RF TEST REPORT

Applicant	Smawave Technology Co. ,Ltd
FCC ID	2AU8HSPH320-A
Product	smart phone
Brand	Smawave
Model	SPH320-a
Report No.	R2005A0340-R4V1
Issue Date	January 12, 2022

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2018)/ FCC CFR 47 Part 25 (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	November 19, 2020
Rev.1	Update description. Add RF power output and Effective Radiated power.	January 11, 2022
Note: This revised report (Report No. R2005A0340-R4V1) supersedes and replaces the previously issued report (Report No. R2005A0340-R4). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF power output and Effective Radiated Power	25.149 (4) (iii)	PASS
2	Radiates Spurious Emission	2.1053	PASS
Date of Testing: June 16, 2020~ July 20, 2020			
Note: PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard. All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

There is only tested RF power output and Effective Radiated power and Radiates Spurious Emission in this report. Other test items please refer to the MGM5607A Module report (Report No. : R2001A0008-R2V1; FCC ID: 2AU8HMGM5607A).

1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City:	Shanghai
Post code:	201201
Country:	P. R. China
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1. General Description of Equipment under Test

1.3. Applicant and Manufacturer Information

Applicant	Smawave Technology Co. ,Ltd
Applicant address	3/F, Building 8, 1001 North Qinzhou Road，Xuhui District, Shanghai, China
Manufacturer	Smawave Technology Co. ,Ltd
Manufacturer address	3/F, Building 8, 1001 North Qinzhou Road，Xuhui District, Shanghai, China

1.4. General information

EUT Description			
Model	SPH320-a		
IMEI	IMEI 1:869922040046018 IMEI 2:869922040056017		
Hardware Version	V2.2		
Software Version	SMAWAVE-SPH320-a		
Power Supply	Battery/ AC Adapter		
Antenna Type	Internal Antenna		
Antenna Gain	3.1dBi		
Test Mode(s)	LTE Band 53;		
Test Modulation	(LTE)QPSK, 16QAM, 64QAM;		
LTE Category	6		
Maximum E.I.R.P./ E.R.P.	LTE Band 53:	22.36 dBm	
Rated Power Supply Voltage	3.8V		
Extreme Voltage	Minimum: 3.6V Maximum: 4.35V		
Extreme Temperature	Lowest: -20°C Highest: +55°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	LTE Band 53	2483.5 ~ 2495	2483.5 ~ 2495
EUT Accessory			
Adapter	Manufacturer: Shenzhen Aquilstar Technology Co., LTD Model: ASSA107W-050200		
Battery	Manufacturer: Guangdong fenghua New Energy Co.,Ltd Model: A106		
Note: The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.			

2. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:
FCC CFR 47 Part 25 (2019)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2018)

KDB 971168 D01 Power Meas License Digital Systems v03r01

3. Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (X axis, horizontal polarization) and the worst case was recorded.

All mode and data rates and positions and RB size and modulations were investigated.
Subsequently, only the worst case emissions are reported.
The following testing in LTE is set based on the maximum RF Output Power.

Test modes are chosen to be reported as the worst case configuration below for LTE Band 53:

Test items	Bandwidth (MHz)				Modulation			RB			Test Channel		
	1.4	3	5	10	QPSK	16QAM	64QAM	1	50%	100%	L	M	H
RF Power Output and Effective Isotropic Radiated Power	O	O	O	O	O	O	O	O	O	O	O	O	O
Radiates Spurious Emission	O	-	O	O	O	-	-	O	-	-	-	O	-
Note	1. The mark “O” means that this configuration is chosen for testing. 2. The mark “-” means that this configuration is not testing.												

4. Test Case Results

4.1 RF Power Output and Effective Radiated Power

Ambient condition

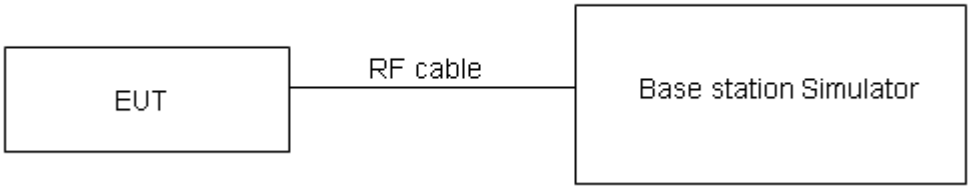
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the Base Station Simulator with a known loss. The EUT is controlled by the Base Station Simulator test set to ensure max power transmission with proper modulation.

ERP can then be calculated as follows:
EIRP (dBm) = Output Power (dBm) - Losses (dB) + Antenna Gain (dBi)
where:dBd refers to gain relative to an ideal dipole.
EIRP (dBm) = ERP (dBm) + 2.15 (dB).

Test Setup



Limits

The maximum transmit power is no more than 1 W with a peak EIRP of no more than 6 dBW;

power Limit	⩽ 1 W (30 dBm)
peak EIRP Limit	⩽ 6 dBW (36dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.4 dB for RF power output, k = 2, U= 1.19 dB for EIRP.

Test Results

LTE TDD Band 53				Maximum Output Power(dBm)			EIRP (dBm)		
Bandwidth	Modulation	RB allocation	offset	Channel/Frequency(MHz)			Channel/Frequency(MHz)		
				60147/ 2484.2	60197/ 2489.2	60248/ 2494.3	60147/ 2484.2	60197/ 2489.2	60248/ 2494.3
1.4MHz	QPSK	1	0	18.86	19.22	18.85	21.96	22.32	21.95
		1	2	18.86	18.46	18.86	21.96	21.56	21.96
		1	5	18.93	18.79	18.88	22.03	21.89	21.98
		3	0	18.67	18.44	18.35	21.77	21.54	21.45
		3	2	18.48	18.47	18.40	21.58	21.57	21.50
		3	3	18.46	18.38	18.33	21.56	21.48	21.43
		6	0	17.46	17.41	17.40	20.56	20.51	20.50
	16QAM	1	0	16.46	16.48	16.43	19.56	19.58	19.53
		1	2	16.44	16.45	16.41	19.54	19.55	19.51
		1	5	16.45	16.46	16.43	19.55	19.56	19.53
		3	0	16.25	16.24	15.82	19.35	19.34	18.92
		3	2	16.12	16.11	16.41	19.22	19.21	19.51
		3	3	16.25	15.70	15.95	19.35	18.80	19.05
		6	0	15.17	15.50	15.06	18.27	18.60	18.16
	64QAM	1	0	15.41	15.40	15.44	18.51	18.50	18.54
		1	2	15.40	15.38	15.45	18.50	18.48	18.55
		1	5	15.41	15.44	15.43	18.51	18.54	18.53
		3	0	15.21	14.60	14.94	18.31	17.70	18.04
		3	2	15.07	15.36	14.97	18.17	18.46	18.07
		3	3	15.21	14.65	14.95	18.31	17.75	18.05
		6	0	14.13	14.43	14.04	17.23	17.53	17.14
Bandwidth	Modulation	RB allocation	offset	Channel/Frequency(MHz)			Channel/Frequency(MHz)		
				60155/ 2485	60197/ 2489.2	60240/ 2493.5	60155/ 2485	60197/ 2489.2	60240/ 2493.5
3MHz	QPSK	1	0	18.88	19.26	18.88	21.98	22.36	21.98
		1	7	18.84	18.49	18.90	21.94	21.59	22.00
		1	14	18.96	18.84	18.92	22.06	21.94	22.02
		8	0	17.77	17.56	17.48	20.87	20.66	20.58
		8	4	17.60	17.57	17.52	20.70	20.67	20.62
		8	7	17.56	17.49	17.43	20.66	20.59	20.53
		15	0	17.46	17.45	17.43	20.56	20.55	20.53
	16QAM	1	0	16.49	16.50	16.46	19.59	19.60	19.56
		1	7	16.47	16.45	16.45	19.57	19.55	19.55
		1	14	16.47	16.50	16.46	19.57	19.60	19.56
		8	0	15.36	15.37	14.94	18.46	18.47	18.04
		8	4	15.23	15.24	15.53	18.33	18.34	18.63
		8	7	15.35	14.82	15.08	18.45	17.92	18.18

		15	0	15.20	15.54	15.09	18.30	18.64	18.19
	64QAM	1	0	15.44	15.42	15.47	18.54	18.52	18.57
		1	7	15.43	15.38	15.47	18.53	18.48	18.57
		1	14	15.43	15.43	15.46	18.53	18.53	18.56
		8	0	14.32	13.73	14.06	17.42	16.83	17.16
		8	4	14.18	14.49	14.09	17.28	17.59	17.19
		8	7	14.31	13.77	14.08	17.41	16.87	17.18
		15	0	14.16	14.47	14.07	17.26	17.57	17.17
Bandwidth	Modulation	RB allocation	offset	Channel/Frequency(MHz)			Channel/Frequency(MHz)		
				60165/ 2486	60197/2 489.2	60230/ 2492.5	60165/ 2486	60197/ 2489.2	60230/ 2492.5
5MHz	QPSK	1	0	18.85	19.24	18.84	21.95	22.34	21.94
		1	13	18.82	18.45	18.87	21.92	21.55	21.97
		1	24	18.93	18.79	18.88	22.03	21.89	21.98
		12	0	17.74	17.51	17.44	20.84	20.61	20.54
		12	6	17.58	17.53	17.47	20.68	20.63	20.57
		12	13	17.54	17.47	17.39	20.64	20.57	20.49
		25	0	17.46	17.44	17.41	20.56	20.54	20.51
	16QAM	1	0	16.46	16.46	16.43	19.56	19.56	19.53
		1	13	16.44	16.43	16.42	19.54	19.53	19.52
		1	24	16.44	16.48	16.42	19.54	19.58	19.52
		12	0	15.34	15.33	14.91	18.44	18.43	18.01
		12	6	15.20	15.19	15.49	18.30	18.29	18.59
		12	13	15.32	14.77	15.04	18.42	17.87	18.14
		25	0	15.18	15.50	15.04	18.28	18.60	18.14
	64QAM	1	0	15.41	15.42	15.44	18.51	18.52	18.54
		1	13	15.40	15.40	15.44	18.50	18.50	18.54
		1	24	15.44	15.41	15.42	18.54	18.51	18.52
		12	0	14.30	13.69	14.07	17.40	16.79	17.17
		12	6	14.15	14.44	14.05	17.25	17.54	17.15
		12	13	14.28	13.72	14.04	17.38	16.82	17.14
		25	0	14.14	14.43	14.02	17.24	17.53	17.12
Bandwidth	Modulation	RB allocation	offset	Channel/Frequency(MHz)			Channel/Frequency(MHz)		
				60190/ 2488.5	60197/ 2489.2	60205/ 2490	60190/ 2488.5	60197/ 2489.2	60205/ 2490
10MHz	QPSK	1	0	18.83	19.17	18.82	21.93	22.27	21.92
		1	25	18.82	18.45	18.86	21.92	21.55	21.96
		1	49	18.90	18.77	18.84	22.00	21.87	21.94
		25	0	17.72	17.47	17.41	20.82	20.57	20.51
		25	13	17.56	17.49	17.44	20.66	20.59	20.54
		25	25	17.50	17.43	17.36	20.60	20.53	20.46
		50	0	17.45	17.37	17.36	20.55	20.47	20.46
	16QAM	1	0	16.42	16.43	16.38	19.52	19.53	19.48

		1	25	16.41	16.42	16.39	19.51	19.52	19.49
		1	49	16.42	16.43	16.40	19.52	19.53	19.50
		25	0	15.31	15.32	14.89	18.41	18.42	17.99
		25	13	15.16	15.16	15.45	18.26	18.26	18.55
		25	25	15.30	14.73	15.01	18.40	17.83	18.11
		50	0	15.16	15.46	15.01	18.26	18.56	18.11
	64QAM	1	0	15.36	15.35	15.39	18.46	18.45	18.49
		1	25	15.37	15.35	15.41	18.47	18.45	18.51
		1	49	15.38	15.36	15.40	18.48	18.46	18.50
		25	0	14.27	13.68	14.01	17.37	16.78	17.11
		25	13	14.11	14.41	14.01	17.21	17.51	17.11
		25	25	14.26	13.68	14.01	17.36	16.78	17.11
		50	0	14.12	14.39	13.99	17.22	17.49	17.09

4.2 Radiates Spurious Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

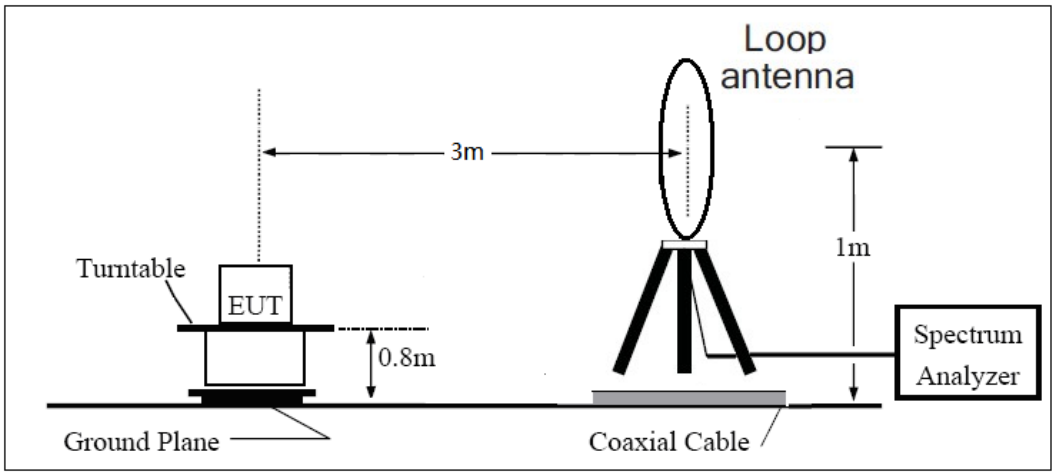
1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).
2. Below 1GHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
3. A loop antenna, A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=200Hz,VBW=600Hz for 9kHz150kHz , RBW=10kHz, VBW=30kHz 150kHz-30MHz , RBW=100kHz,VBW=300kHz for 30MHz to 1GHz and RBW=1MHz, VBW=3MHz for above 1GHz, And the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
7. The measurement results are obtained as described below:
Power(EIRP)=PMea- PAg - Pcl + Ga
The measurement results are amend as described below:
Power(EIRP)=PMea- Pcl + Ga
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP

= EIRP-2.15dBi.

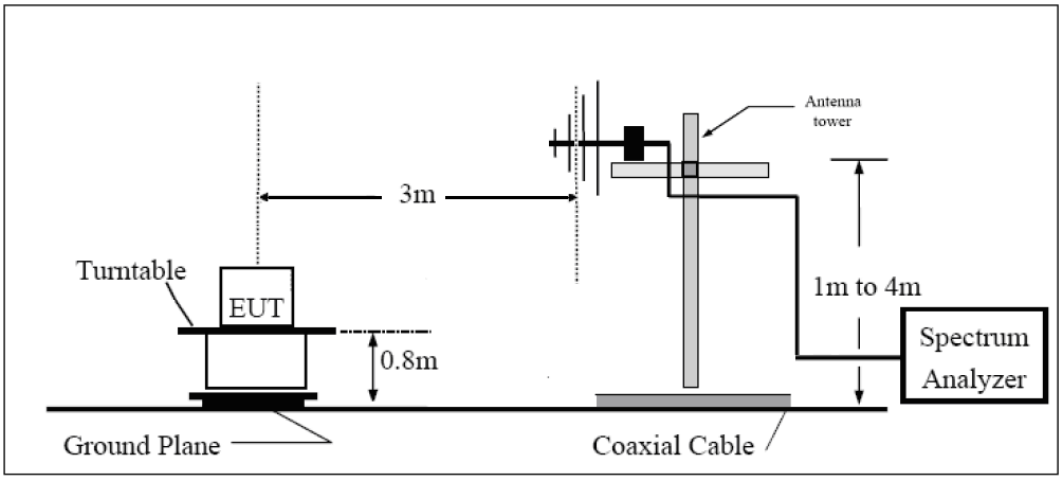
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

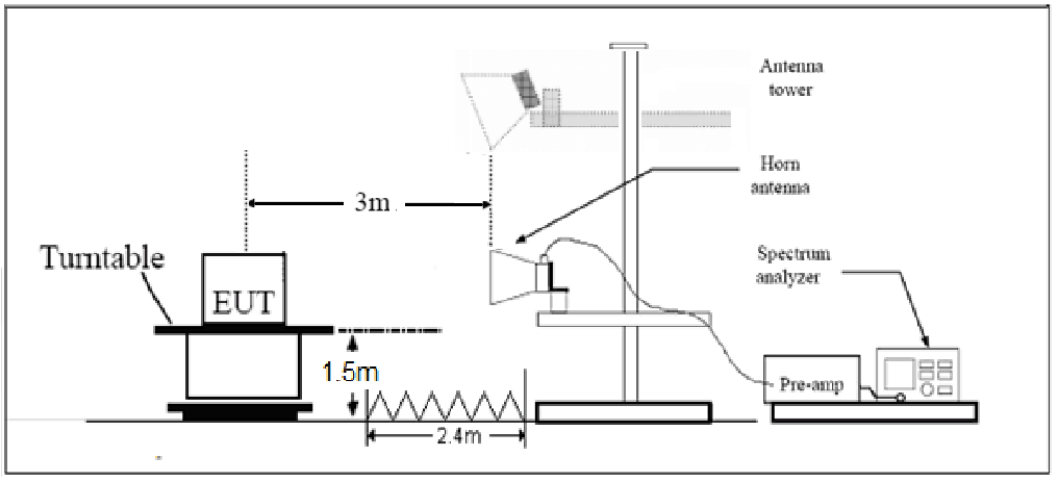
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side: 2.4mX3.6m

Limits

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB."

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95％ confidence level for the normal distribution is with the coverage factor k = 1.96, U= 3.55 dB.

Test Result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

LTE Band 53 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	4977.5	-47.95	2.00	10.15	Horizontal	-39.80	-13.00	26.80	90
3	7469.3	-51.05	2.50	11.35	Horizontal	-42.20	-13.00	29.20	270
4	9963.0	-47.75	4.20	12.05	Horizontal	-39.90	-13.00	26.90	0
5	12458.8	-50.75	5.20	14.85	Horizontal	-41.10	-13.00	28.10	45
6	14956.5	-49.83	5.50	13.23	Horizontal	-42.10	-13.00	29.10	135
7	17456.3	/	/	/	/	/	/	/	/
8	19958.0	/	/	/	/	/	/	/	/
9	22461.8	/	/	/	/	/	/	/	/
10	24967.5	/	/	/	/	/	/	/	/
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Horizontal position.									

LTE Band 53 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	4974.0	-47.45	2.00	10.15	Horizontal	-39.30	-13.00	26.30	315
3	7464.0	-53.07	2.50	11.35	Horizontal	-44.22	-13.00	31.22	90
4	9956.0	-48.14	4.20	12.05	Horizontal	-40.29	-13.00	27.29	0
5	12450.0	-53.02	5.20	14.85	Horizontal	-43.37	-13.00	30.37	45
6	14946.0	-49.41	5.50	13.23	Horizontal	-41.68	-13.00	28.68	180
7	17444.0	/	/	/	/	/	/	/	/
8	19944.0	/	/	/	/	/	/	/	/
9	22446.0	/	/	/	/	/	/	/	/
10	24950.0	/	/	/	/	/	/	/	/
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Horizontal position.									

LTE Band 53 10MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	4969.6	-47.55	2.00	10.15	Horizontal	-39.40	-13.00	26.40	225
3	7457.4	-49.25	2.50	11.35	Horizontal	-40.40	-13.00	27.40	90
4	9947.2	-48.95	4.20	12.05	Horizontal	-41.10	-13.00	28.10	0
5	12439.0	-54.05	5.20	14.85	Horizontal	-44.40	-13.00	31.40	45
6	14932.7	-50.03	5.50	13.23	Horizontal	-42.30	-13.00	29.30	180
7	17428.5	/	/	/	/	/	/	/	/
8	19926.3	/	/	/	/	/	/	/	/
9	22426.1	/	/	/	/	/	/	/	/
10	24927.9	/	/	/	/	/	/	/	/

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.
2. The worst emission was found in the antenna is Horizontal position.

5. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMU200	118133	2020-05-18	2021-05-17
Base Station Simulator	R&S	CMW500	113824	2020-05-18	2021-05-17
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Key sight	N9010A	MY50210259	2020-05-18	2021-05-17
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2020-05-18	2021-05-17
Signal Analyzer	R&S	FSV30	100815	2019-12-15	2020-12-14
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2020-09-25
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2020-11-17
Horn Antenna	R&S	HF907	102723	2018-08-11	2021-08-10
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2021-06-19
Signal generator	R&S	SMB 100A	102594	2020-05-18	2021-05-17
Climatic Chamber	ESPEC	SU-242	93000506	2017-12-17	2020-12-16
Preampflier	R&S	SCU18	102327	2020-05-18	2021-05-17
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2020-05-18	2021-05-17
RF Cable	Agilent	SMA 15cm	0001	2020-06-12	2020-12-11
Software	R&S	EMC32	9.26.0	/	/

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