



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



TEST REPORT

Applicant: TIETI INC

Address: 244 MADISON AVENUE, SUITE 1666 NEW YORK, NY, 10016,
USA

FCC ID: 2A9BL-TK65D

Product Name: TIETI 2.4 GHz Receiver

Model: TIETI TK65D

Standard(s): 47 CFR Part 15, Subpart C(15.249)
ANSI C63.10-2013

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

Report Number: CR221150841-00

Date Of Issue: 2022/11/25

Reviewed By: Sun Zhong

Sun Zhong

Title: Manager

Test Laboratory: China Certification ICT Co., Ltd (Dongguan)

No. 113, Pingkang Road, Dalang Town, Dongguan,
Guangdong, China
Tel: +86-769-82016888

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

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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CONTENTS

TEST FACILITY	2
DECLARATIONS.....	2
1. GENERAL INFORMATION	4
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
1.2 DESCRIPTION OF TEST CONFIGURATION.....	5
1.2.2 Support Equipment List and Details	5
1.2.3 Support Cable List and Details	5
1.2.4 Block Diagram of Test Setup.....	6
1.3 MEASUREMENT UNCERTAINTY	7
2. SUMMARY OF TEST RESULTS	8
3. REQUIREMENTS AND TEST PROCEDURES	9
3.1 AC LINE CONDUCTED EMISSIONS.....	9
3.1.1 Applicable Standard.....	9
3.1.2 EUT Setup.....	10
3.1.3 EMI Test Receiver Setup	10
3.1.4 Test Procedure	11
3.1.5 Corrected Amplitude & Margin Calculation.....	11
3.2 RADIATED EMISSIONS	12
3.2.1 Applicable Standard.....	12
3.2.2 EUT Setup.....	12
3.2.3 EMI Test Receiver & Spectrum Analyzer Setup	13
3.2.4 Test Procedure	13
3.2.5 Corrected Amplitude & Margin Calculation.....	14
3.3 20 DB EMISSION BANDWIDTH:.....	15
3.3.1 Applicable Standard.....	15
3.3.2 EUT Setup.....	15
3.3.3 Test Procedure	15
3.4 ANTENNA REQUIREMENT.....	16
3.4.1 Applicable Standard.....	16
3.4.2 Judgment.....	16
4. Test DATA AND RESULTS	17
4.1 AC LINE CONDUCTED EMISSIONS.....	17
4.2 RADIATION SPURIOUS EMISSIONS.....	20
4.3 20 DB EMISSION BANDWIDTH:.....	26

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Name:	TIETI 2.4 GHz Receiver
EUT Model:	TIETI TK65D
Operation Frequency:	2402-2479 MHz
Modulation Type:	GFSK
Rated Input Voltage:	DC 5V
Serial Number:	1OIX-1
EUT Received Date:	2022/11/3
EUT Received Status:	Good

Operation Frequency Detail:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441
1	2403	40	2442
...
...
37	2439	76	2478
38	2440	77	2479

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

Test Channel	Frequency (MHz)
Lowest	2402
Middle	2446
Highest	2479

Antenna Information Detail ▲:

Antenna Type	input impedance (Ohm)	Antenna Gain /Frequency Range	§15.203 Requirement
PCB	50	-1 dBi/2.4~2.5GHz	Compliance

The Method of §15.203 Compliance:

- Antenna must be permanently attached to the unit.
- Antenna must use a unique type of connector to attach to the EUT.
- Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Accessory Information:

No Accessory.

1.2 Description of Test Configuration

1.2.1 EUT Operation Condition:

EUT Operation Mode:	The system was configured for testing in Engineering Mode, which was provided by the manufacturer.
Equipment Modifications:	No
EUT Exercise Software:	iot_driver.exe
The software was provided by manufacturer ▲. The maximum power was configured default setting.	

1.2.2 Support Equipment List and Details

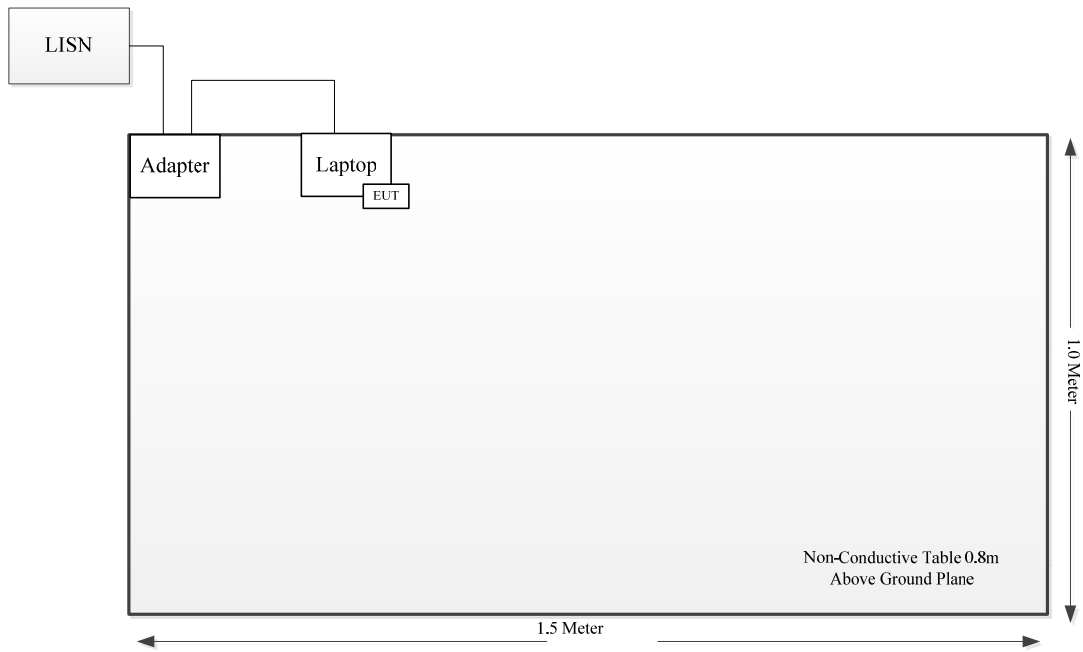
Manufacturer	Description	Model	Serial Number
Lenovo	Laptop	T460S	60PDTEK8
Lenovo	Adapter	ADLX45DLC3A	00HM613

1.2.3 Support Cable List and Details

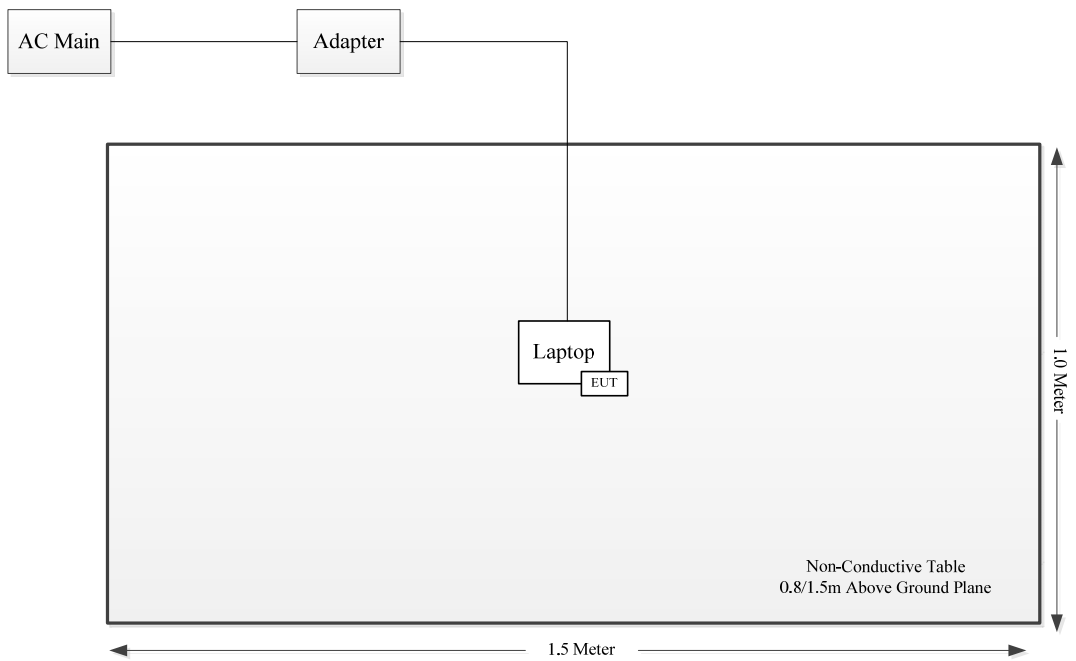
Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Power Cable	No	Yes	1	Adapter	Laptop
Power Cable	No	No	1.2	Adapter	LISN

1.2.4 Block Diagram of Test Setup

AC line conducted emissions:



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 %
Unwanted Emissions, radiated	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
Temperature	±1 °C
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)/Rule(s)	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conduction Emissions	Compliant
15.205, §15.209, §15.249	Radiated Emissions	Compliant
§15.215 (c)	20 dB Bandwidth	Compliant

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 μ H/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.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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:

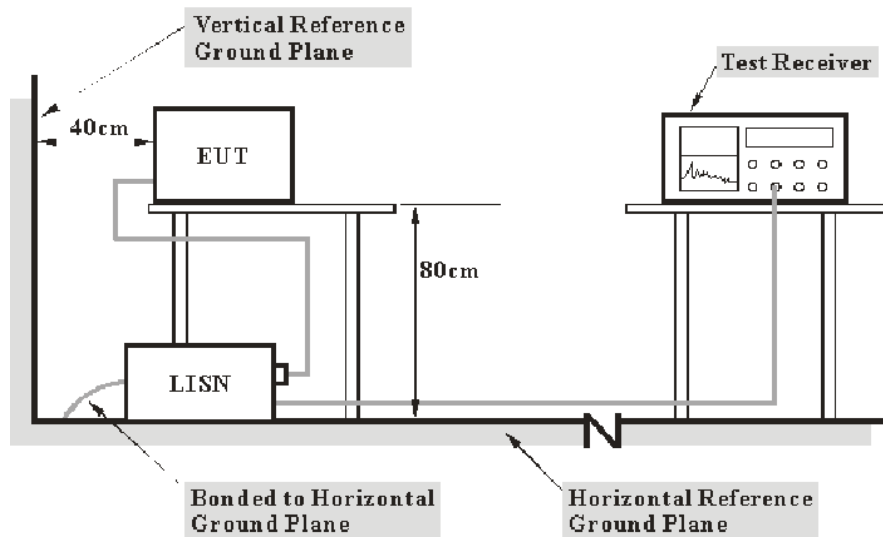
(1) For carrier current system containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 μ V within the frequency band 535-1705 kHz, as measured using a 50 μ H/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, obtaining 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.

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

During the conducted emission test, the EUT was connected to the outlet of the first LISN.

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 Radiated Emissions

3.2.1 Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

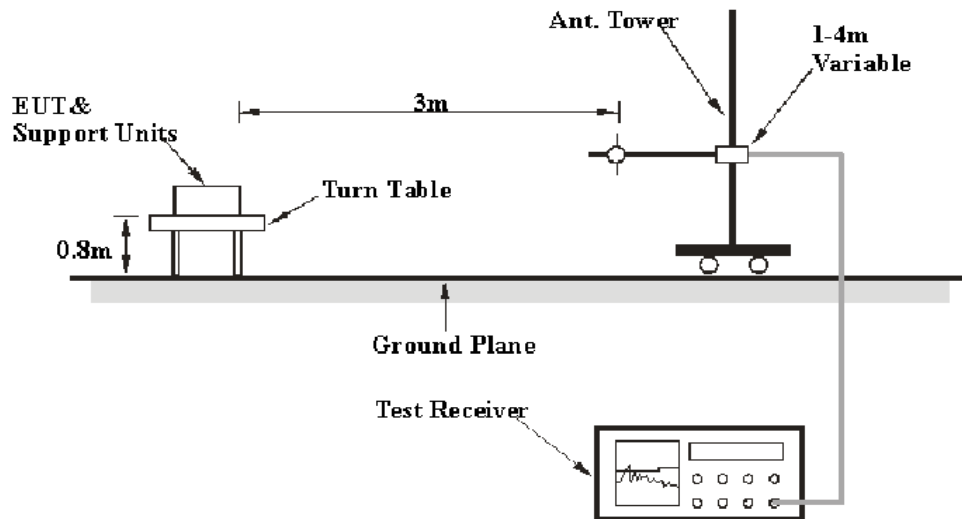
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

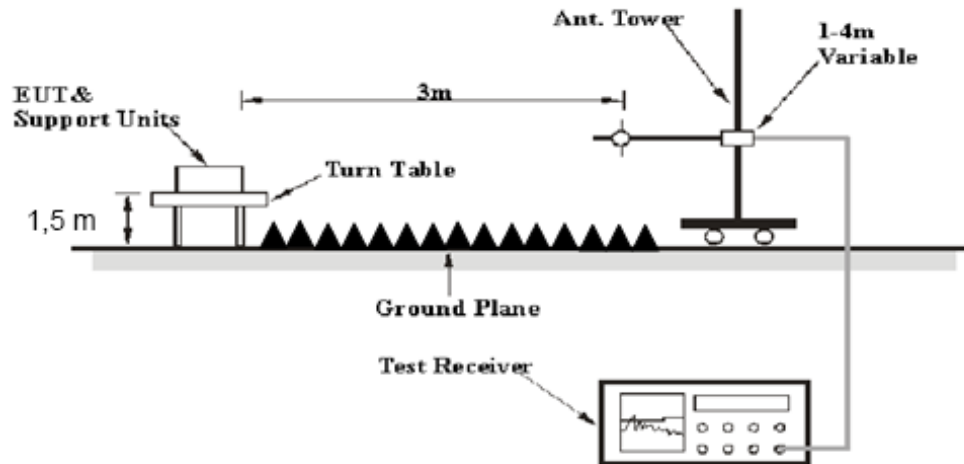
As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) 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 §15.209, whichever is the lesser attenuation.

3.2.2 EUT Setup

Below 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 15.249 limits.

3.2.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

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

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 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

3.2.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$\text{Result} = \text{Reading} + \text{Factor}$$

$$\text{Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Result}$$

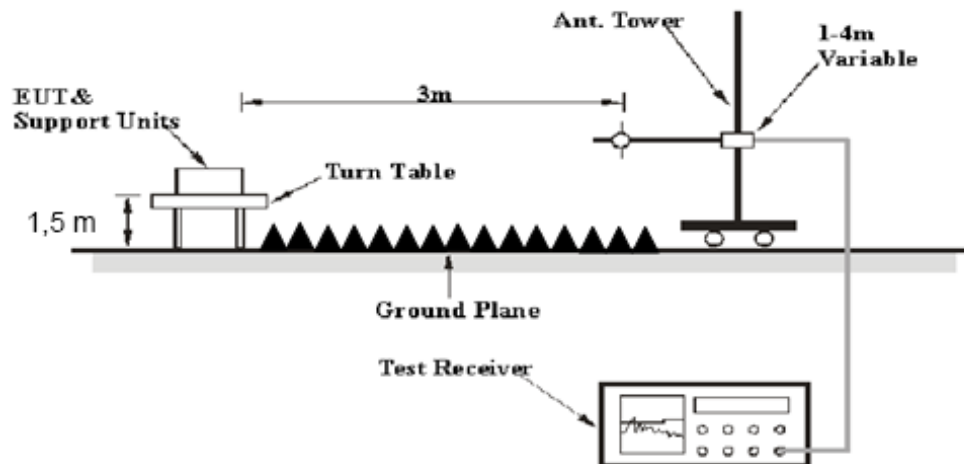
3.3 20 dB Emission Bandwidth:

3.3.1 Applicable Standard

FCC §15.215

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

3.3.2 EUT Setup



3.3.3 Test Procedure

1. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
2. Repeat above procedures until all frequencies measured were complete.

3.4 Antenna Requirement

3.4.1 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

3.4.2 Judgment

Please refer to the Antenna Information detail in Section 1.

4. Test DATA AND RESULTS

4.1 AC Line Conducted Emissions

Serial Number:	1OIX-1	Test Date:	2022/11/07
Test Site:	CE	Test Mode:	Transmitting(Low channel was the worst)
Tester:	Vic Du	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	23.8	Relative Humidity: (%)	71	ATM Pressure: (kPa)	101.2
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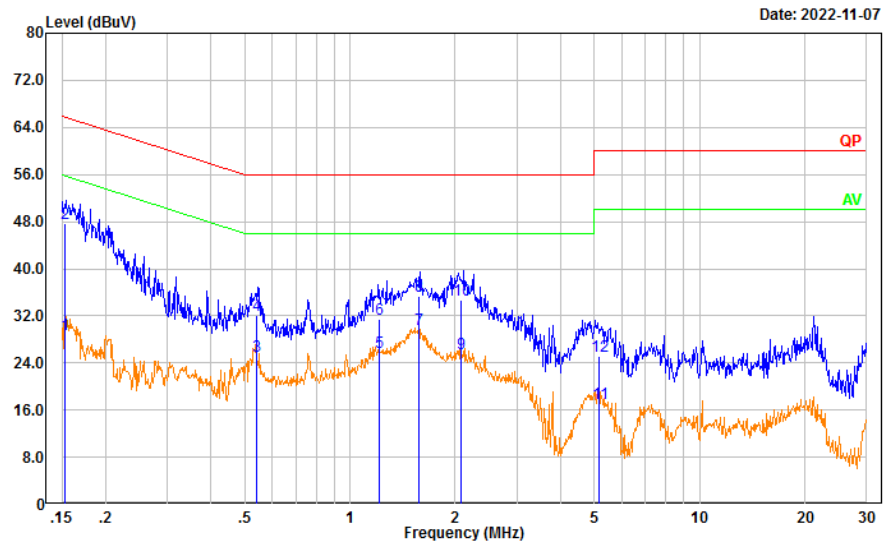
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV216	101134	2022/04/01	2023/03/31
R&S	EMI Test Receiver	ESR3	102726	2022/07/15	2023/07/14
MICRO-COAX	Coaxial Cable	UTIFLEX	C-0200-01	2022/08/07	2023/08/06
Audix	Test Software	E3	190306 (V9)	N/A	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).*

Line:

Test Mode: Transmitting
 Port: Line
 Note:

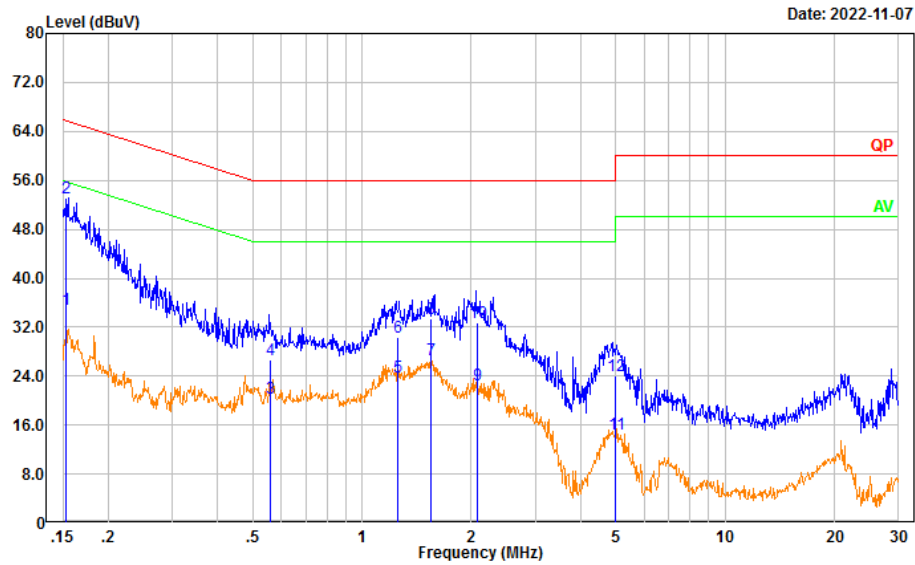


Date: 2022-11-07

No.	Frequency (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.153	19.25	9.61	28.86	55.85	26.99	Average
2	0.153	38.11	9.61	47.72	65.85	18.13	QP
3	0.541	15.62	9.61	25.23	46.00	20.77	Average
4	0.541	22.51	9.61	32.12	56.00	23.88	QP
5	1.216	16.26	9.62	25.88	46.00	20.12	Average
6	1.216	21.91	9.62	31.53	56.00	24.47	QP
7	1.576	20.05	9.63	29.68	46.00	16.32	Average
8	1.576	25.74	9.63	35.37	56.00	20.63	QP
9	2.074	15.95	9.63	25.58	46.00	20.42	Average
10	2.074	25.12	9.63	34.75	56.00	21.25	QP
11	5.172	7.57	9.66	17.23	50.00	32.77	Average
12	5.172	15.46	9.66	25.12	60.00	34.88	QP

Neutral:

Test Mode: Transmitting
 Port: neutral
 Note:



Date: 2022-11-07

No.	Frequency (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.153	25.38	9.61	34.99	55.86	20.87	Average
2	0.153	43.50	9.61	53.11	65.86	12.75	QP
3	0.558	10.78	9.62	20.40	46.00	25.60	Average
4	0.558	17.07	9.62	26.69	56.00	29.31	QP
5	1.253	14.21	9.62	23.83	46.00	22.17	Average
6	1.253	20.81	9.62	30.43	56.00	25.57	QP
7	1.542	16.97	9.63	26.60	46.00	19.40	Average
8	1.542	23.70	9.63	33.33	56.00	22.67	QP
9	2.073	12.93	9.63	22.56	46.00	23.44	Average
10	2.073	23.07	9.63	32.70	56.00	23.30	QP
11	4.989	4.85	9.66	14.51	46.00	31.49	Average
12	4.989	14.32	9.66	23.98	56.00	32.02	QP

4.2 Radiation Spurious Emissions

Serial Number:	1OIX-1	Test Date:	Below 1G: 2022/11/07 Above 1G: 2022/11/16
Test Site:	966-2, 966-1	Test Mode:	Transmitting
Tester:	Carl Xue, Mack Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.3~25.4	Relative Humidity: (%)	59~66	ATM Pressure: (kPa)	100.9~101.2
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2020/10/19	2023/10/18
R&S	EMI Test Receiver	ESR3	102724	2022/07/15	2023/07/14
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2022/07/17	2023/07/16
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2022/07/17	2023/07/16
Sonoma	Amplifier	310N	186165	2022/07/17	2023/07/16
ETS-Lindgren	Horn Antenna	3115	9912-5985	2020/10/13	2023/10/12
R&S	Spectrum Analyzer	FSV40	101591	2022/07/15	2023/07/14
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2022/08/07	2023/08/06
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2022/08/07	2023/08/06
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2022/11/09	2023/11/08
Audix	Test Software	E3	201021 (V9)	N/A	N/A
PASTERNAK	Horn Antenna	PE9852/2F-20	112002	2021/02/05	2024/02/04
AH	Preamplifier	PAM-1840VH	190	2022/11/09	2023/11/08
MICRO-COAX	Coaxial Cable	UFB142A-1-2362-200200	235772-001	2022/08/07	2023/08/06
E-Microwave	Band Rejection Filter	2400-2483.5MHz	OE01902424	2022/08/07	2023/08/06
Mini Circuits	High Pass Filter	VHF-6010+	31119	2022/08/07	2023/08/06

* 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:

Please refer to the below table and plots.

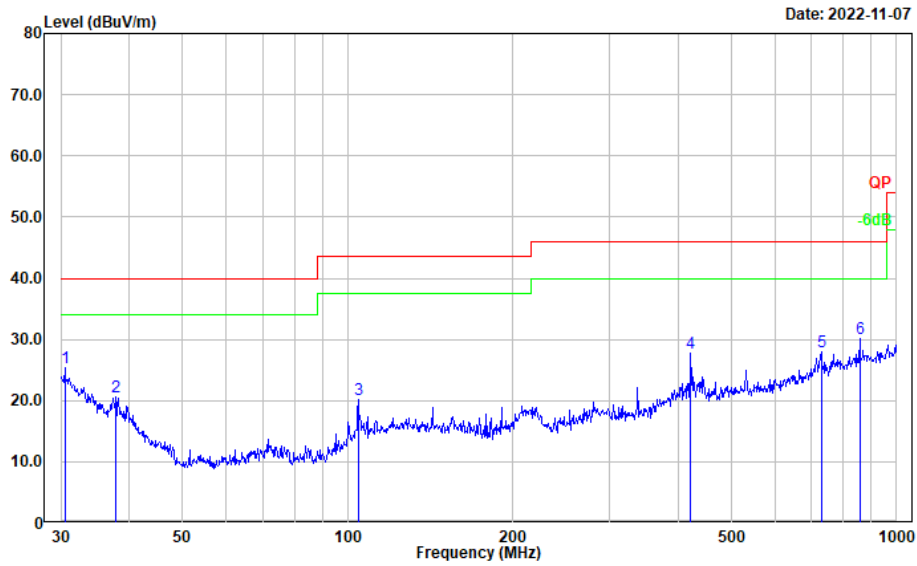
Note: The device can be mounted in multiple orientations, test was performed with X,Y, Z Axis according to C63.10 figure 8, the worst orientation was photographed and it's data was recorded.

Test Data:

1) 30MHz-1GHz(Low channel was the worst):

Horizontal:

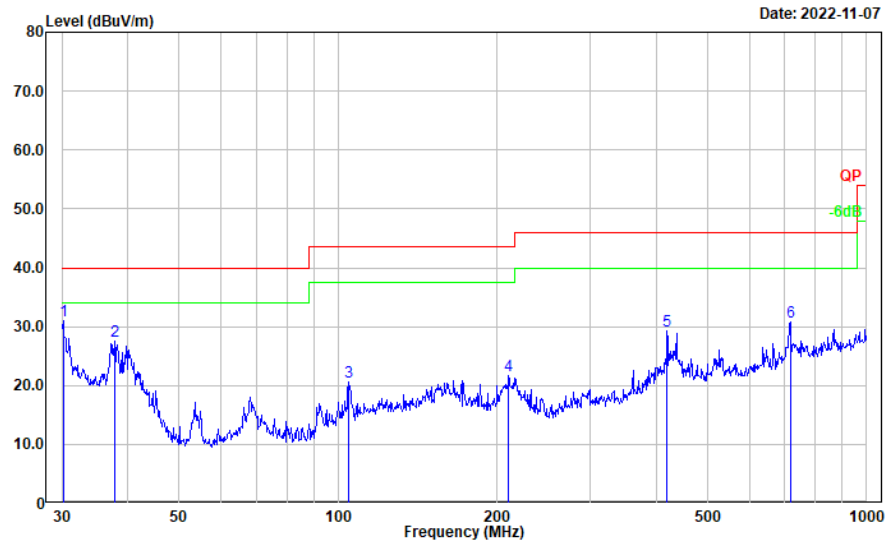
Test Mode: Transmitting
 Polarization: horizontal
 Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.531	29.27	-4.00	25.27	40.00	14.73	Peak
2	37.812	30.25	-9.59	20.66	40.00	19.34	Peak
3	104.536	33.61	-13.44	20.17	43.50	23.33	Peak
4	422.058	35.60	-7.83	27.77	46.00	18.23	Peak
5	729.358	30.89	-2.99	27.90	46.00	18.10	Peak
6	857.025	31.54	-1.33	30.21	46.00	15.79	Peak

Vertical:

Test Mode: Transmitting
 Polarization: vertical
 Note:



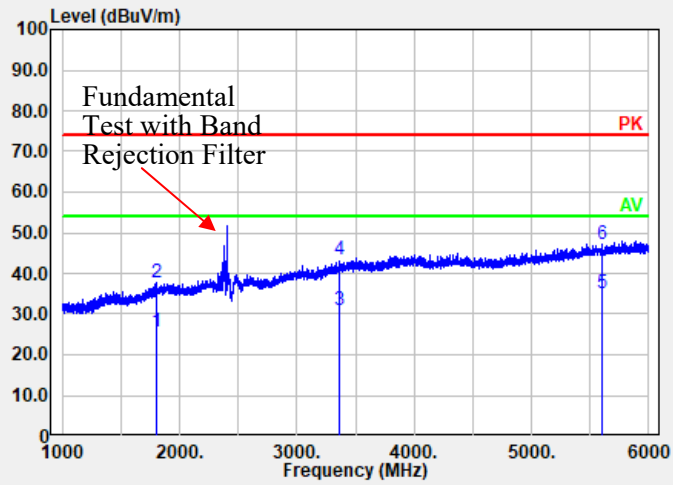
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.211	34.73	-3.76	30.97	40.00	9.03	Peak
2	37.812	37.09	-9.59	27.50	40.00	12.50	Peak
3	104.903	33.89	-13.38	20.51	43.50	22.99	Peak
4	210.048	34.07	-12.47	21.60	43.50	21.90	Peak
5	419.108	37.19	-7.96	29.23	46.00	16.77	Peak
6	716.682	34.16	-3.35	30.81	46.00	15.19	Peak

2) 1GHz-25GHz:

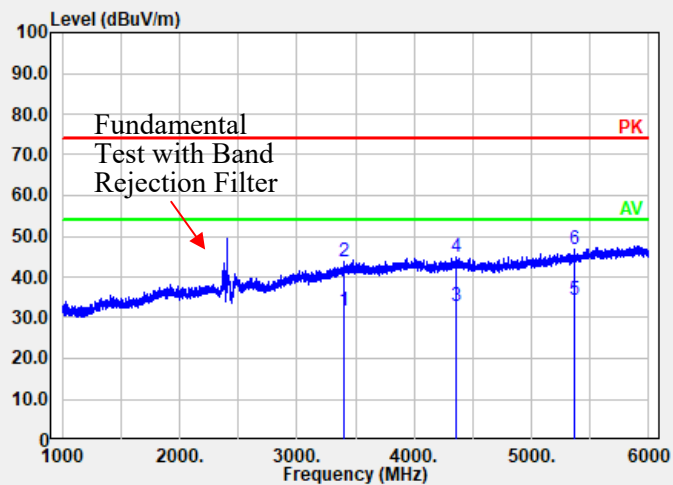
Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
	Reading (dB μ V)	Detector					
Low Channel: 2402 MHz							
2402.000	68.96	PK	H	31.51	100.47	113.98	13.51
2402.000	56.01	AV	H	31.51	87.52	93.98	6.46
2402.000	67.27	PK	V	31.51	98.78	113.98	15.20
2402.000	54.38	AV	V	31.51	85.89	93.98	8.09
2400.000	40.23	PK	H	31.50	71.73	74.00	2.27
2400.000	19.29	AV	H	31.50	50.79	54.00	3.21
4804.000	33.95	PK	H	10.91	44.86	74.00	29.14
4804.000	21.48	AV	H	10.91	32.39	54.00	21.61
7206.000	38.98	PK	H	14.22	53.20	74.00	20.80
7206.000	26.49	AV	H	14.22	40.71	54.00	13.29
Middle Channel: 2446 MHz							
2446.000	67.78	PK	H	31.62	99.40	113.98	14.58
2446.000	54.90	AV	H	31.62	86.52	93.98	7.46
2446.000	66.04	PK	V	31.62	97.66	113.98	16.32
2446.000	53.41	AV	V	31.62	85.03	93.98	8.95
4892.000	33.95	PK	H	11.10	45.05	74.00	28.95
4892.000	21.48	AV	H	11.10	32.58	54.00	21.42
7338.000	36.62	PK	H	14.79	51.41	74.00	22.59
7338.000	24.31	AV	H	14.79	39.10	54.00	14.90
High Channel: 2479 MHz							
2479.000	68.01	PK	H	31.64	99.65	113.98	14.33
2479.000	55.11	AV	H	31.64	86.75	93.98	7.23
2479.000	66.52	PK	V	31.64	98.16	113.98	15.82
2479.000	53.63	AV	V	31.64	85.27	93.98	8.71
2483.500	35.92	PK	H	31.64	67.56	74.00	6.44
2483.500	15.25	AV	H	31.64	46.89	54.00	7.11
4958.000	34.22	PK	H	11.23	45.45	74.00	28.55
4958.000	22.11	AV	H	11.23	33.34	54.00	20.66
7437.000	32.94	PK	H	15.23	48.17	74.00	25.83
7437.000	20.47	AV	H	15.23	35.70	54.00	18.30

Test Plots(Worst for Low Channel)

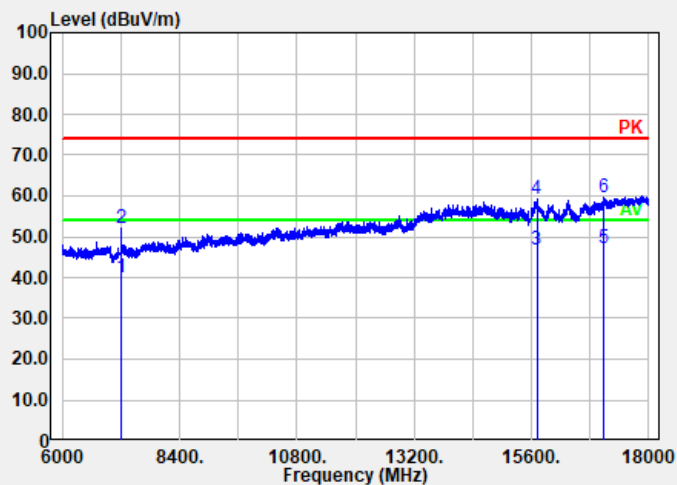
1GHz-6GHz
Horizontal

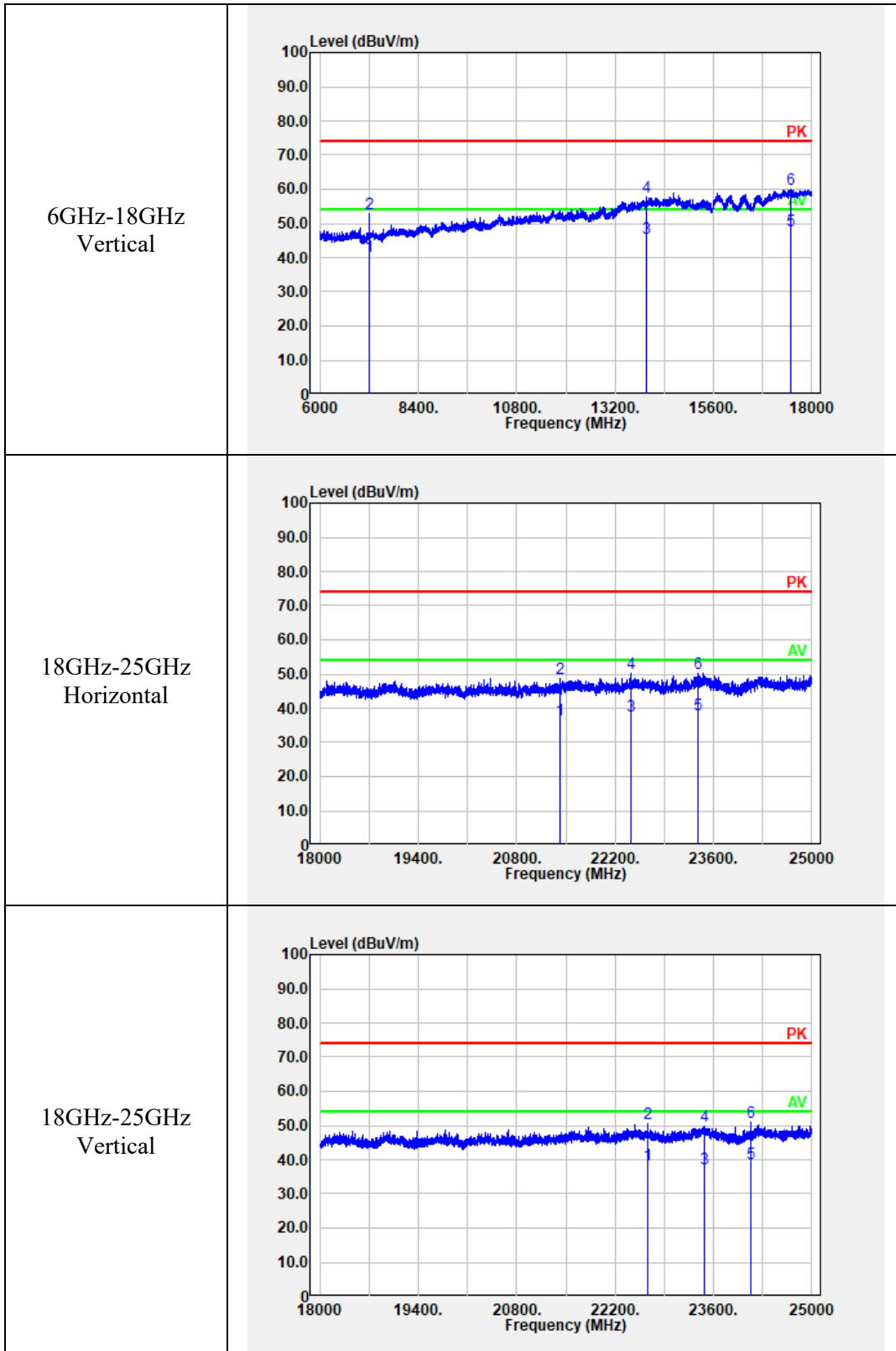


1GHz-6GHz
Vertical



6GHz-18GHz
Horizontal





4.3 20 dB Emission Bandwidth:

Serial Number:	1OIX-1	Test Date:	2022/11/16
Test Site:	966-1	Test Mode:	Transmitting
Tester:	Mack Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.4	Relative Humidity: (%)	66	ATM Pressure: (kPa)	100.9
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
ETS-Lindgren	Horn Antenna	3115	9912-5985	2020/10/13	2023/10/12
R&S	Spectrum Analyzer	FSV40	101591	2022/07/15	2023/07/14
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2022/08/07	2023/08/06
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2022/08/07	2023/08/06
Audix	Test Software	E3	201021 (V9)	N/A	N/A

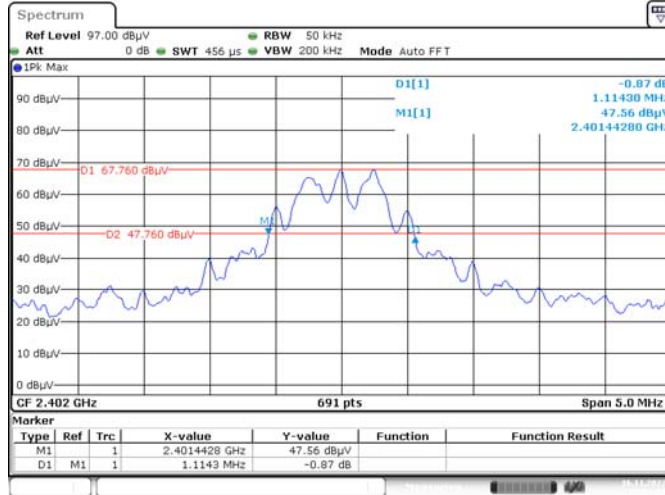
** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Channel	Test Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2402	1.114
Middle	2446	1.122
High	2479	1.100

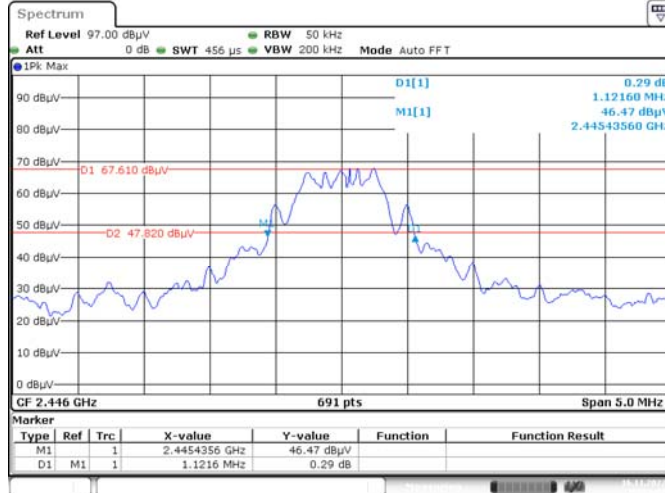
20dB Emission Bandwidth

Low Channel



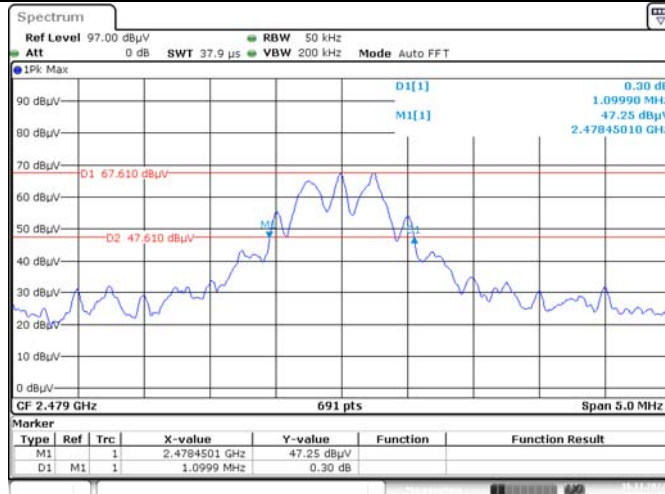
Date: 16,NOV,2022 02:50:00

Middle Channel



Date: 16,NOV,2022 02:48:05

High Channel



Date: 16,NOV,2022 02:43:35

==== END OF REPORT ====