Certificate Number: 5055.02

TEST REPORT FOR RF TESTING

Report No.: SRTC2020-9004(F)-20050604(C)

Product Name: tracker

Product Model: CP314AT

Applicant: Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd

Manufacturer: Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd

Specification: FCC Part 2, Part 24E, Part 22H, Part 27 (2019)

FCC ID: R38YLCP314AT

The State Radio_monitoring_center Testing Center (SRTC)

15th Building, No.30, Shixing Street, Shijingshan District,

Beijing, P.R.China

Tel: 86-10-57996183 Fax: 86-10-57996388

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1. GENERAL INFORMATION

1.1 Notes of the test report

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written permission of The State Radio_monitoring_center Testing Center (SRTC).The test results relate only to individual items of the samples which have been tested. The certification and accreditation identifiers used in this report shall not be applicable to the tested or calibrated samples thereof. The manufacturer shall not mark the tested samples or items (or a separate part of the item) with the identifiers of certification and accreditation to mislead relevant parties about the tested samples or items.

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
Contacted person:	Liu Jia
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1.3 Applicant's details

Company:	Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address:	Building B, Boton Science Park, Chaguang Road, Xili Town, Nanshan District, Shenzhen
City:	Shenzhen
Country or Region:	China
Contacted person:	Emily
Tel:	15089742056
Fax:	---
Email:	zhangxuzhu@yulong.com

1.4 Manufacturer's details

Company:	Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address:	Building B, Boton Science Park, Chaguang Road, Xili Town, Nanshan District, Shenzhen
City:	Shenzhen
Country or Region:	China
Contacted person:	Emily
Tel:	15089742056
Fax:	---
Email:	zhangxuzhu@yulong.com

1.5 Test Environment

Date of Receipt of test sample at SRTC:	2020-05-06
Testing Start Date:	2020-05-06
Testing End Date:	2020-10-21

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient	25	30
Maximum Extreme	55	---
Minimum Extreme	-10	---

Normal Supply Voltage (V d.c.):	3.85
Maximum Extreme Supply Voltage (V d.c.):	4.30
Minimum Extreme Supply Voltage (V d.c.):	3.60

2 DESCRIPTION OF THE EQUIPMENT UNDER TEST

2.1 Final Equipment Build Status

Frequency Range	LTE Band 2: Tx:1850~1910MHz Rx:1930~1990MHz LTE Band 4: Tx:1710~1755MHz Rx:2110~2155MHz LTE Band 5: Tx:824~849 MHz Rx:869 ~894MHz LTE Band 12: Tx:699~716MHz Rx:729~746MHz LTE Band 13: Tx:777~787MHz Rx:746~756MHz LTE Band 25: Tx:1850~1915MHz Rx:1930~1995MHz LTE Band 26: Tx:814~849MHz Rx:859~894MHz LTE Band 41: Tx:2496~2690MHz Rx: 2496~2690MHz LTE Band 66: Tx:1710~1780MHz Rx: 2110~2200MHz LTE Band 71: Tx:617~652MHz Rx: 663~698MHz
Modulation Type	QPSK/16QAM
Antenna Type	Fixed Internal Antenna
Antenna Gain	LTE 2/25: -1.61dBi; LTE 4/66: -1.1dBi;LTE 5/26: -6.2dBi LTE 12: -6.51dBi;LTE 13:-6.0dBi; LTE 41:-2.5dBi; LTE 71:-6.56dBi
Power Supply	Battery/Charger
Hardware Version	P1
Software Version	3.18.505.P0.200514.cp314AT
IMEI	864156050000038

2.2 Support Equipment

The following support equipment was used to exercise the DUT during testing:

Equipment	Battery
Manufacturer	Lishen
Model Number	CPLD-432
Serial Number	---

Equipment	Charger
Manufacturer	Shenzhen RUIDE
Model Number	RD0501000-USBA-18MG
Serial Number	---

2.3 Summary table

FCC Rule Part	Frequency Range(MHz)	EIRP/ERP (W)	Frequency Tolerance (ppm)	Emission Designator	Emission Bandwidth (MHz)	Measured 26dBC Bandwidth (MHz)	Communication Type
LTE BAND2							
24E	1850.7-1909.3	0.145	0.020	1M08G7D	1.4M	1.373	QPSK
	1850.7-1909.3	0.116	0.020	1M08D7W	1.4M	1.369	16QAM
	1851.5-1908.5	0.144	0.033	2M70G7D	3M	3.001	QPSK
	1851.5-1908.5	0.117	0.033	2M70D7W	3M	3.009	16QAM
	1852.5-1907.5	0.145	0.027	4M48G7D	5M	4.996	QPSK
	1852.5-1907.5	0.119	0.027	4M47D7W	5M	4.964	16QAM
	1855-1905	0.149	-0.033	8M92G7D	10M	9.806	QPSK
	1855-1905	0.120	-0.033	8M93D7W	10M	9.725	16QAM
	1857.5-1902.5	0.150	-0.029	13M4G7D	15M	14.430	QPSK
	1857.5-1902.5	0.121	-0.029	13M4D7W	15M	14.400	16QAM
	1860-1900	0.154	0.032	17M8G7D	20M	19.230	QPSK
	1860-1900	0.124	0.032	17M8D7W	20M	19.100	16QAM
LTE BAND4							
27	1710.7-1754.3	0.237	-0.028	1M08G7D	1.4M	1.269	QPSK
	1710.7-1754.3	0.190	-0.028	1M08D7W	1.4M	1.268	16QAM
	1711.5-1753.5	0.232	-0.030	2M69G7D	3M	2.982	QPSK
	1711.5-1753.5	0.193	-0.030	2M69D7W	3M	3.005	16QAM
	1712.5-1752.5	0.242	0.032	4M48G7D	5M	4.941	QPSK
	1712.5-1752.5	0.192	0.032	4M48D7W	5M	4.974	16QAM
	1715-1750	0.240	-0.022	8M94G7D	10M	9.770	QPSK
	1715-1750	0.196	-0.022	8M95D7W	10M	9.708	16QAM
	1717.5-1747.5	0.248	0.036	13M4G7D	15M	14.490	QPSK
	1717.5-1747.5	0.198	0.036	13M4D7W	15M	14.530	16QAM
	1720-1745	0.251	0.033	17M8G7D	20M	19.430	QPSK
	1720-1745	0.200	0.033	17M8D7W	20M	19.160	16QAM
LTE BAND5							
22H	824.7-848.3	0.077	0.033	1M08G7D	1.4M	1.246	QPSK
	824.7-848.3	0.062	0.033	1M08D7W	1.4M	1.240	16QAM
	825.5-847.5	0.080	-0.047	2M69G7D	3M	2.973	QPSK
	825.5-847.5	0.063	-0.047	2M69D7W	3M	2.966	16QAM
	826.5-846.5	0.080	0.034	4M47G7D	5M	4.939	QPSK
	826.5-846.5	0.063	0.034	4M47D7W	5M	4.920	16QAM
	829-844	0.082	-0.039	8M95G7D	10M	9.725	QPSK
	829-844	0.065	-0.039	8M94D7W	10M	9.700	16QAM
LTE BAND12							
27	699.7-715.3	0.053	0.027	1M08G7D	1.4M	1.250	QPSK
	699.7-715.3	0.039	0.027	1M08D7W	1.4M	1.253	16QAM
	700.5-714.5	0.052	-0.031	2M68G7D	3M	2.947	QPSK
	700.5-714.5	0.038	-0.031	2M68D7W	3M	2.941	16QAM
	701.5-713.5	0.053	0.031	4M48G7D	5M	4.965	QPSK
	701.5-713.5	0.039	0.031	4M48D7W	5M	4.917	16QAM
	704-711	0.054	0.032	8M95G7D	10M	9.717	QPSK
	704-711	0.043	0.032	8M95D7W	10M	9.678	16QAM

LTE BAND13							
27	779.5-784.5	0.098	0.031	4M51G7D	5M	5.047	QPSK
	779.5-784.5	0.078	0.031	4M51D7W	5M	5.073	16QAM
	782	0.100	0.027	8M94G7D	10M	9.686	QPSK
	782	0.080	0.027	8M93D7W	10M	9.634	16QAM
LTE BAND25							
24E	1850.7-1914.3	0.143	0.032	1M09G7D	1.4M	1.369	QPSK
	1850.7-1914.3	0.114	0.032	1M09D7W	1.4M	1.341	16QAM
	1851.5-1913.5	0.140	0.028	2M68G7D	3M	3.135	QPSK
	1851.5-1913.5	0.114	0.028	2M68D7W	3M	2.952	16QAM
	1852.5-1912.5	0.146	-0.029	4M48G7D	5M	5.025	QPSK
	1852.5-1912.5	0.115	-0.029	4M48D7W	5M	5.003	16QAM
	1855-1910	0.146	-0.019	8M95G7D	10M	9.748	QPSK
	1855-1910	0.117	-0.019	8M94D7W	10M	9.707	16QAM
	1857.5-1907.5	0.148	0.024	13M4G7D	15M	14.650	QPSK
	1857.5-1907.5	0.119	0.024	13M4D7W	15M	14.650	16QAM
	1860-1905	0.152	0.028	17M9G7D	20M	19.460	QPSK
	1860-1905	0.121	0.028	17M9D7W	20M	19.180	16QAM
LTE BAND26							
22	824.7-848.3	0.085	0.028	1M09G7D	1.4M	1.269	QPSK
	824.7-848.3	0.067	0.028	1M08D7W	1.4M	1.252	16QAM
	825.5-847.5	0.086	-0.032	2M69G7D	3M	2.940	QPSK
	825.5-847.5	0.069	-0.032	2M69D7W	3M	2.935	16QAM
	826.5-846.5	0.088	0.025	4M49G7D	5M	4.928	QPSK
	826.5-846.5	0.070	0.025	4M48D7W	5M	4.908	16QAM
	829-844	0.088	0.031	8M95G7D	10M	9.724	QPSK
	829-844	0.070	0.031	8M96D7W	10M	9.716	16QAM
	831.5-841.5	0.091	-0.030	13M4G7D	15M	14.500	QPSK
	831.5-841.5	0.072	-0.030	13M4D7W	15M	14.510	16QAM
LTE BAND41							
27	2537.5-2652.5	0.227	0.024	4M48G7D	5M	5.154	QPSK
	2537.5-2652.5	0.182	0.024	4M49D7W	5M	5.115	16QAM
	2540-2650	0.232	0.033	8M93G7D	10M	9.744	QPSK
	2540-2650	0.184	0.033	8M92D7W	10M	10.130	16QAM
	2542.5-2647.5	0.231	-0.032	13M4G7D	15M	14.470	QPSK
	2542.5-2647.5	0.186	-0.032	13M4D7W	15M	14.420	16QAM
	2545-2645	0.238	0.025	17M8G7D	20M	19.170	QPSK
	2545-2645	0.190	0.025	17M8D7W	20M	19.030	16QAM
LTE BAND66							
27	1710.7-1779.3	0.318	0.031	1M08G7D	1.4M	1.273	QPSK
	1710.7-1779.3	0.257	0.031	1M08D7W	1.4M	1.268	16QAM
	1711.5-1778.5	0.318	0.018	2M68G7D	3M	2.943	QPSK
	1711.5-1778.5	0.253	0.018	2M68D7W	3M	2.934	16QAM
	1712.5-1777.5	0.322	0.023	4M48G7D	5M	4.955	QPSK
	1712.5-1777.5	0.260	0.023	4M48D7W	5M	4.920	16QAM
	1715-1775	0.333	-0.026	8M94G7D	10M	9.686	QPSK
	1715-1775	0.260	-0.026	8M93D7W	10M	9.711	16QAM
	1717.5-1772.5	0.330	-0.020	13M4G7D	15M	14.370	QPSK
	1717.5-1772.5	0.262	-0.020	13M4D7W	15M	14.310	16QAM
	1720-1770	0.340	0.033	17M8G7D	20M	19.020	QPSK
	1720-1770	0.270	0.033	17M8D7W	20M	19.070	16QAM

LTE BAND71							
27	665.5-695.5	0.088	-0.019	4M49G7D	5M	4.947	QPSK
	665.5-695.5	0.070	-0.019	4M49D7W	5M	4.949	16QAM
	668-693	0.090	0.026	8M95G7D	10M	9.761	QPSK
	668-693	0.073	0.026	8M96D7W	10M	9.748	16QAM
	670.5-690.5	0.091	0.024	13M4G7D	15M	14.580	QPSK
	670.5-690.5	0.073	0.024	13M4D7W	15M	14.430	16QAM
	673-688	0.093	0.036	17M8G7D	20M	19.070	QPSK
	673-688	0.075	0.036	17M9D7W	20M	19.010	16QAM

3 REFERENCE SPECIFICATION

Specification	Version	Title
FCC Part 2	2019	Frequency allocations and radio treaty matters; general rules and regulations
FCC Part 22	2019	Public mobile services
FCC Part 24	2019	Personal communications services
FCC Part 27	2019	Miscellaneous wireless communications services
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	RF Power Output	2.1046	Pass
2	Effective Radiated Power and Effective Isotropic Radiated Power	22.913(a)(5), 24.232(c), 27.50(b)(10), 27.50(c)(10), 27.50(h)(2), 27.50(d)(4), 27.50(a)(3)	Pass
3	Occupied Bandwidth	2.1049	Pass
4	Peak-Average Ratio	24.232(d), 27.50(d)(5)	Pass
5	Emission Bandwidth	2.1049	Pass
6	Spurious Emissions at antenna terminals	2.1051, 22.917(a), 24.238(a), 27.53(c), 27.53(g), 27.53(h), 27.53(m), 27.53(a)	Pass
7	Band Edges Compliance	2.1051, 22.917(a), 24.238(a), 27.53(c), 27.53(g), 27.53(h), 27.53(m), 27.53(a)	Pass
8	Frequency Stability	2.1055, 22.355, 24.235, 27.54	Pass
9	Radiated Spurious Emissions	2.1053, 22.917(a), 24.238(a), 27.53(c), 27.53(g), 27.53(h), 27.53(f), 27.53(a), 27.53(m)	Pass

This Test Report Is Issued by: Mr. Peng Zhen	Checked by: Mr. Li Bin
Tested by: Mr. Tong Daocheng	Issued date: 20201022

6 TEST RESULT

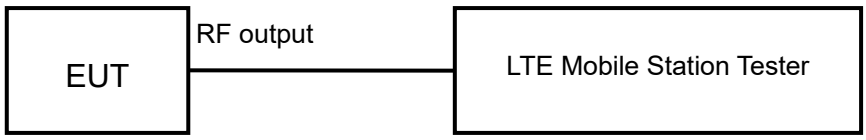
6.1 RF Power Output

Rule Part(s)
FCC: 2.1046

Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

Test Setup:



Test procedure:
After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. Then the test data can be read at the tester screen. The loss between RF output port of the EUT and the input port of the tester will be taken into consideration.

Limits: No RF Power Output requirements in part 2.1046.

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

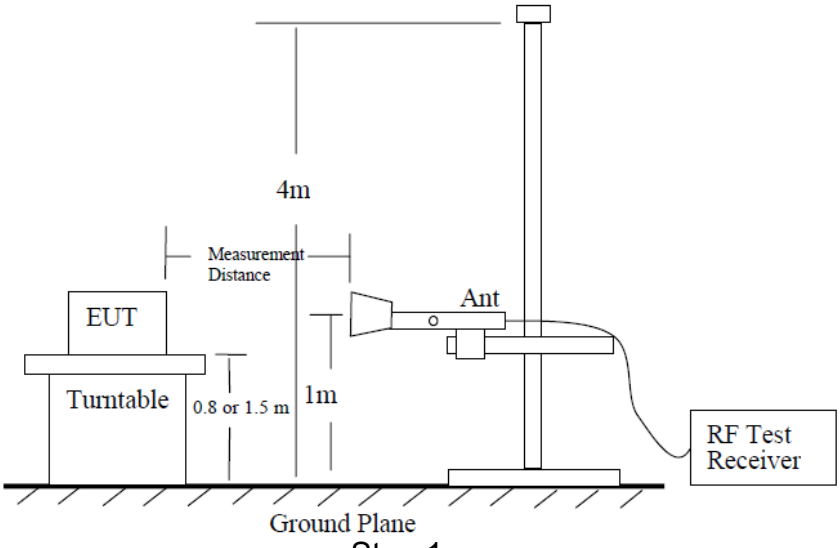
6.2 Effective Radiated Power and Effective Isotropic Radiated Power

Rule Part(s)
FCC: 22.913(a) (5), 24.232(c), 27.50(b) (10), 27.50(c) (10), 27.50(h) (2), 27.50(d) (4), 27.50(a) (3)

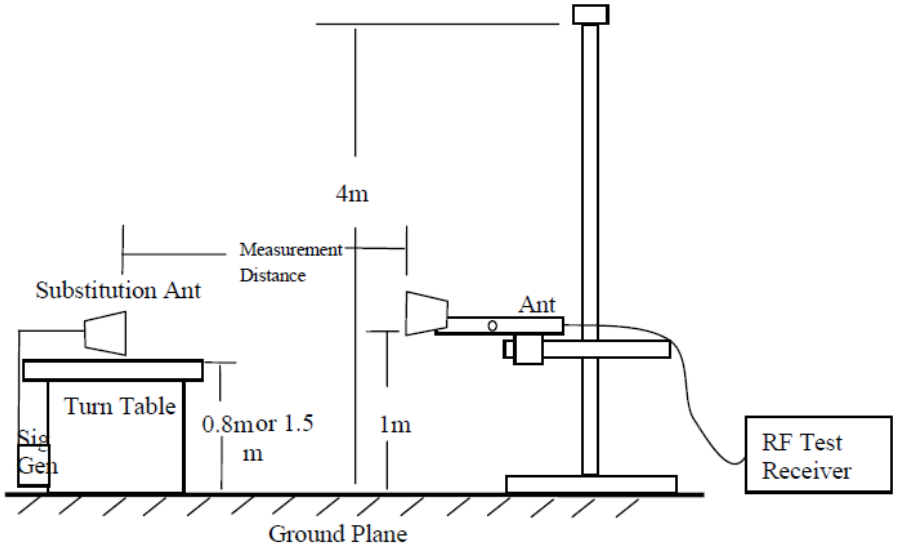
Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

Test setup:



Step 1



Step 2

Test procedure:
The measurements procedures in TIA-603-E-2016 are used.
Step 1:
The measurement is carried out in the chamber. EUT was placed on a 0.8m (f<1GHz)/ 1.5m (f>1GHz) high non-conductive table at a 3 meters test distance from the test receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT. The height of receiving antenna from 1m to 4m and varies in certain range to find the maximum power value. A radio link shall be established between EUT and Tester. The output power of the cell signal of the tester will be decreased until the output power of the EUT reach a maximum value. A peak detector is used and RBW is set to the 99% power bandwidth of the fundamental signal . The antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum power value on spectrum analyzer or receiver. And the maximum value of the receiver should be recorded as (Pr).
Step 2:
A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator. To repeat the same procedure as step1 and the level of signal generator will be adjusted till the same power value on the spectrum analyzer or receiver. The ERP/EIRP of the EUT can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna.
A power (Pmea) is applied to the input of the substitution antenna, and adjusts 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.
A “reference path loss” should be calculated after test. The attenuation of “reference path loss” is the cable loss between the Signal Source with the Substitution Antenna (Pca) and the Substitution Antenna Gain (Ga).
The measurement results are obtained as described below:
Power (EIRP) = Pmea+ Pca+ Ga

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, ERP = EIRP – 2.15 (dB).
22.913(a) (5)
The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.
24.232(c)
Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.
27.50(b) (10)
Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.
27.50(c) (10)
Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.
27.50(h) (2)
Mobile and other user stations.Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

27.50(d) (4)
Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.
27.50(a) (3)
Mobile and portable stations (i) For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth.

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

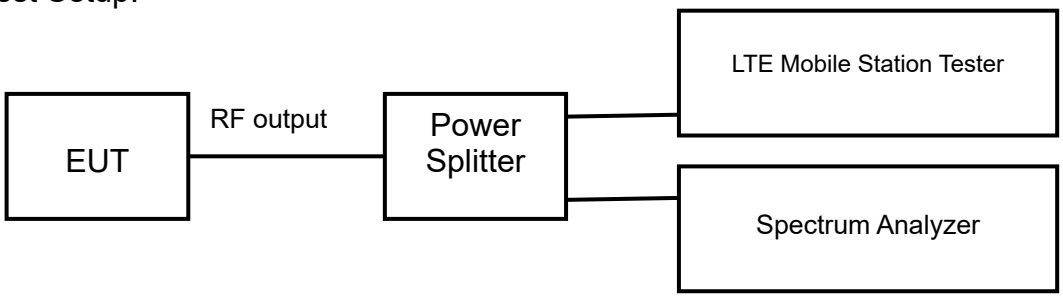
6.3 Occupied Bandwidth

Rule Part(s)
FCC: 2.1049

Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

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 ≥ 3 x 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.

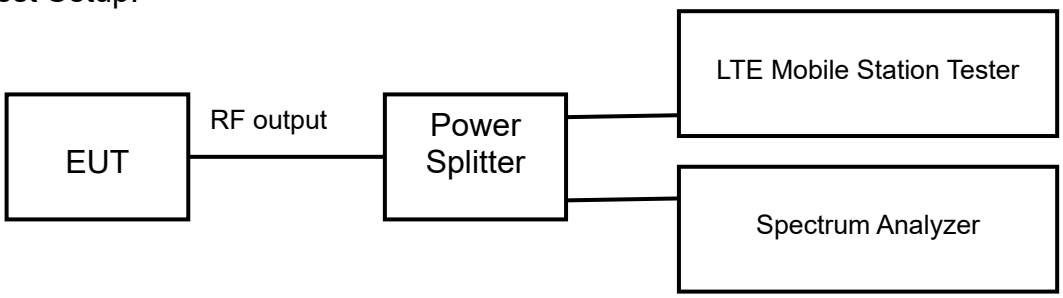
6.4 Emission Bandwidth

Rule Part(s)
FCC: 2.1049

Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

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 ≥ 3 x 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.

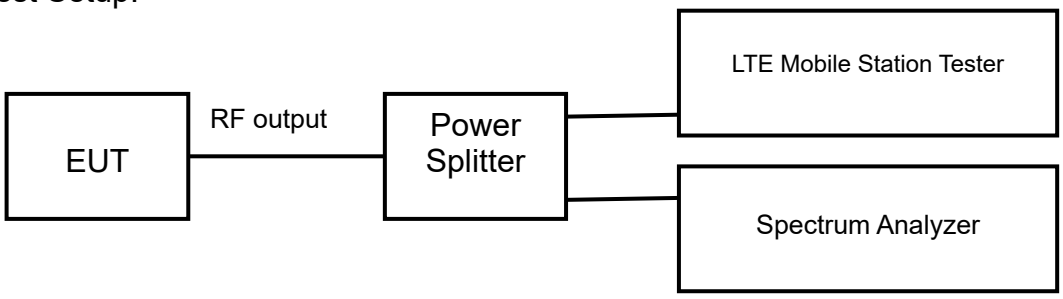
6.5 Peak-Average Ratio

Rule Part(s)
FCC: 24.232(d), 27.50(d) (5)

Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

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 ≥ 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
24.232(d), 27.50(d) (5)
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

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

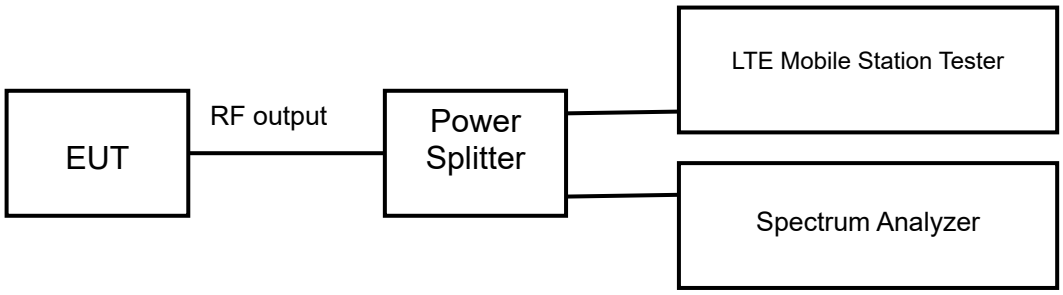
6.6 Spurious Emissions at antenna terminal

Rule Part(s)
FCC: 2.1051, 22.917(a), 24.238(a), 27.53(c), 27.53(g), 27.53(h), 27.53(m), 27.53(a)

Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

Test Setup:



Test procedure:
KDB 971168 D01 v03r01 – Section 6.0

Test Setting:
1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency
2. Detector = RMS
3. RBW=1MHz
4. VBW=3MHz
5. Trace mode = trace average for continuous emissions, max hold for pulse emissions
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Limits
The minimum permissible attenuation level of any spurious emission is 43 + log10 (P [Watts]), where P is the transmitter power in Watts.
For Band 30, the minimum permissible attenuation level of any spurious emission <2288MHz and >2365MHz is 70 + log10 (P [Watts]).
For Band 7 and 41, the minimum permissible attenuation level of any spurious emission is 55 + log10 (P [Watts]).

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

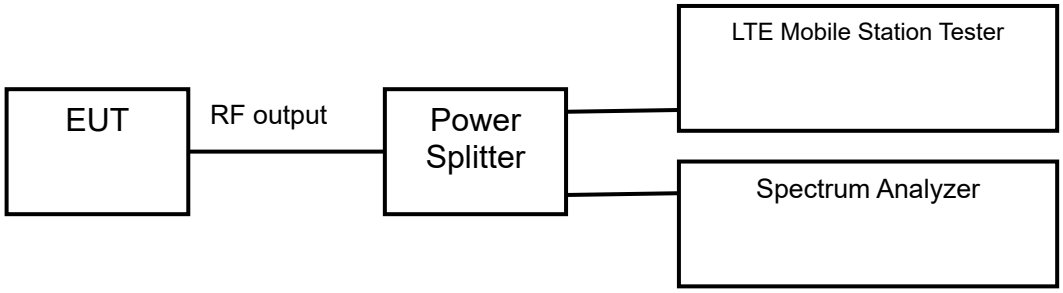
6.7 Band Edges Compliance

Rule Part(s)
FCC: 2.1051, 22.917(a), 24.238(a), 27.53(c), 27.53(g), 27.53(h), 27.53(m), 27.53(a)

Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

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 ≥ 2 x 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
The minimum permissible attenuation level of any spurious emission is 43 + log10 (P [Watts]), where P is the transmitter power in Watts.
The minimum permissible attenuation level for Band 30 is > 43 + 10log10 (P [Watts] at 2300-2305MHz & 2345-2360MHz, > 55 + 10log10 (P [Watts]) at 2320-2324MHz & 2341-2345MHz, > 61 + 10log10 (P [Watts]) at 2324-2328MHz & 2337-2341MHz, > 67 + 10log10 (P [Watts]) at 2288-2292MHz & 2328- 2337MHz, and > 70 + 10log10 (P [Watts]) at frequencies < 2288MHz & >2365MHz.
Per 22.917(b) 24.238(a) 27.53(h) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the

width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.
Per 27.53(g) for operations in the 698-746 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.
Per 27.53(c)(5) for operations in the 776-788 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.
For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c)(4) is 65 + 10log10(P) = -35dBm in a 6.25kHz bandwidth.
Per 27.53(a)(5) in the 1 MHz bands immediately outside and adjacent to the channel blocks at 2305, 2310, 2315, 2320, 2345, 2350, 2355, and 2360 MHz, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 MHz). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5MHz.

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

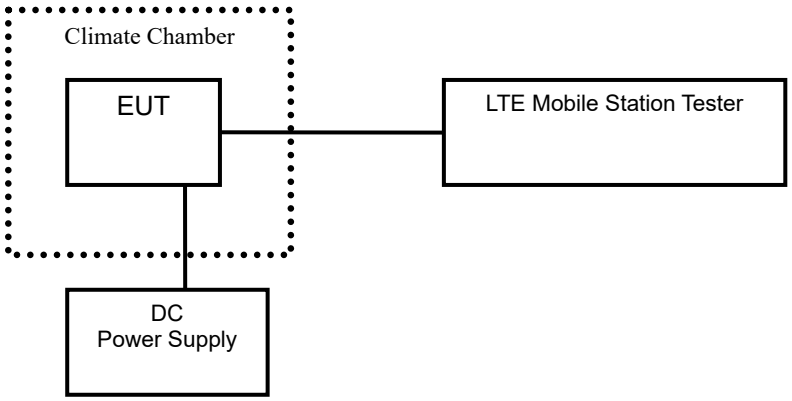
6.8 Frequency Stability

Rule Part(s)
FCC: 2.1055, 22.355, 24.235, 27.54

Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

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: For Part 22, the frequency stability of the transmitter shall be maintained within ±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.

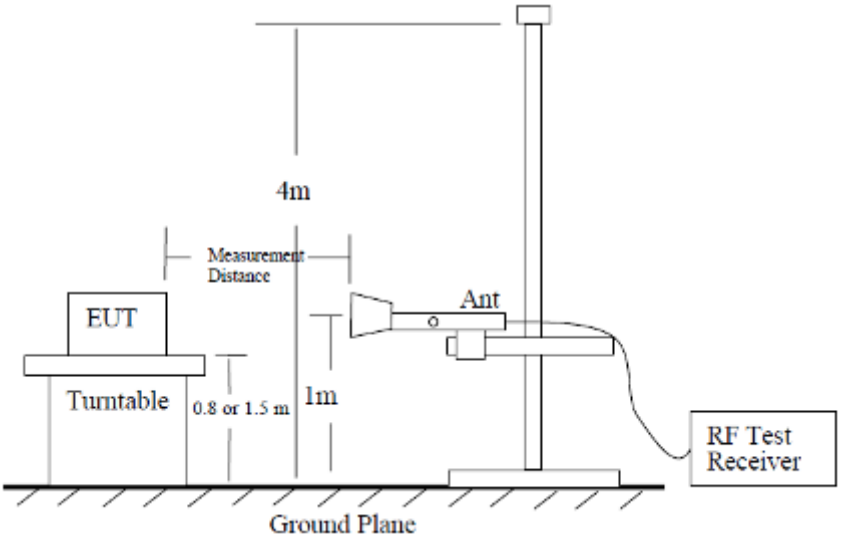
6.9 Radiated Spurious Emissions

Rule Part(s)
FCC: 2.1053, 22.917(a), 24.238(a), 27.53(c), 27.53(g), 27.53(h), 27.53(f), 27.53(a), 27.53(m)

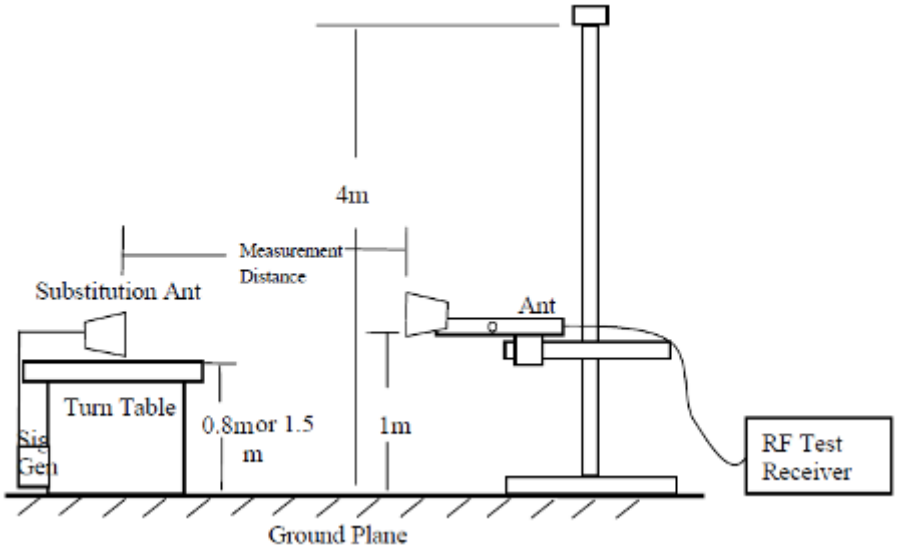
Ambient condition:

Temperature	Relative humidity	Pressure
25°C	30%	101.9kPa

Test Setup:



Step 1



Step 2

Test procedure:
The measurements procedures in TIA-603-E-2016 are used.
The spectrum was scanned from 30MHz to the 10th harmonic of the highest frequency generated within the equipment.
Step 1:
The measurement is carried out in the chamber. EUT was placed on a 0.8m (f<1GHz)/ 1.5m (f>1GHz) high non-conductive table at a 3 meters test distance from the test receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT. The height of receiving antenna from 1m to 4m and varies in certain range to find the maximum power value. A radio link shall be established between EUT and Tester. The output power of the cell signal of the tester will be decreased until the output power of the EUT reach a maximum value. A peak detector is used and RBW is set to 100 kHz (f<1GHz)/1MHz (f>1GHz). The antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum power value on spectrum analyzer or receiver. The spectrum analyzer scans from 30MHz to 10th harmonic of the carrier. A notch filter is necessary in the band near to the carrier frequency. A high pass filter is needed to avoid the distortion of the testing equipment in the band above the carrier frequency.
Step 2:
A log-periodic antenna or double-ridged waveguide 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.
A power (Pmea) is applied to the input of the substitution antenna, and adjusts 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.
A “reference path loss” should be calculated after test. The attenuation of “reference path loss” is the cable loss between the Signal Source with the Substitution Antenna (Pca) and the Substitution Antenna Gain (Ga).
Calculation procedure:
The data of cable loss and antenna gain has been calibrated in full testing frequency range before the testing.
The power of the Radiated Spurious Emissions is calculated by adding the cable loss and antenna gain. The basic equation with a sample calculation is as followed:
Power (EIRP) = Pmea+ Pca + Ga
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, ERP = EIRP – 2.15 (dB).
Assumed the power of signal source record is -20dBm. A cable loss of -30dB, and an antenna gain of 11dB are added.
P=Pmea+Pca+Ga=(-20dBm)+(-30dB)+(11dB)= -39dBm

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

7 MEASUREMENT UNCERTAINTIES

Items	Uncertainty	
RF Power Output	0.6 dB	
Occupied Bandwidth	3 kHz	
Spurious Emissions	30MHz～1GHz	2.83 dB
	1GHz～12.75GHz	2.50 dB
	12.75GHz～25GHz	2.75 dB
Band Edges Compliance	1.2dB	
Frequency Stability	4 Hz	

8 TEST EQUIPMENTS

No.	Name/Model	Manufacturer	S/N	Calibration Date	Calibration Due Date
1	MT8820C Mobile Station Tester	Anritsu	6201300660	2020.08.20	2021.08.19
2	FSV40 Spectrum Analyzer	R&S	101065	2020.08.20	2021.08.19
2	N9020A Spectrum Analyzer	Agilent	MY48010771	2020.08.20	2021.08.19
3	6007 Power Divider	Weinschel	6007-GJ-1	2020.08.20	2021.08.19
4	DC Power Supply E3645A	Agilent	MY40000741	2020.03.01	2021.02.28
5	Temperature chamber SH241	ESPEC	92013758	2020.08.20	2021.08.19
6	12.65m×8.03m×7.50m Fully-Anechoic Chamber	FRANKONIA	-----	-----	-----
7	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	-----	-----
8	Turn table Diameter:1m	FRANKONIA	-----	-----	-----
9	Turn table Diameter:5m	FRANKONIA	-----	-----	-----
10	Antenna master FAC(MA4.0)	MATURO	-----	-----	-----
11	Antenna master SAC(MA4.0)	MATURO	-----	-----	-----
12	9.080m×5.255m×3.525m Shielding room	FRANKONIA	-----	-----	-----
13	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100512	2020.08.20	2021.08.19
14	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100513	2020.08.20	2021.08.19
15	HL562 Ultra log antenna	R&S	100016	2020.08.20	2021.08.19
16	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2020.08.20	2021.08.19
17	ESI 40 EMI test receiver	R&S	100015	2020.08.20	2021.08.19
18	ESCS30 EMI test receiver	R&S	100029	2020.08.20	2021.08.19
19	HL562 Receive antenna	R&S	100167	2020.08.20	2021.08.19
20	ENV216 AMN	R&S	3560.6550.12	2020.08.20	2021.08.19

APPENDIX A – TEST DATA OF CONDUCTED EMISSION

Please refer to the attachment.

APPENDIX B – TEST DATA OF RADIATED EMISSION

Please refer to the attachment.