



SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

SZEMC-TRF-01 Rev. A/0 Aug01,2022

Report No.: SZCR221200413104

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RF EXPOSURE EVALUATION REPORT

Application No.: SZCR2212004131AT
Applicant: Shenzhen RAKwireless Technology Co.,Ltd.
Address of Applicant: Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, China
Manufacturer: Shenzhen RAKwireless Technology Co.,Ltd.
Address of Manufacturer: Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, China
Equipment Under Test (EUT):
EUT Name: All-in-One. 5G
Model No.: M320
Trade Mark: RAK, MNTD
FCC ID: 2AF6B-M320
Standard(s) : FCC Rules 47 CFR §2.1091
KDB 447498 D04 interim General RF Exposure Guidance v01
Date of Receipt: 2022-12-08
Date of Evaluation: 2023-03-14 to 2023-04-08
Date of Issue: 2023-04-19

Evaluation Result:	Pass*
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* In the configuration evaluated, the EUT complied with the standards specified above.

Keny Xu

Keny Xu
EMC Laboratory Manager



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Shenzhen Branch EMC Laboratory

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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023-04-19		Original

Authorized for issue by:				
		Benson Wang		
		Benson Wang/Project Engineer		
		Eric Fu		
		Eric Fu/Reviewer		



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3 General Information

3.1 General Description of E.U.T.

Product Type:	☐ Portable device
	☒ Mobile device
	☐ Fixed device

3.2 Details of E.U.T.

Power supply:	Powered by POE adapter: Adapter model: RP026-5601080YE Input: AC 100-240V 50/60Hz Output: DC 56.0V 1.08A
Cable:	Lan cable x 2: 302cm unshielded
EUT Type:	CBSD
Category of EUT:	Category A
LTE:	
Operation Frequency Band:	Band 48 (3550-3700MHz)
Test Mode:	E-TM1.1; E-TM3.2; E-TM3.1;
Modulation Type:	QPSK, 16QAM, 64QAM
Bandwidth:	10MHz; 20MHz
5G NR:	
Operation Frequency Band:	n48 (3550-3700MHz)
Test Mode:	NR-FR1-TM1.1; NR-FR1-TM3.1; NR-FR1-TM3.1a;
Modulation Type:	QPSK, 64QAM, 256QAM,
SCS:	30KHz
LTE & 5G NR:	
Transmission (TX) and Receiving (RX) Antenna Ports:	TX port: 2
MIMO supported	2*2 UL
Antenna Type:	Integral Antenna
Antenna Gain:	5.5dBi
Technical Specification of Lora DTS	
Operating Frequency:	904.6MHz (SF8) 923.3 - 927.5MHz (SF7 - SF12)
Type of Modulation:	LoRa
Data Rate:	SF7 - SF12, SF8 (904.6MHz)
Channel Number:	9 Channels
Channel Separation:	600KHz
Occupied Bandwidth:	500KHz

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Technical Specification of Lora Hybrid	
Operating Frequency:	903.9 - 905.3MHz
Type of Modulation:	LoRa
Data Rate:	SF7 -SF9 - SF10
Channel Number:	8 Channels (DSS & DTS)
Channel Separation:	200KHz
Occupied Bandwidth:	125KHz
Antenna Gain:	Integral Antenna: 3dBi Fiberglass Antenna 1 (RAKARG14): 5.8dBi; Fiberglass Antenna 2 (RAKARG19): 5.1dBi;
1. The EUT have a integral antenna and two different Fiberglass antennas. The Integral antenna and Fiberglass antenna cannot transmit simultaneously. 2. The Fiberglass Antenna 1 and 2 have the same type and RF characteristics as equivalent antenna, so, only the Fiberglass Antenna 1(High antenna gain) was tested in the report.	

Note:

(1)The antenna gain value is provided by the customer. The test lab will not be responsible for wrong test result due to incorrect information about antenna gain values.

3.3 Separation Distance

Minimum test separation distance:	20cm
Remark: This minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.	

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3.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

3.5 Test Facility

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

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

3.6 Deviation from Standards

None

3.7 Abnormalities from Standard Conditions

None



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4 FCC Radiofrequency radiation exposure limits

According to §1.1310, the limit for general population/uncontrolled exposures

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

5 Measurement and Calculation

5.1 Maximum transmit power

Lora:

The Power Data is based on the RF Test Report SZCR221200413102 and Tune up procedure.

Highest Antenna Gain: 5.8dBi

MPE Calculation

According to the formula $S=P/4\pi R^2$, we can calculate S which is MPE.

Note:

- 1)P (mW)
- 2)R = distance to the center of radiation of antenna (in centimeter)
- 3)MPE limit = 0.6mW/cm²

Test Mode	Frequency Band (MHz)	Max Conducted power (dBm)	Max E.I.R.P (dBm)	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit of Power Density S(mW/cm ²)	Result
Lora	923.3	26	31.8	20	0.30	0.62	Pass

LTE & 5GNR:

The Power Data is based on the RF Test Report SZCR221200413103 and Tune up procedure.

Antenna Gain: 5.5dBi

MPE Calculation

According to the formula $S=P/4\pi R^2$, we can calculate S which is MPE.

Note:

- 4)P (mW)
- 5)R = distance to the center of radiation of antenna (in centimeter)
- 6)MPE limit = 1mW/cm²

Test Mode	Frequency Band (MHz)	Max Conducted power (dBm)	Max E.I.R.P (dBm)	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit of Power Density S(mW/cm ²)	Result
LTE Band 48	3690	25	30.5	20	0.22	1.00	Pass

Test Mode	Frequency Band (MHz)	Max Conducted power (dBm)	Max E.I.R.P (dBm)	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit of Power Density S(mW/cm ²)	Result
5GNR n48	3624.99	25	30.5	20	0.22	1.00	Pass

exposure conditions for simultaneous transmission operations

The EUT has Four modules: Lora module, LTE module, 5GNR module and CM4 module:

- 1) For the module: CM4 (FCC ID: 2ABCB-RPICM4), it can't simultaneous transmission with Lora, LTE and 5GNR module.
- 2) The Lora module, LTE module and 5GNR module, they can simultaneous transmission at the same time. So, Simultaneous transmission SAR test is not required, because the Max. sum of the MPE ratios is $0.48+0.22+0.22=0.92<1$.

--End of the Report--