Certificate Number: 5055.02

TEST REPORT FOR BLE TESTING

Report No.: SRTC2020-9004(F)-20082801(C)

Product Name: Fi Smart Collar 2

Product Model: FC2

Applicant: Barking Labs

Manufacturer: Barking Labs

Specification: FCC CFR47 PART 2, 22H, 24E, 27L (2019)

FCC ID: 2ARXN-FC2

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

CONTENTS

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
Tel:	+86 10 57996183
Fax:	+86 10 57996388
Email:	liujiaf@srtc.org.cn

1.3 Applicant's details

Company:	Barking Labs
Address:	215 Plymouth St., Fl. 1
City:	Brooklyn, NY
Country or Region:	USA
Contacted person:	Bob Blake
Tel:	+1-914-249-9347
Fax:	---
Email:	bob@tryfi.com

1.4 Manufacturer's details

Company:	Barking Labs
Address:	215 Plymouth St., Fl. 1
City:	Brooklyn, NY
Country or Region:	USA
Contacted person:	Bob Blake
Tel:	+1-914-249-9347
Fax:	---
Email:	bob@tryfi.com

1.5 Test Environment

Date of Receipt of test sample at SRTC:	2020-08-28
Testing Start Date:	2020-08-28
Testing End Date:	2020-09-11

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient	25	30
Maximum Extreme	60	---
Minimum Extreme	-20	---

Normal Supply Voltage (V d.c.):	3.85
Maximum Extreme Supply Voltage (V d.c.):	4.35
Minimum Extreme Supply Voltage (V d.c.):	3.00

2 DESCRIPTION OF THE EQUIPMENT UNDER TEST

2.1 Final Equipment Build Status

Frequency Range	LTE_CAT-M1 Band 2: Tx:1850~1910MHz Rx:1930~1990MHz LTE_CAT-M1 Band 4: Tx:1710~1755MHz Rx:2110~2155MHz LTE_CAT-M1 Band 12: Tx:699~716 MHz Rx:729~746 MHz
Modulation Type	QPSK/16QAM
Antenna Type	Fixed Internal Antenna
Power Supply	Battery/Charge
HW Version	Rev.A
SW Version	1.0
IMEI	353863112367317

2.2 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
BAND2							
24E	1850.7-1909.3	0.298	-0.059	1M10G7D	1.4M	1.308	QPSK
	1850.7-1909.3	0.207	-0.059	931KD7W	1.4M	1.181	16QAM
	1851.5-1908.5	0.288	-0.075	1M28G7D	1.4M	1.412	QPSK
	1851.5-1908.5	0.205	-0.075	949KD7W	1.4M	1.335	16QAM
	1852.5-1907.5	0.294	-0.072	1M11G7D	1.4M	1.377	QPSK
	1852.5-1907.5	0.247	-0.072	943KD7W	1.4M	1.493	16QAM
	1855-1905	0.306	0.060	1M13G7D	1.4M	1.593	QPSK
	1855-1905	0.251	0.060	971KD7W	1.4M	1.489	16QAM
	1857.5-1902.5	0.285	-0.070	1M14G7D	1.4M	1.796	QPSK
	1857.5-1902.5	0.277	-0.070	988KD7W	1.4M	1.691	16QAM
	1860-1900	0.301	-0.077	1M15G7D	1.4M	1.822	QPSK
	1860-1900	0.306	-0.077	969KD7W	1.4M	1.664	16QAM
BAND4							
27L	1710.7-1754.3	0.212	-0.059	1M09G7D	1.4M	1.268	QPSK
	1710.7-1754.3	0.147	-0.059	920KD7W	1.4M	1.095	16QAM
	1711.5-1753.5	0.211	-0.075	1M11G7D	1.4M	1.701	QPSK
	1711.5-1753.5	0.146	-0.075	933KD7W	1.4M	1.244	16QAM
	1712.5-1752.5	0.211	-0.072	1M11G7D	1.4M	1.395	QPSK
	1712.5-1752.5	0.213	-0.072	939KD7W	1.4M	1.252	16QAM
	1715-1750	0.210	0.060	1M12G7D	1.4M	2.103	QPSK
	1715-1750	0.217	0.060	962KD7W	1.4M	1.407	16QAM
	1717.5-1747.5	0.208	-0.070	1M14G7D	1.4M	1.665	QPSK
	1717.5-1747.5	0.220	-0.070	978KD7W	1.4M	1.550	16QAM
	1720-1745	0.214	-0.077	1M13G7D	1.4M	1.745	QPSK
	1720-1745	0.218	-0.077	954KD7W	1.4M	1.471	16QAM

BAND12							
27H	699.7-715.3	0.211	-0.075	1M10G7D	1.4M	1.267	QPSK
	699.7-715.3	0.147	-0.075	927KD7W	1.4M	1.128	16QAM
	700.5-714.5	0.209	-0.065	1M11G7D	1.4M	1.459	QPSK
	700.5-714.5	0.145	-0.065	943KD7W	1.4M	1.372	16QAM
	701.5-713.5	0.202	-0.077	1M11G7D	1.4M	1.379	QPSK
	701.5-713.5	0.192	-0.077	939KD7W	1.4M	1.260	16QAM
	704-711	0.205	-0.077	1M12G7D	1.4M	1.950	QPSK
	704-711	0.192	-0.077	942KD7W	1.4M	1.460	16QAM

2.3 Support Equipment

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

Equipment	Battery 1
Manufacturer	Jiade Energy Technology(Zhuhai)Co.,Ltd.
Model Number	JKIT

Equipment	Charger
Manufacturer	JIANGSU CHENYANG ELECTRON CO., LTD.
Model Number	CA05-050100U

3 REFERENCE SPECIFICATION

The tests documented in this report were performed in accordance with ANSI C63.26:2015, FCC CFR 47 Part 2, FCC KDB 971168 D01 v02r02, KDB 971168 D02 v01, Part 22, Part 24, Part 27.

Specification	Version	Title
ANSI C63.26:2015	11 December 2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
FCC CFR 47 Part 2	2019	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
FCC CFR 47 Part 22	2019	PUBLIC MOBILE SERVICES
FCC CFR 47 Part 24	2019	PERSONAL COMMUNICATIONS SERVICES
FCC CFR 47 Part 27	2019	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
KDB 971168 D01	v03r01	MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS
KDB 971168 D02	v02r01	MISCELLANEOUS AND BASIC REVIEW AND APPROVAL ITEMS FOR TRANSMITTING EQUIPMENT USED IN LICENSED RADIO 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

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.
N/T	Test case is not tested.
NTNV	Nominal voltage, Normal Temperature
HV	High voltage, Normal Temperature
LV	Low voltage, Normal Temperature
HTHV	high voltage, High Temperature
LTHV	High voltage, Low Temperature
HTLV	Low voltage, High Temperature
LTLV	Low voltage, Low Temperature

5 RESULT SUMMARY

The following table summarizes the test results obtained.

No.	Test case	FCC reference	Verdict
1	RF Power Output	2.1046	Pass
2	Effective Radiated Power and Effective Isotropic Radiated Power	22.913, 24.232, 27.50	Pass
3	Occupied Bandwidth	2.1049	Pass
4	Peak-Average Ratio	22.913, 24.232, 27.50	Pass
5	Emission Bandwidth	2.1049	Pass
6	Spurious Emissions at antenna terminals	2.1051, 22.901, 22.917, 24.238, 27.53	Pass
7	Band Edges Compliance	2.1051, 22.359, 22.917, 24.238, 27.53	Pass
8	Frequency Stability	2.1055, 22.355, 24.235, 27.54	Pass
9	Radiated Spurious Emissions	2.1053, 22.917, 24.238, 27.53	Pass

This Test Report Is Issued by: Mr. Peng Zhen	Checked by: Mr. Li Bin
Tested by: Miss. Jin Wanqing	Issued date: 20200929

6 TEST RESULT

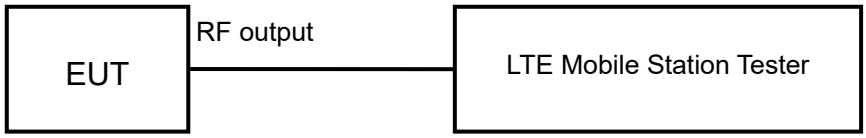
6.1 RF Power Output

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.

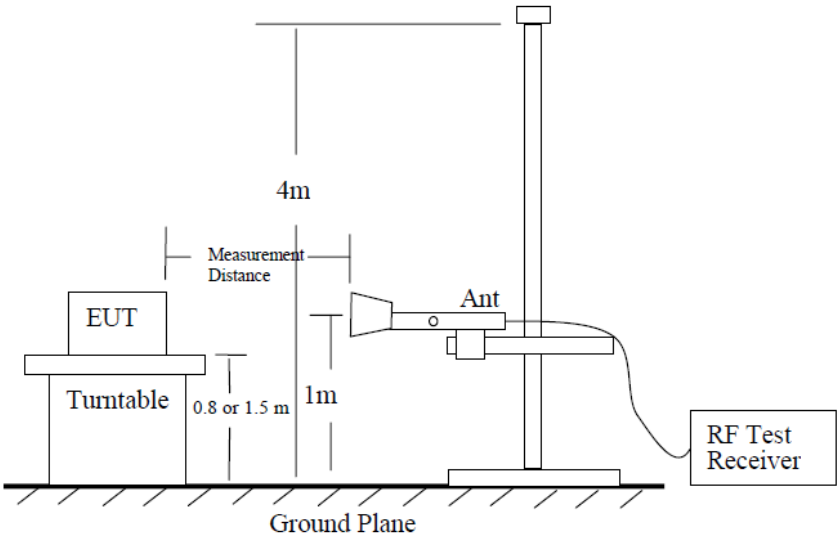
6.2 Effective Radiated Power and Effective Isotropic Radiated Power

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)

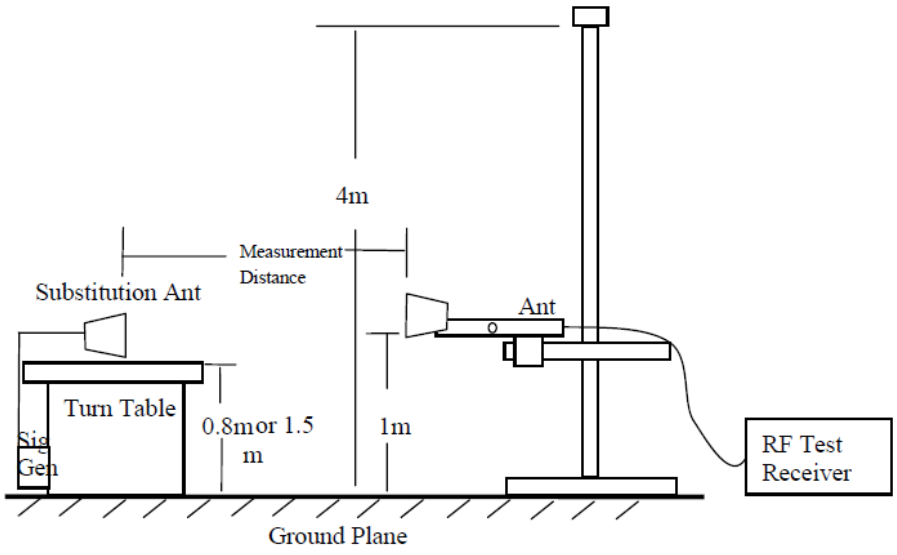
Ambient condition:

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 100KHz(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. 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.

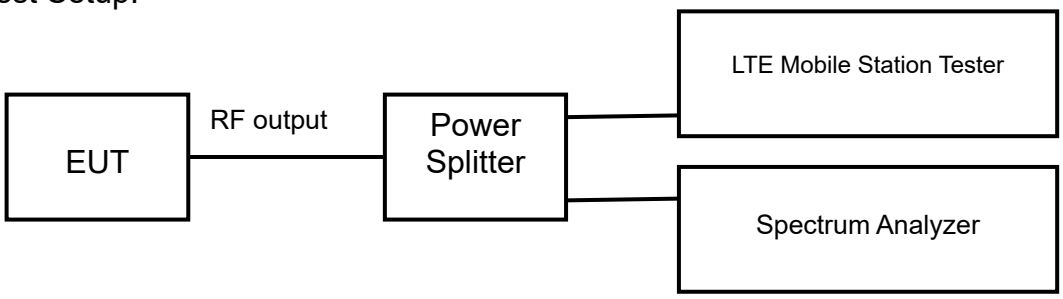
6.3 Occupied Bandwidth

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.

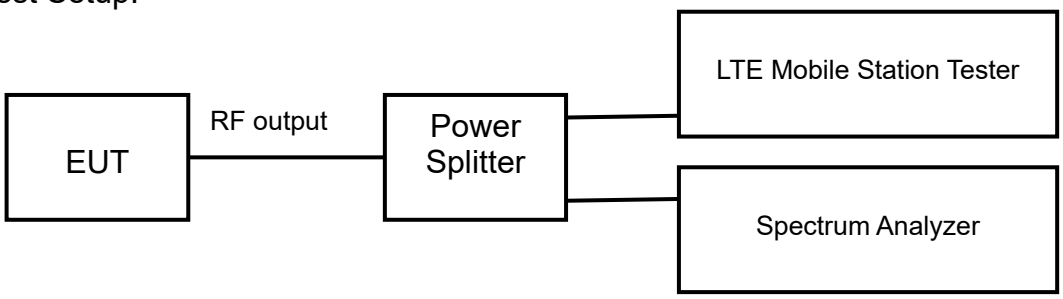
6.4 Emission Bandwidth

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.

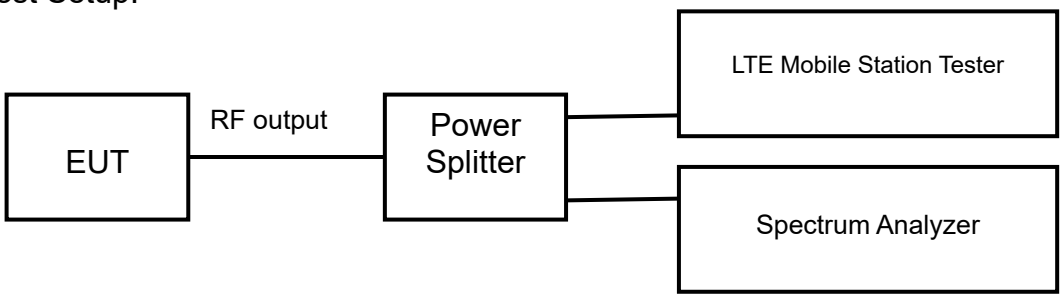
6.5 Peak-Average Ratio

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.

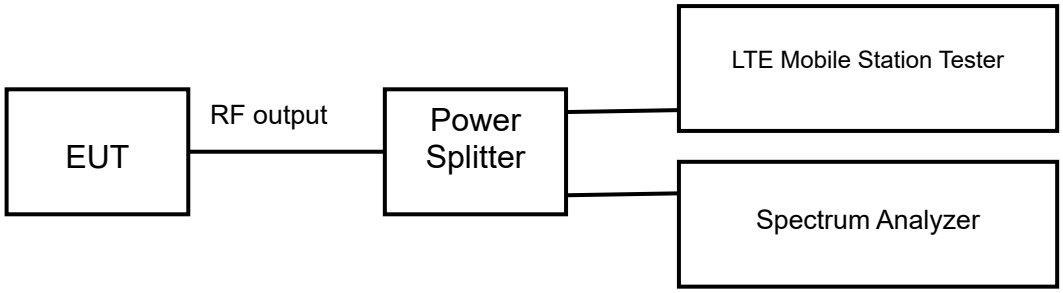
6.6 Spurious Emissions at antenna terminal

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.

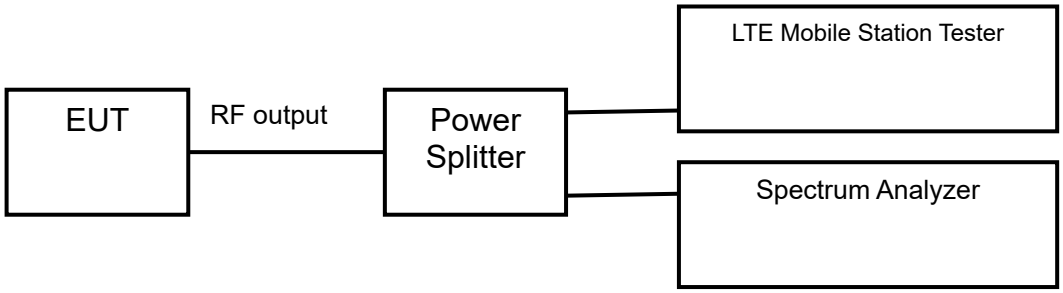
6.7 Band Edges Compliance

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.

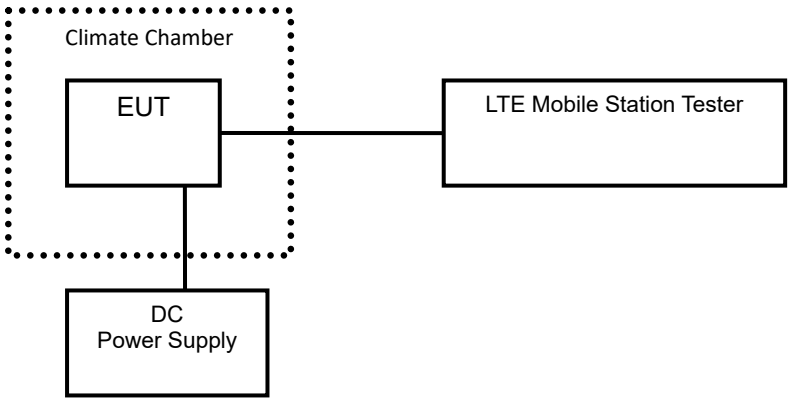
6.8 Frequency Stability

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.

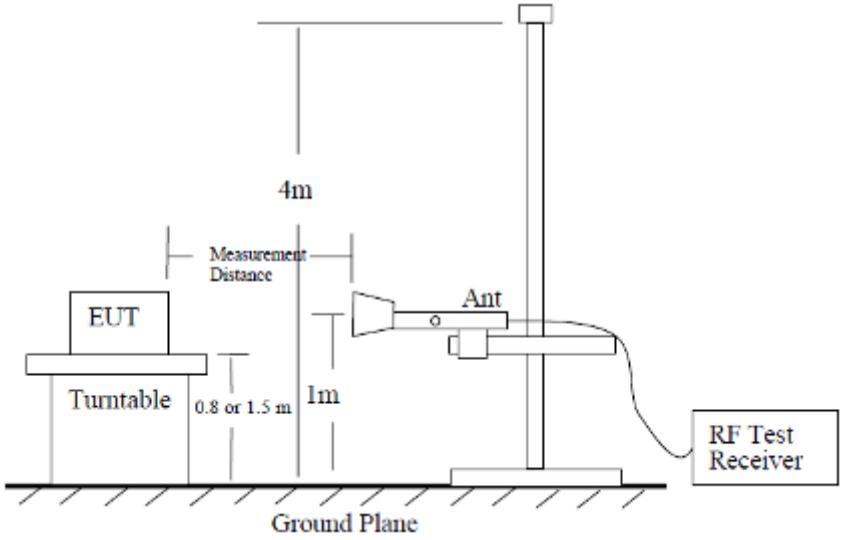
6.9 Radiated Spurious Emissions

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)

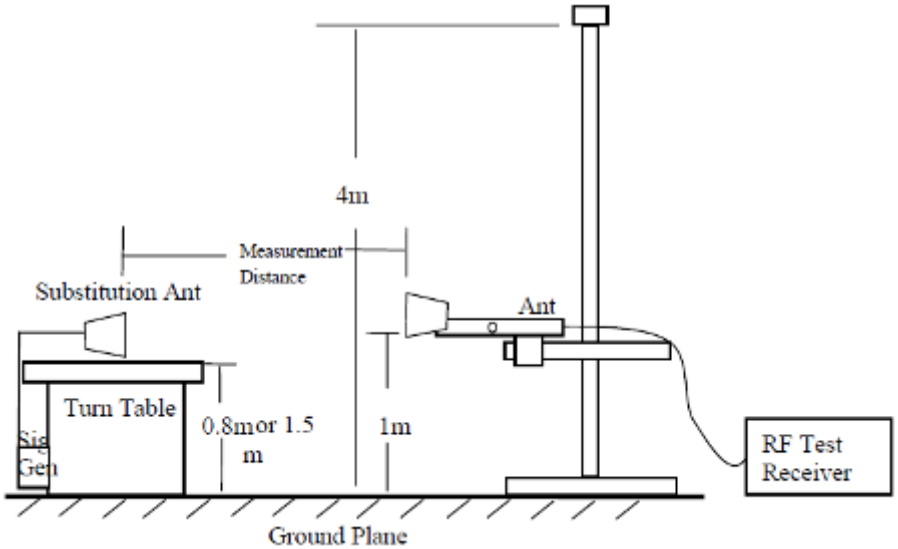
Ambient condition:

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	CMW500 Mobile Station Tester	R&S	134669	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

LTE_CAT.M1_ Band 2

1 RF Power Output

Test result:

Antenna Gain: 0.60dBi

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	1850.7	18607	1.4	1	0	21.45
				6	0	19.44
	1880	18900		1	0	21.35
				6	0	19.70
	1909.3	19193		1	0	21.99
				6	0	19.80
16QAM	1850.7	18607	1.4	1	0	20.04
				1	5	20.14
				5	0	19.48
				5	1	19.85
	1880	18900		1	0	20.24
				1	5	20.38
				5	0	20.02
				5	1	20.06
	1909.3	19193		1	0	20.42
				1	5	20.51
				5	0	20.43
				5	1	20.29
QPSK	1851.7	18615	3	1	0	21.37
				6	0	19.41
	1880	18900		1	0	21.19
				6	0	19.68
	1908.5	19185		1	0	21.84
				6	0	19.77
16QAM	1851.7	18615	3	1	0	20.01
				1	5	20.12
				5	0	19.39
				5	1	19.76
	1880	18900		1	0	20.18
				1	5	20.32
				5	0	20.00
				5	1	20.03
	1908.5	19185		1	0	20.37
				1	5	20.48
				5	0	20.32
				5	1	20.17

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	1852.5	18625	5	1	0	21.78
				6	0	20.36
	1880	18900		1	0	21.89
				6	0	20.82
	1907.5	19175		1	0	21.93
				6	0	20.75
16QAM	1852.5	18625	5	1	0	21.18
				1	5	21.19
				5	0	20.87
				5	1	20.79
	1880	18900		1	0	21.18
				1	5	21.47
				5	0	21.13
				5	1	21.02
	1907.5	19175		1	0	21.16
				1	5	21.48
				5	0	21.12
				5	1	21.21
QPSK	1855	18650	10	1	0	21.84
				6	0	20.48
	1880	18900		1	0	21.94
				6	0	20.74
	1905	19150		1	0	22.11
				6	0	20.74
16QAM	1855	18650	10	1	0	21.20
				1	5	21.23
				5	0	20.98
				5	1	20.88
	1880	18900		1	0	21.19
				1	5	21.49
				5	0	21.21
				5	1	21.06
	1905	19150		1	0	21.25
				1	5	21.53
				5	0	21.18
				5	1	21.24

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	1857.5	18675	15	1	0	21.48
				6	0	21.34
	1880	18900		1	0	21.71
				6	0	21.40
	1902.5	19125		1	0	21.80
				6	0	21.50
16QAM	1857.5	18675	15	1	0	21.39
				1	5	21.32
				5	0	22.05
				5	1	21.91
	1880	18900		1	0	21.52
				1	5	21.54
				5	0	21.97
				5	1	21.53
	1902.5	19125		1	0	21.68
				1	5	21.64
				5	0	22.17
				5	1	22.16
QPSK	1860	18700	20	1	0	22.03
				6	0	21.21
	1880	18900		1	0	21.59
				6	0	21.47
	1900	19100		1	0	21.77
				6	0	21.82
16QAM	1860	18700	20	1	0	21.11
				1	5	21.79
				5	0	21.93
				5	1	21.88
	1880	18900		1	0	21.55
				1	5	21.59
				5	0	22.06
				5	1	21.93
	1900	19100		1	0	22.11
				1	5	21.52
				5	0	22.17
				5	1	22.15

2 Occupied Bandwidth

Test result

Band	Carrier frequency (MHz)	Channel	BW (MHz)	Modulation	RB Size	RB Offset	Bandwidth of 99% Power (MHz)	Bandwidth of -26dB transmitter power (MHz)	Plot
2	1880.0	18900	1.4	QPSK	6	0	1.1005	1.308	Fig.1
				16QAM	5	1	931.26	1.181	Fig.2
			3	QPSK	6	0	1.2837	1.412	Fig.3
				16QAM	5	1	949.49	1.335	Fig.4
			5	QPSK	6	0	1.1152	1.377	Fig.5
				16QAM	5	1	943.05	1.493	Fig.6
			10	QPSK	6	0	1.1364	1.593	Fig.7
				16QAM	5	1	971.00	1.489	Fig.8
			15	QPSK	6	0	1.1426	1.796	Fig.9
				16QAM	5	1	987.80	1.691	Fig.10
			20	QPSK	6	0	1.1524	1.822	Fig.11
				16QAM	5	1	968.73	1.664	Fig.12

Fig.1

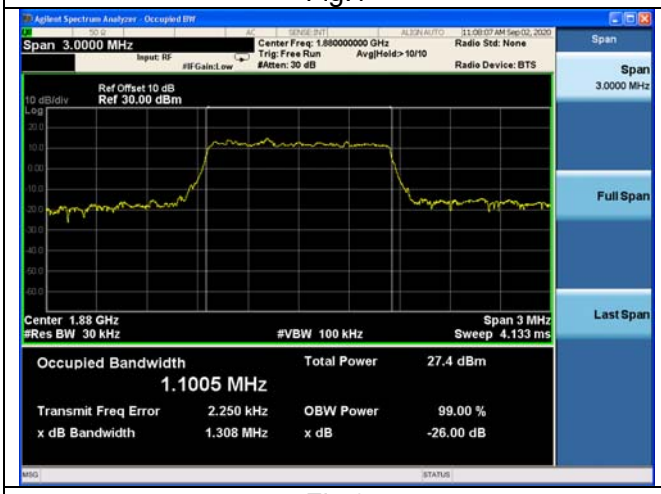


Fig.2

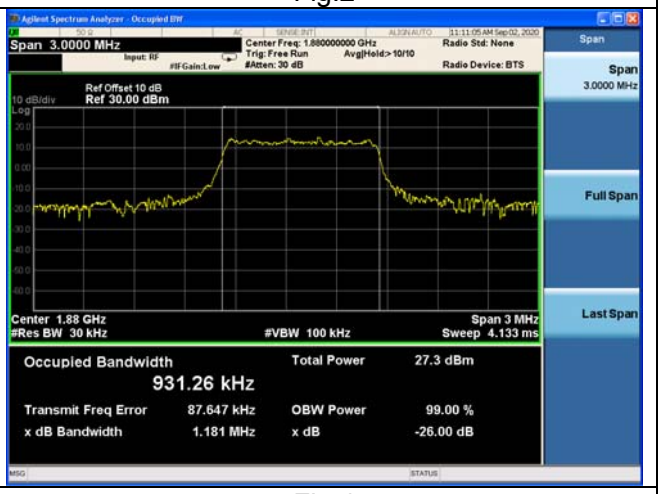


Fig.3

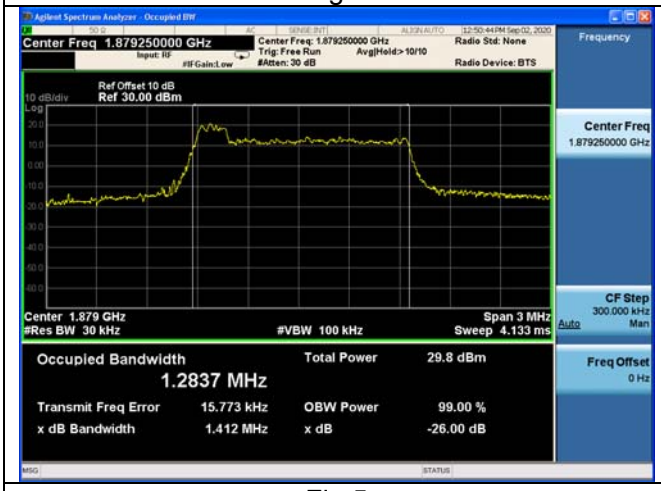


Fig.4

Fig.5

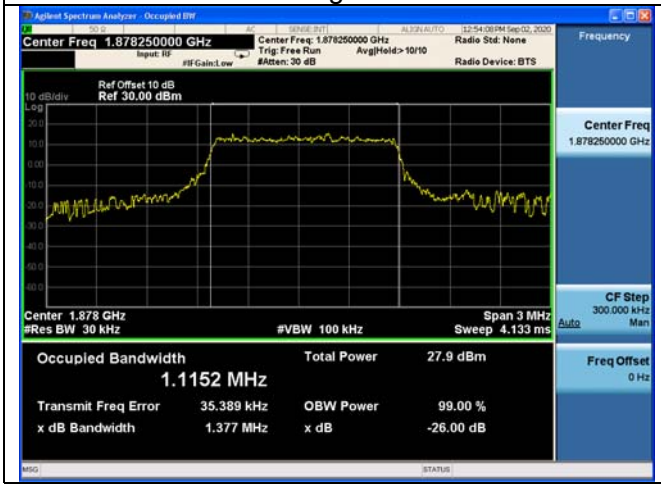


Fig.6

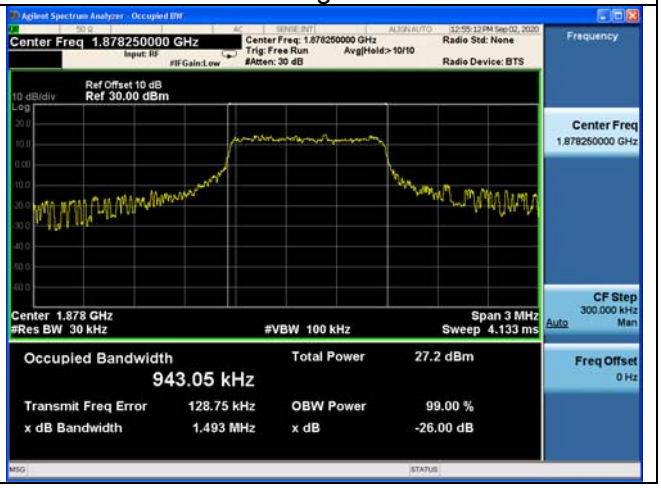


Fig.7

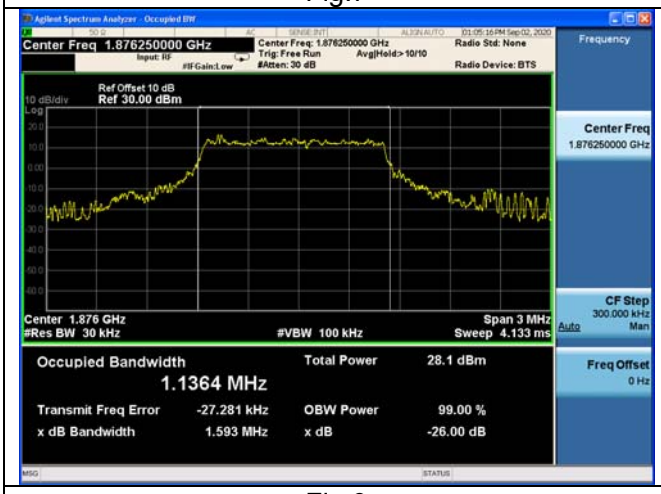


Fig.8

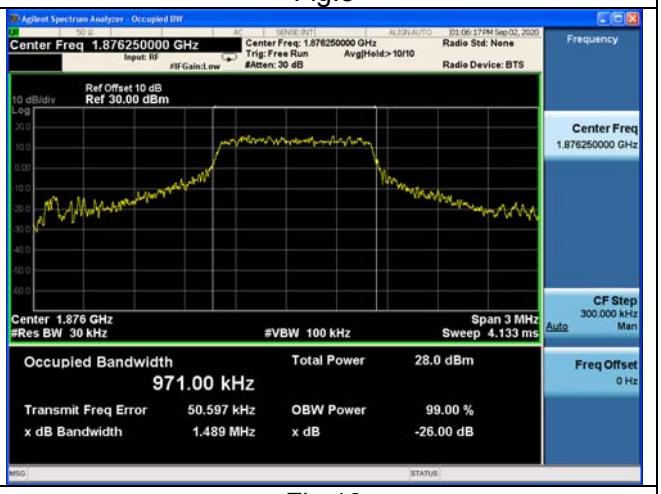


Fig.9

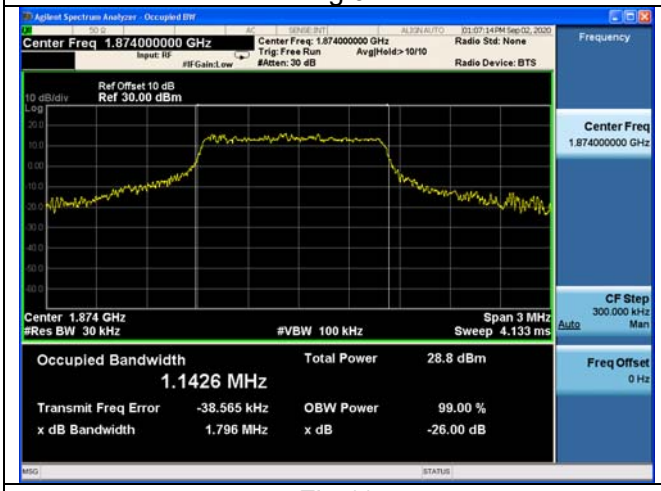


Fig.10

Fig.11

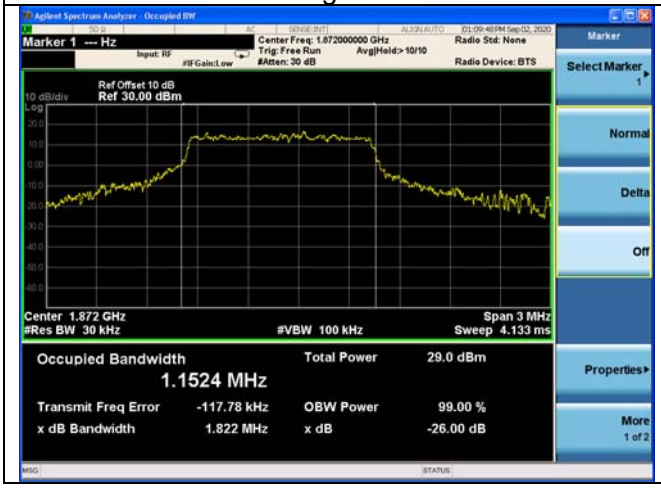
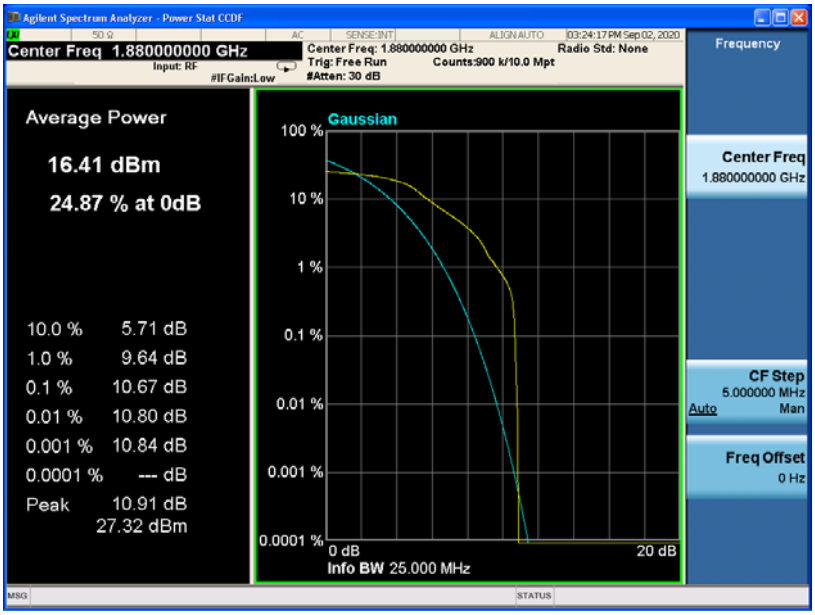


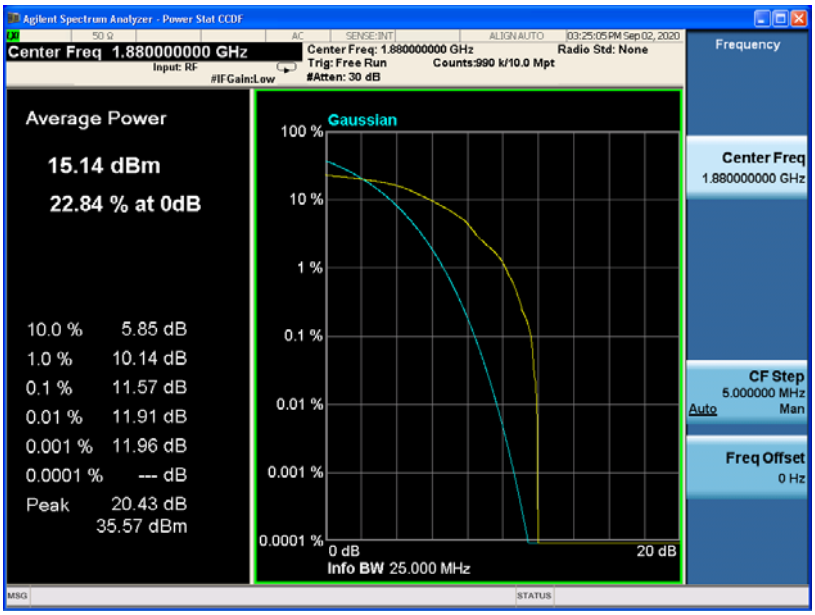
Fig.12

4 Peak-Average Ratio

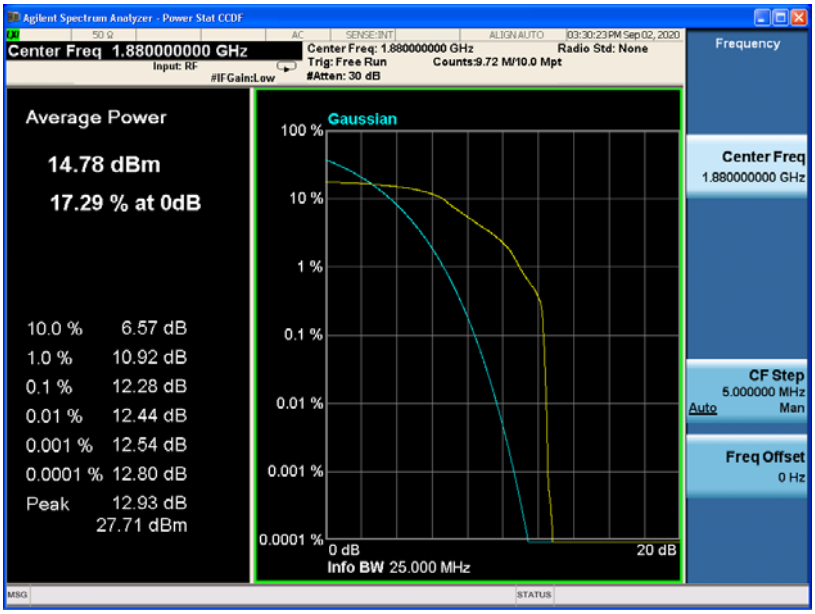
Test result:



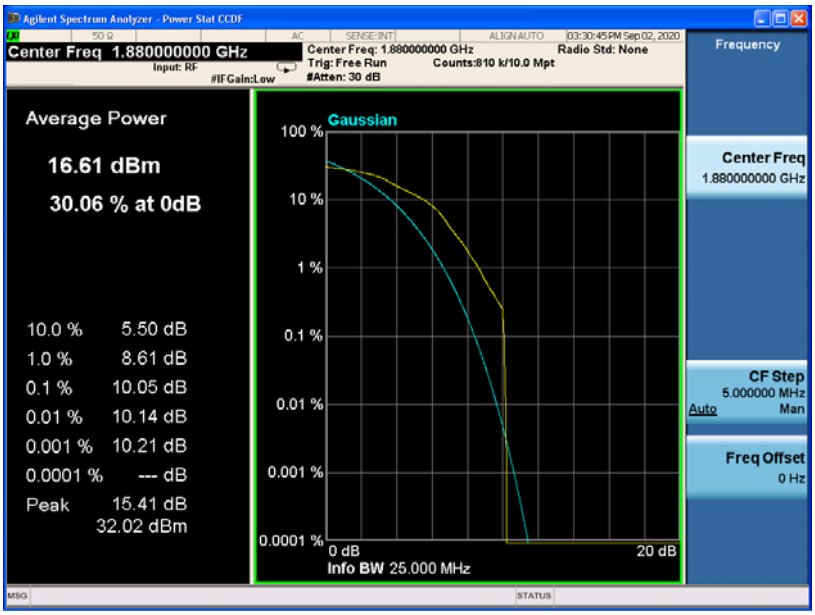
Peak-Average Ratio Plot(1.4MHz BW,QPSK,Band 2-mid Channel)



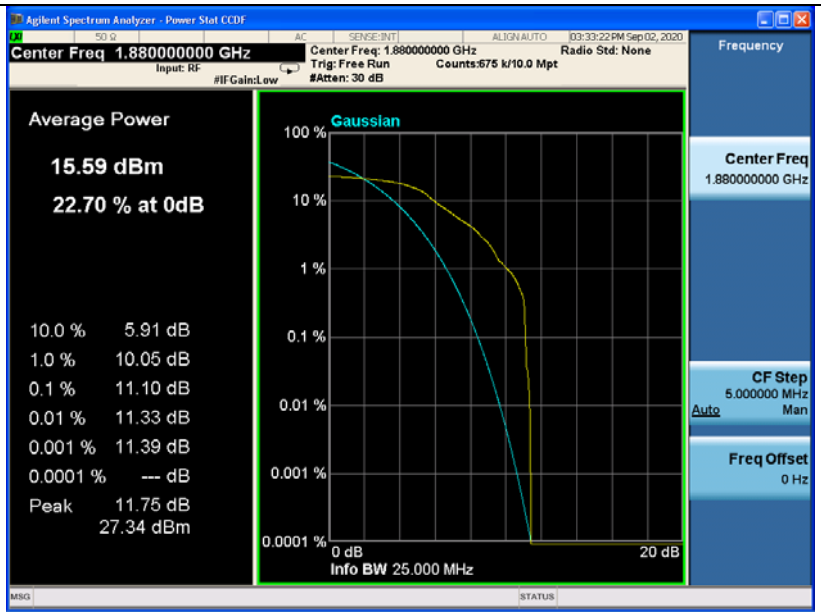
Peak-Average Ratio Plot(1.4MHz BW,16QAM,Band 2-mid Channel)



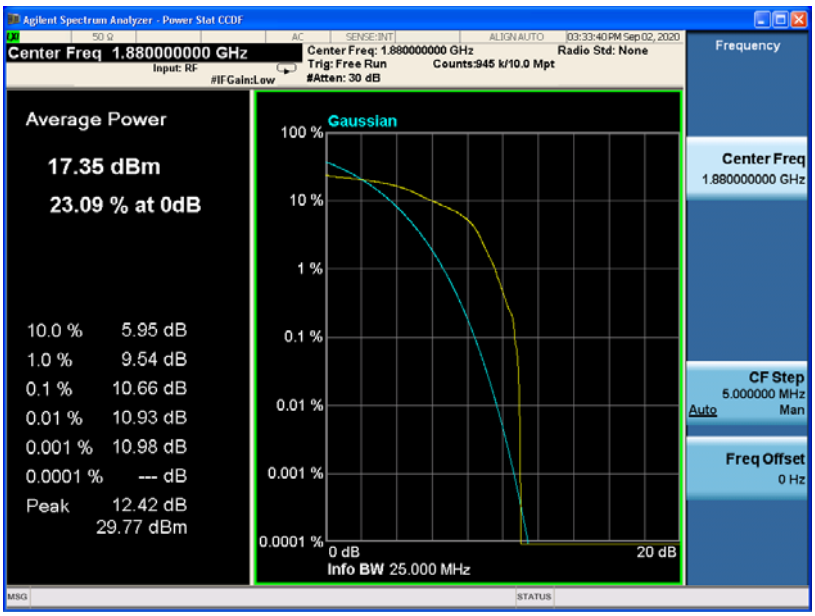
Peak-Average Ratio Plot(3MHz BW,QPSK,Band 2-mid Channel)



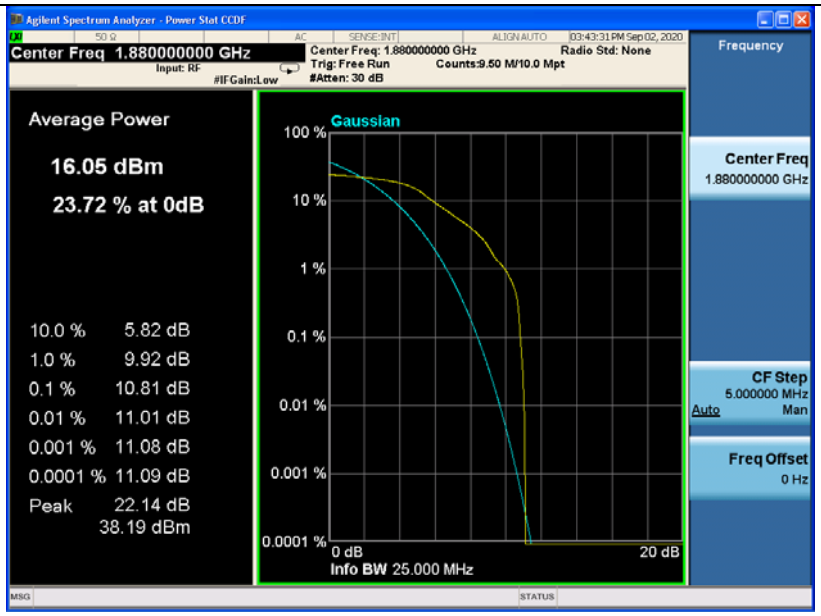
Peak-Average Ratio Plot(3MHz BW,16QAM,Band 2-mid Channel)



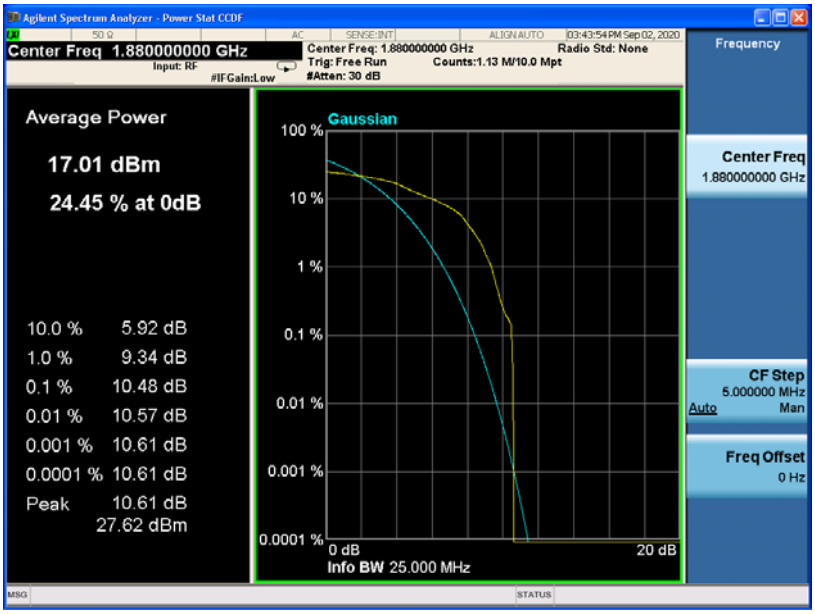
Peak-Average Ratio Plot(5MHz BW,QPSK,Band 2-mid Channel)



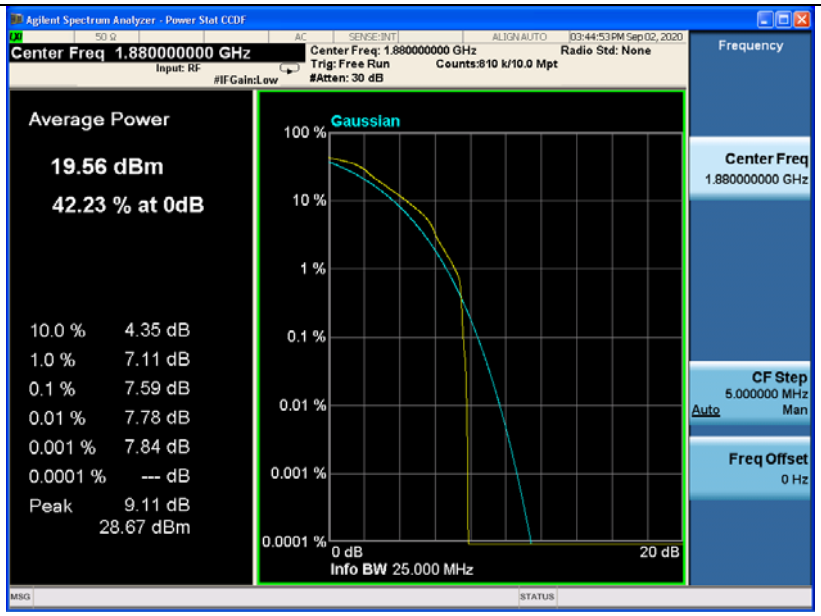
Peak-Average Ratio Plot(5MHz BW,16QAM,Band 2-mid Channel)



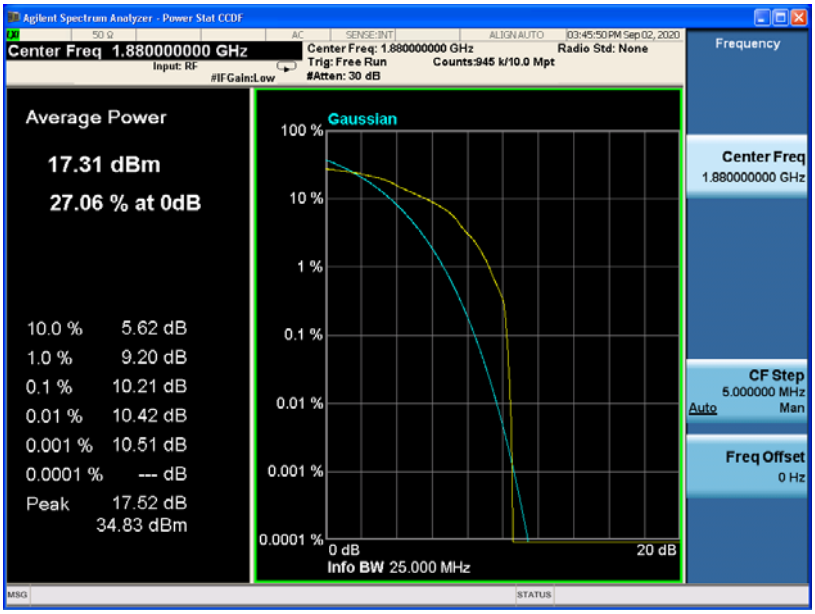
Peak-Average Ratio Plot(10MHz BW,QPSK,Band 2-mid Channel)



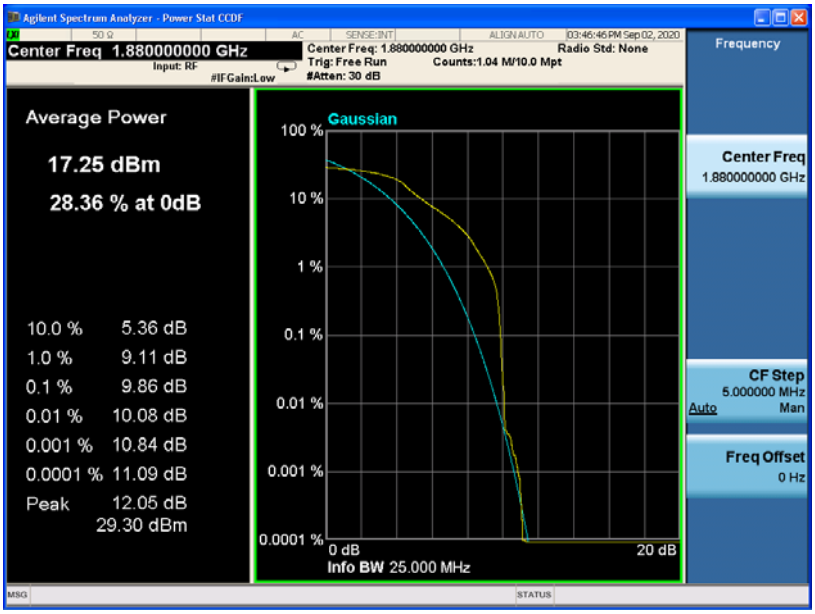
Peak-Average Ratio Plot(10MHz BW,16QAM,Band 2-mid Channel)



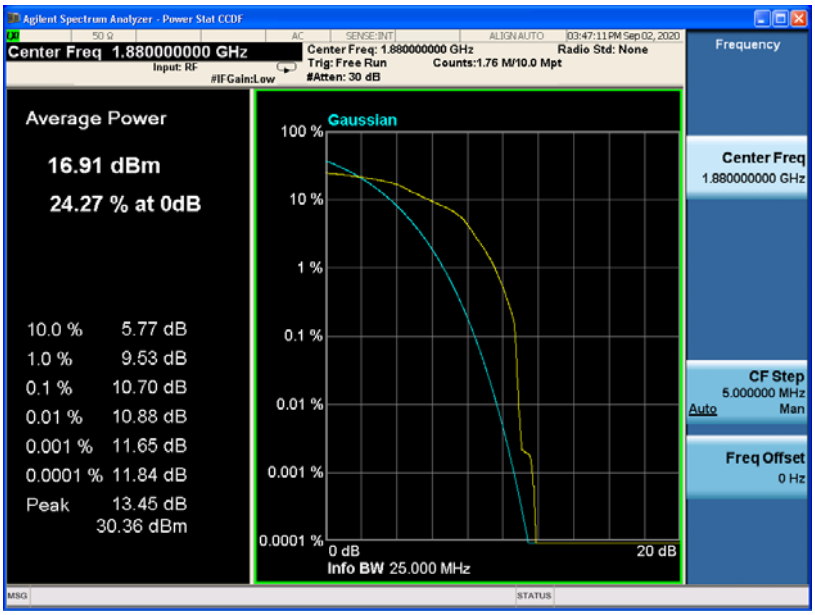
Peak-Average Ratio Plot(15MHz BW,QPSK,Band 2-mid Channel)



Peak-Average Ratio Plot(15MHz BW,16QAM,Band 2-mid Channel)



Peak-Average Ratio Plot(20MHz BW,QPSK,Band 2-mid Channel)



Peak-Average Ratio Plot(20MHz BW,16QAM,Band 2-mid Channel)

5 Spurious Emissions at antenna terminal

Band	Carrier frequency (MHz)	Channel(Low)	BW	RB Size	RB Offset	Conducted Spurious Plot
						QPSK
2	1860	18700	20	1	0	Fig.1

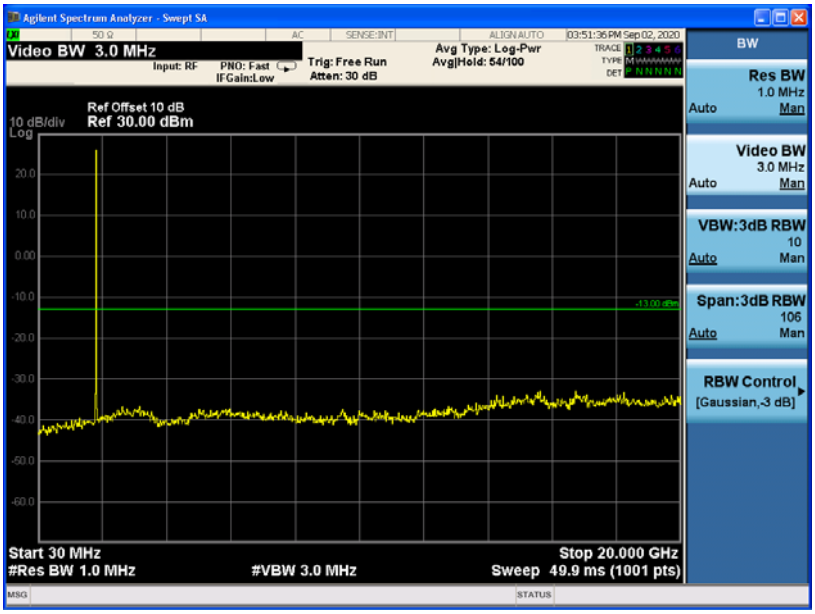


Fig.1

Band	Carrier frequency (MHz)	Channel(Low)	BW	RB Size	RB Offset	Conducted Spurious Plot
						QPSK
2	1880	18900	20	1	0	Fig.1

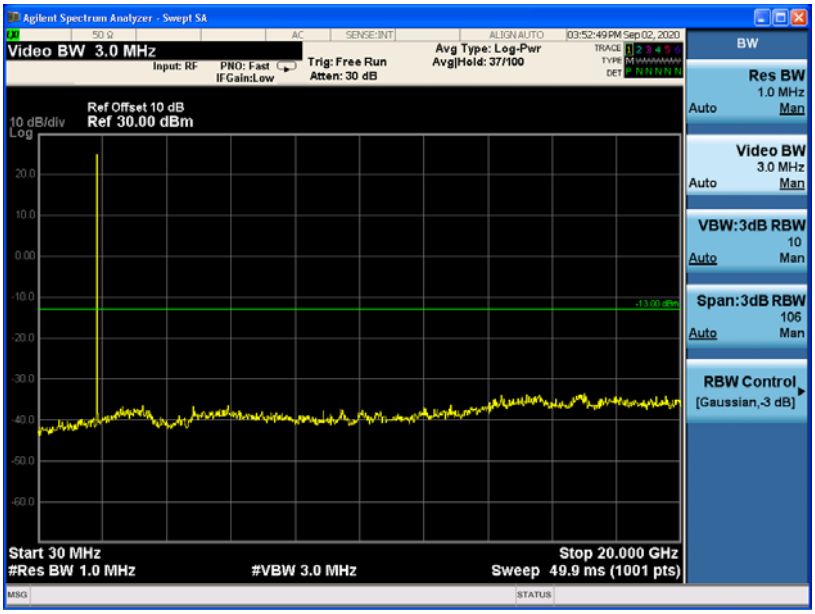


Fig.1

Band	Carrier frequency (MHz)	Channel(Low)	BW	RB Size	RB Offset	Conducted Spurious Plot
						QPSK
2	1900	19100	20	1	0	Fig.1

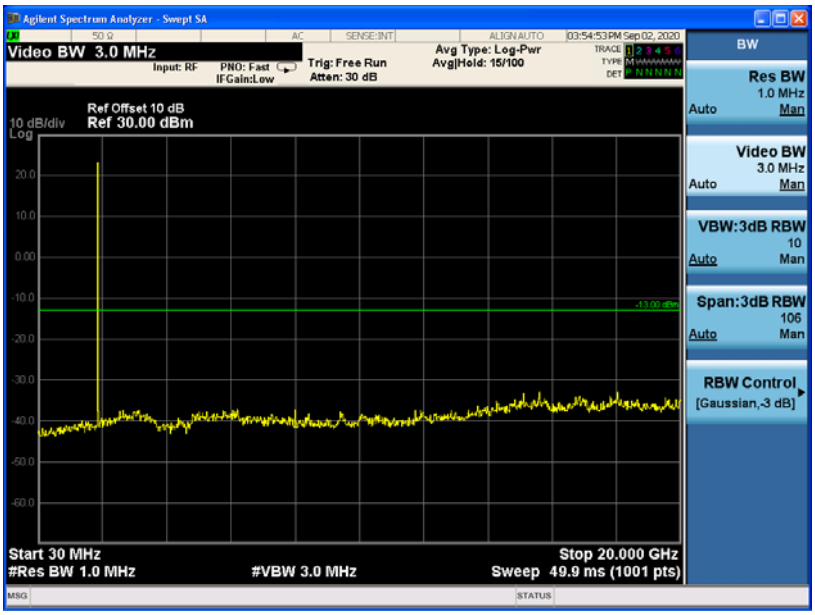


Fig.1

6 Band Edges Compliance

Test result

Band	Carrier frequency (MHz)	Channel	BW	RB Size	RB Offset	Band Edges Plot
						QPSK
2	1850.7	18607	1.4	1	0	Fig.1
				6	0	Fig.2
	1909.3	19193		1	5	Fig.3
				6	0	Fig.4
	1851.5	18615	3	1	0	Fig.5
				6	0	Fig.6
	1908.5	19185		1	5	Fig.7
				6	0	Fig.8
	1852.5	18625	5	1	0	Fig.9
				6	0	Fig.10
	1907.5	19175		1	5	Fig.11
				6	0	Fig.12
	1855	18650	10	1	0	Fig.13
				6	0	Fig.14
	1905	19150		1	5	Fig.15
				6	0	Fig.16
	1857.5	18675	15	1	0	Fig.17
				6	0	Fig.18
	1902.5	19125		1	5	Fig.19
				6	0	Fig.20
	1860	18700	20	1	0	Fig.21
				6	0	Fig.22
	1900	19100		1	5	Fig.23
				6	0	Fig.24

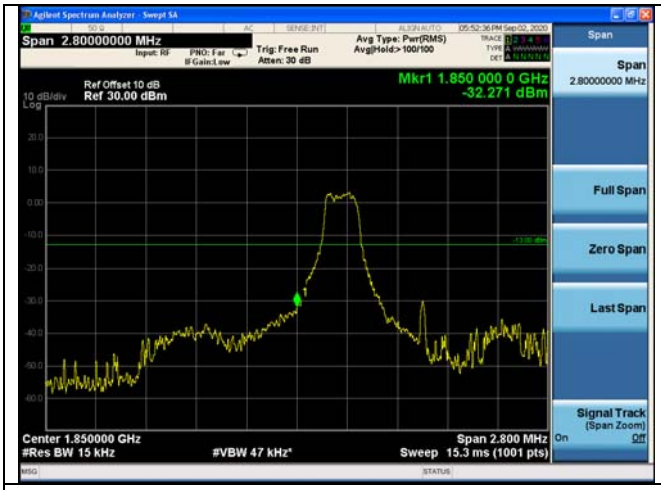


Fig.1

Fig.2

Fig.3

Fig.4

Fig.5

Fig.6

Fig.7

Fig.8

Fig.9

Fig.10

Fig.11

Fig.12

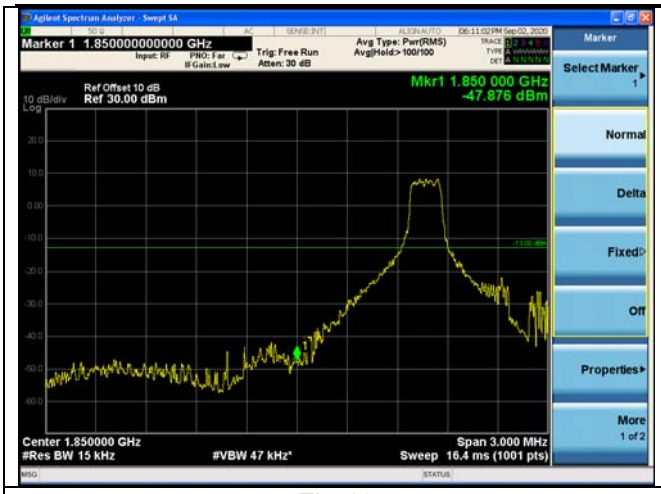


Fig.13

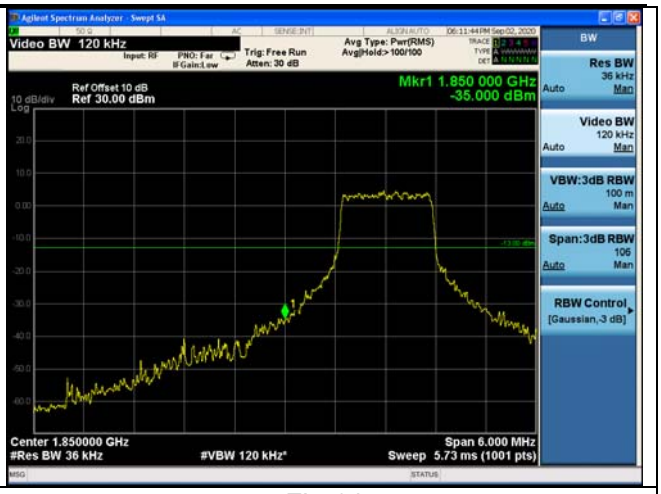


Fig.14

Fig.15

Fig.16

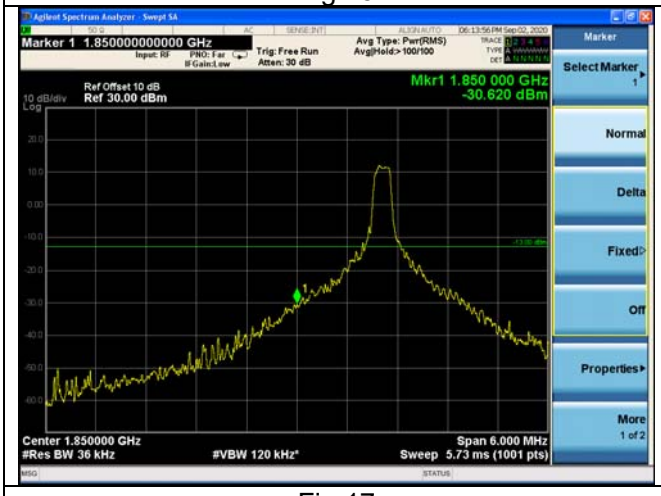


Fig.17

Fig.18

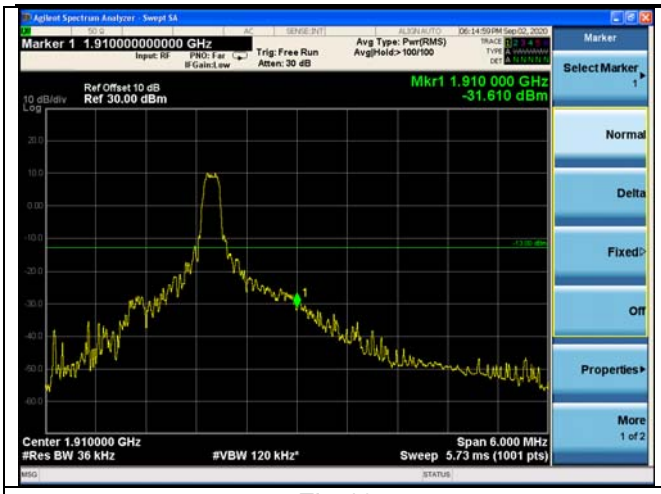


Fig.19

Fig.20

Fig.21

Fig.22

Fig.23

Fig.24

7 Frequency Stability

Test result:

Temperature(°C)	Voltage	Test Result (ppm) Band2 Low Channel					
		1.4M	3M	5M	10M	15M	20M
-20	NV	0.007	-0.077	-0.021	0.010	0.044	-0.011
-10	NV	-0.042	0.040	-0.055	0.021	0.008	0.040
0	NV	0.041	0.003	-0.071	0.048	-0.036	-0.071
+10	NV	-0.064	0.033	0.043	-0.071	0.058	0.045
+20	NV	0.000	0.000	0.000	0.000	0.000	0.000
+30	NV	0.049	0.045	0.048	-0.075	0.009	0.056
+40	NV	-0.027	-0.068	0.063	0.016	0.036	-0.048
+50	NV	0.063	0.024	-0.046	-0.005	0.027	0.047
+60	NV	0.033	-0.069	-0.018	0.058	-0.057	-0.059
+20	LV	0.021	0.026	-0.047	-0.030	-0.022	-0.074
+20	HV	-0.041	-0.045	0.014	-0.004	0.051	-0.002

Temperature(°C)	Voltage	Test Result (ppm) Band2 High Channel					
		1.4M	3M	5M	10M	15M	20M
-20	NV	-0.070	-0.030	0.004	0.055	0.036	-0.022
-10	NV	-0.060	0.015	0.058	-0.013	-0.066	-0.033
0	NV	-0.004	-0.012	-0.037	-0.001	0.002	-0.026
+10	NV	-0.051	0.016	0.018	0.009	0.027	-0.018
+20	NV	0.000	0.000	0.000	0.000	0.000	0.000
+30	NV	-0.035	-0.063	0.006	-0.008	-0.036	-0.042
+40	NV	-0.064	-0.069	-0.022	-0.045	-0.007	-0.026
+50	NV	-0.008	0.007	-0.064	-0.067	-0.024	-0.033
+60	NV	-0.005	-0.059	0.050	0.010	0.015	-0.014
+20	LV	-0.003	-0.076	-0.061	-0.011	0.032	-0.027
+20	HV	-0.022	0.036	-0.026	-0.028	-0.067	0.059

APPENDIX A – TEST DATA OF CONDUCTED EMISSION

LTE_CAT.M1_ Band 4

1 RF Power Output

Test result:

Antenna Gain: -0.70dBi

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	1710.5	19957	1.4	1	0	21.82
				6	0	19.67
	1732.5	20175		1	0	21.61
				6	0	19.47
	1754.3	20393		1	0	21.35
				6	0	19.25
16QAM	1710.5	19957	1.4	1	0	20.23
				1	5	20.31
				5	0	20.01
				5	1	19.96
	1732.5	20175		1	0	20.07
				1	5	20.14
				5	0	19.86
				5	1	19.78
	1754.3	20393		1	0	19.86
				1	5	19.98
				5	0	19.67
				5	1	19.59
QPSK	1711.5	19965	3	1	0	21.79
				6	0	19.48
	1732.5	20175		1	0	21.57
				6	0	19.36
	1753.5	20385		1	0	21.31
				6	0	19.21
16QAM	1711.5	19965	3	1	0	20.18
				1	5	20.23
				5	0	20.09
				5	1	20.03
	1732.5	20175		1	0	20.14
				1	5	20.26
				5	0	20.11
				5	1	20.08
	1753.5	20385		1	0	19.79
				1	5	19.88
				5	0	19.73
				5	1	19.64

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	1712.5	19975	5	1	0	21.80
				6	0	21.57
	1732.5	20175		1	0	21.68
				6	0	21.58
	1752.5	20375		1	0	21.39
				6	0	21.25
16QAM	1712.5	19975	5	1	0	21.46
				1	5	21.63
				5	0	21.70
				5	1	22.03
	1732.5	20175		1	0	21.84
				1	5	22.33
				5	0	22.08
				5	1	22.11
	1752.5	20375		1	0	21.14
				1	5	21.12
				5	0	21.54
				5	1	21.15
QPSK	1715	20000	10	1	0	21.77
				6	0	21.51
	1732.5	20175		1	0	21.75
				6	0	21.64
	1750	20350		1	0	21.42
				6	0	21.17
16QAM	1715	20000	10	1	0	21.40
				1	5	21.64
				5	0	21.67
				5	1	22.07
	1732.5	20175		1	0	21.92
				1	5	22.30
				5	0	22.02
				5	1	22.12
	1750	20350		1	0	21.11
				1	5	21.06
				5	0	21.57
				5	1	21.09

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	1717.5	20025	15	1	0	21.74
				6	0	21.48
	1732.5	20175		1	0	21.69
				6	0	21.58
	1747.5	20325		1	0	21.37
				6	0	21.19
16QAM	1717.5	20025	15	1	0	21.52
				1	5	21.71
				5	0	21.73
				5	1	21.09
	1732.5	20175		1	0	21.97
				1	5	22.25
				5	0	22.07
				5	1	22.17
	1747.5	20325		1	0	21.16
				1	5	21.13
				5	0	21.46
				5	1	21.11
QPSK	1720	20050	20	1	0	21.86
				6	0	21.59
	1732.5	20175		1	0	21.77
				6	0	21.66
	1745	20300		1	0	21.43
				6	0	21.26
16QAM	1720	20050	20	1	0	21.47
				1	5	21.71
				5	0	21.76
				5	1	22.10
	1732.5	20175		1	0	21.93
				1	5	22.37
				5	0	22.09
				5	1	22.13
	1745	20300		1	0	21.17
				1	5	21.14
				5	0	21.59
				5	1	21.16

2 Occupied Bandwidth

Test result

Band	Carrier frequency (MHz)	Channel	BW (MHz)	Modulation	RB Size	RB Offset	Bandwidth of 99% Power (MHz)	Bandwidth of -26dB transmitter power (MHz)	Plot
4	1732.5	20175	1.4	QPSK	6	0	1.0899	1.268	Fig.1
				16QAM	5	1	919.62	1.095	Fig.2
			3	QPSK	6	0	1.1079	1.701	Fig.3
				16QAM	5	1	932.95	1.244	Fig.4
			5	QPSK	6	0	1.1114	1.395	Fig.5
				16QAM	5	1	939.02	1.252	Fig.6
			10	QPSK	6	0	1.1239	2.103	Fig.7
				16QAM	5	1	961.69	1.407	Fig.8
			15	QPSK	6	0	1.1361	1.665	Fig.9
				16QAM	5	1	977.52	1.550	Fig.10
			20	QPSK	6	0	1.1285	1.745	Fig.11
				16QAM	5	1	953.95	1.471	Fig.12

Fig.1

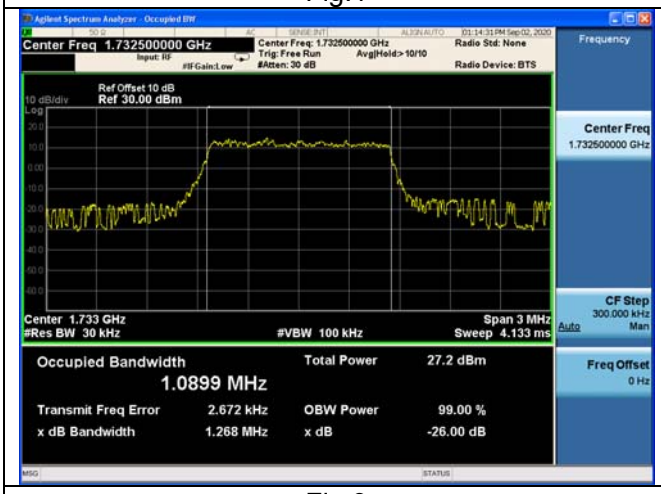


Fig.2

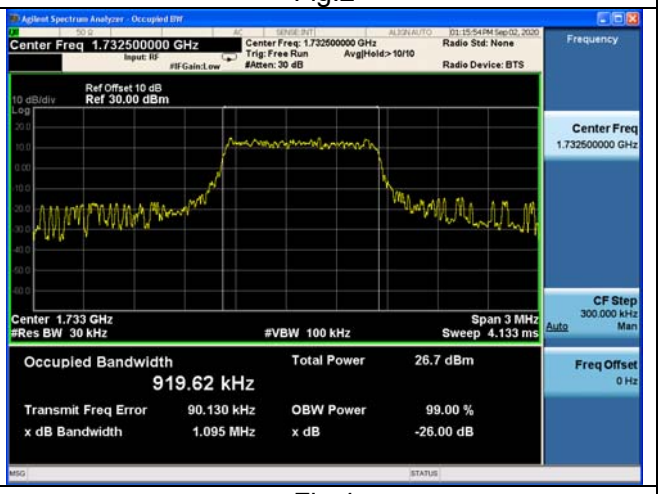


Fig.3

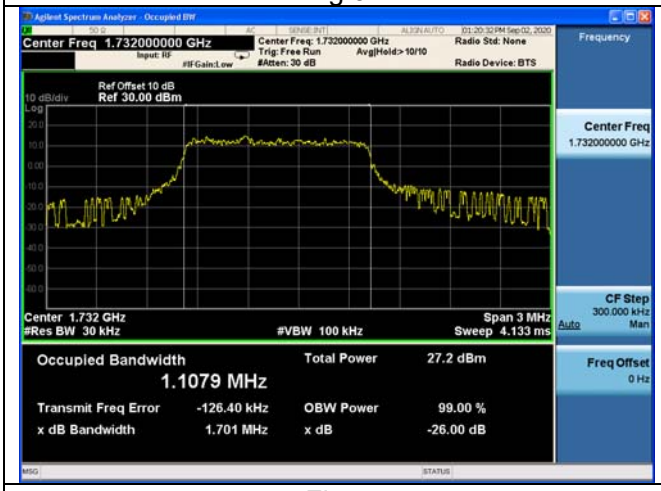


Fig.4

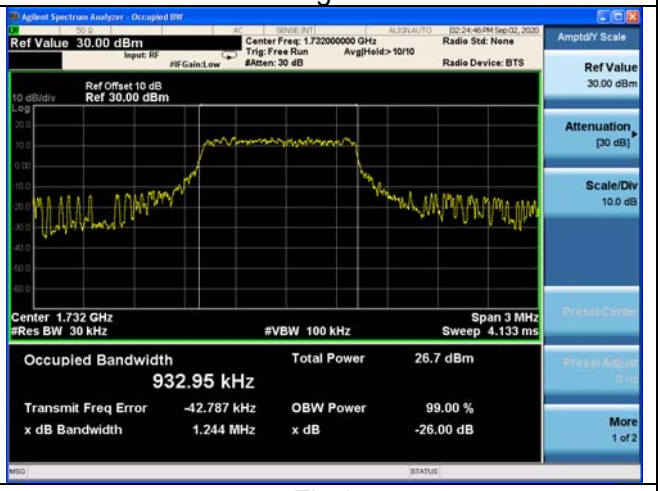


Fig.5

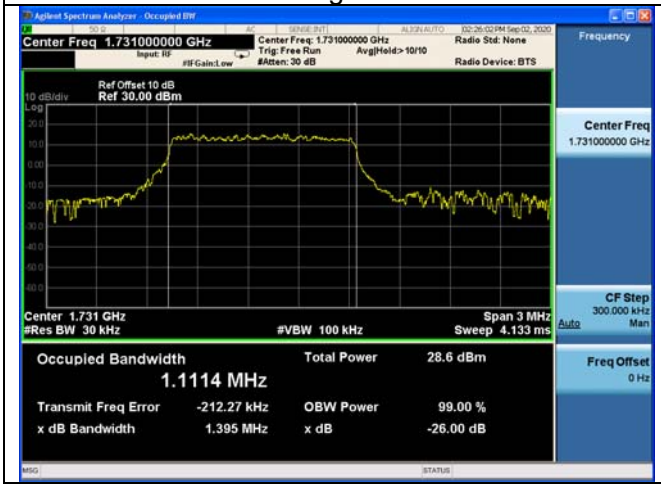


Fig.6

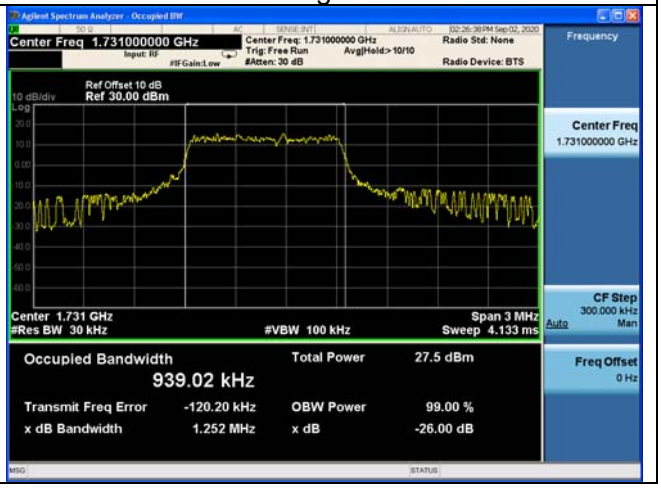


Fig.7

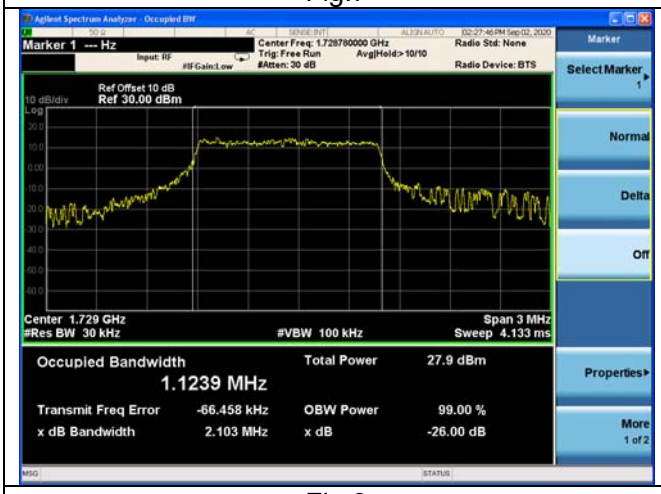


Fig.8

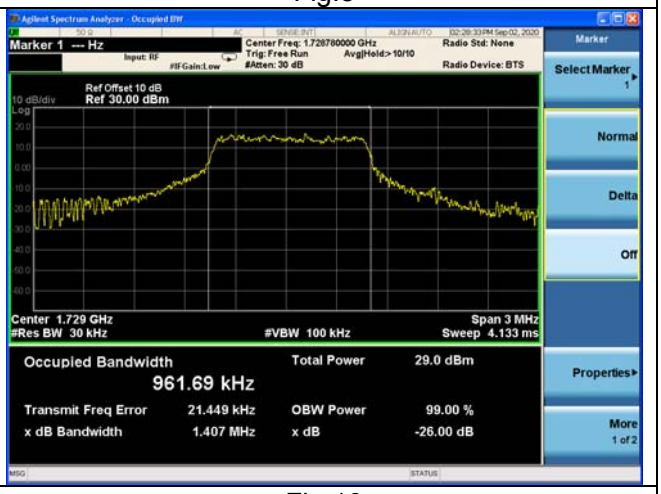


Fig.9

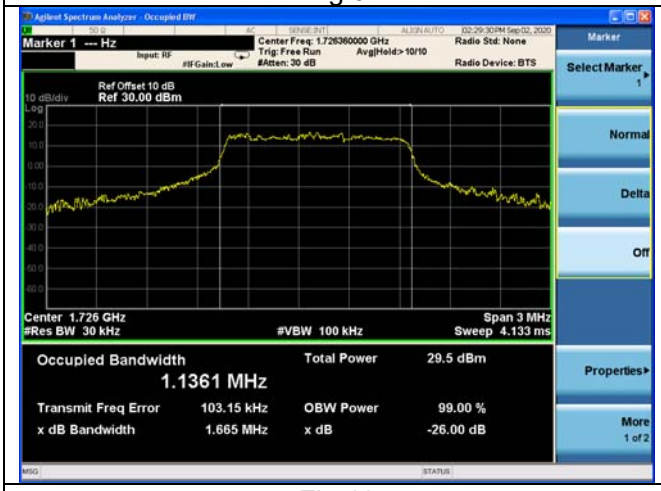


Fig.10

Fig.11

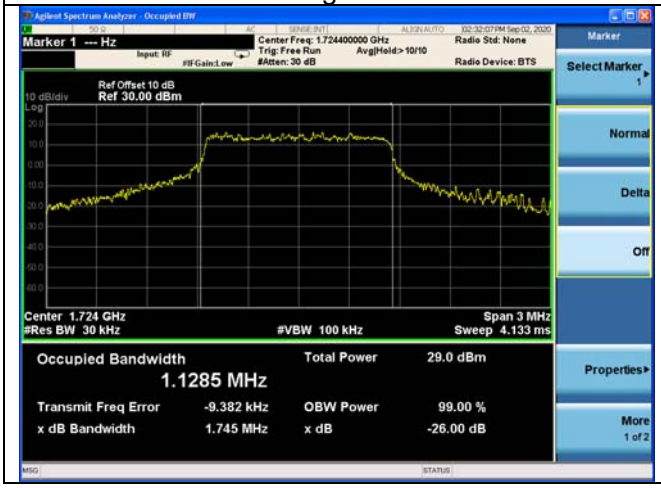
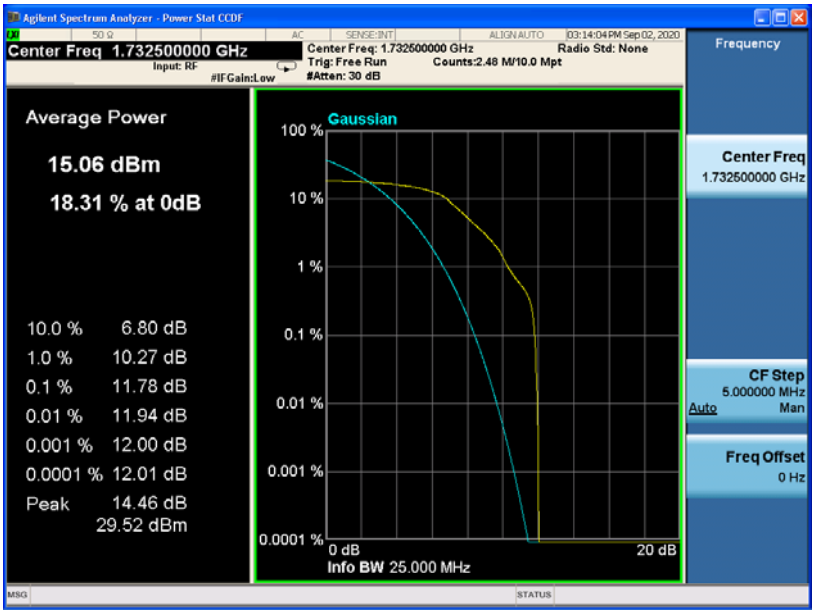


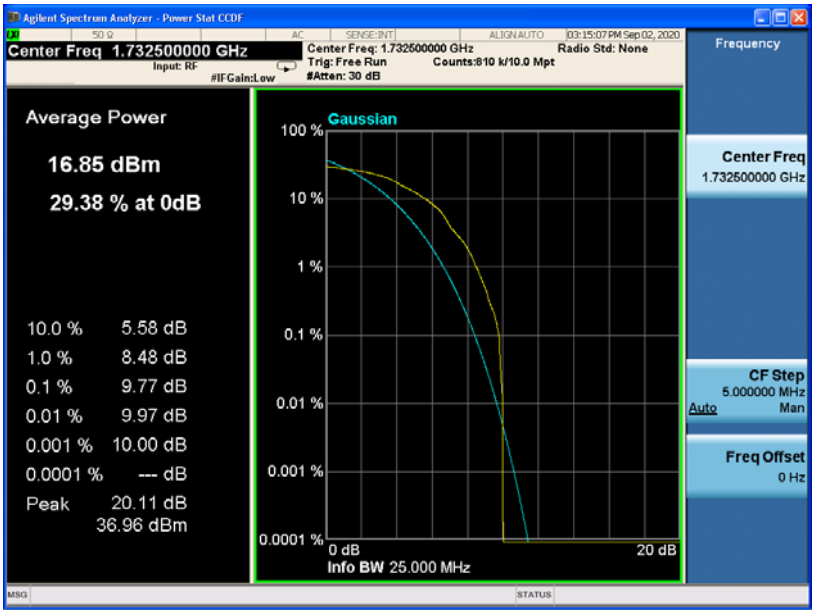
Fig.12

4 Peak-Average Ratio

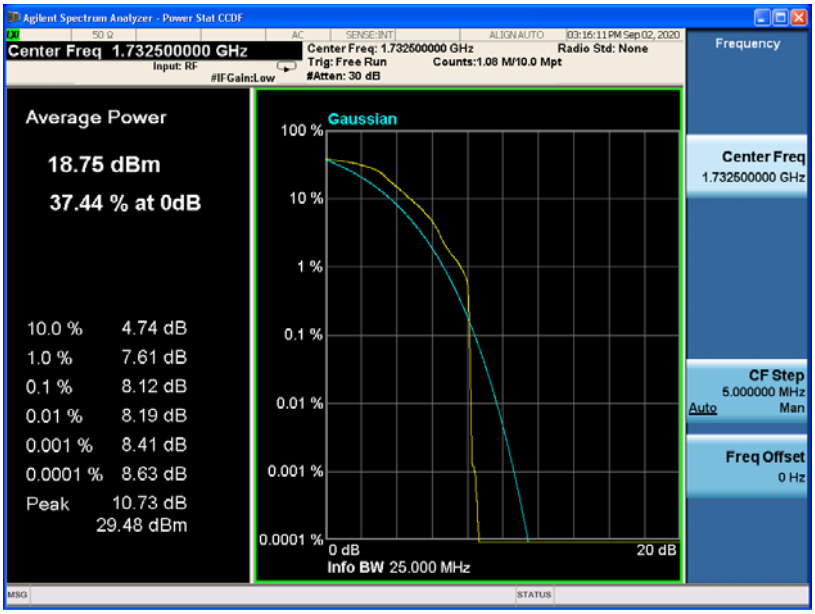
Test result:



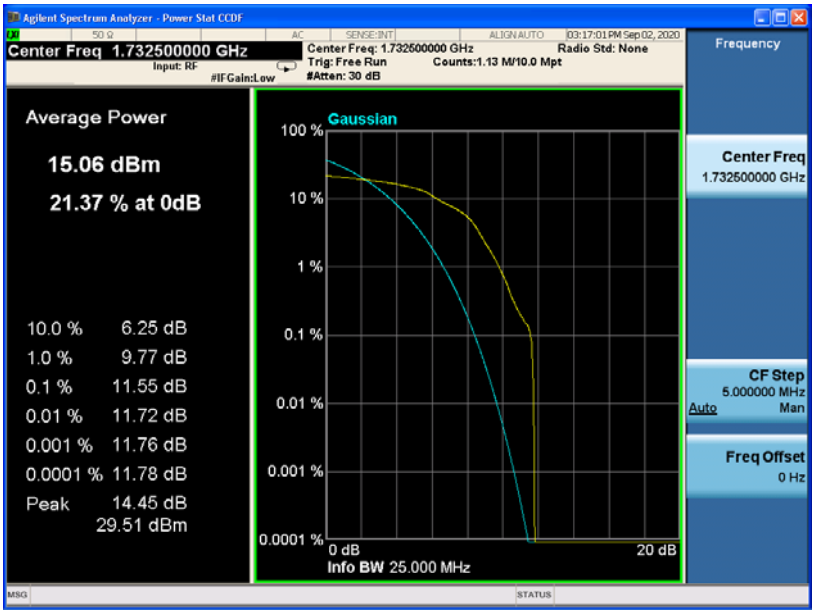
Peak-Average Ratio Plot(1.4MHz BW,QPSK,Band 4-mid Channel)



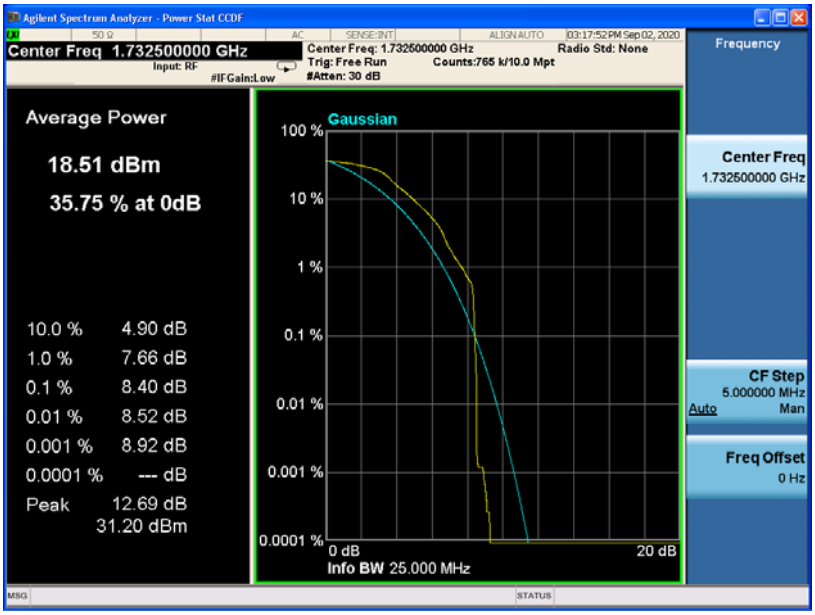
Peak-Average Ratio Plot(1.4MHz BW,16QAM,Band 4-mid Channel)



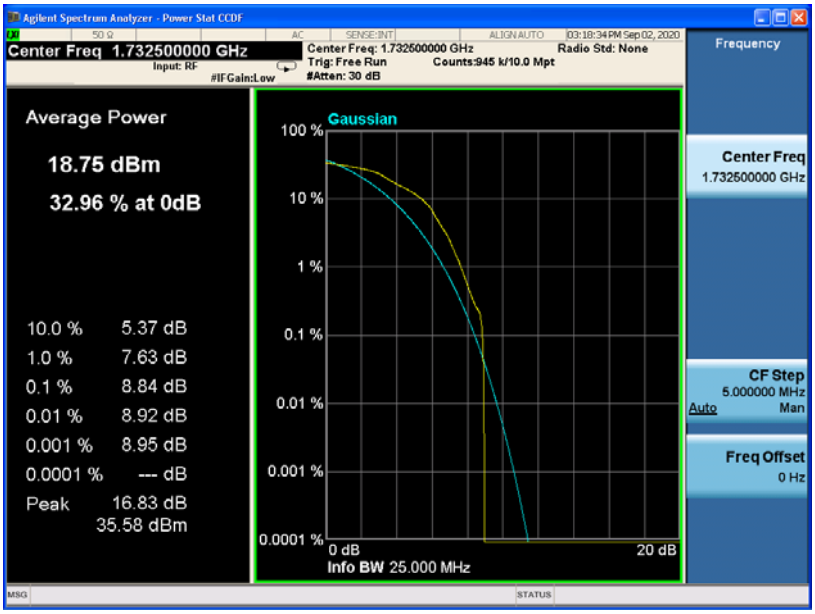
Peak-Average Ratio Plot(3MHz BW,QPSK,Band 4-mid Channel)



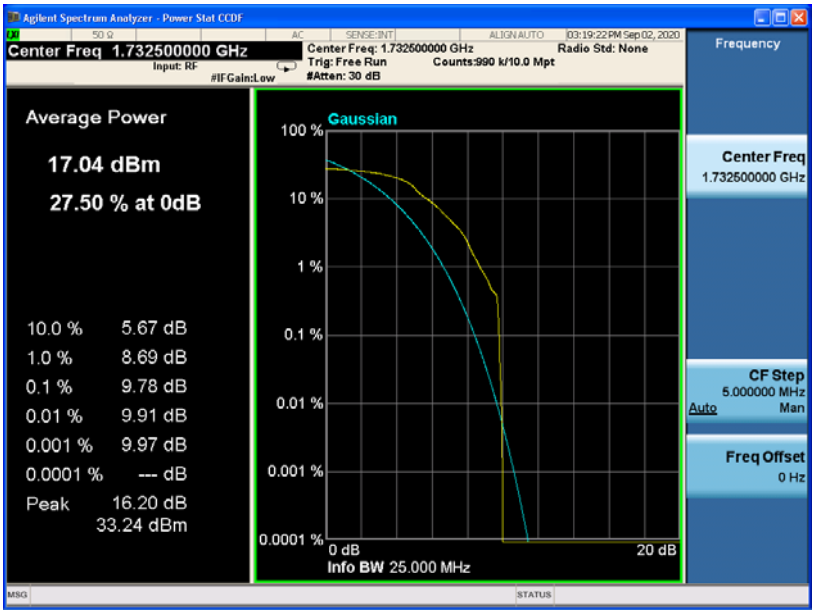
Peak-Average Ratio Plot(3MHz BW,16QAM,Band 4-mid Channel)



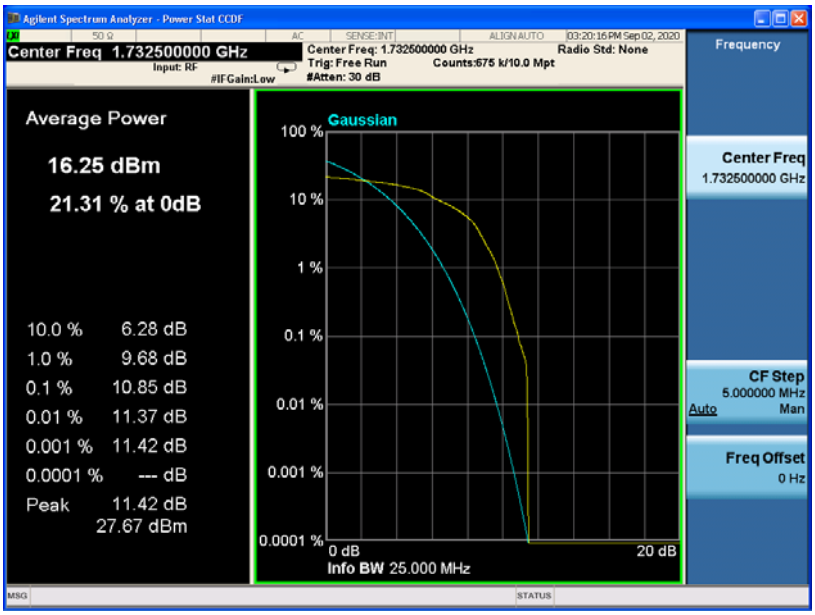
Peak-Average Ratio Plot(5MHz BW,QPSK,Band 4-mid Channel)



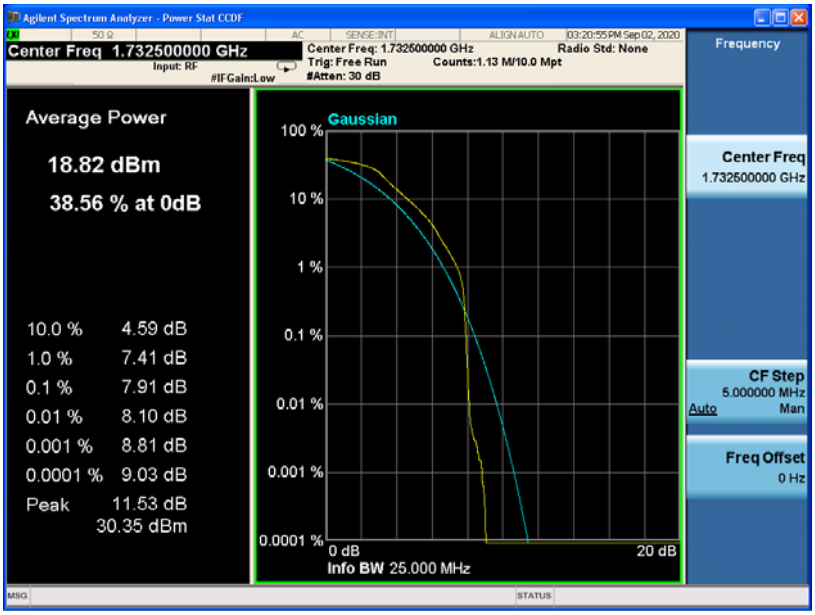
Peak-Average Ratio Plot(5MHz BW,16QAM,Band 4-mid Channel)



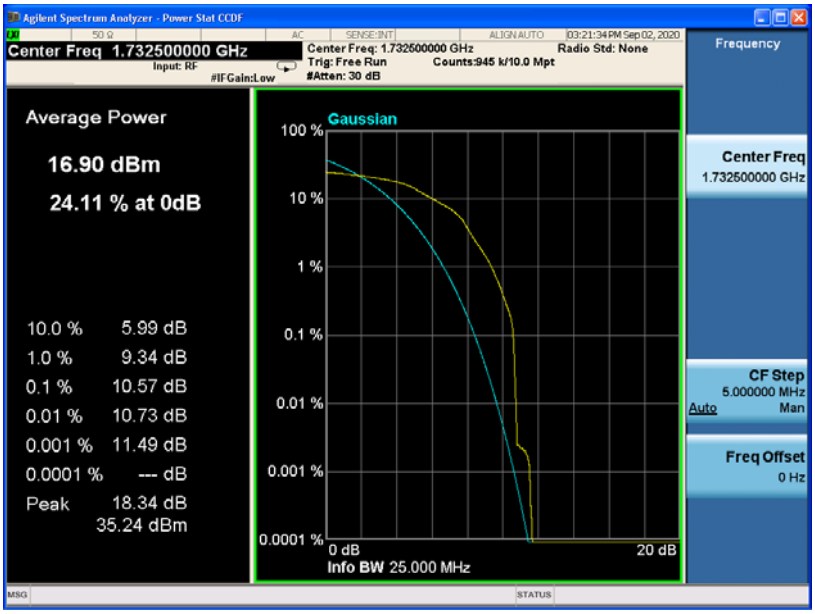
Peak-Average Ratio Plot(10MHz BW,QPSK,Band 4-mid Channel)



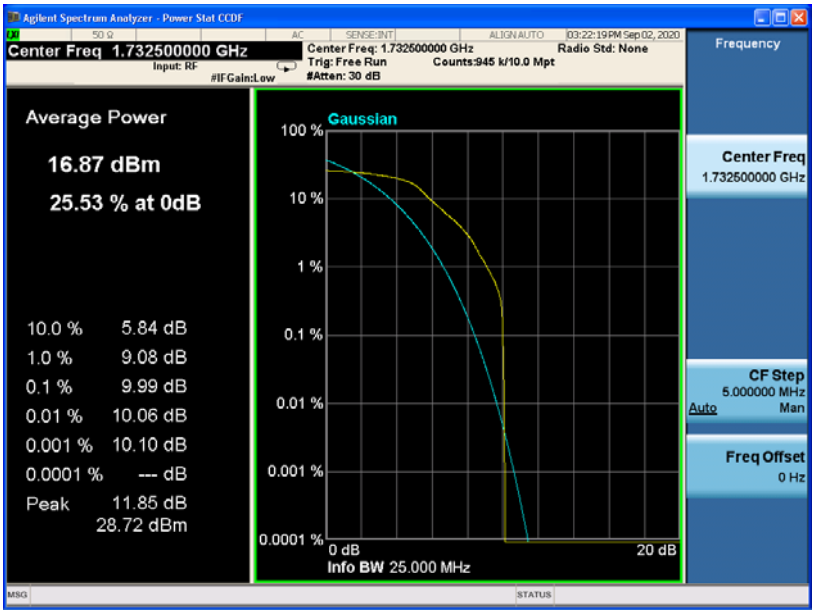
Peak-Average Ratio Plot(10MHz BW,16QAM,Band 4-mid Channel)



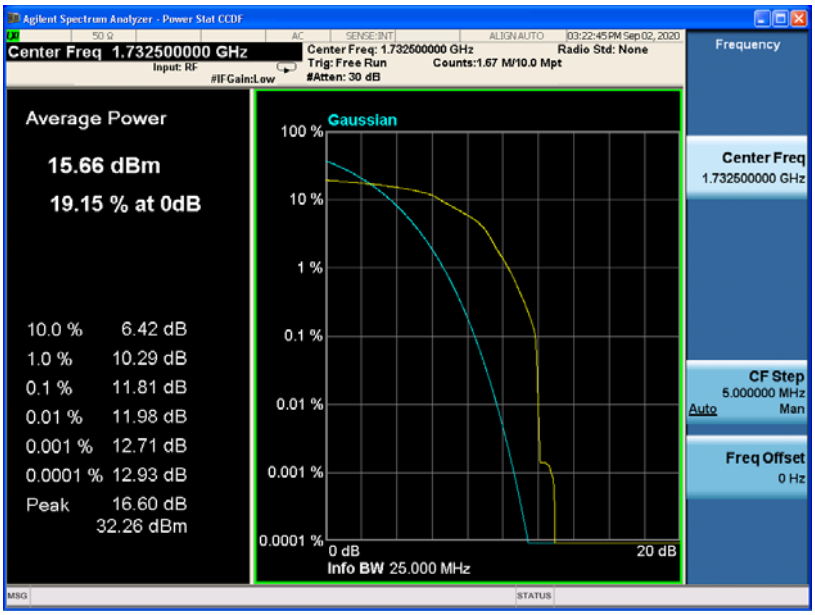
Peak-Average Ratio Plot(15MHz BW,QPSK,Band 4-mid Channel)



Peak-Average Ratio Plot(15MHz BW,16QAM,Band 4-mid Channel)



Peak-Average Ratio Plot(20MHz BW,QPSK,Band 4-mid Channel)



Peak-Average Ratio Plot(20MHz BW,16QAM,Band 4-mid Channel)

5 Spurious Emissions at antenna terminal

Band	Carrier frequency (MHz)	Channel (Low)	BW	RB Size	RB Offset	Conducted Spurious Plot
						QPSK
4	1720	20050	20	1	0	Fig.1

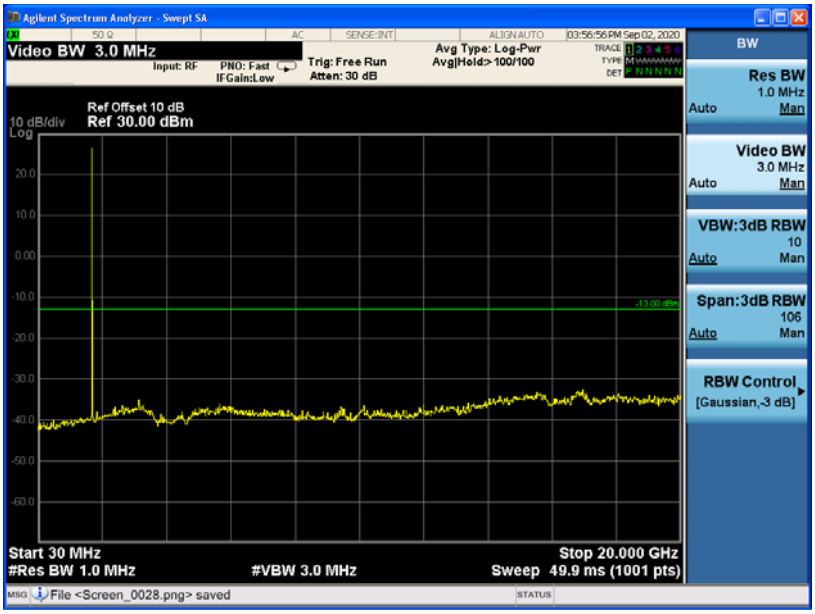


Fig.1

Band	Carrier frequency (MHz)	Channel (Mid)	BW	RB Size	RB Offset	Conducted Spurious Plot
						QPSK
4	1732.5	20175	20	1	0	Fig.1

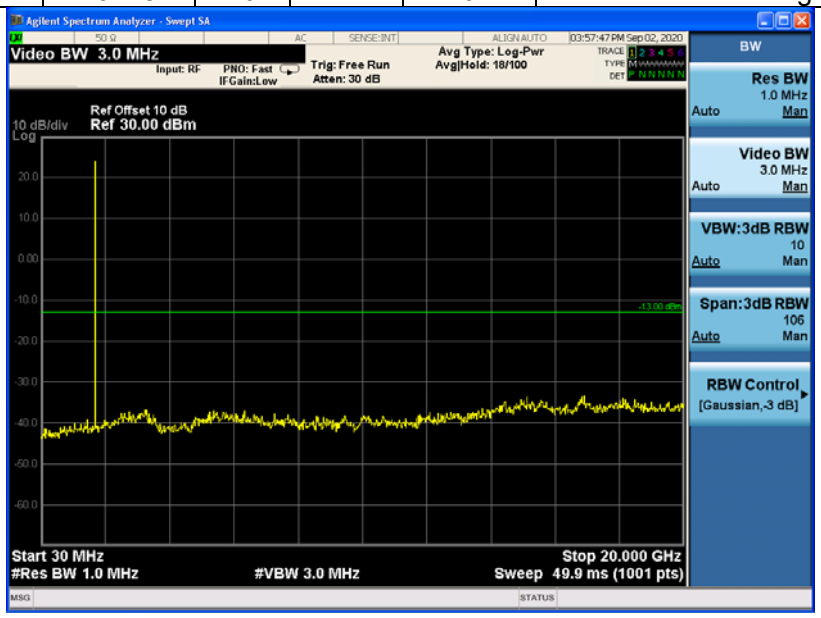


Fig.1

Band	Carrier frequency (MHz)	Channel (High)	BW	RB Size	RB Offset	Conducted Spurious Plot
						QPSK
4	1745	20300	20	1	0	Fig.1

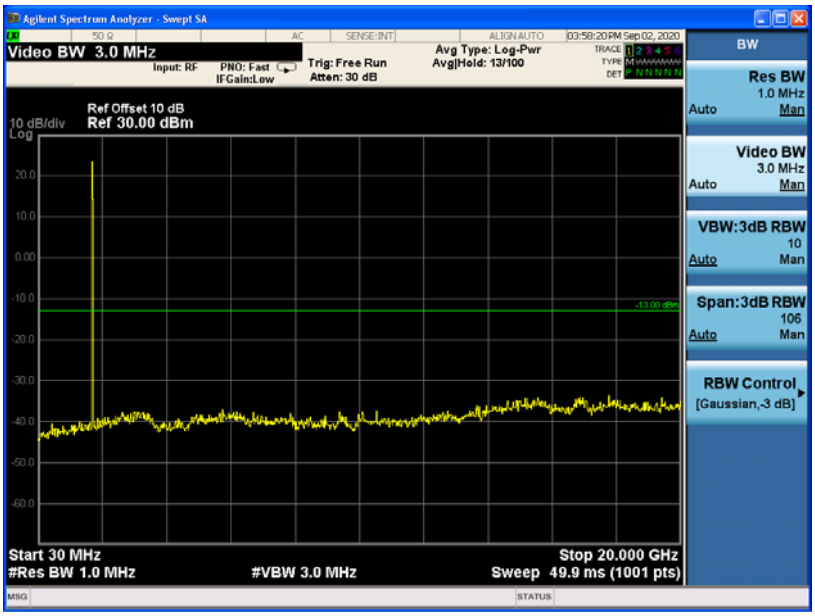


Fig.1

6 Band Edges Compliance

Test result

Band	Carrier frequency (MHz)	Channel	BW	RB Size	RB Offset	Band Edges Plot
						QPSK
4	1710.7	19957	1.4	1	0	Fig.1
				6	0	Fig.2
	1754.3	20393		1	5	Fig.3
				6	0	Fig.4
	1711.5	19965	3	1	0	Fig.5
				6	0	Fig.6
	1753.5	20385		1	5	Fig.7
				6	0	Fig.8
	1712.5	19975	5	1	0	Fig.9
				6	0	Fig.10
	1752.5	20375		1	5	Fig.11
				6	0	Fig.12
	1715	20000	10	1	0	Fig.13
				6	0	Fig.14
	1750	20350		1	5	Fig.15
				6	0	Fig.16
	1717.5	20025	15	1	0	Fig.17
				6	0	Fig.18
	1747.5	20325		1	5	Fig.19
				6	0	Fig.20
	1720	20050	20	1	0	Fig.21
				6	0	Fig.22
	1745	20300		1	5	Fig.23
				6	0	Fig.24

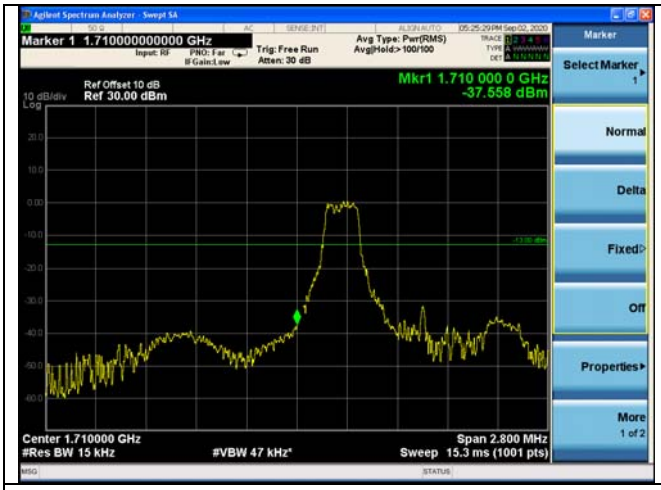


Fig.1

Fig.2

Fig.3

Fig.4

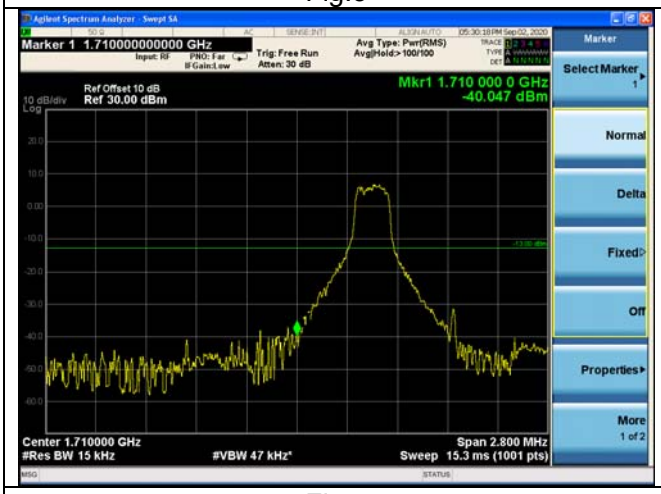


Fig.5

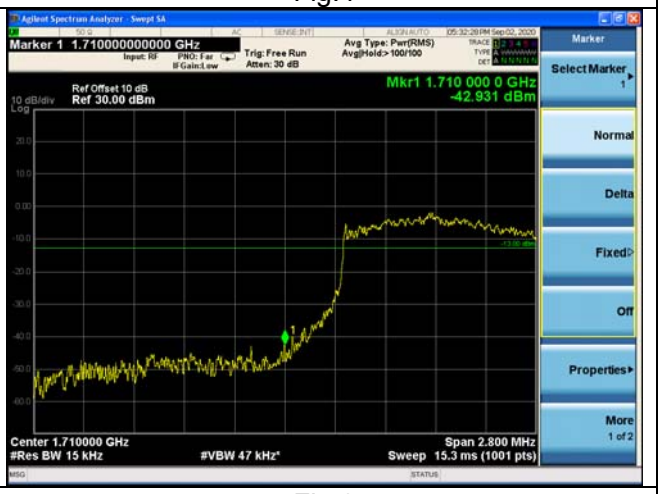


Fig.6

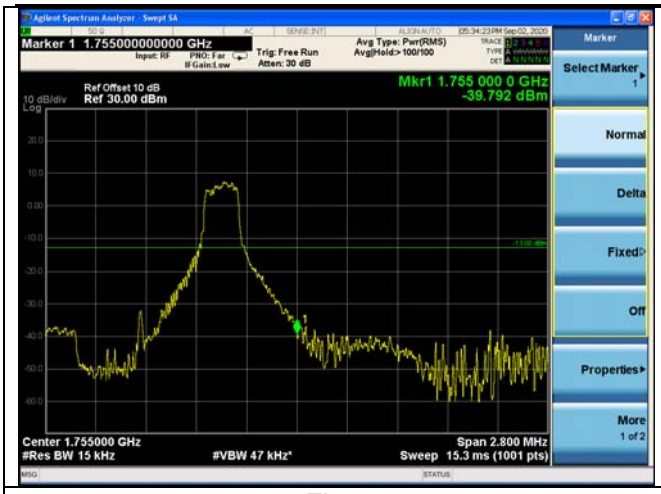


Fig.7

Fig.8

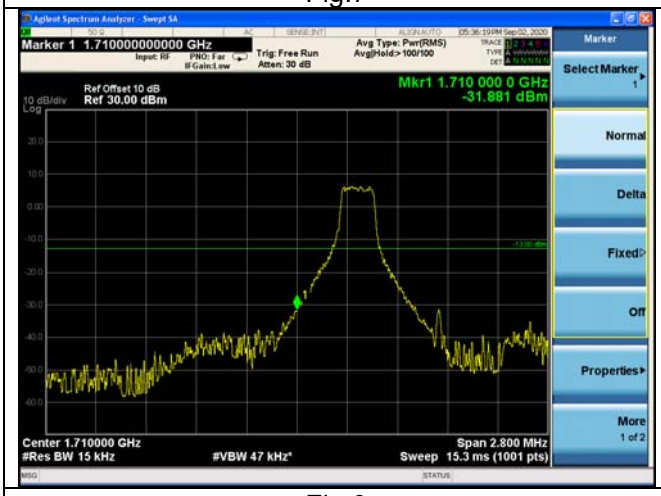


Fig.9

Fig.10

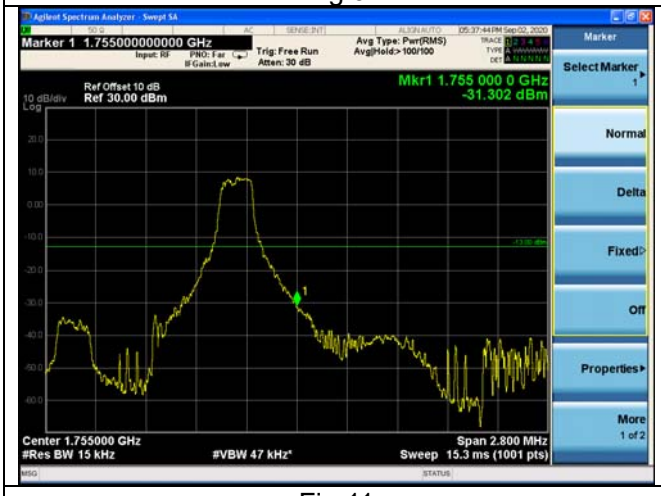


Fig.11

Fig.12

Fig.13

Fig.14

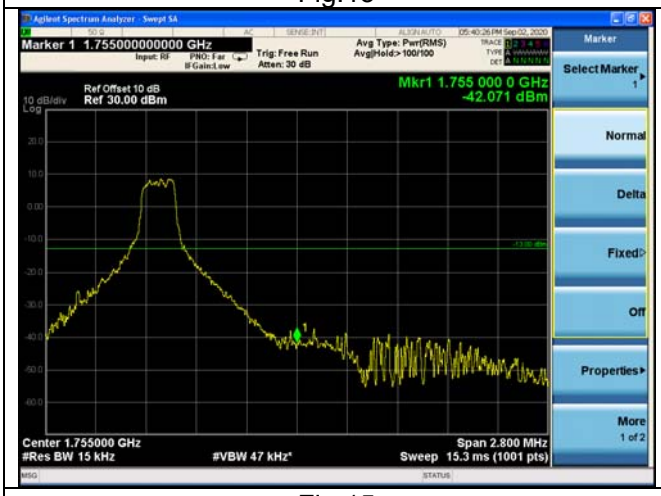


Fig.15

Fig.16

Fig.17

Fig.18

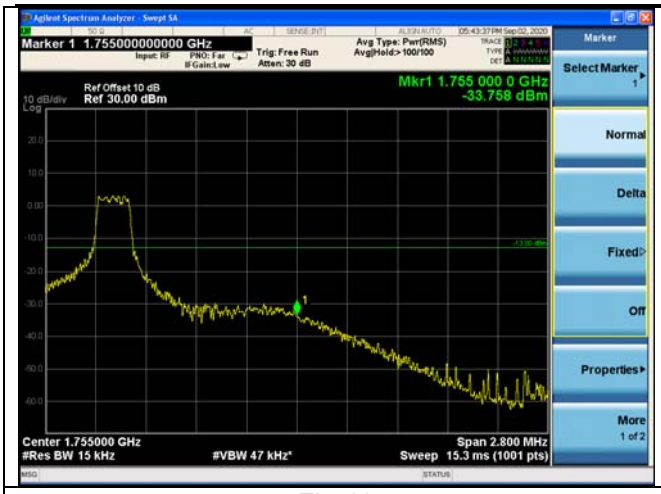


Fig.19

Fig.20

Fig.21

Fig.22

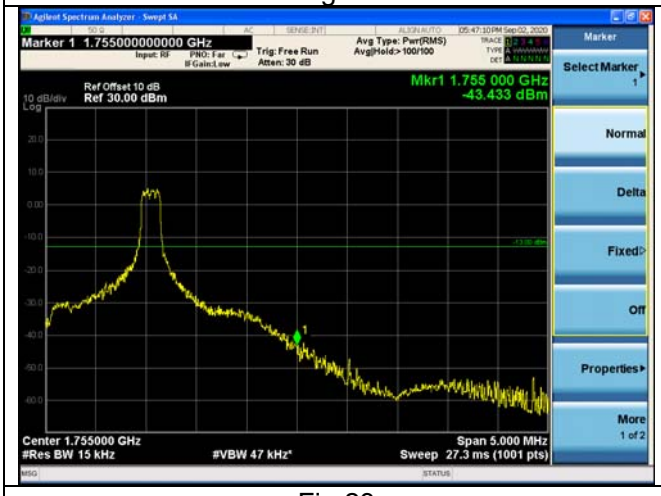


Fig.23

Fig.24

7 Frequency Stability

Test result:

Temperature(°C)	Voltage	Test Result (ppm) Band4 Low Channel					
		1.4M	3M	5M	10M	15M	20M
-20	NV	-0.056	0.032	0.015	0.004	-0.040	-0.061
-10	NV	-0.041	-0.023	0.006	0.042	-0.064	-0.077
0	NV	0.041	-0.067	-0.062	0.038	0.031	-0.033
+10	NV	-0.052	0.023	0.024	-0.058	-0.064	-0.055
+20	NV	0.000	0.000	0.000	0.000	0.000	0.000
+30	NV	0.038	-0.075	-0.033	0.060	-0.005	0.059
+40	NV	0.041	-0.047	0.061	-0.017	-0.054	-0.016
+50	NV	0.013	-0.030	0.055	0.031	0.028	-0.033
+60	NV	0.035	0.051	-0.061	0.048	-0.070	-0.071
+20	LV	0.050	-0.039	-0.029	-0.021	0.048	-0.002
+20	HV	-0.029	0.005	0.004	-0.044	-0.054	0.057

Temperature(°C)	Voltage	Test Result (ppm) Band4 High Channel					
		1.4M	3M	5M	10M	15M	20M
-20	NV	0.044	-0.023	-0.041	-0.057	0.061	0.045
-10	NV	-0.006	-0.074	-0.072	-0.043	0.009	0.026
0	NV	-0.044	0.011	0.062	0.040	0.044	-0.053
+10	NV	-0.047	0.055	0.012	-0.047	0.046	0.050
+20	NV	0.000	0.000	0.000	0.000	0.000	0.000
+30	NV	0.018	0.037	-0.067	0.006	0.004	-0.029
+40	NV	0.039	0.045	0.024	0.037	-0.021	-0.039
+50	NV	0.029	0.033	0.037	0.041	-0.048	-0.047
+60	NV	-0.059	-0.052	0.043	0.057	-0.047	0.014
+20	LV	-0.050	-0.066	-0.067	0.045	0.022	-0.060
+20	HV	-0.027	-0.058	0.005	-0.052	0.016	0.007

APPENDIX A – TEST DATA OF CONDUCTED EMISSION

LTE_CAT.M1_ Band 12

1 RF Power Output

Test result:

Antenna Gain: -2.07dBi

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	699.7	23017	1.4	1	0	23.39
				6	0	21.27
	707.5	23095		1	0	22.97
				6	0	21.34
	715.3	23173		1	0	23.26
				6	0	21.27
16QAM	699.7	23017	1.4	1	0	21.78
				1	5	21.89
				5	0	21.46
				5	1	21.62
	707.5	23095		1	0	21.83
				1	5	21.91
				5	0	21.53
				5	1	21.64
	715.3	23173		1	0	21.78
				1	5	21.88
				5	0	21.48
				5	1	21.60
QPSK	700.5	23025	3	1	0	23.36
				6	0	21.23
	707.5	23095		1	0	22.96
				6	0	21.25
	714.5	23165		1	0	23.21
				6	0	21.24
16QAM	700.5	23025	3	1	0	21.77
				1	5	21.85
				5	0	21.44
				5	1	21.57
	707.5	23095		1	0	21.76
				1	5	21.85
				5	0	21.50
				5	1	21.59
	714.5	23165		1	0	21.72
				1	5	21.86
				5	0	21.41
				5	1	21.59

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Power (dBm)
QPSK	701.5	23035	5	1	0	23.12
				6	0	22.25
	707.5	23095		1	0	23.20
				6	0	22.23
	713.5	23155		1	0	23.19
				6	0	22.28
16QAM	701.5	23035	5	1	0	22.85
				1	5	23.12
				5	0	22.61
				5	1	22.85
	707.5	23095		1	0	22.98
				1	5	23.16
				5	0	22.62
				5	1	22.22
	713.5	23155		1	0	22.91
				1	5	23.03
				5	0	22.78
				5	1	22.14
QPSK	704	23060	10	1	0	23.21
				6	0	22.30
	707.5	23095		1	0	23.22
				6	0	22.28
	711	23130		1	0	23.27
				6	0	22.37
16QAM	704	23060	10	1	0	22.90
				1	5	23.15
				5	0	22.70
				5	1	22.88
	707.5	23095		1	0	22.99
				1	5	23.17
				5	0	22.64
				5	1	22.27
	711	23130		1	0	22.98
				1	5	23.11
				5	0	22.79
				5	1	22.20