

# TEST REPORT

## CERTIFICATE OF CONFORMITY

**Standard:** 47 CFR FCC Part 22  
47 CFR FCC Part 24  
47 CFR FCC Part 27  
47 CFR FCC Part 2

**Report No.:** RFBDWM-WTW-P24050507-2

**FCC ID:** 2AUWW-HALOWA2

**Product:** Halo Collar 4

**Brand:** Halo

**Model No.:** Halo 4

**Received Date:** 2024/5/26

**Test Date:** 2024/7/2 ~ 2024/7/26

**Issued Date:** 2024/8/20

**Applicant:** Protecct Animals with Satellites, LLC

**Address:** 5465 Legacy Dr., Suite 650, Plano, Texas 75024, United States

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Lin Kou Laboratories

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

**Test Location:** (1) No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kewi Shan Dist., Taoyuan City 33383, Taiwan  
(2) No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan

**FCC Registration /** (1) 788550 / TW0003

**Designation Number:** (2) 281270 / TW0032

**Approved by:**

Jeremy Lin

**Date:**

2024/8/20

Jeremy Lin / Project Engineer

This test report consists of 221 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The test results in the report only apply to the tested sample. The test results in this report are traceable to the national or international standards.

Prepared by : Vera Huang / Specialist



This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

## Table of Contents

|                                                                                |           |
|--------------------------------------------------------------------------------|-----------|
| <b>Release Control Record .....</b>                                            | <b>4</b>  |
| <b>1 Certificate.....</b>                                                      | <b>5</b>  |
| <b>2 Summary of Test Results .....</b>                                         | <b>6</b>  |
| 2.1 Measurement Uncertainty .....                                              | 7         |
| 2.2 Supplementary Information .....                                            | 7         |
| <b>3 General Information .....</b>                                             | <b>8</b>  |
| 3.1 General Description of EUT .....                                           | 8         |
| 3.2 Antenna Description of EUT .....                                           | 10        |
| 3.3 Test Mode Applicability and Tested Channel Detail.....                     | 10        |
| 3.4 Test Program Used and Operation Descriptions .....                         | 21        |
| 3.5 Connection Diagram of EUT and Peripheral Devices .....                     | 21        |
| 3.6 Configuration of Peripheral Devices and Cable Connections .....            | 21        |
| <b>4 Test Instruments .....</b>                                                | <b>22</b> |
| 4.1 Effective Radiated Power and Equivalent Isotropically Radiated Power ..... | 22        |
| 4.2 Modulation Characteristics .....                                           | 22        |
| 4.3 Peak to Average Ratio .....                                                | 22        |
| 4.4 Bandwidth.....                                                             | 22        |
| 4.5 Conducted Spurious Emissions .....                                         | 22        |
| 4.6 Radiated Spurious Emissions below 1GHz.....                                | 23        |
| 4.7 Radiated Spurious Emissions above 1GHz .....                               | 24        |
| 4.8 Frequency Stability .....                                                  | 25        |
| <b>5 Limits of Test Items.....</b>                                             | <b>26</b> |
| 5.1 Effective Radiated Power and Equivalent Isotropically Radiated Power ..... | 26        |
| 5.2 Modulation Characteristics .....                                           | 26        |
| 5.3 Peak to Average Ratio .....                                                | 26        |
| 5.4 Bandwidth.....                                                             | 26        |
| 5.5 Conducted Spurious Emissions .....                                         | 27        |
| 5.6 Radiated Spurious Emissions below 1GHz.....                                | 28        |
| 5.7 Radiated Spurious Emissions above 1GHz .....                               | 28        |
| 5.8 Frequency Stability .....                                                  | 28        |
| <b>6 Test Arrangements.....</b>                                                | <b>29</b> |
| 6.1 Effective Radiated Power and Equivalent Isotropically Radiated Power ..... | 29        |
| 6.1.1 Test Setup .....                                                         | 29        |
| 6.1.2 Test Procedure .....                                                     | 29        |
| 6.2 Modulation Characteristics .....                                           | 30        |
| 6.2.1 Test Setup .....                                                         | 30        |
| 6.2.2 Test Procedure .....                                                     | 30        |
| 6.3 Peak to Average Ratio .....                                                | 30        |
| 6.3.1 Test Setup .....                                                         | 30        |
| 6.3.2 Test Procedure .....                                                     | 30        |
| 6.4 Bandwidth.....                                                             | 31        |
| 6.4.1 Test Setup .....                                                         | 31        |
| 6.4.2 Test Procedure .....                                                     | 31        |
| 6.5 Conducted Spurious Emissions .....                                         | 33        |
| 6.5.1 Test Setup .....                                                         | 33        |
| 6.5.2 Test Procedure .....                                                     | 33        |
| 6.6 Radiated Spurious Emissions below 1GHz.....                                | 34        |
| 6.6.1 Test Setup .....                                                         | 34        |
| 6.6.2 Test Procedure .....                                                     | 34        |
| 6.7 Radiated Spurious Emissions above 1GHz .....                               | 35        |
| 6.7.1 Test Setup .....                                                         | 35        |
| 6.7.2 Test Procedure .....                                                     | 35        |
| 6.8 Frequency Stability .....                                                  | 36        |
| 6.8.1 Test Setup .....                                                         | 36        |

|          |                                                                            |            |
|----------|----------------------------------------------------------------------------|------------|
| 6.8.2    | Test Procedure .....                                                       | 36         |
| <b>7</b> | <b>Test Results of Test Item .....</b>                                     | <b>37</b>  |
| 7.1      | Effective Radiated Power and Equivalent Isotropically Radiated Power ..... | 37         |
| 7.1.1    | Cat-M1 Band 2 .....                                                        | 37         |
| 7.1.2    | Cat-M1 Band 4 .....                                                        | 43         |
| 7.1.3    | Cat-M1 Band 5 .....                                                        | 49         |
| 7.1.4    | Cat-M1 Band 12 .....                                                       | 53         |
| 7.1.5    | Cat-M1 Band 13 .....                                                       | 57         |
| 7.2      | Modulation Characteristics .....                                           | 59         |
| 7.2.1    | Cat-M1 Band 2 .....                                                        | 59         |
| 7.2.2    | Cat-M1 Band 4 .....                                                        | 59         |
| 7.2.3    | Cat-M1 Band 5 .....                                                        | 60         |
| 7.2.4    | Cat-M1 Band 12 .....                                                       | 60         |
| 7.2.5    | Cat-M1 Band 13 .....                                                       | 60         |
| 7.3      | Peak to Average Ratio .....                                                | 61         |
| 7.3.1    | Cat-M1 Band 2 .....                                                        | 61         |
| 7.3.2    | Cat-M1 Band 4 .....                                                        | 67         |
| 7.3.3    | Cat-M1 Band 5 .....                                                        | 73         |
| 7.3.4    | Cat-M1 Band 12 .....                                                       | 77         |
| 7.3.5    | Cat-M1 Band 13 .....                                                       | 81         |
| 7.4      | Bandwidth .....                                                            | 83         |
| 7.4.1    | Cat-M1 Band 2 .....                                                        | 83         |
| 7.4.2    | Cat-M1 Band 4 .....                                                        | 89         |
| 7.4.3    | Cat-M1 Band 5 .....                                                        | 95         |
| 7.4.4    | Cat-M1 Band 12 .....                                                       | 99         |
| 7.4.5    | Cat-M1 Band 13 .....                                                       | 103        |
| 7.5      | Conducted Spurious Emissions .....                                         | 105        |
| 7.5.1    | Cat-M1 Band 2 .....                                                        | 105        |
| 7.5.2    | Cat-M1 Band 4 .....                                                        | 117        |
| 7.5.3    | Cat-M1 Band 5 .....                                                        | 129        |
| 7.5.4    | Cat-M1 Band 12 .....                                                       | 137        |
| 7.5.5    | Cat-M1 Band 13 .....                                                       | 145        |
| 7.6      | Radiated Spurious Emissions below 1GHz .....                               | 148        |
| 7.6.1    | Cat-M1 Band 2 .....                                                        | 148        |
| 7.6.2    | Cat-M1 Band 4 .....                                                        | 150        |
| 7.6.3    | Cat-M1 Band 5 .....                                                        | 152        |
| 7.6.4    | Cat-M1 Band 12 .....                                                       | 154        |
| 7.6.5    | Cat-M1 Band 13 .....                                                       | 156        |
| 7.7      | Radiated Spurious Emissions above 1GHz .....                               | 158        |
| 7.7.1    | Cat-M1 Band 2 .....                                                        | 158        |
| 7.7.2    | Cat-M1 Band 4 .....                                                        | 167        |
| 7.7.3    | Cat-M1 Band 5 .....                                                        | 176        |
| 7.7.4    | Cat-M1 Band 12 .....                                                       | 185        |
| 7.7.5    | Cat-M1 Band 13 .....                                                       | 194        |
| 7.8      | Frequency Stability .....                                                  | 198        |
| 7.8.1    | Cat-M1 Band 2 .....                                                        | 198        |
| 7.8.2    | Cat-M1 Band 4 .....                                                        | 204        |
| 7.8.3    | Cat-M1 Band 5 .....                                                        | 210        |
| 7.8.4    | Cat-M1 Band 12 .....                                                       | 214        |
| 7.8.5    | Cat-M1 Band 13 .....                                                       | 218        |
| <b>8</b> | <b>Pictures of Test Arrangements .....</b>                                 | <b>220</b> |
| <b>9</b> | <b>Information of the Testing Laboratories .....</b>                       | <b>221</b> |

## Release Control Record

| Issue No.              | Description      | Date Issued |
|------------------------|------------------|-------------|
| RFBDWM-WTW-P24050507-2 | Original Release | 2024/8/20   |

## 1 Certificate

**Product:** Halo Collar 4

**Brand:** Halo

**Test Model:** Halo 4

**Sample Status:** Engineering sample

**Applicant:** Protecct Animals with Satellites, LLC

**Test Date:** 2024/7/2 ~ 2024/7/26

**Standard:** 47 CFR FCC Part 22  
47 CFR FCC Part 24  
47 CFR FCC Part 27  
47 CFR FCC Part 2

**Measurement** ANSI/TIA/EIA-603-E 2016

**procedure:** ANSI C63.26-2015

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 971168 D02 Misc Rev Approv License Devices v02r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

## 2 Summary of Test Results

| 47 CFR FCC Part 22<br>47 CFR FCC Part 24<br>47 CFR FCC Part 27<br>47 CFR FCC Part 2                                                                                    |                                                                      |        |                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------|---------------------------------------------------|
| Standard / Clause                                                                                                                                                      | Test Item                                                            | Result | Remark                                            |
| FCC 47 CFR Part 2.1046<br>FCC 47 CFR Part 22.913 (a)<br>FCC 47 CFR Part 24.232 (c)<br>FCC 47 CFR Part 27.50(d)<br>FCC 47 CFR Part 27.50(c)<br>FCC 47 CFR Part 27.50(b) | Effective Radiated Power and Equivalent Isotropically Radiated Power | Pass   | Meet the requirement of limit.                    |
| FCC 47 CFR Part 2.1047                                                                                                                                                 | Modulation Characteristics                                           | Pass   | Meet the requirement of limit.                    |
| FCC 47 CFR Part 22.913 (d)<br>FCC 47 CFR Part 24.232 (d)<br>FCC 47 CFR Part 27.50(d)                                                                                   | Peak to Average Ratio                                                | Pass   | Meet the requirement of limit.                    |
| FCC 47 CFR Part 2.1049                                                                                                                                                 | Bandwidth                                                            | Pass   | Meet the requirement of limit.                    |
| FCC 47 CFR Part 2.1051<br>FCC 47 CFR Part 22.917<br>FCC 47 CFR Part 24.238<br>FCC 47 CFR Part 27.53(h)<br>FCC 47 CFR Part 27.53(g)<br>FCC 47 CFR Part 27.53(c)(f)      | Conducted Spurious Emissions                                         | Pass   | Meet the requirement of limit.                    |
| FCC 47 CFR Part 2.1053<br>FCC 47 CFR Part 22.917<br>FCC 47 CFR Part 24.238<br>FCC 47 CFR Part 27.53(h)<br>FCC 47 CFR Part 27.53(g)<br>FCC 47 CFR Part 27.53(c)(f)      | Radiated Spurious Emissions below 1GHz                               | Pass   | Minimum passing margin is -44.10 dB at 450.98 MHz |

47 CFR FCC Part 22  
47 CFR FCC Part 24  
47 CFR FCC Part 27  
47 CFR FCC Part 2

| Standard / Clause                                                                                                                                                 | Test Item                              | Result | Remark                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------|----------------------------------------------------|
| FCC 47 CFR Part 2.1053<br>FCC 47 CFR Part 22.917<br>FCC 47 CFR Part 24.238<br>FCC 47 CFR Part 27.53(h)<br>FCC 47 CFR Part 27.53(g)<br>FCC 47 CFR Part 27.53(c)(f) | Radiated Spurious Emissions above 1GHz | Pass   | Minimum passing margin is -15.90 dB at 1569.00 MHz |
| FCC 47 CFR Part 2.1055<br>FCC 47 CFR Part 22.355<br>FCC 47 CFR Part 24.235<br>FCC 47 CFR Part 27.54                                                               | Frequency Stability                    | Pass   | Meet the requirement of limit.                     |

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

## 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement                            | Specification   | Expanded Uncertainty (k=2)<br>(±) |
|----------------------------------------|-----------------|-----------------------------------|
| Radiated Spurious Emissions below 1GHz | 9 kHz ~ 30 MHz  | 3 dB                              |
|                                        | 30 MHz ~ 1 GHz  | 2.93 dB                           |
| Radiated Spurious Emissions above 1GHz | 1 GHz ~ 18 GHz  | 1.76 dB                           |
|                                        | 18 GHz ~ 40 GHz | 1.77 dB                           |

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

## 2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                     |                    |
|---------------------|--------------------|
| Product             | Halo Collar 4      |
| Brand               | Halo               |
| Test Model          | Halo 4             |
| Status of EUT       | Engineering sample |
| Power Supply Rating | 5 Vdc from adapter |

Note:

1. The following modules can be configured in the EUT.

| Item             | Brand        | Model     | Specification |
|------------------|--------------|-----------|---------------|
| WWAN module      | Quectel      | BG770A-GL | Cat-M1        |
| BT + WiFi module | Silicon labs | RS9116W   | b/g/n+BT LE   |
| BT module        | Nordic       | NRF52840  | BT LE         |

2. EUT Overview

| Band / Bandwidth                         | TX Frequency Range (MHz) | Max. EIRP Power        |                        | Emission Designator |         |
|------------------------------------------|--------------------------|------------------------|------------------------|---------------------|---------|
|                                          |                          | QPSK                   | 16QAM                  | QPSK                | 16QAM   |
| Cat-M1 Band 2 (Channel Bandwidth 1.4MHz) | 1850.7-1909.3            | 23.281mW<br>(13.67dBm) | 25.061mW<br>(13.99dBm) | 1M08G7D             | 1M07D7W |
| Cat-M1 Band 2 (Channel Bandwidth 3MHz)   | 1851.5-1908.5            | 23.014mW<br>(13.62dBm) | 25.177mW<br>(14.01dBm) | 1M08G7D             | 1M07D7W |
| Cat-M1 Band 2 (Channel Bandwidth 5MHz)   | 1852.5-1907.5            | 23.174mW<br>(13.65dBm) | 25.293mW<br>(14.03dBm) | 1M07G7D             | 1M08D7W |
| Cat-M1 Band 2 (Channel Bandwidth 10MHz)  | 1855.0-1905.0            | 23.335mW<br>(13.68dBm) | 25.293mW<br>(14.03dBm) | 1M07G7D             | 1M08D7W |
| Cat-M1 Band 2 (Channel Bandwidth 15MHz)  | 1857.5-1902.5            | 23.335mW<br>(13.68dBm) | 25.177mW<br>(14.01dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 2 (Channel Bandwidth 20MHz)  | 1860.0-1900.0            | 23.281mW<br>(13.67dBm) | 25.235mW<br>(14.02dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 4 (Channel Bandwidth 1.4MHz) | 1710.7-1754.3            | 19.011mW<br>(12.79dBm) | 19.907mW<br>(12.99dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 4 (Channel Bandwidth 3MHz)   | 1711.5-1753.5            | 19.187mW<br>(12.83dBm) | 19.953mW<br>(13.00dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 4 (Channel Bandwidth 5MHz)   | 1712.5-1752.5            | 19.143mW<br>(12.82dBm) | 19.861mW<br>(12.98dBm) | 1M08G7D             | 1M08D7W |
| Cat-M1 Band 4 (Channel Bandwidth 10MHz)  | 1715.0-1750.0            | 19.187mW<br>(12.83dBm) | 19.679mW<br>(12.94dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 4 (Channel Bandwidth 15MHz)  | 1717.5-1747.5            | 19.187mW<br>(12.83dBm) | 19.953mW<br>(13.00dBm) | 1M08G7D             | 1M07D7W |
| Cat-M1 Band 4 (Channel Bandwidth 20MHz)  | 1720.0-1745.0            | 18.967mW<br>(12.78dBm) | 19.999mW<br>(13.01dBm) | 1M07G7D             | 1M08D7W |

| Band / Bandwidth                          | TX Frequency Range (MHz) | Max. ERP Power         |                        | Emission Designator |         |
|-------------------------------------------|--------------------------|------------------------|------------------------|---------------------|---------|
|                                           |                          | QPSK                   | 16QAM                  | QPSK                | 16QAM   |
| Cat-M1 Band 5 (Channel Bandwidth 1.4MHz)  | 824.7-848.3              | 16.866mW<br>(12.27dBm) | 18.281mW<br>(12.62dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 5 (Channel Bandwidth 3MHz)    | 825.5-847.5              | 16.558mW<br>(12.19dBm) | 17.947mW<br>(12.54dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 5 (Channel Bandwidth 5MHz)    | 826.5-846.5              | 16.827mW<br>(12.26dBm) | 18.239mW<br>(12.61dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 5 (Channel Bandwidth 10MHz)   | 829.0-844.0              | 16.482mW<br>(12.17dBm) | 18.155mW<br>(12.59dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 12 (Channel Bandwidth 1.4MHz) | 699.7-715.3              | 43.853mW<br>(16.42dBm) | 39.355mW<br>(15.95dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 12 (Channel Bandwidth 3MHz)   | 700.5-714.5              | 43.853mW<br>(16.42dBm) | 39.446mW<br>(15.96dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 12 (Channel Bandwidth 5MHz)   | 701.5-713.5              | 43.853mW<br>(16.42dBm) | 39.355mW<br>(15.95dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 12 (Channel Bandwidth 10MHz)  | 704.0-711.0              | 43.752mW<br>(16.41dBm) | 38.905mW<br>(15.90dBm) | 1M07G7D             | 1M07D7W |
| Cat-M1 Band 13 (Channel Bandwidth 5MHz)   | 779.5-784.5              | 30.061mW<br>(14.78dBm) | 32.810mW<br>(15.16dBm) | 1M07G7D             | 1M08D7W |
| Cat-M1 Band 13 (Channel Bandwidth 10MHz)  | 782.0                    | 30.130mW<br>(14.79dBm) | 32.810mW<br>(15.16dBm) | 1M07G7D             | 1M07D7W |

3. The EUT uses following accessories.

|               |             |                     |
|---------------|-------------|---------------------|
| Charging dock | Brand       | VSO                 |
|               | Model       | N-841-079-05000002  |
| Type C cable  | Brand       | VSO                 |
|               | Model       | N801-000-00025635   |
|               | Signal Line | 1.2M with shielding |

4. WWAN, WLAN, BT function cannot transmission at the same time.

5. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

### 3.2 Antenna Description of EUT

1. The antenna information is listed as below.

| RF Chain No. | Frequency Band | Antenna Net Gain (dBi) | Antenna Type | Connector Type |
|--------------|----------------|------------------------|--------------|----------------|
| LTE0         | Cat-M1 Band 2  | -8.5                   | PCB          | pogo pin       |
| LTE1         | Cat-M1 Band 4  | -7.6                   | PCB          | pogo pin       |
| LTE2         | Cat-M1 Band 5  | -8.8                   | PCB          | pogo pin       |
| LTE3         | Cat-M1 Band 12 | -5.2                   | PCB          | pogo pin       |
| LTE4         | Cat-M1 Band 13 | -4.6                   | PCB          | pogo pin       |

\* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

### 3.3 Test Mode Applicability and Tested Channel Detail

|             |                                                                                                                                                |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Pre-Scan:   | EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition. |
| Worst Case: | Y-axis                                                                                                                                         |

#### For Cat-M1 Band 2

| Test Item                  | Tested Channel                                                    | Channel Bandwidth | Modulation   | Mode                       |
|----------------------------|-------------------------------------------------------------------|-------------------|--------------|----------------------------|
| EIRP                       | 18607 (1850.70 MHz)<br>18900 (1880.00 MHz)<br>19193 (1909.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 18615 (1851.50 MHz)<br>18900 (1880.00 MHz)<br>19185 (1908.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 18625 (1852.50 MHz)<br>18900 (1880.00 MHz)<br>19175 (1907.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 18650 (1855.00 MHz)<br>18900 (1880.00 MHz)<br>19150 (1905.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 18675 (1857.50 MHz)<br>18900 (1880.00 MHz)<br>19125 (1902.50 MHz) | 15 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 18700 (1860.00 MHz)<br>18900 (1880.00 MHz)<br>19100 (1900.00 MHz) | 20 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
| Modulation Characteristics | 18900 (1880.00 MHz)                                               | 20 MHz            | QPSK / 16QAM | Full RB                    |

| Test Item             | Tested Channel                                                    | Channel Bandwidth | Modulation   | Mode    |
|-----------------------|-------------------------------------------------------------------|-------------------|--------------|---------|
| Peak to Average Ratio | 18607 (1850.70 MHz)<br>18900 (1880.00 MHz)<br>19193 (1909.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB    |
|                       | 18615 (1851.50 MHz)<br>18900 (1880.00 MHz)<br>19185 (1908.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB    |
|                       | 18625 (1852.50 MHz)<br>18900 (1880.00 MHz)<br>19175 (1907.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB    |
|                       | 18650 (1855.00 MHz)<br>18900 (1880.00 MHz)<br>19150 (1905.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB    |
|                       | 18675 (1857.50 MHz)<br>18900 (1880.00 MHz)<br>19125 (1902.50 MHz) | 15 MHz            | QPSK / 16QAM | 1 RB    |
|                       | 18700 (1860.00 MHz)<br>18900 (1880.00 MHz)<br>19100 (1900.00 MHz) | 20 MHz            | QPSK / 16QAM | 1 RB    |
|                       |                                                                   |                   |              |         |
| Occupied Bandwidth    | 18607 (1850.70 MHz)<br>18900 (1880.00 MHz)<br>19193 (1909.30 MHz) | 1.4 MHz           | QPSK / 16QAM | Full RB |
|                       | 18615 (1851.50 MHz)<br>18900 (1880.00 MHz)<br>19185 (1908.50 MHz) | 3 MHz             | QPSK / 16QAM | Full RB |
|                       | 18625 (1852.50 MHz)<br>18900 (1880.00 MHz)<br>19175 (1907.50 MHz) | 5 MHz             | QPSK / 16QAM | Full RB |
|                       | 18650 (1855.00 MHz)<br>18900 (1880.00 MHz)<br>19150 (1905.00 MHz) | 10 MHz            | QPSK / 16QAM | Full RB |
|                       | 18675 (1857.50 MHz)<br>18900 (1880.00 MHz)<br>19125 (1902.50 MHz) | 15 MHz            | QPSK / 16QAM | Full RB |
|                       | 18700 (1860.00 MHz)<br>18900 (1880.00 MHz)<br>19100 (1900.00 MHz) | 20 MHz            | QPSK / 16QAM | Full RB |
|                       |                                                                   |                   |              |         |

| Test Item                              | Tested Channel                                                    | Channel Bandwidth | Modulation | Mode            |
|----------------------------------------|-------------------------------------------------------------------|-------------------|------------|-----------------|
| Conducted Emission                     | 18607 (1850.70 MHz)<br>18900 (1880.00 MHz)<br>19193 (1909.30 MHz) | 1.4 MHz           | 16QAM      | 1 RB<br>Full RB |
|                                        | 18615 (1851.50 MHz)<br>18900 (1880.00 MHz)<br>19185 (1908.50 MHz) | 3 MHz             | 16QAM      | 1 RB<br>Full RB |
|                                        | 18625 (1852.50 MHz)<br>18900 (1880.00 MHz)<br>19175 (1907.50 MHz) | 5 MHz             | 16QAM      | 1 RB<br>Full RB |
|                                        | 18650 (1855.00 MHz)<br>18900 (1880.00 MHz)<br>19150 (1905.00 MHz) | 10 MHz            | 16QAM      | 1 RB<br>Full RB |
|                                        | 18675 (1857.50 MHz)<br>18900 (1880.00 MHz)<br>19125 (1902.50 MHz) | 15 MHz            | 16QAM      | 1 RB<br>Full RB |
|                                        | 18700 (1860.00 MHz)<br>18900 (1880.00 MHz)<br>19100 (1900.00 MHz) | 20 MHz            | 16QAM      | 1 RB<br>Full RB |
| Radiated Spurious Emissions below 1GHz | 19193 (1909.30 MHz)                                               | 1.4 MHz           | 16QAM      | 1 RB            |
| Radiated Spurious Emissions above 1GHz | 18607 (1850.70 MHz)<br>18900 (1880.00 MHz)<br>19193 (1909.30 MHz) | 1.4 MHz           | 16QAM      | 1 RB            |
|                                        | 18625 (1852.50 MHz)<br>18900 (1880.00 MHz)<br>19175 (1907.50 MHz) | 5 MHz             | 16QAM      | 1 RB            |
|                                        | 18700 (1860.00 MHz)<br>18900 (1880.00 MHz)<br>19100 (1900.00 MHz) | 20 MHz            | 16QAM      | 1 RB            |
| Frequency Stability                    | 18607 (1850.70 MHz)<br>19193 (1909.30 MHz)                        | 1.4 MHz           | 16QAM      | Full RB         |
|                                        | 18615 (1851.50 MHz)<br>19185 (1908.50 MHz)                        | 3 MHz             | 16QAM      | Full RB         |
|                                        | 18625 (1852.50 MHz)<br>19175 (1907.50 MHz)                        | 5 MHz             | 16QAM      | Full RB         |
|                                        | 18650 (1855.00 MHz)<br>19150 (1905.00 MHz)                        | 10 MHz            | 16QAM      | Full RB         |
|                                        | 18675 (1857.50 MHz)<br>19125 (1902.50 MHz)                        | 15 MHz            | 16QAM      | Full RB         |
|                                        | 18700 (1860.00 MHz)<br>19100 (1900.00 MHz)                        | 20 MHz            | 16QAM      | Full RB         |

#### For Cat-M1 Band 4

| Test Item                  | Tested Channel                                                    | Channel Bandwidth | Modulation   | Mode                       |
|----------------------------|-------------------------------------------------------------------|-------------------|--------------|----------------------------|
| EIRP                       | 19957 (1710.70 MHz)<br>20175 (1732.50 MHz)<br>20393 (1754.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 19965 (1711.50 MHz)<br>20175 (1732.50 MHz)<br>20385 (1753.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 19975 (1712.50 MHz)<br>20175 (1732.50 MHz)<br>20375 (1752.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 20000 (1715.00 MHz)<br>20175 (1732.50 MHz)<br>20350 (1750.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 20025 (1717.50 MHz)<br>20175 (1732.50 MHz)<br>20325 (1747.50 MHz) | 15 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 20050 (1720.00 MHz)<br>20175 (1732.50 MHz)<br>20300 (1745.00 MHz) | 20 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
| Modulation Characteristics | 20175 (1732.50 MHz)                                               | 20 MHz            | QPSK / 16QAM | Full RB                    |
| Peak to Average Ratio      | 19957 (1710.70 MHz)<br>20175 (1732.50 MHz)<br>20393 (1754.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB                       |
|                            | 19965 (1711.50 MHz)<br>20175 (1732.50 MHz)<br>20385 (1753.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB                       |
|                            | 19975 (1712.50 MHz)<br>20175 (1732.50 MHz)<br>20375 (1752.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB                       |
|                            | 20000 (1715.00 MHz)<br>20175 (1732.50 MHz)<br>20350 (1750.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB                       |
|                            | 20025 (1717.50 MHz)<br>20175 (1732.50 MHz)<br>20325 (1747.50 MHz) | 15 MHz            | QPSK / 16QAM | 1 RB                       |
|                            | 20050 (1720.00 MHz)<br>20175 (1732.50 MHz)<br>20300 (1745.00 MHz) | 20 MHz            | QPSK / 16QAM | 1 RB                       |

| Test Item                              | Tested Channel                                                    | Channel Bandwidth | Modulation   | Mode            |
|----------------------------------------|-------------------------------------------------------------------|-------------------|--------------|-----------------|
| Occupied Bandwidth                     | 19957 (1710.70 MHz)<br>20175 (1732.50 MHz)<br>20393 (1754.30 MHz) | 1.4 MHz           | QPSK / 16QAM | Full RB         |
|                                        | 19965 (1711.50 MHz)<br>20175 (1732.50 MHz)<br>20385 (1753.50 MHz) | 3 MHz             | QPSK / 16QAM | Full RB         |
|                                        | 19975 (1712.50 MHz)<br>20175 (1732.50 MHz)<br>20375 (1752.50 MHz) | 5 MHz             | QPSK / 16QAM | Full RB         |
|                                        | 20000 (1715.00 MHz)<br>20175 (1732.50 MHz)<br>20350 (1750.00 MHz) | 10 MHz            | QPSK / 16QAM | Full RB         |
|                                        | 20025 (1717.50 MHz)<br>20175 (1732.50 MHz)<br>20325 (1747.50 MHz) | 15 MHz            | QPSK / 16QAM | Full RB         |
|                                        | 20050 (1720.00 MHz)<br>20175 (1732.50 MHz)<br>20300 (1745.00 MHz) | 20 MHz            | QPSK / 16QAM | Full RB         |
| Conducted Emission                     | 19957 (1710.70 MHz)<br>20175 (1732.50 MHz)<br>20393 (1754.30 MHz) | 1.4 MHz           | 16QAM        | 1 RB<br>Full RB |
|                                        | 19965 (1711.50 MHz)<br>20175 (1732.50 MHz)<br>20385 (1753.50 MHz) | 3 MHz             | 16QAM        | 1 RB<br>Full RB |
|                                        | 19975 (1712.50 MHz)<br>20175 (1732.50 MHz)<br>20375 (1752.50 MHz) | 5 MHz             | 16QAM        | 1 RB<br>Full RB |
|                                        | 20000 (1715.00 MHz)<br>20175 (1732.50 MHz)<br>20350 (1750.00 MHz) | 10 MHz            | 16QAM        | 1 RB<br>Full RB |
|                                        | 20025 (1717.50 MHz)<br>20175 (1732.50 MHz)<br>20325 (1747.50 MHz) | 15 MHz            | 16QAM        | 1 RB<br>Full RB |
|                                        | 20050 (1720.00 MHz)<br>20175 (1732.50 MHz)<br>20300 (1745.00 MHz) | 20 MHz            | 16QAM        | 1 RB<br>Full RB |
| Radiated Spurious Emissions below 1GHz | 20300 (1745.00 MHz)                                               | 20 MHz            | 16QAM        | 1 RB            |
| Radiated Spurious Emissions above 1GHz | 19957 (1710.70 MHz)<br>20175 (1732.50 MHz)<br>20393 (1754.30 MHz) | 1.4 MHz           | 16QAM        | 1 RB            |
|                                        | 19975 (1712.50 MHz)<br>20175 (1732.50 MHz)<br>20375 (1752.50 MHz) | 5 MHz             | 16QAM        | 1 RB            |
|                                        | 20050 (1720.00 MHz)<br>20175 (1732.50 MHz)<br>20300 (1745.00 MHz) | 20 MHz            | 16QAM        | 1 RB            |

| Test Item           | Tested Channel                             | Channel Bandwidth | Modulation | Mode    |
|---------------------|--------------------------------------------|-------------------|------------|---------|
| Frequency Stability | 19957 (1710.70 MHz)<br>20393 (1754.30 MHz) | 1.4 MHz           | 16QAM      | Full RB |
|                     | 19965 (1711.50 MHz)<br>20385 (1753.50 MHz) | 3 MHz             | 16QAM      | Full RB |
|                     | 19975 (1712.50 MHz)<br>20375 (1752.50 MHz) | 5 MHz             | 16QAM      | Full RB |
|                     | 20000 (1715.00 MHz)<br>20350 (1750.00 MHz) | 10 MHz            | 16QAM      | Full RB |
|                     | 20025 (1717.50 MHz)<br>20325 (1747.50 MHz) | 15 MHz            | 16QAM      | Full RB |
|                     | 20050 (1720.00 MHz)<br>20300 (1745.00 MHz) | 20 MHz            | 16QAM      | Full RB |

# For Cat-M1 Band 5

| Test Item                  | Tested Channel                                                 | Channel Bandwidth | Modulation   | Mode                       |
|----------------------------|----------------------------------------------------------------|-------------------|--------------|----------------------------|
| ERP                        | 20407 (824.70 MHz)<br>20525 (836.50 MHz)<br>20643 (848.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 20415 (825.50 MHz)<br>20525 (836.50 MHz)<br>20635 (847.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 20425 (826.50 MHz)<br>20525 (836.50 MHz)<br>20625 (846.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 20450 (829.00 MHz)<br>20525 (836.50 MHz)<br>20600 (844.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
| Modulation Characteristics | 20525 (836.50 MHz)                                             | 10 MHz            | QPSK / 16QAM | Full RB                    |
| Peak to Average Ratio      | 20407 (824.70 MHz)<br>20525 (836.50 MHz)<br>20643 (848.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB                       |
|                            | 20415 (825.50 MHz)<br>20525 (836.50 MHz)<br>20635 (847.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB                       |
|                            | 20425 (826.50 MHz)<br>20525 (836.50 MHz)<br>20625 (846.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB                       |
|                            | 20450 (829.00 MHz)<br>20525 (836.50 MHz)<br>20600 (844.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB                       |
| Occupied Bandwidth         | 20407 (824.70 MHz)<br>20525 (836.50 MHz)<br>20643 (848.30 MHz) | 1.4 MHz           | QPSK / 16QAM | Full RB                    |
|                            | 20415 (825.50 MHz)<br>20525 (836.50 MHz)<br>20635 (847.50 MHz) | 3 MHz             | QPSK / 16QAM | Full RB                    |
|                            | 20425 (826.50 MHz)<br>20525 (836.50 MHz)<br>20625 (846.50 MHz) | 5 MHz             | QPSK / 16QAM | Full RB                    |
|                            | 20450 (829.00 MHz)<br>20525 (836.50 MHz)<br>20600 (844.00 MHz) | 10 MHz            | QPSK / 16QAM | Full RB                    |
| Conducted Emission         | 20407 (824.70 MHz)<br>20525 (836.50 MHz)<br>20643 (848.30 MHz) | 1.4 MHz           | 16QAM        | 1 RB<br>Full RB            |
|                            | 20415 (825.50 MHz)<br>20525 (836.50 MHz)<br>20635 (847.50 MHz) | 3 MHz             | 16QAM        | 1 RB<br>Full RB            |
|                            | 20425 (826.50 MHz)<br>20525 (836.50 MHz)<br>20625 (846.50 MHz) | 5 MHz             | 16QAM        | 1 RB<br>Full RB            |
|                            | 20450 (829.00 MHz)<br>20525 (836.50 MHz)<br>20600 (844.00 MHz) | 10 MHz            | 16QAM        | 1 RB<br>Full RB            |

| Test Item                              | Tested Channel                                                 | Channel Bandwidth | Modulation | Mode    |
|----------------------------------------|----------------------------------------------------------------|-------------------|------------|---------|
| Radiated Spurious Emissions below 1GHz | 20525 (836.50 MHz)                                             | 10 MHz            | 16QAM      | 1 RB    |
| Radiated Spurious Emissions above 1GHz | 20407 (824.70 MHz)<br>20525 (836.50 MHz)<br>20643 (848.30 MHz) | 1.4 MHz           | 16QAM      | 1 RB    |
|                                        | 20425 (826.50 MHz)<br>20525 (836.50 MHz)<br>20625 (846.50 MHz) | 5 MHz             | 16QAM      | 1 RB    |
|                                        | 20450 (829.00 MHz)<br>20525 (836.50 MHz)<br>20600 (844.00 MHz) | 10 MHz            | 16QAM      | 1 RB    |
|                                        | 20407 (824.70 MHz)<br>20643 (848.30 MHz)                       | 1.4 MHz           | 16QAM      | Full RB |
|                                        | 20415 (825.50 MHz)<br>20635 (847.50 MHz)                       | 3 MHz             | 16QAM      | Full RB |
|                                        | 20425 (826.50 MHz)<br>20625 (846.50 MHz)                       | 5 MHz             | 16QAM      | Full RB |
| Frequency Stability                    | 20450 (829.00 MHz)<br>20600 (844.00 MHz)                       | 10 MHz            | 16QAM      | Full RB |

# For Cat-M1 Band 12

| Test Item                  | Tested Channel                                                 | Channel Bandwidth | Modulation   | Mode                       |
|----------------------------|----------------------------------------------------------------|-------------------|--------------|----------------------------|
| ERP                        | 23017 (699.70 MHz)<br>23095 (707.50 MHz)<br>23173 (715.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 23025 (700.50 MHz)<br>23095 (707.50 MHz)<br>23165 (714.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 23035 (701.50 MHz)<br>23095 (707.50 MHz)<br>23155 (713.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                            | 23060 (704.00 MHz)<br>23095 (707.50 MHz)<br>23130 (711.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
| Modulation Characteristics | 23095 (707.50 MHz)                                             | 10 MHz            | QPSK / 16QAM | Full RB                    |
| Peak to Average Ratio      | 23017 (699.70 MHz)<br>23095 (707.50 MHz)<br>23173 (715.30 MHz) | 1.4 MHz           | QPSK / 16QAM | 1 RB                       |
|                            | 23025 (700.50 MHz)<br>23095 (707.50 MHz)<br>23165 (714.50 MHz) | 3 MHz             | QPSK / 16QAM | 1 RB                       |
|                            | 23035 (701.50 MHz)<br>23095 (707.50 MHz)<br>23155 (713.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB                       |
|                            | 23060 (704.00 MHz)<br>23095 (707.50 MHz)<br>23130 (711.00 MHz) | 10 MHz            | QPSK / 16QAM | 1 RB                       |
| Occupied Bandwidth         | 23017 (699.70 MHz)<br>23095 (707.50 MHz)<br>23173 (715.30 MHz) | 1.4 MHz           | QPSK / 16QAM | Full RB                    |
|                            | 23025 (700.50 MHz)<br>23095 (707.50 MHz)<br>23165 (714.50 MHz) | 3 MHz             | QPSK / 16QAM | Full RB                    |
|                            | 23035 (701.50 MHz)<br>23095 (707.50 MHz)<br>23155 (713.50 MHz) | 5 MHz             | QPSK / 16QAM | Full RB                    |
|                            | 23060 (704.00 MHz)<br>23095 (707.50 MHz)<br>23130 (711.00 MHz) | 10 MHz            | QPSK / 16QAM | Full RB                    |
| Conducted Emission         | 23017 (699.70 MHz)<br>23095 (707.50 MHz)<br>23173 (715.30 MHz) | 1.4 MHz           | QPSK         | 1 RB<br>Full RB            |
|                            | 23025 (700.50 MHz)<br>23095 (707.50 MHz)<br>23165 (714.50 MHz) | 3 MHz             | QPSK         | 1 RB<br>Full RB            |
|                            | 23035 (701.50 MHz)<br>23095 (707.50 MHz)<br>23155 (713.50 MHz) | 5 MHz             | QPSK         | 1 RB<br>Full RB            |
|                            | 23060 (704.00 MHz)<br>23095 (707.50 MHz)<br>23130 (711.00 MHz) | 10 MHz            | QPSK         | 1 RB<br>Full RB            |

| Test Item                              | Tested Channel                                                 | Channel Bandwidth | Modulation | Mode    |
|----------------------------------------|----------------------------------------------------------------|-------------------|------------|---------|
| Radiated Spurious Emissions below 1GHz | 23095 (707.50 MHz)                                             | 5 MHz             | QPSK       | 1 RB    |
| Radiated Spurious Emissions above 1GHz | 23017 (699.70 MHz)<br>23095 (707.50 MHz)<br>23173 (715.30 MHz) | 1.4 MHz           | QPSK       | 1 RB    |
|                                        | 23035 (701.50 MHz)<br>23095 (707.50 MHz)<br>23155 (713.50 MHz) | 5 MHz             | QPSK       | 1 RB    |
|                                        | 23060 (704.00 MHz)<br>23095 (707.50 MHz)<br>23130 (711.00 MHz) | 10 MHz            | QPSK       | 1 RB    |
|                                        |                                                                |                   |            |         |
| Frequency Stability                    | 23017 (699.70 MHz)<br>23173 (715.30 MHz)                       | 1.4 MHz           | QPSK       | Full RB |
|                                        | 23025 (700.50 MHz)<br>23165 (714.50 MHz)                       | 3 MHz             | QPSK       | Full RB |
|                                        | 23035 (701.50 MHz)<br>23155 (713.50 MHz)                       | 5 MHz             | QPSK       | Full RB |
|                                        | 23060 (704.00 MHz)<br>23130 (711.00 MHz)                       | 10 MHz            | QPSK       | Full RB |

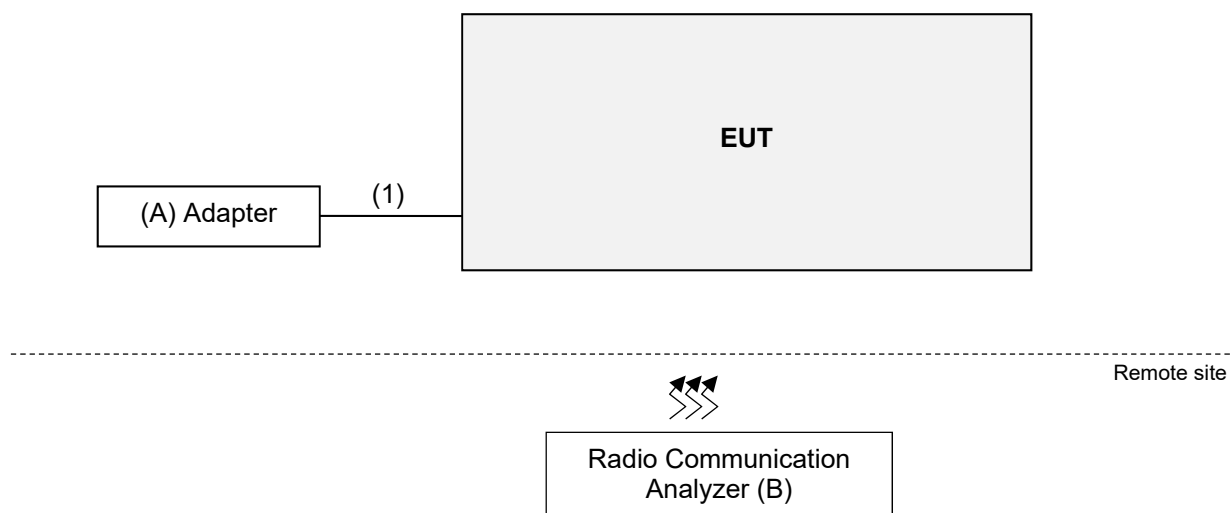
# For Cat-M1 Band 13

| Test Item                              | Tested Channel                                                 | Channel Bandwidth | Modulation   | Mode                       |
|----------------------------------------|----------------------------------------------------------------|-------------------|--------------|----------------------------|
| ERP                                    | 23205 (779.50 MHz)<br>23230 (782.00 MHz)<br>23255 (784.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
|                                        | 23230 (782.00 MHz)                                             | 10 MHz            | QPSK / 16QAM | 1 RB<br>Half RB<br>Full RB |
| Modulation Characteristics             | 23230 (782.00 MHz)                                             | 10 MHz            | QPSK / 16QAM | Full RB                    |
| Peak to Average Ratio                  | 23205 (779.50 MHz)<br>23230 (782.00 MHz)<br>23255 (784.50 MHz) | 5 MHz             | QPSK / 16QAM | 1 RB                       |
|                                        | 23230 (782.00 MHz)                                             | 10 MHz            | QPSK / 16QAM | 1 RB                       |
| Occupied Bandwidth                     | 23205 (779.50 MHz)<br>23230 (782.00 MHz)<br>23255 (784.50 MHz) | 5 MHz             | QPSK / 16QAM | Full RB                    |
|                                        | 23230 (782.00 MHz)                                             | 10 MHz            | QPSK / 16QAM | Full RB                    |
| Conducted Emission                     | 23205 (779.50 MHz)<br>23230 (782.00 MHz)<br>23255 (784.50 MHz) | 5 MHz             | 16QAM        | 1 RB<br>Full RB            |
|                                        | 23230 (782.00 MHz)                                             | 10 MHz            | 16QAM        | 1 RB<br>Full RB            |
| Radiated Spurious Emissions below 1GHz | 23255 (784.50 MHz)                                             | 5 MHz             | 16QAM        | 1 RB                       |
| Radiated Spurious Emissions above 1GHz | 23205 (779.50 MHz)<br>23230 (782.00 MHz)<br>23255 (784.50 MHz) | 5 MHz             | 16QAM        | 1 RB                       |
|                                        | 23230 (782.00 MHz)                                             | 10 MHz            | 16QAM        | 1 RB                       |
| Frequency Stability                    | 23205 (779.50 MHz)<br>23255 (784.50 MHz)                       | 5 MHz             | 16QAM        | Full RB                    |
|                                        | 23230 (782.00 MHz)                                             | 10 MHz            | 16QAM        | Full RB                    |

### 3.4 Test Program Used and Operation Descriptions

There is no need to controlling software during the test, and the EUT can be paired with the Radio Communication Analyzer to test the connection when it is powered on.

### 3.5 Connection Diagram of EUT and Peripheral Devices



### 3.6 Configuration of Peripheral Devices and Cable Connections

| ID | Product                      | Brand   | Model No. | Serial No.        | FCC ID | Remarks         |
|----|------------------------------|---------|-----------|-------------------|--------|-----------------|
| A. | Adapter                      | Apple   | A1720     | FNT912201EHL9J911 | N/A    | Provided by Lab |
| B. | Radio Communication Analyzer | Anritsu | MT8821C   | 6201462755        | N/A    | Provided by Lab |

| No. | Cable Descriptions | Qty. | Length (m) | Shielded (Yes/ No) | Cores (Qty.) | Remark                              |
|-----|--------------------|------|------------|--------------------|--------------|-------------------------------------|
| 1.  | Type C Cable       | 1    | 1.2        | Yes                | 0            | Accessory of the EUT (for RF Setup) |

## 4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 4.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

| Description<br>Manufacturer              | Model No.                        | Serial No. | Calibrated<br>Date | Calibrated<br>Until |
|------------------------------------------|----------------------------------|------------|--------------------|---------------------|
| N9030B - PXA Signal Analyzer<br>KEYSIGHT | N9030B                           | MY57140488 | 2024/3/6           | 2025/3/5            |
| Radio Communication Analyzer<br>Anritsu  | MT8821C                          | 6201462755 | 2024/3/13          | 2025/3/12           |
| Software<br>BV                           | ADT_RF Test Software<br>V6.6.5.4 | N/A        | N/A                | N/A                 |

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/22

### 4.2 Modulation Characteristics

| Description<br>Manufacturer              | Model No.                        | Serial No. | Calibrated<br>Date | Calibrated<br>Until |
|------------------------------------------|----------------------------------|------------|--------------------|---------------------|
| N9030B - PXA Signal Analyzer<br>KEYSIGHT | N9030B                           | MY57140938 | 2024/3/20          | 2025/3/19           |
| Radio Communication Analyzer<br>Anritsu  | MT8821C                          | 6201462755 | 2024/3/13          | 2025/3/12           |
| Software<br>BV                           | ADT_RF Test Software<br>V6.6.5.4 | N/A        | N/A                | N/A                 |

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/19

### 4.3 Peak to Average Ratio

Refer to section 4.2 to get information of the instruments.

### 4.4 Bandwidth

Refer to section 4.2 to get information of the instruments.

### 4.5 Conducted Spurious Emissions

| Description<br>Manufacturer              | Model No.                        | Serial No. | Calibrated<br>Date | Calibrated<br>Until |
|------------------------------------------|----------------------------------|------------|--------------------|---------------------|
| N9030B - PXA Signal Analyzer<br>KEYSIGHT | N9030B                           | MY57140938 | 2024/3/20          | 2025/3/19           |
| Radio Communication Analyzer<br>Anritsu  | MT8821C                          | 6201462755 | 2024/3/13          | 2025/3/12           |
| Software<br>BV                           | ADT_RF Test Software<br>V6.6.5.4 | N/A        | N/A                | N/A                 |

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/19 ~ 2024/7/26

#### 4.6 Radiated Spurious Emissions below 1GHz

| Description<br>Manufacturer       | Model No.                    | Serial No.       | Calibrated<br>Date | Calibrated<br>Until |
|-----------------------------------|------------------------------|------------------|--------------------|---------------------|
| Antenna Tower<br>Max-Full         | MFT-151SS-0.5T               | N/A              | N/A                | N/A                 |
| Bi_Log Antenna<br>Schwarzbeck     | VULB 9168                    | 9168-1213        | 2023/10/13         | 2024/10/12          |
| EMI Test Receiver<br>R&S          | ESR3                         | 102782           | 2023/12/7          | 2024/12/6           |
| Loop Antenna<br>Electro-Metrics   | EM-6879                      | 269              | 2023/9/23          | 2024/9/22           |
| Loop Antenna<br>TESEQ             | HLA 6121                     | 45745            | 2023/8/8           | 2024/8/7            |
| MXA Signal Analyzer<br>Keysight   | N9020B                       | MY60110513       | 2023/12/22         | 2024/12/21          |
| Preamplifier<br>EMCI              | EMC330N                      | 980782           | 2024/1/15          | 2025/1/14           |
|                                   | EMC001340                    | 980201           | 2023/9/27          | 2024/9/26           |
| RF Coaxial Cable<br>EMCI          | EMCCFD400-NM-NM-500          | 201233           | 2024/1/15          | 2025/1/14           |
|                                   | EMCCFD400-NM-NM-3000         | 201235           | 2024/1/15          | 2025/1/14           |
|                                   | EMCCFD400-NM-NM-9000         | 201236(with PAD) | 2024/1/15          | 2025/1/14           |
| Software<br>BV ADT                | ADT_Radiated_<br>V7.6.15.9.5 | N/A              | N/A                | N/A                 |
| Turn Table<br>Max-Full            | MF-7802BS                    | N/A              | N/A                | N/A                 |
| Turn Table Controller<br>Max-Full | MF-7802BS                    | MF780208674      | N/A                | N/A                 |

**Notes:**

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2024/7/10

#### 4.7 Radiated Spurious Emissions above 1GHz

| Description<br>Manufacturer       | Model No.                    | Serial No.  | Calibrated<br>Date | Calibrated<br>Until |
|-----------------------------------|------------------------------|-------------|--------------------|---------------------|
| Antenna Tower<br>Max-Full         | MFT-151SS-0.5T               | N/A         | N/A                | N/A                 |
| EMI Test Receiver<br>R&S          | ESR3                         | 102782      | 2023/12/7          | 2024/12/6           |
| Horn Antenna<br>RFSPIN            | DRH18-E                      | 210103A18E  | 2023/11/12         | 2024/11/11          |
| Horn Antenna<br>Schwarzbeck       | BBHA 9170                    | 9170-1049   | 2023/11/12         | 2024/11/11          |
| MXA Signal Analyzer<br>Keysight   | N9020B                       | MY60110513  | 2023/12/22         | 2024/12/21          |
| Preamplifier<br>EMCI              | EMC118A45SE                  | 980808      | 2023/12/28         | 2024/12/27          |
|                                   | EMC184045SE                  | 980788      | 2024/1/15          | 2025/1/14           |
| RF Coaxial Cable<br>EMCI          | EMC101G-KM-KM-2000           | 201254      | 2024/1/15          | 2025/1/14           |
|                                   | EMC101G-KM-KM-3000           | 201258      | 2024/1/15          | 2025/1/14           |
|                                   | EMC101G-KM-KM-5000           | 201261      | 2024/1/15          | 2025/1/14           |
|                                   | EMC104-SM-SM-1000            | 210102      | 2024/1/15          | 2025/1/14           |
|                                   | EMC104-SM-SM-3000            | 201231      | 2024/1/15          | 2025/1/14           |
|                                   | EMC104-SM-SM-9000            | 201243      | 2024/1/15          | 2025/1/14           |
| Software<br>BV ADT                | ADT_Radiated_<br>V7.6.15.9.5 | N/A         | N/A                | N/A                 |
| Turn Table<br>Max-Full            | MF-7802BS                    | N/A         | N/A                | N/A                 |
| Turn Table Controller<br>Max-Full | MF-7802BS                    | MF780208674 | N/A                | N/A                 |

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2024/7/2 ~ 2024/7/3

#### 4.8 Frequency Stability

| Description<br>Manufacturer                     | Model No.                        | Serial No.     | Calibrated<br>Date | Calibrated<br>Until |
|-------------------------------------------------|----------------------------------|----------------|--------------------|---------------------|
| 3-channel DC power supply<br>JIN YIH Technology | ODP3033                          | ODP30332128138 | N/A                | N/A                 |
| Digital Multimeter<br>Fluke                     | 87-III                           | 70360742       | 2024/7/5           | 2025/7/4            |
| Software<br>BV                                  | ADT_RF Test Software<br>V6.6.5.4 | N/A            | N/A                | N/A                 |
| Spectrum Analyzer<br>R&S                        | FSV40                            | 100980         | 2024/5/6           | 2025/5/5            |
| Temperature & Humidity Chamber<br>TERCHY        | HRM-120RF                        | 931022         | 2023/12/19         | 2024/12/18          |
| Radio Communication Analyzer<br>Anritsu         | MT8821C                          | 6201462755     | 2024/3/13          | 2025/3/12           |

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/19

## 5 Limits of Test Items

### 5.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

#### For Cat-M1 Band 2:

Mobile and portable stations are limited to 2 watts EIRP.

#### For Cat-M1 Band 4:

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

#### For Cat-M1 Band 5:

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

#### For Cat-M1 Band 12:

Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

#### For Cat-M1 Band 13:

Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

### 5.2 Modulation Characteristics

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

### 5.3 Peak to Average Ratio

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

### 5.4 Bandwidth

According to FCC 47 CFR part 2.1049, 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% of the total mean power radiated by a given emission.

## 5.5 Conducted Spurious Emissions

### For Cat-M1 Band 2, Cat-M1 Band 5:

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  $-13$  dBm.

### For Cat-M1 Band 4:

According to FCC 47 CFR part 27.53(h), for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log(P)$  dB. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

### For Cat-M1 Band 12:

According to FCC 47 CFR part 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least  $43 + 10 \log(P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

### For Cat-M1 Band 13:

According to FCC 47 CFR part 27.53(c)(2), for on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

According to FCC 47 CFR part 27.53(c)(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than  $65 + 10 \log(P)$  dB in a 6.25 kHz band segment, for mobile and portable stations.

For operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz (EIRP). The limit of emissions is equal to  $-40$  dBm.

## 5.6 Radiated Spurious Emissions below 1GHz

### For Cat-M1 Band 2, Cat-M1 Band 5:

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  $-13$  dBm.

### For Cat-M1 Band 4:

According to FCC 47 CFR part 27.53(h), for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log(P)$  dB. The limit of emission is equal to  $-13$  dBm.

### For Cat-M1 Band 12:

According to FCC 47 CFR part 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least  $43 + 10 \log(P)$  dB. The limit of emissions is equal to  $-13$  dBm.

### For Cat-M1 Band 13:

According to FCC 47 CFR part 27.53(c)(2), for on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. The limit of emissions is equal to  $-13$  dBm.

For operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz (EIRP). The limit of emissions is equal to  $-40$  dBm.

## 5.7 Radiated Spurious Emissions above 1GHz

### For Cat-M1 Band 2, Cat-M1 Band 5:

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  $-13$  dBm.

### For Cat-M1 Band 4:

According to FCC 47 CFR part 27.53(h), for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log(P)$  dB. The limit of emission is equal to  $-13$  dBm.

### For Cat-M1 Band 12:

According to FCC 47 CFR part 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least  $43 + 10 \log(P)$  dB. The limit of emissions is equal to  $-13$  dBm.

### For Cat-M1 Band 13:

According to FCC 47 CFR part 27.53(c)(2), for on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. The limit of emissions is equal to  $-13$  dBm.

For operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz (EIRP). The limit of emissions is equal to  $-40$  dBm.

## 5.8 Frequency Stability

### For Cat-M1 Band 5:

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

### For Cat-M1 Band 2, Cat-M1 Band 4, Cat-M1 Band 12, Cat-M1 Band 13:

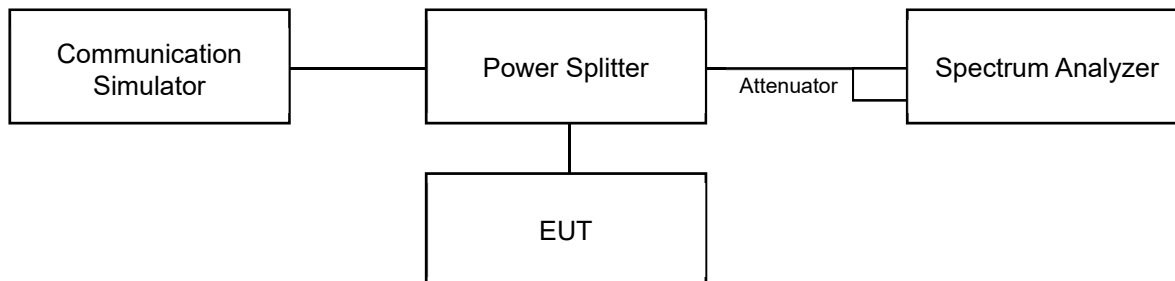
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation (authorized frequency block).

## 6 Test Arrangements

### 6.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

#### 6.1.1 Test Setup

##### Conducted Power Measurement:



#### 6.1.2 Test Procedure

##### Conducted Power Measurement:

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology. The average (rms) power measurement was performed on emulator and power value was measured from power function on emulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

##### Maximum EIRP / ERP

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

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

$$\text{ERP} = P_{\text{Meas}} + G_T - 2.15$$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively

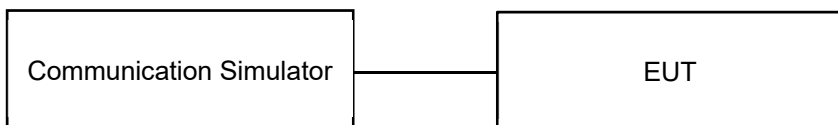
(expressed in the same units as  $P_{\text{Meas}}$ , e.g., dBm or dBW)

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

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

## 6.2 Modulation Characteristics

### 6.2.1 Test Setup

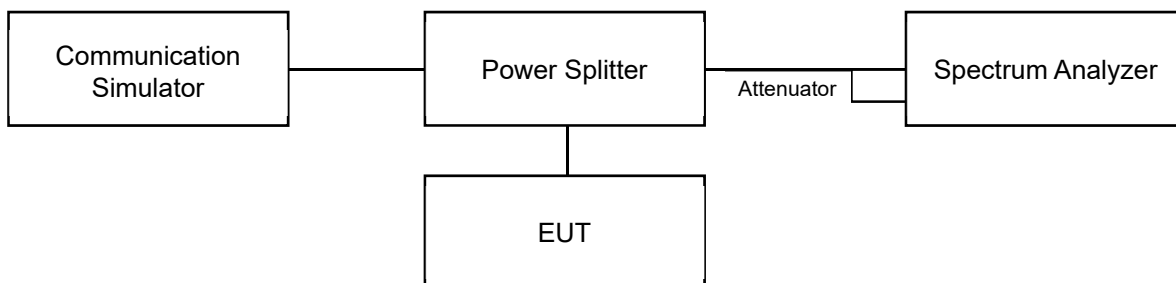


### 6.2.2 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector, the frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

## 6.3 Peak to Average Ratio

### 6.3.1 Test Setup

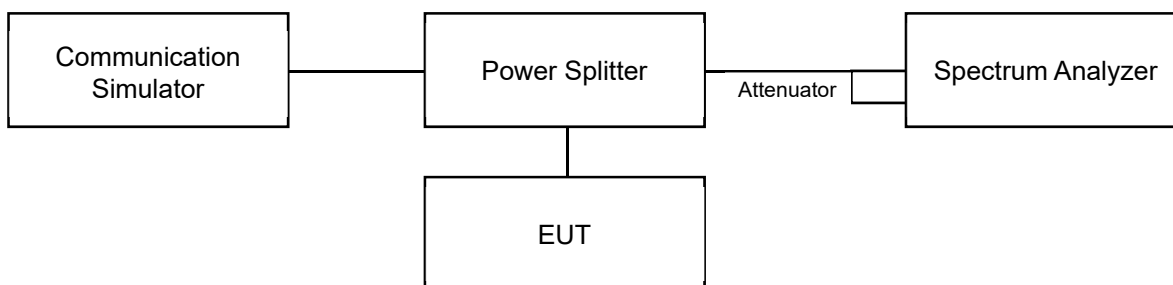


### 6.3.2 Test Procedure

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

## 6.4 Bandwidth

### 6.4.1 Test Setup



### 6.4.2 Test Procedure

For the 26 dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

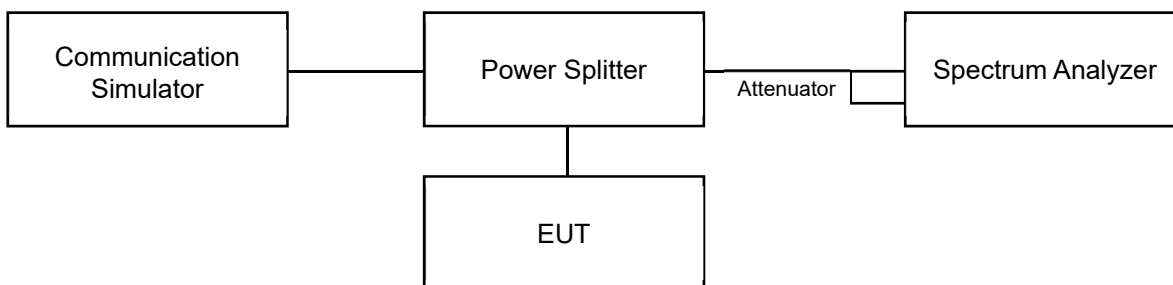
- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set  $\geq 3 \times$  RBW.
- Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- Determine the following reference values: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
- The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set  $\geq 3 \times$  RBW.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d. The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e. Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- f. Determine the reference value by either of the following:
  - g. 1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
  - h. 2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.
- i. Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- j. If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).
- k. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers. The spectral envelope can cross the “-X dB amplitude” at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the “-X dB amplitude.”
- l. The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

## 6.5 Conducted Spurious Emissions

### 6.5.1 Test Setup



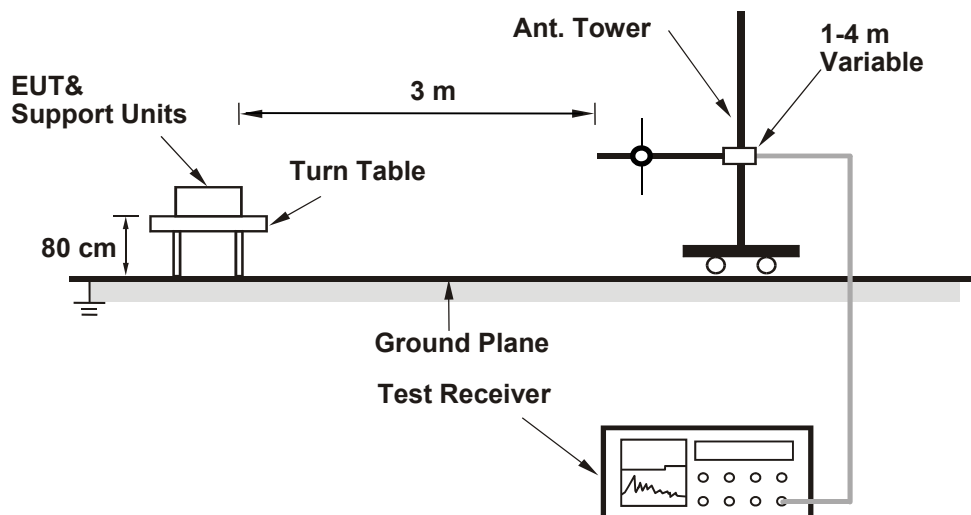
### 6.5.2 Test Procedure

- Measurement refer to ANSI C63.26 section 5.7.
- All measurements were done at 3 channels: low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. 20 dB attenuation pad is connected with spectrum.
- The fundamental frequency above 1 GHz, the spectrum set RBW = 1 MHz, VBW = 3 MHz, Detector = Average.
- The fundamental frequency below 1 GHz, the spectrum set RBW  $\geq$  100 kHz, VBW  $\geq$  3 x RBW, Detector = Average.
- Measuring frequency band edge, narrow RBW (no less than 1% of the OBW) is used for conducted emission measurement.

## 6.6 Radiated Spurious Emissions below 1GHz

### 6.6.1 Test Setup

For radiated emission 30 MHz to 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 6.6.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

- In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following C63.26 section 5.5 and 5.2.7
- $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$ ; where D is the measurement distance (in the far field region) in m.
- $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$ ; where D is the measurement distance (in the far field region) in m.

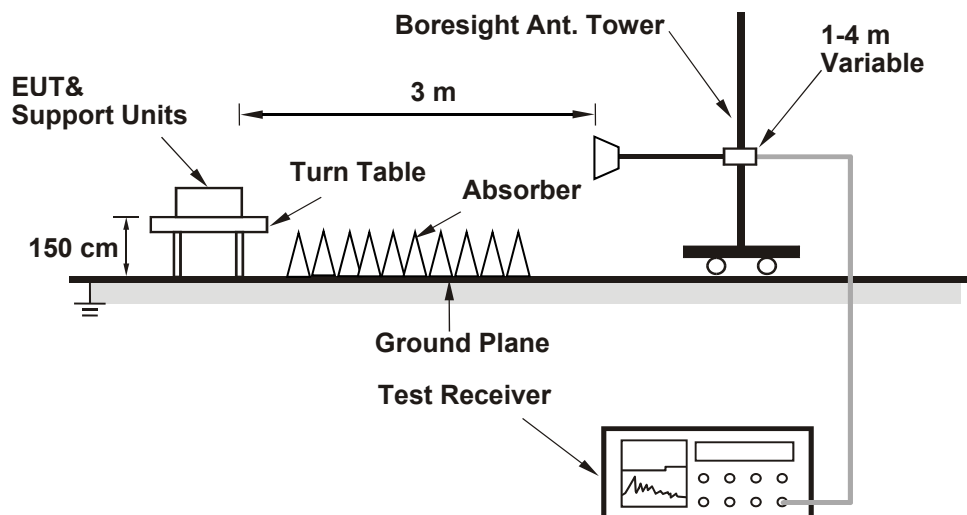
Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector=average
- The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:  
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

## 6.7 Radiated Spurious Emissions above 1GHz

### 6.7.1 Test Setup

For radiated emission above 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 6.7.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

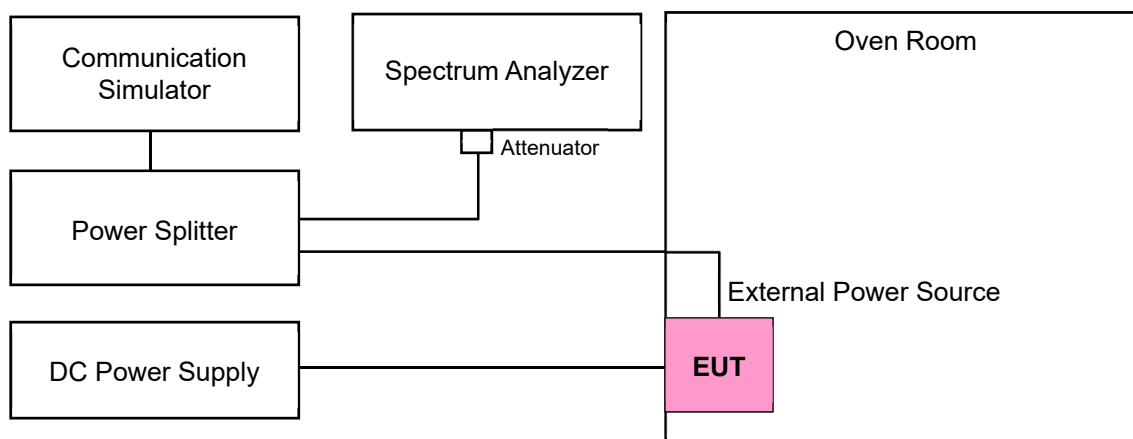
- In the semi-anechoic chamber, EUT placed on the 1.5 m height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following C63.26 section 5.5 and 5.2.7
- $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$ ; where D is the measurement distance (in the far field region) in m.
- $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$ ; where D is the measurement distance (in the far field region) in m.

Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector=average

## 6.8 Frequency Stability

### 6.8.1 Test Setup



### 6.8.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

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

Note: The frequency error was recorded frequency error from the communication simulator.

## 7 Test Results of Test Item

### 7.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

|              |       |                           |              |            |             |
|--------------|-------|---------------------------|--------------|------------|-------------|
| Input Power: | 5 Vdc | Environmental Conditions: | 22°C, 65% RH | Tested By: | Willy Cheng |
|--------------|-------|---------------------------|--------------|------------|-------------|

#### 7.1.1 Cat-M1 Band 2

##### Conducted Output Power (dBm)

| Cat-M1 Band 2 |           |                 |           |       |       |       |
|---------------|-----------|-----------------|-----------|-------|-------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|               |           | Channel         |           | 18700 | 18900 | 19100 |
|               |           | Frequency (MHz) |           | 1860  | 1880  | 1900  |
| 20M           | QPSK      | 1               | 0         | 21.96 | 21.95 | 22.04 |
|               |           | 1               | 50        | 22.17 | 21.97 | 21.95 |
|               |           | 1               | 99        | 21.91 | 21.93 | 22.07 |
|               |           | 50              | 0         | 20.69 | 20.75 | 20.97 |
|               |           | 50              | 25        | 20.80 | 20.85 | 20.88 |
|               |           | 50              | 50        | 20.78 | 20.82 | 20.68 |
|               |           | 100             | 0         | 20.20 | 20.19 | 19.97 |
| 20M           | 16QAM     | 1               | 0         | 22.52 | 22.27 | 22.45 |
|               |           | 1               | 50        | 22.31 | 22.38 | 22.31 |
|               |           | 1               | 99        | 22.46 | 22.31 | 22.43 |
|               |           | 50              | 0         | 20.36 | 20.40 | 20.30 |
|               |           | 50              | 25        | 20.53 | 20.30 | 20.42 |
|               |           | 50              | 50        | 20.57 | 20.35 | 20.58 |
|               |           | 100             | 0         | 19.02 | 19.15 | 18.98 |

| Cat-M1 Band 2 |           |                 |           |        |       |        |
|---------------|-----------|-----------------|-----------|--------|-------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid   | High   |
|               |           | Channel         |           | 18675  | 18900 | 19125  |
|               |           | Frequency (MHz) |           | 1857.5 | 1880  | 1902.5 |
| 15M           | QPSK      | 1               | 0         | 21.88  | 22.17 | 21.96  |
|               |           | 1               | 37        | 21.97  | 22.12 | 22.15  |
|               |           | 1               | 74        | 21.94  | 22.18 | 21.99  |
|               |           | 36              | 0         | 20.81  | 20.94 | 20.79  |
|               |           | 36              | 19        | 20.73  | 20.76 | 20.83  |
|               |           | 36              | 39        | 20.72  | 20.82 | 20.83  |
|               |           | 75              | 0         | 20.14  | 20.16 | 20.13  |
| 15M           | 16QAM     | 1               | 0         | 22.36  | 22.24 | 22.51  |
|               |           | 1               | 37        | 22.27  | 22.32 | 22.31  |
|               |           | 1               | 74        | 22.25  | 22.31 | 22.48  |
|               |           | 36              | 0         | 20.39  | 20.44 | 20.50  |
|               |           | 36              | 19        | 20.36  | 20.39 | 20.38  |
|               |           | 36              | 39        | 20.43  | 20.53 | 20.54  |
|               |           | 75              | 0         | 18.93  | 19.12 | 18.94  |

| Cat-M1 Band 2 |           |                 |           |       |       |       |
|---------------|-----------|-----------------|-----------|-------|-------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|               |           | Channel         |           | 18650 | 18900 | 19150 |
|               |           | Frequency (MHz) |           | 1855  | 1880  | 1905  |
| 10M           | QPSK      | 1               | 0         | 22.16 | 22.12 | 22.10 |
|               |           | 1               | 24        | 21.88 | 22.05 | 22.15 |
|               |           | 1               | 49        | 21.97 | 22.05 | 22.18 |
|               |           | 25              | 0         | 20.72 | 20.77 | 20.75 |
|               |           | 25              | 12        | 20.70 | 20.97 | 20.91 |
|               |           | 25              | 25        | 20.81 | 20.77 | 20.98 |
|               |           | 50              | 0         | 20.14 | 20.15 | 20.27 |
| 10M           | 16QAM     | 1               | 0         | 22.34 | 22.39 | 22.53 |
|               |           | 1               | 24        | 22.44 | 22.42 | 22.41 |
|               |           | 1               | 49        | 22.35 | 22.29 | 22.53 |
|               |           | 25              | 0         | 20.50 | 20.39 | 20.38 |
|               |           | 25              | 12        | 20.35 | 20.50 | 20.29 |
|               |           | 25              | 25        | 20.50 | 20.43 | 20.44 |
|               |           | 50              | 0         | 19.19 | 19.15 | 19.00 |

| Cat-M1 Band 2 |           |                 |           |        |       |        |
|---------------|-----------|-----------------|-----------|--------|-------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid   | High   |
|               |           | Channel         |           | 18625  | 18900 | 19175  |
|               |           | Frequency (MHz) |           | 1852.5 | 1880  | 1907.5 |
| 5M            | QPSK      | 1               | 0         | 22.00  | 22.15 | 22.06  |
|               |           | 1               | 12        | 21.95  | 22.05 | 21.95  |
|               |           | 1               | 24        | 21.97  | 22.14 | 22.14  |
|               |           | 12              | 0         | 20.84  | 20.74 | 20.87  |
|               |           | 12              | 6         | 20.78  | 20.91 | 20.86  |
|               |           | 12              | 13        | 20.98  | 20.98 | 20.77  |
|               |           | 25              | 0         | 20.16  | 20.16 | 20.18  |
| 5M            | 16QAM     | 1               | 0         | 22.38  | 22.28 | 22.47  |
|               |           | 1               | 12        | 22.26  | 22.53 | 22.53  |
|               |           | 1               | 24        | 22.26  | 22.40 | 22.27  |
|               |           | 12              | 0         | 20.49  | 20.40 | 20.52  |
|               |           | 12              | 6         | 20.42  | 20.46 | 20.50  |
|               |           | 12              | 13        | 20.55  | 20.45 | 20.29  |
|               |           | 25              | 0         | 18.94  | 19.02 | 19.22  |

| Cat-M1 Band 2 |           |                 |           |        |       |        |
|---------------|-----------|-----------------|-----------|--------|-------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid   | High   |
|               |           | Channel         |           | 18615  | 18900 | 19185  |
|               |           | Frequency (MHz) |           | 1851.5 | 1880  | 1908.5 |
| 3M            | QPSK      | 1               | 0         | 22.08  | 21.92 | 22.12  |
|               |           | 1               | 7         | 21.91  | 21.96 | 22.07  |
|               |           | 1               | 14        | 21.90  | 22.12 | 22.02  |
|               |           | 8               | 0         | 20.71  | 20.78 | 20.89  |
|               |           | 8               | 3         | 20.96  | 20.90 | 20.96  |
|               |           | 8               | 7         | 20.88  | 20.88 | 20.86  |
|               |           | 15              | 0         | 20.19  | 20.01 | 20.00  |
| 3M            | 16QAM     | 1               | 0         | 22.51  | 22.50 | 22.30  |
|               |           | 1               | 7         | 22.39  | 22.42 | 22.30  |
|               |           | 1               | 14        | 22.25  | 22.38 | 22.33  |
|               |           | 8               | 0         | 20.45  | 20.49 | 20.32  |
|               |           | 8               | 3         | 20.40  | 20.55 | 20.37  |
|               |           | 8               | 7         | 20.35  | 20.57 | 20.57  |
|               |           | 15              | 0         | 19.17  | 19.08 | 18.96  |

| Cat-M1 Band 2 |           |                 |           |        |       |        |
|---------------|-----------|-----------------|-----------|--------|-------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid   | High   |
|               |           | Channel         |           | 18607  | 18900 | 19193  |
|               |           | Frequency (MHz) |           | 1850.7 | 1880  | 1909.3 |
| 1.4M          | QPSK      | 1               | 0         | 21.90  | 22.00 | 22.02  |
|               |           | 1               | 2         | 21.91  | 22.17 | 22.09  |
|               |           | 1               | 5         | 22.11  | 22.16 | 22.16  |
|               |           | 3               | 0         | 20.92  | 20.97 | 20.86  |
|               |           | 3               | 1         | 20.85  | 20.94 | 20.78  |
|               |           | 3               | 3         | 20.85  | 20.77 | 20.74  |
|               |           | 6               | 0         | 20.08  | 19.97 | 20.02  |
| 1.4M          | 16QAM     | 1               | 0         | 22.32  | 22.49 | 22.42  |
|               |           | 1               | 2         | 22.24  | 22.41 | 22.40  |
|               |           | 1               | 5         | 22.44  | 22.30 | 22.41  |
|               |           | 3               | 0         | 20.48  | 20.54 | 20.42  |
|               |           | 3               | 1         | 20.58  | 20.56 | 20.39  |
|               |           | 3               | 3         | 20.47  | 20.56 | 20.49  |
|               |           | 6               | 0         | 18.99  | 19.18 | 19.18  |

**EIRP Power (dBm)**

| Cat-M1 Band 2 |           |                 |           |              |       |       |
|---------------|-----------|-----------------|-----------|--------------|-------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low          | Mid   | High  |
|               |           | Channel         |           | 18700        | 18900 | 19100 |
|               |           | Frequency (MHz) |           | 1860         | 1880  | 1900  |
| 20M           | QPSK      | 1               | 0         | 13.46        | 13.45 | 13.54 |
|               |           | 1               | 50        | <b>13.67</b> | 13.47 | 13.45 |
|               |           | 1               | 99        | 13.41        | 13.43 | 13.57 |
|               |           | 50              | 0         | 12.19        | 12.25 | 12.47 |
|               |           | 50              | 25        | 12.30        | 12.35 | 12.38 |
|               |           | 50              | 50        | 12.28        | 12.32 | 12.18 |
|               |           | 100             | 0         | 11.70        | 11.69 | 11.47 |
| 20M           | 16QAM     | 1               | 0         | <b>14.02</b> | 13.77 | 13.95 |
|               |           | 1               | 50        | 13.81        | 13.88 | 13.81 |
|               |           | 1               | 99        | 13.96        | 13.81 | 13.93 |
|               |           | 50              | 0         | 11.86        | 11.90 | 11.80 |
|               |           | 50              | 25        | 12.03        | 11.80 | 11.92 |
|               |           | 50              | 50        | 12.07        | 11.85 | 12.08 |
|               |           | 100             | 0         | 10.52        | 10.65 | 10.48 |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 2 |           |                 |           |        |              |              |
|---------------|-----------|-----------------|-----------|--------|--------------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid          | High         |
|               |           | Channel         |           | 18675  | 18900        | 19125        |
|               |           | Frequency (MHz) |           | 1857.5 | 1880         | 1902.5       |
| 15M           | QPSK      | 1               | 0         | 13.38  | 13.67        | 13.46        |
|               |           | 1               | 37        | 13.47  | 13.62        | 13.65        |
|               |           | 1               | 74        | 13.44  | <b>13.68</b> | 13.49        |
|               |           | 36              | 0         | 12.31  | 12.44        | 12.29        |
|               |           | 36              | 19        | 12.23  | 12.26        | 12.33        |
|               |           | 36              | 39        | 12.22  | 12.32        | 12.33        |
|               |           | 75              | 0         | 11.64  | 11.66        | 11.63        |
| 15M           | 16QAM     | 1               | 0         | 13.86  | 13.74        | <b>14.01</b> |
|               |           | 1               | 37        | 13.77  | 13.82        | 13.81        |
|               |           | 1               | 74        | 13.75  | 13.81        | 13.98        |
|               |           | 36              | 0         | 11.89  | 11.94        | 12.00        |
|               |           | 36              | 19        | 11.86  | 11.89        | 11.88        |
|               |           | 36              | 39        | 11.93  | 12.03        | 12.04        |
|               |           | 75              | 0         | 10.43  | 10.62        | 10.44        |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 2 |           |                 |           |       |       |              |
|---------------|-----------|-----------------|-----------|-------|-------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid   | High         |
|               |           | Channel         |           | 18650 | 18900 | 19150        |
|               |           | Frequency (MHz) |           | 1855  | 1880  | 1905         |
| 10M           | QPSK      | 1               | 0         | 13.66 | 13.62 | 13.60        |
|               |           | 1               | 24        | 13.38 | 13.55 | 13.65        |
|               |           | 1               | 49        | 13.47 | 13.55 | <b>13.68</b> |
|               |           | 25              | 0         | 12.22 | 12.27 | 12.25        |
|               |           | 25              | 12        | 12.20 | 12.47 | 12.41        |
|               |           | 25              | 25        | 12.31 | 12.27 | 12.48        |
|               |           | 50              | 0         | 11.64 | 11.65 | 11.77        |
| 10M           | 16QAM     | 1               | 0         | 13.84 | 13.89 | <b>14.03</b> |
|               |           | 1               | 24        | 13.94 | 13.92 | 13.91        |
|               |           | 1               | 49        | 13.85 | 13.79 | <b>14.03</b> |
|               |           | 25              | 0         | 12.00 | 11.89 | 11.88        |
|               |           | 25              | 12        | 11.85 | 12.00 | 11.79        |
|               |           | 25              | 25        | 12.00 | 11.93 | 11.94        |
|               |           | 50              | 0         | 10.69 | 10.65 | 10.50        |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 2 |           |                 |           |        |              |              |
|---------------|-----------|-----------------|-----------|--------|--------------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid          | High         |
|               |           | Channel         |           | 18625  | 18900        | 19175        |
|               |           | Frequency (MHz) |           | 1852.5 | 1880         | 1907.5       |
| 5M            | QPSK      | 1               | 0         | 13.50  | <b>13.65</b> | 13.56        |
|               |           | 1               | 12        | 13.45  | 13.55        | 13.45        |
|               |           | 1               | 24        | 13.47  | 13.64        | 13.64        |
|               |           | 12              | 0         | 12.34  | 12.24        | 12.37        |
|               |           | 12              | 6         | 12.28  | 12.41        | 12.36        |
|               |           | 12              | 13        | 12.48  | 12.48        | 12.27        |
|               |           | 25              | 0         | 11.66  | 11.66        | 11.68        |
| 5M            | 16QAM     | 1               | 0         | 13.88  | 13.78        | 13.97        |
|               |           | 1               | 12        | 13.76  | <b>14.03</b> | <b>14.03</b> |
|               |           | 1               | 24        | 13.76  | 13.90        | 13.77        |
|               |           | 12              | 0         | 11.99  | 11.90        | 12.02        |
|               |           | 12              | 6         | 11.92  | 11.96        | 12.00        |
|               |           | 12              | 13        | 12.05  | 11.95        | 11.79        |
|               |           | 25              | 0         | 10.44  | 10.52        | 10.72        |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 2 |           |                 |           |              |              |              |
|---------------|-----------|-----------------|-----------|--------------|--------------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low          | Mid          | High         |
|               |           | Channel         |           | 18615        | 18900        | 19185        |
|               |           | Frequency (MHz) |           | 1851.5       | 1880         | 1908.5       |
| 3M            | QPSK      | 1               | 0         | 13.58        | 13.42        | <b>13.62</b> |
|               |           | 1               | 7         | 13.41        | 13.46        | 13.57        |
|               |           | 1               | 14        | 13.40        | <b>13.62</b> | 13.52        |
|               |           | 8               | 0         | 12.21        | 12.28        | 12.39        |
|               |           | 8               | 3         | 12.46        | 12.40        | 12.46        |
|               |           | 8               | 7         | 12.38        | 12.38        | 12.36        |
|               |           | 15              | 0         | 11.69        | 11.51        | 11.50        |
| 3M            | 16QAM     | 1               | 0         | <b>14.01</b> | 14.00        | 13.80        |
|               |           | 1               | 7         | 13.89        | 13.92        | 13.80        |
|               |           | 1               | 14        | 13.75        | 13.88        | 13.83        |
|               |           | 8               | 0         | 11.95        | 11.99        | 11.82        |
|               |           | 8               | 3         | 11.90        | 12.05        | 11.87        |
|               |           | 8               | 7         | 11.85        | 12.07        | 12.07        |
|               |           | 15              | 0         | 10.67        | 10.58        | 10.46        |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 2 |           |                 |           |        |              |        |
|---------------|-----------|-----------------|-----------|--------|--------------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid          | High   |
|               |           | Channel         |           | 18607  | 18900        | 19193  |
|               |           | Frequency (MHz) |           | 1850.7 | 1880         | 1909.3 |
| 1.4M          | QPSK      | 1               | 0         | 13.40  | 13.50        | 13.52  |
|               |           | 1               | 2         | 13.41  | <b>13.67</b> | 13.59  |
|               |           | 1               | 5         | 13.61  | 13.66        | 13.66  |
|               |           | 3               | 0         | 12.42  | 12.47        | 12.36  |
|               |           | 3               | 1         | 12.35  | 12.44        | 12.28  |
|               |           | 3               | 3         | 12.35  | 12.27        | 12.24  |
|               |           | 6               | 0         | 11.58  | 11.47        | 11.52  |
| 1.4M          | 16QAM     | 1               | 0         | 13.82  | <b>13.99</b> | 13.92  |
|               |           | 1               | 2         | 13.74  | 13.91        | 13.90  |
|               |           | 1               | 5         | 13.94  | 13.80        | 13.91  |
|               |           | 3               | 0         | 11.98  | 12.04        | 11.92  |
|               |           | 3               | 1         | 12.08  | 12.06        | 11.89  |
|               |           | 3               | 3         | 11.97  | 12.06        | 11.99  |
|               |           | 6               | 0         | 10.49  | 10.68        | 10.68  |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

### 7.1.2 Cat-M1 Band 4

#### Conducted Output Power (dBm)

| Cat-M1 Band 4 |           |                 |           |       |        |       |
|---------------|-----------|-----------------|-----------|-------|--------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid    | High  |
|               |           | Channel         |           | 20050 | 20175  | 20300 |
|               |           | Frequency (MHz) |           | 1720  | 1732.5 | 1745  |
| 20M           | QPSK      | 1               | 0         | 20.38 | 20.14  | 20.17 |
|               |           | 1               | 50        | 20.30 | 20.32  | 20.23 |
|               |           | 1               | 99        | 20.28 | 20.27  | 20.19 |
|               |           | 50              | 0         | 19.28 | 19.19  | 19.31 |
|               |           | 50              | 25        | 19.05 | 19.08  | 19.07 |
|               |           | 50              | 50        | 19.25 | 19.11  | 19.10 |
|               |           | 100             | 0         | 18.50 | 18.54  | 18.55 |
| 20M           | 16QAM     | 1               | 0         | 20.52 | 20.35  | 20.51 |
|               |           | 1               | 50        | 20.32 | 20.47  | 20.61 |
|               |           | 1               | 99        | 20.50 | 20.48  | 20.42 |
|               |           | 50              | 0         | 18.48 | 18.25  | 18.37 |
|               |           | 50              | 25        | 18.31 | 18.51  | 18.50 |
|               |           | 50              | 50        | 18.26 | 18.43  | 18.48 |
|               |           | 100             | 0         | 16.92 | 17.09  | 16.92 |

| Cat-M1 Band 4 |           |                 |           |        |        |        |
|---------------|-----------|-----------------|-----------|--------|--------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid    | High   |
|               |           | Channel         |           | 20025  | 20175  | 20325  |
|               |           | Frequency (MHz) |           | 1717.5 | 1732.5 | 1747.5 |
| 15M           | QPSK      | 1               | 0         | 20.36  | 20.30  | 20.13  |
|               |           | 1               | 37        | 20.13  | 20.43  | 20.31  |
|               |           | 1               | 74        | 20.17  | 20.16  | 20.42  |
|               |           | 36              | 0         | 19.21  | 19.19  | 19.31  |
|               |           | 36              | 19        | 19.17  | 19.06  | 19.21  |
|               |           | 36              | 39        | 19.30  | 19.12  | 19.31  |
|               |           | 75              | 0         | 18.52  | 18.63  | 18.47  |
| 15M           | 16QAM     | 1               | 0         | 20.47  | 20.54  | 20.60  |
|               |           | 1               | 37        | 20.52  | 20.52  | 20.54  |
|               |           | 1               | 74        | 20.52  | 20.30  | 20.51  |
|               |           | 36              | 0         | 18.31  | 18.42  | 18.35  |
|               |           | 36              | 19        | 18.42  | 18.54  | 18.50  |
|               |           | 36              | 39        | 18.29  | 18.35  | 18.29  |
|               |           | 75              | 0         | 16.88  | 16.88  | 16.87  |

| Cat-M1 Band 4 |           |                 |           |       |        |       |
|---------------|-----------|-----------------|-----------|-------|--------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid    | High  |
|               |           | Channel         |           | 20000 | 20175  | 20350 |
|               |           | Frequency (MHz) |           | 1715  | 1732.5 | 1750  |
| 10M           | QPSK      | 1               | 0         | 20.14 | 20.33  | 20.19 |
|               |           | 1               | 24        | 20.38 | 20.40  | 20.28 |
|               |           | 1               | 49        | 20.27 | 20.26  | 20.43 |
|               |           | 25              | 0         | 19.21 | 19.10  | 19.21 |
|               |           | 25              | 12        | 19.12 | 19.18  | 19.33 |
|               |           | 25              | 25        | 19.17 | 19.19  | 19.13 |
|               |           | 50              | 0         | 18.77 | 18.68  | 18.54 |
| 10M           | 16QAM     | 1               | 0         | 20.45 | 20.48  | 20.49 |
|               |           | 1               | 24        | 20.35 | 20.36  | 20.54 |
|               |           | 1               | 49        | 20.52 | 20.42  | 20.50 |
|               |           | 25              | 0         | 18.49 | 18.48  | 18.45 |
|               |           | 25              | 12        | 18.26 | 18.43  | 18.25 |
|               |           | 25              | 25        | 18.53 | 18.34  | 18.51 |
|               |           | 50              | 0         | 16.99 | 16.88  | 16.96 |

| Cat-M1 Band 4 |           |                 |           |        |        |        |
|---------------|-----------|-----------------|-----------|--------|--------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid    | High   |
|               |           | Channel         |           | 19975  | 20175  | 20375  |
|               |           | Frequency (MHz) |           | 1712.5 | 1732.5 | 1752.5 |
| 5M            | QPSK      | 1               | 0         | 20.42  | 20.20  | 20.36  |
|               |           | 1               | 12        | 20.41  | 20.32  | 20.36  |
|               |           | 1               | 24        | 20.14  | 20.38  | 20.27  |
|               |           | 12              | 0         | 19.08  | 19.31  | 19.07  |
|               |           | 12              | 6         | 19.33  | 19.06  | 19.07  |
|               |           | 12              | 13        | 19.26  | 19.31  | 19.27  |
|               |           | 25              | 0         | 18.59  | 18.56  | 18.62  |
| 5M            | 16QAM     | 1               | 0         | 20.30  | 20.45  | 20.31  |
|               |           | 1               | 12        | 20.38  | 20.42  | 20.58  |
|               |           | 1               | 24        | 20.47  | 20.31  | 20.38  |
|               |           | 12              | 0         | 18.28  | 18.44  | 18.32  |
|               |           | 12              | 6         | 18.48  | 18.54  | 18.53  |
|               |           | 12              | 13        | 18.24  | 18.52  | 18.49  |
|               |           | 25              | 0         | 16.91  | 16.86  | 17.13  |

| Cat-M1 Band 4 |           |                 |           |        |        |        |
|---------------|-----------|-----------------|-----------|--------|--------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid    | High   |
|               |           | Channel         |           | 19965  | 20175  | 20385  |
|               |           | Frequency (MHz) |           | 1711.5 | 1732.5 | 1753.5 |
| 3M            | QPSK      | 1               | 0         | 20.43  | 20.16  | 20.38  |
|               |           | 1               | 7         | 20.34  | 20.27  | 20.26  |
|               |           | 1               | 14        | 20.30  | 20.32  | 20.33  |
|               |           | 8               | 0         | 19.29  | 19.05  | 19.35  |
|               |           | 8               | 3         | 19.25  | 19.33  | 19.13  |
|               |           | 8               | 7         | 19.30  | 19.27  | 19.12  |
|               |           | 15              | 0         | 18.58  | 18.51  | 18.52  |
| 3M            | 16QAM     | 1               | 0         | 20.42  | 20.55  | 20.46  |
|               |           | 1               | 7         | 20.43  | 20.60  | 20.41  |
|               |           | 1               | 14        | 20.47  | 20.52  | 20.44  |
|               |           | 8               | 0         | 18.51  | 18.41  | 18.41  |
|               |           | 8               | 3         | 18.47  | 18.54  | 18.28  |
|               |           | 8               | 7         | 18.45  | 18.47  | 18.52  |
|               |           | 15              | 0         | 17.03  | 16.85  | 17.01  |

| Cat-M1 Band 4 |           |                 |           |        |        |        |
|---------------|-----------|-----------------|-----------|--------|--------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid    | High   |
|               |           | Channel         |           | 19957  | 20175  | 20393  |
|               |           | Frequency (MHz) |           | 1710.7 | 1732.5 | 1754.3 |
| 1.4M          | QPSK      | 1               | 0         | 20.15  | 20.24  | 20.33  |
|               |           | 1               | 2         | 20.22  | 20.39  | 20.39  |
|               |           | 1               | 5         | 20.24  | 20.27  | 20.16  |
|               |           | 3               | 0         | 19.16  | 19.22  | 19.08  |
|               |           | 3               | 1         | 19.23  | 19.06  | 19.13  |
|               |           | 3               | 3         | 19.18  | 19.20  | 19.35  |
|               |           | 6               | 0         | 18.50  | 18.64  | 18.70  |
| 1.4M          | 16QAM     | 1               | 0         | 20.49  | 20.46  | 20.43  |
|               |           | 1               | 2         | 20.48  | 20.59  | 20.52  |
|               |           | 1               | 5         | 20.45  | 20.46  | 20.34  |
|               |           | 3               | 0         | 18.35  | 18.25  | 18.51  |
|               |           | 3               | 1         | 18.30  | 18.47  | 18.29  |
|               |           | 3               | 3         | 18.41  | 18.52  | 18.30  |
|               |           | 6               | 0         | 17.14  | 16.87  | 16.91  |

**EIRP Power (dBm)**

| Cat-M1 Band 4 |           |                 |           |              |        |              |
|---------------|-----------|-----------------|-----------|--------------|--------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low          | Mid    | High         |
|               |           | Channel         |           | 20050        | 20175  | 20300        |
|               |           | Frequency (MHz) |           | 1720         | 1732.5 | 1745         |
| 20M           | QPSK      | 1               | 0         | <b>12.78</b> | 12.54  | 12.57        |
|               |           | 1               | 50        | 12.70        | 12.72  | 12.63        |
|               |           | 1               | 99        | 12.68        | 12.67  | 12.59        |
|               |           | 50              | 0         | 11.68        | 11.59  | 11.71        |
|               |           | 50              | 25        | 11.45        | 11.48  | 11.47        |
|               |           | 50              | 50        | 11.65        | 11.51  | 11.50        |
|               |           | 100             | 0         | 10.90        | 10.94  | 10.95        |
| 20M           | 16QAM     | 1               | 0         | 12.92        | 12.75  | 12.91        |
|               |           | 1               | 50        | 12.72        | 12.87  | <b>13.01</b> |
|               |           | 1               | 99        | 12.90        | 12.88  | 12.82        |
|               |           | 50              | 0         | 10.88        | 10.65  | 10.77        |
|               |           | 50              | 25        | 10.71        | 10.91  | 10.90        |
|               |           | 50              | 50        | 10.66        | 10.83  | 10.88        |
|               |           | 100             | 0         | 9.32         | 9.49   | 9.32         |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 4 |           |                 |           |        |              |              |
|---------------|-----------|-----------------|-----------|--------|--------------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid          | High         |
|               |           | Channel         |           | 20025  | 20175        | 20325        |
|               |           | Frequency (MHz) |           | 1717.5 | 1732.5       | 1747.5       |
| 15M           | QPSK      | 1               | 0         | 12.76  | 12.70        | 12.53        |
|               |           | 1               | 37        | 12.53  | <b>12.83</b> | 12.71        |
|               |           | 1               | 74        | 12.57  | 12.56        | 12.82        |
|               |           | 36              | 0         | 11.61  | 11.59        | 11.71        |
|               |           | 36              | 19        | 11.57  | 11.46        | 11.61        |
|               |           | 36              | 39        | 11.70  | 11.52        | 11.71        |
|               |           | 75              | 0         | 10.92  | 11.03        | 10.87        |
| 15M           | 16QAM     | 1               | 0         | 12.87  | 12.94        | <b>13.00</b> |
|               |           | 1               | 37        | 12.92  | 12.92        | 12.94        |
|               |           | 1               | 74        | 12.92  | 12.70        | 12.91        |
|               |           | 36              | 0         | 10.71  | 10.82        | 10.75        |
|               |           | 36              | 19        | 10.82  | 10.94        | 10.90        |
|               |           | 36              | 39        | 10.69  | 10.75        | 10.69        |
|               |           | 75              | 0         | 9.28   | 9.28         | 9.27         |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 4 |           |                 |           |       |        |              |
|---------------|-----------|-----------------|-----------|-------|--------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid    | High         |
|               |           | Channel         |           | 20000 | 20175  | 20350        |
|               |           | Frequency (MHz) |           | 1715  | 1732.5 | 1750         |
| 10M           | QPSK      | 1               | 0         | 12.54 | 12.73  | 12.59        |
|               |           | 1               | 24        | 12.78 | 12.80  | 12.68        |
|               |           | 1               | 49        | 12.67 | 12.66  | <b>12.83</b> |
|               |           | 25              | 0         | 11.61 | 11.50  | 11.61        |
|               |           | 25              | 12        | 11.52 | 11.58  | 11.73        |
|               |           | 25              | 25        | 11.57 | 11.59  | 11.53        |
|               |           | 50              | 0         | 11.17 | 11.08  | 10.94        |
| 10M           | 16QAM     | 1               | 0         | 12.85 | 12.88  | 12.89        |
|               |           | 1               | 24        | 12.75 | 12.76  | <b>12.94</b> |
|               |           | 1               | 49        | 12.92 | 12.82  | 12.90        |
|               |           | 25              | 0         | 10.89 | 10.88  | 10.85        |
|               |           | 25              | 12        | 10.66 | 10.83  | 10.65        |
|               |           | 25              | 25        | 10.93 | 10.74  | 10.91        |
|               |           | 50              | 0         | 9.39  | 9.28   | 9.36         |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 4 |           |                 |           |              |        |              |
|---------------|-----------|-----------------|-----------|--------------|--------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low          | Mid    | High         |
|               |           | Channel         |           | 19975        | 20175  | 20375        |
|               |           | Frequency (MHz) |           | 1712.5       | 1732.5 | 1752.5       |
| 5M            | QPSK      | 1               | 0         | <b>12.82</b> | 12.60  | 12.76        |
|               |           | 1               | 12        | 12.81        | 12.72  | 12.76        |
|               |           | 1               | 24        | 12.54        | 12.78  | 12.67        |
|               |           | 12              | 0         | 11.48        | 11.71  | 11.47        |
|               |           | 12              | 6         | 11.73        | 11.46  | 11.47        |
|               |           | 12              | 13        | 11.66        | 11.71  | 11.67        |
|               |           | 25              | 0         | 10.99        | 10.96  | 11.02        |
| 5M            | 16QAM     | 1               | 0         | 12.70        | 12.85  | 12.71        |
|               |           | 1               | 12        | 12.78        | 12.82  | <b>12.98</b> |
|               |           | 1               | 24        | 12.87        | 12.71  | 12.78        |
|               |           | 12              | 0         | 10.68        | 10.84  | 10.72        |
|               |           | 12              | 6         | 10.88        | 10.94  | 10.93        |
|               |           | 12              | 13        | 10.64        | 10.92  | 10.89        |
|               |           | 25              | 0         | 9.31         | 9.26   | 9.53         |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 4 |           |                 |           |              |              |        |
|---------------|-----------|-----------------|-----------|--------------|--------------|--------|
| BW            | MCS Index | RB Size         | RB Offset | Low          | Mid          | High   |
|               |           | Channel         |           | 19965        | 20175        | 20385  |
|               |           | Frequency (MHz) |           | 1711.5       | 1732.5       | 1753.5 |
| 3M            | QPSK      | 1               | 0         | <b>12.83</b> | 12.56        | 12.78  |
|               |           | 1               | 7         | 12.74        | 12.67        | 12.66  |
|               |           | 1               | 14        | 12.70        | 12.72        | 12.73  |
|               |           | 8               | 0         | 11.69        | 11.45        | 11.75  |
|               |           | 8               | 3         | 11.65        | 11.73        | 11.53  |
|               |           | 8               | 7         | 11.70        | 11.67        | 11.52  |
|               |           | 15              | 0         | 10.98        | 10.91        | 10.92  |
| 3M            | 16QAM     | 1               | 0         | 12.82        | 12.95        | 12.86  |
|               |           | 1               | 7         | 12.83        | <b>13.00</b> | 12.81  |
|               |           | 1               | 14        | 12.87        | 12.92        | 12.84  |
|               |           | 8               | 0         | 10.91        | 10.81        | 10.81  |
|               |           | 8               | 3         | 10.87        | 10.94        | 10.68  |
|               |           | 8               | 7         | 10.85        | 10.87        | 10.92  |
|               |           | 15              | 0         | 9.43         | 9.25         | 9.41   |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

| Cat-M1 Band 4 |           |                 |           |        |              |              |
|---------------|-----------|-----------------|-----------|--------|--------------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low    | Mid          | High         |
|               |           | Channel         |           | 19957  | 20175        | 20393        |
|               |           | Frequency (MHz) |           | 1710.7 | 1732.5       | 1754.3       |
| 1.4M          | QPSK      | 1               | 0         | 12.55  | 12.64        | 12.73        |
|               |           | 1               | 2         | 12.62  | <b>12.79</b> | <b>12.79</b> |
|               |           | 1               | 5         | 12.64  | 12.67        | 12.56        |
|               |           | 3               | 0         | 11.56  | 11.62        | 11.48        |
|               |           | 3               | 1         | 11.63  | 11.46        | 11.53        |
|               |           | 3               | 3         | 11.58  | 11.60        | 11.75        |
|               |           | 6               | 0         | 10.90  | 11.04        | 11.10        |
| 1.4M          | 16QAM     | 1               | 0         | 12.89  | 12.86        | 12.83        |
|               |           | 1               | 2         | 12.88  | <b>12.99</b> | 12.92        |
|               |           | 1               | 5         | 12.85  | 12.86        | 12.74        |
|               |           | 3               | 0         | 10.75  | 10.65        | 10.91        |
|               |           | 3               | 1         | 10.70  | 10.87        | 10.69        |
|               |           | 3               | 3         | 10.81  | 10.92        | 10.70        |
|               |           | 6               | 0         | 9.54   | 9.27         | 9.31         |

\*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

### 7.1.3 Cat-M1 Band 5

#### Conducted Output Power (dBm)

| Cat-M1 Band 5 |           |                 |           |       |       |       |
|---------------|-----------|-----------------|-----------|-------|-------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|               |           | Channel         |           | 20450 | 20525 | 20600 |
|               |           | Frequency (MHz) |           | 829   | 836.5 | 844   |
| 10M           | QPSK      | 1               | 0         | 22.98 | 23.12 | 22.98 |
|               |           | 1               | 24        | 23.02 | 23.01 | 23.08 |
|               |           | 1               | 49        | 23.11 | 22.98 | 23.06 |
|               |           | 25              | 0         | 22.13 | 21.97 | 22.25 |
|               |           | 25              | 12        | 22.18 | 22.16 | 22.03 |
|               |           | 25              | 25        | 22.07 | 22.21 | 22.22 |
|               |           | 50              | 0         | 22.24 | 22.07 | 22.32 |
| 10M           | 16QAM     | 1               | 0         | 23.33 | 23.48 | 23.54 |
|               |           | 1               | 24        | 23.31 | 23.39 | 23.37 |
|               |           | 1               | 49        | 23.33 | 23.42 | 23.50 |
|               |           | 25              | 0         | 22.45 | 22.50 | 22.56 |
|               |           | 25              | 12        | 22.31 | 22.48 | 22.29 |
|               |           | 25              | 25        | 22.57 | 22.56 | 22.42 |
|               |           | 50              | 0         | 20.93 | 21.05 | 20.92 |

| Cat-M1 Band 5 |           |                 |           |       |       |       |
|---------------|-----------|-----------------|-----------|-------|-------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|               |           | Channel         |           | 20425 | 20525 | 20625 |
|               |           | Frequency (MHz) |           | 826.5 | 836.5 | 846.5 |
| 5M            | QPSK      | 1               | 0         | 22.96 | 23.07 | 23.10 |
|               |           | 1               | 12        | 23.04 | 22.99 | 23.21 |
|               |           | 1               | 24        | 23.06 | 22.99 | 22.98 |
|               |           | 12              | 0         | 22.10 | 21.99 | 22.27 |
|               |           | 12              | 6         | 22.03 | 21.98 | 22.16 |
|               |           | 12              | 13        | 22.05 | 22.17 | 22.05 |
|               |           | 25              | 0         | 22.13 | 22.27 | 22.05 |
| 5M            | 16QAM     | 1               | 0         | 23.46 | 23.47 | 23.36 |
|               |           | 1               | 12        | 23.56 | 23.30 | 23.41 |
|               |           | 1               | 24        | 23.56 | 23.27 | 23.54 |
|               |           | 12              | 0         | 22.43 | 22.30 | 22.49 |
|               |           | 12              | 6         | 22.53 | 22.54 | 22.57 |
|               |           | 12              | 13        | 22.53 | 22.41 | 22.36 |
|               |           | 25              | 0         | 20.90 | 20.93 | 21.06 |

| Cat-M1 Band 5 |           |                 |           |       |       |       |
|---------------|-----------|-----------------|-----------|-------|-------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|               |           | Channel         |           | 20415 | 20525 | 20635 |
|               |           | Frequency (MHz) |           | 825.5 | 836.5 | 847.5 |
| 3M            | QPSK      | 1               | 0         | 23.08 | 23.14 | 23.09 |
|               |           | 1               | 7         | 23.00 | 23.01 | 23.14 |
|               |           | 1               | 14        | 22.99 | 23.09 | 23.02 |
|               |           | 8               | 0         | 22.09 | 21.99 | 22.20 |
|               |           | 8               | 3         | 22.23 | 22.19 | 22.09 |
|               |           | 8               | 7         | 22.08 | 22.22 | 21.97 |
|               |           | 15              | 0         | 22.29 | 22.07 | 22.33 |
| 3M            | 16QAM     | 1               | 0         | 23.37 | 23.49 | 23.28 |
|               |           | 1               | 7         | 23.33 | 23.29 | 23.48 |
|               |           | 1               | 14        | 23.32 | 23.33 | 23.30 |
|               |           | 8               | 0         | 22.59 | 22.36 | 22.40 |
|               |           | 8               | 3         | 22.51 | 22.56 | 22.58 |
|               |           | 8               | 7         | 22.38 | 22.48 | 22.50 |
|               |           | 15              | 0         | 20.82 | 20.98 | 20.90 |

| Cat-M1 Band 5 |           |                 |           |       |       |       |
|---------------|-----------|-----------------|-----------|-------|-------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|               |           | Channel         |           | 20407 | 20525 | 20643 |
|               |           | Frequency (MHz) |           | 824.7 | 836.5 | 848.3 |
| 1.4M          | QPSK      | 1               | 0         | 23.21 | 22.94 | 23.12 |
|               |           | 1               | 2         | 22.98 | 23.02 | 23.21 |
|               |           | 1               | 5         | 23.00 | 23.22 | 23.08 |
|               |           | 3               | 0         | 22.08 | 22.17 | 22.23 |
|               |           | 3               | 1         | 22.14 | 22.03 | 22.00 |
|               |           | 3               | 3         | 22.27 | 22.23 | 22.25 |
|               |           | 6               | 0         | 22.05 | 22.32 | 22.22 |
| 1.4M          | 16QAM     | 1               | 0         | 23.55 | 23.57 | 23.27 |
|               |           | 1               | 2         | 23.37 | 23.56 | 23.34 |
|               |           | 1               | 5         | 23.55 | 23.28 | 23.30 |
|               |           | 3               | 0         | 22.30 | 22.46 | 22.59 |
|               |           | 3               | 1         | 22.57 | 22.38 | 22.34 |
|               |           | 3               | 3         | 22.37 | 22.40 | 22.58 |
|               |           | 6               | 0         | 20.96 | 21.05 | 20.96 |

## ERP Power (dBm)

| Cat-M1 Band 5 |           |                 |           |       |              |              |
|---------------|-----------|-----------------|-----------|-------|--------------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid          | High         |
|               |           | Channel         |           | 20450 | 20525        | 20600        |
|               |           | Frequency (MHz) |           | 829   | 836.5        | 844          |
| 10M           | QPSK      | 1               | 0         | 12.03 | <b>12.17</b> | 12.03        |
|               |           | 1               | 24        | 12.07 | 12.06        | 12.13        |
|               |           | 1               | 49        | 12.16 | 12.03        | 12.11        |
|               |           | 25              | 0         | 11.18 | 11.02        | 11.30        |
|               |           | 25              | 12        | 11.23 | 11.21        | 11.08        |
|               |           | 25              | 25        | 11.12 | 11.26        | 11.27        |
|               |           | 50              | 0         | 11.29 | 11.12        | 11.37        |
| 10M           | 16QAM     | 1               | 0         | 12.38 | 12.53        | <b>12.59</b> |
|               |           | 1               | 24        | 12.36 | 12.44        | 12.42        |
|               |           | 1               | 49        | 12.38 | 12.47        | 12.55        |
|               |           | 25              | 0         | 11.50 | 11.55        | 11.61        |
|               |           | 25              | 12        | 11.36 | 11.53        | 11.34        |
|               |           | 25              | 25        | 11.62 | 11.61        | 11.47        |
|               |           | 50              | 0         | 9.98  | 10.10        | 9.97         |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

| Cat-M1 Band 5 |           |                 |           |              |       |              |
|---------------|-----------|-----------------|-----------|--------------|-------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low          | Mid   | High         |
|               |           | Channel         |           | 20425        | 20525 | 20625        |
|               |           | Frequency (MHz) |           | 826.5        | 836.5 | 846.5        |
| 5M            | QPSK      | 1               | 0         | 12.01        | 12.12 | 12.15        |
|               |           | 1               | 12        | 12.09        | 12.04 | <b>12.26</b> |
|               |           | 1               | 24        | 12.11        | 12.04 | 12.03        |
|               |           | 12              | 0         | 11.15        | 11.04 | 11.32        |
|               |           | 12              | 6         | 11.08        | 11.03 | 11.21        |
|               |           | 12              | 13        | 11.10        | 11.22 | 11.10        |
|               |           | 25              | 0         | 11.18        | 11.32 | 11.10        |
| 5M            | 16QAM     | 1               | 0         | 12.51        | 12.52 | 12.41        |
|               |           | 1               | 12        | <b>12.61</b> | 12.35 | 12.46        |
|               |           | 1               | 24        | <b>12.61</b> | 12.32 | 12.59        |
|               |           | 12              | 0         | 11.48        | 11.35 | 11.54        |
|               |           | 12              | 6         | 11.58        | 11.59 | 11.62        |
|               |           | 12              | 13        | 11.58        | 11.46 | 11.41        |
|               |           | 25              | 0         | 9.95         | 9.98  | 10.11        |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

| Cat-M1 Band 5 |           |                 |           |       |              |              |
|---------------|-----------|-----------------|-----------|-------|--------------|--------------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid          | High         |
|               |           | Channel         |           | 20415 | 20525        | 20635        |
|               |           | Frequency (MHz) |           | 825.5 | 836.5        | 847.5        |
| 3M            | QPSK      | 1               | 0         | 12.13 | <b>12.19</b> | 12.14        |
|               |           | 1               | 7         | 12.05 | 12.06        | <b>12.19</b> |
|               |           | 1               | 14        | 12.04 | 12.14        | 12.07        |
|               |           | 8               | 0         | 11.14 | 11.04        | 11.25        |
|               |           | 8               | 3         | 11.28 | 11.24        | 11.14        |
|               |           | 8               | 7         | 11.13 | 11.27        | 11.02        |
|               |           | 15              | 0         | 11.34 | 11.12        | 11.38        |
| 3M            | 16QAM     | 1               | 0         | 12.42 | <b>12.54</b> | 12.33        |
|               |           | 1               | 7         | 12.38 | 12.34        | 12.53        |
|               |           | 1               | 14        | 12.37 | 12.38        | 12.35        |
|               |           | 8               | 0         | 11.64 | 11.41        | 11.45        |
|               |           | 8               | 3         | 11.56 | 11.61        | 11.63        |
|               |           | 8               | 7         | 11.43 | 11.53        | 11.55        |
|               |           | 15              | 0         | 9.87  | 10.03        | 9.95         |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

| Cat-M1 Band 5 |           |                 |           |       |              |       |
|---------------|-----------|-----------------|-----------|-------|--------------|-------|
| BW            | MCS Index | RB Size         | RB Offset | Low   | Mid          | High  |
|               |           | Channel         |           | 20407 | 20525        | 20643 |
|               |           | Frequency (MHz) |           | 824.7 | 836.5        | 848.3 |
| 1.4M          | QPSK      | 1               | 0         | 12.26 | 11.99        | 12.17 |
|               |           | 1               | 2         | 12.03 | 12.07        | 12.26 |
|               |           | 1               | 5         | 12.05 | <b>12.27</b> | 12.13 |
|               |           | 3               | 0         | 11.13 | 11.22        | 11.28 |
|               |           | 3               | 1         | 11.19 | 11.08        | 11.05 |
|               |           | 3               | 3         | 11.32 | 11.28        | 11.30 |
|               |           | 6               | 0         | 11.10 | 11.37        | 11.27 |
| 1.4M          | 16QAM     | 1               | 0         | 12.60 | <b>12.62</b> | 12.32 |
|               |           | 1               | 2         | 12.42 | 12.61        | 12.39 |
|               |           | 1               | 5         | 12.60 | 12.33        | 12.35 |
|               |           | 3               | 0         | 11.35 | 11.51        | 11.64 |
|               |           | 3               | 1         | 11.62 | 11.43        | 11.39 |
|               |           | 3               | 3         | 11.42 | 11.45        | 11.63 |
|               |           | 6               | 0         | 10.01 | 10.10        | 10.01 |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

#### 7.1.4 Cat-M1 Band 12

##### Conducted Output Power (dBm)

| Cat-M1 Band 12 |           |                 |           |       |       |       |
|----------------|-----------|-----------------|-----------|-------|-------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|                |           | Channel         |           | 23060 | 23095 | 23130 |
|                |           | Frequency (MHz) |           | 704   | 707.5 | 711   |
| 10M            | QPSK      | 1               | 0         | 23.45 | 23.51 | 23.32 |
|                |           | 1               | 24        | 23.59 | 23.59 | 23.53 |
|                |           | 1               | 49        | 23.34 | 23.44 | 23.49 |
|                |           | 25              | 0         | 23.76 | 23.53 | 23.56 |
|                |           | 25              | 12        | 23.51 | 23.74 | 23.59 |
|                |           | 25              | 25        | 23.49 | 23.67 | 23.76 |
|                |           | 50              | 0         | 21.97 | 21.82 | 21.89 |
| 10M            | 16QAM     | 1               | 0         | 23.16 | 23.25 | 23.01 |
|                |           | 1               | 24        | 23.03 | 23.20 | 23.04 |
|                |           | 1               | 49        | 23.14 | 23.19 | 23.21 |
|                |           | 25              | 0         | 23.02 | 22.97 | 23.02 |
|                |           | 25              | 12        | 22.98 | 23.08 | 22.95 |
|                |           | 25              | 25        | 22.94 | 23.10 | 23.11 |
|                |           | 50              | 0         | 20.80 | 20.77 | 20.75 |

| Cat-M1 Band 12 |           |                 |           |       |       |       |
|----------------|-----------|-----------------|-----------|-------|-------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|                |           | Channel         |           | 23035 | 23095 | 23155 |
|                |           | Frequency (MHz) |           | 701.5 | 707.5 | 713.5 |
| 5M             | QPSK      | 1               | 0         | 23.43 | 23.50 | 23.59 |
|                |           | 1               | 12        | 23.36 | 23.51 | 23.51 |
|                |           | 1               | 24        | 23.49 | 23.44 | 23.40 |
|                |           | 12              | 0         | 23.59 | 23.52 | 23.53 |
|                |           | 12              | 6         | 23.76 | 23.67 | 23.67 |
|                |           | 12              | 13        | 23.62 | 23.77 | 23.68 |
|                |           | 25              | 0         | 21.79 | 22.05 | 21.79 |
| 5M             | 16QAM     | 1               | 0         | 23.01 | 23.21 | 23.22 |
|                |           | 1               | 12        | 23.03 | 23.27 | 23.26 |
|                |           | 1               | 24        | 23.12 | 23.07 | 23.30 |
|                |           | 12              | 0         | 22.98 | 23.02 | 23.14 |
|                |           | 12              | 6         | 22.99 | 22.95 | 22.93 |
|                |           | 12              | 13        | 22.94 | 23.11 | 22.95 |
|                |           | 25              | 0         | 20.74 | 20.71 | 20.76 |

| Cat-M1 Band 12 |           |                 |           |       |       |       |
|----------------|-----------|-----------------|-----------|-------|-------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|                |           | Channel         |           | 23025 | 23095 | 23165 |
|                |           | Frequency (MHz) |           | 700.5 | 707.5 | 714.5 |
| 3M             | QPSK      | 1               | 0         | 23.52 | 23.36 | 23.32 |
|                |           | 1               | 7         | 23.58 | 23.35 | 23.43 |
|                |           | 1               | 14        | 23.44 | 23.56 | 23.44 |
|                |           | 8               | 0         | 23.77 | 23.69 | 23.63 |
|                |           | 8               | 3         | 23.74 | 23.72 | 23.68 |
|                |           | 8               | 7         | 23.50 | 23.77 | 23.63 |
|                |           | 15              | 0         | 21.86 | 22.06 | 22.01 |
| 3M             | 16QAM     | 1               | 0         | 23.31 | 23.30 | 23.08 |
|                |           | 1               | 7         | 23.24 | 23.06 | 23.05 |
|                |           | 1               | 14        | 23.17 | 23.30 | 23.06 |
|                |           | 8               | 0         | 23.04 | 23.00 | 22.98 |
|                |           | 8               | 3         | 23.10 | 22.96 | 22.89 |
|                |           | 8               | 7         | 22.93 | 23.13 | 22.88 |
|                |           | 15              | 0         | 20.68 | 20.61 | 20.80 |

| Cat-M1 Band 12 |           |                 |           |       |       |       |
|----------------|-----------|-----------------|-----------|-------|-------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|                |           | Channel         |           | 23017 | 23095 | 23173 |
|                |           | Frequency (MHz) |           | 699.7 | 707.5 | 715.3 |
| 1.4M           | QPSK      | 1               | 0         | 23.62 | 23.61 | 23.35 |
|                |           | 1               | 2         | 23.34 | 23.45 | 23.48 |
|                |           | 1               | 5         | 23.45 | 23.39 | 23.53 |
|                |           | 3               | 0         | 23.65 | 23.74 | 23.56 |
|                |           | 3               | 1         | 23.58 | 23.77 | 23.50 |
|                |           | 3               | 3         | 23.68 | 23.75 | 23.75 |
|                |           | 6               | 0         | 21.81 | 21.81 | 21.83 |
| 1.4M           | 16QAM     | 1               | 0         | 23.05 | 23.19 | 23.01 |
|                |           | 1               | 2         | 23.30 | 23.25 | 23.08 |
|                |           | 1               | 5         | 23.24 | 23.06 | 23.06 |
|                |           | 3               | 0         | 23.04 | 23.14 | 23.02 |
|                |           | 3               | 1         | 22.88 | 22.92 | 22.90 |
|                |           | 3               | 3         | 23.16 | 23.15 | 23.14 |
|                |           | 6               | 0         | 20.65 | 20.73 | 20.64 |

**ERP Power (dBm)**

| Cat-M1 Band 12 |           |                 |           |              |              |              |
|----------------|-----------|-----------------|-----------|--------------|--------------|--------------|
| BW             | MCS Index | RB Size         | RB Offset | Low          | Mid          | High         |
|                |           | Channel         |           | 23060        | 23095        | 23130        |
|                |           | Frequency (MHz) |           | 704          | 707.5        | 711          |
| 10M            | QPSK      | 1               | 0         | 16.10        | 16.16        | 15.97        |
|                |           | 1               | 24        | 16.24        | 16.24        | 16.18        |
|                |           | 1               | 49        | 15.99        | 16.09        | 16.14        |
|                |           | 25              | 0         | <b>16.41</b> | 16.18        | 16.21        |
|                |           | 25              | 12        | 16.16        | 16.39        | 16.24        |
|                |           | 25              | 25        | 16.14        | 16.32        | <b>16.41</b> |
|                |           | 50              | 0         | 14.62        | 14.47        | 14.54        |
| 10M            | 16QAM     | 1               | 0         | 15.81        | <b>15.90</b> | 15.66        |
|                |           | 1               | 24        | 15.68        | 15.85        | 15.69        |
|                |           | 1               | 49        | 15.79        | 15.84        | 15.86        |
|                |           | 25              | 0         | 15.67        | 15.62        | 15.67        |
|                |           | 25              | 12        | 15.63        | 15.73        | 15.60        |
|                |           | 25              | 25        | 15.59        | 15.75        | 15.76        |
|                |           | 50              | 0         | 13.45        | 13.42        | 13.40        |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

| Cat-M1 Band 12 |           |                 |           |       |              |              |
|----------------|-----------|-----------------|-----------|-------|--------------|--------------|
| BW             | MCS Index | RB Size         | RB Offset | Low   | Mid          | High         |
|                |           | Channel         |           | 23035 | 23095        | 23155        |
|                |           | Frequency (MHz) |           | 701.5 | 707.5        | 713.5        |
| 5M             | QPSK      | 1               | 0         | 16.08 | 16.15        | 16.24        |
|                |           | 1               | 12        | 16.01 | 16.16        | 16.16        |
|                |           | 1               | 24        | 16.14 | 16.09        | 16.05        |
|                |           | 12              | 0         | 16.24 | 16.17        | 16.18        |
|                |           | 12              | 6         | 16.41 | 16.32        | 16.32        |
|                |           | 12              | 13        | 16.27 | <b>16.42</b> | 16.33        |
|                |           | 25              | 0         | 14.44 | 14.70        | 14.44        |
| 5M             | 16QAM     | 1               | 0         | 15.66 | 15.86        | 15.87        |
|                |           | 1               | 12        | 15.68 | 15.92        | 15.91        |
|                |           | 1               | 24        | 15.77 | 15.72        | <b>15.95</b> |
|                |           | 12              | 0         | 15.63 | 15.67        | 15.79        |
|                |           | 12              | 6         | 15.64 | 15.60        | 15.58        |
|                |           | 12              | 13        | 15.59 | 15.76        | 15.60        |
|                |           | 25              | 0         | 13.39 | 13.36        | 13.41        |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

| Cat-M1 Band 12 |           |                 |           |              |              |       |
|----------------|-----------|-----------------|-----------|--------------|--------------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low          | Mid          | High  |
|                |           | Channel         |           | 23025        | 23095        | 23165 |
|                |           | Frequency (MHz) |           | 700.5        | 707.5        | 714.5 |
| 3M             | QPSK      | 1               | 0         | 16.17        | 16.01        | 15.97 |
|                |           | 1               | 7         | 16.23        | 16.00        | 16.08 |
|                |           | 1               | 14        | 16.09        | 16.21        | 16.09 |
|                |           | 8               | 0         | <b>16.42</b> | 16.34        | 16.28 |
|                |           | 8               | 3         | 16.39        | 16.37        | 16.33 |
|                |           | 8               | 7         | 16.15        | <b>16.42</b> | 16.28 |
|                |           | 15              | 0         | 14.51        | 14.71        | 14.66 |
| 3M             | 16QAM     | 1               | 0         | <b>15.96</b> | 15.95        | 15.73 |
|                |           | 1               | 7         | 15.89        | 15.71        | 15.70 |
|                |           | 1               | 14        | 15.82        | 15.95        | 15.71 |
|                |           | 8               | 0         | 15.69        | 15.65        | 15.63 |
|                |           | 8               | 3         | 15.75        | 15.61        | 15.54 |
|                |           | 8               | 7         | 15.58        | 15.78        | 15.53 |
|                |           | 15              | 0         | 13.33        | 13.26        | 13.45 |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

| Cat-M1 Band 12 |           |                 |           |              |              |       |
|----------------|-----------|-----------------|-----------|--------------|--------------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low          | Mid          | High  |
|                |           | Channel         |           | 23017        | 23095        | 23173 |
|                |           | Frequency (MHz) |           | 699.7        | 707.5        | 715.3 |
| 1.4M           | QPSK      | 1               | 0         | 16.27        | 16.26        | 16.00 |
|                |           | 1               | 2         | 15.99        | 16.10        | 16.13 |
|                |           | 1               | 5         | 16.10        | 16.04        | 16.18 |
|                |           | 3               | 0         | 16.30        | 16.39        | 16.21 |
|                |           | 3               | 1         | 16.23        | <b>16.42</b> | 16.15 |
|                |           | 3               | 3         | 16.33        | 16.40        | 16.40 |
|                |           | 6               | 0         | 14.46        | 14.46        | 14.48 |
| 1.4M           | 16QAM     | 1               | 0         | 15.70        | 15.84        | 15.66 |
|                |           | 1               | 2         | <b>15.95</b> | 15.90        | 15.73 |
|                |           | 1               | 5         | 15.89        | 15.71        | 15.71 |
|                |           | 3               | 0         | 15.69        | 15.79        | 15.67 |
|                |           | 3               | 1         | 15.53        | 15.57        | 15.55 |
|                |           | 3               | 3         | 15.81        | 15.80        | 15.79 |
|                |           | 6               | 0         | 13.30        | 13.38        | 13.29 |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

## 7.1.5 Cat-M1 Band 13

**Conducted Output Power (dBm)**

| Cat-M1 Band 13 |           |                 |           |       |
|----------------|-----------|-----------------|-----------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Mid   |
|                |           | Channel         |           | 23230 |
|                |           | Frequency (MHz) |           | 782   |
| 10M            | QPSK      | 1               | 0         | 21.12 |
|                |           | 1               | 24        | 20.96 |
|                |           | 1               | 49        | 21.02 |
|                |           | 25              | 0         | 21.36 |
|                |           | 25              | 12        | 21.54 |
|                |           | 25              | 25        | 21.41 |
|                |           | 50              | 0         | 20.82 |
| 10M            | 16QAM     | 1               | 0         | 21.45 |
|                |           | 1               | 24        | 21.54 |
|                |           | 1               | 49        | 21.63 |
|                |           | 25              | 0         | 21.91 |
|                |           | 25              | 12        | 21.81 |
|                |           | 25              | 25        | 21.75 |
|                |           | 50              | 0         | 19.41 |

| Cat-M1 Band 13 |           |                 |           |       |       |       |
|----------------|-----------|-----------------|-----------|-------|-------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low   | Mid   | High  |
|                |           | Channel         |           | 23205 | 23230 | 23255 |
|                |           | Frequency (MHz) |           | 779.5 | 782   | 784.5 |
| 5M             | QPSK      | 1               | 0         | 21.04 | 21.17 | 21.25 |
|                |           | 1               | 12        | 21.24 | 21.24 | 21.22 |
|                |           | 1               | 24        | 20.99 | 21.22 | 21.23 |
|                |           | 12              | 0         | 21.35 | 21.30 | 21.39 |
|                |           | 12              | 6         | 21.44 | 21.37 | 21.35 |
|                |           | 12              | 13        | 21.53 | 21.25 | 21.41 |
|                |           | 25              | 0         | 20.71 | 20.78 | 20.73 |
| 5M             | 16QAM     | 1               | 0         | 21.55 | 21.57 | 21.63 |
|                |           | 1               | 12        | 21.67 | 21.48 | 21.56 |
|                |           | 1               | 24        | 21.60 | 21.68 | 21.61 |
|                |           | 12              | 0         | 21.66 | 21.84 | 21.78 |
|                |           | 12              | 6         | 21.79 | 21.91 | 21.88 |
|                |           | 12              | 13        | 21.74 | 21.64 | 21.87 |
|                |           | 25              | 0         | 19.33 | 19.50 | 19.29 |

**ERP Power (dBm)**

| Cat-M1 Band 13 |           |                 |           |              |
|----------------|-----------|-----------------|-----------|--------------|
| BW             | MCS Index | RB Size         | RB Offset | Mid          |
|                |           | Channel         |           | 23230        |
|                |           | Frequency (MHz) |           | 782          |
| 10M            | QPSK      | 1               | 0         | 14.37        |
|                |           | 1               | 24        | 14.21        |
|                |           | 1               | 49        | 14.27        |
|                |           | 25              | 0         | 14.61        |
|                |           | 25              | 12        | <b>14.79</b> |
|                |           | 25              | 25        | 14.66        |
|                |           | 50              | 0         | 14.07        |
| 10M            | 16QAM     | 1               | 0         | 14.70        |
|                |           | 1               | 24        | 14.79        |
|                |           | 1               | 49        | 14.88        |
|                |           | 25              | 0         | <b>15.16</b> |
|                |           | 25              | 12        | 15.06        |
|                |           | 25              | 25        | 15.00        |
|                |           | 50              | 0         | 12.66        |

\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

| Cat-M1 Band 13 |           |                 |           |              |              |       |
|----------------|-----------|-----------------|-----------|--------------|--------------|-------|
| BW             | MCS Index | RB Size         | RB Offset | Low          | Mid          | High  |
|                |           | Channel         |           | 23205        | 23230        | 23255 |
|                |           | Frequency (MHz) |           | 779.5        | 782          | 784.5 |
| 5M             | QPSK      | 1               | 0         | 14.29        | 14.42        | 14.50 |
|                |           | 1               | 12        | 14.49        | 14.49        | 14.47 |
|                |           | 1               | 24        | 14.24        | 14.47        | 14.48 |
|                |           | 12              | 0         | 14.60        | 14.55        | 14.64 |
|                |           | 12              | 6         | 14.69        | 14.62        | 14.60 |
|                |           | 12              | 13        | <b>14.78</b> | 14.50        | 14.66 |
|                |           | 25              | 0         | 13.96        | 14.03        | 13.98 |
| 5M             | 16QAM     | 1               | 0         | 14.80        | 14.82        | 14.88 |
|                |           | 1               | 12        | 14.92        | 14.73        | 14.81 |
|                |           | 1               | 24        | 14.85        | 14.93        | 14.86 |
|                |           | 12              | 0         | 14.91        | 15.09        | 15.03 |
|                |           | 12              | 6         | 15.04        | <b>15.16</b> | 15.13 |
|                |           | 12              | 13        | 14.99        | 14.89        | 15.12 |
|                |           | 25              | 0         | 12.58        | 12.75        | 12.54 |

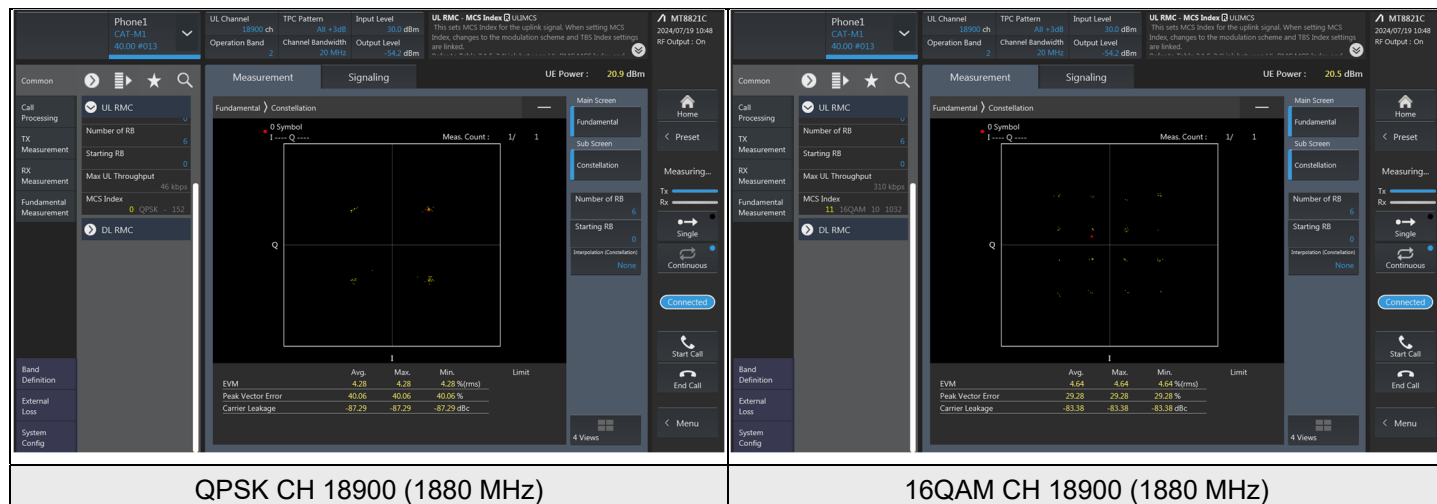
\*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

## 7.2 Modulation Characteristics

|              |       |                           |              |            |            |
|--------------|-------|---------------------------|--------------|------------|------------|
| Input Power: | 5 Vdc | Environmental Conditions: | 22°C, 68% RH | Tested By: | Noah Chang |
|--------------|-------|---------------------------|--------------|------------|------------|

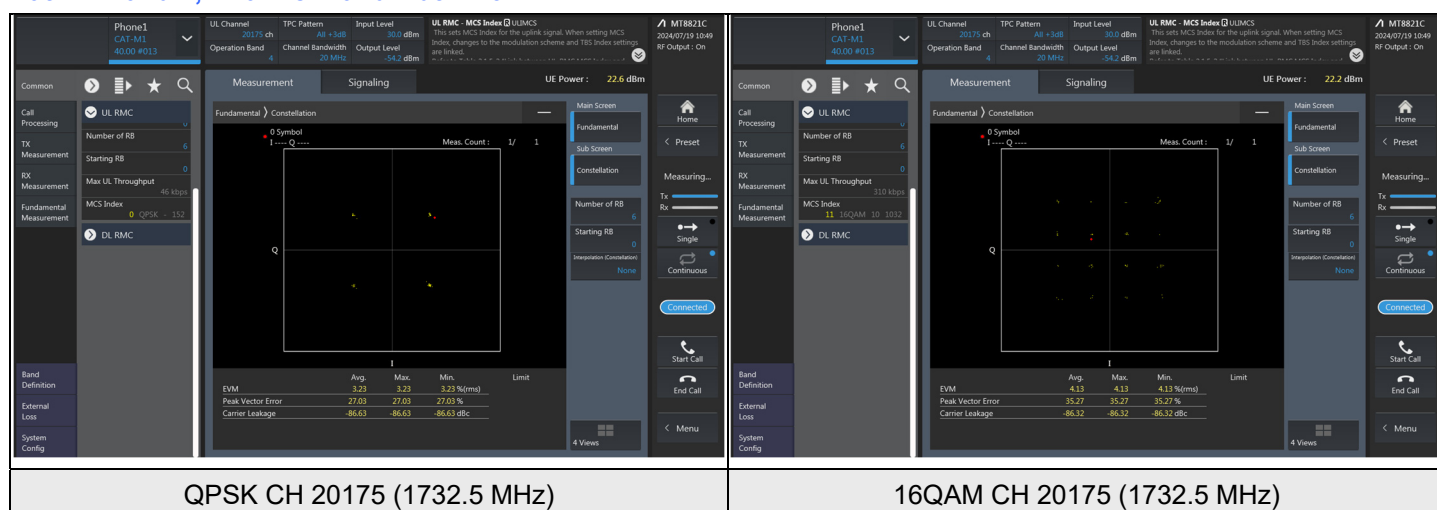
### 7.2.1 Cat-M1 Band 2

#### Cat-M1 Band 2, Channel Bandwidth: 20 MHz



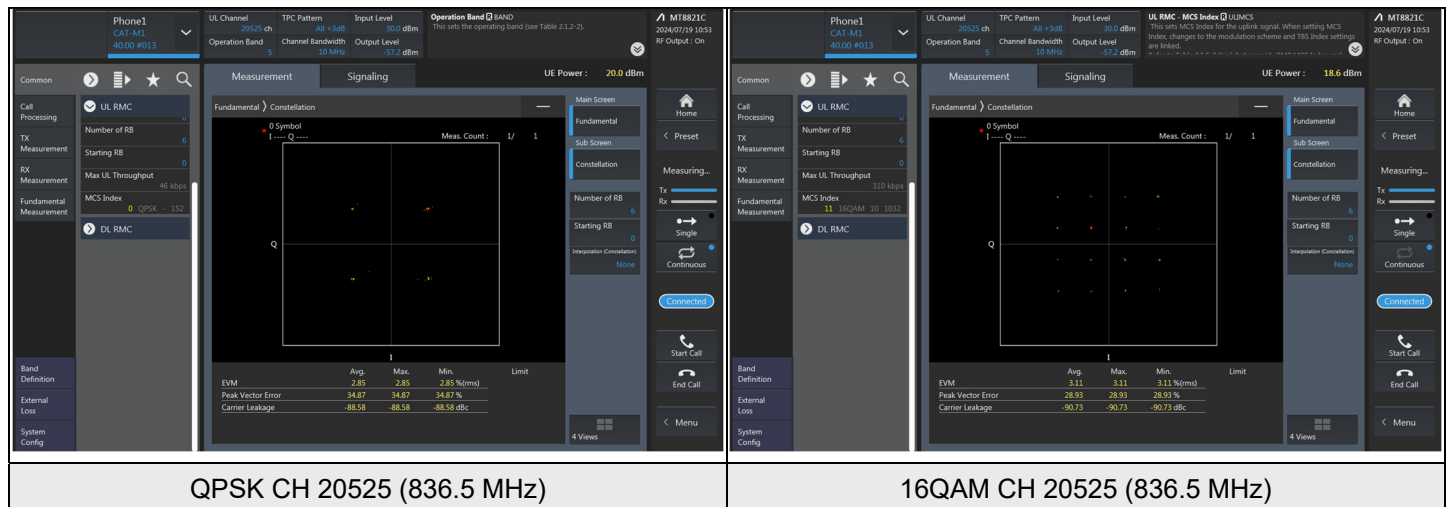
### 7.2.2 Cat-M1 Band 4

#### Cat-M1 Band 4, Channel Bandwidth: 20 MHz



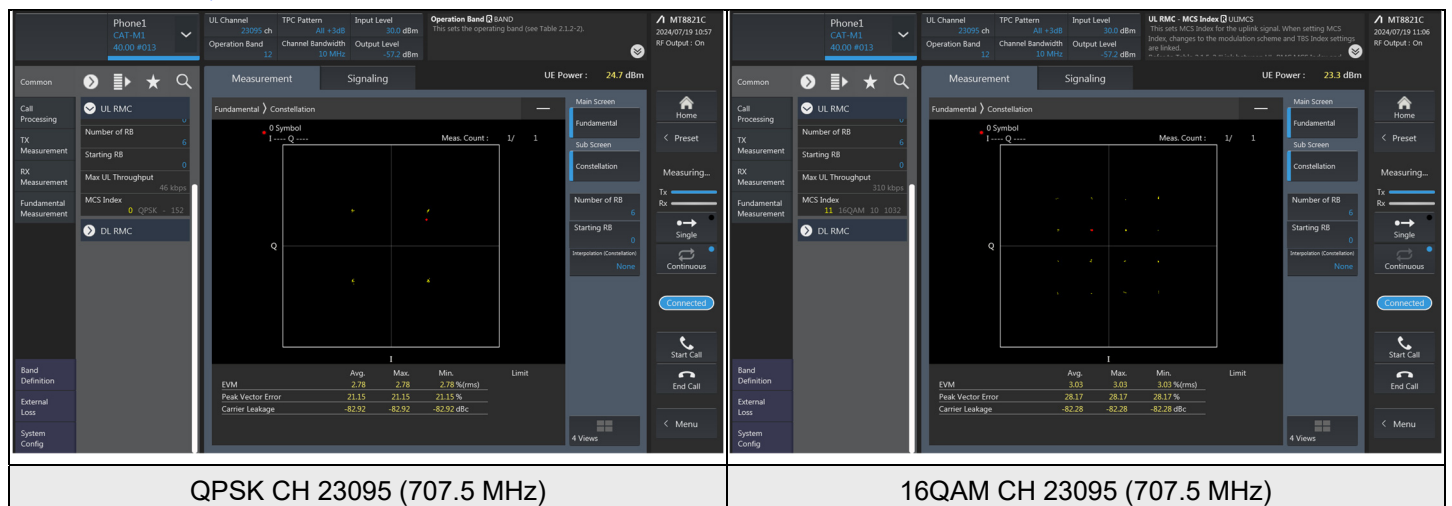
## 7.2.3 Cat-M1 Band 5

### Cat-M1 Band 5, Channel Bandwidth: 10 MHz



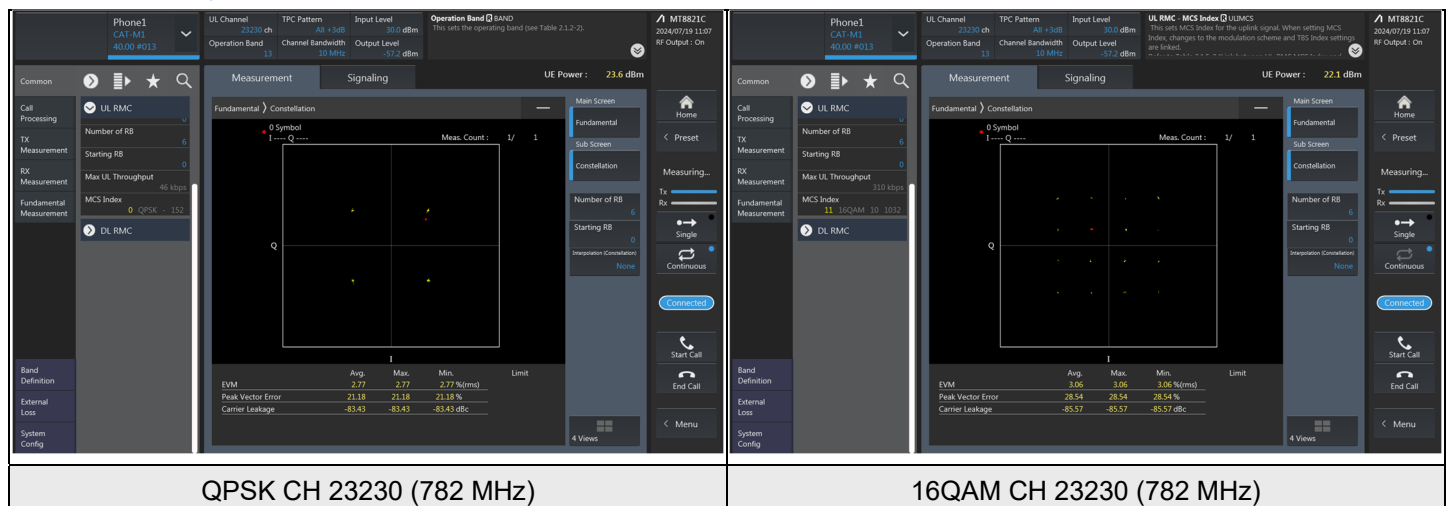
## 7.2.4 Cat-M1 Band 12

### Cat-M1 Band 12, Channel Bandwidth: 10 MHz



## 7.2.5 Cat-M1 Band 13

### Cat-M1 Band 13, Channel Bandwidth: 10 MHz



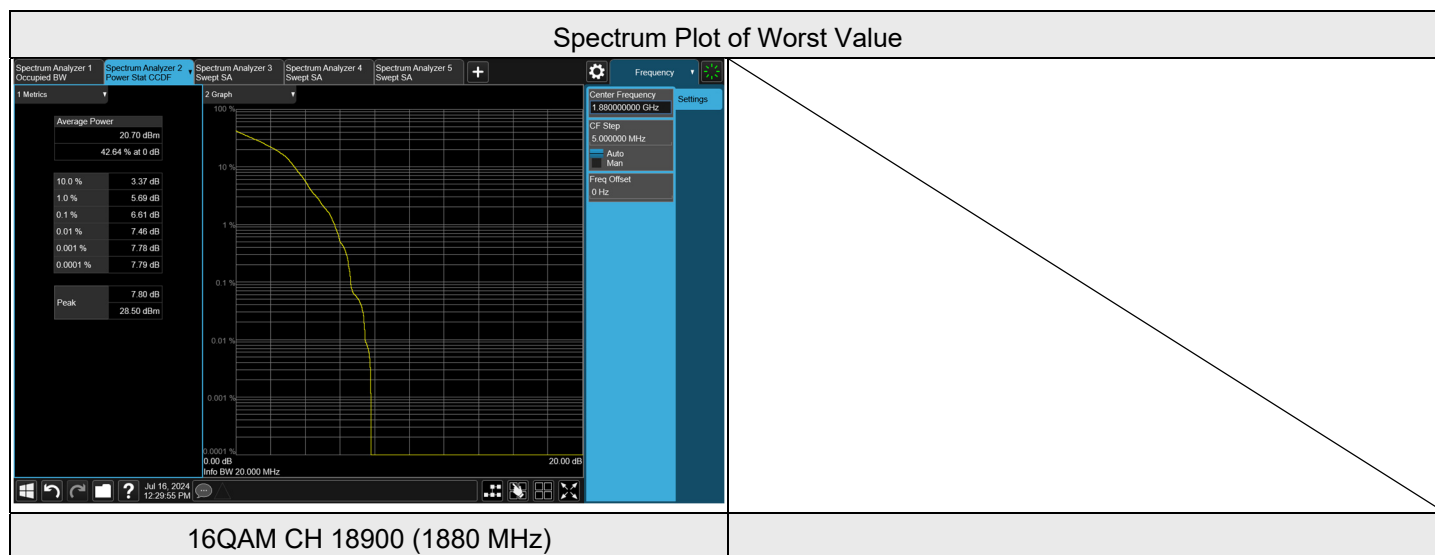
### 7.3 Peak to Average Ratio

|              |       |                           |              |            |            |
|--------------|-------|---------------------------|--------------|------------|------------|
| Input Power: | 5 Vdc | Environmental Conditions: | 22°C, 68% RH | Tested By: | Noah Chang |
|--------------|-------|---------------------------|--------------|------------|------------|

#### 7.3.1 Cat-M1 Band 2

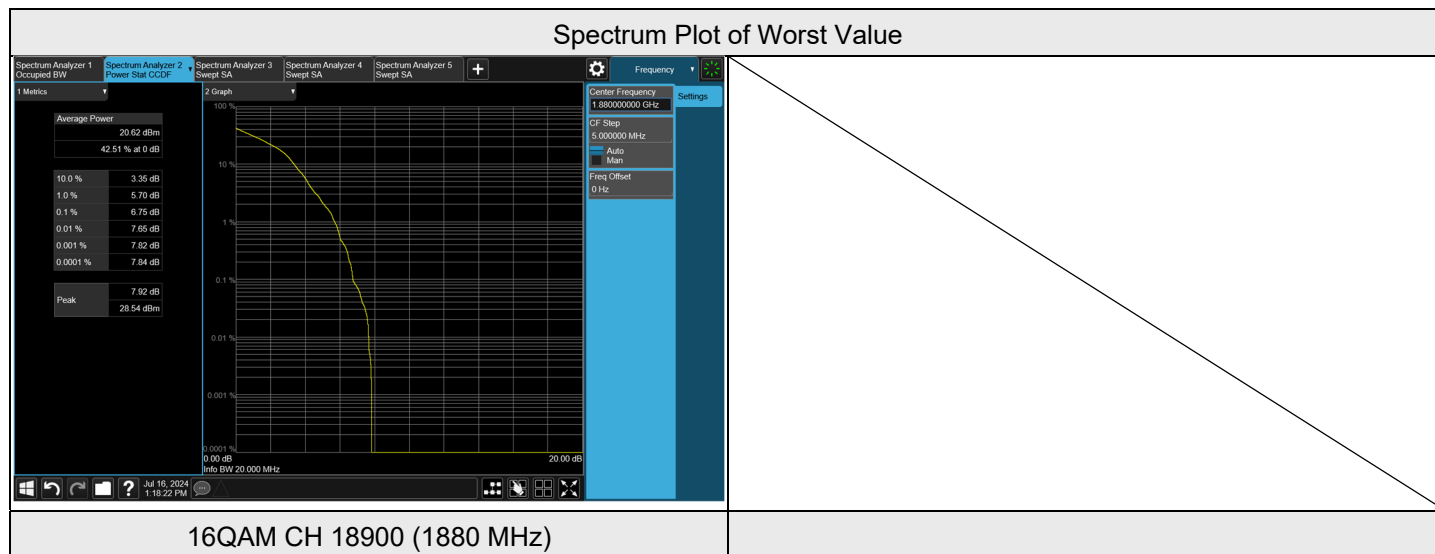
##### Cat-M1 Band 2, Channel Bandwidth: 1.4 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 18607   | 1850.7          | 5.06                  | 13         | PASS   |
| QPSK       | 18900   | 1880            | 5.17                  | 13         | PASS   |
| QPSK       | 19193   | 1909.3          | 4.90                  | 13         | PASS   |
| 16QAM      | 18607   | 1850.7          | 6.26                  | 13         | PASS   |
| 16QAM      | 18900   | 1880            | 6.61                  | 13         | PASS   |
| 16QAM      | 19193   | 1909.3          | 6.05                  | 13         | PASS   |



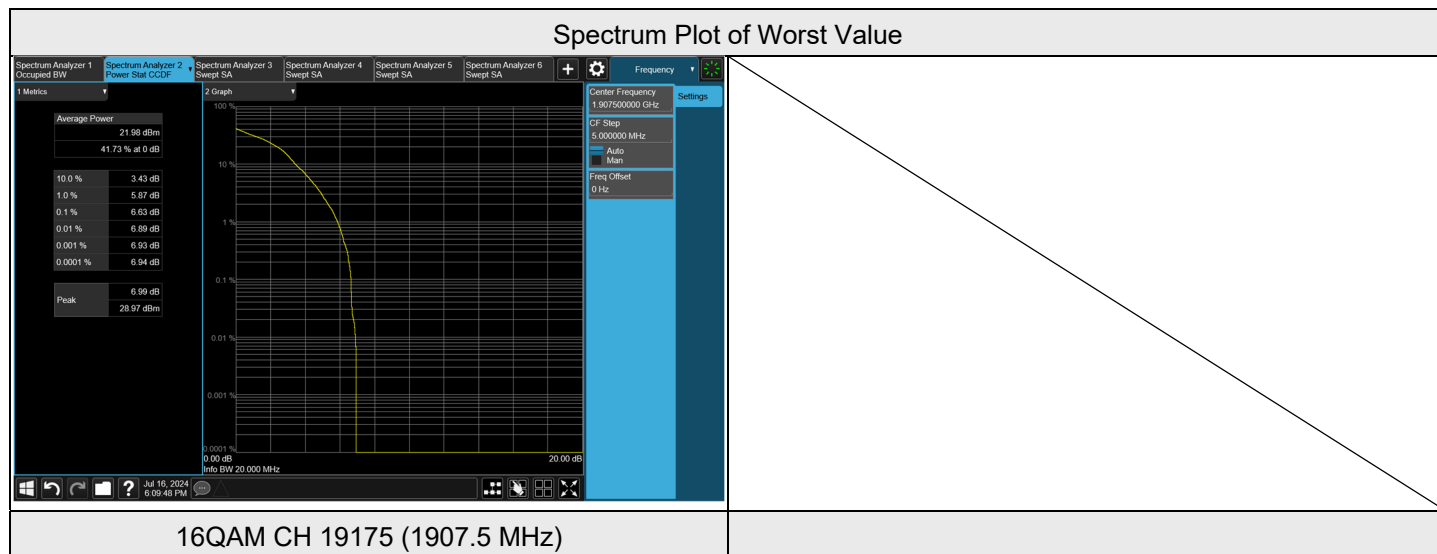
# Cat-M1 Band 2, Channel Bandwidth: 3 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 18615   | 1851.5          | 5.55                  | 13         | PASS   |
| QPSK       | 18900   | 1880            | 5.71                  | 13         | PASS   |
| QPSK       | 19185   | 1908.5          | 5.41                  | 13         | PASS   |
| 16QAM      | 18615   | 1851.5          | 6.53                  | 13         | PASS   |
| 16QAM      | 18900   | 1880            | 6.75                  | 13         | PASS   |
| 16QAM      | 19185   | 1908.5          | 6.44                  | 13         | PASS   |



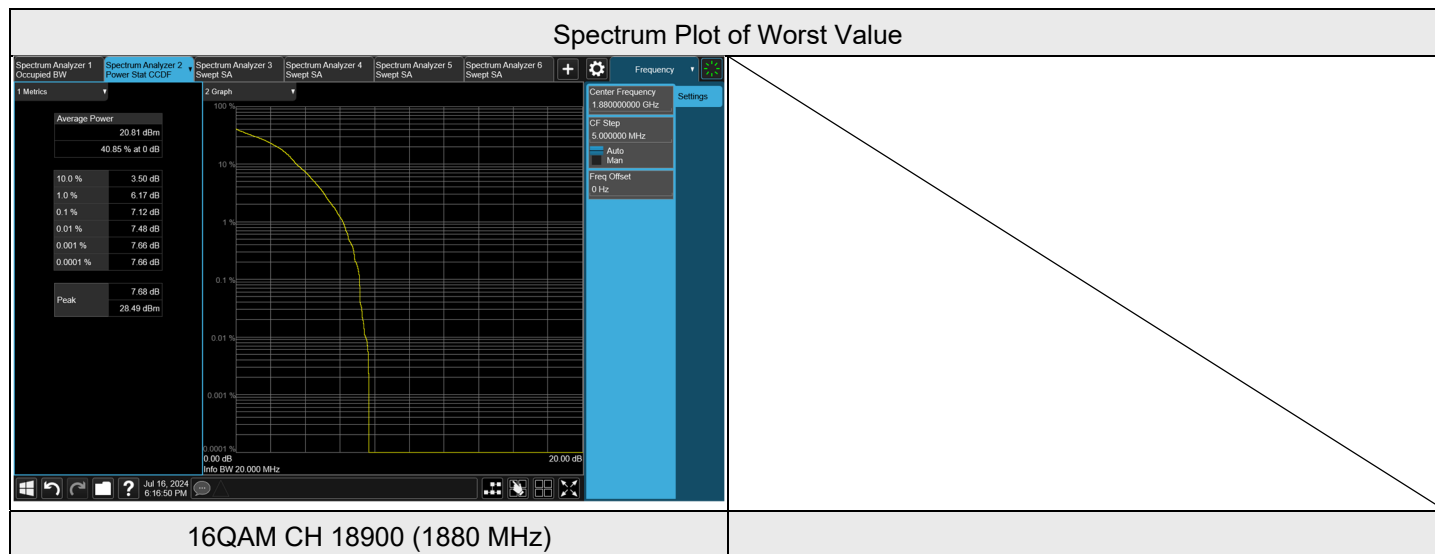
# Cat-M1 Band 2, Channel Bandwidth: 5 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 18625   | 1852.5          | 5.36                  | 13         | PASS   |
| QPSK       | 18900   | 1880            | 5.84                  | 13         | PASS   |
| QPSK       | 19175   | 1907.5          | 5.48                  | 13         | PASS   |
| 16QAM      | 18625   | 1852.5          | 5.51                  | 13         | PASS   |
| 16QAM      | 18900   | 1880            | 5.91                  | 13         | PASS   |
| 16QAM      | 19175   | 1907.5          | 6.63                  | 13         | PASS   |



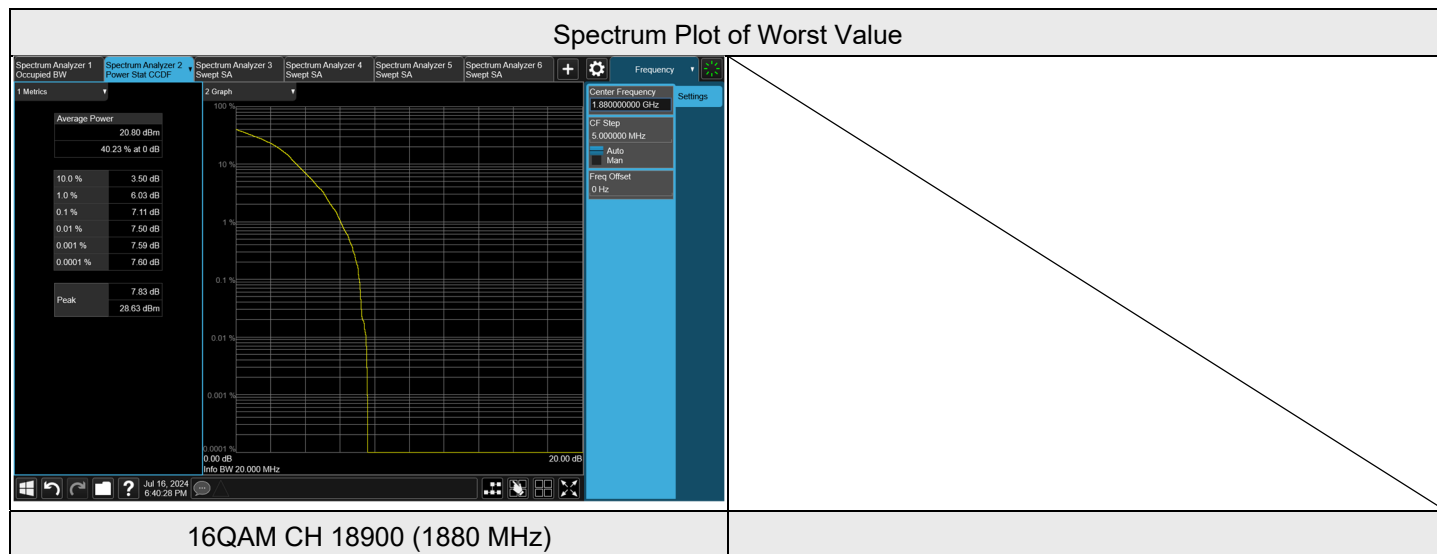
# Cat-M1 Band 2, Channel Bandwidth: 10 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 18650   | 1855            | 5.47                  | 13         | PASS   |
| QPSK       | 18900   | 1880            | 5.78                  | 13         | PASS   |
| QPSK       | 19150   | 1905            | 5.46                  | 13         | PASS   |
| 16QAM      | 18650   | 1855            | 6.49                  | 13         | PASS   |
| 16QAM      | 18900   | 1880            | 7.12                  | 13         | PASS   |
| 16QAM      | 19150   | 1905            | 6.69                  | 13         | PASS   |



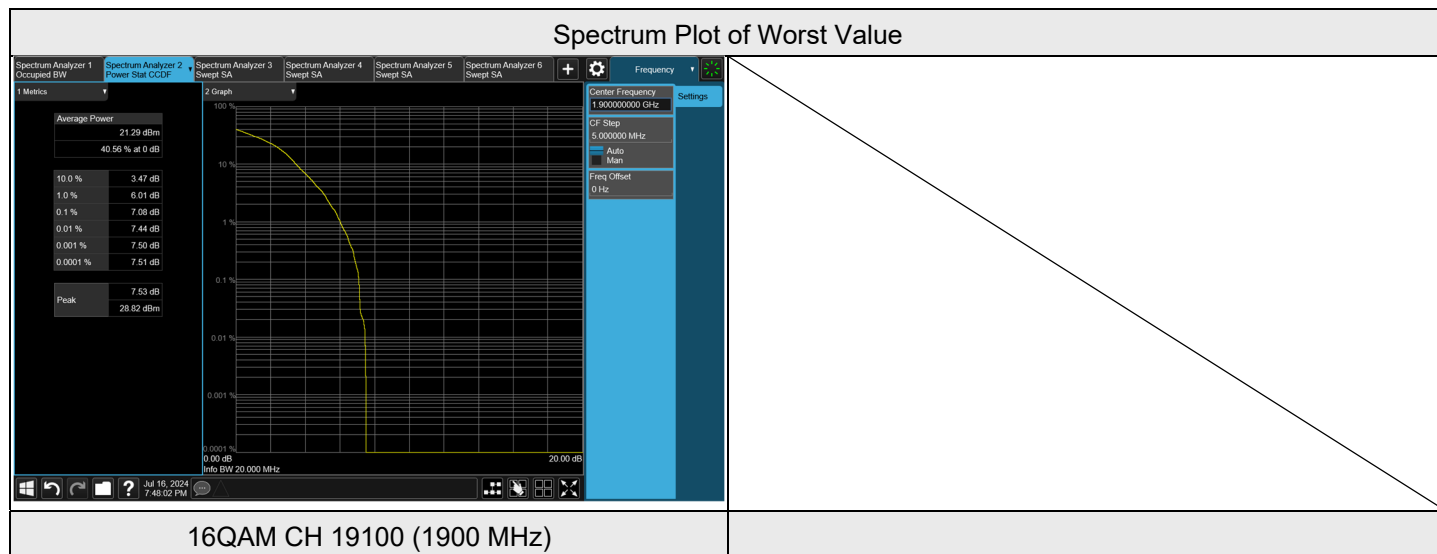
# Cat-M1 Band 2, Channel Bandwidth: 15 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 18675   | 1857.5          | 5.40                  | 13         | PASS   |
| QPSK       | 18900   | 1880            | 5.83                  | 13         | PASS   |
| QPSK       | 19125   | 1902.5          | 5.53                  | 13         | PASS   |
| 16QAM      | 18675   | 1857.5          | 6.70                  | 13         | PASS   |
| 16QAM      | 18900   | 1880            | 7.11                  | 13         | PASS   |
| 16QAM      | 19125   | 1902.5          | 6.91                  | 13         | PASS   |



# Cat-M1 Band 2, Channel Bandwidth: 20 MHz

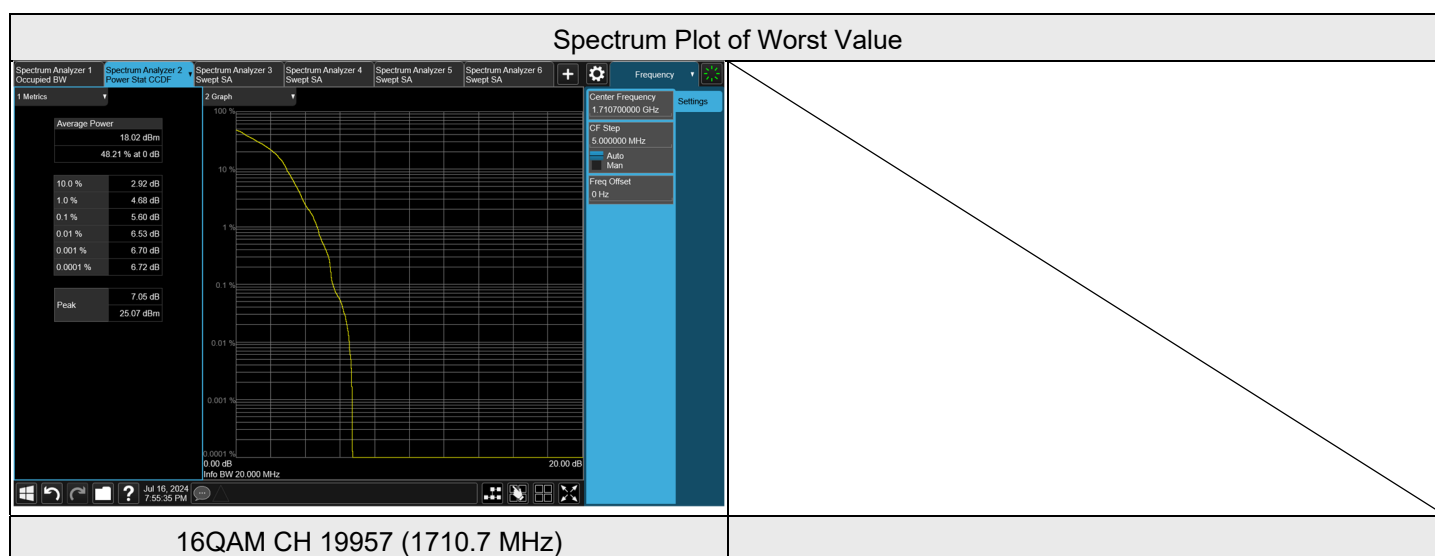
| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 18700   | 1860            | 5.33                  | 13         | PASS   |
| QPSK       | 18900   | 1880            | 5.75                  | 13         | PASS   |
| QPSK       | 19100   | 1900            | 5.46                  | 13         | PASS   |
| 16QAM      | 18700   | 1860            | 6.60                  | 13         | PASS   |
| 16QAM      | 18900   | 1880            | 7.04                  | 13         | PASS   |
| 16QAM      | 19100   | 1900            | 7.08                  | 13         | PASS   |



### 7.3.2 Cat-M1 Band 4

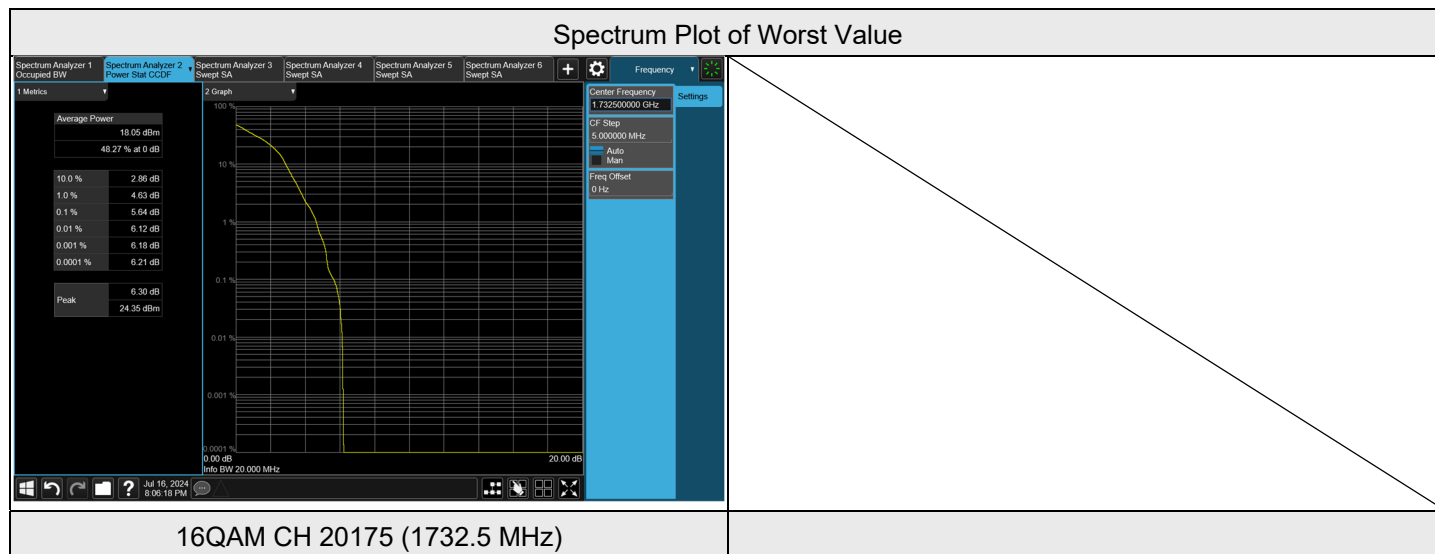
#### Cat-M1 Band 4, Channel Bandwidth: 1.4 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 19957   | 1710.7          | 3.87                  | 13         | PASS   |
| QPSK       | 20175   | 1732.5          | 3.89                  | 13         | PASS   |
| QPSK       | 20393   | 1754.3          | 3.71                  | 13         | PASS   |
| 16QAM      | 19957   | 1710.7          | 5.60                  | 13         | PASS   |
| 16QAM      | 20175   | 1732.5          | 5.53                  | 13         | PASS   |
| 16QAM      | 20393   | 1754.3          | 4.87                  | 13         | PASS   |



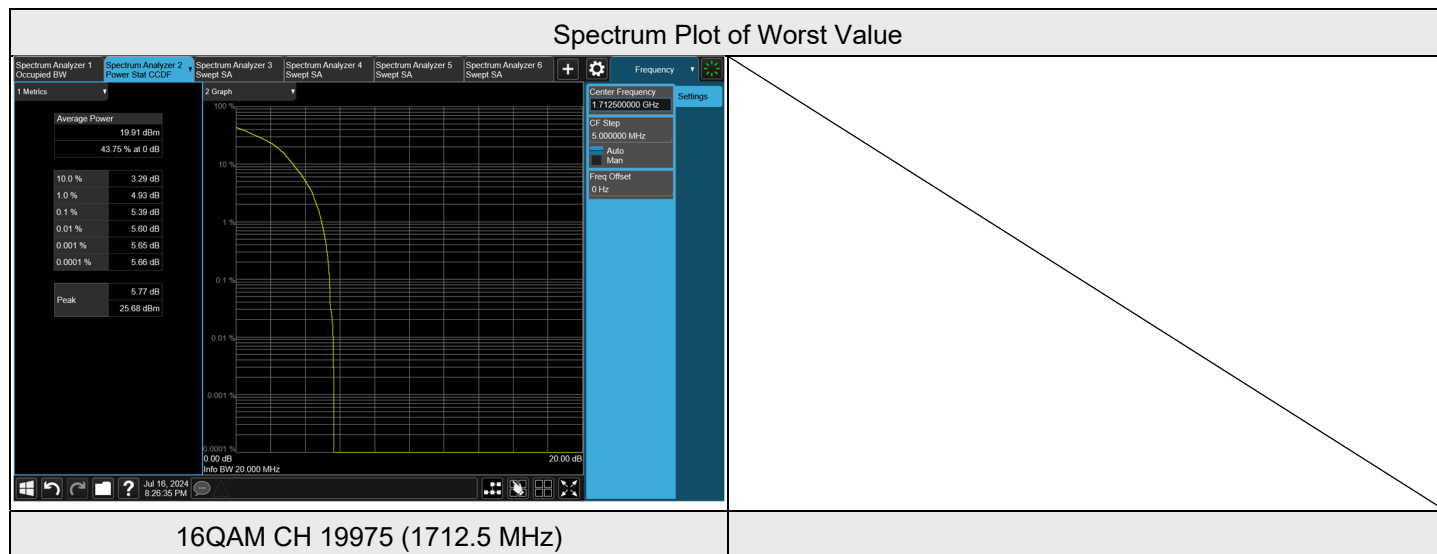
### Cat-M1 Band 4, Channel Bandwidth: 3 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 19965   | 1711.5          | 4.22                  | 13         | PASS   |
| QPSK       | 20175   | 1732.5          | 4.09                  | 13         | PASS   |
| QPSK       | 20385   | 1753.5          | 3.23                  | 13         | PASS   |
| 16QAM      | 19965   | 1711.5          | 5.45                  | 13         | PASS   |
| 16QAM      | 20175   | 1732.5          | 5.64                  | 13         | PASS   |
| 16QAM      | 20385   | 1753.5          | 4.69                  | 13         | PASS   |



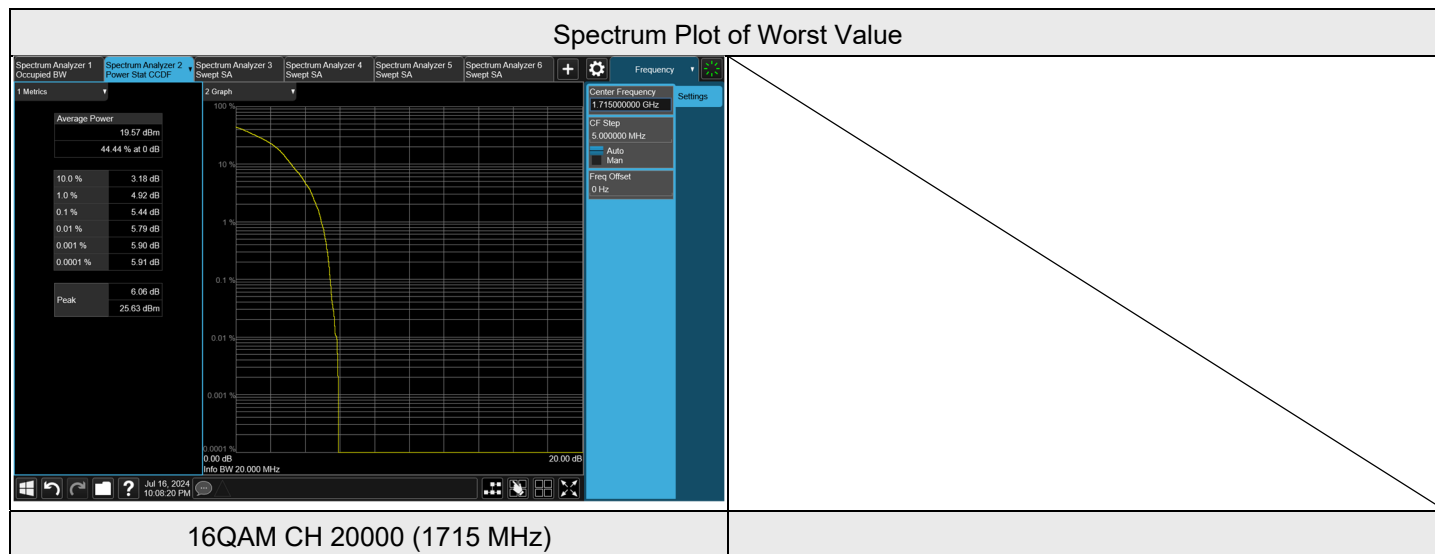
# Cat-M1 Band 4, Channel Bandwidth: 5 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 19975   | 1712.5          | 4.10                  | 13         | PASS   |
| QPSK       | 20175   | 1732.5          | 3.94                  | 13         | PASS   |
| QPSK       | 20375   | 1752.5          | 3.92                  | 13         | PASS   |
| 16QAM      | 19975   | 1712.5          | 5.39                  | 13         | PASS   |
| 16QAM      | 20175   | 1732.5          | 4.08                  | 13         | PASS   |
| 16QAM      | 20375   | 1752.5          | 5.15                  | 13         | PASS   |



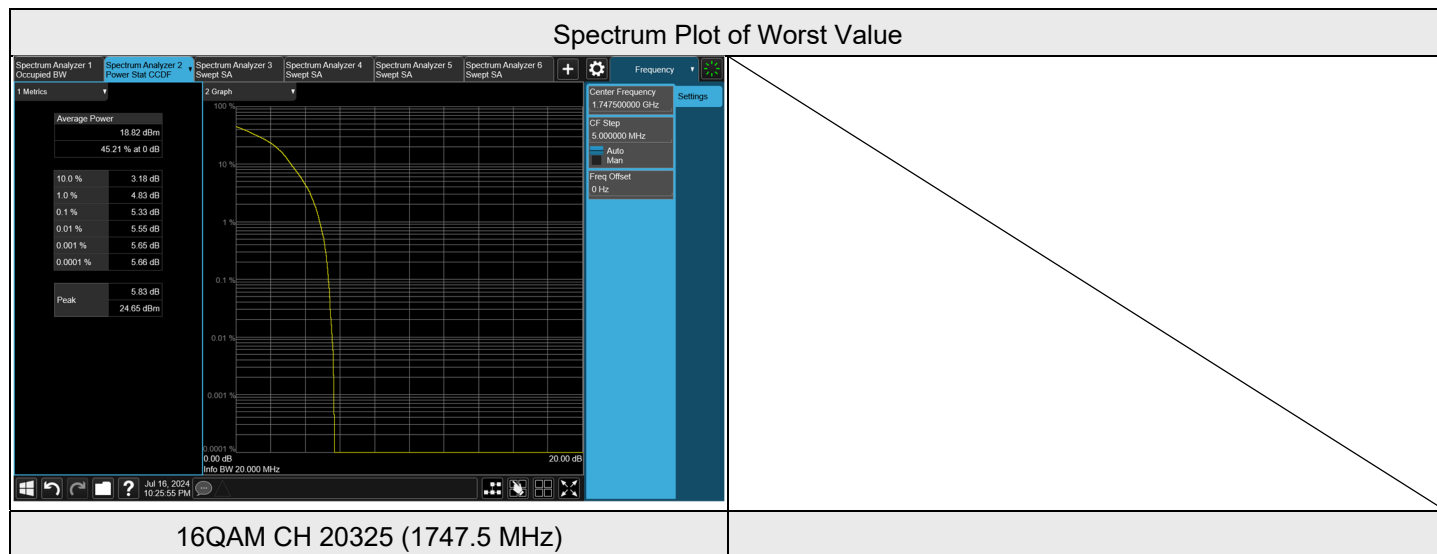
### Cat-M1 Band 4, Channel Bandwidth: 10 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 20000   | 1715            | 4.12                  | 13         | PASS   |
| QPSK       | 20175   | 1732.5          | 3.94                  | 13         | PASS   |
| QPSK       | 20350   | 1750            | 4.03                  | 13         | PASS   |
| 16QAM      | 20000   | 1715            | 5.44                  | 13         | PASS   |
| 16QAM      | 20175   | 1732.5          | 5.38                  | 13         | PASS   |
| 16QAM      | 20350   | 1750            | 5.24                  | 13         | PASS   |



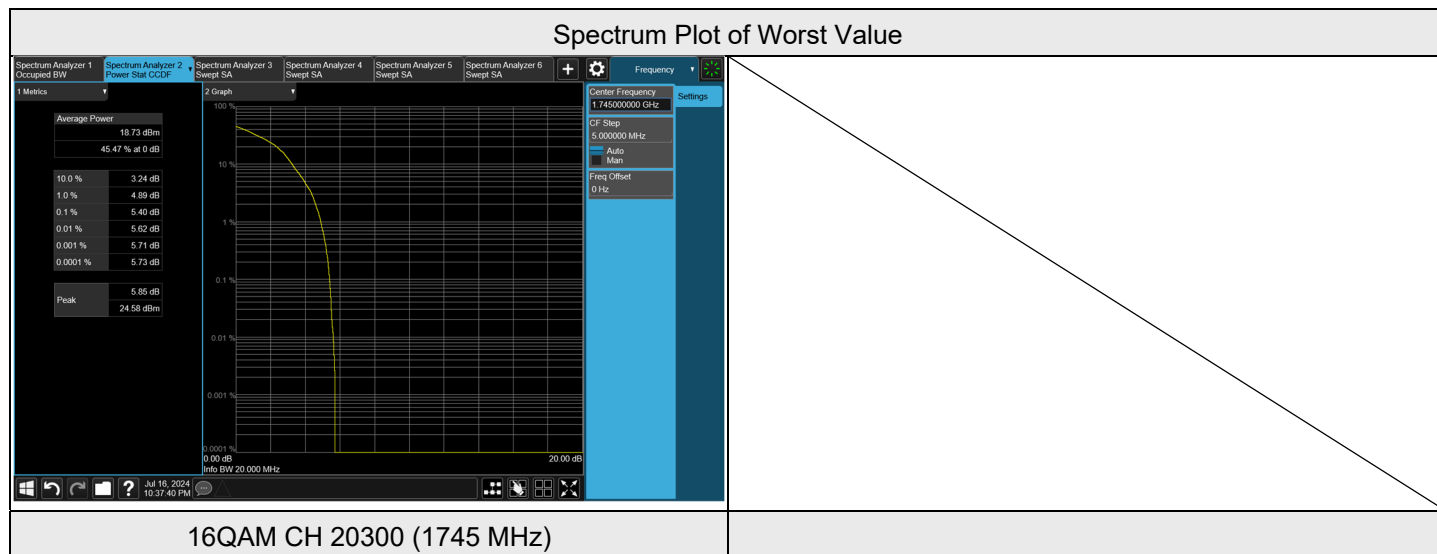
# Cat-M1 Band 4, Channel Bandwidth: 15 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 20025   | 1717.5          | 4.14                  | 13         | PASS   |
| QPSK       | 20175   | 1732.5          | 4.10                  | 13         | PASS   |
| QPSK       | 20325   | 1747.5          | 3.88                  | 13         | PASS   |
| 16QAM      | 20025   | 1717.5          | 5.19                  | 13         | PASS   |
| 16QAM      | 20175   | 1732.5          | 5.05                  | 13         | PASS   |
| 16QAM      | 20325   | 1747.5          | 5.33                  | 13         | PASS   |



# Cat-M1 Band 4, Channel Bandwidth: 20 MHz

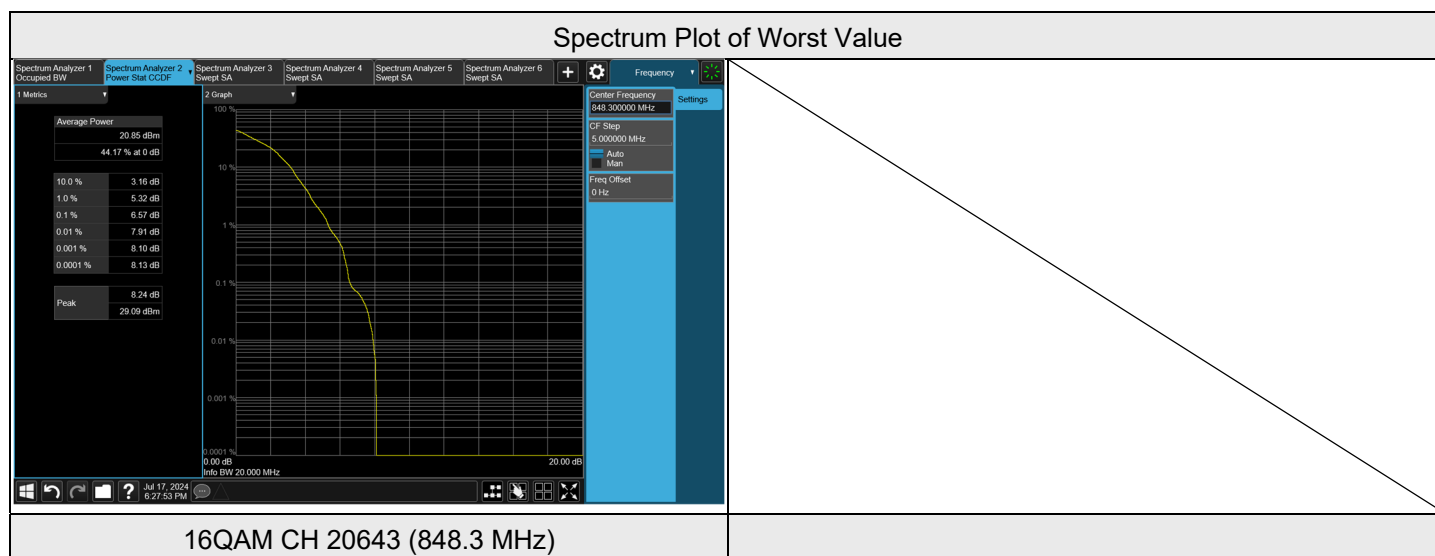
| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 20050   | 1720            | 3.95                  | 13         | PASS   |
| QPSK       | 20175   | 1732.5          | 4.08                  | 13         | PASS   |
| QPSK       | 20300   | 1745            | 4.00                  | 13         | PASS   |
| 16QAM      | 20050   | 1720            | 5.27                  | 13         | PASS   |
| 16QAM      | 20175   | 1732.5          | 5.31                  | 13         | PASS   |
| 16QAM      | 20300   | 1745            | 5.40                  | 13         | PASS   |



### 7.3.3 Cat-M1 Band 5

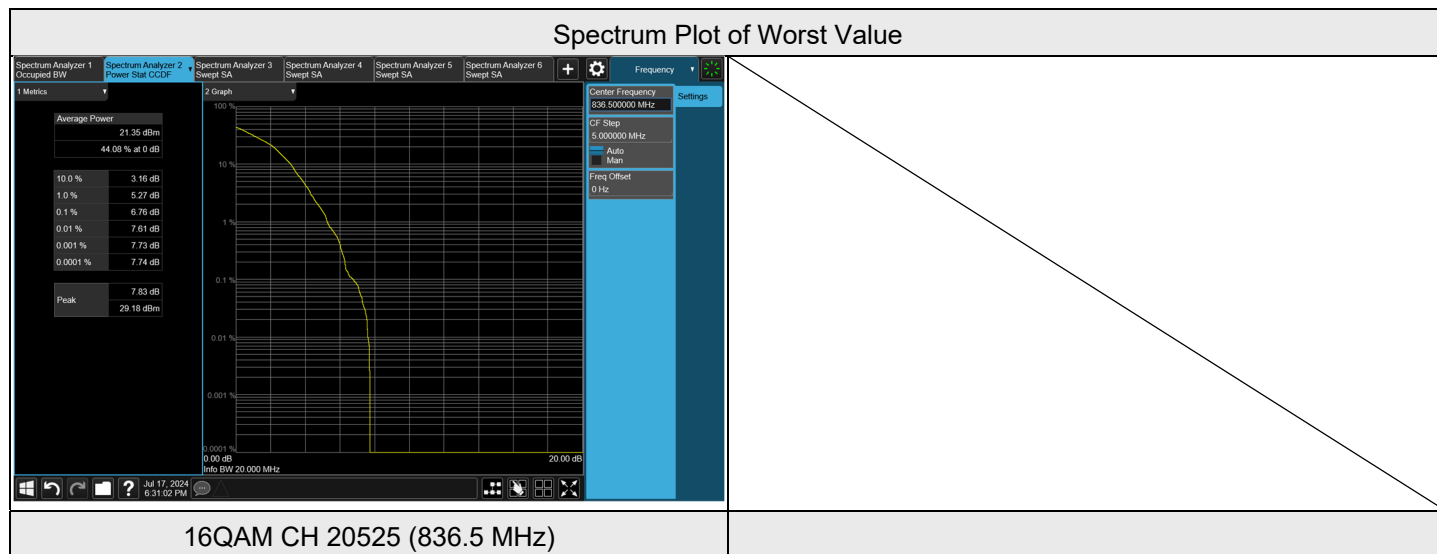
#### Cat-M1 Band 5, Channel Bandwidth: 1.4 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 20407   | 824.7           | 5.13                  | 13         | PASS   |
| QPSK       | 20525   | 836.5           | 5.32                  | 13         | PASS   |
| QPSK       | 20643   | 848.3           | 5.28                  | 13         | PASS   |
| 16QAM      | 20407   | 824.7           | 6.33                  | 13         | PASS   |
| 16QAM      | 20525   | 836.5           | 6.38                  | 13         | PASS   |
| 16QAM      | 20643   | 848.3           | 6.57                  | 13         | PASS   |



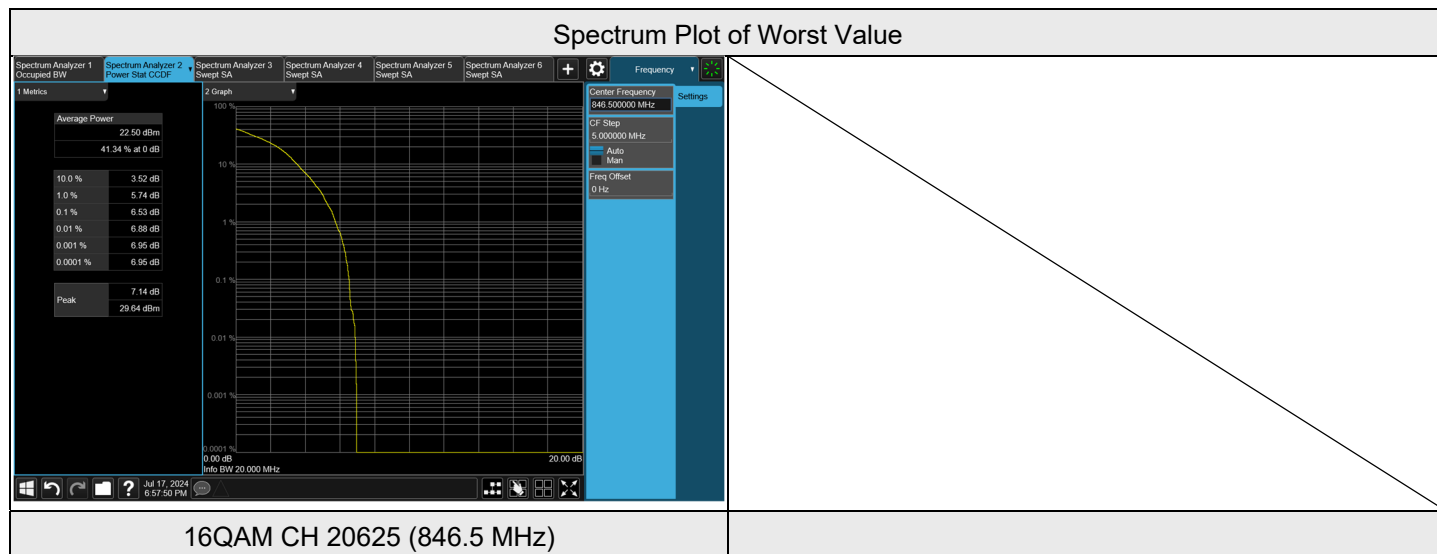
### Cat-M1 Band 5, Channel Bandwidth: 3 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 20415   | 825.5           | 5.57                  | 13         | PASS   |
| QPSK       | 20525   | 836.5           | 5.07                  | 13         | PASS   |
| QPSK       | 20635   | 847.5           | 5.16                  | 13         | PASS   |
| 16QAM      | 20415   | 825.5           | 6.57                  | 13         | PASS   |
| 16QAM      | 20525   | 836.5           | 6.76                  | 13         | PASS   |
| 16QAM      | 20635   | 847.5           | 6.61                  | 13         | PASS   |



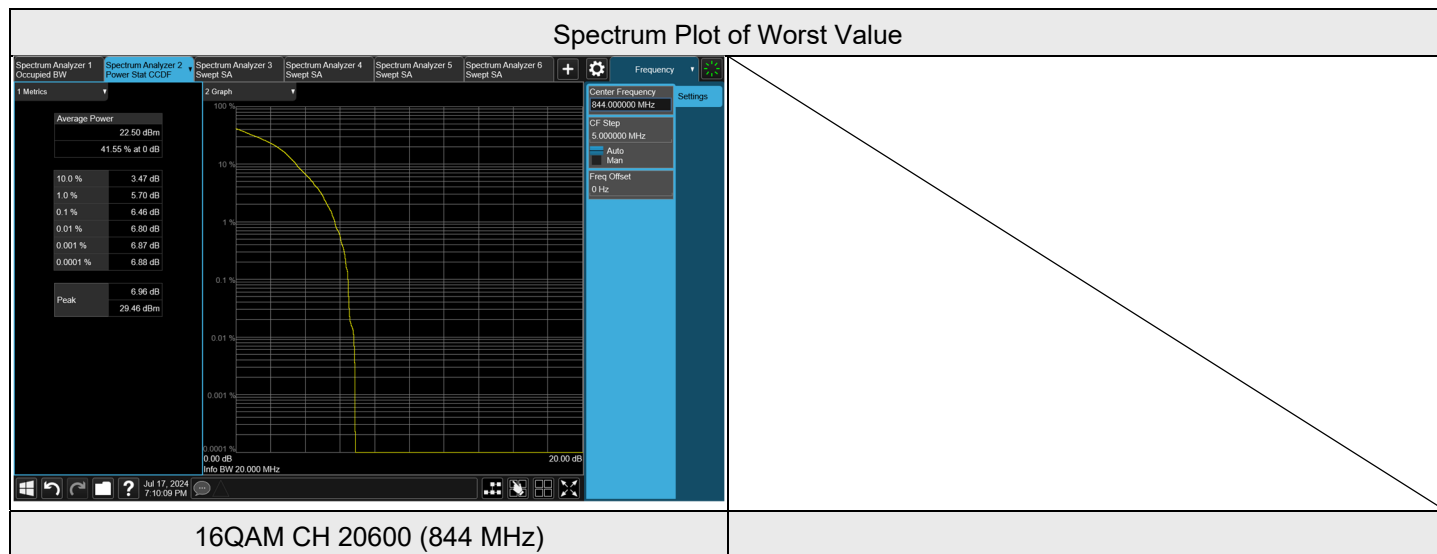
### Cat-M1 Band 5, Channel Bandwidth: 5 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 20425   | 826.5           | 5.73                  | 13         | PASS   |
| QPSK       | 20525   | 836.5           | 5.46                  | 13         | PASS   |
| QPSK       | 20625   | 846.5           | 5.77                  | 13         | PASS   |
| 16QAM      | 20425   | 826.5           | 6.39                  | 13         | PASS   |
| 16QAM      | 20525   | 836.5           | 6.28                  | 13         | PASS   |
| 16QAM      | 20625   | 846.5           | 6.53                  | 13         | PASS   |



# Cat-M1 Band 5, Channel Bandwidth: 10 MHz

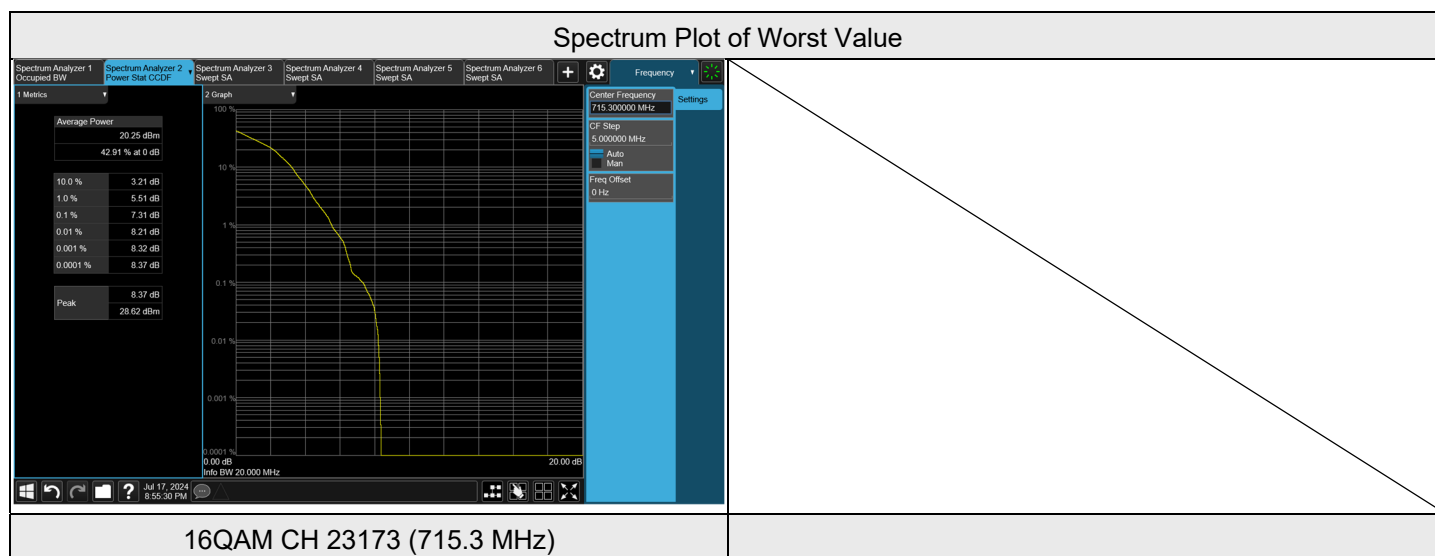
| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 20450   | 829             | 5.72                  | 13         | PASS   |
| QPSK       | 20525   | 836.5           | 5.58                  | 13         | PASS   |
| QPSK       | 20600   | 844             | 5.58                  | 13         | PASS   |
| 16QAM      | 20450   | 829             | 6.17                  | 13         | PASS   |
| 16QAM      | 20525   | 836.5           | 6.43                  | 13         | PASS   |
| 16QAM      | 20600   | 844             | 6.46                  | 13         | PASS   |



### 7.3.4 Cat-M1 Band 12

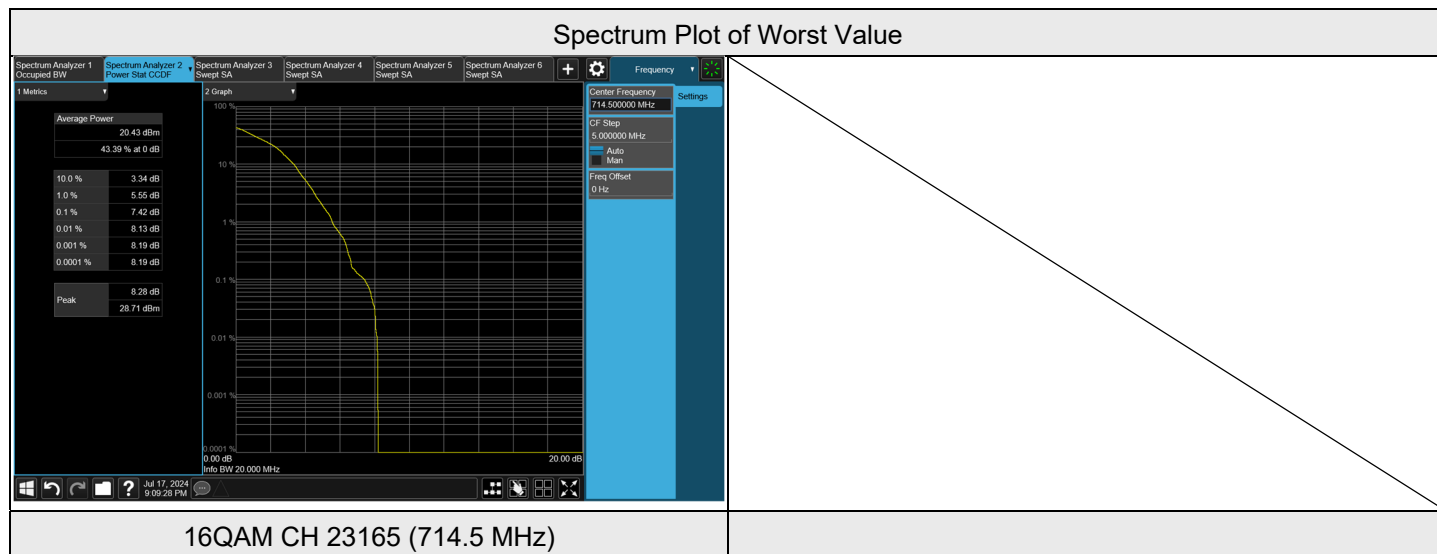
#### Cat-M1 Band 12, Channel Bandwidth: 1.4 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 23017   | 699.7           | 4.46                  | 13         | PASS   |
| QPSK       | 23095   | 707.5           | 4.80                  | 13         | PASS   |
| QPSK       | 23173   | 715.3           | 5.42                  | 13         | PASS   |
| 16QAM      | 23017   | 699.7           | 6.27                  | 13         | PASS   |
| 16QAM      | 23095   | 707.5           | 6.63                  | 13         | PASS   |
| 16QAM      | 23173   | 715.3           | 7.31                  | 13         | PASS   |



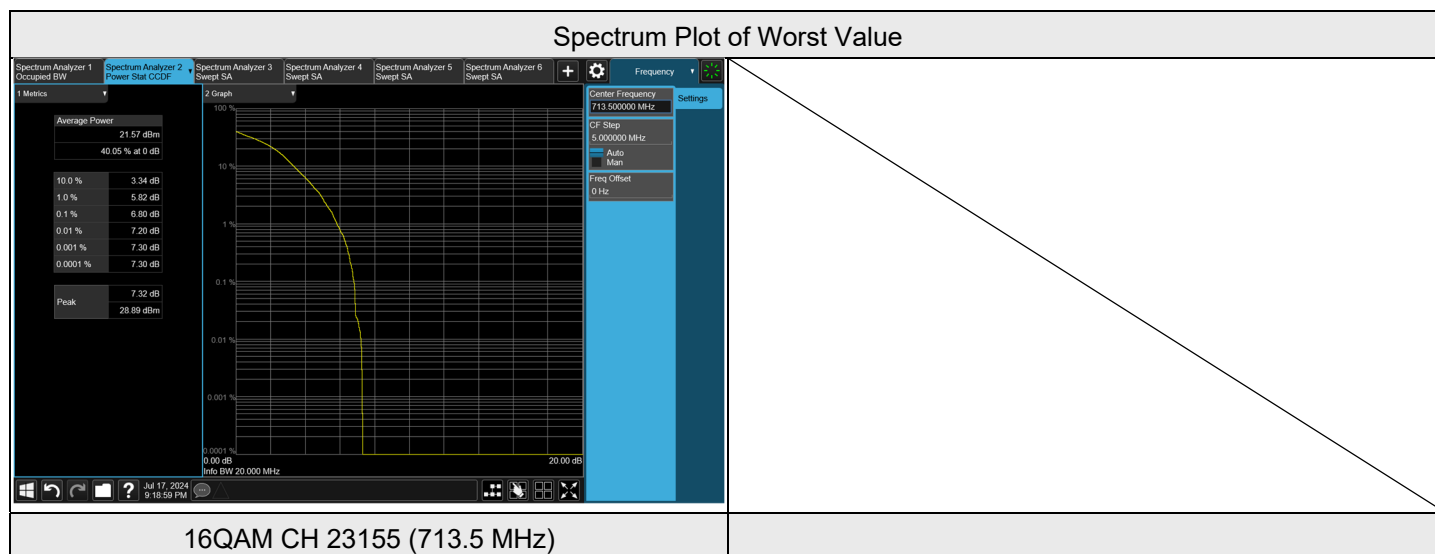
### Cat-M1 Band 12, Channel Bandwidth: 3 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 23025   | 700.5           | 4.74                  | 13         | PASS   |
| QPSK       | 23095   | 707.5           | 4.88                  | 13         | PASS   |
| QPSK       | 23165   | 714.5           | 5.43                  | 13         | PASS   |
| 16QAM      | 23025   | 700.5           | 6.46                  | 13         | PASS   |
| 16QAM      | 23095   | 707.5           | 6.92                  | 13         | PASS   |
| 16QAM      | 23165   | 714.5           | 7.42                  | 13         | PASS   |



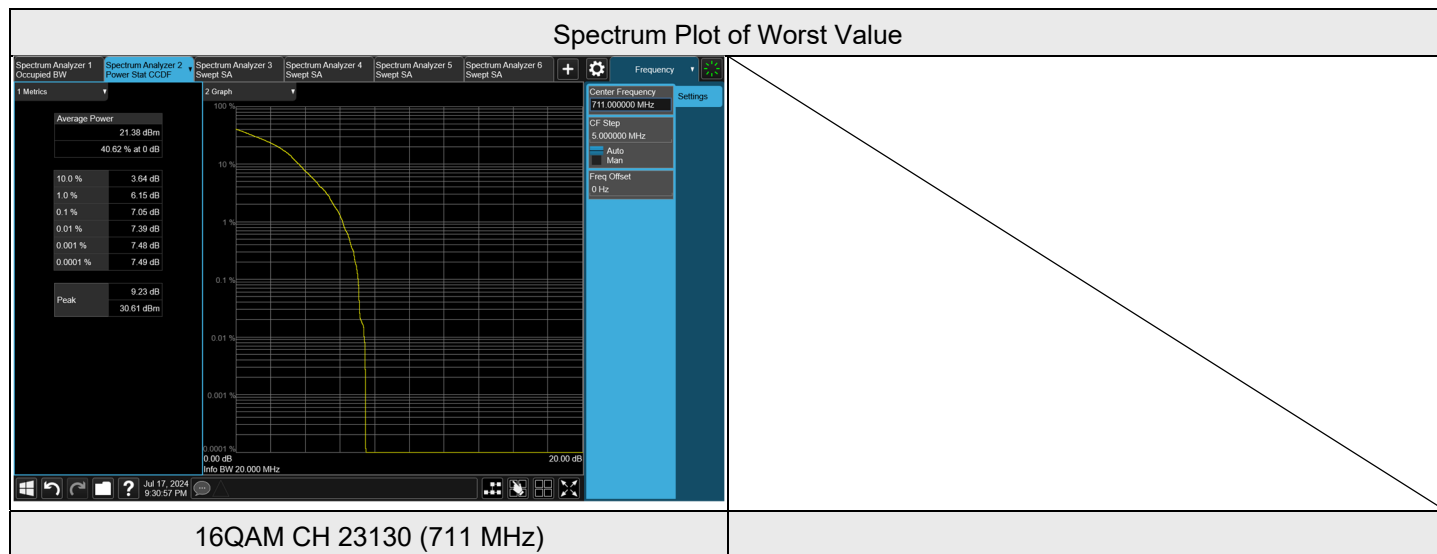
### Cat-M1 Band 12, Channel Bandwidth: 5 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 23035   | 701.5           | 4.84                  | 13         | PASS   |
| QPSK       | 23095   | 707.5           | 5.21                  | 13         | PASS   |
| QPSK       | 23155   | 713.5           | 5.66                  | 13         | PASS   |
| 16QAM      | 23035   | 701.5           | 6.18                  | 13         | PASS   |
| 16QAM      | 23095   | 707.5           | 6.38                  | 13         | PASS   |
| 16QAM      | 23155   | 713.5           | 6.80                  | 13         | PASS   |



# Cat-M1 Band 12, Channel Bandwidth: 10 MHz

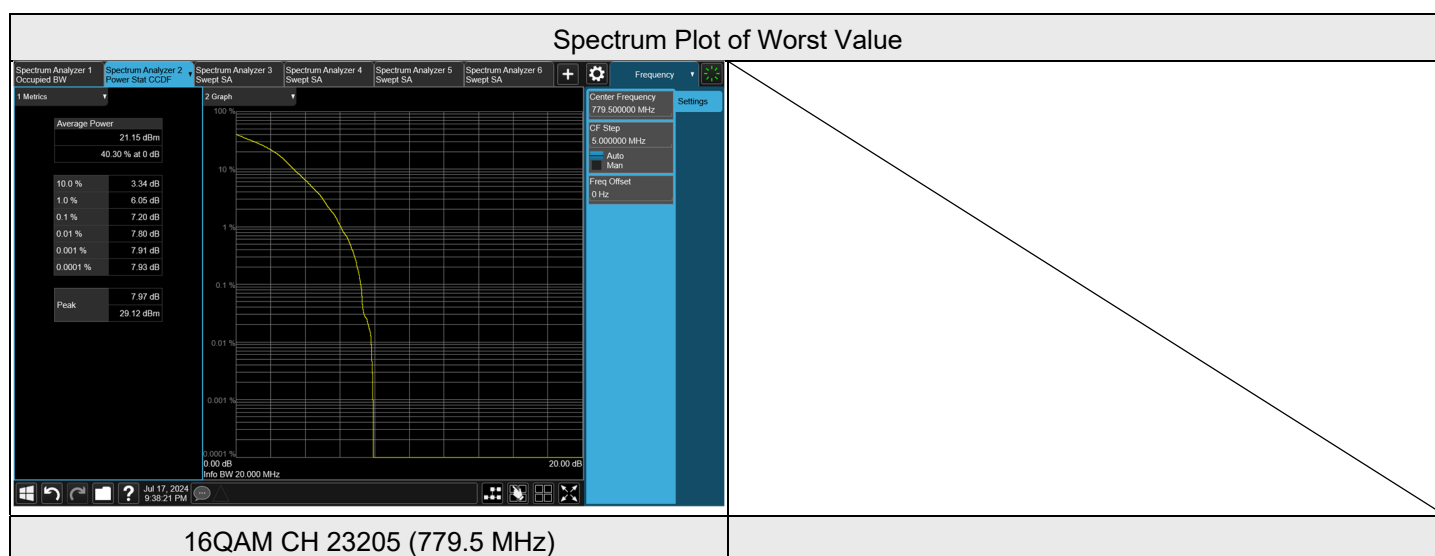
| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 23060   | 704             | 5.08                  | 13         | PASS   |
| QPSK       | 23095   | 707.5           | 5.17                  | 13         | PASS   |
| QPSK       | 23130   | 711             | 5.29                  | 13         | PASS   |
| 16QAM      | 23060   | 704             | 6.16                  | 13         | PASS   |
| 16QAM      | 23095   | 707.5           | 6.62                  | 13         | PASS   |
| 16QAM      | 23130   | 711             | 7.05                  | 13         | PASS   |



### 7.3.5 Cat-M1 Band 13

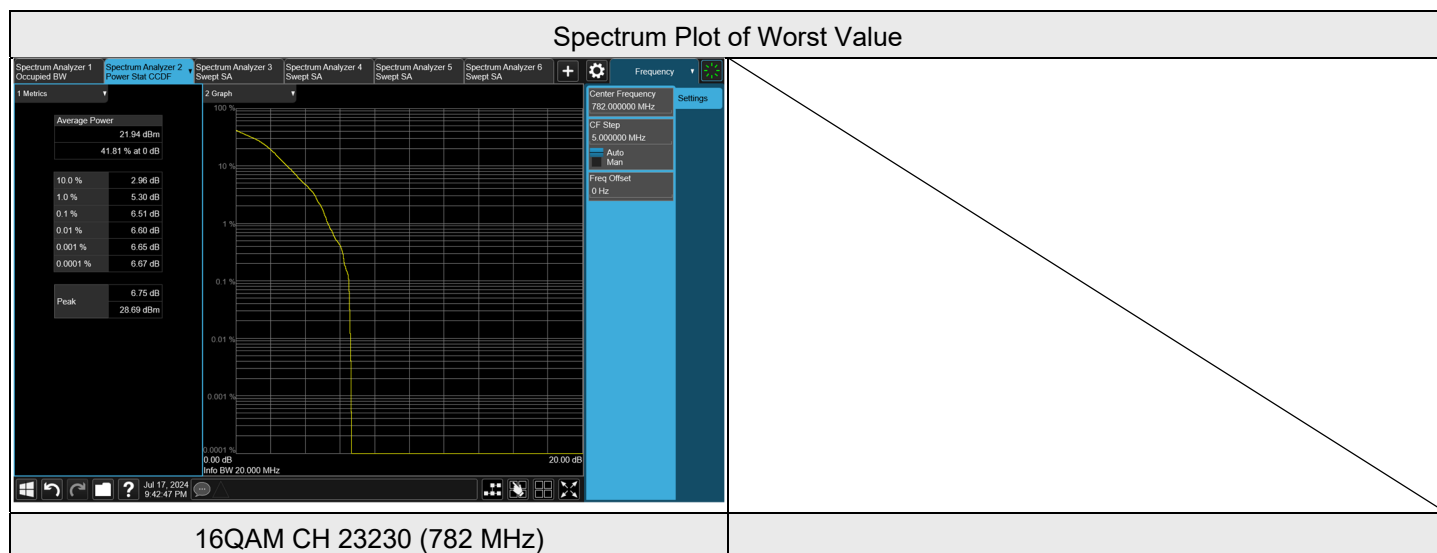
#### Cat-M1 Band 13, Channel Bandwidth: 5 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 23205   | 779.5           | 6.19                  | 13         | PASS   |
| QPSK       | 23230   | 782             | 6.17                  | 13         | PASS   |
| QPSK       | 23255   | 784.5           | 6.21                  | 13         | PASS   |
| 16QAM      | 23205   | 779.5           | 7.20                  | 13         | PASS   |
| 16QAM      | 23230   | 782             | 7.09                  | 13         | PASS   |
| 16QAM      | 23255   | 784.5           | 6.98                  | 13         | PASS   |



# Cat-M1 Band 13, Channel Bandwidth: 10 MHz

| Modulation | Channel | Frequency (MHz) | Measurement Value(dB) | Limit (dB) | Result |
|------------|---------|-----------------|-----------------------|------------|--------|
| QPSK       | 23230   | 782             | 6.14                  | 13         | PASS   |
| 16QAM      | 23230   | 782             | 6.51                  | 13         | PASS   |



## 7.4 Bandwidth

|              |       |                           |              |            |            |
|--------------|-------|---------------------------|--------------|------------|------------|
| Input Power: | 5 Vdc | Environmental Conditions: | 22°C, 68% RH | Tested By: | Noah Chang |
|--------------|-------|---------------------------|--------------|------------|------------|

### 7.4.1 Cat-M1 Band 2

#### Cat-M1 Band 2, Channel Bandwidth: 1.4 MHz

| Modulation | Channel | Frequency (MHz) | Occupied Bandwidth (MHz) | 26 dB Bandwidth (MHz) |
|------------|---------|-----------------|--------------------------|-----------------------|
| QPSK       | 18607   | 1850.7          | 1.0726                   | 1.264                 |
| QPSK       | 18900   | 1880            | 1.0779                   | 1.251                 |
| QPSK       | 19193   | 1909.3          | 1.0752                   | 1.260                 |
| 16QAM      | 18607   | 1850.7          | 1.0725                   | 1.263                 |
| 16QAM      | 18900   | 1880            | 1.0731                   | 1.255                 |
| 16QAM      | 19193   | 1909.3          | 1.0718                   | 1.252                 |

