



# **TEST REPORT**

**Applicant: Transmitter Solutions** 

Address: 2480 South 3850 West, Suite B, Salt Lake City, Utah, United States

FCC ID: 2ASPO-REAKBLENFCV2

**Product Name: Multi-technologies Reader** 

Standard(s): 47 CFR Part 15, Subpart C

ANSI C63.10-2013

KDB 680106 D01 Wireless Power Transfer v04

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: CR230418721-00C** 

**Date Of Issue: 2024/3/6** 

**Reviewed By: Calvin Chen** 

RF Engineer Title:

**Approved By: Sun Zhong** 

alinchen
Sun Zhong Title: Manager

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

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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.

Report No.: CR230418721-00C

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.

#### **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 "\(^{\text{a}}\)". 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**

DOCUMENT REVISION HISTORY	4
1. GENERAL INFORMATION	5
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	5
1.2 DESCRIPTION OF TEST CONFIGURATION	6
1.2.1 EUT Operation Condition: 1.2.2 Support Equipment List and Details 1.2.3 Support Cable List and Details 1.2.4 Block Diagram of Test Setup.  1.3 MEASUREMENT UNCERTAINTY	6 6
2. SUMMARY OF TEST RESULTS	9
3. REQUIREMENTS AND TEST PROCEDURES	10
3.1 AC LINE CONDUCTED EMISSIONS	
3.1.1 Applicable Standard 3.1.2 EUT Setup 3.1.3 EMI Test Receiver Setup 3.1.4 Test Procedure 3.1.5 Corrected Amplitude & Margin Calculation 3.2 RADIATED EMISSIONS	
3.2.1 Applicable Standard	
3.3.1 Applicable Standard 3.3.2 EUT Setup 3.3.3 Test Procedure 3.4 Antenna Requirement	
3.4.1 Applicable Standard	
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	29
5. EUT PHOTOGRAPHS	31
6. TEST SETUP PHOTOGRAPHS	32

# **DOCUMENT REVISION HISTORY**

Revision Number	Report Number	Description of Revision	Date of Revision	
1.0	CR230418721-00C	Original Report	2024/3/6	

## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment under Test (EUT)

EUT Name:	Multi-technologies Reader
EUT Model:	REAKBLENFCV2-LB(BTH352-8K)
Multiple Model:	REABLENFCV2-LB (BTH352-8N), BTH352-7N, BTH352-7K, BTH352-8N, BTH352-9N, BTH352-9K
Operation Frequency:	125 kHz
Rated Input Voltage:	DC 12V
Serial Number:	24JL_1(BTH352-9K), 24JL_2(BTH352-9N)
<b>EUT Received Date:</b>	2023/4/17
EUT Received Status:	Good
37.4	

Report No.: CR230418721-00C

#### Note

#### Antenna Information Detail ▲:

Antenna Type	input impedance (Ohm)	Frequency Range	Antenna Gain		
Loop	50	0.125MHz	Unknown		
The Method of §15.203 Com	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:**

<b>Accessory Description</b>	Manufacturer	Model
/	/	/

<sup>1.</sup> The Multiple models are electrically identical with the test model. Please refer to the declaration letter for more detail, which was provided by manufacturer.

<sup>2.</sup> In the CR230418721-00A report, AC Line Conducted Emissions and Radiated Emissions tests were performed on Model BTH352-9K (Serial Number:24JL\_1) and Model BTH352-9N (Serial Number:24JL\_2). It is found that the emissions of BTH352-9K (Serial Number:24JL\_1) is worst, so Model BTH352-9K (Serial Number:24JL\_1) was selected for fully testing in this report.

# **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.	
<b>Equipment Modifications:</b>	No	
EUT Exercise Software: No		
Engineering Mode was provided by manufacturer A. The maximum power was configured default		

Report No.: CR230418721-00C

Engineering Mode was provided by manufacturer ▲. The maximum power was configured default setting.

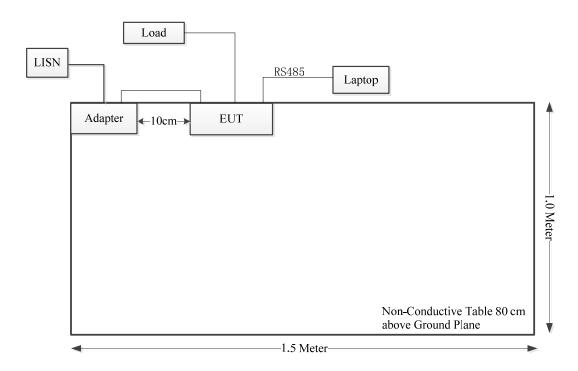
1.2.2 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Laptop	T460S	60PDTEK8
Unkown	Load	Unkown	Unkown
HERO ELE.FTY	Adapter	OH-1015A1201000U3-UL	Unkown
TOTO LINK	Router	X5000R	X5000RK9T0560
AKUVOX	Door Phone	E16C	Unkown
XTOUCH	Smartphone	S40	04069092900015

1.2.3 Support Cable List and Details

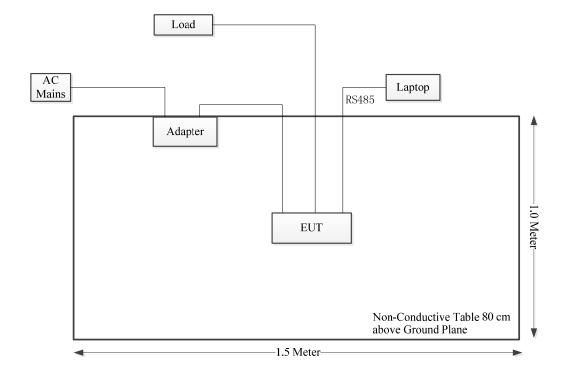
1.2.5 Support Cable List and Details					
Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	То
Power Cable	No	Yes	1.5	Adapter	LISN
Cable*3	No	No	1.5	EUT	GND
Cable	No	No	1.5	EUT	Load
RJ45 Cable	No	No	1.5	EUT	Router
RJ485 Cable	No	No	1.5	EUT	Laptop
RJ45 Cable	No	No	1	Laptop	Router
RJ45 Cable	No	No	2	Router	Door Phone

**1.2.4 Block Diagram of Test Setup** AC line conducted emissions:



Report No.: CR230418721-00C

#### Spurious Emissions:



Page 7 of 32

# 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 %
	9kHz~30MHz: 4.12dB
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

FCC Rules	Description of Test	Result
FCC§15.203	Antenna Requirement	Compliant
FCC§15.207 (a)	Conducted Emissions	Compliant
\$15.225 \$15.209 \$15.205	Radiated Emission Test	Compliant
§15.225(e)	Frequency Stability	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).

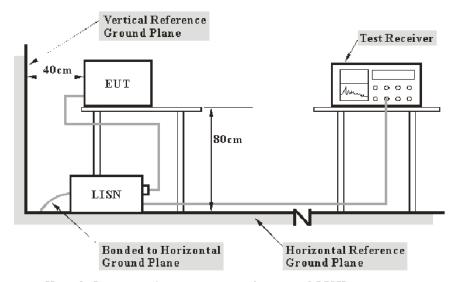
(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu H/50$  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.

	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

<sup>\*</sup>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:  $1000~\mu V$  within the frequency band 535-1705~kHz, as measured using a  $50~\mu H/50$  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



Report No.: CR230418721-00C

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

During the conducted emission test, the adapter was connected to the outlet of the 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.

Report No.: CR230418721-00C

According FCC publication number 174176, for a device with a permanent antenna operating at or below 30 MHz, the measurements done with a suitable dummy load, in lieu of the permanent antenna under the following conditions: (1) perform the AC line conducted tests with the permanent antenna to determine compliance with the Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the permanent antenna to determine compliance with the Section 15.207 limits within the transmitter's fundamental emission band.

#### 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 Part 15.209

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

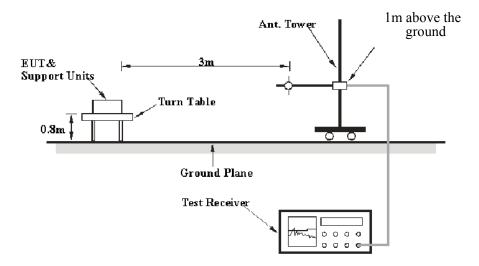
Report No.: CR230418721-00C

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

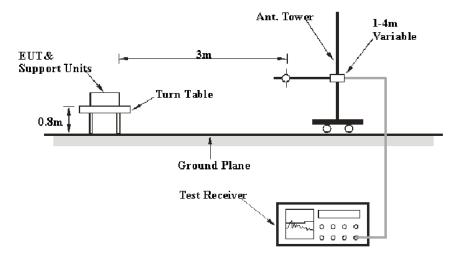
<sup>\*\*</sup> Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

### **3.2.2 EUT Setup**

9kHz-30MHz:



#### 30MHz-1GHz:



Report No.: CR230418721-00C

The radiated emission tests were performed in the 3-meter chamber test site, using the setup accordance with the ANSI C63.10-2013.

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 9 kHz to 1 GHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	Detector
9 kHz – 150 kHz	200 Hz	1 kHz	QP
150 kHz – 30 MHz	9 kHz	30 kHz	QP
30 MHz – 1000 MHz	120 kHz	300 kHz	QP

If the maximized peak measured value complies with the limit, then it is unnecessary to perform an QP measurement

#### 3.2.4 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 20 dB Emission Bandwidth

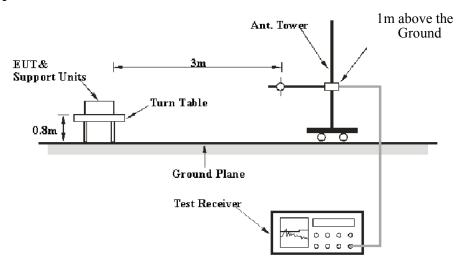
#### 3.3.1 Applicable Standard

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. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of band operation.

Report No.: CR230418721-00C

#### **3.3.2 EUT Setup**



#### 3.3.3 Test Procedure

- 1. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

#### 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:

Report No.: CR230418721-00C

- 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:	24JL_1	Test Date:	2023/5/8
Test Site:	CE	Test Mode:	Transmitting
Tester:	David Huang	Test Result:	Pass

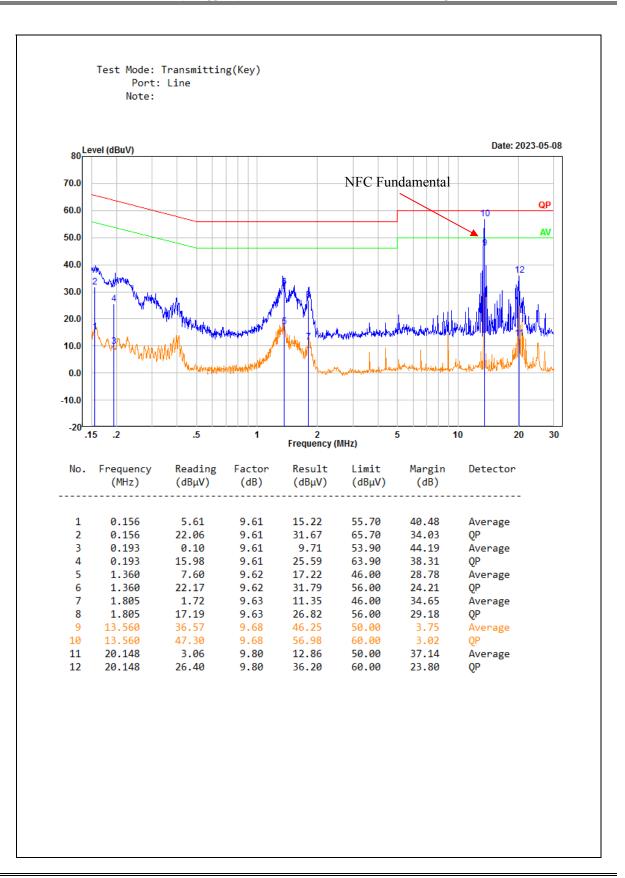
Report No.: CR230418721-00C

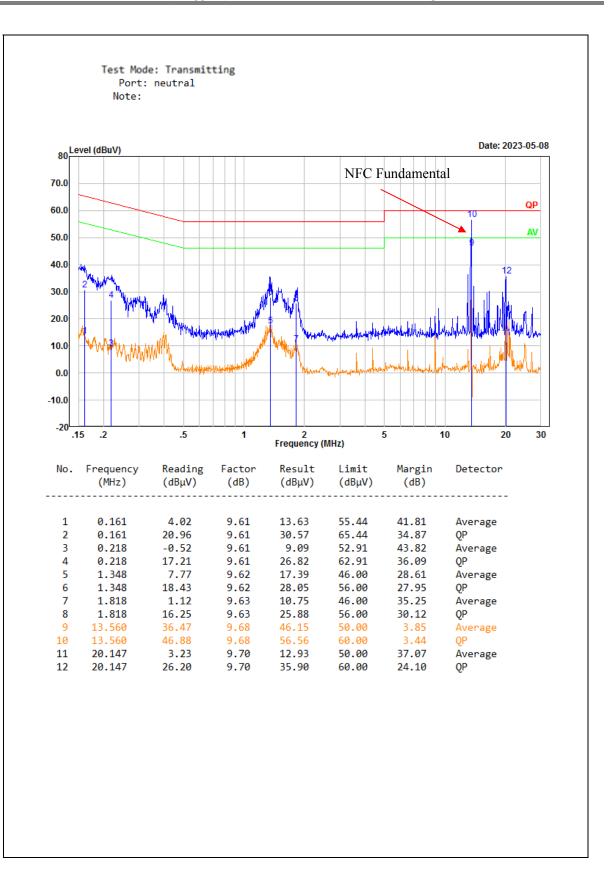
Environmental Conditions:							
Temperature: (°C)	24.8	Relative Humidity: (%)	76	ATM Pressure: (kPa)	101.1		

### **Test Equipment List and Details:**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV216	101134	2023/03/31	2024/03/30
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

<sup>\*</sup> 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).





## **4.2 Radiation Spurious Emissions**

Serial Number:	2411 1	Test Date:	2023/6/19
Test Site:	966-2	Test Mode:	Transmitting
Tester:	Vic Du	Test Result:	Pass

Report No.: CR230418721-00C

Environmental Conditions:						
Temperature: $(^{\circ}\mathbb{C})$	28.2	Relative Humidity: (%)	67	ATM Pressure: (kPa)	100.1	

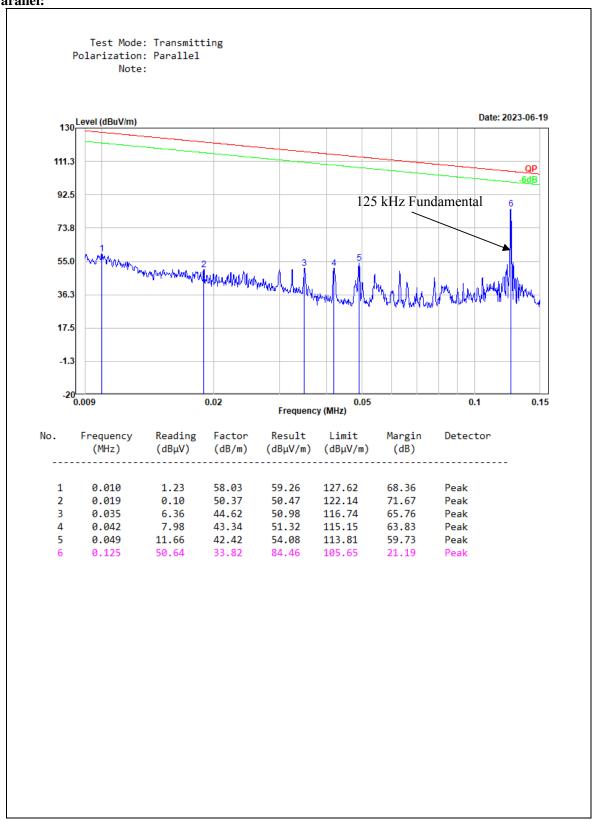
### **Test Equipment List and Details:**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
EMCO	Passive Loop Antenna	6512	9706-1209	2023/2/15	2026/2/14
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
Audix	Test Software	E3	201021 (V9)	N/A	N/A

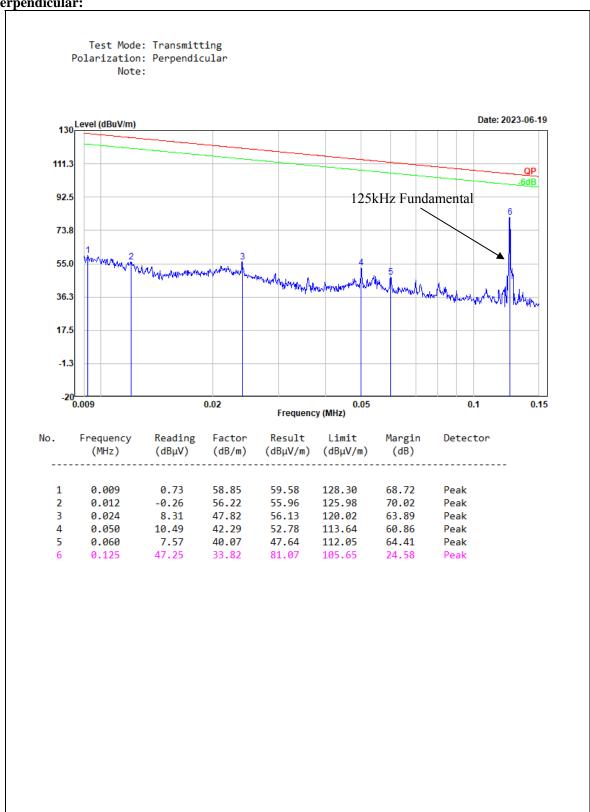
<sup>\*</sup> Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

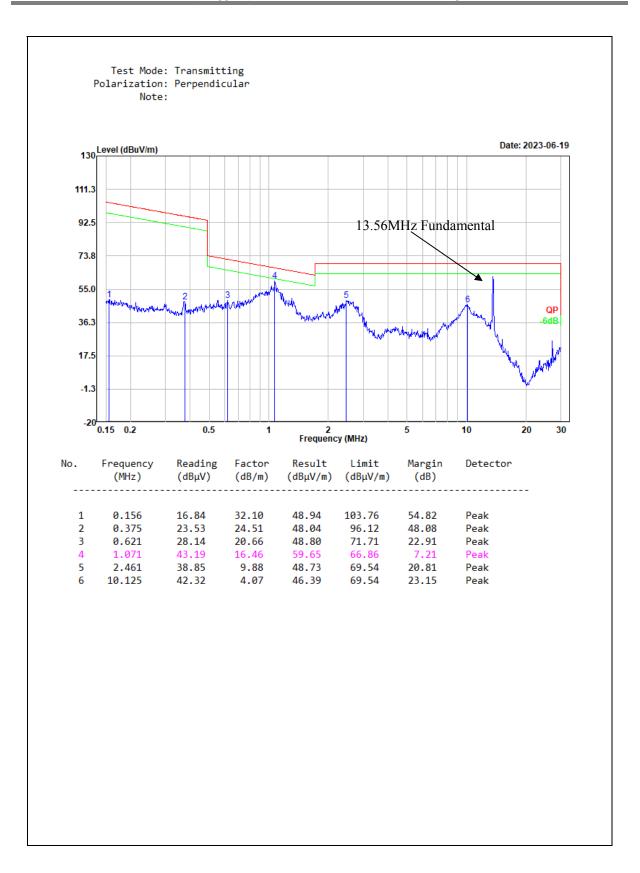
#### 1) 9 kHz~30MHz:

#### Parallel:



### Perpendicular:

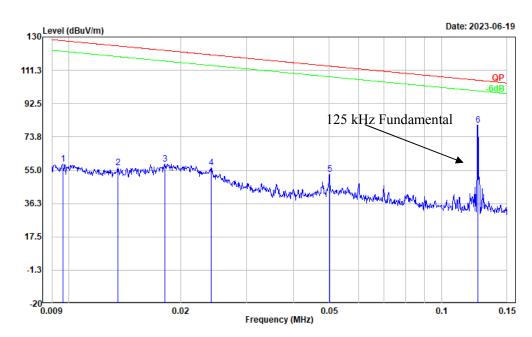




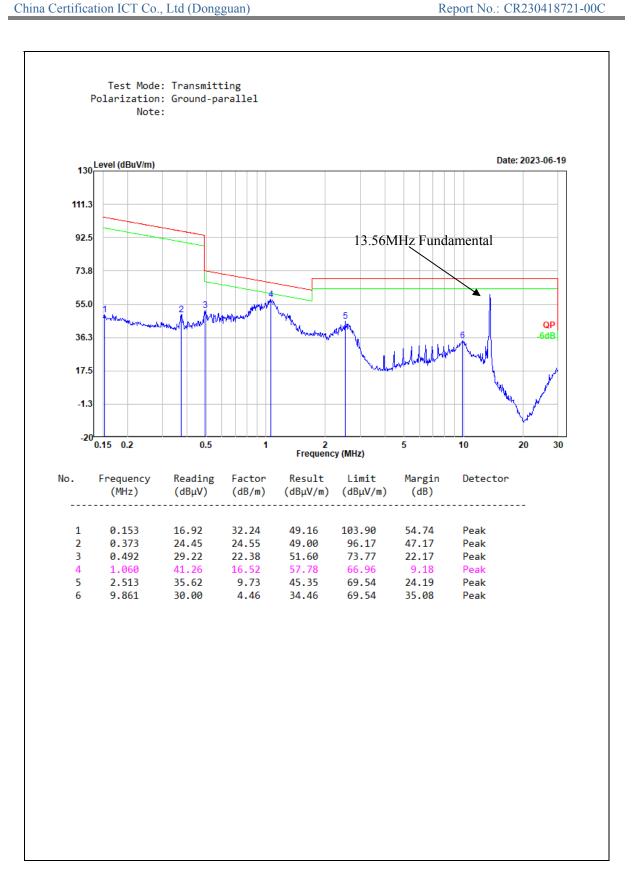
## **Ground-parallel:**

Test Mode: Transmitting
Polarization: Ground-parallel

Note:

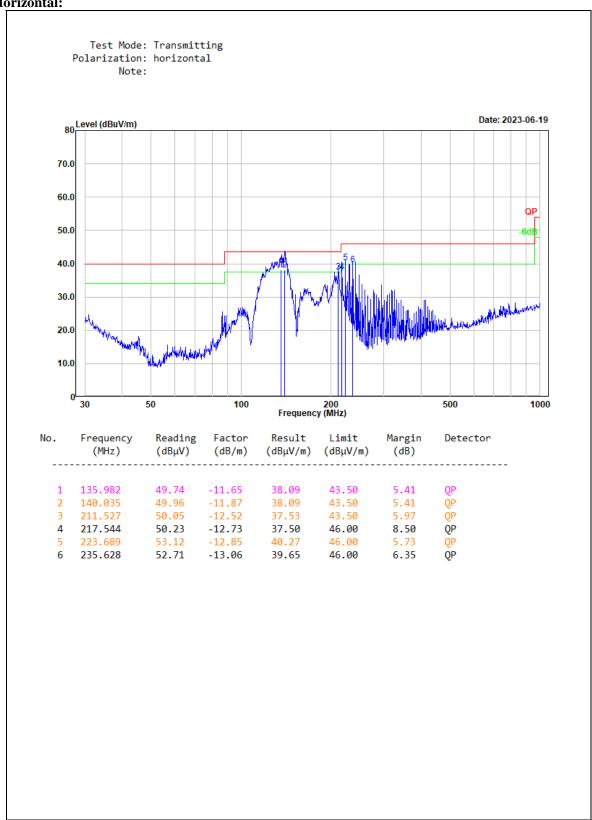


No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	0.010	-0.11	58.43	58.32	127.93	69.61	Peak
2	0.014	1.39	54.93	56.32	124.98	68.66	Peak
3	0.018	7.58	50.96	58.54	122.46	63.92	Peak
4	0.024	8.57	47.78	56.35	119.97	63.62	Peak
5	0.050	10.34	42.26	52.60	113.61	61.01	Peak
6	0.125	46.63	33.82	80.45	105.65	25.20	Peak

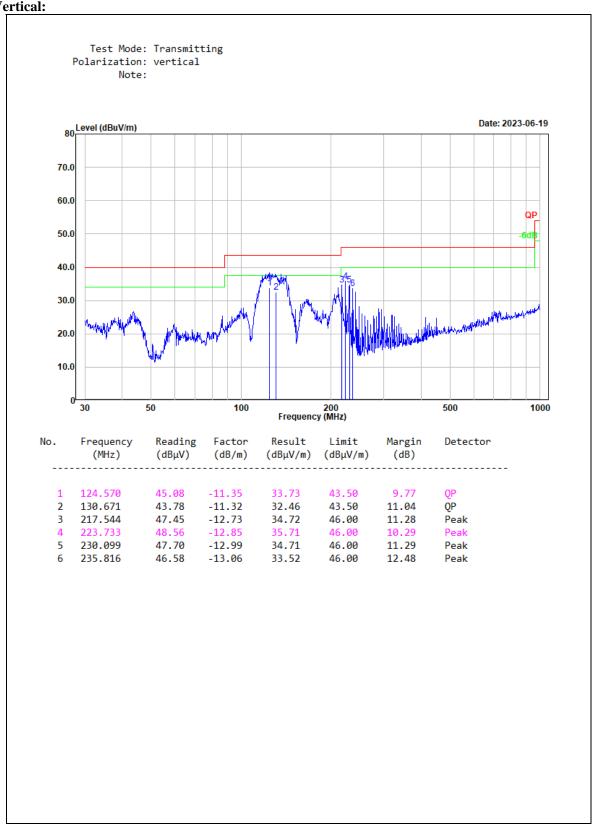


#### 2) 30 MHz~1GHz

#### **Horizontal:**



#### Vertical:



#### 4.3 20 dB Emission Bandwidth

Serial Number:	24JL_1	Test Date:	2023/6/19
Test Site:	966-2	Test Mode:	Transmitting
Tester	Vic Du	Test Result:	Pass

Report No.: CR230418721-00C

Environmental Conditions:					
Temperature:	Relative Humidity: (%)	67	ATM Pressure: (kPa)	100.1	

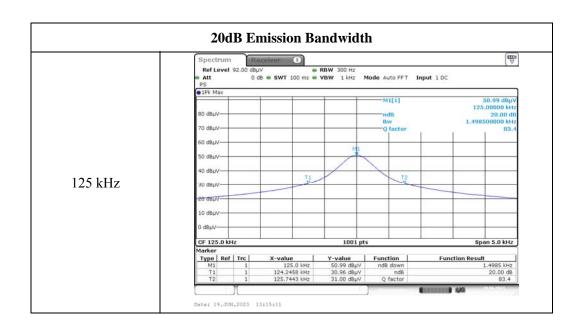
#### **Test Equipment List and Details:**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
EMCO	Passive Loop Antenna	6512	9706-1209	2023/2/15	2026/2/14
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
Audix	Test Software	E3	201021 (V9)	N/A	N/A

<sup>\*</sup> 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 Frequency (MHz)	20 dB Bandwidth (kHz)
0.125	1.499



5. EUT PHOTOGRAPHS			
Please refer to the attachment CR230418721-ECR230418721-INP EUT INTERNAL PHOTO	XP EUT EXTERNAL	PHOTOGRAPHS and	

# 6. TEST SETUP PHOTOGRAPHS

Please refer to the attachment CR230418721-00C-TSP TEST SETUP PHOTOGRAPHS.

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