

# TEST REPORT



**Dt&C Co., Ltd.**

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Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2501-0004

2. Customer

• Name : ST SUNLAB Ltd.

• Address : A-1705, 1706, 32, Digital-ro 9-gil Geumcheon-Gu, Seoul, South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : AI TELEMATICS / ST9730

FCC ID : WA2-ST9730

5. FCC Regulation(s): Part 22, 90

Test Method Used : KDB971168 D01v03r01, ANSI C63.26-2015, ANSI/TIA-603-E-2016

6. Date of Test : 2024.12.07 ~ 2024.12.11

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment : See appended test report.

9. Test Result : Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test report is not related to KOLAS accreditation.

|             |                   |                                                                                     |                   |                                                                                       |
|-------------|-------------------|-------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------|
| Affirmation | Tested by         |  | Technical Manager |  |
|             | Name : SeokHo Han |                                                                                     | Name : JaeJin Lee |                                                                                       |

2025 . 01 . 07 .

**Dt&C Co., Ltd.**

If this report is required to confirmation of authenticity, please contact to [report@dtnc.net](mailto:report@dtnc.net)

# Test Report Version

| Test Report No. | Date          | Description   | Revised by | Reviewed by |
|-----------------|---------------|---------------|------------|-------------|
| DRTFCC2501-0004 | Jan. 07, 2025 | Initial issue | SeokHo Han | JaeJin Lee  |
|                 |               |               |            |             |
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## 1. GENERAL INFORMATION

|                                              |                                                   |
|----------------------------------------------|---------------------------------------------------|
| Equipment Class                              | PCS Licensed Transmitter(PCB)                     |
| Product Name                                 | AI TELEMATICS                                     |
| Model Name                                   | ST9730                                            |
| Add Model Name                               | -                                                 |
| FVIN(Firmware Version Identification Number) | Rev0.1                                            |
| EUT Serial Number                            | No Specified                                      |
| Supplying power                              | DC 12, 24 V                                       |
| Channel Bandwidth(MHz)                       | LTE Band 26: 10, 5, 3, 1.4                        |
| Antenna Information                          | Antenna Type: FPCB Antenna<br>Gain: -0.2 dBi (PK) |

| Mode        | TX Frequency (MHz) | Emission Designator | Modulation | Conducted output power |       | ERP   |       |
|-------------|--------------------|---------------------|------------|------------------------|-------|-------|-------|
|             |                    |                     |            | dBm                    | W     | dBm   | W     |
| LTE Band 26 | 819                | 8M95G7D             | QPSK       | 23.72                  | 0.236 | 21.37 | 0.137 |
| LTE Band 26 | 819                | 8M94W7D             | 16QAM      | 22.96                  | 0.198 | 20.61 | 0.115 |
| LTE Band 26 | 816.5 ~ 821.5      | 4M46G7D             | QPSK       | 23.63                  | 0.231 | 21.28 | 0.134 |
| LTE Band 26 | 816.5 ~ 821.5      | 4M45W7D             | 16QAM      | 23.02                  | 0.200 | 20.67 | 0.117 |
| LTE Band 26 | 815.5 ~ 822.5      | 2M68G7D             | QPSK       | 23.89                  | 0.245 | 21.54 | 0.143 |
| LTE Band 26 | 815.5 ~ 822.5      | 2M68W7D             | 16QAM      | 23.28                  | 0.213 | 20.93 | 0.124 |
| LTE Band 26 | 814.7 ~ 823.3      | 1M08G7D             | QPSK       | 23.90                  | 0.245 | 21.55 | 0.143 |
| LTE Band 26 | 814.7 ~ 823.3      | 1M08W7D             | 16QAM      | 23.34                  | 0.216 | 20.99 | 0.126 |

## 2. INTRODUCTION

### 2.1. EUT DESCRIPTION

The Equipment Under Test (EUT) supports Multi-band LTE, 2.4/5GHz WLAN, Bluetooth(BDR, EDR, BLE).

### 2.2. TESTING ENVIRONMENT

| Ambient Condition   |                 |
|---------------------|-----------------|
| ▪ Temperature       | +20 °C ~ +23 °C |
| ▪ Relative Humidity | 38 % ~ 42 %     |

### 2.3. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

### 2.4. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95 % level of confidence.

| Parameter                          | Measurement uncertainty                               |
|------------------------------------|-------------------------------------------------------|
| Antenna-port conducted emission    | 1.0 dB (The confidence level is about 95 %, $k = 2$ ) |
| Radiated emission (1 GHz Below)    | 5.0 dB (The confidence level is about 95 %, $k = 2$ ) |
| Radiated emission (1 GHz ~ 18 GHz) | 4.8 dB (The confidence level is about 95 %, $k = 2$ ) |
| Radiated emission (18 GHz Above)   | 5.0 dB (The confidence level is about 95 %, $k = 2$ ) |

### 2.5. TEST FACILITY

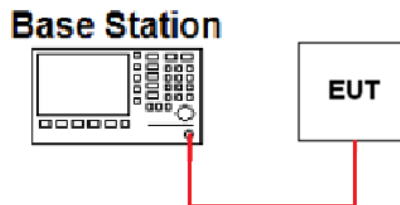
|                                                                                                                                                                                      |   |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------|
| <b>Dt&amp;C Co., Ltd.</b>                                                                                                                                                            |   |                  |
| The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. |   |                  |
| The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.                                                                                             |   |                  |
| - FCC & IC MRA Designation No. : KR0034                                                                                                                                              |   |                  |
| - ISED#: 5740A                                                                                                                                                                       |   |                  |
| <a href="http://www.dtnet.net">www.dtnet.net</a>                                                                                                                                     |   |                  |
| Telephone                                                                                                                                                                            | : | + 82-31-321-2664 |
| FAX                                                                                                                                                                                  | : | + 82-31-321-1664 |

### 3. DESCRIPTION OF TESTS

#### 3.1. MAXIMUM OUTPUT POWER

##### Conducted Output Power

##### Test Set-up



##### Test Procedure

- KDB971168 D01v03r01 - Section 5.2.4
- ANSI C63.26-2015 – Section 5.2.4.2

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurements be performed only over durations of active transmissions at maximum output power level applies. Thus, an average power meter can always be used to perform the measurement when the EUT can be configured to transmit continuously.

If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98%), then the following options can be implemented to facilitate measurement of the average power with an average power meter:

- a) A gated average power meter can be used to perform the measurement if the gating parameters can be adjusted such that the power is measured only during active transmission bursts at maximum output power levels.
- b) A conventional average power meter with no signal gating capability can also be used if the measured burst duty cycle is constant (i.e., duty cycle variations are less than or equal to  $\pm 2\%$ ) by performing the measurement over the on/off burst cycles and then correcting (increasing) the measured level by a factor equal to  $[10 \log (1/\text{duty cycle})]$ .

##### - ERP & EIRP (Effective Radiated Power & Equivalent Isotropic Radiated Power)

##### Test Procedure

- KDB971168 D01v03r01 - Section 5.6
- ANSI C63.26-2015 – Section 5.2.5.5

##### Determining ERP and EIRP from conducted RF output power measurement results

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_T$$

where:

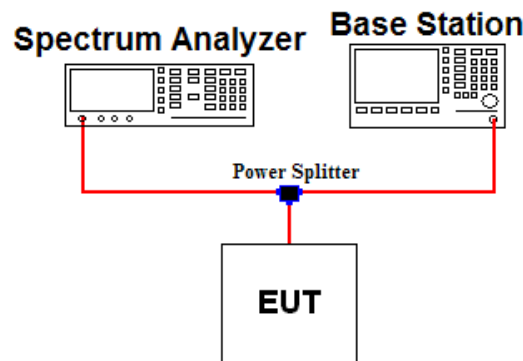
ERP or EIRP = effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as  $P_{\text{Meas}}$ , typically dBW or dBm);

$P_{\text{Meas}}$  = measured transmitter output power or PSD, in dBm or dBW;

$G_T$  = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

## 3.2. PEAK TO AVERAGE RATIO

### Test set-up



### Test Procedure

- KDB971168 D01v03r01 - Section 5.7.2
- ANSI C63.26-2015 – Section 5.2.3.4

A peak to average ratio measurement is performed at the conducted port of the EUT.

The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The present of time the signal spends at or above the level defines the probability for that particular power level.

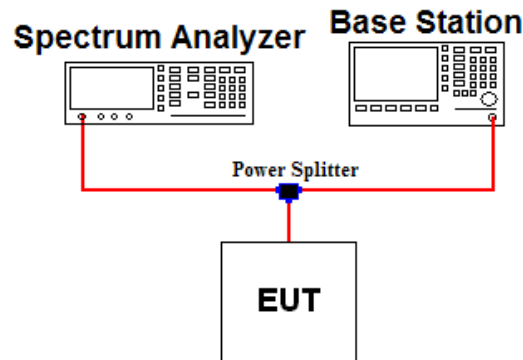
### Test setting

The spectrum Analyzer's CCDF measurement function is enabled.

1. Set resolution/measurement bandwidth  $\geq$  OBW or specified reference bandwidth.
2. Set the number of counts to a value that stabilizes the measured CCDF curve.
3. Set the measurement interval as follows:
  - 1) For continuous transmissions, set to the greater of  $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$  or 1 ms.
  - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
  - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
4. Record the maximum PAPR level associated with a probability of 0.1 %.
5. The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.

### 3.3. OCCUPIED BANDWIDTH

#### Test set-up



#### Test Procedure

- KDB971168 D01v03r01 - Section 4.3
- ANSI C63.26-2015 – Section 5.4.4

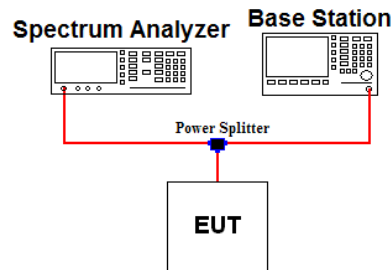
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power of a given emission.

#### Test setting

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 26 dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2.  $RBW = 1 \% \sim 5 \%$  of the expected OBW &  $VBW \geq 3 \times RBW$
3. Detector = Peak
4. Trance mode = Max hold
5. Sweep = Auto couple
6. The trace was allowed to stabilize
7. If necessary, step 2 ~ 6 were repeated after changing the RBW such that it would be within 1 % ~ 5 % of the 99 % occupied bandwidth observed in step 6.

### 3.4. BAND EDGE EMISSIONS AT ANTENNA TERMINAL

#### Test set-up



#### Test Procedure

- KDB971168 D01v03r01 - Section 6, KDB971168D02v02 - Section 8
- ANSI C63.26-2015 – Section 5.7

All out of band emissions are measured by means of a calibrated spectrum analyzer. Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The EUT was setup to maximum output power at its lowest and highest channel with all bandwidths, modulations and RB configurations.

For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $116 \log_{10}(f/6.1)$  decibels or  $50 + 10 \log_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

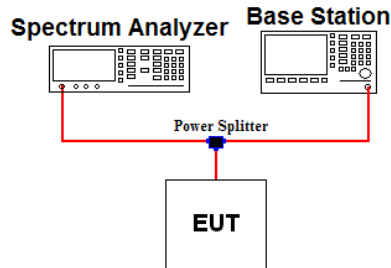
Section 90.691(a) compliance testing, use RBW = 300 Hz for offsets less than 37.5 kHz from a channel edge; RBW = 100 kHz for offsets greater than 37.5 kHz is allowed.

#### Test setting

1. Span was set large enough so as to capture all out of band emissions near the band edge
2. RBW = 300 Hz & VBW  $\geq 3 \times$  RBW (less than 37.5 kHz from a channel edge)  
RBW = 100 KHz & VBW  $\geq 3 \times$  RBW (greater than 37.5 kHz from a channel edge)
3. Detector = RMS & Trace mode = Average
4. Sweep time = Auto couple
5. The trace was allowed to stabilize

### 3.5. SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL

#### Test set-up



#### Test Procedure

- KDB971168 D01v03r01 - Section 6
- ANSI C63.26-2015 – Section 5.7

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The EUT was setup to maximum output power at its low, middle, high channel with all bandwidths, modulations and RB configurations. The spectrum is scanned from 9 kHz up to a frequency including its 10<sup>th</sup> harmonic.

The power of any spurious emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB.

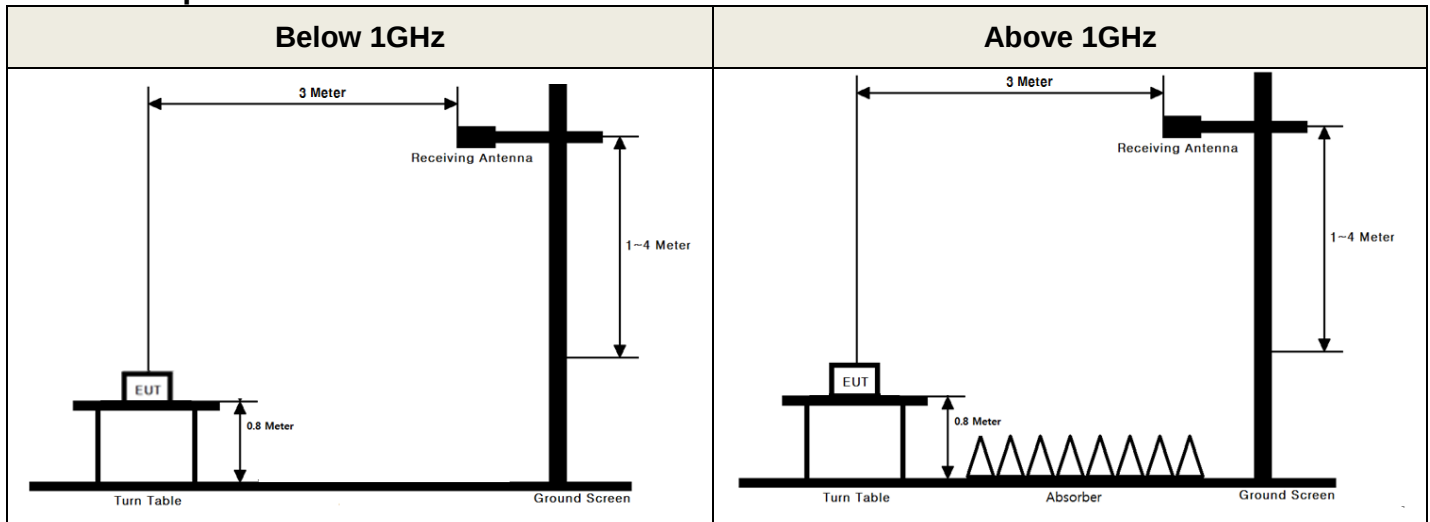
#### Test setting

1. RBW = 100 kHz(Below 1 GHz) or 1 MHz(Above 1 GHz) & VBW  $\geq 3 \times$  RBW ( Refer to Note 1)
2. Detector = RMS & Trace mode = Max hold
3. Sweep time = Auto couple
4. Number of sweep point  $\geq 2 \times$  span / RBW
5. The trace was allowed to stabilize

Note 1: Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1GHz and 1MHz or greater for frequencies greater than 1 GHz.

### 3.6. UNDESIRABLE EMISSIONS

#### Test Set-up



These measurements were performed at 3 test site. The equipment under test is placed on a non-conductive table 0.8 or 1.5 meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.

#### Test Procedure

- ANSI/TIA-603-E-2016 - Section 2.2.12
- KDB971168 D01v03r01 - Section 5.8
- ANSI C63.26-2015 – Section 5.5

#### Test setting

1. RBW = 100 kHz for below 1 GHz and 1 MHz for above 1 GHz / VBW  $\geq 3 \times$  RBW
2. Detector = RMS & Trace mode = Average
3. Sweep time = Auto couple
4. Number of sweep point  $\geq 2 \times$  span / RBW
5. The trace was allowed to stabilize

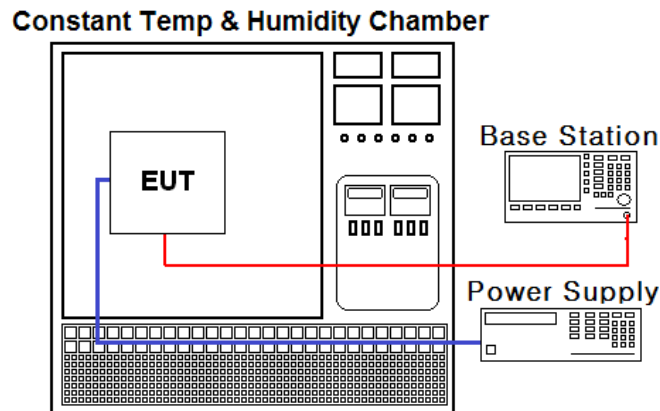
The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

For radiated power measurements below 1 GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

For radiated power measurements above 1 GHz, a Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. The difference between the gain of the horn and an isotropic antenna are taken into consideration.

### 3.7. FREQUENCY STABILITY

#### Test Set-up



#### Test Procedure

- ANSI/TIA-603-E-2016
- KDB971168 D01v03r01 – Section 9

The frequency stability of the transmitter is measured by:

a.) **Temperature:**

The temperature is varied from – 30 °C to + 50 °C using an environmental chamber.

b.) **Primary Supply Voltage:**

The primary supply voltage is varied from 85 % to 115 % of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

#### Specification:

The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm) of the center frequency for Part 90.

#### Time Period and Procedure:

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 one minute 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.  
A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

#### 4. LIST OF TEST EQUIPMENT

| Type                             | Manufacturer             | Model                         | Cal.Date<br>(yy/mm/dd) | Next.Cal. Date<br>(yy/mm/dd) | S/N               |
|----------------------------------|--------------------------|-------------------------------|------------------------|------------------------------|-------------------|
| Spectrum Analyzer                | Agilent Technologies     | N9020A                        | 23/12/15               | 24/12/15                     | MY50110097        |
| Spectrum Analyzer                | Agilent Technologies     | N9020A                        | 23/12/15               | 24/12/15                     | MY50410163        |
| Spectrum Analyzer                | KEYSIGHT                 | N9030B                        | 23/12/15               | 24/12/15                     | MY55480168        |
| DC power supply                  | H.P                      | 66332A                        | 23/12/15               | 24/12/15                     | US37471368        |
| Multimeter                       | FLUKE                    | 17B+                          | 23/12/15               | 24/12/15                     | 36390701WS        |
| Power Splitter                   | Anritsu                  | K241B                         | 24/06/04               | 25/06/04                     | 020611            |
| Temp & Humi                      | SJ Science               | SJ-TH-S50                     | 24/06/11               | 25/06/11                     | SJ-TH-S50-130930  |
| WIDEBAND<br>Communication Tester | Radio<br>ROHDE & SCHWARZ | CMW500                        | 24/11/13               | 25/11/13                     | 169838            |
| Thermohygrometer                 | BODYCOM                  | BJ5478                        | 23/12/15               | 24/12/15                     | 120612-1          |
| Thermohygrometer                 | BODYCOM                  | BJ5478                        | 23/12/15               | 24/12/15                     | 120612-2          |
| Signal Generator                 | ROHDE & SCHWARZ          | SMBV100A                      | 23/12/15               | 24/12/15                     | 255571            |
| Signal Generator                 | ANRITSU                  | MG3695C                       | 23/12/15               | 24/12/15                     | 173501            |
| Loop Antenna                     | ETS-Lindgren             | 6502                          | 24/11/08               | 26/11/08                     | 00060496          |
| BILOG ANTENNA                    | Schwarzbeck              | VULB9160                      | 23/12/15               | 24/12/15                     | 3362              |
| Dipole Antenna                   | Schwarzbeck              | UHA9105                       | 22/12/16               | 24/12/16                     | 2262              |
| HORN ANT                         | ETS                      | 3117                          | 23/12/15               | 24/12/15                     | 00140394          |
| HORN ANT                         | A.H.Systems              | SAS-574                       | 24/06/11               | 25/06/11                     | 155               |
| PreAmplifier                     | H.P                      | 8447D                         | 23/12/15               | 24/12/15                     | 2944A07774        |
| PreAmplifier                     | Agilent                  | 8449B                         | 23/12/15               | 24/12/15                     | 3008A02108        |
| PreAmplifier                     | tsj                      | MLA-1840-J02-45               | 24/06/03               | 25/06/03                     | 16966-10728       |
| High Pass Filter                 | Wainwright Instruments   | WHKX12-935-1000-15000-40SS    | 23/12/15               | 24/12/15                     | 7                 |
| High Pass Filter                 | Wainwright Instruments   | WHKX10-2838-3300-18000-60SS   | 23/12/15               | 24/12/15                     | 2                 |
| High Pass Filter                 | Wainwright Instruments   | WHKX6-6320-8000-26500-40CC    | 23/12/15               | 24/12/15                     | 2                 |
| Cable                            | HUBER+SUHNER             | SUCOFLEX100                   | 24/01/03               | 25/01/03                     | M-1               |
| Cable                            | HUBER+SUHNER             | SUCOFLEX100                   | 24/01/03               | 25/01/03                     | M-2               |
| Cable                            | Junkosha                 | MWX241/B                      | 24/01/03               | 25/01/03                     | M-3               |
| Cable                            | Junkosha                 | MWX221                        | 24/01/03               | 25/01/03                     | M-4               |
| Cable                            | Junkosha                 | MWX221                        | 24/01/03               | 25/01/03                     | M-5               |
| Cable                            | JUNFLON                  | J12J101757-00                 | 24/01/03               | 25/01/03                     | M-7               |
| Cable                            | HUBER+SUHNER             | SUCOFLEX104                   | 24/01/03               | 25/01/03                     | M-8               |
| Cable                            | HUBER+SUHNER             | SUCOFLEX106                   | 24/01/03               | 25/01/03                     | M-9               |
| Cable                            | Junkosha                 | MWX315                        | 24/01/03               | 25/01/03                     | M-10              |
| Cable                            | DTNC                     | Cable                         | 24/01/03               | 25/01/03                     | RFC-69            |
| Cable                            | Junkosha                 | MWX241                        | 24/01/03               | 25/01/03                     | mmW-1             |
| Cable                            | Junkosha                 | MWX241                        | 24/01/03               | 25/01/03                     | mmW-4             |
| Test Software                    | tsj                      | Radiated Emission Measurement | NA                     | NA                           | Version 2.00.0185 |
| Test Software                    | tsj                      | Noise Terminal Measurement    | NA                     | NA                           | Version 2.00.0190 |

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.

## 5. SUMMARY OF TEST RESULTS

| FCC Part Section(s) | Test Description                            | Test Limit                                                                                                                                                                              | Test Condition | Status<br><small>Note 1</small> |
|---------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------|
| 2.1046<br>90.635    | Conducted Output Power                      | < 100 Watts                                                                                                                                                                             | Conducted      | <b>C</b>                        |
| 2.1049              | Occupied Bandwidth                          | N/A                                                                                                                                                                                     |                | <b>C</b>                        |
| 2.1051<br>90.691    | Band Edge /<br>Conducted Spurious Emissions | > 43 + 10log <sub>10</sub> (P) dB for all out-of-band emissions except<br>> 50 + 10log <sub>10</sub> (P) dB at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge |                | <b>C</b>                        |
| 2.1055<br>90.213    | Frequency Stability                         | < 2.5 ppm                                                                                                                                                                               |                | <b>C</b>                        |
| 22.913(a.5)         | Radiated Output Power                       | < 7 Watts max. ERP                                                                                                                                                                      | Radiated       | <b>C</b>                        |
| 2.1053<br>90.691    | Undesirable Emissions                       | > 43 + 10log <sub>10</sub> (P) dB for all out-of-band emissions except<br>> 50 + 10log <sub>10</sub> (P) dB at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge |                | <b>C</b>                        |

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: This radiated test items were performed in three orthogonal EUT positions and the worst case data was reported.

## 6. EMISSION DESIGNATOR AND SAMPLE CALCULATION

### A. Emission Designator

#### LTE Band 26(QPSK)

Emission Designator = **8M95G7D**  
LTE OBW = 8.948 MHz  
G = Phase Modulation  
7 = Quantized/Digital Info  
D = Data Transmission

#### LTE Band 26(16QAM)

Emission Designator = **8M94W7D**  
LTE OBW = 8.940 MHz  
W = Amplitude/Angle Modulated  
7 = Quantized/Digital Info  
D = Data Transmission

### B. For substitution method

#### Unwanted emissions

- 1) The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1 GHz respectively above ground.
- 2) The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
- 3) Vary the measurement antenna height through 1 m to 4 m and the rotate EUT through 360° in order to determine the maximum emission level.
- 4) Record the measured emission level and frequency using the available test method.  
If required by the test method, add  $10 \log(1/\text{duty cycle})$  to measured emission level.
- 5) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 6) Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude. And adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the previously measured emission level.
- 7) The conducted power at the terminal of the substitute antenna is measured.
- 8) Record the level at substituted antenna terminal.
- 9) The result is calculated as below;

**Result: EIRP(dBm) = Level at Substitute antenna terminal + Substitute Antenna Gain (dBi)**

**Result: ERP(dBm) = Level at Substitute antenna terminal + Substitute Antenna Gain (dBd)**

**Where, TX Antenna Gain (dBd) = TX Antenna Gain (dBi) - 2.15 dB**

## 7. TEST DATA

### 7.1. OCCUPIED BANDWIDTH

- Plots of the EUT's Occupied Bandwidth are shown in Clause 8.1

### 7.2. PEAK TO AVERAGE RATIO

- Plots of the EUT's Peak- to- Average Ratio are shown in Clause 8.2

### 7.3. BAND EDEG EMISSIONS (Conducted)

- Plots of the EUT's Band Edge Emissions are shown in Clause 8.3

### 7.4. SPURIOUS AND HARMONICS EMISSIONS (Conducted)

- Plots of the EUT's Spurious Emissions are shown in Clause 8.4

## 7.5. MAXIMUM OUTPUT POWER

### - Test Notes

1) The EUT was tested under all bandwidths, modulations and RB configurations and the worst case data are reported in the below table.

2) EIRP = Conducted Output Power(dBm) + Antenna gain(dBi), ERP = EIRP – 2.15(dB)

### - LTE Band 26

| Channel Bandwidth (MHz) | Tx Freq. (MHz) | Test Mode | RB Size/ Offset | Conducted Output Power (dBm) | Antenna Gain(dBd) | ERP (dBm) | ERP (W) |
|-------------------------|----------------|-----------|-----------------|------------------------------|-------------------|-----------|---------|
| 10                      | 819            | QPSK      | 1/0             | 23.72                        | -0.2              | 21.37     | 0.137   |
|                         |                | 16QAM     | 1/49            | 22.96                        | -0.2              | 20.61     | 0.115   |
| 5                       | 816.5          | QPSK      | 1/0             | 23.54                        | -0.2              | 21.19     | 0.132   |
|                         |                | 16QAM     | 1/12            | 23.02                        | -0.2              | 20.67     | 0.117   |
|                         | 821.5          | QPSK      | 1/0             | 23.63                        | -0.2              | 21.28     | 0.134   |
|                         |                | 16QAM     | 1/0             | 22.42                        | -0.2              | 20.07     | 0.102   |
| 3                       | 815.5          | QPSK      | 1/0             | 23.89                        | -0.2              | 21.54     | 0.143   |
|                         |                | 16QAM     | 1/14            | 23.28                        | -0.2              | 20.93     | 0.124   |
|                         | 819            | QPSK      | 1/0             | 23.45                        | -0.2              | 21.10     | 0.129   |
|                         |                | 16QAM     | 1/0             | 22.37                        | -0.2              | 20.02     | 0.100   |
|                         | 822.5          | QPSK      | 1/0             | 23.71                        | -0.2              | 21.36     | 0.137   |
|                         |                | 16QAM     | 1/14            | 22.90                        | -0.2              | 20.55     | 0.114   |
| 1.4                     | 814.7          | QPSK      | 1/5             | 23.69                        | -0.2              | 21.34     | 0.136   |
|                         |                | 16QAM     | 1/0             | 23.22                        | -0.2              | 20.87     | 0.122   |
|                         | 819            | QPSK      | 1/2             | 23.65                        | -0.2              | 21.30     | 0.135   |
|                         |                | 16QAM     | 1/5             | 22.79                        | -0.2              | 20.44     | 0.111   |
|                         | 823.3          | QPSK      | 1/2             | 23.90                        | -0.2              | 21.55     | 0.143   |
|                         |                | 16QAM     | 1/5             | 23.34                        | -0.2              | 20.99     | 0.126   |

## 7.6. UNDESIRABLE EMISSIONS (Radiated)

### - Test Notes

1. Limit = -13dBm
2. The frequency spectrum is examined from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.
3. All mode and RB configuration were investigated and the worst case data are reported.

### - LTE Band 26

#### - DC 24 V

| Channel Bandwidth (MHz) | Test Freq. (MHz) | RB Size/ Offset | Test Mode | Freq.(MHz) | Ant Pol (H/V) | Level at Antenna Terminal(dBm) | Substitute Antenna Gain(dBd) | Result (dBm) | Limit (dBm) | Margin (dB) |
|-------------------------|------------------|-----------------|-----------|------------|---------------|--------------------------------|------------------------------|--------------|-------------|-------------|
| 10                      | 819              | 1/0             | QPSK      | 1629.21    | V             | -56.74                         | 4.08                         | -52.66       | -13.00      | 39.66       |
|                         |                  |                 |           | 2443.69    | H             | -62.68                         | 3.88                         | -58.80       | -13.00      | 45.80       |
|                         |                  |                 |           | 3258.33    | V             | -58.50                         | 5.44                         | -53.06       | -13.00      | 40.06       |
|                         |                  |                 |           | 4072.95    | V             | -53.17                         | 7.04                         | -46.13       | -13.00      | 33.13       |
|                         |                  |                 |           | 4887.60    | H             | -58.07                         | 7.65                         | -50.42       | -13.00      | 37.42       |
|                         |                  |                 |           | 5702.11    | V             | -65.39                         | 8.38                         | -57.01       | -13.00      | 44.01       |

#### - DC 12 V

| Channel Bandwidth (MHz) | Test Freq. (MHz) | RB Size/ Offset | Test Mode | Freq.(MHz) | Ant Pol (H/V) | Level at Antenna Terminal(dBm) | Substitute Antenna Gain(dBd) | Result (dBm) | Limit (dBm) | Margin (dB) |
|-------------------------|------------------|-----------------|-----------|------------|---------------|--------------------------------|------------------------------|--------------|-------------|-------------|
| 10                      | 819              | 1/0             | QPSK      | 1629.21    | V             | -57.06                         | 4.08                         | -52.98       | -13.00      | 39.98       |
|                         |                  |                 |           | 2443.71    | H             | -61.50                         | 3.88                         | -57.62       | -13.00      | 44.62       |
|                         |                  |                 |           | 3258.38    | V             | -58.34                         | 5.45                         | -52.89       | -13.00      | 39.89       |
|                         |                  |                 |           | 4072.95    | V             | -53.59                         | 7.04                         | -46.55       | -13.00      | 33.55       |
|                         |                  |                 |           | 4887.59    | H             | -57.94                         | 7.65                         | -50.29       | -13.00      | 37.29       |
|                         |                  |                 |           | 5702.14    | V             | -67.11                         | 8.38                         | -58.73       | -13.00      | 45.73       |

## 7.7. FREQUENCY STABILITY

### - LTE Band 26

OPERATING FREQUENCY : 819.00 MHz

REFERENCE VOLTAGE : 24 V DC

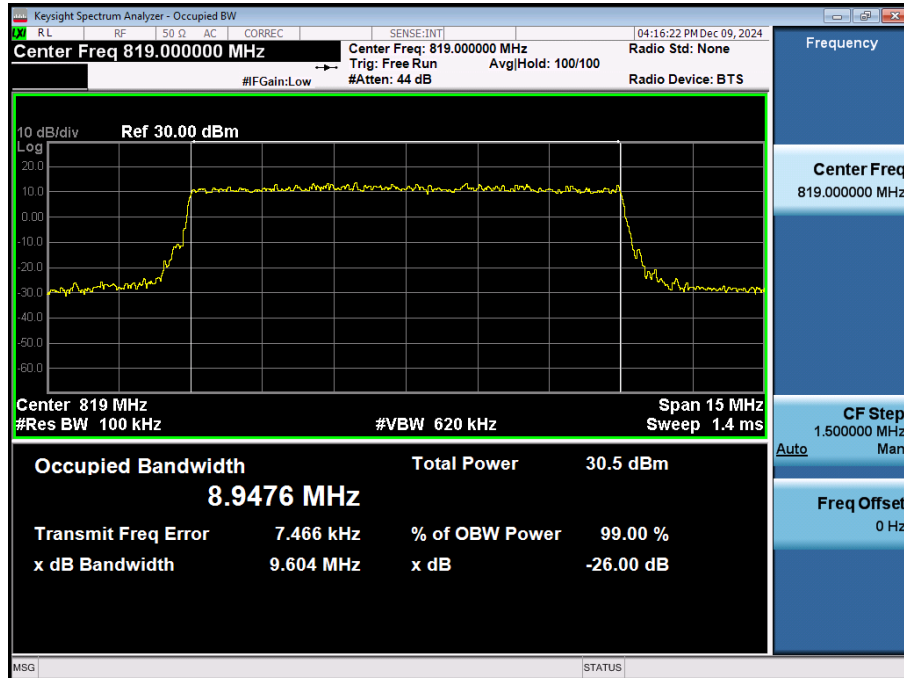
LIMIT : 2.5 ppm

| VOLTAGE<br>(%) | POWER<br>(V DC) | TEMP<br>(°C) | FREQ<br>(Hz) | Deviation  |        |
|----------------|-----------------|--------------|--------------|------------|--------|
|                |                 |              |              | (%)        | (ppm)  |
| 100 %          | 24              | +20          | 818,999,996  | -0.0000005 | -0.005 |
| 100 %          |                 | -30          | 818,999,997  | -0.0000004 | -0.004 |
| 100 %          |                 | -20          | 818,999,998  | -0.0000002 | -0.002 |
| 100 %          |                 | -10          | 818,999,999  | -0.0000001 | -0.001 |
| 100 %          |                 | 0            | 818,999,998  | -0.0000002 | -0.002 |
| 100 %          |                 | +10          | 818,999,997  | -0.0000004 | -0.004 |
| 100 %          |                 | +20          | 818,999,997  | -0.0000004 | -0.004 |
| 100 %          |                 | +30          | 818,999,996  | -0.0000005 | -0.005 |
| 100 %          |                 | +40          | 818,999,998  | -0.0000002 | -0.002 |
| 100 %          |                 | +50          | 818,999,997  | -0.0000004 | -0.004 |
| 115 %          | 27.6            | +20          | 818,999,997  | -0.0000004 | -0.004 |
| 85 %           | *10.2           | +20          | 818,999,996  | -0.0000005 | -0.005 |

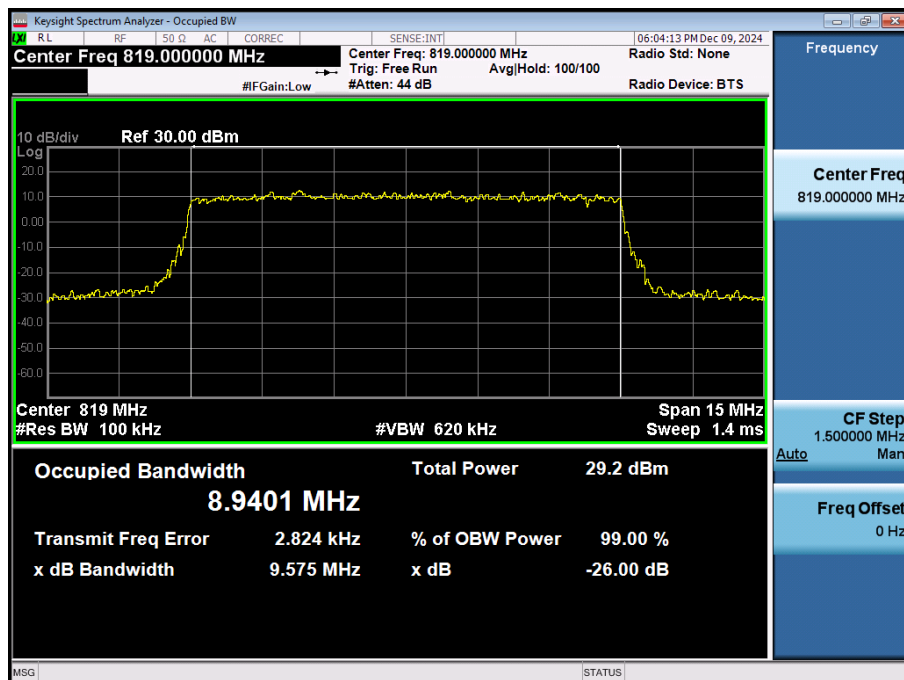
Note: \*Test was performed at 15% below the lowest rated supply voltage(12V).

## 8. TEST PLOTS

### 8.1. OCCUPIED BANDWIDTH



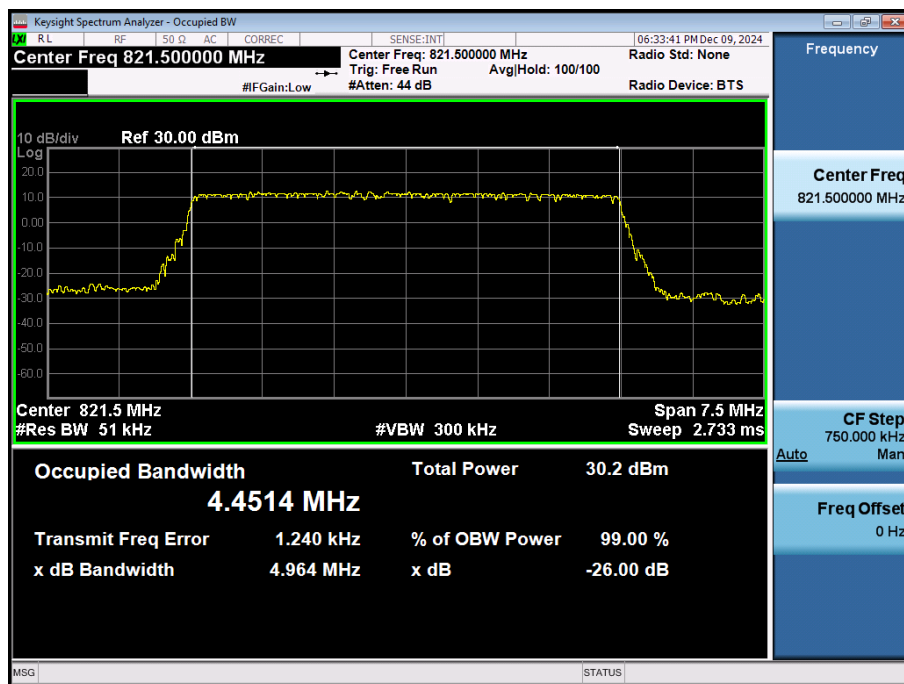
LTE Band 26 / 10 MHz / QPSK - RB Size 50



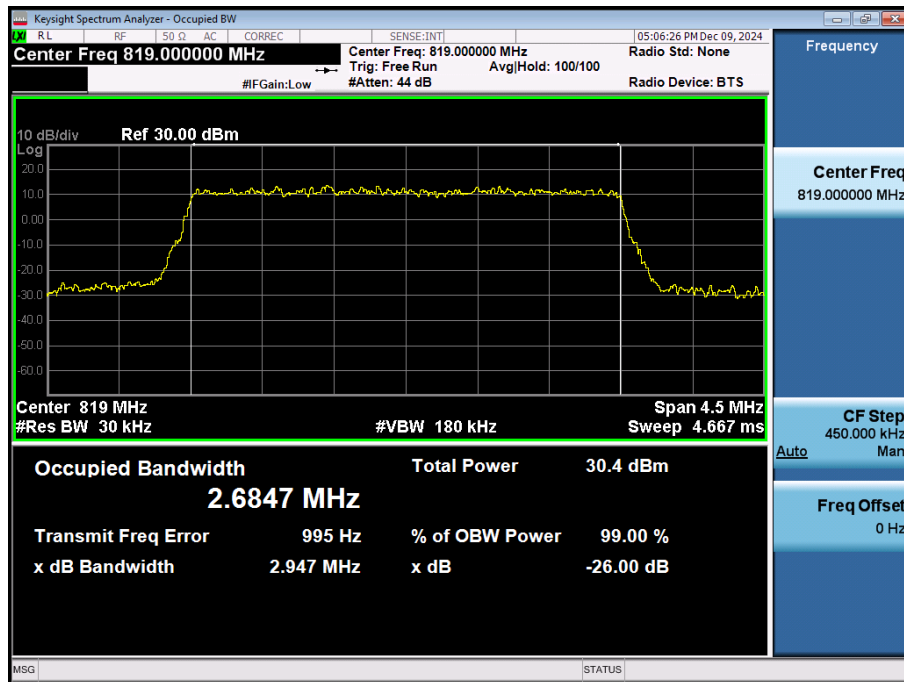
LTE Band 26 / 10 MHz / 16QAM - RB Size 50



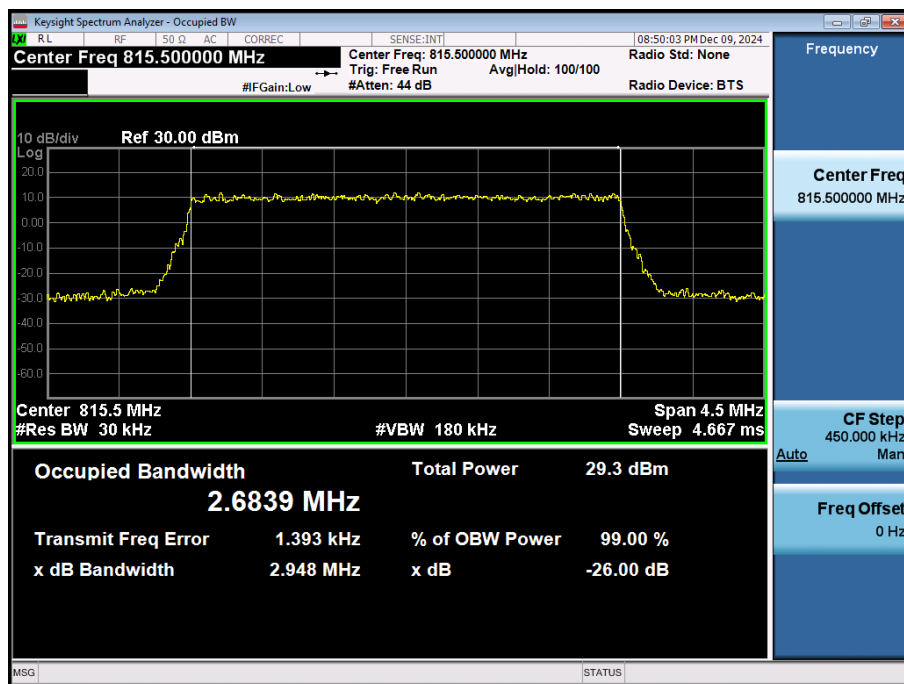
LTE Band 26 / 5 MHz / QPSK - RB Size 25



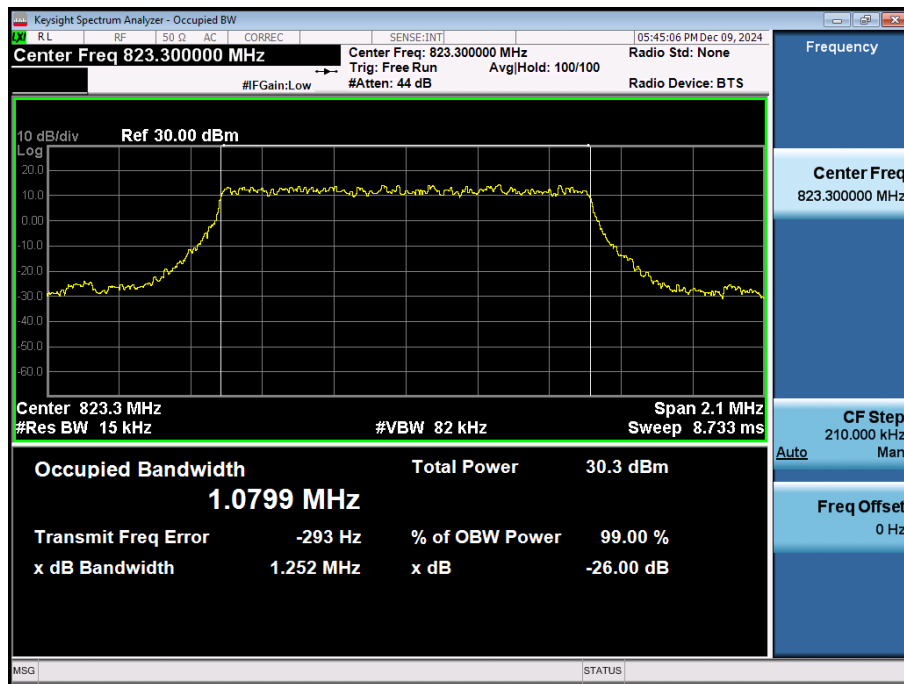
LTE Band 26 / 5 MHz / 16QAM - RB Size 25



LTE Band 26 / 3 MHz / QPSK - RB Size 15



LTE Band 26 / 3 MHz / 16QAM - RB Size 15

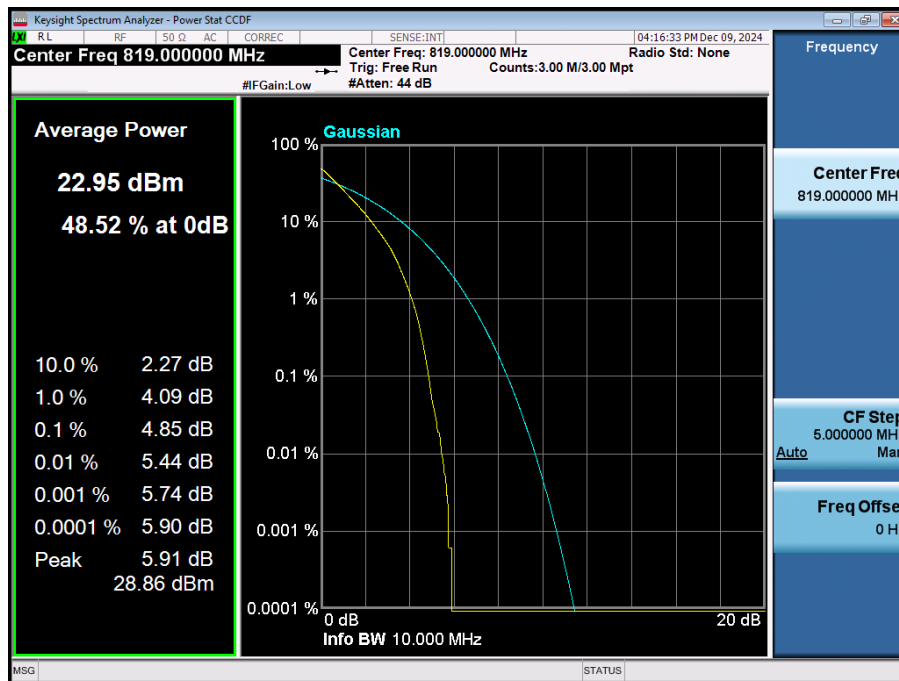


LTE Band 26 / 1.4 MHz / QPSK - RB Size 6

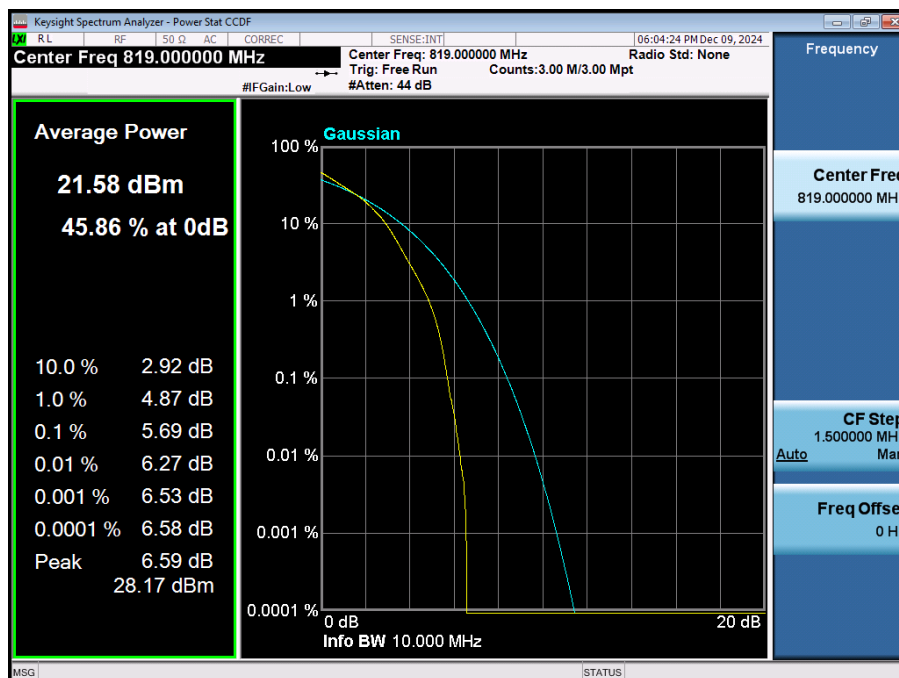


LTE Band 26 / 1.4 MHz / 16QAM - RB Size 6

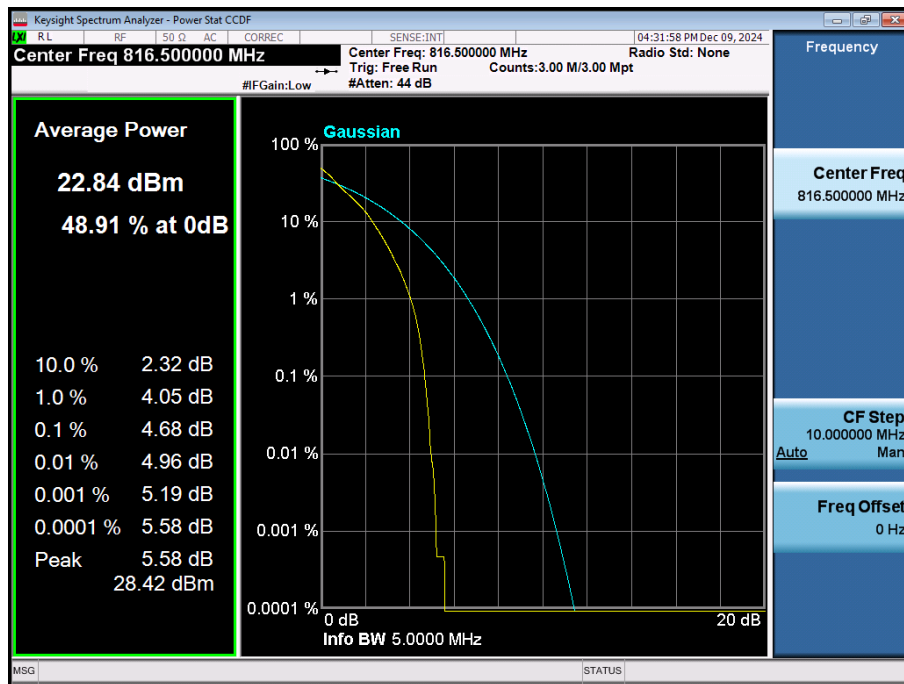
## 8.2. PEAK TO AVERAGE RATIO



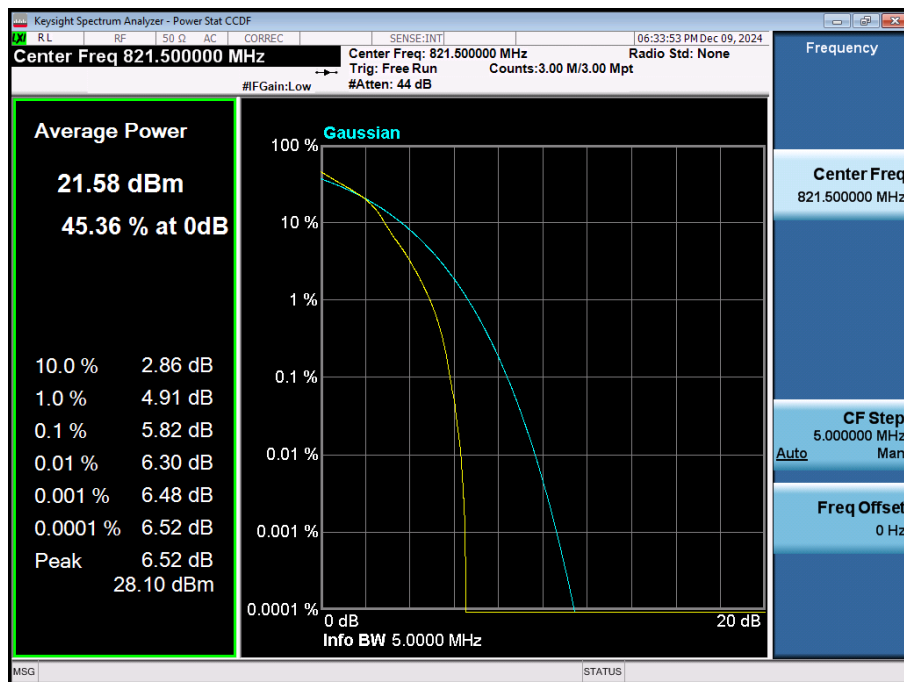
LTE Band 26 / 10 MHz / QPSK - RB Size 50



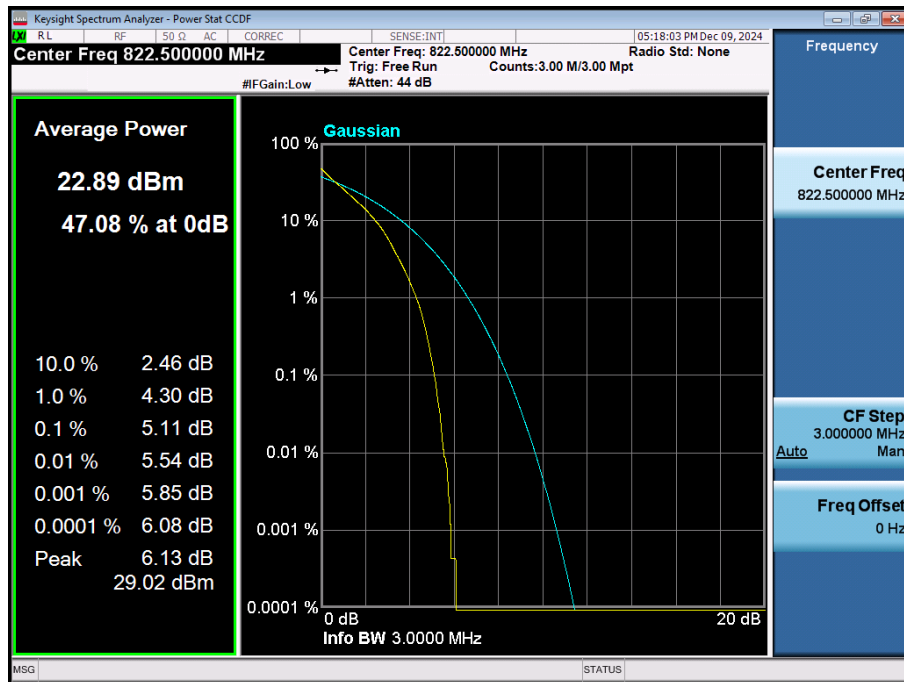
LTE Band 26 / 10 MHz / 16QAM - RB Size 50



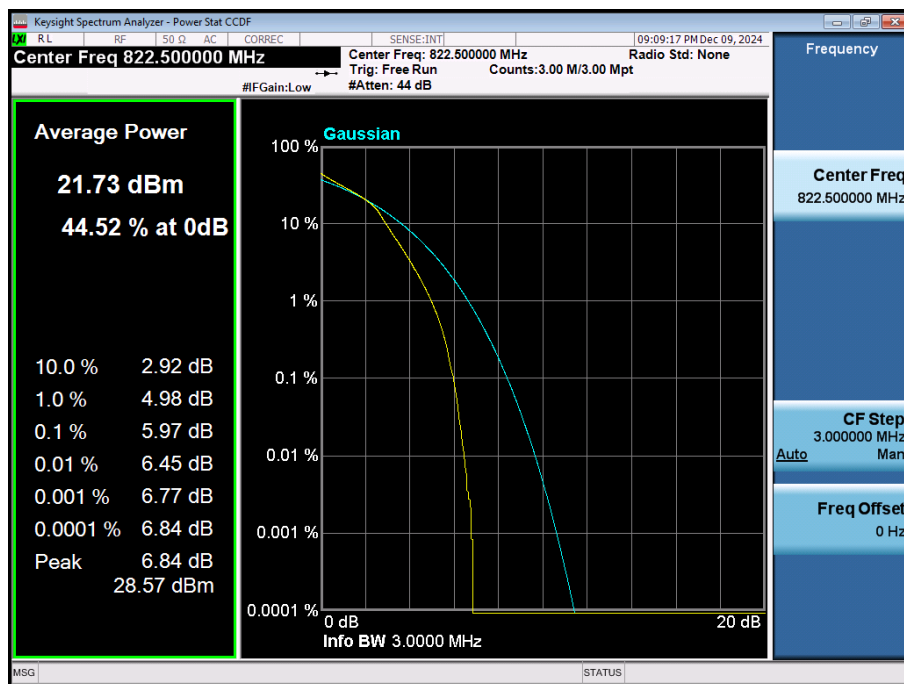
LTE Band 26 / 5 MHz / QPSK - RB Size 25



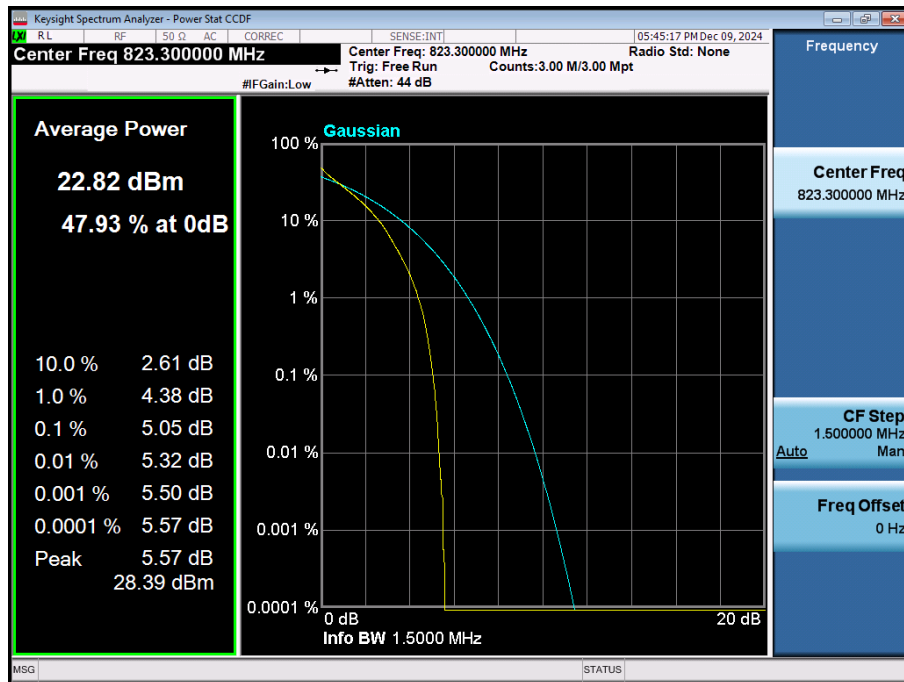
LTE Band 26 / 5 MHz / 16QAM - RB Size 25



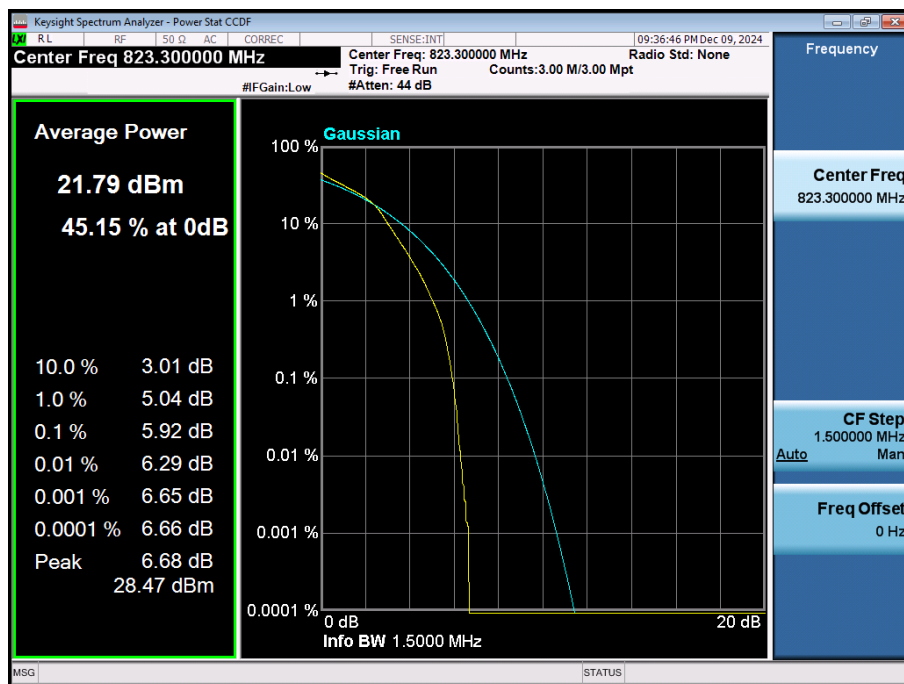
LTE Band 26 / 3 MHz / QPSK - RB Size 15



LTE Band 26 / 3 MHz / 16QAM - RB Size 15



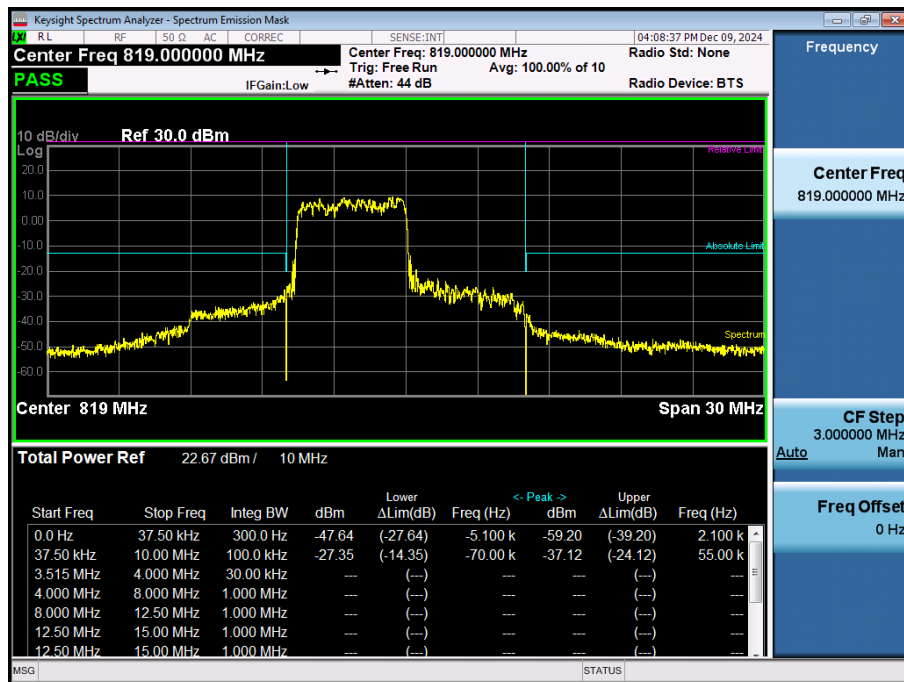
LTE Band 26 / 1.4 MHz / QPSK - RB Size 6



LTE Band 26 / 1.4 MHz / 16QAM - RB Size 6

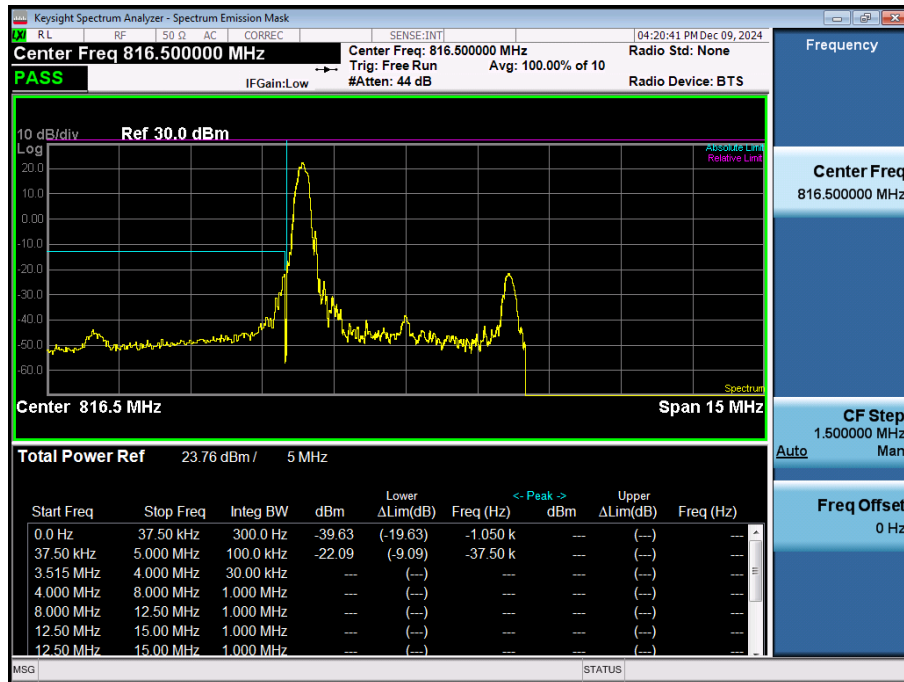
### 8.3. BAND EDGE EMISSIONS(Conducted)

#### - Low Band Edge



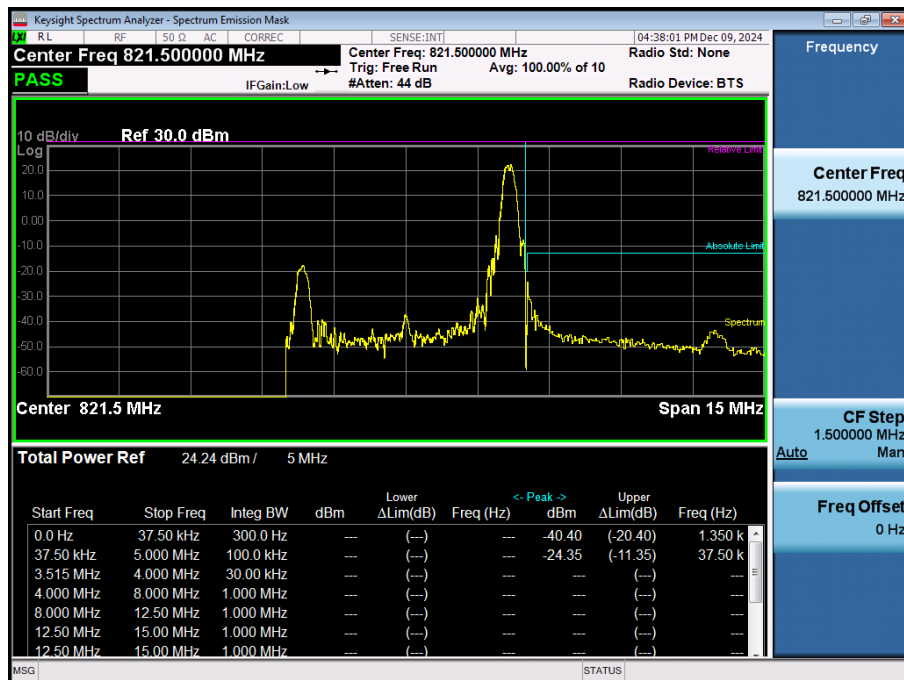
LTE Band 26 / 10 MHz / QPSK - RB Size/Offset (25/0)

- Low Band Edge



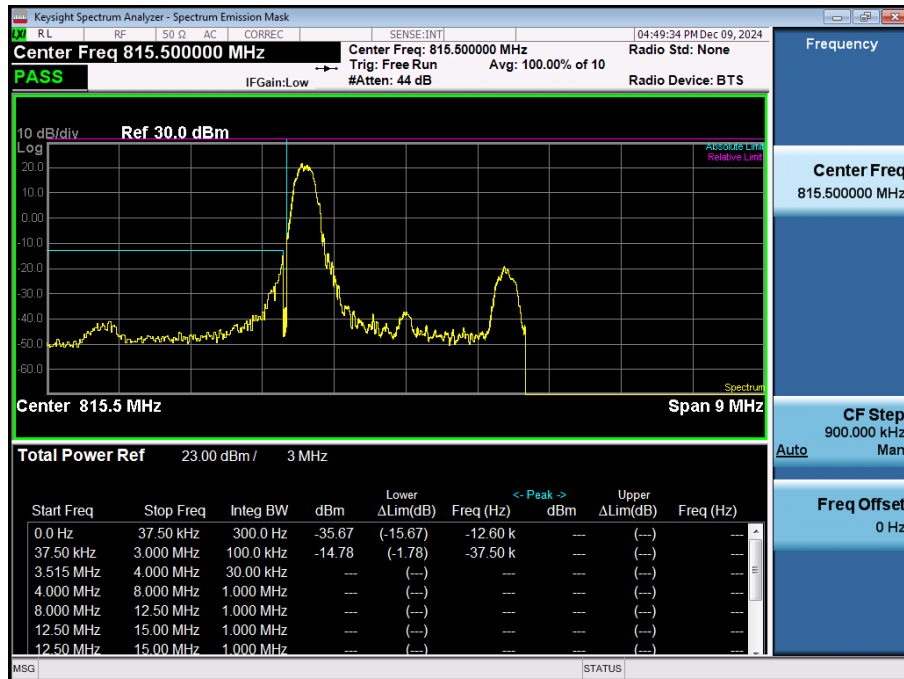
LTE Band 26 / 5 MHz / QPSK - RB Size/Offset (1/0)

- High Band Edge



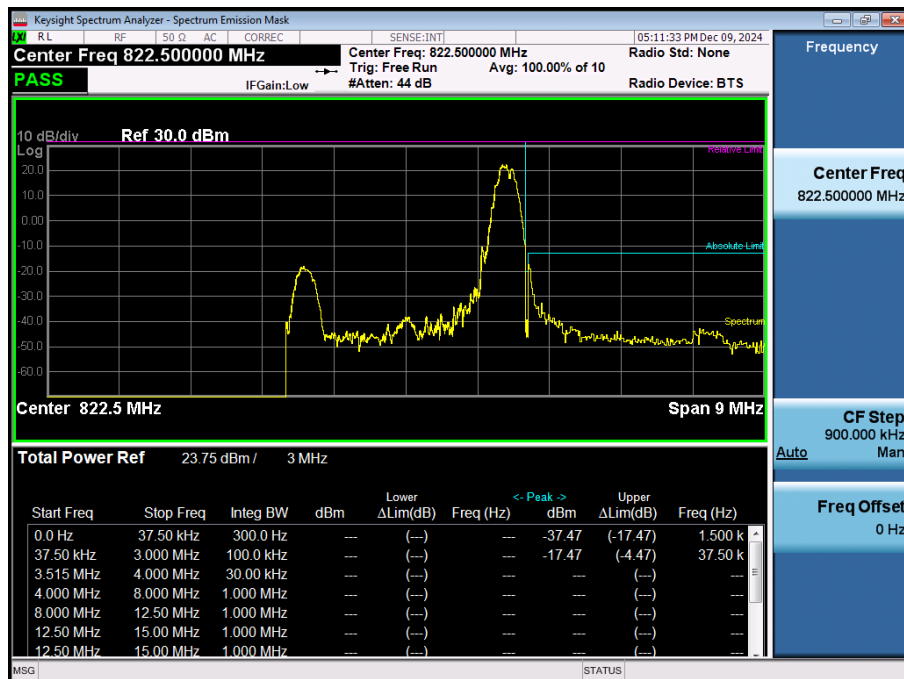
LTE Band 26 / 5 MHz / QPSK - RB Size/Offset (1/24)

## - Low Band Edge



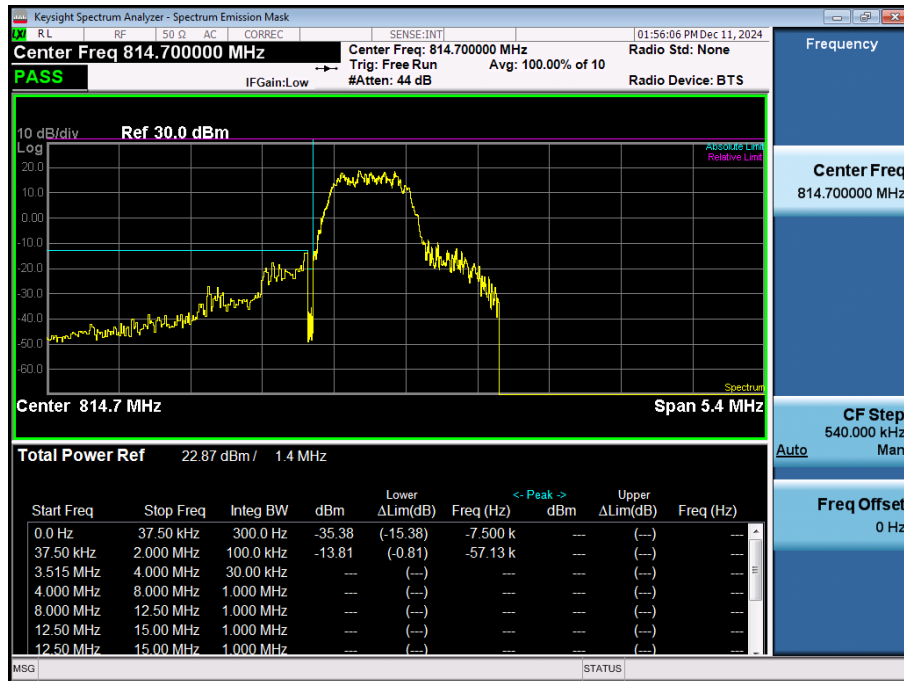
LTE Band 26 / 3 MHz / QPSK - RB Size/Offset (1/0)

## - High Band Edge



LTE Band 26 / 3 MHz / QPSK - RB Size/Offset (1/14)

- Low Band Edge



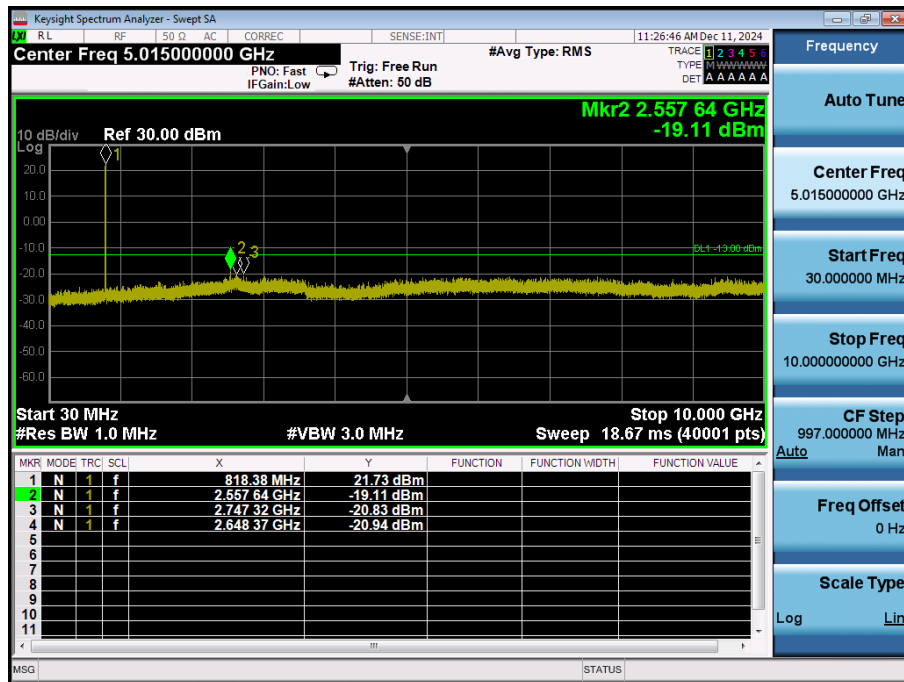
LTE Band 26 / 1.4 MHz / QPSK - RB Size/Offset (3/0)

- High Band Edge

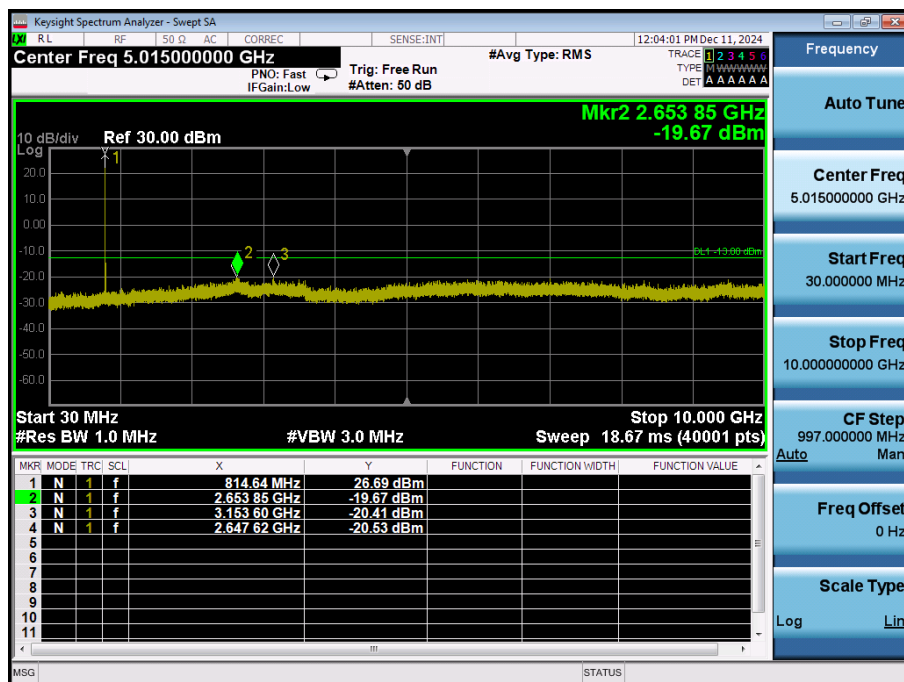


LTE Band 26 / 1.4 MHz / QPSK - RB Size/Offset (3/3)

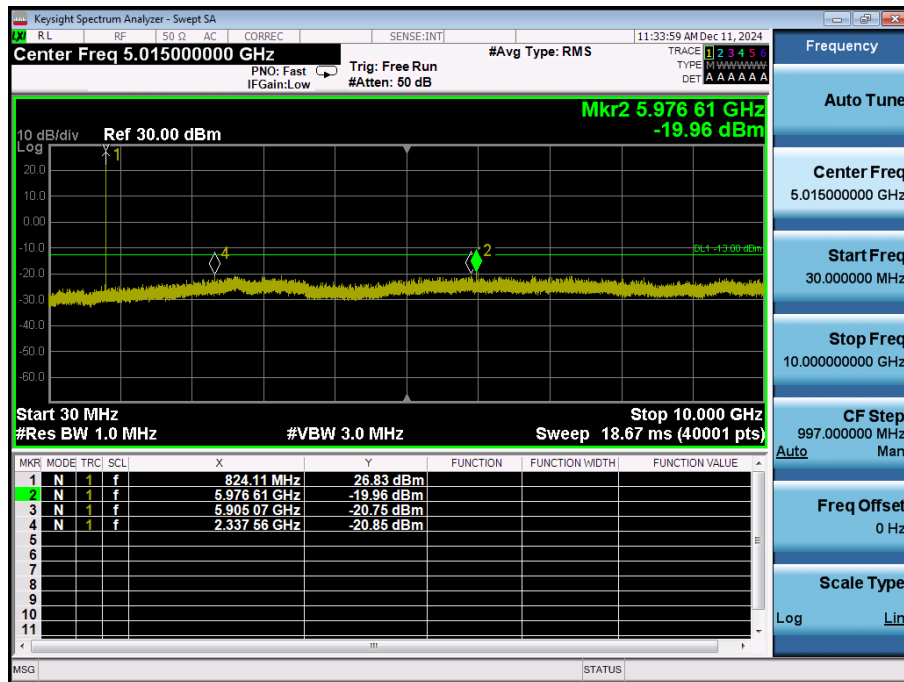
## 8.4. SPURIOUS AND HARMONICS EMISSIONS(Conducted)



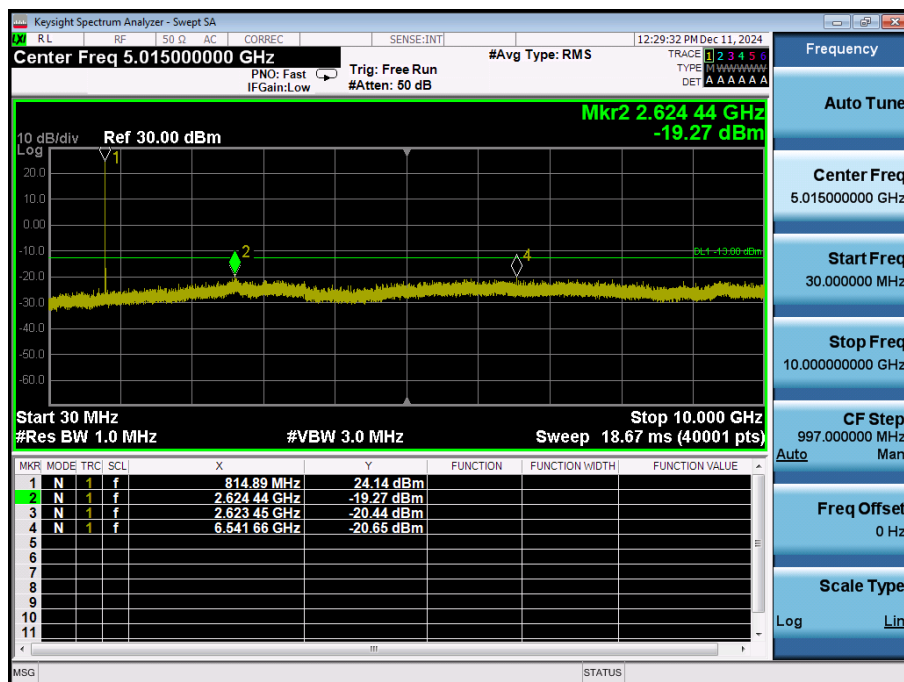
LTE Band 26 / 10 MHz / QPSK - RB Size/Offset (25/25) - Low Channel



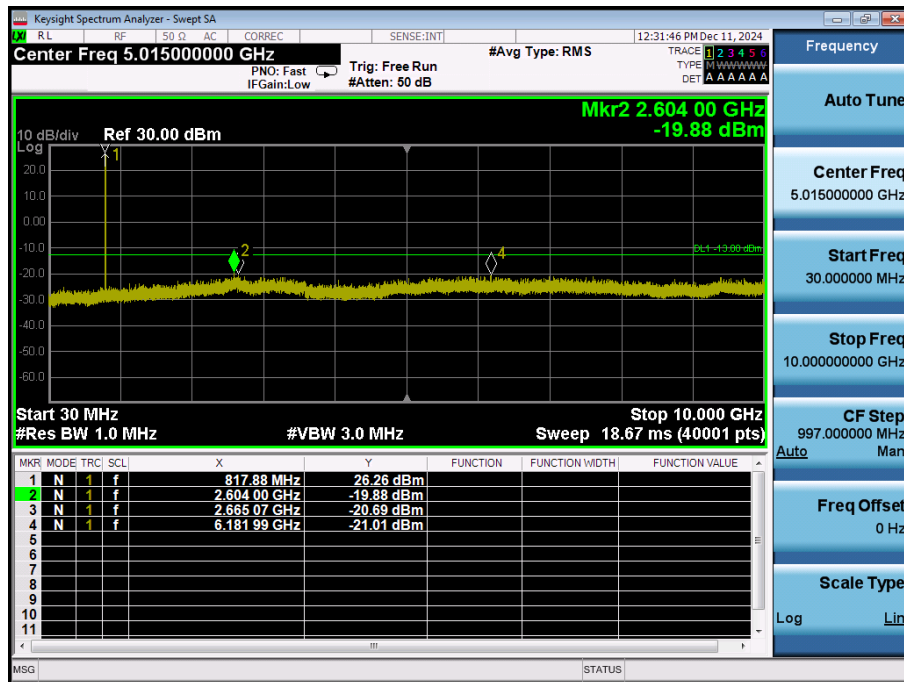
LTE Band 26 / 5 MHz / 16QAM - RB Size/Offset (12/6) - Low Channel



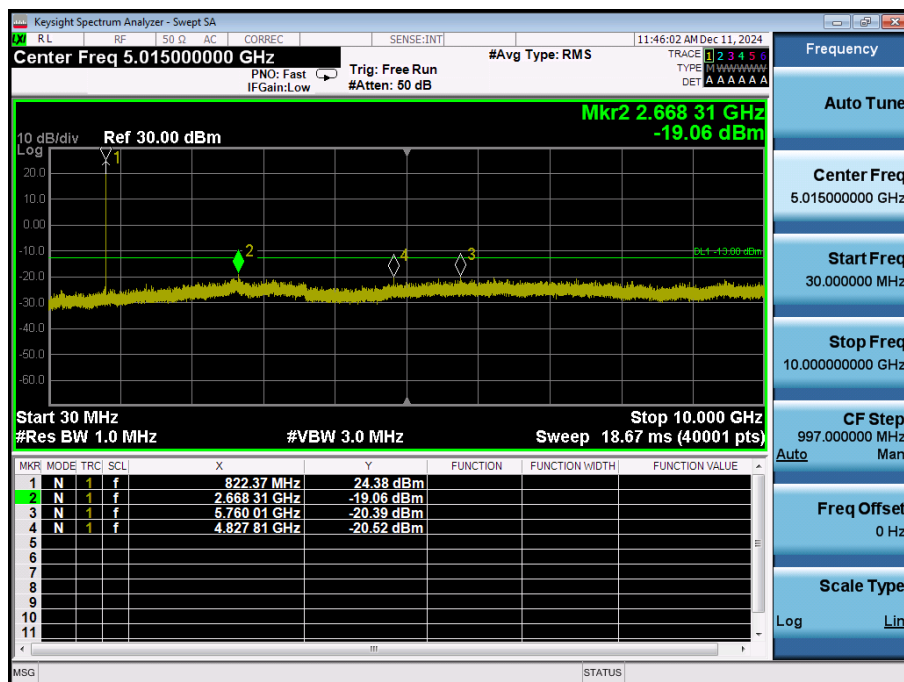
LTE Band 26 / 5 MHz / QPSK - RB Size/Offset (25/0) - High Channel



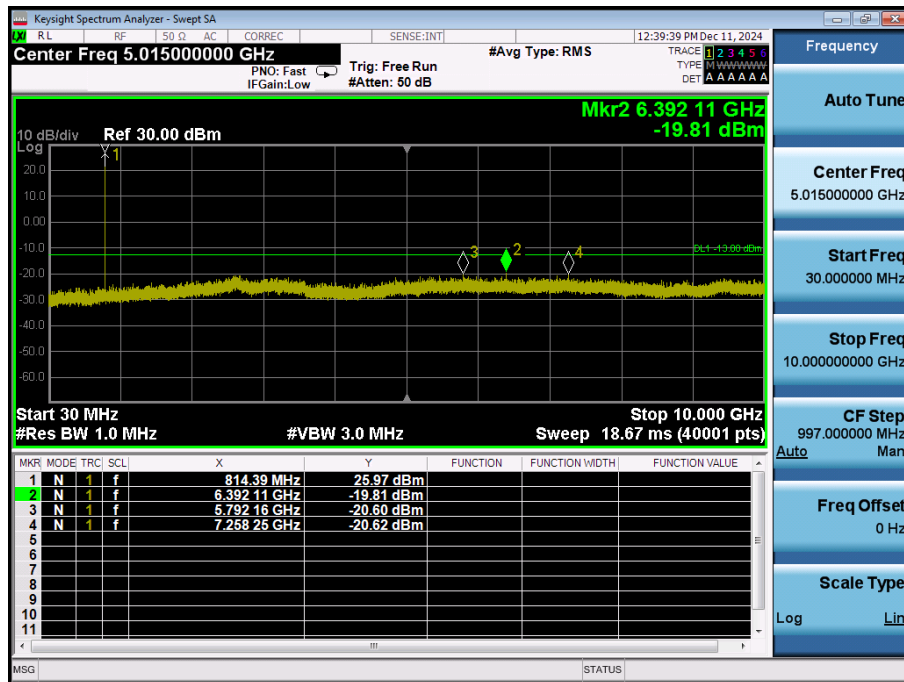
LTE Band 26 / 3 MHz / 16QAM - RB Size/Offset (8/0) - Low Channel



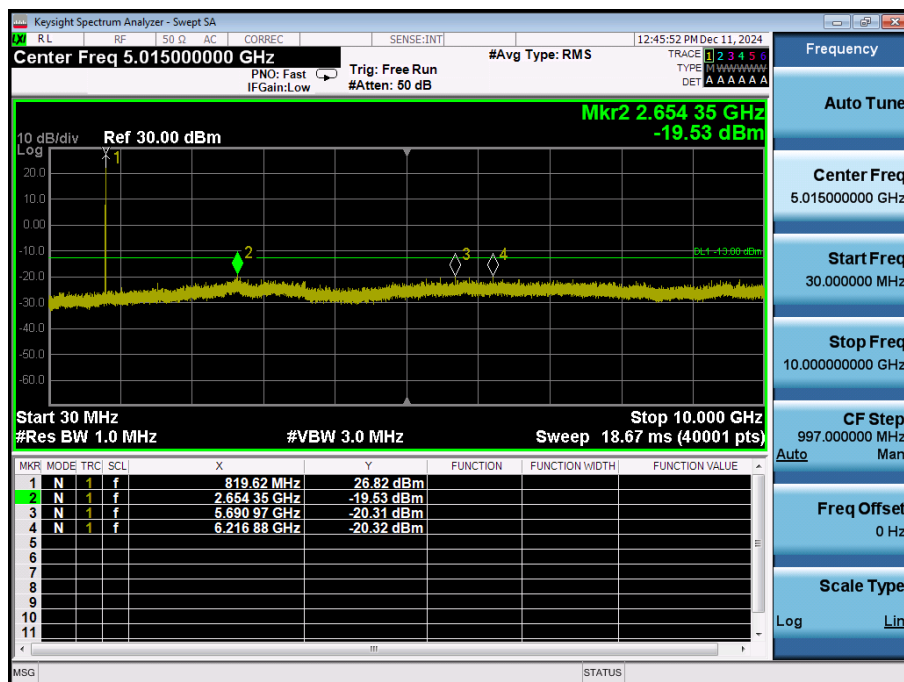
LTE Band 26 / 3 MHz / 16QAM - RB Size/Offset (1/0) - Mid Channel



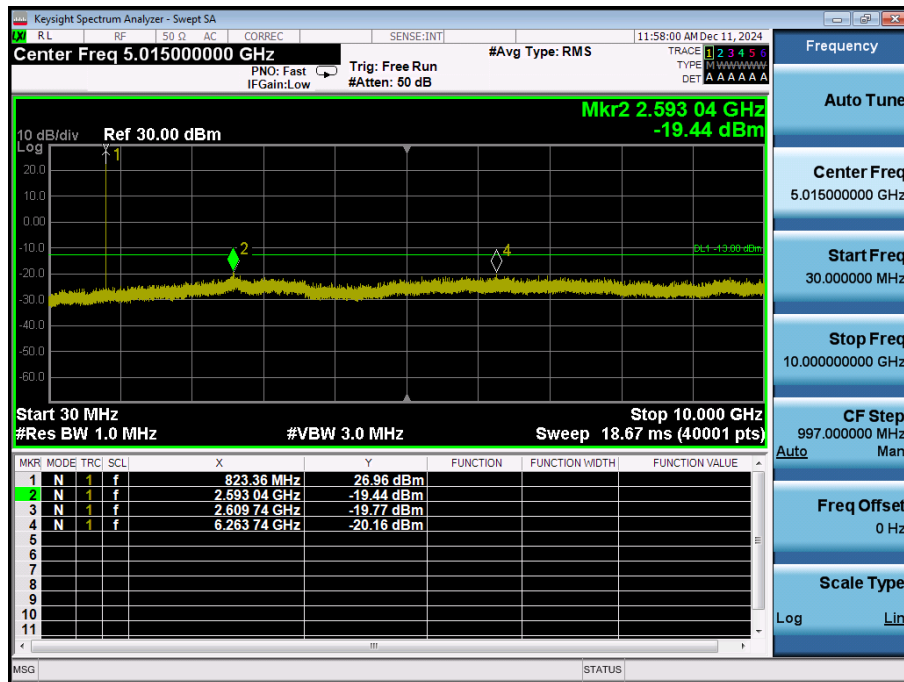
LTE Band 26 / 3 MHz / 64QAM - RB Size/Offset (8/4) - High Channel



LTE Band 26 / 1.4 MHz / 16QAM - RB Size/Offset (1/0) – Low Channel



LTE Band 26 / 1.4 MHz / QPSK- RB Size/Offset (3/0) – Mid Channel



LTE Band 26 / 1.4 MHz / 16QAM - RB Size/Offset (1/2) – High Channel