

## FCC Test Report (Part 27 – NB-IoT B4/B12/B13)

**Report No.:** RFBCYD-WTW-P21090659-2

**FCC ID:** 2AQYP-TRACK1100

**Test Model:** SNT3.5 ULTRA

**Received Date:** Oct. 08, 2021

**Test Date:** Dec. 09, 2021 ~ May 28, 2022

**Issued Date:** May 30, 2022

**Applicant:** Sensolus NV

**Address:** Rijsenbergstraat 148D, 9000 Gent, Belgium

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

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

**Test Location (1):** No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City  
33383, TAIWAN

**FCC Registration /  
Designation Number:** 788550 / TW0003

**Test Location (2):** No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

**FCC Registration /  
Designation Number:** 281270 / TW0032



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### Release Control Record

| Issue No.              | Description      | Date Issued  |
|------------------------|------------------|--------------|
| RFBCYD-WTW-P21090659-2 | Original release | May 30, 2022 |

## 1 Certificate of Conformity

**Product:** TRACK1100

**Brand:** sensolus

**Test Model:** SNT3.5 ULTRA

**Sample Status:** Mass Production

**Applicant:** Sensolus NV

**Test Date:** Dec. 09, 2021 ~ May 28, 2022

**Standards:** FCC Part 27, Subpart C, F, H, L

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

**Prepared by :** Celine Chou , **Date:** May 30, 2022  
Celine Chou / Senior Specialist

**Approved by :** Jeremy Lin , **Date:** May 30, 2022  
Jeremy Lin / Project Engineer

## 2 Summary of Test Results

For NB-IoT Band 4

| Applied Standard: FCC Part 27 & Part 2 |                                         |        |                                                                                     |
|----------------------------------------|-----------------------------------------|--------|-------------------------------------------------------------------------------------|
| FCC Clause                             | Test Item                               | Result | Remarks                                                                             |
| 2.1046<br>27.50<br>(d)                 | Equivalent Isotropically radiated power | Pass   | Meet the requirement of limit.                                                      |
| 2.1047                                 | Modulation characteristics              | Pass   | Meet the requirement                                                                |
| 2.1055<br>27.54                        | Frequency Stability                     | Pass   | Meet the requirement of limit.                                                      |
| 2.1049                                 | Emission Bandwidth                      | Pass   | Meet the requirement of limit.                                                      |
| 2.1051<br>27.53<br>(h)                 | Out of Band Emission Measurements       | Pass   | Meet the requirement of limit.                                                      |
| 27.50<br>(d)(5)                        | Peak To Average Ratio                   | Pass   | Meet the requirement of limit.                                                      |
| 2.1051<br>27.53<br>(h)                 | Conducted Spurious Emissions            | Pass   | Meet the requirement of limit.                                                      |
| 2.1053<br>27.53<br>(h)                 | Radiated Spurious Emissions             | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -24.52dB at 3465.00MHz. |

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

For NB-IoT Band 12

| Applied Standard: FCC Part 27 & Part 2 |                                   |        |                                                                                     |
|----------------------------------------|-----------------------------------|--------|-------------------------------------------------------------------------------------|
| FCC Clause                             | Test Item                         | Result | Remarks                                                                             |
| 2.1046<br>27.50<br>(c)                 | Equivalent radiated power         | Pass   | Meet the requirement of limit.                                                      |
| 2.1047                                 | Modulation characteristics        | Pass   | Meet the requirement                                                                |
| 2.1055<br>27.54                        | Frequency Stability               | Pass   | Meet the requirement of limit.                                                      |
| 2.1049                                 | Emission Bandwidth                | Pass   | Meet the requirement of limit.                                                      |
| 2.1051<br>27.53<br>(g)                 | Out of Band Emission Measurements | Pass   | Meet the requirement of limit.                                                      |
| --                                     | Peak To Average Ratio             | Pass   | Meet the requirement of limit.                                                      |
| 2.1051<br>27.53<br>(g)                 | Conducted Spurious Emissions      | Pass   | Meet the requirement of limit.                                                      |
| 2.1053<br>27.53<br>(g)                 | Radiated Spurious Emissions       | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -31.51dB at 1398.40MHz. |

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

For NB-IoT Band 13

| Applied Standard: FCC Part 27 & Part 2 |                                   |        |                                                                                    |
|----------------------------------------|-----------------------------------|--------|------------------------------------------------------------------------------------|
| FCC Clause                             | Test Item                         | Result | Remarks                                                                            |
| 2.1046 27.50 (b)                       | Equivalent radiated power         | Pass   | Meet the requirement of limit.                                                     |
| 2.1047                                 | Modulation characteristics        | Pass   | Meet the requirement                                                               |
| 2.1055 27.54                           | Frequency Stability               | Pass   | Meet the requirement of limit.                                                     |
| 2.1049                                 | Emission Bandwidth                | Pass   | Meet the requirement of limit.                                                     |
| 2.1051 27.53 (c)                       | Out of Band Emission Measurements | Pass   | Meet the requirement of limit.                                                     |
| --                                     | Peak To Average Ratio             | Pass   | Meet the requirement of limit.                                                     |
| 2.1051 27.53 (c)(f)                    | Conducted Spurious Emissions      | Pass   | Meet the requirement of limit.                                                     |
| 2.1053 27.53 (c)(f)                    | Radiated Spurious Emissions       | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -3.10dB at 1564.00MHz. |

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

## 2.1 Measurement Uncertainty

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

| Measurement                    | Frequency        | Expanded Uncertainty (k=2) (±) |
|--------------------------------|------------------|--------------------------------|
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz     | 3.00 dB                        |
|                                | 30MHz ~ 200MHz   | 2.91 dB                        |
|                                | 200MHz ~ 1000MHz | 2.92 dB                        |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz     | 1.76 dB                        |
|                                | 18GHz ~ 40GHz    | 1.77 dB                        |

## 2.2 Test Site and Instruments

| Description & Manufacturer                    | Model No.                      | Serial No.             | Cal. Date     | Cal. Due      |
|-----------------------------------------------|--------------------------------|------------------------|---------------|---------------|
| Test Receiver<br>Rohde & Schwarz              | ESR3                           | 102579                 | Jul. 05, 2021 | Jul. 04, 2022 |
| Spectrum Analyzer<br>KEYSIGHT                 | N9020B                         | MY60110462             | Dec. 18, 2020 | Dec. 17, 2021 |
|                                               |                                |                        | Dec. 21, 2021 | Dec. 20, 2022 |
| BILOG Antenna<br>SCHWARZBECK                  | VULB9168                       | 995                    | Oct. 28, 2021 | Oct. 27, 2022 |
| HORN Antenna<br>RF SPIN                       | DRH18-E                        | 210104A18E             | Nov. 14, 2021 | Nov. 13, 2022 |
| HORN Antenna<br>SCHWARZBECK                   | BBHA 9170                      | 9170-1049              | Nov. 14, 2021 | Nov. 13, 2022 |
| Loop Antenna<br>TESEQ                         | HLA 6121                       | 45745                  | Jul. 21, 2021 | Jul. 20, 2022 |
| Preamplifier<br>EMCI                          | EMC330N                        | 980783                 | Jan. 19, 2021 | Jan. 18, 2022 |
|                                               |                                |                        | Jan. 17, 2022 | Jan. 16, 2023 |
| Preamplifier<br>EMCI                          | EMC118A45SE                    | 980810                 | Jan. 06, 2021 | Jan. 05, 2022 |
|                                               |                                |                        | Dec. 30, 2021 | Dec. 29, 2022 |
| Preamplifier<br>EMCI                          | EMC184045SE                    | 980787                 | Jan. 18, 2021 | Jan. 17, 2022 |
|                                               |                                |                        | Jan. 17, 2022 | Jan. 16, 2023 |
| RF signal cable<br>EMCI                       | EMC104-SM-SM-(9000+2000+1000)  | 201230+ 201242+ 210101 | Jan. 18, 2021 | Jan. 17, 2022 |
|                                               |                                |                        | Jan. 17, 2022 | Jan. 16, 2023 |
| RF signal cable<br>EMCI                       | EMCCFD400-NM-NM-(9000+300+500) | 201252+ 201250+ 201245 | Jan. 18, 2021 | Jan. 17, 2022 |
|                                               |                                |                        | Jan. 17, 2022 | Jan. 16, 2023 |
| RF signal cable<br>EMCI                       | EMC101G-KM-KM-(5000+3000+2000) | 201259+201256+201253   | Jan. 18, 2021 | Jan. 17, 2022 |
|                                               |                                |                        | Jan. 17, 2022 | Jan. 16, 2023 |
| Software<br>BV CPS                            | ADT_Radiated_V7.6.15.9.5       | NA                     | NA            | NA            |
| Turn Table<br>Max-Full                        | MFT-151SS-0.5T                 | NA                     | NA            | NA            |
| Turn Table Controller<br>Max-Full             | MF-7802BS                      | MF780208675            | NA            | NA            |
| Antenna Tower<br>KaiTuo                       | NA                             | NA                     | NA            | NA            |
| Antenna Tower Controller<br>KaiTuo            | KT-2000                        | NA                     | NA            | NA            |
| Temperature & Humidity Chamber<br>Giant Force | GTH-120-40-CP-AR               | MAA1306-019            | Sep. 10, 2021 | Sep. 09, 2022 |
| JFW 20dB attenuation                          | 50HF-020-SMA                   | NA                     | NA            | NA            |
| True RMS Clamp Meter<br>Fluke                 | 325                            | 31130711WS             | Jun. 02, 2021 | Jun. 01, 2022 |
| DC power supply<br>Keysight                   | U8002A                         | MY56330015             | NA            | NA            |
| Radio Communication Analyzer<br>Anritsu       | MT8821C                        | 6272278310             | Jun. 23, 2021 | Jun. 22, 2022 |

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. The test was performed in WM Chamber 7.

### 3 General Information

#### 3.1 General Description of EUT

|                     |                                          |                       |
|---------------------|------------------------------------------|-----------------------|
| Product             | TRACK1100                                |                       |
| Brand               | sensolus                                 |                       |
| Test Model          | SNT3.5 ULTRA                             |                       |
| Sample Status       | Mass Production                          |                       |
| Power Supply Rating | 3.6Vdc from battery                      |                       |
| Subcarrier Spacing  | 3.75kHz, 15kHz                           |                       |
| Modulation Type     | BPSK, QPSK                               |                       |
| Operating Frequency | NB-IoT Standalone                        |                       |
|                     | NB-IoT Band 4                            | 1710.2MHz ~ 1754.8MHz |
|                     | NB-IoT Band 12                           | 699.2MHz ~ 715.8MHz   |
|                     | NB-IoT Band 13                           | 777.2MHz ~ 786.8MHz   |
|                     | NB-IoT In band                           |                       |
|                     | NB-IoT Band 4 (Channel Bandwidth 3MHz)   | 1711.5MHz ~ 1753.5MHz |
|                     | NB-IoT Band 4 (Channel Bandwidth 5MHz)   | 1712.5MHz ~ 1752.5MHz |
|                     | NB-IoT Band 4 (Channel Bandwidth 10MHz)  | 1715.0MHz ~ 1750.0MHz |
|                     | NB-IoT Band 4 (Channel Bandwidth 15MHz)  | 1717.5MHz ~ 1747.5MHz |
|                     | NB-IoT Band 4 (Channel Bandwidth 20MHz)  | 1720.0MHz ~ 1745.0MHz |
|                     | NB-IoT Band 12 (Channel Bandwidth 3MHz)  | 700.5MHz ~ 714.5MHz   |
|                     | NB-IoT Band 12 (Channel Bandwidth 5MHz)  | 701.5MHz ~ 713.5MHz   |
|                     | NB-IoT Band 12 (Channel Bandwidth 10MHz) | 704.0MHz ~ 711.0MHz   |
|                     | NB-IoT Band 12 (Channel Bandwidth 15MHz) | 706.5MHz ~ 708.5MHz   |
|                     | NB-IoT Band 13 (Channel Bandwidth 3MHz)  | 778.5MHz ~ 785.5MHz   |
|                     | NB-IoT Band 13 (Channel Bandwidth 5MHz)  | 779.5MHz ~ 784.5MHz   |
|                     | NB-IoT Band 13 (Channel Bandwidth 10MHz) | 782.0MHz              |
|                     | NB-IoT Guard band                        |                       |
|                     | NB-IoT Band 4 (Channel Bandwidth 5MHz)   | 1712.5MHz ~ 1752.5MHz |
|                     | NB-IoT Band 4 (Channel Bandwidth 10MHz)  | 1715.0MHz ~ 1750.0MHz |
|                     | NB-IoT Band 4 (Channel Bandwidth 15MHz)  | 1717.5MHz ~ 1747.5MHz |
|                     | NB-IoT Band 4 (Channel Bandwidth 20MHz)  | 1720.0MHz ~ 1745.0MHz |
|                     | NB-IoT Band 12 (Channel Bandwidth 5MHz)  | 701.5MHz ~ 713.5MHz   |
|                     | NB-IoT Band 12 (Channel Bandwidth 10MHz) | 704.0MHz ~ 711.0MHz   |
|                     | NB-IoT Band 12 (Channel Bandwidth 15MHz) | 706.5MHz ~ 708.5MHz   |
|                     | NB-IoT Band 13 (Channel Bandwidth 5MHz)  | 779.5MHz ~ 784.5MHz   |
|                     | NB-IoT Band 13 (Channel Bandwidth 10MHz) | 782.0MHz              |

| Max. EIRP Power |                                         | BPSK                    | QPSK                    |
|-----------------|-----------------------------------------|-------------------------|-------------------------|
|                 | NB-IoT Standalone                       |                         |                         |
|                 | NB-IoT Band 4                           | 393.550mW<br>(25.95dBm) | 429.536mW<br>(26.33dBm) |
|                 | NB-IoT In band                          |                         |                         |
|                 | NB-IoT Band 4 (Channel Bandwidth 3MHz)  | 395.367mW<br>(25.97dBm) | 389.942mW<br>(25.91dBm) |
|                 | NB-IoT Band 4 (Channel Bandwidth 5MHz)  | 396.278mW<br>(25.98dBm) | 392.645mW<br>(25.94dBm) |
|                 | NB-IoT Band 4 (Channel Bandwidth 10MHz) | 384.592mW<br>(25.85dBm) | 380.189mW<br>(25.80dBm) |
|                 | NB-IoT Band 4 (Channel Bandwidth 15MHz) | 385.478mW<br>(25.86dBm) | 382.825mW<br>(25.83dBm) |
|                 | NB-IoT Band 4 (Channel Bandwidth 20MHz) | 386.367mW<br>(25.87dBm) | 381.066mW<br>(25.81dBm) |
|                 | NB-IoT Guard band                       |                         |                         |
|                 | NB-IoT Band 4 (Channel Bandwidth 5MHz)  | 377.572mW<br>(25.77dBm) | 373.250mW<br>(25.72dBm) |
|                 | NB-IoT Band 4 (Channel Bandwidth 10MHz) | 368.978mW<br>(25.67dBm) | 365.595mW<br>(25.63dBm) |
|                 | NB-IoT Band 4 (Channel Bandwidth 15MHz) | 365.595mW<br>(25.63dBm) | 362.243mW<br>(25.59dBm) |
|                 | NB-IoT Band 4 (Channel Bandwidth 20MHz) | 368.129mW<br>(25.66dBm) | 364.754mW<br>(25.62dBm) |

|                   |                                          |                              |                         |      |
|-------------------|------------------------------------------|------------------------------|-------------------------|------|
| Max. ERP Power    |                                          | BPSK                         | QPSK                    |      |
|                   | NB-IoT Standalone                        |                              |                         |      |
|                   | NB-IoT Band 12                           | 185.353mW<br>(22.68dBm)      | 182.810mW<br>(22.62dBm) |      |
|                   | NB-IoT Band 13                           | 159.588mW<br>(22.03dBm)      | 158.125mW<br>(21.99dBm) |      |
|                   | NB-IoT In band                           |                              |                         |      |
|                   | NB-IoT Band 12 (Channel Bandwidth 3MHz)  | 182.810mW<br>(22.62dBm)      | 181.134mW<br>(22.58dBm) |      |
|                   | NB-IoT Band 12 (Channel Bandwidth 5MHz)  | 182.810mW<br>(22.62dBm)      | 181.134mW<br>(22.58dBm) |      |
|                   | NB-IoT Band 12 (Channel Bandwidth 10MHz) | 175.388mW<br>(22.44dBm)      | 174.582mW<br>(22.42dBm) |      |
|                   | NB-IoT Band 12 (Channel Bandwidth 15MHz) | 175.388mW<br>(22.44dBm)      | 173.380mW<br>(22.39dBm) |      |
|                   | NB-IoT Band 13 (Channel Bandwidth 3MHz)  | 162.930mW<br>(22.12dBm)      | 160.694mW<br>(22.06dBm) |      |
|                   | NB-IoT Band 13 (Channel Bandwidth 5MHz)  | 159.221mW<br>(22.02dBm)      | 157.036mW<br>(21.96dBm) |      |
|                   | NB-IoT Band 13 (Channel Bandwidth 10MHz) | 158.125mW<br>(21.99dBm)      | 156.675mW<br>(21.95dBm) |      |
|                   | NB-IoT Guard band                        |                              |                         |      |
|                   | NB-IoT Band 12 (Channel Bandwidth 5MHz)  | 162.555mW<br>(22.11dBm)      | 159.956mW<br>(22.04dBm) |      |
|                   | NB-IoT Band 12 (Channel Bandwidth 10MHz) | 164.059mW<br>(22.15dBm)      | 162.181mW<br>(22.10dBm) |      |
|                   | NB-IoT Band 12 (Channel Bandwidth 15MHz) | 165.196mW<br>(22.18dBm)      | 162.555mW<br>(22.11dBm) |      |
|                   | NB-IoT Band 13 (Channel Bandwidth 5MHz)  | 161.065mW<br>(22.07dBm)      | 155.955mW<br>(21.93dBm) |      |
|                   | NB-IoT Band 13 (Channel Bandwidth 10MHz) | 154.170mW<br>(21.88dBm)      | 151.705mW<br>(21.81dBm) |      |
|                   | Emission Designator                      |                              | BPSK                    | QPSK |
|                   |                                          | NB-IoT Standalone            |                         |      |
| NB-IoT Band 4     |                                          | 60K8G7D                      | 183KG7D                 |      |
| NB-IoT Band 12    |                                          | 58K6G7D                      | 181KG7D                 |      |
| NB-IoT Band 13    |                                          | 57K7G7D                      | 182KG7D                 |      |
| Antenna Type      | NB-IoT Band 4                            | SMD antenna with 2.5dBi gain |                         |      |
|                   | NB-IoT Band 12                           | SMD antenna with 0.5dBi gain |                         |      |
|                   | NB-IoT Band 13                           | SMD antenna with 0.5dBi gain |                         |      |
| Antenna Connector | NA                                       |                              |                         |      |
| Accessory Device  | Battery                                  |                              |                         |      |
| Cable Supplied    | NA                                       |                              |                         |      |

Note:

1. The EUT consumes power from the Battery.

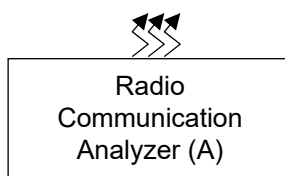
| Battery |                  |
|---------|------------------|
| Brand   | RAMWAY           |
| Model   | ER17505-3        |
| Rating  | 3.6Vdc, 10500mAh |

2. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

### 3.2 Configuration of System under Test



Remote site



#### 3.2.1 Description of Support Units

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

| ID | Product                      | Brand   | Model No. | Serial No. | FCC ID | Remarks |
|----|------------------------------|---------|-----------|------------|--------|---------|
| A. | Radio Communication Analyzer | Anritsu | MT8821C   | 6201010284 | NA     | -       |

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

### 3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X-plane. Following channel(s) was (were) selected for the final test as listed below:

#### NB-IoT Band 4

| EUT<br>Configure<br>Mode | Test item | Available channel |                | Tested Channel                                                | Channel<br>Bandwidth | Subcarrier<br>Spacing | Modulation | Number of<br>Subcarrier /<br>Starting<br>Subcarrier |
|--------------------------|-----------|-------------------|----------------|---------------------------------------------------------------|----------------------|-----------------------|------------|-----------------------------------------------------|
| -                        | EIRP      | Standalone        | 19952 to 20398 | 19952 (1710.2MHz),<br>20175 (1732.5MHz),<br>20398 (1754.8MHz) | -                    | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               | -                    | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |

| EUT<br>Configure<br>Mode | Test item | Available channel |                | Tested Channel                                                | Channel<br>Bandwidth | Subcarrier<br>Spacing | Modulation | Number of<br>Subcarrier /<br>Starting<br>Subcarrier |
|--------------------------|-----------|-------------------|----------------|---------------------------------------------------------------|----------------------|-----------------------|------------|-----------------------------------------------------|
| -                        | EIRP      | In-Band           | 19965 to 20385 | 19965 (1711.5MHz),<br>20175 (1732.5MHz),<br>20385 (1753.5MHz) | 3MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 19975 to 20375 | 19975 (1712.5MHz),<br>20175 (1732.5MHz),<br>20375 (1752.5MHz) | 5MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 20000 to 20350 | 20000 (1715.0MHz),<br>20175 (1732.5MHz),<br>20350 (1750.0MHz) | 10MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 20025 to 20325 | 20025 (1717.5MHz),<br>20175 (1732.5MHz),<br>20325 (1747.5MHz) | 15MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 20050 to 20300 | 20050 (1720.0MHz),<br>20175 (1732.5MHz),<br>20300 (1745.0MHz) | 20MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |

| EUT<br>Configure<br>Mode | Test item | Available channel |                | Tested Channel                                                | Channel<br>Bandwidth | Subcarrier<br>Spacing | Modulation | Number of<br>Subcarrier /<br>Starting<br>Subcarrier |
|--------------------------|-----------|-------------------|----------------|---------------------------------------------------------------|----------------------|-----------------------|------------|-----------------------------------------------------|
| -                        | EIRP      | Guard-Band        | 19975 to 20375 | 19975 (1712.5MHz),<br>20175 (1732.5MHz),<br>20375 (1752.5MHz) | 5MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 20000 to 20350 | 20000 (1715.0MHz),<br>20175 (1732.5MHz),<br>20350 (1750.0MHz) | 10MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 20025 to 20325 | 20025 (1717.5MHz),<br>20175 (1732.5MHz),<br>20325 (1747.5MHz) | 15MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 20050 to 20300 | 20050 (1720.0MHz),<br>20175 (1732.5MHz),<br>20300 (1745.0MHz) | 20MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                               |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                               |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |

| EUT Configure Mode | Test item                    | Available channel |                | Tested Channel                                          | Channel Bandwidth | Subcarrier Spacing | Modulation | Number of Subcarrier / Starting Subcarrier |
|--------------------|------------------------------|-------------------|----------------|---------------------------------------------------------|-------------------|--------------------|------------|--------------------------------------------|
| -                  | Modulation Characteristics   | Standalone        | 19952 to 20398 | 20175 (1732.5MHz)                                       | -                 | 3.75kHz            | BPSK       | 1@0                                        |
|                    |                              |                   |                |                                                         |                   | 15kHz              | QPSK       | 1@0                                        |
| -                  | Frequency Stability          | Standalone        | 19952 to 20398 | 19952 (1710.2MHz), 20398 (1754.8MHz)                    | -                 | 3.75kHz            | BPSK       | 1@0                                        |
|                    |                              |                   |                |                                                         |                   | 15kHz              | QPSK       | 1@0                                        |
| -                  | Occupied Bandwidth           | Standalone        | 19952 to 20398 | 19952 (1710.2MHz), 20175 (1732.5MHz), 20398 (1754.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                              |                   |                |                                                         |                   | 15kHz              | QPSK       | 12@0                                       |
| -                  | Band Edge                    | Standalone        | 19952 to 20398 | 19952 (1710.2MHz), 20398 (1754.8MHz)                    | -                 | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                              |                   |                |                                                         |                   | 15kHz              | QPSK       | 1@0<br>12@0                                |
| -                  | Peak To Average Ratio        | Standalone        | 19952 to 20398 | 19952 (1710.2MHz), 20175 (1732.5MHz), 20398 (1754.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                              |                   |                |                                                         |                   | 15kHz              | QPSK       | 12@0                                       |
| -                  | Conducted Emission           | Standalone        | 19952 to 20398 | 19952 (1710.2MHz), 20175 (1732.5MHz), 20398 (1754.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0                                        |
|                    |                              |                   |                |                                                         |                   | 15kHz              | QPSK       | 12@0                                       |
| -                  | Radiated Emission Below 1GHz | Standalone        | 19952 to 20398 | 20175 (1732.5MHz)                                       | -                 | 3.75kHz            | BPSK       | 1@0                                        |
| -                  | Radiated Emission Above 1GHz | Standalone        | 19952 to 20398 | 19952 (1710.2MHz), 20175 (1732.5MHz), 20398 (1754.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0                                        |

**Note:**

1. The output power for Stand-alone, In-band and Guard-band, measured value of Stand-alone is higher than In-band and Guard-band. The other test items were performed under Stand-alone mode only.
2. The Conducted Emission and Radiated Emission measurement were based on the worst maximum conducted power.
3. For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.

# NB-IoT Band 12

| EUT<br>Configure<br>Mode | Test item | Available channel |                | Tested Channel                                              | Channel<br>Bandwidth | Subcarrier<br>Spacing | Modulation | Number of<br>Subcarrier /<br>Starting<br>Subcarrier |
|--------------------------|-----------|-------------------|----------------|-------------------------------------------------------------|----------------------|-----------------------|------------|-----------------------------------------------------|
| -                        | ERP       | Standalone        | 23012 to 23178 | 23012 (699.2MHz),<br>23095 (707.5MHz),<br>23178 (715.8MHz)  | -                    | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             | -                    | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           | In-Band           | 23025 to 23165 | 23025 (700.5MHz),<br>23095 (707.5MHz),<br>23165 (714.5MHz)  | 3MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 23035 to 23155 | 23035 (701.5MHz),<br>23095 (707.5MHz),<br>23155 (713.5MHz)  | 5MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 23060 to 23130 | 23060 (704.0MHz),<br>23095 (707.5MHz),<br>23130 (711.0 MHz) | 10MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 23085 to 23105 | 23085 (706.5MHz),<br>23095 (707.5MHz),<br>23105 (708.5 MHz) | 15MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                             |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |

| EUT<br>Configure<br>Mode | Test item                     | Available channel |                | Tested Channel                                              | Channel<br>Bandwidth | Subcarrier<br>Spacing | Modulation | Number of<br>Subcarrier /<br>Starting<br>Subcarrier |
|--------------------------|-------------------------------|-------------------|----------------|-------------------------------------------------------------|----------------------|-----------------------|------------|-----------------------------------------------------|
| -                        | ERP                           | Guard-Band        | 23035 to 23155 | 23035 (701.5MHz),<br>23095 (707.5MHz),<br>23155 (713.5MHz)  | 5MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |                               |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |                               |                   | 23060 to 23130 | 23060 (704.0MHz),<br>23095 (707.5MHz),<br>23130 (711.0 MHz) | 10MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |                               |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |                               |                   | 23085 to 23105 | 23085 (706.5MHz),<br>23095 (707.5MHz),<br>23105 (708.5 MHz) | 15MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |                               |                   |                |                                                             |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
| -                        | Modulation<br>Characteristics | Standalone        | 23012 to 23178 | 23095 (707.5MHz)                                            | -                    | 3.75kHz               | BPSK       | 1@0                                                 |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | QPSK       | 1@0                                                 |
| -                        | Frequency<br>Stability        | Standalone        | 23012 to 23178 | 23012 (699.2MHz),<br>23178 (715.8MHz)                       | -                    | 3.75kHz               | BPSK       | 1@0                                                 |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | QPSK       | 1@0                                                 |
| -                        | Occupied<br>Bandwidth         | Standalone        | 23012 to 23178 | 23012 (699.2MHz),<br>23095 (707.5MHz),<br>23178 (715.8MHz)  | -                    | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | QPSK       | 12@0                                                |
| -                        | Band Edge                     | Standalone        | 23012 to 23178 | 23012 (699.2MHz),<br>23178 (715.8MHz)                       | -                    | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | QPSK       | 1@0<br>12@0                                         |
| -                        | Peak To Average<br>Ratio      | Standalone        | 23012 to 23178 | 23012 (699.2MHz),<br>23095 (707.5MHz),<br>23178 (715.8MHz)  | -                    | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |                               |                   |                |                                                             |                      | 15kHz                 | QPSK       | 12@0                                                |

| EUT Configure Mode | Test item                    | Available channel |                | Tested Channel                                             | Channel Bandwidth | Subcarrier Spacing | Modulation | Number of Subcarrier / Starting Subcarrier |
|--------------------|------------------------------|-------------------|----------------|------------------------------------------------------------|-------------------|--------------------|------------|--------------------------------------------|
| -                  | Conducted Emission           | Standalone        | 23012 to 23178 | 23012 (699.2MHz),<br>23095 (707.5MHz),<br>23178 (715.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0                                        |
|                    |                              |                   |                |                                                            |                   | 15kHz              | QPSK       | 12@0                                       |
| -                  | Radiated Emission Below 1GHz | Standalone        | 23012 to 23178 | 23012 (699.2MHz)                                           | -                 | 3.75kHz            | BPSK       | 1@0                                        |
| -                  | Radiated Emission Above 1GHz | Standalone        | 23012 to 23178 | 23012 (699.2MHz),<br>23095 (707.5MHz),<br>23178 (715.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0                                        |

**Note:**

1. The output power for Stand-alone, In-band and Guard-band, measured value of Stand-alone is higher than In-band and Guard-band. The other test items were performed under Stand-alone mode only.
2. The Conducted Emission and Radiated Emission measurement were based on the worst maximum conducted power.
3. For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.

## NB-IoT Band 13

| EUT<br>Configure<br>Mode | Test item | Available channel |                | Tested Channel                                             | Channel<br>Bandwidth | Subcarrier<br>Spacing | Modulation | Number of<br>Subcarrier /<br>Starting<br>Subcarrier |
|--------------------------|-----------|-------------------|----------------|------------------------------------------------------------|----------------------|-----------------------|------------|-----------------------------------------------------|
| -                        | ERP       | Standalone        | 23182 to 23278 | 23182 (777.2MHz),<br>23230 (782.0MHz),<br>23278 (786.8MHz) | -                    | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            | -                    | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           | In-Band           | 23195 to 23265 | 23195 (778.5MHz),<br>23230 (782.0MHz),<br>23265 (785.5MHz) | 3MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 23205 to 23255 | 23205 (779.5MHz),<br>23230 (782.0MHz),<br>23255 (784.5MHz) | 5MHz                 | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |
|                          |           |                   | 23230          | 23230 (782.0MHz)                                           | 10MHz                | 3.75kHz               | BPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@47                                         |
|                          |           |                   |                |                                                            |                      | 15kHz                 | BPSK       | 1@0<br>1@11                                         |
|                          |           |                   |                |                                                            |                      |                       | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                          |

| EUT Configure Mode | Test item                  | Available channel |                | Tested Channel                                             | Channel Bandwidth | Subcarrier Spacing | Modulation | Number of Subcarrier / Starting Subcarrier |
|--------------------|----------------------------|-------------------|----------------|------------------------------------------------------------|-------------------|--------------------|------------|--------------------------------------------|
| -                  | ERP                        | Guard-Band        | 23205 to 23255 | 23205 (779.5MHz),<br>23230 (782.0MHz),<br>23255 (784.5MHz) | 5MHz              | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                            |                   |                |                                                            |                   |                    | QPSK       | 1@0<br>1@47                                |
|                    |                            |                   |                |                                                            |                   | 15kHz              | BPSK       | 1@0<br>1@11                                |
|                    |                            |                   |                |                                                            |                   |                    | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                 |
|                    |                            |                   | 23230          | 23230 (782.0MHz)                                           | 10MHz             | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                            |                   |                |                                                            |                   |                    | QPSK       | 1@0<br>1@47                                |
|                    |                            |                   |                |                                                            |                   | 15kHz              | BPSK       | 1@0<br>1@11                                |
|                    |                            |                   |                |                                                            |                   |                    | QPSK       | 1@0<br>1@11<br>3@3<br>12@0                 |
| -                  | Modulation Characteristics | Standalone        | 23182 to 23278 | 23230 (782.0MHz)                                           | -                 | 3.75kHz            | BPSK       | 1@0                                        |
|                    |                            |                   |                |                                                            |                   | 15kHz              | QPSK       | 1@0                                        |
| -                  | Frequency Stability        | Standalone        | 23182 to 23278 | 23182 (777.2MHz),<br>23278 (786.8MHz)                      | -                 | 3.75kHz            | BPSK       | 1@0                                        |
|                    |                            |                   |                |                                                            |                   | 15kHz              | QPSK       | 1@0                                        |
| -                  | Occupied Bandwidth         | Standalone        | 23182 to 23278 | 23182 (777.2MHz),<br>23230 (782.0MHz),<br>23278 (786.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                            |                   |                |                                                            |                   | 15kHz              | QPSK       | 12@0                                       |
| -                  | Band Edge                  | Standalone        | 23182 to 23278 | 23182 (777.2MHz),<br>23278 (786.8MHz)                      | -                 | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                            |                   |                |                                                            |                   | 15kHz              | QPSK       | 1@0<br>12@0                                |
| -                  | Peak To Average Ratio      | Standalone        | 23182 to 23278 | 23182 (777.2MHz),<br>23230 (782.0MHz),<br>23278 (786.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0<br>1@47                                |
|                    |                            |                   |                |                                                            |                   | 15kHz              | QPSK       | 12@0                                       |
| -                  | Conducted Emission         | Standalone        | 23182 to 23278 | 23182 (777.2MHz),<br>23230 (782.0MHz),<br>23278 (786.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0                                        |
|                    |                            |                   |                |                                                            |                   | 15kHz              | QPSK       | 12@0                                       |

| EUT Configure Mode | Test item                    | Available channel |                | Tested Channel                                             | Channel Bandwidth | Subcarrier Spacing | Modulation | Number of Subcarrier / Starting Subcarrier |
|--------------------|------------------------------|-------------------|----------------|------------------------------------------------------------|-------------------|--------------------|------------|--------------------------------------------|
| -                  | Radiated Emission Below 1GHz | Standalone        | 23182 to 23278 | 23230 (782.0MHz)                                           | -                 | 3.75kHz            | BPSK       | 1@0                                        |
| -                  | Radiated Emission Above 1GHz | Standalone        | 23182 to 23278 | 23182 (777.2MHz),<br>23230 (782.0MHz),<br>23278 (786.8MHz) | -                 | 3.75kHz            | BPSK       | 1@0                                        |

**Note:**

1. The output power for Stand-alone, In-band and Guard-band, measured value of Stand-alone is higher than In-band and Guard-band. The other test items were performed under Stand-alone mode only.
2. The Conducted Emission and Radiated Emission measurement were based on the worst maximum conducted power.
3. For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.

**Test Condition:**

| Test Item                  | Environmental Conditions | Input Power | Tested By  |
|----------------------------|--------------------------|-------------|------------|
| EIRP / ERP                 | 25deg. C, 60%RH          | 3.6Vdc      | James Yang |
| Modulation Characteristics | 25deg. C, 60%RH          | 3.6Vdc      | James Yang |
| Frequency Stability        | 25deg. C, 60%RH          | 3.6Vdc      | James Yang |
| Occupied Bandwidth         | 25deg. C, 60%RH          | 3.6Vdc      | James Yang |
| Band Edge                  | 25deg. C, 60%RH          | 3.6Vdc      | James Yang |
| Peak To Average Ratio      | 25deg. C, 60%RH          | 3.6Vdc      | James Yang |
| Conducted Emission         | 25deg. C, 60%RH          | 3.6Vdc      | James Yang |
| Radiated Emission          | 17deg. C, 62%RH          | 3.6Vdc      | Wade Huang |

### **3.4 EUT Operating Conditions**

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

### **3.5 General Description of Applied Standards and References**

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and References:

#### **Test Standard:**

**FCC 47 CFR Part 2**

**FCC 47 CFR Part 27**

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

ANSI 63.26-2015

#### **References Test Guidance:**

**KDB 971168 D01 Power Meas License Digital Systems v03r01**

All test items have been performed as a reference to the above KDB test guidance.

## 4 Test Types and Results

### 4.1 Output Power Measurement

#### 4.1.1 Limits of Output Power Measurement

For NB-IoT Band 4:

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

For NB-IoT Band 12:

Control and mobile stations in the 698-746 MHz band are limited to 30 watts ERP.

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

For NB-IoT Band 13:

Control stations and mobile stations in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands and fixed stations transmitting in the 787-788 MHz and 805-806 MHz bands are limited to 30 watts ERP.

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

#### 4.1.2 Test Procedures

##### Conducted Power Measurement:

The EUT was set up for the maximum power with NB-IoT link data modulation and link up with simulator (Built-in power meter). Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

##### Maximum EIRP / ERP

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

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

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

where

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

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

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

#### 4.1.3 Test Setup

Conducted Power Measurement:



#### 4.1.4 Test Results

##### Conducted Output Power (dBm)

| NB-IoT Band 4 Standalone |           |                      |                     |        |        |        |
|--------------------------|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing       | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
|                          |           | Channel              |                     | 19952  | 20175  | 20398  |
|                          |           | Frequency (MHz)      |                     | 1710.2 | 1732.5 | 1754.8 |
| 3.75kHz                  | QPSK      | 1                    | 0                   | 23.22  | 23.35  | 23.35  |
|                          |           | 1                    | 47                  | 23.28  | 23.37  | 23.41  |
|                          | BPSK      | 1                    | 0                   | 23.43  | 23.39  | 23.45  |
|                          |           | 1                    | 47                  | 23.41  | 23.40  | 23.41  |
| BW                       | MCS Index | Channel              |                     | 19952  | 20175  | 20398  |
|                          |           | Frequency (MHz)      |                     | 1710.2 | 1732.5 | 1754.8 |
| 15kHz                    | QPSK      | 1                    | 0                   | 23.32  | 23.33  | 23.36  |
|                          |           | 1                    | 11                  | 23.33  | 23.35  | 23.37  |
|                          |           | 3                    | 3                   | 23.80  | 22.88  | 23.05  |
|                          |           | 12                   | 0                   | 23.83  | 21.85  | 22.85  |
|                          | BPSK      | 1                    | 0                   | 23.44  | 23.37  | 23.45  |
|                          |           | 1                    | 11                  | 23.39  | 23.38  | 23.41  |

| NB-IoT Band 4 In-Band |     |           |                      |                     |        |        |        |
|-----------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing    | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
| 3.75kHz               | 20M | QPSK      | Channel              |                     | 20050  | 20175  | 20300  |
|                       |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
|                       |     | BPSK      | 1                    | 0                   | 23.29  | 23.27  | 23.17  |
|                       |     |           | 1                    | 47                  | 23.30  | 23.28  | 23.18  |
|                       |     | BPSK      | 1                    | 0                   | 23.35  | 23.35  | 23.24  |
|                       |     |           | 1                    | 47                  | 23.33  | 23.37  | 23.23  |
|                       | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                       |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                       | 15M | QPSK      | 1                    | 0                   | 23.29  | 23.31  | 23.26  |
|                       |     |           | 1                    | 47                  | 23.27  | 23.33  | 23.27  |
|                       |     | BPSK      | 1                    | 0                   | 23.35  | 23.35  | 23.31  |
|                       |     |           | 1                    | 47                  | 23.33  | 23.34  | 23.32  |
|                       | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                       |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                       | 10M | QPSK      | 1                    | 0                   | 23.30  | 23.29  | 23.27  |
|                       |     |           | 1                    | 47                  | 23.29  | 23.27  | 23.28  |
|                       |     | BPSK      | 1                    | 0                   | 23.33  | 23.35  | 23.32  |
|                       |     |           | 1                    | 47                  | 23.34  | 23.33  | 23.33  |
|                       | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                       |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                       | 5M  | QPSK      | 1                    | 0                   | 23.30  | 23.32  | 23.44  |
|                       |     |           | 1                    | 47                  | 23.28  | 23.30  | 23.42  |
|                       |     | BPSK      | 1                    | 0                   | 23.32  | 23.36  | 23.46  |
|                       |     |           | 1                    | 47                  | 23.34  | 23.35  | 23.48  |
|                       | BW  | MCS Index | Channel              |                     | 19965  | 20175  | 20385  |
|                       |     |           | Frequency (MHz)      |                     | 1711.5 | 1732.5 | 1753.5 |
|                       | 3M  | QPSK      | 1                    | 0                   | 23.28  | 23.32  | 23.41  |
|                       |     |           | 1                    | 47                  | 23.26  | 23.29  | 23.40  |
|                       |     | BPSK      | 1                    | 0                   | 23.32  | 23.37  | 23.47  |
|                       |     |           | 1                    | 47                  | 23.34  | 23.36  | 23.45  |

| NB-IoT Band 4 In-Band |     |           |                      |                     |        |        |        |
|-----------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing    | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
|                       |     |           | Channel              |                     | 20050  | 20175  | 20300  |
|                       |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
| 15kHz                 | 20M | QPSK      | 1                    | 0                   | 23.29  | 23.27  | 23.22  |
|                       |     |           | 1                    | 11                  | 23.31  | 23.29  | 23.20  |
|                       |     |           | 3                    | 3                   | 22.84  | 22.80  | 22.91  |
|                       |     |           | 12                   | 0                   | 21.69  | 21.75  | 21.54  |
|                       |     | BPSK      | 1                    | 0                   | 23.35  | 23.33  | 23.20  |
|                       |     |           | 1                    | 11                  | 23.33  | 23.34  | 23.21  |
|                       | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                       |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                       | 15M | QPSK      | 1                    | 0                   | 23.29  | 23.31  | 23.27  |
|                       |     |           | 1                    | 11                  | 23.30  | 23.28  | 23.29  |
|                       |     |           | 3                    | 3                   | 22.84  | 22.78  | 22.89  |
|                       |     |           | 12                   | 0                   | 21.69  | 21.78  | 21.71  |
|                       |     | BPSK      | 1                    | 0                   | 23.34  | 23.34  | 23.33  |
|                       |     |           | 1                    | 11                  | 23.36  | 23.35  | 23.34  |
|                       | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                       |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                       | 10M | QPSK      | 1                    | 0                   | 23.25  | 23.28  | 23.24  |
|                       |     |           | 1                    | 11                  | 23.28  | 23.27  | 23.26  |
|                       |     |           | 3                    | 3                   | 22.85  | 22.78  | 22.89  |
|                       |     |           | 12                   | 0                   | 21.75  | 21.70  | 21.72  |
|                       |     | BPSK      | 1                    | 0                   | 23.33  | 23.33  | 23.34  |
|                       |     |           | 1                    | 11                  | 23.31  | 23.34  | 23.33  |
|                       | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                       |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                       | 5M  | QPSK      | 1                    | 0                   | 23.35  | 23.27  | 23.34  |
|                       |     |           | 1                    | 11                  | 23.34  | 23.24  | 23.32  |
|                       |     |           | 3                    | 3                   | 22.86  | 22.76  | 22.90  |
|                       |     |           | 12                   | 0                   | 21.66  | 21.75  | 21.79  |
|                       |     | BPSK      | 1                    | 0                   | 23.32  | 23.30  | 23.40  |
|                       |     |           | 1                    | 11                  | 23.35  | 23.32  | 23.41  |
|                       | BW  | MCS Index | Channel              |                     | 19965  | 20175  | 20385  |
|                       |     |           | Frequency (MHz)      |                     | 1711.5 | 1732.5 | 1753.5 |
|                       | 3M  | QPSK      | 1                    | 0                   | 23.26  | 23.23  | 23.34  |
|                       |     |           | 1                    | 11                  | 23.27  | 23.24  | 23.35  |
|                       |     |           | 3                    | 3                   | 22.81  | 22.80  | 22.91  |
|                       |     |           | 12                   | 0                   | 21.74  | 21.63  | 21.79  |
|                       |     | BPSK      | 1                    | 0                   | 23.32  | 23.29  | 23.39  |
|                       |     |           | 1                    | 11                  | 23.31  | 23.28  | 23.40  |

| NB-IoT Band 4 Guard-Band |     |           |                      |                     |        |        |        |
|--------------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing       | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
| 3.75kHz                  | 20M | QPSK      | Channel              |                     | 20050  | 20175  | 20300  |
|                          |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
|                          |     | BPSK      | 1                    | 0                   | 23.11  | 23.08  | 23.01  |
|                          |     |           | 1                    | 47                  | 23.12  | 23.09  | 23.02  |
|                          |     | BPSK      | 1                    | 0                   | 23.15  | 23.12  | 23.05  |
|                          |     |           | 1                    | 47                  | 23.16  | 23.13  | 23.06  |
|                          | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                          |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                          | 15M | QPSK      | 1                    | 0                   | 23.07  | 23.05  | 23.03  |
|                          |     |           | 1                    | 47                  | 23.06  | 23.07  | 23.02  |
|                          |     | BPSK      | 1                    | 0                   | 23.11  | 23.12  | 23.09  |
|                          |     |           | 1                    | 47                  | 23.09  | 23.13  | 23.08  |
|                          | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                          |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                          | 10M | QPSK      | 1                    | 0                   | 23.08  | 23.10  | 23.07  |
|                          |     |           | 1                    | 47                  | 23.07  | 23.09  | 23.05  |
|                          |     | BPSK      | 1                    | 0                   | 23.14  | 23.15  | 23.13  |
|                          |     |           | 1                    | 47                  | 23.15  | 23.14  | 23.12  |
|                          | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                          |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                          | 5M  | QPSK      | 1                    | 0                   | 23.08  | 23.05  | 23.21  |
|                          |     |           | 1                    | 47                  | 23.06  | 23.06  | 23.22  |
|                          |     | BPSK      | 1                    | 0                   | 23.12  | 23.12  | 23.26  |
|                          |     |           | 1                    | 47                  | 23.14  | 23.13  | 23.27  |

| NB-IoT Band 4 Guard-Band |     |           |                      |                     |        |        |        |
|--------------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing       | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
|                          |     |           | Channel              |                     | 20050  | 20175  | 20300  |
|                          |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
| 15kHz                    | 20M | QPSK      | 1                    | 0                   | 23.07  | 23.06  | 22.99  |
|                          |     |           | 1                    | 11                  | 23.09  | 23.05  | 23.00  |
|                          |     |           | 3                    | 3                   | 22.63  | 22.65  | 22.69  |
|                          |     |           | 12                   | 0                   | 21.47  | 21.53  | 21.48  |
|                          |     | BPSK      | 1                    | 0                   | 23.13  | 23.09  | 23.02  |
|                          |     |           | 1                    | 11                  | 23.14  | 23.10  | 23.04  |
|                          | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                          |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                          | 15M | QPSK      | 1                    | 0                   | 23.07  | 23.06  | 23.05  |
|                          |     |           | 1                    | 11                  | 23.09  | 23.09  | 23.07  |
|                          |     |           | 3                    | 3                   | 22.67  | 22.65  | 22.66  |
|                          |     |           | 12                   | 0                   | 21.47  | 21.56  | 21.52  |
|                          |     | BPSK      | 1                    | 0                   | 23.12  | 23.13  | 23.12  |
|                          |     |           | 1                    | 11                  | 23.13  | 23.12  | 23.13  |
|                          | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                          |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                          | 10M | QPSK      | 1                    | 0                   | 23.12  | 23.08  | 23.07  |
|                          |     |           | 1                    | 11                  | 23.13  | 23.09  | 23.05  |
|                          |     |           | 3                    | 3                   | 22.66  | 22.67  | 22.66  |
|                          |     |           | 12                   | 0                   | 21.56  | 21.47  | 21.54  |
|                          |     | BPSK      | 1                    | 0                   | 23.15  | 23.15  | 23.16  |
|                          |     |           | 1                    | 11                  | 23.16  | 23.17  | 23.17  |
|                          | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                          |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                          | 5M  | QPSK      | 1                    | 0                   | 23.13  | 23.11  | 23.14  |
|                          |     |           | 1                    | 11                  | 23.14  | 23.10  | 23.15  |
|                          |     |           | 3                    | 3                   | 22.65  | 22.68  | 22.64  |
|                          |     |           | 12                   | 0                   | 21.53  | 21.55  | 21.58  |
|                          |     | BPSK      | 1                    | 0                   | 23.19  | 23.14  | 23.20  |
|                          |     |           | 1                    | 11                  | 23.20  | 23.15  | 23.23  |

| NB-IoT Band 12 Standalone |           |                      |                     |       |       |       |
|---------------------------|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |           | Channel              |                     | 23012 | 23095 | 23178 |
|                           |           | Frequency (MHz)      |                     | 699.2 | 707.5 | 715.8 |
| 3.75kHz                   | QPSK      | 1                    | 0                   | 24.13 | 24.27 | 24.01 |
|                           |           | 1                    | 47                  | 24.05 | 24.26 | 24.03 |
|                           | BPSK      | 1                    | 0                   | 24.32 | 24.31 | 24.10 |
|                           |           | 1                    | 47                  | 24.23 | 24.33 | 24.01 |
| BW                        | MCS Index | Channel              |                     | 23012 | 23095 | 23178 |
|                           |           | Frequency (MHz)      |                     | 699.2 | 707.5 | 715.8 |
| 15kHz                     | QPSK      | 1                    | 0                   | 24.05 | 24.03 | 23.62 |
|                           |           | 1                    | 11                  | 24.10 | 24.03 | 23.77 |
|                           |           | 3                    | 3                   | 23.92 | 23.91 | 23.54 |
|                           |           | 12                   | 0                   | 24.11 | 22.25 | 23.22 |
|                           | BPSK      | 1                    | 0                   | 24.05 | 24.00 | 23.85 |
|                           |           | 1                    | 11                  | 24.03 | 24.01 | 23.77 |

| NB-IoT Band 12 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
| 3.75kHz                | 15M | QPSK      | Channel              |                     | 23085 | 23095 | 23105 |
|                        |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
|                        |     | BPSK      | 1                    | 0                   | 23.88 | 24.03 | 23.85 |
|                        |     |           | 1                    | 47                  | 23.89 | 24.04 | 23.84 |
|                        |     | BPSK      | 1                    | 0                   | 23.95 | 24.08 | 23.90 |
|                        |     |           | 1                    | 47                  | 23.96 | 24.09 | 23.91 |
|                        | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                        |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                        | 10M | QPSK      | 1                    | 0                   | 23.98 | 24.07 | 23.75 |
|                        |     |           | 1                    | 47                  | 23.99 | 24.06 | 23.77 |
|                        |     | BPSK      | 1                    | 0                   | 24.03 | 24.09 | 23.83 |
|                        |     |           | 1                    | 47                  | 24.05 | 24.08 | 23.82 |
|                        | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                        |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                        | 5M  | QPSK      | 1                    | 0                   | 24.23 | 24.20 | 24.03 |
|                        |     |           | 1                    | 47                  | 24.21 | 24.19 | 24.02 |
|                        |     | BPSK      | 1                    | 0                   | 24.27 | 24.21 | 24.10 |
|                        |     |           | 1                    | 47                  | 24.26 | 24.22 | 24.08 |
|                        | BW  | MCS Index | Channel              |                     | 23025 | 23095 | 23165 |
|                        |     |           | Frequency (MHz)      |                     | 700.5 | 707.5 | 714.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 24.23 | 24.16 | 23.96 |
|                        |     |           | 1                    | 47                  | 24.21 | 24.14 | 23.95 |
|                        |     | BPSK      | 1                    | 0                   | 24.27 | 24.21 | 24.03 |
|                        |     |           | 1                    | 47                  | 24.26 | 24.22 | 24.04 |

| NB-IoT Band 12 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                        |     |           | Channel              |                     | 23085 | 23095 | 23105 |
|                        |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
| 15kHz                  | 15M | QPSK      | 1                    | 0                   | 23.86 | 23.91 | 23.75 |
|                        |     |           | 1                    | 11                  | 23.87 | 23.88 | 23.76 |
|                        |     |           | 3                    | 3                   | 23.70 | 23.67 | 23.59 |
|                        |     |           | 12                   | 0                   | 22.11 | 22.13 | 21.94 |
|                        |     | BPSK      | 1                    | 0                   | 23.92 | 23.95 | 23.73 |
|                        |     |           | 1                    | 11                  | 23.93 | 23.92 | 23.70 |
|                        | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                        |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                        | 10M | QPSK      | 1                    | 0                   | 23.72 | 23.87 | 23.63 |
|                        |     |           | 1                    | 11                  | 23.73 | 23.88 | 23.62 |
|                        |     |           | 3                    | 3                   | 23.63 | 23.61 | 23.52 |
|                        |     |           | 12                   | 0                   | 21.95 | 21.93 | 21.65 |
|                        |     | BPSK      | 1                    | 0                   | 23.79 | 23.85 | 23.61 |
|                        |     |           | 1                    | 11                  | 23.78 | 23.84 | 23.59 |
|                        | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                        |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                        | 5M  | QPSK      | 1                    | 0                   | 23.76 | 23.56 | 23.58 |
|                        |     |           | 1                    | 11                  | 23.77 | 23.55 | 23.59 |
|                        |     |           | 3                    | 3                   | 23.55 | 23.51 | 23.47 |
|                        |     |           | 12                   | 0                   | 21.81 | 21.64 | 21.59 |
|                        |     | BPSK      | 1                    | 0                   | 23.74 | 23.62 | 23.55 |
|                        |     |           | 1                    | 11                  | 23.73 | 23.63 | 23.54 |
|                        | BW  | MCS Index | Channel              |                     | 23025 | 23095 | 23165 |
|                        |     |           | Frequency (MHz)      |                     | 700.5 | 707.5 | 714.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 23.64 | 23.55 | 23.42 |
|                        |     |           | 1                    | 11                  | 23.65 | 23.54 | 23.41 |
|                        |     |           | 3                    | 3                   | 23.49 | 23.33 | 23.25 |
|                        |     |           | 12                   | 0                   | 21.87 | 21.64 | 21.51 |
|                        |     | BPSK      | 1                    | 0                   | 23.71 | 23.61 | 23.48 |
|                        |     |           | 1                    | 11                  | 23.73 | 23.63 | 23.45 |

| NB-IoT Band 12 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | 23085 | 23095 | 23105 |
|                           |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
| 3.75kHz                   | 15M | QPSK      | 1                    | 0                   | 23.71 | 23.76 | 23.73 |
|                           |     |           | 1                    | 47                  | 23.69 | 23.74 | 23.74 |
|                           |     | BPSK      | 1                    | 0                   | 23.76 | 23.80 | 23.82 |
|                           |     |           | 1                    | 47                  | 23.78 | 23.81 | 23.81 |
|                           | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                           |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                           | 10M | QPSK      | 1                    | 0                   | 23.72 | 23.74 | 23.51 |
|                           |     |           | 1                    | 47                  | 23.70 | 23.72 | 23.52 |
|                           |     | BPSK      | 1                    | 0                   | 23.74 | 23.79 | 23.57 |
|                           |     |           | 1                    | 47                  | 23.76 | 23.80 | 23.58 |
|                           | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                           |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 23.69 | 23.65 | 23.51 |
|                           |     |           | 1                    | 47                  | 23.68 | 23.67 | 23.53 |
|                           |     | BPSK      | 1                    | 0                   | 23.75 | 23.71 | 23.59 |
|                           |     |           | 1                    | 47                  | 23.76 | 23.73 | 23.57 |

| NB-IoT Band 12 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | 23085 | 23095 | 23105 |
|                           |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
| 15kHz                     | 15M | QPSK      | 1                    | 0                   | 23.65 | 23.66 | 23.75 |
|                           |     |           | 1                    | 11                  | 23.62 | 23.63 | 23.73 |
|                           |     |           | 3                    | 3                   | 23.48 | 23.46 | 23.51 |
|                           |     |           | 12                   | 0                   | 21.68 | 21.78 | 21.79 |
|                           |     | BPSK      | 1                    | 0                   | 23.77 | 23.73 | 23.82 |
|                           |     |           | 1                    | 11                  | 23.75 | 23.70 | 23.83 |
|                           | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                           |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                           | 10M | QPSK      | 1                    | 0                   | 23.74 | 23.68 | 23.49 |
|                           |     |           | 1                    | 11                  | 23.75 | 23.66 | 23.51 |
|                           |     |           | 3                    | 3                   | 23.51 | 23.47 | 23.37 |
|                           |     |           | 12                   | 0                   | 21.79 | 21.70 | 21.70 |
|                           |     | BPSK      | 1                    | 0                   | 23.72 | 23.71 | 23.47 |
|                           |     |           | 1                    | 11                  | 23.73 | 23.73 | 23.48 |
|                           | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                           |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 23.66 | 23.64 | 23.57 |
|                           |     |           | 1                    | 11                  | 23.65 | 23.65 | 23.56 |
|                           |     |           | 3                    | 3                   | 23.49 | 23.45 | 23.38 |
|                           |     |           | 12                   | 0                   | 21.79 | 21.65 | 21.49 |
|                           |     | BPSK      | 1                    | 0                   | 23.72 | 23.68 | 23.55 |
|                           |     |           | 1                    | 11                  | 23.73 | 23.67 | 23.54 |

| NB-IoT Band 13 Standalone |           |                      |                     |       |       |       |
|---------------------------|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |           | Channel              |                     | 23182 | 23230 | 23278 |
|                           |           | Frequency (MHz)      |                     | 777.2 | 782   | 786.8 |
| 3.75kHz                   | QPSK      | 1                    | 0                   | 23.37 | 23.62 | 23.45 |
|                           |           | 1                    | 47                  | 23.19 | 23.61 | 23.53 |
|                           | BPSK      | 1                    | 0                   | 23.60 | 23.66 | 23.31 |
|                           |           | 1                    | 47                  | 23.47 | 23.67 | 23.44 |
| BW                        | MCS Index | Channel              |                     | 23182 | 23230 | 23278 |
|                           |           | Frequency (MHz)      |                     | 777.2 | 782   | 786.8 |
| 15kHz                     | QPSK      | 1                    | 0                   | 23.40 | 23.61 | 23.64 |
|                           |           | 1                    | 11                  | 23.47 | 23.63 | 23.56 |
|                           |           | 3                    | 3                   | 23.32 | 23.31 | 23.27 |
|                           |           | 12                   | 0                   | 21.59 | 21.86 | 21.72 |
|                           | BPSK      | 1                    | 0                   | 23.46 | 23.68 | 23.59 |
|                           |           | 1                    | 11                  | 23.55 | 23.66 | 23.49 |

| NB-IoT Band 13 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
| 3.75kHz                | 10M | QPSK      | Channel              |                     | -     | 23230 | -     |
|                        |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
|                        |     | BPSK      | 1                    | 0                   | -     | 23.59 |       |
|                        |     |           | 1                    | 47                  | -     | 23.60 |       |
|                        | 5M  | QPSK      | 1                    | 0                   | -     | 23.62 |       |
|                        |     |           | 1                    | 47                  | -     | 23.64 |       |
|                        |     | BPSK      | Channel              |                     | 23205 | 23230 | 23255 |
|                        |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 23.47 | 23.54 | 23.60 |
|                        |     |           | 1                    | 47                  | 23.49 | 23.53 | 23.59 |
|                        |     | BPSK      | 1                    | 0                   | 23.54 | 23.63 | 23.66 |
|                        |     |           | 1                    | 47                  | 23.52 | 23.61 | 23.67 |
|                        | 1M  | QPSK      | Channel              |                     | 23195 | 23230 | 23265 |
|                        |     |           | Frequency (MHz)      |                     | 778.5 | 782   | 785.5 |
|                        |     | BPSK      | 1                    | 0                   | 23.47 | 23.55 | 23.71 |
|                        |     |           | 1                    | 47                  | 23.44 | 23.53 | 23.70 |

| NB-IoT Band 13 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                        |     |           | Channel              |                     | -     | 23230 | -     |
|                        |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
| 15kHz                  | 10M | QPSK      | 1                    | 0                   | -     | 23.45 | -     |
|                        |     |           | 1                    | 11                  | -     | 23.41 | -     |
|                        |     |           | 3                    | 3                   | -     | 23.16 | -     |
|                        |     |           | 12                   | 0                   | -     | 21.62 | -     |
|                        |     | BPSK      | 1                    | 0                   | -     | 23.47 | -     |
|                        |     |           | 1                    | 11                  | -     | 23.45 | -     |
|                        | BW  | MCS Index | Channel              |                     | 23205 | 23230 | 23255 |
|                        |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                        | 5M  | QPSK      | 1                    | 0                   | 23.51 | 23.46 | 23.60 |
|                        |     |           | 1                    | 11                  | 23.52 | 23.49 | 23.61 |
|                        |     |           | 3                    | 3                   | 23.21 | 23.17 | 23.29 |
|                        |     |           | 12                   | 0                   | 21.66 | 21.64 | 21.86 |
|                        |     | BPSK      | 1                    | 0                   | 23.56 | 23.52 | 23.65 |
|                        |     |           | 1                    | 11                  | 23.55 | 23.49 | 23.67 |
|                        | BW  | MCS Index | Channel              |                     | 23195 | 23230 | 23265 |
|                        |     |           | Frequency (MHz)      |                     | 778.5 | 782   | 785.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 23.36 | 23.47 | 23.65 |
|                        |     |           | 1                    | 11                  | 23.39 | 23.50 | 23.64 |
|                        |     |           | 3                    | 3                   | 23.19 | 23.17 | 23.27 |
|                        |     |           | 12                   | 0                   | 21.48 | 21.71 | 21.72 |
|                        |     | BPSK      | 1                    | 0                   | 23.40 | 23.53 | 23.68 |
|                        |     |           | 1                    | 11                  | 23.43 | 23.54 | 23.67 |

| NB-IoT Band 13 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | -     | 23230 | -     |
|                           |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
| 3.75kHz                   | 10M | QPSK      | 1                    | 0                   | -     | 23.46 |       |
|                           |     |           | 1                    | 47                  | -     | 23.44 |       |
|                           |     | BPSK      | 1                    | 0                   | -     | 23.53 |       |
|                           |     |           | 1                    | 47                  | -     | 23.49 |       |
|                           | BW  | MCS Index | Channel              |                     | 23205 | 23230 | 23255 |
|                           |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 23.46 | 23.53 | 23.57 |
|                           |     |           | 1                    | 47                  | 23.48 | 23.51 | 23.58 |
|                           |     | BPSK      | 1                    | 0                   | 23.53 | 23.57 | 23.71 |
|                           |     |           | 1                    | 47                  | 23.54 | 23.58 | 23.72 |

| NB-IoT Band 13 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | -     | 23230 | -     |
|                           |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
| 15kHz                     | 10M | QPSK      | 1                    | 0                   | -     | 23.44 | -     |
|                           |     |           | 1                    | 11                  | -     | 23.43 | -     |
|                           |     |           | 3                    | 3                   | -     | 23.15 | -     |
|                           |     |           | 12                   | 0                   | -     | 21.66 | -     |
|                           |     | BPSK      | 1                    | 0                   | -     | 23.49 | -     |
|                           |     |           | 1                    | 11                  | -     | 23.50 | -     |
|                           | BW  | MCS Index | Channel              |                     | 23205 | 23230 | 23255 |
|                           |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 23.52 | 23.46 | 23.56 |
|                           |     |           | 1                    | 11                  | 23.53 | 23.47 | 23.52 |
|                           |     |           | 3                    | 3                   | 23.22 | 23.16 | 23.27 |
|                           |     |           | 12                   | 0                   | 21.47 | 21.68 | 21.76 |
|                           |     | BPSK      | 1                    | 0                   | 23.55 | 23.53 | 23.59 |
|                           |     |           | 1                    | 11                  | 23.57 | 23.54 | 23.61 |

**EIRP / ERP Power (dBm)**

| NB-IoT Band 4 Standalone |           |                      |                     |        |        |        |
|--------------------------|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing       | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
|                          |           | Channel              |                     | 19952  | 20175  | 20398  |
|                          |           | Frequency (MHz)      |                     | 1710.2 | 1732.5 | 1754.8 |
| 3.75kHz                  | QPSK      | 1                    | 0                   | 25.72  | 25.85  | 25.85  |
|                          |           | 1                    | 47                  | 25.78  | 25.87  | 25.91  |
|                          | BPSK      | 1                    | 0                   | 25.93  | 25.89  | 25.95  |
|                          |           | 1                    | 47                  | 25.91  | 25.90  | 25.91  |
| BW                       | MCS Index | Channel              |                     | 19952  | 20175  | 20398  |
|                          |           | Frequency (MHz)      |                     | 1710.2 | 1732.5 | 1754.8 |
| 15kHz                    | QPSK      | 1                    | 0                   | 25.82  | 25.83  | 25.86  |
|                          |           | 1                    | 11                  | 25.83  | 25.85  | 25.87  |
|                          |           | 3                    | 3                   | 26.30  | 25.38  | 25.55  |
|                          |           | 12                   | 0                   | 26.33  | 24.35  | 25.35  |
|                          | BPSK      | 1                    | 0                   | 25.94  | 25.87  | 25.95  |
|                          |           | 1                    | 11                  | 25.89  | 25.88  | 25.91  |

| NB-IoT Band 4 In-Band |     |           |                      |                     |        |        |        |
|-----------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing    | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
|                       |     |           | Channel              |                     | 20050  | 20175  | 20300  |
|                       |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
| 3.75kHz               | 20M | QPSK      | 1                    | 0                   | 25.79  | 25.77  | 25.67  |
|                       |     |           | 1                    | 47                  | 25.80  | 25.78  | 25.68  |
|                       |     | BPSK      | 1                    | 0                   | 25.85  | 25.85  | 25.74  |
|                       |     |           | 1                    | 47                  | 25.83  | 25.87  | 25.73  |
|                       | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                       |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                       | 15M | QPSK      | 1                    | 0                   | 25.79  | 25.81  | 25.76  |
|                       |     |           | 1                    | 47                  | 25.77  | 25.83  | 25.77  |
|                       |     | BPSK      | 1                    | 0                   | 25.85  | 25.85  | 25.81  |
|                       |     |           | 1                    | 47                  | 25.83  | 25.84  | 25.82  |
|                       | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                       |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                       | 10M | QPSK      | 1                    | 0                   | 25.80  | 25.79  | 25.77  |
|                       |     |           | 1                    | 47                  | 25.79  | 25.77  | 25.78  |
|                       |     | BPSK      | 1                    | 0                   | 25.83  | 25.85  | 25.82  |
|                       |     |           | 1                    | 47                  | 25.84  | 25.83  | 25.83  |
|                       | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                       |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                       | 5M  | QPSK      | 1                    | 0                   | 25.80  | 25.82  | 25.94  |
|                       |     |           | 1                    | 47                  | 25.78  | 25.80  | 25.92  |
|                       |     | BPSK      | 1                    | 0                   | 25.82  | 25.86  | 25.96  |
|                       |     |           | 1                    | 47                  | 25.84  | 25.85  | 25.98  |
|                       | BW  | MCS Index | Channel              |                     | 19965  | 20175  | 20385  |
|                       |     |           | Frequency (MHz)      |                     | 1711.5 | 1732.5 | 1753.5 |
|                       | 3M  | QPSK      | 1                    | 0                   | 25.78  | 25.82  | 25.91  |
|                       |     |           | 1                    | 47                  | 25.76  | 25.79  | 25.90  |
|                       |     | BPSK      | 1                    | 0                   | 25.82  | 25.87  | 25.97  |
|                       |     |           | 1                    | 47                  | 25.84  | 25.86  | 25.95  |

| NB-IoT Band 4 In-Band |     |           |                      |                     |        |        |        |
|-----------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing    | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
|                       |     |           | Channel              |                     | 20050  | 20175  | 20300  |
|                       |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
| 15kHz                 | 20M | QPSK      | 1                    | 0                   | 25.79  | 25.77  | 25.72  |
|                       |     |           | 1                    | 11                  | 25.81  | 25.79  | 25.70  |
|                       |     |           | 3                    | 3                   | 25.34  | 25.30  | 25.41  |
|                       |     |           | 12                   | 0                   | 24.19  | 24.25  | 24.04  |
|                       |     | BPSK      | 1                    | 0                   | 25.85  | 25.83  | 25.70  |
|                       |     |           | 1                    | 11                  | 25.83  | 25.84  | 25.71  |
|                       | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                       |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                       | 15M | QPSK      | 1                    | 0                   | 25.79  | 25.81  | 25.77  |
|                       |     |           | 1                    | 11                  | 25.80  | 25.78  | 25.79  |
|                       |     |           | 3                    | 3                   | 25.34  | 25.28  | 25.39  |
|                       |     |           | 12                   | 0                   | 24.19  | 24.28  | 24.21  |
|                       |     | BPSK      | 1                    | 0                   | 25.84  | 25.84  | 25.83  |
|                       |     |           | 1                    | 11                  | 25.86  | 25.85  | 25.84  |
|                       | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                       |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                       | 10M | QPSK      | 1                    | 0                   | 25.75  | 25.78  | 25.74  |
|                       |     |           | 1                    | 11                  | 25.78  | 25.77  | 25.76  |
|                       |     |           | 3                    | 3                   | 25.35  | 25.28  | 25.39  |
|                       |     |           | 12                   | 0                   | 24.25  | 24.20  | 24.22  |
|                       |     | BPSK      | 1                    | 0                   | 25.83  | 25.83  | 25.84  |
|                       |     |           | 1                    | 11                  | 25.81  | 25.84  | 25.83  |
|                       | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                       |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                       | 5M  | QPSK      | 1                    | 0                   | 25.85  | 25.77  | 25.84  |
|                       |     |           | 1                    | 11                  | 25.84  | 25.74  | 25.82  |
|                       |     |           | 3                    | 3                   | 25.36  | 25.26  | 25.40  |
|                       |     |           | 12                   | 0                   | 24.16  | 24.25  | 24.29  |
|                       |     | BPSK      | 1                    | 0                   | 25.82  | 25.80  | 25.90  |
|                       |     |           | 1                    | 11                  | 25.85  | 25.82  | 25.91  |
|                       | BW  | MCS Index | Channel              |                     | 19965  | 20175  | 20385  |
|                       |     |           | Frequency (MHz)      |                     | 1711.5 | 1732.5 | 1753.5 |
|                       | 3M  | QPSK      | 1                    | 0                   | 25.76  | 25.73  | 25.84  |
|                       |     |           | 1                    | 11                  | 25.77  | 25.74  | 25.85  |
|                       |     |           | 3                    | 3                   | 25.31  | 25.30  | 25.41  |
|                       |     |           | 12                   | 0                   | 24.24  | 24.13  | 24.29  |
|                       |     | BPSK      | 1                    | 0                   | 25.82  | 25.79  | 25.89  |
|                       |     |           | 1                    | 11                  | 25.81  | 25.78  | 25.90  |

| NB-IoT Band 4 Guard-Band |     |           |                      |                     |        |        |        |
|--------------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing       | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
| 3.75kHz                  | 20M | QPSK      | Channel              |                     | 20050  | 20175  | 20300  |
|                          |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
|                          |     | BPSK      | 1                    | 0                   | 25.61  | 25.58  | 25.51  |
|                          |     |           | 1                    | 47                  | 25.62  | 25.59  | 25.52  |
|                          |     | BPSK      | 1                    | 0                   | 25.65  | 25.62  | 25.55  |
|                          |     |           | 1                    | 47                  | 25.66  | 25.63  | 25.56  |
|                          | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                          |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                          | 15M | QPSK      | 1                    | 0                   | 25.57  | 25.55  | 25.53  |
|                          |     |           | 1                    | 47                  | 25.56  | 25.57  | 25.52  |
|                          |     | BPSK      | 1                    | 0                   | 25.61  | 25.62  | 25.59  |
|                          |     |           | 1                    | 47                  | 25.59  | 25.63  | 25.58  |
|                          | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                          |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                          | 10M | QPSK      | 1                    | 0                   | 25.58  | 25.60  | 25.57  |
|                          |     |           | 1                    | 47                  | 25.57  | 25.59  | 25.55  |
|                          |     | BPSK      | 1                    | 0                   | 25.64  | 25.65  | 25.63  |
|                          |     |           | 1                    | 47                  | 25.65  | 25.64  | 25.62  |
|                          | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                          |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                          | 5M  | QPSK      | 1                    | 0                   | 25.58  | 25.55  | 25.71  |
|                          |     |           | 1                    | 47                  | 25.56  | 25.56  | 25.72  |
|                          |     | BPSK      | 1                    | 0                   | 25.62  | 25.62  | 25.76  |
|                          |     |           | 1                    | 47                  | 25.64  | 25.63  | 25.77  |

| NB-IoT Band 4 Guard-Band |     |           |                      |                     |        |        |        |
|--------------------------|-----|-----------|----------------------|---------------------|--------|--------|--------|
| Subcarrier Spacing       | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low    | Mid    | High   |
|                          |     |           | Channel              |                     | 20050  | 20175  | 20300  |
|                          |     |           | Frequency (MHz)      |                     | 1720   | 1732.5 | 1745   |
| 15kHz                    | 20M | QPSK      | 1                    | 0                   | 25.57  | 25.56  | 25.49  |
|                          |     |           | 1                    | 11                  | 25.59  | 25.55  | 25.50  |
|                          |     |           | 3                    | 3                   | 25.13  | 25.15  | 25.19  |
|                          |     |           | 12                   | 0                   | 23.97  | 24.03  | 23.98  |
|                          |     | BPSK      | 1                    | 0                   | 25.63  | 25.59  | 25.52  |
|                          |     |           | 1                    | 11                  | 25.64  | 25.60  | 25.54  |
|                          | BW  | MCS Index | Channel              |                     | 20025  | 20175  | 20325  |
|                          |     |           | Frequency (MHz)      |                     | 1717.5 | 1732.5 | 1747.5 |
|                          | 15M | QPSK      | 1                    | 0                   | 25.57  | 25.56  | 25.55  |
|                          |     |           | 1                    | 11                  | 25.59  | 25.59  | 25.57  |
|                          |     |           | 3                    | 3                   | 25.17  | 25.15  | 25.16  |
|                          |     |           | 12                   | 0                   | 23.97  | 24.06  | 24.02  |
|                          |     | BPSK      | 1                    | 0                   | 25.62  | 25.63  | 25.62  |
|                          |     |           | 1                    | 11                  | 25.63  | 25.62  | 25.63  |
|                          | BW  | MCS Index | Channel              |                     | 20000  | 20175  | 20350  |
|                          |     |           | Frequency (MHz)      |                     | 1715   | 1732.5 | 1750   |
|                          | 10M | QPSK      | 1                    | 0                   | 25.62  | 25.58  | 25.57  |
|                          |     |           | 1                    | 11                  | 25.63  | 25.59  | 25.55  |
|                          |     |           | 3                    | 3                   | 25.16  | 25.17  | 25.16  |
|                          |     |           | 12                   | 0                   | 24.06  | 23.97  | 24.04  |
|                          |     | BPSK      | 1                    | 0                   | 25.65  | 25.65  | 25.66  |
|                          |     |           | 1                    | 11                  | 25.66  | 25.67  | 25.67  |
|                          | BW  | MCS Index | Channel              |                     | 19975  | 20175  | 20375  |
|                          |     |           | Frequency (MHz)      |                     | 1712.5 | 1732.5 | 1752.5 |
|                          | 5M  | QPSK      | 1                    | 0                   | 25.63  | 25.61  | 25.64  |
|                          |     |           | 1                    | 11                  | 25.64  | 25.60  | 25.65  |
|                          |     |           | 3                    | 3                   | 25.15  | 25.18  | 25.14  |
|                          |     |           | 12                   | 0                   | 24.03  | 24.05  | 24.08  |
|                          |     | BPSK      | 1                    | 0                   | 25.69  | 25.64  | 25.70  |
|                          |     |           | 1                    | 11                  | 25.70  | 25.65  | 25.73  |

| NB-IoT Band 12 Standalone |           |                      |                     |       |       |       |
|---------------------------|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |           | Channel              |                     | 23012 | 23095 | 23178 |
|                           |           | Frequency (MHz)      |                     | 699.2 | 707.5 | 715.8 |
| 3.75kHz                   | QPSK      | 1                    | 0                   | 22.48 | 22.62 | 22.36 |
|                           |           | 1                    | 47                  | 22.40 | 22.61 | 22.38 |
|                           | BPSK      | 1                    | 0                   | 22.67 | 22.66 | 22.45 |
|                           |           | 1                    | 47                  | 22.58 | 22.68 | 22.36 |
| BW                        | MCS Index | Channel              |                     | 23012 | 23095 | 23178 |
|                           |           | Frequency (MHz)      |                     | 699.2 | 707.5 | 715.8 |
| 15kHz                     | QPSK      | 1                    | 0                   | 22.40 | 22.38 | 21.97 |
|                           |           | 1                    | 11                  | 22.45 | 22.38 | 22.12 |
|                           |           | 3                    | 3                   | 22.27 | 22.26 | 21.89 |
|                           |           | 12                   | 0                   | 22.46 | 20.60 | 21.57 |
|                           | BPSK      | 1                    | 0                   | 22.40 | 22.35 | 22.20 |
|                           |           | 1                    | 11                  | 22.38 | 22.36 | 22.12 |

| NB-IoT Band 12 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
| 3.75kHz                | 15M | QPSK      | Channel              |                     | 23085 | 23095 | 23105 |
|                        |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
|                        |     | BPSK      | 1                    | 0                   | 22.23 | 22.38 | 22.20 |
|                        |     |           | 1                    | 47                  | 22.24 | 22.39 | 22.19 |
|                        |     | BPSK      | 1                    | 0                   | 22.30 | 22.43 | 22.25 |
|                        |     |           | 1                    | 47                  | 22.31 | 22.44 | 22.26 |
|                        | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                        |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                        | 10M | QPSK      | 1                    | 0                   | 22.33 | 22.42 | 22.10 |
|                        |     |           | 1                    | 47                  | 22.34 | 22.41 | 22.12 |
|                        |     | BPSK      | 1                    | 0                   | 22.38 | 22.44 | 22.18 |
|                        |     |           | 1                    | 47                  | 22.40 | 22.43 | 22.17 |
|                        | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                        |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                        | 5M  | QPSK      | 1                    | 0                   | 22.58 | 22.55 | 22.38 |
|                        |     |           | 1                    | 47                  | 22.56 | 22.54 | 22.37 |
|                        |     | BPSK      | 1                    | 0                   | 22.62 | 22.56 | 22.45 |
|                        |     |           | 1                    | 47                  | 22.61 | 22.57 | 22.43 |
|                        | BW  | MCS Index | Channel              |                     | 23025 | 23095 | 23165 |
|                        |     |           | Frequency (MHz)      |                     | 700.5 | 707.5 | 714.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 22.58 | 22.51 | 22.31 |
|                        |     |           | 1                    | 47                  | 22.56 | 22.49 | 22.30 |
|                        |     | BPSK      | 1                    | 0                   | 22.62 | 22.56 | 22.38 |
|                        |     |           | 1                    | 47                  | 22.61 | 22.57 | 22.39 |

| NB-IoT Band 12 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                        |     |           | Channel              |                     | 23085 | 23095 | 23105 |
|                        |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
| 15kHz                  | 15M | QPSK      | 1                    | 0                   | 22.21 | 22.26 | 22.10 |
|                        |     |           | 1                    | 11                  | 22.22 | 22.23 | 22.11 |
|                        |     |           | 3                    | 3                   | 22.05 | 22.02 | 21.94 |
|                        |     |           | 12                   | 0                   | 20.46 | 20.48 | 20.29 |
|                        |     | BPSK      | 1                    | 0                   | 22.27 | 22.30 | 22.08 |
|                        |     |           | 1                    | 11                  | 22.28 | 22.27 | 22.05 |
|                        | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                        |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                        | 10M | QPSK      | 1                    | 0                   | 22.07 | 22.22 | 21.98 |
|                        |     |           | 1                    | 11                  | 22.08 | 22.23 | 21.97 |
|                        |     |           | 3                    | 3                   | 21.98 | 21.96 | 21.87 |
|                        |     |           | 12                   | 0                   | 20.30 | 20.28 | 20.00 |
|                        |     | BPSK      | 1                    | 0                   | 22.14 | 22.20 | 21.96 |
|                        |     |           | 1                    | 11                  | 22.13 | 22.19 | 21.94 |
|                        | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                        |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                        | 5M  | QPSK      | 1                    | 0                   | 22.11 | 21.91 | 21.93 |
|                        |     |           | 1                    | 11                  | 22.12 | 21.90 | 21.94 |
|                        |     |           | 3                    | 3                   | 21.90 | 21.86 | 21.82 |
|                        |     |           | 12                   | 0                   | 20.16 | 19.99 | 19.94 |
|                        |     | BPSK      | 1                    | 0                   | 22.09 | 21.97 | 21.90 |
|                        |     |           | 1                    | 11                  | 22.08 | 21.98 | 21.89 |
|                        | BW  | MCS Index | Channel              |                     | 23025 | 23095 | 23165 |
|                        |     |           | Frequency (MHz)      |                     | 700.5 | 707.5 | 714.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 21.99 | 21.90 | 21.77 |
|                        |     |           | 1                    | 11                  | 22.00 | 21.89 | 21.76 |
|                        |     |           | 3                    | 3                   | 21.84 | 21.68 | 21.60 |
|                        |     |           | 12                   | 0                   | 20.22 | 19.99 | 19.86 |
|                        |     | BPSK      | 1                    | 0                   | 22.06 | 21.96 | 21.83 |
|                        |     |           | 1                    | 11                  | 22.08 | 21.98 | 21.80 |

| NB-IoT Band 12 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | 23085 | 23095 | 23105 |
|                           |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
| 3.75kHz                   | 15M | QPSK      | 1                    | 0                   | 22.06 | 22.11 | 22.08 |
|                           |     |           | 1                    | 47                  | 22.04 | 22.09 | 22.09 |
|                           |     | BPSK      | 1                    | 0                   | 22.11 | 22.15 | 22.17 |
|                           |     |           | 1                    | 47                  | 22.13 | 22.16 | 22.16 |
|                           | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                           |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                           | 10M | QPSK      | 1                    | 0                   | 22.07 | 22.09 | 21.86 |
|                           |     |           | 1                    | 47                  | 22.05 | 22.07 | 21.87 |
|                           |     | BPSK      | 1                    | 0                   | 22.09 | 22.14 | 21.92 |
|                           |     |           | 1                    | 47                  | 22.11 | 22.15 | 21.93 |
|                           | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                           |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 22.04 | 22.00 | 21.86 |
|                           |     |           | 1                    | 47                  | 22.03 | 22.02 | 21.88 |
|                           |     | BPSK      | 1                    | 0                   | 22.10 | 22.06 | 21.94 |
|                           |     |           | 1                    | 47                  | 22.11 | 22.08 | 21.92 |

| NB-IoT Band 12 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | 23085 | 23095 | 23105 |
|                           |     |           | Frequency (MHz)      |                     | 706.5 | 707.5 | 708.5 |
| 15kHz                     | 15M | QPSK      | 1                    | 0                   | 22.00 | 22.01 | 22.10 |
|                           |     |           | 1                    | 11                  | 21.97 | 21.98 | 22.08 |
|                           |     |           | 3                    | 3                   | 21.83 | 21.81 | 21.86 |
|                           |     |           | 12                   | 0                   | 20.03 | 20.13 | 20.14 |
|                           |     | BPSK      | 1                    | 0                   | 22.12 | 22.08 | 22.17 |
|                           |     |           | 1                    | 11                  | 22.10 | 22.05 | 22.18 |
|                           | BW  | MCS Index | Channel              |                     | 23060 | 23095 | 23130 |
|                           |     |           | Frequency (MHz)      |                     | 704   | 707.5 | 711   |
|                           | 10M | QPSK      | 1                    | 0                   | 22.09 | 22.03 | 21.84 |
|                           |     |           | 1                    | 11                  | 22.10 | 22.01 | 21.86 |
|                           |     |           | 3                    | 3                   | 21.86 | 21.82 | 21.72 |
|                           |     |           | 12                   | 0                   | 20.14 | 20.05 | 20.05 |
|                           |     | BPSK      | 1                    | 0                   | 22.07 | 22.06 | 21.82 |
|                           |     |           | 1                    | 11                  | 22.08 | 22.08 | 21.83 |
|                           | BW  | MCS Index | Channel              |                     | 23035 | 23095 | 23155 |
|                           |     |           | Frequency (MHz)      |                     | 701.5 | 707.5 | 713.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 22.01 | 21.99 | 21.92 |
|                           |     |           | 1                    | 11                  | 22.00 | 22.00 | 21.91 |
|                           |     |           | 3                    | 3                   | 21.84 | 21.80 | 21.73 |
|                           |     |           | 12                   | 0                   | 20.14 | 20.00 | 19.84 |
|                           |     | BPSK      | 1                    | 0                   | 22.07 | 22.03 | 21.90 |
|                           |     |           | 1                    | 11                  | 22.08 | 22.02 | 21.89 |

| NB-IoT Band 13 Standalone |           |                      |                     |       |       |       |
|---------------------------|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |           | Channel              |                     | 23182 | 23230 | 23278 |
|                           |           | Frequency (MHz)      |                     | 777.2 | 782   | 786.8 |
| 3.75kHz                   | QPSK      | 1                    | 0                   | 21.72 | 21.97 | 21.80 |
|                           |           | 1                    | 47                  | 21.54 | 21.96 | 21.88 |
|                           | BPSK      | 1                    | 0                   | 21.95 | 22.01 | 21.66 |
|                           |           | 1                    | 47                  | 21.82 | 22.02 | 21.79 |
| BW                        | MCS Index | Channel              |                     | 23182 | 23230 | 23278 |
|                           |           | Frequency (MHz)      |                     | 777.2 | 782   | 786.8 |
| 15kHz                     | QPSK      | 1                    | 0                   | 21.75 | 21.96 | 21.99 |
|                           |           | 1                    | 11                  | 21.82 | 21.98 | 21.91 |
|                           |           | 3                    | 3                   | 21.67 | 21.66 | 21.62 |
|                           |           | 12                   | 0                   | 19.94 | 20.21 | 20.07 |
|                           | BPSK      | 1                    | 0                   | 21.81 | 22.03 | 21.94 |
|                           |           | 1                    | 11                  | 21.90 | 22.01 | 21.84 |

| NB-IoT Band 13 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
| 3.75kHz                | 10M | QPSK      | Channel              |                     | -     | 23230 | -     |
|                        |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
|                        |     | BPSK      | 1                    | 0                   | -     | 21.94 |       |
|                        |     |           | 1                    | 47                  | -     | 21.95 |       |
|                        |     | BPSK      | 1                    | 0                   | -     | 21.97 |       |
|                        |     |           | 1                    | 47                  | -     | 21.99 |       |
|                        | BW  | MCS Index | Channel              |                     | 23205 | 23230 | 23255 |
|                        |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                        | 5M  | QPSK      | 1                    | 0                   | 21.82 | 21.89 | 21.95 |
|                        |     |           | 1                    | 47                  | 21.84 | 21.88 | 21.94 |
|                        |     | BPSK      | 1                    | 0                   | 21.89 | 21.98 | 22.01 |
|                        |     |           | 1                    | 47                  | 21.87 | 21.96 | 22.02 |
|                        | BW  | MCS Index | Channel              |                     | 23195 | 23230 | 23265 |
|                        |     |           | Frequency (MHz)      |                     | 778.5 | 782   | 785.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 21.82 | 21.90 | 22.06 |
|                        |     |           | 1                    | 47                  | 21.79 | 21.88 | 22.05 |
|                        |     | BPSK      | 1                    | 0                   | 21.86 | 21.97 | 22.12 |
|                        |     |           | 1                    | 47                  | 21.88 | 21.95 | 22.10 |

| NB-IoT Band 13 In-Band |     |           |                      |                     |       |       |       |
|------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing     | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                        |     |           | Channel              |                     | -     | 23230 | -     |
|                        |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
| 15kHz                  | 10M | QPSK      | 1                    | 0                   | -     | 21.80 | -     |
|                        |     |           | 1                    | 11                  | -     | 21.76 | -     |
|                        |     |           | 3                    | 3                   | -     | 21.51 | -     |
|                        |     |           | 12                   | 0                   | -     | 19.97 | -     |
|                        |     | BPSK      | 1                    | 0                   | -     | 21.82 | -     |
|                        |     |           | 1                    | 11                  | -     | 21.80 | -     |
|                        | BW  | MCS Index | Channel              |                     | 23205 | 23230 | 23255 |
|                        |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                        | 5M  | QPSK      | 1                    | 0                   | 21.86 | 21.81 | 21.95 |
|                        |     |           | 1                    | 11                  | 21.87 | 21.84 | 21.96 |
|                        |     |           | 3                    | 3                   | 21.56 | 21.52 | 21.64 |
|                        |     |           | 12                   | 0                   | 20.01 | 19.99 | 20.21 |
|                        |     | BPSK      | 1                    | 0                   | 21.91 | 21.87 | 22.00 |
|                        |     |           | 1                    | 11                  | 21.90 | 21.84 | 22.02 |
|                        | BW  | MCS Index | Channel              |                     | 23195 | 23230 | 23265 |
|                        |     |           | Frequency (MHz)      |                     | 778.5 | 782   | 785.5 |
|                        | 3M  | QPSK      | 1                    | 0                   | 21.71 | 21.82 | 22.00 |
|                        |     |           | 1                    | 11                  | 21.74 | 21.85 | 21.99 |
|                        |     |           | 3                    | 3                   | 21.54 | 21.52 | 21.62 |
|                        |     |           | 12                   | 0                   | 19.83 | 20.06 | 20.07 |
|                        |     | BPSK      | 1                    | 0                   | 21.75 | 21.88 | 22.03 |
|                        |     |           | 1                    | 11                  | 21.78 | 21.89 | 22.02 |

| NB-IoT Band 13 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | -     | 23230 | -     |
|                           |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
| 3.75kHz                   | 10M | QPSK      | 1                    | 0                   | -     | 21.81 |       |
|                           |     |           | 1                    | 47                  | -     | 21.79 |       |
|                           |     | BPSK      | 1                    | 0                   | -     | 21.88 |       |
|                           |     |           | 1                    | 47                  | -     | 21.84 |       |
|                           | BW  | MCS Index | Channel              |                     | 23205 | 23230 | 23255 |
|                           |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 21.81 | 21.88 | 21.92 |
|                           |     |           | 1                    | 47                  | 21.83 | 21.86 | 21.93 |
|                           |     | BPSK      | 1                    | 0                   | 21.88 | 21.92 | 22.06 |
|                           |     |           | 1                    | 47                  | 21.89 | 21.93 | 22.07 |

| NB-IoT Band 13 Guard-Band |     |           |                      |                     |       |       |       |
|---------------------------|-----|-----------|----------------------|---------------------|-------|-------|-------|
| Subcarrier Spacing        | BW  | MCS Index | Number of Subcarrier | Starting Subcarrier | Low   | Mid   | High  |
|                           |     |           | Channel              |                     | -     | 23230 | -     |
|                           |     |           | Frequency (MHz)      |                     | -     | 782   | -     |
| 15kHz                     | 10M | QPSK      | 1                    | 0                   | -     | 21.79 | -     |
|                           |     |           | 1                    | 11                  | -     | 21.78 | -     |
|                           |     |           | 3                    | 3                   | -     | 21.50 | -     |
|                           |     |           | 12                   | 0                   | -     | 20.01 | -     |
|                           |     | BPSK      | 1                    | 0                   | -     | 21.84 | -     |
|                           |     |           | 1                    | 11                  | -     | 21.85 | -     |
|                           | BW  | MCS Index | Channel              |                     | 23205 | 23230 | 23255 |
|                           |     |           | Frequency (MHz)      |                     | 779.5 | 782   | 784.5 |
|                           | 5M  | QPSK      | 1                    | 0                   | 21.87 | 21.81 | 21.91 |
|                           |     |           | 1                    | 11                  | 21.88 | 21.82 | 21.87 |
|                           |     |           | 3                    | 3                   | 21.57 | 21.51 | 21.62 |
|                           |     |           | 12                   | 0                   | 19.82 | 20.03 | 20.11 |
|                           |     | BPSK      | 1                    | 0                   | 21.90 | 21.88 | 21.94 |
|                           |     |           | 1                    | 11                  | 21.92 | 21.89 | 21.96 |

## 4.2 Modulation Characteristics Measurement

### 4.2.1 Limits of Modulation Characteristics

N/A

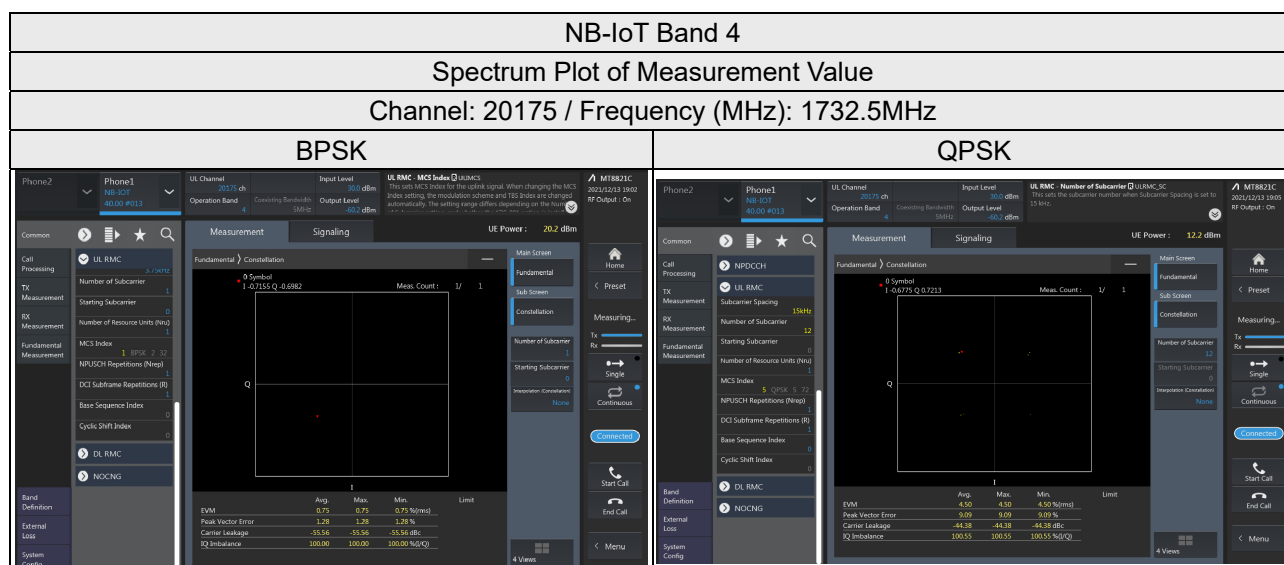
### 4.2.2 Test Procedure

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

### 4.2.3 Test Setup



### 4.2.4 Test Results



## Channel: 23095 / Frequency (MHz): 707.5MHz

The figure displays two side-by-side screenshots of the M18202C software interface, specifically the 'Measurement' screen for a 'Fundamental' signal. Both screenshots show a constellation plot with a grid and a 'Main Screen' button.

**Left Screenshot:**

- Signal:** Fundamental
- Symbol:** 0.0098 Q (-0.0011)
- UE Power:** 23.2 dBm
- Measurement Data:**

| Parameter         | Value  |
|-------------------|--------|
| EVM               | 0.28   |
| Peak Vector Error | 0.64   |
| Carrier Leakage   | -55.83 |
| IQ Imbalance      | 100.00 |

**Right Screenshot:**

- Signal:** Fundamental
- Symbol:** 0.0626 Q (0.0418)
- UE Power:** 10.7 dBm
- Measurement Data:**

| Parameter         | Value  |
|-------------------|--------|
| EVM               | 3.46   |
| Peak Vector Error | 8.65   |
| Carrier Leakage   | -38.31 |
| IQ Imbalance      | 99.63  |

## Channel: 23230 / Frequency (MHz): 782.0MHz

[illegible]

### 4.3 Frequency Stability Measurement

#### 4.3.1 Limits of Frequency Stability Measurement

According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that "The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with specification of EUT  $-30^{\circ}\text{C} \sim 50^{\circ}\text{C}$ .

#### 4.3.2 Test Procedure

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

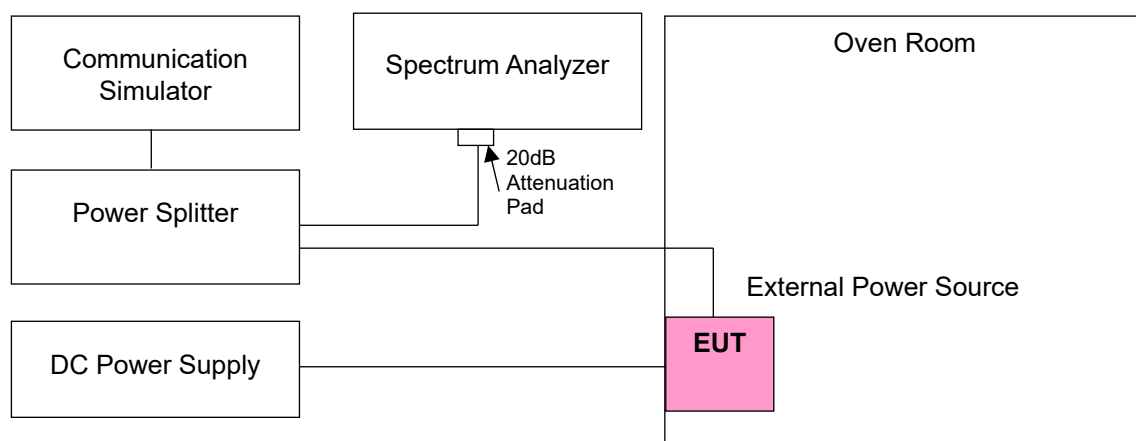
Note: The frequency error was recorded frequency error from the communication simulator.

#### 4.3.3 Test Instruments

| Description & Manufacturer                    | Model No.            | Serial No.  | Cal. Date     | Cal. Due      |
|-----------------------------------------------|----------------------|-------------|---------------|---------------|
| Radio Communication Analyzer<br>Anritsu       | MT8821C              | 6272278310  | Jun. 23, 2021 | Jun. 22, 2022 |
| Temperature & Humidity Chamber<br>Giant Force | GTH-120-40-CP-A<br>R | MAA1306-019 | Sep. 10, 2021 | Sep. 09, 2022 |
| Digital Multimeter<br>Fluke                   | 87-III               | 70360742    | Jun. 24, 2021 | Jun. 23, 2022 |
| DC Power Supply<br>Topward                    | 6306A                | 727263      | NA            | NA            |

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

#### 4.3.4 Test Setup



#### 4.3.5 Test Results

##### Frequency Error vs. Voltage

| Voltage<br>(Vdc) | NB-IoT Band 4             |                       |                 |                       |
|------------------|---------------------------|-----------------------|-----------------|-----------------------|
|                  | SubcarrierSpacing 3.75kHz |                       |                 |                       |
|                  | Low Channel               |                       | High Channel    |                       |
|                  | Frequency (MHz)           | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 3.06             | 1710.200002               | 0.001                 | 1754.800002     | 0.001                 |
| 3.60             | 1710.200003               | 0.002                 | 1754.800004     | 0.002                 |
| 4.14             | 1710.200003               | 0.002                 | 1754.800003     | 0.002                 |

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

##### Frequency Error vs. Temperature

| Temp. (°C) | NB-IoT Band 4             |                       |                 |                       |
|------------|---------------------------|-----------------------|-----------------|-----------------------|
|            | SubcarrierSpacing 3.75kHz |                       |                 |                       |
|            | Low Channel               |                       | High Channel    |                       |
|            | Frequency (MHz)           | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| -20        | 1710.200003               | 0.002                 | 1754.800003     | 0.002                 |
| -10        | 1710.200004               | 0.002                 | 1754.800003     | 0.002                 |
| 0          | 1710.200002               | 0.001                 | 1754.800004     | 0.002                 |
| 10         | 1710.200002               | 0.001                 | 1754.800001     | 0.001                 |
| 20         | 1710.199999               | -0.001                | 1754.799996     | -0.002                |
| 30         | 1710.199997               | -0.002                | 1754.799996     | -0.002                |
| 40         | 1710.199999               | -0.001                | 1754.799997     | -0.001                |
| 50         | 1710.199997               | -0.002                | 1754.799996     | -0.002                |
| 60         | 1710.199996               | -0.002                | 1754.799996     | -0.002                |

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

#### Frequency Error vs. Voltage

| Voltage<br>(Vdc) | NB-IoT Band 4           |                       |                 |                       |
|------------------|-------------------------|-----------------------|-----------------|-----------------------|
|                  | SubcarrierSpacing 15kHz |                       |                 |                       |
|                  | Low Channel             |                       | High Channel    |                       |
|                  | Frequency (MHz)         | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 3.06             | 1710.200002             | 0.001                 | 1754.800003     | 0.002                 |
| 3.60             | 1710.200004             | 0.002                 | 1754.800003     | 0.002                 |
| 4.14             | 1710.200003             | 0.002                 | 1754.800001     | 0.001                 |

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

#### Frequency Error vs. Temperature

| Temp. (°C) | NB-IoT Band 4           |                       |                 |                       |
|------------|-------------------------|-----------------------|-----------------|-----------------------|
|            | SubcarrierSpacing 15kHz |                       |                 |                       |
|            | Low Channel             |                       | High Channel    |                       |
|            | Frequency (MHz)         | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| -20        | 1710.200002             | 0.001                 | 1754.800002     | 0.001                 |
| -10        | 1710.200003             | 0.002                 | 1754.800003     | 0.002                 |
| 0          | 1710.200002             | 0.001                 | 1754.800003     | 0.002                 |
| 10         | 1710.200003             | 0.002                 | 1754.800003     | 0.002                 |
| 20         | 1710.199996             | -0.002                | 1754.799997     | -0.002                |
| 30         | 1710.199997             | -0.002                | 1754.799999     | -0.001                |
| 40         | 1710.199997             | -0.002                | 1754.799998     | -0.001                |
| 50         | 1710.199997             | -0.002                | 1754.799997     | -0.002                |
| 60         | 1710.199999             | -0.001                | 1754.799997     | -0.002                |

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

#### Frequency Error vs. Voltage

| Voltage<br>(Vdc) | NB-IoT Band 12            |                       |                 |                       |
|------------------|---------------------------|-----------------------|-----------------|-----------------------|
|                  | SubcarrierSpacing 3.75kHz |                       |                 |                       |
|                  | Low Channel               |                       | High Channel    |                       |
|                  | Frequency (MHz)           | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 3.06             | 699.200002                | 0.003                 | 715.800002      | 0.003                 |
| 3.60             | 699.200004                | 0.006                 | 715.800004      | 0.005                 |
| 4.14             | 699.200004                | 0.006                 | 715.800002      | 0.003                 |

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

#### Frequency Error vs. Temperature

| Temp. (°C) | NB-IoT Band 12            |                       |                 |                       |
|------------|---------------------------|-----------------------|-----------------|-----------------------|
|            | SubcarrierSpacing 3.75kHz |                       |                 |                       |
|            | Low Channel               |                       | High Channel    |                       |
|            | Frequency (MHz)           | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| -20        | 699.200001                | 0.002                 | 715.800001      | 0.002                 |
| -10        | 699.200003                | 0.004                 | 715.800003      | 0.004                 |
| 0          | 699.200002                | 0.003                 | 715.800003      | 0.004                 |
| 10         | 699.200003                | 0.004                 | 715.800003      | 0.004                 |
| 20         | 699.199998                | -0.003                | 715.799999      | -0.002                |
| 30         | 699.199997                | -0.004                | 715.799997      | -0.005                |
| 40         | 699.199996                | -0.005                | 715.799998      | -0.003                |
| 50         | 699.199998                | -0.003                | 715.799998      | -0.003                |
| 60         | 699.199998                | -0.003                | 715.799998      | -0.003                |

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

#### Frequency Error vs. Voltage

| Voltage<br>(Vdc) | NB-IoT Band 12          |                       |                 |                       |
|------------------|-------------------------|-----------------------|-----------------|-----------------------|
|                  | SubcarrierSpacing 15kHz |                       |                 |                       |
|                  | Low Channel             |                       | High Channel    |                       |
|                  | Frequency (MHz)         | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 3.06             | 699.200002              | 0.002                 | 715.800002      | 0.002                 |
| 3.60             | 699.200003              | 0.004                 | 715.800002      | 0.003                 |
| 4.14             | 699.200002              | 0.002                 | 715.800004      | 0.005                 |

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

#### Frequency Error vs. Temperature

| Temp. (°C) | NB-IoT Band 12          |                       |                 |                       |
|------------|-------------------------|-----------------------|-----------------|-----------------------|
|            | SubcarrierSpacing 15kHz |                       |                 |                       |
|            | Low Channel             |                       | High Channel    |                       |
|            | Frequency (MHz)         | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| -20        | 699.200003              | 0.004                 | 715.800002      | 0.003                 |
| -10        | 699.200002              | 0.003                 | 715.800002      | 0.002                 |
| 0          | 699.200003              | 0.004                 | 715.800004      | 0.006                 |
| 10         | 699.200002              | 0.002                 | 715.800002      | 0.003                 |
| 20         | 699.199997              | -0.005                | 715.799998      | -0.003                |
| 30         | 699.199997              | -0.004                | 715.799996      | -0.006                |
| 40         | 699.199998              | -0.002                | 715.799998      | -0.003                |
| 50         | 699.199999              | -0.002                | 715.799998      | -0.002                |
| 60         | 699.199998              | -0.003                | 715.799998      | -0.003                |

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

#### Frequency Error vs. Voltage

| Voltage<br>(Vdc) | NB-IoT Band 13            |                       |                 |                       |
|------------------|---------------------------|-----------------------|-----------------|-----------------------|
|                  | SubcarrierSpacing 3.75kHz |                       |                 |                       |
|                  | Low Channel               |                       | High Channel    |                       |
|                  | Frequency (MHz)           | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 3.06             | 777.200003                | 0.004                 | 786.800002      | 0.002                 |
| 3.60             | 777.200004                | 0.005                 | 786.800002      | 0.002                 |
| 4.14             | 777.200001                | 0.001                 | 786.800001      | 0.002                 |

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

#### Frequency Error vs. Temperature

| Temp. (°C) | NB-IoT Band 13            |                       |                 |                       |
|------------|---------------------------|-----------------------|-----------------|-----------------------|
|            | SubcarrierSpacing 3.75kHz |                       |                 |                       |
|            | Low Channel               |                       | High Channel    |                       |
|            | Frequency (MHz)           | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| -20        | 777.200003                | 0.004                 | 786.800003      | 0.003                 |
| -10        | 777.200003                | 0.004                 | 786.800002      | 0.002                 |
| 0          | 777.200003                | 0.003                 | 786.800003      | 0.004                 |
| 10         | 777.200002                | 0.002                 | 786.800002      | 0.003                 |
| 20         | 777.199999                | -0.001                | 786.799998      | -0.002                |
| 30         | 777.199998                | -0.003                | 786.799998      | -0.003                |
| 40         | 777.199998                | -0.003                | 786.799996      | -0.005                |
| 50         | 777.199996                | -0.005                | 786.799999      | -0.001                |
| 60         | 777.199998                | -0.003                | 786.799998      | -0.003                |

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

#### Frequency Error vs. Voltage

| Voltage<br>(Vdc) | NB-IoT Band 13          |                       |                 |                       |
|------------------|-------------------------|-----------------------|-----------------|-----------------------|
|                  | SubcarrierSpacing 15kHz |                       |                 |                       |
|                  | Low Channel             |                       | High Channel    |                       |
|                  | Frequency (MHz)         | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 3.06             | 777.200002              | 0.003                 | 786.800002      | 0.003                 |
| 3.60             | 777.200001              | 0.002                 | 786.800003      | 0.004                 |
| 4.14             | 777.200002              | 0.002                 | 786.800002      | 0.003                 |

Note: The applicant defined the normal working voltage is from 3.06Vdc to 4.14Vdc.

#### Frequency Error vs. Temperature

| Temp. (°C) | NB-IoT Band 13          |                       |                 |                       |
|------------|-------------------------|-----------------------|-----------------|-----------------------|
|            | SubcarrierSpacing 15kHz |                       |                 |                       |
|            | Low Channel             |                       | High Channel    |                       |
|            | Frequency (MHz)         | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| -20        | 777.200003              | 0.004                 | 786.800003      | 0.004                 |
| -10        | 777.200003              | 0.004                 | 786.800001      | 0.001                 |
| 0          | 777.200004              | 0.005                 | 786.800003      | 0.003                 |
| 10         | 777.200003              | 0.004                 | 786.800003      | 0.004                 |
| 20         | 777.199997              | -0.005                | 786.799996      | -0.005                |
| 30         | 777.199997              | -0.004                | 786.799997      | -0.004                |
| 40         | 777.199999              | -0.002                | 786.799997      | -0.004                |
| 50         | 777.199997              | -0.003                | 786.799996      | -0.005                |
| 60         | 777.199997              | -0.004                | 786.799999      | -0.002                |

Note: When the EUT temperature is below -20°C, it will shut down and will not work.

## 4.4 Emission Bandwidth Measurement

### 4.4.1 Limits of Emission Bandwidth Measurement

According to FCC 2.1049, the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 % of the total mean power radiated by a given emission.

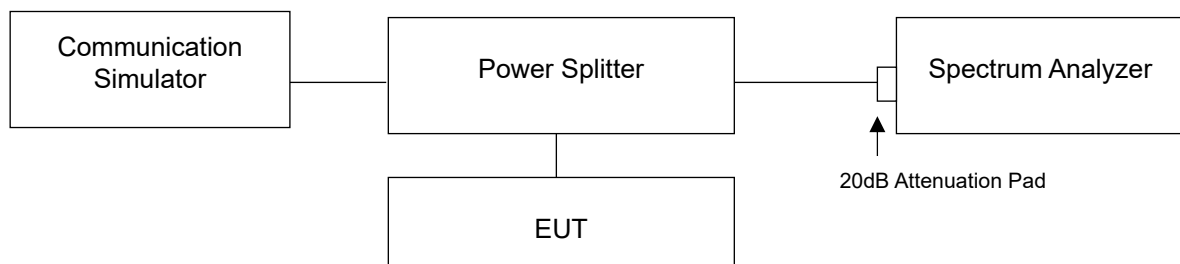
### 4.4.2 Test Procedure

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

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

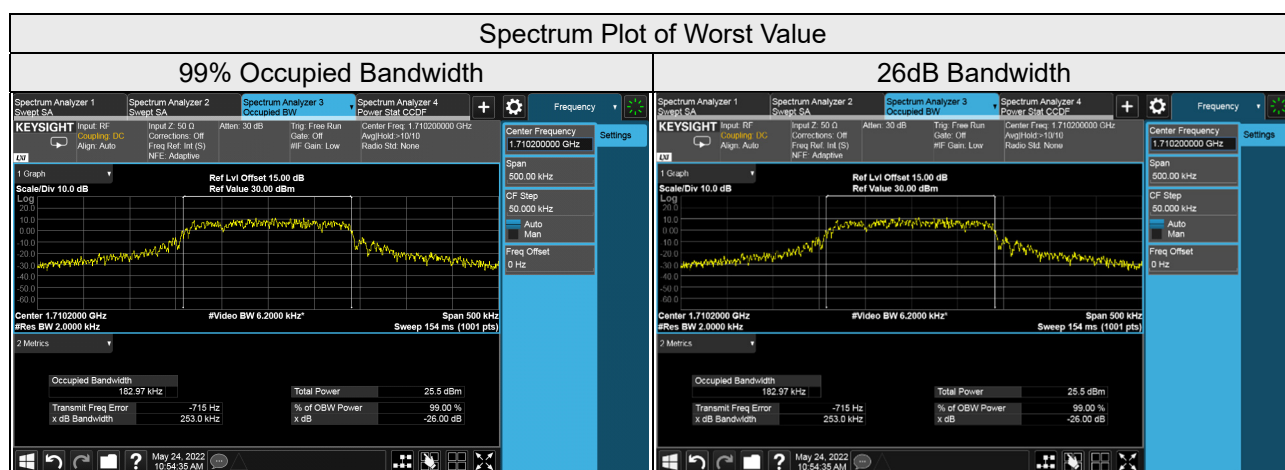
For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

### 4.4.3 Test Setup

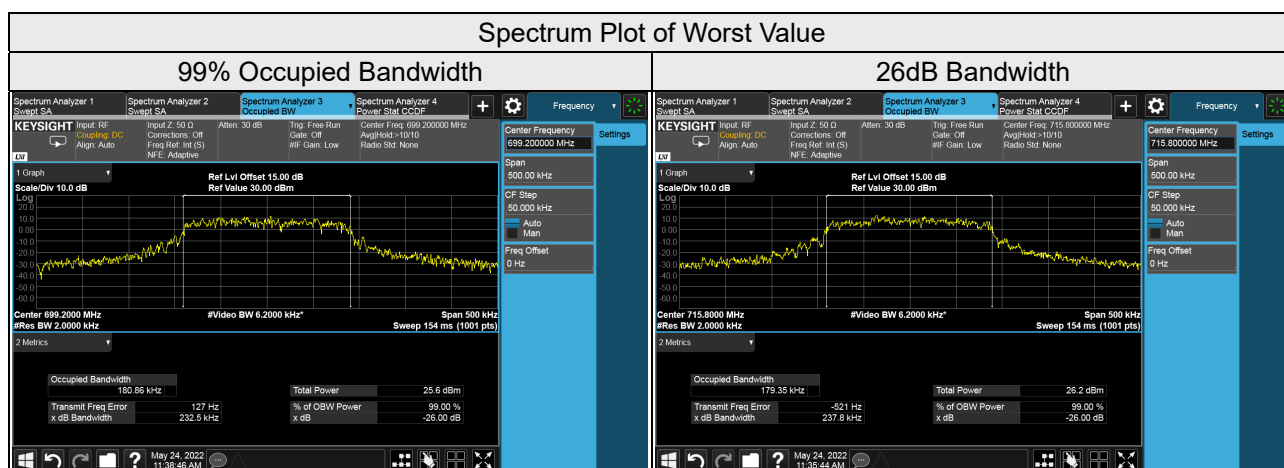


#### 4.4.4 Test Result

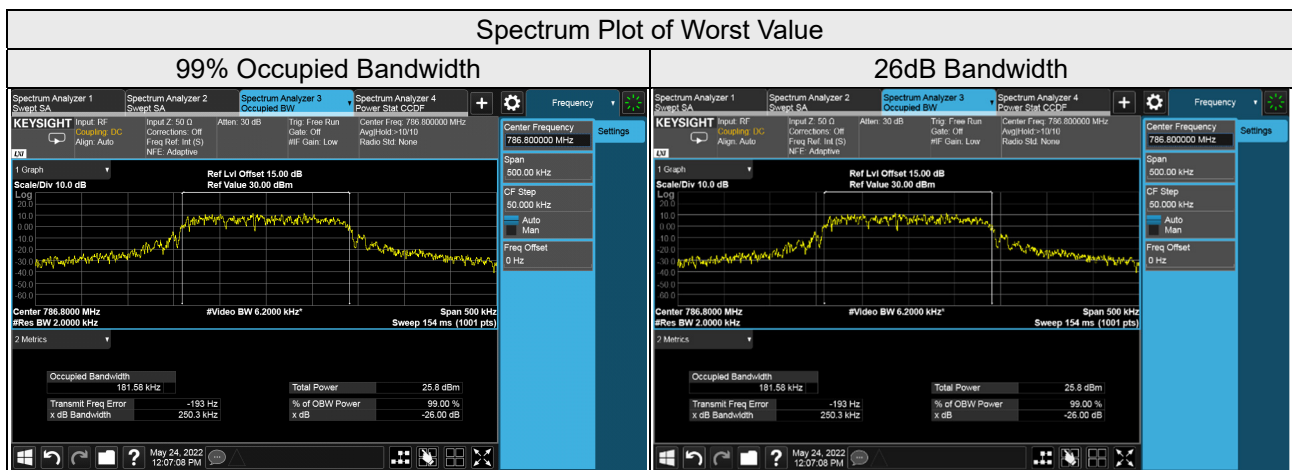
| NB-IoT Band 4 |                 |                          |                                            |            |                              |                      |
|---------------|-----------------|--------------------------|--------------------------------------------|------------|------------------------------|----------------------|
| Channel       | Frequency (MHz) | Subcarrier Spacing (kHz) | Number of Subcarrier / Starting Subcarrier | Modulation | 99% Occupied Bandwidth (kHz) | 26dB Bandwidth (kHz) |
| 19952         | 1710.2          | 3.75                     | 1@0                                        | BPSK       | 59.89                        | 41.87                |
|               |                 | 15                       | 12@0                                       | QPSK       | 182.97                       | 253.00               |
| 20175         | 1732.5          | 3.75                     | 1@0                                        | BPSK       | 59.90                        | 41.27                |
|               |                 | 15                       | 12@0                                       | QPSK       | 181.05                       | 236.00               |
| 20398         | 1754.8          | 3.75                     | 1@47                                       | BPSK       | 60.84                        | 41.78                |
|               |                 | 15                       | 12@0                                       | QPSK       | 180.04                       | 245.60               |



| NB-IoT Band 12 |                 |                          |                                            |            |                              |                      |
|----------------|-----------------|--------------------------|--------------------------------------------|------------|------------------------------|----------------------|
| Channel        | Frequency (MHz) | Subcarrier Spacing (kHz) | Number of Subcarrier / Starting Subcarrier | Modulation | 99% Occupied Bandwidth (kHz) | 26dB Bandwidth (kHz) |
| 23012          | 699.2           | 3.75                     | 1@0                                        | BPSK       | 57.82                        | 41.86                |
|                |                 | 15                       | 12@0                                       | QPSK       | 180.86                       | 232.50               |
| 23095          | 707.5           | 3.75                     | 1@0                                        | BPSK       | 58.62                        | 41.83                |
|                |                 | 15                       | 12@0                                       | QPSK       | 177.65                       | 230.00               |
| 23178          | 715.8           | 3.75                     | 1@47                                       | BPSK       | 57.73                        | 41.45                |
|                |                 | 15                       | 12@0                                       | QPSK       | 179.35                       | 237.80               |



| NB-IoT Band 13 |                 |                          |                                            |            |                              |                      |
|----------------|-----------------|--------------------------|--------------------------------------------|------------|------------------------------|----------------------|
| Channel        | Frequency (MHz) | Subcarrier Spacing (kHz) | Number of Subcarrier / Starting Subcarrier | Modulation | 99% Occupied Bandwidth (kHz) | 26dB Bandwidth (kHz) |
| 23182          | 777.2           | 3.75                     | 1@0                                        | BPSK       | 57.00                        | 41.78                |
|                |                 | 15                       | 12@0                                       | QPSK       | 179.49                       | 235.50               |
| 23230          | 782.0           | 3.75                     | 1@0                                        | BPSK       | 57.68                        | 41.88                |
|                |                 | 15                       | 12@0                                       | QPSK       | 179.33                       | 234.60               |
| 23278          | 786.8           | 3.75                     | 1@47                                       | BPSK       | 57.58                        | 41.62                |
|                |                 | 15                       | 12@0                                       | QPSK       | 181.58                       | 250.30               |



## 4.5 Channel Edge / Out-of-Band Emissions Measurement

### 4.5.1 Limits of Band Edge / Out-of-Band Emissions Measurement

For NB-IoT Band 4:

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

For NB-IoT Band 12:

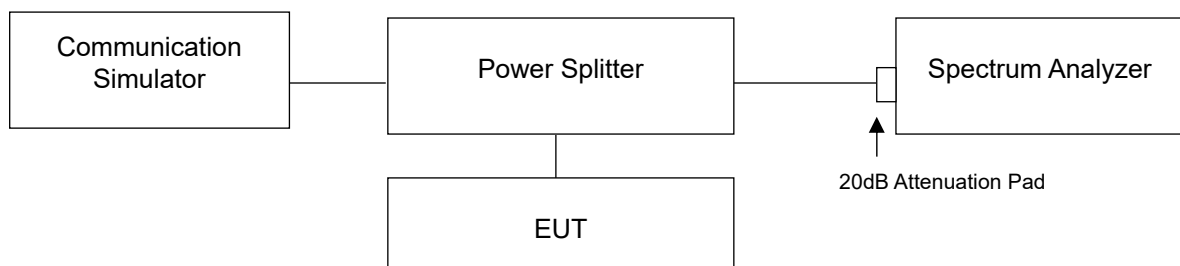
According to FCC 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10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

For NB-IoT Band 13:

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

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

### 4.5.2 Test Setup



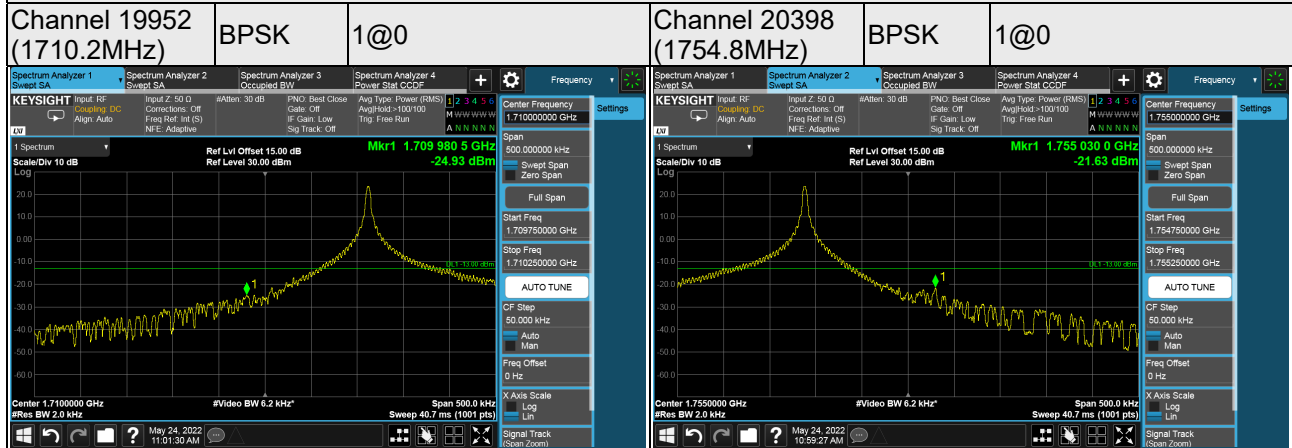
### 4.5.3 Test Procedures

- The EUT was set up for the rated peak power. The power was measured with Spectrum Analyzer. Band edge measurements were done at 2 channels: low and high operational frequency range.
- Measurement refer to ANSI C63.26 section 5.7.2 and FCC Part 27 section 27.53.
- Record the max trace plot into the test report.

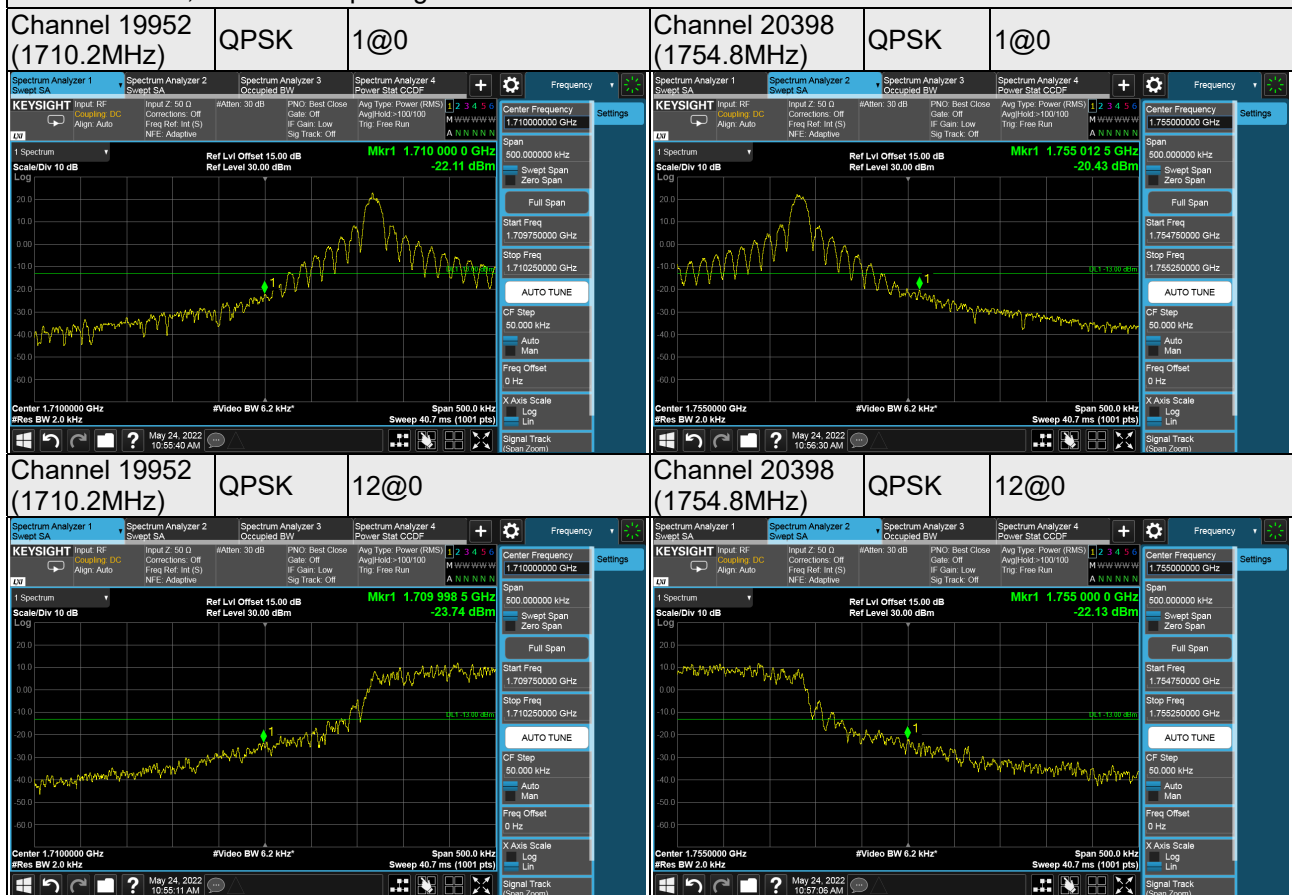
#### 4.5.4 Test Results

##### Band Edge

NB-IoT Band 4, Subcarrier Spacing 3.75kHz

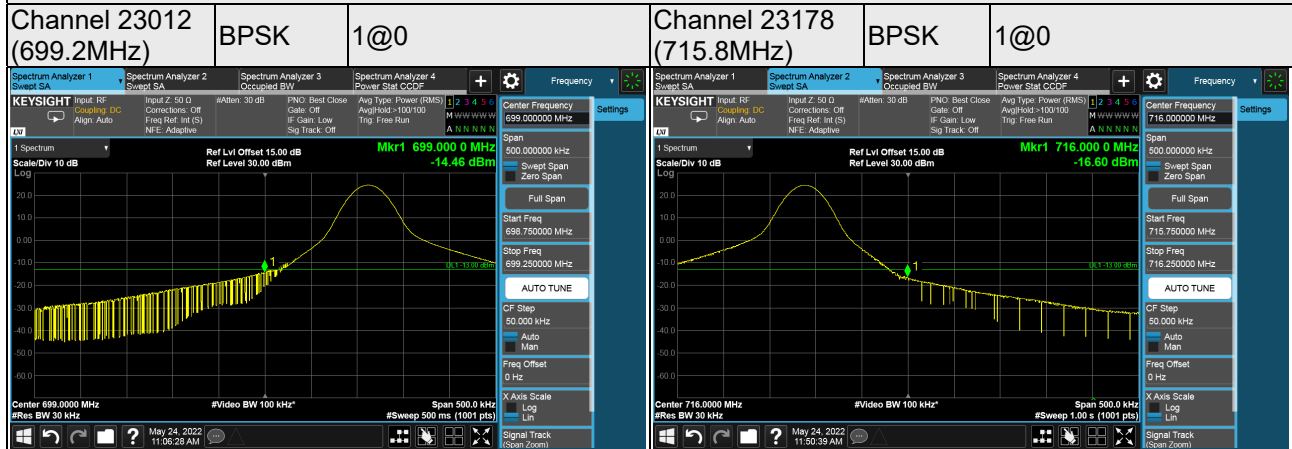


NB-IoT Band 4, Subcarrier Spacing 15kHz

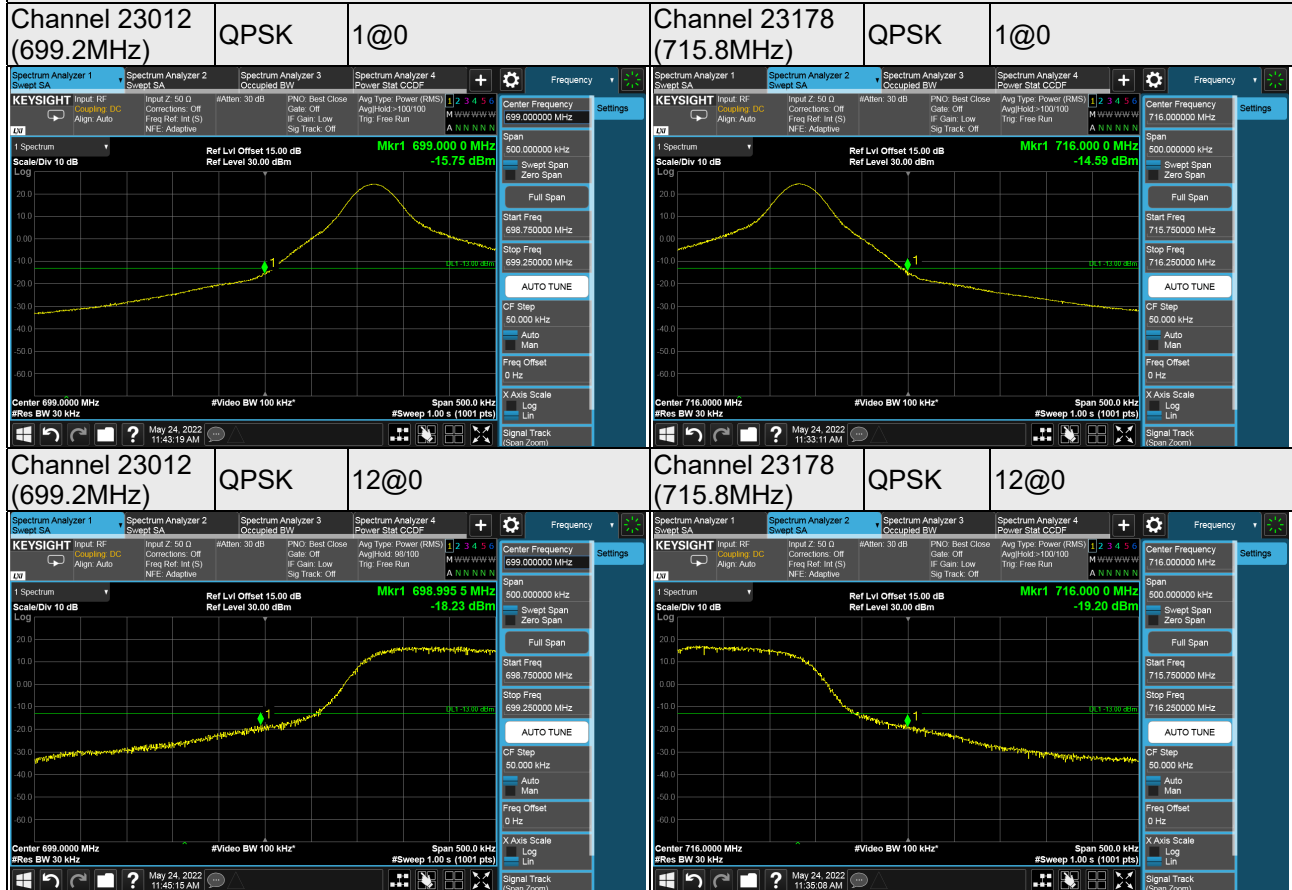


## Band Edge

NB-IoT Band 12, Subcarrier Spacing 3.75kHz

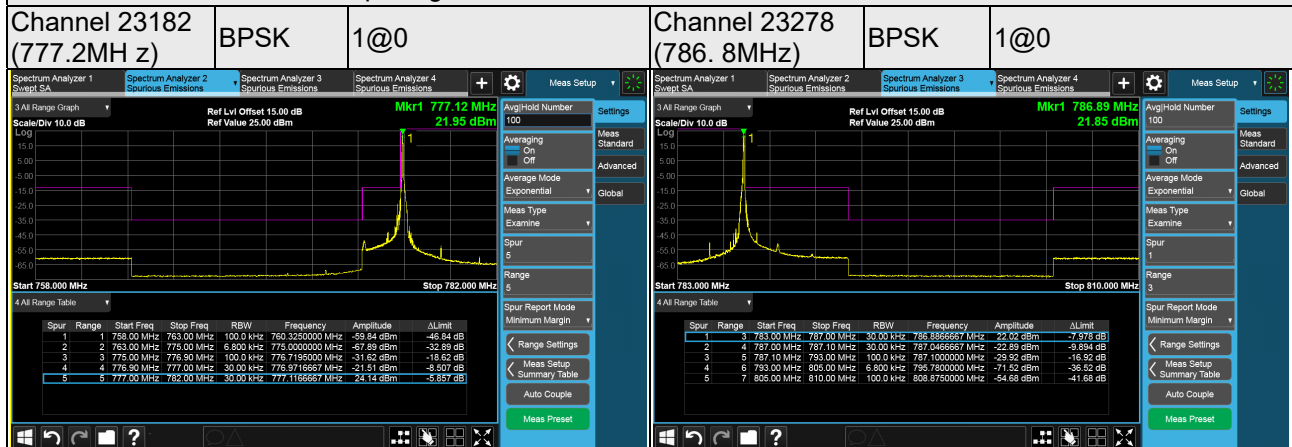


NB-IoT Band 12, Subcarrier Spacing 15kHz

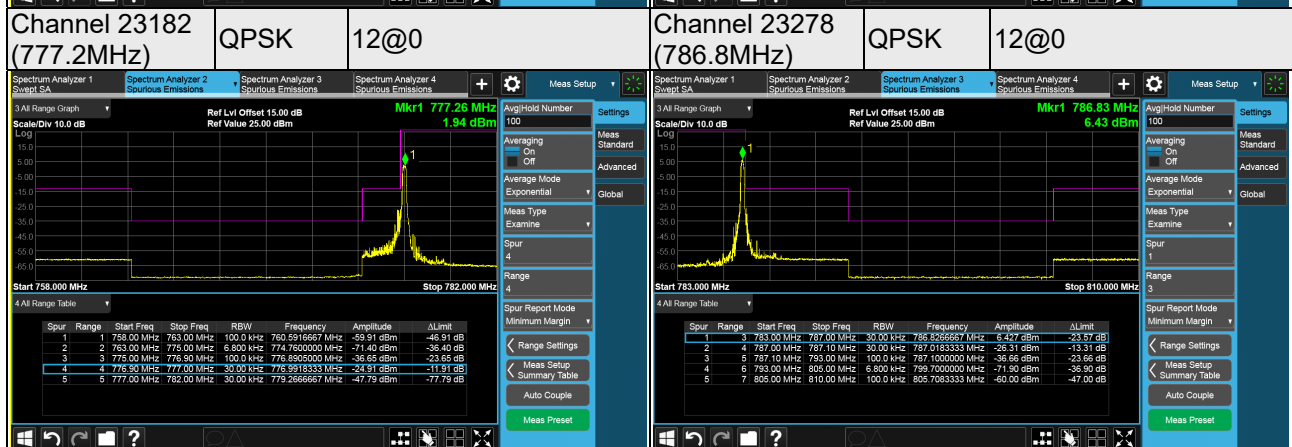
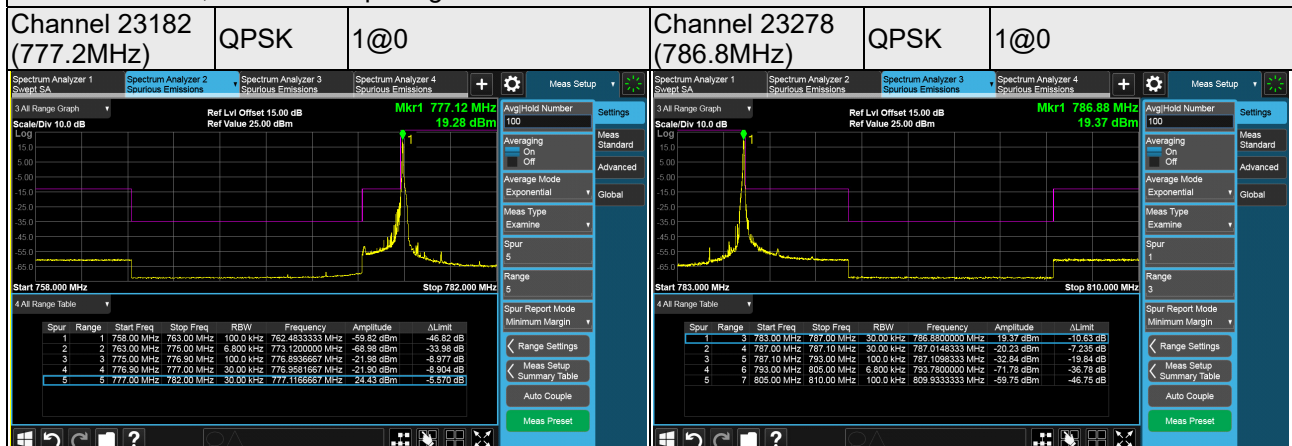


## Band Edge

NB-IoT Band 13, Subcarrier Spacing 3.75kHz



NB-IoT Band 13, Subcarrier Spacing 15kHz

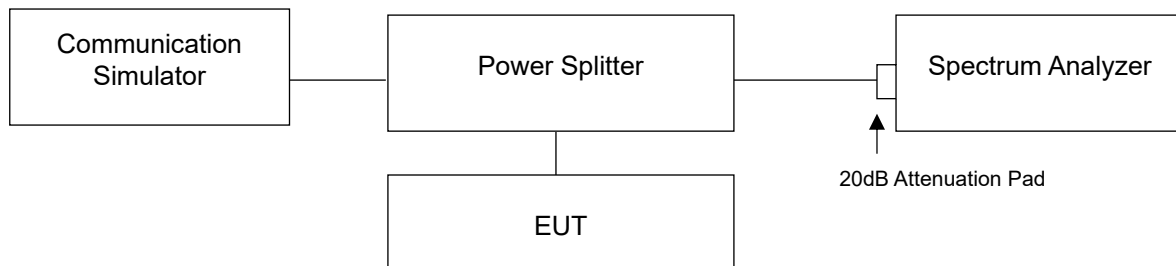


## 4.6 Peak to Average Ratio

### 4.6.1 Limits of Peak to Average Ratio Measurement

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

### 4.6.2 Test Setup

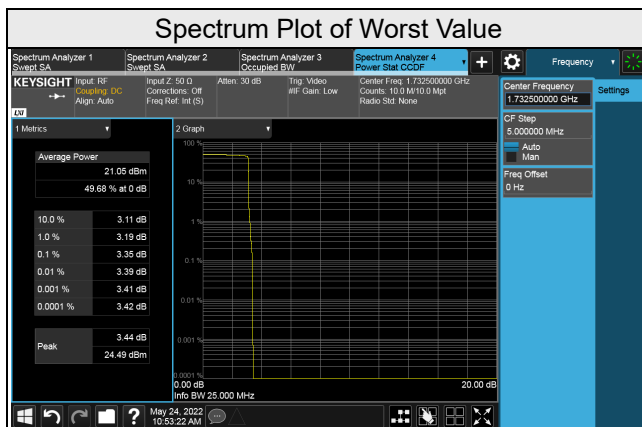


### 4.6.3 Test Procedures

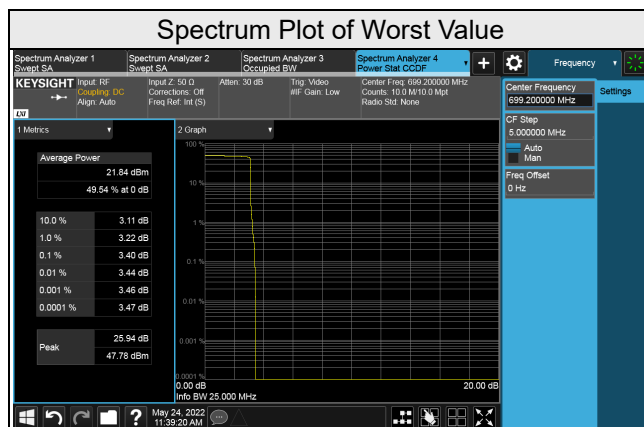
- Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

#### 4.6.4 Test Results

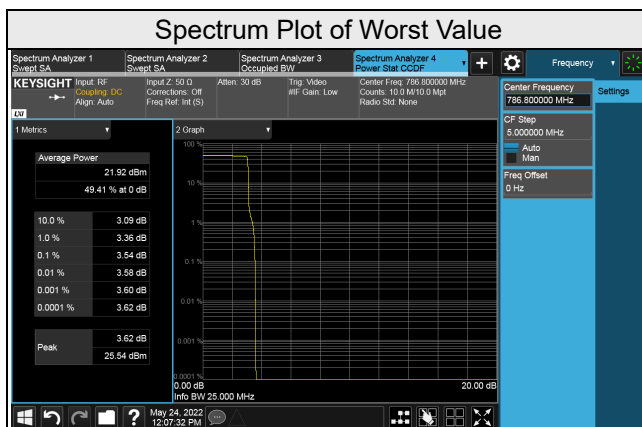
| NB-IoT Band 4 |                 |                          |                                            |            |                            |
|---------------|-----------------|--------------------------|--------------------------------------------|------------|----------------------------|
| Channel       | Frequency (MHz) | Subcarrier Spacing (kHz) | Number of Subcarrier / Starting Subcarrier | Modulation | Peak To Average Ratio (dB) |
| 19952         | 1710.2          | 3.75                     | 1@0                                        | BPSK       | 0.78                       |
|               |                 | 15                       | 12@0                                       | QPSK       | 3.31                       |
| 20175         | 1732.5          | 3.75                     | 1@0                                        | BPSK       | 0.52                       |
|               |                 | 15                       | 12@0                                       | QPSK       | 3.35                       |
| 20398         | 1754.8          | 3.75                     | 1@47                                       | BPSK       | 0.55                       |
|               |                 | 15                       | 12@0                                       | QPSK       | 3.30                       |



| NB-IoT Band 12 |                 |                          |                                            |            |                            |
|----------------|-----------------|--------------------------|--------------------------------------------|------------|----------------------------|
| Channel        | Frequency (MHz) | Subcarrier Spacing (kHz) | Number of Subcarrier / Starting Subcarrier | Modulation | Peak To Average Ratio (dB) |
| 23012          | 699.2           | 3.75                     | 1@0                                        | BPSK       | 0.82                       |
|                |                 | 15                       | 12@0                                       | QPSK       | 3.40                       |
| 23095          | 707.5           | 3.75                     | 1@0                                        | BPSK       | 0.86                       |
|                |                 | 15                       | 12@0                                       | QPSK       | 3.33                       |
| 23178          | 715.8           | 3.75                     | 1@47                                       | BPSK       | 0.89                       |
|                |                 | 15                       | 12@0                                       | QPSK       | 3.37                       |



| NB-IoT Band 13 |                 |                          |                                            |            |                            |
|----------------|-----------------|--------------------------|--------------------------------------------|------------|----------------------------|
| Channel        | Frequency (MHz) | Subcarrier Spacing (kHz) | Number of Subcarrier / Starting Subcarrier | Modulation | Peak To Average Ratio (dB) |
| 23182          | 777.2           | 3.75                     | 1@0                                        | BPSK       | 0.83                       |
|                |                 | 15                       | 12@0                                       | QPSK       | 3.38                       |
| 23230          | 782.0           | 3.75                     | 1@0                                        | BPSK       | 0.86                       |
|                |                 | 15                       | 12@0                                       | QPSK       | 3.52                       |
| 23278          | 786.8           | 3.75                     | 1@47                                       | BPSK       | 0.83                       |
|                |                 | 15                       | 12@0                                       | QPSK       | 3.54                       |



## 4.7 Conducted Spurious Emissions

### 4.7.1 Limits of Conducted Spurious Emissions Measurement

For NB-IoT Band 4:

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

For NB-IoT Band 12:

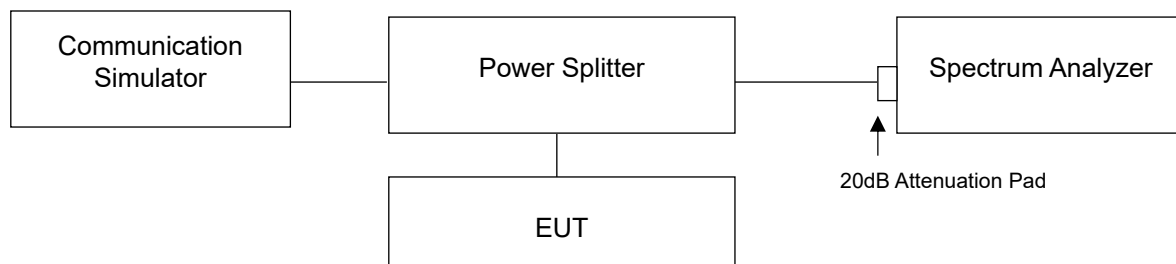
According to FCC 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. The limit of emissions is equal to -13 dBm.

For NB-IoT Band 13:

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

According to FCC 27.53(f), for operations in the 775-788 MHz, emissions in the band 1559-1610MHz shall be limited to -70 dBW/MHz (EIRP). The limit of emissions is equal to -40 dBm.

### 4.7.2 Test Setup



### 4.7.3 Test Procedure

- All measurements were done at low, middle and high channels operational frequency range.
- Measuring frequency range is from 9kHz to 10GHz / 20GHz. 20dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz are used for conducted emission measurement.