
TEST REPORT FOR RF TESTING

Report No.: SRTC2022-9004(F)-22111510(C)

Product Name: LTE Indoor CPE

Model Name: SRT421

Applicant: Smawave Technology Co. ,Ltd

Manufacturer: Smawave Technology Co. ,Ltd

Specification: FCC Part 96 (2022)

FCC ID: 2AU8HSRT421-CBRS

The State Radio_monitoring_center Testing Center (SRTC)

15th Building, No.30 Shixing Street, Shijingshan District, Beijing, P.R.China

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1. GENERAL INFORMATION

1.1 Notes of the test report

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1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Address:	15th Building, No.30 Shixing Street, Shijingshan District, P.R.China
City:	Beijing
Country or Region:	P.R.China
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Designation Number:	CN1267

1.3 Applicant's details

Company:	Smawave Technology Co. ,Ltd
Address:	3/F, Building 8, 1001 North Qinzhou Road, Xuhui District, Shanghai, China

1.4 Manufacturer's details

Company:	Smawave Technology Co. ,Ltd
Address:	3/F, Building 8, 1001 North Qinzhou Road, Xuhui District, Shanghai, China

1.5 Test Environment

Date of Receipt of test sample at SRTC:	2022-11-15
Testing Start Date:	2022-11-15
Testing End Date:	2022-11-17

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient:	25	40
Maximum Extreme:	60	---
Minimum Extreme:	-30	---

Normal Supply Voltage (V d.c.):	12.0
Maximum Extreme Supply Voltage (V d.c.):	15.0
Minimum Extreme Supply Voltage (V d.c.):	9.0

2 DESCRIPTION OF THE EQUIPMENT UNDER TEST

2.1 Final Equipment Build Status

Frequency Range:	LTE Band 48: Tx:3550~3700 MHz Rx: 3550~3700 MHz
Modulation Type:	QPSK/16QAM/64QAM
Antenna Type:	PIFA
Antenna Gain:	LTE B48 MIMO Ant 1:7.4dBi LTE B48 MIMO Ant 2:5.5dBi MIMO Directional gain:6.55 dBi
Power Supply:	Charger
Hardware Version:	V1.0
Software Version:	ST_CBRS_V2.0.0
IMEI:	862165041541640

2.2 Support Equipment

The following support equipment was used to exercise the EUT during testing:
N/A.

3 REFERENCE SPECIFICATION

Specification	Version	Title
FCC Part 96	2022	CITIZENS BROADBAND RADIO SERVICE
ANSI C63.26	2015	American national standard for compliance testing of transmitters used in licensed radio services
KDB 971168 D01	April 9, 2018	Measurement guidance for certification of licensed digital transmitters
TIA-603-E-2016	March 2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

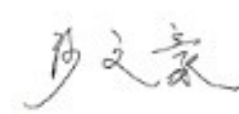
4 KEY TO NOTES AND RESULT CODES

The following are the definition of the test result.

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
NT	Normal Temperature
NV	Nominal voltage
HV	High voltage
LV	Low voltage

5 RESULT SUMMARY

No.	Test case	FCC reference	Verdict
1	Effective Radiated Power and Effective Isotropic Radiated Power	2.1046, 96.41	Pass
2	Occupied Bandwidth	2.1049, 96.41	Pass
3	Peak-Average Ratio	96.41	Pass
4	Emission Bandwidth	96.41	Pass
5	Band Edges Compliance	2.1051, 96.41(e)	Pass
6	Frequency Stability	2.1055	Pass

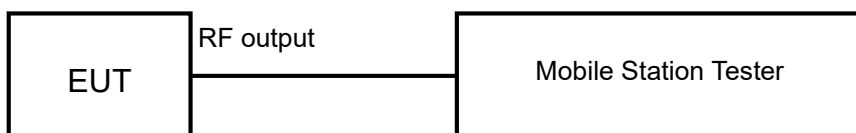
This Test Report Is Issued by: Mr. Peng Zhen 	Checked by: Mr. Sha Wenhao 
Tested by: Mr. Li Bin 	Issued date: 20221129

6 TEST RESULT

6.1 Effective Radiated Power and Effective Isotropic Radiated Power

Rule Part(s)
FCC: 2.1046,96.41

Test setup:



Test procedure:
KDB 971168 D01 v03r01 – Section 5.6

Test Settings

Subclause 5.2.5.5 of ANSI C63.26-2015 is applicable, along with the following provisions. For personal/portable radios utilizing an integral antenna, the factor LC is typically negligible. However, in a fixed station transmit system that utilizes a long cable run between the transmitter and the transmitting antenna, this factor can be significant. The minimum cable loss should be used in this equation.

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured is:

$$\text{ERP/EIRP} = \text{PMeas} - \text{LC} + \text{GT}$$

Where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

ERP/EIRP LIMIT

This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15dB) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, $\text{ERP} = \text{EIRP} - 2.15 \text{ (dB)}$.

96.41 General radio requirements.

Power limits. Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table in this paragraph (b):

Test result:

Device	Maximum EIRP (dBm/10 megahertz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD ¹	47	37

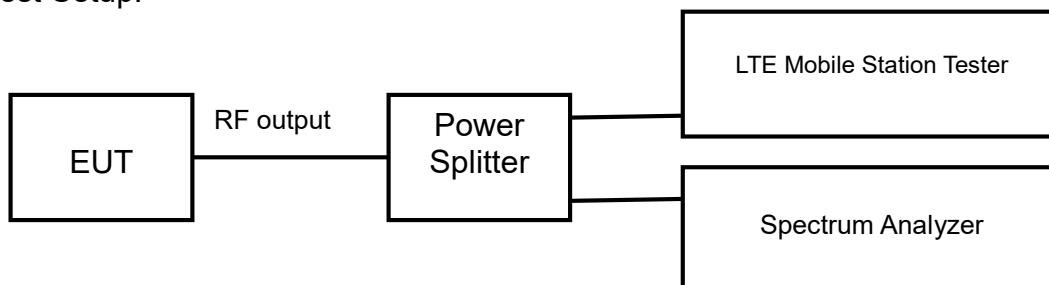
¹ Category B CBSDs will only be authorized for use after an ESC is approved and commercially deployed consistent with §§ 96.15 and 96.67.

The test results are shown in Appendix B.

6.2 Occupied Bandwidth

Rule Part(s)
FCC: 2.1049

Test Setup:



Test procedure:
KDB 971168 D01 v03r01 – Section 4.2

Test Setting:

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. $RBW = 1 - 5\%$ of the expected OBW
3. $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Limits: No specific occupied bandwidth requirements in part 2.1049

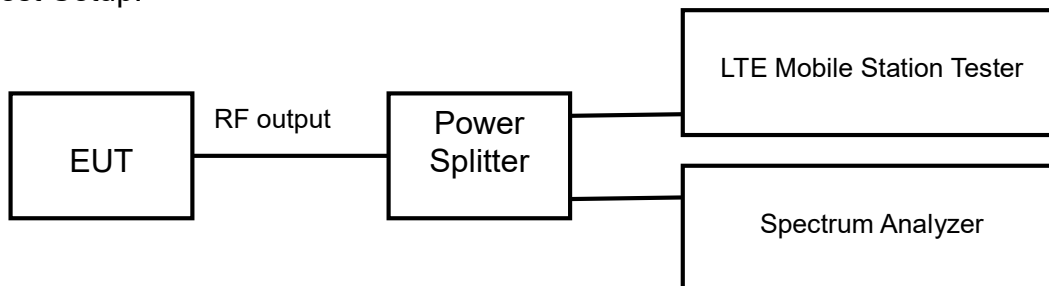
Test result:

The test results are shown in Appendix A.

6.3 Emission Bandwidth

Rule Part(s)
FCC: 2.1049

Test Setup:



Test procedure:
KDB 971168 D01 v03r01 – Section 4.2

Test Setting:

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of 26dB bandwidth observed in Step 7

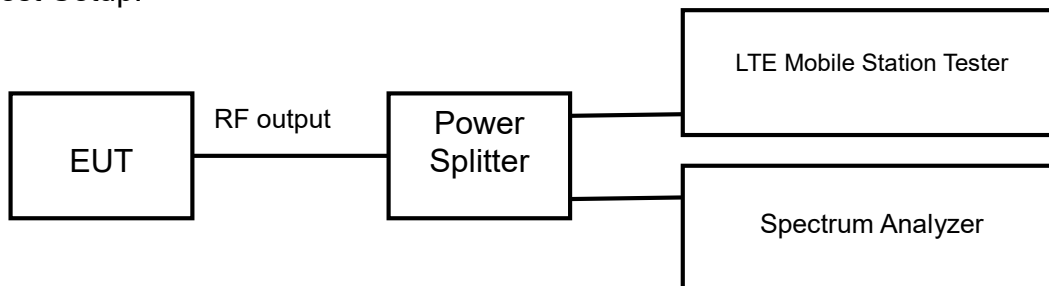
Limits: No specific emission bandwidth requirements in part 2.1049.

Test result:
The test results are shown in Appendix A.

6.4 Peak-Average Ratio

Rule Part(s)
FCC: 96.41(g)

Test Setup:



Test procedure:
KDB 971168 D01 v03r01 – Section 5.7.1

Test Setting:

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW $\geq$ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Limits

96.41(g)

Power measurement. The peak-to-average power ratio (PAPR) of any CBSD transmitter output power must not exceed 13 dB. PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

Test result:

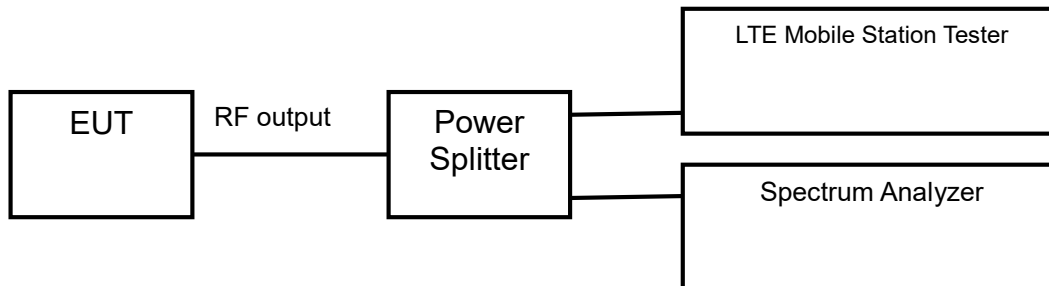
The test results are shown in Appendix A.

6.5 Band Edges Compliance

Rule Part(s)

FCC: 2.1051, 96.41(e)

Test Setup:



Test procedure:

KDB 971168 D01 v03r01 – Section 6.0

Test Setting:

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span/RBW}$
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Limits

Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any CBSD emission outside the fundamental emission bandwidth as specified in paragraph (e)(3) of this section (whether the emission is inside or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the upper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any CBSD emission shall not exceed -25 dBm/MHz. The upper and lower SAS assigned channel edges are the upper and lower limits of any channel assigned to a CBSD by an SAS, or in the case of multiple contiguous channels, the upper and lower limits of the combined contiguous channels.

Additional protection levels. Notwithstanding paragraph (e)(1) of this section, for CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed -25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz..

Test result:

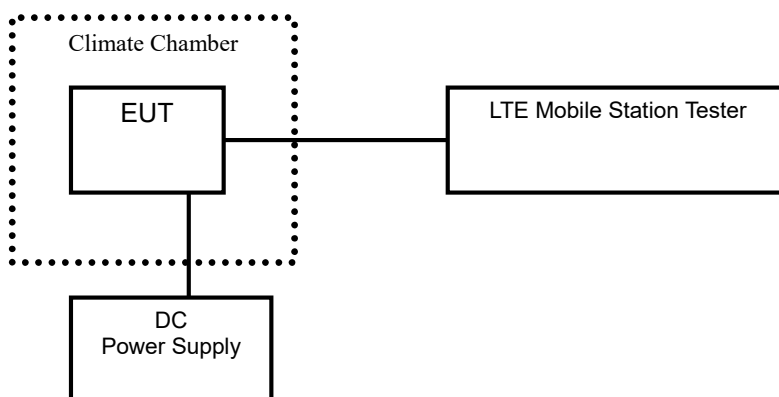
The test results are shown in Appendix A.

6.6 Frequency Stability

Rule Part(s)

FCC: 2.1055,

Test setup:



Test Procedure:

ANSI/TIA-603-E-2016

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C (The temperature range can be declared by the manufacturer). A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Limits: the frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency. For Part 24, Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test result:

The test results are shown in Appendix A.

7 MEASUREMENT UNCERTAINTIES

Items	Uncertainty
RF Power Output	0.6 dB
Effective Radiated Power and Effective Isotropic Radiated Power	0.6 dB
Occupied Bandwidth	3kHz
Emission Bandwidth	3kHz
Peak-Average Ratio	0.8dB
Band Edges Compliance	1.2dB
Frequency Stability	48Hz

8 TEST EQUIPMENTS

No.	Name/Model	Manufacturer	S/N	Calibration Date	Calibration Due Date
1	MT8820C Mobile Station Tester	Anritsu	6201300660	2022.06.21	2023.06.20
2	CMW500 RadioCommunication Station	R&S	161702	2022.06.21	2023.06.20
3	FSV40 Spectrum Analyzer	R&S	101065	2022.06.21	2023.06.20
4	N9020A Spectrum Analyzer	Agilent	MY48010771	2022.06.21	2023.06.20
5	6007 Power Divider	Weinschel	6007-GJ-1	2022.06.21	2023.06.20
6	DC Power Supply E3645A	Agilent	MY40000741	2022.06.21	2023.06.20
7	Temperature chamber SH241	ESPEC	92013758	2022.06.21	2023.06.20
8	12.65m×8.03m×7.50m Fully-Anechoic Chamber	FRANKONIA	----	----	----
9	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	----	----
10	Turn table Diameter:1m	FRANKONIA	----	----	----
11	Turn table Diameter:5m	FRANKONIA	----	----	----
12	Antenna master FAC(MA4.0)	MATURO	----	----	----
13	Antenna master SAC(MA4.0)	MATURO	----	----	----
14	9.080m×5.255m×3.525m Shielding room	FRANKONIA	----	----	----
15	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100512	2022.06.21	2023.06.20
16	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100513	2022.06.21	2023.06.20
17	HL562 Ultra log antenna	R&S	100016	2022.06.21	2023.06.20
18	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2022.06.21	2023.06.20
19	ESI 40 EMI test receiver	R&S	100015	2022.06.21	2023.06.20
20	ESCS30 EMI test receiver	R&S	100029	2022.06.21	2023.06.20
21	HL562 Receive antenna	R&S	100167	2022.06.21	2023.06.20
22	ENV216 AMN	R&S	3560.6550.12	2022.06.21	2023.06.20

APPENDIX – TEST DATA OF CONDUCTED EMISSION

---End of Test Report---