

# FCC Radio Test Report

## FCC ID: XMR2019SC650TNA

This report concerns: Original Grant

**Project No.** : 2001H013  
**Equipment** : Smart Module  
**Brand Name** : QUECTEL  
**Test Model** : SC650T-NA  
**Series Model** : N/A  
**Applicant** : Quectel Wireless Solutions Co., Ltd.  
**Address** : Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233.  
**Manufacturer** : Quectel Wireless Solutions Co., Ltd.  
**Address** : Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233.  
**Date of Receipt** : Jan. 15, 2020  
**Date of Test** : Jan. 15, 2020~Feb. 27, 2020  
**Issued Date** : Mar. 16, 2020  
**Report Version** : R00  
**Test Sample** : Engineering Sample No.: SH2020011452  
**Standard(s)** : 47 CFR FCC Part 90 Subpart S  
                   47 CFR FCC Part 2 & ANSI/TIA/EIA-603-E-2016  
                   FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.



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**Declaration**

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The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

**Limitation**

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and is not use in determining the Pass/Fail results.

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**REPORT ISSUED HISTORY**

| Report Version | Description     | Issued Date   |
|----------------|-----------------|---------------|
| R00            | Original Issue. | Mar. 16, 2020 |

## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

| FCC Part 90 Subpart S & Part 2 |                              |          |        |
|--------------------------------|------------------------------|----------|--------|
| Standard(s) Section            | Test Item                    | Judgment | Remark |
| 2.1046 & 90.635 (b)            | Radiated power               | PASS     | -----  |
| 2.1046 & 90.635 (b)            | Conducted Output Power       | PASS     | -----  |
| 2.1049 & 90.209                | Occupied Bandwidth           | PASS     | -----  |
| 2.1051 & 90.691                | Conducted Spurious Emissions | PASS     | -----  |
| 2.1053 & 90.691                | Radiated Spurious Emissions  | PASS     | -----  |
| 2.1051 & 90.209                | Band Edge Measurements       | PASS     | -----  |
| 2.1055 & 90.213                | Frequency Stability          | PASS     | -----  |
| -                              | Peak To Average Ratio        | PASS     | -----  |

Note:

For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".

### 1.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No. 29, Jintang Road, Tangzhen Industry Park, Pudong New Area, Shanghai 201210, China.

BTL's Test Firm Registration Number for FCC: 476765

BTL's Designation Number for FCC: CN1241

### 1.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2).

The BTL measurement uncertainty as below table:

#### A. Radiated Measurement :

| Test Site | Method | Measurement Frequency Range | Ant.<br>H / V | U,(dB) |
|-----------|--------|-----------------------------|---------------|--------|
| SH-CB01   | CISPR  | 9KHz ~ 30MHz                | V             | 3.79   |
|           |        | 9KHz ~ 30MHz                | H             | 3.57   |
|           |        | 30MHz ~ 200MHz              | V             | 4.12   |
|           |        | 30MHz ~ 200MHz              | H             | 3.20   |
|           |        | 200MHz ~ 1,000MHz           | V             | 3.12   |
|           |        | 200MHz ~ 1,000MHz           | H             | 3.18   |

| Test Site       | Method | Measurement Frequency Range | U,(dB) |
|-----------------|--------|-----------------------------|--------|
| SH-CB01<br>(3m) | CISPR  | 1GHz ~ 6GHz                 | 4.40   |
|                 |        | 6GHz ~ 18GHz                | 4.86   |

| Test Site       | Method | Measurement Frequency Range | U,(dB) |
|-----------------|--------|-----------------------------|--------|
| SH-CB01<br>(3m) | CISPR  | 18 ~ 26.5 GHz               | 3.64   |
|                 |        | 26.5 ~ 40 GHz               | 3.78   |

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

### 1.3 TEST ENVIRONMENT CONDITIONS

| Test Item              | Environmental Conditions | Test Voltage       |
|------------------------|--------------------------|--------------------|
| ERP                    | 23°C, 59%RH              | DC 3.8V            |
| Conducted Output Power | 23°C, 59%RH              | DC 3.8V            |
| Occupied Bandwidth     | 23°C, 59%RH              | DC 3.8V            |
| Conducted Emission     | 23°C, 59%RH              | DC 3.8V            |
| Radiated Emission      | 21°C, 40%RH              | DC 3.8V            |
| Frequency Stability    | Normal and Extreme       | Normal and Extreme |
| Peak to Average Ratio  | 23°C, 59%RH              | DC 3.8V            |

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

|                     |                                         |                                    |       |     |
|---------------------|-----------------------------------------|------------------------------------|-------|-----|
| Equipment           | Smart Module                            |                                    |       |     |
| Brand Name          | QUECTEL                                 |                                    |       |     |
| Test Model          | SC650T-NA                               |                                    |       |     |
| Series Model        | N/A                                     |                                    |       |     |
| Model Difference(s) | N/A                                     |                                    |       |     |
| Software Version    | SC650TNAPAR05A03                        |                                    |       |     |
| Hardware Version    | R1.0                                    |                                    |       |     |
| Power Source        | DC power supply.                        |                                    |       |     |
| Power Rating        | DC 3.8V                                 |                                    |       |     |
| IMEI No.1           | 861394040018223                         |                                    |       |     |
| IMEI No.2           | 861394040018231                         |                                    |       |     |
| Antenna Type        | Dipole                                  |                                    |       |     |
| Antenna Gain        | LTE Band 26                             | 3.19 dBi                           |       |     |
| Modulation Type     | LTE                                     | UL: QPSK, 16QAM<br>DL: QPSK, 16QAM |       |     |
| Operation Frequency | LTE Band 26 (Channel Bandwidth: 1.4MHz) | 814.7 MHz ~ 848.3 MHz              |       |     |
|                     | LTE Band 26 (Channel Bandwidth: 3MHz)   | 815.5 MHz ~ 847.5 MHz              |       |     |
|                     | LTE Band 26 (Channel Bandwidth: 5MHz)   | 816.5 MHz ~ 846.5 MHz              |       |     |
|                     | LTE Band 26 (Channel Bandwidth: 10MHz)  | 819 MHz ~ 844 MHz                  |       |     |
|                     | LTE Band 26 (Channel Bandwidth: 15MHz)  | 821.5 MHz ~ 841.5 MHz              |       |     |
| Max. ERP Power      | LTE Band 26 (Channel Bandwidth: 1.4MHz) | QPSK                               | 24.67 | dBm |
|                     |                                         | 16QAM                              | 23.78 | dBm |
|                     | LTE Band 26 (Channel Bandwidth: 3MHz)   | QPSK                               | 24.64 | dBm |
|                     |                                         | 16QAM                              | 23.53 | dBm |
|                     | LTE Band 26 (Channel Bandwidth: 5MHz)   | QPSK                               | 24.91 | dBm |
|                     |                                         | 16QAM                              | 23.34 | dBm |
|                     | LTE Band 26 (Channel Bandwidth: 10MHz)  | QPSK                               | 25.00 | dBm |
|                     |                                         | 16QAM                              | 23.75 | dBm |
|                     | LTE Band 26 (Channel Bandwidth: 15MHz)  | QPSK                               | 24.55 | dBm |
|                     |                                         | 16QAM                              | 23.46 | dBm |

Note:

For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.



## 2.2 DESCRIPTION OF TEST MODES AND TEST CONDITION

Following channel(s) was (were) selected for the final test as listed below:

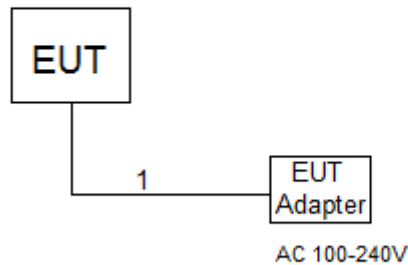
| LTE BAND 26        |                   |                     |                   |             |               |
|--------------------|-------------------|---------------------|-------------------|-------------|---------------|
| Test Item          | Available Channel | Tested Channel      | Channel Bandwidth | Modulation  | Mode          |
| Output Power &ERP  | 26697 to 27033    | 26697, 26865, 27033 | 1.4MHz            | QPSK, 16QAM | 1RB/3RB/6RB   |
|                    | 26705 to 27025    | 26705, 26865, 27025 | 3MHz              | QPSK, 16QAM | 1RB/8RB/15RB  |
|                    | 26715 to 27015    | 26715, 26865, 27015 | 5MHz              | QPSK, 16QAM | 1RB/12RB/25RB |
|                    | 26740 to 26990    | 26740, 26865, 26990 | 10MHz             | QPSK, 16QAM | 1RB/25RB/50RB |
|                    | 26765 to 26965    | 26765, 26865, 26965 | 15MHz             | QPSK, 16QAM | 1RB/36RB/75RB |
| Occupied Bandwidth | 26697 to 27033    | 26697, 26865, 27033 | 1.4MHz            | QPSK, 16QAM | 6RB           |
|                    | 26705 to 27025    | 26705, 26865, 27025 | 3MHz              | QPSK, 16QAM | 15 RB         |
|                    | 26715 to 27015    | 26715, 26865, 27015 | 5MHz              | QPSK, 16QAM | 25 RB         |
|                    | 26740 to 26990    | 26740, 26865, 26990 | 10MHz             | QPSK, 16QAM | 50 RB         |
|                    | 26765 to 26965    | 26765, 26865, 26965 | 15MHz             | QPSK, 16QAM | 75 RB         |
| Conducted Emission | 26697 to 27033    | 26865               | 1.4MHz            | QPSK        | 1 RB          |
|                    | 26705 to 27025    | 26865               | 3MHz              | QPSK        | 1 RB          |
|                    | 26715 to 27015    | 26865               | 5MHz              | QPSK        | 1 RB          |
|                    | 26740 to 26990    | 26865               | 10MHZ             | QPSK        | 1 RB          |
|                    | 26765 to 26965    | 26865               | 15MHZ             | QPSK        | 1 RB          |
| Radiated Emission  | 26697 to 27033    | 27033               | 1.4MHz            | QPSK        | 1 RB          |
|                    | 26765 to 26965    | 26865               | 15MHZ             | QPSK        | 1 RB          |

|                       |                |                     |        |             |       |
|-----------------------|----------------|---------------------|--------|-------------|-------|
| Band Edge             | 26697 to 27033 | 26697               | 1.4MHz | QPSK        | 1 RB  |
|                       |                |                     |        |             | 6 RB  |
|                       |                | 27033               | 1.4MHz | QPSK        | 1 RB  |
|                       |                |                     |        |             | 6 RB  |
|                       | 26705 to 27025 | 26705               | 3MHz   | QPSK        | 1 RB  |
|                       |                |                     |        |             | 15 RB |
|                       |                | 27025               | 3MHz   | QPSK        | 1 RB  |
|                       |                |                     |        |             | 15 RB |
|                       | 26715 to 27015 | 26715               | 5MHz   | QPSK        | 1 RB  |
|                       |                |                     |        |             | 25 RB |
|                       |                | 27015               | 5MHz   | QPSK        | 1 RB  |
|                       |                |                     |        |             | 25 RB |
| Peak to Average Ratio | 26697 to 27033 | 26697, 26865, 27033 | 1.4MHz | QPSK, 16QAM | 6RB   |
|                       |                |                     |        |             |       |
|                       | 26705 to 27025 | 26705, 26865, 27025 | 3MHz   | QPSK, 16QAM | 15 RB |
|                       |                |                     |        |             |       |
|                       | 26715 to 27015 | 26715, 26865, 27015 | 5MHz   | QPSK, 16QAM | 25 RB |
| Frequency Stability   | 26740 to 26990 | 26740, 26865, 26990 | 10MHz  | QPSK, 16QAM | 50 RB |
|                       | 26765 to 26965 | 26765, 26865, 26965 | 15MHz  | QPSK, 16QAM | 75 RB |
|                       | 26797 to 27033 | 26865               | 1.4MHz | QPSK        | 1 RB  |
|                       | 26805 to 27025 | 26865               | 3MHz   | QPSK        | 1 RB  |
|                       | 26815 to 27015 | 26865               | 5MHz   | QPSK        | 1 RB  |
|                       | 26840 to 26990 | 26865               | 10MHZ  | QPSK        | 1 RB  |
|                       | 26765 to 26965 | 26865               | 15MHZ  | QPSK        | 1 RB  |

Note:

- 1) The mark "V" means that this configuration is chosen for testing.
- 2) The mark "-" means that this configuration is not testing.
- 3) The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

## 2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED FOR RADIATED



## 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. |
|------|-----------|-----------|----------------|------------|
| 1    | Adapter   | -         | YHSW-050100U/T | -          |

| Item | Cable Type | Shielded Type | Ferrite Core | Length |
|------|------------|---------------|--------------|--------|
| 1    | DC Cable   | N/A           | N/A          | 1m     |

### 3. TEST RESULT

#### 3.1 OUTPUT POWER MEASUREMENT

##### 3.1.1 LIMIT

Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

##### 3.1.2 TEST PROCEDURE

###### ERP:

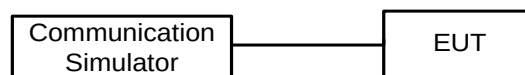
ERP power=EIPR power-2.15dBi.

###### Conducted Power:

The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.  
Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

##### 3.1.3 TESTSETUP LAYOUT

###### Conducted Power Measurement



##### 3.1.4 TEST DEVIATION

No deviation

##### 3.1.5 TEST RESULTS

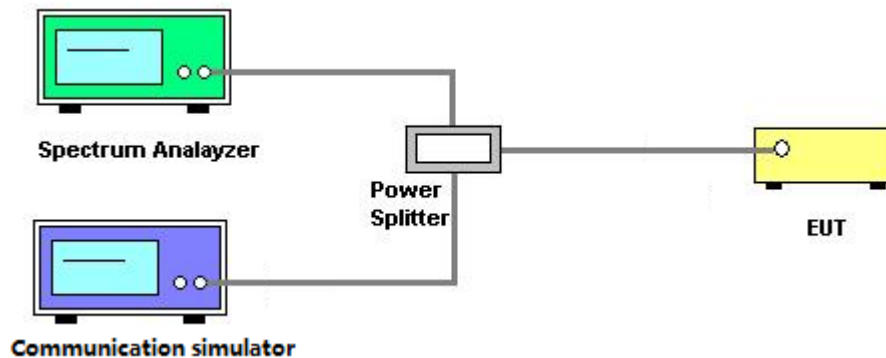
Please refer to the Appendix A.

## 3.2 OCCUPIED BANDWIDTH MEASUREMENT

### 3.2.1 TEST PROCEDURE

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth and 26dB bandwidth.

### 3.2.2 TEST SETUP LAYOUT



### 3.2.3 TEST DEVIATION

No deviation

### 3.2.4 TEST RESULTS

Please refer to the Appendix B.

### 3.3 CONDUCTED EMISSIONS MEASUREMENT

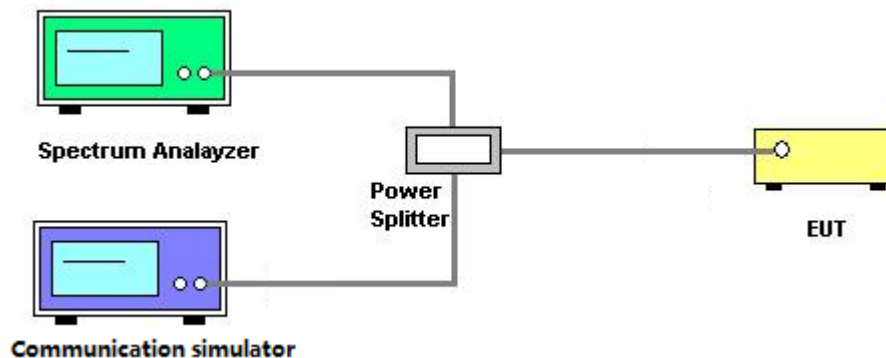
#### 3.3.1 LIMIT

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log_{10} (P)$  dB. The limit of emission is equal to -13dBm.

#### 3.3.2 TEST PROCEDURES

1. The testing follows FCC KDB 971168 v03r01 Section 6.0.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured. Set RBW  $\geq 1\%$  EBW in the 1MHz band immediately outside and adjacent to the band edge.
4. Set spectrum analyzer with RMS detector.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
6. The limit line is derived from  $43 + 10 \log(P)$  dB below the transmitter power P (Watts)  
 $= P(W) - [43 + 10 \log(P)](dB)$   
 $= [30 + 10 \log(P)](dBm) - [43 + 10 \log(P)](dB)$   
 $= -13dBm$

#### 3.3.3 TESTSETUP LAYOUT



#### 3.3.4 TESTDEVIATION

No deviation

#### 3.3.5 TEST RESULTS

Please refer to the Appendix C.

## 3.4 RADIATED EMISSIONS MEASUREMENT

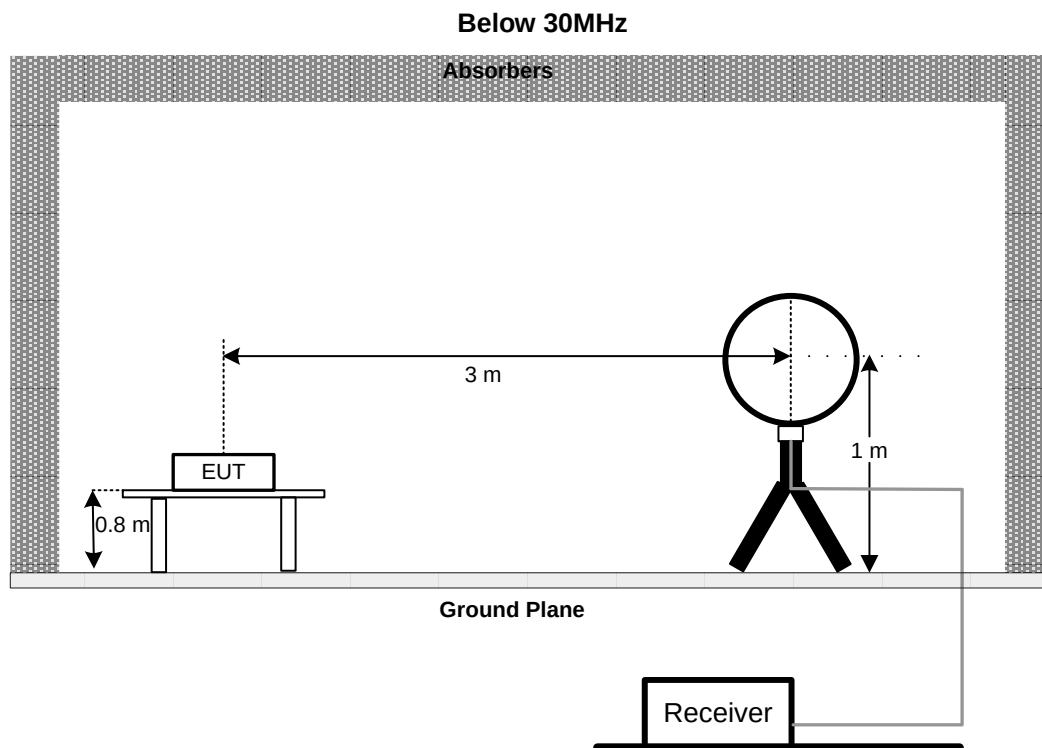
### 3.4.1 LIMIT

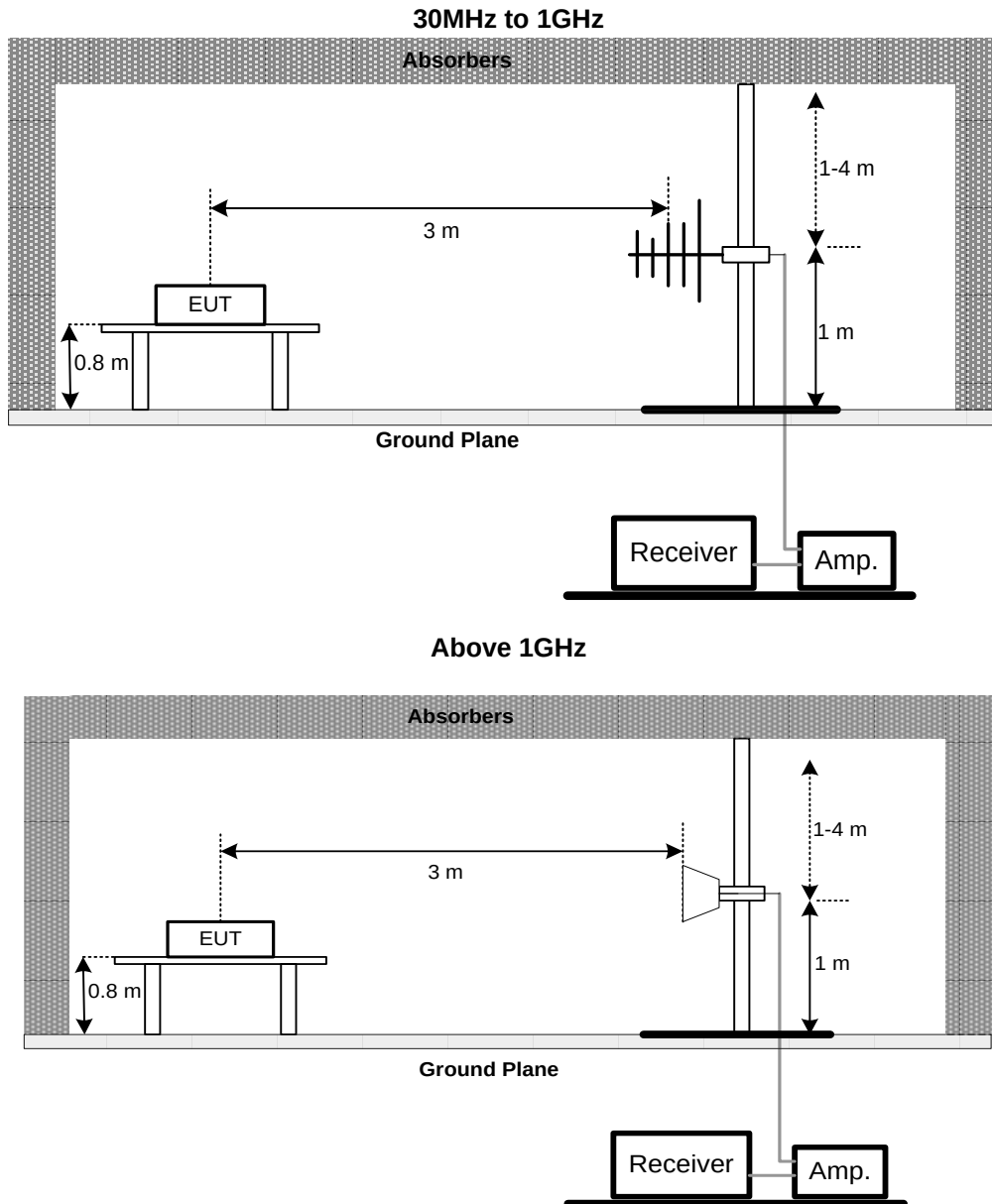
The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log_{10} (P)$  dB. The limit of emission is equal to -13dBm.

### 3.4.2 TEST PROCEDURES

1. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
2. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step a. Record the power level of S.G
3.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
4. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,  $E.R.P \text{ power} = E.I.P.R \text{ power} - 2.15\text{dBi}.$
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

### 3.4.3 TESTSETUP LAYOUT





### 3.4.4 TESTDEVIATION

No deviation

### 3.4.5 TEST RESULTS (30MHZ TO 1000MHZ)

Please refer to the Appendix D.

### 3.4.6 TEST RESULTS (ABOVE 1000MHZ)

Please refer to the Appendix E.



## 3.5 BAND EDGE /EMISSION MASK MEASUREMENT

### 3.5.1 LIMIT

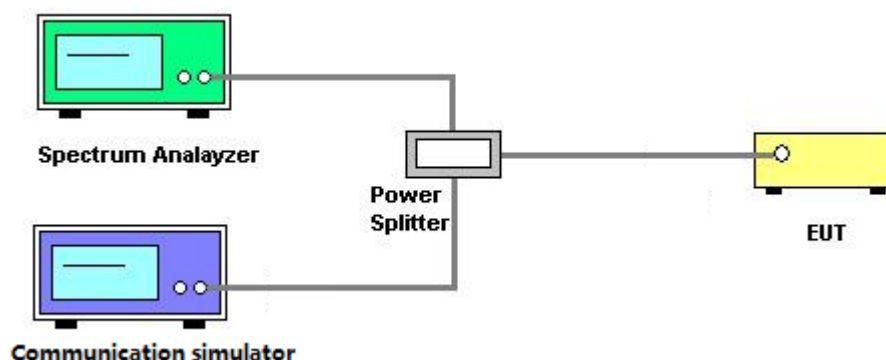
For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations.
- (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.
- (4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.
- (5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

### 3.5.2 TEST PROCEDURES

1. All measurements were done at low and high operational frequency range.
2. Set RBW=1% of 26dBc bandwidth, VBW=3 X RBW, detector=RMS, Sweep time = Auto.
3. Record the max trace plot into the test report.

### 3.5.3 TESTSETUP LAYOUT



### 3.5.4 TESTDEVIATION

No deviation

### 3.5.5 TEST RESULTS

Please refer to the Appendix F.

### 3.6 FREQUENCY STABILITY MEASUREMENT

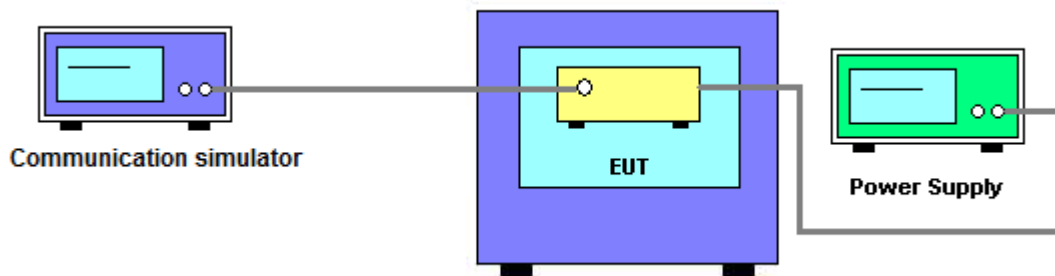
#### 3.6.1 LIMIT

1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

#### 3.6.2 TEST PROCEDURES

1. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
2. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
3. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the  $\pm 0.5^{\circ}\text{C}$  during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.
4. The frequency error was recorded frequency error from the communication simulator.

#### 3.6.3 TESTSETUP LAYOUT



#### 3.6.4 TESTDEVIATION

No deviation

#### 3.6.5 TEST RESULTS

Please refer to the Appendix G.

### 3.7 PEAK TO AVERAGE RATIO MEASUREMENT

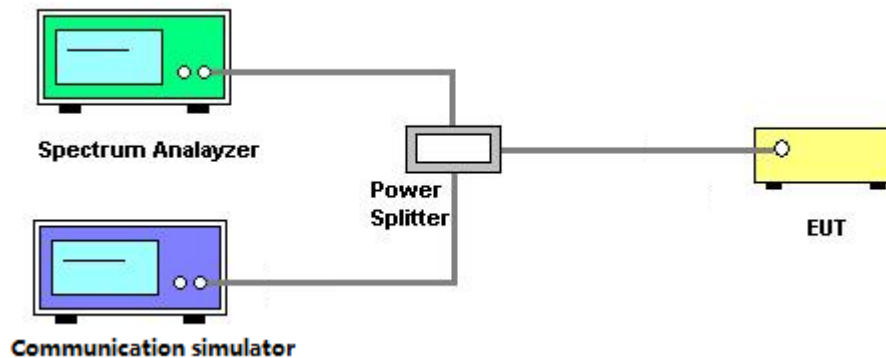
#### 3.7.1 LIMIT

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.

#### 3.7.2 TEST PROCEDURES

1. Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1%.

#### 3.7.3 TEST SETUP LAYOUT



#### 3.7.4 TEST DEVIATION

No deviation

#### 3.7.5 TEST RESULTS

Please refer to the Appendix H.

#### 4. LIST OF MEASUREMENT EQUIPMENTS

| Radiated Emission Measurement(9K-30M) |                      |              |                          |            |                  |
|---------------------------------------|----------------------|--------------|--------------------------|------------|------------------|
| Item                                  | Kind of Equipment    | Manufacturer | Type No.                 | Serial No. | Calibrated until |
| 1                                     | Loop Antenna         | EMCI         | EMCI LPA600              | 275        | Mar. 29, 2020    |
| 2                                     | EMI Test Receiver    | R&S          | ESCI                     | 100082     | Mar. 29, 2020    |
| 3                                     | Measurement Software | Farad        | EZ-EMC<br>Ver.NB-03A1-01 | N/A        | N/A              |

| Radiated Emission Measurement(30M-1G) |                                   |              |                          |            |                  |
|---------------------------------------|-----------------------------------|--------------|--------------------------|------------|------------------|
| Item                                  | Kind of Equipment                 | Manufacturer | Type No.                 | Serial No. | Calibrated until |
| 1                                     | TRILOG Broadband Antenna          | Schwarzbeck  | VULB 9168                | 719        | Mar. 29, 2020    |
| 2                                     | Pre-Amplifier                     | emci         | EMC9135                  | 980400     | Mar. 29, 2020    |
| 3                                     | MXE EMI Receiver                  | Keysight     | N9038A                   | MY57150106 | Mar. 29, 2020    |
| 4                                     | Test Cable                        | emci         | EMC104-SM-SM-7000        | 170330     | Apr. 17, 2020    |
| 5                                     | Test Cable                        | emci         | EMC104-SM-SM-1000        | 170331     | Apr. 17, 2020    |
| 6                                     | Test Cable                        | emci         | EMC104-SM-NM-3500        | 170621     | Apr. 17, 2020    |
| 7                                     | Measurement Software              | Farad        | EZ-EMC<br>Ver.NB-03A1-01 | N/A        | N/A              |
| 8                                     | Wideband Radio Communication Test | R&S          | CMW500                   | 131463     | Sep. 01, 2020    |

| Radiated Emission Measurement(1G-18G) |                                      |              |                   |            |                  |
|---------------------------------------|--------------------------------------|--------------|-------------------|------------|------------------|
| Item                                  | Kind of Equipment                    | Manufacturer | Type No.          | Serial No. | Calibrated until |
| 1                                     | Pre-Amplifier                        | emci         | EMC184045SE       | 980409     | Mar. 29, 2020    |
| 2                                     | Pre-Amplifier                        | emci         | EMC012645SE       | 980421     | Mar. 29, 2020    |
| 3                                     | Pre-Amplifier                        | emci         | EMC9135           | 980400     | Mar. 29, 2020    |
| 4                                     | Double Ridged Broadband Horn Antenna | Schwarzbeck  | BBHA 9120D        | 9120D-1787 | Mar. 29, 2020    |
| 5                                     | Double-Ridged Waveguide Horn Antenna | ETS-Lindgren | 3116C             | 00203919   | Mar. 29, 2020    |
| 6                                     | TRILOG Broadband Antenna             | Schwarzbeck  | VULB 9168         | 719        | Mar. 29, 2020    |
| 7                                     | Cable                                | N/A          | EMC102-SM-SM-6000 | 170336     | Apr. 17, 2020    |
| 8                                     | Wideband Radio Communication Test    | R&S          | CMW500            | 131463     | Sep. 01, 2020    |

| Conducted Emission & Emission Mask & Occupied Bandwidth Measurement |                                   |              |             |            |                  |
|---------------------------------------------------------------------|-----------------------------------|--------------|-------------|------------|------------------|
|                                                                     | Kind of Equipment                 | Manufacturer | Type No.    | Serial No. | Calibrated until |
| 1                                                                   | EXA Spectrum Analyzer             | Keysight     | N9010A      | MY56480579 | Mar. 29, 2020    |
| 2                                                                   | Power Divider                     | JUK          | PD-4SF-2060 | N/A        | N/A              |
| 3                                                                   | Wideband Radio Communication Test | R&S          | CMW500      | 131463     | Sep. 01, 2020    |
| 4                                                                   | Spectrum Analyzer                 | R&S          | FSP40       | 100626     | Mar. 29, 2020    |

| Frequency Stability Measurement |                                   |              |             |            |                  |
|---------------------------------|-----------------------------------|--------------|-------------|------------|------------------|
|                                 | Kind of Equipment                 | Manufacturer | Type No.    | Serial No. | Calibrated until |
| 1                               | EXA Spectrum Analyzer             | Keysight     | N9010A      | MY56480579 | Mar. 29, 2020    |
| 2*                              | Power Divider                     | JUK          | PD-4SF-2060 | N/A        | N/A              |
| 3                               | Wideband Radio Communication Test | R&S          | CMW500      | 131463     | Sep. 01, 2020    |
| 4                               | Spectrum Analyzer                 | R&S          | FSP40       | 100626     | Mar. 29, 2020    |
| 5                               | Temperature And Humidity Box      | Blue pand    | BPHS-120B   | 170616454  | Sep. 01, 2020    |

Remark: "N/A" denotes no model name, serial no. or calibration specified.

All calibration period of equipment list is one year.

## **APPENDIX A - OUTPUT POWER**

### Output Power (dBm):

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26697 CH  | 26865 CH | 27033 CH  |
|               |            |          |           | 814.7 MHz | 831 MHz  | 848.3 MHz |
| 26 / 1.4M     | QPSK       | 1        | 0         | 23.11     | 23.50    | 23.35     |
|               |            | 1        | 2         | 23.37     | 23.42    | 23.31     |
|               |            | 1        | 5         | 23.30     | 23.39    | 23.28     |
|               |            | 3        | 0         | 22.93     | 23.44    | 23.35     |
|               |            | 3        | 1         | 23.04     | 23.63    | 23.08     |
|               |            | 3        | 3         | 22.83     | 23.57    | 23.18     |
|               |            | 6        | 0         | 22.36     | 22.60    | 22.51     |
|               | 16QAM      | 1        | 0         | 22.08     | 22.44    | 22.27     |
|               |            | 1        | 2         | 22.03     | 22.68    | 22.45     |
|               |            | 1        | 5         | 22.06     | 22.64    | 22.02     |
|               |            | 3        | 0         | 22.20     | 22.74    | 22.48     |
|               |            | 3        | 1         | 22.26     | 22.48    | 22.04     |
|               |            | 3        | 3         | 21.98     | 22.21    | 22.07     |
|               |            | 6        | 0         | 21.26     | 21.52    | 21.37     |

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26705 CH  | 26865 CH | 27025 CH  |
|               |            |          |           | 815.5 MHz | 831 MHz  | 847.5 MHz |
| 26 / 3M       | QPSK       | 1        | 0         | 23.03     | 23.33    | 23.21     |
|               |            | 1        | 7         | 23.18     | 23.06    | 23.24     |
|               |            | 1        | 14        | 23.10     | 23.33    | 23.39     |
|               |            | 8        | 0         | 22.97     | 23.14    | 23.25     |
|               |            | 8        | 3         | 22.80     | 23.41    | 23.45     |
|               |            | 8        | 7         | 23.18     | 23.60    | 23.06     |
|               |            | 15       | 0         | 22.17     | 22.57    | 22.43     |
|               | 16QAM      | 1        | 0         | 22.09     | 22.31    | 22.16     |
|               |            | 1        | 7         | 22.23     | 22.05    | 21.88     |
|               |            | 1        | 14        | 21.94     | 22.20    | 22.27     |
|               |            | 8        | 0         | 22.12     | 22.20    | 21.99     |
|               |            | 8        | 3         | 22.36     | 22.16    | 22.02     |
|               |            | 8        | 7         | 22.22     | 22.49    | 22.25     |
|               |            | 15       | 0         | 21.49     | 21.73    | 21.58     |

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26715 CH  | 26865 CH | 27015 CH  |
|               |            |          |           | 816.5 MHz | 831 MHz  | 846.5 MHz |
| 26 / 5M       | QPSK       | 1        | 0         | 23.21     | 23.60    | 23.43     |
|               |            | 1        | 12        | 23.36     | 23.85    | 23.49     |
|               |            | 1        | 24        | 22.99     | 23.78    | 23.35     |
|               |            | 12       | 0         | 22.95     | 23.67    | 23.21     |
|               |            | 12       | 6         | 23.40     | 23.87    | 23.37     |
|               |            | 12       | 13        | 23.29     | 23.41    | 23.56     |
|               |            | 25       | 0         | 22.31     | 22.53    | 22.39     |
|               | 16QAM      | 1        | 0         | 21.87     | 22.09    | 21.97     |
|               |            | 1        | 12        | 22.04     | 22.26    | 21.89     |
|               |            | 1        | 24        | 22.05     | 22.01    | 22.21     |
|               |            | 12       | 0         | 21.92     | 21.97    | 21.82     |
|               |            | 12       | 6         | 22.10     | 22.30    | 22.03     |
|               |            | 12       | 13        | 21.89     | 22.11    | 22.00     |
|               |            | 25       | 0         | 21.24     | 21.60    | 21.43     |

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26740 CH  | 26865 CH | 26990 CH  |
|               |            |          |           | 819.0 MHz | 831 MHz  | 844.0 MHz |
| 26 / 10M      | QPSK       | 1        | 0         | 23.31     | 23.67    | 23.49     |
|               |            | 1        | 24        | 23.34     | 23.54    | 23.47     |
|               |            | 1        | 49        | 23.46     | 23.96    | 23.64     |
|               |            | 25       | 0         | 23.42     | 23.56    | 23.61     |
|               |            | 25       | 12        | 23.59     | 23.96    | 23.41     |
|               |            | 25       | 25        | 23.61     | 23.87    | 23.34     |
|               |            | 50       | 0         | 22.11     | 22.53    | 22.38     |
|               | 16QAM      | 1        | 0         | 22.21     | 22.42    | 22.34     |
|               |            | 1        | 24        | 22.03     | 22.71    | 22.15     |
|               |            | 1        | 49        | 21.97     | 22.22    | 22.12     |
|               |            | 25       | 0         | 22.24     | 22.68    | 22.04     |
|               |            | 25       | 12        | 21.96     | 22.46    | 22.07     |
|               |            | 25       | 25        | 22.23     | 22.38    | 22.18     |
|               |            | 50       | 0         | 21.37     | 21.61    | 21.54     |



| LTE Band / BW | Modulation | RB<br>Sizet | RB<br>Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|-------------|--------------|-----------|----------|-----------|
|               |            |             |              | 26765 CH  | 26865 CH | 26965 CH  |
|               |            |             |              | 821.5 MHz | 831 MHz  | 841.5 MHz |
| 26 / 15M      | QPSK       | 1           | 0            | 23.03     | 23.25    | 23.16     |
|               |            | 1           | 37           | 23.08     | 23.36    | 23.23     |
|               |            | 1           | 74           | 23.27     | 23.06    | 23.16     |
|               |            | 36          | 0            | 23.22     | 23.02    | 22.93     |
|               |            | 36          | 19           | 23.10     | 23.51    | 23.22     |
|               |            | 36          | 39           | 23.05     | 23.14    | 23.00     |
|               |            | 75          | 0            | 22.17     | 22.46    | 22.33     |
|               | 16QAM      | 1           | 0            | 22.14     | 22.38    | 22.25     |
|               |            | 1           | 37           | 21.87     | 22.11    | 22.15     |
|               |            | 1           | 74           | 22.40     | 22.42    | 22.41     |
|               |            | 36          | 0            | 22.05     | 22.28    | 22.32     |
|               |            | 36          | 19           | 22.16     | 22.38    | 22.05     |
|               |            | 36          | 39           | 22.22     | 22.41    | 22.40     |
|               |            | 75          | 0            | 21.18     | 21.54    | 21.36     |

**ERP Power (dBm):**

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26697 CH  | 26865 CH | 27033 CH  |
|               |            |          |           | 814.7 MHz | 831 MHz  | 848.3 MHz |
| 26 / 1.4M     | QPSK       | 1        | 0         | 24.15     | 24.54    | 24.39     |
|               |            | 1        | 2         | 24.41     | 24.46    | 24.35     |
|               |            | 1        | 5         | 24.34     | 24.43    | 24.32     |
|               |            | 3        | 0         | 23.97     | 24.48    | 24.39     |
|               |            | 3        | 1         | 24.08     | 24.67    | 24.12     |
|               |            | 3        | 3         | 23.87     | 24.61    | 24.22     |
|               |            | 6        | 0         | 23.40     | 23.64    | 23.55     |
|               | 16QAM      | 1        | 0         | 23.12     | 23.48    | 23.31     |
|               |            | 1        | 2         | 23.07     | 23.72    | 23.49     |
|               |            | 1        | 5         | 23.10     | 23.68    | 23.06     |
|               |            | 3        | 0         | 23.24     | 23.78    | 23.52     |
|               |            | 3        | 1         | 23.30     | 23.52    | 23.08     |
|               |            | 3        | 3         | 23.02     | 23.25    | 23.11     |
|               |            | 6        | 0         | 22.30     | 22.56    | 22.41     |

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26705 CH  | 26865 CH | 27025 CH  |
|               |            |          |           | 815.5 MHz | 831 MHz  | 847.5 MHz |
| 26 / 3M       | QPSK       | 1        | 0         | 24.07     | 24.37    | 24.25     |
|               |            | 1        | 7         | 24.22     | 24.10    | 24.28     |
|               |            | 1        | 14        | 24.14     | 24.37    | 24.43     |
|               |            | 8        | 0         | 24.01     | 24.18    | 24.29     |
|               |            | 8        | 3         | 23.84     | 24.45    | 24.49     |
|               |            | 8        | 7         | 24.22     | 24.64    | 24.10     |
|               |            | 15       | 0         | 23.21     | 23.61    | 23.47     |
|               | 16QAM      | 1        | 0         | 23.13     | 23.35    | 23.20     |
|               |            | 1        | 7         | 23.27     | 23.09    | 22.92     |
|               |            | 1        | 14        | 22.98     | 23.24    | 23.31     |
|               |            | 8        | 0         | 23.16     | 23.24    | 23.03     |
|               |            | 8        | 3         | 23.40     | 23.20    | 23.06     |
|               |            | 8        | 7         | 23.26     | 23.53    | 23.29     |
|               |            | 15       | 0         | 22.53     | 22.77    | 22.62     |

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26715 CH  | 26865 CH | 27015 CH  |
|               |            |          |           | 816.5 MHz | 831MHz   | 846.5 MHz |
| 26 / 5M       | QPSK       | 1        | 0         | 24.25     | 24.64    | 24.47     |
|               |            | 1        | 12        | 24.40     | 24.89    | 24.53     |
|               |            | 1        | 24        | 24.03     | 24.82    | 24.39     |
|               |            | 12       | 0         | 23.99     | 24.71    | 24.25     |
|               |            | 12       | 6         | 24.44     | 24.91    | 24.41     |
|               |            | 12       | 13        | 24.33     | 24.45    | 24.60     |
|               |            | 25       | 0         | 23.35     | 23.57    | 23.43     |
|               | 16QAM      | 1        | 0         | 22.91     | 23.13    | 23.01     |
|               |            | 1        | 12        | 23.08     | 23.30    | 22.93     |
|               |            | 1        | 24        | 23.09     | 23.05    | 23.25     |
|               |            | 12       | 0         | 22.96     | 23.01    | 22.86     |
|               |            | 12       | 6         | 23.14     | 23.34    | 23.07     |
|               |            | 12       | 13        | 22.93     | 23.15    | 23.04     |
|               |            | 25       | 0         | 22.28     | 22.64    | 22.47     |

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26740 CH  | 26865 CH | 26990 CH  |
|               |            |          |           | 819.0 MHz | 831 MHz  | 844.0 MHz |
| 26 / 10M      | QPSK       | 1        | 0         | 24.35     | 24.71    | 24.53     |
|               |            | 1        | 24        | 24.38     | 24.58    | 24.51     |
|               |            | 1        | 49        | 24.50     | 25.00    | 24.68     |
|               |            | 25       | 0         | 24.46     | 24.60    | 24.65     |
|               |            | 25       | 12        | 24.63     | 25.00    | 24.45     |
|               |            | 25       | 25        | 24.65     | 24.91    | 24.38     |
|               |            | 50       | 0         | 23.15     | 23.57    | 23.42     |
|               | 16QAM      | 1        | 0         | 23.25     | 23.46    | 23.38     |
|               |            | 1        | 24        | 23.07     | 23.75    | 23.19     |
|               |            | 1        | 49        | 23.01     | 23.26    | 23.16     |
|               |            | 25       | 0         | 23.28     | 23.72    | 23.08     |
|               |            | 25       | 12        | 23.00     | 23.50    | 23.11     |
|               |            | 25       | 25        | 23.27     | 23.42    | 23.22     |
|               |            | 50       | 0         | 22.41     | 22.65    | 22.58     |

| LTE Band / BW | Modulation | RB Siset | RB Offset | Low CH    | Mid CH   | High CH   |
|---------------|------------|----------|-----------|-----------|----------|-----------|
|               |            |          |           | 26765 CH  | 26865 CH | 26965 CH  |
|               |            |          |           | 821.5 MHz | 831 MHz  | 841.5 MHz |
| 26 / 15M      | QPSK       | 1        | 0         | 24.07     | 24.29    | 24.20     |
|               |            | 1        | 37        | 24.12     | 24.40    | 24.27     |
|               |            | 1        | 74        | 24.31     | 24.10    | 24.20     |
|               |            | 36       | 0         | 24.26     | 24.06    | 23.97     |
|               |            | 36       | 19        | 24.14     | 24.55    | 24.26     |
|               |            | 36       | 39        | 24.09     | 24.18    | 24.04     |
|               |            | 75       | 0         | 23.21     | 23.50    | 23.37     |
|               | 16QAM      | 1        | 0         | 23.18     | 23.42    | 23.29     |
|               |            | 1        | 37        | 22.91     | 23.15    | 23.19     |
|               |            | 1        | 74        | 23.44     | 23.46    | 23.45     |
|               |            | 36       | 0         | 23.09     | 23.32    | 23.36     |
|               |            | 36       | 19        | 23.20     | 23.42    | 23.09     |
|               |            | 36       | 39        | 23.26     | 23.45    | 23.44     |
|               |            | 75       | 0         | 22.22     | 22.58    | 22.40     |

## **APPENDIX B - OCCUPIED BANDWIDTH**

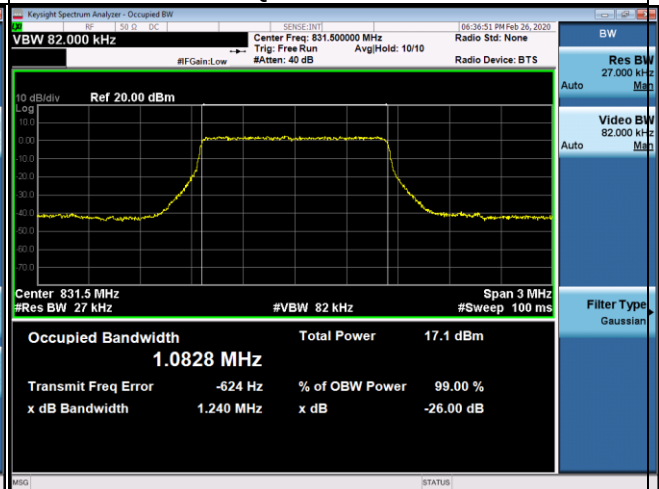
| LTE Band 26_1.4M |                 |                              |         |                 |                              |
|------------------|-----------------|------------------------------|---------|-----------------|------------------------------|
| QPSK             |                 |                              | 16QAM   |                 |                              |
| Channel          | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
| 26697            | 814.7           | 1.0873                       | 26697   | 814.7           | 1.0820                       |
| 26865            | 831             | 1.0828                       | 26865   | 831             | 1.0809                       |
| 27033            | 848.3           | 1.1022                       | 27033   | 848.3           | 1.0813                       |
| Channel          | Frequency (MHz) | 26dB Bandwidth (MHz)         | Channel | Frequency (MHz) | 26dB Bandwidth (MHz)         |
| 26697            | 814.7           | 1.2840                       | 26697   | 814.7           | 1.2340                       |
| 26865            | 831             | 1.2400                       | 26865   | 831             | 1.2410                       |
| 27033            | 848.3           | 1.3120                       | 27033   | 848.3           | 1.2560                       |

## Spectrum Plot

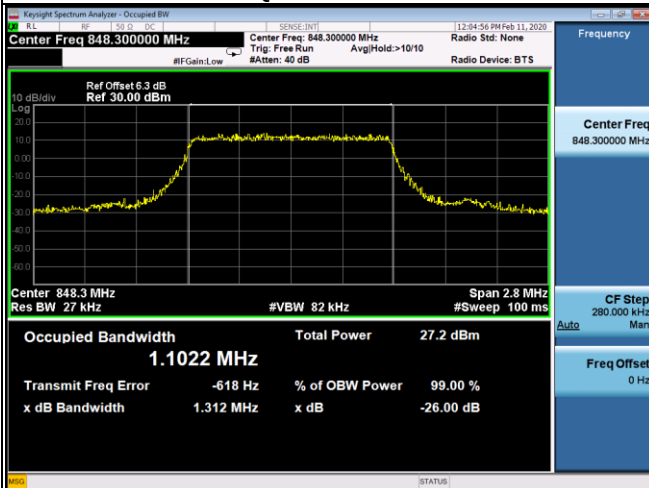
### QPSK-26697



### QPSK-26865



### QPSK-27033



### 16QAM-26697



### 16QAM-26865



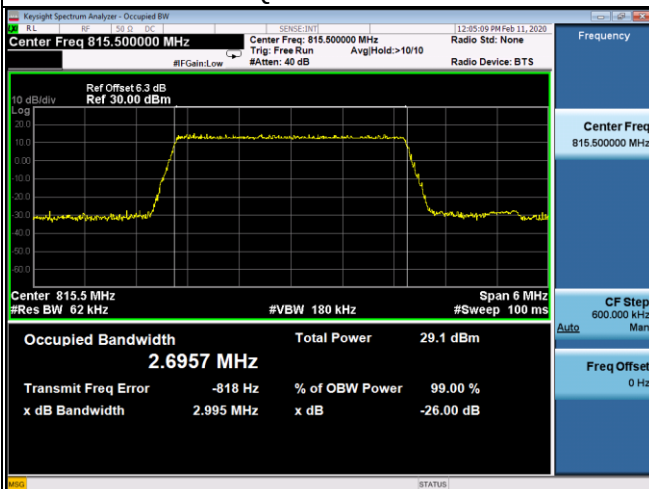
### 16QAM-27033



| LTE Band 26_3M |                 |                              |         |                 |                              |
|----------------|-----------------|------------------------------|---------|-----------------|------------------------------|
| QPSK           |                 |                              | 16QAM   |                 |                              |
| Channel        | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
| 26705          | 815.5           | 2.6957                       | 26705   | 815.5           | 2.6907                       |
| 26865          | 831             | 2.6885                       | 26865   | 831             | 2.6879                       |
| 27025          | 847.5           | 2.7004                       | 27025   | 847.5           | 2.6896                       |
| Channel        | Frequency (MHz) | 26dB Bandwidth (MHz)         | Channel | Frequency (MHz) | 26dB Bandwidth (MHz)         |
| 26705          | 815.5           | 2.9950                       | 26705   | 815.5           | 2.9030                       |
| 26865          | 831             | 2.9120                       | 26865   | 831             | 2.8830                       |
| 27025          | 847.5           | 2.9820                       | 27025   | 847.5           | 2.9040                       |

## Spectrum Plot

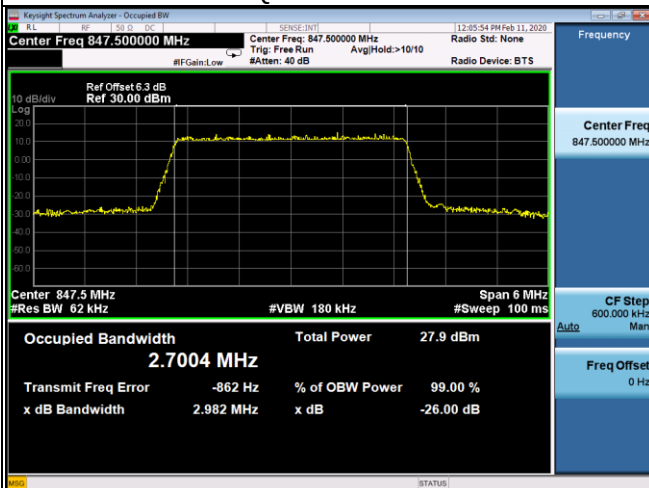
### QPSK-26705



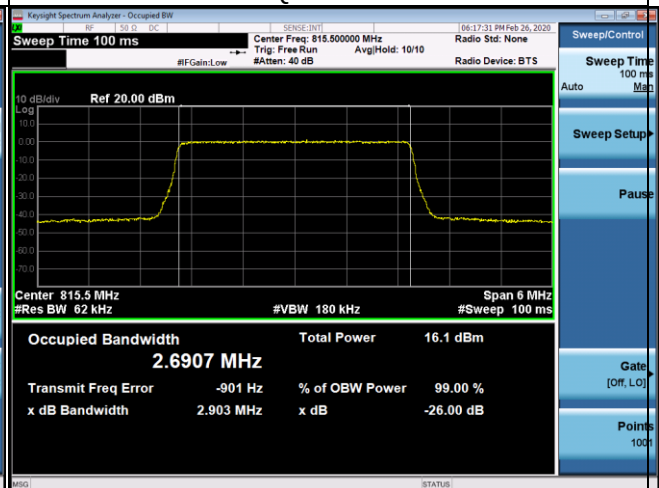
### QPSK-26865



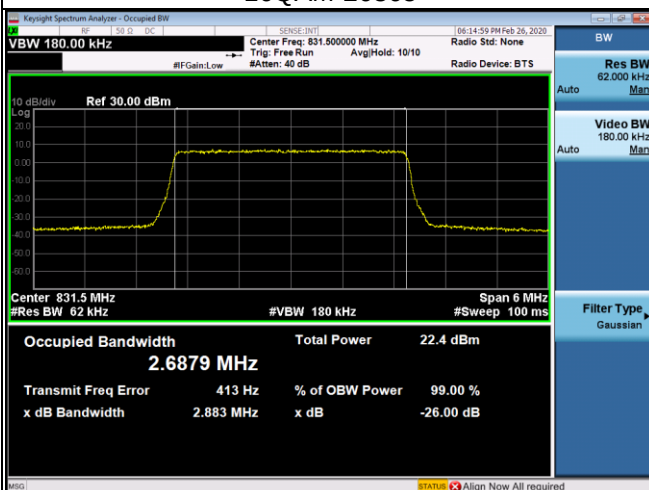
### QPSK-27025



### 16QAM-26705



### 16QAM-26865



### 16QAM-27025

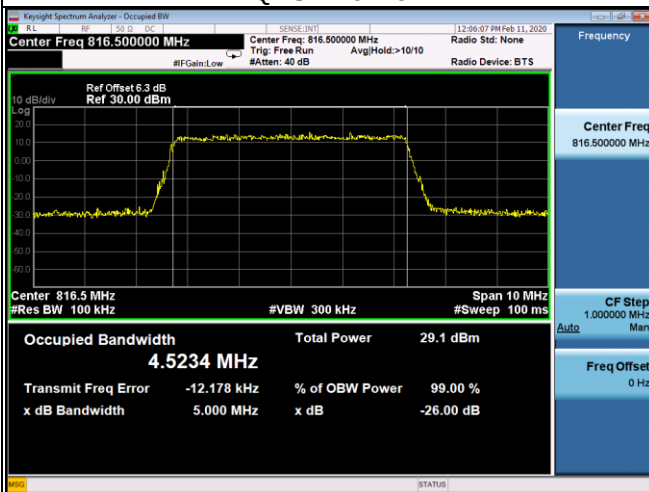




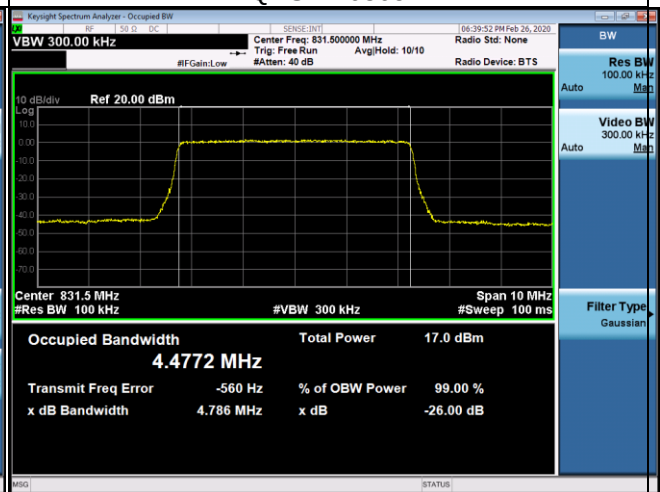
| LTE Band 26_5M |                 |                              |         |                 |                              |
|----------------|-----------------|------------------------------|---------|-----------------|------------------------------|
| QPSK           |                 |                              | 16QAM   |                 |                              |
| Channel        | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
| 26715          | 816.5           | 4.5234                       | 26715   | 816.5           | 4.4765                       |
| 26865          | 831             | 4.4772                       | 26865   | 831             | 4.4760                       |
| 27015          | 846.5           | 4.5064                       | 27015   | 846.5           | 4.4749                       |
| Channel        | Frequency (MHz) | 26dB Bandwidth (MHz)         | Channel | Frequency (MHz) | 26dB Bandwidth (MHz)         |
| 26715          | 816.5           | 5.0000                       | 26715   | 816.5           | 4.7860                       |
| 26865          | 831             | 4.7860                       | 26865   | 831             | 4.7760                       |
| 27015          | 846.5           | 4.9520                       | 27015   | 846.5           | 4.7860                       |

## Spectrum Plot

### QPSK-26715



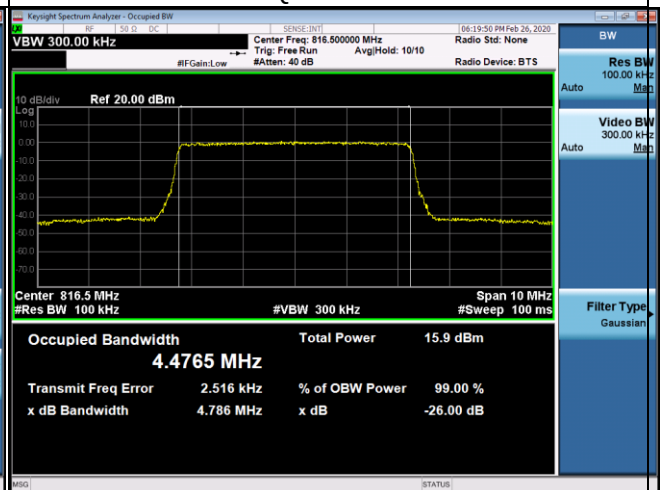
### QPSK-26865



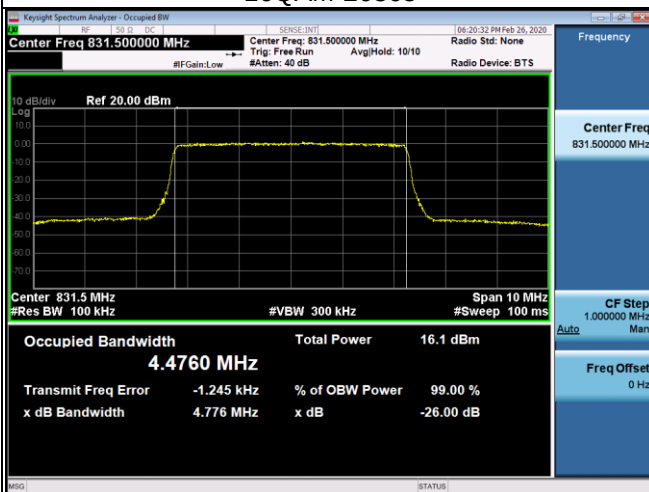
### QPSK-20715



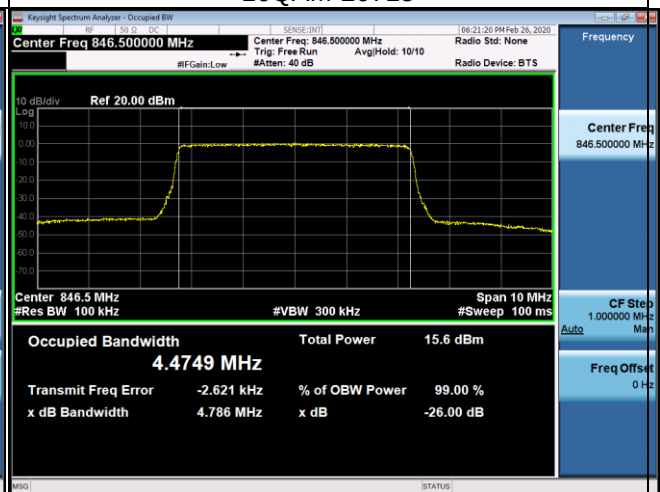
### 16QAM-26715



### 16QAM-26865



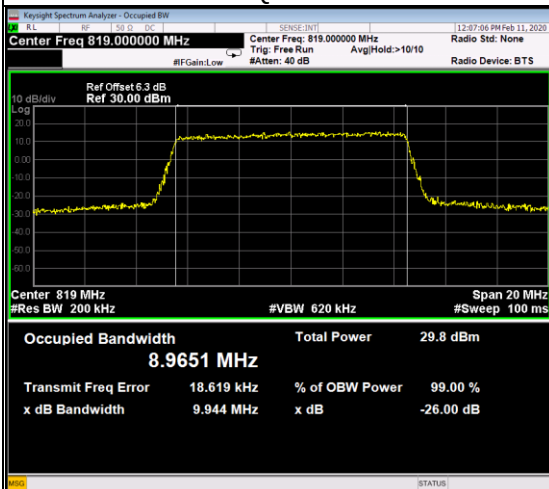
### 16QAM-20715



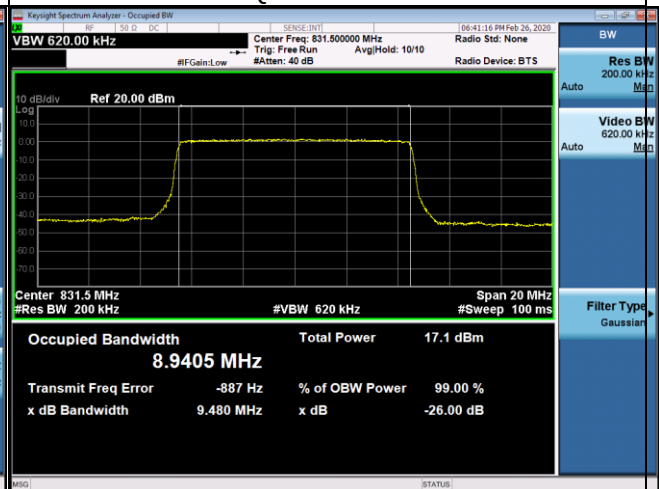
| LTE Band 26_10M |                 |                              |         |                 |                              |
|-----------------|-----------------|------------------------------|---------|-----------------|------------------------------|
| QPSK            |                 |                              | 16QAM   |                 |                              |
| Channel         | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
| 26740           | 819             | 8.9651                       | 26740   | 819             | 8.9437                       |
| 26865           | 831             | 8.9405                       | 26865   | 831             | 8.9402                       |
| 26990           | 844             | 8.9842                       | 26990   | 844             | 8.9378                       |
| Channel         | Frequency (MHz) | 26dB Bandwidth (MHz)         | Channel | Frequency (MHz) | 26dB Bandwidth (MHz)         |
| 26740           | 819             | 9.9440                       | 26740   | 819             | 9.4740                       |
| 26865           | 831             | 9.4800                       | 26865   | 831             | 9.4940                       |
| 26990           | 844             | 9.8850                       | 26990   | 844             | 9.4710                       |

## Spectrum Plot

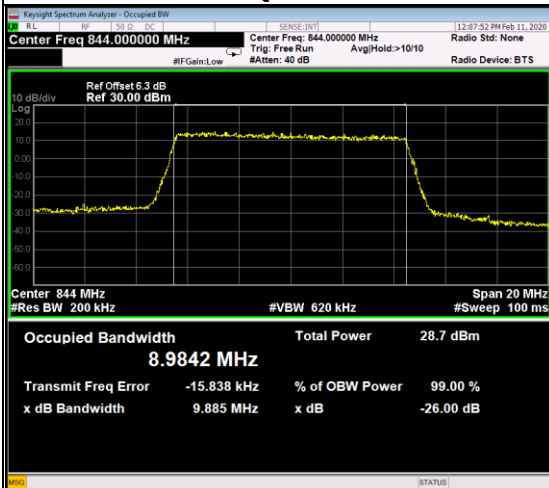
### QPSK-26740



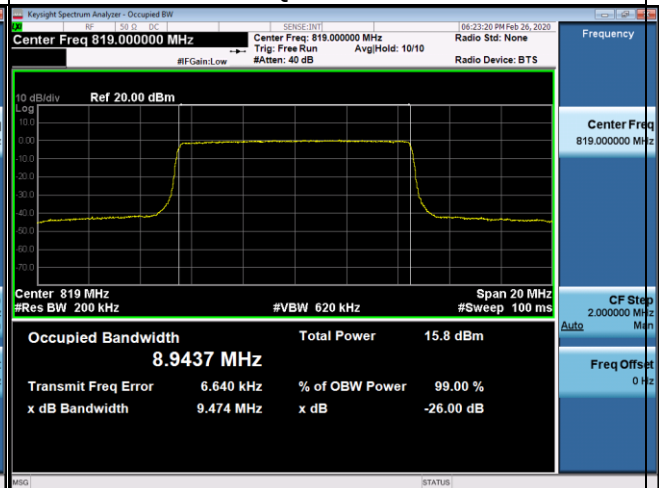
### QPSK-26865



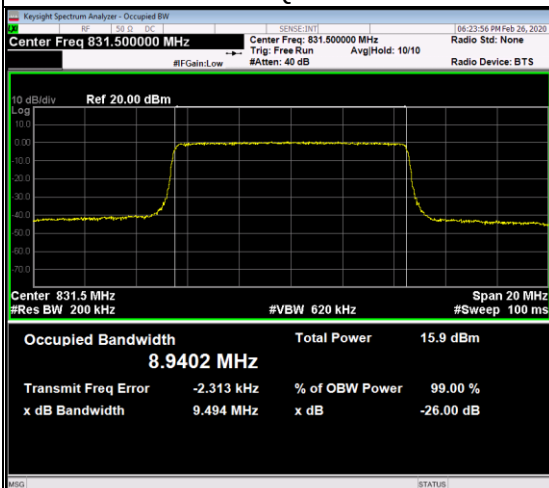
### QPSK-26990



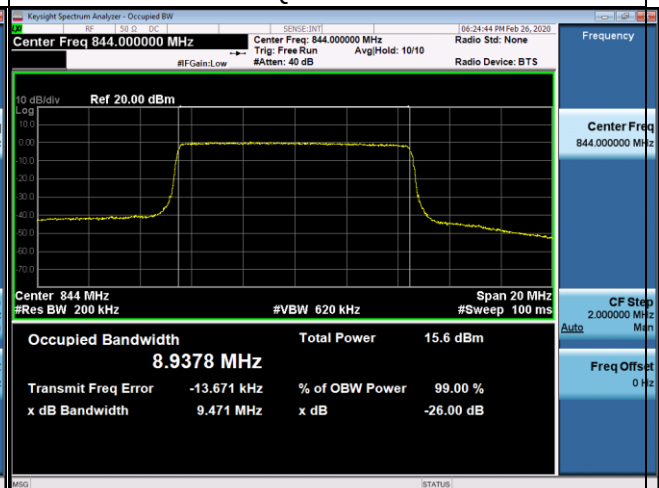
### 16QAM-26740



### 16QAM-26865



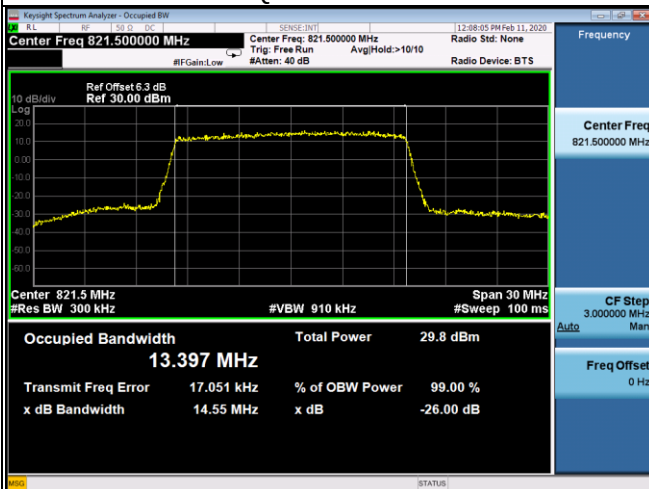
### 16QAM-26990



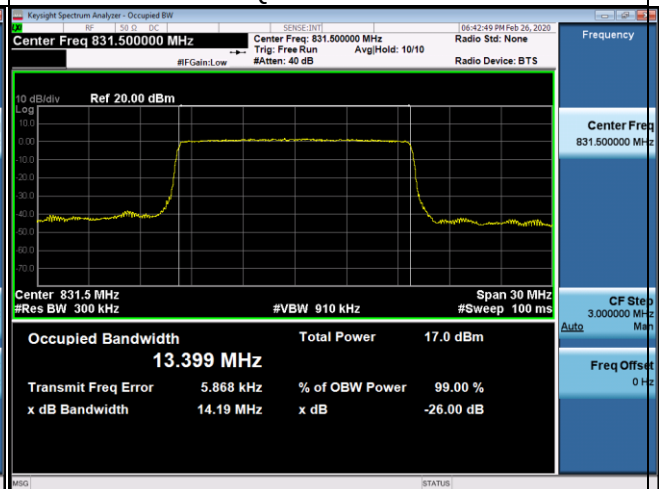
| LTE Band 26_15M |                 |                              |         |                 |                              |
|-----------------|-----------------|------------------------------|---------|-----------------|------------------------------|
| QPSK            |                 |                              | 16QAM   |                 |                              |
| Channel         | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
| 26765           | 821.5           | 13.3970                      | 26765   | 821.5           | 13.3920                      |
| 26865           | 831             | 13.3990                      | 26865   | 831             | 13.3970                      |
| 26965           | 841.5           | 13.3570                      | 26965   | 841.5           | 13.3950                      |
| Channel         | Frequency (MHz) | 26dB Bandwidth (MHz)         | Channel | Frequency (MHz) | 26dB Bandwidth (MHz)         |
| 26765           | 821.5           | 14.5500                      | 26765   | 821.5           | 14.1800                      |
| 26865           | 831             | 14.1900                      | 26865   | 831             | 14.2000                      |
| 26965           | 841.5           | 14.5900                      | 26965   | 841.5           | 14.1900                      |

## Spectrum Plot

### QPSK-26765



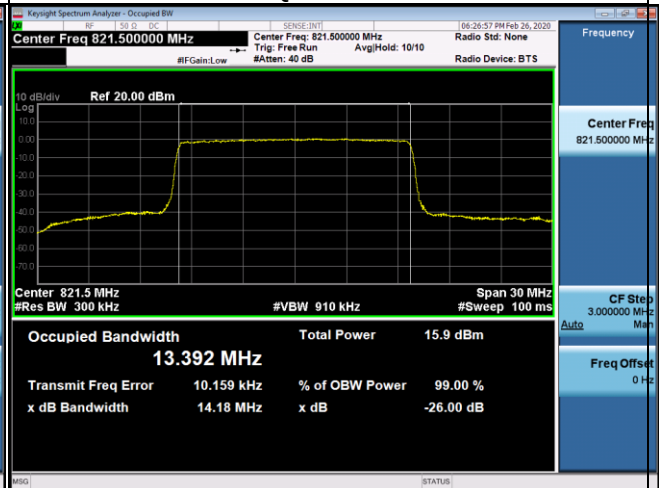
### QPSK-26865



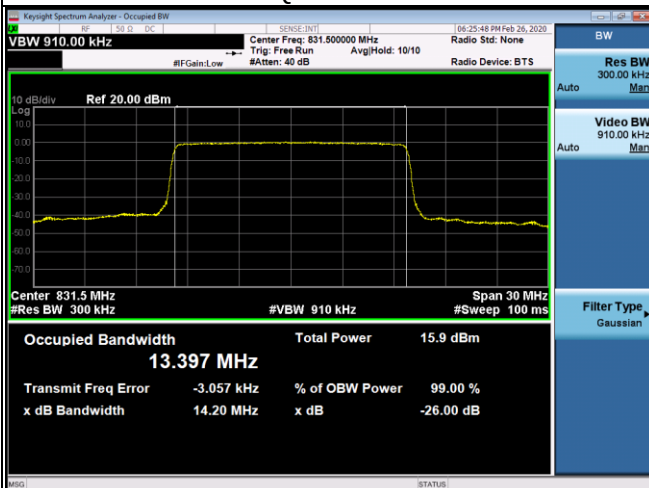
### QPSK-26965



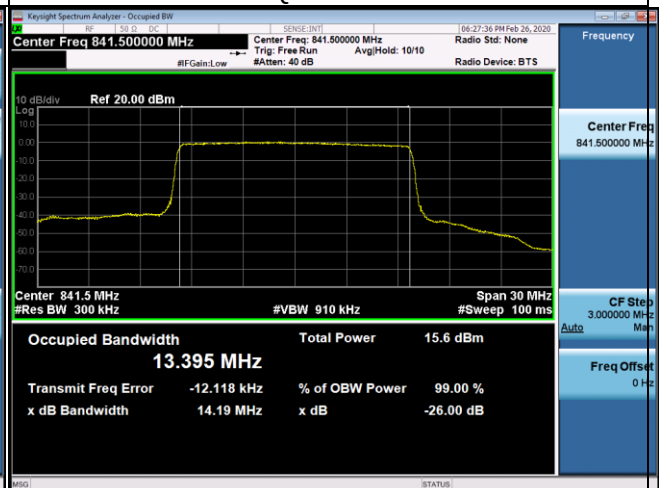
### 16QAM-26765



### 16QAM-26865



### 16QAM-26965



## APPENDIX C - CONDUCTED EMISSIONS

