

# TEST REPORT

**Testing laboratory:****SK Tech Co., Ltd.**

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**Test Report Number: SKT-RFC-230008****Date of issue: November 1, 2023****Applicant:****Intellian Technologies, Inc.**

18-7, Jinwisandan-ro, Jinwi-myeon (Chungho-ri)

Pyeongtaek-si, Gyeonggi-do, 17709 Korea

**Manufacturer:****Intellian Technologies, Inc.**

18-7, Jinwisandan-ro, Jinwi-myeon (Chungho-ri)

Pyeongtaek-si, Gyeonggi-do, 17709 Korea

**Product:**

OW70L

**Model:**

PS-OW70P

**FCC ID:**

XXZ-INTOW70LE

**Project number:**

SKTEU23-1144

**EUT received:**

October 5, 2023

**Applied standards:**

ANSI C63.26-2015

ANSI C63.4-2014 and ANSI C63.4a-2017

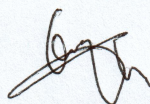
**Rule parts:**

FCC 47 CFR Part 2, Part 25

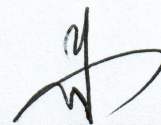
**Equipment Class:****TNB: Licensed Non-Broadcast Station Transmitter****Remarks to the standards:**

None

The above equipment has been tested by SK Tech Co., Ltd., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product or system, which was tested.



Inhee Bae / Testing Engineer



Jongsoo Yoon / Technical Manager

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### Revision History of Test Report

| Rev. | Revisions     | Effect page | Approved by  | Date         |
|------|---------------|-------------|--------------|--------------|
| -    | Initial issue | All         | Jongsoo Yoon | Nov. 1, 2023 |



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## **1 Summary of test results**

| Requirement   | FCC, CFR 47 Section        | Result                 |
|---|----------------------------|------------------------|
| RF power output / Power limits / Off-Axis EIRP Spectral Density | §2.1046, 25.204(a), 25.218 | Meets the requirements |
| Occupied bandwidth  | §2.1049                    | Meets the requirements |
| Spurious emissions at antenna terminals (conducted emissions)   | §2.1051, 25.202(f)         | Meets the requirements |
| Field strength of spurious radiation (radiated emissions)       | §2.1053, 25.202(f)         | Meets the requirements |
| Transmitter frequency stability / Frequency tolerances          | §2.1055, 25.202(d)         | Meets the requirements |



## 2 Description of equipment under test (EUT)

|                   |                  |
|-------------------|------------------|
| Product:          | OW70L            |
| Model:            | PS-OW70P         |
| Serial number:    | None (prototype) |
| Hardware version: | prototype        |
| Software version: | prototype        |

### Model differences:

| Model name | Difference   | Tested (checked)                    |
|------------|--|-------------------------------------|
| PS-OW70PP  | fully tested model that was provided by the applicant. | <input checked="" type="checkbox"/> |

### Technical data:

|                                      |  |
|--------------------------------------|--|
| Transmit frequency                   | Tx: 14.0 GHz to 14.5 GHz<br>Rx: 10.7 GHz to 12.75 GHz  |
| Declared maximum EIRP                | 35.6 dBW / 19.8 MHz (single carrier)<br>38.6 dBW / 39.6 MHz (dual carrier)   |
| Antenna gain                         | 39.0 dBi (Peak)  |
| Authorized bandwidth                 | 19.8 MHz / 39.6 MHz  |
| Number of channels                   | Single carrier (Bandwidth 19.8 MHz): 24<br>Dual carrier (Bandwidth 39.6 MHz): 20                                   |
| Type of modulation                   | TX: QPSK, 8PSK, 16QAM<br>RX: QPSK, 8PSK, 16APSK  |
| Type of radio transmission:          | FDMA   |
| Transmitter output power (conducted) | 26.6 dBm (0.457 W) (average power; single carrier)<br>29.6 dBm (0.912 W) (average power; dual carrier)             |
| Transmitter output power (radiated)  | 65.6 dBm (3630.8 W) (single carrier)<br>68.6 dBm (7244.4 W) (dual carrier)<br>(calculated value with antenna gain) |
| Maximum occupied bandwidth           | 17.2 MHz / 37.4 MHz  |
| Emission designator                  | 17M2G7W, 17M2D7W, 37M4G7W, 37M4D7W   |
| Antenna type                         | Parabolic antenna  |
| Power source                         | AC 100 V to 240 V (DC 56 V for Customer Network Exchange)  |
| Operation temperature range          | -25 °C to +55 °C   |



| I/O port                                       | Type                                 | Q'ty | Remark |
|--|--------------------------------------|------|--------|
| <b>EUT, Primary Antenna Unit</b>               |                                      |      |        |
| Power & Data connector                         | F-type Connector (for Power + Data)  | 1    |        |
| RX   | N-type Connector (for Rx + Power)    | 1    |        |
| TX   | N-type Connector                     | 1    |        |
| ETH  | RJ-45 (for Ethernet)                 | 1    |        |
| SIG  | RJ-45 (for Control Signal)           | 1    |        |
| <b>EUT, Secondary Antenna Unit</b>             |                                      |      |        |
| MNT  | RJ-45                                | 1    |        |
| RX   | N-type Connector (for Rx + Power)    | 1    |        |
| TX   | N-type Connector                     | 1    |        |
| ETH  | RJ-45 (for Ethernet)                 | 1    |        |
| SIG  | RJ-45 (for Control Signal)           | 1    |        |
| <b>EUT, Customer Network Exchange (CNX-BB)</b> |                                      |      |        |
| LAN1   | RJ-45 (To access to OneWeb services) | 1    |        |
| SAT  | F-type Connector (for Power + Data)  | 1    |        |
| POWER  | 6 Contact Power Plug                 | 1    |        |

**Modification of EUT during the compliance testing:** none



### 3 Test and measurement conditions

#### 3.1. Operating modes

Operating modes of the sample:

| No.            | Description  |                    |                    |                          |                           |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|----------------|--|--------------------|--------------------|--------------------------|---------------------------|---------------------------|----------|---------------------------|--------------------|---|---|---------|-------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|---|---|---|---------|--------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|---|---|---|---------|--------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|---|---|---|---------|--------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|----------|---|---------|----------|---|----------------|--------------------------|--|--|----------|---------------------------|--|--|-----|--------|------|-----|--------|------|---|-------|--------|-------|------|------|-------|------|---|-------|--------|-------|------|------|-------|------|---|-------|--------|-------|------|------|-------|------|---|-------|--------|-------|------|------|-------|------|---|-------|--------|-------|------|------|-------|------|---|-------|--------|-------|-------|------|-------|------|---|-------|--------|-------|-------|------|-------|------|---|-------|--------|-------|-------|------|-------|------|
| -              | <p>Normal operating mode: the product can support the following channel plan.</p> <p><b>Transmit (Earth-to-space)</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Channel number</th> <th rowspan="2">Carriers</th> <th rowspan="2">Input IF Frequency (MHz)</th> <th rowspan="2">LO (GHz)</th> <th colspan="2">RF Output Frequency (MHz)</th> </tr> <tr> <th>Bandwidth 19.8 MHz</th> <th>Bandwidth 39.6 MHz</th> </tr> </thead> <tbody> <tr> <td rowspan="6">1</td> <td>1</td> <td>4 063.0</td> <td rowspan="6">9.950</td> <td>14 013.0</td> <td>14 022.9</td> </tr> <tr> <td>2</td> <td>4 082.8</td> <td>14 032.8</td> <td>14 042.7</td> </tr> <tr> <td>3</td> <td>4 102.6</td> <td>14 052.6</td> <td>14 062.5</td> </tr> <tr> <td>4</td> <td>4 122.4</td> <td>14 072.4</td> <td>14 082.3</td> </tr> <tr> <td>5</td> <td>4 142.2</td> <td>14 092.2</td> <td>14 102.1</td> </tr> <tr> <td>6</td> <td>4 162.0</td> <td>14 112.0</td> <td>-</td> </tr> <tr> <td rowspan="6">2</td> <td>1</td> <td>4 063.0</td> <td rowspan="6">10.075</td> <td>14 138.0</td> <td>14 147.9</td> </tr> <tr> <td>2</td> <td>4 082.8</td> <td>14 157.8</td> <td>14 167.7</td> </tr> <tr> <td>3</td> <td>4 102.6</td> <td>14 177.6</td> <td>14 187.5</td> </tr> <tr> <td>4</td> <td>4 122.4</td> <td>14 197.4</td> <td>14 207.3</td> </tr> <tr> <td>5</td> <td>4 142.2</td> <td>14 217.2</td> <td>14 227.1</td> </tr> <tr> <td>6</td> <td>4 162.0</td> <td>14 237.0</td> <td>-</td> </tr> <tr> <td rowspan="6">3</td> <td>1</td> <td>4 063.0</td> <td rowspan="6">10.200</td> <td>14 263.0</td> <td>14 272.9</td> </tr> <tr> <td>2</td> <td>4 082.8</td> <td>14 282.8</td> <td>14 292.7</td> </tr> <tr> <td>3</td> <td>4 102.6</td> <td>14 302.6</td> <td>14 312.5</td> </tr> <tr> <td>4</td> <td>4 122.4</td> <td>14 322.4</td> <td>14 332.3</td> </tr> <tr> <td>5</td> <td>4 142.2</td> <td>14 342.2</td> <td>14 352.1</td> </tr> <tr> <td>6</td> <td>4 162.0</td> <td>14 362.0</td> <td>-</td> </tr> <tr> <td rowspan="6">4</td> <td>1</td> <td>4 063.0</td> <td rowspan="6">10.325</td> <td>14 388.0</td> <td>14 397.9</td> </tr> <tr> <td>2</td> <td>4 082.8</td> <td>14 407.8</td> <td>14 417.7</td> </tr> <tr> <td>3</td> <td>4 102.6</td> <td>14 427.6</td> <td>14 437.5</td> </tr> <tr> <td>4</td> <td>4 122.4</td> <td>14 447.4</td> <td>14 457.3</td> </tr> <tr> <td>5</td> <td>4 142.2</td> <td>14 467.2</td> <td>14 477.1</td> </tr> <tr> <td>6</td> <td>4 162.0</td> <td>14 487.0</td> <td>-</td> </tr> </tbody> </table> <p><b>Receive (space-to-Earth)</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Channel number</th> <th colspan="3">Input RF Frequency (GHz)</th> <th rowspan="2">LO (GHz)</th> <th colspan="3">IF Output Frequency (GHz)</th> </tr> <tr> <th>Low</th> <th>Center</th> <th>High</th> <th>Low</th> <th>Center</th> <th>High</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>10.70</td> <td>10.825</td> <td>10.95</td> <td>8.85</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> <tr> <td>2</td> <td>10.95</td> <td>11.075</td> <td>11.20</td> <td>9.10</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> <tr> <td>3</td> <td>11.20</td> <td>11.325</td> <td>11.45</td> <td>9.35</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> <tr> <td>4</td> <td>11.45</td> <td>11.575</td> <td>11.70</td> <td>9.60</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> <tr> <td>5</td> <td>11.70</td> <td>11.825</td> <td>11.95</td> <td>9.85</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> <tr> <td>6</td> <td>11.95</td> <td>12.075</td> <td>12.20</td> <td>10.10</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> <tr> <td>7</td> <td>12.20</td> <td>12.325</td> <td>12.45</td> <td>10.35</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> <tr> <td>8</td> <td>12.45</td> <td>12.575</td> <td>12.70</td> <td>10.60</td> <td>1.85</td> <td>1.975</td> <td>2.10</td> </tr> </tbody> </table> | Channel number     | Carriers           | Input IF Frequency (MHz) | LO (GHz)                  | RF Output Frequency (MHz) |          | Bandwidth 19.8 MHz        | Bandwidth 39.6 MHz | 1 | 1 | 4 063.0 | 9.950 | 14 013.0 | 14 022.9 | 2 | 4 082.8 | 14 032.8 | 14 042.7 | 3 | 4 102.6 | 14 052.6 | 14 062.5 | 4 | 4 122.4 | 14 072.4 | 14 082.3 | 5 | 4 142.2 | 14 092.2 | 14 102.1 | 6 | 4 162.0 | 14 112.0 | - | 2 | 1 | 4 063.0 | 10.075 | 14 138.0 | 14 147.9 | 2 | 4 082.8 | 14 157.8 | 14 167.7 | 3 | 4 102.6 | 14 177.6 | 14 187.5 | 4 | 4 122.4 | 14 197.4 | 14 207.3 | 5 | 4 142.2 | 14 217.2 | 14 227.1 | 6 | 4 162.0 | 14 237.0 | - | 3 | 1 | 4 063.0 | 10.200 | 14 263.0 | 14 272.9 | 2 | 4 082.8 | 14 282.8 | 14 292.7 | 3 | 4 102.6 | 14 302.6 | 14 312.5 | 4 | 4 122.4 | 14 322.4 | 14 332.3 | 5 | 4 142.2 | 14 342.2 | 14 352.1 | 6 | 4 162.0 | 14 362.0 | - | 4 | 1 | 4 063.0 | 10.325 | 14 388.0 | 14 397.9 | 2 | 4 082.8 | 14 407.8 | 14 417.7 | 3 | 4 102.6 | 14 427.6 | 14 437.5 | 4 | 4 122.4 | 14 447.4 | 14 457.3 | 5 | 4 142.2 | 14 467.2 | 14 477.1 | 6 | 4 162.0 | 14 487.0 | - | Channel number | Input RF Frequency (GHz) |  |  | LO (GHz) | IF Output Frequency (GHz) |  |  | Low | Center | High | Low | Center | High | 1 | 10.70 | 10.825 | 10.95 | 8.85 | 1.85 | 1.975 | 2.10 | 2 | 10.95 | 11.075 | 11.20 | 9.10 | 1.85 | 1.975 | 2.10 | 3 | 11.20 | 11.325 | 11.45 | 9.35 | 1.85 | 1.975 | 2.10 | 4 | 11.45 | 11.575 | 11.70 | 9.60 | 1.85 | 1.975 | 2.10 | 5 | 11.70 | 11.825 | 11.95 | 9.85 | 1.85 | 1.975 | 2.10 | 6 | 11.95 | 12.075 | 12.20 | 10.10 | 1.85 | 1.975 | 2.10 | 7 | 12.20 | 12.325 | 12.45 | 10.35 | 1.85 | 1.975 | 2.10 | 8 | 12.45 | 12.575 | 12.70 | 10.60 | 1.85 | 1.975 | 2.10 |
| Channel number | Carriers   |                    |                    |                          |                           | Input IF Frequency (MHz)  | LO (GHz) | RF Output Frequency (MHz) |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                |  | Bandwidth 19.8 MHz | Bandwidth 39.6 MHz |                          |                           |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 1              | 1  | 4 063.0            | 9.950              | 14 013.0                 | 14 022.9                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 2  | 4 082.8            |                    | 14 032.8                 | 14 042.7                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 3  | 4 102.6            |                    | 14 052.6                 | 14 062.5                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 4  | 4 122.4            |                    | 14 072.4                 | 14 082.3                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 5  | 4 142.2            |                    | 14 092.2                 | 14 102.1                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 6  | 4 162.0            |                    | 14 112.0                 | -                         |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 2              | 1  | 4 063.0            | 10.075             | 14 138.0                 | 14 147.9                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 2  | 4 082.8            |                    | 14 157.8                 | 14 167.7                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 3  | 4 102.6            |                    | 14 177.6                 | 14 187.5                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 4  | 4 122.4            |                    | 14 197.4                 | 14 207.3                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 5  | 4 142.2            |                    | 14 217.2                 | 14 227.1                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 6  | 4 162.0            |                    | 14 237.0                 | -                         |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 3              | 1  | 4 063.0            | 10.200             | 14 263.0                 | 14 272.9                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 2  | 4 082.8            |                    | 14 282.8                 | 14 292.7                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 3  | 4 102.6            |                    | 14 302.6                 | 14 312.5                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 4  | 4 122.4            |                    | 14 322.4                 | 14 332.3                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 5  | 4 142.2            |                    | 14 342.2                 | 14 352.1                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 6  | 4 162.0            |                    | 14 362.0                 | -                         |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 4              | 1  | 4 063.0            | 10.325             | 14 388.0                 | 14 397.9                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 2  | 4 082.8            |                    | 14 407.8                 | 14 417.7                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 3  | 4 102.6            |                    | 14 427.6                 | 14 437.5                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 4  | 4 122.4            |                    | 14 447.4                 | 14 457.3                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 5  | 4 142.2            |                    | 14 467.2                 | 14 477.1                  |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | 6  | 4 162.0            |                    | 14 487.0                 | -                         |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| Channel number | Input RF Frequency (GHz)   |                    |                    | LO (GHz)                 | IF Output Frequency (GHz) |                           |          |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
|                | Low  | Center             | High               |                          | Low                       | Center                    | High     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 1              | 10.70  | 10.825             | 10.95              | 8.85                     | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 2              | 10.95  | 11.075             | 11.20              | 9.10                     | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 3              | 11.20  | 11.325             | 11.45              | 9.35                     | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 4              | 11.45  | 11.575             | 11.70              | 9.60                     | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 5              | 11.70  | 11.825             | 11.95              | 9.85                     | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 6              | 11.95  | 12.075             | 12.20              | 10.10                    | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 7              | 12.20  | 12.325             | 12.45              | 10.35                    | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |
| 8              | 12.45  | 12.575             | 12.70              | 10.60                    | 1.85                      | 1.975                     | 2.10     |                           |                    |   |   |         |       |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |   |   |         |        |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |          |   |         |          |   |                |                          |  |  |          |                           |  |  |     |        |      |     |        |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |      |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |   |       |        |       |       |      |       |      |



**Operating modes used for the Test:**

| No.   | Operating mode  |                                  |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |
|-------|---|----------------------------------|------------|------------------------------|------|------------|------------------------------|-------|------------|------------------------------|------|--------------|----------------------------------|------|--------------|----------------------------------|-------|--------------|----------------------------------|
| 1     | <p>(a) The EUT was operated in the special Test mode, continuously transmitting the modulated/unmodulated RF signals without an off-time interval. The operating modes were controlled by the software (Tera Term, QPST, QRCT4 tool).</p> <p>(b) The tests were performed for each Bandwidth and Modulation at the following frequencies:</p> <p>TX single carrier (19.8 MHz BW)</p> <table border="0"> <tr> <td>fLOW</td> <td>14.013 GHz</td> <td>Channel number 1 + Carrier 1</td> </tr> <tr> <td>fMID</td> <td>14.263 GHz</td> <td>Channel number 3 + Carrier 1</td> </tr> <tr> <td>fHIGH</td> <td>14.487 GHz</td> <td>Channel number 4 + Carrier 6</td> </tr> </table> <p>TX dual carrier (39.6 MHz BW)</p> <table border="0"> <tr> <td>fLOW</td> <td>14.022 9 GHz</td> <td>Channel number 1 + Carrier (1+2)</td> </tr> <tr> <td>fMID</td> <td>14.272 9 GHz</td> <td>Channel number 3 + Carrier (1+2)</td> </tr> <tr> <td>fHIGH</td> <td>14.477 1 GHz</td> <td>Channel number 4 + Carrier (5+6)</td> </tr> </table> | fLOW                             | 14.013 GHz | Channel number 1 + Carrier 1 | fMID | 14.263 GHz | Channel number 3 + Carrier 1 | fHIGH | 14.487 GHz | Channel number 4 + Carrier 6 | fLOW | 14.022 9 GHz | Channel number 1 + Carrier (1+2) | fMID | 14.272 9 GHz | Channel number 3 + Carrier (1+2) | fHIGH | 14.477 1 GHz | Channel number 4 + Carrier (5+6) |
| fLOW  | 14.013 GHz  | Channel number 1 + Carrier 1     |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |
| fMID  | 14.263 GHz  | Channel number 3 + Carrier 1     |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |
| fHIGH | 14.487 GHz  | Channel number 4 + Carrier 6     |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |
| fLOW  | 14.022 9 GHz  | Channel number 1 + Carrier (1+2) |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |
| fMID  | 14.272 9 GHz  | Channel number 3 + Carrier (1+2) |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |
| fHIGH | 14.477 1 GHz  | Channel number 4 + Carrier (5+6) |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |
| 2     | CW carrier activated for the measurement of frequency stability   |                                  |            |                              |      |            |                              |       |            |                              |      |              |                                  |      |              |                                  |       |              |                                  |

**3.2. Description of support units (accessory equipment)**

The following support units or accessories were used to form a representative test configuration during the tests.

| # | Equipment  | Manufacturer               | Model No. | Serial No. |
|---|------------|----------------------------|-----------|------------|
| 1 | Notebook   | HP Inc.                    | HSN-I26C  | -          |
| 2 | AC adapter | Acbel Electronic Co., Ltd. | TPN-AA06  | -          |

**3.3. Interconnection and I/O cables**

The following support units or accessories were used to form a representative test configuration during the tests.

| #  | Start                      |                          | End                          |           | Cable      |                |
|----|----------------------------|--------------------------|------------------------------|-----------|------------|----------------|
|    | Name                       | I/O port                 | Name                         | I/O port  | length (m) | shielded (Y/N) |
| 1  | EUT (Primary Antenna Unit) | (OMT and Feeder removed) | Dummy load                   | -         | -          | -              |
| 2  | EUT (Primary Antenna Unit) | RX                       | EUT (Secondary Antenna Unit) | RX        | 5.0        | Y              |
| 3  | EUT (Primary Antenna Unit) | TX                       | EUT (Secondary Antenna Unit) | TX        | 5.0        | Y              |
| 4  | EUT (Primary Antenna Unit) | ETH                      | EUT (Secondary Antenna Unit) | ETH       | 5.0        | Y              |
| 5  | EUT (Primary Antenna Unit) | SIG                      | EUT (Secondary Antenna Unit) | SIG       | 5.0        | Y              |
| 6  | EUT (Primary Antenna Unit) | Power & DATA             | EUT (CNX-BB)                 | SAT       | 30.0       | Y              |
| 7  | EUT (CNX-BB)               | Power                    | AC adapter                   | DC output | 1.2        | N              |
| 8  | AC Adapter                 | AC Input                 | AC Mains                     | AC Mains  | 1.5        | N              |
| 9  | EUT (CNX-BB)               | LAN                      | Notebook                     | LAN       | 3.0        | N              |
| 10 | Notebook                   | DC Input                 | AC adapter                   | DC output | 1.7        | N              |
| 11 | AC Adapter                 | AC Input                 | AC Mains                     | AC Mains  | 1.5        | N              |

**Note:** All the operating conditions including the cable connection were selected by the applicant.

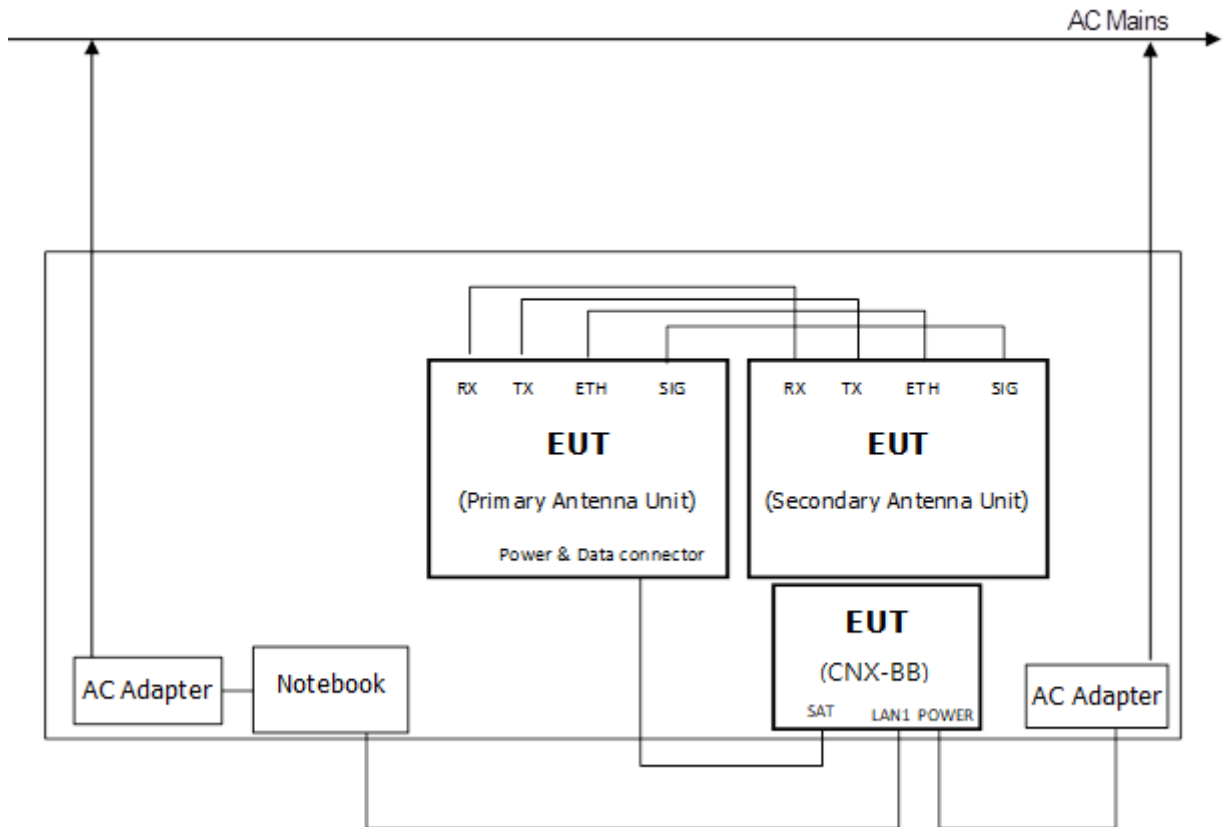




### 3.4. Test configuration (arrangement of EUT)

The tests were performed without antenna feeder; the radiated spurious was measured with the antenna flange terminated by the dummy load, and the conducted spurious was measured via the waveguide coupler.

The EUT (Secondary Antenna Unit) was connected to the EUT (Primary Antenna) without the mechanical parts (removing the reflector, bottom of the enclosure) but the electric parts (RCM, PCAs) were connected in order to provide the representative load.



### 3.5. Test date

|             |                             |
|-------------|-----------------------------|
| Date Tested | Oct 05, 2023 - Oct 13, 2023 |
|-------------|-----------------------------|



## 4 Facilities and accreditations

### 4.1. Facilities

All of the measurements described in this report were performed at SK Tech Co., Ltd.

Site I: 88, Geulgaetul-ro, 81beon-gil, Wabu-eup, Namyangju-si, Gyeonggi-do, Korea

Site II: 124-8, Geulgaetul-ro, Wabu-eup, Namyangju-si, Gyeonggi-do, Korea

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-4. The sites comply with the Normalized Site Attenuation requirements given in ANSI C63.4, and site VSWR requirements specified in CISPR 16-1-4. The FAR used for the radiated spurious emissions fulfills the NSA requirements specified in ETSI TS 102 321 V1.1.1 (2004-05) and ETSI TR 102 273-2 V1.2.1 (2001-12). The measuring apparatus and ancillary equipment conform to CISPR 16-1 series.

### 4.2. Accreditations

The laboratory has been also notified to FCC and ISED by RRA as a Conformity Assessment Body, and designated to perform compliance testing on equipment subject to Certification under Parts 15, 18, 22, 24, 25, 27, 74, 90, 95, 97 and 101 of the FCC Rules, and RSS-GEN, RSS-170, RSS-210, RSS-247.

|                     |        |
|---------------------|--------|
| Designation No.     | KR0007 |
| Company Number (IC) | 5429A  |

### 4.3. List of test and measurement instruments

#### 4.3.1 Instruments for the conducted measurements

| No | Description                      | Model                       | Manufacturer    | Serial No. | Cal. due   | Use                                 |
|----|----------------------------------|-----------------------------|-----------------|------------|------------|-------------------------------------|
| 1  | Spectrum Analyzer                | FSW67                       | Rohde&Schwarz   | 101371     | 2024.06.16 | <input checked="" type="checkbox"/> |
| 2  | Waveguide Coupler                | 17132-20                    | Flann microwave | 197960     | 2024.07.18 | <input checked="" type="checkbox"/> |
| 3  | Waveguide Dummy load             | 17101-300-CH10              | Flann microwave | 275168     | 2024.07.18 | <input checked="" type="checkbox"/> |
| 4  | Pre-amplifier (1 GHz - 18 GHz)   | MLA-0118-J01-40             | TSJ             | 14879      | 2024.04.18 | <input type="checkbox"/>            |
| 5  | Pre-amplifier (18 GHz - 40 GHz)  | MLA-1840-A01-50             | TSJ             | 2610050    | 2024.04.26 | <input checked="" type="checkbox"/> |
| 6  | Pre-amplifier (40 GHz - 60 GHz)  | MLA-4060-J02                | TSJ             | 2Z00027    | 2024.04.27 | <input checked="" type="checkbox"/> |
| 7  | Harmonic Mixer (60 GHz - 75 GHz) | FS-Z75                      | Rohde & Schwarz | 102063     | 2024.07.26 | <input checked="" type="checkbox"/> |
| 8  | RF cable assembly (2 m)          | MWX241                      | JUNFLON MWX     | R07-2      | 2024.04.27 | <input checked="" type="checkbox"/> |
| 9  | RF cable assembly (0.5 m)        | ST40-01-9A40                | SENSORVIEW      | R08        | 2024.04.27 | <input checked="" type="checkbox"/> |
| 10 | RF cable assembly (1 m)          | SCW-VWVW012-F1              | ERAVANT         | R15        | 2024.04.27 | <input checked="" type="checkbox"/> |
| 11 | RF cable assembly (0.3 m)        | SCW-VWVW012-F1              | ERAVANT         | R16        | 2024.04.27 | <input checked="" type="checkbox"/> |
| 12 | RF cable assembly (6.5 m)        | MWX241                      | SENSORVIEW      | R06-2      | 2024.04.27 | <input checked="" type="checkbox"/> |
| 13 | High Pass Filter                 | WHW2-13500-18000-33000-40CC | Wainwright      | 7          | 2024.07.17 | <input checked="" type="checkbox"/> |
| 14 | Attenuator (10 dB)               | 50HFAR-010-2.9MM            | JFW             | -          | 2024.07.17 | <input checked="" type="checkbox"/> |
| 15 | Temperature Chamber              | DJ-THC02                    | DAE JIN ENG.    | 06071      | 2024.09.13 | <input checked="" type="checkbox"/> |
| 16 | Multimeter                       | 17B+                        | FLUKE           | 32700017WS | 2024.01.16 | <input checked="" type="checkbox"/> |
| 17 | Digital Thermo-Hygrometer        | 608-H1                      | Testo           | 41383411   | 2024.05.18 | <input checked="" type="checkbox"/> |



**4.3.2 Instruments for the radiated measurements**

| No | Description                              | Model            | Manufacturer    | Serial No.    | Cal. due   | Use                                 |
|----|--|------------------|-----------------|---------------|------------|-------------------------------------|
| 1  | EMI Test Receiver                        | ESR 26           | Rohde&Schwarz   | 101441        | 2024.07.05 | <input checked="" type="checkbox"/> |
| 2  | EMI Test Receiver                        | ESIB40           | Rohde&Schwarz   | 100277        | 2024.04.17 | <input type="checkbox"/>            |
| 3  | EMI Test Receiver                        | N9048B           | Keysight        | MY62220109    | 2024.07.17 | <input type="checkbox"/>            |
| 4  | Spectrum Analyzer                        | FSW67            | Rohde&Schwarz   | 101371        | 2024.06.16 | <input checked="" type="checkbox"/> |
| 5  | Vector Signal Generator                  | SMBV100B         | Rohde&Schwarz   | 101179        | 2024.04.19 | <input type="checkbox"/>            |
| 6  | Signal Generator                         | SMB100A          | Rohde&Schwarz   | 180704        | 2024.01.17 | <input type="checkbox"/>            |
| 7  | Loop Antenna (9 kHz - 30 MHz)            | HFH2-Z2E         | Rohde&Schwarz   | 100883        | 2023.11.23 | <input checked="" type="checkbox"/> |
| 8  | BiLog broadband Antenna (30 MHz - 1 GHz) | VULB9168         | Schwarzbeck     | 9168-189      | 2024.03.13 | <input checked="" type="checkbox"/> |
| 9  | Horn Antenna (1 GHz - 18 GHz)            | 3117             | ETS Lindgren    | 00205960      | 2024.05.19 | <input checked="" type="checkbox"/> |
| 10 | Horn Antenna (6.5 GHz - 18 GHz)          | LB-65180-20-C-SF | A-INFO          | 2110054000021 | 2024.01.22 | <input type="checkbox"/>            |
| 11 | Horn Antenna (18 GHz - 26.5 GHz)         | 20240-20         | Flann microwave | 273364        | 2023.11.23 | <input checked="" type="checkbox"/> |
| 12 | Horn Antenna (26.5 GHz - 40 GHz)         | 22240-20         | Flann microwave | 274186        | 2023.11.23 | <input checked="" type="checkbox"/> |
| 13 | Horn Antenna (40 GHz - 60 GHz)           | 24240-20         | Flann microwave | 275175        | 2023.12.27 | <input checked="" type="checkbox"/> |
| 14 | Horn Antenna (60 GHz - 75 GHz)           | 25240-20         | Flann microwave | 273466        | 2023.12.10 | <input checked="" type="checkbox"/> |
| 15 | Pre-amplifier (30 MHz - 1 GHz)           | MLA-10K01-B01-27 | TSJ             | 2005350       | 2024.04.17 | <input checked="" type="checkbox"/> |
| 16 | Pre-amplifier (1 GHz - 18 GHz)           | MLA-0118-J01-40  | TSJ             | 14879         | 2024.04.18 | <input checked="" type="checkbox"/> |
| 17 | Pre-amplifier (18 GHz - 40 GHz)          | MLA-1840-A01-50  | TSJ             | 2610050       | 2024.04.26 | <input checked="" type="checkbox"/> |
| 18 | Pre-amplifier (40 GHz - 60 GHz)          | MLA-4060-J02     | TSJ             | 2Z00027       | 2024.04.27 | <input checked="" type="checkbox"/> |
| 19 | Harmonic Mixer (60 GHz - 75 GHz)         | FS-Z75           | Rohde & Schwarz | 102063        | 2024.07.26 | <input checked="" type="checkbox"/> |
| 20 | Waveguide Dummy load                     | 22101-250-CH10   | Flann microwave | 275202        | 2024.07.18 | <input checked="" type="checkbox"/> |
| 21 | Multimeter                               | 17B+             | FLUKE           | 32700017WS    | 2024.01.16 | <input checked="" type="checkbox"/> |
| 22 | Digital Thermo-Hygrometer                | 608-H1           | Testo           | 41383411      | 2024.05.18 | <input checked="" type="checkbox"/> |

Radiated emission measurement software (9 kHz to 30 MHz, 30 MHz to 1 GHz): TEPTO-DV/RE\_Version: 3.1.0051

Radiated spurious emission measurement software (1 GHz to 75 GHz): TEPTO-DV/RSE\_Version: 31.06.0000



## 5 Test and measurements

### 5.1. RF Power Output / Power limits / Off-axis EIRP spectral density

#### 5.1.1 Regulation

##### FCC, CFR 47 Section

**According to 2.1046**, Measurements required: RF power output:

- (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in According to 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.
- (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in According to 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.
- (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

**According to 25.204**, Power limits for earth stations

- (a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:
  - +40 dBW in any 4 kHz band for  $\theta \leq 0^\circ$
  - +40 + 3 $\theta$  dBW in any 4 kHz band for  $0^\circ < \theta \leq 5^\circ$
 where  $\theta$  is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.
- (c) For angles of elevation of the horizon greater than  $5^\circ$  there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.

**According to 25.218**, Off-axis EIRP density envelopes for FSS earth stations transmitting in certain frequency bands

- (f) Digital earth station operation in the conventional Ku-band.
  - (1) For co-polarized transmissions in the plane tangent to the GSO arc:

|                        |           |  |
|------------------------|-----------|--|
| $15-25\log_{10}\theta$ | dBW/4 kHz | for $1.5^\circ \leq \theta \leq 7^\circ$ |
| -6                     | dBW/4 kHz | for $7^\circ < \theta \leq 9.2^\circ$    |
| $18-25\log_{10}\theta$ | dBW/4 kHz | for $9.2^\circ < \theta \leq 19.1^\circ$ |
| -14                    | dBW/4 kHz | for $19.1^\circ < \theta \leq 180^\circ$ |

Where  $\theta$  is as defined in paragraph (c)(1) of this section. The EIRP density levels specified for  $\theta > 7^\circ$  may be exceeded by up to 3 dB in up to 10% of the range of theta ( $\theta$ ) angles from  $\pm 7-180^\circ$ , and by up to 6 dB in the region of main reflector spillover energy.



(2) For co-polarized transmissions in the plane perpendicular to the GSO arc, as defined in § 25.103:

|                        |           |   |
|------------------------|-----------|---|
| $18-25\log_{10}\theta$ | dBW/4 kHz | for $3^\circ \leq \theta \leq 19.1^\circ$ |
| -14                    | dBW/4 kHz | for $19.1^\circ < \theta \leq 180^\circ$  |

Where  $\theta$  is as defined in paragraph (c)(1) of this section. These EIRP density levels may be exceeded by up to 6 dB in the region of main reflector spillover energy and in up to 10% of the range of  $\theta$  angles not included in that region, on each side of the line from the earth station to the target satellite.

(3) For cross-polarized transmissions in the plane tangent to the GSO arc and in the plane perpendicular to the GSO arc:

|                       |           |  |
|-----------------------|-----------|--|
| $5-25\log_{10}\theta$ | dBW/4 kHz | for $1.5^\circ \leq \theta \leq 7^\circ$ |
|-----------------------|-----------|--|

Where  $\theta$  is as defined in paragraph (c)(1) of this section.

NOTE: subtracting the antenna gain values specified in §25.209 Earth station antenna performance standards from these limits, the maximum conducted Off-axis density limit is -14 dBW/4kHz.

### 5.1.2 Test Procedure

The RF output power were measured with the following setting according to Subclause 5.2.4.2, 5.2.4.3 and/or 5.2.4.4 of ANSI C63.26-2015.

Procedure for measuring average power with an average power meter:

An average power meter can always be used to perform the measurement when the EUT can be configured to transmit continuously. If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98%), the measurement should be measured during the active transmission bursts if the gating parameters can be adjusted, otherwise the duty cycle correction should be considered.

Procedure for measuring average power of a narrowband signal with spectrum analyzer:

- (a) Set span to  $2 \times$  to  $3 \times$  the OBW.
- (b) Set RBW  $\geq$  OBW.
- (c) Set VBW  $\geq 3 \times$  RBW.
- (d) Set number of measurement points in sweep  $\geq 2 \times$  span / RBW.
- (e) Sweep time:
  - (1) Set  $\geq$  auto-couple, and enable trace averaging, or
  - (2) Set  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$  and enable a single sweep (automation-compatible) measurement. The sweep time should never be faster than the auto-coupled sweep time.
- (f) Detector = power averaging (rms).
- (g) If the EUT can be configured to transmit continuously, then set the trigger to free run.
- (h) Trace average at least 100 traces in power averaging (i.e., rms) mode if sweep is set to auto-couple. (To accurately determine the average power over multiple transmit symbols, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.)
- (i) Use the peak marker function to determine the maximum amplitude level.



Procedure for measuring average power of a broadband signal with spectrum analyzer:

- (a) Set span to  $2 \times$  to  $3 \times$  the OBW.
- (b) Set RBW = 1% to 5% of the OBW.
- (c) Set VBW  $\geq 3 \times$  RBW.
- (d) Set number of measurement points in sweep  $\geq 2 \times$  span / RBW.
- (e) Sweep time:
  - (1) Set = auto-couple, or
  - (2) Set  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$  for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
- (f) Detector = power averaging (rms).
- (g) If the EUT can be configured to transmit continuously, then set the trigger to free run.
- (h) If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full-power transmissions).
- (i) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over multiple symbols, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.
- (j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Procedure for RF power output in any 4 kHz band:

The average power spectral density was measured according to Subclause 5.2.4.5 of ANSI C63.26-2015. The same test procedure for the measurements of Spurious Emissions at Antenna Terminals (Out-of-band emissions measurements) was used.

NOTE: As shown in the Figure 3, during the measurements, the insertion loss (Waveguide coupler, RF cable assembly) was included in the spectrum analyzer as the TDF, and bandwidth correction factor (1.25 dB) were applied as the Offset.

Procedure for Off-axis EIRP spectral density in any 4 kHz band:

The average power spectral density was measured according to Subclause 5.2.4.5 of ANSI C63.26-2015. The same test procedure for the measurements of Spurious Emissions at Antenna Terminals (Out-of-band emissions measurements) was used, except for subtracting the antenna gain.

NOTE : As shown in the Figure 4, during the measurements, the insertion loss (Waveguide coupler, RF cable assembly) was included in the spectrum analyzer as the TDF, and the bandwidth correction factor (1.25 dB) were applied as the Offset which the antenna gain was set to zero.



5.1.3 Result:

PASS

Table 1: Measured values of RF Power Output

| Bandwidth (carrier)       | Modulation | Antenna power [dBm] (NOTE 1) |                  |                   | EIRP [dBm] (NOTE 2) |                  |                   |
|---------------------------|------------|------------------------------|------------------|-------------------|---------------------|------------------|-------------------|
|                           |            | f <sub>LOW</sub>             | f <sub>MID</sub> | f <sub>HIGH</sub> | f <sub>LOW</sub>    | f <sub>MID</sub> | f <sub>HIGH</sub> |
| 19.8 MHz (single carrier) | QPSK       | 26.6                         | 26.6             | 26.6              | 65.6                | 65.6             | 65.6              |
|                           | 8PSK       | 26.6                         | 26.6             | 26.6              | 65.6                | 65.6             | 65.6              |
|                           | 16QAM      | 26.6                         | 26.6             | 26.6              | 65.6                | 65.6             | 65.6              |
| 39.6 MHz (dual carrier)   | QPSK       | 29.6                         | 29.6             | 29.6              | 68.6                | 68.6             | 68.6              |
|                           | 8PSK       | 29.6                         | 29.6             | 29.6              | 68.6                | 68.6             | 68.6              |
|                           | 16QAM      | 29.6                         | 29.6             | 29.6              | 68.6                | 68.6             | 68.6              |

NOTE 1: As shown in the Figure 1, during the measurements, the insertion loss (Waveguide coupler, RF cable assembly) was included in the spectrum analyzer as the TDF.

NOTE 2: Transmitter radiated output power including the antenna gain (39.0 dBi).

Table 2: Measured values of RF Power Output (measured with Spectrum Analyzer in any 4 kHz band)

| Bandwidth (carrier)       | Modulation | Measured data [dBm] (NOTE 1) |                  |                   | EIRP [dBm] (NOTE 2) |                  |                   | LIMIT [dBm] |
|---------------------------|------------|------------------------------|------------------|-------------------|---------------------|------------------|-------------------|-------------|
|                           |            | f <sub>LOW</sub>             | f <sub>MID</sub> | f <sub>HIGH</sub> | f <sub>LOW</sub>    | f <sub>MID</sub> | f <sub>HIGH</sub> |             |
| 19.8 MHz (single carrier) | QPSK       | 0.82                         | 0.70             | 0.58              | 39.82               | 39.70            | 39.58             | 70          |
|                           | 8PSK       | 0.92                         | 0.80             | 0.80              | 39.92               | 39.80            | 39.80             | 70          |
|                           | 16QAM      | 0.94                         | 0.81             | 0.73              | 39.94               | 39.81            | 39.73             | 70          |
| 39.6 MHz (dual carrier)   | QPSK       | 0.69                         | 0.36             | 0.40              | 39.69               | 39.36            | 39.40             | 70          |
|                           | 8PSK       | 0.76                         | 0.36             | 0.44              | 39.76               | 39.36            | 39.44             | 70          |
|                           | 16QAM      | 0.71                         | 0.38             | 0.42              | 39.71               | 39.38            | 39.42             | 70          |

NOTE 1: The values were obtained from the Figure 4.

NOTE 2: Transmitter radiated output power including the antenna gain (39.0 dBi).

Table 3: Measured values of Off-axis EIRP spectral density

| Bandwidth (carrier)       | Modulation | EIRP [dBm] (NOTE 1) |                  |                   | LIMIT [dBm] |
|---------------------------|------------|---------------------|------------------|-------------------|-------------|
|                           |            | f <sub>LOW</sub>    | f <sub>MID</sub> | f <sub>HIGH</sub> |             |
| 19.8 MHz (single carrier) | QPSK       | 0.82                | 0.70             | 0.58              | 16.0        |
|                           | 8PSK       | 0.92                | 0.80             | 0.80              | 16.0        |
|                           | 16QAM      | 0.94                | 0.81             | 0.73              | 16.0        |
| 39.6 MHz (dual carrier)   | QPSK       | 0.69                | 0.36             | 0.40              | 16.0        |
|                           | 8PSK       | 0.76                | 0.36             | 0.44              | 16.0        |
|                           | 16QAM      | 0.71                | 0.38             | 0.42              | 16.0        |

NOTE 1: The values were obtained from the Figure 4. The gain for the off-axis antenna was 0 dBi for the calculation.

**Figure 1. Plot of RF Power Output**
**RF Power output for each Bandwidth and Modulation**

 $f_{LOW}$  (19.8 MHz, QPSK)

 $f_{LOW}$  (39.6 MHz, QPSK)

 $f_{LOW}$  (19.8 MHz, 8PSK)

 $f_{LOW}$  (39.6 MHz, 8PSK)

 $f_{LOW}$  (19.8 MHz, 16QAM)

 $f_{LOW}$  (39.6 MHz, 16QAM)



**RF Power output for each Bandwidth and Modulation**

 $f_{MID}$  (19.8 MHz, QPSK)

 $f_{MID}$  (39.6 MHz, QPSK)

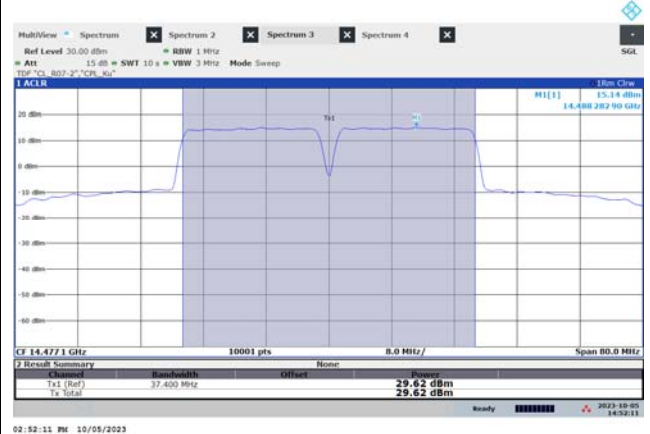
 $f_{MID}$  (19.8 MHz, 8PSK)

 $f_{MID}$  (39.6 MHz, 8PSK)

 $f_{MID}$  (19.8 MHz, 16QAM)

 $f_{MID}$  (39.6 MHz, 16QAM)

**RF Power output for each Bandwidth and Modulation**

 $f_{HIGH}$  (19.8 MHz, QPSK)

 $f_{HIGH}$  (39.6 MHz, QPSK)

 $f_{HIGH}$  (19.8 MHz, 8PSK)

 $f_{HIGH}$  (39.6 MHz, 8PSK)

 $f_{HIGH}$  (19.8 MHz, 16QAM)

 $f_{HIGH}$  (39.6 MHz, 16QAM)



## 5.2. Occupied Bandwidth

### 5.2.1 Regulation

#### FCC, CFR 47 Section

**According to 2.1049**, Measurements required: Occupied bandwidth: The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of 2.1049 (a) through (i) as applicable.

### 5.2.2 Test Procedure

The Occupied bandwidth (99 %) were measured with the following setting according to subclause 5.4.4 of ANSI C63.26.

- (a) Set the spectrum analyzer to be entered in OBW measurement.
- (b) The spectrum analyzer center frequency was set to the nominal EUT channel center frequency.
- (c) The span range for the spectrum analyzer should be wide enough to see sufficient roll off of the signal to make the measurement.
- (d) The RBW should be in the range of 1% to 5% of the anticipated OBW, and the VBW should be set  $\geq 3 \times$  RBW.
- (e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

### 5.2.3 Result:

**PASS**

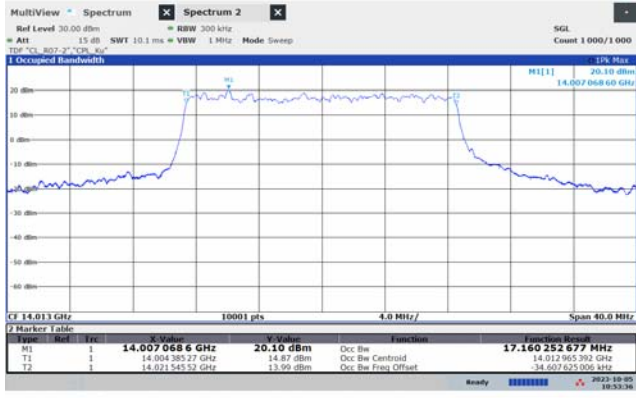
**Table 4: Measured values of Occupied Bandwidth**

| Bandwidth (carrier)       | Modulation | Occupied bandwidth [MHz] |                  |                   |
|---------------------------|------------|--------------------------|------------------|-------------------|
|                           |            | f <sub>LOW</sub>         | f <sub>MID</sub> | f <sub>HIGH</sub> |
| 19.8 MHz (single carrier) | QPSK       | 17.2                     | 17.2             | 17.2              |
|                           | 8PSK       | 17.2                     | 17.2             | 17.2              |
|                           | 16QAM      | 17.2                     | 17.2             | 17.2              |
| 39.6 MHz (dual carrier)   | QPSK       | 37.4                     | 37.4             | 37.4              |
|                           | 8PSK       | 37.4                     | 37.4             | 37.4              |
|                           | 16QAM      | 37.4                     | 37.4             | 37.4              |

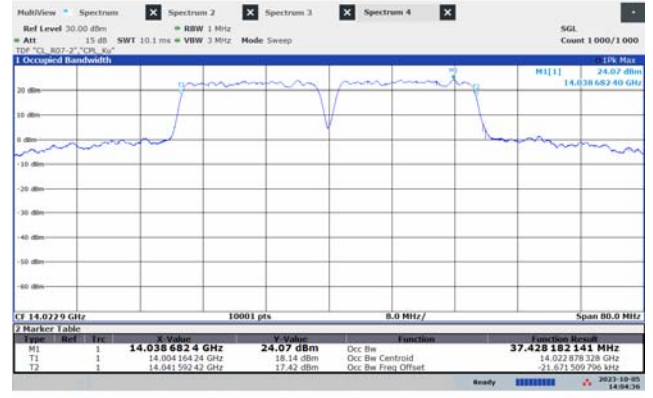


Figure 2. Plot of Occupied Bandwidth

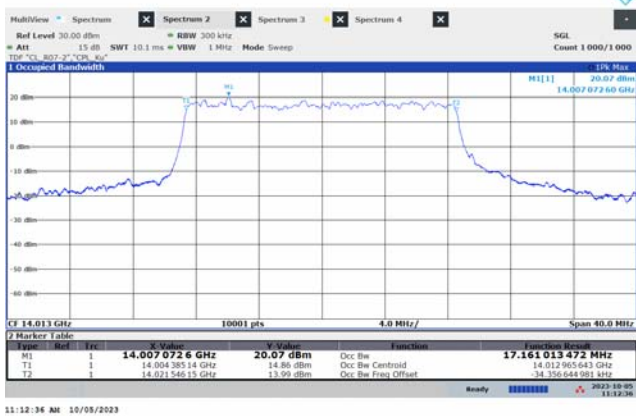
Occupied bandwidth for each Bandwidth and Modulation



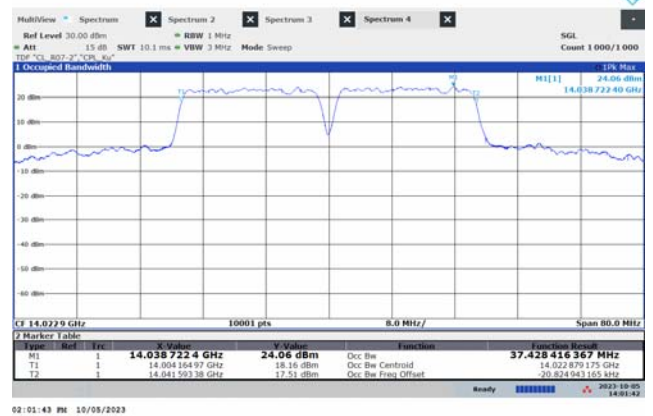
f<sub>LOW</sub> (19.8 MHz, QPSK)



f<sub>LOW</sub> (39.6 MHz, QPSK)



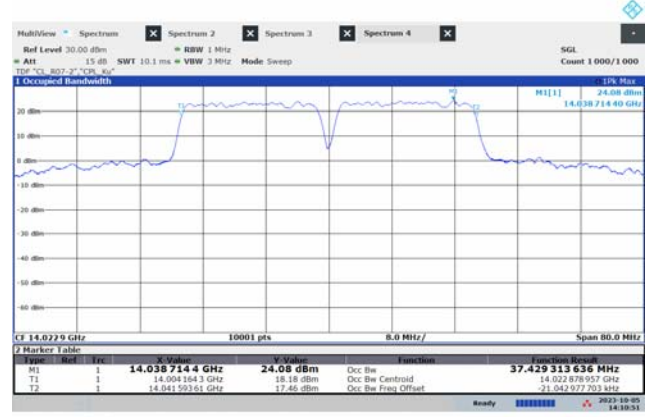
f<sub>LOW</sub> (19.8 MHz, 8PSK)



f<sub>LOW</sub> (39.6 MHz, 8PSK)



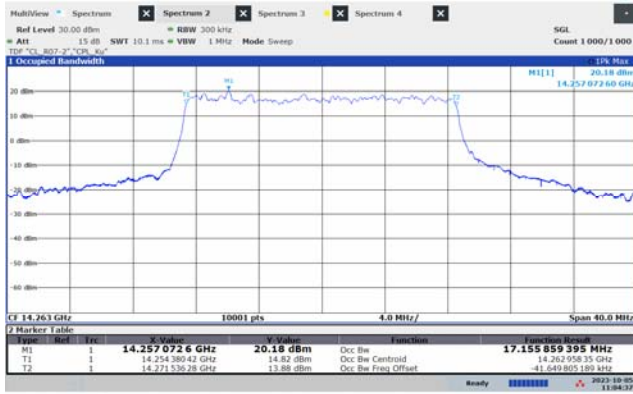
f<sub>LOW</sub> (19.8 MHz, 16QAM)



f<sub>LOW</sub> (39.6 MHz, 16QAM)

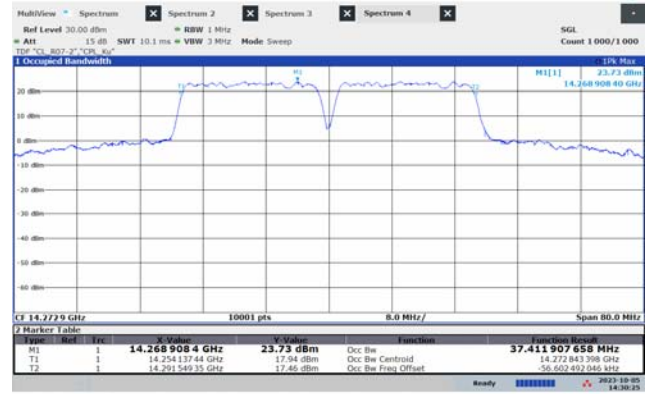


### Occupied bandwidth for each Bandwidth and Modulation



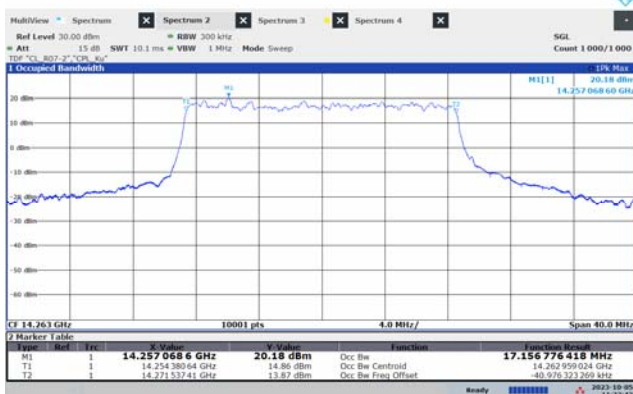
11:04:38 AM 10/05/2023

$f_{MID}$  (19.8 MHz, QPSK)



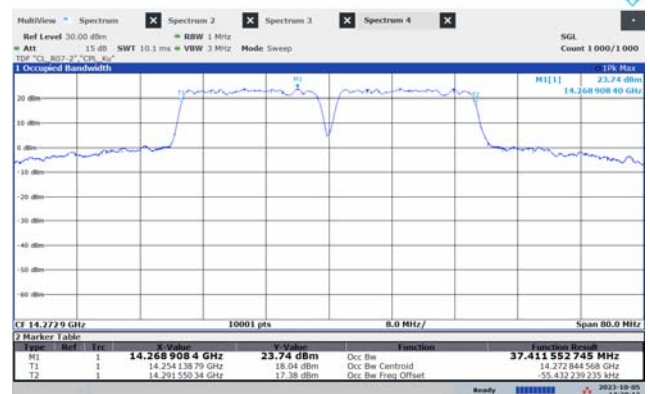
02:30:26 PM 10/05/2023

$f_{MID}$  (39.6 MHz, QPSK)



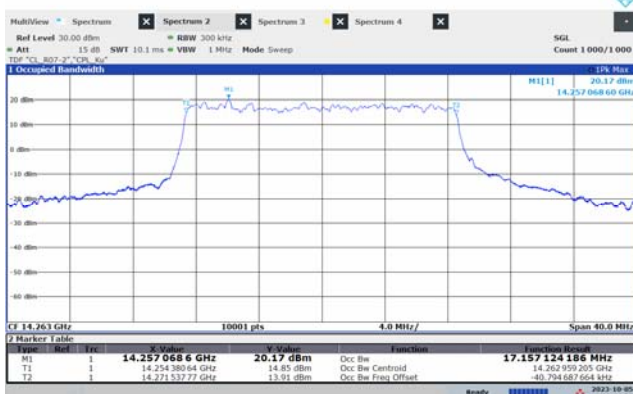
11:22:44 AM 10/05/2023

$f_{MID}$  (19.8 MHz, 8PSK)



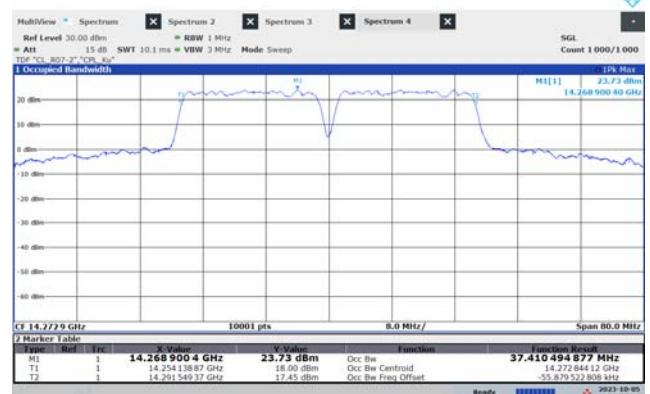
02:29:14 PM 10/05/2023

$f_{MID}$  (39.6 MHz, 8PSK)



11:16:02 AM 10/05/2023

$f_{MID}$  (19.8 MHz, 16QAM)

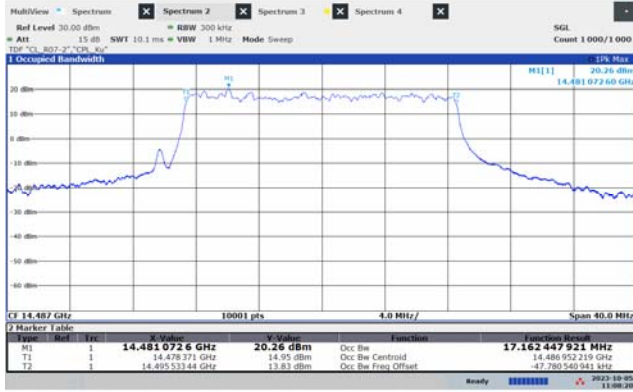


02:27:47 PM 10/05/2023

$f_{MID}$  (39.6 MHz, 16QAM)

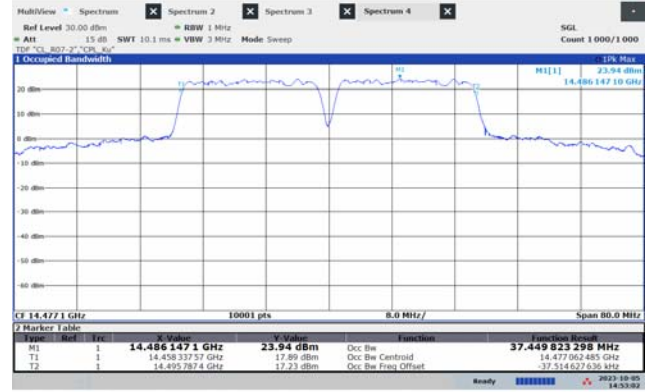


Occupied bandwidth for each Bandwidth and Modulation



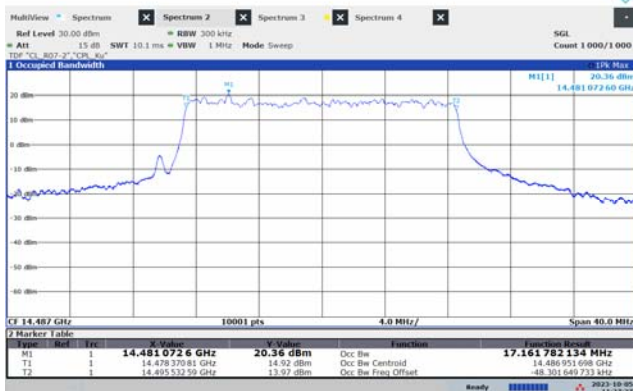
11:08:20 AM 10/05/2023

f<sub>HIGH</sub> (19.8 MHz, QPSK)



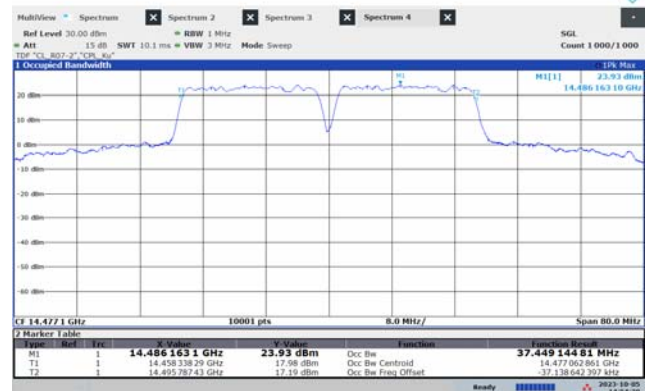
02:53:02 PM 10/05/2023

f<sub>HIGH</sub> (39.6 MHz, QPSK)



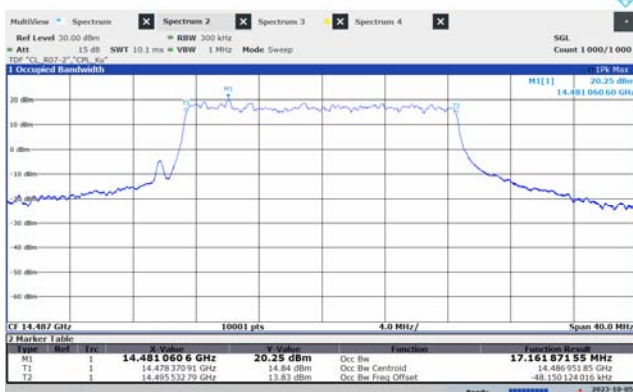
11:27:28 AM 10/05/2023

f<sub>HIGH</sub> (19.8 MHz, 8PSK)



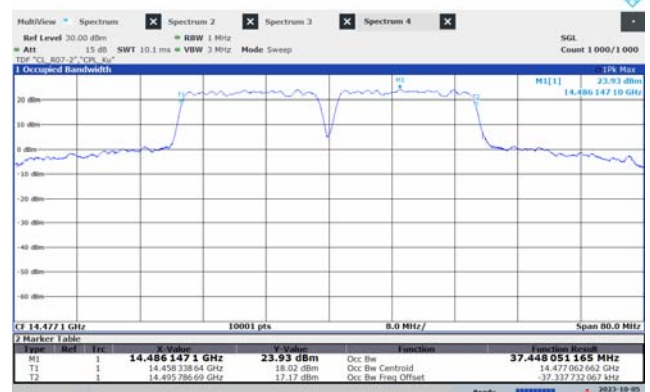
02:54:40 PM 10/05/2023

f<sub>HIGH</sub> (39.6 MHz, 8PSK)



11:35:08 AM 10/05/2023

f<sub>HIGH</sub> (19.8 MHz, 16QAM)



02:56:41 PM 10/05/2023

f<sub>HIGH</sub> (39.6 MHz, 16QAM)



### 5.3. Spurious Emissions at Antenna Terminals (conducted emissions)

#### 5.3.1 Regulation

##### FCC, CFR 47 Section

**According to 2.1051**, Measurements required: Spurious emissions at antenna terminals: The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

**According to 25.202(f)**, Emission limitations. Except for SDARS terrestrial repeaters and as provided for in paragraph (i), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section. The out-of-band emissions of SDARS terrestrial repeaters shall be attenuated in accordance with the schedule set forth in paragraph (h) of this section.

- (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;
- (2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;
- (3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;
- (4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

#### 5.3.2 Test Procedure

The Spurious Emissions at Antenna Terminals were measured with the following setting according to subclause 5.7.3 and 5.7.4 of ANSI C63.26.

Connect the EUT antenna output port to the spectrum analyzer via an appropriate RF cable. Insert external attenuation as necessary and adjust the spectrum analyzer settings to account for the corresponding insertion loss. The unwanted emission limit was expressed in terms of "average" power. The use of "Max Hold" will not result in a true average power measurement. Instead, the proper trace mode for performing an average measurement was the "trace average" mode. Alternatively, a single sweep measurement could be used with the sweep speed set such that a relatively long dwell was realized in each trace bucket (typically at least 1 ms per trace point).

##### Out-of-band emissions measurements:

- (a) Set the spectrum analyzer center frequency to the block, band, or channel edge frequency.
- (b) Set the span wide enough to capture the fundamental emission closest to the authorized block or band edge, and to include all modulation products that spill into the immediately adjacent frequency band. In some cases, it may be possible to set the center frequency and span so as to encompass the



fundamental emission and the unwanted out-of-band (band-edge) emissions on either side of the authorized block, band, or channel. This could be accomplished with a single (slow) sweep, if adequate overload protection and sufficient dynamic range could be maintained.

- (c) Set the number of points in sweep  $\geq 2 \times \text{span} / \text{RBW}$ .
- (d) Sweep time should be auto for peak detection. For rms detection the sweep time should be set as follows:
  - (1) If the device could be configured to transmit continuously, set the (sweep time)  $>$  (number of points in sweep)  $\times$  (symbol period) (e.g., by a factor of  $10 \times$  symbol period  $\times$  number of points). Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols.
  - (2) If the device could not transmit continuously, a gated sweep should be used when possible, set the sweep time  $>$  (number of points in sweep)  $\times$  (symbol period) but the sweep time should always be maintained at a value that was less than or equal to the minimum transmission time.
  - (3) If the device could not be configured to transmit continuously and a free running sweep must be used, set the sweep time so that the averaging was performed over multiple on/off cycles by setting the sweep time  $>$  (number of points in sweep)  $\times$  (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings should subsequently be corrected by  $[10 \log (1/\text{duty cycle})]$ . This assumes that the transmission period and duty cycle was relatively constant (duty cycle variation  $\leq \pm 2\%$ ).
  - (4) If the device could not be configured to transmit continuously and a free-running sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations  $> \pm 2\%$ ), set the sweep time so that the averaging was performed over the on-period by setting the sweep time  $>$  (symbol period)  $\times$  (number of points), while also maintaining the sweep time  $<$  (transmitter on-time). The trace mode should be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold are necessary to ensure that the maximum power was measured.

**Conducted spurious emissions measurements:**

- (a) Set the spectrum analyzer start frequency to the lowest frequency generated by the EUT, without going below 9 kHz, and the stop frequency to the lower frequency covered by the out-of-band emissions measurements. [remark: the measurements were performed from the waveguide cutoff frequency]
- (b) When using an average power (rms) detector, ensure that the number of points in the sweep  $\geq 2 \times$  (span / RBW). This may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the spectrum analyzer capabilities. This requirement does not apply to peak-detected power measurements. When average power was specified by the applicable regulation, a peak-detector could be utilized for preliminary measurements to accommodate wider frequency spans. Any emissions found in the preliminary measurement to exceed the applicable limit(s) should be further examined using a power averaging (rms) detector with the minimum number of measurement points as defined above.
- (c) The sweep time should be set to auto-couple for performing peak-detector measurements. For measurements that use a power averaging (rms) detector, the sweep time should be set as described for out-of-band emissions measurements.
- (d) Identify and measure the highest spurious emission levels in each frequency range. It was not necessary to re-measure the out-of-band emissions as a part of this test. Record the frequencies and amplitudes corresponding to the measured emissions and capture the data plots.
- (e) Repeat step (b) through step (d) for the upper spurious emission frequency range if not already





captured by a wide span measurement.

(f) Compare the results with the corresponding limit in the applicable regulation.

**Calculation of bandwidth correction factor 5.7.2 of ANSI C63.26:**

If the measurement bandwidth used to perform the measurement is less than the reference bandwidth, the following scaling is applied:  $10 \times \log [(reference\ bandwidth) / (resolution\ or\ measurement\ bandwidth)]$

For example, the reference bandwidth is specified as 4 kHz and the RBW 3 kHz is used during the measurement, the bandwidth correction factor =  $10 \times \log (4\ kHz / 3\ kHz) = 1.25\ [dB]$

NOTE 1: As shown in the Figure 3, during the Out-of-band emission measurements, the peak detector was used with RBW 10 kHz for the preliminary measurements. The insertion loss (Waveguide coupler, Preamplifier, RF cable assembly) was included in the spectrum analyzer as the TDF. The final measurements (RMS detector with RBW 3 kHz, and adding the bandwidth correction factor) were not performed because the emissions were very low against the limit.

NOTE 2: As shown in the Figure 4, during the Off-axis EIRP spectral measurements, the insertion loss (Waveguide coupler, RF cable assembly) was included in the spectrum analyzer as the TDF, and the bandwidth correction factor (1.25 dB) were applied as the Offset.

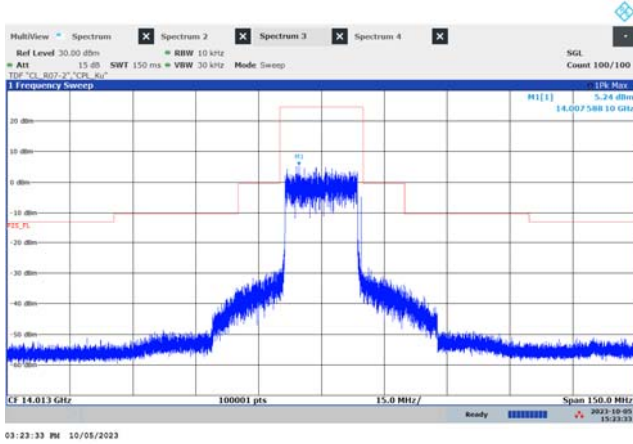
NOTE 3: As shown in the Figure 5, during the spurious emission measurements, the peak detector was used with RBW 100 kHz for the preliminary measurements. The insertion loss (Waveguide coupler, Preamplifier, RF cable assembly) was included in the spectrum analyzer as the TDF.

**5.3.3 Result:**

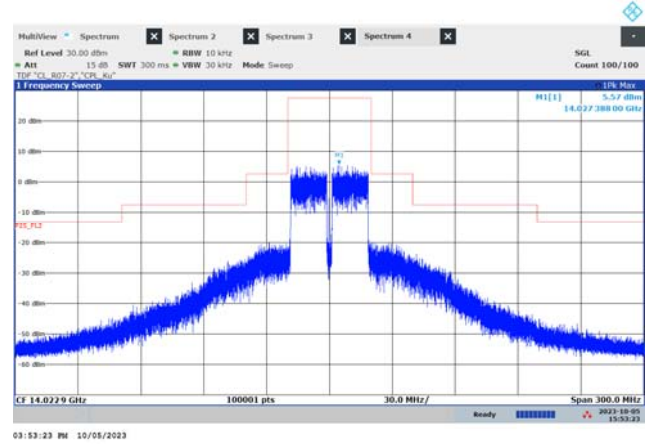
**PASS**

Figure 3. Plot of Out-of-band Emissions (conducted emissions measurements)

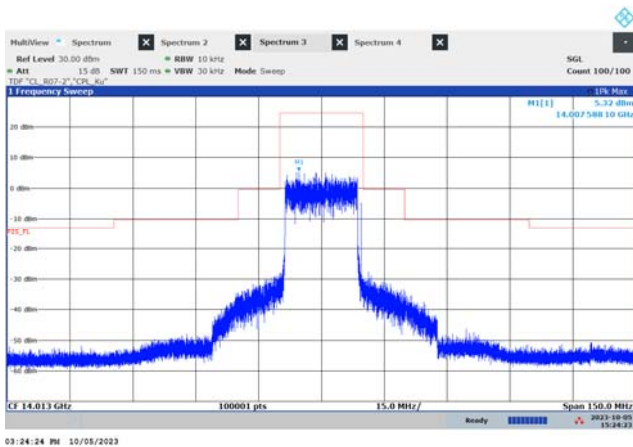
Out-of-band emissions (OOBE) and Band-edge measurements for each Bandwidth and Modulation



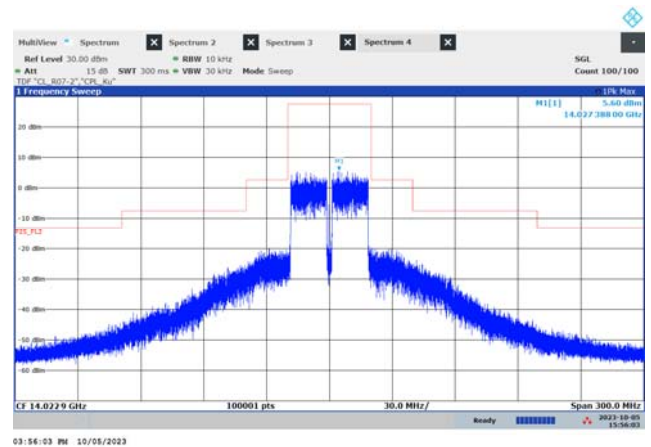
$f_{LOW}$  (19.8 MHz, QPSK)



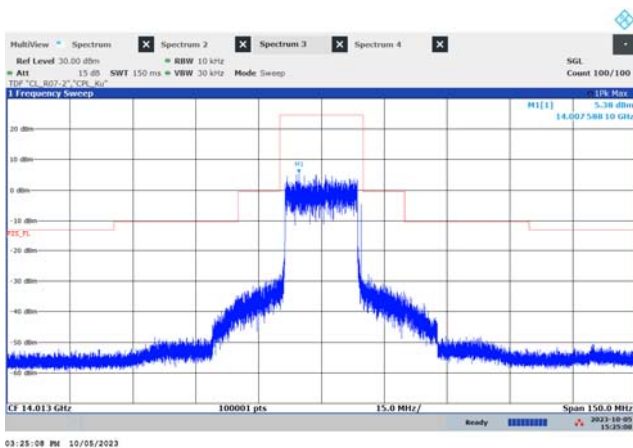
$f_{LOW}$  (39.6 MHz, QPSK)



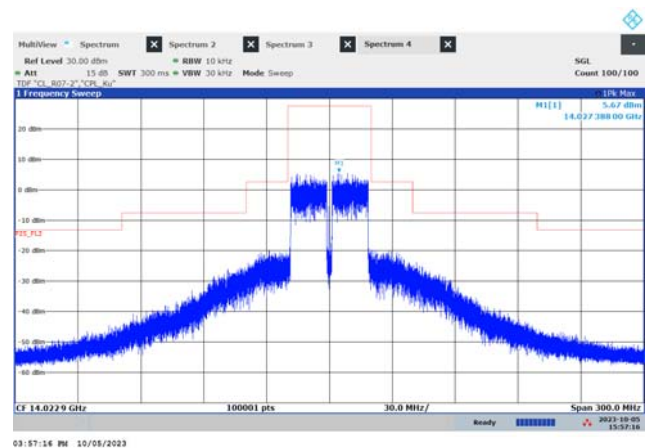
$f_{LOW}$  (19.8 MHz, 8PSK)



$f_{LOW}$  (39.6 MHz, 8PSK)

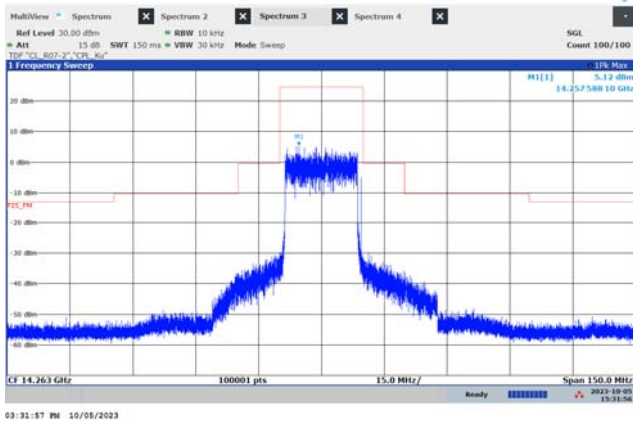


$f_{LOW}$  (19.8 MHz, 16QAM)

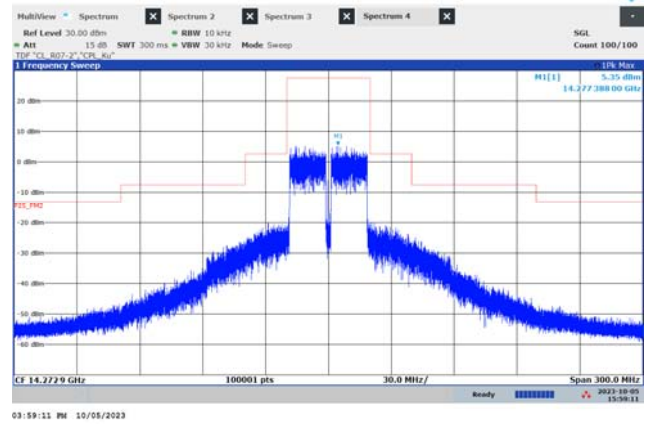


$f_{LOW}$  (39.6 MHz, 16QAM)

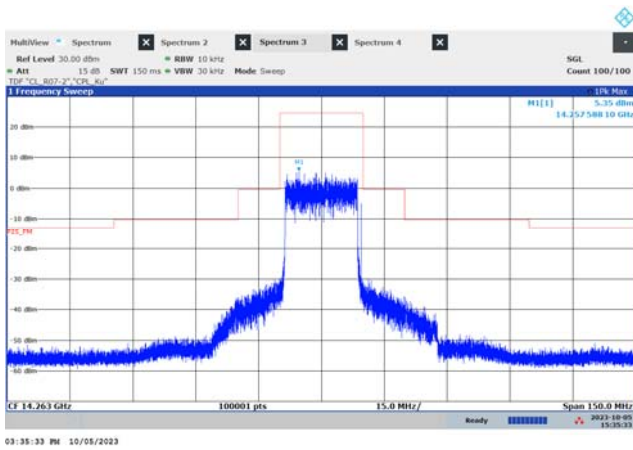
Out-of-band emissions (OOBE) and Band-edge measurements for each Bandwidth and Modulation



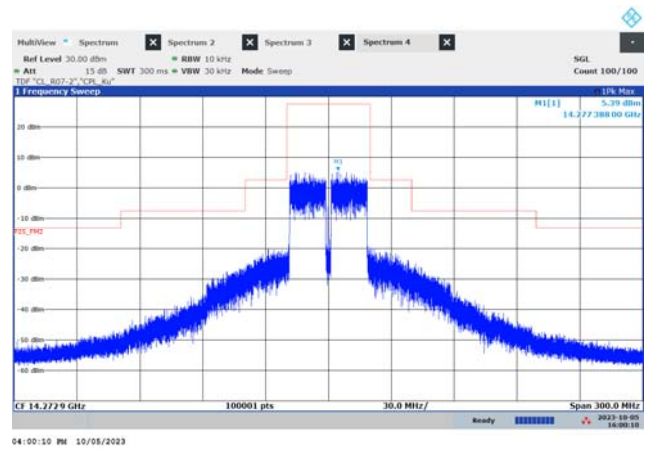
$f_{MID}$  (19.8 MHz, QPSK)



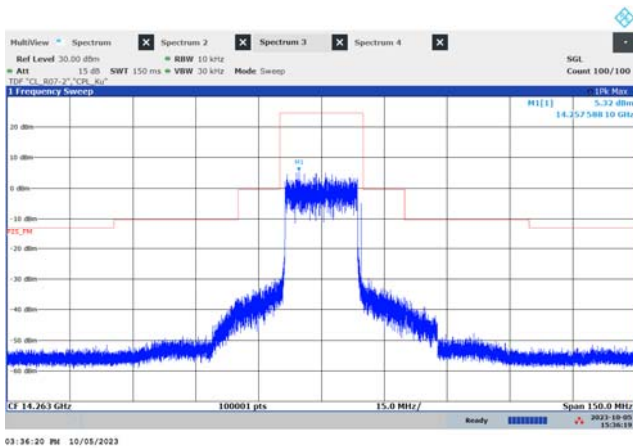
$f_{MID}$  (39.6 MHz, QPSK)



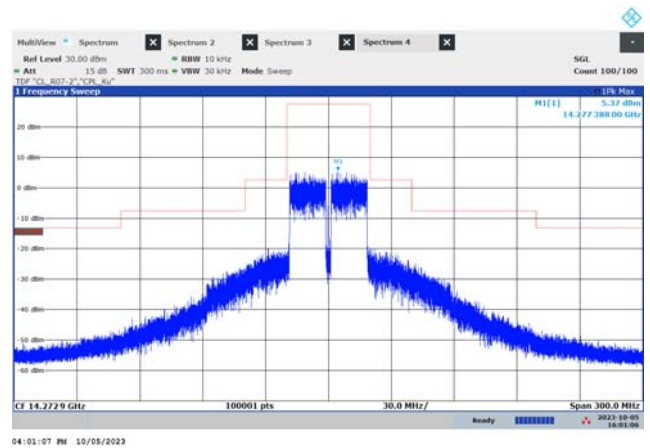
$f_{MID}$  (19.8 MHz, 8PSK)



$f_{MID}$  (39.6 MHz, 8PSK)

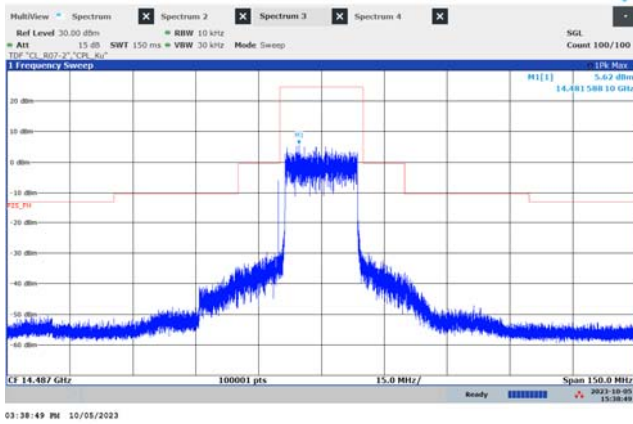


$f_{MID}$  (19.8 MHz, 16QAM)

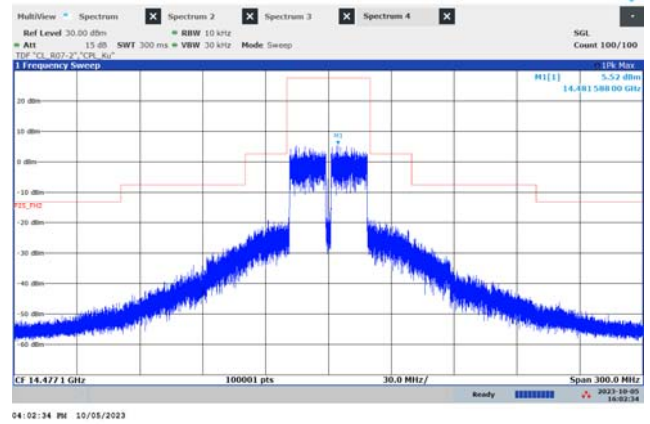


$f_{MID}$  (39.6 MHz, 16QAM)

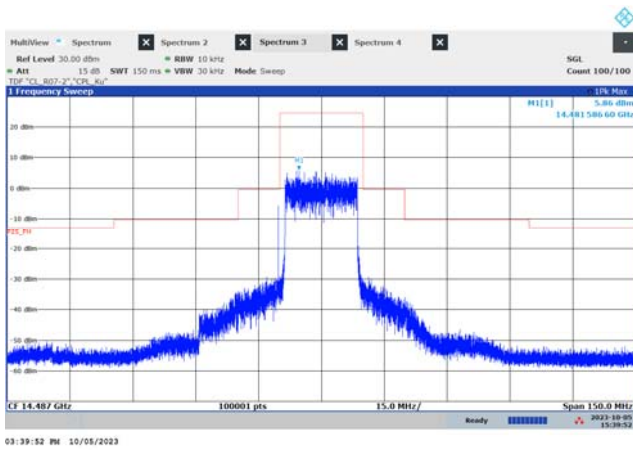
Out-of-band emissions (OOBE) and Band-edge measurements for each Bandwidth and Modulation



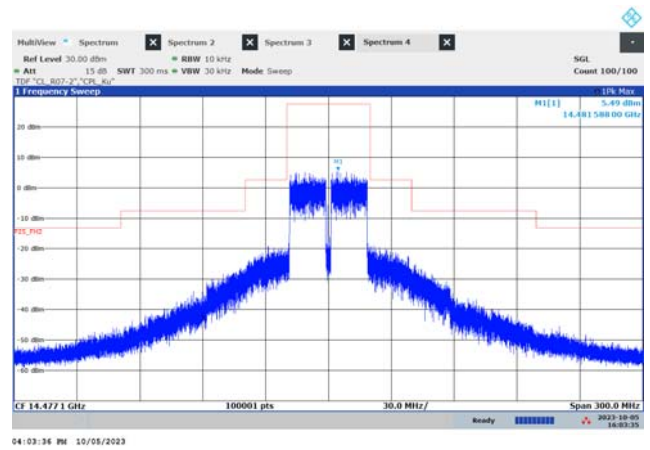
$f_{HIGH}$  (19.8 MHz, QPSK)



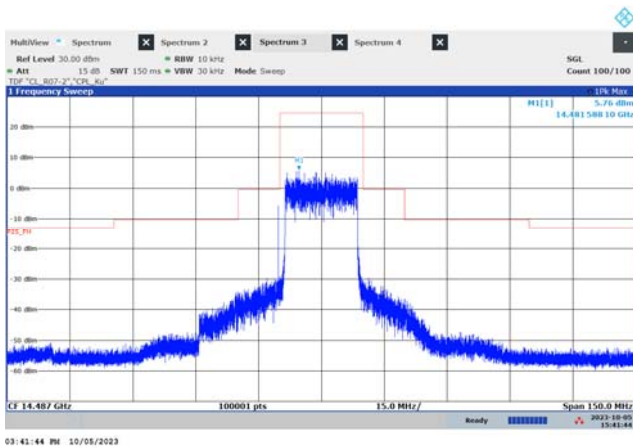
$f_{HIGH}$  (39.6 MHz, QPSK)



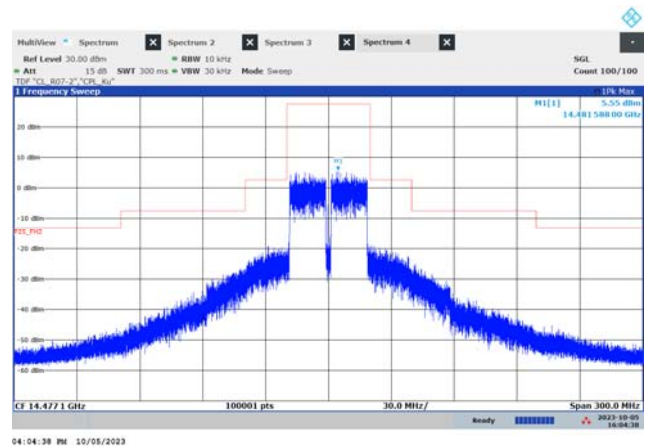
$f_{HIGH}$  (19.8 MHz, 8PSK)



$f_{HIGH}$  (39.6 MHz, 8PSK)



$f_{HIGH}$  (19.8 MHz, 16QAM)



$f_{HIGH}$  (39.6 MHz, 16QAM)