSS-S01-WL, ZSS-S01-CO, ZSS-X-CO2, ZSS-KB-TH-LF-C, BSS-S01-CO, BSS-X-CO2, BSS-S01-PIR, BSS-S01-GL, BSS-S01-GWM, XZ-CGV3, KCTW1Z-04, S01-CO, S01-CO2, S01-NRD, BSS-S01-PT
Operation Frequency:	2405-2480 MHz
Maximum Peak Output Power (Conducted):	2.14 dBm
Modulation Type:	O-QPSK
Rated Input Voltage:	DC 3V by CR2032 Button Battery
Serial Number:	2COF-1 (for Radiated Emissions Test) 2COF-2 (for RF Conducted Test)
EUT Received Date:	2023/10/11
EUT Received Status:	Good
Note: The Multiple models are electrically identical with the test model. Please refer to the declaration letter for more detail, which was provided by manufacturer.	

Operation Frequency Detail:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	**2405**	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	**2440**	26	**2480**

Per section 15.31(m), the below frequencies were performed the test as below:

Test Channel	Frequency (MHz)
Lowest	2405
Middle	2440
Highest	2480

Antenna Information Detail▲:

Antenna Type	input impedance (Ohm)	Frequency Range	Antenna Gain
Built-in PCB Antenna	50	2.4~2.5GHz	1.08 dBi

The Method of §15.203 Compliance:

☒Antenna was permanently attached to the unit.

☐Antenna use a unique type of connector to attach to the EUT.

☐Unit was professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Accessory Information:

Accessory Description	Manufacturer	Model	Parameters
/	/	/	/

1.2 Description of Test Configuration

1.2.1 EUT Operation Condition:

For BLE:

EUT Operation Mode:	The system was configured for testing in Engineering Mode, which was provided by the manufacturer.
Equipment Modifications:	No
EUT Exercise Software:	EMI Test Tool.exe

The software was provided by manufacturer. The maximum power was configured as below, that was provided by the manufacturer▲:

Test Modes	Power Level Setting		
	Lowest Channel	Middle Channel	Highest Channel
ZigBee	3.9	3.9	3.9

1.2.2 Support Equipment List and Details

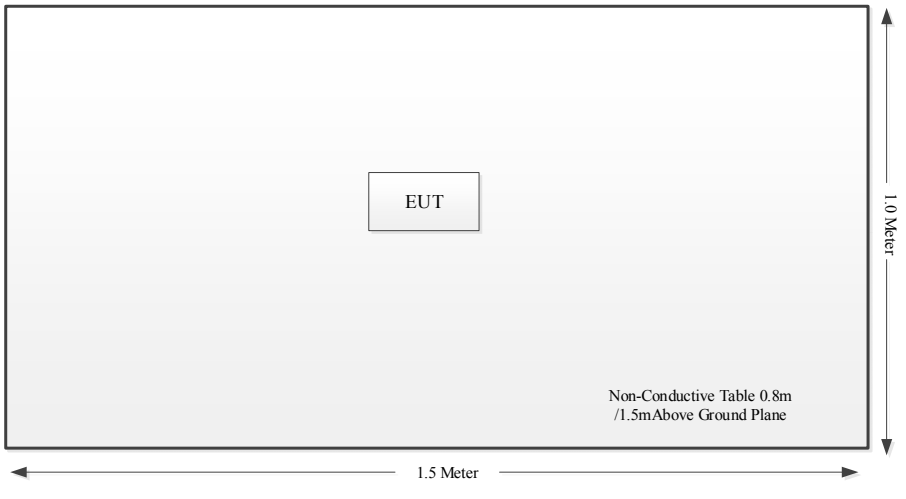
Manufacturer	Description	Model	Serial Number
/	/	/	/

1.2.3 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
/	/	/	/	/	/

1.2.4 Block Diagram of Test Setup

Radiated Spurious Emissions:



1.3 Measurement Uncertainty

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

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	9kHz~30MHz: 4.12 dB 30M~200MHz: 4.15 dB,200M~1GHz: 5.61 dB,1G~6GHz: 5.14 dB, 6G~18GHz: 5.93 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB
Unwanted Emissions, conducted	±1.26 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	2.8 dB (150 kHz to 30 MHz)

2. SUMMARY OF TEST RESULTS

Standard(s) Section	Test Items	Result
§15.207(a)	AC line conducted emissions	Not Applicable
§15.205, §15.209, §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	Minimum 6 dB Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.203	Antenna Requirement	Compliant
FCC§15.247 (i) & §1.1307	RF Exposure Evaluation	Compliant

Note:
Not Applicable: *The device is powered by button battery, so this test item is not applicable.*

3. REQUIREMENTS AND TEST PROCEDURES

3.1 AC Line Conducted Emissions

3.1.1 Applicable Standard

FCC§15.207(a).

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

	Conducted limit (dBμV)	
Frequency of emission (MHz)	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.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

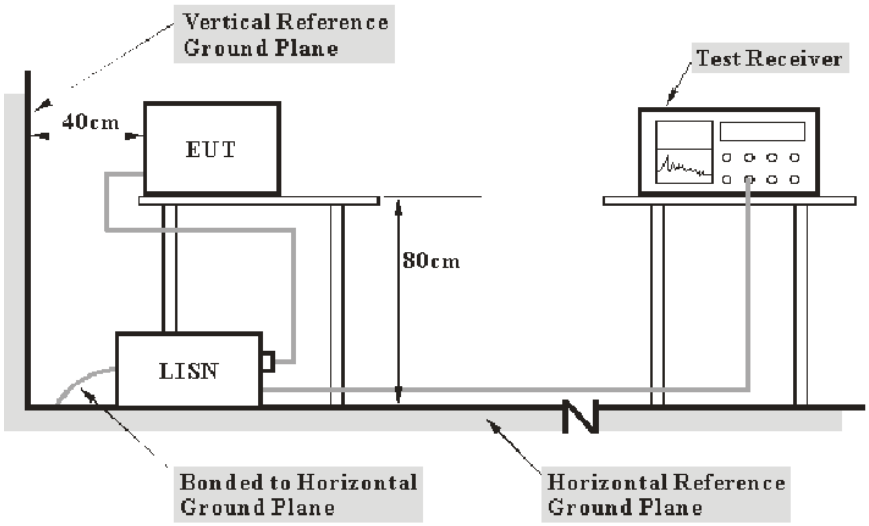
(1) For carrier current system containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 μV within the frequency band 535-1705 kHz, as measured using a 50 μH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtainig their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

3.1.2 EUT Setup



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

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter or EUT was connected to the main LISN with a 120 V/60 Hz AC power source.

3.1.3 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

3.1.4 Test Procedure

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase ("hot") line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

3.1.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor
Factor = attenuation caused by cable loss + voltage division factor of AMN

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

3.2 Radiation Spurious Emissions

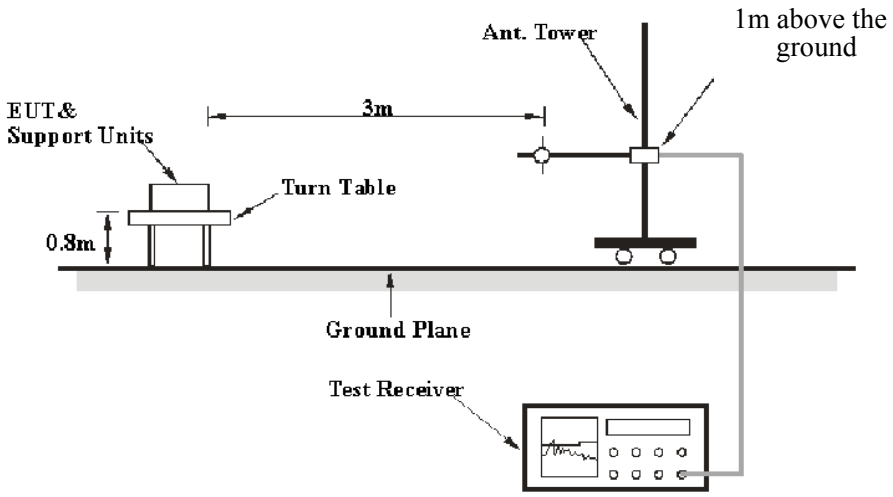
3.2.1 Applicable Standard

FCC §15.247 (d);

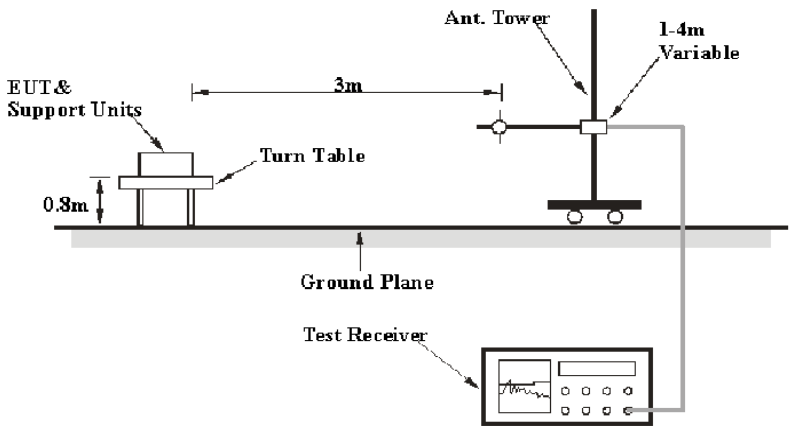
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

3.2.2 EUT Setup

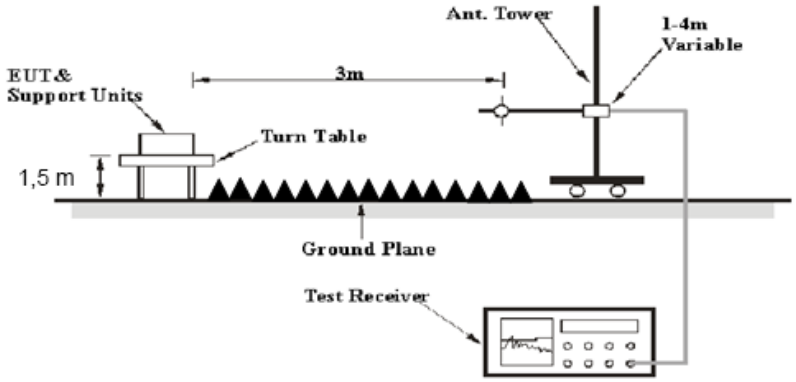
9kHz-30MHz:



30MHz-1GHz:



Above 1GHz:



The radiated emissions were performed in the 3 meters distance, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

For 9kHz-30MHz test, the lowest height of the magnetic antenna shall be 1 m above the ground and three antenna orientations (parallel, perpendicular, and ground-parallel) shall be measured.

3.2.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 9kHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

9 kHz-1000 MHz

Frequency Range	RBW	Video B/W	IF B/W	Measurement
9 kHz – 150 kHz	300 Hz	1 kHz	200 Hz	QP/AV
150 kHz – 30 MHz	10 kHz	30 kHz	9 kHz	QP/AV
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
Ave.	>98%	1MHz	10 Hz
	<98%	1MHz	≥1/T

Note: T is minimum transmission duration

If the maximized peak measured value is under the QP/Average limit by more than 6dB, then it is unnecessary to perform an QP/Average measurement.

The spurious emissions which below the limit more than 20dB was not be recorded.

3.2.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 9 kHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

The spurious emissions which below the limit more than 20dB was not be recorded.

3.2.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor
Factor = Antenna Factor + Cable Loss- Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

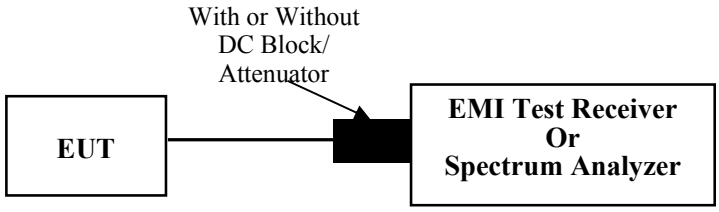
3.3 Minimum 6 dB Bandwidth

3.3.1 Applicable Standard

FCC §15.247 (a)(2)

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

3.3.2 EUT Setup



3.3.3 Test Procedure

According to ANSI C63.10-2013 Section 11.8

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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 6 dB relative to the maximum level measured in the fundamental emission.

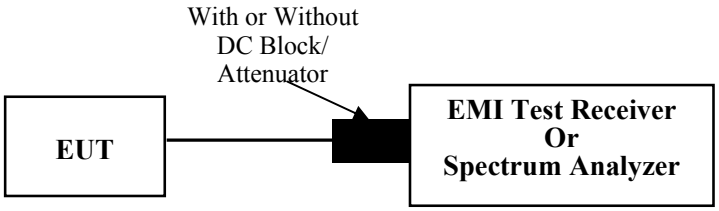
3.4 Maximum Conducted Output Power

3.4.1 Applicable Standard

FCC §15.247 (b)(3)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

3.4.2 EUT Setup



3.4.3 Test Procedure

According to ANSI C63.10-2013 Section 11.9.1.1

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:
a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

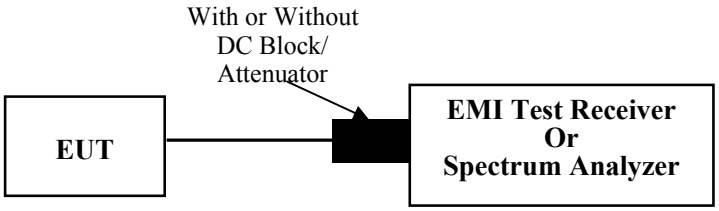
3.5 Maximum power spectral density

3.5.1 Applicable Standard

FCC §15.247 (e)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

3.5.2 EUT Setup



3.5.3 Test Procedure

According to ANSI C63.10-2013 Section 11.10.2

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ [3 × RBW].
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

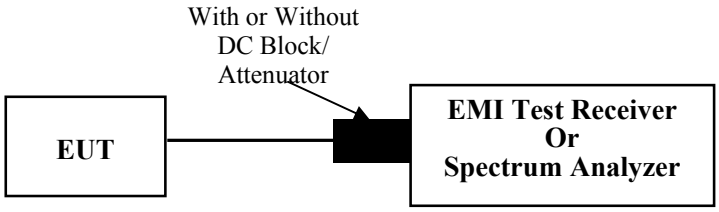
3.6 100 kHz Bandwidth of Frequency Band Edge

3.6.1 Applicable Standard

FCC §15.247 (d);

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

3.6.2 EUT Setup



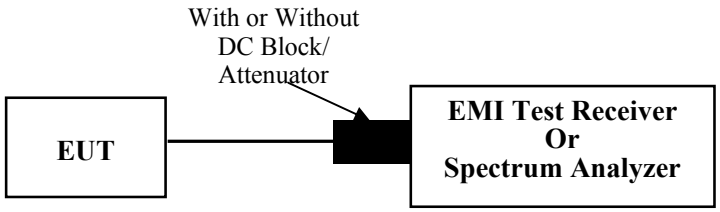
3.6.3 Test Procedure

According to ANSI C63.10-2013 Section 11.11

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

3.7 Duty Cycle

3.7.1 EUT Setup



3.7.2 Test Procedure

According to ANSI C63.10-2013 Section 11.6

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:
1) Set the center frequency of the instrument to the center frequency of the transmission.
2) Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
3) Set VBW ≥ RBW. Set detector = peak or average.
4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if T ≤ 16.7 μs.)

3.8 Antenna Requirement

3.8.1 Applicable Standard

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, 15.221, or §15.236. 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.

3.8.2 Judgment

Compliant. Please refer to the Antenna Information detail in Section 1.

4. Test DATA AND RESULTS

4.1 AC Line Conducted Emissions

Not Applicable, the device was powered by battery when operating.

4.2 Radiation Spurious Emissions

Serial Number:	2COF-1	Test Date:	2023/10/24
Test Site:	966-2,966-1	Test Mode:	Transmitting
Tester:	Jeff Luo, Tao Zhu	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	26.2~26.3	Relative Humidity: (%)	62~65	ATM Pressure: (kPa)	101.2

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
EMCO	Passive Loop Antenna	6512	9706-1209	2023/02/15	2026/02/14
Sunol Sciences	Antenna	JB6	A082520-6	2023/9/18	2026/9/17
R&S	EMI Test Receiver	ESR3	102724	2023/3/31	2024/3/30
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2023/7/16	2024/7/15
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2023/7/16	2024/7/15
Sonoma	Amplifier	310N	186165	2023/7/16	2024/7/15
AH	Double Ridge Guide Horn Antenna	SAS-571	1394	2023/2/22	2025/2/23
R&S	Spectrum Analyzer	FSV40	101591	2023/3/31	2024/3/30
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2023/8/6	2024/8/5
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2023/8/6	2024/8/5
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2022/11/9	2023/11/8
Audix	Test Software	E3	201021 (V9)	N/A	N/A
Quinstar	Horn Antenna	QLW-18405536-JO	15964001005	2023/9/15	2024/9/14
AH	Preamplifier	PAM-1840VH	190	2022/11/9	2023/11/8
MICRO-COAX	Coaxial Cable	UFB142A-1-2362-200200	235772-001	2023/8/6	2024/8/5
E-Microwave	Band Rejection Filter	2400-2483.5MHz	OE01902424	2023/8/6	2024/8/5
Mini Circuits	High Pass Filter	VHF-6010+	31119	2023/8/6	2024/8/5

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:
After pre-scan in the X, Y and Z axes of orientation, the worst case is below:

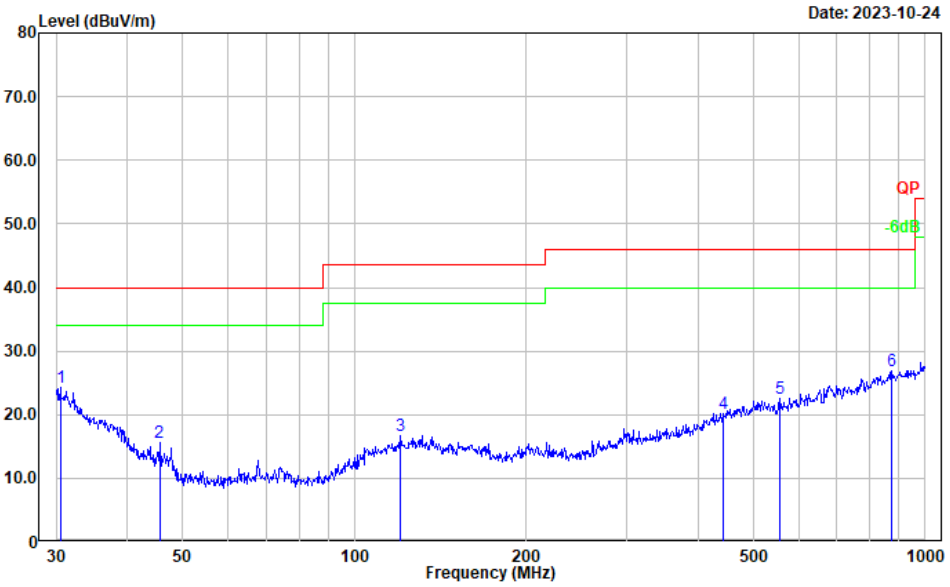
1) 9kHz~30MHz

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

2) 30MHz-1GHz

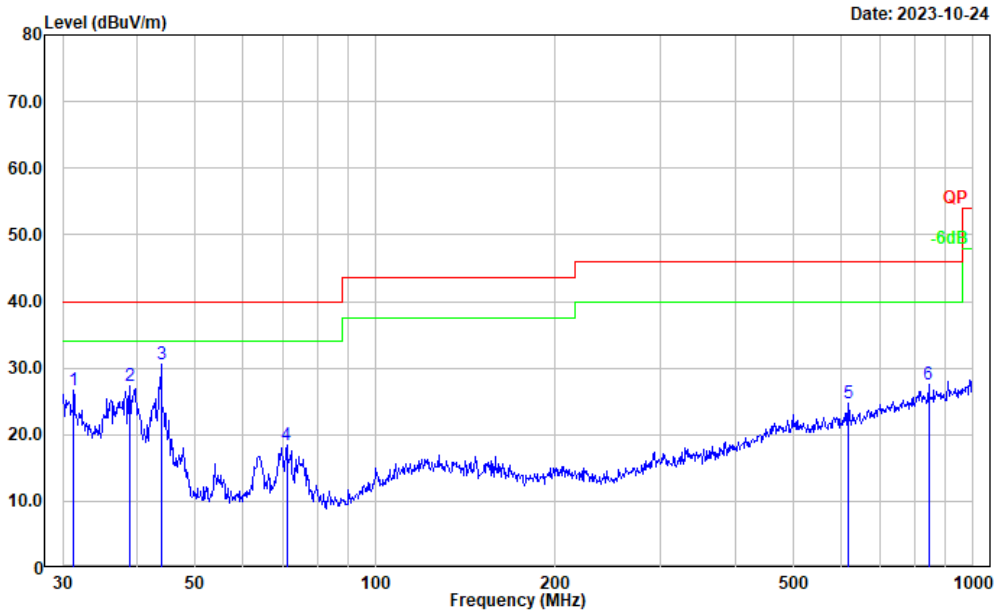
Tested at lowest channel 2405MHz:

Project No.: CR231058663-RF
Tester: Jeff Luo
Polarization: horizontal
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	30.531	28.52	-4.20	24.32	40.00	15.68	Peak
2	45.535	30.10	-14.53	15.57	40.00	24.43	Peak
3	120.277	28.18	-11.44	16.74	43.50	26.76	Peak
4	441.743	27.47	-7.24	20.23	46.00	25.77	Peak
5	554.825	28.29	-5.67	22.62	46.00	23.38	Peak
6	875.247	28.01	-1.18	26.83	46.00	19.17	Peak

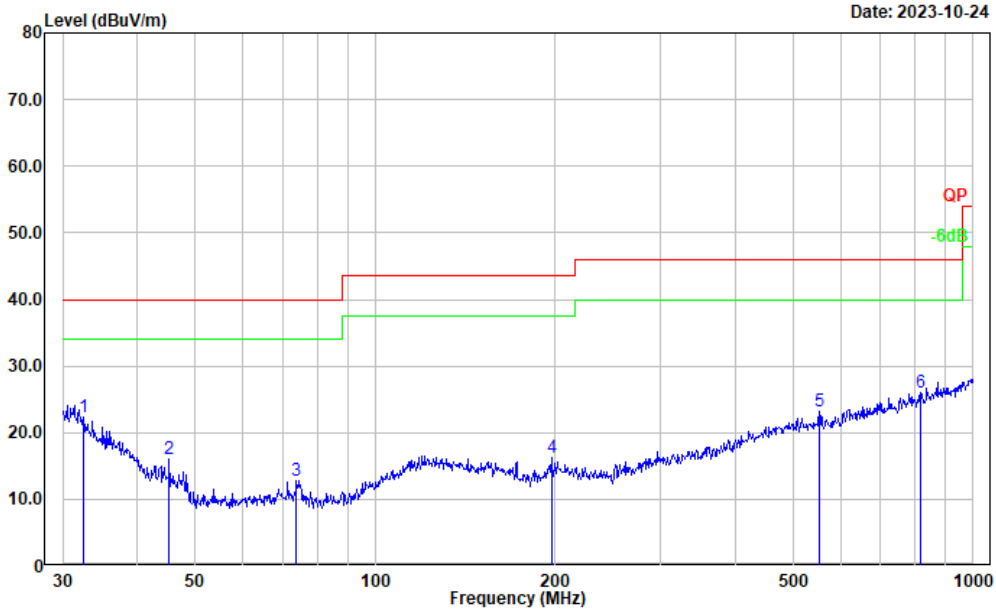
Project No.: CR231058663-RF
Tester: Jeff Luo
Polarization: vertical
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	31.289	31.53	-4.77	26.76	40.00	13.24	Peak
2	38.752	37.85	-10.43	27.42	40.00	12.58	Peak
3	43.812	44.26	-13.58	30.68	40.00	9.32	Peak
4	71.080	35.11	-16.68	18.43	40.00	21.57	Peak
5	618.537	29.53	-4.76	24.77	46.00	21.23	Peak
6	842.130	29.17	-1.71	27.46	46.00	18.54	Peak

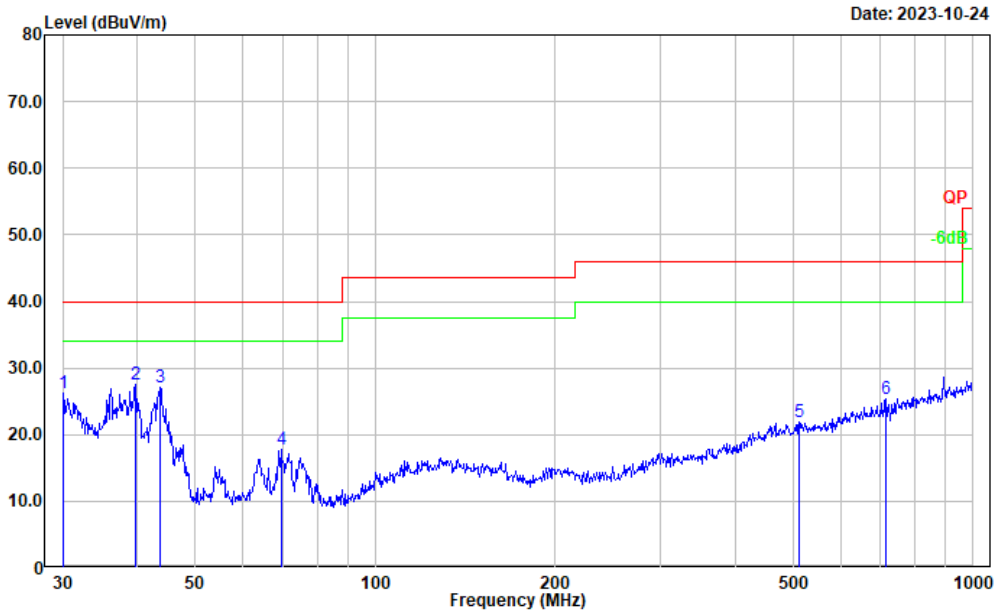
Tested at middle channel 2440MHz:

Project No.: CR231058663-RF
Tester: Jeff Luo
Polarization: horizontal
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	32.520	27.96	-5.71	22.25	40.00	17.75	Peak
2	45.217	30.43	-14.35	16.08	40.00	23.92	Peak
3	73.876	29.79	-16.94	12.85	40.00	27.15	Peak
4	197.200	28.70	-12.52	16.18	43.50	27.32	Peak
5	552.883	28.83	-5.71	23.12	46.00	22.88	Peak
6	815.968	27.82	-1.82	26.00	46.00	20.00	Peak

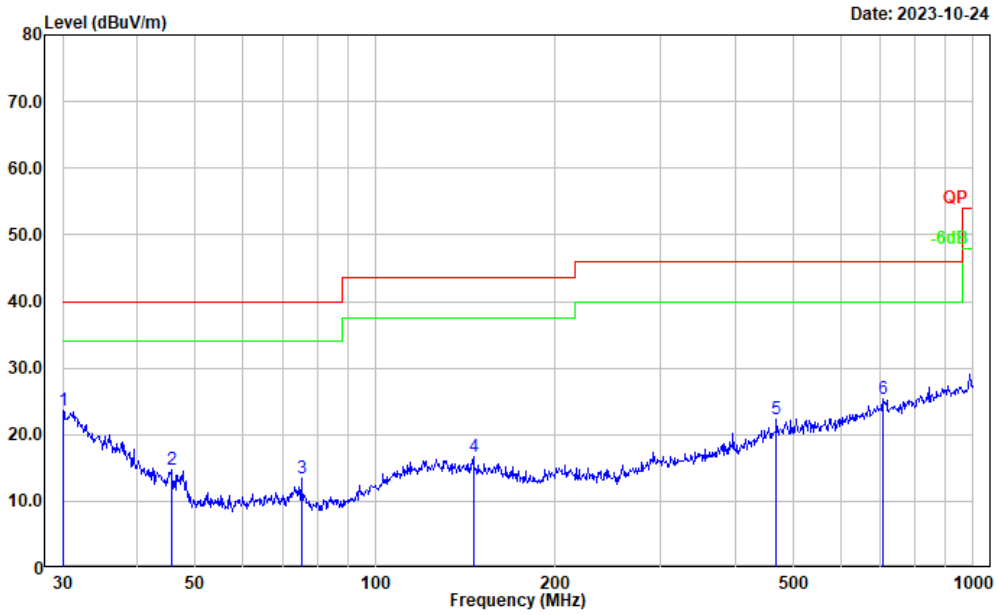
Project No.: CR231058663-RF
Tester: Jeff Luo
Polarization: vertical
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	30.000	30.13	-3.80	26.33	40.00	13.67	Peak
2	39.715	38.75	-11.19	27.56	40.00	12.44	Peak
3	43.659	40.62	-13.49	27.13	40.00	12.87	Peak
4	69.600	34.32	-16.61	17.71	40.00	22.29	Peak
5	511.835	27.74	-5.82	21.92	46.00	24.08	Peak
6	714.173	28.80	-3.49	25.31	46.00	20.69	Peak

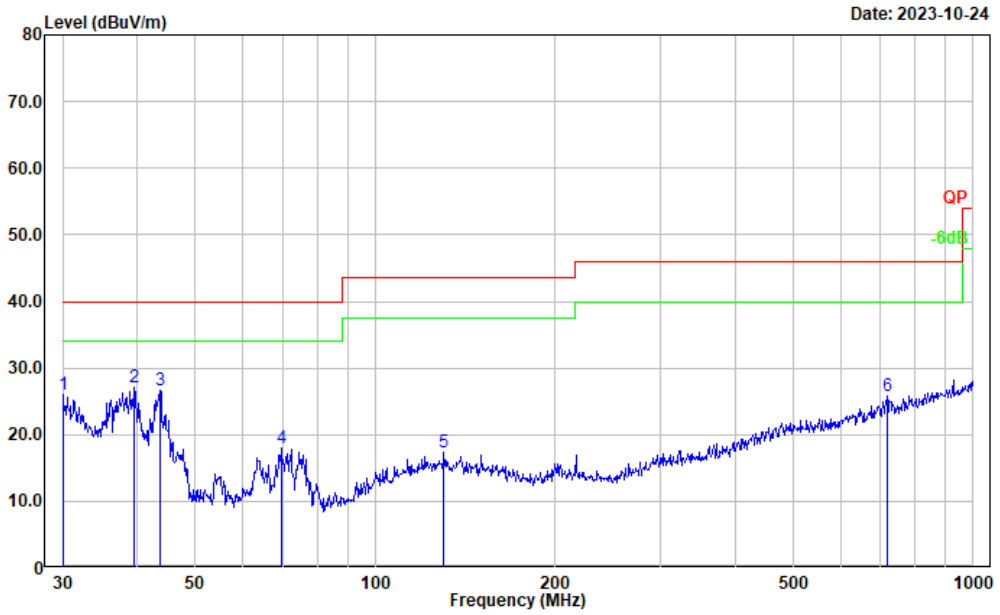
Tested at highest channel 2480MHz:

Project No.: CR231058663-RF
Tester: Jeff Luo
Polarization: horizontal
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	30.105	27.49	-3.88	23.61	40.00	16.39	Peak
2	45.535	29.31	-14.53	14.78	40.00	25.22	Peak
3	75.182	30.36	-17.00	13.36	40.00	26.64	Peak
4	145.861	28.60	-11.87	16.73	43.50	26.77	Peak
5	468.876	28.74	-6.38	22.36	46.00	23.64	Peak
6	706.700	29.01	-3.59	25.42	46.00	20.58	Peak

Project No.: CR231058663-RF
Tester: Jeff Luo
Polarization: vertical
Note:

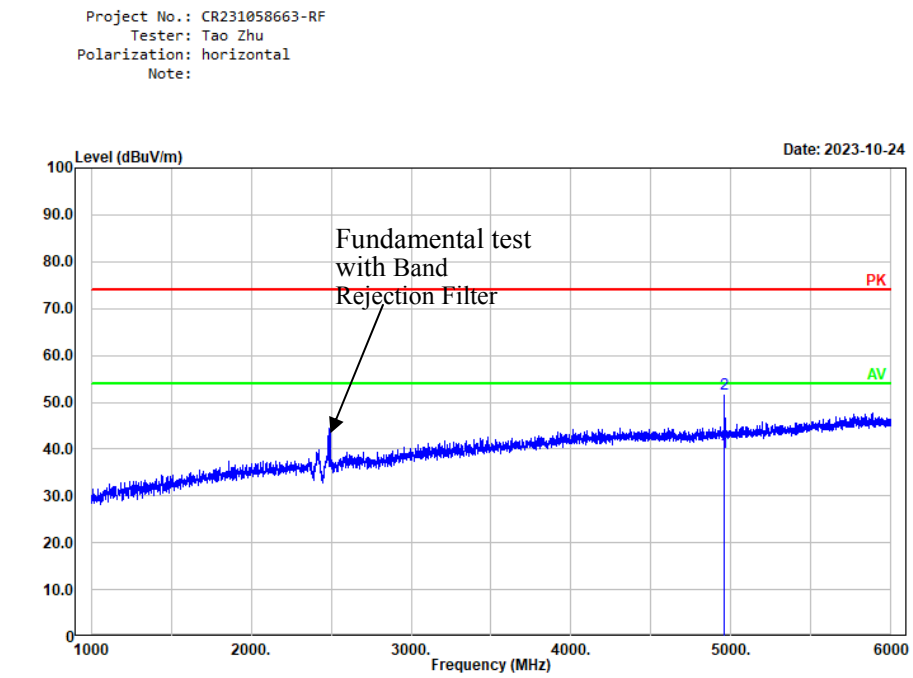


No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	30.000	29.75	-3.80	25.95	40.00	14.05	Peak
2	39.576	38.16	-11.08	27.08	40.00	12.92	Peak
3	43.659	40.18	-13.49	26.69	40.00	13.31	Peak
4	69.600	34.70	-16.61	18.09	40.00	21.91	Peak
5	130.379	28.65	-11.31	17.34	43.50	26.16	Peak
6	716.682	29.19	-3.45	25.74	46.00	20.26	Peak

3) 1-25GHz:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Low Channel: 2405 MHz							
2390.000	26.88	PK	H	31.71	58.59	74.00	15.41
2390.000	13.69	AV	H	31.71	45.40	54.00	8.60
2390.000	26.71	PK	V	31.71	58.42	74.00	15.58
2390.000	13.49	AV	V	31.71	45.20	54.00	8.80
4810.000	38.23	PK	H	11.21	49.44	74.00	24.56
4810.000	25.66	AV	H	11.21	36.87	54.00	17.13
4810.000	37.82	PK	V	11.21	49.03	74.00	24.97
4810.000	24.66	AV	V	11.21	35.87	54.00	18.13
7215.000	33.87	PK	H	15.10	48.97	74.00	25.03
7215.000	20.66	AV	H	15.10	35.76	54.00	18.24
7215.000	33.69	PK	V	15.10	48.79	74.00	25.21
7215.000	20.41	AV	V	15.10	35.51	54.00	18.49
Middle Channel: 2440 MHz							
4880.000	38.69	PK	H	11.48	50.17	74.00	23.83
4880.000	25.77	AV	H	11.48	37.25	54.00	16.75
4880.000	38.12	PK	V	11.48	49.60	74.00	24.40
4880.000	25.42	AV	V	11.48	36.90	54.00	17.10
7320.000	34.23	PK	H	15.58	49.81	74.00	24.19
7320.000	21.25	AV	H	15.58	36.83	54.00	17.17
7320.000	34.07	PK	V	15.58	49.65	74.00	24.35
7320.000	21.20	AV	V	15.58	36.78	54.00	17.22
High Channel: 2480 MHz							
2483.500	26.92	PK	H	32.19	59.11	74.00	14.89
2483.500	13.82	AV	H	32.19	46.01	54.00	7.99
2483.500	26.77	PK	V	32.19	58.96	74.00	15.04
2483.500	13.73	AV	V	32.19	45.92	54.00	8.08
4960.000	40.06	PK	H	11.77	51.83	74.00	22.17
4960.000	27.58	AV	H	11.77	39.35	54.00	14.65
4960.000	39.68	PK	V	11.77	51.45	74.00	22.55
4960.000	26.47	AV	V	11.77	38.24	54.00	15.76
7440.000	34.52	PK	H	15.98	50.50	74.00	23.50
7440.000	21.41	AV	H	15.98	37.39	54.00	16.61
7440.000	33.87	PK	V	15.98	49.85	74.00	24.15
7440.000	20.89	AV	V	15.98	36.87	54.00	17.13

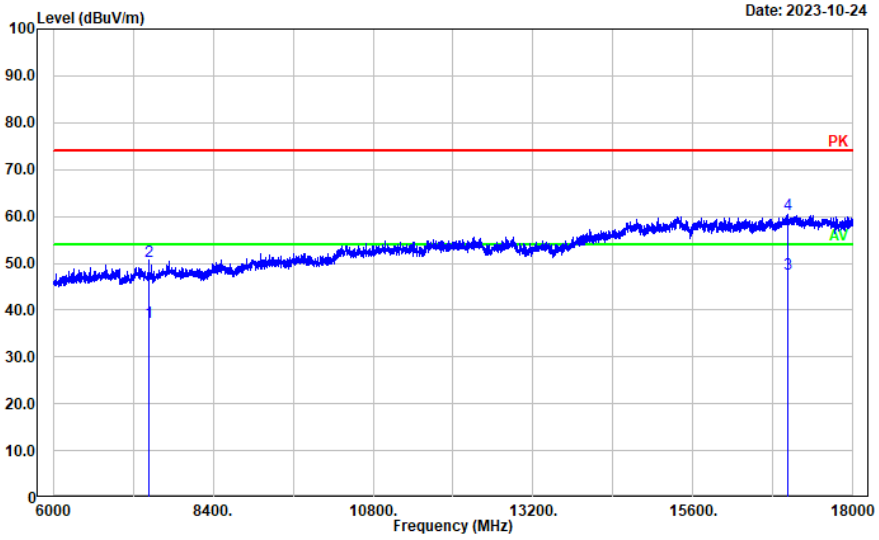
Worst Test plots (highest channel 2480MHz was worst)

Horizontal	
1-6GHz	

No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	4960.000	27.58	11.77	39.35	54.00	14.65	Average
2	4960.000	40.06	11.77	51.83	74.00	22.17	Peak

Horizontal	
6-18GHz	

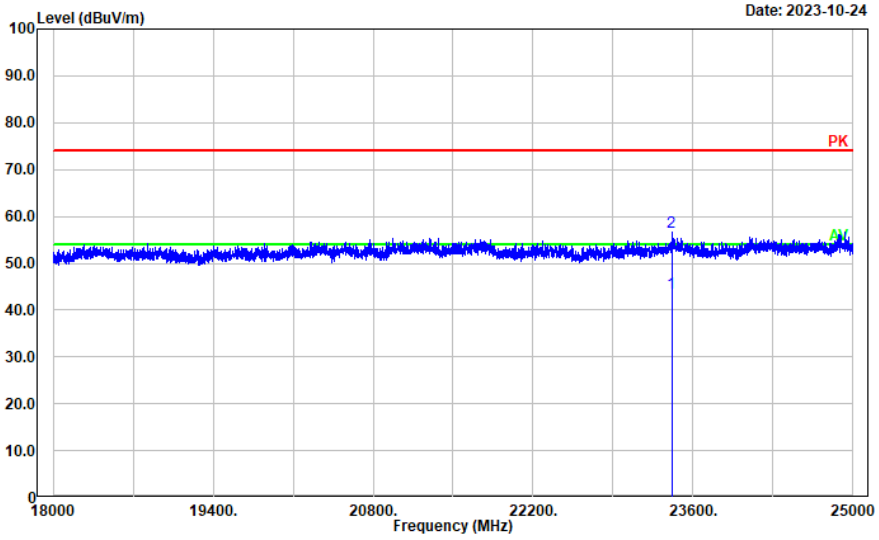
Project No.: CR231058663-RF
Tester: Tao Zhu
Polarization: horizontal
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7440.000	21.41	15.98	37.39	54.00	16.61	Average
2	7440.000	34.52	15.98	50.50	74.00	23.50	Peak
3	17020.600	19.48	28.18	47.66	54.00	6.34	Average
4	17020.600	32.35	28.18	60.53	74.00	13.47	Peak

Horizontal	
18-25GHz	

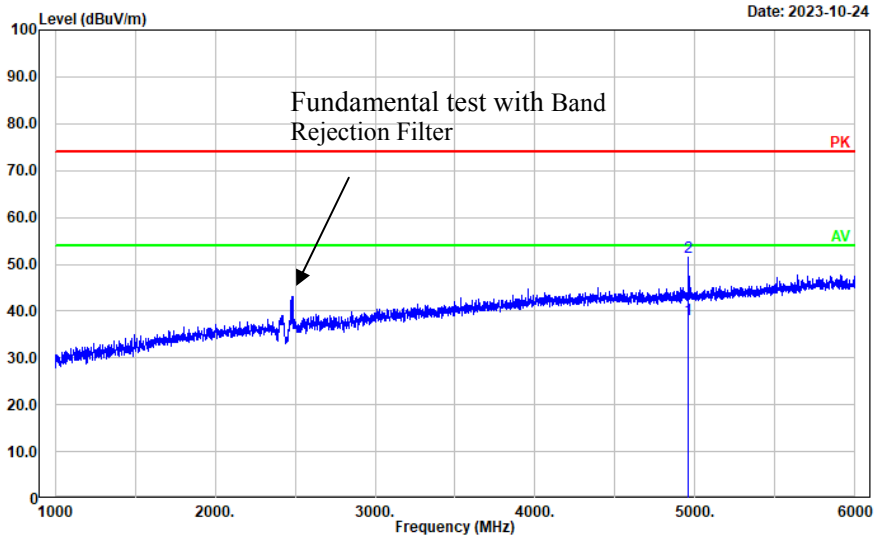
Project No.: CR231058663-RF
Tester: Tao Zhu
Polarization: Horizontal
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	23412.080	38.27	5.40	43.67	54.00	10.33	Average
2	23412.080	51.37	5.40	56.77	74.00	17.23	Peak

Vertical	
1-6GHz	

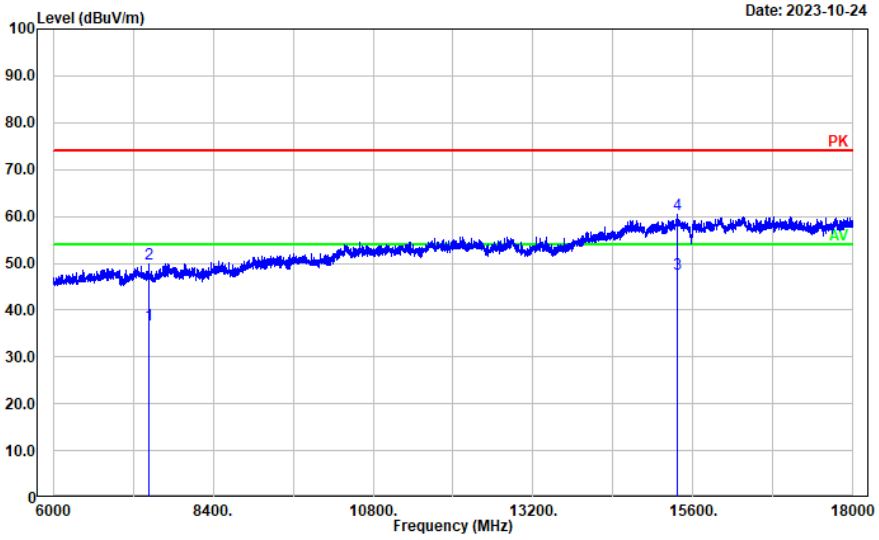
Project No.: CR231058663-RF
Tester: Tao Zhu
Polarization: vertical
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	4960.000	26.47	11.77	38.24	54.00	15.76	Average
2	4960.000	39.68	11.77	51.45	74.00	22.55	Peak

Vertical	
6-18GHz	

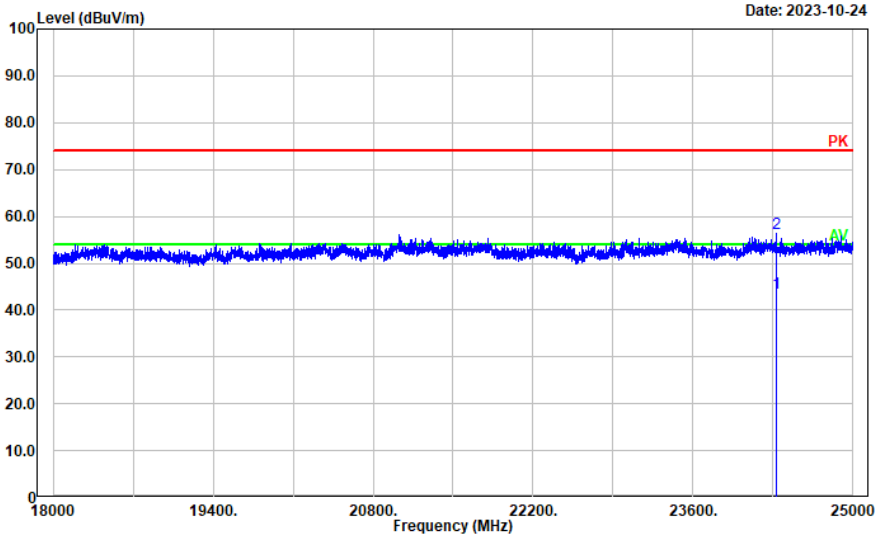
Project No.: CR231058663-RF
Tester: Tao Zhu
Polarization: vertical
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	7440.288	20.89	15.98	36.87	54.00	17.13	Average
2	7440.288	33.87	15.98	49.85	74.00	24.15	Peak
3	15359.470	22.83	24.79	47.62	54.00	6.38	Average
4	15359.470	35.52	24.79	60.31	74.00	13.69	Peak

Vertical	
18-25GHz	

Project No.: CR231058663-RF
Tester: Tao Zhu
Polarization: Vertical
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	24325.060	38.44	5.13	43.57	54.00	10.43	Average
2	24325.060	51.14	5.13	56.27	74.00	17.73	Peak

4.3 6 dB Emission Bandwidth

Serial Number:	2COF-2	Test Date:	2023/10/16
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	26.7	Relative Humidity: (%)	63	ATM Pressure: (kPa)	100.6

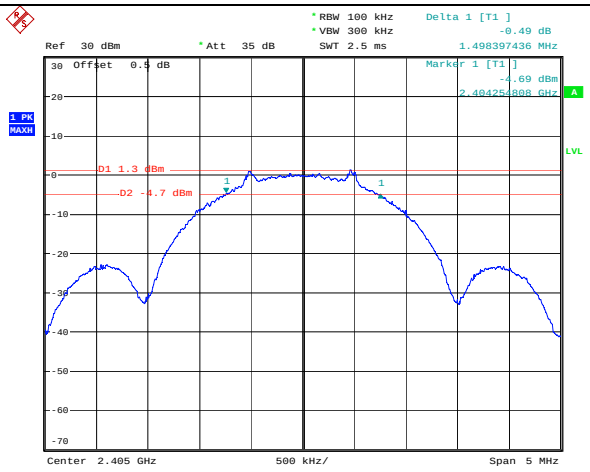
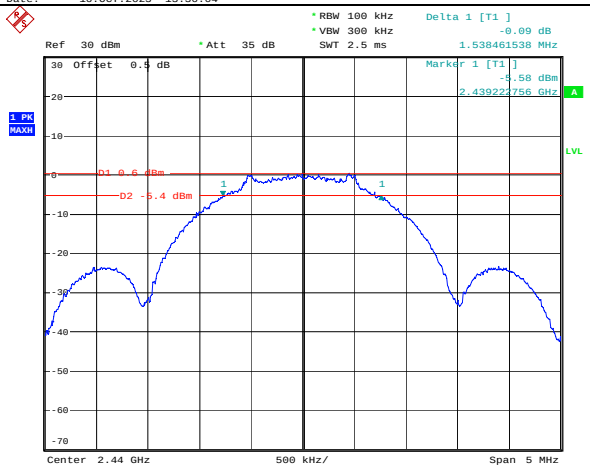
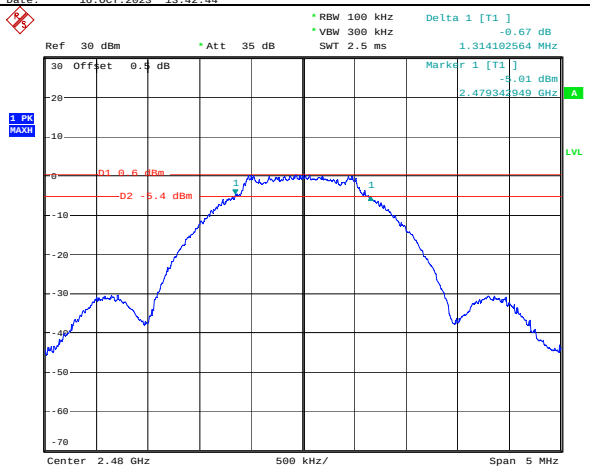
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211003	Each time	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Modes	Test Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
O-QPSK	2405	1.498	≥0.5
	2440	1.538	≥0.5
	2480	1.314	≥0.5

6dB Emission Bandwidth	
Lowest Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 13:36:04
Middle Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 13:42:44
Highest Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 13:45:29

4.4 Maximum Conducted Output Power

Serial Number:	2COF-2	Test Date:	2023/10/16
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	26.7	Relative Humidity: (%)	63	ATM Pressure: (kPa)	100.6

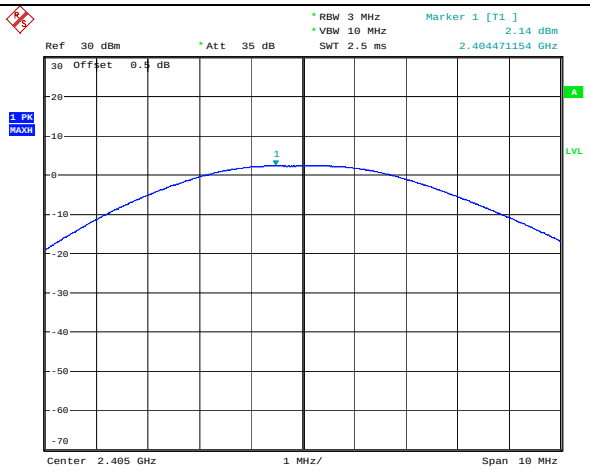
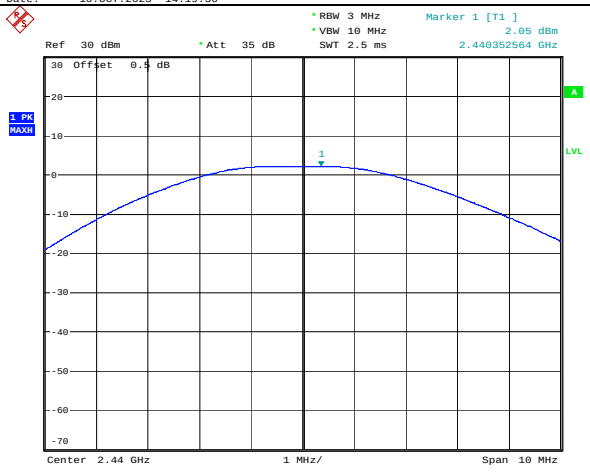
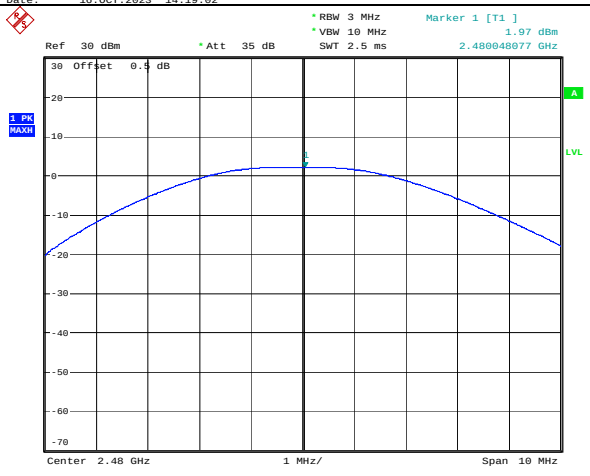
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211003	Each time	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Modes	Test Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	Limit (dBm)
O-QPSK	2405	2.14	≤30
	2440	2.05	≤30
	2480	1.97	≤30

Maximum Conducted Peak Output Power	
Lowest Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 14:19:30
Middle Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 14:19:02
Highest Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 14:18:15

4.5 Maximum Power Spectral Density

Serial Number:	2COF-2	Test Date:	2023/10/16
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	26.7	Relative Humidity: (%)	63	ATM Pressure: (kPa)	100.6

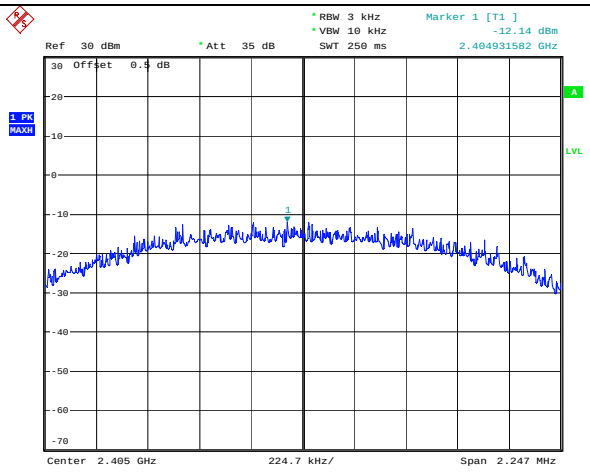
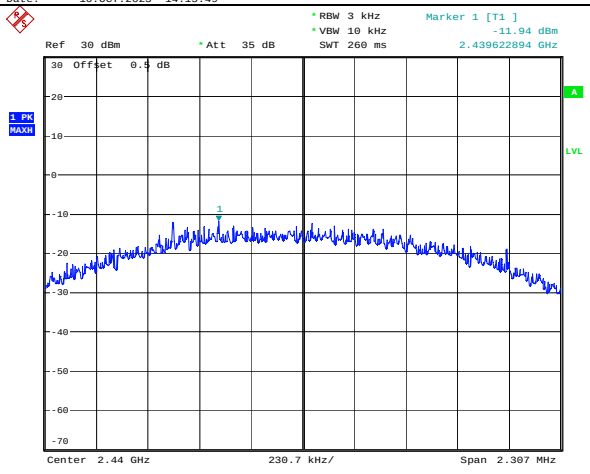
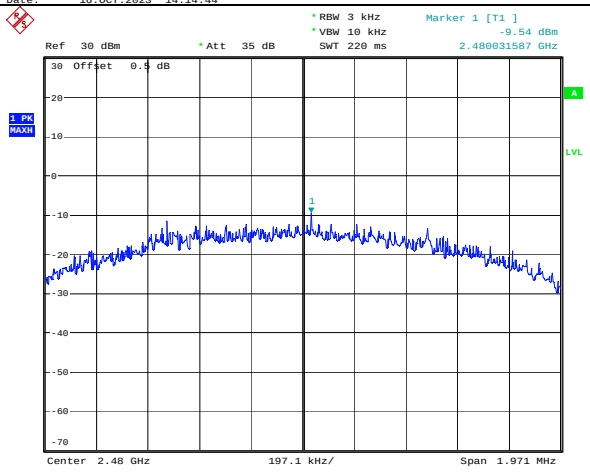
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211003	Each time	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Modes	Test Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
O-QPSK	2405	-12.14	≤8.00
	2440	-11.94	≤8.00
	2480	-9.54	≤8.00

Maximum power spectral density	
Lowest Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 14:15:49
Middle Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 14:14:44
Highest Channel	 Comment: ProjectNo.:CR231058663-RF Tester:LingLing Li Date: 16.OCT.2023 14:17:11

4.6 100 kHz Bandwidth of Frequency Band Edge

Serial Number:	2COF-2	Test Date:	2023/10/16
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

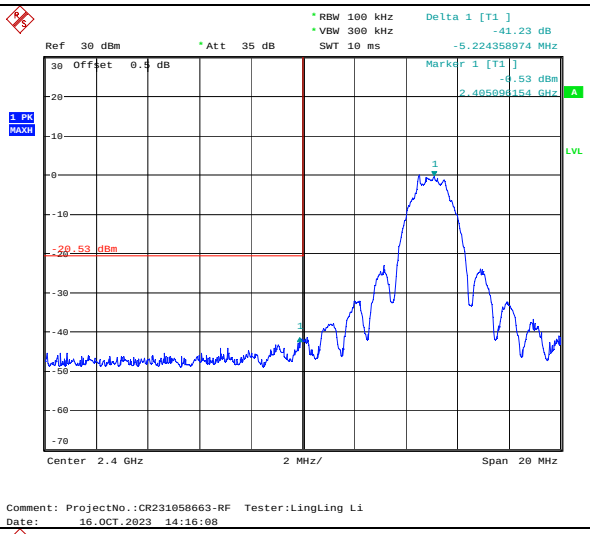
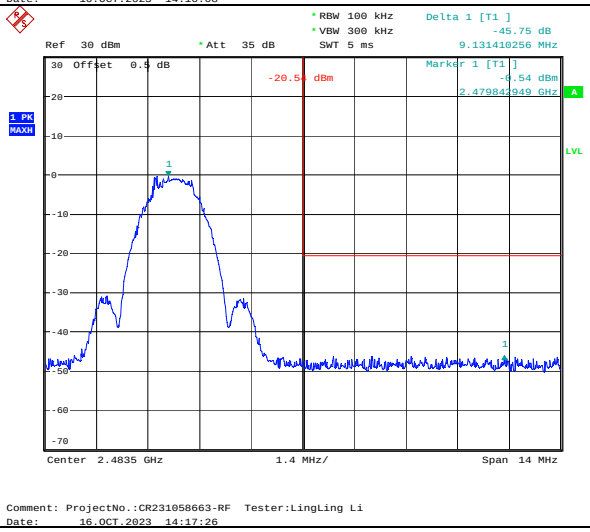
Environmental Conditions:					
Temperature: (℃)	26.7	Relative Humidity: (%)	63	ATM Pressure: (kPa)	100.6

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211003	Each time	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

100 kHz Bandwidth of Frequency Band Edge	
Lowest Band edge	
Highest Band edge	

4.7 Duty Cycle

Serial Number:	2COF-2	Test Date:	2023/10/16
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	N/A

Environmental Conditions:					
Temperature: (℃)	26.7	Relative Humidity: (%)	63	ATM Pressure: (kPa)	100.6

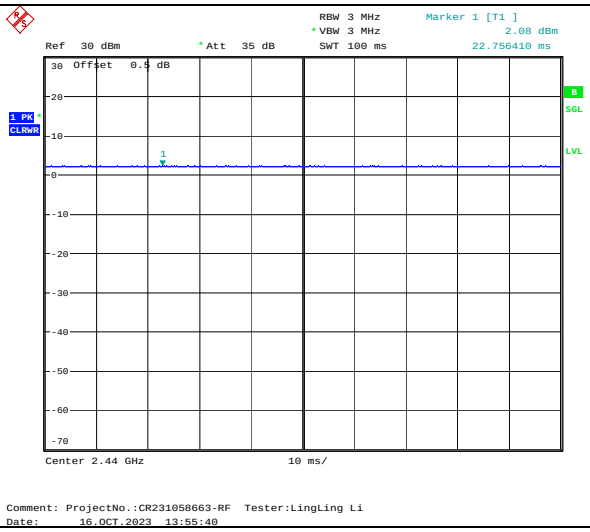
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211003	Each time	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Modes	Test Frequency (MHz)	Ton (ms)	Ton+off (ms)	Duty cycle (%)	1/T (Hz)	VBW Setting (kHz)
O-QPSK	2440	100	100	100.00	/	0.01

Duty Cycle	
O-QPSK	

5. RF EXPOSURE EVALUATION

5.1 Applicable Standard

FCC §15.247 (i) and subpart §1.1307

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

5.2 Procedure

According to §1.1307(b)(3)(i)

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

5.3 Measurement Result

Radio	Frequency (MHz)	λ /2Π (mm)	Distance (mm)	Exemption ERP (mW)	Maximum Conducted Power including Tune-up Tolerance (dBm)	Antenna Gain (dBi)	ERP	
							dBm	mW
Zigbee	2405-2480	19.87	200	768	3	1.08	1.93	1.56

Note:
The Maximum Conducted Power including Tune-up Tolerance was declared by manufacturer.

Result: The device compliant the MPE-Based Exemption at 20cm distances.

6. EUT PHOTOGRAPHS

Please refer to the attachment CR231058663-EXP EUT EXTERNAL PHOTOGRAPHS and CR231058663-INP EUT INTERNAL PHOTOGRAPHS

7. TEST SETUP PHOTOGRAPHS

Please refer to the attachment CR231058663-00B-TSP TEST SETUP PHOTOGRAPHS.

===== END OF REPORT ====