

## RF MEASUREMENT REPORT

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**FCC ID:** XMR2023RG525FNA  
**Application:** Quectel Wireless Solutions Co., Ltd  
**Product:** 5G Sub-6 GHz LGA Module  
**Model No.:** RG525F-NA  
**Brand Name:** Quectel  
**FCC Rule Part(s):** Part90 Subpart R  
**Test Procedure(s):** ANSI C63.26: 2015  
**Result:** Complies  
**Received Date:** 2022-11-14  
**Test Date:** 2022-12-17 ~ 2023-02-19

**Reviewed By:**

\_\_\_\_\_  
Sunny Sun

**Approved By:**

\_\_\_\_\_  
Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.26-2015. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

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### Revision History

| Report No.    | Version | Description    | Issue Date | Note  |
|---------------|---------|----------------|------------|-------|
| 2211RSU034-U2 | Rev. 01 | Initial Report | 2023-02-23 | Valid |
|               |         |                |            |       |

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## 1. General Information

### 1.1. Applicant

Quectel Wireless Solutions Co., Ltd

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

### 1.2. Manufacturer

Quectel Wireless Solutions Co., Ltd

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

### 1.3. Testing Facility

|                                     |                                                                                                                                           |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | <b>Test Site - MRT Suzhou Laboratory</b>                                                                                                  |
|                                     | <b>Laboratory Location (Suzhou - Wuzhong)</b><br>D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China       |
|                                     | <b>Laboratory Location (Suzhou - SIP)</b><br>4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China |
|                                     | <b>Laboratory Accreditations</b>                                                                                                          |
|                                     | A2LA: 3628.01 CNAS: L10551<br>FCC: CN1166 ISED: CN0001<br>VCCI: R-20025, G-20034, C-20020, T-20020                                        |
| <input type="checkbox"/>            | <b>Test Site - MRT Shenzhen Laboratory</b>                                                                                                |
|                                     | <b>Laboratory Location (Shenzhen)</b><br>1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China  |
|                                     | <b>Laboratory Accreditations</b>                                                                                                          |
|                                     | A2LA: 3628.02 CNAS: L10551<br>FCC: CN1284 ISED: CN0105                                                                                    |
| <input type="checkbox"/>            | <b>Test Site - MRT Taiwan Laboratory</b>                                                                                                  |
|                                     | <b>Laboratory Location (Taiwan)</b><br>No. 38, Fuxing 2 <sup>nd</sup> Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)               |
|                                     | <b>Laboratory Accreditations</b>                                                                                                          |
|                                     | TAF: L3261-190725<br>FCC: 291082, TW3261 ISED: TW3261                                                                                     |

#### 1.4. Product Information

|                                                                                                                                                                                                                |                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Product Name                                                                                                                                                                                                   | 5G Sub-6 GHz LGA Module                                                                                                       |
| Model No.                                                                                                                                                                                                      | RG525F-NA                                                                                                                     |
| Brand Name                                                                                                                                                                                                     | Quectel                                                                                                                       |
| IMEI                                                                                                                                                                                                           | Conducted Measurement 1: 860465060012444<br>Conducted Measurement 2: 860465060013152<br>Radiated Measurement: 860465060012444 |
| E-UTRA Band                                                                                                                                                                                                    | Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 30, 38, 41, 42, 43, 48, 66, 71                                                       |
| 5G NR Band                                                                                                                                                                                                     | n2, n5, n7, n12, n13, n14, n25, n26, n30, n38, n41, n48, n66, n71, n77, n78                                                   |
| Operating Temperature                                                                                                                                                                                          | -30 ~ 75 °C                                                                                                                   |
| Power Type                                                                                                                                                                                                     | 3.3 ~ 4.4Vdc, typical 3.8Vdc                                                                                                  |
| Remark: The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. |                                                                                                                               |

#### 1.5. Radio Specification under Test

|                                                                                |                        |
|--------------------------------------------------------------------------------|------------------------|
| FDD TxFrequency Range                                                          | Band 14: 788 ~ 798 MHz |
| FDD RxFrequency Range                                                          | Band 14: 758 ~ 768 MHz |
| Modulation                                                                     | UL & DL up to 256QAM   |
| Remark: For other features of this EUT, test report will be issued separately. |                        |

### 1.6. Description of Available Antennas

| Technology  | Frequency Range (MHz) | Antenna Type | MaxPeak Gain (dBi) |
|-------------|-----------------------|--------------|--------------------|
| LTE Band 2  | 1850 ~ 1910           | Dipole       | 1.37               |
| LTE Band 4  | 1710 ~ 1755           |              | 1.37               |
| LTE Band 5  | 824 ~ 849             |              | 1.20               |
| LTE Band 7  | 2500 ~ 2570           |              | 1.75               |
| LTE Band 12 | 699 ~ 716             |              | -2.60              |
| LTE Band 13 | 777 ~ 787             |              | -0.50              |
| LTE Band 14 | 788 ~ 798             |              | 0.00               |
| LTE Band 17 | 704~ 716              |              | -1.50              |
| LTE Band 25 | 1850 ~ 1915           |              | 1.37               |
| LTE Band 26 | 814 ~ 849             |              | 1.20               |
| LTE Band 30 | 2305 ~ 2315           |              | 1.10               |
| LTE Band 38 | 2570 ~ 2620           |              | 1.60               |
| LTE Band 41 | 2496 ~ 2690           |              | 1.80               |
| LTE Band 42 | 3450 ~ 3550           |              | 0.95               |
| LTE Band 43 | 3700 ~ 3800           |              | 0.60               |
| LTE Band 48 | 3550 ~ 3700           |              | 0.60               |
| LTE Band 66 | 1710 ~ 1780           |              | 1.37               |
| LTE Band 71 | 663 ~ 698             |              | -2.60              |

Note: All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

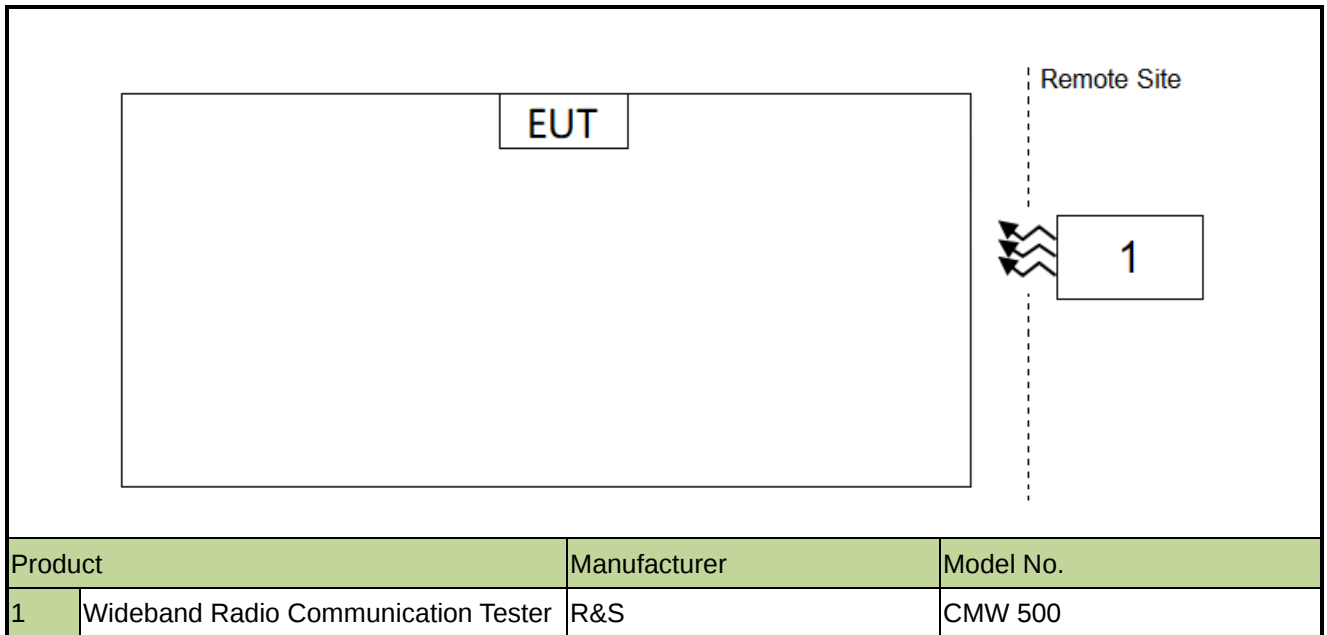
### 1.7. Test Methodology

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.26:2015
- FCC CFR 47 Part 90
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01: Determining ERP and EIRP

## 2. Test Configuration

### 2.1. Test System Connection Diagram



### 2.2. Test Environment Condition

|                     |             |
|---------------------|-------------|
| Ambient Temperature | 15 ~ 35°C   |
| Relative Humidity   | 20% ~ 75%RH |

### 3. Measuring InstrumentX

| Instrument                                    | Manufacturer | Model No.   | Asset No.   | Cali. Interval | Cali. Due Date | Test Site                   |
|-----------------------------------------------|--------------|-------------|-------------|----------------|----------------|-----------------------------|
| EMI Test Receiver                             | R&S          | ESR3        | MRTSUE06185 | 1 year         | 2022-12-28     | SIP-AC2                     |
| EMI Test Receiver                             | R&S          | ESR3        | MRTSUE06185 | 1 year         | 2023-12-28     | SIP-AC2                     |
| Preamplifier                                  | EMCI         | EMC184045SE | MRTSUE06602 | 1 year         | 2023-10-10     | SIP-AC2                     |
| EMI Test Receiver                             | R&S          | ESR3        | MRTSUE06613 | 1 year         | 2023-06-01     | SIP-AC2                     |
| Preamplifier                                  | EMCI         | EMC001330   | MRTSUE06643 | 1 year         | 2023-01-13     | SIP-AC2                     |
| Loop Antenna                                  | Schwarzbeck  | FMZB 1519 B | MRTSUE06937 | 1 year         | 2023-03-14     | SIP-AC2                     |
| Horn Antenna                                  | Schwarzbeck  | BBHA 9170   | MRTSUE06598 | 1 year         | 2023-11-05     | SIP-AC2                     |
| Preamplifier                                  | EMCI         | EMC051845SE | MRTSUE06601 | 1 year         | 2023-11-22     | SIP-AC2                     |
| Thermohygrometer                              | testo        | 608-H1      | MRTSUE06623 | 1 year         | 2023-11-27     | SIP-AC2                     |
| Thermohygrometer                              | testo        | 608-H1      | MRTSUE06624 | 1 year         | 2023-11-27     | SIP-AC2                     |
| TRILOG Antenna                                | Schwarzbeck  | VULB 9168   | MRTSUE06647 | 1 year         | 2023-07-13     | SIP-AC2                     |
| Anechoic Chamber                              | RIKEN        | SIP-AC2     | MRTSUE06781 | 1 year         | 2022-12-22     | SIP-AC2                     |
| Anechoic Chamber                              | RIKEN        | SIP-AC2     | MRTSUE06781 | 1 year         | 2023-12-22     | SIP-AC2                     |
| Horn Antenna                                  | Schwarzbeck  | BBHA 9120D  | MRTSUE06648 | 1 year         | 2023-10-22     | SIP-AC2                     |
| Test loop antenna                             | MRT          | d-2m        | MRTSUE11131 | N/A            | N/A            | SIP-AC2                     |
| Signal Analyzer                               | Keysight     | N9010B      | MRTSUE07028 | 1 year         | 2023-11-25     | SIP-AC2/SIP-TR<br>1/SIP-SR1 |
| Signal Analyzer                               | Keysight     | N9010B      | MRTSUE06559 | 1 year         | 2023-06-01     | SIP-AC2<br>SIP-SR1          |
| Signal Analyzer                               | Keysight     | N9010B      | MRTSUE06603 | 1 year         | 2023-10-25     | SIP-AC2<br>SIP-SR1          |
| Signal Analyzer                               | Keysight     | N9020B      | MRTSUE06604 | 1 year         | 2023-11-07     | SIP-AC2<br>SIP-SR1          |
| Communication Tester                          | R&S          | CMU 200     | MRTSUE06009 | 1 year         | 2023-08-23     | SIP-SR1                     |
| Communication Tester                          | R&S          | CMW500      | MRTSUE06243 | 1 year         | 2023-10-08     | SIP-SR1                     |
| Signal Generator                              | Keysight     | E8257D      | MRTSUE06453 | 1 year         | 2023-06-01     | SIP-SR1                     |
| Thermohygrometer                              | testo        | 622         | MRTSUE06629 | 1 year         | 2024-01-03     | SIP-SR1                     |
| 5G Wireless Test Platform                     | Keysight     | E7515B      | MRTSUE06903 | 1 year         | 2023-10-25     | SIP-SR1                     |
| Signal Generator                              | Keysight     | E8257D      | MRTSUE06904 | 1 year         | 2023-10-25     | SIP-SR1                     |
| DC POWER MODULE                               | Keysight     | N6743B      | MRTSUE06905 | N/A            | N/A            | SIP-SR1                     |
| DC POWER MODULE                               | Keysight     | N6743B      | MRTSUE06906 | N/A            | N/A            | SIP-SR1                     |
| Low-Profile Modular<br>Power System Mainframe | Keysight     | N6700C      | MRTSUE06907 | N/A            | N/A            | SIP-SR1                     |
| FR1 Switching Unit                            | Keysight     | C8880A      | MRTSUE06908 | N/A            | N/A            | SIP-SR1                     |
| Signal Analyzer                               | Keysight     | N9021B      | MRTSUE06915 | 1 year         | 2022-12-28     | SIP-SR1                     |

| Instrument           | Manufacturer | Model No. | Asset No.   | Cali. Interval | Cali. Due Date | Test Site |
|----------------------|--------------|-----------|-------------|----------------|----------------|-----------|
| Signal Analyzer      | Keysight     | N9021B    | MRTSUE06915 | 1 year         | 2023-12-28     | SIP-SR1   |
| Temperature Chamber  | BAOYT        | BYG-80CL  | MRTSUE06932 | 1 year         | 2023-02-27     | SIP-SR1   |
| Shielding Room       | MIX-BEP      | SIP-SR1   | MRTSUE06948 | N/A            | N/A            | SIP-SR1   |
| Signal Analyzer      | Keysight     | N9010B    | MRTSUE06558 | 1 year         | 2023-06-01     | SIP-TR1   |
| Temperature Chamber  | BAOYT        | BYG-408CS | MRTSUE06847 | 1 year         | 2023-02-22     | SIP-TR1   |
| Communication Tester | R&S          | CMW500    | MRTSUE06881 | 1 year         | 2023-06-01     | SIP-TR1   |
| Thermohygrometer     | testo        | 608-H1    | MRTSUE11022 | 1 year         | 2023-11-01     | SIP-TR1   |
| Signal Analyzer      | Keysight     | N9030B    | MRTSUE06395 | 1 year         | 2023-07-08     | SIP-TR1   |
| Signal Generator     | R&S          | SMU200A   | MRTSUE06489 | 1 year         | 2023-02-22     | SIP-TR1   |
| USB Power Sensor     | Keysight     | U2021XA   | MRTSUE06596 | 1 year         | 2023-08-23     | SIP-TR1   |
| Signal Generator     | Keysight     | N5182B    | MRTSUE06605 | 1 year         | 2023-10-25     | SIP-TR1   |
| Signal Analyzer      | Keysight     | N9010B    | MRTSUE07036 | 1 year         | 2023-03-31     | SIP-TR1   |
| USB Power Sensor     | Agilent      | U2021XA   | MRTSUE06030 | 1 year         | 2023-10-08     | SIP-TR1   |

| Software     | Version | Function          |
|--------------|---------|-------------------|
| EMI Software | V3.0.0  | EMI Test Software |

## 4. Decision Rules and Measurement Uncertainty

### 4.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2.  
(Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 4.2. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

| Radiated Spurious Emissions                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ):<br>Horizontal: 9kHz ~ 300MHz: 5.04dB<br>300MHz ~ 1GHz: 4.95dB<br>1GHz ~ 40GHz: 6.40dB<br>Vertical: 9kHz ~ 300MHz: 5.24dB<br>300MHz ~ 1GHz: 6.03dB<br>1GHz ~ 40GHz: 6.40dB |
| Conducted Spurious Emissions                                                                                                                                                                                                                       |
| Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ):<br>0.78dB                                                                                                                                                                   |
| Output Power                                                                                                                                                                                                                                       |
| Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ):<br>1.13dB                                                                                                                                                                   |
| Occupied Bandwidth                                                                                                                                                                                                                                 |
| Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ):<br>0.28%                                                                                                                                                                    |
| Frequency Stability                                                                                                                                                                                                                                |
| Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ):<br>76.2Hz                                                                                                                                                                   |

## 5. Test Result

### 5.1. Summary

| FCC Part Section(s)      | Test Description              | Test Condition | Verdict |
|--------------------------|-------------------------------|----------------|---------|
| 2.1049                   | Occupied Bandwidth            | Conducted      | Pass    |
| 2.1055,90.539(e)         | Frequency Stability           |                | Pass    |
| 90.542(a)(7)             | Equivalent Radiated Power     |                | Pass    |
| 2.1051, 90.543(e)(2)(3)  | Band Edge                     |                | Pass    |
| 2.1051, 90.210(n)        | Emission Mask                 |                |         |
| 2.1051, 90.543(e)(3) (f) | Transmitter Spurious Emission |                |         |
| 2.1053, 90.543(e)(3) (f) | Transmitter Spurious Emission | Radiated       | Pass    |

#### Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All supported modulation types were evaluated. The worst-case emission of modulation was selected. Therefore, the Frequency Stability, Channel Band Edge, Radiated & Conducted Spurious Emission were presented worst-case in the test report.

## 5.2. Occupied Bandwidth Measurement

### 5.2.1. Test Limit

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 radiated by a given emission shall be measured.

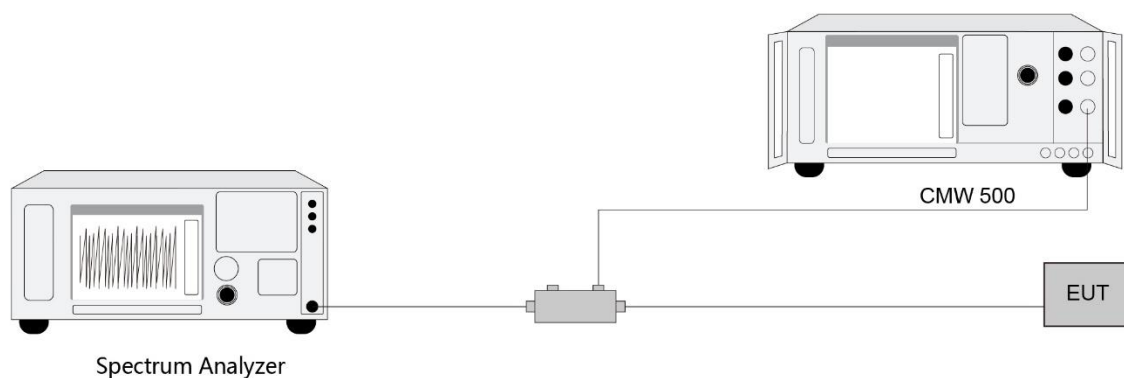
### 5.2.2. Test Procedure

ANSI C63.26-2015 - Section 5.4

### 5.2.3. Test Setting

1. Set center frequency to the nominal EUT channel center frequency
2. RBW = The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW
3.  $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize
8. Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

### 5.2.4. Test Setup



### 5.2.5. Test Result

Refer to Appendix A.1.

### **5.3. Frequency Stability Measurement**

#### **5.3.1. Test Limit**

The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

#### **5.3.2. Test Procedure**

ANSI C63.26-2015 - Section 5.6

#### **5.3.3. Test Setting**

##### **Frequency Stability Under Temperature Variations:**

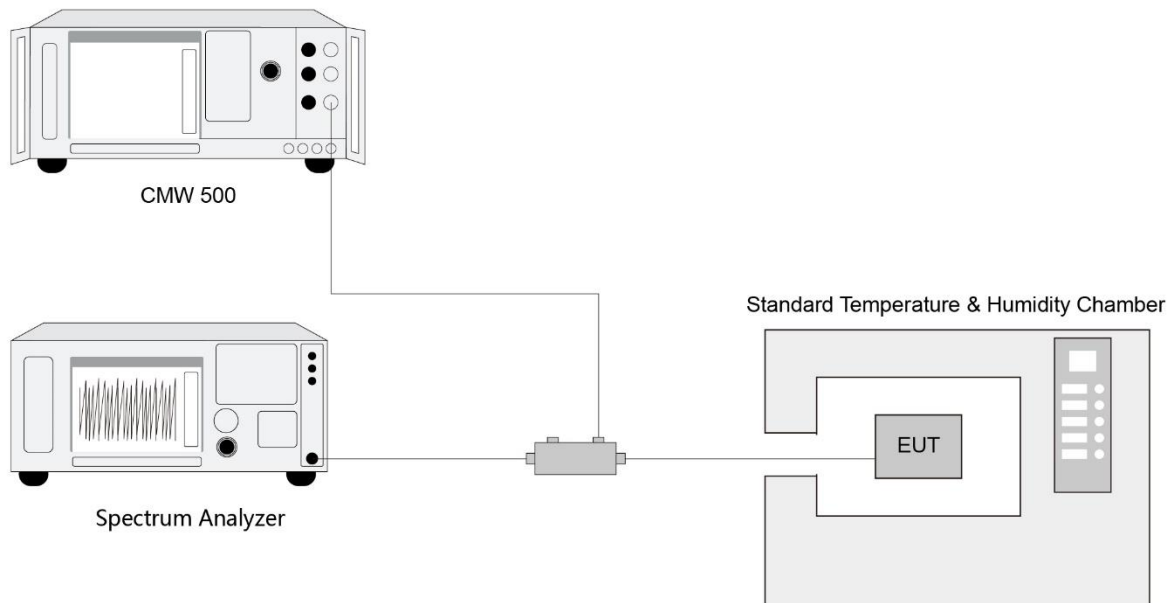
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

##### **Frequency Stability Under Voltage Variations:**

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ( $\pm 15\%$ ) and end point, record the maximum frequency change.

#### 5.3.4. Test Setup



#### 5.3.5. Test Result

Refer to Appendix A.2.

## 5.4. Equivalent Isotropically Radiated Power Measurement

### 5.4.1. Test Limit

Control stations and mobile stations transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 30 watts ERP.

### 5.4.2. Test Procedure

ANSI C63.26-2015 - Section 5.2

### 5.4.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation (1) as follows:

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

where

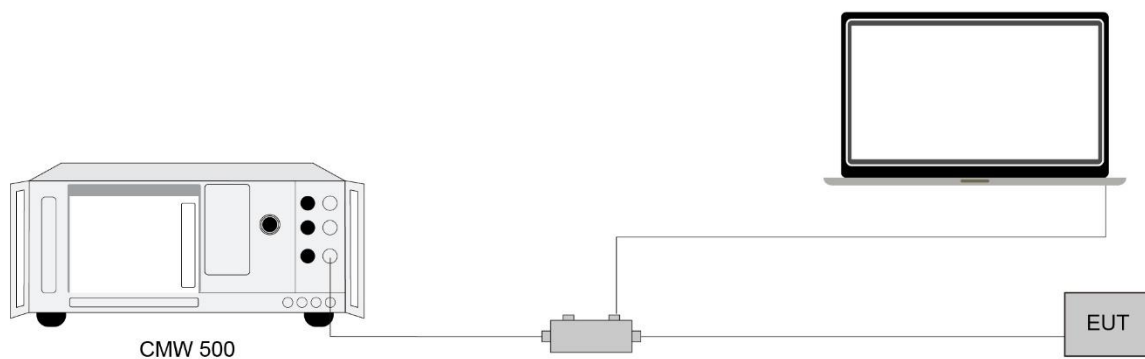
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as  $P_{\text{Meas}}$ , e.g., dBm or dBW)

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

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

$$\text{ERP} = \text{EIRP} - 2.15$$

### 5.4.4. Test Setup



#### **5.4.5. Test Result**

Refer to Appendix A.3.

## **5.5. Band Edge Measurement**

### **5.5.1. Test 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  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations;
- (2) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.

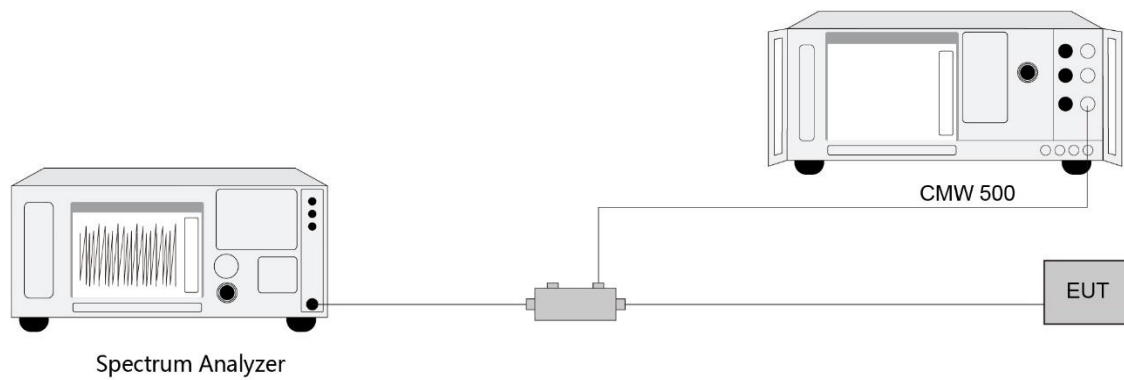
### **5.5.2. Test Procedure**

ANSI C63.26-2015 - Section 5.7

### **5.5.3. Test Setting**

1. Set the analyzer frequency to low or high channel
2.  $RBW \geq$  The nominal RBW shall be in the range of 1% of the anticipated OBW (in the 1MHz band immediately outside and adjacent to the band edge). For improvement of the accuracy in the measurement of the average power of a noise-like emission, a RBW narrower than the specified reference bandwidth can be used (generally limited to no less than 1% of the OBW), provided that a subsequent integration is performed over the full required measurement bandwidth. This integration should be performed using the spectrum analyzer's band power functions.
3.  $VBW \geq 3 \cdot RBW$
4. Sweep time = auto
5. Detector = power averaging (rms)
6. Set sweep trigger to "free run."
7. User gate triggered such that the analyzer only sweeps when the device is transmitting at full power
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

#### 5.5.4. Test Setup



#### 5.5.5. Test Result

Refer to Appendix A.4.

## **5.6. Emission Mask Measurement**

### **5.6.1. Test Limit**

Emission Mask B, for transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

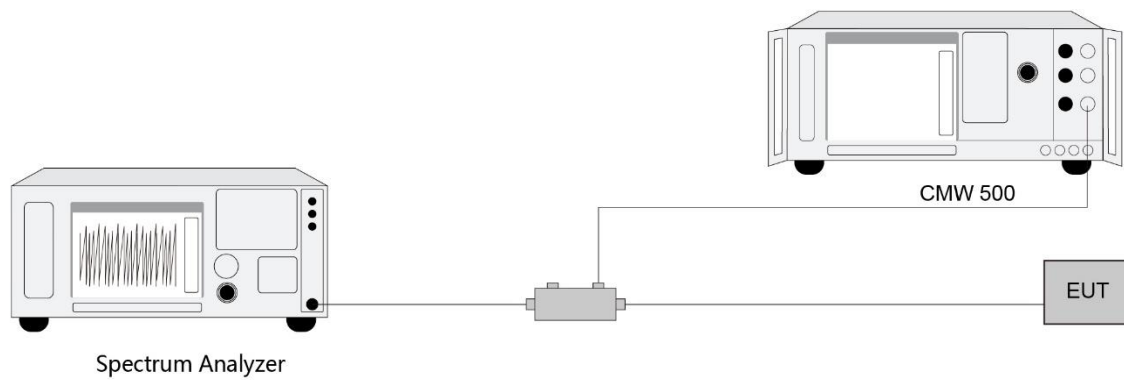
### **5.6.2. Test Procedure**

ANSI C63.26-2015 - Section 5.7

### **5.6.3. Test Setting**

1. Set the analyzer frequency to low or high channel
2.  $RBW \geq$  The nominal RBW shall be in the range of 1% of the anticipated OBW (in the 1MHz band immediately outside and adjacent to the band edge). For improvement of the accuracy in the measurement of the average power of a noise-like emission, a RBW narrower than the specified reference bandwidth can be used (generally limited to no less than 1% of the OBW), provided that a subsequent integration is performed over the full required measurement bandwidth. This integration should be performed using the spectrum analyzer's band power functions.
3.  $VBW \geq 3 \cdot RBW$
4. Sweep time = auto
5. Detector = power averaging (rms)
6. Set sweep trigger to "free run."
7. User gate triggered such that the analyzer only sweeps when the device is transmitting at full power
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

#### 5.6.4. Test Setup



#### 5.6.5. Test Result

Refer to Appendix A.5.

## **5.7. Conducted Spurious Emissions Measurement**

### **5.7.1. Test Limit**

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB. For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and  $-80$  dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

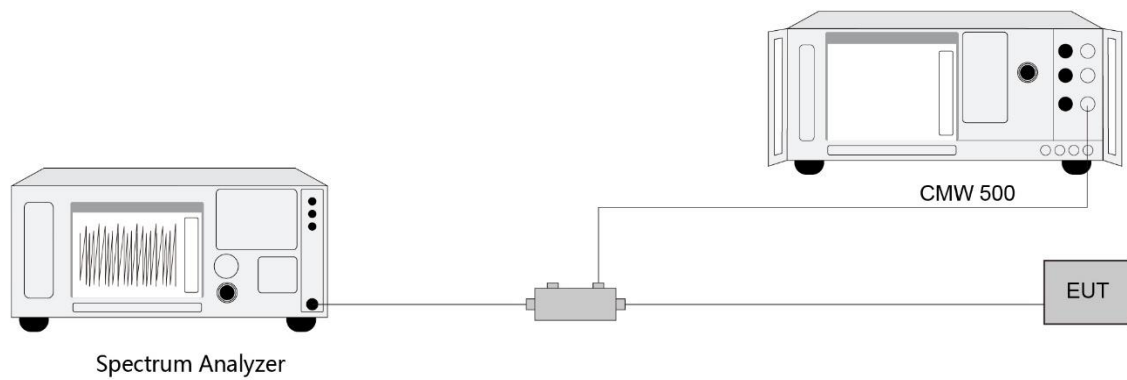
### **5.7.2. Test Procedure**

ANSI C63.26-2015 - Section 5.7

### **5.7.3. Test Setting**

1. Set the analyzer frequency to low, mid, high channel.
2. RBW = 1MHz
3. VBW  $\geq 3 \times$  RBW
4. Sweep time = auto
5. Detector = power averaging (rms)
6. Set sweep trigger to "free run."
7. User gate triggered such that the analyzer only sweeps when the device is transmitting at full power.
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

#### 5.7.4. Test Setup



#### 5.7.5. Test Result

Refer to Appendix A.6.

## **5.8. Radiated Spurious Emissions Measurement**

### **5.8.1. Test Limit**

Out of band emissions: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. The emission limit equal to -13dBm.

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz (-40dBm/MHz) equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW (-50dBm) EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

$E \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} - 20 \log D + 104.8$ ; where D is the measurement distance in meters. The emission limit equal to 82.3dB $\mu$ V/m or 55.3dB $\mu$ V/m.

### **5.8.2. Test Procedure**

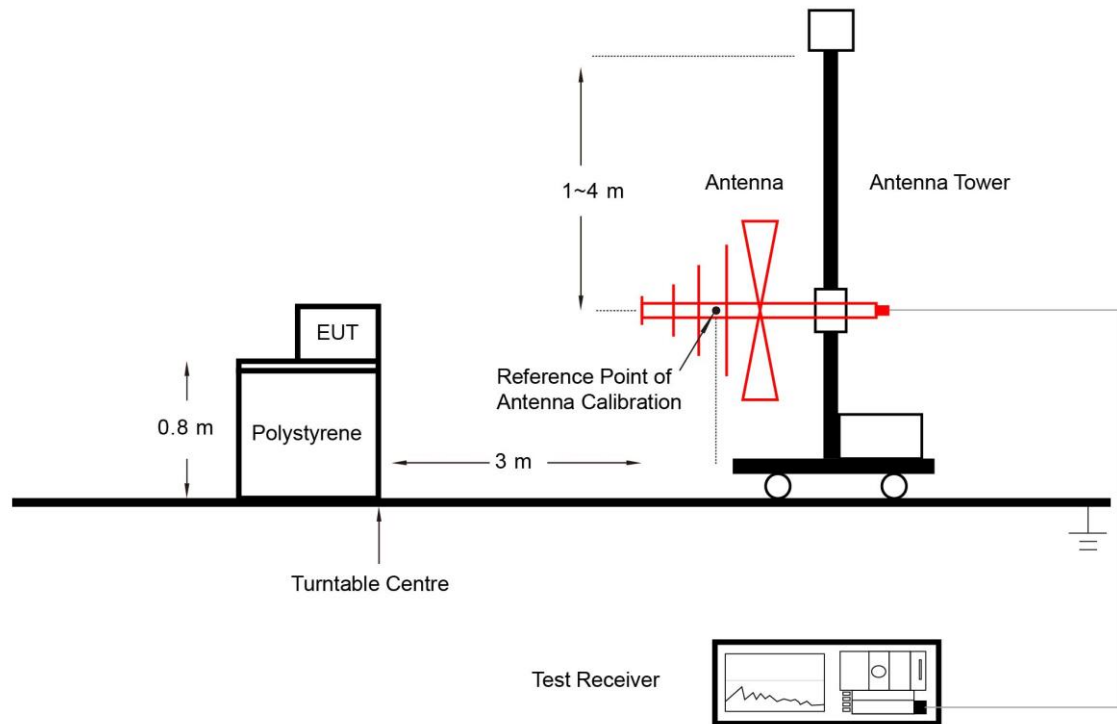
ANSI C63.26-2015 - Section 5.2.7 & 5.5

### **5.8.3. Test Setting**

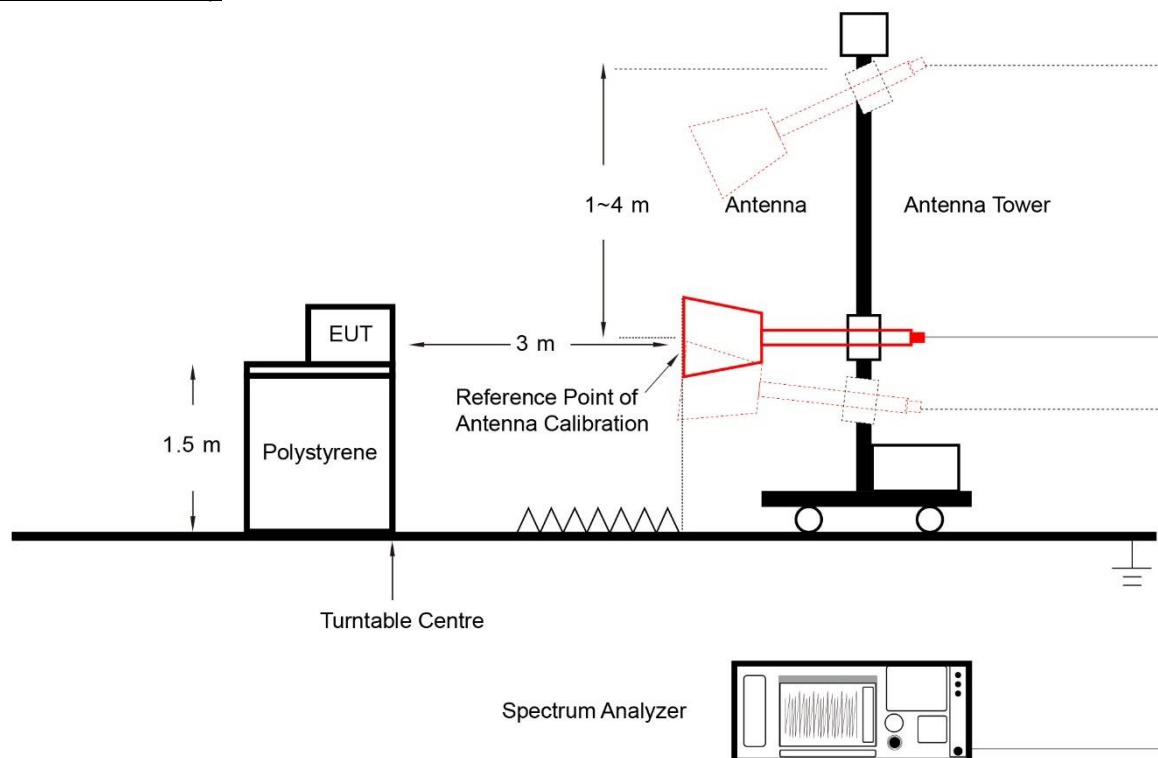
1. RBW = 1MHz
2. VBW  $\geq 3 \times$  RBW
3. Sweep time  $\geq 10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})$
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

#### 5.8.4. Test Setup

##### Below 1GHz Test Setup:



##### Above 1GHz Test Setup:



#### **5.8.5. Test Result**

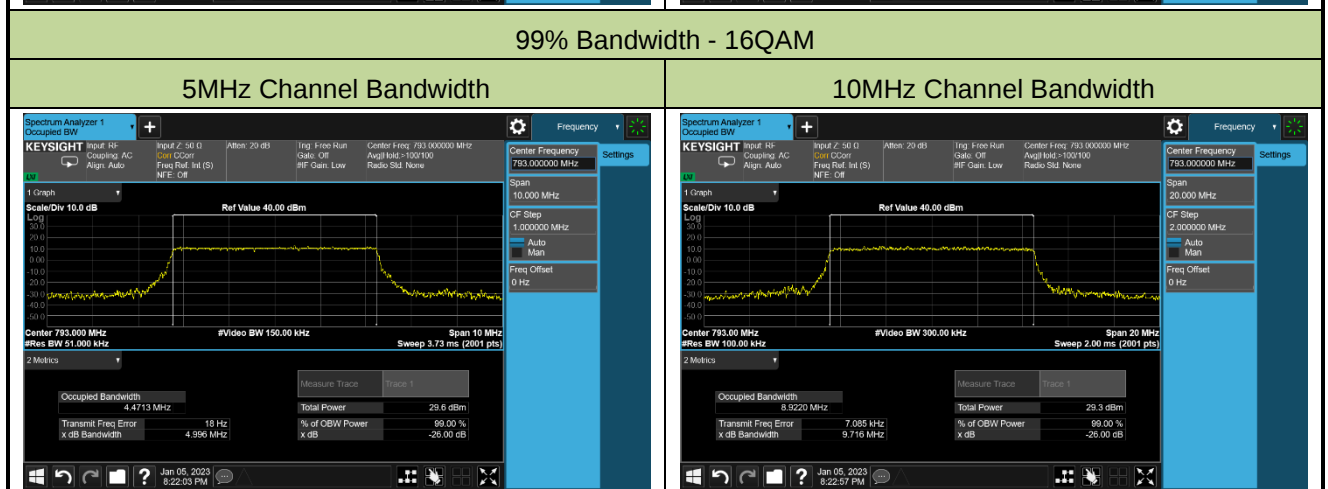
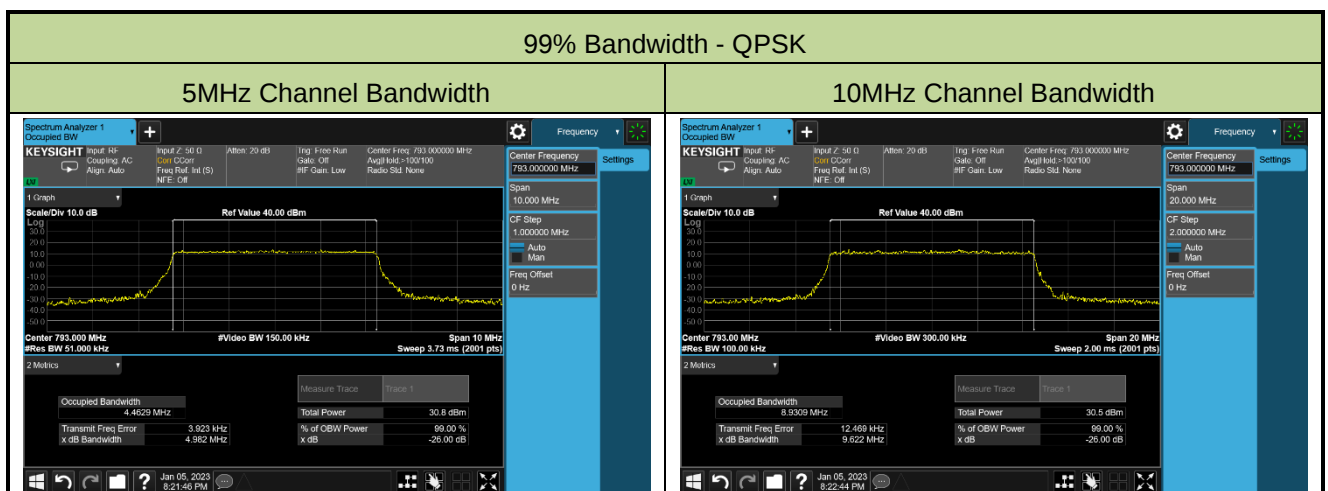
Refer to Appendix A.7.

## Appendix A - Test Result

### A.1 Occupied Bandwidth Test Result

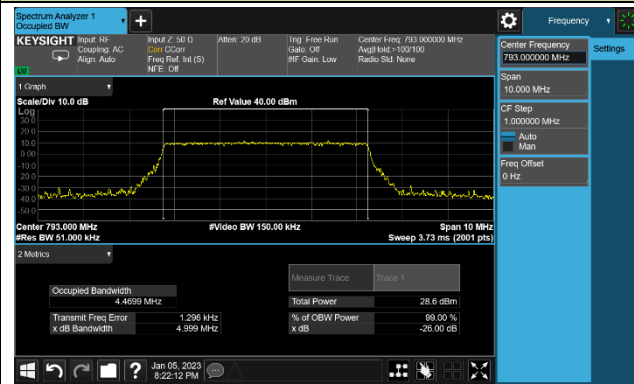
|           |            |               |           |
|-----------|------------|---------------|-----------|
| Test Site | SIP-SR1    | Test Engineer | Allen Zou |
| Test Date | 2023-01-05 | Test Band     | Band 14   |

| Modulation | Frequency (MHz) | Bandwidth (MHz) | 99% Bandwidth (MHz) |
|------------|-----------------|-----------------|---------------------|
| QPSK       | 793.0           | 5               | 4.4629              |
|            |                 | 10              | 8.9309              |
| 16QAM      | 793.0           | 5               | 4.4713              |
|            |                 | 10              | 8.9220              |
| 64QAM      | 793.0           | 5               | 4.4699              |
|            |                 | 10              | 8.9127              |
| 256QAM     | 793.0           | 5               | 4.4678              |
|            |                 | 10              | 8.9226              |

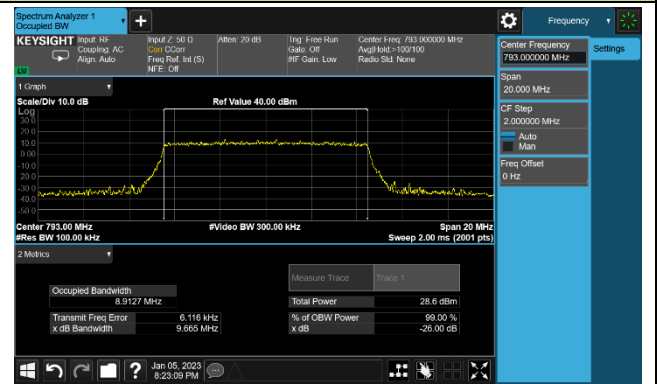


## 99% Bandwidth - 64QAM

## 5MHz Channel Bandwidth

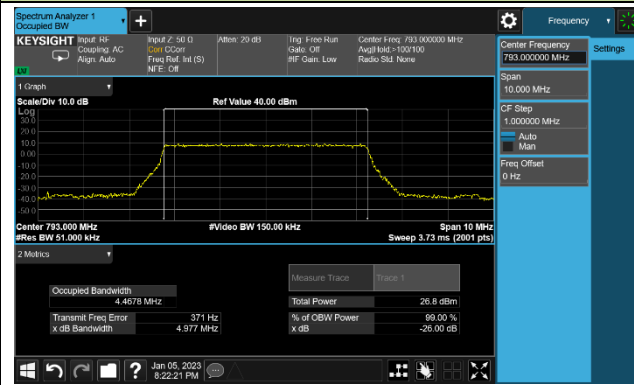


## 10MHz Channel Bandwidth

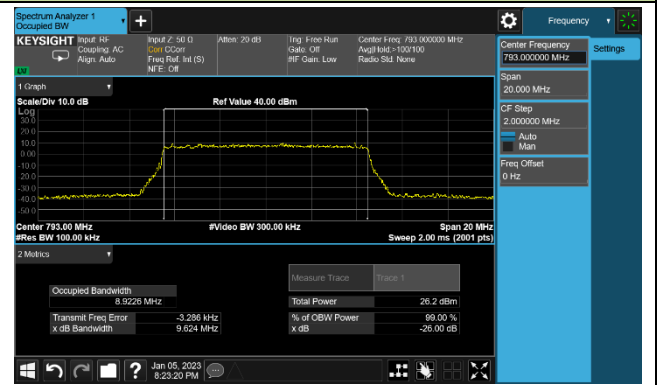


## 99% Bandwidth - 256QAM

## 5MHz Channel Bandwidth



## 10MHz Channel Bandwidth



## A.2 Frequency Stability Test Result

|           |            |               |           |
|-----------|------------|---------------|-----------|
| Test Site | SIP-TR1    | Test Engineer | Allen Zou |
| Test Date | 2023-02-03 | Test Band     | Band 14   |

| Power (Vdc) | Temp. (°C) | Frequency Tolerance (ppm) |
|-------------|------------|---------------------------|
| 3.8         | - 30       | 0.0085                    |
|             | - 20       | 0.0087                    |
|             | - 10       | 0.0088                    |
|             | 0          | 0.0085                    |
|             | + 10       | 0.0097                    |
|             | + 20 (Ref) | 0.0000                    |
|             | + 30       | 0.0018                    |
|             | + 40       | 0.0004                    |
|             | + 50       | 0.0076                    |
| 4.4         | + 20       | 0.0082                    |
| 3.3         | + 20       | 0.0004                    |

### A.3 Equivalent Isotropically Radiated Power Test Result

|           |            |               |           |
|-----------|------------|---------------|-----------|
| Test Site | SIP-SR1    | Test Engineer | Allen Zou |
| Test Date | 2023-01-17 | Test Band     | Band 14   |

| Frequency<br>(MHz)                                                   | Channel<br>Bandwidth<br>(MHz) | RB<br>Size | RB<br>Offset | Output<br>Power<br>(dBm) | ERP<br>(dBm) | Limit<br>(dBm) |
|----------------------------------------------------------------------|-------------------------------|------------|--------------|--------------------------|--------------|----------------|
| QPSK                                                                 |                               |            |              |                          |              |                |
| 790.5                                                                | 5                             | 1          | 0            | 22.60                    | 20.45        | <44.77         |
| 793.0                                                                |                               |            |              | 22.61                    | 20.46        | <44.77         |
| 795.5                                                                |                               |            |              | 22.61                    | 20.46        | <44.77         |
| 790.5                                                                | 5                             | 1          | 12           | 22.64                    | 20.49        | <44.77         |
| 793.0                                                                |                               |            |              | 22.72                    | 20.57        | <44.77         |
| 795.5                                                                |                               |            |              | 22.72                    | 20.57        | <44.77         |
| 790.5                                                                | 5                             | 1          | 24           | 22.59                    | 20.44        | <44.77         |
| 793.0                                                                |                               |            |              | 22.66                    | 20.51        | <44.77         |
| 795.5                                                                |                               |            |              | 22.61                    | 20.46        | <44.77         |
| 790.5                                                                | 5                             | 25         | 0            | 21.67                    | 19.52        | <44.77         |
| 793.0                                                                |                               |            |              | 21.60                    | 19.45        | <44.77         |
| 795.5                                                                |                               |            |              | 21.61                    | 19.46        | <44.77         |
| 793.0                                                                | 10                            | 1          | 0            | 22.59                    | 20.44        | <44.77         |
| 793.0                                                                |                               |            | 24           | 22.66                    | 20.51        | <44.77         |
| 793.0                                                                |                               |            | 49           | 22.56                    | 20.41        | <44.77         |
| 793.0                                                                | 10                            | 50         | 0            | 21.64                    | 19.49        | <44.77         |
| Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15 |                               |            |              |                          |              |                |

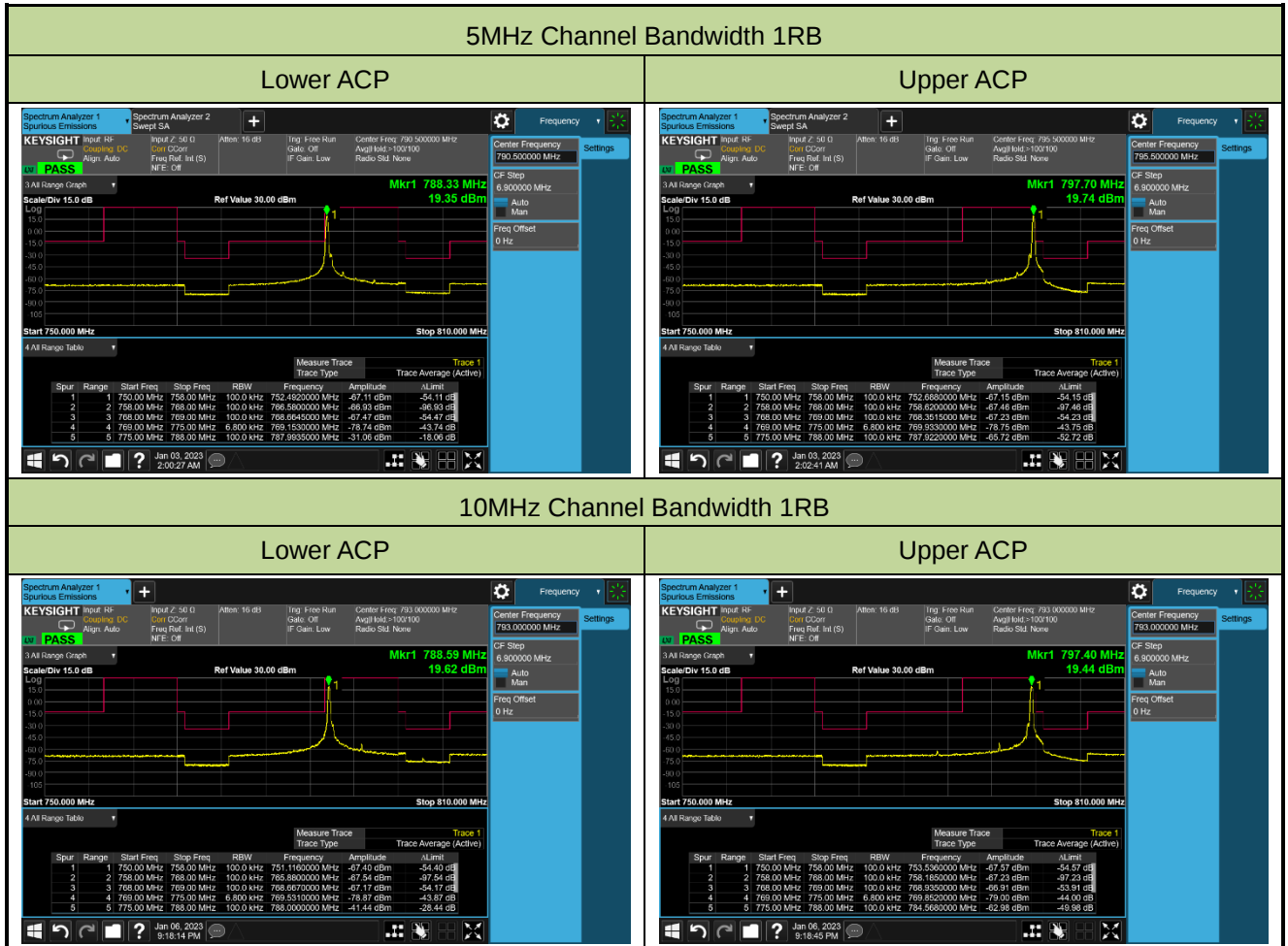
| Frequency<br>(MHz)                                                   | Channel<br>Bandwidth<br>(MHz) | RB<br>Size | RB<br>Offset | Output<br>Power<br>(dBm) | ERP<br>(dBm) | Limit<br>(dBm) |
|----------------------------------------------------------------------|-------------------------------|------------|--------------|--------------------------|--------------|----------------|
| 16QAM                                                                |                               |            |              |                          |              |                |
| 790.5                                                                | 5                             | 1          | 0            | 21.74                    | 19.59        | <44.77         |
| 793.0                                                                |                               |            |              | 21.77                    | 19.62        | <44.77         |
| 795.5                                                                |                               |            |              | 21.86                    | 19.71        | <44.77         |
| 790.5                                                                | 5                             | 1          | 12           | 21.84                    | 19.69        | <44.77         |
| 793.0                                                                |                               |            |              | 21.89                    | 19.74        | <44.77         |
| 795.5                                                                |                               |            |              | 21.87                    | 19.72        | <44.77         |
| 790.5                                                                | 5                             | 1          | 24           | 21.78                    | 19.63        | <44.77         |
| 793.0                                                                |                               |            |              | 21.89                    | 19.74        | <44.77         |
| 795.5                                                                |                               |            |              | 21.74                    | 19.59        | <44.77         |
| 790.5                                                                | 5                             | 25         | 0            | 20.69                    | 18.54        | <44.77         |
| 793.0                                                                |                               |            |              | 20.62                    | 18.47        | <44.77         |
| 795.5                                                                |                               |            |              | 20.64                    | 18.49        | <44.77         |
| 793.0                                                                | 10                            | 1          | 0            | 21.76                    | 19.61        | <44.77         |
| 793.0                                                                |                               |            | 24           | 21.83                    | 19.68        | <44.77         |
| 793.0                                                                |                               |            | 49           | 21.76                    | 19.61        | <44.77         |
| 793.0                                                                | 10                            | 50         | 0            | 20.65                    | 18.50        | <44.77         |
| Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15 |                               |            |              |                          |              |                |

| Frequency<br>(MHz)                                                   | Channel<br>Bandwidth<br>(MHz) | RB<br>Size | RB<br>Offset | Output<br>Power<br>(dBm) | ERP<br>(dBm) | Limit<br>(dBm) |
|----------------------------------------------------------------------|-------------------------------|------------|--------------|--------------------------|--------------|----------------|
| 64QAM                                                                |                               |            |              |                          |              |                |
| 790.5                                                                | 5                             | 1          | 0            | 20.74                    | 18.59        | <44.77         |
| 793.0                                                                |                               |            |              | 20.82                    | 18.67        | <44.77         |
| 795.5                                                                |                               |            |              | 20.74                    | 18.59        | <44.77         |
| 790.5                                                                | 5                             | 1          | 12           | 20.80                    | 18.65        | <44.77         |
| 793.0                                                                |                               |            |              | 20.92                    | 18.77        | <44.77         |
| 795.5                                                                |                               |            |              | 20.74                    | 18.59        | <44.77         |
| 790.5                                                                | 5                             | 1          | 24           | 20.78                    | 18.63        | <44.77         |
| 793.0                                                                |                               |            |              | 20.76                    | 18.61        | <44.77         |
| 795.5                                                                |                               |            |              | 20.82                    | 18.67        | <44.77         |
| 790.5                                                                | 5                             | 25         | 0            | 19.70                    | 17.55        | <44.77         |
| 793.0                                                                |                               |            |              | 19.61                    | 17.46        | <44.77         |
| 795.5                                                                |                               |            |              | 19.59                    | 17.44        | <44.77         |
| 793.0                                                                | 10                            | 1          | 0            | 20.81                    | 18.66        | <44.77         |
| 793.0                                                                |                               |            | 24           | 20.77                    | 18.62        | <44.77         |
| 793.0                                                                |                               |            | 49           | 20.71                    | 18.56        | <44.77         |
| 793.0                                                                | 10                            | 50         | 0            | 19.65                    | 17.50        | <44.77         |
| Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15 |                               |            |              |                          |              |                |

| Frequency<br>(MHz)                                                   | Channel<br>Bandwidth<br>(MHz) | RB<br>Size | RB<br>Offset | Output<br>Power<br>(dBm) | ERP<br>(dBm) | Limit<br>(dBm) |
|----------------------------------------------------------------------|-------------------------------|------------|--------------|--------------------------|--------------|----------------|
| 256QAM                                                               |                               |            |              |                          |              |                |
| 790.5                                                                | 5                             | 1          | 0            | 17.60                    | 15.45        | <44.77         |
| 793.0                                                                |                               |            |              | 17.68                    | 15.53        | <44.77         |
| 795.5                                                                |                               |            |              | 17.80                    | 15.65        | <44.77         |
| 790.5                                                                | 5                             | 1          | 12           | 17.81                    | 15.66        | <44.77         |
| 793.0                                                                |                               |            |              | 17.82                    | 15.67        | <44.77         |
| 795.5                                                                |                               |            |              | 17.87                    | 15.72        | <44.77         |
| 790.5                                                                | 5                             | 1          | 24           | 17.79                    | 15.64        | <44.77         |
| 793.0                                                                |                               |            |              | 17.78                    | 15.63        | <44.77         |
| 795.5                                                                |                               |            |              | 17.65                    | 15.50        | <44.77         |
| 790.5                                                                | 5                             | 25         | 0            | 17.65                    | 15.50        | <44.77         |
| 793.0                                                                |                               |            |              | 17.61                    | 15.46        | <44.77         |
| 795.5                                                                |                               |            |              | 17.60                    | 15.45        | <44.77         |
| 793.0                                                                | 10                            | 1          | 0            | 17.77                    | 15.62        | <44.77         |
| 793.0                                                                |                               |            | 24           | 17.84                    | 15.69        | <44.77         |
| 793.0                                                                |                               |            | 49           | 17.81                    | 15.66        | <44.77         |
| 793.0                                                                | 10                            | 50         | 0            | 17.60                    | 15.45        | <44.77         |
| Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15 |                               |            |              |                          |              |                |

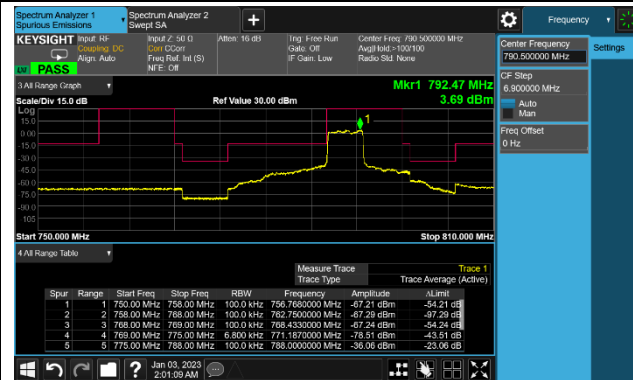
#### A.4 Band Edge Test Result

|           |                       |               |           |
|-----------|-----------------------|---------------|-----------|
| Test Site | SIP-SR1               | Test Engineer | Allen Zou |
| Test Date | 2023-01-03~2023-01-06 | Test Band     | Band 14   |

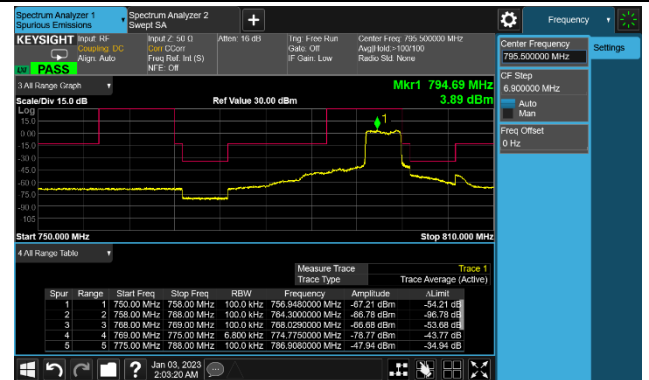


## 5MHz Channel Bandwidth Full RB

## Lower ACP

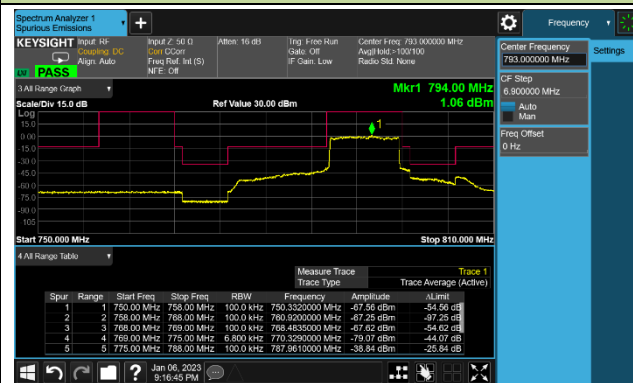


## Upper ACP

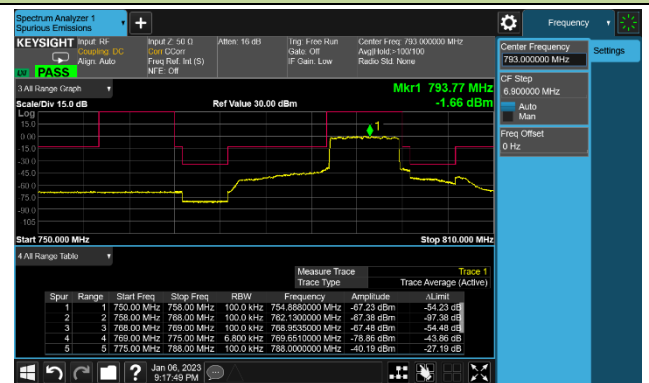


## 10MHz Channel Bandwidth Full RB

## Lower ACP



## Upper ACP



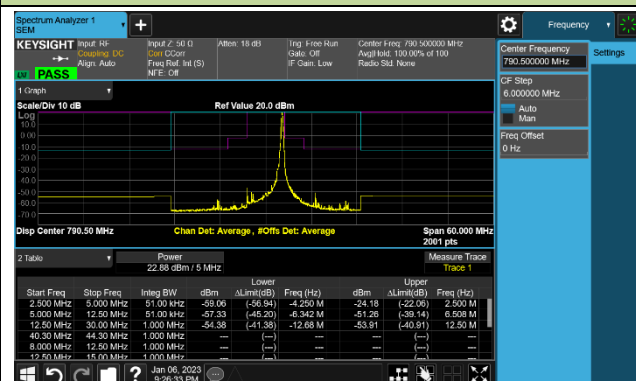
### A.5 Emission Mask Test Result

|           |            |               |           |
|-----------|------------|---------------|-----------|
| Test Site | SIP-SR1    | Test Engineer | Allen Zou |
| Test Date | 2023-01-06 | Test Band     | Band 14   |

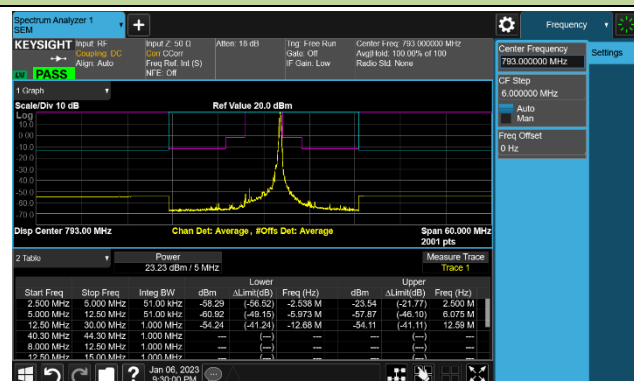


## 5MHz Channel Bandwidth 1RB@24

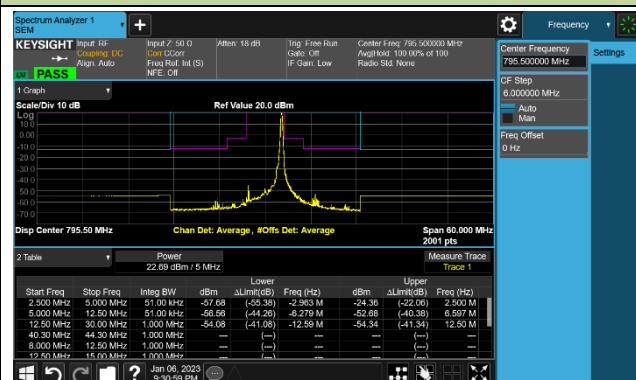
## Low Channel



## Middle Channel

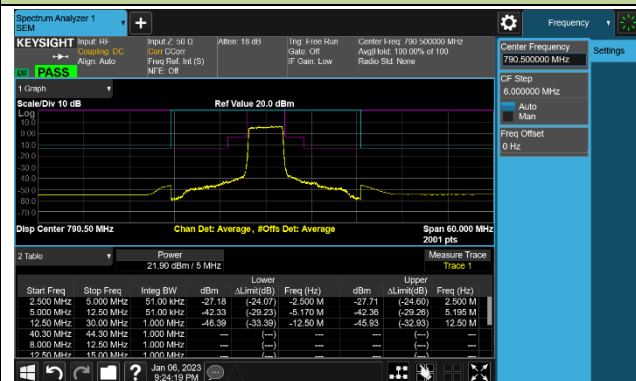


## High Channel

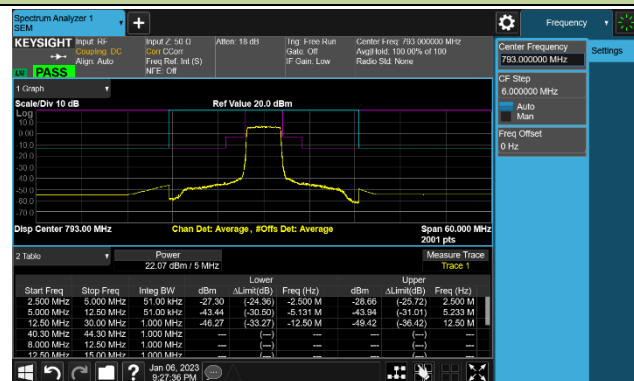


## 5MHz Channel Bandwidth Full RB

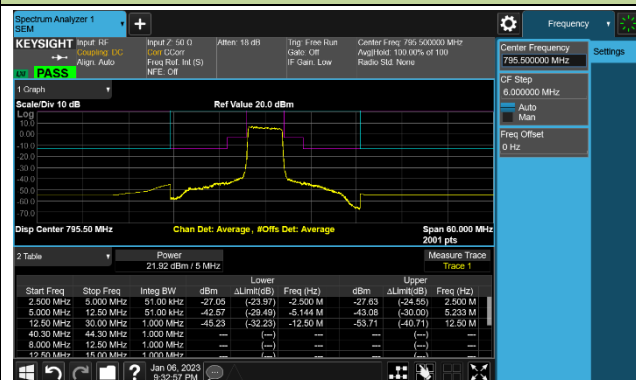
## Low Channel



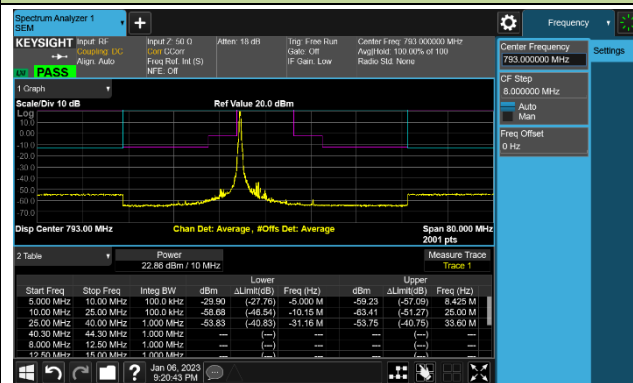
## Middle Channel



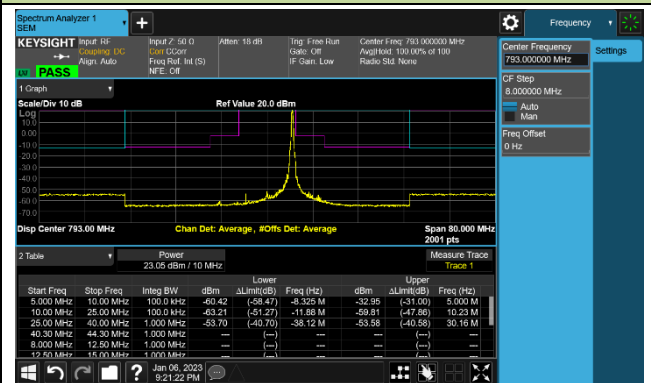
## High Channel



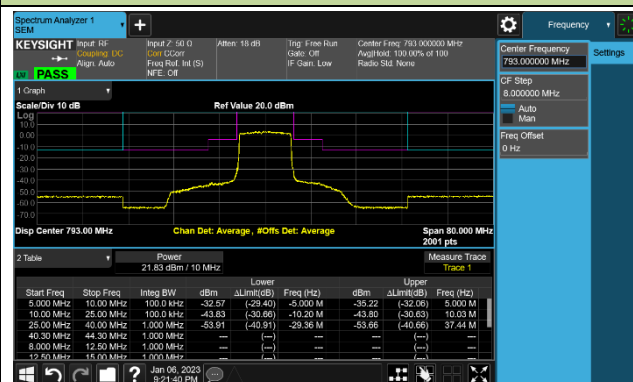
### 10MHz Channel Bandwidth 1RB@0



### 10MHz Channel Bandwidth 1RB@49



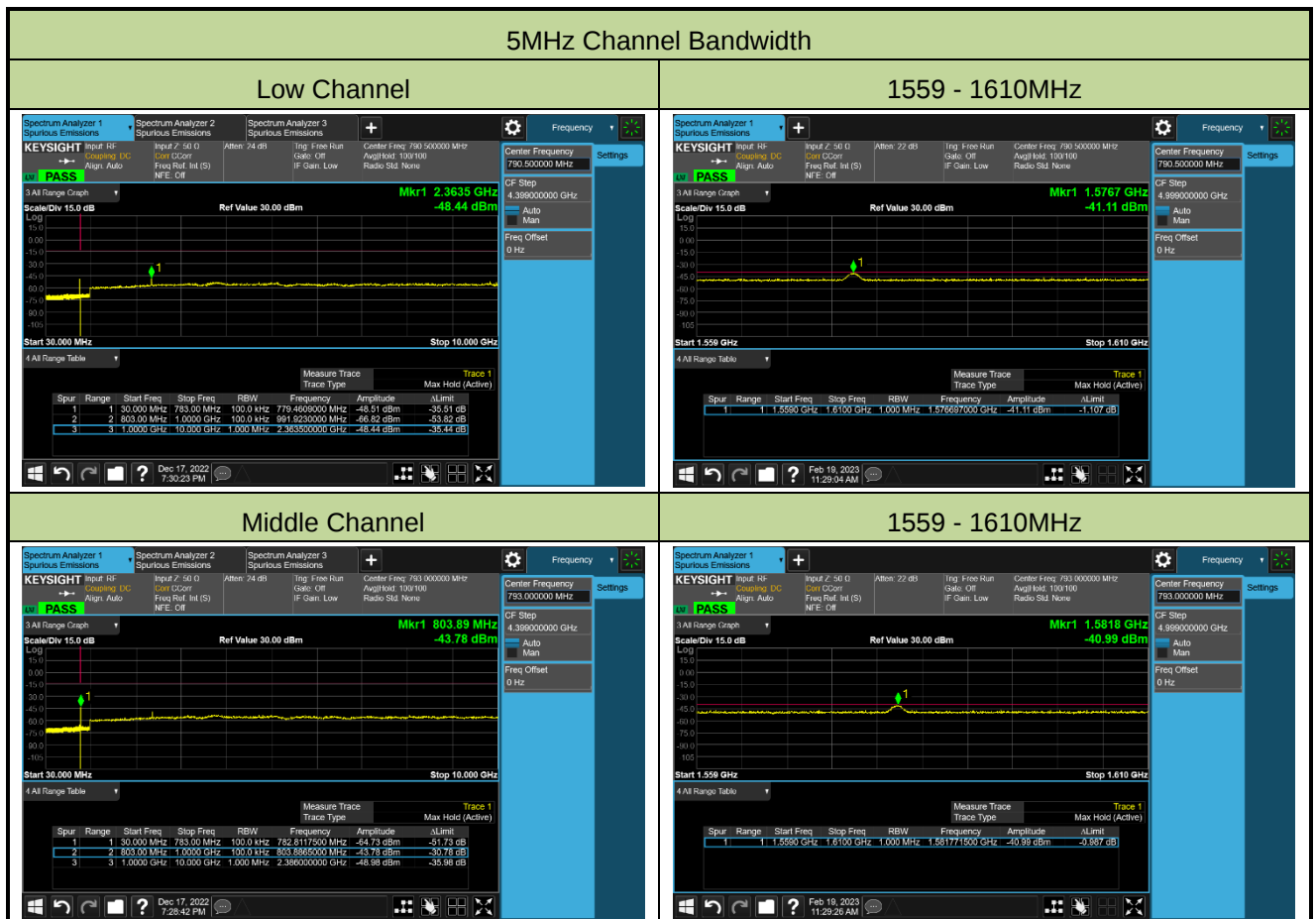
### 10MHz Channel Bandwidth Full RB

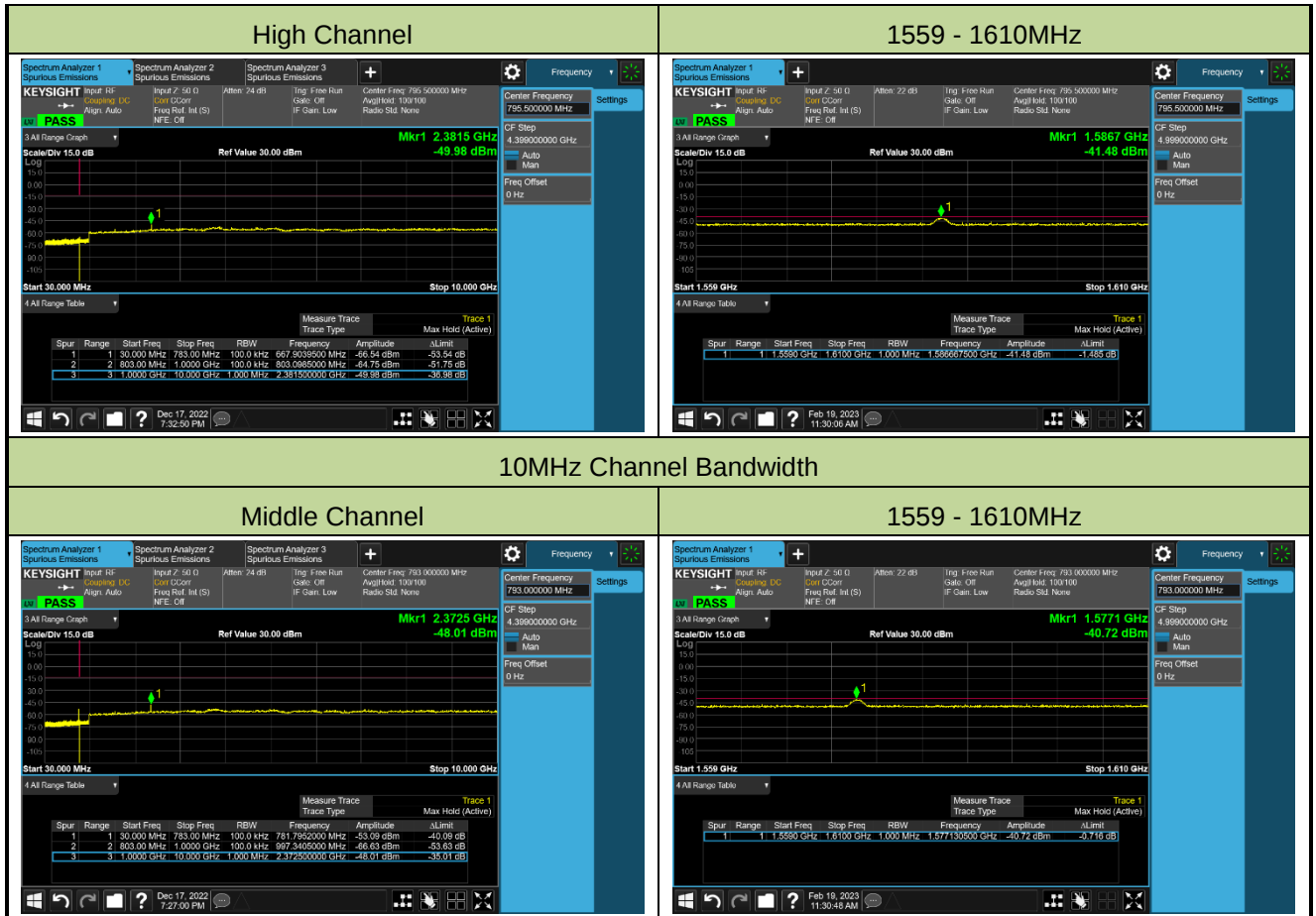


## A.6 Conducted Supurious Emissions Test Result

|           |                         |               |                    |
|-----------|-------------------------|---------------|--------------------|
| Test Site | SIP-SR1                 | Test Engineer | Candy Luo          |
| Test Date | 2022-12-17 ~ 2023-02-19 | Test Band     | Band 14, 1RB, QPSK |

| Frequency (MHz) | Channel Bandwidth (MHz) | Frequency Range (MHz) | Max Spurious Emissions (dBm) | Limit (dBm)   | Result |
|-----------------|-------------------------|-----------------------|------------------------------|---------------|--------|
| 790.5           | 5                       | 30 ~ 10000            | -48.44                       | $\leq -13.00$ | Pass   |
| 793.0           | 5                       | 30 ~ 10000            | -43.78                       | $\leq -13.00$ | Pass   |
| 795.5           | 5                       | 30 ~ 10000            | -49.98                       | $\leq -13.00$ | Pass   |
| 793.0           | 10                      | 30 ~ 10000            | -48.01                       | $\leq -13.00$ | Pass   |
| 790.5           | 5                       | 1559 ~ 1610           | -41.11                       | $\leq -40.00$ | Pass   |
| 793.0           | 5                       | 1559 ~ 1610           | -40.99                       | $\leq -40.00$ | Pass   |
| 795.5           | 5                       | 1559 ~ 1610           | -41.48                       | $\leq -40.00$ | Pass   |
| 793.0           | 10                      | 1559 ~ 1610           | -40.72                       | $\leq -40.00$ | Pass   |





### A.7 Radiated Spurious Emissions Test Result

|           |                       |               |                        |
|-----------|-----------------------|---------------|------------------------|
| Test Site | SIP-AC2               | Test Engineer | Barry Wu & Mero Zhou   |
| Test Date | 2022-12-22~2022-12-23 | Test Band     | LTE Band 14, 1RB, QPSK |

| Frequency<br>(MHz) | Reading Level<br>(dBμV) | Factor<br>(dB/m) | Measure Level<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) | Detector | Polarization |
|--------------------|-------------------------|------------------|---------------------------|-------------------|----------------|----------|--------------|
| Low Channel        |                         |                  |                           |                   |                |          |              |
| 47.5               | 13.5                    | 18.3             | 31.8                      | 82.3              | -50.5          | Peak     | Horizontal   |
| 630.9              | 15.8                    | 26.4             | 42.2                      | 82.3              | -40.1          | Peak     | Horizontal   |
| 47.0               | 15.2                    | 18.3             | 33.5                      | 82.3              | -48.8          | Peak     | Vertical     |
| 624.6              | 16.1                    | 26.3             | 42.4                      | 82.3              | -39.9          | Peak     | Vertical     |
| 1576.0             | 51.1                    | -16.1            | 35.0                      | 55.3              | -20.3          | Peak     | Horizontal   |
| 2460.0             | 51.9                    | -12.2            | 39.7                      | 82.3              | -42.6          | Peak     | Horizontal   |
| 1576.0             | 54.3                    | -16.1            | 38.2                      | 55.3              | -17.1          | Peak     | Vertical     |
| 2460.0             | 55.8                    | -12.2            | 43.6                      | 82.3              | -38.7          | Peak     | Vertical     |
| Middle Channel     |                         |                  |                           |                   |                |          |              |
| 59.6               | 13.7                    | 18.0             | 31.7                      | 82.3              | -50.6          | Peak     | Horizontal   |
| 475.7              | 15.6                    | 23.1             | 38.7                      | 82.3              | -43.6          | Peak     | Horizontal   |
| 58.1               | 15.7                    | 18.1             | 33.8                      | 82.3              | -48.5          | Peak     | Vertical     |
| 612.5              | 14.6                    | 26.3             | 40.9                      | 82.3              | -41.4          | Peak     | Vertical     |
| 1580.0             | 51.4                    | -16.1            | 35.3                      | 55.3              | -20.0          | Peak     | Horizontal   |
| 3636.0             | 47.4                    | -6.7             | 40.7                      | 82.3              | -41.6          | Peak     | Horizontal   |
| 1580.0             | 55.7                    | -16.1            | 39.6                      | 55.3              | -15.7          | Peak     | Vertical     |
| 2460.0             | 55.7                    | -12.2            | 43.5                      | 82.3              | -38.8          | Peak     | Vertical     |
| High Channel       |                         |                  |                           |                   |                |          |              |
| 49.9               | 14.6                    | 18.4             | 33.0                      | 82.3              | -49.3          | Peak     | Horizontal   |
| 592.6              | 15.5                    | 25.7             | 41.2                      | 82.3              | -41.1          | Peak     | Horizontal   |
| 155.6              | 14.6                    | 18.1             | 32.7                      | 82.3              | -49.6          | Peak     | Vertical     |
| 670.7              | 16.1                    | 26.3             | 42.4                      | 82.3              | -39.9          | Peak     | Vertical     |
| 1596.0             | 51.2                    | -16.2            | 35.0                      | 55.3              | -20.3          | Peak     | Horizontal   |
| 2460.0             | 52.6                    | -12.2            | 40.4                      | 82.3              | -41.9          | Peak     | Horizontal   |
| 1596.0             | 56.1                    | -16.2            | 39.9                      | 55.3              | -15.4          | Peak     | Vertical     |
| 2464.0             | 56.0                    | -12.2            | 43.8                      | 82.3              | -38.5          | Peak     | Vertical     |

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

## **Appendix B - Test Setup Photograph**

Refer to “2211RSU034-UT” file.

## **Appendix C - EUT Photograph**

Refer to “2211RSU034-UE” file.